



Geospatial NEPA for Ocean and Coastal Environments

Approaches, Policies, and Possibilities

2015



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I. Introduction

The National Environmental Policy Act (NEPA) requires agencies to analyze the environmental impacts of any major federal action that will significantly affect the quality of the human environment.¹ As described in implementing regulations promulgated by the Council on Environmental Quality (CEQ), NEPA procedures make certain that “environmental information is available to public officials and citizens before decisions are made and before actions are taken.”² In practice, NEPA assessments review actions that occur in many different locations, with substantially varying scopes, encompassing a multitude of environmental, economic, and social factors.

Given the breadth of information included, the overlap in areas and resources analyzed, and the sheer number of assessments completed, NEPA assessments synthesize and generate a tremendous amount of data about the human environment. It would be ideal if these assessments more effectively built upon each other and were easily accessible. Building upon past assessments would help maximize both efficiency and the quality of information assessed, streamlining analysis by avoiding duplication of efforts and improving analysis by allowing consideration of cumulative impacts. Having prior studies and their underlying data easily accessible would facilitate information dissemination, information sharing, and coordinated decision-making.

“Geospatial NEPA” is designed to facilitate access and information sharing by aggregating NEPA documents and geospatial data in a map-based data system. NEPA was enacted in 1970, long before the use of Geographic Information Systems (GIS) technology became common. Thus it is not surprising that the statute does not address geospatial data systems. However, a Geospatial NEPA system could help realize NEPA goals and objectives and overcome the hurdles introduced above. A brief overview of the Act is instructive to provide context for this report, which reviews the content of existing ocean-related NEPA documents, summarizes the agency regulations and policies that guide implementation, and considers how to move toward a geospatial approach to NEPA.

A. NEPA Background

NEPA declares it a national policy to promote “efforts which will prevent or eliminate damage to the environment” and to “enrich the understanding of the ecological systems and natural resources,” among other goals.³ The aim is to improve and coordinate all federal activities⁴ through a “systematic, interdisciplinary approach which will insure the integrated use of the natural and social sciences and the environmental design arts in planning and in decisionmaking.”⁵ To that end, all major federal actions

¹ 42 U.S.C. § 4332.

² 40 C.F.R. § 1500.1(b).

³ 42 U.S.C. § 4321.

⁴ 42 U.S.C. § 4331.

⁵ 42 U.S.C. § 4332.

significantly affecting the quality of the human environment require the development of an environmental impact statement (EIS).⁶

Generally, when agencies do not know whether an action will cause significant impacts, they can undertake an environmental assessment (EA).⁷ If the EA results in a finding of no significant impact (FONSI), then no further impact assessment is required.⁸ If it finds that the impact will be significant, the agency must prepare a full EIS.⁹ Some actions can be granted categorical exclusions (CEs) from the EIS requirement when they are deemed not to individually or cumulatively have significant effects on the human environment, and the agency formally finds no such effect through its procedures.¹⁰ These NEPA documents are “action-forcing,” meaning that they do not mandate a certain action—rather, the documents are to be considered by officials and the public when making the final management decision.¹¹

EA and EIS documents begin with a review of baseline conditions, which is usually contained in an “Affected Environment” chapter. They also include an evaluation of predicted environmental impacts, along with an evaluation of alternative scenarios, which is usually included in an “Environmental Consequences” chapter. The Affected Environment and Environmental Consequences sections include the bulk of the environmental data in NEPA documents.

B. Geospatial NEPA Concept

In practice today, some NEPA documents and data can be difficult to find. Analyses may lack context either within a single document (e.g., the overlap of endangered species habitat with shipping lanes may not be apparent) or across multiple documents (e.g., different agencies may conduct independent analyses for actions that are in close proximity). Geospatial NEPA is designed to overcome these hurdles and increase the efficiency and effectiveness of NEPA assessment. An ideal data system would include the following separate but related functions:

- **Publicly accessible digital archive of NEPA documents**, including environmental impact statements and potentially also environmental assessments, categorical exclusions, records of decision, and other relevant documents.
- **Mechanism to upload new documents** as they are completed.
- Publicly accessible system to conduct **keyword searches** within uploaded NEPA documents.

⁶ *Id.*

⁷ 40 C.F.R. § 1508.9.

⁸ *Id.* § 1508.13.

⁹ *Id.* § 1508.11.

¹⁰ *Id.* § 1508.4.

¹¹ See Nicholas C. Yost & Gary Widman, *The “Action-Forcing” Requirements of NEPA and Ongoing Actions of the Federal Government*, 34 ENVTL. L. REPORTER 10435 (2004).

- **Geospatially referenced** data system that allows identification of relevant NEPA documents by location.
- System that maps and **integrates geospatially relevant information**.
- System that has a **public user interface** that enables users to evaluate the data and upload additional information for specific projects.

This report focuses on the potential deployment of Geospatial NEPA in the marine management context.¹² A Geospatial NEPA system could help increase the relevance and utility of NEPA data by making it easier for decision-makers and the public to consider all the information available in related documents. Such place-based and easy access to information from many documents would help with NEPA’s mandates to consider the cumulative effects of an agency action, with identification of potentially affected users and resources, and with integration of data across assessments, supporting more informed and efficient management decisions. Moreover, Geospatial NEPA could be used as a tool to facilitate public engagement in the decision-making process by making NEPA documents more readily available and helping the public understand potential impacts of agency actions in a place-based way.

In addition to its benefits within the NEPA context, Geospatial NEPA could also be used to increase the efficiency and effectiveness of other marine planning processes, as outlined by Executive Order 13,547¹³ and required by many statutes. Among others, the Coastal Zone Management Act supports state coastal management programs that provide for “comprehensive planning, conservation, and management” for marine resources within state waters.¹⁴ Similarly, sanctuaries designated under the National Marine Sanctuaries Act are multi-use planning areas, with management plans incorporating geospatial variables ranging from mapping the planning area to comprehensive resource assessments.¹⁵ Other statutes require consideration of other activities in an area. For example, the Outer Continental Shelf Lands Act requires that offshore renewable energy activities consider other uses of the sea or seabed; similarly, to the extent possible, the Coast Guard must “reconcile the need for safe access routes with the needs of all other reasonable uses of the area” when designating fairways for vessel operation.¹⁶

In situations such as these that require comprehensive management and coordination among uses, Geospatial NEPA could support more effective management decisions based on the best and most comprehensive data available about conditions, activities, and impacts.

¹² A Geospatial NEPA system can, and ideally will, encompass all management decisions across both marine and terrestrial ecosystems. This report, however, focuses on marine management actions in order to narrow the scope of analysis to a manageable set of data categories, policies, and tools. Conclusions and recommendations would likely be similar in a terrestrial context, but would include expanded data categories, broader sets of agency policies, and additional land management database tools.

¹³ Exec. Order 13547, *Stewardship of the Ocean, Our Coasts, and the Great Lakes* (July 19, 2010).

¹⁴ Coastal Zone Management Act, 16 U.S.C. § 1452.

¹⁵ National Marine Sanctuaries Act, 16 U.S.C. § 1434.

¹⁶ 43 U.S.C. § 1337(p)(4); 33 U.S.C. § 1223(c)(3).

This report explores the current federal framework for undertaking NEPA assessments and aggregating the results. It begins by reviewing the types of data found in existing ocean-related NEPA documents to evaluate what information is useful for marine management and amenable to a geospatial approach. The next section analyzes existing policies for utilizing and sharing geospatial information. This section is followed by an overview of some of the geospatial tools used in practice by agencies both inside and outside of the NEPA process. The final sections examine implementation and design details, building on the data and policy analysis to make recommendations regarding the optimal utilization of geospatial information throughout the NEPA process.

By analyzing current practices, policies, and institutions involved in both NEPA and the display of geospatial information, and by sharing some recommendations, it is our goal to foster the development of Geospatial NEPA at a federal level.

II. Data in Existing Ocean-Related NEPA Documents

At the outset, we explored the types of geospatial data that are currently included in NEPA documents. These data include both explicit geospatial data – that is, data accompanied (or defined) by spatial references such as locations and coordinates – as well as spatially-based data that (if underlying information is provided) could be translated into geospatially referenced data – such as a description of an area or range. In addition, while many types of data may be supported by GIS polygons and data layers, it is not always immediately apparent whether the underlying data is conducive to GIS.¹⁷

As an initial sample, we examined the entirety of seven recent ocean-related NEPA documents (see Table 1). This sampling was intended to yield a general idea of the types of information that could be included in a Geospatial NEPA system. We focused on answering two primary sets of questions:

- *Content*: What is the typical content of geospatial information used for ocean management decisions? Are some geospatial factors mapped more often than others in the documents reviewed?
- *Design Approach*: What are instructive examples of using geospatial information in NEPA documents? What are instances when geospatial information may not be used optimally?

Table 1. Ocean-Related NEPA Documents Reviewed (Sorted by Year)

Document Name	Document Type	Agency	Activity	Year	Region
<i>Deepwater Horizon Oil Spill; Draft Programmatic and Phase III Early Restoration Plan and Draft Early Restoration Programmatic Environmental Impact Statement</i> ¹⁸	Draft Programmatic Environmental Impact Statement	DOI (lead agency)	Early restoration plan	2013	Gulf of Mexico
<i>Commercial Wind Lease Issuance and Site Characterization Activities on the Atlantic Outer Continental Shelf Offshore New Jersey, Delaware, Maryland, and Virginia— Environmental Assessment</i>	Final Environmental Assessment	BOEM	Commercial wind lease	2012	Atlantic
<i>Drakes Bay Oyster Special Use Permit</i>	Final Environmental Impact Statement	National Park Service	Aquaculture lease	2012	Pacific

¹⁷ It is important to note that all of the federal agencies discussed actively use GIS software in environmental analysis. Interviews with GIS experts indicate that almost any data type can be mapped. Time-series analysis and long-term impacts could present the most difficult programming challenges—for discussion of such hurdles, see *infra* Part V.

¹⁸ The Final version of the *Deepwater Horizon* Programmatic EIS was released as the report was going to press; however, it did not undergo changes that significantly affected the analysis in this report.

Document Name	Document Type	Agency	Activity	Year	Region
<i>Chukchi Sea Planning Area Oil and Gas Lease Sale 193</i>	Supplemental Environmental Impact Statement	BOEM	Oil and gas lease sale	2011	Alaska
<i>Amendment 20 Rationalization of the Pacific Coast Groundfish Limited Entry Trawl Fishery—Final Environmental Impact Statement</i>	Final Environmental Impact Statement	Pacific Fishery Management Council and NMFS	FMP amendment	2010	Pacific
<i>Amendment 16 to the Northeast Multispecies Fishery Management Plan</i>	Final Supplemental Environmental Impact Statement	NEFMC & NMFS	FMP Amendment	2009	Atlantic
<i>Florida Keys National Marine Sanctuary Final Management Plan and Environmental Impact Statement</i>	Final Environmental Impact Statement	NOAA	Sanctuary designation	1996	Atlantic/ Gulf of Mexico

The seven selected documents include a broad range of NEPA assessments, including documents prepared by the different major federal agency actors in the ocean and coastal environment (BOEM, NMFS/NOAA, and EPA), addressing different types of actions in varying geographic areas. Specifically:

- Two BOEM documents were reviewed. One focused on commercial wind leasing in the Atlantic and one focused on oil and gas leasing offshore of Alaska, allowing review of alternative and traditional energy activities.
- Three NMFS/NOAA documents were reviewed. The Amendment 20 assessment is a final environmental impact statement (EIS) whose footprint includes much of the Pacific Coast, while the Amendment 16 assessment is a supplemental EIS involving northeast groundfish fisheries; reviewing both facilitated analysis of different regions as well as supplemental documents. The Florida Keys Marine Sanctuary EIS involves a management decision to plan for and enable multiple economic uses of the marine environment, allowing review of a document that focuses on place-based planning and zoning.
- One NPS document was reviewed, concerning oyster harvesting in Drakes Bay, California. It also allowed review of an action with smaller geographic scope and exploration of place-based decisions about compatible and non-compatible uses.
- Finally, one multi-agency document was reviewed. A programmatic environmental impact statement related to *Deepwater Horizon* early restoration was reviewed as an example of restoration-focused assessment and a broad action with the potential for extensive impacts across time and space.

A. Content

A variety of NEPA information is or could be shared in a geospatial way. Table 2 summarizes categories of geospatial information, along with descriptions and examples from the NEPA documents reviewed.

Table 2. Geospatial Information Content Categories

Category	Description	Examples
Agency Action Footprint	Defining the scope or mapping the area of the project	Proposed leases, groundfish management area, restoration project locations
Physical Oceanography and Geology	Physical and geological attributes of ocean area	Ocean circulation, bathymetry
Coastal Geography	Attributes of coastal land and estuaries	Coastal plain, flood zones, hydrology
Water and Air Quality	Pollution levels	Indices or maps of runoff, water quality
Weather Patterns	Meteorological attributes of area	Seasonal hurricane tracks
Fish Habitat and Migration Patterns	Fish species ranges	Essential fish habitat, anadromous species migrations
Other Animal Habitat and Migration Patterns	Species ranges and movement patterns	Marine mammal habitat, whale migrations, migratory bird flyways
Vegetation	Vegetation ranges and zones	Eelgrass cover, wetlands maps
Marine Protected Areas	Areas designated to be protected from one or more activities or development	Marine reserves, marine sanctuaries, fishery restriction zones
Commercial Fishing and Processing Information	Landing, fisheries management, or processing	Landing data and sites, processor data and sites, fishing ports
Energy Development	Locations of offshore sites and activities	Energy lease areas, existing exploitation sites (e.g., oil and gas wells)
Shipping Lanes and Vessel Traffic	Information concerning location and number of ships	Vessel use and tracks, vessel counts by state and port
Onshore Infrastructure and Land Use	Coastal development and existing structures	Ports and port groups, onshore facilities and operations, military installations, canals
Anthropogenic Impacts	Consequences of development or	Spill study areas, impacts on soundscapes

Category	Description	Examples
	other actions on resources	
<i>Social and Economic Factors</i>	Data concerning human populations	Population distribution, working waterfronts data, fishery dependent communities data, environmental justice indices
<i>Recreation and Tourism</i>	Public use and enjoyment of activity area	Recreational charter boat fishing effort
<i>Social and Cultural Sites</i>	Sites of social significance	Shipwrecks and lighthouses

Certain categories of geospatial information are commonly found in NEPA documents. Some categories are mandated by CEQ regulations or agency policy, while others are included based on the expected impact of a specific action. Within this section, we look at the full spectrum of categories to examine the potential scope of a Geospatial NEPA system and what types of information it could and/or should consider.

To that end, we first examined the content that was mapped. Next, we reviewed geospatial information that was not mapped – that is, geospatially referenced data that were presented in narrative form or with tables. For example, the Drakes Bay NEPA document reviewed groundwater resources, limiting the discussion to narrative information without a geospatial component; however, the location of groundwater resources could be geospatially referenced. Other examples include:

- Energy resource assessments and pipeline locations
- Social/community impacts
- Onshore wilderness/public lands areas
- Soundscapes

Table 3 summarizes how frequently we encountered each category of geospatial information in the documents reviewed. It differentiates between instances when the document included the data in a map-based form (labeled with an “X”) versus when the document included geospatially-relevant data without maps (labeled with an “O”).

Table 3. Geospatial Content Category Mapping by NEPA Document (X indicates map included, O indicates geospatial information present but not mapped)¹⁹

Category	DWH	Commercial Wind Lease	Drakes Bay	Chukchi Sea	Amend. 20	Amend. 16	FL Keys
Agency Action Footprint	X O	X O	X	X	X O	X	X O
Physical Oceanography and Geology	X O			X		X	X
Coastal Geography	X O		X	X		X	X
Water and Air Quality		X O	X				O
Weather Patterns		X					
Fish Habitat and Migration Patterns	X		O	X O	X O	X	O
Other Animal Habitat and Migration Patterns	X O	O	X O	X O	O	X	X O
Vegetation	O	O	X			X	
Marine Protected Areas	O		X		X O		
Commercial Fishing and Processing Information	X O	X	O		X O	X O	
Energy Development		X		X	O		
Shipping Lanes and Vessel Traffic	X	X	X			O	X
On-Shore Infrastructure and Land Use	X		X		X O		X O
Anthropogenic Impacts	O		X O	X O			
Social and Economic Factors	O	O	X O		O	O	X O
Recreation and Tourism	X O						O
Social and Cultural Sites							X

While the sample size of reviewed documents is not large enough to make quantitative assertions, several observations stand out:²⁰

¹⁹ In some instances, both an X and an O is included when a particular document maps the category in one section, but does not map the category in another although geospatially-relevant data is discussed. For example, the Deepwater Horizon document maps the “Agency Action Footprint” in relation to the general Gulf Coast region where projects have been selected, but does not map some specific project areas that are instead described narratively.

²⁰ Within this summary list, “some” means 1-2; “much” or “many” means 3-5; and “most” refers to all or all but one of the assessments reviewed.

- The agency action footprint is mapped in most NEPA documents reviewed. Each document defines where actions will occur.
- Habitats and migration ranges are mapped in many documents. Marine mammal ranges and migration patterns are mapped most frequently; fish habitat and migration patterns are mapped less often. Many times, habitat is discussed without including maps.
- Coastal geography, physical oceanography, and geology are mapped much of the time; marine protected areas (MPAs) are mapped some of the time.
- Fishing and processing data and onshore infrastructure and land use are mapped much of the time.
- Geospatial information related to social and economic data was discussed in many documents, but was only mapped in some of the documents reviewed.
- Predicted impacts are only mapped some of the time.
- Shipping lanes and vessel traffic are mapped in many of the documents reviewed.

Generally speaking, categories that were mapped much of the time have well-defined spatial boundaries. The agency action footprint, coastal geography, physical oceanography and geology, MPAs, and energy development sites usually have specific locations that can be mapped.

B. Design Approaches

As discussed above, there are three general instances involving geospatial information in the NEPA documents reviewed:

- Geospatial information is present and is mapped
- Geospatial information is present and is not mapped
- Geospatial information is not present but could be obtained and included

Below, instructive examples are provided illustrating each of these three instances in practice.

i. Geospatial information is present and is mapped

The Affected Environment section of NMFS' Amendment 20 EIS provides two examples of mapping multiple variables. First, Essential Fish Habitat is mapped, then overlaid by fishing gear restrictions, depth, and major ports, from Seattle to Los Angeles – in short, the map displays the program area, fish habitat and fishing, and coastal geography (Figure 1). Second, fish processing relationships are mapped, including processing volume and transportation routes – in short, the map includes fishing and processing and social and economic relationships (Figure 2).

Figure 1. EFH and Program Area

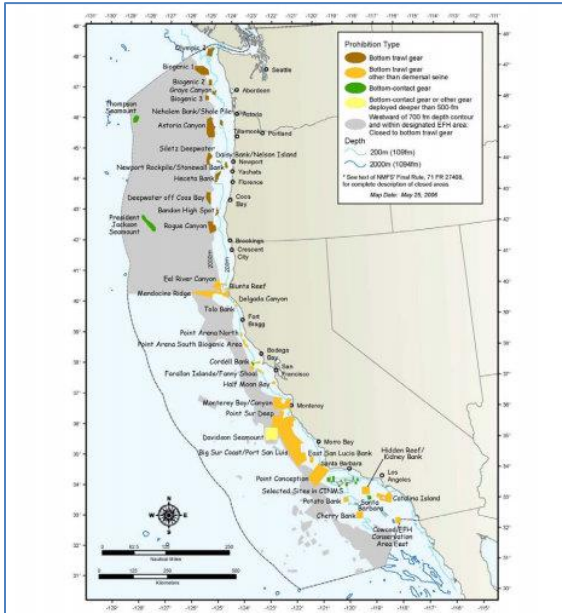


Figure 3-3. EFH closed areas. (Source: http://www.nwr.noaa.gov/Groundfish-Halibut/Groundfish-Fishery-Management/Groundfish-Closed-Areas/Index.cfm#CP_JUMP_30292)

Figure 2. Processing Relationships

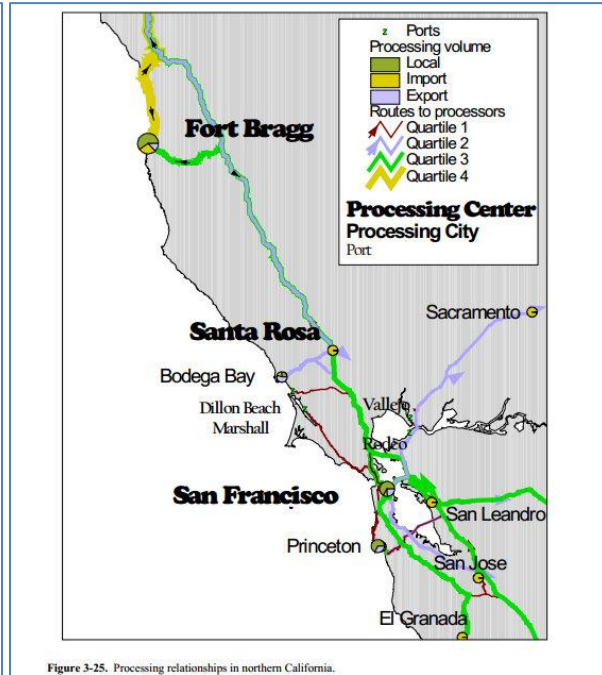
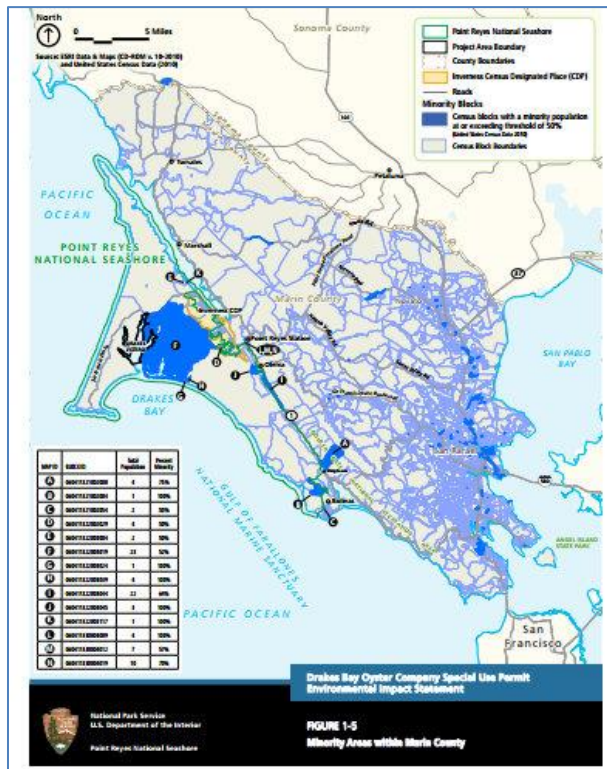


Figure 3-25. Processing relationships in northern California.

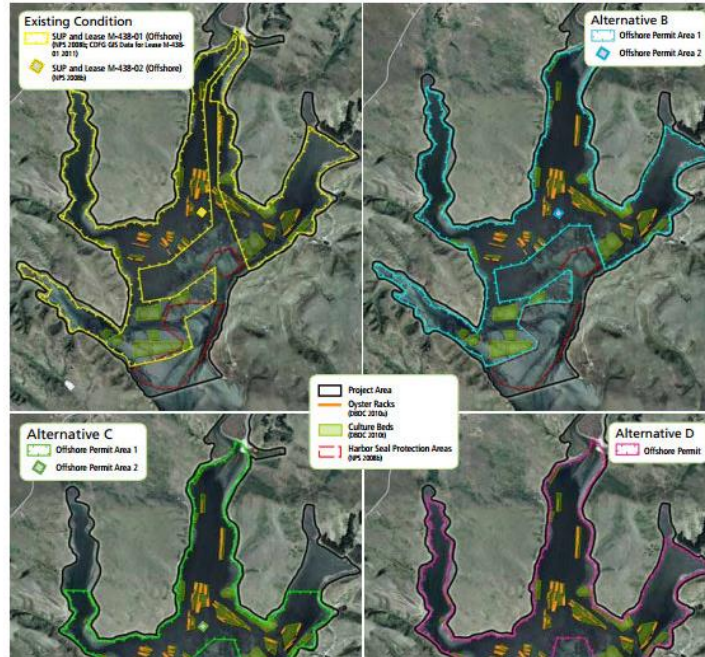
The Drakes Bay Oyster EIS was another document that mapped social and economic variables (Figure 3).

Figure 3. Racial Distribution Mapping



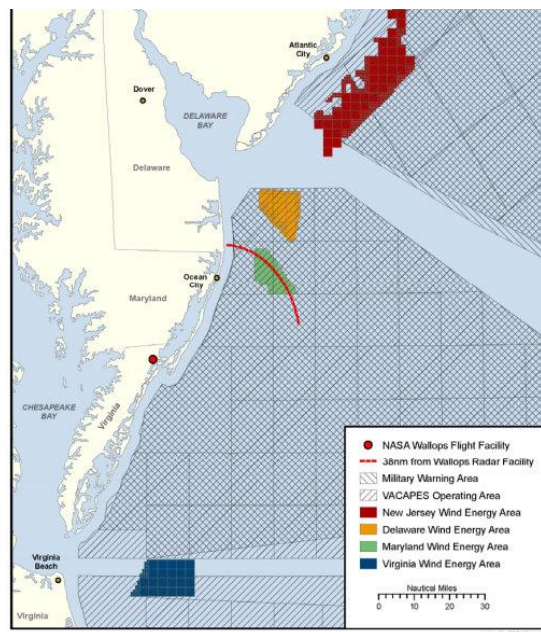
Drakes Bay is the only document reviewed that mapped all of the alternatives on one page (Figure 4).

Figure 4. Mapping of Alternatives



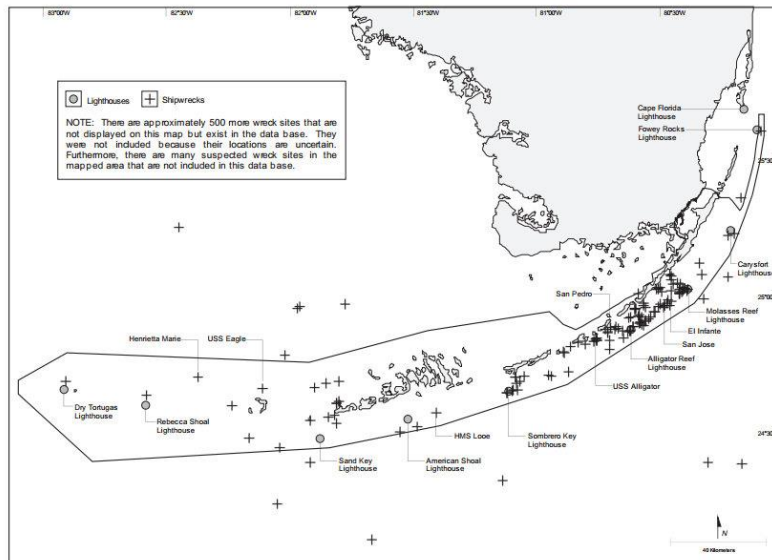
The Commercial Wind Lease document was one of many that mapped military areas. The analysis mapped the existing military areas in relation to potential lease areas (Figure 5).

Figure 5. Military Areas and Program Area



Sites of social or cultural significance were mapped in one of the documents studied, the National Marine Sanctuary EIS, which mapped historic shipwrecks and lighthouses (Figure 6).

Figure 6. Locations of Historic Lighthouses and Selected Shipwrecks



Throughout the documents reviewed, maps are presented for many individual variables, but it is uncommon for maps to combine multiple categories of variables into a single map. Most of the mapped variables could likely be transferred into a GIS system, though it is difficult to discern whether the underlying data include GIS-compatible referencing. While many maps are included, it is rare for the geospatial coordinates themselves to be included in the NEPA documents.

ii. Geospatial information is not present but could be available

There are many instances in which no geospatial information is presented, though the variables are likely conducive to mapping. In such instances, it is unclear whether underlying GIS data are available or not. If they are, there is a clear opportunity to strengthen decisions with geospatial approach. If not, it may be worth exploring whether there are ways to encourage collecting accompanying GIS information for certain data sets that lend themselves to a map-based data system.

For example, in the Amendment 16 EIS, managed species are discussed in bullet points, but geospatial information for range or habitat is not included (Figure 7).

Figure 7. Managed Stocks

- With the addition of Atlantic wolffish, the managed stocks/stocks in the fishery will be:
- GOM cod
 - GB cod
 - GOM haddock
 - GB haddock
 - CC/GOM yellowtail flounder
 - GB yellowtail flounder
 - SNE/MA yellowtail flounder

In this instance, it could be informative to see how the habitats overlap with one another, in order to understand the geospatial interaction of the eight stocks and the reasoning for management divisions.

Similarly, in the *Deepwater Horizon* NEPA document, seagrass habitat is presented in a table that includes a narrative description of habitat range (Figure 8). If underlying GIS data are available, they could be included in a map-based format, varying in detail based on the level of available information (e.g. sharing general habitat ranges versus sharing specific locations of existing habitat).²¹

Figure 8. Seagrass Habitat Tables

Table 3-1. Seagrass species in the Gulf of Mexico.

COMMON NAME	HABITAT NOTES	GEOGRAPHIC DISTRIBUTION
Manatee grass	Subtidal environments (deeper waters) of high salinities.	Mainly in southern Texas and Florida, portions of Louisiana and Mississippi.
Shoal grass	Often exposed during low tide. Early colonizer of impacted areas.	Most common in Mississippi and Alabama. Also occurs in Texas and Louisiana, and Florida.
Turtle grass	Temperature limited, deeper waters.	Most abundant and widely spread in Gulf. Distributed in portions of Texas, Louisiana, Mississippi, and Florida.
Widgeon grass	Grows in both freshwater and saline environments.	Widespread along Texas, Louisiana, and Florida, portions of Mississippi, and Alabama. Dominant in some areas of Louisiana.
Paddle grass	Can grow in turbid waters.	Portions of Florida.
Star grass	Small plant growing in shallow waters.	Widespread in Florida, also occurs in portions of Texas and Mississippi.
Water celery/Eel grass	Grows in shallow coastal embayments and prefers fresh to brackish waters.	Present in all Gulf states.

Here, given the varying habitats of each species, it could be relevant to management decisions to see where specific seagrass is present.

²¹ In this instance, as in many, it is difficult to discern whether the geographic distribution notes are supported by GIS data. The underlying citation is to a 2004 Gulf of Mexico Program report that includes maps for seagrass generally, but does not differentiate between species and does not seem to utilize GIS polygons. At a minimum, it is likely that this dataset could be mapped using GIS for seagrass generally. See Gulf of Mexico Program, Seagrass Habitat in the Northern Gulf of Mexico 16-17 (2004), http://gulfsi.usgs.gov/gom_ims/pdf/pubs_gom.pdf.

In some instances, data that could be mapped are incorporated by reference, which may diminish the value of the primary information for decision-makers and the public who may not review the reference document. For example, in the Commercial Wind Lease document, coastal habitat is incorporated by reference, which may or may not have geospatial maps (Figure 9).

Figure 9. Incorporation by Reference

4.1.2 Biological Resources

4.1.2.1 Coastal Habitats

4.1.2.1.1 Description of the Affected Environment

The Mid-Atlantic WEAs are located offshore of the Atlantic coastal plain. This plain is a flat stretch of land that borders the Atlantic Ocean for approximately 2,200 miles from Cape Cod through the southeast United States. The general description of coastal habitats along the Atlantic Coastal Plain are incorporated here by reference and can be found in Chapter 4.2.13 of the Programmatic EIS (USDOJ, MMS, 2007a) and summarized in this section. The following sections include a description of the affected coastal environments for each state.

While incorporation by reference likely increases efficiency in the NEPA process and is particularly useful when tiering NEPA documents, it could make comparing variables difficult due to the dispersed nature of the data. A geospatial approach to NEPA could use incorporation by reference to create a central data system where the map-based data in the reference document could be included in the system along with links to the reference document.

In relation to social and economic categories, the *Deepwater Horizon* programmatic EIS demonstrates a key challenge: “Only basic information about the social and economic make-up of the Gulf Coast region is described in this document because socio-economic interactions can be difficult to describe and predict at the programmatic level.” Mapping of social and economic data may be omitted in many documents due a lack of data. While mapping known data is unlikely to overcome narrative and predictive difficulties, mapping known data may reduce the risk of such data being overlooked altogether.

iii. Geospatial information is present and is not mapped

In other instances, geospatial information is available and included in the document, but is presented in a table instead of in a map. It would seem beneficial not only to present such underlying data but also to represent the information as geospatial data layers in a data system and include such information in a map within a NEPA document. One example is seen in the Amendment 20 EIS, where the latitudinal distribution of the trawl catch is presented in a table (Figure 10).

Figure 10. Trawl Catch with Geospatial Table

Table 3-34. Latitudinal distribution of retained trawl catch (mt), 2003-06.

Gear	Latitude Area	Year			
		2003	2004	2005	2006
Bottom Trawl	34° 27' to 36°	716	628	388	126
	36° to 38°	1,312	1,589	1,111	840
	38° to 40° 10'	1,594	1,497	1,329	1,185
	40° 10' to 42°	3,113	1,758	2,548	2,744
	42° to 44°	2,975	2,480	2,637	3,051
	44° to 46°	2,660	2,233	2,438	2,820
	46° to 48°	3,927	4,915	4,914	4,783
	48° to US/CAN	3,737	3,029	2,539	1,549
Midwater Trawl	34° 27' to 36°				
	36° to 38°				
	38° to 40° 10'	C	C		C
	40° 10' to 42°	1,038	4,695	3,870	5,228
	42° to 44°	1,888	3,977	4,848	20,294
	44° to 46°	26,025	51,129	47,471	25,646
	46° to 48°	17,432	21,528	24,902	43,008
	48° to US/CAN	133	7,299	16,134	2,062

Source: PacFIN logbook data. November 2007

This tabular presentation makes it difficult to compare retained trawl catch in different areas. It is also not apparent how the specific latitude divisions are significant. A geospatial approach could allow more meaningful comparisons over space and time.

Similarly, in Amendment 16, essential fish habitat areas are described in a table that covers more than five pages (excerpt shown in Figure 11).

Figure 11. EFH in Atlantic (excerpt from Table 46)

Table 46 - EFH descriptions for all benthic life stages of federally-managed species in the U.S. Northeast Shelf Ecosystem. Species with EFH vulnerable to bottom tending gear are shaded (see Stevenson et al. 2004).

Species	Life Stage	Geographic Area of EFH	Depth (meters)	EFH Description
American plaice	juvenile	GOME and estuaries from Passamaquoddy Bay to Saco Bay, ME and from Mass. Bay to Cape Cod Bay, MA	45 - 150	Bottom habitats with fine grained sediments or a substrate of sand or gravel
American plaice	adult	GOME and estuaries from Passamaquoddy Bay to Saco Bay, ME and from Mass. Bay to Cape Cod Bay, MA	45 - 175	Bottom habitats with fine grained sediments or a substrate of sand or gravel
Atlantic cod	juvenile	GOME, GB, eastern portion of continental shelf off southern NE and following estuaries: Passamaquoddy Bay to Saco Bay; Mass. Bay, Boston Harbor, Cape Cod Bay, Buzzards Bay	25 - 75	Bottom habitats with a substrate of cobble or gravel
Atlantic cod	adult	GOME, GB, eastern portion of continental shelf off southern NE and following estuaries: Passamaquoddy Bay to Saco Bay; Mass. Bay, Boston Harbor, Cape Cod Bay, Buzzards Bay	10 - 150	Bottom habitats with a substrate of rocks, pebbles, or gravel
Atlantic halibut	juvenile	GOME, GB	20 - 60	Bottom habitats with a substrate of sand, gravel, or clay
Atlantic halibut	adult	GOME, GB	100 - 700	Bottom habitats with a substrate of sand, gravel, or clay
Atlantic herring	eggs	GOME, GB and following estuaries: Englishman/Machias Bay, Casco Bay, and Cape Cod Bay	20 - 80	Bottom habitats attached to gravel, sand, cobble or shell fragments, also on macrophytes

The narrative description of geographic area may be supported by geospatial information describing habitat. A geospatial data system that incorporates EFH data would facilitate cross-species habitat comparison.

The potential utility of a geospatial system for NEPA is also evident in onshore areas, where human use, development, and habitat intersect across many management decisions. For example, in the Commercial Wind Lease document, a table of beach locations is presented (Figure 12).

Figure 12. Coastal Beaches

Number of Coastal Beaches in New Jersey, Maryland, Delaware and Virginia by County

Coastal Counties	Number
Middlesex – NJ	4
Monmouth – NJ	58
Ocean – NJ	84
Atlantic – NJ	48
Cape May – NJ	69
Sussex – DE	21
Anne Arundel – MD	27
Baltimore – MD	3
Calvert – MD	9
Cecil – MD	6
Kent – MD	8
Queen Anne’s – MD	1
Somerset – MD	2
St. Mary’s – MD	2
Worcester – MD	10
Accomack – VA	2
Gloucester – VA	1
Hampton – VA	2
King George – VA	1
Mathews – VA	1
Newport News – VA	4
Norfolk – VA	9
Northampton – VA	2
Virginia Beach – VA	24
York - VA	1
Total	399

Source: USEPA, 2008b.

A map would help clarify how these beaches are connected to each other and to management decisions.

Demographic and socioeconomic data are often presented in tables. In the Commercial Wind Lease document, a table is used for county-by-county ocean-related tourism information (Figure 13).

Figure 13. Tourism and Employment

Related Tourism and Recreation Economy by County, 2004		
New Jersey Counties	Employment	Wages
Atlantic	7,304	\$126,533,089
Cape May	7,451	\$140,660,261
Middlesex	1,510	\$25,334,877
Monmouth	7,226	\$120,926,902
Ocean	9,530	\$148,370,859
Total	33,021	\$561,825,988
Maryland Counties	Employment	Wages
Anne Arundel	11,917	\$234,873,811
Baltimore	2,415	\$33,447,117
Calvert	1,327	\$14,709,539
Cecil	2,009	\$27,550,770
Queen Anne's	1,682	\$31,417,192
Somerset	442	\$4,462,424
St. Mary's	2,175	\$24,267,003
Worcester	977	\$12,282,840
Total	22,944	\$383,010,696

Geospatial distribution of employment and income is likely relevant to environmental justice and to the ultimate management decision chosen. These types of economic variables with defined geographic boundaries (such as counties) are conducive to mapping, allowing users and practitioners to visually display relevant information. Also, sharing such data in a geospatial way may help the public understand potential impacts to their local ocean and coastal environment in a way that would not be clear from existing approaches to NEPA analysis.

C. Summary

Based on the documents reviewed, it appears the inclusion and presentation of geospatial information depends on the category of information and the scope of the management decision at issue. In all of the NEPA documents reviewed for structural analysis, the section on Affected Environment included at least one geospatial map. Some aspects of preexisting environmental conditions of the study area, usually included in the Affected Environment section of NEPA documents, are mapped frequently.

Many different types of data are included in the NEPA documents, and the data are presented in a range of ways. Categories that were mapped most often were those that have readily available data and well-defined spatial boundaries. However, almost all the identified categories were mapped in at least one document, suggesting the obstacles to incorporating NEPA-derived data sets into geospatial data systems are surmountable (although certainly some variables may be more conducive to geospatial presentation than others).

A key question, which requires additional exploration, is the availability of the underlying data. Our report suggests that there are myriad types of data that *may* be available for integration into a

geospatial system, but additional research is needed to explore when, where, and how these various information types already have underlying GIS data versus when it would need to be collected. In some instances, data may be readily available, leading to a low cost burden for incorporating it into a central data system. In other instances, data may need to be produced, introducing higher costs. As discussed later, it is important to consider cost and institutional capacity during implementation of Geospatial NEPA. Linking a geospatial map of the action footprint to the document itself to make information readily available is the lowest-cost, lowest-burden first step. What comes next depends on a balancing of priorities and resources.

When geospatial information is presented, it is usually in the form of maps but sometimes shared in a narrative way, including geospatial coordinates in limited instances. In instances when geospatial information is present but not mapped, it may be possible to incorporate tabular and narrative data into a central geospatial system.

The availability of geospatial data in existing documents provides a starting point for the development of a data system that includes maps of readily available, spatially-defined data. Whether and how such a system would be allowed, supported, or facilitated by existing agency policies is the focus of the following sections.

III. Agency Policies Relevant to Geospatial NEPA

Environmental planning and assessment practices that integrate geospatial data will need to build from current laws, policies, and guidance. The following section reviews this existing framework as it relates to geospatial data, focusing specifically on federal efforts to coordinate data aggregation and federal agencies that are prominently involved in coastal and marine decisionmaking.

NEPA directs agencies to use a systematic, interdisciplinary approach to evaluate all major federal actions significantly affecting the quality of the human environment. Specific requirements depend on the action at issue, varying from a comprehensive environmental impact statement (EIS) to an environmental assessment (EA) to determine whether there will be significant impacts and a finding of no significant impact (FONSI) when the significance threshold is not met. While the framework for NEPA assessment is spelled out in the statute, agency regulations and policies determine how NEPA is implemented in practice for specific management decisions.

Several key themes emerge from a review of the regulations, policies, and guidance from the Council on Environmental Quality (CEQ), the National Oceanic and Atmospheric Administration (NOAA), the Bureau of Ocean Energy Management (BOEM), the Environmental Protection Agency (EPA), and the Federal Geographic Data Committee (FGDC), including the following:²²

*1. Institutional coordination and integration of analysis*²³

- NEPA documents and assessments should be integrated when possible; in practice, integration often involves specific strategies such as incorporation by reference and adoption of other assessments.
- Agencies are to consult cooperatively with other agencies and entities, working together to make the data-gathering, data dissemination, and decisionmaking processes more efficient.

2. Information-gathering requirements and geospatial data

- Geographic context and geospatial information are important considerations throughout the NEPA process, such as when agencies determine whether a particular action is “significant.”
- All agencies must integrate federal laws and executive orders into the environmental review and information-gathering process.²⁴

*3. Coordinated data systems and tools*²⁵

- There is a general desire to coordinate data systems and utilize geospatial mapping tools, with a particular focus on ocean planning and mapping.

²² Not all themes are discussed relating to each agency.

²³ See, e.g., 40 C.F.R. § 1501.1 (CEQ regulations regarding cooperation); 40 C.F.R. § 1500.2 (regarding incorporation and adoption).

²⁴ See, e.g., 40 C.F.R. § 6.200.

²⁵ Data systems and tools are the topic of Section IV, thus are only discussed briefly here in relation to overarching CEQ policy.

As an overarching matter, federal NEPA policies are conducive to Geospatial NEPA. It is unlikely that policies will need to be *repealed or amended* to implement a geospatial database that aggregates NEPA documents and maps basic project footprints. However, policies could be *supplemented* with additional provisions and/or guidance in order to integrate current agency practices (which are often intra-agency) with a comprehensive, interagency geospatial data system. In short, while the current framework does not impede the development of Geospatial NEPA systems, neither does it actively facilitate or require it.

A. Council on Environmental Quality

Title II of NEPA created the Council on Environmental Quality, which issues regulations and provides guidance for implementing NEPA in practice.²⁶ CEQ regulations provide requirements for scoping,²⁷ environmental impact statements,²⁸ commenting,²⁹ the role of NEPA in decisionmaking,³⁰ and public involvement,³¹ along with other requirements.³² In addition, CEQ issues guidance documents and memoranda for implementing the regulatory requirements and optimizing the NEPA process.

CEQ's regulations and guidance provide a regulatory floor upon which agencies like NOAA, EPA, and BOEM (discussed in subsequent sections) can develop additional agency-specific regulations and guidance for carrying out NEPA's impact assessment requirements. The purpose of CEQ regulations is to "tell federal agencies what they must do to comply with the procedures and achieve the goals" of NEPA.³³ Generally, the regulations encourage the use of geospatial information, but do not require it.

i. Coordination and Integration

At the planning stage, agencies are to consult cooperatively.³⁴ Lead agencies must use the environmental analyses of cooperating agencies that have jurisdictional authority or special expertise to the maximum extent possible.³⁵ CEQ regulations reiterate the policy declared in the Act that agencies should "utilize a systematic, interdisciplinary approach which will insure the integrated use of the natural and social sciences and the environmental design arts."³⁶

²⁶ 42 U.S.C. § 4341.

²⁷ 40 C.F.R. § 1501.7.

²⁸ 40 C.F.R. § 1502.

²⁹ 40 C.F.R. § 1503.

³⁰ 40 C.F.R. § 1505.

³¹ 40 C.F.R. § 1506.6.

³² See 40 C.F.R. § 1506.

³³ 40 C.F.R. § 1500.1(a).

³⁴ 40 C.F.R. § 1501.1.

³⁵ 40 C.F.R. § 1501.6.

³⁶ 40 C.F.R. § 1501.2. *Environmental design arts* has been interpreted to include architecture and urban planning. Charles H. Eccleston, *The NEPA Planning Process: A Comprehensive Guide with Emphasis on Efficiency* 74 (1999).

Regulations call for the Affected Environment and Environmental Consequences sections to consider the proposed action's environmental context in order to achieve the regulatory mandate.³⁷ Material, including technical material, can be incorporated by reference when it is not proprietary and is available for inspection.³⁸ In cooperating with state and local agencies, environmental research and studies can be conducted jointly.³⁹

CEQ guidance documents state the basic principle that "NEPA reviews should coordinate and take advantage of existing documents and studies, including through adoption and incorporation by reference."⁴⁰ Methods of incorporating by reference can include providing a hyperlink to an online location.⁴¹

ii. Information Requirements

Information produced by the NEPA process must be high-quality.⁴² The goal is for federal agencies to implement procedures "to make the NEPA process more useful to decisionmakers and the public."⁴³ To that end, the CEQ regulations guide agencies to reduce paperwork and reduce delay by integrating documents and assessment, along with other mandates.⁴⁴

Geography is referenced several times in the CEQ regulations, and these provisions could provide the impetus for a more thorough geospatial approach. According to regulations, in preparing environmental impact statements on broad actions, one way to conduct the evaluation is geographically, with considerations such as body of water, region, or metropolitan area.⁴⁵ In addition, unique characteristics of the geographic area are considerations in making a "significance" determination.⁴⁶

CEQ reports and other publications further expand on the potential for geospatial information used in the NEPA process. A 2003 report specifically referenced geospatial information: "[m]any agencies with NEPA-process tracking systems are planning enhancements, such as searchable libraries of NEPA analytical documents and links to geospatial data and other reference documents and studies."⁴⁷ The report says that many respondents were interested in using spatial data and GIS.⁴⁸ It also discusses the

³⁷ See 40 C.F.R. § 1502.16.

³⁸ 40 C.F.R. § 1502.21.

³⁹ 40 C.F.R. § 1506.2.

⁴⁰ Memorandum for Heads of Federal Departments and Agencies: Improving the Process for Preparing Efficient and Timely Environmental Reviews under the National Environmental Policy Act 1 (March 6, 2012), *available at* http://ceq.hss.doe.gov/current_developments/docs/Improving_NEPA_Efficiencies_06Mar2012.pdf.

⁴¹ *Id.* at 13.

⁴² 40 C.F.R. § 1500.1(b).

⁴³ 40 C.F.R. § 1500.2.

⁴⁴ 40 C.F.R. §§ 1500.4, 1500.5.

⁴⁵ 40 C.F.R. § 1502.4.

⁴⁶ 40 C.F.R. § 1508.27.

⁴⁷ COUNCIL ON ENVTL. QUALITY, *Chapter 1: Technology and Information Management and Security*, in MODERNIZING NEPA IMPLEMENTATION 9 (2003), *available at* <http://ceq.hss.doe.gov/ntf/report/chapter1.pdf>.

⁴⁸ *Id.* at 12.

importance of creating NEPA document repositories and standardizing data across agencies. However, the report's authors "[do] not think that CEQ is in a position to develop document repositories or standardize environmental information."⁴⁹ In the decade since the report, EPA has created an electronic filing system for all EIS documents—however, despite efforts described by interviewees, data have yet to be standardized across agencies and EPA's filing system does not enable the display of geospatial data layers.

iii. Efforts to Coordinate Data

CEQ conducted a 2006 study "to identify and assess institutional options for developing a national system of environmental indicators."⁵⁰ The study resulted in a National Environmental Status and Trends indicators (NEST indicators) memo, which sets forth an action plan to develop a national system.⁵¹ The memo stated that "data are often difficult to find, combine, compare, and aggregate," resulting in "limited utility to broadly describe, consistently characterize, or confidently assess status and trends of the Nation's environment consistent with the intent of [NEPA]." NEST indicators have two primary components:

- high-quality, science-based statistical measures of selected conditions of the environment and natural resources, which
- address topics that are sufficiently important and cross-cutting to warrant the acquisition of data using measurement methods and statistical designs that are consistent across the entire country and repeated regularly over time.⁵²

To that end, pilot projects were developed to implement the NEST indicators model, with activities coordinated through subcommittees of the Committee on Environment and Natural Resources and the National Science and Technology Council. NEST indicators focused initially on water quality, quantity, and other metrics.⁵³ The effort to develop NEST indicators demonstrates the push toward a system that finds, combines, compares, and aggregates data. However, the utility of the system is limited by its scope and the relatively few indicators used. It has not been broadly implemented despite initial efforts.

⁴⁹ *Id.*

⁵⁰ CEQ, OSTP, OMB memo on National Environmental Status and Trends Indicators (June 2008), *available at* http://ceq.hss.doe.gov/nepa/regs/CEQ_OSTP_OMB_NEST_IndicatorsLetter.pdf.

⁵¹ *Id.*

⁵² *Id.*

⁵³ Richard W. Guldin, *National Environmental Status and Trends (NEST) Project*, J. OF FORESTRY (Jan./Feb. 2010), *available at* [http://www.researchgate.net/publication/43291343_National_Environmental_Status_and_Trends_\(NEST\)_Indicators_Project](http://www.researchgate.net/publication/43291343_National_Environmental_Status_and_Trends_(NEST)_Indicators_Project).

B. Environmental Protection Agency

In addition to CEQ regulations and guidelines, EPA implements NEPA through its own set of regulations and guidance materials, primarily through its Office of Federal Activities. EPA is the official recipient of all EISs prepared by federal agencies.⁵⁴ The agency is also required to review and comment on environmental impacts of all major federal actions pursuant to delegated authority from CEQ stemming from a 1977 Memorandum of Understanding,⁵⁵ along with review requirements under Clean Air Act Section 309. EPA implements NEPA pursuant to its promulgated regulations.⁵⁶ Thus, EPA's role in the NEPA process is that of an aggregator, clearinghouse, and reviewer. Its central role in environmental review could allow it to play a lead part in the development and implementation of Geospatial NEPA.

i. Coordination and Integration

As with CEQ, EPA policies focus on coordination with other government entities at the local, state, and federal level, with an aim of reducing duplication of efforts and increasing synergy.⁵⁷ “Early and continued involvement” of other government entities in EPA-led NEPA processes is encouraged,⁵⁸ as is ongoing conflict resolution for disagreements that may arise given varying NEPA policies and procedures.⁵⁹ In the NEPA process, all relevant environmental documents are to be reviewed and incorporated to the extent possible, regardless of whether they were prepared by EPA or another agency.⁶⁰ To those ends, when appropriate, policy guidance can be drafted to further coordination and other goals.⁶¹ In sum, interagency cooperation is a primary theme within EPA's NEPA regulations.⁶²

ii. Information Requirements

EPA NEPA regulations include some general information requirements that may be relevant to a Geospatial NEPA system. Most EPA actions under the Clean Water Act and Clean Air Act are statutorily exempt from NEPA and are granted a categorical exclusion.⁶³ Even when an action may be eligible for a categorical exclusion, however, NEPA review is required when there are “extraordinary circumstances” present—such as expected significant effects on “environmentally important natural resource areas

⁵⁴ See EIS Filing Guidance, 76 Fed. Reg. 2681 (Jan. 14, 2011), available at

<http://www.epa.gov/compliance/resources/policies/nepa/amended-eis-filing-guidance-pg.pdf>

⁵⁵ Transfer of Responsibilities to the Environmental Protection Agency, Memorandum of Agreement between CEQ and EPA (Oct. 7, 1977),

http://ceq.hss.doe.gov/current_developments/docs/CEQEPA_MOU_EIS_Filing_10071977.pdf.

⁵⁶ 40 C.F.R. § 6.

⁵⁷ See 40 C.F.R. § 6.200.

⁵⁸ 40 C.F.R. § 6.103(b)(3).

⁵⁹ 40 C.F.R. § 6.103(b)(4).

⁶⁰ *Id.*

⁶¹ 40 C.F.R. § 6.103(b)(6).

⁶² 40 C.F.R. § 6.202.

⁶³ 40 C.F.R. § 6.101; see also 40 C.F.R. § 1508.4.

such as wetlands, floodplains, significant agricultural lands, aquifer recharge zones, coastal zones, barrier islands, wild and scenic rivers, and significant fish or wildlife habitat.”⁶⁴

In general, geospatial analysis is relevant at all stages of EPA’s NEPA process, from reviewing documents in a given geographic area to defining the scope and content of the analysis itself. For example, in a review of cumulative effects, guidance states that one consideration is “whether the proposed action is one of several similar actions in the same geographic area,” and another is the findings of other documents in the geographic area.⁶⁵ In addition, the geographic boundaries of areas to consider are broad, and impacts assessment “should be based on all resources of concern and all of the actions that may contribute” in the area, without overly restrictive spatial or temporal limits.⁶⁶ Assessment of past, present, and reasonably foreseeable actions is largely to be based on geographic proximity.⁶⁷ Other guidance documents state that geographic factors are important for ecological analysis,⁶⁸ habitat analysis,⁶⁹ coastal floodplains and wetlands documents,⁷⁰ and review of fisheries management plans,⁷¹ among other types of analysis.

As the clearinghouse for EISs, EPA has additional requirements for the filing of NEPA documents. Beginning on October 1, 2012, EPA no longer accepted hard copies of NEPA documents; it now requires all submissions to occur through a new electronic system, e-NEPA.⁷² All documents must be submitted in PDF format, with metadata entered for certain fields.⁷³ However, there is no requirement to submit geospatial data or other underlying information.

C. National Oceanic and Atmospheric Administration

NOAA has a role in the environmental review of most ocean and coastal NEPA decisions—either as the lead agency or as a cooperating or commenting agency—thus its policies are essential for Geospatial NEPA designed to support marine planning. Within NOAA, NEPA is coordinated by the Office of Program Planning and Integration (PPI). The PPI and NOAA regional offices administer the NEPA process guided

⁶⁴ 40 C.F.R. § 6.204.

⁶⁵ EPA, Consideration Of Cumulative Impacts In EPA Review of NEPA Documents 5 (1999).

⁶⁶ *Id.* at 8.

⁶⁷ *Id.* at 11.

⁶⁸ EPA, Considering Ecological Processes in Environmental Impact Assessments (1999).

⁶⁹ EPA, Habitat Evaluation: Guidance for Review in EIS Documents (1993),

<http://www.epa.gov/compliance/resources/policies/nepa/habitat-evaluation-pg.pdf>

⁷⁰ EPA, Statement of Procedures on Floodplain Management and Wetlands Protection (1979),

<http://www.epa.gov/compliance/resources/policies/nepa/floodplain-management-wetlands-statement-pg.pdf>

⁷¹ EPA, Reviewing Environmental Impact Statements for Fishery Management Plans (2005), *available at* <http://www.epa.gov/compliance/resources/policies/nepa/reviewing-EISs-fishery-management-plans-pg.pdf>.

⁷² Submitting Environmental Impact Statements, EPA,

<http://www.epa.gov/compliance/nepa/submiteis/index.html#comments> (last updated Oct. 9, 2012).

⁷³ EPA, E-NEPA: Electronic Submittal of Environmental Impact Statements to EPA (2012),

<http://www.epa.gov/compliance/nepa/submiteis/e-nepa-guide-on-registration-and-preparing-an-eis-for-electronic-submission.pdf>.

by the statute, CEQ guidelines, Department of Commerce guidance, and internal procedures/guidelines, including the NOAA NEPA Handbook.

NOAA Administrative Order Series 216-6 outlines procedures for implementing NEPA for agency actions.⁷⁴ The Order “describes NOAA’s policies, requirements, and procedures for complying with NEPA” and incorporates the implementing regulations and requirements of:

- CEQ regulations, 40 C.F.R. §§ 1500-1508
- Department of Commerce Department Administrative Order (DAO) 216-6
- Executive Order 12898, Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations
- Executive Order 12114, Environmental Effects Abroad of Major Federal Actions
- DAO 216-12, Environmental Effects Abroad of Major Federal Actions⁷⁵

Generally, the process for NEPA review is to define the action, determine NEPA’s applicability, and then prepare the applicable NEPA document.⁷⁶

i. Coordination and Integration

NOAA has a NEPA Coordinator—among the Coordinator’s responsibilities is to develop and recommend national policy, procedures, and coordination actions or measures and to serve as a liaison with EPA.⁷⁷ It is NOAA’s policy to fully integrate NEPA into agency planning and decision-making, including when conducting planning involving other agencies.⁷⁸

Several provisions relate to coordination with other agencies. As a threshold matter, it is Department of Commerce policy to cooperate fully in the national efforts under NEPA, including “extending its services, to the extent of available resources, to other Federal, State, and local agencies to assist in evaluating the impact of Federal actions upon the environment.”⁷⁹ Cooperation with agencies, tribes, and local governments must occur to “the maximum extent practical to reduce duplication in document preparation,” including joint planning and environmental research.⁸⁰

NOAA may adopt NEPA documents of other agencies in some instances.⁸¹ Incorporation by reference may be appropriate for Affected Environment chapters and Cumulative Impacts sections⁸² and is

⁷⁴ NOAA, Administrative Order Series 216-6 (1999), *available at* http://www.nepa.noaa.gov/NAO216_6.pdf.

⁷⁵ *Id.* § 1.02a.

⁷⁶ *Id.* § 5.01b.

⁷⁷ *Id.* § 2.02a.

⁷⁸ *Id.* § 3.01a.

⁷⁹ Department of Commerce, Departmental Administrative Order (DAO) 216-6, Implementing the National Environmental Policy Act (1983), *available at* http://www.osec.doc.gov/opog/dmp/daos/dao216_6.html.

⁸⁰ NOAA Administrative Order 216-6, § 5.09e.

⁸¹ *Id.* § 5.09f.1.

designed to reduce unnecessary duplication of information.⁸³ Other NEPA documents and information, including geospatial information, can be incorporated.⁸⁴ In addition, other NEPA documents can be adopted.⁸⁵ NEPA documents may be combined with related contents of other management plans or amendments to form a “consolidated” document.⁸⁶ Restoration plans and documents may be consolidated as well.

ii. Information Requirements

Many agency policies address the content of NEPA documents prepared by NOAA. The issues and alternatives are to be defined in detail.⁸⁷ Impacts that should be considered during initial scoping include: floodplains, marine sanctuaries and National Estuarine Research Reserves, habitat, state Coastal Zone Plans, environmental justice, and essential fish habitat.⁸⁸ Specific guidance applies to fishery management actions, including cumulative habitat impacts and socioeconomic impacts.⁸⁹ Requirements that “warrant special emphasis” include that the scope of NEPA assessment will consider impacts on the marine environment both within and beyond the Exclusive Economic Zone, and that the order applies to all major federal actions “potentially subject to NOAA’s control and responsibility,”⁹⁰ which includes almost all coastal actions.

Geospatial information is an explicit consideration in several aspects of NOAA’s NEPA process. Assessment of “significance” requires analysis “with respect to society as a whole, the affected region and interests, and the locality,” along with unique characteristics of the geographic area.⁹¹ The geographic scope of the “affected environment” usually contains the site and immediate vicinity of a project; however, cumulative impacts may broaden the range.⁹²

In some instances, CEs exempt certain NOAA actions from environmental review under NEPA. To determine when a CE is warranted, NOAA considers “the nature of the action, the geographic area of the action, the species affected, the season, the size of the area, etc.”⁹³ CEs do not apply if they involve an area with unique geographic characteristics, among other exceptions.⁹⁴

⁸² *Id.* § 5.09d.

⁸³ NOAA, NEPA Handbook 41 (2010), available at http://www.nepa.noaa.gov/NEPA_HANDBOOK.pdf.

⁸⁴ *Id.*

⁸⁵ *Id.* at 74.

⁸⁶ NOAA Administrative Order 216-6, § 6.03a.1.

⁸⁷ *Id.* § 5.02a.

⁸⁸ *Id.* § 5.02c.3.

⁸⁹ *Id.* § 6.02.

⁹⁰ *Id.* § 1.02b.3.

⁹¹ *Id.* § 6.01b.

⁹² NOAA Handbook, at 37.

⁹³ NOAA Administrative Order 216-6, § 5.05b.

⁹⁴ *Id.* § 5.05c.

In terms of information dissemination, EAs do not need to be distributed to the public, but they must be available on request through CDs or hard copy, though posting on the internet is also acceptable.⁹⁵

D. Bureau of Ocean Energy Management

BOEM implements NEPA based on the statute, CEQ regulations, Department of the Interior (DOI) regulations, and agency policy and regulations. In 2011, the Minerals Management Service was split into BOEM and the Bureau of Safety and Environmental Enforcement (BSEE), and BOEM was given primary responsibility for implementing NEPA for offshore resources management decisions.⁹⁶

i. Coordination and Integration

As with EPA and NOAA, when possible BOEM must consult and coordinate with other agencies, government entities, and tribes.⁹⁷ Coordination must occur as early as is feasible.⁹⁸ Cooperating agencies may assist in the collection and processing of data.⁹⁹ It is DOI policy to encourage integrated assessment across agencies, which can be fostered by memoranda of understanding.¹⁰⁰

When available, NEPA documents should use existing analyses from other NEPA documents to assess impacts.¹⁰¹ When data are available in other NEPA documents and the data are relevant to the action at issue, the data should be used in the present analysis if feasible.¹⁰² BOEM calls for incorporation by reference and adoption of other documents as strategies to make the best use of existing NEPA assessments.¹⁰³ Environmental review documents that include associated analyses or studies must indicate where the information is accessible.¹⁰⁴

ii. Information Requirements

BOEM's regulations regarding NEPA relate to specific management actions and information requirements for each. There is specific guidance for exploration plans, development and production plans, development operations coordination documents, and other plans related to energy development activities.¹⁰⁵ Lease applicants, those submitting plans and other documents, and the

⁹⁵ NOAA Handbook, at 46.

⁹⁶ See Reorganization of Title 30: Bureaus of Safety and Environmental Enforcement and Ocean Energy Management, 76 Fed. Reg. 64,431 (Oct. 18, 2011).

⁹⁷ 43 C.F.R. § 46.155.

⁹⁸ 43 C.F.R. § 46.200.

⁹⁹ 43 C.F.R. § 46.220.

¹⁰⁰ Implementing Integrated Analyses in the National Environmental Policy Act (NEPA) Process, ESM 13-10 (Jan. 7, 2013), <http://www.doi.gov/pmb/oepec/upload/ESM13-10.pdf>.

¹⁰¹ 43 C.F.R. § 46.120.

¹⁰² *Id.*

¹⁰³ *Id.*

¹⁰⁴ 43 C.F.R. § 46.430.

¹⁰⁵ *Id.*

agency must comply with NEPA requirements.¹⁰⁶ NEPA documents must describe the following resources, conditions, and activities affected by the planned development:

- (1) Meteorology, oceanography, geology, and shallow geological or manmade hazards;
- (2) Air and water quality;
- (3) Benthic communities, marine mammals, sea turtles, coastal and marine birds, fish and shellfish, and plant life;
- (4) Threatened or endangered species and their critical habitat;
- (5) Sensitive biological resources or habitats such as essential fish habitat, refuges, preserves, special management areas identified in coastal management programs, sanctuaries, rookeries, and calving grounds;
- (6) Archaeological resources;
- (7) Socioeconomic resources including employment, existing offshore and coastal infrastructure (including major sources of supplies, services, energy, and water), land use, subsistence resources and harvest practices, recreation, recreational and commercial fishing (including typical fishing seasons, location, and type), minority and lower income groups, and coastal zone management programs;
- (8) Coastal and marine uses such as military activities, shipping, and mineral exploration or development; and
- (9) Other resources, conditions, and activities identified by BOEM.¹⁰⁷

Geographic vicinity and locations of other development activities are considerations in environmental review.¹⁰⁸ Geospatial information is relevant to most of the categories of information that need to be included in BOEM NEPA assessments.

In disseminating NEPA documents, DOI also encourages to reach the broader public and facilitate review.¹⁰⁹

E. Federal Geographic Data Committee

The Federal Geographic Data Committee (FGDC) is an inter-agency committee formed in 1990 to “promote[] the coordinated development, use, sharing, and dissemination of geospatial data on a national basis,” and is an important inter-agency coordinating entity for NEPA. Office of Management and Budget Circular A-16, Geographic Information and Related Spatial Data Activities, established the

¹⁰⁶ *Id.*

¹⁰⁷ See 30 C.F.R. § 550.227.

¹⁰⁸ 30 C.F.R. § 550.269

¹⁰⁹ Publication and Distribution of Department of the Interior National Environmental Policy Act (NEPA) Compliance Documents via Electronic Methods, ESM 13-7 (Jan. 7, 2013), <http://www.doi.gov/pmb/oepec/upload/ESM13-7.pdf>.

National Spatial Data Infrastructure to coordinate the use and dissemination of geospatial data.¹¹⁰ In 2010, OMB issued supplemental guidance to clarify and improve the implementation of OMB Circular A-16.¹¹¹ The FGDC published the National Spatial Data Infrastructure Strategic Plan 2014-2016, building from the supplemental guidance, to create a national geospatial network.¹¹² The National Geospatial Data Asset Management Plan, published in March 2014, provides specific implementation guidance.¹¹³

i. Coordination and Integration

The FGDC includes participants from most federal agencies, with the broad goal of sharing digital geographic information resources.¹¹⁴ The FGDC aims to coordinate the use of geospatial information across agencies, primarily focusing on integrating indicators that are relevant in the NEPA process. Its three general goals (not specific to NEPA) for 2014-2016 are to:

1. Develop capabilities for national shared services;
2. Ensure accountability and effective development and management of federal geospatial resources; and
3. Convene leadership of the national geospatial community.¹¹⁵

In addition, the FGDC has a Marine & Coastal Spatial Data Subcommittee, whose members include NOAA, EPA, and other agencies, to coordinate ocean-related efforts across agencies. While not directly related to NEPA, given its cross-agency leadership role as a facilitator, curator, and enabler,¹¹⁶ the FGDC could be an important partner as agencies develop innovative new approaches such as Geospatial NEPA.

F. Summary and Conclusions

In summary, federal NEPA policies seem conducive to Geospatial NEPA. The policies reviewed generally call for coordination, integration of analysis, consideration of geographic factors and geospatial context, and incorporation of federal laws and executive orders. These policies also align with marine planning goals as expressed in Executive Order 13,547 and the recommendations of the Interagency Ocean Policy Task Force, which emphasize the need for coordination, comprehensive management systems, and “spatial plans that build upon and improve existing Federal, State, tribal, local, and regional

¹¹⁰ Office of Management and Budget, Circular A-16 Revised, Coordination of Geographic Information and Related Spatial Data Activities (Aug. 19, 2002), *available at* http://www.whitehouse.gov/omb/circulars/a016/print/a016_rev.html.

¹¹¹ Office of Management & Budget, Issuance of OMB Circular A-16 Supplemental Guidance (Nov. 10, 2010), *available at* <http://www.whitehouse.gov/sites/default/files/omb/memoranda/2011/m11-03.pdf>.

¹¹² Federal Geographic Data Committee, National Spatial Data Infrastructure Strategic Plan 2014-2016 (2013), *available at* <http://www.fgdc.gov/nsdi-plan/nsdi-strategic-plan-2014-2016-FINAL.pdf>

¹¹³ Federal Geographic Data Committee, National Geospatial data Asset Management Plan (2014), *available at* <http://www.fgdc.gov/policyandplanning/a-16/ngda-management-plan>

¹¹⁴ FGDC Strategic Plan, at 17.

¹¹⁵ *Id.* at 1.

¹¹⁶ *Id.* at 12.

decisionmaking and planning processes.”¹¹⁷ Geospatial approaches to NEPA could help facilitate and support marine planning under existing legal requirements.

i. Geospatial NEPA could increase coordination and integration of assessments.

All of the agencies reviewed emphasize the importance of institutional coordination and integration of assessment. Specifically, CEQ calls for reviews to take advantage of existing documents and studies, and EPA aims to reduce duplication of efforts and increase synergy. A Geospatial NEPA data system could allow federal agency NEPA practitioners to access past documents relevant to the agency action footprint, building on past work to develop new analysis for the specific management decision at issue. Methods such as incorporation by reference and adoption could possibly be used to facilitate data integration within and across agencies. In addition, Geospatial NEPA could enable an improved approach to incorporation by reference by making the reference data/documents readily accessible within the data system.

ii. Geospatial NEPA could facilitate spatial planning through increased consideration of spatial data.

The agencies emphasize the importance of considering geospatial information, especially as it relates to coastal and marine issues. Generally, CEQ has the goal “to make the NEPA process more useful to decisionmakers and the public.”¹¹⁸ GIS and geospatial referencing have been found to help policy-makers make efficient and accurate decisions.¹¹⁹ In addition, geospatial approaches have been used successfully to engage the public in natural resource decision-making.¹²⁰ Thus, ensuring consideration of geospatial information could assist optimal decision-making stemming from the analysis in NEPA documents and engagement with the public. In addition, all of the agencies have some aspects of their NEPA processes that require consideration of geographic context, including in making a significance determination, which is at the heart of NEPA.¹²¹

Many of the agencies also have special requirements regarding certain coastal information categories that are conducive to geospatial referencing, such as marine habitat and ecology. Geospatial NEPA could provide the tools to live up to those statutory and regulatory mandates by providing geospatial context to aid decisionmakers and the public. Moreover, Geospatial NEPA would overcome some of the issues regarding incomplete and unavailable information addressed in the CEQ regulations.¹²²

¹¹⁷ Executive Order 13547, Stewardship of the Ocean, Our Coasts, and the Great Lakes (July 19, 2010), § 1; Council on Environmental Quality, *Final Recommendations of the Interagency Ocean Policy Task Force* (July 19, 2010), 32.

¹¹⁸ 40 C.F.R. § 1500.2.

¹¹⁹ See generally, e.g., Christopher Thomas & Nancy Humenik-Sappington, *GIS for Decision Support and Public Policy Making* (2009).

¹²⁰ See, e.g., Michael K. McCall & Christine E. Dunn, *Geo-information Tools for Participatory Spatial Planning: Fulfilling the Criteria for “Good” Governance?*, 43 GEOFORUM 81 (2012).

¹²¹ See 40 C.F.R. § 1508.27.

¹²² 40 C.F.R. § 1508.22.

Interviewees expressed that it was often difficult to find information (such as cumulative effects analysis) from other NEPA processes when completing new assessments—a central database would make information more accessible. Methods such as electronic submission of documents could provide a base from which to move forward on more comprehensive Geospatial NEPA policies. In the future, Geospatial NEPA could be linked with non-NEPA geospatial efforts to create one unified and standardized mapping system, easing the NEPA process while painting a more complete picture of the environment and environmental impacts.

iii. Geospatial NEPA could be implemented through coordinated data systems and tools.

Finally, there is a general desire in CEQ and FGDC policy to develop national shared services and indicators. At an overarching level, as required in the statute, a shared geospatial data system could help enable a “systematic, interdisciplinary approach” that integrates natural and social science in planning and decisionmaking.¹²³ Currently, agencies mostly act separately, with little coordination of tools or approaches, so even if agencies act systematically pursuant to their own NEPA policies, across agencies NEPA implementation is anything but systematic. This agency-by-agency approach is contrary to coordination goals under NEPA and marine planning goals as expressed in Executive Order 13,547.¹²⁴ Geospatial NEPA could allow a systematic approach across the federal government, increasing coordination and consideration of spatial variables.

¹²³ See 40 C.F.R. § 1501.2.

¹²⁴ Executive Order 13547, Stewardship of the Ocean, Our Coasts, and the Great Lakes (July 19, 2010).

IV. Current Agency Practices Related to Geospatial NEPA

When discussing possibilities to expand the use of mapping and coordinated data systems, it is important to consider existing practices and the multitude of ongoing efforts to gather and display geospatial information.

Table 4 is a non-exhaustive list of mapping tools used by EPA, NOAA, and BOEM. With some exceptions, the tools are not specific to NEPA practice, but could be used to support a geospatial approach to NEPA.

Table 4. Agency Geospatial Mapping Approaches

	Tool	Description
EPA	EIS Mapper	The EIS Mapper aggregates documents completed by multiple agencies from across the United States, including links to materials. It does not map the underlying data from the NEPA documents, such as project footprint, habitat range, or shipping lanes.
	NEPAssist	NEPAssist uses GIS information from a central database to update a map feature to screen certain environmental indicators for planning purposes when preparing NEPA documents.
	EJview	EJview focuses on demographic and socioeconomic information, using U.S. Census data to allow users to filter by income, racial distribution, and education, among other variables.
NOAA & BOEM	Multipurpose Marine Cadastre	An integrated marine information system that maps jurisdictional boundaries, ocean uses and planning areas, habitat, physical and oceanographic variables, and marine mammal and turtle ranges.
NOAA	Geospatial Data & Services	Map viewers encompassing a range of variables, including bathymetry, marine geology, and hydrographic surveys.
	National Ocean Service (NOS) Geoportal	Provides centralized access to distributed NOS geospatial data, tools, applications and services.
	Digital Coast	A compilation of data systems and display tools designed for coastal managers, planners, decision-makers, and technical users in charge of management of ocean and coastal resources. Tools range from those with high spatial resolution (e.g., county-by-county coastal viewers) to long time horizons (e.g., sea level rise projection time series maps).
	Environmental Response Management Application	A tool designed for emergency response that integrates both static and real-time data, including data on ship locations, weather, and ocean currents, for responders and decisionmakers.
BOEM	geoESPIS	Plans to index and cross-reference scientific information with GIS software, allowing more informed management decisions.
National Ocean Council	National Ocean Policy: Ocean Data Portal	All agencies “shall coordinate and contribute resources, as appropriate, to assist in establishing a common information management system.” The Ocean Data Portal aggregates data, information, and decision support tools designed to strengthen marine planning.

EPA’s geospatial tools in particular are innovative methods for displaying information, and—in conjunction with the agency’s role as reviewer and aggregator of NEPA documents—could serve as

templates for Geospatial NEPA. More broadly, all of the entities reviewed demonstrate a strong commitment to geospatial mapping and publicly available datasets. FGDC standards, CEQ guidance, and the tools used by EPA, NOAA, and BOEM could provide a strong foundation for the development of Geospatial NEPA.

A. Environmental Protection Agency

EPA has several tools that display geospatial information related to NEPA documents. The **EIS Mapper** was launched in September 2013 and aggregates EISs completed by EPA as well as other agencies from across the U.S.¹²⁵ It allows users to sort by EISs filed since 2004, those filed in the last week, or those with open public comment periods (for draft documents) or wait periods (for final documents), and allows users to access those documents. For each EIS filed since 2004, the EIS Mapper includes the state where the agency action is planned, lead federal agency, contact information, and a link to the EIS document as well as EPA's comments during the NEPA process. EISs that cover multiple states are listed in a separate section. The EIS Mapper is a comprehensive listing of EIS documents from the last decade, divided geospatially by state. However, no data layers beyond state location are included (e.g., project footprint and other data layers are not included). Also, other NEPA documents (e.g., EAs, CEs) are not included.

NEPAssist uses GIS information from a central database to dynamically update a map feature and allow users to screen certain environmental indicators.¹²⁶ It includes a publicly-accessible data system that allows users to enter a location by address, ZIP code, city, county, watershed, or a pair of coordinates. The interactive map allows users to display the following variables:

- EPA facilities (such as brownfields, toxic release sites, and water dischargers)
- water monitoring stations
- places (schools, churches, hospitals, and historic places)
- transportation (airports and railroads)
- water features (impaired bodies of water, streams, and watersheds)
- air quality non-attainment areas
- boundaries, including public lands
- census demographics (featuring many options)
- soil surveys
- wetlands

The map tool aims to “contribute to a streamlined review process that potentially raises important environmental issues at the earliest stages of project development.”¹²⁷ Interviewees described its

¹²⁵ EIS Mapper, EPA, <http://nepassisttool.epa.gov/nepassist/eismapper/index.html>.

¹²⁶ NEPAssist, EPA, <http://nepassisttool.epa.gov/nepassist/entry.aspx>.

¹²⁷ *Id.*

analytical power to answer environmental questions. However, it does not integrate information gathered *from* the NEPA process; instead, it supplies information *to* the NEPA process to improve environmental impact assessment. It does not include ocean or coastal indicators.

EJView takes the same general approach as NEPAssist, but focuses on demographic and socioeconomic indicators.¹²⁸ It uses U.S. Census information to allow users to filter by income, racial distribution, and education, among other variables. Like NEPAssist, it allows users to scroll over sections of the map to obtain more information on facilities, environmental conditions, and communities.

Other tools are used at the regional level within EPA, including the Geographic Information System Screening Tool (GISST) employed by Region 6. GISST is an analytical tool that maps and scores projects based on input variables, and it has been used for preparing and reviewing NEPA documents. GISST is one of several tools being used by EPA Regional offices to help make management decisions—rather than mapping aggregated information contained in NEPA analyses, it focuses on comparative displays of the information considered within an analysis. While it is not an appropriate platform to form the basis of a Geospatial NEPA system, it appears to be a powerful decision-making tool and it could be useful to consider integration or connection with a Geospatial NEPA platform.

B. National Oceanic and Atmospheric Administration

NOAA has several mapping tools that integrate geospatial data into planning and decisionmaking. In partnership with BOEM, NOAA maintains the **Multipurpose Marine Cadastre**, an integrated marine information system that maps jurisdictional boundaries, ocean uses and planning areas, habitat, physical and oceanographic variables, and marine mammal and turtle ranges.¹²⁹ Data are provided by BOEM, NOAA, the Department of Energy, EPA, numerous other agencies, and several nongovernmental organizations.¹³⁰ In short, the Marine Cadastre aims to provide “the geospatial framework needed for the broader ocean planning initiative called for in the president’s National Ocean Policy.”¹³¹ Of note, NOAA and BOEM also partner to support the **Ocean Law Search tool**, which facilitates user searches of laws, cases, legislative histories, and other materials relevant to the protection of underwater cultural heritage on the Outer Continental Shelf.¹³²

NOAA also has a **Geospatial Data & Services** application that includes a number of variables,¹³³ along with a **Geoportal** for ocean issues.¹³⁴ In addition, NOAA administers the **Emergency Response Management Application**, which integrates both static and real-time data, including data on ship

¹²⁸ EJView, EPA, <http://www.epa.gov/environmentaljustice/mapping.html>.

¹²⁹ MarineCadastre.gov National Viewer, NOAA & BOEM, <http://csc.noaa.gov/mmcviewer>.

¹³⁰ Partnerships, MarineCadastre.gov, <http://marinecadastre.gov/MMC%20Pages/partnerships.aspx>.

¹³¹ About, MarineCadastre.gov, <http://marinecadastre.gov/MMC%20Pages/about.aspx>.

¹³² Ocean Law Search, NOAA, <http://www.csc.noaa.gov/digitalcoast/tools/ocean-law>.

¹³³ Geospatial Data & Variables, NOAA, <http://maps.ngdc.noaa.gov/viewers/index.html>.

¹³⁴ Geoportal, NOAA, <http://nosdataexplorer.noaa.gov/NOSDataExplorer/catalog/main/home.page>.

locations, weather, and ocean currents, for responders and decisionmakers.¹³⁵ These tools and others are integrated in **NOAA Digital Coast**, an effort to aggregate and display relevant geospatial information for ocean and coastal managers, with the additional goal of providing the tools and the training to make the information useful to coastal communities.¹³⁶ Generally, NOAA has a robust mapping system that displays geospatial data for planning purposes in a variety of ways, for a variety of purposes. However, the pieces are not integrated with NEPA in either policy or practice.

C. Bureau of Ocean Energy Management

BOEM has a trove of data available online. The data include offshore energy development information and other data sets that are included in the **Multipurpose Marine Cadastre** mapping tool, discussed above.¹³⁷ In addition to the Cadastre, BOEM is developing **geoESPIS**, a geospatial mapping tool that compiles four decades of research into a mapping system.¹³⁸ The programs are summarized in the 2014 issue of *BOEM Ocean Science*, which is dedicated to analyzing ocean mapping tools.¹³⁹ The agency's plan is to index and cross-reference scientific information with GIS software, allowing more informed management decisions.¹⁴⁰ Moving forward, "similar applications could be developed for the dissemination of other BOEM products, such as NEPA analyses ... providing a new way of doing business and sharing information with the public."¹⁴¹ While they are not yet deployed for NEPA, the Cadastre and geoESPIS could provide structure to new, innovative approaches to environmental review using geospatial information.

D. Inter-Agency Practices

At an inter-agency level, among other practices not directly relevant to Geospatial NEPA, CEQ provides administrative support and funding for implementation of the National Ocean Policy.¹⁴² Under the National Ocean Policy, all agencies "shall coordinate and contribute resources, as appropriate, to assist in establishing a common information management system."¹⁴³ The National Ocean Policy Implementation Plan was drafted by the National Ocean Council (co-chaired by CEQ), and specifies that the goal is to "provide easy access to relevant ocean observing data and information for research,

¹³⁵ See Emergency Response Management Application, NOAA, <http://response.restoration.noaa.gov/maps-and-spatial-data/environmental-response-management-application-erma>.

¹³⁶ See About Digital Coast, NOAA, <http://www.csc.noaa.gov/digitalcoast/about>.

¹³⁷ BOEM Geospatial Assets, DOI, <https://data.doi.gov/dataset/boem-geospatial-assets>.

¹³⁸ Modernizing ESPIS Through Digital Mapping with geoESPIS, BOEM Ocean Science (2014), <http://www.boem.gov/Ocean-Science-Jan-Feb-Mar-2014>.

¹³⁹ *Id.*

¹⁴⁰ *Id.* at 11.

¹⁴¹ *Id.*

¹⁴² Executive Order 13547, Stewardship of the Ocean, Our Coasts, and the Great Lakes (July 19, 2010), at § 4(f).

¹⁴³ *Id.* § 6(c).

planning, and decision support.”¹⁴⁴ By 2016, the Implementation Plan aims to “implement a fully coordinated, nationally integrated system for ocean and coastal data,” which will be extended to include the biological, physical, and socioeconomic domains by 2020.¹⁴⁵ The FGDC and agencies discussed below play large roles in implementing these types of initiatives. One data system to be considered is the **Ocean Data Portal**, which is an effort to centralize access to ocean data. It provides geospatial and non-geospatial data sets and tools from federal, state, and nongovernmental entities.¹⁴⁶

E. Summary and Application to Geospatial NEPA

This non-exhaustive review of key data mapping tools relevant to ocean management shows a number of techniques that could provide a framework for a geospatial approach to NEPA. Agencies are already engaged in efforts aimed at making data related to ocean issues more accessible and readily available both within and outside of government. Based on their capabilities to map content and enter and display complex datasets, these existing tools could provide the building blocks or otherwise serve as models for the development of a Geospatial NEPA system.

i. Mapped Content

EPA’s EIS Mapper displays the location of agency actions by state and provides links to EIS documents prepared since 2004, presenting an initial step toward mapping NEPA documents and agency action footprints. However, its map function is limited to highlighting the entire state in which the agency action is located; it does not display the specific footprint of the proposed action within the state, nor does it sort by subject matter. This could inhibit some functionality, such as when a practitioner wants to review analyses in a specific area for a specific type of management action.

While no tools currently map detailed proposed action footprints for NEPA documents, it would be a small step to provide this initial data layer. For example, ELI has a demonstration database for U.S. West Coast ocean and coastal NEPA documents that displays project locations and provide links to the relevant NEPA documents (Figure 15A-B).¹⁴⁷

¹⁴⁴ CEQ, National Ocean Policy Implementation Plan 27 (2013), *available at*

http://www.whitehouse.gov/sites/default/files/national_ocean_policy_implementation_plan.pdf.

¹⁴⁵ National Ocean Council, National Ocean Policy Implementation Plan Appendix 29 (2013), *available at*

http://www.whitehouse.gov/sites/default/files/national_ocean_policy_ip_appendix.pdf.

¹⁴⁶ Ocean Data Portal, Data.gov, <http://www.data.gov/ocean/>.

¹⁴⁷ Geospatial NEPA, Environmental Law Institute, www.eli-ocean.org/planning/geospatial-nepa.

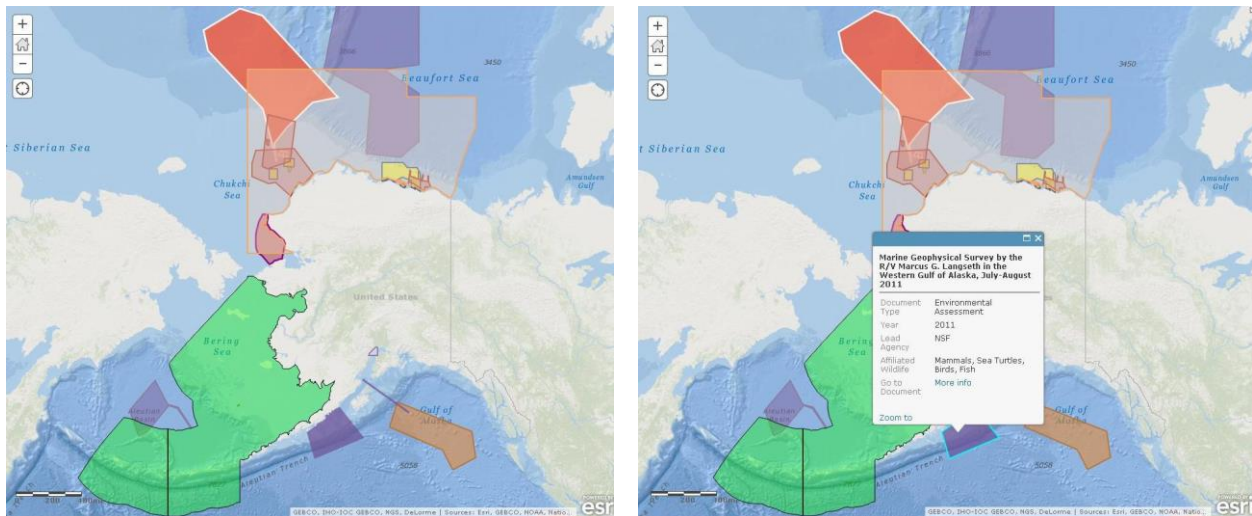


Figure 15A-B. ELI’s Geospatial NEPA pilot includes action footprints for NEPA documents relating to resources management off the U.S. West Coast (see Fig. 15A). Scrolling over a footprint allows a user to access information about the document, along with the document itself (see Fig. 15B).

EPA’s NEPAAssist, BOEM and NOAA’s Multipurpose Marine Cadastre, and other tools like ERMA and geoESPIS map multiple data layers describing existing conditions. Among other mapped categories of variables, NEPAAssist includes 12 data layers on demographics and 7 data layers on water features. The Cadastre maps 24 data layers related to jurisdiction and marine boundaries, 5 data layers on marine habitat, 30 data layers on ocean uses and planning areas, 16 data layers on physical and oceanographic data, and 66 data layers on marine mammals and turtles. These efforts demonstrate the potential to map many complex data layers within a single, cross-agency system. However, none of these systems explicitly use the information contained within NEPA documents; while the information contained in them may support decisions and analysis, no tools currently make use of the vast array of data held within existing NEPA assessments, impact statements, and other documents.

The tools reviewed do not map predicted impacts. However, interviewees indicate that the underlying GIS software is capable of displaying time-series data and that it is relatively simple to program. BOEM’s geoESPIS program may map changing conditions over time.

Alternatives, which are somewhat unique to NEPA analyses, are also not mapped directly in the tools reviewed. However, some tools contain features that may be analogous. For example, the Cadastre maps proposed management decisions, such as the proposed centerline for the Atlantic Wind project, and ERMA maps precipitation forecasts and other variables that have multiple possible scenarios.

ii. Data Entry and Display

The Cadastre is an inter-agency tool, resulting from a partnership between NOAA and BOEM. Other data providers include nongovernmental entities, such as universities and The Nature Conservancy, as well as numerous government agencies, including the Department of Energy, Federal Emergency Management Agency, Department of Defense, U.S. Coast Guard, EPA, Fish & Wildlife Service, U.S. Geological Survey,

National Park Service, and U.S. Integrated Ocean Observing System. Similarly, ERMA resulted from a partnership between a university and NOAA, with significant resources from the EPA, Department of the Interior, and U.S. Coast Guard. Many existing tools appear to leverage resources of public and private entities to maximize data availability. Additionally, ERMA uses open-source GIS software and has quality control and display requirements.¹⁴⁸

Across all of the systems, the underlying GIS software allows an expansive number of data entry attributes such as date of entry and source. ERMA has both a public and a government-only system, allowing only authorized users to access some sensitive or confidential information.¹⁴⁹ ERMA also facilitates special data displays that can be tailored for particular groups such as practitioners, policy-makers, and the public.¹⁵⁰

The various displays allow different levels of user interaction. ERMA allows users to access and export/import datasets, draw shapes and polygons on existing maps, measure distances, and animate data layers, among other capabilities. NEPAassist allows users to zoom in to the county level and map data layers on a local level. Marine Cadastre also has numerous interactive features, such as allowing users to map multiple data layers of their choosing.

iii. Deploying Geospatial NEPA

While none of these tools have been used specifically for integrating analyses gathered during the NEPA process, the elements for Geospatial NEPA are in the underlying GIS software, which has powerful capabilities to combine, aggregate, and display complex data consisting of many data layers across space and time. The following sections review challenges to achieving that integration, along with recommendations for overcoming those challenges.

¹⁴⁸ ERMA Technical Information, NOAA, <http://response.restoration.noaa.gov/maps-and-spatial-data/environmental-response-management-application-erma/technical-information-about>.

¹⁴⁹ *Id.*

¹⁵⁰ *Id.*

V. Design Issues Related to Geospatial NEPA

While agency and inter-agency policies generally support a geospatial approach to NEPA, they do not provide a roadmap for implementation. To gather additional information on implementation, the authors spoke with agency staff and other experts to understand agency practice and potential challenges. These interviews and a literature review indicate several challenges that must be overcome for cross-agency implementation.

The challenges fall into three categories:

- coordination of the development of NEPA assessments;
- data and information requirements for a geospatial data system; and
- utilization of shared data systems or tools.

A. Coordination of NEPA Analyses

NEPA's statutory mandate and CEQ's regulatory requirements have been implemented differently by the many agencies tasked with decision-making that may impact the environment, pursuant to their own policies, procedures, and guidance. According to one interviewee, NEPA implementation has undergone growth, change, and evolution within the different agencies over decades, and it is now remarkable how differently agencies approach their responsibilities. Although there are common threads present in NEPA compliance, practices have largely evolved separately. This divergence introduces challenges to coordination (see Table 5).

Table 5. Coordination Challenges

Challenge	Description
Capacity and resources	Lack of resources and expertise are two key constraints on the development of agency-by-agency geospatial data systems. According to multiple interviewees, increased coordination raises pragmatic and practical questions related to resource allocation among different agencies. One interviewee said that practitioners and planners are kept busy completing assessments, and have little time or capacity left over to expand efforts to increase coordination, comprehensive GIS data input, and systematic data sharing. There must also be GIS expertise and resources within each agency. While all of the agencies discussed in this assessment actively use GIS technology, it is unclear how those resources would be funded and deployed to operationalize Geospatial NEPA.
Varying NEPA procedures	While most NEPA policies articulate a desire for coordination, coordination is hindered by the fact that agencies conduct assessments differently. In

Challenge	Description
	<p>some instances, outside contractors prepare NEPA documents, leading to varying methodologies and data outputs. In essence, NEPA documents are prepared in different silos. The silos are connected by some policies, such as agencies commenting and coordinating pursuant to CEQ regulations; and by a common destination, as all NEPA documents must be submitted electronically to EPA; and other methods, such as incorporation by reference and tiering. However, in practice, most NEPA assessments are completed in virtual isolation within an agency, or even a division of an agency. Coordination policies are likely needed for implementation of Geospatial NEPA.</p>
Data standardization	<p>Coordinating data formats and outputs is a challenge that spreads across all three categories discussed in this section. A Geospatial NEPA system relies on the input of coordinated data streams into a common system. Because there are no specific requirements for document submission beyond EPA’s e-NEPA electronic filing, the underlying data are not evident and geospatial data are not displayed in a common system without extra effort from individual agencies. EPA’s EIS Mapper extracts the basic location of submitted NEPA documents. It is likely that further geospatial details will be difficult to display without coordinated data standardization efforts. Federal agencies use compatible GIS systems, thus it may be possible to coordinate and share information between those systems.</p>

B. Data and Information Requirements

In addition to coordination challenges, data systems and analytical techniques may not currently accommodate a cross-agency geospatial approach to NEPA. From a general perspective, the 2003 CEQ report on Modernizing NEPA Implementation details concerns including the dispersal of data, differences in data element definitions, sampling methodologies, spatial and temporal resolution, technology, and standards, along with a lack of adequate metadata and documentation. Due to the complexity of using and implementing geospatial information, “to use GIS in the NEPA process successfully, uniform standards for GIS and mapping data are needed.”¹⁵¹ The report concludes that “additional opportunities to access and share decentralized Federal, State, Tribal, and local knowledge should be explored.”¹⁵² Table 6 describes data and information challenges.

¹⁵¹ COUNCIL ON ENVTL. QUALITY, *Chapter 1: Technology and Information Management and Security*, in MODERNIZING NEPA IMPLEMENTATION 9 (2003), available at <http://ceq.hss.doe.gov/ntf/report/chapter1.pdf>.

¹⁵² *Id.* at 10.

Table 6. Data and Information Challenges

Challenge	Description
Data Standardization	Agencies (or regions within agencies) gather different types of datasets using varying methodologies. Many NEPA practitioners likely use underlying GIS mapping techniques that could be standardized to facilitate Geospatial NEPA. However, use of GIS approaches is not required, and data will be difficult to collate and compare without standardized data outputs for the categories of variables being mapped.
Digitization of Data	Related to data standardization is the possibility that the data underlying the NEPA assessment be digitized, as opposed to simply summarized in narrative form in the document. Currently, it is only required to submit an electronic PDF to EPA. The raw data underlying the assessment need not be included, even when a map was produced using readily available geospatial information. Another challenge is digitization of past documents and their supporting data. Retrospective digitization would require a concerted effort and dedicated resources—BOEM is digitizing some of its past documents for its geoESPIS system, but this practice does not seem to be occurring at other agencies (which may not have comparable resources available).
Sharing Data	While all data in NEPA documents are part of the public record, there are no policies in place that provide for data sharing and access to datasets. No central databases exist that provide access to the underlying data in NEPA documents. According to one interviewee, public domain data are helpful but subject to institutional obstacles. For example, the U.S. Army Corps is decentralized and autonomous, which presents unique challenges to obtaining datasets. In addition to specific data concerns, one interviewee noted challenges with confidentiality that may arise in, for example, social impact assessment data and cultural/historic site data.
Data Validation	Data quality and validation are major challenges to complex, multi-agency data systems. As one interviewee pointed out, inclusion of data in a centralized data system does not mean it is accurate. A Geospatial NEPA system may need a screening tool to determine when data meets quality assurance and quality control requirements, such as whether data has scientific and professional integrity. ¹⁵³ Another concern is reliance on non-federal data, as it is unclear whether academic, nongovernmental, or local government data can be used in some circumstances. CEQ and agency policies concerning incorporation by reference may provide a guide—

¹⁵³ See 40 C.F.R. § 1524.

Challenge	Description
	incorporated material must be reasonably available for inspection and must meet other data requirements provided by federal law.
Data Content and Scope	In creating a Geospatial NEPA system, there are several open issues regarding data content and scope, including: the categories used as data input variables; the categories that are displayed as outputs (which could vary publicly and internally); and the spatial and temporal resolution of data input and output. GIS software can display different datasets internally and externally and allows mapping of any geospatially referenced variable over space and time, provided the system is programmed to accommodate the variable being mapped. Thus, decisions must be made regarding what variables will be included in the system, what data will be gathered regarding those variables, and how the data will be displayed. Some variables, such as agency action footprint, may be easier to map than others, such as social and economic factors. However, interviews suggest that it is possible to create GIS data layers that can display information encompassing many documents, geographic areas, and time series analyses.
Linking NEPA with non-NEPA Datasets and other Decision Tools	A potential consideration is how to link a Geospatial NEPA system with non-NEPA datasets and tools. The initial goal of Geospatial NEPA should be to display information in NEPA documents. However, in the future, it may be possible and practical to link NEPA with other data and decision tools (ultimately, it may be possible to incorporate all information that goes into management actions). At the outset, however, Geospatial NEPA should likely be confined to NEPA analyses in order to diminish difficulties with technical troubleshooting and data standardization.
Accessibility of NEPA Documents	All EIS documents are publicly available through EPA’s EIS Mapper. However, practices related to sharing other NEPA documents, such as EAs—which make up the large majority of assessments—vary widely between agencies. One interviewee noted that it can be difficult to access EAs from certain agencies—in some cases, accessing non-EIS NEPA documents may require a Freedom of Information Act request.

C. Utilization of Shared Data Systems or Tools

A number of tools exist or are in development that display geospatial information in coastal and marine environments. These tools utilize GIS and geospatial information to display complex datasets—however, those tools and the underlying datasets are not integrated. The Multipurpose Marine Cadastre is a partnership between BOEM and NOAA and provides an example of effective collaboration, and EPA’s EIS Mapper is an effort to compile NEPA data across agencies. However, the effectiveness of these tools and

others is limited by their scope—the Cadastre does not incorporate information from NEPA; the EIS Mapper displays minimal substantive information, but rather links to documents; other tools are not designed for NEPA and lack cross-agency collaboration.

The primary challenge is integrating different agency efforts into a single coherent Geospatial NEPA system. One interviewee said that integration would be natural and relatively simple with EPA’s Geo-platforms. In addition, the interviewee expressed that it is not technically difficult to combine datasets because the underlying GIS software is compatible. But to accomplish such integration, decisions must be made regarding which system and which entity is best equipped to turn varying tools and separate datastreams into a unified Geospatial NEPA system.

VI. Attributes of a Geospatial NEPA System and Options for Next Steps

The core elements of a Geospatial NEPA system already exist in many agency policies and practices. NEPA policies generally support the gathering of geospatial data and coordination across agencies. And in practice, agencies gather geospatial data through NEPA processes and use advanced GIS displays in many areas. The following section explores attributes of a Geospatial NEPA system as first step in exploring how to operationalize this concept.

Key attributes of a Geospatial NEPA system include the following:

Mapped content is the first consideration of a cross-agency Geospatial NEPA system. An ideal system would map agency action footprints, making NEPA documents readily available and geospatially referenced. In addition, the system would allow keyword searches and include data layers to indicate existing conditions or parameters, encompassing many categories of variables from habitat and physical oceanography to energy development sites and socioeconomic data. Further, the system would map predicted impacts, adding a temporal component to the spatial display. The data layers would next be mapped for each alternative discussed in the NEPA document, allowing a user to examine the differential impacts of the actions being considered, both within a single document looking at a single management decision and across multiple documents looking at multiple decisions.

Data entry and display are other important considerations. The ideal Geospatial NEPA system would be inter-agency and allow all agency staff or consultants to enter data, subject to quality control requirements. All data entries would have a list of attributes in addition to the content data layers, such as date of entry, source, and reviewer. The system would have a publicly-accessible face and a government-only face; the government-only system could include confidential and/or unaggregated or raw data (which could be refined and aggregated for public viewing). The data display would be interactive, allowing users to extract and map relevant information. It should be user friendly, especially the public face of the system, to encourage public use of the tool. An ideal system would also facilitate the use of existing NEPA strategies for coordination of analyses.

A final consideration is **the deployment and use of a Geospatial NEPA system**. The system should be linked to planning efforts at all levels, including regional and national efforts. Systems of tiering, adoption, and incorporation by reference need to be considered to achieve the maximal utility for planning and decision-making. Finally, the system could be expanded beyond NEPA, to include additional documents and materials related to natural resource decision-making.

A. Next Steps for Geospatial NEPA

When discussing Geospatial NEPA with agency practitioners, one of the primary responses was that such a system (even if it only mapped agency action footprints, similar to the demonstration in Figure 15)

would be helpful in conducting assessments. Segmented assessments conducted in isolation could be replaced by an integrated, coordinated system of assessment that decreases resources required while increasing the effectiveness of the review. Moreover, the supplementation of lengthy NEPA documents (often hundreds if not thousands of pages, and rarely read in their entirety) with an intuitive online mapping system that puts all relevant information a click away would allow NEPA to better inform the public and decision-makers.

Many agencies have taken steps that provide the foundation for a Geospatial NEPA system, including the following:

- **NOAA** – NOAA is one of the key ocean agencies and has led many efforts to implement marine planning in accordance with numerous ocean and coastal policies and efforts, and the agency’s policies encourage cross-agency coordination at all steps of the NEPA process.
- **EPA** – EPA is the NEPA clearinghouse, and following a recent policy change, all documents already must be submitted to the agency electronically. EPA also has several approaches in place that provide a framework for Geospatial NEPA—EIS Mapper displays NEPA documents by state and provides links to access the documents, and NEPAassist maps many data layers relevant to NEPA assessments. In addition, EPA’s geospatial information team is committed to these types of efforts.
- **BOEM** – BOEM has substantial resources dedicated to aggregating and displaying geospatial information, in terms of both existing tools and financial support. Moreover, the agency has already made it a priority to digitize information related to research and natural resources on the Outer Continental Shelf. The agency’s tools, like the Multipurpose Marine Cadastre (with NOAA) and geoESPIS, provide exciting opportunities to display information.

At first, the development and implementation of Geospatial NEPA may be either uniform across agencies or segmented. Each agency has a trove of geospatial data and tools that can display the data, along with policies that are conducive to Geospatial NEPA and practitioners that could develop Geospatial NEPA at an internal level. While a broad effort would be ideal, a segmented or phased effort may allow for troubleshooting and beta-version conceptualization that would strengthen the system before cross-agency implementation occurs.

As noted previously, current policies and regulations do not present obstacles to Geospatial NEPA. However, the existing framework could be amended and supplemented to actively support and facilitate the development, maintenance, and growth of such a system. A key challenge is that NEPA assessments often are conducted in silos, with separate but parallel agency-by-agency practices that pose a challenge to Geospatial NEPA by creating variations in the type, format, and structure of collected data. Model coordination policies, model memoranda of agreement or understanding, model guidance, reports, or

other materials could build from the existing framework for conducting NEPA analyses and add elements that facilitate integration and display of the geospatial information.

CEQ and the FGDC both work across agencies and have demonstrated interest in systems similar to Geospatial NEPA, and thus could play important roles in leading a Geospatial NEPA approach.

An example of an important design need is deciding on a list of content categories that will be included in Geospatial NEPA. Choices will need to be made regarding which categories of variables are necessary for inclusion, which are highly desirable, and which are optional. Defining the scope of the system is directly related to how it will be used and what resources are required for its development and maintenance. The list of categories should be prioritized in the order in which parties want them addressed, allowing for phased or sequential development of the system (this may be guided by ease of integration, or by utility of the information set).

At the outset, the most straightforward and immediately useful version of Geospatial NEPA may be one that simply maps the agency action footprint and then provides links to the relevant documents and a system to search across documents, making them more easily available to the public and decisionmakers. Subsequent phases could include the strategic inclusion of other content categories to expand the usefulness of the Geospatial NEPA system, with the ultimate scope determined by priorities and available resources.

An example of a key policy need is the development of standardized data reporting policies that provide guidelines for gathering NEPA data in ways that are compatible across agencies. This pertains both to the data collection and to data sharing. The underlying data layers should be reported in a way that can be interpreted within and across agencies and be provided in accessible formats.

What would an optimal system for environmental planning and review look like? It is a difficult question, but not an idle one—recent advances in data gathering and display technologies have opened a world of possibilities that were once only theoretical.

The optimal system would likely have several attributes. It would provide an accurate picture of past, present, and future conditions, with expansive spatial and temporal resolution. It would also be integrated into a central system that is built from existing frameworks of policy and practice. Finally, it would be simple and straightforward, with data input and output that is useful for practitioners, decision-makers, and the public.

This report has explored how to design Geospatial NEPA so that it can be an optimal environmental planning and review system. Existing NEPA documents analyze certain categories of variables that could be standardized, with the threshold inclusion of the action footprint forming the basis for a publicly accessible digital archive of past, present, and planned NEPA documents. Existing GIS technologies and tools could build from NEPA coordination policies to expand the system across time and space, mapping a number of data layers for all of the alternatives from different documents. And laudable coordination

efforts already underway could be organized to develop a data system that efficiently utilizes resources, while adapting to environmental impacts and management realities.

Geospatial NEPA will not spontaneously develop. While there are no existing laws and policies that need to be repealed for the development of a central system, the current framework may need to be supplemented. In addition, practices should be adapted and guidance developed to clarify the scope of Geospatial NEPA. These challenges, however, also present opportunities. NEPA policy is flexible and a Geospatial NEPA system could best satisfy statutory and regulatory mandates. Moreover, a re-thinking of NEPA practices could facilitate more thorough coordination and integration of environmental review.

Moving forward, it is important to recognize that agencies already conduct admirable work throughout the NEPA process. However, for the most part, that work is being completed on an individual basis. By starting a dialogue and working collaboratively on Geospatial NEPA, it may be possible to adapt an NEPA approaches to create a modern system for environmental planning and review.