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## APPENDIX D

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### Watershed and Land Cover



**Date: 6/14/2006 Scenario: N & S Twin Lakes Base With Septic**

Lake Id: North & South Twin  
 Watershed Id: Orthophoto Rect.

**Hydrologic and Morphometric Data**

Tributary Drainage Area: 10425.9 acre  
 Total Unit Runoff: 14.00 in.  
 Annual Runoff Volume: 12163.5 acre-ft  
 Lake Surface Area <As>: 3512.0 acre  
 Lake Volume <V>: 89496.0 acre-ft  
 Lake Mean Depth <z>: 25.5 ft  
 Precipitation - Evaporation: 5.5 in.  
 Hydraulic Loading: 13773.2 acre-ft/year  
 Areal Water Load <qs>: 3.9 ft/year  
 Lake Flushing Rate <p>: 0.15 1/year  
 Water Residence Time: 6.50 year  
 Observed spring overturn total phosphorus (SPO): 24.7 mg/m<sup>3</sup>  
 Observed growing season mean phosphorus (GSM): 16.7 mg/m<sup>3</sup>  
 % NPS Change: 0%  
 % PS Change: 0%

**NON-POINT SOURCE DATA**

Land Use	Acre	Low	Most Likely	High	Loading %	Low	Most Likely	High
	(ac)	Loading (kg/ha-year)				Loading (kg/year)		
Row Crop AG	0.0	0.50	1.00	3.00	0.0	0	0	0
Mixed AG	0.0	0.30	0.80	1.40	0.0	0	0	0
Pasture/Grass	487.7	0.10	0.30	0.50	6.3	20	59	99
HD Urban (1/8 Ac)	67.0	1.00	1.50	2.00	4.4	27	41	54
MD Urban (1/4 Ac)	116.5	0.30	0.50	0.80	2.5	14	24	38
Rural Res (>1 Ac)	921.8	0.05	0.10	0.25	4.0	19	37	93
Wetlands	1343.3	0.10	0.10	0.10	5.8	54	54	54
Forest	7489.6	0.05	0.09	0.18	29.2	152	273	546
Lake Surface	3512.0	0.10	0.30	1.00	45.7	142	426	1421
Lake Surface	3512.0	0.10	0.30	1.00	46.6	142	426	1421

**Land Cover – Urban Areas** (Delineated with Orthophotos and WISCLAND)  
 High Intensity: Developed areas in Village of Phelps  
 Medium Intensity: Commercial areas and girls camp on South Twin  
 Low Intensity: Remaining residencies around lake.

**POINT SOURCE DATA**

Point Sources	Water Load (m <sup>3</sup> /year)	Low (kg/year)	Most Likely (kg/year)	High (kg/year)	Loading %
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**SEPTIC TANK DATA**

Description	Low	Most Likely	High	Loading %
Septic Tank Output (kg/capita-year)	0.30	0.50	0.80	
# capita-years	140			
% Phosphorus Retained by Soil	98.0	73	80.0	
Septic Tank Loading (kg/year)	0.84	18.90	22.40	2.0

**TOTALS DATA**

Description	Low	Most Likely	High	Loading %
Total Loading (lb)	944.8	2057.4	5131.4	100.0
Total Loading (kg)	428.6	933.2	2327.6	100.0
Areal Loading (lb/ac-year)	0.27	0.59	1.46	
Areal Loading (mg/m <sup>2</sup> -year)	30.15	65.66	163.77	
Total PS Loading (lb)	0.0	0.0	0.0	0.0
Total PS Loading (kg)	0.0	0.0	0.0	0.0
Total NPS Loading (lb)	629.6	1075.7	1948.6	98.0
Total NPS Loading (kg)	285.6	487.9	883.9	98.0

**Septic Rational**

Average use: 24 weeks or 0.46 year (Phase I Survey)

Average people: 3.37/property (Phase I Survey)

90 properties have private systems with groundwater flowing through property (GIS estimate)

**Capita-years = 90 x 3.37 x 0.46 = 139.5 Used 140**

## Phosphorus Prediction and Uncertainty Analysis Module

Date: 6/14/2006 Scenario: 2

Observed spring overturn total phosphorus (SPO): 24.7 mg/m<sup>3</sup>

Observed growing season mean phosphorus (GSM): 16.7 mg/m<sup>3</sup>

Back calculation for SPO total phosphorus: 0.0 mg/m<sup>3</sup>

Back calculation GSM phosphorus: 0.0 mg/m<sup>3</sup>

% Confidence Range: 70%

Nurnberg Model Input - Est. Gross Int. Loading: 0 kg

Lake Phosphorus Model	Low	Most Likely	High	Predicted	% Dif.
	Total P (mg/m <sup>3</sup> )	Total P (mg/m <sup>3</sup> )	Total P (mg/m <sup>3</sup> )	-Observed (mg/m <sup>3</sup> )	
Walker, 1987 Reservoir	9	20	49	3	18
Canfield-Bachmann, 1981 Natural Lake	9	14	26	-3	-18
Canfield-Bachmann, 1981 Artificial Lake	10	15	25	-2	-12
Rechow, 1979 General	2	5	13	-12	-72
Rechow, 1977 Anoxic	11	25	61	8	48
Rechow, 1977 water load<50m/year	3	7	18	-10	-60
Rechow, 1977 water load>50m/year	N/A	N/A	N/A	N/A	N/A
Walker, 1977 General	9	19	47	-6	-24
Vollenweider, 1982 Combined OECD	8	15	31	-6	-29
Dillon-Rigler-Kirchner	6	13	33	-12	-49
Vollenweider, 1982 Shallow Lake/Res.	6	11	25	-10	-48
Larsen-Mercier, 1976	7	15	39	-10	-40
Nurnberg, 1984 Oxidic	6	12	30	-5	-30

Lake Phosphorus Model	Confidence	Confidence	Parameter	Back	Model
	Lower Bound	Upper Bound	Fit?	Calculation (kg/year)	Type
Walker, 1987 Reservoir	11	39	Tw	0	GSM
Canfield-Bachmann, 1981 Natural Lake	4	40	FIT	1	GSM
Canfield-Bachmann, 1981 Artificial Lake	5	43	FIT	1	GSM
Rechow, 1979 General	3	10	L	0	GSM
Rechow, 1977 Anoxic	14	48	FIT	0	GSM
Rechow, 1977 water load<50m/year	4	14	FIT	0	GSM
Rechow, 1977 water load>50m/year	N/A	N/A	N/A	N/A	N/A
Walker, 1977 General	9	39	FIT	0	SPO
Vollenweider, 1982 Combined OECD	7	29	FIT	0	ANN
Dillon-Rigler-Kirchner	7	26	L qs p	0	SPO
Vollenweider, 1982 Shallow Lake/Res.	5	22	FIT	0	ANN
Larsen-Mercier, 1976	9	30	Pin	0	SPO
Nurnberg, 1984 Oxidic	6	25	FIT	0	ANN