A Treatability Study for the Phytoremediation of Petroleum-contaminated Sediments

EPA Freshwater Spills Symposium

Cleveland, Ohio

March 19, 2002

Principal Investigators

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Project Cooperators

- USEPA
- US Fish and Wildlife Services
- US Forest Services
- Sand Creek Consultants
- Indiana Dept. of Environmental Management
- Roy F. Weston, Inc. EPA START Contractor
- BP Amoco

Area History

- The Indiana Harbor Canal is located at the southern end of Lake Michigan
- Area is characterized by remnant beaches, marshes, moraines, small ponds and slow-moving rivers

Area History

- Area was once a wilderness of dunes, lakes and marshes
- Increasing shipping in the Great Lakes resulted in the development of canals and harbors and a dramatic alteration of the environment

Area History

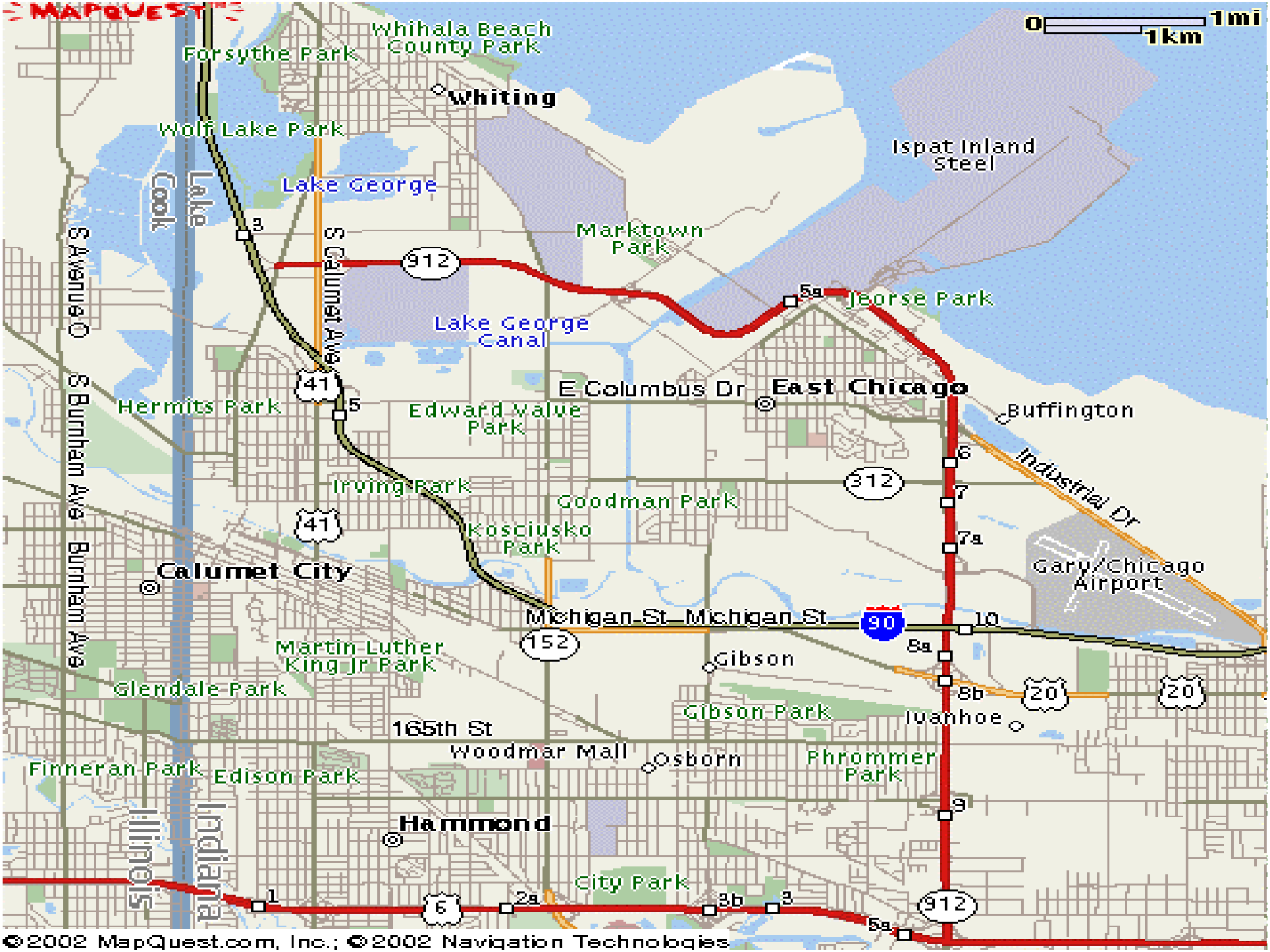
- The region became a desirable location for industry
  - Manufacturing of steel, railroad cars, soap, paint, glue, brick and tile
  - Mining of sand, gravel and clay
  - Processing petroleum
- Indiana Harbor Canal constructed in 1906

Area History

- The Indiana Harbor Canal extends upstream from Indiana Harbor for approximately 7,400 feet to the Forks
- From the Forks, the Lake George Branch extends to the west for an additional 6,800 feet
- The Calumet River Branch extends south for approximately 2 miles to the Grand Calumet River

Project Focus

- East shore of the Calumet River Branch of the Canal
- Aged petroleum hydrocarbons contamination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Project Outline

- Greenhouse treatability study
  - Purdue University
- Field toxicity evaluation
  - Sand Creek Consultants
  - US Forest Service
  - Iowa State University
- Phytoremediation plan

Greenhouse Study Outline

- Sample collection and preparation
- Native plant screening
- Treatability study
- Treatment evaluation

Native Plant Screening

- Select plants observed growing along canal banks or in adjacent wetlands
- Determine which will perform optimally
  - growth
  - survivability

Plant Selection

- Grasses, sedges and rushes
  - Blue joint grass
    - ***Calamagrostis canadensis***
  - Common lake sedge
    - ***Carex lacustris***
  - Common tussock sedge
    - ***Carex stricta***
  - Great bulrush
    - ***Scirpus validus***
  - Eastern gama grass
    - ***Tripsacum dactyloides***

Plant Selection

- Forbs
  - Orange jewel weed
    - ***Impatiens capensis***
  - Common arrowhead
    - ***Sagittaria latifolia***

Plant Selection

- Trees and shrubs
  - Button bush
    - ***Cephalanthus occidentalis***
  - Eastern cottonwood
    - ***Populus deltoides***
  - Mulberry
    - ***Morus rubra***

Treatability Study

- Duration
  - 12 months
- Treatments
  - 2 trees
  - 2 native species
  - 2 common phytoremediation plants
  - unvegetated control

Treatability Study

- Four replicates of each treatment
- Fertilization and water as needed

Treatment Evaluation

- Petroleum contaminants
- Plant biomass

Concerns

- Hydrophobic soil
- Amendments and tilling
- Fluctuating water levels

Concerns

- Pest infestation
- Vandalism
- Variability introduced by non-petroleum contamination
  - metals
  - pesticides

Summary

- Native species screening
  - underway
- Field toxicity evaluation
  - spring 2002
- Phytoremediation plan implementation
  - 2003