Appendix 11

WiLMS and MnLeap Data for both Lakes

Date: 5/8/2006 Scenario: 14

Amnicon 2003 Data

Lake Id: amnicon
Watershed Id: 0

Hydrologic and Morphometric Data

Tributary Drainage Area: 2615.0 acre
Total Unit Runoff: 13.60 in.
Annual Runoff Volume: 2963.7 acre-ft
Lake Surface Area <As>: 426.0 acre
Lake Volume <V>: 4210.4 acre-ft
Lake Mean Depth <z>: 9.9 ft
Precipitation - Evaporation: 5.2 in.
Hydraulic Loading: 7146.7 acre-ft/year
Areal Water Load <qs>: 16.8 ft/year
Lake Flushing Rate <p>: 1.70 1/year
Water Residence Time: 0.59 year
Observed spring overturn total phosphorus (SPO): 18.0 mg/m^3
Observed growing season mean phosphorus (GSM): 20.0 mg/m^3
% NPS Change: 0%
% PS Change: 0%

NON-POINT SOURCE DATA

Land Use	Acre (ac)	Low Loading (kg/ha-year)	Most Likely Loading (kg/ha-year)	High Loading (kg/ha-year)	Loading %	Low Loading (kg/year)	Most Likely Loading (kg/year)	High 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	0.0	0.10	0.30	0.50	0.0	0	0	0
HD Urban (1/8 Ac)	0.0	1.00	1.50	2.00	0.0	0	0	0
MD Urban (1/4 Ac)	287.0	0.30	0.50	0.80	12.9	35	58	92
Rural Res (>1 Ac)	256.0	0.05	0.10	0.25	2.3	5	10	26
Wetlands	800.0	0.10	0.10	0.10	7.2	32	32	32
Forest	1118.0	0.05	0.09	0.18	9.1	23	41	81
Bowling	154.0	0.00	0.00	0.00	0.0	0	0	0
Lake Surface	426.0	0.10	0.30	1.00	11.5	17	52	172

POINT SOURCE DATA

Point Sources	Water Load (m^3/year)	Low (kg/year)	Most Likely (kg/year)	High (kg/year)	Loading %
Bowling outlet	2959200.0	0.0	109.5	0.0	24.4
Streams & intermittent	1972800.0	0.0	73.0	0.0	16.3

SEPTIC TANK DATA

Description		Low	Most Likely	High	Loading %
Septic Tank Output (kg/capita-year)		0.88	0.88	0.88	
# capita-years	360.2				
% Phosphorous Retained by Soil		60.0	77.0	90.0	
Septic Tank Loading (kg/year)		126.79	72.90	31.70	16.2

TOTALS DATA

Description	Low	Most Likely	High	Loading %
Total Loading (lb)	527.0	989.1	962.8	100.0
Total Loading (kg)	239.1	448.7	436.7	100.0
Total Loading (lb/ac-year)	1.24	2.32	2.26	
Total Loading (mg/m^2-year)	138.67	260.25	253.33	
Total PS Loading (lb)	0.0	402.3	0.0	
Total PS Loading (kg)	0.0	182.5	0.0	
Total NPS Loading (lb)	209.5	312.0	512.9	
Total NPS Loading (kg)	95.0	141.5	232.6	

2005

LEAP - Lake Eutrophication Analysis Procedure

Northern Lakes & Forest

Lake Name:	Amnicon	**Ecoregion:**	laurentian mixed forest province
Watershed Area:	2615 Acres	**Surface Area:**	426 Acres
Mean Depth:	9.9 ft	**TP Load:**	172 kg/yr
Lake Outflow:	2 AF/yr	**Avg TP Inflow:**	83 ug/L
Residence Time:	2.5 years		
Areal Water Load:	1.21 m/yr	**P Retention Coef:**	0.67

Variable	Observed	Predicted	Std Error	Residual	T-test
TP (ug/L)	20	28	9	-0.14	-0.86
Chlr a (ug/L)	10.6	8.3	5.0	0.10	0.36
Secchi (m)	1.9	2.2	0.9	-0.06	-0.30

Note: Residual = Log10(Observed/Predicted)

T-test for signifigant difference between observed & predicted

Chlrophyll A Interval Frequencies (%)

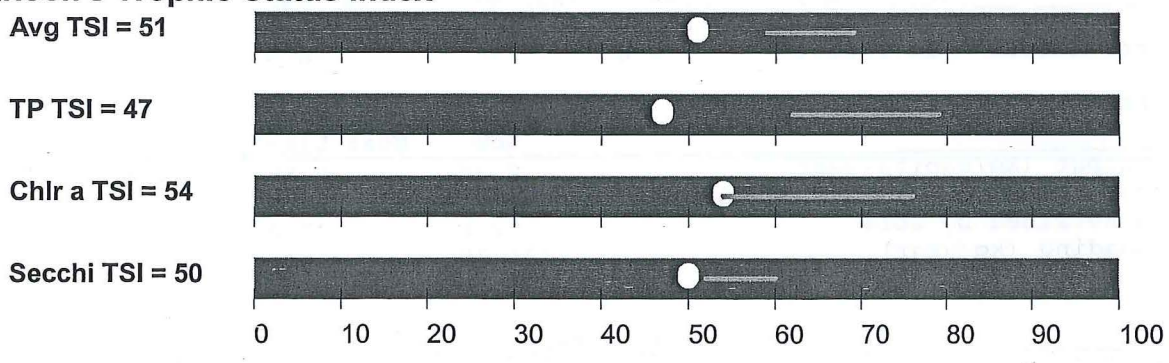
ppb	Observed	Case A	Case B	Case C
10	45%	27%	28%	35%
20	6%	2%	3%	11%
30	1%	0%	0%	4%
60	0%	0%	0%	0%

Case A = within year variation considered

Case B = within year + year-to-year variation

Case C = Case B + Model Error

Carlson's Trophic Status Index



Date: 5/8/2006 Scenario: 15

Lake Id: amnicon
Watershed Id: 0

Amnicon 2003
Add 25% TP

Hydrologic and Morphometric Data

Tributary Drainage Area: 2615.0 acre
Unit Runoff: 13.60 in.
Annual Runoff Volume: 2963.7 acre-ft
Lake Surface Area <As>: 426.0 acre
Lake Volume <V>: 4210.4 acre-ft
Lake Mean Depth <z>: 9.9 ft
Precipitation - Evaporation: 5.2 in.
Hydraulic Loading: 7146.7 acre-ft/year
Areal Water Load <qs>: 16.8 ft/year
Lake Flushing Rate <p>: 1.70 1/year
Water Residence Time: 0.59 year
Observed spring overturn total phosphorus (SPO): 18.0 mg/m^3
Observed growing season mean phosphorus (GSM): 20.0 mg/m^3
% NPS Change: 35%
% PS Change: 35%

NON-POINT SOURCE DATA

Land Use	Acre (ac)	Low Loading (kg/ha-year)	Most Likely Loading (kg/ha-year)	High Loading (kg/ha-year)	Loading %	Low Loading (kg/year)	Most Likely Loading (kg/year)	High 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	0.0	0.10	0.30	0.50	0.0	0	0	0
HD Urban (1/8 Ac)	0.0	1.00	1.50	2.00	0.0	0	0	0
MD Urban (1/4 Ac)	287.0	0.30	0.50	0.80	13.9	47	78	130
Rural Res (>1 Ac)	256.0	0.05	0.10	0.25	2.5	7	14	35
Wetlands	800.0	0.10	0.10	0.10	7.8	44	44	44
Forest	1118.0	0.05	0.09	0.18	9.8	31	55	110
Bowling	154.0	0.00	0.00	0.00	0.0	0	0	0
Lake Surface	426.0	0.10	0.30	1.00	9.2	17	52	172

POINT SOURCE DATA

Point Sources	Water Load (m^3/year)	Low (kg/year)	Most Likely (kg/year)	High (kg/year)	Loading %
Bowling outlet	2959200.0	0.0	109.5	0.0	26.3
Streams & intermittent	1972800.0	0.0	73.0	0.0	17.5

SEPTIC TANK DATA

Description		Low	Most Likely	High	Loading %
Septic Tank Output (kg/capita-year)		0.88	0.88	0.88	
# capita-years	360.2				
% Phosphorous Retained by Soil		60.0	77.0	90.0	
Septic Tank Loading (kg/year)		126.79	72.90	31.70	13.0

TOTALS DATA

Description	Low	Most Likely	High	Loading %
Total Loading (lb)	600.3	1239.1	1142.3	100.0
Total Loading (kg)	272.3	562.1	518.2	100.0
Areal Loading (lb/ac-year)	1.41	2.91	2.68	
Areal Loading (mg/m^2-year)	157.96	326.03	300.56	
Total PS Loading (lb)	0.0	543.2	0.0	
Total PS Loading (kg)	0.0	246.4	0.0	
Total NPS Loading (lb)	282.8	421.2	692.4	
Total NPS Loading (kg)	128.3	191.1	314.1	

Date: 5/8/2006 Scenario: 20
Lake Id: amnicon
Watershed Id: 0

A amnicon 2003
Less 50% TP

Hydrologic and Morphometric Data

Tributary Drainage Area: 2615.0 acre
Total Unit Runoff: 13.60 in.
Annual Runoff Volume: 2963.7 acre-ft
Lake Surface Area <As>: 426.0 acre
Lake Volume <V>: 4210.4 acre-ft
Lake Mean Depth <z>: 9.9 ft
Precipitation - Evaporation: 5.2 in.
Hydraulic Loading: 7146.7 acre-ft/year
Areal Water Load <qs>: 16.8 ft/year
Lake Flushing Rate <p>: 1.70 1/year

Water Residence Time: 0.59 year
Observed spring overturn total phosphorus (SPO): 18.0 mg/m^3
Observed growing season mean phosphorus (GSM): 20.0 mg/m^3
% NPS Change: -50%
% PS Change: 0%

NON-POINT SOURCE DATA

Land Use	Acre (ac)	Low Loading (kg/ha-year)	Most Likely Loading (kg/ha-year)	High Loading (kg/ha-year)	Loading %	Low Loading (kg/year)	Most Likely Loading (kg/year)	High Loading (kg/year)
Low 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	0.0	0.10	0.30	0.50	0.0	0	0	0
HD Urban (1/8 Ac)	0.0	1.00	1.50	2.00	0.0	0	0	0
MD Urban (1/4 Ac)	287.0	0.30	0.50	0.80	7.7	17	29	46
Rural Res (>1 Ac)	256.0	0.05	0.10	0.25	1.4	3	5	13
Wetlands	800.0	0.10	0.10	0.10	4.3	16	16	16
Forest	1118.0	0.05	0.09	0.18	5.4	11	20	41
Bowling	154.0	0.00	0.00	0.00	0.0	0	0	0
Lake Surface	426.0	0.10	0.30	1.00	13.7	17	52	172

POINT SOURCE DATA

Point Sources	Water Load (m^3/year)	Low (kg/year)	Most Likely (kg/year)	High (kg/year)	Loading %
Bowling outlet	2959200.0	0.0	109.5	0.0	29.0
Streams & intermittent	1972800.0	0.0	73.0	0.0	19.3

SEPTIC TANK DATA

Description		Low	Most Likely	High	Loading %
Septic Tank Output (kg/capita-year)		0.88	0.88	0.88	
# capita-years	360.2				
% Phosphorous Retained by Soil		60.0	77.0	90.0	
Septic Tank Loading (kg/year)		126.79	72.90	31.70	19.3

TOTALS DATA

Description	Low	Most Likely	High	Loading %
Total Loading (lb)	422.3	833.1	706.4	100.0
Total Loading (kg)	191.5	377.9	320.4	100.0
Areal Loading (lb/ac-year)	0.99	1.96	1.66	
Areal Loading (mg/m^2-year)	111.11	219.20	185.86	
Total PS Loading (lb)	0.0	402.3	0.0	
Total PS Loading (kg)	0.0	182.5	0.0	
Total NPS Loading (lb)	104.7	156.0	256.4	
Total NPS Loading (kg)	47.5	70.8	116.3	

Date: 5/8/2006 Scenario: 21
Lake Id: amnicon
Watershed Id: 0

Amnicon 2003
Less 50% TP &
No Septic TP

Hydrologic and Morphometric Data

Tributary Drainage Area: 2615.0 acre
Total Unit Runoff: 13.60 in.
Annual Runoff Volume: 2963.7 acre-ft
Lake Surface Area <As>: 426.0 acre
Lake Volume <V>: 4210.4 acre-ft
Lake Mean Depth <z>: 9.9 ft
Precipitation - Evaporation: 5.2 in.
Hydraulic Loading: 7146.7 acre-ft/year
Areal Water Load <qs>: 16.8 ft/year
Lake Flushing Rate <p>: 1.70 1/year
Water Residence Time: 0.59 year
Observed spring overturn total phosphorus (SPO): 18.0 mg/m^3
Observed growing season mean phosphorus (GSM): 20.0 mg/m^3

% NPS Change: -50%
% PS Change: 0%

NON-POINT SOURCE DATA

Land Use	Acre (ac)	Low Loading (kg/ha-year)	Most Likely Loading (kg/ha-year)	High Loading (kg/ha-year)	Loading %	Low Loading (kg/year)	Most Likely Loading (kg/year)	High 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	0.0	0.10	0.30	0.50	0.0	0	0	0
HD Urban (1/8 Ac)	0.0	1.00	1.50	2.00	0.0	0	0	0
MD Urban (1/4 Ac)	287.0	0.30	0.50	0.80	9.5	17	29	46
Rural Res (>1 Ac)	256.0	0.05	0.10	0.25	1.7	3	5	13
Wetlands	800.0	0.10	0.10	0.10	5.3	16	16	16
Forest	1118.0	0.05	0.09	0.18	6.7	11	20	41
Bowling	154.0	0.00	0.00	0.00	0.0	0	0	0
Lake Surface	426.0	0.10	0.30	1.00	17.0	17	52	172

POINT SOURCE DATA

Point Sources	Water Load (m^3/year)	Low (kg/year)	Most Likely (kg/year)	High (kg/year)	Loading %
Bowling outlet	2959200.0	0.0	109.5	0.0	35.9
Streams & intermittent	1972800.0	0.0	73.0	0.0	23.9

SEPTIC TANK DATA

Description		Low	Most Likely	High	Loading %
Septic Tank Output (kg/capita-year)		0.88	0.88	0.88	
# capita-years	0.0				
% Phosphorous Retained by Soil		60.0	77.0	90.0	
Septic Tank Loading (kg/year)		0.00	0.00	0.00	0.0

TOTALS DATA

Description	Low	Most Likely	High	Loading %
Total Loading (lb)	142.8	672.4	636.5	100.0
Total Loading (kg)	64.8	305.0	288.7	100.0
Total Loading (lb/ac-year)	0.34	1.58	1.49	
Total Loading (mg/m^2-year)	37.56	176.91	167.48	
Total PS Loading (lb)	0.0	402.3	0.0	
Total PS Loading (kg)	0.0	182.5	0.0	
Total NPS Loading (lb)	104.7	156.0	256.4	
Total NPS Loading (kg)	47.5	70.8	116.3	

Date: 5/8/2006 Scenario: 13

Lake Id: amnicon

Watershed Id: 0

Amnicon

2004 Data

Hydrologic and Morphometric Data

Tributary Drainage Area: 2615.0 acre
Total Unit Runoff: 13.60 in.
Annual Runoff Volume: 2963.7 acre-ft
Lake Surface Area <As>: 426.0 acre
Lake Volume <V>: 4210.4 acre-ft
Lake Mean Depth <z>: 9.9 ft
Precipitation - Evaporation: 5.2 in.
Hydraulic Loading: 7146.7 acre-ft/year
Areal Water Load <qs>: 16.8 ft/year
Lake Flushing Rate <p>: 1.70 1/year
Water Residence Time: 0.59 year
Observed spring overturn total phosphorus (SPO): 21.0 mg/m^3
Observed growing season mean phosphorus (GSM): 22.0 mg/m^3
% NPS Change: 0%
% PS Change: 0%

NON-POINT SOURCE DATA

Land Use	Acre (ac)	Low Loading (kg/ha-year)	Most Likely Loading (kg/ha-year)	High Loading (kg/ha-year)	Loading %	Low Loading (kg/year)	Most Likely Loading (kg/year)	High 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	0.0	0.10	0.30	0.50	0.0	0	0	0
HD Urban (1/8 Ac)	0.0	1.00	1.50	2.00	0.0	0	0	0
MD Urban (1/4 Ac)	287.0	0.30	0.50	0.80	12.9	35	58	93
Rural Res (>1 Ac)	256.0	0.05	0.10	0.25	2.3	5	10	26
Wetlands	800.0	0.10	0.10	0.10	7.2	32	32	32
Forest	1118.0	0.05	0.09	0.18	9.1	23	41	81
dowling	154.0	0.00	0.00	0.00	0.0	0	0	0
Lake Surface	426.0	0.10	0.30	1.00	11.5	17	52	172

POINT SOURCE DATA

Point Sources	Water Load (m^3/year)	Low (kg/year)	Most Likely (kg/year)	High (kg/year)	Loading %
dowling outlet	2959200.0	0.0	109.5	0.0	24.4
streams & intermittent	1972800.0	0.0	73.0	0.0	16.3

SEPTIC TANK DATA

Description		Low	Most Likely	High	Loading %
Septic Tank Output (kg/capita-year)		0.88	0.88	0.88	
# capita-years	360.2				
% Phosphorous Retained by Soil		60.0	77.0	90.0	
Septic Tank Loading (kg/year)		126.79	72.90	31.70	16.2

TOTALS DATA

Description	Low	Most Likely	High	Loading %
Total Loading (lb)	527.0	989.1	962.8	100.0
Total Loading (kg)	239.1	448.7	436.7	100.0
Areal Loading (lb/ac-year)	1.24	2.32	2.26	
Areal Loading (mg/m^2-year)	138.67	260.25	253.33	
Total PS Loading (lb)	0.0	402.3	0.0	
Total PS Loading (kg)	0.0	182.5	0.0	
Total NPS Loading (lb)	209.5	312.0	512.9	
Total NPS Loading (kg)	95.0	141.5	232.6	

2004

LEAP - Lake Eutrophication Analysis Procedure

Lake Name:	Amnicon	**Ecoregion:**	Northern Lakes and Forests
Watershed Area:	2615 Acres	**Surface Area:**	426 Acres
Mean Depth:	9.9 ft	**TP Load:**	75 kg/yr
Lake Outflow:	3 AF/yr	**Avg TP Inflow:**	28 ug/L
Residence Time:	2.0 years		
Areal Water Load:	1.54 m/yr	**P Retention Coef:**	0.52

Variable	Observed	Predicted	Std Error	Residual	T-test
TP (ug/L)	22	14	4	0.21	1.50
Chlr a (ug/L)	7.6	3.0	1.6	0.41	1.57
Secchi (m)	2.0	4.1	1.5	-0.30	-1.75

Note: Residual = Log10(Observed/Predicted)

T-test for signifigant difference between observed & predicted

Chlrophyll A Interval Frequencies (%)

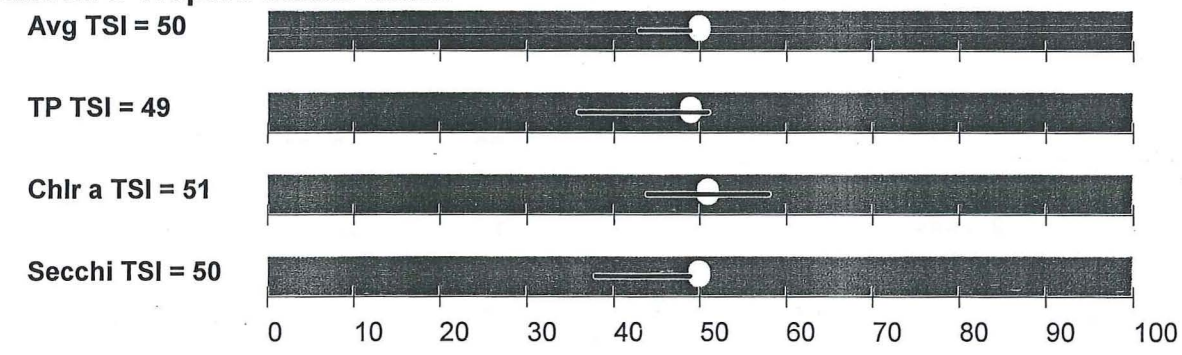
ppb	Observed	Case A	Case B	Case C
10	21%	0%	1%	4%
20	1%	0%	0%	0%
30	0%	0%	0%	0%
60	0%	0%	0%	0%

Case A = within year variation considered

Case B = within year + year-to-year variation

Case C = Case B + Model Error

Carlson's Trophic Status Index



Date: 5/8/2006 Scenario: 12
Lake Id: dowling
Watershed Id: 0

Dowling
2003 Data

Hydrologic and Morphometric Data
Tributary Drainage Area: 1391.0 acre
Total Unit Runoff: 13.60 in.
Annual Runoff Volume: 1576.5 acre-ft
Lake Surface Area <As>: 154.0 acre
Lake Volume <V>: 1113.0 acre-ft
Lake Mean Depth <z>: 7.2 ft
Precipitation - Evaporation: 5.2 in.
Hydraulic Loading: 2492.9 acre-ft/year
Areal Water Load <qs>: 16.2 ft/year
Lake Flushing Rate <p>: 2.24 1/year
Water Residence Time: 0.45 year
Observed spring overturn total phosphorus (SPO): 34.0 mg/m^3
Observed growing season mean phosphorus (GSM): 39.4 mg/m^3
% NPS Change: 0%
% PS Change: 0%

NON-POINT SOURCE DATA

Land Use	Acre (ac)	Low Loading (kg/ha-year)	Most Likely Loading (kg/ha-year)	High Loading (kg/ha-year)	Loading %	Low Loading (kg/year)	Most Likely Loading (kg/year)	High 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	0.0	0.10	0.30	0.50	0.0	0	0	0
HD Urban (1/8 Ac)	0.0	1.00	1.50	2.00	0.0	0	0	0
MD Urban (1/4 Ac)	73.0	0.30	0.50	0.80	9.5	9	15	24
Rural Res (>1 Ac)	30.0	0.05	0.10	0.25	0.8	1	1	3
Wetlands	563.0	0.10	0.10	0.10	14.7	23	23	23
Forest	725.0	0.05	0.09	0.18	17.0	15	26	53
dowling	0.0	0.00	0.00	0.00	0.0	0	0	0
Lake Surface	154.0	0.10	0.30	1.00	12.0	6	19	62

POINT SOURCE DATA

Point Sources	Water Load (m^3/year)	Low (kg/year)	Most Likely (kg/year)	High (kg/year)	Loading %
streams & intermittent	1048050.0	0.0	45.0	0.0	29.0

SEPTIC TANK DATA

Description		Low	Most Likely	High	Loading %
Septic Tank Output (kg/capita-year)		0.88	0.88	0.88	
# capita-years	131.0				
% Phosphorous Retained by Soil		60.0	77.0	90.0	
Septic Tank Loading (kg/year)		46.11	26.51	11.53	17.1

TOTALS DATA

Description	Low	Most Likely	High	Loading %
Total Loading (lb)	218.8	342.6	388.3	100.0
Total Loading (kg)	99.3	155.4	176.1	100.0
Areal Loading (lb/ac-year)	1.42	2.22	2.52	
Areal Loading (mg/m^2-year)	159.29	249.33	282.60	
Total PS Loading (lb)	0.0	99.2	0.0	
Total PS Loading (kg)	0.0	45.0	0.0	
Total NPS Loading (lb)	103.5	143.7	225.5	
Total NPS Loading (kg)	46.9	65.2	102.3	

2003

LEAP - Lake Eutrophication Analysis Procedure

Lake Name:	dowling	**Ecoregion:**	laurentian mixed forest province
Watershed Area:	1391 Acres	**Surface Area:**	154 Acres
Mean Depth:	7.2 ft	**TP Load:**	83 kg/yr
Lake Outflow:	1 AF/yr	**Avg TP Inflow:**	76 ug/L
Residence Time:	1.2 years		
Areal Water Load:	1.76 m/yr	**P Retention Coef:**	0.57

Variable	Observed	Predicted	Std Error	Residual	T-test
TP (ug/L)	39	33	10	0.08	0.56
Chlr a (ug/L)	22.2	10.7	6.0	0.32	1.18
Secchi (m)	1.1	1.9	0.7	-0.25	-1.43

Note: Residual = Log10(Observed/Predicted)

T-test for signifigant difference between observed & predicted

Chlrophyll A Interval Frequencies (%)

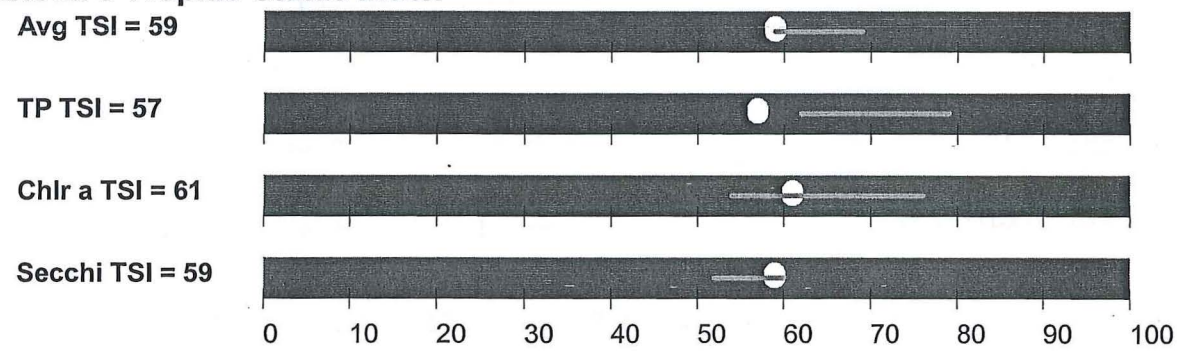
ppb	Observed	Case A	Case B	Case C
10	92%	46%	46%	47%
20	49%	6%	8%	17%
30	19%	1%	1%	7%
60	1%	0%	0%	1%

Case A = within year variation considered

Case B = within year + year-to-year variation

Case C = Case B + Model Error

Carlson's Trophic Status Index



Date: 5/8/2006 Scenario: 16
Lake Id: dowling
Watershed Id: 0

Dowling 2003
Adj 2570 TP.

Hydrologic and Morphometric Data

Tributary Drainage Area: 1391.0 acre
Total Unit Runoff: 13.60 in.
Annual Runoff Volume: 1576.5 acre-ft
Lake Surface Area <As>: 154.0 acre
Lake Volume <V>: 1113.0 acre-ft
Lake Mean Depth <z>: 7.2 ft
Precipitation - Evaporation: 5.2 in.
Hydraulic Loading: 2492.9 acre-ft/year
Areal Water Load <qs>: 16.2 ft/year
Lake Flushing Rate <p>: 2.24 1/year
Water Residence Time: 0.45 year
Observed spring overturn total phosphorus (SPO): 34.0 mg/m^3
Observed growing season mean phosphorus (GSM): 39.4 mg/m^3
% NPS Change: 31%
% PS Change: 41%

NON-POINT SOURCE DATA

Land Use	Acre (ac)	Low Loading (kg/ha-year)	Most Likely Loading (kg/ha-year)	High Loading (kg/ha-year)	Loading %	Low Loading (kg/year)	Most Likely Loading (kg/year)	High 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	0.0	0.10	0.30	0.50	0.0	0	0	0
HD Urban (1/8 Ac)	0.0	1.00	1.50	2.00	0.0	0	0	0
MD Urban (1/4 Ac)	73.0	0.30	0.50	0.80	10.0	12	19	31
Rural Res (>1 Ac)	30.0	0.05	0.10	0.25	0.8	1	2	4
Wetlands	563.0	0.10	0.10	0.10	15.4	30	30	30
Forest	725.0	0.05	0.09	0.18	17.8	19	35	69
dowling	0.0	0.00	0.00	0.00	0.0	0	0	0
Lake Surface	154.0	0.10	0.30	1.00	9.6	6	19	62

POINT SOURCE DATA

Point Sources	Water Load (m^3/year)	Low (kg/year)	Most Likely (kg/year)	High (kg/year)	Loading %
streams & intermittent	1048050.0	0.0	45.0	0.0	32.7

SEPTIC TANK DATA

Description		Low	Most Likely	High	Loading %
Septic Tank Output (kg/capita-year)		0.88	0.88	0.88	
# capita-years	131.0				
% Phosphorous Retained by Soil		60.0	77.0	90.0	
Septic Tank Loading (kg/year)		46.11	26.51	11.53	13.7

TOTALS DATA

Description	Low	Most Likely	High	Loading %
Total Loading (lb)	250.9	427.8	458.2	100.0
Total Loading (kg)	113.8	194.0	207.8	100.0
Areal Loading (lb/ac-year)	1.63	2.78	2.98	
Areal Loading (mg/m^2-year)	182.63	311.36	333.47	
Total PS Loading (lb)	0.0	139.9	0.0	
Total PS Loading (kg)	0.0	63.5	0.0	
Total NPS Loading (lb)	135.5	188.2	295.4	
Total NPS Loading (kg)	61.5	85.4	134.0	

Watershed Id: 0 Dowling

Dowling 2003
Less 25% TP.

Hydrologic and Morphometric Data

Tributary Drainage Area: 1391.0 acre
Total Unit Runoff: 13.60 in.
Annual Runoff Volume: 1576.5 acre-ft
Lake Surface Area <As>: 154.0 acre
Lake Volume <V>: 1113.0 acre-ft
Lake Mean Depth <z>: 7.2 ft
Precipitation - Evaporation: 5.2 in.
Hydraulic Loading: 2492.9 acre-ft/year
Areal Water Load <qs>: 16.2 ft/year
Lake Flushing Rate <p>: 2.24 1/year
Water Residence Time: 0.45 year
Observed spring overturn total phosphorus (SPO): 34.0 mg/m^3
Observed growing season mean phosphorus (GSM): 39.4 mg/m^3
% NPS Change: -25%
% PS Change: 0%

NON-POINT SOURCE DATA

Land Use	Acre (ac)	Low Loading (kg/ha-year)	Most Likely Loading (kg/ha-year)	High Loading (kg/ha-year)	Loading %	Low Loading (kg/year)	Most Likely Loading (kg/year)	High 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	0.0	0.10	0.30	0.50	0.0	0	0	0
MD Urban (1/8 Ac)	0.0	1.00	1.50	2.00	0.0	0	0	0
MD Urban (1/4 Ac)	73.0	0.30	0.50	0.80	8.0	7	11	18
Rural Res (>1 Ac)	30.0	0.05	0.10	0.25	0.7	0	1	2
Wetlands	563.0	0.10	0.10	0.10	12.3	17	17	17
Forest	725.0	0.05	0.09	0.18	14.2	11	20	40
Dowling	0.0	0.00	0.00	0.00	0.0	0	0	0
Lake Surface	154.0	0.10	0.30	1.00	13.4	6	19	62

POINT SOURCE DATA

Point Sources	Water Load (m^3/year)	Low (kg/year)	Most Likely (kg/year)	High (kg/year)	Loading %
Streams & intermittent	1048050.0	0.0	45.0	0.0	32.4

SEPTIC TANK DATA

Description		Low	Most Likely	High	Loading %
Septic Tank Output (kg/capita-year)		0.88	0.88	0.88	
# capita-years	131.0				
% Phosphorous Retained by Soil		60.0	77.0	90.0	
Septic Tank Loading (kg/year)		46.11	26.51	11.53	19.1

TOTALS DATA

Description	Low	Most Likely	High	Loading %
Total Loading (lb)	193.0	306.6	331.9	100.0
Total Loading (kg)	87.5	139.1	150.6	100.0
Areal Loading (lb/ac-year)	1.25	1.99	2.16	
Areal Loading (mg/m^2-year)	140.46	223.19	241.57	
Total PS Loading (lb)	0.0	99.2	0.0	
Total PS Loading (kg)	0.0	45.0	0.0	
Total NPS Loading (lb)	77.6	107.8	169.1	
Total NPS Loading (kg)	35.2	48.9	76.7	

Date: 5/8/2006 Scenario: 18
Lake Id: dowling
Watershed Id: 0

Dowlm 2005

Hydrologic and Morphometric Data

Tributary Drainage Area: 1391.0 acre
Total Unit Runoff: 13.60 in.

Annual Runoff Volume: 1576.5 acre-ft
Lake Surface Area <As>: 154.0 acre
Lake Volume <V>: 1113.0 acre-ft
Lake Mean Depth <z>: 7.2 ft
Precipitation - Evaporation: 5.2 in.
Hydraulic Loading: 2492.9 acre-ft/year
Areal Water Load <qs>: 16.2 ft/year
Lake Flushing Rate <p>: 2.24 1/year
Water Residence Time: 0.45 year
Observed spring overturn total phosphorus (SPO): 34.0 mg/m^3
Observed growing season mean phosphorus (GSM): 39.4 mg/m^3
% NPS Change: -25%
% PS Change: 0%

Less 25% TP a
No Septic TP.

NON-POINT SOURCE DATA

Land Use	Acre (ac)	Low Loading (kg/ha-year)	Most Likely Loading (kg/ha-year)	High Loading (kg/ha-year)	Loading %	Low Loading (kg/year)	Most Likely Loading (kg/year)	High 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	0.0	0.10	0.30	0.50	0.0	0	0	0
HD Urban (1/8 Ac)	0.0	1.00	1.50	2.00	0.0	0	0	0
MD Urban (1/4 Ac)	73.0	0.30	0.50	0.80	9.8	7	11	18
Rural Res (>1 Ac)	30.0	0.05	0.10	0.25	0.8	0	1	2
Wetlands	563.0	0.10	0.10	0.10	15.2	17	17	17
Forest	725.0	0.05	0.09	0.18	17.6	11	20	40
dowling	0.0	0.00	0.00	0.00	0.0	0	0	0
Lake Surface	154.0	0.10	0.30	1.00	16.6	6	19	62

POINT SOURCE DATA

Point Sources	Water Load (m^3/year)	Low (kg/year)	Most Likely (kg/year)	High (kg/year)	Loading %
streams & intermittent	1048050.0	0.0	45.0	0.0	40.0

SEPTIC TANK DATA

Description		Low	Most Likely	High	Loading %
Septic Tank Output (kg/capita-year)		0.88	0.88	0.88	
# capita-years	0.0				
% Phosphorous Retained by Soil		60.0	77.0	90.0	
Septic Tank Loading (kg/year)		0.00	0.00	0.00	0.0

TOTALS DATA

Description	Low	Most Likely	High	Loading %
Total Loading (lb)	91.3	248.2	306.5	100.0
Total Loading (kg)	41.4	112.6	139.0	100.0
Areal Loading (lb/ac-year)	0.59	1.61	1.99	
Areal Loading (mg/m^2-year)	66.47	180.64	223.08	
Total PS Loading (lb)	0.0	99.2	0.0	
Total PS Loading (kg)	0.0	45.0	0.0	
Total NPS Loading (lb)	77.6	107.8	169.1	
Total NPS Loading (kg)	35.2	48.9	76.7	

Date: 5/8/2006 Scenario: 19
Lake Id: dowling
Watershed Id: 0

Dowling 2003
Less 50% TP
& No Septic TP.

Hydrologic and Morphometric Data

ributary Drainage Area: 1391.0 acre
otal Unit Runoff: 13.60 in.
ial Runoff Volume: 1576.5 acre-ft
e Surface Area <As>: 154.0 acre
ake Volume <V>: 1113.0 acre-ft
ake Mean Depth <z>: 7.2 ft

Precipitation - Evaporation: 5.2 in.
ydraulic Loading: 2492.9 acre-ft/year
real Water Load <qs>: 16.2 ft/year
Lake Flushing Rate <p>: 2.24 1/year
Water Residence Time: 0.45 year
bserved spring overturn total phosphorus (SPO): 34.0 mg/m^3
bserved growing season mean phosphorus (GSM): 39.4 mg/m^3
% NPS Change: -50%
PS Change: -41%

NON-POINT SOURCE DATA

Land Use	Acre (ac)	Low Loading (kg/ha-year)	Most Likely Loading (kg/ha-year)	High Loading (kg/ha-year)	Loading %	Low Loading (kg/year)	Most Likely Loading (kg/year)	High Loading (kg/year)
Row Crop AG	0.0	0.50	1.00	3.00	0.0	0	0	0
ixed AG	0.0	0.30	0.80	1.40	0.0	0	0	0
Pasture/Grass	0.0	0.10	0.30	0.50	0.0	0	0	0
Urban (1/8 Ac)	0.0	1.00	1.50	2.00	0.0	0	0	0
MD Urban (1/4 Ac)	73.0	0.30	0.50	0.80	9.5	4	7	12
l Res (>1 Ac)	30.0	0.05	0.10	0.25	0.8	0	1	2
Wetlands	563.0	0.10	0.10	0.10	14.6	11	11	11
orest	725.0	0.05	0.09	0.18	17.0	7	13	26
dowling	0.0	0.00	0.00	0.00	0.0	0	0	0
ake Surface	154.0	0.10	0.30	1.00	24.0	6	19	62

INT SOURCE DATA

Point Sources	Water Load (m^3/year)	Low (kg/year)	Most Likely (kg/year)	High (kg/year)	Loading %
streams & intermittent	1048050.0	0.0	45.0	0.0	34.1

PTIC TANK DATA

Description		Low	Most Likely	High	Loading %
Septic Tank Output (kg/capita-year)		0.88	0.88	0.88	
capita-years	0.0				
Phosphorous Retained by Soil		60.0	77.0	90.0	
Septic Tank Loading (kg/year)		0.00	0.00	0.00	0.0

TALS DATA

Description	Low	Most Likely	High	Loading %
Total Loading (lb)	65.5	171.6	250.1	100.0
tal Loading (kg)	29.7	77.8	113.5	100.0
eal Loading (lb/ac-year)	0.43	1.11	1.62	
Loading (mg/m^2-year)	47.65	124.89	182.05	
PS Loading (lb)	0.0	58.5	0.0	
tal PS Loading (kg)	0.0	26.6	0.0	
tal NPS Loading (lb)	51.7	71.8	112.7	
Total NPS Loading (kg)	23.5	32.6	51.1	

Date: 5/8/2006 Scenario: 11
Lake Id: dowling
Watershed Id: 0

Dowling
2004 Data

Hydrologic and Morphometric Data

Tributary Drainage Area: 1391.0 acre
Total Unit Runoff: 13.60 in.
Annual Runoff Volume: 1576.5 acre-ft
Lake Surface Area <As>: 154.0 acre
Lake Volume <V>: 1113.0 acre-ft
Lake Mean Depth <z>: 7.2 ft
Precipitation - Evaporation: 5.2 in.
Hydraulic Loading: 2492.9 acre-ft/year
Areal Water Load <qs>: 16.2 ft/year
Lake Flushing Rate <p>: 2.24 1/year
Water Residence Time: 0.45 year
Observed spring overturn total phosphorus (SPO): 26.0 mg/m^3
Observed growing season mean phosphorus (GSM): 39.4 mg/m^3
% NPS Change: 0%
% PS Change: 0%

NON-POINT SOURCE DATA

Land Use	Acre (ac)	Low Loading (kg/ha-year)	Most Likely Loading (kg/ha-year)	High Loading (kg/ha-year)	Loading %	Low Loading (kg/year)	Most Likely Loading (kg/year)	High 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	0.0	0.10	0.30	0.50	0.0	0	0	0
HD Urban (1/8 Ac)	0.0	1.00	1.50	2.00	0.0	0	0	0
MD Urban (1/4 Ac)	73.0	0.30	0.50	0.80	9.2	9	15	24
Rural Res (>1 Ac)	30.0	0.05	0.10	0.25	0.8	1	1	3
Wetlands	563.0	0.10	0.10	0.10	14.1	23	23	23
Forest	725.0	0.05	0.09	0.18	16.4	15	26	53
dowling	0.0	0.00	0.00	0.00	0.0	0	0	0
Lake Surface	154.0	0.10	0.30	1.00	11.6	6	19	62

POINT SOURCE DATA

Point Sources	Water Load (m^3/year)	Low (kg/year)	Most Likely (kg/year)	High (kg/year)	Loading %
streams & intermittent	1048050.0	0.0	51.0	0.0	31.6

SEPTIC TANK DATA

Description		Low	Most Likely	High	Loading %
Septic Tank Output (kg/capita-year)		0.88	0.88	0.88	
# capita-years	131.0				
% Phosphorous Retained by Soil		60.0	77.0	90.0	
Septic Tank Loading (kg/year)		46.11	26.51	11.53	16.4

TOTALS DATA

Description	Low	Most Likely	High	Loading %
Total Loading (lb)	218.8	355.8	388.3	100.0
Total Loading (kg)	99.3	161.4	176.1	100.0
Areal Loading (lb/ac-year)	1.42	2.31	2.52	
Areal Loading (mg/m^2-year)	159.29	258.96	282.60	
Total PS Loading (lb)	0.0	112.4	0.0	
Total PS Loading (kg)	0.0	51.0	0.0	
Total NPS Loading (lb)	103.5	143.7	225.5	
Total NPS Loading (kg)	46.9	65.2	102.3	

2004

LEAP - Lake Eutrophication Analysis Procedure

Lake Name:	dowling	**Ecoregion:**	Northern Lakes and Forests
Watershed Area:	1391 Acres	**Surface Area:**	154 Acres
Mean Depth:	7.2 ft	**TP Load:**	35 kg/yr
Lake Outflow:	1 AF/yr	**Avg TP Inflow:**	26 ug/L
Residence Time:	1.0 years		
Areal Water Load:	2.21 m/yr	**P Retention Coef:**	0.42

Variable	Observed	Predicted	Std Error	Residual	T-test
TP (ug/L)	39	15	4	0.42	3.22
Chlr a (ug/L)	43.6	3.4	1.7	1.10	4.44
Secchi (m)	1.0	3.8	1.3	-0.56	-3.36

Note: Residual = Log10(Observed/Predicted)

T-test for signifigant difference between observed & predicted

Chlrophyll A Interval Frequencies (%)

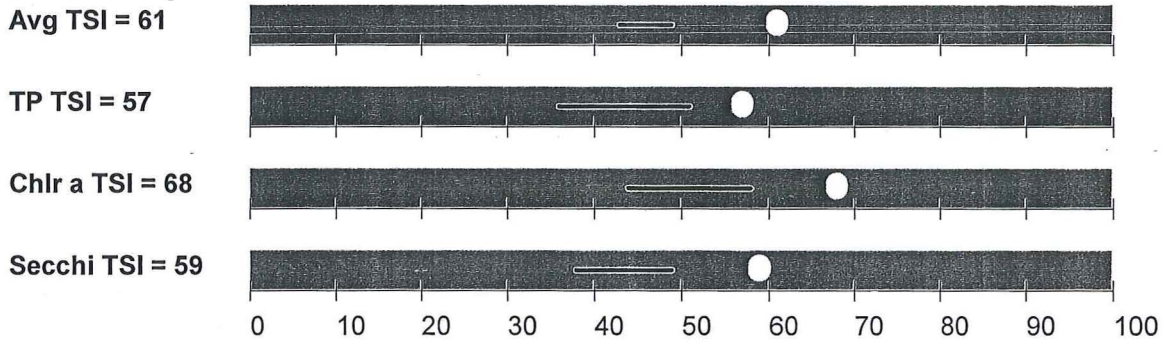
ppb	Observed	Case A	Case B	Case C
10	100%	1%	1%	5%
20	92%	0%	0%	0%
30	71%	0%	0%	0%
60	18%	0%	0%	0%

Case A = within year variation considered

Case B = within year + year-to-year variation

Case C = Case B + Model Error

Carlson's Trophic Status Index



Appendix 12

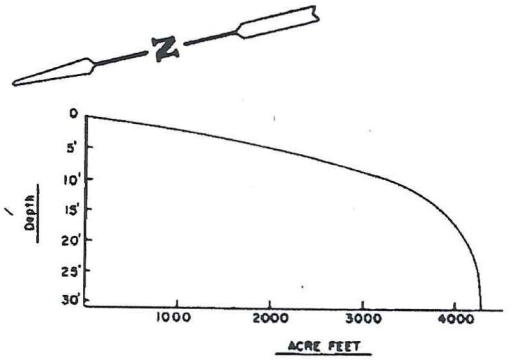
Maps Showing Preferred Walleye and Muskie Spawning Areas

STATE OF WISCONSIN
DEPARTMENT OF NATURAL RESOURCES

LAKE SURVE MAP

AMNICON LAKE — DOUGLAS COUNTY

SEC. 12,13 T. 46 N. R. 14 W.



D.N.R., B.M. 1625-A, is a rail spike on N. side of 12" pine, 45' S. of center of landing, 30' W. of water, 35' E. of 16" pine, at public access on W. side of lake.

Assumed elevation	100.00'
Water level	97.51'
High watermark observed	98.00'
Water level taken	7/19/71

Amnicon Lake

Walleye Spawning Areas

Muskie Spawning Areas

Tomahawk Island D.N.R. owned 21.1 acre

Little Is. D.N.R. owned .8 a.

Dollar Is. D.N.R. owned .13 a.

2.4 acres 13' max. depth

max. depth 30' ±3'

campground

B.M.

Amnicon R.

Superior 13 mi.

Mixed Hardwood & Pine

Tagalder

Leatherleaf

Tamarack

EQUIPMENT RECORDING SONAR MAPPED JULY 1971 (MONTH / YEAR)

TOPOGRAPHIC SYMBOLS

- (B) Brush
- (Pw) Partially wooded
- (W) Wooded
- (C) Cleared
- (P) Pastured
- (A) Agricultural
- B.M. Bench Mark
- a Dwelling
- Resort
- Camp
- Steep slope
- Indefinite shoreline
- Marsh
- Spring
- Intermittent stream
- Permanent inlet
- Permanent outlet
- Dam
- D.N.R. State owned land

LAKE BOTTOM SYMBOLS

P.	Peat	B	Boulders
Mk.	Muck		Stumps & Snags
C.	Clay		Rock danger to navigation
M.	Marl	T	Submergent vegetation
Sd.	Sand		Emergent vegetation
St.	Silt		Floating vegetation
Gr.	Gravel		Brush shelters
R.	Rubble		
Bc	Bedrock		

SCALE 400' 0 400' 800' 1200' 1600'

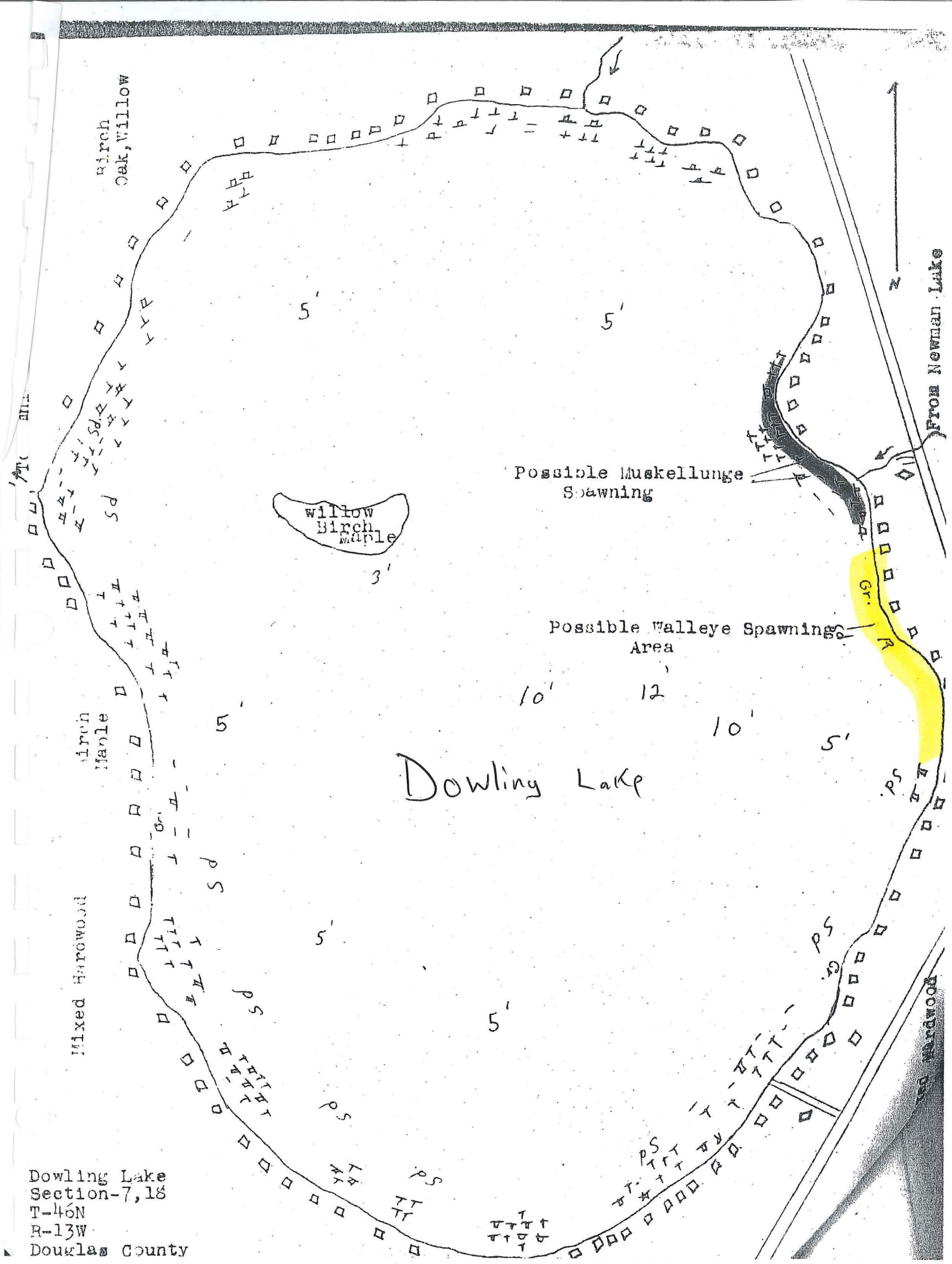
◆ Access ◆ Access with Parking ◆ Boat Livery

Drawn by: T. Ginder

Field work by: C. Busch, G. Lund, & L. Sather

SPECIES OF FISH	Abundant	Common	Present
Muskie		X	
N. Pike			
Walleye	X		
L.M. Bass			X
S.M. Bass			
Panfish		X	
Trout			

WATER AREA	426.0 ACRES
UNDER 3 FT.	9 %
OVER 20 FT.	4 %
MAX. DEPTH	31 FEET.
TOTAL ALK.	24 P.P.M.
VOLUME	4210.4 ACRE FT.
SHORELINE	5.11 MILES
WITH ISLANDS	5.99 MILES



Dowling Lake
Section-7,18
T-46N
R-13W
Douglas County