

Oceanology International 96

‘THE GLOBAL OCEAN – TOWARDS OPERATIONAL OCEANOGRAPHY’

Volume 1 - ISBN: 0 900254 114

Set of three volumes - ISBN: 0 900254 14 9

**Published by Spearhead Exhibitions Ltd
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Surrey KT3 3LZ, UK**

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CONFERENCE PROCEEDINGS VOLUME 1

**ENVIRONMENTAL MANAGEMENT OF SAND AND GRAVEL AND AGGREGATE
RESOURCES ON THE OUTER CONTINENTAL SHELF: THE UNITED STATES
VS. THE UNITED KINGDOM EXPERIENCE AND ONGOING COOPERATION
BETWEEN THE TWO COUNTRIES**

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INTRODUCTION

The United States (U. S.) Government, and specifically, the Minerals Management Service (MMS), a bureau within the U. S. Department of the Interior, has jurisdiction over all mineral resources on the Federal Outer Continental Shelf (OCS), a zone which extends from three miles seaward of the coastal State boundaries out to two hundred miles. Until recently only oil and gas resources were harvested from within this area. However, the potential for exploitation of sand resources located on the OCS as a source of material for beach and barrier islands restoration has grown rapidly in the last several years as similar resources in State waters are being depleted or polluted. Several OCS areas are also being examined as possible sources of aggregate for construction purposes. Resources in U. S. Federal waters may also be environmentally preferable, due to concerns over changes in resident physical oceanographic conditions as large quantities of material are extracted from areas within the existing wave base. This has generated a need for technical information and environmental studies to ensure that offshore minerals are developed in a safe and environmentally sound manner.

The MMS's Office of International Activities and Marine Minerals (INTERMAR) has been developing and procuring contracts to provide needed environmental information in regards to environmental management of these resources. Realizing that marine sand and gravel and aggregate material has been harvested off the coast of the United Kingdom (U. K.) for quite some time, INTERMAR pursued dialogue with several relevant U. K. government and aggregate industry entities to possibly initiate environmental studies of mutual benefit and to examine and to compare the management aspects of marine resources between the two countries. In addition to providing extremely useful management information for the MMS, it has resulted in an ongoing study supported by the MMS and several U. K. marine aggregate companies and associated government entities to examine the physical characteristics of the benthic and surface plumes associated with marine aggregate dredging. Environmental studies of possible benefit to the U. K. Government and aggregate industry are also being funded solely by the MMS.

REGULATORY ASPECTS/ ENVIRONMENTAL MANAGEMENT OF OCS RESOURCES

There are significant differences between the U. K. and the U. S. in respect to the regulatory and management aspects of marine mineral resources on the two entity's OCS. The environmental process is also very different, although the end result relative to the leasing decision is the same: Can a lease to exploit a mineral commodity be granted while ensuring that no environmental damage will occur as a result of the dredging operation. The main differences between the two regulatory regimes are highlighted below.

The U.K

In the U. K., the Crown Estate, as owner of the seabed and the natural resources on the U. K. Continental Shelf, issues licenses, upon request from a prospective company, primarily for the commercial extraction of marine aggregates. Before a license is issued, various Government Departments carry out a thorough assessment of the proposed dredging activity. Of particular concern to the Crown Estate are the potential biological and physical effects and impacts to the seabed and marine life as a consequence of the proposed activity. This environmental assessment constitutes what is known as the Government View Procedure, which is coordinated by the U. K. Department of the Environment (DoE). Comprehensive consultation with all interest groups is an integral part of the Government View Procedure and the Crown Estate will not issue a license except in accordance with a favorable Government View (Crown Estate and MAFF Publication, 1995). The DoE draft document 'Guidance On Environmental Assessment for Marine Aggregate Dredging Proposals' prepared by the ICES Marine Environmental Quality Committee Working Group (ICES, 1993) has become *a proforma* by which environmental assessments in the UK for proposed dredging activities are prepared (with a lack of any real alternative so far). The document summarizes pertinent topics requiring environmental investigation. In respect to the licenses issued, the dredging companies operate within established aggregate license areas and are monitored electronically to ensure that they conduct their operations within their respective licensed zones.

To optimize the responsible use of marine resources, the Crown Estate participates in relevant research projects, most often jointly with government or other entities, such as Hydraulics Research. The U. K. has been conducting research into the environmental effects of aggregate dredging for more than two decades (Kenny and Rees, 1994). The collected information is used during the Government View Procedure to determine whether or not a license should indeed be issued to the requesting company. In addition, the Crown Estate may require that an Environmental Assessment (EA) be included with the formal application for a dredging license. To support these EAs, many companies are beginning to provide funds to support relevant environmental research which can be incorporated into the assessment.

The U. S.

Prior to enactment of Public Law 103-426 in October 1994, OCS hard mineral resources could only be obtained through a competitive lease sale process stipulated under the OCS Lands Act, and essentially similar to that used for the OCS oil and gas program. The new law substantially changed the manner in which Federal mineral resources other than oil and gas are managed in that the law authorizes the Secretary of the Interior to negotiate

agreements for the use of OCS sand, gravel, and shell resources for programs undertaken by Federal, State, or local governments which involve shore protection, beach restoration, or coastal wetlands restoration. Agreements may also be pursued by State or local governments or the private sector for construction projects that are funded in whole or in part by, or are authorized by, the Federal government. To clear up some lingering jurisdictional uncertainties, the new law also provides that any Federal agency that proposes to use OCS sand for any purpose shall enter into a Memorandum of Agreement (MOA) with the DOI for such use. A fee, based on the estimated value of the resource, may be charged to a non-Federal entity. However, this has proved problematic in that the coastal States have traditionally not paid a fee for resources lying in State waters. The negotiated agreement process certainly represents the main area of activity relative to the extraction of marine mineral resources on the U.S. OCS. No competitive lease sales have been held to date, although there is some interest in aggregate material off the coast of New Jersey.

Coastal States and local communities are very supportive of the negotiated agreement process and, in light of diminishing coastal and nearshore resources, recognize the need for access to OCS sand for beach nourishment and coastal restoration. Unlike the U. K., the U. S. does not maintain specific license areas. A negotiated agreement may be sought for any area on the OCS at any time by an appropriate entity. Upon receipt of the request, the MMS determines if the requesting entity qualifies for an agreement under the existing law and, if found to be qualified, begins the negotiated agreement process. To date, several agreements have been pursued by coastal states and by the Department of the Navy:

- A negotiated agreement was completed with the City of Jacksonville/Duval County, Florida to use sand from a borrow site 7 miles offshore to renourish several local beaches. A stipulation was attached to that agreement which requires that a benthic repopulation study be conducted for the actual borrow area.
- On April 19, 1995, the Governor of Louisiana sent a letter to MMS Director Quarterman requesting that the negotiated agreement process to allow for the use of approximately 20 million cubic yards of sand from Ship Shoal, and offshore sand bar, for barrier island restoration be initiated. INTERMAR, the State of Louisiana, and the National Marine Fisheries Service of the U. S. Department of Commerce are currently examining the various options regarding preparation of required NEPA documents, specifically an environmental impact statement.
- The U S Navy is seeking a Memoranda of Agreement to use sand from Sandbridge Shoal, offshore Virginia, to renourish a portion of Federal beach at the Fleet Combat Training Center at Dam Neck, near Virginia Beach. The amount of sand to be requested is on the order of 700,000 cubic yards and would provide protection for some existing buildings and structures which lie just off the beachfront. The MMS has agreed to enter into negotiations for an agreement provided that the Navy's EA prepared for the proposed project is revised to the extent that the document can be adopted by MMS.

- A negotiated agreement is being sought to use OCS sand to renourish Surfside and Garden City beaches in South Carolina.

Regardless of the manner in which a lease is granted, or an agreement is signed for, marine mineral development, the environmental responsibilities of the Federal Government and the MMS remain the same. The MMS must still ensure that all National Environmental Policy Act (NEPA) mandates, NEPA implementing regulations of the Council on Environmental Quality (CEQ), and other appropriate laws and Executive Orders are considered before such lease agreements are executed. However, relative to the negotiated agreement process, Public Law 103-426 did amend Section 20(a) of the OCS Land Act and requires that environmental studies be commenced not later than 6 months prior to commencing negotiations for an agreement or the entering into of an MOA. This has placed a considerable environmental burden on the Agency, in light of the continuing requests for negotiated agreements.

NEPA and CEQ require that, for Federal actions deemed by the responsible Federal Agency to be major in scope, an Environmental Impact Statement (EIS) is to be prepared. The EIS is prepared by the Federal Agency which has the decision to be made, although other agencies, Federal or State, involved in the decision may be cooperating partners. An EA may be prepared by an Agency on any action at any time in order to assist agency planning and decision-making. An EA is normally prepared when, in the Agency's opinion, the proposed action is not considered to be major in scope. An EA is not necessary if an agency has decided to prepare an EIS. The EIS uses available environmental information to assess the possible impacts of the proposed action on the environment and is used as the major decision-making document. For marine mineral development activities, the MMS must determine if certain environmental information needed for decision-making is absent and, if possible, conduct studies to assist in the decision making process.

THE MMS ENVIRONMENTAL STRATEGY

The MMS, in early 1990, recognized the potential for exploration and possible development of sand and gravel and aggregate resources on the U.S. OCS. Therefore, an environmental strategy was formulated under which the Agency would operate to provide technical information and studies to assist in making leasing decisions and to assure that offshore minerals are developed in a safe and environmentally sound manner. The overall strategy with respect to environmental issues was to operate in a forward thinking manner and to use the time available to better understand the environmental implications of marine mineral development in order to facilitate better decisions and, if possible, to develop solutions to the environmental problems which would confront us. The current efforts of several existing Federal-State mineral task forces, which had been focusing primarily on resource assessment and sand borrow area identification, were redirected towards the identification of environmental issues, as well as developing action plans to address issues of concern to the Federal and State governments and the public. In addition, studies to provide needed environmental information specific to the marine minerals program were developed and submitted for funding consideration under the existing MMS Environmental Studies

Program (ESP). The MMS ESP is mandated under the OCSLA and provides Federal dollars to conduct research into the potential effects of OCS resource development on the marine and human environment. Prior to September 1990, however, ESP funds had only been used for oil and gas.

Two general categories of studies were, and have subsequently been developed by INTERMAR and supported by ESP funds:

- Generic field, literature, or brainstorming studies to examine the effects of particular types of mining operations on various aspects of the physical, chemical, and biological environments.
- Site-specific environmental studies in areas where offshore mineral activity is actually proposed or where offshore mineral development appears likely in the near future.

Taken together, the generic and site-specific studies should provide a solid foundation on which the MMS can make sound environmental decisions relative to marine mineral development.

MMS ENVIRONMENTAL STUDIES CONDUCTED TO DATE

Marine Mining Literature Search Study

Prior to commencing any large-scale site-specific effects studies, the MMS funded a study, awarded to a private contractor in September 1991, to survey, analyze, and synthesize existing domestic and foreign literature regarding the potential environmental impacts of marine mineral activity on the environment and to have the information summarized in a single manuscript. The final report was completed and submitted to the MMS in March 1993 (MMS, 1993). Information accessed included factors such as the following: impacts of marine mineral extraction and development on water quality, the seabed, benthic and water column organisms and habitats, and recreational and coastal facilities. Also included were effects relating to the possible offshore disposal of waste material and the effects of offshore and onshore processing and tailings disposal. General environmental analyses, as well as laboratory, field, and modeling studies, were also included in the literature search. The information synthesis was designed, not only to provide an overall picture of the extent of environmental information available, but also to identify mitigating measures which can be implemented during offshore operations to minimize or preclude potential adverse impacts to the environment. Potential models that the MMS could use to predict the fate of material disturbed or discharged during actual operations were also identified and analyzed. The study basically confirmed that, although a certain amount of available research results and generic information could be applied towards proposed activities, site-specific information would still be necessary for leasing decision and management purposes. The study also recommended that environmental information be collected during actual development operations.

Benthic Repopulation Study

As in the U. K., there is considerable concern relative to the impacts of offshore dredging on benthic invertebrate or other benthic organisms which lie within the path of the dredging operation. This population is generally a source of food for many water column-dwelling species. There also exists the risk of changes to the spawning grounds for fish or other marine species that spawn on the sea bottom, as well as long-term changes in the sea bottom population due to changes in the characteristics or grain size of the bottom sediments subsequent to the dredging operation.

A survey of the existing U. S. literature base indicated that, of the studies intended to detail the environmental effects of offshore dredging and mining, a relatively small percentage had focused on the seafloor impacts or mining site itself. The studies that had been conducted had placed primary emphasis on the extent and character of sediment resuspension induced by the mining operation, the impacts of turbidity plumes induced by surface discharges from the mining vessel, and the influence of these materials on local pelagic fish populations or the benthic communities found in the areas adjacent to the area being dredged or mined. Very little information existed regarding the degree to which a dredging activity affects benthic communities and their ability to repopulate after being directly affected by the operation.

INTERMAR therefore developed for Fiscal Year 1992 funding, a study designed to evaluate and gain insight into long-term effects by the nature of, and the degree to which, benthic organisms repopulate the seabed after a dredging activity takes place in a shallow open-ocean area. Through coordination with the U. S. Army Corps of Engineers, dredge sites off the Tampa/St. Petersburg, Florida area were selected for study. These sites are in sandy sediments and were being used to restore several beach areas off the west coast of Florida. The study is nearly completed; instrumentation and sampling involved box coring, otter trawling, and the use of a towed sled carrying a video camera and a sidescan sonar device. The baseline collection phase of the study began in mid-July 1992, before the actual dredging of the sites. Subsequent post-dredging cruises occurred over a period of 22 months. Evaluation of the data, as described in the preliminary draft report, indicates that repopulation occurred very quickly and that, apart from some dredge holes that are still evident in some areas, there appears to be little overall long-term impact from the dredging operations (Blake et al., 1995). The final report is due to the MMS in January 1996.

Marine Mining Technology and Mitigation Study

As a follow-up effort to the literature study mentioned above, in September 1993, the MMS awarded a contract to the Centre for Cold Ocean Resources Engineering at the Memorial University of Newfoundland in St. John's, Newfoundland, Canada to examine and develop mitigation methods to offset or eliminate possible environmental effects of marine mineral development. The project involves an integrated team of marine mining engineers, marine biologists, physical oceanographers, and other marine scientists to undertake a detailed analysis of marine mining technologies, presently available or proposed in order to estimate and evaluate the degree of potential impact to the marine and onshore environments

associated with each extraction technology. Mitigation methods are then to be examined to ascertain the degree to which these impacts can be lessened or eliminated altogether during offshore mineral development activities. The report is due in January 1996 and the information gathered will be used to possibly attach stipulations or require mitigation techniques for specific offshore dredging endeavors.

Investigation of Benthic and Surface Plumes Associated with Marine Aggregate Production in the United Kingdom

This study, which commenced in Summer 1994, is an ongoing cooperative effort between the MMS and several U. K. entities and is covered in a later section of this paper.

Wave Climate Modeling and Evaluation Relative to Sand Mining on Ship Shoal, Offshore Louisiana, for Coastal and Barrier Islands Restoration

This study represents the first MMS-funded site-specific marine mineral study. The State of Louisiana has proposed to renourish their rapidly eroding coastal barrier islands by dredging sand from several offshore sand bars and redepositing the material on the adjacent barrier islands. The initial effort would involve the removal of approximately 20 million cubic yards of sand from Ship Shoal, an offshore feature located in Federal waters and deposition of the material on Isles Dernieres and Timbalier Islands. In support of that effort, the MMS funded this environmental study which involves the use of available current and wave data and an off-the-shelf wave refraction model to evaluate the potential for changes in the physical regime in the coastal areas in and around Ship Shoal and the barrier islands offshore Louisiana, depending upon the amount of sand removed from the Shoal for restoration of Isles Dernieres. The study is being undertaken by an investigator from Louisiana State University (LSU) through a cooperative partnership arrangement between the MMS and LSU. The model runs conducted to date indicate that, even with complete removal of Ship Shoal, there are no effects on the physical regime in the immediate vicinity of the islands. The model results will be incorporated into an EIS to be initiated shortly to evaluate the potential environmental effects of the proposed Louisiana barrier islands restoration effort. The methodology employed for this study may be appropriate for use in other areas where sufficient data exists.

COOPERATION BETWEEN THE U.S. AND THE U. K.

Recognizing the need and the value of conducting environmental studies during actual dredging operations, in the Summer 1994, INTERMAR contracted with Coastline Surveys Limited of Bristol, England to oversee a study off the coast of the United Kingdom, in an area of ongoing marine aggregate extraction. The purpose of the project is to examine the degree to which disturbed sediment persists within the near-bottom and surface water layers during an actual dredging operation. The study involves determination of the physical dynamics of the sediment surface as it comes into contact with the dredging vessel's draghead, as well as the persistence at the surface of the dredge vessel's over-spill material. Recognizing the value

of this research, and in light of increased information being requested by the Crown Estate in the submitted EAs, ARC Marine, South Coast Shipping Limited, and United Marine Dredging Limited, three major suppliers of offshore aggregate in the United Kingdom, as well as Hydraulics Research, a numerical modeling group based in England, are participating along with the MMS. The research effort is described in detail by the Principal Investigator in another paper presented at this conference.

In support of this effort, the principal author traveled to the U. K. during the period 31 January to 6 February 1995. The specific purpose of the visit was to:

- oversee and coordinate several scientific aspects of the benthic/surface plume study,
- to meet with the participating partners in the project (Hydraulics Research, ARC Marine Dredging),
- to solicit new partners and funds for the project (South Coast Shipping, United Marine Aggregates),
- to gather information relative to marine mining environmental studies being conducted in the UK,
- to gain a knowledge of the system which the UK operates under relative to the mining for marine aggregate.

All of the meetings were extremely productive. The highlights of those sessions are summarized below.

Tuesday, January 31:

AM - Meeting with Hydraulics Research (HR) - Oxfordshire, England

HR is one of the premier scientific/modeling entities in the world. Once a UK government agency, they have since been privatized. However, HR still undertakes numerous scientific experiments and projects for the U. K. government. For the benthic/surface plume study, HR is participating in the field observations and doing some sample processing. Part of this effort had been done via funding from the UK DoE.

Results of the Meeting: HR's funding from DOE was to run out in March 1995. However, they were very interested in continuing their involvement in our project and offered to submit a proposal soliciting funds to do so. HR continues to be involved in the effort.

PM- Visit to ARCO Adur Dredging Vessel - Dagenham, England

ARC Marine, which owns and operates the ARCO Adur, is one of our participating project partners. The author spent an hour or so aboard the vessel observing the aggregate off-loading operation and discussing various aspects of the vessel and operations with the Captain

and the crew. Highlights included observations of the dredge head, the black box which transmits location of the vessel back to the Crown Estate and the new positioning system.

Thursday, February 2:

Meeting with ARC Marine, South Coast Shipping, and United Marine Aggregates - Southampton, England

The purpose of this meeting was to confirm ARC Marine's commitment to the project and to brief the other two dredging companies as to the benefit of the intended work.

Results of the Meeting: ARC was very supportive of the project and the other two companies agreed to participate as well, provided that their management was also supportive. It was agreed by all parties that the data we are collecting is being asked for more and more by the UK DoE before the granting of licenses for marine aggregate extraction. The additional monetary support was expended towards the acoustic DOPPLER current profiler (ADCP) work and for analysis of the resulting data. The respective parties also agreed upon a methodology for obtaining the ADCP data.

Friday, February 3:

AM- Meeting with the Ministry of Agriculture, Foods, and Fisheries (MAFF) - Lowestoft, England

MAFF is a UK government agency that collects environmental information for the DoE. The information is used during the granting of licenses or in the regulation of activities. This particular meeting was attended by MAFF scientists who are collecting information relevant to the granting of licenses for marine aggregate extraction. Andrew Kenney, a marine biologist, who has been conducting benthic recolonization and other biological studies for MAFF was in attendance. We discussed MAFF's role in the UK process and the relevance of our plume project to their current goals and objectives.

Results of the Meeting: The scientists at MAFF were extremely interested in working with us as, a primary interest of theirs is the source times and grain size resuspension patterns associated with sand and gravel operations, and the impact on biological organisms. This information is being requested by DoE prior to the granting of aggregate licenses. MAFF agreed to submit a proposal for funding to DoE which would cover funds for a survey boat for one week, use of their ADCP, and data processing of theirs and our ADCP data.

PM - Meeting with the Crown Estate- London

The author and the P. I. met with the marine estates group which handles marine aggregate extraction rights. We had a lengthy and informative discussion as to the CE's functions and the licensing procedures. We also discussed our plume project at length and our morning's meeting with MAFF.

Results of the Meeting: The author came out with quite a clear picture as to the licensing practices relative to marine aggregate extraction in the UK. The CE is supportive of our plume project and recognizes the need for the research effort.

IMMEDIATE IMPLICATIONS FOR THE FUTURE AND THE MMS ESP

The MMS sand and gravel program and the negotiated agreement process certainly offers new opportunities, but also definite environmental challenges, particularly as the U. S. Congress reduces Federal spending on environmental programs, and in particular, the MMS ESP. Efforts are being made to keep the program flexible and responsive to the requests from onshore communities. On environmental issues, the MMS would like to focus analyses on those issues that are truly significant, streamlining the NEPA process perhaps more than the agency's practice for the oil and gas program. The MMS must ensure that the correct issues are being addressed, that information is available to support all analyses and decisions, and that ESP funds that become available for sand and gravel environmental studies are used in the most efficient manner possible. The MMS clearly must continue to leverage the available environmental studies dollars and enhance the value of these efforts by engaging in joint research projects with other entities, particularly in areas of actual marine dredging operations.

INFORMATION NEEDS AND QUESTIONS FOR DECISIONMAKING

What environmental information strategy should MMS now follow to make sure the sand and gravel program is properly administered? For what issues do we need "rigorous" information? For what issues is "less information" acceptable? How much information from our oil and gas studies can be used for sand and gravel decision purposes? From an environmental risk standpoint, what is the relative importance of gathering information for sand and gravel decisions versus oil and gas decisions?

SITE-SPECIFIC ENVIRONMENTAL STUDY MODEL FOR THE FUTURE

The MMS, in conjunction with the Virginia Institute of Marine Science (VIMS), recently developed and entered into a cooperative agreement to conduct a multidisciplinary biological/physical environmental study to provide information for decisions relative to the use of OCS sand off the coast of Virginia to renourish beaches in the vicinity of Virginia Beach. Although no requests from the State or local coastal communities for negotiated agreements have been received, it is expected that one, and probably two, such requests will be forthcoming relatively soon. The design of this study may provide a "blueprint" to follow for future site-specific sand and gravel studies. The study was initiated in August 1995 and will continue for approximately two years.

The VIMS study is comprised of six primary areas of investigation:

- *Benthic resource and habitat mapping using a sediment profile camera* – The primary objective of this task is to assess baseline benthic ecological conditions in and around the potential sand borrow areas. This information will be used to assess the potential for biological impacts from sand dredging.

- Nearshore wave and current observations and modeling - The objective of this task is to study the potential of bathymetric modifications induced by sand mining to waves as they cross the study area.
- Bathymetric data gathering for model use - Provides supplemental bathymetric information for the modeling effort described above.
- Shoreline processes, sediment, and sediment transport evaluation - This task will evaluate the impacts of offshore dredging and consequent beach nourishment in terms of the potential alteration in sediment transport patterns, sedimentary environments, and impacts to local shoreline processes.
- Acoustic Doppler Current Profiler (ADCP) current measurements/ observations/ modeling - (to be undertaken by Old Dominion University) - An ADCP will be used to define the currents at the potential sand mining sites and to define the physical regime between these sites and the shoreline. A numerical model will then be used to predict the effects resulting from alterations to the local bathymetry on the local current field.
- Microfaunal ecology and impact assessment - The United States Geological Survey will investigate the ecology of benthic foraminifera and ostracods (Crustacea) from the Virginia continental shelf habitats identified as potential sites for offshore sand dredging. This information will be used to evaluate the recolonization potential of these sites on the basis of species ecology and wider zoogeographic distribution in adjacent areas.

SUMMARY AND CONCLUSIONS

The regulatory regimes under which the U. S. and the U. K. manage their offshore mineral resources are quite different. However, both countries' goal is to assure that offshore mineral development is carried out in a sound environmental manner in order to minimize potential adverse impacts to the marine and human environments. A dialogue has been established between the two entities and an environmental study which will provide information of mutual benefit is being funded by the MMS and several U. K. aggregate mining companies and other parties. The MMS has, and continues to pursue environmental studies in the U. S. to support the MMS's marine minerals program, particularly the sand and gravel/negotiated agreement process. The results of these efforts may prove of benefit to the U. K. A continuing dialogue and ongoing cooperation between the two parties would seem to be in the best interest of both.

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