REPORT OF FINDINGS AND RECOMMENDATIONS
of
THE DREDGING WORKING GROUP

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Final Report

Introduction

The purpose of this report is to recognize the importance of New Jersey's aquatic transportation infrastructure and to ensure, and where possible, enhance safe navigation for recreation, transportation, commercial, industrial and security purposes while employing the most appropriate and best available management practices while maintaining that infrastructure and a quality environment. The aquatic transportation infrastructure, also known as blue highways and vessel "parking" and "servicing" facilities, is vital to our commerce, national security and the enjoyment of our New Jersey waterways. Since New Jersey is a coastal State containing significant portions of two of the major ports of the United States, important fishing industries, major population centers and outstanding aquatic recreational opportunities; it is incumbent upon the State of New Jersey to ensure safe navigation. Further, it has become necessary to streamline waterway management, especially waterways maintenance to promote a sustainable coastal economy, unfettered by duplication and unnecessarily burdensome regulatory programs.

The information and recommendations presented below are focused on New Jersey waterways and the roles that diverse blue highways serve because of our maritime tradition. The use and characteristics of the State's waterways and moorage areas and their related resources are well documented and inextricably bound and essential to the socio-economic wellbeing of the residents and visitors of our coastal zone.

The New Jersey State Legislature declared in 1973 (and reaffirmed in 1994) "…that New Jersey's bays, harbors, sounds, wetlands, inlets, the tidal portions of fresh, saline or partially saline streams and tributaries and their adjoining upland fastland drainage area nets, channels, estuaries, barrier beaches, near shore waters and intertidal areas together constitute an

exceptional, unique, irreplaceable and delicately balanced physical, chemical and biologically acting and interacting natural environmental resource called the coastal area, that certain portions of the coastal area are now suffering serious adverse environmental effects resulting from existing development activity impacts that would preclude or tend to preclude those multiple uses which support diversity and are in the best long-term, social, economic, aesthetic and recreational interests of all people of the State; and that, therefore, it is in the interest of those kinds of land uses which promote the public health, safety and welfare, protect public and private property, and are reasonably consistent and compatible with the natural laws governing the physical, chemical and biological environment of the coastal area."

"The Legislature further recognizes the legitimate economic aspirations of the inhabitants of the coastal area and wishes to encourage the development of compatible land uses in order to improve the overall economic position of the inhabitants of that area within the framework of a comprehensive environmental design strategy which preserves the most ecologically sensitive and fragile area from inappropriate development and provides adequate environmental safeguards for the construction of any developments in the coastal area." (Coastal Area Facility Review Act, N.J.S.A. 13:19-1 et seq.)

As such, the recommendations presented below are intended to strike the appropriate balance of sustainable multiple uses of our coastal areas consistent with the State's Public Trust Doctrine and our economy, while managing our natural resources in a manner to ensure protection of the richness and diversity which is the hallmark of our coastal environments.

This document has been prepared to address safe usage, navigation, and maintenance of bay waters in the counties bordering the Atlantic Ocean through:

- A well-planned, formal program of waterway maintenance that results in access and safe navigation of coastal waterways;

- A renewed and improved effort to address the problems of dredging and dredged material disposal, including a streamlined permitting process;
- The establishment of a stable, on-going funding source to maintain safe navigation of bay waterways; and
- Research and investment in alternate methods for beneficial-use or disposal of dredge materials.

The Dredging Working Group has been convened over the past months to identify key issues and propose recommendations that will promote clarifications and revisions of the State regulatory programs that impact waterways transportation infrastructure maintenance without adversely impacting the coastal natural resources. This Group is comprised of members representing county and local government, maritime businesses, Stockton University – Coastal Research Center, Rutgers University -- Haskin Shellfish Research Laboratory, engineers, environmental consultants familiar with dredging and associated state and federal permitting. They are individually cited at the end of this report.

At the outset, it is important to recognize that the maritime economy of New Jersey is critically important to the State economy. It includes such diverse economic components that relate directly to the maritime industries in the scale noted below:

- Tourism (of which a significant portion is coastal tourism-related)
  - $40 billion contribution to the State's economy from 90 million visits
  - $20.4 billion in tourism direct sales in the four Atlantic coastal counties
  - 130,500 direct tourism employment in the four Atlantic coastal counties
  - $2,032 million in state and local tax receipts in the four Atlantic coastal counties

- Commercial Fishing Industry
  - 30,753 Jobs
  - 62 million pounds landed in three of the five of its most important ports
  - $2.4 billion in sales
  - $881 million income
- Recreational Boating
  - 17,724 Jobs
  - $1.125 billion in sales
  - $2.2 billion economic impact
  - 500 +/- marinas
  - 176,641 recreational boats
- Port of NY/NJ generates $30 billion in regional economic activity; this does not include the Port of Philadelphia/NJ.

According to the "New Jersey Marine Transportation System Act" (2001), New Jersey's maritime industry adds $50 billion to the economy supporting 300,000 residents. Historically, more than 200 non-Port state channels encompass over 200 nautical miles (Parsons Brinckerhoff, 2013) of New Jersey's maritime transportation asset. The immense challenge to restore navigability to the state's shoaled channels following Hurricane Sandy, including the successful management of dredged material within New Jersey's state channels, is now with the NJ Department of Transportation's, Office of Maritime Resources (NJDOT-OMR). Moreover, there was a recognition that the state program would further serve to assist more broadly the ability for marinas, municipalities and water front marine businesses to maintain their facilities. The NJ Department of Environmental Protection's (NJDEP) Office of Dredging and Sediment Technology (ODST), along with the USACE, continues to regulate and permit the conduct there of.

Determining appropriate locations for the dewatering of dredged material to accommodate future dredging operations – both large and small – presents significant challenges given the urbanization of New Jersey's coast and the historic lack of management of CDFs now reverted to habitat. Most of the traditional upland placement sites in the state are at or near capacity and identifying new locations for dredged material placement has become increasingly problematic (*Sediment Characteristics and Management of New Jersey's Coastal Waterways*, 2012). This issue has been compounded by the significant amount of increased shoaling documented within state navigation channels and marinas as a result of Hurricane Sandy in 2012 (Parsons Brinckerhoff, 2013). Excavation of existing dredged material placement sites to provide "new" capacity, is operationally costly and is made more costly by the existing state and Federal regulatory framework. Nonetheless, without a place to dewater dredged materials, a strong program of beneficial use development and consideration for all entities that require dredging, the marine transportation system in its entirety will remain in disrepair.

With the knowledge and experiences accrued over the years of managing the State's marine transportation infrastructure, it is appropriate at this time to revise the regulatory oversight program to facilitate and streamline dredging and dredged materials management and use.

Multiple Use Determinations for the Management of Dredged Material in the State of New Jersey

Daniel A. Barone, Coastal Research Center, Stockton University

As New Jersey continues to make strides in improving how dredged material is managed in the state, a logical step would be to improve the existing Acceptable Use Determination (AUD) permit rules by implementing a Multiple Use Determination (MUD). This would be particularly helpful in providing multiple beneficial use options for placement of dredged material and alleviate the shrinking capacity within the state's DMMA's. Implementation of this new rule would be extremely timely, due to the recent emphasis on the beneficial use of dredged material in the wake of Hurricane Sandy.

The Problem

As stated in the New Jersey Coastal Zone Management Rules (*NJ CZM Rules*, 2015), any movement and/or placement of dredged material within New Jersey must obtain what is known as an "Acceptable Use Determination", or AUD. An AUD is submitted with the Waterfront Development permit and is issued by NJDEP-ODST. The purpose of the AUD is to track the movement and location of potentially contaminated sediment. Prior to commencing any dredging or DMMA excavation project in New Jersey, an AUD must be issued by the state and the material must be placed at the location and in the manner as outlined in the AUD once the project is completed. The problem with this approach is that it limits the potential for dredged material to be used in a multitude of applications over time that may be deemed appropriate for a specific location and sediment type. For example, if a state channel needs to be dredged, but the closest DMMA to that channel cannot handle the total sediment volume produced by the dredging activity and the AUD states that the material can only be placed within the DMMA, only a portion of the channel can be dredged and shoaling will continue to negatively impact the navigability of the channel. Additionally, if a

channel continually is shoaled with consistent sediment type (i.e. sand proximal to a tidal inlet), and the permit states only one AUD for the sediment dredged from the channel, that sediment can only be placed in the same location over time. In this case, if the AUD states that the sediment can only be used as beach fill, but an abandoned subaqueous borrow bit (dredged hole) proximal to the channel is in need of sand as capping material for environmental restoration, the placement of the dredged material into the dredged hole would require an entirely new AUD for that purpose - which can be costly, time-consuming, and ultimately negatively affect the navigability of the state's waterways.

The Solution

Since there are multiple beneficial uses for dredged material (which is described in detail below), it is proposed that a new "Multiple Use Determination" within the Coastal Zone Management rules be introduced to efficiently and effectively manage dredged material in the future for the continued maintenance of safe, navigable waterways within New Jersey's coastal zone. Since all dredging projects require in-situ sediment sampling to determine grain size and whether sediment is contaminated, instead of issuing one AUD per dredging project, multiple beneficial use opportunities could be pre-identified state-wide. This could be done by outlining the type of beneficial use, sediment grain size required, volume of sediment required, and quality of material required (i.e. "residential" or "non-residential" standards). The NJDOT-OMR in partnership with the Stockton University Coastal Research Center (CRC) is already compiling a GIS-based "beneficial use layer" which includes attributes described above. This is a consistently updated layer that can be used by coastal zone managers in the state to identify multiple beneficial uses for various dredging activities within the state.

Beneficial Uses of Dredged Material

The US Army Corps of Engineers has identified a variety of beneficial uses of dredged material ranging from beach nourishment and aquaculture to developing construction materials and topsoil (US Army Corps of Engineers, Engineer

Research and Development Center, 2013). In recent years, several research projects funded through the NJDOT and the NJDEP have implemented more specific research projects to address this complex issue through identifying new and innovative ways to beneficially use dredged material including:

- Tidal marsh restoration including thin-layer placement & edge restoration for coastal flood mitigation (Barone et al., 2014).
- Restoration and enhancement of diamondback terrapin nesting habitat (Wood et al., 2010).
- Restoration and enhancement of marine habitats through the reclamation of subaqueous borrow pits, or dredged holes (Barone et al., 2013; Howard et al., 2015).
- Using dredged material as capping material for landfill closure (Miskewitz and Barone, 2014).

Conclusions

One of the greatest challenges facing the wide-spread adoption of beneficially using dredged material is the perception that most of the sediments are contaminated and referred to as “spoils”. As stated in NJ’s Coastal Zone Management rules (2015), the beneficial use of dredged material is encouraged and establishing pre-identified beneficial uses throughout the state will only increase safe navigation within the state while enhancing, restoring, and improving the environment for New Jersey and its residents. The NJDOT-OMR is currently in the process of developing state-wide geospatial databases for waterway and dredged material management, and the Multiple Use Determination concept can easily be incorporated into the database’s beneficial use layer to apply pre-identified beneficial uses for future dredging projects within New Jersey’s coastal zone.

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Open Water Placement of Dredged Materials in New Jersey Tidal Waters

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In recent years, increasing sedimentation and shoaling of the navigable tidal waters within the jurisdiction of New Jersey's coastal communities has increased the pressure on these communities to perform dredging operations to provide safe navigation and recreational opportunities in their communities. Likewise, many marinas and other water-dependent commercial operations that rely on safe and usable berthing areas for their vessels face the need to dredge these areas in order to continue to operate.

The single most challenging obstacle to completing the required dredging of these navigable waters is the high cost of disposal of the dredged materials. Disposal alternatives include placement of the material in confined disposal facilities, or CDFs (also known as Dredged Material Management Areas), beach nourishment, habitat development, structural and non-structural fill, landfill cover, and open water disposal. Each of these alternatives poses unique challenges, and many critical municipal and commercial dredging projects have been delayed due to the high cost of compliance with the applicable regulations.

This paper focuses on one category of dredged material disposal – the placement of dredged material within open water. The paper provides a background of the New Jersey Department of Environmental Protection (NJDEP) regulations and policies relative to open water disposal and use alternatives, discusses recent developments in the expansion of viable open water placement alternatives, and provides recommendations for NJDEP policy changes that would facilitate an environmentally sound approach to expanding the use of open water placement alternatives. The paper addresses the concerns of communities and entities within the geographical region described in the Dredging Manual as Region 2, extending along the Atlantic Ocean coast from Sandy Hook to the western entrance to the Cape May Canal.

NJDEP Policy

The NJDEP's authority to regulate dredging activities in the state is derived from multiple statutes, including the New Jersey Waterfront Development Law, Riparian Interests, the New Jersey Water Pollution Control Act, the Federal Clean Water Act, and the Federal Coastal Zone Management Act. (N.J.A.C. 7:7, Appendix G). New Jersey's Coastal Zone Management (CZM) rules (N.J.A.C. 7:7) establish the NJDEP's rules regarding coastal resource use and development, including dredging.

In 1997, the NJDEP published a technical manual entitled "The Management and Regulation of Dredging Activities and Dredged Material in New Jersey's Tidal Waters." Commonly known as the Dredging Manual (and referenced herein as "DM"), the document "establishes the policies and procedures under which the NJDEP will conduct regulatory reviews of dredging activities in tidal waters on the State of New Jersey and the management of the dredged material." (DM, Page 1). Subsequently, in an effort to strengthen the regulatory authority of the Dredging Manual, the CZM Rules were revised to incorporate the Dredging Manual by reference. The most recent revision of the CZM Rules (July 2015), incorporates the Dredging Manual into the rules as Appendix G, with slight modifications. The NJDEP is currently soliciting stakeholder input for further revisions of the dredging regulations, which will rewrite the Appendix G Dredging Manual, incorporating the revisions directly into the body of the rules.

In addition to the Dredging Manual, the CZM Rules establish rules governing dredging activities, including general permits for specific activities (Subchapter 6), rules on development in General Water Areas (Subchapter 12), and requirements for dredging permit applications (Subchapter 23). The NJDEP's policies on open water placement can be found in both the Dredging Manual as well as the above subchapters.

The Dredging Manual provides for the following methods of open water disposal:

- Ocean Disposal
- "Other" Disposal Areas
- Reprofiling
- Filling of Subaqueous Disposal Pits
- Containment Areas, including Habitat Development

Ocean disposal alternatives present a complex set of federal regulatory obstacles that make this alternative cost-prohibitive. Therefore, the ocean disposal alternative is not discussed further in this paper.

The Dredging Manual includes an alternative titled "**Other Open Water Disposal Areas**". The section appears to limit this alternative to two (2) specific sites: Great Sound (north of Gull Island in Cape May County) and Great Bay (behind Little Beach Island in Atlantic County), as it states that "open water disposal is currently acceptable only in the [above] designated sites". However, in the paragraph discussing the potential impacts of this alternative, the Dredging Manual states that open water disposal is "prohibited" in certain areas, but only "discouraged" in other areas. Curiously, this paragraph exempts from the "discouraged" category open water disposal in the ocean and bays greater than six (6) feet deep. The above inconsistencies have been corrected in the revised version of the Dredging Manual as incorporated in Appendix G of the CZM Rules.

Reprofiling is the practice of moving material from shallow areas to adjacent deeper areas without removing the sediments from the water. It is usually accomplished by dragging a steel beam across the area to be reprofiled. The Dredging Manual prohibits this practice other than as an interim measure within the New York – New Jersey Harbor area of Region 1.

Although the **filling of subaqueous disposal pits** is not categorized in the Dredging Manual as an "open water alternative", the practice consists of placing dredged material in excavated holes or trenches on the ocean or bay bottom. Subaqueous pits can include new excavations or existing borrow pits

from past sand mining activities. The discussion of this alternative in the Dredging Manual is limited to contaminated dredged material. Since the potential impacts from this alternative, as discussed in the Dredging Manual, are related to the contaminants in the dredged material, it is assumed that this would be an acceptable alternative for clean material.

Containment areas are defined as "features artificially created in open water or wetlands and include any structure which…result[s] in an extension of existing upland into open waters. Despite this definition, this activity is not categorized in the Dredging Manual as an "open water alternative". The placement of the contained dredged material may be used to create a substrate for wetlands. The Dredging Manual discusses the creation of wetlands using dredged material in a subsequent chapter, where it states that the NJDEP will consider this alternative only under "exceptional conditions".

The CZM Rules (N.J.A.C. 7:7) were most recently amended in July 2015. Changes included in the incorporation of the Coastal Permit Program rules and the CZM rules into one chapter and encouragement of resilient development. Previous amendments following Hurricane Sandy had emphasized the establishment of living shorelines and other features contributing to resiliency.

Subchapters of the CZM rules relevant to open water disposal alternatives include: Subchapter 6, which includes general permits for habitat creation and living shorelines; and Subchapter 12, which addresses various dredging activities including dredged material disposal.

Subchapter 6 of the CZM rules includes provisions for a general permit (GP-24) for "habitat creation, restoration, enhancement, and living shoreline activities". The activity can include restoration of an existing shoreline to its previous location, defined as the boundary of the shoreline as it appears on the applicable Tidelands Map. The general permit requires sponsorship of the project by federal or state agencies, non-profit organizations, or academic institutions.

Subchapter 12 of the CZM rules addresses dredged material disposal (N.J.A.C. 7:7-12.9), and clarifies that disposal of dredged material in bays deeper than six (6) feet, while not "discouraged", is only conditionally acceptable "provided there is no feasible beneficial use or upland placement site available" and that the disposal complies with all applicable requirements of the federal Clean Water Act and U.S. Army Corps of Engineers (USACE) manuals. Disposal of dredged material in subaqueous disposal pits is addressed in a subsequent paragraph in this sub-section of the CZM rules (N.J.A.C. 7:7-12.9.b.4), so it is not clear whether this method also needs to meet the above criteria for open water disposal. However, as mentioned above, the Dredging Manual makes a distinction between the filling of subaqueous disposal pits and open water disposal. Therefore, it appears that the filling of subaqueous borrow pits – or dredge holes – is an acceptable method of open water disposal provided that the borrow pit is anoxic and that the activity meets other listed criteria. In the "rationale" section of this subsection, the rules state that upland placement of dredged materials is preferred to the filling of unconfined subaqueous disposal sites due in part to the difficulty of controlling the "fluid mud" that results from the deposition of fine grain sediments within the disposal area.

Subchapter 12 also includes criteria for the establishment of living shorelines and specifically states that the use of dredged material is acceptable for this purpose, and in fact "promotes the State's long-standing policy of treating dredged material as a resource" (N.J.A.C. 7:7-12.23(c) and (d)).

Renewed Consideration of Open Water Disposal Methods

Treating dredged material as a resource is a long-standing policy of the State (N.J.A.C 7:7-12.23(d)). Specifically, the New Jersey Department of Transportation (NJDOT) has aggressively promoted the beneficial use of dredged material. More recently, following extensive sedimentation of many State channels from Hurricane Sandy, the State has promoted the beneficial use of dredged material by placement in open water through the NJDEP's sponsorship of pilot projects using marsh edge restoration and living shorelines.

Open water disposal of dredged material can provide a cost-effective alternative to upland disposal alternatives as well as a beneficial use of the material by restoring aquatic and/or wetland habitat. The filling of subaqueous borrow pits to the level of surrounding bay bottom can restore the frequently degraded habitat within these areas; in some cases, these areas can be restored to their previous condition as wetlands habitat.

The Stockton University Coastal Research Center performed extensive research on subaqueous borrow pits throughout the Region 2 area south of Sandy Hook, and published their findings in a technical report. The project, which was sponsored by the NJDOT and the Federal Highway Authority, revealed that many of these subaqueous disposal pits exhibit hypoxic conditions (i.e. less than two mg/L of dissolved oxygen), making them unsuitable for both benthic and fish habitat. The report provides a valuable inventory of these potential disposal sites, including their capacity and location. Ten (10) "candidate" and five (5) "priority" sites were investigated in depth, including water quality, benthic grab samples, and contouring.

As described above, the dredging manual and CZM rules have allowed for various methods of open water disposal. However, in recent years the NJDEP has become more receptive to open water disposal methods, including the placement of dredged material along eroded marsh edges and the filling of subaqueous borrow pits. Recent projects approved or supported by the NJDEP involving the restoration of marsh edges include the USACE's Intracoastal Waterway dredging project in Avalon, Downe Township Wildlife Management Area, and Edwin B. Forsythe Wildlife Refuge. The NJDEP also recognizes the potential of subaqueous borrow pits to be a suitable dredged material disposal alternative. The successful filling of a subaqueous borrow pit in Barnegat Bay, and the recent State-wide research, inventory, and prioritization of borrow pits by the Stockton University Coastal Research Center provide precedent and critical preliminary steps to developing these disposal alternatives.

Federal and State policy following the devastation inflicted on the New Jersey coastline from Hurricane Sandy has emphasized the importance of building resilient communities that are better able to withstand and recover from coastal storms. The filling of subaqueous borrow pits can contribute to increasing resilience by reducing water depth within back bay fetches, thereby reducing wave height and currents. In some cases subaqueous borrow pits were excavated from existing tidal marsh within the back bays. Where these pits can be restored to tidal marsh, greater resilience can be achieved by reducing the fetch length, resulting in a significant reduction in wave heights.

Recommendations

The NJDEP's July 2015 amendments to the CZM rules demonstrate an evolution in the NJDEP's approach to approving the use of open water disposal methods. While the dredging manual and pre-Sandy regulations allowed for the theoretical use of these methods, they were "discouraged" and made impracticable by a very high regulatory bar required to justify their use. While much of this language remains in the CZM rules, it is apparent that the NJDEP – both through the language of the rules as well as through their sponsorship of open water alternatives (i.e. marsh edge restoration) – has evolved to be more receptive to these methods.

The below recommendations are offered for consideration by the NJDEP to further expand open water disposal as a potentially cost-effective and environmentally beneficial alternative for the disposal of dredged material:

1. Expand the options for the use of living shoreline and habitat restoration in General Permit 24 by eliminating the requirement that these projects obtain federal or state sponsorship. If it can be demonstrated that the project can be performed without detriment (or provide a benefit) to the environment, it should be able to be undertaken regardless of whether it receives sponsorship by these agencies.
2. Create a general permit for the filling of subaqueous borrow pits. The above referenced technical report prepared by the Stockton University

CRC demonstrates that the filling of many of these pits could restore degraded habitat while providing a potentially cost-effective method of dredge material disposal.

3. Establish or sponsor grants for further study of the water quality and benthic conditions of the State's subaqueous borrow pits. This would facilitate the approval of the use of these sites by various users, including the NJDOT, municipalities, and commercial operations.
4. Reevaluate the prohibition of reprofiling operations within Region 2. While the environmental concerns with this method (discussed in the Dredging Manual) are legitimate in principle, minimal reprofiling at entrances to marinas has the potential to resolve critical navigational problems for small users at minimal cost and with negligible environmental detriment.
5. Appendix G of the CZM rules (formerly the Dredging Manual) "discourages" certain open water disposal alternatives even when those alternatives are not contrary to the CZM rules. A particular open water disposal method should be evaluated on its merits and against a clear set of criteria.
6. Expand the concept of living shorelines to include habitat restoration in general. If marsh edge restoration is an acceptable open water alternative, so also should be the restoration of larger areas that may not be the result of gradual erosion along the fringes of a marsh. These areas should be viewed in the same light as marsh edge restoration.

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Seasonal, Geographical and Listed Species Restrictions within the New Jersey Coastal Tidelands Related to New or Maintenance Dredging

Stewart Farrell, PhD, Director, Coastal Research Center, Stockton University

Introduction:

Dredging projects are subject to both location and time restrictions. Specific areas are restricted based on historical significance, environmental significance, or a specific species presence (hard clams or submerged aquatic vegetation). Seasonal time restrictions are related to specific species life processes such as spawning, nesting, migration, or care of the young. Restrictions are often paired with both a specified distance to be maintained between the individual species occurring near the project and a time interval when this distance must be observed and maintained.

Some location restrictions are mapped and published with little room for modification, while others are project- specific, tied to an occurrence of a listed species proximal to the project site. Seasonal restrictions are based on previous studies of species' habits and behaviors that require restricting project activities in order to avoid negative impact on the target species. *From time to time new research will highlight the need for modification to current policy, and the resource agencies may modify these time frames or the regions to which they apply, or set forth special conditions in the permitting process.*

Environmental windows frequently drive up dredging project costs, have negative impacts on the rate at which improvements to restore safe navigation can be built, and ultimately impact the local marine economy.

Seasonal Restrictions:

Many restrictions on dredging activities have their origins in seeking ways to avoid detrimental impacts on Essential Fish Habitat (EFH) with regard to species migration, spawning, egg hatching and juvenile development in NJ bay

waters. Essential fish habitat has elements specific to geographic regions of the tidal estuary, the sediment type on the bay floor, the general depth/oxygen values found in inlets, channels or tidal flats around the estuary. The seasonal aspect relates to the annual timing of such migrations, spawning, and larval/juvenile growth patterns. These are established to cover more than the known peaks in such activity, and extend conservatively to include one or more standard deviation units of timing for the distribution related to the entire population completing the activity. The following information pulls together the variety of restrictions based on species activities, geographical regions subject to restrictions, and regional aspects for varying environmental policies.

Winter Flounder*, Pseudopleuronectes americanus***;**

Of all the established seasonal restrictions, none impact dredging more than the Winter Flounder (a) Essential Fish Habitat (EFH) rule restricting dredging in New Jersey tidal waters between January 1 and June 30 of any year. The purpose is migratory spawning and the presence of egg masses at the sediment surface or attached to a variety of submerged vegetation. Established decades ago, covering New Jersey coastal waters to Delaware Bay, this restriction has effectively limited both the number and scale of dredging projects.

Research in the early 2000's concluded by 2012 (Rutgers study) that the target species had become rare to absent within southern New Jersey bay waters. The other outcome from the research was the fact that the egg masses did not successfully hatch from locations floored with very fine, organic-rich sediments which accumulated faster than 0.3 mm/month. These data were instrumental in gaining a recommendation as of April 2015 to limit the southern extent of the EFH for winter flounder to Absecon Bay in Atlantic County. This, if formally adopted, could remove this seasonal restriction from all of Cape May County and tidal waters associated with Great Egg Inlet into Atlantic County behind Absecon Island.

Motions to adopt these scientific findings were adopted by wide majority voting during recent Habitat Committee meetings (March 23-24, 2015 and April 9, 2015) Essential Fish Habitat, New England Fisheries Council.

This formalized the scientific research on the issue, however regulatory agency debate is presently on-going with regard to revisions to the established seasonal restrictions related to the migration/spawning of winter flounder in New Jersey. Essentially, all of Cape May County could be removed from the January 1 to June 30 restriction on dredging with the southern limit set at Absecon Inlet as the southern limit for the continuation of this restriction.

Anadromous Fish;

The seasonal restrictions on migratory anadromous fish (species such as shad, Atlantic sturgeon) have been established in New Jersey with a general time frame between March 1st and June 30th. There are a number of species including marine turtles, marine mammals and a few invertebrates that also trigger the same restriction timeframe. The specific locality with restrictions will vary and could be released entirely for highly industrialized ports and known severely contaminated sites. In general, the smaller the dredging project and the more confined a site being dredged, the fewer of these restrictions apply or could apply with a shorter duration. Mechanical excavation of maintenance dredge materials with uplands disposal, or suction dredging with confined disposal facility discharge would incur fewer anadromous fish restrictions than open water discharge of the sediment.

Bald Eagle, *Haliaeetus leucocephalus***;**

Restrictions for disturbance in the vicinity of a bald eagle nest are both temporal and spatial in nature. The time restrictions run from January 1st to July 15th of any calendar year and include nest building, egg laying, incubation, and chick rearing and fledging.

The bald eagle (*Haliaeetus leucocephalus*) is protected by the Bald and Golden Eagle Protection Act (Eagle Act) and the Migratory Bird Treaty Act

(MBTA). The MBTA and the Eagle Act protect bald eagles from a variety of harmful actions and impacts. The U.S. Fish and Wildlife Service (Service) developed these National Bald Eagle Management Guidelines to advise landowners, land managers, and others who share public and private lands with bald eagles when and under what circumstances the protective provisions of the Eagle Act may apply to their activities.

- Follow the **National Bald Eagle Management Guidelines** [PDF]. New Jersey's **Landscape Project** (**online mapper**) provides mapping of eagle habitats.

The major restriction for spatial distance from an active nest is 660 feet for most activities without visual barriers in between the project and the nest. Channel dredging (and associated dredge material management such as CDF earthwork and maintenance) is most likely to come in contact with this restriction. The details involve the nature of the project, noise levels, sound bursts, elevated structures or towers, etc. Every project receives an individualized review to establish project-specific restrictions governing both timing of work and the distance restriction between a nest and the work zone.

Red Knot, *Calidris canutus rufa**;***

On December 11, 2014, the U.S. Fish and Wildlife Service listed the Red knot as a threatened species under the Endangered Species Act of 1973.The Red Knot is a migratory shorebird that uses NJ's Delaware Bay sand shorelines as a critical spring migratory stopover; and on their return migration in the fall, they can be seen in small groups using the barrier island beaches as a stopover site. There are no range-wide population estimates for fall migration or breeding areas because birds are dispersed, and most of the population studies to date have focused on the spring migration. (USFWS 2014) The conflict with dredging activities would be dominated by work in inlets, or the placement of sand dredged elsewhere on shorelines where the species might congregate. The proposed restriction would run from April into June for the migration

each spring with a modified restriction during the return fall migration for groups of birds wherever found on beaches or other shorelines.

Piping Plover, *Charadrius melodus**;***

Plover restrictions are not in as much conflict with dredging unless the disposal location for the dredged sediment is a coastal area where the plover is known to nest or forage. Since this bird mainly nests on barrier islands, and occasionally along sand shorelines near inlets, it avoids contact with most NJ channel or marina maintenance dredging. The time restriction is placed in areas of known nesting each year and extends from March 15th to August 15th each year (and in some cases as early as March 1st). This restriction is absolute in terms of access, project work, even surveying on foot within a nesting area.

Area or Regional Restrictions to Dredging:

The regional restrictions are concentrated on the presence of hard clams as shellfish beds and the presence of areas of submerged aquatic vegetation (SAV). Since these are always associated with tidal bays and lagoonal bay sediments that are the primary target for dredging operations, the consequence is frequently direct regulatory conflict. Existing rules and regulatory philosophy has been to broadly define the conditions of regulation and include the concept of "***potential habitat***". This vague construct means the applicant is always under the obligation to provide extensive, to the point of exhaustive, convincing proof that the scientific possibility of "***potential habitat***" cannot exist within the proposed project site. An added issue to shellfish regulation is the lack of anything approaching recent mapping of the known, active hard clam habitats in the State's tidal waters. The original mapping was done in the 1960's with minor updates done in the 1980's.

There is little doubt that these existing maps are flawed because habitat extents have changed over time. The appendix contains abbreviated summaries of scientific data germane to the recruitment of juvenile clams with ranges of habitat parameters impacting success. The typical water-dependent commercial development in the NJ bay environment accumulates the absolute worst type of

sediment, grainsize and surface pH conditions suitable for juvenile shellfish recruitment, yet marina dredging is often deigned or delayed, with enhanced expenses due to regulatory demands that “potential shellfish habitat” is presumed to exist.

The same mapping issues exist for the known and mapped SAV beds in the NJ tidal lagoons, but here, new technology has allowed re-mapping of large areas of the state (Barnegat Bay) using digital aerial methods. Also, it is far easier to do a SAV determination on a potential project area of the bay floor than determine the presence, absence, or density of hard clams, especially in relation to defining the “potential habitat”.

The aerial methodology used in SAV mapping uses chlorophyll reflectance at specific spectral frequencies and provides digital maps showing plant density and some information as to species. Ground truth at the surface has been vastly improved with the appearance of the GoPro digital camera. The major source of project restriction continues to revolve around the vague and endless regulatory objections (many obsolete or not scientifically sound) over this issue of “potential habitat impacts” of the proposed project.

Special Areas:

Wild and Scenic Rivers;

Special areas, Wild and Scenic River-designated areas in New Jersey’s tidal waters are two in number. The others are located along the upper Delaware River valley. In these areas both the National Park Service and the USF&WS have review authority regarding projects proposed for either location.

Condition G-3: The applicant shall provide written notification to the National Park Service prior to performing the activity, and shall not begin work until notified by the National Park Service in writing that the proposed activity will not adversely affect the Wild and Scenic River designation, or study status. A copy of this approval from the National Park Service shall be forwarded to the District Engineer.

Wild and scenic rivers are subject to special restrictions and approvals by the US National Park Service in addition to the USF&WS. Within the NJ coastal tidelands, they are:

- Great Egg Harbor River; New Jersey; from the mouth of Patcong Creek upstream approximately 40 miles plus several tributaries, in Atlantic, Cape May, Gloucester and Camden Counties. This includes Patcong Creek extending upstream from its confluence with Great Egg Harbor River to the Garden State parkway bridge, approximately 2.8 miles.
- Maurice River; New Jersey; the Maurice River, from Shell Pile approximately 17 miles upstream to the Millville sewage treatment plant, and portions of Menantico Creek, Manumuskin River and Muskee Creek, in Cumberland and Atlantic Counties.

The John H. Chafee Coastal Barrier Resources Act of 1982;

Before Federal funds may be committed to a project, a determination must be made as to whether or not the area or project in question lies within an area designated under CBRA. If the proposed project is within a CBRA unit, the purpose of the project must be examined by the USF&WS to determine whether or not the proposal may be an exemption to the prohibitions against Federal expenditures on “development” within the CBRA.

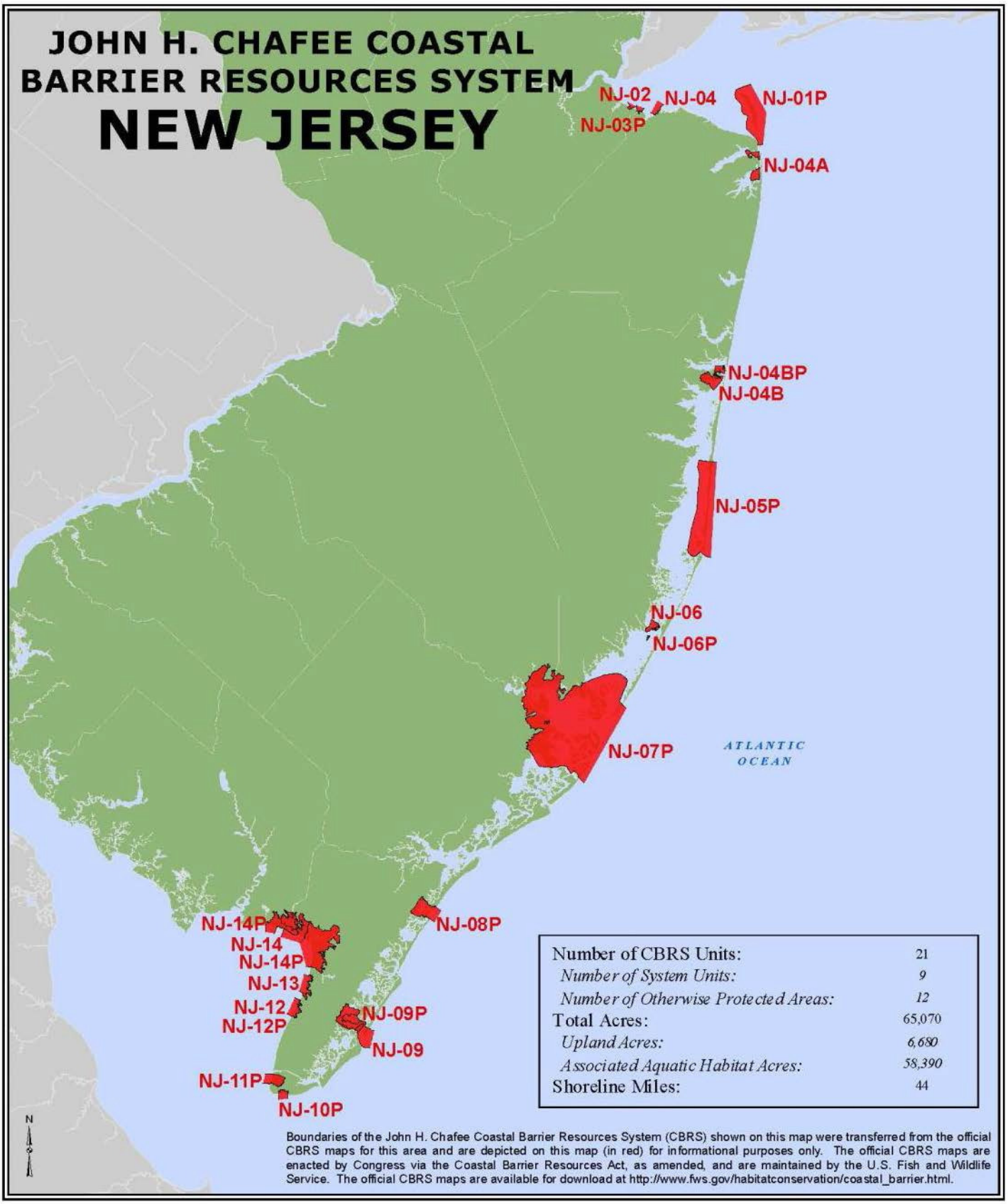
There are multiple CBRA zones in New Jersey (see Map). Updates are supposedly in the works with USGS funding since Hurricane Sandy’s coastal impact. There are no regulations or restrictions in this federal act regarding the expenditure of State or local project-related money within the designated zones. State or state and local sponsor cooperative projects are exempt from the CBRA provisions.

Recommendations:

1. Restrictions based on season, geographical location or protected species must be supported by current science-based data that clearly and accurately document coastal environmental resources and/or conditions

that justify limiting dredging activities.

2. Including references to “potential habitat impacts” as the basis for limiting dredging activities, timing, or extent in established navigation channels or water-dependent development (public, commercial or private) must rest on documented scientific facts, not on agency interpretation of hypothetical possibilities.


JOHN H. CHAFEE COASTAL
BARRIER RESOURCES SYSTEM
NEW JERSEY
NJ-02
NJ-04
NJ-01P
NJ-03P
NJ-04A
NJ-04BP
NJ-04B
NJ-05P
NJ-06
NJ-06P
NJ-07P
ATLANTIC
OCEAN
NJ-14P
NJ-08P
NJ-14
NJ-14P
NJ-13
NJ-12
NJ-12P
NJ-09P
NJ-09
NJ-11P
NJ-10P
N
Number of CBRS Units: 21
Number of System Units: 9
Number of Otherwise Protected Areas: 12
Total Acres: 65,070
Upland Acres: 6,680
Associated Aquatic Habitat Acres: 58,390
Shoreline Miles: 44
Boundaries of the John H. Chafee Coastal Barrier Resources System (CBRS) shown on this map were transferred from the official CBRS maps for this area and are depicted on this map (in red) for informational purposes only. The official CBRS maps are enacted by Congress via the Coastal Barrier Resources Act, as amended, and are maintained by the U.S. Fish and Wildlife Service. The official CBRS maps are available for download at http://www.fws.gov/habitatconservation/coastal_barrier.html.

Appendix

1. Seek to better define terms such as potential habitat impacts based on real probabilistic predictions of a balance between designing a project with 0.001% chance of impact versus a more realistic acceptance that anything changed in the marine environment changes something.
2. Winter Flounder restriction
    a. Copy of the Haskins white paper submitted to the Mid-Atlantic Fisheries Council
    b. Catch data since 2000.
    c. Other data such as the sedimentation rate detrimental to egg spawning and survival
    d. Kaelin/Robins: The Committee recommends to the Council a revision of the southern boundary of the winter flounder EFH designation (eggs, juveniles, and larvae/adults) established at 39° 22' N latitude, such that Absecon Bay would represent the southern limit of winter flounder EFH. *The motion carried 8/0/1 on a show of hands. Subsequently, the entire New England Fisheries Council voted 14-0 to adopt the committee recommendation. The matter has been presented to both the NJ State and Federal fisheries regulatory bodies for review and potential adoption for future dredging projects in the affected areas.*
3. Shore Bird restrictions (nesting & migratory)
    a. Start dates have crept from April 1st, to March 15th, to suggestions of March 1st. *(with no clear decision making framework based on habitat features or the species successful use of the site for nesting and brood rearing).* Shorebird species that may trigger dredging and dredge material management restrictions include
        - Piping plover – (*Charadrius melodus)* - federally threatened
        - Black skimmer (*Rynchops niger*) - state endangered
        - Least tern (*Sternula antillarum* - state endangered
        - American *oystercatcher (Haematopus palliates)* - species of concern (recently caused significant delays /increased expense to a federal beachfill project in N.J. This species of shorebird is known to nest on sandy beaches, marshes and shell rakes. This is more diverse than the previous 3, and clearly more prevalent in the south Jersey region. The buffer area imposed by the State is site specific, but in the case above; it was 300ft.
    b. Coming Red Knot restrictions? If dredging operations or dredge material placement/ management activities have the potential to impact red knot migratory stopover habitat on Delaware Bay beaches, the Corps permit would likely impose a seasonal restriction from April to June unless specifically adjusted by the USF&WS.
4. Horseshoe crab spawning season restrictions are being discussed ~ their season extends beyond the red knot stopover timeframe. Restrictions would likely only be for sediment placement activities.
5. Osprey restrictions are inconsistent among projects
6. Night Heron - restrictions have been imposed on dredging in historic active rookeries (any construction) during nesting season.

7. SAV & Hard Clam mapping problems and proposed changes/improvements
    a. Review of the literature regarding sedimentary habitats found to be suitable for recruiting and larval setting, NOT just adult survival in-place by accidental introduction or storm placement.
    b. Sediment parameters essential to define so as to define clam habitat where successful recruiting could occur.

Summary Notes

1. New Jersey Fish and Wildlife Field Office Procedures for Project Review. **http://www.fws.gov/northeast/njfieldoffice/Endangered/consultation.html**
    2. The U.S .Fish and Wildlife Service recommends these best practices to protect other wildlife resources, which are protected by various Federal and State laws. Please contact the New Jersey Field Office if you require technical assistance in implementing these recommendations. This list is limited to items of potential concern to tideland and coastal dredging projects.
        - Minimize project impacts to **Birds of Conservation Concern** [PDF] and their habitats.
        - Follow **Federal** and **State** regulations to avoid, minimize, and mitigate impacts to **wetlands**.
          Note that coordination with the Service may be required under the **Fish and Wildlife Coordination Act** and/or the 1993 **Memorandum of Agreement** between the Service and the State of New Jersey.
        - Avoid habitat fragmentation and barriers to wildlife movement, such as new roads or dams.
        - Avoid the use of polluting materials [*e.g.* chromated copper arsenate (CCA), ammoniacal copper zinc arsenate (ACZA), alkaline copper quaternary ammonium (ACQ), wolmanized copper azole (CA-B and CA-C), and acid copper chromate (ACC)] in aquatic environments supporting shellfish habitat.
        - Avoid impacts to sensitive wildlife areas such as **habitats for State-listed species, vernal habitats, biodiversity priority sites**, **shellfish beds**, and **submerged aquatic vegetation**.
        - Avoid impacts to **National Wildlife Refuges**.
        - Avoid prohibited activities within the **Coastal Barrier Resources System**.

USF&WS mitigation policy for project impacting a listed species.

As defined by the Council on Environmental Quality and adopted by the USF&WS in the Mitigation Policy, mitigation includes the following objective alternatives:

1. **Avoiding the impact** altogether by not taking a certain action or parts of an action;
2. **Minimizing impacts** by limiting the degree or magnitude of the action and its implementation;
3. **Rectifying the impact** by repairing, rehabilitating, or restoring the affected environment;
4. **Reducing or eliminating the impact over time** by preservation and maintenance operations during the life of the action; and
5. **Compensating** for the impact by replacing or providing substitute resources or environments.

Winter Flounder EFH revisions:

Condition (a): Any dredging on the Delaware River associated with this NWP shall comply with the dredging windows previously developed in conjunction with the Delaware Basin Fish and Wildlife Management Cooperative and approved by the Corps of Engineers.

Condition (b): Any in-water work in other waters of the United States shall comply with the following seasonal restrictions unless otherwise specifically approved by the Corps of Engineers:
March 1 – June 30 for all Atlantic coastal waters and Delaware River tributaries up to and including the Delaware Memorial Bridge and above the Delaware Memorial Bridge from March 15 – June 30.

Condition (c): A complete copy of any PCN submitted to the Corps of Engineers shall also be forwarded directly to the National Marine Fisheries Service Habitat Conservation Division, 74 Magruder Road, Sandy Hook, Highlands, New Jersey 07732. The applicant must provide evidence that this has been accomplished. The Corps of Engineers will coordinate review of the PCN with the National Marine Fisheries Service pursuant to the requirements of the Magnuson Stevens Fishery Conservation and Management Act.

Current costs for compliance with the Endangered Species Act (ESA) for Federal navigation projects exceed
$217 million dollars annually.

The Coastal Research Center

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THE RICHARD STOCKTON COLLEGE OF NEW JERSEY

December 5, 2014
NE Fisheries Council Meeting
Re: Amendment #2 to
Omnibus Essential Fish Habitat Bill Amending the 1997 Magnusson-Fisheries Act

The first amendment to the Act was in 1999 and was adopted. Amendment #2 was initiated in 2004 with a number of goals one of which was to develop a series of fisheries models over the next 5 years.

The Mid-Atlantic Fisheries Council is the local advisor to the NMFS and investigated of Essential Fish Habitat (EHF) on the Winter Flounder from Diamond Shoals, NC to Sable Island, Nova Scotia. This segment of the US/Canada shelf waters is the second fastest warming body of water second only to the Bering Sea.

1. Recommend that waters < 5 fathoms be removed from the EFH due to excessive siltation.
2. Jeff Kalon – Cape May County is presently the southern limit for EFH for the species.
3. Rutgers Haskins lab white paper demonstrates that data on eggs show siltation > 3mm/yr precludes successful hatching for winter flounder. Studies have shown that CM Co. marinas have sedimentation rates of over 6"/year.
4. Cape May County's harbors are man-made and behave in non-natural ways.
5. Shawn Martin, Rutgers Haskins Lab said Cape May Co to LBI was once an area with winter flounder, but they have moved north and east over the past 15 years.
6. 2008 to 2014 catch data found that an average of 4 flounder was caught per year in Cape May Co. Maximum catch was 20 fish.
7. Rick Webber, South Jersey Marina Group argued that Cape May County should be grouped with Delaware for inland bays, and then the restriction goes away.
8. A guidance memo was recommended to the NMFS to move to include the change in restrictions on dredging that begins January 1st to at least LBI if not all of the inland bays of coastal NJ.
9. Peter Hughes said that the economics of dredging costs due to the limited window for work has imposed unbearable burdens on the boating and recreational vessel industry especially since the data indicates that the species

has moved north and east from NJ's bay waters.

10. NMFS data does show that 55% of all winter flounder spawn on the continental shelf, not the inland bays anyway, so why not?
11. Rutgers Shrewsbury and Navesink River tagging research showed that 35 winter flounder released in December with pinger tags immediately buried in the muddy sand on the bottom and remained in the same spot until mid-February when the water temperature turned upward for the coming season. Only then did they begin moving toward spawning or feeding.

Dr. Stewart Farrell,
Executive Director
Coastal Research
Center

APPENDIX OF LITERATURE FOUND DISCUSSING HARD CLAM HABITAT PARAMETERS

The References Below Cover Specific Parameters for *Mercenaria mercenaria* clams

1. ER-L and ER-M sediment quality guideline values are from Long et al. (1995) and Long and Morgan (1990). TEL and PEL sediment quality guidelines are from MacDonald (1994) and MacDonald et al. (1996). Unacceptable DO: any observation with DO < 0.3 mg/l, or 20% or more time-series observations < 2 mg/l, or all time-series observations < 5 mg/l.

2. Northern quahog Mercenaria mercenaria abundance and habitat use in Chesapeake Bay

Journal of Shellfisheries Research, August, 2005 by Roger Mann, Juliana M. Harding, Melissa J. Southworth, James A. Wesson

Clam densities decreased significantly across the four types of substrate with the highest densities observed in shell substrate followed by sand, mud and anoxic muds in order of decreasing occupation (Kruskal Wallis, H = 1,414.27, DF = 3, P < 0.01; Fig. 3). Less than 1% of all clams collected were from anoxic mud substrates whereas shell, sand, and mud substrates contained 11%, 68% and 21% of clams, respectively. Although shell and sand substrates contained the highest observed densities of hard clams, these substrate types were only present in 38% of patent tong samples collected from potential clam habitats.

Smithsonian Marine Station at Fort Pierce

3.

Abundance:

In the IRL as in other areas within its range, *Mercenaria mercenaria* is most abundant in shell- containing soft bottoms. They are also found (in decreasing order of abundance) on sand flats, sand/mud flats and on muddy bottoms (Wells 1957; Pratt 1953). A study by Peterson et al., (1984) also showed that densities of 0 - 2 year old hard clams in eelgrass (*Zostera marina)* beds of North Carolina was more than 5 times the average density of clams in nearby sand flats (9 per square meter in eelgrass, vs. 1.6 per square meter in nearby sand flats. Further, hard clams from *Zostera* beds appeared to be somewhat larger, on average, than those from sand flats. Hydrodynamic baffling by seagrasses may be at least partially responsible for the observed result (Peterson et al., 1984). Reduction in currents near the benthos enhances the deposition of fine sediments and suspended materials between blades of seagrass, especially near patch edges.
Hydrodynamic baffling therefore provides a rich food source for juvenile clams.

4. *FWS/OBS-82/10,77*
AUGUST 1984

HABITAT SUITABILITY INDEX MODELS: HARD CLAM

Rosemarie Mulholland
Florida Cooperative Fish and Wildlife Research Unit
U.S. Fish and Wildlife Service
School of Forest Resources and
Conservation 117 Newins-Ziegler
University of Florida, Gainesville, FL 32611

SPECIFIC HABITAT REQUIREMENTS:

Embryo, Larva, Juvenile

pH. Calabrese (1972) observed that the successful recruitment of mercenaria requires that the pH of estuarine waters not fall below 7.0; he found no significant decrease in the number ofclam embryos developing normally within the pH range of 7.0-8.75, but that number was greatly reduced at pH 9.0. Survival of clam larvae was normal at pH 6.25-8.75, but the range for normal growth was 6.75-8.50. Although clam larvae can survive at pH 6.25, a pH of 7.0 is required for normal development of the embryo. Levels of pH below 7.0 limit recruitment of the species (Calabrese 1972).

Dissolved oxygen. Morrison (1971) found that growth of shelled veligers of M. mercenaria was normal when dissolved oxygen concentration was 4.2 mg/l or greater. Growth essentially ceased at concentrations of 2.4 mg/l and less. Larvae survived extended exposures (14 days) to 1 mg/l dissolved oxygen but grew little. Prolonged exposure to levels of less than 4.0 mg/l lengthened the clam's planktonic stage and decreased its probability of survival. Embryos developed normally at oxygen levels as low as 0.5 mg/l; however, 100% mortality occurred at 0.2 mg/l.
Fluctuations in dissolved oxygen do not affect adult hard clams as much as do fluctuations in temperature and salinity (Stanley and DeWitt 1983). The burrowing ability of M. mercenaria was neither severely nor permanently impaired by exposure to reduced oxygen levels (less than 1*mgl1* seawater) for up to 3 weeks (Savage 1976). Pratt and Campbell (1956) found no correlation between growth rates and various concentrations of dissolved oxygen. All life stages tolerate nearly anoxic conditions for long periods, though they may cease growing (Stanley and DeWitt 1983).

Salinity. Salinity appears to be most critical for M. mercenaria during the egg and larval stages (Stanley and DeWitt 1983). At Long Island Sound, New York, eggs developed into straight- hinged veligers only within the relatively narrow salinity range of 20.0 to 32.5 parts per thousand (ppt), The optimum for development of clam eggs was about 26.5 to 27.5 ppt (Davis 1958). Growth of larvae, once they attained the straight-hinged stage, was comparatively good at salinities as low as 20 ppt (Davis 1958), but Chanley (1958) found that growth of juvenile M. mercenaria was retarded at salinities of 22.5 ppt or lower. Castagna and Chanley (1973) found that metamorphosis of M. mercenaria from veliger to seed clam (byssal plantigrade stage) was inhibited below 17.5 to 20 ppt.

Temperature. Davis and Ca1abrese (1964) noted that 1aboratory-rea red straight-hinged veligers of M. mercenaria were capable of ingestion, but not digestion, at 10°C (50°F),- and consequently did not grow. Growth was positively related to temperature at 18.0° to 30.0°C (64° to 86°F). Growth of straighthinged veligers of M. mercenaria was little affected by temperature differences within the range of 20° to 30°C (68° to 86°F). Although the optimum temperature for growth of M. mercenaria larvae was not well defined, growth was optimum at the following temperature/salinity combinations: 30°C *(86°F)/22.5* ppt and higher, 27.5°C *(81.5°F)/17.5* and 20.0 ppt, and 25°C (77°F)/15.0 ppt.

Substrate. The nature of the bottom substrate seems to be the main factor responsible for settling of larvae and for the qualitative composition of bottom communities (Thorson 1955). Keck et ale (1974) reported from laboratory studies that significantly higher (P ~ 0.05) numbers of M. mercenaria larvae set in sand than in mud; they suggested that the addition of organic material to the sediment may be responsible for reduced setting because of increased bacteria levels, reduced dissolved oxygen, and increased production of hydrogen sulfide. Carriker (1959) recommended that the substrate be firm and free of excessive organic mud for larval clam culture; muddy bottoms can be surfaced with shells, sand, or gravel. Adult Clams were most abundant in predominantly fine sediments, but in these sediments their abundance was generally a function of the coarseness of the minor constituents. Clams do not grow well in silty substrates. Pratt and Campbell (1956) found an inverse relationship between growth of M. mercenaria and the fineness of the sediment (expressed as percentage of silt and clay). The inferior growth was attributed to frequent gi1l clearing, which expended energy and interfered with feeding. Johnson (1977) also reported slower growth of M. mercenaria in finer sediment due to increased expulsion of pseudofeces.

Suspended solids. Davis (1960) noted that both the larvae and egg stage are affected by suspended solids. "Eggs did not develop correctly at silt concentrations of 3.0 or 4.0 g/L, and straight-hinged veligers was normal at silt concentrations of 0.75g/L, retarded at 1.0 to 2.0g/L, and negligible at 3.0 and 4.0g/L."

Recommendations for Faster and More Cost-Effective Pre-Dredge Characterization

John R. Gee, P.E., P.P., L.S.R.P., Principal Engineer, Tetra Tech, Inc.

Overview

NJDEPs Office of Dredging and Sediment Technology (ODST) currently has primary responsibility for regulating dredging activities and for the management of dredge material in New Jersey. There are generally two (2) reasons for generating dredge material; to create or maintain a channel for ship or boat traffic or to replenish destroyed coast line and recreational beaches. Coastal dredging is vital to maintaining New Jersey's marine transportation system, which provides access for recreational boaters, commercial vessels as well as the transportation of people and goods. Dredging is vital to the future of New Jersey's $50 billion maritime industry. Our recommendations primarily address dredging approvals to maintain tidal channels for ship or boat traffic but they can also be used to address dredging for other purposes.

There are many different methods utilized in the dredging process, however, the basic principle consists of removing sediment and accumulated debris from the bottom of navigation channels and waterways and placing the material in a location that is approved by the NJDEP. Sediment is also currently regulated under the NJDEP Site Remediation Program (SRP) if impacted by discharges or if sediment is potentially impacted by a site regulated under the SRP. However, there are important differences when contaminated sediment is identified under the ODST program as compared to the SRP program.

Under ODST, sediment removal begins and proceeds according to the following general steps.

1. Pre-application meeting is recommended but timing does not always allow for this step to occur.

2. Preparation and submission of a Sampling and Analysis Plan.
3. NJDEP ODST approval or request for revisions to the Sampling and Analysis Plan.
4. Implementation of the Sampling and Analysis Plan.
5. Submission of the results of sampling to NJDEP ODST for approval.

This is the traditional step-by-step time consuming and inefficient approval procedure that has proven to be unsustainable in the SRP program and is currently burdening New Jersey stakeholders under the ODST. Many of the requirements of the former NJDEP Dredge Manual (The Management and Regulation of Dredging Activities and Dredge Material in New Jersey's Tidal Waters, October 1997) that have been incorporated into the NJDEP regulations (N.J.A.C. Appendix G) are out-of-date (written almost two decades ago), undefined, and subject to a wide range of interpretation. This creates many resubmittals and expenditures by the regulated community that are not necessary if the latest approaches and techniques were employed as recommended below.

Furthermore, under ODST, contamination found during pre-dredge sampling is not managed in accordance with SRP regulations and guidance. While SRP criteria for remediation are used in evaluating pre-dredge results, contamination identified above NJDEP standards is not normally reported to the NJDEP hotline, delineated or remediated. Instead, ODST routinely either denies a permit to allow dredging, accepts resampling data to permit dredging (if resampling results are below NJDEP standards), and does not require delineation of the impacted area or layer of sediment that was found to be impacted so it can be removed for proper offsite disposal. ODST also allows dredging of sediment with compound concentrations greater than NJDEP Residential Direct Contact Standards but less than NJDEP Non-Residential Direct Contact Standards to be placed into Confined Disposal Facilities (CDFs). This approach makes it more difficult to reuse the sediment in the CDF in the future.

Equilibrium Partitioning Model Rather than MET (1980's approach)

Currently, under NJDEP ODST regulations (N.J.A.C. 7:7 Appendix G, referred to as Appendix G) the primary method required to evaluate contaminant behavior during dredging is the Modified Elutriate Test (MET) analyses of site sediments for disposal in Confined Disposal Facilities (CDF). The MET is required by NJDEP regulations to predict pollutant concentrations of contamination in both the soluble and particulate-bound portion of the dredge discharge.

The MET is an expensive empirical simulation of the dredging process which was developed in 1988. The MET consists of mixing sediment and water from the dredging site into a slurry with the concentration of solids approximately equal to that expected in the disposal site influent. The slurry is placed in 4-liter cylinders and aerated for one (1) hour to ensure oxidizing conditions. The aerated slurry is allowed to settle for a time period equal to the expected field·mean retention time of the disposal area up to a maximum of 24 hours. A sample of the supernatant water is extracted from the cylinder and analyzed for total suspended solids (TSS) and dissolved and total concentrations of contaminants of interest.

Since the development of the MET, the USACOE has developed the Dredging Elutriate Test (DRET) as a potential improvement of the MET (more expensive than the MET) and examined the application of a simple, equilibrium partitioning model as an alternative to the MET or DRET. The USCOE found the equilibrium partitioning model was effective in predicting soluble and particle-bound concentrations obtained in the DRET. The USCOE concluded that the equilibrium partitioning model…

> "*represents, therefore, an alternative to the DRET to predict both soluble and total concentrations of PCB or other contaminants….*". (DiGiano, F. A., Miller, C. T., Yoon, J. (1995). "Dredging elutriate test (DRET) development," Contract Report D-95-1, U.S. Army Engineer Waterways Experiment Station, Vicksburg, MS).

The equilibrium partitioning model is recommended as a method of determining the suitability of sediment for dredging rather than the expensive and out-of-date MET. Use of the equilibrium partitioning model will require the analysis of sediment for total organic carbon (TOC) and analysis of the total compound concentrations of interest to predict surface water impacts without any additional expensive empirical physical testing or laboratory analysis. TOC analysis is currently required for all pre-dredging characterization work as are total compound concentrations.

Equilibrium partitioning is currently used by the NJDEP SRP to determine if the total concentration of a contaminant in soil will produce an unacceptable concentration in groundwater (NJDEP Guidance Document, Development of Impact to Ground Water Soil Remediation Standards using the Soil-Water Partition Equation, Version 2.0 – November 2013 [NJDEP Partition Guidance]). The NJDEP has also produced standardized excel spreadsheets for inputs to use the soil-water partition equation in the development of site specific impact to groundwater standards. It would be a fairly easy adaptation of this existing work to implement the soil-water partition equation for use in regulating dredging operations in New Jersey.

In aquatic systems, a linear relationship exists between the concentration of a contaminant solute in soil/sediment and the concentration of the contaminant in water at equilibrium. In other words, when the concentration of a contaminant in water is increased, the concentration of that contaminant in the soil/sediment will also increase by a constant factor. This linear relationship is expressed mathematically via the solute distribution coefficient, which is the ratio of the solute concentration in sediment (C_s) to the solute concentration in water (C_W).

$$K_d = \frac{C_S}{C_W}$$

K_d is the solute distribution coefficient, C_s is the solute concentration in sediment, and C_w is the solute concentration in water. Knowing the

concentration of a contaminant in one, either water or sediment, allows the prediction of the concentration of a contaminant in the other. NJDEP has published K_d values for regulated compounds in the NJDEP Partition Guidance and developed a simple procedures for determining K_d values for various compounds.

Because the contaminant sorption occurs predominantly by partition into the sediment organic matter, it is more useful to express the distribution coefficient in terms of the sediment organic matter content.

$$K_{oc} = \frac{K_d}{f_{oc}}$$

In this equation, K_{oc} is the partition coefficient normalized to the organic carbon of the soil/sediment, and f_{oc} is the organic carbon fraction of the sediment. The SRP currently allows the use of the Synthetic Precipitation Leaching Procedure (SPLP, a significantly lower cost test than the MET) to determine a site-specific soil-water partition coefficient (Kd) for organic or inorganic contaminants.

The following equations (EPA Soil Screening Guidance: Technical Background Document, May 1996, EPA/540/R95/128) can be used instead to calculate an acceptable sediment concentration for organic compounds. A similar equation is used in the NJDEP Partition Guidance to predict groundwater concentrations from soil.

$$Impact\ to\ Surface\ Water\ Concentration\ from\ Sediment\ = C_W$$

$$= \frac{C_T}{\left[K_d + \frac{\theta_W + H\theta_A}{\rho_d}\right]}$$

Where:

$C_T = the\ total\ concentration\ of\ contaminant\ in\ sediment\ on\ a\ dry\ weight\ basis\ or$

$$C_T = \left(\frac{mass\ of\ contaminant}{mass\ of\ solids}\right)$$

$$\theta_W = water\ filled\ porosity = \left(\frac{volume\ of\ water}{total\ volume}\right)$$

$$\rho_d = dry\ bulk\ density\ of\ sediment = \left(\frac{mass\ of\ solids}{total\ volume\ of\ solids\ and\ pore\ space}\right)$$

$$\theta_A = air\ filled\ prosity = \left(\frac{volume\ of\ air}{total\ volume}\right)$$

$$H = Henry's\ Law\ Coefficient\ (dimensionless)$$

Ignoring the partioning to air would be conservative when calculating the partitioning to soil or water. Thus, assuming the dredge material is fully saturated with no air content, a conservative surface water impact from dredging would be calculated using the following equation:

$$Impact\ to\ Surface\ Water\ Concentration\ from\ Sediment\ = C_W = \frac{C_T}{\left[K_d + \frac{\theta_W}{\rho_d}\right]}$$

Implementation of the equation above for sediment would involve only a minor revision to the current NJDEP Partition Guidance document and would result in the savings of thousands of dollars currently spent on expensive MET analysis for each channel reach characterized for dredging.

Reduce Effort Needed for Approval of Dredging Operations

ODST is currently understaffed and easily overwhelmed by the number of submittals requiring review. Nowhere is this more obvious than the NJDEP Dredge Manual itself which instead of being updated was simply adopted into regulation, even though the manual itself was written almost two (2) decades ago (1997), long before current SRP regulations were envisioned. The original intent was to update the manual more frequently as stated in the former Dredge Manual as follows.

> *"As stated previously, the technical manual may be updated every six months or whenever a regulatory change requires it. Therefore,*

if the publication date of the manual is more than six months old or if you are aware of a regulatory change, you should contact the Maps and Publication Office for a copy of the appropriate revision."

In addition, the approval process for sampling and analysis is replete with routine subjective interpretation. Appendix G states:

"each project (regardless of size) should be assessed on a site-specific basis, taking into consideration reach boundaries and the areal extent of the project, the location(s) of outfalls and tributaries, as well as the volume of dredged material.

The term "reach" is defined in a manner in Appendix G that creates confusion in the regulated community and results in a wide range of interpretations. The extent of a reach is extremely subjective and undefined. Currently Appendix G defines a reach as follows:

"A reach is a continuous stretch of waterway not separated by any structure and subject to similar hydrodynamic and depositional features as well as similar upland inputs. Reach boundaries must be approved by the Department."

The term "similar" is not defined and the above definition allows NJDEP to dictate not only the reach but the resulting number and location of samples required for dredging approval. The result is the need for submission of a Sampling and Analysis Plan to NJDEP for review that routinely needs to be revised in accordance with NJDEP opinion. It is recommended that the concept of a "reach" be eliminated from Appendix G and that number of required samples be specified according to the volume of proposed dredging and length of continuous channel to be dredged with sample locations biased toward outfalls. Appendix G needs to be revised to clearly identify the number, depth and location of samples required for dredge approval that is not open to subjective interpretation.

NJDEP should also consider allowing parties interested in conducting dredging the ability to retain an LSRP to conduct the pre-dredge characterization of the sediment proposed for dredging and revising Appendix G accordingly. The NJDEP LSRP program has been a success throughout New Jersey in addressing and remediating impacted properties in a timely, cost-efficient and effective manner. More than 2,000 Response Action Outcomes (RAOs) have been issued, resulting in an unprecedented reduction in the inventory of open cases at the NJDEP. Using this approach, any impacted sediment can be addressed in accordance with current NJDEP SRP requirements. Impacted sediment can be reported to the NJDEP, delineated, remediated or effectively removed from the environment, and sources identified and addressed. In most cases, the responsible party for contaminated sediment is not the party conducting the dredging project. Currently the responsible party is not held accountable and the persons or local government responsible for channel maintenance bears the full cost of the impacted sediment. Proper reporting of impacted sediment to the NJDEP will assist in identification of the responsible party and ensuring these costs are not borne by

NJDEP should also consider the use and expansion of NJDEP's Linear Construction Technical Guidance, January 2012 (LCTG) to include dredging projects. Maintenance or creation of navigable channels in tidal waters meets the NJDEP concept of a linear construction project. The definition of a linear construction project could be changed in the LCTG guidance as follows (recommended changes noted in bold).

> "*Linear construction project" means construction and development to create, maintain or alter a roadway,* ***navigable channels in tidal waters****, railroad or utility by a person conducting a linear construction project that:*
>
> - ***Includes dredging to maintain the usefulness of a navigable channel in tidal waters; or***
> - *Includes one or more contaminated properties; and*

- *Will generate more than 200 cubic yards of contaminated soil for fill or disposal during the duration of the linear construction project."*

The LCTG could also be modified to include specific requirements for performing due diligence for planning sampling and analysis of material proposed for dredging with reference as needed to current regulations and requirements. The revised LCTG could also include simplified and effective sampling requirements (e.g. one sample for each XX cubic yards of dredge material by Coastal Zone) to replace the current subjective and unclear sampling requirements contained in Appendix G. If pre-dredging characterization is conducted by LSRPs for innocent parties conducting the dredging, the applicant would not need to be burdened with the delay and costs associated with the NJDEP approval of a Sampling and Analysis Plan. Sampling could be conducted without delay, impacted sediment properly addressed, and the responsible party held accountable for impacted sediments.

This process should also allow the parties conducting the dredging the option of undertaking sediment remediation under the oversight of an LSRP without waiting for NJDEPs direction and pre-approvals to commence and continue remediation. Instead, remediation can be initiated and completed under the direction of an LSRP, who would have responsibility for oversight of the environmental investigation and remediation as is currently conducted with any Area of Concern (AOC) reported to the NJDEP. By using an LSRP, the LSRP would prepare a report to ODST certifying that sampling and characterization was conducted in accordance with NJDEP regulations and guidance, and identify the areas of each channel that are acceptable for dredging or that require remediation.

Summary

In summary, it is recommended that:

1. Use of the MET or other expensive empirical testing be replaced by the Equilibrium Partitioning Model which is already widely used and supported by the NJDEP.
2. The subjective and interpretive concept of using a “reach” be replaced in Appendix G as the basis for sampling, by specifying the number of required samples according to the volume of proposed dredging and length of continuous channel to be dredged with sample locations biased toward outfalls.
3. NJDEP allow the option of using an LSRP to characterize sediment, properly identify, delineate and report impacted areas to the NJDEP, and identify areas acceptable for any and all dredging to a CDF or requiring remediation.

Summary of Dredging Working Group Recommendations:

The recommendations below are presented in an effort to clarify ambiguities and adjust NJDEP guidance to facilitate maintenance of our State's aquatic transportation infrastructure, and to promote meaningful regulations that do not unduly burden the regulated public.

1. Revise the dredging permit application program by establishing
    a. A unified application that replaces the nine potential permit/approval programs impacting dredging and
    b. An SPGP for the U.S. Army Corps of Engineers (USACE) application.
2. The background information required for permitting should include reference to a definition of Aquatic Transportation Infrastructure, such as inlets, bays, rivers, channels and mooring areas necessary for the safe navigation of vessels for commercial, industrial, recreational, regional transportation and national security in and adjacent to the State of New Jersey and Mooring Areas which include, but are not limited to, recreational marinas and launch facilities, commercial and industrial dockage facilities, waterborne transportation facilities, and dockage for public safety and security vessels.
3. Actively pursue database management of issues associated with defining and classifying waterways, confined disposal facilities (CDF) and known site conditions.
4. The Geographical Regions within which dredging activities are required should have sub-regions having similar use and environmental conditions/characteristics.
5. The permitting program format and content should include:
    a. The classification of all navigable waterways throughout the State to ensure safe navigation for all potential maritime uses.

b. Include acceptable management practices and restrictions, where and when appropriate.

c. Consider the use of the ACE Environmental Questionnaire-type format addressing the public interest review and environmental issues in the review process.

6. Employ a new “Multiple Use Determination” within the Coastal Zone Management Rules to efficiently and effectively manage dredged material in the future.

7. Establish pre-identified beneficial uses for dredged materials through Multiple Beneficial Use Determination for materials that have Acceptable Use Determinations (AUD) state-wide.

8. Identify and promote new and innovative ways to beneficially use appropriate dredged material.

9. Adapt, after adequate review, the NJDOT-OMG state-wide geospatial data bases for waterway and dredged material management.

10. Permit compliance with regulations must be measured against the cost of application and restrictions as they relate to demonstrable environmental benefits.

11. Expand the options for the use of living shoreline and habitat restoration in General Permit 24 by eliminating the requirement that these projects obtain federal or state sponsorship. If it can be demonstrated that the project can be performed without detriment (or provide a benefit) to the environment, it should be able to be undertaken regardless of whether it receives sponsorship by federal or state agencies.

12. Create a general permit for the filling of subaqueous borrow pits.

13. Establish or sponsor grants for further study of the water quality and benthic conditions of the State’s subaqueous borrow pits.

14. Re-evaluate the prohibition or re-profiling operations with Region 2.

15. Re-evaluate whether certain disposal alternatives should be "discouraged" and consider policies that evaluate disposal alternative based on a clear set of criteria.

16. Expand the concept of living shorelines to include habitat restoration in general.

17. Restrictions based on season, geographical location or protected species must be supported by current science-based data that clearly and accurately document coastal environmental resources and/or conditions that justify limiting dredging activities.

18. Including references to "potential habitat impacts" as the basis for limiting dredging activities, timing, or extent in established navigation channels or water-dependent development (public, commercial or private) must rest on documented scientific facts, not on agency interpretation of hypothetical possibilities.

19. Replace the Modified Elutriate Test (MET) and other empirical testing by the Equilibrium Partitioning Model.

20. Replace "reach" as the basis for sampling by specifying the number of required samples according to the volume of proposed dredging and length of continuous channel to be dredged with sample locations biased toward outfalls.

21. Allow the option of using an LSRP to characterize sediment, and to delineate, report to the NJDEP, and remediate any impacted areas.

The Dredging Working Group is committed to working with appropriate State agencies to advance safe navigation of New Jersey's blue highways and associated aquatic transportation infrastructure, while protecting important coastal resources. In this regard, the Group requests that an inter-agency working group be established to consider the recommendations presented above

and provide for the regulated public a dredging program that accommodates the diverse maritime uses and important coastal resources.

The Dredging Working Group is comprised of:

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Note: The Dredging Working Group expresses its appreciation for participation by the Office of Maritime Resources of New Jersey Department of Transportation, Haskin Shellfish Research Laboratory of Rutgers University and the Office of Dredging and Sediment Technology of the New Jersey Department of Environmental Protection.