

Protecting Our Water Environment

Metropolitan Water Reclamation District of Greater Chicago

## Transmittal Letter For Board Meeting

June 4, 2004

(For Board Meeting of June 17, 2004)

### COMMITTEE ON RESEARCH AND DEVELOPMENT

Mr. John C. Farnan  
General Superintendent  
O F F I C E

**AGENDA SUMMARY:** Report on the Use Attainability Analysis (UAA)  
Study for the Chicago Area Waterways (CAWs)

Dear Sir:

We wish to report on the progress of the UAA Study being conducted by the Illinois Environmental Protection Agency (IEPA), which began at a kick-off meeting of stakeholders in September 2002. This study is required by the Clean Water Act and relevant regulations because those portions of the CAWs that are designated by the Illinois Pollution Control Board (IPCB) as Secondary Contact and Indigenous Aquatic Species (Secondary Contact) waters do not meet the goals of the Clean Water Act. At 33 USC Section 1251(a)(2) it states: "Wherever attainable, water quality provides for the protection and propagation of fish, shellfish, and wildlife and provides for recreation in and on the water." The current Secondary Contact use designation is not intended for body contact recreation (swimming) or for the protection and reproduction of aquatic life species native to the area. It was designated by the IPCB in the early 1970s for those man-made and modified waterways in which flow is dominated by treated municipal effluents. For these reasons, Secondary Contact waters do not meet the goals of the Clean Water Act.

To perform this study, the IEPA required the services of a qualified consultant and selected Camp, Dresser and McKee (CDM) at a fee of \$571,000 for a term beginning January 2003 and ending December 2004. Most of this funding is provided by Region V. In addition, the IEPA formed a Stakeholders Advisory Committee (SAC) to help guide the study. The SAC consists of representatives of environmental groups, federal, state and local governments and industry. The first meeting of the SAC was held in April 2003 and a total of nine meetings

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have been held to date. In addition, IEPA has held three sets of public meetings at three locations within the Chicago area to inform the public and obtain public input.

The District is required to participate in the UAA Study by the terms of the NPDES permits reissued by IEPA in 2002 for the Calumet, North Side and Stickney Water Reclamation Plants. Specifically, these permits require that the District "...shall be a participant in and support the UAA that is being undertaken for the Chicago Waterway System." The UAA process is defined at 40 CFR 131.3(g) as "A structured scientific assessment of the factors affecting the attainment of the use which may include physical, chemical, biological, and economic factors."

The CAWs study area includes the Chicago Waterways System (CWS) as shown on Figure 1, the Calumet River, Grand Calumet River and Lake Calumet. These waterways are completely man-made or are natural water bodies that have been irreversibly modified. Approximately 84 percent of the length of the CAWs are part of the Illinois Waterway, a federal navigation project, supporting commercial navigation. All of these waterways also provide an outlet for urban drainage, important to the public health and welfare of the Chicago area. In recent years, these waterways have also become increasingly used for recreational boating, fishing and other streamside activities. The flow in these waterways is derived from:

- treated effluent from the District's Calumet, Lemont, North Side and Stickney Water Reclamation Plants;
- overflows from the combined sewer systems of numerous municipalities;
- stormwater from numerous federal, state, municipal and private drains;
- baseflow and storm runoff from tributary watersheds;
- cooling water from utilities and private buildings; and
- navigation and discretionary diversion flows from Lake Michigan.

All flows from the CWS and the Grand Calumet River are discharged to the Lower Des Plaines River through the Chicago

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Sanitary and Ship Canal at Lockport, Illinois. The District controls the flows in the CWS in conformance with pertinent requirements contained in the *Code of Federal Regulations*.

The IEPA is conducting the UAA Study according to the following scope of work:

- Review and summarize available data, studies, reports and plans.
- Conduct needed field investigations and monitoring to supplement existing data.
- Use modeling to identify opportunities to improve water quality.
- Assess effectiveness of current water quality improvement technologies.
- Conduct economic and engineering analyses of additional control technologies.
- Propose appropriate use designations and standards.
- Propose regulatory language for adoption.

Much of this work has already been accomplished as is next explained.

Perhaps the most significant effort of CDM has been to gather a wide variety of water quality related data from numerous federal, state, local and private sources; compile and analyze this data and draw conclusions about the present quality of water in the CAWs. Data from the District's various water quality monitoring activities formed the backbone of the assembled data. It is estimated that the District has made an in-kind contribution of nearly \$8 million in data for the past five years in support of the UAA Study.

Based on the analysis of existing data by CDM, water quality is found to be good in the CAWs. The IPCB standards for chemical quality in General Use waters is generally met most of the time at all locations in the CAWs. Since the IPCB does not have a bacterial standard for Secondary Contact waters and the District does not disinfect the effluents of the four plants that discharge to these waters, bacterial water quality does not meet the General Use standards. In addition, the CDM

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analysis shows that dissolved oxygen does not meet the Secondary Contact standard at a few locations during warm-weather months and at most locations following wet-weather events with combined sewer overflows (CSOs). Sediment quality is less than desirable at a few locations, primarily the result of past industrial activity. It is believed that the eventual completion of the TARP reservoirs will abate most of the wet-weather impacts. The UAA Study is not intended to address the limited sediment quality problems.

Given the man-made and irreversibly modified nature of the CAWs, biological conditions for aquatic life are judged to be about as good as may be expected. This does not mean that the conditions cannot be improved; however, improvement would require considerable physical changes to the cross-section of many waterway reaches. A few reaches with sloping canal banks and without the frequent disturbance caused by commercial and recreational navigation favor the reproduction of fish and other aquatic life. Generally, however, conditions do not favor reproduction. In areas with heavily vegetated canal banks, riparian wildlife is found to flourish.

Physical habitat conditions are a good indicator of biological conditions and the waterway characteristics that are favorable to aquatic life. The man-made and modified nature of the CAWs produces waterway cross-sections that are unlike those found in natural rivers. The waterways are relatively deep with relatively steep side slopes, thus lacking in sheltered areas along the canal banks and riffles in the waterway flow. In the Calumet and Chicago Rivers near Lake Michigan is generally found the greatest number of fish and fish species, likely the result of fish in transit from the lake. However, these areas also have poor habitat because of the vertical concrete, steel or wood dock walls, deep canal cross-section and canal bottom devoid of vegetation.

Recreational surveys were conducted on the waterways by the IEPA, CDM and Lake Michigan Federation during 2003. Additional information on recreational use was collected by CDM from the District, marinas along the waterways and the U.S. Army Corps of Engineers lock personnel. An analysis of this data reveals that recreational motor boating is the

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largest use overall, varying from 96 percent on the Chicago River to zero on the Grand Calumet River and Lake Calumet. Fishing was the next most popular activity. Swimming was not observed in any of the waterways. Canoeing and kayaking were popular on the North Shore Channel and North Branch, but not in other waterway segments.

As explained earlier, the Secondary Contact designation does not include standards that provide for reproduction of aquatic life and primary contact recreation (swimming).

Based on the assessment of water quality data, biological conditions and physical habitat by CDM and reviewed by the SAC, the IEPA has proposed three aquatic life use classes shown on Attachment 1. Further, based on federal bacterial criteria, the IEPA has proposed three recreational use classes, also shown on Attachment 1.

Based upon a review of water quality data, biological conditions and physical habitat characteristics, the SAC has determined that the proposed Modified Warm-Water Aquatic Life use would be appropriate for most of the waterways. The Limited Warm-Water Aquatic Life use would be appropriate for the Chicago River, Chicago Sanitary and Ship Canal, Lower North Branch, South Branch and South Fork (Bubbly Creek). Based upon a review of current recreational use of the CAWs, the SAC has determined that the proposed Limited Contact Recreational use would be appropriate for all of the waterways, except for the Chicago Sanitary and Ship Canal. The proposed Recreation Navigation use would be appropriate for the Chicago Sanitary and Ship Canal.

To achieve these proposed uses it will be necessary to address some of the known deficiencies in water quality. The technologies necessary will include disinfection, flow augmentation, supplemental aeration and combined sewer overflow treatment. On March 12, 2004, the IEPA requested the District to use the recently developed water quality model to analyze needed improvements and to conduct engineering investigations of the feasibility and cost of technologies to address the observed water quality deficiencies. On May 21,

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2004, the District responded to the IEPA with a detailed schedule of the work required. The work to be performed by the District is outlined by a Disinfection Strategy shown in Attachment 2 and an Alternative Management Strategy shown in Attachment 3. All of this work is estimated to cost the District approximately \$2 million and not be completed until late 2005.

At this point in time, it is uncertain as to the long-term impact that the UAA Study will have on the District. Obviously, our first priority is to complete the TARP tunnels and reservoirs to abate the impacts of CSOs. This may alleviate the short-term need for treatment of CSOs. It has long been anticipated that some additional supplemental aeration capacity would be needed in some segments of our waterways to improve dissolved oxygen conditions during warm-weather periods.

The more recent suggestion that disinfection is necessary will be a challenge. First, there must be a demonstration that the level of recreational use justifies the capital and operating costs of disinfection. Second, it must be realized that even with disinfection of treated effluents there remains significant sources of bacteria in occasional CSOs, stormwater, tributary inflow and sediments. Third, the technology of disinfection must be demonstrated to result in a benefit to human health that is greater than the negative impact to the environment resulting from increased energy demand and chemical byproducts. Fourth, the chosen disinfection technology must be effective in inactivating all pathogens, not a select few.

We will keep you advised as to the progress of the UAA Study and the future potential impact on the District.

Respectfully submitted,

Richard Lanyon  
Director

Mr. John C. Farnan  
General Superintendent

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Research and Development

Approved:

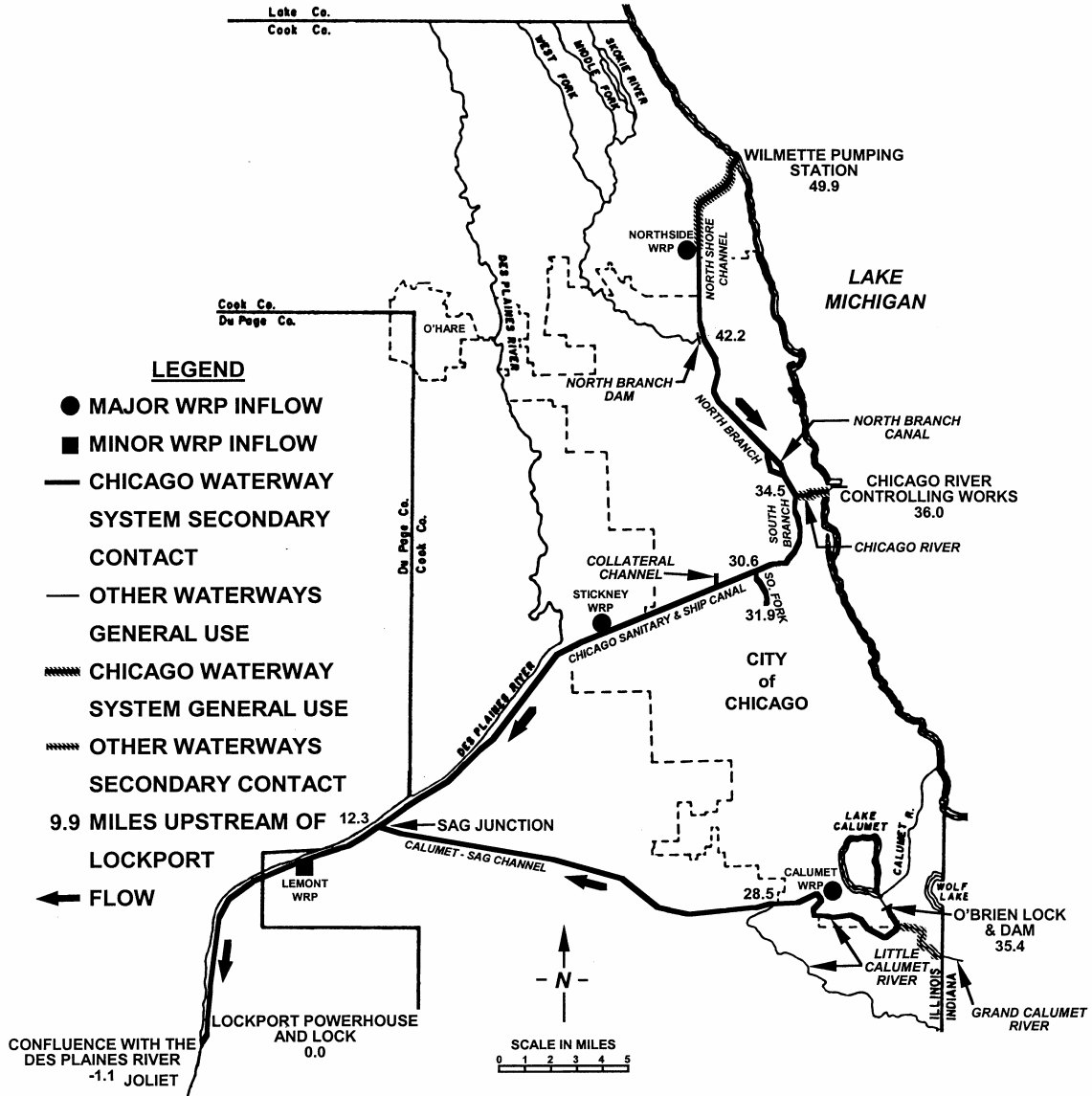
John C. Farnan  
General Superintendent

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Attachments

METROPOLITAN WATER RECLAMATION DISTRICT OF GREATER CHICAGO

FIGURE 1

CHICAGO WATERWAY SYSTEM





### 3rd DRAFT

**Chicago Area Waterway System Standards** - The following standards protect the beneficial uses of the waters in the open channels that flow through the Chicago metropolitan area. They include the following waterbodies:

1. North Shore Channel from Lake Michigan to the confluence with the North Branch of the Chicago River
2. North Branch of the Chicago River from its confluence with the North Shore Channel to its confluence with the South Branch, including the North Branch Canal
3. The Chicago River
4. The South Branch of the Chicago River, including the South Fork and navigation slips
5. The Chicago Sanitary Ship Canal, including the Collateral Channel
6. Lake Calumet and Lake Calumet Entrance Channel
7. The Calumet River from Lake Michigan to the confluence with the Grand Calumet River
8. The Grand Calumet River
9. The Little Calumet River from its junction with the Grand Calumet River to the Calumet-Sag Channel
10. The Calumet-Sag Channel

Beneficial uses and the applicable sections of the 35IL Adm Code Part 302 include the following:

#### **Aquatic Life Use Designations :**

- *General Warm-water Aquatic Life* - These waters are capable of supporting a year-round balanced, diverse warm-water fish and macroinvertebrate community. The fish community is characterized by the presence of a significant proportion of native species, including mimic shiner, spotfin shiner, brook stickleback, longnose dace, hornyhead chub, smallmouth buffalo, rock bass and smallmouth bass. The attributes of species composition, diversity and functional organization will be measured using the Index of Biotic Integrity (IBI)<sup>1</sup>. The biological integrity of these waters are typically reflected by IBI scores ranging between 29 and 45. Water quality standards as identified in 35IL Adm Code Part 302, Subpart B: Sections 302.201 – 302.213 or more appropriate standards based upon recent guidance shall be applied to protect the General Warm-water Aquatic Life use designation.
- *Modified Warm-water Aquatic Life* - These water are presently incapable of supporting and maintaining a balanced, integrated, adaptive community of a warm-water fish and macroinvertebrate

community due to significant modifications of the channel morphology, hydrology and physical habitat that may be recoverable. These waters are capable of supporting and maintaining communities of native fish and macroinvertebrates that are moderately tolerant, and may include desired sport fish species such as channel catfish, largemouth bass, bluegill, and black crappie. The attributes of species composition, diversity and functional organization will be measured using the Index of Biotic Integrity (IBI)<sup>1</sup>. The biological integrity of these waters are typically reflected by IBI scores between 22 and 28. Water quality standards as identified in 35IL Adm Code Part 302, Subpart B: Sections 302.201 – 302.213 or more appropriate standards based upon recent guidance shall be applied to protect the Modified Warm-water Aquatic Life use designation.

- *Limited Warm-water Aquatic Life* - These surface waters are not presently capable of sustaining a balanced and diverse warm-water fish and macroinvertebrate community due to irreversible modifications that result in poor physical habitat and stream hydrology. Such physical modifications are of long-duration (i.e. twenty years or longer) and may include artificially constructed channels consisting of vertical sheet-pile, concrete and rip-rap walls designed to support commercial navigation and the conveyance of stormwater and wastewater. Hydrological modifications include locks and dams that artificially control water discharges and levels. The fish community is comprised of tolerant species, including common carp, central mudminnow, golden shiner, white sucker, bluntnose minnow, yellow bullhead and green sunfish. These waters shall allow for fish passage. The attributes of species composition, diversity and functional organization can be measured by the Index of Biotic Integrity (IBI)<sup>1</sup>. The biological integrity scores for these waters typically range from 12 to 21. Water quality standards as identified in 35IL Adm Code Part 302, Subpart B: Sections 302.201 – 302.213 or more appropriate standards based upon recent guidance or habitat limitations shall be applied to protect the Limited Warm-water Aquatic Life use designation. On a case-by-case basis, General Use water quality criteria may be modified to protect the existing aquatic life use designation.

#### **Recreational Use Designations :**

- *Whole-Body Contact Recreation* - Protects for routine, prolonged and intimate contact uses including swimming and water-skiing. Protection would require attainment of a geometric mean of 126 cfu *E. coli* standard<sup>2</sup> and a daily maximum of 576 cfu *E. coli* standard based on 8 illness per thousand contact. These whole-body contact

recreation criteria shall apply only during the defined recreational period of May 1 through October 31.

- *Limited Contact Recreation*- Protects for incidental or accidental body contact, which the probability of ingesting appreciable quantities of water is minimal, recreational boating (kayaking, canoeing, jet skiing), and any limited contact incident to shoreline activity, such as wading and fishing. Protection would require attainment of 30-day geometric mean 1030 cfu *E. coli* standard<sup>3</sup> based on 10 illnesses per thousand contacts. These limited- body contact recreation criteria shall apply only during the defined recreational period of May 1 through October 31.
  
- *Recreational Navigation* - Protects for non-contact activities including, but not limited to pleasure boating and commercial boating traffic operations. Protection would require attainment of a 30-day geometric mean 2740 cfu *E. coli* standard<sup>4</sup> is based on 14 illnesses per thousand contacts. These limited-body contact recreation criteria shall apply only during the defined recreational period of May 1 through October 31.

#### Footnotes

<sup>1</sup> The Index of Biological Integrity (IBI) shall be calculated using an IBI approach approved by IEPA.

<sup>2</sup> *E. coli* standard of 126 per 100 ml (either MPN or MF) is based upon a thirty-day geometric mean. Compliance shall be based on the geometric mean of all individual samples taken during four or more sampling events representatively spread over a thirty-day period. A daily maximum of 576 cfu *E. coli* would also be appropriate. These numeric values are based on 8 illnesses per thousand contact.

<sup>3</sup> *E. coli* standard 1000 per ml (MPN or MF) is based upon the thirty-day geometric mean of four or more sampling events representatively spread over a thirty-day period.

<sup>4</sup> *E. coli* standard 2750 per ml (MPN or MF) is based upon the thirty-day geometric mean of four or more sampling events representatively spread over a thirty-day period.

Metropolitan Water Reclamation District of Greater Chicago

CHICAGO AREA WATERWAYS USE ATTAINABILITY ANALYSIS STUDY

DISINFECTION STRATEGY

In response to the IEPA letter dated March 12, 2004 regarding the Chicago Area Waterways UAA Study, the District will pursue the matter of disinfection following the five tasks identified below. The key issue in this strategy is the assessment of the risk to human health relative to the designated use. If the selected designated use is non-contact recreation such as canoeing, fishing, etc., then the District will investigate whether a significant lessening of health risk is achieved by disinfecting the effluent and whether the cost of disinfection is justified for the benefit derived.

Risk Assessment of Human Health Impacts of Disinfection vs. No Disinfection

R&D will retain the services of a consultant to perform a comparative risk assessment of the human health impacts of continuing with the current practice of no disinfection vs. initiating disinfection at the three large WRPs. The risk assessment will attempt to quantify the expected reduction, if any, in the incidence of disease to the affected population that instituting disinfection would achieve. The magnitude of the reduction in health impacts, if any, will then be compared to the anticipated costs of instituting disinfection.

Preparation of RFP complete: *June 4, 2004*

RFP advertised: *June 30, 2004*

Agreement for services approved by Board: *September 9, 2004*

Agreement for services executed: *September 30, 2004*

Completion of work: *July 30, 2005*

Establish Whether or not Effluent Disinfection is Effective

R&D will perform additional monitoring for fecal coliform in the waterways in an effort to determine whether disinfection of WRP effluents alone, will significantly reduce fecal coliform levels in the waterways, and provide a meaningful increase in human health protection. R&D will also include fecal coliform modeling in the next phase of water quality model development by Marquette University to better analyze the impact of various sources of bacterial material on ambient levels of fecal coliform in the Chicago Area Waterways.

Additional monitoring begun April 2004

Data analysis during *first quarter 2005*

Waterway model analysis *second quarter 2005*

Additional monitoring may continue in *2005*

Evaluate the USEPA Bacterial Guidance

R&D will retain the services of one or more outside experts to examine the science underlying the USEPA November 2003 draft guidance, *Implementation Guidance for Ambient Water Quality Criteria for Bacteria*, and the *1986 Ambient Water Quality Criteria for Bacteria* to determine whether the

"The guidance contains proper scientific foundation for establishing scientifically defensible and justifiable limits for primary, secondary and limited contact recreation."

Preparation of RFP complete: *June 4, 2004*  
RFP advertised: *June 30, 2004*  
Agreement for services approved by Board: *September 9, 2004*  
Agreement for services executed: *September 30, 2004*  
Completion of work: *March 30, 2005*

Investigate Alternative Technologies for Disinfection and the Impacts of Disinfection Chemicals

Engineering will retain the services of an experienced consultant firm to form a committee of experts from academia and engineering to investigate all possible disinfection technologies and recommend a technology appropriate for the District's Calumet, North Side and Stickney WRPs. The investigation will review different disinfection technologies and their range of pathogen destruction ability. The investigation will also include an examination of the environmental and human health impacts of: the energy required to operate the facility; the energy required for the processing and production of process chemicals; and the conversion and degradation of process chemicals.

Request for Interviews sent to six firms: *May 7, 2004*  
Request for Proposals sent: *June 30, 2004*  
Proposals received: *July 30, 2004*  
Agreement for services approved by Board: *October 21, 2004*  
Agreement for services executed: *November 12, 2004*  
Completion of work: *June 11, 2005*

Estimate the Cost of Disinfection

Engineering will retain the services of one or more engineering consultants to prepare a conceptual level design of the disinfection technology selected above, specific to the Calumet, North Side and Stickney WRPs, and prepare conceptual level cost estimates for the design, construction, operation and maintenance of the disinfection facilities.

Identification of selected technology: *June 11, 2005*  
Completion of work: *December 10, 2005*

Metropolitan Water Reclamation District of Greater Chicago

CHICAGO AREA WATERWAYS USE ATTAINABILITY ANALYSIS STUDY

WATER QUALITY MANAGEMENT ALTERNATIVES STRATEGY

In response to the IEPA letter dated March 12, 2004, regarding the Chicago Area Waterways UAA Study, the District will pursue the matter of water quality management alternatives in the following manner.

Water Quality Modeling

R&D will obtain a proposal from and increase the contract with Marquette University for the additional work necessary to model the water quality conditions to address the dissolved oxygen (DO) deficiencies identified in the letter and determine load reductions needed to meet the three target DO levels specified by the IEPA.

Proposal requested: April 2, 2004.

Proposal dated April 19, 2004, received May 7, 2004.

Submitted to Board of Commissioner for approval: *June 3, 2004*

Notice to proceed: *July 31, 2004*

Simulation development complete: *November 2004*

Evaluation of alternatives complete: *May 2005*

As mentioned in the second to last paragraph of the IEPA letter, these management alternatives are limited to part of the waterway system and these alternatives, and perhaps others, may be considered for additional reaches as the UAA Study progresses. At a later time when further requests are received from IEPA, the District will pursue the matter in the following manner.

Investigate Management Alternatives to Address Water Quality Conditions

Engineering will retain the services of a consulting engineering firm to perform the following tasks:

- Using the modeling results, prepare a conceptual level design for flow augmentation in the Upper North Shore Channel using North Side plant effluent.
- Using the modeling results, prepare a conceptual design for supplemental aeration to meet the target level specified by the IEPA in each of the designated waterways.
- Investigate technologies for end-of-pipe CSO treatment in the designated waterways.

For each of the above, the consultant will prepare conceptual cost estimates for these facilities, including design costs, capital costs, and annual operation and maintenance costs. In addition, for each of the above, the consultant will prepare an examination of the environmental and human health impacts of: the energy required to operate the facility; the energy required for the processing and production of process chemicals; and the conversion and degradation of process chemicals.

Request for Interviews sent to six firms: *May 7, 2004*

Request for Proposals sent: *June 30, 2004*

Proposals received: *July 30, 2004*

Agreement for services approved by Board: *October 21, 2004*

Agreement for services executed: *November 12, 2004*

Receive modeling results: *May 2005*

Completion of work: *November 2005*

**ATTACHMENT 3**