DRAFT SUPPLEMENT TO THE INDIANA HARBOR AND CANAL MAINTENANCE DREDGING AND DISPOSAL ACTIVITIES ENVIRONMENTAL IMPACT STATEMENT

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INDIANA HARBOR AND CANAL DRAFT SUPPLEMENT

SUMMARY

This Supplement to the US Army Corps of Engineers (USACE) Draft Environmental Impact Statement (DEIS) for Maintenance Dredging and Disposal Activities in the Indiana Harbor and Canal (IHC) in Lake County, Indiana was prepared for the US Environmental Protection Agency (USEPA) Region V.

MAJOR CONCLUSIONS AND FINDINGS

The USACE is in the process of completing its DEIS for Maintenance Dredging and Disposal Activities for the Federal navigation channel in the IHC. This Supplement to the DEIS addresses the remediation dredging and disposal of sediments which lie outside of the Federal navigation channel in the Grand Calumet River (GCR) and the IHC, and the associated impacts of the dredging and disposal.

The USEPA and the Chicago District of the USACE have in recent years performed numerous physical and chemical tests on sediments in the IHC. Based on these tests results, the USEPA has classified portions of the sediments as moderately polluted, heavily polluted, and toxic. These designations indicate the sediments are not suitable for open water disposal. The DEIS discusses the need for and impacts of maintenance dredging of the Federal navigation channel and disposal of these sediments. This Supplement discusses remediation dredging in the IHC/GCR outside the scope of the USACE DEIS.

The proposed plan would include the USACE dredging of the present sediment backlog and maintenance of the authorized channel depths, and the USEPA-required remediation dredging of sediments in the IHC/GCR outside the Federal

navigation channel. The proposed plan would also allow for construction and maintenance of at least one confined disposal facility (CDF) for the sediments to be dredged, including sediments regulated under the Toxic Substance Control Act (TSCA).

The environmental impacts of the proposed dredging and disposal would generally be beneficial. The dredging and disposal activities would negatively impact area water quality and aquatic organisms during dredging operations. However, these short-term negative impacts would diminish rapidly and result in the long-term positive benefit of decreased sediment contamination available to the water system.

COMPLIANCE WITH ENVIRONMENTAL STATUTES

The alternative plans for dredging, treatment, and disposal of the sediments outside the Federal navigation channel are the same as those discussed in the DEIS. These plans are in full compliance with all applicable state and Federal regulations.

A portion of the sediments in the area contain levels of polychlorinated biphenyls (PCBs) exceeding 50 parts per milliion (ppm), thereby making their treatment and disposal subject to USEPA regulation pursuant to TSCA. The recommended plan in the DEIS provides for the disposal of these sediments in accordance with TSCA requirements.

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1. INTRODUCTION

The following chapter outlines the purpose and need for this Supplement to the USACE DEIS for the Indiana Harbor and Canal (IHC), discusses the relevant regulatory issues, and includes a background discussion for the project. The project background section centers on the Remedial Action Plan for the IHC, Grand Calumet River (GCR) and the Nearshore Lake Michigan as the major focal point for the remediation of the area.

1.1 Purpose of the Action

In the summer of 1990, USACE requested that USEPA Region V consider becoming a cooperating agency on the USACE DEIS for the IHC. The USEPA Region V views this as an opportunity to address additional environmental contamination problems in the project area. Currently, USEPA has several ongoing actions in the area as described in Section 1.1, Background. These include enforcement activities requiring remediation of contaminated sediments, as well as other initiatives in the area. In October 1991, representatives of the Chicago District of USACE and USEPA Region V signed a Memorandum of Understanding (MOU) outlining each agency's responsibilities and rights. Pursuant to the MOU, USEPA is responsible for preparing this Supplement to address the impacts upon the USACE project from USEPA-required remediation and other USEPA initiatives beyond USACE authority in the IHC/GCR.

1.2 Need for the Action

For 100 years, the area surrounding the IHC/GCR (Figure 1.1) has been heavily industrialized (USEPA and IDEM, 1992). Numerous steel, petroleum, and other manufacturing facilities have bordered the IHC/GCR water system throughout this

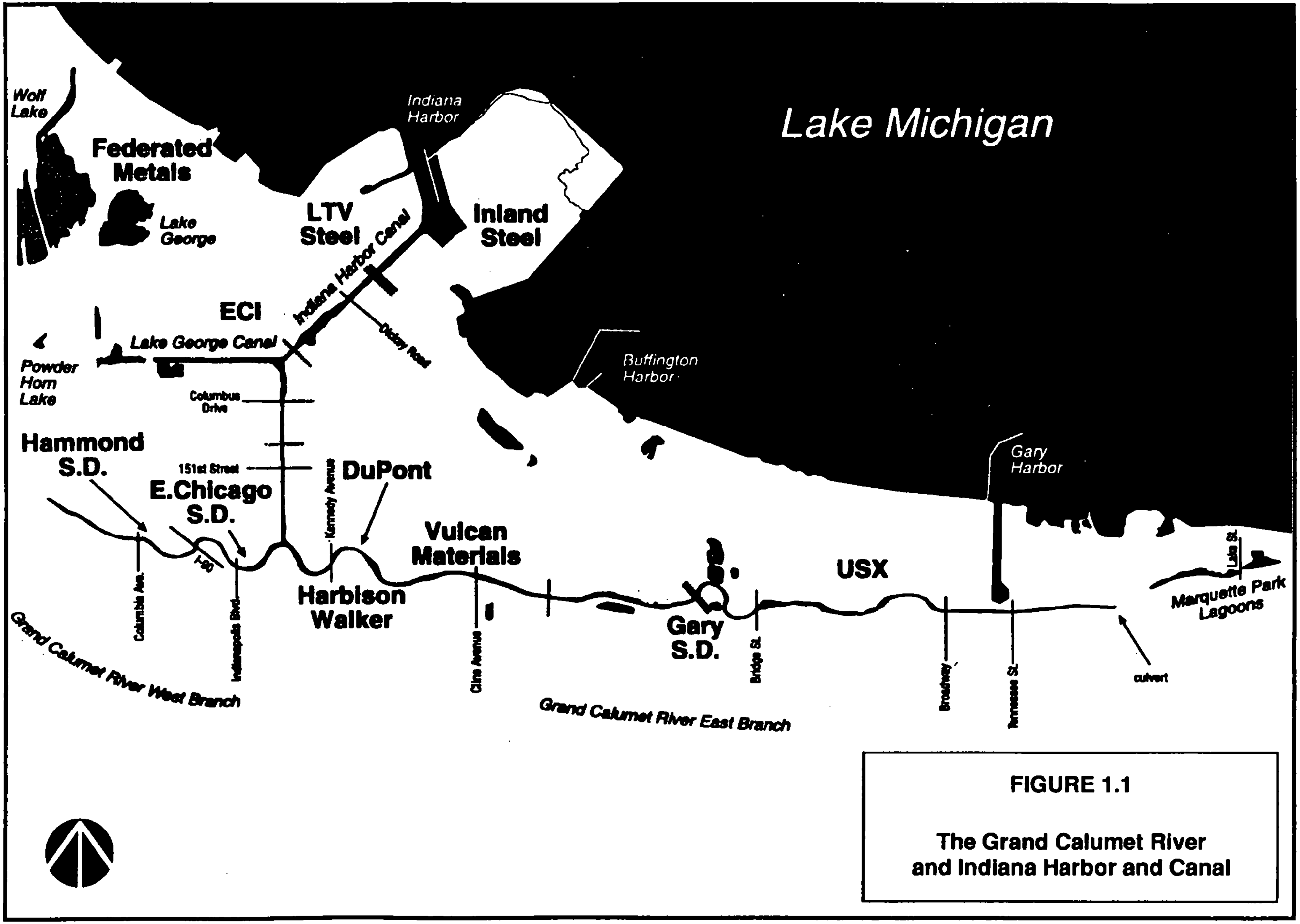

FIGURE 1.1

The Grand Calumet River and Indiana Harbor and Canal

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AOCs &
define RAP. →

IDEM is a
party w/ LTV litigation fD
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& ? maybe others

period. This industrialization has resulted in the significant degradation of the local environment, including southern Lake Michigan. In support of the RAP for the IHC/GCR, the USEPA Region V initiated a policy in 1990 to accelerate measurable environmental improvement in northwest Indiana in support of and by providing assistance to the Indiana Department of Environmental Management (IDEM).

The most significant environmental concern identified in the IHC/GCR RAP was sediment contamination in the Federal navigation channel and other segments of the IHC/GCR (IDEM, 1991). The USEPA is providing assistance to USACE to expedite the dredging of the Federal navigation channel in the IHC. This dredging effort will decrease the annual movement of 150,000 cubic yards of contaminated material from the IHC to Lake Michigan. Additional sediment remediation sought by the USEPA upstream from the IHC would increase long-term sediment and water quality throughout the IHC/GCR, prevent additional contaminated sediments from filling the IHC, and prolong the useful life of the navigation channel. A coordinated dredging effort, involving USACE and USEPA and including both IHC and GCR dredging, would therefore be most beneficial to all involved parties.

1.3 Regulatory Issues

The following is a brief discussion of the Federal regulations applicable to activities in the IHC/GCR and how these regulations apply. The USEPA will comply with all Federal statutes and adhere to the policies and procedures set forth in them.

The maintenance of the Federal Channel was authorized by the River and Harbors Act of 1910, which allows for maintenance dredging and disposal of dredge spoils, and stipulates that the costs of such actions be a Federal expense. Several more recent Federal regulations, however, supersede the River and Harbors Act, because the sediments in the IHC have been deemed toxic or hazardous.

The Toxic Substances Control Act (TSCA) of 1976 requires the USEPA to test chemical substances and mixtures to determine if they constitute an unreasonable risk to health or the environment. If the USEPA determines that a substance or mixture is toxic, then the USEPA can regulate the manufacture, use, labeling, and disposal of those substances or mixtures. The TSCA also regulates the use and disposal of PCBs, including the PCB contaminated sediments found in the IHC.

The Resource Conservation and Recovery Act (RCRA) of 1976 was enacted to protect groundwater, surface water, air, and the land from the contamination by solid waste disposal. The RCRA defined hazardous waste as either characteristic waste or listed waste. Characteristic waste is hazardous because it has properties or characteristics that make it hazardous. Listed waste is waste that has been determined to be hazardous and has been listed by the USEPA as hazardous. Under RCRA, sediments in the IHC are considered both characteristic and listed hazardous wastes and are regulated as such. The RCRA requires facilities that generate or treat a large amount of hazardous waste to obtain a large quantity generator or large quantity treatment permit. Before any action resulting in the treatment or disposal of any large quantity of IHC sediments, a large quantity treatment permit must be obtained by the Confined Disposal Facility (CDF) operator pursuant to RCRA.

The Hazardous and Solid Waste Amendments (HSWA) of 1984 are amendments to RCRA that further define hazardous waste regulations. These amendments emphasized the concept of waste minimization, prohibited land disposal of untreated hazardous wastes, and mandated new technologies for dealing with hazardous waste disposal (e.g., double liners for landfills). The HSWA requires that sediments from the IHC be treated before being placed in a landfill. The amendment also provides design criteria guidance for CDFs.

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only some of the IHC/GCR sediments are characteristic

see comment pg 3 ↗

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The Comprehensive Environmental Response, Compensation and Liabilities Act (CERCLA) of 1980 and the Superfund Amendments and Reauthorization Act (SARA) of 1986 provide for liability, compensation, cleanup, and emergency response in connection with the cleanup of inactive hazardous waste disposal sites. The CERCLA also established a fund (Superfund) to finance the cleanup of those hazardous waste sites where a responsible party cannot be determined. The Act also set up a National Priorities List (NPL) which ranks sites in order from most critical to least critical. There are several NPL sites in the vicinity of the IHC/GCR. Under CERCLA, responsible parties for any NPL sites in the area would potentially be responsible for paying part of the cleanup cost of the IHC if it can be determined that the IHC has been contaminated from the activities at an NPL site. Also pursuant to CERCLA, location of the CDF would not be permitted on any area that is an NPL site.

1.4 Background

The Remedial Action Plan for the Indiana Harbor Canal, the Grand Calumet River and the Nearshore Lake Michigan

In 1985, the International Joint Commission (IJC), an organization established by the US and Canada to protect the Great Lakes, designated the northwest Indiana region as one of 42 "areas of concern" around the Great Lakes (IDEM, 1991). This designation resulted from the area's inability to meet the objectives of the Great Lakes Water Quality Agreement between the US and Canada. The designation requires that the US government cooperate with the State of Indiana to identify the scope of environmental problems and methods to address them (USEPA and IDEM, 1992). The State of Indiana must submit a 3-stage Remedial Action Plan (RAP) for the area. Stage 1 of the RAP defines the specific environmental problems of the area. Stage 2 identifies remedial and regulatory measures to address these problems. Stage 3 will identify when beneficial uses of the area have been restored.

In January 1991, the IDEM submitted the Stage 1 RAP to the IJC. Extensive environmental problems were identified in the IHC/GCR area. The most significant environmental concern was identified as the in-place, polluted sediments and the high rate of sediment transport to Lake Michigan from the IHC/GCR waterway. Another concern identified in the RAP is the large number of waste sites requiring remediation, including five Superfund sites. Groundwater contamination in the harbor area is also an issue, because the high water table allows groundwater contamination to reach the surface of the river, harbor, and Lake Michigan. Finally, wastewater discharges in the IHC/GCR have also degraded the quality of the water systems. Each of these problems has seriously degraded the aquatic communities, especially the fish populations, in the local water systems.

Current and future activities for the program include revision and preparation of the RAP. The State of Indiana, with USEPA assistance, will revise the Stage I RAP in response to IJC comments. The IDEM is updating the Stage 1 RAP by incorporating data from enforcement actions, studies, and investigations that are part of the remediation effort. Preparation of the Stage 2 RAP, which identifies remedial and regulatory measures for the area, is underway. As an interim activity, the USEPA and IDEM have developed the Northwest Indiana Action Plan (NIAP) (USEPA and IDEM, 1992). The NIAP includes various initiatives the USEPA is undertaking in the area in support of the RAP. These activities have been planned and, to varying degrees, implemented to increase the quality of the environment in the area.

The Northwest Indiana Action Plan

In 1990, USEPA Region V initiated a special, multi-year program to accelerate measurable environmental improvement in northwest Indiana. The USEPA's purpose is to support the State of Indiana's commitment to the environment of northwest Indiana, and to assist the state in developing the RAP for IHC, GCR and the Nearshore Lake Michigan. The NIAP was developed to provide a framework for this Federal and state partnership.

The action plan is based on four principles (USEPA and IDEM, 1992). The first principle is that success is to be measured as tangible environmental improvement. The second principle is that creative solutions and non-traditional ways of dealing with environmental problems are to be explored. The third principle is to use an integrated multimedia approach, focused on common objectives. Finally, close coordination between Federal, state, and local governments, and interested community groups, environmental organizations, citizens, businesses, and industry is necessary.

The NIAP identifies six environmental objectives that directly support the RAP efforts for northwest Indiana. The plan includes descriptions of specific programs to reach these objectives. The objectives and the programs as detailed in the plan are summarized as follows (USEPA and IDEM, 1992):

OBJECTIVE #1. Ensure the dredging and sediment remediation of the Federal navigation channel and, where possible, other segments of the Grand Calumet River, utilizing all available mechanisms, including enforcement.

The RAP identified contaminated sediments in the IHC/GCR as the most significant environmental issue in the area of concern. The USEPA is providing extensive assistance to USACE to expedite the dredging of over 1.2 million cubic yards of material from the Federal navigation channel in the IHC. This effort is critical because it will decrease the annual movement of 150,000 cubic yards of contaminated material from the IHC to Lake Michigan. Additional sediment remediation upstream of the IHC would prolong the useful life of the navigation channel and would prevent other contaminated sediments from filling the harbor.

State involvement will be crucial to the success of any dredging effort because of the state's authority to implement regulations for solid and hazardous waste disposal. These regulations will determine how the sediment would be disposed of once it is removed from the harbor, canal, and river.

OBJECTIVE #2. Achieve a high level of compliance with all Federal and state environmental statutes and ensure that the necessary state and local infrastructure is in place to maintain high levels of compliance.

Facilities in northwest Indiana have a historically poor record of compliance with environmental statutes. Monitoring and ensuring compliance with existing regulations is a primary objective for the area. The USEPA is currently litigating for reimbursement of remediation costs from public and private parties in the area.

OBJECTIVE #3. Investigate and remediate the millions of gallons of petroleum distillate in the groundwater of northwest Indiana through Federal, state, and local efforts.

The problem of groundwater contamination caused by industrial leaks and spills in northwest Indiana was identified in the RAP. The USEPA estimates that between 5 and 50 million gallons of petroleum distillate exists in the underlying aquifer. The petroleum distillate poses a threat to the river and Lake Michigan through

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and help State achieve the WQS / goal for the stream.

continued, slow, and constant seepage to surface water. Remedies will primarily be carried out by enforcement of state statutes.

OBJECTIVE #4. Begin a broad-spectrum pollution prevention initiative with local industries and municipalities to reduce ongoing discharges to the environment, protect ongoing and completed cleanups, and ultimately reduce the need for enforcement actions in the Area of Concern.

Pollution prevention is rapidly becoming an integral part of USEPA and IDEM programs. Pollution prevention is a key strategy for protecting the considerable investment of time, effort, and resources committed to the remediation of the northwest Indiana area of concern.

OBJECTIVE #5. Ensure compliance with Annex 2 of the Great Lakes Water Quality Agreement through the state's development of the Remedial Action Plan and the development of the Lakewide Management Plan for Lake Michigan.

Annex 2 of the Great Lakes Water Quality Agreement of 1987 required the preparation of the RAP by IDEM and the Lake Michigan Lakewide Management Plan (LaMP) by the USEPA.

OBJECTIVE #6. Implement a public outreach and participation effort as part of an environmental communication strategy to involve the public in the decision-making process.

A public involvement plan for northwest Indiana has been developed based on interviews with community leaders, industry representatives, citizens at large, and USEPA and state staff. The plan summarizes public concerns about environmental problems in the area and recommends specific public involvement objectives and activities to address those concerns.

The Lake Michigan Lakewide Management Plan

The LaMP is designed to reduce loading of toxic pollutants to Lake Michigan (USEPA and IDEM, 1992). The LaMP objective is to assess the environmental impact of current loading and identify how future loading can be reduced.

There are five ecosystem objectives and LaMP goals for Lake Michigan (USEPA, 1992). The first goal is that the Lake should support "healthy, diverse, reproducing, and self-sustaining" aquatic communities that emphasize native species. Secondly, the waters, coastal wetlands, and upland habitats of the Lake basin should support in sufficient quality and quantity a healthy, diverse, and self-sustaining wildlife community. The third goal provides that human activity should not decrease the quality of the waters and biota of the Lake to levels that affect human health or aesthetics. The fourth goal is that the Lake and nearshore zones should be of sufficient quality and quantity to support ecosystem health, productivity and animal and plant distribution in and adjacent to the Lake. The fifth goal is that human activities should be environmentally ethical and committed to responsible stewardship.

The LaMP process for Lake Michigan is divided into six basic steps (USEPA, 1992). The first step is to monitor the ecosystem and review available information to determine ecosystem impairments and the impairing pollutants, where possible. The next step is to identify the sources of the pollutants. Third, the amounts of pollutants being released, by source, to the Lake are to be quantified. Fourth, load reduction targets or the degree to which loads need to decrease to prevent impacts to the Lake are to then be established. The fifth step is to develop and implement strategies to reduce pollutants existing in the Lake. Finally, the ecosystem is to be reevaluated to measure restoration progress toward beneficial uses and functions and to detect emerging problems (USEPA, 1992).

Geographic Enforcement Initiative

This initiative is the USEPA mandate to enforce remediation in the area. Since February 1990, USEPA Region V has maintained a Geographic Enforcement Initiative (GEI) focused on northwest Indiana, the first of its kind in the nation. Many enforcement activities have been implemented to achieve compliance with all Federal and state environmental statutes and to ensure that the necessary state and local infrastructure is in place to maintain high levels of compliance.

A GEI task force coordinates enforcement actions throughout northwest Indiana. The task force works to develop multimedia enforcement cases and functions as a clearinghouse for enforcement activities. There are numerous cases currently in progress including Inland Steel, Federated Metals Corporation, and Bethlehem Steel.

Numerous consent decrees for the remediation and prevention of environmental problems in the area have also been implemented to ensure that regulatory compliance and desired environmental improvements are attained. The USEPA is implementing the USX Consent Decree (US v. USX Gary Works), under which USX will characterize the sediment quality for 13 miles of the GCR, prepare a comprehensive plan for remediating sediments degraded by its facilities, and carry out $25 million in physical plant environmental improvements. The USEPA is finalizing the LTV Steel Company's Indiana Harbor Works Federal Consent Decree and providing technical support to IDEM in its current civil action against LTV Steel. The USEPA is also implementing the Gary Sanitary District (GSD) Consent Decree (US and the State of Indiana v. GSD). In addition to levying a $1.2 million penalty against the GSD, the decree establishes broad powers for the Mayor to

How is
GEI different
from NWIP ?
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guarantee that GSD completes needed repairs and upgrades to comply with Federal and state laws. The decree requires GSD to carry out $1.7 million in sediment remediation work required to complement the work done by USX in the Grand Calumet water system. The implementation of the TSCA portion of the GSD Consent Decree is also continuing.

The USEPA and IDEM will continue to determine sediment management alternatives for the IHC. The IDEM, with USEPA assistance, will implement the agreement to close the Energy Cooperative, Incorporated (ECI) site (one of four sites currently being considered for the location of a CDF for dredged sediments). The USEPA will continue evaluating sediment characterization studies and reviewing any associated permits for the disposal of the material.

The USEPA will continue developing ways to improve the overall performance of the Gary, Hammond, and East Chicago Sanitary Districts. Enhanced technical assistance and pollution prevention programs are in progress for this purpose. Enforcement actions by USEPA, state, and local authorities against industrial sources that violate pretreatment limits established for sanitary districts are being executed. Enforcement actions are being taken against violators of the municipal contract requirements for the Gary and Hammond Sanitary Districts.

Assessment and Remediation of Contaminated Sediments Initiative

The 1987 amendments to the Clean Water Act authorized USEPA Great Lakes National Program Office (GLNPO) to coordinate and conduct a 5-year study and demonstration project relating to the appropriate treatment of toxic pollutants in bottom sediments. The GCR was one of five areas specified in the Act as requiring priority consideration in conducting demonstration projects. To fulfill the requirements of the Act, GLNPO initiated the Assessment and Remediation of Contaminated Sediments (ARCS) Program. In addition, the Great Lakes Critical

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Programs Act of 1990 extended the program by one year and specified completion dates for certain interim activities.

ARCS is an integrated program for the development and testing of assessment and remedial action alternatives for contaminated sediments. Information from ARCS program activities will be used to guide the development of the RAP and the LaMP.

The ARCS Program is a multi-organizational endeavor. Administered by GLNPO, other participants in ARCS include the USACE, the US Fish and Wildlife Service (USFWS), the National Oceanic and Atmospheric Administration (NOAA), the US Department of Interior, USEPA headquarters offices, USEPA laboratories, USEPA Regions II, III and V, and numerous Great Lakes state agencies, universities, and public interest groups.

Three technical Work Groups identify and prioritize specific tasks to meet the objectives of the program. These are the Toxicity/Chemistry, Risk Assessment/ Modeling, and Engineering/Technology Work Groups. A fourth Work Group, Communication/Liaison, oversees technology transfer, public information, and public participation activities. Finally, the Activities Integration Committee coordinates the technical aspects of the Work Groups' activities.

The ARCS program has three overall objectives. The first objective is to assess the nature and extent of bottom sediment contamination. The second objective is to demonstrate and evaluate the effectiveness of selected remedial options, including removal, immobilization, and advanced treatment technologies, as well as the "no action" alternative. The third objective of ARCS is to provide guidance on contaminated sediment problems and remedial alternatives. It is emphasized that ARCS is not a cleanup program.

Air Program Initiatives

The USEPA Region V Air and Radiation Division has a number of activities in the Northwest Indiana area. Many of these activities involve helping the State of Indiana respond to the requirements of the Clean Air Act. The USEPA and IDEM are examining a more active and effective enforcement program for the area including a number of new industrial regulations and enforcement activities. There are also number of non-regulatory activities that influence northwest Indiana. Some of these activities are aimed at decreasing automobile emissions by increasing public awareness and use of mass transit. Additionally, programs have been initiated for the reduction of organics volatilization from automobile refueling and repair.

Pollution Prevention Initiative

This is broad-spectrum program in which local industries and municipalities work to reduce ongoing discharges to the environment, protect ongoing and completed cleanups, and ultimately reduce the need for enforcement actions in the area. Pollution prevention is rapidly becoming an integral part of USEPA programs. Pollution prevention is a key strategy for protecting the considerable investment of time, effort, and resources committed to the remediation of the area (USEPA and IDEM, 1992).

Several Federal and state pollution prevention projects began in 1991 and 1992 (USEPA and IDEM, 1992). In September 1992, a Pollution Prevention Symposium for the iron and steel industry in the Great Lakes Basin provided a forum for information exchange and education on technical and policy issues related to pollution prevention. Pollution prevention training was held in spring 1992 for staff and citizens involved in developing the IHC/GCR RAP. Many voluntary waste minimization projects sponsored by USEPA's Office of RCRA are underway. In

1991, two northwest Indiana corporations agreed to participate in the project. The USEPA's RCRA Waste Minimization staff and contractors will continue to work with managers and staff from both facilities to complete waste minimization audits, with the goal of achieving measurable reductions of hazardous waste generation at each facility. Development of a pollution prevention strategy specifically for the steel industry in northwest Indiana is in progress.

The USEPA and IDEM identified specific pollution prevention activities for 1992 (USEPA and IDEM, 1992). The agencies are targeting additional northwest Indiana industries for voluntary waste minimization projects. Another activity is the urban Clean Sweep program that educates citizens on safe substitutes for household hazardous waste. The agencies are also working with northwest Indiana industries, municipalities, and environmental groups to establish a toxics use reduction task force. This task force is working to reduce the introduction of toxics into local sewage treatment plants by identifying and reducing sources. Additionally, the agencies are identifying pollution prevention opportunities to be undertaken in coordination with the pollution prevention strategy currently being developed for the Lake Michigan Basin.

<u>The 33/50 Initiative</u>

This initiative refers to the Toxic Reduction Project. Seventeen chemicals are targeted by USEPA for voluntary industrial use reduction or elimination. Goals of 33 percent reductions by 1995 and 50 percent reductions by 1998 of the use of these compounds have been set by USEPA.

An active program under this initiative is the completion of Phase 2 of the Lake Michigan Toxic Reduction Project. This effort will estimate toxic loading from Superfund and RCRA sites to Lake Michigan. The estimates will serve as a basis for prioritizing remediation sites in the Lake Michigan basin (USEPA and IDEM, 1992).

<u>Public and Private Partnerships Initiative</u>

This initiative refers to the USEPA program of providing matching funds to local municipalities, local governments, and business communities for particular environmental projects. This initiative is part of a public outreach and participation strategy to involve the public in the decision-making process. This program is to include local governments, environmental groups, and industry (USEPA and IDEM, 1992).

A public involvement plan for northwest Indiana has been developed based on interviews with community leaders, industry representatives, citizens at large, and USEPA and state staff. The plan summarizes public concerns about environmental problems in the area and recommends specific public involvement objectives and activities to address those concerns. Implementation of the plan will be carried out by USEPA's Office of Public Affairs, IDEM's Office of External Affairs, and IDEM's Northwest Office.

2. DISCUSSION OF ALTERNATIVES

This chapter briefly discusses policy and technology alternatives for sediment management in the areas within and outside the Federal navigation channel. Policy alternatives considered include No Action; dredging, by USACE, of the Federal navigation channel only; dredging outside the Federal navigation channel only, as required by USEPA enforcement activities; and dredging both within and outside the Federal navigation channel. Technology alternatives considered include dredging, treatment, disposal, and isolation.

2.1 Policy Alternatives

This section briefly discusses the four Federal policy alternatives. The No Action Alternative is discussed in terms of current conditions and operations in the IHC/GCR. Alternatives for dredging the Federal navigation channel (USACE activities only), and dredging the IHC/GCR and GCR outside the channel (USEPA-required activities only) are discussed as separate and distinct actions. A combination of USACE and USEPA-required dredging outside the channel is also discussed as an alternative.

2.1.1 No Action Alternative

Under this alternative, dredging of the areas both outside the Federal navigation channel and dredging of the Federal navigation channel would not take place. Sediments in both areas would be allowed to remain in place, and contaminants in the sediments would not be removed. Additionally, authorized depths in the Federal navigation channel, the breakwaters, and other navigation structures would not be maintained.

2.1.2 USACE Dredging of the Federal Navigation Channel

The alternative for dredging the Federal navigation channel is described in detail in the Draft Environmental Impact Statement for Maintenance Dredging and Disposal Activities for the Indiana Harbor and Canal, Lake County, Indiana (USACE, 1990). This alternative includes maintenance dredging and construction of a CDF for the backlog of accumulated sediments in the Federal navigation project at IHC. This alternative consists of: (1) construction of a CDF in the vicinity of the IHC/GCR; (2) maintenance dredging of the Federal navigation channel to authorized depths; (3) treatment and/or disposal of the dredged sediments in the CDF; and (4) routine maintenance of all navigation structures. This alternative does not include the dredging of contaminated sediments outside the Federal navigation channel.

2.1.3 USEPA-Required Dredging for Remediation Outside the Federal Navigation Channel

The alternative for dredging the area outside the Federal navigation channel includes: (1) construction of a CDF in the vicinity of the IHC/GCR; (2) dredging of the contaminated sediments outside the Federal navigation channel; and (3) treatment and/or disposal of the dredged sediments in the CDF. This alternative does not include the dredging the Federal navigation channel.

2.1.4 Combined USACE and USEPA-Required Dredging

The alternative for dredging the sediments both outside and within the Federal navigation channel includes a combination of both Sections 2.1.1.2 and 2.1.1.3 above. This alternative consists of: (1) construction of two or more CDFs in northwest Indiana; (2) maintenance dredging of the Federal navigation channel to authorized depths; (3) dredging of the contaminated sediments outside the Federal navigation channel; (4) treatment and/or disposal of the dredged sediments in the CDFs; and (5) routine maintenance of all navigation structures.

2.2 Technology Alternatives

This section briefly discusses the applicable technologies for sediment management within the IHC/GCR as outlined by USACE (1990). Dredging technologies, including mechanical and hydraulic dredging alternatives, are generally discussed in terms of feasibility and effectiveness. Treatment technologies, including solidification and stabilization, solvent extraction, incineration, and wet air oxidation, are generally discussed in terms of effectiveness and feasibility based on the quality of sediments found in the harbor and canal system. Disposal alternatives are discussed in conjunction with dredging and treatment alternatives. This section also provides a brief overview of sediment isolation alternatives.

It must be noted that dredging, treatment, and disposal alternatives are each best used under specific circumstances and that no one alternative is the most effective or efficient in all cases. A combination of alternatives is often the most environmentally and economically feasible solution. Similarly, dredging and treatment alternatives are often complimentary and these synergies should be explored in the decision-making process.

2.2.1 Dredging Alternatives

Dredging may be performed using a variety of equipment. There are two basic types of dredging: mechanical and hydraulic. Mechanical dredging physically removes sediments by using a large bucket or shovel. Hydraulic dredging removes sediments in a water slurry. In addition, there are several special purpose dredges for specific applications. This section includes brief descriptions of the potential dredging technologies that may be used outside the Federal navigation channel of the IHC and in the GCR.

Mechanical Dredging

Mechanical dredging is accomplished using dipper and bucket dredges (USACE, 1990). A dipper dredge is a barge mounted power shovel. The dipper is a heavy duty excavator, useful for breaking up hard, compacted materials. A bucket-type dredge uses a bucket to excavate materials. A clamshell-type of bucket dredge is used to excavate soft or cohesive sediments, and is useful for deep excavations and for close quarters dredging.

Sediments are excavated with a mechanical dredge and placed into a barge, hopper, or scow for transport to the disposal site. Mechanical dredges typically remove sediments with approximately the same water content that they have in-place.

Mechanical dredging causes sediment agitation and resuspension. The force of the bucket or dipper impacting the bottom, and the loss of sediments as the bucket or dipper is raised through the water column and emptied into a scow causes sediments to be suspended in the water column. Due to the oily nature of the sediments in the IHC, resuspension from mechanical dredging may be higher than normally expected. An oily sediment would not be as cohesive as a compacted sediment and would tend to drain more from the bucket when drawn through the water column and to the scow. A closed bucket design modification to a standard clamshell dredge has been demonstrated to reduce sediment resuspension by 30 to 70 percent. This modification involves welding plates on top of the bucket and gaskets or seals on the sides to reduce the amount of resuspension as the bucket is raised through the water.

All dredging → JD

Advantages of mechanical dredging include greater effectiveness in removing consolidated sediments and sediments in close quarters, and less uptake of carriage water. Mechanical dredging uptakes less carriage water, thereby decreasing the amount of liquid requiring pretreatment and subsequent treatment by municipal sewage treatment plants. Local wastewater treatment plant capacity and the amount of CDF effluent should be factors considered when dredging alternative decisions are made. Mechanical dredging also increases the efficiency (i.e., capacity and useful lifespan) of a CDF.

Another disadvantage of mechanical dredging, in addition to sediment resuspension and the uptake of large amounts of carriage water, is that rehandling of sediments is required. With mechanical dredging, sediments are dredged and placed in a scow and/or other vehicles for transport to a CDF. Any additional rehandling increases the potential for accidental releases of contaminated materials.

Hydraulic Dredging

Hydraulic dredges remove and transport sediments in a liquid slurry (USACE, 1990). There are several types of hydraulic dredges including: cutterhead, suction, dustpan, hopper, and special purpose. These dredges are typically ship or barge mounted and are powered by electric or diesel centrifugal pumps. The pumps force the dredged materials, through pipes and hoses, to the disposal or treatment site.

Hydraulic dredges typically remove sediments with four times the water content that they have in-place. The dredged material and associated carriage water would be placed in a CDF, where the water would be removed by evaporation, drainage, or leaching. The carriage water removed through a drainage system would be pretreated using sand filtration and carbon sorption and then discharged to the Hammond, Gary, or East Chicago sanitary sewer system. This water would receive further treatment from those system's wastewater treatment plants and ultimately be discharged to the GCR.

A cutterhead dredge excavates with a revolving cutter surrounding the intake end of a suction pipe. The cutterhead cuts the sediment that is then drawn into the suction pipe along with a large volume of water. The sediment and water are transported through a pipeline to the disposal site.

A suction dredge is the same as a cutterhead dredge with the cutterhead removed. Suction dredges are only applicable for removing soft, unconsolidated sediments, with little or no debris.

A dustpan dredge is a hydraulic suction dredge with a widely flared dredging head with pressure water jets mounted on the head. The jets loosen and agitate the sediment, which is then captured in the dustpan head as the dredge is advanced. The dustpan dredge is typically used for shallow water dredging in large river channels.

A hopper dredge is a self-propelled seagoing vessel, with large containers (hoppers) used to store and transport dredged materials. Dredged materials are pumped through drag arms and discharged into the hoppers. Hopper dredges are used to dredge large harbors and rivers with ample area to maneuver (USACE, 1990).

Hydraulic dredging has several advantages over mechanical dredging. When properly selected and operated, hydraulic dredging can maximize the removal of sediments, leave virtually no silt behind in its path, effectively control turbidity, and pump the maximum concentration of silt in the slurry in a cost effective manner. Further advantages include the relative non-disturbance of aquatic ecosystems, (i.e., as biota evacuate the area of dredging and return upon completion of the dredging operations) and there is no disturbance of the surrounding shoreline, Really?

pretty strong / operator and condition dependent including dock areas, by heavy equipment (WODCON XII, 1989). Hydraulic dredging is especially advantageous in the removal of contaminated sediments, as resuspension of dredged materials is kept at a minimum.

Disadvantages of hydraulic dredging include limitations on dredging and disposal, and from the equipment. Hydraulic dredges are better adapted to dredging more open areas. Hydraulic dredging also limits the distance that the CDF can be from the dredged materials. Larger distances between the dredged area and the CDF increase costs (by increasing the number of pumps and piping required) and the opportunity for leaks and other accidents with the transport piping.

2.2.2 Treatment Alternatives

Localized areas of sediments in the IHC/GCR (approximately 175,000 cubic yards in the Federal navigation channel and an estimated 250,000 to 1,000,000 cubic yards outside the navigation channel and in the GCR) have concentrations of polychlorinated biphenyls (PCBs) exceeding 50 parts per million (ppm); therefore, a portion of the dredged material for this project is regulated by the TSCA. This Act requires consideration of incineration and other treatment alternatives for disposal of TSCA regulated materials. As part of compliance with this Act, the Chicago District of USACE has conducted an analysis of the applicability of advanced treatment technologies for dredged materials from the IHC (USACE, 1988). A number of advanced treatment technologies were examined and screened based on technical feasibility factors. Based on this analysis, the technologies selected for additional consideration are summarized below. Each of the treatment technologies involve the use of a CDF in some capacity (USACE, 1990).

Solidification and Stabilization

Solidification and stabilization (S/S) is a technology designed to provide both physical immobilization with reduced accessibility of water by entrapment of contaminated solids in a hardened mass (solidification), and chemical immobilization by alteration of the chemical form of the contaminants so that they are less soluble and/or less leachable (stabilization).

Solidification is accomplished by adding setting agents that react with water to form a hardened mass, somewhat like concrete. Material converted to a solid state is expected to be less susceptible to leaching due to reduced accessibility of water to the contaminated solids within the hardened mass. Typical setting agents include portland cement, lime, fly ash, kiln dust, slag, and combinations of these materials. Co-additives such as clay minerals, soluble silicates, and sorbents are sometimes used with the setting agents to give special properties to the final product.

Stabilization is accomplished by controlling pH and alkalinity. Stabilization primarily minimizes the solubility of metal contaminants. Conversely, anions are more difficult to convert to insoluble forms, and most S/S systems rely on physical immobilization of anions. Organic compounds are generally not affected by chemical immobilization when portland cement and pozzolan-based systems are used, however studies have indicated that stabilization does reduce the leachability of PCBs. No S/S systems have been applied in the United States at field scale to dredged materials (USACE, 1990).

Solvent Extraction

Extraction is the removal of chemical constituents from contaminated materials in order to produce an uncontaminated residue. Solvent extraction involves transfer of contaminants from a solid or liquid to another medium, generally a fluid, for treatment and disposal by another set of processes. Since metals cannot be degraded, they can only be extracted and relocated. Solvent extraction has primarily been used to recover organic chemicals from wastewater. Application of solvent extraction to mixtures of solids and liquids, such as dredged materials, is still in the developmental stages (USACE, 1990).

Incineration (on-site and off-site)

Incineration uses high temperature (700 to 1,700 degrees C) thermal oxidation to convert organic wastes to ash and gaseous combustion products. The incineration gas end product contains primarily carbon dioxide and water vapor plus hydrogen chloride, nitrogen oxide, phosphoric pentoxide, sulphur dioxide, particulate matter, and organic products of incomplete combustion. Types of incinerators capable of handling dredged materials include multiple hearth, rotary kiln, and fluidized bed. Air pollution control equipment is required for these types of systems.

The destruction and removal efficiency of an incinerator depends on three factors: temperature, the amount of mixing which occurs between the air and the waste materials, and the residence time of the waste material in contact with air in the incinerator. Higher temperatures in the incineration process allows for more effective destruction and removal of contaminants. Temperature is affected by the thermodynamic properties of the wastes. Since the thermodynamic properties of the dredged materials are such that the material will not sustain combustion, special pretreatment of the materials, such as de-watering and blending with fuel oil, may be required. The incinerator will also be most effective when the waste materials are allowed maximum contact with air. The contact area of the waste materials with air is increased by agitating the waste materials. Likewise, a longer residence time will increase the effectiveness of the incinerator by maximizing the contact with air. Gravity de-watering requires long holding periods in containment facilities. Mechanical de-watering is not practical for high volume dredging projects. The de-watering requirements for incineration may significantly impact the technical feasibility of the process and could be prohibitive (USACE, 1990).

Wet Air Oxidation

Wet air oxidation is based on aqueous phase oxidation of contaminants at elevated temperatures and pressures. Contaminants are oxidized at temperatures that are significantly lower than incineration temperatures. Wet air oxidation uses temperatures of 250 to 325 degrees C and pressures from 1,000 to 2,000 pounds per square inch gage (psig). The process produces a vent gas that may contain volatile organic compounds (requiring removal by air pollution control equipment) and a slurry containing inorganic ash and partially degraded organics. Destruction efficiencies for PCBs are around 60 percent. This process has not been demonstrated for soils or dredged materials (USACE, 1990).

2.2.3 Disposal Alternatives

The location of the USACE CDF will be determined after internal and public review of the USACE DEIS for the IHC. The USACE would build and maintain the CDF, and would reserve approximately 250,000 cubic yards capacity in the proposed CDF for disposal of dredged materials from outside the Federal navigation channel. This reserved capacity would be available at cost and pending review of the USACE future CDF requirements. An estimated 250,000 to 1,000,000 cubic yards of material may be dredged from the IHC/GCR outside the navigation channel. Therefore, at least a second CDF may be required if the combined USACE and USEPA-required dredging alternative is chosen.

Four sites were evaluated in the USACE DEIS for potential construction and operation of a CDF (Figure 2.1). At each of the four sites, several designs and

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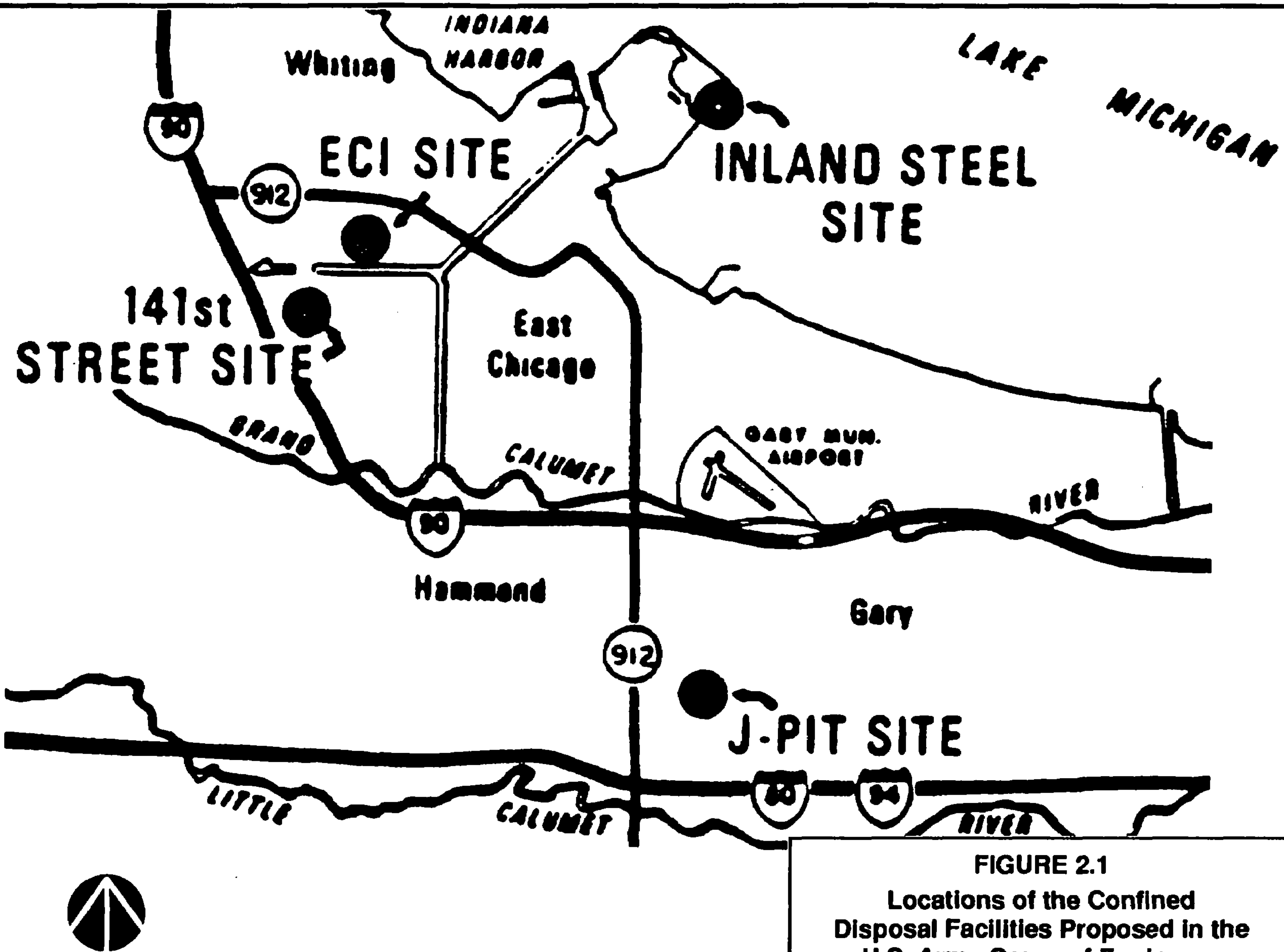
Did they agree to this? JD

why not more?



Source: Adapted from USACE, 1990.

FIGURE 2.1
Locations of the Confined Disposal Facilities Proposed in the U.S. Army Corps of Engineers Draft Environmental Impact Statement

plans of operation were considered with respect to engineering, environmental, and cost factors. A number of environmental controls were developed for each CDF site to minimize the leaching of contaminants from the dredged sediments (USACE, 1990). The design details for each of the CDFs discussed below are provided in the USACE DEIS.

141st St. Site

This plan consists of the construction of a CDF at a site located immediately north of 141st Street and east of the Indiana East-West Tollroad in Hammond. The site is approximately 80 acres in area on lands owned by petrochemical companies and is situated several hundred feet south of the Lake George branch of the IHC. The CDF would be constructed with two cells, a design capacity of 2.0 million cubic yards, and an estimated design life of 15 to 20 years.

J-Pit Site

This plan consists of the construction of a CDF at a site located west of Colifax Avenue, east of the E,J,& E Railroad, and south of 15th Avenue in western Gary. The site is a sand borrow pit, approximately 100 acres in area, and has been excavated to a depth of approximately 40 feet. The pit has been used for disposal of construction wastes. The CDF would be constructed with two cells, a design capacity of 3.0 million cubic yards, and an estimated design life of 30 to 40 years.

Inland Steel Site

This plan consists of the construction of a CDF within the existing lakefill area surrounded by the Indiana Steel breakwater. The CDF would be rectangular in shape, approximately 70 acres in area, and divided into 3 cells of equal area. The

CDF would be constructed with a design capacity of 3.0 million cubic yards, and an estimated design life of 30 to 40 years.

Energy Cooperative, Incorporated (ECI) Site

This plan consists of the construction of a CDF at a site located immediately north of and adjacent to the Lake George branch of the Indiana Harbor Canal. The CDF would be roughly rectangular in shape, approximately 140 acres in area, and divided into 2 cells of unequal size. The CDF would be constructed with a design capacity of 4.25 - 4.75 million cubic yards and an estimated design life of 30 to 40 years.

2.2.4 Sediment Isolation Alternatives

Sediment remediation alternatives which do not involve sediment removal include sediment capping and in-place treatment.

Sediment Capping

Capping is the process by which in-place sediment contamination is encapsulated (capped) by clean materials. The intent of capping is to limit the exposure of sediment contamination to the water column and aquatic life. The feasibility of capping is dependent on the hydraulics of the waterway. Capping materials must completely seal the sediment contamination from the overlying water, prevent penetration from benthic or burrowing organisms, and be resistant to scour. If the capping material is more dense than the sediments, the capping material may settle through to the bottom of the sediments. If the cap does not completely seal the sediments, or if it settles so as to expose the sediments, contaminants may be released through the cap and into the water column. Capping is only effective if all sources of sediment contamination are controlled; otherwise, the cap materials would become covered or contaminated by future contaminated sediments (USACE, 1990).

In-Place Sediment Treatment

In-place (in-situ) treatment consists of the destruction, modification, or immobilization of one or more sediment contaminants in-place. Little is known about the feasibility of in-place treatment. Theoretically, feasible methods include fixation/solidification, requiring the injection of stabilizers and other additives into the sediment deposits, and biodegradation, involving microorganisms which degrade organic contaminants in the sediments. Biodegradation is not applicable to heavy metal contaminants (USACE, 1990).

3. AFFECTED ENVIRONMENT

This chapter briefly addresses the existing environment in and around IHC, the GCR, and the proposed disposal sites.

3.1 Sediment Quality

The IHC/GCR waterway system has a history of sediment quality problems (USACE, 1990). The USACE, USEPA, the IDEM, and other entities have extensively studied the sediment quality of the IHC/GCR. Most of these surveys focus on the sediments within the Federal navigation channel. Generally, IHC/GCR sediments are fine-grained (silt and clay) and, therefore, have a high affinity for adsorbing many pollutants such as PCBs.

Extensive sampling and analysis of IHC/GCR sediments over the last 15 years reveal that they contain high concentrations of organics (including PCBs and oils), nutrients, and numerous metals. The first significant study was conducted by USEPA in 1977 and consisted of the collection of 13 grab samples from the IHC. Table 3-1 summarizes the results of the USEPA's 1977 study. These sediments, except for two lakeward samples, were found to be heavily polluted with respect to a number of parameters according to the USEPA's 1977 Guidelines for Pollutional Classification of Great Lakes Harbor Sediments. The heavily polluted classification applied to various metals (arsenic, cadmium, chromium, copper, iron, lead, nickel, and zinc), PCBs, ammonia, and phosphorus. Most of the sediments in the IHC were found to consist of oily silt, silt, and clay while those sampled in the center of the canal, the eastward end of the approach channel, and in the harbor area were sandy. Sediments in the approach channel consisted of sand and gravel. Overall, the most heavily contaminated sediments tend to lie in the upstream portions of the IHC. A general trend of decreasing contamination occurs in a downstream direction toward Lake Michigan (USACE, 1986; 1990). The USEPA

Table 3-1 Sediment Quality of Indiana Harbor and Canal Sediments Based on USEPA Studies in 1977 and USACE in 1979

Parameter[1]	Moderately Polluted Range[2]	USEPA 1977 Mean Concentration	USACE 1979 Mean Concentration
Volatile Solids	5 - 8	11.6	16
Total Solids	---	---	54
COD	40,000 - 80,000	185,569	191,200
TKN	1000 - 2000	2,592	3,283
Ammonia	75 - 200	285	< 829
Phosphorus	420 - 650	2,577	2,951
Oil and Grease	1000 - 2000	44,631	50,000
Arsenic	3 - 8	29	37
Cadmium	6	9.8	< 11
Chromium	25 - 75	466	404
Copper	25 - 50	174	186
Iron	17,000 - 25,000	110,231	163,000
Lead	40 - 60	601	882
Magnesium	---	---	16,213
Manganese	300 - 500	207	1,837
Mercury	1	0.5	< 1
Nickel	20 - 50	79	91
Zinc	90 - 200	2,635	4,047
Total PCBs	1	9.5	< 16

[1]All parameter concentrations are expressed in milligrams per kilogram (mg/kg), dry weight, except for total solids and total volatile solids which are percent.

[2]USEPA 1977 Guidelines for Pollutional Classification of Great Lakes Harbor Sediments. Sediments with concentrations less than the moderately polluted range are considered unpolluted for that parameter (except for cadmium, mercury and PCBs for which lower limits have not been established). Sediments with concentrations greater than the moderately polluted range are considered heavily polluted.

TKN = total Kjeldahl nitrogen; PCBs = polychlorinated biphenyls.

Source: compiled from USACE (1986 and 1990).

also sampled sediments from six sites in 1980; three in the upstream reach of the IHC and three in the Harbor. Samples were analyzed for metals, PCBs, and polycyclic aromatic hydrocarbons (PAHs). Sediments at every sampling location were again found to be heavily polluted by metals (arsenic, cadmium, chromium, copper, iron, lead, nickel, and zinc). Again, upstream sediments generally exhibited higher pollutant concentrations (USACE, 1986).

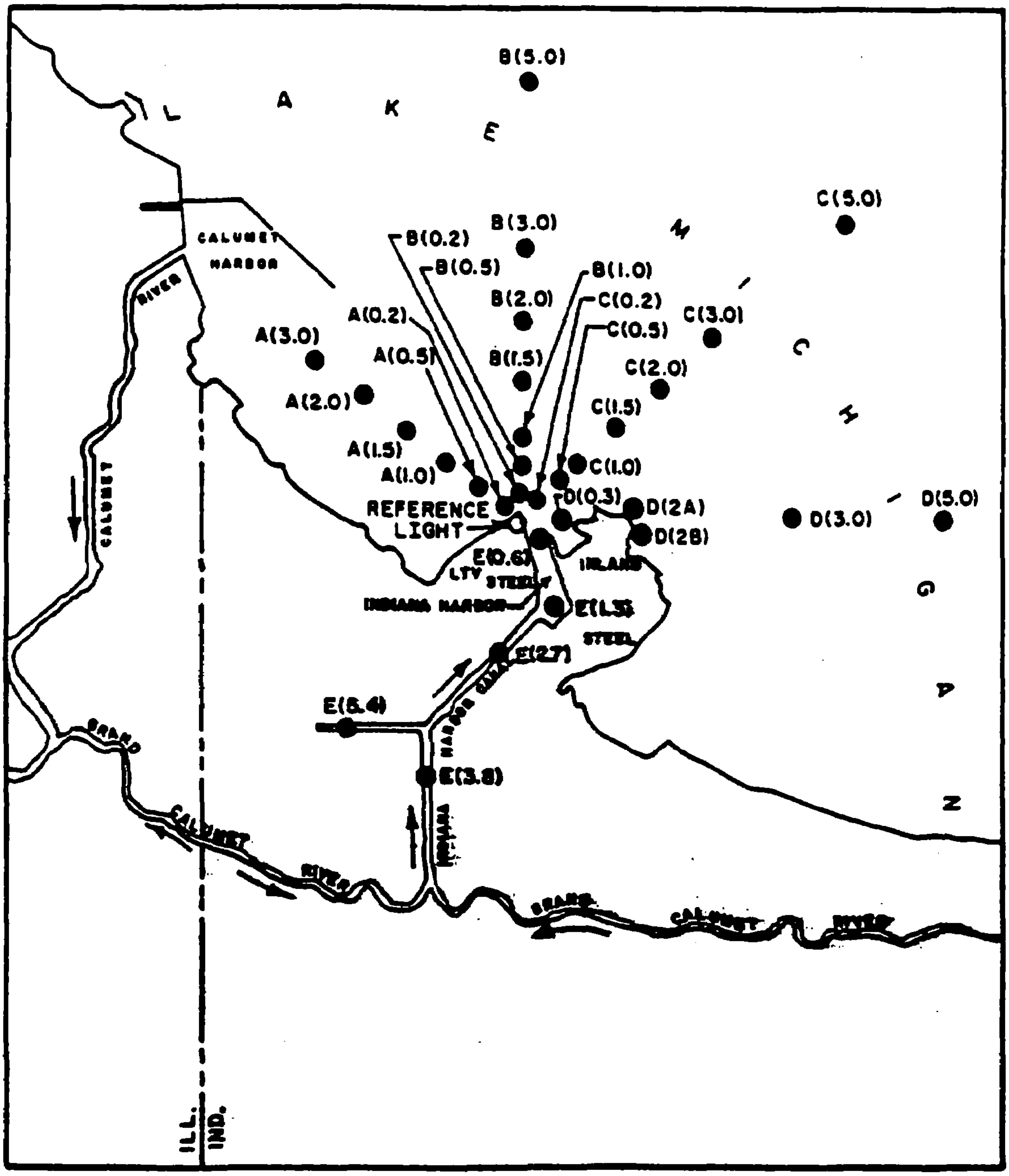
The USACE conducted a sediment study in 1979 which included the collection and analysis of IHC sediment core samples from the same 13 locations which USEPA sampled in 1977. A total of 34 composite sediment samples were analyzed. Results were similar to those of the USEPA's 1977 survey (Table 3-1). However, PCB concentrations in sediments from deep samples in two locations had PCB concentrations which exceeded 50 ppm (USACE, 1986; 1990). Concentrations in these sediment samples were well above the criteria for being heavily polluted. Those sediments are therefore regulated by TSCA.

In 1983, the Chicago District of USACE performed two sediment sampling studies for the purposes of performing PCB and EP-Toxicity tests on 27 core samples. The PCB tests confirmed the results of the USACE's 1979 study that elevated PCB levels were limited to two areas in the IHC and that concentrations exceeding 50 ppm were confined to deeper sediments. None of the five samples analyzed for EP-Toxicity were found to be "hazardous" as defined by RCRA.

In 1984, the Detroit District of USACE collected and analyzed 18 sediment cores from six sites in the harbor and approach channel of the IHC which included a complete priority pollutant analysis. Lakeward samples showed low levels of nearly all pollutants. Nutrients and metals were generally classified as non-polluted to moderately polluted and organic compounds were not present in detectable amounts. Sediments from the outer harbor and entrance channel had levels of PCBs, metals (lead, copper, arsenic, and chromium), and oil and grease and were classified as heavily polluted according to the 1977 USEPA guidelines. Sixteen PAH compounds were found in the sediments at low concentrations (USACE, 1986; 1990). However, the USACE Waterways Experiment Station (WES) collected and analyzed sediment samples from three IHC sites in 1985. Results of this study indicate some PAH contamination in IHC sediments (USACE, 1990).

The Metropolitan Sanitary District of Greater Chicago was contracted in 1987 by USACE to study the transport and deposition of contaminated sediments discharged from the IHC into Lake Michigan (Polls, 1988). Sediment samples were collected along five transects from 30 locations in the canal and harbor areas and up to 5 miles out from the harbor mouth in Lake Michigan (Figure 3.1). Transect E covered the Indiana Harbor, Indiana Harbor Canal, Calumet River Branch of the IHC, and the Lake George Branch of the IHC. Two of the sampling sites were located in the Indiana Harbor (E(0.6) and E(1.3)), one in the Indiana Harbor Canal (E(2.7)), one in the Calumet River Branch of the Indiana Harbor Canal (E(3.8)), and one in the Lake George Branch of the IHC (E(5.4)). These sites were located using bridges as landmarks and coded as to the site's distance from the navigation light located at the northern point of the LTV Steel property boundary on Lake Michigan. Sampling sites were also fixed by LORAN coordinates. The sediments from these IHC sampling sites consisted of an oily sludge.

The sediment samples from these sites were analyzed for total solids; total volatile solids; total organic carbon; fats, oils and greases (FOG); arsenic; chromium; iron; lead; manganese; nickel; zinc; and total PCBs (Polls, 1988). The results of these analyses are summarized in Table 3-2. Total solids were highest in the lakeward samples while total volatile solids decreased downstream. Four total volatile solids samples were classified as heavily polluted; the other total volatile solid samples were in the moderately polluted range. Total organic carbon (TOC) concentrations were highest (71,151 milligrams per kilogram (mg/kg) and 68,859 mg/kg) at sites E(3.8) and E(2.7), respectively. Concentrations of FOG constituents were also



Source: Adapted from Polls, 1988.

FIGURE 3.1

Sediment Sample Locations in the Indiana Harbor Canal, Indiana Harbor, and Lake Michigan

Table 3-2 Chemical Characteristics of Sediment Collected Along Transect E in the Indiana Harbor Canal and Indiana Harbor (September 1987)

		Sediment Sampling Station				
Parameter[1]	Moderately Polluted Range[2]	0.6	1.3	2.7	3.8	5.4
Total Solids	---	48.0	40.8	29.1	23.2	26.4
Total Volatile Solids	5 - 8	6.5	9.7	20.6	19.7	20.1
Total Organic Carbon	---	10,392	23,718	68,859	71,151	47,398
Fats, Oils, and Greases	1000 - 2000	12,433	32,968	74,293	59,970	104,224
Arsenic	3 - 8	<0.1	<0.1	<0.1	<0.1	<0.1
Chromium	25 - 75	108.0	150.0	576.0	478.0	602.0
Iron	17,000 - 25,000	24,000	43,100	45,000	59,900	60,900
Lead	40 - 60	255.0	439.0	963.0	940.0	153.0
Manganese	300 - 500	978.0	1,118.0	996.0	1,207.0	1,207.0
Nickel	20 - 50	30.0	50.0	120.0	70.0	90.0
Zinc	90 - 200	930.0	1,920.0	4,280.0	3,250.0	4,120.0
Total PCBs	1	1.45	2.23	10.14	8.06	17.30

[1]All parameter concentrations are expressed in milligrams per kilogram (mg/kg), dry weight, except for total solids and total volatile solids which are expressed in percent.

[2]USEPA 1977 Guidelines for Pollutional Classification of Great Lakes Harbor Sediments. Sediments with concentrations less than the moderately polluted range are considered unpolluted for that parameter (except for cadmium, mercury and PCBs for which lower limits have not been established). Sediments with concentrations greater than the moderately polluted range are considered heavily polluted.

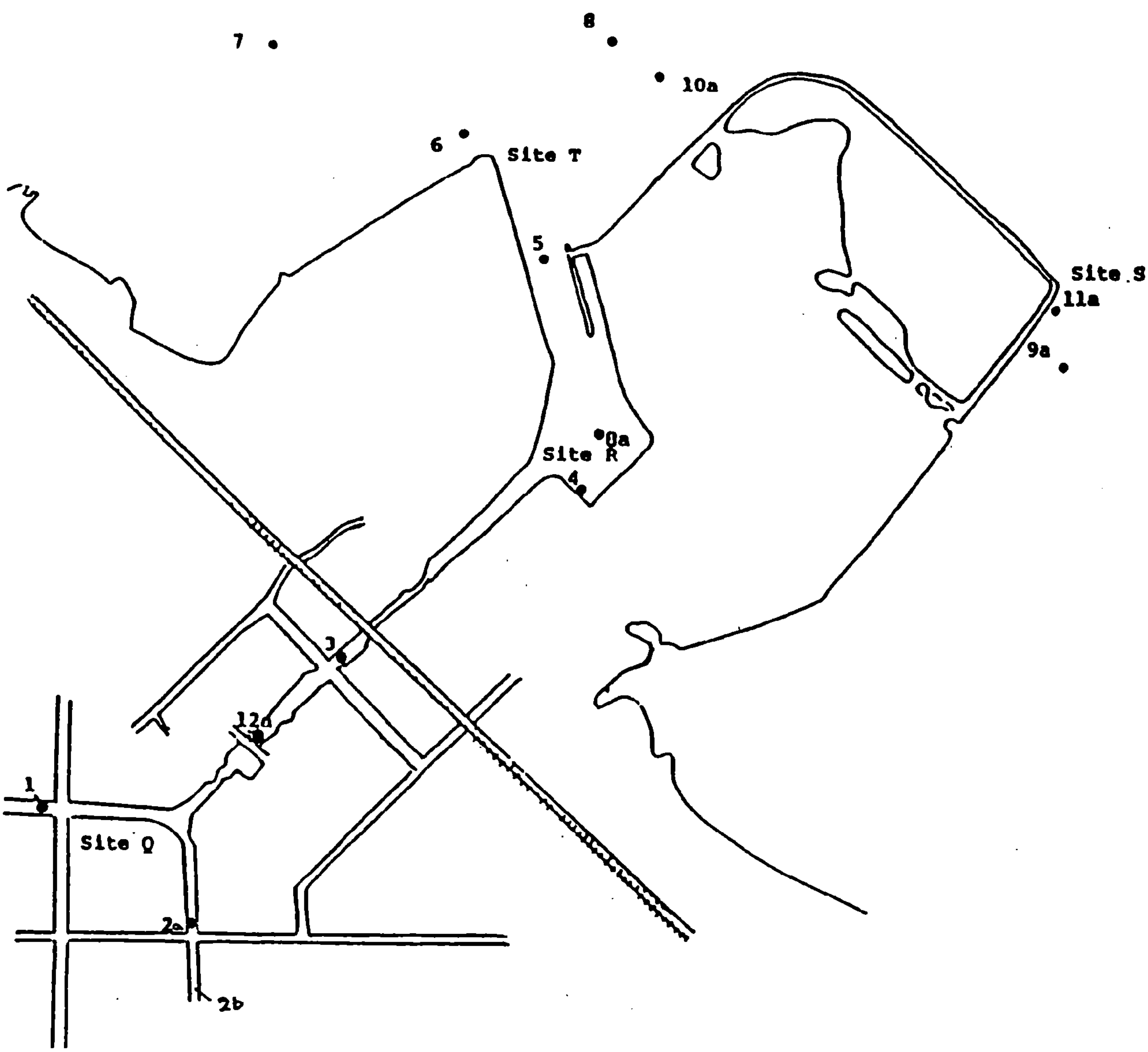
PCBs = polychlorinated biphenyls.

Source: Modified from Polls (1988).

highest in the upstream reaches of the IHC, and were well above the criteria indicating heavily polluted. Similarly, metal concentrations were highest upstream when compared to samples taken in the Harbor. Site E(5.4), in the Lake George Branch, exhibited the highest concentrations of chromium (602 mg/kg), iron (60,900 mg/kg), manganese (1,207 mg/kg), as well as total PCBs (17.30 mg/kg). The maximum lead, nickel, and zinc concentrations were detected in the Grand Calumet Branch of the IHC at site E(2.7) (963, 120, and 4,280 mg/kg, respectively). Except for arsenic in all samples, and iron and nickel in the most lakeward sample E(0.6), every sample was in the heavily polluted range for all metals and PCBs. It should be noted that since samples for site E(5.4) were collected from just downstream of the Indianapolis Boulevard bridge in the Lake George Branch of the IHC, a high depositional environment, significant contaminant accumulation would be expected.

In 1988, the Illinois State Geological Survey and the Illinois Natural History Survey were commissioned by the Chicago District of USACE to collect and analyze sediment samples from the IHC and Lake Michigan, to survey the benthos, and to conduct a series of toxicity screening tests along with a survey of biota and tissue-burden testing of aquatic organisms (Risatti and Ross, 1989). During this study, sediment samples were collected and analyzed from three sites in the Indiana Harbor area (4, 5, and 8a), two sites in the IHC (3 and 12), one in the Lake George Branch of the IHC (1), and from two sites in the Calumet Branch of the IHC (2a and 2b) (Figure 3.2). Sediment samples were analyzed for constituents which included phenolics, ammonia, PCBs, PAHs, cyanide, and 26 different metals. Some results of these analyses are contained in Table 3-3.

As noted in previous studies, high concentrations of metals and nutrients were found in the IHC (Risatti and Ross, 1989). Concentrations indicating heavily polluted sediments (according to the 1977 USEPA guidance) were identified for barium, cadmium, chromium, copper, iron, lead, manganese, mercury, nickel, and



Source: Adapted from Risatti and Ross, 1989.

FIGURE 3.2
Sediment Sample Locations in the Indiana Harbor, the Indiana Harbor Canal, the Lake George Branch of the Indiana Harbor Canal, and the Calumet Branch of the Indiana Harbor Canal

Table 3-3 Concentrations of Pollutants in Sediment Collected from the Indiana Harbor, Indiana Harbor Canal, Lake George Branch of the Indiana Harbor Canal, and from the Calumet Branch of the Indiana Harbor Canal (arranged upstream to downstream, 1 - 5, respectively).

		Sediment Sampling Station							
Parameter[1]	Moderately Polluted Range[2]	1	2b	2a	12	3	4	8a	5
TOC	---	12.57	17.81	16.84	10.30	12.66	7.49	7.64	4.60
PAHs	---	935.28	181.53	141.41	107.53	188.18	87.33	24.20	134.36
Ammonia	75 - 200	55.8	234.5	545.0	54.0	101.5	59.0	58.5	52.0
Phenol	---	0.042	0.070	0.070	0.060	0.278	0.071	0.024	0.024
Total PCBs	1	1.51	BDL	102.52	4.55	58.29	BDL	0.00	BDL
Aluminum	---	9,500	15,000	13,000	9,400	13,600	10,300	14,000	7,980
Arsenic	3 - 8	BDL	BDL	BDL	BDL	BDL	183	BDL	BDL
Barium	20 - 60	180	258	313	120	200	228	128	75
Cadmium	6	23	45	45	30	38	28	33	13
Chromium	25 - 75	940	1,070	993	450	855	423	548	190
Copper	25 - 50	235	268	488	110	275	BDL	90	55
Iron	17,000 - 25,000	76,300	208,000	192,000	168,000	156,000	149,000	164,000	35,500
Lead	40 - 60	1,430	910	835	388	730	208	BDL	95
Manganese	300 - 500	2,530	6,400	5,850	5,550	5,400	38,200	5,050	1,790
Mercury	1	652	1,360	1,710	826	1,420	594	680	253
Nickel	20 - 50	100	125	115	70	103	100	88	50
Phosphorus	420 - 650	2,640	3,980	6,170	2,100	3,800	976	1,390	446
Zinc	90 - 200	3,540	4,700	4,280	2,470	4,630	1,860	4,250	923

[1]All parameter concentrations are expressed in parts per million (ppm) except TOC (%), PAHs (parts per billion (ppb)), PCBs (ppb), and mercury (ppb).

[2]USEPA 1977 Guidelines for Pollutional Classification of Great Lakes Harbor Sediments. Sediments with concentrations less than the moderately polluted range are considered unpolluted for that parameter. Sediments with concentrations greater than the moderately polluted range are considered heavily polluted.

BDL = below detection limit; TOC = total organic carbon; PAHs = polynuclear aromatic hydrocarbons; and PCBs = polychlorinated biphenyls.

Source for sediment sampling station data: Risatti and Ross, 1989.

zinc in all samples, except for copper and lead in the harbor. Ammonia concentrations were elevated in sediment samples from the Grand Calumet Branch of the IHC to indicate heavy pollution. Phosphorus levels in all samples except at the harbor entrance indicated heavy pollution. Concentrations of PCBs in this study were significantly less than previously determined. It was hypothesized that the PCBs were concentrated in deeper sediments as noted above. Site 5, the harbor entrance, had the lowest concentrations for most parameters.

Site 5 samples were taken from the vicinity of the IHC approach channel while samples from site 2A and 2B were taken from opposite sides of the Columbus Drive bridge. Site 5 roughly correlates with the location of site E(0.6) from Polls (1988) as does site 2 with site E(3.8) (Polls, 1988). Overall, both data sets suggest a trend of decreasing parameter concentrations in a downstream (lakeward) direction.

In 1988, USACE contracted Indiana University-Northwest to collect sediment samples from areas with limited bulk chemical data. Metals, nutrients, and oil and grease were detected in concentrations comparable with other data from the IHC. Concentrations of PAHs and PCBs were found to be lower than those found in other surveys (USACE, 1990).

As a result of the analysis of the sampling data outlined above, all of the sediments in the IHC have been judged to be "heavily polluted" based on the USEPA's Region V 1977 "Guidelines for Pollutional Classification of Great Lakes Harbor Sediments." Consequently, such sediments are unsuitable for open-water, unconfined disposal. The USEPA's 1977 guidelines provide a classification scheme by which sediments can be judged to be relatively "non-polluted", "moderately polluted", or "heavily polluted" as determined by bulk pollutant concentrations in sediments. The available data also indicate that IHC sediments are "heavily polluted" with respect to the following chemical parameters: volatile solids, chemical oxygen demand, oil and grease, total Kjeldahl nitrogen, ammonia, cyanide, manganese, phosphorus, arsenic, cadmium, chromium, copper, iron, nickel, lead, zinc, and PCBs. It is estimated that some 70,000 cubic yards of sediments have PCB concentrations that exceed 50 parts per million (ppm). Such sediments classify as "toxic" and are subject to regulation under TSCA. The highest PCB levels have been recorded in the deeper sediments of the extreme upstream portion of the Calumet River Branch of the IHC (between the turning basin and the Federal navigation channel) and in the vicinity of the north bank area between the two most downstream bridges (the Conrail and EJ&E railroad bridges) (USACE, 1986; 1990).

An extensive investigation of sediment quality in the GCR was performed on behalf of USX by Floyd Browne Associates (Floyd Browne Associates, Inc., 1991) in 1991 in accordance with the Consent Decree which USX signed with USEPA in October 1990. The Sediment Characterization Study (SCS) survey area extended from the GCR's eastern headwaters just above USX Outfall 001 to the Columbus Drive bridge. The study also encompassed a segment of the West Branch of the GCR from Indianapolis Boulevard to its confluence with the Calumet River Branch of the IHC. This study is intended to culminate in the development of a Sediment Remediation Plan for the GCR.

Sediment samples were collected from 59 profiles which were numbered sequentially from just upstream of USX Outfall 001 to the Columbus Drive bridge on the Calumet River Branch of the IHC. The SCS included the analysis of "softside" sediment samples (taken from the top 18 to 24 inches of saturated sediment). Also, general analytical samples were collected from each profile and generally composited across the width of the river. In addition to general analysis for metals, inorganics, volatile organic compounds (VOCs), PCBs, dioxins and furans, other tests performed on certain samples included physical tests, Toxic Characteristic Leaching Procedure (TCLP) analyses, and Acid Volatile Sulfide (AVS) analyses. Table 3-4 summarizes the analytical results from the general sediment samples.

Analysis of the general samples yielded several interesting trends. Based on concentrations in the upper sampling horizon, copper, iron, lead, and zinc increased gradually from Profile 1 to Profile 36 (located near the Gary Sanitary District), at which a sharp drop in parameter concentrations was detected. Additional concentration spikes were noted at a number of profile locations between Profile 45 (just downstream from Cline Avenue) to Profile 62 (just upstream of the Columbus Drive bridge). Arsenic and cadmium exhibited a similar trend except that concentrations were more uniform between Profile 1 and 36. Several VOCs (benzene, toluene, ethyl benzene, and xylenes) had highest concentrations between Profiles 2 and 11 while concentrations were below detection or very low elsewhere in the GCR. Similarly, PCB (particularly Aroclors 1248 and 1254) and PAH concentrations were high between Profiles 2 and 11. Mean pollutant concentrations throughout the GCR indicate heavily polluted sediments with respect to oil and grease, PCBs, arsenic, cadmium, chromium, copper, iron, lead, mercury, nickel, and zinc. Concentrations of total Kjeldahl nitrogen and phosphorus indicate moderately polluted sediments.

Profile and other data obtained from the SCS were used to calculate the total volume of "sludge" (defined in the SCS as visibly contaminated sediment) present in East Branch of the GCR, in the West Branch from Indianapolis Boulevard to its confluence with the Calumet River Branch of the IHC, and in the Calumet River Branch of the IHC from the confluence to the Columbus Drive bridge. The contaminated sediment volume was estimated to be approximately 1.1 million cubic yards. Sediment types were found to range from a silty clay to a clayey sand within the upper 12 inches to a silt or clayey silt in the subsurface. Sands were found to underlie the silty subsurface (Floyd Browne Associates, Inc., 1991).

Table 3-4 Summary of General Sediment Quality Characteristics of the Grand Calumet River

Parameter[1]	Moderately Polluted Range[2]	Mean Concentration	Maximum Concentration
Total Solids	---	53	84
TOC	---	42,400	180,000
TKN	1000 - 2000	1,356	6,130
Phenolics	---	8.3	62
Oil and Grease	1000 - 2000	17,700	140,000
Acenaphthene		498	6,300
Anthracene		290	8,200
Benzene		30	583
Benzo(a)anthracene		117	1,400
Chrysene		109	1,400
Fluoranthene		577	9,000
Naphthalene		1,281	30,000
Pyrene		296	4,300
Total PCBs	1	46	1,006
Reactive Sulfide		563	4,020
Total Cyanide		244	2,220
Phosphorus	420 - 650	428	2,210
Arsenic	3 - 8	79	4,900
Barium		79	210
Cadmium	6	7.8	600
Chromium	25 - 75	131	1,300
Copper	25 - 50	152	3,400
Iron	17,000 - 25,000	190,000	790,000
Lead	40 - 60	873	34,000
Mercury	1	1.2	10
Nickel	20 - 50	66	2,700
Zinc	90 - 200	2,360	16,000

[1]All parameter concentrations are expressed in milligrams per kilogram (mg/kg) except total solids which is expressed in percent.

[2]USEPA 1977 Guidelines for Pollutional Classification of Great Lakes Harbor Sediments. Sediments with concentrations less than the moderately polluted range are considered unpolluted for that parameter (except for cadmium, mercury and PCBs for which lower limits have not been established). Sediments with concentrations greater than the moderately polluted range are considered heavily polluted.

TKN = total Kjeldahl nitrogen; PCBs = polychlorinated biphenyls; and TOC = total organic carbon.

Source: Compiled from Floyd Browne Associates, Inc. (1991).

3.2 Water Quality

Surface Water

The quality of surface waters within the IHC/GCR has been affected by both point source and non-point source discharges. These discharge sources include some 40 permitted outfalls to the IHC/GCR system as well as sewer overflow discharges from the sanitary districts of Gary, Hammond, and East Chicago. These waters were classified by the State of Indiana for use as industrial water supply, partial body contact, and limited aquatic life waters. On 3 March 1990, new water quality standards went into effect for the IHC/GCR and Lake Michigan. These standards served to elevate the potential recreational and aquatic life uses of the IHC/GCR and established stringent numerical water quality criteria for some 90 pollutants. Currently, the IHC/GCR is classified for industrial water supply, full body contact, and general use (full aquatic life). In addition, the Indiana portion of Lake Michigan was classified as an outstanding state resource water. This provides for the maintenance of the existing high water quality of Lake Michigan without degradation. A number of water quality parameters have been identified as being of concern in the IHC/GCR including ammonia, bacteria (fecal coliform), and oil and grease as well as several priority pollutants (e.g., copper, lead, mercury, and PCBs) (IDEM, 1991; State of Indiana, 1990).

As compared to Lake Michigan, the ambient water quality of the IHC/GCR system is considered to be poor as the system receives substantial inflow from municipal and industrial wastewater discharge sources (USACE, 1990). A study of the water quality of the IHC was conducted in 1980 (USACE, 1986). Grab samples were taken from six sites within the confines of the navigation channel. Concentrations of ammonia nitrogen, total phosphorus, cyanide, phenolics, and oil and grease were found to be in violation of the water quality standards. Parameter concentrations were found to be generally higher in the upper reaches of the IHC.

Table 3-5 summarizes the water quality data from this study (USACE, 1986). The USACE Chicago District commissioned the preparation of water quality study of the IHC by Polls and Dennison (1984). IHC waters were found to violate water quality standards for phenolics, fecal coliform, iron, and dissolved oxygen. Table 3-5 also summarizes these data.

Many parameters exceed the allowable water quality standards for the IHC/GCR system. Based on the most recent data available, ammonia concentrations in the IHC/GCR typically exceed the state standard. According to IDEM data, ammonia nitrogen concentrations in the IHC/GCR range from 0.60 to 1.96 milligrams per liter (mg/L). The state criterion for ammonia in ambient waters (outside mixing zones) for the East Branch of the GCR and IHC is 0.20 mg/L. Fecal coliform bacteria concentrations typically exceed the state criterion of 125/100 milliliters (ml) during the winter. The IDEM has recorded fecal coliform concentrations ranging from 39 to 3,055/100 ml (USACE, 1990; State of Indiana, 1990). Oil and grease levels have been a problem in the IHC/GCR system as exemplified by the presence of oily sheens on the water surface. This situation is expected to persist since significant quantities of petroleum-based materials are contained in IHC/GCR sediments (IDEM, 1991). Oil and grease concentrations in IHC/GCR waters range from 2.9 to 5.6 mg/L, according to IDEM data. The state water quality criterion for oil and grease is 10 mg/L (USACE, 1990).

While metal concentrations have been cited as being of concern within the IHC/GCR system (IDEM, 1991), the most recent available data indicate that most metal concentrations do not exceed the state's water quality criteria. IDEM data indicate that copper concentrations range from 5 to 7 micrograms per liter (μg/L). The State acute aquatic criterion (AAC) for copper is 31.3 μg/L, based on an average hardness value of 183 mg/L (as the AAC is a hardness dependent value). Most of the priority pollutant metal AACs are hardness dependent and are applied outside the zone of initial dilution or, as applicable, outside the zone of discharge-

Table 3-5 Water Quality Characteristics of the Indiana Harbor and Canal Based on Studies Conducted by USEPA in 1981 and Polls and Dennison in 1984

			USEPA 1981[2]	Polls and Dennison 1984[2]
Parameter	Units	State Standard	Mean Concentration	Mean Concentration
Dissolved Solids	mg/L	---	247.2	267.3
Suspended Solids	mg/L	---	18.2	9.5
BOD	mg/L	---	11.8	3.8
COD	mg/L	---	37.7	20.5
TKN	mg/L	---	2.25	3.79
Phenolics	µg/L	10	7.7	14.8
Ammonia nitrogen	mg/L	0.02	1.66	0.64
Cyanide	mg/L	50	110.3	12.3
Total Phosphorus	mg/L	0.10	0.11	< 0.1
Oil and Grease	mg/L	10	6.8	2.6
Arsenic	µg/L	---	15.7	1.0
Cadmium	µg/L	---	< 2	0.33
Chromium (Hexavalent)	µg/L	25.0[3]	---	< 2
Copper	µg/L	---	9.0	17.6
Iron	µg/L	300[4]	1445.0	554.9
Lead	µg/L	25	< 30	5.0
Manganese	µg/L	---	60.0	122
Mercury	µg/L	0.5	0.17	0.09
Nickel	µg/L	---	< 30	---
Zinc	µg/L	---	81.7	0.08

[1]Source: USACE (1990).

[2]Source: USACE (1986).

[3]Total Chromium Standard.

[4]Dissolved Iron Standard.

BOD = biochemical oxygen demand; COD = chemical oxygen demand; and TKN = total kjeldahl nitrogen.

induced mixing. The AACs were developed to assure the protection of aquatic life. Lead concentrations have been recorded in the 10 μg/L range. The State AAC for lead is 176.2 μg/L and is hardness dependent. The concentration of mercury in IHC surface waters has been recorded in the 0.1 μg/L range. The state AAC for mercury is 2.4 μg/L. There are no IDEM data available on PCB concentrations (USACE, 1990; State of Indiana, 1990).

Groundwater

The Calumet aquifer underlies the IHC/GCR area (USACE, 1990). The aquifer is surficial, lying beneath approximately 10 feet of overburden. It is shallow and composed of fine to medium sand with a saturated thickness of 0 to 45 feet. The aquifer is underlain by glacial till and clay. The Calumet aquifer discharges to the Little Calumet River, IHC/GCR system, and Lake Michigan. Water levels in the aquifer have decreased with development in the region. The aquifer is not a major water supply source to the area.

Groundwater contamination and groundwater discharge to surface waters are of concern in the area. A preliminary study has indicated that groundwater quality varies with land use. Elevated concentrations of phenolics, benzene, and ammonia nitrogen have been found in some wells. A layer of petrochemical pollution contaminates the aquifer in the IHC area. Some of the pollution, characterized as No. 2 fuel oil, is being reclaimed and used by local industry. The USACE DEIS for the IHC includes more specific information on regional and site-specific groundwater conditions at the proposed CDF sites.

3.3 Biological Resources

Biological Resources potentially affected by the program include the aquatic habitat in the IHC/GCR and southern Lake Michigan, and the aquatic, terrestrial, and wetlands habitat within the alternative sites for the CDF.

3.3.1 Aquatic Habitats

Aquatic habitats potentially affected by the program include the nearshore waters of southern Lake Michigan and the waters of the IHC and GCR. Until the early 1900's, Lake Michigan supported a significant commercial native fishery. Since then, this fishery has declined due to water pollution, over-fishing, and the introduction of exotic species. A primarily put-and-take salmonid fishery has been established in Lake Michigan through multi-jurisdictional stocking efforts since the late 1960's. Details concerning periphyton, plankton, invertebrate, and fish species in southern Lake Michigan are provided in the USACE DEIS for the IHC (USACE, 1990).

In March 1990, new water quality standards went into effect for the IHC/GCR and Lake Michigan. These standards served to upgrade the recreational and aquatic life uses of the IHC/GCR. These new standards indicate that the IHC/GCR is suitable for full aquatic life use which includes industrial water supply, full body contact, and general use.

Biological surveys prior to 1970 have reported a virtual absence of biota in the canal and only limited biotic communities near the mouth of the harbor (USACE, 1990). More recent observations by the Illinois State Geological Survey and Illinois Natural History Survey indicate a low diversity of periphyton, plankton, and invertebrate species. The existing benthic community is characterized by a low species diversity and a high density of pollution tolerant organisms such as tubificids and chironomids (Risatti and Ross, 1989; USACE, 1990).

The Marquette Park lagoons, headwaters of the east branch of the GCR, support a higher diversity of benthic invertebrates than do other studied areas in the IHC/GCR (USACE, 1990). The lagoons are upstream of industrial discharges and are connected to the GCR only by partially-constricted culverts (IDEM, 1991). The eastern areas of the lagoons exhibit better water quality while the western lagoon is affected by non-point runoff from the neighboring industrial areas.

Although several fish species have been identified during surveys of the IHC/GCR, sport fishing is limited by safety hazards from large ships, by the poor aesthetics of the area, and by chemical contamination. A fish consumption advisory has been issued stating that no fish from the IHC/GCR should be eaten (USACE, 1990). Researchers have found elevated levels of certain heavy metals (lead, copper, chromium, and zinc) but low levels of mercury and zinc in fish from the IHC (Risotti and Ross, 1989). Aquatic communities in the GCR, especially the west branch, are depressed due to low dissolved oxygen as well as toxic stress (IDEM, 1991).

3.3.2 Terrestrial Habitats

Terrestrial biota on lands immediately surrounding the IHC/GCR is generally very limited in diversity and abundance due to the urbanized and industrial nature of the area and the lack of significant areas of natural habitat (USACE, 1990). Where terrestrial vegetation does occur, it is generally characterized as weedy pioneering species or urban ornamental species. The Lake Michigan shoreline is a major flyway for loons, grebes, waterfowl, raptors, and shorebirds. A diversity of migratory bird species seasonally occur in large numbers in the IHC/GCR area. However, only a limited number of bird species forage or nest in the area. Terrestrial lands within the alternative sites for the CDFs also comprise disturbed lands that support sparse vegetation and that are of limited ecological value as terrestrial habitats.

3.3.3 Wetlands

Wetlands are defined by USACE and USEPA as areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas (FICWD, 1989). Shallow waters within the IHC and GCR that support or periodically support emergent vegetation are wetlands. Paved areas abutting the waterways are not wetlands even if they occupy areas that previously had been wetlands. Certain unpaved areas that are periodically saturated or inundated and support vegetation characteristic of wetlands may meet the definition for wetlands even if they have been previously disturbed or developed.

Roxana Marsh, located near the hydraulic divide of the west branch of the Calumet River, is a wetland of particular note (IDEM, 1991). The marsh is a potentially important refuge and nursery area for aquatic species. This freshwater wetland contains dense cattail stands which provide cover for wildlife. Through natural succession the cattails are spreading to shoreline areas adjacent to the marsh.

Any site selected for a CDF would be inspected for the presence of wetlands using technical procedures in the Corps of Engineers Wetlands Delineation Manual (USACE, 1987). The boundaries of any wetlands identified would be delineated. National Wetland Inventory (NWI) maps indicate that portions of the 141st Street Site and the J-Pit Site are wetlands. A field study would be required to determine how much, if any, of the wetlands identified on the NWI maps actually meet the definition of wetlands. Any wetlands on either site have been subjected to previous disturbance. No areas meeting the definition of wetlands occur on the Inland Steel Site or on the ECI Site (USACE, 1990).

3.3.4 Threatened and Endangered Species

A biological assessment was prepared in 1989 under the authority of Section 7 of the Endangered Species Act by USACE in response to comments provided by the Bloomington, Indiana field office of USFWS concerning the proposed dredging in the Federal navigation channel (USACE, 1990). The USEPA would consult with USFWS and update the biological assessment to include activities proposed for waters outside the Federal navigation channel.

Federally listed threatened or endangered species addressed by USACE include the Indiana bat (*Myotis sodalis*) (endangered), peregrine falcon (*Falco peregrinus*) (endangered), and pitcher's thistle (*Cirsium pitcherii*) (threatened). Federal candidate species thought to possibly occur in the affected area include the forked aster (*Aster furcatus*), heart-leaved plantain (*Plantago cordata*), fragrant (beach) sumac (*Rhus trilobata arenaria*), prairie fame flower (*Talinum rudosperum*), and Karner blue butterfly (*Lycaeides melissa samuelis*) (USACE, 1990).

The Indiana bat hibernates in caves during the winter and forages and breeds along wooded riparian habitats during the rest of the year. The species nests in mature trees with loose bark that are generally over 16 inches in diameter at breast height (DBH). Suitable nesting trees are not likely to occur in the heavily urbanized terrestrial lands in the affected area. The closest recorded sightings of the species are in the Kankakee River basin in Indiana and Cook County in Illinois.

Peregrine falcons migrate and forage along the Indiana shoreline in September and October. The falcon primarily forages on birds in open areas and often near water.

The peregrine falcon will roost and forage in urban environments. A number of these birds have been released in the area as part of a reintroduction effort.

Pitcher's thistle occurs primarily on shoreline dunes close to the Great Lakes. Although any natural dunes near southern Lake Michigan could potentially harbor this plant species, the urbanized lands in the affected area would not contain intact, vegetated dunes.

Federal candidate species are not likely to occur along the IHC/GCR. The four candidate plant species occur in specialized natural habitats such as sand dunes, prairie, forested slopes, and forested riparian areas. Urbanized lands would not provide suitable habitat for any of these species. The Karner blue butterfly is found locally in pine barren habitats associated with wild blue lupine (*Lupinus perennis*), which is its larval food source.

Each of the CDF alternative sites were inspected for the species described above by USACE biologists between 1981 and 1989. None of the species have been sighted (USACE, 1990). Urbanized lands bordering the GCR upstream of the Federal navigation channel are not likely to support any of these species. Other lands would have to be inspected for the possible presence of the plant species. Any undeveloped lands containing trees over 16 inches DBH would have to be inspected for the Indiana bat, and any undeveloped lands containing wild blue lupine would have to be inspected for the Karner blue butterfly.

3.4 Other Significant Resources

Other discipline areas considered in preparing this Supplement were geology and soils, air quality, archaeological and historic resources, and socioeconomics. Of these, only air quality, and socioeconomics were considered to be affected by the proposed activities in the IHC/GCR and surrounding area.

Air Quality

Air quality in the project area is generally poor when compared to the standards specified in the Clean Air Act (USACE, 1990). Industrialization and urbanization in the region have been the major causes. Most of Lake County, where the IHC/GCR is located, is classified as a "non-attainment" area for sulfur dioxide, carbon monoxide, and ozone. Non-attainment is a designation for those areas where ambient air quality concentrations exceed national ambient air quality standards for at least one criteria pollutant. Standards for lead and particulate matter are also violated occasionally, although particulate concentrations have been declining during recent years.

Volatile organic compounds (VOCs) are also an air quality concern in the proposed project area. PCBs, PAHs, and other VOCs can volatilize into the air from sediments and the water column. Concentrations of PCBs up to 11.0 nanograms/m^3 of air were measured in the 1970's. These airborne VOCs can also be deposited into water bodies. The relationships between sediment and water contaminant volatilization and air to water contaminant deposition is currently under investigation.

Socioeconomics

The project area is a large steel and petroleum production and processing center and is heavily industrialized. The local communities are intensely dependent upon these industries, especially the steel industry. The harbor is a major shipping port for oil and other industries in the area. These industries rely on IHC shipping for supply and product transportation.

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4. ENVIRONMENTAL CONSEQUENCES

This chapter briefly discusses the potential impacts of sediment management alternatives and USEPA initiatives, as well as cumulative impacts of all alternatives when considered together.

4.1 Impacts of Sediment Management Policy Alternatives

Environmental impacts of sediment management alternatives are discussed in this section. Impacts of sediment management policy and technology alternatives are discussed separately, with respect to sediment quality, water quality, and biological and other significant resources as available data permit.

4.1.1 Impacts of No Action Alternative

Under the No Action Alternative, USACE would not perform maintenance dredging of the Federal navigation channel nor would USEPA require the dredging of any areas outside the channel in the IHC or any areas in the GCR. The navigability of the IHC would continue to be impeded as shoaling persists and worsens as sedimentation continues. Existing contamination, undiminished, would continue to have deleterious effects on sediment and water quality. Without action, the contaminated sediments within the IHC/GCR system would continue to serve as a reservoir of pollutants to be transported into Lake Michigan.

Sediment quality in the IHC/GCR system would continue to be impacted as relatively clean deposits would likely become contaminated by the existing in-place polluted sediments. Specifically, currents, storms, canal traffic and bioturbation by aquatic organisms would act to rework and to redistribute the existing contamination in the underlying sediments back to the surface thereby maintaining high levels of surface sediment contamination. The sediments and pollutants could be resuspended and transported elsewhere and otherwise made available for uptake by the biota. Contaminated sediments would also continue to have chronic and acute toxic effects on aquatic organisms. This would have a lasting effect on the viability of the aquatic ecosystems of the IHC/GCR and nearshore Lake Michigan.

Sediment quality impacts would continue to persist in Lake Michigan under the No Action Alternative due to the continued discharge of approximately 180 million pounds of contaminated sediment from the IHC/GCR to the nearshore area of Lake Michigan each year (IDEM, 1991). Approximately 67,000 pounds of chromium, 25,000 pounds of copper, 100,000 pounds of lead, and 360 pounds of PCBs are discharged with this annual sediment load. At present, the IHC/GCR system is in a steady-state condition in which deposition is in equilibrium with transport. Thus, the annual loading of sediment to the IHC/GCR equals its discharge to Lake Michigan (USACE, 1990). The discharge and deposition of these sediments would continue to deteriorate the quality of bottom sediments in Lake Michigan, particularly in the nearshore areas.

Existing sediment contamination within the IHC/GCR would potentially continue to affect water quality as the sediments would serve as a pollutant reservoir for the water column and exert other negative effects. Under the No Action Alternative, sediment pollutants (e.g., soluble metals and organics) would continue to have the potential to migrate from the sediment into the water column where they could be more easily bioaccumulated and exert acute and chronic toxic effects on aquatic organisms. In addition, the presence of high concentrations of organic matter in the IHC/GCR sediments induce microbial activity which depletes the supply of dissolved oxygen (DO) in the overlying water column. This, in turn, inhibits aquatic life in the IHC/GCR. This situation is exacerbated as nutrients, which are found in high concentration in IHC/GCR sediments, are released to the water column contributing to eutrophication and further DO depletion. Finally, the continued resuspension of contaminated sediments within the water column would expose aquatic organisms to a larger surface area of contaminated sediments (USACE, 1990). This would increase the likelihood for acute and chronic toxic effects as well as for pollutant uptake and bioaccumulation.

The water quality of the open lake and nearshore areas of Lake Michigan would continue to be impacted under the No Action Alternative due to the transport of contaminated sediments from the IHC/GCR, as described above. The ultimate resuspension of these contaminated sediments and the release of soluble contaminants from bottom and suspended sediments would allow for contaminant uptake by aquatic organisms and, ultimately, by man through ingestion. In addition, this situation would pose a potential threat to drinking water supplies as such sediments may be entrained through municipal surface water intakes (USACE, 1990).

The No Action Alternative would not involve any direct physical disturbance to existing benthic organisms or emergent vegetation in the IHC/GCR. However, shipping activities and other sediment disturbances in the IHC/GCR would physically agitate the in-place sediments. Not removing contaminated sediments from the IHC/GCR would result in continued exposure of aquatic biota in both the IHC/GCR and southern Lake Michigan to contamination originating from those sediments. Contaminants in surface sediments and the water column can be acutely toxic to aquatic biota, whereby short-term exposures cause rapid death, or chronicly toxic, whereby long-term exposures at less than fatal concentrations cause impaired health, growth, or reproduction. Contaminants can also bioaccumulate in the tissues of aquatic organisms, especially organisms high in the food chain such as most sportfish. Mobile aquatic organisms would continue to accumulate and transport contaminants with them, thereby dispersing contaminants from the IHC/GCR to the nearshore waters of Lake Michigan.

Continued microbial metabolism of organic materials in the accumulated sediments in the IHC/GCR could result in the continued depletion of DO in the water column and in the release of organically bound plant nutrients to the water column. Low levels of DO are fatal to most aquatic biota, including fish, and high concentrations of plant nutrients in water results in algal blooms. These algal blooms are unsightly and are subject to rapid die-off causing additional DO depletion as decomposition occurs.

4.1.2 Impacts of USACE Dredging of the Federal Navigation Channel Only (No USEPA Activities)

Maintenance dredging by USACE without USEPA action, would likely have long-term positive impacts on sediment and water quality within the IHC/GCR system and adjacent Lake Michigan. However, short-term negative impacts would be likely.

Sediment quality within the Federal navigation channel portion of the IHC would improve as approximately 1.2 million cubic yards of existing contaminated sediment would be removed under this alternative. This would also minimize the likelihood of contaminated sediments being resuspended and transported into Lake Michigan. This would result in a reduction of the impacts to Lake Michigan which were discussed under the No Action Alternative. Restoration of the project depth of the Federal navigation channel through maintenance dredging would create a sediment trap which would reduce (by approximately 50 percent) the 150,000 cubic yards of contaminated sediment entering Lake Michigan each year (IDEM, 1991; and USEPA and IDEM, 1992). Periodic maintenance dredging would reduce future contaminated sediment loading to Lake Michigan by 50 to 70 percent (USACE, 1990). Sediment quality in the areas outside the Federal navigation channel, particularly in the upstream reaches of the Calumet River Branch of the

IHC and in the GCR (West and East branches), would not be directly affected as USACE dredging would not occur in these areas.

The USACE dredging activities would likely have short-term negative impacts on sediment quality. Some contaminated sediment would be resuspended during dredging and be transported into Lake Michigan and be deposited. However, most of this resuspended material would settle within the IHC where it would be removed by future dredging operations. Resuspension would be reduced by the use of the closed bucket clamshell dredge or hydraulic dredging, where possible. Removal of surficial contaminated sediments may temporarily expose deeper sediments with contamination levels that are higher than in the original surficial sediments that have been removed. It is expected that new sediment deposition from the upstream reaches would cover these deeper sediments with surficial materials of comparable quality to those removed despite pollutant controls reducing the amount of contaminated materials entering the IHC/GCR (USACE, 1990).

Maintenance dredging within the Federal navigation channel would initially reduce adverse water quality impacts within the IHC by removing contaminants which could otherwise be resuspended. However, equally contaminated sediments from the upstream reaches would replace those removed by USACE dredging. The sediment trap created by USACE dredging would decrease adverse water quality impacts to Lake Michigan. No improvement to the water quality of the GCR or the upper reaches of the Calumet River Branch of the IHC (upstream of the navigation channel) would be likely as these areas are upstream of the dredging and contaminated sediments in these areas would be unaffected.

Short-term negative impacts on water quality would likely include increased levels of turbidity and suspended solids in the IHC. The concentration of suspended solids would be expected to range between 50 and 500 mg/L immediately around the dredge. The resuspension of sediments would release certain contaminants in the water column such as ammonia, metals, and trace organics, but concentrations of these pollutants would be diluted rapidly downstream. As described above, water quality within the IHC may deteriorate temporarily as pollutants are released into the water column from the more contaminated sediments underlying the dredge depth. In addition, the exposed underlying sediments would briefly reduce the dissolved oxygen content of the overlying water column. Oil and grease, containing such contaminants as PCBs and PAHs, would likely be resuspended during dredging to form an oil slick on the water surface. Oil booms and sorbents would be used to minimize the impact from this event (USACE, 1990).

Overall, contaminated sediments not dredged from outside the Federal navigation channel within the IHC/GCR would continue to negatively affect sediment and water quality as these sediments are resuspended. Shipping activity would resuspend contaminants in the slips and docks lining the IHC. Sediments would also move laterally and downstream under the influence of flow, seiche action, and currents. Over time, these sediments would be deposited within the Federal navigation channel as the IHC/GCR system works to reestablish sediment transport equilibrium. These sediments would recontaminate new and relatively cleaner sediments as well as reduce the long-term effectiveness and life span of the sediment trap created by the USACE dredging project.

Removal of approximately 1.2 million cubic yards of contaminated sediments would prevent future exposure of aquatic biota to contaminants in those sediments. This would be a beneficial impact to aquatic biota, but it would not completely eliminate the potential for future exposure to contaminants in sediments remaining in the IHC/GCR. The USACE would only remove sediments to a specified navigation depth, leaving deeper sediments in place. Aquatic biota in the upper non-navigable reaches of the GCR would not be benefitted, and mobile biota would continue to transport bioaccumulated contaminants downstream to the navigable waters and to nearshore Lake Michigan.

Physical disruption of sediments by dredging would result in temporary exposure of aquatic biota to localized increases in contaminant concentrations. Resuspended sediments and exposure of deeper, more contaminated sediment layers would result from dredging. Existing benthic organisms within the Federal navigation channel would be destroyed or injured by the dredging operations, but a new benthic community would colonize the channel bottom following completion of the dredging. Some fish may be attracted to the area of dredging and be physically injured or destroyed.

A biological assessment prepared by USACE in 1989 concluded that dredging the Federal navigation channel would not result in significant impacts to Federally-listed threatened or endangered species or critical habitat (USACE, 1990). The USFWS would be consulted to determine whether an updated biological assessment would be necessary.

4.1.3 Impacts of USEPA-Required Dredging for Remediation Outside the Federal Navigation Channel Only (No USACE Activities)

The USEPA-required dredging of areas outside the Federal navigation channel would have positive long-term impacts on sediment and water quality throughout the IHC/GCR. The positive effects would be most pronounced and long-lasting in the upstream portions of the IHC/GCR. However, short-term negative impacts would be likely.

Dredging of the areas upstream and outside the Federal navigation channel would also decrease (by approximately 50 percent) the contaminated sediment load entering the lower portion of the IHC/GCR and, ultimately, Lake Michigan. This would greatly reduce the potential for the resuspension and downstream transport of contaminated sediments which contribute to contamination. This action would also decrease the potential for long-term dispersion of sediment contaminants in the water column and the resulting decrease in ambient water quality. Under this alternative, sediment and water quality within the West Branch of the GCR, East Branch of the GCR, and in the Calumet River Branch of the IHC (upstream of the Federal navigation channel) would likely improve substantially.

Short-term negative impacts on water quality would likely include increased levels of turbidity and suspended solids in the IHC/GCR. The concentration of suspended solids would be expected to range between 50 and 500 mg/L immediately around the dredge. The resuspension of sediments would release certain contaminants in the water column such as ammonia, metals, and trace organics, but concentrations of these pollutants would be diluted rapidly downstream. As described above, water quality within the IHC/GCR may deteriorate temporarily as pollutants are released into the water column from the more contaminated sediments underlying the dredge depth. In addition, the exposed underlying sediments would briefly reduce the DO content of the overlying water column. Oil and grease, containing such contaminants as PCBs and PAHs, would likely be resuspended during dredging to form an oil slick on the water surface. Oil booms and sorbents would be used to minimize the impact from this event.

In the absence of USACE dredging of the IHC, sediment quality and any water quality improvements in areas outside and adjacent to the Federal navigation channel would likely be short-term. Resuspension and migration of contaminated sediments from the Federal navigation channel would eventually re-pollute sediments outside and adjacent to the channel. These re-contaminated sediments could then be resuspended and potentially transported into Lake Michigan.

Aquatic biota in the IHC/GCR and nearshore Lake Michigan would no longer be potentially exposed to contaminants in any sediments removed by dredging. However, this alternative would not eliminate the potential for exposure to contaminants in sediments remaining in the Federal navigation channel. The potential exposure of aquatic biota in the upstream non-navigable reaches of the GCR would be greatly reduced, although mobile species would continue to transport contaminants upstream that have been bioaccumulated from the navigable reaches of the IHC/GCR.

As with the USACE dredging only alternative (section 4.1.1.2), physical disruption of sediments by dredging would result in temporary exposure of aquatic biota to localized increases in contaminant concentrations. Resuspended sediments and exposure of deeper, more contaminated sediment layers would result from dredging outside the Federal navigation channel. Existing benthic organisms outside the channel would be destroyed or injured by the dredging operations, but a new benthic community would colonize the channel bottom following completion of the dredging. Some fish may be attracted to the area of dredging and be physically injured or destroyed. Additionally, some dredging could take place in shallow waters that presently support emergent vegetation, thereby destroying it. Dredging could deepen these waters to the point that emergent vegetation would not re-establish.

The biological assessment prepared by USACE in 1989 did not address dredging in waters outside the Federal navigation channel (USACE, 1990). The USFWS would be consulted to determine whether a new biological assessment would be necessary to determine whether this alternative could result in significant impacts to Federally-listed threatened or endangered species or critical habitat.

4.1.4 Impacts of Combined USACE and USEPA-Required Dredging

Combined USEPA and USACE activities would likely have the most significant and long-lasting positive effect on sediment and water quality with the IHC/GCR system and on adjacent Lake Michigan. However, short-term negative impacts would be likely. The removal of contaminated sediments from the upstream portion of the IHC/GCR and from areas outside and adjacent to the Federal navigation channel would greatly reduce the overall contaminated sediment load to the lower portion of the system and to Lake Michigan. This would result in positive long-term sediment and water quality impacts as discussed in Section 4.1.3. USACE dredging of the Federal navigation channel would remove a substantial portion of the contaminated sediment available for resuspension and transport from the lower portion of the IHC/GCR to Lake Michigan. This would have positive long-term sediment and water quality impacts as described in Section 4.1.2.

The restoration of the design depth of the Federal navigation channel would allow it to function as an effective sediment trap. This sediment trap would then be capable of further mitigating the potential migration of contaminated sediments into the nearshore areas of Lake Michigan. The approximately 150,000 cubic yards of contaminated sediments entering Lake Michigan each year would be reduced by approximately 75 percent. Periodic maintenance dredging of the IHC/GCR would reduce future sediment loading to the lake. An additional sediment trap at "the forks", the triple junction of the east and west branches of the GCR and the IHC, is also currently under study and will be included in future National Environmental Policy Act (NEPA) documentation.

An additional issue requiring further study is the potential change in the hydraulic divide of the West Branch of the GCR. At this area, the flow reverses from an eastward Lake Michigan drainage to a westward Des Plaines River/Illinois River drainage. This divide fluctuates depending on a number of factors including the amount of water flowing from the east branch of the GCR, the stage of Lake Michigan, the wind direction and speed, and the amount of discharge from the local sewage treatment plants (IDEM, 1991). At times there is no divide and all flow is westward towards the Illinois River. Should both USACE and USEPA-required dredging occur in the IHC/GCR, a significant quantity of sediments would be removed potentially altering the flow regime of this area. The hydraulics of the system are currently under study and will be addressed in subsequent NEPA documentation.

Dredging may also impact the hydrologic regime of nearby Roxana Marsh. Additionally, the degree of contamination of Roxana Marsh is under study. If the marsh is found to be contaminated, disturbance of the marsh or other wetlands bordering the IHC to remediate toxic contamination would qualify under a Nationwide General Permit. Nationwide General Permit #38 authorizes "specific activities required to effect the containment, stabilization or removal of hazardous or toxic waste materials that are performed, ordered, or sponsored by a government agency with established legal or regulatory authority" (33 CFR 330 Appendix A(B)(38)). The affected wetlands would be delineated in accordance with the Corps of Engineers Wetlands Delineation Manual (USACE, 1987). Prior to any wetland disturbance, the Detroit District of the USACE would be notified in writing following the procedures outlined in 33 CFR 330, Appendix A(C)(13). All other conditions for Nationwide Permits outlined in 33 CFR 330 Appendix A(C) would be observed. Any mitigation measures specified by the Detroit District of the USACE would be followed.

The combination of both USACE dredging and USEPA-required dredging would further decrease any potential for future exposure of aquatic biota in the IHC/GCR to contaminants accumulated in existing sediments. Small amounts of sediment missed by the dredging could still serve as reservoirs of contamination, but these amounts should be insignificant.

The existing benthic community, dominated by pollution tolerant organisms, would be disrupted by the dredging operations, but a new benthic community would re-colonize following completion of the dredging. Because of the nearly complete elimination of the sediment-borne reservoir of contamination, the new benthic community could become more diverse with time. Some fish could be attracted to the area of dredging and be physically injured or destroyed. Additionally, some dredging could take place in shallow waters that presently support emergent vegetation, thereby destroying it. Dredging could deepen some such waters to the point that emergent vegetation would not re-establish. As with the other dredging alternatives, physical disruption of the sediment load by dredging operations would result in the temporary exposure of aquatic biota to localized increases in contaminants resulting from resuspended sediments.

The biological assessment prepared by USACE in 1989 did not address dredging in waters outside the Federal navigation channel (USACE, 1990). The USFWS would be consulted to determine whether an expanded and updated biological assessment would be necessary to determine whether this alternative could result in significant impacts to Federally-listed threatened or endangered species or critical habitat.

4.2 Impacts of Sediment Management Technology Alternatives

4.2.1 Impacts of Dredging Alternatives

Dredging the IHC navigation channel and areas outside the navigation channel would have long-term beneficial impacts and short-term detrimental impacts on sediment quality. Dredging of these areas would remove in-place contaminated sediments from the aquatic ecosystem, eliminating the potential for contaminants to be resuspended and transported into Lake Michigan. During dredging operations however, sediment resuspension would cause some contaminant movement downstream. Most of the resuspended sediments would be deposited in other areas of the IHC where they would be removed by future dredging operations. A small percentage of resuspended sediments would be transported to Lake Michigan. Sediment resuspension can be minimized by using specific dredging techniques previously discussed (USACE, 1990).

Mechanical dredging would tend to cause more sediment resuspension and turbidity than hydraulic dredging. Use of a closed bucket clamshell dredge would reduce sediment resuspension by 30 to 70 percent over other means of mechanical dredging. Hydraulic dredging has several advantages over mechanical dredging. When properly selected and operated, hydraulic dredging can maximize the removal of silt, leave virtually no silt behind, effectively control turbidity, and pump the maximum concentration of silt in the slurry in a cost effective manner. Further advantages include relatively small disturbances to the aquatic ecosystem and no disturbance of the surrounding shoreline, including dock areas, by heavy equipment (WODCON XII, 1989). Hydraulic dredging is especially advantageous in the removal of contaminated sediments, as resuspension of dredged materials is kept at a minimum.

Hydraulic dredging would result in less exposure of aquatic biota to contamination during and immediately following dredging operations. Hydraulic dredging, relative to mechanical dredging, also minimizes physical disturbance of fish . However, because the sediments are generally fine-grained (USACE, 1990) and dredging has not occurred since 1972, mechanical dredging could be more effective than hydraulic dredging in consolidated sediment removal, thereby resulting in greater long-term benefits to aquatic biota.

4.2.2 Impacts of Treatment Alternatives

All treatment technologies would require the use of a CDF in some capacity (USACE, 1990). No specific impacts to sediment quality and biotic resources from the application of a treatment alternative are expected. Therefore, impacts to these discipline areas from any treatment alternative would be as described for the specific CDF constructed and operated. These impacts are discussed in Section 4.2.3, Disposal Alternatives.

The CDF treatment operations will affect the quality and quantity of discharge water (USACE, 1990). With incineration and wet air oxidation, the de-watered sediments would be processed over a considerable period of time. Capping of the CDF site would be delayed until the solid residue was returned to the CDF, including possible post-treatment by solidification. Extending the treatment period could increase the total quantity of water collected by the underdrain system.

4.2.3 Impacts of Disposal Alternatives

The rehandling and disposal of dredged materials to any of the CDF sites, with the exception of the Inland Steel Site, may result in some release of sediments back into the canal. Rehandling operations would use splash aprons or other devices to minimize spillage to the canal or adjacent lands. Any released sediments would be removed by further dredging operations. No significant impacts to sediment quality are expected for any of the disposal alternatives (USACE, 1990).

The Inland Steel Site would be constructed inside the Inland breakwater, so that any release resulting from rehandling and disposal of sediments would be into the area confined by the breakwater. The disposal operations would use splash aprons or other devices to minimize spillage into the breakwater. Any spilled materials would be isolated from the open waters of Lake Michigan by the existing Inland Steel breakwater (USACE, 1990).

Dredged materials disposed to the CDF at each of the alternative CDF sites, with the exception of the Inland Steel Site, would be evaporated or drawn into an underdrainage system. Water pumped from the underdrain would be pre-treated using sand filtration and carbon sorption and then discharged to the Hammond, Gary, or East Chicago sanitary sewer systems. This water would receive further treatment from those system's wastewater treatment plants and ultimately be discharged to the GCR (USACE, 1990).

The pumping of water from the CDF would occur mainly during disposal operations, with intermittent pumping at other times. Pumping to the respective treatment plant would be managed so as not to impact National Pollutant Discharge Elimination System (NPDES) compliance or the quality of effluent from the treatment facility. As a result, the CDF operations at each alternative site with the exception of the Inland Steel Site would have no significant effects on water quality (USACE, 1990).

The quantity and quality of water discharged from the CDF at the Inland Steel Site would be different from that at any of the upland CDF sites. The primary reason for this is the presence of a permanent pond. The water within the area enclosed by the CDF dikes would gradually be displaced by dredged materials. This entire volume of water, along with some of the water associated with the dredge spoils, would eventually be discharged (USACE, 1990).

The water pumped out of the Inland Steel CDF would be treated by sand filtration and carbon sorption (when needed) and discharged into the ponded area of the Inland Steel fill which would act as a mixing zone. From there, the water would enter Lake Michigan. The initial CDF effluent would exceed state water quality standards for total dissolved solids, ammonia nitrogen, and PCBs. However, the mixing of the effluent with water in the Inland Steel area would reduce these levels such that ammonia nitrogen would meet state standards and PCBs would approach background concentrations prior to ultimate discharge to the lake. As a result, the operation of a CDF at the Inland Steel Site would have no significant impacts on Lake Michigan water quality (USACE, 1990).

The USACE DEIS for the IHC concluded that construction of a CDF on any of the four alternative sites would not result in significant losses of terrestrial or aquatic habitats or wetlands (USACE, 1990). Use of either the 141st Street Site, J-Pit Site, or Inland Steel Site would result in insignificant losses of aquatic habitat due to the filling of shallow waters.

Use of the 141st Street Site or J-Pit Site could result in the filling of areas qualifying as wetlands according to the Corps of Engineers Wetlands Delineation Manual (USACE, 1987). Regardless of which site is selected, the USACE and the USEPA would delineate any wetlands that would be potentially filled by construction of the CDF and have the delineation verified by USACE. If USACE directs that mitigation is required to offset the wetland fill, USEPA would perform this mitigation off-site.

A biological assessment prepared by USACE in 1989 concluded that construction of a CDF on any of the four alternative sites would not result in significant impacts to Federally-listed threatened or endangered species or critical habitat (USACE, 1990). The USFWS would be consulted to determine whether an updated biological assessment would be necessary.

4.2.4 Impacts of Sediment Isolation Alternatives

Sediment capping, when properly applied, would isolate the contaminants in the sediment, and provide a clean substrate for aquatic biota. There is no dredging involved in sediment isolation alternatives, so resuspension of sediments would not occur (WODCON XII, 1989). However, because sediment isolation does not involve dredging, the Federal navigation channel would not be excavated to authorized depths, and navigation would be negatively impacted with subsequent socioeconomic impacts to industries in the area. Because the cap must be of adequate thickness, the navigation channel would become even more shallow than it would be under the No Action Alternative. Therefore, sediment capping is not a viable alternative for the Federal navigation channel, and would only be used in conjunction with another sediment management alternative. Impacts of sediment isolation alternatives would therefore be similar to the impacts of the sediment management alternative that is used concurrently.

An effective sediment cap would provide similar long-term benefits to aquatic biota as would the dredging of contaminated sediments. However, sediment capping allows the contaminated sediments to remain in-place thereby increasing exposure, health and ecological risks in the future. Long-term contaminant release through the sediment cap is another possible risk. Also from a negative perspective, the sediment cap would reduce channel depth, converting certain open shallow waters to vegetated wetlands or to dry uplands. As with dredging, installation of the sediment cap would destroy any existing benthic biota or emergent vegetation.

4.3 Cumulative Impacts of Sediment Management Alternatives

There would be significant beneficial cumulative environmental impacts from the implementation of a sediment management strategy for the IHC and GCR. As discussed previously, remediation of the contaminated sediments in the IHC/GCR would have long term positive effects on sediment and water quality in the river and harbor system and in southern Lake Michigan. Short term negative effects caused by the disruption of the in-place sediments would rapidly diminish.

Dredging of the IHC/GCR would also allow for significant trapping of sediments in the river and canal and decrease the potential for contaminated sediment transport to Lake Michigan. Dredging the IHC or GCR alone would reduce sediment load to Lake Michigan by approximately 50 percent. However, the combined USACE and USEPA-required dredging of the IHC/GCR would reduce sediment transport to Lake Michigan by approximately 75 percent. Future maintenance dredging of the water system would ensure the sediment trapping capacity of the IHC/GCR.

Decreasing contamination in the IHC/GCR would have wide ranging effects, including increases in sediment and water quality which would benefit aquatic and terrestrial biota. An increase in biodiversity would be expected. Increases in sediment and water quality in the IHC/GCR would allow recolonization by species which are less pollution tolerant, and more economically and aesthetically beneficial. Transportation of water- and sediment-borne contaminants from the IHC/GCR to Lake Michigan would decrease from current elevated levels, allowing for continued high quality aquatic habitat uses like water supply and commercial and recreational fishing and boating.

Benefits of sediment remediation in the IHC/GCR would be enhanced by the numerous USEPA initiatives currently planned and in progress for northwest Indiana. These activities have been planned and, to varying degrees, implemented to increase the quality of the environment in the area (Table 4.1). In fact, sediment remediation without continued implementation of these initiatives would potentially serve as only a temporary solution as contamination would again degrade the remediated areas with time. Active environmental management, including pollution prevention programs, source reduction, enforcement of

Table 4.1 Impacts of USEPA Initiatives for the Northwest Indiana Region

Effects of Initiatives	USEPA INTIATIVES							
	33/50 Initiative	Lake Michigan LaMP	RAP for IHC, GCR, and nearshore Lake Michigan	Public and Private Partnerships	Pollution Prevention Initiative	Geographic Enforcement Initiative	Assessment and Remediation of Contaminated Sediments	Air Program Initiative
Source reduction	yes	yes	---	---	yes	yes	---	data not available
Remediation	---	---	yes	---	---	yes	---	data not available
Public outreach	---	---	yes	yes	yes	---	yes	data not available
Sediment quality	potential increase	---	potential increase	---	potential increase	potential increase	potential increase	data not available
Water quality	potential increase	potential increase	potential increase	---	potential increase	potential increase	potential increase	data not available
Habitat quality and quantity	potential increase	potential increase	potential increase	---	potential increase	potential increase	potential increase	data not available
Groundwater quality	potential increase	---	potential increase	---	potential increase	potential increase	---	data not available
Air quality	potential increase	---	potential increase	---	potential increase	potential increase	---	data not available
Socio -economics	unknown	unknown	unknown	---	unknown	unknown	unknown	data not available

environmental statutes, and public outreach and information programs, together with the remediation of existing contamination will increase the probability for environmental enhancement of the northwest Indiana area, including southern Lake Michigan. Therefore, a concerted effort, employing multi-agency and multi-disciplinary approaches, would have a much better chance of success.

5. MITIGATION MEASURES FOR ADVERSE ENVIRONMENTAL IMPACTS

Mitigation measures for the proposed activities which could potentially minimize adverse environmental impacts are listed in Table 5.1. The environmentally adverse impacts of the project are mainly short-term in nature and are countered by the beneficial long-term impacts of removing contaminant sources from the water system. A number of adverse environmental impacts are mitigated by the design and engineering of a specific dredging, treatment, or disposal alternative. See Section 2, Discussion of Alternatives, for more detailed discussions of mitigating design features.

Table 5.1 Potential Mitigation Measures for Groundwater, Sediment, and Water Quality, and Biological Resources

Resource	Measure	Effect
Sediment Quality	Extensively survey the subsurface sediments to determine the exact location and degree of contamination	Allows segregation of sediments into 1) reusable; 2) contaminated but not toxic; and 3) TSCA regulated, thereby extending the life of the CDF and reducing disposal costs
Sediment Quality	Good control of the dredge head is required	Control of dredge head, horizontally and vertically, allows for precise removal of specific sediment areas
Sediment Quality, Water Quality	Install CDF Splash Apron	Decreases release of dredged materials to water outside of CDF
Sediment Quality, Water Quality	Dredge using closed-bucket clamshell (mechanical) or dustpan (hydraulic) dredge head	Minimizes sediment resuspension
Sediment Quality, Water Quality	Limit dredging to slack tidal currents	Reduces distance suspended sediments would be transported
Water Quality	Use oil boom and absorbants for grease and oil in dredging process	Minimizes potential for oil and grease containing dissolved PAHs and PCBs to be re-released into dredged areas
Water Quality	Use of best management practices for CDF maintenance: 1) add flocculants to precipitate out contaminants in the CDF; 2) pretreat water released from CDF with sand filtration and carbon sorption; 3) deliver CDF discharge water to treatment plant prior to release; and 4) control of wind-borne, desiccated soils within the CDF	Releases treated water back into environment (1 - 3) and prevents contaminated soils release from the CDF (4)
Groundwater Quality	Line CDF with ≈3 ft. clay liner, install underdrainage system, install a graded clay cap	Prevents leaching from CDF to groundwater
Biological Resources	Dredge during periods of low biological activity	Minimizes biological impacts of turbidity and contaminants
Biological Resources	Delineate wetlands that would potentially be filled by CDF construction, and if necessary, perform mandatory wetland mitigations	Minimizes loss of wetlands
Biological Resources	Determine whether a biological assessment is necessary, and if necessary, prepare a biological assessment	Prevents destruction of Federally listed, endangered, or candidate species, and of critical habitats
All resources	Enact more stringent legislation controlling source releases	Prevents further pollution from contaminating the area

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