STATE OF NEW MEXICO
ENERGY AND MINERALS DEPARTMENT
OIL CONSERVATION DIVISION
STATE LAND OFFICE BLDG.
SANTA FE, NEW MEXICO

6 June 1984

EXAMINER HEARING

IN THE MATTER OF:

Application of Costa Resources, Inc. for an unorthodox well location, Eddy County, New Mexico. CASE 8204

BEFORE: Richard L. Stamets, Examiner

TRANSCRIPT OF HEARING

A P P E A R A N C E S

For the Oil Conservation Division: W. Perry Pearce
Attorney at Law
Legal Counsel to the Division
State Land Office Bldg.
Santa Fe, New Mexico 87501

For the Applicant:

MR. STAMETS: Call next Case 8204.

MR. PEARCE: That case is on the application of Costa Resources, Inc. for an unorthodox well location, Eddy County, New Mexico.

Mr. Examiner, applicant has requested continuance of that matter until June the 20th, 1984.

MR. STAMETS: The case will be so continued.

(Hearing concluded.)

C E R T I F I C A T E

I, SALLY W. BOYD, C.S.R., DO HEREBY CERTIFY that the foregoing Transcript of Hearing before the Oil Conservation Division was reported by me; that the said transcript is a full, true, and correct record of the hearing, prepared by me to the best of my ability.

Sally W. Boyd CSR

I do hereby certify that the foregoing is a complete record of the proceedings in the Examiner hearing of Case No. _____, heard by me on _____ 19____.

_____, Examiner
Oil Conservation Division

STATE OF NEW MEXICO
ENERGY AND MINERALS DEPARTMENT
OIL CONSERVATION DIVISION
STATE LAND OFFICE BLDG.
SANTA FE, NEW MEXICO

20 June 1984

EXAMINER HEARING

IN THE MATTER OF

Application of Costa Resources, Inc. for an unorthodox well location, Eddy County, New Mexico. CASE 8204

BEFORE: Michael E. Stogner, Examiner

TRANSCRIPT OF HEARING

A P P E A R A N C E S

For the Oil Conservation Division: W. Perry Pearce
Attorney at Law
Legal Counsel to the Division
State Land Office Bldg.
Santa Fe, New Mexico 87501

For the Applicant:

MR. STOGNER: We will now call next Case Number 8204.

MR. PEARCE: That case is on the application of Costa Resources, Inc. for an unorthodox well location, Eddy County, New Mexico.

Mr. Examiner, at the request of the applicant that matter is to be continued until July 11th, 1984.

MR. STOGNER: Case Number 8204 will be so continued to July 11th, 1984 hearing.

(Hearing concluded.)

C E R T I F I C A T E

I, SALLY W. BOYD, C.S.R., DO HEREBY CERTIFY that the foregoing Transcript of Hearing before the Oil Conservation Division was reported by me; that the said transcript is a full, true, and correct record of the hearing, prepared by me to the best of my ability.

Sally W. Boyd CSR

I do hereby certify that the foregoing is a complete record of the proceedings in the Examiner hearing of Case No. 8204 heard by me on June 20 19 84.

Michael E. Stogner, Examiner
Oil Conservation Division

STATE OF NEW MEXICO
ENERGY AND MINERALS DEPARTMENT
OIL CONSERVATION DIVISION
STATE LAND OFFICE BLDG.
SANTA FE, NEW MEXICO

11 July 1984

EXAMINER HEARING

IN THE MATTER OF

Application of Costa Resources, Inc. for an unorthodox well location, Eddy County, New Mexico. CASE 8204

BEFORE: Richard L. Stamets, Examiner

TRANSCRIPT OF HEARING

A P P E A R A N C E S

For the Oil Conservation Division: W. Perry Pearce
Attorney at Law
Legal Counsel to the Division
State Land Office Bldg.
Santa Fe, New Mexico 87501

For the Applicant:

MR. STAMETS: We'll call next Case 8204.

MR. PEARCE: That case is on the application of Costa Resources, Inc. for an unorthodox well location, Eddy County, New Mexico.

Mr. Examiner, that case is to be continued until July 25th, 1984.

MR. STAMETS: The case will be so continued.

(Hearing concluded.)

C E R T I F I C A T E

I, SALLY W. BOYD, C.S.R., DO HEREBY CERTIFY that the foregoing Transcript of Hearing before the Oil Conservation Division was reported by me; that the said transcript is a full, true, and correct record of the hearing, prepared by me to the best of my ability.

Sally W. Boyd CSR

I do hereby certify that the foregoing is a complete record of the proceedings in the Examiner hearing of Case No. 8204 heard by me on 3-14, 1984.

Richard L. Stamets, Examiner
Oil Conservation Division

STATE OF NEW MEXICO
ENERGY AND MINERALS DEPARTMENT
OIL CONSERVATION DIVISION
STATE LAND OFFICE BLDG.
SANTA FE, NEW MEXICO

25 July 1984

EXAMINER HEARING

IN THE MATTER OF:

Application of Costa Resources, Inc. for an unorthodox well location, Eddy County, New Mexico. CASE 8204

BEFORE: Michael E. Stogner, Examiner

TRANSCRIPT OF HEARING

A P P E A R A N C E S

For the Oil Conservation Division: W. Perry Pearce
Attorney at Law
Oil Conservation Commission
State Land Office Bldg.
Santa Fe, New Mexico 87501

For the Applicant:

MR. STOGNER: Call next Case Number 8204.

MR. PEARCE: That case is on the application of Costa Resources, Inc. for an unorthodox well location, Eddy County, New Mexico.

Mr. Examiner, that case is to be continued until August the 15th, 1984.

MR. STOGNER: Case Number 8204 will be so continued.

(Hearing concluded.)

C E R T I F I C A T E

I, SALLY W. BOYD, C.S.R., DO HEREBY CERTIFY that the foregoing Transcript of Hearing before the Oil Conservation Division was reported by me; that the said transcript is a full, true, and correct record of the hearing, prepared by me to the best of my ability.

Sally W. Boyd CSR

I do hereby certify that the foregoing is a complete record of the proceedings in the Examiner hearing of Case No. 8304, heard by me on July 25, 1984.

, Examiner
Oil Conservation Division

STATE OF NEW MEXICO
ENERGY AND MINERALS DEPARTMENT
OIL CONSERVATION DIVISION
STATE LAND OFFICE BLDG.
SANTA FE, NEW MEXICO

15 August 1984

EXAMINER HEARING

IN THE MATTER OF:

Application of Costa Resources, Inc. for an unorthodox well location, Eddy County, New Mexico. CASE 8204

BEFORE: Gilbert P. Quintana, Examiner

TRANSCRIPT OF HEARING

A P P E A R A N C E S

For the Oil Conservation Division: W. Perry Pearce
Attorney at Law
Oil Conservation Commission
State Land Office Bldg.
Santa Fe, New Mexico 87501

For the Applicant: W. Thomas Kellahin
Attorney at Law
KELLAHIN & KELLAHIN
P. O. Box 2265
Santa Fe, New Mexico 87501

A P P E A R A N C E S

For Amoco Production Co.: William F. Carr
Attorney at Law
CAMPBELL & BLACK P.A.
P. O. Box 2208
Santa Fe, New Mexico 87501

I N D E X

I N D E X

E X H I B I T S

MR. QUINTANA: We call next Case 8204.

MR. PEARCE: That case is on the application of Costa Resources, Inc. for an unorthodox well location, Eddy County, New Mexico.

We call for appearances at this time, please.

MR. KELLAHIN: If the Examiner please, I'm Tom Kellahin of Kellahin and Kellahin, Santa Fe, New Mexico, appearing on behalf of Costa Resources, Inc., and I have one witness to be sworn.

MR. QUINTANA: Are there other appearances in this case?

MR. CARR: May it please the Examiner, my name is William F. Carr, with the law firm Campbell and Black, P. A. of Santa Fe, appearing on behalf of Amoco Production Company.

I have one witness.

MR. QUINTANA: Will all witnesses please stand and raise your right hand and be sworn?

(Witnesses sworn.)

MR. KELLAHIN: Mr. Examiner, we have a brief opening statement on behalf of Costa Resources. If it's appropriate, we'd like to make that at this time.

Mr. Examiner, I want to show you what will be Costa Resources Exhibit Number Five, and I think I'll just put it on the wall here.

Mr. Examiner, the applicant seeks approval of an unorthodox Morrow gas well location in Eddy County, New Mexico.

The evidence will demonstrate to you that the applicant, Costa Resources, in Section Number 2, and on Exhibit Number Five that is the spacing and proration unit outlined in red, the applicant proposes to locate a well in that 320-acre tract at a location that's 660 feet from the east line in that spacing unit. The north/south line it would be a standard location under the statewide rules. It is 1600 feet from the south line.

The applicant proposes to find and test one of the Lower Morrow reservoirs in the gross Morrow interval, and what the testimony will demonstrate and show you is that this Lower Morrow channel, which will be called the Number Six Zone, is a separate and distinct reservoir unto itself.

We will present to you Mr. Mark Wilson, who is a petroleum geologist, who has spent a great many years looking for and evaluating and studying and picking the Morrow channel in Eddy County, New Mexico.

He will testify and demonstrate to you what we believe to be the only appropriate location from which to produce gas in this Lower Morrow reservoir and

that that location must be an unorthodox location.

The evidence will demonstrate that without the approval of the unorthodox location waste will occur because a well cannot otherwise be drilled to produce this gas.

We will discuss for you the Commission double circle penalty formula that you may be aware of, that the Commission has used in the past as a benchmark in which to attempt to address whether or not an unorthodox location ought to be penalized.

We will discuss that for you in our testimony and I believe the evidence will demonstrate to you that the application of the double circle penalty is inappropriate; it's not capable to be justified in this fact situation; and that at the conclusion of the evidence we will ask you to approve this location without a penalty.

The evidence will further demonstrate to you that the only offset operator that has objected to the location is Amoco. The evidence will show you that Amoco's acreage adjoins the Costa Resources acreage. The Amoco acreage will be in Section Number One, and that will be the section immediately to the east of the proration unit.

The evidence will show you that in Section Number One Amoco already has, and has fully exercised the opportunity to produce gas out of the reservoir. In fact, they have a well that has produced a significant

amount of the gas from the reservoir.

In addition they've had a second well and we will hopefully demonstrate to you through the evidence that they have had a full and complete opportunity to produce their fair share of the gas.

Mr. Wilson will demonstrate to you why the location that he has requested in Section Number Two is one that will not adversely affect the correlative rights of Amoco.

And that is our position in this case. We believe the discussion is a geologic discussion and we have brought forward to you an eminently qualified geologist that will discuss in great detail the geologic considerations for you to take.

MR. CARR: May it please the Examiner, Costa Resources is appearing before you today seeking approval of an unorthodox well location in the Morrow formation, which is 67 percent too close to the offsetting property.

As Mr. Kellahin noted, only one party has appeared here today and is objecting to this application. It should be noted that that is the only party upon whom this location encroaches.

We submit that we have a classic unorthodox location case we're presenting to you here today. We believe the evidence will show that the well could be drilled at a standard location if the objective is

to produce Costa's resources under his property. We believe that the evidence will show that by moving two-thirds too close to the common lease line, that they will be extending a radius of drainage into the property operated by Amoco; that a standard penalty formula will apply; that a penalty should be imposed; and that at the conclusion of the testimony you will be asked either to deny the application and let Costa develop its reserves from a standard location or you will be asked to approve the application and impose a substantial and meaningful penalty to protect Amoco and the other interest owners in the Empire South Deep Unit from drainage which cannot without the drilling of unnecessary wells be compensated for.

We will ask you at that time to either deny the application or impose a penalty.

MR. QUINTANA: Thank you, Mr. Carr. Mr. Kellahin, you may proceed.

MR. KELLAHIN: Thank you, sir. We'll call Mr. Mark Wilson at this time.

MARK WILSON,

being called as a witness and being duly sworn upon his oath, testified as follows, to-wit:

DIRECT EXAMINATION

BY MR. KELLAHIN:

Q Mr. Wilson, I believe you've been sworn

in at this time.

Would you please state for the record your name and occupation?

A Yes. Mark Wilson, petroleum geologist.

Q Mr. Wilson, where do you reside?

A Midland, Texas.

Q And have you previously testified before the Oil Conservation Division and the Commission as an expert petroleum geologist?

A On many occasions.

Q All right, sir. Would you describe for the Examiner when and where you obtained your degree in geology?

A I have a Bachelor's degree from the University of Pennsylvania, a Master's degree from Ohio State University.

Q In what years did you obtain those degrees?

A '47 and '49.

Q Would you direct the Examiner's attention to your experience in Eddy County, New Mexico, and the studies and efforts you have made to pick Morrow well locations in that county?

A Yeah, I probably have looked at the Morrow in Eddy County about as long as anybody. I can go back to when the Morrow was considered a noneconomic play, for instance, and not many people were looking for it.

There was one field, the oldest field, commercial field in the Morrow is south of Artesia a short ways, in which Yates has had interest. I worked with them. And as this pay unfolded, of course I had been on the scene in New Mexico since 1950, and we were immediately active in it, being with Yates, who has an enormous amount of acreage scattered around through Eddy County, and so we dived into it right off the bat and pursued it probably as hard as anyone, and I think that probably in the early stages of it, we understood more of what was going on in the Morrow than most parties.

Some people were pursuing it on a statistical basis but we found out early in the game that it did not need to be pursued on that basis, and it was not deposited by the devil, there is some rhyme and reason to it.

Q When did you -- when you talk about these early efforts, in what years did this take place?

A Well, I would say from about 1963 on we were, you know, active in the play, and in fact, when the first well was drilled here in the South Empire Deep Unit, the price of gas at that point in time was 35 cents, so that will give you an idea of, you know, what was going on at that stage of the game. That was about 1972. We were all elated because we had been getting 12 and 13 cents.

But I think that as far as we were concerned the key thing as far as our exploration effort was concerned was the realization that we were dealing with an

alluvial valley system where these valleys are carved into the Chester Shale section, in the first stages of erosion, and there is a land area back to the northwest that we call the Pedernal Land Mass. The streams originated in the mountains, flowed down and cut into this Chester Shale section and some short distance actually away from the land areas they would form a delta facies, and you can identify these alluvial valleys, which are largely the crux of the matter, from Isopaching various units of the Morrow. You could work the whole Morrow or you can work with the lower part of the Morrow, but once you have isolated these valleys in the Morrow you find out that a number of really good commercial sands are related to these valleys, and they are largely fluvial sands.

And then in most cases, in a rather remarkable distance you will go from one of the alluvial valleys into a delta system, such as you're seeing up there on the board, where again you're dealing with reservoirs of generally good quality, as for instance, in that example up there, probably the thickest sand in Eddy County occurs in one of those channels where it's 110 feet thick. In the business it's known as the BV Sand, and I'll point it out when I get to that illustration.

Between these two things, we've developed the working principles that we felt have been successful for us, and also we feel that we can, in an area where you've got as much control as we've got in the South Empire Deep

Unit, that we can map individual reservoir sands. We don't have to talk about lumping things and grossing things, and combining things, and in this particular case here we have absolutely got to get down and talk about individual sand reservoirs. It is not enough to lump this stuff together and throw in a bunch of mechanical contours and decide that, well, the whole world is connected, because I think we're going to clearly show it's not connected.

Q Have you followed those principles and conclusions that you've made over the years in preparing the exhibits that you will present today?

A I have.

Q And are these exhibits that you're going to discuss exhibits that were either prepared directly by you or under your immediate direction and control?

A I prepared them all myself.

Q All right, sir.

MR. KELLAHIN: We tender Mr. Wilson as an expert petroleum geologist.

MR. QUINTANA: Mr. Wilson is -- will be accepted as an expert petroleum geologist.

Q Mr. Wilson, let me show you what we've marked as Exhibit Number One, and have you identify that exhibit for us at this time.

A Okay. Exhibit One is a land plat and the proposed drillsite is shown with the tiny red circle and the

acreage to be dedicated, with the green outline, being the south half of Section 2 of Township 18 South, 28 East.

You'll notice that the wellsite is, as we have previously mentioned, 660 feet west of the South Empire Deep Unit, which is shown as a blue outline. That unit was put together by myself and Robert Boling on behalf of Harvey Yates, and it was approved on September the 13th, 1971.

Boling and I sold the deal to Midwest. Midwest drilled a discovery well in Section 1 of 18, 29, and proceeded to drill three additional wells before they were bought out by Amoco, and from that point out Amoco was operator of that unit. That would be through Wells 5 through 21.

The red outline within that unit area is simply the area, the participating area, for the Morrow.

I want to discuss this area in the general vicinity of our drillsite a little further, too.

On February the 8th, 1980, I proposed a 1280-acre unit, which we called the Two Forks Unit, covering all of Section 2 of 18, 28, and all of Section 35 of 17, 28, immediately to the north.

The lease owners in the south half of Section 35 responded by electing to drill their own well. ARCO was the operator; the well was called the State BX No. 1.

Q That well is in the south half of Section 35?

A That's correct.

Q And that's one of the wells you'll be discussing in your cross sections?

A That's correct.

Q All right, sir.

A And that well's shown on your exhibit there with a little dark square in the south half of Section 35. This well was completed as a commercial Morrow producer on 6-16-82. We had lease ownership, I did and the Rio Pecos Corporation, in Section 2, which was the basis for us proposing the unit to start with, but it turned out all we could do was wait for ARCO to get down and then decide what we wanted to do after that.

Since they made a pretty decent well, as a matter of fact, it's producing about 1-1/2 million a day at the moment, and has done so to the tune of well over a billion gas, we decided we would indeed offset that well.

So we, with myself and the corporation owning 40 acres in this north half of 2, we proposed a spacing unit deal, which included the 320 acres in the north half of 2, and, of course, we proposed a drillsite which is immediately south, which is shown with this second little box there on your map, for our well.

Costa Resources is involved in the deal as operator and I might read to you, also, the other people who are involved in this acreage in Section 2. It's a very diversified ownership. There's Costa and a group of inves-

tors that they have; myself, personally; the Rio Pecos Corporation, which is our family company; the Basic Energy, Incorporated; Hansen and McBride Petroleum; Featherstone Development, Olin F. Featherstone II; Featherston Farms, Limited; Ralph Nix; Mrs. Curtis; and various Yates' interests.

Q You made reference to the well in the north half of Section 20. That's identified as the Costa Resources No. 1 Well, is it?

A Yeah, it's called the Two Forks State No. 1.

Q The proposed location in the south half of 2, what will we call that well?

A Probably the Two Forks State 2.

Q All right, sir.

A I might add here, too, this well that we drilled in the north half of 2, the Two Forks State I, was a subject of a forced pooling hearing before this Commission, also, and some of the exhibits I'm going ot use here were presented on that occasion.

Q All right, sir. Mr. Wilson, will you identify for us your Exhibit Number Two at this time?

A Okay. Exhibit Number Two is a portion of the Red Lake topographic sheet and again the wellsite and the spacing unit are shown in red.

The reason I present this exhibit is simply to point out why our footage from the south line is 1600 feet. You'll notice that immediately north of our proposed

drillsite that there's a Highway 360 running northwest southeast, and then a pipeline that runs from the southwest toward to the northeast, and had we gotten up there 1980 from the south line or 2310, or something of that nature, I think we'd have landed right in the middle of an intersec tion that's not a very good place for a launch pad.

Q Apart from the geologic considerations for the unorthodox location, is the surface unorthodox loca tion one that is suitable for topographic reasons?

A Right.

Q All right, sir. Mr. Wilson, let's direct your attention to Costa Resources Exhibit Number Three at this time and have you identify and describe this exhibit.

A Exhibit Three is a structure map on top of the Atoka series and we picked this point because it's a point you can pick throughout Eddy County. It's the base of the Lower Strawn limestone and it's a widely used structural datum.

The contour interval on this map is 100 feet and you will note that our proposed drillsite is going to be on the order of 30 feet low to our first well, the Two Forks State 1 in the north half of 2.

We don't anticipate any problems with the structure. We're simply presenting this map for complete- ness. There's no water being produced in either of the two wells to the north in this reservoir that we're prospecting for.

Q Mr. Wilson, let me direct your attention to Costa Resources Exhibit Number Four and have you identify and describe that exhibit for us.

A Exhibit Four is an Isopach for the total Morrow series.

Q When you say "total Morrow series" would you identify what you mean by that term?

A Could I save that -- answer that question by putting the cross sections up?

Q All right, sir.

A But anyhow, it would be from the top of the Morrow, as we pick it, down to the top of the Chester.

Q We would refer to this as a gross Isopach of that whole Morrow series?

A That's correct.

Q All right, sir.

A Okay. You'll remember that in some of the introductory remarks I had mentioned that prior to Morrow deposition there were rivers that cut down through the Eddy County country and eroded valleys into the Chester Section, usually the Chester shale section, which is very easily eroded, and in a later stage, as the sea level rose these valleys were filled up with Morrow sediments.

We refer to these valleys as alluvial valleys and they're filled up generally with fluvial sandstones, meander belt type sandstones, and perhaps some braided stream deposits over bank deposits, the flood plain

deposits, and that sort of thing.

On this particular map here I have colored in yellow the alluvial valleys I think that are pertinent to this discussion today, and if you'll start up on the north end of the map, there is a valley there I call the Crow Flats Alluvial Valley, and if you'll look at the Isopach data, you'll see there's a maximum of maybe 285 feet of Morrow deposited in that valley as it filled the valley up.

As you come eastward, you can get down to where there is 50 or 100 feet of Morrow.

As you go westward, you can go to zero feet of Morrow. Of course there's another valley over to the west there, which is called the Dayton Diamond Mound Alluvial Valley.

As you come southwest in this valley it begins to do some branching. The principal valley is the Logan Draw Valley, which you see there in the south central part of this map, and that is an extremely important valley because as you leave the south end of the map here, that develops into the Burton Flat delta complex that covers multiple townships from the south end of the map on clear down past Carlsbad.

So there was a bit of sand coming down the Crow Flat Alluvial Valley.

Another branch of that valley we call the East Logan Draw Valley and that would immediately northeast of the Logan Draw Alluvial Valley. That one is very little

known. We've recently, with Phillips, drilled a well in Section 5 of 18, 28, and got us a gas well that we think is related to that valley, but there's much more to be found out there.

Amoco and we worked at one time on a location up there in Section 26 of 17 South, 27 East, and while you're sitting here looking at the maps you might take a look at that drillsite on here.

It's in the northwest end, we think, of that alluvial -- the East Logan Draw Alluvial Valley.

That well was cancelled, I think, due to some market problems with respect to gas.

In the middle of the map there, there is a valley, minor valley. We call it the AB Valley, and that valley is our estimation of where the so-called AB sand would trend. You'll notice there's a gas well in Section 29 of 17, 28. That's an Amoco gas well and it's a very famous well. It's supposed to have about 40-billion reserves and you can see they've drilled all around it and nobody's ever found it again.

But, it seems to be about the same level as one of these major channels over to the east in the South Empire Deep Unit, and we think it is probably related in some fashion to that and we've shown what our idea of that is.

It's not critical to this testimony; I just pointed it out.

The valley that is most critical to what we're going to talk about here is the South Empire Alluvial Valley and we feel that that's the branch and the valley that fed this delta area which you see on the map up on the wall.

It is quite narrow, maybe a half a mile, through most of its range. As you come into the southeast part of 17, 28, it begins to broaden out and that's what we've called the head of the delta, right about there on the map where it says "Alluvial Valley" in "South Empire Alluvial Valley", right where it says "Alluvial Valley" is we have referred to as the head of the delta.

The area that's colored orange on the map is the area where the delta is developed; has come out of the alluvial valley and a stream that's able to spread out or a deltaic plain, and deposit sands in various distributaries, which if they are mapped carefully all come together and point into this alluvial valley. That's why I'm showing this map here. This is just really the gross picture that I want to get down to when I start talking about that delta up there.

Q Let me, while we're on this exhibit, have you identify for us the key wells that we're going to be discussing throughout your testimony, Mr. Wilson.

A Well --

Q We've already discussed the No. 2 Costa Well and the proration unit.

A Okay.

Q Would you identify for us the Amoco wells in Section Number One?

A Tom, would you mind if I did it on that map there, because I think maybe that's going to be a little more pertinent.

Q All right, sir.

A We'll be talking about this one from now on out.

Q That is --

A It's better with the cross sections.

Q -- Exhibit Number Five.

All right, before we get into detail on Exhibit Number Five --

A Right.

Q -- help orient us to the Amoco wells and how they're named.

MR. KELLAHIN: We'll give you copies of all this.

A Okay. I'm going to start with the wells over here in the valley that's most critical to us. We're going to call this --

Q Before you start, I want to clear up what you've identified in the orange area as a delta. Now aren't there various kinds of deltas that could be deposited, and would you specifically identify the kind of delta you're talking about here?

A Yeah, I will do that.

Q Is it easier to do it from Exhibit Five or from this one?

A I'd like to do it with Exhibit Five, Tom, when I get down to that.

Q All right, sir.

A I will do that when I get to it.

Q All right.

A But I'm going to be referring to this valley here -- not this valley, this distributary channel. It's the Two Forks distributary channel. As I go along we'll discuss it.

This channel over here I'm going to refer to as the Amoco No. 6 channel, and that's after the discovery well in that particular channel, which was drilled by Amoco in the unit area here up in the southeast part of Section 1, the Amoco No. 6.

Just north of the No. 6 Well, in the north half of Section 1, right here, is the Amoco No. 10 Well. That did not make a well in this Amoco No. 6 channel. It was completed, rather, in the Upper Morrow; this is in the Lower Morrow.

Now, over in the Two Forks channel, the first well that was drilled in the Two Forks channel, as I mentioned, we tried to put the unit together; the operators decided they wanted to drill on the south half of 35. ARCO operated the well. It was called the State "BX" No. 1, and

that was the discovery well in this channel over here.

Okay. Then our well which we drilled in the north half of 2 was called the Costa Resources Two Forks State No. 1. Our proposed drillsite is the Two Forks State No. 2.

Now, going down into Section 13, there is a group of wells there, and I'll be referring to those as the HEYCO Wells, the Harvey E. Yates Company wells. That's principally development in the Strawn. It's a litte Strawn oil field there, but there are -- channel sands are present in that area and we'll get into that in a little more detail later.

I don't think I need to mention -- I might talk about this well here in Section 12; that's a very critical well. It's a dry hole. It does not have either the Two Forks sand or the Amoco 6 sand, and I'll show you that on this cross section.

Q That well is named the South Deep No. 20 Well?

A That's right.

Q All right, sir.

A There are 21 wells in the unit and that's next to the last one. 21 is up here in the BV channel.

Incidentally, this does Isopach what is presented in the forced pooling hearing in connection with the first well we drilled in here.

Q At this point, Mr. Wilson, based upon all

your studies, have you reached certain conclusions with regards to the drilling of this well at an unorthodox location?

A Yeah. I think that we want to drill at an unorthodox location because we want to take no chances on missing this channel. It's going to be an expensive well, a lot of smaller operators involved in it and we don't want to take any more risk than we have to take.

So we placed it where we think the axis of this channel is. Now you could go to an orthodox drillsite, possibly, further west, gamble with getting the west edge of that channel, but I don't think any sane operator would take that risk unless it was just absolutely mandatory.

I have been along the Morrow long enough to know that you can map channels that are narrow, on the order of a half a mile wide, and it is easy to miss them.

So I'm kind of a curbside geologist when it comes to picking this drillsite here. I know that I have wells in the channel, as we had mapped it before ARCO ever drilled their well, up in the north end, the BX and the Two Forks.

We know also that that channel is present down in Section 13, and I am just crazy enough to take a straight edge and lay it between those wells and decide that's where I want to drill the next one, in spite of all the science I'm going to talk about.

Q Can you express to us your opinion with regards to whether or not this will -- approval of the unorthodox location would infringe upon the correlative rights of Amoco in Section Number One?

A Well, I think to discuss it I had better look at this map that's up on the board here.

Q All right, sir, let's do that.

A I won't give a thorough discussion of this illustration up here, which is Exhibit Five, and to start with, and in answser to your question, if you remember the land plat, which is Exhibit One, the South Empire Deep Unit includes all of Section 1. It includes only the northeast part of Section 12. It includes the east half of Section 36 in the township to the north.

This Two Forks channel, the only portion of the South Empire Deep Unit that that channel affects is 73 acres down here in the southwest corner of Section 1, and that is according to our mapping which is going to backed up here shortly by three major cross sections to demonstrate what we have done here.

And we want to talk about this -- these individual channel sand reservoirs.

Q When you talk about Amoco having 72 acres of this Two Forks channel reservoir, what portion of that reservoir does Costa Resources have under its proration unit?

A I don't know that I have that in acres.

Now that was 17 percent. If we looked at the acreage in Section 2 versus the acreage in Section 1 that's in this Two Forks channel, I think we figured, our engineers did this figuring, we figured it was 17 percent of it, a little bit over it, in the southwest part of Section 1 and it was 83 percent that was in Section 2 in acreage controlled by Costa and the group.

Okay, I want to go a little bit further with this Exhibit Five.

Again, this was presented in connection with Case 7922 on 7-20-83, the forced pooling hearing with regard to this well in the north half of Section 2.

Okay, I'm going to talk about the thickness of the sand in this channel. Up here in the north end in the ARCO well, which is the discovery well, there's about 20 feet of sand. In our well, the Costa well, there's 13. Now these numbers are shown there in the little rectangular boxes colored dark pink to go with these pink channels I've got here, and as you come south towards this Section 13 area, which is the closest penetrations to this sand once you leave Section 2, you'll notice that there thicknesses there that are considerably more than what we have up in the north, as for instance, there's the range here of 32 feet, 34 feet, 38 feet, which is far thicker than what we have up to the north.

Now, a guy would think, well, it's so much thicker, it ought to be so much better, but it's not.

This sand down in here is a very tight sand in general, very firm one. It has different characteristics from what it has in the producing wells further to the northwest. Now, when I say different characteristics, I think that what's going on here, is that as we come out this way we're coming seaward and we're getting into the area where the sand is terminating and probably we'll have a little different type of deposit there associated with the distributary channel. I think we're probably talking about distribatary mouth bar where the sand is dumped in the mouth of the distributary in what is essentially a marine environment and probably gets stirred up with some clays or cementing materials, or whatever.

In any event, it does not have commercial porosity.

There was a well completed there, which we'll show you on the cross section, it looks great on the logs but only made about 200-million gas before they plugged it back to the Strawn oil zone that exists in Section 13.

No other well has produced out of that zone.

So what we've got to say is this: Up here we've got a reservoir that's got porosity, commercial porosity. Down here we have a situation where there probably isn't really a good reservir situation or anything that looks commercial.

Now in between is a stretch of country

from here to there and the question is in our minds where the porosity will end as you come down here coming out of this area. Will there be a new pod in here to be another reservoir?

But given the gas reserves we have up here, we feel that it would be stretching things to believe that this whole thing would be full of gas.

But there could be more than one reservoir. Already we know there's two. There's this one here and one here and there are possibilities here there is still a third.

Now these things are in the same channel and due to internal geometry and cementation factors and so on, you may be in the same channel and have different reservoirs occasionally.

Let me look at my notes here and see if I covered -- okay, I want to mention again this South Empire No. 20 Well in the northeast part of 12.

That was a sad well in the Morrow. They didn't have any commercial sand in the Morrow. They missed both of these channels because of the unfortunate position of being in between them, and we will show you that on a cross section, three well cross section here in a moment.

Okay, here are these numbers I was looking for. You were -- somebody was asking about acreages in Sections 1 and 2. Okay, in Section 2 engineers planimetered the area of the channel in Section 2, and that's 352.6 acres

and the area in Section 1 is 73.46 acres, or in percentages 82.8 percent versus 17.2 percent. And if you looked at it in the larger context of the whole Two Forks channel, that 73 acres in the southwest part of Section 1 is even less of the whole thing.

Okay. The next thing I will discuss will be three stratigraphic cross sections. I say stratigraphic cross sections because they are not hung on a sea level datum, or any other datum for purposes of structural cross sections. They're intended simply to show correlation and when you do that (not understood) to line everything up.

So I will show you those next.

Now the lines for these cross sections are shown here on this Exhibit Five and the A-A' cross section is the -- is the red -- excuse me, green line with four wells on it, the ARCO "BX", our Two Forks 1, and two wells down here in Section 13.

Then the B-B' cross section will be this red line over here which goes the full length of that Amoco No. 6 channel, and I want to do that to show you that you can correlate that sand right straight down that channel. There is no problem whatever in correlating it, and identifying that as a very specific reservoir.

I also brought the north end of that cross section over here and picked up the northern two wells in this Two Forks channel. I did that to show that these two wells here and this channel, this is a little bit lower

stratigraphically than this channel is over here.

Then the third cross section, which will be C-C', is the connecting cross section that runs from Section 13 here, through the dry hole in 12, and up to the Amoco No. 6 Well, again to demonstrate to you that this Two Forks distributary is stratigraphically lower than this distributary is over here, and also to show you the sand in neither well was present in this No. 12 Well. The reason I make such a point out of this is this: If you do not have in your head some kind of a depositional model for the way these sands cut in here, then you have to resort to mechanics and if you resort to mechanics, anything on earth is possible because it doesn't have to make any sense. You're not producing an interpretation, and I think for instance, when you got down to this area here, you could put these points on a map, these points here, even though they are at slightly different strat levels, if you were sort of grossing it, let's say, and you have a well here that didn't have sand in it all at that level, the sand recurring here, and what you'd end up with is maybe a glob of sand that comes wandering up through here, you've got to honor that point, so you can sweep east of it. Then you've got to honor these points, so you'd sweep back here, and you'd totally miss the true picture, which is the connection between these wells here and these wells down here. That channel doesn't have too many holes in it, but fortunately, it's got holes on either end of it. Fortunately this thing is tre-

mendously well controlled. If you can't establish that you'd better give up the science of geology.

You establish this thing. There is a channel up here, the famous "BV" channel and I was here during the hearings on the 21 Well and I'll tell you another sad story there. After this well was drilled here, Boling and I saw what was going on and there a dipmeter survey, probably the only good dipmeter in the whole South Empire Deep Unit, and it showed a trend up this way.

Amoco, unfortunately, moved north. We tried to get a farmout over in here and ARCO again decided they would rather do it themselves. They did and they got a well in there that has a 110 feet of sand that's solid pay. (Not understood) They drilled a second well that has 98 feet of pay and at that point we decided again that we have a location here in this area, and that was the subject of a hearing here that resulted in the drilling of the last well South Empire Deep Unit, which is the 21 Well.

But if you want to know if that channel is satisfactorily established, it is, if you look at these thicknesses and how narrow? It was missed by this well here; it was missed by this well here.

So that thing is absolutely, positively shown to trend this way, and we're going to demonstrate that this is not science fiction, this thing is trending this way, too, that particular individual channel sandstone.

That's kind of important because when you

get into this area over here and you don't have so much control, and you can't go down here, you know, wells a half a mile apart, and you have to decide, well, what is going on here.

You see, when I started this project, what I had was these wells and dry hole here and this trend (not understood) and what I had to do was project where on earth this thing was going to go out of these wells here, but we did project it up through here. We did map this this way before any holes were drilled in this thing other than the holes down in here, and then we had this discovery well here, then our piece of the pie here, and I think it proves quite well, when you see the cross sections you're looking at now, that this is for real. It comes down through here and I think this is going to be extremely conclusive here.

Q Mr. Wilson, I think you've reached a critical point in your discussion with regards to the relationship of Section 2 and Section 1. Let me ask you, can you reach a geologic opinion with reasonable certainty that these two channels are in fact separated as you have depicted them between Section 1 and Section 2?

A I think they will be. By virtue of the overall method as a delta is developed, you'll recall on the Isopach map, you know, when you get up here at the head of the delta, we are coming into this alluvial valley. Right here is where everything tends to sweep into a -- into essentially a marine situation and develop this whole series

of distributaries, which several are extremely well established.

With the amount of well control we have in here, you know, we can pretty dang well define how wide these things are. They do not cover two sections. They cover a half a section or so, and I think that's, as I say, conclusively shown up in here.

Now this one is a little different and this puzzled me a little bit because I was getting sands over in here that were obvious channel sands that were the same strat levels as here, but from all the work I've done in the Morrow, I never in all my life have seen any channel in the Morrow which was that wide, so I figured, okay, the best answer to that is probably a bifurcation here, that there really are, you know, two channels here that are related to back up in this area to a single channel. Now that's not uncommon in the delta business.

We might consider for a moment how deltas form. When you get out into a delta area, let's take this channel here for an instance, and that's the real thick one, that's 110 feet thick. This thing has probably got levees. When you get into a delta, like the old Mississippi is, and in flood stages, that's when there's only any -- the only time there's any action is when the river was flooding. The rest of the time it's carrying nice clear water down to the Gulf of Mexico, or wherever it's heading.

But if in the flood stage you have the

water coming up over this tremendously swampy area which constitutes the delta, and it goes over these levees and sooner or later if you have a big enough flood and a deep enough crevasse in that levee, it's going to say that's the easiest route to go. You got a gradient in that, it's coming off that levee which is built up as a topographic feature on the delta.

So then you will have a new one form. Now, if I wanted to relate that to what I've got up here, I would take this Two Forks channel that is definitely a little bit older and a little bit lower, than this channel is over here, and I would say we develop this thing here and then at some point up here we had this crevasse thing created in a flood and we got a gradient advantage and then we got this one developed, because there it is for sure, and so up in this area here you're going to reach a critical junction up here, where this thing, this channel originates here, it's going to come together with this channel over here, and it will in fact go out to an end here where it originally was sort of a levee up in here someplace.

Q Can you tell us where those two would come together?

A Well, of course that is what I'm trying to show here on the map. Now I have shown that this channel here, if you look carefully, is overlying this channel here, hence I carried the west edge of this channel here across this channel here. Now I don't know that this will be the

absolute truth of this thing up in here because as I explained on this breakout business, this thing is going to terminate somewhere up here, and we'll get into that a little when we go into the thickness of this channel as we go up the channel, where it might terminate up there.

But if there is some connection between this and this, it will be, you know, through -- around the horn here, you might say, going from here up in here and then back down this way. I do not anticipate one iota of connection through here or on down through here because of the way that these things are formed, and because of some pressure data, too.

Q All right, let me make sure I'm clear on the record, Mr. Wilson, that if there's any possible connection between the Two Forks channel through Section 2 and the reservoir in the channel across the Amoco property, that connection is more reasonably to occur up in Section 35?

A That's right, up in here.

Q And that it's your geologic opinion that that connection is not going to take place between Sections 1 and Sections 2 between the Amoco wells and the Costa well that you propose to drill.

A I think that's absolutely correct and I think in addition to the dealing with two separate channels, we're going to be able to show you we're also dealing with two pressure seams that coincide with those two channels.

Okay, now I'd like to go on --

Q You want to go to the cross sections?

A -- yeah, and show the cross sections, and I'd better start with A-A', I guess.

Q All right, let's put this up here.

A Is there a pointer of any kind around here?

Okay, this is A-A', which on this exhibit here, Exhibit 5, it's got four wells on it. That's the northwest end and that's the southeast end, and this ARCO "BX" No. 1, the discovery well in this Two Forks channel, is this well here.

Our Costa Resources No. 2 Well is this one and these two here are down in Section 13. There's nothing else between the well there and here.

We might look first at these two, which are, you know, just 40-acre type offsets, and here is the sand that is productive colored pink here in the ARCO "BX" Well.

Q Excuse me, Mr. Wilson.

A Yeah.

Q It's going to help us in reading the record if you will identify your wells simply by the number of the well on the cross section as opposed to saying "here". It's difficult to read.

A Okay. Okay, let me back up a little bit. I'll discuss this section a little more generally before I

get down to -- all these cross sections you're going to see have some things in common.

First off, they're on a scale of 2-1/2 inches equals 100 feet, and when you're correlating the Morrow I will take issue with anybody that tells me they can correlate it on an inch to 100 feet and really identify the units. The units are really widespread across the Morrow.

Q What was the scale you used again?

A 2-1/2 inches to 100 foot. That's the big scale and the small scale logs that most of us work with.

And the second thing, of all these sections that have been hung, is that they will all be hung on the same datum, which is the top of the Lower Morrow, what we call the "B" zone of the Morrow, and that is a easily pickable, you can pick it throughout this whole area here in the South Empire Deep Unit. By virtue of that, if you want to, you can work with the Upper Morrow or you can work with the Lower Morrow. In this instance here we're only concerned with the Lower Morrow, and to elaborate a little bit on what you might come up with, this is the picture you might come up with in the Lower Morrow, in the Upper Morrow, which is this section in here, there is another delta out here, which has confused a lot of people.

It is coming in with several distributaries from the northeast, almost at right angles to this delta here.

Q You're referring to the Upper Morrow del-

ta as coming in at right angles?

A Right, that's the Upper Morrow. I have no illustration. I have one in my briefcase but I've not drafted it up and made no illustration out of it.

But that's why in this whole area here, nearly -- I don't think there's one single beach sand well in here. Everything's in a channel of one kind or another, either in the Lower Morrow or in the Upper Morrow, those Upper Morrow wells here.

But this difference in trendology, this right angle trendology for the Upper Morrow, has created vast confusion in this business. For instance, I remember when we staked this 21 well here, even at that point in time I had one party tell me that had an interest in that thing, say, "You're crazier than the devil because that thing doesn't run northwest." There's really two channels here, one going through here with 75 feet of sand runs this way, and another one over here that goes to these "BV" wells.

Now we show with the 21 Well that that's not the case and we got 86 feet of sand.

To get back to generalities here, the top of the Morrow is here. The upper unit of the Morrow is an oolitic limestone and there's actually two units here, generally, that are separated with a shale break from the carbonates in the Atoka immediately above this.

When you reach the base of these oolitic limestones. Incidentally, these are all neutron density logs.

The base of the limes is what in the business everybody calls the top of the Morrow Clastics. Now that is our top of A Zone, the Upper Morrow, the Morrow A Zone, the Morrow B Zone.

So I pick my top of A Zone at the base of the carbonates, which is quite a consistent pick, again, throughout this whole area.

In the upper part of the A Zone -- for the A Zone there are two units. The upper unit is usually a complex of sands. The lower part of the A Zone is a shale section. Actually we call these the A sands and the A shales.

That A shale section is remarkable. You can find it over from here to Artesial from here to the Lea County line; from here south to Burton Flat; anywhere you want to track it. So it's a tremendous spread within the Morrow, and it enables you to work with both the Upper and the Lower if you want to do so. You can Isopach it, do whatever you like.

This discussion from this point out is going to be limited in large part to the Lower Morrow, because that's where this devlopment is concerned with in these two reservoirs we're concerned with.

In comparing these two wells here, which are so close together, you can see, for instance, here is the top of the B where this shale zone goes up in the A Shale, the upper part of the B Zone is another very distinc-

tive thing.

There are two units and I'll show them in red on the B-B' cross section and I will have numbered them one and two to show you they correlate all the way through the line of that section. Those things never have any porosity or permeability in this area but they are extremely consistent markers and so you can pick a face of those two units and draw a line there. Of course I'm creeping up on this thing down here, and that's as far as I'm going to creep on this section.

But you can see already with respect to this B Zone marker and this thing here, that you have a sand down here that's pretty well developed that has exactly the same stratigraphic position, and this probably where I'm going to part company with Amoco.

On that I am going to say that that is a distributary channel that is immediately west, in fact the southwesternmost distributary channel in this Lower Morrow delta complex. I am not going to say that the sand here is this sand here and I will show you why in a moment.

And I don't feel that I have to come east and go round the well in 12 to arrive down here in this channel. Now you can see that it is here and thickening off towards the south. That's another thing I want to point out here that this thing is what I initially pointed out earlier, that this sand is thinner up here in the north than it is down there.

That sand looks beautiful in the logs. It's the only good permeable sand down there in all those wells on Section 13. They made about 200-million in gas before they plugged it back to the Strawn.

The typical well down there looks like that, terrible, lots of sand but lousy porosity and permeability.

Okay, I want to go to this B-B' cross section. Better put him over here, I think.

Okay. Let's see, this will be the index map and I might point out again where this thing goes. The first two wells here are two wells in the north of our Two Forks channel. Then on the third well here and from there south, I'm going down this Amoco 6 channel here. The reason I stuck these first two wells in here was to show here's our Two Forks pay, like I showed you on A-A' cross section and here is the No. 6 Well right here. That is the No. 10 Well and it is clearly obvious that this sand here is stratigraphically higher than this sand is over here and they are very close together.

On that scale that might be two feet apart at the bottom.

Then, as you go south, again we see the same phenomena we saw in the A-A' cross section. As we go down the channel toward the sea, you can see this thickening of this channel.

The reason the No. 10 Well in the north

half of Section 2 didn't make a well in this No. 6 channel was that it was too thin or too tight. It was tested there and pressures weren't really all that bad. You've got about 3400 pounds of pressure but very little gas, so a completion was not attempted there in that well. It was completed up here in this A Zone sand.

But on the other hand, the No. 6 Well has a real beautiful porosity development in this particular reservoir and if you go down to the Amoco whatever it is, No. 16 Well, anyhow, this No. 16 Well, which is in Section 7, that is that well right there. That thing flowed 22-million cubic feet of gas a day and obviously has tremendous porosity and permeability.

HEYCO offset the well, well outside the unit, standard location, which is this well here, Number Six, and you can see here that looks kind of sick compared to this well of Amoco's in the north part of the section. It shows you how swiftly things can change in the Morrow, among other things.

There are other wells completed as gas wells as we go on south. For instance, this well here, I think all except the last three, yeah, this one here is the last well as we go south in that particular channel. Now the gas wells I've shown in red, those are completed in the -- in this pink distributary channel sand.

Down here where it's water bearing I've colored the wells light blue. That's unfortunate. It's a

beautiful sand down there and it's got lots of thickness and pretty fair porosity and we run into water, but --

Now let's think, and I'll color it up a little better, again to show you the Morrow wasn't made by the devil. The Morrow can be correlated and as for instance, this dark brown color up here is Upper Morrow oolitic limestone again and those units are somewhat set apart by shaley breaks on top.

Above that, if you need a reference point, is this shale break here up in the Atoka, that you can carry down through there beautifully. Again, the base of the dark brown color here and the beginning of this green color generally is the break which is the top of the Morrow Clastics, or the top of the A Zone. The sands in the A Zone in this case we colored green, just to bring them out. Probably should have done it on A-A' but I ran out of time.

And underneath that are colored brown here is this A Zone shale, which you can carry nearly forever, from here to Carlsbad, for instance, or over to the Lea County line, wherever you happen to want to go until you finally reach a point of Dayton Field, north of here somewhere where you're finally going to get beaches there. That's probably an oolitic shale section, offshore shale section.

Now, the other thing that this section shows beautifully is in the upper part of the Lower Morrow the two units I have colored red here. Those are the same

two units that I mentioned on cross section A-A' where they are tight, silty, never porous and permeable type sandstones, that have tremendous correlation over wide areas.

Immediately under those things, and I numbered them 1, 2, here, a little shale break between them, immediately underneath those is a little -- my color, I forgot to color it here, but it's a little blue beach sandstone and it's about half, less than 10 feet thick, has all the characteristics of a beach; has a coarsening upper character, or rather widespread thing that runs from here, excuse me, from here on south to about here. We run out of it here where that channel thickens up so much down south.

Now we have correlative units in the upper part of the Lower Morrow where we have finally arrived at the very top of this No. 6 sandstone. So I don't think there's any shadow of doubt about the correlation of that No. 6 sandstone from here on south as far as the channel goes. That's clearly something that is beautiful in my mind as far as correlation is concerned.

Therefore I don't have any difficulty in mapping the No. 6 channel sandstone. There it is, and it, of course, if I wanted to show a complete picture, I'd show you cross sections coming across here and it's kind of like dealing with the IRS, if anybody got into that I might have to haul out all those well logs and show you it's not in these wells here.

But I can assure you that I have looked

at all these wells here, as I have looked at this No. 12 Well, and there is no No. 6 channel sandstone here. I did mention that there is one over here, which I think is the second branch of the system here.

That distance there, I think, is rather critical to what we're talking about, also, because we're going to endeavor to prove on pressures, as well, that we have two distinct reservoirs here, and we are not generalizing anything; we are going to show in detail the correlation of these particular reservoir sands and we are offering you an explanation of how they got there.

This is the last illustration, C-C'. Okay, I know you'll be happy to hear this is the last illustration.

This one is designed to connect the other two. Okay, this is the southwest end and this is the same well that I have here on this section here. It's the only pretty sand in that area so I keep using it.

Again, the same color code I have on here; the oolitic limes up here, the A Sands, A Shales, and so on, and then these upper two units in the Lower Morrow that correlate so widely through this area, and the blue sand, again, but I think it is fairly evident here, again, that in the Amoco 6 Well in Section 1, that that sand is higher stratigraphically than this sand is over here in our Two Forks channel, and we're dealing with two individual distributary channels, that with the Two Forks being older,

the first, being lower in the section than this Amoco 6 channel to the east, and also here's this well in the northeast part of 12 which lies between these two distributary channels that does not tap either one of the channels. And that was the second most important reason for making this cross section, and if we draw a logical picture here, a logical delta picture, then we have got to project this thing up here, kind of a wedge-shaped thing, between these two distributaries, because in modern deltas that's the way life is.

I say that you cannot draw a map of anything until you have some notion about how it got there, what its origin is; that mechanical mapping is not adequate to explain what is going on in this system. It is not adequate to develop the system on.

Now you can be awful lucky in the South Empire Deep Unit, given the fact that you have this delta here, with still another delta coming in from the northeast, it's awfully difficult to drill dry holes. I don't care if you don't use any science at all, but given that state of affairs, it's also equally easy to drill an awful lot of good gas wells, even if you're just drilling on a random basis.

But I never preferred to play this game that way. I think that if you're an independent prospecting, if you're going to stay alive, you'd better come up with some awful specific prospects that occasionally will

work out, and so we get down to the business of trying to interpret the environments of deposition and relate the sands development to our interpretation of the environments and we can anticipate that how are these things going to behave; what are the lateral boundaries going to be like; what will determine it, is determination going to be like? Are they going to thicken this way or that way?

Which brings me to a point I want to discuss a little more carefully on this cross section here.

When you look at Section 1 here, at the moment the south half of Section 1 is dedicated to this unorthodox well site that Amoco drilled over here, 1315 feet from the south and east lines. This well in the north half no longer produces from the Morrow. The north half of Section 12 is wide open as a spacing unit to drill a Morrow well in and you could, you know, you could do a lot of things with it. Let's look at some of the possibilities.

Let's look at that well on the cross section here. Now there is the well in the south half of the section, which is a good producing well. It's thicker, it's quite clean, good porosity development, and it's made over 2-billion cubic feet of gas.

It's thinner here going from there to there, it's thinner, and was tested, had, you know, some gas in the pit, no gas to surface, but they had initial shut-in of 3498, final, 3422. There's some kind of reservoir that's so danged tight that they didn't get gas to the surface.

If you were to drill a well, as for instance, in the north half, I am saying this: Number one, you are going to get into this reservoir here, if you get into any at all.

If you drill it 1980 from the west and 660 from the north, it's very likely you're going to get one like that one.

If you come over here to the west, I can't say, but maybe along this west side here you'll get a little thicker and you might even get a well in there.

But I will dang sure say this: In the middle of 1982 Amoco ran a bottom hole pressure on that well and it was down to 1397 pounds. I --

Q What was that, 13 what?

A 1287.

Q In what year, '80?

A '82.

Q That's on the No. 6 Well?

A Yeah, right.

Now I'm getting over into the engineer's territory and I don't want to go on with this, but I will point this out; that over in our channel here, we're talking about pressures on the order of, what, 31-3200 pounds. We're going to look at that a little more carefully.

We are saying that in addition to showing that we have two different reservoirs here, we are saying also the pressure data supports that interpretation.

Now, in conclusion, I will say again that as far as this thing is concerned, this is of very little concern to Amoco.

Q This South Forks channel reservoir.

A The Two Forks channel reservoir --

Q I'm sorry.

A -- because only 73 acres, we think, is on Amoco acreage in the South Empire Deep Unit. They have a third interest in the unit.

And we feel that we're sort of possessive, you might say, we had the idea, we mapped it, we caused the wells to be drilled. We feel almost entitled to exploit this thing, but that doesn't cut any mustard. We know that the biggest part of the thing is really in our territory, or somebody else's territory down in here, and we will probably hear from them in short order if we drill this well, but I think further I've found a drillsite in the middle, and even though I love science, I would prefer to just almost draw a straight line from this No. 2 location down to this best well with the porosity down here, and put myself along that line somewhere, rather than, as they might advocate, extending myself, taking undue risks, and moving out there 1980 feet from that east line. If I wanted to die for sure, I'd probably do this, but I prefer to live, and so as a prudent operator, we do feel that coming south we're drilling a proof of sand thickness.

Now, offsetting that notion and something

that does give us pause is the idea that it's tight down here, and we know if we come down here too far we'll run into tight somewhere down there, or we could run into a reservoir in here between the tight here and what we've got up here.

But we feel like that we have to take our best shot at getting the best reservoir adjacent to produce the gas which we regard as largely in our Two Forks channel over here and we don't want to be too deterred by this 73 acres over here. I have offered, as a matter of fact, and have shown these maps previously, to compromise here a no protest type of arrangement, we can do this, as between us and Amoco. I've agreed to furnish pressure data and whatever data we have; try to be a good fellow, I thought, but we have not been able to reach any agreement on this subject of compromise, so we are here telling our story and that's it.

Q Just in conclusion, Mr. Wilson, do you see any adverse consequences to Amoco's correlative rights if the Costa Resources location is approved as you propose?

A I really don't see any. I don't see how we can drill the south half because that's already dedicated to a well. Now you might dual dedicate but if you do so, you are subject to a possible penalty and we'll dang sure say something.

If you're going to drill the north half, I realize that you have a different set of maps and you have

a different reason and everybody uses his own geologist, but I will say this, if you drill in the north half, in my mind there's just no prayer that you're going to get into our channel over here. What you're going to get into is this No. 6 channel here, which already has a reservoir pressure depleted down to, well, somewhere in the neighborhood of 1400 pounds, 1397.

Okay, that's really all I have to say but if you drill in the north half and dedicate that, I don't see where our Two Forks channel has any relationship to that particular action.

Q All right, sir, thank you very much.

MR. KELLAHIN: If the Examiner please, we move at this time for the introduction of Costa Resources Exhibits One through Eight.

MR. QUINTANA: We will admit Exhibits One through Five.

MR. KELLAHIN: It's One through Eight.

MR. QUINTANA: Excuse me, One through Eight will be admitted.

Let's take a break for about twenty minutes.

(Thereupon a recess was taken.)

MR. QUINTANA: Mr. Carr.

CROSS EXAMINATION

BY MR. CARR:

Q Mr. Wilson, if we go to your Exhibit Number One, it shows the location of your proposed well.

A Yes, sir.

Q What are the standard spacing requirements in the Morrow for a well in the south half of Section 2?

A We could drill, according to the rules, probably 1980 from the east, 660 from the south; 1980 from the east, 660 from the north; 1980 from the west, 660 from the north or the south.

Q And you are two-thirds too close to the east line of the south half of Section 2.

A Okay.

Q Is that right?

A That's it.

Q Now if I look at your Exhibit Number Two, this shows the topographic conditions but the real reason, if I understand your testimony, for locating the well where you propose it, is your geological interpretation.

A I believe I'd better clarify that on Exhibit Two. What I meant to say there was that we would have gone further north with the location to 1980, say, from the south, or even 2310 from the south, or probably 1980 from the south, if the roads and pipelines hadn't gotten in the

way. I don't think it makes a great deal of difference.

Q Your reason for being 660 off the east end of that section is based on your geological interpretation.

A That's correct.

Q Not topographic. Now if we look at your Exhibit Number Five and we focus on the channel in which you propose to locate this -- this well, if I understood your testimony correctly, you testified that you had drawn a straight line from the No. 2 Well in Section 2 to the Yates well, I believe it's a Yates well down in Section --

A HEYCO.

Q HEYCO well in Section 13.

A Right.

Q If prior to the time you had drilled the No. 2 Well defining the channel you would have drawn a straight line from the ARCO well in Section 35 to that HEYCO well, would you not?

A I'm not so sure I would have.

Q As you get additional data from each new well, don't you reevaluate your interpretation?

A Being an average geologist, yes.

Q Being an average geologist? I didn't know you would admit that.

And when you drill the well in Section Number Two, the data you get from that may affect your interpretation of the location of that channel, as well.

A It's -- yeah, I would consider the new data point.

Q We're talking about the Morrow formation here and I think you've testified that --

A Certain parts of the Morrow formation.

Q We're talking about certain --

A I was very specific about that.

Q We're talking about certain portions of the Morrow formation and in this portion that we're talking about, the -- the zones can change in very short distances.

A In what sense do you mean that?

Q I mean if you look at your B-B', I believe you testified that over a very short -- things can swiftly change over very short distances.

A That's correct. If you mean in terms of porosity and permeability.

Q And producing capability.

A Yes.

Q And that it's essential that you hit these sands if you're going to make a -- with porosity in them, if you're going to make a commercial well.

A As a matter of fact, because they do change this -- in short distances, that behooves us to take the best of all possible shots to take into account that it might change.

Q And for that very reason you've testified that it's easy to miss one of these channels and therefore

you have to go to the optimum location.

A I've missed a few in my time.

Q And so consequently, even with the best interpretation you can be wrong.

A I have been wrong.

Q And you wouldn't rule that out in the future, I assume.

The point being that it is an interpretation based on your study of the area.

A That's absolutely correct.

Q And as you get additional data you may revise your interpretation.

A It would depend on what degree you're speaking about.

Q But you --

A If I saw something radically different of course I'd change it, but I would point out also this, as far as the Two Fork channel is concerned. You've got to realize than when we proposed this first Two Forks unit to include Section 35 and Section 2, with the location that ARCO drilled, we did not have any points up there. Our projection in that instance was based upon what we saw down in Section 13 and Section 12 and the knowledge that we had a distributary that was connected into this radiating pattern of distributaries, it would have a certain parallelism with the Amoco 6 channel, but also would tend to focus in to the mouth of this valley up here.

That's what we were going on when we proposed the unit.

Q You had no control point between the data you have from your Costa No. 2 Well in Section 2 down to the HEYCO well in that channel.

A That's right.

Q And when you drill the new well you may get data which will cause you to reevaluate your interpretation.

A Well, yeah, to a degree. I mean I don't --

Q It depends on, I know, what you get, but it depending on what you get --

A -- say that I can predict how many feet of porosity we're going to get.

Q I'm not asking you to do that. I'm asking you to say, tell me whether or not you might get data from the proposed well that would cause you to reevaluate your interpretation.

A I'd be surprised.

Q But that is possible.

A Well, I'll give it a five percent chance.

Q And if you got that five percent chance it could mean that you would move that channel either to the east or to the west somewhat.

A It will depend on the thickness that we got and I would think a good while before I moved it.

Q But you feel then very confident of the location of the channel.

A Fairly confident, yes.

Q But you would be unwilling to move to a standard location.

A That is correct.

Q And if you were called upon to reevaluate the location of that channel, that could affect the number of acres in the south half of Section 1 that would be productive in that channel.

A That's possible. All we know is what we know at the moment.

But let me say this in further answer to it. How do we know how wide it is, for instance? The width of this thing is determined largely by this pattern of wells down in 13, which is the only way we can really estimate its width, and then the direction of the thing is a function of its absence in the northeast part of 12, plus this, you know, large share of parallelism with this Amoco 6 channel, but bearing in mind we've got to focus into this head of the delta area to the north.

Q Is it your testimony, then, that you don't know exactly the width of the channel?

A Well, I would say down in Section 13 that we have a very good notion of the width of the channel.

Q What about in Section 2?

A I don't anticipate in view of -- you

know, you can look at the other channels here where we have control, that you're going to see a major change in the width of the channel as you go northward.

Q So you believe this is the width of the channel, best opinion?

A It's my best estimation, done in the most scientific manner available, I might add that.

Q Now there have been a number of misses, or several misses over in the, well, to the -- to the north and east of the proposed location. I'm talking about two wells that seem to fall right between a couple of channels that you talked about in your earlier interpretation, your discussion.

I can't tell from the map the numbers of the sections, I'm sorry. It looks like one is in Section 36.

A Oh, okay. It might help you, you know, it's a four corners area there. If you point to them on the map I can identify them.

Q I'm talking about the well in Section 36.

A Okay.

Q As the well between two channels. I believe that was one of the near misses that you were talking about?

A Yeah, that's right.

Q And also directly to the northeast of that.

A Right.

Q When those wells were drilled there was more control in that area than what you have down in your proposed location.

A No, I think that you probably don't quite realize the sequence of the wells --

Q Uh-huh.

A -- in that. The first well to find the BV channel was the No. 5 South Empire Deep Unit, which is in the north half of Section 31. Are you with me?

Q Yes.

A Okay. And then subsequent to the drilling of that well, the next well that was drilled, as I recall now, was the one up there just to the north, which is shown as a circle with a dark dot in the middle of it, just east of the gas well there. Can you find that one?

Q Yes.

A Okay. Then HEYCO came in and they drilled the well which is immediately west there, which is a gas well, which incidentally is in the Upper Morrow, not the Lower Morrow.

Sometime later, then, ARCO came over and drilled their well in the southeast part of Section 25 in the township to the west, which is the one that had 110 feet of sand.

I might point out we have gas/water contact in that one in the north half of 31, and we knew,

everybody knew that it had to go up dip, and the dipmeter data said go northwest and as I pointed out, we probably went to northerly with the next drillsite.

But you're quite correct, you know, those two wells that are in the south half of 30 that were drilled showed no evidence of that 110 foot -- or 75 foot, the 110 foot channel.

Q Moving the channel just slightly might have changed that.

A Well, you can see how close it is.

Q Now, you --

A You know, that's the nature of these channels. I might, you know, discuss that a little bit.

When you're talking about a meander belt sand, for instance, I won't necessarily say that this is but it has some of the characteristics, if you want (not understood) of meander belt sand, deposited by meander movement, you've got to envision that that river is in motion, that those meander loops are moving downstream, and they're moving laterally, also, and what the tendency is is to -- everything. If you drew tangents to the meander loops, that whole area between those tangents would be mined out and would be almost entirely sand except for certain clay facies, they're last stage channel, that sort of thing.

In the case of a meander belt sand you're dealing, when you get out to the edge of it, with an erosional edge as well as an erosional bottom. If you've ever

stood on the cut bank of a stream in a meander loop, you can spit over there where the sand is and where you are there is no sand, at least at that point in time, let's say it's abandoned in that point in time. In other words, the boundary of that thing is going to be essentially a vertical wall, could even have some overhang.

So you don't expect that when you get close you're going to get a piece of it. Now beach sands you do, because they interfinger. But in these things, boy, I'm not absolutely sure of the meander belt interpretation here but I am quite sure that when you're near it, you still don't see anything of it.

Q Now a number of these sand stringers which you mapped run virtually straight. There are some, however, that bend, is that not true, particularly the westernmost --

A Yeah, usually there's a minimum of bend in these things in deltas. In the Mississippi delta they don't bend very much, and the Rio Grande, it's a different type of delta, if we were going to talk about deltas here, but it's a -- it's a delta where the streams meander right out to the coastline and there are some of those branches there that are parallel to the beaches, for instance, so you've got to watch or just on trend you could call that a beach sand, but it has entirely different characteristics and log responses. Those would be coursing downward, would have a very sharp basal contact, because it's an erosional

contact. It's cutting into previously existing material.

Q If we looked at the westernmost sand stringer coming down off the main channel, is --

A Which one?

Q I'm talking about the west --

A Oh, the AB? Well, yeah, that's my -- sorry about that.

Q Is that the AB?

A We call it the AB channel.

Q The AB, the westernmost one coming off the main channel, coming down in a southeasterly direction, that has got a curl to it. You have substantially more control in that area for mapping that than you do for the proposed sand stringer, do you not?

A Yeah. Noboy's ever found that channel yet. That gives you an idea, incidentally, if you want to talk about risk, ask those fellows that drilled that circle of wells around that one.

Q It really establishes that you don't know what you'll get until you've drilled it, isn't that true?

A Well, now I'm not that cynical. No, I -- I really firmly believe that -- that this channel here is well defined. I think that you do have this connection between the wells up in 2 and 35 and the wells in 13. I believed it before those wells were drilled. Now that I have those control points, I believe it even more.

Q Now you've talked about wells, I believe

one in Section 36 of 17, 28, with which I believe you stated that you encountered 86 feet of sand.

A Right.

Q Is that all in the Lower Morrow that we're talking about?

A Yes.

Q What about the well you talked about just north of that well in which you had 110 feet of sand, was that all in the --

A It's the same sand.

Q That's the same sand and it's all in the Lower Morrow, the zone we're talking about?

To go over to the east and we're talking now about the --

A Well, the north half of 31?

Q Let me get the number of the section, we're talking about Section 31.

A Okay.

Q There appears to be a well in there in which you've indicated 75 feet of sand.

A Right, that's the --

Q Is that all --

A -- first well drilled in that particular channel.

Q -- just in the Lower, too?

A Yes. I mean it's perfect correlation as well as back to the northwest.

Q And do they also -- do they have any other sand stringers that are in the Morrow in those wells?

A I don't know that I can answer your question. I know that one or two of them do have sands in the Upper but I don't know the details.

Q Have you mapped any of the other Morrow zones in this area?

A Yeah, sure have, like the Upper.

Q And are there wells that are capable of producing from that Upper zone?

A Yes.

Q Did the Amoco well in the north half of Section 2 produce in fact from that Upper zone, that Upper Morrow zone?

A The north half of Section 2, you mean our Costa well?

Q I'm sorry, I mean -- I'm sorry, I mean the north half of Section 1, offsetting your proposed location to the east.

A Oh, as a matter of fact it sure did, about 40-million a day. That was the discovery well.

Q Now, if I look at your cross section B-B', and I look at the fourth well, I believe it is, on the cross section.

A Number four, right.

Q That's the Amoco South Deep No. 6 in the south half of Section 1.

A Okay.

Q And if I read this correctly, the pink area shaded on that is the sand body --

A Yeah, that's the Amoco 6 channel.

Q And the red to the right of that shows porosity.

A Yeah, it's just a spread between the density curve and the neutron curve.

Q And I believe you have indicated the perforations on that well.

A Yes.

Q On that log. They extend down below what you have shaded as pink --

A That's right.

Q -- in the sand body. Why have you excluded the lower 25 feet of the sand body on that log?

A Because that's a different sand.

Q Now I don't have any scale here that I can use, but --

A There's a break between them.

Q Can you tell whether or not that lower sand is producing or not?

A It may be producing some, yes.

Q And it would correlate, then, across to your -- your Costa Resources No. 1 Well.

A I don't believe that.

Q Well --

A Because I think this sand area has different characteristics. You notice, for instance, the cleaner part of the sand goes to the gamma ray curve in the upper part and it varies as you go down, and those are normally accepted indications of the beach sand rather than the channel sand, and you can also see from up here at, well, the 1, in the north half of 1, that that sand is thinning, and I show it going off here as a swallow tail, indicating that it is a beachy type of sand rather than this boxy shape which indicates a wall for these channel sands by the way it goes up.

In other words, this thing would be expected to interfinger where this would not.

Q Do you know whether or not these sands are in communication?

A I do not believe they're in communication.

Q Do you have anything that would establish that?

A I believe that we will be able to establish that in engineering testimony.

Q So you are intending to call an additional witness.

A Very likely.

Q And your interpretation also has discounted the lower sand in the third well on that log as a separate sand body.

A This one here, yeah, I think sand is --

Q So above the shale break there is a separate sand stringer, in your opinion.

A Yes. This one here is a distinct one. If you want to go ahead and look closer --

Q No, I think I --

A -- you can see the break there.

Q Is there a shale break, a similar shale break in the --

A Yes.

Q -- No. 1 Well?

A It's not thick. I'd say it's in the order of two feet but there is a very distinct break there.

You can also -- you can see this character from here, where you see sort of a brown shape of this here, and then beneath that break, as I pointed out, you have the cleaner face of the sand in the upper part and then it varies on down, which is normally an indication of the regressive type of beach sand (not understood).

Q You have a similar shale break in the first well on the cross section?

A Here?

Q Yes.

A No, I don't have. That's a far thicker shale break there that I did not correlate with that two foot break over there.

Q And again you have not included the lower

portion of the sand body as productive sand?

A This here?

Q On the number one well, the first well on the log -- excuse me, I mean the cross section, first well.

A Oh, yeah, that there. You know, that's interesting. Let's consider that for just a minute.

When we first made this projection up here, anyway, okay, this is the well that was considered before we drilled our well. It's the "BX" No. 1, and you see at that point in time the only other wells I had that would have penetrated the thicker channel were down here in the south, and after this well was drilled I said, sure enough, I said this thing here looks the whole -- this sand body runs here down to here, you see, and then we drilled our well here, and we got the thinner sand in here and then I looked back over to the sand body here and I decided at that point, a judgment thing, that the upper part here which was cleaner, the upper 20 feet then, was the portion that would correlate with our sand that we'd gotten in our Two Forks well, and that the sand underneath was, you know, another sand body where this channel was tapped cutting into it, and again it has beach characteristics.

So I think there are really two sand bodies there but they are in contact.

Q Could we go back to your Exhibit Number Five for a minute? It is your recommendation that the well location be approved without a penalty.

A Yes, that's what we recommend.

Q And you would agree that the well at the proposed location would drain reserves from that area shaded in pink in the southwest quarter of Section 1.

A There is a possibility, yes.

Q Do you know of any way that that drainage could be protected against by Amoco absent the drilling of another well over there?

A I think they need to drill another well over there if they want to protect it and we've tried to reach such an agreement with Amoco.

Q And you indicated you would protest the drilling of another well over there, did you not?

A No, I did not, as a matter of fact. I flew down to Houston. I presented all this data, opened everything up, geology, pressure data, everything. I said let us agree that this will be mutually beneficial. It's not all bad. If we make a well there it was for them to have a shot here and I said 660 out of the corner. eliminate all the risk we took, and drill a hole there, and we'll open up any data we've got.

The other aspect of it is that they already have the south half of that in a spacing unit with an unorthodox site there, by the way, 1315 out of the corner.

Q Is that crowding you?

A No. And this acreage was dedicated to that well.

The north half was open and we discussed various alternatives.

I said, well, now for instance, you could drill in the north half, now I don't recommend that based on what I know, or you could dedicate the west half. If you dedicated the west half it would call for a dual dedication of at least half of it, and therefore you'd have to have a hearing, therefore you'd be subject to a protest, so you know, we could agree on this.

Some discussion was had of re-orienting the spacing unit for this well in the southeast part, dedicating the east half rather than the south half, thereby opening up the west half and doing it that way. I said, I have no objection, we just need to reach an agreement about our drillsite over here.

But I really just can't believe -- I don't know what they're going to drill. I'd like to hear about where their location is at some point here.

Q I want to be sure I understand your testimony. You didn't reach an agreement, did you?

A No.

Q And two, did you testify whether -- that you would protest an unorthodox location in the southwest quarter?

A I would say that there would be a good possibility of that.

Q And you'd seek a penalty, wouldn't you?

A Well, let's look at it this way. Here's 73 acres and that's 17 percent of the pay in these two sections here. What kind of penalty would I ask for if I wanted to get something that was in proportion to the amount of pay that we see in Section 1?

I mean with 73 acres there, which is what the 17 percent -- no, some part of the spacing out here, that's pretty lean.

Q And that would be, the 17 percent would assume that this interpretation is correct and you know the number of acres under the south half that would contribute to --

A Yeah, that's right, this is our best interpretation.

Q And your interpretation, the only control you have that actually establishes the separation is that -- that dry hole that's drilled in Section 2.

A No, there's more than that, as I said earlier. You don't draw any map without prejudice. I think most geologists know that. That it is an interpretation. It's based upon the concept of this being a delta and therefore when you say delta, you think certain things in terms of the geology of the sands, and as between the distributaries you do conceive of a shape that that is going to have, and we think we've defined this distributary. We think that this one is quite well defined down here and we think we know we have further definition up here, and that

they're dang sure of those sands in that well. So we're going to define the shape of that thing there.

Q And in defining the shape based on that dry hole in your study --

A Yeah.

Q -- you concluded the separation traverses Section 2 --

A Right.

Q -- Section 1 --

A Right.

Q -- the corner of Section --

A 13.

Q -- 13, and extends into, actually, 35 to the north.

A Yeah, you could put it up there. I mean that's based on the trend of this channel versus the trend of this channel, gives you the definition with this absence here and the absence of this channel here in these wells, all that area of absence between those two, and, I mean, that's really defined by the convergence you can see here between these two.

Q Now, Mr. Wilson, you stated that you thought the productive acreage in the channel in the south half of Section 1 was of little concern to Amoco, you were not speaking for Amoco, of course.

A (Not understood.)

Q Were you speaking for Amoco?

A I will not speak for Amoco.

Q And you indicated, I believe your words were that you were entitled to exploit this portion of the channel.

A Well, I will say this, that I regard it as not a significant amount of acreage, I will say that, in comparison to the whole of it, or in comparison to the amount of acres in Section 2, which we do control, and I don't look at it as a real significant thing.

Q But it is significant --

A I mean I don't think it's significant enough if this picture is correct. there's not a lot of acres you can dedicate to a well in the southwest quarter, and we were at one point willing to reach an agreement along those lines.

Q Would you believe you would be able to produce that -- those reserves without any penalty being imposed by virtue of the unorthodox location?

A I'm not going to say what I believe. I will simply state the truth, that if this well is drilled here, it's rather obvious that it can drain part of those reserves.

Q Is it the truth that you're asking for the well location to be approved with no penalty?

A I am.

Q Thank you.

MR. CARR: I have no further

questions.

REDIRECT EXAMINATION

BY MR. KELLAHIN:

Q Mr. Wilson, let me ask you one question on redirect, sir.

A Okay.

Q Do you have an opinion as to whether or not waste as defined by the statute will occur if the unorthodox location requested by Costa Resources is not approved or is approved with a significant penalty? What are the consequences in terms of the waste propositioin?

A Well, I would think this, that in order to adequately drain the reservoir, we need to drill it in the position where we have the best porosity and permeability, and first off, we have to encounter it, and we feel that our best chance to encounter the sand and encounter it in the best position, best reservoir conditions is at this drill site.

Q If the well is not drilled as you proposed, will there be gas left in the Two Forks channel reservoir that will not be produced?

A I think that is correct, that if we get out on the outer edges of it, say, and do not get as good a reservoir development or missed it entirely, we certainly are not going to do much production.

Q Based upon the geology and your study,

Mr. Wilson, with or without the Costa Resources well in Section 2, is Amoco going to be able to produce the Two Forks reservoir with either one or both of this wells that are located in the east half of Section 1?

A I don't believe that they can with the wells that currently exist.

Q So regardless of whether or not a well is drilled in a standard or an unorthodox location by Costa Resources in Section 2, that if Amoco wants a share of this Two Forks reservoir, they're going to have to drill another well in their section.

A I agree with that.

Q All right.

A And I will go further. I do not think that they can drill in the north half and achieve this purpose. I believe it will have to be drilled in the southwest corner of Section 1 if they want to get their gas in this reservoir in that 73 acres.

Q Thank you very much.

MR. KELLAHIN: Nothing further.

MR. CARR: May I ask a question?

RECROSS EXAMINATION

BY MR. CARR:

Q Your statement that the gas in the southwest quarter of Section 1 could not be produced with any

existing well in the unit is dependent upon your interpretation that that separation exists.

A That is absolutely correct.

Q And if that should be wrong, then that would not be the case.

A Well, I think we're going to present some pressure data that will support what we have seen to date on the geology.

Q But my question is, if that interpretation is not correct, then that statement would also be incorrect, that there was no way to produce it.

A Well, I perceive that that statement is not based on the facts and the truth as I know it.

Q But now you're an expert in -- expert witness in geology and I'm asking you to assume that the separation isn't there, and if that is the case, then your testimony would have to be different about the ability to produced the southwest corner of that section. Is that not true?

A Given that set of circumstances, but I don't believe that for one minute.

Q That's all I asked.

MR. CARR: No further questions.

MR. QUINTANA: Mr. Kellahin, do you plan to have another witness?

MR. KELLAHIN: Not at this time,

Mr. Quintana. We rest our direct case.

MR. QUINTANA: What do you want to do, Mr. Carr? Do you have a witness to --

MR. CARR: Yes, we'll present Mr. Scheffler and then also want it understood we will reserve the right to recall him for rebuttal testimony.

MR. QUINTANA: You may proceed.

STEVE SCHEFFLER,

being called as a witness and being duly sworn upon his oath, testified as follows, to-wit:

DIRECT EXAMINATION

BY MR. CARR:

Q Will you state your full name and place of residence?

A My name is Steve Scheffler. I reside in Houston, Texas.

Q By whom are you employed?

A Amoco Production Company.

Q And in what capacity?

A I'm employed as a Staff -- Senior Staff Petroleum Engineer in our Houston Region Office and I'm currently working in the Regulatory Affairs Group as a Proration Engineer.

Q Have you previously testified before this Commission or one of its examiners and had your credentials

as a petroleum engineer accepted and made a matter of record?

A Yes, sir.

Q Are you familiar with the application filed in this case by Costa Resources?

A Yes, sir.

Q Are you familiar with the subject area?

A Yes, sir.

Q Are you familiar with Amoco's interest in that area?

A Yes.

MR. CARR: We tender Mr. Scheffler as an expert witness in petroleum engineering.

MR. QUINTANA: Mr. Scheffler is accepted as an expert witness.

Q Mr. Scheffler, briefly state what Amoco seeks in this hearing.

A Amoco is requesting in this hearing that the application made by Costa to drill their Two Forks State No. 2 Well at the unorthodox location 660 feet offset the Empire South Deep Unit boundary be denied; that it be -- that the well ultimately be drilled, if it is to be drilled, at an orthodox location, 1980 feet off of the east line of Section 2, in Township 18 South, Range 28 East.

In the alternative, is the well is to be allowed to be drilled at a 660 location, we are requesting that an allowable limitation factor be applied to the well's

ability to deliver gas into the pipeline. This factor would be based upon precedent-setting calculations that have been used in the past that are determined by acreage encroachment and distance from an orthodox location.

Q Have you prepared certain exhibits for introduction in this case?

A Yes, sir.

Q Would you refer to what's been marked Amoco Exhibit Number One, identify this and review it for Mr. Quintana?

A Exhibit Number One is simply a location plat I have prepared. I have identified by the yellow outline the area of the Empire South Deep Unit that is operated by Amoco. I've noted on this exhibit the location of Costa's proposed unorthodox location, which I stated earlier is located some 660 feet at the proposed location from the east line of Section 2, and 1600 feet from the south line of Section 2, at Township 18 South, Range 28 East.

I've also noted within the unit boundary Amoco's offsets, Empire South Deep Unit No. 6. It's denoted by the red dot. This well is located in Section 1 of Township 18 South, Range 28 East, and it is some 1315 feet from the east line of Section 1 and 1315 feet from the south line of said section.

Q Mr. Scheffler, have special pool rules been promulgated for the Morrow in this area?

A The pool rules for the Morrow are under

statewide, dictated by statewide rules.

Q And what location requirements would apply to the proposed Costa well in Section 2?

A Relative to the south half proration unit the most immediate orthodox location would be one located 1980 feet from the east line of Section 2 and a minimum distance from the south line would be 660 feet of the same section.

Q And how much too close are they?

A They're approximately 1320 feet to the east of an orthodox location, or some 67 percent.

Q Would you now refer to what you've -- what has been marked as Amoco Exhibit Number Two and identify this, please?

A Our Exhibit Number Two, Amoco's Exhibit Number Two is a stratigraphic log cross section that has been prepared. The wells that are included on this cross section, the names are indicated above the tops of the porosity logs that are hung.

I would note that these logs are hung on a common shale marker that is used as the datum. I've indicated on this cross section some completion dates and also some initial potential information that existed for the wells upon completion in the scout ticket information.

Q Was this cross section prepared under your direction and supervision?

A Yes, sir.

Q Did you select the wells on the cross section?

A Yes, sir.

Q Have you reviewed it?

A Yes, sir.

Q Are there certain matters on this cross section which need to be corrected?

A Yes, sir, there is some information that I would like to correct.

With regards to the cumulative production information and the, what is indicated to be the -- as "LR", which is last reported production on a daily basis, I would like to note that the cum shown under the State "BX" No. 1 Well, that is the ARCO oil and gas well which is the first well on the cross section, reads correctly. I would like to note that that is through March of 1984, that cumulative indicated.

I would like to correct the last report shown there, the rate that is indicated should read 1.6 million cubic feet of gas per day and 15 barrels condensate per day. This is an average daily rate that existed during the month of March, 1984.

Also, I would like to make the same sort of corrections for Amoco's South Empire Deep Unit No. 6, to state that the cumulative -- cum production shown in there is through March of 1984 and that the rate that is shown would be 1.04 million cubic feet of gas per day and 10 bar

rels of condensate for the month of March of 1984.

Q Is three also an index map on this exhibit?

A Yes, sir, I have -- we have inserted here an index map. The purpose of this map is to identify the location of various wells, which are identified by circles, that were used to build or construct a clean sand Isopach for the, what we're going to call Middle Sand in the Morrow Clastics formation, the sand of interest today.

I have indicated on this cross section the line of cross section that occurs. I have indicated also with the two red dots that are shown in Section 2 of Township 17 South, Range 28 East, I'm sorry, 18 South, Township 18 South, Range 28 East, the unorthodox location, which would be the red dot nearest the easternmost section line of Section 2, and the orthodox location adjusted to some 1320 feet to the west.

I would like to point out that the orthodox location that is noted there falls on a 10-foot clean sand Isopach line, that this compares with a 13-foot sand interval that was considered to be clean in the most recently completed Costa Two Forks Well No. 1.

The orthodox -- unorthodox location, according to this Isopach, would encounter something between 10 and 20 feet of sand, approximately, 15 feet of sand.

Q Would you now go to the cross section portion of this exhibit and review that?

A The purpose of this cross section is to identify, first of all, the presence of a common sand we believe to be the Middle, what we're going to call the Middle Morrow Sand, in each of the wells that I have hung on the section.

I've identified that sand by coloring it yellow. I've noted there with a common correlation line across the top of that sand interval the top of the sand interval.

I would like to point out that there is indicated porosity in each of these wells as per the porosity development that you see on the porosity side of the log.

I would also like to show that there has been production from each of these wells and that the correlation of the -- between the wells of the common sand supports, in my mind, the fact that these sands are all continuous.

I believe that is also supported by the Isopach map which is shown in the lefthand portion of this exhibit.

The important point to me is that there is no displacement, that is the top of one sand body shown in any of these logs does not lie below, let's say, the bottom of another sand body, or the body of a sand body does not lie above the top of the other correlative sand bodies. The sands appear all to be continuous.

Q Does the sand appear to be thickening as you move to the east?

A Yes, sir, I would show that -- I have shown here, or it is indicated here by correlating these sand bodies, that as one moves more towards the Empire South Deep Unit Well No. 6, that one would encounter a thicker sand body. The sand itself has productive qualities as is indicated by the information shown next to the Well No. 6.

I would also point out that by moving towards the Two Forks State No. 1 one would encounter a productive well, as well, as is indicated by the fact that the Two Forks Well is a productive well.

If I were to show an orthodox location between these two wells, it would certainly encounter significant sand, at least as much sand as is present in the Two Forks State No. 1, and I would expect that sand to be productive, as is seen on the information shown and the production that has been indicated by the Two Forks State No. 1.

Q Now, Mr. Scheffler, would you go to Amoco Exhibit Number Three and review this for Mr. Quintana?

A Exhibit Number Three is merely a location plat or a plat of Sections 1 and 2 in Township 18 South, Range 28 East.

On this plat I've identified the location of the Empire South Unit No. 6 and the associated proration unit to which it is assigned, or which is assigned to the well. It's a lawdown 320-acre proration unit.

I've also noted the offset proposed location, the unorthodox location that Costa has an application for at the distance of some 660 feet from the east line of Section 2.

In addition to that, I've noted the orthodox location some 1320 feet to the west of the unorthodox location.

I might point out that the hatched line, the broken line that surrounds the western and portions of the northern, southern boundaries of the Section 1 identify the Amoco-operated Empire South Deep Unit. The circle around which I have -- that I have circumscribed around the unorthodox location encroaches, as can be seen by the purple -- the blue colored area, upon Amoco's Empire South Deep Unit acreage.

By moving the well back to an orthodox location that encroachment is significantly reduced. It is the encroachment that Amoco is concerned about, that we feel will result in the violation of our correlative rights.

Well No. 6 has dedicated a 320-acre south half proration unit. The implication here is that the No. 6 Well, because of its dedication of the proration unit, is going to recover reserves beneath that area.

Q Will you now review Amoco Exhibit Number Four?

A Exhibit Number Four is a proposed production limitation factor that we would ask in the alternative

be applied to the Costa Resources well if it is granted at an unorthodox location that has been made -- that that application has been made for.

I have shown here that the well varies from a standard location at the unorthodox location by some 67 percent of the 1980 location. I've indicated that the area of encroachment on the Empire South Deep Unit as was noted on the previous exhibit, is some 88 acres and this is 28 percent of a 320-acre drainage area for the Morrow completion -- for a Morrow completion.

As a result of this, I would recommend that these two factors be considered in determining a penalty. I would say that with a 67 percent location factor and a 28 percent encroachment factor, that a restriction of the Morrow well some 48 percent be applied. In terms of a production limitation factor this would be equivalent to 52 percent limitation on the well's deliverability.

And this would be applied against the well's ability to produce into the pipeline as would be determined by periodic deliverability tests.

Q Is there precedent for using this two factor approach to the imposition of a penalty?

A Yes, sir, precedent has been set for this type of a limitation factor, this method of calculation.

Order No. R-7008, which was applciation of Estroil Producing Corporation for an unorthodox gas well in Lea County, New Mexico, the order that resulted from that

application utilized this same approach in determining a production limitation factor that was to be applied to a well that we drilled at an unorthodox location.

MR. CARR: May it please, the Examiner, we would request you take administrative notice of Order No. R-7008, which was entered in Case Number 7581 on June 11, 1982.

MR. KELLAHIN: We will object, Mr. Examiner, to you taking administrative order --notice of Order 7008 in that case. There's been no foundation laid to demonstrate that the facts in that case are similar or sufficiently similar to this case from which you can make any sort of comparison. The Commission has applied no penalty in some situations. They've applied various other kinds of penalties apart from the one that Mr. Scheffler suggests here. Unless a proper foundation is laid that somehow that type of penalty as he proposed is directly correlative to the facts in this case, I think that it's improper to incorporate by reference or to take administrative notice of an action in a case in which my client did not participate.

MR. CARR: May it please the Examiner, you may always take administrative note of any of your orders and we are pointing you to one which we believe to be guidance in preparing the order. We think you can take administrative notice of that, as you can of any other order in which a penalty or no penalty was imposed.

MR. QUINTANA: Mr. Kellahin,

your objection will be overruled. We will -- I will take note of the -- that case order and I will look it as to its bearing on this case that will be decided later on.

Q Mr. Scheffler, if a penalty as you recommend is not imposed on the well, what would Amoco have to do to protect its correlative rights under the south half of Section 1?

A The only alternative Amoco would have would be to put itself in a situation where it would be dealing with the question of economic waste because in order to protect our correlative rights we would have to drill a well at that location and we don't feel that that is necessary.

Q Do you believe that that well would be necessary to produce the reserves from the southwest corner of Section 1?

A I feel like that well would be necessary to protect the drainage of reserves from beneath that unit that would otherwise be recovered by the offset South Empire Deep Unit well.

Q You have recommended that a penalty be imposed against -- based on semiannual deliverability tests?

A Yes, sir.

Q What effect will granting the application of Costa Resources have on the correlative rights of Amoco?

A The penalty really is just not justified when a minimum rate is established. It basically undercuts

the purpose of the penalty. It assures that a return on Costa's investment is at the expense of reserve recovery from Amoco.

Q Now, in that regard are you talking about a minimum production rate in the order?

A Yes, sir.

Q Do you recommend that one be included in the order?

A I do not.

Q If the application is simply granted as opposed with no penalty, what effect would the application being approved have on Amoco's correlative rights?

A Well, it wouldn't definitely violate Amoco's correlative rights. There's no doubt about that.

Q Were Exhibits One through Four prepared by you or compiled under your direction and supervision?

A Yes, sir.

Q Have you reviewed them and can you testify as to their accuracy?

A Yes, sir.

MR. CARR: At this time we would offer Amoco's Exhibits One through Four.

MR. QUINTANA: If there are no objections, the Exhibits One through Four presented by Amoco will be admitted into evidence.

MR. CARR: That concludes my direct examination of Mr. Scheffler.

CROSS EXAMINATION

BY MR. KELLAHIN:

Q Mr. Scheffler, you've testified in your capacity as an engineer for Amoco?

A Yes, sir.

Q Do you hold a degree in petroleum engineering?

A Yes, sir, I do.

Q And when did you obtain that degree?

A In 1973.

Q And from what school did you obtain it?

A Louisiana Tech. It was a BS degree.

Q All right, sir. How long have you been employed as a petroleum engineer for Amoco dealing with Eddy County, New Mexico?

A In my capacity as a proration engineer, which I began in 19 -- the latter part of -- or first part of 1981, I have had dealings off and on with the New Mexico area.

Q What --

A I would say that because of the way we're structured I would have to in summary simply say, in terms of putting a time figure on it, it would be very impossible to do, I really couldn't do it, but it's -- the three years I've been with the company, or in this particular assignment, I have looked at it quite often, looked at this parti-

cular area.

Q To make sure I understand what your function is with Amoco, Mr. Scheffler, what is your job description?

A My description or my classification is a Senior Staff Petroleum Engineer and my, basically, what my job entails is the preparation and review of engineering exhibits to be offered before regulatory agencies, whether it be New Mexico or Texas, in an effort to obtain requests, requirements that Amoco has that would aid us in drilling, developing, or insuring that our rights are protected and that there's not a -- prevention of waste does not occur -- or does occur from the standpoint of our operations. I am the engineering witness that is required to take these cases before the regulatory agencies and state our position.

Q You've been involved with the regulatory cases in New Mexico for what period of time now, sir?

A I would say since 1981, probably. Again, to put a time on it, because we switch back and forth so much, I guess I've been dealing with New Mexico on a full-time basis now for about, I'd say, eight months, eight or nine months.

Prior to that time I was dealing with it on a parttime basis.

Q All right, sir. When did you first commence your preparation and supervision of the production of these exhibits for this case?

A I'm sorry, I didn't -- could you restate that?

Q Yes, sir. When did you first start the preparation of Exhibit Number Two, for example, in this case?

A Okay. The cross section did not originally look like this. The cross section that we originally constructed was constructed upon our review of the hearing docket. I believe it was July 25th, where we picked up that there was going to be an application by Costa to drill a well at an unorthodox location. We had no other notice of that through Costa, so we obtained the information just by reviewing the docket, and we prepared a cross section and basically, really every exhibit you see here in some form at that point in time.

Q All right. You said that the first cross section that you prepared when you started studying the specific facts for this case in July of '84 was different than this cross section here?

A Only different in that it did not -- it did not contain -- well, let me back up.

At the time, because of the period of time that we had to work in, our cross section, as I recall, included an east/west cross section for Amoco's Empire South Deep Unit No. 6 to a westerlymost located well, I don't recall exactly what the name of it was.

Q The change in the cross --

A There were two well logs on that cross section.

Q All right, sir. With regards to the preparation of the cross section, I assume you had a staff geologist do that under your direction?

A Yes, sir, we -- our geology group has been, of course, studying this area for some time.

Q Who was the particular geolgist that prepared the cross section?

A Well, the cross section, of course, was prepared with my input and my direction. The geologist who was looking after the supervision, I guess, of the PT and reporting to me was Mike Sullivan.

Q Was it you or Mr. Sullivan that selected the four logs that are on this cross section?

A We discussed which logs we would put on the cross section that would show our -- that we felt would indicate the information that needed to be enlightened upon. It was a combinatio of both of our efforts, actually.

Q All right, sir, when we look at Section 1, the Amoco section, you do have your South Deep Unit No. 10 Well in Section 1, do you not?

A Yes, sir.

Q And that well is not included on your cross section, is it?

A No, sir, it is not.

Q And if we go down into Section 13, does

your cross section include the South Deep No. 20 Well?

A I'm sorry, Section 12, Tom?

Q I believe it's 13, isn't it? No, I'm sorry, Section 12.

A No, sir, it does not.

Q I am in the right section when I say Section 12 for the Deep 20 Well?

A Yes.

Q All right. And your cross section doesn't have that well on it.

A No, sir.

Q In looking at the Isopach here, Mr. Scheffler, is this an Isopach map that was prepared by Mr. Sullivan under your direction?

A This Isopach was prepared by our Geological Group, yes, sir, Mr. Sullivan was the individual geologist that did prepare it.

Q Is Mr. Sullivan here today, Mr. Scheffler?

A No, sir.

Q To what extent, Mr. Scheffler were you involved in the preparation of the clean sand Isopach that is depicted on Exhibit Number Two?

A I reviewed the logs with Mr. Sullivan that, I would say the majority of the logs that fall within the -- the area that, I would say that offset the wells that are included in our line of cross section.

I did not on a well by well basis pick the clean sand interval in every case, no. I relied upon our -- our Division Geological Group and their expertise and this interpretation, which is a matter of record right now, however it does change, of course, with additional information being acquired.

Q You sat here this morning, Mr. Scheffler and listened to Mr. Wilson describe in great detail his geologic study of this area and particularly his location of the Two Fork channel.

A Yes, sir.

Q As well as what he's identified as the No. 6 zone reservoir that the Amoco well is producing out of.

A Yes, sir.

Q Have you made any effort on your part as petroleum engineer to examine Mr. Wilson's geologic opinions in regards to those two reservoirs in this Lower Morrow area?

A I'm not sure I understand exactly what --

Q Well, in -- did you participate in any of the discussions that Mr. Wilson had with Amoco earlier this summer on this fact situation?

A I was not present in any discussions, no, sir.

Q All right, sir. Were you made aware of any of Mr. Wilson's geologic data or exhibits that he sub-

mitted to Amoco earlier this summer?

A Oh, yes, sir, certainly.

Q Have you attempted to explain or evaluate or study his geologic opinions which Amoco has had for some time in terms of the conclusions that you've given us today with regards to this Ispach map?

A Have I tried to relate his interpretation to this Isopach?

Q Yes, sir.

A Is that the question? Well, he doesn't have an Isopach to relate to this interpretation. He didn't offer one.

Q Have you applied or attempted to apply any of Mr. Wilson's geologic opinions with regards to the Morrow channels in this area as opposed to the geologic possibility of this being Morrow beach depositions?

A Have I addressed the question of whether it's a beach deposition or some other type of deposition?

Q Yes, sir.

A No, sir.

Q When we look at the Isopach that you've submitted under Exhibit Number Two, would you locate for us on the Isopach where we might find in Section 1 the Amoco South Deep Unit 10 Well?

A The No. 10 Well?

Q Yes, sir.

A Yes, sir, if you look at, again reference

Section 1 of section -- of Township 18 -- yes, 18 South, 28 East, the No. 10 Well is located just due northeast or northwest, I'm sorry, north/northwest of the Empire South Deep Unit No. 6, which is indicated by a red dot.

Q All right, sir, and that would fall then within the Isopached interval that is equal to or greater than 30 feet of net sand.

A Yes, sir. Matter of fact, as indicated on this particular map, the net sand thickness is indicated to be 35 feet in that particular well.

Q Would you tell us something about the No. 6 Well, Mr. Scheffler, in terms of what the pressures are for that well when it was originally completed?

A For the No. 6 Well?

Q Yes, sir.

A Well, the only information I can give you as regards pressure for that particular well is information that is of record, a number, that number being I believe it was approximately 4,009 pounds in October of '75. That was a 66 hour test.

I have not reviewed the test itself to determine if that was built up or whether there was production prior to that time of the test.

Q And this is on the No. 6 Well?

A Yes, it is.

Q What is the latest pressure information you have on the No. 6 Well?

A I don't recall that I can tell you exactly, but the pressure I would give you here is from the No. 6 Well. I would -- I -- I was given a number but I don't recall what it was. I'm going to say in the vicinity of 1600 pounds.

Q Do you know approximately what period of time that number would relate to?

A I would suggest -- no, sir, I really can't tell you. I'd have to -- I really can't.

Q Let's look at the No. 10 Well, Mr. Scheffler. Do you have any pressure information on the No. 10 Well?

A No, sir, I do not.

Q As a petroleum engineer, Mr. Scheffler, have you attempted to calculate the drainage radius that has been affected by production from the No. 6 Well?

A I have personally not, no.

Q Have you made any engineering studies of the relationship of the No. 10 Well and the No. 6 Well in Section number 1?

A With what regard?

Q With regards to the productivity of either well in this Middle Morrow Clastic?

A Only to observe that even though there was a significant sand thickness for the No. 10 it was not productive out of that Middle Morrow sand, unlike the No. 6 to the south, which was productive.

Q All right, sir.

Let me direct your attention to Section 12, to the South Deep No. 20 Well, Mr. Scheffler. What can you tell us about that well?

A With regard to what, Tom?

Q With regards to whether or not it produced from this Middle sand Morrow Clastic.

A Oh, no, sir, it was, as I recall, that well -- that well did not encounter significant -- what I'll call parent sand over the Morrow. It was left off in terms of any sand thickness shown in this Isopach simply because of the technique that was used in determining the Isopach. It fell far below the cutoff.

Q Have you made any studies of the pressure of either the ARCO "BX" Well or the Costa Resources Two Forks No. 1 Well in the north half of Section 2, the "BX" Well being in the south half of 35?

Have you --

A I --

Q -- made any studies of the pressure in those wells?

A I, again, I inquired as to what the pressure in that well was, looked for a confirmation as to what the pressure in that well was, after observing the pressure indicated on the scout ticket.

Q Which well are we talking about?

A I'm sorry, the State Com "BX" No. 1, the

ARCO well.

Q All right, sir.

A My inquiry was to an engineer with ARCO and I was -- it was confirmed to me that the information shown in the scout ticket, which implied that a shut-in pressure of 3,616 pounds existed at approximately June of '82, that pressure was somewhat lower than what the engineer with ARCO indicated to me to be the proper pressure; she thought it was around 3640 pounds at that time.

Q All right, sir.

A Again, I have not looked at the pressure test. I did not have that at my availability.

Q Is that the only pressure information that you have from the "BX" Well?

A Yes, sir.

Q All right, let's go to the Costa well in the north half of 2, Mr. Scheffler. Do you have any pressure information on that well?

A The Costa well, okay, the Two Forks State No. 1?

Q Yes, sir.

A Again, looking at the scout ticket information, the implication was that there was a pressure in that well measured at 3,281 psi at approximately January of '84.

Q Did you make any study of the Costa and "BX" pressure in relation to the pressure in the Amoco No. 6

Well in Section 1?

A Would you state that again, Tom?

Q Yes, sir. Have you made any pressure comparisons or analyzed or otherwise studied the pressures between the "BX" Well and the Costa well in relation to the Amoco No. 6 Well?

A Only to observe that the "BX" Well and the Costa well were drilled at a significantly long period of time after the Costa No. 6 Well was drilled and that I don't see that there's anything to note other than that I would expect to see a lower pressure in that part of the reservoir.

Q Did you, Mr. Scheffler, make the log correlation on the cross section between the South Deep No. 6 Well and the Two Forks State No. 1 Well?

A If you're asking me if I personally drew the lines to correlate those sands, again, I confided in the geologist's expertise and felt comfortable with his interpretation after I had observed what we believe to be accurate, an accurate interpretation.

Q All right, sir. Mr. Scheffler, with regards to the proposed production limitation factor penalties --

A Yes, sir.

Q -- have you made any attempt to adjust those penalties to take into consideration the relative potential thicknesses of the producing intervals in the No. 6

Well as opposed to the thickness that would be encountered at the unorthodox location?

A No, sir, I have not addressed any reservoir thicknesses in that penalty calculation.

Q Does the proposed productive limitation factor penalty, Mr. Scheffler, take into consideration any opinion by Amoco of the relative productive acreage for each of the proration units that might be affected by this location?

A Well, of course, we wouldn't be asking for a penalty if we didn't think that we had productive acreage beneath our -- our proration unit that was in jeopardy of being drained, so certainly it does.

Q All right, does it assume in taking that into consideration that the productive acreage affected by the double circle calculation is uniform?

A I'm sorry, Tom, I don't follow what you're saying.

Q All right, sir. Looking at the Isopach, the Isopach shows a varying degree of thickness of the interval.

A Uh-huh.

Q All right, sir, in looking at the double circle penalty, that penalty assumes a uniform thickness for purposed of the penalty.

A Okay.

Q Is that not a correct statement? All

right, have you attempted to adjust your penalty to take into consideration the varying thicknesses of the Isopached intervals?

A Well, no, there's no need to.

Q In looking at the double circle, Exhibit Number Three, Mr. Scheffler, you have excluded acreage that the second circle exceeds the first circle if it was acreage not controlled by Amoco.

A I'm sorry, Tom, what is the first circle and second circle?

Q All right, the first circle is the radius around the closest standard location.

A Okay.

Q The second circle will be the circle using a radius around the proposed unorthodox location. I assume that's how you did this?

A The second circle is around the unorthodox location?

Q Yes.

A Okay.

Q All right, and there will an area in which the second circle exceeds the first circle, is that not correct?

A In which the second circle exceeds the first circle?

Q Yes, sir.

A That is correct.

Q And there is a portion of that circle which has not been shaded blue or cross hatched.

A Yes, sir.

Q That excess area then, that's not been shaded in blue, represents acreage not controlled by Amoco.

A Well, in reference to what portion of the circle, Tom? There's a -- there's a couple of areas. There's one area that is controlled by Amoco.

Q In Section 2; in Section 2.

A In Section 2, in Section 2 there is acreage in the second circle area that is not controlled by Amoco, that is correct.

Q All right, and again in Section 11 to the south there is area of the second circle that exceeds the first circle, is there not?

A Yes.

Q All right. My question is in terms of your calculation, using the 88 acres on Exhibit 4 under paragraph two --

A Uh-huh.

Q At the end of that paragraph shows 88 acres, is 88 acres what you have planimetered to be included within the blue area?

A Yes, sir.

Q All right, did you do this yourself?

A Yes, sir.

Q Have you examined, Mr. Scheffler, any of

the other double circle penalty formulas the Commission has used in the unorthodox well location cases, other than the one you've discussed in your direct testimony?

A Not in preparation for this hearing, no, sir.

Q All right.

A Oh, well, I did look at one.

Q All right, sir, which one did you look at?

A I don't have it here with me.

Q Can you remember who the operator was that applied for the well?

A Application of Yates Petroleum Corporation for an unorthodox gas well location.

Q That's Order No. R-5831-A?

A 30 -- R-5832.

Q All right, sir. May I see that, please?

MR. KELLAHIN: Mr. Examiner, might I have a moment and have someone make a couple of copies of this so we can all go through this calculation together?

MR. QUINTANA: We'll take a short five minute recess.

(Thereupon a recess was taken.)

Q Mr. Scheffler, let me direct your atten-

tion to what I've marked as Costa Resources Exhibit Number Nine, which is a copy of the Yates Petroleum Order R-5832 that we were discussing just before the break.

A Yes, sir.

Q And ask you whether or not you have studied how the Commission in that case arrived at the penalized allowable for the unorthodox well.

A I reviewed this order without the benefit of any other plats or maps or anything of that sort. I can't say that I can repeat what has been done here with any accuracy.

Q All right, sir. In that order the Commission did provide in paragraph 12 for a minimum allowable of a million cubic feet a day below which the penalty would not be applied. Is that a correct statement?

A Yes, sir.

Q In addition, the proposed penalty that you've depicted on Exhibit Number Four is different from the one used by the Commission in Exhibit Number Nine with respect to this: That the Exhibit Number Nine shows that the Commission used a three part, or three factor calculation. Are you familiar with that?

A I saw that that was used in this order, yes.

Q Using that formula in the Yates order, Mr. Scheffler, have you calculated what a penalty would be?

A Well, no, sir, it's not applicable here.

Q All right, sir. Let me go back with you to Exhibit Number Two, Mr. Scheffler. I'm interested in exactly what you mean when you say "clean sand Isopach of the Middle Sand Morrow Clastic." What interval is that?

A That interval is identified on this cross section. That is the interval that lies -- the first clean sand that we encountered that lies immediately below what I'm going to call the datum shale marker.

Q If we look at the No. 6 Well on the cross section and that area shaded in yellow, is that what you've used to define the Middle sand on the Isopach?

A Yes, sir. That's correct.

Q You saw Mr. Wilson's exhibits this morning and his cross sections. Can you tell us whether or not there is any difference between what you interpret to be this Middle Sand Morrow Clastic interval and what he is calling the Two Fork reservoir and the No. 6 Zone reservoir?

A Well, Mr. Wilson's presentation was again an interpretation and he has a right to his interpretation.

Q Yes. My questions is are we interpreting the same interval?

A My interval is not the same interval in light of it is thicker than the interval he has shown in his Number Six.

And it also is thicker in my No. 1 Well. It is probably also thicker --

Q You mean your No. 1 Well in the cross

section?

A Yes, sir.

Q All right.

A The "BX" No. 1, I'm sorry.

It may be thicker in the Travis D No. 3, I'm not sure.

Regardless, it is thicker than is indicated on his cross section. In my cross section it is thicker in those two wells.

Q How does the thickness compare in the Costa Resources Two Forks State No. 1 Well between yours and what Mr. Wilson's told us?

A Oh, let's see. It appears that we're talking the same interval there.

Q All right, let's talk about this sand body, then, that we're attempting to --

MR. WILSON: I'm sorry, I unplugged you.

Q My question, Mr. Scheffler, is what kind of sand body are we talking about when we talk about this particular interval that's depicted on your Exhibit Number Two?

How did it get there?

A Well, Tom, I'm not a geologist. I'm an engineer, and I can correlate sands by looking at -- laying logs down next to one another and looking at the development of that sand and correlative markers that I can use to re-

ference back to, and also by looking at production from those sands.

I see no informaiton here that would suggest, for instance, that in No. 6, that there's any reason to believe that those two sands are separated in any way. I mean they're both -- they've got -- there's perforations across that entire thickness.

If those two sands are communicated and if they're correlated as I've shown them there, are able to be correlated with the Two Fork No. 1, they're in communication with that well. Likewise, the same sand shows up in the "BX" No. 1. It's producing from the same correlative interval, therefore it's communicated.

Q All right, sir, let me ask you this. In preparing the Isopach would not it be important for the geologist or the engineer or whoever has the expertise to do it, to understand whether the Isopach bears any relationship to the geologic facts as to how this sand was deposited in the first place?

A Well, I think that the Isopach helps you to identify the sand thickness relative to areas that are -- do not have any sand present; gives you a contour of the area.

It won't help you identify in this case how thick these various areas of deposition are.

Q Would you agree with me, Mr. Scheffler, that the Isopach, however, has to be done based upon know-

ledge of the geologic facts as to how those sands were deposited?

A That's how this -- this one was done.

Q All right, sir.

A This was prepared with the geologic facts that Amoco has interpreted.

Q All right. Are you familiar with the geologic fact that in the Morrow we do have sands deposited in channels? That wasn't a surprise to you when Mr. Wilson talked --

A No, no, no.

Q -- about that.

A No, not at all.

Q All right. Would you explain for me the geologic facts that cause you to believe that this Isopach correctly, depicts this sand when it shows this horseshoe depiction of the sand up here to the north and east of the cross section?

A All the -- what you're looking at there is a lack of sand development in the Middle Morrow, as we define the Middle Morrow, so therefore you have a 10-foot Isopach that is the Isopach that is drawn, and as a result of that you get that horseshoe effect, as you describe it.

Q Is that consistent with showing that these channels in the Morrow have a horseshoe effect in this area?

A I didn't say there was a horseshoe effect

in the area. I'm just telling you that as a result of Isopaching by the method that we've used here, you do get an area here that does not appear to have any clean sand in the Middle Morrow, as we've defined the Middle Morrow.

Whether that's -- I wouldn't say that that's indicative of any particular geologic deposition, other than to say that the Middle sand was not deposited in that area.

Q The Middle sand was not deposited in this area in a channel deposition, is that what you're telling me?

A The Middle sand does not show up or does not appear to be present, utilizing our cutoff. Our cutoff is based upon a review of the gamma ray curve on the logs. If it's greater than 50 API units we consider it to be more likely than not productive. It doesn't necessarily mean that there's not a sand there. It just means that that particular cutoff, that we've described here, implies that we have zero net sand thickness, clean sand thickness.

So if I may have mislead you, no, that does not imply that there is no Morrow sand there. I'm sorry, in the Middle sand area. It just implies that there is no clean Middle sand there.

Q You've used a scale in your cross section of 100 feet to an inch?

A Yes.

Q And Mr. Wilson has used 2-1/2 inched to

100 feet.

A Yes.

Q All right, sir. Would not using this on a scale as Mr. Wilson has used in doing your cross section allow you to more carefully pick and locate the sand that we've been discussing?

A I think the markers that have been used here are as apparent on this particular scale as they are on his scale.

Q Can you tell me why you didn't include the Deep No. 10 Well and the Deep 20 Well in the cross section, Mr. Scheffler?

A I didn't feel that it would have shown any different interpretation than what I have described exists out in this area.

Q Does Amoco have any plans for additional wells in this interval we've been talking about in Section number 1?

A No, sir.

Q Have you made the geologic investigation -- the engineering investigation and calculations to determine whether or not a well drilled at a standard location versus an unorthodox location in Section 2 is going to affect the acreage in Section number 1?

A I have determined that with a well location at an orthodox location that it certainly would affect the area offset in the Empire South Deep Unit. It's appar-

ent to me that's the case.

Q Are there any wells in this sand that have less than the 10-foot, as you've Isopached it, that are productive?

A I'm sorry, one more time?

Q Yes, sir, in looking at the Isopach, I think you've used a 10-foot cutoff.

A That's the last contour that we have shown on this, yes, sir, it is.

Q Yeah, and if you place the Costa Resources well at a standard location, it's below the 10-foot contour line.

A It's almost right on the line. There is, of course, some variance in that line, but as we've depicted it, yes, it would fall just to the west of that line. I feel like a well at that location could encounter 10 feet.

There's nothing magic about the thickness of the sand even if the implication here is that there may be sand but, yes, it would be less than 10 feet, but that does not mean it would not be productive.

Q A well drilled by Costa at either a standard or an unorthodox location is going to recover reserves underlying Section 2 and is going to have the potential to affect the southwest corner of Section 1, unless you drill another well, isn't it?

A Sure.

Q So whether or not this well is penalized

or not, Amoco, in order to recover its share of the gas underlying the southwest corner is going to have to do so with another well.

A I would say that that would depend upon whatever the outcome is of -- of this hearing.

Q Well, the point of the penalty, Mr. Scheffler, is that it will simply require the Costa Resources well to produce at a lesser rate.

A That's correct.

Q Given enough time, if you are correct, it is going to affect some portion of Section number 1.

A I would submit that the No. 6 Well is going to recover reserves underneath that assigned proration unit in Section number 1.

Q All right, and what is the total reserves recovered from the No. 6 Well as of this point?

A Approximately some 2.3 billion cubic feet, as of March of 1984, through March of 1984.

Q I believe you've already told us you have not made a calculation of the drainage radius that would have been affected by the recovery of 2.3 billion cubic feet of gas.

A I personally have not, no, sir.

Q I assume that well has paid for itself.

A I assume that.

Q And you're telling me that Amoco has no plans to drill any well in the west half of Section number 1

to this particular zone of the Morrow?

A Not at this time.

Q All right, sir.

MR. KELLAHIN: May I have just a minute?

Q Mr. Scheffler, you'll have to help me with this. I'm not sure how you handled the fact that in Section 1 on the Isopach for the No. 10 Well --

A Yes, sir.

Q -- when that well falls within a contoured interval on the Isopach that has 35 feet of clean net sands in this zone --

A Uh-huh.

Q -- and the well, did it produce from this zone at all?

A The well produced from what would be considered the upper portion of the Morrow, but it produced a very limited amount of gas, about .3 (inaudible.)

Q So this -- this lower --

A (Inaudible)

Q The lower Morrow interval that we've been talking about here --

A Yes.

Q -- and the interval that's Isopached --

A Yes, sir.

Q -- is not an interval that produced in this well.

A That's correct.

Q Notwithstanding the fact that it had 35 feet of net sand.

A Yes.

Q How do you as an engineer then adjust the Isopach to take into consideratino that known fact?

A The Isopach is not adjusted for production. It's adjusted to show only sand thickness. It's a clean sand Isopach.

MR. KELLAHIN: Thank you, Mr. Examiner.

MR. CARR: I have a couple of questions on redirect.

REDIRECT EXAMINATION

BY MR. CARR:

Q To be sure there's no confusion, Mr. Scheffler, you were aware of the dry hole in Section 12 at the time you made your study of the area?

A Yes, sir.

Q And that was -- the information on that well or absence of information from that well was considered by you in reaching your conclusions.

A Oh, yes, sir.

Q And what was your conclusion concerning the south half of Section 1?

A Well, my conclusion was that that well

has no bearing upon whether or not there is -- one can determine that there is not continuous sand development between Sections 2 and 1.

Q Now, again, to try and be sure there's no confusion, I understood you to testify that a well at an orthodox location would affect Amoco's interest under the south half of 1, is that correct?

A You mean orthodox, is that --

Q Yes.

A It should be at an unorthodox location, I'm sorry.

MR. CARR: I have no further questions.

MR. KELLAHIN: I do, Mr. Examiner.

RECROSS EXAMINATION

BY MR. KELLAHIN:

Q In the basis upon which you have reached that opinion, Mr. Scheffler, I believe it is by looking at this Isopach.

A The basis is by using the Isopach and by using a cross section, which shows the sands to be continuous, in my opinion.

MR. KELLAHIN: At this time, Mr. Examiner, we move to strike Exhibit Number Two and move to strike Mr. Scheffler's testimony with regards to any

opinions he's reached about this exhibit.

I think it's abundantly clear that Mr. Scheffler did, while he may have supervised someone else, did not directly involve himself with the geologic factors that are so important in this case.

Mike Sullivan apparently is the geologist that did this work. I've attempted to be as generous with Mr. Scheffler as I possibly could in giving him every opportunity to help explain what went on here and he simply does not know.

I think it's critical that we have the ability to cross examine the geologist from Amoco that did the underlying work from which Mr. Scheffler is now drawing conclusions for which he does not have direct knowledge.

We think that is essential. It's a violation of our right to due process and the only way to cure this matter is to strike the exhibit and strike the testimony and we'd request that you do so.

MR. CARR: We certainly do appreciate all the generosity extended to this witness by Mr. Kellahin. I do think the testimony was prepared by an engineer, Mr. Scheffler, working with Mike Sullivan, a geologist. They sat down and reviewed the logs. They sat down and they reviewed the (inaudible). They together concluded and determined which wells should be place on the logs and together they prepared the exhibit.

I don't believe there's anything that's been said today that Mr. Scheffler has not indicated any opinion that wasn't his; any data that he has reviewed and worked with, anything that he isn't competent, qualified to look at, evaluate and work with as a tool that is available to him and other engineers in reaching these conclusions.

We think that the motion is nothing more than a last ditch attempt to try and prevent somebody from having a contrary opinion to that held by Mr. Wilson, and we think the application -- the motion ought to be denied.

MR. QUINTANA: Mr. Kellahin, your request to strike from the record will be overruled and this exhibit will be taken into evidence.

Are there any further questions of this witness?

MR. KELLAHIN: I have none.

MR. CARR: I have none.

MR. QUINTANA: In that case he may be dismissed.

MR. CARR: I have no further witnesses to call on direct.

MR. KELLAHIN: Mr. Examiner, I propose to recall Mr. Wilson and I also propose to call Mr. Jim Brown, a petroleum engineer.

I think I can get through one of those witnesses before lunch. Perhaps we might have to come back after lunch and do the second one. I'd like, be-

cause we've talked geology all morning, perhaps to start my rebuttal with Mr. Wilson and then come back after lunch with Mr. Brown, if that will be accepted.

MR. QUINTANA: Do you -- how long do you propose Mr. Brown will take?

MR. KELLAHIN: I can't guess. I would -- I would anticipate maybe half an hour with him.

MR. QUINTANA: You may start with Mr. Wilson and then we will decide whether to continue through lunch then at that time.

MR. KELLAHIN: All right.

I would request the Examiner to admit what we have marked as Costa Resources Exhibit Number Nine.

MR. CARR: And I will object to that. I believe the objection that Mr. Kellahin had to our asking you to take administrative notice of the Estoril order are certainly appropriate when it comes to admitting something into evidence.

We think no foundation has been laid for the exhibit. There is nothing in the record that would show that the facts of this case actually relate to the facts in the case that is covered by the Yates application.

We would have no objection to your taking administrative notice of this order and considering it. We don't think it should be made a part of the

record where that foundation hasn't been laid.

MR. KELLAHIN: Mr. Examiner, I can see no difference between putting this in the record and having you go outside of the record and look at the file of the hearing and I will adopt Mr. Carr's responses to my earlier objection which you overruled and would hope that you would be consistent and deny his objection.

MR. CARR: I think if you want to be consistent, Mr. Examiner, you can take administrative of both of them and admit one and not admit the other.

If, however, you'd like to admit them both, I'll be happy to mark the Estoril order as an exhibit so they'll both be before you in the same posture.

MR. QUINTANA: Mr. Kellahin, in order to be fair --

MR. KELLAHIN: That's all I seek, Mr. Examiner.

MR. QUINTANA: -- you both know that I will take a look at it whether it's in the record or not, so I will -- I will not accept Exhibit Number Nine but I will take administrative notice of Case 6232, Order No. R-5832.

MR. KELLAHIN: All right, sir.

If the Examiner please, I have recalled Mr. Mark Wilson and I would appreciate the record reflecting that he has already been placed under oath and he is still testifying as an expert petroleum geologist and may

the record so note.

MARK WILSON,

being recalled as a witness on rebuttal and having been previously sworn, testified as follows, to-wit:

REDIRECT EXAMINATION

BY MR. KELLAHIN:

Q Mr. Wilson, let me direct your attention to Amoco Exhibit Number Two, sir. In particular I would like to divide my questions for you in two areas of review.

First of all, I would like to direct your attention to the cross section itself. My second questions will be related to the clean sand Isopach map that's depicted on the right margin of that exhibit.

With regards to the cross section itself, and the attempt to show geologic correlation and continuity from the No. 6 Well across through the Two Forks State 1 Well to the "BX" State No. 1 Well, do you, sir, have a a geologic opinion about whether you agree or disagree with the interpretation on this exhibit?

A Yeah, I do have.

Q What is that opinion?

A Well, first of all, this cross section is on a scale of an inch to 100 feet. It's not in my opinion on a big enough scale to really draw the detailed correlations that I've pointed out already. My cross sections are

clearly in sight on the board up here and we are identifying sands principally with respect to this B zone datum, which is identified here as the datum shale marker.

It's the base of the A zone and the top of the B zone. I have not looked carefully to see if this is precisely the same point in these wells as I have it up here, but I will say this.

If you look at the Amoco Empire South Deep Unit No. 6 and compare that with the Costa Resources Two Forks Well, it is immediately apparent that with respect to that marker, the marker down to the top of the sand there is a much shorter interval than it is over here in this well here; therefore I think that it's a risky proposition to say that those sands are indeed correlative sands. In fact if I can go back up here just a minute, here's the No. 6 Well on a much more expanded scale where you can actually see some units, the thinning units within the Morrow and I don't think we'll have any arguments about where the top of the B zone is which is the datum for this cross section.

And these upper two units, they missed the coloring there, but these upper two units, which are labeled 1 and 2 here on the cross section, those two units you can trace all the way through this cross section clear on down to channels that go southwesterly, this way, and immediately underneath is this thin sand here, which I have colored blue, and again missed a little coloring there, but that is also an extensive sand, and you will see here that

this rests directly upon the upper unit and so it's really two sand units in this well as compared to one. Well, you have these sands below here but they are deep water sands so they're really not channel sands. They were deposited under marine conditions.

And by doing this I think it is fairly evident there with this expanded scale, that this reservoir here, what we're calling the Two Forks reservoir, and this is the Costa Resources well, the very same well he's got on his cross section over here, that that sand is at a different level from this sand up here which is the principal pay sand in the No. 6 Well.

With regard to the Isopach, and we're talking about Middle Morrow sands, now, we're saying that we have, what, 35 feet of clean sand here. Well, probably by his definition of clean sand, I would say there may well be 35 feet there, if you include the both of these sands.

In point of fact, though, that well was never completed in that reservoir. It was completed up here and yet you look at the Isopach map here on which we're basing opinions about connections within this reservoir between Sections 1 and 2, on the gross sand thicknesses with a certain cutoff, and I would submit that that Isopach map is not necessarily an accurate depiction of what the connection is.

Of course, already I have indicated that I have a different interpretation of all of the -- welcome to our interpretation, but I think we're talking about two

distributary channels and I still say that and I think we'll hear some testimony in the pressure line. We have a little more data on the Amoco 6 Well than Amoco's got here at the hearing, and I'll say flatly that the pressure in that sand, in this eastern sand, is different entirely than the pressure in this reservoir over here, and I think that's extremely important data. I think the engineer will bring this out after lunch.

Q Well, I want you to elaborate for me, Mr. Wilson, on the reasons why you think the Amoco Exhibit Number Two, when it attempts to depict the clean sand Isopach as they have here, is not based upon sound geologic facts as you find them to be in this area.

A Well, in the first place, you know, by working overall, for example, from here, you're dealing with several different sands, and what we're saying is that on neither the map nor on the cross section, I mean those sands are so close together on an inch to 100 scale, what you can do, it looks good there after you get it colored in, but the fact is that those sands don't connect in the fashion that's shown on that cross section, if you compare that with an expanded scale cross section.

That's not continuity within this -- these reservoir systems, and that's the common error.

I did a study in the Citronel (sic) Field which involved distributary channels. CORE Lab had done one and explained it all to pieces because we had channels that

were so close together that those people were just going up and down, up and down across that field and the only way it correlates is on a cross section.

Q Is the --

A They took blanket sands where it's entirely channel sands; there's very little connection.

Q Is this Isopach that Amoco has used consistent with the -- your geologic opinion that this is a channel sand deposition?

A I don't know what to make of that Isopach. It's my -- that's what I was talking about earlier. This is a mechanical thing. There is no concept behind it of how these sands really got in here.

I don't see any background here as to what environmental deposition is involved here. You can't interpret the trend of the sand until you know, you know, something about the environment of deposition and the geometry of the sands in the area as they relate to the environment of deposition.

I will take issue immediately with this big, fat blank area sitting right in here. If you will go back to the hearing where we have -- the forced pooling hearing on the Two Forks State No. 1, in connection to that hearing I presented a cross section that goes zipping right up across here. In fact I'll show you the line here, across this delta and across this thick channel here, 75 feet thick or more, the same strat level as these sands here, and yet

they're showing a total zero up there and I would ask the Examiner to go back and pull that exhibit out of that hearing that we had there and see that that is absolutely impossible in the way of correlations, because of these wells here are common to both of those cross sections, and take these wells here, and as a matter of fact it extended more over here than up here, and compare up through here where they're saying there are no sands at all, and I think on that cross section it's clearly shown that there are major sand units up in here where there's no sand shown, and it's not just a question of tight sand. I mean you're talking about 75 foot sands nearly all the way through.

So I would invite you in considering this case to get this cross section and tie it in with this cross section and this one down here, on around, and it's on the same scale, 2-1/2 inch to 100 feet, and in your own mind draw your conclusions about the accuracy of this mapping here up through this area here, where we're cutting across one channel after another at the same strat level that we're calling Middle Morrow.

This -- this illustration here will show that these sands are across the same strata level as far as this complex delta system here.

Q I believe, Mr. Wilson, you have addressed those points that I wanted you to comment on Exhibit Number Two and I have no further questions of this witness.

MR. QUINTANA: Any further

questions? The witness may be excused.

Mr. Kellahin, how long will it take you with this next witness?

MR. KELLAHIN: I anticipate at least half an hour, Mr. Quintana.

MR. QUINTANA: That's for you, sir?

MR. KELLAHIN: Yes, sir.

MR. QUINTANA: I suppose you guys are going to want to cross examine, too.

MR. CARR: I suppose we will.

MR. QUINTANA: Well, in light of that matter, I think we're going to go ahead and break for lunch now and we will adjourn -- I mean we will -- we will reinstate the hearing at 1:30.

(Thereupon the noon recess was taken.)

MR. QUINTANA: You may proceed, Mr. Kellahin.

MR. KELLAHIN: Thank you, Mr. Examiner.

We'll call as our first witness this afternoon, Mr. Jim Brown. I do not believe you have been sworn yet, have you?

MR. BROWN: That's correct, I have not.

(Witness sworn.)

JAMES D. BROWN, JR.,
being called as a witness and being duly sworn upon his oath, testified as follows, to-wit:

DIRECT EXAMINATION

BY MR. KELLAHIN:

Q Mr. Brown, for purposes of the record would you please state your name and occuaption?

A Jim Brown, and I'm a resident of Basic Energy, Incorporated, out of Dallas.

Q What does Basic Energy Corporation do, sir?

A We're a new, small company that's been formed to, among other things, to -- as an independent operator to produce in southeast New Mexico.

We have been operating out here for about a year and a quarter.

Q Do you hold any degrees in engineering?

A Yes, sir. I was a graduate of Southern Methodist University with a Bachelor of Science in mechanical engineering in 1959.

Q Subsequent to graduation, Mr. Brown, have you been employed as a petroleum engineer in the oil and gas industry?

A Yes, sir.

Q Would you describe for us in a summary way your background in that industry?

A Until March of 1983 I was employed since 1959 with General American Oil Company of Texas. It was acquired and merged into Phillips Petroleum Company. I had progressed through the ranks in various engineering capacities and at the conclusion of my employment with General American Oil Company I was Vice President and U. S. Production Manager.

Q Have you testified as a petroleum engineer in the State of Texas?

A Yes, I have.

Q Before what types of administrative bodies have you testified?

A Before the Texas Railroad Commission.

Q And pursuant to you testifying today, Mr. Brown, have you made a study of the engineering data that immediately affects the subject of this application?

A I have.

Q Would you describe for us your relationship with Costa Resources?

A Yes, sir. Costa Resources, who has -- is, by the way, represented today by Mr. Steve Hamilton, and is the operator of this Two Forks State No. 1 and the proposed Two Forks State No. 2, is a working interest owner, as is Basic Energy. We are very interested in the matter

that's before the Commission today because we are in the position of having to make some very hard decisions about drilling a well. We have had a very successful relationship with Mark Wilson over a number of years, including the time during which Mark Wilson worked with General American Oil Company and with our people and provided us with geological prospects based on the same principals and the same geology, the same philosophy of approach to geology that he's presented to you today, and because of our interest and Costa's interests we're represented today to try to reflect upon what the true facts in the case are and do what we can to try to explain to the Commission our willingness to participate in a well, but the importance of locating that well at the ideal location as is provided in the application.

Q So you not only are preparing and studying this from the aspect of being an expert witness, a professional engineer, but you are also placing at risk your own funds and the funds your business associates in this prospect.

A That's correct.

Q All right.

MR. KELLAHIN: We tender Mr. Brown as an expert witness.

MR. QUINTANA: Mr. Brown is considered an expert witness.

Q Mr. Brown, I would like to direct your testimony to the engineering aspects of the proposed unor-

thodox location, and as a preliminary matter to discussing those engineering aspects, I would like for you, sir, to express for us in a general way what is your opinion with regards to the reasonableness of approval of a location as you've requested and having that location approved by the Oil Conservation Division without a penalty.

My specific question for you as an expert witness is whether or not the application, if approved, would help prevent waste.

Conversely, if the application is denied or if a penalty is imposed upon the unorthodox location, would in fact waste occur.

Let me have you address that first point and ask you if you have an opinion to express on the waste issue?

A Yes, sir, I do. We recognize that this is an unorthodox location but at this location we feel like it provides us with the optimum opportunity to locate the well in what we believe is to be the axis or the main bed of this distributary channel, and we believe that a well producing at that location will most efficiently drain the reservoir and will ultimately result in the maximum recovery of natural gas and therefore we believe underground underground waste will be prevented.

Q Conversely, if the Commission disproves the requested location or approves the location with a significant penalty factor, Mr. Brown, would that result in

waste occurring?

A Yes, sir, I see that there's two -- in fact there are two ways that waste can occur in that situation.

In the event that the Commission were to deny the location, for all purposes and only permit us to drill at an orthodox -- let me say that again -- an orthodox location, we believe that by not being located in the axis of the distributary channel that the ultimate recovery from the well would be less than it would be if it were located at the unorthodox location.

Q All right, sir.

A And then as a second point, if we are permitted to drill at the unorthodox location but are -- would be restricted, then the economics as far as our decisions to drill a well with subject to some penalty could result in our not drilling the well at all, in which case no gas would be recovered out of that portion of the reservoir.

Q Before we discuss in detail the basis upon which you express those opinions, I'd like to direct your attention to the second part of the decision process with regards to the potential to violate or infringe upon the correlative rights of Amoco.

Can you, or do you have a professional opinion as to whether or not approval of this location as Costa has requested without a penalty would result in the impairment or the violation of Amoco's correlative rights?

A I do not see how Amoco's correlative rights will be adversely affected by the decision of the Commission to permit us to operate -- to drill a well at either an orthodox or an unorthodox location, unless they are willing to drill a well in the southwest quarter of Section 1 for themselves to protect their correlative rights.

Q So let's go through some of the exhibits that you have prepared and then we'll get back into the factual basis upon which you've expressed those opinions.

A All right, sir.

Q Let's commence first of all, Mr. Brown, by showing you what is marked as Costa Exhibit Number Ten.

As a preliminary matter to this exhibit, Mr. Brown, and to all the rest of your exhibits, was Exhibit Ten and all subsequent exhibits prepared by you directly?

A Yes, sir, they were all prepared by me and no one else.

Q Let me ask you to identify Exhibit Number Ten and explain what this information is.

Q Obviously, this is not a complicated exhibit. It was only developed for the purpose of -- of expressing to the Commission and the other interested parties the approximate distance between some of the pertinent wells that have been the subject of this hearing today, and is much like a mileage map on a road map. It just gives you an ability to go through and take the distances between any

variety of the wells and these are approximate, and have been scaled off of a map.

Q Let's go, for example, to the distances from the Amoco Deep No. 6 Well in Section number 1, using that as the point where we start our discussion.

Would you describe for us how far that well is from the western boundary of Section 1, western boundary being that line between Sections 1 and 2 and the difference between the Amoco and the Costa properties?

A Right. The No. 6 Well would be approximately 4100 feet, or in excess of three-quarters of a mile from the -- the eastern boundary of our lease or the western boundary of the Amoco lease.

Q By comparison, do you wish to draw any comparisons with the distance of any of the other wells from that boundary line?

A Yes, sir, I think we might digress a little bit and discuss some of the performance factors that we should put into evidence today that I would like to discuss with you.

We might refer back to Exhibit Five, which is on the wall, and was Mark Wilson's exhibit, simply for the purpose of locating some of these wells and to think in terms of his --his identification of the two distributary channels.

If you will note that -- let's identify the ARCO "BX" State No. 1 again, which is located in the

south half of Section 35, and let's also locate the Costa Two Forks State No. 1, which is in the north half of Section 2, and after you've located those you'll see that those are very close -- located close together. They were both approximately 660 feet from the common boundary between them. The approximate distance between the two wells as the crow flies there is -- is about 1350 feet.

The ARCO Well, which was completed approximately two years ago, initially produced at 1.12 million cubic feet per day.

Two years later when the Costa Two Forks State No. 1 was completed, it was completed and potentialed and is currently producing over 3-million cubic feet a day. In a very short space between those two wells we see quite a difference in the -- the apparent quality of the reservoir.

Now if we go to the east into Section 1, we'll notice that the Amoco South Empire Deep Unit No. 6, which is located in the south half of Section 1, has produced over 2-billion cubic feet of gas since it was completed in 1975, Last year, in 1983, it averaged 1.2-million cubic feet per day and only 2000 feet to the north of that well we have the South Empire Deep Unit No. 10, which was not productive in the same interval and was completed up the hole in a totally different Morrow sand reservoir, and it produced for only three years and depleted after producing very little gas.

Now if we look to the south half of our

Section number 2, our proposed location is at approximately 660 feet from the east boundary.

If we don't drill a well at the optimum location and if Amoco doesn't drill a well at the optimum location, then there's going to be gas that otherwise would have been recoverable out of this reservoir that will not be produced, and that's why we have a firm conviction that we need to understand that the location of the well is of utmost importance and that we, speaking as an investor, and taking off that engineering hat for just a moment, but as an investor, I'm going to believe the geologist and want to go along and drill with him at the best location that he believes is available to him, and for that reason we believe that this is a waste issue case and again are concerned that the maximum ultimate recovery be obtained by drilling the well at that location.

Q All right, sir, let's go on to Exhibit Number Eleven, if you please.

A All right, sir, and do Twelve at the same time?

Q Sure, let's do Eleven and Twelve at the same time. I think it's -- all right, Mr. Brown, let's discuss Exhibits Eleven and Twelve at the same time.

A Basically what we have here are two data sheets with Exhibit Number Eleven covering some pertinent data regarding the ARCO State "BX" No. 1, which we just recently discussed, which is located in the south half of Sec-

tion 35, and Exhibit Twelve covers some comparable data for the Costa Two Forks State No. 1, which we mentioned is approximately 1350 feet south of the ARCO State "BX" No. 1.

And as we mentioned earlier, the ARCO State "BX" No. 1 was completed in July of 1982. The Costa Two Forks State No. 1 completed approximately 18 months later, and at the present time the Two Forks State No. 1 is producing over 3-million a day, which is approximately what it was producing on its original completion after treatment with acid, while the ARCO State "BX" No. 1 is producing at approximately half that rate.

Q All right, sir, let's go to Exhibit Number Thirteen and have you identify that for us.

All right, sir, what have you presented in Exhibit Number Thirteen?

A This exhibit presents the history of the pressure performance based on the data that's been available to us for three of the four wells that are presently located in Sections 35, 1, and 2, and again we're talking about the Amoco South Empire Deep Unit No. 6, which is located in Section 1; the ARCO State "BX" No. 1, located in Section 35; and the Costa Two Forks State No. 1, located in Section 2.

Q All right, sir, what are the conclusions that you draw based upon the comparisons of the bottom hole pressure information from those wells?

A I think the -- we should isolate first on the numbers which I believe Mr. Scheffler confirmed this

morning as being the bottom hole pressure in the Amoco South Empire Deep Unit No. 6, as was reported to the Commission in September of 1975.

I believe that was shortly after the completion of the well.

Q That's the 4000 pound pressure?

A That is correct. Then we have a report from Amoco, the source is Steve Brown in the Houston office, who has advised us that on June the 18th of 1982 a bottom hole pressure was run in the same well, the Amoco South Empire Deep Unit No. 6, and the shut-in bottom hole pressure at the conclusion of 72 hours was 1397 pounds, which would be a decrease in pressure of some 2600 pounds from the time that the well was completed seven years earlier.

Q All right, sir, go ahead.

A Okay, if you'll recall from Exhibit Number Eleven, the ARCO State "BX" No. 1 in Section 25 was completed in June of 1982, and its first bottom hole pressure survey, which was run the following October after the well had produced some 90-million cubic feet, the pressure was recorded as 2646 pounds after 44 hours of being shut in.

Then the two remaining pressures that are indicated on this survey are pressures that were taken in the Two Forks State No. 1 in June and July of 1984 after the well had been produced for approximately one month before the test in June and at the conclusion of two months production for the test in July.

The -- one of the most obvious revelations from looking at pressure information here is that at approximately the same time that the Amoco South Empire Deep Unit was reporting of a pressure of 1397 pounds, the ARCO State "BX" No. 1 Well was being completed and after a short production period its bottom hole pressure is approximately 2400 or 2300 pounds higher than the pressure over in Section 1.

Q What is -- what is the conclusion that you can draw from a study of this pressure data, Mr. Brown?

A There may be some slight decline in the ARCO "BX" No. 1 that would be a result of production from the Amoco Deep Unit No. 6. It's not definitive. It's not definite. We could make that interpretation but surely it has not had a substantial effect on this well in the five years of its production, and referring now back --

Q Excuse me, it's more than five years production, isn't it?

A I'm sorry. I'm sorry. Yes, sir.

Q Closer like seven years.

A It's been eight years of production now.

Q Eight years of production and there's a pressure differential of about 400 pounds, is it?

A Yes.

Q All right.

A Now, I think the point to make from this information, I would like to ask you now to go back to Exhi-

bit Ten, is that the distance, as you would scale it from the map, between the Amoco South Empire Deep Unit No. 6, reading across the top to your right, to the ARCO State "BX" No. 1 is 7600 feet.

So 7600 feet away we had virtually no effect, so regardless of whose geology you might believe is true, the evidence is that the ARCO well is not providing any particular effect upon the pressure 7600 feet to the west of it.

Now let me take this a step further and --

Q You mean the Amoco No. 6 after eight years has not shown any effect on the ARCO Well?

A Yes, sir. If I misstated that, I sure stand corrected.

Q Okay. All right. By using that comparison, what kind of conclusion can you make with regards to the Amoco No. 6 Well and the reservoir we propose to drill into in the south half of Section 2?

A Well, if you'll note that the -- that the location of the Costa Two Forks State No. 2 that we propose is approximately 4800 feet away and its very difficult for me to believe that there's going to be any substantial effect between the location that we propose and the South Empire Deep Unit No. 6 and vice versa. We're talking about a distance of 4800 feet.

Now let me go a step further. The dis-

tance between the Amoco South Empire Deep Unit No. 6 and their western lease boundary is only approximately 4100 feet, while the distance between our proposed location and the lease boundary is 660 feet.

Now let's go another step further. Let's suppose that we even drilled a well at the orthodox location. We would be 1980 feet from their line and yet their South Empire Deep Unit No. 6 would be 4100 feet from their line.

In my opinion they are not going to be in a position to protect their correlative rights with the South Empire Deep Unit No. 6 regardless of where we drill our well to the extent, if any, that they could by drilling a well in the southwest quarter of No. 1 to protect their lease line.

Q What is the -- what is your judgement with regards to the effect of the bottom hole pressure in the Amoco Deep No. 6 Well being approximately 1400 pounds at the present time in relation to this drainage question, Mr. Brown?

A In what respect? I'm sorry.

Q Well, in respect to the potential for a well that demonstrates 1400 pounds back in 1982 having the capacity or the ability to drain a significant area of the reservoir?

A I do not believe that it is going to be effective in draining the west half of the southwest quarter

of Section 1 or even the west half of the northwest quarter of Section 1.

Q Mr. Carr, in his opening statement indicated that Amoco needed this penalty in order to protect itself from drainage and we heard from Mr. Scheffler that Amoco has no plans to drill any other wells in the west half of Section 1.

Can you express for us an expert opinion with regards to whether or not the imposition of a penalty on the Costa Resources well makes any difference at all about protecting or not protecting Amoco's correlative rights?

A It's my opinion that Amoco must drill a well to protect their own correlative rights. The, I'm repeating myself, but I do not believe the Amoco South Empire Deep Unit No. 6 has the capacity with the bottom hole pressure it presently has to protect their boundary, their western boundary.

Q All right, sir, let me ask you this. You expressed an opinion earlier that you did not think Amoco's correlative rights were being impaired by approval of the well at this location.

Would you give us the specific facts upon which you've reached that conclusion?

A Yes, sir. As testified earlier by Mr. Wilson to some extent, who couldn't wait to preempt me a little bit, we did take his geology and attempt to identify

the areas underlying the various properties being represented here at the hearing, and that determination indicated that in the west half of Section 1 the small triangular shaped part of the channel indicated in the light red or the pink on our Exhibit Number Five, the Amoco interest, is 73 acres and that the remaining amount, a total of 422 acres is in both Section 1 and Section 2.

That's only 17 percent of the total between the two sections, and we should be permitted to drill a well at a location which would permit us to produce at an actual capacity, deliverability, in proportion to the reservoir that's underlying our property.

And from that viewpoint we think that we're willing to go in and spend the money to drill a well at the proposed location and that we're willing to protect our correlative rights on that basis. We offered to Amoco through Mr. Wilson to cross waive objections to unorthodox locations so that both of us could benefit from participation in this reservoir, and we've been turned down on that, so we're willing to go ahead and -- and spend our money to try to develop these reserves and we think that it's only appropriate that Amoco do the same thing.

Q Mr. Brown, let me direct your attention to another subject matter.

Mr. Scheffler has recommended through his Exhibits Three and Four, which I will show you, that the Commission apply a production limitation factor on the Costa

Resources well. In one example he's come up with 48 percent. In another example he's up to 50 percent.

Let me show you Exhibit Number Three that he's introduced and ask you if you have an opinion as an expert petroleum engineer whether the imposition of an acreage encroachment calculation using the double circle has any relevance or relationship to the facts as you know them to be?

Let me ask you that a different way, if you're having trouble with the question.

A No, I'm not. I'm not having trouble with it.

It would be nice if we could make the calculation based on a circle as to what the drainage radius was going to be. I think there's plenty of evidence from the fact that the No. 6 Well is obviously not draining in a circle fashion like this, because the sand is not even productive in the No. 10 Well to the north in Section 1, so it isn't that we can go on quite as -- as fundamental an approach like this; however, it think that the facts are that the -- the geology indicates that the -- only 17 percent and not these higher percentages of the reservoir underlying the two sections are represented by the ARCO interest and the other 83 percent is in Section 2.

From that standpoint I do not see any reasonableness associated with this particular approach. This is -- this is a unique situation, perhaps, but it does not seem applicable in today's circumstances.

Q Mr. Brown, Mr. Scheffler testified this morning that he was recommending the Examiner continue to apply any penalty to the well and not set up a minimum producing rate below which any penalty would not apply.

We have shown the Examiner, I think, several different options in this area, and we'd like the benefit of your opinion with regards to a minimum producing rate in the event the Commission should elect to impose some type of penalty on the well because of this location.

Can you express for us an opinion as to, first of all, whether or not the well ought to be allowed to produce at some minimum rate?

A Obviously, from an economic standpoint, as business people we are not going to drill a well that we do not believe is going to give us an adequate return on our investment. Amoco's not going to do that, either.

We have to have some reasonable assurances that taking into account the normal risks in this business, that we can expect to have a reasonable return.

If there is no basement, if you will, or no floor, set in some formula below which we're protected against the unlikely event, but still it could happen, that the well would not come in at a very high rate, then it would impair our judgment with respect to drilling the well. We would know that ahead of time.

We have made a determination that -- that based on the economics associated with -- with similar wells

in the area, based upon the present prices being received for the gas, and based on cost of drilling wells in this area to this depth, that we would have to have a minimum of 900,000 cubic feet a day of sales and production from this well in order for us to justify drilling it.

If there's any penalty that would allow that or require that we be permitted to produce less than that amount, we'd be in a position of not being able to economically justify the drilling of the well.

Q What is the timing, Mr. Brown, with regards to when Costa Resources would like to commence the drilling of this well?

A We will be ready to drill the well upon the successful conclusion of this -- this case.

We can move with pretty good speed on that.

Q All right, sir. I think we've covered the basic elements of your testimony, Mr. Brown. If I have overlooked anything, please tell me.

A I believe that covers it.

Q All right, sir.

MR. KELLAHIN: I tender Mr. Brown for cross examination.

MR. QUINTANA: Mr. Carr, you may proceed.

MR. CARR: Thank you.

CROSS EXAMINATION

BY MR. CARR:

Q Mr. Brown, as I understand your testimony, you're accepting as a basis for your presentation the geological interpretation of Mark Wilson.

A Mr. Wilson has been -- I've alluded to this briefly. He has been highly successful in his association with us and with other people that we're familiar with. That is the way the business is played and that's the way that we all operate. You do the same thing and other operators do the same thing and our basis for continuing to believe and proceed with him is that his geology has proved out.

Q And you're accepting his interpretation as the basis for your presentation today?

A I've stated that some of the things I've commented on are based upon a belief in his geology, correct.

Q So your answer is yes.

A To some of the things I've testified to; not to all of the things. Some are based on --

Q Do you differ from his interpretation in any way?

A No.

Q Now, if we look at the well at the proposed location, that well has been moved about 1320 feet to the east of the standard location. In your opinion does

that -- and that I understand to be your testimony that in your opinion this is the optimum location for draining the channel, is that correct?

A This is the -- Mr. Wilson's optimum location for locating the main bed or the center line or the axis of the channel.

Q And this would be the best location for producing the reserves in the south half of Section 2?

A That's what he's testified to.

Q And this would also be the best location for producing the reserves from the south half of Section 1.

A I beg your pardon.

Q This would be the best location for producing the reserves that are present in the southwest of Section 1.

A We -- I don't understand the question. We're not talking about --

Q By moving, by moving 320 feet to the -- 1320 feet to the east, in your opinion do you improve the ability of the well at that location to produce the gas that underlies the southwest of Section 1?

A You improve the opportunity for producing the maximum amount of gas out of the well as compared with the orthodox location.

Q And that would include the south -- gas under the southwest of Section 1 in this channel.

A That will provide any gas that is invol-

ved in that part of the reservoir that isn't being produced by another well.

Q And that would include the gas in the southwest of Section 1.

A Assuming Amoco does not drill a well of its own.

Q And even if they did, you would still be in the optimum position to produce the gas in that channel from that location, is that not right?

A Isofar as we are from our property line. On the other hand, if Amoco were to drill at an unorthodox location which we have agreed to in the southwest quarter of 9 -- of 1, excuse me, then they would be in a similar position to protect their correlative rights.

Q Forgetting about Amoco, you're improving your position to produce those reserves by moving to the unorthodox location.

A We're improving the ultimate recovery. In other words, we're going to be helping to prevent waste.

Q You will be producing the reserves efficiently, in your opinion, based on this interpretation no matter where the channel lies, whether it be under Section 2 or Section 1.

A I don't understand the question.

Q I'm just trying to ask you whether or not you believe you've got the optimum location for producing the reserves whether they be in Section 2 or in Section 1.

A This location, the proposed location will in our opinion produce the maximum ultimate recovery that can be produced with one well.

Q Okay. If I look at your Exhibit Number Thirteen, the first entry in the table dated September 30, 1975, is the initial shut-in pressure on the Empire Deep Unit No. 6 Well, is that correct?

A I believe it's a bottom hole pressure that was at the conclusion of 66 hours; not an initial shut-in pressure.

Q Okay, but that is after only 66 hours of production?

A No, sir. That's having been shut-in for 66 hours.

Q Do you have any idea how much gas had been produced from the well at the time that test was taken?

A I believe the well was completed -- just a moment, please.

I believe the well was completed within a few months before that. I will stipulate if you would like to put it in the record what the -- what the completion date was.

Q What is it?

MR. SCHEFFLER: Well --

A Or initial production would be better.

Q Okay, the completion date was 9-13-75.

A Okay.

Q So what we have here is a pressure figure early in the life of the well.

A Correct.

Q And then the next entry on that table is a pressure figure of 1,397 pounds after a 72-hour test.

A Uh-huh.

Q And that was approximately seven years after the original.

A Right.

Q Do you know how much had been produced from the well prior to that time?

A Yes, sir. These will be approximations based on the records in the Commission office.

Approximately 1.5 or 6 billion cubic feet.

Q So that is the volume that had been produced while the pressure declined from approximately 4000 pounds --

A Right.

Q -- to approximately 1400 pounds.

Now if we go to the next entry, this is the ARCO State "BX" Wells that's -- and I believe you testified 7600 feet away from the ARCO well.

A Yes.

Q From the Amoco well, I'm sorry.

A Sure.

Q And that pressure was 3,646 pounds, and

-- is that correct?

A That is .

Q That is approximately 350 pounds less than what was encountered in the Amoco South Empire Deep Unit Well seven years prior.

A Yes, sir.

Q And you, it is your conclusion that that 4 -- or 350 pound decline is not a result of drainage from that well.

A Let me comment on that. There are a couple of factors to consider. As you just verified by your own data, the South Empire Deep Unit No. 6 had only produced a short period of time when its 66-hour bottom hole pressure was 4,009 pounds.

The ARCO pressure 3646 was after 44 hours, a shorter period of time, and had produced approximately 90 or 100-million cubic feet of gas.

To accurately determine the relative pressures there, it would be necessary to take into account these flowing periods prior to the shut-in pressures and you can't necessarily just take the two pressures and draw a direct conclusion.

I did specify earlier that there -- there's probably some connection. I would be inclined to believe that it would be more through this terminus here, this relationship here.

Q And so you're showing that the drainage

is over the top of the separation or north of what Mr. Wilson has placed on Exhibit Number Five as the separation, is what you're saying, or the communication would be that way. Just when you say "here" it doesn't show --

A I understand. For the record it's difficult to do, my point being that -- that it could very well be, so to speak, around the horn, rather than as the crow flies.

Q Now would the -- your response be the same to the fact that 18 months later the Costa Two Forks State No. 1 Well was drilled with a pressure, oh, say, approximately 600 pounds lower than that encountered in the State "BX" Well 350 feet away? In your opinion these figures would not necessarily show that that was the result of drainage?

A No, I haven't discussed that yet. Let me tell you what my opinion is, and again we'll have to treat the pressures the same way as we did before, because the Costa Well, the Two Fork State No. 1, with the 3,063 pounds pressure had produced approximately 90-million cubic feet at that time, so we can't just take the finite difference between the two and try to draw any conclusions, but I have no question in my mind, based on the evidence that I've seen, that there is a relationship between the two wells in that there is some pressure communication between the two wells.

Q Now, let me ask you this. If we go to Mr. Wilson's Exhibit Number Five, and I believe you talked

about the, I hope I've got it right, the No. 10 Well that is the Amoco well in the north half of Section number 1, I believe you testified that that was nonproductive in this sand and therefore constituted some sort of a boundary up there, is that correct?

Is that a correct summary of your testimony?

A I don't recall using the word "boundary".

Q Okay.

A I think that the -- what you may be referring to is when I talked about the fact that -- that it would appear then that if the No. 10 Well is not productive and lacks the quality of the sand, the permeability and porosity to produce at the No. 10 location, that the No. 6 Well then must be draining in an irregular pattern. That's what I would expect in the Morrow sand, anyway.

Q An elliptical as opposed to a pure circle or radial drainage?

A Yes.

Q Okay. Now you testified about a minimum rate. You stated that you felt 900,000 Mcf per day was appropriate.

A Right.

Q This is based on economic considerations?

A Yes.

Q This would compare to 90 percent of the production in the Amoco No. 6 Well at this time.

A I beg your pardon?

Q The Amoco No. 6 Well, do you know what the producing rate is on that well?

A Yes, sir, I think I indicated that it was approximately 1.2 million a day in 1983.

Q In 1983. Do you have a current producing rate? Did you hear Mr. Scheffler testify about the April rate?

A I don't recall what it was. I'll stipulate.

MR. WILSON: Well, I have the requested figures.

A I'll stipulate it.

Q Subject to, I think we can agree that it's still a substantial portion of the current producing rate of the offsetting well.

A What offsetting well?

Q The No. 6 Well, the Amoco No. 6 Well.

A What is "it" in your sentence?

Q I'm talking about the requested minimum allowable would be 900,000 as opposed to the current producing rate of somewhere between a million and a million-two in the offsetting Amoco well.

A A million and a million-two?

Q Yes, I'm sorry.

A Whatever it is, it's 900 -- 88 percent, or whatever it is.

Q Okay, you are not recommending any penalty, though, whatsoever.

A I beg your pardon?

Q Are you recommending any penalty figure to the Commission?

A No, no, we're not recommending a penalty.

Q But you are recommending a minimum rate.

A We're stating what minimum would put us in a position of not being able to justify drilling the well and --

Q If a penalty is imposed.

A If a penalty is imposed. To put it into perspective it should be pointed out that that is a significant factor that could be overlooked otherwise.

Q I understand. I was just trying -- I heard minimum rate but I didn't hear penalty recommendation and I wanted to be sure I didn't have half of it.

A Okay.

MR. CARR: That's all I have.

MR. KELLAHIN: I have no redirect for this witness, Mr. Examiner, thank you.

MR. QUINTANA: Are there any further questions of the witness?

If not, he may be excused.

A Thank you.

MR. QUINTANA: Do you want to enter Exhibits Ten through Thirteen?

MR. KELLAHIN: Yes, sir, at this time we would move the introduction of Costa Exhibits Ten through Thirteen.

MR. CARR: No objection.

MR. QUINTANA: If there is no objection, Exhibits Ten through Thirteen for Costa Resources, Incorporated will be admitted into evidence.

MR. KELLAHIN: That concludes my rebuttal.

MR. QUINTANA: Mr. Carr, do you wish to put your witness back on the stand?

MR. CARR: No, I have nothing further. I'm ready to make a closing statement.

MR. QUINTANA: In this case, Mr. Carr, you may go first.

MR. CARR: May it please the Examiner, Costa Resources stands before you today proposing to drill a well that under the existing pool rules of the area would be 67 percent too close to the east boundary of that spacing or proration unit; 67 percent too close to the Amoco-operated unit that offsets it to the east.

They admit that reserves will be drained from the Amoco tract but they come before you in the face of that admission and recommend that no penalty be imposed on the production from that well.

Let's look at the evidence. As Mr. Wilson stated when he started his second portion of --

or the start of the rebuttal testimony, "welcome to our interpretation."

I think that may be the key statement in the case.

What we have here are interpretations by Costa, interpretations by Amoco. They both have worked in the area; the interpretations don't agree.

Mr. Wilson contends there is a separation between two stringers that traverses the Section number 1 in which Amoco has its No. 6 Well. He bases this on a dry hole approximately a mile south of that and his theory of how the sands are deposited in the area.

I think if you review the testimony you'll find that it is clear that the location, the exact location of these stringers can and will move as the area is further developed and additional data becomes known.

And even if we accept their theory, which we don't, the productive acreage as depicted on their Exhibit Five in the south half of Section 1 could and will, we submit, change as additional development comes along. As the channels move, if their theory is correct, the interest of Amoco and the interest owners in that unit will be affected to a greater or to a lesser extent.

We believe that to establish a channel Mr. Wilson also looked at the sand intervals in the wells that are in this immediate area and he concluded that we have separate producing zones.

In his rebuttal testimony he looked at Amoco's Exhibit Number Two, and if you will look at that exhibit, he notes that the sand body in the wells off to the east are slightly higher. If you look, what he's talking about is a distance of a mile to a mile and a half and the difference in elevation of the producing sands in the well are 10 to perhaps 15 feet.

We've had some pressure data presented this afternoon. We submit that the pressure data is inconclusive; that as logical an explanation as that presented by Costa is simply that Amoco drilled it's first well, the No. 6 Well, seven years before they developed; seven years later the pressure was down in their well several hundred pounds, and you can go right down their chart and you can see at succeeding intervals, the longer a reservoir produces, the lower the pressure in the subsequent wells drilled, and we submit that there is, if their theory is correct, communication around the horn. If their theory is not correct, we submit there's communication across Section 1 to Section 2.

We also think it's interesting that the data that's been presented by Costa had extensive presentations, cross sections, and yet they can arbitrarily ignore portions of the sand intervals that are involved. They can look at a well that has a perforated interval which extends below the productive sand, as indicated on a cross section, disregard that lower sand and then by disregarding

it say the zones don't correlate.

We submit the Amoco interpretation is better and the Morrow correlates across the area which is the subject of this dispute.

We believe that what Amoco's interpretation shows is simply a continuous sand, a sand body that will be drained by an unorthodox location, impairing our correlative rights.

The only option for us if there isn't a penalty on the well or if they are not required to drill at a standard location, would be the drilling of an additional well, which they recommend is a great idea for Amoco, a well that we believe because of the drainage from the No. 6 Well would be unnecessary and would constitute economic waste.

We therefore have asked a substantial penalty be imposed on the production from the well.

I think it's important also, as you look at the application of Costa to remember that it is based, and their whole interpertation is based on their understanding of the Morrow. Mr. Wilson testified it's easy to miss. He's missed it, in fact, himself, and that it changes over very short intervals.

Mr. Brown's testimony also confirmed that.

Their theory of the entire case depends upon their being entirely correct.

We don't know what's actually there, Mr. Quintana, until the well is drilled. We have interpretations that conflict and I would submit we have plenty of theories in this case, but in deciding the case it's important for you to look at what we actually do know.

They propose to drill a well. They are advancing on Amoco. They're 67 percent too close to the common lease line. They're going to increase their ability to drain the acreage to the east. And one very important fact which I think probably overrides everything else that's been said here today is that other wells in the area are producing from other Morrow stringers. The well in the north part of Section 1 produced from another Morrow sand and everyone here has got to accept the fact that the nature of the Morrow -- with the nature of the Morrow such as it is, there may be other zones that are encountered in that well and it is essential, therefore, that the penalty that we ask you to impose apply to all Morrow zones, not to any individual stringer as identified in this proceeding here today.

What else we think is obvious is that there are only two possible ways to offset the advantage. One is to impose the penalty; the other is to require the drilling of the well at a standard location.

We've recommended a 48 percent penalty based on what we believe is sound precedent from the Commission. We don't think there's any reason to discount

the quality of the acreage that is in the southwest quarter of Section 1 as you compare that to acreage in the southeast quarter of Section number 2, for if you look at Mr. Wilson's Exhibit Number Five, the very core of the channel that he's trying to intercept intersects the southwest corner of Section number 1.

We think that the penalty should be imposed; that a minimum allowable is simply absurd. All this is, all this does is say put an economic floor under me that anyone else in the industry who drills a well simply doesn't have. If there are not the reserves there to justify this well at the unorthodox location and a minimum allowable factor comes into play, we submit the only effect of it is to assure that their well pays out by letting them drain from the offsetting owner and we submit no minimum allowable should be imposed by the order.

We think there's only one thing that you can do. You can impose a reasonable and effective penalty on production from the well or require that they drill at a standard location.

These are the only ways we can see that you can prevent waste and protect correlative rights. If you don't, we believe you will be, in the words of Mr. Wilson, permitting exploitation of the interest of Amoco in the offsetting section and this is contrary to your statutory duty.

MR. QUINTANA: Mr. Kellahin?

MR. KELLAHIN: Thank you, Mr. Quintana.

You may know some of the background about penalizing unorthodox well locations in the deep gas formations. If you do, you can ignore what I'm about to tell you; if not, I hope you'll listen to what I think has been the history with regards to the double circle penalty.

It is my recollection that the first time Mr. Stamets and Mr. Nutter attempted to find a way to solve the problem of an unorthodox well location and attempt to come up with some way to penalize that well, they were addressing cases that were usually deep Morrow gas wells and invariably where the first well drilled in an attempt to find a Morrow channel or a Morrow stringer in Eddy and Lea County.

The applicant would come forward and want a very close location out of the corner of a section, 660 out of the corner. Being the first well in the area there was no good geology, no good engineering data, from which to make a judgment about whether or not it would adversely affect the offsetting operator.

The offsetting operator would come in and say they're awful close, the rule doesn't permit it, you've got to do something, and it's been a very difficult problem, particularly in the Morrow where the proration unit is 320 acres, giving it a long side and a short side,

and you know a standard location would be 660 by 1980. Invariably the Morrow as not laid down in such a convenient way that you would have a standard location that would encounter these Morrow channels.

The Commission has consistently recognized that it ws far more important to avoid waste and to allow the well to be drilled at an unorthodox location thereby recovering gas reserves that would not otherwise be developed, and I believe the Commission has, I don't want to say 100 percent, but at least 99 percent of the time approved unorthodox locations simply to prevent waste, and if you will read the statute and look at the cases that talk about waste, waste is the primary, paramount thing that you are concerned about today.

The definition for correlative rights is a secondary issue that you must address yourself to. We'll talk about correlative rights in a moment.

But in terms of history, the Commission has exercised its obligation to first consider the waste issue, has approved these locations, and in an attempt to find some way to at least placate, if not solve, the concerns of the offsetting operators, Mr. Stamets and Mr. Nutter developed the double circle penalty. It has absolutely no relationship to facts or anything else. You can look at it and see it was simply arbitrary.

It has been used as a benchmark, however, from which to begin a decision about what to

do with a penalty. We have seen historically that it was usually addressed to those areas where there was absolutely no well control at all and to handle that first case.

We have progressed beyond that and the Commission has deviated from the double circle penalty when there was adequate geology and engineering to demonstrate that they should do otherwise.

They have recently done that in the Western Oil Producers case in the Scharb-Bone Springs. The Commission heard that case and determind that there was no justification for a penalty, notwithstanding the location, and it was done on data not unlike what you've seen today.

I think it is essential and you have no other choice but to take the arbitrary double circle formula and if you determine it's necessary to apply a penalty at all, that you have got to tailor that penalty to the specific facts of this case.

We asked Mr. Scheffler if he had made any attempt to tailor the double circle penalty to any of the facts we were talking about. We talked about a few of the specific points. We talked about the net pay, the varying thickness on his Isopach, and whatnot, and he'd done none of those things. We think it would be arbitrary and capricious for you to do as Mr. Carr suggests.

If you want to use the double circle penalty, which I am not persuaded nor do I think you

ought to be persuaded ought to be used, the only evidence in the record to show you how to do that would be to take Mr. Brown's testimony based upon Mr. Wilson's mapping, to demonstrate to you that the Two Forks reservoir extends only into Section number 1 by some 17 percent. You are fully capable and have the evidence before you to make that judgment in your discretion and it certainly would be no abuse of your discretion; the facts would support a penalty based upon that kind of calculation, where you would penalize the allowable some -- some 17 percent.

That would be to take Mr. Scheffler's Exhibit Number Three and he's calculated the penalty using all the encroachment of the second circle as it affects Section 1, and that's just what Mr. Brown has done for you in his testimony. He has shown you that portion of this reservoir that encroaches upon Section number 1 and it's the 17 percent.

While we're talking about the penalty, let's also address the minimum allowable. Mr. Carr says we ought to penalize this well down forever and he reminded us this morning that he was relying in great extent on the Estoril order entered in June of '82 and he and Mr. Scheffler went through their proposal based upon that because they thought it was appropriate. That was Order No. R-7708. I'll invite the Commission's and the Examiner's attention to the fact that that order does in fact provide for a minimum 1-million cubic feet a day as a reasonable figure,

so using Mr. Carr's own order that he wants to bootstrap himself into a penalty on, there is a minimum, and in fact the Commission historically has allowed wells at an unorthodox location to receive a minimum allowable. There is no other testimony in the record except Mr. Brown's on that point. It's unrefuted and uncontested that a minimum allowable needs to be equal to or greater than 900,000 cubic feet of gas a day. If it's not, and Mr. Brown was very frank with you, saying that they cannot drill the well if it's not an economic venture and what's going to happen, we're going to have waste. We're going to leave gas in place that otherwise could be produced.

Let's talk about some of the things Mr. Carr has indicated to us. He tends to project this case as one of a difference of opinion between experts, a matter of interpretation.

You listened to Mr. Wilson this morning, I think it's indisputable that -- that Mr. Wilson is probably the foremost expert on the Morrow channel in Eddy County, and particularly this area. He has given you a doctorate dissertation, I think, on this area of Eddy County, and I think that's essential because that's exactly what happened in the Western Oil Producers case, where the Commission tailored the fact situation to show no penalty was justified.

You can see exactly what has occurred here; that we have a separate reservoir and no

one's here to fool anyone. I think Mr. Wilson and Mr. Brown have been very frank to you. They say it does not matter whether the well is drilled at an unorthodox location or at an orthodox location. The facts are that the Amoco Wells cannot protect that 73 acres in Section 1. A penalty you impose is not going to work.

They have done all of Amoco's homework for them. They told thkem exactly where to drill their well and how to protect themselves, and that gets us back to the definition of correlative rights.

It's not an absolute right. You can look in the rule book right under the definition section in the first portion. It talks about correlative rights. It's simply nothing more than the opportunity to produce their fair and equitable share of the gas underlying their proration unit.

We tell you that they've had that opportunity and they've fully exercised that opportunity. They have picked a location in the east half of that section for two wells and have penetrated the reservoir and have produced gobs of gas out of there. They've been doing it for seven years.

It's our turn. Our witnesses show that there is no adverse consequences on Amoco; that in order to protect correlative rights the only thing they can do is Amoco can drill another well and Mr. Scheffler sat here and said they had no plans to do that. He did not say

that they had any legal preclusion from doing that. We've invited them to immediately offset and protect themselves and get their share.

A penalty in this case is really not going to do much but follow the rudiments of an arbitrary formula. I think the practicalities are such that you simply ought to approve the application without a penalty but if you desire to do so, we've given you enough facts, I think, from which you can draw those conclusions.

I think the comparison that Mr. Carr attempts to draw between the Amoco case and the Costa Resources case is not fair. He says this is a matter of interpretation. I asked Mr. Scheffler in detail about the geology. His principal answer to me is he didn't do the work, he didn't know, and the geologist that did stayed home.

This is not a direct confrontation between two expert witnesses. Mr. Wilson comes here with decades of experience and the Amoco witness, whoever he is that started working on this sixty days ago decided to stay home.

We have attempted to make a comparison in the geology. We've looked at their Isopach that they've placed on their cross section and it doesn't have any relationship to the geologic facts underneath that. Mr. Wilson was right, the devil didn't do it. It has basic geologic facts upon which that sand deposition was made and

he's documented them for you.

I think it's very clear for you that you have no other choice but to approve this application without any penalty.

That concludes my comments. Thank you.

MR. QUINTANA: Thank you gentlemen.

I reserved the right for me to ask a few questions after your closing statements because I don't want my questions to interfere with your -- your case testimony and so right now I would like to ask a few questions here to better understand it in my mind before I take this case under advisement.

And I'd like to first direct this question to Mr. Wilson, is it? Mr. Wilson, would you --

Okay, my first question is looking at Exhibit Number Five on your Two Forks prospect, Lower Morrow delta, this -- yeah, you're looking at it right there.

MR. WILSON: Yes, let me get my short range glasses right here.

All right.

MR. QUINTANA: Looking at the HEYCO wells in the southern end of that finger that's extending from your B through B', to you see where I'm talking

about, the HEYCO wells in the very bottom of the --

MR. WILSON: Okay, down in Section 13.

MR. QUINTANA: Right. Those wells that -- there's four wells right there.

MR. WILSON: Right.

MR. QUINTANA: How does the permeability and porosity of those wells differ going across that finger?

MR. WILSON: Okay.

MR. QUINTANA: Do you happen to know?

MR. WILSON: Yeah. Actually, two of those wells have no permeability, no porosity, no permeability.

The one that has the 34-foot figure on it and the one that has the 38-foot figure on it, now the well that I have used on the cross section and Steve has used on his cross section, I believe, is that well which shows 32 feet we thought would show -- did show good porosity. A person would have expected far better performance out of the well than what it actually did.

I believe it produced on the order of 200-million gas before they went up and completed in the Strawn carbonate reservoir.

That is the principal pay in that area, and the well to the north there in Section 12,

which shows 24 feet, that was even a more miserable producer, about 38-million before -- and yet there were some other sands perforated in that well, by the way, but the total production was about 38-million.

So you would have to say in general within that particular area that the porosity and permeability is not commercial.

MR. QUINTANA: What you're telling me, you're telling me that the porosity and permeability sort of pinch out through the northeast and to the southwest of that finger.

MR. WILSON: Yeah, now of course we have discussed the production record of the ARCO "BX" Well and our Two Forks No. 1 up in the north and it's quite obvious that the porosity and permeability, even though it's thin up there, for instance we only perforated four feet in our Two Forks No. 1 Well, and we're getting about 3.2 million gas, and we know it to have a substantial reserve. The porosity and permeability obviously is much better up there and we have not discussed total reserves in this reservoir to any extent but we believe it to be on the order of between 5 and 6-billion cubic feet of gas.

And obviously it is going to -- this porosity and permeability effectively is going to have to go out somewhere between those wells and the wells down in Section 13. That is one of the risk we have in our location there, that we don't necessarily come up with a tre-

mendoustly thick, porous sand there, we can also go the other way.

MR. QUINTANA: Okay, so I take it you determined that the -- the thinner access of that finger by taking your Costa Resources Two Forks Well No. 1 and drawing a straight line across the 32 because the one -- the well with 32 feet of pay in it, do you know which one I'm talking about, the HEYCO, you drew a straight line across there and you determined that to be the axis because the one with 32 feet of pay was the best producer of those?

MR. WILSON: Well, not entirely.

MR. QUINTANA: Well, let me explain myself further.

MR. WILSON: Okay.

MR. QUINTANA: Why did you not just set, you know you have a set width of that finger. Why did you not just center your axis right down the middle?

MR. WILSON: Well, I think that's basically what I've done. It's pretty close to the center of that particular distributary channel, but let me review just a little bit.

Of course, I have mapped all the channels in here and you can see various widths and there's not a real good correlation between the thickness of the channel and the width of the channel. As for example, if you go further north into this, what most people call the

"BV" channel, the very thick one that we've talked about, you can see how narrow that is. It's less than a half a mile.

This channel here that even though it is -- the Two Forks channel, even though it is thinner is obviously wider when you've looked at the group of wells around Section 13, but then in drawing the -- let's take the east boundary of that channel. Why did I put it there, and it has been there since the very beginning. It's obviously absent in the well in the northeast quarter of Section 12, so the boundary must lie, then, between the wells which have it to the south and that well there.

And then if you'll go back and remember, I showed you an Isopach of the total Morrow. I showed you an alluvial valley coming from the northwest and then branching out into this area here where the delta is.

I feel that all of these sands must eventually arrive at the head of that delta to the entrance to that valley and that is why I drew this sand with the trend that I did, even before the ARCO "BX" was drilled I had to have some reason to do that, to want to go up there and drill a well and I had to establish the orientation of it, and that is the way that I did it.

So it's based on a number of factors. The width of it is determined principally by that group of wells in Section 13 and to this date I have had absolutely no reason to change the position of either one of

those boundaries.

MR. QUINTANA: Thank you, that will do it.

My next question is directed to Mr. Scheffler.

Having not decided whether there is a single Morrow pay across from Section 1 to Section 2 or whether there's fingered sand strings like Mr. Wilson has indicated, assuming that an orthodox location was allowed there at the place of their requesting, would Amoco consider drilling in the west half of that -- of their section to protect their correlative rights?

MR. SCHEFFLER: Did you say assuming an unorthodox location?

MR. QUINTANA: Yes.

MR. SCHEFFLER: Would Amoco consider drilling a well? Amoco would have to drill a well there to protect their correlative rights and be faced with economic waste.

MR. QUINTANA: You answered my question. I have no further questions.

Is there anything else in --

MR. CARR: May we submit a proposed order?

MR. QUINTANA: Yes. Would you gentlemen please submit a proposed order to me?

MR. KELLAHIN: Yes, sir.

MR. QUINTANA: Is there anything else in Case 8204?

If not, the case will be taken under advisement and this hearing is adjourned.

(Hearing concluded.)

C E R T I F I C A T E

I, SALLY W. BOYD, C.S.R., DO HEREBY CERTIFY that the foregoing Transcript of Hearing before the Oil Conservation Division was reported by me; that the said transcript is a full, true, and correct record of the hearing, prepared by me to the best of my ability.

Sally W. Boyd CSR

I do hereby certify that the foregoing is a complete record of the proceedings in the Examiner hearing of Case No. 8204 heard by me on AUGUST 15 1984.

Gilbert P. Quintana, Examiner
Oil Conservation Division