Municipality of Temagami

Surface Water Impact Assessment – Temagami North Lagoon

Type of Document:
Final Report

Project Name:
Surface Water Impact Assessment – Temagami North Lagoon

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Table of Contents

1 Introduction

Exp Services Inc. (**exp)** was retained by the Municipality of Temagami ("the Municipality") to provide a detailed surface water assessment report of E. coli from the Temagami North Lagoon to the receiving lake (Net Lake). The report is required to address the potential removal of Condition 12 of the Temagami North Lagoon's Environmental Compliance Approval ("ECA"), which stipulates the installation of a disinfection system for the sewage works.

The surface water impact assessment was based on surface water quality monitoring and dispersion modelling.

2 Scope of Investigation

The following was undertaken to complete the scope of work for this project:

2.1 Data Review and Consultation

Exp attended meetings in person or vie telephone. Meeting participants included Municipality personnel and personnel from the Ministry of Environment and Climate Change (MOECC). The objective of the meeting was to establish information requirements and expectations of the MOECC and to gather information for the study.

Exp reviewed the following information on the Temagami North Lagoon and Net Lake, as provided by the Municipality and other sources:

- Amended Environmental Compliance Approval Number 9498-9V7J5Y for the Temagami North Lagoon.
- Effluent discharge sample data from the Temagami North Lagoon.
- A preliminary E. coli dispersion estimation from Ontario Clean Water Agency (OCWA).
- A letter from OCWA dated September 23, 2015 concerning Condition 12 of the ECA.
- Net Lake mean level and flow data for hydat stations 02DC010 and 02JE028 from Environment Canada data.
- Net Lake Broad-scale Fisheries Monitoring Bulletin from Ontario Ministry of Natural Resources and Forestry (ONRF), generated March 4, 2016.
- Net Lake bathymetry map by ONRF, generated from survey data obtained August 1970.
- Net Creek Dam compliance monitoring graph, 2014. From Matabitchuan River Water Management Plan Standing Advisory Committee 2014 Annual Report.
- Temagami North Drinking Water System 2015 Annual/Summary Report by OCWA.

2.2 Surface Water Monitoring

Exp conducted a surface water monitoring program of Net Lake in the vicinity of the Temagami North lagoon. A total of six surface water monitoring locations were established in Net Lake. Drawing 1 shows the surface water monitoring locations, which included two background monitoring locations upstream of the lagoon (Background-1 and Background-2), a station at the location of Temagami North drinking water system intake, (DW) a station adjacent to the lagoon outlet (Lagoon), a station in the central part of east Net Lake downstream of the lagoon (NL), and a station in Outlet Bay upstream of the Net Creek Dam outflow (OB).

Exp conducted monitoring on May 4, June 15, July 13 and August 9, 2017. Field monitoring included measurements of water temperature, dissolved oxygen and conductivity at each monitoring station. Water samples were collected at either one, two or three depth intervals at each station (depending on water depth): 1 m below water surface, 3 m below water surface and 1 m above lake bottom. The samples were collected using a Van Dorn sampler.
The water samples were submitted to AGAT Laboratories for analysis of E. coli, total phosphorus

and pH. Information on sampling locations and specifications are provided in Table 2.1. Field measurements and analytical results are provided in Appendix B.

2.3 Preparation of Dispersion Model

Exp developed a preliminary dispersion model for the Temagami North Lagoon outflow into Net Lake.

For the numerical dispersion model, the US-EPA Water Quality Analysis Simulation Program (WASP) was used. **Exp** used the WASP8 version. This model is a dynamic compartment-modeling program for aquatic systems which allows for investigation of 1, 2, and 3 dimensional systems and a number of pollutant types. WASP allowing for time varying processes of advection, dispersion, point and diffuse mass loading and boundary exchange. WASP8 has a pre-processor, a data processor, and a graphical post-processor that enable the modeler to run WASP and evaluate model results both numerically and graphically.

The WASP8 system consists of two stand-alone computer programs, DYNHYD5 and WASP8. The hydrodynamics program, DYNHYD5, simulates the movement of water while the water quality program, WASP6, simulates the movement and interaction of pollutants within the water. The basic principle of both the hydrodynamics and water-quality program is the conservation of mass. The water volume and water-quality constituent masses being studied are tracked and accounted for over time and space using a series of mass balancing equations. The hydrodynamics program also conserves momentum, or energy, throughout time and space.

For Temagami North Lagoon outflow to Net Lake, **exp** used WASP8's Advanced Toxicant model type with Euler solution for fluid flow. A conservative "Tracer Solid" was used to simulate the dispersion of e. coli. We selected the Kinematic Wave hydrodynamic flow option to simulate advective flow. Kinematic Wave simulated one-dimensional flow wave propagation and resulting variations in flow, depths and velocities for the model system. A total of seven (7) segments were constructed; however, one segment (N.Net Lake) was not incorporated into the flow simulation. Three flow systems were incorporated into the model, including Main Flow from the west and northwest parts of Net Lake, North Flow from the northeast section of Net Lake and Lagoon, which simulated lagoon outflow into Net Lake. Outflow for the model was established at a boundary at the Downstream segment.

The model was run for the time interval between January 15, 2014 and July 15, 2016. Net Lake outflow input data for this time period was bases on Environment Canada measurements at the Net Creek Dam HYDAT station. Temagami North Lagoon outflow and E. coli. input data for this time period was based on data provided by the Municipality.

A schematic of the model segments and input parameters for the WASP8 model are provided in Appendix C.

3 Findings

3.1 Net Lake Hydrology and Lagoon Outflow

Net Lake is part of the Matabitchuan River System, which is controlled due to the presence of the Ontario Power Generation Inc. Matabitchuan Generating Station. The Matabitchuan River Water Management Plan dictates operational plans and activities, including control and monitoring at the three dams: the Net Lake Dam, the North Milne Dam and the Rabbit Lake Dam.

MNRF (2016) state that Net Lake has a surface area of 759 hectares, a maximum depth of 42.7 m and an average depth of 8.1 m. Net Lake has a large catchment, with numerous streams discharging into the north, west and south sides of the lake. Outflow is at the southeast end of Net Lake into Net Creek, which is controlled by the Net Creek Dam. The Matabitchuan River Water Management Plan dictates that the Net Creek Dam control the water level at a maximum of 297.05 m above mean sea level (asl), a minimum of 295.30 m asl between the fall and spring and a summer minimum of 296.16 m asl. Net Creek discharges to Cassels Lake approximately 500 m downstream of the Net Creek Dam.

Between 2010 and 2015, average outflow at the Net Creek Dam was just under 5 cubic metres per second (m^3/s). During this period, the minimum monthly average flow was 0.25 m^3/s and the maximum monthly average flow was 26.6 m^3/s. Seasonal high flows were in the spring and seasonal low flows were in the summer.

The Temagami North Lagoon outflows to the south-central part of Net Lake, approximately 600 m east of the Highway 11 bridge. The lagoon is downstream of the west and northwest parts of Net Lake, and upstream of the northeast and east parts of Net Lake. The lagoon is approximately 5 km upstream of the Net Creek Dam.

Between 2010 and 2016, average outflow at the Temagami North Lagoon was 0.0036 m^3/s. During this period, the minimum monthly average flow was 0 m^3/s and the maximum monthly average flow was 0.024 m^3/s. Seasonal high flows were in the winter and seasonal low flows were in the fall.

Between 2010 and 2016, the average E. coli. level in the Temagami North Lagoon effluent was 5,500 cfu/100 mL. However, this average appears to be skewed by unusually high levels in the winter and spring of 2011. When these levels are removed from the dataset, the average E. coli. level in the Temagami North Lagoon effluent was 457 cfu/100 mL. During this period, the minimum monthly average E. coli. level effluent was 5 cfu/100 mL and the maximum monthly average E. coli. level effluent was 220,000 cfu/100 mL. Seasonal high e. coli. Levels were in the winter and seasonal low E. coli levels were in the summer.

The Temagami North Drinking Water System's facilities are located approximately 0.3 km north of the lagoon. The water intake for the drinking water system is located in the northeast part of Net Lake, approximately 0.5 km upstream of the lagoon outflow point. OCWA (2016) stated that the intake is located 10 m below the low water level of the lake. The system is approved for the taking of water at a maximum of 460 m^3/day and a maximum rate of 456 L/minute. E. coli. was not detected in a total of fifty-two (52) raw water samples from the drinking water system in 2015.

3.2 Surface Water Monitoring Results

Analytical results and field measurements for the Net Lake surface water monitoring are provided in Appendix B. Analytical results for E. coli, total phosphorus and pH are presented graphically in Figures B.1 and B.2.

E. coli. was detected in the water samples immediately downstream of the Temagami North Lagoon outflow. The Lagoon-S, Lagoon-M and Lagoon-D stations detected E. coli at least once in the four sampling events.

However, E. coli was also detected consistently in the samples from Background-2, which is located approximately 500 m west (and supposedly upstream) of the lagoon. Additionally, E. coli. was detected in water samples from all locations (except the NL location) in the August 9 water samples. This included the highest E. coli level – 53 CFU/mL in the deep sample from Background 2. This results appears to be anomalous.

Total phosphorus generally ranged between 0.005 mg/L and 0.015 mg/L in the water samples, with no apparent pattern related to the lagoon outflow. The highest total phosphorus level of 0.029 mg/L was recorded in the June 15 sample from Background-2S.

The pH levels generally ranged between 7.10 and 7.60 in the water samples, with no apparent pattern related to the lagoon outflow. The highest pH level of 7.68 was recorded in the June 15 sample from OB-D and the lowest pH level of 6.51 was recorded in the May 4 sample from Background-2S.

3.3 Dispersion Model Output

As described in Section 2.3, a conservative tracer was used to simulate the dispersion of e. coli. in the WASP8 model. The tracer was loaded to the Lagoon model segment based on monthly average E. coli concentrations in raw effluent and lagoon outflows from 2014 to 2016. Output from the WASP8 model is provided in Appendix C. The modelled tracer concentrations in the Lagoon, CentralNetLake, Downstream and Upstream segments are shown graphically in Figure C.1 to Figure C.4.

The model output showed tracer concentration in the Lagoon segment fluctuating between 0.1 mg/L and 9.5 mg/L. The Upstream model segment showed the tracer to essentially be not be present (consistently <0.2 mg/L). Further downstream from the Lagoon tracer loadings, the model segment CentralNetLake showed the tracer to fluctuate between 0.1 mg/L and 1.75 mg/L. In the Downstream segment, the tracer fluctuated between 0.1 mg/L and 1.6 mg/L.

4 Summary and Discussion

The findings of this study indicate that the Temagami North Lagoon is discharging to Net Lake, and that the dispersion of effluent appears to be influenced by a complex hydrodynamic system.

Data on the Temagami North Lagoon show that average outflow was 0.0036 m^3/s between 2010 and 2016, ranging between 0 and the maximum monthly average flow was 0.024 m^3/s. Seasonal high flows were in the winter and seasonal low flows were in the fall. During this time period, the average E. coli. level in raw effluent was 5,500 cfu/100 mL ranging between a minimum monthly average of 5 cfu/100 mL and a maximum monthly average of 220,000 cfu/100 mL. Seasonal high e. coli. levels were in the winter and seasonal low E. coli levels were in the summer.

Water quality monitoring in May, June, July and August 2017 showed E. coli. consistently detected in samples closest to the Lagoon outflow. However, E. coli was also consistently detected in samples from the Background-2 station, which was 500 m west (and technically upstream) of the lagoon outflow. E. coli was also detected in multiple locations in the August samples, including stations in northeast Net Lake (again, technically upstream of the lagoon outflow).

Utilizing the US-EPA WASP8 modeller, a dispersion model for Net Lake downstream of the lagoon was constructed. A conservative tracer was used to simulate E. coli dispersion. The model showed a dispersion pattern that had tracer concentration fluctuating between 0.1 mg/L and 9.5 mg/L immediately downstream of the lagoon outflow, fluctuating between 0.1 mg/L and 1.75 mg/L in the central segment of the model and fluctuating between 0.1 mg/L and 1.6 mg/L in the downstream boundary segment of the model.

The WASP8 model output showed tracer concentration fluctuation (between 0.1 mg/L and 9.5 mg/L) in the Lagoon segment. These results are somewhat similar to the E. coli. fluctuations in the water samples from the Lagoon monitoring station on Net Lake (“non-detect” to 10 CFU/100 mL).

However, model outputs for other segments do not correlate with the 2017 water quality monitoring results from Net Lake, including the persistence presence of E. coli. in Background-2 samples, the detection of E. coli. in the northeast part of Net Lake (Background-1 and DW stations) and the high E. coli. count in the August sample from the west end of Net Lake. These results suggest that other potential sources of E. coli. may be contributing to water quality in Net Lake. However, the E. coli levels at the Background-2 station may also be attributable to eddies, backflow, calm-water dispersion or other hydrodynamic patterns in Net Lake. It is possible that the Temagami North lagoon may be the source of E. coli at Background-2.

5 Conclusions

The preliminary findings indicate that outflow from the Temagami North Lagoon is impacting Net Lake and E. coli. is being dispersed downstream of the lagoon.

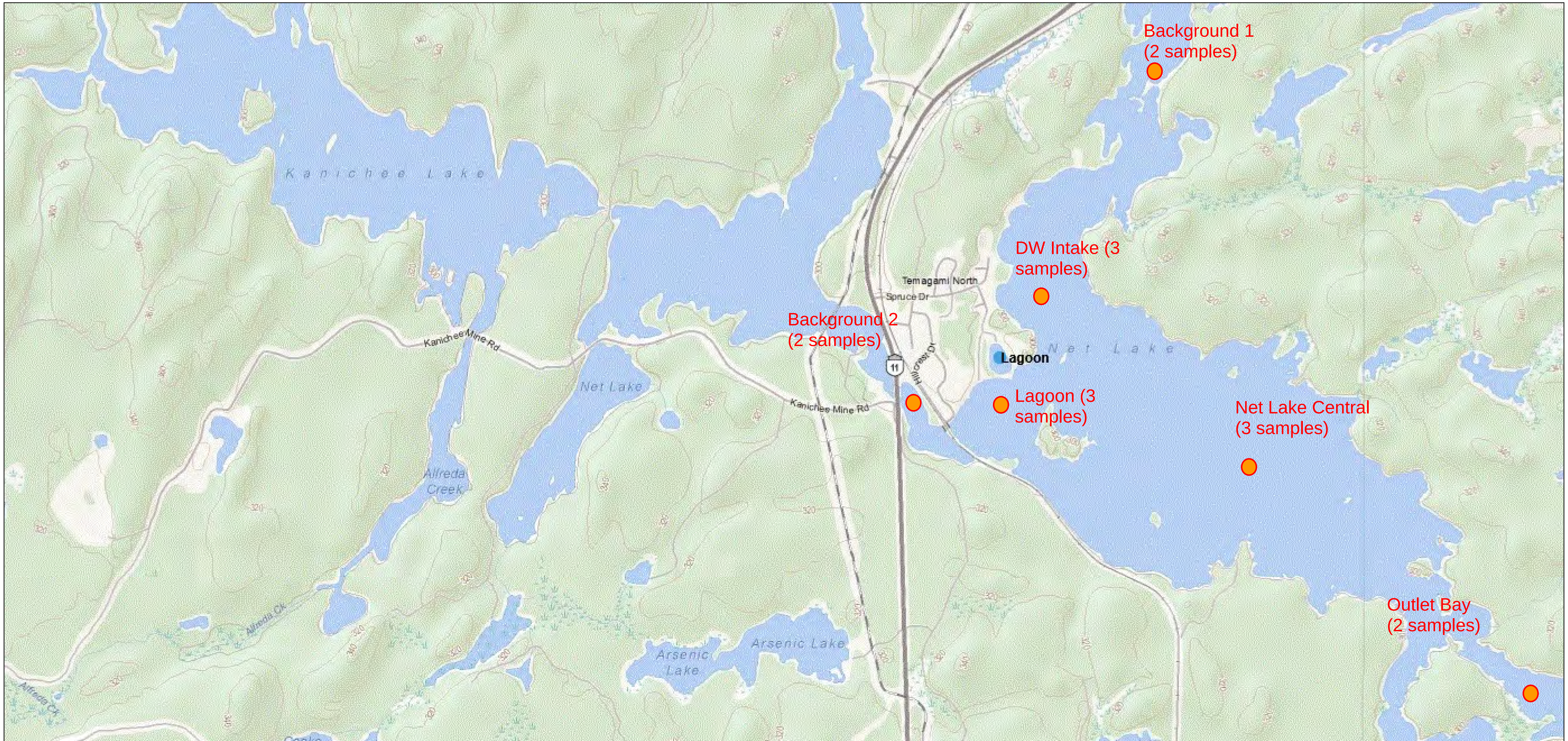
A more rigorous study, including a more detailed field monitoring program, is required to characterize the hydrodynamics of Net Lake downstream of the lagoon. This characterization is necessary in order to properly simulate the dispersion of E. coli. in Net Lake.

Yours truly,

exp Services Inc.

Perry Sarvas, P.Geo.
Senior Hydrogeologist
Earth & Environmental

Appendix A – Drawings



Legend

- Building as Symbol
- Building to Scale
- Airport
- Heliport \ Hospital Heliport
- Seaplane Base
- Ferry Route
- Trail Head \ Trail
- Railway \ Train Station
- Railway with Bridge
- Railway with Tunnel
- Road (Major → Minor)
- Winter Road
- Road with Bridge
- Road with Tunnel
- Primary, Kings or 400 Series Highway
- Secondary Highway
- Tertiary Highway
- District, County, Regional or Municipal Road
- Toll Highway
- One Way Road
- Road with Permanent Blocked Passage
- Road with Address Ranges
- Hydro Line, Communication Line or Unknown Transmission Line
- Natural Gas Pipeline, Water Pipeline or Unknown Pipeline
- Spot Height
- Index Contour
- Contour
- Wooded Area
- Wetland
- Waterbody
- Waterbody Elevation
- Watercourse
- Falls
- Rapids
- Rapids \ Falls
- Rapids
- Rocks
- Lock Gate
- Dam \ Hydro Wall
- Dam \ Hydro Wall
- Provincial \ State Boundary
- International Boundary
- Upper Tier \ District Municipal Boundary
- Lower Tier \ Single Tier Municipal Boundary
- Lot Line
- Indian Reserve
- Provincial Park
- National Park
- Conservation Reserve
- Military Lands

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PROJECT TITLE AND LOCATION:
Net Lake Monitoring Locations
Temagami North Lagoon
Temagami North, ON

PROJECT NO.: **NWL-01601031**		DWN.:	**PS**
SCALE: **As shown**		CHKD.:	**PS**
DATE: **October 2017**		FIGURE:	**1**

0 1.2 km

Projection: Web Mercator

N

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Appendix B – Monitoring Results

Analytical results from Net Lake monitoring stations, May to August 2017

Sample Description	**Background-1S**	**Background-1B**	**Background-2S**	**Background-2B**	**DW-S**	**DW-M**	**DW-D**	**Lagoon-S**	**Lagoon-M**	**Lagoon-D**
Escherichia coli (CFU/100 mL)										
May 4, 2017	-	-	**2**	ND	ND	ND	ND	**2**	-	**4**
June 15, 2017	ND	ND	**4**	**2**	ND	ND	ND	**10**	-	**10**
July 13, 2017	**1**	ND	**1**	**4**	ND	ND	ND	ND	ND	ND
August 9, 2017	**2**	ND	**14**	**53**	**3**	**1**	ND	**2**	**1**	ND
Total Phosphorus (mg/L)										
May 4, 2017	-	-	0.010	0.010	0.010	0.011	0.011	0.008	-	0.012
June 15, 2017	0.007	0.018	0.029	0.010	0.010	0.009	0.009	0.013	-	0.013
July 13, 2017	0.008	0.008	0.007	0.008	<0.006	0.008	0.008	0.007	0.008	0.006
August 9, 2017	0.010	0.012	0.013	0.018	0.011	0.010	0.016	0.009	0.010	0.012
pH										
May 4, 2017	-	-	6.51	7.01	7.23	7.28	7.28	7.26	-	7.27
June 15, 2017	7.25	7.63	7.54	7.56	7.67	7.66	7.62	7.64	-	7.63
July 13, 2017	7.14	7.11	7.07	7.07	7.12	7.11	7.13	7.12	7.11	7.13
August 9, 2017	7.42	7.52	7.41	7.49	7.49	7.48	7.41	7.48	7.49	7.40

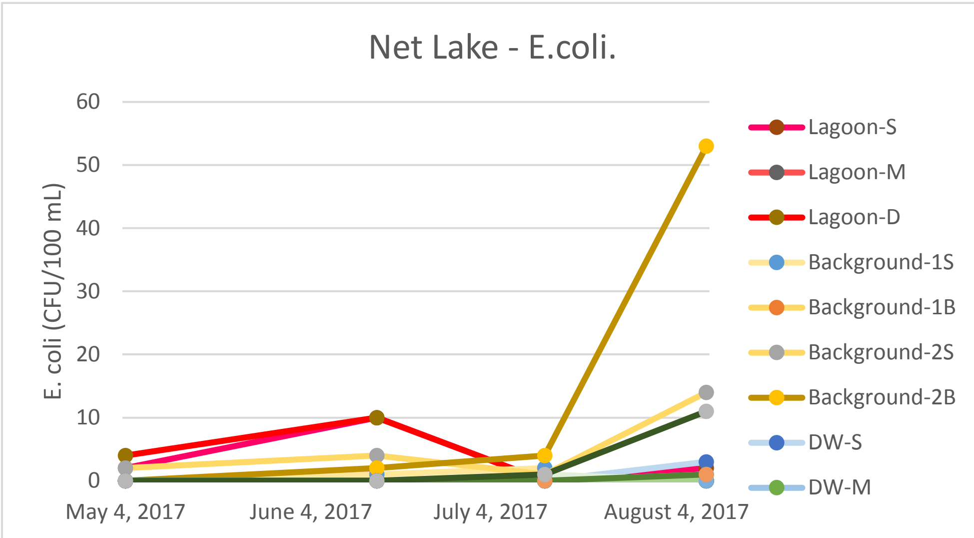
Sample Description	**NL-S**	**NL-M**	**NL-D**	**OB-S**	**OB-D**
Escherichia coli (CFU/100 mL)					
May 4, 2017	ND	ND	ND	ND	ND
June 15, 2017	ND	ND	ND	ND	ND
July 13, 2017	**1**	ND	ND	ND	**1**
August 9, 2017	ND	ND	ND	**1**	**11**
Total Phosphorus (mg/L)					
May 4, 2017	0.012	0.010	0.010	0.011	0.016
June 15, 2017	0.010	0.012	0.010	0.012	0.010
July 13, 2017	0.010	<0.006	0.008	<0.006	<0.006
August 9, 2017	0.011	<0.006	0.009	0.01	0.014
pH					
May 4, 2017	7.29	7.30	7.30	7.33	7.29
June 15, 2017	7.65	7.62	7.63	7.67	7.68
July 13, 2017	7.13	7.10	7.11	7.19	7.24
August 9, 2017	7.48	7.49	7.42	7.53	7.52

Field monitoring results at Net Lake monitoring stations, May to August 2017

Sample Description	Background-1S	Background-1B	Background-2S	Background-2B	DW-S	DW-M	DW-D	Lagoon-S	Lagoon-M	Lagoon-D
Temperature (°C)										
May 4, 2017	-	-	6.00	-	6.00	4.20	4.20	5.70	-	5.70
June 15, 2017	-	-	-	-	-	-	-	-	-	-
July 13, 2017	20.80	-	20.90	21.00	21.00	20.80	-	21.30	21.30	-
August 9, 2017	20.20	19.80	21.30	19.60	21.00	8.50	-	21.40	8.70	-
Dissolved Oxygen (mg/L)										
May 4, 2017	-	-	11.01	-	13.60	1.97	0.79	11.80	-	11.68
June 15, 2017	-	-	-	-	-	-	-	-	-	-
July 13, 2017	10.10	-	8.10	8.10	10.20	6.00	-	11.10	9.20	-
August 9, 2017	6.80	7.20	7.50	7.00	7.40	7.80	-	8.00	8.80	-
Conductivity (S/cm)										
May 4, 2017	-	-	0.00	-	0.00	0.00	0.00	0.00	-	0.00
June 15, 2017	-	-	-	-	-	-	-	-	-	-
July 13, 2017	0.07	-	0.05	0.05	0.08	0.07	-	0.06	0.06	-
August 9, 2017	0.08	0.08	0.22	0.21	0.07	0.05	-	0.23	0.15	-

Sample Description	NL-S	NL-M	NL-D	OB-S	OB-D
Temperature (°C)					
May 4, 2017	5.20	4.20	3.80	5.30	5.20
June 15, 2017	-	-	-	-	-
July 13, 2017	21.40	16.60	-	21.60	20.60
August 9, 2017	20.70	9.60	-	20.90	19.60
Dissolved Oxygen (mg/L)					
May 4, 2017	11.64	11.17	11.10	14.22	5.60
June 15, 2017	-	-	-	-	-
July 13, 2017	10.20	8.00	-	10.20	7.80
August 9, 2017	7.80	7.80	-	7.60	5.40
Conductivity (S/cm)					
May 4, 2017	0.00	0.00	0.00	0.00	0.00
June 15, 2017	-	-	-	-	-
July 13, 2017	0.07	0.06	-	0.08	0.09
August 9, 2017	0.10	0.12	-	0.11	0.10

Figure B.1. E. coli levels in Net Lake monitoring stations, May to August 2017



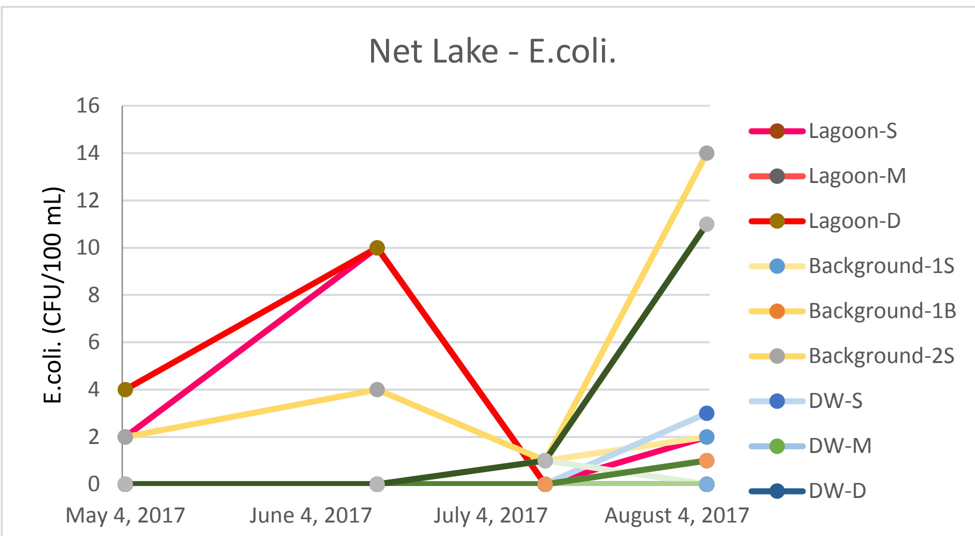
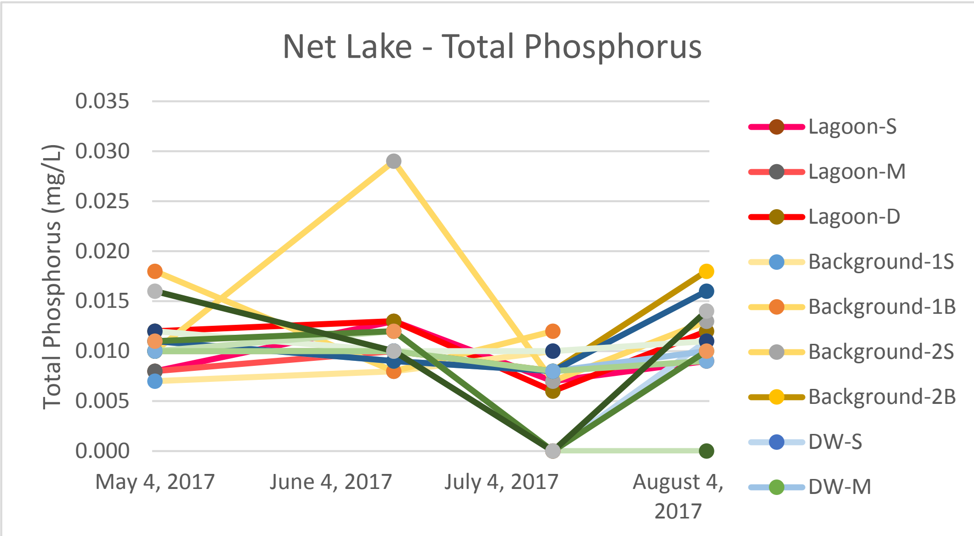
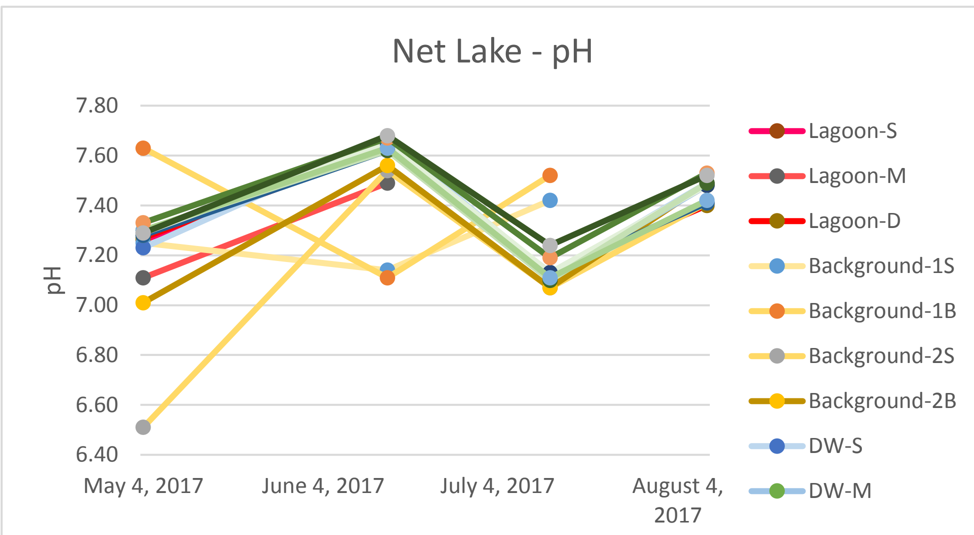


Figure B.2. Total Phosphorus and pH levels in Net Lake monitoring stations, May to August 2017





Appendix C –
WASP8 Model Input and Output

Figure C.1. WASP 8 Model Output
Tracer concentration in Lagoon segment, 2014 - 2016

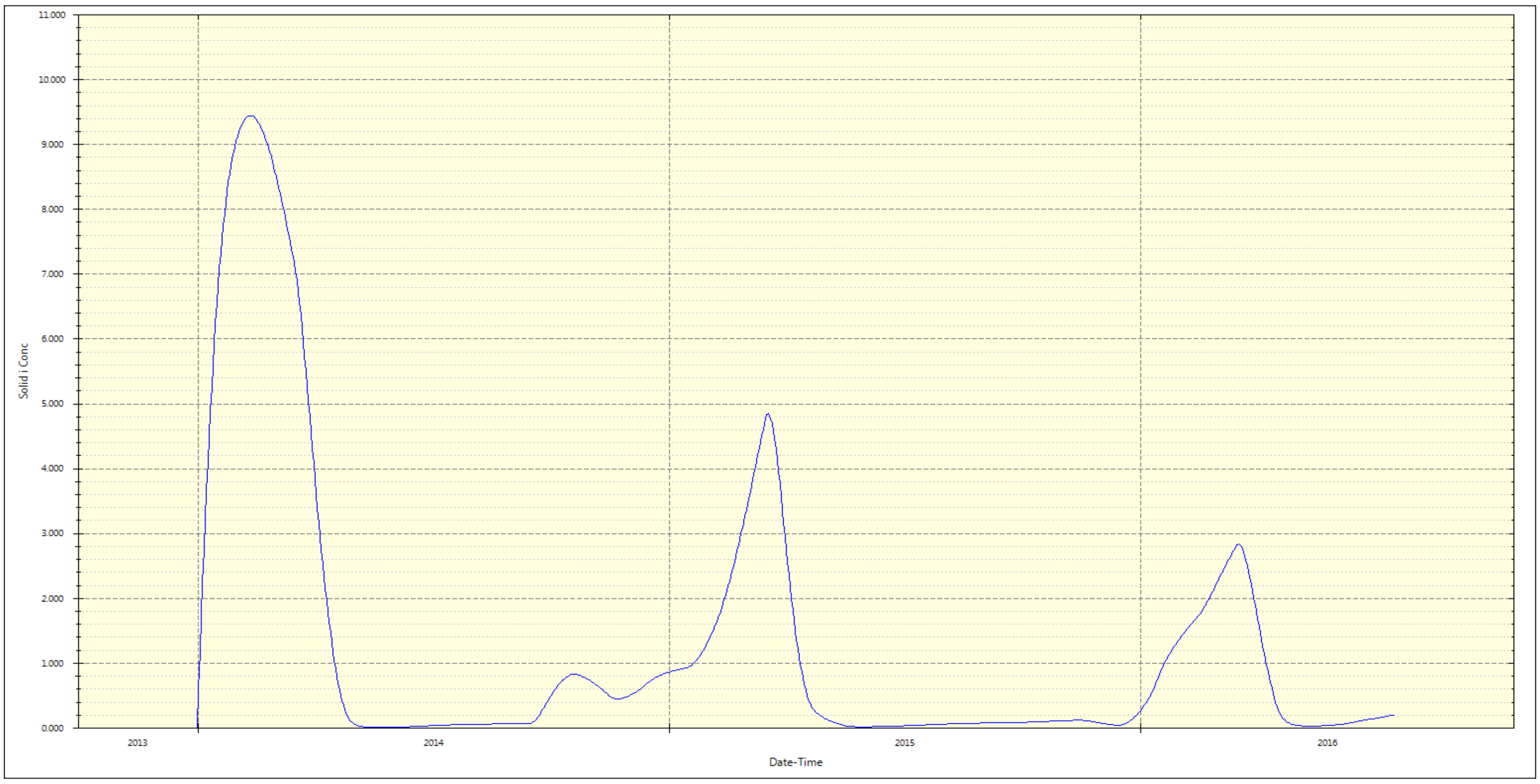


Figure C.2. WASP 8 Model Output
Tracer concentration in CentalNetLake segment, 2014 - 2016

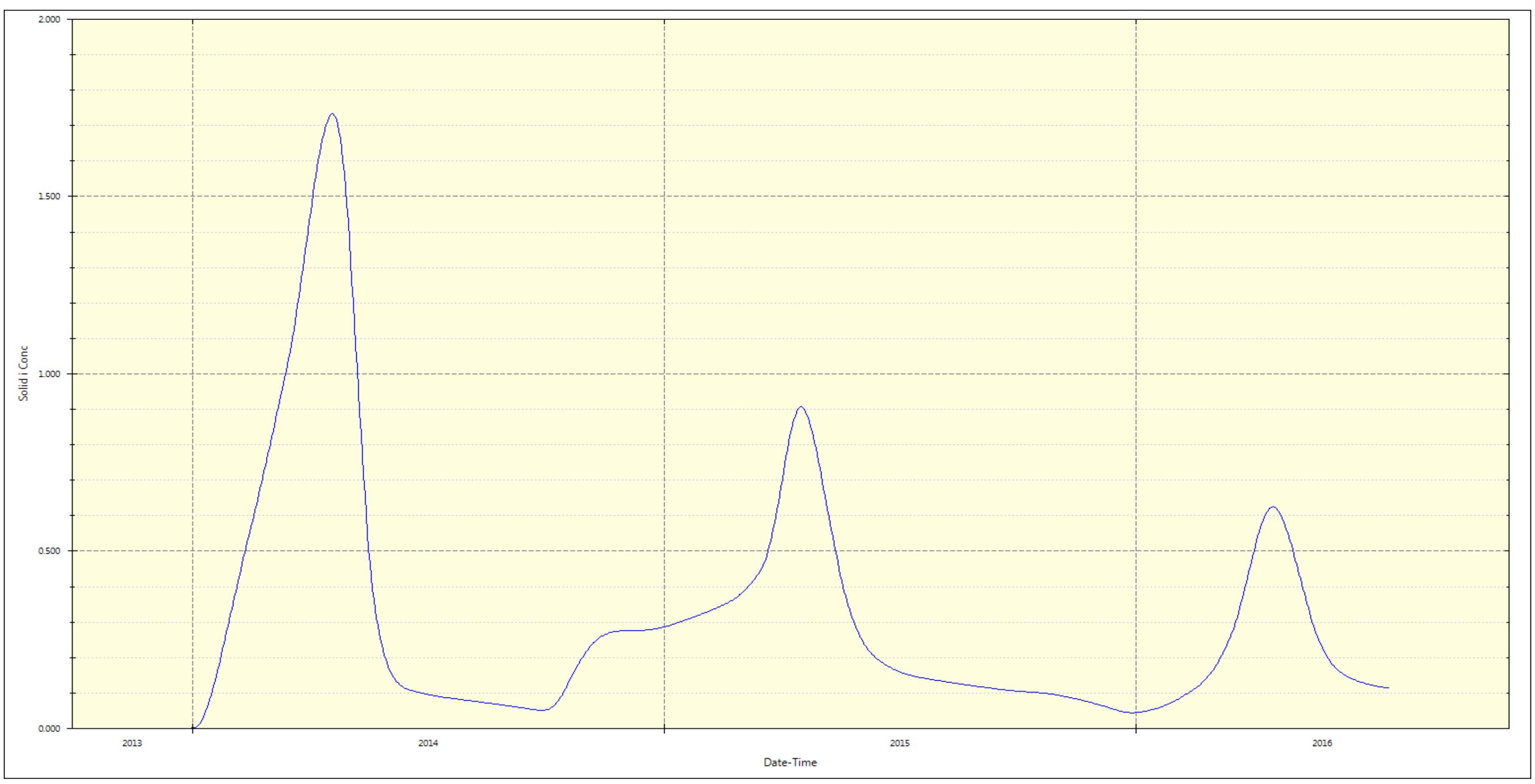


Figure C.3. WASP 8 Model Output
Tracer concentration in Downstream segment, 2014 - 2016

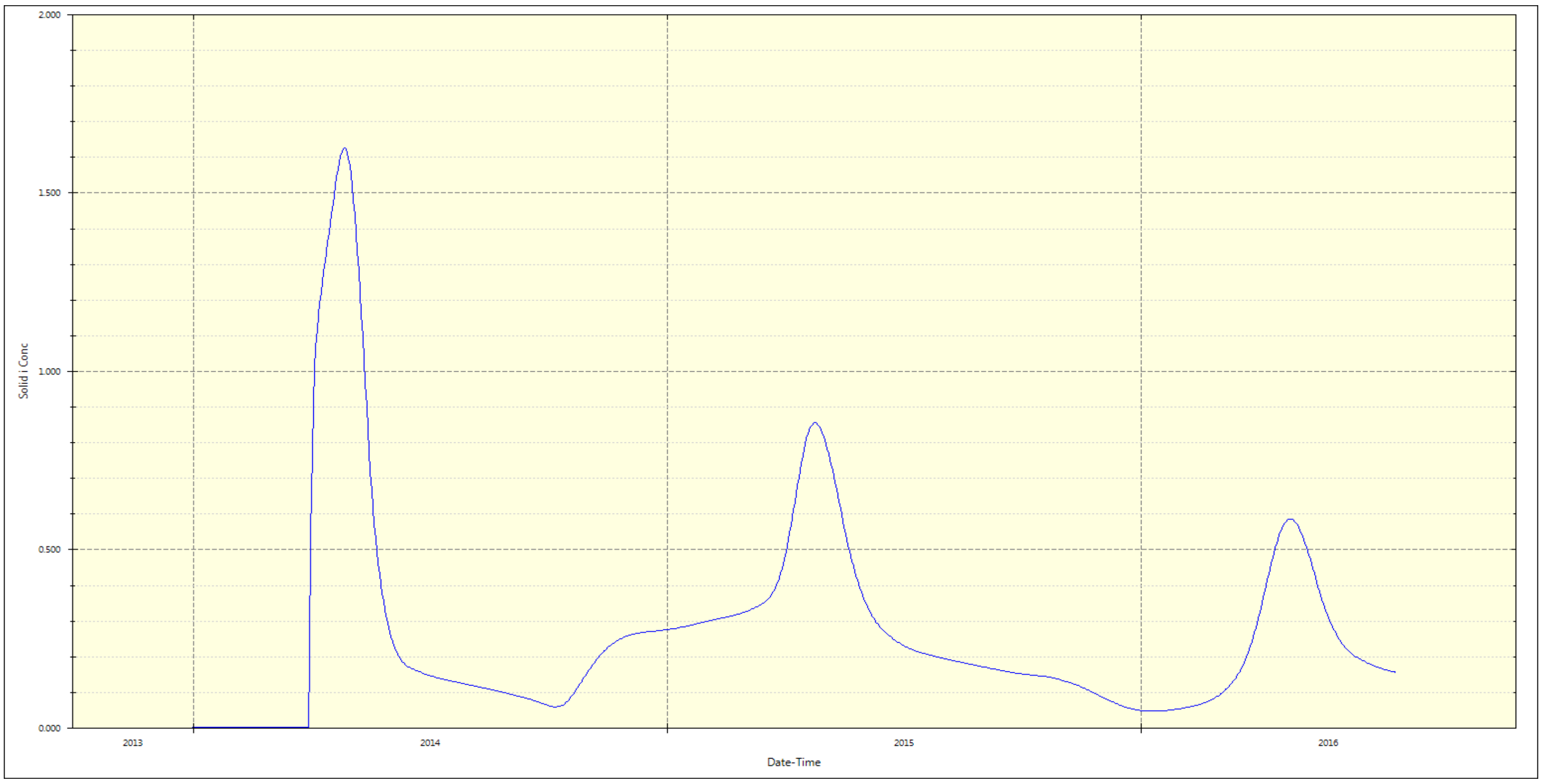
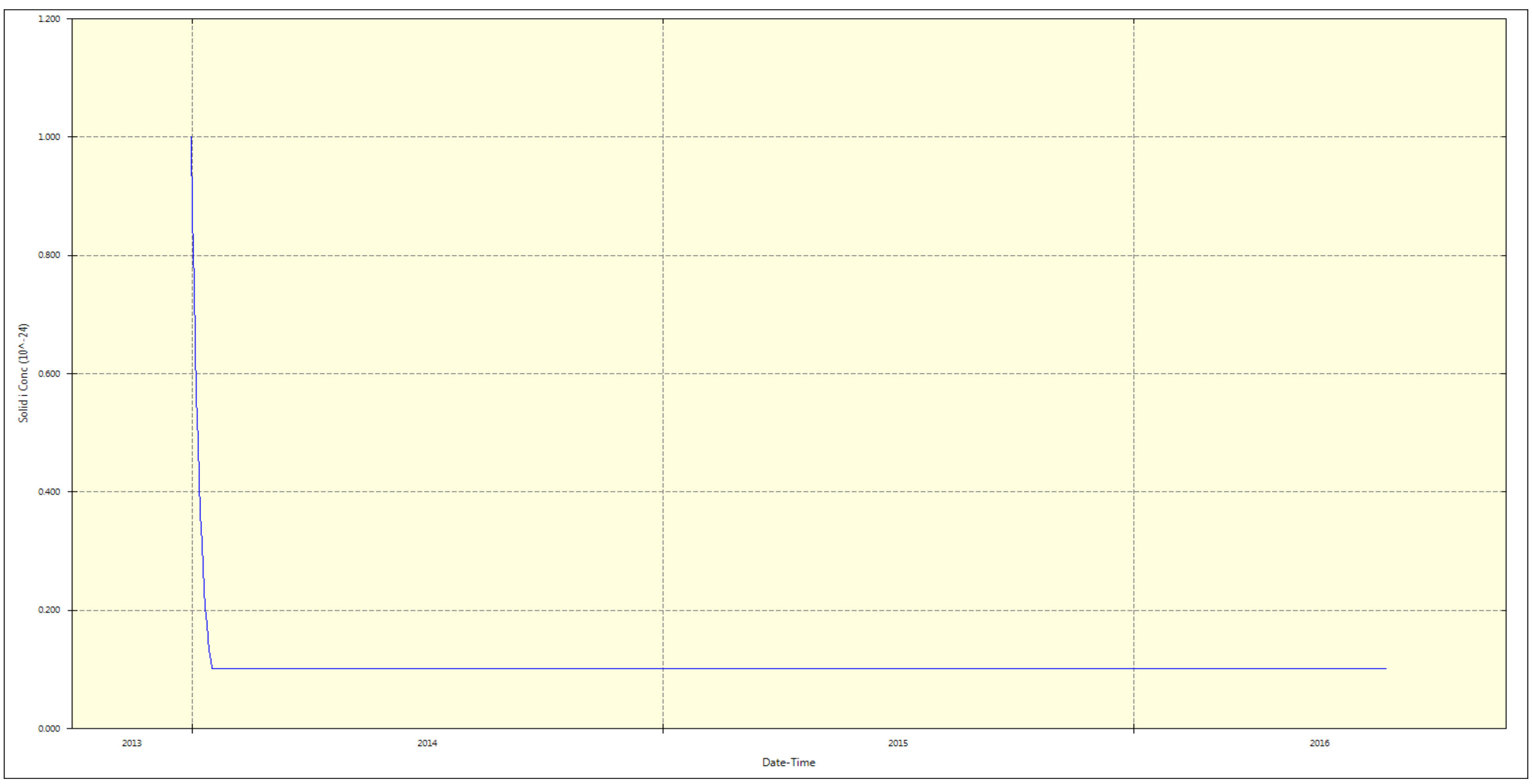


Figure C.4. WASP 8 Model Output
Tracer concentration in Upstream segment, 2014 - 2016



Net Lake WASP8 Model Input Parameters

System	Variable	Model Input
TAB	Lagoon 17	Lagoon 17
Data Set	Model Type	Advanced Toxicant
	Solution	Euler
	Start Date	1/15/2014
	End Date	7/15/2016
	Max Time Step	1
	Min Time Step	0.0001
Systems	System Type	SOLID
	System Name	Tracer Solid
	Particulate Transport	Solids 1
	Mass Balance	checked
	Density	1.000
	Dispersion Bypass	unchecked
	Flow Bypass	unchecked
Segments	**UPSTREAM**	
	Segment Type	Surface Water
	Transport Mode	Kinematic Wave
	Segment Below	None
	Initial Conditions	Tracer Solid 0
	Fraction Dissolved	Tracer Solid 0
	LAGOON	
	Segment Type	Surface Water
	Transport Mode	Kinematic Wave
	Segment Below	None
	Initial Conditions	Tracer Solid 0
	Fraction Dissolved	Tracer Solid 0
	NorthNetLake	
	Segment Type	Surface Water
	Transport Mode	Kinematic Wave
	Segment Below	None
	Initial Conditions	Tracer Solid 0
	Fraction Dissolved	Tracer Solid 0
	EastNetLake	
	Segment Type	Surface Water
	Transport Mode	Kinematic Wave
	Segment Below	None
	Initial Conditions	Tracer Solid 0
	Fraction Dissolved	Tracer Solid 0
	CENTRALNETLAKE	
	Segment Type	Surface Water
	Transport Mode	Ponded Weir
	Segment Below	None
	Initial Conditions	Tracer Solid 0
	Fraction Dissolved	Tracer Solid 0

	WestNetLake	
	Segment Type	Surface Water
	Transport Mode	Ponded Weir
	Segment Below	None
	Initial Conditions	Tracer Solid 0
	Fraction Dissolved	Tracer Solid 0
	DOWNSTREAM	
	Segment Type	Surface Water
	Transport Mode	Kinematic Wave
	Segment Below	None
	Initial Conditions	Tracer Solid 0
	Fraction Dissolved	Tracer Solid 0
External Data		None selected
Parameters	**Solids**	None selected
	System	None
	Scale Factor	1
	All Segments	1
	All Other Parameters	None selected
Constants	**All Functions**	None selected
Time Functions	**All Functions**	None selected
Exchanges	**All Functions**	None selected
Flows	**Channel Geometry**	
	UPSTREAM	
	Volume	621,600
	Length	1,120
	Width	185
	Slope	0.0001
	Min Depth	3.000
	Roughness	0.050
	Initial Depth	3.5
	Depth Multiplier	3
	Depth Exponent	0.45
	Velocity Multiplier	1
	Velocity Exponent	0
	LAGOON	
	Volume	1,595,000
	Length	580
	Width	550
	Slope	0.0001
	Min Depth	5.000
	Roughness	0.050
	Initial Depth	5.5
	Depth Multiplier	3
	Depth Exponent	0.45
	Velocity Multiplier	1
	Velocity Exponent	0
	NorthNetLake	

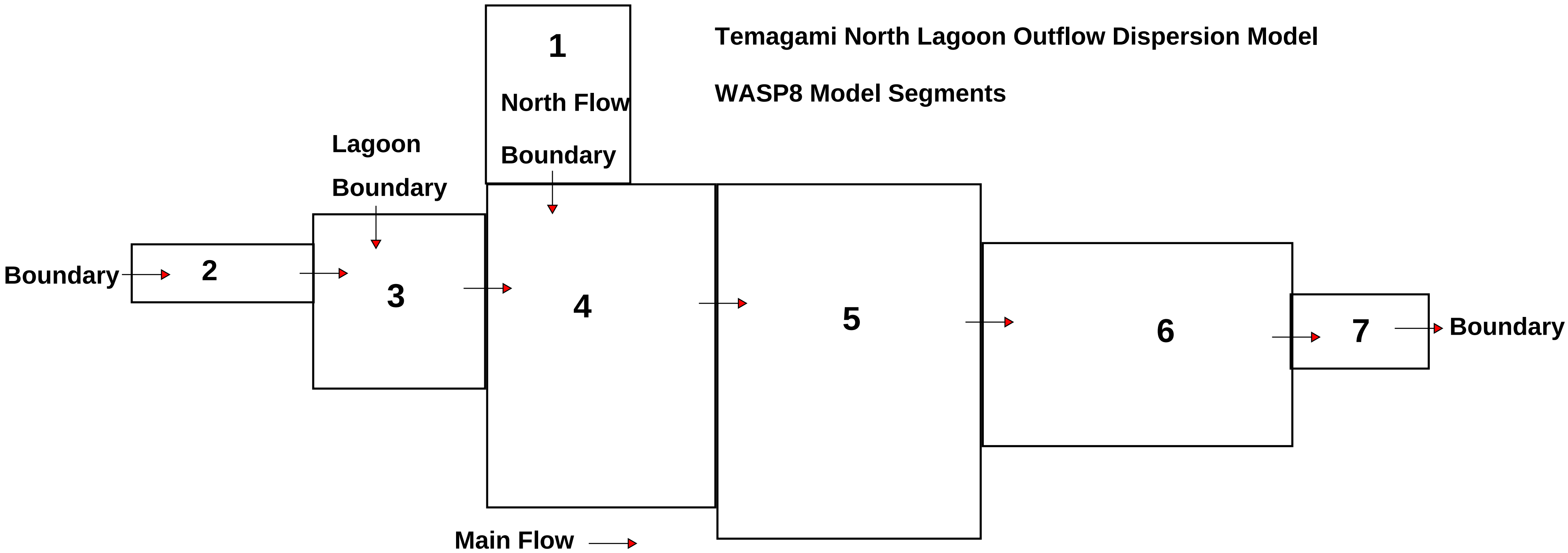
Volume	8,925,000
Length	2,550
Width	500
Slope	0.0001
Min Depth	7.000
Roughness	0.050
Initial Depth	7.5
Depth Multiplier	3
Depth Exponent	0.45
Velocity Multiplier	1
Velocity Exponent	0
EastNetLake	
Volume	10,080,000
Length	840
Width	1,200
Slope	0.0001
Min Depth	10.000
Roughness	0.050
Initial Depth	10.5
Depth Multiplier	3
Depth Exponent	0.45
Velocity Multiplier	1
Velocity Exponent	0
CENTRALNETLAKE	
Volume	16,282,500
Length	835
Bottom Elevation	
Width	1,300
Slope	
Min Depth	15.000
Roughness	
Initial Depth	15.5
Initial Surface Elevation	
Depth Multiplier	3
Depth Exponent	0.45
Velocity Multiplier	1
Velocity Exponent	0
Weir Height	5.0
WestNetLake	
Volume	7,560,000
Length	1,350
Width	700
Slope	
Min Depth	8.000
Roughness	
Initial Depth	8.5
Depth Multiplier	3

Depth Exponent	0.45
Velocity Multiplier	1
Velocity Exponent	0
Weir Height	5.0
DOWNSTREAM	
Volume	606,000
Length	1,010
Width	200
Slope	0.0001
Min Depth	3.000
Roughness	0.050
Initial Depth	3.5
Depth Multiplier	3
Depth Exponent	0.45
Velocity Multiplier	1
Velocity Exponent	0
Surface Water	
Flow Field	
Conversion	1
Scale	1
Function	**North Flow**
Interpolation	Linear
Scale Factor	1
Bound	Flow
Data Source	None
Segment Pairs	Boundary to 4 (EastNetLake)
Fraction	1
Start Date	1/15/2014
End Date	7/15/2016
Value	**See SW Flows 2014 to 2016**
Function	**Lagoon**
Interpolation	Linear
Scale Factor	1
Bound	Flow
Data Source	None
Segment Pairs	Boundary to 3 (Lagoon)
Fraction	1
Start Date	1/15/2014
End Date	7/15/2016
Value	**See SW Flows 2014 to 2016**
Function	**Main Flow**
Interpolation	Linear
Scale Factor	1
Bound	Flow
Data Source	None
Segment Pairs	Boundary to 2
	2 to 3

		3 to 4
		4 to 5
		5 to 6
		6 to 7
		7 to Boundary
	Fraction	1
	Start Date	1/15/2014
	End Date	7/15/2016
	Value	**See SW Flows 2014 to 2016**
	All Others	None selected
Boundaries	**UPSTREAM**	
	Start Date	1/15/2014
	End Date	7/15/2016
	Value	0
	Time Series Scale	1
	Interpolation	Linear
	Lagoon	
	Start Date	1/15/2014
	End Date	7/15/2016
	Value	0
	Time Series Scale	1
	Interpolation	Linear
	DOWNSTREAM	
	Start Date	1/15/2014
	End Date	7/15/2016
	Value	0
	Time Series Scale	1
	Interpolation	Linear
Loads	**Tracer Solid**	
	Lagoon	
	Start Date	1/15/2014
	End Date	7/15/2016
	Value	**See E coli loads 2014 to 2016**
	Time Series Scale	1
	Interpolation	Linear
	Boundary Scale Factor	1
	Load Scale Factor	1
	All Others	None selected

Temagami North Lagoon Outflow Dispersion Model

WASP8 Model Segments



Segment #	Segment Name	Volume (m^3)	Length (m)	Width (m)	Minumum Depth (m
1	N. Net Lake	8,925,000	2550	500	7.00
2	Upstream 1	621,600	1120	185	3.00
3	Lagoon	1,595,000	580	550	5.00
4	EastNetLake	10,080,000	840	1200	10.00
5	CentralNetLake	16,282,500	835	1300	15.00
6	WestNetLake	7,560,000	1350	700	8.00
7	Downstream	606,000	1010	200	3.00
	Total Volume	36,745,100			