

Chapter 3: Risk-Based Beach Evaluation and Classification Process

This chapter describes the risk-based beach evaluation and classification process, including the evaluation steps and recommended information that a state or tribe should consider when ranking beaches.

3.1 Performance Criterion

Performance Criterion 1 addresses the risk-based beach evaluation process. The general and specific requirements associated with this criterion are included in table 3-1.

Table 3-1. Summary of Risk-Based Evaluation and Classification Process Performance Criterion

Performance Criteria		Chapter Section
General Requirements	Specific Requirements	
<p>Risk-based Beach Evaluation and Classification (Performance Criterion 1). This performance criterion requires a state or tribe to develop a risk-based beach evaluation and classification plan and apply it to state or tribal coastal recreation waters. A state or tribal government program must describe the factors used in its evaluation and classification process and explain how its coastal recreation waters are ranked as a result of the process. This process must result in the identification of a list of coastal recreation waters, including coastal recreation waters adjacent to beaches or similar points of access used by the public.</p>	<ul style="list-style-type: none"> • Identification of factors used to evaluate and rank beaches. • Identification of coastal recreation waters in the state or tribe. • Identification of beaches, or similar points of access used by the public for swimming, bathing, surfing, or similar water contact activities, adjacent to coastal recreation waters. • Identification and review of available information describing (1) the potential risk to human health presented by pathogens and (2) the use of the beach. • Notification of EPA annually when the ranking of beaches changes and alters the sampling frequency at beaches. 	3.2–3.5

Risk-based beach evaluation and classification is a means to identify the potential risk of disease to swimmers and to protect public health. Although a state or tribe may develop its own risk-based approach, it must address both the general and specific requirements summarized in table 3-1.

The goal of the evaluation process is for a grant recipient to use these requirements to evaluate its coastal recreation waters adjacent to beaches or similar points of access and classify those waters in an appropriate tier based on the potential risk to human health presented by pathogens and the use of the waters. EPA recommends establishing an evaluation and classification process that uses

uses a three-tiered process because this approach will enable beach managers to efficiently allocate monitoring and public notification resources to waters on the basis of use and potential disease risk. A classification of Tier 1, for example, could indicate that waters are of such high risk and/or receive such high usage that significant resources should be devoted to more intensive monitoring and public notification efforts for that area. EPA recommends this three-tiered model program; however, it is recognized that state or tribal programs will vary. The program must, however, ultimately result in a risk-based ranking. This classification can then be used to direct appropriate resources toward monitoring and notification programs for coastal recreation waters adjacent to beaches or similar points of access (see chapters 4 and 5).

3.2 Step 1: Identify Coastal Recreation Waters

According to the BEACH Act, *coastal recreation waters* are defined as the Great Lakes and marine coastal waters (including coastal estuaries) designated under CWA section 303(c) by a state or tribe for use for swimming, bathing, surfing, or similar water contact activities. The BEACH Act explicitly excludes from the definition of coastal recreation waters both inland waters and waters upstream of the mouth of a river or stream that has an unimpaired natural connection with the open sea. The first step in evaluating and classifying coastal recreation waters adjacent to beaches or similar points of access is to make a list of all coastal recreation waters (figure 3-1).

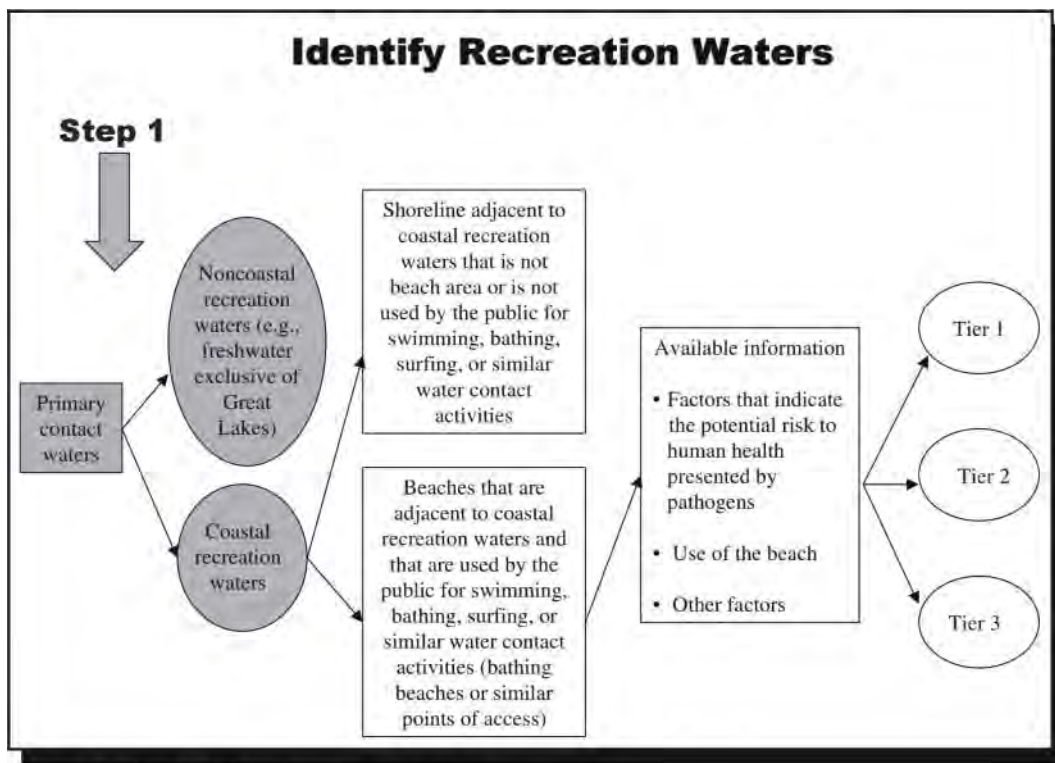


Figure 3-1. Step 1: Identify recreation waters.

3.2.1 Designated Uses of Waterbodies

Properly identifying coastal recreation waters requires identifying the designated use of a waterbody. Under CWA section 303(c)(2)(A), each water quality standard adopted by a state must consist of “designated uses” for the water to which the standard applies and criteria to protect these uses. The state or tribe must then submit the new or revised water quality standards to EPA for review. If EPA disapproves a water quality standard submission or if the EPA Administrator determines that new or revised water quality standards are necessary to meet the requirements of the CWA, EPA must adopt a new or revised water quality standard itself, including designated uses, when appropriate. In other words, the applicable water quality standards (including, in this instance, designated uses for the purpose of the BEACH Act) may be adopted by states, tribes, or EPA, depending on the circumstances.

Most states and some tribes have established designations for their primary contact waters. Assigning a designated use to a waterbody is a means of identifying and classifying that waterbody’s intended use (e.g., aquatic life support, fish consumption, shellfish harvesting, drinking water supply, primary contact recreation, secondary contact recreation). Any change to the designated use of a waterbody must be submitted to EPA for the Agency’s review and approval or disapproval. Typically, states and tribes review their water quality standards every three years and revise the standards as appropriate.

In designating a use for a waterbody and setting the appropriate water quality criteria to protect that use, the state or tribe also must take downstream water quality into consideration and ensure that its water quality standards provide for attaining and maintaining the water quality standards for downstream waters.

3.2.2 Recreational Uses of Waterbodies

Recreation occurs in many forms throughout the United States and frequently centers around waterbodies and activities that take place in and on the water. Waters where people engage in or are likely to engage in activities that could result in ingestion of the water or immersion are designated for use in state and tribal water quality standards as “primary contact recreation” waters. A primary contact recreation use should be adopted for any waterbody where people engage in or are likely to engage in activities that could result in ingestion of the water or immersion. These activities include swimming, water skiing, and kayaking.

Often a state or tribe will designate most or all of its surface waters for primary contact recreation. Those waters adjacent to bathing beaches typically constitute a subset of the waters designated for primary contact recreation.

Although most recreation waters are designated for year-round primary contact recreation to protect people engaged in primary contact activities, for some waters a primary contact recreation

use is designated on only a seasonal basis. These uses can include the designation of intermittent, secondary, or seasonal recreation uses. For example, a state or tribe might choose to designate waters for primary contact recreation use only during certain months of the year if climate precludes such use at other times. Similarly, a state or tribe might designate waters for nonprimary contact recreational use, often known as secondary contact use. Subject to the provisions of 40 CFR 131.10, secondary contact recreation uses might be appropriate on a year-round basis, for example, where waters have been irreversibly affected by wet weather events or where protecting a primary contact recreation use at all times would result in substantial and widespread social and economic impact.

3.2.3 Coastal Recreation Waters

The requirements of the BEACH Act apply only to states and tribes that have “coastal recreation waters.” As amended by the BEACH Act, CWA section 502(21) defines *coastal recreation waters* as the Great Lakes and marine coastal waters (including coastal estuaries) that are designated under section 303(c) by a state or tribe for use for swimming, bathing, surfing, or similar water contact activities. Coastal recreation waters do not include either inland waters or

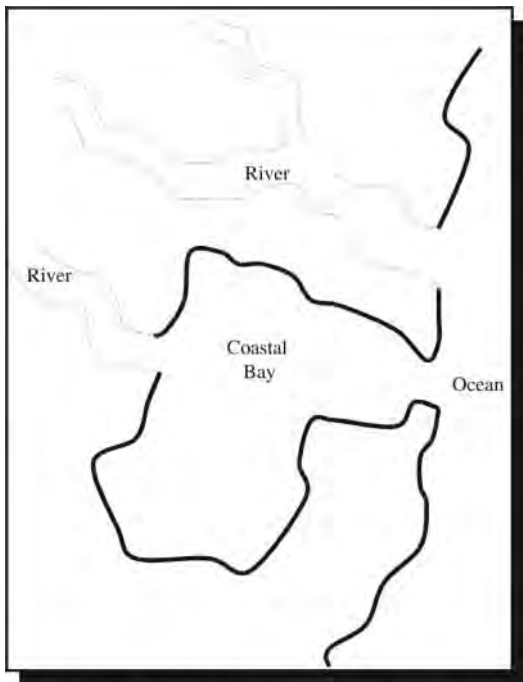


Figure 3-2. Examples of coastal and noncoastal recreation waters.

waters upstream of the mouth of a river or stream having an unimpaired natural connection with the open sea. Figure 3-2 illustrates what beaches and similar points of access may or may not be considered adjacent to coastal recreation waters under the BEACH Act. The heavy lines indicate areas that would be designated coastal recreation waters; the thin lines indicate areas that would not be designated coastal recreation waters. The decision to identify and classify waters as coastal or noncoastal should be made by an individual state or tribe in consultation with EPA, taking site-specific conditions into consideration.

3.3 Step 2: Identify Beaches or Similar Points of Access Used by the Public for Swimming, Bathing, Surfing, or Similar Water Contact Activities

The second step in evaluating and classifying beaches is to identify beaches and similar points of access that are adjacent to coastal recreation waters and used by the public for swimming, bathing, surfing, or similar water contact activities (figure 3-3). After beaches and similar points of access and adjacent waters used by the public are identified, the waters can be evaluated using the Beach

Evaluation and Classification List (appendix F). Typically, waters used by the public for swimming, bathing, surfing, or similar water contact activities are:

- Not contained within a man-made structure or building.
- Under the control of a state, tribe, or local government.
- Used for swimming or other contact recreational activity (partial body contact with the water).

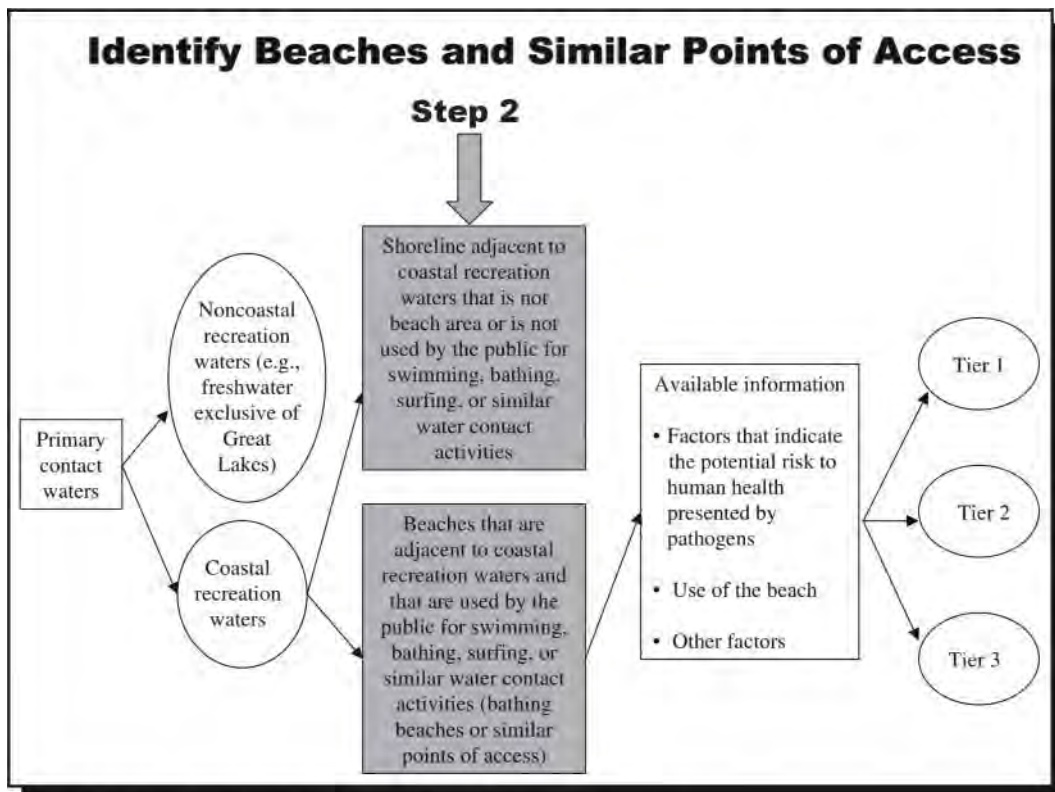


Figure 3-3. Step 2: Identify beaches and similar points of access.

Beaches and similar points of access adjacent to these waters can include seashores, oceanfronts, and shorelines associated with estuaries and bays. They also can include shorelines associated with natural lakes, reservoirs, impoundments, ponds, rivers, streams, and creeks, but (except for the Great Lakes) those beaches and similar points of access are not covered by the BEACH Act. Beaches and similar points of access can be located in rural or urban areas. Privately owned beaches and similar points of access adjacent to waters used by the public for swimming, bathing, surfing, or similar water contact activities are covered by the BEACH Act and therefore must be included in the identification, evaluation, and classification of beaches to meet this performance criterion.

Factors to consider when defining beaches and similar points of access include geography, geology, the type of recreational use, and the type of access these areas provide.

- *Geography.* A beach or similar point of access may be described by a jurisdictional boundary (e.g., nation, state, region, county, township, municipality) or by location on an ocean, a sound, a bay, an estuary, an inlet, or one of the Great Lakes.
- *Geology.* A beach or similar point of access may be defined as a gently sloping waterfront area or the shoreline of an ocean, a sea, or a lake, covered by sand, gravel, or larger rock fragments, possibly accompanied by mud.
- *Access.* Access to the waterbody might be from a shoreline structure, or the beach might be adjacent to a recreational waterbody.
- *Designated use.* (See section 3.2.1.)

3.4 Step 3: Review Available Information

The third step in evaluating and classifying a beach is to review all available information about the beach, including historical knowledge of the beach, its uses, and possible sources of microbial pathogens (figure 3-4). This information should help identify the most important issues and data gaps. Source information may be located in state, tribal, or local government agency files; literature and records in local libraries; beach management reports; community association reports; public health records; papers and journals available at colleges and universities; and work performed by local nonprofit organizations. The following factors must be used to rank beaches:

- Factors that indicate the potential risk to human health presented by pathogens
- Use of the beach

Other factors, such as importance to the local economy or community, also can be considered, but the BEACH Act requires state, tribal, and local governments to prioritize the use of grant funds for particular coastal recreation waters based on the use of the water and the risk to human health presented by pathogens or pathogen indicators. Sources that might provide this information are listed below under each factor in a suggested order of relevant importance. EPA recognizes that some sources might be more important than others, depending on the conditions and availability of information. Appendix F provides an additional list of information that might help in classifying and ranking beaches.

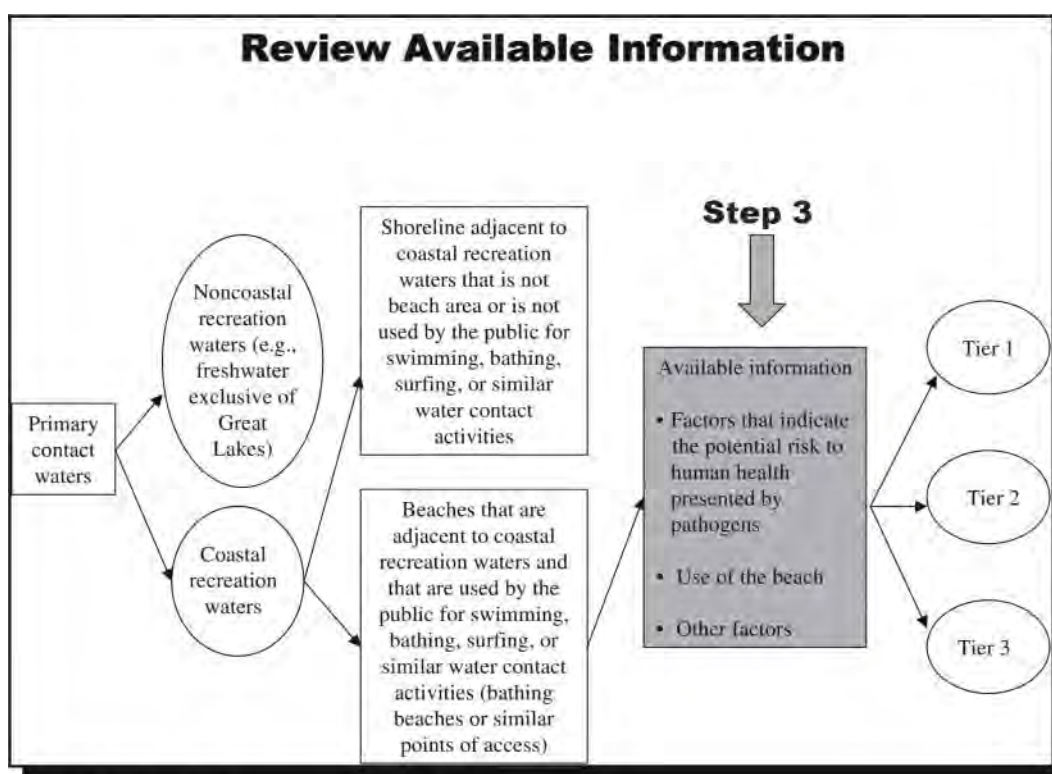


Figure 3-4, Step 3: Review available information.

3.4.1 Factors That Indicate the Potential for Fecal Contamination

Part of the process of evaluating potential health risks related to exposure to pathogens during bathing or swimming activities is to compile available information about each beach indicating the potential for contamination by microbial pathogens. This information can be found in reports that include information on waterbodies that are or are not in attainment of their designated uses, lists of impaired waterbodies, medical records, past advisory and closure reports, planning reports, and actual discharge data. The following reports can be used to help classify and rank beaches.

Water Quality Monitoring Reports

Previous monitoring reports that contain actual bacterial concentrations might be helpful in evaluating and classifying beaches. In addition, state or tribal water quality monitoring reports that contain temperature, flow, and turbidity data might be helpful in identifying water quality patterns. For example, Francy and Darner (1998) found a relationship between turbidity and concentrations of *E. coli* at three Lake Erie beaches; as turbidity increased, *E. coli* concentrations also increased. In that study, other environmental and water quality variables also were shown to be related to *E. coli* concentrations.

Advisory Reports and Closings

Previously recorded advisories and closings can provide insight into problems associated with maintaining beach water quality, links to closings caused by rain events, the frequency of closings during the swimming season, causes of closings (preemptive, outfalls, increased sampling, rain), and the number of swimming days affected by an advisory or a closing.

Water Quality Modeling Reports

Water quality models also can assist in evaluating and classifying beaches. Models that predict bacterial contamination during rainfall events can help reduce the risk of swimmer exposure to contaminants between normal sampling periods (USEPA, 1999). Chapter 4 provides additional information on these types of models.

Sanitary Surveys

A sanitary survey can be used to evaluate and document sources of contaminants that might adversely affect public health. Although sanitary surveys are frequently associated with water supply systems, they can be used to identify sources of pollution and to provide information on source controls and identification, persistent problems such as exceeding of water quality standards, magnitude of pollution from sources, and management actions and links to controls. A Registered Sanitarian or professional with experience in these areas should perform the survey. A sanitary survey can be an effective tool for protecting human health at bathing beaches and can provide information that helps in designing monitoring programs and selecting sampling locations, times, and frequencies.

Additional information on sanitary surveys is provided in appendix G. The sanitary survey list can be used to evaluate and identify the potential and existing microbiological hazards that could affect the safe use of a particular stretch of recreational water or bathing beach.

Point Source Discharge Data

Facilities authorized to discharge wastewater under the National Pollutant Discharge Elimination System (NPDES) program, including combined sewer overflows (CSOs), concentrated animal feeding operations (CAFOs), and publicly owned treatment works (POTWs), provide information on the contents and locations of their point source discharges.

CSOs

CSOs consist of mixtures of domestic sewage, industrial and commercial wastewaters, and storm water runoff. Untreated CSOs often contain high levels of suspended solids, pathogenic microorganisms, toxic pollutants, organic compounds, oil and grease, and other pollutants that can cause water quality standards to be exceeded, posing risks to human health (USEPA, 1994).

CAFOs

CAFOs and other animal feeding operations (AFOs) can pose a number of risks to water quality and public health, mainly because of the amount of animal manure and wastewater they generate (USEPA, 1998). Manure and wastewater from AFOs and CAFOs have the potential to contribute pollutants such as nutrients (e.g., nitrogen, phosphorus), sediment, pathogens, heavy metals, hormones, antibiotics, and ammonia to the environment.

POTWs

POTWs are waste treatment works owned by a state, unit of local government, or tribe; they are usually designed to treat predominantly domestic wastewaters.

State Water Quality Report (CWA Section 305(b) Report)

A state's or tribe's 305(b) report identifies assessed waterbodies that are in full attainment, partial attainment, or nonattainment of their designated uses. One purpose of the report is to help determine pollution control and management priorities at the state, tribal, and national levels. The report indicates how the state or tribe measures waterbodies against its standards and lists known problems, known or suspected causes, and proposed corrective actions. The 305(b) report is a good source of information for locating potential problem areas in recreational waterbodies. EPA also uses the reports to compile the *National Water Quality Inventory* (USEPA, 1998), a national assessment of progress toward the nation's clean water goals. The *National Water Quality Inventory* state reports are available through state or tribal water quality management agencies or at <http://www.epa.gov/OWOW/305b/>.

List of Impaired Waters (CWA Section 303(d) List)

A state or tribe's 303(d) list is a list of impaired waters that have been identified as not meeting water quality standards and require Total Maximum Daily Loads (TMDLs). Each state or tribe must develop TMDLs for each waterbody listed. A TMDL presents the maximum amount of a pollutant that a waterbody can receive and still meet water quality standards, and it includes an allocation of that amount to the point and nonpoint sources. The 303(d) lists include a priority ranking of the waters and an identification of the pollutant(s) causing the impairment.

Waterbodies on the 303(d) list must be reexamined periodically. Monitoring or sampling performed by the state or tribe in support of its section 303(d) listing activities can sometimes support monitoring or sampling efforts being conducted for beach programs; however, an advisory or a closing should not be issued for a particular waterbody simply because it has been placed on the 303(d) list. The BEACH Act addresses concerns about the health risks associated with microbial pathogens. Section 303(d) lists, by contrast, reflect concerns about all types of pollutants that might impair any designated use. Therefore, it is quite possible that a waterbody might be listed for a pollutant or stressor that is harmful to aquatic species but does not threaten public health. The 303(d) list for a state or tribe can be obtained from its water quality management agency. Links to these agencies are provided at <http://www.epa.gov/owow/tmdl>.

Nonpoint Source (CWA Section 319) Reports

In 1987 Congress enacted CWA section 319, which requires states to develop management programs to reduce and control nonpoint sources of pollution.

Nonpoint source pollution can be caused by rainfall or snowmelt moving over and through the ground and carrying natural and human-made pollutants into lakes, rivers, streams, wetlands, estuaries, other coastal waters, and ground water.

Nonpoint source pollution also can result from resuspension of bacteria-laden beach sands and hydrological modification. Section 319(h)(11) of the CWA requires states and tribes to report annually on their progress in meeting nonpoint source management program milestones. They must also report available information on reductions in nonpoint source pollution and on improvements in water quality resulting from program implementation. States and tribes may wish to include a list of further actions necessary to achieve CWA goals, including any recommendations for future EPA programs to control nonpoint source pollution, as well as brief case studies of any particularly successful nonpoint source control efforts.

Microbial Analysis of Storm Water

Coliforms, pathogenic bacteria, and viruses were detected in both combined sewer flows and storm sewer flows in Baltimore, Maryland. The levels of fecal coliforms found in storm flows ranged from 200 to more than 2,000 most probable number (MPN) per 100 milliliters (mL), and 123 of the 136 samples had fecal coliform bacteria counts of greater than 2,000 MPN/100 mL. Of those 123 samples, 95 percent were positive for *Salmonella*. Six storm water flows were examined for viruses, and all six tested positive (USEPA, 1977).

Swimmer Reports or Hospital Records

Medical records and epidemiological studies can provide information related to the historical risk of swimming at a particular beach. Swimmer illness reports or complaints to a state or tribal agency are also valuable sources of information and can answer the following questions: Have any swimmers complained to the agency about illnesses believed to be related to the water quality or debris at the beach? Have any hospitals or other medical facilities documented such reports of illness? Have any epidemiological studies been conducted at the beach (Ferley et al., 1989; Fleischer et al., 1996; Haile, 1996)? Have other government agencies described health problems at this beach or adjacent shoreline areas? Approximately how many reports of illness have occurred? How many have occurred within the past year? The frequency and severity of reports of swimming-associated illnesses can provide important insights into the risks of bathing at a particular beach. In many cases, however, people who contract diseases as a result of bathing in contaminated water do not always associate their illness symptoms with swimming. As a result, disease outbreaks are often inconsistently reported. On the other hand, people might associate illnesses caused by other sources with contaminated water. Caution should therefore be used in determining the significance of such data. Because interpretation of medical records and epidemiological information can be a complex process, professionals trained in data interpretation should perform this function.

Development Planning Reports

Previous management plans or inspection reports can provide information on sewer lines, outfalls, trash collection areas, septic systems, and other infrastructure and can help to answer questions concerning the identification of potential sources of human pathogens at a beach (e.g., bathrooms, shower facilities). The types of bathroom facilities in the area should be known, as well as any threats of sewage contamination nearby. Potential sources of microbiological contamination of recreational waters might be associated with system failures in municipal wastewater treatment facilities, leaking sewer lines, or rainfall and runoff. Other sources include releases from boat and recreational vehicle holding tanks, pumping stations, portable toilets, and leachate from poorly maintained or flooding septic systems (CADHS, 1998). The sources of contamination listed in the example Beach Evaluation and Classification List (appendix F) could increase the human health risk of using nearby recreational waters.

Although these plans and reports are useful, it is important to keep in mind other factors affecting contamination. For example, a study conducted by the Texas Natural Resource Conservation Commission found that the density and variability of fecal coliform bacteria appeared to be strongly influenced by storm water runoff. Summer sampling over one 30-day period at six stations (five or six samples were collected) demonstrated that substantial changes in density were observed within as little as 24 to 48 hours. The range of densities around each station's geometric mean varied from 765 to 18,840 colony-forming units (CFU) per 100 mL of water. Thus, infrequent sample collection did not provide an adequate measure of fecal coliform density and variability, particularly in waters affected by storm events (McGinnis and Mummert, 1996).

Environmental Group Reports

Many environmental groups conduct studies and publish reports on local beaches and recreation waters. These reports can be helpful in classifying beaches because they might evaluate levels of pathogen indicators and identify potential sources of pollution that could pose a health risk to swimmers. These environmental reports also might include historical information and report how water quality conditions have changed over time.

3.4.2 Use of the Beach

The frequency of use and thus exposure to pathogens can be measured by determining how many people use a beach and when the peak periods of use occur. Exposure estimates can be refined by considering the percentage of people visiting the beach who actually enter the water, beach use during holidays, the length of the swimming season, and a number of other factors.

The frequency of beach use can vary considerably from day to day or season to season. States and tribes should consider this variability in assessing the frequency of use. When people who have a

compromised immune system or otherwise are at high risk become infected with pathogens, severe, life-threatening illness can occur (Ahmed, 1991). Thus, children, senior citizens, and people with weakened immune systems (such as persons with AIDS or other immune system diseases, cancer patients receiving chemotherapy, and organ transplant recipients) are more likely to become ill when they come into contact with contaminated water. Fattal et al. (1987) observed a significant association between enteric disease symptoms and recreation waters with high levels of bacterial indicators in children ages birth to 4 years. Alexander et al. (1992) found that children between the ages of 6 and 11 who came into contact with seawater contaminated with sewage were likely to suffer from vomiting, diarrhea, itchy skin, fever, lack of energy, and loss of appetite. These effects can be more significant in waterbodies with restricted circulation.

This increased risk is of particular significance during high-frequency use periods because bacterial densities and the potential presence of pathogens are directly related to the number of swimmers. Studies have demonstrated an association between high swimmer densities and an increase in bacterial densities. Therefore, swimmers should pay special attention when swimming during peak bathing hours, especially if they are immunocompromised or otherwise at high risk.

3.4.3 Other Factors

Additional factors, such as the importance to the local economy and community input, may be used as secondary considerations in evaluating and classifying beaches. While the state, tribe, or local government must prioritize its use of grant funds for particular coastal recreation waters based on the use of the water and the risk to human health presented by pathogens or pathogen indicator, there could be a need for a further ranking of beaches. For example, if there are more beaches that present an equal level of risk to the same number of people than a state can monitor, the state may use other considerations to determine which of those beaches to include in its grant-funded monitoring and notification program. If available, other beach characterization data describing such factors as nearshore flow dynamics, the presence of marinas and moored boats, and surrounding land uses can be used to evaluate potential risk and rank beaches.

Chambers of Commerce and other government agencies often publish reports on the economic value of natural resources or beach recreation. These reports can be a resource for considering how beaches and recreational waters contribute to the local economy. For example, NRDC (1997) found that tourists spend billions of dollars annually visiting coastal and Great Lakes counties and their beaches. California, Florida, and South Carolina estimated the value of their coastal tourism to be more than \$37 billion, \$23 billion, and \$4 billion, respectively (NRDC, 1997; 1999).

3.5 Step 4: Rank Beaches

The final step in evaluating and classifying beaches is to rank the beaches (figure 3-5). The beach ranking must be based on factors indicating the potential risk to human health presented by

pathogens, and use of the beach. Other factors such as importance to the local economy or community also can be used when ranking beaches, but risk and use must be given the highest priority.

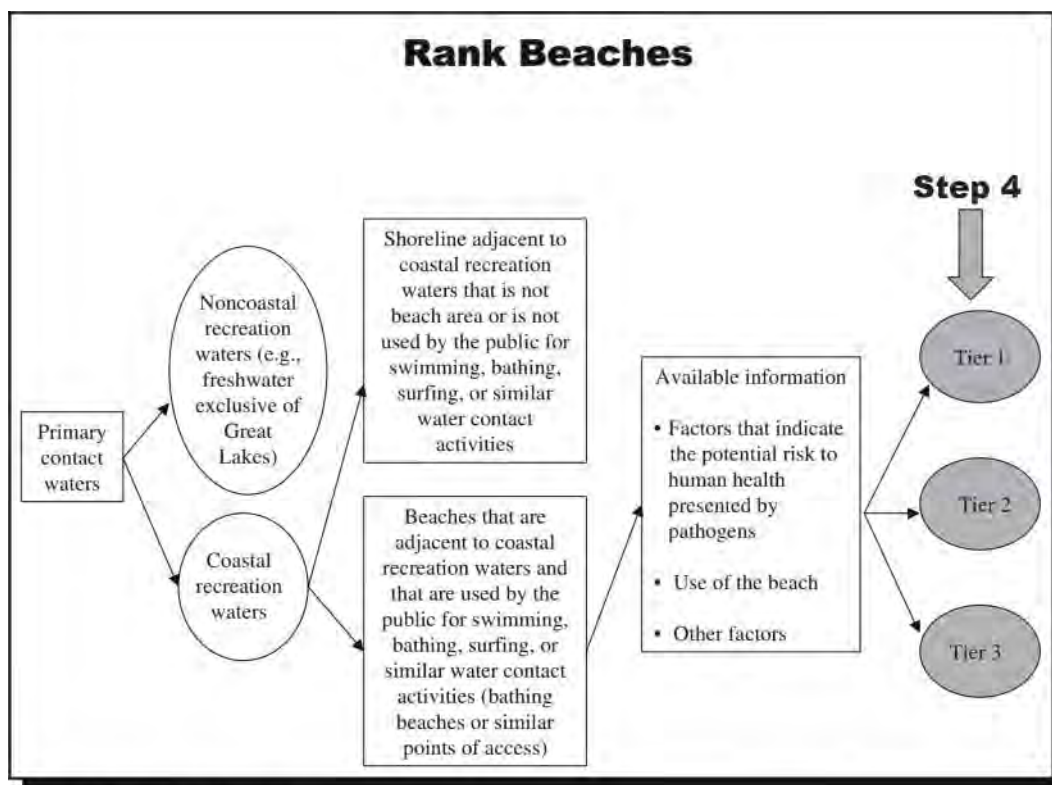


Figure 3-5. Step 4: Rank beaches.

Public Comments

The BEACH Act requires that the public be provided an opportunity to review the ranking program through a process that provides for public notice and an opportunity to comment (see performance criterion 9, section 2.2.9). In particular, states and tribes should seek to gather input from the community regarding the ranking of coastal recreation waters. An annual public or community meeting, surveys of the users at the beach, local newspaper articles, or other sources can provide insight into public opinion about the beach, including why the beach is or is not used (e.g., for sunning, running, swimming, or surfing), perceptions of water quality and health problems, and whether beach users desire a monitoring and notification program (if none exists) or how satisfied they are with the program that has been implemented.

3.6 References

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