Biohabitats, Inc.

TRANSMITTAL

Ecological Restoration, Planning and Assessments
Voice, 410/337-3659
Fax, 410/583-5678
303 Allegheny Avenue
Towson, Maryland 21204

RECEIVED
JUL 31 1997
DEPARTMENT OF PERMITTING SERVICES

To: MCDEP
250 Hungerford Drive
Rockville, MD 20850

Attn: Richard Brush

Date: 7/29/97

Re: Clarksburg Town Center Monitoring

Project/Proposal No: 97004.01

We are sending you: ___Drawings ___Specifications ___Prints X Reports ___Details ___Copy of Letter ___Other

Via: ___Postal Service ___Same-Day Delivery ___Overnight Delivery ___Under Separate Cover

Copies/Description:

2 Clarksburg Town Center 1st Quarterly Report

Remarks:

Enclosed are two copies of the first quarterly monitoring report. If you have any questions, you can contact Marshall Rud. or me at (410) 337-3659

Sincerely,

Michael Cunningham

cc:File/ Steve Klebanoff with one copy

Fostering Ecological Stewardship

Please recycle this paper

WATER QUALITY MONITORING QUARTERLY REPORT
APRIL 1997 - JUNE 1997

for

CLARKSBURG TOWN CENTER
MONTGOMERY COUNTY, MARYLAND

Prepared For:

Clarksburg Limited Partnership
C/O First Sumner L.L.C.
342 Hungerford Drive
Rockville, Maryland 20850

Submitted To:

Montgomery County
Department of Environmental Protection
250 Hungerford Drive
Rockville, Maryland 20850

Prepared By:

Biohabitats, Inc.
15 West Aylesbury Road
Timonium, Maryland 21093

July 23, 1997

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TABLE OF CONTENTS

1.0 INTRODUCTION

Little Seneca Creek watershed is designated as a Special Protection Area (SPA) by the Montgomery County Council. Development within SPAs requires measures to protect water quality and quantity so pre- and post-construction conditions are near equal. The Clarksburg Town Center is located within the headwaters of an unnamed mainstem tributary, and its two tributaries, which flows into Little Seneca Creek.

In cooperation with the Montgomery County Department of Environmental Protection, Biohabitats developed and implemented a monitoring program for the Clarksburg Town Center that will monitor water quality and quantity before construction, thus establishing pre-construction baseline conditions. This document is the first quarterly report on the results of the monitoring program.

1.1 Project Background

The Clarksburg Town Center is located in Clarksburg, Maryland and is bordered to the north by Clarksburg Road (Route 121), to the east by Piedmont Road, to the south by Stringtown Road, and to the west by Frederick Road (Route 355). The site consists of 268 acres of land which will be developed for commercial and residential usage.

The site surrounds an unnamed, first order, main stem tributary which becomes a second order stream downstream of its confluence with two unnamed tributaries, one from the east and one from the west. Current land use of the site is agricultural, corn and soybean, with some forested areas. These forested areas are located on steeper slopes and in corridors along the three tributaries. The forested buffers along the tributaries range from 50 feet to 100 feet wide and the flood plains along the tributaries are comprised of seep wetlands.

1.2 Document Structure

Section 2.0 includes the monitoring protocols, monitoring schedule, and descriptions of monitoring equipment. Section 3.0 provides a summary of the monitoring data with an analysis of the results. Section 4.0 contains concluding remarks.

2.0 MATERIALS AND METHODS

2.1 Monitoring Protocols

The following monitoring protocols are based on those established in the reports "Water Quality Inventory, Water Quality Plan Submissions for Clarksburg Town Center, Montgomery County, Maryland" prepared by Biohabitats, Inc. and submitted to Montgomery County Department of Environmental Protection on March 27, 1995 and its addendum dated June 5, 1995, revised on June 22, 1995. In addition, the monitoring protocols were further refined during a meeting between MCDEP, Biohabitats, and MK Enterprises on February 26, 1997.

2.1.1 *Monitoring Stations*

Three permanent cross sections were established on each stream to monitor flow, however only the monitoring station on the main stem contains an automated flow logger. The cross sections on the east and west tributaries were monitored once for flow, as per monitoring protocols by Montgomery County. The monitoring station on the west tributary is located approximately 60 feet upstream of the confluence and the monitoring station on the east tributary is located approximately 400 feet upstream of the confluence. The in-stream monitoring station is located approximately 30 feet upstream of the Stringtown Road culvert, downstream of the confluence. Biohabitats installed the automated flow logger (see Section 2.2) on March 28, 1997. In addition, automated temperature loggers (see Section 2.2) were installed in each tributary on March 28, 1997. The temperature logger on the west tributary is located approximately 60 feet upstream of the confluence; the temperature logger on the mainstem tributary is located approximately 100 feet downstream of the Kings Pond outfall; and the east tributary temperature logger is located approximately 200 feet upstream of the confluence. Both flow and temperature loggers record data at 15 minute intervals.

2.1.2 *Daily Rain Data*

One rain gage was installed at the flow logger monitoring station (near Stringtown Road) on March 28, 1997. The rain gage monitors rainfall to the nearest 0.01 inche at 15 minute intervals.

2.1.3 *Water Quality*

The water quality paramater study was contracted to Versar, Inc., located in Columbia, MD by Biohabitats. The paramaters analyzed for this project are:

- pH	- Conductivity	- DO	- Alkalinity
- BOD	- Hardness	- Nitrate	- Nitrite
-Total Phosphorus	- TSS	- Cadmium	- Total Kjeldahl Nitrogen
- Chromium	- Copper	- Lead	- Mercury
- Nickel	- Zinc	- Metals digestion	- Total Petroleum Hydrocarbon
- VOCs	- Pesticides/PCBs	- Herbicides	

Grab samples and instream analyses were required to be taken at four designated sites, one site on each of the three tributaries upstream of the confluence and one site downstream of the confluence. Samples were taken during baseflow conditions and during a storm event to provide flow weighted samples. Results of the water quality study will be included in a report which will be an addendum to this first quarterly report.

2.2 Monitoring Devices

This section presents descriptions of the equipment used to perform the monitoring. Specifications for each item are included in Appendix A.

2.2.1 *In-Stream Automated Flow Logger*

Equipment

Submerged Probe Flow Logger
Model: 4120

Company

Isco, Inc., Environmental Division
531 Westgate Blvd.
Lincoln, NE 68528
(402) 474-2233

2.2.2 *In-Stream Automated Temperature Meter*

Equipment

8K Optic Stowaway Logger
Model: WTA08-05+37, s/n 821-824
Optic Shuttle
Model: DT128A, s/n 131

Company

Onset Computer Corporation
536 MacArthur Blvd.
Box 3450
Pocasset, MA 02559
(508) 563-9477

2.2.3 *Daily Rain Data*

Equipment

Tipping Bucket Rain Gauge
Model: 674

Company

Isco, Inc., Environmental division
531 Westgate Blvd.
Lincoln, NE 68528
(402) 474-2233

2.3 Monitoring Schedule

The monitoring schedule for the pre-construction phase is presented in the table form below.

PRE-CONSTRUCTION MONITORING SCHEDULE

START DATE	TYPE	NUMBER	FREQUENCY	DURATION
3/28/97	In-Stream Automated Flow Logger	1	15 Minute Intervals	Minimum Two Months
3/28/97	In-Stream Automated Temperature Meter	3	15 Minute Intervals	Minimum Two Months
3/28/97	Automated Rain Gage	1	Continuous During Each Storm Event	Minimum Two Months

Table 2.1 Schedule for pre-construction monitoring.

3.0 SUMMARY OF RESULTS

3.1 Flow, Rainfall, and Temperature

Automated data loggers are used to record streamflow, rainfall, and temperature at 15 minute intervals. Monthly streamflow and rainfall are plotted together for each monitoring station and are represented in Figures 3.2 - 3.4.

3.1.1 *Converting Water Level to Discharge*

The ISCO 4120 automated flow logger calculates the water surface elevation by measuring hydrostatic pressure with a pressure transducer installed directly in the stream channel. The relation between water surface elevation and discharge was determined by direct field measurement of discharge and water surface elevation at different flow stages. Mannings Equation was calibrated by the field measurements and used to extrapolate the relation beyond the range of measured flows. The relation between water surface elevation and discharge is non-linear due to irregular changes in cross section area with depth, changes in channel roughness, and hysteresis among other reasons. The relation is approximated by a linear function developed using the field measurements in combination with the Mannings Equation as described above. Figure 3.1 graphs the relation at the flow logger location.

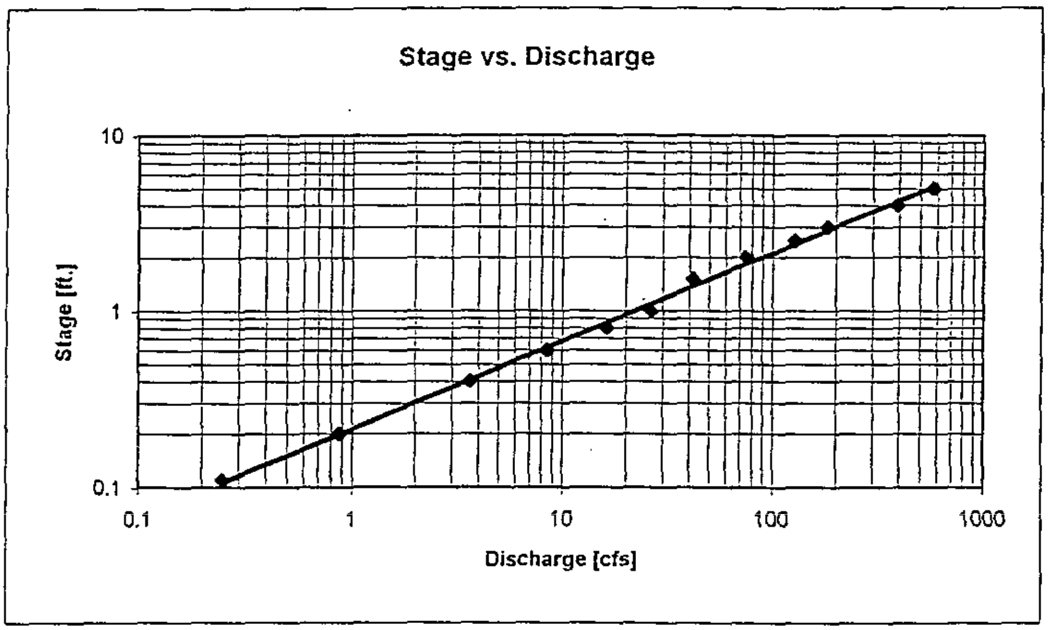


Figure 3.1 Relation between discharge and water surface elevation determined by field measurement at the Stringtown Road flow logger location.

3.1.2 *Rainfall Data*

The Isco rain gage records rainfall to the nearest 0.01 inch at 15 minute intervals. Daily rainfall totals are plotted against stream flow for the monthly summary plots in Figures 3.2 - 3.4.

3.1.3 *Temperature*

Stream temperature is recorded at 15 minute intervals on each of the three tributaries. Plots of temperature show daily temperature fluctuations and monthly trends. Table 3.1 presents a summary of temperature data. Data for the west tributary is unavailable since this temperature logger was unable to be recovered. This temperature logger was installed on March 28, 1997 and was not recovered after two attempts, one on July 3, 1997 and another on July 10, 1997. During both attempts, the stream channel was thoroughly explored with both a shovel and hands. The disappearance of the temperature logger is most likely a result of deposition of sediment which buried the logger as flows have dissipated due to the summer season and the recent lack of rainfall. However it is also possible that the culprit may be channel scouring during high flows which removed the anchored logger from the channel bottom and washed it away downstream. A new temperature logger was installed and activated on July 25, 1997. This logger was installed more securely and better denoted in the field to allow for precise locating to prevent this situation from reoccurring.

Temperature Data Summary for April 1997			
Temperature Logger	Mean Temp [F]	Minimum Temp [F]	Maximum Temp [F]
Main Stem	53.87	44.81 (4/1/97)	63.84 (4/4/97)
East Tributary	49.37	39.99 (4/10/97)	60.71 (4/30/97)

Temperature Data Summary for May 1997			
Temperature Logger	Mean Temp [F]	Minimum Temp [F]	Maximum Temp [F]
Main Stem	58.08	49.81 (5/11/97)	49.81 (5/11/97)
East Tributary	53.28	45.31 (5/5/97)	60.99 (5/5/97)

Temperature Data Summary for June 1997			
Temperature Logger	Mean Temp [F]	Minimum Temp [F]	Maximum Temp [F]
Main Stem	65.60	55.65 (6/9/97)	75.4 (6/25/97)
East Tributary	59.10	51.45 (6/5/97)	67.93 (6/26/97)

Table 3.1 Summary of temperature data.

3.1.4 *Tributary Permanent Cross Sections*

Two permanent cross sections were required to be established on each of the two tributaries. As per the protocols, these cross sections were only required to be flow monitored once a quarter. During a site visit on July 3, 1997, both cross sections were monitored. At the time of this field visit, the west tributary was calculated to have a discharge of .04 cfs and the east tributary was calculated to have a discharge of .05 cfs.

3.1.4 *Monthly Summary Plots*

Average and peak discharge are given for each month in Table 3.2. Discharge, water elevation, daily rainfall, and temperature are plotted in Figures 3.2 - 3.6.

	April 1997		May 1997		July 1997	
	Mean	Peak	Mean	Peak	Mean	Peak
Logger	0.74 cfs	4.08 cfs	1.19 cfs	1.95 cfs	0.42 cfs	5.87 cfs

Table 3.2 Monthly average and peak flows for April 1997 through July 1997.

The monitoring stations on the east and west tributary were monitored for flow during a site visit on July 3, 1997.

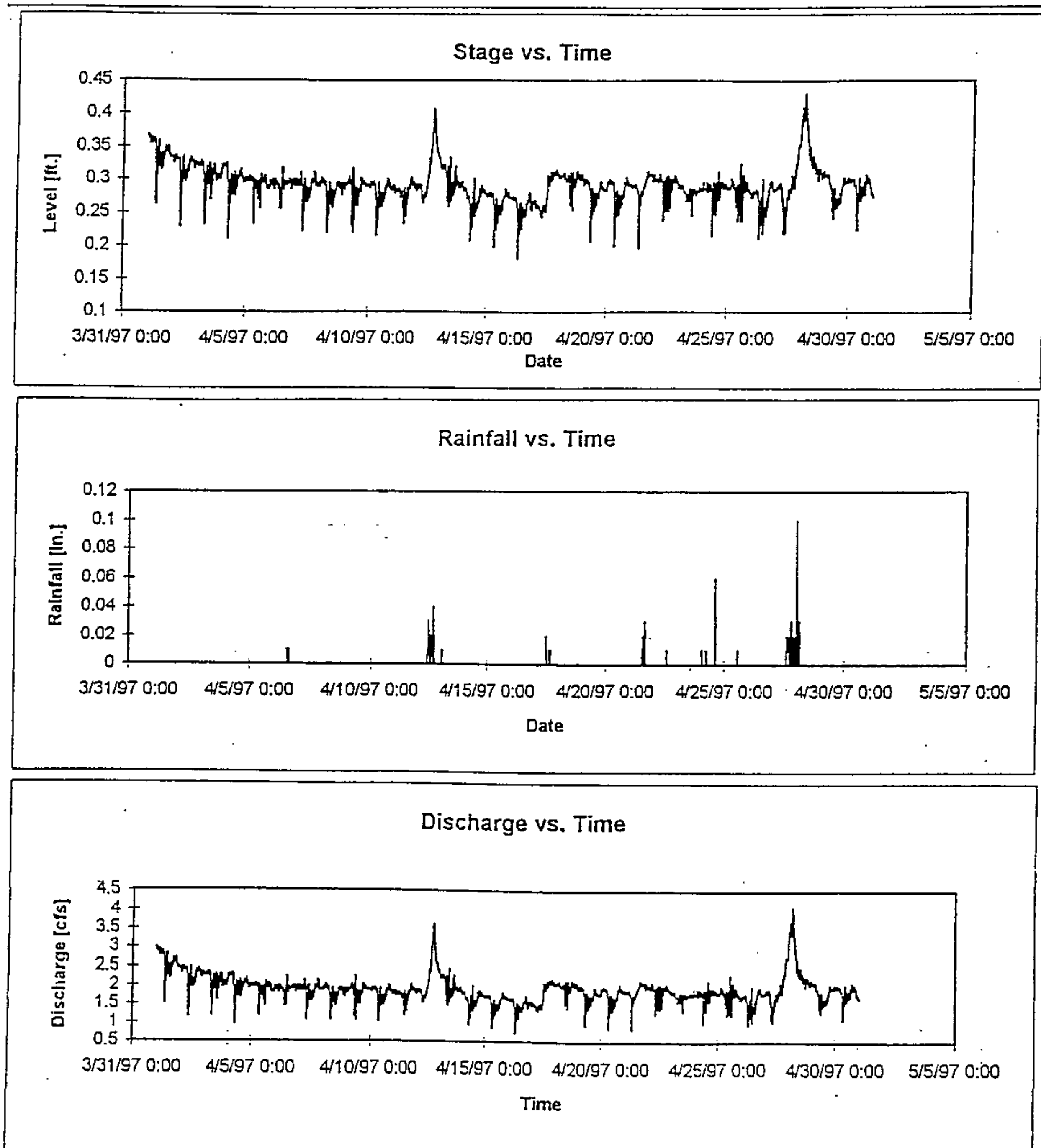


Figure 3.2 Water level, discharge, and daily rainfall at the Stringtown Road logger during April 1997.

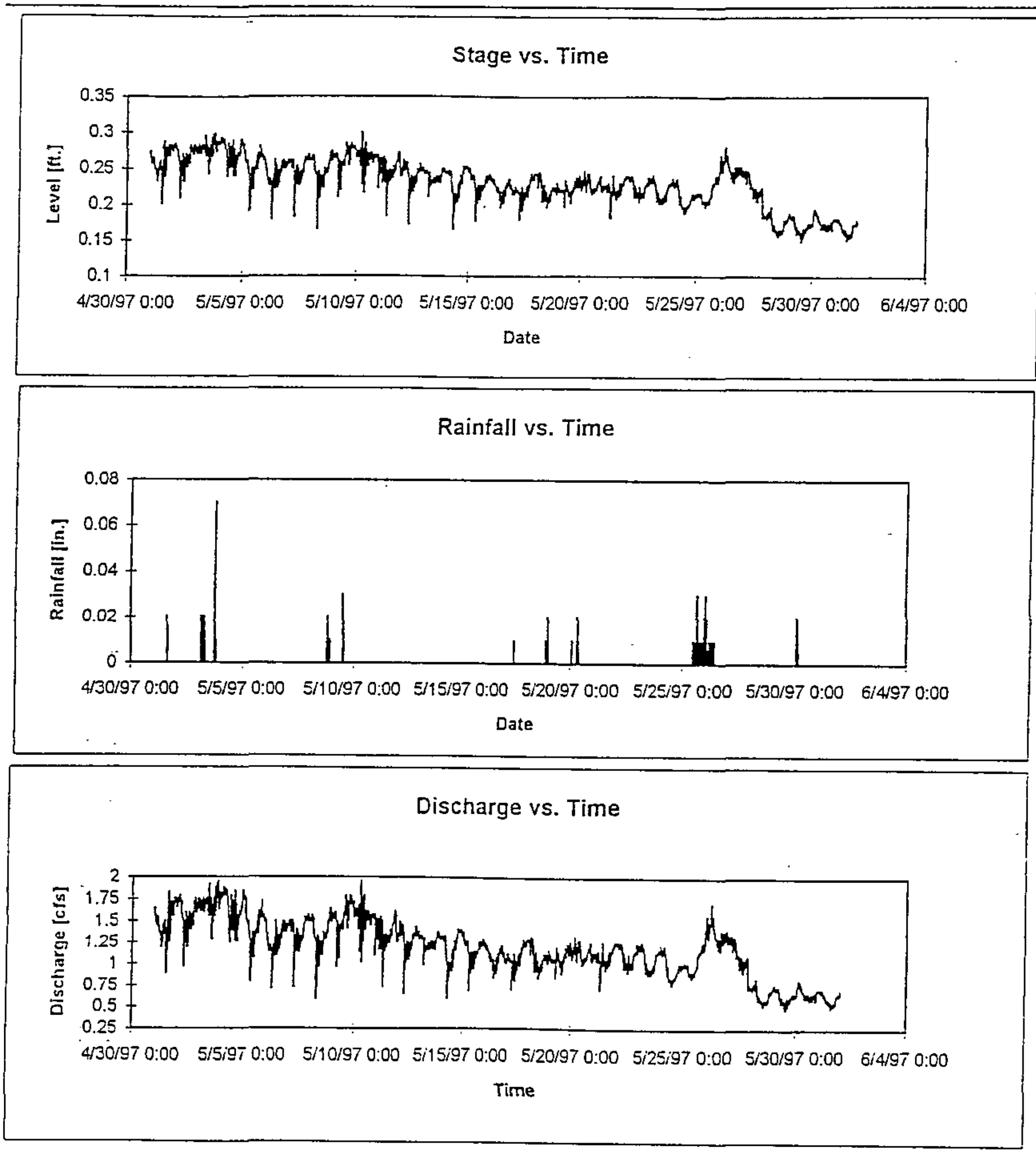


Figure 3.3 Water level, discharge, and daily rainfall at the Stringtown Road logger during May 1997.

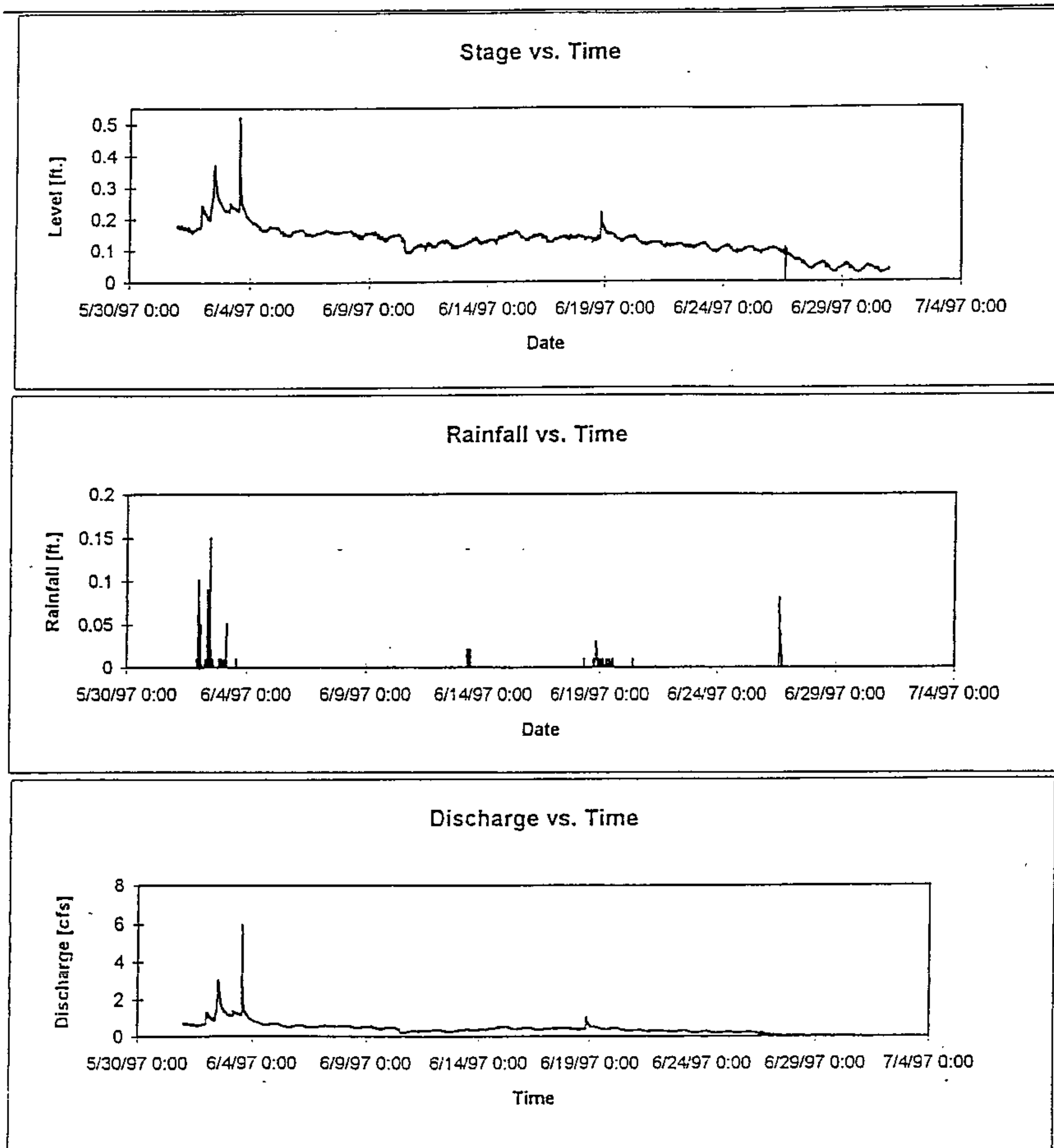


Figure 3.4 Water level, discharge, and daily rainfall at Stringtown Road logger during June 1997.

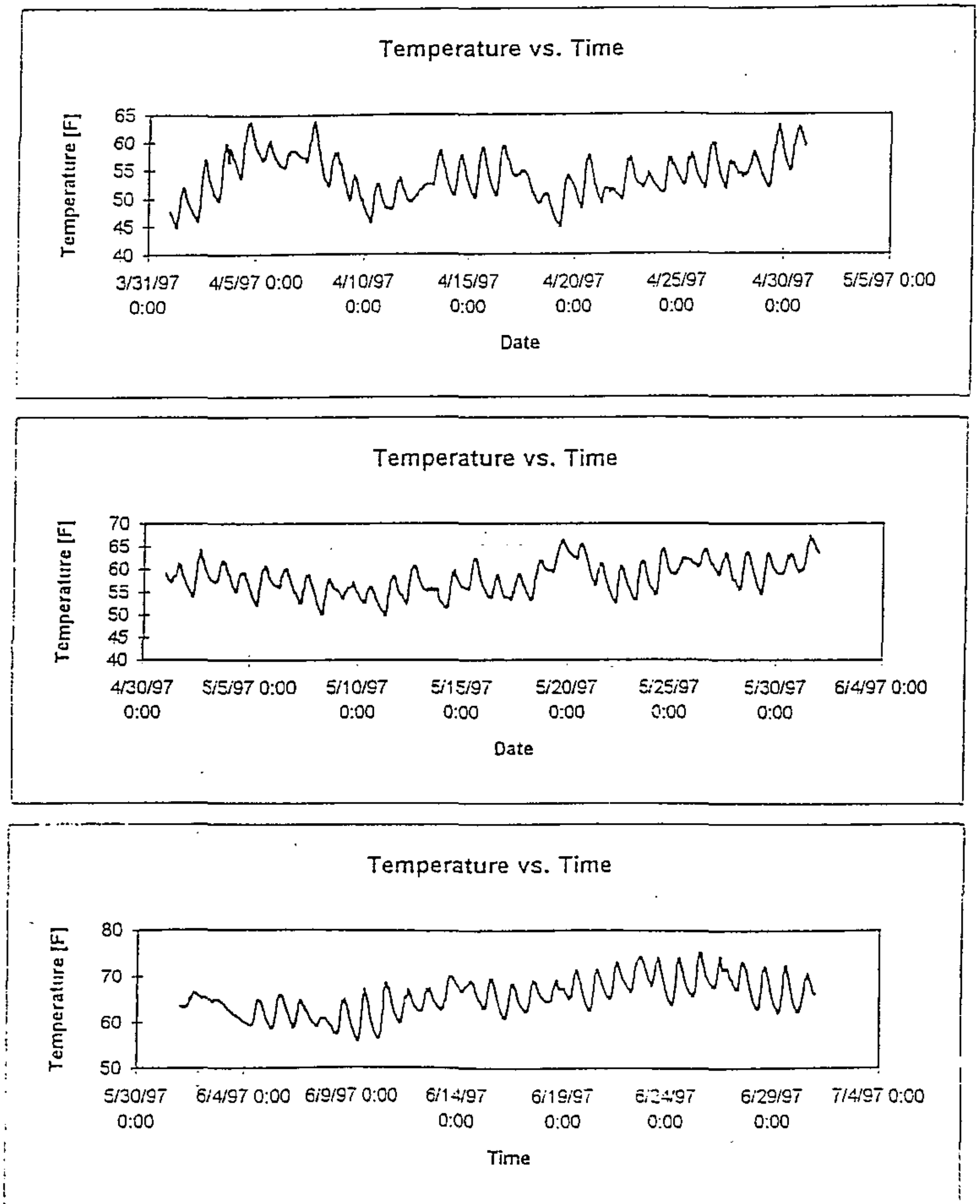
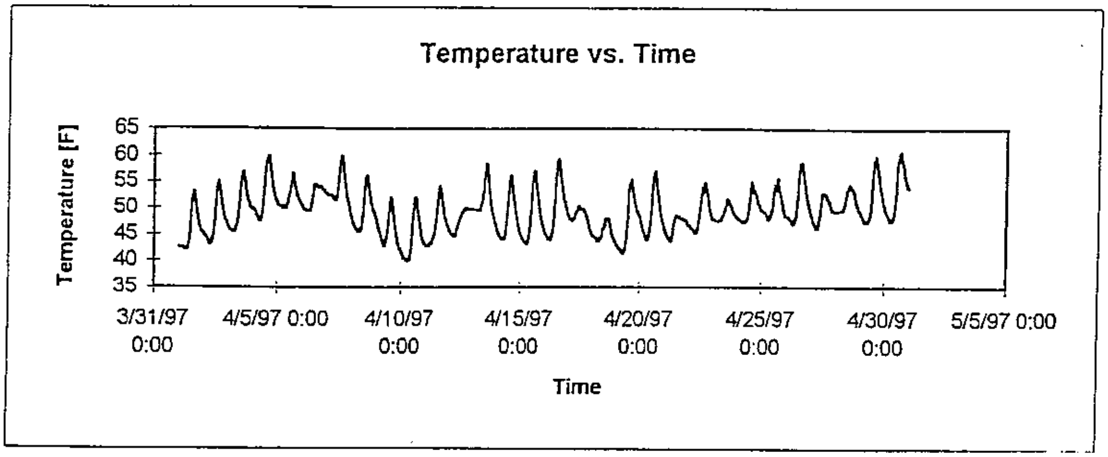
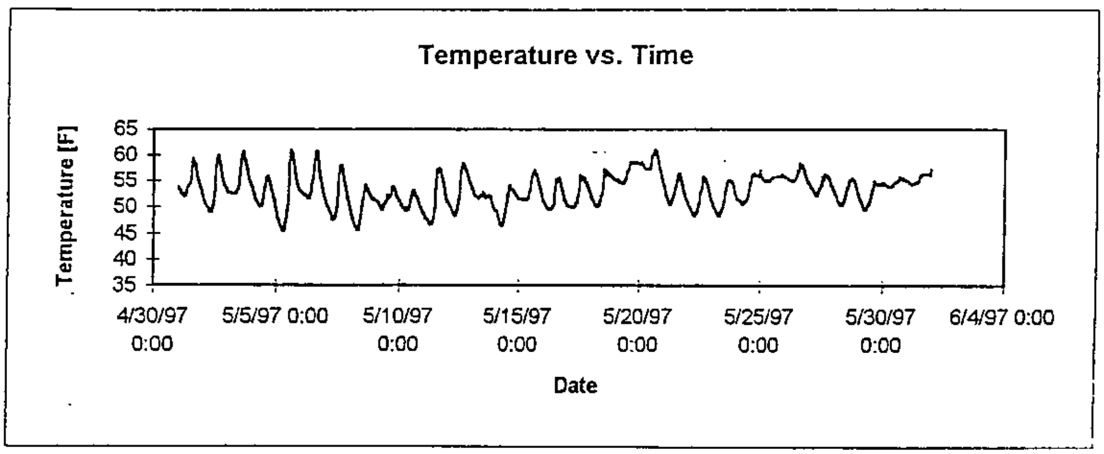


Figure 3.5 Water temperature at the main stem logger during April through June 1997.





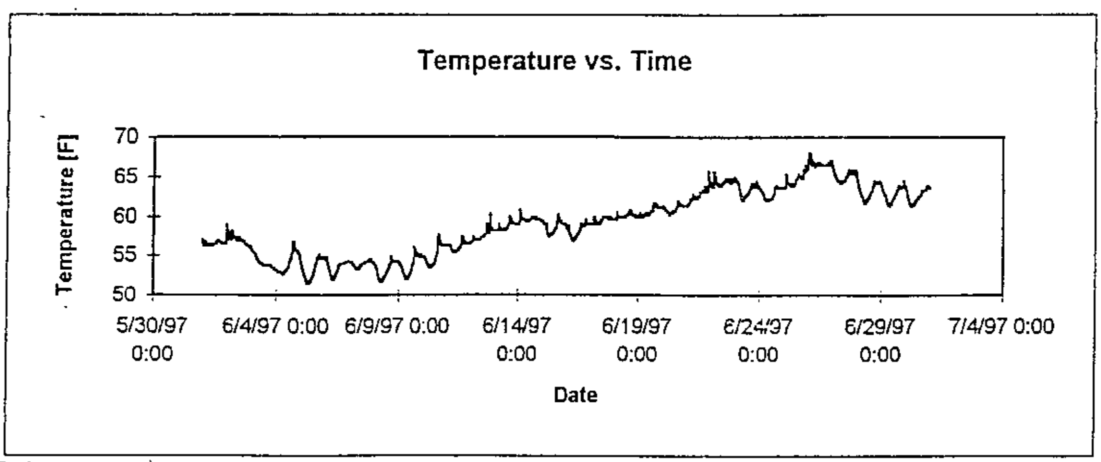


Figure 3.6 Water temperature at the east tributary logger during April through June 1997.

4.0 Concluding Remarks

During this monitoring period, typical trends to a headwater stream were observed with respect to flow and temperature. As exemplified in the results section of this report, the stream has a short lag time between the peak rainfall and peak discharge which is typical of a headwater stream. Furthermore, an obvious decrease in discharge later in the monitoring period was noticed, perhaps due to the summer season and from the lack of rainfall that the area is suffering. In addition, the stream temperature also behaves like a typical headwater stream. Due to the low volume of flow, the stream exhibits obvious diurnal fluctuations in temperature. Also, the stream is showing a noticeable warming trend as the seasons change and the summer begins.

It should be noted that since this is the first of four quarterly reports that it is too early to make any assumptions about the stream's behavior. Water quality data for this first quarter will be included in a report by Versar, Inc. which will serve as an addendum to this report. Monitoring data included in this report will be supplemented by the second quarterly report that will cover the period from July 1997 through September 1997. This body of monitoring data obtained during the pre-development phase of this project provides a set of baseline data to be used in the evaluation of potential impacts of the proposed residential development of the Clarksburg Town Center.

APPENDIX A: MONITORING EQUIPMENT SPECIFICATIONS

Appendix A. Technical Specifications

Figure 22 Materials Used in the 4120

1. Case and battery compartment door: polystyrene.

2. Connector panel: Noryl

3. Labels: polyester (not shown)

4. Strap: nylon

5. Strap latches: acetyl plastic

6. Strap-latch retainer: stainless steel

7. Suspension hook: stainless steel (not shown)

8. Connector caps: acetyl plastic

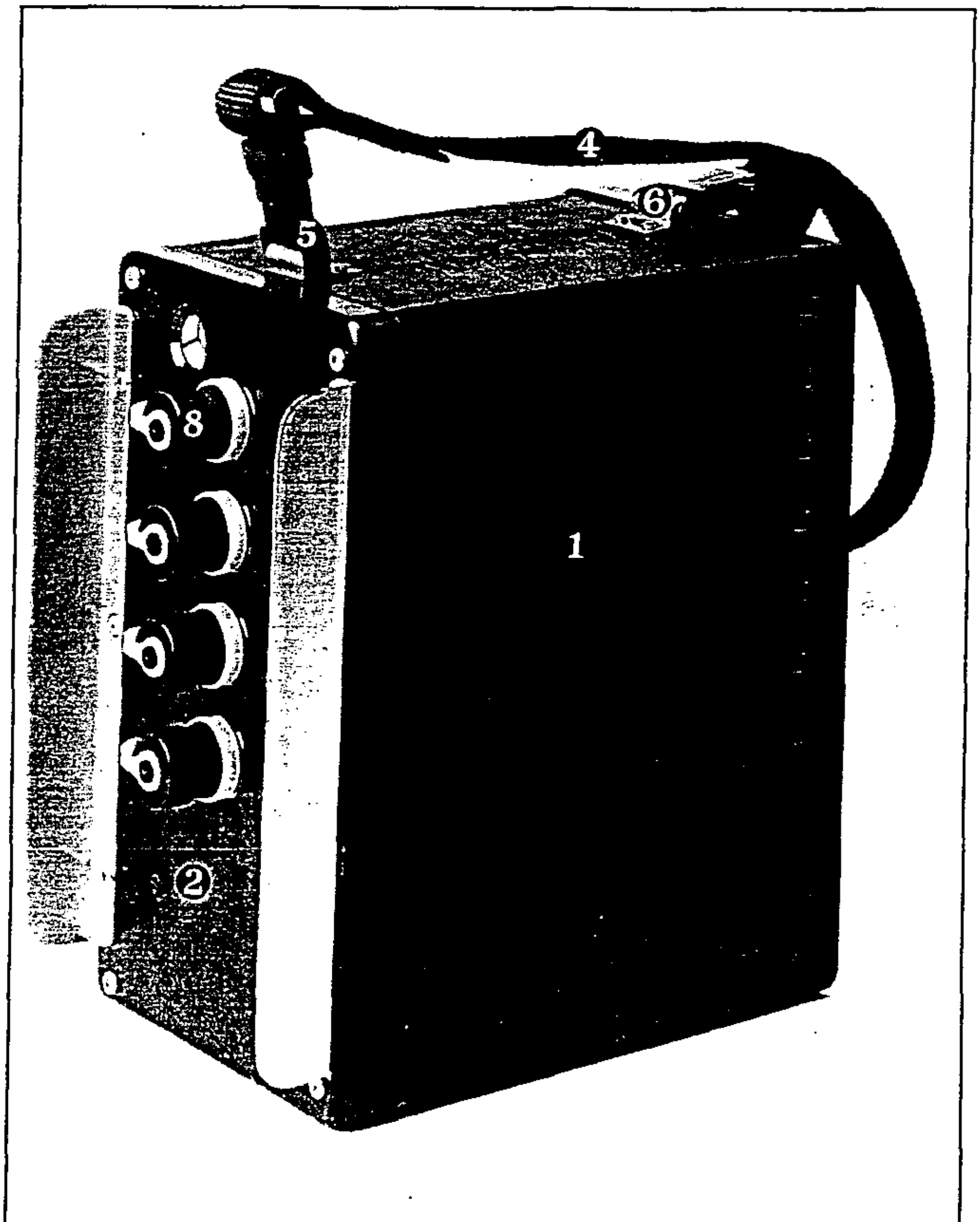


Table 2 Specifications: 4120 Flow Logger

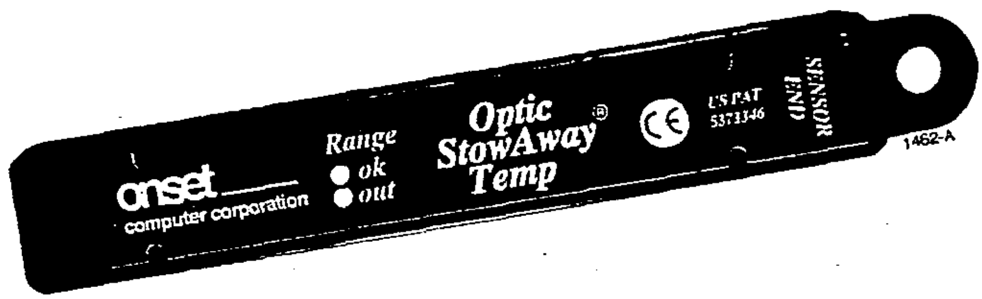
Size	10.5 x 9.0 x 6.0 inches (26.7 x 22.9 x 15.2 centimeters)
Weight	8 pounds (3.6 kilograms), without batteries.
Operating Temperature	0° to 140° F (-18° to 60° C)
StorageTemperature	-40° to 140° F (-40° to 60° C)
Enclosure	Self-certified NEMA 4X, 6
Power	Two 6-volt lantern batteries or one 12-volt Model 947 Flow Logger Lead-Acid Battery
Alkaline Battery Life	6 months with minimum reading intervals of 15 minutes.

Table 3 Specifications: Submerged Probe with 10-Foot Measurement Range

Sensor Size	Sensor 7/8 inch (2.2 centimeters) in diameter 5-1/2 inches (14.0 centimeters) long without nose cone 9-1/2 inches (24.1 centimeters) long with standard nose cone 0.765 square inches (1.9 centimeters) frontal area Amplifier Box (watertight enclosure) 2 x 2 x 1-1/2 inches (5.1 x 5.1 x 3.8 centimeters)
Sensor Weight	Probe and cable: 3 pounds (1.4 kilograms)
Cable Length	25 feet (7.6 meters) from sensor to amplifier box
Connector	5-pin male Amphenol, attached to a 12-inch (30.5 centimeter) cable. The 12-inch cable is attached to the amplifier box, located 25 feet from the sensor.
Sensor Material	Transducer diaphragm: Type 315 stainless steel Body: CPVC
Probe Cable Material	0.3-inch diameter black PVC (polyvinyl chloride)
Operating Temperature	32° to 160° F (0° to 71° C)
StorageTemperature	-40° to 160° F (-40° to 71° C)
Level-Measurement Accuracy	0.1 to 5.0 feet ± 0.01 foot (3.0 to152.4 centimeters ± 0.3 centimeters) 0.1 to 7.0 feet ± 0.03 foot (3.0 to 213.0 centimeters ± 0.9 centimeters) 0.1 to 10.0 feet ± 0.10 foot (3.0 to 304.8 centimeters ± 3.0 centimeters) *(Includes nonlinearity, repeatability, and hysteresis, but does not include temperature coefficient.)*
Maximum Allowable Level	20 feet (6.1 meters)
Compenstated-Temperature Range	32° to 100° F (0° to 38° C)
Temperature Coefficient	0.1 to 4.0 feet: ± 0.005 feet per degree F (3.0 to 121.9 centimeters: ± 0.15 centimeter per degree F) 4.0 to 10.0 feet: ± 0.007 feet per degree F (121.9 to 304.8 centimeters: ± 0.21 centimeter per degree F)

Optic StowAway® Temp

User's Manual



onset
computer corporation
Tel: (508) 563-9000 ÷ Fax: (508) 563-9477 ÷ email: loggerhelp@onsetcomp.com
536 MacArthur Blvd. ÷ Box 3450 ÷ Pocasset, MA 02559-3450

Thank you for purchasing an Optic StowAway® Temp logger. The minimum optic logging system is made of these components; the Optic StowAway Temp logger, the Optic Coupler™ and the Optic Base Station™ which connect the logger to the host computer, and LogBook® software. By adding the Optic Shuttle™, you can leave your Optic StowAway Temp in the field up to ten years.

Launching your Optic StowAway Temp

Connect the Optic Base Station™ to the host computer using the appropriate interface cable (PC-3.5 for a PC and Mac-3.5 for a Macintosh). Then slide the Optic StowAway Temp into the Optic Coupler™ on the Optic Base Station™ (as pictured below).

Triggered launch and the Optic StowAway Temp

The Optic StowAway Temp has an optional triggered launch. Launch your logger choosing the triggered launch option. After you have launched the logger with the triggered launch option selected, remove the logger from the Optic Coupler™. When you want to trigger the logger to launch, place it in the Optic Coupler™ again and it will launch when it is removed. You don't need to have the Optic Base Station™ to trigger the launch, a magnet in the Optic Coupler™ is doing the work. The magnet is in the outrigger on the side of the Optic Coupler™. You could also trigger the logger with any strong magnet placed near the top of the logger over the 'O' in Onset.

Data recovery

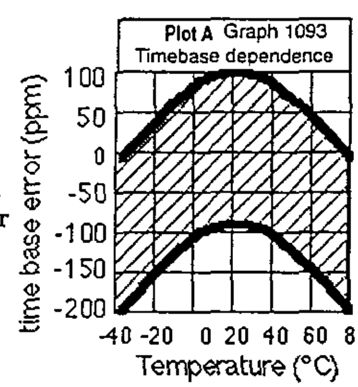
After you have launched the Optic StowAway Temp, remove the logger from the Optic Coupler™ and deploy the logger. At the end of the deployment, either bring the logger back and reattach it to the Optic Base Station™ for readout or use the Optic Shuttle™ to readout the data in the field. Be sure to keep your logger free from dirt and dust. To clean your logger use only a non-abrasive mild soap and warm water with a non-scratching sponge or cloth. Any scratches or abrasions on the optic logger's surface may impair communication. (For tougher cleaning jobs use a plastic polish such as Novus® plastic polish.)

Seeing if the alarm has been tripped

The Optic StowAway Temp has two LEDs. The green LED blinks during use if it has not recorded out-of-range conditions (see LogBook® User's Manual for how to set the alarm). If it has recorded out-of-range conditions, the red LED will blink. When the Optic StowAway Temp is full it will no longer blink either LED.

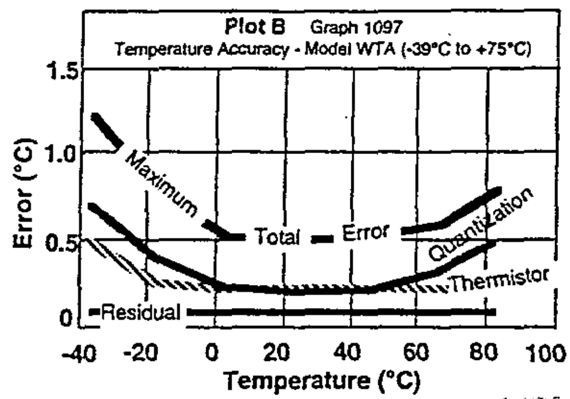
Time accuracy

At room temperature, the logger's idea of time can vary from the actual time by as much as one hour per year (100 ppm, or about one sample interval for the 8K logger). There is an additional temperature effect shown in Plot A, leading to a worst case time base error of two hours per year (200 ppm, two measurements for the 8K logger), if operated continuously at extremes of -40°C or +80°C.



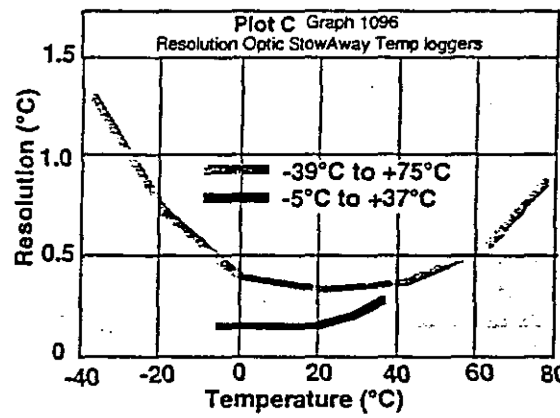
Wide range accuracy

The Optic StowAway Temp is also available in a wide temperature range version. Plot B shows the maximum error expected for this version of the logger. These errors include: thermistor error, quantization error (step errors in the digital representation of the temperature), and a small residual error. The residual error remains after all the other errors have been calibrated out.



Differences between loggers

The calibration process adjusts the measured values of individual loggers with the same temperature range. This means that two loggers will not necessarily have the same step values, so that two loggers exposed to the same temperature may report different values. Each logger, however, will be correct within its accuracy.



Temperature resolution

The Optic StowAway Temp's resolution (difference between temperature steps) is shown in Plot C. Note the similarity between the resolution and accuracy given for the widest range StowAway™, where most of the error is quantization error.

The blinking LEDs

The Optic StowAway Temp's LEDs tell you exactly what the logger is doing. Until an alarm condition has been met all indications will be shown by the green blinking LED.

Waiting for trigger: Weak blink every six seconds.
Waiting out delay: Weak blink every four seconds.
Logging: Bright blink every measurement, and weak every two seconds between measurements. If the Optic StowAway Temp is in multiple sampling mode, it will blink at each measurement, not each time data is recorded.
Alarm: A logger is out-of-range if it has recorded a value that is above the high alarm limit or below the low alarm limit. The red LED will blink during the duration of the deployment instead of the green LED.

Details of the Optic StowAway® Temp logger

Sealed logger designed for field operation

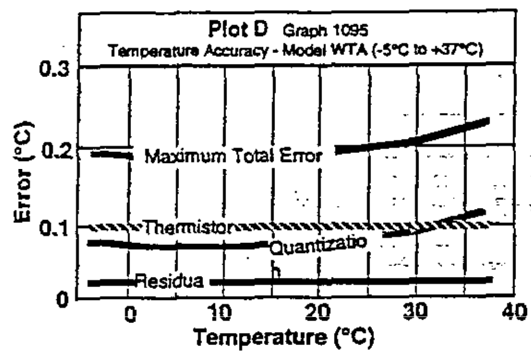
The Optic StowAway® Temp data logger is completely sealed. It communicate optically so it can be used in wet or dirty locations or be completely submerged. The Optic StowAway Temp logger can be launched and read out directly to a host computer using the Optic Base Station™ and an interface cable.

Individual calibration

All StowAways, except the water temperature range Optic StowAway Temp, use thermistors with a 0.2°C interchangeability in the range 0°C to +75°C. This error rises at lower or higher temperatures. The water temperature range of the Optic StowAway Temp (WTA, -5°C +37°C) uses a thermistor that has 0.1°C interchangeability. Other factors that limit the logger's accuracy are imperfections (resistor variations and A-D nonlinearities), and quantization error (difference between temperature steps). Onset's proprietary test procedures effectively eliminates the resistor and A-D errors, leaving only the thermistor accuracy and quantization error, and a small residual calibration error.

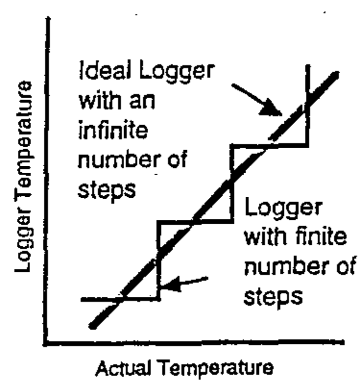
±0.2°C total error for the water temperature range

Adding the quantization error to the 0.1°C thermistor error and allowing 0.02% residual error from other sources gives the error curve shown in Plot D. The typical error at any temperature is much closer to 0.1°C than the 0.2°C worst case error shown in the Maximum Total Error curve.



What is quantization error?

Ideally a logger would record a different temperature for each temperature applied to it. The Optic StowAway Temp can store only 255 different temperature values in its temperature range. If you exposed the logger to a slowly rising temperature, the logger would record a constant value and then jump to a higher value, recording that value for a while. The difference between the steps is twice the quantization error since a perfectly calibrated logger will never be more than half a step away from the actual value.



Depth: rated to 100 feet

We have tested the polycarbonate case at depths to 400 ft. without problems. The rated depth of 100 ft. is a combination of a lack of extensive field experience and our natural conservatism.

Operating temperature range -40°C to +75°C

The Optic StowAway Temp will operate properly in the temperature range from -40°C to +75°C. For temperatures above the highest value in its range it will read its highest value, and for temperatures below the lowest value in its range it will read its lowest value. Continued exposure to temperatures substantially above room temperature will reduce the battery life of the Optic StowAway Temp.

Logger case limitations

The Optic StowAway Temp's case is made of pollycarbonate. This material cannot withstand exposure to many chemicals, it cannot be frozen in ice or withstand physical stress. This logger should not be exposed to high humidity above temperatures of 60°C. For additional information regarding the use and deployment of this product, please contact Onset Computer Corporation.

1" x 0.8" x 5.2" and 1.3 oz.

The shape of the Optic StowAway Temp was chosen to minimize its volume and for easy alignment between the logger and the other optic components. The logger weighs 1.3 oz. and has a slight positive buoyancy.

90 second offload (8K version)

The Optic StowAway Temp communicates at 1200 baud. Its cleverly optimized LogBook® software allows a full 8K offload in only ninety seconds (six minutes for a 32K Optic StowAway Temp).

Ten year battery life

The ten year battery life is valid if the logger is continuously in use in long duration applications (> 1 day) without multiple sampling, or in very long duration applications (> 100 days) with multiple sampling. If the logger is only used intermittently (not relaunched immediately after offload) the battery life can be much greater. Alternately if the logger is used constantly in short duration applications the battery life can be substantially reduced.

Battery life examples

20,000 one hour deployments (single measurement)
15,000 two hour deployments (single measurement)
200 four day deployments (multiple sampling)

Factory replaceable battery

The battery is not user-replaceable (the case must be destroyed to open it). Factory replacement of the battery (with the unavoidable case replacement) is available. Call Onset for details.

APPENDIX B: WATER QUALITY RESULTS FROM VERSAR, INC.

Versar INC.
ESM Operations

July 25, 1997

Marshall Rudo
Biohabitats Inc.
15 West Aylesbury Road
Timonium, Maryland 21204

Dear Marshall,

The Ecological Sciences and Analysis Division of Versar is submitting the results of the pre-construction water chemistry monitoring for the baseline characterization of the Clarksburg Towncenter construction site. Enclosed are the laboratory results of this first phase of monitoring.

Background

The proposed Clarksburg Towncenter is located around three first order tributaries to Seneca Creek in the Little Seneca Creek Watershed (part of the larger Potomac River watershed) in Montgomery County, Maryland. These tributaries hold a Class IV use designation as defined by the Maryland Department of the Environment (MDE). The Clarksburg area is designated by Montgomery County as a Special Protection Area (SPA). This stream water chemistry monitoring project is part of a large effort to comply with the regulatory requirements for this SPA.

Methods

Pre-construction stream water chemistry monitoring consisted of a combination of baseflow and storm event sampling. A total of four sites were established at the study area (see attached map). Site 1 is located below the confluence of all three tributaries, just northwest of Stringtown Road; Site 2 is located on the southern most tributary; Site 3 is located on the center tributary; and Site 4 is located on the northern most tributary.

Versar field crews collected stream baseflow data on May 21, 1997. Onsite measurements of water temperature, pH, dissolved oxygen, conductivity, and flow rates were collected at each of the four designated sample sites. Grab samples were also collected at each site. The grab samples were transported in coolers (iced) at 4 °C to the laboratory for analysis. The parameters analyzed at the laboratory are listed in Table 1-1.

Storm event data were collected during a single rain event on June 26, 1997. Water temperature, pH, dissolved oxygen, and conductivity were measured one half hour after the start of rainfall. Grab samples were collected at 20 minute intervals over the duration of the 2 hour storm at each of the four sample sites. Flow rates specific to each site were recorded simultaneously with grab sample collection. Grab samples were transported at 4 °C back to the laboratory for compositing. Using the flow data specific to each site, flow-weighted aliquot volumes for each grab were composited. Laboratory analysis was conducted on the composited samples for the parameters listed in Table 1-1. Proper chain of custody procedures were observed in sample shipment to the laboratory.

Results

Water chemistry results for the May 21 baseflow monitoring are listed in Table 1-2. Instream temperatures at the four sites during baseflow conditions ranged from 12.6 C to 14.2 C; pH ranged from 6.5 and 7.0; dissolved oxygen ranged from 6.3 mg/l to 8.8 mg/l; and conductivity ranged from .133 to .330 ms/cm. These water chemistry conditions fall within accepted levels for fish and invertebrate survival (MDE, 1994).

Baseflow water chemistry was generally excellent with only alkalinity and nitrate-nitrogen straying from optimum levels. Low alkalinity values at each site indicate a reduced ability of the stream to buffer abrupt changes in pH. These low values may be attributed to the soil type and/or organic concentration. Waters with sandy or highly organic substrates tend to have lower alkalinity (Boyd, 1990).

Nitrate-nitrogen levels at all sites during baseflow sampling were slightly elevated compared to the results found by the 1994 Maryland Biological Stream Survey (MBSS) in the region (Volstad et al., 1994). The nitrate-nitrogen levels measured at the four sites ranged from 3.0 mg/l to 7.3 mg/l., and averaged 5 mg/l. The 1994 MBSS measured nitrate-nitrogen levels at thirteen nearby stream sections, arriving at an average of 3.01 mg/l. Presumably, surface runoff of fertilizer introduced by agricultural practices in the area may be the source increasing nitrogen levels in the stream. The MDE 1994 report on the status of Maryland's waters noted elevated nutrient levels (nitrates etc.) resulting from agricultural and urban runoff in the Washington Metropolitan Sub-Basin.

It should also be noted that in the case of one parameter, toxaphene, the non-detectable reporting limit (1.0 μg/l) was higher than MDE criteria for acute toxicity (0.73 μg/l).

Water chemistry monitoring results at the four sampling sites during the June 26 storm event also indicate generally good water quality. The results are illustrated in Table 1-3. Instream water temperatures at the four sites spanned a range of 17.9 °C to 21.7 °C; pH ranged from 6.6 to 7.1 (varying only slightly from the baseflow values of 6.5 to 7.0); dissolved oxygen ranged from 4.2 mg/l to 6.4 mg/l; and conductivity ranged from 0.108 to 0.299 ms/cm.

Dissolved oxygen values below 5ppm were found at sites 1 and 3 at the onset of the storm event. This level is below MDE water quality standards for this stream type (Class IV). Low oxygen levels may be attributed to lower flow and higher water temperatures (owing to sparse rainfall during the previous month) than those observed during baseflow monitoring.

Nitrate-nitrogen levels measured during storm sampling averaged 3.0 mg/l for the four sites. This is lower than the average measured during baseflow sampling (5.0 mg/l). These findings may be attributed to dilution of nitrate-nitrogen levels during the storm event and may indicate a significant groundwater component to the nutrient levels.

The overall water quality based on storm chemistry results can be characterized as excellent. This corresponds to Montgomery County's stream assessment categorizing the biological integrity of the watershed as "good" to "excellent" (Montgomery County Department of Environmental Protection, 1997).

If you have any questions regarding this report, please do not hesitate to give me a call at (410) 740-6116.

Sincerely,

James P. Hakala

James P. Hakala
Environmental Technician

JPH:jph/sg
F:\DATA\WPSHARED\DEPT.74\BIOHAB\11440-I.wpd
Enc.

cc: File: 3619-001

Literature Cited

Boyd, C. E. 1990. Water Quality in Ponds for Aquaculture. Alabama Agricultural Experiment Station, Auburn University, Alabama. 482pp.

Maryland Department of the Environment Chesapeake Bay and Watershed Management Administration. 1994. Maryland Water Quality Inventory, 1991-1993, Baltimore, Maryland. technical report #94-002, 236 pp.

Montgomery County Department of Environmental Protection. 1997. Montgomery County's Countywide Stream Protection Strategy Draft, Montgomery County, Maryland.

Volstad, J.H., M.T. Southerland, S.B. Weisberg, H.T. Wilson, D.G. Heimbuch, and J.C. Seibel. 1996. Maryland Biological Stream Survey: the 1994 Demonstration Project. Prepared by Versar Inc., Columbia, MD, for Maryland Department of Natural Resources, Monitoring and Non-Tidal Assessment Division.

WATER QUALITY SITES

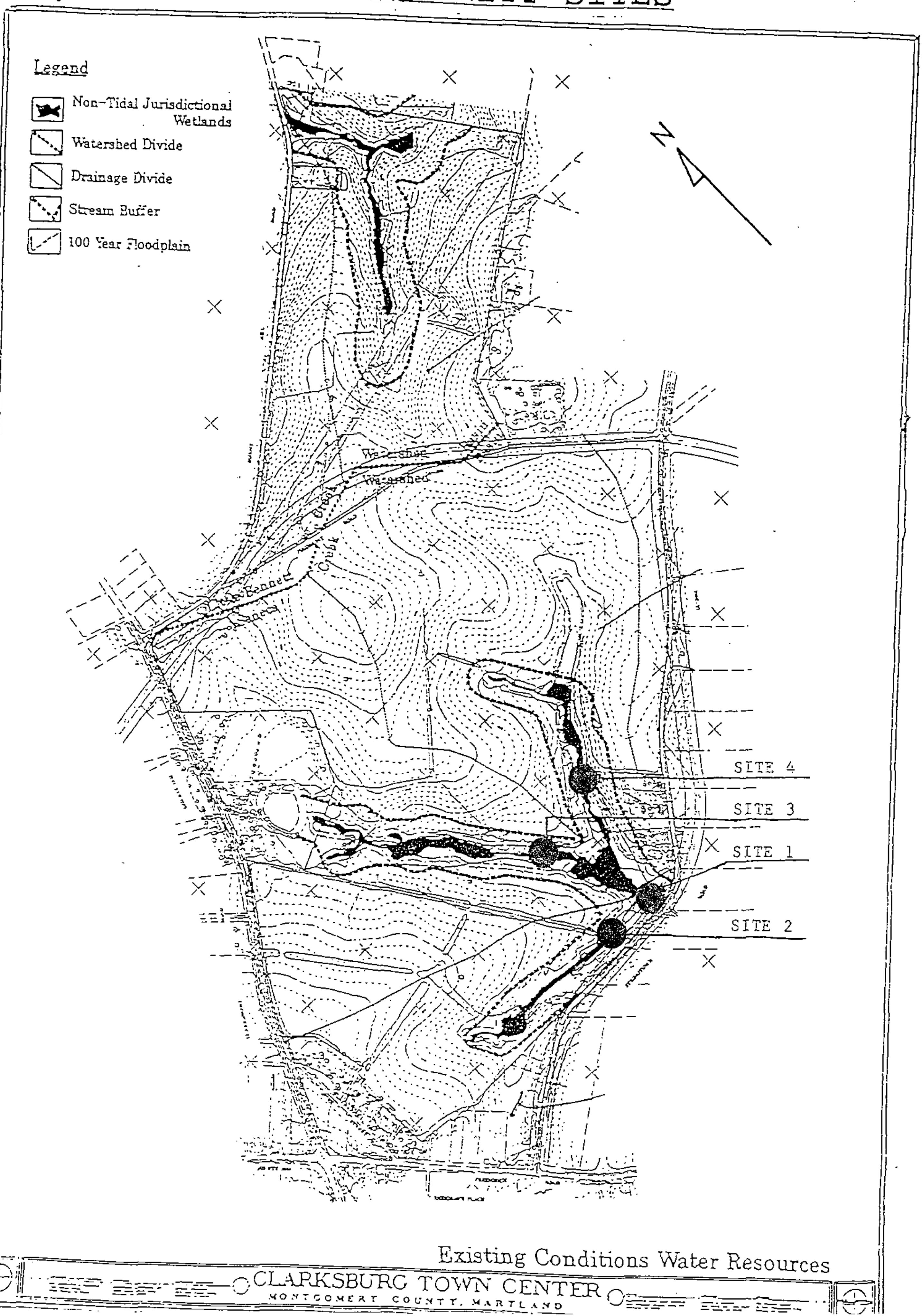


Table 1-1

CLARKSBURG TOWNCENTER CONSTRUCTION SITE
Recommended Analysis Parameters
Pre, During and Post Construction

Alkalinity	EPA 310.2
BOD	EPA 405.1
Hardness	EPA 130.2
Nitrate	EPA 353.2
Nitrite	EPA 354.1
Total Kjeldahl Nitrogen	EPA 351.2
Total Phosphorus	EPA 365.4
Total Suspended Solids	EPA 160.2
Cadmium	EPA 213.2
Chromium	ICP(6010)
Copper	EPA220.2
Lead	EPA239.2
Mercury	EPA7470
Nickel	ICP (6010)
Zinc	EPA200.7
Metals digestion	SW3005
Total Petroleum Hydrocarbon	EPA418.1
VOCs (see attached list of analytes)	EPA624
Pesticides/PCBs (see attached list of analytes)	EPA8080
Herbicides (see attached list of analytes)	EPA8150

Table 1-2. Water quality results from May 21, 1997 baseflow monitoring					
Parameters	**Site 1**	**Site 2**	**Site 3**	**Site 4**	**Units**
Water Temperature	13.1	14.1	14.2	12.6	°C
pH	6.5	6.8	6.6	7.0	(SU)
Dissolved Oxygen	7.6	8.1	6.3	8.8	(mg/l)
Conductivity	0.168	0.330	0.146	0.133	(ms/cm)
Total Alkalinity	17.0	12.0	20.0	ND	(mg/l)
Biochemical Oxygen Demand	ND	ND	ND	ND	(mg/l)
Hardness	47.0	62.0	47.0	66.0	(mg/l)
Nitrate	4.1	5.6	3.0	7.3	(mg/l)
Nitrate-Nitrite	4.1	5.6	3.0	7.3	(mg/l)
Nitrite	ND	ND	ND	ND	(mg/l)
TKN	0.6	0.6	1.3	0.30	(mg/l)
Total Phosphorous	ND	ND	ND	ND	(mg/l)
TSS	21.0	8.0	6.0	ND	(mg/l)
Total Cadmium	ND	ND	ND	ND	(mg/l)
Total Copper	ND	ND	ND	ND	(mg/l)
Total Lead	0.001	0.002	ND	0.001	(mg/l)
Total Mercury	ND	ND	ND	ND	(mg/l)
Total Chromium	ND	ND	ND	ND	(mg/l)
Total Nickel	ND	ND	ND	ND	(mg/l)
Total Zinc	0.08	0.07	0.05	0.07	(mg/l)
Petroleum Hydrocarbon	ND	ND	ND	ND	(mg/l)
Pesticide/PCBs	ND	ND	ND	ND	(μg/l)
Herbicides	ND	ND	ND	ND	(μg/l)
VOC	ND	ND	ND	ND	(μg/l)
Average Flow	0.109	0.041	0.039	0.071	(cfs)

Table 1-3. Results of June storm event baseflow monitoring					
Parameters	**Site 1**	**Site 2**	**Site 3**	**Site 4**	**Units**
Water Temperature	20.5	21.7	17.9	20.4	°C
pH	7.1	6.9	6.6	6.6	(SU)
Dissolved Oxygen	4.2	5.4	4.7	6.4	(mg/l)
Conductivity	0.146	0.299	0.109	0.108	(ms/cm)
Total Alkalinity	17.0	23.0	24.0	11.0	(mg/l)
Oxygen Demand	5.0	10	6.0	5.0	(mg/l)
Hardness	46.0	62.0	42.0	47.0	(mg/l)
Nitrate	2.4	3.1	2.3	4.2	(mg/l)
Nitrate-Nitrite	2.4	3.1	2.3	4.2	(mg/l)
Nitrite	0.02	0.02	0.03	0.01	(mg/l)
TKN	0.4	ND	1.0	0.5	(mg/l)
Total Phosphorous	ND	ND	ND	ND	(mg/l)
TSS	43.0	110.0	73.0	30.0	(mg/l)
Total Cadmium	ND	ND	ND	ND	(mg/l)
Total Copper	ND	0.007	ND	ND	(mg/l)
Total Lead	ND	0.004	0.004	ND	(mg/l)
Total Mercury	ND	ND	ND	ND	(mg/l)
Total Chromium	ND	0.005	0.005	0.005	(mg/l)
Total Nickel	ND	ND	ND	ND	(mg/l)
Total Zinc	0.03	0.04	0.03	0.04	(mg/l)
Petroleum Hydrocarbon	ND	ND	ND	ND	(mg/l)
Pesticide/PCBs	ND	ND	ND	ND	(μg/l)
Herbicides	ND	ND	ND	ND	(μg/l)
VOC	ND	ND	ND	ND	(μg/l)