

knowledge about the direction and rate of longshore transport as well as onshore/offshore transport.

Sediment movement in the marine littoral zone consists of two mechanisms that depend on sediment size. Sediments finer than sand remain in suspension in the water and are removed relatively quickly offshore. The almost total lack of clays and silts within the Columbia River mouth proper and the lower reaches of the Columbia River navigation channel attest to the efficiency of this mechanism. Sediments, sand size or coarser, may occasionally be suspended by wave action near the bottom, and are moved by bottom currents or directly as bedload. Tidal, wind and wave forces contribute to generating bottom currents that act in relation to the sediment grain size and water depth to produce sediment transport. Net transport for sand-sized material along the Oregon and Washington coast is to the north and northwest at a very slow rate. Sand placed in depths less than 60 feet can be mobilized by the combined forces of wave action and current and be transported within the littoral system.

Data available on prevailing current direction indicates that the prevailing current at the MCR is to the north and northwest. Current velocity varies seasonally and is greatest during ebb tide conditions. Sediments placed in the nearshore area, such as at the proposed Shallow Water site, appear to mix into the existing substrate. Movement of this material is expected to be in the direction of the prevailing current, to the north and northwest. This conclusion seems to be verified by monitoring conducted at the proposed Shallow Water site since 1997 and recent Corps' modeling studies.

The proposed Deep Water site is less influenced by the many dynamic interactions at MCR. Located at its closest point 4.5 miles from the entrance, dredged material placed on the sea bottom is at a depth where the prevailing currents are not expected to have any significant effects. Over time, as the mound accumulates, ocean currents, sloughing and consolidation of the material will tend to flatten the mound and distribute some of the placed material into the margins of the buffer. Sediments placed at Deep Water site are lost to the littoral system.

#### *7. Existence and Effects of Current and Previous Discharges and Dumping in the Area (Including Cumulative Effects)*

The proposed Deep Water site has not been used for disposal of dredged material. Designated Site E and Expanded Site E, which this rule

proposes to incorporate into the footprint of the proposed Shallow Water site, have received varying quantities of dredged material, averaging about 3.5 mcy annually. Over the years, crab fishermen have reported some reduced harvest of crabs and loss of equipment at all designated ODMDS, including Site E, and expressed concern that disposal at Expanded Site E could contribute to adverse wave conditions. EPA and the Corps have studied the Site E and Expanded E in considerable detail. Recent computer modeling has not substantiated crab fishermen concerns relative to adverse wave conditions. Crab studies suggest that some crab mortality occurs as a direct result of the inability of a limited number of crabs to dig out from a burial by dredged materials. This effect is minimal relative to the crab resource and fishery at the MCR. Additional sampling of both the Deep Water Site and the Shallow Water Site was done in the late spring/early summer and fall of 2002. Preliminary results from these surveys are supportive of the earlier resource assessments (IFR/EIS 1999).

The historic record for the MCR suggests that between 1905 and 1940 approximately 8 mcy of sediment was dredged from the MCR bar and placed in open water by hopper dredge. Between 1945 and 1955, a total of approximately 13 mcy was dredged; while between 1956 and 1998, a total of 184 mcy has been dredged and placed in-water. The total volume of material dredged from the MCR channel between 1904 and 1998 is approximately 206 mcy. Beginning in 1977, placement of dredged materials from the MCR bar was limited to EPA designated "interim sites," including Site E, which became "final sites" in 1986. Disposal was further limited as the final sites were used and effects were observed. The most pronounced cumulative effect of past disposal has been the development of mounds at designated Sites A and B. Mounding altered the bathymetry at these sites to the point that the wave climate in the area was affected.

Monitoring of benthic infauna has generally not shown any long-term effects due to the dredged material disposal. Oceanographic conditions are the driving factor in benthic infaunal productivity and diversity. The exception to this is lowered productivity on the crest of the mound in designated site B. Crab fishermen have also reported lower crab yields in the area of the mound at site B, which may be due to reduced productivity or the more difficult conditions for setting and retrieving crab pots. Crab pots have been buried or lost during dredged

material disposal operations. Crab pot loss is not considered a cumulative, or significant, effect of disposal in the area.

#### *8. Interference With Shipping, Fishing, Recreation, Mineral Extraction, Desalination, Fish and Shellfish Culture, Areas of Special Scientific Importance, and Other Legitimate Uses of the Ocean*

##### *Commercial and Recreational Fishing.*

Major commercial and recreational fishing occur in the offshore area. The predominant commercial fisheries are for salmon, Dungeness crab, bottomfish and pink shrimp. Salmon trolling and crab fishing are done over much of the nearshore area. The actual location and effort, however, varies from year to year depending on the abundance of fish or crabs, and resulting seasonal restrictions.

The principal recreational fishing occurring off the MCR is for salmon and bottom fish. Salmon fishing is done by charter boat and private boat and occurs near the same areas as commercial fishing, but generally closer to shore. Bottom fishing is conducted by charter and private boat for halibut, rockfish, and lingcod, which are generally associated with rocky areas. Other recreational activities include clamming in the bay and along the beach and fishing off the jetties. Dredging operations have not been identified as impacting any of these fishing activities. Crab fishermen have stated that disposal of material at the existing ODMDS, Site E, has affected their fishery by creating mounds which affect small boat navigation, or create a soft bottom condition which lets crab pots sink into the sediments making removal difficult, expensive or impossible. Crab pots have been damaged or lost due to burial when dredged material was placed on them or by the dredges snagging the buoy lines. The Corps has been and will continue to coordinate with the fishermen to minimize this impact. Crab fishermen have also expressed the concern that disposal kills crabs by smothering them or by changing the bottom habitat which may reduce the number of crabs available to catch.

In order to evaluate the impacts to individual crabs by dredged material disposal, the Corps contracted with Battelle NW Laboratories in Sequim, Washington and Scripps Institute of Oceanography in La Jolla, California. Because assessing these impacts during an actual disposal event could not be done in the ocean, it was decided to simulate disposal conditions in the laboratory. The tests at the Battelle Lab were done with recently molted soft-shelled crabs, which have the greatest