Cockreham Island Flood Hazard Reduction Buy-out Total Benefit Cost Analysis

Prepared for

GeoEngineers, Inc

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Prepared by

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Abbreviations

BCA	Benefit Cost Analysis
BCR	Benefit cost ratio
DDF	depth-damage function
EEA	Ecological Economic Analysis
ES	Ecosystem Services
FEMA	Federal Emergency Management Agency
OMB	Federal Office of Management and Budget ()
SCPW	Skagit County Public Works
TBCA	Total Benefit Cost Analysis
TBCR	Total benefit cost ratio
TEV	Total Economic Value

Executive Summary

The purpose of the Cockreham Island Flood Hazard Buy-out Total Benefit Cost Analysis (TBCA) is to estimate the benefits and costs of a proposed buy-out of Cockreham Island. Currently, much of the land of Cockreham Island floods with some frequency. The TBCA compares an estimate of future flood damage costs, which would be avoided if a buy-out occurs, to the costs of the proposed buy-out. If a proposed buy-out occurs and the levee is removed reconnecting the river to a floodplain, ecological benefits could occur. The TBCA includes this value through the valuation of the added ecosystem goods and services.

The categories of benefits and costs included in the TBCA are listed in Table ES-1 and described in the text below.

Table ES-1. Benefits and Costs Included in TBCA

Benefits	Costs
Traditional avoided costs of flood (includes):	Property acquisition
Building damage	Demolition of buildings
Agricultural damage	Removal of infrastructure
Loss of function	Lost tax revenue
Displacement	
Road maintenance	
Levee maintenance	
Ecosystem goods and services	

Traditional Benefit Cost Analysis of flood damage considers the avoided costs of flood damage and levee maintenance as the study benefits. The proposed buy-out would retire land from production which is prone to frequent flooding. The buy-out would eliminate the need to repair flood damage to buildings, roads and farm fields after a flood has occurred as well as the avoid displacement costs of the residents. Additionally, the proposed buy-out would eliminate or reduce the need for public investment in levee maintenance.

The second category of benefit is referred to as the **Ecological Economic Analysis,** which considers the value of the ecosystem goods and services that may become available as the purchased land returns to historical conditions. Ecosystem goods are measured in terms of something that an ecosystem produces, such as habitat or increased recreational opportunities. Ecosystem services are measured in terms of regulating functions, such as potential water quality improvements, like temperature reductions and uptake of nitrogen that can occur in a natural riparian zone.

The costs for the study include: buying out private property owners, removing buildings and infrastructure, and lost property taxes currently collected on the private property which would be bought out.

Figure ES-1 and Figure ES-2 show summary results of the TBCA. Figure ES-1 shows the present value of estimates for costs and benefits using a 3.0 percent discount rate and Figure ES-2 showing results using the 7.0 percent discount rate.

Figure ES-1. Present Value Estimate of Total Benefits and Costs
3 Percent Discount Rate ($2005)

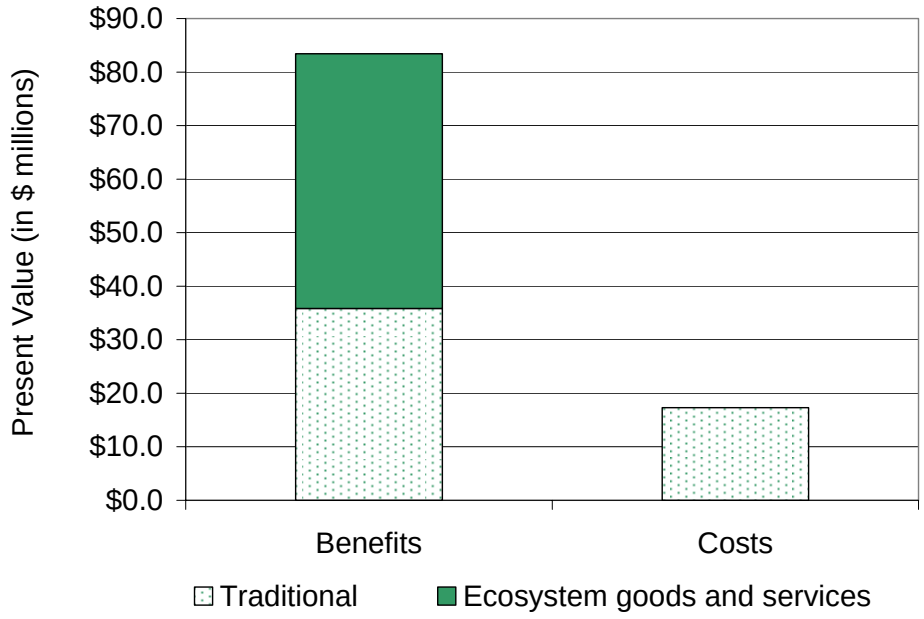
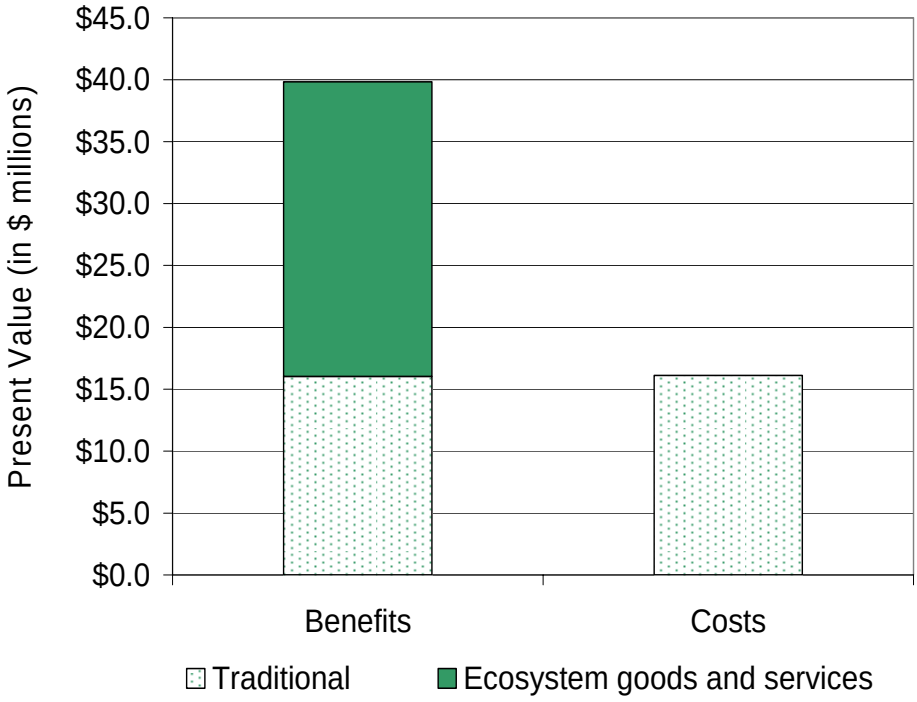


Figure ES-2. Present Value Estimate of Total Benefits and Costs
7 Percent Discount Rate ($2005)



Benefits and costs of the proposed buy-out occur over many years. The TBCA must calculate the present value of all benefits and costs over the life of a project. A present value analysis considers the stream of annual future value of benefits and costs over a 100-year time frame. The 100-year time frame is assumed given the permanency of the proposed buy-out. In order to sum the stream of future benefits and costs they must be expressed in present dollars. Discount rates are used to express values in present dollars. Two discount rates were used for the BCA because the Federal Office of Management and Budget (OMB) specifies that agencies should use a 3.0 percent discount rate for projects (OMB, 2006a), while Federal Emergency Management Agency (FEMA) requires the use of a 7.0 percent discount rate for its grant applications (FEMA, 2005b).

The higher the discount rate, the lower the present value of future benefits or costs; therefore, the net effect of the FEMA mandate to use a 7.0 percent discount rate is to value benefits or cost savings that occur closer to the present time much more than savings that occur farther in the future.

Depending upon the discount rate, the present value of estimated total benefits over the 100-year time period ranges from $39.8 million to $83.4 million. The present value of estimated total costs over the 100-year time period ranges from $16.1 million to $17.3 million.

Clearly demonstrated in Figure ES-1 and Figure ES-2 is the value of ecological services. When the present value of ecological services is included in the benefit, the present value of estimated benefits of the proposed buy-out outweighs the present value of costs. Further, the benefit-cost ratio of the study is between 2.5 and 4.8. A benefit cost ratio greater than one indicates that benefits are greater than costs—the larger the ratio, the larger the benefits relative to costs. The benefit cost ratio is provided in Table ES-2.

Table ES-2. Summary of Total Benefits and Costs ($2005)

	Three percent discount			Seven percent discount		
Category of Benefit and Cost	**Benefits** ($millions)	**Costs** ($millions)	**BCR** (B/C)	**Benefits** ($millions)	**Costs** ($millions)	**BCR** (B/C)
Traditional BCA	$35.8	$17.3		$16.0	$16.1	
Ecosystem Goods and Services	$47.6	$0.00		$23.8	$0.00	
Total	$83.4	$17.3	4.8	$39.8	$16.1	2.5

1 Introduction

Cockreham Island is a rural residential and agricultural area located between the communities of Lyman, Washington and Hamilton, Washington along the shores of the Skagit River. The Skagit River bends around Cockreham Island's 1,637 acres, an area within the 100-year floodplain (see Figure 1). Recent history suggests that heavy flooding is occurring with increasing frequency. Much of the land of Cockreham Island is devoted to dairy operations, pastureland, cropland, and other agricultural uses, along with residential properties. Flooding events have become "old-hat" for many of the local residents as they have experienced many floods over the years causing damage to the residences, and losses to their agricultural operations (crops, pastureland, debris removal, etc.). The Cockreham Island Flood Hazard Buy-out (the study) was undertaken by Skagit County public works to determine whether purchasing the land and permanently retiring it is a feasible flood management program.

1.1 Study Purpose

The purpose of the Cockreham Island Flood Hazard Buy-out Total Benefit Cost Analysis (TBCA) is to determine the economic feasibility of a proposed buy-out of Cockreham Island. The TBCA compares an estimate of future flood damage costs, which would be avoided if a buy-out occurs, to the costs of the proposed buy-out. This comparison is a traditional Benefit Cost Analysis (BCA). In addition to the traditional BCA, the study estimates the value of ecological benefits that could occur from removing the levee and reconnecting the river to a floodplain. When added to the traditional benefit cost analysis, these estimates complete the TBCA.

The traditional BCA compares the estimated traditional benefits (e.g., avoided costs of flood protection) to the costs of purchasing the land. Purchasing property from private landowners and retiring it would require an upfront investment. It would involve removing homes and infrastructure. Additionally, there would be the annual loss of tax revenue from the privately-owned property. However, not purchasing the property would also be costly; as flooding continues to occur, levee repairs and upgrades will be needed, and Cockreham residents will continue to endure expenses related to flooding events.

The Ecological Economic Analysis (EEA) includes valuing ecosystem services that would result from reconnecting the floodplain to the river via the buy-out of private property. To account for these additional benefits, the study team considers ecosystem goods and service values given the current habitat conditions on Cockreham Island and the likely future habitat conditions on Cockreham Island and the adjoining Skagit River.

The following section provides background to Cockreham Island and the study. Following the background is a description of how this report is organized.

1.2 Background

Cockreham Island is located in unincorporated western Skagit County, between the communities of Lyman and Hamilton. Cockreham Island consists of 1,637 acres divided into 144 parcels of land. According to the 2000 U.S. Census, there were 30 housing units on Cockreham Island, 23 of which were occupied. The resident population of Cockreham Island in 2000 was 58 people (US Census Bureau, 2000).

Much of Cockreham Island has been developed for agricultural purposes. Almost 1,100 acres of the island are used for crop field, grasslands, or pasture, providing food supplies and space for cattle, horses, and an assortment of other farm animals. An aerial photograph of Cockreham Island is provided in Figure 1. The checkerboard pattern visible on the photo demonstrates the rural and agricultural nature of the area, and the close relationship of the Skagit River to the island.

Figure 1. Aerial Photograph of Cockreham Island

Source: GeoEngineers, 2006.

1.3 Report Organization

The first section presents the TBCA. The TBCA combines the results of the traditional BCA with the results of the EEA, presenting the total benefits and total costs of the proposed property buy-out and infrastructure removal.

The TBCA results section is followed by a section that presents the details of the traditional BCA. The details of the traditional BCA analysis are followed by a section that presents the details of the EEA.

Figures B-1 through B-9 follow the report text and provide a spatial display of the results of the study.

Figure B-1 displays the locations of buildings used in this evaluation. Figures B-2 and B-3 display which parcels are cost effective for buy-out based upon a traditional BCA for 3 percent and 7 percent discount rates respectively. Figure B-4 displays the ecosystem service value of existing conditions, while B-5 provides ecosystem service values for potential future conditions. Figures B-6 and B-7 display which parcels are cost effective for buy-out based upon a TBCA (once ecosystem values have been incorporated) for 3 percent and 7 percent discount rates respectively. Figures B-8 and B-9 Display the same data as B-6 and B-7, although the data are color coded to highlight the most cost effective parcels.

2 Total Benefit and Cost Analysis

The TBCA of the Cockreham Island Flood Hazard Reduction Buy-Out estimates the present value of benefits and costs of a flood damage mitigation study. The categories of costs and benefit analyzed for the TBCA are described in Table 1. The proposed buy-out of private property would provide benefits in two broad categories; 1) the traditional benefit categories of flood control studies (i.e., avoided costs of flood damage) and 2) the value of ecosystem goods and services. Each of these categories of benefits is described below in more detail.

Table 1. Benefit and Cost Categories

Benefit and Cost Category	Description
Benefits	
Traditional avoided costs of flood (includes):	
Building damage	Damage to homes and out-builds that result from a flood
Agricultural damage	Damage to farm fields and agricultural operations that result from a flood
Loss of function	Business income, such as farm sales that are lost to a flood
Displacement	The costs associated with flood victims housing costs while they are waiting to return to their homes
Road maintenance	Annual cost of maintaining the roads on the island plus the cost of repairing the roads following a flood
Levee maintenance	Annual cost of maintaining the roads on the island plus the cost of repairing the roads following a flood
Ecosystem goods and services	The value of goods and services provided by naturally functioning landscapes
Costs	
Property acquisition	Cost of purchasing the private property from land owners
Demolition of buildings	Cost of removing residences, farm buildings, and other out buildings
Removal of infrastructure	Cost of removing roads and public utilities
Lost tax revenue	Loss of the annual tax revenue currently paid to the County from the landowners

Traditional Benefit Cost Analysis of flood damage considers the avoided costs of flood damage and levee maintenance as benefits. The proposed buy-out plan would retire land from production which is prone to frequent flooding. The buy-out would eliminate the need to repair flood damage to buildings, roads and farm fields after a flood has occurred as well as the displacement costs of the residents. Additionally, the proposed buy-out would eliminate or reduce the need for public investment in levee maintenance.

The second category of benefit is referred to as the **Ecological Economic Analysis,** which considers the value of the ecosystem goods and services that may become available as the purchased land returns to historical conditions. Ecosystem goods are measured in terms of something that an ecosystem produces, such as habitat or increased recreational opportunities. Ecosystem services are measured in terms of regulating functions, such as potential water quality improvements, like temperature reductions and uptake of nitrogen that can occur in a natural riparian zone.

The costs of the proposed buy-out include: buying out private property owners, removing buildings and infrastructure, and lost property taxes currently collected on the private property which would be bought out.

The benefits and costs of the proposed buy-out would occur over a long period of time. In order to account for this stream of future benefits, a present value calculation is done. The time frame of 100 years is a standard value assumed for the period of analysis given the permanency of the proposed buy-out. In order to sum the stream of future benefits and costs, the values must be expressed in present dollars. Discount rates are used to account for this time value of money. Two discount rates are used for this study: the Federal Emergency Management Agency (FEMA) rate of 7.0 percent and the Federal Office of Management and Budget (OMB) rate of 3.0 percent. More information is provided about discounting and the rates used in Section 3.2.3.

A summary of the results of the present value of the estimated benefits and costs are provided in Figure 2 and Figure 3 using the 7 percent and 3 percent discount rates respectively. These figures demonstrate the importance of ecosystem goods and services; when the value of ecosystem goods and services are taken under consideration, the benefits of the proposed buy-out far outweighs the cost. The estimated net present value of benefits for the proposed buy-out range from $39.8 to $83.4 million, and the estimated net present value of costs range between $16.1 million and $17.3 million. In total, the estimated net present value of ecological economic benefits of the proposed buy-out range between $23.8 million and $47.6 million.

Figure 2. Total Benefits and Costs, 7% Discount Rate ($2005)

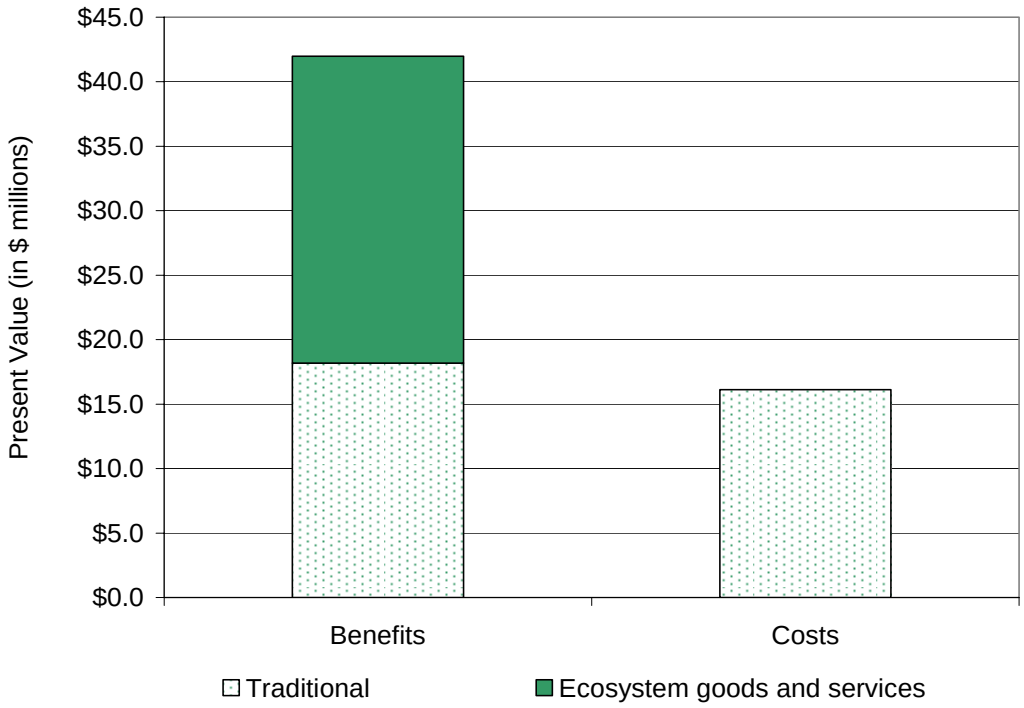
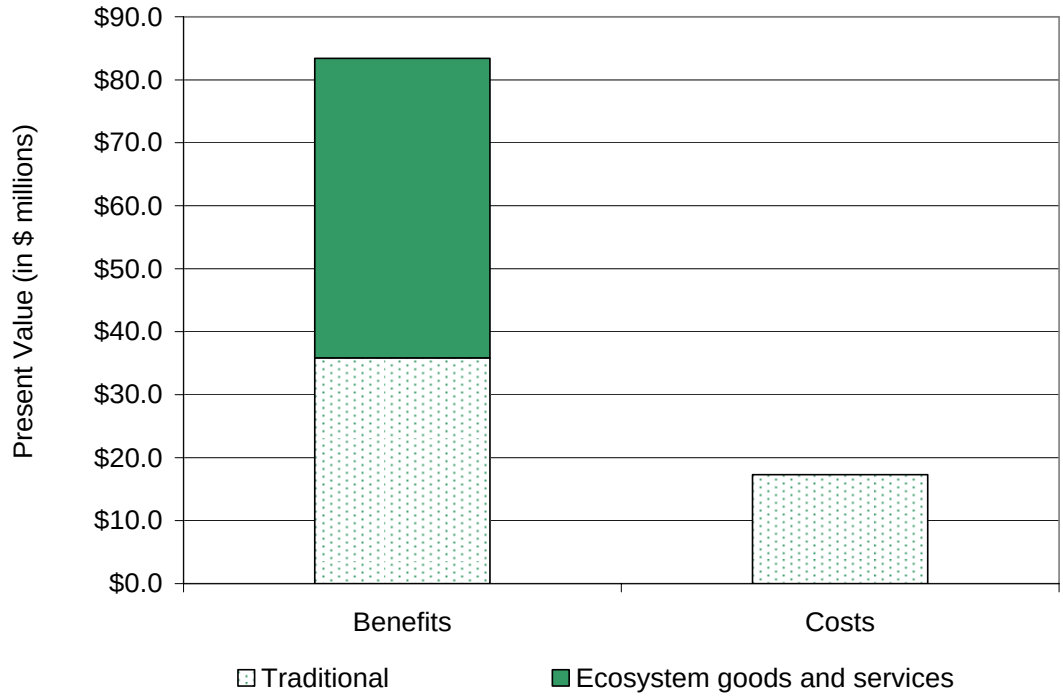


Figure 3. Total Benefits and Costs, 3% Discount Rate ($2005)



The present value of total benefits and total costs can be used to calculate the total benefit cost ratio (TBCR). This ratio is calculated as:

Present Value of Total Benefits / Present Value of Total Costs = TBCR

If the TBCR is greater than 1.0, the present value of the estimated benefits is greater than the present value of the estimated costs. If the TBCR is less than 1.0, then the present value of estimated benefits is less than the present value of estimated costs.

Table 2 shows the present value estimate of total benefits and total costs for each parcel on Cockreham Island. Additionally, some benefits and costs, that were unable to be allocated by parcel, are shown at the end of the Table 2. The proposed buy-out is cost-effective; there are more benefits than costs from the proposed buyout (the TBCR is 4.82 under a three percent discount and the TBCR is 2.47 under a seven percent discount). On a parcel-by-parcel basis, the study team found that 98 and 86 parcels are cost-effective for the property buy-out under the 3 percent and 7 percent discount rate, respectively.[1]

[1] Note that the unallocated benefit of cost savings from road and levee maintenance and repair are not included in the parcel level analysis nor is the cost of public infrastructure removal. Demolition and removal of residences is included in the parcel level analysis.

Table 2. Total Benefit Cost Analysis for Cockreham Island Parcels ($2005)

	Three Percent Discount			Seven Percent Discount		
Parcel	**Benefit**	**Cost**	**TBCR**	**Benefit**	**Cost**	**TBCR**
P109700	$55,063	$89,625	0.61	$27,532	$80,069	0.34
P114772	$182,385	$241,924	0.75	$90,276	$192,605	0.47
P116676	$29,118	$27,972	1.04	$14,559	$23,846	0.61
P116907	$26,357	$3,601	7.32	$13,178	$3,070	4.29
P119138	$54,240	$23,967	2.26	$27,120	$20,427	1.33
P41173	$37,016	$91,744	0.40	$18,508	$77,436	0.24
P41212	$37,137	$776	47.83	$18,568	$524	35.47
P41219	$1,934,885	$1,166,083	1.66	$956,789	$1,059,134	0.90
P41220	$954,417	$91,289	10.45	$477,208	$89,331	5.34
P41221	$1,002,148	$85,746	11.69	$486,654	$84,447	5.76
P41222	$44,816	$8,996	4.98	$22,408	$7,565	2.96
P41223	$93,775	$19,062	4.92	$46,887	$16,056	2.92
P41224	$5,862	$2,550	2.30	$2,931	$1,993	1.47
P41225	$111,301	$7,202	15.45	$54,137	$6,882	7.87
P41226	$122,739	$10,886	11.28	$59,443	$10,734	5.54
P41227	$830,362	$158,567	5.24	$402,357	$152,230	2.64
P41229	$439,345	$16,188	27.14	$219,672	$13,752	15.97
P41230	$2,562,062	$95,376	26.86	$1,264,212	$93,531	13.52
P41236	$1,397,073	$494,488	2.83	$689,359	$467,390	1.47
P41237	$211,182	$542,809	0.39	$98,051	$480,017	0.20
P41238	$1,583,451	$219,543	7.21	$772,917	$211,506	3.65
P41239	$117,322	$5,613	20.90	$58,661	$4,650	12.61
P41240	$731,638	$71,489	10.23	$352,702	$69,902	5.05
P41241	$18,871	$6,937	2.72	$9,436	$5,908	1.60
P41242	$456,315	$26,095	17.49	$223,436	$25,513	8.76
P41243	$1,607,128	$78,640	20.44	$788,817	$76,708	10.28
P41244	$436,311	$26,095	16.72	$213,525	$25,513	8.37
P41245	$523,434	$51,548	10.15	$252,037	$50,408	5.00
P41246	$2,504,197	$632,921	3.96	$1,161,067	$590,430	1.97
P41247	$516,440	$51,548	10.02	$248,808	$50,408	4.94
P41248	$354,679	$26,303	13.48	$172,981	$25,611	6.75
P41249	$525,769	$181,532	2.90	$248,570	$217,412	1.14
P41250	$7,024,980	$144,062	48.76	$3,305,974	$141,150	23.42
P41251	$312,986	$14,290	21.90	$154,019	$13,977	11.02
P41253	$2,693,851	$36,936	72.93	$1,336,621	$36,014	37.11
P41254	$2,751,676	$137,629	19.99	$1,347,550	$135,490	9.95
P41255	$759,665	$65,554	11.59	$366,155	$64,251	5.70
P41256	$121,246	$250,363	0.48	$56,381	$220,153	0.26
P41257	$470,692	$89,437	5.26	$235,346	$88,940	2.65
P41258	$820,410	$199,675	4.11	$400,634	$189,162	2.12
P41259	$593,086	$24,865	23.85	$293,268	$24,353	12.04

	Three Percent Discount			Seven Percent Discount		
Parcel	**Benefit**	**Cost**	**TBCR**	**Benefit**	**Cost**	**TBCR**
P41260	$64,219	$179,348	0.36	$29,172	$158,059	0.18
P41261	$79,821	$9,346	8.54	$39,911	$7,782	5.13
P41262	$630,981	$23,603	26.73	$311,018	$23,230	13.39
P41263	$68,239	$226,412	0.30	$49,527	$199,686	0.25
P41265	$302,983	$303,331	1.00	$143,724	$267,357	0.54
P41266	$249,242	$182,514	1.37	$116,816	$222,204	0.53
P41269	$71,009	$548	129.54	$35,019	$523	67.01
P41270	$1,753,842	$3,459	507.11	$876,921	$2,950	297.30
P41271	$790,330	$202,607	3.90	$388,274	$193,585	2.01
P41272	$298,577	$24,440	12.22	$147,410	$24,200	6.09
P41273	$117,725	$273,198	0.43	$53,933	$240,851	0.22
P41274	$250,071	$90,088	2.78	$120,762	$89,432	1.35
P41275	$269,163	$70,903	3.80	$132,780	$70,636	1.88
P41276	$1,649,282	$349,733	4.72	$809,209	$301,036	2.69
P41277	$372,076	$22,867	16.27	$181,845	$22,354	8.13
P41278	$211,660	$145,164	1.46	$101,936	$127,552	0.80
P41280	$694,295	$38,303	18.13	$339,212	$71,598	4.74
P41281	$421,997	$223,059	1.89	$207,819	$196,979	1.06
P41283	$581,003	$410,181	1.42	$273,435	$362,734	0.75
P41284	$302,636	$15,569	19.44	$149,581	$15,426	9.70
P41286	$1,348,385	$1,325,056	1.02	$645,438	$1,203,128	0.54
P41289	$747,742	$297,821	2.51	$353,327	$288,995	1.22
P41290	$1,438,350	$464,484	3.10	$704,065	$486,713	1.45
P41291	$55,181	$3,348	16.48	$27,139	$3,323	8.17
P41292	$33,602	$3,348	10.04	$16,342	$3,323	4.92
P41294	$70,324	$128,138	0.55	$34,366	$86,777	0.40
P41295	$96,178	$308,808	0.31	$48,032	$272,233	0.18
P41296	$2,544	$2,160	1.18	$1,272	$4,500	0.28
P41298	$1,459,740	$266,333	5.48	$726,807	$234,450	3.10
P41299	$148,411	$14,696	10.10	$72,350	$14,220	5.09
P41300	$326,362	$236,320	1.38	$158,559	$208,581	0.76
P41301	$213,228	$50,621	4.21	$106,614	$42,965	2.48
P41302	$536,320	$267,052	2.01	$260,509	$235,319	1.11
P41304	$179,495	$7,196	24.95	$88,234	$7,039	12.54
P41306	$965,516	$44,693	21.60	$474,540	$43,688	10.86
P41307	$202,993	$7,836	25.91	$99,996	$7,658	13.06
P41308	$961,532	$101,807	9.44	$473,869	$100,795	4.70
P41309	$977,880	$126,454	7.73	$474,182	$109,716	4.32
P41310	$378,878	$10,322	36.71	$187,438	$10,098	18.56
P41312	$172,963	$16,815	10.29	$83,551	$16,435	5.08
P41313	$288,241	$29,221	9.86	$138,927	$28,573	4.86
P41314	$578,249	$57,601	10.04	$278,487	$56,326	4.94

	Three Percent Discount			Seven Percent Discount		
Parcel	**Benefit**	**Cost**	**TBCR**	**Benefit**	**Cost**	**TBCR**
P41316	$868,285	$156,956	5.53	$428,137	$143,980	2.97
P41327	$745,549	$15,120	49.31	$372,774	$12,600	29.59
P41410	$3,561	$6,091	0.58	$1,781	$5,193	0.34
P41542	$815,908	$395,191	2.06	$402,957	$457,965	0.88
P41543	$12,046	$287,899	0.04	$6,010	$253,153	0.02
P41546	$1,113,977	$25,027	44.51	$552,770	$24,322	22.73
P41743	$573,725	$50,394	11.38	$277,438	$49,229	5.64
P41744	$195,681	$106,760	1.83	$95,080	$94,018	1.01
P41745	$40,092	$43,653	0.92	$20,046	$37,201	0.54
P41746	$215,893	$37,509	5.76	$107,947	$31,718	3.40
P41750	$296,446	$24,439	12.13	$144,029	$23,410	6.15
P41782	$18,075	$1,342	13.47	$8,533	$1,320	6.47
P41799	$849,476	$84,135	10.10	$408,906	$82,258	4.97
P41800	$164,605	$58,547	2.81	$79,755	$58,257	1.37
P41801	$25,876	$1,343	19.26	$12,467	$1,320	9.44
P41825	$119,281	$7,032	16.96	$58,446	$6,962	8.40
P41828	$1,018,876	$290,021	3.51	$494,552	$309,433	1.60
P41829	$938,042	$100,702	9.32	$453,465	$98,684	4.60
P41830	$926,150	$473,584	1.96	$444,258	$498,222	0.89
P41847	$401,369	$42,371	9.47	$193,851	$42,015	4.61
P41850	$639,201	$58,785	10.87	$310,573	$57,359	5.41
P41851	$499,412	$48,321	10.34	$240,403	$47,248	5.09
P41852	$529,671	$111,851	4.74	$254,484	$96,347	2.64
P41853	$1,039,498	$103,135	10.08	$500,463	$100,833	4.96
P65608	$5,644	$944	5.98	$2,822	$815	3.46
P65609	$11,410	$6,408	1.78	$5,705	$5,342	1.07
P65622	$27,326	$48,695	0.56	$13,663	$41,531	0.33
P65623	$23,571	$48,003	0.49	$11,785	$40,941	0.29
P65624	$40,456	$50,078	0.81	$20,228	$42,710	0.47
P65625	$20,446	$47,035	0.43	$10,223	$40,115	0.25
P65626	$50,606	$60,868	0.83	$25,303	$51,913	0.49
P65627	$42,224	$57,825	0.73	$21,112	$49,318	0.43
P65628	$51,016	$91,740	0.56	$25,152	$80,892	0.31
P65630	$86,127	$188,514	0.46	$40,181	$173,514	0.23
P65631	$31,228	$81,898	0.38	$15,234	$72,129	0.21
P65632	$85,820	$99,580	0.86	$39,834	$87,696	0.45
P65633	$33,777	$92,437	0.37	$16,416	$81,508	0.20
P65634	$41,401	$103,840	0.40	$19,997	$91,669	0.22
P65635	$40,583	$103,690	0.39	$19,606	$91,519	0.21
P65636	$46,125	$98,786	0.47	$22,165	$87,327	0.25
P65637	$24,177	$43,772	0.55	$12,088	$5,851	2.07
P65638	$36,029	$158,605	0.23	$17,696	$139,496	0.13

	Three Percent Discount			Seven Percent Discount		
Parcel	**Benefit**	**Cost**	**TBCR**	**Benefit**	**Cost**	**TBCR**
P65639	$35,903	$107,096	0.34	$17,747	$94,559	0.19
P65640	$12,331	$32,290	0.38	$6,165	$27,358	0.23
P65641	$17,902	$30,768	0.58	$8,951	$26,060	0.34
P65642	$27,447	$34,780	0.79	$13,723	$29,482	0.47
P65643	$14,608	$38,653	0.38	$7,304	$32,785	0.22
P65644	$22,311	$39,760	0.56	$11,156	$33,729	0.33
P65645	$20,034	$41,282	0.49	$10,017	$35,027	0.29
P65646	$20,809	$53,239	0.39	$10,405	$40,690	0.26
P65647	$17,636	$40,452	0.44	$8,818	$34,319	0.26
P65648	$26,429	$42,803	0.62	$13,215	$36,325	0.36
P65649	$39,099	$42,803	0.91	$19,550	$36,325	0.54
P65650	$34,133	$44,740	0.76	$17,067	$37,976	0.45
P65651	$35,659	$45,847	0.78	$17,830	$38,920	0.46
P65652	$34,593	$44,602	0.78	$17,297	$37,859	0.46
P65653	$34,351	$41,225	0.83	$17,176	$35,159	0.49
P65654	$75,127	$69,384	1.08	$35,262	$60,951	0.58
P65655	$63,155	$47,092	1.34	$31,577	$39,982	0.79
P65656	$56,740	$58,570	0.97	$27,651	$51,671	0.54
P65657	$79,192	$53,537	1.48	$39,596	$45,660	0.87
Subtotal	$68,832,819	$16,906,573		$33,489,944	$15,703,688	
Unallocated						
Fresh water habitat	$4,285,945			$2,142,973		
Road and Levee Maintenance Cost Savings	$10,300,000			$4,200,000		
Road and Infrastructure Removal Costs		$410,000			$410,000	
Total	**$83,418,764**	**$17,316,573**	**4.82**	**$39,832,917**	**$16,113,688**	**2.47**

3 Traditional Benefit Cost Analysis

The primary 'traditional benefit' of the buy-out is the costs avoided to: 1) maintain levees and 2) repair flood damage to homes, farm buildings and farm fields when levees fail. Eliminating the need to pay for flood management, in the form of levee repairs, and cleaning up and repairing flood damage is perceived as a significant benefit.

The primary cost of the buy-out would come from having to buy the homes and lands. Additionally, Skagit County would lose the property tax revenue that is currently collected from land owners within the study area.

This section provides the details of the approach used to 1) estimate the benefits and costs and 2) develop the benefit cost ratio (BCR). Prior to discussing those details is a summary of the results of the BCA.

3.1 BCA Results Summary

The BCA considers each benefit (non-ecological) and cost for each parcel, as well as benefits and costs that are not allocated to a specific parcel. When benefits of a study are greater than the estimated study costs, then the ratio of benefits to cost (benefits/costs), or BCR, is greater than 1.0. Of the 144 parcels in the buy-out study, the BCR of between 51 and 61 parcels is estimated to be greater than 1.0. The range of BCRs is between 30 and 0. The total BCR, adding the unallocated benefits and costs to the parcel-specific benefits and costs is estimated to be between 1.0 percent and 2.1 percent.

Details about the approach used to estimate the BCRs are provided in the following sections. Additionally, Table 3 presents the benefits, costs and BCR for each individual parcel in the study area.

Table 3. Traditional BCA Summary Results ($2005)

Three Percent Discount Rate			Seven Percent Discount Rate		
Benefits ($ millions)	Costs ($ millions)	BCR B/C	Benefits ($ millions)	Costs ($ millions)	BCR B/C
$35.8	$16.9	2.11	$16.0	$15.8	1.02

3.2 BCA Approach

The steps to develop the BCA are as follows:

- Define the categories of benefits and costs appropriate to the study
- Estimate the *expected annual* benefit/cost by category
- Define the study life
- Select a discount rate appropriate for the study
- Calculate the present value of the benefits and costs by discounting the expected annual benefit/cost estimates, for each year of the study life

Each of these steps is described below in more detail.

3.2.1 Categories of Study Benefits and Costs

The categories of traditional benefits and costs for the BCA of the study are shown in Table 4. The categories are grouped into parcel-specific categories and those where the present value is too difficult to allocate to a parcel. The latter are categorized as unallocated. The study benefit and cost categories are defined below.

Table 4. Categories of Traditional Benefits and Costs for the BCA

Level of Analysis		
	Benefit and Cost Category	**Description**
Parcel Level		
Benefits	Traditional avoided costs of flood includes:	
	Building damage	Damage to homes and out-builds that result from a flood
	Agricultural damage	Damage to farm fields and agricultural operations that result from a flood
	Loss of function	Business income, such as farm sales that are lost to a flood
	Displacement	The costs associated with flood victims housing costs while they are waiting to return to their homes
Costs	Property acquisition	Cost of purchasing the private property from land owners
	Lost tax revenue	Loss of the annual tax revenue currently paid to the County from the landowners
Unallocated		
Benefits	Road maintenance	Annual cost of maintaining the roads on the island plus the cost of repairing the roads following a flood
	Levee maintenance	Annual cost of maintaining the roads on the island plus the cost of repairing the roads following a flood
Costs	Removal of infrastructure	Cost of removing the residences, farm buildings, roads, etc. after the parcels are purchased

Source: Northern Economics, Inc., 2007

3.2.1.1 Benefits

Benefits for hazard mitigation studies are the avoided costs associated with future damages and losses. To avoid future flooding damages and costs, private properties would be purchased and residents would relocate. Since the proposed buy-out would result in the permanent removal of residences and infrastructure from Cockreham Island, benefits (or avoided costs) accrue over several years into the future.

Benefit categories include: avoided physical damages (buildings and agricultural lands), avoided loss of function costs, and avoided public expenditures. The Federal Emergency Management Agency describes these categories as follows (FEMA, 2005b).

Avoided physical damages are usually the easiest benefits to identify and calculate. Physical damages are simply the costs to repair or replace damaged residences and buildings due to flooding events, including building structure, contents, and supportive infrastructure. These costs are estimated by the study team from information provided by local building contractors and through use of the FEMA BCA model. Physical damages may include loss of crops and costs for replacing crops, or general damage to pasture lands. Physical damage to fields is estimated by the study team based upon information gathered on agricultural production and the likely damage under different flooding scenarios.

Avoided loss-of-function costs are estimated from decreases in the losses, costs, and direct economic impacts that occur when physical damages are severe enough to interrupt the function of a building or parcel of land. For a building, loss-of-function impacts may include the costs for temporary quarters while repairs are made. For utilities, loss of function means a loss of service or a reduction in the level of service. For a road or bridge, loss of function means closures of a road or bridge, or delays arising from a reduction in traffic capacity of a damaged road or bridge. For land, such as agriculture or recreation land, loss of function means loss of production and is calculated on a per-acre unit dependent upon the agricultural use of land.

Avoided public expenditures include expenses related to specific flood events and expenditures related to maintenance and repairs. For example, road maintenance is an ongoing expense that would no longer exist if Cockreham Island residents were bought out and the land was converted back to its natural state. Public expenditures are also made for maintenance and repair of the river levee.

3.2.1.2 Costs

The costs for the proposed buy-out are related to the costs of purchasing the property and removing buildings and infrastructure, foregone revenue, and the loss in tax

revenue. The loss in tax revenue occurs as a consequence of purchasing existing farm land so that Skagit County will no longer collect annual property taxes.

The cost of property is the anticipated cost of purchasing privately owned property on Cockreham Island. Infrastructure removal costs include the cost of demolishing buildings and infrastructure. Property tax losses are the tax revenues which would not be collected if the proposed study occurs.

3.2.2 Determining the Study Life

The study life is assumed to be 100 years. Compared to other studies, this is a relatively long evaluation period. This time period was selected because of the permanency of the proposed buy-out of properties and removal of residences and infrastructure.

3.2.3 Discount Rate

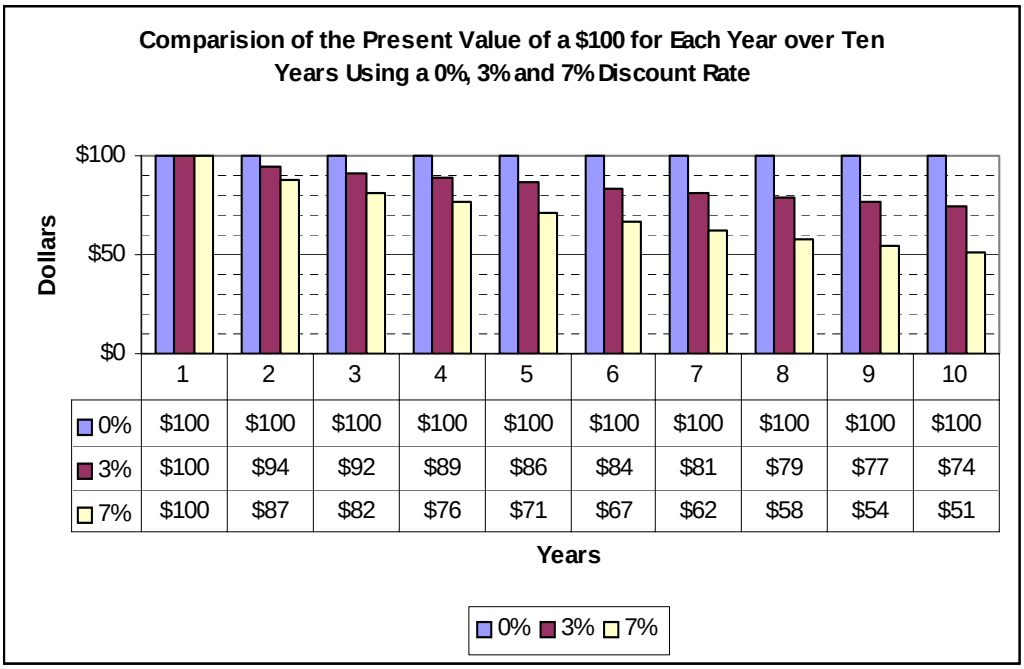
Discount rates are used to compute the present value of future benefits and costs (see call-out box, *How Discount Rates Effect Present Value*). Two discount rates were used for the BCA. FEMA requires the use of a 7.0 percent discount rate for its grant applications (FEMA, 2005b). The FEMA rate of 7.0 percent closely approximates the pre-tax return on private investments in recent years; this rate is usually considered a maximum for evaluating federal projects, because the rate of return on public projects is generally assumed to be lower than the rate on private projects.

This relatively high rate discounts future benefits relatively rapidly. This rapid discounting may not be appropriate for the study, since it implies that the study proponents are discounting future generations' value of the benefits. As such, the study team also calculated the present value of benefits using a 3.0 percent discount rate for informational purposes. Currently, the OMB specifies that a 3.0 percent discount rate is appropriate for all federal projects that are not water resource related projects.

How Discount Rates Effect Present Value

In a benefit-cost analysis, a discount rate is used to calculate a value today (the present value) of future benefits. Calculating the present value of future benefits and costs allows for meaningful comparisons of future benefits and costs over the life of a project.

The magnitude of the discount rate has an impact on the benefit-cost analysis. A high discount rate reduces future values relatively more than a lower discount rate. For example, the figure below shows the present value of $100, for each year (1 through 10), using three different discount rates: 0%, 3% and 7%. Using a 0% discount rate, the present value of $100 never changes over the 10-year period. The total present value of a stream of $100 payments over a 10-year period using a 0% discount rate is $1,000 (the sum of $100 over 10 years). Using a 3% discount rate, the present value of $100 decreases each year, valued at $74 by year 10. The total present value of a stream of $100 payments over a 10-year period using a 3% discount rate is $856. Using a 7% discount rate, the present value of the $100 decreases every year, valued at $51 by year 10. The total present value of a stream of $100 payments over a 10-year period using a 7% discount rate is $708.



	1	2	3	4	5	6	7	8	9	10
0%	$100	$100	$100	$100	$100	$100	$100	$100	$100	$100
3%	$100	$94	$92	$89	$86	$84	$81	$79	$77	$74
7%	$100	$87	$82	$76	$71	$67	$62	$58	$54	$51

3.2.4 Calculating the Present Value of Estimated Costs and Benefits

The purpose of the discussion is to explain how the expected annual value is used to create the present value. The present value of the benefits and costs is calculated by first estimating the expected annual benefits and costs. The methodology used to estimate the expected annual benefit and cost for each category follows in the next section. The expected annual value is discounted to 2005 dollars, using the appropriate rate, for every year of the study's life. The present value of the expected annual benefits can then be added together. The result is one number for each category of

benefit or cost, representing the present value of the benefits of that category over the study's life.

3.3 Calculating the BCA

Three different models/methods were used to calculate the benefits and costs by category. Table 5 lists the model/method that was used in the calculations. In the following subsections of the report, each of three models/methods shown in Table 5 are described in detail. Subsection 3.3.1 describes the use of the FEMA model, used to estimate the parcel-level benefits and the unallocated costs of infrastructure removal. Subsection 3.3.2, titled Skagit Count Government, describes how information gathered from the Skagit County was used to estimate parcel-specific costs of property acquisition, lost tax revenue as well as the unallocated avoided costs of road and levee maintenance and infrastructure removal. Lastly, the subsection 3.3.3, entitled 'Agriculture' describes the method used to estimate loss of function.

Table 5. Methods/Models of the BCA Calculation Used for Various Categories of Benefit and Cost

Level of Analysis		Model/Data Source		
	Benefit and Cost Category	FEMA Model	Skagit County Government Data	Agriculture Model
Parcel Level				
Benefits	Traditional avoided cost of flood includes:			
	Building damage	X		
	Agricultural damage	X		
	Loss of function			X
	Displacement	X		
Costs	Estimated property value	X	X	
	Lost tax revenue		X	
Unallocated				
Benefits	Road maintenance		X	
	Levee maintenance		X	
Costs	Removal of infrastructure	X	X	

3.3.1 FEMA Model

FEMA has BCA software available to assist persons and organizations with analyzing the benefits and costs of proposed hazard mitigation projects. The FEMA BCA Full Data model was used by the study team as part of the BCA for assessing the benefits of

structures on Cockreham Island. According to the Skagit County Assessor's office, there are 50 parcels with structures on Cockreham Island.

The FEMA Full Data Module for parcel-level benefit cost analysis uses engineering data on the probability and severity of flooding, along with data on building value and repair costs, to estimate damages and losses before and after the mitigation activity.

The FEMA Full Data Module analysis is dependent upon the following factors:

- Damages and losses from flooding without the mitigation activity
- Effectiveness of the mitigation activity in reducing those damages and losses
- Frequency that the house is flooded and the depth of the flood water
- Discount rate (the FEMA approved discount rate is seven percent, while the OMB approved discount rate is three percent)
- Mitigation activity useful lifetime
- Mitigation costs

Flood depth is the number of feet of water above the ground level of the parcel or the top of the lowest finished floor of a house on the parcel. Annual probability of flooding is the likelihood that flooding will occur at each flood level. Damages and losses are an estimate of the total damages and losses that are estimated at each flood level. The expected annual damages and losses consider both the damages and losses at the various flood depths and annual probability that flooding will occur at each depth. Expected annual damages and losses are calculated by multiplying the annual probability of each flood depth and the associated damages and losses at each flood level.

The sum of the expected annual damages and losses is the best estimate of expected annual damages and losses, accounting for the expected project life, and the net present value of future benefits.[2] Expected annual damages and losses do not actually occur every year, but are rather an estimate of the longer term average per year over the life of the study.

[2] For the building elevation example, the expected Project lifetime is 30 years and the discount rate is seven percent- the FEMA-approved discount rate.

3.3.1.1 Example of FEMA BCA Calculation

Table 6 provides an example of the data used by the FEMA model for calculating the benefits and costs of removing a structure from Cockreham Island. This example parcel is a residential parcel including a house with no out buildings and no agricultural land.

Table 6. Data used for Analysis, Parcel Example: P65639 ($2005)

Data Used for this Analysis	Value
Building Replacement Value ($/sf)	$69.36
Total Floor Area (square feet)	284
Total Building Replacement Value	$19,698
Demolition Threshold Damage Percentage	50%
Total Contents Value	$5,909
Total Displacement Costs ($/month)	$784
One-Time Displacement Costs($)	$500
Total Mitigation Costs	$83,480
Discount Rate	3.00%
Project Useful Life (years)	100

Source: FEMA Full Data Module as used by Northern Economics, Inc. 2006.

The data used for the analysis are based upon a combination of data assumptions developed by FEMA and presented in the FEMA Data Documentation Template included in the FEMA Mitigation Benefit-Cost Analysis Toolkit (FEMA, 2005a), and parcel specific information collected by NEI from GeoEngineers and the Skagit County Assessors Office (2005).

Data values and relevant background information include the following:

- The building replacement value is estimated at $69.36/square foot based upon a comparison of the assessed value of new homes built in Skagit County in 2005 and their square footages (Skagit County Assessors Office, 2005). For outbuildings, the replacement is calculated at $14.09/square foot based upon a comparison of the assessed value of new outbuildings built in Skagit County in 2005 and their square footages.
- The total floor area is the total square feet of the residence or building.
- The total building replacement value is based upon the $/square foot building replacement value and the total floor area.
- The total contents value is an assumed value of 30 percent of the total building replacement value. The 30 percent assumption is based upon guidance provided by the FEMA Data Documentation Template.

- The total displacement costs are the costs borne by occupants during the time when a building is flooded and they are unable to occupy it. Based upon information gathered from local realtors and guidance provided by the FEMA Documentation Template, residential rentals are estimated at $1/square foot, and outbuilding rentals are estimated at $.69/square foot.
- Total mitigation costs include the cost of purchasing the subject parcel and the cost of demolishment of all buildings from the parcel (cost of demolishment is described in section3.3.1.2).
- Two discount rates were used for the study: three percent (as shown in Table 6), and seven percent. Three percent is the discount rate approved by the OMB, while seven percent discount rate is recommended by FEMA.

Flood hazard data are used for estimating damages associated with various flooding levels. This information, for the parcel example P65639 is shown in Table 7. Flood frequency is the annual probability of various flood events. For example, flood frequency 10 is a level of flooding expected to occur on average every 10 years. Discharge is the rate of flow for the various flood years. This information was provided to NEI by GeoEngineers. Flood elevation is the expected level of flooding in feet associated with various flood years.

Table 7. Flood Hazard Data, Parcel Example: P65639 ($2005)

Flood Frequency (years)	Discharge (cfs)	Flood Elevation (feet above)
10	119,600	86.68
50	190,687	90.56
100	232,778	92.45
500	284,160	94.34

Source: FEMA BCA Full Data Module as used by Northern Economics, Inc. 2006

Table 8 shows the model inputs used for the FEMA analysis of building flood damage by flood elevation and building elevation. Flood elevation is the height of the flood in feet above mean sea level). Building DDF is the building depth-damage function and describes the percent building space which is flooded at each flood elevation. Contents DDF is the contents depth-damage function and is an estimate of the percent of contents damaged at each flooding elevation. Displacement time is the number of days residents are expected to be displaced dependent upon the flood depth. Project mitigation effectiveness is a measure of the effectiveness of the proposed buy-out in reducing flooding costs; in the case of a property buy-out, the mitigation is 100 percent effective, because the damage to residences, buildings, and agricultural land

would no longer happen if a property buy-out occurs. Annual number of floods is dependent upon probability of flooding by flood depth.

Table 8. Data that Vary by Flood Elevation, Parcel Example: P65639

Flood Depth (ft)	Building DDF Percent	Contents DDF Percent	Displacement Time (Days)	Mitigation Effectiveness Percent	Annual Number of Floods
-2	0	0	0	N/A	1.243E-02
-1	0	0	0	N/A	8.034E-03
0	9	13.5	0	100	5.813E-03
1	14	21	62	100	5.271E-03
2	22	33	126	100	4.274E-03
3	27	40.5	166	100	1.689E-03
4	29	43.5	182	100	7.289E-04
5	30	45	190	100	3.381E-04
6	40	60	270	100	1.666E-04
7	43	64.5	294	100	8.646E-05
8	44	66	302	100	4.690E-05
>8	45	67.5	310	100	6.802E-05

Source: FEMA BCA Full Data Module as used by Northern Economics, Inc. 2006.

Table 9 and Table 10 show the BCA results according to the FEMA Full Data Module for example parcel P65639. This information **does not** include costs from loss of tax revenues or benefits from foregone agricultural losses. The expected annual damages before mitigation are the annual cost of damages without the property buy-out. The expected annual damages after mitigation are the expected cost of damages on an annual basis after the property buy-out has occurred. These damages are $0 given that the building will have been removed. Expected annual benefits are the cost savings from not having flood damage. Lastly, the present value of annual benefits is an estimate of the total present value from the buy-out of the example parcel.

Table 9. Summary of Expected Damages and Benefits, Parcel Example: P65639 ($2005)

Type	Expected Annual Damages Before Mitigation	Expected Annual Damages After Mitigation	Expected Annual Benefits	Present Value of Annual Benefits
Building Damages	$62	$0	$62	$1,945
Contents Damages	$28	$0	$28	$875
Displacement Costs	$44	$0	$44	$1,396
Business Income Lost	$0	$0	$0	$0
Rental Income Lost	$0	$0	$0	$0
Public Services Lost	$0	$0	$0	$0
Total Losses & Benefits	$133	$0	$133	$4,217

Source: FEMA BCA Full Data Module as used by Northern Economics, Inc. 2006

Table 10. Summary of Benefits and Costs, Parcel Example: P65639 ($2005)

Benefits and Costs	Value
Study Benefits	$4,217
Study Costs[1]	$83,480
Benefits minus Costs	($79,263)
Benefit-Cost Ratio	0.05

Source: FEMA BCA Full Riverine Software as used by Northern Economics, Inc. 2006.
Note: [1]these estimates are based solely on FEMA model inputs and do not include property tax losses (addressed in Section 3.3.2.3). If the NPV of future property tax losses ($23,616) are included in the summary of benefits and costs, the total Study costs $107,096 and the BCR is .04.

3.3.1.2 Cost of Demolition

The per-parcel cost of demolishing buildings on Cockreham Island depends largely on the total square footage of the parcel's building, not on the size of the parcel. Demolition costs for each parcel on Cockreham Island with infrastructure are shown in Table 11. Building demolition costs approximately $2 per square foot plus a lump sum overhead cost for demolishing each building (Leonard, Boudinot, and Skodje, 2006). To remove all buildings from Cockreham Island, approximately 54,300 square feet of residential space and 343,300 square feet of non-residential "outbuildings" would need to be removed. The estimated cost is $2.09 per square foot.

Table 11. Demolition Costs for Parcels with Infrastructure ($2005)

Parcel	Residences (square feet)	Outbuilding (Square Feet)	Total Square Feet	Demolition Costs
P114772	1,068	3,360	4,428	$11,120
P41173	0	264	264	$1,528
P41219	1,432	94,944	96,376	$189,552
P41227	0	5,400	5,400	$11,800
P41236	2,520	2,328	4,848	$9,056
P41237	2,576	11,036	13,612	$26,472
P41238	1,224	6,443	7,667	$17,286
P41246	1,824	71,992	73,816	$88,384
P41249	1,430	1,560	2,990	$7,520
P41250	0	24,813	24,813	$50,626
P41256	1,296	576	1,872	$3,400
P41258	1,704	2,920	4,624	$10,240
P41260	1,190	864	2,054	$6,128
P41263	1,224	1,920	3,144	$8,240
P41265	1,826	2,160	3,986	$8,720
P41266	1,740	0	1,740	$6,880
P41271	1,152	0	1,152	$3,400
P41273	1,756	2,080	3,836	$8,560
P41276	0	160	160	$1,320
P41278	912	0	912	$2,400
P41281	1,378	2,932	4,310	$10,264
P41283	2,700	8,185	10,885	$20,770
P41286	1,692	25,100	26,792	$93,700
P41289	1,716	11,532	13,248	$27,464
P41290	1,620	7,880	9,500	$20,160
P41294	2,344	360	2,704	$5,120
P41295	1,436	2,512	3,948	$9,424
P41298	960	2,184	3,144	$7,768
P41300	1,824	4,080	5,904	$11,560
P41302	1,922	0	1,922	$7,600
P41309	0	1,560	1,560	$4,120
P41316	1,244	0	1,244	$5,888
P41542	1,336	3,740	5,076	$11,880
P41543	1,350	0	1,350	$6,100
P41744	0	384	384	$1,768
P41828	2,088	1,144	3,232	$6,688
P41830	2,176	32,976	35,152	$70,352
P41852	0	96	96	$1,192
P65628	0	508	508	$2,016
P65630	1,280	432	1,712	$5,264
P65631	0	48	48	$1,096

Parcel	Residences (square feet)	Outbuilding (Square Feet)	Total Square Feet	Demolition Costs
P65632	1,296	368	1,664	$4,136
P65633	0	520	520	$2,040
P65634	0	1087	1,087	$3,174
P65635	0	1012	1,012	$3,024
P65636	0	1506	1,506	$4,012
P65638	796	0	796	$4,992
P65639	284	0	284	$3,968
P65654	0	120	120	$1,240
P65656	0	252	252	$1,504
Total	54,316	343,338	397,654	$830,916

Source: Leonard, Boudinot, and Skodje, 2006.

Road removal and demolition for all of Cockreham Island is estimated to cost $373,034 and power line and pole removal is estimated to cost $40,000. The total estimated cost for demolition of buildings, roads, and electrical infrastructure is $1.24 million. Road and electrical line removal costs are shown in Table 12.

Table 12. Road and Electricity Infrastructure Removal Costs ($2005)

Activity	Cost
Road removal costs	$373,034
Power line and pole removal costs	$40,000
Total	$413,034

Source: Leonard, Boudinot, and Skodje, 2006.

3.3.2 Skagit County Government

This section describes the information gathered from the Skagit County government for the BCA, as well as some of the costs and benefits associated with this information. Skagit County government refers to the agencies and districts as a whole, which could be impacted by the proposed buy-out.

The benefits of the proposed buy-out are cost-savings related to eliminating public expenditures on Cockreham Island associated with both flooding events and continued maintenance of public infrastructure. The costs of the buy-out are lost tax revenues, the cost of removal of buildings and infrastructure (including roads) on Cockreham Island, and property acquisition. At the time of this study, it is not know who the purchaser of property would be; it is not assumed that Skagit County is the purchaser.

Table 13. Benefits and Cost Related to Skagit County ($2005)

Benefits and Costs	Three Percent Discount Rate	Seven Percent Discount Rate
Benefits		
Avoided Road and Levee Maintenance	$10.1 million	$4.2 million
Costs		
Estimated property value	$12.7 million	$12.7 million
Foregone Tax Revenue	$2.9 million	$1.4 million
Demolition of Buildings, Roads, and Electrical Infrastructure	$1.2 million	$1.2 million

Source: Northern Economics, Inc., 2006

The following sections describe the analysis completed for estimating costs and benefits related to infrastructure, property values, and property taxes.

3.3.2.1 Infrastructure

The analysis of infrastructure costs relies on road and levee maintenance cost data provided by the Skagit County Public Works (SCPW). The SCPW supplied the study team with maintenance and repair costs from 1975 through 2005 for the Cockreham Island roads that would be removed, or no longer subject to repairs from flooding events, under the proposed buy-out. These roads included Cockreham Island Road, Cockreham Lane, Lyman Hamilton Highway, North Lyman Ferry Road, River Tract Lane, Snider Road, and West River Tract Lane. In addition, the South Skagit Highway would likely no longer need flood-related repairs if the buy-out occurs; therefore the benefits of avoiding flood-related damages on that road are also included. SCPW also provided expenditures related to the maintenance and repair of the Cockreham Island Levee.

The cost analysis relies on producer price index data from the U.S. Bureau of Labor Statistics to account for the effect of inflation over the 1975 through 2005 time period. The producer price index for construction is used because of the type of goods that are produced through repair and construction (SCPW of Labor, 2006).

Analysis

The analysis of road and levee maintenance expenditures includes the following steps:

- Identify costs using data provided by SCPW and the Skagit County Assessors Office
- Determine whether each cost was related to flooding or levee-related work or general maintenance based on notes and comments provided by SCPW

- Adjust costs incurred before 2005 for inflation using the producer price index so that all costs are expressed in 2005 dollars
- Analyze the data for differences between recent cost trends and trends for costs incurred in the past
- Study future savings expressed in 2005 dollars over a 100-year time frame associated with road and levee abandonment

Results

Between 1975 and 2005, SCPW spent $4.2 million ($US 2005) on road/levee maintenance and repair (see Table 14). The analysis estimates that approximately $0.9 million of this amount was spent on general maintenance of roads on Cockreham Island (excluding South Skagit Highway), while levee and flood-related expenditures accounted for $3.3 million (including South Skagit Highway flood-related repairs). The study was unable to assign roughly $0.1 million to either category because of a lack of information.

Table 14. Estimated Flood and Non-Flood Related Expenses, 1975 through 2005 ($US 2005)

Year	Unrelated Costs	Unknown Costs	Flood/Levee Related Costs	Total Costs
1975	$12,000	$0	$145,000	$157,000
1976	$11,200	$0	$0	$11,200
1977	$10,400	$0	$0	$10,400
1978	$9,400	$0	$0	$9,400
1979	$8,500	$0	$0	$8,500
1980	$7,900	$0	$299,900	$307,800
1981	$25,100	$22,900	$478,000	$526,000
1982	$100	$0	$0	$100
1983	$1,600	$0	$0	$1,600
1984	$2,200	$300	$0	$2,500
1985	$21,000	$0	$0	$21,000
1986	$2,800	$400	$0	$3,200
1987	$8,000	$0	$0	$8,000
1988	$23,500	$0	$0	$23,500
1989	$2,100	$7,600	$10,400	$20,100
1990	$200	$39,800	$0	$40,000
1991	$3,700	$28,700	$277,500	$309,900
1992	$3,900	$0	$0	$3,900
1993	$500	$0	$0	$500
1994	$5,200	$0	$0	$5,200
1995	$266,500	$0	$1,156,700	$1,423,200
1996	$9,600	$0	$175,100	$184,700
1997	$307,700	$0	$0	$307,700
1998	$0	$0	$32,900	$32,900
1999	$1,000	$0	$0	$1,000
2000	$5,600	$0	$0	$5,600
2001	$6,700	$0	$0	$6,700
2002	$2,100	$0	$0	$2,100
2003	$16,000	$0	$91,300	$107,300
2004	$500	$0	$164,400	$164,900
2005	$28,000	$0	$491,900	$519,900
Grand Total	$802,900	$99,700	$3,323,200	$4,225,800
Average	$25,900	$3,200	$107,200	$136,300
Average 1975-1984	$8,800	$2,300	$92,300	$103,400
Average 1985-1994	$7,100	$7,700	$28,800	$43,600
Average 1995-2005	$58,500	$0	$192,000	$250,500

Source: Northern Economics, Inc.' estimates based on data from SCPW, 2005.

Over the entire period analyzed, SCPW spent an average of $25,900 per year on expenses unrelated to flood or levee costs and $107,200 per year on flood or levee-related expenses (see Table 14). The year with the highest expenditures was 1995, due to major repairs on the Cockreham Island levee and the Lyman Hamilton Highway. The average yearly costs not related to flood events (e.g., general maintenance) have risen steadily, even after accounting for inflation. Between 1975 and 1984 the average yearly

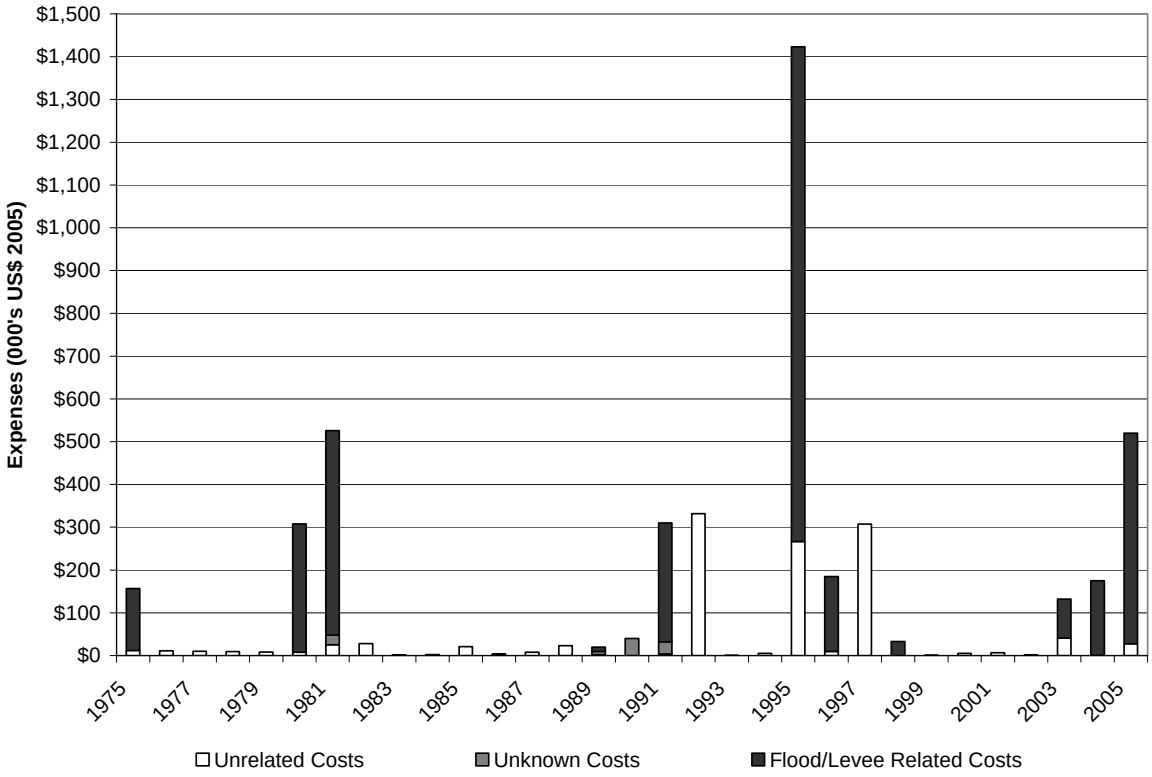
costs not related to flood or the levee repairs was $8,800 while between 1985 and 1994 they were $7,100 per year. Between 1995 and 2005, those average yearly costs rose to $58,500.

Based on all data provided by SCPW for all affected roads (including the South Skagit Highway), the analysis estimates that the unrelated costs rose at an annualized rate of approximately 2.1 percent after accounting for inflation. The benefits model includes this estimate and assumes that the increasing costs post-inflation would continue into the future.

Flood and levee-related costs also increased between 1975 and 2005, but given the unpredictable nature of flooding, it is hard to say whether this pattern will continue in the future. Annualized costs could drop if the frequency of flood events fell. For example, there were relatively few flood events between 1985 and 1994 and annualized costs dropped to $28,800 per year from the $92,300 per year seen between 1975 and 1984. However, the frequency of flood events and damages has increased in the last decade and current annualized costs for the 1995 to 2005 period were $192,000 per year.

While significant year-to-year variation exists in both categories, the unrelated expenses category appears to be less variable than the flood and levee-related expense category, which tends to be driven by flood events. For example, there are many years when there are no floods or levee-related expenses, but expenses in this category tend to spike in the year of a flood event and for several years afterward. These spikes can be seen in the data around the time of the 1975, 1980/1981, 1990, 1995, and 2003 flood events (see Figure 4).

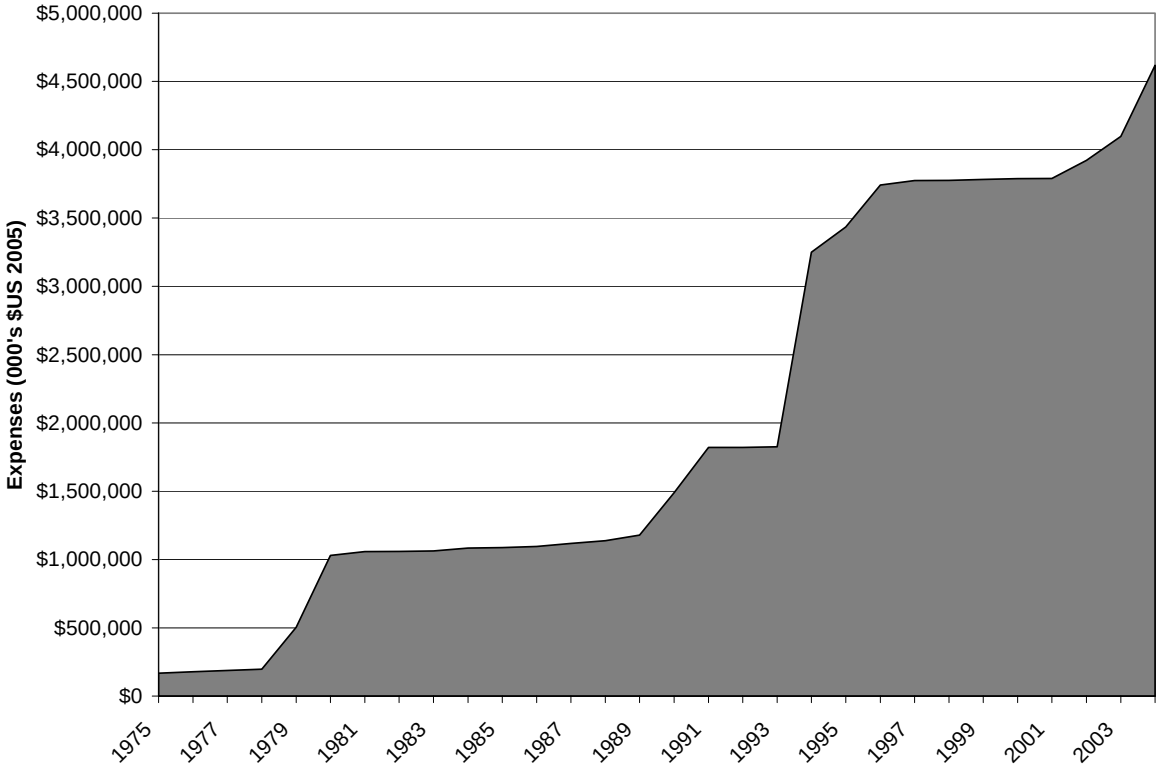
Figure 4. Estimated Flood and Non-Flood Related Expenses, 1975-2005



Source: Northern Economics, Inc.' estimates based on data from SCPW, 2005.

As shown in Figure 5, the total amount spent on Cockreham Island road maintenance and flood/levee repairs tends to increase gradually over years without flood events and then increases dramatically after years with flood events as the county government absorbs the costs associated with flood repair. Figure 5 shows large jumps in total historical expenditures after the 1979/1980, 1990, 1995, and 2003 flood events.

Figure 5. Cumulative Amount Spent, 1975-2005



Source: Northern Economics, Inc.' estimates based on data from SCPW, 2005.

Given the increasing cost trend displayed by the data, the analysis uses the 1995 to 2005 average costs to project future benefits. The costs average $58,500 per year for non-flood or levee-related expenses and $192,000 per year for flood and levee-related expenses. Over a 100-year time frame, if the county did not have to maintain the roads or repair flood-related damages, it would save between $4.2 million and $10.1 million, depending on the assumed discount rate. Table 15 shows how the assumed discount rate affects the results of the analysis. Again, a 7.0 percent discount rate is required by FEMA, while OMB currently specifies that agencies use a 3.0 percent discount rate for projects expected to last 30 years or longer.

Table 15. Estimated Net Present Value of Reduced Expenditures

Expense Averages	Annual Unrelated Expenses	Annual Related Expenses	Three Percent Discount Rate	Seven Percent Discount Rate
1995-2005	$58,400	$192,000	$10.1 Million	$4.2 Million

Source: Northern Economics, Inc.' estimates based on data from SCPW, 2005.

The wide difference in the estimates noted in Table 15 results from the use of substantially different discount rates and their application over a long time frame. For example, as shown in Table 16, the proposed buy-out would save the county approximately $250,500 per year in forgone maintenance and repair expenditures. In the first year of the study, that value in $US 2005 dollars is the same. However, the different discount rates value those savings differently as time progresses. In year 100, the three percent discount rate values the savings at $34,400 in current 2005 dollars while the seven percent rate values the savings at just $800 in current dollars. Hence, the net effect of the FEMA mandate to use a seven percent discount rate is to place greater value on savings that occur closer to the present time than savings that occur farther into the future. Under this formula, projects that produce "front-loaded" benefits may be preferred over a similar project that provides a "constant" or "increasing" stream of future benefits.

Table 16. Estimated Net Present Value of Reduced Expenditures

Study Year	Three Percent Discount Rate	Seven Percent Discount Rate
1	$250,500	$250,500
5	$227,100	$194,800
10	$201,200	$142,500
15	$178,600	$104,400
20	$158,900	$76,700
25	$141,700	$56,400
30	$126,600	$41,600
35	$113,400	$30,800
40	$101,900	$22,800
45	$91,800	$16,900
50	$82,800	$12,600
55	$75,000	$9,400
60	$68,100	$7,000
65	$61,900	$5,300
70	$56,500	$4,000
75	$51,700	$3,000
80	$47,400	$2,300
85	$43,600	$1,700
90	$40,200	$1,300
95	$37,100	$1,000
100	$34,400	$800

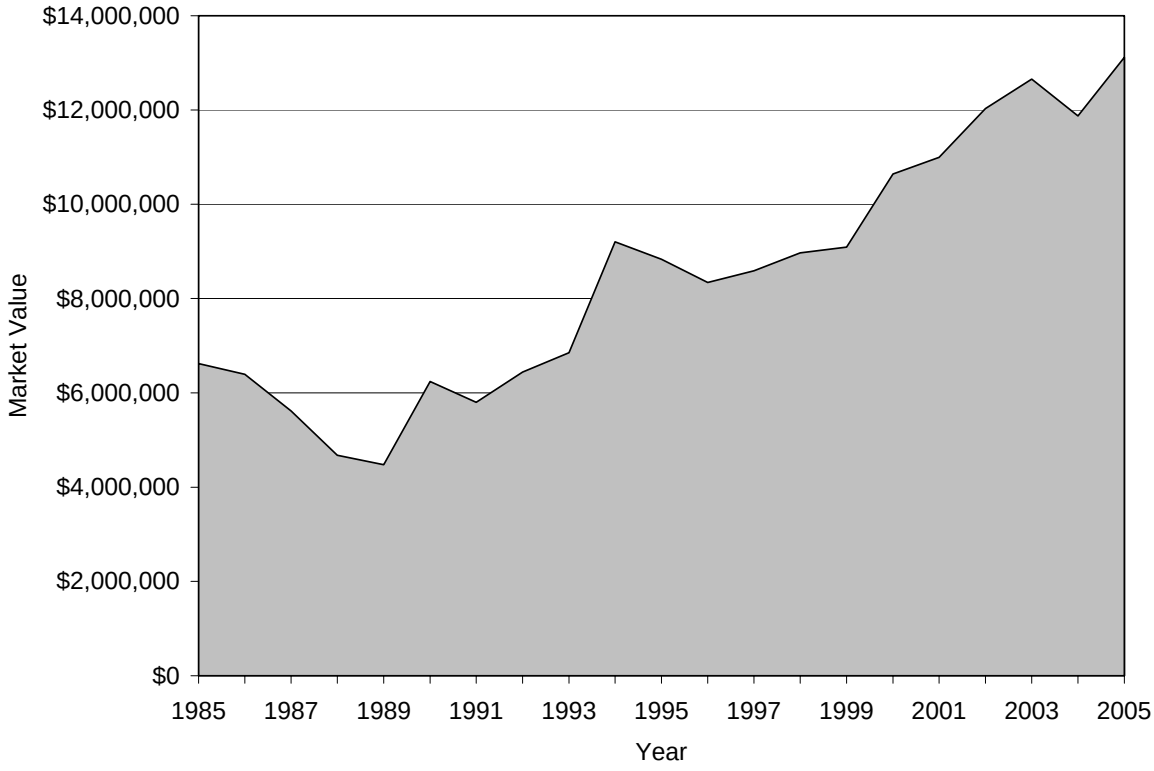
Source: Northern Economics, Inc.' estimates based on data from SCPW, 2005.

3.3.2.2 Property Value

The Skagit County Assessors' office publishes their assessed values of property parcels on their website and maintains records in their office. Assessed "market values" are likely not a close representation of the value a seller would receive from the sale of their property. Through discussions with staff at the Skagit County Assessors office, it was recommended that the rule of thumb of 1.3 times assessed "market value" be used for parcels with structures. In addition, property owners can apply for open space, agriculture, disability or senior exemptions. Such exemptions are reflected in the property's assessed "market value". The reported land market value (available through the Assessor's office) was used to adjust the value of parcels to better estimate possible market values for agricultural, open space, and other land types.

In the last two years (2004 and 2005), property values in Skagit County have increased at the fastest rate since 1990. Figure 6 shows Cockreham Island property values from 1985 through 2005. All property values have been adjusted to 2005 dollars in order to demonstrate how the real value of property has changed over this time period.

Figure 6. Cockreham Island Property Value, 1985 through 2005 ($2005)



Source: Skagit County Assessors Office, 2005.

Based upon information provided by the Skagit County Assessors office, NEI assumed that the market value for properties with structures (primarily residences) on Cockreham Island is approximately 130 percent of the assessed value. Market value for agricultural land was assumed to be the reported land market value, because the appraised value of agricultural land is often exempt to full property tax assessments due to Washington State's Open Space Assessment Act (Washington State SCPW of Revenue, 2005)

Table 17. Cockreham Island Property Market Values ($2005)

	Value of Parcels with Structures	Value of Agricultural and Open Space Land	Total Value
Market Value	$7.73 million	$4.93 million	$12.66 million

Source: Skagit County Assessors Office, 2005.

3.3.2.3 Property Taxes

Data on property taxes paid by Cockreham Island property owners were collected from the Skagit County Assessors Office (Skagit County Assessors, 2005). The Assessors Office database reports the total general tax and special assessments paid per parcel for all of Skagit County. Tax information is available to the public through the Assessor's property database. The Cockreham Island parcels were drawn from the database and the general taxes and special assessment for the applicable taxing districts were totaled for Cockreham Island parcels.

Methodology

The properties under consideration fall into three different Taxing Districts distinguished by levy codes, and are split into general taxes and special assessments. Special assessments varied by their contribution to the Skagit County Drainage Utility, State Forest Fire Protection, and State Fire Fund Fee. Special assessment contributions are not based on Levy Code, so percentage contributions could not be determined from Assessor's Data. The total special assessment contribution from the Cockreham Island properties was $5,178 in 2005. The only difference in the Taxing Districts' general tax contribution was by Fire District.

General tax contributions are divided between County General, County Road, State Levy, Sedro Woolley School Dist, Port District 2, Hospital District 304, Conservation Futures, Fire District 8 & 10, and Skagit County EMS (Medic 1) levies. The 2006 levy rates were used to estimate the contribution of the general tax to the specific levies. The estimates are based on the percentage contribution the individual levies make to the general tax.

The contributions from each Tax District were estimated individually and then summarized in Table 18.

Foregone tax revenues were determined by taking the 2005 general tax and special assessment totals, and individually calculating their net present value for the next 100 years using the specified three percent and seven percent discount rates. These values are totaled and presented in Table 18. The growth rate in real property values was not readily available. Without data to separate increases in value due to improvements from increases in real property values, an accurate prediction of the growth in tax contribution could not be made. Predictions were further complicated by differences in market value and taxable value.

3.3.2.4 Results

Cockreham Island parcel tax information was drawn from the Skagit County Assessor's Office database and compared to Skagit County tax totals. Estimated tax revenues from Cockreham Island properties amount to less than 0.2 percent of total property tax levies raised in Skagit County in 2005.

Estimated taxes paid by Skagit County and Cockreham Island property owners in 2005 are provided in Table 18. The county total is inclusive of Cockreham Island, but both categories are provided in order to show the amount of county taxes paid by Cockreham Island property owners. In total, Cockreham Island properties accounted for approximately $103 thousand in tax revenues out of an estimated $65.322 million in tax revenues paid by county property owners in 2005. In total, Cockreham Island accounted for less than 0.2 percent of total taxes paid by Skagit County landowners.

Tax collected by levy category is also shown. Levy categories include state taxes, Skagit County general fund, County Roads, School District 101, Port District 2, Conservation Future, Medic 1, Hospital District 304, Fire District 8, and Fire District 10. The largest amount of taxes paid by Cockreham Island property owners was to School District 101, which generated approximately $36,400 in tax revenue and accounted for 0.5 percent of taxes paid to School District 101 by property owners in Skagit County. Cockreham Island properties contributed less than 0.1 percent of the revenues collected for Skagit County, State levy, Conservation Futures, and Medic 1 taxes.

Table 18. Estimated Taxes Paid by Skagit County and Cockreham Island Property Owners, ($2005)

Levy Category	County Total	Cockreham Island Total[1]	Percent of County Total
State	$27,616,737	$22,505	0.081
Skagit County	$15,870,115	$13,621	0.086
County Road	$10,294,938	$15,484	0.150
School District 101	$7,241,933	$36,366	0.502
Port District 2	$650,205	$896	0.138
Conservation Futures	$588,766	$478	0.081
Medic 1	$2,353,642	$1,912	0.081
Hospital District 304	NA	$1,576	NA
Fire District 8	$589,371	$9,889	1.678
Fire District 10	$126,936	$0	0.000
Total Levy	$65,332,643	$102,727	0.157

Source: Northern Economics, Inc.' estimates based on data from the Skagit County Assessor, 2005.
Note: [1]Cockreham island total includes the total taxes paid by all Cockreham Island land owners.

Specials assessments are shown in Table 19. Special assessments are taxes collected for the County Drainage Utility (Boge, R., 2007). The total tax paid by Cockreham Island residents in 2005 was $107,906, including special assessments.

Table 19. Special Assessments Received from Cockreham Island Landowners, ($2005)

Tax Category	Tax paid
Special Assessments	$5,178

Source: Skagit County Assessor, 2005.

The analysis estimates that the total net present value of general tax and special assessment revenues generated by Cockreham Island properties at between $1.43 and $3.0 million dollars depending on whether the analysis uses a three percent discount rate (as prescribed by OMB) or a seven percent discount rate (as prescribed by FEMA). With both discount rates, the vast majority of the lost revenue comes from general tax categories.

Table 20. Estimated Net Present Value ($2005) of Foregone Tax Revenues for Cockreham Island

Tax Category	Three Percent Discount Rate	Seven Percent Discount Rate
General Tax	$2,884,326	$1,355,621
Special Assessments	$168,552	$79,070
Combined Total	$3,052,878	$1,434,691

Source: Northern Economics, Inc.' estimates based on data from the Skagit County Assessor, 2005.

Data on property taxes paid by Cockreham Island property owners were collected from the Skagit County Assessors Office (Skagit County Assessors, 2005). The net present

value of future property taxes paid over the 100-year time frame was calculated for all parcels on Cockreham Island. The results of this calculation are shown in Table 21. These values were added to the cost per parcel to account for the lost tax revenues to Skagit County.

As with all discounted calculations, the net present value of the forgone tax revenues decreases over time.

Table 21. Estimated Net Present Value of Foregone Property Taxes for Cockreham Island Parcels ($2005)

Parcel	Three Percent Discount Rate	Seven Percent Discount Rate
P109700	$17,925	$8,369
P114772	$40,685	$19,086
P116676	$7,772	$3,646
P116907	$1,001	$470
P119138	$6,667	$3,127
P41173	$25,444	$11,936
P41212	$476	$224
P41219	$201,452	$94,503
P41220	$3,689	$1,731
P41221	$2,446	$1,147
P41222	$2,696	$1,265
P41223	$5,662	$2,656
P41224	$1,050	$493
P41225	$602	$282
P41226	$286	$134
P41227	$11,937	$5,600
P41229	$4,588	$2,152
P41230	$3,476	$1,631
P41236	$51,043	$23,945
P41237	$118,278	$55,486
P41238	$15,138	$7,101
P41239	$1,813	$850
P41240	$2,989	$1,402
P41241	$1,937	$908
P41242	$1,095	$513
P41243	$3,640	$1,708
P41244	$1,095	$513
P41245	$2,148	$1,008
P41246	$80,038	$37,547
P41247	$2,148	$1,008
P41248	$1,303	$611
P41249	$40,762	$19,122
P41250	$5,486	$2,574
P41251	$590	$277

Parcel	Three Percent Discount Rate	Seven Percent Discount Rate
P41253	$1,736	$814
P41254	$4,029	$1,890
P41255	$2,454	$1,151
P41256	$56,904	$26,694
P41257	$937	$440
P41258	$41,276	$19,363
P41259	$965	$453
P41260	$40,101	$18,812
P41261	$2,946	$1,382
P41262	$703	$330
P41263	$50,343	$23,617
P41265	$67,762	$31,788
P41266	$28,914	$13,564
P41269	$48	$23
P41270	$959	$450
P41271	$38,787	$18,195
P41272	$440	$200
P41273	$60,929	$28,582
P41274	$1,188	$532
P41275	$503	$236
P41276	$6,003	$2,816
P41277	$967	$454
P41278	$33,174	$15,562
P41280	$1,403	$658
P41281	$49,126	$23,046
P41283	$89,372	$41,925
P41284	$269	$126
P41286	$319,367	$149,819
P41289	$57,708	$27,072
P41290	$27,107	$12,716
P41291	$48	$23
P41292	$48	$23
P41294	$77,909	$36,548
P41295	$68,895	$32,320
P41296	$660	$3,000
P41298	$60,056	$28,173
P41299	$896	$420
P41300	$52,251	$24,512
P41301	$14,421	$6,765
P41302	$59,773	$28,040
P41304	$296	$139
P41306	$1,893	$888
P41307	$336	$158
P41308	$1,907	$895

Parcel	Three Percent Discount Rate	Seven Percent Discount Rate
P41309	$2,784	$1,306
P41310	$422	$198
P41312	$715	$335
P41313	$1,221	$573
P41314	$2,401	$1,126
P41316	$5,436	$2,550
P41327	$4,620	$2,100
P41410	$1,691	$793
P41542	$41,922	$19,666
P41543	$65,449	$30,703
P41546	$1,327	$622
P41743	$2,194	$1,029
P41744	$24,002	$11,260
P41745	$12,153	$5,701
P41746	$10,909	$5,118
P41750	$1,939	$910
P41782	$42	$20
P41799	$3,535	$1,658
P41800	$547	$257
P41801	$43	$20
P41825	$132	$62
P41828	$46,634	$21,876
P41829	$3,802	$1,784
P41830	$77,723	$36,461
P41847	$671	$315
P41850	$2,685	$1,259
P41851	$2,021	$948
P41852	$2,419	$1,135
P41853	$4,335	$2,033
P65608	$244	$115
P65609	$2,008	$942
P65622	$13,495	$6,331
P65623	$13,303	$6,241
P65624	$13,878	$6,510
P65625	$13,035	$6,115
P65626	$16,868	$7,913
P65627	$16,025	$7,518
P65628	$20,434	$9,586
P65630	$28,255	$13,255
P65631	$18,402	$8,633
P65632	$22,385	$10,501
P65633	$20,587	$9,658
P65634	$22,926	$10,755
P65635	$22,926	$10,755

Parcel	Three Percent Discount Rate	Seven Percent Discount Rate
P65636	$21,584	$10,125
P65637	$12,472	$5,851
P65638	$35,995	$16,886
P65639	$23,616	$11,079
P65640	$9,290	$4,358
P65641	$8,868	$4,160
P65642	$9,980	$4,682
P65643	$11,053	$5,185
P65644	$11,360	$5,329
P65645	$11,782	$5,527
P65646	$23,639	$11,090
P65647	$11,552	$5,419
P65648	$12,203	$5,725
P65649	$12,203	$5,725
P65650	$12,740	$5,976
P65651	$13,047	$6,120
P65652	$12,702	$5,959
P65653	$11,425	$5,359
P65654	$15,884	$7,451
P65655	$13,392	$6,282
P65656	$12,996	$6,097
P65657	$14,837	$6,960
Total	**$2,884,326**	**$1,355,621**

Source: Northern Economics, Inc.' estimates based on data from the Skagit County Assessor, 2005.

The following section describes possible benefit-cost savings from agricultural activities on Cockreham Island.

3.3.3 Agriculture

Several of the parcels with infrastructure are also used for agriculture production. Dairy production, horses, and cattle, along with field crops, are agricultural activities that occur on Cockreham Island. Much of Cockreham Island is covered with pasture land, hay fields, and cropland producing field corn and silage. The land provides valuable inputs for feeding cattle, horses, and other farm animals, and when it is flooded, the crop, hay or other field produce is lost. The farmer must replace the damaged food source for his/her livestock, or is out the revenue he/she would generate through the sale of the crop.

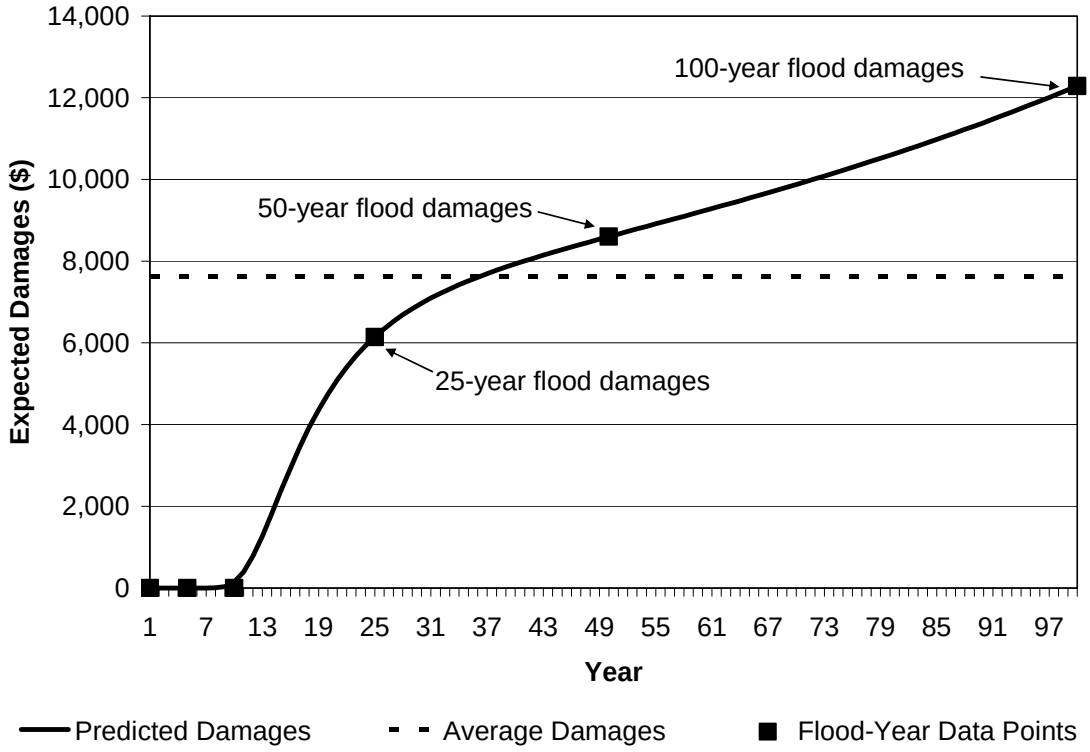
3.3.3.1 Methodology

Benefits or cost-savings for agricultural activities were calculated based upon the assumption that farmers would have to replace damaged crops, hay, or pasture land. The dollar value to a grower of field crops is valued at $512/acre, based upon Washington State University's Cooperative Extension report, Skagit County Ag Stats (2003).[3] According to the study, field crops include alfalfa, barley, corn and grass silage, and grass.

The damage estimates for agricultural lands was calculated based upon information provided by GeoEngineers for each parcel, indicating the percentage of the parcel which would be flooded for 5-year, 10-year, 25-year, 50-year and 100-year floods. Next, an equation was developed based on flood damage data and the likelihood of various flooding levels. The equation was based upon the logic that over a 100-year period there is likely to be at least one 100-year flood. Similarly, over a 50-year period there is likely to be at least one 50-year flood. However, during that 50-year period there is also likely to be at least one 49-year flood, at least one 48-year flood, and so on. Using this logic we fitted an equation to flood damage data for each parcel using TableCurve®, and then predicted damages for each year from 1 to 100. The expected damage in any given year is the average of the predicted estimates over the 100-year period. Figure 7 shows an example of the methodology for Parcel 41236.

[3] Vales adjusted to 2005 dollars based upon US SCPW of Labor, Bureau of Labor Statistics, 2006.

Figure 7. Predicted Agricultural Damages by Average Damages and Flood Year Data Points for Parcel 41236



Source: Northern Economics, Inc. 2006

Table 22 shows the net present value of agricultural damages for parcels on Cockreham Island, the number of acres per parcel, and the average annual agricultural damages due to flowing.

Table 22. Net Present Value of Agricultural Damages

Parcels	Acres	Annual Average Agriculture Damage	NPV with Three Percent Discount Rate	NPV with Seven Percent Discount Rate
P114772	13	$564	$18,348	$8,607
P41219	35	$10,573	$344,120	$161,431
P41221	33	$14,344	$466,849	$219,004
P41225	3	$1,505	$48,995	$22,984
P41226	4	$1,916	$62,370	$29,259
P41227	25	$11,234	$365,630	$171,521
P41230	37	$16,729	$544,483	$255,423
P41236	24	$7,822	$254,567	$119,420
P41238	35	$15,093	$491,223	$230,438
P41240	27	$13,048	$424,659	$199,212
P41242	10	$4,696	$152,848	$71,703
P41243	30	$14,669	$477,420	$223,963

Parcels	Acres	Annual Average Agriculture Damage	NPV with Three Percent Discount Rate	NPV with Seven Percent Discount Rate
P41244	10	$4,606	$149,923	$70,331
P41245	20	$9,629	$313,379	$147,010
P41246	39	$16,358	$532,386	$249,748
P41247	20	$9,362	$304,689	$142,933
P41248	10	$4,336	$141,111	$66,197
P41249	16	$7,244	$235,763	$110,599
P41250	16	$7,893	$256,888	$120,509
P41251	5	$2,461	$80,087	$37,570
P41253	21	$10,249	$333,585	$156,488
P41254	58	$28,138	$915,809	$429,616
P41255	28	$13,605	$442,802	$207,723
P41258	11	$5,311	$172,866	$81,093
P41259	7	$3,257	$106,018	$49,734
P41262	9	$4,449	$144,810	$67,932
P41266	1	$492	$16,017	$7,514
P41269	1	$483	$15,728	$7,378
P41271	11	$5,201	$169,264	$79,404
P41272	4	$1,868	$60,809	$28,526
P41274	10	$4,251	$138,370	$64,911
P41275	4	$1,792	$58,308	$27,353
P41277	9	$4,171	$135,762	$63,687
P41280	9	$7,893	$256,888	$120,509
P41283	5	$2,396	$77,992	$36,587
P41284	4	$1,728	$56,243	$26,384
P41286	37	$15,634	$508,837	$238,701
P41289	12	$5,753	$187,228	$87,831
P41290	27	$12,324	$401,120	$188,170
P41291	1	$449	$14,628	$6,862
P41292	1	$457	$14,876	$6,979
P41299	4	$1,845	$60,062	$28,176
P41304	3	$1,505	$48,995	$22,984
P41306	17	$8,175	$266,068	$124,815
P41307	3	$1,493	$48,583	$22,791
P41308	14	$6,860	$223,275	$104,741
P41309	22	$10,757	$350,108	$164,239
P41310	4	$1,990	$64,777	$30,388
P41312	6	$2,915	$94,886	$44,512
P41313	11	$5,166	$168,133	$78,873
P41314	22	$10,581	$344,381	$161,553
P41316	26	$5,632	$183,297	$85,987
P41542	29	$4,826	$157,070	$73,683
P41546	9	$4,196	$136,571	$64,067
P41743	19	$9,375	$305,118	$143,134

Parcels	Acres	Annual Average Agriculture Damage	NPV with Three Percent Discount Rate	NPV with Seven Percent Discount Rate
P41750	9	$4,171	$135,762	$63,687
P41782	1	$502	$16,331	$7,661
P41799	32	$15,748	$512,555	$240,445
P41800	5	$2,534	$82,458	$38,682
P41801	1	$469	$15,266	$7,161
P41825	3	$1,189	$38,685	$18,147
P41828	36	$13,610	$442,960	$207,797
P41829	39	$15,474	$503,615	$236,251
P41830	33	$12,323	$401,085	$188,153
P41847	14	$6,797	$221,232	$103,782
P41850	22	$8,979	$292,250	$137,098
P41851	19	$9,254	$301,179	$141,287
P41852	20	$9,506	$309,397	$145,142
P41853	40	$19,183	$624,354	$292,892
Total	**1,145**	**$499,038**	**$16,242,151**	**$7,619,372**

Source: Skagit County Assessors Office, 2005 and Northern Economics, Inc., 2005.

3.4 Traditional BCA Results

Table 23 shows the BCA results for Cockreham Island parcels based upon the traditional BCA on a parcel basis and aggregate level. The results incorporate the benefits and costs analysis described in prior subsections of Section 3. In total, traditional benefits vary between $16.04 million and $35.84 million and costs vary between $15.70 million and $16.91 million.

Table 23. Traditional BCA Analysis by Parcel and Study Area

	Three Percent Discount Rate			Seven Percent Discount Rate		
Parcel	Benefits	Costs	BCR	Benefits	Costs	BCR
P109700	$0	$89,625	0.00	$0	$80,069	0.00
P114772	$25,577	$241,924	0.11	$11,872	$192,605	0.06
P116676	$0	$27,972	0.00	$0	$23,846	0.00
P116907	$0	$3,601	0.00	$0	$3,070	0.00
P119138	$0	$23,967	0.00	$0	$20,427	0.00
P41173	$0	$91,744	0.00	$0	$77,436	0.00
P41212	$0	$776	0.00	$0	$524	0.00
P41219	$344,611	$1,166,083	0.30	$161,652	$1,059,134	0.15
P41220	$0	$91,289	0.00	$0	$89,331	0.00
P41221	$466,849	$85,746	5.44	$219,004	$84,447	2.59
P41222	$0	$8,996	0.00	$0	$7,565	0.00
P41223	$0	$19,062	0.00	$0	$16,056	0.00

	Three Percent Discount Rate			Seven Percent Discount Rate		
Parcel	Benefits	Costs	BCR	Benefits	Costs	BCR
P41224	$0	$2,550	0.00	$0	$1,993	0.00
P41225	$48,995	$7,202	6.80	$22,984	$6,882	3.34
P41226	$62,370	$10,886	5.73	$29,259	$10,734	2.73
P41227	$397,219	$158,567	2.51	$185,786	$152,230	1.22
P41229	$0	$16,188	0.00	$0	$13,752	0.00
P41230	$544,483	$95,376	5.71	$255,423	$93,531	2.73
P41236	$281,706	$494,488	0.57	$131,675	$467,390	0.28
P41237	$155,707	$542,809	0.29	$70,313	$480,017	0.15
P41238	$566,292	$219,543	2.58	$264,337	$211,506	1.25
P41239	$0	$5,613	0.00	$0	$4,650	0.00
P41240	$424,659	$71,489	5.94	$199,212	$69,902	2.85
P41241	$0	$6,937	0.00	$0	$5,908	0.00
P41242	$152,848	$26,095	5.86	$71,703	$25,513	2.81
P41243	$477,420	$78,640	6.07	$223,963	$76,708	2.92
P41244	$149,923	$26,095	5.75	$70,331	$25,513	2.76
P41245	$313,379	$51,548	6.08	$147,010	$50,408	2.92
P41246	$2,072,604	$632,921	3.27	$945,271	$590,430	1.60
P41247	$304,689	$51,548	5.91	$142,933	$50,408	2.84
P41248	$141,111	$26,303	5.36	$66,197	$25,611	2.58
P41249	$380,977	$181,532	2.10	$176,174	$217,412	0.81
P41250	$4,357,614	$144,062	30.25	$1,972,291	$141,150	13.97
P41251	$80,087	$14,290	5.60	$37,570	$13,977	2.69
P41253	$333,585	$36,936	9.03	$156,488	$36,014	4.35
P41254	$915,809	$137,629	6.65	$429,616	$135,490	3.17
P41255	$442,802	$65,554	6.75	$207,723	$64,251	3.23
P41256	$87,597	$250,363	0.35	$39,557	$220,153	0.18
P41257	$0	$89,437	0.00	$0	$88,940	0.00
P41258	$260,231	$199,675	1.30	$120,545	$189,162	0.64
P41259	$106,018	$24,865	4.26	$49,734	$24,353	2.04
P41260	$60,658	$179,348	0.34	$27,392	$158,059	0.17
P41261	$0	$9,346	0.00	$0	$7,782	0.00
P41262	$144,810	$23,603	6.14	$67,932	$23,230	2.92
P41263	$66,786	$226,412	0.29	$48,800	$199,686	0.24
P41265	$160,395	$303,331	0.53	$72,430	$267,357	0.27
P41266	$166,974	$182,514	0.91	$75,682	$222,204	0.34
P41269	$15,728	$548	28.69	$7,378	$523	14.12
P41270	$0	$3,459	0.00	$0	$2,950	0.00
P41271	$203,601	$202,607	1.00	$94,909	$193,585	0.49
P41272	$60,809	$24,440	2.49	$28,526	$24,200	1.18
P41273	$101,785	$273,198	0.37	$45,963	$240,851	0.19
P41274	$138,370	$90,088	1.54	$64,911	$89,432	0.73
P41275	$58,308	$70,903	0.82	$27,353	$70,636	0.39

	Three Percent Discount Rate			Seven Percent Discount Rate		
Parcel	Benefits	Costs	BCR	Benefits	Costs	BCR
P41276	$492,151	$349,733	1.41	$230,644	$301,036	0.77
P41277	$135,762	$22,867	5.94	$63,687	$22,354	2.85
P41278	$80,409	$145,164	0.55	$36,311	$127,552	0.28
P41280	$256,888	$38,303	6.71	$120,509	$71,598	1.68
P41281	$65,672	$223,059	0.29	$29,656	$196,979	0.15
P41283	$380,662	$410,181	0.93	$173,265	$362,734	0.48
P41284	$56,243	$15,569	3.61	$26,384	$15,426	1.71
P41286	$778,056	$1,325,056	0.59	$360,273	$1,203,128	0.30
P41289	$492,047	$297,821	1.65	$225,480	$288,995	0.78
P41290	$457,286	$464,484	0.98	$213,533	$486,713	0.44
P41291	$14,628	$3,348	4.37	$6,862	$3,323	2.07
P41292	$14,876	$3,348	4.44	$6,979	$3,323	2.10
P41294	$16,423	$128,138	0.13	$7,416	$86,777	0.09
P41295	$1,168	$308,808	0.00	$527	$272,233	0.00
P41296	$0	$2,160	0.00	$0	$4,500	0.00
P41298	$63,266	$266,333	0.24	$28,569	$234,450	0.12
P41299	$60,062	$14,696	4.09	$28,176	$14,220	1.98
P41300	$95,449	$236,320	0.40	$43,102	$208,581	0.21
P41301	$0	$50,621	0.00	$0	$42,965	0.00
P41302	$157,998	$267,052	0.59	$71,348	$235,319	0.30
P41304	$48,995	$7,196	6.81	$22,984	$7,039	3.27
P41306	$266,068	$44,693	5.95	$124,815	$43,688	2.86
P41307	$48,583	$7,836	6.20	$22,791	$7,658	2.98
P41308	$223,275	$101,807	2.19	$104,741	$100,795	1.04
P41309	$431,558	$126,454	3.41	$201,020	$109,716	1.83
P41310	$64,777	$10,322	6.28	$30,388	$10,098	3.01
P41312	$94,886	$16,815	5.64	$44,512	$16,435	2.71
P41313	$168,133	$29,221	5.75	$78,873	$28,573	2.76
P41314	$344,381	$57,601	5.98	$161,553	$56,326	2.87
P41316	$190,397	$156,956	1.21	$89,193	$143,980	0.62
P41327	$0	$15,120	0.00	$0	$12,600	0.00
P41410	$0	$6,091	0.00	$0	$5,193	0.00
P41542	$160,065	$395,191	0.41	$75,036	$457,965	0.16
P41543	$273	$287,899	0.00	$123	$253,153	0.00
P41546	$136,571	$25,027	5.46	$64,067	$24,322	2.63
P41743	$305,118	$50,394	6.05	$143,134	$49,229	2.91
P41744	$56,993	$106,760	0.53	$25,736	$94,018	0.27
P41745	$0	$43,653	0.00	$0	$37,201	0.00
P41746	$0	$37,509	0.00	$0	$31,718	0.00
P41750	$135,762	$24,439	5.56	$63,687	$23,410	2.72
P41782	$16,331	$1,342	12.17	$7,661	$1,320	5.81
P41799	$512,555	$84,135	6.09	$240,445	$82,258	2.92

	Three Percent Discount Rate			Seven Percent Discount Rate		
Parcel	Benefits	Costs	BCR	Benefits	Costs	BCR
P41800	$82,458	$58,547	1.41	$38,682	$58,257	0.66
P41801	$15,266	$1,343	11.36	$7,161	$1,320	5.42
P41825	$38,685	$7,032	5.50	$18,147	$6,962	2.61
P41828	$467,806	$290,021	1.61	$219,017	$309,433	0.71
P41829	$503,615	$100,702	5.00	$236,251	$98,684	2.39
P41830	$533,827	$473,584	1.13	$248,096	$498,222	0.50
P41847	$221,232	$42,371	5.22	$103,782	$42,015	2.47
P41850	$292,250	$58,785	4.97	$137,098	$57,359	2.39
P41851	$301,179	$48,321	6.23	$141,287	$47,248	2.99
P41852	$325,793	$111,851	2.91	$152,546	$96,347	1.58
P41853	$624,354	$103,135	6.05	$292,892	$100,833	2.90
P65608	$0	$944	0.00	$0	$815	0.00
P65609	$0	$6,408	0.00	$0	$5,342	0.00
P65622	$0	$48,695	0.00	$0	$41,531	0.00
P65623	$0	$48,003	0.00	$0	$40,941	0.00
P65624	$0	$50,078	0.00	$0	$42,710	0.00
P65625	$0	$47,035	0.00	$0	$40,115	0.00
P65626	$0	$60,868	0.00	$0	$51,913	0.00
P65627	$0	$57,825	0.00	$0	$49,318	0.00
P65628	$7,363	$91,740	0.08	$3,325	$80,892	0.04
P65630	$59,528	$188,514	0.32	$26,881	$173,514	0.15
P65631	$7,851	$81,898	0.10	$3,545	$72,129	0.05
P65632	$63,508	$99,580	0.64	$28,679	$87,696	0.33
P65633	$9,745	$92,437	0.11	$4,401	$81,508	0.05
P65634	$14,536	$103,840	0.14	$6,564	$91,669	0.07
P65635	$14,154	$103,690	0.14	$6,391	$91,519	0.07
P65636	$18,533	$98,786	0.19	$8,369	$87,327	0.10
P65637	$0	$43,772	0.00	$0	$5,851	0.00
P65638	$6,571	$158,605	0.04	$2,967	$139,496	0.02
P65639	$4,217	$107,096	0.04	$1,904	$94,559	0.02
P65640	$0	$32,290	0.00	$0	$27,358	0.00
P65641	$0	$30,768	0.00	$0	$26,060	0.00
P65642	$0	$34,780	0.00	$0	$29,482	0.00
P65643	$0	$38,653	0.00	$0	$32,785	0.00
P65644	$0	$39,760	0.00	$0	$33,729	0.00
P65645	$0	$41,282	0.00	$0	$35,027	0.00
P65646	$0	$53,239	0.00	$0	$40,690	0.00
P65647	$0	$40,452	0.00	$0	$34,319	0.00
P65648	$0	$42,803	0.00	$0	$36,325	0.00
P65649	$0	$42,803	0.00	$0	$36,325	0.00
P65650	$0	$44,740	0.00	$0	$37,976	0.00
P65651	$0	$45,847	0.00	$0	$38,920	0.00

	Three Percent Discount Rate			Seven Percent Discount Rate		
Parcel	**Benefits**	**Costs**	**BCR**	**Benefits**	**Costs**	**BCR**
P65652	$0	$44,602	0.00	$0	$37,859	0.00
P65653	$0	$41,225	0.00	$0	$35,159	0.00
P65654	$14,855	$69,384	0.21	$5,126	$60,951	0.08
P65655	$0	$47,092	0.00	$0	$39,982	0.00
P65656	$14,855	$58,570	0.25	$6,708	$51,671	0.13
P65657	$0	$53,537	0.00	$0	$45,660	0.00
Total	$25,539,328	$16,906,573		$11,843,198	$15,703,688	
Road and Levee Maintenance Cost Savings	$10,300,000			$4,200,000		
Road and Infrastructure Removal		$410,000			$410,000	
Total	**$35,839,327**	**$16,906,573**	**2.11**	**$16,043,198**	**$15,703,688**	**1.02**

Source: Northern Economics, 2006.

4 Ecological Economic Analysis

The proposed property buy-out, and infrastructure removal would increase the natural habitat on Cockreham Island. Since these values are not considered in a traditional benefit cost analysis, an ecological economic analysis (EEA) is completed with the goal of incorporating the value of ecosystem goods and services into the benefit cost analysis.

For the purposes of the EEA, two alternative land use scenarios are considered for comparison: (1) the base case continuance of the *status quo*, with no property buy-out and (2) the value of native habitat of the site. Following the standard BCA assumptions discussed above in section 3, the period considered is 100 years and two discount rates are used to calculate Present Values: the FEMA seven percent rate, and the OMB three percent rate.

The study area includes all properties located on Cockreham Island. Similar to the previous benefit cost analysis, the ecological economic valuation is completed on a parcel-by-parcel basis. Since the traditional BCA was also completed on a parcel-by-parcel basis, it is possible to combine the two analyses for a more holistic view of the proposed property buy-out.

The analysis establishes that the Cockreham Island property buy-out represents potential *ecological economic gain* to the residents of Skagit County. Employing a value transfer analysis, aggregate *Present Value of* ecological benefits associated with the property buy-out were calculated to range from **$21.6 million** (seven percent discount rate) to **$43.3 million** (three percent discount rate).[4] This represents a **$14,370,778** (seven percent discount rate) to **$28,741,556** (three percent discount rate) increase over the ecological value of the current or status quo habitat on Cockreham Island.

4.1 Ecosystem Goods and Services

The goods and services provided by naturally functioning landscapes and the ecosystems that they produce represent significant economic value to society as they contribute to the well-being of people, both directly and indirectly (Daily 1997; de Groot, Wilson et al. 2002; Wilson and Carpenter 1999). The ability to estimate the value of ecosystem goods and services is increasingly recognized as an important part of integrated environmental decision-making and land use planning worldwide (Heal, Barbier et al. 2005; Millennium Ecosystem Assessment 2003).

[4] Values are in $2005.

> ***Ecosystem goods and services*** *are the benefits people obtain either directly or indirectly from ecological systems. These include products such as food, fuel, and fiber; services such as climate and water regulation and flood control; and nonmaterial assets such as recreational or aesthetic benefits.*

As the above definition suggests, the concept of ecosystem goods and services is inherently *people-oriented*: It is the presence of people that enables the translation of basic ecological structures and processes into values. Because they are difficult to measure, however, ecosystem goods and services tend to be overlooked or taken for granted by decision-makers and their value implicitly set to zero in decisions concerning conservation or restoration (Bingham, Bishop *et al.* 1995). While once acceptable, a failure to assign a dollar value to ecosystem goods and services is problematic today because substantial evidence now shows the social and economic benefits of ecosystem services (Heal, Barbier *et al.* 2005).

Including ecological economic benefits in a BCA allows people to make more informed decisions regarding the tradeoffs between maintaining the status quo and restoring the natural environment (Ableson 1979; Environmental Protection Agency 2000). The identification and valuation of economic benefits associated with the natural environment is not only possible, it has proven to be essential for informing the rational allocation of resources among competing demands on the environment (Heal, Barbier *et al.* 2005; Millennium Ecosystem Assessment 2003; U.S. Office of Management and Budget 1996).

4.2 Ecosystem Goods and Services on Cockreham Island

Riparian and terrestrial ecosystems are increasingly recognized as providing economically valuable ecosystem services. The biological and physical structures of such ecosystems that would be affected by maintaining the status quo on Cockreham Island or implementing the proposed property buy-out provide a variety of marketable goods to society—critical salmon habitat and recreation opportunities, being two well known examples. Additionally, there are services that these natural ecosystems provide to people which are not always observable in day-to-day market transactions (Daily 1997; Holmlund and Hammer 1999; Wilson and Carpenter 1999). Such ecosystem services include things like water supply, waste assimilation, climate regulation, and biodiversity maintenance.

Building on the available technical literature on ecosystem service valuation, the project team created a comprehensive list of ecosystem goods and services associated with the proposed Cockreham Island property buy-out site. This list is provided in Table 24.

Table 24. Ecosystem Goods and Services

Ecosystem Good or Service	Examples
Gas and Climate Regulation	Carbon Dioxide sequestration by forests
Disturbance Prevention	Flood prevention
Water Supply	Water quality
	Groundwater recharge
Waste Treatment	Pollution control/detoxification
	Trapping sediments and pollutants
Wildlife Habitat Refugium	Nursery, feeding and breeding ground for Coho and Chinook Salmon
	Habitat for resident and migratory waterfowl and mammals
Aesthetic and Recreational	Salmon fishing
	Aesthetic enjoyment of natural scenery
Cultural and Spiritual	Subsistence fishing and hunting
	Cultural and archaeological heritage sites

While the list presented here is not exhaustive, it does account for many of the essential ecosystem goods and services provided in Cockreham Island area. The list also suggests that for many important landscape features on Cockreham Island, there will be different services provided, each of which offers a unique contribution to human welfare. For instance, a mixed forest may help gas and climate through carbon sequestration, it may prevent soil erosion and provide humus for soil regulation, and it may also provide aesthetic beauty and recreation opportunities. Alternatively, a freshwater wetland may provide fresh water supply and regulation, waste assimilation of nutrients and toxic compounds, and critical wildlife habitat. All of the goods and services associated with each land cover type at the Cockreham Island site—e.g., forest and wetland—thus contribute to the *total economic value* provided by the functioning ecological system.

4.3 Economic Valuation

This section assesses available techniques for valuing ecosystem services using economic methods. The focus is on the sources of ecological value that can be captured through economic valuation, and is not a comprehensive list of all ecological value inherent to Cockreham Island (Goulder and Kennedy 1997).

Economic valuation can help to ensure that ecosystem services that are not valued in the traditional market sense, receive explicit treatment in economic assessments. Our goal is not to 'create' values for ecosystems in Skagit County; rather, the purpose is to generate a conservative baseline estimate of the values that people already hold with respect to these ecosystems through an assessment of the best available economic

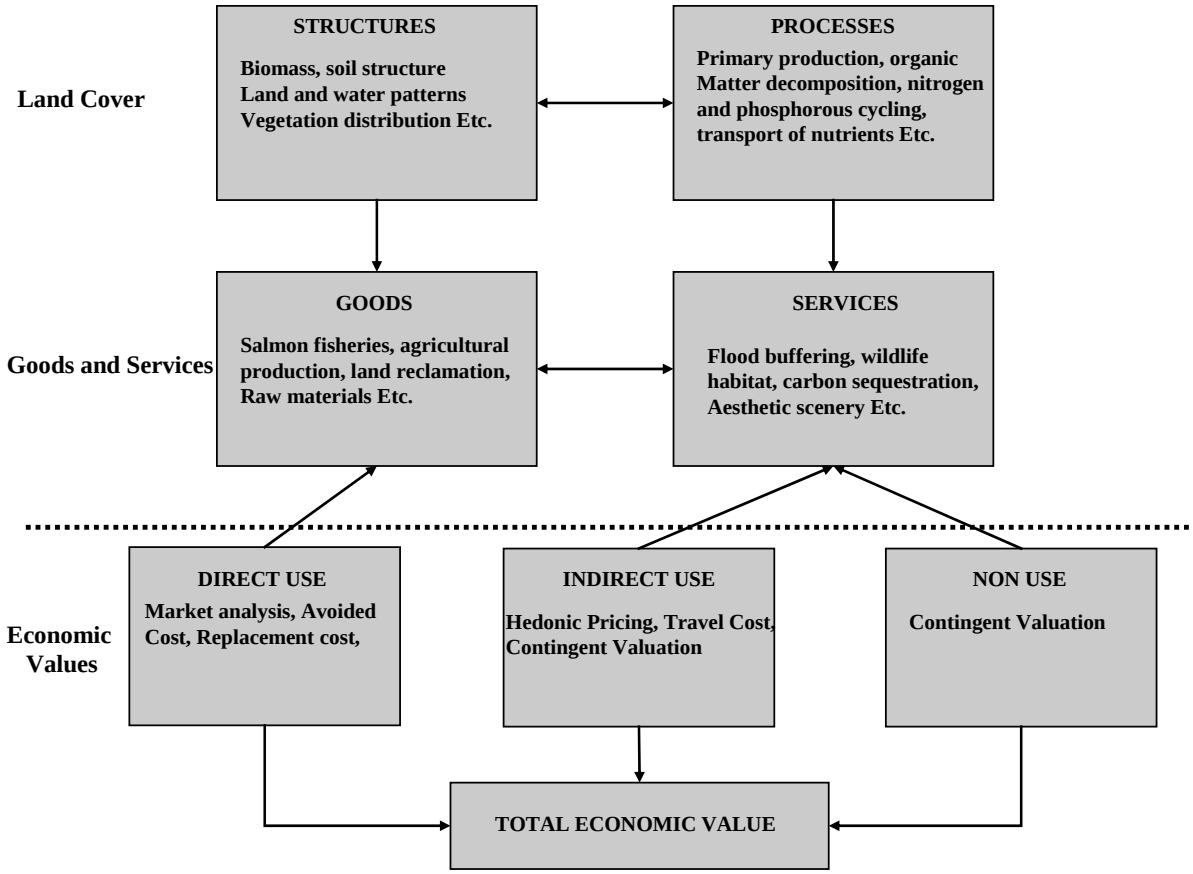
literature. Such information will in turn assist in the assessments of the benefits and costs provided by the proposed property buy-out on Cockreham Island.

The following section provides an overview of economic valuation and the role it can play in improving environmental decision-making.

4.3.1 The Total Economic Value Framework

The *total economic value (TEV)* framework used for this ecological economic analysis is based on the assumption that individuals can hold many different kinds of values for ecosystems in the Cockreham Island study area. However, the TEV framework also provides a basis for understanding these myriad values or benefits. Although any classification of such values is somewhat arbitrary and may differ from one use to another, the TEV framework is necessary to ensure that all components of value are given recognition (Bishop, Boyle *et al.* 1987). A representation of the TEV framework is provided in Figure 8.

Figure 8. Total Economic Value Framework



Source: Turner, 2000.

In its simplest form, the framework shown in Figure 8 distinguishes between *use* values and *nonuse* values. Use values refer to those values associated with current or future (potential) use of an environmental resource by an individual, while the nonuse values are values that arise from the continued existence of the resource and are unrelated to use (Freeman 1993). Typically, use values involve some human interaction with the resource, whereas nonuse values do not. Importantly, within this framework an individual can have both use and nonuse values for natural ecosystems.

Using the TEV framework, consider an extreme flood event on Cockreham Island resulting in lost agricultural production—this is a loss in *direct use* value. In addition, the flood could damage the ecosystem in ways that would not directly affect agricultural production and that residents would never observe. It might, for example, destroy birds or mammals that nest on the island but that are rarely seen by residents, but people do pay money for the possibility to view these animals when visiting the area, which is an *indirect use*. Additionally, both residents and people who do not visit the island might experience a loss because of the damage. The loss by those who do not actually visit the island would be a loss of *nonuse* value. The TEV framework implies that analysts need to investigate the potential loss in both use and in nonuse values of property owners and in nonuse values of people who do not visit the site regularly.

A number of similar frameworks have been proposed in recent decades (Bishop, Boyle *et al.* 1987; Freeman 1993; Turner 2000). Although varied in detail and application, the distinction between use and nonuse values is a fundamental theme. The TEV framework, as applied to typical ecosystem services associated with the Cockreham Island site, is illustrated by Figure 8. The discussion of valuation methods below shows that some methods are better able to measure selected components of TEV than others.

4.3.2 Ecosystem Valuation Methods

Ecosystem valuation methods used in this analysis are explained in this section.[5] A common framework used to distinguish between valuation approaches is based upon how economic value is estimated. As shown in Table 25 this categorization is usually organized according to two criteria:

1. Whether the valuation method is to be based on observed economic behavior, or whether the method is to be based on responses to survey questions that reveal stated preferences by individuals, or
2. Whether the monetary estimates of values are directly observed or inferred through some indirect method of data analysis.

[5] For an extensive review of economic valuation methods see Freeman (1993).

Because of the public nature of many of the ecosystem goods and services, market prices may not exist. Direct survey and indirect valuation methods are the most commonly used approaches, and the discussion below focuses on these approaches.

Table 25 demonstrates that there are a variety of valuation approaches that can be applied to ecosystem services. No single method can be considered the best at all times and for all types of ecosystems, as different methods may work better depending upon the situation. The purpose of such valuation is ultimately to aid decision-making and the effective management of ecosystems. When the money or time does not exist to conduct an economic study on the ground, using one of the methods reported above, decision-makers often turn to the value-transfer approach. The value-transfer approach is the approach used for the Cockreham Island ecosystem services evaluation.

Table 25. Valuation Approaches

	Revealed Preferences	Stated Preferences
Direct	Competitive market prices	Contingent valuation
	Simulated market prices	Open-ended response format
Indirect	Household production function models	Contingent valuation, discrete-choice
	Time allocation	and interval response formats
	Random utility and travel cost	Contingent behavior
	Averting behavior	Conjoint analysis (attribute based)
	Hedonics	
	Production function models	
	Referendum votes	

Source: Freeman, 1993.

Value transfer by definition involves the adaptation of existing valuation information or data to a new study site or what is referred to as a "policy site" (Troy and Wilson 2006; Wilson and Hoehn 2006)[6]. Value-transfers are increasingly being used in environmental valuation. The transfer involves obtaining an estimate for the economic value of non-market goods or services through the analysis of a single study, or group of studies, that have been previously carried out to value similar goods or services. The transfer itself refers to the application of estimated point values, derived utility functions, and other information from the original 'study site' to a 'policy site' (Desvousges, Johnson *et al.* 1998; Loomis 1992).

While primary valuation research will always be a "first-best" strategy for gathering information about the value of ecosystem goods and services (Downing and Ozuna

[6] Following Desvouges et. al. (1998), the term 'value transfer' is used instead of 'benefit transfer' to reflect the fact that the method is not restricted to benefits, but can include economic costs such as agricultural externalities.

1996; Kirchhoff, Colby *et al.* 1997; Smith 1992), value transfer has become an increasingly practical way to inform the public and policy makers when primary data collection is not possible due to budget and time constraints (Environmental Protection Agency 2000; National Research Council 2004).

In sum, value transfer represents a sensible compromise solution. When primary valuation research is not possible, then value transfer, as a "second-best" strategy, is important to consider as a source of meaningful evaluation of management and policy impacts on ecosystem goods and services. The unacceptable alternative would be to treat the economic values of ecosystem services at the study site as zero; that is unvaluable to society (Daily 1997; Heal, Barbier *et al.* 2005; Millennium Ecosystem Assessment 2003).

4.4 Land Cover Typology

To conduct the value transfer analysis for Cockreham Island, the study team needed to create a land cover typology. Land cover typology is a detailed categorization of land cover types and land uses. Working with data obtained from GeoEngineers, a land cover typology was created for the site.

To create the land cover typology, the study team assessed available data coverage to determine which land cover classes, at what level of categorical precision, could be accurately mapped for the Cockreham Island study area. The study team assessed the availability of peer-reviewed literature for values associated with these cover types. Table 26 shows the resulting typology with a description of each cover type.

Table 26. Cockreham Island Land Cover Typology

Land Use/Land Cover	Description
Bare Gravel	Floodplain and main channel gravel bars
Modified	Hydromodified mainstem bank or bar areas
Salmon Habitat	Includes all riparian areas such off-channel Floodplain slough used by coho and Chinook salmon
Forest	All forest habitat categories
Low Intensity Residential	Residential areas
Commercial Agriculture	Intensive agriculture—row crops or livestock operations
Commercial/Industrial	Commercial or industrial buildings
Shrubland	Shrubs and forbes
Grasslands/Herbaceous	Non-pastoral herbaceous grassland
Pasture/Hay	Agricultural livestock operations
Row Crops	Agricultural cropping
Wetlands	Freshwater wetlands
Managed Uplands	A combined category comprised of ½ Grassland and ½ Forest

Two unique land use/land cover types at the Cockreham Island site were generated for the purposes of this analysis: Salmon Habitat and Managed Uplands. Following consultation with GeoEngineers, Inc., the Salmon Habitat land cover category was created to identify all freshwater river areas (i.e, off-channel slough area, Tributary channel) that would be conducive to Coho and Chinook salmon. The Managed Uplands land use class represents the conversion of all upland areas at the Cockreham Island site into grassland meadows and forests after the possible property buy-out. As the future distribution between grassland meadow and forest is uncertain, the project team adopted a conservative assumption and assigned half of this land use class to grasslands and half to forests with the understanding that future distributions may vary depending upon post-buy-out conditions.

Furthermore, not all land use cover types identified for the Cockreham Island site in Table 26 were able to be matched up with existing economic studies of ecosystem services in the literature. For example, there are currently no empirical economic studies to draw ecosystem service values for Bare Gravel, Modified mainstream bank areas, or Commercial buildings. Therefore, these types were excluded from the ecological economic valuation analysis. Similarly, because economic studies tend to lump together agriculture-related land use types in their analysis of ecosystem services, the three land use categories—Commercial Agriculture, Pasture/Hay, Row Crops—at the site were aggregated into a single land use type, Agriculture, for the purposes of economic analysis. The final list of five unique land use/land cover types and their associated economic values is provided in the following section.

4.5 Alternative Land Use Scenarios

The research team conducted a value transfer exercise to measure the ecological economic values that would accrue if (1) no buy-out occurs and there is a continuance of the status quo and (2) buy-out occurs and infrastructure is removed and natural habitat increases.

Table 27 shows the land cover/land use distribution for the status quo or existing conditions and land cover/land use distribution for the proposed buy-out. The land cover/land use quantities are used for estimating ecosystem service values, along with the values collected for the benefits-transfer exercise. Descriptions of land cover/land use types are shown in Table 26.

Table 27. Land Cover/land Use Distribution with Alternative Scenarios (Acres)

Habitat	Status Quo	Proposed Buyout	Change Gain/(Loss)
Bare Gravel	2.75	3.56	0.81
Modified	48.31	10.32	(37.99)

River (Salmon Habitat)	272.32	432.83	160.51
Forest	166.09	329.55	163.45
Low Intensity Residential	48.64	0.00	(48.64)
Commercial Agriculture	34.96	0.00	(34.96)
Commercial/Industrial	36.81	0.00	(36.81)
Shrubland	70.83	0.00	(70.83)
Gasslands/Herbaceous	50.92	0.00	(50.92)
Pasture/Hay	639.77	0.00	(639.77)
Row Crops	406.24	0.00	(406.24)
Freshwater Wetlands	143.41	284.04	140.64
Managed Uplands	0.00	860.75	860.75

Source: Spatial Informatics Group.

Under the status quo scenario, approximately 60 percent of the land is used for agricultural or pasture related activities. The buy-out alternative involves removing commercial agriculture, residential structures, and reconnecting the land to the historical floodplain. As Table 27 demonstrates, the results are a net loss of several hundred acres of land devoted to residential and agricultural uses and a gain of several hundred acres in native habitat and managed uplands.

4.6 Value-Transfer Analysis

In the following section, sources from the economic literature are reviewed and summarized to generate a baseline value transfer estimate for ecological economic values associated with the buy-out of properties on Cockreham Island. To estimate the economic value of ecosystem goods and services associated with Cockreham Island, the research team used a decision-support methodology developed by Spatial Informatics Group LLC, termed the NaturalAssets™ Information System. This system allowed the team to dynamically query, review and select economic valuation research that has been done in similar contexts.

4.6.1 Literature Search Methodology

The raw material for the value transfer exercise comes from previously published studies that measured the economic value of both market-based and non-market environmental goods and services at sites with similar characteristics to Cockreham Island and the Skagit River. The following search criteria were used to limit economic studies included in the analysis:

- Empirical economic studies conducted in North America—USA or Canada
- Peer-reviewed journal articles, books and book chapters, and proceedings

- For water-based analysis, studies that looked specifically at freshwater river fisheries and fish species indigenous to the Washington State area (i.e., Salmon and trout)
- Economic studies that were conducted in explicitly non-urban or rural settings

To acquire information and materials on ecosystem goods and services specific to the Skagit County region, the NaturalAssets™ Information System was queried to generate estimates for five land cover types where economic values were identified in the study area. To expand the geographically explicit (per acre) analysis with information on salmon fisheries that would be impacted by the buy-out, the project team also searched the database for non-spatial recreational data gathered in the Pacific Northwest region that dealt specifically with salmon fisheries in the region.

Using the above-specified search criteria, a final list of 25 economic studies was compiled and this list was thoroughly examined and categorized according to its application of ecosystem goods and services provided by the alternative land use land cover types present at the Cockreham Island site. With the exception of recreational fishing studies, all resulting data were standardized to 2005 U.S. dollar equivalents *per acre* to provide a consistent basis for comparison[7].

4.6.2 Findings

The following tables and text summarize both the spatially explicit and non-spatially explicit recreational values that might be associated with the buy-out of residential and agricultural properties on Cockreham Island. As noted previously, the analysis is based upon two alternatives: (1) the base case continuance of the status quo, with no property buy-out, and (2) a full buy-out.

Our goal is to use the best available economic data to generate present value estimates that can be integrated into the traditional BCA of the proposed Cockreham Island property buy-out for the Total Benefits and Costs of the proposed buy-out. Given the gaps in the available valuation data, the results presented here should be treated as conservative baselines, not upper bound estimates. In short, the estimates presented here are likely to underestimate, not overestimate the actual value of ecosystem goods and services in the study area

[7] All dollar values are standardized to 2005 using Consumer Price Index tables published by the U.S. SCPW of Labor. http://www.bls.gov/cpi/home.htm.

4.6.2.1 Salmon Fishing Recreation Estimates (Non-Spatial)

In addition to conducting spatially-explicit valuation of the Cockreham island site, the SIG research team analyzed results from peer reviewed studies that looked at the per-day and per-year dollar value of recreational salmon fishing in the Pacific Northwest (Table 28).

Table 28. Recreation Services ($2005)

Land Cover Type	Citation Source	Site	Estimate	Units
Salmon Habitat	Layman, R.C., Boyce, J.R., and Criddle, K.R. (1996)	Gulkana River, OR	$48.44	
	Loomis (1992)	Deschutes River, OR	$123.44	
		Coquille River, OR	$66.49	
		Hood River, OR	$67.58	
		Alsea River, OR	$78.65	
		Clackamas River, OR	$81.63	
		Wilson River, OR	$84.79	
		Umpqua River, OR	$89.28	
		Siletz River, OR	$119.40	
		John Day River, OR	$124.17	
		Rogue River, OR	$89.34	
		Daily Average	$88.47	Trip/Daily
	Morey, E. R., Shaw, W. D. and Rowe, R. D. (1991)	Multnomah (Portland), Cou	$130.85	
		Clatsop County, OR	$239.82	
		Curry County, OR	$12.63	
		Deschutes (central) County	$29.16	
		Douglass County, OR	$26.17	
		Lane County, OR	$40.59	
		Lincoln County, OR	$84.20	
		Tillamook Country, OR	$145.07	
		Yearly Average	$88.56	Individual/Yearly

Source: Spatial Informatics Group.

Non-spatial fishing values were estimated using data from three different research teams yielding a total of 20 valuation estimates for salmon fishing. All three teams used a variation of the travel-cost model to estimate use values associated with Salmon sportfishing in Oregon. Working with angler data from the Oregon anglers, Loomis (1992) estimated sportfishing values for 10 rivers in Oregon. Assuming per-trip angler benefits, the author estimates an average of $88.47 per trip with an upper bound of $124.17 for the John Day River and a lower bound of $66.49 for the Coquille River. Similarly, using a discrete choice random utility model to evaluate data from fishery intercept surveys in Oregon, Morey and colleagues (1991) estimated the annual value for salmon fishing at rivers in eight Oregon counties. On average, the authors

estimated a baseline economic significance of $88.56 per individual, per year in 2005 dollars maintaining access to salmon sport fisheries.

When applied to the recreational potential associated with the Cockreham Island buy-out, the results shown above should be viewed as a very conservative lower-bound recreation estimate because they do not include values for other recreational activities in the Skagit river area such as wildlife viewing, camping, and hiking, all of which are likely to be fairly substantial given the attractiveness of the Skagit river area for nature tourism as a Wild and Scenic River.

4.6.2.2 Spatially-Explicit Ecosystem Service Value Estimates

Here, the study team presents results from the spatially explicit valuation analysis for ecosystem goods and services in the study region (Troy and Wilson 2006). Using the NaturalAssets™ information system, the study team was able to generate dynamic queries of peer-reviewed economic valuation data to generate baseline estimates for five land use/land cover types located in the study area. The aggregated non-market ecosystem service value results for these land cover types are presented in Table 29.

Table 29. Non Market Goods and Services ($2005 Per acre/year)

Land Cover	Ecosystem Service	Cites	Min	Max	Average
Forest	CO2 Gas Regulation	2	$5.14	$33.09	$19.12
	Soil Regulation	1	$113.79	$498.58	$306.19
	Disturbance Regulation	1	$16.42	$75.08	$45.75
	Raw Materials	1	$78.20	$78.20	$78.20
	Water Supply	1	$89.16	$391.82	$240.49
	Recreation	3	$0.92	$280.38	$58.27
	Habitat Refugium	1	$31.73	$31.73	$31.73
Total Forest		**10**			**$779.74**
Fresh Wetlands	Waste Regulation	2	$477.41	$3,156.89	$1,817.15
	Water Supply	3	$25.16	$1,572.86	$579.44
	Aesthetic and Amenity	3	$18.46	$662.50	$378.87
	Recreation	5	$86.00	$1,862.37	$372.38
	Habitat Refugium	3	$6.44	$2,907.66	$986.21
Total Fresh Wetlands		**16**			**$4,133.95**
Grassland	Gas Regulation	2	$1.44	$106.71	$54.07
	Soil Regulation	1	$53.35	$53.35	$53.35
Total Grassland		**3**			**$107.43**
River (Salmon Habitat)	Cultural Service	1	$12.97	$118.27	$65.62
	Supporting Service	3	$0.29	$279.65	$142.17
Total Salmon Habitat		**4**			**$207.79**
Agriculture (Costs)	Water Regulation	2	($0.67)	($23.27)	($7.48)
	Disturbance Regulation	1	($0.57)	($1.65)	($1.11)
	Water Quality	3	($0.55)	($45.53)	($10.96)
	Recreation	1	($1.55)	($9.62)	($5.58)
	Habitat Refugium	1	($3.41)	($3.52)	($3.46)
Total Agriculture		**8**			**($28.61)**

Source: SIG NaturalAssets™ Information System.

As the data show, there are a total of (n=41) individual valuation point estimates from a set of 22 empirical economic studies resulting in fairly robust coverage across several essential ecosystem goods and services identified for Cockreham Island. Because each study may contain more than one estimate of economic value, the end result is a collection of several individual data points for each ecosystem land cover/ecosystem service, allowing the team to derive a lower bound, an upper bound, and an average dollar estimate for each land cover type. Every land cover type shown in Table 29 has several specific ecosystem goods and service estimates associated with it, resulting in a range of reported minimum, maximum and average non-market values.

Consistent with previously published literature (Wilson and Troy 2005), the data reveal how different land cover types at the Cockreham Island study area provide different ecosystem services and thus, value. For example, freshwater wetlands deliver the most

value (average per acre) of the four land cover types. The finding that freshwater wetlands provide substantial economic value is consistent with the literature (Woodward and Wui 2001). Moreover, it should be noted that while grassland may provide the least ecosystem service (ES) value per acre, the buy-out option provides for substantial grassland coverage at the site which, when aggregated, will result in significant economic value.

As Table 29 also shows, land involved in commercial agricultural production can negatively affect ecosystem health (Pretty et. al 2000; Tegtmeir and Duffy 2004). Following standard externality accounting procedures for agricultural systems, these dollar value coefficients are shown as costs (in parentheses). Such impacts, or externalities, are quantified indirectly by assigning dollar values through a process called 'avoided cost' estimation. As noted above in section 4.5, three land use types currently present at the Cockreham Island site are allocated to agricultural uses: Commercial Agriculture, Pasture/Hay, and Row Crops. Building on the peer-reviewed work of Tegtmeir and Duffy (2004), this study estimates the ecological costs of agriculture production at the study site for five ecosystem services.[8] Importantly, since the proposed buy-out alternative would remove most intensive agricultural production from the island, these can be seen as avoided costs that accrue as benefits to Skagit County.

4.6.2.3 Present Value of Ecosystem Services

Here, the results are summarized in terms of present value of ecological costs and benefits associated with the status quo and full buy-out scenarios at the Cockreham Island site. First, the values associated with doing nothing and leaving things as they currently exist on Cockreham Island and second, the values associated with the proposed buy-out alternative.

The following two tables show the total ecological benefits and costs of the status quo (Table 30) and the buy-out (Table 31). These ES benefits and costs result from combining the ES values reported above with each alternative's estimated impact on land use and land cover habitat on the Cockreham Island study area.

Consistent with the BCA presented in Section 3, two discount rates were used to estimate the present value of ecosystem services—the FEMA seven percent discount rate and the Federal OMB three percent discount rate. The evaluation period for the flow of ecosystem services is 100 years, given the permanency of the solution of the floodplain buy-out and removal of residential and commercial agricultural properties.

[8] Tegtmeir and Duffy (2004) estimate both human health and ecological impacts from agriculture. To remain consistent with the ecosystem service typology, we limit the cost effects to non-market ecological impacts only.

Table 30. Present Ecological Value of Status Quo ($2005)

Habitat	$ acre/year	Land (in acres)	Annual ES Value	Present Value with 3% Discount Rate (in $million)	Present Value with 7% Discount Rate (in $million)
Bare Gravel	$0.00	2.75	$0.00	$0.00	$0.00
Modified	$0.00	48.31	$0.00	$0.00	$0.00
Salmon Habitat	$207.79	272.32	$56,587	$1.41	$0.71
Forest	$779.94	186.09	$129,508	$3.24	$1.62
Low Intensity Residential	$0.00	48.64	$0.00	$0.00	$0.00
Commercial Agriculture	($28.60)	34.96	($1,000)	($0.03)	($0.01)
Commercial/ Industrial	$0.00	36.81	$0.00	$0.00	$0.00
Shrubland	$0.00	70.83	$0.00	$0.00	$0.00
Grasslands/ Herbaceous	$107.97	50.92	$5,498	$0.14	$0.07
Pasture/Hay	($28.60)	639.77	($18,300)	($0.46)	($0.23)
Row Crops	($28.60)	406.24	($11,620)	($0.29)	($0.15)
Wetlands	$4133.95	143.41	$592,844	$14.82	$7.41
Managed Upland	$433.86	$0.00	$0.00	$0.00	$0.00
Total		**1,921.1**	**$753,515**	**$18.84**	**$9.42**

Table 31. Present Ecological Value of Proposed Buy-out

Habitat	$ acre/year	Land (in acres)	Annual ES Value	Present Value with 3% Discount Rate (in $million)	Present Value with 7% Discount Rate (in $million)
Bare Gravel	$0.00	3.56	$0.00	$0.00	$0.00
Modified	$0.00	10.32	$0.00	$0.00	$0.00
Salmon Habitat	$207.79	432.83	$89,940	$2.25	$1.12
Forest	$779.94	329.55	$256,961	$6.42	$3.21
Low Intensity Residential	$0.00	0.0	$0.00	$0.00	$0.00
Commercial Agriculture	($28.60)	0.0	$0.00	$0.00	$0.00
Commercial/Industrial	$0.00	0.0	$0.00	$0.00	$0.00
Shrubland	$0.00	0.0	$0.00	$0.00	$0.00
Grasslands/Herbaceous	$107.97	0.0	$0.00	$0.00	$0.00
Pasture/Hay	($28.60)	0.0	$0.00	$0.00	$0.00
Row Crops	($28.60)	0.0	$0.00	$0.00	$0.00
Wetlands	$4133.95	284.04	$1,174,225	$29.36	$14.68
Managed Upland	$433.86	860.75	$382,052	$9.55	$4.78
Total		**1,921.1**	**$1,903,177**	**$47.58**	**$23.79**

As Table 30 and Table 31 show, under the present value analysis conditions, significant differences do appear between the two land use alternatives, and while net ecological benefits do flow from the current status quo conditions, the results strongly favor the proposed buy-out for the Cockreham Island site.

Under the three percent discount rate, the difference between the two scenarios reveals an increase in ecological benefit of approximately **$28,741,556**. Following the FEMA required seven percent discount rate, the increase in ecological benefit remains positive at approximately **$14,370,778**. Thus, in aggregate terms, the ecological economic value-transfer results indicate that the proposed buy-out plan would provide a *gain* in ES values to Skagit County.

Turning to consider present values associated with individual property parcels under each alternative scenario, the study team assessed the ecosystem service flows that each development alternative would generate for individual parcels on Cockreham Island. The parcel level results for both the status quo and the proposed buy-out are presented in Table 32 and Table 33. The parcel level results do not include the non-terrestrial freshwater habitat included in the aggregate analysis and Total Benefit Cost Analysis.

The parcel-by-parcel analysis reveals the same general pattern as the data in the aggregate analysis, and includes ecological benefits associated with the property buy-out range from **$21.6 million** (seven percent discount rate) **to $43.3 million** (three percent discount rate). [9]

Table 32. Present Value of Parcels under the Status Quo ($2005)

Parcels	Acres	Annual ES Value	NPV with 3%	NPV with 7%
P109700	4.8	($142)	($3,549)	($1,774)
P114772	12.8	($343)	($8,573)	($4,287)
P116676	2.5	$227	$5,670	$2,835
P116907	1.4	$252	$6,307	$3,153
P119138	2.5	($71)	($1,764)	($882)
P41173	1.8	$0	$0	$0
P41212	1.9	$1,440	$35,998	$17,999
P41219	36.1	$52,104	$1,302,604	$651,302
P41220	36.3	$22,588	$564,707	$282,353
P41221	27.4	$5	$121	$61
P41222	2.4	$1,802	$45,059	$22,529
P41223	4.7	$0	$0	$0
P41224	0.3	$0	$0	$0
P41225	3.2	$376	$9,412	$4,706

[9] Values are in $2005.

Parcels	Acres	Annual ES Value	NPV with 3%	NPV with 7%
P41226	5.3	($151)	($3,768)	($1,884)
P41227	25.9	($762)	($19,057)	($9,529)
P41229	8.0	$16,631	$415,774	$207,887
P41230	36.4	$69,710	$1,742,744	$871,372
P41236	25.1	$35,308	$882,708	$441,354
P41237	4.8	($95)	($2,386)	($1,193)
P41238	33.5	$4,094	$102,348	$51,174
P41239	2.5	$4,496	$112,404	$56,202
P41240	26.4	($780)	($19,511)	($9,756)
P41241	1.6	($48)	($1,205)	($602)
P41242	9.6	($284)	($7,105)	($3,553)
P41243	29.6	$9,355	$233,875	$116,938
P41244	9.8	$1,041	$26,021	$13,011
P41245	18.3	($542)	($13,538)	($6,769)
P41246	36.5	($1,078)	($26,952)	($13,476)
P41247	18.5	($546)	($13,646)	($6,823)
P41248	11.9	$221	$5,523	$2,762
P41249	15.0	$366	$9,153	$4,576
P41250	32.5	$27,440	$686,012	$343,006
P41251	5.2	$5,282	$132,047	$66,023
P41253	39.3	$38,217	$955,434	$477,717
P41254	44.2	$16,920	$422,996	$211,498
P41255	24.4	($338)	($8,458)	($4,229)
P41256	2.3	($59)	($1,482)	($741)
P41257	10.4	$5,355	$133,874	$66,937
P41258	10.4	$6,550	$163,741	$81,870
P41259	7.3	$2,962	$74,050	$37,025
P41260	0.3	($2)	($41)	($20)
P41261	1.8	$1,477	$36,923	$18,461
P41262	9.6	($248)	($6,208)	($3,104)
P41263	0.1	($0)	($1)	($1)
P41265	2.2	$2,671	$66,763	$33,382
P41266	1.0	$382	$9,555	$4,778
P41269	1.6	$822	$20,552	$10,276
P41270	30.9	$9,730	$243,262	$121,631
P41271	10.7	$10,036	$250,908	$125,454
P41272	4.7	$8,452	$211,307	$105,654
P41273	1.4	($2)	($44)	($22)
P41274	9.8	($281)	($7,023)	($3,512)
P41275	4.4	($121)	($3,016)	($1,508)
P41276	29.3	$31,058	$776,453	$388,227
P41277	9.1	$1,538	$38,451	$19,225
P41278	1.9	$2,610	$65,242	$32,621

Parcels	Acres	Annual ES Value	NPV with 3%	NPV with 7%
P41280	8.2	$2,817	$70,437	$35,218
P41281	5.1	$12,418	$310,456	$155,228
P41283	5.8	$2,904	$72,602	$36,301
P41284	5.2	$3,697	$92,420	$46,210
P41286	32.5	($395)	($9,869)	($4,934)
P41289	10.8	$742	$18,542	$9,271
P41290	25.6	$15,555	$388,881	$194,441
P41291	1.0	$1,286	$32,159	$16,080
P41292	0.9	$746	$18,651	$9,325
P41294	1.1	$1,873	$46,827	$23,413
P41295	8.3	($210)	($5,238)	($2,619)
P41296	0.2	($7)	($164)	($82)
P41298	25.4	$47,894	$1,197,361	$598,680
P41299	3.6	$1,411	$35,271	$17,635
P41300	5.1	$8,023	$200,583	$100,292
P41301	5.8	$6,393	$159,830	$79,915
P41302	6.5	$13,167	$329,184	$164,592
P41304	3.9	$3,681	$92,033	$46,017
P41306	20.7	$10,683	$267,069	$133,535
P41307	3.9	$4,439	$110,963	$55,482
P41308	14.9	$2,053	$51,315	$25,658
P41309	23.9	($606)	($15,148)	($7,574)
P41310	3.8	($111)	($2,777)	($1,389)
P41312	6.8	($201)	($5,031)	($2,516)
P41313	10.4	($308)	($7,699)	($3,849)
P41314	20.4	($603)	($15,071)	($7,536)
P41316	21.0	$13,389	$334,726	$167,363
P41327	19.5	$29,835	$745,875	$372,938
P41410	0.3	$6	$145	$73
P41542	21.4	$15,622	$390,561	$195,281
P41543	1.0	$0	$0	$0
P41546	15.0	$32,328	$808,188	$404,094
P41743	18.4	$1,272	$31,796	$15,898
P41744	12.7	$1,947	$48,668	$24,334
P41745	7.4	$299	$7,476	$3,738
P41746	21.8	$6,495	$162,375	$81,188
P41750	8.8	($47)	($1,166)	($583)
P41782	0.3	($10)	($241)	($121)
P41799	31.6	($896)	($22,403)	($11,201)
P41800	6.0	($116)	($2,903)	($1,452)
P41801	0.9	($23)	($567)	($283)
P41825	5.1	$3,148	$78,696	$39,348
P41828	38.5	$4,485	$112,123	$56,062

Parcels	Acres	Annual ES Value	NPV with 3%	NPV with 7%
P41829	36.6	($549)	($13,733)	($6,866)
P41830	34.2	($988)	($24,699)	($12,350)
P41847	12.1	($88)	($2,200)	($1,100)
P41850	25.4	($540)	($13,498)	($6,749)
P41851	18.2	($525)	($13,137)	($6,568)
P41852	19.3	($557)	($13,915)	($6,957)
P41853	38.3	($1,105)	($27,627)	($13,814)
P65608	0.3	$1	$24	$12
P65609	0.6	$0	$0	$0
P65622	2.4	($69)	($1,734)	($867)
P65623	2.0	($13)	($333)	($167)
P65624	2.1	$1,463	$36,587	$18,294
P65625	1.8	($52)	($1,296)	($648)
P65626	4.3	$1	$30	$15
P65627	3.5	($96)	($2,389)	($1,194)
P65628	2.2	$111	$2,786	$1,393
P65630	1.5	$25	$630	$315
P65631	1.4	$34	$848	$424
P65632	1.3	$37	$921	$460
P65633	1.4	$33	$824	$412
P65634	1.5	$29	$727	$363
P65635	1.4	$23	$581	$291
P65636	1.5	$23	$581	$291
P65637	1.2	$6	$145	$73
P65638	1.6	$23	$581	$291
P65639	1.7	$1,188	$29,700	$14,850
P65640	0.6	$493	$12,331	$6,165
P65641	0.9	$660	$16,497	$8,249
P65642	1.4	$978	$24,443	$12,222
P65643	0.8	$652	$16,303	$8,152
P65644	1.3	$1,015	$25,364	$12,682
P65645	1.2	$968	$24,201	$12,100
P65646	1.2	$960	$24,007	$12,003
P65647	1.0	$773	$19,332	$9,666
P65648	1.3	$1,085	$27,132	$13,566
P65649	2.0	$1,238	$30,960	$15,480
P65650	1.7	$1,367	$34,181	$17,091
P65651	1.8	$1,426	$35,659	$17,830
P65652	1.7	$1,397	$34,932	$17,466
P65653	1.7	$1,387	$34,666	$17,333
P65654	3.0	$2,406	$60,151	$30,075
P65655	3.1	$2,513	$62,815	$31,408
P65656	2.1	$1,610	$40,252	$20,126

Parcels	Acres	Annual ES Value	NPV with 3%	NPV with 7%
P65657	4.3	$922	$23,053	$11,526
Total	**1,490.0**	**$650,972**	**$16,274,293**	**$8,137,147**

Table 33. Present Value of Parcels under Proposed Buy-out ($2005)

Parcels	Acres	Annual ES Value	NPV with 3%	NPV with 7%
P109700	4.8	$2,203	$55,063	$27,532
P114772	12.8	$6,272	$156,808	$78,404
P116676	2.5	$1,165	$29,118	$14,559
P116907	1.4	$1,054	$26,357	$13,178
P119138	2.5	$2,170	$54,240	$27,120
P41173	1.8	$1,481	$37,016	$18,508
P41212	1.9	$1,485	$37,137	$18,568
P41219	36.1	$63,611	$1,590,274	$795,137
P41220	36.3	$38,177	$954,417	$477,208
P41221	27.4	$21,412	$535,300	$267,650
P41222	2.4	$1,793	$44,816	$22,408
P41223	4.7	$3,751	$93,775	$46,887
P41224	0.3	$235	$5,862	$2,931
P41225	3.2	$2,492	$62,307	$31,153
P41226	5.3	$2,415	$60,369	$30,184
P41227	25.9	$17,326	$433,143	$216,572
P41229	8.0	$17,574	$439,345	$219,672
P41230	36.4	$80,703	$2,017,579	$1,008,790
P41236	25.1	$44,615	$1,115,367	$557,684
P41237	4.8	$2,219	$55,475	$27,738
P41238	33.5	$40,686	$1,017,159	$508,580
P41239	2.5	$4,693	$117,322	$58,661
P41240	26.4	$12,279	$306,979	$153,490
P41241	1.6	$755	$18,871	$9,436
P41242	9.6	$12,139	$303,467	$151,733
P41243	29.6	$45,188	$1,129,709	$564,854
P41244	9.8	$11,456	$286,388	$143,194
P41245	18.3	$8,402	$210,055	$105,027
P41246	36.5	$17,264	$431,593	$215,796
P41247	18.5	$8,470	$211,751	$105,875
P41248	11.9	$8,543	$213,568	$106,784
P41249	15.0	$5,792	$144,793	$72,396
P41250	32.5	$106,695	$2,667,366	$1,333,683
P41251	5.2	$9,316	$232,899	$116,450
P41253	39.3	$94,411	$2,360,266	$1,180,133

Parcels	Acres	Annual ES Value	NPV with 3%	NPV with 7%
P41254	44.2	$73,435	$1,835,867	$917,934
P41255	24.4	$12,675	$316,863	$158,432
P41256	2.3	$1,346	$33,649	$16,824
P41257	10.4	$18,828	$470,692	$235,346
P41258	10.4	$22,407	$560,179	$280,089
P41259	7.3	$19,483	$487,068	$243,534
P41260	0.3	$142	$3,561	$1,781
P41261	1.8	$3,193	$79,821	$39,911
P41262	9.6	$19,447	$486,172	$243,086
P41263	0.1	$58	$1,454	$727
P41265	2.2	$5,704	$142,588	$71,294
P41266	1.0	$3,291	$82,268	$41,134
P41269	1.6	$2,211	$55,281	$27,641
P41270	30.9	$70,154	$1,753,842	$876,921
P41271	10.7	$23,469	$586,730	$293,365
P41272	4.7	$9,511	$237,768	$118,884
P41273	1.4	$638	$15,940	$7,970
P41274	9.8	$4,468	$111,701	$55,851
P41275	4.4	$8,434	$210,854	$105,427
P41276	29.3	$46,285	$1,157,131	$578,566
P41277	9.1	$9,453	$236,315	$118,157
P41278	1.9	$5,250	$131,251	$65,626
P41280	8.2	$17,496	$437,407	$218,703
P41281	5.1	$14,253	$356,326	$178,163
P41283	5.8	$8,014	$200,341	$100,170
P41284	5.2	$9,856	$246,392	$123,196
P41286	32.5	$22,813	$570,329	$285,165
P41289	10.8	$10,228	$255,695	$127,847
P41290	25.6	$39,243	$981,064	$490,532
P41291	1.0	$1,622	$40,553	$20,276
P41292	0.9	$749	$18,726	$9,363
P41294	1.1	$2,156	$53,901	$26,950
P41295	8.3	$3,800	$95,010	$47,505
P41296	0.2	$102	$2,544	$1,272
P41298	25.4	$55,859	$1,396,474	$698,237
P41299	3.6	$3,534	$88,349	$44,174
P41300	5.1	$9,237	$230,913	$115,456
P41301	5.8	$8,529	$213,228	$106,614
P41302	6.5	$15,133	$378,322	$189,161
P41304	3.9	$5,220	$130,500	$65,250
P41306	20.7	$27,978	$699,448	$349,724
P41307	3.9	$6,176	$154,410	$77,205
P41308	14.9	$29,530	$738,257	$369,128

Parcels	Acres	Annual ES Value	NPV with 3%	NPV with 7%
P41309	23.9	$21,853	$546,322	$273,161
P41310	3.8	$12,564	$314,101	$157,051
P41312	6.8	$3,123	$78,077	$39,039
P41313	10.4	$4,804	$120,108	$60,054
P41314	20.4	$9,355	$233,868	$116,934
P41316	21.0	$27,116	$677,888	$338,944
P41327	19.5	$29,822	$745,549	$372,774
P41410	0.3	$142	$3,561	$1,781
P41542	21.4	$26,234	$655,843	$327,922
P41543	1.0	$471	$11,773	$5,887
P41546	15.0	$39,096	$977,406	$488,703
P41743	18.4	$10,744	$268,607	$134,303
P41744	12.7	$5,548	$138,688	$69,344
P41745	7.4	$1,604	$40,092	$20,046
P41746	21.8	$8,636	$215,893	$107,947
P41750	8.8	$6,427	$160,684	$80,342
P41782	0.3	$70	$1,744	$872
P41799	31.6	$13,477	$336,921	$168,461
P41800	6.0	$3,286	$82,147	$41,073
P41801	0.9	$424	$10,611	$5,305
P41825	5.1	$3,224	$80,597	$40,298
P41828	38.5	$22,043	$551,070	$275,535
P41829	36.6	$17,377	$434,427	$217,213
P41830	34.2	$15,693	$392,324	$196,162
P41847	12.1	$7,205	$180,137	$90,069
P41850	25.4	$13,878	$346,950	$173,475
P41851	18.2	$7,929	$198,233	$99,117
P41852	19.3	$8,155	$203,878	$101,939
P41853	38.3	$16,606	$415,144	$207,572
P65608	0.3	$226	$5,644	$2,822
P65609	0.6	$456	$11,410	$5,705
P65622	2.4	$1,093	$27,326	$13,663
P65623	2.0	$943	$23,571	$11,785
P65624	2.1	$1,618	$40,456	$20,228
P65625	1.8	$818	$20,446	$10,223
P65626	4.3	$2,024	$50,606	$25,303
P65627	3.5	$1,689	$42,224	$21,112
P65628	2.2	$1,746	$43,653	$21,827
P65630	1.5	$1,064	$26,599	$13,300
P65631	1.4	$935	$23,377	$11,689
P65632	1.3	$892	$22,311	$11,156
P65633	1.4	$961	$24,031	$12,016
P65634	1.5	$1,075	$26,866	$13,433

Parcels	Acres	Annual ES Value	NPV with 3%	NPV with 7%
P65635	1.4	$1,057	$26,429	$13,215
P65636	1.5	$1,104	$27,592	$13,796
P65637	1.2	$967	$24,177	$12,088
P65638	1.6	$1,178	$29,458	$14,729
P65639	1.7	$1,267	$31,686	$15,843
P65640	0.6	$493	$12,331	$6,165
P65641	0.9	$716	$17,902	$8,951
P65642	1.4	$1,098	$27,447	$13,723
P65643	0.8	$584	$14,608	$7,304
P65644	1.3	$892	$22,311	$11,156
P65645	1.2	$801	$20,034	$10,017
P65646	1.2	$832	$20,809	$10,405
P65647	1.0	$705	$17,636	$8,818
P65648	1.3	$1,057	$26,429	$13,215
P65649	2.0	$1,564	$39,099	$19,550
P65650	1.7	$1,365	$34,133	$17,067
P65651	1.8	$1,426	$35,659	$17,830
P65652	1.7	$1,384	$34,593	$17,297
P65653	1.7	$1,374	$34,351	$17,176
P65654	3.0	$2,411	$60,272	$30,136
P65655	3.1	$2,526	$63,155	$31,577
P65656	2.1	$1,675	$41,885	$20,943
P65657	4.3	$3,168	$79,192	$39,596
Total	**1490.5**	**$1,731,740**	**$43,293,491**	**$21,646,745**

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