TASK 2.3

FINAL REPORT

ON

SHELLFISH PROTECTION PROGRAM

prepared by

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Mason County Water Quality Program

Department of General Services

for

The Shellfish Protection Program

Washington State Department of Ecology

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BACTERIOLOGICAL SURVEY

Ambient Monitor

The field methods for ambient or background monitoring followed procedures used in the original Totten/Little Skookum Water Quality Study (September 1986). Water samples were collected at pre-determined sample stations throughout the Skookum Creek watershed and Little Skookum Inlet. One hundred milliliter samples were collected using sterile technique and cooled for transport to the lab. Bacterial loading, a product of bacteria density and streamflow, was calculated to determine the stream's overall relative contribution of contamination. A Marsh-McBirney 201-D flow meter was used to measure velocity (feet per second) of sections of the stream's profile with the sum of the sections representing the total streamflow (cubic feet per second).

Sample frequency was greatly reduced from that of the original study. Quarterly monitoring netted four samples per station for this follow-up monitoring, while the bi-weekly sampling of the original study resulted in approximately 26 discrete samples. Four samples are hardly sufficient to accurately depict current water quality conditions, however, they provide enough information to make a general comparison with previous studies, and also can warn local authorities of deteriorating conditions in identifiable segments of the watershed. For example, Totten Shores Creek was found to continue to have elevated fecal coliform levels even after a failing sewage system, suspected as the original source, was somewhat repaired. The continued monitoring of that creek showed that the repair by the owner was less than effective.

Results of fecal coliform sampling and the subsequent loadings are summarized in Table I. These stations are also those sampled during the original intensive study. Most stations were sampled on each sample day, however, due to the logistics of field work some stations were not covered each time.

The high fecal coliform densities shown on 9-23-86 represent the rainy season's "first flush" or first significant rainfall to occur in the watershed. The rainfall on this day was 1.12 inches recorded at ITT Rayonier Research Lab, Shelton, WA. The rainfall for the previous 15-day period was 1.94 inches which indicates that the soils were at least partially saturated and runoff from farm pastures and residential areas would reach the watershed tributaries.

Fecal coliform densities of ">2400" indicate the minimum number of bacteria in a given bacterial culture. The actual number of bacteria over the ">" is not clear. In the previous study, dilutions were requested during the storm event of October 1985 for streams suspected to be heavily contaminated. Densities were

TABLE I
Ambient Monitor
Fecal Coliform Density (FC/100ml) and Loading Rate (FC/day)
Little Skookum Watershed

STATION	DATE 9/23/86 FC 100ml	9/23/86 FC/Day x 10^8	12/9/86 FC 100ml	12/9/86 FC/Day x 10^8	8/17/87 FC 100ml	8/17/87 FC/Day x 10^8	5/19/87 FC 100ml	5/19/87 FC/Day x 10^8	GMV
FRESHWATER									
Skookum Crk. Headwtrs. (5-8.4)	251	143	0	0	4	9	3	2	7.4
108 Br.	-	-	3	10	3	-	5	-	
Eich Rd.	>1000	2640	15	116	43	-	20	52	61.0
101 Br. (5-1.1)	980	2180	24.5	234	11.6	293	67.5	17	67.2
Kamilche (5-0.7)			37.4		93		70		
Hurley Waldrip Crk. Mouth	>1000	157	15	11	11.6	28	219.2	51	80.6
Little Skookum Crk. Mouth	465	128	3.3		-	-	10	3	27.0
Clary Crk. Mouth	>2400	>47	64.8	8	14.5	17	139.6	7	135.2
Lynch Crk. Mouth	-	-	-	-	23	54	0	0	
Totten Shores Crk. Mouth	-	-	330	49	>2400	-	-	-	890.5
MARINE									
S-3 Headwaters	2		10.1		-		2		
Shrumshore	7.8								
S-2 Mud Cat Pt.	4.5		<1.8		4.5		4.8		
Drain Cove	13		2		-				
S-1 Wildcat Cove	4.5		0.7		4.5		<1.8		
Precipitation Previous 24 Hrs.	1.12		0		0.60		0		
Previous 72 Hrs.	1.12		0.01		0.68		0		

TABLE II

Comparison of Fecal Coliform Densities of Ambient Monitoring Stations Between Original Study (McNicholas, 1985) and Followup

STATION	Totten/Little Skookum No. of Samples	Totten/Little Skookum GMV*	Follow-Up Study No. of Samples	Follow-Up Study GMV
FRESHWATER				
Skookum Crk. Sta. 1 Headwaters	16	4.2	4	7.4
Sta. 4 101 Br.	25	41.9	4	67.2
Hurley Waldrip Crk.	22	50.5	4	80.6
Clary Creek	28	119.6	4	135.2
Little Skookum Crk.	27	25.3	3	37.0
Lynch Creek	27	15.9	2	3.9
Totten Shores Crk.	9	133.29	2	890.5
MARINE				
Skookum Inlet S-3 Headwaters	28	2.7	4	
Shrum Shore	16	4.3	2	
S-2 Mid Estuary	28	1.8	4	
Drain Cove	6	3	3	

*Geometric Mean Value

found to range up to 12,000 at Clary Creek. During this follow-up study dilutions again were requested of the suspected "hot" streams, but misunderstanding between field and lab workers resulted in standard analysis. Statistically, the "12,000" count will appear more contaminated than the ">2400" while in truth the latter figure may be greater than, or less than, or equal to 12,000. A direct comparison of the two periods is not appropriate with this data, but assessing the relative contributions of the streams is possible.

The results indicate that fecal coliform densities in the watershed's tributaries may not have significantly changed. Problem areas identified in the originalstudy, Hurley Waldrip, creek, Clary Creek and Totten Shores, remain as the principle bacteria contributors. This is likely because the agricultural runoff affecting these areas has not been adequately addressed. (For more information see "Corrective Action.")

Storm Event Monitor

The storm monitored in the Skookum Creek watershed during this follow-up study took place from September 23 through September 25, 1986. The three days of rain equalled only 1.54 inches, but represented the first significant rainfall of the coming rainy season. Streamflows did not increase dramatically as in previous storm monitorings, but bacterial densities were high. Table III shows data collected during this particular storm while Figure 1 compares this recent data with that of 1984 and 1985.

One can see that the marine waters of Little Skookum Inlet were less contaminated during this rain than previous studies. The most likely reason is that this storm was not as severe in either intensity or duration. Another consideration may be that the thirteen failing sewage systems found on Little Skookum Inlet during the original study have been corrected and the reduction of that contamination may have had a measurable impact on water quality.

In retrospect, having data from the "first flush" storm event may be of some value, however, the storms occurring later in the season of more intensity and duration provide a better understanding of the watershed's characteristics of bacterial contamination during wet weather. A second storm event monitoring for this follow-up study would have been worthwhile, but due to limited staff resources was not an option.

TABLE III

Storm Event Monitor
Fecal Coliform Density and Loading Rate
Little Skookum Watershed

STATION	DATE 9/23/86 FC 100ml	9/23/86 FC/Day x 10^8	9/34/86 FC 100ml	9/34/86 FC/Day x 10^8	9/25/86 FC 100ml	9/25/86 FC/Day x 10^8	GMV FC 100ml
FRESHWATER							
Skookum Crk.	251		60		25		72.6
Hdwtrs. Sta. 1		143		33		10	
Eich Rd. Sta. 3	>1000		455		275		500.3
		2640		1070		533	
101 Br. Sta. 4	980		625		235		524.3
		2180		1570		498	
Kamilche Sta. 5	>953		630		233		519.3
		-		-		-	
Hurley Waldrip Creek	>1000		345		105		331.4
		157		23		8	
Clary Creek	>2400		>2400		>2400		>2400
		47		89		110	
Little Skookum Creek	46.5		85		25		100.4
		128		-		4	
MARINE							
S-3 Headwaters	2		32		23		12.3
Shrum Shore	7.8		<1.8		<1.8		1.1
S-2 Mid Estuary (Mud Cat Point)	4.5		<1.8		<1.8		0.8
Drain Cove	13		2		<1.8		2.5
S-1 Mouth (Wildcat Cove)	4.5		<1.8		<1.8		1.1
Precipitation							
Previous 24 Hrs.	1.12		0.32		0.10		
Previous 72 Hrs.	1.12		1.44		1.54		

CORRECTIVE ACTION

On-Site Sewage Systems

Of the 453 on-site sewage systems inspected during the original Totten/Little Skookum Water Quality Study 21 were found to be failing. The first phase of inspections took place on the shoreline of Little Skookum Inlet and Skookum Creek's watershed. The second phase covered the remainder of Mason County's Totten Inlet shoreline and the remaining watershed areas not previously inspected.

All of the 13 failed sewage systems on Little Skookum Inlet were repaired, replaced or vacated by July 1986. Only 7 of the 13 failures represented an immediate threat to water quality through close proximity to the inlet or one of its tributaries. Four of the 13 failures were vacated because the owners chose not to, or were unable to, make corrections. Since the last report, one of the owners walked away from his property and the mortgage holder, who took possession, was able to purchase land from an adjacent landowner sufficient for drainfield construction. The new system is due for completion soon. Another home which was posted by the county for "No Occupancy" was rented to a young couple even though no repairs had been made on the failing sewage system. The county immediately started a civil action (citation) which will be heard in court this summer. The renters have again moved from this house.

The second phase of corrective action is also nearly complete. Of the remaining eight failures all but two have been repaired or replaced. Two of the six systems repaired were designed by the county for low income home owners who elected to install their own new systems. The two sewage systems still failing are likely responsible for the high bacteria counts in Totten Shores Creek. One system was repaired in a haphazard manner by the landlord, but dye testing indicates the repair was not effective. Another homeowner on this drainage has attempted some mitigative action on the advice of the county to ease the pressure on his failing drainfield. However, the results are not encouraging. A registered letter which initiates the "repair or vacate" order has been sent; further action is planned.

Agriculture Practices

The original study reported inspections on eighteen farms in the Little Skookum watershed. All of the farms are relatively small and none represent the owner's principal source of income. The largest farm is 80 acres with 70 beef cattle on Skookum Creek. The smallest is less than two acres with a menagerie of fowl near Arcadia Point. These two farms and most of the others in the watershed were found not to be contributing to bacterial pollution. The primary factor in controlling the runoff was simply the distances from open water courses and the topography of the

farmland. In some cases, conscientious animal keeping practices were responsible for protecting runoff from contamination. The farms found to have animal keeping practices favorable to water quality protection include the 80 acre beef cattle operation of the Dick Reller family on Skookum Creek, the Jim Penney family sheep farm on the shoreline of Little Skookum Inlet and the cattle ranch on Skookum Creek owned by a Bellevue investment group led by Mr. Wager.

The few farms that do present a real threat to water quality do so because of animal access to streams or barnyard runoff contamination of nearby streams.

TABLE IV

Farms in Skookum Creek Watershed
Identified as Sources of Contamination

Farm	Surface Water Impacted	Problem	Solution Progress
1. R. Clary	Clary Creek	Horses in creek; paddock drains to creek.	One fence built by Conservation Corps through county assistance but animals still in creek.
2. W. Clary	Skookum Crk. (S 1.2)	Cattle trampling streambank and contaminating creek at 3 sites.	None.
3. R. Larson	Little Skookum Inlet	Cattle with seasonal access to tidal marsh.	Working with SCS to develop farm plan.

Other farms identified in the watershed were found to have a lesser impact on water quality. One farm on Hurley Waldrip Creek was sold to a land developer in 1986. One hundred forty acres of farmland has been divided into five acre lots which are now being developed. High bacteria levels from this creek continue to plague water quality. A site visit confirmed that runoff from stockpiled animal waste was still contaminatng the creek though the animals had been off the pasture for over six months. It is assumed that with time and high temperatures through this summer the levels of bacteria from this waste should decrease.

Repeated contact with problem farmers has been shown to have some merit in achieving improvements in animal keeping practices which reduce contamination. During the original study most farmers were visited by county and by the Soil Conservation Services staff several times when their practices warranted correction.

Due to limited staff resources for this follow-up only farmers exhibiting initial willingness to change their practices were visited. It is probable that more time will be available to pressure recalcitrant farmers into adopting best management practices when the Mason County Conservation District staff is hired this year.

PURCHASE FLOW METER

Bacteriological investigation relies on laboratory analysis and streamflow measurements for determining the significance of any stream's bacterial contribution. Mason County has relied on neighboring county water labs for analysis of its water quality samples. While this has not been ideal for scheduling field work it is workable. However, Mason County did not have a meter for streamflow measurements and was forced to borrow the equipment from DOE when it was available. This situation was not workable. Travel time and the inavailability of equipment put extreme constraints on field work accomplishment.

The Shellfish Protection Program staff at the DOE recognized the difficulties caused by lack of equipment for county programs and agreed to fund the purchase of the flow meter. State and other local agencies were polled to find the types in common use. The research indicated that the Marsh-McBirney Model 201-D was the most appropriate flow meter for our purpose. After a great deal of procedural activity involving the county's purchase of a "large ticket" piece of equipment, the March-McBirney flow meter was received on September 2, 1986.

COMMUNITY EDUCATION

Adopt-A-Bay by Emily Garlich

The Adopt-a-Bay group for 1986-1987 was composed of students Brandon Ulrich, 8th grade; Cori Olsen, Laura Lacey, Leina Johannsen and Brad Powers, 12th grade; and Amy Adams, 11th grade, from the Shelton School District. Emily Garlich was the teacher involved in the group. Jim Freed, County Extension Agent, also volunteered some time to the group. Rick McNicholas, County Water Quality Agent, was instrumental in providing us with resources such as boat, flow meter, and ran samples to the lab for us. We tried to sample the areas that he felt were important for the County to know about in Oakland Bay.

We started our study of what water quality was in the Oakland Bay Watersheds in the spring of 1986 by picking a creek, Deer Creek, that looked to be the most impacted by animals and humans in the upper reaches of the bay. We chose not to study Goldsborough or Shelton Creeks in the inner harbor area as we wanted to look initially at rural impact factors.

The first meeting was spent looking at maps and aerial photographs of Deer Creek and going out to a site on the creek to learn the methods of taking water samples and flow measurements. Rick McNicholas from the County and Barbara Carey of DOE came out to train us. The second meeting a team of us walked approximately one mile up stream from the mouth noting land use. From this survey we chose three sample stations. Station One was near the mouth above most of the influence of the tide; Station Two at the Highway 3 bridge that crosses the creek, and down stream from houses and horses; Station Three, taken from a log bridge approximately one-half mile up stream from Station Two. This station marked the up stream limit of human residence and best represented natural water quality conditons. Each station was marked with flagging and a stake. We sampled on April 26, May 26, and June 24, 1986. We ran our own total coliform tests and found less than 40 at each station. These were all day affairs as we hand evacuated the milapore filter and did replicate samples.

By the summer we had decided that a video tape of water quality sampling would be a good way to educate more people on what was meant by water quality. We hired Burke Long to tape and edit a seven minute video. We taped in September, 1986, and showed the tape at the Oyster Fest in October. During the Fest we helped "man" the Mason County's water quality education booth.

A Saturday morning in September Jim Freed gave a short seminar on upland farming practices to the students. December 14, 1986, we sampled Deer Creek. These samples were sent to the Thurston County Lab to be processed for fecal coliforms. The results showed low fecal coliform concentrations.

In December we decided to shift our focus to the bay itself. DSHS was planning to sample Oakland Bay in February. This provided an excellent opportunity for the students to observe, help and understand what DSHS does for monitoring water quality. On February 2, 1987, we took a school field trip on DSHS's boat as they sampled the bay. The students learned about sample siteing, salinity, sanitary lines, the effect of the sewage treatment plant and the City of Shelton on the waters of the bay. Besides assisting in taking marine samples the students observed the functioning of the sewage treatment plant and helped take a stream sample at Shelton Creek. Burke Long accompanied us on the trip to video tape the methods of testing and the questions the students posed to the DSHS staff.

On March 11 and April 15, 1987, we took our own samples of the bay with the assistance of Rick McNicholas and the Mason County's water quality boat. These samples were sent to the Thurston County Lab for analysis. The data was utilized by the County and DOE in their search for sources of pollution.

During April the group met in the mornings before school to work out an outline of the video script on water quality. Then on May 16, we went out with Burke Long for a day to tape comments from farmers of both land and sea- and the County Water Quality Specialist on water quality.

From all the footage we have taped, a 15 to 20 minute video will be produced by the end of the summer on water quality in a bay. We are aiming the level of the presentation to middle school students.

A spin off from this group effort was a science fair experiment done by one of the students on the variability of samples across a transect of a stream. He was awarded a second place prize in the State Science Fair. This coming year he plans to do another experiment related to water quality through the water quality program. The tentative subject will involve developing a model through controlled experimentation of the relationship of fecal coliform density in the water column to that of oyster tissue.

All the students greatly increased their knowledge of what is meant by water quality and the factors involved. They understand what an indicator species is such as E. Coli. They also experienced field lwork in all types of weather and now better understand what a biologist does on a study.

The video tape on water quality will be given to the school district to be used in their science programs thus increasing the numbers of people educated on the subject. As of this report only a rough edit of our video tape is available. Mr. Long will complete the final edit as part of his own course work for college credits by August 30, 1987.

File:

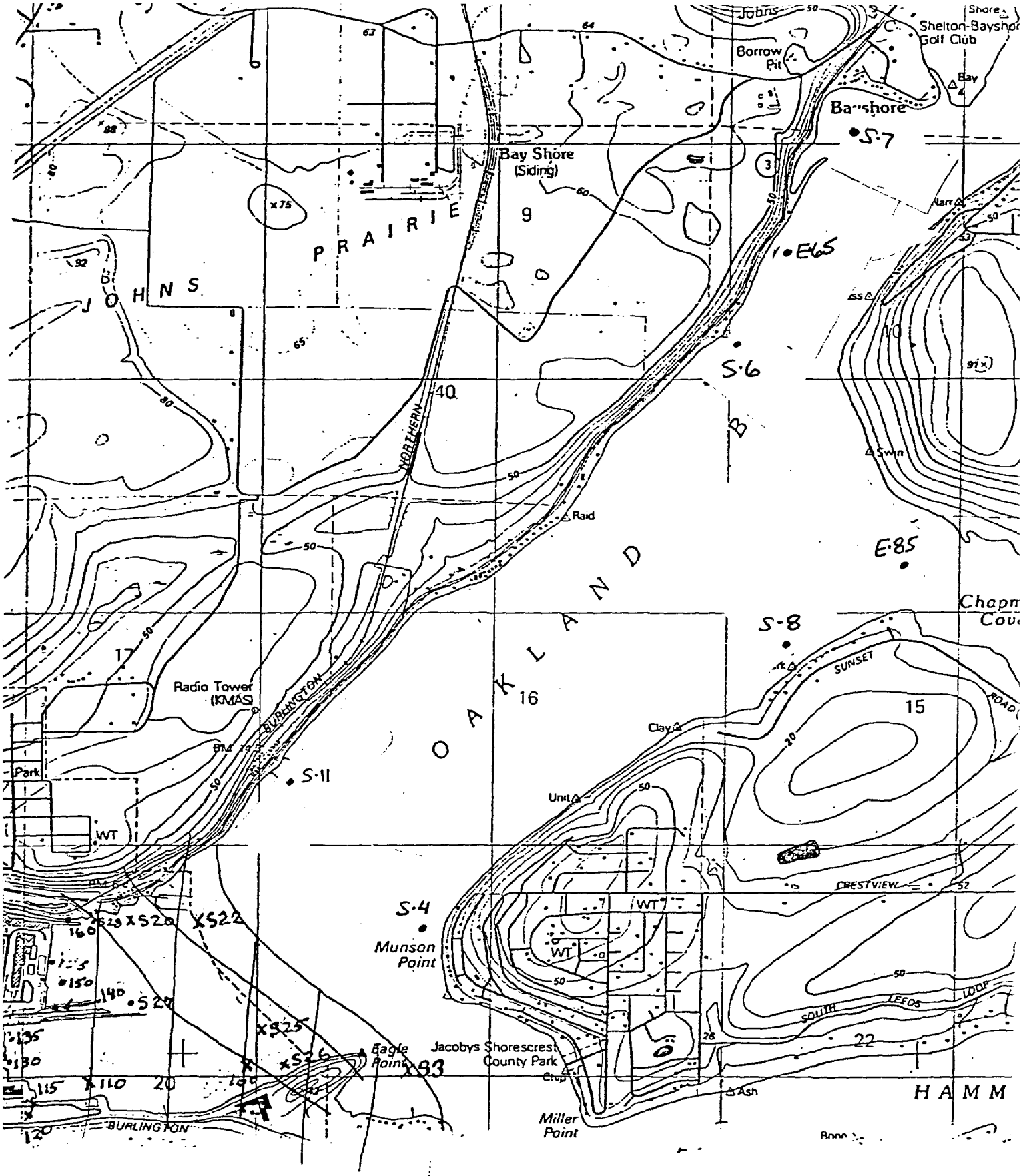
6/28/87

SHELTON HIGH SCHOOL ADOPT-A-BAY DATA SUMMARY
OAKLAND BAY

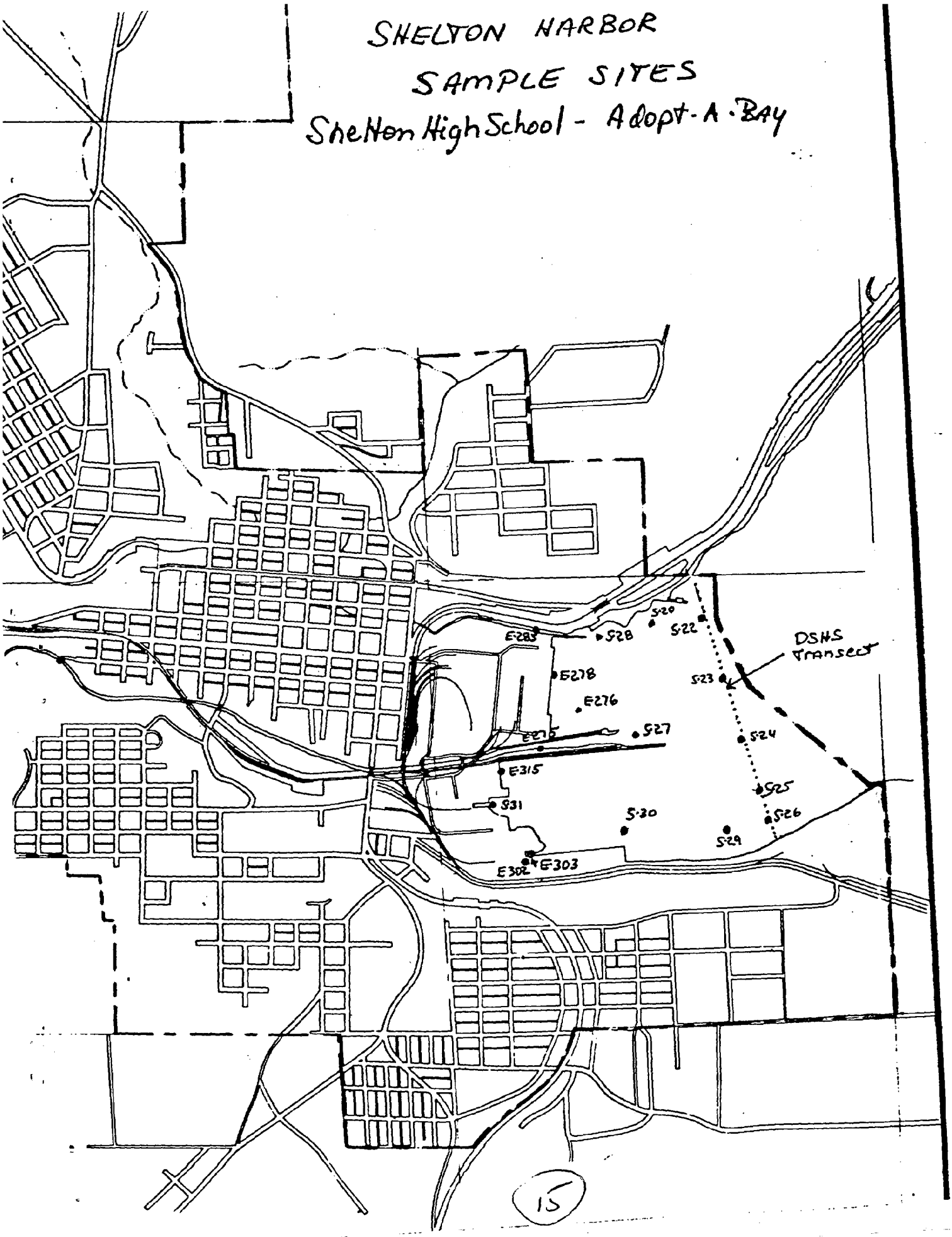
WEATHER SUMMARY
FEB 1-87 RAIN, WIND-15-30 SW, TIDE EBB(HIGH8:30A), START9:30AM
MAR 11-87 OVERCAST, TIDE EBB (HIGH1:32P), START 3:25PM
APR 15-87 LIGHT RAIN, CHILLY, WINDY, TIDE EBB(HIGH 5:20P), START 9:30A

SAMPLE STATION NUMBER	FECAL COLIFORM PER ONE HUNDRED ML FEB. 1-87	MAR.11-87	APR.15-87	COMMENTS
OAKLAND BAY				
S-3	93	75		STP OUTFALL AREA
S-11		43	9	OIL DOCK- OAKLAND BAY
S-6	93	43	<3	NEW HOUSE - OAKLAND BAY
E-65		9	7	
S-7		150	<3	OVER DIKES BAYSHORE
E-105		<3	<3	NORTH OF BAYSHORE
S-8		4	<3	MOUTH OF CHAPMAN COVE
E-95		23	43	HEAD OF CHAPMAN COVE
S-4			9	MUNSON PT
SHELTON HARBOR				
S-20	23			BOAT LAUNCH
S-21	43			DSHS TRANSECT NORTH
S-22	43	93	23	
S-23	93			
S-24	93		93	
S-25	43	240		NEAR LOG RAFTS
S-26	430		23	DSHS TRANSECT SOUTH
S-29	240			WEST 50YDS OF S-26
S-30	93			WEST 150YDS OF S-26
E-302		460	4600	MANKE YARD RUNOFF
E-303		>2400	1100	ITT OUTFALL-OILY MUCK
S-31	>2400	>2400	>2400	UPWELLING AT BARGE
E-315	>2400	>2400	>2400	PIPE 12-18" BLKHD @LOG LOADR
S-27	930	75		GOLDSBOROUGH CR ESTUARY
E-275	240	75		GOLDSBOROUGH 50YDS UP STREA
E-276	93	240	23	
E-278		>2400	1100	PIPE 6-8" DIA IN BLKHD NORT
S-28	93	93		SHELTON CR ESTUARY
E-285				SHELTON CR 50 YDS UPSTREAM

LAB WORK DONE AT THURSTON COUNTY LAB FEB. 1
LAB WORK DONE AT BREMERTON/KITSAP LAB MAR 11 AND APR 15


Shelton-Bayshor Golf Club
Borrow Pit
Bay
Ba-shore
S-7
Bay Shore (Siding)
PRAIRIE
JOHNS
E-65
S-6
NORTHERN
Raid
E-85
OAKLAND
S-8
Chapm
Cou
SUNSET
ROAD
Radio Tower (KMAS)
BURLINGTON
Clay
S-11
Park
WT
Unit
CRESTVIEW
S-4
Munson Point
XS20
XS22
XS25
XS26
XS27
S-20
Eagle Point
Jacobys Shorescrest County Park
SOUTH
LEEDS
LOOP
Ash
Miller Point
HAMM
BURLINGTON

SHELTON HARBOR
SAMPLE SITES
SheNon High School - Adopt-A-Bay



Community Outreach

The only workshop on Totten/Little Shookum Watershed was held on August 20, 1986 at Griffin Elementary School. On September 6, 1987 Mason County lost one of its two planning staff members to a job elsewhere and has been unable to replace that staff due to budget cutbacks. Community meetings have not taken place since the staff cutback. However, some background information has been collected and snythesized for future planning efforts, such as maps of short plats in the watershed, and an aerial photo mosaic of the watershed with a photo story of water quality problems identified.

One type of community outreach found very effective was the attended exhibit at the Mason County Oysterfest. The display of the Totten/Little Skookum Watershed's aerial mosaic with a photo story of actual pollution sources was effective in communicating quickly and simply what our problems were. A report summary was provided to interested viewers to further involve them in the program. The display is now to be used in planning meetings to help identify sites of individual concern.