Mississippi Valley Division,
Regional Planning and Environment Division South

Hatchie/Loosahatchie, Mississippi River Mile 775-736, TN and AR Final Integrated Feasibility Report and Environmental Assessment

Appendix 7 – Economics

February 2024

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Section 1
COST-EFFECTIVE AND INCREMENTAL COST ANALYSES

For environmental planning, where traditional benefit-cost analysis is not possible because costs and benefits are expressed in different units, two analytical methods are used to assist Corps planners in the decision process. First, cost-effectiveness (CE) analysis is conducted to ensure that the least cost solution is identified for each possible level of environmental output. Subsequent incremental cost analysis (ICA) of the cost-effective solutions is conducted to reveal changes in costs for increasing levels of environmental outputs. In the absence of a common measurement unit for comparing the non-monetary benefits with the monetary costs of environmental plans, cost-effectiveness and incremental cost analysis are valuable tools to assist in decision making.

It is important to keep in mind that the most useful information developed by these two methods is what it tells decision makers about the relative relationships among solutions – that one will likely produce greater output than another, or one is likely to be more costly than another – rather than the specific numbers that are calculated. Furthermore, these analyses will usually not lead, and are not intended to lead, to a single best solution (as in economic cost-benefit analysis); however, they will improve the quality of decision making by ensuring that a rational, supportable approach is used in considering and selecting alternative methods to produce environmental outputs.

To perform the CE/ICA, use was made of the IWR Planning Suite Decision Support Software developed by the US Army Corps of Engineers Institute for Water Resources (IWR). IWR Planning Suite has been developed to assist with plan comparison by conducting cost-effectiveness and incremental cost analyses, identifying the plans which are the “Best Buys”, and displaying the effects of each on a range of decision variables. The software is available via the IWR Planning Suite Internet. The latest version (2.0.9.1) has been certified for use by USACE Headquarters, meaning that it has been reviewed and certified by the appropriate Planning Center of Expertise (PCX) and represents a corporate approval that the model is sound and functional.

1.1 ITERATIONS

Multiple iterations of the IWR Planning Suite were used to identify efficient measures and combinations of measures to form the final array of alternatives and ultimately the TSP selection.

Costs and outputs were developed for 83 management measures across all complexes with outputs for each ecological measure being determined by the associated model. The measures from the best buys for each ecological model, and subsequently for each objective, were combined and reassessed in multiple iterations of CE/ICA to identify a final array of plans (“best of the best” plans on the efficient frontier).

1.2 ROUND 1

The first round of IWR Planning Suite runs were conducted on ecological measures using ecological outputs and parametric costs estimates (construction, real estate, OMRR&R, and Adaptive Management and Monitoring). Subsequently, 956 cost-effective plans and 92 best buy plans were identified. Measures that were included in the best buy plans were retained and moved forward to the second iteration. Cost-effective measures were examined based on habitat weighting, and in cases where an important habitat would be screened out, it was retained until the next round (non-efficient plans were removed from further consideration). Sixty-four measures were retained and moved to the 2nd round of CE/ICA. See Figures 1 – 16 for the full range of solutions (where possible) and the incremental cost and output for the best buy plans.

NOTE: Because different ecological models were used in the evaluation of measures, different types of outputs were produced, namely Average Annual Habitat Units (AAHU) or Average Annual Functional Capacity Units (AAFCU). Because of the limitations of the IWR Planning Suite, data in the following figures represent both AAHUs and AAFCU even though only AAHUs are referenced.

Table 7-1. HGM Plantings

Measure ID	Island Complex	Habitat Addressed	AAFCU	Average Annual Cost
BR_6	Brandywine	BLH (floodplain)	66	$15,400
BR_7	Brandywine	BLH (floodplain)	48	$34,413
BR_8	Brandywine	BLH (floodplain)	133	$45,903
BR_9	Brandywine	BLH (floodplain)	31	$14,603
BR_11	Brandywine	BLH (floodplain)	626	$106,654
BR_15	Brandywine	Seasonally herbaceous wetland (aquatic & floodplain)	203	$171,579
HB_1	HopefieldPoint	Seasonally herbaceous wetland (aquatic & floodplain)	9	$15,936
I35_2	Island35_DeanIsland	BLH (floodplain)	65	$18,204
I35_6b	Island35_DeanIsland	BLH (floodplain)	25	$5,706
I35_9b	Island35_DeanIsland	BLH (floodplain)	27	$4,947
I35_12a	Island35_DeanIsland	Cypress - Tupelo (floodplain)	32	$3,827

I40_1a	Island 40_41	BLH (floodplain)	46	$10,299
I40_2a	Island 40_41	BLH (floodplain)	36	$75,381
I40_7b	Island 40_41	BLH (floodplain)	116	$18,138
M_6	Meeman_Shelby	Moist Soil (aquatic & floodplain)	14	$36,894
RL_4	RedmanPoint_LoosahatchieBar	BLH (floodplain)	676	$184,179
RCP_1	Richardson_CedarPoint	Cypress - Tupelo (floodplain)	19	$3,280
RCP_2	Richardson_CedarPoint	Seasonally herbaceous wetland (aquatic & floodplain)	177	$33,218
S_8	Sunrise_Island34	Cypress - Tupelo (floodplain)	30	$7,790
S_9	Sunrise_Island34	BLH (floodplain)	1,614	$631,592
S_10	Sunrise_Island34	Riverfront Forest - Riparian buffers (floodplain)	36	$8,767

Table 7-2. HGM No plantings

Measure ID	Island Complex	Habitat Addressed	AAFCU	Average Annual Costs
HT_6	HatchieTowhead_Randolph	Riverfront Forest - Riparian buffers (floodplain)	26	$12,257
HT_8	HatchieTowhead_Randolph	Riverfront Forest - Riparian buffers (floodplain)	3.4	$40,741
HB_2c	HopefieldPoint_BigRiverPark	Seasonally herbaceous wetland (aquatic & floodplain)	39	$46,305
I35_7h	Island35_DeanIsland	Riverfront Forest - Riparian buffers (floodplain)	18	$1,886
I35_12b	Island35_DeanIsland	Riverfront Forest - Riparian buffers (floodplain)	126	$12,964
I40_3	Island40_41	Riverfront Forest - Riparian buffers (floodplain)	102	$13,897
M_5	MeemanShelbyForest_EagleLake	Cypress - Tupelo (floodplain)	8	$2,281
M_11	MeemanShelbyForest_EagleLake	Moist Soil (aquatic & floodplain)	24	$18,074
M_13	MeemanShelbyForest_EagleLake	BLH (floodplain)	29	$34,699

RCP_3	Richardson_CedarPoint	Riverfront Forest - Riparian buffers (floodplain)	177	$107,340
RCP_4	Richardson_CedarPoint	Riverfront Forest - Riparian buffers (floodplain)	69	$2,593

Table 7-3. Riverine Eddy

Measure ID	Island Complex	Habitat Addressed	AAFCU	Average Annual Costs
Br_5	Brandywine	BLH (floodplain)	444.609	$43,931
I35_7g	Island35_DeanIsland	Secondary Channels (lotic aquatic)	2.67	$53,096
M_1	MeemanShelbyForest_EagleLake	Secondary Channels (lotic aquatic)	5.35	$106,329

Table 7-4. Invertebrate

Measure ID	Island Complex	Habitat Addressed	AAFCU	Average Annual Costs
Br_2	Brandywine	Secondary Channels (lotic aquatic)	83.952	$4,019
D_3	Densford	Secondary Channels (lotic aquatic)	99	$3,845
HT_2	HatchieTowhead_Randolph	MC/Main Channel Border (lotic aquatic)	22.275	$460,448
M_14	MeemanShelbyForest_EagleLake	Secondary Channels (lotic aquatic)	586.08	$3,863
RL_6	RedmanPoint_LoosahatchieBar	Secondary Channels (lotic aquatic)	625.68	$3,995
S_7	Sunrise_Island34	Secondary Channels (lotic aquatic)	100.584	$3,932

Table 7-5. Unidirectional

Measure ID	Island Complex	Habitat Addressed	AAFCU	Average Annual Costs
Br_1	Brandywine	Secondary Channels (lotic aquatic)	22.58	$8,491
Br_4	Brandywine	Meander Scarp/ tertiary channels (lotic aquatic)	112.15	$304,528
I35_3	Island35_DeanIsland	Meander Scarp/ tertiary channels (lotic aquatic)	44.67	$345,638
I35_7a	Island35_DeanIsland	Secondary Channels (lotic aquatic)	59.62	$9,750
S_4	Sunrise_Island34	Meander Scarp/ tertiary channels (lotic aquatic)	275.45	$432,219

Table 7-6. Borrow

Measure ID	Island Complex	Habitat Addressed	AAFCU	Average Annual Costs
Br_14	Brandywine	Borrow Areas (lentic aquatic)	4.41	$100,640
Br_16	Brandywine	Borrow Areas (lentic aquatic)	3.76	$112,750
D_2	Densford	Borrow Areas (lentic aquatic)	5.27	$184,093
HB_3	HopefieldPoint_BigRiverPark	Borrow Areas (lentic aquatic)	1.41	$19,510
HB_4	HopefieldPoint_BigRiverPark	Borrow Areas (lentic aquatic)	1.63	$22,618
HB_5	HopefieldPoint_BigRiverPark	Borrow Areas (lentic aquatic)	1.41	$19,510
HB_6	HopefieldPoint_BigRiverPark	Borrow Areas (lentic aquatic)	2.75	$41,264
HB_7	HopefieldPoint_BigRiverPark	Borrow Areas (lentic aquatic)	1.83	$25,725
HB_8	HopefieldPoint_BigRiverPark	Borrow Areas (lentic aquatic)	3.22	$50,587

HB_9	HopefieldPoint_BigRiverPark	Borrow Areas (lentic aquatic)	2.58	$38,156
I40_7a	Island40_41	Borrow Areas (lentic aquatic)	4.52	$90,987

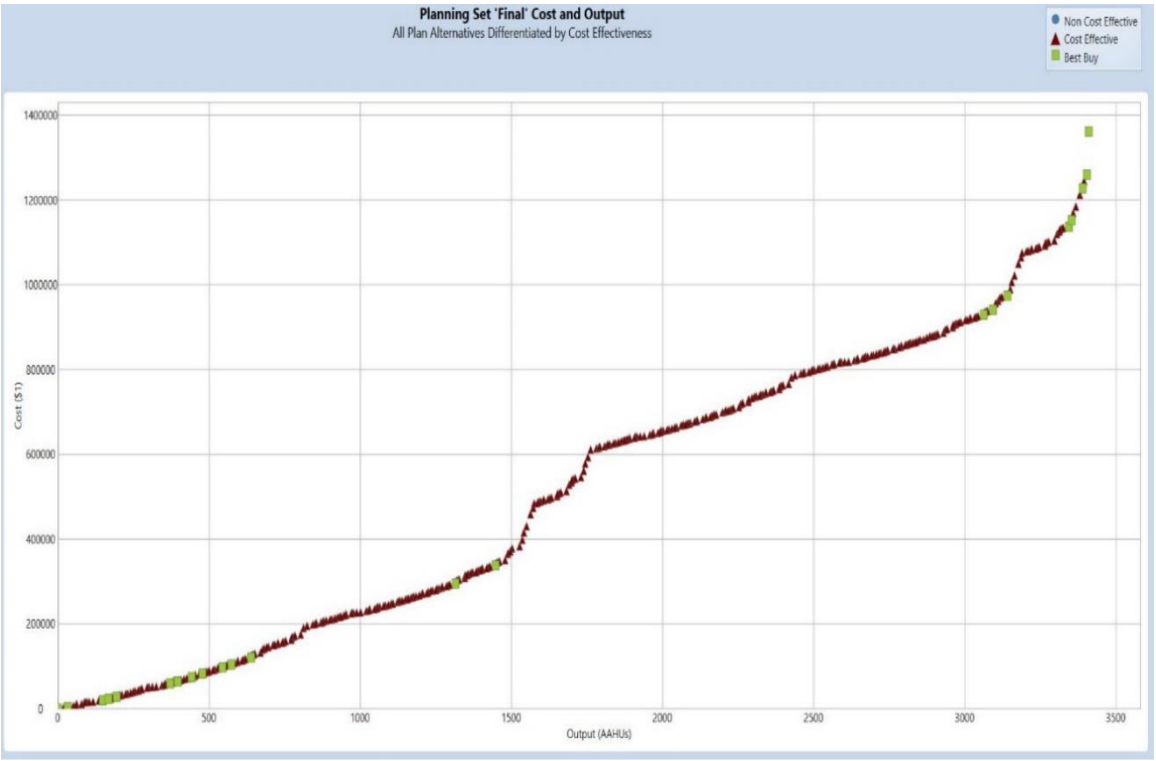
Table 7-7. Bidirectional

Measure ID	Island Complex	Habitat Addressed	AAFCU	Average Annual Costs
Br_10	Brandywine	Slough (lentic aquatic)	0.06	$2,307
Br_12	Brandywine	Slough (lentic aquatic)	2.98	$19,107
Br_13	Brandywine	Slough (lentic aquatic)	4.76	$62,271
D_1	Densford	Slough (lentic aquatic)	3.85	$13,733
HT_1	HatchieTowhead_Randolph	Slough (lentic aquatic)	0.47	$26,953
HT_4	HatchieTowhead_Randolph	Slough (lentic aquatic)	4.69	$23,836
HT_7	HatchieTowhead_Randolph	Slough (lentic aquatic)	0.07	$3,877
HT_10	HatchieTowhead_Randolph	Slough (lentic aquatic)	0.04	$2,896
HB_2ab	HopefieldPoint_BigRiverPark	Slough (lentic aquatic)	0.55	$19,393
I35_6c	Island35_DeanIsland	Borrow Areas (lentic aquatic)	0.1	$6,673
I35_8_a	Island35_DeanIsland	Slough (lentic aquatic)	7.64	$115,326
I35_10a	Island35_DeanIsland	Slough (lentic aquatic)	0.02	$3,678
I35_11	Island35_DeanIsland	Slough (lentic aquatic)	0.76	$33,601
I40_1b	Island40_41	Slough (lentic aquatic)	2.44	$27,359
I40_2b	Island40_41	Slough (lentic aquatic)	0.89	$19,294
I40_4	Island40_41	Slough (lentic aquatic)	0.22	$6,170
I40_5	Island40_41	Slough (lentic aquatic)	1.17	$18,704
RL_3	RedmanPoint_LoosahatchieBar	Secondary Channels (lotic aquatic)	0.42	$3,701
RL_7	RedmanPoint_LoosahatchieBar	Slough (lentic aquatic)	4.68	$22,337
S_1	Sunrise_Island34	Slough (lentic aquatic)	0.93	$12,054

S_2	Sunrise_Island34	Slough (lentic aquatic)	0.12	$3,089
S_6	Sunrise_Island34	Secondary Channels (lotic aquatic)	46	$2,495

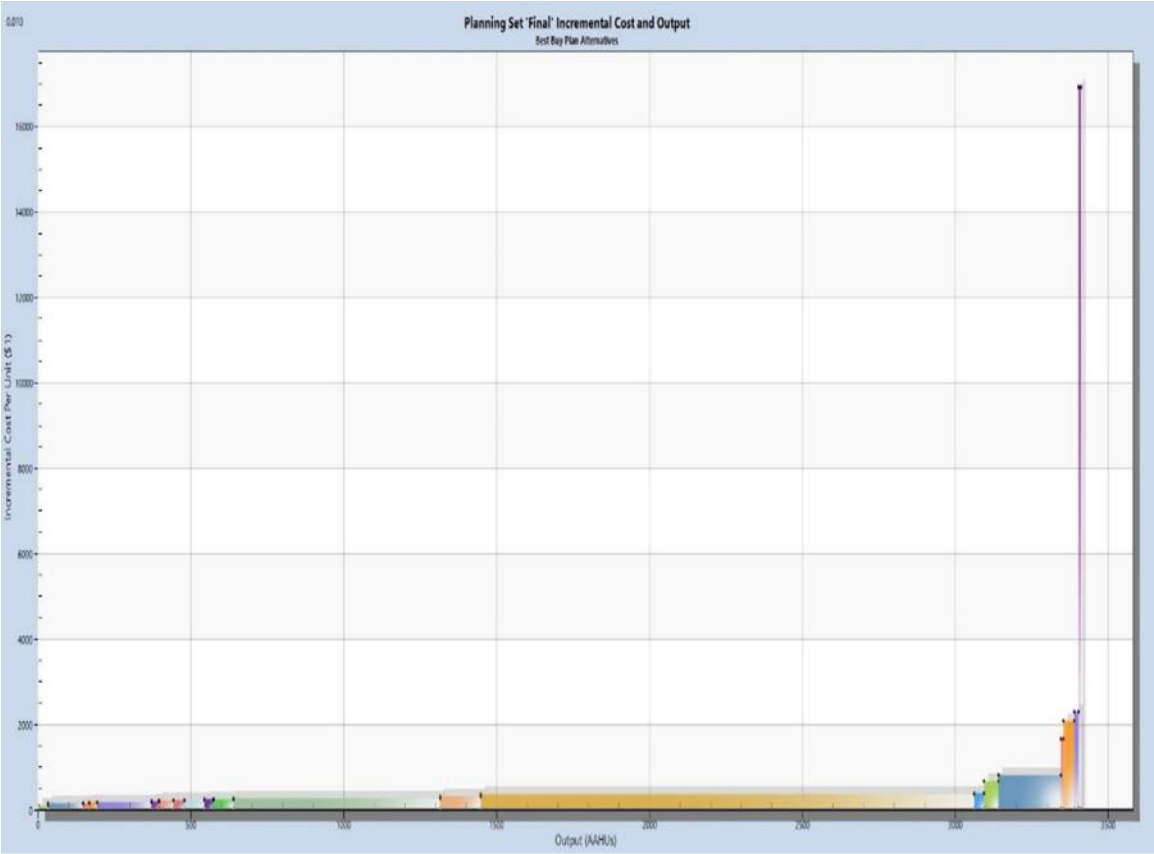
Table 7-8. Isolation

Measure ID	Island Complex	Habitat Addressed	AAFCU	Annual
HB_10	HopefieldPoint_BigRiverPark	Borrow Areas (lentic aquatic)	0.6	$3,514
I35_4b	Island35_DeanIsland	Borrow Areas (lentic aquatic)	0.11	$2,740
I35_5c	Island35_DeanIsland	Slough (lentic aquatic)	0.33	$7,881
I40_6	Island40_41	Borrow Areas (lentic aquatic)	1.48	$6,421



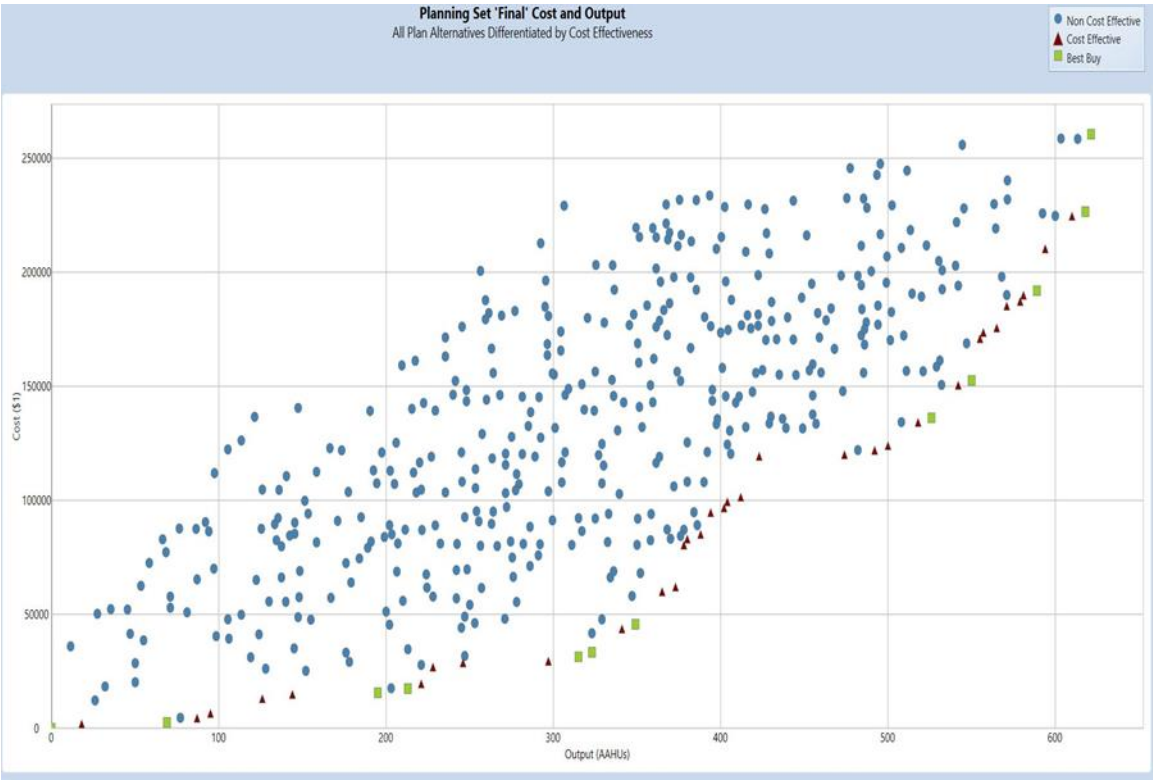
Note: The X-axis is net AAHUs; the Y-axis is the average annual cost ($).

Figure 7-1. Full Range of Solutions: HGM Planting



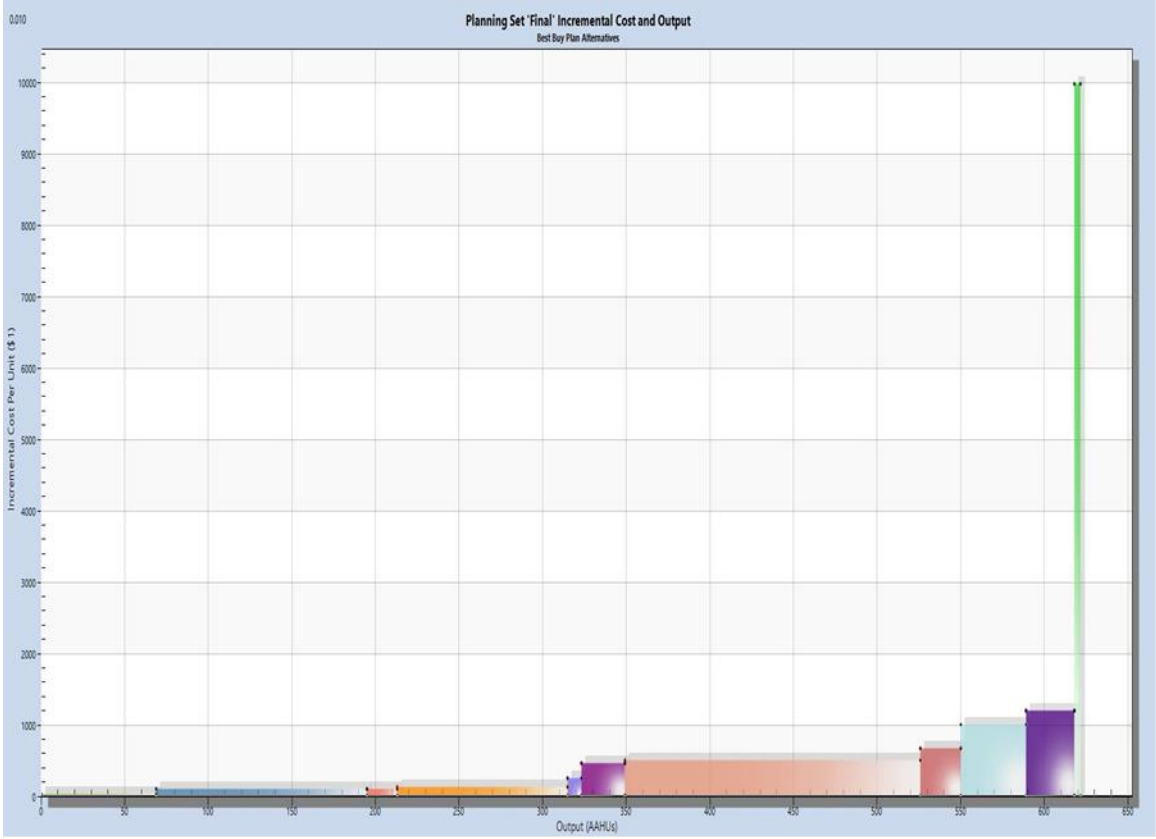
Note: The X-axis is net AAHUs; the Y-axis is the incremental cost per AAHU.

Figure 7-2. Incremental Cost Output for the Best Buy Plans: HGM Planting



Note: The X-axis is net AAHUs; the Y-axis is the average annual cost ($).

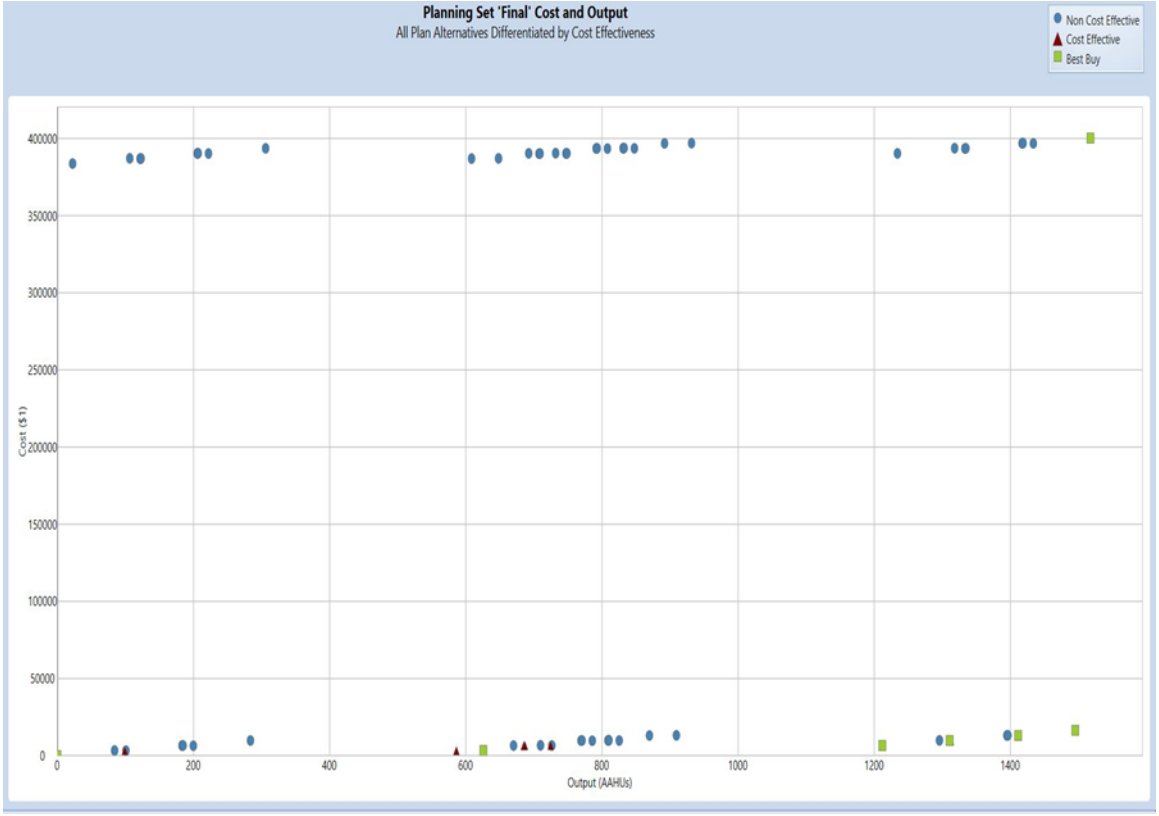
Figure 7-3. Full Range of Solutions: HGM No Planting



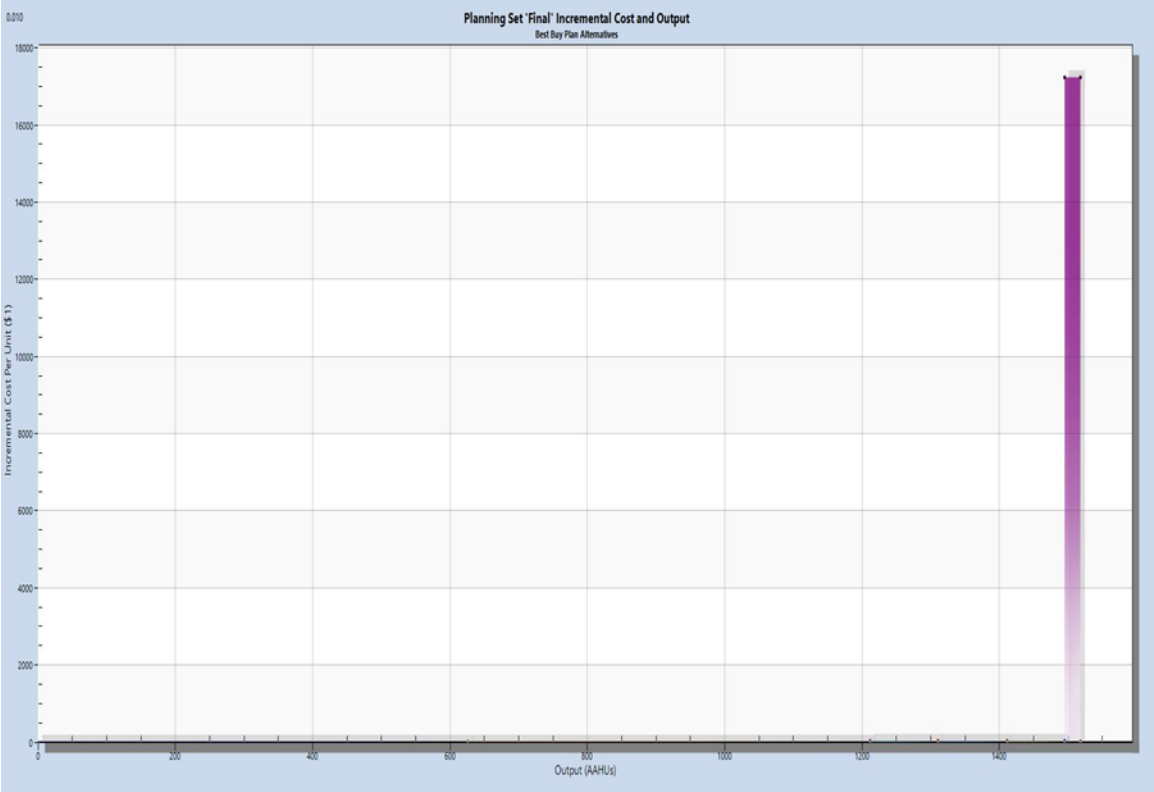
Note: The X-axis is net AAHUs; the Y-axis is the incremental cost per AAHU.

Figure 7-4. Incremental Cost and Output for the Best Buy Plans: HGM No Planting

Figure 7-5. Full Range of Solutions: Invertebrate

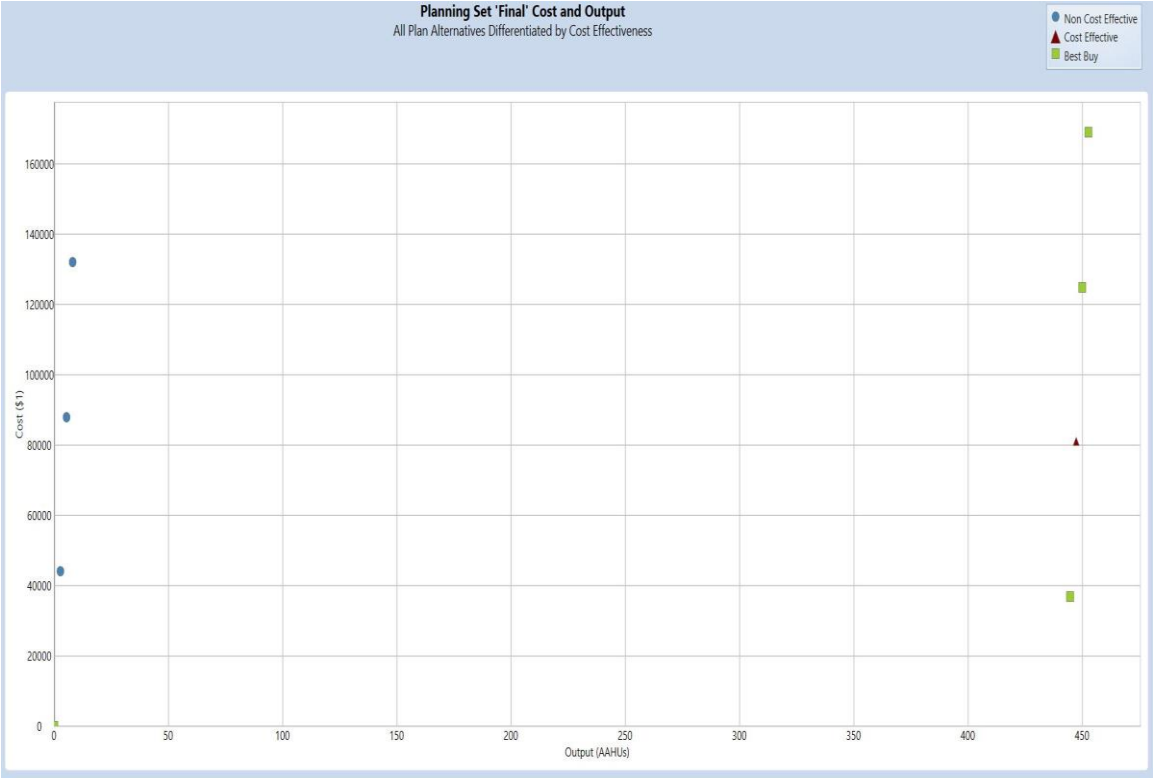


Note: The X-axis is net AAHUs; the Y-axis is the average annual cost ($).



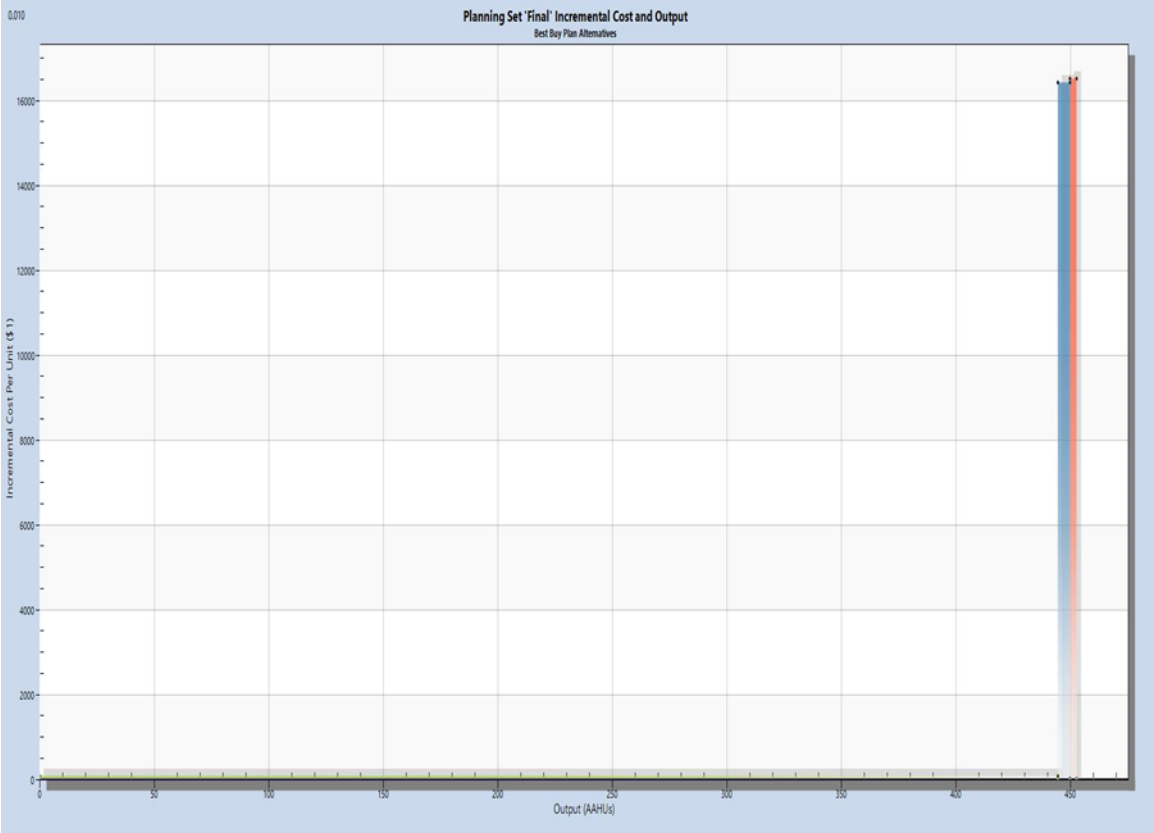
Note: The X-axis is net AAHUs; the Y-axis is the incremental cost per AAHU.

Figure 7-6. Incremental Cost and Output for the Best Buy Plans: Invertebrate



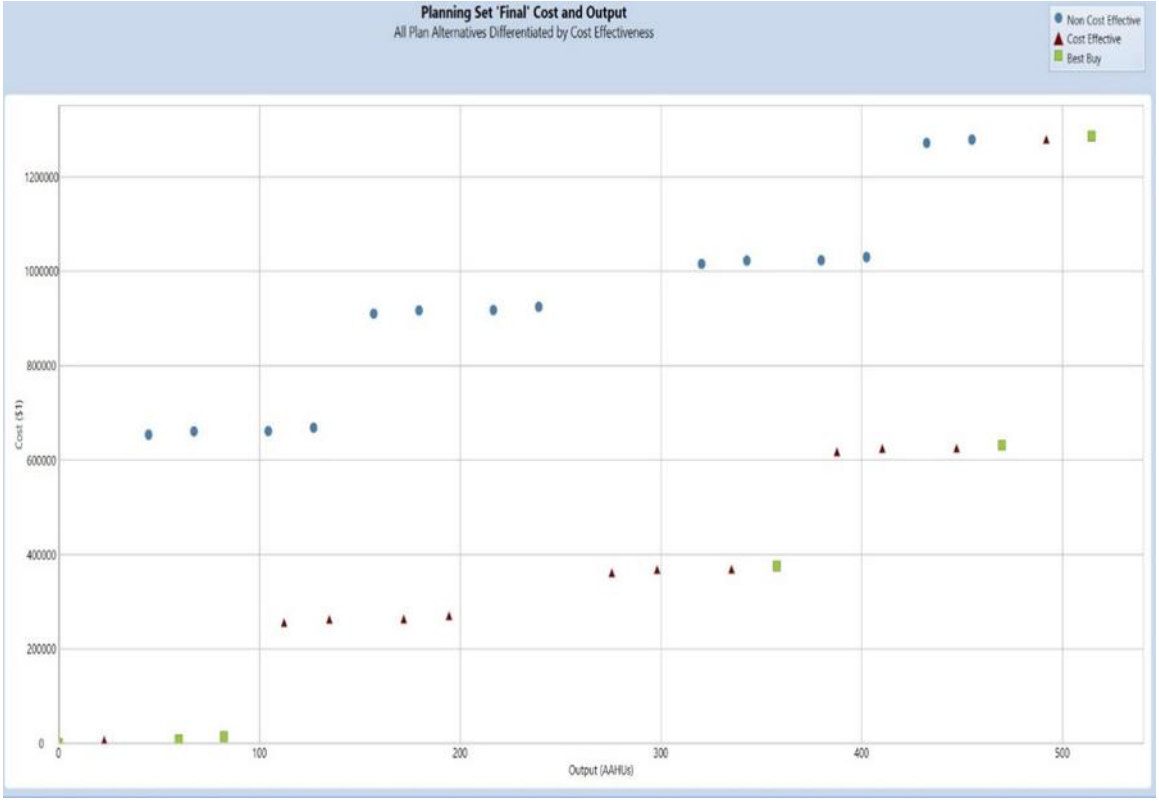
Note: The X-axis is net AAHUs; the Y-axis is the average annual cost ($).

Figure 7-7. Full Range of Solutions: Riverine



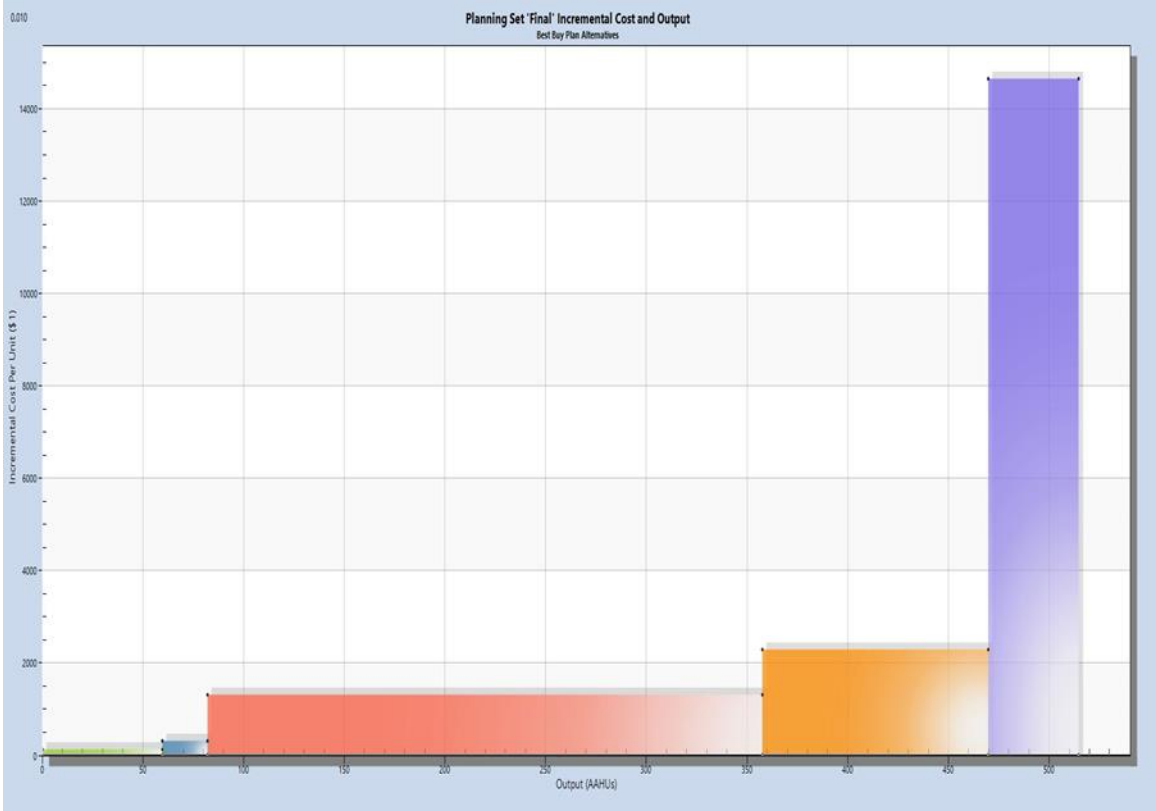
Note: The X-axis is net AAHUs; the Y-axis is the incremental cost per AAHU.

Figure 7-8. Incremental Cost and Output for the Best Buy Plans: Riverine



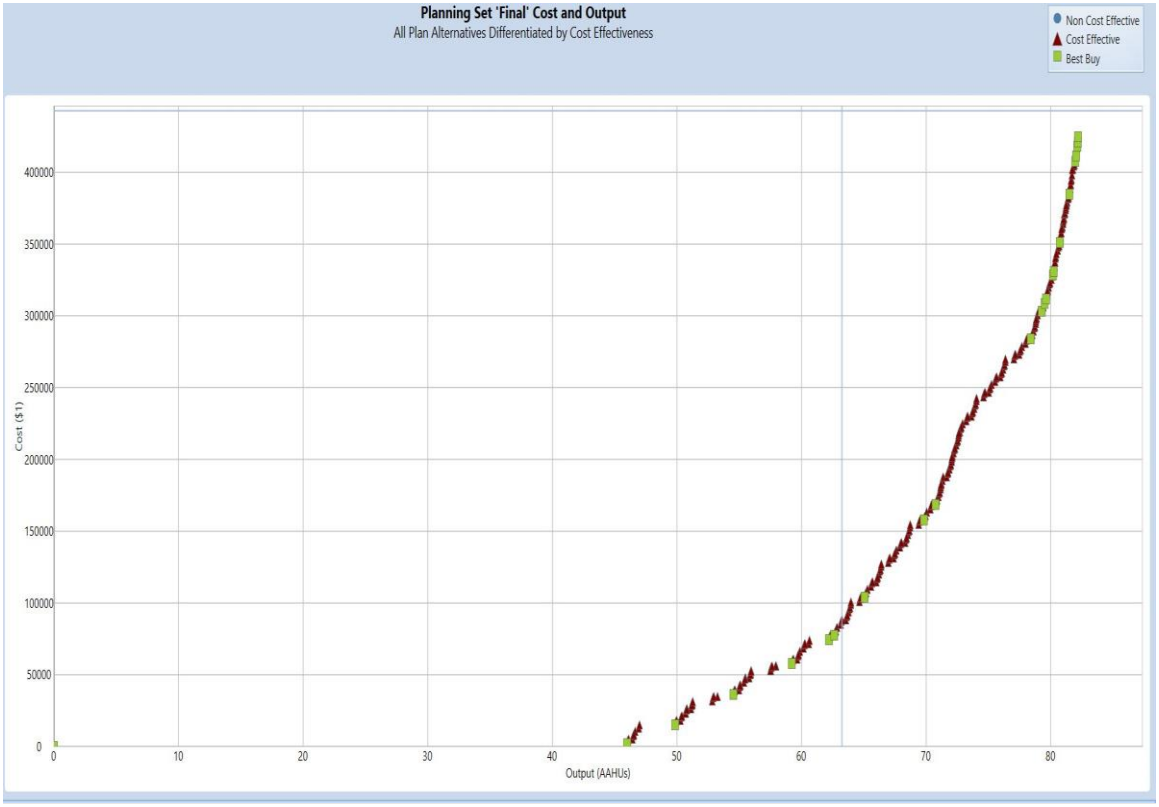
Note: The X-axis is net AAHUs; the Y-axis is the average annual cost ($).

Figure 7-9. Full Range of Solutions: Unidirectional



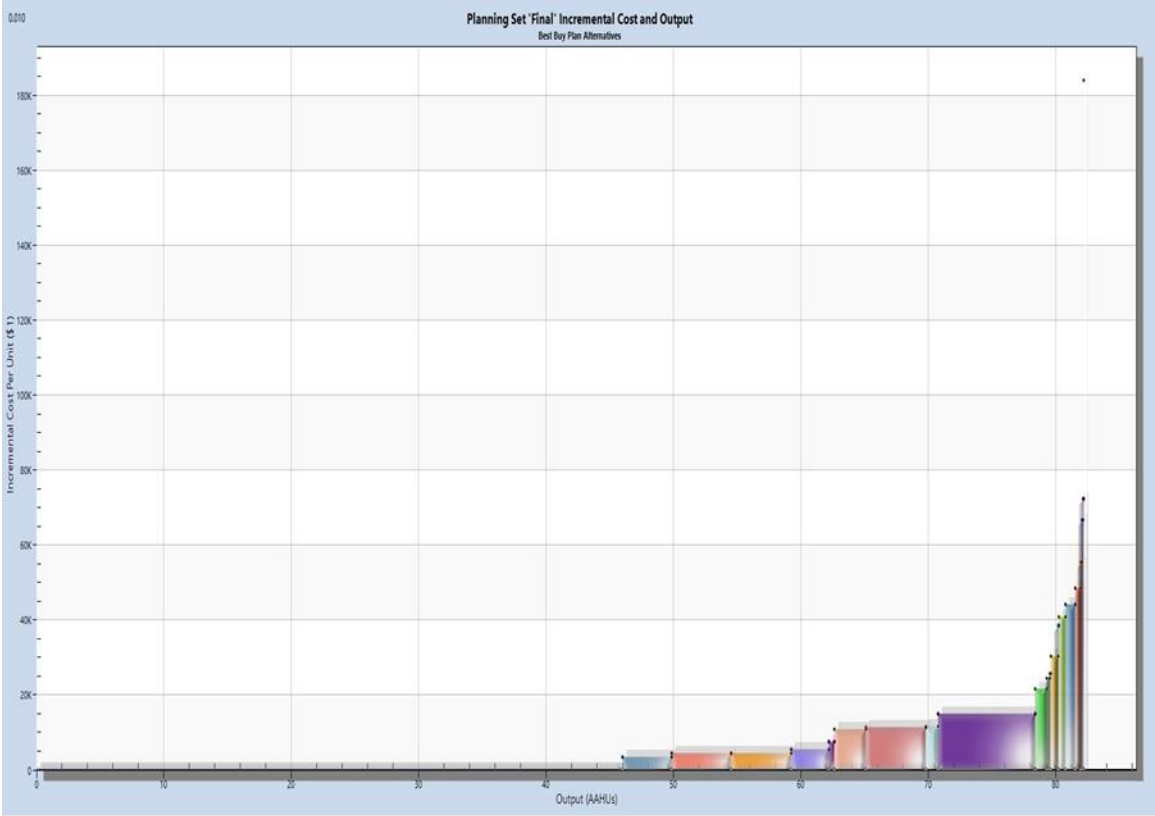
Note: The X-axis is net AAHUs; the Y-axis is the incremental cost per AAHU.

Figure 7-10. Incremental Cost and Output for the Best Buy Plans: Unidirectional



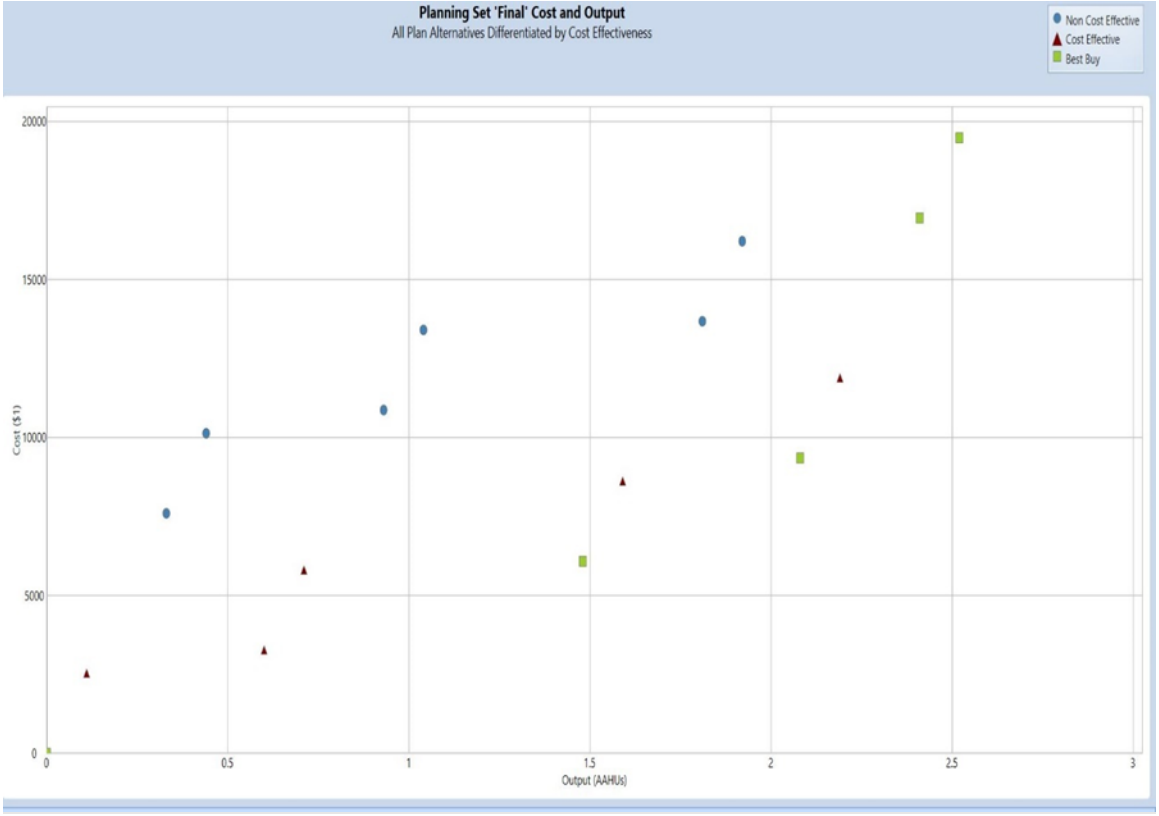
Note: The X-axis is net AAHUs; the Y-axis is the average annual cost ($).

Figure 7-11. Full Range of Solutions: Bidirectional



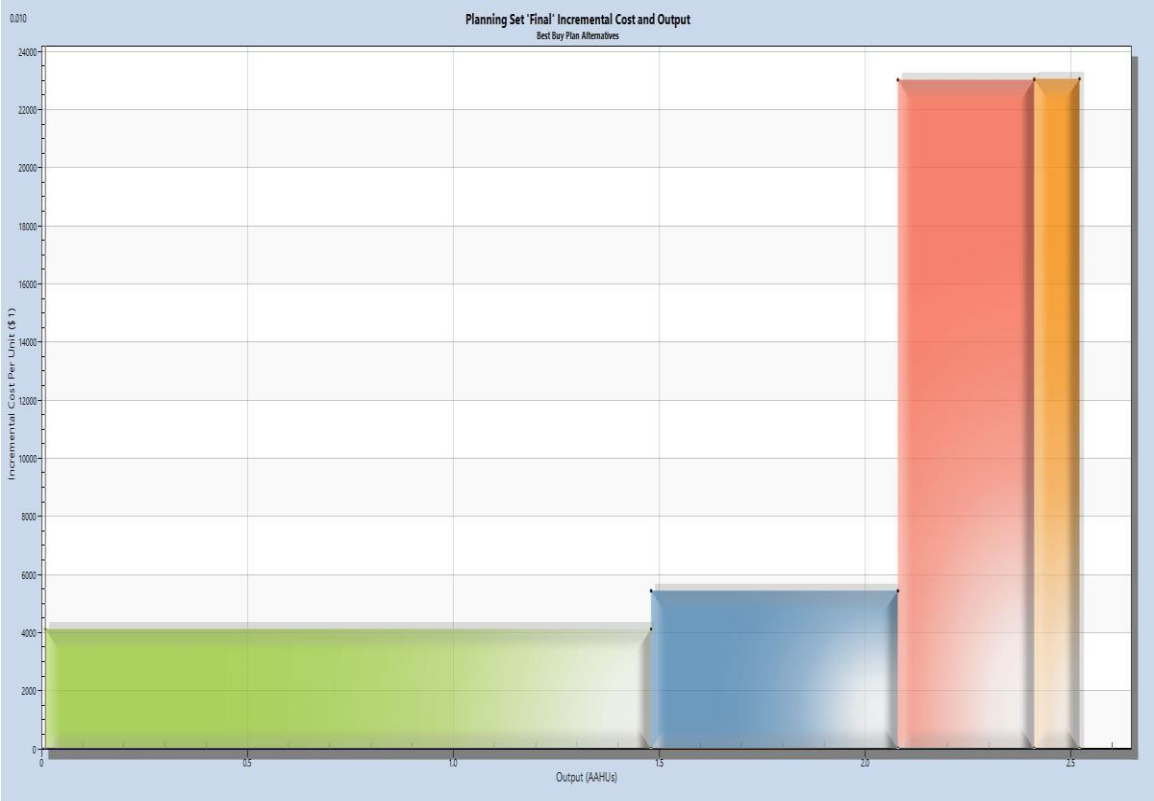
Note: The X-axis is net AAHUs; the Y-axis is the incremental cost per AAHU.

Figure 7-12. Incremental Cost and Output for the Best Buy Plans: Bidirectional



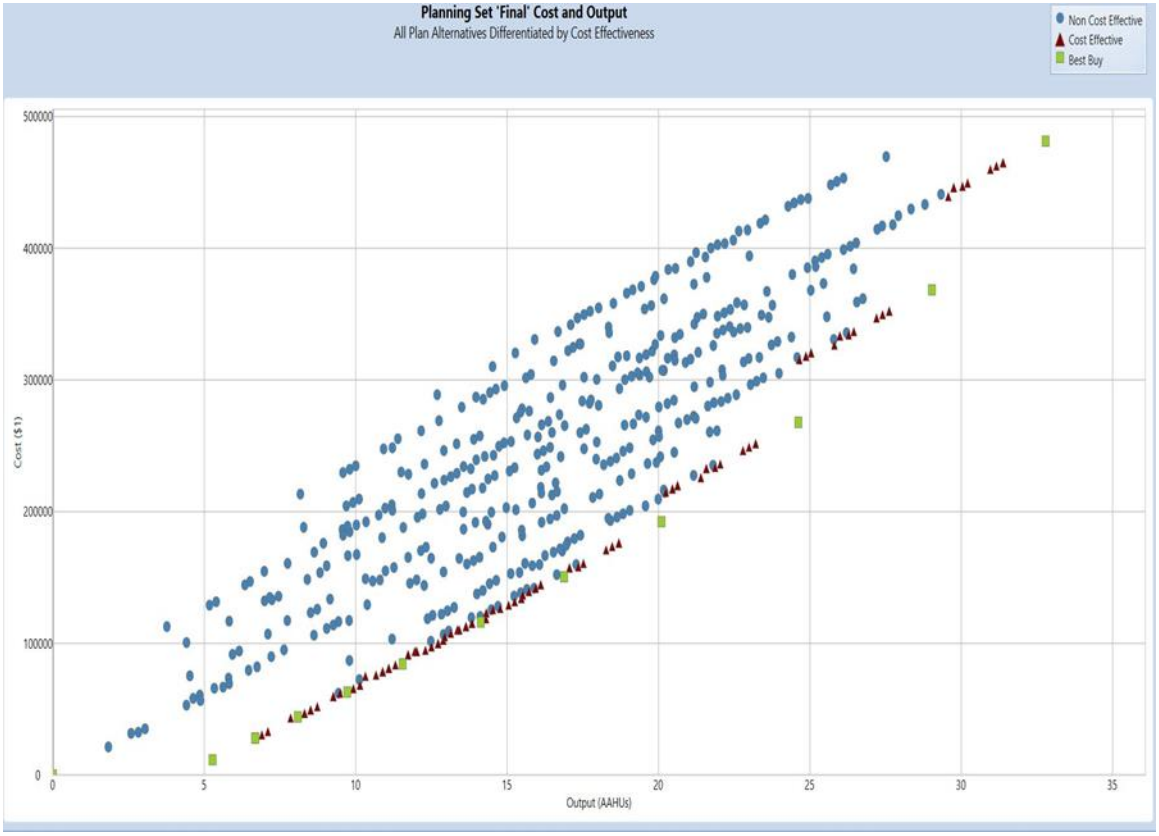
Note: The X-axis is net AAHUs; the Y-axis is the average annual cost ($).

Figure 7-13. Full Range of Solutions: Isolation



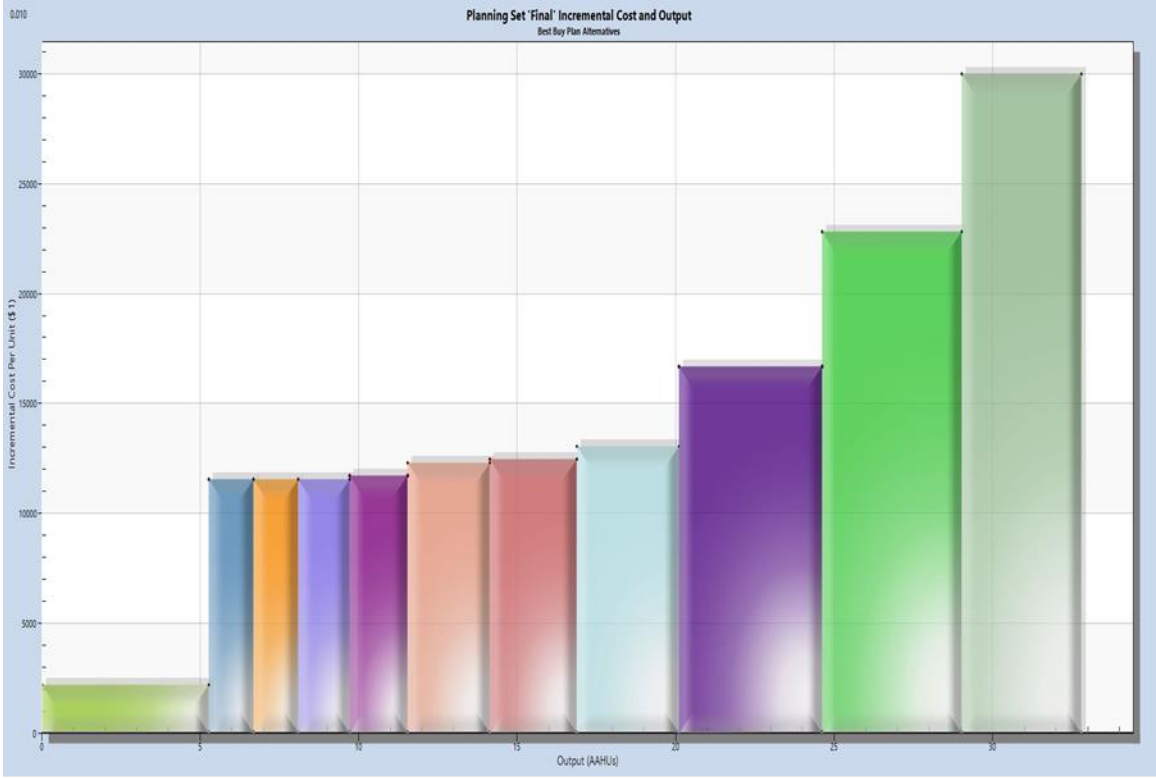
Note: The X-axis is net AAHUs; the Y-axis is the incremental cost per AAHU.

Figure 7-14. Incremental Cost and Output for the Best Buy Plans: Isolation



Note: The X-axis is net AAHUs; the Y-axis is the average annual cost ($).

Figure 7-15. Full Range of Solutions: Borrow



Note: The X-axis is net AAHUs; the Y-axis is the incremental cost per AAHU.

Figure 7-16. Incremental Cost and Output for the Best Buy Plans: Borrow

1.3 ROUND 2

For the second round of CE/ICA, the remaining measures were grouped by objective and all measures under each objective were combined and run together. As a result, 833 cost-effective plans and 68 best buy plans were identified. Measures that were included in the best buy plans were retained and moved forward to the third iteration. Cost-effective measures were examined based on habitat weighting, and in cases where an important habitat would be screened out, it was retained until the next round (non-efficient plans were removed from further consideration). Fifty-eight measures were retained and grouped into twenty-seven measure groups based on synergy and overlapping benefit areas. Twenty-seven measure groups (C) moved to the 3rd round of CE/ICA and were run as separate combinable features. Two additional alternatives based on diversity (A) and efficient measures on public lands (B) were run alongside the twenty-seven combinable alternatives. See figures 17–22 for the full range of solutions (where possible) and the incremental cost and output for the best buy plans.

Table 7-9. Objective 1

Measure ID	Island Complex	Habitat Addressed	AAFCU	Average Annual Cost
BR_6	Brandywine	BLH (floodplain)	66	$15,400
BR_7	Brandywine	BLH (floodplain)	48	$34,413
BR_8	Brandywine	BLH (floodplain)	133	$45,903
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HT_6	HatchieTowhead_Randolph	Riverfront Forest - Riparian buffers (floodplain)	26	$12,257
HB_1	HopefieldPoint_BigRiverPark	Seasonally herbaceous wetland (aquatic & floodplain)	9	$15,936
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RCP_1	Richardson_CedarPoint	Cypress - Tupelo (floodplain)	19	$3,280
RCP_2	Richardson_CedarPoint	Seasonally herbaceous wetland (aquatic & floodplain)	177	$33,218

RCP_4	Richardson_CedarPoint	Riverfront Forest - Riparian buffers (floodplain)	69	$2,593
RL_4	RedmanPoint_LoosahatchieBar	BLH (floodplain)	676	$184,179
S_8	Sunrise_Island34	Cypress - Tupelo (floodplain)	30	$7,790
S_10	Sunrise_Island34	Riverfront Forest - Riparian buffers (floodplain)	36	$8,767

Table 7-10. Objective 2

Measure ID	Island Complex	Habitat Addressed	AAFCU	Average Annual Cost
Br_1	Brandywine	Secondary Channels (lotic aquatic)	22.58	$8,491
Br_2	Brandywine	Secondary Channels (lotic aquatic)	83.952	$4,019
Br_4	Brandywine	Meander Scarp/ tertiary channels (lotic aquatic)	112.15	$304,528
Br_5	Brandywine	BLH (floodplain)	444.609	$43,931
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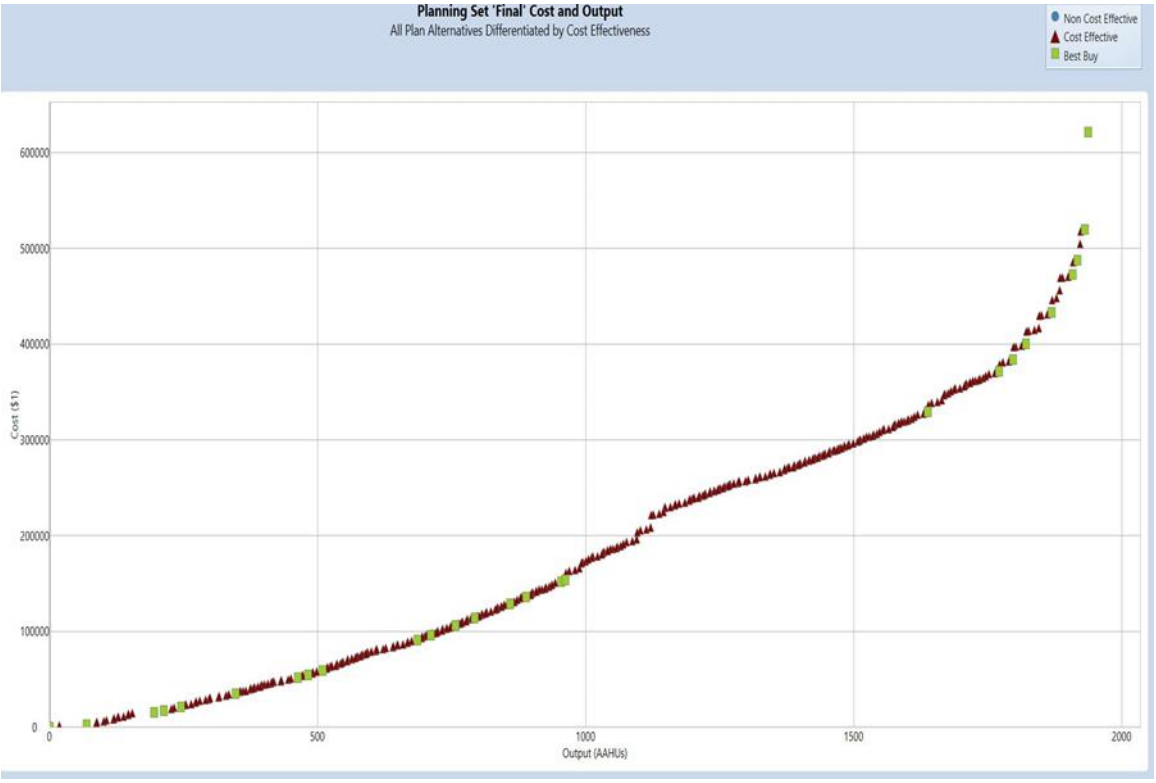
S_4	Sunrise_Island34	Meander Scarp/ tertiary channels (lotic aquatic)	275.45	$432,219
S_7	Sunrise_Island34	Secondary Channels (lotic aquatic)	100.584	$3,932

Table 7-11. Objective 3

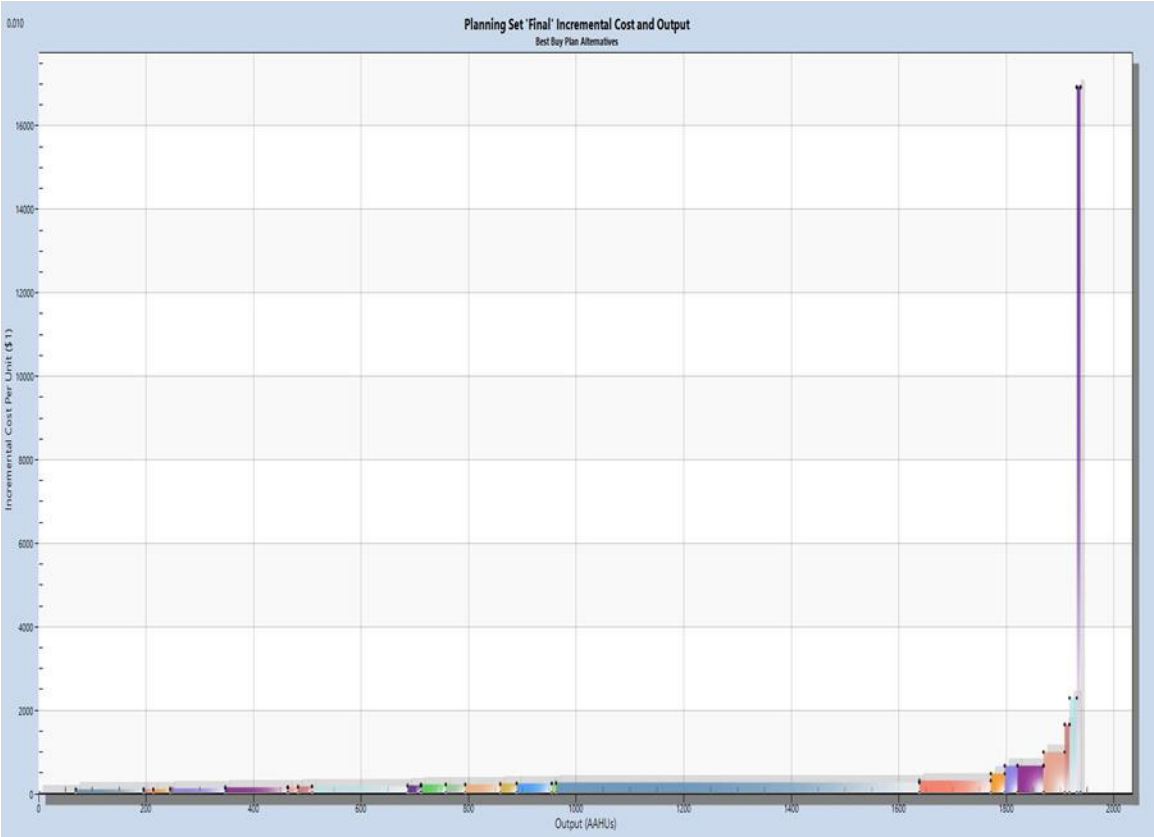
Measure ID	Island Complex	Habitat Addressed	AAFCU	Average Annual Cost
Br_12	Brandywine	Slough (lentic aquatic)	2.98	$19,107
Br_13	Brandywine	Slough (lentic aquatic)	4.76	$62,271
D_1	Densford	Slough (lentic aquatic)	3.85	$13,733
D_2	Densford	Borrow Areas (lentic aquatic)	5.27	$184,093
HT_1	HatchieTowhead_Randolph	Slough (lentic aquatic)	0.47	$26,953
HT_4	HatchieTowhead_Randolph	Slough (lentic aquatic)	4.69	$23,836
HB_2ab	HopefieldPoint_BigRiverPark	Slough (lentic aquatic)	0.55	$19,393
HB_3	HopefieldPoint_BigRiverPark	Borrow Areas (lentic aquatic)	1.41	$19,510
HB_4	HopefieldPoint_BigRiverPark	Borrow Areas (lentic aquatic)	1.63	$22,618
HB_5	HopefieldPoint_BigRiverPark	Borrow Areas (lentic aquatic)	1.41	$19,510
HB_6	HopefieldPoint_BigRiverPark	Borrow Areas (lentic aquatic)	2.75	$41,264
HB_7	HopefieldPoint_BigRiverPark	Borrow Areas (lentic aquatic)	1.83	$25,725
HB_8	HopefieldPoint_BigRiverPark	Borrow Areas (lentic aquatic)	3.22	$50,587
HB_9	HopefieldPoint_BigRiverPark	Borrow Areas (lentic aquatic)	2.58	$38,156
HB_10	HopefieldPoint_BigRiverPark	Borrow Areas (lentic aquatic)	0.6	$3,514
I35_4b	Island35_DeanIsland	Borrow Areas (lentic aquatic)	0.11	$2,740
I35_5c	Island35_DeanIsland	Slough (lentic aquatic)	0.33	$7,881
I40_1b	Island40_41	Slough (lentic aquatic)	2.44	$27,359
I40_4	Island40_41	Slough (lentic aquatic)	0.22	$6,170
I40_5	Island40_41	Slough (lentic aquatic)	1.17	$18,704
I40_6	Island40_41	Borrow Areas (lentic aquatic)	1.48	$6,421
I40_7a	Island40_41	Borrow Areas (lentic aquatic)	4.52	$90,987
RL_3	RedmanPoint_LoosahatchieBar	Secondary Channels (lotic aquatic)	0.42	$3,701
RL_7	RedmanPoint_LoosahatchieBar	Slough (lentic aquatic)	4.68	$22,337
S_1	Sunrise_Island34	Slough (lentic aquatic)	0.93	$12,054

S_6	Sunrise_Island34	Secondary Channels (lotic aquatic)	46	$2,495



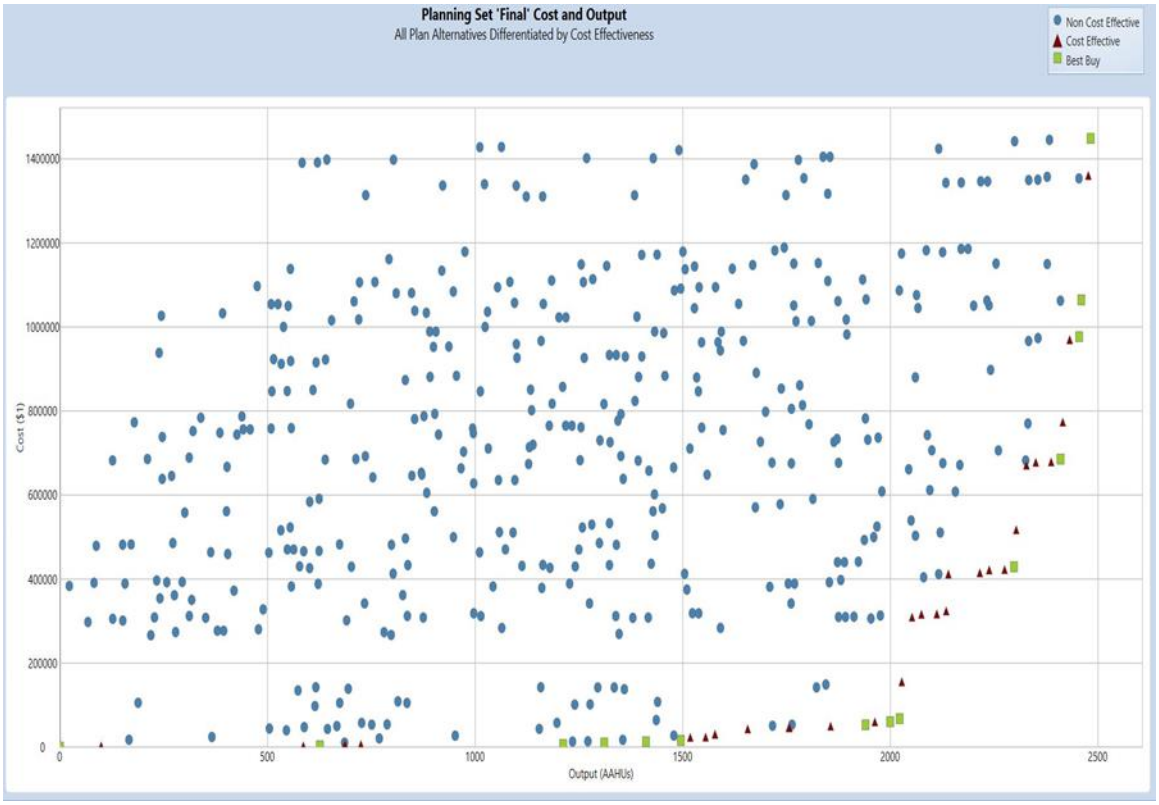
Note: The X-axis is net AAHUs; the Y-axis is the average annual cost ($).

Figure 7-17. Full Range of Solutions: Objective 1



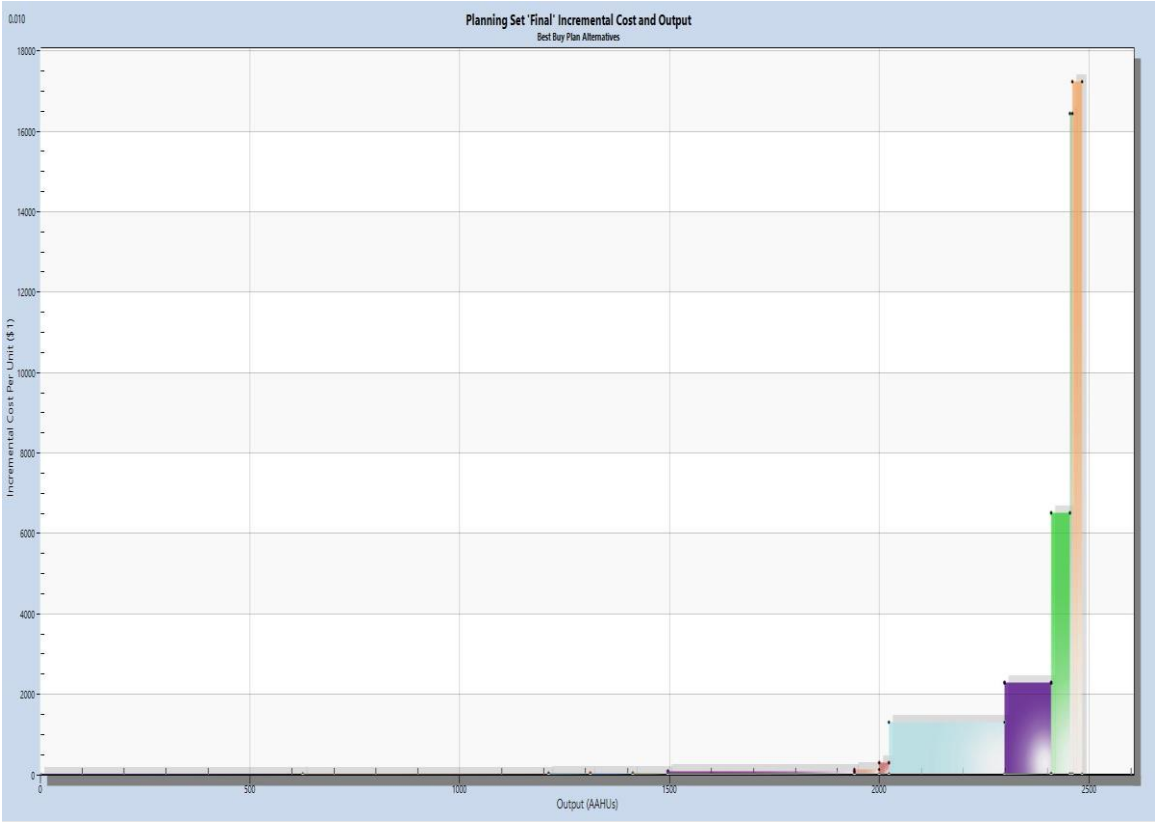
Note: The X-axis is net AAHUs; the Y-axis is the incremental cost per AAHU.

Figure 7-18. Incremental Cost and Output for the Best Buy Plans: Objective 1



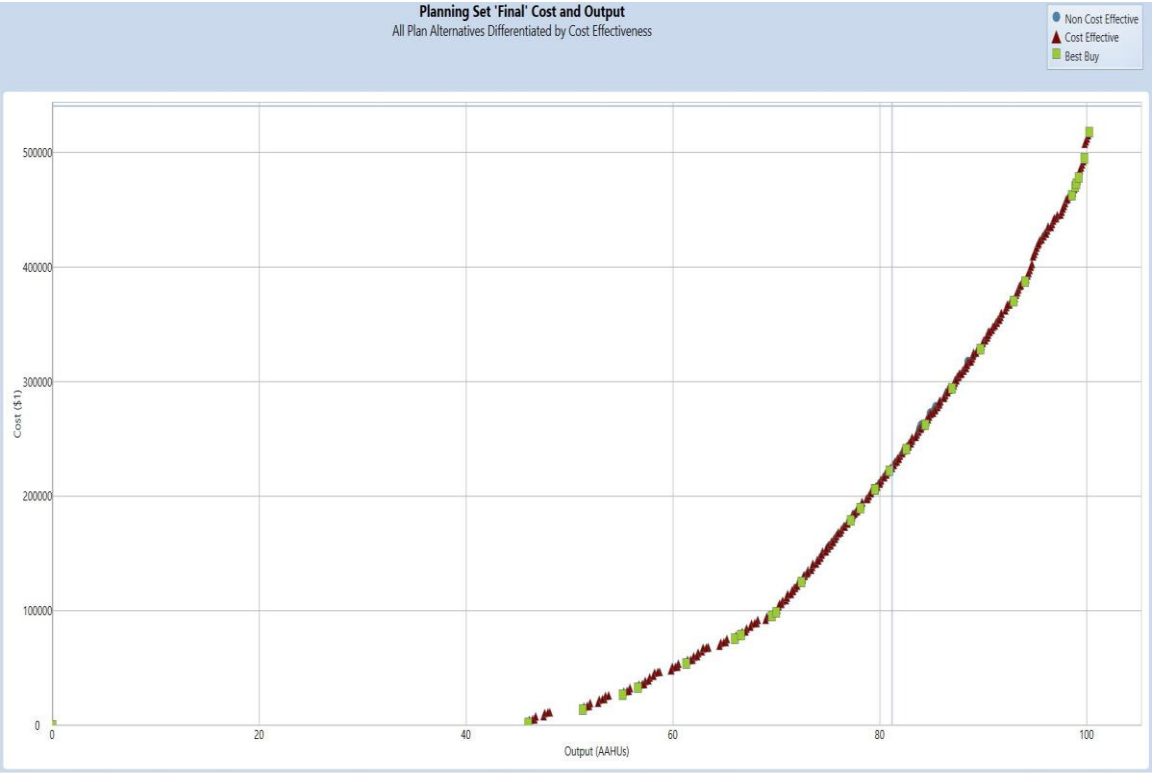
Note: The X-axis is net AAHUs; the Y-axis is the average annual cost ($).

Figure 7-19. Full Range of Solutions: Objective 2



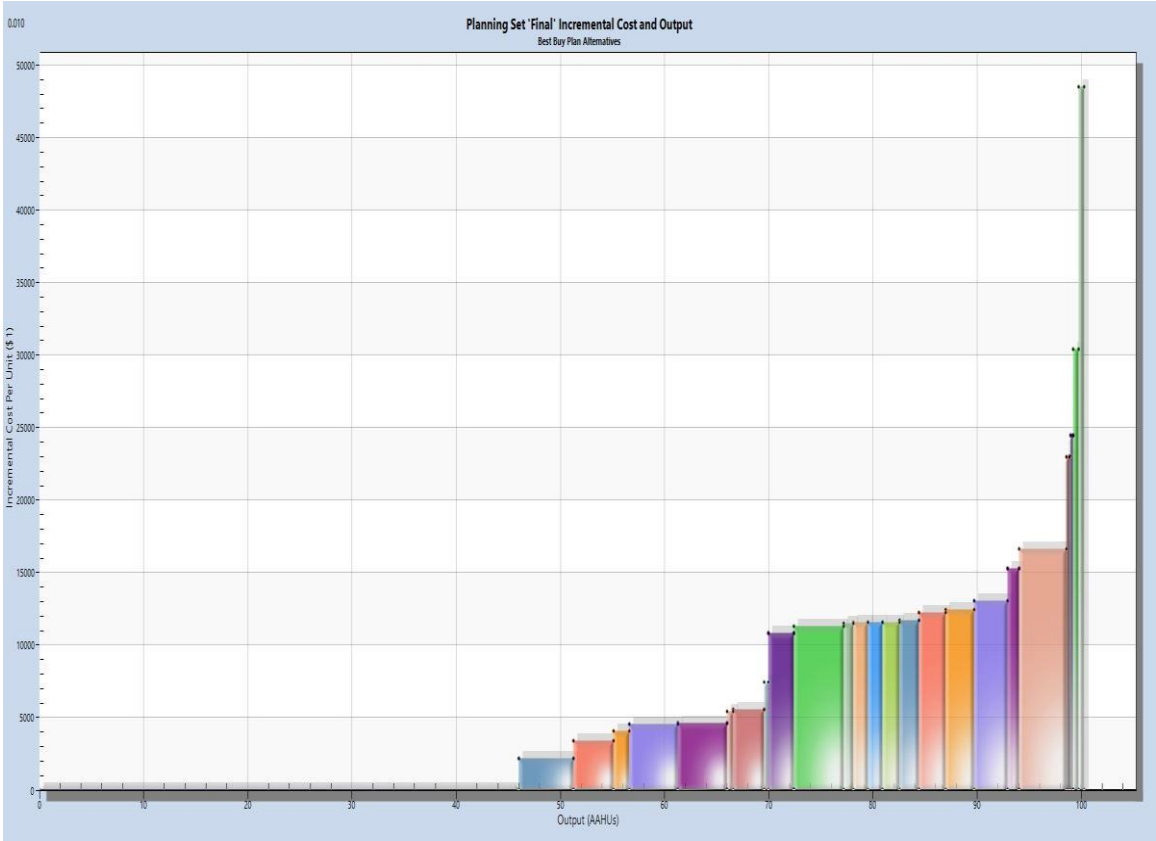
Note: The X-axis is net AAHUs; the Y-axis is the incremental cost per AAHU.

Figure 7-20. Incremental Cost and Output for the Best Buy Plans: Objective 2



Note: The X-axis is net AAHUs; the Y-axis is the average annual cost ($).

Figure 7-21. Full Range of Solutions: Objective 3



Note: The X-axis is net AAHUs; the Y-axis is the incremental cost per AAHU.

Figure 7-22. Incremental Cost and Output for the Best Buy Plans: Objective 3

1.4 ROUND 3

The 3rd and final round of CEICA was conducted to determine the final array of alternatives. The study team identified two standalone alternatives (Alternatives A and B) by manually combining measures. Alternative A incorporated measures characterized as Best Buys for habitat diversity from all objectives and all model runs. Alternative B incorporated measures within public lands where real estate acquisition was minimal. Alternative A and B were not combinable with other alternatives or measures. To develop additional alternatives in the final array, the CEICA tool was used to create efficient combinations of the identified 27 measure groups. The CEICA resulted in 501 efficient plans and 27 Best Buys.

Table 7-12 displays the groupings A, B, and C and their corresponding measures.

Table 7-12. A, B, and C

Grouping		Measures	AAFCU	Average Annual Costs
A		BR_1, BR_2, BR_5, BR_6, D_1, D_2, D_3, HB_10, HT_4, I35_2, I35_6b, I35_7a, I35_7h, I35_9b, I35_12a, I35_12b, I40_1a, I40_3, I40_6, I40_7b, M_5, M_14, RCP_1, RCP_2, RCP_4, RL_6, RL_7, S_4, S_6, S_7, S_8, S_10	3,112	$933,261
B		BR_1, BR_2, BR_5, D_3, HB_1, HB_3, HB_4, HB_5, HB_6, HB_7, HB_8, HB_9, I35_7a, M1, M5, M6, M11, M14, RL_3, RL_6, S_4, S_6, S_7	2,206	$917,123
C	1	BR_12, BR_13, HB_3, HB_4, HB_5, HB_6, HB_7, HB_8, HB_9, RL_3, S_1	24.04	$314,502
	2	BR_4	121.88	$304,528
	3	BR_5	444.609	$43,931
	4	BR_6, BR_7, BR_8, BR_11	873	$200,903
	5	HB_1, HB_2ab, HB_2c	48.56	$81,633
	6	HT_1, HT_2	22.11	$487,401
	7	HT_6	26	$12,257
	8	I35_12a, I35_12b	158	$16,792
	9	I35_2	65	$18,204
	10	I35_6b	25	$5,706
	11	I35_7h	18	$1,886
	12	I35_9b	27	$4,947
	13	I40_1a, I40_1b	48.47	$37,659
	14	I40_3	102	$13,897
	15	I40_4, I40_5	1.41	$24,873
	16	I40_6, I40_7a	6	$97,409
	17	M_5, M_6	21.73	$39,174
	18	RCP_1	19	$3,280
	19	RCP_2	177	$33,218
	20	RCP_4	69	$2,593
	21	RL_4	676	$184,179
	22	D_1, D_2, HB_10, HT_4, RL_7	19.23	$247,514
	23	S_10	36	$8,767
	24	S_4	300.16	$432,219
	25	BR_1, BR_2, D_3, I_35_7a, I_35_7g, M_14, RL_3, RL_6, S_6, S_7	1,388.263	$97,187
	26	S_8	30	$7,790

The final array of 10 alternatives was identified based on the CEICA results by looking at the alternatives identified on the efficiency frontier breakpoints in the scatter plot of average annual costs and outputs, and the bar chart of the resulting Best Buys. Study objectives and the technical significance of the habitat were also considered in the identification of the final array. The recreational opportunities were added to the final array. All alternatives in the final array incorporated LW_1, and alternatives that included measures on land within Meeman-Shelby Forest State Park also incorporated measure M_2.

The final array of alternatives (Table 7-13) includes the following:

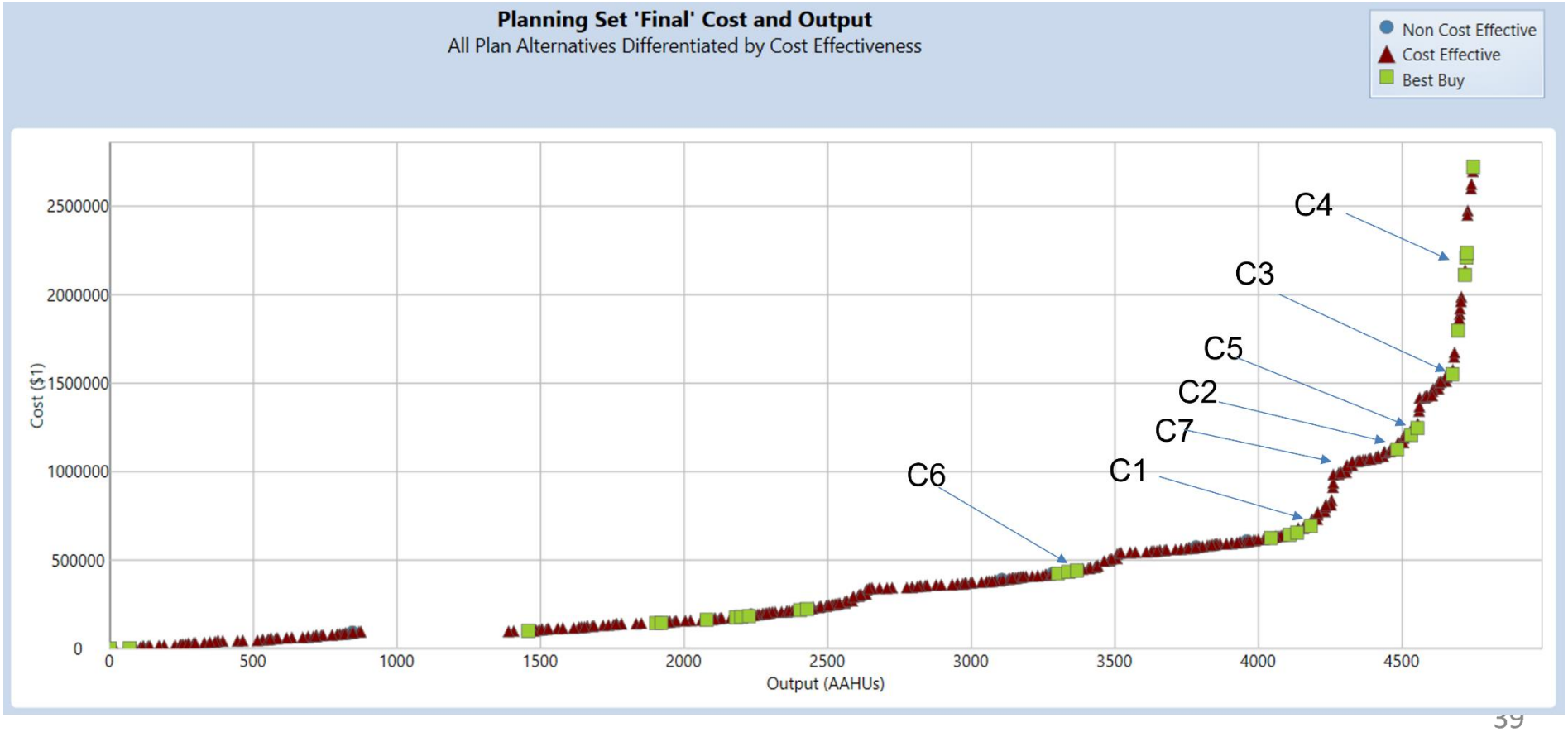
- No Action Alternative-Baseline for comparison
- Alternative A-study team Developed
- Alternative B-study team Developed
- Alternative C1-CEICA Developed
- Alternative C2-CEICA Developed
- Alternative C3-CEICA Developed
- Alternative C4-CEICA Developed
- Alternative C5-CEICA Developed
- Alternative C6-CEICA Developed
- Alternative C7-CEICA Developed

Table 7-13. Measures Included in the Final Array of Alternatives

	Measures
No Action	none
A	Br_1, BR_2, Br_5, BR_6, D_1, D_2, D_3, HB_10, HT_4, I35_12a, I35_12b, I35_2, I35_6b, I35_7a, I35_7h, I35_9b, I40_1a, I40_3, I40_6, I40_7b, M_14, M_5, RCP_1, RCP_2, RCP_4, RL_6, RL_7, S_10, S_4, S_6, S_7, S_8, LW_1, M_2
B	BR_1, BR_2, BR_5, D_3, HB_1, HB_3, HB_4, HB_5, HB_6, HB_7, HB_8, HB_9, I35_7a, M1, M5, M6, M11, M14, RL_3, RL_6, S_4, S_6, S_7, LW_1, M_2
C1	BR_1, BR_11, BR_2, BR_5, BR_6, BR_7, BR_8, D_3, HT_6, I35_12a, I35_12b, I35_2, I35_6b, I35_7a, I35_7g, I35_7h, I35_9b, I40_1a, I40_1b, I40_3, M_14, RCP_1, RCP_2, RCP_4, RL_3, RL_4, RL_6, S_10, S_6, S_7, S_8, LW_1
C2	BR_1, BR_11, BR_2, BR_5, BR_6, BR_7, BR_8, D_3, HT_6, I35_12a, I35_12b, I35_2, I35_6b, I35_7a, I35_7g, I35_7h, I35_9b, I40_1a, I40_1b, I40_3, M_14, RCP_1, RCP_2, RCP_4, RL_3, RL_4, RL_6, S_10, S_4, S_6, S_7, S_8, LW_1

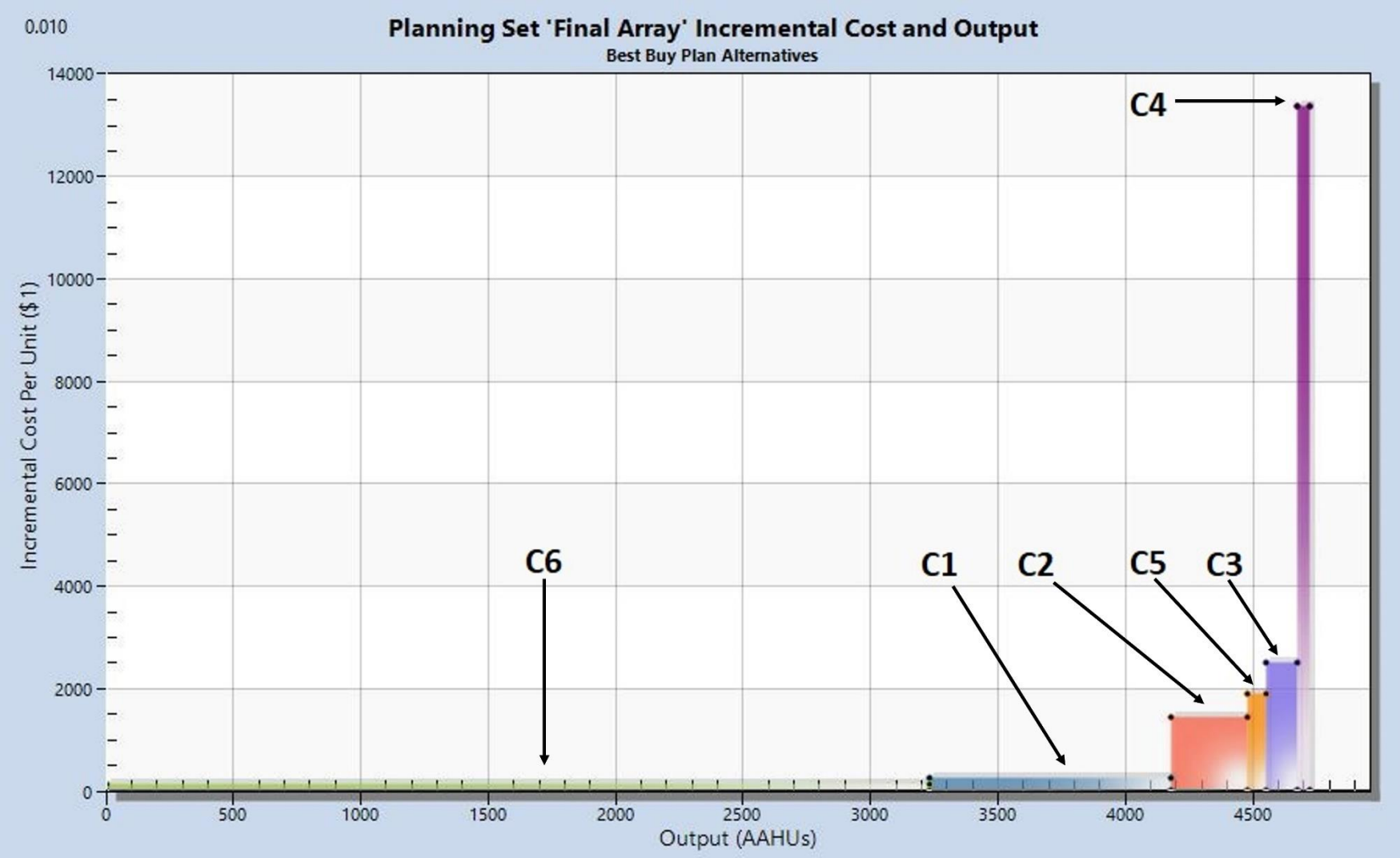
C3	BR_1, BR_11, BR_2, BR_4, BR_5, BR_6, BR_7, BR_8, D_3, HB_1, HB_2ab, HB_2c, HT_6, I35_12a, I35_12b, I35_2, I35_6b, I35_7a, I35_7g, I35_7h, I35_9b, I40_1a, I40_1b, I40_3, M_14, M_5, M_6, RCP_1, RCP_2, RCP_4, RL_3, RL_4, RL_6, S_10, S_4, S_6, S_7, S_8, LW_1, M_2
C4	BR_1, BR_11, BR_12, BR_13, BR_2, BR_4, BR_5, BR_6, BR_7, BR_8, D_1, D_2, D_3, HB_1, HB_10, HB_2ab, HB_2c, HB_3, HB_4, HB_5, HB_6, HB_7, HB_8, HB_9, HT_4, HT_6, I35_12a, I35_12b, I35_2, I35_6b, I35_7a, I35_7g, I35_7h, I35_9b, I40_1a, I40_1b, I40_3, I40_6, I40_7a, M_14, M_5, M_6, RCP_1, RCP_2, RCP_4, RL_3, RL_4, RL_6, RL_7, S_1, S_10, S_4, S_6, S_7, S_8, LW_1, M_2
C5	BR_1, BR_11, BR_2, BR_5, BR_6, BR_7, BR_8, D_3, HB_1, HB_2ab, HB_2c, HT_6, I35_12a, I35_12b, I35_2, I35_6b, I35_7a, I35_7g, I35_7h, I35_9b, I40_1a, I40_1b, I40_3, M_14, M_5, M_6, RCP_1, RCP_2, RCP_4, RL_3, RL_4, RL_6, S_10, S_4, S_6, S_7, S_8, LW_1, M_2
C6	BR_1, BR_2, BR_5, D_3, I35_12a, I35_12b, I35_2, I35_6b, I35_7a, I35_7g, I35_7h, I35_9b, I40_3, M_14, RCP_1, RCP_2, RCP_4, RL_3, RL_4, RL_6, S_10, S_6, S_7, S_8, LW_1
C7	BR_1, BR_11, BR_2, BR_5, BR_6, BR_7, BR_8, D_3, I35_12a, I35_12b, I35_2, I35_7a, I35_7g, I35_7h, I35_9b, I40_3, M_14, RCP_1, RCP_2, RCP_4, RL_3, RL_4, RL_6, S_4, S_6, S_7, S_8, LW_1

Figure 7-23 shows the range of cost-effective solutions for Round 3; Figure 7-24 shows the incremental cost and output for the Best Buy plans from the final array.



Note: The X-axis is net AAHUs; the Y-axis is the average annual cost ($).

Figure 7-23. Range of Cost-Effective Solutions: Round 3



Note: The X-axis is net AAHUs; the Y-axis is the incremental cost per AAHU.

Figure 7-24. Incremental Cost and Output for the Best Buy Plans: Final Array

1.5 TENTATIVELY SELECTED PLAN

Alternative C3 was chosen as the Tentatively Selected Plan (TSP). Table 7-14 displays the Tentatively Selected Plan's (C3) measures and average annual costs.

Table 7-14.
C3 Measures and Average Annual Costs

Name of Measure	Average Annual Cost
BR_1	$ 8,491
BR_2	$ 4,019
BR_4	$ 304,528
BR_5	$ 43,931
BR_6	$ 15,400
BR_7	$ 34,413
BR_8	$ 45,903
BR_11	$ 106,654
D_3	$ 3,845
HB_1	$ 15,936
HB_2ab	$ 19,393
HB_2c	$ 46,305
HT_6	$ 12,257
I35_2	$ 18,204
I35_6b	$ 5,706
I35_7a	$ 9,750
I35_7g	$ 53,096
I35_7h	$ 1,886

I35_9b	$ 4,947
I35_12a	$ 3,827
I35_12b	$ 12,964
I40_1a	$ 10,299
I40_1b	$ 27,359
I40_3	$ 13,897
M_5	$ 2,281
M_6	$ 36,894
M_14	$ 3,863
RCP_1	$ 3,280
RCP_2	$ 33,218
RCP_4	$ 2,593
RL_3	$ 3,701
RL_4	$ 184,179
RL_6	$ 3,995
S_4	$ 432,219
S_6	$ 2,495
S_7	$ 3,932
S_8	$ 7,790
S_10	$ 8,767
M_2	$ 13,278
LW_1	$ 5,125
TOTAL	$ 1,570,621

Notes: Costs are shown at the 2023 price level and were annualized using the current FY23 Federal discount rate of 2.5 percent over a 50-year period of analysis. Measures M_2 and LW_1 are recreational features.

After selection of C3 as the RP, initial costs reflected in Table 7-14 were further refined and updated to FY24. The FY24 Federal discount rate was also updated to 2.75 percent. Table 7-15 displays these updated overall costs for C3.

Table 7-15. C3 Overall Costs

First Cost	$ 55,538,000
Interest During Construction	$ 758,000
Total Investment Cost	$ 56,296,000
Average Annual OMRR&R	$ 133,000
Total Average Annual Cost	$ 2,432,000

Section 2
OTHER SOCIAL EFFECTS

2.1 PURPOSE

The purpose of this appendix is to consider the other social effects account of the Hatchie-Loosahatchie Mississippi River Mile 775-736, TN and AR Planning Study. This appendix was prepared in accordance with the Planning Guidance Notebook (ER 1105-2-100) as well as the Institute for Water Resources 09-R-4 and 2013-R-03.

2.2 STUDY AREA

The study area is composed of a 39-Mile reach along the Mississippi River beginning at the Hatchie River and extending just south of the Wolf River Harbor. Additionally, there are 3 tributary rivers: Hatchie, Loosahatchie, and Wolf. The area is surrounded by five counties in Tennessee and Arkansas. Those counties are Lauderdale County, Tennessee, Tipton County, Tennessee, Shelby County, Tennessee, Mississippi County, Arkansas, and Crittenden County, Arkansas.

2.3 OVERVIEW OF OTHER SOCIAL EFFECTS:

The Other Social Effects Account (OSE) account includes effects, both indirect and direct, of a plan on social aspects including Economic Vitality, and Leisure & recreation.

Section 3
COMMUNITY CHARACTERISTICS & OTHER SOCIAL EFFECTS FACTORS

3.1 SOCIOECONOMICS:

3.1.1 Population:

The populations from 1970 – 2020 per the Census Bureau's decennial censuses are reported for Crittenden County, Arkansas, Mississippi County, Arkansas, Lauderdale County, Tennessee, Shelby County, Tennessee, and Tipton County, Tennessee in Table 2. In Lauderdale County, Tipton County, and Crittenden County, populations grew consistently over time. The Shelby County population grew at a higher rate starting in 1970 and had a significantly larger population than that of the other counties in the area. Mississippi County, Arkansas is the only county in the study area to experience a large contraction in population. This population decrease is largely due to the closure of the Eaker United States Air Force base in Blytheville, Arkansas (Agency, 2022).

Table 7-16. Population

Population by County (Thousands) 1970 - 2020						
County	1970	1980	1990	2000	2010	2020
Crittenden County, Arkansas	48.28	49.49	49.96	50.92	50.94	48.163
Mississippi County, Arkansas	62.28	59.47	57.56	51.85	46.38	40.685
Lauderdale County, Tennessee	20.33	24.5	23.57	27.11	27.73	25.143
Shelby County, Tennessee	724.13	776.21	828.45	898.21	928.63	929.744
Tipton County, Tennessee	28.08	33.01	37.9	51.58	61.15	60.97
Source: U.S. Census Bureau (BOC)						

3.1.2 Median Age:

The median age of Crittenden & Mississippi Counties in Arkansas is 35.3 and 36.8 respectively. These are just slightly older than the median age of Arkansas of 38.5. The median age of Lauderdale County, Tennessee is 39.1, Shelby County, Tennessee is 35.8,

and Tipton County, Tennessee is 38 whereas the median age of Tennessee in its entirety is 39.2.

3.1.3 Per Capita Personal Income:

Per Capita Personal Income is represented by Table 7-2. The rate of growth for Per Capita Personal Income is consistent for all of the counties within the study area.

Table 7-17. Per Capita Personal Income

Per Capita Personal Income (USD) by County (1970 - 2020)						
County	1970	1980	1990	2000	2010	2020
Crittenden County, Arkansas	2847.00	6828.00	13275.00	20274.00	28962.00	41474.00
Mississippi County, Arkansas	2851.00	6807.00	13673.00	18748.00	28867.00	37730.00
Lauderdale County, Tennessee	2342.00	5917.00	12206.00	18160.00	22798.00	35267.00
Shelby County, Tennessee	3760.00	9744.00	19180.00	31733.00	39534.00	53855.00
Tipton County, Tennessee	2690.00	7353.00	14387.00	23533.00	30267.00	43147.00
Source: U.S. Bureau of Economic Analysis (BEA)						

3.1.4 Employment:

The unemployment rates of Crittenden County, Arkansas, Mississippi County, Arkansas, Lauderdale County, Tennessee, Shelby County, Tennessee, and Tipton County, Tennessee are included in Table 7-3. In the year 2020, all of the counties in the study area experienced an increase in unemployment rate. This is due to the COVID-19 pandemic that occurred affecting employment. Crittenden and Mississippi counties in Arkansas do have a higher unemployment rate than their neighboring counties in Tennessee.

According to the Bureau of Labor Statistics Quarterly Census of Employment and Wages, employment industries as of 2020 in Mississippi County, Arkansas are led by trade, transportation, utilities followed by leisure & hospitality, manufacturing, education, health services respectively. Industry in Crittenden County, Arkansas is mostly manufacturing followed by trade, transportation, utilities. Lauderdale County, Tennessee employment is vastly attributed to Trade, Transportation, Utilities as well as manufacturing. Shelby County, Tennessee has varying significant industries of employment with the largest being trade,

transportation, utilities followed by education, health services, professional business services, leisure and hospitality. In Tipton County, Tennessee the leading industries are trade, transportation, utilities, manufacturing, education, health services, construction, leisure and hospitality.

Table 7-18. Unemployment Rates by County

Unemployment Rates by County (2020)	
County	Unemployment Rate (%)
Crittenden County, Arkansas	5.8
Mississippi County, Arkansas	5.5
Lauderdale County, Tennessee	3.4
Shelby County, Tennessee	4.7
Tipton County, Tennessee	3.2
Source: U.S. Census Bureau (BOC)	

3.2 OTHER SOCIAL EFFECTS: EXISTING CONDITIONS

3.2.1 Leisure & Recreation:

Leisure & Recreation are very important to communities as they enhance the quality of life. The study area directly includes a vast number of areas for individuals in an urban area to recreate. These recreation activities include water-based activities such as boating and fishing, as well as camping and hiking. Significant recreation locations within the study area include the Lower Hatchie National Wildlife Refuge, Meeman-Shelby State Park, and Hopefield Point – Big River Park. In 2021, the Meeman-Shelby Forest State Park saw 763.5 thousand visitors an increase from 666.2 thousand visitors in 2020 (Economic Impact of Tennessee State Parks, 2021).

3.2.2 Economic Vitality:

Economic Vitality of a region refers to the quality of life of residents in the affected area as a result of the economy's capability to provide a good standard of living. (Dunning & Durden, 2009) The study area includes the Meeman-Shelby State Park as well as several other parks spanning the entirety of the study. According to the Tennessee Department of Environment & Recreation, the Meeman-Shelby State Park had an economic impact of

$52.5 M in 2021 up from $44.3M in 2020. The economic impact was computed using lodging, shopping, and recreation expenditures. This economic impact follows the increase in visitors as outlined in section 2.2.5 Leisure & Recreation.

In each of the five counties included in the study area there are a considerable number of people employed by the leisure and hospitality industry. This industry employs 18% of Crittenden County, Arkansas, 12% of Tipton County, Tennessee, 10% of Shelby County, Tennessee, and 7% of both Mississippi County, Arkansas, and Lauderdale County, Tennessee.

3.2.3 Health & Safety:

Health and Safety of a region as it relates to other social effects refers to the basic human need for personal and group safety. Unhealthy conditions can create personal stress and dissatisfaction among those affected in the region of interest. Within the surrounding 3-mile radius of the Hatchie-Loosahatchie project area, there are several communities that are designated as food deserts in accordance with the USDA's definition where census tracts that do not have access to fresh food grocers within a half mile for urban areas and 10 mile radius for rural areas. Figure 7-25 represents food deserts no greater than 3 miles away from measures included in C3. Within the study area, subsistence fishing is present; where community members rely on catching fish to eat or sell in an effort to supplement nutrition and/or income.

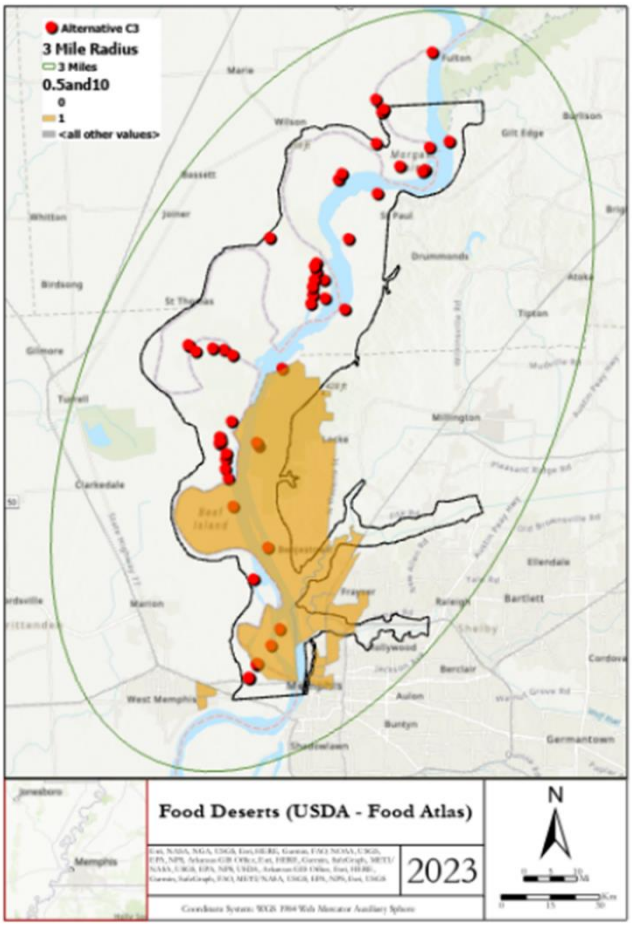


Figure 7-25. Food Deserts within a 3-mile radius

3.2.4 Environmental Justice:

Figure 7-26 represents census tracts that are identified as areas of Environmental Justice concern in accordance with the Council on Environmental Quality (CEQ) Climate and Economic Justice Screening Tool's climate burden. Census tracts that are burdened under this theme meet are within the 90th percentile for any of the following statistics: expected agriculture loss rate, expected building loss rate, expected population loss rate, projected flood risk, or projected wildfire risk in addition to being at or above the 65th percentile for low income. Meeting these thresholds indicate that the identified area will disproportionately feel the effects of climate change, including that of wildlife and agriculture.

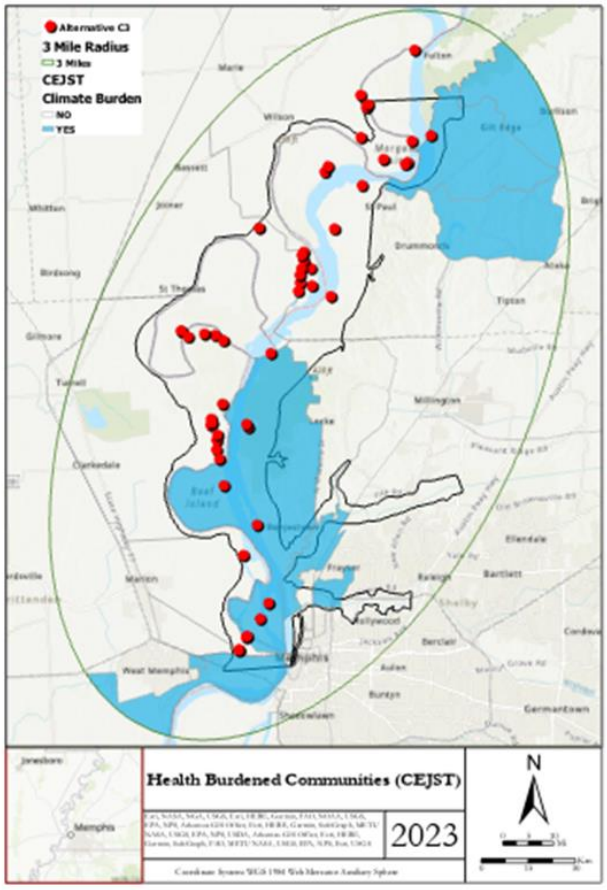


Figure 7-26. Area of EJ Concern under Climate Change Burden within a 3-Mile Radius

Section 4
OTHER SOCIAL EFFECTS EVALUATION OF ALTERNATIVES

4.1 LEISURE & RECREATION:

Leisure and recreational opportunities are enhanced in all alternatives. Meander Scarps and Secondary channels are critical to endangered species. Alternatives that include measures to decrease habitat scarcity and promote endangered species provide a unique opportunity for recreation. All of the proposed alternatives include secondary channels, including Dike Notching, which provides recreational access. Alternatives A, B, C2, C5, and C7 provide 1 meander scarp to promote endangered species habitats while alternatives C3 and C4 include 2 meander scarps.

Additionally, all of the proposed alternatives include added recreation measures at Meeman Shelby State Park and Loosahatchie River Wolf River, which are both located north of Memphis, Tennessee.

4.2 ECONOMIC VITALITY

The unique opportunities that these alternatives provide increased eco-tourism in the area. This results in greater consumer spending for the local economies. All of the counties surrounding the study area have a number of individuals employed by the leisure and hospitality industry, as discussed in section 2.2.2 Economic Vitality of this appendix.

Crittenden County, Arkansas has the highest employment by the hospitality industry. Measures in Brandywine, Island 40 – 41, Redman Loosahatchie Bar, and Hopefield Point – Big River Park are in or directly surrounding Crittenden County, Arkansas. Alternatives including these complexes include the following: A, C3, C4, and C5.

Tipton county, Tennessee is the second largest county in the study for hospitality employment. Complexes that would affect this county would be Hatchie Towhead Randolph, Island 35 – Dean Island, Richardson Point Loosahatchie Bar, Densford, and Brandywine. The alternatives that include these complexes are A, C1, C2, C3, C4, and C5.

Shelby County, Tennessee has 10% of individuals working in the hospitality industry. Complexes in or directly surrounding this county include Brandywine, Island 40 – 41, Redman Point Loosahatchie Bar, and Hopefield Point Big River Park. Alternatives encompassing these complexes include A, C1, C2, C3, C4, and C5.

Lauderdale County, Tennessee and Mississippi County, Arkansas have the smallest number of individuals employed by the hospitality industry at 7% each. Complexes affecting Lauderdale County include Sunrise Island 34 and Hatchie Towhead Randolph. Alternatives encompassing these complexes are A, C1, C2, C3, C4, and C5. Complexes affecting Mississippi County include Sunrise Island 34, Island 35 – Dean Island, and Brandywine. All alternatives encompass these complexes.

Section 5
SUMMARY OF ALTERNATIVE ANALYSIS

C3 is the tentatively selected plan for the Hatchie-Loosahatchie Mississippi River Planning study. This alternative presents unique recreational opportunities as well as enhancement regarding economic vitality in the area. The meander scarp measures as well as secondary channels create habitats for endangered species which provide individuals with unique, accessible recreational opportunities. In addition, the plan would bring eco-tourism to the complexes in or surrounding each of the counties included in the study area.

Section 6
REGIONAL ECONOMIC DEVELOPMENT (RED)

6.1 GENERAL

The Regional Economic Development (RED) account addresses the impacts that the USACE expenditures associated with the construction of a coastal storm risk management system will have on the levels of income, output, and employment throughout the region. These impacts are not included in the NED analysis but can still be used by decision makers as part of their investment decision process.

This Regional Economic Development (RED) analysis employs input-output economic analysis, which measures the interdependence among industries and workers in an economy. This analysis uses a matrix representation of a regional economy to predict the effect that changes in one industry will have on other industries. The greater the interdependence among industry sectors, the larger the multiplier effect on the economy. Changes to government spending drive the input-output model to project new levels of sales (output), value added Gross Regional Product (GRP), employment, and income for each industry.

RECONS Version 2 was the specific input-output model used to estimate the regional economic development impacts of the Recommended Plan. The U.S. Army Corps of Engineers (USACE) Institute for Water Resources, Louis Berger, and Michigan State University developed the regional economic impact modeling tool, RECONS (Regional Economic System), that provides estimates of jobs and other economic measures such as labor income, value added, and sales that are supported by USACE programs, projects, and activities. This modeling tool automates calculations and generates estimates of jobs, labor income, value added, and sales through the use of IMPLAN®'s multipliers and ratios, customized impact areas for USACE project locations, and customized spending profiles for USACE projects, business lines, and work activities. RECONS allows the USACE to evaluate the regional economic impact and contribution associated with USACE expenditures, activities, and infrastructure.

6.2 DESCRIPTION OF METRICS

"Output" is the sum total of transactions that take place as a result of the construction project, including both value added and intermediate goods purchased in the economy. "Labor Income" includes all forms of employment income, including employee compensation (wages and benefits) and proprietor income. "Value Added" or "Gross Regional Product" represents the value-added output of the study regions. This metric captures all final goods and services produced in the study areas because of the existence of the project. It is different from output in the sense that one dollar of a final good or service may have multiple transactions associated with it. "Jobs" is the estimated worker-years of labor required to build the project.

6.3 ASSUMPTIONS

Input-output analysis rests on the following assumptions. The production functions of industries have constant returns to scale, so if output is to increase, inputs will increase in the same proportion. Industries face no supply constraints; they have access to all the materials they can use. Industries have a fixed commodity input structure; they will not substitute any commodities or services used in the production of output in response to price changes. Industries produce their commodities in fixed proportions, so an industry will not increase production of a commodity without increasing production in every other commodity it produces. Furthermore, it is assumed that industries use the same technology to produce all of their commodities. For this analysis, the Long-Term Impacts and Contributions module was used to account for expenditures occurring throughout the period of analysis. The economic impacts results are presented for the entire period of analysis, aggregated for all 50 years for output, labor income, and value added. The number of jobs is presented as an average across all years included in the period of analysis.

6.4 RESULTS

Table 7-19. Local, State, and National Impacts: Alt A

Area	Local Capture	Output	Jobs *	Labor Income	Value Added
Local					
Direct Impact		$21,271,512	266.3	$18,404,464	$10,106,854
Secondary Impact		$26,120,907	145.6	$8,565,455	$14,547,106
Total Impact	$21,271,512	$47,392,419	411.8	$26,969,920	$24,653,960
State					
Direct Impact		$23,229,730	297.8	$20,295,169	$12,041,893
Secondary Impact		$28,461,252	157.8	$9,257,898	$15,685,235
Total Impact	$23,229,730	$51,690,983	455.7	$29,553,067	$27,727,128
US					
Direct Impact		$24,790,710	328.1	$21,969,079	$14,450,491

Secondary Impact		$54,371,680	247.5	$16,882,297	$29,283,726
Total Impact	$24,790,710	$79,162,390	575.6	$38,851,376	$43,734,217

* Jobs are presented in full-time equivalence (FTE)

Table 7-20. Local, State, and National Impacts: Alt B

Area	Local Capture	Output	Jobs*	Labor Income	Value Added
Local					
Direct Impact		$20,375,301	255.0	$17,629,048	$9,681,032
Secondary Impact		$25,020,381	139.4	$8,204,576	$13,934,207
Total Impact	$20,375,301	$45,395,682	394.5	$25,833,623	$23,615,239
State					
Direct Impact		$22,251,015	285.3	$19,440,093	$11,534,544
Secondary Impact		$27,262,123	151.2	$8,867,844	$15,024,385
Total Impact	$22,251,015	$49,513,138	436.5	$28,307,937	$26,558,929
US					
Direct Impact		$23,746,228	314.3	$21,043,478	$13,841,663
Secondary Impact		$52,080,893	237.1	$16,171,012	$28,049,944
Total Impact	$23,746,228	$75,827,121	551.3	$37,214,490	$41,891,607

* Jobs are presented in full-time equivalence (FTE)

Table 7-21. Local, State, and National Impacts: Alt C1

Area	Local Capture	Output	Jobs*	Labor Income	Value Added
Local					
Direct Impact		$15,427,700	193.1	$13,348,301	$7,330,250
Secondary Impact		$18,944,845	105.6	$6,212,312	$10,550,655

Total Impact	$15,427,700	$34,372,545	298.7	$19,560,613	$17,880,905
State					
Direct Impact		$16,847,947	216.0	$14,719,582	$8,733,686
Secondary Impact		$20,642,240	114.5	$6,714,523	$11,376,112
Total Impact	$16,847,947	$37,490,186	330.5	$21,434,105	$20,109,798
US					
Direct Impact		$17,980,086	238.0	$15,933,627	$10,480,582
Secondary Impact		$39,434,430	179.5	$12,244,311	$21,238,759
Total Impact	$17,980,086	$57,414,516	417.5	$28,177,938	$31,719,341

* Jobs are presented in full-time equivalence (FTE)

Table 7-22. Local, State, and National Impacts: Alt C2

Area	Local Capture	Output	Jobs*	Labor Income	Value Added
Local					
Direct Impact		$25,330,621	317.1	$21,916,472	$12,035,481
Secondary Impact		$31,105,395	173.3	$10,199,947	$17,323,038
Total Impact	$25,330,621	$56,436,016	490.4	$32,116,419	$29,358,519
State					
Direct Impact		$27,662,513	354.7	$24,167,968	$14,339,772
Secondary Impact		$33,892,334	188.0	$11,024,524	$18,678,350
Total Impact	$27,662,513	$61,554,847	542.6	$35,192,492	$33,018,121
US					
Direct Impact		$29,521,365	390.7	$26,161,300	$17,207,987
Secondary Impact		$64,747,085	294.7	$20,103,839	$34,871,754
Total Impact	$29,521,365	$94,268,450	685.4	$46,265,139	$52,079,741

* Jobs are presented in full-time equivalence (FTE)

Table 7-23. Local, State, and National Impacts: Alt C3

Area	Local Capture	Output	Jobs*	Labor Income	Value Added
Local					
Direct Impact		$35,371,618	442.8	$30,604,110	$16,806,317
Secondary Impact		$43,435,500	242.0	$14,243,182	$24,189,849
Total Impact	$35,371,618	$78,807,118	684.8	$44,847,292	$40,996,166
State					
Direct Impact		$38,627,868	495.2	$33,748,093	$20,024,023
Secondary Impact		$47,327,174	262.5	$15,394,619	$26,082,403
Total Impact	$38,627,868	$85,955,042	757.7	$49,142,712	$46,106,426
US					
Direct Impact		$41,223,564	545.6	$36,531,576	$24,029,192
Secondary Impact		$90,412,675	411.5	$28,072,953	$48,694,835
Total Impact	$41,223,564	$131,636,239	957.1	$64,604,530	$72,724,027

* Jobs are presented in full-time equivalence (FTE)

Table 7-24. Local, State, and National Impacts: Alt C4

Area	Local Capture	Output	Jobs*	Labor Income	Value Added
Local					
Direct Impact		$50,573,764	633.0	$43,757,258	$24,029,399
Secondary Impact		$62,103,371	346.0	$20,364,670	$34,586,253
Total Impact	$50,573,764	$112,677,135	979.1	$64,121,928	$58,615,651
State					
Direct Impact		$55,229,497	708.1	$48,252,474	$28,630,022
Secondary Impact		$67,667,623	375.3	$22,010,976	$37,292,195
Total Impact	$55,229,497	$122,897,120	1,083.3	$70,263,449	$65,922,218

US					
Direct Impact		$58,940,780	780.1	$52,232,253	$34,356,548
Secondary Impact		$129,270,572	588.4	$40,138,252	$69,623,082
Total Impact	$58,940,780	$188,211,352	1,368.5	$92,370,505	$103,979,630

* Jobs are presented in full-time equivalence (FTE)

Table 7-25. Local, State, and National Impacts: Alt C5

Area	Local Capture	Output	Jobs*	Labor Income	Value Added
Local					
Direct Impact		$28,093,010	351.6	$24,306,537	$13,347,991
Secondary Impact		$34,497,543	192.2	$11,312,286	$19,212,174
Total Impact	$28,093,010	$62,590,553	543.9	$35,618,823	$32,560,164
State					
Direct Impact		$30,679,203	393.3	$26,803,566	$15,903,572
Secondary Impact		$37,588,406	208.5	$12,226,785	$20,715,287
Total Impact	$30,679,203	$68,267,610	601.8	$39,030,351	$36,618,858
US					
Direct Impact		$32,740,769	433.3	$29,014,277	$19,084,576
Secondary Impact		$71,807,972	326.9	$22,296,231	$38,674,636
Total Impact	$32,740,769	$104,548,741	760.2	$51,310,508	$57,759,212

* Jobs are presented in full-time equivalence (FTE)

Table 7-26. Local, State, and National Impacts: Alt C6

Area	Local Capture	Output	Jobs*	Labor Income	Value Added
Local					
Direct Impact		$9,633,629	120.6	$8,335,175	$4,577,281

Secondary Impact		$11,829,865	65.9	$3,879,199	$6,588,221
Total Impact	$9,633,629	$21,463,494	186.5	$12,214,374	$11,165,501
State					
Direct Impact		$10,520,484	134.9	$9,191,454	$5,453,638
Secondary Impact		$12,889,781	71.5	$4,192,798	$7,103,667
Total Impact	$10,520,484	$23,410,265	206.4	$13,384,252	$12,557,305
US					
Direct Impact		$11,227,434	148.6	$9,949,549	$6,544,465
Secondary Impact		$24,624,323	112.1	$7,645,803	$13,262,270
Total Impact	$11,227,434	$35,851,757	260.7	$17,595,352	$19,806,735

* Jobs are presented in full-time equivalence (FTE)

Table 7-27. Local, State, and National Impacts: Alt C7

Area	Local Capture	Output	Jobs*	Labor Income	Value Added
Local					
Direct Impact		$23,887,249	299.0	$20,667,643	$11,349,684
Secondary Impact		$29,332,969	163.4	$9,618,741	$16,335,949
Total Impact	$23,887,249	$53,220,218	462.4	$30,286,384	$27,685,632
State					
Direct Impact		$26,086,267	334.4	$22,790,845	$13,522,673
Secondary Impact		$31,961,104	177.3	$10,396,332	$17,614,033
Total Impact	$26,086,267	$58,047,371	511.7	$33,187,178	$31,136,706
US					
Direct Impact		$27,839,199	368.4	$24,670,594	$16,227,453
Secondary Impact		$61,057,711	277.9	$18,958,296	$32,884,716
Total Impact	$27,839,199	$88,896,910	646.4	$43,628,891	$49,112,169

* Jobs are presented in full-time equivalence (FTE)

6.5 LOSS OF AGRICULTURAL INCOME

Because the alternatives include measures that contain agriculturally productive acres, removing these acres from production for the project will result in a loss of agricultural net income. As agriculture is a perfectly competitive market (soybeans or corn from these acres are no different than soybeans or corn from other areas in the nation), the loss of these margins along the streambank would not affect the agricultural market and are thus considered RED. Using data for acreage productivity from a mix of yields of soybean, corn, and cotton crops for the project area, Table 7-10 displays the loss of annual agricultural net income by alternative. Table 7-11 displays the net income per acre used in the calculations.

Table 7-28. Loss of Annual Agricultural Net Income

Alternative	**Total Acres #**	**Annual Agricultural Net Income $/year**
Alt_A	371	124,000
Alt_B	77	26,000
Alt_C1	423	142,000
Alt_C2	423	142,000
Alt_C3	530	177,000
Alt_C4	530	177,000
Alt_C5	530	177,000
Alt_C6	334	112,000
Alt_C7	302	101,000

Table 7-29. Net Income per Acre

Crop	%	Net Income/acre	Weighted Net Income
Soybeans	82	352.57	289.11
Corn	16	249.16	39.87
Cotton	2	303.92	6.08
Total			335.05

However, because these acres occasionally experience loss of productivity due to flooding, adjustments for flood events were incorporated into the results. Table 7-12 displays the percentage of years with no crop production for each relevant measure; table 7-13 displays the adjusted loss of agricultural net income for each alternative.

Table 7-30. Net Income per Acre

Measure	RM	% of Years with No Crop Production
I40_3	746.4	28
I35_7h	761.1	8
I35_9b	759.8	14
I35_12a	765.8	24
I35_12b	766.3	8
RCP_1	767.5	2
RCP_2	761	4
RCP_4	758.5	2
S_8	768.8	8
I40_1a	749.5	12
I35_6b	767.7	4
S_10	774.6	14

Table 7-31. Adjusted Loss of Annual Agricultural Net Income

Alternative	Total Acres #	Annual Agricultural Net Income $/year	Adjusted Acres #	Adjusted Annual Agricultural Net Income $/year
Alt_A	371	124,000	330	110,000
Alt_B	77	26,000	77	26,000
Alt_C1	423	142,000	382	128,000
Alt_C2	423	142,000	382	128,000
Alt_C3	530	177,000	489	164,000
Alt_C4	530	177,000	489	164,000
Alt_C5	530	177,000	489	164,000
Alt_C6	334	112,000	297	100,000
Alt_C7	302	101,000	268	90,000

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List of Acronyms and Abbreviations

Cost-Effectiveness	**CE**
Incremental Cost Analysis	**ICA**
Institute for Water Resources	**IWR**
Planning Center of Expertise	**PCX**
Other Social Effects Account	**OSE**
United State's Dollars	**USD**
Regional Economic Development	**RED**