Chapter III. The Model

3.1 An Analysis of the Land Trust Model

Losses of large tracts of lands that hold low economic value such as open space, scenic, historic or farmland has led to the proliferation of land trusts intending to protect these lands from development. To inspire landowners to donate the development rights of their property non-profit land trusts have appealed to the altruistic and philanthropic qualities of the landowner. Land trusts have been effective in saving large amounts of land from development with this focus. Yet, by concentrating almost wholly on philanthropic and altruistic motivations for development right donation by a landholder, the land trust is assuming that landowners derive more satisfaction from preserving the land in open space than from the economic return of selling the land to development.

The model presented here acknowledges the altruistic motivation of development right donation and presents a corollary method of conservation easement donation impetus that includes an economic motivation. The author postulates that conditions exist under which a landowner can benefit economically as well as altruistically from conservation easement donation.

To better understand the Land Trust Model of landowner motivations for conservation easement donation, variables can be assigned to the motivations acknowledged by land trusts. First, let U = the total utility a household (or landowner) derives from their land parcel. Then let Q = the utility derived from the philanthropic satisfaction related to keeping the land in open space and the altruistic satisfaction from passing on farmland to the heirs of the landowner. [1] This variable Q is a function of the satisfaction a landowner derives from keeping their "family land" free of development in perpetuity, passing on open space to their heirs or society in general, the environmental benefit gained by society from open space, or "a love of the land."

[1] Utility can be equated to satisfaction. The rational person will maximize their utility in all cases.

While these portions of satisfaction a landowner derives from a land parcel may be somewhat hard to measure quantitatively, methods exist which can measure these motivations. Contingent valuation method is an example of a test used to measure utility. However, it isn't really necessary to measure the variable Q quantitatively. More important is the weight a landowner places on this motivation compared to the utility a landowner derives from the economic value a land parcel holds.

Let the total economic value of the land parcel = D. As explained in Chapter 1, this economic value is made up of two parts; the land used in open space or agrarian manners and the development rights of the land parcel. Let X = the development rights of a land parcel and E = its undeveloped property value. The value of the undeveloped land parcel can be found by subtracting the development rights from the total economic value of the land parcel.

$$E = D \quad X$$
$$D = X + E$$

This equation illustrates that D is a simple summed function of X and E. This is a restatement of principles presented in Chapter 1. Now that variables have been established for the economic and 'altruistic/philanthropic' motivations of a landowner for conservation easement donation, we can derive an equation that more completely encompasses a landholder's utility function.

$$U = f(Q,D)$$

A landowner's total utility is comprised of an altruistic motivation for open space or farmland conservation and the economic value that it holds. It is important to recognize that Q can take on any value, including negative ones.

3.2 A revised landowner motivation model

We have assigned a value to the altruistic or philanthropic motivation of every landowner termed '*Q*' above stemming from several sources.

In this revised landowner motivation model, demographic and economic factors are included with the altruistic and philanthropic motivations to analyze a landowner's decision to donate the development rights of their property.

U = total household utility

D = land parcel's total economic value

E = agrarian/ open space use value

X = development rights

$$\boldsymbol{D = X + E}$$

These variables and the resultant equation are restated from above. Development right value is equal to the developed land value less the value of the land in agrarian use. Two important assumptions are made in the mathematics of this thesis.

First, we assume that the undeveloped land value does not increase when a conservation easement is placed on the deed. This assumption will very likely not hold in many cases over time. The scenic and other amenities associated with owning a land parcel that is encumbered with a conservation easement could cause the undeveloped land value to increase more than the returns from agriculture would warrant. However, for the purposes of the initial appraisal, and therefore the income tax deduction derived from the donation, the pre-easement undeveloped land value would be used.[2]

Second, it is assumed that as land values increase over time, developed land value increases at the same rate as agricultural land. This assumption was made in order to simplify the models and spreadsheet program. The actual expected rate of increase in developed land value will be site specific.

The contribution this thesis makes to previous studies of the economics of open space preservation is in the inclusion of the investment potential of the tax benefits derived from conservation easement donation. To represent these quantities let R = the investment return on the invested tax benefits and t = time duration of tax benefit investment, a function of landowner age.

Finally, we conclude the model's variables with the motivations that are more difficult to measure. To restate Q = representing the altruistic or philanthropic utility held by a landowner, and introduce the variable P = the willingness for risk in the investment stream by the landholder. This risk premium will have a negative affect on the economic valuation of performing the conservation easement.

With these variables we can more completely examine the relationships which affect total utility (U) when a conservation easement is donated. The complete model of a landowner's motivation to donate a conservation easement presented in this thesis is:

$$\boldsymbol{U = Q + [E + X\,(1+R)^t] \quad X \quad P}$$

This equation states that total utility U is equal to the sum of altruistic utility derived from maintaining the land in present use (Q), the value of the land in agrarian use (E) and the investment potential of the income tax benefits invested to time t, $X\,(1+R)^t$. These values are diminished by the loss of the development right value of the land parcel (X) and the potential for risk introduced by the investment (P).

Returning to an economic valuation of the Q variable, with the above defined variables we can use a 'willingness to pay' realized pricing method to determine an economic value for the altruistic sentiments held by a landowner. Given that a rational landowner will not decrease the utility they derive from their land parcel by donating a

[2] Virginia Outdoor Foundation

conservation easement, the donating landowner's utility derived from the land after the easement is donated (U^2) will be equal to or greater than before the easement (U^1).

$$U^2 >= U^1$$

The landowner's utility function before the easement is:

$$U^1 = Q + D$$

The post-easement utility function presented in this thesis alters the economic variable (D):

$$U^2 = Q + [E + X (1+R)^t] \quad X \quad P$$

The difference between the pre-easement economic value and the post-easement value can be thought of as the "realized" economic impact to the landowner of donating an easement.

$$Q = D \quad ([E + X (1+R)^t] \quad X \quad P)$$

If an economic loss is sustained through easement donation: $D > ([E + X (1+R)^t] \quad X \quad P)$, the economic value of the Q variable is equal to or greater than the difference: $Q \geq D \quad ([E + X (1 + R)^t] \quad X \quad P)$.

3.3 Examples and graphical representation of the model

In deriving a private landowner economic impetus supporting the use of conservation easements one must consider the changes it represents for the tax liability of an estate. In order to visualize the implications of the change on tax liability, subsequent investment potential and estate values, the following example is presented.

Case Scenario I

Consider a 45 year old married landowner supporting no dependents that has a yearly gross income of $200,000. They have a 200-acre land parcel with a developed value of $5,000/ acre and an undeveloped value of $2,500/ acre. The following figures follow the 1999 1040 tax form:

The Case Scenarios in this thesis are based on the Spreadsheet Program described in section 3.7. Following the format of the spreadsheet program, the variables in parts 1 and 2 can be attenuated to reflect each land and landowner demographic. Parts 3 and 4 are automatically calculated based on this information.

Case Scenario 1

PART 1

Landowner Information (landowner income level, exemptions, and expected investment duration based on landowner age)

Adjusted Gross Income.....$200,000
Exemptions claimed.....2
Standard Deduction.....$0
Exemption deduction.....$570
Investment Horizon..... 30 years
Investment rate..... 10%

PART 2

Land Profile

Developed land value.....$1,000,000
Undeveloped land value.....$500,000
Development Rights.....$500,000

PART 3

Income tax work (using the 1040 Y-1 because assumed demographic is married filing jointly, no other dependents or deductions)

line 33 AGI $200,000
line 35 Standard Deduction (lost due to itemization) $0

line 35 Itemized Deduction:

<u>Reduction of Income Tax liability</u> (max. 30%) <u>Actual Tax Savings</u>

year 1..... $60,000	year 1 .....$20,500
year 2..... $60,000	year 2 .....$20,500
year 3..... $60,000	year 3 .....$20,500
year 4..... $60,000	year 4 .....$20,500
year 5..... $60,000	year 5 .....$20,500
year 6..... $60,000	year 6 .....$20,500
total $360,000	**total $123,003**

PART 4

Results of conservation easement donation

Investment Potential: 30 year investment at 10%.....$1,713,766

Total Net Worth at Estate Turnover

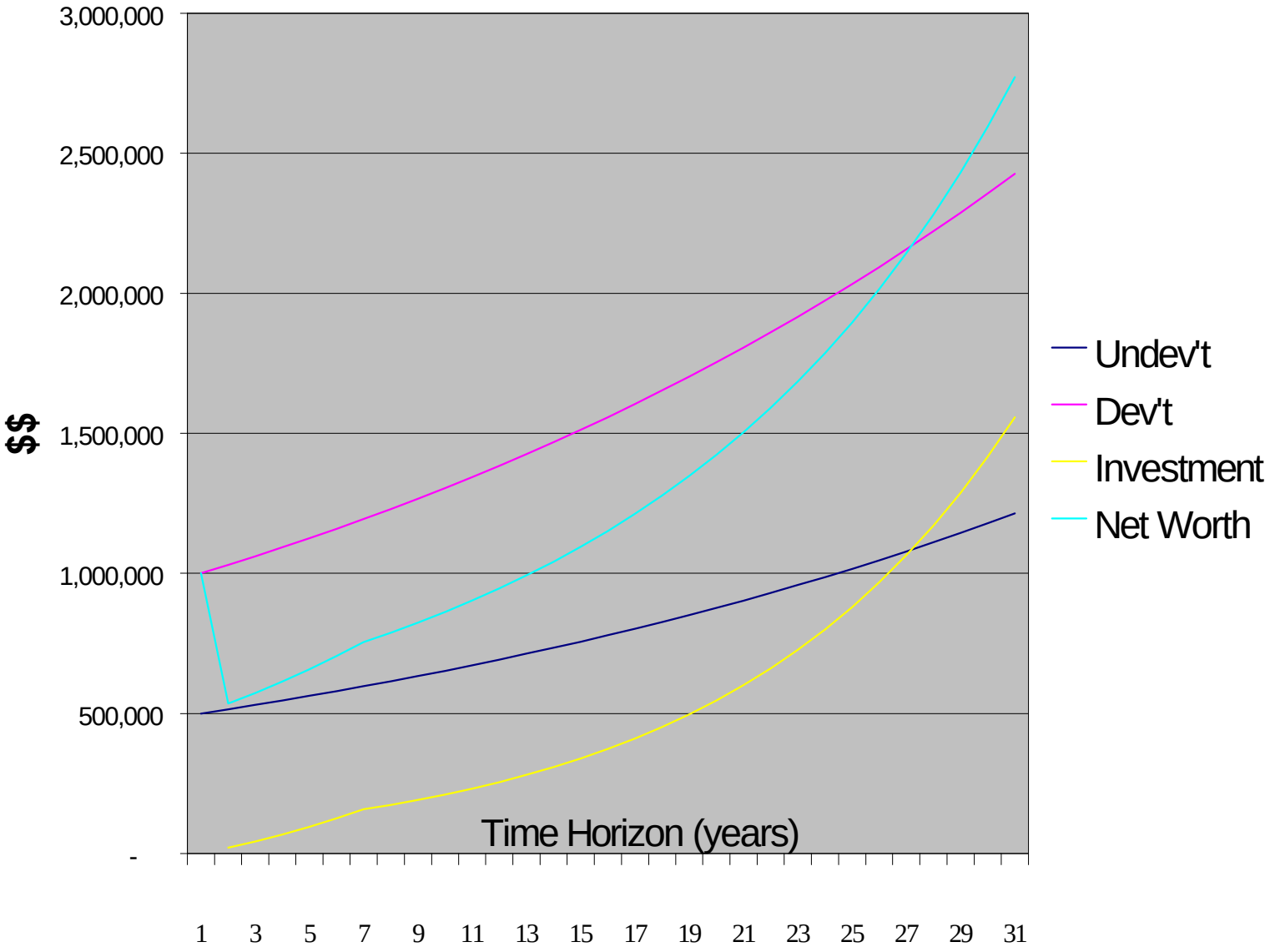
(invested tax benefits + undeveloped land value).....$2,927,398

Developed land value (3% appreciation).....$2,427,262

Shortfall.....$0

Figure 3.1

Case Scenario 1 An example of a positive economic outcome of conservation easement donation. Here, the net worth of the landowner is greater than the developed land value in the 27th year after the easement donation.



In the demographic profile outlined in Case Scenario I, and all given assumptions hold, the landowner's Q value does not have to be positive for the conservation easement to maximize utility. Donating a conservation easement might be ideal for this landowner. However, if the land trust failed to present the economic outcome of performing an easement, including the investment potential of tax benefits, the landowner would not realize the possible positive economic outcome. Obviously, the demographic profile will not yield a financially beneficial easement procedure in all cases. Another case scenario is presented with a landholder for which the donation is not economically advantageous.

Case Scenario 2

PART 1

Landowner Information (landowner income level, exemptions, and expected investment duration based on landowner age)

Adjusted Gross Income.....$50,000

Exemptions claimed.....2

Standard Deduction.....$0

Exemption deduction.....$5,500

Investment Horizon..... 20 years

Investment rate..... 10%

PART 2

Land Profile

Developed land value.....$200,000

Undeveloped land value.....$75,000

Development Rights.....$125,000

PART 3

Income tax work (using the 1040 Y-1 because assumed demographic is married filing jointly, no other dependents or deductions)

line 33 AGI $50,000

line 35 Standard Deduction (lost due to itemization) $0

line 35 Itemized Deduction:

Reduction of Income Tax liability (max. 30%)	Actual Tax Savings
year 1.....$15,000	year 1 .....$2,439
year 2.....$15,000	year 2 .....$2,439
year 3.....$15,000	year 3 .....$2,439
year 4.....$15,000	year 4 .....$2,439

year 5..... $15,000	year 5 .....$2,439
year 6..... $15,000	year 6 .....$2,439
total $90,000	**total $14,631**

PART 4

Results of conservation easement donation

Investment Potential: 20 year investment at 10%.....$78,593

Total Net Worth at Estate Turnover

(invested tax benefits + undeveloped land value).....$214,051

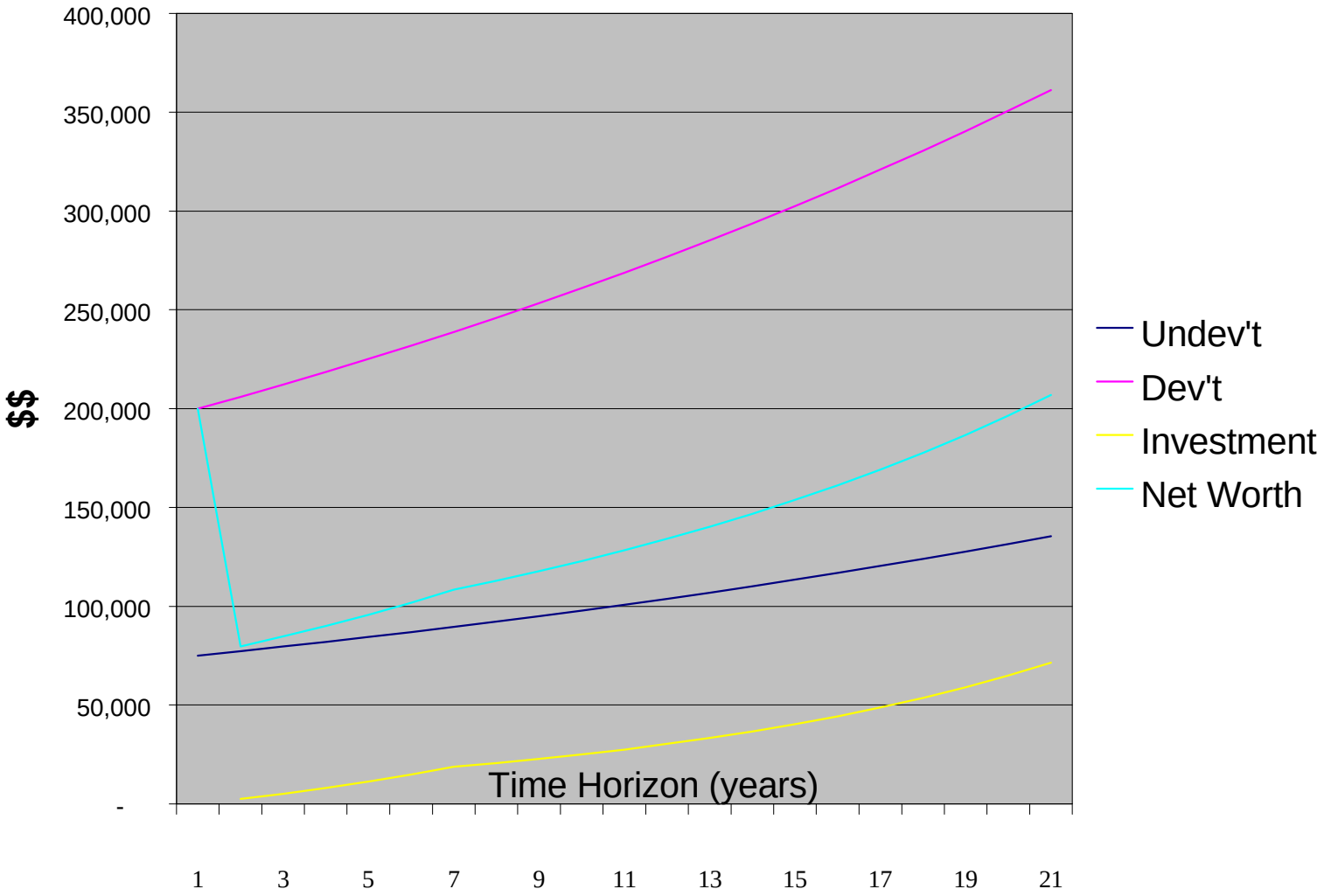
Developed land value (3% appreciation).....$361,222

Shortfall.....$147,171

Amount needed to be made whole.....$21,876

Figure3.2

Case Scenario 2 An example of a negative economic outcome of conservation easement donation. Here, the net worth of the landowner is less than the developed land value at the end of the expected investment duration, 20 years after the easement donation.



3.4 Implications of the model for development right purchase

Currently, the only method for the preservation of open space and farmland from landholders that do not voluntarily donate or sell the development rights of their land parcel is the purchase of the development rights of their land parcel, or the purchase of their land parcel in fee simple. Using the model introduced by this thesis, it is shown that this method can be more costly to society than it needs to be.

From Case Scenario 2, described above, the landowner will lose over $145,000 at the time of estate turnover if they elect to donate their development rights. As was discussed in Chapter 2.5, the estate tax implications for many landowners could make the difference for making this an economically optimal decision. However, unless this estate had considerable value in other assets, it would not be subject to estate taxation[3]. Estate tax implications being disregarded, this landholder is left with a sizeable economic loss at estate turnover.

The landowner's utility function must exhibit more satisfaction derived from the preservation of open space, than the financial returns from the development right donation. In terms of our variables: $\boldsymbol{Q > [E + D\,(1+R)^{T}]} \quad \boldsymbol{X} \quad \boldsymbol{P}$ for the landowner to donate the conservation easement.

However, the shortfall at estate turnover, over $145,000 in this case, could be 'purchased' from the landholder. If a lump-sum payment were put into the investment stream, along with the income tax benefits, the shortfall could be ameliorated. In this case the $147,171 shortfall amount discounted to the present with the equation: $PV = FV / (1+R)^{T}$ to $21,876. In other words, $125,000 worth of development rights can be purchased for $21,876.

[3] $600,000 being the current threshold for estate taxation in 1999. This amount is being phased up to $1,000,000 by 2002.

This lump-sum payment concept could also be used as an extra economic incentive for landholders that are hesitant to donate a conservation easement even if they are informed of the complete economic implications of donation. Furthermore, the lump-sum addition to the investment stream could be used to ameliorate the *P* value (risk premium).

3.5 Capturing complete economic benefit from the donation

In the case that a landholder's income is not sufficient to provide a tax liability that would completely capture the easement donation value in the 6-year tax deduction period, this thesis posits parceling the donation amount. The landholder can donate development rights equal to the amount of tax liability that can be deducted in the 6-year time limit. The following example illustrates this concept.

A landholder has a 60-acre land parcel valued at $6 million in developed land use. The undeveloped land value is $1 million making an easement value $5 million. In order for the landholder to capture the complete benefit of the tax deductions they would have to earn a yearly income of over $840,000. The landholder that doesn't earn this level of income can still capture complete benefit of the tax deductions if they donate smaller portions of the land parcel every 6 years until the entire parcel holds an easement.

If this landholder earns $100,000 each year, using the assumptions for all of the case scenarios in this thesis, their maximum reduction in yearly income tax liability is $30,000. For the landowner to capture the total benefit from the tax deduction they can, at most, donate $30,000 * 6. This equation is derived from yearly income tax liability times the amount of years they may deduct the donation. In this case, the landholder could only donate 1.8 acres every 6 years in order to capture total income tax deduction benefit.

$6,000,000 / 60 acres = $100,000 / acre

$30,000 * 6 = $180,000

$180,000 / $100,000 = 1.8 acre development right donation per 6 year tax deduction period.

Most land trusts will not accept easement donations of this size. Another example could be a 100-acre parcel valued at $500,000, of which $300,000 are represented in development right value. If the landowner earns $100,000 they could donate the development rights of their entire parcel in three donation periods.

$500,000 / 100 acres = $5,000 / acre

$30,000 * 6 = $180,000

$180,000 / $5,000 = 36 acre development right donation per 6 year tax deduction period.

Using this method the landowner must plan very early to fully cover their property with a conservation easement. The practical applications of this method are as of yet unproven.[4] The complicity of land trust organizations to this type of easement planning is untested.

If estate tax liability is a major concern, another way to decrease the estate tax liability for the intergenerational transfer of wealth is the gift tax exclusion. A married couple is allowed a $20,000 per year gift tax exclusion for each of their children. Therefore, if the landowner described in the first case above is married and has 3 children, they could give their children 0.6 acres of land each year. Working together, these two methods could allow a landowner to transfer their land without being forced to sell the land to development interests due to encumbering estate taxes.

3.6 The Decision Map

A graphical depiction of the landowner's decision sequence is included in Appendix B. The decision map illustrates the alternate motivations for open space and farmland preservation, and how these motivations are interrelated. The map is intended

for use by a land preservation facilitator, such as a land trust or government agency, to illustrate the benefits and tradeoffs of a conservation easement donation.

The decision map begins with the overriding question: "Should a landowner donate their development rights?" The next qualification necessary to continue the donation process is whether the land parcel is suitable for a conservation easement. This qualification is subject to stipulations such as minimum size requirements and location of the land parcel.

The decision map continues after the suitability constraint by ascertaining the specific motivating force for the conservation easement. There are three probable motivations for a conservation easement. The map begins with the altruistic and philanthropic motivations of a landowner. This motivation can be further supported with the economic model presented in this thesis. A landowner with philanthropic motivations for land preservation might have a demographic profile that provides an affirmative response to the next question in the decision map: "Can the landowner have their cake and eat it too?" This question could be answered with the spreadsheet model presented in this thesis. The altruistic and philanthropic motivations of the heirs of the landowner's estate are also addressed on this side of the decision map. The decision to donate a conservation easement could be further supported if the wishes of the heirs concerning the land parcel were similar to that of the landowner.

The other possible motivator for the landowner wishing to donate a conservation easement is the economic benefits derived from the tax implications of donation. This motivator also leads the decision map to the economic and spreadsheet model presented in this thesis. The economic motivations of the heirs of the estate are addressed on this side of the map.

The third impetus for a conservation easement is from a conservation or government organization. These groups could find that a specific land parcel should be

[4] Virginia Outdoor Foundation

preserved to meet their goals and interests. The decision map leads these organizations to determine the motivation of the landowner, be it economic or philanthropic, to facilitate the development right transfer. The decision map turns back to these organizations if the donation is determined to be economically infeasible. If the loss of estate value is an insurmountable obstacle to development right donation, one of these organizations could be approached to supplement the investment stream. This economic supplementation could take place through the purchase of part of the land parcel, or the development rights of the land parcel.

3.7 Implications for Governmental and Land Trust Organizations

Popular interest in growth management appears to be widespread and building. Many candidates in the 1998 and 1999 elections from both parties stated preferences for managing growth in one form or another in areas where growth management and improving or protecting the quality of life were major issues.

If Congress decides to consider growth management issues, a number of policy options are available. These options can be placed in four broad categories, from less involvement to more. The least involvement would emphasize providing information to localities and states, and include fostering exchanges of knowledge and experiences among governments. Greater involvement would be to offer financial assistance to places that voluntarily wish to address issues. It could more directly intervene by creating disincentives through tax policies or limits on federal spending. The highest level of intervention would be to apply regulation. The federal government already uses each of these levels to address topics that are components in the growth management debate.

The federal government has provided information for decades that describes resource conditions and informs decision-makers. Numerous examples can be identified where the government collects and compiles information, then provides it to any

interested party, such as the soil surveys, conducted by the U.S. Geological Survey. An example of a more active information effort is a farmland protection provision in the 1981 farm act that requires all federal agencies to report annually on how their activities affect the conversion of farmland to other uses. While this provision has never been effectively implemented, it still could be used to track how federal programs are affecting the rate and pattern of farmland conversions.

The federal government frequently provides financial incentives to encourage voluntary participation. For example, the 1972 Coastal Zone Management Act (P.L. 92-583) provides grants to states to develop and implement coastal management programs. These programs balance conservation, preservation, and development pressures in a coordinated fashion. While appropriations are limited to about $50 million per year, 32 of the 35 eligible states and territories participate. A much older example is the NRCS Conservation Technical Assistance Program, which provides conservation planning and implementation assistance to farmers who request it. The availability of this assistance, at little or no cost to farmers, is thought to encourage them to practice conservation.

Disincentives are less widely used than incentives, although the tax code has many provisions, such as tax credits and depreciation rates, that discourage some action and encourage others. The Coastal Barrier Resources Act of 1982 (P.L. 97-348) is a disincentive program that prohibits federal assistance, such as flood insurance and infrastructure funding to enhance development on designated coastal barriers because they are likely to suffer significant storm damage periodically. In such areas, assistance is available only for maintenance and for post-disaster restoration. This law does not prohibit actions by private parties, but the federal government will neither pay any costs nor assume additional risks at these places. Another example is two agriculture compliance programs, conservation compliance and swampbuster. These programs eliminate access to most federal farm program benefits to producers who cultivate highly erodible soils without a conservation program, or who alter wetlands to make agricultural land. Agencies administering both programs try to work with violators. Critics of the

administration of these programs point out that no more than 650 producers have lost benefits in any year.

Federal regulations deal with elements of some growth management issues, including wetland protection, air quality, and water quality. The §404 program under the Clean Water Act of 1972 requires landowners to obtain a permit from the U.S. Army Corps of Engineers before they can alter wetlands by disposing of dredge and fill material. The actual effectiveness of the program is a subject of debate because it protects most, but not all, wetlands from some, but not all, activities.

Each approach may be appropriate under some circumstances when addressing growth management. There are many views on when these circumstances might occur, ranging from a minimal federal role with no new or expanded regulations to an expanded federal role with greater use of disincentives and regulation. Recent debates over aspects of military base closings, including which bases will be closed and how facilities abandoned by the military might be used, capture many points about the current federal role and about federal relations with local and state government.

Pressure on local and state government to address growth management questions is spreading. In some instances, this pressure and its resolution are entirely local. However, in many instances, the federal government is viewed as either a significant contributor to the problem, or a significant part of the solution. If Congress chooses to review how federal activities contribute to growth and growth management, and how it might involve the federal government in this debate without impinging on local and state prerogatives, it will be able to draw on many relevant experiences.

The landtrust umbrella organizations, the Land Trust Alliance (LTA) and the American Farmland Trust (AFT), need to seek funding from federal sources. As the House Appropriations Committee decides how to distribute the Land and Water Conservation Fund, these organizations can lobby committee members for research funds directed at effective use of conservation funds. The AFT and LTA can use federal

funding to coordinate and maximize the effect of local funding for land preservation. The large amount of bond referendums that were passed in 1998 and 1999 have created a substantial fund at the local level for land preservation. It is important for these funds to be used in the best possible manner. The AFT and LTA should take an active role at the local level educating local trusts on the optimal use of these funds. Use of the method described in this thesis could be a part of LTA's and AFT's education and direction effort.

A cost-effective method for this information exchange could include posting a web-based version of the 'faceplate' page of the Excel program included in this thesis on their websites. Local land trusts facilitating the use of the local funds could access the program through the Internet during interviews with prospective landowners.

3.8 The Spreadsheet Program

The spreadsheet algorithm is programmed in Microsoft Excel format. The program is composed on four pages of a single worksheet named faceplate, master, tie-in and graph. The four pages are interfaced and referenced together in order that inputs can be entered for individual landowner demographics and land parcel profiles on the faceplate page. This lengthy discussion is written in the goal that the algorithm may be updated as the tax code changes. The algorithm uses the assumption that the landowner files a joint return with their spouse and has no other deductions. The tax information uses the 1999 U.S. tax code schedule Y-1.

The faceplate page is a user-friendly entry point for use by a land donation facilitator such as a landtrust or government representative. The input cells on the faceplate page are color coded blue and in italics. The faceplate page is divided into 4 parts. The first part is the Landowner Information section. The first input cell in this section is Cell H4 for the landowner's joint (the landowner and their spouse's) income.

Although the number of exemptions for landowner's in this model, using the assumption of married filing jointly, will always be two, the exemption demographic has

been included in Cell H5 and referenced throughout the algorithm so that altering the program in the future for other demographic profiles is facilitated.

The taxpayer's standard deduction is entered in Cell H6. This value is included as an input cell in order that a realistic figure of tax benefits can be derived. Many landowners will have tax habits that will cause this figure to change. Often couples filing jointly will have interest from a mortgage, charitable donations, or other reasons that they forego the standard deduction. In these cases, the standard deduction will be zero every year and should not be recognized in the tax profile. On the other hand, if the taxpayer normally uses the standard deduction, and the conservation easement charitable donation causes them to forego this deduction, the amount of the deduction should not be included in the tax benefits derived from the donation. For the purposes of the Case Scenarios in the Appendix of this thesis the standard deduction amount is zero.

The tax exemption amount is shown in Cell H7. This is not an input cell and is referenced to 'master page Cell E3' where the exact amount of exemption is calculated based on income. Cell H8 is an input cell for the expected investment horizon of the tax benefits derived from the donation. This figure is meant to be an expected life span of the donating landowner. The program allows for entries in this cell to be 10, 20, 30, or 40. The last input cell for the Landowner income section is the interest rate expected on the invested tax benefits in Cell H9. This amount is inversely proportional to the amount of risk adversity the landowner has on their investment.

The second section of the faceplate page is for input of the variables associated with the land parcel. The land parcel's value in developed use is entered into the first input cell, H12. The land parcel's undeveloped land value is entered into Cell H13. The development right value of the land parcel is then automatically calculated and displayed in Cell H14. This cell is referenced to 'master page Cell A5' for calculation.

Part 3 of the faceplate page has no input cells and automatically calculates the income tax implications of the donation. Cell H18 restates the landowner's income as

Adjusted Gross Income, referenced from Cell H4. Cell H19 restates the standard deduction from Cell H6 lost by itemizing the donation deduction. Cells C22-27 are referenced to 'master page Cells B16-21' displaying the amount of income tax liability reduced each year resulting from the donation. The income tax liability reduction is subject to a 30% of AGI constraint following Schedule A of the 1999-tax code. The total amount of income tax liability reduction is summed in Cell C28 and can be compared to the charitable donation amount to assess the loss of donation value.

The actual tax savings derived from the donation deduction are displayed in Cells H22-27. These figures are referenced to 'master page Cell D16-21' where they are calculated using tax due before the donation and tax due after the donation. This procedure is used in order to account for taxation reduction 'at the margin'. This allows for the fact that taxation increases on the margin at higher income tax liability levels. The total amount of tax benefits derived from the donation procedure is displayed in Cell H28. This figure is referenced to 'master page Cell D23' where it is calculated.

The final section of the faceplate page is the Results section. The first line of this section displays the investment potential of the tax benefits. Cell B32 displays the investment horizon referenced to the input Cell H8. The expected interest rate is displayed in Cell E32 and is referenced to the input Cell H9. The total investment value at the end of the expected investment horizon is displayed in Cell H32. This figure is referenced to 'master page Cell C29'.

The total net worth of the estate at the end of the investment horizon is a sum of the undeveloped land value and the investment value. This value is displayed in Cell H34 referenced to 'master page Cell C31'. This value can be compared to the expected future value of the land in developed use, which is displayed in Cell H36. The present development value is appreciated by 3% to the end of the expected investment horizon for this value. The difference between the future net worth of the estate and future value of developed land is compared in Cell H38, referenced to 'master page Cell C32'. The last cell on the faceplate page is the "amount needed to be made whole". This value is

derived from the value of extra funds needed to be inserted into the investment stream at the time of donation that would make the donating landowner as economically well off at the end of the investment horizon as if they sell their land to development interests. This value is calculated on 'master page Cell C35'.

The second page in the algorithm is the master page. This page is divided into eight sections. The first section displays the land parcel's value potentials. Cell A3 is the land parcel's developed land value referenced from the 'faceplate page Cell H12'. Cell B3 is the land parcel's undeveloped land value referenced from 'faceplate page Cell H13'. Cell A5 calculates the development rights associated with the land parcel by subtracting Cell B3 from Cell A3 using the formula: =A3-B3.

The second section of the master page displays the landowner's demographic information. Cell D4 contains the landowner's AGI referenced from 'faceplate page Cell H4. Cell D5 displays the number of exemptions claimed by the taxpayer, referenced from 'faceplate page Cell H5'. This number is used for the calculation of the Exemption Deduction in Cell E3. Cell E3 uses an "if/and" statement to calculate the exemption deduction. The values of exemption are taken from the 1999 1040 form. The statement: =IF(D3<94975,2750*D5,IF(D3-186800<0,2700*D5,IF(D3-186800>124500,0,((D3-186800)/2500)*0.02)*(2700*D5))) is a "nested if statement". The logic statement tests if Cell D3, the landowner's AGI, is less than $94,975. If this logic statement is true (if the AGI is less than $94,975) than the number of deductions claimed by the taxpayer, Cell D5, is multiplied by $2,750 to display the exemption deduction allowed for this taxpayer. The nested if statement continues to allow for each different level of exemption deduction reduction for higher AGI values. The next if statement tests if the AGI is greater than $94,975 but less than $186,800. If so, the exemption amount for each deduction is $2,700, which is multiplied by Cell D5 (the number of exemptions). If the AGI is over $311,300 the exemption deduction vanishes and the cell value becomes zero. If the AGI is between $186,800 and $311,300, the formula for exact exemption deduction is AGI-186,800 divided by 2,500 multiplied by 0.02 times 2,700 times the number of

exemptions claimed. This formula is described in the Deductions for Exemption Worksheet –line 38 found on page 30 of the instructions for the 1040 form.

The program calculates the total taxable income in Cell E5. This figure is the AGI value minus the exemption deduction: =D3-E3. Unlike the standard deduction, the exemption deduction is not lost due to itemizing a deduction. Therefore, the income used for the calculations requiring income liability values use the total taxable income value in Cell E5. The last cell in the income section is the standard deduction value found in Cell F5. This value is referenced to 'faceplate page Cell H6'.

The next sections of the master page are the two tax calculation sections. The first section calculates the tax due for the taxpayer without performing the conservation easement donation. Cells B9-14 use nested if statements to calculate the amount of tax the taxpayer is liable for each of six years. This is done to compare the amount of tax due with and without the donation deduction. Using this method, the fact that higher income values are taxed at higher percentages is taken into account. The Cells B9-14 all use the nested if statement: =IF(E5-F5<43050.15*E5-F5,IF(E5-F5<104050,6457.5+0.28*(E5-F5-43050),IF(E5-F5<158550,23537.5+0.31*(E5-F5-104050),IF(E5-F5<283150,40432.5+0.36*(E5-F5-158550),85288.5+0.396*(E5-F5-283150)))))

This function uses logic statements testing if the taxable income, Cell E5, minus the standard deduction, Cell F5, is under a certain value and applying the specific tax applicable to each. The first logic statement: =IF(E5-F5<43050.15*E5-F5 tests if the taxable income minus the standard deduction is less than $43,050. If it is, the taxable income less the standard deduction is multiplied by 15% to calculate the tax due. The function continues to test income level ranges and apply the correct tax for each level.

The next logic statement: IF(E5-F5<104050,6457.5+0.28*(E5-F5-43050) tests if the taxable income liability (AGI minus the standard deduction) is less than $104,050. This income level has a fixed tax of $6,457.50 and a variable rate of 28% of any income over $43,050. The next statement: IF(E5-F5<158550,23537.5+0.31*(E5-F5-104050)

tests if the taxable income liability is less than $158,550. This income level has a fixed tax of $23,537.50 plus a variable rate of 31% of income exceeding $104,050. The next statement: IF(E5-F5<283150,40432.5+0.36*(E5-F5-158550) tests if the taxable income liability is less than $283,150. This level of income has a fixed tax of $40432.50 plus a variable rate of 36% of any income exceeding $158,550. The last statement: 85288.5+0.396*(E5-F5-283150) includes a tax schedule for any taxable income liability greater than $283,150. The fixed tax at this income level is $85,288.50 plus 39.6% of any income exceeding $283,150.

This schedule of tax due given the landowner's income, without a charitable donation, represents a context or a control that is compared to the tax due considering the charitable donation for each of the six years the donation deduction may be amortized. The next section calculates the tax values for the landowner after the conservation easement donation is deducted from taxable income liability. Cells E9-15 calculate the tax due after the donation value is deducted for each of the six years the landowner is allowed to amortize the deduction. The nested if statement: =IF(($D$3-$E$3-B16)<42350,0.15*($D$3-$E$3-B16),IF(($D$3-$E$3-B16)<102300,6352.5+0.28*($D$3-$E$3-B16-42350),IF(($D$3-$E$3-B16)<155950,23138.5+0.31*($D$3-$E$3-B16-102300),IF(($D$3-$E$3-B16)<278450,39770+0.36*($D$3-$E$3-B16-155950),83870+0.396*($D$3-$E$3-B16-278450))))) is used only in Cell E9. The first statement of this formula: =IF(($D$3-$E$3-B16)<42350,0.15*($D$3-$E$3-B16), tests if the taxable income (AGI minus the exemption deduction, D3-E3) minus the tax liability avoided in the first year of amortization, B16, is less than $42,350. If this decreased taxable income amount is less than 42,350, the decreased income value is multiplied by 15% to derive the tax due for year.

The dollar signs ($) are used as part of the Excel language to fix the cell reference for ease of manipulation and duplication of the function. This is needed because the tax liability avoided changes throughout the amortization, and therefore the function is copied down through Cell E15 with a relative cell reference to the tax liability avoided for each year, Cells B16-21. The rest of the statement uses a tax table statement tests

identical to the ones used in the tax due section described above. The income levels are the only difference between these two sections. The taxation without donation section uses the AGI minus the Exemption Deduction minus the Standard Deduction to calculate the tax due. The taxation with donation section uses the AGI minus the Exemption Deduction minus the tax liability avoided in that year to calculate the tax due. The tax liability avoided values are calculated in Cells B16-21. Because the two tax due sections are identical in logic and use almost identical formulas, a discussion of the next section, tax liability avoided, follows.

The tax liability avoided each year is dependent on two constraints. First, the AGI may not be reduced more than 30%.[5] Second, the amount of the donation constrains the tax liability avoided. The statement found in Cell B16: =IF(D3<=A5,D3*0.3,IF(A5<=D3*0.3,A5,D3*0.3)) calculates the appropriate tax liability reduction for the donation year (year 1) based on these constraints. The statement tests if the AGI, Cell D3, is less than the development right donation amount, Cell A5. If it is Cell B16 displays the maximum tax reduction for year 1 based on the 30% of AGI constraint, AGI (D3) times 30%. If the donation value is not greater than the maximum deduction amount, AGI times 30%, the entire donation value is displayed(Cell A5). If the donation value is greater than the maximum deduction amount, the maximum donation value, AGI times 30%, is displayed.

Cells B17-21 use the same logic described above while accounting for decreased availability of donation funds. Cell B17 contains the formula =IF(D3<=(A5-B16),D3*0.3,IF(A5-B16<=D3*0.3,A5-B16,D3*0.3)). This statement tests if the AGI, Cell D3, is less than or equal to the donation amount, Cell A5, minus the amount of donation funds used in Cell B16. If the AGI is less than the amount of donation funds available for deduction Cell B17 displays the maximum allowed deduction, 30% of AGI. If the available donation funds are not greater than AGI, the second if statement tests if the available donation funds (A5-B16) is less than 30% of AGI. If so, the cell displays 30% of AGI. If not, the cell displays the entire remaining donation amount, A5-B16. If

[5] Schedule A 1040, page A-4 Gifts to Charity instructions for the 1040

the available donation funds are greater than 30% of AGI, then 30% of AGI is displayed as the tax liability deduction for that year.

Cell B18 continues with this format. The formula in B18 is =IF(D3<(A5-B16-B17),D3*0.3,IF(A5-B16-B17<=D3*0.3,A5-B16-B17,D3*0.3)). While this discussion may seem superfluous, it is entertained to avoid confusion for future manipulation of the model. The first if statement in Cell B18 tests if the AGI, Cell D3, is less than or equal to the donation amount, Cell A5, minus the amount of donation funds used in Cells B16 and B17 (years 1 and 2). If the AGI is less than the amount of donation funds available for deduction Cell B18 displays the maximum allowed deduction, 30% of AGI. If the available donation funds are not greater than AGI, the second if statement tests if the available donation funds (A5-B16-B17) is less than 30% of AGI. If so, the cell displays 30% of AGI. If not, the cell displays the entire remaining donation amount, A5-B16-B17. If the available donation funds are greater than 30% of AGI, then 30% of AGI is displayed as the tax liability deduction for that year.

Continuing this format, the formula in B19 is =IF(D3<(A5-B16-B17-B18),D3*0.3,IF(A5-B16-B17-B18<=D3*0.3,A5-B16-B17-B18,D3*0.3)). The first if statement in Cell B19 tests if the AGI, Cell D3, is less than or equal to the donation amount, Cell A5, minus the amount of donation funds used in Cells B16-18 (years 1, 2, and 3). If the AGI is less than the amount of donation funds available for deduction Cell B19 displays the maximum allowed deduction, 30% of AGI. If the available donation funds are not greater than AGI, the second if statement tests if the available donation funds (A5-B16-B17-B18) is less than 30% of AGI. If so, the cell displays 30% of AGI. If not, the cell displays the entire remaining donation amount, A5-B16-B17-B18. If the available donation funds are greater than 30% of AGI, then 30% of AGI is displayed as the tax liability deduction for that year.

The formula in B20 is =IF(D3<(A5-B16-B17-B18-B19),D3*0.3,IF((0.3*D3)<A5-B16-B17-B18-B19,(0.3*D3),A5-B16-B17-B18-B19)). The first if statement in Cell B20 tests if the AGI, Cell D3, is less than or equal to the donation amount, Cell A5, minus the

amount of donation funds used in Cells B16-19 (years 1, 2, 3, and 4). If the AGI is less than the amount of donation funds available for deduction Cell B20 displays the maximum allowed deduction, 30% of AGI. If the available donation funds are not greater than AGI, the second if statement tests if the available donation funds (A5-B16-B17-B18-B19) is less than 30% of AGI. If so, the cell displays 30% of AGI. If not, the cell displays the entire remaining donation amount, A5-B16-B17-B18-B19. If the available donation funds are greater than 30% of AGI, then 30% of AGI is displayed as the tax liability deduction for that year.

The last formula in this series is found in B21 and follows the same logic as above: =IF(D3<(A5-B16-B17-B18-B19-B20),D3*0.3,IF((0.3*D3)<A5-B16-B17-B18-B19-B20,(0.3*D3),A5-B16-B17-B18-B19-B20)). The first if statement in Cell B21 tests if the AGI, Cell D3, is less than or equal to the donation amount, Cell A5, minus the amount of donation funds used in Cells B16-20 (years 1, 2, 3, 4, and 5). If the AGI is less than the amount of donation funds available for deduction Cell B21 displays the maximum allowed deduction, 30% of AGI. If the available donation funds are not greater than AGI, the second if statement tests if the available donation funds (A5-B16-B17-B18-B19-B20) is less than 30% of AGI. If so, the cell displays 30% of AGI. If not, the cell displays the entire remaining donation amount, A5-B16-B17-B18-B19-B20. If the available donation funds are greater than 30% of AGI, then 30% of AGI is displayed as the tax liability deduction for that year.

The values in this series are summed and subtracted from the total development right value to display the amount of development right funds not captured in income tax deduction in Cell B23. The formula is =(A5-SUM(B16:B21)). The tax liability avoided series is used to determine the taxable income for the calculations of tax due with donation section. As described above, the taxable income, Cell E5, minus the tax liability avoided, Cells B16-21, is the post-donation taxable income. The tax due after the donation is then calculated in Cells E9-14.

The tax due before and after the donation is compared in the tax benefit section. Cells D16-21 simply take the difference between Cells B9-14, the tax due before the donation, and Cells D9-14. The formula in D16 is: =IF(B9-E9>=0,B9-E9,0). This if statement tests if the difference is positive, and if so D16 displays the difference as the tax benefit derived from the development right donation in year 1. If the difference is not positive, a zero is displayed signifying that no tax benefits are derived. This formula is copied relatively through the Cell series D16-21 displaying the tax benefits for each of the six years allowed for donation deduction amortization. Cell D23 sums the total tax benefits from the 6 years of amortization.

Below the tax benefit calculation sections the investment duration and expected interest rate for the invested tax benefits are referenced from 'faceplate page Cells B32 and H9'. The investment section is the 7th section of the master page. The total returns from the invested tax benefits at the end of the investment horizon are displayed in Cell C29. The function =IF(master!A27=40,'tie-in'!F42,IF(master!A27=30,'tie-in'!F32,IF(master!A27=20,'tie-in'!F22,IF(master!A27=10,'tie-in'!F12,'tie-in'!F27)))) tests which investment duration is specified by the landowner and references the appropriate cell on the tie-in page from which to display the investment potential of the tax benefits. The first statement in the function tests if the specified investment duration, Cell A27 is 40. If so, 'tie-in page F42' is referenced for the correct invested tax benefit value at the end of a 40-year investment. If not, the statement tests if the investment duration is 30 years. If this is the horizon period chosen by the landowner, 'tie-in page Cell F32' is displayed in Cell C29. This logic is followed for 20 and 10 year investment horizons.

The next cell in the investment section is the Conserved Land Value. Cell C30 is referenced to the 'tie-in page' cell appropriate considering the investment horizon. The statement in Cell C30 is: =IF(master!A27=40,'tie-in'!C42,IF(master!A27=30,'tie-in'!C32,IF(master!A27=20,'tie-in'!C22,IF(master!A27=10,'tie-in'!C12,'tie-in'!F27)))). This equation uses the same logic as the Investment Returns cell described above. The Undeveloped (conserved) land value is allowed to increase at 3% to derive the future value.

The third part of the investment section displays Total Net Worth of the donating landowner at the time of estate turnover. This value is equal to the sum of the investment value and the undeveloped land value. The function in Cell C31 is: =IF(master!A27=40,'tie-in'!E42,IF(master!A27=30,'tie-in'!E32,IF(master!A27=20,'tie-in'!E22,IF(master!A27=10,'tie-in'!E12,'tie-in'!E27)))). Again the logic used in the previous two parts of the investment section are used, referencing the 'tie-in page' depending on the appropriate investment duration.

The last part of the investment section is the Developed Land Value found in Cell C31. This land value is allowed to appreciate at the same rate as the undeveloped land value, 3%. This cell also references the 'tie-in page' for the correct value based on the investment duration. The amount of difference between the Total Net Worth and the Developed Land Value is calculated in Cell C34 to display the amount of value lost by the landowner as a result of development right donation. The function: =IF(C31>C32,0,C32-C31) tests if there is in fact a shortfall, and if so to display the value in Cell C34. If the net worth is greater than the development right value (C32>C31), a zero is displayed in Cell C34 signifying that no shortfall exists and that the landowner actually makes money by donating the development rights.

The line below the shortfall calculation contains a cell that calculates the amount of funds that would be inserted into the investment stream at the time of donation which would make the total net worth equal the developed land value. This "amount to 'be made whole'" is calculated in Cell C35 with the formula: =IF((C32-C31)<0,0,((C32-C31)/((1+C27)^A27))). This statement tests if there is no shortfall, C31>C32, then no funds are necessary to make the landowner's net worth equal after the donation and a zero is displayed in Cell C35. If a shortfall does exist then the formula is developed land value minus the total net worth divided by one plus the interest rate raised to a power equal to the investment duration. In other words, the principle needed to make the landowner whole is calculated with the formula: $p/(1+r)^t$. This figure could be useful to a

government or conservation organization to determine the amount of funds that would financially compensate the landowner completely for their development right donation.

The last section of the master page is the Estate Tax implication section. The goal of this section is to calculate the comparative net worth of the landowner's estate if they chose to donate their development rights or not. The first subdivision of the estate tax implication section is the land value subject to estate taxation at the time of estate turnover if the landowner donates a conservation easement. This section uses policy implications of §2031 of the Taxpayer Relief Act discussed in chapter 2.4 of this thesis. Multiple cells were used to calculate this value due to the constraint of Microsoft Excel limiting the number of nested if statements to seven. Cells A40-43 hold the formulas that calculate this value.

Cell A40 holds the formula: =IF((B3/A3)<=0.7,0.6*C30,IF((B3/A3)<=0.71,0.62*C30,IF((B3/A3)<=0.72,0.64*C30,IF((B3/A3)<=0.73,0.64*C30,IF((B3/A3)<=0.74,0.66*C30,IF((B3/A3)<=0.75,0.68*C30,IF((B3/A3)<=0.76,0.7*C30,IF((B3/A3)>=0.77,,)))))))). This function tests to what degree the conservation easement decreased the value of the land parcel. The first 'if statement' in this formula tests if the undeveloped land value, Cell B3, divided by the developed land value, Cell A3, is less than 70%. If this is true, the amount of land value subject to estate taxation is 60% of the undeveloped land value at the time of estate turnover, 0.6 times Cell C30.

If the value was not decreased by this percentage, the amount of estate tax liability reduction diminishes by 2% for every 1% the decrease in value is less than 30%. The 'if statement' allows for this tax policy by directing the negative response to the first test to the next 'nested if statement'. The second 'if statement' tests if the reduction in land value was 29% or more. The formula for this case is: IF((B3/A3)<=0.71,0.62*C30, saying that if undeveloped land value divided by developed land value is greater than or equal to 71%, the amount of land value subject to estate taxation is 62% of the

undeveloped land value at the time of estate turnover, 0.62 times Cell C30. The algorithm continues this logic for every possible percentage reduction.

The constraint on the maximum number of 'nested if statements' allowed by Microsoft Excel makes it impossible to program every estate tax percentage reduction in Cell A40. The logic described above continues for land ratios (undeveloped land to developed land value) of 72% to 76%, the 76% ratio statement being: IF((B3/A3)<=0.76,0.7*C30. This last ratio is followed by the last 'nested if statement' in Cell A40: IF((B3/A3)>=0.77,,. This statement directs the function to test if the ratio of undeveloped land value to developed land value is greater than or equal to 77%. If the land value ratio (undeveloped land to developed land value) is 77% or greater, Cell A40 will display a blank value. The blank value is read as a zero by Excel.

Cell A41 is programmed with the 'if statement': =IF((B3/A3)<=0.76,,IF((B3/A3)<=0.77,0.72*C30,IF((B3/A3)<=0.78,0.74*C30,IF((B3/A3)<=0.79,0.76*C30,IF((B3/A3)<=0.8,0.78*C30,IF((B3/A3)<=0.81,0.8*C30,IF((B3/A3)>=0.82,,))))))). This function starts with the statement: =IF((B3/A3)<=0.76,, testing if the land value ratio is less than 76%. If so, a blank value is displayed in Cell A41, the estate tax liability held in land value would be displayed in Cell A40. The next 'nested if statements' follow the same logic described above for land value ratios 77% to 81%. The function's last 'nested if statement': IF((B3/A3)>=0.82,, directs Cell A41 to display a blank value if the land value ratio is greater than or equal to 82%.

This land value estate tax liability calculation continues in Cell A42 with the function: =IF((B3/A3)<=0.81,,IF((B3/A3)<=0.82,0.82*C30,IF((B3/A3)<=0.83,0.84*C30,IF((B3/A3)<=0.84,0.86*C30,IF((B3/A3)<=0.85,0.88*C30,IF((B3/A3)<=0.86,0.9*C30,IF((B3/A3)>=0.87,,))))))). Again, the first statement directs the cell to display a blank value if the land value ratio is less than 82%. In these cases, Cell A40 or A41 will display the land value subject to estate taxation. The next 'nested if statements' follow the logic described above. Land value estate tax reductions for land value ratios of 82% to 86%

are calculated and displayed in Cell A42. The last 'nested if statement': IF((B3/A3)>=0.87,, directs Cell A42 to display a blank value if the land value ratio is greater than or equal to 87%. In these cases, the land value estate tax liability is displayed in Cell A43.

Cell A43 continues this land value estate tax liability calculation with the function: =IF((B3/A3)<=0.86,,IF((B3/A3)<=0.87,0.92*C30,IF((B3/A3)<=0.88,0.94*C30,IF((B3/A3)<=0.89,0.96*C30,IF((B3/A3)<=0.9,0.98*C30,IF((B3/A3)>=0.91,C30,)))))). Again, the first statement directs the cell to display a blank value if the land value ratio is less than or equal to 86%. In these cases, Cell A40, A41, or A42 will display the land value subject to estate taxation. The next 'nested if statements' follow the logic described above. Land value estate tax reductions for land value ratios of 87% to 90% are calculated and displayed in Cell A43. The last 'nested if statement': IF((B3/A3)>=0.91,C30, directs Cell A43 to display the full undeveloped value of the land parcel if the reduction in value resulting from the conservation easement is less than 10%. § 2031 of the Taxpayer Relief Act states that any estate tax liability reduction vanishes if the land value reduction is less than 10%.

The estate tax implication section continues with the calculation of the total estate tax liability of the donating landowner at the time of estate turnover in Cell B40. The formula in Cell B40 is: =IF(A40<>0,A40+C29,IF(A41<>0,A41+C29,IF(A42<>0,A42+C29,IF(A43<>0,A43+C29,C29+C30)))). This 'nested if statement' checks each of the Cells A40-A43 to find which one holds a value for the land parcel's estate tax liability. The first 'nested if statement': =IF(A40<>0,A40+C29, tests if Cell A40 holds a value other than zero. If so, the total estate tax liability is the land parcel's reduced tax liability, Cell A40, summed with the invested tax benefits at the end of the investment horizon, Cell 29. If Cell A40 displays a blank value the function in Cell B40 tests if Cell A41 with the 'nested if statement': IF(A41<>0,A41+C29. If Cell A41 holds a value other than zero Cell A41 is summed with Cell C29 to derive the total estate tax liability. If both Cells A40 and A41

are blank this logic is continued to test if Cells A42 or A43 contain a value and add Cell C29 to the appropriate land value tax liability to derive the total estate tax liability.

The next subdivision in the Estate Tax Implication section calculates the appropriate taxation of the estate for the donating landowner. Cells C40-C42 use 'nested if statements' to calculate the correct estate tax for the total estate value, displayed in Cell B40. The tax tables from Form 706 of the 2006 U.S. tax code were used in this section in order to accommodate the upcoming $1 million estate tax exemption.

Cell C40 tests the lowest estate tax values using the function:
=IF(B40>1080000,,IF(B40<=1000000,,IF(1010000>=B40,0.18*(B40-1000000),IF(1020000>=B40,1800+0.2*(B40-1010000),IF(1040000>=B40,3800+0.22*(B40-1020000),IF(1060000>=B40,8200+0.24*(B40-1040000),IF(1080000>=B40,13000+0.26*(B40-1060000)))))))).

The first 'nested if statement' =IF(B40>1080000,, directs Cell C40 to display a blank value if the estate tax liability value is greater than $1,080,000. Estates valued above this amount are addressed in the following cells in the series, Cells C41 and C42. The next 'if statement' in the function: IF(B40<=1000000,, directs Cell C40 to display a blank value if the estate value does not exceed the $1 million exemption amount. These first two statements ensure that only the estate values that are addressed in Cell C40 will display a value. If the estate value in question is not addressed in Cell C40, it will remain blank.

The next 'nested if statements' in Cell C40 follow the same logic as the Tax Due sections described above. The first 'nested if statement' calculating the estate tax is: estate value from Cell B40 is: IF(1010000>=B40,0.18*(B40-1000000), this statement tests if the estate tax liability, Cell B40, is less than or equal to $1,010,000. If the estate value meets this criterion the appropriate tax equation is 18% of the estate value that exceeds the $1 million exemption amount. Cell C40 continues with this logic for each of

the 17 tax divisions in Table A, the Unified Rate Schedule, of form 706. In order to avoid any confusion for future use of this algorithm, each 'if statement' is explained.

The following statement in Cell C40 is: IF(1020000>=B40,1800+0.2*(B40-1010000). This statement tests if the estate tax liability, Cell B40, is less than or equal to $1,020,000. If the estate value meets this criterion the appropriate tax equation is 20% of the estate value that exceeds $1,010,000. The next statement: IF(1040000>=B40,3800+0.22*(B40-1020000) tests if the estate tax liability, Cell B40, is less than or equal to $1,040,000. If the estate value meets this criterion the appropriate tax equation is 22% of the estate value that exceeds $1,020,000. The next statement: IF(1060000>=B40,8200+0.24*(B40-1040000) tests if the estate tax liability, Cell B40, is less than or equal to $1,060,000. If the estate value meets this criterion the appropriate tax equation is 24% of the estate value that exceeds $1,040,000. The final statement in Cell C40: IF(1080000>=B40,13000+0.26*(B40-1060000))))))) tests if the estate tax liability, Cell B40, is less than or equal to $1,080,000. If the estate value meets this criterion the appropriate tax equation is 26% of the estate value that exceeds $1,060,000.

The next cell in the Estate Tax Due after development right donation, Cell C41, continues the logic used in Cell C40. The 'nested if statement' is: =IF(B40>2000000,,IF(B40<1080000,,IF(1100000>=B40,18200+0.28*(B40-1080000),IF(1150000>=B40>1100000,23800+0.3*(B40-1100000),IF(1250000>=B40>1150000,38800+0.32*(B40-1150000),IF(1500000>=B40>1250000,70800+0.34*(B40-1250000),IF(1750000>=B40>1500000,155800+0.37*(B40-1500000),IF(2000000>=B40>1750000,248300+0.39*(B40-1750000)))))))). Again, if the estate value is not addressed in Cell C41, it will display a blank value. This is programmed using the first two 'if statements': IF(B40>2000000,,IF(B40<1080000,, saying that if Cell B40 is not between $2 million and $1,080,000 Cell C41 will remain blank. The following statements in the function test Cell B40 for increasing estate values, computing the appropriate tax for the applicable estate value.

Cell C42 continues with this logic:
=IF(B40<2000000,,IF(2250000>=B40>2000000,345800+0.41*(B40-2000000),IF(2500000>=B40>2250000,448300+0.43*(B40-2250000),IF(3000000>=B40>1500000,555800+0.45*(B40-1500000),IF(3500000>=B40>3000000,780800+0.49*(B40-3000000),IF(4000000>=B40>3500000,1025800+0.53*(B40-3500000),IF(B40>4000000,1290800+0.55*(B40-4000000)))))))). In this cell, the upper levels of estate values are addressed. The first statement: IF(B40<2000000,, directs Cell C42 to display a blank value if the estate value, Cell B40, is less than $2 million. The following 'nested if statements' calculate the appropriate estate tax for these higher estate values using the same logic as Cells C40 and C41.

The next sub-section of the Estate Tax Implication section is the estate tax due without development right donation. This sub-section, programmed in Cells D40-42, calculates the appropriate estate tax due following the same logic used in the last sub-section, using a different test cell as the estate tax liability amount, Cell C32, the developed land value. Because the logic in this sub-section follows that of the last exactly, no explanation will be given. The following function is used in Cell D40:
=IF(C32>1080000,,IF(C32<=1000000,,IF(C32<=1010000,0.18*(C32-1000000),IF(1020000>=C32,1800+0.2*(C32-1010000),IF(1040000>=C32,3800+0.22*(C32-1020000),IF(1060000>=C32,8200+0.24*(C32-1040000),IF(1080000>=C32,13000+0.26*(C32-1060000)))))))). The following function is used in Cell D41:
=IF(B40>2000000,,IF(C32<1080000,,IF(1100000>=C32,18200+0.28*(C32-1080000),IF(1150000>=C32,23800+0.3*(C32-1100000),IF(1250000>=C32,38800+0.32*(C32-1150000),IF(1500000>=C32,70800+0.34*(C32-1250000),IF(1750000>=C32,155800+0.37*(C32-1500000),IF(2000000>=C32,248300+0.39*(C32-1750000)))))))). The last cell in this series, Cell D42, holds the function:

=IF(C32<2000000,,IF(2250000>=C32,345800+0.41*(C32-2000000),IF(2500000>=C32,448300+0.43*(C32-2250000),IF(3000000>=C32,555800+0.45*(C32-1500000),IF(3500000>=C32,780800+0.49*(C32-3000000),IF(4000000>=C32,1025800+0.53*(C32-3500000),IF(C32>4000000,1290800+0.55*(C32-4000000)))))))).

The last cells on the 'master page' compute the final values of the estate after turnover, considering if the landowner donated their development rights or not. Cell A46 calculates the estate value after turnover if the landowner performed a conservation easement. Cell A46 contains the formula: =IF(C40<>0,C31-C40,IF(C41<>0,C31-C41,IF(C42<>0,C31-C42))). This 'nested if statement' tests which cell in the series C40-42 holds any non-zero value. The cell that contains a non-zero value is subtracted from Cell C31, the total net worth of the estate with a conservation easement (undeveloped land value plus invested tax benefits), displaying the final estate value after taxes have been paid.

This after-tax estate value may be compared to the next sub-section, estate value after turnover without a conservation easement. Cell D46 contains the function: =IF(D40<>0,C32-D40,IF(D41<>0,C32-D41,IF(D42<>0,C32-D42))). This 'nested if statement' tests which cell in the series D40-42 contains a non-zero value and subtracts that value from Cell C32, the total developed land value.

The third page in the algorithm is the 'tie-in page'. This page is used to calculate the yearly marginal values of the four components of the estate value comparison: undeveloped land value, developed land value, total net worth for the donating landowner, and investment potential of the tax benefits. In Column B a time series of years from 0-40 is displayed. Column C contains the undeveloped land value series for years 0 through 40. Cell C2 contains the formula: =master!B3, referencing the undeveloped land value cell on the 'master page', and represents the original undeveloped land value. Cell C3 starts the appreciation values of the land value. In this

thesis, the land value appreciates at 3%. This assumption is seen in the formula used in Cell C3: =C$2*(1+0.03)^B3. This formula uses the original undeveloped land value found in Cell C2 (the dollar sign fixes the Row number so the function can be easily copied through the entire time series) as the principal investment amount for the formula: $p(1+r)^t$. Again, the rate of return, r, is 3% and the time is referenced to the time series listed in Column B. The only part of the equation that changes throughout the series is the time cell reference, which changes every year. Cell C4 contains the function: =C$2*(1+0.03)^B4.

The next section of the 'tie-in page' is the developed land value appreciation series. This column is programmed exactly like Column C using the developed land value as the principal investment amount. Cell D2 references the 'master page' for the original developed land value: =master!A3. Cell D3 starts the appreciated land value series with the function: =D$2*(1+0.03)^B3.

The next section of the 'tie-in page' is the investment potential series found in Column E. At time zero, before the donation, there are no tax benefits and thus no investment. Therefore, Cell E2 is blank. Cell E3 represents the investment funds in year one and is tied into a computation box found at the far right of the page. An explanation of this computation box is necessary before the investment column explanation is continued. In the computation box Cells G3-8 are referenced to 'master page' Cells D16-21. This series replicates the tax benefits derived from conservation easement donation computed on the 'master page'. The other series in the computation box, found in Cells I3-8, computes the investment potential of the tax benefits for the first six years. Cell I3 is referenced to Cell G3 representing the investment in the first year.

In order for Cell I4 to represent the investment in the 2nd year the equation must allow for the tax benefits from the first year to be increased by a given interest rate as well as be increased by the year's tax benefits. The function in Cell I4 is: =G4+G3*(1+B1). The tax benefits derived in the 2nd year are referenced from Cell G4. This value is summed with the tax benefits in year one increased by an investment

equation: $p(1+r)^t$. The tax benefit from year one, Cell G3, is the principal investment amount and the investment rate is referenced to Cell B1. Cell B1 is referenced to 'master page' Cell C27, the investment rate accepted by the landowner. The next cell in the series is Cell I5, which holds the equation: =G5+(G3*(1+B1)^2)+G4*(1+B1). This function sums the tax benefits from years one and two, each allowed to increase by the interest rate in Cell B1 for the appropriate time frame, with the tax benefit derived in year three.

Cell I6 continues this logic increasing the time variable for the invested returns and adding the tax benefits from year four. The equation in Cell I6 is: =G6+(G3*(1+B1)^3)+G4*(1+B1)^2+G5*(1+B1). Again, the tax benefits from previous years are earning interest and the tax benefit from year four is added to them. The same logic continues in Cell I7 with the equation: =G7+(G3*(1+B1)^4)+G4*(1+B1)^3+G5*(1+B1)^2+G6*(1+B1), and in Cell I8: =G8+(G3*(1+B1)^5)+G4*(1+B1)^4+G5*(1+B1)^3+G6*(1+B1)^2+G7*(1+B1).

The series Cells I3-I8 is referenced for the first six years of the investment series. Cell E3 is referenced to Cell I3, Cell E4 to Cell I4 and so on. The equation in Cell E9 uses the investment value at the end of the tax benefit amortization period found in Cell I8. The equation in Cell E9 is: =$I$8*(1+$B$1)^B4. This equation fixes Cell I8 as the principal investment fund, multiplies it by one plus the interest rate, fixed as Cell B1, and lets the time change each year, here it is Cell B4 representing the investment in its second year. The only variable changing over time in this equation is the time variable. Thus in Cell E10 the function is: =$I$8*(1+$B$1)^B5, representing the investment in its third year.

The last section of the 'tie-in page' is the Net Worth column. Cell F2 represents the landowner's net worth before the easement is donated, year 0, and is referenced to the developed land value in that year. Cell F3 begins the series of landowner net worth after the easement has been donated. This value is simply a summation of the undeveloped land value and the invested tax benefits, Column C plus Column E.

The ‘tie-in page’ facilitates graphing in Excel. A ‘graph page’ is the last page in the algorithm. A discussion of this is not undertaken due to the germane nature of the task.