WATER QUALITY IMPACT ASSESSMENT OF WATER BODIES CONTAINED IN THE BEDFORD WEST PLANNING AREA USING A PHOSPHORUS LOADING MODEL APPROACH

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CWRS Internal Report 04-02

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EXECUTIVE SUMMARY

The Centre for Water Resources Studies (CWRS) was contracted by Annapolis Group Inc. to investigate the potential changes in water quality resulting from two development scenarios, expressed in terms of phosphorus concentrations and trophic status, through the application of a phosphorus loading model. The first of the scenarios considered current land use, while the second considered future land use in the Kearney Lake-Papermill Lake watersheds.

A refined version of the Dillon-Rigler (1975) phosphorus loading model was used to assess potential changes to water quality as a result of development associated with "Bedford West" and surrounding private lands. A steady-state model based on extensive research in Ontario, it has been the subject of on-going research and minor refinements (Waller, 1977; Hart et al., 1978; Waller and Hart, 1985; Dillon et al., 1986, 1994; Hutchinson et al., 1991; Vokey, 1998; Scott et al., 2000). The model incorporates input variables that describe the hydrology, land use and type of development. This version of the model has been applied to the headwaters region of the Gaspereau River system (Horner Associates, 1995; Lowe, J.S., 2003) and is now being considered by the Nova Scotia Department of Environment and Labour (NSDEL) as the phosphorus model of choice for use in the province (Brylinsky, 2004).

The objectives of the study were:

- to identify, through the application of the model, potential changes in lake water quality, expressed in terms of phosphorus concentrations and trophic status, resulting from current and future land use distribution for major water bodies in the drainage basin draining through Papermill Lake. Future land use areas include that portion of the Bedford West Planning Area that lies within the drainage basin, the area recognised as Bedford South, and undeveloped lands in the Papermill Lake watershed, and
- to classify the trophic status of lakes using a fixed-boundary system.

Study Highlights

Twenty-one lakes and ponds were considered in the modelling. They are:

Ash Lake
Belchers Pond
Big Cranberry Lake
Big Horseshoe Lake
Charlies Lake
Crane Lake
Flat Lake
Fox Lake
Hobsons Lake
Jack Lake
Kearney Lake
Little Cranberry Lake
Little Horseshoe Lake
McQuade Lake
Papermill Lake
Papermill Lake, Basin 2
Papermill Lake, Basin 3
Quarry Lake
Susies Lake
Three Finger Lake
Washmill Lake

Refinements to the way in which hydrologic input variables are treated in the model and model calibration generated predictions of lake phosphorus concentration with acceptable accuracy in the majority of cases.

Two options were identified that could reduce the total phosphorus load reaching lakes and ponds in the drainage system. The first, is to consider storm water treatment at appropriate sites in the study area. The second, which addresses a major source of anthropogenic phosphorus, is the collection and disposal of domestic wastewater by a central sewer system.

A recommendation is presented that additional information on lakes in the study area should be collected over the short term, to ensure that modelling predictions can be as definitive as possible. Longer term recommendations for the study area are a monitoring programme to track changes in phosphorus concentrations and lake trophic status to be sure that model predictions are accurate; as well as consideration of options for drainage from McQuade Lake, which has the potential to adversely affect downstream lakes in the system.

General recommendations that could apply to the study area but are more generic in nature include the gathering of new data that would increase the phosphorus loading model's accuracy in urban situations, education of local residents about the potential effects of their activities on water quality, and the opportunity for better stormwater management approaches that are appropriate for conditions in Nova Scotia.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

1.0 INTRODUCTION

Predictive water quality models have been specifically developed to provide the basis for the design and implementation of lake and watershed management strategies with specific water quality limits or objectives for maintaining desired water uses. This form of planning tool has been extensively applied to Nova Scotia watersheds to investigate and to assist in limiting the impacts of various types of watershed development on the province's freshwater resources.

Phosphorus loading models of varying complexity and applicability are one such water quality tool, which can be used to predict the effects of human developments on receiving waters. Phosphorus is used as an indicator to predict the changes in the trophic status of lakes from changes in loading. The models consider natural and anthropogenic phosphorus sources (atmospheric deposition, sewage disposal, urban stormwater, and land use within a watershed). The reasons for using phosphorus are associated with the element's importance in controlling lake productivity, specifically the abundance of planktonic algae. Typically, phosphorus is seen as the limiting nutrient to algal growth.

2.0 PHOSPHORUS LOADING MODELS AND TROPHIC STATUS

2.1 Phosphorus Loading Model

A refined version of the Dillon-Rigler (1975) phosphorus loading model was used to assess potential changes to water quality as a result of development associated with “Bedford West” and surrounding private lands. A steady-state model based on extensive research in Ontario, it has been the subject of on-going research and minor refinements (Waller, 1977; Hart et al., 1978; Waller and Hart, 1985; Dillon et al., 1986, 1994; Hutchinson et al., 1991; Vokey, 1998; Scott et al., 2000). The model incorporates input variables that describe the hydrology, land use and type of development. This version of the model has been applied to the headwaters region of the Gaspereau River system (Horner Associates, 1995; Lowe, J.S., 2003) and is now being considered by the Nova Scotia Department of Environment and Labour (NSDEL) as the phosphorus model of choice for use in the province (Brylinsky,

2004). For convenience, the model shall be referred to from this point forward as "*The Model*".

2.2 Trophic Status

Almost all lakes contain biological communities which utilise materials and energy. The trophic status of a lake refers to the amount of energy which flows through the system over a given period of time. Generally, energy is derived from sunlight and becomes "fixed" by microscopic green plants (algae) that are consumed by higher organisms. The amount of energy that can be fixed is dependent on a variety of climatic conditions such as sunlight and temperature, but also on the availability of chemical substances necessary for life. When a substance is in limited supply in the environment, the growth of algae may be limited until more of that substance is added. In general, two components of the environment (phosphorus and nitrogen) are responsible for the rate of growth of green plants. In cases where the ratio of nitrogen to phosphorus is greater than 12, phosphorus tends to be the limiting factor. When the ratio is less than 12, nitrogen is responsible. From available water quality data, phosphorus is considered the limiting nutrient for lakes in the Papermill Lake drainage system.

As nutrients become more available to aquatic systems, the systems go through a natural process called eutrophication. This process is typified by an increase in living biological material, as well as, an increase in sedimentation to the bottom of the lake as organisms die. As this process continues, relatively small algal populations increase to large populations and the density of the algae increases such that over time a lake which was originally clear may have so many algal cells growing in it that visibility is restricted to the upper few centimetres of the water column. The stages that a lake goes through are termed oligotrophic, meaning poorly fed; mesotrophic, meaning moderately fed; and eutrophic, meaning well fed. "Oligotrophic" systems usually contain high concentrations of oxygen from surface to bottom, high visibility within the water column, and in suitable water acidity conditions, the presence of oxygen-loving species such as trout. "Eutrophic" systems are typified by low visibility, lack of oxygen in much of the water column through

much of the year and the potential for on-going oxygen depletion in bottom waters through the entire year. In extreme cases, eutrophic lakes may smell of hydrogen sulphide due to the decay of dead plant and animal materials in the sediments. "Mesotrophic" systems possess intermediate qualities. While the process of change from oligotrophic to eutrophic might take tens of thousands of years in an undisturbed lake, it may be greatly accelerated when inputs of nutrients increase due to human activities. This increased rate is referred to as cultural eutrophication.

3.0 STUDY OBJECTIVE

The objectives of the study were:

- to identify, through the application of the model, potential changes in lake water quality, expressed in terms of phosphorus concentrations and trophic status, resulting from current and future land use distribution for major water bodies in the drainage basin draining through Papermill Lake. Future land use areas include that portion of the Bedford West Planning Area that lies within the drainage basin, the area recognised as Bedford South, and undeveloped lands in the Papermill Lake watershed, and
- to classify the trophic status of lakes using a fixed-boundary system.

4.0 MODEL APPLICATION

4.1 Model Information Requirements

To predict lake-phosphorus concentration and trophic status, specific model inputs are necessary. For this modelling exercise, these data were compiled by both Annapolis Group and CWRS staff.

Annapolis Group staff generated the following information for each of the 21 lakes and ponds modelled:

- lake surface area;
- watershed area (land only);
- number of lots, both existing and approved, serviced by on-site septic systems; and
- area serviced by central sewer, both existing and long-term, separated into residential, commercial, industrial and institutional land use categories.

Information gathered by CWRS staff included:

- lake volumes;
- precipitation, lake evaporation, and runoff;
- rate of atmospheric phosphorus deposition;
- rate of overland phosphorus export; and
- number of persons per household.

4.2 Model Output Information

Model outputs include:

- mean depth (when a value for lake volume is available);
- flushing rate (when a value for lake volume is available);
- total runoff;
- phosphorus retention coefficient (that portion of the phosphorus entering the lake which will remain in the lake);

- total runoff phosphorus;
- upstream phosphorus (the amount of P from all tributary lake sources);
- phosphorus from precipitation;
- phosphorus from specific land use categories, for this case forested, residential, commercial, industrial, institutional;
- phosphorus from on-site systems;
- total phosphorus load; and
- mean annual lake concentration.

4.3 Sources of Input Data

4.3.1 Phosphorus Loading Rates

The total amount of phosphorus loading to a lake is calculated by applying a loading rate to each associated input variable. Specific variables are precipitation, the various forms of land use (forest, urban, commercial, industrial, etc.) and the number of on-site septic systems. Locally published values used for this study, extensively applied in modelling efforts throughout the province, are provided in Table 1.

Table 1. Summary of loading rates used in the model.

Input Variable	Loading Rate mg m^{-2} yr^{-1}	Source
Precipitation	17.3	Underwood (1984)
Land Use		
Forest	6.9	Scott et al. (2000)
Forest + >15% Cleared	8.3	Scott et al. (2000)
Urban (residential)	52.0	Waller (1977)
Commercial (light)	40.0	Waller and Hart (1985)
Commercial/Industrial	202.0	Waller and Hart (1985)
Institutional	42.0	Waller and Hart (1985)
On-Site Septic Systems[1]		
0.4kg P $capita^{-1}$ yr^{-1} x 2.6 $persons^{-household}$	1.04kg	Hart et al. (1978)

[1] Statistics Canada 2001 average household occupancy = 2.6 persons

4.3.2 Lake Bathymetry and Lake Volume

Although information describing lake basin shape and volume are not essential in the assessment of potential development effects on lake phosphorus concentration, it is necessary to estimate mean depth (average water depth of lake), flushing rate (number of times per year a lake's volume is exchanged) and response time (time required for a lake's phosphorus concentration to respond to a change in loading). For a report of this type, it is believed that inclusion of all available and relevant data will result in a more complete study deliverable.

CWRS has produced bathymetric maps and estimated lake volumes for the five major lakes in the study area. Copies of these maps, reproduced by the Annapolis Group for this document, are provided in Figures 1-5. Papermill Lake (Figure 1) was mapped in 2003 for the Annapolis Group. Bathymetry of Kearney Lake (Figure 2) was generated in 1992. The mapping for Washmill Lake (Figure 3), Quarry Lake (Figure 4), and Susies Lake (Figure 5), was part of a study funded by the former City of Halifax in 1994-95. Values used for water surface area, island area, and lake volume in the modelling, were based on these maps.

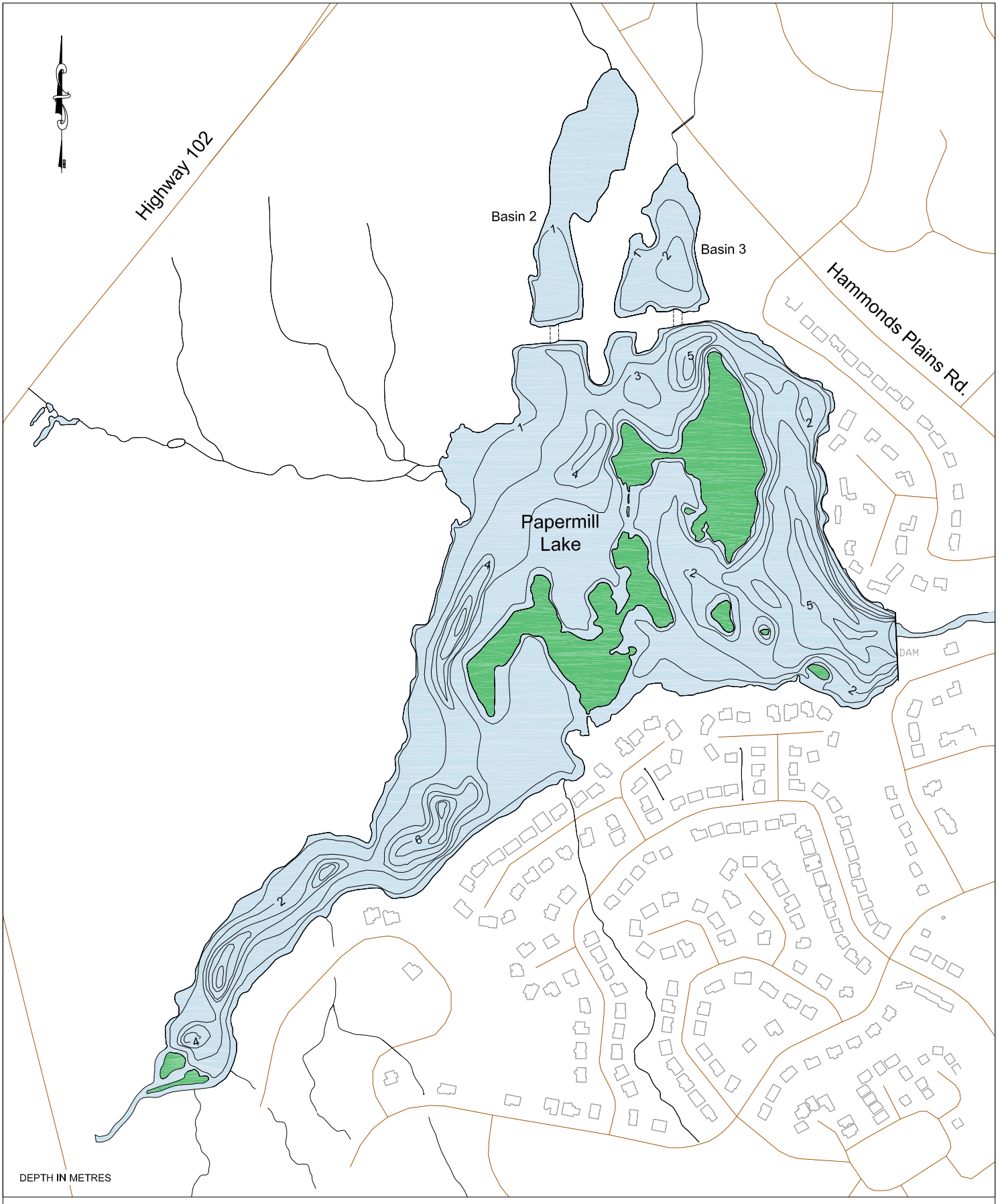
4.3.3 Land Use Distribution Information and Land Use Scenarios

Annapolis Group staff provided information describing land use area and the number of building lots (both with dwellings and approved) that was used in the modelling. A pictorial representation of land use is contained in Figure 6. Tables 2 and 3 provide a detailed breakdown of areas and lot numbers. All of this information was generated using provincial land use information (Land Information Services, Municipal Affairs) validated to the end of 2003.

Two land use scenarios, *present* and *future*, were considered in the phosphorus modelling. Present land use is described as what exists today. This category of land use also includes a small number of approved residential building lots in the Kearney Lake sub-watershed. Modelling results pertaining to present use are either referred to as *present-day* (as in what

can be expected in 2004 given current land use) or *present ultimate* (what will occur at some point in time given current land use). *Future* land use considers all land use changes related to Bedford West, Bedford South, and all potential future development in the Papermill Lake sub-watershed. It is anticipated that presently planned land use changes will be instituted over the next 25 years.

Existing information on some land uses and physical characteristics of the study area, such as highways and lake surface areas was examined in more detail before being input to the model. Runoff coefficients were also examined to enable the distinction between urban land uses, which tend to have more rapid and higher volumes of runoff, than rural land uses. This examination is discussed in sections 4.3.4-4.3.7.



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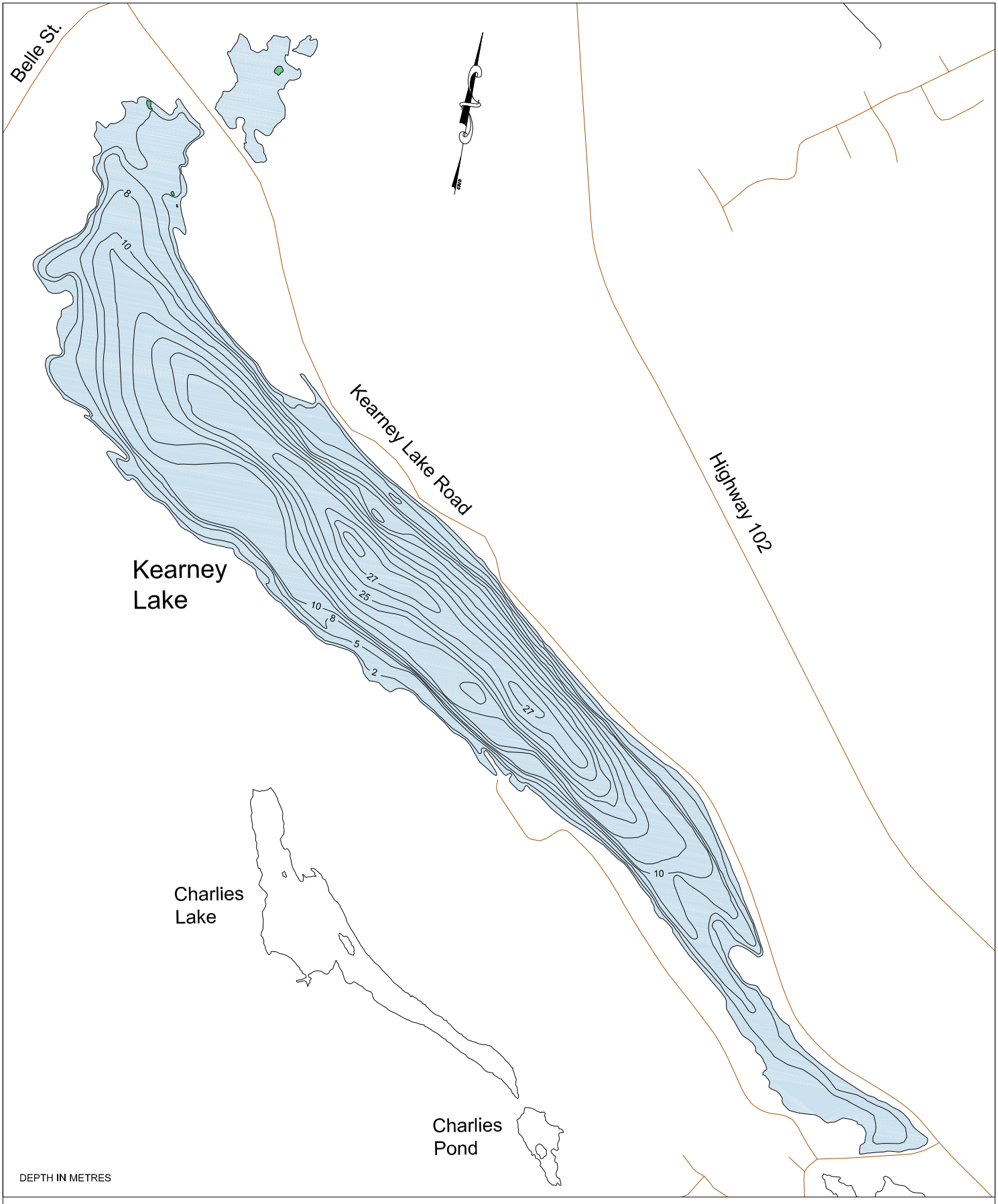
PAPERMILL LAKE
BATHYMETRIC STUDY

Figure **1**

SCALE 1: 6,000
APRIL, 2004



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KEARNEY LAKE BATHYMETRIC STUDY

Figure **2**

SCALE 1: 10,000
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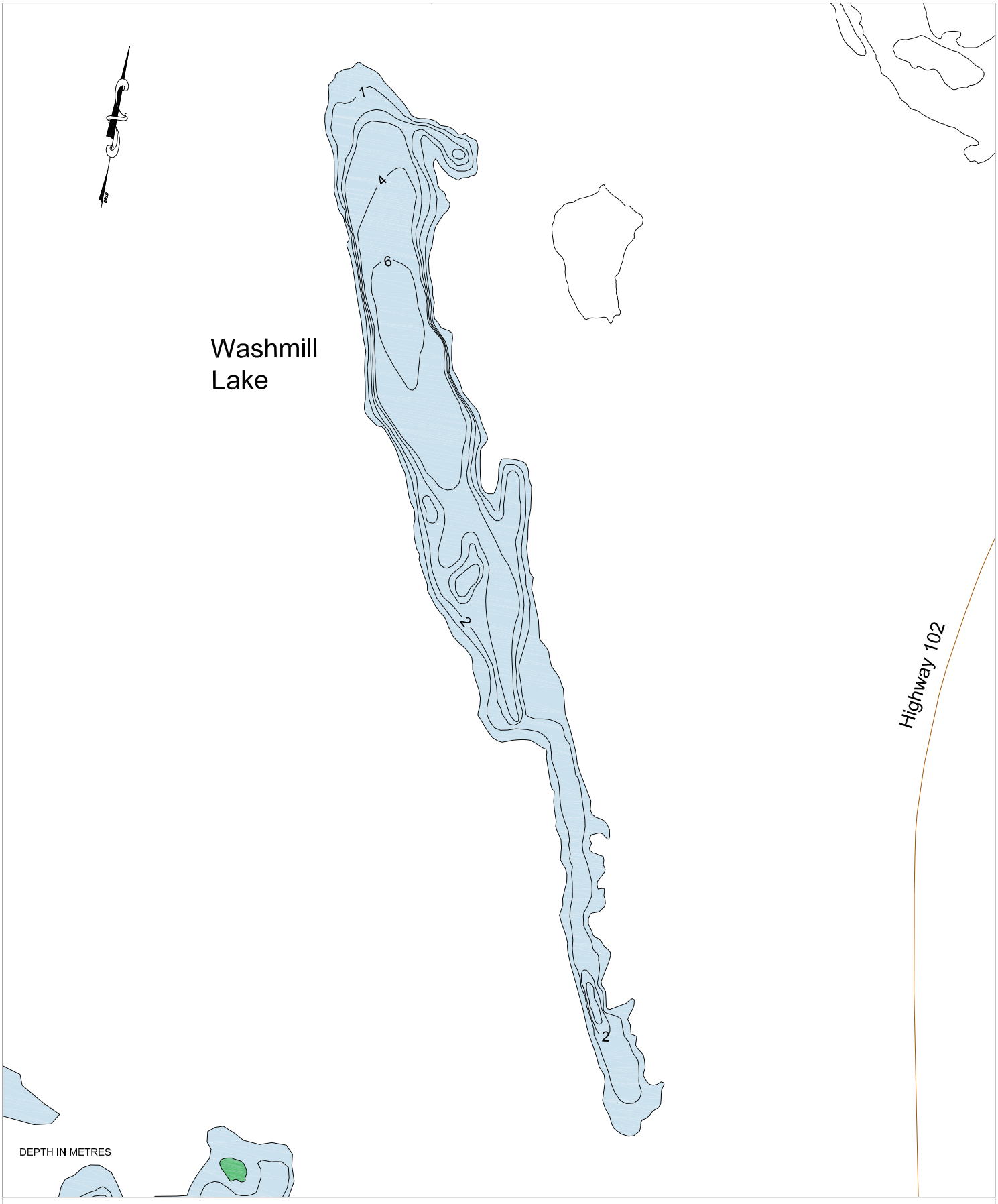

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WASHMILL LAKE
BATHYMETRIC STUDY

Figure **3**

SCALE 1: 5,000
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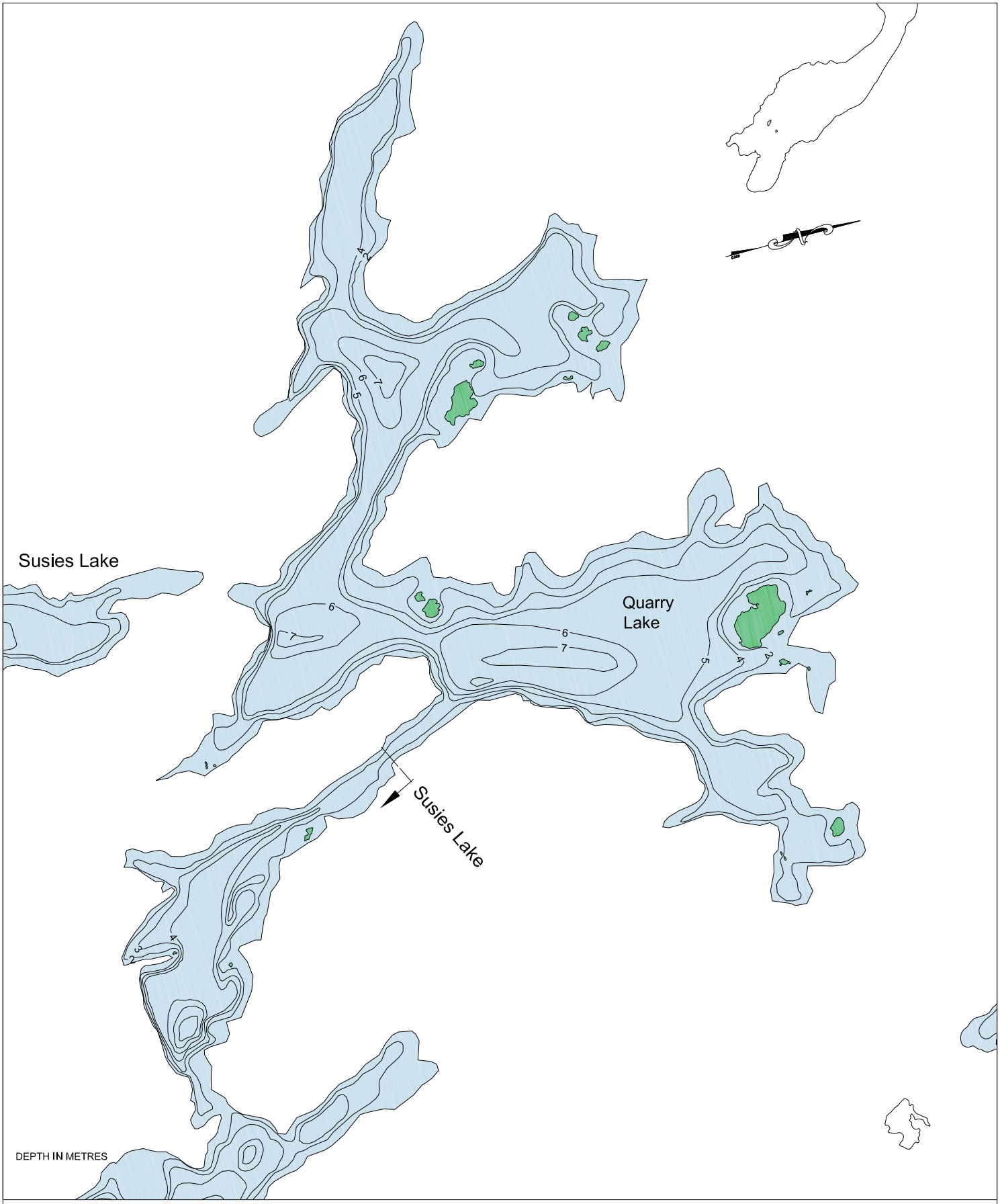

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QUARRY LAKE
BATHYMETRIC STUDY

Figure **4**

SCALE 1: 8,000
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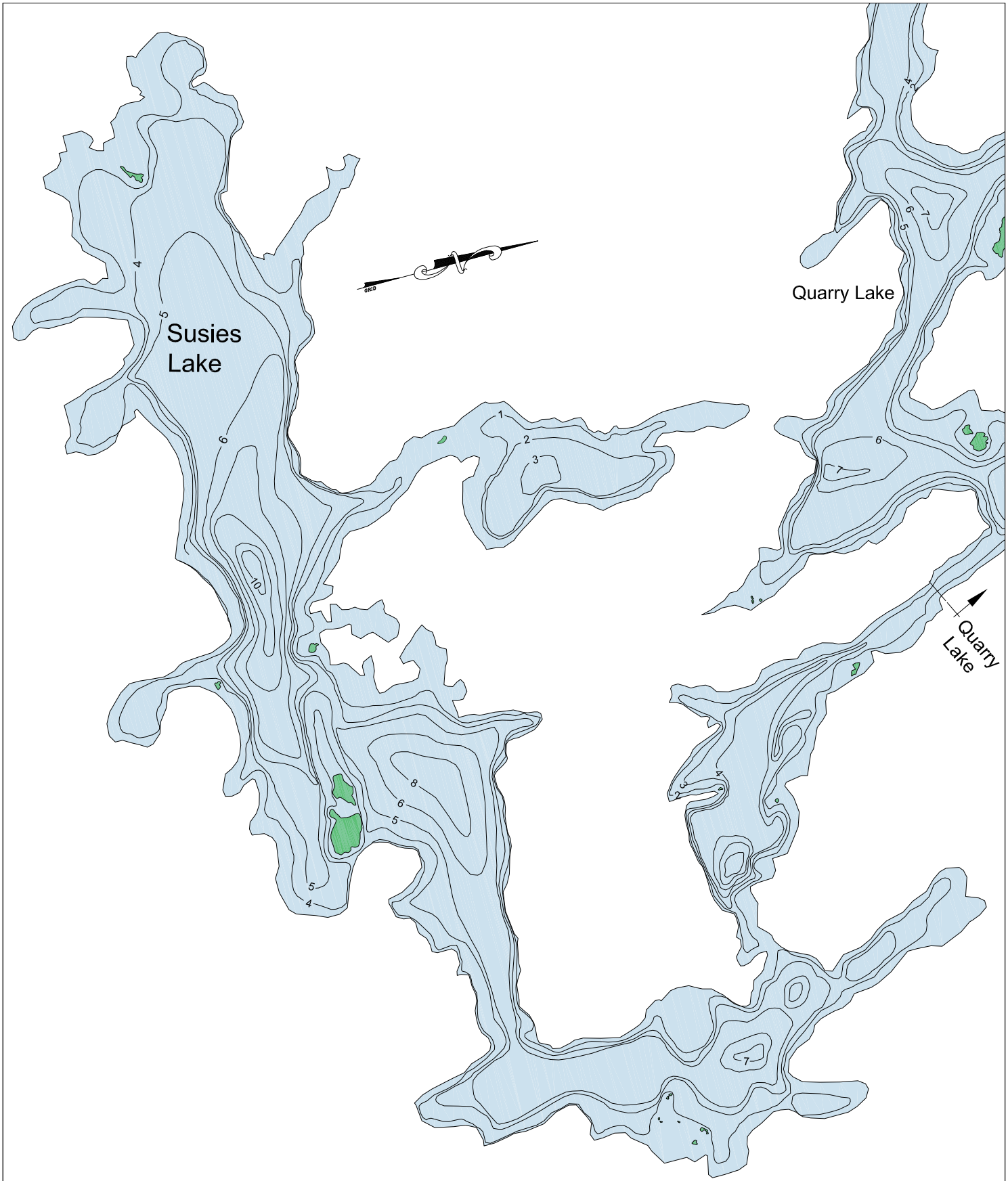

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SUSIES LAKE
BATHYMETRIC STUDY

Figure **5**

SCALE 1: 8,000
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Table 2. Present Land Use Distribution

Sub-Basin (See Fig. 6)	Lake				Residential						Hwy 102	Hwy 113	Passive Park or Forest
		Total	Land	Lakes	Rural		Urban	Institut.	Comm.	Industrial	U/F+C/F[1]	U/F+C/F[1]	
		Area in Ha.			# of Lots	Area in Ha.							
11	Three Finger	124.0	117.5	6.5									117.5
12A	Little Horseshoe	51.0	50.0	1.0									50.0
12B	Big Horseshoe	80.0	73.0	7.0									73.0
13	Flat	54.0	52.0	2.0									52.0
14A	Little Cranberry	22.0	20.4	1.6									20.4
14B	Big Cranberry	27.0	22.6	4.4									22.6
15	Crane	48.0	36.0	12.0									36.0
16	Ash	148.0	118.0	30.0									118.0
17	Fox	93.0	77.0	16.0									77.0
18A	Susies	620.0	539.4	80.6					81.0	65.0			393.4
18B	Quarry	183.0	137.9	45.1									137.9
21	Belchers	93.0	90.5	2.5			89.0						1.5
22	Charlies	45.0	39.0	6.0									39.0
23	Washmill	240.0	231.8	8.2			54.0						177.8
24	Hobsons	153.0	149.0	4.0									149.0
25	McQuade	68.0	61.0	7.0	89	61.0							0.0
26	Kearney	308.0	307.0	1.0	132	132.0							175.0
27	Kearney	490.0	428.5	61.5	115	92.0	34.7			10.8	3.6/5.4/8.9		273.1
33	Papermill B2	40.0	38.2	1.8							2.2/3.4/5.6		27.0
34	Jack	26.5	22.7	3.8									22.7
35	Papermill B3	90.5	89.3	1.2			47.0						42.3
28	Papermill	61.4	59.4	2.0						8.2			53.2
31	Papermill	125.8	125.8	0.0			8.0			9.0	1.1/1.7/2.8		103.2
32	Papermill	121.0	120.6	0.4						1.3	1.4/2.2/3.6		112.5
36	Papermill	85.4	63.2	22.2			14.4						48.8
37	Papermill	109.6	109.6	0.0			64.6						45.0
Total		3507.2	3179.4	327.8	336	285.0	311.7	0.0	81.0	94.3	0.0	0.0	2367.9

[1] Total area provided by Annapolis Staff was sub-divided into landuse categories U: Urban (20%), F+C: forest + cleared (30%), and F: forested (50%)

Table 3. Future Land Use Distribution: Includes present, Bedford West, Bedford South and future Papermill Lake.

Sub-Basin (See Fig. 6)	Lake	Total	Land	Lakes	Residential						Hwy 102	Hwy 113	Passive Park or Forest
					Rural		Urban	Institut.	Comm.	Industrial	U/F+C/F[1]	U/F+C/F[1]	
		Area in Ha.			# of Lots	Area in Ha.							
11	Three Finger	124.0	117.5	6.5									117.5
12A	Little Horseshoe	51.0	50.0	1.0									50.0
12B	Big Horseshoe	80.0	73.0	7.0									73.0
13	Flat	54.0	52.0	2.0									52.0
14A	Little Cranberry	22.0	20.4	1.6									20.4
14B	Big Cranberry	27.0	22.6	4.4									22.6
15	Crane	48.0	36.0	12.0									36.0
16	Ash	148.0	118.0	30.0									118.0
17	Fox	93.0	77.0	16.0									77.0
18A	Susies	620.0	539.4	80.6					81.0	65.0			393.4
18B	Quarry	183.0	137.9	45.1									137.9
21	Belchers	93.0	90.5	2.5			89.0						1.5
22	Charlies	45.0	39.0	6.0			2.7						36.3
23	Washmill	240.0	231.8	8.2			59.7						172.1
24	Hobsons	153.0	149.0	4.0									149.0
25	McQuade	68.0	61.0	7.0	89	61.0							0.0
26	Kearney	308.0	307.0	1.0	132	132.0	78.5					3.3/5.0/8.2	81.0
27	Kearney	490.0	428.5	61.5	25	38.1	282.0	6.5	16.1	10.8	3.6/5.4/8.9	1.8/2.7/4.6	48.0
33	Papermill B2	40.0	38.2	1.8			11.3			1.0	2.2/3.4/5.6		14.9
34	Jack	26.5	22.7	3.8									22.7
35	Papermill B3	90.5	89.3	1.2			47.0						42.3
28	Papermill	61.4	59.4	2.0			19.0		24.8	8.2		1.5/2.2/3.7	2.0
31	Papermill	125.8	125.8	0.0			105.5	1.1		9.0	1.1/1.7/2.8	0.6/0.9/1.6	1.5
32	Papermill	121.0	120.6	0.4			63.8	10.0		16.0	1.4/2.2/3.6	1.5/2.2/3.7	16.6
36	Papermill	85.4	63.2	22.2			62.4						0.8
37	Papermill	109.6	109.6	0.0			109.6						0.0
Total		3507.2	3179.4	327.8	246	231.1	930.5	17.6	121.9	110.0	0.0	0.0	1686.5

[1] Total area provided by Annapolis Staff was sub-divided into landuse categories U: Urban, F+C: forest + cleared, and F: forested

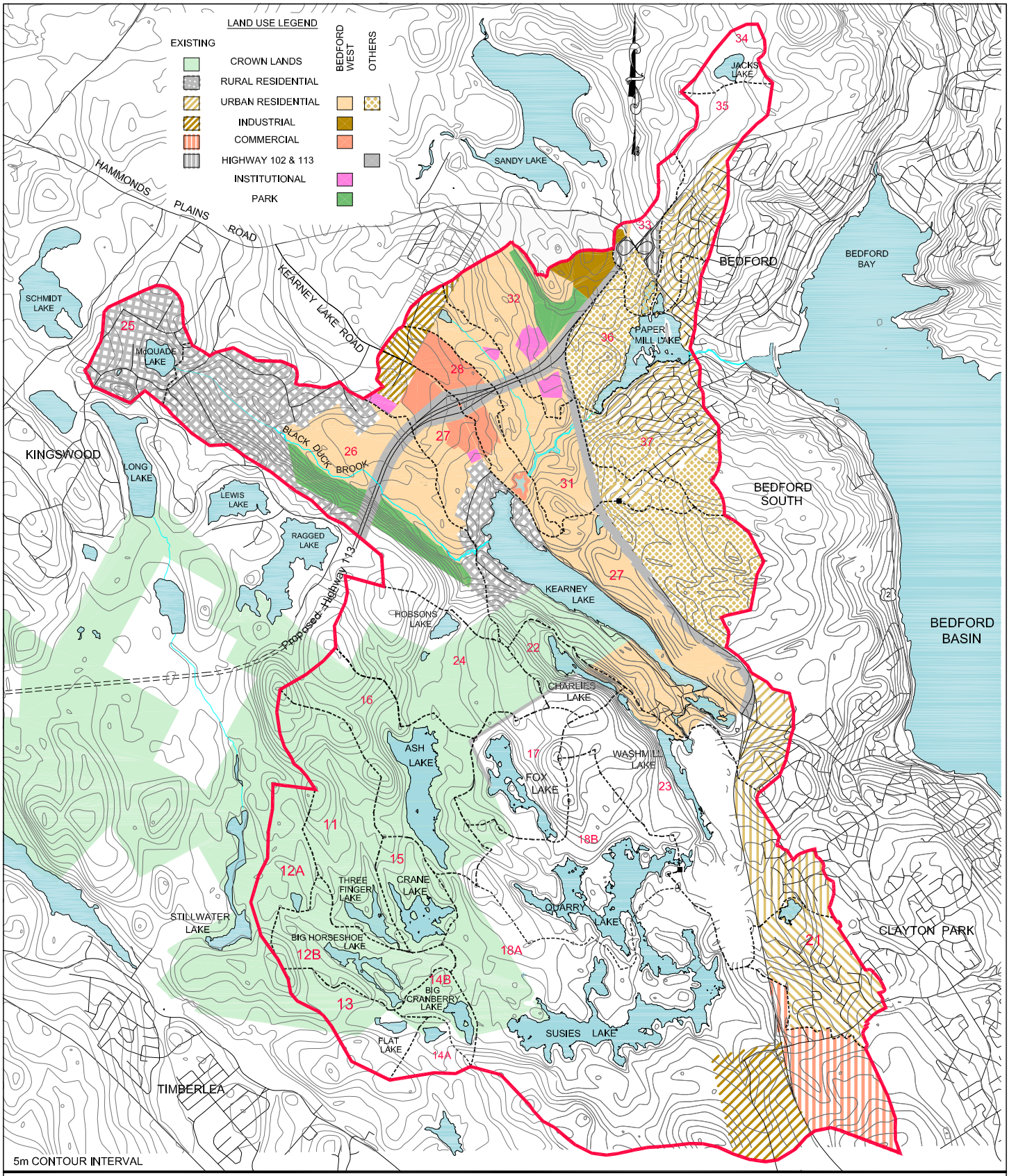

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Figure **6**

LAND USE DISTRIBUTION

EXISTING, BEDFORD WEST, BEDFORD SOUTH & PAPER MILL LAKE

APRIL, 2004

4.3.4 Highway Areas

Areas provided by Annapolis Group staff for Highways 102 and 113 designate the total area bounded by the 152 metre right-of-way. Because these areas would be comprised of forested and cleared area and paved surfaces, it was necessary to sub-divide them into their component parts. For this purpose, a 50:30:20 ratio was applied to calculate the relative areas for forested, forest + cleared, and urban land use categories considered by the model, to which loading rates of 6.9, 8.3 and 52 mg m^{-2} yr^{-1}, respectively, were assigned.

4.3.5 Lake Areas

Values for lake area produced by the Annapolis Group varied slightly from historical data that were based on bathymetric mapping. Seven water bodies are affected. With the exception of Quarry Lake, where the difference between the two data sets is 9.9 hectares, the remaining lake areas differed by between 0.2 and 2.7 hectares. To maintain uniformity between the lake area and lake volume data, values derived from the bathymetric maps for these seven lakes and lake basins were applied in the modelling. Water surface areas provided by the Annapolis Group were used for the remaining 14 lakes and ponds. Adjustments to account for the differences were applied to land use (forest) and watershed areas. Table 4 provides a list of the water bodies and areas involved.

Table 4. Water surface area and adjustment to land use values.

Sub-Watershed	Water Body	Annapolis Group Water Surface Area	Water Surface Area at Time of Sounding CWRS	Added(+) or Subtracted(-) from Forest or Total Sub-Watershed Areas
18A	Susies Lake	81.0	80.6	+0.4
18B	Quarry Lake	55.0	45.1	+9.9
23	Washmill Lake	8.0	8.2	-0.2
27	Kearney Lake	61.0	61.5	-0.5
33	Papermill Lake Basin 2	1.6	1.8	-0.2
35	Papermill Lake Basin 3	1.0	1.2	-0.2
36	Papermill Lake	19.5	22.2	-2.7

4.3.6 Smaller Water Bodies

Several water bodies exist in the drainage basin that were identified by Annapolis Group as being smaller than 2 hectares in size. Because these entities would not be normally be considered as a water body in the modelling and otherwise omitted from the total sub-watershed area in which they were found, the area was assigned to the forested category for the sub-watersheds in question. The two watersheds affected were Kearney Lake and Papermill Lake. The specific areas added to the forest category for each sub-watershed were 1.0 and 3.9 hectares, respectively.

4.3.7 Runoff Coefficient

The basic design of the model allows for the input of a single coefficient for runoff, regardless of land use. This weakness can have a significant influence on predicted phosphorus concentration in watersheds with more than one land use with varying runoff coefficients. For this reason, we used appropriate runoff coefficients for non-urban and urban land use categories. Non-urban uses include forest and forest + cleared; urban uses include urban, institutional, commercial, industrial and highway. Runoff coefficients applied are 1.02 m yr^{-1} (Dillon Consulting et al. 1996) and 1.33 m yr^{-1} (assumed to be 90 percent of 30-year normal precipitation of 1478mm for the Halifax International Airport (Environment Canada)) for non-urban and urban categories, respectively.

5.0 RESULTS

5.1 Phosphorus Modelling

A total of 21 water bodies in the drainage basin flowing through Papermill Lake were considered in the application of the phosphorus loading model. A complete list of lakes and ponds is noted in the Table 5.

A summary of results of the phosphorus modelling for the two land use scenarios, "Present" and “Future”, are presented in Table 6. Appendix I contains detailed tables that described specific input and output data for each of the 21 water bodies for each of the three land use distribution scenarios.

Table 5. List of lakes and ponds modelled. Figure 6 can be used to locate the water bodies in drainage basin. Codes following each name refer to sub-watershed number.

Ash Lake, 16
Belchers Pond, 21
Big Cranberry Lake, 14B
Big Horseshoe Lake, 12B
Charlies Lake, 22

Crane Lake, 15
Flat Lake, 13
Fox Lake, 17
Hobsons Lake, 24
Jack Lake, 34
Kearney Lake, 27
Little Cranberry Lake, 14A
Little Horseshoe Lake, 12A
McQuade Lake, 25
Papermill Lake, 36
Papermill Lake, Basin 2, 33

Papermill Lake, Basin 3, 35
Quarry Lake, 18B
Susies Lake, 18A
Three Finger Lake, 11
Washmill Lake, 23

The first step when interpreting the model predictions is to compare predicted to observed phosphorus concentrations for the present-day conditions. This comparison provides an indication of model accuracy and the need for model calibration. The observed lake phosphorus concentration means for the comparison were calculated using data reported in Dillon et al. (1996), Keizer et al. (1993), Scott et al. (2003) and that provided by the Annapolis Group (2004).

The predicted and observed phosphorus concentrations agree, with reasonable accuracy, for those lakes with relatively undeveloped watersheds, indicating that the model is applicable. Since the main function of this type of model is to predict steady-state conditions (what phosphorus levels will be once the system has reached equilibrium following a change in land use), it is not unrealistic for this agreement between predicted and observed phosphorus levels for developed watersheds to be less accurate. The main reason for this difference lies in the fact that a time lags exists between when a change in land use occurs and when a lake is seen to respond to that change.

The lakes and ponds in developed watersheds showing the greatest variation in predicted versus observed phosphorus values are Belchers Pond, a water body mainly influenced by urban effects, McQuade Lake, with a significant septic system influence, Kearney Lake, influenced by a combination of both urban and septic systems, and Papermill Lake, a water body with mainly urban influences.

To explore this further and to address any confusion associated with the interpretation of phosphorus concentrations predicted by the model, a model calibration step was performed. Details are provided in the following section.

5.2 Model Calibration Step

Based on the land use as it has been approved today, the model has predicted that phosphorus concentrations in the two major downstream lakes, Kearney Lake and Papermill Lake, will eventually be 15.4 and 15.1 ug L^{-1}, respectively, considerably higher than the phosphorus mean values based on measured values reported in this report for these two lakes (Kearney Lake = 6.7 ug L^{-1}; Papermill Lake = 8.8 ug L^{-1}). It must be remembered that the model values are predicted to occur at some time in the future as the result of today's land use.

The model was calibrated using phosphorus and land use data for the McQuade Lake watershed to separate the influence of on-site septic systems on Kearney Lake and Papermill Lake phosphorus levels and to see what effect this had on the accuracy of

model predictions. To do this, a baseline lake phosphorus concentration in McQuade Lake was estimated that presumed a pre-development forested state. The value generated in this fashion was assumed to be legitimate since satisfactory agreement has been demonstrated by the model for other non-developed upper drainage basin lakes. It was determined that in the absence of development, the mean annual lake phosphorus concentration for McQuade Lake would have been 3.4 ug L^{-1}.

From this point, the amount of phosphorus on a per household basis, necessary to increase the lake phosphorus concentration from the baseline concentration of 3.4 ug L^{-1} to the observed mean concentration of 10.2 ug L^{-1}, was calculated. A total of eighty-nine households was used for the calculation. It is estimated that the total amount of phosphorus presently reaching McQuade Lake from on-site systems in its watershed (the amount necessary to increase lake concentration by 6.8 ug L^{-1}) is 9,800 gm yr^{-1}, or an average of 110 gm yr^{-1} septic $system^{-1}$. A very small fraction of the increase (not included in the 9,800 gm yr^{-1}) is attributable to the change from a forested to forest + cleared land use designation. The unit load of 110 gm P yr^{-1} septic $system^{-1}$ was then applied to the Kearney Lake watershed using the number of existing households or household equivalents. Based on a total number of 235 (226 single family units plus 9 household equivalents representing 4 commercial operations), the phosphorus load from on-site systems to Kearney Lake is estimated to be 25,850 gm yr^{-1}.

Finally, the 9,800 gm yr^{-1} and 25,850 gm yr^{-1} estimates, representing the amount of phosphorus from on-site systems currently reaching McQuade and Kearney lakes, respectively, were applied in the model. Model predicted phosphorus concentrations resulting from this calibration step are 8.5 ug L^{-1} for Kearney Lake and 9.9 ug L^{-1} for Papermill Lake, which are similar to the observed lake means of 6.7 and 8.8 ug L^{-1}, respectively.

6.0 DISCUSSION

The calibration step performed as described in Section 5.2, has demonstrated the model's applicability to urbanised lakes with the exception of Belcher's Pond. This may be the case for the two small basins north of Papermill Lake(Basin 2 and Basin 3, Figure 1) as well, but it is not possible to conclude in the absence of recent phosphorus data for these small water bodies. As to why the comparison between predicted and measured phosphorus concentration for Belcher's Pond is poor is unknown at this time. Possible reasons for the difference may include insufficient up-to-date empirical data (that used in the report was collected in 1994-95) and an inflated urban export coefficient. The slight positive bias (over-estimate) expressed in the predictions for the two other urban lakes, Kearney Lake and Papermill Lake, may also be due, in part, to the same inflated export coefficient.

Figures 7 and 8 are graphical representations of predicted whole lake total phosphorus concentrations in McQuade, Kearney and Papermill Lakes as the long term result of present and future development within the watershed. These predictions can be considered the "worst case" scenario because they do not take into account all possible strategies to reduce total phosphorus inputs, especially the treatment of stormwater.

Figure 7 shows the extent to which contributions from on-site wastewater disposal systems affect phosphorus concentrations over the long term. Assuming that phosphorus loading from on-site systems can be eliminated through other management options, the predicted effects of present development on Kearney Lake (8.5 ug L^{-1}) plus the predicted effects of future development (an additional 3.6 ug L^{-1}) would result in a phosphorus concentration of 12.1 ug L^{-1}. If upstream on-site inputs reach their ultimate values, the predicted phosphorus concentration in Kearney Lake could reach 16.7 ug L^{-1}. For Papermill Lake, present development (9.9ug ug L^{-1}) plus predicted effects of future development (6.3 ug L^{-1}) would result in a whole lake average concentration of 16.2 ug L^{-1}. Addition of phosphorus inputs from upstream of Papermill would result in a concentration of 19.7 ug L^{-1} (see Table 7).

Figure 8 uses data from Table 6 to show the effects of upstream contributions of phosphorus predicted to be derived from on-site waste water systems on whole lake phosphorus concentrations in Kearney and Papermill Lakes. The predicted value of about 62 ug L^{-1} in McQuade Lake is very high and, if reached will have serious consequences for the condition of that lake in the future. As discussed above, there are potential downstream effects that could lower water quality in the lakes receiving drainage from McQuade Lake. Therefore, management options are presented later in this section.

It is possible, given the worst case, that phosphorus concentration in Papermill lake will eventually be very close to the 20 ug L^{-1} value that indicates a transitional state between mesotrophy and eutrophy. Other lakes in HRM with phosphorus concentrations in the 22-25 ug L^{-1} range have been of concern because the aesthetic and/or recreational values of those lakes has decreased. It is important to consider the major sources of phosphorus and alternatives that could reduce their impact.

Examination of Figure 7 shows that the predicted impact of future development will contribute less phosphorus than the ultimate effects of existing development. This is largely due to the fact that new, and some existing development will be serviced by central sewage facilities and phosphorus in the wastewater will be exported from the watershed. The high concentrations of phosphorus predicted for McQuade Lake are largely due to the number of septic systems in its watershed. Phosphorus contained in McQuade lake outlet waters will ultimately be a major contributor to downstream lakes.

Results of removing the effects of septic systems are also shown in Figure 7 and suggest that if all those effects were removed, the ultimate trophic status of both Papermill and Kearney Lakes would be mesotrophic. While it may be impractical to remove the effects of septic systems from the McQuade Lake watershed itself, there may be options for greatly decreasing or eliminating the effects of the phosphorus derived from those systems on downstream lakes. Collection and diversion of sewage is theoretically possible, but may not be practical. Another option that may be practical is the

construction of a wetland to intercept the flow from McQuade Lake and reduce its phosphorus concentration. Environment Canada (2004) cites examples in which up to 85% of phosphorus can be removed using such a method, however the design and implementation of such a solution is outside the scope of this report.

Other management options are available to reduce phosphorus inputs to the system. These include:

- A significant proportion of the total phosphorus load for McQuade, Kearney, and Papermill lakes originates from on-site wastewater disposal systems. The removal of a fraction of this load will be accomplished by connecting buildings on Hamshaw Drive and lots fronting on Kearney Lake Road to central sewer as part of the Bedford West Management Area Plan, 148 exiting lots in the Kearney Lake sub-watershed will continue to be serviced by on-site systems. These proposed changes were considered in the modelling. Elimination of the load for the remaining lots by the same method would result in a significant reduction in modelled phosphorus concentrations for the affected lakes. Obviously, any future strategy that provided central sewer connections to other existing development in the Kearney Lake sub-watershed would result in similar reductions in phosphorus loads.
- Encouraging residents to use low phosphorus fertilisers (or no fertiliser) on lawns. Inorganic lawn and garden fertilisers can be significant sources of nitrogen and phosphorus when applied too heavily or too often. Some of the newer organic or slow release products produce good results but are not as easily dissolved and washed into water courses.
- Managing organic wastes such as leaves and grass clippings, as well as dog feces in appropriate ways. It has been shown in several municipalities, including HRM, that leaves and grass clippings that are deposited in gutters or along streets can contribute large amounts of phosphorus due to mechanical breakage caused by the passage of cars. Regular street cleaning and/or avoiding the deposition of these materials in the street leads to reduction in nutrient loads. Observance of "poop

and scoop" by-laws also helps reduce inputs of fecal coliform bacteria to surface waters.

- Leaving wide buffer strips of natural vegetation along lake and stream shores. Buffers of natural vegetation tend to slow overland flow during high rainfall periods or times when the ground is partially frozen. Slowing the runoff allows it more time to enter the underlying soil, which tends to remove phosphorus from the liquid.
- Various options exist for reducing the phosphorus contained in urban stormwater drainage. There are several options for detaining urban stormwater that encourage the removal of a variety of pollutants, including phosphorus. Wetlands, referred to above, are one option, as are detention ponds, permeable surfaces for parking lots, and others that fall under the general category of Best Management Practices, or "BMPs".

Figure 7. Sources of Lake Phosphorus
(based on modelled values; no stormwater treatment)

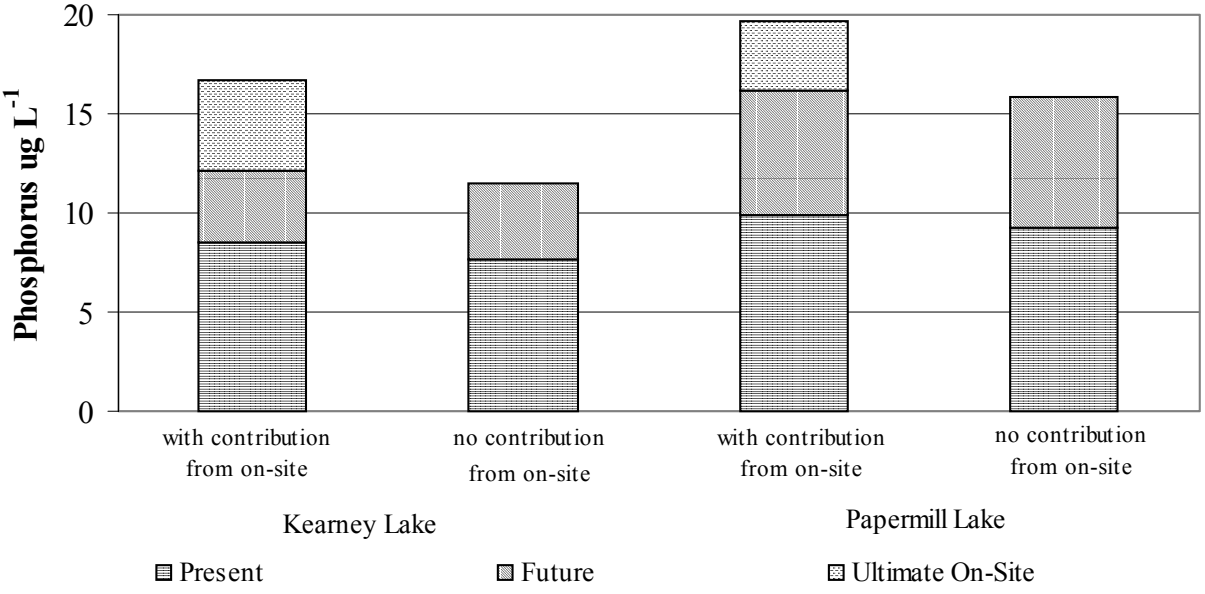

Figure 8. Model Predictions

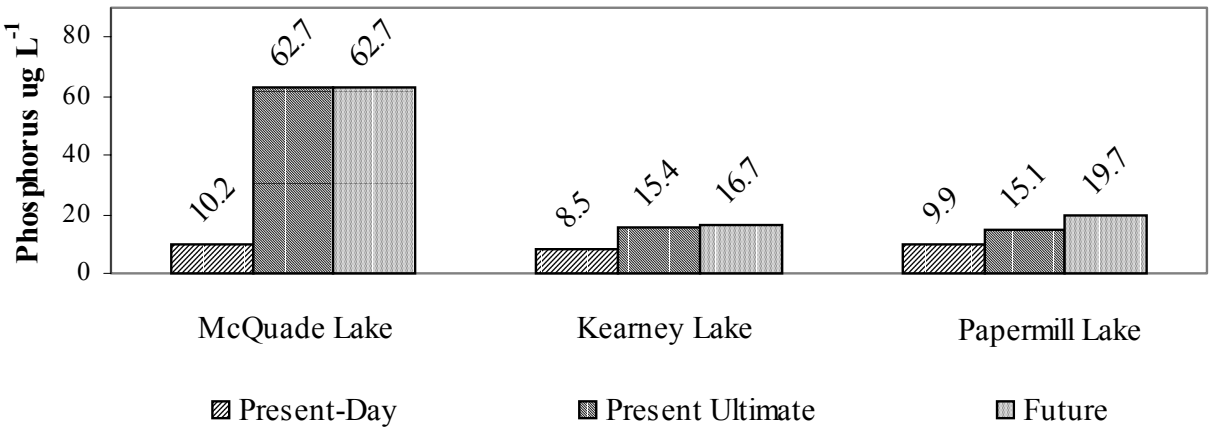

Table 6. Model predictions of lake phosphorus concentrations in the 21 lakes and ponds for the two development scenarios identified.

	Little Horseshoe Lake	Three Finger Lake	Big Horseshoe Lake	Flat Lake	Little Cranberry Lake	Big Cranberry Lake	Crane Lake	Ash Lake	Fox Lake	Susies Lake	Quarry Lake
Drainage Sub-Basins (See Figure 6)	11	12A	12B	13	14A	14B	15	16	17	18A	18B
					Mean Annual P, ug L^{-1}						
Present-Day	5.6	4.5	4.3	4.9	4.0	4.1	2.3	2.6	2.7	9.9	6.9
Present Ultimate	5.6	4.5	4.3	4.9	4.0	4.1	2.3	2.6	2.7	9.9	6.9
Future	5.6	4.5	4.3	4.9	4.0	4.1	2.3	2.6	2.7	9.9	6.9
Mean Obs. Lake Conc. ug/L	7.0	4.2	6.9	7.0	6.6	8.6	3.4	2.2	3.1	7.2	5.6
# of Sampling Dates (1990-2002)	2	2	2	2	2	2	2	2	2	5	5

	Belchers Lake	Charlies Lake	Washmill Lake	Hobsons Lake	McQuade Lake	Kearney Lake	Papermill Lake Basin 2	Jack Lake	Papermill Lake Basin 3	Papermill Lake
Drainage Sub-Basins (See Figure 6)	21	22	23	24	25	26, 27	33	34	35	28, 31, 32, 36, 37
					Mean Annual P, ug L^{-1}					
Present-Day	30.6	3.1	9.0	5.3	10.2	8.5	6.2	3.0	19.1	9.9
Present Ultimate	30.6	3.1	9.0	5.3	62.7	15.4	16.3	3.0	19.1	15.1
Future	30.6	4.2	9.2	5.3	62.7	16.7	16.3	3.0	19.1	19.7
Mean Obs. Lake Conc. ug/L	7.6	3.5	5.1	7.2	10.2	6.7	-	3.6	-	8.8
# of Sampling Dates (1990-2002)	2	2	4	2	2	8	-	2	-	11

TP Data Sources used to calculate observed mean:
Porter Dillon Ltd. et al.. (1996) - 19 lakes; 2-4 dates in 1994-95
Keizer et al. (1991) - 4 lakes; 1 date
Scott et al. (2003) - 2 lakes; 3 dates
Annapolis Group (2004)

Table 7. Predicted whole-lake phosphorus concentrations based on present development (present-day), future development serviced by central sewer (future), and modelled on-site contributions (on-site ultimate).

Lake	Present-Day		Future		Sub-Total		On-Site Ultimate		Total
Kearney	8.5	+	3.6	=	12.1	+	4.6	=	16.7
Papermill	9.9	+	6.3	=	16.2	+	3.5	=	19.7

7.0 TROPHIC STATUS

Until such time that the model is fully calibrated, the trophic status categories identified for lakes affected by either development scenario are tentative and should be treated as such.

Using observed and predicted values for phosphorus concentration, lakes were classified using a fixed-boundary system. A fixed boundary system (Table 8) uses ranges of phosphorus concentration to define the trophic status of lakes. The system generally used in North America (Environment Canada, 2004) is as follows: "ultra-oligotrophic" ≤4.0 ug L^{-1}, "ultra-oligotrophic" ≤10 ug L^{-1}, "mesotrophic" 10-35 ug L^{-1}, or "eutrophic" ≥35 ug L^{-1}. Results are tabulated in Table 9.

Table 8. Fixed-boundary lake classification system (Environment Canada, 2004).

Trophic Level	**Total Phosphorus, ug L^{-1}**
Ultra-oligotrophic	≤4.0
Oligotrophic	≤10
Mesotrophic	10-35
Eutrophic	≥35

Table 9 shows the trophic status of each lake in the study area using the fixed boundary system of classification. This approach summarises trophic status by indicating the classification of each lake rather than presenting numerical data, in other words, the range of phosphorus concentrations into which each lake falls. As would be expected, lakes that are isolated from development do not show changes in trophic status as the result of existing or future development. Susies lake is predicted to change from Oligotrophic to Mesotrophic, while Charlies Lake is predicted to change from Ultra Oligotrophic to Oligotrophic. Papermill and Kearney Lakes will remain in the Mesotrophic category, although their status will move closer to the transition between Mesotrophic and Eutrophic based on existing and future development in the watershed. McQuade Lake is presently Mesotrophic but is predicted to become highly Eutrophic based on loadings due to existing development.

Table 9. Lake trophic status using a fixed-boundary classification system.

	Little Horseshoe Lake	Three Finger Lake	Big Horseshoe Lake	Flat Lake	Little Cranberry Lake	Big Cranberry Lake	Crane Lake	Ash Lake	Fox Lake
Drainage Sub-Basins (See Figure 6)	11	12A	12B	13	14A	14B	15	16	17
Present Ultimate	O	O	O	O	O	O	OU	OU	OU
Future	O	O	O	O	O	O	OU	OU	OU
Measured	O	O	O	O	O	O	OU	OU	OU

	Susies Lake	Quarry Lake	Belchers Lake	Charlies Lake	Washmill Lake	Hobsons Lake	McQuade Lake	Kearney Lake	Papermill Lake Basin 2
Drainage Sub-Basins (See Figure 6)	18A	18B	21	22	23	24	25	26, 27	33
Present Ultimate	O	O	M	OU	O	O	E	M	M
Future	O	O	M	O	O	O	E	M	M
Measured	O	O	O	OU	O	O	M	O	-

	Jack Lake	Papermill Lake Basin 3	Papermill Lake
Drainage Sub-Basins (See Figure 6)	34	35	28, 31, 32, 36, 37
Present Ultimate	OU	M	O
Future	OU	M	M
Measured	OU	-	O

8.0 RECOMMENDATIONS

Recommendations are presented that apply both to short and longer term needs within the study area, as well as recommendations that are more general in nature that could apply to any urbanising area. Appendix II contains suggested water quality monitoring protocols related to the recommendations for data collection.

8.1 Short Term Recommendation

Application of the phosphorus loading model to the Papermill Lake drainage basin identified the need for specific information for the purpose of model validation and calibration. There is a scarcity of up-to-date water quality data for most lakes in this drainage basin that are appropriate for model validation. A monitoring program should be implemented that is designed to characterise phosphorus levels on an annual basis in four target lakes, namely McQuade, Washmill, Kearney, and Papermill.

8.2 Long Term Recommendations

1. To evaluate the accuracy of the model predictions, a water quality monitoring program should be established that would gather phosphorus and other selected water quality data on a regular long term basis and should focus on lakes in the lower part of the drainage basin. Lakes in question include McQuade, Washmill, Kearney, and Papermill. The program should also be expanded to gather phosphorus data for the remaining lakes, but at a reduced sampling frequency.
2. Consideration should be given to strategies that could reduce phosphorus outputs from the McQuade Lake sub-watershed. The possibility of installing a constructed wetland between the outlet of McQuade Lake and the inlet to Kearney Lake should be investigated.

8.3 General Recommendations

The following recommendations relate to information requirements or management strategies that relate to the present study, but have broader application or use.

1. Although the calibration of the model improved the comparison between predicted and measured phosphorus concentrations for some urban lakes, poor agreement in the case of Belchers Pond raises the question of whether the urban phosphorus export coefficients used in the model may result in overestimates of phosphorus loads. To address this uncertainty, information should be collected to provide a more precise value suitable for local urban areas.
2. Residents should be made aware of the impact their behaviour can have on surface water quality. As discussed above, residents can reduce their additions of phosphorus by using appropriate amounts and types of fertilisers, composting yard waste, and obeying "poop and scoop" by-laws. In buildings that use on-site sewage disposal, the use of low phosphate household products, proper septic system management and regular pumping and inspection will also be helpful.
3. Vegetation buffer strips along water courses will encourage infiltration of surface runoff during much of the year and will allow nutrients to be absorbed by plants.
4. Options for storm water management should be considered insofar as they are appropriate for reducing phosphorus concentrations under local conditions.

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APPENDIX I

Detailed summaries of model predictions and input and output variables for current and future land use distribution scenarios.

The lakes and ponds are placed in order of where they are located, from top to bottom, in the drainage basin.

Little Horseshoe Lake (Area 12A) - 1						
Input Parameters	**Symbol**	**Value**	**Units**	**Budgets**		
Morphology				**Hydraulic Budget (m^{-3})**		
Drainage Basin Area (Excl. of Lake Area)	Ad	50.0	ha			
Area Land Use Category 1 (Forest)	Ad1	50.0	ha			**% Total**
Area Land Use Category 2 (Forest/Cleared)	Ad2	0.0	ha	Upstream Inflow	0	0
Area Land Use Category 3 (Urban Exist)	Ad3	0.0	ha	Precipitation	14780	2.82
Area Land Use Category 4 (Commercial Exist)	Ad4	0.0	ha	Surface Run Off	510000	97.18
Area Land Use Category 5 (Industrial Exist)	Ad5	0.0	ha	Evaporation	-4580	0.87
Area Land Use Category 6 (Institutional Exist)	Ad6	0.0	ha	Total Outflow	520200	99.13
Area Land Use Category 7 (Urban BW)	Ad7	0.0	ha	Total Check		100.00
Area Land Use Category 8 (Commercial BW)	Ad8	0.0	ha			
Area Land Use Category 9 (Industrial BW)	Ad9	0.0	ha	**Phosphorus Budget (gm yr^{-1})**		
Area Land Use Category 10 (Institutional BW)	Ad10	0.0	ha			
Lake Surface Area	Ao	1.0	ha			**% Total**
Lake Volume	V	0.00	10^6 m^3	Upstream Inflow	0	0
Hydrology				Atmosphere	173	4.78
Upstream Hydraulic Inputs	Qi	0	m^3 yr^{-1}	Land Run Off	3450	95.22
Annual Unit Precipitation	Pr	1.478	m yr^{-1}	Development	0	0.00
Annual Unit Lake Evaporation	Ev	0.458	m yr^{-1}	Sedimentation	-688	18.99
Annual Unit Hydraulic Runoff - Veg. Surfaces	Ru	1.020	m yr^{-1}			
Annual Unit Hydraulic Runoff - Urban	Ru	1.330	m yr^{-1}	Total Outflow	2935	81.01
P Loading				Total Check		100.00
Upstream P Input	Pi	0	gm P yr^{-1}			
Annual Unit Atmospheric P Deposition	Da	0.0173	gm P m^{-2} yr^{-1}			
Land Use Category 1 P Export Coefficient	E1	0.0069	gm P m^{-2} yr^{-1}	**Model Validation**		
Land Use Category 2 P Export Coefficient	E2	0.0083	gm P m^{-2} yr^{-1}			
Land Use Category 3 P Export Coefficient	E3	0.0520	gm P m^{-2} yr^{-1}			
Land Use Category 4 P Export Coefficient	E4	0.0400	gm P m^{-2} yr^{-1}	Pedicted P (mg L^{-1})		0.0056
Land Use Category 5 P Export Coefficient	E5	0.2020	gm P m^{-2} yr^{-1}	Measured P (mg L^{-1})		0.0070
Land Use Category 6 P Export Coefficient	E6	0.0420	gm P m^{-2} yr^{-1}	% Difference		-20.0
Land Use Category 7 P Export Coefficient	E7	0.0520	gm P m^{-2} yr^{-1}			
Land Use Category 8 P Export Coefficient	E8	0.0400	gm P m^{-2} yr^{-1}			
Land Use Category 9 P Export Coefficient	E9	0.2020	gm P m^{-2} yr^{-1}			
Land Use Category 10 P Export Coefficient	E10	0.0420	gm P m^{-2} yr^{-1}			
Number of Dwellings	N_d	0	#			
Average number of Persons per Dwelling	N_u	2.60	n/a			
Average Fraction of Year Dwellings Occupied	N_{pc}	1	yr^{-1}			
Phosphorus Load per Capita per Year	Sl	800	gm P cap^{-1} yr^{-1}			
Septic System Retention Coefficient	Rsp	0.5	n/a			
Point Source Input 1	PS1	0				
Point Source Input 2	PS2	0				
Point Source Input 3	PS3	0				
Point Source Input 4	PS4	0				
Point Source Input 5	PS5	0				
Phosphorus Retention Coefficient	v	12.4	n/a			
Model Outputs						
Total Precipitation Hydraulic Input	P_{pti}	14780	m^3 yr^{-1}			
Total Evaporation Hydraulic Loss	Eo	4580	m^3 yr^{-1}			
Total Hydraulic Surface Run Off	Ql	510000	m^3 yr^{-1}			
Total Hydraulic Input	Qt	524780	m^3 yr^{-1}			
Areal Hydraulic Load	q_s	52.02	m yr^{-1}			
Total Hydraulic Outflow	Qo	520200	m^3 yr^{-1}			
Upstream P Input	Ju	0	gm yr^{-1}			
Total Atmospheric P Input	Jd	173	gm yr^{-1}			
Total Overland Run Off P Input	Je	3450	gm yr^{-1}			
Total Development P Input	Jd	0	gm yr^{-1}			
Total P Input	Jt	3623	gm yr^{-1}			
Lake P Retention Factor	Rp	0.19	n/a			
Lake Phosphorus Retention	Ps	688	gm yr^{-1}			
Predicted Lake Phosphorus Concentration	[P]	**0.0056**	mg L^{-1}			
Lake Phosphorus Outflow	Jo	2935	gm yr^{-1}			
Lake Mean Depth	z	0	m			
Lake Turnover Time	TT	0	yr			
Lake Flushing Rate	FR	#DIV/0!	times yr^{-1}			
Lake Response Time	RT	#DIV/0!	yr			

Three Finger Lake (Area 11) - 1

Input Parameters	Symbol	Value	Units
Morphology			
Drainage Basin Area (Excl. of Lake Area)	Ad	117.5	ha
Area Land Use Category 1 (Forest)	Ad1	117.5	ha
Area Land Use Category 2 (Forest/Cleared)	Ad2	0.0	ha
Area Land Use Category 3 (Urban Exist)	Ad3	0.0	ha
Area Land Use Category 4 (Commercial Exist)	Ad4	0.0	ha
Area Land Use Category 5 (Industrial Exist)	Ad5	0.0	ha
Area Land Use Category 6 (Institutional Exist)	Ad6	0.0	ha
Area Land Use Category 7 (Urban BW)	Ad7	0.0	ha
Area Land Use Category 8 (Commercial BW)	Ad8	0.0	ha
Area Land Use Category 9 (Industrial BW)	Ad9	0.0	ha
Area Land Use Category 10 (Institutional BW)	Ad10	0.0	ha
Lake Surface Area	Ao	6.5	ha
Lake Volume	V	0.00	10^6 m^3
Hydrology			
Upstream Hydraulic Inputs	Qi	0	m^3 yr^{-1}
Annual Unit Precipitation	Pr	1.478	m yr^{-1}
Annual Unit Lake Evaporation	Ev	0.458	m yr^{-1}
Annual Unit Hydraulic Runoff - Veg. Surfaces	Ru	1.020	m yr^{-1}
Annual Unit Hydraulic Runoff - Urban	Ru	1.330	m yr^{-1}
P Loading			
Upstream P Input	Pi	0	gm P yr^{-1}
Annual Unit Atmospheric P Deposition	Da	0.0173	gm P m^{-2} yr^{-1}
Land Use Category 1 P Export Coefficient	E1	0.0069	gm P m^{-2} yr^{-1}
Land Use Category 2 P Export Coefficient	E2	0.0083	gm P m^{-2} yr^{-1}
Land Use Category 3 P Export Coefficient	E3	0.0520	gm P m^{-2} yr^{-1}
Land Use Category 4 P Export Coefficient	E4	0.0400	gm P m^{-2} yr^{-1}
Land Use Category 5 P Export Coefficient	E5	0.2020	gm P m^{-2} yr^{-1}
Land Use Category 6 P Export Coefficient	E6	0.0420	gm P m^{-2} yr^{-1}
Land Use Category 7 P Export Coefficient	E7	0.0520	gm P m^{-2} yr^{-1}
Land Use Category 8 P Export Coefficient	E8	0.0400	gm P m^{-2} yr^{-1}
Land Use Category 9 P Export Coefficient	E9	0.2020	gm P m^{-2} yr^{-1}
Land Use Category 10 P Export Coefficient	E10	0.0420	gm P m^{-2} yr^{-1}
Number of Dwellings	N_d	0	#
Average number of Persons per Dwelling	N_u	2.60	n/a
Average Fraction of Year Dwellings Occupied	N_{pc}	1	yr^{-1}
Phosphorus Load per Capita per Year	Sl	800	gm P cap^{-1} yr^{-1}
Septic System Retention Coefficient	Rsp	0.5	n/a
Point Source Input 1	PS1	0	
Point Source Input 2	PS2	0	
Point Source Input 3	PS3	0	
Point Source Input 4	PS4	0	
Point Source Input 5	PS5	0	
Phosphorus Retention Coefficient	v	12.4	n/a
Model Outputs			
Total Precipitation Hydraulic Input	P_{pti}	96070	m^3 yr^{-1}
Total Evaporation Hydraulic Loss	Eo	29770	m^3 yr^{-1}
Total Hydraulic Surface Run Off	Ql	1198500	m^3 yr^{-1}
Total Hydraulic Input	Qt	1294570	m^3 yr^{-1}
Areal Hydraulic Load	q_s	19.46	m yr^{-1}
Total Hydraulic Outflow	Qo	1264800	m^3 yr^{-1}
Upstream P Input	Ju	0	gm yr^{-1}
Total Atmospheric P Input	Jd	1125	gm yr^{-1}
Total Overland Run Off P Input	Je	8108	gm yr^{-1}
Total Development P Input	Jd	0	gm yr^{-1}
Total P Input	Jt	9233	gm yr^{-1}
Lake P Retention Factor	Rp	0.39	n/a
Lake Phosphorus Retention	Ps	3601	gm yr^{-1}
Predicted Lake Phosphorus Concentration	[P]	**0.0045**	mg L^{-1}
Lake Phosphorus Outflow	Jo	5632	gm yr^{-1}
Lake Mean Depth	z	0	m
Lake Turnover Time	TT	0	yr
Lake Flushing Rate	FR	#DIV/0!	times yr^{-1}
Lake Response Time	RT	#DIV/0!	yr

Hydraulic Budget (m^{-3})

		% Total
Upstream Inflow	0	0
Precipitation	96070	7.42
Surface Run Off	1198500	92.58
Evaporation	-29770	2.3
Total Outflow	1264800	97.7
Total Check		100.00

Phosphorus Budget (gm yr^{-1})

		% Total
Upstream Inflow	0	0
Atmosphere	1125	12.18
Land Run Off	8108	87.82
Development	0	0.00
Sedimentation	-3601	39.00
Total Outflow	5632	61.00
Total Check		100.00

Model Validation

Pedicted P (mg L^{-1})		0.0045
Measured P (mg L^{-1})		0.0042
% Difference		7.1

Big Horseshoe Lake (Area 12B) - 1						
Input Parameters	**Symbol**	**Value**	**Units**	**Budgets**		
Morphology				**Hydraulic Budget (m^{-3})**		
Drainage Basin Area (Excl. of Lake Area)	Ad	73.0	ha			
Area Land Use Category 1 (Forest)	Ad1	73.0	ha			**% Total**
Area Land Use Category 2 (Forest/Cleared)	Ad2	0.0	ha	Upstream Inflow	1785000	67.79
Area Land Use Category 3 (Urban Exist)	Ad3	0.0	ha	Precipitation	103460	3.93
Area Land Use Category 4 (Commercial Exist)	Ad4	0.0	ha	Surface Run Off	744600	28.28
Area Land Use Category 5 (Industrial Exist)	Ad5	0.0	ha	Evaporation	-32060	1.22
Area Land Use Category 6 (Institutional Exist)	Ad6	0.0	ha	Total Outflow	2601000	98.78
Area Land Use Category 7 (Urban BW)	Ad7	0.0	ha	Total Check		100.00
Area Land Use Category 8 (Commercial BW)	Ad8	0.0	ha			
Area Land Use Category 9 (Industrial BW)	Ad9	0.0	ha	**Phosphorus Budget (gm yr^{-1})**		
Area Land Use Category 10 (Institutional BW)	Ad10	0.0	ha			
Lake Surface Area	Ao	7.0	ha			**% Total**
Lake Volume	V	0.00	10^6 m^3	Upstream Inflow	8567	57.83
Hydrology				Atmosphere	1211	8.17
Upstream Hydraulic Inputs	Qi	1785000	m^3 yr^{-1}	Land Run Off	5037	34.00
Annual Unit Precipitation	Pr	1.478	m yr^{-1}	Development	0	0.00
Annual Unit Lake Evaporation	Ev	0.458	m yr^{-1}	Sedimentation	-3704	25.00
Annual Unit Hydraulic Runoff - Veg. Surfaces	Ru	1.020	m yr^{-1}	Total Outflow	11111	75.00
Annual Unit Hydraulic Runoff - Urban	Ru	1.330	m yr^{-1}	Total Check		100.00
P Loading						
Upstream P Input	Pi	8567	gm P yr^{-1}			
Annual Unit Atmospheric P Deposition	Da	0.0173	gm P m^{-2} yr^{-1}	**Model Validation**		
Land Use Category 1 P Export Coefficient	E1	0.0069	gm P m^{-2} yr^{-1}			
Land Use Category 2 P Export Coefficient	E2	0.0083	gm P m^{-2} yr^{-1}			
Land Use Category 3 P Export Coefficient	E3	0.0520	gm P m^{-2} yr^{-1}	Pedicted P (mg L^{-1})		0.0043
Land Use Category 4 P Export Coefficient	E4	0.0400	gm P m^{-2} yr^{-1}	Measured P (mg L^{-1})		0.0069
Land Use Category 5 P Export Coefficient	E5	0.2020	gm P m^{-2} yr^{-1}	% Difference		-37.7
Land Use Category 6 P Export Coefficient	E6	0.0420	gm P m^{-2} yr^{-1}			
Land Use Category 7 P Export Coefficient	E7	0.0520	gm P m^{-2} yr^{-1}			
Land Use Category 8 P Export Coefficient	E8	0.0400	gm P m^{-2} yr^{-1}			
Land Use Category 9 P Export Coefficient	E9	0.2020	gm P m^{-2} yr^{-1}			
Land Use Category 10 P Export Coefficient	E10	0.0420	gm P m^{-2} yr^{-1}			
Number of Dwellings	N_d	0	#			
Average number of Persons per Dwelling	N_u	2.60	n/a			
Average Fraction of Year Dwellings Occupied	N_{pc}	1	yr^{-1}			
Phosphorus Load per Capita per Year	Sl	800	gm P cap^{-1} yr^{-1}			
Septic System Retention Coefficient	Rsp	0.5	n/a			
Point Source Input 1	PS1	0				
Point Source Input 2	PS2	0				
Point Source Input 3	PS3	0				
Point Source Input 4	PS4	0				
Point Source Input 5	PS5	0				
Phosphorus Retention Coefficient	v	12.4	n/a			
Model Outputs						
Total Precipitation Hydraulic Input	Ppt_i	103460	m^3 yr^{-1}			
Total Evaporation Hydraulic Loss	Eo	32060	m^3 yr^{-1}			
Total Hydraulic Surface Run Off	Ql	744600	m^3 yr^{-1}			
Total Hydraulic Input	Qt	2633060	m^3 yr^{-1}			
Areal Hydraulic Load	q_s	37.16	m yr^{-1}			
Total Hydraulic Outflow	Qo	2601000	m^3 yr^{-1}			
Upstream P Input	Ju	8567	gm yr^{-1}			
Total Atmospheric P Input	Jd	1211	gm yr^{-1}			
Total Overland Run Off P Input	Je	5037	gm yr^{-1}			
Total Development P Input	Jd	0	gm yr^{-1}			
Total P Input	Jt	14815	gm yr^{-1}			
Lake P Retention Factor	Rp	0.25	n/a			
Lake Phosphorus Retention	Ps	3704	gm yr^{-1}			
Predicted Lake Phosphorus Concentration	[P]	**0.0043**	mg L^{-1}			
Lake Phosphorus Outflow	Jo	11111	gm yr^{-1}			
Lake Mean Depth	z	0	m			
Lake Turnover Time	TT	0	yr			
Lake Flushing Rate	FR	#DIV/0!	times yr^{-1}			

Flat Lake (Area 13) - 1

Input Parameters	Symbol	Value	Units
Morphology			
Drainage Basin Area (Excl. of Lake Area)	Ad	52.0	ha
Area Land Use Category 1 (Forest)	Ad1	52.0	ha
Area Land Use Category 2 (Forest/Cleared)	Ad2	0.0	ha
Area Land Use Category 3 (Urban Exist)	Ad3	0.0	ha
Area Land Use Category 4 (Commercial Exist)	Ad4	0.0	ha
Area Land Use Category 5 (Industrial Exist)	Ad5	0.0	ha
Area Land Use Category 6 (Institutional Exist)	Ad6	0.0	ha
Area Land Use Category 7 (Urban BW)	Ad7	0.0	ha
Area Land Use Category 8 (Commercial BW)	Ad8	0.0	ha
Area Land Use Category 9 (Industrial BW)	Ad9	0.0	ha
Area Land Use Category 10 (Institutional BW)	Ad10	0.0	ha
Lake Surface Area	Ao	2.0	ha
Lake Volume	V	0.00	10^6 m^3
Hydrology			
Upstream Hydraulic Inputs	Qi	0	m^3 yr^{-1}
Annual Unit Precipitation	Pr	1.478	m yr^{-1}
Annual Unit Lake Evaporation	Ev	0.458	m yr^{-1}
Annual Unit Hydraulic Runoff - Veg. Surfaces	Ru	1.020	m yr^{-1}
Annual Unit Hydraulic Runoff - Urban	Ru	1.330	m yr^{-1}
P Loading			
Upstream P Input	Pi	0	gm P yr^{-1}
Annual Unit Atmospheric P Deposition	Da	0.0173	gm P m^{-2} yr^{-1}
Land Use Category 1 P Export Coefficient	E1	0.0069	gm P m^{-2} yr^{-1}
Land Use Category 2 P Export Coefficient	E2	0.0083	gm P m^{-2} yr^{-1}
Land Use Category 3 P Export Coefficient	E3	0.0520	gm P m^{-2} yr^{-1}
Land Use Category 4 P Export Coefficient	E4	0.0400	gm P m^{-2} yr^{-1}
Land Use Category 5 P Export Coefficient	E5	0.2020	gm P m^{-2} yr^{-1}
Land Use Category 6 P Export Coefficient	E6	0.0420	gm P m^{-2} yr^{-1}
Land Use Category 7 P Export Coefficient	E7	0.0520	gm P m^{-2} yr^{-1}
Land Use Category 8 P Export Coefficient	E8	0.0400	gm P m^{-2} yr^{-1}
Land Use Category 9 P Export Coefficient	E9	0.2020	gm P m^{-2} yr^{-1}
Land Use Category 10 P Export Coefficient	E10	0.0420	gm P m^{-2} yr^{-1}
Number of Dwellings	N_d	0	#
Average number of Persons per Dwelling	N_u	2.60	n/a
Average Fraction of Year Dwellings Occupied	N_{pc}	1	yr^{-1}
Phosphorus Load per Capita per Year	Sl	800	gm P cap^{-1} yr^{-1}
Septic System Retention Coefficient	Rsp	0.5	n/a
Point Source Input 1	PS1	0	
Point Source Input 2	PS2	0	
Point Source Input 3	PS3	0	
Point Source Input 4	PS4	0	
Point Source Input 5	PS5	0	
Phosphorus Retention Coefficient	v	12.4	n/a
Model Outputs			
Total Precipitation Hydraulic Input	P_{pti}	29560	m^3 yr^{-1}
Total Evaporation Hydraulic Loss	Eo	9160	m^3 yr^{-1}
Total Hydraulic Surface Run Off	Ql	530400	m^3 yr^{-1}
Total Hydraulic Input	Qt	559960	m^3 yr^{-1}
Areal Hydraulic Load	q_s	27.54	m yr^{-1}
Total Hydraulic Outflow	Qo	550800	m^3 yr^{-1}
Upstream P Input	Ju	0	gm yr^{-1}
Total Atmospheric P Input	Jd	346	gm yr^{-1}
Total Overland Run Off P Input	Je	3588	gm yr^{-1}
Total Development P Input	Jd	0	gm yr^{-1}
Total P Input	Jt	3934	gm yr^{-1}
Lake P Retention Factor	Rp	0.31	n/a
Lake Phosphorus Retention	Ps	1220	gm yr^{-1}
Predicted Lake Phosphorus Concentration	[P]	**0.0049**	mg L^{-1}
Lake Phosphorus Outflow	Jo	2714	gm yr^{-1}
Lake Mean Depth	z	0	m
Lake Turnover Time	TT	0	yr
Lake Flushing Rate	FR	#DIV/0!	times yr^{-1}
Lake Response Time	RT	#DIV/0!	yr

Hydraulic Budget (m^{-3})

		% Total
Upstream Inflow	0	0
Precipitation	29560	5.28
Surface Run Off	530400	94.72
Evaporation	-9160	1.64
Total Outflow	550800	98.36
Total Check		100.00

Phosphorus Budget (gm yr^{-1})

		% Total
Upstream Inflow	0	0
Atmosphere	346	8.80
Land Run Off	3588	91.20
Development	0	0.00
Sedimentation	-1220	31.01
Total Outflow	2714	68.99
Total Check		100.00

Model Validation

Pedicted P (mg L^{-1})		0.0049
Measured P (mg L^{-1})		0.0070
% Difference		-30.0

Little Cranberry Lake (Area 14A) - 1						
Input Parameters	**Symbol**	**Value**	**Units**	**Budgets**		
Morphology				**Hydraulic Budget (m^{-3})**		
Drainage Basin Area (Excl. of Lake Area)	Ad	20.4	ha			
Area Land Use Category 1 (Forest)	Ad1	20.4	ha			**% Total**
Area Land Use Category 2 (Forest/Cleared)	Ad2	0.0	ha	Upstream Inflow	0	0
Area Land Use Category 3 (Urban Exist)	Ad3	0.0	ha	Precipitation	23648	10.21
Area Land Use Category 4 (Commercial Exist)	Ad4	0.0	ha	Surface Run Off	208080	89.79
Area Land Use Category 5 (Industrial Exist)	Ad5	0.0	ha	Evaporation	-7328	3.16
Area Land Use Category 6 (Institutional Exist)	Ad6	0.0	ha	Total Outflow	224400	96.84
Area Land Use Category 7 (Urban BW)	Ad7	0.0	ha	Total Check		100.00
Area Land Use Category 8 (Commercial BW)	Ad8	0.0	ha			
Area Land Use Category 9 (Industrial BW)	Ad9	0.0	ha	**Phosphorus Budget (gm yr^{-1})**		
Area Land Use Category 10 (Institutional BW)	Ad10	0.0	ha			
Lake Surface Area	Ao	1.6	ha			**% Total**
Lake Volume	V	0.00	10^6 m^3	Upstream Inflow	0	0
Hydrology				Atmosphere	277	16.43
Upstream Hydraulic Inputs	Qi	0	m^3 yr^{-1}	Land Run Off	1408	83.56
Annual Unit Precipitation	Pr	1.478	m yr^{-1}	Development	0	0.00
Annual Unit Lake Evaporation	Ev	0.458	m yr^{-1}	Sedimentation	-792	47.00
Annual Unit Hydraulic Runoff - Veg. Surfaces	Ru	1.020	m yr^{-1}			
Annual Unit Hydraulic Runoff - Urban	Ru	1.330	m yr^{-1}	Total Outflow	893	53.00
P Loading				Total Check		99.99
Upstream P Input	Pi	0	gm P yr^{-1}			
Annual Unit Atmospheric P Deposition	Da	0.0173	gm P m^{-2} yr^{-1}			
Land Use Category 1 P Export Coefficient	E1	0.0069	gm P m^{-2} yr^{-1}	**Model Validation**		
Land Use Category 2 P Export Coefficient	E2	0.0083	gm P m^{-2} yr^{-1}			
Land Use Category 3 P Export Coefficient	E3	0.0520	gm P m^{-2} yr^{-1}			
Land Use Category 4 P Export Coefficient	E4	0.0400	gm P m^{-2} yr^{-1}	Pedicted P (mg L^{-1})		0.0040
Land Use Category 5 P Export Coefficient	E5	0.2020	gm P m^{-2} yr^{-1}	Measured P (mg L^{-1})		0.0066
Land Use Category 6 P Export Coefficient	E6	0.0420	gm P m^{-2} yr^{-1}	% Difference		-39.4
Land Use Category 7 P Export Coefficient	E7	0.0520	gm P m^{-2} yr^{-1}			
Land Use Category 8 P Export Coefficient	E8	0.0400	gm P m^{-2} yr^{-1}			
Land Use Category 9 P Export Coefficient	E9	0.2020	gm P m^{-2} yr^{-1}			
Land Use Category 10 P Export Coefficient	E10	0.0420	gm P m^{-2} yr^{-1}			
Number of Dwellings	N_d	0	#			
Average number of Persons per Dwelling	N_u	2.60	n/a			
Average Fraction of Year Dwellings Occupied	N_{pc}	1	yr^{-1}			
Phosphorus Load per Capita per Year	Sl	800	gm P cap^{-1} yr^{-1}			
Septic System Retention Coefficient	Rsp	0.5	n/a			
Point Source Input 1	PS1	0				
Point Source Input 2	PS2	0				
Point Source Input 3	PS3	0				
Point Source Input 4	PS4	0				
Point Source Input 5	PS5	0				
Phosphorus Retention Coefficient	v	12.4	n/a			
Model Outputs						
Total Precipitation Hydraulic Input	P_{pti}	23648	m^3 yr^{-1}			
Total Evaporation Hydraulic Loss	Eo	7328	m^3 yr^{-1}			
Total Hydraulic Surface Run Off	Ql	208080	m^3 yr^{-1}			
Total Hydraulic Input	Qt	231728	m^3 yr^{-1}			
Areal Hydraulic Load	q_s	14.03	m yr^{-1}			
Total Hydraulic Outflow	Qo	224400	m^3 yr^{-1}			
Upstream P Input	Ju	0	gm yr^{-1}			
Total Atmospheric P Input	Jd	277	gm yr^{-1}			
Total Overland Run Off P Input	Je	1408	gm yr^{-1}			
Total Development P Input	Jd	0	gm yr^{-1}			
Total P Input	Jt	1685	gm yr^{-1}			
Lake P Retention Factor	Rp	0.47	n/a			
Lake Phosphorus Retention	Ps	792	gm yr^{-1}			
Predicted Lake Phosphorus Concentration	[P]	**0.0040**	mg L^{-1}			
Lake Phosphorus Outflow	Jo	893	gm yr^{-1}			
Lake Mean Depth	z	0	m			
Lake Turnover Time	TT	0	yr			
Lake Flushing Rate	FR	#DIV/0!	times yr^{-1}			
Lake Response Time	RT	#DIV/0!	yr			

Big Cranberry Lake (Area 14B) - 1						
Input Parameters	**Symbol**	**Value**	**Units**	**Budgets**		
Morphology				**Hydraulic Budget (m^{-3})**		
Drainage Basin Area (Excl. of Lake Area)	Ad	22.6	ha			
Area Land Use Category 1 (Forest)	Ad1	22.6	ha			**% Total**
Area Land Use Category 2 (Forest/Cleared)	Ad2	0.0	ha	Upstream Inflow	3376200	91.95
Area Land Use Category 3 (Urban Exist)	Ad3	0.0	ha	Precipitation	65032	1.77
Area Land Use Category 4 (Commercial Exist)	Ad4	0.0	ha	Surface Run Off	230520	6.28
Area Land Use Category 5 (Industrial Exist)	Ad5	0.0	ha	Evaporation	-20152	0.55
Area Land Use Category 6 (Institutional Exist)	Ad6	0.0	ha	Total Outflow	3651600	99.45
Area Land Use Category 7 (Urban BW)	Ad7	0.0	ha	Total Check		100.00
Area Land Use Category 8 (Commercial BW)	Ad8	0.0	ha			
Area Land Use Category 9 (Industrial BW)	Ad9	0.0	ha	**Phosphorus Budget (gm yr^{-1})**		
Area Land Use Category 10 (Institutional BW)	Ad10	0.0	ha			
Lake Surface Area	Ao	4.4	ha			**% Total**
Lake Volume	V	0.00	10^6 m^3	Upstream Inflow	14718	86.38
Hydrology				Atmosphere	761	4.47
Upstream Hydraulic Inputs	Qi	3376200	m^3 yr^{-1}	Land Run Off	1559	9.15
Annual Unit Precipitation	Pr	1.478	m yr^{-1}	Development	0	0.00
Annual Unit Lake Evaporation	Ev	0.458	m yr^{-1}	Sedimentation	-2215	13.00
Annual Unit Hydraulic Runoff - Veg. Surfaces	Ru	1.020	m yr^{-1}			
Annual Unit Hydraulic Runoff - Urban	Ru	1.330	m yr^{-1}	Total Outflow	14823	87.00
P Loading				Total Check		100.00
Upstream P Input	Pi	14718	gm P yr^{-1}			
Annual Unit Atmospheric P Deposition	Da	0.0173	gm P m^{-2} yr^{-1}			
Land Use Category 1 P Export Coefficient	E1	0.0069	gm P m^{-2} yr^{-1}	**Model Validation**		
Land Use Category 2 P Export Coefficient	E2	0.0083	gm P m^{-2} yr^{-1}			
Land Use Category 3 P Export Coefficient	E3	0.0520	gm P m^{-2} yr^{-1}			
Land Use Category 4 P Export Coefficient	E4	0.0400	gm P m^{-2} yr^{-1}	Pedicted P (mg L^{-1})		0.0041
Land Use Category 5 P Export Coefficient	E5	0.2020	gm P m^{-2} yr^{-1}	Measured P (mg L^{-1})		0.0086
Land Use Category 6 P Export Coefficient	E6	0.0420	gm P m^{-2} yr^{-1}	% Difference		-52.3
Land Use Category 7 P Export Coefficient	E7	0.0520	gm P m^{-2} yr^{-1}			
Land Use Category 8 P Export Coefficient	E8	0.0400	gm P m^{-2} yr^{-1}			
Land Use Category 9 P Export Coefficient	E9	0.2020	gm P m^{-2} yr^{-1}			
Land Use Category 10 P Export Coefficient	E10	0.0420	gm P m^{-2} yr^{-1}			
Number of Dwellings	N_d	0	#			
Average number of Persons per Dwelling	N_u	2.60	n/a			
Average Fraction of Year Dwellings Occupied	N_{pc}	1	yr^{-1}			
Phosphorus Load per Capita per Year	Sl	800	gm P cap^{-1} yr^{-1}			
Septic System Retention Coefficient	Rsp	0.5	n/a			
Point Source Input 1	PS1	0				
Point Source Input 2	PS2	0				
Point Source Input 3	PS3	0				
Point Source Input 4	PS4	0				
Point Source Input 5	PS5	0				
Phosphorus Retention Coefficient	v	12.4	n/a			
Model Outputs						
Total Precipitation Hydraulic Input	P_{pti}	65032	m^3 yr^{-1}			
Total Evaporation Hydraulic Loss	Eo	20152	m^3 yr^{-1}			
Total Hydraulic Surface Run Off	Ql	230520	m^3 yr^{-1}			
Total Hydraulic Input	Qt	3671752	m^3 yr^{-1}			
Areal Hydraulic Load	q_s	82.99	m yr^{-1}			
Total Hydraulic Outflow	Qo	3651600	m^3 yr^{-1}			
Upstream P Input	Ju	14718	gm yr^{-1}			
Total Atmospheric P Input	Jd	761	gm yr^{-1}			
Total Overland Run Off P Input	Je	1559	gm yr^{-1}			
Total Development P Input	Jd	0	gm yr^{-1}			
Total P Input	Jt	17038	gm yr^{-1}			
Lake P Retention Factor	Rp	0.13	n/a			
Lake Phosphorus Retention	Ps	2215	gm yr^{-1}			
Predicted Lake Phosphorus Concentration	[P]	**0.0041**	mg L^{-1}			
Lake Phosphorus Outflow	Jo	14823	gm yr^{-1}			
Lake Mean Depth	z	0	m			
Lake Turnover Time	TT	0	yr			
Lake Flushing Rate	FR	#DIV/0!	times yr^{-1}			
Lake Response Time	RT	#DIV/0!	yr			

Crane Lake (Area 15) - 1

Input Parameters	Symbol	Value	Units
Morphology			
Drainage Basin Area (Excl. of Lake Area)	Ad	36.0	ha
Area Land Use Category 1 (Forest)	Ad1	36.0	ha
Area Land Use Category 2 (Forest/Cleared)	Ad2	0.0	ha
Area Land Use Category 3 (Urban Exist)	Ad3	0.0	ha
Area Land Use Category 4 (Commercial Exist)	Ad4	0.0	ha
Area Land Use Category 5 (Industrial Exist)	Ad5	0.0	ha
Area Land Use Category 6 (Institutional Exist)	Ad6	0.0	ha
Area Land Use Category 7 (Urban BW)	Ad7	0.0	ha
Area Land Use Category 8 (Commercial BW)	Ad8	0.0	ha
Area Land Use Category 9 (Industrial BW)	Ad9	0.0	ha
Area Land Use Category 10 (Institutional BW)	Ad10	0.0	ha
Lake Surface Area	Ao	12.0	ha
Lake Volume	V	0.00	10^6 m^3
Hydrology			
Upstream Hydraulic Inputs	Qi	0	m^3 yr^{-1}
Annual Unit Precipitation	Pr	1.478	m yr^{-1}
Annual Unit Lake Evaporation	Ev	0.458	m yr^{-1}
Annual Unit Hydraulic Runoff - Veg. Surfaces	Ru	1.020	m yr^{-1}
Annual Unit Hydraulic Runoff - Urban	Ru	1.330	m yr^{-1}
P Loading			
Upstream P Input	Pi	0	gm P yr^{-1}
Annual Unit Atmospheric P Deposition	Da	0.0173	gm P m^{-2} yr^{-1}
Land Use Category 1 P Export Coefficient	E1	0.0069	gm P m^{-2} yr^{-1}
Land Use Category 2 P Export Coefficient	E2	0.0083	gm P m^{-2} yr^{-1}
Land Use Category 3 P Export Coefficient	E3	0.0520	gm P m^{-2} yr^{-1}
Land Use Category 4 P Export Coefficient	E4	0.0400	gm P m^{-2} yr^{-1}
Land Use Category 5 P Export Coefficient	E5	0.2020	gm P m^{-2} yr^{-1}
Land Use Category 6 P Export Coefficient	E6	0.0420	gm P m^{-2} yr^{-1}
Land Use Category 7 P Export Coefficient	E7	0.0520	gm P m^{-2} yr^{-1}
Land Use Category 8 P Export Coefficient	E8	0.0400	gm P m^{-2} yr^{-1}
Land Use Category 9 P Export Coefficient	E9	0.2020	gm P m^{-2} yr^{-1}
Land Use Category 10 P Export Coefficient	E10	0.0420	gm P m^{-2} yr^{-1}
Number of Dwellings	N_d	0	#
Average number of Persons per Dwelling	N_u	2.60	n/a
Average Fraction of Year Dwellings Occupied	N_{pc}	1	yr^{-1}
Phosphorus Load per Capita per Year	Sl	800	gm P cap^{-1} yr^{-1}
Septic System Retention Coefficient	Rsp	0.5	n/a
Point Source Input 1	PS1	0	
Point Source Input 2	PS2	0	
Point Source Input 3	PS3	0	
Point Source Input 4	PS4	0	
Point Source Input 5	PS5	0	
Phosphorus Retention Coefficient	v	12.4	n/a
Model Outputs			
Total Precipitation Hydraulic Input	P_{pti}	177360	m^3 yr^{-1}
Total Evaporation Hydraulic Loss	Eo	54960	m^3 yr^{-1}
Total Hydraulic Surface Run Off	Ql	367200	m^3 yr^{-1}
Total Hydraulic Input	Qt	544560	m^3 yr^{-1}
Areal Hydraulic Load	q_s	4.08	m yr^{-1}
Total Hydraulic Outflow	Qo	489600	m^3 yr^{-1}
Upstream P Input	Ju	0	gm yr^{-1}
Total Atmospheric P Input	Jd	2076	gm yr^{-1}
Total Overland Run Off P Input	Je	2484	gm yr^{-1}
Total Development P Input	Jd	0	gm yr^{-1}
Total P Input	Jt	4560	gm yr^{-1}
Lake P Retention Factor	Rp	0.75	n/a
Lake Phosphorus Retention	Ps	3420	gm yr^{-1}
Predicted Lake Phosphorus Concentration	[P]	**0.0023**	mg L^{-1}
Lake Phosphorus Outflow	Jo	1140	gm yr^{-1}
Lake Mean Depth	z	0	m
Lake Turnover Time	TT	0	yr
Lake Flushing Rate	FR	#DIV/0!	times yr^{-1}
Lake Response Time	RT	#DIV/0!	yr

Hydraulic Budget (m^{-3})

		% Total
Upstream Inflow	0	0
Precipitation	177360	32.57
Surface Run Off	367200	67.43
Evaporation	-54960	10.09
Total Outflow	489600	89.91
Total Check		100.00

Phosphorus Budget (gm yr^{-1})

		% Total
Upstream Inflow	0	0
Atmosphere	2076	45.53
Land Run Off	2484	54.47
Development	0	0.00
Sedimentation	-3420	75.00
Total Outflow	1140	25.00
Total Check		100.00

Model Validation

Pedicted P (mg L^{-1})		0.0023
Measured P (mg L^{-1})		0.0034
% Difference		-32.4

Ash Lake (Area 16) - 1

Input Parameters	Symbol	Value	Units	Budgets		
Morphology				**Hydraulic Budget (m^{-3})**		
Drainage Basin Area (Excl. of Lake Area)	Ad	118.0	ha			
Area Land Use Category 1 (Forest)	Ad1	118.0	ha			**% Total**
Area Land Use Category 2 (Forest/Cleared)	Ad2	0.0	ha	Upstream Inflow	0	0
Area Land Use Category 3 (Urban Exist)	Ad3	0.0	ha	Precipitation	443400	26.92
Area Land Use Category 4 (Commercial Exist)	Ad4	0.0	ha	Surface Run Off	1203600	73.08
Area Land Use Category 5 (Industrial Exist)	Ad5	0.0	ha	Evaporation	-137400	8.34
Area Land Use Category 6 (Institutional Exist)	Ad6	0.0	ha	Total Outflow	1509600	91.66
Area Land Use Category 7 (Urban BW)	Ad7	0.0	ha	Total Check		100.00
Area Land Use Category 8 (Commercial BW)	Ad8	0.0	ha			
Area Land Use Category 9 (Industrial BW)	Ad9	0.0	ha	**Phosphorus Budget (gm yr^{-1})**		
Area Land Use Category 10 (Institutional BW)	Ad10	0.0	ha			
Lake Surface Area	Ao	30.0	ha			**% Total**
Lake Volume	V	0.00	10^6 m^3	Upstream Inflow	0	0
Hydrology				Atmosphere	5190	38.93
Upstream Hydraulic Inputs	Qi	0	m^3 yr^{-1}	Land Run Off	8142	61.07
Annual Unit Precipitation	Pr	1.478	m yr^{-1}	Development	0	0.00
Annual Unit Lake Evaporation	Ev	0.458	m yr^{-1}	Sedimentation	-9466	71.00
Annual Unit Hydraulic Runoff - Veg. Surfaces	Ru	1.020	m yr^{-1}			
Annual Unit Hydraulic Runoff - Urban	Ru	1.330	m yr^{-1}	Total Outflow	3866	29.00
P Loading				Total Check		100.00
Upstream P Input	Pi	0	gm P yr^{-1}			
Annual Unit Atmospheric P Deposition	Da	0.0173	gm P m^{-2} yr^{-1}			
Land Use Category 1 P Export Coefficient	E1	0.0069	gm P m^{-2} yr^{-1}	**Model Validation**		
Land Use Category 2 P Export Coefficient	E2	0.0083	gm P m^{-2} yr^{-1}			
Land Use Category 3 P Export Coefficient	E3	0.0520	gm P m^{-2} yr^{-1}			
Land Use Category 4 P Export Coefficient	E4	0.0400	gm P m^{-2} yr^{-1}	Pedicted P (mg L^{-1})		0.0026
Land Use Category 5 P Export Coefficient	E5	0.2020	gm P m^{-2} yr^{-1}	Measured P (mg L^{-1})		0.0022
Land Use Category 6 P Export Coefficient	E6	0.0420	gm P m^{-2} yr^{-1}	% Difference		18.2
Land Use Category 7 P Export Coefficient	E7	0.0520	gm P m^{-2} yr^{-1}			
Land Use Category 8 P Export Coefficient	E8	0.0400	gm P m^{-2} yr^{-1}			
Land Use Category 9 P Export Coefficient	E9	0.2020	gm P m^{-2} yr^{-1}			
Land Use Category 10 P Export Coefficient	E10	0.0420	gm P m^{-2} yr^{-1}			
Number of Dwellings	N_d	0	#			
Average number of Persons per Dwelling	N_u	2.60	n/a			
Average Fraction of Year Dwellings Occupied	N_{pc}	1	yr^{-1}			
Phosphorus Load per Capita per Year	Sl	800	gm P cap^{-1} yr^{-1}			
Septic System Retention Coefficient	Rsp	0.5	n/a			
Point Source Input 1	PS1	0				
Point Source Input 2	PS2	0				
Point Source Input 3	PS3	0				
Point Source Input 4	PS4	0				
Point Source Input 5	PS5	0				
Phosphorus Retention Coefficient	v	12.4	n/a			
Model Outputs						
Total Precipitation Hydraulic Input	P_{pti}	443400	m^3 yr^{-1}			
Total Evaporation Hydraulic Loss	Eo	137400	m^3 yr^{-1}			
Total Hydraulic Surface Run Off	Ql	1203600	m^3 yr^{-1}			
Total Hydraulic Input	Qt	1647000	m^3 yr^{-1}			
Areal Hydraulic Load	q_s	5.03	m yr^{-1}			
Total Hydraulic Outflow	Qo	1509600	m^3 yr^{-1}			
Upstream P Input	Ju	0	gm yr^{-1}			
Total Atmospheric P Input	Jd	5190	gm yr^{-1}			
Total Overland Run Off P Input	Je	8142	gm yr^{-1}			
Total Development P Input	Jd	0	gm yr^{-1}			
Total P Input	Jt	13332	gm yr^{-1}			
Lake P Retention Factor	Rp	0.71	n/a			
Lake Phosphorus Retention	Ps	9466	gm yr^{-1}			
Predicted Lake Phosphorus Concentration	[P]	**0.0026**	mg L^{-1}			
Lake Phosphorus Outflow	Jo	3866	gm yr^{-1}			
Lake Mean Depth	z	0	m			
Lake Turnover Time	TT	0	yr			
Lake Flushing Rate	FR	#DIV/0!	times yr^{-1}			
Lake Response Time	RT	#DIV/0!	yr			

Fox Lake (Area 17) - 1						
Input Parameters	**Symbol**	**Value**	**Units**	**Budgets**		
Morphology				**Hydraulic Budget (m^{-3})**		
Drainage Basin Area (Excl. of Lake Area)	Ad	77.0	ha			
Area Land Use Category 1 (Forest)	Ad1	77.0	ha			**% Total**
Area Land Use Category 2 (Forest/Cleared)	Ad2	0.0	ha	Upstream Inflow	0	0
Area Land Use Category 3 (Urban Exist)	Ad3	0.0	ha	Precipitation	236480	23.14
Area Land Use Category 4 (Commercial Exist)	Ad4	0.0	ha	Surface Run Off	785400	76.86
Area Land Use Category 5 (Industrial Exist)	Ad5	0.0	ha	Evaporation	-73280	7.17
Area Land Use Category 6 (Institutional Exist)	Ad6	0.0	ha	Total Outflow	948600	92.83
Area Land Use Category 7 (Urban BW)	Ad7	0.0	ha	Total Check		100.00
Area Land Use Category 8 (Commercial BW)	Ad8	0.0	ha			
Area Land Use Category 9 (Industrial BW)	Ad9	0.0	ha	**Phosphorus Budget (gm yr^{-1})**		
Area Land Use Category 10 (Institutional BW)	Ad10	0.0	ha			
Lake Surface Area	Ao	16.0	ha			**% Total**
Lake Volume	V	0.00	10^6 m^3	Upstream Inflow	0	0
Hydrology				Atmosphere	2768	34.25
Upstream Hydraulic Inputs	Qi	0	m^3 yr^{-1}	Land Run Off	5313	65.75
Annual Unit Precipitation	Pr	1.478	m yr^{-1}	Development	0	0.00
Annual Unit Lake Evaporation	Ev	0.458	m yr^{-1}	Sedimentation	-5495	68.00
Annual Unit Hydraulic Runoff - Veg. Surfaces	Ru	1.020	m yr^{-1}			
Annual Unit Hydraulic Runoff - Urban	Ru	1.330	m yr^{-1}	Total Outflow	2586	32.00
P Loading				Total Check		100.00
Upstream P Input	Pi	0	gm P yr^{-1}			
Annual Unit Atmospheric P Deposition	Da	0.0173	gm P m^{-2} yr^{-1}			
Land Use Category 1 P Export Coefficient	E1	0.0069	gm P m^{-2} yr^{-1}	**Model Validation**		
Land Use Category 2 P Export Coefficient	E2	0.0083	gm P m^{-2} yr^{-1}			
Land Use Category 3 P Export Coefficient	E3	0.0520	gm P m^{-2} yr^{-1}			
Land Use Category 4 P Export Coefficient	E4	0.0400	gm P m^{-2} yr^{-1}	Pedicted P (mg L^{-1})		0.0027
Land Use Category 5 P Export Coefficient	E5	0.2020	gm P m^{-2} yr^{-1}	Measured P (mg L^{-1})		0.0031
Land Use Category 6 P Export Coefficient	E6	0.0420	gm P m^{-2} yr^{-1}	% Difference		-12.9
Land Use Category 7 P Export Coefficient	E7	0.0520	gm P m^{-2} yr^{-1}			
Land Use Category 8 P Export Coefficient	E8	0.0400	gm P m^{-2} yr^{-1}			
Land Use Category 9 P Export Coefficient	E9	0.2020	gm P m^{-2} yr^{-1}			
Land Use Category 10 P Export Coefficient	E10	0.0420	gm P m^{-2} yr^{-1}			
Number of Dwellings	N_d	0	#			
Average number of Persons per Dwelling	N_u	2.60	n/a			
Average Fraction of Year Dwellings Occupied	N_{pc}	1	yr^{-1}			
Phosphorus Load per Capita per Year	Sl	800	gm P cap^{-1} yr^{-1}			
Septic System Retention Coefficient	Rsp	0.5	n/a			
Point Source Input 1	PS1	0				
Point Source Input 2	PS2	0				
Point Source Input 3	PS3	0				
Point Source Input 4	PS4	0				
Point Source Input 5	PS5	0				
Phosphorus Retention Coefficient	v	12.4	n/a			
Model Outputs						
Total Precipitation Hydraulic Input	P_{pti}	236480	m^3 yr^{-1}			
Total Evaporation Hydraulic Loss	Eo	73280	m^3 yr^{-1}			
Total Hydraulic Surface Run Off	Ql	785400	m^3 yr^{-1}			
Total Hydraulic Input	Qt	1021880	m^3 yr^{-1}			
Areal Hydraulic Load	q_s	5.93	m yr^{-1}			
Total Hydraulic Outflow	Qo	948600	m^3 yr^{-1}			
Upstream P Input	Ju	0	gm yr^{-1}			
Total Atmospheric P Input	Jd	2768	gm yr^{-1}			
Total Overland Run Off P Input	Je	5313	gm yr^{-1}			
Total Development P Input	Jd	0	gm yr^{-1}			
Total P Input	Jt	8081	gm yr^{-1}			
Lake P Retention Factor	Rp	0.68	n/a			
Lake Phosphorus Retention	Ps	5495	gm yr^{-1}			
Predicted Lake Phosphorus Concentration	[P]	**0.0027**	mg L^{-1}			
Lake Phosphorus Outflow	Jo	2586	gm yr^{-1}			
Lake Mean Depth	z	0	m			
Lake Turnover Time	TT	0	yr			
Lake Flushing Rate	FR	#DIV/0!	times yr^{-1}			
Lake Response Time	RT	#DIV/0!	yr			

Susies Lake (Area 18A) - 1						
Input Parameters	**Symbol**	**Value**	**Units**	**Budgets**		
Morphology				**Hydraulic Budget (m^{-3})**		
Drainage Basin Area (Excl. of Lake Area)	Ad	539.4	ha			
Area Land Use Category 1 (Forest)	Ad1	393.4	ha			**% Total**
Area Land Use Category 2 (Forest/Cleared)	Ad2	0.0	ha	Upstream Inflow	5650800	44.16
Area Land Use Category 3 (Urban Exist)	Ad3	0.0	ha	Precipitation	1191268	9.31
Area Land Use Category 4 (Commercial Exist)	Ad4	81.0	ha	Surface Run Off	5954480	46.53
Area Land Use Category 5 (Industrial Exist)	Ad5	65.0	ha	Evaporation	-369148	2.88
Area Land Use Category 6 (Institutional Exist)	Ad6	0.0	ha	Total Outflow	12427400	97.12
Area Land Use Category 7 (Urban BW)	Ad7	0.0	ha	Total Check		100.00
Area Land Use Category 8 (Commercial BW)	Ad8	0.0	ha			
Area Land Use Category 9 (Industrial BW)	Ad9	0.0	ha	**Phosphorus Budget (gm yr^{-1})**		
Area Land Use Category 10 (Institutional BW)	Ad10	0.0	ha			
Lake Surface Area	Ao	80.6	ha			**% Total**
Lake Volume	V	2.61	10^6 m^3	Upstream Inflow	19829	8.83
Hydrology				Atmosphere	13944	6.21
Upstream Hydraulic Inputs	Qi	5650800	m^3 yr^{-1}	Land Run Off	190845	84.96
Annual Unit Precipitation	Pr	1.478	m yr^{-1}	Development	0	0.00
Annual Unit Lake Evaporation	Ev	0.458	m yr^{-1}	Sedimentation	-101078	45.00
Annual Unit Hydraulic Runoff - Veg. Surfaces	Ru	1.020	m yr^{-1}			
Annual Unit Hydraulic Runoff - Urban	Ru	1.330	m yr^{-1}	Total Outflow	123540	55.00
P Loading				Total Check		100.00
Upstream P Input	Pi	19829	gm P yr^{-1}			
Annual Unit Atmospheric P Deposition	Da	0.0173	gm P m^{-2} yr^{-1}			
Land Use Category 1 P Export Coefficient	E1	0.0069	gm P m^{-2} yr^{-1}	**Model Validation**		
Land Use Category 2 P Export Coefficient	E2	0.0083	gm P m^{-2} yr^{-1}			
Land Use Category 3 P Export Coefficient	E3	0.0520	gm P m^{-2} yr^{-1}			
Land Use Category 4 P Export Coefficient	E4	0.0400	gm P m^{-2} yr^{-1}	Pedicted P (mg L^{-1})		0.0099
Land Use Category 5 P Export Coefficient	E5	0.2020	gm P m^{-2} yr^{-1}	Measured P (mg L^{-1})		0.0072
Land Use Category 6 P Export Coefficient	E6	0.0420	gm P m^{-2} yr^{-1}	% Difference		37.5
Land Use Category 7 P Export Coefficient	E7	0.0520	gm P m^{-2} yr^{-1}			
Land Use Category 8 P Export Coefficient	E8	0.0400	gm P m^{-2} yr^{-1}			
Land Use Category 9 P Export Coefficient	E9	0.2020	gm P m^{-2} yr^{-1}			
Land Use Category 10 P Export Coefficient	E10	0.0420	gm P m^{-2} yr^{-1}			
Number of Dwellings	N_d	0	#			
Average number of Persons per Dwelling	N_u	2.60	n/a			
Average Fraction of Year Dwellings Occupied	N_{pc}	1	yr^{-1}			
Phosphorus Load per Capita per Year	Sl	800	gm P cap^{-1} yr^{-1}			
Septic System Retention Coefficient	Rsp	0.5	n/a			
Point Source Input 1	PS1	0				
Point Source Input 2	PS2	0				
Point Source Input 3	PS3	0				
Point Source Input 4	PS4	0				
Point Source Input 5	PS5	0				
Phosphorus Retention Coefficient	v	12.4	n/a			
Model Outputs						
Total Precipitation Hydraulic Input	P_{pti}	1191268	m^3 yr^{-1}			
Total Evaporation Hydraulic Loss	Eo	369148	m^3 yr^{-1}			
Total Hydraulic Surface Run Off	Ql	5954480	m^3 yr^{-1}			
Total Hydraulic Input	Qt	12796548	m^3 yr^{-1}			
Areal Hydraulic Load	q_s	15.42	m yr^{-1}			
Total Hydraulic Outflow	Qo	12427400	m^3 yr^{-1}			
Upstream P Input	Ju	19829	gm yr^{-1}			
Total Atmospheric P Input	Jd	13944	gm yr^{-1}			
Total Overland Run Off P Input	Je	190845	gm yr^{-1}			
Total Development P Input	Jd	0	gm yr^{-1}			
Total P Input	Jt	224618	gm yr^{-1}			
Lake P Retention Factor	Rp	0.45	n/a			
Lake Phosphorus Retention	Ps	101078	gm yr^{-1}			
Predicted Lake Phosphorus Concentration	[P]	**0.0099**	mg L^{-1}			
Lake Phosphorus Outflow	Jo	123540	gm yr^{-1}			
Lake Mean Depth	z	3.2	m			
Lake Turnover Time	TT	0.21	yr			
Lake Flushing Rate	FR	4.77	times yr^{-1}			
Lake Response Time	RT	0.09	yr			

Quarry Lake (Area 18B) - 1						
Input Parameters	**Symbol**	**Value**	**Units**	**Budgets**		
Morphology				**Hydraulic Budget (m^{-3})**		
Drainage Basin Area (Excl. of Lake Area)	Ad	137.9	ha			
Area Land Use Category 1 (Forest)	Ad1	137.9	ha			**% Total**
Area Land Use Category 2 (Forest/Cleared)	Ad2	0.0	ha	Upstream Inflow	13376000	86.58
Area Land Use Category 3 (Urban Exist)	Ad3	0.0	ha	Precipitation	666578	4.31
Area Land Use Category 4 (Commercial Exist)	Ad4	0.0	ha	Surface Run Off	1406580	9.1
Area Land Use Category 5 (Industrial Exist)	Ad5	0.0	ha	Evaporation	-206558	1.34
Area Land Use Category 6 (Institutional Exist)	Ad6	0.0	ha	Total Outflow	15242600	98.66
Area Land Use Category 7 (Urban BW)	Ad7	0.0	ha	Total Check		99.99
Area Land Use Category 8 (Commercial BW)	Ad8	0.0	ha			
Area Land Use Category 9 (Industrial BW)	Ad9	0.0	ha	**Phosphorus Budget (gm yr^{-1})**		
Area Land Use Category 10 (Institutional BW)	Ad10	0.0	ha			
Lake Surface Area	Ao	45.1	ha			**% Total**
Lake Volume	V	1.60	10^6 m^3	Upstream Inflow	126126	87.93
Hydrology				Atmosphere	7802	5.44
Upstream Hydraulic Inputs	Qi	13376000	m^3 yr^{-1}	Land Run Off	9515	6.63
Annual Unit Precipitation	Pr	1.478	m yr^{-1}	Development	0	0.00
Annual Unit Lake Evaporation	Ev	0.458	m yr^{-1}	Sedimentation	-38730	27.00
Annual Unit Hydraulic Runoff - Veg. Surfaces	Ru	1.020	m yr^{-1}			
Annual Unit Hydraulic Runoff - Urban	Ru	1.330	m yr^{-1}	Total Outflow	104713	73.00
P Loading				Total Check		100.00
Upstream P Input	Pi	126126	gm P yr^{-1}			
Annual Unit Atmospheric P Deposition	Da	0.0173	gm P m^{-2} yr^{-1}			
Land Use Category 1 P Export Coefficient	E1	0.0069	gm P m^{-2} yr^{-1}	**Model Validation**		
Land Use Category 2 P Export Coefficient	E2	0.0083	gm P m^{-2} yr^{-1}			
Land Use Category 3 P Export Coefficient	E3	0.0520	gm P m^{-2} yr^{-1}			
Land Use Category 4 P Export Coefficient	E4	0.0400	gm P m^{-2} yr^{-1}	Pedicted P (mg L^{-1})		0.0069
Land Use Category 5 P Export Coefficient	E5	0.2020	gm P m^{-2} yr^{-1}	Measured P (mg L^{-1})		0.0056
Land Use Category 6 P Export Coefficient	E6	0.0420	gm P m^{-2} yr^{-1}	% Difference		23.2
Land Use Category 7 P Export Coefficient	E7	0.0520	gm P m^{-2} yr^{-1}			
Land Use Category 8 P Export Coefficient	E8	0.0400	gm P m^{-2} yr^{-1}			
Land Use Category 9 P Export Coefficient	E9	0.2020	gm P m^{-2} yr^{-1}			
Land Use Category 10 P Export Coefficient	E10	0.0420	gm P m^{-2} yr^{-1}			
Number of Dwellings	N_d	0	#			
Average number of Persons per Dwelling	N_u	2.60	n/a			
Average Fraction of Year Dwellings Occupied	N_{pc}	1	yr^{-1}			
Phosphorus Load per Capita per Year	Sl	800	gm P cap^{-1} yr^{-1}			
Septic System Retention Coefficient	Rsp	0.5	n/a			
Point Source Input 1	PS1	0				
Point Source Input 2	PS2	0				
Point Source Input 3	PS3	0				
Point Source Input 4	PS4	0				
Point Source Input 5	PS5	0				
Phosphorus Retention Coefficient	v	12.4	n/a			
Model Outputs						
Total Precipitation Hydraulic Input	Ppt_i	666578	m^3 yr^{-1}			
Total Evaporation Hydraulic Loss	Eo	206558	m^3 yr^{-1}			
Total Hydraulic Surface Run Off	Ql	1406580	m^3 yr^{-1}			
Total Hydraulic Input	Qt	15449158	m^3 yr^{-1}			
Areal Hydraulic Load	q_s	33.8	m yr^{-1}			
Total Hydraulic Outflow	Qo	15242600	m^3 yr^{-1}			
Upstream P Input	Ju	126126	gm yr^{-1}			
Total Atmospheric P Input	Jd	7802	gm yr^{-1}			
Total Overland Run Off P Input	Je	9515	gm yr^{-1}			
Total Development P Input	Jd	0	gm yr^{-1}			
Total P Input	Jt	143443	gm yr^{-1}			
Lake P Retention Factor	Rp	0.27	n/a			
Lake Phosphorus Retention	Ps	38730	gm yr^{-1}			
Predicted Lake Phosphorus Concentration	[P]	**0.0069**	mg L^{-1}			
Lake Phosphorus Outflow	Jo	104713	gm yr^{-1}			
Lake Mean Depth	z	3.5	m			
Lake Turnover Time	TT	0.1	yr			
Lake Flushing Rate	FR	9.56	times yr^{-1}			
Lake Response Time	RT	0.06	yr			

Belchers Pond (Area 21) - 1

Input Parameters	Symbol	Value	Units
Morphology			
Drainage Basin Area (Excl. of Lake Area)	Ad	90.5	ha
Area Land Use Category 1 (Forest)	Ad1	1.5	ha
Area Land Use Category 2 (Forest/Cleared)	Ad2	0.0	ha
Area Land Use Category 3 (Urban Exist)	Ad3	89.0	ha
Area Land Use Category 4 (Commercial Exist)	Ad4	0.0	ha
Area Land Use Category 5 (Industrial Exist)	Ad5	0.0	ha
Area Land Use Category 6 (Institutional Exist)	Ad6	0.0	ha
Area Land Use Category 7 (Urban BW)	Ad7	0.0	ha
Area Land Use Category 8 (Commercial BW)	Ad8	0.0	ha
Area Land Use Category 9 (Industrial BW)	Ad9	0.0	ha
Area Land Use Category 10 (Institutional BW)	Ad10	0.0	ha
Lake Surface Area	Ao	2.5	ha
Lake Volume	V	0.00	10^6 m^3
Hydrology			
Upstream Hydraulic Inputs	Qi	0	m^3 yr^{-1}
Annual Unit Precipitation	Pr	1.478	m yr^{-1}
Annual Unit Lake Evaporation	Ev	0.458	m yr^{-1}
Annual Unit Hydraulic Runoff - Veg. Surfaces	Ru	1.020	m yr^{-1}
Annual Unit Hydraulic Runoff - Urban	Ru	1.330	m yr^{-1}
P Loading			
Upstream P Input	Pi	0	gm P yr^{-1}
Annual Unit Atmospheric P Deposition	Da	0.0173	gm P m^{-2} yr^{-1}
Land Use Category 1 P Export Coefficient	E1	0.0069	gm P m^{-2} yr^{-1}
Land Use Category 2 P Export Coefficient	E2	0.0083	gm P m^{-2} yr^{-1}
Land Use Category 3 P Export Coefficient	E3	0.0520	gm P m^{-2} yr^{-1}
Land Use Category 4 P Export Coefficient	E4	0.0400	gm P m^{-2} yr^{-1}
Land Use Category 5 P Export Coefficient	E5	0.2020	gm P m^{-2} yr^{-1}
Land Use Category 6 P Export Coefficient	E6	0.0420	gm P m^{-2} yr^{-1}
Land Use Category 7 P Export Coefficient	E7	0.0520	gm P m^{-2} yr^{-1}
Land Use Category 8 P Export Coefficient	E8	0.0400	gm P m^{-2} yr^{-1}
Land Use Category 9 P Export Coefficient	E9	0.2020	gm P m^{-2} yr^{-1}
Land Use Category 10 P Export Coefficient	E10	0.0420	gm P m^{-2} yr^{-1}
Number of Dwellings	N_d	0	#
Average number of Persons per Dwelling	N_u	2.60	n/a
Average Fraction of Year Dwellings Occupied	N_{pc}	1	yr^{-1}
Phosphorus Load per Capita per Year	Sl	800	gm P cap^{-1} yr^{-1}
Septic System Retention Coefficient	Rsp	0.5	n/a
Point Source Input 1	PS1	0	
Point Source Input 2	PS2	0	
Point Source Input 3	PS3	0	
Point Source Input 4	PS4	0	
Point Source Input 5	PS5	0	
Phosphorus Retention Coefficient	v	12.4	n/a
Model Outputs			
Total Precipitation Hydraulic Input	Ppti	36950	m^3 yr^{-1}
Total Evaporation Hydraulic Loss	Eo	11450	m^3 yr^{-1}
Total Hydraulic Surface Run Off	Ql	1199000	m^3 yr^{-1}
Total Hydraulic Input	Qt	1235950	m^3 yr^{-1}
Areal Hydraulic Load	q_s	48.98	m yr^{-1}
Total Hydraulic Outflow	Qo	1224500	m^3 yr^{-1}
Upstream P Input	Ju	0	gm yr^{-1}
Total Atmospheric P Input	Jd	433	gm yr^{-1}
Total Overland Run Off P Input	Je	46384	gm yr^{-1}
Total Development P Input	Jd	0	gm yr^{-1}
Total P Input	Jt	46817	gm yr^{-1}
Lake P Retention Factor	Rp	0.2	n/a
Lake Phosphorus Retention	Ps	9363	gm yr^{-1}
Predicted Lake Phosphorus Concentration	[P]	**0.0306**	mg L^{-1}
Lake Phosphorus Outflow	Jo	37454	gm yr^{-1}
Lake Mean Depth	z	0	m
Lake Turnover Time	TT	0	yr
Lake Flushing Rate	FR	#DIV/0!	times yr^{-1}
Lake Response Time	RT	#DIV/0!	yr

Hydraulic Budget (m^{-3})

		% Total
Upstream Inflow	0	0
Precipitation	36950	2.99
Surface Run Off	1199000	97.01
Evaporation	-11450	0.93
Total Outflow	1224500	99.07
Total Check		100.00

Phosphorus Budget (gm yr^{-1})

		% Total
Upstream Inflow	0	0
Atmosphere	433	0.92
Land Run Off	46384	99.08
Development	0	0.00
Sedimentation	-9363	20.00
Total Outflow	37454	80.00
Total Check		100.00

Model Validation

Pedicted P (mg L^{-1})	0.0306
Measured P (mg L^{-1})	0.0076
% Difference	302.6

Charlies Lake (Area 22) - 1						
Input Parameters	**Symbol**	**Value**	**Units**	**Budgets**		
Morphology				**Hydraulic Budget (m^{-3})**		
Drainage Basin Area (Excl. of Lake Area)	Ad	39.0	ha			
Area Land Use Category 1 (Forest)	Ad1	39.0	ha			**% Total**
Area Land Use Category 2 (Forest/Cleared)	Ad2	0.0	ha	Upstream Inflow	0	0
Area Land Use Category 3 (Urban Exist)	Ad3	0.0	ha	Precipitation	88680	18.23
Area Land Use Category 4 (Commercial Exist)	Ad4	0.0	ha	Surface Run Off	397800	81.77
Area Land Use Category 5 (Industrial Exist)	Ad5	0.0	ha	Evaporation	-27480	5.65
Area Land Use Category 6 (Institutional Exist)	Ad6	0.0	ha	Total Outflow	459000	94.35
Area Land Use Category 7 (Urban BW)	Ad7	0.0	ha	Total Check		100.00
Area Land Use Category 8 (Commercial BW)	Ad8	0.0	ha			
Area Land Use Category 9 (Industrial BW)	Ad9	0.0	ha	**Phosphorus Budget (gm yr^{-1})**		
Area Land Use Category 10 (Institutional BW)	Ad10	0.0	ha			
Lake Surface Area	Ao	6.0	ha			**% Total**
Lake Volume	V	0.00	10^6 m^3	Upstream Inflow	0	0
Hydrology				Atmosphere	1038	27.84
Upstream Hydraulic Inputs	Qi	0	m^3 yr^{-1}	Land Run Off	2691	72.16
Annual Unit Precipitation	Pr	1.478	m yr^{-1}	Development	0	0.00
Annual Unit Lake Evaporation	Ev	0.458	m yr^{-1}	Sedimentation	-2312	62.00
Annual Unit Hydraulic Runoff - Veg. Surfaces	Ru	1.020	m yr^{-1}			
Annual Unit Hydraulic Runoff - Urban	Ru	1.330	m yr^{-1}	Total Outflow	1417	38.00
P Loading				Total Check		100.00
Upstream P Input	Pi	0	gm P yr^{-1}			
Annual Unit Atmospheric P Deposition	Da	0.0173	gm P m^{-2} yr^{-1}			
Land Use Category 1 P Export Coefficient	E1	0.0069	gm P m^{-2} yr^{-1}	**Model Validation**		
Land Use Category 2 P Export Coefficient	E2	0.0083	gm P m^{-2} yr^{-1}			
Land Use Category 3 P Export Coefficient	E3	0.0520	gm P m^{-2} yr^{-1}			
Land Use Category 4 P Export Coefficient	E4	0.0400	gm P m^{-2} yr^{-1}	Pedicted P (mg L^{-1})		0.0031
Land Use Category 5 P Export Coefficient	E5	0.2020	gm P m^{-2} yr^{-1}	Measured P (mg L^{-1})		0.0035
Land Use Category 6 P Export Coefficient	E6	0.0420	gm P m^{-2} yr^{-1}	% Difference		-11.4
Land Use Category 7 P Export Coefficient	E7	0.0520	gm P m^{-2} yr^{-1}			
Land Use Category 8 P Export Coefficient	E8	0.0400	gm P m^{-2} yr^{-1}			
Land Use Category 9 P Export Coefficient	E9	0.2020	gm P m^{-2} yr^{-1}			
Land Use Category 10 P Export Coefficient	E10	0.0420	gm P m^{-2} yr^{-1}			
Number of Dwellings	N_d	0	#			
Average number of Persons per Dwelling	N_u	2.60	n/a			
Average Fraction of Year Dwellings Occupied	N_{pc}	1	yr^{-1}			
Phosphorus Load per Capita per Year	Sl	800	gm P cap^{-1} yr^{-1}			
Septic System Retention Coefficient	Rsp	0.5	n/a			
Point Source Input 1	PS1	0				
Point Source Input 2	PS2	0				
Point Source Input 3	PS3	0				
Point Source Input 4	PS4	0				
Point Source Input 5	PS5	0				
Phosphorus Retention Coefficient	v	12.4	n/a			
Model Outputs						
Total Precipitation Hydraulic Input	P_{pti}	88680	m^3 yr^{-1}			
Total Evaporation Hydraulic Loss	Eo	27480	m^3 yr^{-1}			
Total Hydraulic Surface Run Off	Ql	397800	m^3 yr^{-1}			
Total Hydraulic Input	Qt	486480	m^3 yr^{-1}			
Areal Hydraulic Load	q_s	7.65	m yr^{-1}			
Total Hydraulic Outflow	Qo	459000	m^3 yr^{-1}			
Upstream P Input	Ju	0	gm yr^{-1}			
Total Atmospheric P Input	Jd	1038	gm yr^{-1}			
Total Overland Run Off P Input	Je	2691	gm yr^{-1}			
Total Development P Input	Jd	0	gm yr^{-1}			
Total P Input	Jt	3729	gm yr^{-1}			
Lake P Retention Factor	Rp	0.62	n/a			
Lake Phosphorus Retention	Ps	2312	gm yr^{-1}			
Predicted Lake Phosphorus Concentration	[P]	**0.0031**	mg L^{-1}			
Lake Phosphorus Outflow	Jo	1417	gm yr^{-1}			
Lake Mean Depth	z	0	m			
Lake Turnover Time	TT	0	yr			
Lake Flushing Rate	FR	#DIV/0!	times yr^{-1}			
Lake Response Time	RT	#DIV/0!	yr			

Washmill Lake (Area 23) - 1						
Input Parameters	**Symbol**	**Value**	**Units**	**Budgets**		
Morphology				**Hydraulic Budget (m^{-3})**		
Drainage Basin Area (Excl. of Lake Area)	Ad	231.8	ha			
Area Land Use Category 1 (Forest)	Ad1	177.8	ha			**% Total**
Area Land Use Category 2 (Forest/Cleared)	Ad2	0.0	ha	Upstream Inflow	16926100	86.45
Area Land Use Category 3 (Urban Exist)	Ad3	54.0	ha	Precipitation	121196	0.62
Area Land Use Category 4 (Commercial Exist)	Ad4	0.0	ha	Surface Run Off	2531760	12.93
Area Land Use Category 5 (Industrial Exist)	Ad5	0.0	ha	Evaporation	-37556	0.19
Area Land Use Category 6 (Institutional Exist)	Ad6	0.0	ha	Total Outflow	19541500	99.81
Area Land Use Category 7 (Urban BW)	Ad7	0.0	ha	Total Check		100.00
Area Land Use Category 8 (Commercial BW)	Ad8	0.0	ha			
Area Land Use Category 9 (Industrial BW)	Ad9	0.0	ha	**Phosphorus Budget (gm yr^{-1})**		
Area Land Use Category 10 (Institutional BW)	Ad10	0.0	ha			
Lake Surface Area	Ao	8.2	ha			**% Total**
Lake Volume	V	0.2025	10^6 m^3	Upstream Inflow	143584	77.47
Hydrology				Atmosphere	1419	0.77
Upstream Hydraulic Inputs	Qi	16926100	m^3 yr^{-1}	Land Run Off	40348	21.77
Annual Unit Precipitation	Pr	1.478	m yr^{-1}	Development	0	0.00
Annual Unit Lake Evaporation	Ev	0.458	m yr^{-1}	Sedimentation	-9268	5.00
Annual Unit Hydraulic Runoff - Veg. Surfaces	Ru	1.020	m yr^{-1}			
Annual Unit Hydraulic Runoff - Urban	Ru	1.330	m yr^{-1}	Total Outflow	176083	95.00
P Loading				Total Check		100.01
Upstream P Input	Pi	143584	gm P yr^{-1}			
Annual Unit Atmospheric P Deposition	Da	0.0173	gm P m^{-2} yr^{-1}			
Land Use Category 1 P Export Coefficient	E1	0.0069	gm P m^{-2} yr^{-1}	**Model Validation**		
Land Use Category 2 P Export Coefficient	E2	0.0083	gm P m^{-2} yr^{-1}			
Land Use Category 3 P Export Coefficient	E3	0.0520	gm P m^{-2} yr^{-1}			
Land Use Category 4 P Export Coefficient	E4	0.0400	gm P m^{-2} yr^{-1}	Pedicted P (mg L^{-1})		0.0090
Land Use Category 5 P Export Coefficient	E5	0.2020	gm P m^{-2} yr^{-1}	Measured P (mg L^{-1})		0.0051
Land Use Category 6 P Export Coefficient	E6	0.0420	gm P m^{-2} yr^{-1}	% Difference		76.5
Land Use Category 7 P Export Coefficient	E7	0.0520	gm P m^{-2} yr^{-1}			
Land Use Category 8 P Export Coefficient	E8	0.0400	gm P m^{-2} yr^{-1}			
Land Use Category 9 P Export Coefficient	E9	0.2020	gm P m^{-2} yr^{-1}			
Land Use Category 10 P Export Coefficient	E10	0.0420	gm P m^{-2} yr^{-1}			
Number of Dwellings	N_d	0	#			
Average number of Persons per Dwelling	N_u	2.60	n/a			
Average Fraction of Year Dwellings Occupied	N_{pc}	1	yr^{-1}			
Phosphorus Load per Capita per Year	Sl	800	gm P cap^{-1} yr^{-1}			
Septic System Retention Coefficient	Rsp	0.5	n/a			
Point Source Input 1	PS1	0				
Point Source Input 2	PS2	0				
Point Source Input 3	PS3	0				
Point Source Input 4	PS4	0				
Point Source Input 5	PS5	0				
Phosphorus Retention Coefficient	v	12.4	n/a			
Model Outputs						
Total Precipitation Hydraulic Input	P_{pti}	121196	m^3 yr^{-1}			
Total Evaporation Hydraulic Loss	Eo	37556	m^3 yr^{-1}			
Total Hydraulic Surface Run Off	Ql	2531760	m^3 yr^{-1}			
Total Hydraulic Input	Qt	19579056	m^3 yr^{-1}			
Areal Hydraulic Load	q_s	238.31	m yr^{-1}			
Total Hydraulic Outflow	Qo	19541500	m^3 yr^{-1}			
Upstream P Input	Ju	143584	gm yr^{-1}			
Total Atmospheric P Input	Jd	1419	gm yr^{-1}			
Total Overland Run Off P Input	Je	40348	gm yr^{-1}			
Total Development P Input	Jd	0	gm yr^{-1}			
Total P Input	Jt	185351	gm yr^{-1}			
Lake P Retention Factor	Rp	0.05	n/a			
Lake Phosphorus Retention	Ps	9268	gm yr^{-1}			
Predicted Lake Phosphorus Concentration	[P]	**0.0090**	mg L^{-1}			
Lake Phosphorus Outflow	Jo	176083	gm yr^{-1}			
Lake Mean Depth	z	2.5	m			
Lake Turnover Time	TT	0.01	yr			
Lake Flushing Rate	FR	96.5	times yr^{-1}			
Lake Response Time	RT	0.01	yr			

McQuade Lake (Area 25) - 1						
Input Parameters	**Symbol**	**Value**	**Units**	**Budgets**		
Morphology				**Hydraulic Budget (m^{-3})**		
Drainage Basin Area (Excl. of Lake Area)	Ad	61.0	ha			
Area Land Use Category 1 (Forest)	Ad1	0.0	ha			**% Total**
Area Land Use Category 2 (Forest/Cleared)	Ad2	61.0	ha	Upstream Inflow	0	0
Area Land Use Category 3 (Urban Exist)	Ad3	0.0	ha	Precipitation	103460	14.26
Area Land Use Category 4 (Commercial Exist)	Ad4	0.0	ha	Surface Run Off	622200	85.74
Area Land Use Category 5 (Industrial Exist)	Ad5	0.0	ha	Evaporation	-32060	4.42
Area Land Use Category 6 (Institutional Exist)	Ad6	0.0	ha	Total Outflow	693600	95.58
Area Land Use Category 7 (Urban BW)	Ad7	0.0	ha	Total Check		100.00
Area Land Use Category 8 (Commercial BW)	Ad8	0.0	ha			
Area Land Use Category 9 (Industrial BW)	Ad9	0.0	ha	**Phosphorus Budget (gm yr^{-1})**		
Area Land Use Category 10 (Institutional BW)	Ad10	0.0	ha			
Lake Surface Area	Ao	7.0	ha			**% Total**
Lake Volume	V	0.0000	10^6 m^3	Upstream Inflow	0	0
Hydrology				Atmosphere	1211	1.23
Upstream Hydraulic Inputs	Qi	0	m^3 yr^{-1}	Land Run Off	5063	5.12
Annual Unit Precipitation	Pr	1.478	m yr^{-1}	Development	92560	93.65
Annual Unit Lake Evaporation	Ev	0.458	m yr^{-1}	Sedimentation	-55347	56.00
Annual Unit Hydraulic Runoff - Veg. Surfaces	Ru	1.020	m yr^{-1}			
Annual Unit Hydraulic Runoff - Urban	Ru	1.330	m yr^{-1}	Total Outflow	43487	44.00
P Loading				Total Check		100.00
Upstream P Input	Pi	0	gm P yr^{-1}			
Annual Unit Atmospheric P Deposition	Da	0.0173	gm P m^{-2} yr^{-1}			
Land Use Category 1 P Export Coefficient	E1	0.0069	gm P m^{-2} yr^{-1}	**Model Validation**		
Land Use Category 2 P Export Coefficient	E2	0.0083	gm P m^{-2} yr^{-1}			
Land Use Category 3 P Export Coefficient	E3	0.0520	gm P m^{-2} yr^{-1}			
Land Use Category 4 P Export Coefficient	E4	0.0400	gm P m^{-2} yr^{-1}	Pedicted P (mg L^{-1})		0.0627
Land Use Category 5 P Export Coefficient	E5	0.2020	gm P m^{-2} yr^{-1}	Measured P (mg L^{-1})		0.0102
Land Use Category 6 P Export Coefficient	E6	0.0420	gm P m^{-2} yr^{-1}	% Difference		514.7
Land Use Category 7 P Export Coefficient	E7	0.0520	gm P m^{-2} yr^{-1}			
Land Use Category 8 P Export Coefficient	E8	0.0400	gm P m^{-2} yr^{-1}			
Land Use Category 9 P Export Coefficient	E9	0.2020	gm P m^{-2} yr^{-1}			
Land Use Category 10 P Export Coefficient	E10	0.0420	gm P m^{-2} yr^{-1}			
Number of Dwellings + Approved Lots	N_d	89	#			
Average number of Persons per Dwelling	N_u	2.60	n/a			
Average Fraction of Year Dwellings Occupied	N_{pc}	1	yr^{-1}			
Phosphorus Load per Capita per Year	Sl	800	gm P cap^{-1} yr^{-1}			
Septic System Retention Coefficient	Rsp	0.5	n/a			
Point Source Input 1	PS1	0				
Point Source Input 2	PS2	0				
Point Source Input 3	PS3	0				
Point Source Input 4	PS4	0				
Point Source Input 5	PS5	0				
Phosphorus Retention Coefficient	v	12.4	n/a			
Model Outputs						
Total Precipitation Hydraulic Input	P_{pti}	103460	m^3 yr^{-1}			
Total Evaporation Hydraulic Loss	Eo	32060	m^3 yr^{-1}			
Total Hydraulic Surface Run Off	Ql	622200	m^3 yr^{-1}			
Total Hydraulic Input	Qt	725660	m^3 yr^{-1}			
Areal Hydraulic Load	q_s	9.91	m yr^{-1}			
Total Hydraulic Outflow	Qo	693600	m^3 yr^{-1}			
Upstream P Input	Ju	0	gm yr^{-1}			
Total Atmospheric P Input	Jd	1211	gm yr^{-1}			
Total Overland Run Off P Input	Je	5063	gm yr^{-1}			
Total Development P Input	Jd	92560	gm yr^{-1}			
Total P Input	Jt	98834	gm yr^{-1}			
Lake P Retention Factor	Rp	0.56	n/a			
Lake Phosphorus Retention	Ps	55347	gm yr^{-1}			
Predicted Lake Phosphorus Concentration	[P]	**0.0627**	mg L^{-1}			
Lake Phosphorus Outflow	Jo	43487	gm yr^{-1}			
Lake Mean Depth	z	0	m			
Lake Turnover Time	TT	0	yr			
Lake Flushing Rate	FR	#DIV/0!	times yr^{-1}			
Lake Response Time	RT	#DIV/0!	yr			

Hobsons Lake (Area 24) - 1						
Input Parameters	**Symbol**	**Value**	**Units**	**Budgets**		
Morphology				**Hydraulic Budget (m^{-3})**		
Drainage Basin Area (Excl. of Lake Area)	Ad	149.0	ha			
Area Land Use Category 1 (Forest)	Ad1	149.0	ha			**% Total**
Area Land Use Category 2 (Forest/Cleared)	Ad2	0.0	ha	Upstream Inflow	0	0
Area Land Use Category 3 (Urban Exist)	Ad3	0.0	ha	Precipitation	59120	3.74
Area Land Use Category 4 (Commercial Exist)	Ad4	0.0	ha	Surface Run Off	1519800	96.26
Area Land Use Category 5 (Industrial Exist)	Ad5	0.0	ha	Evaporation	-18320	1.16
Area Land Use Category 6 (Institutional Exist)	Ad6	0.0	ha	Total Outflow	1560600	98.84
Area Land Use Category 7 (Urban BW)	Ad7	0.0	ha	Total Check		100.00
Area Land Use Category 8 (Commercial BW)	Ad8	0.0	ha			
Area Land Use Category 9 (Industrial BW)	Ad9	0.0	ha	**Phosphorus Budget (gm yr^{-1})**		
Area Land Use Category 10 (Institutional BW)	Ad10	0.0	ha			
Lake Surface Area	Ao	4.0	ha			**% Total**
Lake Volume	V	0.0000	10^6 m^3	Upstream Inflow	0	0
Hydrology				Atmosphere	692	6.31
Upstream Hydraulic Inputs	Qi	0	m^3 yr^{-1}	Land Run Off	10281	93.69
Annual Unit Precipitation	Pr	1.478	m yr^{-1}	Development	0	0.00
Annual Unit Lake Evaporation	Ev	0.458	m yr^{-1}	Sedimentation	-2634	24.00
Annual Unit Hydraulic Runoff - Veg. Surfaces	Ru	1.020	m yr^{-1}			
Annual Unit Hydraulic Runoff - Urban	Ru	1.330	m yr^{-1}	Total Outflow	8339	76.00
P Loading				Total Check		100.00
Upstream P Input	Pi	0	gm P yr^{-1}			
Annual Unit Atmospheric P Deposition	Da	0.0173	gm P m^{-2} yr^{-1}			
Land Use Category 1 P Export Coefficient	E1	0.0069	gm P m^{-2} yr^{-1}	**Model Validation**		
Land Use Category 2 P Export Coefficient	E2	0.0083	gm P m^{-2} yr^{-1}			
Land Use Category 3 P Export Coefficient	E3	0.0520	gm P m^{-2} yr^{-1}			
Land Use Category 4 P Export Coefficient	E4	0.0400	gm P m^{-2} yr^{-1}	Pedicted P (mg L^{-1})		0.0053
Land Use Category 5 P Export Coefficient	E5	0.2020	gm P m^{-2} yr^{-1}	Measured P (mg L^{-1})		0.0072
Land Use Category 6 P Export Coefficient	E6	0.0420	gm P m^{-2} yr^{-1}	% Difference		-26.4
Land Use Category 7 P Export Coefficient	E7	0.0520	gm P m^{-2} yr^{-1}			
Land Use Category 8 P Export Coefficient	E8	0.0400	gm P m^{-2} yr^{-1}			
Land Use Category 9 P Export Coefficient	E9	0.2020	gm P m^{-2} yr^{-1}			
Land Use Category 10 P Export Coefficient	E10	0.0420	gm P m^{-2} yr^{-1}			
Number of Dwellings	N_d	0	#			
Average number of Persons per Dwelling	N_u	2.60	n/a			
Average Fraction of Year Dwellings Occupied	N_{pc}	1	yr^{-1}			
Phosphorus Load per Capita per Year	Sl	800	gm P cap^{-1} yr^{-1}			
Septic System Retention Coefficient	Rsp	0.5	n/a			
Point Source Input 1	PS1	0				
Point Source Input 2	PS2	0				
Point Source Input 3	PS3	0				
Point Source Input 4	PS4	0				
Point Source Input 5	PS5	0				
Phosphorus Retention Coefficient	v	12.4	n/a			
Model Outputs						
Total Precipitation Hydraulic Input	P_{pti}	59120	m^3 yr^{-1}			
Total Evaporation Hydraulic Loss	Eo	18320	m^3 yr^{-1}			
Total Hydraulic Surface Run Off	Ql	1519800	m^3 yr^{-1}			
Total Hydraulic Input	Qt	1578920	m^3 yr^{-1}			
Areal Hydraulic Load	q_s	39.02	m yr^{-1}			
Total Hydraulic Outflow	Qo	1560600	m^3 yr^{-1}			
Upstream P Input	Ju	0	gm yr^{-1}			
Total Atmospheric P Input	Jd	692	gm yr^{-1}			
Total Overland Run Off P Input	Je	10281	gm yr^{-1}			
Total Development P Input	Jd	0	gm yr^{-1}			
Total P Input	Jt	10973	gm yr^{-1}			
Lake P Retention Factor	Rp	0.24	n/a			
Lake Phosphorus Retention	Ps	2634	gm yr^{-1}			
Predicted Lake Phosphorus Concentration	[P]	**0.0053**	mg L^{-1}			
Lake Phosphorus Outflow	Jo	8339	gm yr^{-1}			
Lake Mean Depth	z	0	m			
Lake Turnover Time	TT	0	yr			
Lake Flushing Rate	FR	#DIV/0!	times yr^{-1}			
Lake Response Time	RT	#DIV/0!	yr			

Kearney Lake (Areas 26 and 27) - 1

Input Parameters	Symbol	Value	Units
Morphology			
Drainage Basin Area (Excl. of Lake Area)	Ad	736.5	ha
Area Land Use Category 1 (Forest)	Ad1	457.0	ha
Area Land Use Category 2 (Forest/Cleared)	Ad2	230.4	ha
Area Land Use Category 3 (Urban Exist)	Ad3	38.3	ha
Area Land Use Category 4 (Commercial Exist)	Ad4	0.0	ha
Area Land Use Category 5 (Industrial Exist)	Ad5	10.8	ha
Area Land Use Category 6 (Institutional Exist)	Ad6	0.0	ha
Area Land Use Category 7 (Urban BW)	Ad7	0.0	ha
Area Land Use Category 8 (Commercial BW)	Ad8	0.0	ha
Area Land Use Category 9 (Industrial BW)	Ad9	0.0	ha
Area Land Use Category 10 (Institutional BW)	Ad10	0.0	ha
Lake Surface Area	Ao	61.5	ha
Lake Volume	V	6.9779	10^6 m^3
Hydrology			
Upstream Hydraulic Inputs	Qi	21795700	m^3 yr^{-1}
Annual Unit Precipitation	Pr	1.478	m yr^{-1}
Annual Unit Lake Evaporation	Ev	0.458	m yr^{-1}
Annual Unit Hydraulic Runoff - Veg. Surfaces	Ru	1.020	m yr^{-1}
Annual Unit Hydraulic Runoff - Urban	Ru	1.330	m yr^{-1}
P Loading			
Upstream P Input	Pi	227909	gm P yr^{-1}
Annual Unit Atmospheric P Deposition	Da	0.0173	gm P m^{-2} yr^{-1}
Land Use Category 1 P Export Coefficient	E1	0.0069	gm P m^{-2} yr^{-1}
Land Use Category 2 P Export Coefficient	E2	0.0083	gm P m^{-2} yr^{-1}
Land Use Category 3 P Export Coefficient	E3	0.0520	gm P m^{-2} yr^{-1}
Land Use Category 4 P Export Coefficient	E4	0.0400	gm P m^{-2} yr^{-1}
Land Use Category 5 P Export Coefficient	E5	0.2020	gm P m^{-2} yr^{-1}
Land Use Category 6 P Export Coefficient	E6	0.0420	gm P m^{-2} yr^{-1}
Land Use Category 7 P Export Coefficient	E7	0.0520	gm P m^{-2} yr^{-1}
Land Use Category 8 P Export Coefficient	E8	0.0400	gm P m^{-2} yr^{-1}
Land Use Category 9 P Export Coefficient	E9	0.2020	gm P m^{-2} yr^{-1}
Land Use Category 10 P Export Coefficient	E10	0.0420	gm P m^{-2} yr^{-1}
Number of Dwellings	N_d	238	#
Average number of Persons per Dwelling	N_u	2.60	n/a
Average Fraction of Year Dwellings Occupied	N_{pc}	1	yr^{-1}
Phosphorus Load per Capita per Year	Sl	800	gm P cap^{-1} yr^{-1}
Septic System Retention Coefficient	Rsp	0.5	n/a
Point Source Input 1	PS1	0	
Point Source Input 2	PS2	0	
Point Source Input 3	PS3	0	
Point Source Input 4	PS4	0	
Point Source Input 5	PS5	0	
Phosphorus Retention Coefficient	v	12.4	n/a
Model Outputs			
Total Precipitation Hydraulic Input	P_{pti}	908822.2	m^3 yr^{-1}
Total Evaporation Hydraulic Loss	Eo	281624.2	m^3 yr^{-1}
Total Hydraulic Surface Run Off	Ql	7664510	m^3 yr^{-1}
Total Hydraulic Input	Qt	30369032	m^3 yr^{-1}
Areal Hydraulic Load	q_s	48.93	m yr^{-1}
Total Hydraulic Outflow	Qo	30087408	m^3 yr^{-1}
Upstream P Input	Ju	227909	gm yr^{-1}
Total Atmospheric P Input	Jd	10638	gm yr^{-1}
Total Overland Run Off P Input	Je	92388	gm yr^{-1}
Total Development P Input	Jd	247520	gm yr^{-1}
Total P Input	Jt	578455	gm yr^{-1}
Lake P Retention Factor	Rp	0.2	n/a
Lake Phosphorus Retention	Ps	115691	gm yr^{-1}
Predicted Lake Phosphorus Concentration	[P]	**0.0154**	mg L^{-1}
Lake Phosphorus Outflow	Jo	462764	gm yr^{-1}
Lake Mean Depth	z	11.3	m
Lake Turnover Time	TT	0.23	yr
Lake Flushing Rate	FR	4.31	times yr^{-1}
Lake Response Time	RT	0.13	yr

Hydraulic Budget (m^{-3})

		% Total
Upstream Inflow	21795700	71.77
Precipitation	908822.2	2.99
Surface Run Off	7664510	25.24
Evaporation	-281624.2	0.93
Total Outflow	30087408	99.07
Total Check		100.00

Phosphorus Budget (gm yr^{-1})

		% Total
Upstream Inflow	227909	39.4
Atmosphere	10638	1.84
Land Run Off	92388	15.97
Development	247520	42.79
Sedimentation	-115691	20.00
Total Outflow	462764	80.00
Total Check		100.00

Model Validation

Pedicted P (mg L^{-1})		0.0154
Measured P (mg L^{-1})		0.0067
% Difference		129.9

Papermill Lake Basin 2 (Area 33) - 1

Input Parameters	Symbol	Value	Units
Morphology			
Drainage Basin Area (Excl. of Lake Area)	Ad	38.2	ha
Area Land Use Category 1 (Forest)	Ad1	32.6	ha
Area Land Use Category 2 (Forest/Cleared)	Ad2	3.4	ha
Area Land Use Category 3 (Urban Exist)	Ad3	2.2	ha
Area Land Use Category 4 (Commercial Exist)	Ad4	0.0	ha
Area Land Use Category 5 (Industrial Exist)	Ad5	0.0	ha
Area Land Use Category 6 (Institutional Exist)	Ad6	0.0	ha
Area Land Use Category 7 (Urban BW)	Ad7	0.0	ha
Area Land Use Category 8 (Commercial BW)	Ad8	0.0	ha
Area Land Use Category 9 (Industrial BW)	Ad9	0.0	ha
Area Land Use Category 10 (Institutional BW)	Ad10	0.0	ha
Lake Surface Area	Ao	1.8	ha
Lake Volume	V	0.0113	10^6 m^3
Hydrology			
Upstream Hydraulic Inputs	Qi	0	m^3 yr^{-1}
Annual Unit Precipitation	Pr	1.478	m yr^{-1}
Annual Unit Lake Evaporation	Ev	0.458	m yr^{-1}
Annual Unit Hydraulic Runoff - Veg. Surfaces	Ru	1.020	m yr^{-1}
Annual Unit Hydraulic Runoff - Urban	Ru	1.330	m yr^{-1}
P Loading			
Upstream P Input	Pi	0	gm P yr^{-1}
Annual Unit Atmospheric P Deposition	Da	0.0173	gm P m^{-2} yr^{-1}
Land Use Category 1 P Export Coefficient	E1	0.0069	gm P m^{-2} yr^{-1}
Land Use Category 2 P Export Coefficient	E2	0.0083	gm P m^{-2} yr^{-1}
Land Use Category 3 P Export Coefficient	E3	0.0520	gm P m^{-2} yr^{-1}
Land Use Category 4 P Export Coefficient	E4	0.0400	gm P m^{-2} yr^{-1}
Land Use Category 5 P Export Coefficient	E5	0.2020	gm P m^{-2} yr^{-1}
Land Use Category 6 P Export Coefficient	E6	0.0420	gm P m^{-2} yr^{-1}
Land Use Category 7 P Export Coefficient	E7	0.0520	gm P m^{-2} yr^{-1}
Land Use Category 8 P Export Coefficient	E8	0.0400	gm P m^{-2} yr^{-1}
Land Use Category 9 P Export Coefficient	E9	0.2020	gm P m^{-2} yr^{-1}
Land Use Category 10 P Export Coefficient	E10	0.0420	gm P m^{-2} yr^{-1}
Number of Dwellings	N_d	0	#
Average number of Persons per Dwelling	N_u	2.60	n/a
Average Fraction of Year Dwellings Occupied	N_{pc}	1	yr^{-1}
Phosphorus Load per Capita per Year	Sl	800	gm P cap^{-1} yr^{-1}
Septic System Retention Coefficient	Rsp	0.5	n/a
Point Source Input 1	PS1	0	
Point Source Input 2	PS2	0	
Point Source Input 3	PS3	0	
Point Source Input 4	PS4	0	
Point Source Input 5	PS5	0	
Phosphorus Retention Coefficient	v	12.4	n/a
Model Outputs			
Total Precipitation Hydraulic Input	P_{pti}	26456.2	m^3 yr^{-1}
Total Evaporation Hydraulic Loss	Eo	8198.2	m^3 yr^{-1}
Total Hydraulic Surface Run Off	Ql	396460	m^3 yr^{-1}
Total Hydraulic Input	Qt	422916	m^3 yr^{-1}
Areal Hydraulic Load	q_s	23.17	m yr^{-1}
Total Hydraulic Outflow	Qo	414718	m^3 yr^{-1}
Upstream P Input	Ju	0	gm yr^{-1}
Total Atmospheric P Input	Jd	310	gm yr^{-1}
Total Overland Run Off P Input	Je	3676	gm yr^{-1}
Total Development P Input	Jd	0	gm yr^{-1}
Total P Input	Jt	3986	gm yr^{-1}
Lake P Retention Factor	Rp	0.35	n/a
Lake Phosphorus Retention	Ps	1395	gm yr^{-1}
Predicted Lake Phosphorus Concentration	[P]	**0.0062**	mg L^{-1}
Lake Phosphorus Outflow	Jo	2591	gm yr^{-1}
Lake Mean Depth	z	0.6	m
Lake Turnover Time	TT	0.03	yr
Lake Flushing Rate	FR	36.7	times yr^{-1}
Lake Response Time	RT	0.01	yr

Hydraulic Budget (m^{-3})

		% Total
Upstream Inflow	0	0
Precipitation	26456.2	6.26
Surface Run Off	396460	93.74
Evaporation	-8198.2	1.94
Total Outflow	414718	98.06
Total Check		100.00

Phosphorus Budget (gm yr^{-1})

		% Total
Upstream Inflow	0	0
Atmosphere	310	7.77
Land Run Off	3676	92.22
Development	0	0.00
Sedimentation	-1395	35.00
Total Outflow	2591	65.00
Total Check		99.99

Model Validation

Pedicted P (mg L^{-1})		0.0062
Measured P (mg L^{-1})		0.0000
% Difference		#DIV/0!

Jack Lake (Area 34) - 1

Input Parameters	Symbol	Value	Units
Morphology			
Drainage Basin Area (Excl. of Lake Area)	Ad	22.7	ha
Area Land Use Category 1 (Forest)	Ad1	22.7	ha
Area Land Use Category 2 (Forest/Cleared)	Ad2	0.0	ha
Area Land Use Category 3 (Urban Exist)	Ad3	0.0	ha
Area Land Use Category 4 (Commercial Exist)	Ad4	0.0	ha
Area Land Use Category 5 (Industrial Exist)	Ad5	0.0	ha
Area Land Use Category 6 (Institutional Exist)	Ad6	0.0	ha
Area Land Use Category 7 (Urban BW)	Ad7	0.0	ha
Area Land Use Category 8 (Commercial BW)	Ad8	0.0	ha
Area Land Use Category 9 (Industrial BW)	Ad9	0.0	ha
Area Land Use Category 10 (Institutional BW)	Ad10	0.0	ha
Lake Surface Area	Ao	3.8	ha
Lake Volume	V	0.0000	10^6 m^3
Hydrology			
Upstream Hydraulic Inputs	Qi	0	m^3 yr^{-1}
Annual Unit Precipitation	Pr	1.478	m yr^{-1}
Annual Unit Lake Evaporation	Ev	0.458	m yr^{-1}
Annual Unit Hydraulic Runoff - Veg. Surfaces	Ru	1.020	m yr^{-1}
Annual Unit Hydraulic Runoff - Urban	Ru	1.330	m yr^{-1}
P Loading			
Upstream P Input	Pi	0	gm P yr^{-1}
Annual Unit Atmospheric P Deposition	Da	0.0173	gm P m^{-2} yr^{-1}
Land Use Category 1 P Export Coefficient	E1	0.0069	gm P m^{-2} yr^{-1}
Land Use Category 2 P Export Coefficient	E2	0.0083	gm P m^{-2} yr^{-1}
Land Use Category 3 P Export Coefficient	E3	0.0520	gm P m^{-2} yr^{-1}
Land Use Category 4 P Export Coefficient	E4	0.0400	gm P m^{-2} yr^{-1}
Land Use Category 5 P Export Coefficient	E5	0.2020	gm P m^{-2} yr^{-1}
Land Use Category 6 P Export Coefficient	E6	0.0420	gm P m^{-2} yr^{-1}
Land Use Category 7 P Export Coefficient	E7	0.0520	gm P m^{-2} yr^{-1}
Land Use Category 8 P Export Coefficient	E8	0.0400	gm P m^{-2} yr^{-1}
Land Use Category 9 P Export Coefficient	E9	0.2020	gm P m^{-2} yr^{-1}
Land Use Category 10 P Export Coefficient	E10	0.0420	gm P m^{-2} yr^{-1}
Number of Dwellings	N_d	0	#
Average number of Persons per Dwelling	N_u	2.60	n/a
Average Fraction of Year Dwellings Occupied	N_{pc}	1	yr^{-1}
Phosphorus Load per Capita per Year	Sl	800	gm P cap^{-1} yr^{-1}
Septic System Retention Coefficient	Rsp	0.5	n/a
Point Source Input 1	PS1	0	
Point Source Input 2	PS2	0	
Point Source Input 3	PS3	0	
Point Source Input 4	PS4	0	
Point Source Input 5	PS5	0	
Phosphorus Retention Coefficient	v	12.4	n/a
Model Outputs			
Total Precipitation Hydraulic Input	P_{pti}	56164	m^3 yr^{-1}
Total Evaporation Hydraulic Loss	Eo	17404	m^3 yr^{-1}
Total Hydraulic Surface Run Off	Ql	231540	m^3 yr^{-1}
Total Hydraulic Input	Qt	287704	m^3 yr^{-1}
Areal Hydraulic Load	q_s	7.11	m yr^{-1}
Total Hydraulic Outflow	Qo	270300	m^3 yr^{-1}
Upstream P Input	Ju	0	gm yr^{-1}
Total Atmospheric P Input	Jd	657	gm yr^{-1}
Total Overland Run Off P Input	Je	1566	gm yr^{-1}
Total Development P Input	Jd	0	gm yr^{-1}
Total P Input	Jt	2223	gm yr^{-1}
Lake P Retention Factor	Rp	0.64	n/a
Lake Phosphorus Retention	Ps	1423	gm yr^{-1}
Predicted Lake Phosphorus Concentration	[P]	**0.003**	mg L^{-1}
Lake Phosphorus Outflow	Jo	800	gm yr^{-1}
Lake Mean Depth	z	0	m
Lake Turnover Time	TT	0	yr
Lake Flushing Rate	FR	#DIV/0!	times yr^{-1}
Lake Response Time	RT	#DIV/0!	yr

Hydraulic Budget (m^{-3})

		% Total
Upstream Inflow	0	0
Precipitation	56164	19.52
Surface Run Off	231540	80.48
Evaporation	-17404	6.05
Total Outflow	270300	93.95
Total Check		100.00

Phosphorus Budget (gm yr^{-1})

		% Total
Upstream Inflow	0	0
Atmosphere	657	29.57
Land Run Off	1566	70.45
Development	0	0.00
Sedimentation	-1423	64.01
Total Outflow	800	35.99
Total Check		100.02

Model Validation

Pedicted P (mg L^{-1})	0.0030
Measured P (mg L^{-1})	0.0036
% Difference	-16.7

Papermill Lake Basin 3 (Area 35) - 1

Input Parameters	Symbol	Value	Units
Morphology			
Drainage Basin Area (Excl. of Lake Area)	Ad	89.3	ha
Area Land Use Category 1 (Forest)	Ad1	42.3	ha
Area Land Use Category 2 (Forest/Cleared)	Ad2	0.0	ha
Area Land Use Category 3 (Urban Exist)	Ad3	47.0	ha
Area Land Use Category 4 (Commercial Exist)	Ad4	0.0	ha
Area Land Use Category 5 (Industrial Exist)	Ad5	0.0	ha
Area Land Use Category 6 (Institutional Exist)	Ad6	0.0	ha
Area Land Use Category 7 (Urban BW)	Ad7	0.0	ha
Area Land Use Category 8 (Commercial BW)	Ad8	0.0	ha
Area Land Use Category 9 (Industrial BW)	Ad9	0.0	ha
Area Land Use Category 10 (Institutional BW)	Ad10	0.0	ha
Lake Surface Area	Ao	1.2	ha
Lake Volume	V	0.0147	10^6 m^3
Hydrology			
Upstream Hydraulic Inputs	Qi	270300	m^3 yr^{-1}
Annual Unit Precipitation	Pr	1.478	m yr^{-1}
Annual Unit Lake Evaporation	Ev	0.458	m yr^{-1}
Annual Unit Hydraulic Runoff - Veg. Surfaces	Ru	1.020	m yr^{-1}
Annual Unit Hydraulic Runoff - Urban	Ru	1.330	m yr^{-1}
P Loading			
Upstream P Input	Pi	800	gm P yr^{-1}
Annual Unit Atmospheric P Deposition	Da	0.0173	gm P m^{-2} yr^{-1}
Land Use Category 1 P Export Coefficient	E1	0.0069	gm P m^{-2} yr^{-1}
Land Use Category 2 P Export Coefficient	E2	0.0083	gm P m^{-2} yr^{-1}
Land Use Category 3 P Export Coefficient	E3	0.0520	gm P m^{-2} yr^{-1}
Land Use Category 4 P Export Coefficient	E4	0.0400	gm P m^{-2} yr^{-1}
Land Use Category 5 P Export Coefficient	E5	0.2020	gm P m^{-2} yr^{-1}
Land Use Category 6 P Export Coefficient	E6	0.0420	gm P m^{-2} yr^{-1}
Land Use Category 7 P Export Coefficient	E7	0.0520	gm P m^{-2} yr^{-1}
Land Use Category 8 P Export Coefficient	E8	0.0400	gm P m^{-2} yr^{-1}
Land Use Category 9 P Export Coefficient	E9	0.2020	gm P m^{-2} yr^{-1}
Land Use Category 10 P Export Coefficient	E10	0.0420	gm P m^{-2} yr^{-1}
Number of Dwellings	N_d	0	#
Average number of Persons per Dwelling	N_u	2.60	n/a
Average Fraction of Year Dwellings Occupied	N_{pc}	1	yr^{-1}
Phosphorus Load per Capita per Year	Sl	800	gm P cap^{-1} yr^{-1}
Septic System Retention Coefficient	Rsp	0.5	n/a
Point Source Input 1	PS1	0	
Point Source Input 2	PS2	0	
Point Source Input 3	PS3	0	
Point Source Input 4	PS4	0	
Point Source Input 5	PS5	0	
Phosphorus Retention Coefficient	v	12.4	n/a
Model Outputs			
Total Precipitation Hydraulic Input	Ppti	17736	m^3 yr^{-1}
Total Evaporation Hydraulic Loss	Eo	5496	m^3 yr^{-1}
Total Hydraulic Surface Run Off	Ql	1056560	m^3 yr^{-1}
Total Hydraulic Input	Qt	1344596	m^3 yr^{-1}
Areal Hydraulic Load	q_s	111.59	m yr^{-1}
Total Hydraulic Outflow	Qo	1339100	m^3 yr^{-1}
Upstream P Input	Ju	800	gm yr^{-1}
Total Atmospheric P Input	Jd	208	gm yr^{-1}
Total Overland Run Off P Input	Je	27359	gm yr^{-1}
Total Development P Input	Jd	0	gm yr^{-1}
Total P Input	Jt	28367	gm yr^{-1}
Lake P Retention Factor	Rp	0.1	n/a
Lake Phosphorus Retention	Ps	2837	gm yr^{-1}
Predicted Lake Phosphorus Concentration	[P]	**0.0191**	mg L^{-1}
Lake Phosphorus Outflow	Jo	25530	gm yr^{-1}
Lake Mean Depth	z	1.2	m
Lake Turnover Time	TT	0.01	yr
Lake Flushing Rate	FR	91.1	times yr^{-1}
Lake Response Time	RT	0.01	yr

Hydraulic Budget (m^{-3})

		% Total
Upstream Inflow	270300	20.1
Precipitation	17736	1.32
Surface Run Off	1056560	78.58
Evaporation	-5496	0.41
Total Outflow	1339100	99.59
Total Check		100.00

Phosphorus Budget (gm yr^{-1})

		% Total
Upstream Inflow	800	2.82
Atmosphere	208	0.73
Land Run Off	27359	96.45
Development	0	0.00
Sedimentation	-2837	10.00
Total Outflow	25530	90.00
Total Check		100.00

Model Validation

Pedicted P (mg L^{-1})		0.0191
Measured P (mg L^{-1})		0.0000
% Difference		#DIV/0!

Papermill Lake (Areas 28, 31, 32, 36 and 37) - 1						
Input Parameters	**Symbol**	**Value**	**Units**	**Budgets**		
Morphology				**Hydraulic Budget (m^{-3})**		
Drainage Basin Area (Excl. of Lake Area)	Ad	481.0	ha			
Area Land Use Category 1 (Forest)	Ad1	369.1	ha			**% Total**
Area Land Use Category 2 (Forest/Cleared)	Ad2	3.9	ha	Upstream Inflow	31841226	85.11
Area Land Use Category 3 (Urban Exist)	Ad3	89.5	ha	Precipitation	328263.8	0.88
Area Land Use Category 4 (Commercial Exist)	Ad4	0.0	ha	Surface Run Off	5241000	14.01
Area Land Use Category 5 (Industrial Exist)	Ad5	18.5	ha	Evaporation	-101721.8	0.27
Area Land Use Category 6 (Institutional Exist)	Ad6	0.0	ha	Total Outflow	37308768	99.73
Area Land Use Category 7 (Urban BW)	Ad7	0.0	ha	Total Check		100.00
Area Land Use Category 8 (Commercial BW)	Ad8	0.0	ha			
Area Land Use Category 9 (Industrial BW)	Ad9	0.0	ha	**Phosphorus Budget (gm yr^{-1})**		
Area Land Use Category 10 (Institutional BW)	Ad10	0.0	ha			
Lake Surface Area	Ao	22.2	ha			**% Total**
Lake Volume	V	0.4906	10^6 m^3	Upstream Inflow	490885	81.21
Hydrology				Atmosphere	3842	0.64
Upstream Hydraulic Inputs	Qi	31841226	m^3 yr^{-1}	Land Run Off	109702	18.15
Annual Unit Precipitation	Pr	1.478	m yr^{-1}	Development	0	0.00
Annual Unit Lake Evaporation	Ev	0.458	m yr^{-1}	Sedimentation	-42310	7.00
Annual Unit Hydraulic Runoff - Veg. Surfaces	Ru	1.020	m yr^{-1}			
Annual Unit Hydraulic Runoff - Urban	Ru	1.330	m yr^{-1}	Total Outflow	562119	93.00
P Loading				Total Check		100.00
Upstream P Input	Pi	490885	gm P yr^{-1}			
Annual Unit Atmospheric P Deposition	Da	0.0173	gm P m^{-2} yr^{-1}			
Land Use Category 1 P Export Coefficient	E1	0.0069	gm P m^{-2} yr^{-1}	**Model Validation**		
Land Use Category 2 P Export Coefficient	E2	0.0083	gm P m^{-2} yr^{-1}			
Land Use Category 3 P Export Coefficient	E3	0.0520	gm P m^{-2} yr^{-1}			
Land Use Category 4 P Export Coefficient	E4	0.0400	gm P m^{-2} yr^{-1}	Pedicted P (mg L^{-1})		0.0151
Land Use Category 5 P Export Coefficient	E5	0.2020	gm P m^{-2} yr^{-1}	Measured P (mg L^{-1})		0.0088
Land Use Category 6 P Export Coefficient	E6	0.0420	gm P m^{-2} yr^{-1}	% Difference		71.6
Land Use Category 7 P Export Coefficient	E7	0.0520	gm P m^{-2} yr^{-1}			
Land Use Category 8 P Export Coefficient	E8	0.0400	gm P m^{-2} yr^{-1}			
Land Use Category 9 P Export Coefficient	E9	0.2020	gm P m^{-2} yr^{-1}			
Land Use Category 10 P Export Coefficient	E10	0.0420	gm P m^{-2} yr^{-1}			
Number of Dwellings	N_d	0	#			
Average number of Persons per Dwelling	N_u	2.60	n/a			
Average Fraction of Year Dwellings Occupied	N_{pc}	1	yr^{-1}			
Phosphorus Load per Capita per Year	Sl	800	gm P cap^{-1} yr^{-1}			
Septic System Retention Coefficient	Rsp	0.5	n/a			
Point Source Input 1	PS1	0				
Point Source Input 2	PS2	0				
Point Source Input 3	PS3	0				
Point Source Input 4	PS4	0				
Point Source Input 5	PS5	0				
Phosphorus Retention Coefficient	v	12.4	n/a			
Model Outputs						
Total Precipitation Hydraulic Input	P_{pti}	328263.8	m^3 yr^{-1}			
Total Evaporation Hydraulic Loss	Eo	101721.8	m^3 yr^{-1}			
Total Hydraulic Surface Run Off	Ql	5241000	m^3 yr^{-1}			
Total Hydraulic Input	Qt	37410490	m^3 yr^{-1}			
Areal Hydraulic Load	q_s	167.98	m yr^{-1}			
Total Hydraulic Outflow	Qo	37308768	m^3 yr^{-1}			
Upstream P Input	Ju	490885	gm yr^{-1}			
Total Atmospheric P Input	Jd	3842	gm yr^{-1}			
Total Overland Run Off P Input	Je	109702	gm yr^{-1}			
Total Development P Input	Jd	0	gm yr^{-1}			
Total P Input	Jt	604429	gm yr^{-1}			
Lake P Retention Factor	Rp	0.07	n/a			
Lake Phosphorus Retention	Ps	42310	gm yr^{-1}			
Predicted Lake Phosphorus Concentration	[P]	**0.0151**	mg L^{-1}			
Lake Phosphorus Outflow	Jo	562119	gm yr^{-1}			
Lake Mean Depth	z	2.2	m			
Lake Turnover Time	TT	0.01	yr			
Lake Flushing Rate	FR	76.05	times yr^{-1}			
Lake Response Time	RT	0.01	yr			

Little Horseshoe Lake (Area 12A) - 2

Input Parameters	Symbol	Value	Units
Morphology			
Drainage Basin Area (Excl. of Lake Area)	Ad	50.0	ha
Area Land Use Category 1 (Forest)	Ad1	50.0	ha
Area Land Use Category 2 (Forest/Cleared)	Ad2	0.0	ha
Area Land Use Category 3 (Urban Exist)	Ad3	0.0	ha
Area Land Use Category 4 (Commercial Exist)	Ad4	0.0	ha
Area Land Use Category 5 (Industrial Exist)	Ad5	0.0	ha
Area Land Use Category 6 (Institutional Exist)	Ad6	0.0	ha
Area Land Use Category 7 (Urban BW)	Ad7	0.0	ha
Area Land Use Category 8 (Commercial BW)	Ad8	0.0	ha
Area Land Use Category 9 (Industrial BW)	Ad9	0.0	ha
Area Land Use Category 10 (Institutional BW)	Ad10	0.0	ha
Lake Surface Area	Ao	1.0	ha
Lake Volume	V	0.00	10^6 m^3
Hydrology			
Upstream Hydraulic Inputs	Qi	0	m^3 yr^{-1}
Annual Unit Precipitation	Pr	1.478	m yr^{-1}
Annual Unit Lake Evaporation	Ev	0.458	m yr^{-1}
Annual Unit Hydraulic Runoff - Veg. Surfaces	Ru	1.020	m yr^{-1}
Annual Unit Hydraulic Runoff - Urban	Ru	1.330	m yr^{-1}
P Loading			
Upstream P Input	Pi	0	gm P yr^{-1}
Annual Unit Atmospheric P Deposition	Da	0.0173	gm P m^{-2} yr^{-1}
Land Use Category 1 P Export Coefficient	E1	0.0069	gm P m^{-2} yr^{-1}
Land Use Category 2 P Export Coefficient	E2	0.0083	gm P m^{-2} yr^{-1}
Land Use Category 3 P Export Coefficient	E3	0.0520	gm P m^{-2} yr^{-1}
Land Use Category 4 P Export Coefficient	E4	0.0400	gm P m^{-2} yr^{-1}
Land Use Category 5 P Export Coefficient	E5	0.2020	gm P m^{-2} yr^{-1}
Land Use Category 6 P Export Coefficient	E6	0.0420	gm P m^{-2} yr^{-1}
Land Use Category 7 P Export Coefficient	E7	0.0520	gm P m^{-2} yr^{-1}
Land Use Category 8 P Export Coefficient	E8	0.0400	gm P m^{-2} yr^{-1}
Land Use Category 9 P Export Coefficient	E9	0.2020	gm P m^{-2} yr^{-1}
Land Use Category 10 P Export Coefficient	E10	0.0420	gm P m^{-2} yr^{-1}
Number of Dwellings	N_d	0	#
Average number of Persons per Dwelling	N_u	2.60	n/a
Average Fraction of Year Dwellings Occupied	N_{pc}	1	yr^{-1}
Phosphorus Load per Capita per Year	Sl	800	gm P cap^{-1} yr^{-1}
Septic System Retention Coefficient	Rsp	0.5	n/a
Point Source Input 1	PS1	0	
Point Source Input 2	PS2	0	
Point Source Input 3	PS3	0	
Point Source Input 4	PS4	0	
Point Source Input 5	PS5	0	
Phosphorus Retention Coefficient	v	12.4	n/a
Model Outputs			
Total Precipitation Hydraulic Input	P_{pti}	14780	m^3 yr^{-1}
Total Evaporation Hydraulic Loss	Eo	4580	m^3 yr^{-1}
Total Hydraulic Surface Run Off	Ql	510000	m^3 yr^{-1}
Total Hydraulic Input	Qt	524780	m^3 yr^{-1}
Areal Hydraulic Load	q_s	52.02	m yr^{-1}
Total Hydraulic Outflow	Qo	520200	m^3 yr^{-1}
Upstream P Input	Ju	0	gm yr^{-1}
Total Atmospheric P Input	Jd	173	gm yr^{-1}
Total Overland Run Off P Input	Je	3450	gm yr^{-1}
Total Development P Input	Jd	0	gm yr^{-1}
Total P Input	Jt	3623	gm yr^{-1}
Lake P Retention Factor	Rp	0.19	n/a
Lake Phosphorus Retention	Ps	688	gm yr^{-1}
Predicted Lake Phosphorus Concentration	[P]	**0.0056**	mg L^{-1}
Lake Phosphorus Outflow	Jo	2935	gm yr^{-1}
Lake Mean Depth	z	0	m
Lake Turnover Time	TT	0	yr
Lake Flushing Rate	FR	#DIV/0!	times yr^{-1}
Lake Response Time	RT	#DIV/0!	yr

Hydraulic Budget (m^{-3})

		% Total
Upstream Inflow	0	0
Precipitation	14780	2.82
Surface Run Off	510000	97.18
Evaporation	-4580	0.87
Total Outflow	520200	99.13
Total Check		100.00

Phosphorus Budget (gm yr^{-1})

		% Total
Upstream Inflow	0	0
Atmosphere	173	4.78
Land Run Off	3450	95.22
Development	0	0.00
Sedimentation	-688	18.99
Total Outflow	2935	81.01
Total Check		100.00

Model Validation

Pedicted P (mg L^{-1})	0.0056
Measured P (mg L^{-1})	0.0070
% Difference	-20.0

Three Finger Lake (Area 11) - 2						
Input Parameters	**Symbol**	**Value**	**Units**	**Budgets**		
Morphology				**Hydraulic Budget (m^{-3})**		
Drainage Basin Area (Excl. of Lake Area)	Ad	117.5	ha			
Area Land Use Category 1 (Forest)	Ad1	117.5	ha			**% Total**
Area Land Use Category 2 (Forest/Cleared)	Ad2	0.0	ha	Upstream Inflow	0	0
Area Land Use Category 3 (Urban Exist)	Ad3	0.0	ha	Precipitation	96070	7.42
Area Land Use Category 4 (Commercial Exist)	Ad4	0.0	ha	Surface Run Off	1198500	92.58
Area Land Use Category 5 (Industrial Exist)	Ad5	0.0	ha	Evaporation	-29770	2.3
Area Land Use Category 6 (Institutional Exist)	Ad6	0.0	ha	Total Outflow	1264800	97.7
Area Land Use Category 7 (Urban BW)	Ad7	0.0	ha	Total Check		100.00
Area Land Use Category 8 (Commercial BW)	Ad8	0.0	ha			
Area Land Use Category 9 (Industrial BW)	Ad9	0.0	ha	**Phosphorus Budget (gm yr^{-1})**		
Area Land Use Category 10 (Institutional BW)	Ad10	0.0	ha			
Lake Surface Area	Ao	6.5	ha			**% Total**
Lake Volume	V	0.00	10^6 m^3	Upstream Inflow	0	0
Hydrology				Atmosphere	1125	12.18
Upstream Hydraulic Inputs	Qi	0	m^3 yr^{-1}	Land Run Off	8108	87.82
Annual Unit Precipitation	Pr	1.478	m yr^{-1}	Development	0	0.00
Annual Unit Lake Evaporation	Ev	0.458	m yr^{-1}	Sedimentation	-3601	39.00
Annual Unit Hydraulic Runoff - Veg. Surfaces	Ru	1.020	m yr^{-1}			
Annual Unit Hydraulic Runoff - Urban	Ru	1.330	m yr^{-1}	Total Outflow	5632	61.00
P Loading				Total Check		100.00
Upstream P Input	Pi	0	gm P yr^{-1}			
Annual Unit Atmospheric P Deposition	Da	0.0173	gm P m^{-2} yr^{-1}			
Land Use Category 1 P Export Coefficient	E1	0.0069	gm P m^{-2} yr^{-1}	**Model Validation**		
Land Use Category 2 P Export Coefficient	E2	0.0083	gm P m^{-2} yr^{-1}			
Land Use Category 3 P Export Coefficient	E3	0.0520	gm P m^{-2} yr^{-1}			
Land Use Category 4 P Export Coefficient	E4	0.0400	gm P m^{-2} yr^{-1}	Pedicted P (mg L^{-1})		0.0045
Land Use Category 5 P Export Coefficient	E5	0.2020	gm P m^{-2} yr^{-1}	Measured P (mg L^{-1})		0.0042
Land Use Category 6 P Export Coefficient	E6	0.0420	gm P m^{-2} yr^{-1}	% Difference		7.1
Land Use Category 7 P Export Coefficient	E7	0.0520	gm P m^{-2} yr^{-1}			
Land Use Category 8 P Export Coefficient	E8	0.0400	gm P m^{-2} yr^{-1}			
Land Use Category 9 P Export Coefficient	E9	0.2020	gm P m^{-2} yr^{-1}			
Land Use Category 10 P Export Coefficient	E10	0.0420	gm P m^{-2} yr^{-1}			
Number of Dwellings	N_d	0	#			
Average number of Persons per Dwelling	N_u	2.60	n/a			
Average Fraction of Year Dwellings Occupied	N_{pc}	1	yr^{-1}			
Phosphorus Load per Capita per Year	Sl	800	gm P cap^{-1} yr^{-1}			
Septic System Retention Coefficient	Rsp	0.5	n/a			
Point Source Input 1	PS1	0				
Point Source Input 2	PS2	0				
Point Source Input 3	PS3	0				
Point Source Input 4	PS4	0				
Point Source Input 5	PS5	0				
Phosphorus Retention Coefficient	v	12.4	n/a			
Model Outputs						
Total Precipitation Hydraulic Input	P_{pti}	96070	m^3 yr^{-1}			
Total Evaporation Hydraulic Loss	Eo	29770	m^3 yr^{-1}			
Total Hydraulic Surface Run Off	Ql	1198500	m^3 yr^{-1}			
Total Hydraulic Input	Qt	1294570	m^3 yr^{-1}			
Areal Hydraulic Load	q_s	19.46	m yr^{-1}			
Total Hydraulic Outflow	Qo	1264800	m^3 yr^{-1}			
Upstream P Input	Ju	0	gm yr^{-1}			
Total Atmospheric P Input	Jd	1125	gm yr^{-1}			
Total Overland Run Off P Input	Je	8108	gm yr^{-1}			
Total Development P Input	Jd	0	gm yr^{-1}			
Total P Input	Jt	9233	gm yr^{-1}			
Lake P Retention Factor	Rp	0.39	n/a			
Lake Phosphorus Retention	Ps	3601	gm yr^{-1}			
Predicted Lake Phosphorus Concentration	[P]	**0.0045**	mg L^{-1}			
Lake Phosphorus Outflow	Jo	5632	gm yr^{-1}			
Lake Mean Depth	z	0	m			
Lake Turnover Time	TT	0	yr			
Lake Flushing Rate	FR	#DIV/0!	times yr^{-1}			
Lake Response Time	RT	#DIV/0!	yr			

Big Horseshoe Lake (Area 12B) - 2						
Input Parameters	**Symbol**	**Value**	**Units**	**Budgets**		
Morphology				**Hydraulic Budget (m^{-3})**		
Drainage Basin Area (Excl. of Lake Area)	Ad	73.0	ha			
Area Land Use Category 1 (Forest)	Ad1	73.0	ha			**% Total**
Area Land Use Category 2 (Forest/Cleared)	Ad2	0.0	ha	Upstream Inflow	1785000	67.79
Area Land Use Category 3 (Urban Exist)	Ad3	0.0	ha	Precipitation	103460	3.93
Area Land Use Category 4 (Commercial Exist)	Ad4	0.0	ha	Surface Run Off	744600	28.28
Area Land Use Category 5 (Industrial Exist)	Ad5	0.0	ha	Evaporation	-32060	1.22
Area Land Use Category 6 (Institutional Exist)	Ad6	0.0	ha	Total Outflow	2601000	98.78
Area Land Use Category 7 (Urban BW)	Ad7	0.0	ha	Total Check		100.00
Area Land Use Category 8 (Commercial BW)	Ad8	0.0	ha			
Area Land Use Category 9 (Industrial BW)	Ad9	0.0	ha	**Phosphorus Budget (gm yr^{-1})**		
Area Land Use Category 10 (Institutional BW)	Ad10	0.0	ha			
Lake Surface Area	Ao	7.0	ha			**% Total**
Lake Volume	V	0.00	10^6 m^3	Upstream Inflow	8567	57.83
Hydrology				Atmosphere	1211	8.17
Upstream Hydraulic Inputs	Qi	1785000	m^3 yr^{-1}	Land Run Off	5037	34.00
Annual Unit Precipitation	Pr	1.478	m yr^{-1}	Development	0	0.00
Annual Unit Lake Evaporation	Ev	0.458	m yr^{-1}	Sedimentation	-3704	25.00
Annual Unit Hydraulic Runoff - Veg. Surfaces	Ru	1.020	m yr^{-1}			
Annual Unit Hydraulic Runoff - Urban	Ru	1.330	m yr^{-1}	Total Outflow	11111	75.00
P Loading				Total Check		100.00
Upstream P Input	Pi	8567	gm P yr^{-1}			
Annual Unit Atmospheric P Deposition	Da	0.0173	gm P m^{-2} yr^{-1}			
Land Use Category 1 P Export Coefficient	E1	0.0069	gm P m^{-2} yr^{-1}	**Model Validation**		
Land Use Category 2 P Export Coefficient	E2	0.0083	gm P m^{-2} yr^{-1}			
Land Use Category 3 P Export Coefficient	E3	0.0520	gm P m^{-2} yr^{-1}			
Land Use Category 4 P Export Coefficient	E4	0.0400	gm P m^{-2} yr^{-1}	Pedicted P (mg L^{-1})		0.0043
Land Use Category 5 P Export Coefficient	E5	0.2020	gm P m^{-2} yr^{-1}	Measured P (mg L^{-1})		0.0069
Land Use Category 6 P Export Coefficient	E6	0.0420	gm P m^{-2} yr^{-1}	% Difference		-37.7
Land Use Category 7 P Export Coefficient	E7	0.0520	gm P m^{-2} yr^{-1}			
Land Use Category 8 P Export Coefficient	E8	0.0400	gm P m^{-2} yr^{-1}			
Land Use Category 9 P Export Coefficient	E9	0.2020	gm P m^{-2} yr^{-1}			
Land Use Category 10 P Export Coefficient	E10	0.0420	gm P m^{-2} yr^{-1}			
Number of Dwellings	N_d	0	#			
Average number of Persons per Dwelling	N_u	2.60	n/a			
Average Fraction of Year Dwellings Occupied	N_{pc}	1	yr^{-1}			
Phosphorus Load per Capita per Year	Sl	800	gm P cap^{-1} yr^{-1}			
Septic System Retention Coefficient	Rsp	0.5	n/a			
Point Source Input 1	PS1	0				
Point Source Input 2	PS2	0				
Point Source Input 3	PS3	0				
Point Source Input 4	PS4	0				
Point Source Input 5	PS5	0				
Phosphorus Retention Coefficient	v	12.4	n/a			
Model Outputs						
Total Precipitation Hydraulic Input	P_{pti}	103460	m^3 yr^{-1}			
Total Evaporation Hydraulic Loss	Eo	32060	m^3 yr^{-1}			
Total Hydraulic Surface Run Off	Ql	744600	m^3 yr^{-1}			
Total Hydraulic Input	Qt	2633060	m^3 yr^{-1}			
Areal Hydraulic Load	q_s	37.16	m yr^{-1}			
Total Hydraulic Outflow	Qo	2601000	m^3 yr^{-1}			
Upstream P Input	Ju	8567	gm yr^{-1}			
Total Atmospheric P Input	Jd	1211	gm yr^{-1}			
Total Overland Run Off P Input	Je	5037	gm yr^{-1}			
Total Development P Input	Jd	0	gm yr^{-1}			
Total P Input	Jt	14815	gm yr^{-1}			
Lake P Retention Factor	Rp	0.25	n/a			
Lake Phosphorus Retention	Ps	3704	gm yr^{-1}			
Predicted Lake Phosphorus Concentration	[P]	**0.0043**	mg L^{-1}			
Lake Phosphorus Outflow	Jo	11111	gm yr^{-1}			
Lake Mean Depth	z	0	m			
Lake Turnover Time	TT	0	yr			
Lake Flushing Rate	FR	#DIV/0!	times yr^{-1}			
Lake Response Time	RT	#DIV/0!	yr			

Flat Lake (Area 13) - 2						
Input Parameters	**Symbol**	**Value**	**Units**	**Budgets**		
Morphology				**Hydraulic Budget (m^{-3})**		
Drainage Basin Area (Excl. of Lake Area)	Ad	52.0	ha			
Area Land Use Category 1 (Forest)	Ad1	52.0	ha			**% Total**
Area Land Use Category 2 (Forest/Cleared)	Ad2	0.0	ha	Upstream Inflow	0	0
Area Land Use Category 3 (Urban Exist)	Ad3	0.0	ha	Precipitation	29560	5.28
Area Land Use Category 4 (Commercial Exist)	Ad4	0.0	ha	Surface Run Off	530400	94.72
Area Land Use Category 5 (Industrial Exist)	Ad5	0.0	ha	Evaporation	-9160	1.64
Area Land Use Category 6 (Institutional Exist)	Ad6	0.0	ha	Total Outflow	550800	98.36
Area Land Use Category 7 (Urban BW)	Ad7	0.0	ha	Total Check		100.00
Area Land Use Category 8 (Commercial BW)	Ad8	0.0	ha			
Area Land Use Category 9 (Industrial BW)	Ad9	0.0	ha	**Phosphorus Budget (gm yr^{-1})**		
Area Land Use Category 10 (Institutional BW)	Ad10	0.0	ha			
Lake Surface Area	Ao	2.0	ha			**% Total**
Lake Volume	V	0.00	10^6 m^3	Upstream Inflow	0	0
Hydrology				Atmosphere	346	8.80
Upstream Hydraulic Inputs	Qi	0	m^3 yr^{-1}	Land Run Off	3588	91.20
Annual Unit Precipitation	Pr	1.478	m yr^{-1}	Development	0	0.00
Annual Unit Lake Evaporation	Ev	0.458	m yr^{-1}	Sedimentation	-1220	31.01
Annual Unit Hydraulic Runoff - Veg. Surfaces	Ru	1.020	m yr^{-1}			
Annual Unit Hydraulic Runoff - Urban	Ru	1.330	m yr^{-1}	Total Outflow	2714	68.99
P Loading				Total Check		100.00
Upstream P Input	Pi	0	gm P yr^{-1}			
Annual Unit Atmospheric P Deposition	Da	0.0173	gm P m^{-2} yr^{-1}			
Land Use Category 1 P Export Coefficient	E1	0.0069	gm P m^{-2} yr^{-1}	**Model Validation**		
Land Use Category 2 P Export Coefficient	E2	0.0083	gm P m^{-2} yr^{-1}			
Land Use Category 3 P Export Coefficient	E3	0.0520	gm P m^{-2} yr^{-1}			
Land Use Category 4 P Export Coefficient	E4	0.0400	gm P m^{-2} yr^{-1}	Pedicted P (mg L^{-1})		0.0049
Land Use Category 5 P Export Coefficient	E5	0.2020	gm P m^{-2} yr^{-1}	Measured P (mg L^{-1})		0.0070
Land Use Category 6 P Export Coefficient	E6	0.0420	gm P m^{-2} yr^{-1}	% Difference		-30.0
Land Use Category 7 P Export Coefficient	E7	0.0520	gm P m^{-2} yr^{-1}			
Land Use Category 8 P Export Coefficient	E8	0.0400	gm P m^{-2} yr^{-1}			
Land Use Category 9 P Export Coefficient	E9	0.2020	gm P m^{-2} yr^{-1}			
Land Use Category 10 P Export Coefficient	E10	0.0420	gm P m^{-2} yr^{-1}			
Number of Dwellings	N_d	0	#			
Average number of Persons per Dwelling	N_u	2.60	n/a			
Average Fraction of Year Dwellings Occupied	N_{pc}	1	yr^{-1}			
Phosphorus Load per Capita per Year	Sl	800	gm P cap^{-1} yr^{-1}			
Septic System Retention Coefficient	Rsp	0.5	n/a			
Point Source Input 1	PS1	0				
Point Source Input 2	PS2	0				
Point Source Input 3	PS3	0				
Point Source Input 4	PS4	0				
Point Source Input 5	PS5	0				
Phosphorus Retention Coefficient	v	12.4	n/a			
Model Outputs						
Total Precipitation Hydraulic Input	P_{pti}	29560	m^3 yr^{-1}			
Total Evaporation Hydraulic Loss	Eo	9160	m^3 yr^{-1}			
Total Hydraulic Surface Run Off	Ql	530400	m^3 yr^{-1}			
Total Hydraulic Input	Qt	559960	m^3 yr^{-1}			
Areal Hydraulic Load	q_s	27.54	m yr^{-1}			
Total Hydraulic Outflow	Qo	550800	m^3 yr^{-1}			
Upstream P Input	Ju	0	gm yr^{-1}			
Total Atmospheric P Input	Jd	346	gm yr^{-1}			
Total Overland Run Off P Input	Je	3588	gm yr^{-1}			
Total Development P Input	Jd	0	gm yr^{-1}			
Total P Input	Jt	3934	gm yr^{-1}			
Lake P Retention Factor	Rp	0.31	n/a			
Lake Phosphorus Retention	Ps	1220	gm yr^{-1}			
Predicted Lake Phosphorus Concentration	[P]	**0.0049**	mg L^{-1}			
Lake Phosphorus Outflow	Jo	2714	gm yr^{-1}			
Lake Mean Depth	z	0	m			
Lake Turnover Time	TT	0	yr			
Lake Flushing Rate	FR	#DIV/0!	times yr^{-1}			
Lake Response Time	RT	#DIV/0!	yr			

Little Cranberry Lake (Area 14A) - 2						
Input Parameters	**Symbol**	**Value**	**Units**	**Budgets**		
Morphology				**Hydraulic Budget (m^{-3})**		
Drainage Basin Area (Excl. of Lake Area)	Ad	20.4	ha			
Area Land Use Category 1 (Forest)	Ad1	20.4	ha			**% Total**
Area Land Use Category 2 (Forest/Cleared)	Ad2	0.0	ha	Upstream Inflow	0	0
Area Land Use Category 3 (Urban Exist)	Ad3	0.0	ha	Precipitation	23648	10.21
Area Land Use Category 4 (Commercial Exist)	Ad4	0.0	ha	Surface Run Off	208080	89.79
Area Land Use Category 5 (Industrial Exist)	Ad5	0.0	ha	Evaporation	-7328	3.16
Area Land Use Category 6 (Institutional Exist)	Ad6	0.0	ha	Total Outflow	224400	96.84
Area Land Use Category 7 (Urban BW)	Ad7	0.0	ha	Total Check		100.00
Area Land Use Category 8 (Commercial BW)	Ad8	0.0	ha			
Area Land Use Category 9 (Industrial BW)	Ad9	0.0	ha	**Phosphorus Budget (gm yr^{-1})**		
Area Land Use Category 10 (Institutional BW)	Ad10	0.0	ha			
Lake Surface Area	Ao	1.6	ha			**% Total**
Lake Volume	V	0.00	10^6 m^3	Upstream Inflow	0	0
Hydrology				Atmosphere	277	16.43
Upstream Hydraulic Inputs	Qi	0	m^3 yr^{-1}	Land Run Off	1408	83.56
Annual Unit Precipitation	Pr	1.478	m yr^{-1}	Development	0	0.00
Annual Unit Lake Evaporation	Ev	0.458	m yr^{-1}	Sedimentation	-792	47.00
Annual Unit Hydraulic Runoff - Veg. Surfaces	Ru	1.020	m yr^{-1}			
Annual Unit Hydraulic Runoff - Urban	Ru	1.330	m yr^{-1}	Total Outflow	893	53.00
P Loading				Total Check		99.99
Upstream P Input	Pi	0	gm P yr^{-1}			
Annual Unit Atmospheric P Deposition	Da	0.0173	gm P m^{-2} yr^{-1}			
Land Use Category 1 P Export Coefficient	E1	0.0069	gm P m^{-2} yr^{-1}	**Model Validation**		
Land Use Category 2 P Export Coefficient	E2	0.0083	gm P m^{-2} yr^{-1}			
Land Use Category 3 P Export Coefficient	E3	0.0520	gm P m^{-2} yr^{-1}			
Land Use Category 4 P Export Coefficient	E4	0.0400	gm P m^{-2} yr^{-1}	Pedicted P (mg L^{-1})		0.0040
Land Use Category 5 P Export Coefficient	E5	0.2020	gm P m^{-2} yr^{-1}	Measured P (mg L^{-1})		0.0066
Land Use Category 6 P Export Coefficient	E6	0.0420	gm P m^{-2} yr^{-1}	% Difference		-39.4
Land Use Category 7 P Export Coefficient	E7	0.0520	gm P m^{-2} yr^{-1}			
Land Use Category 8 P Export Coefficient	E8	0.0400	gm P m^{-2} yr^{-1}			
Land Use Category 9 P Export Coefficient	E9	0.2020	gm P m^{-2} yr^{-1}			
Land Use Category 10 P Export Coefficient	E10	0.0420	gm P m^{-2} yr^{-1}			
Number of Dwellings	N_d	0	#			
Average number of Persons per Dwelling	N_u	2.60	n/a			
Average Fraction of Year Dwellings Occupied	N_{pc}	1	yr^{-1}			
Phosphorus Load per Capita per Year	Sl	800	gm P cap^{-1} yr^{-1}			
Septic System Retention Coefficient	Rsp	0.5	n/a			
Point Source Input 1	PS1	0				
Point Source Input 2	PS2	0				
Point Source Input 3	PS3	0				
Point Source Input 4	PS4	0				
Point Source Input 5	PS5	0				
Phosphorus Retention Coefficient	v	12.4	n/a			
Model Outputs						
Total Precipitation Hydraulic Input	P_{pti}	23648	m^3 yr^{-1}			
Total Evaporation Hydraulic Loss	Eo	7328	m^3 yr^{-1}			
Total Hydraulic Surface Run Off	Ql	208080	m^3 yr^{-1}			
Total Hydraulic Input	Qt	231728	m^3 yr^{-1}			
Areal Hydraulic Load	q_s	14.03	m yr^{-1}			
Total Hydraulic Outflow	Qo	224400	m^3 yr^{-1}			
Upstream P Input	Ju	0	gm yr^{-1}			
Total Atmospheric P Input	Jd	277	gm yr^{-1}			
Total Overland Run Off P Input	Je	1408	gm yr^{-1}			
Total Development P Input	Jd	0	gm yr^{-1}			
Total P Input	Jt	1685	gm yr^{-1}			
Lake P Retention Factor	Rp	0.47	n/a			
Lake Phosphorus Retention	Ps	792	gm yr^{-1}			
Predicted Lake Phosphorus Concentration	[P]	**0.004**	mg L^{-1}			
Lake Phosphorus Outflow	Jo	893	gm yr^{-1}			
Lake Mean Depth	z	0	m			
Lake Turnover Time	TT	0	yr			
Lake Flushing Rate	FR	#DIV/0!	times yr^{-1}			
Lake Response Time	RT	#DIV/0!	yr			

Big Cranberry Lake (Area 14B) - 2						
Input Parameters	**Symbol**	**Value**	**Units**	**Budgets**		
Morphology				**Hydraulic Budget (m^{-3})**		
Drainage Basin Area (Excl. of Lake Area)	Ad	22.6	ha			
Area Land Use Category 1 (Forest)	Ad1	22.6	ha			**% Total**
Area Land Use Category 2 (Forest/Cleared)	Ad2	0.0	ha	Upstream Inflow	3376200	91.95
Area Land Use Category 3 (Urban Exist)	Ad3	0.0	ha	Precipitation	65032	1.77
Area Land Use Category 4 (Commercial Exist)	Ad4	0.0	ha	Surface Run Off	230520	6.28
Area Land Use Category 5 (Industrial Exist)	Ad5	0.0	ha	Evaporation	-20152	0.55
Area Land Use Category 6 (Institutional Exist)	Ad6	0.0	ha	Total Outflow	3651600	99.45
Area Land Use Category 7 (Urban BW)	Ad7	0.0	ha	Total Check		100.00
Area Land Use Category 8 (Commercial BW)	Ad8	0.0	ha			
Area Land Use Category 9 (Industrial BW)	Ad9	0.0	ha	**Phosphorus Budget (gm yr^{-1})**		
Area Land Use Category 10 (Institutional BW)	Ad10	0.0	ha			
Lake Surface Area	Ao	4.4	ha			**% Total**
Lake Volume	V	0.00	10^6 m^3	Upstream Inflow	14718	86.38
Hydrology				Atmosphere	761	4.47
Upstream Hydraulic Inputs	Qi	3376200	m^3 yr^{-1}	Land Run Off	1559	9.15
Annual Unit Precipitation	Pr	1.478	m yr^{-1}	Development	0	0.00
Annual Unit Lake Evaporation	Ev	0.458	m yr^{-1}	Sedimentation	-2215	13.00
Annual Unit Hydraulic Runoff - Veg. Surfaces	Ru	1.020	m yr^{-1}			
Annual Unit Hydraulic Runoff - Urban	Ru	1.330	m yr^{-1}	Total Outflow	14823	87.00
P Loading				Total Check		100.00
Upstream P Input	Pi	14718	gm P yr^{-1}			
Annual Unit Atmospheric P Deposition	Da	0.0173	gm P m^{-2} yr^{-1}			
Land Use Category 1 P Export Coefficient	E1	0.0069	gm P m^{-2} yr^{-1}	**Model Validation**		
Land Use Category 2 P Export Coefficient	E2	0.0083	gm P m^{-2} yr^{-1}			
Land Use Category 3 P Export Coefficient	E3	0.0520	gm P m^{-2} yr^{-1}			
Land Use Category 4 P Export Coefficient	E4	0.0400	gm P m^{-2} yr^{-1}	Pedicted P (mg L^{-1})		0.0041
Land Use Category 5 P Export Coefficient	E5	0.2020	gm P m^{-2} yr^{-1}	Measured P (mg L^{-1})		0.0086
Land Use Category 6 P Export Coefficient	E6	0.0420	gm P m^{-2} yr^{-1}	% Difference		-52.3
Land Use Category 7 P Export Coefficient	E7	0.0520	gm P m^{-2} yr^{-1}			
Land Use Category 8 P Export Coefficient	E8	0.0400	gm P m^{-2} yr^{-1}			
Land Use Category 9 P Export Coefficient	E9	0.2020	gm P m^{-2} yr^{-1}			
Land Use Category 10 P Export Coefficient	E10	0.0420	gm P m^{-2} yr^{-1}			
Number of Dwellings	N_d	0	#			
Average number of Persons per Dwelling	N_u	2.60	n/a			
Average Fraction of Year Dwellings Occupied	N_{pc}	1	yr^{-1}			
Phosphorus Load per Capita per Year	Sl	800	gm P cap^{-1} yr^{-1}			
Septic System Retention Coefficient	Rsp	0.5	n/a			
Point Source Input 1	PS1	0				
Point Source Input 2	PS2	0				
Point Source Input 3	PS3	0				
Point Source Input 4	PS4	0				
Point Source Input 5	PS5	0				
Phosphorus Retention Coefficient	v	12.4	n/a			
Model Outputs						
Total Precipitation Hydraulic Input	P_{pti}	65032	m^3 yr^{-1}			
Total Evaporation Hydraulic Loss	Eo	20152	m^3 yr^{-1}			
Total Hydraulic Surface Run Off	Ql	230520	m^3 yr^{-1}			
Total Hydraulic Input	Qt	3671752	m^3 yr^{-1}			
Areal Hydraulic Load	q_s	82.99	m yr^{-1}			
Total Hydraulic Outflow	Qo	3651600	m^3 yr^{-1}			
Upstream P Input	Ju	14718	gm yr^{-1}			
Total Atmospheric P Input	Jd	761	gm yr^{-1}			
Total Overland Run Off P Input	Je	1559	gm yr^{-1}			
Total Development P Input	Jd	0	gm yr^{-1}			
Total P Input	Jt	17038	gm yr^{-1}			
Lake P Retention Factor	Rp	0.13	n/a			
Lake Phosphorus Retention	Ps	2215	gm yr^{-1}			
Predicted Lake Phosphorus Concentration	[P]	**0.0041**	mg L^{-1}			
Lake Phosphorus Outflow	Jo	14823	gm yr^{-1}			
Lake Mean Depth	z	0	m			
Lake Turnover Time	TT	0	yr			
Lake Flushing Rate	FR	#DIV/0!	times yr^{-1}			
Lake Response Time	RT	#DIV/0!	yr			

Ash Lake (Area 16) - 2

Input Parameters	Symbol	Value	Units
Morphology			
Drainage Basin Area (Excl. of Lake Area)	Ad	118.0	ha
Area Land Use Category 1 (Forest)	Ad1	118.0	ha
Area Land Use Category 2 (Forest/Cleared)	Ad2	0.0	ha
Area Land Use Category 3 (Urban Exist)	Ad3	0.0	ha
Area Land Use Category 4 (Commercial Exist)	Ad4	0.0	ha
Area Land Use Category 5 (Industrial Exist)	Ad5	0.0	ha
Area Land Use Category 6 (Institutional Exist)	Ad6	0.0	ha
Area Land Use Category 7 (Urban BW)	Ad7	0.0	ha
Area Land Use Category 8 (Commercial BW)	Ad8	0.0	ha
Area Land Use Category 9 (Industrial BW)	Ad9	0.0	ha
Area Land Use Category 10 (Institutional BW)	Ad10	0.0	ha
Lake Surface Area	Ao	30.0	ha
Lake Volume	V	0.00	10^6 m^3
Hydrology			
Upstream Hydraulic Inputs	Qi	0	m^3 yr^{-1}
Annual Unit Precipitation	Pr	1.478	m yr^{-1}
Annual Unit Lake Evaporation	Ev	0.458	m yr^{-1}
Annual Unit Hydraulic Runoff - Veg. Surfaces	Ru	1.020	m yr^{-1}
Annual Unit Hydraulic Runoff - Urban	Ru	1.330	m yr^{-1}
P Loading			
Upstream P Input	Pi	0	gm P yr^{-1}
Annual Unit Atmospheric P Deposition	Da	0.0173	gm P m^{-2} yr^{-1}
Land Use Category 1 P Export Coefficient	E1	0.0069	gm P m^{-2} yr^{-1}
Land Use Category 2 P Export Coefficient	E2	0.0083	gm P m^{-2} yr^{-1}
Land Use Category 3 P Export Coefficient	E3	0.0520	gm P m^{-2} yr^{-1}
Land Use Category 4 P Export Coefficient	E4	0.0400	gm P m^{-2} yr^{-1}
Land Use Category 5 P Export Coefficient	E5	0.2020	gm P m^{-2} yr^{-1}
Land Use Category 6 P Export Coefficient	E6	0.0420	gm P m^{-2} yr^{-1}
Land Use Category 7 P Export Coefficient	E7	0.0520	gm P m^{-2} yr^{-1}
Land Use Category 8 P Export Coefficient	E8	0.0400	gm P m^{-2} yr^{-1}
Land Use Category 9 P Export Coefficient	E9	0.2020	gm P m^{-2} yr^{-1}
Land Use Category 10 P Export Coefficient	E10	0.0420	gm P m^{-2} yr^{-1}
Number of Dwellings	N_d	0	#
Average number of Persons per Dwelling	N_u	2.60	n/a
Average Fraction of Year Dwellings Occupied	N_{pc}	1	yr^{-1}
Phosphorus Load per Capita per Year	Sl	800	gm P cap^{-1} yr^{-1}
Septic System Retention Coefficient	Rsp	0.5	n/a
Point Source Input 1	PS1	0	
Point Source Input 2	PS2	0	
Point Source Input 3	PS3	0	
Point Source Input 4	PS4	0	
Point Source Input 5	PS5	0	
Phosphorus Retention Coefficient	v	12.4	n/a
Model Outputs			
Total Precipitation Hydraulic Input	P_{pti}	443400	m^3 yr^{-1}
Total Evaporation Hydraulic Loss	Eo	137400	m^3 yr^{-1}
Total Hydraulic Surface Run Off	Ql	1203600	m^3 yr^{-1}
Total Hydraulic Input	Qt	1647000	m^3 yr^{-1}
Areal Hydraulic Load	q_s	5.03	m yr^{-1}
Total Hydraulic Outflow	Qo	1509600	m^3 yr^{-1}
Upstream P Input	Ju	0	gm yr^{-1}
Total Atmospheric P Input	Jd	5190	gm yr^{-1}
Total Overland Run Off P Input	Je	8142	gm yr^{-1}
Total Development P Input	Jd	0	gm yr^{-1}
Total P Input	Jt	13332	gm yr^{-1}
Lake P Retention Factor	Rp	0.71	n/a
Lake Phosphorus Retention	Ps	9466	gm yr^{-1}
Predicted Lake Phosphorus Concentration	[P]	**0.0026**	mg L^{-1}
Lake Phosphorus Outflow	Jo	3866	gm yr^{-1}
Lake Mean Depth	z	0	m
Lake Turnover Time	TT	0	yr
Lake Flushing Rate	FR	#DIV/0!	times yr^{-1}
Lake Response Time	RT	#DIV/0!	yr

Hydraulic Budget (m^{-3})

		% Total
Upstream Inflow	0	0
Precipitation	443400	26.92
Surface Run Off	1203600	73.08
Evaporation	-137400	8.34
Total Outflow	1509600	91.66
Total Check		100.00

Phosphorus Budget (gm yr^{-1})

		% Total
Upstream Inflow	0	0
Atmosphere	5190	38.93
Land Run Off	8142	61.07
Development	0	0.00
Sedimentation	-9466	71.00
Total Outflow	3866	29.00
Total Check		100.00

Model Validation

Pedicted P (mg L^{-1})		0.0026
Measured P (mg L^{-1})		0.0022
% Difference		18.2

Crane Lake (Area 15) - 2						
Input Parameters	**Symbol**	**Value**	**Units**	**Budgets**		
Morphology				**Hydraulic Budget (m^{-3})**		
Drainage Basin Area (Excl. of Lake Area)	Ad	36.0	ha			
Area Land Use Category 1 (Forest)	Ad1	36.0	ha			**% Total**
Area Land Use Category 2 (Forest/Cleared)	Ad2	0.0	ha	Upstream Inflow	0	0
Area Land Use Category 3 (Urban Exist)	Ad3	0.0	ha	Precipitation	177360	32.57
Area Land Use Category 4 (Commercial Exist)	Ad4	0.0	ha	Surface Run Off	367200	67.43
Area Land Use Category 5 (Industrial Exist)	Ad5	0.0	ha	Evaporation	-54960	10.09
Area Land Use Category 6 (Institutional Exist)	Ad6	0.0	ha	Total Outflow	489600	89.91
Area Land Use Category 7 (Urban BW)	Ad7	0.0	ha	Total Check		100.00
Area Land Use Category 8 (Commercial BW)	Ad8	0.0	ha			
Area Land Use Category 9 (Industrial BW)	Ad9	0.0	ha	**Phosphorus Budget (gm yr^{-1})**		
Area Land Use Category 10 (Institutional BW)	Ad10	0.0	ha			
Lake Surface Area	Ao	12.0	ha			**% Total**
Lake Volume	V	0.00	10^6 m^3	Upstream Inflow	0	0
Hydrology				Atmosphere	2076	45.53
Upstream Hydraulic Inputs	Qi	0	m^3 yr^{-1}	Land Run Off	2484	54.47
Annual Unit Precipitation	Pr	1.478	m yr^{-1}	Development	0	0.00
Annual Unit Lake Evaporation	Ev	0.458	m yr^{-1}	Sedimentation	-3420	75.00
Annual Unit Hydraulic Runoff - Veg. Surfaces	Ru	1.020	m yr^{-1}			
Annual Unit Hydraulic Runoff - Urban	Ru	1.330	m yr^{-1}	Total Outflow	1140	25.00
P Loading				Total Check		100.00
Upstream P Input	Pi	0	gm P yr^{-1}			
Annual Unit Atmospheric P Deposition	Da	0.0173	gm P m^{-2} yr^{-1}			
Land Use Category 1 P Export Coefficient	E1	0.0069	gm P m^{-2} yr^{-1}	**Model Validation**		
Land Use Category 2 P Export Coefficient	E2	0.0083	gm P m^{-2} yr^{-1}			
Land Use Category 3 P Export Coefficient	E3	0.0520	gm P m^{-2} yr^{-1}			
Land Use Category 4 P Export Coefficient	E4	0.0400	gm P m^{-2} yr^{-1}	Pedicted P (mg L^{-1})		0.0023
Land Use Category 5 P Export Coefficient	E5	0.2020	gm P m^{-2} yr^{-1}	Measured P (mg L^{-1})		0.0034
Land Use Category 6 P Export Coefficient	E6	0.0420	gm P m^{-2} yr^{-1}	% Difference		-32.4
Land Use Category 7 P Export Coefficient	E7	0.0520	gm P m^{-2} yr^{-1}			
Land Use Category 8 P Export Coefficient	E8	0.0400	gm P m^{-2} yr^{-1}			
Land Use Category 9 P Export Coefficient	E9	0.2020	gm P m^{-2} yr^{-1}			
Land Use Category 10 P Export Coefficient	E10	0.0420	gm P m^{-2} yr^{-1}			
Number of Dwellings	N_d	0	#			
Average number of Persons per Dwelling	N_u	2.60	n/a			
Average Fraction of Year Dwellings Occupied	N_{pc}	1	yr^{-1}			
Phosphorus Load per Capita per Year	Sl	800	gm P cap^{-1} yr^{-1}			
Septic System Retention Coefficient	Rsp	0.5	n/a			
Point Source Input 1	PS1	0				
Point Source Input 2	PS2	0				
Point Source Input 3	PS3	0				
Point Source Input 4	PS4	0				
Point Source Input 5	PS5	0				
Phosphorus Retention Coefficient	v	12.4	n/a			
Model Outputs						
Total Precipitation Hydraulic Input	P_{pti}	177360	m^3 yr^{-1}			
Total Evaporation Hydraulic Loss	Eo	54960	m^3 yr^{-1}			
Total Hydraulic Surface Run Off	Ql	367200	m^3 yr^{-1}			
Total Hydraulic Input	Qt	544560	m^3 yr^{-1}			
Areal Hydraulic Load	q_s	4.08	m yr^{-1}			
Total Hydraulic Outflow	Qo	489600	m^3 yr^{-1}			
Upstream P Input	Ju	0	gm yr^{-1}			
Total Atmospheric P Input	Jd	2076	gm yr^{-1}			
Total Overland Run Off P Input	Je	2484	gm yr^{-1}			
Total Development P Input	Jd	0	gm yr^{-1}			
Total P Input	Jt	4560	gm yr^{-1}			
Lake P Retention Factor	Rp	0.75	n/a			
Lake Phosphorus Retention	Ps	3420	gm yr^{-1}			
Predicted Lake Phosphorus Concentration	[P]	**0.0023**	mg L^{-1}			
Lake Phosphorus Outflow	Jo	1140	gm yr^{-1}			
Lake Mean Depth	z	0	m			
Lake Turnover Time	TT	0	yr			
Lake Flushing Rate	FR	#DIV/0!	times yr^{-1}			
Lake Response Time	RT	#DIV/0!	yr			

Susies Lake (Area 18A) - 2						
Input Parameters	**Symbol**	**Value**	**Units**	**Budgets**		
Morphology				**Hydraulic Budget (m^{-3})**		
Drainage Basin Area (Excl. of Lake Area)	Ad	539.4	ha			
Area Land Use Category 1 (Forest)	Ad1	393.4	ha			**% Total**
Area Land Use Category 2 (Forest/Cleared)	Ad2	0.0	ha	Upstream Inflow	5650800	44.16
Area Land Use Category 3 (Urban Exist)	Ad3	0.0	ha	Precipitation	1191268	9.31
Area Land Use Category 4 (Commercial Exist)	Ad4	81.0	ha	Surface Run Off	5954480	46.53
Area Land Use Category 5 (Industrial Exist)	Ad5	65.0	ha	Evaporation	-369148	2.88
Area Land Use Category 6 (Institutional Exist)	Ad6	0.0	ha	Total Outflow	12427400	97.12
Area Land Use Category 7 (Urban BW)	Ad7	0.0	ha	Total Check		100.00
Area Land Use Category 8 (Commercial BW)	Ad8	0.0	ha			
Area Land Use Category 9 (Industrial BW)	Ad9	0.0	ha	**Phosphorus Budget (gm yr^{-1})**		
Area Land Use Category 10 (Institutional BW)	Ad10	0.0	ha			
Lake Surface Area	Ao	80.6	ha			**% Total**
Lake Volume	V	2.61	10^6 m^3	Upstream Inflow	19829	8.83
Hydrology				Atmosphere	13944	6.21
Upstream Hydraulic Inputs	Qi	5650800	m^3 yr^{-1}	Land Run Off	190845	84.96
Annual Unit Precipitation	Pr	1.478	m yr^{-1}	Development	0	0.00
Annual Unit Lake Evaporation	Ev	0.458	m yr^{-1}	Sedimentation	-101078	45.00
Annual Unit Hydraulic Runoff - Veg. Surfaces	Ru	1.020	m yr^{-1}			
Annual Unit Hydraulic Runoff - Urban	Ru	1.330	m yr^{-1}	Total Outflow	123540	55.00
P Loading				Total Check		100.00
Upstream P Input	Pi	19829	gm P yr^{-1}			
Annual Unit Atmospheric P Deposition	Da	0.0173	gm P m^{-2} yr^{-1}			
Land Use Category 1 P Export Coefficient	E1	0.0069	gm P m^{-2} yr^{-1}	**Model Validation**		
Land Use Category 2 P Export Coefficient	E2	0.0083	gm P m^{-2} yr^{-1}			
Land Use Category 3 P Export Coefficient	E3	0.0520	gm P m^{-2} yr^{-1}			
Land Use Category 4 P Export Coefficient	E4	0.0400	gm P m^{-2} yr^{-1}	Pedicted P (mg L^{-1})		0.0099
Land Use Category 5 P Export Coefficient	E5	0.2020	gm P m^{-2} yr^{-1}	Measured P (mg L^{-1})		0.0072
Land Use Category 6 P Export Coefficient	E6	0.0420	gm P m^{-2} yr^{-1}	% Difference		37.5
Land Use Category 7 P Export Coefficient	E7	0.0520	gm P m^{-2} yr^{-1}			
Land Use Category 8 P Export Coefficient	E8	0.0400	gm P m^{-2} yr^{-1}			
Land Use Category 9 P Export Coefficient	E9	0.2020	gm P m^{-2} yr^{-1}			
Land Use Category 10 P Export Coefficient	E10	0.0420	gm P m^{-2} yr^{-1}			
Number of Dwellings	N_d	0	#			
Average number of Persons per Dwelling	N_u	2.60	n/a			
Average Fraction of Year Dwellings Occupied	N_{pc}	1	yr^{-1}			
Phosphorus Load per Capita per Year	Sl	800	gm P cap^{-1} yr^{-1}			
Septic System Retention Coefficient	Rsp	0.5	n/a			
Point Source Input 1	PS1	0				
Point Source Input 2	PS2	0				
Point Source Input 3	PS3	0				
Point Source Input 4	PS4	0				
Point Source Input 5	PS5	0				
Phosphorus Retention Coefficient	v	12.4	n/a			
Model Outputs						
Total Precipitation Hydraulic Input	P_{pti}	1191268	m^3 yr^{-1}			
Total Evaporation Hydraulic Loss	Eo	369148	m^3 yr^{-1}			
Total Hydraulic Surface Run Off	Ql	5954480	m^3 yr^{-1}			
Total Hydraulic Input	Qt	12796548	m^3 yr^{-1}			
Areal Hydraulic Load	q_s	15.42	m yr^{-1}			
Total Hydraulic Outflow	Qo	12427400	m^3 yr^{-1}			
Upstream P Input	Ju	19829	gm yr^{-1}			
Total Atmospheric P Input	Jd	13944	gm yr^{-1}			
Total Overland Run Off P Input	Je	190845	gm yr^{-1}			
Total Development P Input	Jd	0	gm yr^{-1}			
Total P Input	Jt	224618	gm yr^{-1}			
Lake P Retention Factor	Rp	0.45	n/a			
Lake Phosphorus Retention	Ps	101078	gm yr^{-1}			
Predicted Lake Phosphorus Concentration	[P]	**0.0099**	mg L^{-1}			
Lake Phosphorus Outflow	Jo	123540	gm yr^{-1}			
Lake Mean Depth	z	3.2	m			
Lake Turnover Time	TT	0.21	yr			
Lake Flushing Rate	FR	4.77	times yr^{-1}			
Lake Response Time	RT	0.09	yr			

Fox Lake (Area 17) - 2

Input Parameters	Symbol	Value	Units
Morphology			
Drainage Basin Area (Excl. of Lake Area)	Ad	77.0	ha
Area Land Use Category 1 (Forest)	Ad1	77.0	ha
Area Land Use Category 2 (Forest/Cleared)	Ad2	0.0	ha
Area Land Use Category 3 (Urban Exist)	Ad3	0.0	ha
Area Land Use Category 4 (Commercial Exist)	Ad4	0.0	ha
Area Land Use Category 5 (Industrial Exist)	Ad5	0.0	ha
Area Land Use Category 6 (Institutional Exist)	Ad6	0.0	ha
Area Land Use Category 7 (Urban BW)	Ad7	0.0	ha
Area Land Use Category 8 (Commercial BW)	Ad8	0.0	ha
Area Land Use Category 9 (Industrial BW)	Ad9	0.0	ha
Area Land Use Category 10 (Institutional BW)	Ad10	0.0	ha
Lake Surface Area	Ao	16.0	ha
Lake Volume	V	0.00	10^6 m^3
Hydrology			
Upstream Hydraulic Inputs	Qi	0	m^3 yr^{-1}
Annual Unit Precipitation	Pr	1.478	m yr^{-1}
Annual Unit Lake Evaporation	Ev	0.458	m yr^{-1}
Annual Unit Hydraulic Runoff - Veg. Surfaces	Ru	1.020	m yr^{-1}
Annual Unit Hydraulic Runoff - Urban	Ru	1.330	m yr^{-1}
P Loading			
Upstream P Input	Pi	0	gm P yr^{-1}
Annual Unit Atmospheric P Deposition	Da	0.0173	gm P m^{-2} yr^{-1}
Land Use Category 1 P Export Coefficient	E1	0.0069	gm P m^{-2} yr^{-1}
Land Use Category 2 P Export Coefficient	E2	0.0083	gm P m^{-2} yr^{-1}
Land Use Category 3 P Export Coefficient	E3	0.0520	gm P m^{-2} yr^{-1}
Land Use Category 4 P Export Coefficient	E4	0.0400	gm P m^{-2} yr^{-1}
Land Use Category 5 P Export Coefficient	E5	0.2020	gm P m^{-2} yr^{-1}
Land Use Category 6 P Export Coefficient	E6	0.0420	gm P m^{-2} yr^{-1}
Land Use Category 7 P Export Coefficient	E7	0.0520	gm P m^{-2} yr^{-1}
Land Use Category 8 P Export Coefficient	E8	0.0400	gm P m^{-2} yr^{-1}
Land Use Category 9 P Export Coefficient	E9	0.2020	gm P m^{-2} yr^{-1}
Land Use Category 10 P Export Coefficient	E10	0.0420	gm P m^{-2} yr^{-1}
Number of Dwellings	N_d	0	#
Average number of Persons per Dwelling	N_u	2.60	n/a
Average Fraction of Year Dwellings Occupied	N_{pc}	1	yr^{-1}
Phosphorus Load per Capita per Year	Sl	800	gm P cap^{-1} yr^{-1}
Septic System Retention Coefficient	Rsp	0.5	n/a
Point Source Input 1	PS1	0	
Point Source Input 2	PS2	0	
Point Source Input 3	PS3	0	
Point Source Input 4	PS4	0	
Point Source Input 5	PS5	0	
Phosphorus Retention Coefficient	v	12.4	n/a
Model Outputs			
Total Precipitation Hydraulic Input	P_{pti}	236480	m^3 yr^{-1}
Total Evaporation Hydraulic Loss	Eo	73280	m^3 yr^{-1}
Total Hydraulic Surface Run Off	Ql	785400	m^3 yr^{-1}
Total Hydraulic Input	Qt	1021880	m^3 yr^{-1}
Areal Hydraulic Load	q_s	5.93	m yr^{-1}
Total Hydraulic Outflow	Qo	948600	m^3 yr^{-1}
Upstream P Input	Ju	0	gm yr^{-1}
Total Atmospheric P Input	Jd	2768	gm yr^{-1}
Total Overland Run Off P Input	Je	5313	gm yr^{-1}
Total Development P Input	Jd	0	gm yr^{-1}
Total P Input	Jt	8081	gm yr^{-1}
Lake P Retention Factor	Rp	0.68	n/a
Lake Phosphorus Retention	Ps	5495	gm yr^{-1}
Predicted Lake Phosphorus Concentration	[P]	**0.0027**	mg L^{-1}
Lake Phosphorus Outflow	Jo	2586	gm yr^{-1}
Lake Mean Depth	z	0	m
Lake Turnover Time	TT	0	yr
Lake Flushing Rate	FR	#DIV/0!	times yr^{-1}
Lake Response Time	RT	#DIV/0!	yr

Hydraulic Budget (m^{-3})

		% Total
Upstream Inflow	0	0
Precipitation	236480	23.14
Surface Run Off	785400	76.86
Evaporation	-73280	7.17
Total Outflow	948600	92.83
Total Check		100.00

Phosphorus Budget (gm yr^{-1})

		% Total
Upstream Inflow	0	0
Atmosphere	2768	34.25
Land Run Off	5313	65.75
Development	0	0.00
Sedimentation	-5495	68.00
Total Outflow	2586	32.00
Total Check		100.00

Model Validation

Pedicted P (mg L^{-1})		0.0027
Measured P (mg L^{-1})		0.0031
% Difference		-12.9

Quarry Lake (Area 18B) - 2

Input Parameters	Symbol	Value	Units
Morphology			
Drainage Basin Area (Excl. of Lake Area)	Ad	137.9	ha
Area Land Use Category 1 (Forest)	Ad1	137.9	ha
Area Land Use Category 2 (Forest/Cleared)	Ad2	0.0	ha
Area Land Use Category 3 (Urban Exist)	Ad3	0.0	ha
Area Land Use Category 4 (Commercial Exist)	Ad4	0.0	ha
Area Land Use Category 5 (Industrial Exist)	Ad5	0.0	ha
Area Land Use Category 6 (Institutional Exist)	Ad6	0.0	ha
Area Land Use Category 7 (Urban BW)	Ad7	0.0	ha
Area Land Use Category 8 (Commercial BW)	Ad8	0.0	ha
Area Land Use Category 9 (Industrial BW)	Ad9	0.0	ha
Area Land Use Category 10 (Institutional BW)	Ad10	0.0	ha
Lake Surface Area	Ao	45.1	ha
Lake Volume	V	1.60	10^6 m^3
Hydrology			
Upstream Hydraulic Inputs	Qi	13376000	m^3 yr^{-1}
Annual Unit Precipitation	Pr	1.478	m yr^{-1}
Annual Unit Lake Evaporation	Ev	0.458	m yr^{-1}
Annual Unit Hydraulic Runoff - Veg. Surfaces	Ru	1.020	m yr^{-1}
Annual Unit Hydraulic Runoff - Urban	Ru	1.330	m yr^{-1}
P Loading			
Upstream P Input	Pi	126126	gm P yr^{-1}
Annual Unit Atmospheric P Deposition	Da	0.0173	gm P m^{-2} yr^{-1}
Land Use Category 1 P Export Coefficient	E1	0.0069	gm P m^{-2} yr^{-1}
Land Use Category 2 P Export Coefficient	E2	0.0083	gm P m^{-2} yr^{-1}
Land Use Category 3 P Export Coefficient	E3	0.0520	gm P m^{-2} yr^{-1}
Land Use Category 4 P Export Coefficient	E4	0.0400	gm P m^{-2} yr^{-1}
Land Use Category 5 P Export Coefficient	E5	0.2020	gm P m^{-2} yr^{-1}
Land Use Category 6 P Export Coefficient	E6	0.0420	gm P m^{-2} yr^{-1}
Land Use Category 7 P Export Coefficient	E7	0.0520	gm P m^{-2} yr^{-1}
Land Use Category 8 P Export Coefficient	E8	0.0400	gm P m^{-2} yr^{-1}
Land Use Category 9 P Export Coefficient	E9	0.2020	gm P m^{-2} yr^{-1}
Land Use Category 10 P Export Coefficient	E10	0.0420	gm P m^{-2} yr^{-1}
Number of Dwellings	N_d	0	#
Average number of Persons per Dwelling	N_u	2.60	n/a
Average Fraction of Year Dwellings Occupied	N_{pc}	1	yr^{-1}
Phosphorus Load per Capita per Year	Sl	800	gm P cap^{-1} yr^{-1}
Septic System Retention Coefficient	Rsp	0.5	n/a
Point Source Input 1	PS1	0	
Point Source Input 2	PS2	0	
Point Source Input 3	PS3	0	
Point Source Input 4	PS4	0	
Point Source Input 5	PS5	0	
Phosphorus Retention Coefficient	v	12.4	n/a
Model Outputs			
Total Precipitation Hydraulic Input	P_{pti}	666578	m^3 yr^{-1}
Total Evaporation Hydraulic Loss	Eo	206558	m^3 yr^{-1}
Total Hydraulic Surface Run Off	Ql	1406580	m^3 yr^{-1}
Total Hydraulic Input	Qt	15449158	m^3 yr^{-1}
Areal Hydraulic Load	q_s	33.8	m yr^{-1}
Total Hydraulic Outflow	Qo	15242600	m^3 yr^{-1}
Upstream P Input	Ju	126126	gm yr^{-1}
Total Atmospheric P Input	Jd	7802	gm yr^{-1}
Total Overland Run Off P Input	Je	9515	gm yr^{-1}
Total Development P Input	Jd	0	gm yr^{-1}
Total P Input	Jt	143443	gm yr^{-1}
Lake P Retention Factor	Rp	0.27	n/a
Lake Phosphorus Retention	Ps	38730	gm yr^{-1}
Predicted Lake Phosphorus Concentration	[P]	**0.0069**	mg L^{-1}
Lake Phosphorus Outflow	Jo	104713	gm yr^{-1}
Lake Mean Depth	z	3.5	m
Lake Turnover Time	TT	0.1	yr
Lake Flushing Rate	FR	9.56	times yr^{-1}
Lake Response Time	RT	0.06	yr

Hydraulic Budget (m^{-3})

		% Total
Upstream Inflow	13376000	86.58
Precipitation	666578	4.31
Surface Run Off	1406580	9.1
Evaporation	-206558	1.34
Total Outflow	15242600	98.66
Total Check		99.99

Phosphorus Budget (gm yr^{-1})

		% Total
Upstream Inflow	126126	87.93
Atmosphere	7802	5.44
Land Run Off	9515	6.63
Development	0	0.00
Sedimentation	-38730	27.00
Total Outflow	104713	73.00
Total Check		100.00

Model Validation

Pedicted P (mg L^{-1})		0.0069
Measured P (mg L^{-1})		0.0056
% Difference		23.2

Charlies Lake (Area 22) - 2

Input Parameters	Symbol	Value	Units
Morphology			
Drainage Basin Area (Excl. of Lake Area)	Ad	39.0	ha
Area Land Use Category 1 (Forest)	Ad1	36.0	ha
Area Land Use Category 2 (Forest/Cleared)	Ad2	0.0	ha
Area Land Use Category 3 (Urban Exist)	Ad3	0.0	ha
Area Land Use Category 4 (Commercial Exist)	Ad4	0.0	ha
Area Land Use Category 5 (Industrial Exist)	Ad5	0.0	ha
Area Land Use Category 6 (Institutional Exist)	Ad6	0.0	ha
Area Land Use Category 7 (Urban BW)	Ad7	3.0	ha
Area Land Use Category 8 (Commercial BW)	Ad8	0.0	ha
Area Land Use Category 9 (Industrial BW)	Ad9	0.0	ha
Area Land Use Category 10 (Institutional BW)	Ad10	0.0	ha
Lake Surface Area	Ao	6.0	ha
Lake Volume	V	0.00	10^6 m^3
Hydrology			
Upstream Hydraulic Inputs	Qi	0	m^3 yr^{-1}
Annual Unit Precipitation	Pr	1.478	m yr^{-1}
Annual Unit Lake Evaporation	Ev	0.458	m yr^{-1}
Annual Unit Hydraulic Runoff - Veg. Surfaces	Ru	1.020	m yr^{-1}
Annual Unit Hydraulic Runoff - Urban	Ru	1.330	m yr^{-1}
P Loading			
Upstream P Input	Pi	0	gm P yr^{-1}
Annual Unit Atmospheric P Deposition	Da	0.0173	gm P m^{-2} yr^{-1}
Land Use Category 1 P Export Coefficient	E1	0.0069	gm P m^{-2} yr^{-1}
Land Use Category 2 P Export Coefficient	E2	0.0083	gm P m^{-2} yr^{-1}
Land Use Category 3 P Export Coefficient	E3	0.0520	gm P m^{-2} yr^{-1}
Land Use Category 4 P Export Coefficient	E4	0.0400	gm P m^{-2} yr^{-1}
Land Use Category 5 P Export Coefficient	E5	0.2020	gm P m^{-2} yr^{-1}
Land Use Category 6 P Export Coefficient	E6	0.0420	gm P m^{-2} yr^{-1}
Land Use Category 7 P Export Coefficient	E7	0.0520	gm P m^{-2} yr^{-1}
Land Use Category 8 P Export Coefficient	E8	0.0400	gm P m^{-2} yr^{-1}
Land Use Category 9 P Export Coefficient	E9	0.2020	gm P m^{-2} yr^{-1}
Land Use Category 10 P Export Coefficient	E10	0.0420	gm P m^{-2} yr^{-1}
Number of Dwellings	N_d	0	#
Average number of Persons per Dwelling	N_u	2.60	n/a
Average Fraction of Year Dwellings Occupied	N_{pc}	1	yr^{-1}
Phosphorus Load per Capita per Year	Sl	800	gm P cap^{-1} yr^{-1}
Septic System Retention Coefficient	Rsp	0.5	n/a
Point Source Input 1	PS1	0	
Point Source Input 2	PS2	0	
Point Source Input 3	PS3	0	
Point Source Input 4	PS4	0	
Point Source Input 5	PS5	0	
Phosphorus Retention Coefficient	v	12.4	n/a
Model Outputs			
Total Precipitation Hydraulic Input	Ppt_i	88680	m^3 yr^{-1}
Total Evaporation Hydraulic Loss	Eo	27480	m^3 yr^{-1}
Total Hydraulic Surface Run Off	Ql	407100	m^3 yr^{-1}
Total Hydraulic Input	Qt	495780	m^3 yr^{-1}
Areal Hydraulic Load	q_s	7.81	m yr^{-1}
Total Hydraulic Outflow	Qo	468300	m^3 yr^{-1}
Upstream P Input	Ju	0	gm yr^{-1}
Total Atmospheric P Input	Jd	1038	gm yr^{-1}
Total Overland Run Off P Input	Je	4044	gm yr^{-1}
Total Development P Input	Jd	0	gm yr^{-1}
Total P Input	Jt	5082	gm yr^{-1}
Lake P Retention Factor	Rp	0.61	n/a
Lake Phosphorus Retention	Ps	3100	gm yr^{-1}
Predicted Lake Phosphorus Concentration	[P]	**0.0042**	mg L^{-1}
Lake Phosphorus Outflow	Jo	1982	gm yr^{-1}
Lake Mean Depth	z	0	m
Lake Turnover Time	TT	0	yr
Lake Flushing Rate	FR	#DIV/0!	times yr^{-1}
Lake Response Time	RT	#DIV/0!	yr

Hydraulic Budget (m^{-3})

		% Total
Upstream Inflow	0	0
Precipitation	88680	17.89
Surface Run Off	407100	82.11
Evaporation	-27480	5.54
Total Outflow	468300	94.46
Total Check		100.00

Phosphorus Budget (gm yr^{-1})

		% Total
Upstream Inflow	0	0
Atmosphere	1038	20.43
Land Run Off	4044	79.57
Development	0	0.00
Sedimentation	-3100	61.00
Total Outflow	1982	39.00
Total Check		100.00

Model Validation

Pedicted P (mg L^{-1})		0.0042
Measured P (mg L^{-1})		0.0035
% Difference		20.0

Belchers Pond (Area 21) - 2

Input Parameters	Symbol	Value	Units
Morphology			
Drainage Basin Area (Excl. of Lake Area)	Ad	90.5	ha
Area Land Use Category 1 (Forest)	Ad1	1.5	ha
Area Land Use Category 2 (Forest/Cleared)	Ad2	0.0	ha
Area Land Use Category 3 (Urban Exist)	Ad3	89.0	ha
Area Land Use Category 4 (Commercial Exist)	Ad4	0.0	ha
Area Land Use Category 5 (Industrial Exist)	Ad5	0.0	ha
Area Land Use Category 6 (Institutional Exist)	Ad6	0.0	ha
Area Land Use Category 7 (Urban BW)	Ad7	0.0	ha
Area Land Use Category 8 (Commercial BW)	Ad8	0.0	ha
Area Land Use Category 9 (Industrial BW)	Ad9	0.0	ha
Area Land Use Category 10 (Institutional BW)	Ad10	0.0	ha
Lake Surface Area	Ao	2.5	ha
Lake Volume	V	0.00	10^6 m^3
Hydrology			
Upstream Hydraulic Inputs	Qi	0	m^3 yr^{-1}
Annual Unit Precipitation	Pr	1.478	m yr^{-1}
Annual Unit Lake Evaporation	Ev	0.458	m yr^{-1}
Annual Unit Hydraulic Runoff - Veg. Surfaces	Ru	1.020	m yr^{-1}
Annual Unit Hydraulic Runoff - Urban	Ru	1.330	m yr^{-1}
P Loading			
Upstream P Input	Pi	0	gm P yr^{-1}
Annual Unit Atmospheric P Deposition	Da	0.0173	gm P m^{-2} yr^{-1}
Land Use Category 1 P Export Coefficient	E1	0.0069	gm P m^{-2} yr^{-1}
Land Use Category 2 P Export Coefficient	E2	0.0083	gm P m^{-2} yr^{-1}
Land Use Category 3 P Export Coefficient	E3	0.0520	gm P m^{-2} yr^{-1}
Land Use Category 4 P Export Coefficient	E4	0.0400	gm P m^{-2} yr^{-1}
Land Use Category 5 P Export Coefficient	E5	0.2020	gm P m^{-2} yr^{-1}
Land Use Category 6 P Export Coefficient	E6	0.0420	gm P m^{-2} yr^{-1}
Land Use Category 7 P Export Coefficient	E7	0.0520	gm P m^{-2} yr^{-1}
Land Use Category 8 P Export Coefficient	E8	0.0400	gm P m^{-2} yr^{-1}
Land Use Category 9 P Export Coefficient	E9	0.2020	gm P m^{-2} yr^{-1}
Land Use Category 10 P Export Coefficient	E10	0.0420	gm P m^{-2} yr^{-1}
Number of Dwellings	N_d	0	#
Average number of Persons per Dwelling	N_u	2.60	n/a
Average Fraction of Year Dwellings Occupied	N_{pc}	1	yr^{-1}
Phosphorus Load per Capita per Year	Sl	800	gm P cap^{-1} yr^{-1}
Septic System Retention Coefficient	Rsp	0.5	n/a
Point Source Input 1	PS1	0	
Point Source Input 2	PS2	0	
Point Source Input 3	PS3	0	
Point Source Input 4	PS4	0	
Point Source Input 5	PS5	0	
Phosphorus Retention Coefficient	v	12.4	n/a
Model Outputs			
Total Precipitation Hydraulic Input	P_{pti}	36950	m^3 yr^{-1}
Total Evaporation Hydraulic Loss	Eo	11450	m^3 yr^{-1}
Total Hydraulic Surface Run Off	Ql	1199000	m^3 yr^{-1}
Total Hydraulic Input	Qt	1235950	m^3 yr^{-1}
Areal Hydraulic Load	q_s	48.98	m yr^{-1}
Total Hydraulic Outflow	Qo	1224500	m^3 yr^{-1}
Upstream P Input	Ju	0	gm yr^{-1}
Total Atmospheric P Input	Jd	433	gm yr^{-1}
Total Overland Run Off P Input	Je	46384	gm yr^{-1}
Total Development P Input	Jd	0	gm yr^{-1}
Total P Input	Jt	46817	gm yr^{-1}
Lake P Retention Factor	Rp	0.2	n/a
Lake Phosphorus Retention	Ps	9363	gm yr^{-1}
Predicted Lake Phosphorus Concentration	[P]	**0.0306**	mg L^{-1}
Lake Phosphorus Outflow	Jo	37454	gm yr^{-1}
Lake Mean Depth	z	0	m
Lake Turnover Time	TT	0	yr
Lake Flushing Rate	FR	#DIV/0!	times yr^{-1}
Lake Response Time	RT	#DIV/0!	yr

Budgets		
Hydraulic Budget (m^{-3})		
		% Total
Upstream Inflow	0	0
Precipitation	36950	2.99
Surface Run Off	1199000	97.01
Evaporation	-11450	0.93
Total Outflow	1224500	99.07
Total Check		100.00
Phosphorus Budget (gm yr^{-1})		
		% Total
Upstream Inflow	0	0
Atmosphere	433	0.92
Land Run Off	46384	99.08
Development	0	0.00
Sedimentation	-9363	20.00
Total Outflow	37454	80.00
Total Check		100.00
Model Validation		
Pedicted P (mg L^{-1})		0.0306
Measured P (mg L^{-1})		0.0076
% Difference		302.6

Washmill Lake (Area 23) - 2

Input Parameters	Symbol	Value	Units
Morphology			
Drainage Basin Area (Excl. of Lake Area)	Ad	231.8	ha
Area Land Use Category 1 (Forest)	Ad1	172.1	ha
Area Land Use Category 2 (Forest/Cleared)	Ad2	0.0	ha
Area Land Use Category 3 (Urban Exist)	Ad3	54.0	ha
Area Land Use Category 4 (Commercial Exist)	Ad4	0.0	ha
Area Land Use Category 5 (Industrial Exist)	Ad5	0.0	ha
Area Land Use Category 6 (Institutional Exist)	Ad6	0.0	ha
Area Land Use Category 7 (Urban BW)	Ad7	5.7	ha
Area Land Use Category 8 (Commercial BW)	Ad8	0.0	ha
Area Land Use Category 9 (Industrial BW)	Ad9	0.0	ha
Area Land Use Category 10 (Institutional BW)	Ad10	0.0	ha
Lake Surface Area	Ao	8.2	ha
Lake Volume	V	0.2025	10^6 m^3
Hydrology			
Upstream Hydraulic Inputs	Qi	16935400	m^3 yr^{-1}
Annual Unit Precipitation	Pr	1.478	m yr^{-1}
Annual Unit Lake Evaporation	Ev	0.458	m yr^{-1}
Annual Unit Hydraulic Runoff - Veg. Surfaces	Ru	1.020	m yr^{-1}
Annual Unit Hydraulic Runoff - Urban	Ru	1.330	m yr^{-1}
P Loading			
Upstream P Input	Pi	144149	gm P yr^{-1}
Annual Unit Atmospheric P Deposition	Da	0.0173	gm P m^{-2} yr^{-1}
Land Use Category 1 P Export Coefficient	E1	0.0069	gm P m^{-2} yr^{-1}
Land Use Category 2 P Export Coefficient	E2	0.0083	gm P m^{-2} yr^{-1}
Land Use Category 3 P Export Coefficient	E3	0.0520	gm P m^{-2} yr^{-1}
Land Use Category 4 P Export Coefficient	E4	0.0400	gm P m^{-2} yr^{-1}
Land Use Category 5 P Export Coefficient	E5	0.2020	gm P m^{-2} yr^{-1}
Land Use Category 6 P Export Coefficient	E6	0.0420	gm P m^{-2} yr^{-1}
Land Use Category 7 P Export Coefficient	E7	0.0520	gm P m^{-2} yr^{-1}
Land Use Category 8 P Export Coefficient	E8	0.0400	gm P m^{-2} yr^{-1}
Land Use Category 9 P Export Coefficient	E9	0.2020	gm P m^{-2} yr^{-1}
Land Use Category 10 P Export Coefficient	E10	0.0420	gm P m^{-2} yr^{-1}
Number of Dwellings	N_d	0	#
Average number of Persons per Dwelling	N_u	2.60	n/a
Average Fraction of Year Dwellings Occupied	N_{pc}	1	yr^{-1}
Phosphorus Load per Capita per Year	Sl	800	gm P cap^{-1} yr^{-1}
Septic System Retention Coefficient	Rsp	0.5	n/a
Point Source Input 1	PS1	0	
Point Source Input 2	PS2	0	
Point Source Input 3	PS3	0	
Point Source Input 4	PS4	0	
Point Source Input 5	PS5	0	
Phosphorus Retention Coefficient	v	12.4	n/a
Model Outputs			
Total Precipitation Hydraulic Input	P_{pti}	121196	m^3 yr^{-1}
Total Evaporation Hydraulic Loss	Eo	37556	m^3 yr^{-1}
Total Hydraulic Surface Run Off	Ql	2549430	m^3 yr^{-1}
Total Hydraulic Input	Qt	19606026	m^3 yr^{-1}
Areal Hydraulic Load	q_s	238.64	m yr^{-1}
Total Hydraulic Outflow	Qo	19568470	m^3 yr^{-1}
Upstream P Input	Ju	144149	gm yr^{-1}
Total Atmospheric P Input	Jd	1419	gm yr^{-1}
Total Overland Run Off P Input	Je	42919	gm yr^{-1}
Total Development P Input	Jd	0	gm yr^{-1}
Total P Input	Jt	188487	gm yr^{-1}
Lake P Retention Factor	Rp	0.05	n/a
Lake Phosphorus Retention	Ps	9424	gm yr^{-1}
Predicted Lake Phosphorus Concentration	[P]	**0.0092**	mg L^{-1}
Lake Phosphorus Outflow	Jo	179063	gm yr^{-1}
Lake Mean Depth	z	2.5	m
Lake Turnover Time	TT	0.01	yr
Lake Flushing Rate	FR	96.63	times yr^{-1}
Lake Response Time	RT	0.01	yr

Hydraulic Budget (m^{-3})

		% Total
Upstream Inflow	16935400	86.38
Precipitation	121196	0.62
Surface Run Off	2549430	13
Evaporation	-37556	0.19
Total Outflow	19568470	99.81
Total Check		100.00

Phosphorus Budget (gm yr^{-1})

		% Total
Upstream Inflow	144149	76.48
Atmosphere	1419	0.75
Land Run Off	42919	22.77
Development	0	0.00
Sedimentation	-9424	5.00
Total Outflow	179063	95.00
Total Check		100.00

Model Validation

Pedicted P (mg L^{-1})		0.0092
Measured P (mg L^{-1})		0.0051
% Difference		80.4

McQuade Lake (Area 25) - 2

Input Parameters	Symbol	Value	Units
Morphology			
Drainage Basin Area (Excl. of Lake Area)	Ad	61.0	ha
Area Land Use Category 1 (Forest)	Ad1	0.0	ha
Area Land Use Category 2 (Forest/Cleared)	Ad2	61.0	ha
Area Land Use Category 3 (Urban Exist)	Ad3	0.0	ha
Area Land Use Category 4 (Commercial Exist)	Ad4	0.0	ha
Area Land Use Category 5 (Industrial Exist)	Ad5	0.0	ha
Area Land Use Category 6 (Institutional Exist)	Ad6	0.0	ha
Area Land Use Category 7 (Urban BW)	Ad7	0.0	ha
Area Land Use Category 8 (Commercial BW)	Ad8	0.0	ha
Area Land Use Category 9 (Industrial BW)	Ad9	0.0	ha
Area Land Use Category 10 (Institutional BW)	Ad10	0.0	ha
Lake Surface Area	Ao	7.0	ha
Lake Volume	V	0.0000	10^6 m^3
Hydrology			
Upstream Hydraulic Inputs	Qi	0	m^3 yr^{-1}
Annual Unit Precipitation	Pr	1.478	m yr^{-1}
Annual Unit Lake Evaporation	Ev	0.458	m yr^{-1}
Annual Unit Hydraulic Runoff - Veg. Surfaces	Ru	1.020	m yr^{-1}
Annual Unit Hydraulic Runoff - Urban	Ru	1.330	m yr^{-1}
P Loading			
Upstream P Input	Pi	0	gm P yr^{-1}
Annual Unit Atmospheric P Deposition	Da	0.0173	gm P m^{-2} yr^{-1}
Land Use Category 1 P Export Coefficient	E1	0.0069	gm P m^{-2} yr^{-1}
Land Use Category 2 P Export Coefficient	E2	0.0083	gm P m^{-2} yr^{-1}
Land Use Category 3 P Export Coefficient	E3	0.0520	gm P m^{-2} yr^{-1}
Land Use Category 4 P Export Coefficient	E4	0.0400	gm P m^{-2} yr^{-1}
Land Use Category 5 P Export Coefficient	E5	0.2020	gm P m^{-2} yr^{-1}
Land Use Category 6 P Export Coefficient	E6	0.0420	gm P m^{-2} yr^{-1}
Land Use Category 7 P Export Coefficient	E7	0.0520	gm P m^{-2} yr^{-1}
Land Use Category 8 P Export Coefficient	E8	0.0400	gm P m^{-2} yr^{-1}
Land Use Category 9 P Export Coefficient	E9	0.2020	gm P m^{-2} yr^{-1}
Land Use Category 10 P Export Coefficient	E10	0.0420	gm P m^{-2} yr^{-1}
Number of Dwellings + Approved Lots	N_d	89	#
Average number of Persons per Dwelling	N_u	2.60	n/a
Average Fraction of Year Dwellings Occupied	N_{pc}	1	yr^{-1}
Phosphorus Load per Capita per Year	Sl	800	gm P cap^{-1} yr^{-1}
Septic System Retention Coefficient	Rsp	0.5	n/a
Point Source Input 1	PS1	0	
Point Source Input 2	PS2	0	
Point Source Input 3	PS3	0	
Point Source Input 4	PS4	0	
Point Source Input 5	PS5	0	
Phosphorus Retention Coefficient	v	12.4	n/a
Model Outputs			
Total Precipitation Hydraulic Input	P_{pti}	103460	m^3 yr^{-1}
Total Evaporation Hydraulic Loss	Eo	32060	m^3 yr^{-1}
Total Hydraulic Surface Run Off	Ql	622200	m^3 yr^{-1}
Total Hydraulic Input	Qt	725660	m^3 yr^{-1}
Areal Hydraulic Load	q_s	9.91	m yr^{-1}
Total Hydraulic Outflow	Qo	693600	m^3 yr^{-1}
Upstream P Input	Ju	0	gm yr^{-1}
Total Atmospheric P Input	Jd	1211	gm yr^{-1}
Total Overland Run Off P Input	Je	5063	gm yr^{-1}
Total Development P Input	Jd	92560	gm yr^{-1}
Total P Input	Jt	98834	gm yr^{-1}
Lake P Retention Factor	Rp	0.56	n/a
Lake Phosphorus Retention	Ps	55347	gm yr^{-1}
Predicted Lake Phosphorus Concentration	[P]	**0.0627**	mg L^{-1}
Lake Phosphorus Outflow	Jo	43487	gm yr^{-1}
Lake Mean Depth	z	0	m
Lake Turnover Time	TT	0	yr
Lake Flushing Rate	FR	#DIV/0!	times yr^{-1}
Lake Response Time	RT	#DIV/0!	yr

Hydraulic Budget (m^{-3})

		% Total
Upstream Inflow	0	0
Precipitation	103460	14.26
Surface Run Off	622200	85.74
Evaporation	-32060	4.42
Total Outflow	693600	95.58
Total Check		100.00

Phosphorus Budget (gm yr^{-1})

		% Total
Upstream Inflow	0	0
Atmosphere	1211	1.23
Land Run Off	5063	5.12
Development	92560	93.65
Sedimentation	-55347	56.00
Total Outflow	43487	44.00
Total Check		100.00

Model Validation

Pedicted P (mg L^{-1})		0.0627
Measured P (mg L^{-1})		0.0102
% Difference		514.7

Hobsons Lake (Area 24) - 2

Input Parameters	Symbol	Value	Units
Morphology			
Drainage Basin Area (Excl. of Lake Area)	Ad	149.0	ha
Area Land Use Category 1 (Forest)	Ad1	149.0	ha
Area Land Use Category 2 (Forest/Cleared)	Ad2	0.0	ha
Area Land Use Category 3 (Urban Exist)	Ad3	0.0	ha
Area Land Use Category 4 (Commercial Exist)	Ad4	0.0	ha
Area Land Use Category 5 (Industrial Exist)	Ad5	0.0	ha
Area Land Use Category 6 (Institutional Exist)	Ad6	0.0	ha
Area Land Use Category 7 (Urban BW)	Ad7	0.0	ha
Area Land Use Category 8 (Commercial BW)	Ad8	0.0	ha
Area Land Use Category 9 (Industrial BW)	Ad9	0.0	ha
Area Land Use Category 10 (Institutional BW)	Ad10	0.0	ha
Lake Surface Area	Ao	4.0	ha
Lake Volume	V	0.0000	10^6 m^3
Hydrology			
Upstream Hydraulic Inputs	Qi	0	m^3 yr^{-1}
Annual Unit Precipitation	Pr	1.478	m yr^{-1}
Annual Unit Lake Evaporation	Ev	0.458	m yr^{-1}
Annual Unit Hydraulic Runoff - Veg. Surfaces	Ru	1.020	m yr^{-1}
Annual Unit Hydraulic Runoff - Urban	Ru	1.330	m yr^{-1}
P Loading			
Upstream P Input	Pi	0	gm P yr^{-1}
Annual Unit Atmospheric P Deposition	Da	0.0173	gm P m^{-2} yr^{-1}
Land Use Category 1 P Export Coefficient	E1	0.0069	gm P m^{-2} yr^{-1}
Land Use Category 2 P Export Coefficient	E2	0.0083	gm P m^{-2} yr^{-1}
Land Use Category 3 P Export Coefficient	E3	0.0520	gm P m^{-2} yr^{-1}
Land Use Category 4 P Export Coefficient	E4	0.0400	gm P m^{-2} yr^{-1}
Land Use Category 5 P Export Coefficient	E5	0.2020	gm P m^{-2} yr^{-1}
Land Use Category 6 P Export Coefficient	E6	0.0420	gm P m^{-2} yr^{-1}
Land Use Category 7 P Export Coefficient	E7	0.0520	gm P m^{-2} yr^{-1}
Land Use Category 8 P Export Coefficient	E8	0.0400	gm P m^{-2} yr^{-1}
Land Use Category 9 P Export Coefficient	E9	0.2020	gm P m^{-2} yr^{-1}
Land Use Category 10 P Export Coefficient	E10	0.0420	gm P m^{-2} yr^{-1}
Number of Dwellings	N_d	0	#
Average number of Persons per Dwelling	N_u	2.60	n/a
Average Fraction of Year Dwellings Occupied	N_{pc}	1	yr^{-1}
Phosphorus Load per Capita per Year	Sl	800	gm P cap^{-1} yr^{-1}
Septic System Retention Coefficient	Rsp	0.5	n/a
Point Source Input 1	PS1	0	
Point Source Input 2	PS2	0	
Point Source Input 3	PS3	0	
Point Source Input 4	PS4	0	
Point Source Input 5	PS5	0	
Phosphorus Retention Coefficient	v	12.4	n/a
Model Outputs			
Total Precipitation Hydraulic Input	P_{pti}	59120	m^3 yr^{-1}
Total Evaporation Hydraulic Loss	Eo	18320	m^3 yr^{-1}
Total Hydraulic Surface Run Off	Ql	1519800	m^3 yr^{-1}
Total Hydraulic Input	Qt	1578920	m^3 yr^{-1}
Areal Hydraulic Load	q_s	39.02	m yr^{-1}
Total Hydraulic Outflow	Qo	1560600	m^3 yr^{-1}
Upstream P Input	Ju	0	gm yr^{-1}
Total Atmospheric P Input	Jd	692	gm yr^{-1}
Total Overland Run Off P Input	Je	10281	gm yr^{-1}
Total Development P Input	Jd	0	gm yr^{-1}
Total P Input	Jt	10973	gm yr^{-1}
Lake P Retention Factor	Rp	0.24	n/a
Lake Phosphorus Retention	Ps	2634	gm yr^{-1}
Predicted Lake Phosphorus Concentration	[P]	**0.0053**	mg L^{-1}
Lake Phosphorus Outflow	Jo	8339	gm yr^{-1}
Lake Mean Depth	z	0	m
Lake Turnover Time	TT	0	yr
Lake Flushing Rate	FR	#DIV/0!	times yr^{-1}
Lake Response Time	RT	#DIV/0!	yr

Hydraulic Budget (m^{-3})

		% Total
Upstream Inflow	0	0
Precipitation	59120	3.74
Surface Run Off	1519800	96.26
Evaporation	-18320	1.16
Total Outflow	1560600	98.84
Total Check		100.00

Phosphorus Budget (gm yr^{-1})

		% Total
Upstream Inflow	0	0
Atmosphere	692	6.31
Land Run Off	10281	93.69
Development	0	0.00
Sedimentation	-2634	24.00
Total Outflow	8339	76.00
Total Check		100.00

Model Validation

Pedicted P (mg L^{-1})		0.0053
Measured P (mg L^{-1})		0.0072
% Difference		-26.4

Kearney Lake (Areas 26 and 27) - 2						
Input Parameters	**Symbol**	**Value**	**Units**	**Budgets**		
Morphology				**Hydraulic Budget (m^{-3})**		
Drainage Basin Area (Excl. of Lake Area)	Ad	736.5	ha			
Area Land Use Category 1 (Forest)	Ad1	150.7	ha			**% Total**
Area Land Use Category 2 (Forest/Cleared)	Ad2	183.2	ha	Upstream Inflow	21822670	69.3
Area Land Use Category 3 (Urban Exist)	Ad3	38.4	ha	Precipitation	908822.2	2.89
Area Land Use Category 4 (Commercial Exist)	Ad4	0.0	ha	Surface Run Off	8760360	27.82
Area Land Use Category 5 (Industrial Exist)	Ad5	0.0	ha	Evaporation	-281624.2	0.89
Area Land Use Category 6 (Institutional Exist)	Ad6	0.0	ha	Total Outflow	31210228	99.11
Area Land Use Category 7 (Urban BW)	Ad7	330.8	ha	Total Check		100.01
Area Land Use Category 8 (Commercial BW)	Ad8	16.1	ha			
Area Land Use Category 9 (Industrial BW)	Ad9	10.8	ha	**Phosphorus Budget (gm yr^{-1})**		
Area Land Use Category 10 (Institutional BW)	Ad10	6.5	ha			
Lake Surface Area	Ao	61.5	ha			**% Total**
Lake Volume	V	6.9779	10^6 m^3	Upstream Inflow	230889	35.34
Hydrology				Atmosphere	10638	1.63
Upstream Hydraulic Inputs	Qi	21822670	m^3 yr^{-1}	Land Run Off	248574	38.04
Annual Unit Precipitation	Pr	1.478	m yr^{-1}	Development	163280	24.99
Annual Unit Lake Evaporation	Ev	0.458	m yr^{-1}	Sedimentation	-130676	20.00
Annual Unit Hydraulic Runoff - Veg. Surfaces	Ru	1.020	m yr^{-1}			
Annual Unit Hydraulic Runoff - Urban	Ru	1.330	m yr^{-1}	Total Outflow	522705	80.00
P Loading				Total Check		100.00
Upstream P Input	Pi	230889	gm P yr^{-1}			
Annual Unit Atmospheric P Deposition	Da	0.0173	gm P m^{-2} yr^{-1}			
Land Use Category 1 P Export Coefficient	E1	0.0069	gm P m^{-2} yr^{-1}	**Model Validation**		
Land Use Category 2 P Export Coefficient	E2	0.0083	gm P m^{-2} yr^{-1}			
Land Use Category 3 P Export Coefficient	E3	0.0520	gm P m^{-2} yr^{-1}			
Land Use Category 4 P Export Coefficient	E4	0.0400	gm P m^{-2} yr^{-1}	Pedicted P (mg L^{-1})		0.0167
Land Use Category 5 P Export Coefficient	E5	0.2020	gm P m^{-2} yr^{-1}	Measured P (mg L^{-1})		0.0067
Land Use Category 6 P Export Coefficient	E6	0.0420	gm P m^{-2} yr^{-1}	% Difference		149.3
Land Use Category 7 P Export Coefficient	E7	0.0520	gm P m^{-2} yr^{-1}			
Land Use Category 8 P Export Coefficient	E8	0.0400	gm P m^{-2} yr^{-1}			
Land Use Category 9 P Export Coefficient	E9	0.2020	gm P m^{-2} yr^{-1}			
Land Use Category 10 P Export Coefficient	E10	0.0420	gm P m^{-2} yr^{-1}			
Number of Dwellings	N_d	157	#			
Average number of Persons per Dwelling	N_u	2.60	n/a			
Average Fraction of Year Dwellings Occupied	N_{pc}	1	yr^{-1}			
Phosphorus Load per Capita per Year	Sl	800	gm P cap^{-1} yr^{-1}			
Septic System Retention Coefficient	Rsp	0.5	n/a			
Point Source Input 1	PS1	0				
Point Source Input 2	PS2	0				
Point Source Input 3	PS3	0				
Point Source Input 4	PS4	0				
Point Source Input 5	PS5	0				
Phosphorus Retention Coefficient	v	12.4	n/a			
Model Outputs						
Total Precipitation Hydraulic Input	P_{pti}	908822.2	m^3 yr^{-1}			
Total Evaporation Hydraulic Loss	Eo	281624.2	m^3 yr^{-1}			
Total Hydraulic Surface Run Off	Ql	8760360	m^3 yr^{-1}			
Total Hydraulic Input	Qt	31491852	m^3 yr^{-1}			
Areal Hydraulic Load	q_s	50.76	m yr^{-1}			
Total Hydraulic Outflow	Qo	31210228	m^3 yr^{-1}			
Upstream P Input	Ju	230889	gm yr^{-1}			
Total Atmospheric P Input	Jd	10638	gm yr^{-1}			
Total Overland Run Off P Input	Je	248574	gm yr^{-1}			
Total Development P Input	Jd	163280	gm yr^{-1}			
Total P Input	Jt	653381	gm yr^{-1}			
Lake P Retention Factor	Rp	0.2	n/a			
Lake Phosphorus Retention	Ps	130676	gm yr^{-1}			
Predicted Lake Phosphorus Concentration	[P]	**0.0167**	mg L^{-1}			
Lake Phosphorus Outflow	Jo	522705	gm yr^{-1}			
Lake Mean Depth	z	11.3	m			
Lake Turnover Time	TT	0.22	yr			
Lake Flushing Rate	FR	4.47	times yr^{-1}			
Lake Response Time	RT	0.13	yr			

Jack Lake (Area 34) - 2

Input Parameters	Symbol	Value	Units
Morphology			
Drainage Basin Area (Excl. of Lake Area)	Ad	22.7	ha
Area Land Use Category 1 (Forest)	Ad1	22.7	ha
Area Land Use Category 2 (Forest/Cleared)	Ad2	0.0	ha
Area Land Use Category 3 (Urban Exist)	Ad3	0.0	ha
Area Land Use Category 4 (Commercial Exist)	Ad4	0.0	ha
Area Land Use Category 5 (Industrial Exist)	Ad5	0.0	ha
Area Land Use Category 6 (Institutional Exist)	Ad6	0.0	ha
Area Land Use Category 7 (Urban BW)	Ad7	0.0	ha
Area Land Use Category 8 (Commercial BW)	Ad8	0.0	ha
Area Land Use Category 9 (Industrial BW)	Ad9	0.0	ha
Area Land Use Category 10 (Institutional BW)	Ad10	0.0	ha
Lake Surface Area	Ao	3.8	ha
Lake Volume	V	0.0000	10^6 m^3
Hydrology			
Upstream Hydraulic Inputs	Qi	0	m^3 yr^{-1}
Annual Unit Precipitation	Pr	1.478	m yr^{-1}
Annual Unit Lake Evaporation	Ev	0.458	m yr^{-1}
Annual Unit Hydraulic Runoff - Veg. Surfaces	Ru	1.020	m yr^{-1}
Annual Unit Hydraulic Runoff - Urban	Ru	1.330	m yr^{-1}
P Loading			
Upstream P Input	Pi	0	gm P yr^{-1}
Annual Unit Atmospheric P Deposition	Da	0.0173	gm P m^{-2} yr^{-1}
Land Use Category 1 P Export Coefficient	E1	0.0069	gm P m^{-2} yr^{-1}
Land Use Category 2 P Export Coefficient	E2	0.0083	gm P m^{-2} yr^{-1}
Land Use Category 3 P Export Coefficient	E3	0.0520	gm P m^{-2} yr^{-1}
Land Use Category 4 P Export Coefficient	E4	0.0400	gm P m^{-2} yr^{-1}
Land Use Category 5 P Export Coefficient	E5	0.2020	gm P m^{-2} yr^{-1}
Land Use Category 6 P Export Coefficient	E6	0.0420	gm P m^{-2} yr^{-1}
Land Use Category 7 P Export Coefficient	E7	0.0520	gm P m^{-2} yr^{-1}
Land Use Category 8 P Export Coefficient	E8	0.0400	gm P m^{-2} yr^{-1}
Land Use Category 9 P Export Coefficient	E9	0.2020	gm P m^{-2} yr^{-1}
Land Use Category 10 P Export Coefficient	E10	0.0420	gm P m^{-2} yr^{-1}
Number of Dwellings	N_d	0	#
Average number of Persons per Dwelling	N_u	2.60	n/a
Average Fraction of Year Dwellings Occupied	N_{pc}	1	yr^{-1}
Phosphorus Load per Capita per Year	Sl	800	gm P cap^{-1} yr^{-1}
Septic System Retention Coefficient	Rsp	0.5	n/a
Point Source Input 1	PS1	0	
Point Source Input 2	PS2	0	
Point Source Input 3	PS3	0	
Point Source Input 4	PS4	0	
Point Source Input 5	PS5	0	
Phosphorus Retention Coefficient	v	12.4	n/a
Model Outputs			
Total Precipitation Hydraulic Input	P_{pti}	56164	m^3 yr^{-1}
Total Evaporation Hydraulic Loss	Eo	17404	m^3 yr^{-1}
Total Hydraulic Surface Run Off	Ql	231540	m^3 yr^{-1}
Total Hydraulic Input	Qt	287704	m^3 yr^{-1}
Areal Hydraulic Load	q_s	7.11	m yr^{-1}
Total Hydraulic Outflow	Qo	270300	m^3 yr^{-1}
Upstream P Input	Ju	0	gm yr^{-1}
Total Atmospheric P Input	Jd	657	gm yr^{-1}
Total Overland Run Off P Input	Je	1566	gm yr^{-1}
Total Development P Input	Jd	0	gm yr^{-1}
Total P Input	Jt	2223	gm yr^{-1}
Lake P Retention Factor	Rp	0.64	n/a
Lake Phosphorus Retention	Ps	1423	gm yr^{-1}
Predicted Lake Phosphorus Concentration	[P]	**0.003**	mg L^{-1}
Lake Phosphorus Outflow	Jo	800	gm yr^{-1}
Lake Mean Depth	z	0	m
Lake Turnover Time	TT	0	yr
Lake Flushing Rate	FR	#DIV/0!	times yr^{-1}
Lake Response Time	RT	#DIV/0!	yr

Hydraulic Budget (m^{-3})

		% Total
Upstream Inflow	0	0
Precipitation	56164	19.52
Surface Run Off	231540	80.48
Evaporation	-17404	6.05
Total Outflow	270300	93.95
Total Check		100.00

Phosphorus Budget (gm yr^{-1})

		% Total
Upstream Inflow	0	0
Atmosphere	657	29.57
Land Run Off	1566	70.45
Development	0	0.00
Sedimentation	-1423	64.01
Total Outflow	800	35.99
Total Check		100.02

Model Validation

Pedicted P (mg L^{-1})	0.0030
Measured P (mg L^{-1})	0.0036
% Difference	-16.7

Papermill Lake Basin 2 (Area 33) - 2						
Input Parameters	**Symbol**	**Value**	**Units**	**Budgets**		
Morphology				**Hydraulic Budget (m^{-3})**		
Drainage Basin Area (Excl. of Lake Area)	Ad	38.4	ha			
Area Land Use Category 1 (Forest)	Ad1	20.5	ha			**% Total**
Area Land Use Category 2 (Forest/Cleared)	Ad2	3.4	ha	Upstream Inflow	0	0
Area Land Use Category 3 (Urban Exist)	Ad3	2.2	ha	Precipitation	26456.2	5.71
Area Land Use Category 4 (Commercial Exist)	Ad4	0.0	ha	Surface Run Off	436630	94.29
Area Land Use Category 5 (Industrial Exist)	Ad5	0.0	ha	Evaporation	-8198.2	1.77
Area Land Use Category 6 (Institutional Exist)	Ad6	0.0	ha	Total Outflow	454888	98.23
Area Land Use Category 7 (Urban BW)	Ad7	11.3	ha	Total Check		100.00
Area Land Use Category 8 (Commercial BW)	Ad8	0.0	ha			
Area Land Use Category 9 (Industrial BW)	Ad9	1.0	ha	**Phosphorus Budget (gm yr^{-1})**		
Area Land Use Category 10 (Institutional BW)	Ad10	0.0	ha			
Lake Surface Area	Ao	1.8	ha			**% Total**
Lake Volume	V	0.0113	10^6 m^3	Upstream Inflow	0	0
Hydrology				Atmosphere	310	2.80
Upstream Hydraulic Inputs	Qi	0	m^3 yr^{-1}	Land Run Off	10737	97.19
Annual Unit Precipitation	Pr	1.478	m yr^{-1}	Development	0	0.00
Annual Unit Lake Evaporation	Ev	0.458	m yr^{-1}	Sedimentation	-3646	33.00
Annual Unit Hydraulic Runoff - Veg. Surfaces	Ru	1.020	m yr^{-1}			
Annual Unit Hydraulic Runoff - Urban	Ru	1.330	m yr^{-1}	Total Outflow	7401	67.00
P Loading				Total Check		99.99
Upstream P Input	Pi	0	gm P yr^{-1}			
Annual Unit Atmospheric P Deposition	Da	0.0173	gm P m^{-2} yr^{-1}			
Land Use Category 1 P Export Coefficient	E1	0.0069	gm P m^{-2} yr^{-1}	**Model Validation**		
Land Use Category 2 P Export Coefficient	E2	0.0083	gm P m^{-2} yr^{-1}			
Land Use Category 3 P Export Coefficient	E3	0.0520	gm P m^{-2} yr^{-1}			
Land Use Category 4 P Export Coefficient	E4	0.0400	gm P m^{-2} yr^{-1}	Pedicted P (mg L^{-1})		0.0163
Land Use Category 5 P Export Coefficient	E5	0.2020	gm P m^{-2} yr^{-1}	Measured P (mg L^{-1})		0.0000
Land Use Category 6 P Export Coefficient	E6	0.0420	gm P m^{-2} yr^{-1}	% Difference		#DIV/0!
Land Use Category 7 P Export Coefficient	E7	0.0520	gm P m^{-2} yr^{-1}			
Land Use Category 8 P Export Coefficient	E8	0.0400	gm P m^{-2} yr^{-1}			
Land Use Category 9 P Export Coefficient	E9	0.2020	gm P m^{-2} yr^{-1}			
Land Use Category 10 P Export Coefficient	E10	0.0420	gm P m^{-2} yr^{-1}			
Number of Dwellings	N_d	0	#			
Average number of Persons per Dwelling	N_u	2.60	n/a			
Average Fraction of Year Dwellings Occupied	N_{pc}	1	yr^{-1}			
Phosphorus Load per Capita per Year	Sl	800	gm P cap^{-1} yr^{-1}			
Septic System Retention Coefficient	Rsp	0.5	n/a			
Point Source Input 1	PS1	0				
Point Source Input 2	PS2	0				
Point Source Input 3	PS3	0				
Point Source Input 4	PS4	0				
Point Source Input 5	PS5	0				
Phosphorus Retention Coefficient	v	12.4	n/a			
Model Outputs						
Total Precipitation Hydraulic Input	Ppt_i	26456.2	m^3 yr^{-1}			
Total Evaporation Hydraulic Loss	Eo	8198.2	m^3 yr^{-1}			
Total Hydraulic Surface Run Off	Ql	436630	m^3 yr^{-1}			
Total Hydraulic Input	Qt	463086	m^3 yr^{-1}			
Areal Hydraulic Load	q_s	25.41	m yr^{-1}			
Total Hydraulic Outflow	Qo	454888	m^3 yr^{-1}			
Upstream P Input	Ju	0	gm yr^{-1}			
Total Atmospheric P Input	Jd	310	gm yr^{-1}			
Total Overland Run Off P Input	Je	10737	gm yr^{-1}			
Total Development P Input	Jd	0	gm yr^{-1}			
Total P Input	Jt	11047	gm yr^{-1}			
Lake P Retention Factor	Rp	0.33	n/a			
Lake Phosphorus Retention	Ps	3646	gm yr^{-1}			
Predicted Lake Phosphorus Concentration	[P]	**0.0163**	mg L^{-1}			
Lake Phosphorus Outflow	Jo	7401	gm yr^{-1}			
Lake Mean Depth	z	0.6	m			
Lake Turnover Time	TT	0.02	yr			
Lake Flushing Rate	FR	40.26	times yr^{-1}			
Lake Response Time	RT	0.01	yr			

Papermill Lake Basin 3 (Area 35) - 2

Input Parameters	Symbol	Value	Units
Morphology			
Drainage Basin Area (Excl. of Lake Area)	Ad	89.3	ha
Area Land Use Category 1 (Forest)	Ad1	42.3	ha
Area Land Use Category 2 (Forest/Cleared)	Ad2	0.0	ha
Area Land Use Category 3 (Urban Exist)	Ad3	47.0	ha
Area Land Use Category 4 (Commercial Exist)	Ad4	0.0	ha
Area Land Use Category 5 (Industrial Exist)	Ad5	0.0	ha
Area Land Use Category 6 (Institutional Exist)	Ad6	0.0	ha
Area Land Use Category 7 (Urban BW)	Ad7	0.0	ha
Area Land Use Category 8 (Commercial BW)	Ad8	0.0	ha
Area Land Use Category 9 (Industrial BW)	Ad9	0.0	ha
Area Land Use Category 10 (Institutional BW)	Ad10	0.0	ha
Lake Surface Area	Ao	1.2	ha
Lake Volume	V	0.0147	10^6 m^3
Hydrology			
Upstream Hydraulic Inputs	Qi	270300	m^3 yr^{-1}
Annual Unit Precipitation	Pr	1.478	m yr^{-1}
Annual Unit Lake Evaporation	Ev	0.458	m yr^{-1}
Annual Unit Hydraulic Runoff - Veg. Surfaces	Ru	1.020	m yr^{-1}
Annual Unit Hydraulic Runoff - Urban	Ru	1.330	m yr^{-1}
P Loading			
Upstream P Input	Pi	800	gm P yr^{-1}
Annual Unit Atmospheric P Deposition	Da	0.0173	gm P m^{-2} yr^{-1}
Land Use Category 1 P Export Coefficient	E1	0.0069	gm P m^{-2} yr^{-1}
Land Use Category 2 P Export Coefficient	E2	0.0083	gm P m^{-2} yr^{-1}
Land Use Category 3 P Export Coefficient	E3	0.0520	gm P m^{-2} yr^{-1}
Land Use Category 4 P Export Coefficient	E4	0.0400	gm P m^{-2} yr^{-1}
Land Use Category 5 P Export Coefficient	E5	0.2020	gm P m^{-2} yr^{-1}
Land Use Category 6 P Export Coefficient	E6	0.0420	gm P m^{-2} yr^{-1}
Land Use Category 7 P Export Coefficient	E7	0.0520	gm P m^{-2} yr^{-1}
Land Use Category 8 P Export Coefficient	E8	0.0400	gm P m^{-2} yr^{-1}
Land Use Category 9 P Export Coefficient	E9	0.2020	gm P m^{-2} yr^{-1}
Land Use Category 10 P Export Coefficient	E10	0.0420	gm P m^{-2} yr^{-1}
Number of Dwellings	N_d	0	#
Average number of Persons per Dwelling	N_u	2.60	n/a
Average Fraction of Year Dwellings Occupied	N_{pc}	1	yr^{-1}
Phosphorus Load per Capita per Year	Sl	800	gm P cap^{-1} yr^{-1}
Septic System Retention Coefficient	Rsp	0.5	n/a
Point Source Input 1	PS1	0	
Point Source Input 2	PS2	0	
Point Source Input 3	PS3	0	
Point Source Input 4	PS4	0	
Point Source Input 5	PS5	0	
Phosphorus Retention Coefficient	v	12.4	n/a
Model Outputs			
Total Precipitation Hydraulic Input	Ppti	17736	m^3 yr^{-1}
Total Evaporation Hydraulic Loss	Eo	5496	m^3 yr^{-1}
Total Hydraulic Surface Run Off	Ql	1056560	m^3 yr^{-1}
Total Hydraulic Input	Qt	1344596	m^3 yr^{-1}
Areal Hydraulic Load	q_s	111.59	m yr^{-1}
Total Hydraulic Outflow	Qo	1339100	m^3 yr^{-1}
Upstream P Input	Ju	800	gm yr^{-1}
Total Atmospheric P Input	Jd	208	gm yr^{-1}
Total Overland Run Off P Input	Je	27359	gm yr^{-1}
Total Development P Input	Jd	0	gm yr^{-1}
Total P Input	Jt	28367	gm yr^{-1}
Lake P Retention Factor	Rp	0.1	n/a
Lake Phosphorus Retention	Ps	2837	gm yr^{-1}
Predicted Lake Phosphorus Concentration	[P]	**0.0191**	mg L^{-1}
Lake Phosphorus Outflow	Jo	25530	gm yr^{-1}
Lake Mean Depth	z	1.2	m
Lake Turnover Time	TT	0.01	yr
Lake Flushing Rate	FR	91.1	times yr^{-1}
Lake Response Time	RT	0.01	yr

Hydraulic Budget (m^{-3})

		% Total
Upstream Inflow	270300	20.1
Precipitation	17736	1.32
Surface Run Off	1056560	78.58
Evaporation	-5496	0.41
Total Outflow	1339100	99.59
Total Check		100.00

Phosphorus Budget (gm yr^{-1})

		% Total
Upstream Inflow	800	2.82
Atmosphere	208	0.73
Land Run Off	27359	96.45
Development	0	0.00
Sedimentation	-2837	10.00
Total Outflow	25530	90.00
Total Check		100.00

Model Validation

Pedicted P (mg L^{-1})		0.0191
Measured P (mg L^{-1})		0.0000
% Difference		#DIV/0!

Papermill Lake (Areas 28, 31, 32, 36 and 37) - 2						
Input Parameters	**Symbol**	**Value**	**Units**	**Budgets**		
Morphology				**Hydraulic Budget (m^{-3})**		
Drainage Basin Area (Excl. of Lake Area)	Ad	481.0	ha			
Area Land Use Category 1 (Forest)	Ad1	36.3	ha			**% Total**
Area Land Use Category 2 (Forest/Cleared)	Ad2	9.2	ha	Upstream Inflow	33004216	83.37
Area Land Use Category 3 (Urban Exist)	Ad3	89.5	ha	Precipitation	328263.8	0.83
Area Land Use Category 4 (Commercial Exist)	Ad4	0.0	ha	Surface Run Off	6256250	15.8
Area Land Use Category 5 (Industrial Exist)	Ad5	18.5	ha	Evaporation	-101721.8	0.26
Area Land Use Category 6 (Institutional Exist)	Ad6	0.0	ha	Total Outflow	39487008	99.74
Area Land Use Category 7 (Urban BW)	Ad7	276.9	ha	Total Check		100.00
Area Land Use Category 8 (Commercial BW)	Ad8	24.8	ha			
Area Land Use Category 9 (Industrial BW)	Ad9	14.7	ha	**Phosphorus Budget (gm yr^{-1})**		
Area Land Use Category 10 (Institutional BW)	Ad10	11.1	ha			
Lake Surface Area	Ao	22.2	ha			**% Total**
Lake Volume	V	0.4906	10^6 m^3	Upstream Inflow	555636	66.55
Hydrology				Atmosphere	3842	0.46
Upstream Hydraulic Inputs	Qi	33004216	m^3 yr^{-1}	Land Run Off	275442	32.99
Annual Unit Precipitation	Pr	1.478	m yr^{-1}	Development	0	0.00
Annual Unit Lake Evaporation	Ev	0.458	m yr^{-1}	Sedimentation	-58444	7.00
Annual Unit Hydraulic Runoff - Veg. Surfaces	Ru	1.020	m yr^{-1}			
Annual Unit Hydraulic Runoff - Urban	Ru	1.330	m yr^{-1}	Total Outflow	776476	93.00
P Loading				Total Check		100.00
Upstream P Input	Pi	555636	gm P yr^{-1}			
Annual Unit Atmospheric P Deposition	Da	0.0173	gm P m^{-2} yr^{-1}			
Land Use Category 1 P Export Coefficient	E1	0.0069	gm P m^{-2} yr^{-1}	**Model Validation**		
Land Use Category 2 P Export Coefficient	E2	0.0083	gm P m^{-2} yr^{-1}			
Land Use Category 3 P Export Coefficient	E3	0.0520	gm P m^{-2} yr^{-1}			
Land Use Category 4 P Export Coefficient	E4	0.0400	gm P m^{-2} yr^{-1}	Pedicted P (mg L^{-1})		0.0197
Land Use Category 5 P Export Coefficient	E5	0.2020	gm P m^{-2} yr^{-1}	Measured P (mg L^{-1})		0.0088
Land Use Category 6 P Export Coefficient	E6	0.0420	gm P m^{-2} yr^{-1}	% Difference		123.9
Land Use Category 7 P Export Coefficient	E7	0.0520	gm P m^{-2} yr^{-1}			
Land Use Category 8 P Export Coefficient	E8	0.0400	gm P m^{-2} yr^{-1}			
Land Use Category 9 P Export Coefficient	E9	0.2020	gm P m^{-2} yr^{-1}			
Land Use Category 10 P Export Coefficient	E10	0.0420	gm P m^{-2} yr^{-1}			
Number of Dwellings	N_d	0	#			
Average number of Persons per Dwelling	N_u	2.60	n/a			
Average Fraction of Year Dwellings Occupied	N_{pc}	1	yr^{-1}			
Phosphorus Load per Capita per Year	Sl	800	gm P cap^{-1} yr^{-1}			
Septic System Retention Coefficient	Rsp	0.5	n/a			
Point Source Input 1	PS1	0				
Point Source Input 2	PS2	0				
Point Source Input 3	PS3	0				
Point Source Input 4	PS4	0				
Point Source Input 5	PS5	0				
Phosphorus Retention Coefficient	v	12.4	n/a			
Model Outputs						
Total Precipitation Hydraulic Input	P_{pti}	328263.8	m^3 yr^{-1}			
Total Evaporation Hydraulic Loss	Eo	101721.8	m^3 yr^{-1}			
Total Hydraulic Surface Run Off	Ql	6256250	m^3 yr^{-1}			
Total Hydraulic Input	Qt	39588730	m^3 yr^{-1}			
Areal Hydraulic Load	q_s	177.79	m yr^{-1}			
Total Hydraulic Outflow	Qo	39487008	m^3 yr^{-1}			
Upstream P Input	Ju	555636	gm yr^{-1}			
Total Atmospheric P Input	Jd	3842	gm yr^{-1}			
Total Overland Run Off P Input	Je	275442	gm yr^{-1}			
Total Development P Input	Jd	0	gm yr^{-1}			
Total P Input	Jt	834920	gm yr^{-1}			
Lake P Retention Factor	Rp	0.07	n/a			
Lake Phosphorus Retention	Ps	58444	gm yr^{-1}			
Predicted Lake Phosphorus Concentration	[P]	**0.0197**	mg L^{-1}			
Lake Phosphorus Outflow	Jo	776476	gm yr^{-1}			
Lake Mean Depth	z	2.2	m			
Lake Turnover Time	TT	0.01	yr			
Lake Flushing Rate	FR	80.49	times yr^{-1}			
Lake Response Time	RT	0.01	yr			

APPENDIX II

Recommended water quality monitoring strategies

WATER QUALITY MONITORING PROGRAMS

INTRODUCTION

The modelling work carried out provides a "best guess" of the expected change in lake phosphorus concentrations associated with the three development scenarios identified. The modelling effort itself incorporates several assumptions that can individually influence to varying degrees the accuracy of model predictions. As a means of evaluating these predictions, it is strongly recommended that ***a short-term monitoring program*** be established that looks at phosphorus levels in specific receiving waters. It is preferable that this work be completed prior to initiating any major development activity in order that existing or baseline conditions be documented. These data are essential for model calibration.

Subsequent to this period short-term data recovery, it is recommended that ***an on-going maintenance program*** be established that would examine water quality over the long-term, especially as it relates to the response of the target lakes to land use changes and agreement with the predictions of the phosphorus loading model.

Since the land use scenarios assessed in this report affect only the lower end of the drainage basin, the focus of ***"short-term"*** and ***"on-going" water quality monitoring programs*** can be restricted to McQuade, Washmill, Kearney and Papermill lakes. Data gathered from McQuade Lake would be used to validate the calibration step applied in the model. Washmill Lake would act as a control – a lake whose watershed and tributary lake systems are presumed to be protected from significant urbanization over the life of either monitoring program. It is important to note, however, that if this situation was to change prior to or during either of these two monitoring programs proposed, the scope of the affected program would need to be re-assessed. Kearney and Papermill lakes, on the other hand, water bodies situated in the sub-watersheds containing the land use changes identified, would be monitored to verfiy model predictions and to track any changes in water quality due resulting from this urbanization. To date, water quality data gathered by various researchers has for the most part is sparse and temporally incomplete for any given year.

It is also recommended the quality of urban runoff be investigated such that several fractions of phosphorus be measured. This recommendation stems from the fact that the current modelling exercise produced some uncertainity that is suggested to be possibly related to the urban land use loading rates applied in the model. To adequately address this issue, it is recommended that a ***one year monitoring program targeting phosphorus fractions in urban runoff*** be carried out.

SHORT-TERM WATER QUALITY MONITORING PROGRAM

Duration and Sampling Frequency

A one year monitoring program is recommended. Lakes should be sampled on a monthly basis between October and May, and bi-weekly between June and September, for a total of 16 sampling dates.

Monitoring Locations

Monitoring stations in each of three lakes should be established. One deep-lake station in each of McQuade, Washmill and Kearney lakes and two deep-lake stations in Papermill Lake should be monitored. Station selection is based on the assumption that water quality at these sites is representative of average lake conditions. In the case of Papermill Lake, two stations are considered necessary because of basin morphometry. During periods of thermal stratification, multiple descrete water samples (up to 7) should be collected through the water column. For non-stratified periods, it is possible to reduce this number (up to 5 samples at each lake station).

Parameters

The chemical test required to calibrate the phosphorus model is ***Total Phosphorus***, which should be performed on all water samples collected. ***Chlorophyll$_a$***, a biological response indicator to phosphorus present, should be performed on euphotic zone (depth to which 1% of ambient light penetrates, approximately 2.5 times Secchi depth) samples, and preferably on all samples.

Other auxillary information that should be collected is ***water temperature*** and ***dissolved oxygen***. One-metre profiles should be recorded at each of the three lake stations for each of the 16 sampling dates. ***Secchi Disc*** readings should also be taken as a measure of water transparency. Its measurement is required to estimate euphotic zone depth.

The proposed monitoring program provides an opportunity to gather additional water quality data that will enhance our understanding of the two subject lakes as their watersheds develop and the inclusion of additional parameters should be considered. One of the more useful water quality indicators is ***Escherichia coli,*** a member of the fecal coliform group of bacteria. This test is of particular use when tracking the effects of stormwater. The general water quality status of a lake can be tracted by performing a variety of tests that include, but not limited to, ***major ions, metals, pH, conductivity, and colour.***

Timing

The short-term program should be completed prior to the commencement of any substantial construction project in the drainage basin that might influence existing water quality conditions in any of the four study lakes.

LONG-TERM WATER QUALITY MONITORING PROGRAM

It is highly recommended that a scaled-down version of the "short-term" water quality monitoring program be maintained following its conclusion to measure changes over the long-term. At a minimum, for each year this program is operational, the frequency of sample collection should be quarterly, corresponding with the seasonal thermal regimes of the study lakes – McQuade, Washmill, Kearney and Papermill. It is further recommended that the monitoring stations proposed for the "Short-term" program be retained and that the annual program be carried out for multiple years, not necessarily on a continuous basis, as development in the drainage basin proceeds.

Chemical parameters should be consistent with those adopted for the short-term program.

PHOSPHORUS FRACTIONS IN URBAN RUNOFF MONITORING PROGRAM

The following outlines the monitoring program recommended to characterize the phosphorus content of urban runoff. The main objectives of this study are to quantify specific phosphorus fractions, and then apply these findings in the calibration of the phosphorus loading model.

Duration and Sampling Frequency

Ideally, the most accurate means of determining the loading rates for various phosphorus fractions from an urban catchment would be to collect and analyze every cubic metre of runoff. Realistically, a both scientifically acceptable and economical means of accomplishing this task is to collect and analyze representative composite samples from each runoff event occuring over a year. This is simplified through the use of automatic flow and water sampling equipment.

Therefore, it is recommended that a one year monitoring program be considered. For each runoff event, a single volume-weighted composite sample made up from hourly to two-hourly grab samples should be analyzed for each of the phosphorus fractions specified.

Possible Study Locations

Belcher's Pond or Papermill Lake sub-watersheds are the areas most suited in which to carry out the study. One or two sub-catchments draining residential areas within either of these watersheds should be chosen.

Timing

Since a residential urban catchment chosen for this type of study would be fully developed at the time of water sample collection, the timing of a study of this nature is

not critical. However, it would be beneficial to obtain this information as expediously as possible for phosphorus loading model calibration purposes.