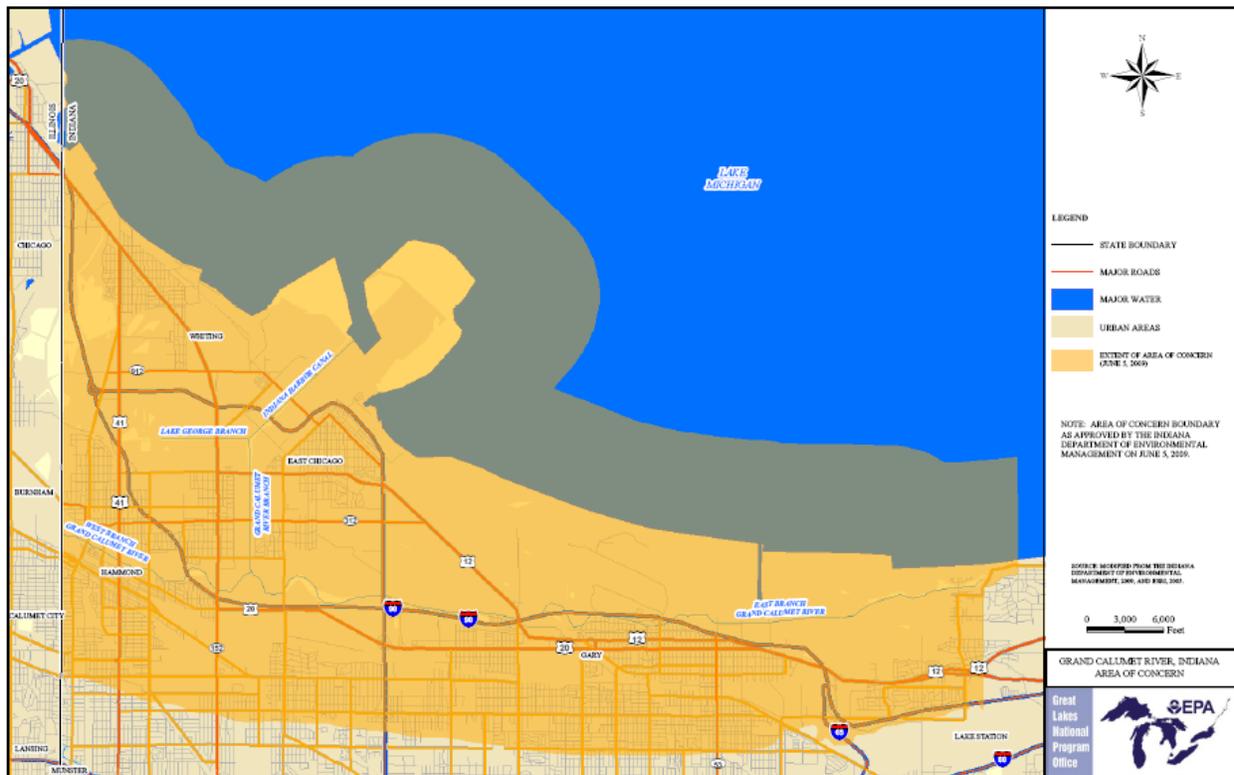


Update to the Stage 2.5 Remedial Action Plan (RAP) Grand Calumet River/Indiana Harbor Ship Canal Area of Concern



Indiana Department
Of
Environmental Management
June 20, 2012

Compiled by:

Ashley Snyder
Grand Calumet River/Indiana Harbor Ship Canal RAP Coordinator
Indiana Department of Environmental Management (IDEM)
Northwest Regional Office
8380 Louisiana Street
Merrillville, IN 46410
Phone: 219-757-0277
Fax: 219-757-0267
Email: asnyder@idem.IN.gov

Acknowledgements:

John Fekete, RAP Consultant
Dr. Jim Smith, IDEM
Paul Labus, The Nature Conservancy (TNC)
The Grand Calumet River /Indiana Harbor Ship Canal (GCR/IHSC) Citizens Advisory for
the Remediation of the Environment (CARE) Committee

Grand Calumet River/ Indiana Harbor Ship Canal Area of Concern Updated Stage 2.5 Remedial Action Plan

The Grand Calumet River/Indiana Harbor Ship Canal (GCR/IHSC) Area of Concern (AOC) is primarily driven by the river and its connection to habitat areas that are the focus for restoration and protection efforts. Presented within this document is the history, current status, and future need of restoration and protection efforts within the GCR/IHSC AOC.

Background and History:

In 1978 the Great Lakes Water Quality Agreement was established between the United States and Canada. The Agreement addressed forty-three Areas of Concern (AOC) recognized in the Great Lakes Basin. These AOCs were identified by having at least one impairment to the fourteen beneficial uses of the Great Lakes ecosystem. This led to the initiation of the Remedial Action Plan (RAP), the blueprint for restoring the beneficial uses.

All fourteen beneficial uses were determined to be impaired in the Grand Calumet River and Indiana Harbor Ship Canal (GCR/IHSC). As part of the Remedial Action Plan process, former Indiana Department of Environmental Management (IDEM) Commissioner, Kathy Prosser, appointed a group of individuals to oversee the development of a Remedial Action Plan. This continues to be the case as Commissioner Thomas Easterly has appointed several new members to the group to ensure continued representation from citizen groups, industry, local government, and academia. The group exists to assist in the development and coordination of the Remedial Action Plan, and is known as the Citizens Advisory for the Remediation of the Environment committee, or CARE.

The International Joint Commission required that Remedial Action Plans be submitted in three separate stages. The Stage I RAP for the GCR/IHSC AOC, released in 1992, defined the environmental problems and identified the beneficial uses that are impaired. The Stage II RAP, released in 1997, included remedial and regulatory measures to restore the AOC by taking an ecosystem approach in designing remedial measures. The Stage II addendum, RAP II.V, was released in 1998 and evaluated whether the multitude of regulatory and remedial efforts described in the Stage II RAP would restore beneficial uses enough to remove the GCR/IHSC from the IJC's list of AOCs. The United States Environmental Protection Agency (U.S. EPA), recently in 2011, required that AOC advisory committees provide an update on the work required within their AOC to meet removal criteria in the form of the Stage II RAPs. Within the GCR/IHSC AOC this document would be an update to the RAP II.V as the Stage II RAP was developed in 1997. Stage III RAPs have not yet been required or developed. This update is required to be a document that illustrates the current work within the AOC and the additional work that is needed to move towards removal of BUI's and the ultimate delisting of the AOC.

Introduction:

The GCR/IHSC was initially listed as impaired for all fourteen of the following beneficial uses:

1. Restrictions on fish and wildlife consumption
2. Tainting of fish and wildlife flavor
3. Degradation of fish and wildlife populations
4. Fish tumors or other deformities
5. Bird or animal deformities or reproduction problems
6. Degradation of benthos
7. Restriction on dredging activities
8. Eutrophication or undesirable algae
9. Restrictions on drinking water consumption, or taste and odor
10. Beach closings
11. Degradation of aesthetics
12. Added costs to agriculture or industry
13. Degradation of phytoplankton and zooplankton populations
14. Loss of fish and wildlife habitat

However, in September of 2011 BUI # 12 was officially removed from the AOC after it was determined that there was no added cost to agriculture or industry in utilizing water within the AOC and in March of 2012 the restrictions on drinking water consumption, or taste and odor BUI #9 was removed from the AOC as no additional treatment is required for drinking water in comparison to drinking water outside the AOC. Efforts toward removing the 12 remaining BUIs are currently in differing phases of completion as legacy sediment contaminants in the GCR continue to be the most persistent and long-term problem. Although water quality has greatly improved since the 1980s, parameters such as ammonia, cyanide, oil and grease, poly-chlorinated biphenyls (PCBs) and mercury in fish tissues do not currently meet state standards due to the legacy contaminants in the sediments. Contaminated sediment in the GCR has direct effects on BUIs #1, 2, 3, 4, 5, 6, 7, 8, 11, 13, and 14 – therefore resulting in the largest contributing factor of contamination in the AOC.

The river, riverbanks, and side stream wetlands contain contaminated sediment. While there have been ongoing restoration activities to improve ecosystems surrounding the aquatic habitat within the AOC, sediment contaminants are pervasive and persistent, and natural attenuation of contaminants cannot be relied on to restore the river. Therefore, it is believed that sediment removal and remediation in the GCR aquatic ecosystem will likely assist in restoring 11 of the remaining 12 BUIs. Dredging is the required course of action, followed by the in-stream restoration of habitat.

Dredging-Completed and Underway:

Consent Decrees

In 1997 the United States and the State of Indiana entered into a Consent Decree with the Industrial users of the Hammond Sanitary District, which settled claims

for the discharge of pollutants to the West Branch Grand Calumet River (WBGCR). The Consent Decree established the Grand Calumet River Restoration Fund (GCRRF) and the Grand Calumet River Restoration Fund Council. The council had one representative appointed by each of the Regulatory Agencies, U.S. EPA, IDEM, and Indiana Department of Natural Resources (IDNR), and one representative appointed by each Natural Resource Trustee, U.S. Fish and Wildlife Service, IDEM and IDNR. A total of 4.7 million dollars were deposited into the Trust. In 1999 the United States and the State of Indiana entered into a Consent Decree with the Hammond Sanitary District which settled claims and established a schedule for Wastewater Treatment Plant Compliance Program Implementation. An additional 2.1 million dollars were paid into the GCRRF Trust. All monies in the Trust were to be used for the cleanup of contaminated sediment and the restoration of natural resources in the West Branch Grand Calumet River defined in the court order as that portion of the Grand Calumet River between Indianapolis Boulevard and the Indiana-Illinois Stateline. All dollars in the Trust Fund were expended on the characterization of the WBGCR and Roxana Marsh and also on the sediment removal and habitat restoration at Roxana Marsh. Approximately 7.4 million dollars have been used as a match for the Great Lakes Legacy Act (GLLA) project on the marsh cleanup.

The U.S. Steel Corporation, pursuant to a 1999 Federal Clean Water Act Consent Decree and a 1998 Resource Conservation and Recovery Act (RCRA) Corrective Action Order, dredged a five (5) mile segment of the east branch of the river and removed more than 800,000 cubic yards of contaminated sediment from the river. Completion of the dredge portion of this project occurred in 2007. Additionally, pursuant to the requirements of a 1999 Natural Resource Damage Assessment Consent Decree, U.S. Steel Corporation worked with the Natural Resource Trustees to develop and implement in-stream restoration of the 5 mile dredged segment. Post-dredge restoration work that, included re-vegetation of the riverbanks and mitigation of Purple Loosestrife was completed in July of 2010. Following the US EPA approval of the Dredge Completion Report, additional in stream restoration was completed in December of 2011. The restorative efforts of in-stream riffles, boulder piles, bank scalloping, wing deflectors with snags, and the planting of native trees and shrubs along banks has resulted in habitat improvements for fish and other aquatic species. To date, U. S. Steel has spent more than \$60 million on this project.

The Gary Sanitary District (GSD), pursuant to the 1992 and 2002 Federal Consent Decrees, has an US EPA selected remedial alternative for sediment remediation of the Ralston Street Lagoons. The Sanitary District has completed pre-design investigations, remedial designs, and is currently implementing phase one of the selected remedy. The Gary Sanitary District continues to work with the US EPA to fulfill the additional requirements of the Modified Consent Decree and Judgement-2002. The additional requirements include but are not limited to preparing a plan for sediment characterization and remediation in the river from the GSD outfall to Cline Avenue.

In 2003 The United States and the State of Indiana entered into a bankruptcy settlement with LTV Steel. Initial and subsequent recoveries have resulted in the collection of over \$11.8 Million for natural resource restoration in the GCR AOC. These dollars have supported land acquisition (i.e., Beemsterboer, South Shore Railroad

properties, Cline Avenue Nature Preserves et. al.), restoration staff for IDNR and GLLA Cleanup activities on the WBGCR and the East Branch Grand Calumet River (EBGCR).

In 2005 a settlement for Natural Resource Damages at the Grand Calumet Riverine Site was reached with 8 industrial parties. Through this settlement approximately 200 acres of land were placed into protection via conservation easement or fee title transfer to a public agency. Along with land protection \$56.9 million was established in the Department of Interior (DOI) Natural Resource Damages Assessment and Restoration (NRDAR) Fund for restoration of the Grand Calumet River AOC. These dollars have been used to match grant funds from the National Oceanic and Atmospheric Administration (NOAA), Great Lakes Restoration Initiative (GLRI), United States Army Corp. of Engineers (USACE) and others to complete habitat restoration on many remnant dune and swale properties in the AOC, to support GLLA remediation of contaminated sediments, and restoration of riverine wetlands.

Great Lakes Legacy Act

As consent decrees initiated dredging within the AOC the US government signed into law the Great Lakes Legacy Act (GLLA) in 2002. The Legacy Act authorized the use of millions of federal dollars for the recovery of US AOCs plagued by legacy contaminants. To date Indiana has been awarded 65% of the costs to complete a dredge and cap of the following portions of the GCR within the AOC; the DuPont Reach in the East branch and the West branch of the river including Indianapolis Blvd. to Stateline and Roxana Marsh. The additional 35% of the cost has been provided by the Natural Resources Damage Assessment funds and local partners. Attached Tables A, B, and C indicate the specific partners for each project, associated costs and expected completion dates for sites currently funded through the GLLA. While some portions are complete work is still underway in other reaches of the river. At the completion of the funded projects over 700,000 cubic yards of contaminated sediment will be remediated.

US Army Corp. of Engineers

Historically, from 1911 to 1972, The US Army Corp. of Engineers (USACE) regularly dredged the Indiana harbor and ship canal. As early as 1968, the USACE began evaluation of confined disposal sites (CDFs) for disposal of the dredged sediments, and by 1978 sampling by the USEPA indicated that the sediment contained elevated levels of PCBs, metals, PAHs, and oil and grease. After years of contentious public debates as to where to dispose of these contaminated sediments, the USACE proposed two upland sites in 1989. One of the proposed sites, and the selected location, is the former ECI location where a refinery had previously operated. In 1994, the East Chicago Waterways Management District (ECWMD) was formed for the purpose of becoming the local sponsor for the construction of the CDF, and dredging of the canal. In September of 1998 the USACE released a lengthy study of the canal and disposal alternatives in their "Comprehensive Management Plan and Final EIS (Blue volumes 1 and 2)". Meanwhile, during 1999, Congress furnished funds to the USACE for CDF construction at the former ECI site. Then in 2000, the USACE and the ECWMD signed a formal Project Cooperation Agreement for the purposes of dredging the canal, and building the CDF. In 2002 the USACE began construction of the CDF. According to the EIS, it is estimated that 4.7 million cubic yards of sediment may be

dredged over the life of the project. Upon completion of the CDF dredging is estimated to begin in 2012.

Fish and Wildlife:

The impact on Fish and Wildlife by the contaminated sediments within the AOC is high due to the bioaccumulation of the contaminants in the tissue of such species as they are moved up the food chain. This contamination has contributed to reproductive problems, declines in populations and deformities in fish.

Resident bird populations that feed on fish in the AOC and depend on the open waters of the river for both summer and winter habitat have experienced in-egg deformities and low recruitment. The scarce or non-existent sensitive macroinvertebrate taxa in the AOC indicate that the contaminated sediments are more hospitable to pollutant tolerant species. Fish community structure and function has changed drastically with only pollution tolerant and non-native fish dominating the river. A high percentage of fish in the river suffer from deformities, erosions, lesions, and tumors, or DELTs, due to contaminants in the system and sediment. The ridge and swale habitat that once encompassed the area was filled with a diverse assemblage of herpetofauna. Many amphibians and reptiles use the river for breeding and foraging; therefore, they are also suffering the same ill effects of the sediment contamination as the fish and birds.

Since many of these species are dependent on each other for survival and research has shown the effects that bioaccumulation of the COCs has had on wildlife, it is evident that sediment remediation will assist in reducing impairment to wildlife populations and habitat.

In addition to the accumulation of chemicals in fish tissue impacting fecundity and survivorship of wildlife in the AOC, it has also resulted in restrictions on fish consumption. Fish consumption advisories have been issued by the Indiana State Department of Health due to high levels of harmful to human chemicals found in fish tissue. The accumulation of chemical contaminants in fish tissue also leads to flavor tainting.

Remediation of contaminated sediments through dredging and capping efforts will have a significant positive impact towards removal of 11 BUIs and greatly reduce the negative effects on fish and wildlife populations listed above that are driven by the legacy contaminants in the river sediments.

Along with the work toward sediment dredging, other types of restoration are also being conducted that contribute towards removal of habitat for fish and wildlife BUIs. Several groups and agencies are working within the AOC including The Nature Conservancy (TNC), the USFWS, IDEM, IDNR, Shirley Heinze Land Trust (SHLT), Lake County Parks, and Save the Dunes Council (StDC). These groups have acquired and are actively restoring and managing natural areas in and along the Grand Calumet River. Many of these groups and agencies were able to acquire land for the purposes of protection and restoration through the Natural Resource Damage Settlements or purchased with dollars obtained through Natural Resource Damage Settlements. A list of these sites is as follows and a map may be found in Appendix A, AOC Segment Areas and Maps:

1. BP Wetlands – status – IDNR obtained final Conservation Easement in 2011.
2. Lake Mary Pond – Status – IDNR obtained final Conservation Easement in 2011.
3. Roxana Marsh (includes lands south and north of river east of I-90 Toll Road and small lot in industrial complex to northeast of the Marsh – Status – IDNR holds title.
4. DuPont Natural Area – Status – IDNR holds conservation easement.
5. South Shore Railroad site – Status – Save-the-Dunes holds title.
6. Beemsterboer Natural Area – Status – The Nature Conservancy holds title.
7. Cline Avenue Nature Preserve – Status – Save-the-Dunes holds title.
8. Ivanhoe South (south of 5th Avenue, Gary) – Status – Shirley Heinze Land Trust holds the title to many parcels (but not all).
9. Gary Lagoons (north of Gary Airport) – Status – IDNR holds Title.
10. Pine Station Nature Preserve – Status – IDNR Holds Title.
11. Republic Steel Parcel (northeast of I65 and US 12 junction) – Status – Indiana Dunes National Lakeshore holds Title.
12. City of Gary site (east of Republic Steel Parcel) – Status – Indiana Dunes National Lakeshore holds title.
13. US Steel Mitigation site (south of Grand Calumet Lagoons) – Status – Indiana Dunes National Lakeshore holds title.

Though these are not the only sites that require restoration and protection, the placement of such lands into the hands of knowledgeable property managers is a step in the right direction. Permanent protection and continual monitoring and maintenance of these natural areas will provide healthy environments for the native flora and fauna of the area.

Great Lakes Restoration Initiative

In September of 2010 the IDEM was awarded a grant for 1,398,248 dollars through the Great Lake Restoration Initiative Fund. This award was given to fund habitat restoration within the AOC through four partners: The Nature Conservancy, Save the Dunes, Lake County Parks, and the Indiana Department of Natural Resources. Through their combined efforts a total of 204 acres of habitat will be restored by the removal and treatment of invasive species within the AOC by September 30, 2014. Treatment areas include the DuPont nature Preserve, Beemsterboer Natural Area, Gibson Woods Complex, Pine Station Nature Preserve, Cline Avenue Nature Preserve, and Martin Oil Natural Area. The funding requirements and the exact acreage for each of these sites are referenced in the attached Table C.

The River and Near shore Lake Michigan Water:

Beaches

The Environmental Protection Agency's Beaches Environmental Assessment and Coastal Health (BEACH) Act of 2000 required coastal states to construct and implement appropriate monitoring and notification plans for advisories and closures at beaches. For Indiana, this meant that beaches along Lake Michigan were required to implement the state water quality standard of 235 colony forming units of E. coli per 100mL of water. Beaches subject to the BEACH Act within the Area of Concern

boundary are Whihala Beach east and west in Whiting, Hammond Beach east and west, Jeorse Park in East Chicago, and Buffington Harbor, Marquette Park, Wells Street, and Lake Street in Gary.

Monitoring of these beaches began under the BEACH Act in 2004. To assess delisting target status beaches will continue to be monitored and any samples that exceed the state water quality standard for E. coli will be tracked. Currently, most AOC beaches are performing fairly well and are at least close to removal target status. One stretch of beach however, Jeorse Park and Buffington Harbor, has continued to have excessive numbers of exceedences.

Beach problems are complex and E. coli contamination can originate from both point sources (direct discharges to water) and nonpoint sources (agricultural runoff, storm runoff). Both possibilities will need to be assessed to determine the root cause of major E. coli contamination at AOC beaches. The delisting target for Beach Closures includes a component that if the first part of the delisting target is not met within five years then a comparison study of other Indiana Lake Michigan beaches will be performed to assess whether AOC beaches are behaving differently than others. While this comparison method still means Jeorse Park and Buffington Harbor have a long way to go in reaching delisting, the comparison may provide helpful insight into whether E. coli issues at AOC beaches are inherent to the AOC or are a larger scale basin-wide issue.

Funding continues to be sought out in order to research the E. coli contamination at the Jeorse Park and Buffington Harbor beaches. In 2011 through a GLRI grant the IDEM was able to partner with the US Geological Survey (USGS) to conduct microbial source tracking at Jeorse Park. At first the data seemed to point to an avian problem at the beach however later reviews determined this to be inconclusive and further investigation is required to determine the root cause. The USGS believes there is the potential that there is an illegal point source discharge occurring near the area, but there is currently no evidence to prove this existence.

Due to the need for further studies into the cause of the contamination at Jeorse Park, IDEM is working with U.S. EPA to obtain funding for USGS to continue monitoring and to perform hydrologic modeling of the water at Jeorse Park through Fiscal year 2013.

Eutrophication

Eutrophication or undesirable algae occurs throughout the river system. Blue-green algal mats coat much of the bottom of the river and canal. As gases build up under these mats, clumps break off the bottom and float in or on top of the water column. Combined Sewer Overflow (CSO) events also result in nutrients and mass algae (and duckweed) growths in and on top of the water column. These accelerated growths are especially prominent in relatively shallow areas or restricted water flow areas at bridges or culverts (or behind oil control booms on the canal). Elimination of sources of nutrients, primarily CSOs in conjunction with sediment remediation will lead to delisting of this BUI in the AOC.

Current Status:

Today, the CARE committee members and the organizations they represent continue working to achieve success in the Grand Calumet River and Indiana Harbor Ship Canal AOC. Monthly workgroup meetings are held with those members appointed by IDEM's Commissioner to continue work included in the Remedial Action Plan. In addition, quarterly public meetings are held to keep the public apprised of the status of the RAP process and AOC interests.

Recent activities include the completion of the removal targets for the fourteen beneficial use impairments of the GCR/IHSC AOC in December of 2008, and the approval of a segment approach to the AOC in 2008 which broke the AOC up into the following six segments;

1. Riverine Wetlands
2. Grand Calumet River and the Indiana Harbor Ship Canal up to Columbus Drive (includes lagoons)
3. Indiana Harbor Ship Canal north of Columbus Drive
4. Dune & Swale Habitat (including dry prairies, copses, black oak savannas)
5. Inland Water Bodies (Lake George, Wolf Lake, ponds)
6. Beaches and Near Shore

This approach allows for specific segments within the AOC to be deemed ready for BUI removal once that segment is remediated. A list of the segment areas and the BUIs for which they are impaired can be found in the attached Appendix A.

Additional accomplishments for the CARE committee were the removal of the added cost to agriculture and industry BUI in September of 2011 and the removal of the restrictions on drinking water consumption taste and odor BUI in March 2012. With the removal of these BUI's the GCR AOC is currently only impaired for 12 beneficial uses and has started us on the path toward delisting.

Dredging, habitat restoration, continued monitoring, and research work within the AOC is constantly being conducted for the remediation and removal of each of the BUI's. Even with continued progress and the excellent efforts of the CARE committee funding sources and matches for dredging in the GCR may soon cease to exist. As completion of dredging is vital to the removal of 11 of the remaining 12 BUI's, continued progress is contingent upon adequate funding and partners to continue dredging, and to monitor the river's status post-dredge.

The attached Grand Calumet River/Indiana Harbor Ship Canal AOC BUI Removal Matrix identifies the work required for BUI removal within the AOC along with the current number of segment areas that are impaired. The associated costs, funding, and project leads are also identified where available. Removal dates are not yet known for many of the BUI's as their ultimate removal will be dependent on the completion of sediment dredging. For the BUI's that require dredging and habitat restoration for removal, the attached Tables A, B, and C have been prepared. These tables document the individual segments/reaches within the larger segment areas of Appendix A that require work to be completed prior to those BUI's being removed. These tables include any identified sponsors/partners, estimated costs, and completion dates.

Next Steps:

The River and its connection to habitat areas having been defined as the primary driver of the GRC/IHSC AOC led the members of the CARE committee to identify and prioritize dredge and habitat projects that would be immediately available for consideration if funding in the required amounts were made available. Located in the attached Tables A, B, and C priority projects have been labeled and assigned a priority number. This number is in an inverse relationship to the priority level, with #1 being the highest priority. These priority projects are being or have been planned, have identified partners, and are available for any funding cycle. Even with the priority projects identified the CARE committee will continue to seek funding for scientific research and monitoring to assess the effects of remediation on the status of each BUI. However, the removal and complete delisting of the AOC will be dependent on the completion of the identified priority projects.

As researchⁱ and on the ground work is completed within the AOC the work outlined in the Removal Matrix may be reduced or increased as need justifies. At this time however based on previous work and the 2011 Data Gap analysis prepared by Environmental Consulting & Technology, Inc. the Removal Matrix provides an adequate overview of the steps required for the removal of each BUI. Although exact removal dates are difficult to project, it is our hope that as the outlined work and scientific studies are conducted BUI's will begin to be removed from the segments within the AOC. This segmental removal will document the progress toward the final removal of each BUI from the AOC as a whole and demonstrate that we are on the track to the ultimate goal of delisting.

ⁱ Current research and monitoring studies include, "*BUI #4 Fish Tumors and Other Deformities of the GCR/IHSC AOC 1988-2010*" *Biological Report 2011* by Dan Sparks of the US Fish and Wildlife Service, and "*Assessment Tools and Delisting Criteria for Beneficial Use Impairments in Great Lakes Areas of Concern*" *Great Lakes Restoration Initiative funded project* by Tom Simon through Indiana State University to be completed September 2012. Completed studies which may affect/support future BUI removal include the "*IBI metric Development and Validation for Amphibians and Reptiles of the GCR AOC*" by Alan and Donna Resetar May 20, 2007.

Grand Calumet River/Indiana Harbor Ship Canal AOC BUI Removal Matrix

Beneficial Use Impairment	Work Required for Removal	Estimated Costs of Work	Funding Source	Project Lead	Targeted Removal Date	Comments
1. Restrictions on Fish and Wildlife Consumption Impaired for 5 Segments	Environmental Dredging and Monitoring	Refer to Tables A, B, & C	Refer to Tables A, B, & C	Sponsors, IDEM, Federal Gov.	Currently unknown due to the need for future dredge funding.	This BUI maybe able to be removed from certain AOC segments as dredging and post dredge monitoring are completed in reaches of the river and riverine wetlands.
	Post dredge sediment quality data collection	Currently Unknown	Currently Unknown	IDEM, Contractual		
	Fish tissue sampling, Evaluation of Fish Advisories	Currently Unknown	IDEM, Indiana State Department of Health	IDEM, ISDH, IDNR-(Fish Advisories)		
2. Tainting of Fish and Wildlife Flavor Impaired for 4 Segments	Environmental Dredging and Monitoring	Refer to Tables A, B, & C	Refer to Tables A, B, & C	Sponsors, IDEM, Federal Gov.	Currently unknown due to the need for future dredge funding.	This BUI maybe able to be removed from certain AOC segments as dredging and post dredge monitoring are completed in reaches of the river and riverine wetlands.
	Post dredge sediment quality data collection	Currently Unknown	Currently Unknown	IDEM, Contractual		
	Fish tissue sampling	Currently Unknown	Currently Unknown	IDEM, Contractual, Potential FWS		
3. Degradation of Fish and Wildlife Populations Impaired for 6 Segment	Environmental Dredging and Monitoring	Refer to Tables A, B, & C	Refer to Tables A, B, & C	Sponsors, IDEM, Federal Gov.	Currently unknown due to the need for future dredge funding.	This BUI maybe able to be removed from certain AOC segments as dredging and post dredge monitoring are completed in reaches of the river and riverine wetlands.
	Habitat Restoration/Invasive Species Removal	\$2,000-3,000/Acre Refer to Tables B & C	Partial through GLRI grant GL-00E00490. Still a need for continued funding	IDEM, TNC, STD, IDNR, Lake Co. Parks		
	Follow-up Invasive treatment and monitoring	≈\$500/Acre for 5 years Refer to Tables B & C	Currently Unknown	IDEM, TNC, STD, IDNR, Lake Co. Parks		
	Post dredge sediment quality data collection	Currently Unknown	Currently Unknown	IDEM, Contractual		
	Fish population sampling study	Currently Unknown	Currently Unknown	IDEM, Contractual, Potential FWS, Potential Tom Simon		
	Wildlife diversity Index study	Currently Unknown	Currently Unknown	IDEM, Contractual, Potential FWS, Potential Tom Simon		
4. Fish Tumors and Deformities Impaired for 4 Segments	Environmental Dredging and Monitoring	Refer to Tables A, B, & C	Refer to Tables A, B, & C	Sponsors, IDEM, Federal Gov.	Currently unknown due to the need for future dredge funding.	This BUI maybe able to be removed from certain AOC segments as dredging and post dredge monitoring are completed in reaches of the river and riverine wetlands.
	Post dredge sediment quality data collection	Currently Unknown	Currently Unknown	IDEM, Contractual		
	Fish tissue sampling	Currently Unknown	Currently Unknown	State fish advisory testing		

Grand Calumet River/Indiana Harbor Ship Canal AOC BUI Removal Matrix

5. Bird and Animal Deformities or Reproduction Problems Impaired for 6 Segments	Environmental Dredging and Monitoring	Refer to Tables A, B, & C	Refer to Tables A, B, & C	Sponsors, IDEM, Federal Gov.	Currently unknown due to the need for future dredge funding.	This BUI maybe able to be removed from certain AOC segments as dredging and post dredge monitoring are completed in reaches of the river and riverine wetlands.
	Post dredge sediment quality data collection	Currently Unknown	Currently Unknown	IDEM, Contractual		
	Bird and Animal tissue Sampling	Currently Unknown	Currently Unknown	IDEM, Contractual, Potential FWS		
6. Degradation of Benthos Impaired for 6 Segments	Environmental Dredging and Monitoring	Refer to Tables A, B, & C	Refer to Tables A, B, & C	Sponsors, IDEM, Federal Gov.	Currently unknown due to the need for future dredge funding.	This BUI maybe able to be removed from certain AOC segments as dredging and post dredge monitoring are completed in reaches of the river and riverine wetlands.
	Post dredge sediment quality data collection	Currently Unknown	Currently Unknown	IDEM, Contractual		
	MIBI data collection	Currently Unknown	Currently Unknown	IDEM, Contractual		
7. Restrictions on Dredging Activity Impaired for 4 Segments	Environmental Dredging and Monitoring	Refer to Tables A, B, & C	Refer to Tables A, B, & C	Sponsors, IDEM, Federal Gov.	Currently unknown due to the need for future dredge funding.	This BUI maybe able to be removed from certain AOC segments as dredging and post dredge monitoring are completed in reaches of the river and riverine wetlands.
	Post dredge sediment quality data collection	Currently Unknown	Currently Unknown	IDEM, Contractual		
8. Eutrophication of Undesirable Algae Impaired for 4 Segments	Environmental Dredging and Monitoring	Refer to Tables A, B, & C	Refer to Tables A, B, & C	Sponsors, IDEM, Federal Gov.	Currently unknown due to the need for future dredge funding.	This BUI maybe able to be removed from certain AOC segments as dredging and post dredge monitoring are completed in reaches of the river and riverine wetlands.
	Removal of CSOs	Unknown	Local Municipalities	IDEM		
	DO, Nutrient and Algae monitoring	Unknown, possibly built into Indiana's 303 (d) funding plan	IDEM 303(d) monitoring funds			
9. Restrictions on Drinking Water Taste and Odor Not impaired for any segments	No further Action required. BUI has been removed.	N/A	N/A	IDEM, ECT	Removal approved on Mar. 5, 2012	US EPA approved removal on Mar. 5, 2012
10. Beach Closures Impaired for 1 Segment	Continued Microbial source tracking at Jeorse Park & Water Flow modeling	Dependent upon USGS costs	US EPA	US EPA, IDEM, USGS	2017-?	This BUI applies only to the beaches and the nearshore of Lake Michigan.
	Potential Investigation	Currently Unknown	Currently Unknown	IDEM		
	Potential Beach Restructure	Currently Unknown	Currently Unknown	IDEM, Contractual		

Grand Calumet River/Indiana Harbor Ship Canal AOC BUI Removal Matrix

11. Degradation of Aesthetics Impaired for 6 Segments	Monitoring protocol development	≈\$25,000	Currently Unknown	IDEM	Currently unknown due to the need for future dredge funding.	This BUI maybe able to be removed from certain AOC segments as dredging and post dredge monitoring are completed in reaches of the river and riverine wetlands.
	Field assessment	≈\$25,000	Currently Unknown	IDEM, Contractual/ volunteers		
	Environmental Dredging and Monitoring	Refer to Tables A, B, & C	Refer to Tables A, B, & C	Sponsors, IDEM, Federal Gov.		
	Post Dredge Field assessment	Currently Unknown	Currently Unknown	IDEM, Contractual/ volunteers		
12. Added Costs to Agriculture of Industry Not impaired for any segments	No further Action required. BUI has been removed.	N/A	N/A	IDEM, ECT	Removal approved on Sept. 30, 2011	US EPA approved removal on Sept. 30, 2011
13. Degradation of Phyto and Zooplankton Impaired for 4 Segments	Baseline Monitoring for Plankton populations, chlorophyll-a, and dissolved oxygen levels	In preparation by Tom Simon (ISU)	LaMP Grant GL-00E00724	IDEM, Tom Simon (ISU)	Currently unknown due to the need for future dredge funding.	This BUI maybe able to be removed from certain AOC segments as dredging and post dredge monitoring are completed in reaches of the river and riverine wetlands.
	Environmental Dredging and Monitoring	Refer to Tables A, B, & C	Refer to Tables A, B, & C	Sponsors, IDEM, Federal Gov.		
	Post Dredge Water Monitoring for Plankton populations, chlorophyll-a, and dissolved oxygen levels	Currently Unknown	Currently Unknown	IDEM, Contractual		
14. Loss of Fish and Wildlife Habitat Impaired for 6 Segments	Environmental Dredging and Monitoring	Refer to Tables A, B, & C	Refer to Tables A, B, & C	Sponsors, IDEM, Federal Gov.	Currently Unknown due to future need for Dredge Funding	This BUI maybe able to be removed from certain AOC segments as dredging and post dredge monitoring are completed in reaches of the river and riverine wetlands.
	Habitat Restoration/Invasive Species Removal	\$2,000-3,000/Acre Refer to Tables B & C	Partial through GLRI, need for continued funding	IDEM, TNC, STD, IDNR, Lake Co. Parks		
	Follow-up Invasive treatment and monitoring	≈\$500/Acre for 5 years Refer to Tables B & C	Currently Unknown	IDEM, TNC, STD, IDNR, Lake Co. Parks		
	Fish population study	Currently Unknown	Currently Unknown	IDEM, Contractual, Potential FWS, Potential Tom Simon		
	Wildlife population study	Currently Unknown	Currently Unknown	IDEM, Contractual, Potential FWS, Potential Tom Simon		

TABLE A

Grand Calumet River/Indiana Harbor Canal Dredging Costs				
Area/Segments (with USACoE Feasibility Designations)	Sponsors/Partners	Estimated Cost	Estimated Dredge/Cap Completion Date	Estimated Monitoring Cost per monitoring event
Grand Calumet Lagoons				
East Lagoon (5C)	RDA/Gary GLRI	\$20- \$40 Million	Dependant on City of Gary	\$100,000
Middle Lagoon (5B)	NA	NA	NA	NA
West Lagoon (5A)	US Steel RCRA	NA	Dependant on RCRA corrective Action	Currently unknown
East Branch Grand Calumet River				
East 5 Miles	US Steel Dredged	60.7 Million	Completed Phase 1-Dec. 2003 and Phase 2-Dec. 2007	\$333,000
Gary Reach (4C, 4D, 4E, 4F)	Future sponsors/State/Federal	\$80 + Million*	Currently unknown	\$200,000
DuPont Reach (4A, 4B)	GLLA/NRD Trustees	\$85 Million*	July 2014	\$100,000
EBGCR/WBGCR/IHC Junction				
Indianapolis Blvd. to Kennedy Ave. (2A, 2B, 2C)	Future sponsors/State/Federal	30.7 Million*	Currently unknown	\$100,000
West Branch Grand Calumet River				
Indianapolis Blvd to Columbia Ave (1C,1D)	GLLA/NRD Trustees	\$46 Million*	May 2012	\$100,000
Columbia Ave. to Hohman Ave. (1B)	GLLA/NRD Trustees	\$28 Million	Completed Oct. 2010	\$75,000
Hohman Ave. to Stateline (1A)	GLLA/NRD Trustees/NIPSCO	\$12 Million	December 2013	\$60,000
Indiana Harbor Canal				
Federal Channel	Funded US ACE	\$150 Million	Currently unknown	NA
IHC (Calumet Branch)	Future sponsors/State/Federal	\$7 Million	Currently unknown	\$75,000
IHC (Lake George Branch)(3A)	Future sponsors/State/Federal	\$6 Million	Currently unknown	\$100,000
IHC (Lake George Branch-Calumet Ave.)	Future sponsors/State/Federal	\$4.5 Million	Currently unknown	\$75,000
Note: Costs do not include Operation and Maintenance of Remedy. A map of the river can be found in Appendix A				
* Includes Restoration of wetlands -see River Wetlands Sheet				

TABLE B

Riverine Wetlands					
Area	Acres	Dredge/Cap Costs and Funding	Estimated Dredge/Cap Completion Date	Restoration funding need/completion date	Maintenance
Grant Street (Priority #7)	8			\$38,400	\$20,000
USS Oxbow	35	\$850,000	Completed Dec. 2007	Completed Dec. 2011	\$87,500
Pine Station (Priority #6)					
Oxbow	19.4	\$8 Million	Currently Unknown	\$49,000	\$48,500
North Bank	2			\$4,000	\$5,000
Gary Reach (Priority #5)	24	\$14 Million	Currently Unknown	\$72,000	\$60,000
	2			\$9,600	\$5,000
DuPont Reach (Priority #1)	78	GLLA Project	In Design		\$195,000
USS Lead (Priority #2)	25			\$95,000	\$62,500
	12.5	\$6.7 Million	Currently Unknown	\$120,000	\$31,250
Shell/East Chicago (Priority #3)	13.2	\$4.6 Million	Currently Unknown	\$166,000	\$33,000
Roxana Marsh Reach	38	Funded GLLA Project	Completed June 2012	Included in GLLA	\$95,000
BP Wetlands/Lake Mary (Priority #4)	57	NA	NA	\$377,000	\$110,000
Lake George (Priority #4)	20	NA	NA	\$187,774	\$45,000
Total need for riverine wetland remediation(dredge/cap)					\$33.3 Million
Total need for riverine wetland restoration					\$1,118,774
Total need for riverine maintenance for 5 years					\$797,750

TABLE C

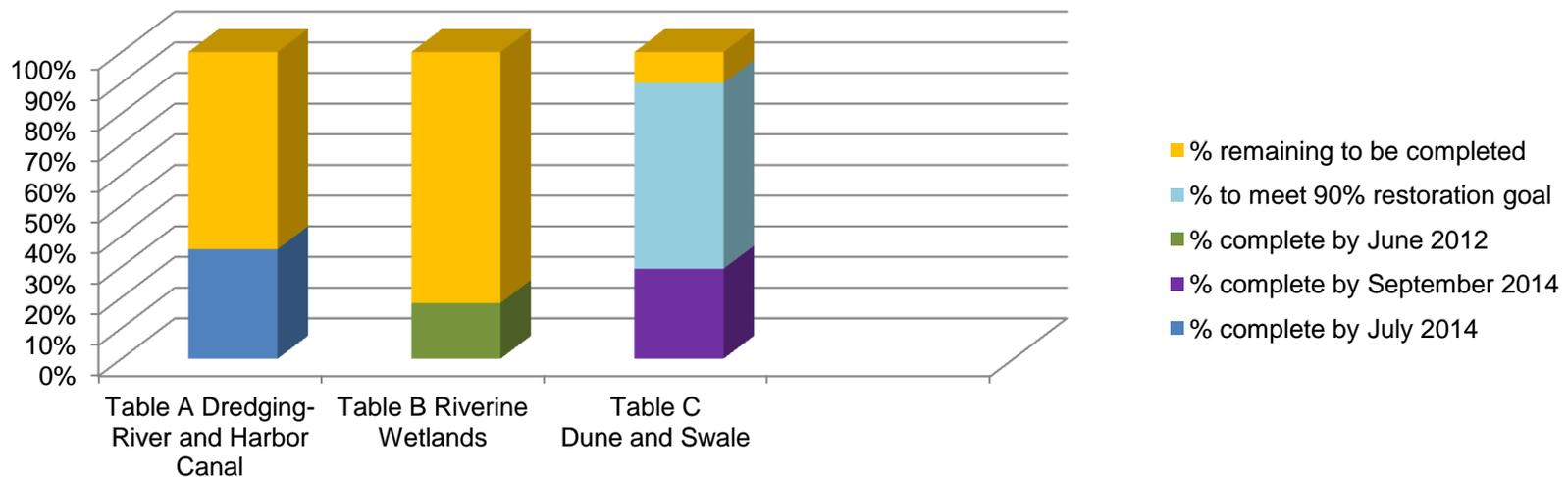
Dune and Swale Habitat Complexes				
Area	Acres	Restoration Cost/Funding	Estimated Restoration Completion Date	Five Year Maintenance
DuPont/Toleston Woods/Gibson Woods Complex				
DuPont	175	\$90,000/Partial GLRI	108 Acres in 2014	\$437,500
Beemsterboer (Priority #3)	40	\$37,500/Partial GLRI	10 Acres in 2014	\$125,000
Sceidner D&S	30	\$15,000	Currently unknown	\$75,000
USS Lead	20	\$60,000	Currently unknown	\$50,000
Cline Ave NP	9	\$22,500/Partial GLRI	7 Acres in 2014	\$22,500
Martin Oil	15	\$45,000/Partial GLRI	8 Acres in 2014	\$37,500
Toleston Ridges (Priority #5)	40	\$255,000	Currently unknown	\$212,500
Gibson Woods Complex (Priority #2)	115	\$420,000/Partial GLRI	35 Acres in 2014	\$350,000
Ivanhoe Complex				
Ivanhoe South (Priority #4)	70	\$210,000	Currently unknown	\$175,000
Ivanhoe West	84	\$20,000/Partial GLRI	60 Acres in 2014	\$ 150,000
Ivanhoe East	45	GLRI funded complete	35 Acres in 2014	
Clark & Pine/Pine Station Complex				
Clark & Pine	45	\$41,250	Currently unknown	\$137,500
Railroad Prairie	30	\$90,000	Currently unknown	\$75,000
US Steel Prairie	33	\$99,000	Currently unknown	\$82,500
Pine Station (Priority #1)	158	\$468,500/partial GLRI	20 Acres in 2014	\$395,000
Grey Trust/Gary Lagoons	55	\$165,000	Currently unknown	\$137,500
Total Restored Acres to meet Delisting Goals				964
(90% Goal) *				867
Total Cost of Restoration Need				\$2,038,750
(90% Goal) *				\$1,834,875
Total Maintenance Need for 5 years				\$2,462,500
(90% Goal) *				\$2,216,250

Acreage amounts and costs are close estimates of the actual need for Habitat and Riverine wetlands. Some overlap may occur between sites, but as specific projects are undertaken exact acreage amounts and costs will be determined.

*A goal of 90% completion has been set based on current sites that provide a direct connect with the goal of BUI removal. An explanation for the selection of these sites may be found in the attached Appendix C, Habitat Site Locations. If 90% of the acres at these sites are remediated/restored to meet the removal criteria listed in Appendix B then the BUI can be considered for removal. Other properties/sites are not necessarily excluded from consideration towards the removal goal, however, in order to be considered proposed locations must meet the following guidelines;

- The site must be able to be restored to the level of quality that meets the removal criteria for the Habitat BUI listed in Appendix B
- The site must have a recognizable relationship/connection to the Grand Calumet River
- The site must have a project scope
- The site must have identified Project Management (Ownership)
- Once the site is identified a remediation/restoration timeline must be in place (Completion within 5 years – extension waiver granted for cause)
- The project must have potential funding identified and be achievable based on prospective site locations
- Acreage not connected to the river may be included in the inventory once they are completed.

Graphical Depiction of Table A, B, and C**



**Graph does not include monitoring or maintenance needs

Appendix A

AOC Segment Areas and Maps

GRAND CALUMET RIVER AREA OF CONCERN (AOC)															
		BENEFICIAL USE IMPAIRMENTS (BUI's)													
		BUI No. 1	BUI No. 2	BUI No. 3	BUI No. 4	BUI No. 5	BUI No. 6	BUI No. 7	BUI No. 8	BUI No. 9	BUI No. 10	BUI No. 11	BUI No. 12	BUI No. 13	BUI No. 14
AOC SEGMENT AREAS		Restrictions on fish and wildlife consumption	Tainting of fish and wildlife flavor	Degraded fish and wildlife populations*	Fish tumors and deformities	Bird or animal deformities or reproduction problems	Degradation of benthos	Restrictions on dredging activities	Eutrophication or undesirable algae	Restrictions on drinking water consumption, or taste and odor	Beach closings	Degradation of aesthetics*	Added costs to agriculture or industry	Degradation of phytoplankton and zooplankton populations	Loss of fish and wildlife habitat*
A	GCR/IHC to Columbus Dr. (includes Lagoons)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	Yes	No	Yes	Yes
B	Indiana Harbor Ship Canal (includes Lake George Branch to Land Bridge)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	Yes	No	Yes	Yes
C	Riverine Wetlands	No	No	Yes	No	Yes	Yes	Yes	No	No	No	Yes	No	No	Yes
D	Inland Water Bodies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	Yes	No	Yes	Yes
E	Beaches & Near Shore	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	No	Yes	Yes	No	Yes	Yes
F	Dune & Swale Habitat	No	No	Yes	No	Yes	No	No	No	No	No	Yes	No	No	Yes

Color Key

Table Color	Description
	BUI has been removed
	BUI remains impaired

Segment Area Map



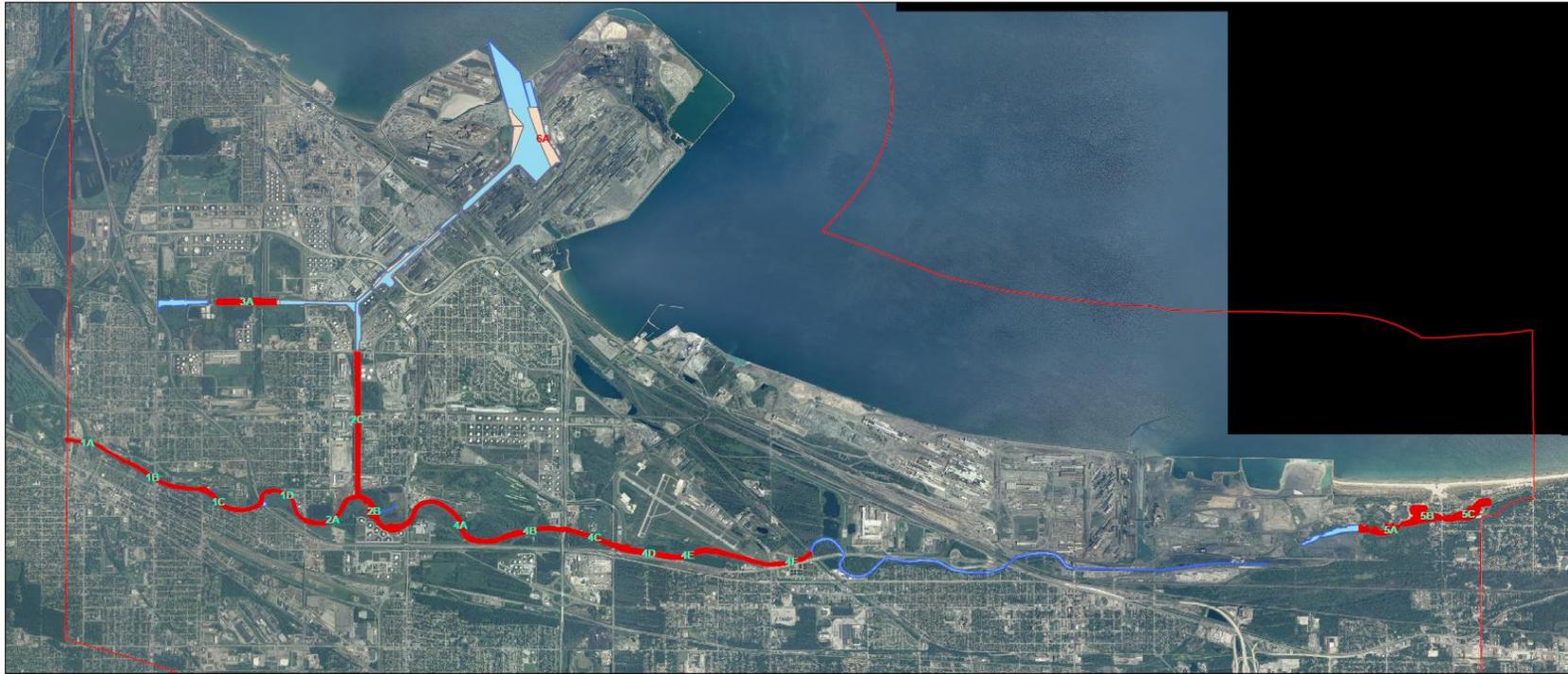
Color Key

Map Color	Site Description*
Yellow	Habitat Sites
Blue	Inland Water bodies
Light Blue	Lagoons, River, and Canal
Light Blue	Beaches
Light Blue	Nearshore Lake Michigan
Hatched	Wetlands adjacent to the River

*This map does not depict the current AOC boundaries, but is used as a reference for Segment Areas located within the AOC.

Map of the Grand Calumet Area based on USACE 2010 Draft Feasibility Study Designations

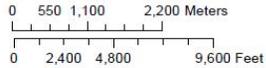
Grand Calumet River/Indiana Harbor Canal AOC _ Reach and Sediment Management Unit - Draft USACE FS_2010



This map is intended to serve as an aid in graphic representation only. This information is not warranted for accuracy or other purposes.

Mapped By:
Dr. Jim Smith, Office of Land Quality/Legal Counsel
Date: 09/08/2012

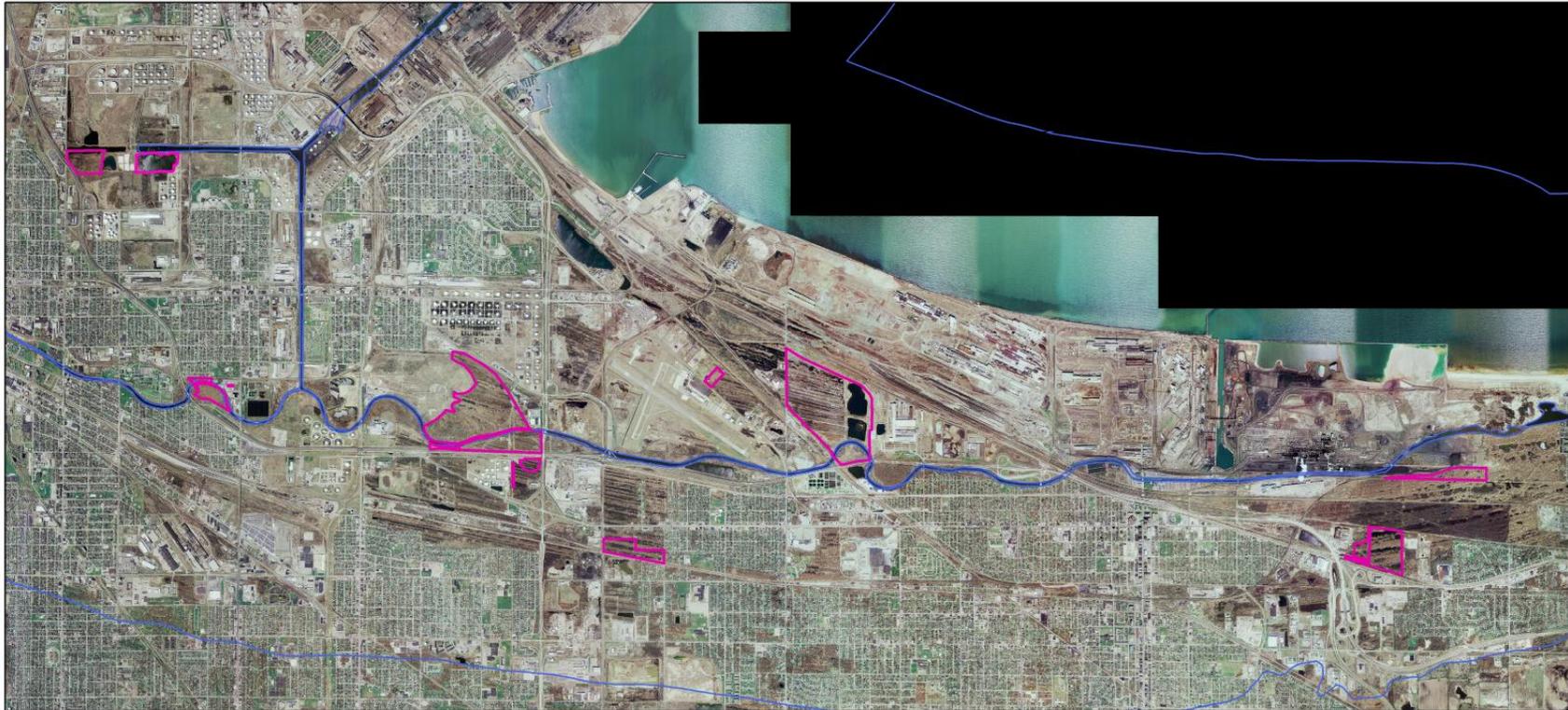
Sources:
Non-Orthorectification
Data - Obtained from the State of Indiana Geographical Information Office Library
Orthorectification - Obtained from USDA Data Gateway - NAIP Lake County, IN 2010 (www.indianagis.org)
Map Projection: UTM Zone 16 N Map Datum: NAD83



Legend	
■	GCR_mu
■	US Canal_Reach 6A
■	GCR_IHC_IH
□	2009_AOC_Boundary

NRD Settlement Habitat Site Land Acquisition Map

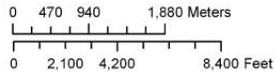
Figure 1. Lands aquired or purchased with funds received through Natural Resource Damage Settlements in GCR/IHC AOC.



This map is intended to serve as an aid in graphic representation only. This information is not warranted for accuracy or other purposes.

Mapped By:
Dr. Jim Smith, Office of Land Quality, NRD Program
Date: 10/05/2010

Sources:
Non-Orthophotography
Data - Obtained from the State of Indiana Geographical Information Office Library
Orthophotography - Obtained from Indiana Map Framework Data (www.indianamap.org)
Map Projection: UTM Zone 16 N Map Datum: NAD83



Appendix B

REMOVAL TARGETS FOR BENEFICIAL USE IMPAIRMENTS APPLICABLE TO THE GRAND CALUMET RIVER AOC

1. Restrictions on Fish and Wildlife Consumption

This BUI can be considered for removal when:

- Bioaccumulative chemicals of concern (BCCs) (including PCBs, mercury, dioxins, and furans) within the AOC have been controlled through issuance of the appropriate regulatory control document or eliminated; and
- Indiana Fish consumption advisories for the AOC, attributable to conditions within the AOC, fall within Group 1 or Group 2 for two consecutive sampling cycles; and
- Waters within the Grand Calumet River AOC are not listed as impaired due to fish consumption advisories and/or contaminant levels in fish tissue in the most recent Indiana Integrated Water Monitoring and Assessment Report (submitted to US EPA every two years) and/or the most recent Indiana Fish Consumption Advisory;

Or if the above is not achievable within 5 years:

- BCCs (including PCBs, mercury, dioxins, and furans) within the AOC have been controlled or eliminated; and
- A multi-year comparison study of fish tissue contaminant levels demonstrates that there is no statistically significant difference (with a 95% confidence interval) in fish tissue BCC concentrations in the AOC compared to fish tissue BCC concentrations in a representative non-impacted control site within the Lake Michigan Basin.

Actions

- Determine appropriate fish species for tissue concentration trend analysis.
- If a multi-year comparison study is necessary, establish appropriate control/comparison sites within the AOC or a similar watershed for evaluating relative progress toward attaining the restoration criteria utilizing comparative contaminant analysis. The studies should be designed to control variables known to influence contaminant concentrations such as species, size, age, sample type, lipids, and collection dates. The control site should be chosen based on physical, chemical, and biological similarity to the AOC.

2. Tainting of Fish and Wildlife Flavor

This BUI can be considered for removal when:

- All known sources of materials that could result in tainting of fish and/or wildlife within the AOC have been controlled through issuance of the appropriate regulatory control document or eliminated; and
- Tissue analysis over two consecutive monitoring cycles shows that there are no chemicals present at concentrations that would result in tainting of the fish/wildlife flavor.

Actions

- Determine appropriate fish species for tissue trend analysis.
- Establish appropriate monitoring locations within the AOC to determine baseline conditions and trends.
- Determine appropriate chemicals to monitor for and establish acceptable levels.

3. Degradation of Fish and Wildlife Populations

State of Indiana Removal Target for Fish:

- Meet ecoregion or applicable biological criteria (IBI and MIwb) for AOC Grand Calumet River and other appropriate habitat types (i.e., lagoon, dune and swale, wetland, pond, or lake designations); and meet biological indices guidelines for riverine, vernal pond, palustrine, or lacustrine wetland; and nearshore reaches of Lake Michigan; and
- Where applicable, sediment-associated contaminants are not at levels that inhibit normal benthic organism growth as determined by the delisting target for degradation of benthos.

For Wildlife:

- Healthy, reproducing populations of appropriate sentinel species are present; and
- Where applicable, sediment-associated contaminants are not at levels that inhibit normal benthic organism growth as determined by the delisting target for degradation of benthos.

Actions for Fish

- Track changes in fish assemblage survey results.
- Ecoregional biocriteria or guideline scores are met in AOC mainstem, wetland habitats, and nearshore Lake Michigan. Establish fish indicator goals for various habitat types in AOC.

For Wildlife

- Track changes in wildlife population survey results.

- Track progress toward achievement of restoration goals and management objectives related to sites within the boundaries of the AOC.
- Select sentinel wildlife species to monitor in the AOC, representative of aquatic (amphibian species) and terrestrial habitats.

Suggested Assessment Approach to Determine Wildlife Impairment Status

1. Form a RAP sub-group to:
 - a. Produce a database of wildlife managers who are familiar with wildlife issues in the AOC.
 - b. Develop a form to survey the wildlife managers.
2. Using the survey form, collect the necessary data to determine wildlife targets and assess the status of the use impairment.
3. Select sentinel species

4. Fish Tumors and Deformities

This BUI can be considered for removal when:

- All known sources of contaminants that are known causes of Deformities, Eroded Fins, Lesions, and Tumors (DELT) anomalies have been controlled in the AOC through issuance of the appropriate regulatory control; and
- There have been no exceedence of reports greater than 1.3% of external Deformities, Eroded Fins, Lesions, and Tumors (DELT) anomalies or internal organ/system impacts due to chemical contaminants that have been verified through observation and analysis by the IDEM/IDNR for an appropriate recent sampling period.
- Once levels of 1.3% or less of reported DELTs are met, reproductive health should be assessed.

OR, in cases where reports greater than 1.3% of DELT anomalies have been reported:

- A comparison study of resident benthic fish of comparable age and at maturity, or of fish species which have historically been associated with this BUI, in the AOC and a control site that showcases existing condition in the surrounding areas of NW IN indicates that there is no statistically significant difference (with a 95% confidence interval) in the incidence of liver tumors or deformities; and
- A comparison study of resident non-benthic fish of comparable age and at maturity in the AOC and a control site that showcases existing conditions in the surrounding areas of NW IN indicates that there is no statistically significant difference (with a 95% confidence interval) in the incidence of contaminant related external DELTs.

Actions

- Prepare a report comparing that status of DELT anomalies and the species affected by DELT anomalies should be prepared for the AOC;
- Correlations between sediment contaminant concentrations and DELT anomaly incidence should be completed using a stressor identification analysis (Morris et al. 2004). Pre-dredging concentrations and DELT incidence should be compared to post-dredging DELT incidence to determine the improvements and trend in the DELT trajectory in the AOC, and
- If the AOC still has DELT incidence levels greater than the background concentrations found in NW Indiana, then liver enzyme studies using caged fish or other appropriate internal investigations should be conducted to determine the levels and incidence of individuals affected by contaminants and the effects on reproductive condition.
- Once levels of 1.3% or less reports of DELT anomalies are met, reproductive health should be assessed (healthy reproducing populations should exhibit gonad conditions typical of seasonally expected male and female individuals and be free from cysts, tumors, and atrophy. Populations will experience expected hatchability of fertilized eggs and larvae will develop without teratogens¹ or other abnormalities).

5. Bird or Animal Deformities or Reproduction Problems

This BUI can be considered for removal when:

Tissue Contaminant Levels as an Indicator of Deformities or Reproductive Problems

- Tissue concentrations of Bioaccumulative chemicals of concern (BCCs) in the AOC are at or lower than the LOEL known to cause reproductive or developmental problems in fish-eating birds and mammals, **or**
- Tissue concentrations of BCCs in the AOC are not statistically different than the associated Great Lake (at 95% confidence interval).

Animals of a size and species to be prey for the wildlife species under consideration must be used for the tissue data.

Actions

- Determine appropriate bird and amphibian indicator species
- Determine appropriate comparison site(s) if necessary
- Design sampling/observation program

6. Degradation of Benthos

This BUI can be considered for removal when:

¹ Agents that can disturb the development of an embryo or fetus.

- All remedial/restoration actions for specific impacted benthic communities are completed (except for minor repairs required during operations and maintenance) and monitored according to the approved plan(s); and
- Known contaminant sources within the AOC contributing to sediment contamination and degraded benthos have been identified and control measures implemented; and
- The macroinvertebrate Index of Biotic Integrity (mIBI) at all sampling sites is a minimum of 3 for samples collected following acceptable state protocols.; and
- Acute sediment toxicity survival is at least 80% of toxicity test controls at all sampling locations; and
- Chronic sediment toxicity survival is at least 80% of toxicity test controls at all sampling locations.

Actions

- Determine appropriate sampling locations within the AOC based on historical sampling locations and sites of known impact.
- Sediment monitoring will need to include toxicity testing, both acute and chronic, when delisting is near.

7. Restrictions on Dredging Activities

This BUI can be considered for removal when:

- When contaminants within the sediments do not exceed applicable standards, criteria, or guidelines. As such, there would be no restrictions on dredging or disposal activities; or
- When sediments have been dredged and a protective cap put into place and maintained.

Actions

- Track dredge spoil disposal requirements for projects within the AOC to determine when criteria are being met through review of issued dredging permits.
- Determine the degree of contamination in the river sediments and track trends in the level of contamination as remediation efforts precede throughout the watershed.

8. Eutrophication or Undesirable Algae

This BUI can be considered for removal when:

- There are no violations of the minimum dissolved oxygen concentrations established in 327 IAC Article 2 in the AOC due to excessive sediment or algal growths; and

- Levels of chlorophyll-a are consistent with IDEM “fully supporting” levels throughout the AOC.

Actions

- Establish appropriate monitoring locations within the AOC to determine baseline conditions and trends.
- Determine if concentrations are at the appropriate level.
- Develop scientifically based monitoring program to establish trends and determine when concentration criteria have been accomplished.

9. Restrictions on Drinking Water Consumption, or Taste and Odor

- BUI has been removed

10. Beach Closures

This BUI can be considered for removal when:

- No sanitary sewer overflows or unpermitted combined sewer overflows have occurred within the AOC during the previous five year period that are inconsistent with approved consent decrees or long term control plans; and
- All municipalities within the AOC have adopted and are implementing storm water pollution reduction programs including an illicit discharge elimination program; and
- Beaches will be open 90% of the time during any 30 day period of the active swim season based on bacterial concerns; and
- No water bodies affecting the beaches located within the AOC are included on the list of impaired waters due to contamination with E. coli or other beach indicator in the most recent Indiana Integrated Water Monitoring and Assessment Report which is submitted to U.S. EPA every two years.

Actions

- Continue ongoing bacterial monitoring programs within the AOC and expand as necessary.
- Conduct annual review of the data collected to determine if sample numbers and/or locations should be increased or decreased.
- Document implementation effectiveness of storm water reduction programs within the AOC.

11. Degradation of Aesthetics

State of Indiana Removal Target

- The general surface water quality shall meet the criteria outlined in Indiana Administrative Code Chapter 327 to the extent practical and possible.

This section is summarized as:

- Free from substances, materials, floating debris, oil, or scum attributable to municipal, industrial, agricultural, and other land use practices, or other discharges:
 - that will settle to form putrescent or otherwise objectionable deposits;
 - that are in amounts sufficient to be unsightly or deleterious;
 - that produce color, visible oil sheen, odor, or other conditions in such a degree as to create a nuisance;
 - that are in concentrations or combinations that will cause or contribute to the growth of aquatic plants or algae in such a degree as to create a nuisance, be unsightly, or otherwise impair the designated uses; that are toxic or harmful to human, animal or aquatic life and/or are rapidly lethal in the mixing zone;
 - that are in amounts sufficient to be acutely toxic to, or to otherwise severely injure or kill aquatic life, other animals, plants, or humans.

Actions

- Monitor change in problem Grand Calumet River, Indiana Harbor Ship Canal, and lagoon segments within the AOC.
- Track implementation of source reduction and/or elimination projects.
- Monitor change in problem areas for reoccurrence.
- Monitor the AOC for new problem locations.
- Track that "free froms" in the Indiana Administrative Code 327 are being met.

12. Added Costs to Agriculture and Industry

- BUI has been removed

13. Degradation of Phytoplankton and Zooplankton Populations

This BUI can be considered for removal when:

- There are no violations of the minimum dissolved oxygen concentrations established in 327 IAC article 2 in the AOC
- Levels of chlorophyll-a are consistent with IDEM "fully supporting" levels throughout the AOC; and
- Waters within the Grand Calumet River AOC are not listed as impaired due to degradation of phytoplankton or zooplankton in the most recent Indiana Integrated Water Monitoring and Assessment Report (submitted to U.S. EPA every two years) and/or the most recent Indiana Fish Consumption Advisory.

Actions

- Develop appropriate scientifically based monitoring scenarios to establish a baseline and trends.

14. Loss of Fish and Wildlife Habitat

State of Indiana Removal Target Fish Habitat:

- The habitat quality shall average a qualitative habitat evaluation index (QHEI)² score of 33 or better throughout the free-flowing stream stretches of the AOC; and
- If QHEI is assessed at 33 or better, then habitat quality should be maintained at or above that level.

State of Indiana Removal Target Wildlife Habitat:

- The habitat quality shall average a QHEI score of 33 or better using the Great lakes Drowned River Mouth Coastal Wetland criteria; and
- Plant Index of Biotic Integrity shall meet 35; and
- Floristic Quality Index³ without adventives⁴ shall meet 20 ; mean CC⁵ value = 6; and
- If QHEI is assessed at 33 or better, then habitat quality should be maintained at or above that level.

Actions for Fish Habitat:

- Track changes and measure QHEI scores.
- Track watershed survey results (Technical Support Documents, TMDLs, Water Quality Monitoring and Assessment Report, etc.)
- Conduct a habitat assessment of applicable segments in the AOC.

For Wildlife Habitat:

- Track changes and measure Great Lakes drowned river mouth coastal wetland habitat scores.
- Track percentage of riparian buffers along the Grand Calumet River and Indiana Harbor Ship Canal.
- Habitat is sufficient to support wildlife goals for the applicable segments within the AOC.
- Establish a monitoring program using plant indicators as measures of habitat quality to determine the appropriate restoration goals for the AOC;
- Develop restoration goals based on pIBI reference conditions for the AOC when implementing the appropriate restoration measures and benchmarks.

² The QHEI is a comprehensive assessment of physical characteristics of a stream or river.

³ Used to determine the level of degradation of an area based on the plant species that live there.

⁴ Not native to and not fully established in a new habitat or environment.

⁵ Coefficient of conservatism (based on a scale of 1-10).

Appendix C Habitat Site Locations

Background

Located within the GCR AOC is a series of natural area remnants that continue to support fragments of the native dune and swale ecosystem. Despite their hostile surrounding and decades of neglect, the natural communities captured within these sites are surprisingly diverse. For example, the Clark and Pine Nature Preserve has the highest concentration of rare, threatened and endangered species per acre throughout all of Indiana. Since 1979, The Nature Conservancy, Indiana Department of Natural Resources, Lake County Parks and Recreation Department, The Shirley Heinze Land Trust, and the Save the Dunes Conservation Fund have protected approximately 900 acres of this highly threatened dune and swale ecosystem. Of these acres approximately 650 were purchased or protected through conservation easements after 1987 when the Grand Calumet River was listed as an AOC. Historically dune and swale covered approximately 45 square miles of land surrounding the Grand Calumet River in northwest Indiana. Currently there are roughly 1000 acres of intact dune swale remaining in the western portion of the AOC. These tracts range in size from less than 15 acres to 150 acres and are scattered across the landscape in relative degrees of isolation. There are an additional 500 acres in the eastern portion, most of which is captured in the Miller Woods unit of the Indiana Dunes National Lakeshore.

The overriding threat to the dune and swale remnants is the past and current impact of urban and industrial development on the key ecological processes that sustain the natural communities captured within the site. Fire suppression and the proliferation of exotic species have caused immediately recognizable changes to community structure and composition. The physical destruction of habitat, throughout the region, has created a host of problems associated with fragmented communities. Changes in habitat conditions along the edges of fragments disrupt the biotic communities and allow for the influx of exotic species. Small habitat patches generally have higher rates of extinction, lower rates of recolonization and lower levels of species diversity than larger tracts. Species that once interacted across the broader landscape are isolated within these small islands, and ecological interactions such as, succession, gene flow, and pollination, and predator-prey relationships are impaired (TNC 1999).

Site Selection

The RAP identifies protection, restoration and management of the dune and swale system as a critical component of restoring fish and wildlife habitat in the AOC. In order to establish specific delisting criteria the CARE committee identified specific tracts that 1) contribute to a landscape based preserve design, and 2) are in close proximity to the Grand Calumet River. The rationale for the landscape based preserve design is based on mitigating the threats caused by habitat fragmentation, with a primary goal of enhancing ecological connectivity between habitat fragments (The Nature Conservancy and Ball State University, 1999. *Biodiversity Conservation Opportunities in the Toleston*

Costs

The most immediate threat to the natural communities of the dune and swale system is ongoing habitat degradation caused by both the spread of invasive species and the disruption of natural fire regimes. Ecological restoration of the natural community structure and composition is required to abate these threats. Restoration activities focus primarily on removing large stands of non-native species and recreating appropriate savanna structure by reducing invasive shrubs and trees that have increased in the absence of wildfires. Currently the majority of these sites remain in a semi-degraded state, with land managers working to prevent them from slipping further away. The land management organizations working within the Grand Calumet River Area of Concern are committed to the long-term ecological management of these natural areas. However, the current challenge is restoring them to a state that allows for more manageable stewardship activities.

Restoration activities will include the control and management of exotic invasive plant species and native aggressive trees and shrubs. The restoration projects will include broadcast foliar spraying of appropriate herbicides to herbaceous invasive plant species. Methods of application will be designed to fit the ecological setting of infestations. Treatment methods will also include the cutting of targeted woody plant species, herbicide applications to the cut stumps and/or resprout foliage, and some cut material removal. Finally, restoration activities will involve some savanna structure improvements. This will require the cutting of larger tree species that have establish in the absence of fire.

Cost estimates were established through a group discussion of local land managers and are based on individual site conditions and current costs for similar restorations. Experience has taught us that the first 5 years after initial treatment is a critical period in maintaining restorations. In order to ensure the success of restorations, costs for systematic follow up treatments during this period were included.

ⁱⁱ Site names and acreage amounts listed in the Strategic Plan may differ from what is documented in this RAP update due to name change over time and that the Plan acreage was determined based on aerial photography, while the RAP Tables were based on property ownership knowledge.