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Economic and Social Analysis of the Boardman River Dams: Quantification of Existing Conditions

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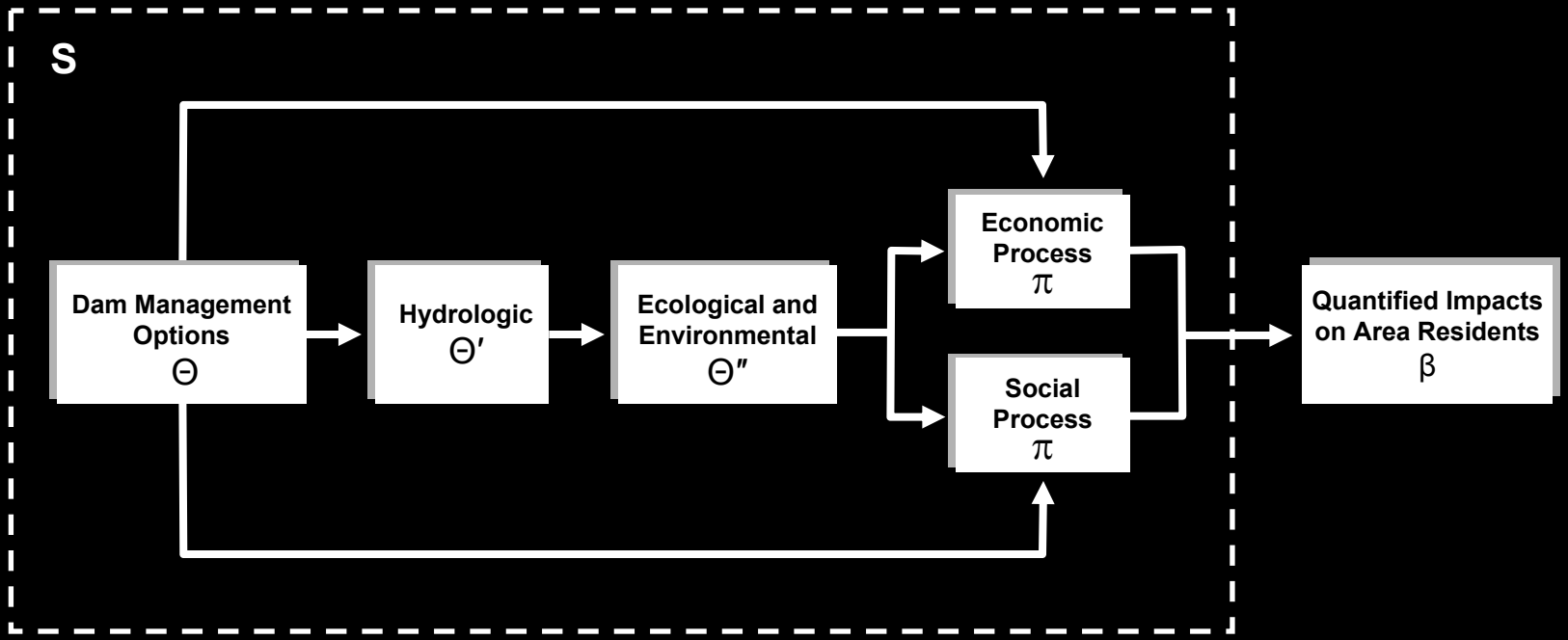
Components of the Report

- Identifies the methodologies to be used in the socioeconomic evaluation of dam-management alternatives
- Quantifies the existing conditions for recreational use of the Boardman River
- Quantifies the existing level of recreational expenditures for recreational users of the Boardman River
- Quantifies the values of potentially affected properties along the Boardman River
- Considers conditions for electricity generation from three of the dams.

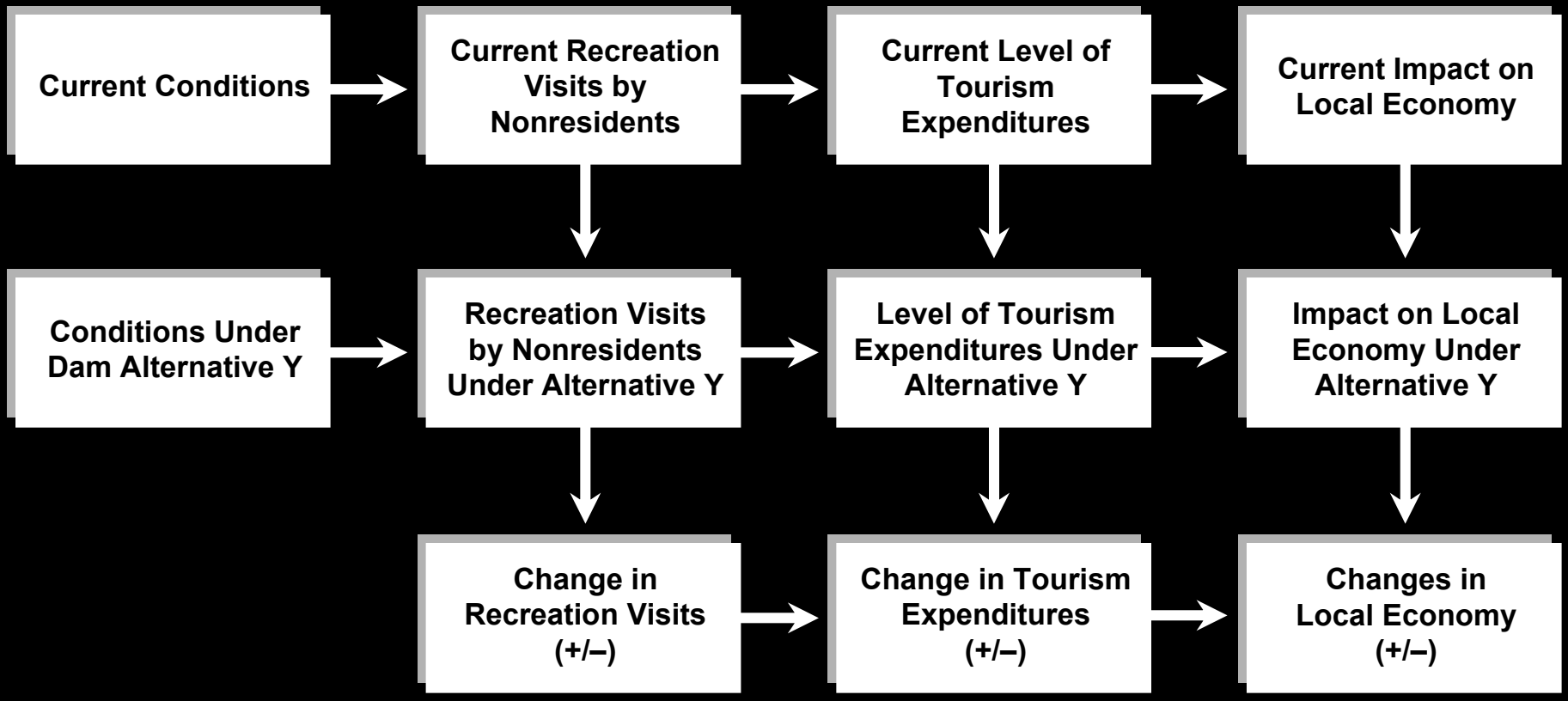
Methodological Overview



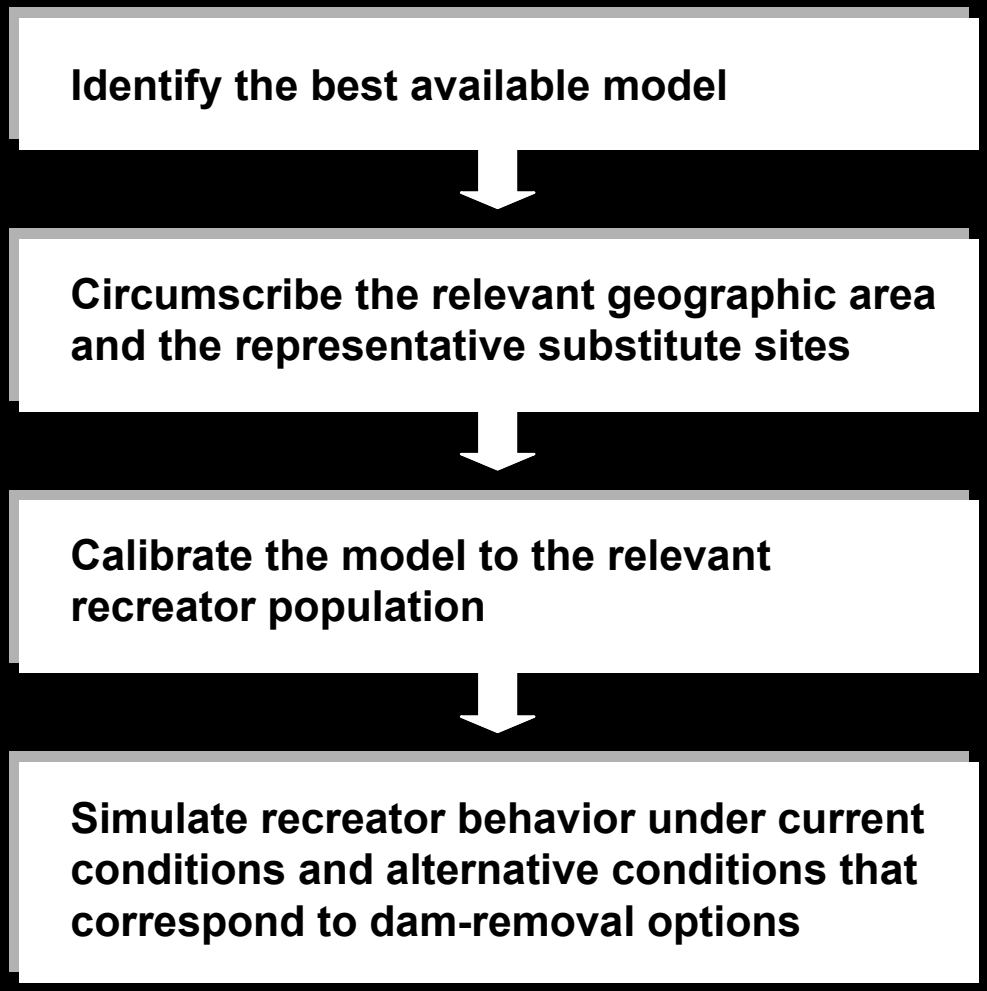
Socioeconomic Modeling Considerations

- Site characteristics and resource performance metrics
- System structure and parameter specification
- Information required for recreation model
- Residential property values
- Local economic impacts
- Electricity asset operation

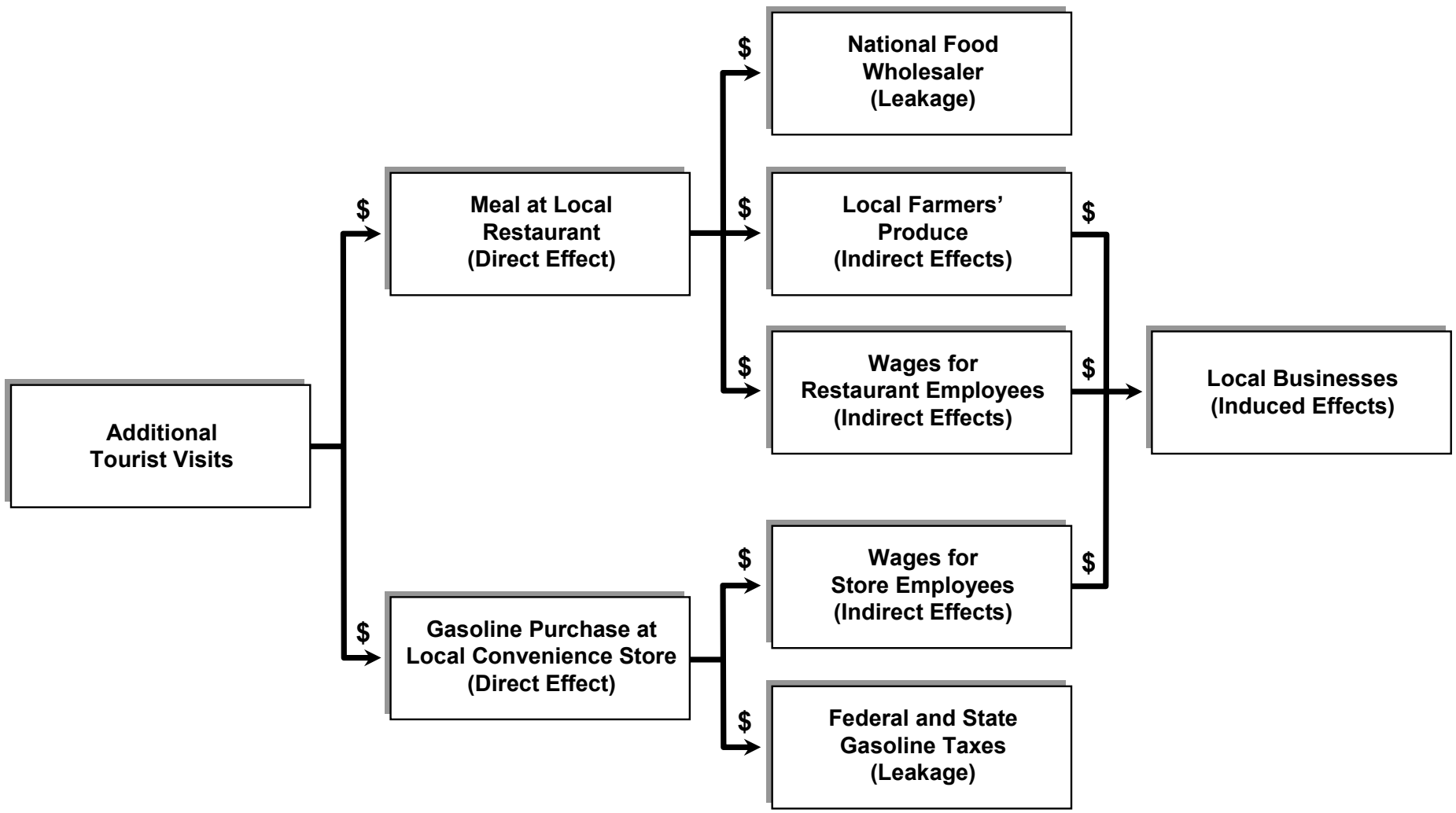
Quantitative Evaluation of Dam Disposition Alternative Y on Local Economy



Simulating Recreation Behaviors

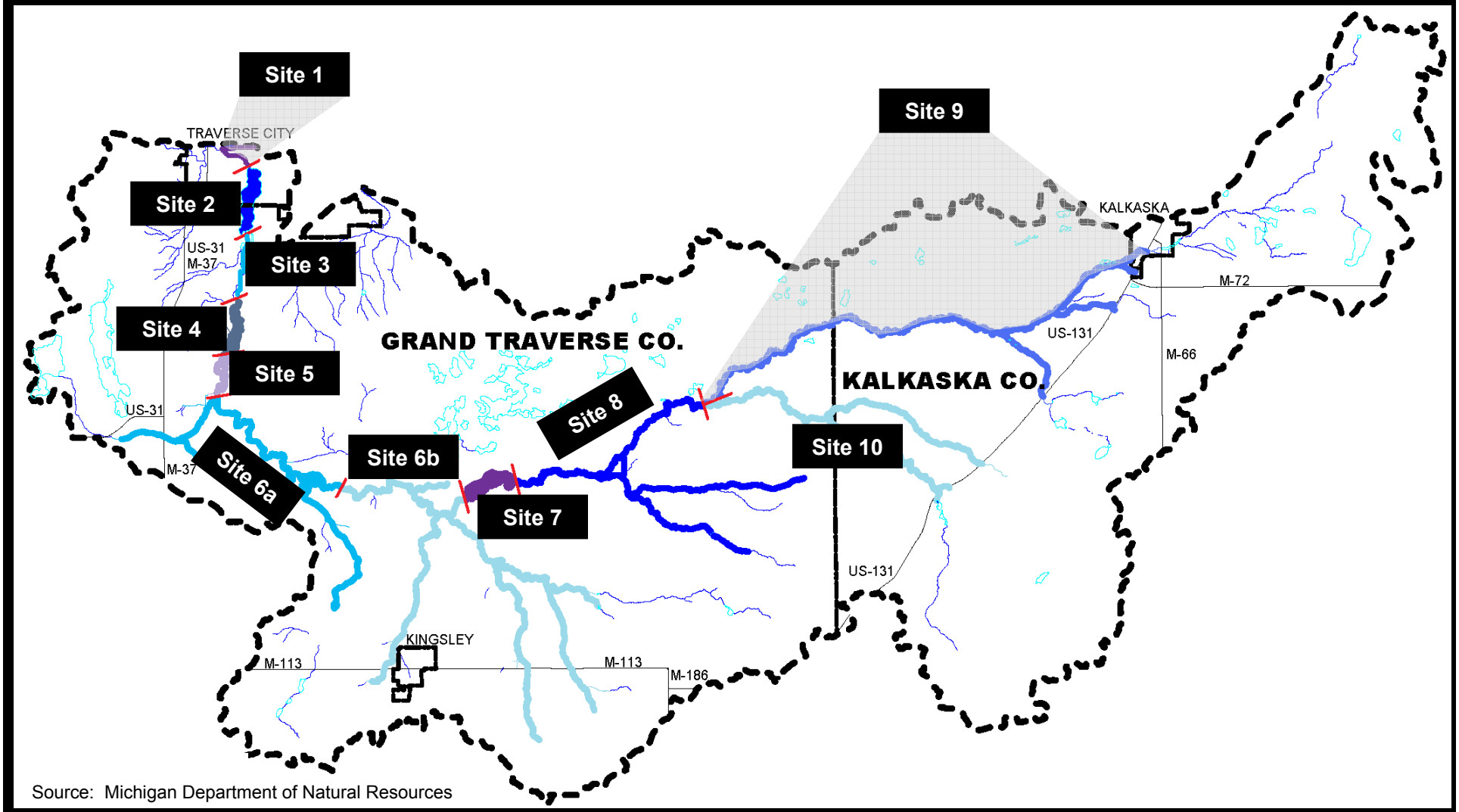


Simulating Economic Impacts



Boardman-0012

Site Definitions



Source: Michigan Department of Natural Resources

Site Definitions

Segment	Description
1	From Mouth to Union Street Dam
2	Boardman Lake
3	Inlet of Boardman Lake to Sabin Dam
4	Sabin Pond
5	Keystone Pond & Boardman Dam
6a	Inlet of Keystone to mid point
6b	Mid point to Brown Bridge Dam
7	Brown Bridge Pond
8	Inlet of Brown Bridge Pond to Forks
9	North Branch
10	South Branch

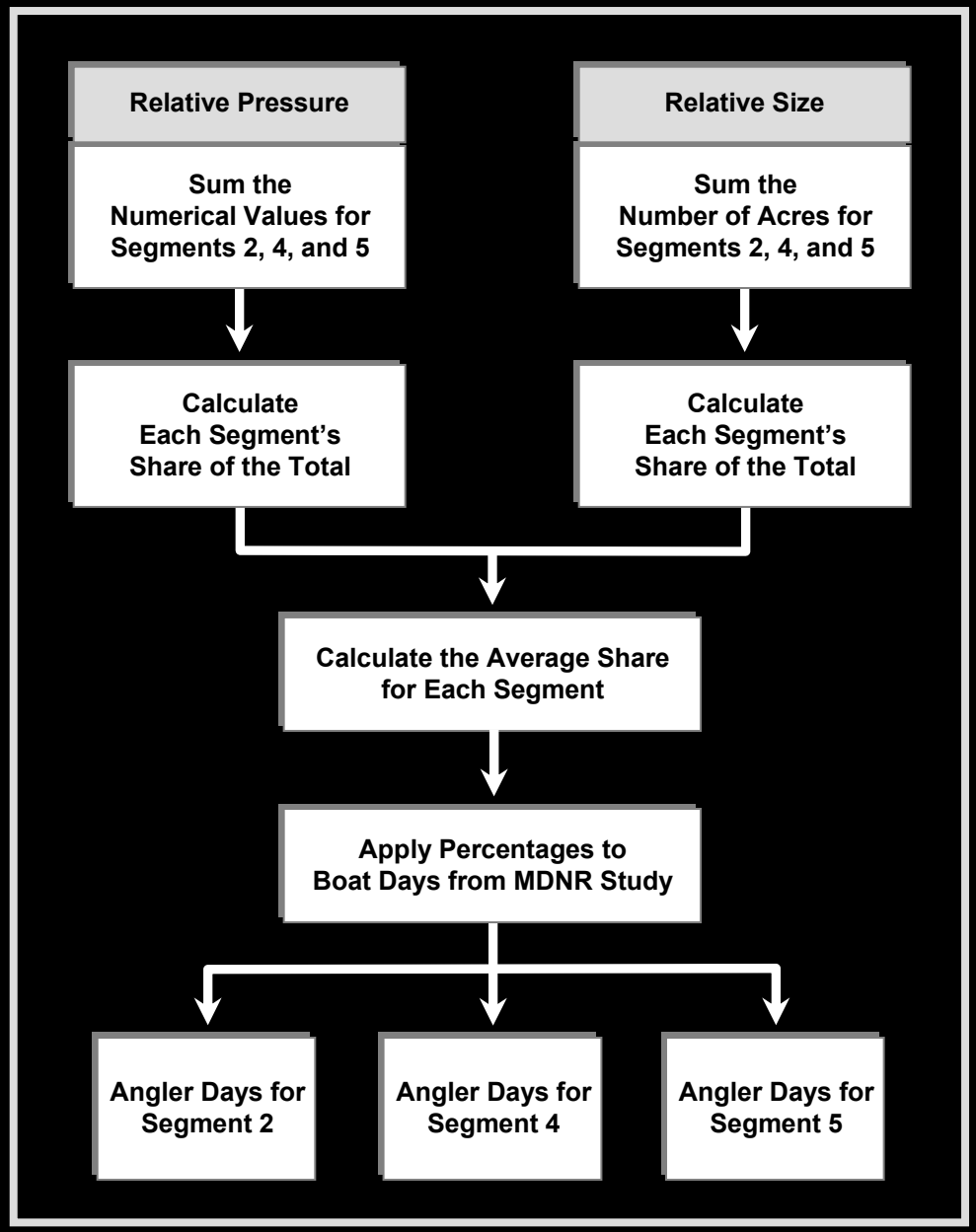
Site Characteristics: Fishing

Segment	Water Body Type	Species Type	Anadromous Catch Rates (Fish per Hour)					Miles of Top Quality Stream[a]	Miles of Second Quality Stream[a]	Lake Acres
1	River	Anadromous Warm Cold	Coho Chinook Rainbow	0.001 0.006 0.084	to to to	0.014 0.042 0.237		1.2	0.0	—
2	Impoundment	Warm	N/A					—	—	339
3	River	Anadromous Cold	Coho Chinook Rainbow	0.000 0.002 0.067	to to to	0.001 0.006 0.084		0.0	2.2	—
4	Impoundment	Warm	N/A					—	—	40
5	Impoundment	Warm	N/A					—	—	103
6a	River	Cold	N/A					6.9	0.0	—
6b	River	Cold	N/A					6.9	0.0	—
7	Impoundment	Warm	N/A					—	—	191
8	River	Cold	N/A					6.0	0.0	—
9	River	Cold	N/A					23.5	0.0	—
10	River	Cold	N/A					10.0	0.0	—

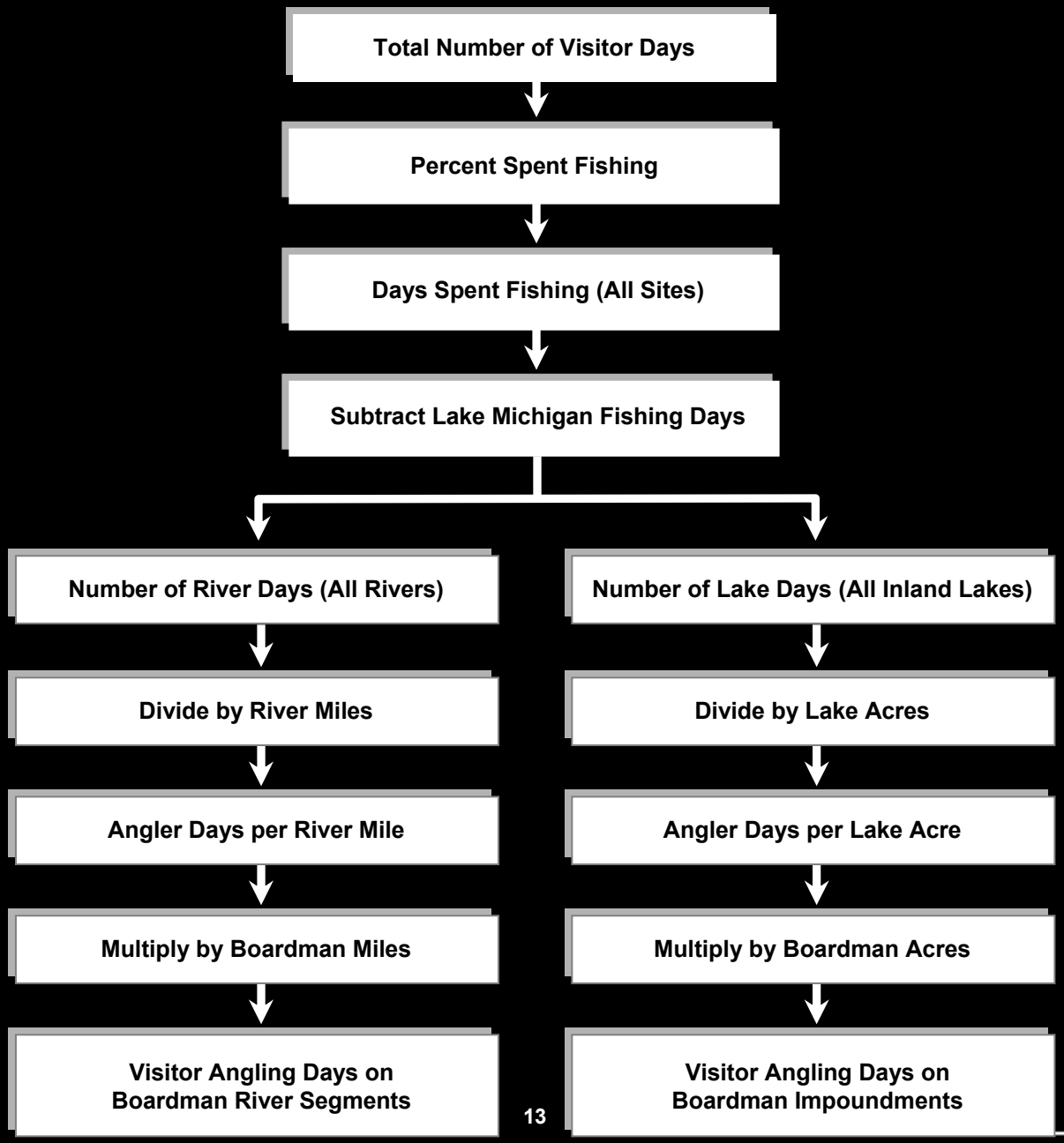
Qualitative Pressure Ratings for Boardman River Fishing Sites

Segment	Description	Qualitative Pressure Rating by Largent	Qualitative Pressure Rating by Kalish	Assigned Numerical Value
1	From Mouth to Union Street Dam	Heavy	Heavy	6
2	Boardman Lake	Moderate	Moderate	4
3	Inlet of Boardman Lake to Sabin Dam	Moderate to Low	Moderate	3.5
4	Sabin Pond	Very Low	Low	1.5
5	Keystone Pond & Boardman Dam	Moderate to Low	Moderate	3.5
6a	Inlet of Keystone to mid point	Moderate to Heavy	Heavy	5.5
6b	Mid point to Brown Bridge Dam	Moderate to Heavy	Heavy	5.5
7	Brown Bridge Pond	Moderate to Heavy	Moderate	4.5
8	Inlet of Brown Bridge Pond to Forks	Heavy	Heavy	6
9	North Branch	Heavy	Moderate	5
10	South Branch	Moderate	Moderate	4

Methodology for Allocation of Angler Days Across Impoundments



Methodology for Determining Angling Days by Visitors



Boardman River Paddling Site Characteristics

Segment	Description	Current Whitewater Quality	Parking	Crowding	Water Quality (Pollution)	Scenic Rating	Predictability of Water Level
1	From Mouth to Union Street Dam	0.0	3.8	3.8	3.0	1.8	4.6
2	Boardman Lake	0.0	4.0	3.9	2.9	3.0	4.8
3	Inlet of Boardman Lake to Sabin Dam	0.0	3.1	4.0	4.3	4.8	4.6
4	Sabin Pond	0.0	3.3	4.4	4.3	4.4	4.6
5	Keystone Pond & Boardman Dam	1.0	3.5	4.1	4.3	3.6	3.5
6	Inlet of Keystone to Brown Bridge Dam	1.6	4.0	3.4	4.0	4.6	4.2
7	Brown Bridge Pond	0.0	4.3	4.3	4.4	5.0	4.4
8	Inlet of Brown Bridge Pond to Forks	0.4	4.2	3.2	4.2	4.8	4.2
9	North Branch	0.0	2.7	4.7	3.7	5.0	4.3
10	South Branch	0.0	2.7	4.7	3.7	5.0	4.3

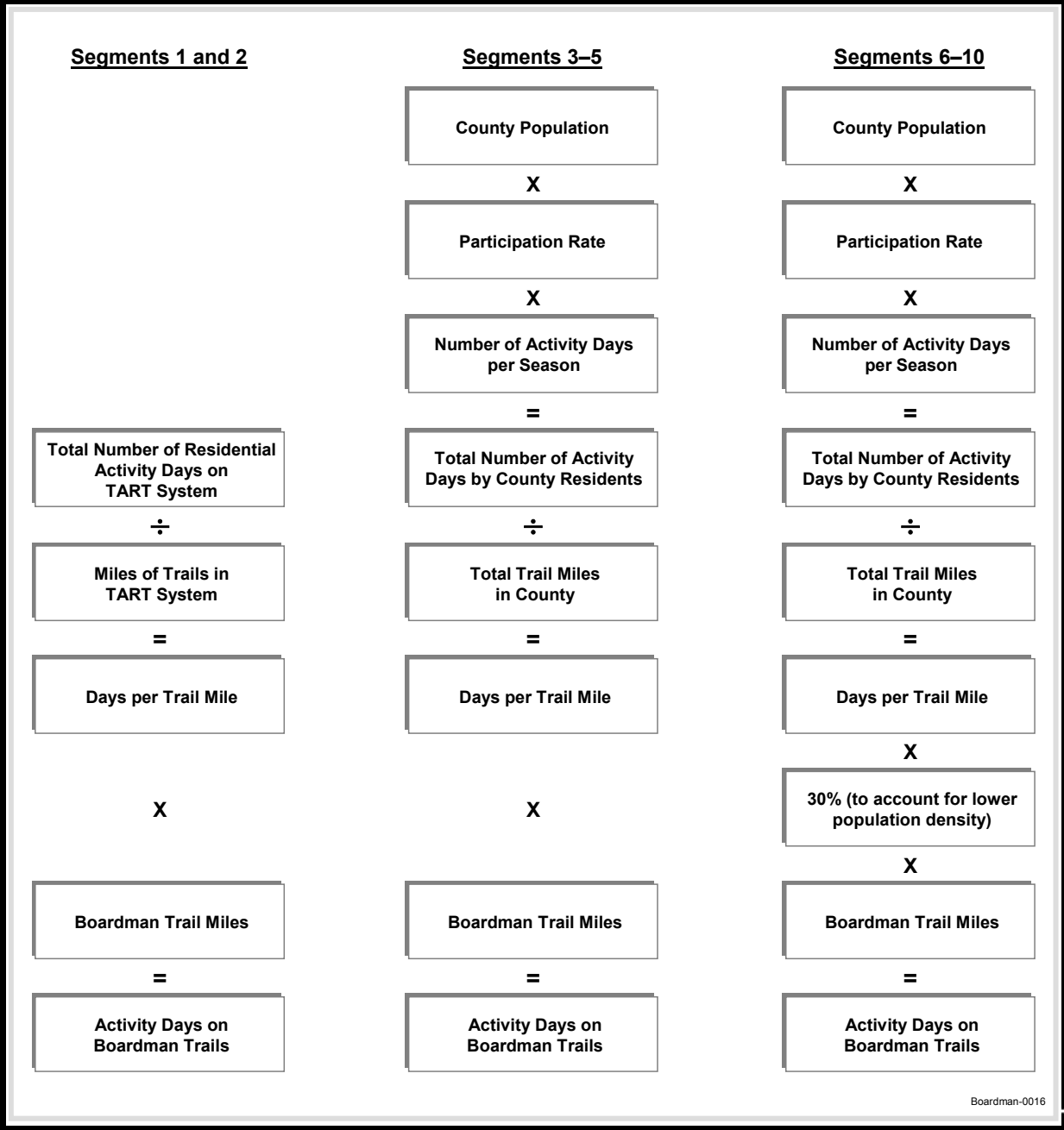
Trails Along the Boardman River

Segment Number	Name of Trail	Number of Trail Miles	Scenic Beauty
1	None	1.2[a]	1.8
2	Boardman Lake TART	2.0	3.0
3	Fox Den Trail	0.6	4.8
4	Sabin Pond Trail Beaver Pond Trail	1.5	4.4
5	Lone Pine Trail	0.8	3.6
6a	Oleson Bridge Trail Keystone Rapids Trail	1.1	4.6
6b	None	6.9[a]	4.6
7	Brown Bridge “Quiet Area” Trails	6.0[b]	5.0
8	Includes portions of the North Country Trail and the Michigan Shore-to-Shore Riding Trail	6.7	4.8
9	Includes portions of the North Country Trail and the Michigan Shore-to-Shore Riding Trail	19.1	5.0
10	Includes portions of the North Country Trail	10.0[a]	5.0
TOTAL		55.8	

[a]This estimate is based on river miles.

[b]This estimate is calculated from the map on the GTCD website.

Top-Down Approach for Hiking Days by Residents



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Current Level of Recreational Spending by Visitors to the Boardman River

Activity	Recreational Spending ($/year)
Fishing	$298,200
Paddling	$317,400
Camping	$207,300
Trail Activities	$1,110,300
TOTAL	$1,933,200

Summary of Recreational Visits to the Boardman River

Activity	Residents Days Spent on Activity	Visitors Days Spent on Activity	Total Annual Spending
Fishing	16,800 to 26,400	4,200 to 6,600	$298,200
Paddling	3,300 to 10,160	2,215 to 6,760	$317,400
Camping		4,000 to 6,500[a]	$207,300
Trail activities	72,300 to 154,000	18,100 to 23,125	$1,110,300
	92,400 to 190,560	28,515 to 42,985	$1,933,200

[a]Range of camping days combines resident and visitor days

Economic Impacts of Visitor Spending

Sector/ Spending Category	Direct Effects			
	Direct Sales ($ Thousands)	Jobs	Personal Income ($ Thousands)	Value Added ($ Thousands)
Lodging	371	7	121	184
Camping	21	0	3	6
Restaurants	409	10	139	194
Admissions and fees	135	4	47	77
Local transportation	160	4	91	107
Retail trade	241	6	123	192
Wholesale trade	34	0	14	23
Local production of goods	11	0	1	2
Total direct effects	1,382	31	538	785
Indirect and induced effects	625	8	225	387
Total effects	$2,007	39	$763	$1,172

Residential Property Near the Boardman River

Segment	Description	Number of Residential Parcels within ½ Mile	Total Number of Acres	Total Current Assessed Value ($ Millions)
1	From Mouth to Union Street Dam	1,304	233	$137
2	Boardman Lake	1,778	403	$130
3	Inlet of Boardman Lake to Sabin Dam	166	403	$9
4	Sabin Pond	42	305	$4
5	Keystone Pond & Boardman Dam	61	504	$5
6	Inlet of Keystone to Brown Bridge Dam	493	4,759	$40
7	Brown Bridge Pond	8	276	$1
8	Inlet of Brown Bridge Pond to Forks	69	576	$5
9	North Branch	N/A	—	—
10	South Branch	N/A	—	—
	TOTAL	3,921	7,459	$331

Information Needs for Phase 3 of Boardman River Socioeconomic Assessment

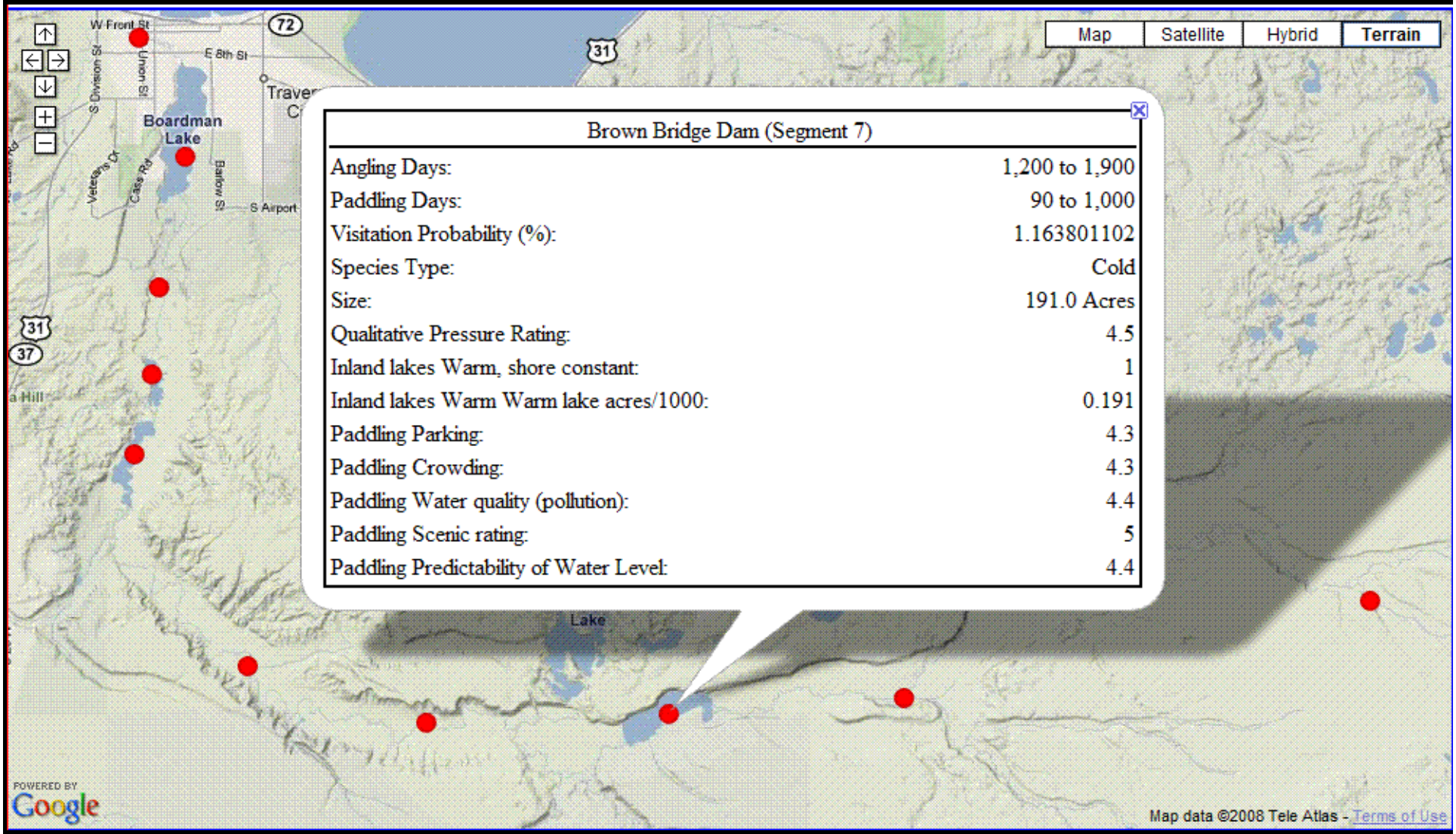
Data Needs for Recreation/Tourism Assessment
Segment 5: Keystone Pond

Component	Current	Alt. 1	Alt. 25	Alt. 41	Alt. 43	Alt. 79	Alt. 81
Angler catch these kinds of species	Warmwater	Warmwater	Warmwater	Warmwater	Warmwater	Warmwater	Warmwater
Percent increase in population of Coho	0	0					
Percent increase in population of Chinook	0	0					
Percent increase in population of rainbow	0	0					
Size of impoundment (acres)	103	103	n/a	103	103	n/a	n/a
Stream miles	n/a	n/a		n/a	n/a		
MDNR stream rating	n/a	n/a		n/a	n/a		
Scenic quality	3.6	3.6		3.6	3.6		
Miles of hiking trails	0.8	0.8	0.8	0.8	0.8	0.8	0.8
Whitewater quality	1.0	1.0		1.0			

Note: Shaded cells indicate a potential change from the current conditions.

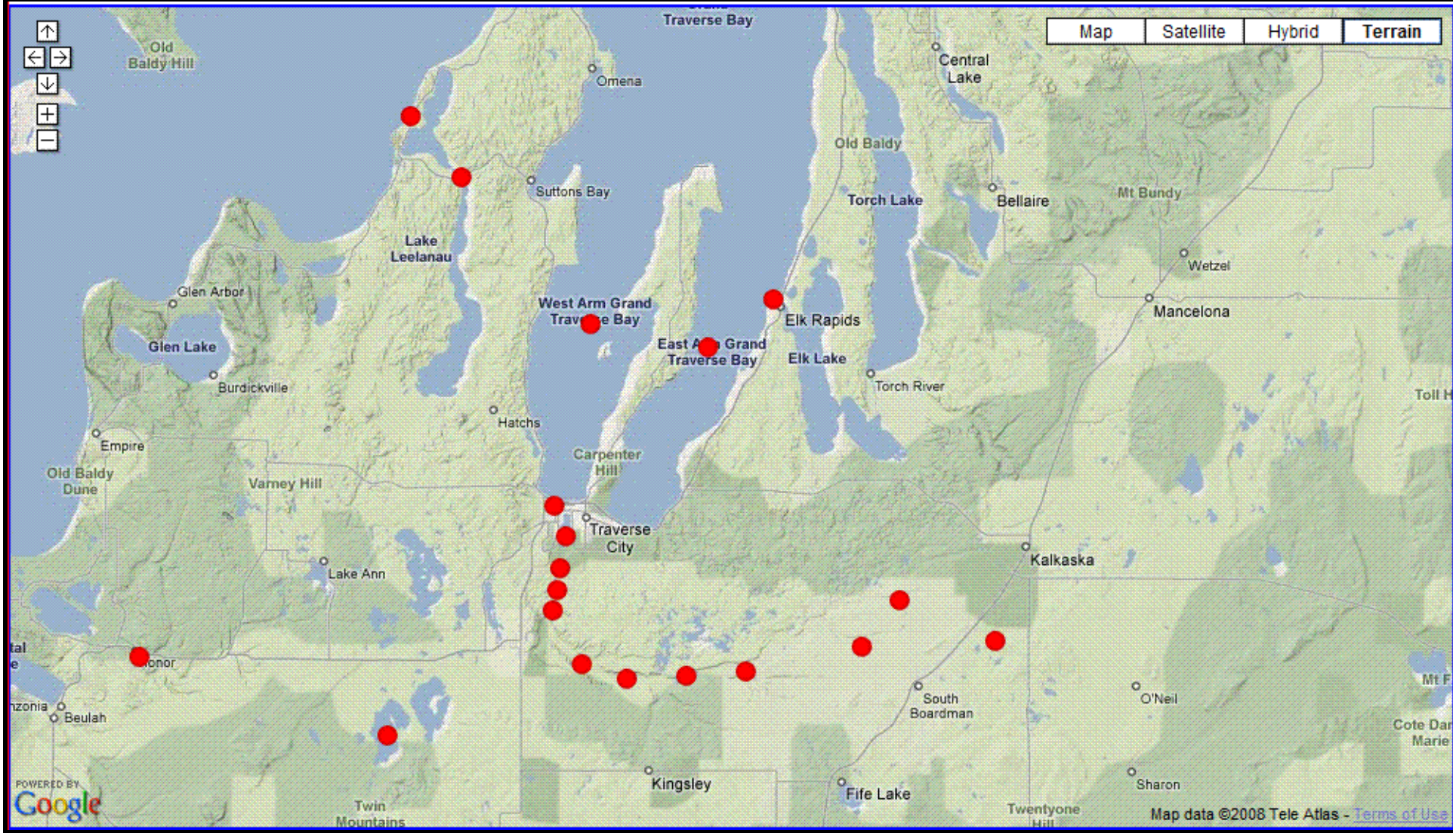
Details of Results

Area Map with Site Characteristics



Brown Bridge Dam (Segment 7)	
Angling Days:	1,200 to 1,900
Paddling Days:	90 to 1,000
Visitation Probability (%):	1.163801102
Species Type:	Cold
Size:	191.0 Acres
Qualitative Pressure Rating:	4.5
Inland lakes Warm, shore constant:	1
Inland lakes Warm Warm lake acres/1000:	0.191
Paddling Parking:	4.3
Paddling Crowding:	4.3
Paddling Water quality (pollution):	4.4
Paddling Scenic rating:	5
Paddling Predictability of Water Level:	4.4

Area Map


Map
Satellite
Hybrid
Terrain
Traverse Bay
Old Baldy Hill
Omena
Central Lake
Old Baldy
Suttons Bay
Torch Lake
Bellaire
Mt Bundy
Lake Leelanau
Wetzel
Glen Arbor
West Arm Grand Traverse Bay
Elk Rapids
Mancelona
Glen Lake
East Arm Grand Traverse Bay
Elk Lake
Burdickville
Torch River
Hatchs
Empire
Carpenter Hill
Old Baldy Dune
Varney Hill
Traverse City
Kalkaska
Lake Ann
Beulah
South Boardman
O'Neil
Kingsley
Fife Lake
Sharon
Twin Mountains
Twentyone Hill
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Map data ©2008 Tele Atlas - Terms of Use

Annual Number of Angler Days on the Boardman River

Segment	Resident Days	Visitor Days
1	880 to 1,440	220 to 360
2	720 to 1,120	180 to 280
3	800 to 1,200	200 to 300
4	160 to 240	40 to 60
5	320 to 560	80 to 140
6a	1,680 to 2,720	420 to 680
6b	1,680 to 2,720	420 to 680
7	960 to 1,520	240 to 380
8	1,760 to 2,720	440 to 680
9	5,840 to 8,960	1,460 to 2,240
10	2,000 to 3,200	500 to 800
TOTAL	16,800 to 26,400	4,200 to 6,600

Annual Number of Resident and Visitor Paddling Days on the Boardman River

Segment Number	Resident Days			Visitor Days		
1	120	to	180	80	to	120
2	50	to	60	40	to	40
3	300	to	1,140	200	to	760
4	50	to	60	40	to	40
5	30	to	300	15	to	200
6a	600	to	2,400	400	to	1,600
6b	600	to	1,800	400	to	1,200
7	50	to	600	40	to	400
8	1,500	to	3,600	1,000	to	2,400
9	—	to	10	—	to	—
10	—	to	10	—	to	—
TOTAL	3,300	to	10,160	2,215	to	6,760

Annual Trail Activity Days on the Boardman River

Segment	Resident Days			Visitor Days		
1	12,000	to	14,000	3,000	to	4,000
2	20,000	to	24,000	5,000	to	6,500
3	1,500	to	4,000	500	to	625
4	4,000	to	11,000	1,000	to	1,250
5	2,000	to	6,000	700	to	875
6a	800	to	2,000	300	to	375
6b	5,000	to	15,000	2,000	to	2,500
7	4,500	to	13,000	1,500	to	1,875
8	5,000	to	14,000	2,000	to	2,500
9	11,500	to	33,000	1,200	to	1,500
10	6,000	to	18,000	900	to	1,125
TOTAL	72,300	to	154,000	18,100	to	23,125

Annual Number of Camping Nights Spent Along the Boardman River

Segment Number	TOTAL
1	0
2	0
3	0
4	0
5	0
6a	0
6b	0
7	0
8	3,000 to 5,000
9	1,000 to 1,500
10	0
TOTAL	4,000 to 6,500

Summary of Economic and Social Analysis

Activity	Component	Assessment of Certainty	Source of Uncertainty
Fishing	Total Number of Days for Segments 1–8	High	Site-specific estimate developed by MDNR from a 2005 creel survey. May be less precise due to year to year variation.
	Total Number of Days for Segments 9–10	Moderate	Extrapolation from MDNR creel survey of other Boardman segments. May be less precise due to year to year variation. The extrapolation technique fails to account for potential differences in access and angler preferences and may not be precise.
	Allocation of Total Days across Segments	Moderate	Allocation methodology assumes that boat trips occur in impoundments and that shore trips occur on the stream segments. Equal weighting between size/length and quality is assumed and may not precisely reflect angler choices.
	Allocation of Days between Residents and Visitors	Moderate	Total visitor days based on participation rates for fishing and hunting combined. Allocation assumes that visitors select the type of site (lake, river, etc.) in the same proportions as residents do.
	Current site characteristics for Boardman Segments	High	Based on site-specific information collected by the MDNR. Catch rates may be less precise due to year to year variation.
	Current site characteristics for substitute sites	High	Based on site-specific information collected by the MDNR. Catch rates may be less precise due to year to year variation.
	Days at Substitute Sites	High	Based on site-specific information collected by the MDNR. May be less precise due to year to year variation.

Summary of Economic and Social Analysis, cont.

Activity	Component	Assessment of Certainty	Source of Uncertainty
Fishing, continued	RUM	High	Based on a survey of Michigan anglers for all types of fishing and a rigorous statistical model.
	Visitor Spending per Day	Moderate	Based in part on recent expenditures by anglers throughout Michigan. Upper end of the range reflects national spending patterns by anglers fishing in National Forests.
	Alternative Site Characteristics for Boardman Segments	Unknown	To be determined in next phase of work
Paddling	Total Number of Paddling Days	Moderate	Based on key informant interviews and groundtruthing with publicly available information
	Allocation of Paddling Days Across Segments	Moderate	Based on key informant interviews
	Allocation of Days between Residents and Visitors	Low	Total visitor days based on participation rates for all boating. Allocation does not consider flat water. Assumes that all streams in county are of equal popularity relative to length.

Summary of Economic and Social Analysis, cont.

Activity	Component	Assessment of Certainty	Source of Uncertainty
Paddling, continued	Current site characteristics for Boardman Segments	Low	Based on an informal survey of a small number of local paddlers
	Current site characteristics for substitute sites	Low	Based on an informal survey of a small number of local paddlers
	Days at Substitute Sites	Low	Based on an allocation of Michigan total days. Does not consider flat water. Assumes that all streams in the state are of equal popularity relative to length.
	RUM	Low	Reflects preferences of Irish whitewater paddlers based on a convenience sampling methodology. Does not include length of run or portage conditions, which are applicable for the Boardman.
	Visitor Spending per Day	Moderate	Based on surveys of paddlers in Virginia and Wisconsin. Similar whitewater experiences.
	Alternative Site Characteristics for Boardman Segments	Unknown	To be determined in next phase of work

Summary of Economic and Social Analysis, cont.

Activity	Component	Assessment of Certainty	Source of Uncertainty
Trail Activities	Number of Trail Activity Days for Segments 1–2	High	Based on data for similar trails in Traverse City. May be less precise due to year to year variation.
	Number of Trail Activity Days for Segments 3–10	Moderate	Based on "top down" approach, which reflects a statewide participation rate for day hiking. Assumes that trails in the county are of equal popularity relative to length. Estimates are complicated by the heterogeneous nature of the activity.
	Allocation of Days between Residents and Visitors for Segments 1–2	High	Based on data for similar trails in Traverse City, which identified visitors and residents separately. May be less precise due to year-to-year variation.
	Allocation of Days between Residents and Visitors for Segments 3–10	Low	Assumes that trails in the county are of equal popularity relative to length. Estimates are complicated by the heterogeneous nature of the activity. Upper end of the range is assumed.
	RUM	Missing	There is no existing model in the literature from which to develop a site-calibrated RUM.
	Visitor Spending per Day	Moderate	Reflects trail activity spending for residents of Wisconsin and users of National Forests.

Summary of Economic and Social Analysis, cont.

Activity	Component	Assessment of Certainty	Source of Uncertainty
Camping	Number of Camping Nights	Moderate	Reflects occupancy rate for State Forest Campgrounds in Michigan. May be less precise due to year to year variation.
	Allocation of Nights between Residents and Visitors	Moderate	Based on state-level data, all are assigned to visitors. Some small percentage may be residents.
	RUM	Missing	There is no existing model in the literature from which to develop a site-calibrated RUM.
	Visitor Spending per Night	Moderate	Reflects spending by campers for users of National Forests and users of State Forest Campgrounds in Michigan. The latter data source is more than 10 years old.

Electricity Cost and Revenue Parameters

Power = Head • Flow • Constant (64.4/550 • 0.7457)

Property Characteristics Determining Property Value

$$P = V_i$$

$$V_i = f(\Theta, S)$$

$$P = f(\Theta, S)$$

$$\Delta \text{ Value} = f(\Theta, S) - f(\bar{O}, S)$$

$$\Delta \text{ Value} = dP/d\Theta$$

Monte Carlo Analysis for Visitor Expenditures