

Grand Calumet River Area of Concern Beneficial Use Impairments

Currently the AOC is impaired for the following:

| Impairment | Endpoint |
|---|--|
| Restriction on fish and wildlife consumptions | similar across the AOC |
| Tainting of fish flavor | similar across the AOC |
| Degradation of fish and wildlife population | Each reach will have a different endpoint |
| Fish tumors and other deformities | similar across the AOC |
| Bird or animal deformities or reproductive problems | Endpoint similar across the AOC |
| Degradation of Benthos | similar across the AOC |
| Restrictions on dredging activities | Each reach will have a different endpoint |
| Eutrophication or undesirable algae | Each reach will have a different endpoint |
| Restriction on drinking water consumption, or taste and odor problems | similar across the AOC |
| Beach closings | Applies only to Wolf Lake, and Nearshore Lake Michigan |
| Degradation of aesthetics | Each reach will have a different endpoint |
| Added cost to agriculture and industry | Endpoint similar across the AOC |
| Degradation of phytoplankton and zooplankton | Each reach will have a different endpoint |
| Loss of fish and wildlife habitat | Each reach will have a different endpoint |

Restrictions on Fish & Wildlife Consumption:

Total fish consumption restrictions exist for the Grand Calumet River, and the Indiana Harbor and the Canal. Partial consumption restrictions exist for Grand Calumet Lagoons (east end of the AOC) and Wolf Lake (West end of the AOC) and nearshore Lake Michigan. The Indiana Department of Environmental Management (IDEM) and the Indiana State Department of Health has identified degraded fish populations, including tainted fish ([Fish Consumption Advisory](#)).

LISTING GUIDELINE

When contaminant levels in fish or wildlife populations exceed current standards, objectives, guidelines, or public health advisories are in effect for human consumption of fish or wildlife. Contaminant levels in fish and wildlife must be due to contaminant input from the watershed.

DELISTING GUIDELINE

When contaminant levels in fish and wildlife populations do not exceed current standards, objectives or guidelines. Contaminant levels in fish and wildlife must not be due to contaminant input from the watershed.

Safety of Fish for Human Consumption

Measure

The concentration of total polychlorinated biphenyls (PCBs), polycyclic aromatic hydrocarbons (PAHs), and mercury (Hg) in edible fish and wildlife tissue. Track fish consumption advisories (FCA) for resident fish species. FCA should meet Indiana Standards.

Purpose

Track the concentrations of total PCBs, PAHs and mercury in fish tissue.

Ecosystem Objective

Fish consumption advisories in the AOC after sediment remediation projects are complete should reach Group 2.

| <u>ADVISORY GROUPS</u> | |
|------------------------|--|
| Group 1 | Unrestricted consumption. One meal per week for women who are pregnant or breastfeeding, women who plan to have children, and children under the age of 15 |
| Group 2 | One meal per week (52 meals per year for adult males and females. One meal per month for women who are pregnant or breastfeeding, women who plan to have children, and children under the age of 15. |
| Group 3 | One meal per month (12 meals per year) for adult males and females. Women who are pregnant or breastfeeding, women who plan to have children and children under the age of 15 do not eat. |
| Group 4 | One meal every 2 months (6 meals per year) for adult males and females. Women who are pregnant or breastfeeding, women who plan to have children and children under the age of 15 do not eat. |
| Group 5 | No consumption (DON'T EAT) |

Endpoint Features

This indicator will monitor the fluctuations in the concentration of contaminants in sentinel fish species in each of the nine reaches. The average fish concentration is the average PBT concentration for each fish-species weighted by the proportion of that species' mass caught in each reach of the river.

Fish Consumption Advisories

| <u>Fish Species</u> | <u>Fish length</u> | <u>GCR</u> | <u>Desired Score</u> |
|---------------------|--------------------|------------|----------------------|
| | Inches | | |
| Carp | All | 5 | 2 |
| Goldfish | All | 5 | 2 |
| Golden Shiner | All | 5 | 2 |
| Blunt Nose Minnow | All | 5 | 2 |

Delisting Endpoint

Once concentrations of PCBs represented by the fish consumption advisories reach the target of Group 2 for two consecutive sampling seasons.

Justification

The TMDL for the Cheat River in Fayette County, PA describes the listing process and their fish consumption advisory. The EPA estimated that a group 5 "Do not eat" was issued for segments of the Cheat in 1990. EPA recommends two consecutive sampling events to justify the lifting of an advisory. Fish tissue data should be gathered from two separate generations of fish. The current IDEM sampling protocol requires five years between sampling events. The five years allows for new generations.

Illustration

Use fish consumption advisory to construct a bar graph showing changes in advisories over time.

Tainting of Fish Flavor:

LISTING GUIDELINE

When ambient water quality standards, objectives, or guidelines, for the anthropogenic substance(s) known to cause tainting, are being exceeded or survey results have identified tainting of fish or wildlife flavor.

DELISTING GUIDELINE

When survey results confirm no tainting of fish or wildlife flavor.

Chemical Contaminants in Fish Tissue

Measure

Concentration of; 1) total PCBs , 2) PAHs^{***}, 3) Phenolics^{***} 4) Total Chlorinated Phenols^{***}; 5) Cd^{*}, Hg^{*}, Pb^{*}, Cr^{**}, Cu^{**}, Ni^{**}, and Zn^{**} in edible fish tissue. These chemicals are part of the Indiana State Fish consumption advisory.

(*) = Fish Tissue parameters currently monitored

(**) = Water Chemistry parameters currently monitored

(***) = Not being monitored

Purpose

The purpose of this indicator is to measure the concentration of taste-altering chemicals in the edible portions of fish. Currently, fish tissue contaminant data is used to develop Indiana's Fish Consumption Advisories. Fish tissue data is used in ecological risk assessment modeling.

Endpoint

Reduction in 1) total PCBs^{*}, 2) PAHs^{***}, 3) Phenolics^{***} 4) Total Chlorinated Phenols^{***}; 5) Cd^{*}, Hg^{*}, Pb^{*}, Cr^{**}, Cu^{**}, Ni^{**}, and Zn^{**} in edible fish tissue to levels that do not pose a risk to populations consuming fish from bodies of water in the Area of Concern. The State currently recommends that fish caught in Indiana should, at a minimum, be in a Group 2 advisory statewide. The Group 2 fish consumption advisory is an appropriate endpoint for each of the reaches in the AOC. Currently, the Grand Calumet River has Group 5 fish consumption advisory. (See list 1 for fish species found in the Grand Calumet Area of Concern.)

Ecosystem Objective

Fish should be safe for consumption and palatable.

Feature

Chlorinated phenols have been shown to impair the flavor of freshwater fish flesh at concentrations much lower than those at which it has a toxic effect. Rainbow trout were exposed for 48 hours to a range of concentrations of five different chlorinated phenols, and a panel of 15 judges scored the flavor of the cooked and coded fish samples on an increasing impairment scale of 0 to 6. The results were then plotted against exposure concentrations and graphically interpreted to arrive at an estimate of the highest concentration, which would not impair the flavor of the flesh. Five different compounds ranged from 23 ug/l for 2,5-chlorophenol to 84 ug/l for 2,3-dichlorophenol" (U.S. EPA, 1980 a). For 2,4-dichlorophenol, "flavor impairment studies showed that flesh tainting occurred when 2, 4-dichlorophenol concentrations ranging from 0.4 ug/l to 14 ug/l, depending on the species of fish tested, were exceeded" (U.S. EPA, 1980 b). Currently, IDEM does not sample for PAHs, Phenolics, and Total Chlorinated Phenols.

Illustration

Use raw data to construct simple bar graphs showing the fluctuation of contaminants over time and space.

Degradation of Fish and Wildlife populations:

LISTING GUIDELINE

When fish and wildlife management programs have identified degraded fish or wildlife populations due to a cause within the watershed. In addition, this use will be considered impaired when relevant, field-validated; fish or wildlife bioassays with appropriate quality assurance/quality controls confirm significant toxicity from water column or sediment contaminants.

DELISTING GUIDELINE

When environmental conditions support healthy, self-sustaining communities of desired fish and wildlife at predetermined levels of abundance that would be from the amount and quality of suitable physical, chemical and biological habitat present. An effort must be made to ensure that fish and wildlife objectives for Areas of Concern are consistent with Great Lakes ecosystem objectives and Great Lakes Fishery Commission fish community goals. Further, in the absence of structure data, this use will be considered restored when fish and wildlife bioassays confirm no significant toxicity from water column or sediment contaminants.

Fish Community Health

Measure

An Index of Biotic Integrity (IBI) will measure species richness and abundance, percent exotic species, percent phytophils and other appropriate parameters. IBI Score and attributes from Karr et al. (1986) *

| | |
|-------------------|--|
| Excellent = 58-60 | Comparable to the best situation without human disturbance; all regionally expected species for the habitat and stream size, including the most tolerant forms are present with a full array of (size) classes; balance trophic structure. |
| Good = 48-52 | Species richness somewhat below expectations, especially due to the loss of the most intolerant forms; some species are present with less than optimal abundance or size distribution; trophic structure shows some signs of stress. |
| Fair = 40-44 | Signs of additional deterioration include loss of intolerant forms, fewer species, highly skewed trophic structure (e.g. increasing frequency of |

omnivores and other tolerant species); older age classes of top predators may be rare.

Poor = 28-34

Dominated by omnivores, tolerant forms, and habitat generalists; few top carnivores; growth rates and conditions factors commonly depressed; hybrid and diseased fish often present.

No Fish = 0

Repeated sampling finds no fish

*The numeric gaps in the index account for uncertainty and regional variability.

Purpose

The purpose of this indicator is to assess fish community diversity, and to infer habitat suitability for the AOC, except for the Indiana Harbor Ship Canal. The Ship Canal will be excluded due to the hardened banks, lack of riparian cover, and limited aquatic habitat availability. Fish use the Ship Canal as a mechanism to move between Lake Michigan and the Grand Calumet River.

Ecosystem Objective

Restore and maintain the diverse fish communities of the Grand Calumet River, Wolf Lake, George Lake, and the Calumet Lagoons.

Endpoint

Grand Calumet River IBI score of Fair (38-40); Wolf Lake IBI score of Good (48-52), George Lake an IBI score of Fair (38-40), and the Calumet Lagoons IBI score of Good (48-52).

An

Features

The IBI provides a rigorous approach to quantify the biological condition of fish communities within the Great Lakes. It is based on reference conditions and is developed from a composite of specific measures used to describe fish community, structure, function, individual health, and abundance. Specific parameters, termed "metrics," are scored based on how similar they are to the reference condition. These parameters will include species richness and abundance, percent exotic species, and percent phytophils. The IBI will provide a measure of the environmental condition, calibrated for use in the AOC. IDEM collects fish tissue and other fish community data every two years to develop this indicator.

Illustration

The sediment viewer will display the IBI scores for each reach of the Area of Concern. Color-coded symbols could be used to reflect site scores for each reach. As sufficient IBI data becomes available, graphs showing trends over time would be included.

Delisting Endpoint

An IBI score that represents the best attainable fish community in the AOC (40) monitored for ten consecutive years. The IBI Score is determined by U.S. Fish and Wildlife Service and IDEM's Ecological Potential Study. (Scheduled for publication Winter 2002).

Terrestrial Community Health

Measure

Far field biological survey data will assess the concentration of chemicals of ecological concern (COC) for birds and mammals in the Area of Concern.

Purpose

The purpose of this indicator is to assess the insectivorous birds, waterfowl, piscivorous birds, and wildlife.

Ecosystem Objective

Restore, maintain and protect the diverse wildlife communities along the Grand Calumet River corridor and in the significant habitat areas (i.e., Gary Works Natural Area, Gary Enterprise Zone, Brunswick Central Savanna, Penn Central, Ivanhoe South, Tolleston Woods, Lakeshore Prairie, Clarke and Pine Dune and Swale, Clarke Junction East, Clarke and Pine General Refractories Addition, Clarke Junction West, Cline Ave. Dune and Swale, Tolleston Ridges, Explorer Pipeline Triangle, Beemsterboer, Roxana Marsh, Grand Calumet Tern Site, DuPont, George Lake Woods, and Migrant Bird Trap).

Endpoint

Each of the reaches of the AOC will have different endpoints, AOC waterbodies will be removed from the 303(d) and 305(b).

A line graph will display the concentration of each chemical of ecological concern (COC) in birds and mammals and compare it the toxicological reference value for Southern Lake Michigan conditions. The spatial, temporal and population data will be integrated into the Grand Calumet River Impaired Uses Data Viewer (GCRIUDV).

Fish tumors and other deformities:**LISTING GUIDELINE**

When the incidence rates of fish tumors or other deformities exceed rates at unimpacted control sites or when survey data confirm the presence of neoplastic or preneoplastic liver tumors in bullheads or suckers.

DELISTING GUIDELINE

When the incidence rates of fish tumors or other deformities do not exceed rates at unimpacted control sites and when survey data confirm the absence of neoplastic or preneoplastic liver tumors in bullheads or suckers.

Deformities, Eroded Fins, Lesions and Tumors (DELT) Fish**Measure**

Frequency of tumors and other related anomalies on fish located in the AOC.

Purpose

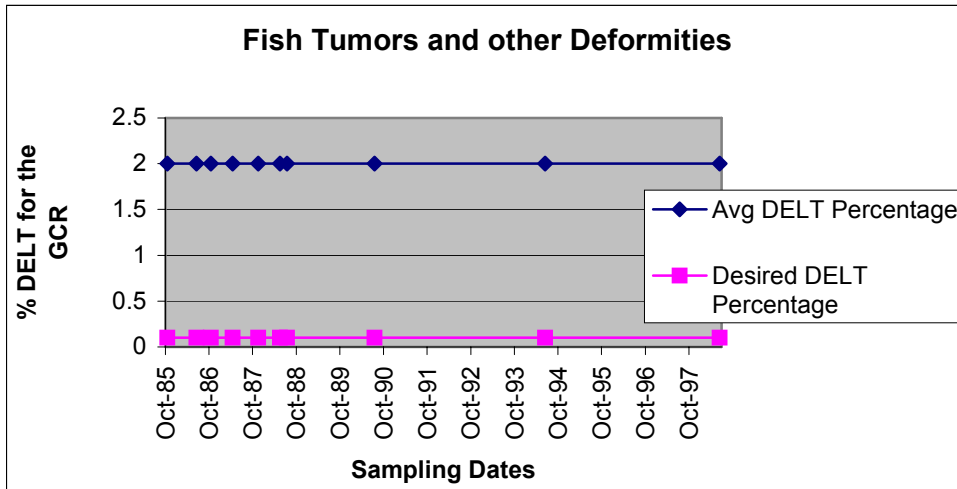
The indicator will assess the combination of deformities, eroded fins, lesions and tumors (DELT index) in fish.

Ecosystem Objective

To provide a habitat that is protective of the aquatic communities for the Area of Concern. This indicator supports AOC Objective 1, 2, & 3.

Endpoint

The DELT should be less than 0.1 percent. The Tech Team is reviewing the literature to develop a delisting timeline.



Bird or Animal Deformities or Reproductive Problems:

LISTING GUIDELINE

When wildlife survey data confirm the presence of deformities (e.g. cross-bill syndrome) or other reproductive problems (e.g. egg-shell thinning) in sentinel wildlife species.

DELISTING GUIDELINE

When the incidence rates of deformities (e.g. cross-bill syndrome) or reproductive problems (e.g. egg-shell thinning) in sentinel wildlife species do not exceed levels in inland control populations.

Breeding Bird Deformities

Measure

This indicator will measure the frequency of tumors and other related anomalies on birds.

Purpose

This indicator will assess the combination of deformities, lesions and tumors (DLT index) on birds.

Ecosystem Objective

To provide a habitat that is protective of the both sentinel and migratory, bird communities.

Features

Some tumors are genetically induced, others are virally induced, and a third group is chemically induced. Chemical carcinogens affecting the liver typically cause the chemically induced tumors. The assessment of the DLT should evaluate external deformities. The DLT anomaly index provides a tool for assessing the impact of such deformities.

Illustration

For each reference species, a graph will present the DLT metric. The x-axis will show years and the y-axis will show the DLT metric.

Degradation of Benthos:

LISTING GUIDELINE

When the benthic macroinvertebrate community structure significantly diverges from unimpacted control sites of comparable physical and chemical characteristics. In addition, this use will be considered impaired when toxicity (as defined by relevant, field-validated, bioassays with appropriate quality assurance/quality controls) of sediment associated contaminants at a site is significantly higher than controls.

DELISTING GUIDELINE

When the benthic macroinvertebrate community structure does not significantly diverge from unimpacted control sites of comparable physical and chemical characteristics. Further, in the absence of community structure data, this use will be considered restored when toxicity of sediment-associated contaminants is not significantly higher than controls.

Benthos Diversity and Abundance

Measure

Diversity and abundance of the benthic community

Purpose

The indicator will assess species diversity and abundance of a healthy invertebrate community, and it will compare the relative health of the benthic community versus a reference or potentially expected macroinvertebrate Index of Biological Integrity (mIBI).

Ecosystem Objective

The indicator addresses the general Fish Community Goal Objective (FCGO) to protect and enhance fish habitat, achieve no net loss of the productive capacity of habitat supporting fish communities, and restore damaged habitats. This indicator supports AOC Objectives 1,2, & 3.

Endpoint

Appropriate quantitative measures of species abundance and diversity as reference values for a healthy, diverse benthic community, based on the potential ecological endpoint for macroinvertebrate recruitment.

Features

The macroinvertebrate index of biotic integrity (mIBI) has been used as an index to assess the relative health of the benthic community. Invertebrates are widespread and their abundance varies directly with the degree of organic enrichment. In addition, benthic invertebrate species differ in their tolerances to polluted conditions; as organic enrichment declines, species composition shifts from pollution-tolerant to pollution-sensitive species. The desired trend is toward a diverse benthic invertebrate species with inclusion of pollution-sensitive species.

Restrictions on Dredging Activities:

LISTING GUIDELINE

When contaminants in sediments exceed standards, criteria, or guidelines such that there are restrictions on dredging or disposal activities.

DELISTING GUIDELINE

When contaminants in sediments do not exceed standards, criteria, or guidelines such that there are restrictions on dredging or disposal activities.

Purpose

The indicator will assess the ability for sediments in the AOC to have a beneficial reuse. These sediments are a resource that can be used for a variety of beneficial purposes, including beach nourishment, construction fill, landscaping, and landfill cover.

Ecosystem Objective

The goal is to reduce the impact to the ecosystem from harmful chemicals currently embedded in the sediments.

Features

This indicator provides information to locations where contaminated sediments have been remediated.

Delisting Endpoint

The endpoint for this indicator is when sediments in the AOC meet land application standards.

Eutrophication or Undesirable Algae:

LISTING GUIDELINE

When there are persistent water quality problems (e.g. dissolved oxygen depletion of bottom waters, nuisance algal blooms or accumulation, decreased water clarity, etc.) attributed to cultural eutrophication.

DELISTING GUIDELINE

When there are no persistent water quality problems (e.g. dissolved oxygen depletion of bottom waters, nuisance algal blooms or accumulation decreased water clarity, etc.) attributed to cultural eutrophication.

Phosphorus Concentrations**Measure**

Total phosphorus levels in the Area of Concern during the spring, summer and fall, in the Wolf, and George Lakes, and in the Calumet Lagoons, and the Grand Calumet River.

Purpose

The indicator will assess the total phosphorus levels in the Area of Concern.

Ecosystem Objective

The goal of phosphorus control is to maintain a balanced aquatic state. The AOC will maintain a relative algal biomass that is below a nuisance condition.

Features

This indicator provides information to infer the baseline potential productivity of the AOC and linkages to future biological problems related to a potential return to excess nutrient loads. Particular emphasis should be placed on data collected in the spring of the year.

Restriction on Drinking Water Consumption, or Taste and Odor Problems:

LISTING GUIDELINE

When treated drinking water supplies are impacted to the extent that: 1) densities of disease-causing organisms or concentrations of hazardous or toxic chemicals or radioactive substances exceed human health standards, objectives or guidelines; 2) taste and odor problems are present; or 3) treatment needed to make raw water suitable for drinking is beyond the standard

treatment used in comparable portions of the Great Lakes which are not degraded (i.e. settling, coagulation, disinfection).

DELISTING GUIDELINE

For treated drinking water supplies: 1) when densities of disease-causing organisms or concentrations of hazardous or toxic chemicals or radioactive substances do not exceed human health objectives, standards or guidelines; 2) when taste and odor problems are absent; and 3) when treatment needed to make raw water suitable for drinking does not exceed the standard treatment used in comparable portions of the Great Lakes which are not degraded (i.e. settling, coagulation, disinfection).

Drinking Water Quality

Measure

Concentrations of chemical substances such as alkylphenols, metals (e.g., lead, mercury) and other inorganic compounds, pesticides, radionuclides, and drinking water disinfection by-products (e.g., trihalomethanes) as well as microbial parameters such as bacteria, viruses and parasites in treated drinking water.

Purpose

The indicator will measure chemical and microbial contaminant levels in drinking water.

Ecosystem Objective

Treated drinking water supplies should be safe to drink. This objective is consistent with Sustainable Development Objective.

Endpoint

Densities of disease-causing organisms or concentrations of hazardous or toxic chemicals or radioactive substances should not exceed maximum contamination levels (MCLs). See regulated Chemical Drinking Water Contaminants Maximum Contamination Levels.

Delisting Endpoint

Concentrations of contaminants do not exceed MCL levels at the Indiana American Water Co. in Gary, Hammond Drinking Water Facility in Hammond, East Chicago and the Whiting Drinking Water Facility in Whiting, for five consecutive years.

Beach Closings:

LISTING GUIDELINE

When waters, used for total-body contact or partial-body contact recreation, exceed standards, objectives, or guidelines for such use.

DELISTING GUIDELINE

When waters, used for total-body contact or partial body-contact recreation, do not exceed standards, objectives, or guidelines for use.

Monitor:

Marquette Park Beach, Gary, IN

Lake Street Beach, Gary, IN

Jeorse Park Beach East Chicago, IN

Wolf Lake Beach, Hammond, IN

Lake Front Park Beach, Hammond, IN

Whilhala County Beach, Whiting, IN

The RAP technical team shall review the effluent discharge reports for *E.coli*. Combined Sewer Overflows discharged into the Grand Calumet River should be tracked to determine their impacts on the beaches within the AOC.

Fecal Pollution Levels

Measure

The number of times each beach exceed the water quality standard at each location.

Purpose

The indicator will directly measure E. coli levels at beaches in the AOC, and as a surrogate indicator for other pathogen types, to measure potential harm to human health through body contact with recreational waters.

Ecosystem Objective

Waters should be safe for recreational use. Waters used for recreational activities involving body contact should be substantially free from pathogens, including bacteria, parasites, and viruses, that may harm human health. This indicator complies with ecosystem objective

Endpoint

E. coli levels should not exceed the State standard of 235 colonies per 100ml.

Features

Recreational water quality in the AOC should be free from microbial contamination. Recreational waters may become contaminated with animal and human feces from sources and conditions such as combined sewer overflows that occur in certain areas after heavy rains. This indicator will track E.coli and Fecal Coliform abundance and the frequency of beach closings over time and across the Area of Concern. Analysis of data may show seasonal (April 1 to October 31 for wastewater treatment facilities and Memorial Day to Labor Day for the public beach season) and local trends in recreational waters. The trends provided by this indicator will aid in beach management and in the prediction of episodes of poor water quality.

Illustration

For each site selected, a bar graph will represent the counts of E. coli over several years. Statistical analysis will examine the temporal and spatial trends in water quality. A bar graph or a GIS map will show the number of beach closings over time. The bar graph will also show the number of beach closures compared to beach openings.

Delisting Endpoint

Five percent beach closures or four beach closures a season in the AOC due to 235 *E.Coli* count / 100ml of water from April 1 to October 31. (*Currently in GLNPO draft beach strategy.*)

Degradation of Aesthetics:

LISTING GUIDELINE

When any substance in water produces a persistent objectionable deposit, unnatural color or turbidity, or unnatural odor (e.g. oil slick, surface scum).

DELISTING GUIDELINE

When the waters are devoid of any substance which produces a persistent objectionable deposit, unnatural color, turbidity, or unnatural odor (e.g. oil slick, surface scum).

Indicator: Aesthetics Condition Indicator

Measure

The indicator will provide a descriptive (water color, odor, debris) and analytical parameters (turbidity, wind speed, wind direction, water temperature, and Secchi depth) that affect the water bodies' aesthetics.

Purpose

The indicator will assess the aesthetic benefits of management programs, future remediation and habitat restoration projects by providing descriptive and analytical information.

Ecosystem Objective

To provide a habitat that is free of persistent objectionable deposit, unnatural color, turbidity, or unnatural odor (e.g. oil slick, surface scum) in the aquatic communities of the Area of Concern. This indicator supports AOC Objective 1,2, & 3.

Endpoint

When the AI score for the Area of Concern is rated good. (*Aesthetic data is being collected to establish the baseline for this indicator.*)

Features

The numerical scale used to represent the state of each parameter varies from zero to ten, depending on the descriptor(s) which best reflects environmental conditions at the time of observation. For each parameter, a value of ten is assigned to the descriptor that reflects an optimum aesthetic condition, while a value of zero is assigned to the descriptor to reflect the worst possible conditions. For the debris parameter, a value of 40 is assigned to the descriptor None (or best possible) aesthetic condition. Since debris conditions can occur simultaneously, the parameter value is the sum of observed values subtracted from 40.

Added Cost to Agriculture and Industry:

LISTING GUIDELINE

When there are additional costs required to treat the water prior to use for agricultural purposes (i.e. including, but not limited to, livestock watering, irrigation and crop-spraying) or industrial purposes (i.e. intended for commercial or industrial applications and non-contact food processing).

DELISTING GUIDELINE

When there are no additional costs required to treat the water prior to use for agricultural purposes (i.e. including, but not limited to, livestock watering, irrigation and crop-spraying) and industrial purposes (i.e. intended for commercial or industrial applications and non-contact food processing).

Indicators: Survey industries to determine the increased cost of light-loading ships.

Purpose or nature of the indicator

This indicator will assess the presence, abundance and distribution of invasive exotic species in the AOC ecosystem and their impacts on ecosystem function.

This indicator will assess the impact the lack of dredging the Indiana Harbor Ship Canal has on industrial users.

A. Feature of the indicator

Cost Benefit Analysis of the lack dredging the Indiana Harbor Ship Canal compared to other harbors on Lake Michigan i.e. Port of Indiana.

B. Illustration of the index

Degradation of Phytoplankton and Zooplankton:

LISTING GUIDELINE

When phytoplankton or zooplankton community structure significantly diverges from unimpacted control sites of comparable physical and chemical characteristics. In addition, this will be considered impaired when relevant, field- validated, phytoplankton or zooplankton bioassays (e.g. Ceriodaphnia; algal fractionation bioassays) with appropriate quality assurance/quality controls confirm toxicity in ambient waters.

DELISTING GUIDELINE

When phytoplankton and zooplankton community structure does not significantly diverge from unimpacted control sites of comparable physical and chemical characteristics. Further, in the absence of community structure data, this use will be considered restored when phytoplankton and zooplankton bioassays confirm no significant toxicity in ambient waters.

Zooplankton Populations

Measure

1) Community Composition; 2) Mean Individual Size; and 3) Biomass and Production.

Purpose

The indicator will assess characteristics of the zooplankton community, and it will track changes in vertebrate or invertebrate predation, system productivity, energy transfer within the Great Lakes, or other food web dynamics.

Ecosystem Objective

Maintain the biological integrity of the Area of Concern to support a healthy and diverse fishery. This indicator supports objective #2 Aquatic Community. This BUI will support the goal of developing a healthy and representative aquatic community.

Illustration

The sediment viewer will display the zIBI scores for each reach of the Area of Concern. Color-coded symbols could be used to reflect site scores for each reach. As sufficient IBI data becomes available, graphs showing trends over time would be included.

Endpoint

Guidance for zooplankton and Phytoplankton is currently under development by EPA. IDEM staff are participating on the EPA workgroups. Once the guidance is completed, The Tech Team will recommend an endpoint and a delisting time-line for zooplankton and phytoplankton.

Loss of Fish and Wildlife Habitat:

LISTING GUIDELINE

When fish and wildlife management goals have not been met as a result of loss of fish and wildlife habitat due to a perturbation in the physical, chemical, or biological integrity of the Boundary Waters, including wetlands.

DELISTING GUIDELINE

When the amount and quality of physical, chemical, and biological habitat to meet fish and wildlife management goals have been achieved and protected.

The habitat portion of the Fish IBI and the Floristic Quality Index

Measure

The indicator will assess the quality and quantity of aquatic and terrestrial habitat in the Area of Concern ecosystem, and it will infer the progress in rehabilitating degraded habitat.

Primary Areas

Restore, maintain and protect the diverse wildlife communities along the Grand Calumet River corridor and in the significant habitat areas (i.e., Gary Works Natural Area, Gary Enterprise Zone, Brunswick Central Savanna, Penn Central, Ivanhoe South, Tolleston Woods, Lakeshore Prairie, Clarke and Pine Dune and Swale, Clarke Junction East, Clarke and Pine General Refractories Addition, Clarke Junction West, Cline Ave. Dune and Swale, Tolleston Ridges, Explorer Pipeline Triangle, Beemsterboer, Roxana Marsh, Grand Calumet Tern Site, DuPont, George Lake Woods, and Migrant Bird Trap).

Fish Habitat Restoration

Measure

The pattern of natural habitat remaining within ecoregions/subsections, as measured by 1) amount of emergent and submerged vegetation; and 2) substrate type.

Purpose

The purpose of this indicator is to measure the quantity and quality of habitat areas in the Area of Concern and to measure the amount and distribution of natural fish habitat remaining within AOC ecoregions.

Ecosystem Objective

Maximize the quantity and quality of aquatic habitat needed to meet the needs of resident and transient aquatic species.

Endpoint

When the quantity of habitat in the Nearshore Lake Michigan, Wolf and George Lakes, the river, and wetlands are restored and functional.

Features

This indicator will present trends in remaining aquatic habitats within the Area of Concern. Sufficient acres of emergent and submerged habitat are necessary to support wildlife. For example, the lack of wetland habitat adversely influences the reproduction of fish.

Wildlife Habitat Restoration

Measure

The pattern of natural habitat remaining within ecoregions/subsections, as measured by 1) area to perimeter ratio; 2) habitat patch size; 3) structural type and 4) percent intact cover.

Ecosystem Objective

The objective is to maximize the quality of riparian habitat, meet the habitat needs of terrestrial species.

Features

The indicator will present trends in remaining natural habitat within ecoregions/subsections over time. Sufficient parcels of natural habitat are necessary to support wildlife activities such as breeding and migration.