A Review and Analysis

of the

Published Parameters Used

by the

Kern County Assessor

to

Appraise Oil and Gas Properties

for

Ad Valorem Tax

Special Emphasis on the Procedure

for

Selecting Market Value Discount Rate

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SUMMARY and CONCLUSIONS

The purpose of this study is to examine the standards published by the office of the Kern County Assessor ("KCA") to select and assign discount rates (capitalization rates) to specific properties for ad valorem tax appraisal and to determine if those standards and the selection methods employed result in discount rates that replicate market conditions. The results of the test should indicate whether the KCA parameters are a valid method of discount rate selection.

This study examines the KCA parameters for tax years 1995-96 (Exhibit I) and 2001-2002 (Exhibit II) in detail, in four parts.

A. The Basic Capitalization Rate Range ("BCRR").
In 1995-96 the BCRR is 12-20% BFIT.
In 2001-2002 the BCRR is 11-19% BFIT.

B. The Property Quality and Risk Criteria.
In both years KCA uses three ratios to define Risk and one ratio to define Quality.

C. The Discount Rate Selection matrix.
The Risk and Quality ratios are used to select discount rates from a matrix of rates.

D. The Incremental Additions.
Increments may be added to the selected discount rate to account for the Number of Wells and Production Rate.

Conclusions Regarding Base Capitalization Rate Range

The KCA has not provided any information that would document the validity of the 12-20% BFIT or the 11-19% BFIT discount rates. In contrast, analysis of market sales data prepared for the annual WSPA property sales studies and separate studies prepared by the Texas Property Tax Division, strongly suggests that market discount rates occupy a range of 19-31% BFIT.

Conclusions Regarding Risk and Quality Criteria

In the absence of analysis which demonstrates that the discount rate is a direct function of the Gross/Net Ratio, the KCA discount rate selection based on the Gross/Net Ratio has the appearance of being subjective and arbitrary. The three Risk Ratios would appear to be redundant in some respects since they attempt to measure the same Risk in three different ways. The Reserves Risk would appear to be the most direct measure of risk but the other ratios are apparently given equal weight in the selection grid.

All three ratios have been tested numerous times as part of the WSPA study and in assessment appeals hearings. The 2001 Statistical study consolidates those results as shown in Tables 2, 3, and 4 of this report. None of those tests suggest any relation of the Capital Ratio and/or the Production Rate Ratio to the FMV discount rate. There is a modest statistical relation of discount rate to the Reserve Ratio. Like the %PDP reserves used in the WSPA study, the Reserves Ratio measures the composition of the reserves attributed to a property and infers a relation based on the risk of one class of reserves compared to another class. The Reserves Ratio increases as the proportion of Proved Undeveloped (PUD) reserves increases. Since PUD reserves are considered to be higher risk than Proved Developed Producing (PDP) reserves the greater the ratio over 1.00 the greater the discount rate should be.

The results of the correlation analysis would strongly suggest that the factors employed by KCA as selection criteria are not related to the discount rate. Conversely, the discount rate is apparently not a function of the Gross/Net Ratio, the Capital Ratio or the Production Rate Ratio, and may have only a passing relation to the Risk Ratio. Also, discount rate is shown to not be a function of the Number of Wells or Initial Production Rate. Therefore, the criteria used by KCA are not a valid means of selecting a discount rate for fair market value analysis.

Conclusions Regarding the Discount Rate Selection Procedure

The methodology used in the KCA Parameters for 1995-96 and 2000-2001 was tested using the 2001 WSPA Sales Study Working Database and two sub-sets of that database. The purpose is to determine if the KCA procedure would return the same discount rate as that derived from the actual sale. The test results indicate that the KCA procedure would provide discount rates that were 6% to 10 % below the actual market discount rates. Use of these rates would have the effect of over-valuing a property.

Conclusions Regarding the KCA Parameters

The primary problem with the KCA discount rate parameters is that the BCRR is substantially below the level of market derived discount rates for properties sold in California. The BCRR does not seem to comply with Rule 8(g) because (1) the BCRR does not conform to market derived discount rate data and (2) is significantly below the cost-of-capital discount rate levels described in Rule8(g)(2).

DISCUSSION

Purpose

The purpose of this study is to examine the published standards used by the office of the Kern County Assessor ("KCA") to select and assign discount rates (capitalization rates), "... in the market value appraisal of oil and gas properties for ad valorem tax purposes...", and to determine if those standards result in discount rates that replicate market conditions. The results of the test should indicate whether the KCA parameters are a valid method of discount rate selection.

Premise

In this study we test the discount rates parameters published by the KCA for the tax years 1995-96,[1] and 2001-2002[2] by applying the selection process established for each tax year to the database of property sales information accumulated for the annual WSPA study. The premise of the test is as follows:

1. Property valuation for ad valorem tax purposes is based on the fair market value of the property.
2. The value placed on a property by a market transaction is considered to be the market value.
3. A procedure that is used to estimate market value or properties for ad valorem tax should produce values that would be consistent with the value placed on those properties by the marketplace.
4. A procedure that does not achieve values similar to the values that are defined by the marketplace should be considered flawed and should be either modified or replaced.

Kern County Assessor Parameter Composition

The portion of the KCA Appraisal Parameter Guide covering Capitalization Rates consists of four parts:

Part One is the Basic Capitalization Rate Range (BCRR) which defines the range of discount rates that can be applied to producing oil and gas properties "...that have a sufficient history to

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[1] "1995-1996, Kern County Assessor, Oil and Gas Division Appraisal Parameters," Kern County Assessor's Office.

[2] "2000-2001, Kern County Assessor, Oil and Gas Division Appraisal Parameters," Kern County Assessor's Office.

extrapolate future production with a reasonable degree of certainty."[3] That is, for Proved Reserves.

Part Two consists of two grids which are used to define the "Property Quality" and the "Property Risk" respectively. The Property Quality is measured by the Gross/Net Ratio and defines Quality for four categories of properties as Good, Average or Poor. The Property Risk is measured by three ratios - the Reserve Ratio, the Capital Ratio and the Production Rate Ratio - which are used, individually and/or in combination to define the property as LOW, AVERAGE or HIGH Risk.

Part Three is a matrix from which a discount rate is selected based on the forgoing determination of the Property Quality and Property Risk. The matrix suggests a low rate (12%) for properties with Good Quality and Low Risk, but recommends a high rate (20%) for properties with Poor Quality and High Risk. The rates selected from this matrix are *"...to provide an indication as to the appropriate rate for general development and (or) investment scenarios."* [4]

Part Four consists of increments that may be added to the discount rate derived in Part Three. These increments are for properties with a small number of wells and/or low production. In the 1995-96 parameters, a property with only one producing well would be eligible for an increment of 3% whereas a property with 4 or more wells receives no increment. Similarly, a property that produces only 3 BOPD[5] per well would receive an incremental increase of 3% while a property producing 10 BOPD per well would not be eligible for any incremental increase.

The four parts can be considered as four steps in the discount rate selection process. The final step is for the evaluator to exercise his or her experience and judgement. As noted by KCA, *"The actual rate used in a specific property's evaluation will be determined by that property's history and characteristics and the analysis of comparable property sales..."*[6]

Testing the KCA Discount Rate Parameters

This study examines the KCA parameters in detail in the four parts described above.

1. The Basic Capitalization Rate Range.
2. The Property Quality and Risk Criteria
3. The Discount Rate Selection matrix.
4. The Incremental Additions.

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[3] "1995-1996, Kern County Assessor, Oil and Gas Division Appraisal Parameters," Kern County Assessor's Office, pg. 4.

[4] Ibid, pg. 4

[5] Barrels of Oil Per Day

[6] Ibid, pg. 4

The test of the KCA parameters was constructed as follows:

A. The "...basic capitalization rate range of 12% to 20%..."[7] used by KCA in 1995-96 and the "...basic capitalization rate range of 11% to 19%..."[8] used by KCA in 2001-02 were tested for validity in comparison to actual market data.

B. The criteria used by KCA to select discount rates were tested to determine if they had a measurable and significant predictive relationship to the discount rate.

C. Using the sales data in the 2001 WSPA[9] database, a discount rate was calculated for each of 231 actual transactions based on the criteria defined by KCA for the two years tested.

D. The discount rate obtained from the matrix in Step C for each transaction was compared to the discount rate derived from the actual sale to determine whether the KCA methodology produced a discount rate that matched, or differed from, the actual rate.

Basic Capitalization Rate Range

In the 1995-96 parameters, KCA establishes a Basic Capitalization Rate Range (BCRR) of 12-20% BFIT. In 2001-02, KCA employs a range of 11-19% BFIT (nominal) and 8-16% (real). KCA notes, in each of the three annual parameter guides, that "The actual rates used in a specific property's evaluation will be determined by ..." [in part] "...the analysis of comparable property sales by the Assessor Office."[10]

The accuracy and applicability of the BCRR is questionable given the information that is available regarding discount rates derived from property transactions in California over the past 15 years. The BCRR used by the Assessor suggests that, if all oil and gas properties in Kern County (and by extension in California) were to be sold at market value on lien date, the derived discount rates for each those transactions would not be less than 11-12% and would not be greater than 19-20%. Since not all properties are sold every year on lien date, data from actual sales of properties

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7 Ibid, pg. 4.

8 "2000-2001, Kern County Assessor, Oil and Gas Division Appraisal Parameters," Kern County Assessor's Office, pg. 4.

9 "Fair Market Value Transactions, Cost-of-Capital, and Risk: California Oil and Gas Property. Transactions 1983 through 2000," Richard J. Miller & Associates, Inc., for Western Oil and Gas Association, February 2, 2001

10 "1995-1996, Kern County Assessor, Oil and Gas Division Appraisal Parameters," Kern County Assessor's Office, pg. 4.

throughout the year must be used as surrogates for the entire marketplace. The use of actual transactions as a sample measure of market valuation is a foundation of modern appraisal practice and is required, where possible, by California regulations.

The BCRR raises several issues in regard to ad valorem tax appraisal under California regulations. Rule8(g)[11] defines two methods of deriving a discount rate for application to assessment appraisal. These methods are described as follows:

> *(g) The capitalization rate maybe developed by either of two means:*
>
> *1. By comparing the net incomes that could reasonably have been anticipated from recently sold comparable properties with their sales prices, adjusted, if necessary, to cash equivalents (the market-derived rate). This method of deriving a capitalization rate is preferred when the required sales prices and incomes are available. When the comparable properties have similar capital gains prospects, the derived rate already includes a capital gain (or loss) allowance and the income to be capitalized should not include such a gain (or loss) at the terminus of the income estimate.*
>
> *2. By deriving a weighted average of the capitalization rates for debt and for equity capital appropriate to the California money markets (the band-of-investment method) and adding increments for expenses that are excluded from outgo because they are based on the value that is being sought or the income that is being capitalized. The appraiser shall weight the rates for debt and equity capital by the respective amounts of such capital he deems most likely to be employed by prospective purchaser.*

For simplicity of discussion, Rule 8(g)(1) discount rates are hereafter referred to as "market derived discount rates" while Rule 8(g)(2) rates are referred to as "cost-of-capital discount rates."

While Rule 8(g) describes two methods of developing discount rates and indicates that those derived from market sales are "preferred," as is true in generally accepted appraisal practice, there is no suggestion that the rates "developed" from the two methods should not be equivalent. Stated differently, the manner of presentation in Rule 8(g) strongly implies that the rates developed from the two methods, when applied correctly, should provide the same result. The procedures to be used in deriving market derived and cost-of-capital discount rates are described in detail in publications of the California State Board of Equalization which draw on standard appraisal methods documented in industry texts and practice. These procedures have also been the subject of lengthy assessment appeals board and judicial debate. The derivation procedures are not further discussed here.

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[11] California Administrative Code, Title 18, § 8

If the presumption of equivalence of Rule 8(g)(1) and (g)(2) discount rates is correct, as it must be, then the BCRR can be tested using both the market derived and cost-of-capital rate approaches.

The BCRR would appear to fail in three areas relative to appraisal practice and particularly to ad valorem tax appraisal practice.

1. The range of BCRR discount rates is several percentage points below the demonstrated range of actual market discount rates.

2. The discount rates included in the BCRR have not been shown to represent discount rates that would occur in the market place for oil property sales.

3. The lower portion of the BCRR is less than the BFIT cost-of-capital of prospective and actual purchasers of oil and gas properties in California.

Market Derived Discount Rates

The primary questions regarding the BCRR are two-fold:

1. Does the BCRR represent the range of discount rates prevalent in the market place for oil and gas properties?

2. Does the BCRR conform to the requirements of Rule 8(g) with regard to the development of discount rates?

The annual WSPA Property Sales Study, which is recognized as an authoritative guide to discount rates by ad valorem tax authorities,[12] [13] has consistently found that over 90% of FMV transactions occur at discount rates that exceed 16% BFIT and that over 70% occur at discount rates that equal or exceed 20% BFIT (Figure 1). The WSPA Study has consistently found in those transactions in which property risk is included as part of the discount rate, that the FMV discount rate, derived in accordance with Rule 8(g)(1), displays a normal distribution with a mean of 24.0% and a standard deviation of 7.0 percentage points.[14] This would create a range of discount rates from 17.0% to 31.0% within in which 65-75% of transactions would fall. As reported in numerous

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[12] "Assessment of Petroleum Properties," Assessor's Handbook Section 566, California State Board of Equalization August, 1996.

[13] "Texas Property Tax: Manual for Discounting Oil & Gas Income," Texas Comptroller of Public Accounts, Austin, TX, 1999.

[14] "Fair Market Value Transactions, Cost-of-Capital, and Risk: California Oil and Gas Property. Transactions 1983 through 2000," Richard J. Miller & Associates, Inc., for Western Oil and Gas Association, February 2, 2001

WSPA studies statistical analysis indicates that the sample of properties represented in the WSPA study would predict that if all properties in California if sold at a given time, the Mean discount rate from those sales would fall in a range from 23-25% with a 95% confidence level.[15] Lastly, statistical analysis has also shown a reasonable strong relationship between the discount rate and the Reserves Risk in a property where the discount rate for 100% Proved Developed Producing properties is about 22% while a discount rate for 0% PDP properties (100% PUD) would be about 30%.[16] These results, relating required return to perceived risk, are consistent with surveys of industry professionals[17] and with modern portfolio analysis in financial management.

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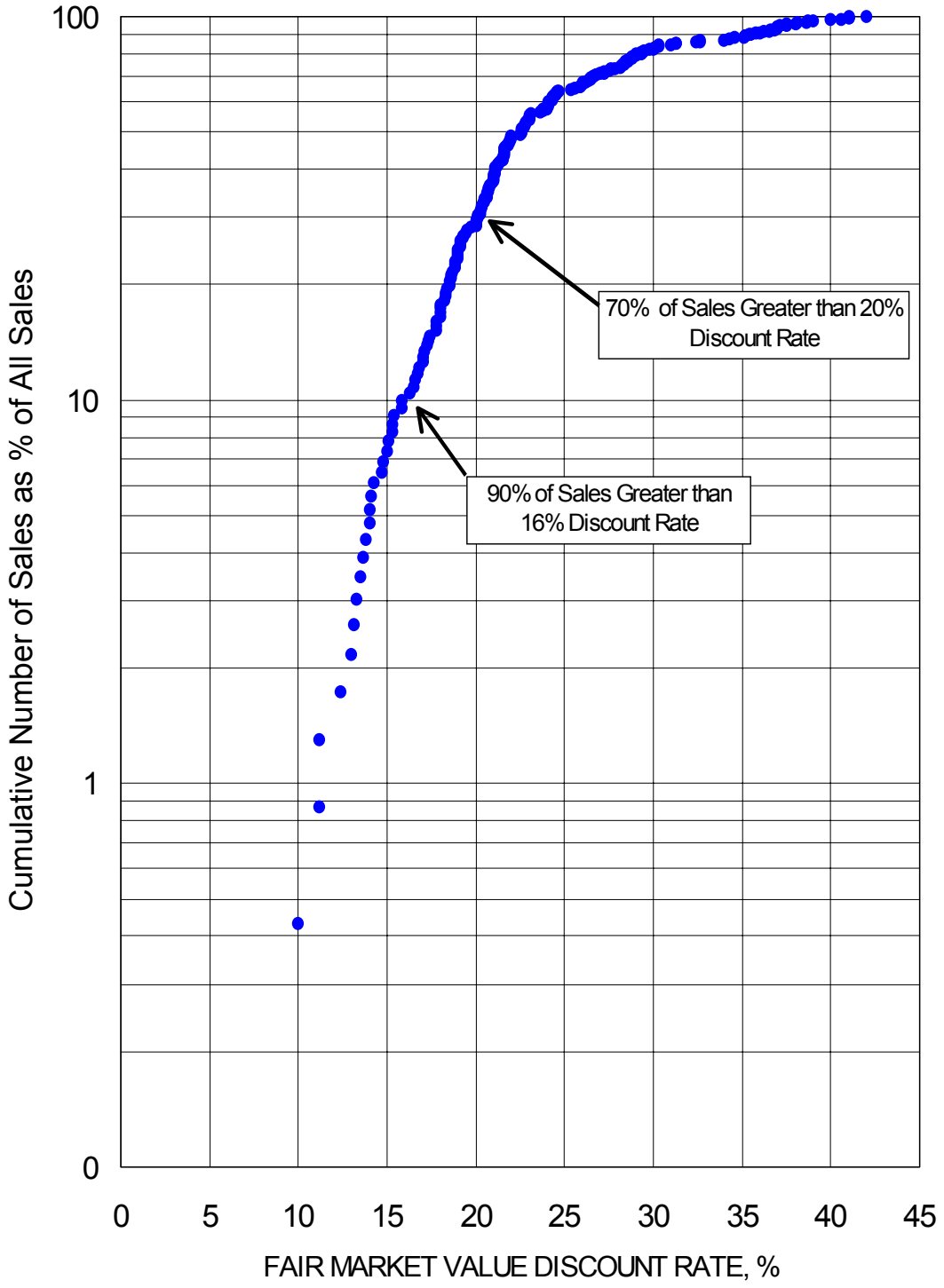
15 Ibid, pg. 31

16 Ibid, pg. 32

17 Nineteenth Annual, "Survey of Economic Parameters Used in Economic Evaluation," Society of Petroleum Evaluation Engineers, June, 2000 Houston, TX.

FIGURE 1 - FAIR MARKET VALUE DISCOUNT RATE as a function of CUMULATIVE SALES



These results should suggest that the BCRR offered by KCA is below market and is not supported by market sales of properties that are comparable for discount rate purposes.

This study has focused on the KCA Parameters for 1995-96 and 2000-2001 as test examples. However, the basic form of the BCRR was established in the late 1980's, with the matrix approach added in the early 1990's. Therefore, it is fair to say that the BCRR, using the same discount rate range from low to high, has spanned over 10 years of market activity. The BCRR in the 1988-93 period was derived from the work and recommendations of consultants retained by the Petroleum Standards Advisory Committee (PSAC).

As part of this study, three reports prepared by consultants to PSAC were examined to ascertain if the studies supported the BCRR. These are:

- *Analysis of Sales of Oil and Associated Gas Producing Properties Occurring in the State of California During the Period 1987 Through 1993 for Lien Date 1993,* R.B. Campbell-Taylor and Associates, Inc. as of December 31, 1992.

- *1999 Petroleum Property Sales Analysis*, Harold W. Bertholf Inc. (1/2000).

- *2000 Petroleum Property Sales Analysis*, Harold W. Bertholf Inc. (2/2001).

The Campbell-Taylor report is of particular utility for two reasons. First, the report covered market sales from 1986 through 1992. Second, it was the last published PSAC study prior to 1999. The study has been evaluated in some depth to determine whether the study could be used to support the BCRR.

It is of interest that the study reports the following:

< Market Derived discount rates from 82 transaction from calendar year1987 through calendar year 1992 with an arithmetic Mean of 20.7% BFIT and a Standard Deviation of 8.8 percentage points.

< Individual year discount rates for small transactions (<$1 million) ranging from 21.1% to 27.9%.

< Discount rates distributed by year and transactions size (Table 1) ranging from 11.7% up to 39.0%.

The Campbell-Taylor study attempted to show a relation between discount rate and transaction size. This relation has since been shown to be statistically and conceptually invalid but the tabular presentation does allow some conclusions regarding the distribution of market discount rates.

It is apparent that, with the exception of a few points which are often found to be for single transactions, 29 out of the 34 data points reported in the Campbell-Taylor study indicate discount rates that (1) equal or exceed the cost-of-capital over the reference period and (2) range from 15.2% BFIT up to 39.0%. In order for the Mean of all sales to be 20.7% there must be a large number of data points with discount rates above 20.7%. The standard deviation of 8.8% would suggest a range of 11.9% to 29.5% BFIT containing 67.67% of all transactions. These results are not inconsistent with the WSPA study results.

The BCRR effectively cuts this range in half and only considers the lower half of the range. There is no discussion regarding the reason for this truncating of the upper half of the market data which would seem, under Rule8(g)(1), to be just as applicable as the lower half.

Table 1 - 1993 Campbell-Taylor Market Sales Study
Arithmetic Mean Discount Rate

Purchase Price Range	All Years	1993	1992	1991	1990	1989	1988	1987	1986
<$1,000,000	22.7	26.0	21.1	27.1	21.3	21.7	23.6	12.6	27.9
<$1,000,000 to <$5,000,000	25.2		20.8		18.8	17.2	23.8	39.0**	31.8
$5,000,000 to <10,000,000	15.2		15.7	23.3	12.6*		12.9**	11.7**	
$10,000,000 to <$10,000,000	17.4			16.3	21.0	15.9	16.8		17.1
>$100,000,000	16.5			16.5		21.3	13.8	16.8	14.0

* Typographical error in original report. The data point should be 21.7%
** One Transaction

The 1999 Petroleum Property Sales Analysis and the 2000 study of the same name done by the Bertholf firm (hereafter the "Bertholf Sales Studies") report the following:

- In 1999, based on 37 sales analyzed the mean discount rate is 18.64% and the median is 14.61% BFIT for all properties. Among oil properties, the mean and median are 20.36% and 14.32% respectively.

- In the 1999 report, 24 of the 37 sales (65%) have discount rates less than the Cost-of-Capital of 16.2% BFIT for 1998 (the last year prior to 1999). Of those 24, six have discount rates less than 10% compared to the Prime Interest Rate of 8.37% in late 1999.

The 2000 Bertholf study reports very similar results:

- A total of 52 sales from 1995 through 1999 are analyzed. Presumably these include the 37 sales from the 1999 report.
- The 52 sales have a mean discount rate of 17.42% BFIT and Median of 14.24% BFIT.
- The discount rates are tabulated by year and by purchase price with no discernable trend or pattern.
- Of the 52 sales, 35 are at or below the cost-of-capital (15.6% BFIT for 1999; 16.1% BFIT for 1990-1999).
- Twelve sales have discount rates less then 10% BFIT and two sales are shown to be zero or negative.

These results would suggest that many of the sales included in the two studies are:

1. Not market value sales.
2. Have anticipated value that is not a part of the income stream.
3. Are adjusted for risk in some manner and/or contain provisions in the purchase or evaluation that are not compatible with Rule 8.

Cost-of-Capital Discount Rates

The cost-of-capital argument is important because of the reliance in SBE Rule 8(g) on both market derived discount rates and cost-of-capital derived discount rates. There are numerous studies of oil industry cost-of-capital conducted by WSPA, state tax authorities and well-known consulting firms. These studies, while varying marginally from year to year and among sources, document industry WACC at an average of 16.1% BFIT for the 1990-2000 period. This is substantially higher

than the lower end of the BCRR. In addition, several studies[18] [19] have demonstrated that the discount rates derived from actual transactions whether from (Table 2) all (i) sales or (ii) only those with 100% PDP reserves consistently exceed, on an annual average basis, the BFIT WACC over the 1985-2000 period (Table 2).

Further, the WACC as used in financial management and appraisal practice is only a minimum rate for property evaluation; adjustments are necessary before a WACC based discount rate can be applied to a specific property evaluation. As an example, a 1997 study done by Ibbotson Associates specifically addressed this issue through the derivation of a "Pure-Play" WACC for oil and gas producing companies. This study found that a WACC of 20.15% BFIT would be representative of a company whose sole business was the production and sale of crude oil and natural gas. As cautioned by Ibbotson, this rate is to be applied only to income streams that have been adjusted for risk. It should also be noted that the 20.15% rate is only return-on-investment and does not include a return-of-investment component.

Conclusions Regarding Base Capitalization Rate Range

The KCA has not provided information that would document the validity of the 12-20% discount rate. In contrast, analysis of market sales data prepared for the WSPA studies and by the Texas Property Tax Division, strongly suggest that market discount rates occupy a range of 19-31% BFIT.

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[18] Texas Comptroller of Public Accounts, Annual report of "Oil and Gas Discount Rate Calculation" 1983 through 1999, Austin, TX.

[19] Miller, Richard J. "Discount Rates from Market Sales vs. Cost-of-Capital: From Whence Cometh the Difference?," SPE 71426, October, 2001 Dallas, TX.

Table 2 - Market Derived Discount Rate v. Weighted Average Cost-of-Capital

Year	All Properties Mean DCR %	Risk Inclusive Mean DCR %	100% PDP Mean DCR %	Cost-of-Capital Mean WACC %	[a]All %	[a]RI %	[a]PDP %
1985	27.6	26.9	25.7	18.9	8.7	8.0	6.8
1986	23.8	26.4	24.1	15.0	8.8	11.4	9.1
1987	22.1	24.9	23.0	15.1	7.0	9.8	7.9
1988	24.2	22.8	22.8	15.6	8.6	7.2	7.2
1989	25.5	22.0	27.6	15.6	9.9	6.4	12.0
1990	21.8	20.5	21.1	18.8	3.0	1.7	2.3
1991	22.8	22.6	22.2	18.5	4.3	4.1	3.7
1992	25.5	24.8	24.7	15.5	10.0	9.3	9.2
1993	24.2	27.7	22.4	13.8	10.4	13.9	8.6
1994	25.6	25.8	22.1	17.3	8.3	8.5	4.8
1995	22.4	23.3	22.4	14.8	7.6	8.5	7.6
1996	22.3	21.8	19.2	16.0	6.3	5.8	3.2
1997	20.6	*	19.9	14.1	6.5	-	5.8
1998	26.7	*	*	16.2	10.5	-	-
1999	18.6	*	*	15.6	3.0	-	-
1985-1999	23.3	24.1	21.8	16.1	7.57	7.88	6.8

* Insufficient data points

Property Quality and Risk Criteria

Property Quality Criteria

The KCA parameters use the Gross/Net Ratio (also known as the Income Ratio) as a measure of Property Quality. The ratio is calculate as follows:

$$\frac{\text{Gross}}{\text{Net}} = \frac{\text{Gross Income}}{\text{Net Income + Development Capital}}$$

Gross Income is defined as all revenue from product sales. In one version of the ratio, Gross Income is net of production and severance tax. As used in this calculation, Net Income is the same as Cash Flow.

The Gross/Net Ratio is a comparison of the amount of revenue from the property *before* operating costs to the revenue remaining *after* operating costs and is an indirect measure of relative operating costs. An increase in the Gross/Net Ratio over 1.00 indicates that the property has higher operating costs than another property with lower costs. A Gross/Net Ratio of 2.00 indicates that for every $2 of Total Net Revenue $1 is consumed by operating costs, leaving $1 of Net Operating Revenue. The Gross/Net has numerous flaws as a measure of operating costs. The lumping together of all costs into a single number is only one of them. It is, at best, an indirect measure of risk and then only if a high operating-cost margin is considered a risk included in the discount rate. Presumably, the higher ratio indicates a greater risk, and therefore, the discount rate would have to be higher.

In the KCA methodology, the Property Quality is then classified as Good, Average, Poor or Marginal, based on the value calculated for the Gross/Net Ratio. These classifications are then used to select a discount rate from within the BCRR. The presumption of this exercise is that the discount rate in a market transaction is a function of Property "Quality" and that Property Quality can be defined by the ratio of Gross Income to Net Income. For example, in the 1995-96 appraisal parameters, for properties of average risk the discount rate would increase from 12.0% for a Quality property to 16.0+% for a Poor Quality Property (Exhibit I). This method of assignment of discount rates suggests a direct correlation between the Gross/Net Ratio such that an average property with a G/N of 2.10 or less would be valued using a 13% discount rate whereas an average property with a G/N of 3.10 or greater would be valued using a 17% discount rate. Further, the use of such a relation for the selection of discount rates suggest that this method is also used in the market place for the evaluation of oil properties.

The Gross/Net or Income Ratio has been tested in several earlier WSPA reports (under the term Income Ratio) using single linear regression. Those studies generally found little or no relation as shown below. The 1997 study found an inverse relationship with $R = -0.850$ and $R^2 = 0.0070$.

The 1999 study did not review the Gross/Net Ratio. In the 2001 statistical study,[20] the Gross/Net Ratio is tabulated for 220 sales and ranges from 1.00 for a group of royalty transactions to over 11.6 for one sale. The Mean is 2.39, which suggests the average sale has operating costs equal to about 58% of Net Revenue. The correlation of the Gross/Net Ratio to market-derived discount rate was tested using the Working Database, the Risk Inclusive Database and the 100%PDP Database. The results are presented in Table 3. The correlation coefficient of G/N relative to FMV discount rate never exceeds 0.05 and at best equals only 0.0407. It is readily apparent that the Gross/Net Ratio derived from actual sales has no statistically significant relation to discount rate; and it seems apparent that the Gross/Net Ratio is unrelated to discount rate and has no utility as either a measure of quality or as a guide to selecting a discount rate for property appraisal.

Table 3 - Discount Rate v. Gross/Net Ratio

Regression Form	Working Database R^2	Risk Inclusive Database R^2	100%PDP Database R^2
Gross/Net Ratio = 1 to 14			
Number of Sales	220	136	149
Linear	0.0069	0.0058	0.0002
Logarithmic	0.0132	0.0153	4E-05
Exponential	0.0070	0.0037	4E-05
Polynomials			
2nd Order	0.0121	0.0186	0.0003
3rd Order	0.0181	0.0336	0.0010
4th Order	0.0265	0.0339	0.0148
Gross/Net Ratio = 1 to 3			
Number of Sales	181	114	116
Linear	0.0253	0.0245	0.0031
Logarithmic	0.0249	0.0242	0.0032
Exponential	0.0249	0.0199	0.0027
Polynomials			
2nd Order	0.0253	0.0245	0.0031
3rd Order	0.0284	0.0275	0.0079
4th Order	0.0407	0.0275	0.0089

[20] "Statistical Analysis of California Oil and Gas Property Transactions: A Supplement to WSPA Property Sales Studies 1985 through 2001," Richard J. Miller & Associates, Inc., for Western States Petroleum Association, September 28, 2001.

Property Risk Criteria

The KCA parameters use three ratios as the criteria to describe the Property Risk. The Reserve Ratio, the Capital Ratio and the Production Rate Ratio are calculated separately and used individually to define a property as being Low, Average, or High Risk. The use of the three Risk ratios is similar to the use of the Gross/Net Ratio to measure Quality. As an example, according to the parameters for 2001-02, a property with a Capital Ratio of less than 1.10 would be classed as Low Risk while a property with a Capital Ratio of greater than 1.20 would be classed as High Risk. Assuming a property of Average Quality, the Low Risk classification would result in a discount rate of 11.0% while a High Risk property would obtain a discount rate of 16.0%. This suggests a direct relation between the Capital Ratio and the Discount Rate. The same relation is suggested for the Reserve Ratio and for the Production Rate Ratio. The three ratios are defined in the KCA parameter publication as follows:

$$\text{Reserve Ratio} = \frac{\text{PD + PUD}}{\text{PD}} = \frac{\text{Proved Developed Reserves + Proved Undeveloped Reserves}}{\text{Proved Developed Reserves}}$$

$$\text{Capital Ratio} = \frac{\text{Fair Market Value + P.W. Projected Development Capital}}{\text{Fair Market Value}}$$

$$\text{Production Rate Ratio} = \frac{\text{Initial Production Rate}}{\text{Maximum Production Rate During Property Life}}$$

The **Reserve Ratio** is intended to be a direct measure of property risk. The larger the volume of Proved Undeveloped (PUD) reserves in the total reserves, the greater the value of the Reserve Ratio. PUD reserves are considered to be greater risk than PDP reserves, therefore an increasing Reserve Ratio indicates greater risk. KCA sets the relative risk levels as shown in (Exhibit I) where a ratio of 1.00 to 1.10 is LOW risk while a ratio exceeding 1.25 is HIGH risk.

There are some problems with this ratio but it does recognize the risk inherent in reserves of differing certainty. The Reserve Ratio parallels, to some extent, the %PDP Reserves used for the WSPA study.

The **Capital Ratio** is also intended to be a measure of risk but it is an indirect indicator. The presumption of the Capital Ratio is that all of the future capital expenditure (1) is attributable to the development of additional production and (2) that the development would be of higher risk reserves or would entail a greater uncertainty of recovery than does the purchase price of the property. The presumption is that Future Capital Investment would be primarily for the purpose of increasing production, reserves and cash flow. This argument further presupposes that there is attendant risk

of not recovering the expected production and/or cash flow and that this risk may be captured in the discount rate if it is not taken into account elsewhere in the evaluation. Rather than assume that risk is measured by total dollars of Future Capital Investment (FCI) or Total Required Investment (TRI), the Capital Ratio presumes that risk would be measured or approximated by the relative amounts of FCI and Cash Equivalent Purchase Price (CEPP) in an evaluation. Those evaluations that include a large amount of FCI relative to the Purchase Price would be expected to have larger exposure to high(er) risk PBP and PUD reserves and their attendant risk.

A Capital Ratio of 1.00 would indicate no additional Capital Investment and no apparent additional risk. Capital Ratio increasing above 1.00 would suggest greater Capital Investment relative to Purchase Price and, therefore, greater risk. As shown in (Exhibit I), a Capital Ratio of 1.00 - 1.10 is supposed to suggest LOW risk whereas a ratio of 1.25 or greater is HIGH Risk.

There are several problems with the Capital Ratio as a measure of property risk.

- The capital investment may be for purposes other than development of new production. It may be scheduled for low risk infill drilling or for recompletion work.

- The use of a Present Worth value of Projected Capital Development requires the introduction of a present worth factor. The present worth factor must be selected with care since capital expenditures may or may carry the same level of risk as acquisition expenditures.

- The use of present worth Capital diminishes the importance of those capital expenditures that are scheduled in latter years by reducing them to small(er) amounts in the ratio even through they may represent the same or greater level of risk.

The Capital Ratio ("CR") can be constructed using either un-discounted or discounted Future Capital Investment as follows:

$$\textbf{Un-discounted CR (CR)} = \frac{\text{Fair Market Value + Projected Development Capital}}{\text{Fair Market Value}}$$

$$\textbf{Discounted CR (PWCR)} = \frac{\text{Fair Market Value + Projected Development Capital}}{\text{Fair Market Value}}$$

The Fair Market Value is always considered to be in current dollars and is, therefore, always present value. In the PWCR version of the ratio, the Future Capital Investment is reduced to present value using the cost-of-capital for the invested capital as the discount rate. Using the PWCR rather than the CR could resolve the effect of differences in timing of expenditures.

Analysis of the Capital Ratio was first reported in the 1991 WSPA Study. The *Un-discounted CR* form has been tested in several subsequent reports including the 2001 Statistical Study.

	Single Linear Regression	
	R	**R^2**
1991 Report	0.16500	0.02722
1993 Report	0.16500	0.02722
1995 Report	0.06001	0.00360

The present value form of the ratio ("*PWCR*") has also been tested. The 1995 WSPA Report found on R = 0.09290 and R^2 = 0.00863 for 177 sales using single linear regression. The 1997 WSPA Report tested Discount Rate as a function of PWCR and found an R value of -0.11383 and R^2 = 0.01295, which suggests a weak and inverse relation. The 1999 WSPA Study did not review the Capital Ratio in either form.

The 2001 Statistical Study examined the Un-Discounted Capital Ratio (Table 4) and the Present Worth Capital Ratio (Table 5) to determine if any relation to discount rate could be found using methods other than single linear regression. The results are reported below for the Working and Risk-Inclusive databases, using all transactions with Capital Ratio greater than 1.00.

The R^2 values obtained for the Un-Discounted Capital Ratio = 1 to 25, illustrates one of the difficulties of relying on one set of results to determine a relationship. The relatively high R^2, particularly for the Risk Inclusive data set, results from having virtually all the data points grouped together at one end of the scale and one or two points at the other end of the scale. The regression equation treats the cluster of points as one end of the curve and the 1-2 isolated points as the other end to give a result that appears to be a better relation than is actually the case. The lack of relation is shown by looking at the Capital Ratio = 1 to 5 or 1 to 2 ranges. In those ranges, where most of the data points reside, there is no relation between Capital Ratio and Discount Rate.

The concept of discount rate being related to Future Capital Investment is reasonable if (1) risk is included in the discount rate, and (2) there is risk associated with the projects developed from the Capital Investment. In regard to the latter issue, if the investment is for new drilling or EOR startup there may be reserves classed as PUD that are inherently of greater risk than PDP. But, Capital Investment can be used for many purposes other than increasing production and reserves. For that reason, the measurement of risk may be better done directly rather than through an indirect ratio.

The Capital Ratio is burdened by a serious problem of construction by including the FMV as part of the ratio. The purpose of using the Capital Ratio and the discount rate matrix is to select a discount rate for application to an income stream in order to calculate a market value. The stated

purpose of the KCA parameters is to select a discount rate for use in appraising oil and gas properties, presumably to be valued at Fair Market Value. In the normal progression of events the discount rate is selected and then used to convert a future income stream to present value. If the discount rate selected carefully, the present value should represent Fair Market Value. The Capital Ratio turns that process on its head by first requiring a determination of Fair Market Value which is then used to create a ratio which is used to select a discount rate. The Capital Ratio then requires that the value be known before the calculation of value is done.

The **Production Rate Ratio** is intended to measure the property risk by inferring that an increase in production rate in the future compared to the production rate at the time of acquisition is a measure of risk. The PRR is calculated as the ratio of the highest annual average projected Future Production Rate ("*FPR*") to the Initial Production Rate ("*IPR*").[21] A PRR of 1.0 would indicate no future increase in production over the initial production rate; whereas a ratio greater than 1.0 would indicate a future increase in production; the higher the ratio, the greater the future increase in production. The higher FPR could be expected to result from (1) additional property development, drilling and remedial/recompletion work and/or (2) EOR activity. The PRR would reflect the anticipated results of those projects. As noted above, additional production development or EOR activity could involve additional risk above that of PDP reserves, so it might be expected that an evaluation with a PRR greater than 1.00 would result in a discount rate which exceeded the discount rate from a 100%PDP reserves evaluation.

The construction of the ratio is awkward particularly when compared to the Reserve and Capital Ratios. Those factors measure "Risk" by an increase over 1.00 but the Production Rate Ratio measures risk by a decline in the ratio such that 0.90 - 1.00 is LOW risk and a ratio less than 0.75 is HIGH risk. A consistent construction would be to invert the ratio so that Future Production Rate divided by Initial Production Rate would be 1.00 or greater.

[21] More finite comparisons could be made in Bbls per day or Bbls per month if such data were available.

Table 4 - Discount Rate v. Un-Discounted Capital Ratio

Regression Form	2001 Study Working Database R^2	2001 Study Risk-Inclusive Database R^2
Capital Ratio = 1 to 25		
Number of Sales	106	71
Linear	0.0891	0.2739
Logarithmic	0.0195	0.2299
Exponential	0.0465	0.2133
Polynomials		
2nd Order	0.1300	0.2810
3rd Order	0.1698	0.2933
4th Order	0.1706	0.2945
Capital Ratio = 1 to 5		
Number of Sales	97	63
Linear	0.0286	0.0117
Logarithmic	0.0250	0.0099
Exponential	0.0351	0.0136
Polynomials		
2nd Order	0.0297	0.0189
3rd Order	0.0300	0.0716
4th Order	0.0303	0.0716
Capital Ratio = 1 to 2		
Number of Sales	66	47
Linear	4E-05	0.0124
Logarithmic	3E-06	0.0151
Exponential	7E-05	0.0159
Polynomials		
2nd Order	0.0076	0.0325
3rd Order	0.0085	0.0510
4th Order	0.0256	0.0522

Table 5 - Discount Rate v. Present Worth Capital Ratio

Regression Form	2001 Study Working Database R^2	2001 Study Risk-Inclusive Database R^2
PW Capital Ratio = 1 to 25		
Number of Sales	93	59
Linear	0.0573	0.1817
Logarithmic	0.0125	0.1602
Exponential	0.0331	0.1447
Polynomials		
2nd Order	0.0835	0.1835
3rd Order	0.1458	0.1888
4th Order	0.1547	0.2025
PW Capital Ratio = 1 to 5		
Number of Sales	89	55
Linear	0.0390	0.0008
Logarithmic	0.0388	0.0042
Exponential	0.0446	0.0006
Polynomials		
2nd Order	0.0423	0.0371
3rd Order	0.0570	0.0744
4th Order	0.0582	0.0746
PW Capital Ratio = 1 to 2		
Number of Sales	69	46
Linear	0.0119	0.0154
Logarithmic	0.0091	0.0222
Exponential	0.0184	0.0158
Polynomials		
2nd Order	0.0327	0.1300
3rd Order	0.0433	0.1945
4th Order	0.1120	0.2098

The conceptual problem with the Production Rate Ratio is that it presumes that an increase in production rate is an indicator of risk in the property. However, production rate increases can come about through improved operations which entail no particular risk. This is commonly projected in the case of a takeover of a neglected property. The increase may not represent new reserves or require capital expenditures.

The 1991 WSPA Study [22] was the first time that the PRR was tested as a function of discount rate. That study tested 113 sales and reported R = 0.051 (R^2 = 0.0026). The 1993 study (113 sales) reported R = -0.116 and an R^2 of 0.01345 using a linear regression of PRR against discount rate. The 1995 WSPA Study found a linear regression of R^2 = 0.0026, R = 0.050963) from 177 sales. Finally, the 1997 report found an R of 0.05590 (R^2 = 0.00310) from 187 sales, again using a linear regression. These results are thought to be conclusive that the PRR is not related to the discount rate. The analyses used all data points including PRR = 1.00.

For the 2001 Statistical study, the PRR was analyzed using the entire database of 231 sales and the Risk-Inclusive Database of 146 sales. The analysis (Table 6) included only those transactions with PRR greater than 1.00.

The PRR relationship shows a significant improvement in correlation when the smaller Risk-Inclusive Database is used instead of the Working Database. This result might be expected since the Risk-Inclusive Database is the one used to measure the Reserves Risk relation to discount rate. PRR greater than 1.00 indicates a future increase in production, which may be reflective of future additions to PDP reserves from sources that are currently classed as PBP or PUD. On the other hand, an increase in PRR could occur due to improved production of PDP reserves through workovers, wells returned to production, or other causes. In that case, the PRR could be measuring the same risk relation as Reserves Risk, but the measurement is indirect so that the PRR may be supplemental to the Reserves Risk relation but is probably not a substitute.

In this test, as in others discussed above, the future production rates and current production rate which form the PRR are integral parts of the cash flow and are reflected in the purchase price. To the extent that the PRR reflects the risk in the production projection, the source of the increase in PRR must be examined. Future production rates can be increased by any number of methods including:

a) Returning idle wells to production
b) Repairing wells and equipment
c) Remedial work on existing wells
d) Adding Behind-Pipe production

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[22] *"Analysis of Oil and Gas Property Transfer Sales and Derivation of a Band of Investment 1983 through 1990,"* March 1, 1991, Richard J. Miller & Associates, Inc., prepared for Western States Petroleum Association, Glendale, CA, page C-15

e) New Drilling:
    Infill wells
    Extension wells
    Replacement wells
f) Production stimulation
    Fracturing
    Cyclic Steaming
g) New well drilling
h) EOR Projects

The progression from (a) to (h) is an increase in relative Risk that might be reflected in the discount rate. Each case from (a) to (h) could produce the same PRR of 1.5 or 2.0 or 5.0; however, the PRR would give no indication of the risk associated with the source of the increase. Also, as noted previously for other relations, the improved correlation obtained with higher order polynomials (up to 0.1885 for a 4th Order equation) results from a tortuous curve-fit that would require an appraiser to increase and then decrease the discount rate as PRR increased. Therefore, the PRR is not a very useful indicator of risk and has no utility in selecting a discount rate.

Conclusions Regarding Risk and Quality Criteria

In the absence of analysis which demonstrates that the discount rate is a direct function of the Gross/Net Ratio, the KCA discount rate selection based on Gross/Net Ratio has the appearance of being subjective and arbitrary. The three Risk Ratios would appear to be redundant in some respects since they attempt to measure the same Risk in three different ways. The Reserves Risk would appear to be the most direct measure of risk but the other ratios are apparently given equal weight in the selection grid.

All three ratios have been tested numerous times as part of the WSPA study and in assessment appeals hearings. The 2001 Statistical study consolidates those results as shown in Tables 3, 4, and 5. None of those tests suggest any relation of the Capital Ratio and/or Production Rate Ratio to the FMV discount rate. There is a modest statistical relation of discount rate to the Reserve Ratio. Like the %PDP reserves used in the WSPA study, the Reserves Ratio measures the composition of the reserves attributed to a property and infers a relation based on the risk of one class of reserves compared to another class. The Reserves Ratio increases as the proportion of PUD reserves increases. Since PUD reserves are considered to be higher risk than PDP reserves, the greater the ratio over 1.00 the greater the discount rate should be.

The results of the correlation analysis would strongly suggest that the factors used by KCA as selection criteria are not related to the discount rate. Conversely, the discount rate is apparently not a function of the Gross/Net Ratio, Capital Ratio or Production Rate Ratio, and may have only a passing relation to the Risk Ratio. Also, discount rate is shown to not to be a function of the Number of Wells or current Production Rate. Therefore, the criteria used by KCA are not a valid means of selecting a discount rate for fair market value analysis.

Table 6 - Discount Rate v. Production Rate Ratio > 1.00

Regression Form	2001 Study Working Database R^2	2001 Study Risk Inclusive Database R^2
All Sales		
Number of Sales	76	40
Linear	0.0002 0.0908	
Logarithmic	0.0018 0.1483	
Exponential	0.0003 0.0838	
Polynomials		
2nd Order	0.0002 0.1256	
3rd Order	0.0133 0.1381	
4th Order	0.0520	0.1885
PRR = 0 to 10		
Number of Sales	67	30
Linear	0.0367 0.0653	
Logarithmic	0.0280 0.0777	
Exponential	0.0193 0.0527	
Polynomials		
2nd Order	0.0433 0.0872	
3rd Order	0.0491 0.0872	
4th Order	0.0537	0.1185

Incremental Additions

In addition to the Quality and Risk Criteria for selecting discount rates, KCA proposes that increments may be added to the selected discount rate to account for additional risk of a property having only 1-3 wells and/or a production rate of 7 BOPD per well or less. As with the Quality and Risk criteria, there is a presumption that a small number of wells and a low production rate are acceptable measures of risks such that a direct relation between Number of Wells and Production Rate is possible. The WSPA study has tested both Number of Wells and Initial Production Rate to define the extent of any relationship to discount rate and has found none. [23] Those analyses are not repeated here.

[23] See: Statistical Analysis...." pg.48 and pg.54

The Discount Rate Selection Matrix

An argument could be made that even through the various Quality and Risk ratios and other criteria have been shown to be unrelated to the discount rate, the Assessor needs some objective method of selecting discount rates which, at the very least, provide a framework within which an evaluator or appraiser can employ his experience and judgement. For that reason, we test the KCA discount rate selection process to determine the ability of the procedure to provide a rational and accurate discount rate.

To do this test, we used the WSPA 2001 Working Database and two sub-sets of that database. We calculated the Gross/Net Ratio, Reserves Ratio, Capital Production Ratio and Production Rate Ratio for each of the 231 sales in the 2001 Database. We also tabulated the Number of Wells and IP for each transaction which reports such data. We then apply the KCA 1995-96 discount rate procedure to each of the 231 sales to determine the discount rate that would be applied to the property buyer's cashflow by KCA. This discount rate was then compared to the discount rate derived from the actual transaction evaluation to see if the KCA method would duplicate the market approach. This process than was repeated using the WSPA 2001 Risk Inclusive Database and the WSPA 2001 100% PDP Database.

The 1995-96 KCA Discount Rate Parameters

We began with the 1995-96 KCA parameters. The 1995 parameters were selected as being the defining publication on which later year parameters are based. In regard to the discount rate or capitalization rate, in 1995 KCA has elected to base the selection of an individual property rate on several measures of property "Risk" and "Quality." No definitions of the terms Risk or Quality are offered. The only definitions of either term are a series of ratios which are considered to be measures of Quality and/or Risk.

KCA Procedure

The KCA discount rate grid or matrix is shown in Exhibit I. Three Risk Ratios and a Quality Ratio are calculated from the information contained in the cashflow for the property. The evaluator calculates the Reserve Ratio, the Capital Ratio, and the Production Rate Ratio. He then compares the calculated value for each ratio to the matrix to determine if the property is LOW, AVERAGE, or HIGH Risk. Presumably if the ratios are reliable measures of risk the calculated ratios would all give the same answer as to the level of risk. For example, a property with a Reserve Ratio of 1.15, a Cap Ratio of 1.21 and a Rate Ratio of 0.89 should all indicate AVERAGE risk. However if the Reserve Ratio was 1.35 then two factors would indicate AVERAGE risk while the Reserve Ratio would suggest HIGH risk.

The evaluator then calculates the Gross/Net Ratio as a measure of Quality. In this case "Quality" is purely an economic measure. Here again the evaluator compares the calculated ratio to the matrix to determine if the property is GOOD, AVERAGE, or POOR Quality. The comparison

is made more involved by the use of four categories of properties, as shown in (Exhibit I); Non-Associated Gas, Primary Oil, Cyclic Steam, and Steam Drive.

The Gross/Net Ratio is a measure of the proportion of gross revenue that is claimed by operating costs. The higher the ratio of Gross Income to Net Income plus Development Capital the more the operating costs must be. But this depends on the type of property. A Gross/Net Ratio of 1.80 is a POOR Primary property, but it is a AVERAGE Cyclic Steam property, and a GOOD Steam Drive Property.

Logical Test

Using the 2001 WSPA Working Database of 231 sales and Microsoft Excel 97, a Gross/Net Ratio, a Reserve Ratio, a Production Rate Ratio, and a Capital Ratio was calculated for each sale for which data was available.[24] In addition the Number of Wells and the Initial Production Rate were tabulated for each sale. The Gross/Net Ratio was then used to assign a Quality indicator to each sale. If the Gross/Net was 1.40 or less the Quality was said be Good and was assigned a 1. Similarly, Average Quality was assigned a 2 and Poor a 3.

The Reserves, Capital and Production Rate Ratios were then used individually to assign indicators to each property for Risk:

Low Risk	=	1
Average Risk	=	2
High Risk	=	3

These data were tabulated on an Excel spreadsheet. Using the IF/THEN Logical facility in Excel, the Risk and Quality indicators for each transaction (property) were interpreted to assign a discount rate based on the KCA matrix. This step resulted in a single discount rate for each transaction. Presumably this would be the rate that would be assigned to the property by KCA in assessment appraisal.

The "KCA Discount Rate" for each sale was then compared to the market derived discount rate for that sale. The results of this analysis are tabulated below:

[24] Not all sales are sufficiently detailed to allow calculation of every ratio. In order to be used in the test, the sale must provide a G/N ratio and at least two of three Risk Ratios.

Database	Mean KCA Discount Rate, %	Mean Market Derived Discount Rate, %	Δ %
Working	16.24	23.90	7.66
100% PDP	15.45	23.25	7.80
Risk-Inclusive	16.38	23.75	7.37

Based on these results, it is apparent that the KCA methodology does not replicate the marketplace. The discount rates selected from the matrix are too low by more than seven percentage points regardless of which database is used. Moreover, the vast majority (over 90%) of market discount rates exceed the KCA discount rate. The standard deviation of the KCA/market difference for the Working database is 7.33.

The next step was to take into account the Incremental Adjustments for Number of Wells and Production Rate. This was done by allowing Excel to interpolate the KCA matrix for Number of Wells and Production Rate and to assign discount rate increments for each sale which qualified for such increments. The assigned increments were then added to the "KCA Discount Rate" to obtain an "Adjusted KCA Discount Rate." This adjusted rate was then compared to the Market Derived discount rate.

The addition of the increments for Number of Wells and Production Rate improves the discrepancy modestly but the difference still exceeds six percentage points.

Database	Mean Adjusted KCA Discount Rate, %	Mean Market Derived Discount Rate, %	Δ %
Working	17.30	23.90	6.60
100% PDP	16.71	23.25	6.54
Risk-Inclusive	17.46	23.75	6.29

These results might suggest that the cause of the differences between the Market Derived discount rates and those selected based on the KCA procedure is that the BCRR is simply too low and that raising the BCRR to accurately reflect demonstrated market activity would bring the measured and selected discount rates together. While there is no question that the BCRR is too low and should be raised, it is by no means clear that the low BCRR is the only issue. It is entirely possible that even with an increase in BCRR the KCA procedure would not be successful in selecting discount rates that match the market place. As test, the KCA Selected rate were regressed against the Market Derived discount rates to determine how well the individual selected rates matched the actual market discount rate. For this purpose a single linear regression model was used.

Database	Mean KCA Discount Rate, R^2	Mean Adjusted KCA Discount Rate, R^2
Working	0.0065	0.0099
100% PDP	0.0080	0.0083
Risk-Inclusive	0.0407	0.0165

These results suggest that there is no statistical or practical relevance to the KCA selection method since the selected rates are unrelated to the actual market rates. Were the low BCRR the only issue, the rates should correlate and show a consistent direct relation but this does not occur. This suggests that the KCA selection method produces random discount rates that cannot be said to reflect market conditions.

The 2001 - 2002 Parameters

The 2001-02 parameters are very similar in construction to the 1995-96 parameters. The procedure consists of the same four parts or steps to define Property Quality and Risk as well as the matrix for selection of discount rates. The Basic Capitalization Rate Range has been reduced from 12-20% to 11-19% and a range of "real" discount rates have been added to the nominal rates. The real rates appear to reflect a 3% inflation rate.

The Property Quality grid has been reduced from four property categories to simply Oil or Gas. In addition to Good, Average and Poor Quality a property may now be classed as Marginal if the Gross/Net Ratio exceeds 2.30 for gas or 3.10 for oil. The Property Risk Grid has been expanded to include a new, undefined Water Ratio which applies only to gas wells. The Production Rate Ratio has been redefined as the inverse of the prior (1995-96) definition which makes the ratio more consistent in construction with the Reserves and Capital Ratios.

The Discount Rate Matrix has been expanded to include the new Marginal Quality category and to include real as well as nominal discount rates. Finally, the incremental discount rate for Number of Wells has been retained but the increment for Production Rate has been deleted.

The 2000-01 KCA Parameters were tested in the same manner as the 1995-96 parameters. The results are reported below:

Database	Mean KCA Discount Rate, %	Mean Market Derived Discount Rate, %	Î %	Mean Adjusted KCA Discount Rate, %	Î %
Working	13.79	23.90	10.11	14.80	9.10
100% PDP	12.66	23.25	10.69	13.14	10.11
Risk-Inclusive	13.31	23.75	10.44	13.66	10.09

The difference between the Market Derived and "KCA Discount Rate" using the 2001 discount rate parameter is substantially greater than the difference using the 1995-96 parameters. The difference of 9-10 percentage points can, of course, produce significant differences in value on a property by property basis.

Correlation analysis of actual market discount rates to those selected using the 2001 parameters was done in the same manner as described above for the 1995-96 parameters with very similar results.

Database	Mean KCA Discount Rate, R^2	Mean Adjusted KCA Discount Rate, R^2
Working	0.0014	0.0040
100% PDP	0.0134	0.0064
Risk-Inclusive	0.0779	0.0443

The primary cause of the difference in results between 1995-96 and 2001 is the reduction in the discount rate scale in the 2001 parameters. The shift in the matrix is weighted toward reducing discount rates for Poor Quality, High Risk (PQHR) Properties. A comparison of the two matrices shows that in 1995-96 a Good Quality, Low Risk (GQLR) property got a discount rate of 12.0% whereas a PQHR property got a 20% discount rate. In 2001, the GQLR property would get an 11% discount rate but the PQHR properties would get only a 17% discount rate. There is a 1% drop for GQLR properties but a 3% drop for PQHR properties. The new Marginal Category has a top rate of 19%.

These changes are accompanied by significant changes in the range of values for each ratio which is used to define the category of Quality and/or Risk. The major change is in the Gross/Net Ratio where a Good Quality Property which had a ratio of 1.40 in 1995-96 would require a ratio of 2.10 in the 2001 parameters; the 2.10 is the equivalent of a Poor Quality Steam Drive in the 1995-96

parameters. The definition of the Gross/Net Ratio is the same in 1995 as in 2001. The effect is to move properties that were Poor Quality in 1995-96 into the Good Quality category in 2001.

No attempt has been made to quantify the difference in dollar value that would occur through the use of either the 1995-96 or 2001 KCA parameters to value the properties in the WSPA database.

Conclusions Regarding the KCA Parameters

The KCA discount rates selection procedure, if used in the form published in the annual Appraisal Parameters, does not replicate market discount rates as required by Rule 8. The primary problem with the KCA discount rate parameters is that the BCRR is substantially below the level of market derived discount rates for properties sold in California. The BCRR does not seem to comply with Rule 8(g) because the BCRR does not conform to market derived discount rate data as would be obtained from Rule8(g)(2) and is significantly below the cost-of-capital discount rate levels described in Rule8(g)(2).

A second major problem is that the methodology produces random results when tested against market data suggesting that the method is arbitrary and cannot obtain market values when used in ad valorem tax appraisal.

Kern County Assessor's Office
CAPITALIZATION RATES
1995-96

The Assessor's Office will utilize a basic capitalization rate range of 12% to 20% in the market value appraisal of oil and gas properties for ad valorem tax purposes in 1995. The rate is to be applied to producing oil and gas properties that have a sufficient history to extrapolate future production with a reasonable degree of certainty.

Factors to Consider
In Discount Rate Determination

Property Quality Gross/Net Ratio Basis[*1]				
Classification	Non-Associated Gas	Primary Oil	Cyclic Steam	Steam Drive
GOOD	1.15-	1.40-	1.60-	1.80-
AVERAGE	1.15 - 1.55	1.40 - 1.70	1.60 - 1.90	1.80 - 2.10
POOR	1.55+	1.70+	1.90+	2.10+

Property Risk Reserve/Capital/Rate Ratio Basis			
Classification	Reserve Ratio[*2]	Capital Ratio[*3]	Rate Ratio[*4]
LOW	1.00 - 1.10	1.00 - 1.10	.90 - 1.00
AVERAGE	1.10 - 1.25	1.10 - 1.25	.75 - .90
HIGH	1.25+	1.25+	.75-

	Low Risk	Average Risk	High Risk
Good Quality	12.0	14.0	16.0
Average Quality	14.0	16.0	18.0
Poor Quality	16.0	18.0	20.0

Plus 1 % for Tax Component

The factors and rates listed above are to provide an indication as to the appropriate rate for general development and (or) investment scenarios. The actual rate used in a specific property's evaluation will be determined by that property's history and characteristics and the analysis of comparable property sales by the Assessor's Office.

*1 $\frac{\text{GROSS INCOME}}{\text{NET INCOME + DEVELOPMENT CAPITAL}}$

*2 $\frac{\text{PD + PUD}}{\text{PD}}$

*3 $\frac{\text{FMV + P.W. PROJECTED DEVELOPMENT CAPITAL}}{\text{FMV}}$

*4 $\frac{\text{INITIAL PRODUCTION RATE @ DATE OF VALUATION}}{\text{MAXIMUM PRODUCTION RATE DURING PROPERTY LIFE}}$

EXHIBIT I

In addition to the basic rate determined from the appraiser's analysis, the following incremental rates may be used when it is appropriate for a specific property.

A. Number of mature (settled production) producing wells on property which are not part of a larger operating unit or group of leases.

No. of Wells	1	2	3	4
_ DR%	3	2	1	0

B. Average barrels oil equivalent per day per well for an appraisal unit.

B/D/W	3	5	7	10
_ DR%	3	2	1	0

These factors may be used as a guideline to assist in determining the capitalization rate for any given appraisal unit. CHARACTERISTICS UNIQUE TO A PARTICULAR PROPERTY MAY WARRANT CHANGES TO THE CAPITALIZATION RATE EITHER ABOVE OR BELOW THE RATE INDICATED BY THE GUIDELINES.

APPRAISAL UNIT

The property to be appraised is that which would typically sell as a unit in the market place. This would include pooling or operating unit (bound together by a legally binding agreement, i.e., unit agreement), two or more leases that are contiguous, under a single operator or a co-operative agreement, and are of steam, water disposal facilities, tankage, etc.), or a single operating lease. It is not necessarily correlative with, nor the same as, an assessor's parcel.

Note: (1) The increment added to the basic rate for County Property Tax is one percent.
(2) To determine oil equivalent, in BBL, for MCF gas reserves or production, it is necessary to divide by a factor of 5.8.

OIL AND GAS PROPERTY
2001
CAPITALIZATION RATES

The Assessor's Office will utilize a nominal basic capitalization rate range of 11% to 19% (real 8% - 16%) to the market value appraisal of oil and gas properties for ad valorem tax purposes in 2001. The rate is to be applied to the Assessor's cash flow for producing oil and gas properties that have a sufficient history to predict future production with a reasonable degree of certainty.

Factors to Consider In Discount Rate Determination [*1]

Property Quality Gross/Net Ratio (Profit Margin Basis)		
Classification	Gas (Median 1.57)	Oil (Median 2.34)
1. GOOD	<1.40	<2.10
2. AVERAGE	1.40 - 1.80	2.10 - 2.60
3. POOR	1.80 - 2.30	2.60 - 3.10
4. MARGINAL	>2.30	>3.10

Property Operating Risk Reserve/Capital/Rate/Water Ratio Basis				
Classification	Reserve Ratio	Capital Ratio	Rate Ratio	Water Ratio[*2]
1. LOW	<1.10	<1.10	<1.10	<0.1
2. AVERAGE	1.10 - 1.20	1.10 - 1.20	1.10 - 1.20	01 - 1.0
3. HIGH	>1.20	>1.20	>1.20	>1.0

	Low Risk[*3]		Average Risk[*3]		High Risk[*3]	
	Nominal	(Real)	Nominal	(Real)	Nominal	(Real)
Good Quality	11.0	(8.0)	13.0	(10.0)	15.0+	(12.0)
Average Quality	12.0	(9.0)	14.0	(11.0)	16.0+	(13.0)
Poor Quality	13.0	(10.0)	15.0	(12.0)	17.0+	(14.0)
Marginal	15.0+	(12.0)	17.0+	(14.0)	19.0+	(16.0)

*1 The factors and rates listed above are for assistance in determining appropriate capitalization rates. The annual rate applicable to a specific property's evaluation will also depend upon appraisal judgement applied to that specific property's history, characteristics, as well as the analysis of comparable property sales.

*2 Applicable to dry gas wells only

*3 PLUS, A PROPERTY TAX COMPONENT

EXHIBIT II

2001-2002 YIELD CAPITALIZATION RATES

The Assessors Office will utilize a basic yield capitalization rate range of 8% to16% in the income approach market value appraisal of oil and gas properties for ad valorem tax purposes as of January 1, 2001. The rate is to be applied to the forecasted net income of producing oil and gas properties that have a sufficient history to extrapolate future production and costs with a reasonable degree of certainty.

The rates listed below are to provide an indication as to the appropriate rate for general development and (or) investment scenarios. The range of rates is considered appropriate when reasonable expectations or forecasts for production and expenses are utilized in a property's evaluation. The actual rate used in a specific property's evaluation will be determined by that property's history, characteristics and the analysis of comparable property sales by the Assessor's Office.

YIELD CAPITALIZATION RATE GUIDELINES
(no inflation)

Lower Risk	Medium Risk	Higher Risk
8.0-12.0	10.0-14.0	12.0-16.0

The increment for County property tax is added to the rate determined by the appraiser (approximately 1 %).

In addition to the basic rate determined from the appraiser's analysis, the following incremental rates may be used when it is appropriate for a specific property.

No. of Wells	1	2	3	4
DR% +	3	2	1	0

These factors may be used as a guideline to assist in determining the capitalization rate for any given appraisal unit. CHARACTERISTICS UNIQUE TO A PARTICULAR PROPERTY MAY WARRANT CHANGES TO THE RATE. EITHER ABOVE OR BELOW THE RATE INDICATED BY THE GUIDE

APPRAISAL UNIT

The property to be appraised is that which would typically sell as a unit in the market place. This would include pooling or operating units (bound together by a legally binding agreement, i.e., unit agreement). Multiple leases may also be defined as an "Appraisal Unit" if they are under a single operator or a co-operative agreement, utilizing common steam, water processing, tankage or other facilities or are otherwise operated as a single property or profit center. It is not necessarily correlative with, nor the same as, an assessor's parcel.

Note: To determine oil equivalent, in Bbls, for Mcf gas reserves or production, divide by a factor of 5.8