Evaluation of Large Scale Industrial Development Using Real Options Analysis
– A Case Study –

by

Tatsuyuki Ariizumi

B.Eng., Architecture and Building Engineering, 1994
M.Eng., Environmental Engineering, 1996

Tokyo Institute of Technology

Submitted to the Department of Architecture in Partial Fulfillment of the Requirements for the Degree of Master of Science in Real Estate Development

at the

Massachusetts Institute of Technology

September, 2006

Signature of Author____

Department of Architecture
July 28, 2006

Certified by____

David Geltner
Professor of Real Estate Finance,
Department of Urban Studies and Planning
Thesis Supervisor

Accepted by____

David Geltner
Chairman, Interdepartmental Degree Program in
Real Estate Development

Evaluation of Large-Scale Industrial Development Using Real-Options Analysis
– A Case Study –

by

Tatusyuki Ariizumi

Submitted to the Department of Architecture on July 28, 2006
in Partial Fulfillment of the Requirements for the Degree of
Master of Science in Real Estate Development

ABSTRACT

Recently, real-option analysis has gained attention as an innovative valuation method for complex real estate projects. However, considering its potential, this method has not become as popular as it should have. One major reason may be its complexity, and perhaps, its effectiveness is not yet widely known in the industry.

Accumulating high-quality case studies can help demonstrate the effectiveness of any theory. Case studies can also help standardize the application process, providing guidelines that help people use the model more easily. In addition, it can reveal and provide solutions for various types of properties, and the means to accommodate the specifics of real-world problems met while applying the model.

This case study deals with a large-scale industrial development project, which is suitable for the application of the real-option model. Usually industrial developers obtain large sites and then develop them in a phased manner. This allows them the freedom to choose phase timing and to modify their initial building plans more freely than with other types of property development. This flexibility adds certain amount of value to the land.

We found that, with some modifications, the real-option model is fairly effective when applied to large-scale industrial development. The model facilitates more precise valuations of land by taking into account various options, such as waiting for better timing and selling the vacant land as is. This study also offers a method to analyze the proper timing of each phase's commencement—a useful decision-making tool for the developer.

Thesis Supervisor: David Geltner
Title: Professor of Real Estate Finance, Department of Urban Studies and Planning

Title: Evaluation of Large Scale Industrial Development Using Real Options Analysis
– A Case Study –

Table of Contents

Chapter 1 Introduction

Background

Recently, real-option analysis has gained attention as an innovative valuation method for complex real estate projects; however, considering its potential, it has not become as popular as it should be. A major reason could be the complexity of the method; moreover, the effectiveness of this method is not yet widely known in the industry.

By providing a number of case studies that apply the real-option method, it is possible to demonstrate the model's effectiveness as well as point out practical ways to apply the model. Case studies can help standardize an application process, which will in turn facilitate the use of the model. Furthermore, different types of property and development have specific issues that must be dealt with, and each case study can focus on the requirements of a specific property type.

When developing industrial business parks, developers often acquire a large amount of land property, which is then developed in phases. The proper timing for each phase of development is typically based on current market conditions.

This type of large-scale industrial development has relatively short construction periods and requires keeping costs low; therefore, it is a suitable candidate for applying the real-option model.

Objectives

- Investigate the real-option method as an evaluation and decision-making tool for large-scale industrial developments
- Demonstrate the effectiveness of the real-option model in evaluating large-scale industrial developments
- Identify practical problems in applying the real-option model in an actual business situation, and provide solutions.

Our goal is to provide an idea of how the real-option model works in directing an investment strategy, and to provide a useful and understandable tool for making investment decisions in a real industrial-development process.

Chapter 2 Methodology

Overview

The method in this case study is based on Geltner and Miller's *Commercial Real Estate Analysis and Investments,* 1st edition (2001), and the forthcoming 2nd edition (2006). This chapter addresses the fundamentals of the method; specific modifications of the model for the case study will be addressed in the next chapter. This chapter simply provides the essence of the model, to allow the reader to understand the case study. Please refer to the referenced book in order to comprehend the structure of the model.

An *option* is defined as "the right without obligation to obtain something of value upon the payment or giving up of something else of value." Our objective is to evaluate the value of land for a development project. In this context, the above definition can be restated as "the right without obligation to obtain residual land value based on property developed now, upon giving up land value based on future development." By choosing the optimal timing to develop their land, landowners can maximize its value. An option to develop a certain site now precludes an option to develop the same site later. The landowner may be better off by developing a given site later, rather than now, but normal DCF (Discounted Cash Flow) methods are not able to evaluate this value. The option model used here, however, can capture the flexibility that landowners may have. Of course, there are other options besides developing or not developing, such as the "switching" option, where the developer chooses to change the use of the land, and the "sellout" option, where the land is sold as is. All these options have value, but we will focus on the "wait" option in this chapter—the option that allows landowners to choose the timing of development.

The fundamental concept of this model is that it can compare the values of the land based on whether it is developed immediately, or if development is postponed.

$$\textbf{Option value} = \textbf{Maximum} \begin{Bmatrix} \textbf{PV of the land developed now,} \\ \textbf{PV of the land developed in the future} \end{Bmatrix}$$

The above equation implies that, if the present value (PV) of immediate development is greater than that of later development, a landowner should commence a project now; otherwise, waiting maximizes the option value.

It is not difficult to calculate the PV of immediate development, because we can simply apply a DCF model. The difficulty is in evaluating the land value after future development because the development has infinite possibilities. The option of future development in this model is regarded as a "call" option, which is an option that can be exercised anytime before it expires. In other words, the landowners can develop their land anytime they want, and this factor, this flexibility, makes calculating the land value based on future development more complex.

We used the binominal model introduced in Geltner and Miller's book to capture the value of the call option's flexibility.

Before moving on to the binominal model, we will define the variables used in this study:

Variables

PV_t (*Exercise*) = Present value of the land developed at time t

PV_t (*Wait*) = Present value of the land developed in the future (year 1)

V_t = Value of built property at time t

$V_{t,up}$ = Expected value of built property when the value increases at time t

$V_{t,down}$ = Expected value of built property when the value decreases at time t

$\%V_{t,up} = V_{t+1,up}/PV_t[V_{t+1}]$

$\%V_{t,down} = V_{t+1,down}/PV_t[V_{t+1}]$

K_t = Construction costs and other costs to develop a property at time t

C_t = Option value (land value) at time t

$C_{t,up}$ = Expected option value when option value increases at time t

$C_{t,down}$ = Expected option value when option value decreases at time t

$\%C_{t,up} = C_{t+1,up}/PV_t[C_{t+1}]$

$\%C_{t,down} = C_{t+1,down}/PV_t[C_{t+1}]$

p = Probability of option value increasing

OCC = Opportunity cost of capital

rf = Risk free rate

r_V = Expected annual total return on the built property

y_V = Annual net rent income cash yield as a fraction of current building value

g_V = Expected growth rate in built property

g_K = Expected growth rate in construction costs

*$(1 + r_V) = (1 + y_V)(1 + g_V)$

σ_V = Expected annual volatility of returns of the built property

y_K =Construction cost yield, the difference between the opportunity cost of capital of construction cost cash flows and the expected growth rate in construction costs

ttb = Time to build

Table 2-1 Inputs for the Study

Parameters	Value	Remarks
rf	6.00%	5 year treasury note
r_V	10.25%	y_V + 100 bp
y_V	9.25%	Based on the pro-forma created for the project
g_V	0.92%	$(1 + r_V) = (1 + y_V)(1 + g_V)$
g_K	2.00%	
σ_V	15.00%	Volatility for the individual project
y_K	3.92%	$(1 + rf) = (1 + y_K)(1 + g_K)$
ttb	7–10 months	Based on the pro-forma created for the project

Binominal Real-Option Model

Figure 2-1 shows a simple single-term binominal model. The option value (land value) at time 0 is calculated as

$$\textit{Option Value}\ (C_0) = \text{Maximum}\ \{PV_0\,(\textit{Exercise}),\ PV_0\,(\textit{Wait})\}$$

$$PV_0\ (\textit{Exercise}) = V_0 - K_0$$

$$PV_0\ (\textit{Wait}) = \frac{\textit{Expected Option Value}(yr1)}{1+OCC} = \frac{pC_{1,up} + (1-p)C_{1,down}}{1+OCC}$$

*Here, construction is assumed to finish instantly. A method for incorporating "time to build" will be stated later.

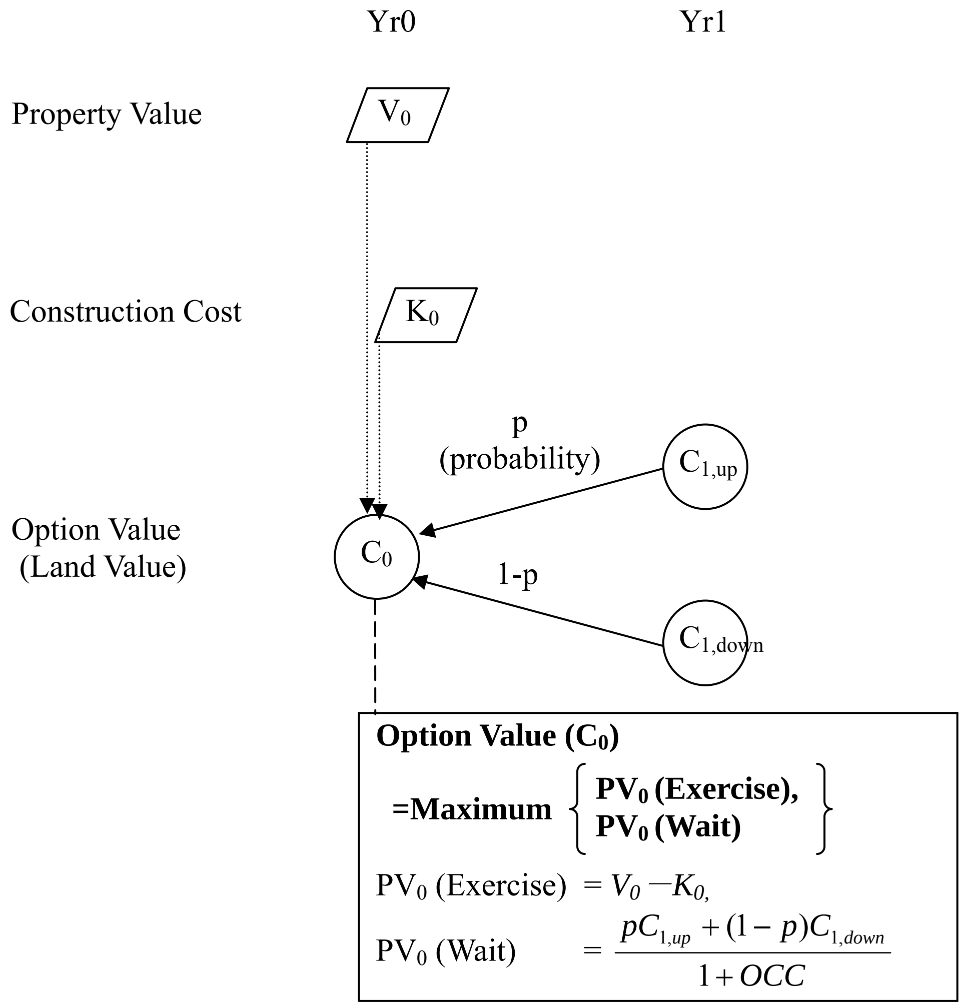


Figure 2-1 Simple One-Period Binominal Model

The essence of the binominal real-option model is included in this simple one-period model. Expanding the unit (triangle) rightward creates a complete model, depending on when the option expires. Figure 2-2 illustrates the model over two periods. Note that the period can be broken into smaller terms, such as quarters or months. In this case, we used terms of a year.

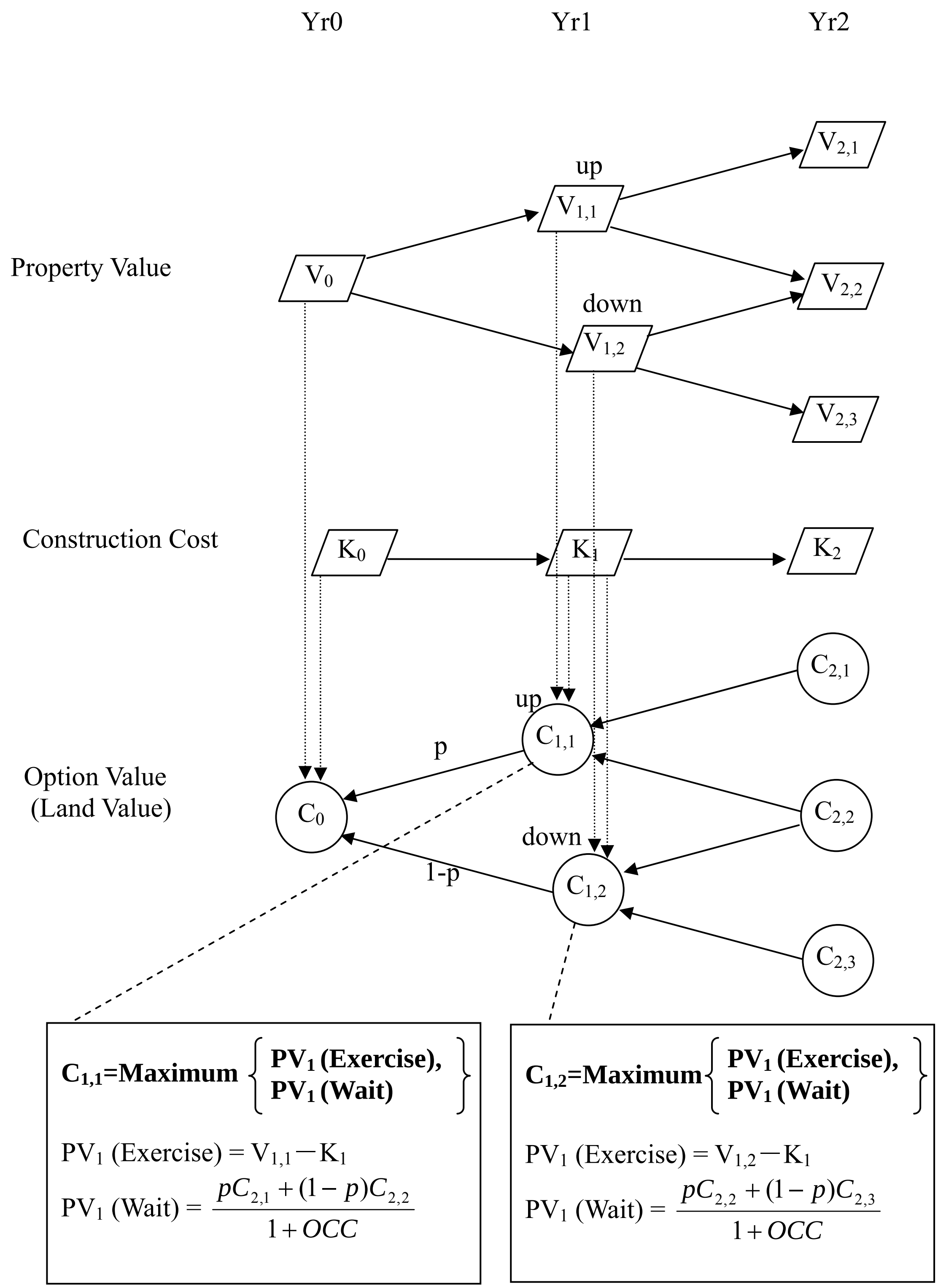


Figure 2-2 Two- Period Binominal Model

The following formula represents the value of the option at each node, except for the point at which the option expires. We derive the formula for the wait option and the exercise option described in the following sections.

for all t < T, (T = terminal period)

Option Value ($C_{t,j}$) = Maximum {PV_t (*Exercise*), PV_t (*Wait*)}

$$= \text{Maximum}\left\{ \mathrm{v_{t,i}} - \mathrm{k_t}, \frac{pC_{t+1,i} + (1-p)C_{t+1,i+1}}{1+OCC} \right\}$$

$$= \text{Maximum}\left\{ \mathrm{V_{t,i}}/(1+\mathrm{y_V})^{\mathrm{ttb}} - \mathrm{K_t}/(1+\mathrm{y_k})^{\mathrm{ttb}}, \frac{\left(pC_{t+1,i} + (1-p)C_{t+1,i+1}\right) - \frac{RPv}{\left(\%V_{t,up} - \%V_{t,down}\right)} \times \left(C_{t+1,i} - C_{t+1,i+1}\right)}{(1+r_f)} \right\}$$

$$= \text{Maximum}\left\{ \mathrm{V_{t,i}}/(1+\mathrm{y_V})^{\mathrm{ttb}} - \mathrm{K_t}/(1+\mathrm{y_k})^{\mathrm{ttb}}, \frac{\left(pC_{t+1,i} + (1-p)C_{t+1,i+1}\right) - \frac{r_V - rf}{\left((1+\sigma_V) - 1/(1+\sigma_V)\right)} \times \left(C_{t+1,i} - C_{t+1,i+1}\right)}{(1+r_f)} \right\}$$

for all t = T,

Option Value ($C_{t,j}$) = PV_t (*Exercise*)

Numerical Example

$V_t = 100$, $K_t = 90$ $C_{up} = 8$ $C_{down} = 0$
Other parameters follow them in the Table 2-1

Option Value ($C_{t,j}$) = Maximum {PV_t (*Exercise*), PV_t (*Wait*)}

$$= Maximum\left\{ \mathrm{V}_{t,i}/(1+\mathrm{y}_V)^{ttb} - \mathrm{K}_t/(1+\mathrm{y}_k)^{ttb}, \frac{\left(pC_{t+1,i} + (1-p)C_{t+1,i+1}\right) - \frac{r_V - rf}{\left((1+\sigma_V) - 1/(1+\sigma_V)\right)} \times \left(C_{t+1,i} - C_{t+1,i+1}\right)}{(1+r_f)} \right\}$$

$$= Maximum\left\{ 100/(1+9.25\%)^1 - 90/(1+3.92\%)^1, \frac{\left(0.8306 \times 8 + 0.1694 \times 0\right) - \frac{10.25\% - 6\%}{\left(1.15 - 1/(1.15)\right)} \times (8-0)}{(1+6\%)} \right\}$$

$$= Maximum\{4.93, 5.13\}$$
$$= 5.13$$

If PV_t (*Exercise*) < PV_t (*Wait*), then the wait option is better than the exercise option in this example.

Present Value of the Exercise Option

PV_t(Exercise) = PV_t (Built Property) – PV_t (Development Costs (excluding land))

$= \quad v_{t,\text{i}} - k_t$

$= \quad \text{V}_{\text{t,i}}/(1+\text{y}_{\text{V}})^{\text{ttb}} - \text{K}_{\text{t}}/(1+\text{y}_{\text{k}})^{\text{ttb}}$

First, calculate the present value of built property at the time for each node using the binominal tree. Starting from V_0, construct the *V* value tree by applying the following formula.

$$V_{t+1,up} = PV_t[V_{t+1}] \times \%V_{t+1,up} = PV_t[V_{t+1}] \times (1+\sigma_V) = \frac{V_t(1+g_V)}{(1+r_V)} \times (1+\sigma_V) = \frac{V_t}{(1+y_V)} \times (1+\sigma_V)$$

$$V_{t+1,down} = PV_t[V_{t+1}] \times \%V_{t+1,down} = PV_t[V_{t+1}] \times \frac{1}{(1+\sigma_V)} = \frac{V_t(1+g_V)}{(1+r_V)} \times \frac{1}{(1+\sigma_V)} = \frac{V_t}{(1+y_V)} \times \frac{1}{(1+\sigma_V)}$$

$*1+g_V = (1+y_V)/(1+r_V)$

$*\%V_{up} = (1+\sigma_V)$, $\%V_{down} = 1/(1+\sigma_V)$

It should be noted that this tree is constructed such that the “down” movements from the upper left and “up” movements from the lower left create the same number. This can reduce the complexity of the model.

$$V_{t+2,down} = \frac{V_{t,i}}{(1+y_V)^2} = V_{t+2,up}$$

$$\Uparrow$$

$$V_{t+2,down} = \frac{V_{t+1,up}}{(1+y_V)} \times \frac{1}{(1+\sigma_V)} = \frac{\frac{V_{t,i}}{(1+y_V)} \times (1+\sigma_V)}{(1+y_V)} \times \frac{1}{(1+\sigma_V)} = \frac{V_{t,i}}{(1+y_V)^2}$$

$$V_{t+2,up} = \frac{V_{t+1,down}}{(1+y_V)} \times (1+\sigma_V) = \frac{\frac{V_{t,i}}{(1+y_V)} \times \frac{1}{(1+\sigma_V)}}{(1+y_V)} \times (1+\sigma_V) = \frac{V_{t,i}}{(1+y_V)^2}$$

These relations are shown in Figure 2-3.

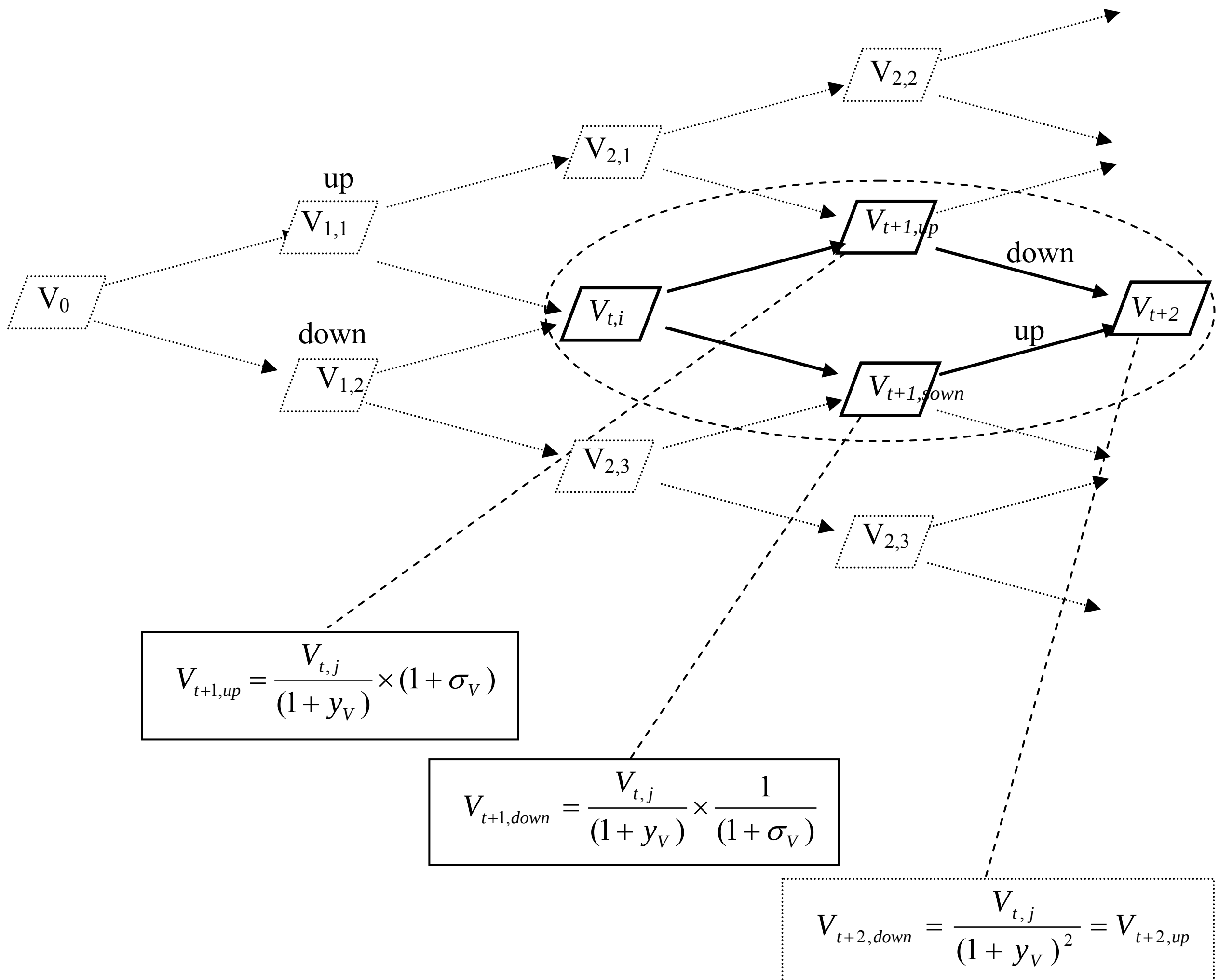


Figure 2-3 Property Value Tree

Because the landowner cannot get these *V* values until construction work is completed, the following adjustments are needed to take into account the time to build:

$$PV_t[V_t] = v_t \ = \frac{Expected\ V\ at\ Completion}{OCC\ \ for\ Built\ Propety} = \frac{V_t(1+g_V)^{ttb}}{(1+r_V)^{ttb}} = \frac{V_t\left(\frac{(1+r_V)}{(1+y_V)}\right)^{ttb}}{(1+r_V)^{ttb}} = \frac{V_t}{(1+y_V)^{ttb}}$$

Development costs (*K*), however, are computed simply by applying the development cost (mainly construction cost) growth rate.

$$K_{t+1} = K_t(1+g_K)$$

The time to build can be taken into account following the same process, using the built-property value.

$$PV_t[K_t] = k_t \ = \frac{Expected\ K\ at\ Completion}{OCC\ \ for\ Development\ Cost} = \frac{K_t(1+g_K)^{ttb}}{(1+r_f)^{ttb}} = \frac{K_t\left(\frac{(1+r_f)}{(1+y_K)}\right)^{ttb}}{(1+r_f)^{ttb}} = \frac{K_t}{(1+y_K)^{ttb}}$$

Here, we use the "risk-free rate" as an opportunity cost for development, because the negative cash flow (cash outflow) from development costs has almost no correlation with the entire financial market movement (i.e., market portfolio). Also it is notable that the payment of all development costs is assumed to occur at the completion in this model. It is based on the assumption that almost all development costs except for land are usually covered by construction loan. This assumption allows us to think only of *Time 0* (beginning of the construction) and *Time t* (end of construction) in terms of cash flow.

Normally, in order to compute the residual land value from a development project, an estimated *OCC* for the project is applied to the net cash flow accrued during the development process. However, it is often difficult to determine the proper *OCC* for measuring the risk of a project. This method calculates the present value for the built property separately from the development costs. This method, called the "canonical formula" is introduced and described in detail in Geltener and Miller (Chapter 29).

$$PV[Land] \quad = \quad PV[Built\ Propety] \quad - \quad PV[Development\ Cost]$$

$$\frac{V_t - K_t}{(OCC\ \ for\ Development)^{ttb}} = \frac{V_t}{(OCC\ \ for\ Built\ Property)^{ttb}} - \frac{K_t}{(OCC\ \ for\ Development\ Cost)^{ttb}}$$

$$\frac{V_t - K_t}{(1+r_C)^{ttb}} = \frac{V_t}{(1+r_V)^{ttb}} - \frac{K_t}{(1+r_f)^{ttb}}$$

Present Value of the Wait Option

Discounting the expected option value of two future options (binominal) at each node (one triangle) gives the present value of the wait option. The expected option value is the average of the two options, weighted by their up and down probabilities.

$$PV_t(Wait) = \frac{Expected\ Option\ Value\,(1yr\ later)}{1+OCC} = \frac{pC_{t+1,up} + (1-p)C_{t+1,down}}{1+OCC} = \frac{pC_{t+1,up} + (1-p)C_{t+1,down}}{1+r_f + RPc}$$

$$\Downarrow$$

$$(1+r_f + RPc)PV_t(Wait) = \left(pC_{t+1,up} + (1-p)C_{t+1,down}\right)$$

$$(1+r_f)PV_t(Wait) = \left(pC_{t+1,up} + (1-p)C_{t+1,down}\right) - RPcPV_t(Wait)$$

$$PV_t(Wait) = \frac{\left(pC_{t+1,up} + (1-p)C_{t+1,down}\right) - RPcPV_t(Wait)}{(1+r_f)} \quad \cdots\cdots \quad ①$$

$$RPcPV_t(Wait) = \frac{RPc}{\left(\$C_{t+1,up} - \$C_{t+1,down}\right)} \times \left(\$C_{t+1,up} - \$C_{t+1,down}\right) \times PV_t(Wait)$$

$$= \frac{RPc}{\left(\$C_{t+1,up} - \$C_{t+1,down}\right) \Big/ PV_t(wait)} \times \left(\$C_{i+1,up} - \$C_{t+1,down}\right)$$

$$= \frac{RPc}{\left(\%C_{t+1,up} - \%C_{t+1,down}\right)} \times \left(\$C_{t+1,up} - \$C_{t+1,down}\right)$$

$$\frac{RPc}{\left(\%C_{t+1,up} - \%C_{t+1,down}\right)} = \frac{RPv}{\left(\%V_{t+1,up} - \%V_{t+1,down}\right)} \quad \cdots\cdots \quad ②$$

$$RPcPV_t(Wait) = \frac{RPv}{\left(\%V_{t+1,up} - \%V_{t+1,down}\right)} \times \left(\$C_{t+1,up} - \$C_{t+1,down}\right) \quad \cdots\cdots \quad ③$$

By combining ① & ③, we get

$$PV_t(Wait) = \frac{\left(pC_{t+1,up} + (1-p)C_{t+1,down}\right) - RPcPV_t(Wait)}{(1+r_f)}$$

$$= \frac{\left(pC_{t+1,up} + (1-p)C_{t+1,down}\right) - \frac{RPv}{\left(\%V_{t+1,up} - \%V_{t+1,down}\right)} \times \left(C_{t+1,up} - C_{t+1,down}\right)}{(1+r_f)}$$

$$= \frac{\left(pC_{t+1,up} + (1-p)C_{t+1,down}\right) - \frac{r_V - r_f}{((1+\sigma_v) - 1/(1+\sigma_v))} \times \left(C_{t+1,up} - C_{t+1,down}\right)}{(1+r_f)}$$

One of the most important concepts in this model (also, in the entire investment world) is the "price of risk," i.e., the risk premium per unit of risk. Expected return (risk premium + risk free rate) must be consistent with the risk associated with the investment, regardless of the type of underlying asset. Therefore, the unit of risk must be the same for the built property and the undeveloped land; otherwise, an arbitrage opportunity exists. The preceding formula ② is based on this relationship shown in Figure 2-4. Here, risk, the volatility of value change, can be expressed as the range of expected values.

Price of Risk for Option (*Land*) = *Price of Risk for Built Property*

$$\frac{RPc}{\left(\%C_{up} - \%C_{down}\right)} = \frac{RPv}{\left(\%V_{up} - \%V_{down}\right)}$$

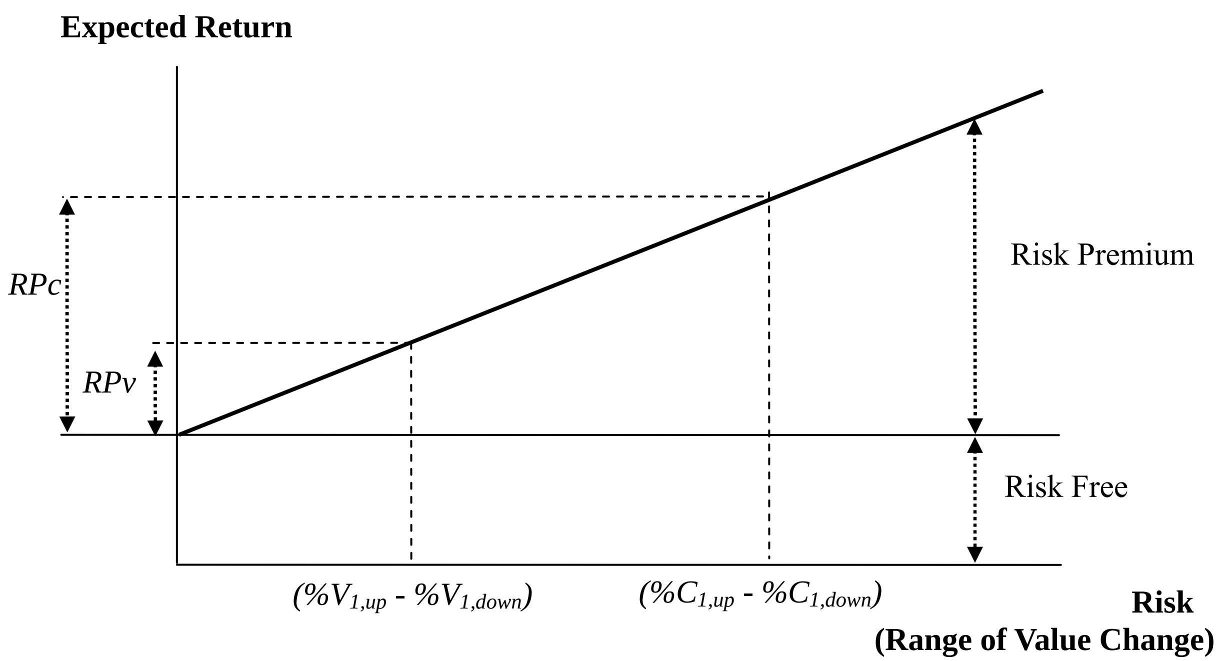


Figure 2-4 Price of Risk

The probability (p) can be determined to increase the expected V value one term later to the expected return of built property (r_V).

$$p = \frac{1 + r_V - \%V_{1,down}}{\%V_{1,up} - \%V_{1,down}} = \frac{1 + r_V - 1/(1+\sigma_V)}{(1+\sigma_V) - 1/(1+\sigma_V)}$$

$$\Uparrow$$

$$1 + r_V = p\%V_{1,up} + (1-p)\%V_{1,down}$$
$$p(\%V_{1,up} - \%V_{1,down}) = 1 + r_V - \%V_{1,down}$$

$$\%V_{1,up} = \frac{V_{1,up}}{PV[V_1]} = \frac{V_0(1+\sigma_V)/(1+y_V)}{V_0(1+g_V)/(1+r_V)} = \frac{V_0(1+\sigma_V)/(1+y_V)}{V_0(1+y_V)} = 1 + \sigma_V$$
$$\%V_{1,down} = \frac{V_{1,down}}{PV[V_1]} = \frac{V_0/(1+\sigma_V)/(1+y_V)}{V_0(1+g_V)/(1+r_V)} = \frac{V_0/(1+\sigma_V)/(1+y_V)}{V_0(1+y_V)} = 1/1 + \sigma_V$$
$$* 1 + g_V = (1+y_V)/(1+r_V)$$

Perpetual Option Valuation Model (Samuelson–McKean Formula)

While the binominal model can only evaluate finite-lived options, the Samuelson–McKean formula can capture values with infinite options. Basically, land ownership is perpetual, and an option to develop a particular site of land lasts infinitely. This formula suits the task of evaluating land value with simple singular-phase development without time constratins. Further, it is applicable to the determination of option (land) value of the last phase in a multi-phased project.

$$\text{Option (land) value} = C_0 = (V^* - K_0)\left(\frac{V_0}{V^*}\right)^{\eta}$$

$$\eta = \left\{y_V - y_K + \sigma_V{}^2/2 + [(y_V - y_K + \sigma_V{}^2/2)^2 + 2y_K\sigma_V{}^2]^{1/2}\right\}/\sigma_V{}^2$$

$$V^* = K_0\eta/(\eta - 1)$$

* η = Option elasticity

*V^* = Hurdle value of the developed property

Compound Real Option Model

When a developer purchases a site for development, it is not realistic to delay construction, since the decision to develop the site has normally already been made before the purchase.

Thus far, we have described evaluation of the wait option for simple projects with no phases. The true benefit of the model is in its application to large-scale, multi-phased projects. Such projects require a long time to complete, and the development plan must be continually modified regarding the timing of construction, design, and use, depending on the current market situation. Therefore, these important decisions need to be made not only at the beginning of the project but also periodically as it progresses. In other words, the later phases have a great deal of flexibility to adapt to market conditions, and this flexibility has a huge impact on the land value.

The compound real-option model provides a method of evaluating land value for multi-phased projects. There are two ways to structure the model: simultaneous or sequential. In a simultaneous-option model, the phases are independent of each other, and can start anytime, regardless of the progress of the other phases. In sequential mode, however, subsequent phases cannot start until the current phase finishes. Thus, we call this version the option-on-option model. For this case study, we deal with only the sequential model.

The steps to construct a sequential compound real-option model are

1) Construct a binominal option model for each phase. (Normally, the Samuelson–McKean formula is the right choice for the last phase)
2) Add an optional value for each subsequent phase only when the timing for exercise of the option is optimal. Normally, the landowners cannot get the value of a subsequent phase until current phase's completion. In order to incorporate this lag into the evaluation, the subsequent option value received by current phase can be computed by

discounting the option value at the time of completion to the value at the time of exercise.

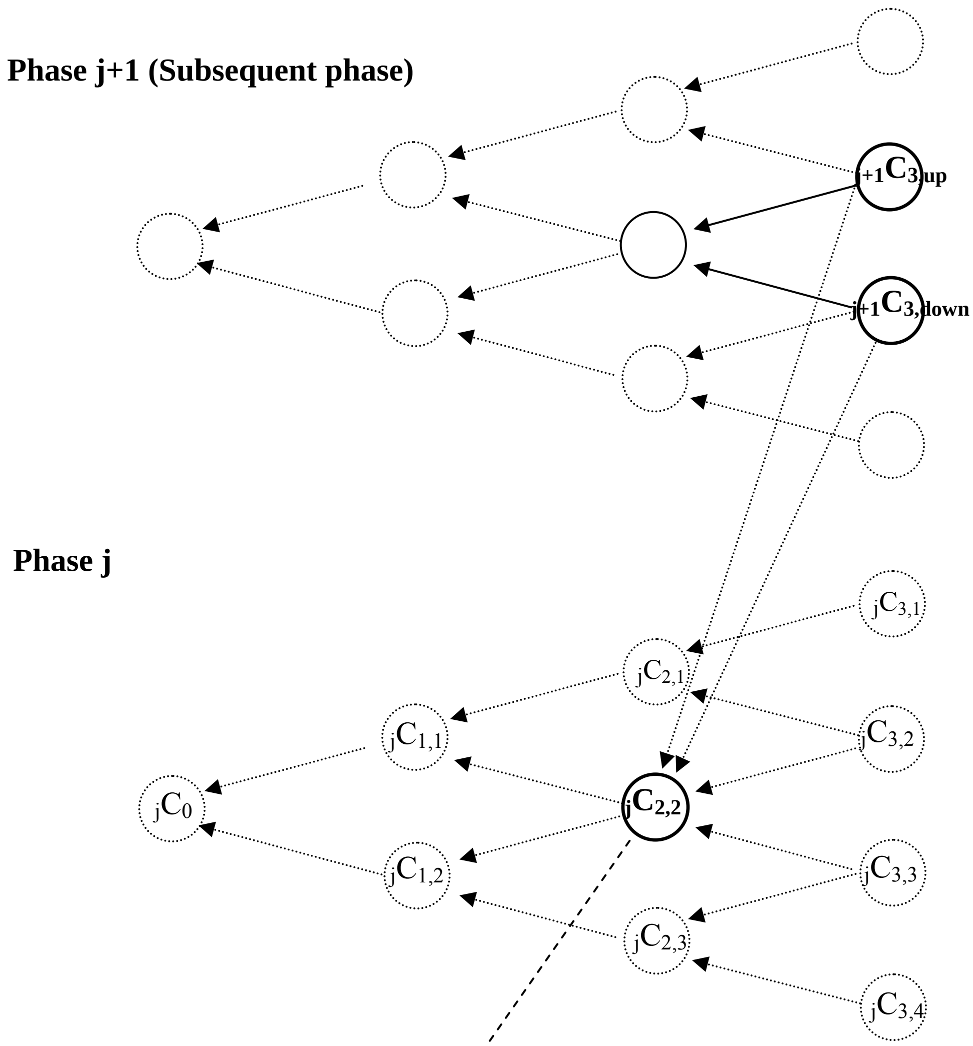
The following formula and Figure 2-5 shows the above procedure (assuming one term lag).

Option Value ($_jC_{t,i}$)
= Maximum {PV_t (*Exercise*)+ ***PV*** $\boldsymbol{PV_t}$ **(*Subsequent Phase Option Value*)**, PV_t (*Wait*)}

$$\boldsymbol{PV_t}\ \textbf{(\textit{Subsequent Phase Option Value})} = \frac{p\ _{j+1}C_{t+1,up} + (1-p)\ _{j+1}C_{t+1,down}}{1+OCC}$$

$$= \frac{\left(p\ _{j+1}C_{t+1,up} + (1-p)\ _{j+1}C_{t+1,down}\right) - \dfrac{RPv}{\left(\%\ _{j+1}V_{t+1,up} - \%\ _{j+1}V_{t+1,down}\right)} \times \left(_{j+1}C_{t+1,up} - _{j+1}C_{t+1,down}\right)}{(1+r_f)}$$

$$= \frac{\left(p\ _{j+1}C_{t+1,up} + (1-p)\ _{j+1}C_{t+1,down}\right) - \dfrac{r_V - r_f}{\left((1+\sigma_v) - 1/(1+\sigma_v)\right)} \times \left(_{j+1}C_{t+1,up} - _{j+1}C_{t+1,down}\right)}{(1+r_f)}$$



$$ {}_{j}C_{2,2} = \textbf{Maximum} \begin{Bmatrix} \textbf{PV}_2\textbf{(Exercise)+PV}_2\textbf{(Subsequent Phase Option Value),} \\ \textbf{PV}_2\textbf{(Wait)} \end{Bmatrix} $$

PV_2 (Subsequent Phase Option Value)

$$ = \frac{p \; {}_{j+1}C_{3,up} + (1-p) \; {}_{j+1}C_{3,down}}{1+OCC} $$

$$ = \frac{\left(p \; {}_{j+1}C_{3,up} + (1-p) \; {}_{j+1}C_{3,down}\right) - \dfrac{r_V - r_f}{\left((1+\sigma_v) - 1/(1+\sigma_v)\right)} \times \left({}_{j+1}C_{3,up} - {}_{j+1}C_{3,down} \right)}{(1+r_f)} $$

*assuming 1 term lag

Figure 2-5 Option (land) Value -compound option-

Chapter 3 Case Study

Data Source

This case study is based on actual data from a major industrial developer in the US. Some numbers have been modified due to confidentiality issues. We used financial data that was created at the beginning of the project and data created at the beginning of each phase.

Project Overview

- Location

This industrial business park is located about 20 miles away from the central business district (CBD) of one of the largest cities in the US. The 164-acre site is ideally suited for a business park because of its easy access to highways and proximity to an airport.

- Size

The developer planned to develop nine distribution buildings of total three million square feet in area. The site suits both local and regional distribution facilities, which allowed the developer to adopt the strategy of developing a mixture of different-sized warehouses that would match the needs of both. The planned buildings ranged from 130,000 to 540,000 sf.

- Quality and Design

The developer applied high-quality standards to both the design and construction of the buildings and landscape. Establishing organized codes and covenants helped to maintain architectural continuity throughout the business park.

- Schedule & Phasing

The developer purchased the site in 1995, and planned to develop the entire site over a period of six years. The project consisted of five phases, with each phase covering the construction of one or two distribution facilities. The infrastructure for the site, including the ingress/egress, roads, signs, common area landscaping, and utilities, were planned to be constructed with Phases I, II, and IV.

➢ Market Conditions

At the time of the proposal for purchasing the site (1995), the overall vacancy rate was around 5%, which was historically low for this area. The vacancy rate for "Class A" property, such as this one, had fallen to less than 1%.

➢ Valuation Method for the Acquisition Price

The following table shows the costs and profitability summary for Phase I and the total that includes all phases of the project. The first phase site-acquisition price of $0.82million gives 11% profit margin on costs. The $5.17 million total site-acquisition cost represents the same price per acreage as paid in Phase I.

Table 3-1 Costs and Profitability Summary (*$1,000*)

	Phase I	All Phases	
Land Acreage	26	164	
Sight Acquisition	820	5,174	6.3%
Construction	9,406	59,328	72.2%
Soft Costs	2,794	17,623	21.5%
Total Development costs	13,020	82,125	100.0%
NOI	1,378	8,692	
Cap Rate	9.25%		
Projected Sales Price	14,897	93,966	
Selling Expenses	(149)	(940)	
Net Sales Proceeds	14,748	93,026	
Profits	1,458	9,197	
Margin on Costs	11%	11%	

Valuation Model and Assumptions

The project was divided into five phases, as shown in Table 3-2. We can apply the sequential (compound) real-option model for this case, since a certain percentage of the previous phase's absorption triggers the start of the next phase.

The Phase I option is assumed to expire in a year because the decision to start Phase I had already been made at the time the land was purchased. On the other hand, there are basically no time constraints for exercising the later phases. This could be called the "infinite on infinite" option. Our compound real-option model cannot fully capture an infinite on infinite option value. Thus, 40-year binominal trees approximate the infinite option for the phases between the first and final phase. This is considered to be long enough for the evaluation.

Table3-2 Valuation Method for Each Phase

Phase	Building	Option Expiration	Valuation Method
I	A	1 year	Binominal Tree
II	B,I	40 year	〃
III	C,F	〃	〃
IV	D,H	〃	〃
V	E,G	Infinite	Samuelson–McKean formula

The developer chooses the option that gives the maximum value among "Sellout," "Exercise," and "Wait" in each node of the option tree. The following function shows the basic construction of the binominal tree.

[All Phases Prior to the Last Phase]

For all t < T

C_t = Maximum (*Sellout Option Value, Exercise Option Value, Wait Option Value*)

– *Carrying Costs*

= Maximum (*Sellout Option Value*, $PV_t[V_{t+1} - K_{t+1}] + PV_t$[*Subsequent Phase Opt* $_{t+1}$],

$PV_t[C_{t+1}]$) – *Carrying Costs*

$C_t = 0$ (If $C_t < 0$)

For t = T

C_t = Maximum (*Sellout Option Value, Exercise Option Value*) – *Carrying Costs*

$C_t = 0$ (If $C_t < 0$)

[Last phase]

For all t < T

C_t = Maximum (*Sellout Option Value, Exercise Option Value, Wait Option Value*)

– *Carrying costs*

= Maximum (*Sellout Value*, $PV_t[V_{t+1}\text{-}K_{t+1}]$, $PV_t[C_{t+1}]$)

$C_t = 0$ (If $C_t < 0$)

For t = T (T=terminal period)

C_t = Maximum (*Sellout Option Value, Exercise Option Value*)

$C_t = 0$ (If $C_t < 0$)

- Sellout Option Value

Occasionally, the return on a project is optimized by selling the land as is, rather than pursuing industrial development. To valuate the sellout option value in this case study, considering the surrounding environment, we assumed the development of single-family housing as the fallback alternative use. The basic assumptions for the sellout price valuation are shown in Table 3-3.

Table 3-3 Assumptions for Sellout Option Valuation

Total sf	7,143,840	sf	
Lot size	20,000	sf	*Average sigle-family lot size = 16,675 in the US (US Census Bureau)
Efficiency	80%		
Total lots	286		
V_0/lot	124,200	$/lot	*Average sigle-family sales price in the area
V_0	35,491	1,000$	
Land Value	3,549	1,000$	
Rezoning Costs	1,775	50%	

Enter (input)*:		***Resulting (output):***		
Period length (T/n) in yrs =	1.0000			
Risk free interest rate (rf) =	6.00%	rf/period=		6.00%
Underlying Asset Total Return (rV) =	10.25%	rV/period =		10.25%
Underlying Asset Cash yield (yV) =	9.25%	yV/period=		9.25%
K Growth rate (gK) =		K gro/per=		
Time to build (periods)		V gro/per=		0.92%
Volatility (σ) =	15%	σ /period=		15.00%
V(initial) =		yK/period=		
K(initial) =		"p" real prob=		0.8306
Land Carrying Costs			"u" =	1.1500
Residual Land Ratio (beginning)			"d" =	0.8696
*Note: All input rates nominal annual rates.				

We assumed that the value of the land, based on residential use, would fluctuate in a manner similar to that of the industrial market (More specific assumptions can be made depending on the nature of a specific project, but this simple assumption was applied here). Changing the use can also entail the hurdle of rezoning costs. This includes not only actual rezoning costs, such as legal fees or infrastructure costs, but also the time spent rezoning and the potential degradation of value due to the mix of industrial and residential uses. We used 50% of the land value for rezoning costs as a basic assumption (the sensitivity of land value to the rezoning costs is presented in the subsequent section). The sellout-option value tree is shown in Table 3-4.

Table 3-4 Sellout Option Value Tree

($1,000)

Year:	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Period ("t"):	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Expected Values of V:		1,791	1,807	1,824	1,840	1,857	1,874	1,891	1,909	1,926	1,944	1,962	1,980	1,998	2,016	2,034	2,053	2,072	2,091	2,110	2,129
(" i "):																					
0	1,775	1,945	2,125	2,316	2,517	2,729	2,954	3,191	3,441	3,705	3,984	4,278	4,588	4,916	5,262	5,626	6,011	6,416	6,844	7,295	7,771
1		1,034	1,166	1,306	1,454	1,611	1,776	1,951	2,136	2,332	2,538	2,756	2,987	3,230	3,487	3,758	4,044	4,346	4,665	5,002	5,357
2			441	543	651	765	886	1,014	1,150	1,293	1,445	1,606	1,776	1,955	2,145	2,346	2,557	2,781	3,018	3,267	3,531
3				-34	43	126	213	306	404	508	619	736	860	991	1,130	1,277	1,433	1,598	1,772	1,956	2,151
4					-416	-358	-296	-230	-160	-85	-6	78	168	262	363	470	583	703	830	965	1,107
5						-723	-681	-635	-586	-534	-479	-419	-356	-289	-217	-141	-60	26	118	215	318
6							-972	-942	-909	-874	-836	-795	-752	-705	-656	-603	-546	-485	-421	-352	-279
7								-1,173	-1,153	-1,130	-1,106	-1,080	-1,051	-1,021	-987	-952	-913	-872	-828	-781	-730
8									-1,337	-1,324	-1,310	-1,295	-1,278	-1,259	-1,238	-1,216	-1,191	-1,165	-1,136	-1,105	-1,071
9										-1,471	-1,465	-1,457	-1,449	-1,439	-1,428	-1,415	-1,401	-1,386	-1,369	-1,350	-1,329
10											-1,582	-1,580	-1,578	-1,575	-1,571	-1,566	-1,560	-1,553	-1,545	-1,535	-1,524
11												-1,673	-1,676	-1,678	-1,680	-1,680	-1,680	-1,680	-1,678	-1,675	-1,672
12													-1,750	-1,756	-1,762	-1,767	-1,771	-1,775	-1,779	-1,781	-1,783
13														-1,815	-1,824	-1,832	-1,840	-1,848	-1,855	-1,861	-1,868
14															-1,871	-1,881	-1,892	-1,902	-1,912	-1,922	-1,932
15																-1,919	-1,931	-1,944	-1,956	-1,968	-1,980
16																	-1,961	-1,975	-1,989	-2,003	-2,016
17																		-1,999	-2,014	-2,029	-2,044
18																			-2,032	-2,049	-2,065
19																				-2,064	-2,080
20																					-2,092

Year:	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
Period ("t"):	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40
Expected Values of V:	2,149	2,168	2,188	2,208	2,228	2,249	2,269	2,290	2,311	2,332	2,354	2,375	2,397	2,419	2,441	2,463	2,486	2,509	2,532	2,555
(" i "):																				
0	8,272	8,801	9,359	9,946	10,566	11,219	11,907	12,633	13,397	14,203	15,052	15,946	16,889	17,882	18,928	20,030	21,192	22,415	23,704	25,062
1	5,731	6,126	6,543	6,982	7,446	7,935	8,450	8,994	9,567	10,170	10,807	11,478	12,186	12,931	13,717	14,545	15,418	16,337	17,306	18,327
2	3,810	4,104	4,414	4,741	5,087	5,451	5,836	6,242	6,670	7,122	7,598	8,100	8,630	9,188	9,777	10,397	11,052	11,742	12,469	13,235
3	2,357	2,574	2,804	3,047	3,303	3,574	3,860	4,161	4,480	4,816	5,171	5,546	5,941	6,358	6,797	7,261	7,751	8,267	8,811	9,385
4	1,258	1,418	1,586	1,765	1,954	2,154	2,365	2,588	2,824	3,073	3,336	3,614	3,908	4,217	4,545	4,890	5,254	5,639	6,045	6,473
5	427	543	666	796	934	1,080	1,235	1,398	1,572	1,755	1,949	2,153	2,370	2,599	2,841	3,097	3,367	3,652	3,953	4,272
6	-201	-118	-30	64	163	268	380	499	625	758	899	1,049	1,208	1,375	1,553	1,741	1,940	2,150	2,372	2,607
7	-676	-618	-556	-490	-420	-345	-266	-181	-91	5	106	214	329	450	579	716	860	1,014	1,176	1,348
8	-1,035	-996	-954	-909	-861	-810	-754	-696	-633	-565	-494	-417	-336	-250	-157	-60	44	155	272	396
9	-1,307	-1,282	-1,255	-1,226	-1,195	-1,161	-1,124	-1,084	-1,042	-996	-947	-895	-839	-779	-714	-646	-573	-495	-412	-323
10	-1,512	-1,498	-1,483	-1,466	-1,447	-1,426	-1,403	-1,378	-1,351	-1,322	-1,290	-1,256	-1,219	-1,179	-1,135	-1,089	-1,039	-986	-929	-867
11	-1,667	-1,662	-1,655	-1,647	-1,637	-1,627	-1,615	-1,601	-1,585	-1,568	-1,550	-1,529	-1,506	-1,481	-1,454	-1,424	-1,392	-1,357	-1,320	-1,279
12	-1,785	-1,785	-1,785	-1,784	-1,782	-1,778	-1,774	-1,769	-1,762	-1,755	-1,746	-1,735	-1,723	-1,710	-1,695	-1,678	-1,659	-1,638	-1,615	-1,590
13	-1,873	-1,879	-1,883	-1,887	-1,891	-1,893	-1,895	-1,896	-1,896	-1,896	-1,894	-1,891	-1,888	-1,883	-1,877	-1,869	-1,861	-1,850	-1,839	-1,825
14	-1,941	-1,949	-1,958	-1,966	-1,973	-1,980	-1,986	-1,992	-1,997	-2,002	-2,006	-2,009	-2,012	-2,013	-2,014	-2,014	-2,013	-2,011	-2,008	-2,003
15	-1,991	-2,003	-2,014	-2,025	-2,035	-2,045	-2,055	-2,065	-2,074	-2,083	-2,091	-2,099	-2,106	-2,112	-2,118	-2,124	-2,128	-2,132	-2,135	-2,138
16	-2,030	-2,043	-2,056	-2,069	-2,082	-2,095	-2,108	-2,120	-2,132	-2,144	-2,155	-2,166	-2,177	-2,187	-2,197	-2,207	-2,216	-2,224	-2,232	-2,239
17	-2,059	-2,074	-2,089	-2,103	-2,118	-2,133	-2,147	-2,161	-2,176	-2,190	-2,203	-2,217	-2,230	-2,244	-2,257	-2,269	-2,282	-2,294	-2,305	-2,316
18	-2,081	-2,097	-2,113	-2,129	-2,145	-2,161	-2,177	-2,193	-2,209	-2,224	-2,240	-2,256	-2,271	-2,286	-2,302	-2,317	-2,331	-2,346	-2,360	-2,375
19	-2,097	-2,114	-2,131	-2,148	-2,165	-2,182	-2,199	-2,217	-2,234	-2,251	-2,268	-2,285	-2,302	-2,319	-2,336	-2,352	-2,369	-2,386	-2,402	-2,419
20	-2,110	-2,127	-2,145	-2,163	-2,181	-2,199	-2,217	-2,235	-2,253	-2,271	-2,289	-2,307	-2,325	-2,343	-2,361	-2,379	-2,398	-2,416	-2,434	-2,452
21	-2,119	-2,137	-2,156	-2,174	-2,192	-2,211	-2,229	-2,248	-2,267	-2,286	-2,305	-2,324	-2,343	-2,362	-2,381	-2,400	-2,419	-2,438	-2,458	-2,477
22		-2,145	-2,164	-2,182	-2,201	-2,220	-2,239	-2,258	-2,278	-2,297	-2,317	-2,336	-2,356	-2,376	-2,395	-2,415	-2,435	-2,456	-2,476	-2,496
23			-2,170	-2,189	-2,208	-2,227	-2,247	-2,266	-2,286	-2,306	-2,326	-2,346	-2,366	-2,386	-2,407	-2,427	-2,448	-2,469	-2,489	-2,510
24				-2,193	-2,213	-2,232	-2,252	-2,272	-2,292	-2,312	-2,332	-2,353	-2,373	-2,394	-2,415	-2,436	-2,457	-2,478	-2,500	-2,521
25					-2,217	-2,236	-2,256	-2,276	-2,297	-2,317	-2,338	-2,358	-2,379	-2,400	-2,421	-2,443	-2,464	-2,486	-2,507	-2,529
26						-2,239	-2,260	-2,280	-2,300	-2,321	-2,342	-2,362	-2,384	-2,405	-2,426	-2,448	-2,469	-2,491	-2,513	-2,536
27							-2,262	-2,282	-2,303	-2,324	-2,345	-2,366	-2,387	-2,408	-2,430	-2,452	-2,473	-2,496	-2,518	-2,540
28								-2,284	-2,305	-2,326	-2,347	-2,368	-2,389	-2,411	-2,433	-2,454	-2,477	-2,499	-2,521	-2,544
29									-2,306	-2,327	-2,348	-2,370	-2,391	-2,413	-2,435	-2,457	-2,479	-2,501	-2,524	-2,547
30										-2,329	-2,350	-2,371	-2,393	-2,414	-2,436	-2,458	-2,481	-2,503	-2,526	-2,549
31											-2,351	-2,372	-2,394	-2,415	-2,437	-2,460	-2,482	-2,504	-2,527	-2,550
32												-2,373	-2,394	-2,416	-2,438	-2,460	-2,483	-2,505	-2,528	-2,551
33													-2,395	-2,417	-2,439	-2,461	-2,484	-2,506	-2,529	-2,552
34														-2,417	-2,439	-2,462	-2,484	-2,507	-2,530	-2,553
35															-2,440	-2,462	-2,485	-2,507	-2,530	-2,553
36																-2,462	-2,485	-2,508	-2,531	-2,554
37																	-2,485	-2,508	-2,531	-2,554
38																		-2,508	-2,531	-2,554
39																			-2,531	-2,554
40																				-2,554

➢ Exercise Option Value

As described in Chapter II, the exercise option value consists of the residual land value from exercised property, and the value of options of later phases. The later phase option value cannot be captured until current phase's completion. To incorporate this lag, we added the option value of one year later (PV_t[subsequent phase Opt $_{t+1}$]) . Although the construction schedule for each phase is less than one year in this project (see Table 3-6), we think the one-year lag is reasonable because it takes a few months to prepare for construction after the decision-making process (i.e., 1 year = construction + preparation period).

➢ Wait Option Value

The wait option value is calculated by the following formula, introduced in Chapter II.

$$PV_t(Wait) = \frac{\left(pC_{t+1,up} + (1-p)C_{t+1,down}\right) - RPcPV_t(Wait)}{(1+r_f)}$$

$$= \frac{\left(pC_{t+1,up} + (1-p)C_{t+1,down}\right) - \frac{RPv}{\left(\%V_{t+1,up} - \%V_{t+1,down}\right)} \times \left(C_{t+1,up} - C_{t+1,down}\right)}{(1+r_f)}$$

$$= \frac{\left(pC_{t+1,up} + (1-p)C_{t+1,down}\right) - \frac{r_V - r_f}{\left((1+\sigma_v) - 1/(1+\sigma_v)\right)} \times \left(C_{t+1,up} - C_{t+1,down}\right)}{(1+r_f)}$$

➢ Carrying Costs

Maintaining vacant land for future development has some carrying costs, such as property tax, insurance, and maintenance. These costs reduce the value of the waiting option. The larger these costs, the sooner developers must exercise their option and the less valuable the option of waiting.

Property tax for land is usually 1%–2% of the value per year. Our analysis, therefore, uses 2% of the acquisition price as the total carrying cost. Carrying costs naturally decline as the project progresses, because carrying costs refer to land vacant at the time.

During the first four phases, these carrying costs were subtracted from each node, to account for the reality that carrying costs are incurred every year.

In the final phase, based on the Samuelson–McKean formula, carrying costs are roughly the equivalent of an increment to the underlying asset payout rate (yield), the parameter y_V. This parameter indicates the opportunity cost of *not* exercising the option, in terms of foregone cash flow. Foregoing a positive cash flow is the same as foregoing the elimination of a negative cash flow. Thus, if property taxes (and other carrying costs) are around 2% of the land value annually, and the land value is around 10% of the developed property value, we can add 0.2% (20 basis points) to the yield (y_V) value (9.45% = 9.25% + 0.20%). This will make the option slightly less valuable, with a tendency to be exercised slightly sooner (lower hurdle benefit/cost ratio).

Accumulated carrying costs can theoretically create a negative option value. However, in reality, a landowner can give up the land for effectively zero cost. Therefore, if the maximum of the three options (sell, exercise, wait) is negative, the option value (abandonment) would equal zero.

➢ Other Assumptions

Table 3-5 shows basic assumptions in this study and Table 3-6 and 3-7 show the calculation of V_0 and K_0 for each building and phase. The project has two types of buildings: "Inventory" and "Build to Suit (BTS)." Inventory buildings have no tenants at the beginning of the construction; thus, the V_0/SF value for inventory buildings should be lower than that for BTS buildings, reflecting tenant risk (here, we assumed it is 50 basis points lower for BTS buildings in terms of Cap rate).

Table 3-5 Basic Assumptions

Enter (input)*:		***Resulting (output):***	
Period length (*T/n*) in yrs =	1.0000		
Riskfree interest rate (rf) =	6.00%	rf/period=	6.00%
Underlying Asset Total Return (rV) =	10.25%	rV/period =	10.25%
Underlying Asset Cash yield (yV) =	9.25%	yV/period=	9.25%
K growth rate (gK) =	2.00%	K gro/per=	2.00%
Time to build (periods)	0.58	V gro/per=	0.92%
Volatility (σ) =	15%	σ /period=	15.00%
		yK/period=	3.92%
		"p" real prob=	0.8306
		"u" =	1.1500
Residual Land Ratio (beginning)	100%	"d" =	0.8696
*Note: All input rates nominal annual rates.			

*Table 3-6 V (**Built Property Value**) and K (**Development Costs**) Values for Each Building*

Phase	Building	Building Type	Square Footage	Net Acreage	Cap Rate	Start	Comp letion	Time to build (months)	V_0	V_0/SF	Dev. Costs	Dev. Costs/SF
I	A	INV	537,600	26	9.25%	8/95	2/96	7	$14,748,260	$ 27.43	$11,289,989	$ 21.00
II	B	BTS	400,000	20	8.75%	11/96	5/97	7	$11,600,460	$ 29.00	$ 8,400,289	〃
	I	INV	356,000	19	9.25%	11/96	6/97	8	$ 9,766,333	$ 27.43	$ 7,476,258	〃
III	C	INV	200,000	10	9.25%	5/98	10/98	5	$ 5,486,704	$ 27.43	$ 4,200,145	〃
	F	BTS	400,000	21	8.75%	6/98	1/99	8	$11,600,460	$ 29.00	$ 8,400,289	〃
IV	D	INV	130,000	8	9.25%	6/99	2/00	9	$ 3,566,358	$ 27.43	$ 2,730,094	〃
	H	BTS	400,000	21	8.75%	6/99	1/00	8	$11,600,460	$ 29.00	$ 8,400,289	〃
V	E	INV	480,000	25	9.25%	7/00	3/01	9	$13,168,089	$ 27.43	$10,080,347	〃
	G	BTS	255,000	14	8.75%	8/00	5/01	10	$ 7,395,293	$ 29.00	$ 5,355,185	〃
	Total		3,158,600	164					$88,932,415		$66,332,886	

Table 3-7 V (Built Property Value) and K (Development Costs) Values for Each Phase

	Building	Square Footage	Net Acreage	Cumulative (Beginning)	Residual (Beginning)	Start	Completion	Time to build (Weighted avg.)
Phase Ⅰ	A	537,600	26	-	100%	8/95	2/96	7
Phase Ⅱ	B,I	756,000	39	16%	84%	11/96	6/97	7.5
Phase Ⅲ	C,F	600,000	31	40%	60%	5/98	1/99	7.0
Phase Ⅳ	D,H	530,000	29	59%	41%	6/99	2/00	8.2
Phase Ⅴ	E,G	735,000	39	76%	24%	7/00	5/01	9.3
Total		3,158,600	164					

	Building	Square Footage	V_0	V_0/SF	Infrastructure	Dev. Costs	K_0	K_0/SF	Carrying costs / yr
Phase Ⅰ	A	537,600	$ 14,748,260	$ 27.43	$ 1,376,000	$ 11,289,989	$ 12,665,989	$ 23.56	$ 103,481
Phase Ⅱ	B,I	756,000	$ 21,366,792	〃	$ 841,000	$ 15,876,547	$ 16,717,547	$ 22.11	$ 87,075
Phase Ⅲ	C,F	600,000	$ 17,087,163	〃		$ 12,600,434	$ 12,600,434	$ 21.00	$ 62,467
Phase Ⅳ	D,H	530,000	$ 15,166,817	〃	$ 841,000	$ 11,130,384	$ 11,971,384	$ 22.59	$ 42,907
Phase Ⅴ	E,G	735,000	$ 20,563,382	〃		$ 15,435,532	$ 15,435,532	$ 21.00	$ 24,608
Total		3,158,600	$ 88,932,415		$ 3,058,000	$ 66,332,886	$ 69,390,886		$ 103,481

The value of y_V is 9.25% based on the pro-forma at the beginning of the project. 10.25% is used as r_V, reflecting the growth expectation at the time. In addition, we tested the sensitivity of the calculated land value with regard to these parameters (see page 37).

In 1995, using the five-year Treasury note, we assumed 6% as the risk-free rate.

Valuation

Based on these assumptions, we reevaluated the entire project using the real-option model. The calculated site value for this project is \$9.91 million, which is higher than the actual acquisition price of \$5.17 million by \$4.74 million.

The possible reasons for this difference are (1) the market value (acquisition price) assumed lower volatility than our model; (2) the market value did not take into account the option value; or (3) the sellout possibility is ignored.

In addition, the model gives indicators for whether the current market is optimal for starting a phase. As can be seen in Table 3-8, the projected property value at the time justifies the immediate exercise of Phase I.

Table 3-8 Phase I Valuation Results

This is a compound call option based on the Phase I assets and the Phase II–V option, expiring at the end of one year from Time 0.

V tree (net of payout, "ex dividend" values):		
Year:	**<u>1995</u>**	**<u>1996</u>**
Period ("*t*"):	0	1
Expected Values of V:		14,883
"down" moves ("*i*"):		
0	14,748	15,524
1		11,739

K tree (development costs):		
Period ("*t*"):	0	1
"down" moves ("*i*"):		
0	12,666	12,919
1		12,919

Phase Option Value:		
Period ("t"):	0	1
"down" moves ("*i*"):		
0	9,906	11,893
1		0

Phase Optimal Exercise:		
Period ("*t*"):	0	1
"down" moves ("*i*"):		
0	exer	exer
1		abnd

exer: exercise
wait: wait
sell: sellout
abnd: abandonment

Table 3-9 shows the sensitivity of the calculated site value based on the real-option model. Our basis assumption of 15% volatility gives \$9.91 million as a site value. If the volatility parameter is 10%, the estimated site value turns out to be \$8.65 million, which is still higher than the actual acquisition price by \$3.48 million. Volatility for industrial property is expected to be lower than other types of properties because of its relatively shorter delivery lag; therefore, 10% seems more reasonable for this kind of Class A industrial project.

Table 3-9 Sensitivity Analysis

[Volatility(σ)] vs [Built property cash yield]

Sensitivity Analysis				
		Sigma		
		10%	15%	20%
y_V	8.25%	**$9,921**	**$11,233**	**$12,918**
	9.25%	**$8,651**	**$9,906**	**$11,540**
	10.25%	**$7,585**	**$8,763**	**$10,340**

[Volatility] vs [Rezoning costs]

Sensitivity Analysis				
		Sigma		
		10%	15%	20%
Rezoning costs /total land value	0%	**$9,144**	**$10,381**	**$12,052**
	50%	**$8,651**	**$9,906**	**$11,540**
	100%	**$8,479**	**$9,824**	**$11,526**

The model can back out the opportunity cost of capital associated with a project that has multiple phases. The following formula calculates the opportunity cost of capital as 29.66% at time 0, i.e., prior to building any phases. The project's implied investment risk is 5.55 times higher than the risk of the built property; in other words, the risk premium for the development project is 5.55 higher than that for built property.

$$PV_0\ [Option\ Value] = \frac{Expected\ Option\ Value}{1+OCC} = \frac{pC_{1,up} + (1-p)C_{1,down}}{1+OCC}$$

$$\Downarrow$$

$$1+OCC = \frac{Expected\ Option\ Value}{PV_0\ [Option\ Value]} = \frac{pC_{1,up} + (1-p)C_{1,down}}{C_0} = 1.296$$

$$\frac{Risk\ \ premium\ \ for\ Option\ (RP_C\ )}{Risk\ \ premium\ \ for\ Option\ (RP_V\ )} = \frac{29.6\% - 6\%}{10.25\% - 6\%} = 5.55$$

Review of the Actual Results

- Actual Project History

We have collected data regarding the actual history of the project, so we can compare our valuation with the up-to-date figures. Since its ground-breaking start in 1995, the project has progressed steadily. Nine buildings have been completed so far, and only one site is left for construction. However, this does not mean the project exactly followed the initial plan and schedule. As shown in Table 3-10, the size of the buildings is largely according to the initial plan, but the construction schedule has changed drastically. This happened because the developer modified the order of the construction to accommodate the needs for buildings of each size.

Table 3-10 Comparison of Initial Plan and Exercise

Phase	Phase I	Phase II		Phase III		Phase IV		Phase V	
Building	A	B	I	C	F	D	H	E	G
Square Footage									
Initial plan	537,600	400,000	356,000	200,000	400,000	130,000	400,000	480,000	255,000
Exercise	537,600	440,000		202,361	485,745	143,017	252,776	502,716	292,800
Start of Construction									
Initial Plan	Aug-95	Nov-96	Nov-96	May-98	Jun-98	Jun-99	Jun-99	Jul-00	Aug-00
Exercise	Aug-95	Jul-96		Jun-96	Jan-98	Jan-97	Nov-98	Jan-97	Jun-03
V									
Initial (V_0)	$ 14,748,260	$ 11,600,460	$ 9,766,333	$ 5,486,704	$ 11,600,460	$ 3,566,358	$ 11,600,460	$ 13,168,089	$ 7,395,293
Exercise (V_t)	$ 14,897,232	$ 12,662,043		$ 6,235,384	$ 14,563,021	$ 4,754,411	$ 8,651,564	$ 14,550,793	$ 10,085,333
Initial (V_0/SF)	$ 27.4	$ 29.0	$ 27.4	$ 27.4	$ 29.0	$ 27.4	$ 29.0	$ 27.4	$ 29.0
Exercise (V_t/SF)	$ 27.7	$ 28.8		$ 30.8	$ 30.0	$ 33.2	$ 34.2	$ 28.9	$ 34.4
K									
Initial (K_0)	$ 12,665,989	$ 8,845,263	$ 7,872,284	$ 4,200,145	$ 8,400,289	$ 2,927,849	$ 9,043,535	$ 10,080,347	$ 5,355,185
Exercise (K_t)	$ 12,665,989	$ 9,688,729		$ 4,790,139	$ 10,747,610	$ 3,947,854	$ 7,133,174	$ 11,058,317	$ 7,437,707
Initial (K_0/SF)	$ 23.6	$ 22.1		$ 21.0	$ 21.0	$ 22.5	$ 22.6	$ 21.0	$ 21.0
Exercise (K_t/SF)	$ 23.6	$ 22.0		$ 23.7	$ 22.1	$ 27.6	$ 28.2	$ 22.0	$ 25.4

*A part of the site for Building I was sold as land, while the rest of it remains vacant.

We have the proposals for the commencement of building construction, which includes the estimated underlying asset value (V_t) and construction costs (K_t) at the time of the exercise (they are different from "ex-post numbers," actual sales price and construction costs).

We calculated the IRR (Internal Rate of Return) for the project based on the projected data at the beginning of the project, hereinafter called "Initial," and again based on up-to-date projected values, calculated it at the time of the exercise for each building, called "Exercise" (see Table 3-11). "Exercise IRR" is 16.24%, which is higher than "Initial IRR," 14.99%. This shows that the market turned out to be favorable for the project.

Almost all buildings have been completed and sold. The actual sales prices ended up being mostly higher than the exercise prices stated above. This appears to do as much with the conservative projections used for the proposal as it does with improvement in the market during the construction.

Table 3-11 Comparison of IRR

Initial Plan (*$1,000*)

	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	Total
Phase Ⅰ	(11,290)	14,883									3,593
Phase Ⅱ		(16,194)	21,760								5,566
Phase Ⅲ				(13,109)	17,721						4,612
Phase Ⅳ					(11,812)	15,874					4,062
Phase Ⅴ						(16,708)	21,719				5,011
Land	(5,174)										(5,174)
Infrastructur	(1,376)	(841)			(841)						(3,058)
Total	(17,840)	(2,152)	21,760	(13,109)	5,069	(834)	21,719				14,612

IRR	14.99%

Exercise (*Up-to-date projected value*) (*$1,000*)

	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	Total
Phase Ⅰ	(12,666)	15,034									2,368
Phase Ⅱ		(14,479)	19,070								4,592
Phase Ⅲ			(15,006)	19,482							4,476
Phase Ⅳ				(17,881)	23,427						5,546
Phase Ⅴ									(16,197)	20,779	4,581
Land	(5,174)										(5,174)
Infrastructur											-
Total	(17,840)	555	4,064	1,601	23,427	-	-	-	(16,197)	20,779	16,388

IRR	16.24%

*Infrastructure costs were included in construction costs for each building.

- Review of the Exercise Price and Timing

For each phase, developers face the decision of whether to exercise the option or wait. Making that decision requires understanding if the projected value, based on the current market, justifies moving forward. One of the benefits of the real-option model is that it can give important insights into the optimal timing of construction.

We reviewed the exercise prices when the decision was made. The method is fairly simple. The option value tree in the previous study starts in 1995. Now, we need to move the staring point to the beginning of each phase that we wish to analyze in this simulation. We can ignore the phases before the targeted phase and calculate the compound option value for all the phases that follow. For example, if we want to examine Phase IV in 1998, we need to capture the compound real-option value of two phases. This puts the starting point of the trees at 1998; therefore, V_0 (=V_{1998}) and K_0 (=K_{1998}) should be updated based on current information.

Table 3-12 V and K Values Projected in 1998 **($1,000)**

	V_{1998}	K_{1998}
Phase IV	$23,215	$17,881
Phase V	$20,394	$15,708

Other parameters, such as the risk free rate or y_V, could change over time with the market. Table 3-13 shows the results based on the above values. Our calculations showed that the value of exercising the option in 1999 was higher than the other options, which means that our analysis justified the decision to commence Phase IV. Thus, this procedure could be a helpful tool for decision making in multi-phased projects such as this.

Table 3-13

Phase IV and V Option Value

Year:	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**
Period (" t "):	0	1	2	3	4	5
"down" moves ("i"):	*Phase Option Value:*					
0	7,370	8,650	10,072	11,601	13,247	15,020
1		728	1,137	1,756	2,653	3,660
2			140	182	227	274
3				0	0	9
4					0	0
5						0

Phase Optimal Exercise

Year:	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**
Period (" t "):	0	1	2	3	4	5
"down" moves ("i"):	*Phase Optimal exercise:*					
0	exer	exer	exer	exer	exer	exer
1		wait	wait	exer	exer	exer
2			sell	sell	sell	sell
3				abnd	abnd	sell
4					abnd	abnd
5						abnd

Chapter 4 Conclusions

- We found that the real-option model is fairly effective when applied to a large-scale industrial-development project with multiple phases.
- Recalculated land value based on the real-option model was higher than the actual acquisition price in this case. Possible reasons are (1) implied volatility for the project is lower than our assumption; (2) the market does not fully incorporate the waiting option value; and 3) the possibility of selling the land for another use could be ignored.
- The model requires some modifications for application to specific projects. For example, we incorporated the sellout option value assuming single-family residential use. In addition, we took into account carrying costs, thereby reducing the value of the options.
- The model proves useful in deciding the optimal timing for the exercise of each phase. In this case, our model found that each phase was properly exercised.
- The model can help the design/decision process quantitatively, by providing analysis of alternative phasing schemes.
- Also, the model is useful to evaluate “development right.” A Developer sometimes obtains the right that they can develop the sight anytime until the right expires, instead of purchasing the land itself. The model can capture the value of “development right” just by modifying time of expiration in the model.

Exhibits

Exhibit I-1 Inputs (Phase I)

Enter (input)*:		***Resulting (output):***	
Period length (T/n) in yrs =	1.0000	η =	6.29
Riskfree interest rate (rf) =	6.00%	rf/period=	6.00%
Underl Asset Total Return (rV) =	10.25%	rV/period =	10.25%
Underl Asset Cash yield (yV) =	9.25%	yV/period=	9.25%
K growth rate (gK) =	2.00%	K gro/per=	2.00%
Time to build (periods)	0.58	V gro/per=	0.92%
Volatility (σ) =	15.00%	σ /period=	15.00%
V(initial) =	14,748	yK/period=	3.92%
K(initial) =	12,666	"p" real prob=	0.8306
Land Carrying Costs (per yr)	103	"u" =	1.1500
Resisual Land Ratio (beginning)	100%	"d" =	0.8696
*Note: All input rates nominal annual rates.		**Option Val=**	**9,906**

Exhibit I-2 V Value Tree (Phase I)

Year:	1995	1996
Period ("t"):	0	1
Expected Values of V:		14,883
(" i "):		
0	14,748	15,524
1		11,739

Exhibit I-3 K Value Tree (Phase I)

Year:	1995	1996
Period (" t "):	0	1
(" i "):		
0	12,666	12,919
1		12,919

Exhibit I-4 Option Value Tree (Phase I)

Year:	1995	1996
Period (" t "):	0	1
(" i "):		
0	9,906	11,893
1		0

Exhibit I-5 Phase Optimal Exercise   (Phase I)

Year:	1995	1996
Period (" t "):	0	1
(" i "):		
0	exer	exer
1		abnd

Exhibit II-1 Inputs (Phase II)

Enter (input)*:		***Resulting (output):***	
Period length (T/n) in yrs =	1.0000	η =	6.29
Riskfree interest rate (rf) =	6.00%	rf/period=	6.00%
Underl Asset Total Return (rV) =	10.25%	rV/period =	10.25%
Underl Asset Cash yield (yV) =	9.25%	yV/period=	9.25%
K growth rate (gK) =	2.00%	K gro/per=	2.00%
Time to build (periods)	0.62	V gro/per=	0.92%
Volatility (σ) =	15.00%	σ /period=	15.00%
V(initial) =	21,367	yK/period=	3.92%
K(initial) =	16,718	"p" real prob=	0.8306
Land Carrying Costs	87	"u" =	1.1500
Resisual Land Ratio (beginning)	84%	"d" =	0.8696
*Note: All input rates nominal annual rates.		**Option Val=**	**10,534**

Exhibit II-2 V Value Tree (Phase II)

($1,000)

Year:	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Period ("t"):	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Expected Values of V:		21,562	21,760	21,959	22,160	22,363	22,567	22,774	22,982	23,193	23,405	23,619	23,836	24,054	24,274	24,496	24,720	24,947	25,175	25,405	25,638
(" i "):																					
0	21,367	22,491	23,675	24,921	26,233	27,613	29,067	30,597	32,207	33,902	35,686	37,565	39,542	41,623	43,814	46,120	48,547	51,102	53,792	56,623	59,603
1		17,007	17,902	18,844	19,836	20,880	21,979	23,135	24,353	25,635	26,984	28,404	29,899	31,473	33,129	34,873	36,708	38,640	40,674	42,815	45,068
2			13,536	14,249	14,999	15,788	16,619	17,494	18,414	19,384	20,404	21,478	22,608	23,798	25,051	26,369	27,757	29,218	30,756	32,374	34,078
3				10,774	11,341	11,938	12,566	13,228	13,924	14,657	15,428	16,240	17,095	17,995	18,942	19,939	20,988	22,093	23,256	24,480	25,768
4					8,576	9,027	9,502	10,002	10,529	11,083	11,666	12,280	12,926	13,607	14,323	15,077	15,870	16,705	17,585	18,510	19,484
5						6,826	7,185	7,563	7,961	8,380	8,821	9,285	9,774	10,289	10,830	11,400	12,000	12,632	13,296	13,996	14,733
6							5,433	5,719	6,020	6,337	6,670	7,021	7,391	7,780	8,189	8,620	9,074	9,551	10,054	10,583	11,140
7								4,324	4,552	4,791	5,044	5,309	5,588	5,883	6,192	6,518	6,861	7,222	7,602	8,002	8,424
8									3,442	3,623	3,814	4,014	4,226	4,448	4,682	4,929	5,188	5,461	5,748	6,051	6,369
9										2,739	2,884	3,035	3,195	3,363	3,540	3,727	3,923	4,129	4,347	4,575	4,816
10											2,180	2,295	2,416	2,543	2,677	2,818	2,966	3,122	3,287	3,460	3,642
11												1,736	1,827	1,923	2,024	2,131	2,243	2,361	2,485	2,616	2,754
12													1,381	1,454	1,531	1,611	1,696	1,785	1,879	1,978	2,082
13														1,099	1,157	1,218	1,282	1,350	1,421	1,496	1,574
14															875	921	970	1,021	1,074	1,131	1,190
15																697	733	772	812	855	900
16																	554	584	614	647	681
17																		441	465	489	515
18																			351	370	389
19																				280	294
20																					223

Year:	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
Period ("t"):	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40
Expected Values of V:	25,873	26,109	26,348	26,590	26,833	27,079	27,326	27,577	27,829	28,084	28,341	28,600	28,862	29,126	29,393	29,662	29,933	30,207	30,484	30,763
(" i "):																				
0	62,740	66,042	69,518	73,177	77,028	81,082	85,350	89,842	94,570	99,548	104,787	110,302	116,108	122,218	128,651	135,422	142,550	150,052	157,950	166,263
1	47,440	49,937	52,565	55,332	58,244	61,310	64,537	67,933	71,509	75,272	79,234	83,404	87,794	92,415	97,279	102,399	107,788	113,461	119,433	125,719
2	35,872	37,760	39,747	41,839	44,041	46,359	48,799	51,367	54,071	56,917	59,912	63,066	66,385	69,879	73,557	77,428	81,503	85,793	90,308	95,061
3	27,124	28,552	30,054	31,636	33,301	35,054	36,899	38,841	40,885	43,037	45,302	47,687	50,196	52,838	55,619	58,547	61,628	64,872	68,286	71,880
4	20,510	21,589	22,726	23,922	25,181	26,506	27,901	29,369	30,915	32,542	34,255	36,058	37,956	39,953	42,056	44,270	46,600	49,052	51,634	54,352
5	15,508	16,325	17,184	18,088	19,040	20,042	21,097	22,208	23,376	24,607	25,902	27,265	28,700	30,211	31,801	33,474	35,236	37,091	39,043	41,098
6	11,727	12,344	12,993	13,677	14,397	15,155	15,952	16,792	17,676	18,606	19,585	20,616	21,701	22,844	24,046	25,311	26,644	28,046	29,522	31,076
7	8,867	9,334	9,825	10,342	10,886	11,459	12,062	12,697	13,365	14,069	14,809	15,589	16,409	17,273	18,182	19,139	20,146	21,207	22,323	23,498
8	6,705	7,058	7,429	7,820	8,232	8,665	9,121	9,601	10,106	10,638	11,198	11,787	12,408	13,061	13,748	14,472	15,234	16,035	16,879	17,768
9	5,070	5,337	5,617	5,913	6,224	6,552	6,897	7,260	7,642	8,044	8,467	8,913	9,382	9,876	10,396	10,943	11,519	12,125	12,763	13,435
10	3,833	4,035	4,248	4,471	4,706	4,954	5,215	5,489	5,778	6,082	6,403	6,739	7,094	7,468	7,861	8,274	8,710	9,168	9,651	10,159
11	2,899	3,051	3,212	3,381	3,559	3,746	3,943	4,151	4,369	4,599	4,841	5,096	5,364	5,647	5,944	6,257	6,586	6,932	7,297	7,681
12	2,192	2,307	2,429	2,556	2,691	2,833	2,982	3,139	3,304	3,478	3,661	3,853	4,056	4,270	4,494	4,731	4,980	5,242	5,518	5,808
13	1,657	1,745	1,836	1,933	2,035	2,142	2,255	2,373	2,498	2,630	2,768	2,914	3,067	3,228	3,398	3,577	3,765	3,964	4,172	4,392
14	1,253	1,319	1,389	1,462	1,539	1,620	1,705	1,794	1,889	1,988	2,093	2,203	2,319	2,441	2,570	2,705	2,847	2,997	3,155	3,321
15	948	997	1,050	1,105	1,163	1,225	1,289	1,357	1,428	1,503	1,583	1,666	1,754	1,846	1,943	2,045	2,153	2,266	2,386	2,511
16	716	754	794	836	880	926	975	1,026	1,080	1,137	1,197	1,260	1,326	1,396	1,469	1,547	1,628	1,714	1,804	1,899
17	542	570	600	632	665	700	737	776	817	860	905	952	1,003	1,055	1,111	1,169	1,231	1,296	1,364	1,436
18	410	431	454	478	503	529	557	587	617	650	684	720	758	798	840	884	931	980	1,031	1,086
19	310	326	343	361	380	400	421	444	467	491	517	545	573	603	635	669	704	741	780	821
20	234	247	260	273	288	303	319	335	353	372	391	412	433	456	480	506	532	560	590	621
21	177	186	196	207	217	229	241	254	267	281	296	311	328	345	363	382	402	424	446	469
22		141	148	156	164	173	182	192	202	212	224	235	248	261	275	289	304	320	337	355
23			112	118	124	131	138	145	153	161	169	178	187	197	208	219	230	242	255	268
24				89	94	99	104	110	115	121	128	135	142	149	157	165	174	183	193	203
25					71	75	79	83	87	92	97	102	107	113	119	125	132	138	146	153
26						57	60	63	66	69	73	77	81	85	90	94	99	105	110	116
27							45	47	50	53	55	58	61	64	68	71	75	79	83	88
28								36	38	40	42	44	46	49	51	54	57	60	63	66
29									29	30	32	33	35	37	39	41	43	45	48	50
30										23	24	25	26	28	29	31	33	34	36	38
31											18	19	20	21	22	23	25	26	27	29
32												14	15	16	17	18	19	20	21	22
33													11	12	13	13	14	15	16	16
34														9	10	10	11	11	12	12
35															7	8	8	8	9	9
36																6	6	6	7	7
37																	5	5	5	5
38																		4	4	4
39																			3	3
40																				2

Exhibit II-3 K Value Tree (Phase II)

($1,000)

Year:	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
Period (" t "):	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40
(" i "):																																									
0	16,718	17,052	17,393	17,741	18,096	18,458	18,827	19,203	19,587	19,979	20,379	20,786	21,202	21,626	22,058	22,500	22,950	23,409	23,877	24,354	24,841	25,338	25,845	26,362	26,889	27,427	27,975	28,535	29,106	29,688	30,282	30,887	31,505	32,135	32,778	33,433	34,102	34,784	35,480	36,189	36,913
1		17,052	17,393	17,741	18,096	18,458	18,827	19,203	19,587	19,979	20,379	20,786	21,202	21,626	22,058	22,500	22,950	23,409	23,877	24,354	24,841	25,338	25,845	26,362	26,889	27,427	27,975	28,535	29,106	29,688	30,282	30,887	31,505	32,135	32,778	33,433	34,102	34,784	35,480	36,189	36,913
2			17,393	17,741	18,096	18,458	18,827	19,203	19,587	19,979	20,379	20,786	21,202	21,626	22,058	22,500	22,950	23,409	23,877	24,354	24,841	25,338	25,845	26,362	26,889	27,427	27,975	28,535	29,106	29,688	30,282	30,887	31,505	32,135	32,778	33,433	34,102	34,784	35,480	36,189	36,913
3				17,741	18,096	18,458	18,827	19,203	19,587	19,979	20,379	20,786	21,202	21,626	22,058	22,500	22,950	23,409	23,877	24,354	24,841	25,338	25,845	26,362	26,889	27,427	27,975	28,535	29,106	29,688	30,282	30,887	31,505	32,135	32,778	33,433	34,102	34,784	35,480	36,189	36,913
4					18,096	18,458	18,827	19,203	19,587	19,979	20,379	20,786	21,202	21,626	22,058	22,500	22,950	23,409	23,877	24,354	24,841	25,338	25,845	26,362	26,889	27,427	27,975	28,535	29,106	29,688	30,282	30,887	31,505	32,135	32,778	33,433	34,102	34,784	35,480	36,189	36,913
5						18,458	18,827	19,203	19,587	19,979	20,379	20,786	21,202	21,626	22,058	22,500	22,950	23,409	23,877	24,354	24,841	25,338	25,845	26,362	26,889	27,427	27,975	28,535	29,106	29,688	30,282	30,887	31,505	32,135	32,778	33,433	34,102	34,784	35,480	36,189	36,913
6							18,827	19,203	19,587	19,979	20,379	20,786	21,202	21,626	22,058	22,500	22,950	23,409	23,877	24,354	24,841	25,338	25,845	26,362	26,889	27,427	27,975	28,535	29,106	29,688	30,282	30,887	31,505	32,135	32,778	33,433	34,102	34,784	35,480	36,189	36,913
7								19,203	19,587	19,979	20,379	20,786	21,202	21,626	22,058	22,500	22,950	23,409	23,877	24,354	24,841	25,338	25,845	26,362	26,889	27,427	27,975	28,535	29,106	29,688	30,282	30,887	31,505	32,135	32,778	33,433	34,102	34,784	35,480	36,189	36,913
8									19,587	19,979	20,379	20,786	21,202	21,626	22,058	22,500	22,950	23,409	23,877	24,354	24,841	25,338	25,845	26,362	26,889	27,427	27,975	28,535	29,106	29,688	30,282	30,887	31,505	32,135	32,778	33,433	34,102	34,784	35,480	36,189	36,913
9										19,979	20,379	20,786	21,202	21,626	22,058	22,500	22,950	23,409	23,877	24,354	24,841	25,338	25,845	26,362	26,889	27,427	27,975	28,535	29,106	29,688	30,282	30,887	31,505	32,135	32,778	33,433	34,102	34,784	35,480	36,189	36,913
10											20,379	20,786	21,202	21,626	22,058	22,500	22,950	23,409	23,877	24,354	24,841	25,338	25,845	26,362	26,889	27,427	27,975	28,535	29,106	29,688	30,282	30,887	31,505	32,135	32,778	33,433	34,102	34,784	35,480	36,189	36,913
11												20,786	21,202	21,626	22,058	22,500	22,950	23,409	23,877	24,354	24,841	25,338	25,845	26,362	26,889	27,427	27,975	28,535	29,106	29,688	30,282	30,887	31,505	32,135	32,778	33,433	34,102	34,784	35,480	36,189	36,913
12													21,202	21,626	22,058	22,500	22,950	23,409	23,877	24,354	24,841	25,338	25,845	26,362	26,889	27,427	27,975	28,535	29,106	29,688	30,282	30,887	31,505	32,135	32,778	33,433	34,102	34,784	35,480	36,189	36,913
13														21,626	22,058	22,500	22,950	23,409	23,877	24,354	24,841	25,338	25,845	26,362	26,889	27,427	27,975	28,535	29,106	29,688	30,282	30,887	31,505	32,135	32,778	33,433	34,102	34,784	35,480	36,189	36,913
14															22,058	22,500	22,950	23,409	23,877	24,354	24,841	25,338	25,845	26,362	26,889	27,427	27,975	28,535	29,106	29,688	30,282	30,887	31,505	32,135	32,778	33,433	34,102	34,784	35,480	36,189	36,913
15																22,500	22,950	23,409	23,877	24,354	24,841	25,338	25,845	26,362	26,889	27,427	27,975	28,535	29,106	29,688	30,282	30,887	31,505	32,135	32,778	33,433	34,102	34,784	35,480	36,189	36,913
16																	22,950	23,409	23,877	24,354	24,841	25,338	25,845	26,362	26,889	27,427	27,975	28,535	29,106	29,688	30,282	30,887	31,505	32,135	32,778	33,433	34,102	34,784	35,480	36,189	36,913
17																		23,409	23,877	24,354	24,841	25,338	25,845	26,362	26,889	27,427	27,975	28,535	29,106	29,688	30,282	30,887	31,505	32,135	32,778	33,433	34,102	34,784	35,480	36,189	36,913
18																			23,877	24,354	24,841	25,338	25,845	26,362	26,889	27,427	27,975	28,535	29,106	29,688	30,282	30,887	31,505	32,135	32,778	33,433	34,102	34,784	35,480	36,189	36,913
19																				24,354	24,841	25,338	25,845	26,362	26,889	27,427	27,975	28,535	29,106	29,688	30,282	30,887	31,505	32,135	32,778	33,433	34,102	34,784	35,480	36,189	36,913
20																					24,841	25,338	25,845	26,362	26,889	27,427	27,975	28,535	29,106	29,688	30,282	30,887	31,505	32,135	32,778	33,433	34,102	34,784	35,480	36,189	36,913
21																						25,338	25,845	26,362	26,889	27,427	27,975	28,535	29,106	29,688	30,282	30,887	31,505	32,135	32,778	33,433	34,102	34,784	35,480	36,189	36,913
22																							25,845	26,362	26,889	27,427	27,975	28,535	29,106	29,688	30,282	30,887	31,505	32,135	32,778	33,433	34,102	34,784	35,480	36,189	36,913
23																								26,362	26,889	27,427	27,975	28,535	29,106	29,688	30,282	30,887	31,505	32,135	32,778	33,433	34,102	34,784	35,480	36,189	36,913
24																									26,889	27,427	27,975	28,535	29,106	29,688	30,282	30,887	31,505	32,135	32,778	33,433	34,102	34,784	35,480	36,189	36,913
25																										27,427	27,975	28,535	29,106	29,688	30,282	30,887	31,505	32,135	32,778	33,433	34,102	34,784	35,480	36,189	36,913
26																											27,975	28,535	29,106	29,688	30,282	30,887	31,505	32,135	32,778	33,433	34,102	34,784	35,480	36,189	36,913
27																												28,535	29,106	29,688	30,282	30,887	31,505	32,135	32,778	33,433	34,102	34,784	35,480	36,189	36,913
28																													29,106	29,688	30,282	30,887	31,505	32,135	32,778	33,433	34,102	34,784	35,480	36,189	36,913
29																														29,688	30,282	30,887	31,505	32,135	32,778	33,433	34,102	34,784	35,480	36,189	36,913
30																															30,282	30,887	31,505	32,135	32,778	33,433	34,102	34,784	35,480	36,189	36,913
31																																30,887	31,505	32,135	32,778	33,433	34,102	34,784	35,480	36,189	36,913
32																																	31,505	32,135	32,778	33,433	34,102	34,784	35,480	36,189	36,913
33																																		32,135	32,778	33,433	34,102	34,784	35,480	36,189	36,913
34																																			32,778	33,433	34,102	34,784	35,480	36,189	36,913
35																																				33,433	34,102	34,784	35,480	36,189	36,913
36																																					34,102	34,784	35,480	36,189	36,913
37																																						34,784	35,480	36,189	36,913
38																																							35,480	36,189	36,913
39																																								36,189	36,913
40																																									36,913

Exhibit II-4 Option Value Tree (Phase II)

($1,000)

Year:	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Period (" t "):	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
(" i "):																				
0	10,534	12,377	14,564	16,933	19,496	22,239	25,163	28,282	31,620	35,186	39,000	43,085	47,443	52,092	57,032	62,277	67,844	73,751	80,016	86,661
1		1,174	1,834	2,824	4,166	5,612	7,162	8,826	10,710	12,791	15,112	17,743	20,595	23,678	26,974	30,488	34,237	38,248	42,533	47,116
2			284	370	461	557	659	766	881	1,093	1,636	2,439	3,642	5,259	6,999	8,862	10,868	13,139	15,643	18,436
3				0	0	19	92	170	253	341	434	532	637	747	864	988	1,119	1,257	1,551	2,214
4					0	0	0	0	0	0	0	0	54	134	218	308	404	504	611	725
5						0	0	0	0	0	0	0	0	0	0	0	0	0	12	94
6							0	0	0	0	0	0	0	0	0	0	0	0	0	0
7								0	0	0	0	0	0	0	0	0	0	0	0	0
8									0	0	0	0	0	0	0	0	0	0	0	0
9										0	0	0	0	0	0	0	0	0	0	0
10											0	0	0	0	0	0	0	0	0	0
11												0	0	0	0	0	0	0	0	0
12													0	0	0	0	0	0	0	0
13														0	0	0	0	0	0	0
14															0	0	0	0	0	0
15																0	0	0	0	0
16																	0	0	0	0
17																		0	0	0
18																			0	0
19																				0
20																				
21																				
22																				
23																				
24																				
25																				
26																				
27																				
28																				
29																				
30																				
31																				
32																				
33																				
34																				
35																				
36																				
37																				
38																				
39																				
40																				

Year:	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
Period (" t "):	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40
(" i "):																					
0	93,707	101,177	109,093	117,478	126,358	135,758	145,708	156,237	167,378	179,163	191,628	204,809	218,746	233,479	249,052	265,509	282,900	301,275			
1	52,024	57,262	62,847	68,780	75,079	81,765	88,858	96,383	104,362	112,823	121,793	131,298	141,366	152,026	163,312	175,257	187,898	201,272			
2	21,602	25,036	28,745	32,705	36,928	41,433	46,254	51,402	56,909	62,807	69,101	75,811	82,937	90,503	98,531	107,050	116,086	125,668			
3	3,193	4,661	6,609	8,701	10,942	13,364	16,096	19,110	22,473	26,286	30,421	34,880	39,640	44,713	50,129	55,921	62,107	68,724			
4	845	971	1,106	1,248	1,398	1,557	1,725	2,122	2,934	4,132	5,929	8,274	10,790	13,485	16,406	19,694	23,320	27,368			
5	180	272	370	473	583	699	822	952	1,090	1,235	1,390	1,553	1,725	1,907	2,100	2,304	2,519	2,746			
6	0	0	0	0	0	50	139	233	333	439	551	670	796	929	1,070	1,220	1,378	1,545			
7	0	0	0	0	0	0	0	0	0	0	0	2	93	189	292	400	515	637			
8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			
9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			
10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			
11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			
12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			
13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			
14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			
15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			
16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			
17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			
18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			
19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			
20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			
21		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			
22			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			
23				0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			
24					0	0	0	0	0	0	0	0	0	0	0	0	0	0			
25						0	0	0	0	0	0	0	0	0	0	0	0	0			
26							0	0	0	0	0	0	0	0	0	0	0	0			
27								0	0	0	0	0	0	0	0	0	0	0			
28									0	0	0	0	0	0	0	0	0	0			
29										0	0	0	0	0	0	0	0	0			
30											0	0	0	0	0	0	0	0			
31												0	0	0	0	0	0	0			
32													0	0	0	0	0	0			
33														0	0	0	0	0			
34															0	0	0	0			
35																0	0	0			
36																	0	0			
37																		0			
38																					
39																					
40																					

Exhibit II-5 Phase Optimal Exercise   (Phase II)

Year:	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
Period (" t "):	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40
(" i "):																																									
0	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer			
1		wait	wait	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer			
2			sell	sell	sell	sell	sell	sell	sell	wait	wait	wait	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer			
3				abnd	abnd	sell	sell	sell	sell	sell	sell	sell	sell	sell	sell	sell	sell	sell	wait	wait	wait	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer			
4					abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	sell	sell	sell	sell	sell	sell	sell	sell	sell	sell	sell	sell	sell	sell	sell	wait	wait	wait	exer	exer	exer	exer	exer	exer	exer	exer			
5						abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	sell	sell	sell	sell	sell	sell	sell	sell	sell	sell	sell	sell	sell	sell	sell	sell	sell	sell	sell	sell			
6							abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	sell	sell	sell	sell	sell	sell	sell	sell	sell	sell	sell	sell	sell			
7								abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	sell	sell	sell	sell	sell	sell	sell			
8									abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd			
9										abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd			
10											abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd			
11												abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd			
12													abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd			
13														abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd			
14															abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd			
15																abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd			
16																	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd			
17																		abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd			
18																			abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd			
19																				abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd			
20																					abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd			
21																						abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd			
22																							abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd			
23																								abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd			
24																									abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd			
25																										abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd			
26																											abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd			
27																												abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd			
28																													abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd			
29																														abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd			
30																															abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd			
31																																abnd	abnd	abnd	abnd	abnd	abnd	abnd			
32																																	abnd	abnd	abnd	abnd	abnd	abnd			
33																																		abnd	abnd	abnd	abnd	abnd			
34																																			abnd	abnd	abnd	abnd			
35																																				abnd	abnd	abnd			
36																																					abnd	abnd			
37																																						abnd			
38																																									
39																																									
40																																									

Exhibit III-1 Inputs (Phase III)

Enter (input)*:		**Resulting (output):**	
Period length (T/n) in yrs =	1.0000	η =	6.29
Riskfree interest rate (rf) =	6.00%	rf/period=	6.00%
Underl Asset Total Return (rV) =	11.25%	rV/period =	11.25%
Underl Asset Cash yield (yV) =	9.25%	yV/period=	9.25%
K growth rate (gK) =	2.00%	K gro/per=	2.00%
Time to build (periods)	0.58	V gro/per=	1.83%
Volatility (σ) =	15.00%	σ /period=	15.00%
V(initial) =	17,087	yK/period=	3.92%
K(initial) =	12,600	"p" real prob=	0.8663
Land Carrying Costs	62	"u" =	1.1500
Resisual Land Ratio (beginning)	60%	"d" =	0.8696
*Note: All input rates nominal annual rates.		**Option Val=**	**8,484**

Exhibit III-2 V Value Tree (Phase III)

($1,000)

Year:	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
Period ("t"):	0	1	2	3	4	5	6	7	8	9	10	11	12	13
Expected Values of V:		17,400	17,719	18,043	18,373	18,710	19,052	19,401	19,756	20,118	20,486	20,861	21,243	21,632
(" i "):														
0	17,087	17,986	18,933	19,930	20,979	22,083	23,245	24,468	25,756	27,112	28,539	30,041	31,622	33,286
1		13,600	14,316	15,070	15,863	16,698	17,577	18,502	19,475	20,500	21,579	22,715	23,911	25,169
2			10,825	11,395	11,995	12,626	13,290	13,990	14,726	15,501	16,317	17,176	18,080	19,031
3				8,616	9,070	9,547	10,049	10,578	11,135	11,721	12,338	12,987	13,671	14,391
4					6,858	7,219	7,599	7,999	8,420	8,863	9,329	9,820	10,337	10,881
5						5,459	5,746	6,048	6,367	6,702	7,054	7,426	7,816	8,228
6							4,345	4,573	4,814	5,067	5,334	5,615	5,910	6,221
7								3,458	3,640	3,832	4,033	4,246	4,469	4,704
8									2,752	2,897	3,050	3,210	3,379	3,557
9										2,191	2,306	2,427	2,555	2,690
10											1,744	1,835	1,932	2,034
11												1,388	1,461	1,538
12													1,105	1,163
13														879

Year:	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Period ("t"):	14	15	16	17	18	19	20	21	22	23	24	25	26	27
Expected Values of V:	22,028	22,431	22,842	23,260	23,686	24,119	24,561	25,010	25,468	25,934	26,409	26,893	27,385	27,886
(" i "):														
0	35,038	36,882	38,823	40,867	43,017	45,282	47,665	50,173	52,814	55,594	58,520	61,600	64,842	68,255
1	26,494	27,888	29,356	30,901	32,527	34,239	36,041	37,938	39,935	42,037	44,249	46,578	49,030	51,610
2	20,033	21,087	22,197	23,366	24,595	25,890	27,253	28,687	30,197	31,786	33,459	35,220	37,074	39,025
3	15,148	15,945	16,784	17,668	18,598	19,576	20,607	21,691	22,833	24,035	25,300	26,631	28,033	29,508
4	11,454	12,057	12,691	13,359	14,062	14,803	15,582	16,402	17,265	18,174	19,130	20,137	21,197	22,313
5	8,661	9,117	9,597	10,102	10,633	11,193	11,782	12,402	13,055	13,742	14,465	15,227	16,028	16,872
6	6,549	6,894	7,256	7,638	8,040	8,463	8,909	9,378	9,871	10,391	10,938	11,513	12,119	12,757
7	4,952	5,213	5,487	5,776	6,080	6,400	6,736	7,091	7,464	7,857	8,271	8,706	9,164	9,646
8	3,744	3,941	4,149	4,367	4,597	4,839	5,094	5,362	5,644	5,941	6,254	6,583	6,929	7,294
9	2,831	2,980	3,137	3,302	3,476	3,659	3,852	4,054	4,268	4,492	4,729	4,978	5,240	5,515
10	2,141	2,254	2,372	2,497	2,628	2,767	2,912	3,066	3,227	3,397	3,576	3,764	3,962	4,170
11	1,619	1,704	1,794	1,888	1,987	2,092	2,202	2,318	2,440	2,568	2,704	2,846	2,996	3,153
12	1,224	1,288	1,356	1,428	1,503	1,582	1,665	1,753	1,845	1,942	2,044	2,152	2,265	2,384
13	926	974	1,026	1,080	1,136	1,196	1,259	1,325	1,395	1,469	1,546	1,627	1,713	1,803
14	700	737	775	816	859	904	952	1,002	1,055	1,110	1,169	1,230	1,295	1,363
15		557	586	617	650	684	720	758	798	840	884	930	979	1,031
16			443	467	491	517	544	573	603	635	668	703	741	779
17				353	371	391	412	433	456	480	505	532	560	589
18					281	296	311	328	345	363	382	402	423	446
19						224	235	248	261	274	289	304	320	337
20							178	187	197	208	218	230	242	255
21								142	149	157	165	174	183	193
22									113	119	125	131	138	146
23										90	94	99	105	110
24											71	75	79	83
25												57	60	63
26													45	48
27														36

Year:	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
Period ("t"):	28	29	30	31	32	33	34	35	36	37	38	39	40
Expected Values of V:	28,397	28,917	29,446	29,985	30,534	31,093	31,662	32,242	32,832	33,433	34,045	34,668	35,303
(" i "):													
0	71,847	75,628	79,609	83,799	88,209	92,852	97,739	102,883	108,298	113,998	119,998	126,313	132,961
1	54,327	57,186	60,196	63,364	66,699	70,209	73,905	77,794	81,889	86,199	90,736	95,511	100,538
2	41,079	43,241	45,517	47,912	50,434	53,088	55,883	58,824	61,920	65,179	68,609	72,220	76,021
3	31,061	32,696	34,417	36,229	38,135	40,142	42,255	44,479	46,820	49,284	51,878	54,609	57,483
4	23,487	24,723	26,024	27,394	28,836	30,353	31,951	33,633	35,403	37,266	39,227	41,292	43,465
5	17,759	18,694	19,678	20,714	21,804	22,952	24,160	25,431	26,770	28,179	29,662	31,223	32,866
6	13,429	14,136	14,879	15,663	16,487	17,355	18,268	19,230	20,242	21,307	22,428	23,609	24,851
7	10,154	10,688	11,251	11,843	12,467	13,123	13,813	14,540	15,306	16,111	16,959	17,852	18,791
8	7,678	8,082	8,507	8,955	9,426	9,923	10,445	10,995	11,573	12,182	12,824	13,498	14,209
9	5,806	6,111	6,433	6,771	7,128	7,503	7,898	8,313	8,751	9,212	9,696	10,207	10,744
10	4,390	4,621	4,864	5,120	5,390	5,673	5,972	6,286	6,617	6,965	7,332	7,718	8,124
11	3,319	3,494	3,678	3,872	4,075	4,290	4,516	4,753	5,003	5,267	5,544	5,836	6,143
12	2,510	2,642	2,781	2,927	3,082	3,244	3,414	3,594	3,783	3,982	4,192	4,413	4,645
13	1,898	1,998	2,103	2,214	2,330	2,453	2,582	2,718	2,861	3,011	3,170	3,337	3,512
14	1,435	1,511	1,590	1,674	1,762	1,855	1,952	2,055	2,163	2,277	2,397	2,523	2,656
15	1,085	1,142	1,202	1,266	1,332	1,402	1,476	1,554	1,636	1,722	1,812	1,908	2,008
16	820	864	909	957	1,007	1,060	1,116	1,175	1,237	1,302	1,370	1,443	1,518
17	620	653	687	724	762	802	844	888	935	984	1,036	1,091	1,148
18	469	494	520	547	576	606	638	672	707	744	784	825	868
19	355	373	393	414	436	458	483	508	535	563	592	624	656
20	268	282	297	313	329	347	365	384	404	426	448	472	496
21	203	213	225	237	249	262	276	290	306	322	339	357	375
22	153	161	170	179	188	198	209	220	231	243	256	270	284
23	116	122	128	135	142	150	158	166	175	184	194	204	215
24	88	92	97	102	108	113	119	126	132	139	146	154	162
25	66	70	73	77	81	86	90	95	100	105	111	117	123
26	50	53	56	58	62	65	68	72	76	80	84	88	93
27	38	40	42	44	47	49	52	54	57	60	63	67	70
28	29	30	32	33	35	37	39	41	43	45	48	50	53
29		23	24	25	27	28	29	31	33	34	36	38	40
30			18	19	20	21	22	23	25	26	27	29	30
31				14	15	16	17	18	19	20	21	22	23
32					12	12	13	13	14	15	16	16	17
33						9	10	10	11	11	12	12	13
34							7	8	8	9	9	9	10
35								6	6	6	7	7	7
36									5	5	5	5	6
37										4	4	4	4
38											3	3	3
39												2	2
40													2

Exhibit III-3 K Value Tree (Phase III)

($1,000)

Year:	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
Period (" t "):	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40
(" i "):																																									
0	12,600	12,852	13,109	13,372	13,639	13,912	14,190	14,474	14,763	15,059	15,360	15,667	15,980	16,300	16,626	16,959	17,298	17,644	17,997	18,356	18,724	19,098	19,480	19,870	20,267	20,672	21,086	21,508	21,938	22,376	22,824	23,280	23,746	24,221	24,705	25,199	25,703	26,218	26,742	27,277	27,822
1		12,852	13,109	13,372	13,639	13,912	14,190	14,474	14,763	15,059	15,360	15,667	15,980	16,300	16,626	16,959	17,298	17,644	17,997	18,356	18,724	19,098	19,480	19,870	20,267	20,672	21,086	21,508	21,938	22,376	22,824	23,280	23,746	24,221	24,705	25,199	25,703	26,218	26,742	27,277	27,822
2			13,109	13,372	13,639	13,912	14,190	14,474	14,763	15,059	15,360	15,667	15,980	16,300	16,626	16,959	17,298	17,644	17,997	18,356	18,724	19,098	19,480	19,870	20,267	20,672	21,086	21,508	21,938	22,376	22,824	23,280	23,746	24,221	24,705	25,199	25,703	26,218	26,742	27,277	27,822
3				13,372	13,639	13,912	14,190	14,474	14,763	15,059	15,360	15,667	15,980	16,300	16,626	16,959	17,298	17,644	17,997	18,356	18,724	19,098	19,480	19,870	20,267	20,672	21,086	21,508	21,938	22,376	22,824	23,280	23,746	24,221	24,705	25,199	25,703	26,218	26,742	27,277	27,822
4					13,639	13,912	14,190	14,474	14,763	15,059	15,360	15,667	15,980	16,300	16,626	16,959	17,298	17,644	17,997	18,356	18,724	19,098	19,480	19,870	20,267	20,672	21,086	21,508	21,938	22,376	22,824	23,280	23,746	24,221	24,705	25,199	25,703	26,218	26,742	27,277	27,822
5						13,912	14,190	14,474	14,763	15,059	15,360	15,667	15,980	16,300	16,626	16,959	17,298	17,644	17,997	18,356	18,724	19,098	19,480	19,870	20,267	20,672	21,086	21,508	21,938	22,376	22,824	23,280	23,746	24,221	24,705	25,199	25,703	26,218	26,742	27,277	27,822
6							14,190	14,474	14,763	15,059	15,360	15,667	15,980	16,300	16,626	16,959	17,298	17,644	17,997	18,356	18,724	19,098	19,480	19,870	20,267	20,672	21,086	21,508	21,938	22,376	22,824	23,280	23,746	24,221	24,705	25,199	25,703	26,218	26,742	27,277	27,822
7								14,474	14,763	15,059	15,360	15,667	15,980	16,300	16,626	16,959	17,298	17,644	17,997	18,356	18,724	19,098	19,480	19,870	20,267	20,672	21,086	21,508	21,938	22,376	22,824	23,280	23,746	24,221	24,705	25,199	25,703	26,218	26,742	27,277	27,822
8									14,763	15,059	15,360	15,667	15,980	16,300	16,626	16,959	17,298	17,644	17,997	18,356	18,724	19,098	19,480	19,870	20,267	20,672	21,086	21,508	21,938	22,376	22,824	23,280	23,746	24,221	24,705	25,199	25,703	26,218	26,742	27,277	27,822
9										15,059	15,360	15,667	15,980	16,300	16,626	16,959	17,298	17,644	17,997	18,356	18,724	19,098	19,480	19,870	20,267	20,672	21,086	21,508	21,938	22,376	22,824	23,280	23,746	24,221	24,705	25,199	25,703	26,218	26,742	27,277	27,822
10											15,360	15,667	15,980	16,300	16,626	16,959	17,298	17,644	17,997	18,356	18,724	19,098	19,480	19,870	20,267	20,672	21,086	21,508	21,938	22,376	22,824	23,280	23,746	24,221	24,705	25,199	25,703	26,218	26,742	27,277	27,822
11												15,667	15,980	16,300	16,626	16,959	17,298	17,644	17,997	18,356	18,724	19,098	19,480	19,870	20,267	20,672	21,086	21,508	21,938	22,376	22,824	23,280	23,746	24,221	24,705	25,199	25,703	26,218	26,742	27,277	27,822
12													15,980	16,300	16,626	16,959	17,298	17,644	17,997	18,356	18,724	19,098	19,480	19,870	20,267	20,672	21,086	21,508	21,938	22,376	22,824	23,280	23,746	24,221	24,705	25,199	25,703	26,218	26,742	27,277	27,822
13														16,300	16,626	16,959	17,298	17,644	17,997	18,356	18,724	19,098	19,480	19,870	20,267	20,672	21,086	21,508	21,938	22,376	22,824	23,280	23,746	24,221	24,705	25,199	25,703	26,218	26,742	27,277	27,822
14															16,626	16,959	17,298	17,644	17,997	18,356	18,724	19,098	19,480	19,870	20,267	20,672	21,086	21,508	21,938	22,376	22,824	23,280	23,746	24,221	24,705	25,199	25,703	26,218	26,742	27,277	27,822
15																16,959	17,298	17,644	17,997	18,356	18,724	19,098	19,480	19,870	20,267	20,672	21,086	21,508	21,938	22,376	22,824	23,280	23,746	24,221	24,705	25,199	25,703	26,218	26,742	27,277	27,822
16																	17,298	17,644	17,997	18,356	18,724	19,098	19,480	19,870	20,267	20,672	21,086	21,508	21,938	22,376	22,824	23,280	23,746	24,221	24,705	25,199	25,703	26,218	26,742	27,277	27,822
17																		17,644	17,997	18,356	18,724	19,098	19,480	19,870	20,267	20,672	21,086	21,508	21,938	22,376	22,824	23,280	23,746	24,221	24,705	25,199	25,703	26,218	26,742	27,277	27,822
18																			17,997	18,356	18,724	19,098	19,480	19,870	20,267	20,672	21,086	21,508	21,938	22,376	22,824	23,280	23,746	24,221	24,705	25,199	25,703	26,218	26,742	27,277	27,822
19																				18,356	18,724	19,098	19,480	19,870	20,267	20,672	21,086	21,508	21,938	22,376	22,824	23,280	23,746	24,221	24,705	25,199	25,703	26,218	26,742	27,277	27,822
20																					18,724	19,098	19,480	19,870	20,267	20,672	21,086	21,508	21,938	22,376	22,824	23,280	23,746	24,221	24,705	25,199	25,703	26,218	26,742	27,277	27,822
21																						19,098	19,480	19,870	20,267	20,672	21,086	21,508	21,938	22,376	22,824	23,280	23,746	24,221	24,705	25,199	25,703	26,218	26,742	27,277	27,822
22																							19,480	19,870	20,267	20,672	21,086	21,508	21,938	22,376	22,824	23,280	23,746	24,221	24,705	25,199	25,703	26,218	26,742	27,277	27,822
23																								19,870	20,267	20,672	21,086	21,508	21,938	22,376	22,824	23,280	23,746	24,221	24,705	25,199	25,703	26,218	26,742	27,277	27,822
24																									20,267	20,672	21,086	21,508	21,938	22,376	22,824	23,280	23,746	24,221	24,705	25,199	25,703	26,218	26,742	27,277	27,822
25																										20,672	21,086	21,508	21,938	22,376	22,824	23,280	23,746	24,221	24,705	25,199	25,703	26,218	26,742	27,277	27,822
26																											21,086	21,508	21,938	22,376	22,824	23,280	23,746	24,221	24,705	25,199	25,703	26,218	26,742	27,277	27,822
27																												21,508	21,938	22,376	22,824	23,280	23,746	24,221	24,705	25,199	25,703	26,218	26,742	27,277	27,822
28																													21,938	22,376	22,824	23,280	23,746	24,221	24,705	25,199	25,703	26,218	26,742	27,277	27,822
29																														22,376	22,824	23,280	23,746	24,221	24,705	25,199	25,703	26,218	26,742	27,277	27,822
30																															22,824	23,280	23,746	24,221	24,705	25,199	25,703	26,218	26,742	27,277	27,822
31																																23,280	23,746	24,221	24,705	25,199	25,703	26,218	26,742	27,277	27,822
32																																	23,746	24,221	24,705	25,199	25,703	26,218	26,742	27,277	27,822
33																																		24,221	24,705	25,199	25,703	26,218	26,742	27,277	27,822
34																																			24,705	25,199	25,703	26,218	26,742	27,277	27,822
35																																				25,199	25,703	26,218	26,742	27,277	27,822
36																																					25,703	26,218	26,742	27,277	27,822
37																																						26,218	26,742	27,277	27,822
38																																							26,742	27,277	27,822
39																																								27,277	27,822
40																																									27,822

Exhibit III-4 Option Value Tree (Phase III)

($1,000)

Year:	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
Period (" t "):	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40
(" i "):																																									
0	8,484	9,855	11,434	13,191	15,095	17,159	19,370	21,726	24,235	26,907	29,752	32,781	36,005	39,437	43,090	46,969	51,085	55,449	60,077	64,983	70,181	75,688	81,522	87,699	94,240	101,162	108,489	116,240	124,441	133,114	142,287	151,986	162,239	173,076	184,530	196,634	209,422	222,932	237,203		
1		1,061	1,658	2,560	3,586	4,725	5,957	7,278	8,702	10,280	12,004	13,902	16,016	18,309	20,794	23,450	26,281	29,295	32,506	35,923	39,562	43,435	47,559	51,948	56,606	61,548	66,789	72,347	78,237	84,479	91,091	98,095	105,512	113,364	121,675	130,471	139,777	149,621	160,034		
2			204	265	330	399	473	550	632	949	1,432	2,152	3,241	4,481	5,854	7,336	8,925	10,641	12,539	14,612	16,896	19,440	22,200	25,190	28,382	31,783	35,405	39,262	43,368	47,740	52,393	57,348	62,619	68,213	74,148	80,442	87,115	94,188	101,683		
3				0	0	13	66	122	181	244	311	382	457	536	620	709	803	908	1,307	1,893	2,766	4,085	5,582	7,238	9,020	10,931	13,000	15,283	17,777	20,526	23,588	26,912	30,508	34,343	38,429	42,781	47,415	52,349	57,601		
4					0	0	0	0	0	0	0	0	39	96	157	221	289	362	439	520	606	697	793	895	1,003	1,117	1,267	1,753	2,465	3,526	5,130	6,939	8,933	11,077	13,375	15,867	18,613	21,614	24,921		
5						0	0	0	0	0	0	0	0	0	0	0	0	0	9	67	129	195	265	340	418	501	590	683	782	886	997	1,114	1,238	1,368	1,506	1,710	2,300	3,164	4,453		
6							0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	36	100	167	239	315	395	480	571	667	768	875	988	1,108	1,235		
7								0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	67	136	209	287	370	457	549		
8									0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	31		
9										0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
10											0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
11												0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
12													0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
13														0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
14															0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
15																0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
16																	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
17																		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
18																			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
19																				0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
20																					0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
21																						0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
22																							0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
23																								0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
24																									0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
25																										0	0	0	0	0	0	0	0	0	0	0	0	0	0		
26																											0	0	0	0	0	0	0	0	0	0	0	0	0		
27																												0	0	0	0	0	0	0	0	0	0	0	0		
28																													0	0	0	0	0	0	0	0	0	0	0		
29																														0	0	0	0	0	0	0	0	0	0		
30																															0	0	0	0	0	0	0	0	0		
31																																0	0	0	0	0	0	0	0		
32																																	0	0	0	0	0	0	0		
33																																		0	0	0	0	0	0		
34																																			0	0	0	0	0		
35																																				0	0	0	0		
36																																					0	0	0		
37																																						0	0		
38																																							0		
39																																									
40																																									

Exhibit III-5 Phase Optimal Exercise (Phase III)

Year:	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
Period (" t "):	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40
(" i "):																																									
0	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer		
1		wait	wait	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer		
2			sell	sell	sell	sell	sell	sell	sell	wait	wait	wait	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer		
3				abnd	abnd	sell	sell	sell	sell	sell	sell	sell	sell	sell	sell	sell	sell	wait	wait	wait	wait	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer		
4					abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	sell	sell	sell	sell	sell	sell	sell	sell	sell	sell	sell	sell	sell	sell	wait	wait	wait	wait	exer	exer	exer	exer	exer	exer	exer	exer	exer		
5						abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	sell	sell	sell	sell	sell	sell	sell	sell	sell	sell	sell	sell	sell	sell	sell	sell	sell	wait	wait	wait	exer		
6							abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	sell	sell	sell	sell	sell	sell	sell	sell	sell	sell	sell	sell	sell	sell		
7								abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	sell	sell	sell	sell	sell	sell	sell	sell		
8									abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	sell		
9										abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd		
10											abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd		
11												abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd		
12													abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd		
13														abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd		
14															abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd		
15																abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd		
16																	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd		
17																		abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd		
18																			abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd		
19																				abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd		
20																					abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd		
21																						abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd		
22																							abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd		
23																								abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd		
24																									abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd		
25																										abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd		
26																											abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd		
27																												abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd		
28																													abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd		
29																														abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd		
30																															abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd		
31																																abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd		
32																																	abnd	abnd	abnd	abnd	abnd	abnd	abnd		
33																																		abnd	abnd	abnd	abnd	abnd	abnd		
34																																			abnd	abnd	abnd	abnd	abnd		
35																																				abnd	abnd	abnd	abnd		
36																																					abnd	abnd	abnd		
37																																						abnd	abnd		
38																																							abnd		
39																																									
40																																									

Exhibit IV-1 Inputs (Phase IV)

Enter (input)*:		***Resulting (output):***	
Period length (T/n) in yrs =	1.0000	η =	6.29
Riskfree interest rate (rf) =	6.00%	rf/period=	6.00%
Underl Asset Total Return (rV) =	11.25%	rV/period =	11.25%
Underl Asset Cash yield (yV) =	9.25%	yV/period=	9.25%
K growth rate (gK) =	2.00%	K gro/per=	2.00%
Time to build (periods)	0.69	V gro/per=	1.83%
Volatility (σ) =	15.00%	σ /period=	15.00%
V(initial) =	15,167	yK/period=	3.92%
K(initial) =	11,971	"p" real prob=	0.8663
Land Carrying Costs	43	"u" =	1.1500
Resisual Land Ratio (beginning)	41%	"d" =	0.8696
*Note: All input rates nominal annual rates.		**Option Val=**	**5,864**

Exhibit IV -2 V Value Tree (Phase IV)

($1,000)

Year:	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Period ("t"):	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Expected Values of V:		15,444	15,727	16,015	16,308	16,607	16,911	17,220	17,536	17,857	18,184	18,516	18,855	19,201	19,552	19,910	20,275	20,646	21,024	21,409	21,800
(" i "):																					
0	15,167	15,965	16,805	17,690	18,621	19,601	20,633	21,718	22,862	24,065	25,331	26,665	28,068	29,545	31,100	32,737	34,460	36,274	38,183	40,193	42,308
1		12,072	12,707	13,376	14,080	14,821	15,601	16,422	17,287	18,196	19,154	20,162	21,223	22,340	23,516	24,754	26,057	27,428	28,872	30,391	31,991
2			9,609	10,114	10,647	11,207	11,797	12,418	13,071	13,759	14,483	15,246	16,048	16,893	17,782	18,718	19,703	20,740	21,831	22,980	24,190
3				7,648	8,050	8,474	8,920	9,389	9,884	10,404	10,951	11,528	12,135	12,773	13,445	14,153	14,898	15,682	16,508	17,376	18,291
4					6,087	6,408	6,745	7,100	7,473	7,867	8,281	8,717	9,175	9,658	10,167	10,702	11,265	11,858	12,482	13,139	13,831
5						4,845	5,100	5,368	5,651	5,948	6,262	6,591	6,938	7,303	7,688	8,092	8,518	8,966	9,438	9,935	10,458
6							3,856	4,059	4,273	4,498	4,735	4,984	5,246	5,522	5,813	6,119	6,441	6,780	7,137	7,512	7,908
7								3,069	3,231	3,401	3,580	3,768	3,967	4,176	4,395	4,627	4,870	5,127	5,396	5,680	5,979
8									2,443	2,572	2,707	2,850	2,999	3,157	3,324	3,498	3,683	3,876	4,080	4,295	4,521
9										1,945	2,047	2,155	2,268	2,387	2,513	2,645	2,785	2,931	3,085	3,248	3,419
10											1,548	1,629	1,715	1,805	1,900	2,000	2,106	2,216	2,333	2,456	2,585
11												1,232	1,297	1,365	1,437	1,512	1,592	1,676	1,764	1,857	1,955
12													981	1,032	1,086	1,144	1,204	1,267	1,334	1,404	1,478
13														780	822	865	910	958	1,009	1,062	1,118
14															621	654	688	725	763	803	845
15																494	520	548	577	607	639
16																	394	414	436	459	483
17																		313	330	347	365
18																			249	262	276
19																				198	209
20																					158

Year:	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
Period ("t"):	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40
Expected Values of V:	22,200	22,606	23,020	23,441	23,870	24,307	24,752	25,205	25,667	26,137	26,615	27,102	27,599	28,104	28,618	29,142	29,676	30,219	30,772	31,336
(" i "):																				
0	44,535	46,879	49,346	51,943	54,677	57,555	60,584	63,773	67,129	70,662	74,381	78,296	82,417	86,754	91,320	96,127	101,186	106,512	112,118	118,019
1	33,675	35,447	37,313	39,276	41,344	43,520	45,810	48,221	50,759	53,431	56,243	59,203	62,319	65,599	69,051	72,686	76,511	80,538	84,777	89,239
2	25,463	26,803	28,214	29,699	31,262	32,907	34,639	36,462	38,381	40,401	42,528	44,766	47,122	49,602	52,213	54,961	57,854	60,898	64,104	67,477
3	19,254	20,267	21,334	22,456	23,638	24,882	26,192	27,571	29,022	30,549	32,157	33,849	35,631	37,506	39,480	41,558	43,746	46,048	48,472	51,023
4	14,558	15,325	16,131	16,980	17,874	18,815	19,805	20,847	21,945	23,100	24,315	25,595	26,942	28,360	29,853	31,424	33,078	34,819	36,651	38,580
5	11,008	11,588	12,198	12,840	13,515	14,227	14,975	15,764	16,593	17,467	18,386	19,354	20,372	21,444	22,573	23,761	25,012	26,328	27,714	29,172
6	8,324	8,762	9,223	9,709	10,220	10,757	11,324	11,920	12,547	13,207	13,902	14,634	15,404	16,215	17,068	17,967	18,912	19,908	20,956	22,059
7	6,294	6,625	6,974	7,341	7,727	8,134	8,562	9,013	9,487	9,987	10,512	11,065	11,648	12,261	12,906	13,585	14,301	15,053	15,845	16,679
8	4,759	5,010	5,273	5,551	5,843	6,151	6,474	6,815	7,174	7,551	7,949	8,367	8,807	9,271	9,759	10,273	10,813	11,382	11,981	12,612
9	3,599	3,788	3,987	4,197	4,418	4,651	4,895	5,153	5,424	5,710	6,010	6,327	6,660	7,010	7,379	7,768	8,176	8,607	9,060	9,537
10	2,721	2,864	3,015	3,174	3,341	3,517	3,702	3,897	4,102	4,317	4,545	4,784	5,036	5,301	5,580	5,873	6,183	6,508	6,850	7,211
11	2,058	2,166	2,280	2,400	2,526	2,659	2,799	2,946	3,101	3,265	3,436	3,617	3,808	4,008	4,219	4,441	4,675	4,921	5,180	5,453
12	1,556	1,638	1,724	1,815	1,910	2,011	2,116	2,228	2,345	2,469	2,598	2,735	2,879	3,031	3,190	3,358	3,535	3,721	3,917	4,123
13	1,176	1,238	1,303	1,372	1,444	1,520	1,600	1,685	1,773	1,867	1,965	2,068	2,177	2,292	2,412	2,539	2,673	2,814	2,962	3,117
14	890	936	986	1,038	1,092	1,150	1,210	1,274	1,341	1,411	1,486	1,564	1,646	1,733	1,824	1,920	2,021	2,127	2,239	2,357
15	673	708	745	784	826	869	915	963	1,014	1,067	1,123	1,183	1,245	1,310	1,379	1,452	1,528	1,609	1,693	1,782
16	509	535	564	593	624	657	692	728	767	807	849	894	941	991	1,043	1,098	1,156	1,216	1,280	1,348
17	385	405	426	449	472	497	523	551	580	610	642	676	712	749	789	830	874	920	968	1,019
18	291	306	322	339	357	376	396	416	438	461	486	511	538	566	596	628	661	695	732	771
19	220	231	244	256	270	284	299	315	331	349	367	387	407	428	451	475	500	526	554	583
20	166	175	184	194	204	215	226	238	251	264	278	292	308	324	341	359	378	398	419	441
21	126	132	139	147	154	162	171	180	189	199	210	221	233	245	258	271	286	301	316	333
22		100	105	111	117	123	129	136	143	151	159	167	176	185	195	205	216	227	239	252
23			80	84	88	93	98	103	108	114	120	126	133	140	147	155	163	172	181	190
24				63	67	70	74	78	82	86	91	96	101	106	111	117	123	130	137	144
25					50	53	56	59	62	65	69	72	76	80	84	89	93	98	103	109
26						40	42	44	47	49	52	55	58	61	64	67	71	74	78	82
27							32	34	35	37	39	41	43	46	48	51	53	56	59	62
28								25	27	28	30	31	33	35	36	38	40	42	45	47
29									20	21	22	24	25	26	28	29	31	32	34	36
30										16	17	18	19	20	21	22	23	24	26	27
31											13	14	14	15	16	17	17	18	19	20
32												10	11	11	12	13	13	14	15	15
33													8	9	9	9	10	11	11	12
34														6	7	7	8	8	8	9
35															5	5	6	6	6	7
36																4	4	5	5	5
37																	3	3	4	4
38																		3	3	3
39																			2	2
40																				2

Exhibit IV -3 K Value Tree (Phase IV)

($1,000)

Year:	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
Period (" t "):	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40
(" i "):																																									
0	11,971	12,211	12,455	12,704	12,958	13,217	13,482	13,751	14,026	14,307	14,593	14,885	15,183	15,486	15,796	16,112	16,434	16,763	17,098	17,440	17,789	18,145	18,508	18,878	19,255	19,640	20,033	20,434	20,842	21,259	21,685	22,118	22,561	23,012	23,472	23,941	24,420	24,909	25,407	25,915	26,433
1		12,211	12,455	12,704	12,958	13,217	13,482	13,751	14,026	14,307	14,593	14,885	15,183	15,486	15,796	16,112	16,434	16,763	17,098	17,440	17,789	18,145	18,508	18,878	19,255	19,640	20,033	20,434	20,842	21,259	21,685	22,118	22,561	23,012	23,472	23,941	24,420	24,909	25,407	25,915	26,433
2			12,455	12,704	12,958	13,217	13,482	13,751	14,026	14,307	14,593	14,885	15,183	15,486	15,796	16,112	16,434	16,763	17,098	17,440	17,789	18,145	18,508	18,878	19,255	19,640	20,033	20,434	20,842	21,259	21,685	22,118	22,561	23,012	23,472	23,941	24,420	24,909	25,407	25,915	26,433
3				12,704	12,958	13,217	13,482	13,751	14,026	14,307	14,593	14,885	15,183	15,486	15,796	16,112	16,434	16,763	17,098	17,440	17,789	18,145	18,508	18,878	19,255	19,640	20,033	20,434	20,842	21,259	21,685	22,118	22,561	23,012	23,472	23,941	24,420	24,909	25,407	25,915	26,433
4					12,958	13,217	13,482	13,751	14,026	14,307	14,593	14,885	15,183	15,486	15,796	16,112	16,434	16,763	17,098	17,440	17,789	18,145	18,508	18,878	19,255	19,640	20,033	20,434	20,842	21,259	21,685	22,118	22,561	23,012	23,472	23,941	24,420	24,909	25,407	25,915	26,433
5						13,217	13,482	13,751	14,026	14,307	14,593	14,885	15,183	15,486	15,796	16,112	16,434	16,763	17,098	17,440	17,789	18,145	18,508	18,878	19,255	19,640	20,033	20,434	20,842	21,259	21,685	22,118	22,561	23,012	23,472	23,941	24,420	24,909	25,407	25,915	26,433
6							13,482	13,751	14,026	14,307	14,593	14,885	15,183	15,486	15,796	16,112	16,434	16,763	17,098	17,440	17,789	18,145	18,508	18,878	19,255	19,640	20,033	20,434	20,842	21,259	21,685	22,118	22,561	23,012	23,472	23,941	24,420	24,909	25,407	25,915	26,433
7								13,751	14,026	14,307	14,593	14,885	15,183	15,486	15,796	16,112	16,434	16,763	17,098	17,440	17,789	18,145	18,508	18,878	19,255	19,640	20,033	20,434	20,842	21,259	21,685	22,118	22,561	23,012	23,472	23,941	24,420	24,909	25,407	25,915	26,433
8									14,026	14,307	14,593	14,885	15,183	15,486	15,796	16,112	16,434	16,763	17,098	17,440	17,789	18,145	18,508	18,878	19,255	19,640	20,033	20,434	20,842	21,259	21,685	22,118	22,561	23,012	23,472	23,941	24,420	24,909	25,407	25,915	26,433
9										14,307	14,593	14,885	15,183	15,486	15,796	16,112	16,434	16,763	17,098	17,440	17,789	18,145	18,508	18,878	19,255	19,640	20,033	20,434	20,842	21,259	21,685	22,118	22,561	23,012	23,472	23,941	24,420	24,909	25,407	25,915	26,433
10											14,593	14,885	15,183	15,486	15,796	16,112	16,434	16,763	17,098	17,440	17,789	18,145	18,508	18,878	19,255	19,640	20,033	20,434	20,842	21,259	21,685	22,118	22,561	23,012	23,472	23,941	24,420	24,909	25,407	25,915	26,433
11												14,885	15,183	15,486	15,796	16,112	16,434	16,763	17,098	17,440	17,789	18,145	18,508	18,878	19,255	19,640	20,033	20,434	20,842	21,259	21,685	22,118	22,561	23,012	23,472	23,941	24,420	24,909	25,407	25,915	26,433
12													15,183	15,486	15,796	16,112	16,434	16,763	17,098	17,440	17,789	18,145	18,508	18,878	19,255	19,640	20,033	20,434	20,842	21,259	21,685	22,118	22,561	23,012	23,472	23,941	24,420	24,909	25,407	25,915	26,433
13														15,486	15,796	16,112	16,434	16,763	17,098	17,440	17,789	18,145	18,508	18,878	19,255	19,640	20,033	20,434	20,842	21,259	21,685	22,118	22,561	23,012	23,472	23,941	24,420	24,909	25,407	25,915	26,433
14															15,796	16,112	16,434	16,763	17,098	17,440	17,789	18,145	18,508	18,878	19,255	19,640	20,033	20,434	20,842	21,259	21,685	22,118	22,561	23,012	23,472	23,941	24,420	24,909	25,407	25,915	26,433
15																16,112	16,434	16,763	17,098	17,440	17,789	18,145	18,508	18,878	19,255	19,640	20,033	20,434	20,842	21,259	21,685	22,118	22,561	23,012	23,472	23,941	24,420	24,909	25,407	25,915	26,433
16																	16,434	16,763	17,098	17,440	17,789	18,145	18,508	18,878	19,255	19,640	20,033	20,434	20,842	21,259	21,685	22,118	22,561	23,012	23,472	23,941	24,420	24,909	25,407	25,915	26,433
17																		16,763	17,098	17,440	17,789	18,145	18,508	18,878	19,255	19,640	20,033	20,434	20,842	21,259	21,685	22,118	22,561	23,012	23,472	23,941	24,420	24,909	25,407	25,915	26,433
18																			17,098	17,440	17,789	18,145	18,508	18,878	19,255	19,640	20,033	20,434	20,842	21,259	21,685	22,118	22,561	23,012	23,472	23,941	24,420	24,909	25,407	25,915	26,433
19																				17,440	17,789	18,145	18,508	18,878	19,255	19,640	20,033	20,434	20,842	21,259	21,685	22,118	22,561	23,012	23,472	23,941	24,420	24,909	25,407	25,915	26,433
20																					17,789	18,145	18,508	18,878	19,255	19,640	20,033	20,434	20,842	21,259	21,685	22,118	22,561	23,012	23,472	23,941	24,420	24,909	25,407	25,915	26,433
21																						18,145	18,508	18,878	19,255	19,640	20,033	20,434	20,842	21,259	21,685	22,118	22,561	23,012	23,472	23,941	24,420	24,909	25,407	25,915	26,433
22																							18,508	18,878	19,255	19,640	20,033	20,434	20,842	21,259	21,685	22,118	22,561	23,012	23,472	23,941	24,420	24,909	25,407	25,915	26,433
23																								18,878	19,255	19,640	20,033	20,434	20,842	21,259	21,685	22,118	22,561	23,012	23,472	23,941	24,420	24,909	25,407	25,915	26,433
24																									19,255	19,640	20,033	20,434	20,842	21,259	21,685	22,118	22,561	23,012	23,472	23,941	24,420	24,909	25,407	25,915	26,433
25																										19,640	20,033	20,434	20,842	21,259	21,685	22,118	22,561	23,012	23,472	23,941	24,420	24,909	25,407	25,915	26,433
26																											20,033	20,434	20,842	21,259	21,685	22,118	22,561	23,012	23,472	23,941	24,420	24,909	25,407	25,915	26,433
27																												20,434	20,842	21,259	21,685	22,118	22,561	23,012	23,472	23,941	24,420	24,909	25,407	25,915	26,433
28																													20,842	21,259	21,685	22,118	22,561	23,012	23,472	23,941	24,420	24,909	25,407	25,915	26,433
29																														21,259	21,685	22,118	22,561	23,012	23,472	23,941	24,420	24,909	25,407	25,915	26,433
30																															21,685	22,118	22,561	23,012	23,472	23,941	24,420	24,909	25,407	25,915	26,433
31																																22,118	22,561	23,012	23,472	23,941	24,420	24,909	25,407	25,915	26,433
32																																	22,561	23,012	23,472	23,941	24,420	24,909	25,407	25,915	26,433
33																																		23,012	23,472	23,941	24,420	24,909	25,407	25,915	26,433
34																																			23,472	23,941	24,420	24,909	25,407	25,915	26,433
35																																				23,941	24,420	24,909	25,407	25,915	26,433
36																																					24,420	24,909	25,407	25,915	26,433
37																																						24,909	25,407	25,915	26,433
38																																							25,407	25,915	26,433
39																																								25,915	26,433
40																																									26,433

Exhibit IV -4 Option Value Tree (Phase IV)

($1,000)

Year:	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
Period (" t "):	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40
(" i "):																																									
0	5,864	6,879	8,020	9,251	10,581	12,022	13,584	15,255	17,033	18,924	20,935	23,071	25,340	27,750	30,309	33,023	35,904	38,958	42,196	45,629	49,267	53,120	57,202	61,524	66,100	70,943	76,068	81,491	87,228	93,296	99,712	106,496	113,668	121,249	129,261	137,726	146,671	156,120	166,101	176,643	
1		560	875	1,347	2,056	2,868	3,800	4,820	5,918	7,099	8,372	9,745	11,226	12,828	14,563	16,443	18,450	20,586	22,858	25,272	27,838	30,564	33,459	36,531	39,791	43,250	46,918	50,807	54,928	59,296	63,923	68,824	74,013	79,506	85,321	91,474	97,984	104,871	112,155	119,857	
2			140	182	227	274	325	378	434	518	774	1,151	1,716	2,571	3,556	4,684	5,911	7,232	8,653	10,185	11,836	13,620	15,548	17,637	19,899	22,310	24,876	27,605	30,505	33,587	36,861	40,338	44,028	47,943	52,096	56,501	61,170	66,120	71,364	76,919	
3				0	0	9	45	84	125	168	214	262	314	368	426	487	551	620	733	1,043	1,498	2,179	3,210	4,405	5,767	7,244	8,832	10,543	12,386	14,373	16,520	18,841	21,357	24,076	26,974	30,056	33,334	36,818	40,520	44,452	
4					0	0	0	0	0	0	0	0	27	66	108	152	199	249	301	357	416	479	545	615	689	767	850	1,001	1,376	1,927	2,752	4,001	5,450	7,095	8,870	10,782	12,840	15,057	17,449	20,033	
5						0	0	0	0	0	0	0	0	0	0	0	0	0	6	46	89	134	182	233	287	344	405	469	537	609	685	765	850	940	1,035	1,135	1,331	1,784	2,451	3,448	
6							0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	25	68	115	164	216	271	330	392	458	527	601	679	761	848	941	
7								0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	46	93	144	197	254	314	377	445	
8									0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	21	70	
9										0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
10											0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
11												0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
12													0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
13														0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
14															0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
15																0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
16																	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
17																		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
18																			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
19																				0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
20																					0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
21																						0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
22																							0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
23																								0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
24																									0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
25																										0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
26																											0	0	0	0	0	0	0	0	0	0	0	0	0	0	
27																												0	0	0	0	0	0	0	0	0	0	0	0	0	
28																													0	0	0	0	0	0	0	0	0	0	0	0	
29																														0	0	0	0	0	0	0	0	0	0	0	
30																															0	0	0	0	0	0	0	0	0	0	
31																																0	0	0	0	0	0	0	0	0	
32																																	0	0	0	0	0	0	0	0	
33																																		0	0	0	0	0	0	0	
34																																			0	0	0	0	0	0	
35																																				0	0	0	0	0	
36																																					0	0	0	0	
37																																						0	0	0	
38																																							0	0	
39																																								0	
40																																									

Exhibit IV -5 Phase Optimal Exercise   (Phase IV)

Year:	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
Period (" t "):	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40
(" i "):																																									
0	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	
1		wait	wait	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	
2			sell	sell	sell	sell	sell	sell	sell	wait	wait	wait	wait	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	
3				abnd	abnd	sell	sell	sell	sell	sell	sell	sell	sell	sell	sell	sell	sell	sell	wait	wait	wait	wait	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	
4					abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	sell	sell	sell	sell	sell	sell	sell	sell	sell	sell	sell	sell	sell	sell	sell	wait	wait	wait	wait	exer	exer	exer	exer	exer	exer	exer	exer	exer	
5						abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	sell	sell	sell	sell	sell	sell	sell	sell	sell	sell	sell	sell	sell	sell	sell	sell	sell	sell	wait	wait	wait	exer	
6							abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	sell	sell	sell	sell	sell	sell	sell	sell	sell	sell	sell	sell	sell	sell	sell	
7								abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	sell	sell	sell	sell	sell	sell	sell	sell	sell	
8									abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	sell	sell	
9										abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	
10											abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	
11												abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	
12													abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	
13														abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	
14															abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	
15																abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	
16																	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	
17																		abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	
18																			abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	
19																				abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	
20																					abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	
21																						abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	
22																							abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	
23																								abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	
24																									abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	
25																										abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	
26																											abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	
27																												abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	
28																													abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	
29																														abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	
30																															abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	
31																																abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	
32																																	abnd	abnd	abnd	abnd	abnd	abnd	abnd	abnd	
33																																		abnd	abnd	abnd	abnd	abnd	abnd	abnd	
34																																			abnd	abnd	abnd	abnd	abnd	abnd	
35																																				abnd	abnd	abnd	abnd	abnd	
36																																					abnd	abnd	abnd	abnd	
37																																						abnd	abnd	abnd	
38																																							abnd	abnd	
39																																								abnd	
40																																									

Exhibit V-1 Inputs (Phase V)

Enter (input)*:		***Resulting (output):***			
Period length (T/n) in yrs =	1.0000	η =	6.45		
Riskfree interest rate (rf) =	6.00%	rf/period=	6.00%		
Underl Asset Total Return (rV) =	10.25%	rV/period =	10.25%		
Underl Asset Cash yield (yV) =	9.25%	yV/period=	9.25%	yV (for η calc.)	9.45%
K growth rate (gK) =	2.00%	K gro/per=	2.00%		
Time to build (periods)	0.78	V gro/per=	0.92%		
Volatility (σ) =	15.00%	σ /period=	15.00%		
V(initial) =	20,563	yK/period=	3.92%		
K(initial) =	15,436	"p" real prob=	0.8306		
Land Carrying Costs	25	"u" =	1.1500		
Resisual Land Ratio (beginning)	24%	"d" =	0.8696		
*Note: All input rates nominal annual rates.		**Option Val=**	**3,969**		

Exhibit V -2 V Value Tree (Phase V)

($1,000)

Year:	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Period ("t"):	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Expected Values of V:		20,752	20,942	21,133	21,327	21,522	21,719	21,918	22,118	22,321	22,525	22,731	22,939	23,149	23,361	23,575	23,791	24,009	24,228	24,450	24,674
(" i "):																					
0	20,563	21,646	22,785	23,984	25,246	26,575	27,974	29,446	30,996	32,627	34,345	36,152	38,055	40,058	42,166	44,385	46,722	49,181	51,769	54,494	57,362
1		16,367	17,229	18,135	19,090	20,095	21,152	22,266	23,437	24,671	25,969	27,336	28,775	30,289	31,884	33,562	35,328	37,188	39,145	41,205	43,374
2			13,027	13,713	14,435	15,194	15,994	16,836	17,722	18,655	19,637	20,670	21,758	22,903	24,109	25,378	26,713	28,119	29,599	31,157	32,797
3				10,369	10,915	11,489	12,094	12,730	13,400	14,106	14,848	15,630	16,452	17,318	18,230	19,189	20,199	21,262	22,381	23,559	24,799
4					8,253	8,687	9,145	9,626	10,133	10,666	11,227	11,818	12,440	13,095	13,784	14,510	15,273	16,077	16,923	17,814	18,752
5						6,569	6,915	7,279	7,662	8,065	8,489	8,936	9,407	9,902	10,423	10,971	11,549	12,157	12,797	13,470	14,179
6							5,229	5,504	5,793	6,098	6,419	6,757	7,113	7,487	7,881	8,296	8,733	9,192	9,676	10,185	10,721
7								4,162	4,381	4,611	4,854	5,109	5,378	5,661	5,959	6,273	6,603	6,951	7,316	7,702	8,107
8									3,312	3,487	3,670	3,863	4,067	4,281	4,506	4,743	4,993	5,256	5,532	5,823	6,130
9										2,636	2,775	2,921	3,075	3,237	3,407	3,587	3,775	3,974	4,183	4,403	4,635
10											2,098	2,209	2,325	2,448	2,576	2,712	2,855	3,005	3,163	3,330	3,505
11												1,670	1,758	1,851	1,948	2,051	2,159	2,272	2,392	2,518	2,650
12													1,329	1,399	1,473	1,551	1,632	1,718	1,809	1,904	2,004
13														1,058	1,114	1,172	1,234	1,299	1,367	1,439	1,515
14															842	887	933	982	1,034	1,088	1,146
15																670	706	743	782	823	866
16																	534	562	591	622	655
17																		425	447	471	495
18																			338	356	375
19																				269	283
20																					214

Year:	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
Period ("t"):	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40
Expected Values of V:	24,900	25,128	25,358	25,590	25,824	26,060	26,299	26,540	26,783	27,028	27,275	27,525	27,777	28,031	28,288	28,546	28,808	29,071	29,338	29,606
(" i "):																				
0	60,381	63,559	66,904	70,425	74,132	78,033	82,140	86,464	91,014	95,805	100,847	106,155	111,742	117,623	123,814	130,330	137,190	144,410	152,011	160,011
1	45,657	48,060	50,589	53,252	56,054	59,004	62,110	65,379	68,820	72,442	76,255	80,268	84,493	88,940	93,621	98,548	103,735	109,195	114,942	120,991
2	34,523	36,340	38,253	40,266	42,385	44,616	46,964	49,436	52,038	54,777	57,660	60,694	63,889	67,251	70,791	74,517	78,439	82,567	86,913	91,487
3	26,104	27,478	28,924	30,447	32,049	33,736	35,512	37,381	39,348	41,419	43,599	45,894	48,309	50,852	53,528	56,345	59,311	62,432	65,718	69,177
4	19,739	20,777	21,871	23,022	24,234	25,509	26,852	28,265	29,753	31,319	32,967	34,702	36,529	38,451	40,475	42,605	44,848	47,208	49,693	52,308
5	14,925	15,711	16,538	17,408	18,324	19,289	20,304	21,372	22,497	23,681	24,928	26,240	27,621	29,075	30,605	32,216	33,911	35,696	37,575	39,552
6	11,286	11,880	12,505	13,163	13,856	14,585	15,353	16,161	17,011	17,907	18,849	19,841	20,885	21,985	23,142	24,360	25,642	26,991	28,412	29,907
7	8,534	8,983	9,455	9,953	10,477	11,028	11,609	12,220	12,863	13,540	14,253	15,003	15,792	16,623	17,498	18,419	19,389	20,409	21,483	22,614
8	6,453	6,792	7,150	7,526	7,922	8,339	8,778	9,240	9,726	10,238	10,777	11,344	11,941	12,570	13,231	13,928	14,661	15,432	16,245	17,100
9	4,879	5,136	5,406	5,691	5,990	6,306	6,637	6,987	7,354	7,742	8,149	8,578	9,029	9,505	10,005	10,531	11,086	11,669	12,283	12,930
10	3,689	3,883	4,088	4,303	4,529	4,768	5,019	5,283	5,561	5,854	6,162	6,486	6,827	7,187	7,565	7,963	8,382	8,823	9,288	9,777
11	2,790	2,936	3,091	3,254	3,425	3,605	3,795	3,995	4,205	4,426	4,659	4,904	5,163	5,434	5,720	6,021	6,338	6,672	7,023	7,393
12	2,109	2,220	2,337	2,460	2,590	2,726	2,870	3,021	3,180	3,347	3,523	3,708	3,904	4,109	4,325	4,553	4,793	5,045	5,310	5,590
13	1,595	1,679	1,767	1,860	1,958	2,061	2,170	2,284	2,404	2,531	2,664	2,804	2,952	3,107	3,271	3,443	3,624	3,815	4,015	4,227
14	1,206	1,270	1,336	1,407	1,481	1,559	1,641	1,727	1,818	1,914	2,014	2,120	2,232	2,349	2,473	2,603	2,740	2,884	3,036	3,196
15	912	960	1,010	1,064	1,120	1,179	1,241	1,306	1,375	1,447	1,523	1,603	1,688	1,776	1,870	1,968	2,072	2,181	2,296	2,417
16	690	726	764	804	847	891	938	987	1,039	1,094	1,152	1,212	1,276	1,343	1,414	1,488	1,567	1,649	1,736	1,827
17	521	549	578	608	640	674	709	747	786	827	871	917	965	1,016	1,069	1,125	1,185	1,247	1,313	1,382
18	394	415	437	460	484	510	536	565	594	626	658	693	730	768	808	851	896	943	993	1,045
19	298	314	330	348	366	385	406	427	449	473	498	524	552	581	611	643	677	713	751	790
20	225	237	250	263	277	291	307	323	340	358	376	396	417	439	462	487	512	539	567	597
21	170	179	189	199	209	220	232	244	257	270	285	300	315	332	350	368	387	408	429	452
22		136	143	150	158	167	175	185	194	204	215	227	239	251	264	278	293	308	324	342
23			108	114	120	126	133	140	147	155	163	171	180	190	200	210	221	233	245	258
24				86	90	95	100	106	111	117	123	130	136	144	151	159	167	176	186	195
25					68	72	76	80	84	88	93	98	103	109	114	120	127	133	140	148
26						54	57	60	64	67	70	74	78	82	86	91	96	101	106	112
27							43	46	48	51	53	56	59	62	65	69	72	76	80	84
28								34	36	38	40	42	45	47	49	52	55	58	61	64
29									27	29	30	32	34	35	37	39	41	44	46	48
30										22	23	24	25	27	28	30	31	33	35	36
31											17	18	19	20	21	22	24	25	26	28
32												14	15	15	16	17	18	19	20	21
33													11	12	12	13	14	14	15	16
34														9	9	10	10	11	11	12
35															7	7	8	8	9	9
36																6	6	6	6	7
37																	4	5	5	5
38																		4	4	4
39																			3	3
40																				2

Exhibit V -3 K Value Tree (Phase V)

($1,000)

Year:	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
Period (" t "):	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40
(" i "):																																									
0	15,436	15,744	16,059	16,380	16,708	17,042	17,383	17,731	18,085	18,447	18,816	19,192	19,576	19,968	20,367	20,774	21,190	21,613	22,046	22,487	22,936	23,395	23,863	24,340	24,827	25,324	25,830	26,347	26,874	27,411	27,959	28,519	29,089	29,671	30,264	30,869	31,487	32,116	32,759	33,414	34,082
1		15,744	16,059	16,380	16,708	17,042	17,383	17,731	18,085	18,447	18,816	19,192	19,576	19,968	20,367	20,774	21,190	21,613	22,046	22,487	22,936	23,395	23,863	24,340	24,827	25,324	25,830	26,347	26,874	27,411	27,959	28,519	29,089	29,671	30,264	30,869	31,487	32,116	32,759	33,414	34,082
2			16,059	16,380	16,708	17,042	17,383	17,731	18,085	18,447	18,816	19,192	19,576	19,968	20,367	20,774	21,190	21,613	22,046	22,487	22,936	23,395	23,863	24,340	24,827	25,324	25,830	26,347	26,874	27,411	27,959	28,519	29,089	29,671	30,264	30,869	31,487	32,116	32,759	33,414	34,082
3				16,380	16,708	17,042	17,383	17,731	18,085	18,447	18,816	19,192	19,576	19,968	20,367	20,774	21,190	21,613	22,046	22,487	22,936	23,395	23,863	24,340	24,827	25,324	25,830	26,347	26,874	27,411	27,959	28,519	29,089	29,671	30,264	30,869	31,487	32,116	32,759	33,414	34,082
4					16,708	17,042	17,383	17,731	18,085	18,447	18,816	19,192	19,576	19,968	20,367	20,774	21,190	21,613	22,046	22,487	22,936	23,395	23,863	24,340	24,827	25,324	25,830	26,347	26,874	27,411	27,959	28,519	29,089	29,671	30,264	30,869	31,487	32,116	32,759	33,414	34,082
5						17,042	17,383	17,731	18,085	18,447	18,816	19,192	19,576	19,968	20,367	20,774	21,190	21,613	22,046	22,487	22,936	23,395	23,863	24,340	24,827	25,324	25,830	26,347	26,874	27,411	27,959	28,519	29,089	29,671	30,264	30,869	31,487	32,116	32,759	33,414	34,082
6							17,383	17,731	18,085	18,447	18,816	19,192	19,576	19,968	20,367	20,774	21,190	21,613	22,046	22,487	22,936	23,395	23,863	24,340	24,827	25,324	25,830	26,347	26,874	27,411	27,959	28,519	29,089	29,671	30,264	30,869	31,487	32,116	32,759	33,414	34,082
7								17,731	18,085	18,447	18,816	19,192	19,576	19,968	20,367	20,774	21,190	21,613	22,046	22,487	22,936	23,395	23,863	24,340	24,827	25,324	25,830	26,347	26,874	27,411	27,959	28,519	29,089	29,671	30,264	30,869	31,487	32,116	32,759	33,414	34,082
8									18,085	18,447	18,816	19,192	19,576	19,968	20,367	20,774	21,190	21,613	22,046	22,487	22,936	23,395	23,863	24,340	24,827	25,324	25,830	26,347	26,874	27,411	27,959	28,519	29,089	29,671	30,264	30,869	31,487	32,116	32,759	33,414	34,082
9										18,447	18,816	19,192	19,576	19,968	20,367	20,774	21,190	21,613	22,046	22,487	22,936	23,395	23,863	24,340	24,827	25,324	25,830	26,347	26,874	27,411	27,959	28,519	29,089	29,671	30,264	30,869	31,487	32,116	32,759	33,414	34,082
10											18,816	19,192	19,576	19,968	20,367	20,774	21,190	21,613	22,046	22,487	22,936	23,395	23,863	24,340	24,827	25,324	25,830	26,347	26,874	27,411	27,959	28,519	29,089	29,671	30,264	30,869	31,487	32,116	32,759	33,414	34,082
11												19,192	19,576	19,968	20,367	20,774	21,190	21,613	22,046	22,487	22,936	23,395	23,863	24,340	24,827	25,324	25,830	26,347	26,874	27,411	27,959	28,519	29,089	29,671	30,264	30,869	31,487	32,116	32,759	33,414	34,082
12													19,576	19,968	20,367	20,774	21,190	21,613	22,046	22,487	22,936	23,395	23,863	24,340	24,827	25,324	25,830	26,347	26,874	27,411	27,959	28,519	29,089	29,671	30,264	30,869	31,487	32,116	32,759	33,414	34,082
13														19,968	20,367	20,774	21,190	21,613	22,046	22,487	22,936	23,395	23,863	24,340	24,827	25,324	25,830	26,347	26,874	27,411	27,959	28,519	29,089	29,671	30,264	30,869	31,487	32,116	32,759	33,414	34,082
14															20,367	20,774	21,190	21,613	22,046	22,487	22,936	23,395	23,863	24,340	24,827	25,324	25,830	26,347	26,874	27,411	27,959	28,519	29,089	29,671	30,264	30,869	31,487	32,116	32,759	33,414	34,082
15																20,774	21,190	21,613	22,046	22,487	22,936	23,395	23,863	24,340	24,827	25,324	25,830	26,347	26,874	27,411	27,959	28,519	29,089	29,671	30,264	30,869	31,487	32,116	32,759	33,414	34,082
16																	21,190	21,613	22,046	22,487	22,936	23,395	23,863	24,340	24,827	25,324	25,830	26,347	26,874	27,411	27,959	28,519	29,089	29,671	30,264	30,869	31,487	32,116	32,759	33,414	34,082
17																		21,613	22,046	22,487	22,936	23,395	23,863	24,340	24,827	25,324	25,830	26,347	26,874	27,411	27,959	28,519	29,089	29,671	30,264	30,869	31,487	32,116	32,759	33,414	34,082
18																			22,046	22,487	22,936	23,395	23,863	24,340	24,827	25,324	25,830	26,347	26,874	27,411	27,959	28,519	29,089	29,671	30,264	30,869	31,487	32,116	32,759	33,414	34,082
19																				22,487	22,936	23,395	23,863	24,340	24,827	25,324	25,830	26,347	26,874	27,411	27,959	28,519	29,089	29,671	30,264	30,869	31,487	32,116	32,759	33,414	34,082
20																					22,936	23,395	23,863	24,340	24,827	25,324	25,830	26,347	26,874	27,411	27,959	28,519	29,089	29,671	30,264	30,869	31,487	32,116	32,759	33,414	34,082
21																						23,395	23,863	24,340	24,827	25,324	25,830	26,347	26,874	27,411	27,959	28,519	29,089	29,671	30,264	30,869	31,487	32,116	32,759	33,414	34,082
22																							23,863	24,340	24,827	25,324	25,830	26,347	26,874	27,411	27,959	28,519	29,089	29,671	30,264	30,869	31,487	32,116	32,759	33,414	34,082
23																								24,340	24,827	25,324	25,830	26,347	26,874	27,411	27,959	28,519	29,089	29,671	30,264	30,869	31,487	32,116	32,759	33,414	34,082
24																									24,827	25,324	25,830	26,347	26,874	27,411	27,959	28,519	29,089	29,671	30,264	30,869	31,487	32,116	32,759	33,414	34,082
25																										25,324	25,830	26,347	26,874	27,411	27,959	28,519	29,089	29,671	30,264	30,869	31,487	32,116	32,759	33,414	34,082
26																											25,830	26,347	26,874	27,411	27,959	28,519	29,089	29,671	30,264	30,869	31,487	32,116	32,759	33,414	34,082
27																												26,347	26,874	27,411	27,959	28,519	29,089	29,671	30,264	30,869	31,487	32,116	32,759	33,414	34,082
28																													26,874	27,411	27,959	28,519	29,089	29,671	30,264	30,869	31,487	32,116	32,759	33,414	34,082
29																														27,411	27,959	28,519	29,089	29,671	30,264	30,869	31,487	32,116	32,759	33,414	34,082
30																															27,959	28,519	29,089	29,671	30,264	30,869	31,487	32,116	32,759	33,414	34,082
31																																28,519	29,089	29,671	30,264	30,869	31,487	32,116	32,759	33,414	34,082
32																																	29,089	29,671	30,264	30,869	31,487	32,116	32,759	33,414	34,082
33																																		29,671	30,264	30,869	31,487	32,116	32,759	33,414	34,082
34																																			30,264	30,869	31,487	32,116	32,759	33,414	34,082
35																																				30,869	31,487	32,116	32,759	33,414	34,082
36																																					31,487	32,116	32,759	33,414	34,082
37																																						32,116	32,759	33,414	34,082
38																																							32,759	33,414	34,082
39																																								33,414	34,082
40																																									34,082

Exhibit V -4 Option Value Tree (Phase V)

($1,000)

Year:	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
Period (" t "):	0	1	2	3	4	5	6	7	8	9	10	11	12	13
(" i "):														
0	3,969	4,663	5,403	6,191	7,031	7,926	8,878	9,892	10,969	12,114	13,331	14,623	15,996	17,452
1		872	1,090	1,362	1,702	2,128	2,659	3,319	4,050	4,831	5,665	6,554	7,501	8,511
2			179	224	280	350	438	547	684	855	1,068	1,335	1,669	2,086
3				37	46	58	72	90	113	141	176	220	275	343
4					8	9	12	15	19	23	29	36	45	62
5						2	2	2	3	4	5	6	7	9
6							0	0	1	1	1	1	1	2
7								0	0	0	0	0	0	0
8									0	0	0	0	0	0
9										0	0	0	0	0
10											0	0	0	0
11												0	0	0
12													0	0
13														0

Year:	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Period (" t "):	14	15	16	17	18	19	20	21	22	23	24	25	26	27
(" i "):														
0	18,998	20,637	22,376	24,219	26,172	28,242	30,434	32,756	35,215	37,818	40,572	43,487	46,571	49,833
1	9,586	10,730	11,947	13,241	14,617	16,078	17,630	19,279	21,028	22,884	24,853	26,940	29,153	31,499
2	2,607	3,259	4,061	4,940	5,879	6,881	7,949	9,088	10,301	11,592	12,966	14,428	15,983	17,635
3	429	536	671	838	1,048	1,309	1,637	2,045	2,557	3,195	3,994	4,968	6,024	7,152
4	86	112	139	167	197	229	269	337	421	526	657	822	1,027	1,284
5	12	15	18	23	28	51	76	102	129	158	189	222	257	294
6	2	2	3	4	5	6	7	9	11	14	18	39	64	90
7	0	0	0	1	1	1	1	2	2	2	3	4	5	6
8	0	0	0	0	0	0	0	0	0	0	0	1	1	1
9	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13	0	0	0	0	0	0	0	0	0	0	0	0	0	0
14	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15		0	0	0	0	0	0	0	0	0	0	0	0	0
16			0	0	0	0	0	0	0	0	0	0	0	0
17				0	0	0	0	0	0	0	0	0	0	0
18					0	0	0	0	0	0	0	0	0	0
19						0	0	0	0	0	0	0	0	0
20							0	0	0	0	0	0	0	0
21								0	0	0	0	0	0	0
22									0	0	0	0	0	0
23										0	0	0	0	0
24											0	0	0	0
25												0	0	0
26													0	0
27														0

Year:	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
Period (" t "):	28	29	30	31	32	33	34	35	36	37	38	39	40
(" i "):													
0	53,283	56,932	60,789	64,866	69,176	73,730	78,542	83,626	88,997	94,669	100,661	106,987	113,667
1	33,984	36,616	39,404	42,356	45,481	48,788	52,287	55,990	59,906	64,047	68,427	73,057	77,951
2	19,391	21,255	23,234	25,335	27,564	29,928	32,435	35,093	37,909	40,893	44,054	47,401	50,945
3	8,356	9,640	11,008	12,465	14,017	15,668	17,424	19,291	21,276	23,385	25,624	28,001	30,524
4	1,605	2,006	2,507	3,133	3,916	4,894	6,074	7,343	8,699	10,146	11,688	13,332	15,083
5	333	374	417	516	645	806	1,007	1,259	1,573	1,966	2,458	3,072	3,840
6	119	149	180	214	249	287	327	369	414	461	511	564	632
7	7	9	11	25	51	78	107	138	170	205	241	280	321
8	1	1	2	2	3	4	4	6	7	11	37	65	94
9	0	0	0	0	0	1	1	1	1	1	2	2	3
10	0	0	0	0	0	0	0	0	0	0	0	0	0
11	0	0	0	0	0	0	0	0	0	0	0	0	0
12	0	0	0	0	0	0	0	0	0	0	0	0	0
13	0	0	0	0	0	0	0	0	0	0	0	0	0
14	0	0	0	0	0	0	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0	0	0	0	0	0
21	0	0	0	0	0	0	0	0	0	0	0	0	0
22	0	0	0	0	0	0	0	0	0	0	0	0	0
23	0	0	0	0	0	0	0	0	0	0	0	0	0
24	0	0	0	0	0	0	0	0	0	0	0	0	0
25	0	0	0	0	0	0	0	0	0	0	0	0	0
26	0	0	0	0	0	0	0	0	0	0	0	0	0
27	0	0	0	0	0	0	0	0	0	0	0	0	0
28	0	0	0	0	0	0	0	0	0	0	0	0	0
29		0	0	0	0	0	0	0	0	0	0	0	0
30			0	0	0	0	0	0	0	0	0	0	0
31				0	0	0	0	0	0	0	0	0	0
32					0	0	0	0	0	0	0	0	0
33						0	0	0	0	0	0	0	0
34							0	0	0	0	0	0	0
35								0	0	0	0	0	0
36									0	0	0	0	0
37										0	0	0	0
38											0	0	0
39												0	0
40													0

Exhibit V -5 Phase Optimal Exercise (Phase V)

Year:	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
Period (" t "):	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40
(" i "):																																									
0	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer
1		wait	wait	wait	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer
2			wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer
3				wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer
4					wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	exer	exer	exer	exer	exer	exer	exer	exer	exer	exer
5						wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	exer
6							wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	abnd
7								wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	abnd
8									wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	abnd
9										wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	abnd
10											wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	abnd
11												wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	abnd
12													wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	abnd
13														wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	abnd
14															wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	abnd
15																wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	abnd
16																	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	abnd
17																		wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	abnd
18																			wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	abnd
19																				wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	abnd
20																					wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	abnd
21																						wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	abnd
22																							wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	abnd
23																								wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	abnd
24																									wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	abnd
25																										wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	abnd
26																											wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	abnd
27																												wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	abnd
28																													wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	abnd
29																														wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	abnd
30																															wait	wait	wait	wait	wait	wait	wait	wait	wait	wait	abnd
31																																wait	wait	wait	wait	wait	wait	wait	wait	wait	abnd
32																																	wait	wait	wait	wait	wait	wait	wait	wait	abnd
33																																		wait	wait	wait	wait	wait	wait	wait	abnd
34																																			wait	wait	wait	wait	wait	wait	abnd
35																																				wait	wait	wait	wait	wait	abnd
36																																					wait	wait	wait	wait	abnd
37																																						wait	wait	wait	abnd
38																																							wait	wait	abnd
39																																								wait	abnd
40																																									abnd

References

Amram, M., and N. Kulatilaka (1999).
Real Options: Managing Strategic Investment in an Uncertain World,
Boston, MA: Harvard Business School Press.

Bodie, Z., A. Ane and A. J.. Marcus (2002).
Investments, 5th ed.,
McGraw-Hill, New York, NY.

Brealey, R.A. and S.C. Myers (2003).
Principles of Corporate Finance, 7th ed.,
McGraw-Hill, New York, NY.

Copeland, T. and V. Antikarov (2001).
Real Options: A Practitioner's Guide,
Texere, New York, NY.

Damodaran, A. (1999).
Applied Corporate Finance: A User's Manual,
New York, NY: John Wiley and Sons.

Dixit, A.V. and R.S. Pindyck (1994).
Investment Under Uncertainty,
Princeton University Press, Princeton, NJ.

Geltner, D. (1989).
"On the Use of the Financial Option Price Model to Value and Explain Vacant Urban Land,"
AREUEA Journal, v. 17, n. 2, pp. 142-158.

Geltner, D. and N.G. Miller (2001).
Commercial Real Estate Analysis andinvestments, 1st ed.,
South-Western/College Publishing Co., Mason, OH.

Geltner, D. and N.G. Miller (2006).
Commercial Real Estate Analysis andinvestments, 2_{nd} ed.,
South-Western/College Publishing Co., Mason, OH.

Geltner, D., T. Riddiough and S. Stojanovic (1996).
"Insight on the effect of Land useChoice: The Perpetual Option on the Best of Two Underlying Assets,"
Journal ofUrban Economics, no. 39, pp. 20-50.

Grenadier, S.R. (1995).
"The Persistence of Real Estate Cycles,"
Journal of Real Estate Finance and Economics, v. 10, pp. 95-119.

Grenadier, S.R. (1995).
"Valuing Lease Contracts: A Real Options Approach".
Journal of Financial Economics 38 (1995), 297-331.

Grenadier, S.R. (1996).
"Strategic Exercise of Options: Development Cascades and Overbuilding in Real Estate Markets,"
Journal of Finance, v. 51, pp. 1653-1679.

Hengels, A., (2003).
Creating a Practical Model Using Real Options to Evaluate Large-Scale Real Estate Development Projects,
Research paper, Massachusetts Institute of Technology

Howell S., et al (2001).
Real Options: Evaluating Corporate Investment Opportunities in a Dynamic World, Prentice Hall, London, Great Britain.

Hull, J. (2003).
Options, Futures and Other Derivative Securities, 5_{th} ed.,
Prentice Hall, Englewood Cliffs, NJ.

Mun, J. (2002).
Real Options Analysis: Tools and Techniques for Valuing Strategic Investments and Decisions,
John Wiley & Sons, Hoboken, NJ.

Mun, J. (2003).
Real Options Analysis Course: Business Cases and Software Applications,
John Wiley and Sons.

Schwartz, E.S. & L. Trigeorgis, L. eds. (2001).
Real Options and Investment Under Uncertainty: Classical Readings and Recent Contributions,
Cambridge, MA: MIT Press.

Trigeorgis, L. (1996).
Real Options: Managerial Flexibility and Strategy in Resource Allocation,
Cambridge, MA: MIT Press.

Trigeorgis, L. ed. (1999).
Real Options and Business Strategy: Applications to Decision Making,
London, UK: Risk Books.