



North Carolina Department of Environment and Natural Resources
Division of Coastal Management

Michael F. Easley, Governor

Charles S. Jones, Director

William G. Ross Jr., Secretary

January 11, 2005

MEMORANDUM

I&S 05-01

TO: Implementation and Standards Committee

FROM: Jeff Warren

SUBJECT: Sediment Criteria Recommendations for Nourishment and Dredged Material Disposal on North Carolina Oceanfront Beaches

The Coastal Resources Commission (CRC) Science Panel on Coastal Hazards finalized a comprehensive set of sediment criteria recommendations for the placement of nourishment and dredged material on North Carolina oceanfront beaches in October 2004 (see Appendix A, attached). These recommendations will be formally presented to the CRC at their meeting on January 27, 2005 by the chairman of the Science Panel, Dr. John Fisher from the Department of Civil, Construction and Environmental Engineering at North Carolina State University.

The genesis of the Science Panel's sediment compatibility discussions that led to these recommendations, primarily the need to define the term "compatible", arose from an abundance of coarse material placed on the beaches of Oak Island (cobbles) and Pine Knoll Shores (shell hash) in 2001 and 2002, respectively. In addition, the existing rule language that governs the sediment compatibility of beach nourishment on the oceanfront, i.e. 15A NCAC 07H.0308(a)(3), is deemed vague and ineffective: sand used for beach nourishment shall be compatible with existing grain size and type; sand to be used for beach nourishment shall be taken only from those areas where the resulting environmental impacts will be minimal.

It is the recommendation of staff that the CRC considers the amendment of the aforementioned rule in a three-phase approach: 1) recommendation, 2) validation and development, and 3) implementation. The Science Panel's formal recommendations to the CRC will complete the first phase of this process. If the CRC chooses to move forward with the second phase, staff will assess if and how current and recent beach nourishment and dredge disposal projects would have been affected by the Science Panel recommendations. Based on this validation procedure, continued research of pertinent data and peer-reviewed research, and stakeholder input, draft rule language will be developed by staff and presented to the CRC for discussion (likely at their November 2005 meeting). At the conclusion of this second phase, the CRC can choose to implement the resultant sediment criteria by amending existing rule language as set forth in the North Carolina Administrative Procedure Act (GS §150B).

Sediment Criteria Recommendations for Nourishment and Dredged Material Disposal Projects on North Carolina Oceanfront Beaches

Final Version, January 27, 2005

Prepared by the North Carolina Coastal Resources Commission Science
Panel on Coastal Hazards[☒]

PART 1: GENERAL DEFINITIONS

- A. **Beach Nourishment:** The process of placing compatible sediment on the beach.
- B. **Borrow Area:** The source area from which sediment used in a beach nourishment project is acquired. Borrow areas can be upland (above sea level) or submerged (below sea level).
- C. **Sand Resource:** A concentration of a sand commodity that is not considered usable for beach nourishment because it meets either of the following conditions: A) it is a hypothetical resource in a known district, a speculative resource in an undiscovered district, and/or it is defined with a low degree of certainty and B) fiscal analysis indicates a low feasibility for an economically recoverable sand volume (i.e., not economically recoverable) when extracted in a legal manner at the time of evaluation (Figure 1). The term “sand” is used herein as a generic reference to the dominant grain size classification of the sediment population (see “sediment” definition in Part 1F).
- D. **Sand Reserve:** A concentration of a sand commodity that is considered usable for beach nourishment because it meets both of the following conditions: 1) it has been identified and characterized with a high degree of certainty (i.e., proved, probable, or possible reserve) and 2) fiscal analysis indicates a high feasibility for an economically recoverable sand volume (i.e., not economically paramarginal or submarginal) when extracted in a legal manner at the time of evaluation (Figure 1). The term “sand” is used here as a generic reference to the dominant grain size classification in the sediment population (see “sediment” definition in Part 1F).

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- E. **Compatible:** Sediment compatibility refers to the relative size characteristics and mineralogical similarity between sediment from the original, pre-nourished profile of the beach to be nourished and sediment being considered for nourishment (borrow site). Sediment compatibility also refers to the biological suitability of the nourishment material.
- F. **Sediment:** In a geological context, a grain or accumulation of grains defined as a particle of rock, mineral, or biogenic material including, but not limited to, shell and coral.
- G. **Grain Size:** Grain size is the diameter of a grain measured by standard techniques including sieve analysis and elutriation. Grain size shall be reported in millimeters and classified according to the basic categories of the Wentworth standard sediment classification scheme, i.e., gravel, sand, silt and clay.

PART 2: CHARACTERIZATION OF BEACH TO BE NOURISHED

- A. Sediment sampling methodology shall be designed to generally acceptable geological and engineering standards to adequately capture the three-dimensional spatial variability of the sediment characteristics (e.g., grain size, sorting, and mineralogy) within the natural system.
- B. The spatial distribution of sampling along the shoreline shall be done along a minimum of three, evenly spaced, shore-perpendicular transects. Transect spacing shall not exceed 5,000 feet in the shore-parallel direction.
- C. Transects shall include the crest of the frontal dune, across the dry sand beach, and offshore to a depth of –30 feet or toe of the lower shoreface (mean fair-weather wavebase), whichever is less. The sampling shall be designed to incorporate each of the following morphodynamic zones, where present: 1) dune, 2) dune toe, 3) mid berm, 4) mean high water, 5) mid tide, 6) trough, 7) bar crest, and 8) active shoreface. Of the total number of samples taken along the transect (referred to as n), half ($n/2$) shall be acquired landward of mean low water and half shall be acquired seaward of mean low water ($n/2$). One additional sample shall be taken at mean low water (as defined by the North American Datum of 1983, North Carolina State Plane Coordinate System, English units).
- D. Textural properties of the beach to be nourished shall be determined objectively based on sediment grain size and mineralogical composition.
- E. The average grain size of the beach to be nourished shall be calculated by taking a simple arithmetic mean of all samples collected. In addition, a simple arithmetic mean shall be calculated for the fine-grained sediment

fraction (<0.0625 mm) as well as the coarse-grained sediment fraction (>4.76 mm).

- F. For beaches that have been nourished prior to promulgation of these guidelines, sediment textural properties and standards shall be defined using: a) studies consistent with the criteria listed above completed prior to the nourishment or b) best available data that most closely reflects the probable conditions of the beach prior to alteration if no characterization exists that is consistent with the criteria listed above.
- G. Once a beach has received sediment as part of a nourishment project, the beach sediment characterization standards established herein (Part 2A-2G above) shall be used for all subsequent nourishment projects.

PART 3: CHARACTERIZATION OF BORROW SITE MATERIAL

- A. Characterization and material sampling of the potential borrow area(s), including upland sites and dredge disposal areas (e.g., offshore storage areas or spoil islands), shall be accomplished utilizing appropriate acoustic and/or equivalent remotely sensed bathymetric and subsurface survey techniques including, but not limited to, LIDAR (light distance and ranging), sidescan sonar, chirp sonar, high-resolution seismic and ground-penetrating radar. In addition, sediment sampling methodology shall utilize a core barrel of no less than 3 inches (76.2 mm) in diameter.
- B. Characterization and material sampling shall not be required from a site that is completely confined to a regularly maintained navigation channel except as noted in Part 4 section D.
- C. Geophysical, sedimentological, and stratigraphic surveys shall be designed to generally acceptable geological and engineering standards to accurately capture sediment facies, stratigraphic variation, buried hard bottoms and/or other similar features. The characterization and material sampling in potential borrow areas shall accurately capture and display in three dimensions the fine-grained sediment fraction (<0.0625 mm) and the coarse-grained sediment fraction (>4.76 mm; gravel) including, but not limited to, shells, shell fragments, and rock. Comprehensive subsurface geophysical surveys are not required at sites where documentation indicates that sediments match these criteria (e.g., Brandt Island dredged material disposal site).
- D. The characterization of the borrow site shall include previously acquired data. The subsurface survey and sampling of the borrow site shall be adequate to define a proved sand reserve for the nourishment project intended. A borrow site defined as a sand resource shall be considered inadequate for the use of that site in a beach nourishment project.

- E. The average grain size of the proved sand reserve within the borrow site shall be calculated by taking a simple arithmetic mean of all samples collected. In addition, a simple arithmetic means shall be calculated for the fine-grained sediment fraction (<0.0625 mm) as well as the coarse-grained sediment fraction (>4.76 mm).
- F. Borrow sites used for beach nourishment purposes shall be limited to sites that are documented to have materials that, based on composite statistics from samples collected pursuant to this section, do not exceed the grain size or composition criteria for material used for beach nourishment listed in Part 4 sections A, B and C.

PART 4: COMPATIBILITY OF BORROW SITE MATERIAL TO THE BEACH TO BE NOURISHED

- A. The average percentage by weight of the fine-grained sediment fraction (<0.0625 mm) in a borrow site to be used for beach nourishment shall not exceed the average percentage by weight percent of the fine-grained sediment fraction (<0.0625 mm) of the pre-nourished beach plus 5% (e.g, if the pre-nourished, fine-grained sediment fraction accounts for 10% of the total sediment population, the post-nourishment fine-grained sediments shall not account for more than 15% of the post-nourishment, fine-grained sediment fraction of the total population).
- B. The average percentage by weight of the coarse-grained sediment fraction (>4.76 mm) in a borrow site to be used for beach nourishment shall not exceed the average percentage by weight of the coarse-grained sediment fraction (>4.76 mm) of the pre-nourished beach plus 4% (e.g., if the pre-nourished, coarse-grained sediment fraction accounts for 5% of the total sediment population, the post-nourishment, coarse-grained sediment fraction shall not account for more than 9% of the post-nourishment, coarse-grained sediment fraction of the total population).
- C. The composite mineralogy of the material in a borrow site to be used for beach nourishment shall be similar to the mineralogy of the sediments of the pre-nourished beach. Specifically, the carbonate content in the borrow site shall not exceed the carbonate content of the beach to be nourished by 40% (i.e., the borrow site cannot be >40% plus native CaCO₃). This topic warrants further investigation and shall be revisited as future data become available.
- D. Sandy sediment from the direct maintenance of coastal navigation channels shall be deemed suitable for beach placement with up to 10% fine-grained material (<0.0625 mm) provided that it is from maintenance of a previously dredged navigation channel, the maintenance excavation does not exceed previous channel dimensions.

PART 5: EXECUTION OF NOURISHMENT PROJECT

- A. Sediment used for beach nourishment shall be compatible with the natural grain size and mineralogical composition of the beach to be nourished.
- B. Sediment to be used for beach nourishment shall be taken only from those areas where the resulting environmental impacts will be minor.
- C. In no case can the material placed on a beach as part of a beach nourishment project result in violation of water quality standards.
- D. Excavation of borrow sites within Areas of Environmental Concern shall be consistent with the Use Standards found in 15A NCAC 07H.0208 (b)(12), Submerged Lands Mining.
- E. Excavation of borrow sites within Areas of Environmental Concern shall not alter wave refraction patterns which results in adverse impacts on adjacent oceanfront or inlet shorelines.
- F. Excavation of borrow sites within Areas of Environmental Concern shall not alter inlet hydrology which results in increased erosion on adjacent oceanfront on inlet lands or adversely impact inlet, oceanfront, or estuarine ecosystems or habitat.
- G. Excavation of borrow sites within areas of environmental concern shall be done in a manner which is consistent with state policies regarding habitat protection.
- H. Material used for beach nourishment shall not contain foreign matter including, but not limited to, construction debris, toxic material, and other man-made materials.

I.

PART 6: POST-NOURISHMENT MONITORING AND MITIGATION OF BEACH AND BORROW SITE

- A. If exceedingly coarse material (>64mm) is present in material used for beach nourishment and is greater than the fraction of similar exceedingly coarse material (>64 mm) of pre-nourished beach values plus 1% (e.g., if the pre-nourished coarse material accounts for 2% of the total population, the post-nourishment coarse material cannot account for more than 3% of the total population), then the coarse material shall be removed from the beach in an environmentally sound manner until the coarse fraction is below the critical threshold of pre-nourished coarse material (>64 mm) plus 1%.

- B. Biological and physical monitoring data shall be used to design biological and ecological mitigation where impacts are sufficient to require it.

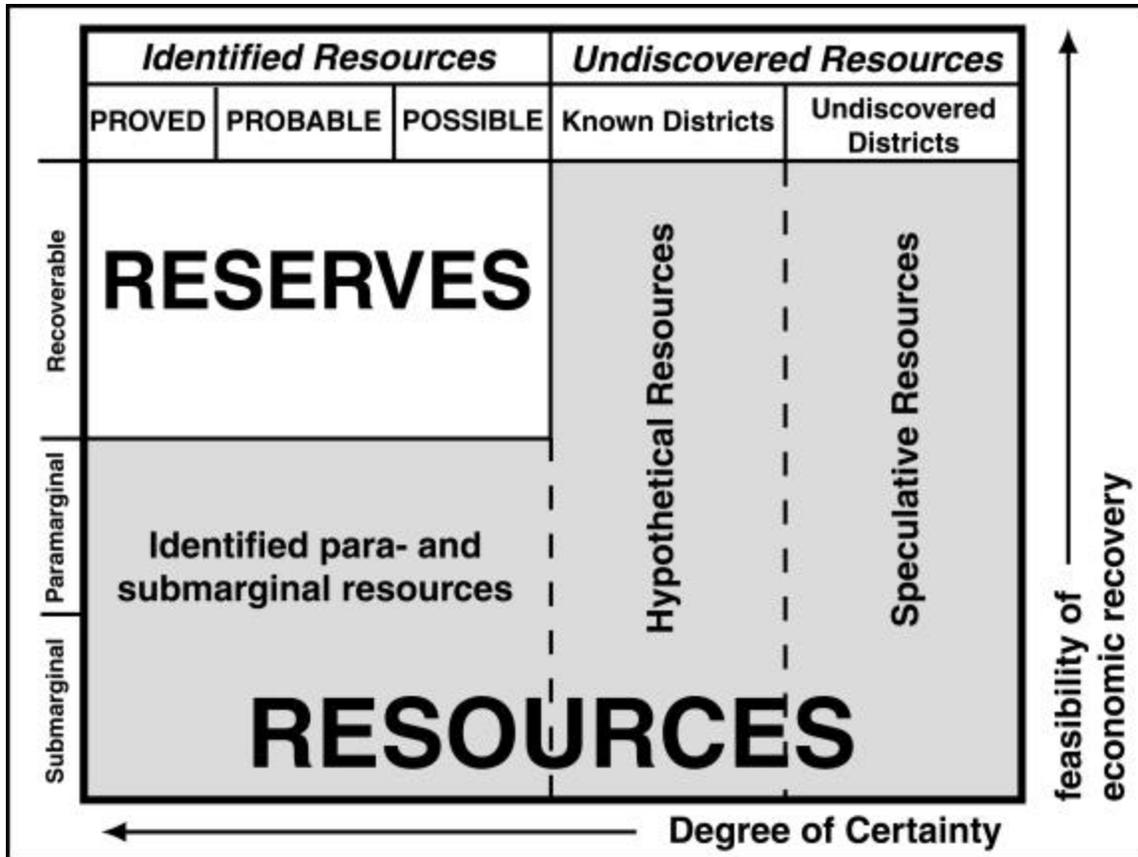


Figure 1. Delineation between a mineral resource and a mineral reserve. In this case, the mineral commodity is sediment being considered for beach nourishment and referred to in general terms as sand. In relative terms, a proved sand reserve has the highest feasibility of economic recovery as well as the highest degree of certainty. (Figure adapted from Mckelvey, V.E., 1973, Mineral potential of the United States. In Cameron, E.N. (ed.), *The Mineral Position of the United States, 1975-2000*, Proceedings of a symposium sponsored by the Society of Economic Geologists, Minneapolis, MN, November 1972, The University of Wisconsin Press, Madison, WI, p. 67-82.)