Exhibit ___ (JWW-3)
Docket No. UG-040640, et al.
Witness: John W. Wilson

BEFORE THE WASHINGTON UTILITIES AND TRANSPORTATION COMMISSION

WASHINGTON UTILITIES AND TRANSPORTATION COMMISSION, Complainant, v. PUGET SOUND ENERGY, INC. Respondent.	DOCKET NO. UG-040640 DOCKET NO. UE-040641 *(consolidated)*

EXHIBIT TO TESTIMONY OF

JOHN W. WILSON

The Discounted Cash Flow Model

September 23, 2004

The Discounted Cash Flow Model

Discounted cash flow (or DCF) models are frequently used as a method of measuring the cost or required return for a firm's common equity capital. The DCF model is based upon two fundamental principles. First, it is based on the principle that rational investors evaluate the risks and expected returns of securities in capital markets and establish a price for a particular security which adequately compensates investors for the risks they perceive. Second, the model is based upon the proposition that the total return received by shareholders consists of dividends and capital gains, and these are measured in terms of the current dividend yield plus the expected rate of dividend growth. The DCF model, which combines yield and growth information to produce the total return expected by investors, is the following:

Total Return to Investor	=	Current Dividend Yield	+	Expected Dividend Growth Rate

The model makes no separate provision for capital gains since they are fully accounted for in the growth component. Capital gains are a consequence of price appreciation which, in turn, is a consequence of rising dividends and expected dividend growth.

Since an individual investor cannot control either the current dividend rate or the dividend growth rate, his decision about the adequacy of returns is reflected by his buy, sell, and hold decisions. If the expected return exceeds the required return, the price of common stock will be greater than the stock's book value. If the expected return is lower than investor requirements, the market price will fall below book. If investor

expectations and requirements are the same, the stock will trade at a price equal to book value.

In other words, the DCF procedure for estimating capital cost reflects the fact that the maximum price a logical investor will pay for a security is an amount equal to the present value of the dividends that he expects to receive over the years during which he holds the security plus its resale price, including capital gains, when he sells it. Algebraically, this observation can be represented by the following equation:

$$P_o = \frac{D_1}{1+R} + \frac{D_2}{(1+R)^2} + \ldots + \frac{D_t}{(1+R)^t} + \frac{P_t}{(1+R)^t}$$

where P_o is the price of a company's common stock today; D_1, D_2 ... D_t are expected dividends in subsequent periods; Pt is the expected resale price of the stock at some time in the future; and R is the discount rate or required return (often referred to as the opportunity cost of capital).

The market price is the present value of all cash flows expected in the future, discounted at a rate equal to the rate of return investors require on the investment. Present value is the current worth of expected future returns – that is, what an investor would be willing to pay today in order to obtain the expected cash flows in the future. Today's price is the present value of these expected cash flows, discounted at a rate that reflects the cost of capital, including the risk perceived by investors that their expectations will not be met.

Calculating present value is accomplished simply by adding up the discounted total future returns. Since a dollar in hand today can be invested profitably and result in a dollar plus

compounded interest at some future date, a dollar today is worth more than a dollar tomorrow. If, for example, a dollar can be invested and obtain a 10 percent annual return, the expectation of receiving a dollar in one year is worth 90.9 cents today; i.e.,

$$\frac{\$1.00}{1.10} = \$0.909$$

Similarly, the expectation of receiving a dollar two years from now is worth 82.6 cents; i.e.,

$$\frac{\$1.00}{(1.10)^2} = \$0.826$$

That is true simply because the investment of 82.6 cents today at 10 percent annual interest will result in $1.00 in two years; i.e.,

$0.826 x 1.10 = $0.909 at the end of year one,

and

$0.909 x 1.10 = $1.00 at the end of year two.

Of course, not all individual investors make explicit present value calculations of this type when making stock or bond acquisitions. This computation, however, accurately describes the operation of the market as a whole, and this discounting principle is implicit in virtually all investment pricing decisions.

Discounted cash flow computations equate market price with expected cash flows, discounted at the return requirement for the investment. For example, suppose that it is expected that a security will pay a dividend of $1.00 per year, and after 2 years it can be sold for $15.00. Also suppose that, as an alternative to this potential investment, there is

another enterprise of equal risk (for example, a certificate of deposit or money market fund) which will produce a 10 percent rate of return. Applying the discounted cash flow principle, it can therefore be estimated that the appropriate price for this security is $14.13; i.e.,

$$P_o = \frac{D_1}{1+R} + \frac{D_2}{(1+R)^2} + \frac{P_2}{(1+R)^2}$$

$$Po = \frac{\$1.00}{1.10} + \frac{\$1.00}{(1.10)^2} + \frac{\$15.00}{(1.10)^2}$$

$$P_o = \$0.909 + \$0.826 + \$12.397$$

$$P_o = \$14.132$$

The accuracy of this price estimate can be checked by calculating what $14.13 would yield in the equivalent alternative investment at 10 percent compounded over two years. The result is $17.10 ($14.132 x 1.10 x 1.10), which is precisely correct. After two years this stock sells for $15.00 and the dividends then would have totaled $2.00 plus 10 cents for reinvesting the first year's $1.00 dividend at the assumed 10 percent rate. Consequently, when the opportunity cost of capital is 10 percent, the investor in this example will wish to buy this security if it is offered at a price of $14-1/8 or below. He will invest in alternative opportunities if the market price is above that level.

In this simplified hypothetical illustration, a $15.00 selling price two years from the present is the price which reflects investors' expectations concerning future cash flows at that point in time. In other words, the projected selling price in two years reflects

subsequent cash flow expectations just like the current price reflects currently expected cash flows. For example, if the discount rate remains at 10 percent, and the dividends in years 3, 4, and 5 are expected to grow at a rate of 5 percent per year, and the resale value at the end of year 5 is expected to be $16.32, then investor No. 1 can expect to be able to sell the security to another buyer, investor No. 2, for $15.00 at the end of year 2. That is, where P_2 is the price at the end of year 2, the present value of the income from years 3, 4, and 5, including the selling price in year 5, is:

$$P_2 = \frac{(1.00)(1.05)}{1.10} + \frac{(1.00)(1.05)^2}{(1.10)^2} + \frac{(1.00)(1.05)^3}{(1.10)^3} + \frac{16.32}{(1.10)^3} = 15.00$$

This process is continuous. That is, an expected price of $16.32 in year 5 is based on expectations regarding dividends and resale values from that point forward, and so on. Because of the discount factor, expected values in the very distant future will not have a substantial effect on the current present value computation. For example, with a discount factor of 10 percent, $1.00 in 10 years is worth only $0.38 today; $1.00 in year 25 is worth only $0.09; $1.00 in year 50 is worth only $0.01. The more distant into the future is the expected return, the less is its present value today. Thus, while this DCF model technically reflects an infinite stream of returns, with a 10 percent discount rate and a level cash flow, more than 90 percent of the total present value is realized in less than twenty-five years and more than 99 percent of the total value is realized in less than fifty years.

A security's price today, is based on expected dividends and capital gains, since they are the basis of both the yield and future stock prices. The time horizon for DCF analysis is long-term. This is true because it is future income stream expectations as of the resale date that determine the resale price and capital gains. Intermediate prices between now and the long term "wash" because every seller's price is someone else's buying price. And of course, no rational investor will be willing to pay more than the present value of his or her expected future returns. DCF analysis, therefore, reflects capital gains because the gains are a consequence of price appreciation, which, in turn, is a consequence of expected dividend growth. The basic DCF equation shown above can be reduced algebraically to:

$$P_O = \frac{D_1}{R - g}$$

where P_O is the market price of common stock, D_1 is the currently expected annual dividend, R is the discount rate or opportunity cost of equity capital, and g is the expected dividend growth rate. This expression converts to:

$$R = D_1/P_O + g$$

where R is the annual required rate of return on common equity capital. The discount rate, R, is the rate of return that could be obtained from an alternative comparable investment. It follows, therefore, that R will provide a competitive rate of return and thus meet the capital attraction test of a fair rate of return. Moreover, since R is equivalent to the rate of return that investors can obtain from comparable alternative investments, the

result not only corresponds to the capital attraction requirement, but conforms to the comparable earnings requirement as well – and thus meets traditional regulatory requirements.

The DCF equation is a statement of the price that investors are willing to pay for a security, given their estimate of the dividend growth that they believe is likely over the long term. The current dividend yield and expected dividend growth are the determinants of price for investors; growth is not an element of the return that investors can control. Only the current yield portion of the return can be controlled by investors, and they exercise their control by setting market prices. Because of this relationship between yields and growth, dividend yields are established in response to growth expectations. Dividend yields do not "cause" growth expectations. Growth expectations "cause" dividend yields. That is so because growth influences market price, and market price is the denominator in calculating dividend yields.

In this regard, it is important to emphasize that the task of the rate of return analyst is to determine what growth rate investors are expecting, and not to forecast the actual growth rate the analyst expects. Nor does it matter whether investors' expectations turn out to be right or wrong. Today's common stock prices, which enter the DCF calculation through the dividend yield term, depend upon today's expectations for future growth. Of course, expectations and requirements may be different at different times, and therefore the cost of common equity is likely to change over time. For example, when interest rates are very high, it is likely that required equity returns are higher than when interest rates are low. Similarly, when expected long-term inflation rates are high, it is likely that the cost

of common equity will be higher than when long-term inflation expectations are low. A cost of common equity established at one point in time may be quite different from that established previously, or that found to be true in the future. Tomorrow's hindsight may prove that today's expectations were wrong, but that does not and cannot possibly affect today's cost of capital. That is why it is necessary only for the rate of return analyst to determine correctly what present investor expectations actually are, and not whether they are correct.