

Quality Assurance Project Plan

2003 BEACH Pilot Project

by
Lynn Schneider

Environmental Monitoring & Trends Section (EMTS)
Environmental Assessment Program
Washington State Department of Ecology
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2003 BEACH Pilot Project

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June 2003

Indicator Bacteria Monitoring at Marine Public Bathing Beaches

Approvals

Approved by: Lynn Schneider, BEACH Program Coordinator, EMTS	July 20, 2003 Date
Approved by: Jan Newton, Principal Investigator, EMTS	July 17, 2003 Date
Approved by: Ken Dzinbal, Section Manager, EMTS	March 19, 2004 Date
Approved by: Cliff Kirchmer, Ecology Quality Assurance Officer	March 19, 2004 Date

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Distribution List

Rob Pedersen, EPA

Jan Newton, Ecology (Principal Investigator)

Lynn Schneider (Project/QA Manager)

ITAS BEACH Data Coordinator (Data Processor)

Gary Fraser (WA Department of Health)

Bill Jolly (WA Parks and Recreation Commission)

Washington's Coastal County Health Department Environmental Health Directors:

- Doug George, Grays Harbor County
- Jerry Deeter, Bremerton-Kitsap County Health District
- Ray Hanowell, Pierce County
- Sherri McDonald, Thurston County
- Tim McDonald, Island County
- Corrine Story, Skagit County

Washington's Coastal County Local Health Jurisdiction Pilot Project Leads:

- Kathleen Parvin, Island County
- Andy Ross, Skagit County
- Shawn Ultican, Bremerton-Kitsap County Health District

Abstract

This is a Quality Assurance Project Plan for the Washington State 2003 BEACH Pilot Project. This project will support a marine recreational beach monitoring and notification program in Grays Harbor, Kitsap, Pierce, Island, Skagit, and Thurston Counties. The project will determine the concentrations of the bacteria enterococci along with the options of fecal coliforms and/or *E-coli* in samples of water taken from the swimming areas of specified recreational beaches. Public notification will take place when sample results are above EPA's recommended threshold limits.

Project Organization and Responsibilities

Name	Responsibilities	Qualifications
Dr. Jan Newton Lead Investigator	Lead investigator and quality Management Lead – Controls all decisions of the project WA Department of Ecology	PhD in Oceanography Over 13 years experience in marine water quality management
Lynn Schneider BEACH Program Coordinator	Monitoring program supervisor Program management WA Department of Ecology and Health	BS Chemistry Over 10 years experience with water quality sampling and analysis
Gary Fraser Recreational Water Health Specialist	Technical support Assists in collaboration between WA Dept of Health, Ecology and local health jurisdictions WA Department of Health	MS Microbiology Over 32 years experience with environmental health management
Bill Jolly Environmental Program Management	State Parks and Recreation Commission liaison	Over 35 years' experience with natural resources policy and management at field and administrative levels
Doug George Marine monitoring lead Grays Harbor County	Monitoring Program Lead Grays Harbor County	BS Bacteriology and Public Health Over 30 years environmental health and water monitoring programs
Ray Hanowell Environmental Health Director, Pierce County	Monitoring Program Lead Pierce County	BS Fisheries Over 18 years environmental health and water monitoring programs
Kathleen Parvin Marine monitoring lead Island County	Monitoring Program Lead Island County	BA Entomology and Botany Over 13 years experience with environmental health and water monitoring programs
Andy Ross Marine monitoring lead Skagit County	Monitoring Program Lead Skagit County	Masters in Public Health Over 6 years experience with environmental health and water monitoring programs
Art Starrie Marine monitoring lead Thurston County	Monitoring Program Lead Thurston County	BS Bacteriology and Public Health Over 20 years environmental health and water monitoring programs
Shawn Ultican Marine monitoring lead Bremerton-Kitsap County Health District	Monitoring Program Lead Bremerton-Kitsap County Health District	BA Biology Over 7 years experience with environmental health and water monitoring programs
BEACH Program Database Coordinator	Data management	Position yet to be filled
Anne Duffy	Data management Public notification Web site coordinator WA Department of Health	Data Processor Update BEACH Program Web site

Schedule

The following table provides a schedule of the primary activities for the 2003 BEACH Program Pilot Project.

Task	Date
Ecology QAPP preparation, review and approval	June 2003
EPA QAPP review and approval	June 2003
Indicator bacteria collection	July, August and September 2003
Data entry/validation	Weekly
Data evaluation	Weekly
Data reporting to Health	Weekly
Data reporting to EPA	January 2004
Pilot Project summary and evaluation	October 2003

Background

Washington's Beach Environmental Assessment, Communication, and Health (BEACH) Program is a statewide marine recreational beach water quality monitoring program. An inter-agency committee has developed the Program; see Table 1 for list of BEACH Committee members. Development of Washington's BEACH Program is occurring in response to the BEACH Act. The BEACH Act amended the US Clean Water Act in 2000. It gave the United States Environmental Protection Agency (US EPA) the authority to offer funds to states to develop and implement marine recreational beach monitoring and public notification programs.

The Washington State Department of Ecology (Ecology) applied for and received a grant from EPA in December 2001 to develop and implement Washington State's component of the BEACH Act. The BEACH Committee was convened during the spring of 2002 to begin planning Washington State's BEACH Program. The committee used a workgroup format and committee meetings to develop the guidelines as outlined in EPA's *National Beach Guidance and Required Performance Criteria for Grants* (USEPA, 2002). This pilot project will be used to evaluate the effectiveness of the guidelines and to test the implementation strategies prior to full implementation in 2004.

Implementation of the BEACH Program, as outlined in the BEACH Program Guidance (Schneider, 2002) will begin by utilizing a pilot with Grays Harbor, Island, Kitsap, Pierce, Skagit, and Thurston Counties. The pilot will allow the participating parties and the public an opportunity to evaluate and comment on the Program.

The BEACH Program's goal is to reduce the risk of disease to users of Washington's marine recreational beaches. The Program was developed to support microbiological monitoring and an efficient communication system that will notify the public of potential exposure to disease-causing microorganisms. Monitoring will take place at beaches that have an average of more than five users per day during the recreational season and have a potential for fecal pollution.

Monitoring and notification of coastal marine water quality will provide information to the public regarding the relationship between water quality and human health and safety.

Human activities including sewer treatment plants, failing septic systems, improper handling of boat waste, combined sewer outfalls, agricultural activities, and animal waste have the potential of carrying disease-causing microorganisms. As a result, microbial contaminants may be a risk to the public in Washington’s coastal waters. Washington’s coastal beaches are popular recreational locations for tourists. The economy of coastal cities and towns is dependent on the tourism industry.

Of the 14 coastal counties in Washington, only Island and Kitsap Counties have monitoring and public notification programs; while Skagit and King Counties monitor saltwater beaches they do not have a procedure for public notification. Pierce County monitors the marine recreational beaches periodically to determine if an ongoing monitoring program is needed. Prior to the BEACH Program, Washington State did not have uniform standardization of sampling methods or analysis. Consequently, the Surfrider Foundation and the National Resource Defense Council have classified Washington State as “Beach Bums”. This classification has the potential to negatively influence the recreational use of coastal beaches thereby causing adverse impacts to coastal cities and towns.

As a result of the negative media reports and to ensure the public’s safety, Ecology applied for and received a BEACH Act grant from USEPA. The development and implementation of Washington’s BEACH Program is funded through this grant from USEPA and will fund the implementation of the 2003 BEACH Program Pilot Project.

Table 1. BEACH Committee

Julia Bos	Marine Monitoring Specialist	Department of Ecology
Wayne Clifford	Shellfish Specialist	Department of Health
Jim Eychaner	Recreation Resource Planner	Interagency Committee for Outdoor Recreation
Duane Fagergren	Deputy Director	Puget Sound Action Team
Gary Fraser	Recreational Water Health Specialist	Department of Health
Bill Jolly	Environmental Program Manager	Parks and Recreation Commission
Andrew Kolosseus	Water Quality Standards	Department of Ecology
Jan Newton	Senior Biological Oceanographer	Department of Ecology
Arvilla Ohlde	Parks Manager	City of Edmonds
Kevin Ranker	NW Regional Lead	Surfrider Foundation
Scott Redman	Acting Chair	Puget Sound Action Team
Brad Sele	Point Whitney Shellfish Laboratory Director	Department of Fish and Wildlife
Lynn Schneider	BEACH Coordinator	Department of Ecology
Kim Stark	Senior Water Quality Planner	King County Department of Natural Resources and Parks
Derrick Toba	Natural Resource Program Coordinator	Department of Natural Resources
Shawn Ultican	Marine Monitoring and Planning Specialist	Bremerton-Kitsap County Health District

Pilot Project Objectives

This Quality Assurance Project Plan is developed for the BEACH Program Pilot Project in order to implement a federally standardized sampling, analysis, and notification program. This project has been designed by state, county, and local agencies in conjunction with public input. It will give the users of the program and the citizens of the state an opportunity to evaluate and comment on the Program prior to full implementation in 2004.

To accomplish the goals of this pilot project, water samples will be collected by Local Health Jurisdictions (LHJs) or trained volunteers and state accredited laboratories will determine the concentrations of enterococci along with fecal coliform and/or *E-coli*. LHJs will also measure ancillary water and environmental conditions when possible (e.g. temperature and rainfall) and help to determine useful information desired for full implementation.

The objectives of the BEACH Program Pilot Project are to:

1. Use the BEACH Program Guidance document as a tool for administering a state-wide marine water quality monitoring and notification program.
2. Evaluate the Program to ensure the BEACH Program Guidance document describes an effective monitoring and notification program which meets the goals of the Program.
3. Identify and document the existing condition of specified beaches [Appendix A] in Grays Harbor, Island, Kitsap, Pierce, Skagit, and Thurston County's marine recreational beaches.
4. Identify background levels in bacteriological water quality and environmental conditions.

Project Description

Marine public beaches available for public use have been assessed for water contact recreational activities and the number of people using the water. Sites which have greater than five users with water contact per day during the recreational season have been identified as sites to potentially monitor during the pilot project. This project will determine the concentrations of the bacteria enterococci along with the options of fecal coliforms and/or *E-coli* in samples of water taken from the swimming areas of specified recreational beaches [Appendix A] in Grays Harbor, Kitsap, Pierce, Island, Skagit, and Thurston Counties.

LHJs have the necessary training and equipment to conduct monitoring or supervise volunteers to conduct monitoring. State personnel will be used for back up when county and volunteer sample collectors are not available. Each beach will be sampled weekly.

Water samples will be submitted to specified labs [Appendix A] and tested for enterococci [only laboratories accredited for determining enterococcus by Washington State will be used]. LHJs have traditionally used *E-coli* to determine the presence of fecal pollution. Some LHJs have requested determining *E-coli* in addition to enterococci to compare how the two indicators perform. All laboratories must be accredited by Washington State for the the indicator determinations. Laboratory results will be sent via e-mail or fax from the lab and entered into the BEACH Program Database by the BEACH Program Coordinator or the BEACH Program

Database Coordinator. Public notification of beach status will be made available via the Department of Health's (Health) Recreational Beach Web site. Ecology will submit data to USEPA via CDX by January 31, 2004.

The intent of the BEACH Program is to offer rapid and accurate assessment of beach water quality conditions through routine monitoring of coastal marine recreational waters and to determine if levels of the indicator bacteria, enterococci, exceed the single sample maximum and geometric mean water quality criteria established by EPA's *Ambient Water Quality Criteria for Bacteria-1986* (USEPA, 1986). Failure to meet this criterion will result in issuance of an "Advisory". A "Warning" shall be issued when a single sample of enterococci results exceed the single sample maximum of 276 enterococci bacteria colonies per 100 milliliters. Monitoring coastal marine waters for these bacterial indicators will help determine if the waters are suitable for recreational use by Washington residents and tourists.

Project Communication

The BEACH Program is a collaborative effort between Ecology, Health, and LHJs requiring effective communication. Regular and frequent communication between all parties will occur through phone calls, e-mails, and site visits. The BEACH Program Coordinator will be the link between all parties and will have official work stations in both Ecology and Health's Headquarters.

The lead investigator shall:

1. Meet with the BEACH Program Coordinator monthly to track progress and determine compliance with grant requirements.

The BEACH Program Coordinator shall:

1. Meet with the lead investigator monthly.
2. By e-mail, discuss general analytical needs and QAPP requirements with the LHJs.
3. Support the posting and notification process as necessary.
4. Verify field results and validate laboratory data.
5. Report and verify resample procedures for sample results above threshold limits.

LHJ staff shall:

1. Communicate with BEACH Program Coordinator via e-mail and telephone as necessary.
2. Report fecal pollution events to BEACH Coordinator via telephone or e-mail within two hours.
3. Train volunteers and evaluate quality of volunteer-collected data if applicable.

The QA officer shall:

1. Review and approve the Quality Assurance Project Plan.
2. Review and confirm QC problems presented by the BEACH Program Coordinator and recommend solutions.

Specified laboratories shall:

1. By e-mail, inform the BEACH Program Coordinator of any difficulties in meeting QAPP requirements.
2. Report results of analysis by e-mail as soon as possible or within four hours of completion.
3. By phone, inform the BEACH Program Coordinator of lost samples, failure of one or more QC requirements, or the need for a resample.

Measurement Quality Objectives

Table 2 outlines the Data Quality Objectives (DQOs) for the variables measured in this pilot project. Accuracy of the laboratory determinations will be assured through the laboratory procedures of the various accredited labs. Accuracy has been demonstrated and assured in the State Accreditation process.

Standard protocols for data and sample collection will be followed throughout the study to limit sources of bias. Sources of bias from sampling procedures and sample handling will be minimized by adherence to standard operating procedures.

Table 2. Data Quality Objectives

Parameter	Reporting Units	Reporting Limit	Relative Percent Deviation (RPD)
Enterococci	1	2 cfu	50%
Fecal coliforms	1	2 cfu	50%
E-coli	1	2 cfu	50%
Water temperature	°C	+/- 0.5 ° C	30%
Turbidity	NTU	0.5 NTU	10 %

Study Design

Used as a tool to evaluate the risk of waterborne illness to bathers, Grays Harbor, Kitsap, Pierce Island, Skagit, and Thurston County Local Health Jurisdictions will conduct or manage weekly water sampling for indicator bacteria at specified marine recreational beach sites [Appendix A].

Samples will be collected in knee-deep water in the middle of the bathing area; if there is a freshwater/stormwater discharge in the bathing area, sampling should occur near the discharge. Additional samples will be collected every 200 yards up to a maximum of 600 yards from the discharge. Individual sample locations will be geo-referenced using a GPS unit and the locations stored in the BEACH Program database. Water sampling will begin the first week in July and continue weekly through September 2003.

Water samples will be collected by LHJ staff, volunteers managed by LHJ staff, or state personnel when county and volunteers are not available. Samples will be delivered to specified [Appendix A] laboratories ideally within six hours. Samples will be analyzed for indicator bacteria, which are not disease causing pathogens, but can indicate the presence of fecal contamination.

Ancillary water and environmental conditions can influence bacterial levels. LHJs will measure water temperature, turbidity, and other environmental conditions when feasible; however, these

are not required elements of this project, and are not a part of this QAPP. LHJs should maintain their own sampling QA and metadata for these variables. This information will be used to determine useful information desired for full implementation.

Field Procedures

The Standard Operating Procedures (SOPs) for field sampling are described as “Step-by-Step Procedures” below, including specific facilities, equipment, materials and methods, and QA/QC procedures. The proper collection, preservation and storage of beach water samples are necessary to reduce errors in analysis. One sample per beach will be collected in the center of the bathing beach near one freshwater inflow, if present and adjacent to the bathing beach. Beaches greater than 200 yards in length will have two sample locations. Beaches greater than 400 yards will have three sample locations. Beaches greater than 600 yards will be treated as two separate beaches.

Marine water samples are susceptible to rapid increases or death of microorganisms and hence will be held for the shortest time possible to minimize change. Steps for the preservation and transit of collected water samples will be followed precisely, or the sample will not be analyzed and another sample will be collected. Bacteriological samples must be iced or refrigerated at a temperature of 1-4° Celsius (C) and stored in insulated containers to assure proper maintenance of sample temperature during transit to the laboratory. Samples will be delivered only to laboratories approved by Ecology.

Step-by-Step Procedures

The protocol for sampling was derived from the procedures outlined in the EPA’s *Microbiological Methods for Monitoring the Environment: Water and Wastes* (EPA, 1978).

Do NOT open the collection bag or sample container until just prior to taking the sample in order to protect the bag from contamination. Carefully move or use a wand, so as not to stir up sediment and debris, to a location at approximately three feet of water depth.

1. Identify sampling site on the label and a field log sheet before collecting the sample. [The tag or label should contain as a minimum: sample number, sample location number, date and time taken. The tags must be filled out legibly in waterproof ink.]
2. Tear on perforation: simply grasp the top edge and tear away from the bag.
3. Pull tabs to open: allows you to open the bag top wide without touching the edges.
4. Grasp the bag at the mouth using an 18-inch water scoop or sterile gloves.
5. With one hand plunge the bag mouth down into the water (to avoid introducing surface scum.)
6. Position the mouth of the bag or the sample container into the current away from the collector’s body.
7. Collector or bottle using the wand should be knee deep or approximately three feet out in the water source.
8. The sampling depth should be just below the water surface.
9. Tip the bag slightly upwards to allow air to exit and the bag to fill.

10. Collections should be done in a continuous scooping motion.
11. After removal of the bag or sample bottle from the water source, pour out a small portion of the sample to allow an air space of 2.5-5.0 cm (1-2 in) above each sample.
12. Tightly seal the labeled bag.

Ensure sample bags or bottles are not totally immersed in water/melted ice during transit or storage. Samples must be examined as soon as possible after collection so that the holding time limit will not exceed six hours between collection and initiation of sample determination. Samples will be delivered only to laboratories *accredited* by Washington State.

Design Assumptions

Samples will be collected weekly for all beaches selected for the monitoring and notification program. In order to allow time for the resampling of poor results before the next sampling period, field personnel will be required to collect the samples on Monday or Tuesday of the sampling period and collect any re-samples later in the week. LHJ staff or volunteers will document rainfall and tidal information to explain sample collection difficulties (for example: the current was too strong to safely enter the water). If the sample cannot be collected according to the plan, due to holidays or inclement weather, then personnel will collect the sample as soon as possible to ensure that any re-samples can be conducted before the next sampling period. If the situation does not allow for sampling in the required time frame, LHJ staff or volunteers must contact the BEACH Coordinator within the sampling period in question. Laboratories will be required to have the ability to handle weekly samples and to report results to the BEACH Coordinator in a timely manner.

Sample Custody Procedure

Chain of Custody (COC) procedures are to be followed whenever samples are collected, transferred, stored, or analyzed. Specific laboratory COCs are outlined in the required QA manuals developed for Ecology *accredited* laboratories. LHJ staff or volunteers will follow the sampling protocol developed and will directly deliver samples to the laboratory for analysis. When the samples are at the laboratory, LHJ staff, volunteers and laboratory staff will complete any COC records required by each laboratory. Specific laboratory COCs are outlined in the required QA manuals developed for Ecology *accredited* laboratories.

Laboratory Procedures

Indicator	Method	Reference
Fecal Coliform		
Fecal Coliform by Multiple Tube Fermentation (MTF) m-EC	SM 9221 C, E	APHA, 1998
Fecal Coliform by Membrane Filtration (MF) m-EC	SM 9222 D	APHA, 1998
Enterococci		
Enterococci by Membrane Filtration (MF)	SM 9230 C	APHA, 1998
Using mEI or me	SM 9213 D	APHA, 1998
Enterococci by Quant-Tray	Enterolert	EPA, 2001
E – Coli		
Most Probable Number	LTB EC-MUG	APHA, 1998
Most Probable Number	9221B	APHA, 1998
Membrane Filtration (MF)	SM 9221 C, E(2) 9213 B, D	APHA, 1998

Decision Criteria

Closure action or other emergency action may only be taken by the local health officer under RCW 70.05.070, Local health Officer - Powers and Duties.

WAC 246-260-180 Bathing beaches. No bathing beach shall be maintained or operated when such water is determined by the health officer to be so polluted or subject to pollution as to constitute a menace to health if used for bathing. Where bathhouse and toilet facilities are provided for use of bathers they shall be constructed, maintained and operated in a sanitary manner approved by the health officer.

The BEACH Program's decision criteria are based on EPA's ambient water quality criteria (EPA, 1986) for two reasons:

1. Enterococci have a better correlation between indicator levels and illness rates than fecal coliform.
2. Washington State's marine Bacteria Indicator Water Quality Standards protect for the consumption of shellfish. Protection from human illness due to primary marine water contact is not mentioned in Washington State's Water Quality Standards. Closing a beach or advising against water contact based on a single sample of 41 fecal coliform colonies/100mL or having a geometric mean of 14 fecal coliform colonies/100mL could result in excessive advisories. A financial hardship on local communities could result from unnecessary and excessive postings. Public confidence in the Program could also drop resulting in a human health hazard due to future postings being ignored.

The decision to post an “Advisory” or “Warning” will be based on these thresholds (Schneider, 2002):

The **minimum** advisory level protective bacteriological standards for marine recreational beaches used for primary contact recreation shall be as follows:

1. Based on a single sample, the density of bacteria in water from each sampling station shall not exceed¹:
 - A. 104 *enterococci* bacteria colonies per 100 milliliters, or
 - B. 200 *fecal coliform* bacteria colonies per 100 milliliters.
2. Based on the geometric mean of results from a minimum of five weekly samples (including any additional samples) the density of bacteria in water from any sampling station shall not exceed:
 - A. 35 *enterococci* bacteria colonies per 100 milliliters, or
 - B. 100 *fecal coliform* bacteria colonies per 100 milliliters.

The **critical** warning level protective bacteriological standards for coastal marine waters used for primary contact recreation shall be as follows:

3. Based on a single sample, the density of bacteria in water from each sampling station shall not exceed²:
 - A. 276 *enterococci* bacteria colonies per 100 milliliters, or
 - B. 400 *fecal coliform* bacteria colonies per 100 milliliters

To make the necessary decision, data must be indicative of water quality conditions to adequately assess sanitary conditions of the beach. Due to inherent uncertainty involved with sampling and analytical determination of bacteria levels, decisions will be made when there is no reason to doubt the accuracy of the sample.

¹ Enterococcus gives the best correlation between indicator levels and illness rates, thus EPA requires states receiving BEACH Act Grants to use it as an indicator for marine waters. EPA’s criterion is based upon an “Acceptable Swimming Associated Gastroenteritis Rate” of 19 cases/1000 swimmers.

² This number is derived from EPA’s upper 90 % confidence level.

Quality Control Procedures

Field Quality Control

The BEACH Coordinator will accompany field-sampling crews on several occasions throughout July, August and September 2003 to ensure samples are collected at the correct location and according to the SOP. Each county will collect duplicate water samples at one station each week to assess variation associated with field replicates and laboratory analysis. Duplicate measurements will also be taken at the QC station.

State Accreditation Status

All testing, inspection, and maintenance of laboratory equipment will be conducted as prescribed by laboratory QC manuals. The QA procedures for the specified laboratories [Appendix A] were reviewed and maintained through Washington State Accreditation status.

Data Reduction and Management Procedures

Laboratory data reduction and validation will be conducted by the laboratory analyzing the samples in accordance with methods requirements and standard operating procedure of the laboratory. The BEACH Coordinator or BEACH Data Coordinator will assess the data for completeness and data entry errors and will enter the data into an Microsoft Access© database. Any discrepancies will result in the notification of LHJ representatives and the laboratory.

Reports

Data will be reported to the BEACH Coordinator via e-mail by the LHJ staff or volunteers and the analysing laboratory.

Ecology will report data from 2003 BEACH Program Pilot Project to EPA via CDX/STORET by January 31, 2004

Data Verification and Validation

Data will be verified by the LHJ laboratory then faxed or e-mailed to the BEACH Program Coordinator.

The BEACH Program Coordinator will validate the results then transfer them to a Microsoft Access© database. Further validation will occur to ensure:

- The data are consistent, correct, and complete according to the data recording sheets filled out in the field,
- Any qualifiers with the data are identified,
- Accuracy meets program objectives, and
- The protocols outlined in this QAPP were followed.

Data Quality Assessment

After the data has been validated, to make decisions regarding the risk of disease to users of Washington's marine recreational beaches:

- Data will be reviewed within 24 hours of determination, resample decisions will be made when sample results are above threshold limits as outlined in the Decision Criteria section.
- Resample data will be reviewed and compared to threshold limits, when sample results remain above threshold limits outlined in the Decision Criteria section, public notification, further investigation, and a recommendation to the LHJ to conduct a shoreline survey will occur.
- Application of statistical tests will occur to evaluate and ensure determinations remain below the specified geometric means.
- Verify the assumptions of the statistical tests.
- Draw conclusions from the data.
- Data will be reviewed and recommendations made for BEACH Program implementation in 2004.

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Appendix A

County	Laboratory	Sample Sites
Grays Harbor County	Grays Harbor County	North Jetty Beach Access Ocean City State Park Pacific Beach State Park Westhaven State Park/South Jetty Westport Light State Park
Island County	Skagit County	City Beach Park Freeland/Holmes Harbor County Park Camano Country Club Lagoon Manroe Landing
Kitsap County	Bremerton-Kitsap County Health District	Arness County Park Evergreen Park Illahee State Park Indianola Dock Kitsap Memorial State Park Lions Park Manchester State Park Silverdale County Park Additional sites (May be included if staff time and budget allow) Eagle Harbor Park Fay Bainbridge State Park Ross Point Tidelands Scenic Beach State Park
Pierce	AmTest or STL	Browns Point Dash Point County Park Kopachuck State Park Owens Beach Penrose State Park Purdy Sandspit Ruston Way Sunnyside Beach Park Titlow Beach
Skagit	Skagit County	Alexander Delmar Bayview State Park Community of Christ Church Samish Bay Access Dewey Beach Guemmas - North Beach Deception Pass Rosario
Thurston	Undetermined	Swantown Marina Westbay Marina