EXHIBIT 5

Developing a Discount Rate from Sales
1. Obtain recent sales prices from a variety of oil- and gas-producing properties.
2. Develop cash flow projections for each property.
3. Calculate for each sale the internal rate of return (IRR), also known as the DCF return on investment (DCFROI).

Step 1: Obtain Sales

The best source for sales information is the buyer or seller. Other sources that list oil and gas property sales include the Texas Railroad Commission, Oil and Gas Journal, private firms and oil and gas companies. It is important to remember that the sale of an oil or gas property must be a market transaction when developing a discount rate from sales.

Like market surveys, sales analysis results in rates that include all of the discount rate components. The appraiser must estimate the property-specific risk premium (unless the sales sample is directly comparable to the property being appraised) and adjust for atypically high or low risk.

Step 2: Develop cash flow projections

The appraiser develops cash flow projections for each property using the verified sales prices. To the extent possible, the appraiser must talk with the parties to each sale to determine their expectations of the property. The derived discount rate's validity is a direct function of the buyer's and seller's cash flow projections. The appraiser must incorporate this information into the projections. If the appraiser's projections differ from the buyer's and seller's expectations, the discount rate derived from the sale will be invalid.

Step 3: Calculate the internal rate of return (IRR)

The IRR is the yield (discount) rate at which the cash income stream's present value equals the cash expenditure's present value (the sales price in our analysis) necessary to produce that income stream. This discount rate is prospective; it depends on the market's expectation of future performance rather than the historical performance of the property. The discount rate at which the cash flow's present value equals the sales price can be determined by trial and error or by using calculators and computer software that solves for the discount rate (IRR).

This measure is also referred to as the profitability index and investor's method. The IRR recognizes that funds received now are more valuable than those received at some future date. The investment outlay can be regarded as borrowed funds and the pre-tax cash flow as the payment of principal, plus compound interest on the investment.

Weighted Average Cost of Capital (WACC)

This third technique (aka band of investments) produces a rate that does not contain a component for property-specific risk. Because it lacks this component, potential purchasers' typical WACC sets a minimum value for a discount rate. The appraiser must calculate the typical WACC of potential purchasers to know this lower limit. On a case-by-case basis, the appraiser excludes oil companies from the WACC calculation if they cannot participate in the market for the subject property. For instance, small companies may not be able to bid on certain high-valued oil and gas properties due to insufficient capital. A typical WACC for larger oil companies would establish an appropriate minimum discount rate for appraising the subject property.

An investor should not buy a property at a discount rate lower than the WACC; otherwise, the investor's net worth will decrease. The appraiser must add the property-specific risk premium to potential purchasers' typical WACC to develop a discount rate.

The basis for this analysis is financial data from a broad sample of oil companies that derive most of their operating revenues from oil and gas production. Since petroleum property valuation typically involves discounting cash flows over a long period of time, a long-term cost of capital is most appropriate for developing an oil or gas property discount rate. The appraiser incorporates a broad time series of data to approximate a long-term cost of capital. **Exhibit 6** lists the four steps used to calculate WACC.

EXHIBIT 6

Calculating the WACC
1. Derive the typical capital structure and express it as a proportion of debt and equity.
2. Calculate the typical cost of outstanding debt based on bond yields.
3. Compute the typical cost of equity using the capital asset pricing model (CAPM) or another method, such as the DCF model.
4. Weight debt and equity costs according to the typical capital structure percentages to derive a typical cost of capital.

the overall capital structure. **Exhibit 8** shows the equation for each, and **Exhibit 9** shows the discount rate component expanded. **Appendix A, Figures 3-6** illustrate the WACC estimating technique.

EXHIBIT 8

Capital Structure		
Weighted average cost of equity	=	(cost of equity percentage) X (equity fraction)
Weighted average cost of debt	=	(cost of debt percentage) X (debt fraction)
Weighted average cost of capital	=	weighted average cost of equity + weighted average cost of debt

EXHIBIT 9

Discount Rate Component Summary	
	Inflation rate
+	Risk-free component
=	Risk-free rate
	Risk-free rate
+	General risk premium
=	WACC

Final Discount Rate Selection

The typical WACC of potential purchasers sets the lower end of the discount rate range. To help establish the upper end of the discount rate range, the appraiser can calculate a standard deviation of all the discount rates indicated by the sales sample and the survey. One standard deviation above and below the mean contains 68 percent of all the observations in a normally distributed set of data. Two standard deviations above and below the mean contains more than 99 percent of all the observations in a normally distributed set of data. Although the data may not be normally distributed, this kind of analysis may help the appraiser to establish the upper end of the discount rate range.

High-risk properties (e.g., a one-well lease with high water production near the end of its economic life) may be discounted by the market at two standard deviations above the mean. Properties with lesser risk will have correspondingly lower discount rates. One standard deviation above the mean may establish an upper limit for properties in a typical risk-range. The mean or median of the discount rates from the sales analysis and the survey indicate the mid-range discount rate.

For a standard deviation analysis to have meaning in selecting an upper limit to the discount rate range, the survey or sales dataset must contain properties with broadly varying risk. A high-end discount rate selected by this method will not apply to very risky properties (it will be too low) unless the sales dataset used in the analysis contains similar risky properties.

To select a discount rate for an individual property, the appraiser must assess the property-specific risk inherent in the property.

FIGURE 2

DCF Calculation Procedures

1. Net oil production is gross oil production multiplied by net revenue interest (NRI), which equals 87.5 percent.
2. Starting oil price equals $56.26 per barrel with an escalation rate of 4 percent per year.
3. Gross income equals net oil production multiplied by oil price.
4. Operating expenses plus severance taxes: Operating expenses escalated at a rate of 4 percent per year. Severance tax on oil is 4.6 percent per year.
5. Net income equals gross income less operating expenses and severance taxes.
6. Discount factor (mid-year) @15.67 percent equals:

Year	Formula		Discount Factor Percentage
1	$1/((1+.1567)^{(1-.5)})$	=	.929800
2	$1/((1+.1567)^{(2-.5)})$	=	.803839
3	$1/((1+.1567)^{(3-.5)})$	=	.694941
4	$1/((1+.1567)^{(4-.5)})$	=	.600797
5	$1/((1+.1567)^{(5-.5)})$	=	.519406
6	$1/((1+.1567)^{(6-.5)})$	=	.449041
7	$1/((1+.1567)^{(7-.5)})$	=	.388209
NOTE: The discount factor of 15.67 percent includes 1.85 percent for property taxes. Some appraisers handle property taxes as a deduction from gross income.			

7. DCF equals net income multiplied by the discount factor.

The DCF method should also include capital expenditures, environmental remediation costs and the present worth of equipment salvage value less well-plugging costs.

FIGURE 3

Estimation of WACC

1. Derive the typical capital structure of a broad sample of potential purchasers as a proportion of debt and equity. Data can be found in the 12/31/20xx issue of "The Value Line Investment Survey" under Petroleum (Integrated) Industry and Petroleum (Producing) Industry.

Outstanding common stock (oil company)	=	157,627,284 shares @ 12/31/20xx
Closing common stock price	=	$106.75/share
Common stock equity	=	157,627,284 shares X $106.75/share
	=	$16,827,000,000 @ 12/31/20xx
Total debt	=	$6,791,000,000 @ 12/31/20xx
Total capital	=	Debt + equity
	=	$6,791,000,000 + $16,827,000,000
	=	$23,618,000,000
Debt	=	$6,791,000,000/$23,618,000,000
	=	.288 or 28.8 percent
Equity	=	$16,827,000,000/$23,618,000,000
	=	.712 or 71.2 percent
The capital structure is 28.8 percent debt and 71.2 percent equity.		
Repeat this procedure for each company in the sample.		

FIGURE 5
Calculating the Cost of Equity Equation

3. Use the capital asset pricing model (CAPM) equation.

K = Rfc + B(Rm - Rfh)			
K	Cost of equity (after tax), percentage per year		
Rfc	Current risk-free rate, percentage per year*		2.26% per year
Rfh	Historic market return on long-term government bonds, percentage per year**		5.90% per year
Rm	Historic market return on equities, percentage per year**		11.90% per year
B	Beta coefficient***		1.70
K	=	Rfc + B(Rm - Rfh)	
	=	2.26 + 1.70 (11.90 - 5.90)	
	=	12.46 percent per year	
K (pre-tax)	=	12.46/(1 - .21)	
K	=	15.77 percent per year	

*Federal Reserve Statistical Release (January of current year)

**Duff & Phelps SBBI® Yearbook – Stocks, Bonds, Bills and Inflation®

***The Value Line Investment Survey, 4th Quarter, 20xx

FIGURE 6
Calculating a Typical WACC

4. Calculate a typical WACC by plugging the mean (or other measure of central tendency) cost of debt, cost of equity and capital structure from the sample companies.

WACC	=	((cost of debt) X (percent debt)) + ((cost of equity) X (percent equity))
	=	(7.98 X .288) + (15.77 X .712)
	=	13.53 percent/year

FIGURE 7
Average the Data Arithmetically

The standard deviation is the square root of the average squared difference between the individual observations and the average value. The first step in calculating the standard deviation is to average the data arithmetically. The arithmetic average or mean value is denoted as z.

$z = 1/n(x1 + x2 + x3 + ... + xn)$	
z	Mean value of a data set of n values
x1	Unique value in dataset
n	Total number of values in data set

FIGURE 8
Standard Deviation

The standard deviation is denoted by the symbol S.

$S = (((x1 - z)^2 + ... + (xn - z)^2)/(n-1))^{.5}$	
S	Standard deviation of a dataset with n values
x1	Unique value in dataset
xn	nth value in dataset
n	Total number of values in dataset

FIGURE 9
Standard Deviation Example

Procedure for calculating the standard deviation of a dataset that includes 10 sales with various internal rates of return (IRR).

Sales No.		IRR (%)	(x - z)	$(x - z)^2$
1	X 1	11.0	-4.7	22.09
2	X 2	25.0	9.3	86.49
3	X 3	6.0	-9.7	94.09
4	X 4	16.0	0.3	0.09
5	X 5	16.0	0.3	0.09
6	X 6	22.0	6.3	39.69
7	X 7	9.0	-6.7	44.89
8	X 8	14.0	-1.7	2.89
9	X 9	13.0	-2.7	7.29
10	X 10	25.0	9.3	86.49
Totals		**157.0**		**384.10**

FIGURE 10
Calculating the Standard Deviation

1. Calculate the arithmetic average z.

z	=	Sum(IRR (%)/Sum(Sales No.)
	=	157.0/10
	=	15.7

2. Calculate the arithmetic average S.

S	=	$\text{Sum}((x - z)^2)/\text{Sum}(\text{Sales No.}) - 1))^{.5}$
	=	$(384.1 / (10 - 1))^{.5}$
	=	6.5

3. Calculate the range of 1 standard deviation.

	=	$z \pm S$
	=	15.7 ± 6.5
	=	$9.2 < 15.7 < 22.2$

4. Calculate the range of 2 standard deviations.

	=	$z \pm S(2)$
	=	$15.7 \pm 6.5(2)$
	=	$2.7 < 15.7 < 28.7$

28.7 percent per year is the upper range of the discount rate for high-risk properties.

FIGURE 11
Property-Specific Risk Factors

Property-Specific Risk Factors
One well lease
Oil lease with high water production
Lease near the end of its economic life
Gas well reservoir under partial or active water drive (recovery uncertain)
Curtailed gas well
Rapidly declining lease
Lease with less than six (6) months' production history
Secondary recovery project in early stages before fill-up
Offshore oil or gas lease
Unusually high operating expenses (e.g.: paraffin problems, sour gas etc.)
The appraiser should add any other property-specific factors that increase the investor's risk to the base discount rate (WACC).

Appendix B: Escalation or De-escalation Formula

This is the formula for determining the maximum average annual escalation or de-escalation percentage of crude oil and natural gas prices for years two through six of the appraisals.

$((X/100)^{(1/Y)}-1) \times 100$	
X	Most recent year annual average (not seasonally adjusted) producer price index (PPI) for crude petroleum (domestic production) [Commodity Code 0561, Series ID# WPU0561] or natural gas [Commodity Code 0531], obtained from the U.S. Bureau of Labor Statistics during the month of January, which may contain preliminary statistics.
Y	Number of years from base year 1982 through the most recent year (most recent year minus base year).
	The denominator of 100 in the formula is the PPI annual average for domestically produced petroleum and natural gas in base year 1982.

Most recent year	=	2019
X	=	157.8 for crude petroleum domestic production (Commodity Code 0561) [Series ID# WPU0561]; 185.8 for natural gas (Commodity Code 0531)
	=	2019 - 1982 = 37 years
1/Y	=	1/37
	=	0.027027027

Crude petroleum (domestic production)	=	$((157.8/100)^{0.027027027} - 1) \times 100$
	=	1.240 percent
Natural gas	=	$((85.6/100)^{0.027027027} - 1) \times 100$
	=	-0.419 percent