Hydrothermal and Water Quality Modeling for Evaluation of Ashumet Pond Trophic State

by

Seth J. Schneider
B.S., Civil and Environmental Engineering
Cornell University, 1996

Submitted to the Department of Civil and Environmental Engineering
In Partial Fulfillment of the Requirements for the Degree of

MASTER OF ENGINEERING
IN CIVIL AND ENVIRONMENTAL ENGINEERING

at the

MASSACHUSETTS INSTITUTE OF TECHNOLOGY
June 1997

Signature of the Author ______________________
Seth J. Schneider
Department of Civil and Environmental Engineering
May 9, 1997

Certified by ______________________
Peter Shanahan, Ph.D.
Lecture Professor of
Civil and Environmental Engineering
Thesis Supervisor

Accepted by ______________________
Professor Joseph Sussman
Chairman, Department Committee on Graduate Studies

Hydrothermal and Water Quality Modeling for Evaluation of Ashumet Pond Trophic State
by
Seth J. Schneider

Submitted to the Department of Civil and Environmental Engineering on May 9, 1997 in Partial Fulfillment of the Requirement for the Degree of Master of Engineering in Civil and Environmental Engineering

ABSTRACT

The Ashumet Valley area of Falmouth, Massachusetts has been one of the areas most affected by activities on the Massachusetts Military Reservation. As a result of many years wastewater disposal on the reservation, there is now a plume originating from the wastewater disposal beds (known as the sewage treatment plant, or STP plume) that contains high levels of dissolved solids, chloride, sodium, boron, detergents, and various forms of nitrogen and phosphorus. Currently, the STP Plume extends more than 17,000 feet from the wastewater treatment plant.

This study focuses on the health of Ashumet Pond in Falmouth and Mashpee, Massachusetts. As a result of the interception of phosphorus contaminated groundwater by Ashumet Pond, the pond has seen a large influx of phosphorous in recent years. Because phosphorous is the limiting nutrient for biological production in the pond, any increased phosphorous loading in the pond could cause an increase of the productivity in the pond. If this productivity becomes too great, eutrophication can occur. Based on steady-state predictions such as the Vollenweider equation, Ashumet Pond is estimated to currently be in the oligotrophic-mesotrophic range. However, based upon predictions of future phosphorus loadings to Ashumet Pond, the pond is estimated to become eutrophic to hypereutrophic.

CE-QUAL-R1 was chosen for detailed numerical eutrophication modeling of Ashumet Pond. CE-QUAL-R1 is a numerical model developed by the Army Corps of Engineers that describes the vertical distribution of temperature and chemical and biological materials in a reservoir. CE-QUAL-R1 also includes a separate thermal analysis model entitled CE-THERM-R1. CE-THERM-R1 can be used to quantify temperature profiles that can then be used as inputs to CE-QUAL-R1. Once calibrated, CE-THERM-R1 gives a reasonably accurate prediction of Ashumet Pond temperature profiles.

Predictions of Ashumet Pond trophic state based upon CE-QUAL-R1 modeling are significantly lower than the level of eutrophication predicted by steady-state models. There are many possible reasons for this discrepancy. Thus, because of the inconclusive nature of the CE-QUAL-R1 modeling study, it is recommended that further study be undertaken before such drastic action as constructing a barrier wall is begun.

Thesis Supervisor: Peter Shanahan, Ph.D.
Title: Lecture Professor of Civil and Environmental Engineering

AKNOWLEDGEMENTS

I would like to take this opportunity to thank the many people that have helped me, not only with this thesis, but throughout the entire M.Eng. program. First and foremost, I would like to thank my advisor, Dr. Peter Shanahan. Dr. Shanahan has been an incredible help to me in completing this thesis. Without his guidance, the task of putting together my eutrophication model would have seemed impossible.

Next, I would like to thank Professor David Marks, Shawn Morrissey, and Charlie Helliwell. Professor Marks has gone out of his way from the first time I met him to make me feel comfortable at M.I.T. I am forever indebted to Professor Marks for all of his help. Additionally, Shawn Morrissey has been a tremendous help in my job search. All of the time I spent chatting with Shawn about my career path made the whole experience of a job search much easier to handle.

Last, and most importantly, I would like to thank my parents. For steering me towards graduate school, and for always supporting the decisions I've made, I owe them everything. Without their endless support throughout the years, none of what I have accomplished today would have been possible. I love you!

TABLE OF CONTENTS

LIST OF FIGURES 6
LIST OF TABLES 7
GLOSSARY OF TERMS 8
LIST OF UNITS, SYMBOLS, AND ABBREVIATIONS 10
1. BACKGROUND AND SITE DESCRIPTION 13
2. INTRODUCTION 15
2.1 Goals 15
2.2 Ashumet Pond 15
2.3 The MMR Wastewater Treatment Plant 16
3. PROBLEM STATEMENT 18
4. THE EUTROPHICATION PROBLEM 23
4.1 Phosphorus and the Eutrophication Process 23
4.2 Surface Water Hydrodynamics 24
4.3 Measures of Trophic State 25
4.3.1 Vollenweider Criteria 25
4.3.2 Trophic Level Index 26
4.3.3 Carlson's Trophic State Index 27
4.4 Predictions of Ashumet Pond Phosphorus Loading 29
4.4.1 Background groundwater 29
4.4.2 Direct Precipitation 30
4.4.3 Watershed Runoff 30
4.4.4 Storm Drainage 31
4.4.5 Discharge from Cranberry Bog 31
4.4.6 Septic Tank Discharge 32
4.4.7 MMR STP Plume 32
4.5 Steady-State Eutrophication Predictions for Ashumet Pond 34
4.5.1 Vollenweider Equation 35
4.5.2 Vollenweider-Dillon Relationship 36
4.5.3 Larson-Mercier Relationship 38

5. DETAILED NUMERICAL EUTROPHICATION MODELING 40

5.1 Model Introduction 40

5.2 Model Operation 41

5.3 Model Assumptions and Shortcomings 42

5.4 CE-THERM-R1 Modeling 44

5.4.1 Introduction..........................44

5.4.2 Data Set Compilation..........................44

5.4.3 Model Calibration..........................52

5.5 CE-QUAL-R1 modeling..........................55

5.5.1 Introduction..........................55

5.5.2 Analysis of results 56

5.5.3 Conclusions..........................63

6. RECOMMENDATIONS..........................66

BIBLIOGRAPHY..........................67

Appendix A. Example CE-THERM-R1 Data Set..........................71

Appendix B. Example CE-THERM-R1 Output..........................83

LIST OF FIGURES

Figure 1-1. MMR Site Map (E.C. Jordan Co., 1988) 14

Figure 2-1. MMR Wastewater Treatment Plant (Shanahan, 1996) 17

Figure 3-1. Ashumet Valley Plume Map (ABB, 1994) 19

Figure 3-2. Anoxic and Suboxic Zones Within the Ashumet Valley Plume (Shanahan, 1996) 21

Figure 5-1. Area as a Function of Elevation for Ashumet Pond 46

Figure 5-2. Bathymetric Map of Ashumet Pond (K-V Associates, 1991) 47

Figure 5-3. Width as a Function of Elevation for Ashumet Pond 48

Figure 5-4. Comparison of Actual and Model-Predicted Temperature Profiles 54

Figure 5-5. Populations of Algal Compartments in the Top Layer of Ashumet Pond as a Function of Day of the Year 57

Figure 5-6. Maximum Algal Populations in the Top Layer of Ashumet Pond as a Function of Inflowing Phosphorus Concentration 59

Figure 5-7. Chlorophyll-a concentrations as a function of inflowing phosphorus concentrations 61

Figure 5-8. Carlson's Trophic State Index as a function of inflowing phosphorus concentration 63

LIST OF TABLES

Table 4-1. Breakdown of Severity Points (HAZWRAP, 1995)..27

Table 4-2. Water Quality Data for Ashumet Pond and Associated TSI values. (Shanahan, 1996)..29

Table 4-3. Estimates of Ashumet Pond Phosphorus Loading in lbs/year.........................34

Table 4-4. Steady-State Phosphorus Concentration Predictions for Ashumet Pond Based on the Vollenweider Equation and Corresponding Trophic Status............36

Table 4-5. Mean Annual Total Phosphorus Concentration Predictions for Ashumet Pond Based on the Vollenweider-Dillon Relationship and Corresponding Trophic Status. 38

Table 4-6. Trophic Level of Ashumet Pond Based Upon Loading Estimates. 39

Table 5-1. The Ratio of Chlorophyll-a Concentration (in µg/L) to Total Phytoplankton Biomass (in mg/L) (Adapted from Dolan et al., 1978).............................61

GLOSSARY OF TERMS

aerobic- containing oxygen and/or nitrate

bathymetric map- a map which shows contours of constant depth for a water body

calibration- the procedure by which a model is adjusted to be able to fit actual data

epilimnion- the top, warmest (and thus least dense) area of a surface water body

eutrophic- a condition of high nutrient content in a surface water body, leading to heavy biological productivity

eutrophication- an increased growth of aquatic biota, particularly algae and macrophytes, relative to the normal rate of productivity in the absence of perturbations to the system

Gaussian elimination- a procedure in which a matrix is solved by subsequently adding and subtracting multiples of each row (each equation)

hydraulic residence time- the time, on average, in which a particle of water spends in a particular water body

hydrodynamics- the study of water movement

hypereutrophic- a condition of extremely high nutrient content in a surface water body, leading to intense biological productivity

hypolimnion- the bottom, coolest (and thus most dense) area of a surface water body

ionic- having a net electrical charge

limiting nutrient- the element required for organism growth that is present in the least amount relative to the organism's needs

mesotrophic- a condition of intermediate nutrient content in a surface water body, leading to medium biological productivity

metalimnion- the middle area of a surface water body characterized by intermediate temperatures (and thus densities)

morphometry- the geometry of a water body

nucleotide- a monomeric unit of nucleic acid, consisting of sugar, phosphate, and nitrogeneous base oligotrophic- a condition of low nutrient content in a surface water body, leading to minimal biological productivity

organic- containing the elements carbon and hydrogen

phospholipids- water-insoluble molecules containing a substituted phosphate group and two fatty acid chains on a glycerol backbone. Lipids in general are important in the structure of the cell membrane and (in some organisms) the cell wall

plume- an area of pollution in any environmental medium

Secchi disk- a small, circular object that is submerged in water bodies to give a measure of clarity

stratification- a condition of layering in a water body caused by temperature differences between different layers

steady-state- when conditions are not significantly changing over time

thermocline- the area in a stratified surface water body where temperatures rapidly decrease over a small depth

LIST OF UNITS, SYMBOLS, AND ABBREVIATIONS

Units

°C - degrees Centigrade

°F - degrees Fahrenheit

μg/L- micrograms (10^{-6} grams) per liter

einstein/L^2- einsteins per unit area, where an einstein= 1 mole of photons

ft - feet

g/m^2-yr- grams per square meter per year

kcal/kg- kilocalories per kilogram

kcal/m^2-sec- kilocalories per square meter per second

kg/year - kilograms (10^3 grams) per year

lbs/ acre-year - pounds per acre per year

lbs/year - pounds per year

m - meter

m/sec- meters per second

m^3/year - cubic meters per year

mb- millibars

mg/L- milligrams (10^{-3} grams) per liter

mg/m^3 - milligrams (10^{-3} grams) per cubic meter

mgd - million gallons per day

Symbols and Abbreviations

$\frac{d}{dt}$ - Time rate of change

ε- Extinction coefficient [L^{-1}], and in Equations 5.8-5.10

β- The fraction of solar radiation absorbed in a 0.6 m surface layer [dimensionless] in Equation 5.9

ρ- Density of water [kg/m^3] in Equation 5.7

ρ- Hydraulic flushing rate in Equations 4.8 and 4.9

τ- Hydraulic residence time of the lake in Equation 4.6

a- The wind speed coefficient AA [dimensionless] in Equation 5.7

A- A concentration-dependent factor that includes transport and biological and chemical rate effects in Equation 5.1-5.3

ACOEF(1), ACOEF(2), and ACOEF(3)= User specified constants in Equations 5.4 and 5.5

A_p- The cross sectional area along the pond of the part of the plume that contains phosphorus [L^2] in Equation 4.4

Area(I)- The area of the I^{th} layer in Equations 5.4 and 5.5

b- The wind speed coefficient BB [dimensionless] in Equation 5.7

C- A concentration of a particular biological or chemical constituent in Equation 5.1-5.3

Chl- Surface chlorophyll-a concentration in Equation 4.2

C_p- The average concentration of phosphorus in the plume along the pond in Equation 5.3

e_s- Saturated vapor pressure at the water surface temperature [mb] in Equation 5.7

e_a- Vapor pressure at the air temperature [mb] in Equation 5.7

Elevation- Elevation above the bottom of the pond in Equation 5.6

I- Solar radiation at the surface [einstein/L^2] in Equation 5.8

i- A counter variable used in Equation 5.1-5.3

i- Hydraulic gradient in Equation 4.4

I_0- Solar radiation at a given depth [einstein/L^2] in Equation 5.8

K- Hydraulic conductivity in Equation 4.4

L- Latent heat of vaporization [kcal/kg] in Equation 5.7

L- Mean annual phosphorus loading in Equation 4.8

L- Phosphorus loading rate per unit surface area in Equation 4.6

L_c- Critical limiting phosphorus load in Equation 4.9

ln - The natural logarithm

MMR- Massachusetts Military Reservation

N- Nitrogen

P - phosphorus

P- A concentration-independent factor that includes inflow and biological and chemical transfers in Equation 5.1-5.3

P- Mean annual total phosphorus concentration in Equation 4.8

P- Steady-state phosphorus concentration in the lake in Equation 4.6

P- Total phosphorus concentration in Equation 4.9

PO_4^{3-}- phosphate

q- Areal water loading rate in Equation 4.7

Q_e- Evaporative heat loss [kcal/m^2-sec] in Equation 5.7

Q_p- The flux of phosphorus into the pond in Equation 4.5

Q_w- The flux of water into the pond in Equation 4.4

R- Phosphorus retention coefficient in Equation 4.7

R- Phosphorus retention coefficient in Equation 4.9

SD- Secchi disk transparency in Equation 4.1

STP- Sewage treatment plant

TDS- Total dissolved solids

TKE- Turbulent kinetic energy

TP- Surface total phosphorus in Equation 4.3

TSI- Trophic state index

USGS- United States Geological Survey

V- Layer volume in Equation 5.1-5.3

W- Wind speed [m/sec] in Equation 5.7

WCOEF(1) and WCOEF(2)- User specified constants in Equation 5.6

Width- The width of the pond at a given elevation in Equation 5.6

Z(I)- The elevation of the I^{th} layer as measured from the bottom of the lake in Equations 5.4 and 5.5

Z- Depth [L] in Equation 5.8

Z- Average lake depth in Equations 4.6, 4.8, and 4.9

Z_s- Secchi Disk depth [L] in Equation 5.9

1. BACKGROUND AND SITE DESCRIPTION

Since 1911 the Massachusetts Military Reservation (MMR), located on Cape Cod (see Figure 1-1), has hosted various branches of the Armed Forces. At its peak as the United States' primary staging ground for World War II, the MMR was home to over 10,000 soldiers. The industrial and military activities associated with use of the MMR has had far-reaching impacts upon the environment of Cape Cod. In 1989, as a result of widespread groundwater contamination in the area, the MMR was placed on the National Priority List of Superfund sites.

The Ashumet Valley area of Falmouth, Massachusetts has been one of the areas most affected by activities on the MMR. There have been two major sources of contamination to the Ashumet Valley Region. The first source is known as Fire Training Area Number 1 (FTA-1). Through the use of FTA-1 for military fire training activities, there is a plume emanating from this site that is composed of hydrocarbons from jet fuel, including benzene, toluene, ethylbenzene, and xylene (BTEX), and chlorinated organics such as trichloroethylene (TCE) and perchloroethylene (PCE).

The second major source of contamination to Ashumet Valley is from the MMR Wastewater Treatment Plant, located approximately 1600 feet upgradient of Ashumet Pond. Wastewater disposal began at this site in the 1930's. Since this time it is estimated that nearly 10 billion gallons of wastewater have infiltrated to the groundwater that eventually flows towards Ashumet Pond. As a result of this wastewater disposal, there is now a plume originating from the wastewater disposal beds (known as the sewage treatment plant, or STP plume) that contains high levels of dissolved solids, chloride, sodium, boron, detergents, and various forms of nitrogen and phosphorus.

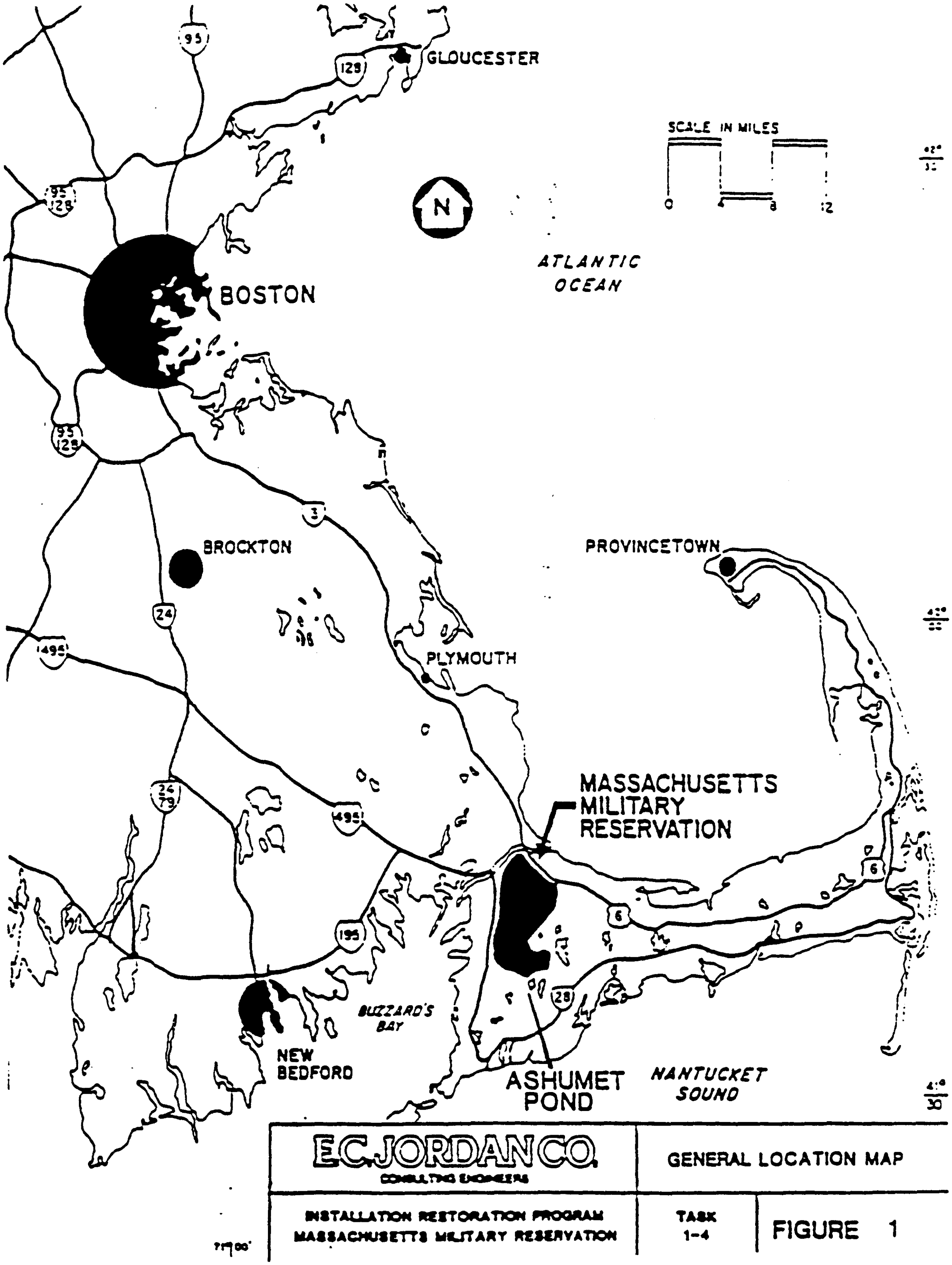

Figure 1-1. MMR Site Map (E.C. Jordan Co., 1988)

2. INTRODUCTION

2.1 Goals

The main goal of this project is to provide a more complete and accurate estimate, than has previously been done through steady-state models, of future Ashumet Pond phosphorus concentrations. This detailed estimate will be provided by CE-QUAL-R1 modeling. Various estimates of future Ashumet Pond phosphorus loadings are input to CE-QUAL-R1 in order to model the effect of the STP plume on the pond's productivity. The estimates of pond phosphorus concentrations provided by the model are then compared to steady-state predictions of phosphorus concentrations previously completed by E.C. Jordan Co. (1988), K-V Associates (1991), and others. Once predictions of future phosphorus concentrations are made, policy recommendations are given as to what should be done (if anything) to stop the influx of phosphorus to Ashumet Pond from the STP plume.

2.2 Ashumet Pond

This study focuses on the health of Ashumet Pond in Falmouth and Mashpee, Massachusetts. Ashumet Pond is an example of one of the many "kettle-hole" ponds on Cape Cod. The pond is formed by the intersection of the groundwater table with a kettle depression formed by a melted glacier (K-V Associates, 1991). The groundwater inlet to the pond is at Fisherman's Cove. Aside from the groundwater feed, Ashumet Pond has a small inlet from drained cranberry bogs and no noticeable outlet. Ashumet Pond maintains a large trout population, and is a popular place for fishing. In addition, the pond is heavily used for swimming and boating. Because of this heavy recreational use, the welfare of Ashumet Pond is a high priority for the many year-round and seasonal residents of Cape Cod.

2.3 The MMR Wastewater Treatment Plant

The wastewater treatment plant on the MMR was built in 1936 with an average capacity of 0.9 million gallons per day (mgd). In 1941, the plant was expanded to an average capacity of 3 mgd, with a peak capacity of 6 mgd (Shanahan, 1996). The sewage treated at the this plant was alternately disposed of in 20 half-acre sand infiltration beds. The original design called for only eight beds to be operational at any given time, with occasional rotation of the beds. However, from 1977 to 1984 only the four infiltration beds nearest to Ashumet Pond (see Figure 2-1) were used (LeBlanc, 1984b). In order to dispose of treated wastewater, the infiltration beds were flooded with wastewater, which then slowly percolated to the groundwater.

As World War II ended, the number of troops stationed at the MMR decreased. Thus, flow to the treatment plant decreased significantly as well. In fact, the average flow during the 1980's and 1990's was less than 0.3 mgd (Shanahan, 1996). As a result of the large amount of unused capacity as well as the aging of the plant, the plant was decommissioned in December, 1995. A smaller plant was then brought online next to the location of the old plant and use of the infiltration beds ceased.

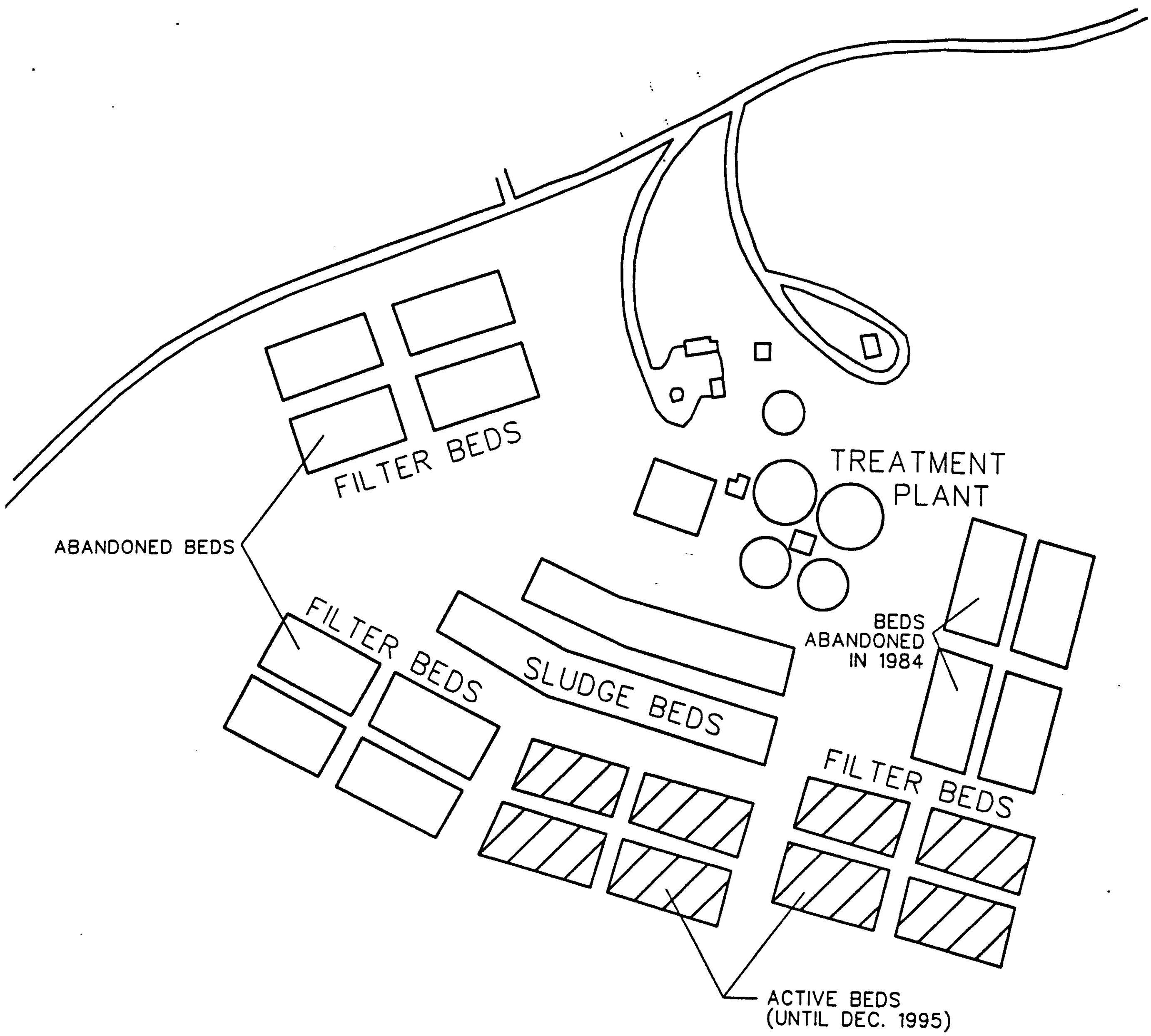

Figure 2-1. MMR Wastewater Treatment Plant (Shanahan, 1996)

3. PROBLEM STATEMENT

The first recognition that groundwater was being contaminated by the wastewater from the infiltration beds occurred in the 1970's. At this time, the Town of Falmouth closed a public water supply well located 9,000 feet downgradient of the wastewater treatment plant because water coming from the well was foaming. The foaming was determined to be a direct result of detergents that had entered the groundwater from the wastewater infiltration beds. In 1977, the U.S. Geological Survey (USGS) conducted a study which showed that the plume of contaminated groundwater originating from the wastewater treatment plant extended more than 11,000 feet downgradient of the disposal beds and had a width of 2,500 to 3,500 feet (LeBlanc, 1984a).

Currently, the Ashumet Valley Plume extends more than 17,000 feet from the wastewater treatment plant (see Figure 3-1). In addition to contaminants from the wastewater treatment plant, the plume also contains high concentrations of chlorinated organic solvents from FTA-1. However, the phosphorus in the groundwater has not traveled as far as the other constituents of the Ashumet Valley Plume. This smaller travel distance is because phosphorus is strongly adsorbed to soil particles, causing a retardation of phosphorus travel. It is widely believed that phosphorus adsorption in the subsurface is controlled by metal oxides. Among metal oxides, ferric, aluminum, and calcium hydroxides appear to be the most active in forming nearly insoluble compounds with phosphorus (Shanahan, 1996). In fact, metal oxides bind phosphorus so strongly that it is generally accepted among environmental engineers that phosphorus effectively does not move in groundwater under aerobic conditions, and thus is not a concern in groundwater contamination.

However, under anaerobic (or anoxic) conditions in groundwater, phosphorous can be expected to be somewhat mobile. It has been shown that under anaerobic conditions, phosphorus has a retardation factor of approximately five (E.C. Jordan Co., 1988). This means that phosphorous will move five times slower than conservative substances (substances that will not react with other chemicals in the groundwater). This approxi-

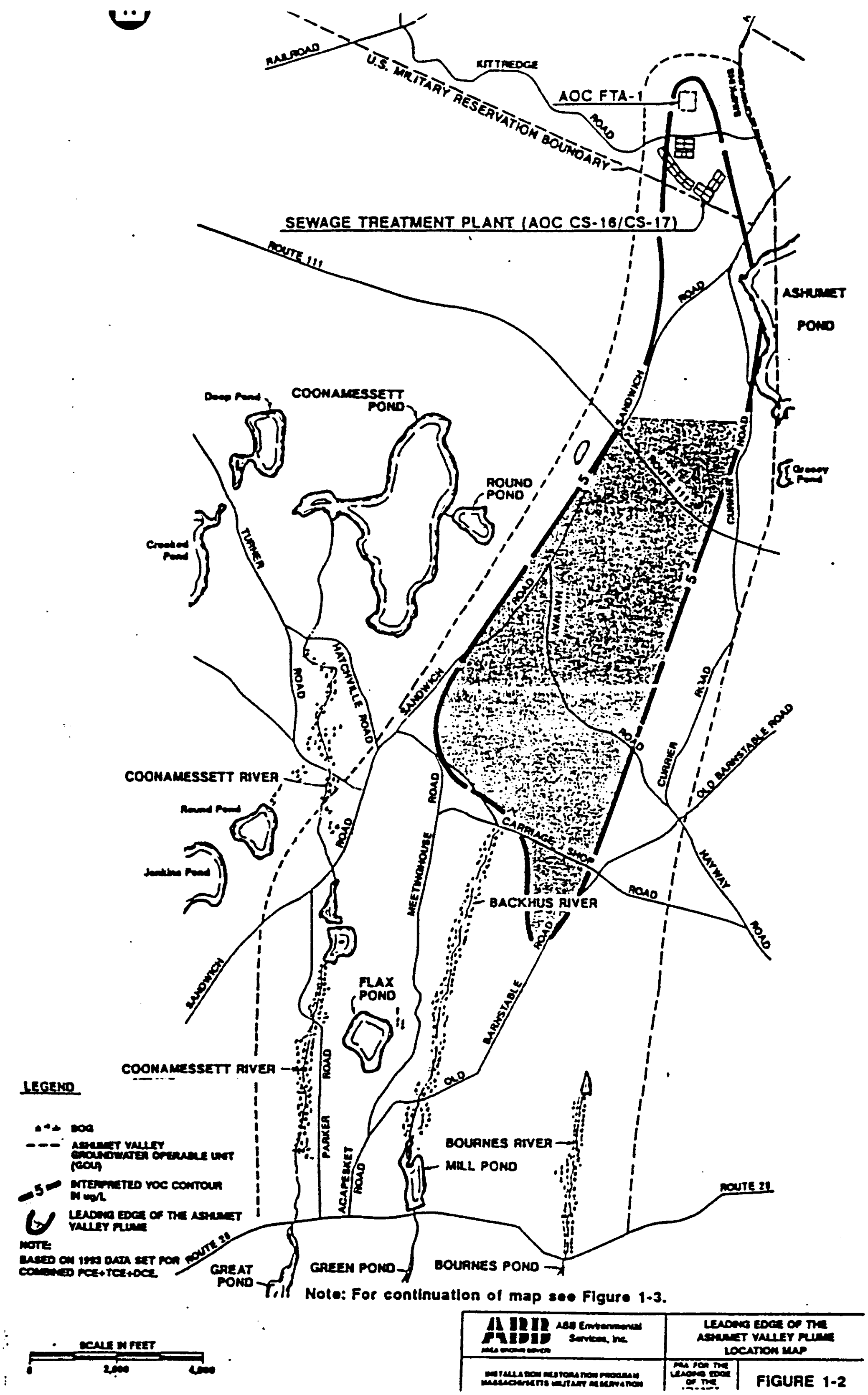

Figure 3-1. Ashumet Valley Plume Map (ABB, 1994)

mation seems to be holding quite well for the Ashumet Valley Plume, as the phosphorus plume is at least five times shorter than the plumes of conservative substances such as chloride and sodium.

Nevertheless, this approximation does not hold everywhere in the plume because the mobility of the phosphorus plume appears to be dependent upon the iron chemistry of the groundwater. Near the infiltration beds there is an area in which the groundwater has become anaerobic (without dissolved oxygen). This anaerobic condition has been caused by the use of oxygen by microbes in degrading the wastewater plume. When conditions are anoxic, iron becomes soluble. Thus, in the anaerobic area, most of the iron is dissolved and is being leached from the soil particles. This area is also referred to as the iron zone because of the solubility of iron in this region. Because retardation of phosphorus flow appears to be mainly caused by binding with iron hydroxides, in areas where most of the iron has been leached from soil particles, there are a decreased number of sites for phosphorus adsorption. As a result of this decrease in available binding sites, phosphorus is most mobile in this area. (Wetzel, 1983)

Figure 3-2 shows that there are zones of anoxic and suboxic conditions within the wastewater plume. The suboxic areas are those regions where dissolved oxygen is between 0.1 and 1.0 mg/l. In both the anoxic and suboxic zones, manganese is also quite soluble. Thus, high levels of dissolved manganese are found in both zones. As demonstrated in Figure 3-2, the suboxic zone extends to the groundwater flowing to Ashumet Pond. This zone is also referred to as the manganese zone because only manganese (and not iron) is soluble in this zone. There is physical evidence of this zone of high dissolved manganese near the pond. As the dissolved manganese contacts the water in the pond (which contains a fairly high level of dissolved oxygen), the manganese precipitates, causing a black deposit on the rocks near Fisherman's Cove.

As a result of the interception of phosphorus contaminated water by Ashumet Pond, the pond has seen a large influx of phosphorous in recent years. Because phosphorous is a nutrient necessary for biological production, any increased phosphorous loading in the pond could cause an increase of the productivity in the pond. If this productivity becomes too great, algal populations in the pond could become overgrown. Such a

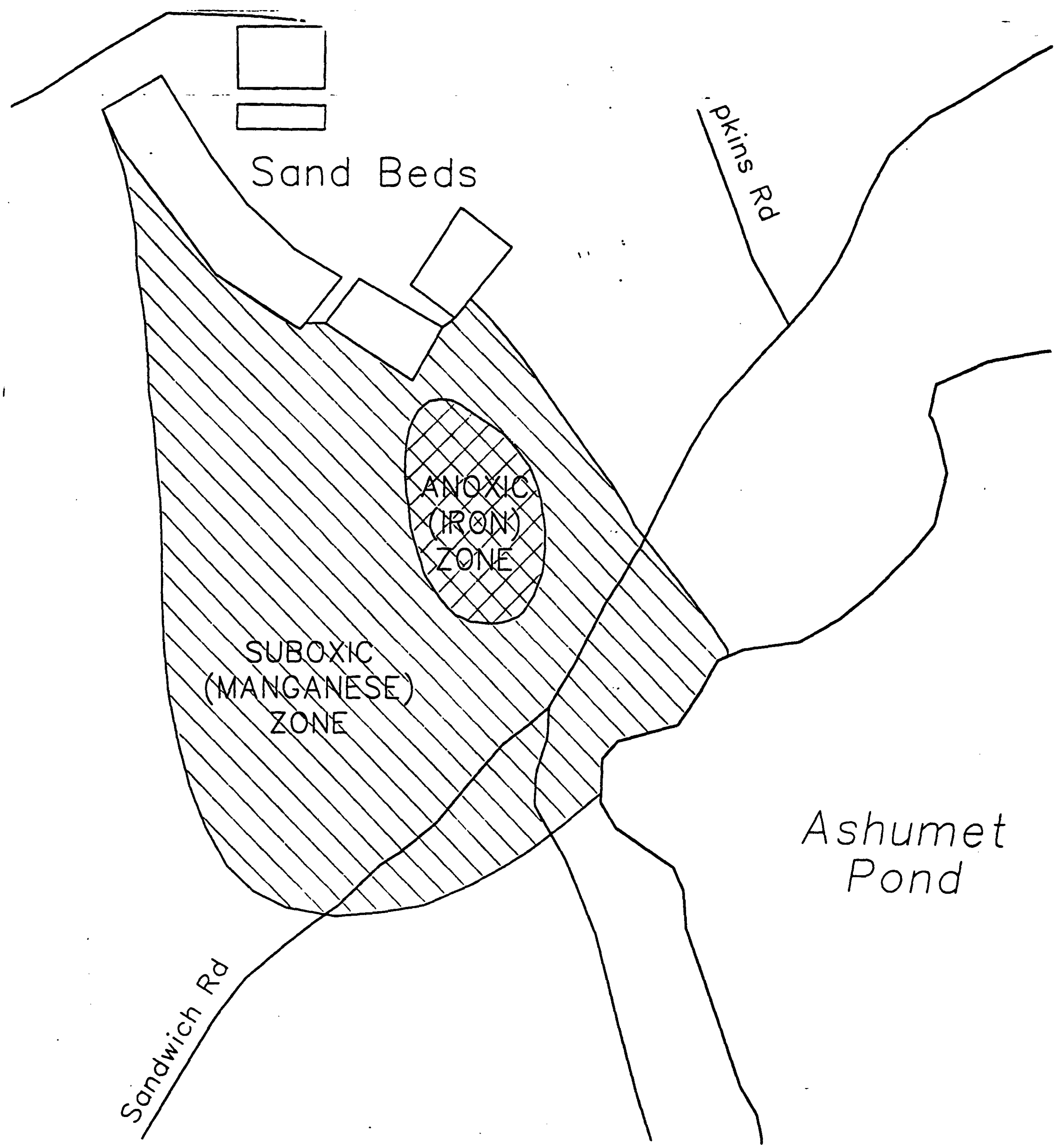

Figure 3-2. Anoxic and Suboxic Zones Within the Ashumet Valley Plume (Shanahan, 1996)

condition can result in a lake with depleted dissolved oxygen as algae die and decompose. Without sufficient dissolved oxygen, aquatic life cannot survive. In addition, an overgrown lake will become green from the algae and can begin to have odor problems as a result of hydrogen sulfide production. This problem of a lake whose productivity is too great is called eutrophication.

4. THE EUTROPHICATION PROBLEM

4.1 Phosphorus and the Eutrophication Process

The term *eutrophication* generally refers to an increased growth of aquatic biota relative to the normal rate of productivity in the absence of perturbations to the system. In surface waters, eutrophication normally relates to algal growth. The most important elements necessary for supporting algal growth are carbon, nitrogen, and phosphorus. Typical aquatic algae require these elements in the ratio of 1 part (by weight) phosphorus to seven parts nitrogen to 40 parts carbon (Wetzel, 1983). According to Liebig's Law of the Minimum, the growth of any organism will be limited by the element that is present in the least amount relative to its needs. This element is referred to as the "limiting nutrient." In a vast majority of surface waters, it has been shown that phosphorus is the limiting nutrient (Wetzel, 1983).

In general, if the total nitrogen to total phosphorus ratio exceeds between 8:1 and 15:1, the system is, in all likelihood, phosphorus limited. If the ratio is below approximately 4:1, the system is nitrogen limited. Ratios in between these two ranges indicate no clear limiting nutrient (E.C. Jordan Co., 1988). In 1985-1986, Ashumet Pond was found to have a total nitrogen to total phosphorus ratio of 47:1 (K-V Associates, 1986). Thus, Ashumet Pond is clearly phosphorus limited. Because phosphorus is the limiting nutrient in Ashumet Pond, its abundance will have the greatest effect upon the productivity of the pond, and thus will be the focus of this study.

There are many different forms of phosphorus that are present in surface waters. These different forms are generally broken up into organic and inorganic fractions. Greater than 90 percent of phosphorus in fresh waters is in the form of organic phosphates and cellular constituents of biota. However, the most important form of phosphorus for uptake by algae is inorganic soluble phosphorus. Inorganic soluble phosphorus concentrations are typically quite low in fresh waters. The percentage of inorganic soluble phosphorus in total phosphorus is fairly constant among different lakes at approximately 5%. Though, the form of phosphorus that is truly available for algal uptake is ionic orthophosphate (PO_4^{3-}). The percentage of ionic orthophosphate in most waters is significantly less than 5%. (Wetzel, 1983)

Phosphorus is important to algae because it is used for almost all phases of metabolism. Of particular importance in surface waters is the use of phosphorus in the energy transformations that occur during photosynthesis. Furthermore, phosphorus is required for the synthesis of nucleotides, phospholipids, and sugar phosphates. Thus, because of the relative lack of abundance of phosphorus and its importance in algal growth processes, phosphorus has always been important to the study of surface waters. (Wetzel, 1983)

4.2 Surface Water Hydrodynamics

In order to understand the problem of eutrophication, it is necessary to comprehend the thermal structure and hydrodynamics of surface water bodies. Most lakes in temperate climate zones have characteristic annual cycles, with variations in temperature and dissolved oxygen with depth. During the winter, a lake is usually mixed from top to bottom, with temperatures remaining constant at approximately four degrees Celsius (the temperature at which water is most dense). However, as springtime approaches and the lake surface is warmed by the atmospheric temperature and by solar radiation, the surface is warmed faster than the deeper waters. Therefore, the process of stratification begins where the epilimnion, or surface water, is composed of warmer and less dense water while the hypolimnion, or deeper water, is colder and thus more dense. In between these two layers is the metalimnion, characterized by a thermocline, which is an area in which temperature drops rapidly with depth. During the summer, stratification becomes stronger with larger temperature differences between the hypolimnion and epilimnion. Finally, stratification begins to break down in the fall due to atmospheric temperature changes and reductions in solar radiation, until the lake is once again isothermal.

This yearly stratification cycle has important implications for chemical and biological fate and transport in a lake. In a stratified lake, the epilimnion is well mixed by wind, however the hypolimnion is not in contact with the surface and thus does not circulate as much. Furthermore, because of the strong density gradient between the hypolimnion and epilimnion, water does not often circulate between the two layers. As a result, there is very little transport of chemical and biological constituents between the two layers. Because the hypolimnion is not in contact with the surface, and little diffusion of dissolved oxygen occurs between the layers, the hypolimnion can become devoid of oxygen during a seasonal period of stratification.

4.3 Measures of Trophic State

4.3.1 Vollenweider Criteria

In 1966, R.A. Vollenweider first proposed criteria for relating phosphorus concentrations to trophic conditions in surface waters. He defined trophic states ranging from nutrient poor, or oligotrophic ("poorly fed"), to nutrient rich, or eutrophic ("well fed"). The middle range between these two states is mesotrophic. Vollenweider made these delineations on the basis of the total steady-state phosphorus concentration in the lake as follows:

Trophic State	**Total Steady-State Phosphorus Concentration**
Oligotrophic	<10 μg/L
Mesotrophic	10-25 μg/L
Eutrophic	25-60 μg/L
Hypereutrophic	>60 μg/L

A typical lake will become more eutrophic with geological time. The speed at which this transition occurs varies from lake to lake and can be greatly accelerated by human activity. Such human activity can include inflow from septic systems, runoff from farmlands, and urban runoff. All of these processes contribute nutrients to a surface water and can speed the eutrophication of a lake in a process known as "cultural eutrophication." It is also important to note that most lakes (including Ashumet Pond) undergo a yearly cycle in which productivity is highest during the summer season. As a result of seasonal variation in productivity, Vollenweider has defined the phosphorus concentrations used in his scale to be those at steady-state. Although steady-state never really exists in a lake, phosphorus loads will generally be repetitive over a number of years. Therefore, a yearly average phosphorus load can be used as an approximation to steady-state (Wetzel, 1983).

4.3.2 Trophic Level Index

The trophic state of a pond can also be evaluated using the Trophic Level Index which was developed by the Massachusetts Division of Water Pollution Control (Commonwealth of Massachusetts, 1976). The Trophic Level index assigns a given number of severity points for certain water quality criteria in order to rate the trophic status of a pond. The trophic condition of the pond can be evaluated as follows:

Trophic Score	Trophic Condition of Pond	Production Level
0-6	Oligotrophic	Low
6-12	Mesotrophic	Moderate
12-18	Eutrophic	High

Table 4-1 gives the breakdown of severity points assigned based upon water quality criteria and gives the ranking of Ashumet Pond as determined by K-V Associates for 1985-1986 and HAZWRAP for 1993. As shown in this table, Ashumet Pond was in the mesotrophic range for both 1985-1986 and 1993. It is unknown whether the decrease in total severity points from 1985-1986 to 1993 represents an actual improvement in the pond's trophic status, or whether it simply has to do with natural variations related to a storm event or some other abiotic factor (HAZWRAP, 1995).

Table 4-1. Breakdown of Severity Points (HAZWRAP, 1995)

Parameter	Degree of Severity	Severity Points	Ashumet Pond 1985-1986	Ashumet Pond 1993
Hypolimnetic Dissolved Oxygen (mg/L)	>5.0 3.0-5.0 1.0-3.0 <1.0	0 1 2 3	3	3
Transparency (Secchi depth, ft.)	>15 10-15 4-10 <4	0 1 2 3	2	1
Phytoplankton (aerial standard units, ASU)	0-500 500-1000 1000-1500 >1500	0 1 2 3	3	3
Epilimnetic Dissolved Inorganic Nitrogen (mg/L)	0-0.15 0.15-0.3 0.3-0.5 >0.5	0 1 2 3	2	0
Epilimnetic Total Phosphorus (mg/L)	0-0.01 0.01-0.05 0.05-0.10 >0.1	0 1 2 3	1	1
Aquatic Vegetation	Sparse Medium Dense Very Dense	0 1 2 3	0	0
Total			11	8

4.3.3 Carlson's Trophic State Index

Another common measure used to rate the trophic status of a pond is Carlson's Trophic State Index (TSI). Rather than rating trophic state on a nomenclatural scale as the other scales do, Carlson's TSI gives trophic state on a numerical scale. This scale goes from 0-100, with 0 being the least trophic state (corresponding to an oligotrophic lake) and 100 being the most trophic (corresponding to a hypereutrophic lake). Carlson's index gives trophic condition on the basis of chlorophyll-a concentration, Secchi disk transparency, and total phosphorus. In deriving the equations that give TSI as a function of each of these parameters, Carlson related each of these parameters to the other two. The advantage of relating each parameter is that, unlike other scales, the computed TSI value should be the same no matter which equation is used. In other words, if one plugs in Secchi disk transparency, chlorophyll-a concentration, and total phosphorus into their respective equations, each equation should give the same TSI value. The equations are as follows:

$$\mathrm{TSI(SD)} = 10\left(6 - \frac{\ln(\mathrm{SD})}{\ln 2}\right) \tag{4.1}$$

$$\mathrm{TSI(Chl)} = 10\left(6 - \frac{2.04 - 0.69\ln(\mathrm{Chl})}{\ln 2}\right) \tag{4.2}$$

$$\mathrm{TSI(TP)} = 10\left(6 - \frac{\ln\left(\frac{48}{\mathrm{TP}}\right)}{\ln 2}\right) \tag{4.3}$$

Where,

SD= Secchi disk transparency [m]

Chl= Surface chlorophyll-a concentration [mg/m^3]

TP= Surface total phosphorus [mg/m^3]

It is important to note that when deriving these equations, Carlson used only summer values (July and August) for each parameter. The reason for using just summer values is that these values provide the best agreement between the parameters in the regression model. Additionally, summer is the season when the most sampling is likely to occur. Carlson states that if all parameters do not give approximately the same TSI value, that this situation "demands investigation" (Carlson, 1977). As demonstrated in Table 4-2, Ashumet Pond ranks in the middle to low range of the TSI in both 1985-1986 and 1992-1994. This range roughly correlates to an oligotrophic to mesotrophic rating. Carlson's TSI thus yields approximately the same general ranking for Ashumet Pond as do the

Table 4-2. Water Quality Data for Ashumet Pond and Associated TSI values. (Shanahan, 1996)

	Station	Chlorophyll-a (mg/m^3)	TSI(Chl)	Secchi Disk Transparency (m)	TSI(SD)	Total Phosphorus (mg/m^3)	TSI(TP)
1985-	1	2.20	38	3.56	42	14	42
1986	2	2.77	41	N/A	N/A	27	52
Average	3	1.39	34	2.70	46	13	41
	4	1.60	35	3.49	42	12	40
1992-	1	11.63	55	3.80	41	16	44
1994	2	10.75	54	3.94	40	14	42
Average	3	8.36	51	3.33	43	12	40
	4	10.61	54	3.61	41	11	39

Vollenweider scale and the Trophic Level Index. Additionally, TSI values determined using each of the three different water quality parameters correlate fairly well. Differences in values using each parameter may be related to measurement inaccuracies.

4.4 Predictions of Ashumet Pond Phosphorus Loading

Because pond phosphorus concentrations are critical in determining the overall trophic state of a lake, it is important to have a good idea of how much phosphorus is coming into the lake. Once phosphorus inputs have been quantified, there are a number of methods by which these inputs can be used to predict pond phosphorus concentrations. Two general ways to predict phosphorus concentrations are with a steady-state model or with a more complicated time varying mathematical model. These two methods are discussed in Section 4.5 and Chapter 5 respectively.

4.4.1 Background groundwater

Ashumet Pond receives varying amounts of phosphorus from a number of sources. The first major source of phosphorus to Ashumet Pond is background groundwater. In groundwater near the Ashumet Pond area that is free from sewage or detergents, an estimation of 0.005 mg/L of phosphorus was made (K-V Associates, 1986). Thus, for estimation purposes a value of 0.005 mg/L of phosphorus in background groundwater was used for a low estimate, and 0.01 mg/L was used as a high estimate by E.C. Jordan Co. (1988). With an estimated groundwater flow of 2.64×10^6 m^3/year, this estimate results in a low value of 0.016 mg/m^2-year of phosphorus. With an areal loading of 82 ha, the total expected phosphorus loading from background groundwater is between 29.1 and 58.2 lbs/year (E.C. Jordan Co., 1988). K-V Associates (1991) estimates a background groundwater loading of 22 lbs/year based upon a phosphorus concentration of 0.005 mg/L and without explanation of the flow rate used.

4.4.2 Direct Precipitation

The next source of phosphorus to Ashumet Pond is direct rainfall on the pond. For non-polluted rainfall, a phosphorus concentration of 0.03 mg/L is estimated (Wetzel, 1983). Based on a total annual rainfall of 46.06 inches and a pond phosphorus loading of between 1 and 10 mg/m^2-year, K-V Associates (1991) estimates a loading of 50 lbs/year of phosphorus from direct rainfall.

4.4.3 Watershed Runoff

Runoff from the watershed surrounding Ashumet Pond is another important source of phosphorus. E.C. Jordan Co. estimates watershed runoff to be 2.41×10^6 m^3/year. Based on the assumption of a phosphorus concentration in runoff water of 0.25 mg/L, the phosphorus loading to Ashumet Pond contributed by surface runoff is 13.3 lbs/year.

4.4.4 Storm Drainage

A significant amount of storm water from the MMR storm drainage system enters Ashumet Pond. The estimate for storm water is that 7.14×10^4 m^3/year directly enters the pond (E.C. Jordan Co., 1988). K-V Associates (1986) states that the phosphorus concentration in this storm water drainage is approximately 0.25 mg/L. These two estimates give a phosphorus loading of 39.2 lbs/year. K-V Associates (1991) gives a runoff value of 49 lbs/year of phosphorus entering the pond which apparently lumps watershed runoff together with storm drainage (it is not clear if this is indeed the case). This value is lower than the E.C. Jordan Co. (1988) estimate of 52.5 lbs/year from watershed runoff and storm water drainage.

4.4.5 Discharge from Cranberry Bog

The abandoned cranberry bog near Ashumet Pond contributes water to the pond in two ways. The first way is from groundwater that flows through the bog and enters the pond as surface water flow (the only surface water inlet to Ashumet Pond). It is estimated that 7.92×10^4 m^3/year enters the pond in this manner. Additionally, because the water table is essentially at the surface in the cranberry bog, any precipitation that falls on the bog will directly enter the surface water stream that flows to the pond. Based on a bog area of 5.3 ha and an annual rainfall of 46.06 inches, direct precipitation on the cranberry bog is estimated to contribute 2.83×10^4 m^3/year to Ashumet Pond. Thus, the total inflow due to the cranberry bog is 1.08×10^5 m^3/year. E.C. Jordan Co. (1988) uses a range of possible phosphorus concentrations in water from the cranberry bog of between 0.025 and 0.053 mg/L. Thus, the cranberry bog contributes 6.0 to 12.6 lbs/year of phosphorus to Ashumet Pond. K-V Associates (1991) uses a much higher flow rate for cranberry bog inflow and thus estimates the phosphorus loading from the bog to be 47 lbs/year.

4.4.6 Septic Tank Discharge

Another source of phosphorus to Ashumet Pond is septic tanks from homes in Falmouth that are upgradient of the pond. At present there are 32 homes upgradient of the pond and within 300 ft. According to the Town of Falmouth bylaws, phosphorus discharge from septic tanks within 300 ft of the shoreline should be estimated at 0.25 lbs/person-year (Town of Falmouth, 1986). Assuming an average of 4 persons per household (E.C. Jordan Co., 1988), total phosphorus loading from septic tanks is estimated to be 8 lbs/year. According to E.C. Jordan Co. (1988), this shoreline area is currently 60% developed. If full development of the area were to occur in the future, 13 lbs/year of phosphorus could be contributed to Ashumet Pond by septic systems. K-V Associates (1991) places this estimate at 27 lbs/year.

4.4.7 MMR STP Plume

The final source of phosphorus loading to Ashumet Pond is the MMR STP plume. There are a number of different estimates for present and future loadings from the wastewater plume. The estimate done by E.C. Jordan Co. (1988) assumes annual groundwater flow into the pond to be 1.87×10^5 m^3/year. At the time of the E.C. Jordan Co. study, groundwater entering the pond at Fisherman's Cove had a phosphorus concentration between 0.1 and 0.3 mg/L. However, in the anoxic zone of the wastewater plume, concentrations of between 1.0 and 2.0 mg/L were assumed by E.C. Jordan Co. Based on this information, phosphorus loading from the wastewater plume in 1991 was calculated to be between 41.2 and 124.7 lbs/year. It was also estimated that when the zone of highest phosphorus concentration reaches the pond, loadings could range from 412 to 825 lbs/year.

The next estimate was done by K-V Associates (1991). Based upon an assumed phosphorus concentration in the plume of 0.09 mg/L, a loading to the pond of 82 lbs/year was determined. No estimate of future pond loading was determined.

Another estimate of present pond loading was made by Walter et al. (1995). First, they determined the flux of water entering the pond from the area of the wastewater plume using Darcy's Law:

$$Q_w = KiA_p \tag{4.4}$$

Where,

Q_w= The flux of water into the pond [L^3/T]

K= Hydraulic conductivity [L/T]

i= Hydraulic gradient [dimensionless], and

A_p= The cross sectional area along the pond of the part of the plume that contains phosphorus [L^2].

Next, the mass flux of phosphorus into the pond was determined by multiplying the flux of water into the pond by the average concentration of phosphorus in the plume along the pond:

$$Q_p = Q_w C_p \tag{4.5}$$

Where,

Q_p= The flux of phosphorus into the pond [M/T]; and

C_p= The average concentration of phosphorus in the plume along the pond [M/L^3].

In this way, Walter et al. determined the average flux of phosphorus into the pond from 1993-1994 to be 67 kg/year (147 lbs/year).

The most recent estimate of Ashumet Pond phosphorus loading was made in 1996 by Shanahan. This estimate was based upon the fact that the peak phosphorus concentration in the plume is approximately three times greater than the concentration that is currently at the edge of the pond. Thus, in making this estimate, Shanahan multiplied the loading given by Walter by approximately three. Table 4-3 gives a summary of the different Ashumet Pond phosphorus loadings broken up by source.

Table 4-3. Estimates of Ashumet Pond Phosphorus Loading in lbs/year

Source	E.C. Jordan Co., 1988 Present Best Case	E.C. Jordan Co., 1988 Present Worst Case	E.C. Jordan Co., 1988 Future Best Case	E.C. Jordan Co., 1988 Future Worst Case	K-V Associates, 1991	Walter et al., 1995	Shanahan, 1996
MMR STP Plume	41.2	124.7	412	825	82	147	451
Background Groundwater	29.1	58.2	29.1	58.2	22	58.2	58.2
Direct Precipitation	18.1	63.5	18.1	63.5	50	63.5	63.5
Storm Drainage	39.2	39.2	39.2	39.2	49	39.2	39.2
Watershed Runoff	13.3	13.3	13.3	13.3	Included in above	13.3	13.3
Discharge from Cranberry Bog	6.0	12.6	6.0	12.6	47	12.6	12.6
Septic Tank Discharge	8.0	8.0	13.0	13.0	27	8.0	8.0
Total	154.9	319.5	530.7	1024.8	277	341.8	645.8

4.5 Steady-State Eutrophication Predictions for Ashumet Pond

As early as 1939 it was recognized that a relationship exists between the amount of nutrients input to a water body and the level of production in that water body. In 1947, Sawyer first stated that if certain critical levels of nitrogen and phosphorus were exceeded, a lake would show signs of eutrophication. Finally, in 1968, Vollenweider related quantified inputs of nitrogen and phosphorus to the expected trophic condition of a water body. (Wetzel, 1983)

It is from the work of Vollenweider and others that we can now predict, with reasonable accuracy, the trophic level of many water bodies (mainly those in temperate climates) by knowing the concentrations of essential nutrients such as nitrogen and phosphorus. Today, there are many methods that exist for predicting trophic status. Nevertheless, these methods can be grouped into two major categories. The first method is through the use of simple, steady-state equations that relate phosphorus loading to steady-state phosphorus concentration (and thus, to trophic level), given certain morphometric parameters. The advantage to this method is that these equations give a quick and inexpensive indication of the status of a water body. However, if the proper data is collected, more complicated, time varying, numerical models can give a more accurate prediction of trophic levels. This section will focus on steady-state predictions of the phosphorus concentration in Ashumet Pond. The use of CE-QUAL-R1, a more in-depth numerical model, in relating nutrient loading to trophic status in Ashumet Pond will then be described in Chapter 5.

4.5.1 Vollenweider Equation

One of the most commonly used equations for predicting the steady-state phosphorus concentration in a lake is the Vollenweider equation:

$$P = \frac{L}{Z} \frac{1}{\frac{1}{\tau} + \sqrt{\frac{1}{\tau}}} \tag{4.6}$$

Where,

P= Steady-state phosphorus concentration in the lake $[M/L^3]$

L= Phosphorus loading rate per unit surface area $[M/T\text{-}L^2]$

Z= Average lake depth [L]; and

τ= Hydraulic residence time of the lake [T].

Despite being quite simplistic, the Vollenweider equation has been proven in many studies to be an excellent predictor of steady-state phosphorus concentrations for a large number of lakes. The morphometric parameters necessary for steady-state phosphorus concentration predictions of Ashumet Pond are as follows: Mean depth is 23 feet (7 meters), surface area is 203 acres (82 hectares), and hydraulic residence time is 1.8 years (K-V Associates, 1991; Shanahan, 1996). Table 4-4 gives predictions for the steady-state phosphorus concentration in Ashumet Pond using the Vollenweider equation for the various estimates of phosphorus loading given in Section 4.4. Additionally, Table 4-4 shows the corresponding trophic status of Ashumet Pond according to the Vollenweider criteria described in Section 4.3.1. It is important at this point to again note that steady-state never really exists in a surface water body. The concentrations predicted by such equations as the Vollenweider equation are more like yearly averages.

Table 4-4. Steady-State Phosphorus Concentration Predictions for Ashumet Pond Based on the Vollenweider Equation and Corresponding Trophic Status.

Estimate	Phosphorus Loading (lbs/year)	Areal Phosphorus Loading (g/m^2-yr)	Predicted Steady-State Phosphorus Concentration (μg/L)	Corresponding Trophic Status
E.C. Jordan Co., 1988 Present Best Case	154.9	0.085	9.3	Oligotrophic
E.C. Jordan Co., 1988 Present Worst Case	319.5	0.179	19.7	Mesotrophic
E.C. Jordan Co., 1988 Future Best Case	530.7	0.29	31.9	Eutrophic
E.C. Jordan Co., 1988 Future Worst Case	1024.8	0.566	62.2	Hypereutrophic
K-V Associates, 1991 (Present)	277	0.152	16.7	Mesotrophic
Walter et al., 1995 (Present)	341.8	0.189	20.7	Mesotrophic
Shanahan, 1996 (Future)	645.8	0.357	39.2	Eutrophic

4.5.2 Vollenweider-Dillon Relationship

Another model that is used to predict trophic state is the Vollenweider-Dillon Relationship. This relationship was developed in 1974 (Dillon, 1974). The Vollenweider-Dillon Relationship predicts mean annual total phosphorus concentration based upon mean annual phosphorus loading, hydraulic flushing rate (defined as the inverse of the hydraulic residence time), mean depth, and the phosphorus retention coefficient. The hydraulic flushing rate for Ashumet Pond is approximately 0.56 $years^{-1}$. The phosphorus retention coefficient is a measure of phosphorus which will be retained in a lake and represents a balance of phosphorus inputs and losses (E.C. Jordan Co., 1988). The empirical relationship developed by Kirchner and Dillon (1975) is:

$$R = 0.426 \exp(-0.271q) + 0.574 \exp(-0.00949q) \tag{4.7}$$

Where,

R= Phosphorus retention coefficient [dimensionless]; and

q= Areal water loading rate [m/year].

The areal water loading rate for Ashumet Pond has been estimated as 4.23 m/year (E.C. Jordan Co., 1988). This loading rate gives a phosphorus retention coefficient of 0.687. The Vollenweider-Dillon Relationship for mean annual total phosphorus concentration is then:

$$P = \frac{L(1-R)}{Z\rho} \tag{4.8}$$

Where,

P= Mean annual total phosphorus concentration [M/L^3]

L= Mean annual phosphorus loading [M/L^2-T]

Z= Mean depth [L]; and

ρ= Hydraulic flushing rate [T^{-1}].

Table 4-5 gives the predictions for mean annual total phosphorus concentration based upon the Vollenweider-Dillon Relationship for the different phosphorus loading predictions. Furthermore, Table 4-5 shows the corresponding trophic status of the pond as determined by the Vollenweider criteria. It is demonstrated in Table 4-5 that the Vollenweider-Dillon Relationship gives consistently lower predictions for mean annual phosphorus concentration than the Vollenweider equation gives for steady-state phosphorus concentration.

4.5.3 Larson-Mercier Relationship

A third commonly used relationship for determining trophic status is the Larson-Mercier Relationship developed in 1976. In developing their relationship between phosphorus loading and trophic status, Larson and Mercier developed "critical limiting loads." Based on the following formula, critical limiting phosphorus loads can be determined at which a lake will have a certain phosphorus concentration:

Table 4-5. Mean Annual Total Phosphorus Concentration Predictions for Ashumet Pond Based on the Vollenweider-Dillon Relationship and Corresponding Trophic Status.

Estimate	Phosphorus Loading (lbs/year)	Areal Phosphorus Loading (g/m²-yr)	Predicted Mean Annual Phosphorus Concentration (µg/L)	Corresponding Trophic Status
E.C. Jordan Co., 1988 Present Best Case	154.9	0.085	6.9	Oligotrophic
E.C. Jordan Co., 1988 Present Worst Case	319.5	0.179	14.4	Mesotrophic
E.C. Jordan Co., 1988 Future Best Case	530.7	0.29	23.4	Mesotrophic
E.C. Jordan Co., 1988 Future Worst Case	1024.8	0.566	45.6	Eutrophic
K-V Associates, 1991	277	0.152	12.3	Mesotrophic
Walter et al., 1995	341.8	0.189	15.2	Mesotrophic
Shanahan, 1996	645.8	0.357	28.7	Eutrophic

$$L_c = 8.9 \rho ZP \frac{1}{1-R} \quad (4.9)$$

Where,

L_c= Critical limiting phosphorus load [lbs/year-acre]

ρ= Hydraulic flushing rate [years^{-1}]

Z= Mean depth [m]

P= Total phosphorus concentration [μg/L]

R= Phosphorus retention coefficient [dimensionless];

and 8.9 is a unit conversion factor.

Based on this relationship, the critical phosphorus load can be determined for any total pond phosphorus concentration. Larson and Mercier set a critical level of 20 μg/L of total phosphorus above which a lake is considered to be eutrophic and a level of 10 μg/L of total phosphorus above which a lake is considered mesotrophic. Below 10 μg/L the lake can be considered oligotrophic. With a phosphorus retention coefficient of 0.687, a mean depth of 7 meters, and a hydraulic flushing rate of 0.56 years^{-1}, Ashumet Pond will become mesotrophic with a phosphorus loading of 1.11 lbs/year-acre and eutrophic with a loading of 2.21 lbs/year-acre according to the Larson-Mercier Relationship. Ashumet Pond has an area of 203 acres, and will thus become mesotrophic with a phosphorus loading of 225 lbs/year and will become eutrophic with a loading of 449 lbs/year. Table 4-6 shows the various estimations of Ashumet Pond phosphorus loading and the corresponding trophic level of Ashumet Pond based upon the Larson-Mercier Relationship.

Table 4-6. Trophic Level of Ashumet Pond Based Upon Loading Estimates.

Estimate	**Phosphorus Loading (lbs/year)**	**Corresponding Trophic Status**
E.C. Jordan Co., 1988 Present Best Case	154.9	Oligotrophic
E.C. Jordan Co., 1988 Present Worst Case	319.5	Mesotrophic
E.C. Jordan Co., 1988 Future Best Case	530.7	Eutrophic
E.C. Jordan Co., 1988 Future Worst Case	1024.8	Eutrophic
K-V Associates, 1991	277	Mesotrophic
Walter et al., 1995	341.8	Mesotrophic
Shanahan, 1996	645.8	Eutrophic

5. DETAILED NUMERICAL EUTROPHICATION MODELING

5.1 Model Introduction

The CE-QUAL-R1 model was developed in 1986 by the U.S. Army Corps of Engineers from research done at the Waterways Experiment Station (U.S. Army Corps of Engineers, 1986). This model was chosen for this study because it is a proven and widely used method for eutrophication modeling. Additionally, a one-dimensional model such as CE-QUAL-R1 has been shown to give an accurate representation of seasonally stratified ponds such as Ashumet. CE-QUAL-R1 is a numerical model that describes the vertical distribution of temperature and chemical and biological materials in a reservoir throughout a specified time period. CE-QUAL-R1 is one dimensional and is horizontally averaged. Thus, temperature and water quality constituents are only computed in the vertical direction. Furthermore, constituents are uniformly mixed in each layer. Inflowing and outflowing water are placed in appropriate layers based upon density. Because CE-QUAL-R1 was developed for reservoir management, outflows can take place on a scheduled basis, or they can be continuous. Additionally, these outflows can be modeled as occurring via flow over a weir, flow through ports, or a combination of both.

Transport of heat or matter between thermally stratified layers of water can occur either through entrainment or turbulent diffusion. Entrainment is a result of kinetic energy inputs from wind shear and from convective mixing. Turbulent diffusion is calculated through the use of wind speed, inflow and outflow magnitudes, and density differences.

An important feature of CE-QUAL-R1 is that it models the interaction of many different biological and chemical constituents. Furthermore, CE-QUAL-R1 can model these interactions in both aerobic and anaerobic waters, an important advantage for heavily stratified water bodies that will tend to become anaerobic in the hypolimnion during a prolonged period of stratification. Another feature of CE-QUAL-R1 is that it includes a separate thermal analysis model entitled CE-THERM-R1. CE-THERM-R1 can be used to quantify temperature profiles that can then be used as inputs to CE-QUAL-R1. CE-THERM-R1 is discussed further in Section 5.4.

5.2 Model Operation

Each biological or chemical constituent in the model is described mathematically by a differential equation that describes conservation of mass in each horizontal layer, i. The general equation for each of the n layers is:

$$\frac{d}{dt} V_i C_i = A_{i1} C_{i-1} + A_{i2} C_i + A_{i3} C_{i+1} + P_i \quad \text{for } i = 2,3,\ldots n-1 \tag{5.1}$$

Where,

C= A concentration of a particular biological or chemical constituent

V= Layer volume

A= A concentration-dependent factor that includes transport and biological and chemical rate effects; and

P= A concentration-independent factor that includes inflow and biological and chemical transfers.

It is demonstrated in Equation 5.1 that each layer is only influenced by the layers immediately above or below it. Thus, the bottom layer can only be influenced by the layer above it:

$$\frac{d}{dt} V_1 C_1 = A_{11} C_1 + A_{12} C_2 + P_1 \tag{5.2}$$

Additionally, the top layer can only be influenced by the layer below it:

$$\frac{d}{dt} V_n C_n = A_{n1} C_{n-1} + A_{n2} C_n + P_n \tag{5.3}$$

Once defined, these equations form a tridiagonal matrix that is integrated for each user-defined computational interval by Gaussian elimination.

5.3 Model Assumptions and Shortcomings

One major simplification built into CE-QUAL-R1 is the one-dimensional assumption. In making this simplification, the model can not address variations in water quality throughout the length and width of the water body, only the depth. In addition, all inflows are assumed to be instantaneously mixed and then placed into fully-mixed horizontal layers based upon density.

Another cause of possible error in the model is that all processes are described via the use of conservation of mass as given by Equations 5.1-5.3. However, conservation of mass may not always be met because the differential equations used are solved numerically and not in closed form. Such numerical solutions may result in the occurrence of small errors. These errors should not be significant for purposes of trophic state predictions.

Because the ecological interactions in any water body are extremely complex and not completely understood, CE-QUAL-R1 makes many simplifying assumptions to make dealing with such interactions manageable. Additionally, it would be unrealistic for a user to collect data for all species present in a water body. Thus, many species are placed into functional groups. For instance, all zooplankton, fish, and organic sediments are grouped together into one model compartment each. All algal species are placed into one of three compartments. In this way, data collection and model computation are both made manageable.

There are also two conditions that are not specifically modeled by CE-QUAL-R1. These two conditions are an anaerobic environment and ice cover. The model only focuses on a few key chemical species under anaerobic conditions, and does not attempt to model the complexity of interactions during such conditions. Additionally, the model does not account for ice cover. However, periods of ice cover are not generally key periods in determining the health of a lake because lake temperatures are too low for most biological processes to be occurring.

A final shortcoming of CE-QUAL-R1 is realized when trying to adapt the model to a groundwater fed pond such as Ashumet. Because CE-QUAL-R1 was developed as a reservoir model, it is designed to handle outflows over a weir or through ports such as a reservoir would have. Moreover, the model is designed to have inflow from one or two tributaries. In order to successfully model the groundwater inflow and outflow of Ashumet Pond, a number of "tricks" must be employed. Inflow to Ashumet Pond can be modeled as coming from either one or two tributaries. In the case of Ashumet Pond, the bulk of inflow is from groundwater. Thus, Ashumet Pond inflow is modeled as occurring from only one tributary. Furthermore, it has been shown that for a groundwater fed pond, the greatest amount of inflow occurs near the shore (in the shallowest region of the pond) and inflow volume decreases in an approximately exponential manner away from the shore (McBride and Pfannkuch, 1975; Cherkauer and Zager, 1989). CE-QUAL-R1 immediately places inflow into the layer of most similar density (as calculated from temperature and solids concentration). Because groundwater temperature is approximately constant at 58°F (14.4°C) throughout the year, the inflowing groundwater will be more dense than the lake water at some times and less dense at others. Quite often, though, the groundwater inflow will be more dense than the top layers of the pond and less dense than the bottom layers, and thus will be placed somewhere in between. Based upon CE-THERM-R1 thermal modeling of Ashumet Pond, it has been determined that modeling Ashumet Pond groundwater inflow as occurring from one tributary with a constant temperature of 14.4°C provides a remarkably accurate estimate of actual groundwater inflow.

The outflow from Ashumet Pond is modeled as occurring at multiple ports, evenly spaced in the vertical from top to bottom. Because the bottom of the pond is at different depths depending on distance from the shore, groundwater recharge will occur at different depths as well. If enough ports are specified so as to effectively have a continuous outlet structure, Ashumet Pond's groundwater outflow should be modeled quite well. Thus, the maximum of eight outflow ports, each with a height of 2.48 m are used so as to cover the entire 19.8 m depth of the pond. As can be recognized from this section, the hydrodynamics of Ashumet Pond can be modeled quite well, even with a model such as CE-QUAL-R1 that was not designed specifically for groundwater-fed ponds.

5.4 CE-THERM-R1 Modeling

5.4.1 Introduction

In order to be able to successfully model the biological and chemical interactions that are occurring within the pond, it is first necessary to understand the hydrodynamics of the pond as they relate to thermal and water budgets. Thus, when modeling biological and chemical interactions, it is necessary to have continuously updated thermal, inflow, and outflow data. Because it is simply not feasible to collect inflow, outflow, and temperature profile data continuously throughout the year, it is desirable to have a model that will supply this information. In this regard, CE-THERM-R1 is a valuable tool for supplying continuous data as needed by CE-QUAL-R1.

5.4.2 Data Set Compilation

A large amount of the work that went into modeling Ashumet Pond was in compiling a data set that would accurately represent conditions in the pond. Among the most important inputs to CE-THERM-R1 are morphometric parameters (so that the model can reproduce the geometry of the pond), inflow and outflow data (flow rates, specification of the mode of water withdrawal and recharge, temperature, and solids content), mixing parameters, solar radiation information (such as the light extinction coefficient), solids settling rate, initial solids content, and meteorological data. An example data set for CE-THERM-R1 is given in Appendix A.

The morphometry of a lake is represented in CE-THERM-R1 by two sets of parameters; area coefficients and width coefficients. The area coefficients are used to give the area of the water body as a function of depth. There are two options provided in CE-

THERM-R1 for this specification. The first option gives area as a function of elevation by the following formula:

$$\text{Area(I)} = [\text{ACOEF}(1) * \text{Z(I)}]^{\text{ACOEF}(2)} \quad (5.4)$$

The second option for area specification as a function of elevation is given by Equation 5.5:

$$\text{Area(I)} = \text{ACOEF}(1) + \text{ACOEF}(2) * \text{Z(I)} + \text{ACOEF}(3) * [\text{Z(I)}]^2 \quad (5.5)$$

Where,

Area(I)= The area of the I^{th} layer

ACOEF(1), ACOEF(2), and ACOEF(3)= User specified constants; and

Z(I)= The elevation of the I^{th} layer as measured from the bottom of the lake.

A bathymetric map such as that shown in Figure 5-2 was used to determine which equation should be used to represent the area of Ashumet Pond, and then to give the values of each parameter. In order to find the area as a function of depth, a planimeter was used to trace out the areas inside each contour of constant depth. The areas were then scaled up to the scale of the map. Figure 5-1 is a graph of area as a function of elevation for Ashumet Pond.

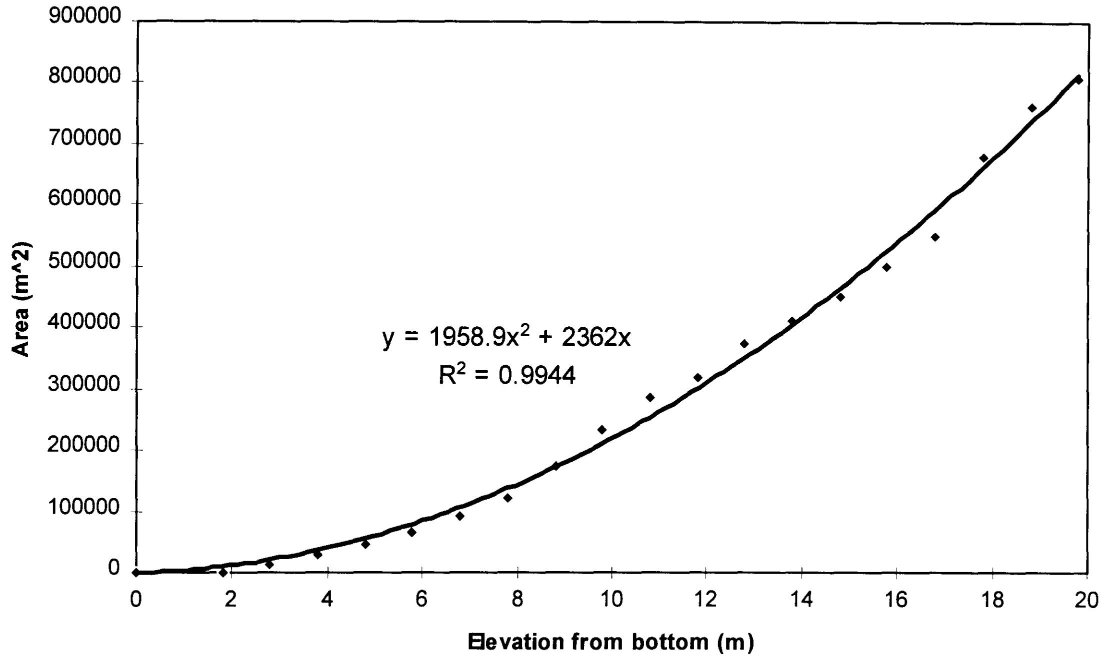

Figure 5-1. Area as a Function of Elevation for Ashumet Pond

As can be seen from this figure, a least-squares regression curve was fit to this data, giving area as a function of elevation in the form of Equation 5.5. Thus, from Equation 5.5, ACOEF(1)= 0, ACOEF(2)= 2362, and ACOEF(3)= 1958.9.

The next important piece of morphometric data that must be supplied to CE-THERM-R1 is pond width as a function of elevation. This specification must be made in the form of the following equation:

$$\text{Width} = [\text{WCOEF}(1) * \text{Elevation}]^{\text{WCOEF}(2)} \qquad (5.6)$$

Where,

Width= The width of the pond at a given elevation

WCOEF(1) and WCOEF(2)= User specified constants; and

Elevation= Elevation above the bottom of the pond.

From a cross-section of the center of Ashumet Pond (see E.C. Jordan Co., 1988), width was determined as a function of elevation as given in Figure 5-3.

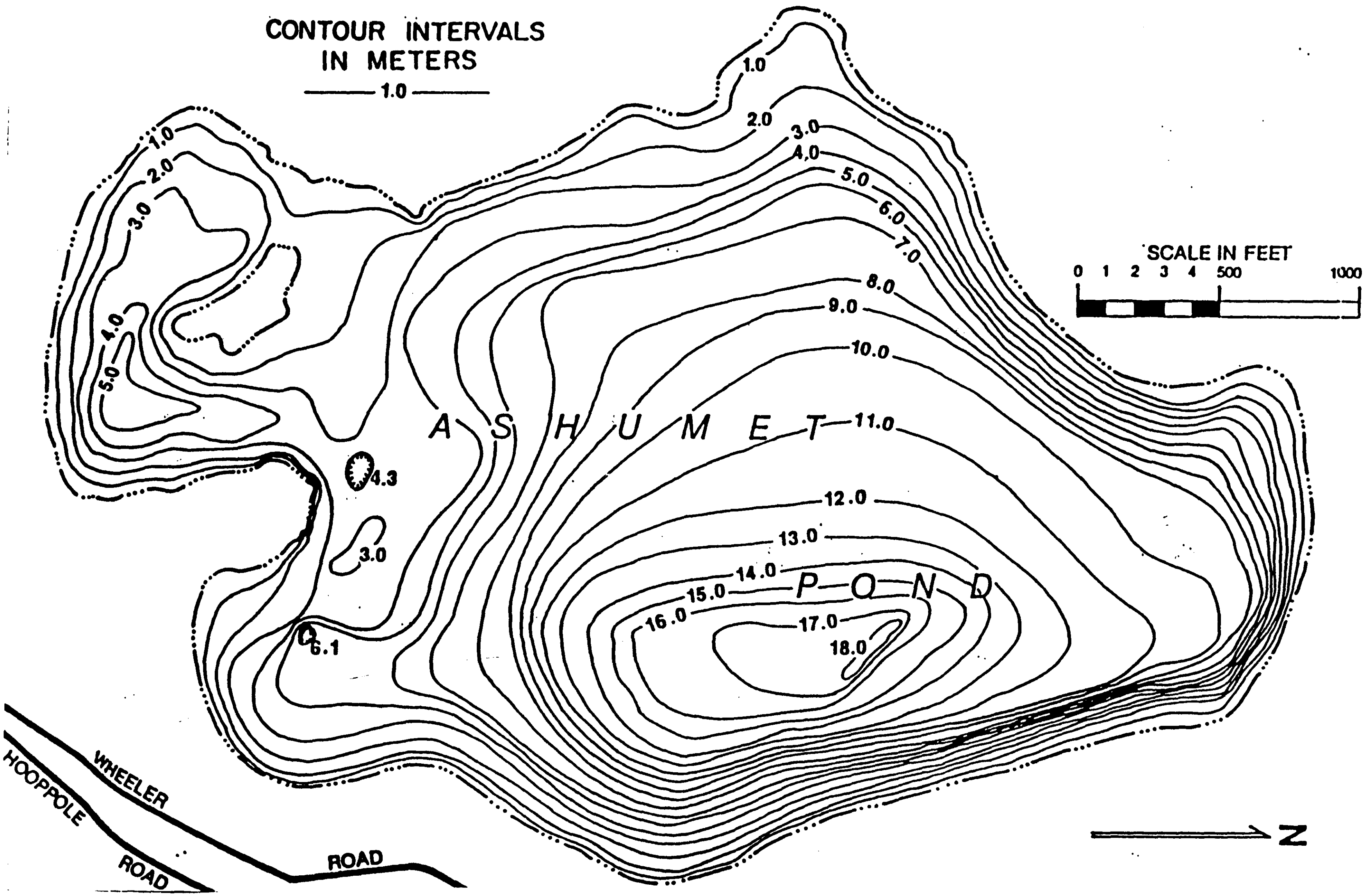

Figure 5-2. Bathymetric Map of Ashumet Pond (K-V Associates, 1991)

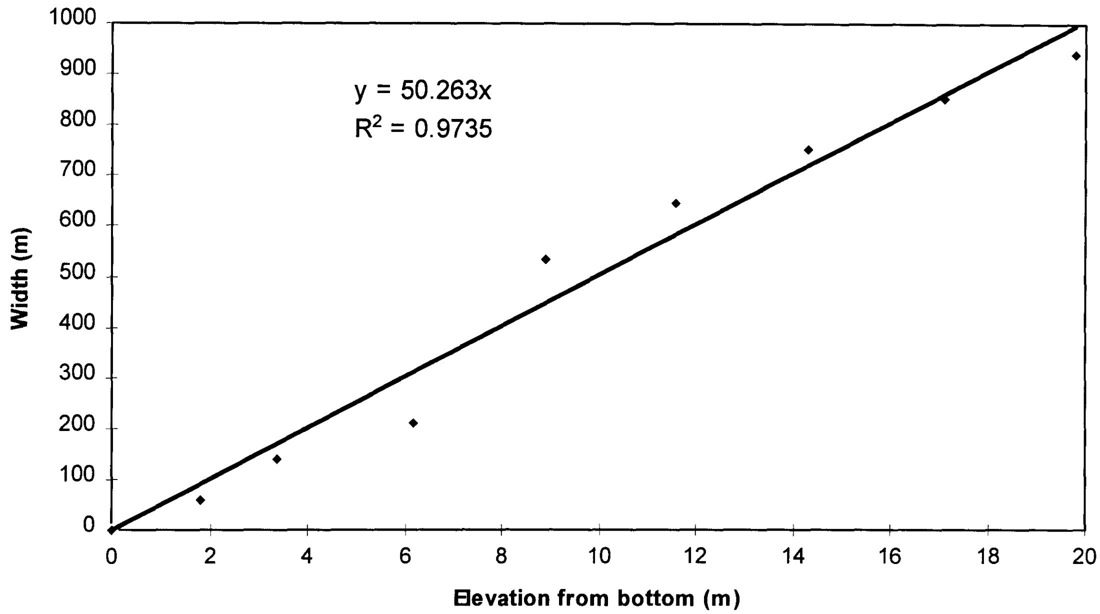

Figure 5-3. Width as a Function of Elevation for Ashumet Pond

The best fit to the data given in Figure 5-3 was determined to be a straight line. Thus, from equation 5.6, WCOEF(1)= 50.263 and WCOEF(2)=1.

A third parameter necessary for representation of pond morphometry is the pond length. For modeling purposes, the pond length was taken as being the distance from north to south, which is approximately in the direction of flow. In this direction, the pond length is 1356 m.

The final important morphometric parameter to be input to Ashumet Pond was the initial number of layers. It is suggested in the CE-QUAL-R1 manual (Army Corps of Engineers, 1986) that a 1 m average layer thickness be used. Thus, because Ashumet Pond is 19.8 m deep at its deepest point, 19 layers of initial thickness 1 m, and a 20th layer of an average thickness of 0.8 m were used. As Ashumet Pond experiences fluctuations in water level, the number of layers used to represent the pond will be varied by the model.

The modeling of both the inflow and outflow of Ashumet Pond are discussed in Section 5.3. Because Ashumet Pond is almost completely groundwater fed (it has a small, intermittent surface inflow from an abandoned cranberry bog), the pond was modeled as having one inflow tributary. Because precipitation is a significant fraction of the total inflow to Ashumet Pond, it is accounted for in the total inflow rate. Additionally, the rate of groundwater inflow was modeled as being constant throughout the year (a good assumption for a groundwater fed pond). As discussed in Section 5.3, this representation of Ashumet Pond is a good approximation to reality. Accounting for all sources, the net inflow to Ashumet Pond is given as 4.18×10^6 m^3/year, or 0.133 m^3/s.

As discussed in Section 5.3, eight outflow ports (the maximum allowed by CE-THERM-R1), each with a height of 2.48 m were used to approximate the groundwater outflow from Ashumet Pond. The total outflow from the pond was approximated as being 3.13×10^6 m^3/year. This outflow was assumed to be constant throughout the year and was assumed to occur evenly through all eight outflow ports. Thus, the outflow from each port was given as 0.0125 m^3/s.

Mixing parameters are an essential input to CE-THERM-R1 in that they relate to how materials and heat are transferred between layers. The first important mixing parameter is the sheltering coefficient. This coefficient is used to modify the turbulent kinetic energy (TKE) supplied by wind to the top layers of the lake. The necessary input to CE-THERM-R1 for this sheltering coefficient is the fraction of the total water surface area that is exposed to the wind. If there are abrupt changes in relief near the edge of the water (such as a cliff), or if there are many trees near the edge, portions of the surface will essentially be sheltered from wind. In the case of Ashumet Pond, the area surrounding the pond is relatively flat with very few trees in close proximity. Thus, the sheltering coefficient was taken to be unity. Additionally, through modeling of Ashumet Pond, it was discovered that, in this situation, CE-THERM-R1 is almost completely insensitive to this parameter within its reasonable bounds.

Another necessary input parameter for mixing is the penetrative convection fraction. This parameter is the fraction of TKE produced by natural convection that is available for entrainment and deepening of the upper mixed layer. It has been shown that the model is almost insensitive to this parameter in modeling of Ashumet Pond. Thus, 0.3, the value recommended by the CE-QUAL-R1 manual (Army Corps of Engineers, 1986) is used.

In order to determine the extent to which solar radiation affects the thermal structure of a water body, CE-QUAL-R1 requires a few crucial input parameters. The first of these parameters is the dust attenuation coefficient. This coefficient represents the degree to which solar radiation reaching the water body is mitigated through scattering and absorption by dust particles. The value of 0.06 recommended by the CE-QUAL-R1 manual was used because this parameter will generally not vary much except in extreme conditions of high dust or persistent haze (which are not an issue for Ashumet Pond).

Next, a wind speed function is used to calculate evaporative and convective heat fluxes that are affected by wind. These wind speed coefficients (called AA and BB) are utilized by CE-QUAL-R1 in the following equation for evaporative heat loss (U.S. Army Corps of Engineers, 1986):

$$Q_e = \rho L(a + bW)(e_s - e_a) \qquad (5.7)$$

Where,

Q_e= Evaporative heat loss [kcal/m^2-sec]

L= Latent heat of vaporization [kcal/kg]

ρ= Density of water (kg/m^3)

a= The wind speed coefficient AA [dimensionless]

b= The wind speed coefficient BB [dimensionless]

W= Wind speed [m/sec]

e_s= Saturated vapor pressure at the water surface temperature [mb]; and

e_a= Vapor pressure at the air temperature [mb].

The CE-QUAL-R1 manual references many different empirical values for the coefficients input to the wind speed function. However, CE- THERM-R1 was found to be quite sensitive to the values of these coefficients. Thus, these coefficients were adjusted until a suitable fit to available temperature profile data was found. The best data fit was obtained with the first coefficient (AA) equaling $1.00\text{x}10^{-9}$ and the second coefficient (BB) equaling $1.75\text{x}10^{-9}$.

One of the most crucial model inputs for determining the effect of solar radiation on a water body's thermal structure is the extinction coefficient. The extinction coefficient is used in the Beer-Lambert Law to determine the amount of solar radiation absorbed as a function of depth in the water body (Schwarzenbach et al., 1993). The Beer-Lambert Law is:

$$I = I_0 e^{-\varepsilon Z} \tag{5.8}$$

Where,

I= Solar radiation at the surface [einstein/L^2]

I_0= Solar radiation at a given depth [einstein/L^2]

ε= Extinction coefficient [L^{-1}], and

Z= Depth [L].

The extinction coefficient is extremely dependent on the clarity of a water body. Thus, the extinction coefficient can be directly related to the Secchi Disk depth by the empirical formula which was obtained from a regression analysis (Williams, 1980):

$$\varepsilon = 1.1\, Z_s^{-0.73} \tag{5.9}$$

Where,

ε= Extinction coefficient [L^{-1}]

Z_s= Secchi Disk depth [L].

The inputs to CE-THERM-R1 only require an initial extinction coefficient applicable to the beginning of the model run. As CE-THERM-R1 models Secchi Disk depth, the extinction coefficient is adjusted based upon Equation 5.9. From data collected on March 21, 1986 (E.C. Jordan Co., 1988), an initial extinction coefficient of 0.5 m^{-1} was used.

A final parameter affecting solar radiation absorption is the fraction of solar radiation that is absorbed in a 0.6 m surface layer. This parameter is obtained once the extinction coefficient is determined, based upon the following formula, obtained from regression analysis (Army Corps of Engineers, 1986):

$$\beta = 0.27 \ln(\varepsilon) + 0.61 \tag{5.10}$$

Where,

β= The fraction of solar radiation absorbed in a 0.6 m surface layer [dimensionless]

ln= The natural logarithm; and

ε= Extinction coefficient determined from Equation 5.9 [L^{-1}]

With the extinction coefficient given by Equation 5.9, a value of 0.42 was used for the fraction of solar radiation absorbed in a 0.6 m surface layer.

Because CE-THERM-R1 models the behavior of solids in a water body, both the suspended solids settling rate and initial solids concentrations (both in the pond and entering the pond) must be specified. Lane (1938) states that for particles of diameter 0.002 mm, a settling rate of 0.86 m/day is appropriate. Because particles in Ashumet Pond are thought to be in this size range, a value of 1 m/day was used for settling rate.

Using data obtained from Walter et al. (1995), a value of 146 mg/L was used for total dissolved solids (TDS) concentration in the groundwater that enters the pond. Based on data obtained from K-V Associates (1987b), initial pond concentrations for TDS were taken to be 42 mg/L near the surface and 49 mg/L near the bottom of the pond. Additionally, initial suspended solids concentrations were taken to be 1.9 mg/L near the surface and 5.0 mg/L near the bottom.

The final major input requirement for CE-THERM-R1 is meteorological data for the year to be modeled. Included among the necessary meteorological data is the fraction of cloud cover, dry bulb temperature, dew point temperature, barometric pressure, and wind speed. All of these data were input on a daily basis. The data used was "Summary of the Day- First Order" data obtained from the National Climatic Data Center World Wide Web page (http://www.ncdc.noaa.gov) for Logan Airport in Boston, Massachusetts.

5.4.3 Model Calibration

As it is quite important for CE-QUAL-R1 modeling to be able to accurately represent the hydrodynamics of Ashumet Pond, calibration of CE-THERM-R1 is the first step in the modeling process. CE-THERM-R1 can simply be calibrated by comparing temperature profiles predicted by the model to those taken in the field. In this calibration procedure, a number of different model parameters were adjusted until model-predicted temperature profiles were sufficiently similar to actual profiles. Data for 1993 was used to calibrate CE-THERM-R1 because the greatest number (four) of temperature profiles are available in that year for comparison (HAZWRAP, 1993). Because the model requires initial conditions, the first temperature profile was used to provide initial temperature conditions. Thus, model simulation was begun on the date that the first temperature profile was performed (April 15), leaving only three temperature profiles available for model calibration. Figures 5-4a-c show model predicted temperatures as compared to measured temperature profiles for the three available temperature profiles performed in 1993.

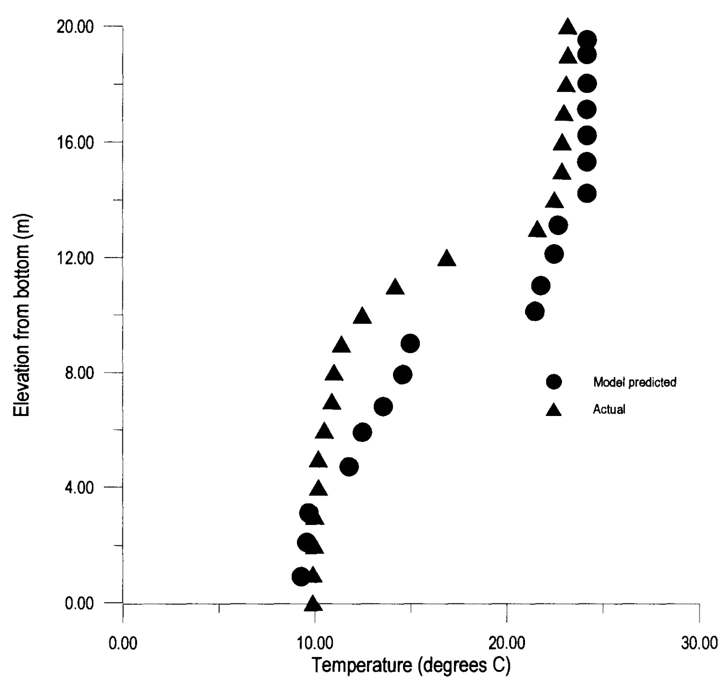

Figure 5-4a. Comparison of Temperature Profiles for June 29, 1993

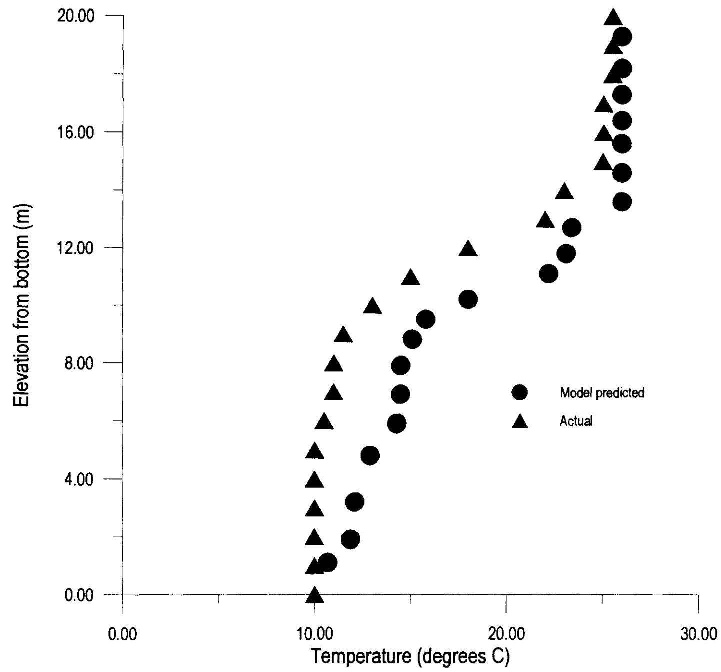

Figure 5-4b. Comparison of Temperature Profiles for August 3, 1993

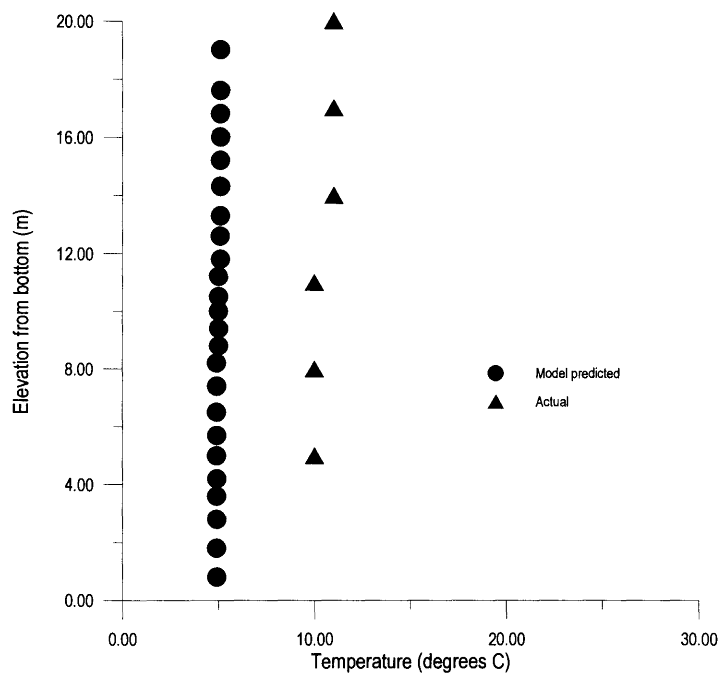

Figure 5.4c. Comparison of Temperature Profiles for December 5, 1993

Figure 5-4. Comparison of Actual and Model-Predicted Temperature Profiles

As can be seen in Figures 5-4a-c, CE-THERM-R1 gives a reasonably accurate prediction of Ashumet Pond temperature profiles. In general, the model predicts temperatures to be slightly higher than they were in reality for 1993. This is especially the case for the last profile which was performed in December. However, this is not a cause for concern because temperatures, and thus productivity, are quite low during the winter months. Thus, the crux of the model is to predict conditions during the summer when the productivity is the highest, causing the greatest concern for water quality. Furthermore, the model was also run using 1994 data. When compared to 1994 data, the model often gives temperature predictions that are lower than those that were measured. In addition, the meteorological data used is for Boston, which can be somewhat different from weather conditions on Cape Cod. This data difference might explain some of the difference in model predicted results and actual temperature profiles. Thus, for the reasons given above, it is apparent that the model is not giving results that are chronically skewed in one direction. An example output from CE-THERM-R1 is given in Appendix B.

5.5 CE-QUAL-R1 modeling

5.5.1 Introduction

As discussed in Section 5.1, CE-QUAL-R1 provides detailed modeling of aquatic organisms. For the purposes of this study, however, the focus of model predictions will be on algal species. A major feature of CE-QUAL-R1 is that it is a eutrophication model, and as such is able to predict algal populations under a variety of different conditions. Because the main goal of this project is to determine the effect of the STP plume on the future trophic state of Ashumet Pond, the model was run under a variety of different phosphorus loading conditions. Predictions of the effect of the STP plume on total Ashumet Pond phosphorus loading are shown in Section 4.4.7. Because many of these predictions differ significantly, the model was run under a variety of these different loading scenarios (see Table 4-3).

CE-QUAL-R1 models algal populations in a simplified manner. The model provides three compartments to represent phytoplankton instead of modeling each species (or even each algal group) individually. Despite this simplification, CE-QUAL-R1 can provide an understanding of potential eutrophication problems due to simulated algal biomass magnitudes and timing of algal blooms. The algal compartments are picked in such a manner as to represent the dominant species of the lake. In this way, the major species that will be affected by increased nutrient loads can be modeled quite well. For this reason the first and second compartments were chosen to represent blue-green algae and green algae, respectively. The third compartment for algae is reserved for a species that is silica limited. Thus, this compartment represents diatoms.

5.5.2 Analysis of results

For reasons discussed previously in Section 4.2, there is a significant seasonal variation in algal populations. Peak algal populations (as measured in terms of total amount of biomass) in the summer are often an order of magnitude higher than algal populations throughout the rest of the year. Figures 5-5a and 5-5b show this seasonal variation in algal populations at the top of the lake for the present best case phosphorus loading of 0.0167 g/m^3 determined by E.C. Jordan Co. (1988).

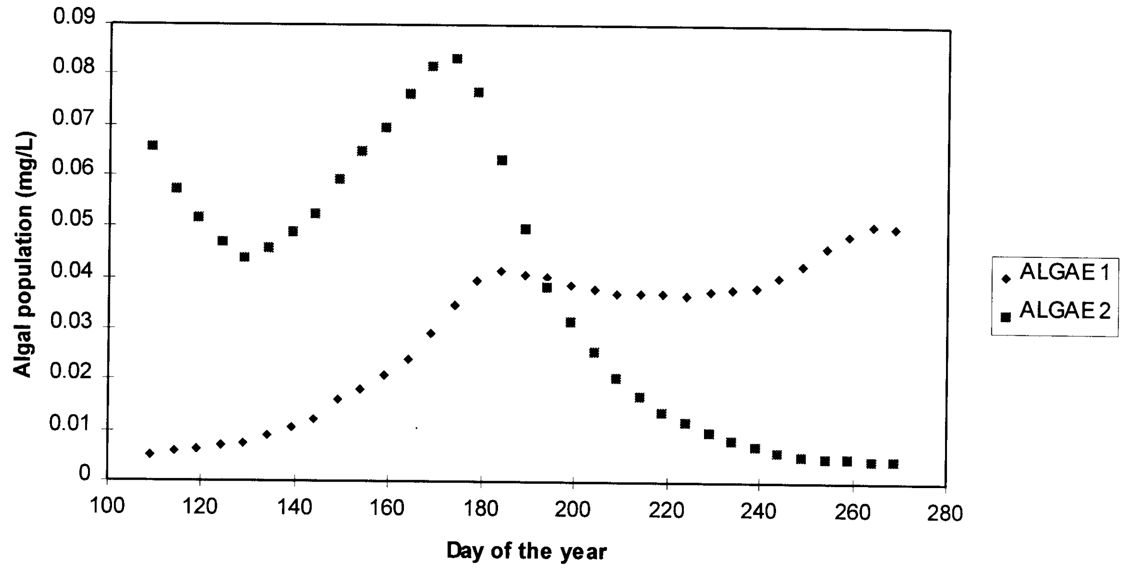

Figure 5-5a. Algal Compartments One and Two

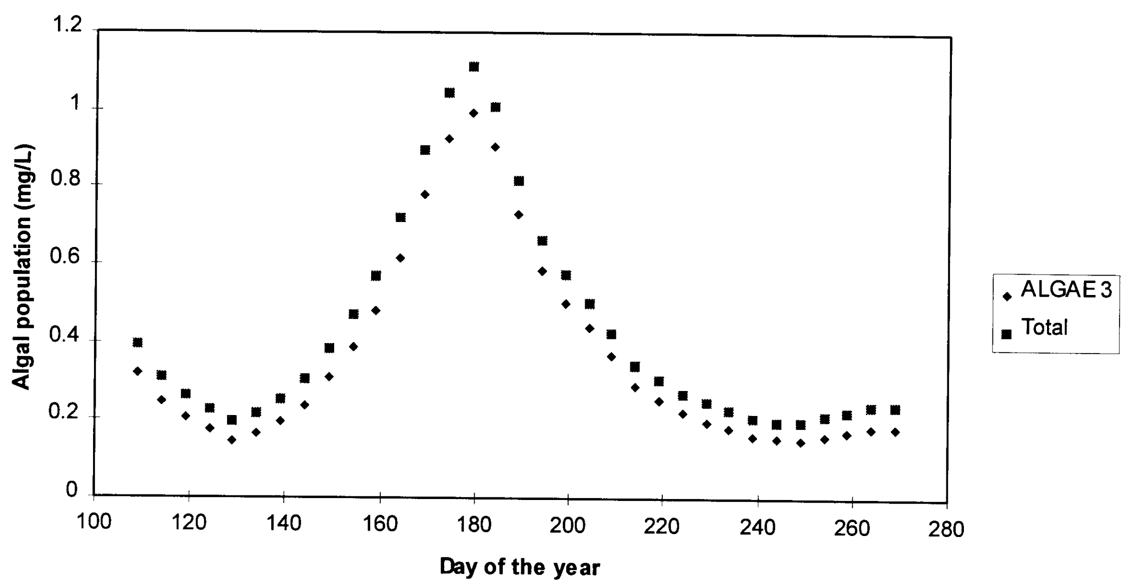

Figure 5-5b. Algal Compartment Three and Total Algal Population

Figure 5-5. Populations of Algal Compartments in the Top Layer of Ashumet Pond as a Function of Day of the Year

Figures 5-5a and 5-5b demonstrate that all algal species have seasonal variations in population. Although the timing of each species' population peak varies, all species tend to peak around the beginning of summer (May and June). Interestingly, algal compartment number one has another peak around day 260 (towards the end of August).

There is also a wide variation in algal populations throughout the depth of a lake. Because algae require sunlight to undergo photosynthesis, there are much greater algal populations in the top of a lake where sun can easily penetrate, compared to the bottom of a lake which is generally devoid of sunlight. As mentioned previously, the major concern for water quality is the peak algal concentrations that occur in the summer months. Furthermore, when analyzing the effect of various phosphorus loadings on a pond, it is only necessary to compare algal populations in the top layer of the pond. Although the other layers of the pond will also experience variations in algal populations with phosphorus loading, the effects upon the algae in the top layer should be representative of the overall change in species populations.

Because Ashumet Pond is currently phosphorus limited, it would be expected that any additional phosphorus load to the pond would result in increased productivity. Such a result is easily observed when analyzing the output from CE-QUAL-R1. Figure 5-6a shows the increase in maximum yearly populations (on a mass basis) of the first and second algal compartments (which roughly correspond to green and blue-green algae, respectively) with an increase in the phosphorus concentration of water entering Ashumet Pond. Figure 5-6b shows the same analysis for the third algal compartment (roughly corresponding to diatoms), as well as the total of all three algal compartments.

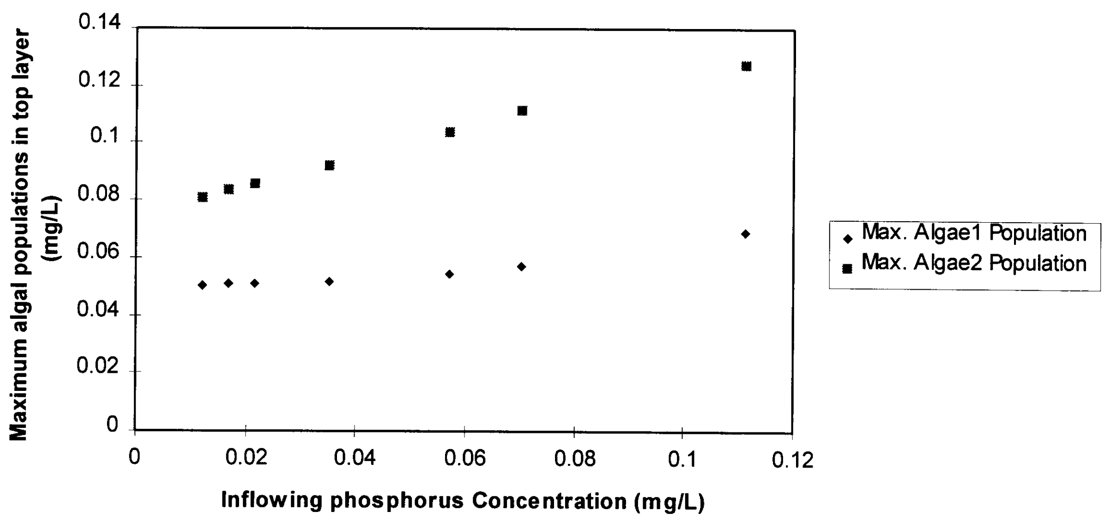

Figure 5-6a. Algal Compartments One and Two

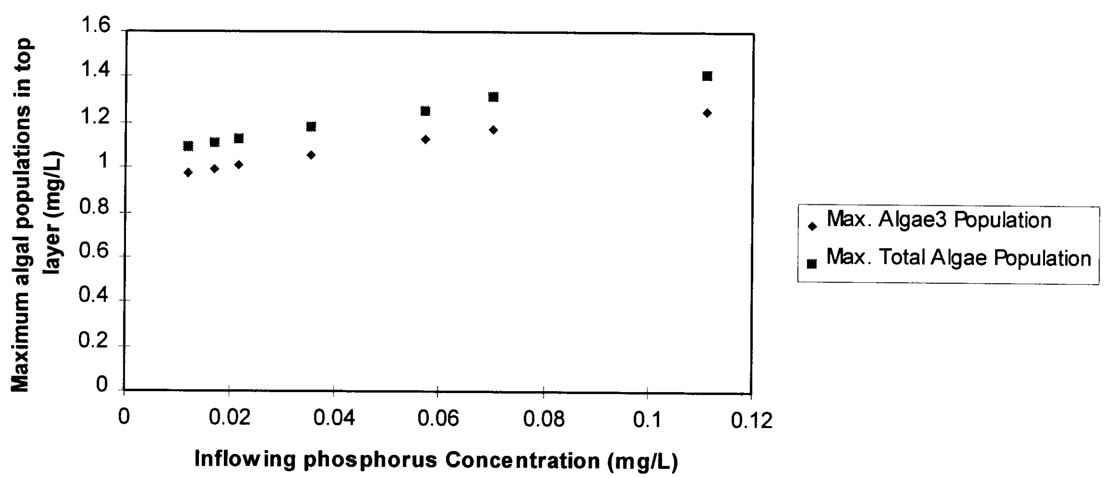

Figure 5-6b. Algal Compartment Three and Total Algal Population

Figure 5-6. Maximum Algal Populations in the Top Layer of Ashumet Pond as a Function of Inflowing Phosphorus Concentration

It is quite clear from Figures 5-6a and 5-6b that algal populations in Ashumet Pond will increase significantly with an increased loading of phosphorus (assumed to all be in the form of orthophosphate and thus available for algal uptake). In fact, there is almost a linear relationship between inflowing phosphorus concentrations and maximum yearly algal populations in the top layer of the pond.

In order to achieve the stated goal of comparing Ashumet Pond trophic state predictions given by steady-state models with the results of CE-QUAL-R1 modeling, it is necessary to be able to correlate algal biomass with trophic state. Unfortunately, there is no simple way of directly making this correlation. The main reason for this complexity is that different ponds will have different assimilative capacities for biomass. Furthermore, different algal species will have different effects upon the overall well-being of a pond.

However, chlorophyll-a can be used as an intermediary in the transition from algal biomass to trophic state. Because chlorophyll-a is produced by algae when they undergo photosynthesis in the growth process, chlorophyll-a concentrations in the water are a good indicator of biomass. Additionally, chlorophyll-a is largely responsible for the green color associated with a eutrophic lake. Thus, a high concentration of chlorophyll-a is usually a sign that a lake is becoming eutrophic. Because chlorophyll-a is such a good indicator of trophic state, and because of the relative ease with which it can be measured, chlorophyll-a is often used in trophic state studies. As discussed in Section 4.3.3, Carlson (1977) gave a direct quantitative relationship between chlorophyll-a concentrations and the trophic state of a water body as represented by the Trophic State Index, or TSI.

Ratios of biomass to chlorophyll-a concentrations vary seasonally and from water body to water body. However, there have been good, general relationships proposed to correlate these two water quality parameters. One of the simplest correlations was performed by Dolan et al. (1978). In this study, chlorophyll-a concentrations were compared to total phytoplankton biomass during on many different days in 1974 for Saginaw Bay, Michigan. The ratio of these two parameters was found to vary quite significantly with the season. The results of this study are shown in Table 5-1 for different days from April through December.

The next step in relating phytoplankton biomass to a corresponding trophic state is to convert biomass data as predicted by CE-QUAL-R1 to coinciding chlorophyll-a concentrations. For this purpose, the ratios of chlorophyll-a to biomass given in Table 5-1 have been linearly interpolated to provide ratios on a daily basis. Finally, using this daily ratio, chlorophyll-a data have been generated that correspond to biomass data given

Table 5-1. The Ratio of Chlorophyll-a Concentration (in μg/L) to Total Phytoplankton Biomass (in mg/L) (Adapted from Dolan et al., 1978)

Date	Sample Size	Mean	Standard Error
4/17	23	6.42	1.14
4/28	35	3.29	1.12
5/13	32	2.75	1.12
6/3	34	5.58	1.13
6/18	35	9.12	1.14
7/8	30	32.14	1.19
7/25	31	15.49	1.08
8/13	32	11.94	1.06
9/18	34	18.92	1.08
10/6	34	10.70	1.06
11/11	20	7.03	1.09
12/17	10	9.03	1.21

in model output. It is important to note that Carlson's Trophic State Index (see Section 4.3.3) only uses chlorophyll-a data obtained during the summer months. Thus, the only biomass data used in calculating chlorophyll-a concentrations is data for the summer months. The results of this conversion to chlorophyll-a concentrations is shown in Figure 5-7.

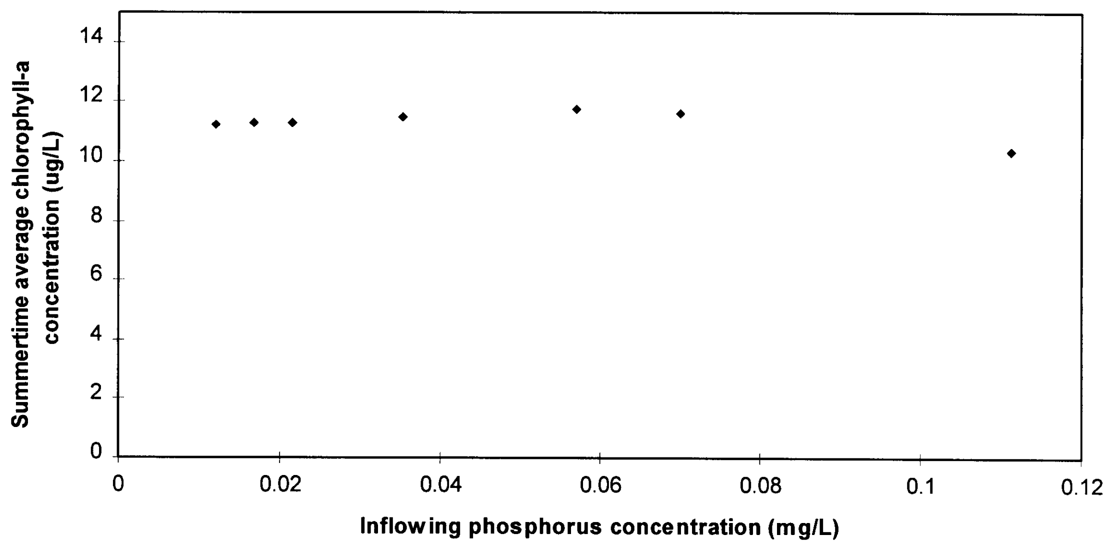

Figure 5-7. Chlorophyll-a concentrations as a function of inflowing phosphorus concentrations

As can be seen from Figure 5-7, there is not much variation in summer averaged chlorophyll-a concentrations with increasing phosphorus load. There is however an upward trend in chlorophyll-a as would be expected. The reason that there is actually a decrease in chlorophyll-a concentration at the highest phosphorus loading has to do with the timing of the peak algal populations at this loading. With such a high loading, algal populations peak at an earlier date (around mid-June) than do algal populations under smaller phosphorus loadings. As can be seen from Table 5-1, there is a sharp increase in the ratio of chlorophyll-a concentration to biomass from mid-June through July. Thus, when algal populations peak around early July, chlorophyll-a concentrations associated with this peak will be much higher than chlorophyll-a concentrations associated with a peak in mid-June. Therefore, because algal populations peak around mid-June for the highest populations, the chlorophyll-a concentrations associated with this peak are smaller than those associated with lower phosphorus loadings which induce algal peaks at later dates.

Finally, the chlorophyll-a concentrations shown in Figure 5-8 can be related to Ashumet Pond trophic state using Carlson's Trophic State Index. Figure 5-8 shows Carlson's Trophic State Index values as a function of phosphorus influx to Ashumet Pond as predicted by CE-QUAL-R1.

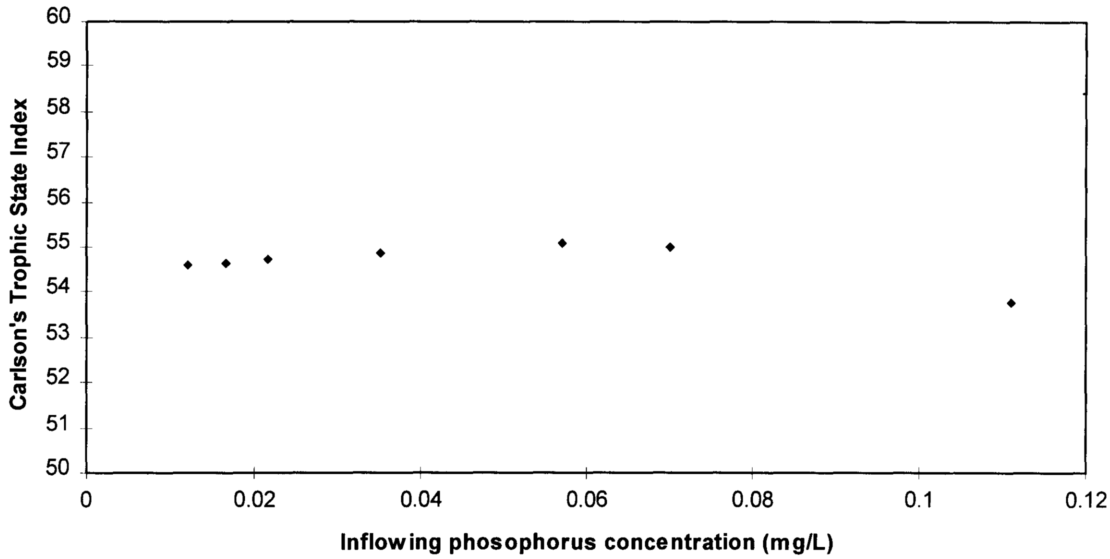

Figure 5-8. Carlson's Trophic State Index as a function of inflowing phosphorus concentration

As would be expected on the basis of the chlorophyll-a data, there is not much variation in TSI values with changes in phosphorus influx to Ashumet Pond.

5.5.3 Conclusions

As discussed previously, values of the TSI in the 50's roughly correspond to a mesotrophic pond. Although this result is consistent with steady-state estimates of Ashumet Pond trophic state under present loading conditions, it is significantly lower than the level of eutrophication predicted under heavy future loading scenarios by the steady-state models. There are many possible reasons for this discrepancy. The first reason could be simply that Ashumet Pond has a greater assimilative capacity than would be predicted on the basis of steady-state models alone. The next reason for this inconsistency could be that the ratios that were used to correlate biomass to chlorophyll-a are not accurate for Ashumet Pond. In fact, the data used (Dolan et al., 1978) are quite site specific and were only done for one particular year. Because these data were never replicated, their universality is very much in doubt. If such a correlation of chlorophyll-a to biomass could be obtained specifically for Ashumet Pond, then the conversion from biomass to chlorophyll-a could be made with much more confidence. However, when biomass and chlorophyll-a data collected from Ashumet Pond (HAZWRAP, 1995a; HAZWRAP, 1995b; HAZWRAP, 1995c; CDM Federal Programs Corporation, 1995a; CDM Federal Programs Corporation, 1995b) were analyzed for such a correlation, none was apparent. This lack of correlation with site-specific data casts even more doubt upon the validity of a conversion from biomass to chlorophyll-a for Ashumet Pond.

A further explanation for this inconsistency could be that Ashumet Pond is indeed not phosphorus limited during some portions of the year, as suggested by previously obtained data (see Section 4.1). In fact, with heavy phosphorus loading from the STP plume, ratios of N:P in the pond will steadily decline. Thus, if N:P ratios drop low enough (i.e., phosphorus concentrations in the pond become high enough), the pond could very well become nitrogen limited. In this case, increased phosphorus loading would have little or no impact upon the trophic state of the pond. This theory of nitrogen limitation could be tested by comparing total nitrogen to total phosphorus numbers predicted by CE-QUAL-R1. Yet, such a comparison of total nitrogen and total phosphorus predictions is not possible because CE-QUAL-R1 only gives predictions for biologically available phosphorus (e.g., orthophosphate) not for total phosphorus. CE-QUAL-R1 does, though, predict whether nitrogen, phosphorus, or light is limiting in each layer of the pond for each time period. Under all phosphorus loading conditions described in Section 4.4, phosphorus is predicted to be limiting in the top layers, and light is predicted to be limiting in the lower layers. However, as discussed in Section 3.2.1, there is not a definite division between an N:P ratio that indicates phosphorus limitation, and that which indicates nitrogen limitation. If Ashumet Pond were indeed nitrogen limited in some layers, it would not be strongly nitrogen limited (i.e., the N:P ratio would be on the border of nitrogen and phosphorus limitation). Therefore, the nutrient limitation given by CE-QUAL-R1 might not be entirely accurate, as the ratio used by the model to determine the limiting nutrient might not strictly hold in this case.

All of these possible reasons may contribute to the discrepancy between steady-state model predictions and CE-QUAL-R1 predictions. However, in this case it is difficult to determine the cause of the problem because a rigorous calibration and verification of the CE-QUAL-R1 model was not attempted. In the course of calibration and verification it could be determined, on the basis of parameter adjustment, which type of model is most applicable to Ashumet Pond. Additionally, the model that is most capable (if any) of accurate predictions would be determined in the verification procedure by comparing model predicted data to newly obtained data. Nonetheless, such a calibration and verification procedure is out of the scope of this project, and would have required much additional time that was not available.

6. RECOMMENDATIONS

Because the CE-QUAL-R1 modeling study yields substantially different results than the steady-state modeling study, it is recommended that further study be undertaken before such drastic action as constructing a barrier wall is begun. A first step for such further study is to determine whether or not Ashumet Pond will remain phosphorus limited under heavy loadings from the STP plume, as discussed above. If it is determined that Ashumet Pond may indeed be nitrogen limited during some or all parts of the year, then it will be apparent that the steady-state models discussed in this paper are not applicable to Ashumet Pond. In this case, further detailed numerical modeling may in fact be warranted.

Regardless of the results of this first step, the second step for further study is the rigorous calibration and verification procedure discussed above. In the calibration step, another detailed eutrophication model such as the U.S. Army Corps of Engineers' (1978) Water Quality for River-Reservoir Systems (WQRRS) model should be used. By inputting parameters similar to those used in the CE-QUAL-R1 model, it can be determined whether the CE-QUAL-R1 model is yielding erroneous results. If results from the WQRRS modeling match the results from CE-QUAL-R1, then it can be stated with much confidence that the inconsistency in results between CE-QUAL-R1 and the steady-state models is not due to problems with CE-QUAL-R1.

However, such a result does not then mean that the steady-state models are giving accurate predictions. In order to make this determination, a verification procedure must be undertaken. In the verification procedure, steady-state model results are compared to newly collected data to determine whether the steady-state models can accurately predict future conditions. In order to determine if these models have predictive capabilities under high phosphorus loading conditions, one must wait until high loading conditions are experienced. Unfortunately, by the time these high loading conditions are seen, Ashumet Pond may already be quite eutrophic.

If the further study and data collection necessary for model calibration and verification are not possible (under budget constraints or the like), it is recommended that a "wait and see" approach be utilized. Because detailed numerical modeling has failed to show that the STP plume will have a detrimental effect upon Ashumet Pond, it is best not to assume that the pond will become eutrophic in the near future on the basis of steady-state predictions alone. Although steady-state predictions such as the Vollenweider equation have been demonstrated to be quite predictive in many instances, they are far from being applicable to all cases. It may very well be the case that such steady-state models (for any number of reasons discussed above) may not be applicable to the present and future condition of Ashumet Pond. The advantage of the "wait and see" approach is that if the steady-state models are proven to hold under increased phosphorus loading conditions, there will still be time to contain the plume before the zones of heaviest phosphorus loading reach Ashumet Pond. If, however, the steady-state models are predicting significantly more eutrophic conditions than the pond is experiencing, then steady-state models can be deemed inaccurate for this case. In this case, expensive containment options that would be recommended on the basis of steady-state predictions alone will not need to be exercised.

BIBLIOGRAPHY

Carlson, R.E., 1977. "A Trophic State Index for Lakes". Limnology and Oceanography. Vol. 22, No. 2, February, 1977. pp. 361-369.

CDM Federal Programs Corporation, 1995a. Ashumet and Johns Ponds Year 2 Revised Quarterly Report No. 2. Prepared for Hazardous Waste Remedial Actions Program, Oak Ridge, Tennessee. CDM Federal Programs Corporation, Oak Ridge, Tennessee. March, 1995.

CDM Federal Programs Corporation, 1995b. Ashumet and Johns Ponds Year 2 Quarterly Report No. 3. Prepared for Hazardous Waste Remedial Actions Program, Oak Ridge, Tennessee. CDM Federal Programs Corporation, Oak Ridge, Tennessee. June, 1995.

CDM Federal Programs Corporation, 1996a. Ashumet and Johns Ponds 1994 Annual Report. Volume I, Text and Appendices. Prepared for Hazardous Waste Remedial Actions Program, Oak Ridge, Tennessee. CDM Federal Programs Corporation, Oak Ridge, Tennessee. August, 1996.

CDM Federal Programs Corporation, 1996b. Ashumet and Johns Ponds 1994 Annual Report. Volume II, Figures and Tables. Prepared for Hazardous Waste Remedial Actions Program, Oak Ridge, Tennessee. CDM Federal Programs Corporation, Oak Ridge, Tennessee. August, 1996.

Cherkauer, Douglas S. and John P. Zager, 1989. "Groundwater Interaction with a Kettle-Hole Lake: Relations of Observations to Digital Simulations." Journal of Hydrology. Vol. 109, pp. 167-184.

Commonwealth of Massachusetts, 1976. "Massachusetts Surface Water Quality Standards". Code of Massachusetts Regulations, Title 314.

Dillon P.J., 1974. The Prediction of Phosphorus and Chlorophyll Concentrations in Lakes. Ph.D. Thesis. University of Toronto, Toronto, Canada. 330 pages.

Dolan, David M., Victor J. Bierman, Jr., Merlin H. Dipert, and Raymond D. Geist, 1978. "Statistical Analysis of the Spatial and Temporal Variability of the Ratio of Chlorophyll-a to Phytoplankton Cell Volume in Saginaw Bay, Lake Huron." Journal of Great Lakes Research, Volume 4, Number 1, March 1978. pp. 75-83.

E.C. Jordan Co., 1988. Installation Restoration Program, Ashumet Pond Trophic State and Eutrophication Control Assessment, Final Report: Task 1-4. Prepared for

Hazardous Waste Remedial Actions Program, Oak Ridge, Tennessee. E.C. Jordan Co., Portland, Maine. March, 1988.

EPA, 1983. Technical Guidance Manual for Performing Waste Load Allocations. Book IV, Lakes and Impoundments. Prepared for Office of Water Regulations and Standards, Monitoring and Data Support Division, Monitoring Branch, United States Environmental Protection Agency. Washington, D.C. August, 1983.

EPA, 1985. Rates, Constants, and Kinetics Formulations in Surface Water Quality Modeling (Second Edition). United States Environmental Protection Agency, Environmental Research Laboratory. Athens, GA. July, 1985.

HAZWRAP, 1993. Ashumet and Johns Ponds Study Quarterly Report No. 2. Hazardous Waste Remedial Actions Program, Oak Ridge, Tennessee. July, 1993.

HAZWRAP, 1995a. Ashumet and Johns Ponds 1993 Data Addendum. Hazardous Waste Remedial Actions Program, Oak Ridge, Tennessee. February, 1995.

HAZWRAP, 1995b. Ashumet and Johns Ponds 1993 Annual Report (Final). Volume I. Hazardous Waste Remedial Actions Program, Oak Ridge, Tennessee. June, 1995.

HAZWRAP, 1995c. Ashumet and Johns Ponds 1993 Annual Report (Final). Volume II. Hazardous Waste Remedial Actions Program, Oak Ridge, Tennessee. June, 1995.

Kirchner, W.B., and P.J. Dillon, 1975. "An Empirical Method for Estimating the Retention of Phosphorus in Lakes." Water Resources Research 11: pp. 182-183.

K-V Associates, Inc., 1986. Ashumet Pond: A Diagnostic/Feasibility Study; Third Quarterly Report. Prepared for Towns of Falmouth and Mashpee, Barnstable County, Massachusetts. K-V Associates, Inc., Falmouth, Massachusetts. May, 1986; revised October, 1986.

K-V Associates, Inc. and IEP, Inc., 1987a. Ashumet Pond, Falmouth and Mashpee, Massachusetts: A Diagnostic/Feasibility Study; Volume 1, Diagnostic. Prepared for Towns of Falmouth and Mashpee, Barnstable County, Massachusetts and The Commonwealth of Massachusetts Department of Environmental Quality Engineering, Division of Water Pollution Control, Clean Lakes Program. K-V Associates, Inc., Falmouth, Massachusetts and IEP, Inc., Sandwich, Massachusetts.

K-V Associates, Inc. and IEP, Inc., 1987b. Ashumet Pond, Falmouth and Mashpee, Massachusetts: A Diagnostic/Feasibility Study; Volume 2, Feasibility Study. Prepared for Towns of Falmouth and Mashpee, Barnstable County, Massachusetts and The Commonwealth of Massachusetts Department of Environmental Quality Engineering, Division of Water Pollution Control, Clean Lakes Program. K-V

Associates, Inc., Falmouth, Massachusetts and IEP, Inc., Sandwich, Massachusetts.

K-V Associates, Inc., 1991. Ashumet Pond: A Diagnostic/Feasibility Study, Volume 1, Diagnostic. Prepared for Towns of Falmouth and Mashpee, Massachusetts and Massachusetts Clean Lakes Program. K-V Associates, Inc., Falmouth, Massachusetts and IEP Inc., Sandwich, Massachusetts. January, 1991.

Lane, E.W., 1938. "Notes on the Formation of Sand." Transactions of the American Geophysical Union, Vol. 18, pp. 505-508.

Larson, D.P. and M.T. Mercier, 1976. Phosphorus Retention Capacity of Lakes. Joint Fisheries Board of Canada, 33: 1742-1750.

LeBlanc, D.R., 1984a. Sewage Plume in a Sand and Gravel Aquifer, Cape Cod, Massachusetts. Water Supply Paper 2218. U.S. Geological Survey, Denver, Colorado.

LeBlanc, D.R., 1984b. "Digital Modeling of Solute Transport in a Plume of Sewage-Contaminated Groundwater". In: D.R. LeBlanc, editor. Movement and Fate of Solutes in a Plume of Sewage-Contaminated Groundwater, Cape Cod, Massachusetts. U.S. Geological Survey Toxic Waste Groundwater Contamination Program. Papers presented at the Toxic Waste Technical Meeting, Tucson, Arizona, March 20-22, 1984. Open-File Report 84-475. U.S. Geological Survey, Boston, Massachusetts.

McBride, M.S. and H.O. Pfannkuch, 1975. "The Distribution of Seepage within Lake Beds." U.S. Geological Survey Journal of Research. Volume 3, Number 5, September-October, 1975. pp. 505-512.

National Climatic Data Center World Wide Web page: http://www.ncdc.noaa.gov.

Schwarzenbach, Rene P., Philip M. Gschwend, and Dieter M. Imboden. Environmental Organic Chemistry. New York: John Wiley & Sons, 1993.

Shanahan, P., 1996. Effect of the MMR Sewage Plume on the Present and Potential Future Health of Ashumet Pond. Prepared for Ashumet-Johns Pond TAG Coalition Committee, Falmouth and Mashpee, Massachusetts. HydroAnalysis, Inc., Acton, Massachusetts. November 1993; revised February, 1996.

Stefan, H. et al., 1988. "Surface Water Quality Models: Modeler's Perspective (Draft)." Presented at the International Symposium on Water Quality Modeling of Agricultural Non-Point Sources, Utah State University, Logan, Utah. June 19-23, 1988.

Town of Falmouth, 1986. Bylaws Applicable to Eutrophication. Section 5342, Analysis of Development Impact.

U.S. Army Corps of Engineers, 1978. Water Quality for River-Reservoir Systems Computer Program Description. Prepared by Donald J. Smith, Resource Management Associates, Inc., Lafayette, California. October, 1978.

U.S. Army Corps of Engineers, 1986. CE-QUAL-RI: A Numerical One-Dimensional Model of Reservoir Water Quality, User's Manual. Prepared for Department of the Army, U.S. Army Corps of Engineers. Environmental Laboratory, Department of the Army, Waterways Experiment Station, U.S. Army Corps of Engineers. July, 1986.

Vollenweider, R.A., 1966. "Advances in Defining Critical Loading Levels for Phosphorus in Lake Eutrophication". Mem. 1st. Ital. Idrobiol. 33: pp. 53-83.

Walter, D.A., B.A. Rea, K.G. Stollenwerk, and J. Savoie, 1995. Geochemical and Hydrologic Controls on Phosphorus Transport in a Sewage-Contaminated Sand and Gravel Aquifer Near Ashumet Pond, Cape Cod, Massachusetts. Water-Resources Investigations Report 95-381. U.S. Geological Survey, Marlborough, Massachusetts.

Wetzel, R.G., 1983. Limnology. W.B. Saunders Company, Philadelphia.

Williams, D.T. 1980. "Determination of Light Extinction Coefficients in Lakes and Reservoirs." Surface Water Impoundments, Proceedings of the Symposium on Surface Water Impoundments. H.G. Stefan, ed., American Society of Civil Engineers.

Appendix A. Example CE-THERM-R1 Data Set

```
TITLE               1993 ASHUMET POND
TITLE                TRIAL DATA SET
TITLE
TITLE         LAST UPDATED: FEBRUARY 25, 1997
TITLE
JOB            1     365       6     720     105      93
MODE      NORMAL    PORT SPECIFY     YES
PHYS1          1      20    41.6    70.5    0.06 1.00-09 1.75-09   24.34
PHYS2       1356     0.4     1.6
PHYS2+ 1     1.0     1.0     1.0     1.0     1.0     1.0     1.0     1.0     1.0
PHYS2+ 2     1.0     1.0     1.0     1.0     1.0     1.0     1.0     1.0     1.0
PHYS2+ 3     1.0     0.8
OUTLET         8
PHYS3      18.56    2.48   991.0
PHYS3      16.08    2.48   991.0
PHYS3      13.60    2.48   991.0
PHYS3      11.12    2.48   991.0
PHYS3       8.64    2.48   991.0
PHYS3       6.16    2.48   991.0
PHYS3       3.68    2.48   991.0
PHYS3       1.20    2.48   991.0
CURVE       POLY
AREAC        0.0  2362.0  1958.7
WIDTHC    50.263     1.0
MIXING       1.0    0.30  1.0-05  1.0-06    0.01
LIGHT        0.5     0.4    0.01
SSETL        1.0
INIT0          2
INIT2        0.9     6.2    49.0     5.0
INIT2       19.0     8.1    42.0     1.9
FILES    TRIAL1  TRIAL2  TRIAL3  TRIAL4
FILID    ASHUMET POND 1993 TRIAL DATA SET
WEATH1        24     366
W2 1993        1    0.19     1.9    -8.4  1015.1    28.5
W2 1993        2    0.00    -3.6   -14.9  1030.5    20.3
W2 1993        3    0.74    -1.4    -9.0  1035.8    15.9
W2 1993        4    0.36    11.1     6.8  1020.5    28.0
W2 1993        5    0.93    10.0     8.3  1010.0    28.5
W2 1993        6    1.00     2.5    -3.4  1022.9    13.2
W2 1993        7    0.32     3.9    -3.8  1021.9    13.5
W2 1993        8    1.00     3.9    -3.2  1018.5    15.5
W2 1993        9    1.00    -2.2   -10.3  1031.0    22.1
W2 1993       10    0.70    -7.5   -13.3  1037.8    18.0
W2 1993       11    0.99    -3.6    -8.8  1033.7     9.3
W2 1993       12    0.96     0.6    -2.6  1028.3     7.7
W2 1993       13    1.00    -1.7    -0.7  1016.5    23.5
W2 1993       14    0.66    -5.3    -8.7  1021.2    16.9
W2 1993       15    0.97    -1.9    -4.1  1021.2    10.3
W2 1993       16    0.30     1.1    -6.2  1015.1    10.0
W2 1993       17    0.91    -0.6    -5.4  1005.3    14.8
W2 1993       18    0.01    -2.8   -15.1  1020.9    23.3
W2 1993       19    0.01    -5.8   -17.4  1032.7    16.1
W2 1993       20    0.03    -0.8    -9.2  1029.7    16.3
W2 1993       21    0.41     0.6    -3.9  1033.4    11.1
W2 1993       22    1.00     5.6     4.0  1015.5    11.6
W2 1993       23    0.42     7.8     1.8  1012.1    18.2
W2 1993       24    0.13     6.4     2.9  1011.7    17.1
W2 1993       25    0.00     5.8    -9.1  1016.8    28.3
W2 1993       26    0.00    -1.9   -11.6  1028.3    11.3
W2 1993       27    0.92     0.3    -5.1  1011.7    13.7
W2 1993       28    0.09     0.3   -13.9  1013.1    15.8
W2 1993       29    0.39    -0.6   -10.6  1010.0    30.4
W2 1993       30    0.09    -6.4   -19.9  1014.4    29.6
W2 1993       31    0.94    -8.3   -13.3  1001.6    15.3
W2 1993       32    0.34    -9.4   -15.3  1003.1    28.7
W2 1993       33    0.05    -8.1   -18.1  1020.2    25.6
W2 1993       34    0.21    -1.7   -10.5  1013.8    17.4
W2 1993       35    0.00    -0.6   -12.6  1014.8    29.3
W2 1993       36    0.12     2.8   -10.3  1013.4    25.8
W2 1993       37    0.57    -6.9   -19.8  1024.6    19.0
W2 1993       38    0.32   -10.0   -18.0  1026.0    13.4
W2 1993       39    0.25     0.0    -8.4  1016.0    25.3
W2 1993       40    0.01    -7.2   -15.8  1029.2    19.6
```

W2	1993	41	0.23	2.2	-2.8	1021.9	20.6
W2	1993	42	0.81	2.8	-7.7	1029.3	24.3
W2	1993	43	1.00	1.1	-3.1	1023.9	38.0
W2	1993	44	0.99	2.8	0.2	989.4	28.5
W2	1993	45	0.29	0.6	-7.6	1002.3	26.9
W2	1993	46	0.00	-0.3	-10.4	1023.8	17.5
W2	1993	47	1.00	4.7	-0.2	1019.9	19.8
W2	1993	48	0.34	3.1	-5.0	1006.5	29.3
W2	1993	49	0.33	-3.6	-11.9	1015.8	16.7
W2	1993	50	0.36	-5.6	-13.8	1017.2	24.2
W2	1993	51	0.00	-5.6	-16.5	1017.8	18.4
W2	1993	52	0.61	-4.4	-8.3	1020.2	21.1
W2	1993	53	1.00	-1.1	-3.9	1002.9	22.7
W2	1993	54	0.64	-1.9	-5.7	1004.6	16.6
W2	1993	55	0.00	-5.8	-15.7	1012.8	28.2
W2	1993	56	0.01	-8.6	-20.3	1026.3	26.9
W2	1993	57	0.13	-6.4	-17.1	1027.7	11.6
W2	1993	58	0.56	-5.8	-10.8	1026.0	24.2
W2	1993	59	0.37	-3.3	-15.6	1017.5	30.6
W2	1993	60	0.00	0.6	-15.2	1010.4	21.1
W2	1993	61	0.01	2.2	-7.5	1007.7	16.3
W2	1993	62	0.15	4.7	-4.0	1015.3	15.5
W2	1993	63	0.81	2.5	-2.3	1021.9	30.9
W2	1993	64	1.00	-0.6	-0.8	1011.1	44.0
W2	1993	65	0.23	0.0	-5.4	1006.3	21.1
W2	1993	66	0.00	3.9	-5.1	1010.0	20.3
W2	1993	67	0.30	4.7	-1.0	1005.6	11.8
W2	1993	68	0.94	5.0	1.5	1004.6	18.8
W2	1993	69	0.29	3.1	-2.8	1012.2	19.8
W2	1993	70	0.79	1.9	-3.4	1005.0	23.5
W2	1993	71	0.06	-2.2	-16.9	1021.2	22.5
W2	1993	72	1.00	-0.3	-5.2	1006.7	41.2
W2	1993	73	0.35	-1.1	-8.7	981.3	42.0
W2	1993	74	0.00	-6.7	-19.7	1027.0	25.4
W2	1993	75	0.05	0.6	-6.7	1033.7	33.0
W2	1993	76	0.91	3.9	3.1	1021.6	28.5
W2	1993	77	0.19	-5.0	-15.3	1029.3	27.9
W2	1993	78	0.06	-6.4	-14.2	1040.5	16.7
W2	1993	79	0.17	-0.6	-7.8	1033.4	16.7
W2	1993	80	0.93	2.8	-0.6	1026.0	18.2
W2	1993	81	0.24	5.8	-5.4	1027.0	21.4
W2	1993	82	0.27	2.5	-4.9	1031.7	16.6
W2	1993	83	1.00	1.4	0.4	1026.0	19.0
W2	1993	84	1.00	3.3	1.5	1023.9	15.9
W2	1993	85	0.07	8.6	4.1	1021.0	10.3
W2	1993	86	0.06	9.7	5.1	1019.9	10.5
W2	1993	87	1.00	8.6	7.4	1016.8	15.9
W2	1993	88	1.00	7.5	5.6	1008.0	20.8
W2	1993	89	1.00	7.2	6.1	1006.7	20.3
W2	1993	90	0.09	7.8	2.3	1014.4	16.7
W2	1993	91	1.00	4.2	2.3	1012.4	35.1
W2	1993	92	1.00	2.2	0.1	1008.4	22.9
W2	1993	93	0.95	4.2	-0.9	1011.9	16.4
W2	1993	94	0.96	3.9	-1.8	1018.2	18.5
W2	1993	95	0.00	6.1	-2.1	1023.2	15.1
W2	1993	96	0.03	4.4	-0.3	1025.6	18.4
W2	1993	97	0.00	5.6	-2.4	1024.9	13.0
W2	1993	98	0.04	7.2	-2.3	1021.2	14.2
W2	1993	99	0.78	7.5	5.1	1019.5	15.9
W2	1993	100	1.00	8.3	8.3	1008.0	21.1
W2	1993	101	1.00	10.8	9.7	1002.9	13.4
W2	1993	102	1.00	8.1	6.9	1003.9	21.1
W2	1993	103	1.00	9.2	5.6	1010.7	20.4
W2	1993	104	0.35	8.6	3.9	1015.1	15.5
W2	1993	105	1.00	8.1	5.3	1019.9	12.7
W2	1993	106	0.70	14.4	11.5	1016.1	28.3
W2	1993	107	0.70	14.4	10.8	1005.6	28.8
W2	1993	108	0.46	9.7	0.2	1010.7	21.7
W2	1993	109	0.09	13.6	1.6	1013.4	25.4
W2	1993	110	0.16	16.4	6.4	1015.1	25.4
W2	1993	111	0.38	16.4	10.4	1010.7	25.0
W2	1993	112	1.00	9.4	8.3	998.9	18.0
W2	1993	113	1.00	8.1	3.3	992.8	22.2

W2	1993	114	0.24	12.8	-1.7	1016.1	18.8
W2	1993	115	0.17	16.7	6.9	1016.8	25.9
W2	1993	116	0.91	11.9	8.9	1014.8	22.4
W2	1993	117	0.37	4.4	-1.1	1024.9	25.6
W2	1993	118	0.00	6.9	-3.3	1028.7	18.5
W2	1993	119	0.03	8.3	1.0	1022.7	15.9
W2	1993	120	0.62	9.7	5.8	1020.2	16.7
W2	1993	121	0.38	12.2	7.7	1019.9	12.2
W2	1993	122	0.00	15.3	5.7	1025.3	16.4
W2	1993	123	0.64	8.9	5.7	1032.7	20.1
W2	1993	124	0.52	12.8	8.9	1027.7	14.7
W2	1993	125	0.67	19.7	14.0	1020.2	21.6
W2	1993	126	0.45	21.7	12.1	1011.9	18.5
W2	1993	127	0.52	14.2	9.3	1018.8	19.2
W2	1993	128	0.02	15.6	8.8	1022.6	15.9
W2	1993	129	0.00	20.0	6.8	1019.2	16.1
W2	1993	130	0.53	11.4	7.3	1022.4	18.5
W2	1993	131	0.29	22.2	11.3	1006.7	21.7
W2	1993	132	0.68	15.6	10.8	1000.6	16.4
W2	1993	133	0.74	12.8	8.6	1002.3	13.7
W2	1993	134	0.21	12.2	4.6	1008.4	16.9
W2	1993	135	0.03	16.4	6.9	1008.7	18.8
W2	1993	136	0.46	18.9	9.7	1008.0	17.5
W2	1993	137	0.08	16.4	1.8	1011.4	16.9
W2	1993	138	0.55	12.8	6.5	1013.4	13.4
W2	1993	139	1.00	10.0	8.9	1006.8	16.1
W2	1993	140	1.00	10.3	9.0	1007.0	11.6
W2	1993	141	0.21	15.6	6.0	1007.3	14.3
W2	1993	142	0.42	14.7	6.9	1011.4	15.8
W2	1993	143	0.00	16.4	2.9	1012.8	19.6
W2	1993	144	0.50	18.1	9.6	1013.1	16.3
W2	1993	145	0.36	22.5	14.1	1010.7	22.4
W2	1993	146	0.25	18.1	7.3	1013.4	22.7
W2	1993	147	0.25	16.7	5.0	1013.8	24.8
W2	1993	148	0.40	17.2	7.1	1014.4	16.9
W2	1993	149	0.35	17.2	5.8	1009.0	27.2
W2	1993	150	0.03	17.5	2.1	1013.1	23.7
W2	1993	151	0.51	14.2	8.0	1012.4	18.7
W2	1993	152	0.59	16.9	8.7	1005.0	23.5
W2	1993	153	0.24	15.6	2.6	1009.4	22.1
W2	1993	154	0.18	18.6	4.2	1007.7	22.4
W2	1993	155	0.45	18.3	7.3	1009.4	14.0
W2	1993	156	0.48	15.6	8.8	1014.6	15.0
W2	1993	157	1.00	11.9	9.2	1011.4	24.0
W2	1993	158	0.17	17.8	8.0	1012.6	21.7
W2	1993	159	0.18	20.3	9.8	1014.1	19.6
W2	1993	160	0.75	18.3	15.7	1010.6	15.1
W2	1993	161	0.04	22.5	13.8	1005.6	26.7
W2	1993	162	0.36	21.4	13.1	1012.1	22.2
W2	1993	163	0.20	14.2	11.2	1023.2	15.8
W2	1993	164	0.16	21.1	11.6	1022.6	18.8
W2	1993	165	0.01	24.2	13.4	1018.2	18.8
W2	1993	166	0.05	22.2	12.9	1016.5	24.2
W2	1993	167	0.10	22.5	12.8	1018.5	19.2
W2	1993	168	0.00	19.7	12.1	1022.6	16.9
W2	1993	169	0.12	25.8	16.6	1018.3	19.6
W2	1993	170	0.49	23.9	18.2	1015.5	15.9
W2	1993	171	0.92	19.7	16.5	1020.9	11.3
W2	1993	172	0.62	22.8	18.7	1011.4	17.1
W2	1993	173	0.09	23.9	14.4	1002.3	28.0
W2	1993	174	0.06	21.4	3.9	1010.7	32.5
W2	1993	175	0.00	19.4	8.2	1022.2	18.4
W2	1993	176	0.00	23.1	12.2	1021.2	17.7
W2	1993	177	0.03	25.8	15.5	1014.4	27.7
W2	1993	178	0.58	23.9	18.1	1013.1	14.8
W2	1993	179	0.20	26.4	18.4	1009.4	16.9
W2	1993	180	0.14	23.6	14.6	1011.7	14.0
W2	1993	181	0.26	23.1	13.9	1014.1	12.7
W2	1993	182	0.00	18.6	12.1	1020.9	15.6
W2	1993	183	0.25	16.4	13.8	1021.2	15.6
W2	1993	184	0.89	18.3	16.8	1012.4	10.0
W2	1993	185	0.03	26.1	16.6	1011.7	17.4
W2	1993	186	0.00	21.9	13.6	1018.5	17.4

W2	1993	187	0.00	25.8	16.3	1016.8	23.3
W2	1993	188	0.27	30.0	21.2	1013.4	18.7
W2	1993	189	0.21	25.8	20.7	1013.3	14.7
W2	1993	190	0.02	28.3	20.8	1011.7	14.0
W2	1993	191	0.00	30.0	19.0	1009.7	20.3
W2	1993	192	0.00	28.9	13.9	1009.0	18.0
W2	1993	193	0.30	27.2	17.5	1006.3	16.9
W2	1993	194	0.01	27.8	11.0	1013.1	20.8
W2	1993	195	0.16	26.4	14.1	1016.0	17.5
W2	1993	196	0.12	26.1	13.3	1009.7	24.2
W2	1993	197	0.10	23.3	9.9	1009.0	22.5
W2	1993	198	0.03	21.4	10.1	1011.4	23.8
W2	1993	199	0.00	22.8	11.9	1017.5	20.3
W2	1993	200	0.57	22.2	14.5	1016.5	21.9
W2	1993	201	0.63	23.1	18.3	1009.4	13.7
W2	1993	202	0.22	25.0	13.4	1009.7	20.4
W2	1993	203	0.06	22.5	10.1	1010.4	24.8
W2	1993	204	0.37	22.5	12.3	1011.7	16.7
W2	1993	205	0.11	23.3	13.0	1016.5	16.6
W2	1993	206	0.03	19.7	13.8	1020.9	17.2
W2	1993	207	0.02	18.9	13.5	1020.5	17.7
W2	1993	208	0.94	18.9	16.9	1012.8	19.0
W2	1993	209	0.31	23.6	20.2	1010.0	13.0
W2	1993	210	0.53	23.9	20.6	1007.0	13.7
W2	1993	211	0.31	23.3	17.9	1006.3	15.1
W2	1993	212	0.03	23.3	17.4	1010.4	13.8
W2	1993	213	0.22	23.6	18.5	1011.4	15.5
W2	1993	214	0.25	25.6	19.3	1010.0	20.4
W2	1993	215	0.33	28.3	20.6	1013.4	14.5
W2	1993	216	0.32	25.0	19.9	1013.4	14.8
W2	1993	217	0.05	23.1	12.1	1014.4	20.3
W2	1993	218	0.24	20.6	12.3	1017.5	16.4
W2	1993	219	0.43	19.4	13.5	1018.2	12.9
W2	1993	220	0.34	20.6	14.1	1023.6	14.7
W2	1993	221	0.40	22.2	16.8	1026.0	15.9
W2	1993	222	0.00	22.2	15.2	1025.3	16.4
W2	1993	223	0.18	20.6	17.1	1023.1	14.7
W2	1993	224	0.27	20.0	16.2	1019.2	14.8
W2	1993	225	0.37	20.8	16.7	1015.8	13.8
W2	1993	226	0.19	22.8	17.8	1014.4	14.0
W2	1993	227	0.15	22.5	18.4	1015.8	14.8
W2	1993	228	0.44	21.4	18.2	1017.7	15.6
W2	1993	229	0.75	21.9	19.3	1015.8	13.8
W2	1993	230	0.54	21.1	18.6	1016.8	14.0
W2	1993	231	0.41	20.8	17.7	1017.2	13.4
W2	1993	232	0.51	23.3	19.2	1009.4	15.0
W2	1993	233	0.17	20.3	14.8	1011.2	16.1
W2	1993	234	0.07	17.5	11.8	1019.5	14.3
W2	1993	235	0.04	20.0	15.6	1017.8	15.0
W2	1993	236	0.26	23.9	18.7	1017.5	22.4
W2	1993	237	0.12	27.5	18.6	1016.5	20.1
W2	1993	238	0.00	28.6	18.2	1019.2	13.8
W2	1993	239	0.02	30.3	18.2	1015.1	18.5
W2	1993	240	0.24	30.0	20.6	1010.0	21.1
W2	1993	241	0.01	23.1	14.5	1016.1	15.6
W2	1993	242	0.00	22.8	15.1	1019.5	14.7
W2	1993	243	0.24	25.8	18.2	1015.5	22.2
W2	1993	244	0.74	23.6	18.1	1015.5	18.0
W2	1993	245	0.03	19.4	14.6	1020.9	15.5
W2	1993	246	0.50	26.7	21.2	1012.4	20.4
W2	1993	247	0.96	22.5	19.1	1009.7	13.4
W2	1993	248	0.14	20.6	17.2	1012.8	13.2
W2	1993	249	0.08	20.6	16.6	1016.5	13.0
W2	1993	250	0.41	19.2	16.0	1018.8	15.0
W2	1993	251	1.00	18.6	16.6	1016.8	10.9
W2	1993	252	0.69	19.7	17.6	1011.1	13.5
W2	1993	253	0.69	20.8	16.7	1003.1	20.9
W2	1993	254	0.05	17.2	6.5	1011.4	24.5
W2	1993	255	0.15	16.4	8.6	1023.9	17.2
W2	1993	256	0.00	22.2	14.2	1023.2	25.6
W2	1993	257	0.00	24.4	17.1	1020.2	27.0
W2	1993	258	0.02	26.7	19.5	1013.8	27.5
W2	1993	259	1.00	17.8	11.8	1024.6	21.9

W2	1993	260	1.00	14.4	13.6	1023.2	14.7
W2	1993	261	0.71	15.8	13.4	1016.1	10.5
W2	1993	262	0.11	15.3	5.1	1016.1	20.4
W2	1993	263	0.09	11.7	-1.1	1021.6	17.7
W2	1993	264	0.88	12.8	7.4	1020.5	9.7
W2	1993	265	0.98	15.0	12.3	1020.5	13.2
W2	1993	266	0.73	17.5	13.1	1014.1	16.4
W2	1993	267	0.00	15.8	5.2	1015.1	19.5
W2	1993	268	0.05	15.6	7.5	1018.5	16.6
W2	1993	269	1.00	17.2	15.2	1012.4	11.9
W2	1993	270	0.77	19.4	18.5	1007.7	16.6
W2	1993	271	0.08	16.7	8.8	1008.4	26.2
W2	1993	272	0.09	13.9	4.9	1016.5	18.4
W2	1993	273	0.12	9.2	3.1	1021.0	15.9
W2	1993	274	0.00	10.6	3.2	1024.6	16.7
W2	1993	275	0.25	16.9	11.6	1018.5	21.4
W2	1993	276	0.74	12.8	8.0	1012.4	15.3
W2	1993	277	0.01	15.0	6.4	1008.0	32.0
W2	1993	278	0.09	11.1	1.1	1020.0	22.1
W2	1993	279	0.00	11.7	2.8	1029.3	16.7
W2	1993	280	0.00	17.2	10.6	1020.9	25.9
W2	1993	281	0.18	18.3	13.1	1014.4	15.8
W2	1993	282	0.44	15.6	12.7	1004.6	17.4
W2	1993	283	0.21	8.9	-3.9	1016.1	24.8
W2	1993	284	0.00	4.7	-3.9	1026.3	16.4
W2	1993	285	1.00	8.3	6.7	1011.4	19.3
W2	1993	286	0.07	8.1	-1.2	1015.8	21.7
W2	1993	287	0.37	6.1	0.7	1027.0	11.1
W2	1993	288	1.00	10.0	9.0	1026.6	7.6
W2	1993	289	0.87	11.4	10.2	1024.1	9.5
W2	1993	290	1.00	11.7	12.2	1013.4	10.3
W2	1993	291	0.13	15.6	7.2	1009.4	22.1
W2	1993	292	0.00	11.4	2.7	1023.6	14.3
W2	1993	293	1.00	9.4	7.3	1028.3	13.5
W2	1993	294	0.98	15.0	12.4	1016.0	19.2
W2	1993	295	0.15	11.9	-0.2	1017.2	24.8
W2	1993	296	0.04	9.7	-2.3	1022.2	20.3
W2	1993	297	0.00	10.8	2.7	1018.2	23.7
W2	1993	298	0.01	13.6	4.4	1020.5	21.6
W2	1993	299	0.68	8.6	3.1	1028.3	20.8
W2	1993	300	1.00	9.7	8.6	1009.7	17.4
W2	1993	301	0.77	10.3	1.9	1002.9	17.2
W2	1993	302	0.14	10.0	3.6	1009.4	20.9
W2	1993	303	1.00	8.6	7.7	1008.7	20.6
W2	1993	304	1.00	6.4	5.2	1004.3	28.2
W2	1993	305	0.98	7.5	4.3	1000.6	28.5
W2	1993	306	0.08	5.8	-5.2	1024.6	21.9
W2	1993	307	0.82	6.7	1.4	1022.2	15.9
W2	1993	308	0.11	9.2	2.2	1017.8	16.4
W2	1993	309	0.95	11.7	10.3	1009.0	19.0
W2	1993	310	0.57	11.4	5.2	1002.3	22.1
W2	1993	311	0.48	4.4	-5.6	1016.3	20.9
W2	1993	312	0.00	4.4	-5.6	1029.7	17.4
W2	1993	313	0.63	5.6	-3.3	1027.5	14.2
W2	1993	314	0.09	7.2	-3.4	1024.3	13.2
W2	1993	315	0.03	6.9	-0.3	1021.7	19.5
W2	1993	316	0.48	8.3	1.4	1019.2	25.4
W2	1993	317	0.66	5.0	-0.1	1027.0	13.0
W2	1993	318	0.33	16.1	11.7	1014.1	20.8
W2	1993	319	0.31	19.2	11.4	1010.0	23.3
W2	1993	320	0.00	10.6	3.3	1026.0	16.1
W2	1993	321	0.76	8.9	6.6	1018.2	16.3
W2	1993	322	0.01	7.8	2.6	1020.2	20.3
W2	1993	323	0.82	6.9	4.8	1013.4	14.0
W2	1993	324	0.48	7.2	-0.8	1000.2	27.5
W2	1993	325	0.07	3.6	-6.3	1021.9	25.6
W2	1993	326	0.05	10.6	-1.1	1024.9	22.2
W2	1993	327	0.49	7.5	2.8	1027.3	16.6
W2	1993	328	0.90	6.7	2.7	1019.9	19.6
W2	1993	329	0.32	-3.9	-15.2	1034.8	20.1
W2	1993	330	0.04	1.7	-10.0	1033.4	11.8
W2	1993	331	0.72	5.6	1.0	1034.4	20.3
W2	1993	332	1.00	13.3	11.7	1010.7	35.9

```
W2 1993       333     0.03     8.1     -4.2  1016.1     18.4
W2 1993       334     0.16     2.8     -4.7  1031.0     21.6
W2 1993       335     0.02     0.0     -5.3  1042.9     15.1
W2 1993       336     0.80     1.9     -0.3  1033.7     10.9
W2 1993       337     0.52     8.3      3.1  1022.6     19.0
W2 1993       338     0.84     5.8      2.1  1018.2     13.0
W2 1993       339     1.00     6.9      6.2  1000.2     23.2
W2 1993       340     0.15     4.4      0.6  1009.0     20.4
W2 1993       341     0.32     7.2      0.7  1016.5     18.0
W2 1993       342     0.70     3.6     -1.4  1020.9     14.3
W2 1993       343     0.11     2.2     -2.9  1022.9     14.8
W2 1993       344     0.79     6.9      5.8  1012.4     20.0
W2 1993       345     1.00     4.2      5.3   993.5     23.5
W2 1993       346     0.29     0.3     -8.3  1003.9     30.8
W2 1993       347     0.89     1.7     -5.2  1012.4     32.4
W2 1993       348     1.00     3.9      3.8  1010.0     25.3
W2 1993       349     1.00     6.1      5.7  1005.6     24.2
W2 1993       350     0.87     2.5     -2.7  1012.8     37.2
W2 1993       351     0.00     1.9     -8.8  1023.8     17.4
W2 1993       352     0.63     1.7     -4.0  1018.8     15.8
W2 1993       353     1.00     2.5      1.6  1009.7     15.6
W2 1993       354     0.75     3.9      1.1  1017.5     14.5
W2 1993       355     1.00     8.1      5.7   995.1     36.7
W2 1993       356     0.00     3.1     -5.1  1000.2     35.3
W2 1993       357     0.99    -2.2     -9.5  1013.4     22.7
W2 1993       358     0.59    -4.2    -14.3  1018.8     14.8
W2 1993       359     1.00     0.8     -3.3  1003.3     12.1
W2 1993       360     0.40    -6.7    -18.0  1004.6     37.8
W2 1993       361     0.00   -10.8    -23.4  1026.3     24.3
W2 1993       362     0.36    -6.1    -17.4  1028.5     19.2
W2 1993       363     0.20    -9.2    -14.7  1020.5     14.8
W2 1993       364     0.37    -5.6    -11.1  1008.0     27.4
W2 1993       365     0.19    -5.3    -12.6  1021.7     23.5
W2 1993       366     0.37     1.4     -5.0  1021.2     21.3
SOUTL1         24      366
SOUTL2 ROG84  1          1  0.0125        2  0.0125        3  0.0125        4  0.0125
SOUTL2 ROG84  1          5  0.0125        6  0.0125        7  0.0125        8  0.0125
Q1  QIN        24       41
Q2 1        0.133    0.133    0.133    0.133    0.133    0.133    0.133    0.133    0.133
Q2 10       0.133    0.133    0.133    0.133    0.133    0.133    0.133    0.133    0.133
Q2 19       0.133    0.133    0.133    0.133    0.133    0.133    0.133    0.133    0.133
Q2 28       0.133    0.133    0.133    0.133    0.133    0.133    0.133    0.133    0.133
Q2 37       0.133    0.133    0.133    0.133    0.133    0.133    0.133    0.133    0.133
Q2 46       0.133    0.133    0.133    0.133    0.133    0.133    0.133    0.133    0.133
Q2 55       0.133    0.133    0.133    0.133    0.133    0.133    0.133    0.133    0.133
Q2 64       0.133    0.133    0.133    0.133    0.133    0.133    0.133    0.133    0.133
Q2 73       0.133    0.133    0.133    0.133    0.133    0.133    0.133    0.133    0.133
Q2 82       0.133    0.133    0.133    0.133    0.133    0.133    0.133    0.133    0.133
Q2 91       0.133    0.133    0.133    0.133    0.133    0.133    0.133    0.133    0.133
Q2 100      0.133    0.133    0.133    0.133    0.133    0.133    0.133    0.133    0.133
Q2 109      0.133    0.133    0.133    0.133    0.133    0.133    0.133    0.133    0.133
Q2 118      0.133    0.133    0.133    0.133    0.133    0.133    0.133    0.133    0.133
Q2 127      0.133    0.133    0.133    0.133    0.133    0.133    0.133    0.133    0.133
Q2 136      0.133    0.133    0.133    0.133    0.133    0.133    0.133    0.133    0.133
Q2 145      0.133    0.133    0.133    0.133    0.133    0.133    0.133    0.133    0.133
Q2 154      0.133    0.133    0.133    0.133    0.133    0.133    0.133    0.133    0.133
Q2 163      0.133    0.133    0.133    0.133    0.133    0.133    0.133    0.133    0.133
Q2 172      0.133    0.133    0.133    0.133    0.133    0.133    0.133    0.133    0.133
Q2 181      0.133    0.133    0.133    0.133    0.133    0.133    0.133    0.133    0.133
Q2 190      0.133    0.133    0.133    0.133    0.133    0.133    0.133    0.133    0.133
Q2 199      0.133    0.133    0.133    0.133    0.133    0.133    0.133    0.133    0.133
Q2 208      0.133    0.133    0.133    0.133    0.133    0.133    0.133    0.133    0.133
Q2 217      0.133    0.133    0.133    0.133    0.133    0.133    0.133    0.133    0.133
Q2 226      0.133    0.133    0.133    0.133    0.133    0.133    0.133    0.133    0.133
Q2 235      0.133    0.133    0.133    0.133    0.133    0.133    0.133    0.133    0.133
Q2 244      0.133    0.133    0.133    0.133    0.133    0.133    0.133    0.133    0.133
Q2 253      0.133    0.133    0.133    0.133    0.133    0.133    0.133    0.133    0.133
Q2 262      0.133    0.133    0.133    0.133    0.133    0.133    0.133    0.133    0.133
Q2 271      0.133    0.133    0.133    0.133    0.133    0.133    0.133    0.133    0.133
Q2 280      0.133    0.133    0.133    0.133    0.133    0.133    0.133    0.133    0.133
Q2 289      0.133    0.133    0.133    0.133    0.133    0.133    0.133    0.133    0.133
Q2 298      0.133    0.133    0.133    0.133    0.133    0.133    0.133    0.133    0.133
Q2 307      0.133    0.133    0.133    0.133    0.133    0.133    0.133    0.133    0.133
```

```
Q2 316     0.133    0.133    0.133    0.133    0.133    0.133    0.133    0.133    0.133
Q2 325     0.133    0.133    0.133    0.133    0.133    0.133    0.133    0.133    0.133
Q2 334     0.133    0.133    0.133    0.133    0.133    0.133    0.133    0.133    0.133
Q2 343     0.133    0.133    0.133    0.133    0.133    0.133    0.133    0.133    0.133
Q2 352     0.133    0.133    0.133    0.133    0.133    0.133    0.133    0.133    0.133
Q2 361     0.133    0.133    0.133    0.133    0.133    0.133    0.000    0.000    0.000
WQ TEMP      24       41
TEMP   1    14.4     14.4     14.4     14.4     14.4     14.4     14.4     14.4     14.4
TEMP  10    14.4     14.4     14.4     14.4     14.4     14.4     14.4     14.4     14.4
TEMP  19    14.4     14.4     14.4     14.4     14.4     14.4     14.4     14.4     14.4
TEMP  28    14.4     14.4     14.4     14.4     14.4     14.4     14.4     14.4     14.4
TEMP  37    14.4     14.4     14.4     14.4     14.4     14.4     14.4     14.4     14.4
TEMP  46    14.4     14.4     14.4     14.4     14.4     14.4     14.4     14.4     14.4
TEMP  55    14.4     14.4     14.4     14.4     14.4     14.4     14.4     14.4     14.4
TEMP  64    14.4     14.4     14.4     14.4     14.4     14.4     14.4     14.4     14.4
TEMP  73    14.4     14.4     14.4     14.4     14.4     14.4     14.4     14.4     14.4
TEMP  82    14.4     14.4     14.4     14.4     14.4     14.4     14.4     14.4     14.4
TEMP  91    14.4     14.4     14.4     14.4     14.4     14.4     14.4     14.4     14.4
TEMP 100    14.4     14.4     14.4     14.4     14.4     14.4     14.4     14.4     14.4
TEMP 109    14.4     14.4     14.4     14.4     14.4     14.4     14.4     14.4     14.4
TEMP 118    14.4     14.4     14.4     14.4     14.4     14.4     14.4     14.4     14.4
TEMP 127    14.4     14.4     14.4     14.4     14.4     14.4     14.4     14.4     14.4
TEMP 136    14.4     14.4     14.4     14.4     14.4     14.4     14.4     14.4     14.4
TEMP 145    14.4     14.4     14.4     14.4     14.4     14.4     14.4     14.4     14.4
TEMP 154    14.4     14.4     14.4     14.4     14.4     14.4     14.4     14.4     14.4
TEMP 163    14.4     14.4     14.4     14.4     14.4     14.4     14.4     14.4     14.4
TEMP 172    14.4     14.4     14.4     14.4     14.4     14.4     14.4     14.4     14.4
TEMP 181    14.4     14.4     14.4     14.4     14.4     14.4     14.4     14.4     14.4
TEMP 190    14.4     14.4     14.4     14.4     14.4     14.4     14.4     14.4     14.4
TEMP 199    14.4     14.4     14.4     14.4     14.4     14.4     14.4     14.4     14.4
TEMP 208    14.4     14.4     14.4     14.4     14.4     14.4     14.4     14.4     14.4
TEMP 217    14.4     14.4     14.4     14.4     14.4     14.4     14.4     14.4     14.4
TEMP 226    14.4     14.4     14.4     14.4     14.4     14.4     14.4     14.4     14.4
TEMP 235    14.4     14.4     14.4     14.4     14.4     14.4     14.4     14.4     14.4
TEMP 244    14.4     14.4     14.4     14.4     14.4     14.4     14.4     14.4     14.4
TEMP 253    14.4     14.4     14.4     14.4     14.4     14.4     14.4     14.4     14.4
TEMP 262    14.4     14.4     14.4     14.4     14.4     14.4     14.4     14.4     14.4
TEMP 271    14.4     14.4     14.4     14.4     14.4     14.4     14.4     14.4     14.4
TEMP 280    14.4     14.4     14.4     14.4     14.4     14.4     14.4     14.4     14.4
TEMP 289    14.4     14.4     14.4     14.4     14.4     14.4     14.4     14.4     14.4
TEMP 298    14.4     14.4     14.4     14.4     14.4     14.4     14.4     14.4     14.4
TEMP 307    14.4     14.4     14.4     14.4     14.4     14.4     14.4     14.4     14.4
TEMP 316    14.4     14.4     14.4     14.4     14.4     14.4     14.4     14.4     14.4
TEMP 325    14.4     14.4     14.4     14.4     14.4     14.4     14.4     14.4     14.4
TEMP 334    14.4     14.4     14.4     14.4     14.4     14.4     14.4     14.4     14.4
TEMP 343    14.4     14.4     14.4     14.4     14.4     14.4     14.4     14.4     14.4
TEMP 352    14.4     14.4     14.4     14.4     14.4     14.4     14.4     14.4     14.4
TEMP 361    14.4     14.4     14.4     14.4     14.4     14.4      0.0      0.0      0.0
WQ TDS     8760        1
TDS        46.0
WQ SSOL    8760        1
SSOL        2.0
VERIFY1     YES
VERIFY2       4
VERIFY3   105  17  0.0       8.1  1.0       8.0  2.0       8.0  3.0       8.0
VERIFY3        17  4.0       8.0  5.0       7.5  6.0       7.5  7.0       7.5
VERIFY3        17  8.0       7.5  9.0       7.5 10.0       7.2 11.0       7.2
VERIFY3        17 12.0       7.2 13.0       7.2 14.0       7.1 15.0       6.8
VERIFY3        17 16.0       6.2  0.0       0.0  0.0       0.0  0.0       0.0
VERIFY3   180  21  0.0      23.2  1.0      23.2  2.0      23.1  3.0      23.0
VERIFY3        21  4.0      22.9  5.0      22.9  6.0      22.5  7.0      21.6
VERIFY3        21  8.0      16.9  9.0      14.2 10.0      12.5 11.0      11.4
VERIFY3        21 12.0      11.0 13.0      10.9 14.0      10.5 15.0      10.2
VERIFY3        21 16.0      10.2 17.0      10.0 18.0      10.0 19.0       9.9
VERIFY3        21 20.0       9.9  0.0       0.0  0.0       0.0  0.0       0.0
VERIFY3   215  21  0.0      25.5  1.0      25.5  2.0      25.5  3.0      25.1
VERIFY3        21  4.0      25.1  5.0      25.0  6.0      23.0  7.0      22.0
VERIFY3        21  8.0      18.0  9.0      15.0 10.0      13.0 11.0      11.5
VERIFY3        21 12.0      11.0 13.0      11.0 14.0      10.5 15.0      10.0
VERIFY3        21 16.0      10.0 17.0      10.0 18.0      10.0 19.0      10.0
VERIFY3        21 20.0      10.0  0.0       0.0  0.0       0.0  0.0       0.0
VERIFY3   339   6  0.0      11.0  3.0      11.0  6.0      11.0  9.0      10.0
VERIFY3         6 12.0      10.0 15.0      10.0  0.0       0.0  0.0       0.0
```

Appendix B. Example CE-THERM-R1 Output

1

THIS IS 'CE-THERM-R1',THE THERMAL ANALYSIS PORTION OF 'CE-QUAL-R1'

CE-QUAL-R1 IS A RESEARCH TOOL FOR RESERVOIR ECOSYSTEM ANALYSIS USED BY THE WATER QUALITY MODELING GROUP, WATERWAYS EXPERIMENT STATION. NOTE THAT ORGANIZATIONAL AND PROCEDURAL CLARITY HAVE PRIORITY OVER COMPUTATIONAL EFFICIENCY
VAX VERSION. LAST UPDATE = JAN 27, 1986.

1993 ASHUMET POND
TRIAL DATA SET

LAST UPDATED: FEBRUARY 25, 1997

DATA SUMMARY:

START DAY
1
INITIALIZATION DAY 105 STOP DAY 365 COMP.INTERVAL,HRS 6 OUTPUT INTERVAL,HRS 720 NUMBER OF OUTLETS
8
NUMBER OF TRIBUTARIES 1 LATITUDE,DEG 41.60 LONGITUDE,DEG 70.50 TURBIDITY FACTOR 0.1 EMP.WIND COEF,AA0.10E-
08
EMP.WIND COEF,BB0.17E-08 MIN.LAYER THKNS,M 0.4 MAX.LAYER THKNS,M 1.6 INIT.POOL HGT,M 19.8 EFF.RES.LENGTH,M 135
6.
MIXING PARAMETERS....... 'PEFRAC' 0.30 'SHELCF' 1.00 'CDIFW' 0.10E-04 'CDIFF' 0.10E-
05
EXTINC.COEF,1/M 0.500 INFLO CRIT(KG/M3) 0.0100 SURFACE RAD.FRACT. 0.400 PUMPBACK COEF . 0.00
AREA COEFFICIENTS....... ACOEF(1) 0.000 ACOEF(2) 2362.000 ACOEF(3) 1958.700 EXTINS,1/M-MG/L 0.0
10
WIDTH COEFFICIENTS...... WCOEF(1) 50.263 WCOEF(2) 1.000 TSSETL,M/DAY 1.0

INITIAL GEOMETRIC ATTRIBUTES AND TEMPERATURE PROFILE:

LAYER NUMBER	LOWER SURFACE ELEVATION M	UPPER SURFACE ELEVATION M	LAYER THICKNESS M	LOWER SURFACE AREA M2	UPPER SURFACE AREA M2	LAYER VOLUME M3	TOTAL VOLUME UP TO LOWER SURFACE M3	LAYER WIDTH M	TEMPERATUR E DEG C
20	19.00	19.80	0.80	751969.	814656.	626483.	4904582.	975.10	0.00
19	18.00	19.00	1.00	677135.	751969.	714225.	4190357.	929.87	8.10
18	17.00	18.00	1.00	606218.	677135.	641350.	3549007.	879.60	7.99
17	16.00	17.00	1.00	539219.	606218.	572392.	2976614.	829.34	7.89
16	15.00	16.00	1.00	476138.	539219.	507352.	2469263.	779.08	7.78
15	14.00	15.00	1.00	416973.	476138.	446229.	2023034.	728.81	7.68
14	13.00	14.00	1.00	361726.	416973.	389023.	1634010.	678.55	7.57
13	12.00	13.00	1.00	310397.	361726.	335735.	1298275.	628.29	7.47
12	11.00	12.00	1.00	262985.	310397.	286364.	1011911.	578.02	7.36
11	10.00	11.00	1.00	219490.	262985.	240911.	771000.	527.76	7.26

10	9.00	10.00	1.00	179913.	219490.	199375.	571625.	477.50	7.15
9	8.00	9.00	1.00	144253.	179913.	161756.	409869.	427.24	7.04
8	7.00	8.00	1.00	112510.	144253.	128055.	281814.	376.97	6.94
7	6.00	7.00	1.00	84685.	112510.	98271.	183542.	326.71	6.83
6	5.00	6.00	1.00	60778.	84685.	72405.	111138.	276.45	6.73
5	4.00	5.00	1.00	40787.	60778.	50456.	60682.	226.18	6.62
4	3.00	4.00	1.00	24714.	40787.	32424.	28257.	175.92	6.52
3	2.00	3.00	1.00	12559.	24714.	18310.	9947.	125.66	6.41
2	1.00	2.00	1.00	4321.	12559.	8113.	1834.	75.39	6.31
1	0.00	1.00	1.00	1.	4321.	1833.	1.	25.13	6.20

OUTLET STRUCTURE

PORT NUMBER	ELEVATION,M	AREA,M2
1	18.6	2457.7
2	16.1	2457.7
3	13.6	2457.7
4	11.1	2457.7
5	8.6	2457.7
6	6.2	2457.7
7	3.7	2457.7
8	1.2	2457.7

	0 5 10 15 20 25 30 35	TEMP. DEG.C	TOT.DISS. SOLIDS G/M3	SUSPENDED SOLIDS G/M3	S/W RADIATION KC/M2/HR	LAYER INFLOW M3/SEC	LAYER OUTFLOW M3/SEC	DIFFUSION COEF. M2/HR	UPPER ELEVATION M
20*		0.0	0.0	0.0	0.00	0.00	0.00	0.0000	19.8
19	*	8.1	242.0	1.9	0.00	0.00	0.00	0.0000	19.0
18	*	8.0	242.4	2.1	0.00	0.00	0.00	0.0000	18.0
17	*	7.9	242.8	2.2	0.00	0.00	0.00	0.0000	17.0
16	*	7.8	243.2	2.4	0.00	0.00	0.00	0.0000	16.0
15	*	7.7	243.6	2.6	0.00	0.00	0.00	0.0000	15.0
14	*	7.6	243.9	2.8	0.00	0.00	0.00	0.0000	14.0
13	*	7.5	244.3	2.9	0.00	0.00	0.00	0.0000	13.0
12	*	7.4	244.7	3.1	0.00	0.00	0.00	0.0000	12.0
11	*	7.3	245.1	3.3	0.00	0.00	0.00	0.0000	11.0
10	*	7.1	245.5	3.4	0.00	0.00	0.00	0.0000	10.0
9	*	7.0	245.9	3.6	0.00	0.00	0.00	0.0000	9.0
8	*	6.9	246.3	3.8	0.00	0.00	0.00	0.0000	8.0
7	*	6.8	246.7	4.0	0.00	0.00	0.00	0.0000	7.0
6	*	6.7	247.1	4.1	0.00	0.00	0.00	0.0000	6.0
5	*	6.6	247.4	4.3	0.00	0.00	0.00	0.0000	5.0
4	*	6.5	247.8	4.5	0.00	0.00	0.00	0.0000	4.0
3	*	6.4	248.2	4.7	0.00	0.00	0.00	0.0000	3.0
2	*	6.3	248.6	4.8	0.00	0.00	0.00	0.0000	2.0

1 * 6.2 249.0 5.0 0.00 0.00 0.00 0.0000 1.0
1

DAILY INFORMATION

HOUR	DAY	SIM.INT.	ELEV M	INFLOW M3/S	TEMP C	OUTFLOW M3/S	TEMP C	IF REGULATION TARGET T. C.	PORT	FLOW M3/S	PORT	FLOW M3/S	PORT	FLOW M3/S	MORE?
2502	104	1	19.8	0.1	14.4	0.1	6.9		1	0.0	2	0.0	3	0.0	YES
2508	104	2	19.8	0.1	14.4	0.1	6.8		1	0.0	2	0.0	3	0.0	YES
2514	104	3	19.8	0.1	14.4	0.1	7.0		1	0.0	2	0.0	3	0.0	YES

1
STATUS AT END OF SIMULATION HOUR 2520 THIS IS JULIAN DAY 105, CALENDAR DAY 15APR
93

AVERAGE METEOROLOGICAL QUANTITIES FOR THIS COMPUTATION PERIOD:

CLOUD COVER 0.78 AIR PRESSURE,MB 1017.05 WIND SPEED,KPH 24.40 DRYBULB TEMP,DEGC, 12.8 DEWPOINT TEMP,DEGC, 10
.0
S/W RAD,KC/M2/HR 2.1 L/W RAD,KC/M2/HR 267.8 VAPOR PRESSURE,MB 12.8 SAT.VAP.PRES,MB 10.5 EVAP.RATE,M/HR 0.00
00
TOTAL EVAP., M. 0.
00
SURFACE ELEVATION,M: 19.8 EL.ABOVE MSL,M. 44.1

INFLOWING QUANTITIES FOR THIS COMPUTATION INTERVAL:

TRIBUTARY	INFLOW M3/SEC	TEMPERATURE DEG C	TOT.DISS.SOLIDS G/M3	SUSPENDED SOLIDS G/M3
1	0.13	14.4	32.8	1.4

OUTFLOWING QUANTITIES FOR THIS COMPUTATION INTERVAL:

PORT	LAYER	OUTFLOW,M3/SEC
1	19	0.01
2	17	0.01
3	14	0.01
4	12	0.01
5	9	0.01
6	7	0.01
7	4	0.01
8	2	0.01

TOTAL OUTFLOW,M3/SEC 0.10 TEMPERATURE,DEG C 7.1 TOT.DISS.SOLIDS,G/M3 229.9 SUSP.SOLIDS,G/M3 3.0

LAYER	0 5 10 15 20 25 30 35	TEMP. DEG.C	TOT.DISS. SOLIDS G/M3	SUSPENDED SOLIDS G/M3	S/W RADIATION KC/M2/HR	LAYER INFLOW M3/SEC	LAYER OUTFLOW M3/SEC	DIFFUSION COEF. M2/HR	UPPER ELEVATION M
20	D	7.7	206.9	1.6	1.11	0.13	0.00	1.3079	19.8
19	D	7.7	207.0	1.6	0.66	0.00	0.01	0.9780	19.0
18	D	7.6	207.1	1.6	0.39	0.00	0.01	0.7734	18.0
17	D	7.6	207.2	1.7	0.23	0.00	0.01	0.8013	17.0
16	D	7.6	207.4	1.7	0.14	0.00	0.00	0.6938	16.0
15	D	7.5	207.7	1.7	0.08	0.00	0.01	0.5226	15.0
14	*D	7.5	208.7	1.7	0.05	0.00	0.00	0.3155	14.0
13	*D	7.4	212.4	1.9	0.03	0.00	0.01	0.0967	13.0
12	*D	7.3	230.0	2.3	0.02	0.00	0.00	0.1097	12.0
11	*D	7.2	240.7	2.8	0.01	0.00	0.00	0.1044	11.0
10	D	7.2	244.3	3.2	0.01	0.00	0.00	0.0928	10.0
9	D	7.1	245.6	3.4	0.00	0.00	0.01	0.0820	9.0
8	D	7.0	246.2	3.6	0.00	0.00	0.01	0.0732	8.0
7	D	6.9	246.6	3.8	0.00	0.00	0.00	0.0658	7.0
6	D	6.7	247.0	4.0	0.00	0.00	0.01	0.0597	6.0
5	D	6.6	247.4	4.2	0.00	0.00	0.00	0.0548	5.0
4	D*	6.5	247.8	4.4	0.00	0.00	0.00	0.0503	4.0
3	*	6.4	248.1	4.7	0.00	0.00	0.01	0.0465	2.9
2	*	6.3	248.5	5.2	0.00	0.00	0.00	0.0395	1.9
1	*	6.3	248.8	6.2	0.00	0.00	0.00	0.0000	0.9

1

DAILY INFORMATION

HOUR	DAY	SIM.INT.	ELEV M	INFLOW M3/S	TEMP C	OUTFLOW M3/S	TEMP C	IF REGULATION TARGET T. C.	PORT	FLOW M3/S	PORT	FLOW M3/S	PORT	FLOW M3/S	MORE?
2520	105	4	19.8	0.1	14.4	0.1	7.1		1	0.0	2	0.0	3	0.0	YES
2526	105	1	19.8	0.1	14.4	0.1	7.2		1	0.0	2	0.0	3	0.0	YES
2532	105	2	19.8	0.1	14.4	0.1	7.4		1	0.0	2	0.0	3	0.0	YES
2538	105	3	19.8	0.1	14.4	0.1	7.7		1	0.0	2	0.0	3	0.0	YES
2544	106	4	19.8	0.1	14.4	0.1	7.8		1	0.0	2	0.0	3	0.0	YES
2550	106	1	19.8	0.1	14.4	0.1	8.0		1	0.0	2	0.0	3	0.0	YES
2556	106	2	19.8	0.1	14.4	0.1	8.1		1	0.0	2	0.0	3	0.0	YES
2562	106	3	19.8	0.1	14.4	0.1	8.2		1	0.0	2	0.0	3	0.0	YES
2568	107	4	19.8	0.1	14.4	0.1	8.3		1	0.0	2	0.0	3	0.0	YES
2574	107	1	19.8	0.1	14.4	0.1	8.3		1	0.0	2	0.0	3	0.0	YES
2580	107	2	19.8	0.1	14.4	0.1	8.5		1	0.0	2	0.0	3	0.0	YES
2586	107	3	19.8	0.1	14.4	0.1	8.6		1	0.0	2	0.0	3	0.0	YES
2592	108	4	19.8	0.1	14.4	0.1	8.7		1	0.0	2	0.0	3	0.0	YES
2598	108	1	19.8	0.1	14.4	0.1	8.7		1	0.0	2	0.0	3	0.0	YES
2604	108	2	19.8	0.1	14.4	0.1	8.8		1	0.0	2	0.0	3	0.0	YES
2610	108	3	19.8	0.1	14.4	0.1	9.0		1	0.0	2	0.0	3	0.0	YES
2616	109	4	19.8	0.1	14.4	0.1	9.1		1	0.0	2	0.0	3	0.0	YES

2622	109	1	19.8	0.1	14.4	0.1	9.1	1	0.0	2	0.0	3	0.0	YES
2628	109	2	19.8	0.1	14.4	0.1	9.2	1	0.0	2	0.0	3	0.0	YES
2634	109	3	19.8	0.1	14.4	0.1	9.5	1	0.0	2	0.0	3	0.0	YES
2640	110	4	19.8	0.1	14.4	0.1	9.6	1	0.0	2	0.0	3	0.0	YES
2646	110	1	19.8	0.1	14.4	0.1	9.7	1	0.0	2	0.0	3	0.0	YES
2652	110	2	19.8	0.1	14.4	0.1	9.8	1	0.0	2	0.0	3	0.0	YES
2658	110	3	19.8	0.1	14.4	0.1	9.9	1	0.0	2	0.0	3	0.0	YES
2664	111	4	19.8	0.1	14.4	0.1	10.0	1	0.0	2	0.0	3	0.0	YES
2670	111	1	19.8	0.1	14.4	0.1	9.9	1	0.0	2	0.0	3	0.0	YES
2676	111	2	19.8	0.1	14.4	0.1	9.9	1	0.0	2	0.0	3	0.0	YES
2682	111	3	19.8	0.1	14.4	0.1	9.8	1	0.0	2	0.0	3	0.0	YES
2688	112	4	19.8	0.1	14.4	0.1	9.9	1	0.0	2	0.0	3	0.0	YES
2694	112	1	19.8	0.1	14.4	0.1	9.8	1	0.0	2	0.0	3	0.0	YES
2700	112	2	19.8	0.1	14.4	0.1	9.8	1	0.0	2	0.0	3	0.0	YES
2706	112	3	19.8	0.1	14.4	0.1	9.9	1	0.0	2	0.0	3	0.0	YES
2712	113	4	19.8	0.1	14.4	0.1	9.9	1	0.0	2	0.0	3	0.0	YES
2718	113	1	19.8	0.1	14.4	0.1	9.8	1	0.0	2	0.0	3	0.0	YES
2724	113	2	19.8	0.1	14.4	0.1	9.8	1	0.0	2	0.0	3	0.0	YES
2730	113	3	19.8	0.1	14.4	0.1	9.9	1	0.0	2	0.0	3	0.0	YES
2736	114	4	19.8	0.1	14.4	0.1	10.1	1	0.0	2	0.0	3	0.0	YES
2742	114	1	19.8	0.1	14.4	0.1	10.1	1	0.0	2	0.0	3	0.0	YES
2748	114	2	19.8	0.1	14.4	0.1	10.2	1	0.0	2	0.0	3	0.0	YES
2754	114	3	19.8	0.1	14.4	0.1	10.3	1	0.0	2	0.0	3	0.0	YES
2760	115	4	19.8	0.1	14.4	0.1	10.5	1	0.0	2	0.0	3	0.0	YES
2766	115	1	19.8	0.1	14.4	0.1	10.4	1	0.0	2	0.0	3	0.0	YES
2772	115	2	19.8	0.1	14.4	0.1	10.4	1	0.0	2	0.0	3	0.0	YES
2778	115	3	19.8	0.1	14.4	0.1	10.4	1	0.0	2	0.0	3	0.0	YES
2784	116	4	19.8	0.1	14.4	0.1	10.5	1	0.0	2	0.0	3	0.0	YES
2790	116	1	19.8	0.1	14.4	0.1	10.6	1	0.0	2	0.0	3	0.0	YES
2796	116	2	19.8	0.1	14.4	0.1	10.4	1	0.0	2	0.0	3	0.0	YES
2802	116	3	19.8	0.1	14.4	0.1	10.4	1	0.0	2	0.0	3	0.0	YES
2808	117	4	19.8	0.1	14.4	0.1	10.5	1	0.0	2	0.0	3	0.0	YES
2814	117	1	19.8	0.1	14.4	0.1	10.3	1	0.0	2	0.0	3	0.0	YES
2820	117	2	19.8	0.1	14.4	0.1	10.2	1	0.0	2	0.0	3	0.0	YES
2826	117	3	19.8	0.1	14.4	0.1	10.3	1	0.0	2	0.0	3	0.0	YES
2832	118	4	19.8	0.1	14.4	0.1	10.5	1	0.0	2	0.0	3	0.0	YES
2838	118	1	19.8	0.1	14.4	0.1	10.3	1	0.0	2	0.0	3	0.0	YES
2844	118	2	19.8	0.1	14.4	0.1	10.3	1	0.0	2	0.0	3	0.0	YES
2850	118	3	19.8	0.1	14.4	0.1	10.5	1	0.0	2	0.0	3	0.0	YES
2856	119	4	19.8	0.1	14.4	0.1	10.6	1	0.0	2	0.0	3	0.0	YES
2862	119	1	19.8	0.1	14.4	0.1	10.5	1	0.0	2	0.0	3	0.0	YES
2868	119	2	19.8	0.1	14.4	0.1	10.5	1	0.0	2	0.0	3	0.0	YES
2874	119	3	19.8	0.1	14.4	0.1	10.6	1	0.0	2	0.0	3	0.0	YES
2880	120	4	19.8	0.1	14.4	0.1	10.7	1	0.0	2	0.0	3	0.0	YES
2886	120	1	19.8	0.1	14.4	0.1	10.7	1	0.0	2	0.0	3	0.0	YES
2892	120	2	19.8	0.1	14.4	0.1	10.7	1	0.0	2	0.0	3	0.0	YES
2898	120	3	19.8	0.1	14.4	0.1	10.9	1	0.0	2	0.0	3	0.0	YES
2904	121	4	19.8	0.1	14.4	0.1	11.0	1	0.0	2	0.0	3	0.0	YES
2910	121	1	19.8	0.1	14.4	0.1	11.0	1	0.0	2	0.0	3	0.0	YES
2916	121	2	19.8	0.1	14.4	0.1	11.0	1	0.0	2	0.0	3	0.0	YES
2922	121	3	19.8	0.1	14.4	0.1	11.2	1	0.0	2	0.0	3	0.0	YES
2928	122	4	19.8	0.1	14.4	0.1	11.2	1	0.0	2	0.0	3	0.0	YES

2934	122	1	19.8	0.1	14.4	0.1	11.2	1	0.0	2	0.0	3	0.0	YES
2940	122	2	19.8	0.1	14.4	0.1	11.3	1	0.0	2	0.0	3	0.0	YES
2946	122	3	19.8	0.1	14.4	0.1	11.3	1	0.0	2	0.0	3	0.0	YES
2952	123	4	19.8	0.1	14.4	0.1	11.4	1	0.0	2	0.0	3	0.0	YES
2958	123	1	19.8	0.1	14.4	0.1	11.4	1	0.0	2	0.0	3	0.0	YES
2964	123	2	19.8	0.1	14.4	0.1	11.5	1	0.0	2	0.0	3	0.0	YES
2970	123	3	19.8	0.1	14.4	0.1	11.5	1	0.0	2	0.0	3	0.0	YES
2976	124	4	19.8	0.1	14.4	0.1	11.6	1	0.0	2	0.0	3	0.0	YES
2982	124	1	19.8	0.1	14.4	0.1	11.7	1	0.0	2	0.0	3	0.0	YES
2988	124	2	19.8	0.1	14.4	0.1	11.8	1	0.0	2	0.0	3	0.0	YES
2994	124	3	19.8	0.1	14.4	0.1	12.0	1	0.0	2	0.0	3	0.0	YES
3000	125	4	19.8	0.1	14.4	0.1	12.1	1	0.0	2	0.0	3	0.0	YES
3006	125	1	19.8	0.1	14.4	0.1	12.1	1	0.0	2	0.0	3	0.0	YES
3012	125	2	19.8	0.1	14.4	0.1	12.1	1	0.0	2	0.0	3	0.0	YES
3018	125	3	19.8	0.1	14.4	0.1	12.3	1	0.0	2	0.0	3	0.0	YES
3024	126	4	19.8	0.1	14.4	0.1	12.3	1	0.0	2	0.0	3	0.0	YES
3030	126	1	19.8	0.1	14.4	0.1	12.2	1	0.0	2	0.0	3	0.0	YES
3036	126	2	19.8	0.1	14.4	0.1	12.3	1	0.0	2	0.0	3	0.0	YES
3042	126	3	19.8	0.1	14.4	0.1	12.4	1	0.0	2	0.0	3	0.0	YES
3048	127	4	19.8	0.1	14.4	0.1	12.4	1	0.0	2	0.0	3	0.0	YES
3054	127	1	19.8	0.1	14.4	0.1	12.4	1	0.0	2	0.0	3	0.0	YES
3060	127	2	19.8	0.1	14.4	0.1	12.4	1	0.0	2	0.0	3	0.0	YES
3066	127	3	19.8	0.1	14.4	0.1	12.6	1	0.0	2	0.0	3	0.0	YES
3072	128	4	19.8	0.1	14.4	0.1	12.6	1	0.0	2	0.0	3	0.0	YES
3078	128	1	19.8	0.1	14.4	0.1	12.5	1	0.0	2	0.0	3	0.0	YES
3084	128	2	19.8	0.1	14.4	0.1	12.6	1	0.0	2	0.0	3	0.0	YES
3090	128	3	19.8	0.1	14.4	0.1	12.7	1	0.0	2	0.0	3	0.0	YES
3096	129	4	19.8	0.1	14.4	0.1	12.7	1	0.0	2	0.0	3	0.0	YES
3102	129	1	19.8	0.1	14.4	0.1	12.6	1	0.0	2	0.0	3	0.0	YES
3108	129	2	19.8	0.1	14.4	0.1	12.6	1	0.0	2	0.0	3	0.0	YES
3114	129	3	19.8	0.1	14.4	0.1	12.7	1	0.0	2	0.0	3	0.0	YES
3120	130	4	19.8	0.1	14.4	0.1	12.9	1	0.0	2	0.0	3	0.0	YES
3126	130	1	19.8	0.1	14.4	0.1	12.9	1	0.0	2	0.0	3	0.0	YES
3132	130	2	19.8	0.1	14.4	0.1	12.9	1	0.0	2	0.0	3	0.0	YES
3138	130	3	19.8	0.1	14.4	0.1	13.1	1	0.0	2	0.0	3	0.0	YES
3144	131	4	19.8	0.1	14.4	0.1	13.1	1	0.0	2	0.0	3	0.0	YES
3150	131	1	19.8	0.1	14.4	0.1	13.0	1	0.0	2	0.0	3	0.0	YES
3156	131	2	19.8	0.1	14.4	0.1	12.9	1	0.0	2	0.0	3	0.0	YES
3162	131	3	19.8	0.1	14.4	0.1	13.0	1	0.0	2	0.0	3	0.0	YES
3168	132	4	19.8	0.1	14.4	0.1	13.0	1	0.0	2	0.0	3	0.0	YES
3174	132	1	19.8	0.1	14.4	0.1	12.9	1	0.0	2	0.0	3	0.0	YES
3180	132	2	19.8	0.1	14.4	0.1	12.9	1	0.0	2	0.0	3	0.0	YES
3186	132	3	19.8	0.1	14.4	0.1	13.0	1	0.0	2	0.0	3	0.0	YES
3192	133	4	19.8	0.1	14.4	0.1	12.9	1	0.0	2	0.0	3	0.0	YES
3198	133	1	19.8	0.1	14.4	0.1	12.8	1	0.0	2	0.0	3	0.0	YES
3204	133	2	19.8	0.1	14.4	0.1	13.0	1	0.0	2	0.0	3	0.0	YES
3210	133	3	19.8	0.1	14.4	0.1	13.1	1	0.0	2	0.0	3	0.0	YES

1

STATUS AT END OF SIMULATION HOUR 3216 THIS IS JULIAN DAY 134, CALENDAR DAY 14MAY 93

AVERAGE METEOROLOGICAL QUANTITIES FOR THIS COMPUTATION PERIOD:

CLOUD COVER 0.08 AIR PRESSURE,MB 1008.63 WIND SPEED,KPH 18.33 DRYBULB TEMP,DEGC, 15.3 DEWPOINT TEMP,DEGC, 6
.3
S/W RAD,KC/M2/HR 16.6 L/W RAD,KC/M2/HR 257.0 VAPOR PRESSURE,MB 9.7 SAT.VAP.PRES,MB 19.7 EVAP.RATE,M/HR 0.00
04
TOTAL EVAP., M. 0.
14
SURFACE ELEVATION,M: 19.8 EL.ABOVE MSL,M. 44.1

INFLOWING QUANTITIES FOR THIS COMPUTATION INTERVAL:

TRIBUTARY	INFLOW M3/SEC	TEMPERATURE DEG C	TOT.DISS.SOLIDS G/M3	SUSPENDED SOLIDS G/M3
1	0.13	14.4	29.1	1.3

OUTFLOWING QUANTITIES FOR THIS COMPUTATION INTERVAL:

PORT	LAYER	OUTFLOW,M3/SEC
1	17	0.01
2	15	0.01
3	12	0.01
4	10	0.01
5	8	0.01
6	6	0.01
7	3	0.01
8	1	0.01

TOTAL OUTFLOW,M3/SEC 0.10 TEMPERATURE,DEG C 13.1 TOT.DISS.SOLIDS,G/M3 216.3 SUSP.SOLIDS,G/M3 0.1

	0 5 10 15 20 25 30 35	TEMP. DEG.C	TOT.DISS. SOLIDS G/M3	SUSPENDED SOLIDS G/M3	S/W RADIATION KC/M2/HR	LAYER INFLOW M3/SEC	LAYER OUTFLOW M3/SEC	DIFFUSION COEF. M2/HR	UPPER ELEVATION M
18	*	17.1	208.7	0.0	8.37	0.00	0.00	0.5002	19.8
17	*	17.1	208.7	0.0	5.06	0.00	0.00	0.5002	18.8
16	*	17.1	208.7	0.0	3.07	0.00	0.00	0.0595	17.8
15	*	17.1	208.7	0.0	1.86	0.00	0.02	0.0222	16.8
14	*	17.1	208.7	0.0	1.13	0.00	0.00	0.0237	15.8
13	*	17.1	208.7	0.0	0.63	0.00	0.01	0.0010	14.8
12	*	14.6	197.3	0.1	0.36	0.13	0.00	0.0024	13.6
11	*	14.0	209.0	0.1	0.21	0.00	0.00	0.0034	12.5
10	*	13.6	210.1	0.1	0.13	0.00	0.01	0.0045	11.5
9	*	13.4	210.3	0.1	0.07	0.00	0.00	0.0050	10.4
8	*	13.2	210.4	0.1	0.04	0.00	0.01	0.0006	9.4
7	*	12.1	211.3	0.1	0.03	0.00	0.00	0.0022	8.3
6	*	11.8	211.7	0.1	0.01	0.00	0.00	0.0016	7.3
5	*	11.4	213.3	0.1	0.01	0.00	0.01	0.0005	6.1

4	*	8.4	231.7	0.1	0.00	0.00	0.01	0.0011	5.0
3	*	7.6	236.5	0.2	0.00	0.00	0.01	0.0172	3.8
2	*	7.6	236.8	0.2	0.00	0.00	0.00	0.1967	2.5
1	*	7.6	236.8	0.2	0.00	0.00	0.00	0.0000	1.2

1

DAILY INFORMATION

HOUR	DAY	SIM.INT.	ELEV M	INFLOW M3/S	TEMP C	OUTFLOW M3/S	TEMP C	IF REGULATION TARGET T. C.	PORT	FLOW M3/S	PORT	FLOW M3/S	PORT	FLOW M3/S	MORE?
3222	134	1	19.8	0.1	14.4	0.1	13.0		1	0.0	2	0.0	3	0.0	YES
3228	134	2	19.8	0.1	14.4	0.1	13.0		1	0.0	2	0.0	3	0.0	YES
3234	134	3	19.8	0.1	14.4	0.1	13.2		1	0.0	2	0.0	3	0.0	YES
3240	135	4	19.8	0.1	14.4	0.1	13.3		1	0.0	2	0.0	3	0.0	YES
3246	135	1	19.8	0.1	14.4	0.1	13.2		1	0.0	2	0.0	3	0.0	YES
3252	135	2	19.8	0.1	14.4	0.1	13.2		1	0.0	2	0.0	3	0.0	YES
3258	135	3	19.8	0.1	14.4	0.1	13.3		1	0.0	2	0.0	3	0.0	YES
3264	136	4	19.8	0.1	14.4	0.1	13.4		1	0.0	2	0.0	3	0.0	YES
3270	136	1	19.7	0.1	14.4	0.1	13.2		1	0.0	2	0.0	3	0.0	YES
3276	136	2	19.7	0.1	14.4	0.1	13.2		1	0.0	2	0.0	3	0.0	YES
3282	136	3	19.7	0.1	14.4	0.1	13.4		1	0.0	2	0.0	3	0.0	YES
3288	137	4	19.7	0.1	14.4	0.1	13.3		1	0.0	2	0.0	3	0.0	YES
3294	137	1	19.7	0.1	14.4	0.1	13.2		1	0.0	2	0.0	3	0.0	YES
3300	137	2	19.7	0.1	14.4	0.1	13.2		1	0.0	2	0.0	3	0.0	YES
3306	137	3	19.7	0.1	14.4	0.1	13.2		1	0.0	2	0.0	3	0.0	YES
3312	138	4	19.7	0.1	14.4	0.1	13.2		1	0.0	2	0.0	3	0.0	YES
3318	138	1	19.7	0.1	14.4	0.1	13.0		1	0.0	2	0.0	3	0.0	YES
3324	138	2	19.7	0.1	14.4	0.1	13.0		1	0.0	2	0.0	3	0.0	YES
3330	138	3	19.7	0.1	14.4	0.1	13.0		1	0.0	2	0.0	3	0.0	YES
3336	139	4	19.7	0.1	14.4	0.1	12.9		1	0.0	2	0.0	3	0.0	YES
3342	139	1	19.7	0.1	14.4	0.1	12.9		1	0.0	2	0.0	3	0.0	YES
3348	139	2	19.7	0.1	14.4	0.1	12.9		1	0.0	2	0.0	3	0.0	YES
3354	139	3	19.7	0.1	14.4	0.1	13.0		1	0.0	2	0.0	3	0.0	YES
3360	140	4	19.7	0.1	14.4	0.1	13.1		1	0.0	2	0.0	3	0.0	YES
3366	140	1	19.7	0.1	14.4	0.1	12.9		1	0.0	2	0.0	3	0.0	YES
3372	140	2	19.7	0.1	14.4	0.1	12.9		1	0.0	2	0.0	3	0.0	YES
3378	140	3	19.7	0.1	14.4	0.1	13.1		1	0.0	2	0.0	3	0.0	YES
3384	141	4	19.7	0.1	14.4	0.1	13.1		1	0.0	2	0.0	3	0.0	YES
3390	141	1	19.7	0.1	14.4	0.1	13.0		1	0.0	2	0.0	3	0.0	YES
3396	141	2	19.7	0.1	14.4	0.1	13.1		1	0.0	2	0.0	3	0.0	YES
3402	141	3	19.7	0.1	14.4	0.1	13.2		1	0.0	2	0.0	3	0.0	YES
3408	142	4	19.7	0.1	14.4	0.1	13.2		1	0.0	2	0.0	3	0.0	YES
3414	142	1	19.7	0.1	14.4	0.1	13.0		1	0.0	2	0.0	3	0.0	YES
3420	142	2	19.7	0.1	14.4	0.1	13.0		1	0.0	2	0.0	3	0.0	YES
3426	142	3	19.7	0.1	14.4	0.1	13.2		1	0.0	2	0.0	3	0.0	YES
3432	143	4	19.7	0.1	14.4	0.1	13.3		1	0.0	2	0.0	3	0.0	YES
3438	143	1	19.7	0.1	14.4	0.1	13.2		1	0.0	2	0.0	3	0.0	YES
3444	143	2	19.7	0.1	14.4	0.1	13.2		1	0.0	2	0.0	3	0.0	YES

3450	143	3	19.7	0.1	14.4	0.1	13.4	1	0.0	2	0.0	3	0.0	YES
3456	144	4	19.7	0.1	14.4	0.1	13.5	1	0.0	2	0.0	3	0.0	YES
3462	144	1	19.7	0.1	14.4	0.1	13.5	1	0.0	2	0.0	3	0.0	YES
3468	144	2	19.7	0.1	14.4	0.1	13.6	1	0.0	2	0.0	3	0.0	YES
3474	144	3	19.7	0.1	14.4	0.1	13.7	1	0.0	2	0.0	3	0.0	YES
3480	145	4	19.7	0.1	14.4	0.1	13.8	1	0.0	2	0.0	3	0.0	YES
3486	145	1	19.7	0.1	14.4	0.1	13.7	1	0.0	2	0.0	3	0.0	YES
3492	145	2	19.7	0.1	14.4	0.1	13.6	1	0.0	2	0.0	3	0.0	YES
3498	145	3	19.7	0.1	14.4	0.1	13.8	1	0.0	2	0.0	3	0.0	YES
3504	146	4	19.7	0.1	14.4	0.1	13.7	1	0.0	2	0.0	3	0.0	YES
3510	146	1	19.7	0.1	14.4	0.1	13.6	1	0.0	2	0.0	3	0.0	YES
3516	146	2	19.7	0.1	14.4	0.1	13.6	1	0.0	2	0.0	3	0.0	YES
3522	146	3	19.7	0.1	14.4	0.1	13.7	1	0.0	2	0.0	3	0.0	YES
3528	147	4	19.7	0.1	14.4	0.1	13.7	1	0.0	2	0.0	3	0.0	YES
3534	147	1	19.7	0.1	14.4	0.1	13.6	1	0.0	2	0.0	3	0.0	YES
3540	147	2	19.7	0.1	14.4	0.1	13.6	1	0.0	2	0.0	3	0.0	YES
3546	147	3	19.7	0.1	14.4	0.1	13.7	1	0.0	2	0.0	3	0.0	YES
3552	148	4	19.7	0.1	14.4	0.1	13.7	1	0.0	2	0.0	3	0.0	YES
3558	148	1	19.7	0.1	14.4	0.1	13.8	1	0.0	2	0.0	3	0.0	YES
3564	148	2	19.7	0.1	14.4	0.1	13.8	1	0.0	2	0.0	3	0.0	YES
3570	148	3	19.7	0.1	14.4	0.1	13.9	1	0.0	2	0.0	3	0.0	YES
3576	149	4	19.7	0.1	14.4	0.1	13.9	1	0.0	2	0.0	3	0.0	YES
3582	149	1	19.7	0.1	14.4	0.1	13.7	1	0.0	2	0.0	3	0.0	YES
3588	149	2	19.7	0.1	14.4	0.1	13.7	1	0.0	2	0.0	3	0.0	YES
3594	149	3	19.7	0.1	14.4	0.1	13.8	1	0.0	2	0.0	3	0.0	YES
3600	150	4	19.7	0.1	14.4	0.1	13.8	1	0.0	2	0.0	3	0.0	YES
3606	150	1	19.7	0.1	14.4	0.1	13.7	1	0.0	2	0.0	3	0.0	YES
3612	150	2	19.7	0.1	14.4	0.1	13.7	1	0.0	2	0.0	3	0.0	YES
3618	150	3	19.7	0.1	14.4	0.1	13.8	1	0.0	2	0.0	3	0.0	YES
3624	151	4	19.7	0.1	14.4	0.1	13.8	1	0.0	2	0.0	3	0.0	YES
3630	151	1	19.7	0.1	14.4	0.1	13.7	1	0.0	2	0.0	3	0.0	YES
3636	151	2	19.7	0.1	14.4	0.1	13.7	1	0.0	2	0.0	3	0.0	YES
3642	151	3	19.7	0.1	14.4	0.1	13.8	1	0.0	2	0.0	3	0.0	YES
3648	152	4	19.7	0.1	14.4	0.1	13.8	1	0.0	2	0.0	3	0.0	YES
3654	152	1	19.7	0.1	14.4	0.1	13.7	1	0.0	2	0.0	3	0.0	YES
3660	152	2	19.7	0.1	14.4	0.1	13.6	1	0.0	2	0.0	3	0.0	YES
3666	152	3	19.7	0.1	14.4	0.1	13.8	1	0.0	2	0.0	3	0.0	YES
3672	153	4	19.7	0.1	14.4	0.1	13.8	1	0.0	2	0.0	3	0.0	YES
3678	153	1	19.7	0.1	14.4	0.1	13.7	1	0.0	2	0.0	3	0.0	YES
3684	153	2	19.7	0.1	14.4	0.1	13.7	1	0.0	2	0.0	3	0.0	YES
3690	153	3	19.7	0.1	14.4	0.1	13.8	1	0.0	2	0.0	3	0.0	YES
3696	154	4	19.7	0.1	14.4	0.1	13.9	1	0.0	2	0.0	3	0.0	YES
3702	154	1	19.7	0.1	14.4	0.1	13.8	1	0.0	2	0.0	3	0.0	YES
3708	154	2	19.7	0.1	14.4	0.1	13.9	1	0.0	2	0.0	3	0.0	YES
3714	154	3	19.7	0.1	14.4	0.1	14.0	1	0.0	2	0.0	3	0.0	YES
3720	155	4	19.7	0.1	14.4	0.1	14.1	1	0.0	2	0.0	3	0.0	YES
3726	155	1	19.7	0.1	14.4	0.1	14.0	1	0.0	2	0.0	3	0.0	YES
3732	155	2	19.7	0.1	14.4	0.1	14.0	1	0.0	2	0.0	3	0.0	YES
3738	155	3	19.7	0.1	14.4	0.1	14.1	1	0.0	2	0.0	3	0.0	YES
3744	156	4	19.7	0.1	14.4	0.1	14.0	1	0.0	2	0.0	3	0.0	YES
3750	156	1	19.6	0.1	14.4	0.1	14.1	1	0.0	2	0.0	3	0.0	YES
3756	156	2	19.6	0.1	14.4	0.1	14.1	1	0.0	2	0.0	3	0.0	YES

3762	156	3	19.6	0.1	14.4	0.1	14.2	1	0.0	2	0.0	3	0.0 YES
3768	157	4	19.6	0.1	14.4	0.1	14.2	1	0.0	2	0.0	3	0.0 YES
3774	157	1	19.6	0.1	14.4	0.1	14.1	1	0.0	2	0.0	3	0.0 YES
3780	157	2	19.6	0.1	14.4	0.1	14.1	1	0.0	2	0.0	3	0.0 YES
3786	157	3	19.6	0.1	14.4	0.1	14.3	1	0.0	2	0.0	3	0.0 YES
3792	158	4	19.6	0.1	14.4	0.1	14.5	1	0.0	2	0.0	3	0.0 YES
3798	158	1	19.6	0.1	14.4	0.1	14.4	1	0.0	2	0.0	3	0.0 YES
3804	158	2	19.6	0.1	14.4	0.1	14.4	1	0.0	2	0.0	3	0.0 YES
3810	158	3	19.6	0.1	14.4	0.1	14.6	1	0.0	2	0.0	3	0.0 YES
3816	159	4	19.6	0.1	14.4	0.1	14.7	1	0.0	2	0.0	3	0.0 YES
3822	159	1	19.6	0.1	14.4	0.1	14.6	1	0.0	2	0.0	3	0.0 YES
3828	159	2	19.6	0.1	14.4	0.1	14.7	1	0.0	2	0.0	3	0.0 YES
3834	159	3	19.6	0.1	14.4	0.1	14.9	1	0.0	2	0.0	3	0.0 YES
3840	160	4	19.6	0.1	14.4	0.1	15.0	1	0.0	2	0.0	3	0.0 YES
3846	160	1	19.6	0.1	14.4	0.1	15.2	1	0.0	2	0.0	3	0.0 YES
3852	160	2	19.6	0.1	14.4	0.1	15.2	1	0.0	2	0.0	3	0.0 YES
3858	160	3	19.6	0.1	14.4	0.1	15.4	1	0.0	2	0.0	3	0.0 YES
3864	161	4	19.6	0.1	14.4	0.1	15.6	1	0.0	2	0.0	3	0.0 YES
3870	161	1	19.6	0.1	14.4	0.1	15.6	1	0.0	2	0.0	3	0.0 YES
3876	161	2	19.6	0.1	14.4	0.1	15.6	1	0.0	2	0.0	3	0.0 YES
3882	161	3	19.6	0.1	14.4	0.1	15.7	1	0.0	2	0.0	3	0.0 YES
3888	162	4	19.6	0.1	14.4	0.1	15.8	1	0.0	2	0.0	3	0.0 YES
3894	162	1	19.6	0.1	14.4	0.1	15.6	1	0.0	2	0.0	3	0.0 YES
3900	162	2	19.6	0.1	14.4	0.1	15.6	1	0.0	2	0.0	3	0.0 YES
3906	162	3	19.6	0.1	14.4	0.1	16.0	1	0.0	2	0.0	3	0.0 YES
3912	163	4	19.6	0.1	14.4	0.1	16.3	1	0.0	2	0.0	3	0.0 YES
3918	163	1	19.6	0.1	14.4	0.1	16.1	1	0.0	2	0.0	3	0.0 YES
3924	163	2	19.6	0.1	14.4	0.1	16.1	1	0.0	2	0.0	3	0.0 YES
3930	163	3	19.6	0.1	14.4	0.1	16.4	1	0.0	2	0.0	3	0.0 YES

1

STATUS AT END OF SIMULATION HOUR 3936 THIS IS JULIAN DAY 164, CALENDAR DAY 13JUN
93

AVERAGE METEOROLOGICAL QUANTITIES FOR THIS COMPUTATION PERIOD:

CLOUD COVER 0.05 AIR PRESSURE,MB 1019.30 WIND SPEED,KPH 18.80 DRYBULB TEMP,DEGC, 23.4 DEWPOINT TEMP,DEGC, 13
.0
S/W RAD,KC/M2/HR 26.8 L/W RAD,KC/M2/HR 302.4 VAPOR PRESSURE,MB 15.1 SAT.VAP.PRES,MB 24.1 EVAP.RATE,M/HR 0.00
03
TOTAL EVAP., M. 0.
38

SURFACE ELEVATION,M: 19.6 EL.ABOVE MSL,M. 44.0

INFLOWING QUANTITIES FOR THIS COMPUTATION INTERVAL:

TRIBUTARY	INFLOW M3/SEC	TEMPERATURE DEG C	TOT.DISS.SOLIDS G/M3	SUSPENDED SOLIDS G/M3
1	0.13	14.4	25.4	1.1

OUTFLOWING QUANTITIES FOR THIS COMPUTATION INTERVAL:

PORT	LAYER	OUTFLOW,M3/SEC

1	17	0.01
2	15	0.01
3	12	0.01
4	10	0.01
5	8	0.01
6	5	0.01
7	3	0.01
8	1	0.01

TOTAL OUTFLOW,M3/SEC 0.10 TEMPERATURE,DEG C 16.5 TOT.DISS.SOLIDS,G/M3 210.5 SUSP.SOLIDS,G/M3 0.0

	0 5 10 15 20 25 30 35	TEMP. DEG.C	TOT.DISS. SOLIDS G/M3	SUSPENDED SOLIDS G/M3	S/W RADIATION KC/M2/HR	LAYER INFLOW M3/SEC	LAYER OUTFLOW M3/SEC	DIFFUSION COEF. M2/HR	UPPER ELEVATION M
18	*	20.2	207.0	0.0	15.31	0.00	0.00	0.5507	19.6
17	*	20.2	207.0	0.0	9.40	0.00	0.00	0.0915	18.9
16	*	20.2	207.0	0.0	5.83	0.00	0.01	0.0290	17.9
15	*	20.2	207.0	0.0	3.63	0.00	0.01	0.0190	17.0
14	*	20.2	207.0	0.0	2.26	0.00	0.00	0.0290	16.0
13	*	20.2	207.0	0.0	1.32	0.00	0.00	0.0199	15.1
12	*	20.2	207.0	0.0	0.73	0.00	0.01	0.0237	14.0
11	*	20.2	207.0	0.0	0.43	0.00	0.01	0.0292	12.8
10	*	19.6	206.7	0.0	0.24	0.00	0.01	0.0344	11.8
9	*	19.5	206.7	0.0	0.14	0.00	0.01	0.0369	10.6
8	*	19.4	206.5	0.0	0.07	0.00	0.01	0.0005	9.6
7	*	13.6	139.4	0.1	0.04	0.13	0.00	0.0018	8.3
6	*	13.3	154.6	0.1	0.03	0.00	0.00	0.0005	7.3
5	*	12.2	204.3	0.1	0.02	0.00	0.01	0.0010	6.3
4	*	11.6	213.5	0.1	0.01	0.00	0.01	0.0005	5.3
3	*	9.1	228.0	0.1	0.00	0.00	0.00	0.0011	3.7
2	*	8.4	231.8	0.1	0.00	0.00	0.01	0.1684	2.4
1	*	8.4	231.8	0.1	0.00	0.00	0.01	0.0000	1.4

1

DAILY INFORMATION

HOUR	DAY	SIM.INT.	ELEV M	INFLOW M3/S	TEMP C	OUTFLOW M3/S	TEMP C	IF REGULATION TARGET T. C.	PORT	FLOW M3/S	PORT	FLOW M3/S	PORT	FLOW M3/S	MORE?
3942	164	1	19.6	0.1	14.4	0.1	16.5		1	0.0	2	0.0	3	0.0	YES
3948	164	2	19.6	0.1	14.4	0.1	16.5		1	0.0	2	0.0	3	0.0	YES
3954	164	3	19.6	0.1	14.4	0.1	16.7		1	0.0	2	0.0	3	0.0	YES
3960	165	4	19.6	0.1	14.4	0.1	16.9		1	0.0	2	0.0	3	0.0	YES

3966	165	1	19.6	0.1	14.4	0.1	16.7	1	0.0	2	0.0	3	0.0	YES
3972	165	2	19.6	0.1	14.4	0.1	16.7	1	0.0	2	0.0	3	0.0	YES
3978	165	3	19.6	0.1	14.4	0.1	17.0	1	0.0	2	0.0	3	0.0	YES
3984	166	4	19.6	0.1	14.4	0.1	16.2	1	0.0	2	0.0	3	0.0	YES
3990	166	1	19.6	0.1	14.4	0.1	16.6	1	0.0	2	0.0	3	0.0	YES
3996	166	2	19.6	0.1	14.4	0.1	16.6	1	0.0	2	0.0	3	0.0	YES
4002	166	3	19.6	0.1	14.4	0.1	16.2	1	0.0	2	0.0	3	0.0	YES
4008	167	4	19.6	0.1	14.4	0.1	16.4	1	0.0	2	0.0	3	0.0	YES
4014	167	1	19.6	0.1	14.4	0.1	16.9	1	0.0	2	0.0	3	0.0	YES
4020	167	2	19.6	0.1	14.4	0.1	16.9	1	0.0	2	0.0	3	0.0	YES
4026	167	3	19.6	0.1	14.4	0.1	16.5	1	0.0	2	0.0	3	0.0	YES
4032	168	4	19.6	0.1	14.4	0.1	16.9	1	0.0	2	0.0	3	0.0	YES
4038	168	1	19.6	0.1	14.4	0.1	17.6	1	0.0	2	0.0	3	0.0	YES
4044	168	2	19.6	0.1	14.4	0.1	17.6	1	0.0	2	0.0	3	0.0	YES
4050	168	3	19.6	0.1	14.4	0.1	17.1	1	0.0	2	0.0	3	0.0	YES
4056	169	4	19.6	0.1	14.4	0.1	17.2	1	0.0	2	0.0	3	0.0	YES
4062	169	1	19.6	0.1	14.4	0.1	17.9	1	0.0	2	0.0	3	0.0	YES
4068	169	2	19.6	0.1	14.4	0.1	18.0	1	0.0	2	0.0	3	0.0	YES
4074	169	3	19.6	0.1	14.4	0.1	18.1	1	0.0	2	0.0	3	0.0	YES
4080	170	4	19.6	0.1	14.4	0.1	18.1	1	0.0	2	0.0	3	0.0	YES
4086	170	1	19.6	0.1	14.4	0.1	18.1	1	0.0	2	0.0	3	0.0	YES
4092	170	2	19.6	0.1	14.4	0.1	18.1	1	0.0	2	0.0	3	0.0	YES
4098	170	3	19.6	0.1	14.4	0.1	17.1	1	0.0	2	0.0	3	0.0	YES
4104	171	4	19.6	0.1	14.4	0.1	17.2	1	0.0	2	0.0	3	0.0	YES
4110	171	1	19.6	0.1	14.4	0.1	17.1	1	0.0	2	0.0	3	0.0	YES
4116	171	2	19.6	0.1	14.4	0.1	17.1	1	0.0	2	0.0	3	0.0	YES
4122	171	3	19.6	0.1	14.4	0.1	18.1	1	0.0	2	0.0	3	0.0	YES
4128	172	4	19.6	0.1	14.4	0.1	18.0	1	0.0	2	0.0	3	0.0	YES
4134	172	1	19.6	0.1	14.4	0.1	17.9	1	0.0	2	0.0	3	0.0	YES
4140	172	2	19.6	0.1	14.4	0.1	17.8	1	0.0	2	0.0	3	0.0	YES
4146	172	3	19.6	0.1	14.4	0.1	18.1	1	0.0	2	0.0	3	0.0	YES
4152	173	4	19.6	0.1	14.4	0.1	17.9	1	0.0	2	0.0	3	0.0	YES
4158	173	1	19.6	0.1	14.4	0.1	17.6	1	0.0	2	0.0	3	0.0	YES
4164	173	2	19.6	0.1	14.4	0.1	17.4	1	0.0	2	0.0	3	0.0	YES
4170	173	3	19.6	0.1	14.4	0.1	17.6	1	0.0	2	0.0	3	0.0	YES
4176	174	4	19.6	0.1	14.4	0.1	17.6	1	0.0	2	0.0	3	0.0	YES
4182	174	1	19.6	0.1	14.4	0.1	17.3	1	0.0	2	0.0	3	0.0	YES
4188	174	2	19.6	0.1	14.4	0.1	17.3	1	0.0	2	0.0	3	0.0	YES
4194	174	3	19.6	0.1	14.4	0.1	17.4	1	0.0	2	0.0	3	0.0	YES
4200	175	4	19.6	0.1	14.4	0.1	17.5	1	0.0	2	0.0	3	0.0	YES
4206	175	1	19.6	0.1	14.4	0.1	17.4	1	0.0	2	0.0	3	0.0	YES
4212	175	2	19.6	0.1	14.4	0.1	17.4	1	0.0	2	0.0	3	0.0	YES
4218	175	3	19.5	0.1	14.4	0.1	16.9	1	0.0	2	0.0	3	0.0	YES
4224	176	4	19.5	0.1	14.4	0.1	17.0	1	0.0	2	0.0	3	0.0	YES
4230	176	1	19.5	0.1	14.4	0.1	17.0	1	0.0	2	0.0	3	0.0	YES
4236	176	2	19.5	0.1	14.4	0.1	17.0	1	0.0	2	0.0	3	0.0	YES
4242	176	3	19.5	0.1	14.4	0.1	17.2	1	0.0	2	0.0	3	0.0	YES
4248	177	4	19.5	0.1	14.4	0.1	17.3	1	0.0	2	0.0	3	0.0	YES
4254	177	1	19.5	0.1	14.4	0.1	17.3	1	0.0	2	0.0	3	0.0	YES
4260	177	2	19.5	0.1	14.4	0.1	17.4	1	0.0	2	0.0	3	0.0	YES
4266	177	3	19.5	0.1	14.4	0.1	17.5	1	0.0	2	0.0	3	0.0	YES
4272	178	4	19.5	0.1	14.4	0.1	17.6	1	0.0	2	0.0	3	0.0	YES

4278	178	1	19.5	0.1	14.4	0.1	17.6	1	0.0	2	0.0	3	0.0	YES
4284	178	2	19.5	0.1	14.4	0.1	17.7	1	0.0	2	0.0	3	0.0	YES
4290	178	3	19.5	0.1	14.4	0.1	17.9	1	0.0	2	0.0	3	0.0	YES
4296	179	4	19.5	0.1	14.4	0.1	18.0	1	0.0	2	0.0	3	0.0	YES
4302	179	1	19.5	0.1	14.4	0.1	17.9	1	0.0	2	0.0	3	0.0	YES
4308	179	2	19.5	0.1	14.4	0.1	17.9	1	0.0	2	0.0	3	0.0	YES
4314	179	3	19.5	0.1	14.4	0.1	18.1	1	0.0	2	0.0	3	0.0	YES

1
STATUS AT END OF SIMULATION HOUR 4320 THIS IS JULIAN DAY 180, CALENDAR DAY 29JUN
93

AVERAGE METEOROLOGICAL QUANTITIES FOR THIS COMPUTATION PERIOD:

CLOUD COVER 0.23 AIR PRESSURE,MB 1013.50 WIND SPEED,KPH 13.03 DRYBULB TEMP,DEGC, 23.2 DEWPOINT TEMP,DEGC, 14
.1
S/W RAD,KC/M2/HR 24.3 L/W RAD,KC/M2/HR 301.9 VAPOR PRESSURE,MB 16.0 SAT.VAP.PRES,MB 30.4 EVAP.RATE,M/HR 0.00
04
TOTAL EVAP., M. 0.
53
SURFACE ELEVATION,M: 19.5 EL.ABOVE MSL,M. 43.9

INFLOWING QUANTITIES FOR THIS COMPUTATION INTERVAL:

TRIBUTARY	INFLOW M3/SEC	TEMPERATURE DEG C	TOT.DISS.SOLIDS G/M3	SUSPENDED SOLIDS G/M3
1	0.13	14.4	23.3	1.0

OUTFLOWING QUANTITIES FOR THIS COMPUTATION INTERVAL:

PORT	LAYER	OUTFLOW,M3/SEC
1	18	0.01
2	15	0.01
3	13	0.01
4	11	0.01
5	8	0.01
6	6	0.01
7	4	0.01
8	2	0.01

TOTAL OUTFLOW,M3/SEC 0.10 TEMPERATURE,DEG C 18.1 TOT.DISS.SOLIDS,G/M3 189.5 SUSP.SOLIDS,G/M3 0.0

	0 5 10 15 20 25 30 35	TEMP. DEG.C	TOT.DISS. SOLIDS G/M3	SUSPENDED SOLIDS G/M3	S/W RADIATION KC/M2/HR	LAYER INFLOW M3/SEC	LAYER OUTFLOW M3/SEC	DIFFUSION COEF. M2/HR	UPPER ELEVATION M
19	D*	24.2	211.7	0.0	19.10	0.00	0.00	0.1406	19.5
18	D*	24.2	211.7	0.0	9.31	0.00	0.00	0.1406	19.0

17	D*	24.2	211.7	0.0	5.84	0.00	0.00	0.0044	18.0
16	D*	24.2	211.7	0.0	3.68	0.00	0.01	0.0024	17.1
15	D*	24.2	211.7	0.0	2.33	0.00	0.00	0.0030	16.2
14	D*	24.2	211.7	0.0	1.39	0.00	0.00	0.0017	15.3
13	D*	24.2	211.7	0.0	0.79	0.00	0.01	0.0005	14.2
12	D*	22.7	210.9	0.0	0.48	0.00	0.00	0.0006	13.1
11	D *	22.5	210.8	0.0	0.28	0.00	0.01	0.0005	12.1
10	D *	21.8	210.4	0.0	0.18	0.00	0.00	0.0005	11.0
9	D *	21.5	207.5	0.0	0.10	0.00	0.00	0.0005	10.1
8	D *	15.0	97.6	0.0	0.06	0.00	0.01	0.0005	9.0
7	D *	14.6	92.8	0.1	0.03	0.13	0.00	0.0005	7.9
6	D *	13.6	143.2	0.1	0.02	0.00	0.01	0.0005	6.8
5	D *	12.5	185.5	0.1	0.01	0.00	0.00	0.0005	5.9
4	D *	11.8	204.8	0.1	0.01	0.00	0.01	0.0005	4.7
3	D	9.7	223.7	0.1	0.00	0.00	0.01	0.0006	3.1
2	D	9.6	224.4	0.1	0.00	0.00	0.01	0.0005	2.1
1	*D	9.3	226.3	0.2	0.00	0.00	0.00	0.0000	0.9

1

DAILY INFORMATION

HOUR	DAY	SIM.INT.	ELEV M	INFLOW M3/S	TEMP C	OUTFLOW M3/S	TEMP C	IF REGULATION TARGET T. C.	PORT	FLOW M3/S	PORT	FLOW M3/S	PORT	FLOW M3/S	MORE?
4320	180	4	19.5	0.1	14.4	0.1	18.1		1	0.0	2	0.0	3	0.0	YES
4326	180	1	19.5	0.1	14.4	0.1	18.0		1	0.0	2	0.0	3	0.0	YES
4332	180	2	19.5	0.1	14.4	0.1	18.0		1	0.0	2	0.0	3	0.0	YES
4338	180	3	19.5	0.1	14.4	0.1	18.2		1	0.0	2	0.0	3	0.0	YES
4344	181	4	19.5	0.1	14.4	0.1	18.1		1	0.0	2	0.0	3	0.0	YES
4350	181	1	19.5	0.1	14.4	0.1	17.8		1	0.0	2	0.0	3	0.0	YES
4356	181	2	19.5	0.1	14.4	0.1	17.8		1	0.0	2	0.0	3	0.0	YES
4362	181	3	19.5	0.1	14.4	0.1	17.9		1	0.0	2	0.0	3	0.0	YES
4368	182	4	19.5	0.1	14.4	0.1	18.0		1	0.0	2	0.0	3	0.0	YES
4374	182	1	19.5	0.1	14.4	0.1	17.8		1	0.0	2	0.0	3	0.0	YES
4380	182	2	19.5	0.1	14.4	0.1	17.9		1	0.0	2	0.0	3	0.0	YES
4386	182	3	19.5	0.1	14.4	0.1	18.0		1	0.0	2	0.0	3	0.0	YES
4392	183	4	19.5	0.1	14.4	0.1	17.9		1	0.0	2	0.0	3	0.0	YES
4398	183	1	19.5	0.1	14.4	0.1	18.0		1	0.0	2	0.0	3	0.0	YES
4404	183	2	19.5	0.1	14.4	0.1	18.0		1	0.0	2	0.0	3	0.0	YES
4410	183	3	19.5	0.1	14.4	0.1	18.1		1	0.0	2	0.0	3	0.0	YES
4416	184	4	19.5	0.1	14.4	0.1	18.2		1	0.0	2	0.0	3	0.0	YES
4422	184	1	19.5	0.1	14.4	0.1	18.1		1	0.0	2	0.0	3	0.0	YES
4428	184	2	19.5	0.1	14.4	0.1	18.1		1	0.0	2	0.0	3	0.0	YES
4434	184	3	19.5	0.1	14.4	0.1	18.3		1	0.0	2	0.0	3	0.0	YES
4440	185	4	19.5	0.1	14.4	0.1	18.1		1	0.0	2	0.0	3	0.0	YES
4446	185	1	19.5	0.1	14.4	0.1	18.0		1	0.0	2	0.0	3	0.0	YES
4452	185	2	19.5	0.1	14.4	0.1	18.0		1	0.0	2	0.0	3	0.0	YES
4458	185	3	19.5	0.1	14.4	0.1	18.1		1	0.0	2	0.0	3	0.0	YES
4464	186	4	19.5	0.1	14.4	0.1	18.1		1	0.0	2	0.0	3	0.0	YES

4470	186	1	19.5	0.1	14.4	0.1	18.2	1	0.0	2	0.0	3	0.0	YES
4476	186	2	19.5	0.1	14.4	0.1	18.2	1	0.0	2	0.0	3	0.0	YES
4482	186	3	19.5	0.1	14.4	0.1	18.4	1	0.0	2	0.0	3	0.0	YES
4488	187	4	19.5	0.1	14.4	0.1	18.6	1	0.0	2	0.0	3	0.0	YES
4494	187	1	19.5	0.1	14.4	0.1	18.5	1	0.0	2	0.0	3	0.0	YES
4500	187	2	19.5	0.1	14.4	0.1	18.6	1	0.0	2	0.0	3	0.0	YES
4506	187	3	19.5	0.1	14.4	0.1	18.7	1	0.0	2	0.0	3	0.0	YES
4512	188	4	19.5	0.1	14.4	0.1	18.9	1	0.0	2	0.0	3	0.0	YES
4518	188	1	19.5	0.1	14.4	0.1	18.8	1	0.0	2	0.0	3	0.0	YES
4524	188	2	19.5	0.1	14.4	0.1	18.9	1	0.0	2	0.0	3	0.0	YES
4530	188	3	19.5	0.1	14.4	0.1	19.0	1	0.0	2	0.0	3	0.0	YES
4536	189	4	19.5	0.1	14.4	0.1	19.1	1	0.0	2	0.0	3	0.0	YES
4542	189	1	19.5	0.1	14.4	0.1	19.0	1	0.0	2	0.0	3	0.0	YES
4548	189	2	19.5	0.1	14.4	0.1	19.1	1	0.0	2	0.0	3	0.0	YES
4554	189	3	19.5	0.1	14.4	0.1	19.3	1	0.0	2	0.0	3	0.0	YES
4560	190	4	19.5	0.1	14.4	0.1	19.3	1	0.0	2	0.0	3	0.0	YES
4566	190	1	19.5	0.1	14.4	0.1	19.3	1	0.0	2	0.0	3	0.0	YES
4572	190	2	19.5	0.1	14.4	0.1	19.3	1	0.0	2	0.0	3	0.0	YES
4578	190	3	19.5	0.1	14.4	0.1	19.5	1	0.0	2	0.0	3	0.0	YES
4584	191	4	19.5	0.1	14.4	0.1	19.5	1	0.0	2	0.0	3	0.0	YES
4590	191	1	19.5	0.1	14.4	0.1	19.3	1	0.0	2	0.0	3	0.0	YES
4596	191	2	19.5	0.1	14.4	0.1	19.3	1	0.0	2	0.0	3	0.0	YES
4602	191	3	19.5	0.1	14.4	0.1	19.4	1	0.0	2	0.0	3	0.0	YES
4608	192	4	19.5	0.1	14.4	0.1	19.5	1	0.0	2	0.0	3	0.0	YES
4614	192	1	19.5	0.1	14.4	0.1	19.3	1	0.0	2	0.0	3	0.0	YES
4620	192	2	19.5	0.1	14.4	0.1	19.3	1	0.0	2	0.0	3	0.0	YES
4626	192	3	19.5	0.1	14.4	0.1	19.4	1	0.0	2	0.0	3	0.0	YES
4632	193	4	19.4	0.1	14.4	0.1	19.3	1	0.0	2	0.0	3	0.0	YES
4638	193	1	19.4	0.1	14.4	0.1	19.1	1	0.0	2	0.0	3	0.0	YES
4644	193	2	19.4	0.1	14.4	0.1	19.1	1	0.0	2	0.0	3	0.0	YES
4650	193	3	19.4	0.1	14.4	0.1	19.2	1	0.0	2	0.0	3	0.0	YES

1
STATUS AT END OF SIMULATION HOUR 4656 THIS IS JULIAN DAY 194, CALENDAR DAY 13JUL
93

AVERAGE METEOROLOGICAL QUANTITIES FOR THIS COMPUTATION PERIOD:

CLOUD COVER 0.12 AIR PRESSURE,MB 1015.27 WIND SPEED,KPH 18.32 DRYBULB TEMP,DEGC, 26.8 DEWPOINT TEMP,DEGC, 13
.3
S/W RAD,KC/M2/HR 22.6 L/W RAD,KC/M2/HR 321.3 VAPOR PRESSURE,MB 15.6 SAT.VAP.PRES,MB 33.7 EVAP.RATE,M/HR 0.00
06
TOTAL EVAP., M. 0.
68
SURFACE ELEVATION,M: 19.4 EL.ABOVE MSL,M. 43.8

INFLOWING QUANTITIES FOR THIS COMPUTATION INTERVAL:

TRIBUTARY	INFLOW M3/SEC	TEMPERATURE DEG C	TOT.DISS.SOLIDS G/M3	SUSPENDED SOLIDS G/M3
1	0.13	14.4	21.6	0.9

OUTFLOWING QUANTITIES FOR THIS COMPUTATION INTERVAL:

PORT	LAYER	OUTFLOW,M3/SEC
1	19	0.01
2	16	0.01
3	14	0.01
4	11	0.01
5	8	0.01
6	6	0.01
7	4	0.01
8	1	0.01

TOTAL OUTFLOW,M3/SEC 0.10 TEMPERATURE,DEG C 19.1 TOT.DISS.SOLIDS,G/M3 187.4 SUSP.SOLIDS,G/M3 0.0

	0 5 10 15 20 25 30 35	TEMP. DEG.C	TOT.DISS. SOLIDS G/M3	SUSPENDED SOLIDS G/M3	S/W RADIATION KC/M2/HR	LAYER INFLOW M3/SEC	LAYER OUTFLOW M3/SEC	DIFFUSION COEF. M2/HR	UPPER ELEVATION M
19	*	25.9	217.3	0.0	9.40	0.00	0.01	0.5398	19.4
18	*	25.9	217.3	0.0	5.94	0.00	0.01	0.5398	18.1
17	*	25.9	217.3	0.0	3.79	0.00	0.01	0.5398	17.2
16	*	25.9	217.3	0.0	2.43	0.00	0.01	0.0634	16.3
15	*	25.9	217.3	0.0	1.47	0.00	0.00	0.0243	15.4
14	*	25.9	217.3	0.0	0.86	0.00	0.01	0.0253	14.4
13	*	25.9	217.3	0.0	0.54	0.00	0.01	0.0081	13.3
12	*	25.9	217.3	0.0	0.33	0.00	0.00	0.0005	12.4
11	*	24.2	212.5	0.0	0.22	0.00	0.01	0.0005	11.4
10	*	21.5	195.7	0.0	0.13	0.00	0.00	0.0005	10.5
9	*	16.2	108.8	0.0	0.08	0.00	0.00	0.0005	9.5
8	*	14.7	67.2	0.0	0.05	0.00	0.00	0.0068	8.7
7	*	14.6	61.0	0.1	0.03	0.00	0.00	0.0005	7.7
6	*	13.8	128.4	0.1	0.02	0.13	0.01	0.0005	6.4
5	*	12.7	180.3	0.1	0.01	0.00	0.00	0.0005	5.5
4	*	11.9	201.7	0.1	0.01	0.00	0.01	0.0023	4.1
3	*	11.7	203.9	0.1	0.00	0.00	0.01	0.0005	3.2
2	*	10.0	220.5	0.1	0.00	0.00	0.01	0.0017	2.4
1	*	9.8	223.0	0.2	0.00	0.00	0.00	0.0000	1.2

1

DAILY INFORMATION

HOUR	DAY	SIM.INT.	ELEV M	INFLOW M3/S	TEMP C	OUTFLOW M3/S	TEMP C	IF REGULATION TARGET T. C.	PORT	FLOW M3/S	PORT	FLOW M3/S	PORT	FLOW M3/S	MORE?
4662	194	1	19.4	0.1	14.4	0.1	18.9		1	0.0	2	0.0	3	0.0	YES

4668	194	2	19.4	0.1	14.4	0.1	18.9	1	0.0	2	0.0	3	0.0	YES
4674	194	3	19.4	0.1	14.4	0.1	19.0	1	0.0	2	0.0	3	0.0	YES
4680	195	4	19.4	0.1	14.4	0.1	19.1	1	0.0	2	0.0	3	0.0	YES
4686	195	1	19.4	0.1	14.4	0.1	18.9	1	0.0	2	0.0	3	0.0	YES
4692	195	2	19.4	0.1	14.4	0.1	18.9	1	0.0	2	0.0	3	0.0	YES
4698	195	3	19.4	0.1	14.4	0.1	19.0	1	0.0	2	0.0	3	0.0	YES
4704	196	4	19.4	0.1	14.4	0.1	18.9	1	0.0	2	0.0	3	0.0	YES
4710	196	1	19.4	0.1	14.4	0.1	18.6	1	0.0	2	0.0	3	0.0	YES
4716	196	2	19.4	0.1	14.4	0.1	18.5	1	0.0	2	0.0	3	0.0	YES
4722	196	3	19.4	0.1	14.4	0.1	18.6	1	0.0	2	0.0	3	0.0	YES
4728	197	4	19.4	0.1	14.4	0.1	18.4	1	0.0	2	0.0	3	0.0	YES
4734	197	1	19.4	0.1	14.4	0.1	18.2	1	0.0	2	0.0	3	0.0	YES
4740	197	2	19.4	0.1	14.4	0.1	18.1	1	0.0	2	0.0	3	0.0	YES
4746	197	3	19.4	0.1	14.4	0.1	18.3	1	0.0	2	0.0	3	0.0	YES
4752	198	4	19.4	0.1	14.4	0.1	18.2	1	0.0	2	0.0	3	0.0	YES
4758	198	1	19.4	0.1	14.4	0.1	17.9	1	0.0	2	0.0	3	0.0	YES
4764	198	2	19.4	0.1	14.4	0.1	17.9	1	0.0	2	0.0	3	0.0	YES
4770	198	3	19.4	0.1	14.4	0.1	18.0	1	0.0	2	0.0	3	0.0	YES
4776	199	4	19.4	0.1	14.4	0.1	18.0	1	0.0	2	0.0	3	0.0	YES
4782	199	1	19.4	0.1	14.4	0.1	17.8	1	0.0	2	0.0	3	0.0	YES
4788	199	2	19.4	0.1	14.4	0.1	17.8	1	0.0	2	0.0	3	0.0	YES
4794	199	3	19.4	0.1	14.4	0.1	17.9	1	0.0	2	0.0	3	0.0	YES
4800	200	4	19.4	0.1	14.4	0.1	18.0	1	0.0	2	0.0	3	0.0	YES
4806	200	1	19.4	0.1	14.4	0.1	17.9	1	0.0	2	0.0	3	0.0	YES
4812	200	2	19.4	0.1	14.4	0.1	17.9	1	0.0	2	0.0	3	0.0	YES
4818	200	3	19.4	0.1	14.4	0.1	18.1	1	0.0	2	0.0	3	0.0	YES
4824	201	4	19.4	0.1	14.4	0.1	18.1	1	0.0	2	0.0	3	0.0	YES
4830	201	1	19.4	0.1	14.4	0.1	18.0	1	0.0	2	0.0	3	0.0	YES
4836	201	2	19.4	0.1	14.4	0.1	17.9	1	0.0	2	0.0	3	0.0	YES
4842	201	3	19.4	0.1	14.4	0.1	18.1	1	0.0	2	0.0	3	0.0	YES
4848	202	4	19.4	0.1	14.4	0.1	18.0	1	0.0	2	0.0	3	0.0	YES
4854	202	1	19.3	0.1	14.4	0.1	17.8	1	0.0	2	0.0	3	0.0	YES
4860	202	2	19.3	0.1	14.4	0.1	17.7	1	0.0	2	0.0	3	0.0	YES
4866	202	3	19.3	0.1	14.4	0.1	17.8	1	0.0	2	0.0	3	0.0	YES
4872	203	4	19.3	0.1	14.4	0.1	17.8	1	0.0	2	0.0	3	0.0	YES
4878	203	1	19.3	0.1	14.4	0.1	17.6	1	0.0	2	0.0	3	0.0	YES
4884	203	2	19.3	0.1	14.4	0.1	17.6	1	0.0	2	0.0	3	0.0	YES
4890	203	3	19.3	0.1	14.4	0.1	17.8	1	0.0	2	0.0	3	0.0	YES
4896	204	4	19.3	0.1	14.4	0.1	17.8	1	0.0	2	0.0	3	0.0	YES
4902	204	1	19.3	0.1	14.4	0.1	17.7	1	0.0	2	0.0	3	0.0	YES
4908	204	2	19.3	0.1	14.4	0.1	17.7	1	0.0	2	0.0	3	0.0	YES
4914	204	3	19.3	0.1	14.4	0.1	17.8	1	0.0	2	0.0	3	0.0	YES
4920	205	4	19.3	0.1	14.4	0.1	17.9	1	0.0	2	0.0	3	0.0	YES
4926	205	1	19.3	0.1	14.4	0.1	17.8	1	0.0	2	0.0	3	0.0	YES
4932	205	2	19.3	0.1	14.4	0.1	18.0	1	0.0	2	0.0	3	0.0	YES
4938	205	3	19.3	0.1	14.4	0.1	18.1	1	0.0	2	0.0	3	0.0	YES
4944	206	4	19.3	0.1	14.4	0.1	18.1	1	0.0	2	0.0	3	0.0	YES
4950	206	1	19.3	0.1	14.4	0.1	17.9	1	0.0	2	0.0	3	0.0	YES
4956	206	2	19.3	0.1	14.4	0.1	17.9	1	0.0	2	0.0	3	0.0	YES
4962	206	3	19.3	0.1	14.4	0.1	18.0	1	0.0	2	0.0	3	0.0	YES
4968	207	4	19.3	0.1	14.4	0.1	18.0	1	0.0	2	0.0	3	0.0	YES
4974	207	1	19.3	0.1	14.4	0.1	17.8	1	0.0	2	0.0	3	0.0	YES

4980	207	2	19.3	0.1	14.4	0.1	17.8	1	0.0	2	0.0	3	0.0	YES
4986	207	3	19.3	0.1	14.4	0.1	18.0	1	0.0	2	0.0	3	0.0	YES
4992	208	4	19.3	0.1	14.4	0.1	18.0	1	0.0	2	0.0	3	0.0	YES
4998	208	1	19.3	0.1	14.4	0.1	18.0	1	0.0	2	0.0	3	0.0	YES
5004	208	2	19.3	0.1	14.4	0.1	18.1	1	0.0	2	0.0	3	0.0	YES
5010	208	3	19.3	0.1	14.4	0.1	18.2	1	0.0	2	0.0	3	0.0	YES
5016	209	4	19.3	0.1	14.4	0.1	18.3	1	0.0	2	0.0	3	0.0	YES
5022	209	1	19.3	0.1	14.4	0.1	18.3	1	0.0	2	0.0	3	0.0	YES
5028	209	2	19.3	0.1	14.4	0.1	18.3	1	0.0	2	0.0	3	0.0	YES
5034	209	3	19.3	0.1	14.4	0.1	18.5	1	0.0	2	0.0	3	0.0	YES
5040	210	4	19.3	0.1	14.4	0.1	18.4	1	0.0	2	0.0	3	0.0	YES
5046	210	1	19.3	0.1	14.4	0.1	18.4	1	0.0	2	0.0	3	0.0	YES
5052	210	2	19.3	0.1	14.4	0.1	18.6	1	0.0	2	0.0	3	0.0	YES
5058	210	3	19.3	0.1	14.4	0.1	18.7	1	0.0	2	0.0	3	0.0	YES
5064	211	4	19.3	0.1	14.4	0.1	18.6	1	0.0	2	0.0	3	0.0	YES
5070	211	1	19.3	0.1	14.4	0.1	18.7	1	0.0	2	0.0	3	0.0	YES
5076	211	2	19.3	0.1	14.4	0.1	18.7	1	0.0	2	0.0	3	0.0	YES
5082	211	3	19.3	0.1	14.4	0.1	18.8	1	0.0	2	0.0	3	0.0	YES
5088	212	4	19.3	0.1	14.4	0.1	18.8	1	0.0	2	0.0	3	0.0	YES
5094	212	1	19.3	0.1	14.4	0.1	18.8	1	0.0	2	0.0	3	0.0	YES
5100	212	2	19.3	0.1	14.4	0.1	18.8	1	0.0	2	0.0	3	0.0	YES
5106	212	3	19.3	0.1	14.4	0.1	18.9	1	0.0	2	0.0	3	0.0	YES
5112	213	4	19.3	0.1	14.4	0.1	18.8	1	0.0	2	0.0	3	0.0	YES
5118	213	1	19.3	0.1	14.4	0.1	18.8	1	0.0	2	0.0	3	0.0	YES
5124	213	2	19.3	0.1	14.4	0.1	18.9	1	0.0	2	0.0	3	0.0	YES
5130	213	3	19.3	0.1	14.4	0.1	19.0	1	0.0	2	0.0	3	0.0	YES
5136	214	4	19.3	0.1	14.4	0.1	19.1	1	0.0	2	0.0	3	0.0	YES
5142	214	1	19.3	0.1	14.4	0.1	19.1	1	0.0	2	0.0	3	0.0	YES
5148	214	2	19.3	0.1	14.4	0.1	19.1	1	0.0	2	0.0	3	0.0	YES
5154	214	3	19.3	0.1	14.4	0.1	19.1	1	0.0	2	0.0	3	0.0	YES

1
STATUS AT END OF SIMULATION HOUR 5160 THIS IS JULIAN DAY 215, CALENDAR DAY 3AUG
93

AVERAGE METEOROLOGICAL QUANTITIES FOR THIS COMPUTATION PERIOD:

CLOUD COVER 0.32 AIR PRESSURE,MB 1013.40 WIND SPEED,KPH 14.73 DRYBULB TEMP,DEGC, 25.8 DEWPOINT TEMP,DEGC, 20
.1
S/W RAD,KC/M2/HR 14.1 L/W RAD,KC/M2/HR 318.6 VAPOR PRESSURE,MB 23.4 SAT.VAP.PRES,MB 34.0 EVAP.RATE,M/HR 0.00
03
TOTAL EVAP., M. 0.
90
SURFACE ELEVATION,M: 19.3 EL.ABOVE MSL,M. 43.6

INFLOWING QUANTITIES FOR THIS COMPUTATION INTERVAL:

TRIBUTARY	INFLOW M3/SEC	TEMPERATURE DEG C	TOT.DISS.SOLIDS G/M3	SUSPENDED SOLIDS G/M3
1	0.13	14.4	18.9	0.8

OUTFLOWING QUANTITIES FOR THIS COMPUTATION INTERVAL:

PORT	LAYER	OUTFLOW,M3/SEC
1	20	0.01
2	17	0.01
3	14	0.01
4	12	0.01
5	8	0.01
6	6	0.01
7	4	0.01
8	2	0.01

TOTAL OUTFLOW,M3/SEC 0.10 TEMPERATURE,DEG C 19.3 TOT.DISS.SOLIDS,G/M3 170.0 SUSP.SOLIDS,G/M3 0.0

	0 5 10 15 20 25 30 35	TEMP. DEG.C	TOT.DISS. SOLIDS G/M3	SUSPENDED SOLIDS G/M3	S/W RADIATION KC/M2/HR	LAYER INFLOW M3/SEC	LAYER OUTFLOW M3/SEC	DIFFUSION COEF. M2/HR	UPPER ELEVATION M
20	D	26.0	223.7	0.0	6.59	0.00	0.00	0.2254	19.3
19	D	26.0	223.7	0.0	4.22	0.00	0.00	0.0151	18.2
18	*	26.0	223.7	0.0	2.73	0.00	0.01	0.0044	17.3
17	D*	26.0	223.7	0.0	1.78	0.00	0.01	0.0038	16.4
16	D*	26.0	223.7	0.0	1.11	0.00	0.00	0.0042	15.6
15	D*	26.0	223.7	0.0	0.67	0.00	0.01	0.0047	14.6
14	D *	26.0	223.7	0.0	0.43	0.00	0.01	0.0005	13.6
13	D*	23.4	221.8	0.0	0.28	0.00	0.00	0.0005	12.7
12	D *	23.1	221.0	0.0	0.19	0.00	0.00	0.0005	11.8
11	D *	22.2	211.8	0.0	0.12	0.00	0.01	0.0005	11.1
10	*	18.0	126.9	0.0	0.09	0.00	0.00	0.0005	10.2
9	D *	15.8	83.5	0.0	0.06	0.00	0.00	0.0005	9.5
8	D *	15.1	70.9	0.0	0.04	0.00	0.01	0.0005	8.8
7	D *	14.5	43.7	0.0	0.02	0.07	0.01	0.0048	7.9
6	D *	14.5	43.5	0.1	0.01	0.06	0.01	0.0005	6.9
5	D *	14.3	67.4	0.1	0.01	0.00	0.00	0.0005	5.9
4	D *	12.9	162.8	0.1	0.00	0.00	0.01	0.0005	4.8
3	D *	12.1	193.3	0.1	0.00	0.00	0.00	0.0005	3.2
2	D *	11.9	199.5	0.1	0.00	0.00	0.01	0.0005	1.9
1	D*	10.7	213.5	0.2	0.00	0.00	0.00	0.0000	1.1

1

DAILY INFORMATION

HOUR	DAY	SIM.INT.	ELEV M	INFLOW M3/S	TEMP C	OUTFLOW M3/S	TEMP C	IF REGULATION TARGET T. C.	PORT	FLOW M3/S	PORT	FLOW M3/S	PORT	FLOW M3/S	MORE?
5160	215	4	19.3	0.1	14.4	0.1	19.3		1	0.0	2	0.0	3	0.0	YES

5166	215	1	19.3	0.1	14.4	0.1	19.1	1	0.0	2	0.0	3	0.0	YES
5172	215	2	19.3	0.1	14.4	0.1	19.2	1	0.0	2	0.0	3	0.0	YES
5178	215	3	19.3	0.1	14.4	0.1	19.2	1	0.0	2	0.0	3	0.0	YES
5184	216	4	19.3	0.1	14.4	0.1	19.2	1	0.0	2	0.0	3	0.0	YES
5190	216	1	19.3	0.1	14.4	0.1	19.0	1	0.0	2	0.0	3	0.0	YES
5196	216	2	19.3	0.1	14.4	0.1	19.0	1	0.0	2	0.0	3	0.0	YES
5202	216	3	19.3	0.1	14.4	0.1	19.0	1	0.0	2	0.0	3	0.0	YES
5208	217	4	19.3	0.1	14.4	0.1	19.0	1	0.0	2	0.0	3	0.0	YES
5214	217	1	19.3	0.1	14.4	0.1	18.9	1	0.0	2	0.0	3	0.0	YES
5220	217	2	19.3	0.1	14.4	0.1	18.8	1	0.0	2	0.0	3	0.0	YES
5226	217	3	19.3	0.1	14.4	0.1	18.9	1	0.0	2	0.0	3	0.0	YES
5232	218	4	19.3	0.1	14.4	0.1	18.9	1	0.0	2	0.0	3	0.0	YES
5238	218	1	19.3	0.1	14.4	0.1	18.7	1	0.0	2	0.0	3	0.0	YES
5244	218	2	19.3	0.1	14.4	0.1	18.7	1	0.0	2	0.0	3	0.0	YES
5250	218	3	19.3	0.1	14.4	0.1	18.7	1	0.0	2	0.0	3	0.0	YES
5256	219	4	19.3	0.1	14.4	0.1	18.8	1	0.0	2	0.0	3	0.0	YES
5262	219	1	19.3	0.1	14.4	0.1	18.6	1	0.0	2	0.0	3	0.0	YES
5268	219	2	19.3	0.1	14.4	0.1	18.6	1	0.0	2	0.0	3	0.0	YES
5274	219	3	19.3	0.1	14.4	0.1	18.7	1	0.0	2	0.0	3	0.0	YES
5280	220	4	19.3	0.1	14.4	0.1	18.5	1	0.0	2	0.0	3	0.0	YES
5286	220	1	19.3	0.1	14.4	0.1	18.4	1	0.0	2	0.0	3	0.0	YES
5292	220	2	19.3	0.1	14.4	0.1	18.4	1	0.0	2	0.0	3	0.0	YES
5298	220	3	19.3	0.1	14.4	0.1	18.6	1	0.0	2	0.0	3	0.0	YES
5304	221	4	19.3	0.1	14.4	0.1	18.6	1	0.0	2	0.0	3	0.0	YES
5310	221	1	19.3	0.1	14.4	0.1	18.5	1	0.0	2	0.0	3	0.0	YES
5316	221	2	19.3	0.1	14.4	0.1	18.5	1	0.0	2	0.0	3	0.0	YES
5322	221	3	19.3	0.1	14.4	0.1	18.6	1	0.0	2	0.0	3	0.0	YES
5328	222	4	19.2	0.1	14.4	0.1	18.6	1	0.0	2	0.0	3	0.0	YES
5334	222	1	19.2	0.1	14.4	0.1	18.5	1	0.0	2	0.0	3	0.0	YES
5340	222	2	19.2	0.1	14.4	0.1	18.5	1	0.0	2	0.0	3	0.0	YES
5346	222	3	19.2	0.1	14.4	0.1	18.6	1	0.0	2	0.0	3	0.0	YES
5352	223	4	19.2	0.1	14.4	0.1	18.6	1	0.0	2	0.0	3	0.0	YES
5358	223	1	19.2	0.1	14.4	0.1	18.5	1	0.0	2	0.0	3	0.0	YES
5364	223	2	19.2	0.1	14.4	0.1	18.5	1	0.0	2	0.0	3	0.0	YES
5370	223	3	19.2	0.1	14.4	0.1	18.6	1	0.0	2	0.0	3	0.0	YES

1

STATUS AT END OF SIMULATION HOUR 5376 THIS IS JULIAN DAY 224, CALENDAR DAY 12AUG
93

AVERAGE METEOROLOGICAL QUANTITIES FOR THIS COMPUTATION PERIOD:

CLOUD COVER 0.34 AIR PRESSURE,MB 1016.65 WIND SPEED,KPH 14.05 DRYBULB TEMP,DEGC, 20.6 DEWPOINT TEMP,DEGC, 16
.6
S/W RAD,KC/M2/HR 9.8 L/W RAD,KC/M2/HR 290.2 VAPOR PRESSURE,MB 18.9 SAT.VAP.PRES,MB 29.9 EVAP.RATE,M/HR 0.00
03
TOTAL EVAP., M. 0.
99
SURFACE ELEVATION,M: 19.2 EL.ABOVE MSL,M. 43.6

INFLOWING QUANTITIES FOR THIS COMPUTATION INTERVAL:

TRIBUTARY	INFLOW	TEMPERATURE	TOT.DISS.SOLIDS	SUSPENDED SOLIDS

		M3/SEC	DEG C	G/M3	G/M3
	1	0.13	14.4	17.8	0.8

OUTFLOWING QUANTITIES FOR THIS COMPUTATION INTERVAL:

PORT	LAYER	OUTFLOW,M3/SEC
1	21	0.01
2	18	0.01
3	15	0.01
4	12	0.01
5	9	0.01
6	7	0.01
7	5	0.01
8	3	0.01

TOTAL OUTFLOW,M3/SEC 0.10 TEMPERATURE,DEG C 18.6 TOT.DISS.SOLIDS,G/M3 167.6 SUSP.SOLIDS,G/M3 0.0

```
   0    5    10   15   20   25   30   35
21                         *
20                         *
19                         *
18                         *
17                         *
16                         *
15                         *
14                         *
13                         *
12                       *
11                    *
10                 *
 9                *
 8                *
 7                *
 6               *
 5              *
 4             *
 3             *
 2             *
 1            *
1
```

	TEMP. DEG.C	TOT.DISS. SOLIDS G/M3	SUSPENDED SOLIDS G/M3	S/W RADIATION KC/M2/HR	LAYER INFLOW M3/SEC	LAYER OUTFLOW M3/SEC	DIFFUSION COEF. M2/HR	UPPER ELEVATION M
21	23.9	227.1	0.0	4.80	0.00	0.00	0.1896	19.2
20	23.9	227.1	0.0	3.09	0.00	0.00	0.1896	18.2
19	23.9	227.1	0.0	2.01	0.00	0.01	0.0204	17.3
18	23.9	227.1	0.0	1.32	0.00	0.00	0.0071	16.5
17	23.9	227.1	0.0	0.83	0.00	0.00	0.0031	15.7
16	23.9	227.1	0.0	0.51	0.00	0.00	0.0049	14.7
15	23.9	227.1	0.0	0.33	0.00	0.00	0.0065	13.7
14	23.9	227.1	0.0	0.21	0.00	0.00	0.0091	12.9
13	23.9	227.1	0.0	0.15	0.00	0.00	0.0005	12.0
12	22.3	202.9	0.0	0.10	0.00	0.01	0.0005	11.3
11	18.7	134.1	0.0	0.07	0.00	0.00	0.0005	10.5
10	16.4	90.6	0.0	0.05	0.00	0.00	0.0005	9.8
9	15.4	70.2	0.0	0.03	0.00	0.01	0.0005	9.2
8	14.6	42.0	0.0	0.02	0.00	0.00	0.0015	8.4
7	14.5	36.1	0.0	0.01	0.00	0.01	0.0005	7.3
6	14.3	61.5	0.1	0.00	0.13	0.00	0.0005	5.8
5	13.0	157.4	0.1	0.00	0.00	0.01	0.0005	4.4
4	12.2	190.3	0.1	0.00	0.00	0.00	0.0012	2.8
3	12.2	191.7	0.1	0.00	0.00	0.01	0.0005	1.9
2	11.8	198.8	0.1	0.00	0.00	0.00	0.0005	1.0
1	11.2	207.8	0.2	0.00	0.00	0.00	0.0000	0.6

DAILY INFORMATION

HOUR	DAY	SIM.INT.	ELEV M	INFLOW M3/S	TEMP C	OUTFLOW M3/S	TEMP C	IF REGULATION TARGET T. C.	PORT	FLOW M3/S	PORT	FLOW M3/S	PORT	FLOW M3/S	MORE?
5382	224	1	19.2	0.1	14.4	0.1	18.5		1	0.0	2	0.0	3	0.0	YES
5388	224	2	19.2	0.1	14.4	0.1	18.5		1	0.0	2	0.0	3	0.0	YES
5394	224	3	19.2	0.1	14.4	0.1	18.7		1	0.0	2	0.0	3	0.0	YES
5400	225	4	19.2	0.1	14.4	0.1	18.7		1	0.0	2	0.0	3	0.0	YES
5406	225	1	19.2	0.1	14.4	0.1	18.6		1	0.0	2	0.0	3	0.0	YES
5412	225	2	19.2	0.1	14.4	0.1	18.6		1	0.0	2	0.0	3	0.0	YES
5418	225	3	19.2	0.1	14.4	0.1	18.7		1	0.0	2	0.0	3	0.0	YES
5424	226	4	19.2	0.1	14.4	0.1	18.8		1	0.0	2	0.0	3	0.0	YES
5430	226	1	19.2	0.1	14.4	0.1	18.7		1	0.0	2	0.0	3	0.0	YES
5436	226	2	19.2	0.1	14.4	0.1	18.7		1	0.0	2	0.0	3	0.0	YES
5442	226	3	19.2	0.1	14.4	0.1	18.8		1	0.0	2	0.0	3	0.0	YES
5448	227	4	19.2	0.1	14.4	0.1	18.8		1	0.0	2	0.0	3	0.0	YES
5454	227	1	19.2	0.1	14.4	0.1	18.7		1	0.0	2	0.0	3	0.0	YES
5460	227	2	19.2	0.1	14.4	0.1	18.7		1	0.0	2	0.0	3	0.0	YES
5466	227	3	19.2	0.1	14.4	0.1	18.8		1	0.0	2	0.0	3	0.0	YES
5472	228	4	19.2	0.1	14.4	0.1	18.8		1	0.0	2	0.0	3	0.0	YES
5478	228	1	19.2	0.1	14.4	0.1	18.8		1	0.0	2	0.0	3	0.0	YES
5484	228	2	19.2	0.1	14.4	0.1	18.8		1	0.0	2	0.0	3	0.0	YES
5490	228	3	19.2	0.1	14.4	0.1	18.8		1	0.0	2	0.0	3	0.0	YES
5496	229	4	19.2	0.1	14.4	0.1	18.8		1	0.0	2	0.0	3	0.0	YES
5502	229	1	19.2	0.1	14.4	0.1	18.7		1	0.0	2	0.0	3	0.0	YES
5508	229	2	19.2	0.1	14.4	0.1	18.7		1	0.0	2	0.0	3	0.0	YES
5514	229	3	19.2	0.1	14.4	0.1	18.8		1	0.0	2	0.0	3	0.0	YES
5520	230	4	19.2	0.1	14.4	0.1	18.8		1	0.0	2	0.0	3	0.0	YES
5526	230	1	19.2	0.1	14.4	0.1	18.7		1	0.0	2	0.0	3	0.0	YES
5532	230	2	19.2	0.1	14.4	0.1	18.7		1	0.0	2	0.0	3	0.0	YES
5538	230	3	19.2	0.1	14.4	0.1	18.8		1	0.0	2	0.0	3	0.0	YES
5544	231	4	19.2	0.1	14.4	0.1	18.8		1	0.0	2	0.0	3	0.0	YES
5550	231	1	19.2	0.1	14.4	0.1	18.7		1	0.0	2	0.0	3	0.0	YES
5556	231	2	19.2	0.1	14.4	0.1	18.7		1	0.0	2	0.0	3	0.0	YES
5562	231	3	19.2	0.1	14.4	0.1	18.8		1	0.0	2	0.0	3	0.0	YES
5568	232	4	19.2	0.1	14.4	0.1	18.8		1	0.0	2	0.0	3	0.0	YES
5574	232	1	19.2	0.1	14.4	0.1	18.6		1	0.0	2	0.0	3	0.0	YES
5580	232	2	19.2	0.1	14.4	0.1	18.6		1	0.0	2	0.0	3	0.0	YES
5586	232	3	19.2	0.1	14.4	0.1	18.6		1	0.0	2	0.0	3	0.0	YES
5592	233	4	19.2	0.1	14.4	0.1	18.6		1	0.0	2	0.0	3	0.0	YES
5598	233	1	19.2	0.1	14.4	0.1	18.5		1	0.0	2	0.0	3	0.0	YES
5604	233	2	19.2	0.1	14.4	0.1	18.4		1	0.0	2	0.0	3	0.0	YES
5610	233	3	19.2	0.1	14.4	0.1	18.5		1	0.0	2	0.0	3	0.0	YES
5616	234	4	19.2	0.1	14.4	0.1	18.6		1	0.0	2	0.0	3	0.0	YES
5622	234	1	19.2	0.1	14.4	0.1	18.4		1	0.0	2	0.0	3	0.0	YES
5628	234	2	19.2	0.1	14.4	0.1	18.4		1	0.0	2	0.0	3	0.0	YES
5634	234	3	19.2	0.1	14.4	0.1	18.7		1	0.0	2	0.0	3	0.0	YES
5640	235	4	19.2	0.1	14.4	0.1	18.7		1	0.0	2	0.0	3	0.0	YES
5646	235	1	19.2	0.1	14.4	0.1	18.5		1	0.0	2	0.0	3	0.0	YES
5652	235	2	19.2	0.1	14.4	0.1	18.6		1	0.0	2	0.0	3	0.0	YES
5658	235	3	19.2	0.1	14.4	0.1	18.8		1	0.0	2	0.0	3	0.0	YES

5664	236	4	19.2	0.1	14.4	0.1	18.9	1	0.0	2	0.0	3	0.0	YES
5670	236	1	19.2	0.1	14.4	0.1	18.7	1	0.0	2	0.0	3	0.0	YES
5676	236	2	19.2	0.1	14.4	0.1	18.8	1	0.0	2	0.0	3	0.0	YES
5682	236	3	19.2	0.1	14.4	0.1	18.9	1	0.0	2	0.0	3	0.0	YES
5688	237	4	19.2	0.1	14.4	0.1	19.0	1	0.0	2	0.0	3	0.0	YES
5694	237	1	19.2	0.1	14.4	0.1	18.9	1	0.0	2	0.0	3	0.0	YES
5700	237	2	19.2	0.1	14.4	0.1	18.9	1	0.0	2	0.0	3	0.0	YES
5706	237	3	19.2	0.1	14.4	0.1	19.2	1	0.0	2	0.0	3	0.0	YES
5712	238	4	19.2	0.1	14.4	0.1	19.2	1	0.0	2	0.0	3	0.0	YES
5718	238	1	19.2	0.1	14.4	0.1	19.2	1	0.0	2	0.0	3	0.0	YES
5724	238	2	19.2	0.1	14.4	0.1	19.3	1	0.0	2	0.0	3	0.0	YES
5730	238	3	19.2	0.1	14.4	0.1	19.5	1	0.0	2	0.0	3	0.0	YES
5736	239	4	19.2	0.1	14.4	0.1	19.5	1	0.0	2	0.0	3	0.0	YES
5742	239	1	19.2	0.1	14.4	0.1	19.5	1	0.0	2	0.0	3	0.0	YES
5748	239	2	19.2	0.1	14.4	0.1	19.5	1	0.0	2	0.0	3	0.0	YES
5754	239	3	19.2	0.1	14.4	0.1	19.3	1	0.0	2	0.0	3	0.0	YES
5760	240	4	19.2	0.1	14.4	0.1	19.3	1	0.0	2	0.0	3	0.0	YES
5766	240	1	19.2	0.1	14.4	0.1	19.5	1	0.0	2	0.0	3	0.0	YES
5772	240	2	19.2	0.1	14.4	0.1	19.4	1	0.0	2	0.0	3	0.0	YES
5778	240	3	19.2	0.1	14.4	0.1	19.2	1	0.0	2	0.0	3	0.0	YES
5784	241	4	19.2	0.1	14.4	0.1	19.2	1	0.0	2	0.0	3	0.0	YES
5790	241	1	19.2	0.1	14.4	0.1	19.2	1	0.0	2	0.0	3	0.0	YES
5796	241	2	19.2	0.1	14.4	0.1	19.2	1	0.0	2	0.0	3	0.0	YES
5802	241	3	19.2	0.1	14.4	0.1	19.3	1	0.0	2	0.0	3	0.0	YES
5808	242	4	19.2	0.1	14.4	0.1	19.1	1	0.0	2	0.0	3	0.0	YES
5814	242	1	19.2	0.1	14.4	0.1	19.3	1	0.0	2	0.0	3	0.0	YES
5820	242	2	19.2	0.1	14.4	0.1	19.3	1	0.0	2	0.0	3	0.0	YES
5826	242	3	19.2	0.1	14.4	0.1	19.1	1	0.0	2	0.0	3	0.0	YES
5832	243	4	19.2	0.1	14.4	0.1	19.1	1	0.0	2	0.0	3	0.0	YES
5838	243	1	19.2	0.1	14.4	0.1	19.2	1	0.0	2	0.0	3	0.0	YES
5844	243	2	19.2	0.1	14.4	0.1	19.2	1	0.0	2	0.0	3	0.0	YES
5850	243	3	19.2	0.1	14.4	0.1	19.0	1	0.0	2	0.0	3	0.0	YES
5856	244	4	19.2	0.1	14.4	0.1	19.0	1	0.0	2	0.0	3	0.0	YES
5862	244	1	19.2	0.1	14.4	0.1	19.1	1	0.0	2	0.0	3	0.0	YES
5868	244	2	19.2	0.1	14.4	0.1	19.0	1	0.0	2	0.0	3	0.0	YES
5874	244	3	19.2	0.1	14.4	0.1	18.9	1	0.0	2	0.0	3	0.0	YES
5880	245	4	19.2	0.1	14.4	0.1	18.9	1	0.0	2	0.0	3	0.0	YES
5886	245	1	19.2	0.1	14.4	0.1	19.0	1	0.0	2	0.0	3	0.0	YES
5892	245	2	19.2	0.1	14.4	0.1	19.1	1	0.0	2	0.0	3	0.0	YES
5898	245	3	19.2	0.1	14.4	0.1	19.0	1	0.0	2	0.0	3	0.0	YES
5904	246	4	19.2	0.1	14.4	0.1	19.0	1	0.0	2	0.0	3	0.0	YES
5910	246	1	19.2	0.1	14.4	0.1	19.2	1	0.0	2	0.0	3	0.0	YES
5916	246	2	19.2	0.1	14.4	0.1	19.2	1	0.0	2	0.0	3	0.0	YES
5922	246	3	19.2	0.1	14.4	0.1	19.3	1	0.0	2	0.0	3	0.0	YES
5928	247	4	19.1	0.1	14.4	0.1	19.3	1	0.0	2	0.0	3	0.0	YES
5934	247	1	19.1	0.1	14.4	0.1	18.7	1	0.0	2	0.0	3	0.0	YES
5940	247	2	19.1	0.1	14.4	0.1	18.7	1	0.0	2	0.0	3	0.0	YES
5946	247	3	19.1	0.1	14.4	0.1	18.8	1	0.0	2	0.0	3	0.0	YES
5952	248	4	19.1	0.1	14.4	0.1	18.8	1	0.0	2	0.0	3	0.0	YES
5958	248	1	19.1	0.1	14.4	0.1	18.7	1	0.0	2	0.0	3	0.0	YES
5964	248	2	19.1	0.1	14.4	0.1	18.7	1	0.0	2	0.0	3	0.0	YES
5970	248	3	19.1	0.1	14.4	0.1	18.8	1	0.0	2	0.0	3	0.0	YES

5976	249	4	19.1	0.1	14.4	0.1	18.8	1	0.0	2	0.0	3	0.0	YES
5982	249	1	19.1	0.1	14.4	0.1	18.6	1	0.0	2	0.0	3	0.0	YES
5988	249	2	19.1	0.1	14.4	0.1	18.5	1	0.0	2	0.0	3	0.0	YES
5994	249	3	19.1	0.1	14.4	0.1	18.6	1	0.0	2	0.0	3	0.0	YES
6000	250	4	19.1	0.1	14.4	0.1	18.5	1	0.0	2	0.0	3	0.0	YES
6006	250	1	19.1	0.1	14.4	0.1	18.5	1	0.0	2	0.0	3	0.0	YES
6012	250	2	19.1	0.1	14.4	0.1	18.4	1	0.0	2	0.0	3	0.0	YES
6018	250	3	19.1	0.1	14.4	0.1	18.4	1	0.0	2	0.0	3	0.0	YES
6024	251	4	19.1	0.1	14.4	0.1	18.4	1	0.0	2	0.0	3	0.0	YES
6030	251	1	19.1	0.1	14.4	0.1	18.3	1	0.0	2	0.0	3	0.0	YES
6036	251	2	19.1	0.1	14.4	0.1	18.3	1	0.0	2	0.0	3	0.0	YES
6042	251	3	19.1	0.1	14.4	0.1	18.3	1	0.0	2	0.0	3	0.0	YES
6048	252	4	19.1	0.1	14.4	0.1	18.3	1	0.0	2	0.0	3	0.0	YES
6054	252	1	19.1	0.1	14.4	0.1	18.3	1	0.0	2	0.0	3	0.0	YES
6060	252	2	19.1	0.1	14.4	0.1	18.3	1	0.0	2	0.0	3	0.0	YES
6066	252	3	19.1	0.1	14.4	0.1	18.3	1	0.0	2	0.0	3	0.0	YES
6072	253	4	19.1	0.1	14.4	0.1	18.1	1	0.0	2	0.0	3	0.0	YES
6078	253	1	19.1	0.1	14.4	0.1	17.8	1	0.0	2	0.0	3	0.0	YES
6084	253	2	19.1	0.1	14.4	0.1	17.6	1	0.0	2	0.0	3	0.0	YES
6090	253	3	19.1	0.1	14.4	0.1	17.6	1	0.0	2	0.0	3	0.0	YES

1

STATUS AT END OF SIMULATION HOUR 6096 THIS IS JULIAN DAY 254, CALENDAR DAY 11SEP
93

AVERAGE METEOROLOGICAL QUANTITIES FOR THIS COMPUTATION PERIOD:

CLOUD COVER 0.13 AIR PRESSURE,MB 1020.78 WIND SPEED,KPH 19.02 DRYBULB TEMP,DEGC, 16.6 DEWPOINT TEMP,DEGC, 8
.1
S/W RAD,KC/M2/HR 0.0 L/W RAD,KC/M2/HR 261.6 VAPOR PRESSURE,MB 10.9 SAT.VAP.PRES,MB 24.9 EVAP.RATE,M/HR 0.00
05
TOTAL EVAP., M. 1.
23
SURFACE ELEVATION,M: 19.1 EL.ABOVE MSL,M. 43.5

INFLOWING QUANTITIES FOR THIS COMPUTATION INTERVAL:

TRIBUTARY	INFLOW M3/SEC	TEMPERATURE DEG C	TOT.DISS.SOLIDS G/M3	SUSPENDED SOLIDS G/M3
1	0.13	14.4	14.0	0.6

OUTFLOWING QUANTITIES FOR THIS COMPUTATION INTERVAL:

PORT	LAYER	OUTFLOW,M3/SEC
1	24	0.01
2	21	0.01
3	18	0.01
4	14	0.01
5	10	0.01
6	8	0.01
7	5	0.01
8	3	0.01

TOTAL OUTFLOW,M3/SEC 0.10 TEMPERATURE,DEG C 17.5 TOT.DISS.SOLIDS,G/M3 144.7 SUSP.SOLIDS,G/M3 0.0

```
                                                  TOT.DISS. SUSPENDED        S/W    LAYER    LAYER DIFFUSION     UPPER
    0    5   10   15   20   25   30   35      TEMP.    SOLIDS    SOLIDS  RADIATION   INFLOW  OUTFLOW     COEF. ELEVATION
                                            DEG.C      G/M3      G/M3   KC/M2/HR   M3/SEC   M3/SEC     M2/HR         M

  24                     *                    20.8     227.1       0.0       0.00     0.00     0.00    0.5946      19.1
  23                     *                    20.8     227.1       0.0       0.00     0.00     0.01    0.5946      18.4
  22                     *                    20.8     227.1       0.0       0.00     0.00     0.00    0.5946      17.5
  21                     *                    20.8     227.1       0.0       0.00     0.00     0.00    0.5946      16.7
  20                     *                    20.8     227.1       0.0       0.00     0.00     0.01    0.5946      15.9
  19                     *                    20.8     227.1       0.0       0.00     0.00     0.01    0.5946      15.0
  18                     *                    20.8     227.1       0.0       0.00     0.00     0.00    0.5946      14.1
  17                     *                    20.8     227.1       0.0       0.00     0.00     0.00    0.5946      13.3
  16                     *                    20.8     227.1       0.0       0.00     0.00     0.00    0.5946      12.6
  15                     *                    20.8     227.1       0.0       0.00     0.00     0.00    0.5946      12.0
  14                     *                    20.8     227.1       0.0       0.00     0.00     0.00    0.5946      11.3
  13                     *                    20.8     227.1       0.0       0.00     0.00     0.00    0.0005      10.7
  12                 *                        16.9      82.2       0.0       0.00     0.00     0.00    0.0005      10.2
  11                *                         15.5      52.2       0.0       0.00     0.00     0.00    0.0015       9.6
  10               *                          15.0      40.6       0.0       0.00     0.00     0.01    0.0025       8.9
   9               *                          14.7      33.2       0.0       0.00     0.00     0.00    0.0081       8.1
   8               *                          14.6      30.7       0.0       0.00     0.06     0.00    0.0041       7.1
   7              *                           14.4      27.3       0.1       0.00     0.04     0.00    0.1136       6.1
   6              *                           14.4      27.3       0.1       0.00     0.03     0.00    0.0054       5.3
   5              *                           14.4      30.8       0.1       0.00     0.00     0.01    0.0005       4.4
   4             *                            13.5     118.4       0.1       0.00     0.00     0.00    0.0007       3.1
   3             *                            13.1     147.5       0.1       0.00     0.00     0.01    0.0005       1.9
   2             *                            12.6     171.3       0.1       0.00     0.00     0.00    0.0010       1.0
   1            *                             12.5     176.7       0.2       0.00     0.00     0.00    0.0000       0.5
1
```

DAILY INFORMATION

HOUR	DAY	SIM.INT.	ELEV M	INFLOW M3/S	TEMP C	OUTFLOW M3/S	TEMP C	IF REGULATION TARGET T. C.	PORT	FLOW M3/S	PORT	FLOW M3/S	PORT	FLOW M3/S	MORE?
6102	254	1	19.1	0.1	14.4	0.1	17.3		1	0.0	2	0.0	3	0.0	YES
6108	254	2	19.1	0.1	14.4	0.1	17.3		1	0.0	2	0.0	3	0.0	YES
6114	254	3	19.1	0.1	14.4	0.1	17.3		1	0.0	2	0.0	3	0.0	YES
6120	255	4	19.1	0.1	14.4	0.1	17.3		1	0.0	2	0.0	3	0.0	YES
6126	255	1	19.1	0.1	14.4	0.1	17.2		1	0.0	2	0.0	3	0.0	YES
6132	255	2	19.1	0.1	14.4	0.1	17.1		1	0.0	2	0.0	3	0.0	YES
6138	255	3	19.1	0.1	14.4	0.1	17.3		1	0.0	2	0.0	3	0.0	YES

6144	256	4	19.1	0.1	14.4	0.1	17.4	1	0.0	2	0.0	3	0.0	YES
6150	256	1	19.1	0.1	14.4	0.1	17.3	1	0.0	2	0.0	3	0.0	YES
6156	256	2	19.1	0.1	14.4	0.1	17.4	1	0.0	2	0.0	3	0.0	YES
6162	256	3	19.1	0.1	14.4	0.1	17.6	1	0.0	2	0.0	3	0.0	YES
6168	257	4	19.1	0.1	14.4	0.1	17.7	1	0.0	2	0.0	3	0.0	YES
6174	257	1	19.1	0.1	14.4	0.1	17.7	1	0.0	2	0.0	3	0.0	YES
6180	257	2	19.1	0.1	14.4	0.1	17.8	1	0.0	2	0.0	3	0.0	YES
6186	257	3	19.1	0.1	14.4	0.1	17.9	1	0.0	2	0.0	3	0.0	YES
6192	258	4	19.1	0.1	14.4	0.1	17.8	1	0.0	2	0.0	3	0.0	YES
6198	258	1	19.1	0.1	14.4	0.1	17.7	1	0.0	2	0.0	3	0.0	YES
6204	258	2	19.1	0.1	14.4	0.1	17.6	1	0.0	2	0.0	3	0.0	YES
6210	258	3	19.1	0.1	14.4	0.1	17.5	1	0.0	2	0.0	3	0.0	YES
6216	259	4	19.1	0.1	14.4	0.1	17.4	1	0.0	2	0.0	3	0.0	YES
6222	259	1	19.1	0.1	14.4	0.1	17.3	1	0.0	2	0.0	3	0.0	YES
6228	259	2	19.1	0.1	14.4	0.1	17.2	1	0.0	2	0.0	3	0.0	YES
6234	259	3	19.1	0.1	14.4	0.1	17.2	1	0.0	2	0.0	3	0.0	YES
6240	260	4	19.1	0.1	14.4	0.1	17.2	1	0.0	2	0.0	3	0.0	YES
6246	260	1	19.1	0.1	14.4	0.1	17.1	1	0.0	2	0.0	3	0.0	YES
6252	260	2	19.1	0.1	14.4	0.1	17.0	1	0.0	2	0.0	3	0.0	YES
6258	260	3	19.1	0.1	14.4	0.1	17.0	1	0.0	2	0.0	3	0.0	YES
6264	261	4	19.1	0.1	14.4	0.1	17.0	1	0.0	2	0.0	3	0.0	YES
6270	261	1	19.1	0.1	14.4	0.1	16.8	1	0.0	2	0.0	3	0.0	YES
6276	261	2	19.1	0.1	14.4	0.1	16.7	1	0.0	2	0.0	3	0.0	YES
6282	261	3	19.1	0.1	14.4	0.1	16.7	1	0.0	2	0.0	3	0.0	YES
6288	262	4	19.1	0.1	14.4	0.1	16.5	1	0.0	2	0.0	3	0.0	YES
6294	262	1	19.1	0.1	14.4	0.1	16.3	1	0.0	2	0.0	3	0.0	YES
6300	262	2	19.1	0.1	14.4	0.1	16.2	1	0.0	2	0.0	3	0.0	YES
6306	262	3	19.1	0.1	14.4	0.1	16.2	1	0.0	2	0.0	3	0.0	YES
6312	263	4	19.1	0.1	14.4	0.1	16.2	1	0.0	2	0.0	3	0.0	YES
6318	263	1	19.1	0.1	14.4	0.1	16.1	1	0.0	2	0.0	3	0.0	YES
6324	263	2	19.1	0.1	14.4	0.1	16.0	1	0.0	2	0.0	3	0.0	YES
6330	263	3	19.1	0.1	14.4	0.1	16.0	1	0.0	2	0.0	3	0.0	YES
6336	264	4	19.1	0.1	14.4	0.1	16.0	1	0.0	2	0.0	3	0.0	YES
6342	264	1	19.1	0.1	14.4	0.1	15.9	1	0.0	2	0.0	3	0.0	YES
6348	264	2	19.1	0.1	14.4	0.1	15.9	1	0.0	2	0.0	3	0.0	YES
6354	264	3	19.1	0.1	14.4	0.1	15.9	1	0.0	2	0.0	3	0.0	YES
6360	265	4	19.1	0.1	14.4	0.1	16.1	1	0.0	2	0.0	3	0.0	YES
6366	265	1	19.1	0.1	14.4	0.1	16.0	1	0.0	2	0.0	3	0.0	YES
6372	265	2	19.1	0.1	14.4	0.1	15.9	1	0.0	2	0.0	3	0.0	YES
6378	265	3	19.1	0.1	14.4	0.1	16.0	1	0.0	2	0.0	3	0.0	YES
6384	266	4	19.1	0.1	14.4	0.1	16.0	1	0.0	2	0.0	3	0.0	YES
6390	266	1	19.1	0.1	14.4	0.1	16.0	1	0.0	2	0.0	3	0.0	YES
6396	266	2	19.1	0.1	14.4	0.1	15.8	1	0.0	2	0.0	3	0.0	YES
6402	266	3	19.1	0.1	14.4	0.1	15.9	1	0.0	2	0.0	3	0.0	YES
6408	267	4	19.1	0.1	14.4	0.1	16.1	1	0.0	2	0.0	3	0.0	YES
6414	267	1	19.1	0.1	14.4	0.1	15.9	1	0.0	2	0.0	3	0.0	YES
6420	267	2	19.1	0.1	14.4	0.1	15.9	1	0.0	2	0.0	3	0.0	YES
6426	267	3	19.1	0.1	14.4	0.1	16.0	1	0.0	2	0.0	3	0.0	YES
6432	268	4	19.1	0.1	14.4	0.1	16.1	1	0.0	2	0.0	3	0.0	YES
6438	268	1	19.1	0.1	14.4	0.1	16.1	1	0.0	2	0.0	3	0.0	YES
6444	268	2	19.1	0.1	14.4	0.1	16.0	1	0.0	2	0.0	3	0.0	YES
6450	268	3	19.1	0.1	14.4	0.1	16.0	1	0.0	2	0.0	3	0.0	YES

6456	269	4	19.1	0.1	14.4	0.1	16.1	1	0.0	2	0.0	3	0.0	YES
6462	269	1	19.1	0.1	14.4	0.1	16.0	1	0.0	2	0.0	3	0.0	YES
6468	269	2	19.1	0.1	14.4	0.1	16.1	1	0.0	2	0.0	3	0.0	YES
6474	269	3	19.1	0.1	14.4	0.1	16.3	1	0.0	2	0.0	3	0.0	YES
6480	270	4	19.1	0.1	14.4	0.1	16.5	1	0.0	2	0.0	3	0.0	YES
6486	270	1	19.1	0.1	14.4	0.1	16.7	1	0.0	2	0.0	3	0.0	YES
6492	270	2	19.1	0.1	14.4	0.1	16.5	1	0.0	2	0.0	3	0.0	YES
6498	270	3	19.1	0.1	14.4	0.1	16.6	1	0.0	2	0.0	3	0.0	YES
6504	271	4	19.1	0.1	14.4	0.1	16.6	1	0.0	2	0.0	3	0.0	YES
6510	271	1	19.1	0.1	14.4	0.1	16.4	1	0.0	2	0.0	3	0.0	YES
6516	271	2	19.1	0.1	14.4	0.1	16.2	1	0.0	2	0.0	3	0.0	YES
6522	271	3	19.1	0.1	14.4	0.1	16.2	1	0.0	2	0.0	3	0.0	YES
6528	272	4	19.1	0.1	14.4	0.1	16.2	1	0.0	2	0.0	3	0.0	YES
6534	272	1	19.1	0.1	14.4	0.1	15.9	1	0.0	2	0.0	3	0.0	YES
6540	272	2	19.1	0.1	14.4	0.1	15.8	1	0.0	2	0.0	3	0.0	YES
6546	272	3	19.1	0.1	14.4	0.1	15.8	1	0.0	2	0.0	3	0.0	YES
6552	273	4	19.1	0.1	14.4	0.1	15.7	1	0.0	2	0.0	3	0.0	YES
6558	273	1	19.1	0.1	14.4	0.1	15.4	1	0.0	2	0.0	3	0.0	YES
6564	273	2	19.1	0.1	14.4	0.1	15.3	1	0.0	2	0.0	3	0.0	YES
6570	273	3	19.1	0.1	14.4	0.1	15.4	1	0.0	2	0.0	3	0.0	YES
6576	274	4	19.1	0.1	14.4	0.1	15.4	1	0.0	2	0.0	3	0.0	YES
6582	274	1	19.1	0.1	14.4	0.1	15.3	1	0.0	2	0.0	3	0.0	YES
6588	274	2	19.1	0.1	14.4	0.1	15.2	1	0.0	2	0.0	3	0.0	YES
6594	274	3	19.1	0.1	14.4	0.1	15.3	1	0.0	2	0.0	3	0.0	YES
6600	275	4	19.1	0.1	14.4	0.1	15.4	1	0.0	2	0.0	3	0.0	YES
6606	275	1	19.1	0.1	14.4	0.1	15.2	1	0.0	2	0.0	3	0.0	YES
6612	275	2	19.1	0.1	14.4	0.1	15.1	1	0.0	2	0.0	3	0.0	YES
6618	275	3	19.1	0.1	14.4	0.1	15.1	1	0.0	2	0.0	3	0.0	YES
6624	276	4	19.0	0.1	14.4	0.1	15.2	1	0.0	2	0.0	3	0.0	YES
6630	276	1	19.0	0.1	14.4	0.1	14.9	1	0.0	2	0.0	3	0.0	YES
6636	276	2	19.0	0.1	14.4	0.1	14.7	1	0.0	2	0.0	3	0.0	YES
6642	276	3	19.0	0.1	14.4	0.1	14.7	1	0.0	2	0.0	3	0.0	YES
6648	277	4	19.0	0.1	14.4	0.1	14.6	1	0.0	2	0.0	3	0.0	YES
6654	277	1	19.0	0.1	14.4	0.1	14.3	1	0.0	2	0.0	3	0.0	YES
6660	277	2	19.0	0.1	14.4	0.1	14.1	1	0.0	2	0.0	3	0.0	YES
6666	277	3	19.0	0.1	14.4	0.1	14.1	1	0.0	2	0.0	3	0.0	YES
6672	278	4	19.0	0.1	14.4	0.1	14.1	1	0.0	2	0.0	3	0.0	YES
6678	278	1	19.0	0.1	14.4	0.1	13.8	1	0.0	2	0.0	3	0.0	YES
6684	278	2	19.0	0.1	14.4	0.1	13.8	1	0.0	2	0.0	3	0.0	YES
6690	278	3	19.0	0.1	14.4	0.1	13.9	1	0.0	2	0.0	3	0.0	YES
6696	279	4	19.0	0.1	14.4	0.1	13.9	1	0.0	2	0.0	3	0.0	YES
6702	279	1	19.0	0.1	14.4	0.1	13.9	1	0.0	2	0.0	3	0.0	YES
6708	279	2	19.0	0.1	14.4	0.1	13.9	1	0.0	2	0.0	3	0.0	YES
6714	279	3	19.0	0.1	14.4	0.1	14.1	1	0.0	2	0.0	3	0.0	YES
6720	280	4	19.0	0.1	14.4	0.1	14.1	1	0.0	2	0.0	3	0.0	YES
6726	280	1	19.0	0.1	14.4	0.1	14.1	1	0.0	2	0.0	3	0.0	YES
6732	280	2	19.0	0.1	14.4	0.1	14.2	1	0.0	2	0.0	3	0.0	YES
6738	280	3	19.0	0.1	14.4	0.1	14.3	1	0.0	2	0.0	3	0.0	YES
6744	281	4	19.0	0.1	14.4	0.1	14.4	1	0.0	2	0.0	3	0.0	YES
6750	281	1	19.0	0.1	14.4	0.1	14.3	1	0.0	2	0.0	3	0.0	YES
6756	281	2	19.0	0.1	14.4	0.1	14.3	1	0.0	2	0.0	3	0.0	YES
6762	281	3	19.0	0.1	14.4	0.1	14.4	1	0.0	2	0.0	3	0.0	YES

6768	282	4	19.0	0.1	14.4	0.1	14.5	1	0.0	2	0.0	3	0.0	YES
6774	282	1	19.0	0.1	14.4	0.1	14.0	1	0.0	2	0.0	3	0.0	YES
6780	282	2	19.0	0.1	14.4	0.1	13.8	1	0.0	2	0.0	3	0.0	YES
6786	282	3	19.0	0.1	14.4	0.1	13.7	1	0.0	2	0.0	3	0.0	YES
6792	283	4	19.0	0.1	14.4	0.1	13.4	1	0.0	2	0.0	3	0.0	YES
6798	283	1	19.0	0.1	14.4	0.1	13.1	1	0.0	2	0.0	3	0.0	YES
6804	283	2	19.0	0.1	14.4	0.1	12.9	1	0.0	2	0.0	3	0.0	YES
6810	283	3	19.0	0.1	14.4	0.1	12.9	1	0.0	2	0.0	3	0.0	YES

1
STATUS AT END OF SIMULATION HOUR 6816 THIS IS JULIAN DAY 284, CALENDAR DAY 11OCT
93

AVERAGE METEOROLOGICAL QUANTITIES FOR THIS COMPUTATION PERIOD:

CLOUD COVER 0.75 AIR PRESSURE,MB 1015.12 WIND SPEED,KPH 18.58 DRYBULB TEMP,DEGC, 7.4 DEWPOINT TEMP,DEGC, 4
.1
S/W RAD,KC/M2/HR 0.0 L/W RAD,KC/M2/HR 244.1 VAPOR PRESSURE,MB 8.8 SAT.VAP.PRES,MB 14.9 EVAP.RATE,M/HR 0.00
02
TOTAL EVAP., M. 1.
43
SURFACE ELEVATION,M: 19.0 EL.ABOVE MSL,M. 43.4

INFLOWING QUANTITIES FOR THIS COMPUTATION INTERVAL:

TRIBUTARY	INFLOW M3/SEC	TEMPERATURE DEG C	TOT.DISS.SOLIDS G/M3	SUSPENDED SOLIDS G/M3
1	0.13	14.4	10.2	0.4

OUTFLOWING QUANTITIES FOR THIS COMPUTATION INTERVAL:

PORT	LAYER	OUTFLOW,M3/SEC
1	26	0.01
2	23	0.01
3	20	0.01
4	16	0.01
5	11	0.01
6	7	0.01
7	4	0.01
8	1	0.01

TOTAL OUTFLOW,M3/SEC 0.10 TEMPERATURE,DEG C 12.7 TOT.DISS.SOLIDS,G/M3 192.7 SUSP.SOLIDS,G/M3 0.0

	0	5	10	15	20	25	30	35	TEMP. DEG.C	TOT.DISS. SOLIDS G/M3	SUSPENDED SOLIDS G/M3	S/W RADIATION KC/M2/HR	LAYER INFLOW M3/SEC	LAYER OUTFLOW M3/SEC	DIFFUSION COEF. M2/HR	UPPER ELEVATION M
26			*						12.7	192.7	0.0	0.00	0.13	0.00	0.5460	19.0

25	*	12.7	192.7	0.0	0.00	0.00	0.00	0.5460	18.3
24	*	12.7	192.7	0.0	0.00	0.00	0.00	0.5460	17.5
23	*	12.7	192.7	0.0	0.00	0.00	0.00	0.5460	16.7
22	*	12.7	192.7	0.0	0.00	0.00	0.00	0.5460	15.9
21	*	12.7	192.7	0.0	0.00	0.00	0.00	0.5460	15.1
20	*	12.7	192.7	0.0	0.00	0.00	0.00	0.5460	14.2
19	*	12.7	192.7	0.0	0.00	0.00	0.00	0.5460	13.5
18	*	12.7	192.7	0.0	0.00	0.00	0.00	0.5460	12.7
17	*	12.7	192.7	0.0	0.00	0.00	0.00	0.5460	12.2
16	*	12.7	192.7	0.0	0.00	0.00	0.00	0.5460	11.6
15	*	12.7	192.7	0.0	0.00	0.00	0.00	0.5460	11.1
14	*	12.7	192.7	0.0	0.00	0.00	0.00	0.5460	10.6
13	*	12.7	192.7	0.0	0.00	0.00	0.00	0.5460	10.1
12	*	12.7	192.7	0.0	0.00	0.00	0.00	0.5460	9.5
11	*	12.7	192.7	0.0	0.00	0.00	0.00	0.5460	8.8
10	*	12.7	192.7	0.0	0.00	0.00	0.00	0.5460	8.1
9	*	12.7	192.7	0.0	0.00	0.00	0.00	0.5460	7.3
8	*	12.7	192.7	0.0	0.00	0.00	0.00	0.5460	6.8
7	*	12.7	192.7	0.0	0.00	0.00	0.00	0.5460	6.2
6	*	12.7	192.7	0.0	0.00	0.00	0.00	0.5460	5.8
5	*	12.7	192.7	0.0	0.00	0.00	0.01	0.5460	5.3
4	*	12.7	192.7	0.0	0.00	0.00	0.01	0.5460	4.2
3	*	12.7	192.7	0.0	0.00	0.00	0.00	0.5460	3.3
2	*	12.7	192.7	0.0	0.00	0.00	0.01	0.5460	2.4
1	*	12.7	192.7	0.0	0.00	0.00	0.01	0.0000	1.4

1

DAILY INFORMATION

HOUR	DAY	SIM.INT.	ELEV M	INFLOW M3/S	TEMP C	OUTFLOW M3/S	TEMP C	IF REGULATION TARGET T. C.	PORT	FLOW M3/S	PORT	FLOW M3/S	PORT	FLOW M3/S	MORE?
6822	284	1	19.0	0.1	14.4	0.1	12.5		1	0.0	2	0.0	3	0.0	YES
6828	284	2	19.0	0.1	14.4	0.1	12.4		1	0.0	2	0.0	3	0.0	YES
6834	284	3	19.0	0.1	14.4	0.1	12.4		1	0.0	2	0.0	3	0.0	YES
6840	285	4	19.0	0.1	14.4	0.1	12.2		1	0.0	2	0.0	3	0.0	YES
6846	285	1	19.0	0.1	14.4	0.1	11.9		1	0.0	2	0.0	3	0.0	YES
6852	285	2	19.0	0.1	14.4	0.1	11.8		1	0.0	2	0.0	3	0.0	YES
6858	285	3	19.0	0.1	14.4	0.1	11.8		1	0.0	2	0.0	3	0.0	YES
6864	286	4	19.0	0.1	14.4	0.1	11.7		1	0.0	2	0.0	3	0.0	YES
6870	286	1	19.0	0.1	14.4	0.1	11.5		1	0.0	2	0.0	3	0.0	YES
6876	286	2	19.0	0.1	14.4	0.1	11.5		1	0.0	2	0.0	3	0.0	YES
6882	286	3	19.0	0.1	14.4	0.1	11.5		1	0.0	2	0.0	3	0.0	YES
6888	287	4	19.0	0.1	14.4	0.1	11.5		1	0.0	2	0.0	3	0.0	YES
6894	287	1	19.0	0.1	14.4	0.1	11.5		1	0.0	2	0.0	3	0.0	YES
6900	287	2	19.0	0.1	14.4	0.1	11.5		1	0.0	2	0.0	3	0.0	YES
6906	287	3	19.0	0.1	14.4	0.1	11.5		1	0.0	2	0.0	3	0.0	YES
6912	288	4	19.0	0.1	14.4	0.1	11.5		1	0.0	2	0.0	3	0.0	YES
6918	288	1	19.0	0.1	14.4	0.1	11.5		1	0.0	2	0.0	3	0.0	YES

6924	288	2	19.0	0.1	14.4	0.1	11.5	1	0.0	2	0.0	3	0.0	YES
6930	288	3	19.0	0.1	14.4	0.1	11.6	1	0.0	2	0.0	3	0.0	YES
6936	289	4	19.0	0.1	14.4	0.1	11.6	1	0.0	2	0.0	3	0.0	YES
6942	289	1	19.0	0.1	14.4	0.1	11.6	1	0.0	2	0.0	3	0.0	YES
6948	289	2	19.0	0.1	14.4	0.1	11.6	1	0.0	2	0.0	3	0.0	YES
6954	289	3	19.0	0.1	14.4	0.1	11.7	1	0.0	2	0.0	3	0.0	YES
6960	290	4	19.0	0.1	14.4	0.1	11.7	1	0.0	2	0.0	3	0.0	YES
6966	290	1	19.0	0.1	14.4	0.1	11.8	1	0.0	2	0.0	3	0.0	YES
6972	290	2	19.0	0.1	14.4	0.1	11.8	1	0.0	2	0.0	3	0.0	YES
6978	290	3	19.0	0.1	14.4	0.1	11.9	1	0.0	2	0.0	3	0.0	YES
6984	291	4	19.0	0.1	14.4	0.1	11.9	1	0.0	2	0.0	3	0.0	YES
6990	291	1	19.0	0.1	14.4	0.1	11.8	1	0.0	2	0.0	3	0.0	YES
6996	291	2	19.0	0.1	14.4	0.1	11.8	1	0.0	2	0.0	3	0.0	YES
7002	291	3	19.0	0.1	14.4	0.1	11.8	1	0.0	2	0.0	3	0.0	YES
7008	292	4	19.0	0.1	14.4	0.1	11.9	1	0.0	2	0.0	3	0.0	YES
7014	292	1	19.0	0.1	14.4	0.1	11.7	1	0.0	2	0.0	3	0.0	YES
7020	292	2	19.0	0.1	14.4	0.1	11.7	1	0.0	2	0.0	3	0.0	YES
7026	292	3	19.0	0.1	14.4	0.1	11.7	1	0.0	2	0.0	3	0.0	YES
7032	293	4	19.0	0.1	14.4	0.1	11.8	1	0.0	2	0.0	3	0.0	YES
7038	293	1	19.0	0.1	14.4	0.1	11.8	1	0.0	2	0.0	3	0.0	YES
7044	293	2	19.0	0.1	14.4	0.1	11.8	1	0.0	2	0.0	3	0.0	YES
7050	293	3	19.0	0.1	14.4	0.1	11.9	1	0.0	2	0.0	3	0.0	YES
7056	294	4	19.0	0.1	14.4	0.1	11.8	1	0.0	2	0.0	3	0.0	YES
7062	294	1	19.0	0.1	14.4	0.1	11.7	1	0.0	2	0.0	3	0.0	YES
7068	294	2	19.0	0.1	14.4	0.1	11.5	1	0.0	2	0.0	3	0.0	YES
7074	294	3	19.0	0.1	14.4	0.1	11.5	1	0.0	2	0.0	3	0.0	YES
7080	295	4	19.0	0.1	14.4	0.1	11.4	1	0.0	2	0.0	3	0.0	YES
7086	295	1	19.0	0.1	14.4	0.1	11.2	1	0.0	2	0.0	3	0.0	YES
7092	295	2	19.0	0.1	14.4	0.1	11.1	1	0.0	2	0.0	3	0.0	YES
7098	295	3	19.0	0.1	14.4	0.1	11.1	1	0.0	2	0.0	3	0.0	YES
7104	296	4	19.0	0.1	14.4	0.1	11.0	1	0.0	2	0.0	3	0.0	YES
7110	296	1	19.0	0.1	14.4	0.1	10.8	1	0.0	2	0.0	3	0.0	YES
7116	296	2	19.0	0.1	14.4	0.1	10.8	1	0.0	2	0.0	3	0.0	YES
7122	296	3	19.0	0.1	14.4	0.1	10.8	1	0.0	2	0.0	3	0.0	YES
7128	297	4	19.0	0.1	14.4	0.1	10.9	1	0.0	2	0.0	3	0.0	YES
7134	297	1	19.0	0.1	14.4	0.1	10.8	1	0.0	2	0.0	3	0.0	YES
7140	297	2	19.0	0.1	14.4	0.1	10.7	1	0.0	2	0.0	3	0.0	YES
7146	297	3	19.0	0.1	14.4	0.1	10.8	1	0.0	2	0.0	3	0.0	YES
7152	298	4	19.0	0.1	14.4	0.1	10.8	1	0.0	2	0.0	3	0.0	YES
7158	298	1	19.0	0.1	14.4	0.1	10.6	1	0.0	2	0.0	3	0.0	YES
7164	298	2	19.0	0.1	14.4	0.1	10.5	1	0.0	2	0.0	3	0.0	YES
7170	298	3	19.0	0.1	14.4	0.1	10.5	1	0.0	2	0.0	3	0.0	YES
7176	299	4	19.0	0.1	14.4	0.1	10.5	1	0.0	2	0.0	3	0.0	YES
7182	299	1	19.0	0.1	14.4	0.1	10.4	1	0.0	2	0.0	3	0.0	YES
7188	299	2	19.0	0.1	14.4	0.1	10.4	1	0.0	2	0.0	3	0.0	YES
7194	299	3	19.0	0.1	14.4	0.1	10.4	1	0.0	2	0.0	3	0.0	YES
7200	300	4	19.0	0.1	14.4	0.1	10.4	1	0.0	2	0.0	3	0.0	YES
7206	300	1	19.0	0.1	14.4	0.1	10.2	1	0.0	2	0.0	3	0.0	YES
7212	300	2	19.0	0.1	14.4	0.1	10.2	1	0.0	2	0.0	3	0.0	YES
7218	300	3	19.0	0.1	14.4	0.1	10.2	1	0.0	2	0.0	3	0.0	YES
7224	301	4	19.0	0.1	14.4	0.1	10.2	1	0.0	2	0.0	3	0.0	YES
7230	301	1	19.0	0.1	14.4	0.1	10.0	1	0.0	2	0.0	3	0.0	YES

7236	301	2	19.0	0.1	14.4	0.1	10.0	1	0.0	2	0.0	3	0.0	YES
7242	301	3	19.0	0.1	14.4	0.1	10.0	1	0.0	2	0.0	3	0.0	YES
7248	302	4	19.0	0.1	14.4	0.1	10.1	1	0.0	2	0.0	3	0.0	YES
7254	302	1	19.0	0.1	14.4	0.1	10.0	1	0.0	2	0.0	3	0.0	YES
7260	302	2	19.0	0.1	14.4	0.1	9.9	1	0.0	2	0.0	3	0.0	YES
7266	302	3	19.0	0.1	14.4	0.1	9.8	1	0.0	2	0.0	3	0.0	YES
7272	303	4	19.0	0.1	14.4	0.1	9.7	1	0.0	2	0.0	3	0.0	YES
7278	303	1	19.0	0.1	14.4	0.1	9.6	1	0.0	2	0.0	3	0.0	YES
7284	303	2	19.0	0.1	14.4	0.1	9.4	1	0.0	2	0.0	3	0.0	YES
7290	303	3	19.0	0.1	14.4	0.1	9.3	1	0.0	2	0.0	3	0.0	YES
7296	304	4	19.0	0.1	14.4	0.1	9.2	1	0.0	2	0.0	3	0.0	YES
7302	304	1	19.0	0.1	14.4	0.1	9.0	1	0.0	2	0.0	3	0.0	YES
7308	304	2	19.0	0.1	14.4	0.1	8.9	1	0.0	2	0.0	3	0.0	YES
7314	304	3	19.0	0.1	14.4	0.1	8.9	1	0.0	2	0.0	3	0.0	YES
7320	305	4	19.0	0.1	14.4	0.1	8.7	1	0.0	2	0.0	3	0.0	YES
7326	305	1	19.0	0.1	14.4	0.1	8.5	1	0.0	2	0.0	3	0.0	YES
7332	305	2	19.0	0.1	14.4	0.1	8.3	1	0.0	2	0.0	3	0.0	YES
7338	305	3	19.0	0.1	14.4	0.1	8.3	1	0.0	2	0.0	3	0.0	YES
7344	306	4	19.0	0.1	14.4	0.1	8.3	1	0.0	2	0.0	3	0.0	YES
7350	306	1	19.0	0.1	14.4	0.1	8.1	1	0.0	2	0.0	3	0.0	YES
7356	306	2	19.0	0.1	14.4	0.1	8.1	1	0.0	2	0.0	3	0.0	YES
7362	306	3	19.0	0.1	14.4	0.1	8.1	1	0.0	2	0.0	3	0.0	YES
7368	307	4	19.0	0.1	14.4	0.1	8.2	1	0.0	2	0.0	3	0.0	YES
7374	307	1	19.0	0.1	14.4	0.1	8.1	1	0.0	2	0.0	3	0.0	YES
7380	307	2	19.0	0.1	14.4	0.1	8.1	1	0.0	2	0.0	3	0.0	YES
7386	307	3	19.0	0.1	14.4	0.1	8.1	1	0.0	2	0.0	3	0.0	YES
7392	308	4	19.0	0.1	14.4	0.1	8.2	1	0.0	2	0.0	3	0.0	YES
7398	308	1	19.0	0.1	14.4	0.1	8.2	1	0.0	2	0.0	3	0.0	YES
7404	308	2	19.0	0.1	14.4	0.1	8.2	1	0.0	2	0.0	3	0.0	YES
7410	308	3	19.0	0.1	14.4	0.1	8.3	1	0.0	2	0.0	3	0.0	YES
7416	309	4	19.0	0.1	14.4	0.1	8.6	1	0.0	2	0.0	3	0.0	YES
7422	309	1	19.0	0.1	14.4	0.1	8.5	1	0.0	2	0.0	3	0.0	YES
7428	309	2	19.0	0.1	14.4	0.1	8.5	1	0.0	2	0.0	3	0.0	YES
7434	309	3	19.0	0.1	14.4	0.1	8.5	1	0.0	2	0.0	3	0.0	YES
7440	310	4	19.0	0.1	14.4	0.1	8.4	1	0.0	2	0.0	3	0.0	YES
7446	310	1	19.0	0.1	14.4	0.1	8.2	1	0.0	2	0.0	3	0.0	YES
7452	310	2	19.0	0.1	14.4	0.1	8.0	1	0.0	2	0.0	3	0.0	YES
7458	310	3	19.0	0.1	14.4	0.1	8.0	1	0.0	2	0.0	3	0.0	YES
7464	311	4	19.0	0.1	14.4	0.1	7.8	1	0.0	2	0.0	3	0.0	YES
7470	311	1	19.0	0.1	14.4	0.1	7.6	1	0.0	2	0.0	3	0.0	YES
7476	311	2	19.0	0.1	14.4	0.1	7.5	1	0.0	2	0.0	3	0.0	YES
7482	311	3	19.0	0.1	14.4	0.1	7.5	1	0.0	2	0.0	3	0.0	YES
7488	312	4	19.0	0.1	14.4	0.1	7.4	1	0.0	2	0.0	3	0.0	YES
7494	312	1	19.0	0.1	14.4	0.1	7.3	1	0.0	2	0.0	3	0.0	YES
7500	312	2	19.0	0.1	14.4	0.1	7.2	1	0.0	2	0.0	3	0.0	YES
7506	312	3	19.0	0.1	14.4	0.1	7.2	1	0.0	2	0.0	3	0.0	YES
7512	313	4	19.0	0.1	14.4	0.1	7.2	1	0.0	2	0.0	3	0.0	YES
7518	313	1	19.0	0.1	14.4	0.1	7.1	1	0.0	2	0.0	3	0.0	YES
7524	313	2	19.0	0.1	14.4	0.1	7.0	1	0.0	2	0.0	3	0.0	YES
7530	313	3	19.0	0.1	14.4	0.1	7.1	1	0.0	2	0.0	3	0.0	YES

1

STATUS AT END OF SIMULATION HOUR 7536 THIS IS JULIAN DAY 314, CALENDAR DAY 10NOV

93

AVERAGE METEOROLOGICAL QUANTITIES FOR THIS COMPUTATION PERIOD:

CLOUD COVER 0.04 AIR PRESSURE,MB 1022.35 WIND SPEED,KPH 17.92 DRYBULB TEMP,DEGC, 7.0 DEWPOINT TEMP,DEGC, -1
.1
S/W RAD,KC/M2/HR 0.0 L/W RAD,KC/M2/HR 213.2 VAPOR PRESSURE,MB 5.8 SAT.VAP.PRES,MB 10.2 EVAP.RATE,M/HR 0.00
02
TOTAL EVAP., M. 1.
55
SURFACE ELEVATION,M: 19.0 EL.ABOVE MSL,M. 43.4

INFLOWING QUANTITIES FOR THIS COMPUTATION INTERVAL:

TRIBUTARY	INFLOW M3/SEC	TEMPERATURE DEG C	TOT.DISS.SOLIDS G/M3	SUSPENDED SOLIDS G/M3
1	0.13	14.4	6.5	0.3

OUTFLOWING QUANTITIES FOR THIS COMPUTATION INTERVAL:

PORT	LAYER	OUTFLOW,M3/SEC
1	24	0.01
2	21	0.01
3	18	0.01
4	15	0.01
5	10	0.01
6	7	0.01
7	3	0.01
8	1	0.01

TOTAL OUTFLOW,M3/SEC 0.10 TEMPERATURE,DEG C 7.1 TOT.DISS.SOLIDS,G/M3 183.5 SUSP.SOLIDS,G/M3 0.0

	0 5 10 15 20 25 30 35	TEMP. DEG.C	TOT.DISS. SOLIDS G/M3	SUSPENDED SOLIDS G/M3	S/W RADIATION KC/M2/HR	LAYER INFLOW M3/SEC	LAYER OUTFLOW M3/SEC	DIFFUSION COEF. M2/HR	UPPER ELEVATION M
24	*	7.1	183.5	0.0	0.00	0.13	0.00	0.4779	19.0
23	*	7.1	183.5	0.0	0.00	0.00	0.00	0.4779	18.0
22	*	7.1	183.5	0.0	0.00	0.00	0.00	0.4779	17.1
21	*	7.1	183.5	0.0	0.00	0.00	0.00	0.4779	16.3
20	*	7.1	183.5	0.0	0.00	0.00	0.00	0.2873	15.5
19	*	7.1	183.5	0.0	0.00	0.00	0.01	0.2172	14.6
18	*	7.1	183.5	0.0	0.00	0.00	0.00	0.1783	13.7
17	*	7.1	183.5	0.0	0.00	0.00	0.00	0.1533	13.0
16	*	7.1	183.5	0.0	0.00	0.00	0.00	0.0953	12.2
15	*	7.1	183.5	0.0	0.00	0.00	0.00	0.1564	11.6
14	*	7.1	183.5	0.0	0.00	0.00	0.00	0.2219	11.0

13	*	7.1	183.5	0.0	0.00	0.00	0.00	0.2797	10.5
12	*	7.1	183.5	0.0	0.00	0.00	0.00	0.3235	10.0
11	*	7.1	183.5	0.0	0.00	0.00	0.00	0.3505	9.4
10	*	7.1	183.5	0.0	0.00	0.00	0.00	0.3628	8.8
9	*	7.1	183.5	0.0	0.00	0.00	0.00	0.3697	8.1
8	*	7.1	183.5	0.0	0.00	0.00	0.00	0.3770	7.3
7	*	7.1	183.5	0.0	0.00	0.00	0.00	0.3848	6.5
6	*	7.1	183.5	0.0	0.00	0.00	0.00	0.3942	5.9
5	*	7.1	183.5	0.0	0.00	0.00	0.00	0.4026	5.2
4	*	7.1	183.5	0.0	0.00	0.00	0.00	0.4137	4.7
3	*	7.1	183.5	0.0	0.00	0.00	0.01	0.4333	4.0
2	*	7.1	183.5	0.0	0.00	0.00	0.01	0.4564	2.7
1	*	7.1	183.5	0.0	0.00	0.00	0.01	0.0000	1.3

1

DAILY INFORMATION

HOUR	DAY	SIM.INT.	ELEV M	INFLOW M3/S	TEMP C	OUTFLOW M3/S	TEMP C	IF REGULATION TARGET T. C.	PORT	FLOW M3/S	PORT	FLOW M3/S	PORT	FLOW M3/S	MORE?
7542	314	1	19.0	0.1	14.4	0.1	6.9		1	0.0	2	0.0	3	0.0	YES
7548	314	2	19.0	0.1	14.4	0.1	6.9		1	0.0	2	0.0	3	0.0	YES
7554	314	3	19.0	0.1	14.4	0.1	6.9		1	0.0	2	0.0	3	0.0	YES
7560	315	4	19.0	0.1	14.4	0.1	6.9		1	0.0	2	0.0	3	0.0	YES
7566	315	1	19.0	0.1	14.4	0.1	6.8		1	0.0	2	0.0	3	0.0	YES
7572	315	2	19.0	0.1	14.4	0.1	6.8		1	0.0	2	0.0	3	0.0	YES
7578	315	3	19.0	0.1	14.4	0.1	6.8		1	0.0	2	0.0	3	0.0	YES
7584	316	4	19.0	0.1	14.4	0.1	6.8		1	0.0	2	0.0	3	0.0	YES
7590	316	1	19.0	0.1	14.4	0.1	6.7		1	0.0	2	0.0	3	0.0	YES
7596	316	2	19.0	0.1	14.4	0.1	6.7		1	0.0	2	0.0	3	0.0	YES
7602	316	3	19.0	0.1	14.4	0.1	6.7		1	0.0	2	0.0	3	0.0	YES
7608	317	4	19.0	0.1	14.4	0.1	6.8		1	0.0	2	0.0	3	0.0	YES
7614	317	1	19.0	0.1	14.4	0.1	6.9		1	0.0	2	0.0	3	0.0	YES
7620	317	2	19.0	0.1	14.4	0.1	7.1		1	0.0	2	0.0	3	0.0	YES
7626	317	3	19.0	0.1	14.4	0.1	7.3		1	0.0	2	0.0	3	0.0	YES
7632	318	4	19.0	0.1	14.4	0.1	7.5		1	0.0	2	0.0	3	0.0	YES
7638	318	1	19.0	0.1	14.4	0.1	7.6		1	0.0	2	0.0	3	0.0	YES
7644	318	2	19.0	0.1	14.4	0.1	7.7		1	0.0	2	0.0	3	0.0	YES
7650	318	3	19.0	0.1	14.4	0.1	7.9		1	0.0	2	0.0	3	0.0	YES
7656	319	4	19.0	0.1	14.4	0.1	7.9		1	0.0	2	0.0	3	0.0	YES
7662	319	1	19.0	0.1	14.4	0.1	7.9		1	0.0	2	0.0	3	0.0	YES
7668	319	2	19.0	0.1	14.4	0.1	7.9		1	0.0	2	0.0	3	0.0	YES
7674	319	3	19.0	0.1	14.4	0.1	7.9		1	0.0	2	0.0	3	0.0	YES
7680	320	4	19.0	0.1	14.4	0.1	7.9		1	0.0	2	0.0	3	0.0	YES
7686	320	1	19.0	0.1	14.4	0.1	7.9		1	0.0	2	0.0	3	0.0	YES
7692	320	2	19.0	0.1	14.4	0.1	7.8		1	0.0	2	0.0	3	0.0	YES
7698	320	3	19.0	0.1	14.4	0.1	7.9		1	0.0	2	0.0	3	0.0	YES
7704	321	4	19.0	0.1	14.4	0.1	8.0		1	0.0	2	0.0	3	0.0	YES
7710	321	1	19.0	0.1	14.4	0.1	8.0		1	0.0	2	0.0	3	0.0	YES

7716	321	2	19.0	0.1	14.4	0.1	8.0	1	0.0	2	0.0	3	0.0	YES
7722	321	3	19.0	0.1	14.4	0.1	8.0	1	0.0	2	0.0	3	0.0	YES
7728	322	4	19.0	0.1	14.4	0.1	8.1	1	0.0	2	0.0	3	0.0	YES
7734	322	1	19.0	0.1	14.4	0.1	8.0	1	0.0	2	0.0	3	0.0	YES
7740	322	2	19.0	0.1	14.4	0.1	8.1	1	0.0	2	0.0	3	0.0	YES
7746	322	3	19.0	0.1	14.4	0.1	8.1	1	0.0	2	0.0	3	0.0	YES
7752	323	4	19.0	0.1	14.4	0.1	8.1	1	0.0	2	0.0	3	0.0	YES
7758	323	1	19.0	0.1	14.4	0.1	7.9	1	0.0	2	0.0	3	0.0	YES
7764	323	2	19.0	0.1	14.4	0.1	7.8	1	0.0	2	0.0	3	0.0	YES
7770	323	3	19.0	0.1	14.4	0.1	7.7	1	0.0	2	0.0	3	0.0	YES
7776	324	4	19.0	0.1	14.4	0.1	7.5	1	0.0	2	0.0	3	0.0	YES
7782	324	1	19.0	0.1	14.4	0.1	7.2	1	0.0	2	0.0	3	0.0	YES
7788	324	2	19.0	0.1	14.4	0.1	7.1	1	0.0	2	0.0	3	0.0	YES
7794	324	3	19.0	0.1	14.4	0.1	7.1	1	0.0	2	0.0	3	0.0	YES
7800	325	4	19.0	0.1	14.4	0.1	7.0	1	0.0	2	0.0	3	0.0	YES
7806	325	1	19.0	0.1	14.4	0.1	6.9	1	0.0	2	0.0	3	0.0	YES
7812	325	2	19.0	0.1	14.4	0.1	6.9	1	0.0	2	0.0	3	0.0	YES
7818	325	3	19.0	0.1	14.4	0.1	6.9	1	0.0	2	0.0	3	0.0	YES
7824	326	4	19.0	0.1	14.4	0.1	7.0	1	0.0	2	0.0	3	0.0	YES
7830	326	1	19.0	0.1	14.4	0.1	6.9	1	0.0	2	0.0	3	0.0	YES
7836	326	2	19.0	0.1	14.4	0.1	6.8	1	0.0	2	0.0	3	0.0	YES
7842	326	3	19.0	0.1	14.4	0.1	6.9	1	0.0	2	0.0	3	0.0	YES
7848	327	4	19.0	0.1	14.4	0.1	6.9	1	0.0	2	0.0	3	0.0	YES
7854	327	1	19.0	0.1	14.4	0.1	6.7	1	0.0	2	0.0	3	0.0	YES
7860	327	2	19.0	0.1	14.4	0.1	6.6	1	0.0	2	0.0	3	0.0	YES
7866	327	3	19.0	0.1	14.4	0.1	6.5	1	0.0	2	0.0	3	0.0	YES
7872	328	4	19.0	0.1	14.4	0.1	6.3	1	0.0	2	0.0	3	0.0	YES
7878	328	1	19.0	0.1	14.4	0.1	5.9	1	0.0	2	0.0	3	0.0	YES
7884	328	2	19.0	0.1	14.4	0.1	5.7	1	0.0	2	0.0	3	0.0	YES
7890	328	3	19.0	0.1	14.4	0.1	5.6	1	0.0	2	0.0	3	0.0	YES
7896	329	4	19.0	0.1	14.4	0.1	5.5	1	0.0	2	0.0	3	0.0	YES
7902	329	1	19.0	0.1	14.4	0.1	5.3	1	0.0	2	0.0	3	0.0	YES
7908	329	2	19.0	0.1	14.4	0.1	5.2	1	0.0	2	0.0	3	0.0	YES
7914	329	3	19.0	0.1	14.4	0.1	5.2	1	0.0	2	0.0	3	0.0	YES
7920	330	4	19.0	0.1	14.4	0.1	5.1	1	0.0	2	0.0	3	0.0	YES
7926	330	1	19.0	0.1	14.4	0.1	5.1	1	0.0	2	0.0	3	0.0	YES
7932	330	2	19.0	0.1	14.4	0.1	5.1	1	0.0	2	0.0	3	0.0	YES
7938	330	3	19.0	0.1	14.4	0.1	5.2	1	0.0	2	0.0	3	0.0	YES
7944	331	4	19.0	0.1	14.4	0.1	5.3	1	0.0	2	0.0	3	0.0	YES
7950	331	1	19.0	0.1	14.4	0.1	5.6	1	0.0	2	0.0	3	0.0	YES
7956	331	2	19.0	0.1	14.4	0.1	5.8	1	0.0	2	0.0	3	0.0	YES
7962	331	3	19.0	0.1	14.4	0.1	5.9	1	0.0	2	0.0	3	0.0	YES
7968	332	4	19.0	0.1	14.4	0.1	6.0	1	0.0	2	0.0	3	0.0	YES
7974	332	1	19.0	0.1	14.4	0.1	6.0	1	0.0	2	0.0	3	0.0	YES
7980	332	2	19.0	0.1	14.4	0.1	5.9	1	0.0	2	0.0	3	0.0	YES
7986	332	3	19.0	0.1	14.4	0.1	5.9	1	0.0	2	0.0	3	0.0	YES
7992	333	4	19.0	0.1	14.4	0.1	5.8	1	0.0	2	0.0	3	0.0	YES
7998	333	1	19.0	0.1	14.4	0.1	5.6	1	0.0	2	0.0	3	0.0	YES
8004	333	2	19.0	0.1	14.4	0.1	5.5	1	0.0	2	0.0	3	0.0	YES
8010	333	3	19.0	0.1	14.4	0.1	5.4	1	0.0	2	0.0	3	0.0	YES
8016	334	4	19.0	0.1	14.4	0.1	5.3	1	0.0	2	0.0	3	0.0	YES
8022	334	1	19.0	0.1	14.4	0.1	5.1	1	0.0	2	0.0	3	0.0	YES

8028	334	2	19.0	0.1	14.4	0.1	5.0	1	0.0	2	0.0	3	0.0	YES
8034	334	3	19.0	0.1	14.4	0.1	5.0	1	0.0	2	0.0	3	0.0	YES
8040	335	4	19.0	0.1	14.4	0.1	4.9	1	0.0	2	0.0	3	0.0	YES
8046	335	1	19.0	0.1	14.4	0.1	4.8	1	0.0	2	0.0	3	0.0	YES
8052	335	2	19.0	0.1	14.4	0.1	4.8	1	0.0	2	0.0	3	0.0	YES
8058	335	3	19.0	0.1	14.4	0.1	4.8	1	0.0	2	0.0	3	0.0	YES
8064	336	4	19.0	0.1	14.4	0.1	4.8	1	0.0	2	0.0	3	0.0	YES
8070	336	1	19.0	0.1	14.4	0.1	4.8	1	0.0	2	0.0	3	0.0	YES
8076	336	2	19.0	0.1	14.4	0.1	4.8	1	0.0	2	0.0	3	0.0	YES
8082	336	3	19.0	0.1	14.4	0.1	4.9	1	0.0	2	0.0	3	0.0	YES
8088	337	4	19.0	0.1	14.4	0.1	4.9	1	0.0	2	0.0	3	0.0	YES
8094	337	1	19.0	0.1	14.4	0.1	4.9	1	0.0	2	0.0	3	0.0	YES
8100	337	2	19.0	0.1	14.4	0.1	4.9	1	0.0	2	0.0	3	0.0	YES
8106	337	3	19.0	0.1	14.4	0.1	4.9	1	0.0	2	0.0	3	0.0	YES
8112	338	4	19.0	0.1	14.4	0.1	4.9	1	0.0	2	0.0	3	0.0	YES
8118	338	1	19.0	0.1	14.4	0.1	4.9	1	0.0	2	0.0	3	0.0	YES
8124	338	2	19.0	0.1	14.4	0.1	4.9	1	0.0	2	0.0	3	0.0	YES
8130	338	3	19.0	0.1	14.4	0.1	5.0	1	0.0	2	0.0	3	0.0	YES

1

STATUS AT END OF SIMULATION HOUR 8136 THIS IS JULIAN DAY 339, CALENDAR DAY 5DEC
93

AVERAGE METEOROLOGICAL QUANTITIES FOR THIS COMPUTATION PERIOD:

CLOUD COVER 0.36 AIR PRESSURE,MB 1006.80 WIND SPEED,KPH 21.10 DRYBULB TEMP,DEGC, 5.0 DEWPOINT TEMP,DEGC, 2
.0
S/W RAD,KC/M2/HR 0.0 L/W RAD,KC/M2/HR 206.1 VAPOR PRESSURE,MB 6.8 SAT.VAP.PRES,MB 8.8 EVAP.RATE,M/HR 0.00
01
TOTAL EVAP., M. 1.
62

SURFACE ELEVATION,M: 19.0 EL.ABOVE MSL,M. 4.4

INFLOWING QUANTITIES FOR THIS COMPUTATION INTERVAL:

TRIBUTARY	INFLOW M3/SEC	TEMPERATURE DEG C	TOT.DISS.SOLIDS G/M3	SUSPENDED SOLIDS G/M3
1	0.13	14.4	3.3	0.1

OUTFLOWING QUANTITIES FOR THIS COMPUTATION INTERVAL:

PORT	LAYER	OUTFLOW,M3/SEC
1	24	0.01
2	22	0.01
3	19	0.01
4	15	0.01
5	11	0.01
6	8	0.01
7	5	0.01
8	2	0.01

TOTAL OUTFLOW,M3/SEC 0.10 TEMPERATURE,DEG C 5.0 TOT.DISS.SOLIDS,G/M3 175.6 SUSP.SOLIDS,G/M3 0.0

	0 5 10 15 20 25 30 35	TEMP. DEG.C	TOT.DISS. SOLIDS G/M3	SUSPENDED SOLIDS G/M3	S/W RADIATION KC/M2/HR	LAYER INFLOW M3/SEC	LAYER OUTFLOW M3/SEC	DIFFUSION COEF. M2/HR	UPPER ELEVATION M
24	* D	5.1	175.0	0.0	0.00	0.13	0.01	0.8799	19.0
23	*	5.1	175.0	0.0	0.00	0.00	0.01	0.8493	17.6
22	* D	5.1	175.0	0.0	0.00	0.00	0.01	0.7425	16.8
21	*	5.1	175.0	0.0	0.00	0.00	0.01	0.6522	16.0
20	*	5.1	175.0	0.0	0.00	0.00	0.01	0.5829	15.2
19	*	5.1	175.0	0.0	0.00	0.00	0.00	0.5195	14.3
18	* D	5.1	175.0	0.0	0.00	0.00	0.00	0.4761	13.3
17	*	5.1	175.0	0.0	0.00	0.00	0.00	0.4386	12.6
16	*	5.1	175.4	0.0	0.00	0.00	0.00	0.3924	11.8
15	*	5.0	175.5	0.0	0.00	0.00	0.00	0.3752	11.2
14	* D	5.0	175.6	0.0	0.00	0.00	0.00	0.3629	10.5
13	*	5.0	175.6	0.0	0.00	0.00	0.00	0.3568	10.0
12	*	5.0	175.7	0.0	0.00	0.00	0.00	0.3528	9.4
11	*	5.0	175.8	0.0	0.00	0.00	0.01	0.3525	8.8
10	*	4.9	175.9	0.0	0.00	0.00	0.00	0.3577	8.2
9	* D	4.9	175.9	0.0	0.00	0.00	0.01	0.3697	7.4
8	*	4.9	176.0	0.0	0.00	0.00	0.00	0.3884	6.5
7	*	4.9	176.0	0.0	0.00	0.00	0.00	0.4099	5.7
6	*	4.9	176.1	0.0	0.00	0.00	0.00	0.4393	5.0
5	* D	4.9	176.1	0.0	0.00	0.00	0.00	0.4701	4.2
4	*	4.9	176.1	0.0	0.00	0.00	0.00	0.5185	3.6
3	*	4.9	176.1	0.0	0.00	0.00	0.00	0.5948	2.8
2	*	4.9	176.2	0.0	0.00	0.00	0.01	0.7145	1.8
1	*	4.9	176.2	0.0	0.00	0.00	0.00	0.0000	0.8

1

DAILY INFORMATION

HOUR	DAY	SIM.INT.	ELEV M	INFLOW M3/S	TEMP C	OUTFLOW M3/S	TEMP C	IF REGULATION TARGET T. C.	PORT	FLOW M3/S	PORT	FLOW M3/S	PORT	FLOW M3/S	MORE?
8136	339	4	19.0	0.1	14.4	0.1	5.0		1	0.0	2	0.0	3	0.0	YES

1
STATUS AT END OF SIMULATION HOUR 8142 THIS IS JULIAN DAY 339, CALENDAR DAY 5DEC
93

AVERAGE METEOROLOGICAL QUANTITIES FOR THIS COMPUTATION PERIOD:

CLOUD COVER 0.15 AIR PRESSURE,MB 1009.00 WIND SPEED,KPH 20.40 DRYBULB TEMP,DEGC, 4.4 DEWPOINT TEMP,DEGC, 0
.6

S/W RAD,KC/M2/HR 0.0 L/W RAD,KC/M2/HR 204.0 VAPOR PRESSURE,MB 6.4 SAT.VAP.PRES,MB 8.7 EVAP.RATE,M/HR 0.00
01
TOTAL EVAP., M. 1.
62
SURFACE ELEVATION,M: 19.0 EL.ABOVE MSL,M. 43.4

INFLOWING QUANTITIES FOR THIS COMPUTATION INTERVAL:

TRIBUTARY	INFLOW M3/SEC	TEMPERATURE DEG C	TOT.DISS.SOLIDS G/M3	SUSPENDED SOLIDS G/M3
1	0.13	14.4	3.3	0.1

OUTFLOWING QUANTITIES FOR THIS COMPUTATION INTERVAL:

PORT	LAYER	OUTFLOW,M3/SEC
1	24	0.01
2	22	0.01
3	19	0.01
4	15	0.01
5	11	0.01
6	8	0.01
7	5	0.01
8	2	0.01

TOTAL OUTFLOW,M3/SEC 0.10 TEMPERATURE,DEG C 4.9 TOT.DISS.SOLIDS,G/M3 175.4 SUSP.SOLIDS,G/M3 0.0

	0	5	10	15	20	25	30	35	TEMP. DEG.C	TOT.DISS. SOLIDS G/M3	SUSPENDED SOLIDS G/M3	S/W RADIATION KC/M2/HR	LAYER INFLOW M3/SEC	LAYER OUTFLOW M3/SEC	DIFFUSION COEF. M2/HR	UPPER ELEVATION M
24		*	D						5.0	175.0	0.0	0.00	0.13	0.00	0.7753	19.0
23		*							5.0	175.0	0.0	0.00	0.00	0.00	0.7753	17.6
22		*	D						5.0	175.0	0.0	0.00	0.00	0.00	0.7753	16.8
21		*							5.0	175.0	0.0	0.00	0.00	0.00	0.7753	16.0
20		*							5.0	175.0	0.0	0.00	0.00	0.01	0.7753	15.2
19		*							5.0	175.0	0.0	0.00	0.00	0.01	0.7753	14.3
18		*	D						5.0	175.0	0.0	0.00	0.00	0.01	0.7753	13.3
17		*							5.0	175.0	0.0	0.00	0.00	0.01	0.3202	12.6
16		*							5.0	175.0	0.0	0.00	0.00	0.00	0.2260	11.8
15		*							5.0	175.0	0.0	0.00	0.00	0.00	0.2311	11.2
14		*	D						5.0	175.0	0.0	0.00	0.00	0.00	0.2398	10.5
13		*							5.0	175.0	0.0	0.00	0.00	0.00	0.2457	10.0
12		*							5.0	175.0	0.0	0.00	0.00	0.00	0.2520	9.4
11		*							5.0	175.0	0.0	0.00	0.00	0.00	0.2593	8.8
10		*							5.0	175.6	0.0	0.00	0.00	0.00	0.2691	8.1
9		*	D						4.9	175.8	0.0	0.00	0.00	0.01	0.2833	7.4
8		*							4.9	175.9	0.0	0.00	0.00	0.00	0.3019	6.5

7	*		4.9	176.0	0.0	0.00	0.00	0.00	0.3224	5.7
6	*		4.9	176.0	0.0	0.00	0.00	0.00	0.3501	5.0
5	*	D	4.9	176.0	0.0	0.00	0.00	0.00	0.3792	4.2
4	*		4.9	176.1	0.0	0.00	0.00	0.00	0.4256	3.5
3	*		4.9	176.1	0.0	0.00	0.00	0.00	0.4997	2.8
2	*		4.9	176.1	0.0	0.00	0.00	0.01	0.6168	1.8
1	*		4.9	176.1	0.0	0.00	0.00	0.00	0.0000	0.8

1

DAILY INFORMATION

HOUR	DAY	SIM.INT.	ELEV M	INFLOW M3/S	TEMP C	OUTFLOW M3/S	TEMP C	IF REGULATION TARGET T. C.	PORT	FLOW M3/S	PORT	FLOW M3/S	PORT	FLOW M3/S	MORE?
8142	339	1	19.0	0.1	14.4	0.1	4.9		1	0.0	2	0.0	3	0.0	YES

1

STATUS AT END OF SIMULATION HOUR 8148 THIS IS JULIAN DAY 339, CALENDAR DAY 5DEC

93

AVERAGE METEOROLOGICAL QUANTITIES FOR THIS COMPUTATION PERIOD:

CLOUD COVER 0.19 AIR PRESSURE,MB 1010.87 WIND SPEED,KPH 19.80 DRYBULB TEMP,DEGC, 5.1 DEWPOINT TEMP,DEGC, 0

.6

S/W RAD,KC/M2/HR 165.0 L/W RAD,KC/M2/HR 207.7 VAPOR PRESSURE,MB 6.4 SAT.VAP.PRES,MB 8.6 EVAP.RATE,M/HR 0.00

01

TOTAL EVAP., M. 1.

62

SURFACE ELEVATION,M: 19.0 EL.ABOVE MSL,M. 43.4

INFLOWING QUANTITIES FOR THIS COMPUTATION INTERVAL:

TRIBUTARY	INFLOW M3/SEC	TEMPERATURE DEG C	TOT.DISS.SOLIDS G/M3	SUSPENDED SOLIDS G/M3
1	0.13	14.4	3.2	0.1

OUTFLOWING QUANTITIES FOR THIS COMPUTATION INTERVAL:

PORT	LAYER	OUTFLOW,M3/SEC
1	24	0.01
2	22	0.01
3	19	0.01
4	15	0.01
5	11	0.01
6	8	0.01
7	5	0.01
8	2	0.01

TOTAL OUTFLOW,M3/SEC 0.10 TEMPERATURE,DEG C 4.9 TOT.DISS.SOLIDS,G/M3 175.3 SUSP.SOLIDS,G/M3 0.0

	0 5 10 15 20 25 30 35	TEMP. DEG.C	TOT.DISS. SOLIDS G/M3	SUSPENDED SOLIDS G/M3	S/W RADIATION KC/M2/HR	LAYER INFLOW M3/SEC	LAYER OUTFLOW M3/SEC	DIFFUSION COEF. M2/HR	UPPER ELEVATION M
24	* D	4.9	175.0	0.0	66.73	0.13	0.00	0.6932	19.0
23	*	4.9	175.0	0.0	43.31	0.00	0.01	0.6932	17.6
22	* D	4.9	175.0	0.0	28.67	0.00	0.00	0.6932	16.8
21	*	4.9	175.0	0.0	19.20	0.00	0.00	0.6932	16.0
20	*	4.9	175.0	0.0	12.29	0.00	0.01	0.6932	15.2
19	*	4.9	175.0	0.0	7.75	0.00	0.01	0.6932	14.3
18	* D	4.9	175.0	0.0	5.23	0.00	0.00	0.6932	13.3
17	*	4.9	175.0	0.0	3.55	0.00	0.00	0.6932	12.6
16	*	4.9	175.0	0.0	2.61	0.00	0.00	0.6932	11.8
15	*	4.9	175.0	0.0	1.89	0.00	0.00	0.6932	11.2
14	* D	4.9	175.0	0.0	1.42	0.00	0.00	0.6932	10.5
13	*	4.9	175.0	0.0	1.09	0.00	0.00	0.6932	9.9
12	*	4.9	175.0	0.0	0.82	0.00	0.00	0.6932	9.4
11	*	4.9	175.0	0.0	0.58	0.00	0.01	0.2430	8.8
10	*	4.9	175.0	0.0	0.40	0.00	0.01	0.1535	8.1
9	* D	5.0	175.6	0.0	0.26	0.00	0.00	0.1877	7.4
8	*	4.9	175.8	0.0	0.17	0.00	0.00	0.2186	6.5
7	*	4.9	175.9	0.0	0.12	0.00	0.00	0.2451	5.7
6	*	4.9	175.9	0.0	0.08	0.00	0.00	0.2760	4.9
5	* D	4.9	176.0	0.0	0.06	0.00	0.00	0.3062	4.2
4	*	4.9	176.0	0.0	0.04	0.00	0.00	0.3527	3.5
3	*	4.9	176.0	0.0	0.02	0.00	0.00	0.4260	2.7
2	*	4.9	176.0	0.0	0.01	0.00	0.01	0.5412	1.8
1	*	4.9	176.0	0.0	0.01	0.00	0.00	0.0000	0.8

1

DAILY INFORMATION

HOUR	DAY	SIM.INT.	ELEV M	INFLOW M3/S	TEMP C	OUTFLOW M3/S	TEMP C	IF REGULATION TARGET T. C.	PORT	FLOW M3/S	PORT	FLOW M3/S	PORT	FLOW M3/S	MORE?
8148	339	2	19.0	0.1	14.4	0.1	4.9		1	0.0	2	0.0	3	0.0	YES

1
STATUS AT END OF SIMULATION HOUR 8154 THIS IS JULIAN DAY 339, CALENDAR DAY 5DEC
93

AVERAGE METEOROLOGICAL QUANTITIES FOR THIS COMPUTATION PERIOD:

CLOUD COVER 0.24 AIR PRESSURE,MB 1012.75 WIND SPEED,KPH 19.20 DRYBULB TEMP,DEGC, 5.8 DEWPOINT TEMP,DEGC, 0
.6

S/W RAD,KC/M2/HR 187.0 L/W RAD,KC/M2/HR 211.5 VAPOR PRESSURE,MB 6.4 SAT.VAP.PRES,MB 8.6 EVAP.RATE,M/HR 0.00
01
TOTAL EVAP., M. 1.
62
SURFACE ELEVATION,M: 19.0 EL.ABOVE MSL,M. 43.4

INFLOWING QUANTITIES FOR THIS COMPUTATION INTERVAL:

TRIBUTARY	INFLOW M3/SEC	TEMPERATURE DEG C	TOT.DISS.SOLIDS G/M3	SUSPENDED SOLIDS G/M3
1	0.13	14.4	3.2	0.1

OUTFLOWING QUANTITIES FOR THIS COMPUTATION INTERVAL:

PORT	LAYER	OUTFLOW,M3/SEC
1	24	0.01
2	22	0.01
3	19	0.01
4	15	0.01
5	11	0.01
6	8	0.01
7	5	0.01
8	2	0.01

TOTAL OUTFLOW,M3/SEC 0.10 TEMPERATURE,DEG C 5.0 TOT.DISS.SOLIDS,G/M3 175.3 SUSP.SOLIDS,G/M3 0.0

	0 5 10 15 20 25 30 35	TEMP. DEG.C	TOT.DISS. SOLIDS G/M3	SUSPENDED SOLIDS G/M3	S/W RADIATION KC/M2/HR	LAYER INFLOW M3/SEC	LAYER OUTFLOW M3/SEC	DIFFUSION COEF. M2/HR	UPPER ELEVATION M
24	* D	5.0	174.8	0.0	75.49	0.13	0.00	0.6177	19.0
23	*	5.0	174.8	0.0	49.00	0.00	0.00	0.6177	17.6
22	* D	5.0	174.8	0.0	32.43	0.00	0.00	0.6177	16.8
21	*	5.0	174.9	0.0	21.72	0.00	0.00	0.6177	15.9
20	*	5.0	174.9	0.0	13.90	0.00	0.00	0.6177	15.1
19	*	5.0	175.0	0.0	8.76	0.00	0.01	0.6177	14.3
18	* D	5.0	175.0	0.0	5.91	0.00	0.00	0.6177	13.3
17	*	5.0	175.0	0.0	4.01	0.00	0.00	0.6177	12.5
16	*	4.9	175.0	0.0	2.95	0.00	0.00	0.6177	11.8
15	*	4.9	175.0	0.0	2.14	0.00	0.00	0.6177	11.2
14	* D	4.9	175.0	0.0	1.61	0.00	0.00	0.6177	10.5
13	*	4.9	175.0	0.0	1.23	0.00	0.00	0.6177	9.9
12	*	4.9	175.0	0.0	0.92	0.00	0.00	0.6177	9.4
11	*	4.9	175.0	0.0	0.65	0.00	0.01	0.6177	8.8
10	*	4.9	175.1	0.0	0.45	0.00	0.01	0.4677	8.1
9	* D	4.9	175.3	0.0	0.29	0.00	0.01	0.1534	7.4
8	*	4.9	175.6	0.0	0.19	0.00	0.00	0.1691	6.5

7	*		4.9	175.7	0.0	0.13	0.00	0.00	0.1894	5.7
6	*		4.9	175.8	0.0	0.09	0.00	0.00	0.2165	4.9
5	*	D	4.9	175.9	0.0	0.06	0.00	0.00	0.2444	4.2
4	*		4.9	175.9	0.0	0.04	0.00	0.00	0.2884	3.5
3	*		4.9	176.0	0.0	0.03	0.00	0.00	0.3590	2.7
2	*		4.9	176.0	0.0	0.02	0.00	0.01	0.4716	1.8
1	*		4.9	176.0	0.0	0.01	0.00	0.00	0.0000	0.8

1

DAILY INFORMATION

HOUR	DAY	SIM.INT.	ELEV M	INFLOW M3/S	TEMP C	OUTFLOW M3/S	TEMP C	IF REGULATION TARGET T. C.	PORT	FLOW M3/S	PORT	FLOW M3/S	PORT	FLOW M3/S	MORE?
8154	339	3	19.0	0.1	14.4	0.1	5.0		1	0.0	2	0.0	3	0.0	YES
8160	340	4	19.0	0.1	14.4	0.1	5.0		1	0.0	2	0.0	3	0.0	YES
8166	340	1	19.0	0.1	14.4	0.1	4.9		1	0.0	2	0.0	3	0.0	YES
8172	340	2	19.0	0.1	14.4	0.1	4.9		1	0.0	2	0.0	3	0.0	YES
8178	340	3	19.0	0.1	14.4	0.1	4.9		1	0.0	2	0.0	3	0.0	YES
8184	341	4	19.0	0.1	14.4	0.1	4.9		1	0.0	2	0.0	3	0.0	YES
8190	341	1	19.0	0.1	14.4	0.1	4.8		1	0.0	2	0.0	3	0.0	YES
8196	341	2	19.0	0.1	14.4	0.1	4.8		1	0.0	2	0.0	3	0.0	YES
8202	341	3	19.0	0.1	14.4	0.1	4.8		1	0.0	2	0.0	3	0.0	YES
8208	342	4	19.0	0.1	14.4	0.1	4.7		1	0.0	2	0.0	3	0.0	YES
8214	342	1	19.0	0.1	14.4	0.1	4.6		1	0.0	2	0.0	3	0.0	YES
8220	342	2	19.0	0.1	14.4	0.1	4.5		1	0.0	2	0.0	3	0.0	YES
8226	342	3	19.0	0.1	14.4	0.1	4.5		1	0.0	2	0.0	3	0.0	YES
8232	343	4	19.0	0.1	14.4	0.1	4.5		1	0.0	2	0.0	3	0.0	YES
8238	343	1	19.0	0.1	14.4	0.1	4.6		1	0.0	2	0.0	3	0.0	YES
8244	343	2	19.0	0.1	14.4	0.1	4.6		1	0.0	2	0.0	3	0.0	YES
8250	343	3	19.1	0.1	14.4	0.1	4.6		1	0.0	2	0.0	3	0.0	YES

1

STATUS AT END OF SIMULATION HOUR 8256 THIS IS JULIAN DAY 344, CALENDAR DAY 10DEC
93

AVERAGE METEOROLOGICAL QUANTITIES FOR THIS COMPUTATION PERIOD:

CLOUD COVER 0.95 AIR PRESSURE,MB 998.22 WIND SPEED,KPH 22.63 DRYBULB TEMP,DEGC, 4.9 DEWPOINT TEMP,DEGC, 5
.4
S/W RAD,KC/M2/HR 0.0 L/W RAD,KC/M2/HR 235.0 VAPOR PRESSURE,MB 8.9 SAT.VAP.PRES,MB 8.5 EVAP.RATE,M/HR 0.00
00
TOTAL EVAP., M. 1.
63

SURFACE ELEVATION,M: 19.1 EL.ABOVE MSL,M. 43.4

INFLOWING QUANTITIES FOR THIS COMPUTATION INTERVAL:

TRIBUTARY	INFLOW M3/SEC	TEMPERATURE DEG C	TOT.DISS.SOLIDS G/M3	SUSPENDED SOLIDS G/M3

1	0.13	14.4	2.7	0.1

OUTFLOWING QUANTITIES FOR THIS COMPUTATION INTERVAL:

PORT	LAYER	OUTFLOW,M3/SEC
1	23	0.01
2	21	0.01
3	18	0.01
4	15	0.01
5	10	0.01
6	7	0.01
7	4	0.01
8	1	0.01

TOTAL OUTFLOW,M3/SEC 0.10 TEMPERATURE,DEG C 4.6 TOT.DISS.SOLIDS,G/M3 173.6 SUSP.SOLIDS,G/M3 0.0

	0	5	10	15	20	25	30	35	TEMP. DEG.C	TOT.DISS. SOLIDS G/M3	SUSPENDED SOLIDS G/M3	S/W RADIATION KC/M2/HR	LAYER INFLOW M3/SEC	LAYER OUTFLOW M3/SEC	DIFFUSION COEF. M2/HR	UPPER ELEVATION M
23		*							4.8	173.2	0.0	0.00	0.13	0.01	1.1275	19.1
22		*							4.8	173.2	0.0	0.00	0.00	0.01	1.0859	17.6
21		*							4.8	173.2	0.0	0.00	0.00	0.00	1.0031	16.7
20		*							4.8	173.3	0.0	0.00	0.00	0.00	0.9521	15.9
19		*							4.7	173.4	0.0	0.00	0.00	0.01	0.9072	15.1
18		*							4.7	173.5	0.0	0.00	0.00	0.00	0.8936	14.2
17		*							4.7	173.5	0.0	0.00	0.00	0.00	0.8400	13.3
16		*							4.7	173.6	0.0	0.00	0.00	0.00	0.8404	12.5
15		*							4.6	173.7	0.0	0.00	0.00	0.00	0.8322	11.7
14		*							4.6	173.7	0.0	0.00	0.00	0.00	0.8239	11.1
13		*							4.6	173.7	0.0	0.00	0.00	0.00	0.8203	10.4
12		*							4.6	173.8	0.0	0.00	0.00	0.00	0.8200	9.9
11		*							4.6	173.8	0.0	0.00	0.00	0.00	0.8227	9.3
10		*							4.6	173.8	0.0	0.00	0.00	0.00	0.8289	8.7
9		*							4.6	173.8	0.0	0.00	0.00	0.00	0.8394	8.0
8		*							4.6	173.9	0.0	0.00	0.00	0.00	0.8552	7.3
7		*							4.6	173.9	0.0	0.00	0.00	0.01	0.8751	6.4
6		*							4.6	173.9	0.0	0.00	0.00	0.00	0.8951	5.5
5		*							4.5	173.9	0.0	0.00	0.00	0.00	0.9198	4.8
4		*							4.5	173.9	0.0	0.00	0.00	0.00	0.9431	4.0
3		*							4.5	173.9	0.0	0.00	0.00	0.00	0.9771	3.3
2		*							4.5	173.9	0.0	0.00	0.00	0.01	1.0253	2.5
1		*							4.5	173.9	0.0	0.00	0.00	0.01	0.0000	1.5

1

DAILY INFORMATION

HOUR	DAY	SIM.INT.	ELEV M	INFLOW M3/S	TEMP C	OUTFLOW M3/S	TEMP C	IF REGULATION TARGET T. C.	PORT	FLOW M3/S	PORT	FLOW M3/S	PORT	FLOW M3/S	MORE?
8262	344	1	19.1	0.1	14.4	0.1	4.6		1	0.0	2	0.0	3	0.0	YES
8268	344	2	19.1	0.1	14.4	0.1	4.6		1	0.0	2	0.0	3	0.0	YES
8274	344	3	19.1	0.1	14.4	0.1	4.6		1	0.0	2	0.0	3	0.0	YES
8280	345	4	19.1	0.1	14.4	0.1	4.4		1	0.0	2	0.0	3	0.0	YES
8286	345	1	19.1	0.1	14.4	0.1	4.1		1	0.0	2	0.0	3	0.0	YES
8292	345	2	19.0	0.1	14.4	0.1	4.0		1	0.0	2	0.0	3	0.0	YES
8298	345	3	19.0	0.1	14.4	0.1	3.8		1	0.0	2	0.0	3	0.0	YES
8304	346	4	19.0	0.1	14.4	0.1	3.7		1	0.0	2	0.0	3	0.0	YES
8310	346	1	19.0	0.1	14.4	0.1	3.5		1	0.0	2	0.0	3	0.0	YES
8316	346	2	19.0	0.1	14.4	0.1	3.4		1	0.0	2	0.0	3	0.0	YES
8322	346	3	19.0	0.1	14.4	0.1	3.3		1	0.0	2	0.0	3	0.0	YES
8328	347	4	19.0	0.1	14.4	0.1	3.3		1	0.0	2	0.0	3	0.0	YES
8334	347	1	19.0	0.1	14.4	0.1	3.2		1	0.0	2	0.0	3	0.0	YES
8340	347	2	19.1	0.1	14.4	0.1	3.2		1	0.0	2	0.0	3	0.0	YES
8346	347	3	19.1	0.1	14.4	0.1	3.3		1	0.0	2	0.0	3	0.0	YES
8352	348	4	19.1	0.1	14.4	0.1	3.4		1	0.0	2	0.0	3	0.0	YES
8358	348	1	19.1	0.1	14.4	0.1	3.4		1	0.0	2	0.0	3	0.0	YES
8364	348	2	19.1	0.1	14.4	0.1	3.4		1	0.0	2	0.0	3	0.0	YES
8370	348	3	19.1	0.1	14.4	0.1	3.5		1	0.0	2	0.0	3	0.0	YES
8376	349	4	19.1	0.1	14.4	0.1	3.4		1	0.0	2	0.0	3	0.0	YES
8382	349	1	19.1	0.1	14.4	0.1	3.3		1	0.0	2	0.0	3	0.0	YES
8388	349	2	19.1	0.1	14.4	0.1	3.2		1	0.0	2	0.0	3	0.0	YES
8394	349	3	19.1	0.1	14.4	0.1	3.1		1	0.0	2	0.0	3	0.0	YES
8400	350	4	19.1	0.1	14.4	0.1	3.1		1	0.0	2	0.0	3	0.0	YES
8406	350	1	19.1	0.1	14.4	0.1	3.0		1	0.0	2	0.0	3	0.0	YES
8412	350	2	19.1	0.1	14.4	0.1	3.0		1	0.0	2	0.0	3	0.0	YES
8418	350	3	19.1	0.1	14.4	0.1	3.0		1	0.0	2	0.0	3	0.0	YES
8424	351	4	19.1	0.1	14.4	0.1	2.9		1	0.0	2	0.0	3	0.0	YES
8430	351	1	19.1	0.1	14.4	0.1	2.9		1	0.0	2	0.0	3	0.0	YES
8436	351	2	19.1	0.1	14.4	0.1	2.8		1	0.0	2	0.0	3	0.0	YES
8442	351	3	19.1	0.1	14.4	0.1	2.9		1	0.0	2	0.0	3	0.0	YES
8448	352	4	19.1	0.1	14.4	0.1	2.9		1	0.0	2	0.0	3	0.0	YES
8454	352	1	19.1	0.1	14.4	0.1	2.8		1	0.0	2	0.0	3	0.0	YES
8460	352	2	19.1	0.1	14.4	0.1	2.8		1	0.0	2	0.0	3	0.0	YES
8466	352	3	19.1	0.1	14.4	0.1	2.8		1	0.0	2	0.0	3	0.0	YES
8472	353	4	19.1	0.1	14.4	0.1	2.8		1	0.0	2	0.0	3	0.0	YES
8478	353	1	19.1	0.1	14.4	0.1	2.8		1	0.0	2	0.0	3	0.0	YES
8484	353	2	19.1	0.1	14.4	0.1	2.8		1	0.0	2	0.0	3	0.0	YES
8490	353	3	19.1	0.1	14.4	0.1	2.8		1	0.0	2	0.0	3	0.0	YES
8496	354	4	19.1	0.1	14.4	0.1	2.9		1	0.0	2	0.0	3	0.0	YES
8502	354	1	19.1	0.1	14.4	0.1	3.0		1	0.0	2	0.0	3	0.0	YES
8508	354	2	19.1	0.1	14.4	0.1	3.1		1	0.0	2	0.0	3	0.0	YES
8514	354	3	19.1	0.1	14.4	0.1	3.2		1	0.0	2	0.0	3	0.0	YES
8520	355	4	19.1	0.1	14.4	0.1	3.2		1	0.0	2	0.0	3	0.0	YES
8526	355	1	19.1	0.1	14.4	0.1	3.0		1	0.0	2	0.0	3	0.0	YES
8532	355	2	19.1	0.1	14.4	0.1	2.9		1	0.0	2	0.0	3	0.0	YES

8538	355	3	19.1	0.1	14.4	0.1	2.8	1	0.0	2	0.0	3	0.0	YES
8544	356	4	19.1	0.1	14.4	0.1	2.7	1	0.0	2	0.0	3	0.0	YES
8550	356	1	19.1	0.1	14.4	0.1	2.6	1	0.0	2	0.0	3	0.0	YES
8556	356	2	19.1	0.1	14.4	0.1	2.5	1	0.0	2	0.0	3	0.0	YES
8562	356	3	19.1	0.1	14.4	0.1	2.4	1	0.0	2	0.0	3	0.0	YES
8568	357	4	19.1	0.1	14.4	0.1	2.3	1	0.0	2	0.0	3	0.0	YES
8574	357	1	19.1	0.1	14.4	0.1	2.3	1	0.0	2	0.0	3	0.0	YES
8580	357	2	19.1	0.1	14.4	0.1	2.2	1	0.0	2	0.0	3	0.0	YES
8586	357	3	19.1	0.1	14.4	0.1	2.1	1	0.0	2	0.0	3	0.0	YES
8592	358	4	19.1	0.1	14.4	0.1	2.1	1	0.0	2	0.0	3	0.0	YES
8598	358	1	19.1	0.1	14.4	0.1	2.1	1	0.0	2	0.0	3	0.0	YES
8604	358	2	19.1	0.1	14.4	0.1	2.1	1	0.0	2	0.0	3	0.0	YES
8610	358	3	19.1	0.1	14.4	0.1	2.0	1	0.0	2	0.0	3	0.0	YES
8616	359	4	19.1	0.1	14.4	0.1	1.7	1	0.0	2	0.0	3	0.0	YES
8622	359	1	19.1	0.1	14.4	0.1	1.2	1	0.0	2	0.0	3	0.0	YES
8628	359	2	19.1	0.1	14.4	0.1	0.8	1	0.0	2	0.0	3	0.0	YES
8634	359	3	19.1	0.1	14.4	0.1	0.6	1	0.0	2	0.0	3	0.0	YES
8640	360	4	19.1	0.1	14.4	0.1	0.6	1	0.0	2	0.0	3	0.0	YES
8646	360	1	19.1	0.1	14.4	0.1	0.6	1	0.0	2	0.0	3	0.0	YES
8652	360	2	19.1	0.1	14.4	0.1	0.5	1	0.0	2	0.0	3	0.0	YES
8658	360	3	19.1	0.1	14.4	0.1	0.5	1	0.0	2	0.0	3	0.0	YES
8664	361	4	19.1	0.1	14.4	0.1	0.5	1	0.0	2	0.0	3	0.0	YES
8670	361	1	19.1	0.1	14.4	0.1	0.5	1	0.0	2	0.0	3	0.0	YES
8676	361	2	19.1	0.1	14.4	0.1	0.5	1	0.0	2	0.0	3	0.0	YES
8682	361	3	19.1	0.1	14.4	0.1	0.5	1	0.0	2	0.0	3	0.0	YES
8688	362	4	19.1	0.1	14.4	0.1	0.5	1	0.0	2	0.0	3	0.0	YES
8694	362	1	19.1	0.1	14.4	0.1	0.5	1	0.0	2	0.0	3	0.0	YES
8700	362	2	19.1	0.1	14.4	0.1	0.5	1	0.0	2	0.0	3	0.0	YES
8706	362	3	19.1	0.1	14.4	0.1	0.5	1	0.0	2	0.0	3	0.0	YES
8712	363	4	19.1	0.1	14.4	0.1	0.5	1	0.0	2	0.0	3	0.0	YES
8718	363	1	19.1	0.1	14.4	0.1	0.5	1	0.0	2	0.0	3	0.0	YES
8724	363	2	19.1	0.1	14.4	0.1	0.5	1	0.0	2	0.0	3	0.0	YES
8730	363	3	19.1	0.1	14.4	0.1	0.5	1	0.0	2	0.0	3	0.0	YES
8736	364	4	19.1	0.1	14.4	0.1	0.4	1	0.0	2	0.0	3	0.0	YES
8742	364	1	19.1	0.1	14.4	0.1	0.4	1	0.0	2	0.0	3	0.0	YES
8748	364	2	19.1	0.1	14.4	0.1	0.4	1	0.0	2	0.0	3	0.0	YES
8754	364	3	19.1	0.1	14.4	0.1	0.4	1	0.0	2	0.0	3	0.0	YES
8760	365	4	19.1	0.1	14.4	0.1	0.4	1	0.0	2	0.0	3	0.0	YES