APPENDIX B

POLLUTION CONTROL BOARD

RULING AND AMENDMENT

ILLINOIS POLLUTION CONTROL BOARD
July 13, 1988

IN THE MATTER OF:	)	
	)	
JOINT PETITION OF THE AURORA SANITARY	)	
DISTRICT, THE CITY OF AURORA, AND THE	)	
ILLINOIS ENVIRONMENTAL PROTECTION	)	PCB 85-224
AGENCY FOR EXCEPTION TO THE COMBINED	)	
SEWER OVERFLOW (CSO) REGULATIONS	)	

OPINION AND ORDER OF THE BOARD (by R.C. Flemal):

This matter comes before the Board on a December 31, 1985 joint petition filed by the Aurora Sanitary District ("ASD") and the City of Aurora ("City") (hereinafter collectively referred to as "Aurora") and the Illinois Environmental Protection Agency ("Agency") for exception to 35 Ill. Adm. Code 306.305 (a) and (b) to relieve Aurora from the requirement to construct and operate certain combined sewer overflow ("CSO") transport and treatment facilities.

Hearing was held at the Aurora City Hall on March 6, 1986. On June 6, 1986 Petitioners filed a Proposed Order ("Proposed Order"). On June 20, 1986 the petition was remanded to the Petitioners by Board Order. On March 27, 1987 Petitioners filed an Amended Joint Petition ("Amended Pet."). On July 1, 1988 Petitioners filed a Second Amended Joint Petition ("2nd Amended Pet."). No additional hearing has been held.

For the reasons described below, the Board finds that Petitioners have made the showings requisite for granting the relief requested. The relief will accordingly be granted, subject to conditions as stipulated to by Petitioners and consistent with the Board's rules and regulations.

CSO REGULATIONS

The Board's CSO regulations are contained in 35 Ill. Adm. Code Subtitle C, Chapter I, Part 306. They were amended in R81-17, 51 PCB 383, March 24, 1983. Sections pertinent to the instant matter are Sections 306.305 and 306.361(a). Section 306.305 provides as follows:

> All combined sewer overflows and treatment plant bypasses shall be given sufficient treatment to prevent pollution, or the violation of applicable water standards unless an exception has been granted by the Board pursuant to Subpart D.

Sufficient treatment shall consist of the following:

a) All dry weather flows, and the first flush of storm flows as determined by the Agency, shall meet the applicable effluent standards; and

b) Additional flows, as determined by the Agency but not less than ten times average dry weather flow for the design year, shall receive a minimum of primary treatment and disinfection with adequate retention time; and

c) Flows in excess of those described in subsection (b) shall be treated, in whole or in part, to the extent necessary to prevent accumulations of sludge deposits, floating debris and solids in accordance with 35 Ill. Adm. Code 302.203, and to prevent depression of oxygen levels; or

d) Compliance with a treatment program authorized by the Board in an exception granted pursuant to Subpart D.

Subpart D allows the discharger to file a petition for an exception either singly, or jointly with the Agency as Aurora has done. A joint petition may seek an exception based on minimal discharge impact as provided in Section 306.361(a):

> An exception justification based upon minimal discharge impact shall include, as a minimum, an evaluation of receiving stream ratios, known stream uses, accessibility to stream and side land use activities (residential, commercial, agricultural, industrial, recreational), frequency and extent of overflow events, inspections of unnatural bottom deposits, odors, unnatural floating material or color, stream morphology and results of limited stream chemical analyses.

Pursuant to 306.361(a) Aurora and the Agency assert that overflows from its combined storm and sanitary sewer system have minimal impact on the water quality of, and do not restrict the use of, the Fox River and Indian Creek (the receiving streams).

SUPPORT DOCUMENTS

Petitioners have presented several documents in support of their petition. Included among these is a two-volume combined sewer overflow study undertaken by Walter E. Deuchler Associates, Inc. This document was attached to the Petition and Amended Petition as Attachment A; it was also admitted as hearing exhibit

1. Among other matters, the study contains analysis of impact of the existing CSOs on the Fox River and the reduction of flow and pollutant loads that can be expected from implementation of several CSO options.

In response to concerns as expressed by the Board in its June 20, 1986 Order, Petitioners commissioned and submitted a study: "An Assessment of Indian Creek Bottom Sediments in the Vicinity of Combined Sewer Overflow 25 in Aurora, Illinois", Illinois State Water Survey Contract Report 412, January 1987. This report is Appendix G to the Amended Petition of March 27, 1987.

On January 28, 1988 Aurora completed a study, as an amendment to its Municipal Compliance Plan, which provides an update on relief sewer projects undertaken as part of the overall CSO program. This report was submitted to the Board along with the 2nd Amended Pet as Exhibit I.

BACKGROUND

The ASD provides wastewater treatment for Aurora, North Aurora, Montgomery, Boulder Hill, and part of Oswego. Its facility plan area encompasses portions of DuPage, Kane, Kendall, and Will Counties. The population currently served by the ASD is approximately 120,000, with a projected population for the year 2003 of 193,000 (R. at 12).

The ASD's only treatment plant is located west of the Fox River and south of Montgomery, Illinois. The plant provides preliminary treatment, primary clarification, biological oxidation and nitrification, tertiary sand filtration, and chlorine disinfection. It has a design average flow capacity of 32 mgd, with a design maximum flow capacity of 68 mgd (R. at 12). Discharge is to the Fox River.

The City of Aurora has both combined and separate sanitary sewer systems, while the remainder of the service area has separate sanitary and storm sewers. The City's combined sewers serve approximately 4,360 acres (6.9 sq. mi.) of the approximately 50 square miles served by the ASD (R. at 52, 89). No new combined sewers have been constructed since 1937 pursuant to a city ordinance (R. at 52).

The system has fourteen CSO overflow points (Amended Pet. at 3). Thirteen are located within the City and one is located at the ASD plant. All of the discharges are directly to the Fox River, with the exception of one City point which discharges to Indian Creek. The overflows occur primarily at diversion structures which serve to limit wet weather flow to the treatment plant. Four of the City overflow points are considered major by the Petitioners because they collectively receive flow from more than two thirds of the land areas within the City served by combined sewers. These four points, plus the ADS treatment plant overflow, account for 79% of the total overflow volume. The remaining nine City overflow points are considered minor by the Petitioners in that they collectively receive flow from less than 1/3 of the acreage served by the combined sewers and account for only 21% of overflows (Id. at 3-4). The major City overflow points are numbered 1, 4, 8, and 25; 1, 4, and 8 are located at the Fox River at Rathbone Avenue, Hazel Avenue, and Benton Street, respectively; CSO 25 is tributary to Indian Creek.

CONTROL AND IMPACT-REDUCTION OPTIONS

Aurora has investigated options by which it might moot the need for the relief requested, or, in the alternative, minimize the impact of its CSOs. Six options were considered, including: (1) complete elimination of all combined sewers, (2) construction of facilities necessary to achieve compliance under Section 306.305, and (3) four options - identified in the record as Alternatives A, B, C, and D - which provide for progressively greater reduction in the impact of existing CSOs.

Elimination of all existing combined sewers is estimated to cost at least $160 million[1] (Amended Pet. at 14).

Full compliance with Section 306.305 could be achieved by providing the necessary treatment to combined sewer discharges. The required facilities would include large storage basins at four locations and several relief sewers to assure hydraulic capacity for all first flush flow. Additionally, three treatment facilities with a combined capacity of 51 mgd would be required at the ASD plant to provide treatment for flows up to 10 x average dry weather flow. The total cost of these facilities is approximately $99 million (Amended Pet. at 14).

Petitioners contend that neither the complete CSO elimination option nor the 306.305 compliance option is cost effective (Amended Pet. at 4), and, moreover, that neither would materially improve the water quality or enhance any beneficial uses of the Fox River (R. at 15). Accordingly, Petitioners have turned to the options which would at least reduce CSO impact.

Petitioners have opted to pursue and present to the Board Alternative D, which provides the greatest impact reduction among the four alternatives. Alternative D is designed to assure:

[1] Control option cost figures cited herein are in 1986 dollars.

1) Complete treatment of peak dry weather flow;

2) Complete treatment of up to 2.5 x average dry weather flow;

3) Complete treatment of 57% of first flush; and

4) Complete or primary treatment of 65% of flows in excess of 2.5 x average dry weather flow.

Amended Pet. at 5

Alternative D would conservatively[2] also cause a 58.9% reduction in CSO flows and a reduction in pollutant loads ranging from 50.1% for suspended solids to 77.5% for phosphate (Id. at 6).

At $22.25 million, Alternative D is the most costly of the four impact-reduction options (Amended Pet. at 13-18). Among the activities to be undertaken are sewer separations, addition and replacement of sewer pipes, modification of siphon and weir structures, re-routing of combined sewer flows, implementation of inflow/infiltration reduction strategies, and elimination of one CSO. Aurora has stipulated to carrying out these improvements, and Petitioners request (Proposed Order at 1-2) that they be listed in the Board's Order.

Aurora additionally stipulates to a schedule for completion of the improvements (Amended Pet., Appen. G, as modified in 2nd Amended Pet.), and Petitioners request that this schedule also be incorporated into the Board's Order. However, the Board notes that both the internal and final completion dates for all but two of the many individual projects within the program are now past. Presumably, therefore, all but two of the projects are now complete. For this reason the Board will condition the grant of relief only upon the agreed-upon final dates.

DOCUMENTATION OF MINIMAL IMPACT

Section 306.361(a) requires that Petitioners seeking a CSO exception on the basis of minimal discharge impact, as is the case here, make a number of showings. Pursuant thereto, Petitioners provide the following information and observations:

[2] Calculation of CSO impacts under Alternative D was made prior to certain additional improvements made to the Alternative D program at the Agency's suggestion. The precise impact of these additional improvements has not been determined, and is therefore not reflected in the Alternative D impact figures (Amended Pet. at 5, 7).

Receiving Stream Ratios

The average discharge of the Fox River at Aurora is approximately 1,810 cubic feet per second ("cfs"). The average CSO flow rate from all City and ASD overflow points is 3.9 cfs, or 0.20% of the average river discharge. Petitioners also contend that pollution loading of the CSOs is small relative to the load of the Fox River. In support thereof, Petitioners present the following data:

	Total Load (tons/yr)	CSO CONTRIBUTION Prior to Alt. D (tons/yr)	Percent	After Alt. D (Percent)
BOD	26,800	350	1.30	.40
Ammonia-Nitrogen	530	16	3.02	.79
Nitrate-Nitrogen	3,550	2.1	.06	.02
Phosphate	710	1.9	.27	.06

From these data Petitioners concluded that "[i]t is thus apparent that the extremely low ratios of CSO flow and pollutant loads to Fox River flow and pollutant loads assure that the City and ASD CSOs have no significant impact on Fox River water quality" (Amended Pet. at 7).

Indian Creek is an intermittent stream with a ten-year, seven-day low flow of zero (Amended Pet. at 7).

Known Stream Uses

Petitioners report that a 1981 Northeastern Illinois Planning Commission study listed the following uses for the Fox River in Kane County:

(i) fishing;
(ii) canoeing;
(iii) other types of pleasure boating;
(iv) picnicking, fishing, hiking, etc., in public parks along the shore;
(v) agricultural drainage;
(vi) "urban drainage" from commercial and residential land along the river;
(vii) receiving effluents from several wastewater treatment plants and overflow diversion structures.

Petitioners additionally point out that the Fox River in the CSO study area is abutted for the most part by commercial and residential properties (Amended Pet. at 8). They also note that "Indian Creek is basically an urban drainage channel" for its lower 3 to 4 miles, although in its upper reaches it receives runoff from farmlands (Id.).

Accessibility to Stream Side Land Use Activities

Regarding accessibility to stream-side land, Petitioners note:

> The combined sewer portion of the ASD service area consists almost exclusively of residential and commercial establishments. Agricultural land and open space account for but a small fraction of acreage abutting the river in the ASD service area. Some light manufacturing plants and warehouses abut the river in the southwest portion of the combined sewer area. (Appendix A at p. 2-5). Exhibit 4 to the CSO study details the riparian land use in the CSO area. Generally, the river is not readily accessible to the general public, with the exception of boaters who use two designated "boat access areas" in the City of Aurora.
>
> Indian Creek is, for the most part, within the Burlington Northern Railroad right of way and the activities along the stretch both immediately upstream and downstream of OVF. No. 25 can be characterized as industrial.

Amended Pet. at 8-9.

Frequency and Extent of Overflow Events

The CSO study (Ex. 1) estimates that 1,187 overflow events per year, with a total yearly flow of 914 million gallons, occurred prior to implementation of Alternative D. Of these, 663 events and 568 million gallons were attributable to the major overflow points 1, 4, 8, and 25. Full implementation of Alternative D is expected to reduce yearly overflow events to 658 and total overflow volume to 375 million gallons, reductions of 44.5% and 59.0%, respectively (Amended Pet. at 9; see also footnote 2).

Inspections of Outfalls (Bottom Deposits, Odors, etc.)

Regarding inspections of unnatural bottom deposits, Petitioners note:

> In June, 1983, the Fox River was examined for sludge deposits, sewer-related odors, sediment in quiet portions of the river, and sewer-related impact on vegetation. The purpose of the inspections was to determine if CSOs significantly contributed to sludge deposits or adverse environmental impacts.

The CSO study details inspection locations, methods and results. (Appendix A at pp. 3-5 to 3-11). To summarize, approximately 30 locations in the river, including points upstream and downstream of all CSO points, were examined for sediment depth, color, texture and odor. At the same time depth of water, the size of the stream-bed area examined, and the amount and nature of floating debris, if any, were noted. The inspections revealed that, with the exception of the shoreline areas, most of the river bottom is rock or gravel with no sludge deposits. However, some sludge deposits were noted in low velocity areas -- i.e., near shorelines and downstream of islands. Sewage-related odors were detectable at a few small and localized areas near CSO outfalls. Although a relatively large area of sludge deposits was noted upstream of all CSO points, no comparable deposits were found downstream of the overflow points. The study concludes that there is no correlation between the overflow points and sludge deposits in the Fox River in the Aurora CSO areas. (Appendix A at p. 3-11).

In addition to inspecting the river, the contractor reviewed a 1978 NIPC study of sediment oxygen demand in the Fox River. The study showed varying sediment oxygen demands at five different locations in the river. However, no relation between sediment oxygen demand and CSOs could be detected. In fact, of the five sampling points, the highest sediment oxygen demand was found upstream of all of the overflow points. (Appendix A at pp. 2-5 to 2-8).

The Agency survey (Appendix D at p. 4) shows black septic sludge at the site of overflow No. 25. Further investigations reveal that the most severe incidence of bottom deposits is limited to 500 or 600 feet downstream of the overflow.

As noted above, sewage-related odors were detected in localized areas near a few CSO outfalls. (Appendix A at 3-11). Odors are moderate to severe near Overflow No. 25, but they can be detected for some distance downstream (±500 ft.) and intermittently throughout Indian Creek.

No unnatural colors were noted in the course of the river inspection. Floating debris was found in several locations, but all floating materials noted were unrelated to sewer overflows -- the specific items noted were tree branches, drums, tires, cardboard boxes and pipes. (Appendix A at pp. 3-6 to 3-10).

> Rags, tissue paper, etc. were observed in brush and log jams immediately below OVF No. 25 up to a distance of approximately 200 feet downstream.
>
> Amended Pet. at 9-11

Pursuant to concerns raised at hearing and to the Board's Order of June 20, 1986 Petitioners have caused further investigation of CSO impacts on Indian Creek. In particular, a study was undertaken by the Illinois State Water Survey and reached the following conclusions (Amended. Pet., Appendix G at 9-10):

a) Indian Creek below overflow 25 exhibits some benthic sediment degradation. However, this degradation is relatively minor and is in line with that of other streams receiving intermittent combined sewage overflows or a steady flow of well-treated effluent.

b) Benthos and phytoplankton productivity is low both upstream and downstream of the outfall.

c) The stream supports lush and extensive periphyton growth. Sediment oxygen demand is contributed by bottom-dwelling diatoms, iron bacteria respiration, and ammonia oxidation. The latter accounts for almost two-thirds of the sediment oxygen demand in the outfall area, but none of the sediment oxygen demand at a station above the outfall.

d) Gross visual and aesthetic pollution due to discharges from overflow 25 was not evident.

e) A reduction in the frequency and quantity of the CSO probably would enhance downstream conditions.

Petitioners further note that the sediment oxygen demands of Indian Creek are comparable to those of the Fox River (Amended Pet. at 19), and that the impacts of overflow 25 appear to be localized to the first 600 feet downstream of the outfall (Id.).

Stream Morphology

The condition of the Fox River through Aurora has been described in a Northeastern Illinois Planning Commission 1981 stream use inventory as "natural" with scarce aquatic vegetation and "fair to good" aesthetic appeal (Amended Pet. at 11). The streamside vegetation was noted to be "mature forest/brush" (Id.). Petitioners further note that the river is locally free of log jams and other accumulations of vegetative debris and that the river substrate is rock or gravel; some channelization has occurred in the highly-developed areas (Id. at 11-12).

Indian Creek has a relatively steep gradient and flows in a series of riffles and pools (Amended Pet. at 12).

Stream Chemical Analyses

Aurora undertook a sampling of CSO water quality and instream water quality during two storm events in 1981 (See Ex. 1 at 3-1 to 3-4 and Appendix B; Exhibit 10; Exhibit 11). From these data Petitioners conclude that "there appears to be little if any correlation between the combined sewer overflows and Fox River water quality during and after rainfalls" (Amended Pet. at 13). No chemical analyses were conducted on Indian Creek because the Petitioners "assumed that during the time overflow is active, the creek would reflect basically degraded conditions" (Id.).

CONCLUSION

The Board determines that Petitioners have shown pursuant to 35 Ill. Adm. Code 306.361(a) that exception to 35 Ill. Adm. Code 306.305(a), as it relates to first flush of storm flows, and to 35 Ill. Adm. Code 306.305(b) would produce minimal impact on the receiving stream. Accordingly, the Board will grant the exception. The Board further will accept the conditions as agreed to by Petitioners in their June 6, 1986 Proposed Order as modified in the Amended Petition of March 27, 1987 and Second Amended Petition of July 1, 1988.

ORDER

Aurora Sanitary District and the City of Aurora are hereby granted an exception from combined sewer overflow regulations 35 Ill. Adm. Code 306.305 (a) as it relates to first flush storm flows, and to 35 Ill. Adm. Code 306.305 (b), subject to the following conditions:

1. The City and District shall implement the following system improvements:

   a. Provide an additional 15" diameter connecting pipe at overflow No. 1 located at Rathbone Avenue.

   b. Modify the existing west siphon chamber at Hurd's Island to facilitate maintenance, and provide a manhole at the bend in the interceptor just north of the railroad bridge.

c. Remove siphon over Western United Gas and Electric Co. discharge tunnels and replace it with a 54" diameter connecting pipe.

d. Re-route Basins 8 and 33 to the wastewater treatment plant through the Waubonsie Interceptor.

e. Implement and maintain programmed maintenance on critical areas comprised of overflows 1, 4 and all the siphons.

f. Sewer separation upstream of overflow numbers 4, 8, 22 and 25 to reduce runoff into the combined system. Additionally implement inflow-infiltration reduction strategies in basins 24, 25, 26, 28, 29, 30 and 36.

g. Eliminate overflow number 6 diverting all flows from tributary sub-basins into the Hazel Avenue Interceptor.

h. Raise weirs 6" on overflows 5, 22, and 23 to eliminate bypassing during small storms.

i. Perform sewer separation in a 60 acre tract associated with the Transportation center project.

2. Improvements identified in paragraph 1 above shall be completed by July 31, 1988, with the exception of:

   a. 30-inch storm sewer along Plum Street in basins 24 and 25, which shall be completed by November 1, 1988.

   b. Removing of storm inlets along Lake Street in Basin 29, which shall be completed by November 1, 1988.

3. The Aurora Sanitary District Treatment facility shall be operated in accordance with the following provisions:

   a. All flows received at the treatment plant must be screened and metered.

   b. All flows up to 74 million gallons per day ("MGD") must receive a minimum of primary clarification prior to and during any occurrence of bypassing.

   c. All flows up to 68 MGD must receive full treatment prior to and during any occurrence of bypassing ahead of or following primary treatment units.

4. Aurora Sanitary District and the City of Aurora shall conduct performance evaluation and reporting of the improvements specified in this Order in accordance with the Plan of Study appended to and which is hereby made a part of this Order.

5. This grant of exception does not preclude the Agency from exercising its authority to require as a permit condition a CSO monitoring program sufficient to assess compliance with this exception and any other Board regulations and other controls, if needed, for compliance, including compliance with water quality standards.

6. This grant of exception is not to be construed as affecting the enforceability of any provisions of this exception, other Board regulations, or the Environmental Protection Act.

IT IS SO ORDERED.

I, Dorothy M. Gunn, Clerk of the Illinois Pollution Control Board, hereby certify that the above Opinion and Order was adopted on the 13th day of July, 1988, by a vote of 7-0.

Dorothy M. Gunn

Dorothy M. Gunn, Clerk
Illinois Pollution Control Board

ILLINOIS POLLUTION CONTROL BOARD
June 21, 1990

IN THE MATTER OF:	)	
	)	
JOINT PETITION OF THE AURORA SANITARY	)	
DISTRICT, THE CITY OF AURORA, AND THE	)	
ILLINOIS ENVIRONMENTAL PROTECTION	)	PCB 85-224
AGENCY FOR EXCEPTION TO THE COMBINED	)	(CSO Exception)
SEWER OVERFLOW (CSO) REGULATIONS	)	

ORDER OF THE BOARD (by R.C. Flemal):

This matter comes before the Board on a Motion for Modification of a Board Order filed June 14, 1990 by Aurora Sanitary District ("ASD"), the City of Aurora, and the Illinois Environmental Protection Agency.

The Board's final Order in this matter, in which the Board granted the CSO exception, was entered on July 13, 1988. Conditions attached to the grant of exception include certain construction and operational requirements imposed on the ASD as found at Condition (paragraph) #3 of the July 13 Order. Among other matters, Condition #3 does not specify a date certain upon which these requirements are to be in effect.

Subsequent to entry of the July 13 Board Order, the ASD obtained a State of Illinois Loan to enable it to carry out the requirements of Condition #3. A condition of the loan is that Condition #3 be modified to reflect a completion date of July 1, 1992. Petitioners accordingly now request that the Board so modify Condition #3.

Petitioners' motion is granted. Condition #3 of the Board's Order in this matter of July 13, 1988 is hereby amended to read as follows:

3. The Aurora Sanitary District Treatment facility shall be operated in accordance with the following provisions, effective July 1, 1992:

    a. All flows received at the treatment plant must be screened and metered.

    b. All flows up to 74 million gallons per day ("MGD") must receive a minimum of primary clarification prior to and during any occurrence of bypassing.

    c. All flows up to 68 MGD must receive full treatment prior to and during any occurrence of bypassing ahead of or following primary treatment units.

IT IS SO ORDERED.

Board Member J.D. Dumelle concurred.

I, Dorothy M. Gunn, Clerk of the Illinois Pollution Control Board, hereby certify that the above Order was adopted on the 21st day of June, 1990, by a vote of 7-0.

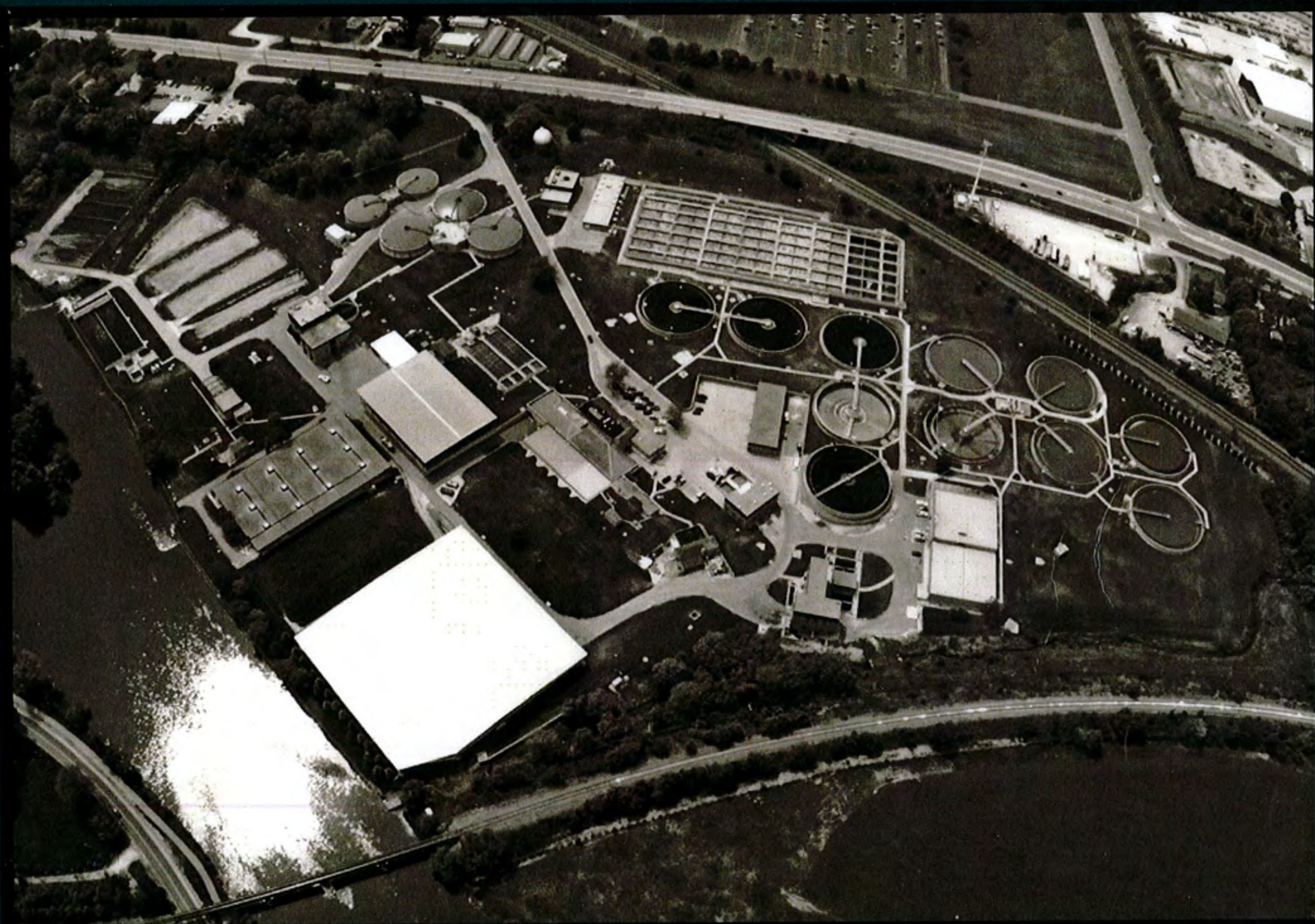
Dorothy M. Gunn /kk.
Dorothy M. Gunn, Clerk
Illinois Pollution Control Board

APPENDIX C

2005 WET WEATHER STUDY

Fox Metro
Water Reclamation District

COMBINED SEWER OVERFLOW (CSO) LONG TERM CONTROL PLAN (LTCP) APPENDIX C



March 31, 2010

Prepared By:

Walter E. Deuchler Associates, Inc.
Consulting Engineers

THE FOX METRO WATER RECLAMATION DISTRICT

WET-WEATHER FACILITIES STUDY

APRIL, 2005

PREPARED BY:

WALTER E. DEUCHLER ASSOCIATES, INC.
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AURORA, IL. 60506

Table of Contents

1.0 INTRODUCTION

The Fox Metro Water Reclamation District (FMWRD) prepared a new Master Planning Report to meet the challenges of a rapidly developing Facility Planning Area and pending new water quality objectives. Walter E. Deuchler Associates (WEDA) was retained to prepare the report for the purpose of identifying areas of collection and treatment that need to be upgraded, expanded or improved to meet the needs of Facility Planning Area. That study, prepared in April, 2005 evaluated the existing infrastructure, prepared population and loading projections, identified appropriate improvement options, prepared cost opinions, and recommended improvements. This report entitled "Wet-Weather Facilities Study" is attached to and part of that master planning report.

Under earlier and separate work orders to the Master Planning Report, the FMWRD retained WEDA to prepare flow analyses for the following areas:

- ✓ 2000 - Northeast Service Area contributing to the Reckinger Road Pump Station
- ✓ 2002 - Boulder Hill Interceptor
- ✓ 2002 - Waubonsie Interceptor
- ✓ 2002 - Combined Sewer Interceptor
- ✓ 2002 - Influent flows to the WWTP
- ✓ 2003 - Oswego Interceptor
- ✓ 2004 - North Aurora Interceptor

Flows from the five (5) major interceptor sewers with monitoring points near the wastewater treatment plant were reviewed as a part of the evaluation process of existing infrastructure. Flows from several of those main sewers were found to be excessive and in need of further study. Based upon the results of a cost-effective analysis that compared the cost of rehabilitation of the sewer main to the existing cost of transporting and treating the wastewater, the Master Planning Report identified three interceptors that have excess flows and that could be improved economically. The three major sewers to be further studied include the North Aurora, Waubonsie and Boulder Hill interceptors.

Since the passage of the Federal Water Pollution Control Act Amendments of 1972, more emphasis has been placed on the importance of reducing excessive I&I and in evaluating and rehabilitating sanitary sewer systems. Significantly reducing I&I helps to relieve overburdened collection systems and treatment facilities, lowers capital costs associated with treatment plant expansions, reduces operation and maintenance costs, and prolongs the life of the collection systems and treatment facility.[1]

1.1 PURPOSE AND SCOPE

The FMWRD believes that the major interceptors must be further studied to quantify extraneous water sources, pipeline capacities and project future hydraulic loadings that will be imposed on the system. WEDA was retained to provide this report on the North Aurora and the Waubonsie interceptors, with a focus on considering alternatives that can shave-off the peak flow rates. The objectives of the report include:

- ✓ Use the recent flow data / analyses collected to further identify the location of inflow entering the North Aurora and Waubonsie interceptors, from areas tributary to them,
- ✓ Assemble future hydraulic loadings data from previous studies and growth projections,
- ✓ Project hydraulic loading rates for each drainage basin at full development, to determine the pipeline adequacy,
- ✓ Provide a recommendation for the rehabilitation of tributary sewers, or siting of flow-equalization basin/s (FEB), and/or providing relief sewers with pump stations and additional treatment capacity, along the North Aurora and Waubonsie Interceptors,
- ✓ Provide a cost opinion for recommended improvements,
- ✓ Provide a cost-effective analysis to compare the cost of providing flow-equalizing

storage basins versus the cost of providing relief sewers and additional treatment facilities, and / or collection system rehabilitation.

It is assumed that the Boulder Hill interceptor will have additional flow analyses under a future work order, to further locate and quantify I&I sources and to recommend repairs and replacements.

1.2 BACKGROUND

The level of protection adopted on all sanitary sewers in the Fox Metro Water Reclamation District's Facility Planning areas is a 5-year storm frequency. Therefore, all inflows, monitored as part of this study, were scaled to a 5-year storm frequency to permit the determination of the current level of protection for the sewer system. The level of protection refers to the capability of the sanitary sewer system to handle a certain frequency wet weather occurrence. For example, a 5-year frequency level of protection assumes that all wet weather flows of a 5-year frequency or less would be transported to the treatment facility within capacity and without difficulties. On the other hand, wet weather flows from a storm event greater than a 5-year frequency (such as a 10-year storm event) would exceed the capacity of the sewer system. During those occurrences, the excess flow would cause surcharging of the sewers resulting in potential basement backups and/or overflows.

The basic design parameters developed by the Master Planning Report for the treatment options to be considered for the expansion and improvement of plant processes were based upon the removal of a major portion of the inflow from the identified major trunk mains. The design criteria for the proposed plant expansion are based upon the 5-year storm inflows being reduced by approximately 38 MGD, to lower the capital and operating costs of the wastewater treatment plant (WWTP).

The FMWRD collection system is a combination of combined and separate sewers. As part of the Master Planning process, flow meters were installed on the major interceptors at or near the wastewater treatment plant site and maintained over several years. A significant storm event on May 11 and 12, 2002 was chosen to determine a five-year wet weather peak hour flow. Several years of data were used to determine the low-flow and average daily flow to the plant. Those projected 5-year storm flow rates (in million gallons per day or MGD) to the WWTP as of the year 2002 are as follows:

		Existing (MGD)	2025 (MGD)	Diff. (MGD)
1.	Lowest flow day	19.10	36.20	+17.00
2.	Average dry weather flow	30.88	52.20	+21.32
3.	Projected peak hourly flow of storm	161.48	213.41	+51.93
4.	Projected peak inflow rate	100.37	100.37	0.00

1.3 REFERENCES AND ACKNOWLEDGMENTS

The following sources of information were instrumental in the preparation of this report:

1. *Existing Sewer Evaluation and Rehabilitation*. ASCE Manuals and Reports on Engineering Practice No. 62, WEF Manual of Practice FD-6, American Society of Civil Engineers, Water Environment Federation, 1994.

2.0 EXISTING CONDITIONS

2.1 STUDY AREA

The North Aurora and the Waubonsie interceptors encircle the City of Aurora and currently serve a population of approximately 153,600. When tributary build-out is reached on these interceptors, the projected population is estimated at 242,000. Maps have been prepared of the interceptors and are included as Exhibit 1 and Exhibit 2 at the end of this report. The maps show the locations of the identified flows, projected future flows, and pipeline capacities.

2.2 FLOW ANALYSES

The level of protection adopted on all sanitary sewers in the Fox Metro Water Reclamation District's (FMWRD) Facility Planning Area (FPA) is a 5-year storm frequency, as discussed in Section 1. Therefore, all inflows monitored as part of this study were scaled to a 5-year storm frequency for comparison and for planning purposes. A discussion of each drainage basin or collection area and the flows that were monitored (between the years 2000 and 2004) is included below.

North Aurora Interceptor:

The North Aurora Interceptor drainage basin is 55% developed with 16,703 sewered acres out of a total of 30,369 acres. This sewer was constructed in the early 1960's to address the needs of the northern areas of the FPA The current served population of approximately 74,600 is projected to grow to around 107,500 by 2025.

A study of the North Aurora Trunk main was conducted in the spring and summer of 2004, for the purpose of quantifying existing infiltration and inflows associated with that area. Flow monitoring with 14 recorders were simultaneously conducted at locations ranging from the Wastewater Treatment Plant upstream to the North Aurora Pump Station (see Table 2-1 for the Summary of Flow Analysis). A rain event of significant intensity occurred on June 11th thru the 12th of 2004. This rainfall generated a 7-year rainstorm intensity with 3.03 inches of rainfall within a 4-hour and 41-minute time period. The inflow scaling factor used to adjust the flows to a 5-year storm was 0.91..

TABLE 2-1

SUMMARY OF FLOW ANALYSIS
JUNE 11 & 12, 2004
NORTH AURORA INTERCEPTOR - 5-YEAR STORM

FLOW CONDITIONS *	MONITORING POINTS					
	39-009 (48")	50-162 (60")	20-012 (60")	20-140 (60")	18-077 (66")	18-070A (60")
Pipe Capacity	32.41 mgd	47.99 mgd	61.14 mgd	69.48 mgd	117.58 mgd	128.96 mgd
Average Dry Weather Flow	3.57 mgd	4.90 mgd	6.96 mgd	7.85 mgd	10.74 mgd	10.77 mgd
Peak Dry Weather Flow	4.27 mgd	5.53 mgd	7.68 mgd	8.55 mgd	11.95 mgd	11.99 mgd
Dry Weather Flow w/ High Groundwater Table (infiltration)	7.83 mgd	10.62 mgd	14.64 mgd	18.20 mgd	26.78 mgd	29.40 mgd
Projected Peak Wet Weather Flow w/ High Groundwater Table (5-year storm recurrence)	31.95 mgd	37.00 mgd	49.99 mgd	54.10 mgd	63.05 mgd	64.24 mgd

* Storm Event - June 11 & 12, 2004

<u>Waubonsie Interceptor:</u> The Waubonsie Interceptor drainage basin is 85% developed with 16,106 sewered acres out of a total of 18,948 acres. This sewer was constructed in the early 1980's to address the needs of a rapidly developing area and to provide a new discharge point for the Farnsworth Pump Station. The current served population of approximately 74,600 is projected to grow to around 107,500 by 2025.

The study of the Waubonsie trunk main was initiated several years ago by collecting flow data collection at the wastewater treatment plant and has since progressed upstream into the tributary area. The flow measurement data along the trunk has been assembled and modeled. The resulting flow analysis has noted areas of deficient pipeline capacity. The peak wet-weather flow was recorded in this interceptor during the May 11 &12, 2002 storm event at a location near the Wastewater Treatment Plant (MH # 18-070A). The 5-year storm projections of the existing flows (as of 2004) for that interceptor are shown on Table 2-2 below.

TABLE 2-2

SUMMARY OF FLOW ANALYSIS
May 11 & 12, 2002
WAUBONSIE INTERCEPTOR - 5-YEAR STORM

FLOW CONDITIONS *	MONITORING POINTS			
	54-153 (36")	44-013 (60")	45-057 (66")	45-006 (54")
Pipe Capacity	10.80 mgd	53.10 mgd	47.80 mgd	45.40 mgd
Average Dry Weather Flow	1.13 mgd	4.65 mgd	6.68 mgd	7.14 mgd
Peak Dry Weather Flow	1.60 mgd	6.06 mgd	9.44 mgd	10.38 mgd
Dry Weather Flow w/ High Groundwater Table (infiltration)	1.96 mgd	11.74 mgd	16.11 mgd	16.39 mgd
Projected Peak Wet Weather Flow w/ High Groundwater Table (5-year storm recurrence)	2.71 mgd	27.24 mgd	42.97 mgd	43.33 mgd

* Storm Event – May 11 & 12, 2002

Boulder Hill Interceptor: This interceptor currently serves approximately 8200 people with a projected growth to approximately 8800 by the year 2025. The Boulder Hill area of 1030 acres would then be fully developed.

A flow analysis report for the Boulder Hill interceptor was completed in February, 2004. Flows were measured in the summer of 2003, and projected to a five-year storm flow. Those flows were compared to flow measurements taken in 1990 at the same monitoring points. The comparison notes a marked decrease (nearly 60 %) in the projected peak inflows between 1990 and 2003, which is the result of rehabilitation efforts by the FMWRD.

TABLE 2-3

SUMMARY OF FLOW ANALYSIS
July 17, 2003
BOULDER HILL COLLECTION SYSTEM – 5-YEAR STORM

FLOW CONDITIONS*	MONITORING POINTS IN COLLECTION SYSTEM			
	MH 41-290 (12")	MH 41-288 (15")	MH 43-271 (18")	MH 43-523 (15")
Pipe Capacity, mgd	1.26	1.67	2.36	1.67
Peak Dry Weather Flow, mgd	0.11	0.34	0.45	0.26
Projected Peak Wet Weather Flow w/High Groundwater Table (5-Year Storm), mgd	0.99	2.00	2.21	0.97

Table 2-3 above is an indication that the collection system in the Boulder Hill Addition is sized large enough to accept the 5-year flows. .However, the 2003 flow monitoring did not measure the total flows produced in the drainage basin.

For total Boulder Hill Interceptor flow data, we have used the monitoring results from the May 11 – 12, 2002 storm event that were taken at a manhole located near the WWTP. That data shows that there is still room for improvement of this interceptor as we recorded a Peak Wet-Weather Flow of 12.63 mgd which is approximately 957% of the average daily flow of 1.32 mgd. See Table 2-4 below for flow conditions in that storm.

Table 2-4

SUMMARY OF FLOW ANALYSIS
May 11-12, 2002
BOULDER HILL INTERCEPTOR @ WWTP – 5-YEAR STORM

Pipe Capacity, mgd	16.18
Average daily flow, mgd	1.32
Peak Wet-Weather Flow, mgd	12.63
Projected peak inflow rate, mgd	9.34

Although it has been our experience that inflow sources can be cost-effectively reduced by fifty percent, a considerable amount of inflow reduction work was completed before the 2003 flow monitoring. For this reason, we will first look to the other two interceptors to accomplish the reduction goal of 38 mgd.

3.0 Future Conditions

The next step of this study is to assemble the projected 5-year storm flow hydraulic loadings for the future, including full development of the drainage basin on each of the two interceptors and compare those 5-year projected flows to the interceptor's hydraulic capacities for the prediction of problem areas. A discussion of each interceptor follows.

3.1 North Aurora Interceptor

Table 3-1 compares the pipeline capacity at various flow monitoring points along the North Aurora Interceptor to the future (built-out) 5-year storm flows without the benefit of sewer rehabilitation, relief sewers, or flow equalization storage.

TABLE 3-1
Comparison of Pipeline Capacities to Future Loadings
North Aurora Interceptor

	MH #	Diameter, in.	Capacity, MGD	Future PWWF, MGD	Future Inflow, MGD	Reserve Capacity
1.	39-009	48	32.41	46.14	33.93	<13.73>
2.	50-162	60	47.99	58.34	37.98	<10.35>
3.	20-012	60	61.14	65.57	40.95	<4.43>
4.	20-140	60	69.48	71.30	45.14	<1.82>
5.	18-077	66	117.68	80.27	46.42	37.41
6.	18-070A	60	128.96	124.81	61.85	4.15

It is clear from Table 3-1 that if nothing is done to lower the 5-year storm peak hourly flows, the North Aurora pipeline capacity will be exceeded before infill is completed and transportation / treatment capacity related problems will develop (see Exhibit 1 for monitoring locations). The table shows that the point of maximum deficiency is in the area of manholes numbered 39-009 and 50-162, and that the upper two-thirds of the interceptor capacity will be deficient. In addition, the collector lines that feed the main interceptor will be at risk of surcharging as well.

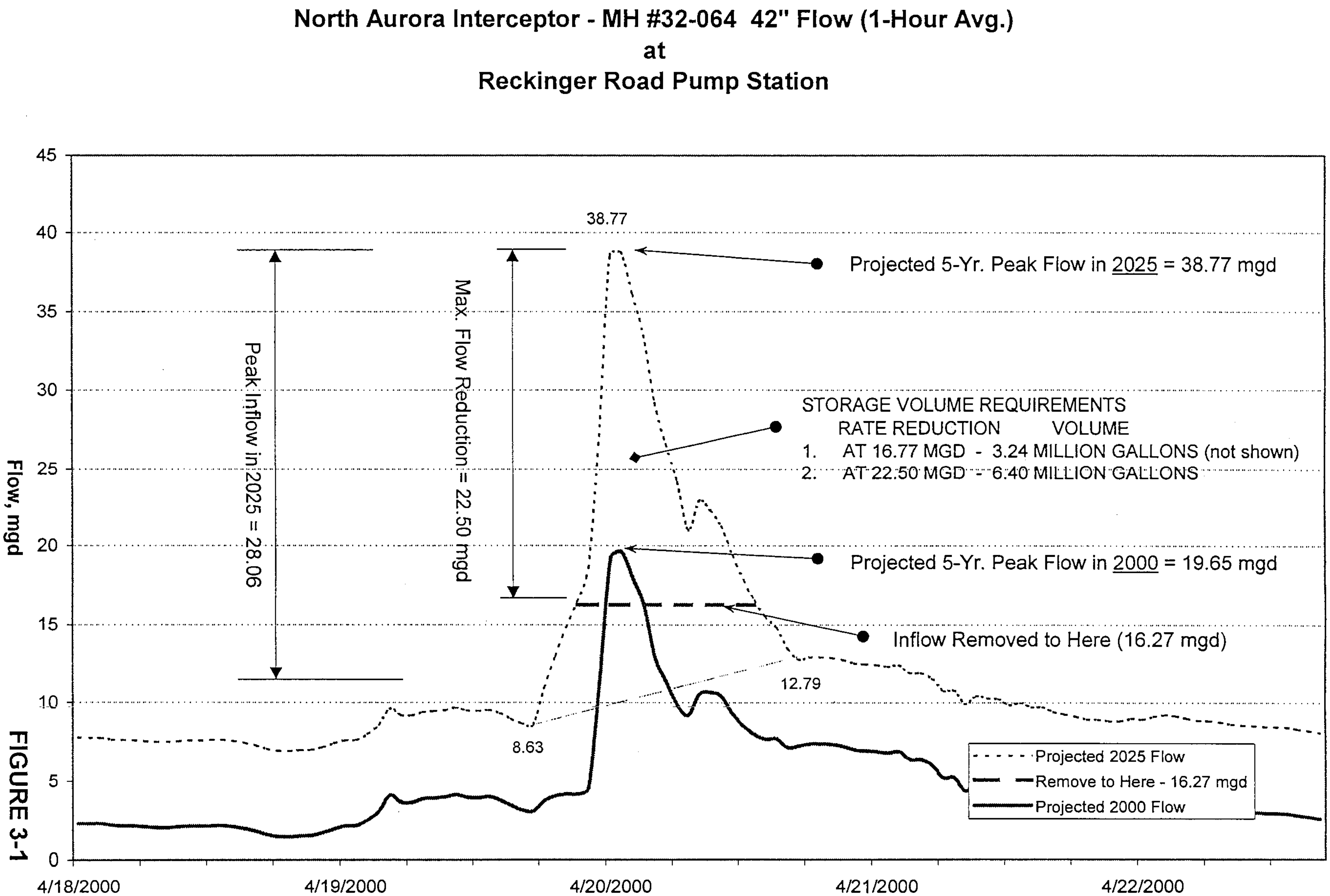
We have determined herein that peak flows received at the North Aurora pump station from the Reckinger Road Pump Station and other developed areas located east of the Fox River must be lowered to protect the North Aurora Interceptor. The Reckinger Road Pumping Station flow analysis (prepared in 2000) said the average daily flow to the Reckinger Road Pump Station was measured at 2.65 mgd. A 5-year storm event in that same year was projected to be 19.65 mgd, for a factor of 7.4, which is excessive. The calculated inflow from the 5-year storm event in 2000 was projected to be 14.38 mgd.

Figure 3-1 is a hydrograph that exhibits the 5-year storm flows during the 2000 flow monitoring and the projected 5-year storm flows when the drainage basin is fully developed. The future peak flows into the Reckinger Road Pumping Station must be lowered by a minimum of 16.8 mgd to safeguard the homes served by the North Aurora Interceptor. The alternates considered in the master plan were based upon the flows in the North Aurora Interceptor being reduced by a minimum of 19.48 mgd. Table 3-2 below shows the volume of water that must be removed or stored to accomplish various flow rate reductions at a point near the Reckinger Road Pump Station.

TABLE 3-2

Required Volumes of Removal / Storage at Reckinger Road Pump Station

Flow Rate Reduction, mgd.	Million Gallons Removed
10.48	1.44
13.00	2.06
15.67	2.88
17.25	3.50
18.96	4.32
22.49	6.40



North Aurora Interceptor - MH #32-064 42" Flow (1-Hour Avg.)
at
Reckinger Road Pump Station
Flow, mgd
45
40
35
30
25
20
15
10
5
0
4/18/2000
4/19/2000
4/20/2000
4/21/2000
4/22/2000
38.77
Projected 5-Yr. Peak Flow in 2025 = 38.77 mgd
Peak Inflow in 2025 = 28.06
Max. Flow Reduction = 22.50 mgd
STORAGE VOLUME REQUIREMENTS
RATE REDUCTION VOLUME
1. AT 16.77 MGD - 3.24 MILLION GALLONS (not shown)
2. AT 22.50 MGD - 6.40 MILLION GALLONS
Projected 5-Yr. Peak Flow in 2000 = 19.65 mgd
Inflow Removed to Here (16.27 mgd)
12.79
8.63
Projected 2025 Flow
Remove to Here - 16.27 mgd
Projected 2000 Flow

FIGURE 3-1

3.2 Waubonsie Interceptor

Table 3-2 compares the pipeline capacity at various flow monitoring points along the Waubonsie Interceptor to the future (built-out) 5-year storm flows without the benefit of shaving the peak hour flows.

TABLE 3-3
Comparison of Pipeline Capacities to Future Loadings
Waubonsie Interceptor

MH #	Diameter, in.	Capacity, MGD	Future PWWF, MGD	Future Inflow, MGD	Reserve Capacity
1. 54-153	36	10.80	2.71	0.96	8.09
2. 44-013	60	53.10	27.24	13.80	25.86
3. 45-057	66	47.80	55.57	24.25	<7.77>
4. 45-006	54	45.40	56.03	24.35	<10.63>

Table 3-3 above shows that if nothing is done to lower the 5-year storm peak hour flows, the Waubonsie Interceptor capacity will be exceeded before infill is completed and transportation / treatment capacity related problems will develop (see Exhibit 2 for locations). The capacity problem begins where the 66" pipe flows into the 54" pipe segment at Manhole # 45-057.

The flow monitoring report completed in 2002 showed the average daily flow of the Waubonsie Interceptor to the WWTP at 8.20 mgd. A 5-year storm event in that same year was projected to be 43.33 mgd, for a factor of 5.3, which is excessive. The calculated inflow from the 5-year storm event in 2002 was projected to be 24.35 mgd.

Figure 3-2 is a hydrograph that exhibits the 5-year storm flows during the 2002 flow monitoring and the projected future 5-year storm flows for a fully developed drainage basin. The projected peak flows into the Wastewater Treatment Plant for the year 2025 must be lowered by a minimum of 11.0 mgd to safeguard the homes that are served by the 54" section of the Waubonsie Interceptor. The alternates considered in the master plan were based upon the flows in the Waubonsie Interceptor being reduced by a minimum of 13.47 mgd.

Table 3-4 below shows the volume of water that must be removed or stored to accomplish various flow rate reductions. The graph on Figure 3-2 also lists the volume of water that must be stored or removed to accomplish various flow rate reductions.

TABLE 3-4

Required Volumes of Removal
at
MH #45-006

Flow Rate Reduction, mgd.	Million Gallons Removed
10.82	1.32
11.86	1.44
13.47	1.82
17.71	2.88
22.54	4.60
25.36	6.40

Waubonsie Interceptor - MH #45-057 66" Flow (1-Hour Avg.)

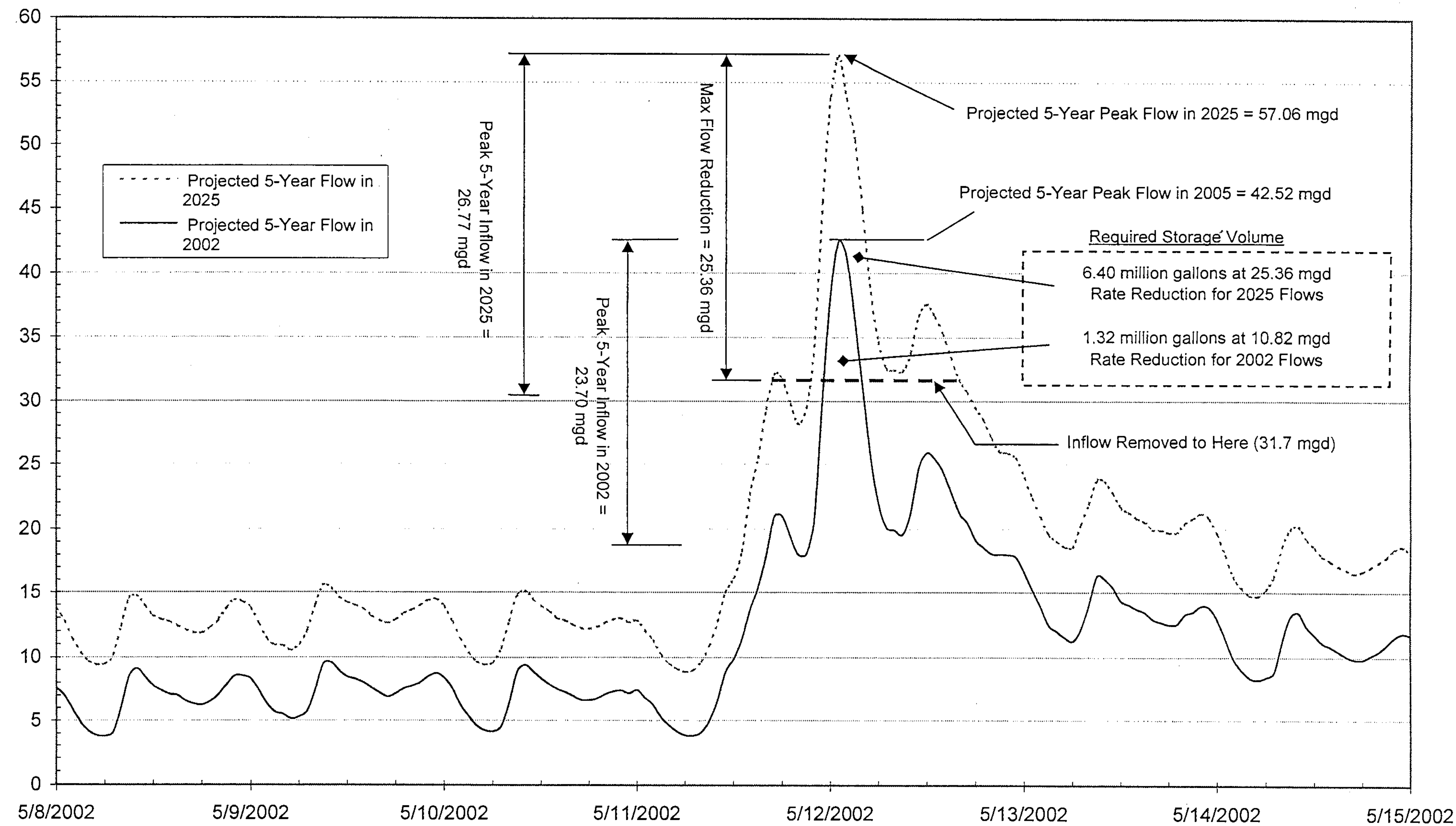


FIGURE 3-2

4.0 CONSIDERED ALTERNATIVES

This section summarizes alternative approaches that will lower the peak hourly flows which are imposed on the collection system through a storm event. The alternatives considered herein will address the projected future hydraulic loadings as well as the current conditions. The alternative approaches include:

a) Sewer Rehabilitation or restoration;

b) Transport and Treat - Relief Sewers with dedicated pump stations, force-mains, and the storage and/or treatment improvements required to provide secondary treatment, tertiary filtration, and disinfection to the by-passed wastewater; and

c) Flow Equalization Basins that will accept and store the by-passed peak flows and slowly return them to the trunk main for conveyance and treatment.

The evaluation of alternatives will include economic factors such as, but not limited to the following:

a) Increased operation and maintenance costs for pumping and treating excess flows;

b) Need for increasing treatment capacity

The evaluation will also consider the environmental impacts of each alternative and rank them accordingly. A discussion of each of the alternatives and how they relate to each of the two interceptors is included below:

4.1 Option 1 – Sewer Rehabilitation

4.1.1 General Description

In order to proceed with the Sewer Rehabilitation option, certain assumptions have to be made regarding what quantity of I&I will remain influent to the interceptor should the wastewater collection system be rehabilitated. We have elected to be conservative by assuming the following:

- Approximately 50% of inflow reduction will be achieved by rehabilitation
- Zero infiltration will be removed

This assumption is based upon our experiences with sanitary sewer rehabilitation in other local municipalities, as well as our belief that other sources of inflow will emerge while performing the rehabilitation in the subject area.

A common error in estimating the effectiveness of rehabilitation is to assume net system wide effects will be equal to the sum of the I&I values initially allocated to specific rehabilitated components. Consideration has to be given to the "fluid" nature of the I&I sources, particularly if rehabilitation is limited to specific components in the total system. Rehabilitation in one area can result in raising the groundwater level, increasing the leakage in shallower sewers, and creating new leakage in previously adequate sewers because of the increased hydraulic head. This is particularly true where rehabilitation efforts have been limited to (public) sewers while ignoring privately owned service laterals. Understanding the effectiveness of the sewer rehabilitation I&I control program is essential to making the right decisions regarding rehabilitation versus increasing conveyance and treatment plant capacity. Recent successful I&I reduction efforts have recognized these interrelated factors by adopting I&I reduction rehabilitation approaches that take a total basin-by-basin approach to overcome the interference effects of more piecemeal efforts.[1]

It is important to remember that this option will focus on the immediate problem only, and will not necessarily provide a long-term solution for a one time investment. However, without a continual program of sewer rehabilitation with preventative maintenance and strict code enforcement, the levels of I&I will increase, collection capacities will diminish, structural failures will occur, and risks to public health and safety will increase. From an economic perspective, pipelines and structures must be maintained to avoid the much higher cost of replacement.

4.1.2. North Aurora Interceptor

The FMWRD and the City of Aurora allocate substantial sums of money each year for the reduction of infiltration and inflow (I&I) and for combined sewer separation. A project of sanitary and combined sewer rehabilitation in the northeast service area upstream of the Reckinger Road Pump Station has been designed and is currently waiting for final approval from the City of Aurora and the FMWRD. The project will restore a portion of the collection system serving approximately 330 sewered acres, which contributes flow to the North Aurora Interceptor. This project includes pipeline replacement (217 lineal feet), pipeline lining (17,456 lf), service tee replacement, manhole rehabilitation (83), and pipeline joint grouting (367 lf). That construction work is estimated to cost approximately $1,750,000, and is planned to reduce the I&I in these pipelines by approximately 9.8 MGD. This project averages $5,303 per sewered acre, which is considerably more than the average of $2,855 per acre as calculated from other recent projects. Post Rehabilitation flow-monitoring is also scheduled to make a final determination of the short-term improvements. Long term benefits in flow reduction from this rehabilitation effort are difficult to estimate accurately, but are assumed in this report to be in the range of 5 MGD.

Field investigations are currently underway for the collection of data to locate and rehabilitate clear water sources throughout the North Aurora drainage basin. Flow monitoring efforts were expanded in the fall of 2004 in an area located south of I-88, east of Orchard Road, west of Randall Road, and north of Galena. As the deficient areas are further identified and located, more accurate evaluations and recommended improvements will be prepared.

Based upon our previous experience with costs for sewer rehabilitation in this system and in neighboring communities, we will use the average estimated cost of repairing existing sewers of $2,855 per sewered acre. This cost opinion is for the removal of 50% of the existing inflow. From the previous description of the North Aurora Interceptor (as addressed in Section 2) we know that the basin has a total of 16,703 sewered acres. WEDA believes that a reasonable cost opinion to rehabilitate the entire basin would be $47,687,065. A portion of this cost must be appropriated each year, regardless if this option is selected, simply to maintain the structural soundness of the collection system.

4.1.3. Waubonsie Interceptor

The same types of field investigations and rehabilitation investments that were discussed above for the North Aurora Interceptor have been and are now taking place to improve the Waubonsie Interceptor. Again we know that the Waubonsie Interceptor has 16,106 sewered acres and that a reasonable cost to rehabilitate it will be $45,982,630. Again, in order to maintain the structural soundness of the collection system, a portion of this cost must be appropriated each year, regardless if this option is selected as the most cost-effective alternative.

4.2 Option 2 – Transport & Treat

4.2.1. General Description

The excess wastewater that will be collected, transported, and treated in this option will be from a separated collection system, therefore requiring full treatment and disinfection in accordance with the NPDES Permit. The design concept of this option would include the following major features:

a. Flow Diverter structure with a weir that will ensure that flows in a given sewer line will not exceed a certain depth, or flow rate. The flow would be transported with a gravity sewer to a new pump station.

b. A new pump station with a minimum firm capacity to match or exceed the excess flows would receive flows from the diverter structure and pump it through a new force main to the wastewater treatment plant (WWTP) for storage and treatment.

c. A new force main will be constructed through the City of Aurora (most of which is developed) to a new Wastewater Treatment Expansion that is located on or near the existing WWTP site.

d. The new treatment facility would have a Design Peak Hour Flow that would match the new pump station.

4.2.2. North Aurora Interceptor

As shown in Section 3, the pipe capacity of this interceptor will be deficient to handle the estimated future loadings in 2025 during a 5-year storm event. The peak hour flows received from east of the Fox River in the Northeast Service Area and the Reckinger Road Pump Station must be reduced by a minimum of 16.7 MGD (see Figure 3-1), to enable the North Aurora Interceptor to address the future 5-year storm flows. The excess flow collection point should be on the 42" diameter trunk main at a point immediately upstream from the pump station (possibly north of Reckinger Road). A weir at the collection point would allow overflow as pump station wet-well reaches a specified level.

Under this concept, excess flows to the Reckinger Road Pump Station are intercepted and pumped (11,600 gpm) directly to the wastewater treatment plant for treatment, disinfection, and discharge. An opinion of cost for option 2 "Transport & Treat" as it applies to the North Aurora Interceptor in the amount of approximately $243 million is shown in Table 4-1.

4.2.3. Waubonsie Interceptor

The best location for the installation of an excess flow collection structure would be somewhere between Farnsworth Avenue and the U.S. Highway 30 By-pass. If only 16.7 MGD is taken off the peak flows of the North Aurora Interceptor, it will be necessary to shave approximately 22.3 MGD off of the peak

TABLE 4-1

Cost Opinion TRANSPORT & TREAT - 16.7 mgd NORTH AURORA INTERCEPTOR @ RECKINGER ROAD					
					01/25/05
Item/Description	**Qty**	**Unit**	**Unit Cost**	**Extension**	**Totals**
1 Collection Point					
a. Splitter Box w / Adjustable Weir and Bar-Screen	1	ea.	$155,000	$155,000	
b. Gravity Sewer - 30"	150	LF	$500	$75,000	
c. Manhole - 72"	1	ea.	$3,000	$3,000	
d. Site work	1	LS	$15,000	$15,000	
e. Misc	1	LS	$37,200	$37,200	
				sub-total	$285,200
2 Raw Sewage Pump Station					
a. Building & Concrete	3,600	SF	$300	$1,080,000	
b. Raw Sewage Pumps (10,600 gpm)	3	LS	$175,000	$525,000	
c. Piping, Gates, Valves, & Miscellaneous	1	LS	$636,631	$636,631	
d. Scada Modifications	1	LS	$15,000	$15,000	
e. Electrical	1	LS	$338,495	$338,495	
f. Bridge Cranes & Trolley Hoists	1	LS	$165,000	$165,000	
g. Ultrasonic Flow meter	1	ea.	$30,000	$30,000	
h. Site work	1	LS	$183,944	$183,944	
i. Misc	1	LS	$446,110	$446,110	
				sub-total	$3,420,180
3 Force main					
a. DIP Force main (36")	44,500	LF	$900	$40,050,000	
b. Misc.	1	LS	$6,007,500	$6,007,500	
				sub-total	$46,057,500
4 Wastewater Treatment Plant					
a. WWTP	15.17	MGD	$7,000,000	$106,190,000	
b. Misc.	1	LS	$15,928,500	$15,928,500	
				sub-total	$122,118,500
Total Estimated Construction Cost					**$171,881,380**
Total Estimated Engineering Fees					**$42,970,345**
Total Estimated Contingencies					
a. Legal and Administrative					**$8,594,069**
b. Land & Easements					**$2,500,000**
c Construction Interest					**$16,945,935**
Total Estimated Project Cost					**$242,891,729**

flow rate that the Waubonsie Interceptor will receive during a 5-year storm event in the year 2025. The flow analysis indicates that as much as 24.2 MGD of inflow to the

WWTP is available for removal in that area. The facilities will be designed to remove that inflow with a firm capacity of 16,806 gpm.

Under the May 12, 2002 storm data, excess flows to the collection point are intercepted and pumped (16,806 gpm) directly to the wastewater treatment plant for treatment, disinfection, and discharge. An opinion of cost for option 2 "Transport & Treat" as it applies to the Waubonsie Interceptor in the amount of approximately $285 million is shown in Table 4-2.

4.3 Option 3 – Flow Equalization Basins

4.3.1. General Description

The excess wastewater that will be collected and stored in this option will be from a separated collection system, therefore requiring full treatment and disinfection in accordance with the NPDES Permit. The design concept of this option would include the following major features:

a. Flow Diverter structure with a weir that will ensure that flows in a trunk sewer will not exceed a certain depth, or flow rate. The flow would be transported with a gravity sewer to a new pump station.

b. The new pump station with a minimum firm capacity to match or exceed the excess flows would receive flows from the diverter structure and pump it to the storage basins. After the flow rate in the trunk main subsides to a manageable rate, the stored water will automatically be slowly returned to the trunk sewer for transportation to the WWTP.

c. Clean-up of the basin floors will be automated with tipping buckets that use potable water as a supply. Basin walls will be cleaned with water cannons and flexible hoses.

TABLE 4-2

Cost Opinion TRANSPORT & TREAT - 22.4 mgd WAUBONSIE INTERCEPTOR @ FARNSWORTH AVE.					
					01/26/05
Item/Description	**Qty**	**Unit**	**Unit Cost**	**Extension**	**Totals**
1 Collection Point					
a. Splitter Box w / Adjustable Weir and Bar-Screen	1	ea.	$155,000	$155,000	
b. Gravity Sewer - 36"	150	LF	$525	$78,750	
c. Manhole - 72"	1	ea.	$3,000	$3,000	
d. Site work	1	LS	$15,000	$15,000	
e. Misc	1	LS	$37,763	$37,763	
				sub-total	$289,513
2 Raw Sewage Pump Station					
a. Building & Concrete	4,080	SF	$300	$1,224,000	
b. Raw Sewage Pumps (15,600 gpm)	3	LS	$175,000	$525,000	
c. Piping, Gates, Valves, & Miscellaneous	1	LS	$687,031	$687,031	
d. Scada Modifications	1	LS	$15,000	$15,000	
e. Electrical	1	LS	$367,655	$367,655	
f. Bridge Cranes & Trolley Hoists	1	LS	$165,000	$165,000	
g. Ultrasonic Flow meter	1	ea.	$30,000	$30,000	
h. Site work	1	LS	$183,944	$183,944	
i. Misc	1	LS	$479,644	$479,644	
				sub-total	$3,677,274
3 Force main					
a. DIP Force main (42")	15,840	LF	$975	$15,444,000	
b. Misc.	1	LS	$2,316,600	$2,316,600	
				sub-total	$17,760,600
4 Wastewater Treatment Plant					
a. WWTP	22.40	MGD	$7,000,000	$156,800,000	
b. Misc.	1	LS	$23,520,000	$23,520,000	
				sub-total	$180,320,000
Total Estimated Construction Cost					**$202,047,387**
Total Estimated Engineering Fees					**$50,511,847**
Total Estimated Contingencies					
a. Legal and Administrative					**$10,102,369**
b. Land & Easements					**$2,500,000**
c Construction Interest					**$19,887,120**
Total Estimated Project Cost					**$285,048,723**

d. The new storage facility would be covered with a building for security and odor control. The split-faced block building will have an odor control system to ensure compatibility with the neighborhood.

4.3.2. North Aurora Interceptor

The peak hour flows received from east of the Fox River in the Northeast Service Area and the Reckinger Road Pump Station must be reduced by a minimum of 16.7 MGD (see Table 3-1), to enable the North Aurora Interceptor to address the future 5-year storm flows. The excess flow collection point should be on the 42" diameter trunk main at a point immediately upstream from the Reckinger Road Pump Station. A weir at the collection point would allow overflow as the Reckinger Road Pump Station wet-well reaches a specified level.

Under this concept, excess flows to the Reckinger Road Pump Station are intercepted and pumped (11,600 gpm) to storage as described earlier. An opinion of cost for Option 3 "Flow Equalization" as it applies to the North Aurora Interceptor in the amount of approximately $24 million is shown in Table 4-3.

It should be noted that as development fills in the remaining areas of the drainage basin, and an additional collection point is under consideration, a very good future storage site is located east of Deerpath, South of I-88, West of the interceptor, and North of Sullivan Road.

TABLE 4-3

COST OPINION FLOW EQUALIZATION BASIN - 16.7 mgd NORTH AURORA INTERCEPTOR @ RECKINGER ROAD							
Item/Description			**Qty**	**Unit**	**Unit Cost**	**Extension**	**Totals**
1	Equipment Cost, in place						
a.	Tipping Buckets		28	ea.	$35,000	$980,000	
b.	Raw Sewage Pumps		3	ea.	$178,000	$534,000	
c.	Odor Control Equipment (scrubber)		1	ea.	$475,000	$475,000	
d.	Scada Modifications		1	LS	$15,000	$15,000	
e	Aluminum Railing		1	LS	$140,000	$140,000	
f	Pre-packaged Plant Water System		1	LS	$60,000	$60,000	
g	Fiberglass Stop Plates		72	ea.	$450	$32,400	
h	Sluice Gates		18	ea.	$35,000	$630,000	
i	Aerators		54	ea.	$6,500	$351,000	
j	Bridge Cranes & Trolley Hoists		1	LS	$165,000	$165,000	
k	Ultrasonic Flow meter		1	ea.	$30,000	$30,000	
l	Piping, Gates, Valves, & Miscellaneous		1	LS	$696,150	$696,150	
						sub-total	$4,108,550
2	Concrete						
a.	Influent / Effluent Channel		1	LS	$416,100	$416,100	
b.	Storage Basins		1	LS	$3,310,739	$3,310,739	
c.	Raw Sewage Pump Station		1	LS	$442,167	$442,167	
						sub-total	$4,169,006
3	Buildings						
a.	Pump Station Building						
		2-story Split Faced Block Bldg	7,250	SF	$60	$435,000	
		mechanical	1	LS	$108,750	$108,750	
		electrical	1	LS	$81,563	$81,563	
b.	Storage Building						
		Split Faced Block Building	77,141	SF	$40	$3,085,640	
		mechanical	1	LS	$1,079,974	$1,079,974	
		electrical	1	LS	$624,842	$624,842	
						sub-total	$5,415,769
4	Site work						
a.	Dewatering		1	LS	$20,000	$20,000	
b.	Erosion Control		1	LS	$25,000	$25,000	
c.	Grading & Seeding		1	LS	$35,000	$35,000	
d	Influent Structure		1	LS	$25,000	$25,000	
e	Effluent Structure		1	LS	$20,000	$20,000	
f	48" DIP		250	LF	$370	$92,500	
g.	18" DIP		200	LF	$90	$18,000	
h	15" DIP		600	LF	$80	$48,000	
i	Deep Manhole (5' Dia.)		2	ea	$3,500	$7,000	
						sub-total	$290,500
5	Miscellaneous Construction		1	LS	$2,097,574	$2,097,574	
						sub-total	$2,097,574
Total Estimated Construction Cost							**$16,081,398**
Total Estimated Engineering Fees							**$4,020,349**
Total Estimated Contingencies							
a.	Legal and Administrative						**$804,070**
b.	Land & Easements						**$2,000,000**
c	Construction Interest						**$1,145,291**
Total Estimated Project Cost							**$24,051,108**

4.3.3. Waubonsie Interceptor

The best location for the installation of an excess flow collection structure would be somewhere between Farnsworth Avenue and the U.S. Highway 30 By-pass. If only 16.7 MGD is taken off the peak flows of the North Aurora Interceptor, it will be necessary to shave approximately 22.3 MGD off of the peak flow rate that the Waubonsie Interceptor will receive during a 5-year storm event in the year 2025. The flow analysis indicates that as much as 24.2 MGD of inflow is available for removal in that area. The facilities will be designed to remove that inflow with a firm capacity of at least 22.4 mgd or 15,560 gpm. An opinion of cost for Option 3 "Flow Equalization Basin" as it applies to the Waubonsie Interceptor in the amount of approximately $23 million is shown below in Table 4-4.

TABLE 4-4

COST OPINION FLOW EQUALIZATION BASIN - 22.4 mgd WAUBONSIE INTERCEPTOR @ FARNSWORTH AVENUE							
Item/Description			**Qty**	**Unit**	**Unit Cost**	**Extension**	**Totals**
1	Equipment Cost, in place						
a.	Tipping Buckets		28	ea.	$35,000	$980,000	
b.	Raw Sewage Pumps		3	ea.	$178,000	$534,000	
c.	Odor Control Equipment (scrubber)		1	ea.	$475,000	$475,000	
d.	Scada Modifications		1	LS	$15,000	$15,000	
e	Aluminum Railing		1	LS	$140,000	$140,000	
f	Pre-packaged Plant Water System		1	LS	$60,000	$60,000	
g	Fiberglass Stop Plates		72	ea.	$450	$32,400	
h	Sluice Gates		18	ea.	$35,000	$630,000	
i	Aerators		54	ea.	$6,500	$351,000	
j	Bridge Cranes & Trolley Hoists		1	LS	$165,000	$165,000	
k	Ultrasonic Flow meter		1	ea.	$30,000	$30,000	
l	Piping, Gates, Valves, & Miscellaneous		1	LS	$696,150	$696,150	
						sub-total	$4,108,550
2	Concrete						
a.	Influent / Effluent Channel		1	LS	$416,100	$416,100	
b.	Storage Basins		1	LS	$3,310,739	$3,310,739	
c.	Raw Sewage Pump Station		1	LS	$442,167	$442,167	
						sub-total	$4,169,006
3	Buildings						
a.	Pump Station Building						
		2-story Split Faced Block Bldg	7,250	SF	$60	$435,000	
		mechanical	1	LS	$108,750	$108,750	
		electrical	1	LS	$81,563	$81,563	
b.	Storage Building						
		Split Faced Block Building	77,141	SF	$40	$3,085,640	
		mechanical	1	LS	$1,079,974	$1,079,974	
			1	LS	$624,842	$624,842	
						sub-total	$5,415,769
4	Site work						
a.	Dewatering		1	LS	$20,000	$20,000	
b.	Erosion Control		1	LS	$25,000	$25,000	
c.	Grading & Seeding		1	LS	$35,000	$35,000	
d	Influent Structure		1	LS	$25,000	$25,000	
e	Effluent Structure		1	LS	$20,000	$20,000	
f	60" PCCP		250	LF	$470	$117,500	
g.	18" DIP		200	LF	$90	$18,000	
h	15" DIP		600	LF	$80	$48,000	
i	Deep Manhole (5' Dia)		2	ea	$3,500	$7,000	
						sub-total	$315,500
5	Miscellaneous Construction		1	LS	$2,101,324	$2,101,324	
						sub-total	$2,101,324
Total Estimated Construction Cost							**$16,110,148**
Total Estimated Engineering Fees							**$4,027,537**
Total Estimated Contingencies							
a.	Legal and Administrative						**$805,507**
b.	Land & Easements						**$1,000,000**
	Construction Interest						**$1,097,160**
Total Estimated Project Cost							**$23,040,352**

5.0 ANALYSIS OF ALTERNATIVES

One of the primary purposes of this report is to evaluate environmental impacts and economic impacts of the alternatives being considered. The results of those evaluations are presented in the following subsections.

5.1 Environmental Impacts

The environmental impacts associated with the implementation of these alternatives may be categorized as primary and secondary impacts. Primary impacts are those that have direct impacts resulting from the construction of or operation of the treatment plant, pumping stations, force mains, and sewers. Secondary impacts include those impacts resulting from induced changes in land use or population growth as a result of the proposed improvements.

5.1.1 Wastewater Treatment Plant

The treatment portion of work for Option 2 will confine construction activity to the existing plant site. The existing site is bounded on the east by the Fox River, on the West by Highway 31, on the north by Railroad, and on the south by a 175' wide right-of-way owned by the Commonwealth Edison Power Company.

The majority of the environmental impacts from construction of Option 2 plant improvements will be temporary and therefore stem from the construction of facilities on the site, and those impacts will be temporary. Plant-site construction activities will create some adverse impacts including higher noise levels, minor amounts of sediment eroding into the river, and minor amounts of impaired air quality due to dust and vehicle exhausts from equipment using fossil fuels. These negative impacts can be mitigated by providing energy-efficient equipment for all new facilities, complying with current watershed development ordinances for all new construction, and requiring mitigation measures to control site erosion.

Long-term detrimental impacts with Options 2 will include the utilization of natural gas and electric power. The beneficial impacts from all three options include improvements in the groundwater and surface water quality, especially in the Fox River. The treatment plant effluent will continue to be a high quality water resource to the river. The long term operation of any of the three options will not increase odors, artificial lighting or noise conditions in the area.

Proposed facilities of Option 2 will be adequately protected from the 100-year flood elevation. Existing facilities that are subject to damage from floods will be flood-proofed.

The Illinois Department of Natural Resources (IDNR) has been contacted for information on potential rare or endangered species of plants and animals at the plant site. While our contact with the IDNR agency was a request for information and not an official consultation, they did indicate that there were no records within the Natural Heritage database of a State listed threatened or endangered species, Illinois Natural Area Inventory sites, dedicated Illinois Nature Preserves, or registered Land and Water Reserves. A copy of their response is included in the appendices of the 2005 Master Planning Report.

The Illinois Historic Preservation Agency and the Federal Fish & Wildlife Service were also contacted, for their input. Both agencies requested that a study be performed on the site, and were subsequently satisfied with the report findings. Their comments are attached in the appendices of the 2005 Master Planning Report that was referenced earlier.

5.1.2. Sludge Disposal

The treatment process included with Option 2 will produce digested sludge from its processes. Disposal of digested sludge on agricultural field provides significant environmental benefits to the soil. The material is applied onto or below the surface of land to take advantage of the soil enhancing qualities of the sewage sludge. Land applied sewage sludge improves the structure of the soil while supplying nutrients to crops and other vegetation grown in the soil. Digested sludge has low odor levels, does not volatilize to the atmosphere, and will not attract insects, rodents, or other undesirable life forms.

Option 2 will not require the construction of new sludge digestion tankage over what has been proposed in the 2005 Master Planning Report, but all solids options considered will require some pipeline and other miscellaneous construction that will disturb the earth, and temporarily cause dust, noise and the potential of erosion. Adverse long-term environmental impacts include increased energy consumption for sludge digestion, de-watering, and handling prior to agricultural application.

5.1.3. Pump Station and Force main

As with the wastewater treatment plant impacts, the majority of the environmental impacts will be temporary and therefore stem from the construction of force main, pumping, or storage facilities. The pipeline, Pump Station, and / or Storage Facilities-site construction activities will create some adverse impacts including higher noise levels, minor amounts of sediment eroding into the river, and minor amounts of impaired air quality due to dust and vehicle exhausts from equipment using fossil fuels. These negative impacts can be mitigated by providing energy-efficient equipment for all new facilities, complying with current watershed development ordinances for all new construction, and requiring mitigation measures to control site erosion.

Long-term detrimental impacts with Options 2 or 3 will include utilization of natural gas and electric power. The beneficial impacts from all three options include improvements in the groundwater and surface water quality, especially in the Fox River. The long term operation of the proposed storage and pumping improvements will not increase odors, lighting or noise conditions in the area.

Proposed facilities at the pumping stations and/or flow equalization basins will be adequately protected from the 100-year flood elevation.

5.2 Cost Effective Analysis

The economic characteristics associated with each of the three alternatives for addressing the future sanitary wastewater conveyance need of the two major interceptors are evaluated in this subsection. The analysis of these economic characteristics includes the initial construction costs described in Section 4, and Salvage Values and O&M costs over twenty (20) years of service. The costs associated with treatment, pump stations and pipelines are based on sizes to meet the demands for the year 2025.

The present worth and average annual equivalent costs associated with each alternative were determined to provide a consistent standard for comparison of the comprehensive costs. The discount rate of 8% was used to determine the present worth values.

5.2.1. Capital Cost Opinions

As discussed above, the cost opinions for each option are included in Section 4.

5.2.2. Estimated Operation and Maintenance Costs

The calculations for operation and maintenance cost data for Option 2 (Transport & Treat) and Option 3 (Flow Equalization Basins) are listed below.

TABLE 5-1

OPTION 2 - TRANSPORT & TREAT

OPERATION & MAINTAINENANCE COSTS

North Aurora Interceptor @ Reckinger Road							
	Pump Station	WWTP Hdwrk	Scdy Trtmt	Filt Equip	Sldg Thk	Digst	Sldg Dwtr
Labor (Hours / Week)							
Checks, Maintenance and Records	3	1.5	2	1.5	1.5	1.5	1.5
Cleaning	1	1.5	1	1.5	1.5	1	1.5
Operational Oversight (Sampling/Screening Disposal/Equip. Startup/Etc.)		2	2	1	2.5	2	2.5
Process Control (Wasting Rt., Polymer, Misc., Etc.)		0.5	3	1	1.5	2.5	1.5
MRO / IEPA Correspondence	2						
Travel, Admin., Miscellaneous	4						
Sub-Total per Process	10	5.5	8	5	7	7	7
Total Labor Hours	50						
Annual Cost @ $48/HR - Design Condition	**$123,552**						
Electric (See Attached Worksheet)							
Approx. Annual Cost at Design Conditions	$2,500	$1,600	$7,179	$1,143	$111	$8	$135
Annual Cost @ Design Condition	**$12,676**						
Operating Supplies/Services							
Includes Chemicals, Analytical Reagents, Equip. and Glassware, Office Equipment, Etc.	**$7,500**						
Miscellaneous / Contingency	**$5,000**						
Outside Services (Engineering, Legal, Lab, Etc.)	**$7,500**						
Administration	**$3,000**						
Total Annual O&M Costs at Design Condition	$159,228						
Period for Present Worth Evaluation	20						
Interest Rate for Present Worth Evaluation	0.08						
Present Worth of Annualized Costs	**$1,563,324**						

TABLE 5-2

OPTION 2 - TRANSPORT & TREAT (Cont'd)

OPERATION & MAINTAINTENANCE COSTS

Waubonsie Interceptor @ Farnsworth Ave.	Pump Station	WWTP Hdwks	Scdry Trmt	Filt. Equip.	Sldg Thck	Digst	Sldg Dwtr
Labor (Hours / Week)							
Checks, Maintenance and Records	3	1.5	2	1.5	1.5	1.5	1.5
Cleaning	1	1.5	1	1.5	1.5	1	1.5
Operational Oversight (Sampling/Screening Disposal/Equip. Startup/Etc.)		2	2	1	2.5	2	2.5
Process Control (Wasting Rt., Polymer, Misc., Etc.)		0.5	3	1	1.5	2.5	1.5
MRO / IEPA Correspondence	2						
Travel, Admin., Miscellaneous	4						
Sub-Total per Process	$10	5.5	8	5	7	7	7
Total Labor Hours	$50						
Annual Cost @ $48/HR - Design Condition	$123,552						
Electric (See Attached Worksheet)							
Approx. Annual Cost at Design Conditions	$3,288	$2,087	$9,782	$1,239	$112	$8	$166
Annual Cost @ Design Condition	$16,682						
Operating Supplies/Services							
Includes Chemicals, Analytical Reagents, Equip. and Glassware, Office Equipment, Etc.	$7,500						
Miscellaneous / Contingency	$5,000						
Outside Services (Engineering, Legal, Lab, Etc.)	$7,500						
Administration	$3,000						
Total Annual O&M Costs at Design Condition	**$163,234**						
Period for Present Worth Evaluation	20						
Interest Rate for Present Worth Evaluation	0.08						
Present Worth of Annualized Costs	**$1,602,655**						

Total Present Worth of Option 2 - Annualized Costs **$3,165,979**

TABLE 5-3

OPTION 3 - FLOW EQUALIZATION BASINS

OPERATION & MAINTAINENANCE COSTS

North Aurora Interceptor @ Reckinger Road	General	Headworks	Equipment
Labor (Hours / Week)			
Checks, Maintenance and Records	1	2	2
Cleaning	1	1.5	1
Operational Oversight (Sampling/Screening Disposal/Equip. Startup/Etc.)		1	2
MRO / IEPA Correspondence	1		
Travel, Admin., Miscellaneous	2		
Sub-Total per Process	5	4.5	5
Total Labor Hours	14.5		
Annual Cost @ $48/HR - Design Condition	$36,192		
Electric (See Attached Worksheet)			
Approx. Annual Cost at Design Conditions	$21,600	$2,500	$2,800
Annual Cost @ Design Condition	$26,900		
Operating Supplies / Services			
Miscellaneous / Contingency	$5,000		
Outside Services (Engineering, Legal, Lab, Etc.)	$7,000		
Administration	$3,000		
Total Annual O&M Costs at Design Cond.	**$78,092**		
Period for Present Worth Evaluation	20		
Interest Rate for Present Worth Evaluation	0.08		
Present Worth of Annualized Costs	**$766,719**		

TABLE 5-4

OPTION 3 - FLOW EQUALIZATION BASINS (Cont'd)

OPERATION & MAINTAINTENANCE COSTS

Waubonsie Interceptor @ Farnsworth Ave.	General	Headworks	Equipment
Labor (Hours / Week)			
Checks, Maintenance and Records	1	3	2
Cleaning	1	1.5	1
Operational Oversight (Sampling/Screening Disposal/Equip. Startup/Etc.)		2	2
MRO / IEPA Correspondence	2		
Travel, Admin., Miscellaneous	4		
Sub-Total per Process	8	6.5	5
Total Labor Hours	19.5		
Annual Cost @ $48/HR - Design Condition	**$48,672**		
Electric (See Attached Worksheet)			
Approx. Annual Cost at Design Conditions	$19,600	$3,300	$1,200
Annual Cost @ Design Condition	**$24,100**		
Operating Supplies / Services			
Miscellaneous / Contingency	**$5,000**		
Outside Services (Engineering, Legal, Lab, Etc.)	**$7,000**		
Administration	**$3,000**		
Total Annual O&M Costs at Design Condition	**$87,772**		
Period for Present Worth Evaluation	20		
Interest Rate for Present Worth Evaluation	0.08		
Present Worth of Annualized Costs	**$861,758**		

Total Present Worth of Option 3 – Annualized Costs - **$1,628,477**

Option 1 is not considered to have operation and maintenance costs that will be included in this analysis.

5.2.3. Estimated Salvage Values

Salvage value will be calculated for any lands purchased or new improvements made for this project that are expected to have value at the end of the planning period. Land acquisition will be necessary for the pumping stations and storage facilities sites. Where improvements can be expected to continue to fulfill their planned use at the end of the planning period, salvage value will be assigned. Salvage value will based upon on the remaining service life of the improvements and calculated on straight line depreciation.

The salvage values of the constructed facilities were roughly based on the following useful life estimations:

1. Sewers	100	years
2. Concrete Structures	50	years
3. Equipment	20	years
4. Roadways	50	years
5. Miscellaneous	20 – 40	years

In a situation where there is a salvage value, or future value at the end of the useful life of an asset, the result is to decrease the equivalent uniform annual cost (EUAC). The present worth of the salvage value is subtracted from the sum of the initial cost of the project plus the present worth of the cost of operation. Salvage values are an important factor when calculating cost-effectiveness of an option, but should not be used if calculating cash flow requirements.

The following salvage values have been prepared to assist in the comparison of options.

OPTION 1

For the purposes of this study the salvage value of Option 1 for both drainage basins will be considered to be 25% of the original capital cost. Therefore the two basins are calculated as follows:

North Aurora Interceptor:

Salvage Value = $47,687,065 x 25% = $11,921,766

Waubonsie Interceptor:

Salvage Value = $45,982,630 x 25% = $11,495,658

TOTAL SALVAGE VALUE OF OPTION 1 = **$23,417,424**

OPTION 2

The salvage values of Option 2 are calculated in Table 5-5 and Table 5-6.

OPTION 3

The salvage values of Option 3 are calculated in Table 5-7 and Table 5-8.

TABLE 5-5

SALVAGE VALUE – OPTION 2

TRANSPORT & TREAT - NORTH AURORA INTERCEPTOR

COST OPINION				SALVAGE VALUE At 20 YEARS	
Item/Description		**Extension**	**Totals**	**Life (Yrs)**	**Salvage Value**
1 Collection Point					
a.	Splitter Box w / Adjustable Weir and Bar-Screen	$155,000		50	**$93,000**
b.	Gravity Sewer - 30"	$75,000		100	**$60,000**
c.	Manhole - 72"	$3,000		50	**$1,800**
d.	Site work	$15,000		50	**$9,000**
e.	Misc.	$37,200		30	**$12,400**
		sub-total	$285,200		
2 Raw Sewage Pump Station					
a.	Building & Concrete	$1,080,000		50	**$648,000**
b.	Raw Sewage Pumps (11,600 gpm)	$525,000		20	**$0**
c.	Piping, Gates, Valves, & Miscellaneous	$636,631		50	**$381,978**
d.	Scada Modifications	$15,000		20	**$0**
e.	Electrical	$338,495		50	**$203,097**
f.	Bridge Cranes & Trolley Hoists	$165,000		35	**70,714**
g.	Ultrasonic Flow meter	$30,000		20	**0**
h.	Site work	$183,944		50	**$110,367**
i.	Misc	$446,110		30	**$148,703**
		sub-total	$3,420,180		
3 Force main					
a.	DIP Force main (36")	$40,050,000		50	**$24,030,000**
b.	Misc.	$6,007,500		30	**$2,002,500**
		sub-total	$46,057,500		
4 Wastewater Treatment Plant					
a.	WWTP	$106,190,000		50	**$63,714,000**
b.	Misc.	$15,928,500		30	**$5,309,500**
		sub-total	$122,118,500		
Total Estimated Construction Cost			**$171,881,380**		
Total Estimated Engineering Fees			**$42,970,345**		
Total Estimated Contingencies					
a.	Legal and Administrative		**$8,594,069**		
b.	Land & Easements		**$2,500,000**		**$ 2,500,000**
c	Construction Interest		**$16,945,935**		
Total Estimated Project Cost			**$242,891,729**		
			Salvage Value =		$ 99,295,060

TABLE 5-6

SALVAGE VALUE – OPTION 2

TRANSPORT & TREAT - WAUBONSIE INTERCEPTOR

COST OPINION				SALVAGE VALUE AT 20 YEARS	
Item/Description		**New Value**	**Totals**	**Life YRS**	**Salvage Value**
1	Collection Point				
a.	Splitter Box w / Adjustable Weir and Bar-Screen	$155,000		50	**$93,000**
b.	Gravity Sewer - 36"	$78,750		100	**$63,000**
c.	Manhole - 72"	$3,000		100	**$2,400**
d.	Site work	$15,000		50	**$9,000**
e.	Misc	$37,763		30	**$12,588**
		sub-total	$289,513		
2	Raw Sewage Pump Station				
a.	Building & Concrete	$1,224,000		50	**$734,400**
b.	Raw Sewage Pumps (15,600 gpm)	$525,000		20	**$0**
c.	Piping, Gates, Valves, & Miscellaneous	$687,031		50	**$412,218**
d.	Scada Modifications	$15,000		20	**$0**
e.	Electrical	$367,655		50	**$220,593**
f.	Bridge Cranes & Trolley Hoists	$165,000		35	**$70,714**
g.	Ultrasonic Flow meter	$30,000		20	**$0**
h.	Site work	$183,944		50	**$110,367**
i.	Misc	$479,644		30	**$159,881**
		sub-total	$3,677,274		
3	Force main				
a.	DIP Force main (42")	$15,444,000		100	**$12,355,200**
b.	Misc.	$2,316,600		30	**$772,200**
		sub-total	$17,760,600		
4	Wastewater Treatment Plant				
a.	WWTP	$156,800,000		50	**$94,080,000**
b.	Misc.	$23,520,000		30	**$7,840,000**
		sub-total	$180,320,000		
Total Estimated Construction Cost			**$202,047,387**		
Total Estimated Engineering Fees			**$50,511,847**		
Total Estimated Contingencies					
a.	Legal and Administrative		**$10,102,369**		
b.	Land & Easements		**$2,500,000**		**$2,500,000**
c	Construction Interest		**$19,887,120**		
Total Estimated Project Cost			**$285,048,723**		
			SALVAGE VALUE		$119,435,561

The total salvage value for Option 2 can be determined by adding $99,295,060 (Table 5-5) plus $119,435,561 (Table 5-6) which equals **$218,740,621**.

TABLE 5-7

SALVAGE VALUE – OPTION 3

FLOW EQUALIZATION BASIN - NORTH AURORA INTERCEPTOR

COST OPINION					SALVAGE VALUE AT 20 YEARS	
Item / Description			**Future Value**	**Totals**	**Life (Yrs)**	**Salvage Value**
1	Equipment Cost, in place					
	a.	Tipping Buckets	$980,000		20	$0
	b.	Raw Sewage Pumps	$534,000		20	$0
	c.	Odor Control Equipment (scrubber)	$475,000		20	$0
	d.	Scada Modifications	$15,000		20	$0
	e	Aluminum Railing	$140,000		20	$0
	f	Pre-packaged Plant Water System	$60,000		20	$0
	g	Fiberglass Stop Plates	$32,400		20	$0
	h	Sluice Gates	$630,000		20	$0
	i	Aerators	$351,000		20	$0
	j	Bridge Cranes & Trolley Hoists	$165,000		35	$70,714
	k	Ultrasonic Flow meter	$30,000		20	$0
	l	Piping, Gates, Valves, & Misc.	$696,150		50	$417,690
			sub-total	$4,108,550		
2	Concrete					
	a.	Influent / Effluent Channel	$416,100		50	$249,660
	b.	Storage Basins	$3,310,739		50	$1,986,443
	c.	Raw Sewage Pump Station	$442,167		50	$265,300
			sub-total	$4,169,006		
3	Buildings					
	a.	Pump Station Building				
		2-stry Splt Fcd Block Bldg	$435,000		50	$261,000
		mechanical	$108,750		50	$65,250
		electrical	$81,563		50	$48,938
	b.	Storage Building	$0			
		Split Faced Block Building	$3,085,640		50	$1,851,384
		mechanical	$1,079,974		50	$647,984
			$624,842			
			sub-total	$5,415,769		
4	Site work					
	a.	Dewatering	$20,000		20	$0
	b.	Erosion Control	$25,000		20	$0
	c.	Grading & Seeding	$35,000		20	$0
	d	Influent Structure	$25,000		50	$15,000
	e	Effluent Structure	$20,000		50	$12,000
	f	48" DIP	$92,500		100	$74,000
	g.	18" DIP	$18,000		100	$14,400
	h	15" DIP	$48,000		100	$38,400
	i	Deep Manhole (5' Dia)	$7,000		100	$5,600
			sub-total	$290,500		
5	Miscellaneous Construction		$2,097,574		30	$699,191
			sub-total	$2,097,574		

Table 5-7 Cont'd				
Total Estimated Construction Cost		**$16,081,398**		
Total Estimated Engineering Fees		**$4,020,349**		
Total Estimated Contingencies				
a. Legal and Administrative		**$804,070**		
b. Land & Easements		**$2,000,000**		**$2,000,000**
c Construction Interest		**$1,145,291**		
Total Estimated Project Cost		**$24,051,108**		
		Salvage Value =		$8,722,955

TABLE 5-8

SALVAGE VALUE – OPTION 3

FLOW EQUALIZATION BASIN

WAUBONSIE INTERCEPTOR @ FARNSWORTH AVE.

COST OPINION						SALVAGE VALUE AT 20 YEARS	
Item/Description				New Value	Totals	Life (Yrs)	Salvage Value
1	Equipment Cost, in place						
	a.	Tipping Buckets		$980,000		20	$0
	b.	Raw Sewage Pumps		$534,000		20	$0
	c.	Odor Control Equipment (scrubber)		$475,000		20	$0
	d.	Scada Modifications		$15,000		20	$0
	e	Aluminum Railing		$140,000		20	$0
	f	Pre-packaged Plant Water System		$60,000		20	$0
	g	Fiberglass Stop Plates		$32,400		20	$0
	h	Sluice Gates		$630,000		20	$0
	i	Aerators		$351,000		20	$0
	j	Bridge Cranes & Trolley Hoists		$165,000		35	$70,714
	K	Ultrasonic Flow meter		$30,000		20	$0
	l	Piping, Gates, Valves, & Misc.		$696,150		50	$417,690
				sub-total	$4,108,550		
2	Concrete						
	a.	Influent / Effluent Channel		$416,100		50	$249,660
	b.	Storage Basins		$3,310,739		50	$1,986,443
	c.	Raw Sewage Pump Station		$442,167		50	$265,300
				sub-total	$4,169,006		
3	Buildings						
	a.	Pump Station Building					
			2-stry Splt Fcd Block Bldg	$435,000		50	$261,000
			mechanical	$108,750		50	$65,250
			electrical	$81,563		50	$48,938
	b.	Storage Building					
			Split Faced Block Bldg	$3,085,640		50	$1,851,384
			mechanical	$1,079,974		50	$647,984
				$624,842			
				sub-total	$5,415,769		
4	Site work						
	a.	Dewatering		$20,000		20	$0
	b.	Erosion Control		$25,000		20	$0
	c.	Grading & Seeding		$35,000		20	$0
	d	Influent Structure		$25,000		50	$15,000
	e	Effluent Structure		$20,000		50	$12,000
	f.	60" PCCP		$117,500		100	$94,000

TABLE 5-8 Cont'd				
g. 18" DIP	$18,000		100	**$14,400**
h 15" DIP	$48,000		100	**$38,400**
i Deep Manhole (5' Dia)	$7,000		100	**$5,600**
	sub-total	$315,500		
5 Miscellaneous Construction	$2,101,324		30	**$700,441**
	sub-total	$2,101,324		
Total Estimated Construction Cost		**$16,110,148**		
Total Estimated Engineering Fees		**$4,027,537**		
Total Estimated Contingencies				
a. Legal and Administrative		**$805,507**		
b. Land & Easements		**$1,000,000**		**$1,000,000**
c Construction Interest		**$1,097,160**		
Total Estimated Project Cost		**$23,040,352**	**Salvage Value =**	**$7,744,205**

The total salvage value for Option 3 can be determined by adding $ 8,722,955 (Table 5-7) plus $ 7,744,205 (Table 5-8) which equals **$16,467,160.**

5.2.4. Work Sheets for Cost Effective Analysis

The calculations for the cost effective analysis for all three (3) options are listed below for both interceptors. The first two tables (Table 5-9 & Table 5-10) are for Option 1 – Sewer Rehabilitation for both interceptors.

TABLE 5-9

Cost Effective Analysis
Option 1
North Aurora Interceptor

Rehabilitate 16,703 Acres of Sewered Area			
Given:			
1	Planning Period	20	
2	Interest Rate	8%	
3	Capital Cost	$47,687,065	
4	Salvage Value (2025)	$11,921,766	
5	Operational Costs / Year	$0	
6	Operational Cost Increase / Yr	$0	
7	Land Costs	$0	
A.	**Present Worth Calculation**		
1	Initial Cost		$47,687,065
2	Present Worth of Operational Costs		
	Operational Costs		$0
	Variable Costs		$0
	TOTAL		$0
3	Present Worth of Salvage Value		($2,557,794)
4	TOTAL PRESENT WORTH	=	**$45,129,271**
B.	**Average Annual Equivalent Cost**		
	(Present Worth x Capital Recovery Factor)		
	$45,129,271 * ((0.08) * 1.08^20) / ((1.08^20) - 1)		
		=	**$4,596,516**

TABLE 5-10

Cost Effective Analysis
Option 1
Waubonsie Interceptor

Rehabilitate 16,106 Acres of Sewered Area			
Given:			
1	Planning Period	20	
2	Interest Rate	8%	
3	Capital Cost	$45,982,630	
4	Salvage Value (2025)	$11,495,658	
5	Operational Costs / Year	$0	
6	Operational Cost Increase / Yr	$0	
7	Land Costs	$0 **	
	** Included in Salvage Value		
A.	**Present Worth Calculation**		
1	Initial Cost		$45,982,630
2	Present Worth of Operational Costs		
	Operational Costs		$0
	Variable Costs		$0
	TOTAL		$0
3	Present Worth of Salvage Value		($2,466,373)
4	**TOTAL PRESENT WORTH**	=	**$43,516,257**
B.	**Average Annual Equivalent Cost**		
	(Present Worth x Capital Recovery Factor)		
	$43,516,257 * ((0.08) * 1.08^20) / ((1.08^20) - 1)		
		=	**$4,432,227**

The total average annual equivalent cost for Option 1 can be determined by adding $4,596,516 (Table 5-9) plus $4,432,227 (Table 5-10) which equals **$9,028,743.**

The next two tables (Table 5-11 & Table 5-12) are the calculation of average annual equivalent cost for Option 2 – Transport & Treat, for the North Aurora and the Waubonsie Interceptors.

TABLE 5-11

Cost Effective Analysis
Option 2
North Aurora Interceptor

Transport and Treat 16.7 MGD				
Given:				
1	Planning Period	20		
2	Interest Rate	8%		
3	Capital Cost (without land costs)	$242,891,729		
4	Salvage Value (2025)	$99,295,060		
5	Operational Costs / Year	$159,228		
6	Operational Cost Increase / Yr	$0		
7	Land Costs	$2,500,000	**	
	** Included in Salvage Value			
A.	**Present Worth Calculation**			
1	Initial Cost			$242,891,729
2	Present Worth of Operational Costs			
	Operational Costs			$1,563,324
	Variable Costs			$0
	TOTAL			$1,563,324
3	Present Worth of Salvage Value			($21,303,577)
4	**TOTAL PRESENT WORTH**	=		**$223,151,476**
B.	**Average Annual Equivalent Cost**			
	(Present Worth x Capital Recovery Factor)			
	$223,151,476 * ((0.08) * 1.08^20) / ((1.08^20) - 1)			
		=		**$22,728,471**

TABLE 5-12

Cost Effective Analysis
Option 2
Waubonsie Interceptor

Transport and Treat 22.4 MGD				
Given:				
1	Planning Period	20		
2	Interest Rate	8%		
3	Capital Cost	$285,048,723	*	
4	Salvage Value (2025)	$119,435,561		
5	Operational Costs / Year	$163,234		
6	Operational Cost Increase / Yr	$0		
7	Land Costs	$2,500,000	**	
	* Land Costs Not Included			
	** Included in Salvage Value			
A.	**Present Worth Calculation**			
1	Initial Cost			$285,048,723
2	Present Worth of Operational Costs			
		Operational Costs		$1,602,655
		Variable Costs		$0
	TOTAL			$1,602,655
3	Present Worth of Salvage Value			($25,624,557)
4	**TOTAL PRESENT WORTH** =			**$261,026,693**
B.	**Average Annual Equivalent Cost**			
	(Present Worth x Capital Recovery Factor)			
	$261,026,693 * ((0.08) * 1.08^20) / ((1.08^20) - 1)			
		=		**$26,586,145**

The total average annual equivalent cost for Option 2 can be determined by adding $22,728,471 (Table 5-11) plus $26,586,145 (Table 5-12) which equals **$49,314,616.**

The next two tables (Table 5-13 & Table 5-14) are the calculation of average annual equivalent cost for Option 3 – Flow Equalization Basins, for the North Aurora and the Waubonsie Interceptors.

TABLE 5-13

Cost Effective Analysis
Option 3
North Aurora Interceptor

Flow Equalization Basin - 6.4 MG				
Given:				
1	Planning Period	20		
2	Interest Rate	8%		
3	Capital Cost	$24,051,108	*	
4	Salvage Value (2025)	$8,722,955		
5	Operational Costs / Year	$78,092		
6	Operational Cost Increase / Yr	$0		
7	Land Costs	$2,000,000	**	
	* Land Costs Not Included			
	** Included in Salvage Value			
A.	**Present Worth Calculation**			
1	Initial Cost			$24,051,108
2	Present Worth of Operational Costs			
	Operational Costs			$766,719
	Variable Costs			$0
	TOTAL			$766,719
3	Present Worth of Salvage Value			($1,871,494)
4	**TOTAL PRESENT WORTH**		=	**$22,946,332**
B.	**Average Annual Equivalent Cost**			
	(Present Worth x Capital Recovery Factor)			
	$22,946,332 * ((0.08) * 1.08^20) / ((1.08^20) - 1)			
			=	**$2,337,135**

TABLE 5-14

Cost Effective Analysis
Option 3
Waubonsie Interceptor

Flow Equalization Basin - 6.4 MG				
Given:				
1	Planning Period	20		
2	Interest Rate	8%		
3	Capital Cost	$23,040,352		
4	Salvage Value (2025)	$7,744,205		
5	Operational Costs / Year	$87,772		
6	Operational Cost Increase / Yr	$0		
7	Land Costs	$1,000,000	**	
	** Included in Salvage Value			
A.	**Present Worth Calculation**			
1	Initial Cost			$23,040,352
2	Present Worth of Operational Costs			
	Operational Costs			$861,758
	Variable Costs			$0
	TOTAL			$861,758
3	Present Worth of Salvage Value			($1,661,505)
4	**TOTAL PRESENT WORTH**	=		**$22,240,605**
B.	**Average Annual Equivalent Cost**			
	(Present Worth x Capital Recovery Factor)			
	$23,041,372 * ((0.08) * 1.08^20) / ((1.08^20) - 1)			
			=	**$2,265,255**

The total average annual equivalent cost for Option 3 can be determined by adding $2,337,135 (Table 5-13) plus $2,265,255 (Table 5-14) which equals **$4,602,389.**

6.0 SELECTION OF PREFERRED OPTION

6.1 Method for Evaluation of Alternatives

The selection and analysis of a wastewater collection system requires both theoretical knowledge and practical experience. Specific objectives can be achieved by creating a combination of peak extraneous flow controlling options that are developed with that knowledge and experience.

The major elements involved in selecting appropriate alternatives for controlling extraneous flows include 1) meeting the needs of the owners, 2) past experience, 3) regulatory agency requirements, 4) sewer system modeling and hydraulic analysis, 5) compatibility with existing facilities, 6) cost considerations, 7) environmental considerations, and 8) other important considerations such as personnel, energy, and equipment.

6.2 Ranking of the Options

The selection of a plan will involve making reasoned choices among the alternatives based upon the display of all significant costs and effects of each. The process of choosing the most cost-effective option will recognize that cost-effectiveness includes more than monetary costs. It will give appropriate credit to environmental costs and social costs as well. Other factors including public acceptance, reliability, permitting obstacles, and plan implementation must also influence the plan selection. The display of all significant costs will aid in identifying tradeoffs between the alternatives and will facilitate effective involvement in the selection process of representatives of concerned interest groups and organizations. Receiving a broad range of perceptions of relative values is essential to obtain a general agreement on the best plan and the measures needed for plan implementation.

The following figures have been prepared to display the costs and effects of the peak extraneous flow reducing options in quantitative terms. The evaluation of each option regarding environmental impact and water quality impact will be ranked with:

+	=	improvement
-	=	adverse effect
N	=	no effect
T	=	temporary effect
U	=	unknown

Under monetary costs, the implementation capability, energy and resource use, and reliability of the options are ranked from 1 to 4, with 4 being the lowest ranking.

TABLE 6-1

RANKING OF OPTIONS

SIGNIFICANT EFFECTS					
		Options	**1**	**2**	**3**
1.	Environmental Effects				
	a.	Aquatic biota	+	-	+
	b.	Terrestrial	N	N	N
	c.	Wildlife Habitat	N	N	N
	d.	Cultural areas	N	N	N
	e.	Groundwater and Surface Water Pollution	+	+	+
	f.	Air Pollution	T	T	T
	g.	Aesthetics, noise, odor, and dust	T	T	T
	h.	Land Use	N	N	N
	i.	Social factors	N	N	N
2.	Monetary Costs				
	a.	Capital	2	3	1
	b.	Operational	1	3	2
	c.	Average Annual Equivalent Cost	2	3	1
3.	Contributions to Water Quality Objectives		1	1	1
4.	Implementation Capabilities		2	4	1
5.	Energy and Resource Use		1	3	3
6.	Reliability (Plant upsets, spills, and CSO overflows)		2	1	1
7.	Expandability		1	1	1
	Composite Ranking		**1.5**	**2.4**	**1.4**

Option 3 has the advantage over Options 1 and 2 and will be the recommended option.

6.3 Summary of Selected Plan

The recommended plan for providing the reduction of peak extraneous flows for the North Aurora and Waubonsie Interceptors is as selected above and defined previously, with Option 3 (Flow Equalization Basins).

6.3.1. Reasons for Selection

Option 3

All three options would be acceptable in accomplishing the stated objectives for the reduction of flows to the wastewater treatment plant. The identified primary differences include the capital cost, average annual equivalent cost, environmental effects, implementation capability, reliability, and expandability.

The reasons for selecting Option 3 are discussed in the following paragraphs:

6.3.1.1. Environmental Effects

The plant discharge to the Fox River will continue to be at the same location of the current discharge point, which will minimize adverse impacts to the river bank and the aquatic life habitat. The proposed plant improvements will not discharge more water or increase the organic loading to the river.

New facility improvements will be planned on the property at elevations well above the Fox River level in the upper reaches of the collection system. That will minimize the adverse impacts to wetlands and floodplain areas.

6.3.1.2. Monetary Costs

Option 3 is substantially less costly than the other options.

6.3.1.3. Contribution to Water Quality Objectives

All three options would help meet the water quality objectives by reducing the peak hour flow to the wastewater treatment plant by 39 MGD. As a result of that improvement, a larger fraction of the wastewater received at the plant will receive full treatment.

6.3.1.4. Implementation Capabilities

The complex process of siting, designing and constructing the new satellite storage facilities can be carried out without interfering with or jeopardizing the full operation of the existing wastewater treatment plant or the existing pump stations.

6.3.1.5. Reliability

Option 3 will essentially be operated in a similar manner to the existing CSO Treatment Plant located at 400 North Broadway in Aurora. The maintenance staff is very comfortable and efficient with that process operation. Option 3 is a tried and proven process with which the regulatory agencies and the public are confident.

6.3.1.6. Expandability

The best plan for expandability lies in Option 3. The site will be designed to accommodate additional storage cells with little or no pumping station changes.

6.3.1.7. Public Interests and Concerns

The selected plan will have a beneficial impact on the homes within the drainage basin by reducing the potential for back-ups into basements. The goal of any sewer rehabilitation program is to prepare a cost-effective approach for the simultaneous protection of the collection system and the public's health and safety.

6.3.2. Environmental Impacts of Selected Plan

The adverse environmental impacts associated with the selected plan are primarily limited to temporary impacts during construction of the wastewater treatment plant improvements. The potential for adverse impacts of a more permanent nature have been reduced with improved peak flow controlling facilities. Because the wastewater treatment plant effluent will continue to grow as a major water resource to the river, the improved effluent quality from these improvements will have a positive environmental impact to the water quality of the Fox River..

6.4 Financial Considerations

6.4.1. General

The FMWRD currently serves approximately 73,000 residential, commercial, industrial and institutional patrons. The User Charge rate for all patrons is currently $2.20 per 1000 gallons of water used. New hook-up fees are collected at the rate of $750 per new connection. In addition, non-operating fees are collected from the municipalities served known as Annexation fees and Infrastructure Participation (IFP) fees that are intended to fund the capital costs of Wastewater Treatment and Trunk Main construction, respectively.

The average monthly water usage per meter has been 7,840 gallons. The projected operating income for the FMWRD in 2005 is estimated at approximately $15,100,000. The average sewer use charge per patron has therefore been about $17 per month.

The user charges cover the operation and maintenance costs of the total system, debt service charges for bonded debt and existing State Revolving Fund Loans (SRF), and the funding of reserve accounts.

6.4.2. Financial Impact of Selected Plan

The FMWRD may choose to finance the project in a number of ways. Both Bonds and the low-interest SRF loan program have been used to fund past projects. Regardless of the financing method, the project can be phased to spread the revenue requirements over a longer period of time. That method will allow the patron base to continue growing, which in-turn will minimize the impact of rate increases for future phases. A rate study is currently underway by others for the purpose of reviewing the current revenue requirements and to forecast the necessary rate increase to accommodate any new improvements.

6.5 Implementation Of Selected Plan

6.5.1. Phased Construction Plan

Due to the desire of the FMWRD to control increases in user charges, a phased construction of the selected plan could be implemented. The phased construction plan includes the following components:

1. Phase 1 – On line by 2010

   Complete all site work, pump station, underground piping, and 4 storage basins for the Reckinger Road Storage Facility.

2. Phase 2 –.On line by 2012

   Complete 4 storage basins for the Reckinger Road Storage Facility.

   Complete all site work, pump station, underground piping, and 4 storage basins (with building and equipment) for the Waubonsie Storage Facility.

3. Phase 3 –.On line by 2014

Complete 4 storage basins for the Reckinger Road Storage Facility.

Complete 4 storage basins (with building and equipment) for the Waubonsie Storage Facility.

4. Phase 4 –.On line by 2017

Complete 6 storage basins for the Reckinger Road Storage Facility.

Complete 4 storage basins for the Waubonsie Storage Facility.

5. Phase 5 –.On line by 2018

Complete 6 storage basins for the Waubonsie Storage Facility.

The sequence and schedule of the Phased improvements discussed above are very approximate, and will of course be dictated by the rate of development. However, Phase 1 improvements must be on-line by 2010 to avoid exceeding capacity during a 5-year storm event.

6.5.2. Recommendations

The following recommendations are offered to outline a plan of action for the implementation of the project:

1. FMWRD should accept and approve this Wet-Weather Facilities Study,

2. Submit report to the IEPA for their review and comments,

3. Develop a detailed financing plan to fund the Phased Construction Plan,

4. Authorize WEDA to submit the Phase 1 Drawings, specifications, and contract documents to the IEPA for review and approval,

5. Upon receipt of the IEPA approval and construction permit, bids for the Phase 1 improvements should be received, the contracts should be awarded, and the work completed,

6. The annually budgeted funding for sewer rehabilitation improvements should be maintained and implemented as before to avoid structural damage to the collection system.

LEGEND

Monitored Sanitary Sewer

Flow Monitor Locations

2025 Flow Growth Locations

MH# (xx")	5-YEAR STORM JUNE 2004	5-YEAR STORM 2025
PEAK WET WEATHER FLOW	xx mgd	xx mgd
PEAK DRY WEATHER FLOW	xx mgd	xx mgd
INFLOW	xx mgd	xx mgd
FULL PIPE CAPACITY	xx mgd	xx mgd

Projected 5-Year Flows for June 11/12, 2004.
Projected 5-Year Flows for 2025

WALTER E. DEUCHLER ASSOCIATES, INC.
Consulting Engineers — Aurora, Illinois

SHEET

OF

DATE 2/15/05

JOB NUMBER 111/04032-00

SCALE: NONE

Exhibit No. 1
North Aurora Interceptor - 2025 Flow Projections

WALTER E. DEUCHLER ASSOCIATES, INC.
Consulting Engineers — Aurora, Illinois

REVISIONS

DATE 2/15/05 | CAD DWGF: \ASD\02007-00\Waubonsie 5-year 2025 Projection | JOB NO. 111/02007-00 | DRAWN RDC

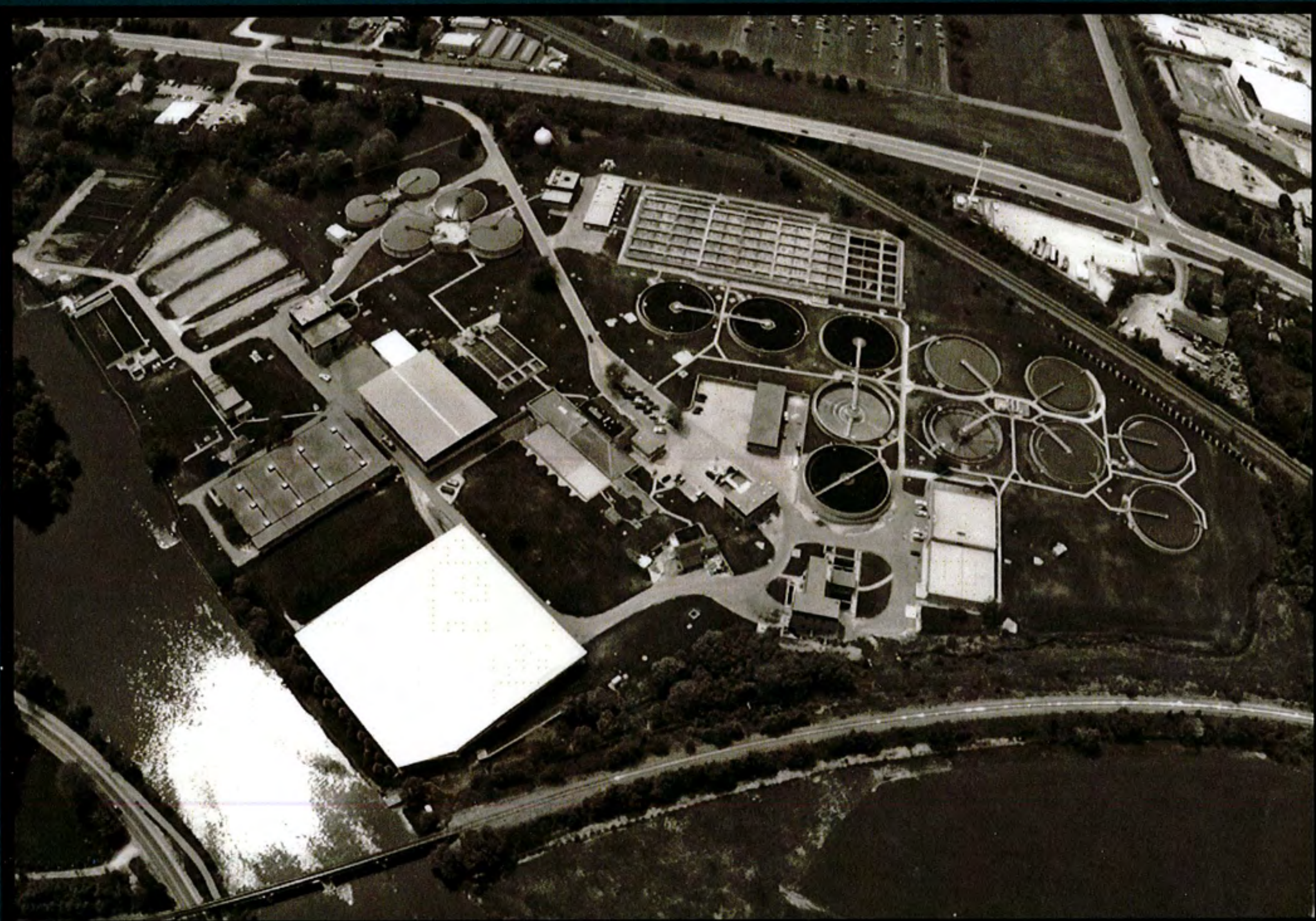
EXHIBIT No. 2
WAUBONSIE INTERCEPTOR
EXISTING SANITARY SEWER SYSTEM

APPENDIX D

2008 QAPP/AMENDMENTS TO 2009 QAPP

Fox Metro
Water Reclamation District

COMBINED SEWER OVERFLOW (CSO) LONG TERM CONTROL PLAN (LTCP) APPENDIX D



March 31, 2010

Prepared By:

Walter E. Deuchler Associates, Inc.
Consulting Engineers

QUALITY ASSURANCE PROJECT PLAN

For the Combined Sewer Overflow Long Term Control Project

NPDES Permit No. IL0020818, Special Condition 14

Prepared by

Walter E. Deuchler Associates, Inc. AND Deuchler Environmental, Inc.

for the Fox Metro Water Reclamation District

March 21, 2008

The following personnel have approved this document:

Philippe Moreau, P.E.
Project Manager

04-04-08
Date

Carrie Carter
Carrie Carter
Project Quality Assurance Officer

04.04.08
Date

TABLE OF CONTENTS

TABLES

APPENDICES

1.0 PROJECT MANAGEMENT

1.1 Distribution

Data collection and management for this project will be the responsibility of Walter E. Deuchler Associates, Inc. (WEDA) and Deuchler Environmental, Inc. (DEI). Laboratory analysis will be provided by the Fox Metro Water Reclamation District (FMWRD) and First Environmental Laboratories (Naperville, Illinois). Model selection, calibration and validation will be the responsibility of the Illinois State Water Survey (ISWS).

All of the following individuals will receive a copy of the QAPP.

TABLE 1
Distribution List

Individual	Organization
Philippe Moreau, Project Manager	WEDA
Tom Muth, District Manager	FMWRD
Randy Hummer, Lab Supervisor	FMWRD
James Slowikowski, Field Coordinator	Illinois State Water Survey (ISWS)
Alena Bartosova, Assistant Professional Scientist	ISWS
Carrie Carter, Project Engineer and Project Quality Assurance Officer	DEI
Karen Clementi, Project Scientist	DEI
Ryan Cramer, Project Engineer	WEDA
Steve Leppert, Project Technician	WEDA
Tim Rutsay, Project Technician	WEDA

1.2 Project/Task Organization

An organizational chart describing lines of communication and responsibilities for the FMWRD CSO study can be seen in **Appendix A.** **Table 2** lists individuals that will participating in this study and the role that each participant will have in this project.

TABLE 2
Roles and Responsibilities

Individual	Organization	Role	Responsibility
Philippe Moreau	WEDA	Project Manager	General oversight of project Review and revise QAPP
Carrie Carter	DEI	QA Officer	Ensure the quality of all aspects of the project
Karen Clementi	DEI	Bridge Team Leader/ Macroinvertebrates	General oversight of bridge sampling Macroinvertebrate sampling
Carrie Carter	DEI	Co-project manager/CSO Lead	Supervision of sample collection Review and revise QAPP Technical Support Manage ISCO Samplers Format data for modeling by ISWS
John Frerich	WEDA	Hydraulics Manager	General Oversight of Hydraulics Calculations
Dan Stein	WEDA	Discharge Measurements Leader	Supervison of stream gaging/velocity measurements
Randy Hummer	FMWRD	Laboratory Manager	Analyze all CSO and bridge samples (except chlorophyll a) QA/QC all laboratory data Provide data to DEI in excel format
Ryan Cramer	WEDA	Bridge Team Leader - Team 1	General oversight of bridge sampling.
Steve Leppert	WEDA	Bridge Team Leader - Team 2	General oversight of bridge sampling.
Alena Bartosova	ISWS	Project Manager Modeling Team	Provide guidance in data collection/develop models

1.3 Project Background

The Illinois Environmental Protection Agency (IEPA) *Illinois Water Quality Report 2000* (IEPA, 2000) listed parts of the Fox River in McHenry and Kane Counties as impaired. The IEPA 2002 report listed the entire length of the Fox River in Illinois as impaired. The IEPA included the Fox River on its list of impaired waters, commonly called the 303(d) list (IEPA, 2006). The most prevailing causes for the listing were flow alterations, habitat, sedimentation/siltation, dissolved oxygen, suspended solids, excess algal growth, fecal coliform and polychlorinated biphenyls. The most prevailing potentials for the listings were hydromodification and flow regulation, urban runoff and combined sewer overflows.

The City of Aurora (COA) began installing separate storm sewers in the mid-1960's, for the purpose of reducing sewage backups into residential basements and reducing combined sewer overflows into the Fox River during rain storm events. Currently, there are 14 permitted CSO outfalls (Rathbone, E. Illinois, Hazel, Third, E. Benton, First, W. Benton, Clark, Stolp, W. Galena, W. Park, Superior, W. Illinois and Pierce) discharging to the Fox River and one CSO discharging to Indian Creek (Dearborn-Trask) within the City of Aurora. There is one permitted CSO outfall at the FMWRD facility. In 1997, the COA and FMWRD built a CSO primary treatment facility for storing combined sewer overflows and treating excess flows from four of the previously mentioned CSOs prior to discharge to the river. The CSO facility is located at 400 North Broadway on the east side of Aurora.

FMWRD NPDES Permit (#IL0020818) was renewed in February 2007. As part of its permit, the FMWRD is required to develop a Long Term CSO Control Plan (LTCP). One of the components of the LTCP is to characterize, monitor and model the combined sewer system.

1.4 Project Description

This project seeks to collect data in support of characterizing potential impacts to the Fox River from the COA and FMWRD combined sewer overflows. Data collected will be used to model potential impacts to the Fox River from CSO discharges as well as simulate potential treatment alternatives. Data for characterization of the main stem will be collected at five (5) bridge locations crossing the Fox River in North Aurora, Aurora, Montgomery, and Oswego and one (1) location on Indian Creek in order to determine background conditions and to evaluate the potential water quality impact of the CSOs on the mainstem. In addition, macroinvertebrate studies will be conducted in spring, summer and fall as river levels permit, dissolved oxygen will be continuously monitored from approximately April to October, and velocity and stage measurements will be collected at select locations in order to develop a discharge rating curve. **Appendix B** includes a map of the Aurora area that shows the sampling locations for this project.

River water samples will be collected from the bridges using a depth integrating sampler for the locations on the Fox River mainstem and a Van-Dorn sampler will be used for Indian Creek sampling. Bridge sampling will be coordinated with the collection of water samples from seven (7) CSOs outfalls in order determine the concentration and loading of pollutants originating from the CSOs during overflow events. CSO samples will be collected using programmable, automated Isco samplers.

Since 2006, Hester-Dendy samplers have been used to collect data on quantity and quality of the macroinvertebrate population within the Fox River. Seven to nine locations are utilized per sampling event. Sampling locations vary slightly from year to year depending on river conditions, past vandalism and access to the locations. In 2007, there were seven sampling locations utilized. These same stations will be utilized in 2008 and are described in **Table 3.**

Since 2005, continuous dissolved oxygen data has been collected from April to October at several locations along the Fox River using a YSI sondes. In 2008, there will be three locations: Sullivan Bridge, Ashland Bridge, and the Route 34 Bridge.

Currently, there is one gauging station within the study area located at the Montgomery dam. This station is located below all the combined sewers for Aurora. Three additional gauging stations will be deployed in 2008 in order to monitor flows upstream of Aurora's CSOs and to quantify flow from the Indian Creek to the Fox River. One gauging station will be located just below the North Aurora dam, a second gauging station will be located in the mill race whose inlet is just above this dam, and third gauging station will be located on Indian Creek.

1.0 PROJECT MANAGEMENT

1.1 Distribution

Data collection and management for this project will be the responsibility of Walter E. Deuchler Associates, Inc. (WEDA) and Deuchler Environmental, Inc. (DEI). Laboratory analysis will be provided by the Fox Metro Water Reclamation District (FMWRD) and First Environmental Laboratories (Naperville, Illinois). Model selection, calibration and validation will be the responsibility of the Illinois State Water Survey (ISWS).

All of the following individuals will receive a copy of the QAPP.

TABLE 1
Distribution List

Individual	Organization
Philippe Moreau, Project Manager	WEDA
Tom Muth, District Manager	FMWRD
Randy Hummer, Lab Supervisor	FMWRD
James Slowikowski, Field Coordinator	Illinois State Water Survey (ISWS)
Alena Bartosova, Assistant Professional Scientist	ISWS
Carrie Carter, Project Engineer and Project Quality Assurance Officer	DEI
Karen Clementi, Project Scientist	DEI
Ryan Cramer, Project Engineer	WEDA
Steve Leppert, Project Technician	WEDA
Tim Rutsay, Project Technician	WEDA

1.2 Project/Task Organization

An organizational chart describing lines of communication and responsibilities for the FMWRD CSO study can be seen in **Appendix A.** **Table 2** lists individuals that will participating in this study and the role that each participant will have in this project.

TABLE 2
Roles and Responsibilities

Individual	Organization	Role	Responsibility
Philippe Moreau	WEDA	Project Manager	General oversight of project Review and revise QAPP
Carrie Carter	DEI	QA Officer	Ensure the quality of all aspects of the project
Karen Clementi	DEI	Bridge Team Leader/ Macroinvertebrates	General oversight of bridge sampling Macroinvertebrate sampling
Carrie Carter	DEI	Co-project manager/CSO Lead	Supervision of sample collection Review and revise QAPP Technical Support Manage ISCO Samplers Format data for modeling by ISWS
John Frerich	WEDA	Hydraulics Manager	General Oversight of Hydraulics Calculations
Dan Stein	WEDA	Discharge Measurements Leader	Supervison of stream gaging/velocity measurements
Randy Hummer	FMWRD	Laboratory Manager	Analyze all CSO and bridge samples (except chlorophyll a) QA/QC all laboratory data Provide data to DEI in excel format
Ryan Cramer	WEDA	Bridge Team Leader - Team 1	General oversight of bridge sampling.
Steve Leppert	WEDA	Bridge Team Leader - Team 2	General oversight of bridge sampling.
Alena Bartosova	ISWS	Project Manager Modeling Team	Provide guidance in data collection/develop models

1.3 Project Background

The Illinois Environmental Protection Agency (IEPA) *Illinois Water Quality Report 2000* (IEPA, 2000) listed parts of the Fox River in McHenry and Kane Counties as impaired. The IEPA 2002 report listed the entire length of the Fox River in Illinois as impaired. The IEPA included the Fox River on its list of impaired waters, commonly called the 303(d) list (IEPA, 2006). The most prevailing causes for the listing were flow alterations, habitat, sedimentation/siltation, dissolved oxygen, suspended solids, excess algal growth, fecal coliform and polychlorinated biphenyls. The most prevailing potentials for the listings were hydromodification and flow regulation, urban runoff and combined sewer overflows.

The City of Aurora (COA) began installing separate storm sewers in the mid-1960's, for the purpose of reducing sewage backups into residential basements and reducing combined sewer overflows into the Fox River during rain storm events. Currently, there are 14 permitted CSO outfalls (Rathbone, E. Illinois, Hazel, Third, E. Benton, First, W. Benton, Clark, Stolp, W. Galena, W. Park, Superior, W. Illinois and Pierce) discharging to the Fox River and one CSO discharging to Indian Creek (Dearborn-Trask) within the City of Aurora. There is one permitted CSO outfall at the FMWRD facility. In 1997, the COA and FMWRD built a CSO primary treatment facility for storing combined sewer overflows and treating excess flows from four of the previously mentioned CSOs prior to discharge to the river. The CSO facility is located at 400 North Broadway on the east side of Aurora.

FMWRD NPDES Permit (#IL0020818) was renewed in February 2007. As part of its permit, the FMWRD is required to develop a Long Term CSO Control Plan (LTCP). One of the components of the LTCP is to characterize, monitor and model the combined sewer system.

1.4 Project Description

This project seeks to collect data in support of characterizing potential impacts to the Fox River from the COA and FMWRD combined sewer overflows. Data collected will be used to model potential impacts to the Fox River from CSO discharges as well as simulate potential treatment alternatives. Data for characterization of the main stem will be collected at five (5) bridge locations crossing the Fox River in North Aurora, Aurora, Montgomery, and Oswego and one (1) location on Indian Creek in order to determine background conditions and to evaluate the potential water quality impact of the CSOs on the mainstem. In addition, macroinvertebrate studies will be conducted in spring, summer and fall as river levels permit, dissolved oxygen will be continuously monitored from approximately April to October, and velocity and stage measurements will be collected at select locations in order to develop a discharge rating curve. **Appendix B** includes a map of the Aurora area that shows the sampling locations for this project.

River water samples will be collected from the bridges using a depth integrating sampler for the locations on the Fox River mainstem and a Van-Dorn sampler will be used for Indian Creek sampling. Bridge sampling will be coordinated with the collection of water samples from seven (7) CSOs outfalls in order determine the concentration and loading of pollutants originating from the CSOs during overflow events. CSO samples will be collected using programmable, automated Isco samplers.

Since 2006, Hester-Dendy samplers have been used to collect data on quantity and quality of the macroinvertebrate population within the Fox River. Seven to nine locations are utilized per sampling event. Sampling locations vary slightly from year to year depending on river conditions, past vandalism and access to the locations. In 2007, there were seven sampling locations utilized. These same stations will be utilized in 2008 and are described in **Table 3**.

Since 2005, continuous dissolved oxygen data has been collected from April to October at several locations along the Fox River using a YSI sondes. In 2008, there will be three locations: Sullivan Bridge, Ashland Bridge, and the Route 34 Bridge.

Currently, there is one gauging station within the study area located at the Montgomery dam. This station is located below all the combined sewers for Aurora. Three additional gauging stations will be deployed in 2008 in order to monitor flows upstream of Aurora's CSOs and to quantify flow from the Indian Creek to the Fox River. One gauging station will be located just below the North Aurora dam, a second gauging station will be located in the mill race whose inlet is just above this dam, and third gauging station will be located on Indian Creek.

The reaches of the Fox River and Indian Creek that are part of this study will be modeled using a water quality model capable of simulating dynamic water quality processes. At this time, the most appropriate model may be WASP7. However, part of this study will be selecting the correct model based on reach specifics and the data encountered during the initial stages of the project.

The model will be calibrated and validated using the discharge and water quality data collected during overflow events. In order to meet the requirements of an IEPA NPDES permit application, the model will be calibrated and modeled to simulate the following constituents during overflow events: suspended solids, fecal coliform, and dissolved oxygen.

The model selected will establish the current conditions in the receiving waters under CSO events and will be capable of simulating scenarios, which may affect the receiving waters during overflow events.

All data will be managed using Microsoft Excel and Microsoft Access in order that it may be later downloaded into the Fox River Database.

Table 3
Sample Locations

Category	Site Name/Location	Continuous Sampling	Discrete Sampling	Macroinvertebrate	Discharge and Stage Measurement
Mainstem	Fox River - North Aurora Dam				Continuous (Gaging Station)
Mainstem	Fox River - Sullivan Road Bridge	Every 30 minutes	Prior, During, After Rain Events	Spring, Summer and Autumn (1 sampler)	
Mainstem	Fox River - North Avenue		Prior, During, After Rain Events	Spring, Summer and Autumn (2 samplers)	
Mainstem	Fox River - Park Avenue		None	Spring, Summer and Autumn (2 samplers)	
Mainstem	Fox River - Ashland Bridge	Every 30 minutes	Prior, During, After Rain Events		Continuous (USGS Station)
Mainstem	Fox River - Mill Street Bridge		Prior, During, After Rain Events	Spring, Summer and Autumn (2 samplers)	
Mainstem	Fox River - Route 34 Bridge	Every 30 minutes (2004-2007)	Prior, During, After Rain Events		
Tributary	Indian Creek - Pedestrian		Prior, During, After Rain Events	Spring, Summer and Autumn (1 sampler)	Continuous (Gaging Station)
CSO - Mainstem	Rathbone - OVF 1		When discharging		
CSO - Mainstem	Hazel - OVF 4		When discharging		
CSO - Mainstem	East Benton - OVF 8		When discharging		
CSO - Mainstem	Prairie & River -OVF 10		When discharging		
CSO - Mainstem	W. Benton - OVF 15		When discharging		
CSO - Mainstem	W. Galena - OVF 18		When discharging		
CSO - Mainstem	FMWRD - OVF 002		When discharging	Spring, Summer and Autumn (1 sampler)	

1.5 Quality Objectives and Criteria for Measurement Data

The purpose of this project is to provide data in order to characterize potential impacts to the Fox River from combined sewer overflows.

1.5.1 Field Measurements and Observations

Preventative maintenance and calibration of equipment is part of the quality control procedures for this project. **Table 4** shows the parameter and meter specifications for the field measurement equipment. **Table 5** shows the calibration procedures and frequency to be used for the project.

TABLE 4
Parameter and Meter Specifications

Discrete Monitoring				
Parameter	**Meter**	**Meter Range**	**Accuracy**	**Resolution**
Water Temperature	Hach Sension 6	0 to 50° C.	± 1°C	0.01°C
DO	Hach Sension 6	0 to 20 mg/L 0-200% saturation	± 1% of full scale	0.01 mg/L 0.01 %
pH	Omega PHH-60BMS	0 to 14 units	± 2 % of span	10 ppm
Conductivity	Omega PHH-60BMS	0 to 19990 ppm	± 2 % of span	10 ppm
Continuous Monitoring				
DO (2004-2006)	YSI 6600 EDS (Membrane Sensor)	0 to 50 mg/L	0 to 20 mg/L ± 2% or 0.2 mg/L 20 to 50 mg/L ± 6%	0.01mg/L
DO (2007 – 2010)	YSI 6600 EDS (Optical Sensor)	0 to 50 mg/L	0 to 20 mg/L ± 1% or 0.1 mg/L 20 to 50 mg/L ± 15%	0.01mg/L
Water Temperature	YSI 6600 EDS	-5 to 45 °C	+0.15 °C	0.1 °C

TABLE 5
Calibration Requirements

Parameter	Unit	Laboratory Calibration	Frequency	Field Calibration/ Preparation	Frequency
Discrete Monitoring					
Water Temperature	^0C	Factory Calibration	NA	NA/Rinse with DI Water	Daily/Between Sites
DO	mg/L	Air Calibration Chamber	Daily	Air Calibration Chamber	Daily/Between Sites
pH	Standard Units	2 points; 7 and 10 standards	Daily	NA/Rinse with Distilled Water	Daily/Between Sites
Conductivity	µS	1 point; 1000 µS	Daily	NA/Rinse with Distilled Water	Daily/Between Sites
Continuous Monitoring					
Water Temperature	^0C	Factory Calibration	NA	NA/Rinse with Distilled Water	Each Site Visit
DO (Optical Sensor)	mg/L	Air Calibration Chamber	Daily	Air Saturated Water	Weekly
DO (Optical Sensor)	mg/L	Air Calibration Chamber	Daily	Air Saturated Water	Twice Monthly

1.5.2 Physical and Chemical Analytical Samples

To ensure good quality analytical data, sampling, preservation, and transport methods will be followed exactly.

For bridge sampling, two opaque, plastic, one-liter Na lgene bottles will be used to collect samples from each bridge. These bottles will be used to collect a sample for analysis of all parameters with the exception of fecal coliform and chlorophyll. The Nalgene bottles will be washed by FMWRD's laboratory for reuse. Fecal coliform samples will be a grab sample and will be collected using sterile 100-ml locking plastic bottles. Chlorophyll samples will be composited and collected in one-liter amber glass bottles, placed on ice, and taken to an IEPA accredited laboratory, First Environmental, Inc. (Naperville, IL) for analysis.

Samples to be composited will be collected in a pre-rinsed stainless steel bucket with a lid to mix the samples. **Table 6** shows the sampling, handling, and storage requirements for the physical and chemical analytical samples.

TABLE 6
Sampling, Transport, and Storage Requirements

Parameter	Sample Container	Transport/Storage in Field	Holding Time
CBOD5	1 L plastic opaque wide mouth bottle	Ice (Temp. <6°C)	48 hours
Total Suspended Solids	1 L plastic opaque wide mouth bottle	Ice (Temp. <6° C)	7 days
Nitrate	1 L plastic opaque wide mouth bottle	Ice (Temp. <6° C)	48 hours
Nitrite	1 L plastic opaque wide mouth bottle	Ice (Temp. <6° C)	48 hours
Ammonia Nitrogen	1 L plastic opaque wide mouth bottle	Ice (Temp. <6° C)	28 days
Total Kjedahl Nitrogen	1 L plastic opaque wide mouth bottle	Ice (Temp. <6° C)	28 days
Dissolved Reactive Phosphorus	1 L plastic opaque wide mouth bottle	Ice (Temp. <6° C)	48 hours
Total Phosphorus	1 L plastic opaque wide mouth bottle	Ice (Temp. <6° C)	28 days
Fecal Coliform	100 ml sterile bottle	Ice (Temp. <6° C)	6 hours
Chloride	1 L plastic opaque wide mouth bottle	Ice (Temp. <6° C)	28 days
Fluoride	1 L plastic opaque wide mouth bottle	Ice (Temp. <6° C)	28 days
Chlorophyll (Bridges Only)	1 L wide mouth amber bottle	Ice (Temp. <6° C)	7 days (filter within 48 hours)

Samples collected from the CSO overflows will be collected in plastic bottles which are designed to fit in the ISCO samplers. When a standard size sampler is used, 1 one-liter plastic bottle will be collected per sample time. When a compact sampler is used two 500 milliliter plastic bottles will be collected per sample. Each bottle will be fitted with a Teflon coated cap prior to transportation to the lab.

In order to characterize the macroinvertebrate population upstream and within the areas of CSO discharges, round multiple plate Hester-Dendy samplers will be used to collect benthic macroinvertebrates. These samplers will be left in the river for four to six weeks. Once removed from the river, each sampler will be placed in a zip-loc bag with river water and will be labeled with time, date, location of sampler, company and field personnel. Subsequently, this bag will be placed in a larger zip-loc bag which will also be labeled and then placed on ice, ~~for~~ overnight shipment to an outside laboratory for analysis.

Since both the data sondes and the velocity meter are in-situ measuring devices, there is no additional handling.

1.5.3 Data Quality Indicators

The overall objective for this project is to develop and implement procedures for field sampling, laboratory analysis, chain of custody, and reporting that will provide quality data for modeling purposes. A series of standard quality tests (precision, accuracy, representativeness, and completeness) will be run on the data following completion of the sampling season. If the data is found to be of insufficient quality, it will be flagged and used on a discretionary basis.

Precision

Precision is defined as a measure of the degree to which two or more measurements are in agreement. The precision of selected chemical analysis will be examined by using standard methods and comparison of duplicate analysis. Duplicate water quality samples will be collected at 10% of the bridge sample locations. If field measurements of the duplicate samples do not agree with the primary sample, the duplicate and primary sample will be re-analyzed (if sufficient quantity is available) to confirm or refute the discrepancy in the results.

Relative percent difference (RPD) will be calculated for field duplicate analysis to assess the precision of field collection procedure. Laboratory precision will be determined by calculating the RPD of the primary sample results and the laboratory duplicate results using the following formula:

$$RPD = \{(V1-V2)/[(V1+V2)/2]\} \times 100$$

Where:

RPD = Relative Percent Difference
V1 = Larger of the two observed values
V2 = Smaller of the two observed values

Accuracy

Accuracy is defined as the degree of agreement between the observed value and an accepted reference or true value. Accuracy depends on precision and on how well systematic errors including faulty equipment calibration and observer bias can be controlled. The accuracy of data will be calculated for both field and laboratory techniques. Field accuracy will be assessed by the use of field blanks. These samples will be collected, preserved, transported and stored in the same manner as all other samples. These samples should have no detectable concentrations of any of the constituents being analyzed. Laboratory accuracy is assessed through the analysis of MS/MSDs, laboratory control samples (ALCS=s@) and surrogate compounds and the subsequent determination of percent recoveries (A%R=s@). The formula for calculating percent recovery is as follows:

$$\%R = 100 \times (Rm/Ra)$$

Where:

$\%R$ = Percent Recovery
Rm = Measured concentration of standard reference solution
Ra = Actual concentration of standard reference solution

Completeness

Completeness is defined as a measure of the amount of valid data obtained from a measurement system compared to the amount that was expected to be obtained under normal conditions. Normal conditions are defined as the conditions expected if the sampling plan is implemented as planned.

Field completeness is a measure of the amount of valid measurements obtained from all the measurements taken in the project. The field completeness objective is 90%. Laboratory completeness is a measure of the amount of valid measurements obtained from all the measurements taken in the project. The laboratory completeness objective is greater than 95%. The formula for completeness is as follows:

$$\%C = 100 \times (V/n)$$

Where:

$\%C$ = Percent completeness
V = number of data points determined to be valid
n = number of expected data points.

Representativeness

Representativeness expresses the degree to which data accurately and precisely represents a characteristic of a population, parameter variations at a sampling point, a process condition or an environmental condition within a defined spatial and/or temporal boundary.

Representativeness is dependent upon the proper design of the sampling program and will be satisfied by ensuring that the field sampling techniques as described in the QAPP are followed and that proper sampling techniques are used. In designing the sampling program, media of concern will be specified.

Using the proper analytical procedures to ensure representativeness in the laboratory including appropriate methods, meeting sample holding times and analyzing and assessing field duplicate samples.

Comparability

Comparability expresses the confidence with which one data set can be compared to another. Field comparability is dependent upon the proper design of the sampling program and will be satisfied by ensuring that the QAPP and SOPs are followed and that proper sampling techniques are used.

Analytical data will be comparable by using similar sampling and analytical methods, meeting hold times and assessment and comparison of field duplicate samples.

1.6 Special Training

A special training session was conducted on August 20, 2007 to ensure all WEDA and DEI personnel who may be involved with this project are familiar with the techniques and procedures outlined in the project QAPP. Only staff members who have completed training will participate in this project. A sample agenda for this training session is included as **Appendix C**. Additional training sessions will be held in February and March 2008 to refresh all staff members on proper sampling technique and procedures and to review changes to the sampling protocol for 2008.

1.7 Documents and Records

Ms. Carrie Carter and Ms. Karen Clementi of DEI will be responsible for managing the QAPP, including version control, updates, distribution, and disposition. In the case of a revision, all appropriate project personnel will receive a revised version by hard copy.

Ms. Carrie Carter and Ms. Karen Clementi of DEI will be responsible for managing and archiving all data, including the sampling and analytical procedures, field data sheets, calibration logs, and laboratory analytical results pertaining to this project. Hard copies of these files will be stored at the DEI offices. With the exception of chlorophyll results, FMWRD will provide all analytical results including field data in an excel spreadsheet form using their Laboratory Information Management System (LIMS). FMWRD will be responsible for storing all analytical data and QA/QC in their system.

First Environmental Laboratories, Inc. (Naperville, IL) will provide a hard copy of chlorophyll results and these will be added to the spreadsheets provided by FMWRD. The Excel spreadsheets will be formatted by DEI and imported to an access database suitable for use in the FoxDB when permitted. See **Appendix D** for examples of the spreadsheet received from FMWRD.

2.0 SAMPLE DESIGN

2.1 Sample Locations

The sampling locations are shown on the map in **Appendix B.** There are several sampling activities involved in this project including bridge sampling, combined sewer overflow sampling, macroinvertebrate sampling, dissolved oxygen monitoring, and stream gauging.

2.1.1 Discrete Water Quality Sampling Locations

Bridges

The first sampling activity includes sampling the Fox River at five (5) bridge locations and one location at Indian Creek. The bridge locations include the Sullivan Road Bridge, Indian Creek pedestrian bridge, and North Avenue Bridge in Aurora; the Ashland Avenue Bridge and Mill Street Bridge in Montgomery; and the Route 34 Bridge in Oswego. Based on the results of past sampling events, it is known that the Fox River will have different results across the river transects.

The sampling stations on each bridge are shown in **Table 7.** The sampling stations on each bridge were chosen as follows.

The Sullivan Road Bridge was selected for this project due to the fact that it is upstream of the northern most CSO in Aurora (East and West Illinois Avenue) and therefore not impacted by combined sewer overflows. Other bridges were considered for the upstream sampling location for this project including: the Illinois Avenue Bridge and the Indian Trail Bridge. The Illinois Avenue Bridge was rejected due to ongoing construction activities and the potential impact of the East and West Illinois CSOs, which are located underneath the bridge abutments. The Indian Trail Bridge was rejected because it is considered unsafe because there is no sidewalk to access the bridge. Sullivan Road Bridge was chosen as the most upstream bridge sampling station. In 2007, three (3) stations were chosen on this bridge to ascertain the background conditions across the river. The three (3) stations are approximately equidistant from one another and divide the river into thirds. The next downstream bridge is the Fox River Trail pedestrian bridge at the confluence of Indian Creek with the Fox River. CSO discharge #25 near Dearborn and Trask Avenues is located approximately one (1) mile upstream on Indian Creek. One (1) sampling station is located at the pedestrian bridge over Indian Creek at the midpoint of the stream.

Bridge construction on the I-88 Tollway began in September 2007, this construction includes temporarily filling in the Fox River on both the east and west banks thereby channeling the flow. It should be noted that although samples ~~will~~ continue to be collected at the Sullivan Road Bridge in 2008, samples maybe impacted from construction activities upstream of this location.

The next downstream bridge is the North Avenue Bridge. The North Avenue Bridge is located downstream of the downtown Aurora CSOs. The Fox River is narrower in this station than at the Sullivan Road Bridge and field observation indicates that the CSO discharge stays close to each bank as they overflow. Therefore, two (2) sampling stations were chosen at the North Avenue bridge and are located approximately ¼ width of the stream from the east and west bank.

The Ashland Avenue Bridge is the next bridge downstream and located approximately one quarter mile downstream of two major CSO discharges (Rathbone and Hazel Avenues). There are no other CSO discharges located between the North Avenue Bridge and the Ashland Avenue Bridge. There is an island at the Ashland Avenue Bridge and the majority of river flow is confined to the west channel because the east channel is dammed at the south end. One (1) sampling station was chosen at the center of the west bank channel.

The next sampling location downstream is the Mill Street Bridge in Montgomery. There are no CSO discharges between Ashland Avenue and Mill Street. The purpose of this sampling location is to gauge the persistence of the CSO impact, if any, to the water quality of the Fox River. Two (2) sampling stations are located on the Mill Street Bridge, each located approximately 1/3 the width of the stream.

The final sampling location is the Route 34 Bridge in Oswego. This bridge is the closest bridge downstream of the FMWRD STP Headworks CSO outfall, located at the wastewater treatment plant facility. There are two (2) sampling stations on this bridge. It should be noted that this sampling location is slightly downstream of the Waubonsie Creek tributary. While this tributary is not part of the sampling plan it may have some minor impacts to this sample location.

TABLE 7
Bridge Sampling Stations

Bridge Name	Latitude	Longitude
North Aurora Main Street Bridge	41°48'23.40"N	88°19'27.03"W
Sullivan Road	41°47'19.10"N	88°19'03.41"W
Indian Creek Foot Bridge	41°46'07.33"N	88°18'33.13"W
North Avenue	41°45'09.09"N	88°19'21.24"W
Ashland Avenue	41°44'15.96"N	88°19'51.29"W
Mill Street	41°44'00.59"N	88°20'02.06"W
Route 34 Oswego	41°41'04.91"N	88°21'21.57"W

CSO Outfalls

The second sampling activity includes collecting samples from seven (7) CSO outfalls to determine the concentration and loading of pollutants originating from the CSOs. These seven (7) CSOs are: West Galena, East Benton, West Benton, First (Prairie), Hazel, Rathbone, and FMWRD. These CSOs were chosen because they are the combined sewer overflows that discharge the most frequently and for the longest duration. **Table 8** summarizes the CSO sampling location information from the most upstream to the most downstream.

The West Galena overflow (OVF #18) is located beneath the Galena Boulevard Bridge in the west abutment wall. It discharges into the west channel of the Fox River in downtown Aurora. The discharge pipe size is 24 inches. The tributary area to this overflow is approximately 40 acres. The ISCO sampler and the flow meter are installed in a manhole serving as a diversion structure located at the intersection of River Street and Galena Blvd.

The East Benton overflow (OVF #8) is located on the east bank of the Fox River at Benton Street. The 54 inch interceptor transports flows from the combined sewer through a diversion structure. The diverted flows are controlled by a 16 foot, 8 inch long dam in the overflow structure. The discharge outfall pipe size is 72 inches. The ISCO sampler and flow meter are located in the diversion chamber.

The West Benton overflow (OVF #15) is located in the abutment wall underneath the Benton Street Bridge. The discharge outfall pipe size is 42 inches. The ISCO sampler and the flow meter are installed in a manhole serving as a diversion structure on West Benton Street.

The First Street overflow (OVF #10) is located at Prairie Avenue (formerly named First Street). The tributary area to this overflow is approximately 118 acres. A 15 inch sewer carries the flow to the West Bank Interceptor. The discharge outfall pipe is 27 inches. The ISCO sampler and flow meter installed in a manhole serving as a diversion structure at the intersection of Prairie Avenue and River Street.

The Hazel overflow (OVF #4) is located on the east bank of the Fox River, just south of the old railroad trestle across Hazel Avenue in a park owned by the Fox Valley Park District. All flows are screened in a bar screen prior to the overflow. The ISCO sampler and the flow meter are installed inside the bar screen chamber.

The Rathbone overflow (OVF #1) is located at the intersection of Rathbone Avenue and River Street in Aurora. At the overflow diversion structure, the dry weather flows from the 96-inch combined sewer discharges into the 69-inch east and west bank interceptors via two 15-inch concrete pipes. Excess flow discharges into the river via a 96 inch outfall pipe extending approximately 150 linear feet into the center of the Fox River. The Rathbone overflow serves the largest tributary area of all of the overflows. The ISCO sampler and the flow meter are installed in the diversion structure.

The FMWRD overflow pipe, also known as the STP Headworks (#002) overflow, is located on the west bank of the Fox River at the wastewater treatment plant. It is located upstream approximately one quarter mile of the WWTP treated effluent (STP Outfall #001). All combined flows as well as flows from all separated sewage areas are combined at the headworks. The ISCO sampler is located in the 84-inch outfall pipe to the river.

TABLE 8
CSO Outfall Sampling Locations

CSO Name	CSO Number	Latitude	Longitude
West Galena	#18	41°45′32.54″N	88°19′01.10″W
East Benton	#8	41°45′20.42″N	88°18′58.38″W
West Benton	#15	41°45′24.26″N	88°19′07.24″W
First (Prairie)	#10	41°45′04.81″N	88°19′32.74″W
Hazel	#4	41°44′38.38″N	88°19′38.37″W
Rathbone	#1	41°44′36.12″N	88°19′44.85″W
STP Headworks	#002	41°42′55.92″N	88°20′59.38″W

2.1.2 Benthic Macroinvertebrate Locations

In order to conduct upstream versus downstream comparisons of the conditions in the Fox River through the CSO area, macroinvertebrate sampling was conducted using Hester-Dendy samplers. In 2006, Hester-Dendy samplers were placed at nine locations along the Fox River mainstem as shown in **Table 9**. In 2006, the Hester-Dendy sampler on the west bank at Indian Trail Avenue was relocated during the sampling event due to repeated tampering. In 2007, the Indian Trail sampling location was not utilized due to continued tampering. Additionally, two new Hester-Dendy locations were added in 2007. One sampler was placed at Sullivan Road and one sampler was placed on Indian Creek, approximately 0.5 mile upstream from the confluence of the Fox River, to total nine Hester Dendy samplers for the 2007 sampling event.

TABLE 9
Hester-Dendy Locations

Location	Year of Sampling	Reason	Latitude	Longitude
Sullivan Road Bridge	2007	Upstream of CSOs	41°47′19.10″N	88°19′03.41″W
East Bank Indian Trail	2006	Upstream of CSOs	41° 46.872′	88° 18.727′
West Bank Indian Trail (original location)	2006	Upstream of CSOs	41° 46.864′	88° 18.807′
West Bank Indian Trail (new location)	2006	Upstream of CSOs	41° 46.922′	88° 18.854′
East Bank Park Avenue	2006 and 2007	Characterize Impacts from Indian Creek	41° 45.997′	88° 18.589′
West Bank Park Avenue	2006 and 2007	Characterize Impacts from Indian Creek	41° 45.992′	88° 18.656′
Indian Creek Mainstem	2007	Characterize Impacts from Indian Creek	41°46'0.88"	88°18'16.72"
East Bank North Avenue	2006 and 2007	Characterize Impacts from CSO discharges	41° 45.180′	88° 19.313′
West Bank North Avenue	2006 and 2007	Characterize Impacts from CSO discharges	41° 45.190′	88° 19.361′
East Bank Mill Street	2006 and 2007	Downstream of Aurora CSOs	41° 43.774′	88° 20.331′
West Bank Mill Street	2006 and 2007	Downstream of Aurora CSOs	41° 43.784′	88° 20.331′
West Bank FMWRD	2006 and 2007	Downstream of FMWRD CSO	41° 42.857′	88° 21.046′

2.1.~~3~~4 Continuous Water Quality Sampling

Dissolved oxygen sampling locations have been selected to monitor DO levels upstream and downstream of all City of Aurora CSOs, and below discharges from FMWRD's outfalls. Originally the upstream location of the DO sondes was under the Indian Trail Bridge. The data sondes remained at this location for several seasons (2004 through 2006). However, prior to installation in 2007, it was found that the cables used to hold the sondes in place had been tampered with during the winter. The park beneath the Indian Trail Bridge is heavily used by fishermen. Since the area around the Sullivan Bridge is not as heavily used, it was determined that this was a more secure location to deploy the DO sondes and in 2007, the monitoring station was moved. The monitor lies horizontally in the river at both these locations.

The Ashland Avenue Bridge is the division line between Montgomery and Aurora and serves as the monitoring location downstream of the COA CSO discharges. There was one incident of tampering at this location; however, this location is the only location that can be used for monitoring discharges downstream of the COA. To move it further downstream would require the use of buoy and would be too close to the influences of the Montgomery Dam. This sondes hangs from the bridge vertically.

The last location is at the Route 34 Bridge in Oswego. This location was selected to be downstream of FMWRD's outfall. This monitor hangs from the bridge vertically. To avoid influences from Waubonsie Creek which is slightly upstream of this location, the data sondes will likely be moved to the pedestrian bridge at Violet Patch Park. A decision has not been reached regarding this location at the time of writing this QAPP.

2.1.4 Velocity and Stage Measurements

Although a gauging station at Sullivan Road would be closer to the actual study area of the CSOs in Aurora, the upstream gauging station for this study will be located below the North Aurora Dam. It was determined that even though the mill race in this same location would require the use of two gauges, it was felt that it would be easier to calibrate and measure velocities and levels at this location. In order to quantify flow impacts from Indian Creek, a third gauging station was located approximately 1/4 mile east of where Indian Creek and the Fox River meet, away from the influence of the river's backwaters.

2.2 Sample Frequency and Duration

2.2.1 Discrete Water Sampling

According to 35 IAC 375.402 the intensity and duration of first flush are a function of variables including physical and hydraulic features of the sewer system and tributary watershed; amount of sediment accumulated in the sewer system and on impervious surfaces of the watershed; and the intensity and duration of the storm event causing the flushing. Conditions for this determination are defined as storm event of 1.2 inch per hour intensity with a duration of 60 minutes, which approximates a one-year-one-hour storm for the City of Aurora which occurs after a ten day period of dry weather.

Bridges

As part of determining the impacts to the Fox River from the CSOs, Mr. Philippe Moreau and Ms. Carrie Carter will observe the weather forecast using http://www.intellicast.com to see if a significant rainfall event is projected. A significant rainfall event for this project is defined as at least 0.25 inches of rain within 1 hour. This rainfall event must be preceded by a dry weather period of approximately ten to fourteen days. If the weather forecast predicts a significant rainfall event, a sample from each bridge will be collected once on the day preceding the forecasted storm event. The day of and the day after the storm event, all bridge locations will be sampled as many times as possible during daylight hours using two sample teams.

To facilitate the efforts of the Illinois State Water Survey (ISWS) and the Fox River Study Group (FRSG), bridge samples will also be collected during non-significant rainfall events when requested and provided there is adequate laboratory capacity at FMWRD. Grab samples from bridge locations will be collected as many times as possible during daylight hours as prescribed previously.

CSO Outfalls

ISCO samplers are equipped with a liquid actuator and are automatically triggered to sample if an overflow occurs during or after storm event. Samples collected by the ISCO samplers will be retrieved during daylight conditions for safety. If a significant rain event has occurred as described in **Table 10**, samples will be collected as previously described, placed on ice and taken to FMWRD for analysis. If the ISCO samplers collect samples during a non-significant rainfall event, these samples will be discarded and the samplers will be cleaned accordingly.

TABLE 10
Sample Frequency and Location

Rainfall Event	CSO Outfalls	Bridge Locations
Significant = Minimum of 0.25 inches of rain Minimum of 1 hour duration Approximately 10 days of dry weather	Collect samples	Collect at least one sample before the event, collect as frequently as possible during, and after a storm event
Not Significant = Less than 0.25 inches of rain Less than 1 hour duration Less than 10 days of dry weather	Discard samples	Collect at least one sample before the event, collect as frequently as possible during, and after a storm event

2.2.2 Benthic Macroinvertebrates

Benthic macroinvertebrate sampling will occur at four week intervals during the spring, summer and fall for 2008. At least one set of Hester-Dendy samplers at each of the nine sampling locations utilized in 2007 will be deployed during each season.

2.2.3 Continuous Water Sampling

Dissolved oxygen levels will be collected every thirty minutes from April to October using data sondes.

2.2.4 Velocity and Stage Measurements

Velocity and stage measurements will be collected as needed to create stage curves. Measurements will be made bi-weekly or more often when river stages rise or lower significantly. These measurements will be repeated throughout the entire 2008 season and will continue into the following years for a minimum of at least six times during each year.

2.3 Sample Methods

A standard operating procedure (SOP) will be developed detailing the step-by-step sampling process to be utilized in the field (**Appendix E**). The sections below discuss the general field sampling methods.

2.3.1 Discrete Water Quality Sampling

Bridges

During 2007 sampling events, at least one sample teams consisting of two to three trained field crews will be used to conduct sample collection. A sampling device constructed by Randy Hummer at FMWRD was utilized for the 2007 sampling events. This sampler consists of 4-250 ml plastic bottles equally distributed at 12 inch intervals on a rod with a weight on the bottom. This sampler is tied to a rope and lowered from the bridge sampling stations as described in Section 2.1. The sample is composited and split into 3 sample bottles: one sterilized 100-ml bottle for fecal coliform and two one-liter bottles for the remaining constituents shown on **Table 3**. Each station on each bridge will be kept separate from one another in an attempt to discern the potential water quality differences that exist between the Fox River and Indian Creek. The sampling bottles are rinsed with distilled water between each sampling station on each bridge. Each sampling team consisted of a minimum of 2 persons. One or two sampling teams were utilized, depending on staff availability. This method was approved by the IEPA on March 25, 2002 as part of the QAPP for use by Fox River Study Group's Fox River Water Quality Study.

During the 2008 sampling events, two teams of a minimum of two and a maximum of three trained field crew members will be used for sampling bridges. A DH-2 depth integrating sampler will be utilized for sampling at the bridge stations. The procedures as outlined in the Federal Interagency Sedimentation Project (FISP) Operations Manual will be utilized. If the flow or velocity requirements of the DH-2 are not met, a Van-Dorn type sampler called the Horizontal Beta Bottle by Wildco will be used. At the same time, a composite sample is collected at each bridge location, a fecal coliform sample will be collected using the sampling device described in the previous paragraph at the center of each bridge location. In addition, a grab sample using the DH-2 sampler will be collected at the same location and analyzed for the same parameters as the composite sample. This sample will be used for comparison with the grab samples that will be collected throughout the day. Subsequently, on a rotating basis grab samples will be collected from each bridge at the same location so that each bridge can be sampled several times during the day. If adequate personnel are available, each bridge location will be sampled every one to two hours.

In order to establish a baseline of water quality data for the bridge sampling locations, one transect sample per bridge will be collected every two weeks during the 2008 season if no additional sampling has been done. A minimum of ten samples across the span of each bridge will be collected and composited for analysis with the exception of the Indian Creek foot bridge. Samples collected will be weighted to include variations in velocities across the river. In addition to collecting a transect sample, for comparison purposes, a grab sample from the center of each bridge location will be collected for analysis. Fecal coliform samples will also be grab samples.

TABLE 11
Bridge Length and Number of Sample Stations per Bridge

Bridge Name	Length	2007 sampling stations (grab)	2008 sampling stations (composite)
North Aurora Main Street Bridge	280 + 43	0	0
Sullivan Road	520	3	15
Indian Creek Foot		1	3
North Avenue	445	2	15
Ashland Avenue	185	1	10
Mill Street	250	2	10
Route 34 Oswego	263	2	10
Total Sample Locations		11	58

CSO Outfall Sampling

One sample team of two to three people will be used for collecting samples from the ISCO sampler. Overflow discharges will be collected using a Teledyne ISCO 3700 series portable samplers. These samplers are programmable and suitable for use in sanitary sewers. The Model 3700 Standard is designed to hold 24 wide-mouth, polypropylene one-liter bottles. There are numbers molded into the sampler's base to identify the sample location of each bottle during collection. The 3700 Compact is a smaller version of the 3700 Standard and will be used in manholes where the larger standard model will not fit. The 3700 Compact has an inner sleeve which is numerically coded to indicate which bottle is which. The sleeve which holds the bottles is keyed with the sampler so the sleeve can be placed in the sampler only one way. The 3700 Compact holds 24 polypropylene bottles of 500 milliliter capacity.

Both models use a peristaltic pump for sample collection. Each sampling cycle includes an air pre-sample purge and post-sample purge to clear the suction line before and after sampling. The samplers are powered by 12 VDC rechargeable nickel-cadmium batteries. These batteries will be changed on a biweekly basis during the sample season to ensure adequate power during a sampling event. Programming, maintenance and care for both samplers are the same and will be followed as detailed in the Installation and Operation Guide included with the samplers.

The 3700 Compact samplers will be used in the following overflow locations: West Galena, East Benton, West Benton, and First (Prairie). The 3700 Standard sampler will be installed at Hazel, Rathbone, and the STP Headworks. With the exception of the locations at the STP Headworks and Hazel, all samplers will be suspended by an armed device which hangs on the rim of the manhole beneath the cover. Cables will suspend the sampler in the manhole and keep the sampler vertical. At the Hazel location, the sampler will be suspended by cables from a bolt connected to the side of the siphon chamber. At the STP headworks, the sampler will sit outside next to the manhole to be sampled.

In order to sample only during an overflow event, an ISCO liquid level actuator model #1640 will be used to trigger the pre-programmed sample routine when the liquid level reaches a predetermined height. The actuator will inhibit sampling if the flow level falls below the actuator's probe until the level rises again. In order to sample only the overflow event, the actuator probes and strainers at Rathbone, Hazel, East Benton and West Benton will be mounted on top of the overflow dam located in the overflow pipe. At the First overflow structure, the actuator probe will be located at the bottom of the manhole. At the West Galena overflow, the actuator probe will be mounted at the invert elevation of the outfall pipe which discharges to the river.

The 3700 Standard sampler will be programmed to collect one 1-liter bottle at the following intervals: initiation (0 minutes), 5 minutes, 10 minutes, 15 minutes, 30 minutes, 45 minutes, 1 hour, 2 hours, 3 hours, 4 hours, 5 hours, and 6 hours. Since overflows may occur during late night or early morning hours, sample retrieval will occur as soon as possible in the morning. Samples will be labeled, capped and placed on ice for compositing in the laboratory.

In order to ensure sufficient sample for laboratory analysis, the 3700 Compact sampler will be programmed to collect two 500 ml bottles at the following times: initiation (0 minutes), 5 minutes, 10 minutes, 15 minutes, 30 minutes, 45 minutes, 1 hour, 2 hours, 3 hours, 4 hours, 5 hours, and 6 hours. Part of the first of two bottles will be placed in a sterile container for fecal coliform analysis, part of the first bottle will be used for the in-situ measurements, and the remaining part of the first bottle of each sample will be capped and placed on ice along with the second bottle for laboratory analysis.

On both the Compact and Standard sampler, information regarding the time and date of the sample collection will be retrieved and recorded at the same time as the samples are collected.

All CSO outfall locations are equipped with Marsh McBirney Flowmeters which are maintained by WEDA. These meters continuously log velocity and levels using an electromagnetic sensor for velocities and pressure transducers for flow levels. These meters will be used to verify that an overflow has occurred when the ISCO sampler collects samples.

Since the strainers have been placed at the depth of the start of presumed overflow (see previous description of strainer location) recorded overflow data from the ISCO sampler can be compared with data downloaded and viewed from the flow meters. The time and date information from the ISCO sampler will be compared with the flow meter data to see if times are comparable for the overflow event. The data collected from the Marsh McBirney meters can be used to verify that samples were collected during the overflow event and will be of assistance to trouble shoot potential problems with the samplers.

A typical readout for an overflow from a Marsh McBirney flow meter can be seen in **Appendix F**.

2.3.2 Benthic Macroinvertebrate Community

The mainstem of the river and Indian Creek will be sampled to characterize the effect of discharges on the macroinvertebrate community. Hester-Dendy samplers will be deployed upstream of the CSO discharges as well as in areas where CSO discharges occur. Each Hester-Dendy consists of a round, multiple plate sampler with fourteen 7.5 cm diameter hardboard plates spaced by eight single spacers, one double spacer, two triple spacers, and two quadruple spacers with a surface area of approximately 0.13 square meters anchored to a round landscaping stones using long bolts. The landscaping stones serve as ballast and are attached to steel cables which are fastened to rocks, roots, etc. on the river bank in order to facilitate locating the samplers once deployed. The locations of the samplers are based on the locations of the CSOs within Aurora and at the FMWRD facility's outfall. These samplers will be deployed for approximately four weeks to six weeks in the spring, in the summer and in the fall in 2008.

2.3.3 Continuous Water Quality Monitoring

At each site the sondes will be deployed at a pre-determined location as shown in Table 3. The exact location on each bridge will be selected using DO and velocity profiles collected prior to the monitoring effort, with the sondes being placed at the location where the DO location is the most representative of the DO concentration of the entire stream cross-section. A Hach Sension 6 will be utilized to obtain DO measurements as part of the profiling activities. To summarize, vertical DO profiles will be taken at 10 equal distant locations across the stream channel. As part of the vertical profiling, DO measurements will be taken at 1.5 to 2 foot increments. Data obtained will be statistically analyzed to determine the location for the sondes placem ent. Profiling may be done several times during the summer depending on river levels.

The sondes will be calibrated as recommended by the manufacturer. Methods for sondes set-up, data download, deployment and retrieval will be based on professional experience. Methods are detailed in the SOP manual. DO and temperature will be collected at 30 minute intervals and logged in a data recorder. The sondes calibration will be checked against a calibrated Hach Sension 6 on a bi-weekly basis. The use of luminescent DO probes during 2007 have shown this technology to be extremely stable and not subject to sensor drift and fouling compared to the membrane probes used in previous years. All calibration data and deployment data will be recorded in a field book dedicated to DO monitoring.

2.3.4 Velocity and Stage Measurements

In support of installation of gauging stations at Indian Creek and the Fox River mainstem at North Aurora dam, from January 2008 forward, velocity and stage measurements will be collected as often as necessary to accommodate changes in the river stage. To facilitate this effort, the river beds of both Indian Creek and the Fox River at the Main Street Bridge in North Aurora were surveyed and plotted prior to any velocity readings being collected. Velocity measurements for calculating discharge of the stream will be completed as described in Rantz (1982).

2.4 Sample Handling

2.4.1 Discrete Water Quality Monitoring

Bridge Sampling

As samples are collected, the sample number, date, and time are recorded on the appropriate sampling form. Copies of the sampling forms for the bridge sampling are provided in **Appendix G.** All samples will be transferred to an ice-filled cooler immediately following completion of sampling at a bridge. Samples will be transported to the FMWRD laboratory as soon as possible to meet holding times.

All field measurements will be performed in-situ and in accordance with EPA recognized methods as shown on **Table 12.** The FMWRD laboratory will use approved methods listed in the most current editions of "Standard Methods" of 40 CFR 136.

TABLE 12
Field Measurement Methods

Meter	Parameter	Method
Hach Sension 6	DO	Standard Method 4500-O G
Hach Sension 6	Temperature	Standard Method 2550
Omega PHH-60MBS	pH	Standard Method 4500
Omega PHH-60MBS	Conductivity	Standard Method 2510

CSO Monitoring

As samples are collected, the sample number, date, and time are recorded on the appropriate sampling form. Copies of the sampling forms for the ISCO samplers are provided in **Appendix H.** All samples will be transferred to an ice-filled cooler immediately following completion of sampling at the CSO outfall location. Samples will be transported to the FMWRD laboratory as soon as possible to meet holding times. For CSO samples only, pH and conductivity will be measured in the field.

2.4.2 Benthic Macroinvertebrate Community Monitoring

When the deployment period is complete, the Hester-Dendy samplers will be retrieved using a 500-micron, D-frame net to prevent loss of organisms. Each Hester-Dendy will be removed from its ballast and the Hester-Dendy will be double packaged in zip-loc bags containing river water, placed on ice, and mailed to a lab with appropriate chain of custody procedures. Observations regarding the sample location will be recorded.

2.4.3 Dissolved Oxygen Monitoring

All sample measurements are performed at the sample location (i.e. in-situ) therefore there is no sample collection, preservation, shipment or storage.

2.4.4 Velocity and Stage Measurements

All sample measurements are performed at the sample location (i.e. in-situ) therefore there is no sample collection, preservation, shipment or storage.

2.5 Analytical Methods

2.5.1 Discrete Water Quality Monitoring

All discrete water quality monitoring analysis and measurement will be EPA recognized methods. Methods for field measurements can be found in **Table 12**. Laboratory analysis methods conducted my FMWRD and First Environmental Laboratories can be found in **Table 13**.

TABLE 13
Laboratory and Method Analysis

Parameter	Laboratory	Method
CBOD5	FMWRD	Std Method 5210B
Total Suspended Solids	FMWRD	Std Method 2540D
Nitrate	FMWRD	EPA 300.0
Nitrite	FMWRD	EPA 300.0
Ammonia Nitrogen	FMWRD	Std Method 4500-NH3-E
Total Kjedahl Nitrogen	FMWRD	Std Method 4500-Norg B
Dissolved Reactive Phosphorus	FMWRD	Std Method 4500 – P B&E
Total Phosphorus	FMWRD	Std Method 4500 – P B&E
Fecal Coliform	FMWRD	Std Method 9222D
Chloride	FMWRD	EPA 300.0
Fluoride	FMWRD	EPA 300.0
Chlorophyll a (Bridges Only)	First Environmental Laboratories	Std Method 10200H

It is anticipated that when bridge locations are sampled, there will be a sufficient quantity of sample from each location to measure all parameters. Since the quantity of sample collected from the ISCO samplers is limited, there may be times when there is not enough water sample to analyze for all the parameters. If this is the case, FMWRD and WEDA have prioritized the order of analyses which are most critical if sufficient quantity from a sample is not available. If there is insufficient sample then the lowest priority parameter(s) will not be analyzed. The priority of sample analysis, from highest to lowest priority, is as follows:

Fecal Coliform
$CBOD_5$
Total Suspend Solids
Ammonia Nitrogen
Nitrate
Nitrite
Total Phosphorus
Dissolved Phosphorus
Total Kjedahl Nitrogen

Chloride
Fluoride
Chlorophyll a (bridges only)

2.5.2 Continuous Water Quality Monitoring

All field measurement methodologies used are EPA recognized methods. Methods for field measurements can be found in **Table 12**. All monitoring is performed at the point of the sample collection and therefore there is no laboratory analysis.

2.6 Instruments and Equipment

2.6.1 Testing, Inspection, and Maintenance

To ensure that all data collected under this project is of sufficient quality, all instruments and equipment used that are owned by WEDA and DEI will be maintained on a regular basis by Ms. Carrie Carter of DEI. Records of all maintenance activities will be documented and stored at the DEI office. A kit, which includes replacement parts for each of the pieces of equipment to be used as well as tools to conduct this maintenance, will be present at the DEI office.

The pH and conductivity probes on the Omega PHH-60 MBS will be replaced yearly. The DO membrane for the Hach Sension 6 will be changed at least yearly but more frequently if it appears that calibration is drifting. Tubing connecting the strainer to the pump will be inspected yearly and replaced as needed. Tubing for the peristaltic pump will be changed on a yearly basis.

2.6.2 Calibration and Frequency

All calibrations will be conducted as recommended by the manufacturer. Calibration procedures and frequency for this project can be found in **Table 5** of **Section 1.5**. If during the time of collection any values seem to fall outside of the expected range, these values will be noted and a calibration check will be conducted upon completion of the sampling to verify the validity of the measurements taken. Calibrations will be checked again at the end of each day during field activities.

2.7 Quality Control

2.7.1 Field Measurement and Sample Collection

Field QA/QC will be obtained by using trained staff for field measurements and sample collection. Only those individuals who have read this QAPP and associated SOPs prior to sample collection will conduct measurements and sample collection.

All equipment used for field measurements will be properly maintained and decontaminated as described in the SOPs. Logbooks of calibration and maintenance of equipment will be kept, documenting all procedures conducted on equipment throughout the sampling season.

Prior to the start of the discrete water quality sampling all equipment utilized will be decontaminated by placing the equipment in a detergent bath. The equipment will be removed and triple rinsed with distilled water. Subsequently the equipment will be rinsed with distilled water. Following the field sampling activities at each location, the equipment will be rinsed with distilled water and stream/river water obtained from the next sampling site to be sampled.

2.7.2 QA/QC Samples

QA/QC samples will include equipment rinsate blank, trip blank, method blank, field duplicate, laboratory duplicate, and matrix spike samples. Each bridge sample team will be required to collect at least one laboratory duplicate per day. Due to the nature of the samples collected, no duplicates will be collected for the CSO locations. At least one equipment blank per bridge sampling team and CSO sampling team per day will be required to be collected and analyzed. Equipment blanks for the CSO samplers will be collected only from samplers that have an overflow occur. For bridge sampling, equipment blanks will be collected using the same method as normal sample collection. The sampling apparatus will be filled with distilled water and decanted into pre-cleaned bottles. All samples will be analyzed to assess the quality of the data resulting from the field sampling and analytical programs. In general:

> Equipment rinsate consisting of distilled water will be submitted to the analytical laboratory to provide the means to assess the quality of the data resulting from the field sampling program. Equipment rinsate blank samples are analyzed to check for procedural contamination at the site that may cause sample contamination. Trip blanks are used to assess the potential for contamination of samples due to contamination migration during shipment and storage;
>
> Method blank samples are generated within the laboratory and are used to assess contamination resulting from laboratory procedures;
>
> Duplicate samples are analyzed to check for sampling and analytical reproducibility;

2.8 Data Management

WEDA and DEI staff will manage all data generated by this project. The following procedures will be used for the management of the data obtained during this project.

2.8.1 Data Recording

Data that is transposed from field datasheets to an excel spreadsheet will be verified after transcription. Field data (located on the Chain of Custody) will be transposed into an Excel spreadsheet by FMWRD. DEI staff will check the transcription for accuracy. Once accuracy is verified data will be formatted and copied into the database.

2.8.2 Data Transformation

It is expected that data transformations made during this investigation will be relatively simplistic and all calculations made during data transformation will be checked 100% prior to dissemination of the transformed information. Calculations conducted during data transcription will be conducted by members of the field sampling teams.

2.8.3 Data Reduction

Raw data from field measurements will be recorded directly on the field data sheets. Examples of the field data sheets are included in **Appendix G** and **Appendix H.** If errors are made, results will be legibly crossed out, initialed and dated by the person recording the data, and corrected in a space adjacent to the original (erroneous) entry. Data sheets will be reviewed by DEI staff to insure that records are complete, accurate, and legible.

2.8.4 Data Analysis

Following data analysis, field measurements and water quality monitoring data will be entered into a Microsoft Excel by FMWRD and then formatted by DEI prior to importing into the Microsoft Access database. This data will then be forwarded to ISWS for use in modeling and other analyses.

3.0 ASSESSMENT AND OVERSIGHT

3.1 Assessment and Response Reactions

Performance evaluations of the sampling/sample transport teams shall be performed periodically. The teams will be evaluated to ensure that established protocols have been followed. The FMWRD laboratory will maintain all internal QA documents. Any noncompliance issues shall be reported to the project managers. No data will be released that has failed to meet all QA/QC requirements as established in this QAPP or in the internal QA plans of the laboratories. Samples that have not met the QA/QC requirements will be retested if possible or rejected.

3.2 Reports to Management

Mr. Philippe Moreau will receive notification of any non-compliance issues and reports related to quality control issues.

4.0 DATA VALIDATION AND USABILITY

4.1 Data Review

All data shall be reviewed by Ms. Carrie Carter, Project Quality Assurance Officer, and Mr. Philippe Moreau, Project Manager to determine its usability.

Sampling Design

Sample collection plans will be developed and used during the sample collection periods. These plans will include a detailed map of the sample locations and the types of samples to be collected. The team leader will develop the sample collection plan and brief the sample collection teams on the objective of the sampling.

Sonde Drift During Deployment

Throughout the summer the data sondes will be field checked as previously described to assure that each sondes remains in calibration. DO and temperature will be measured with both the sondes and hand-held Hach Sension6 to verify that the sondes has held its calibration and that dissolved oxygen readings are within 0.7 mg/L of each instrument. Data not meeting this criteria will be flagged accordingly.

Data Reduction and Processing

Analytical data quality will be assessed to determine if the objectives have been met. In addition data will be reviewed by QA/QC Officer for indications of interference to results caused by sample matrices, cross contamination during sampling or in the laboratory and storage anomalies. For instance holding times may be exceeded for samples collected by the ISCO samplers since outfalls may be discharging in the late evening or early morning hours.

4.2 Verification and Validation Methods

Sample collection and field measurements should be verified by the sampling teams with records kept by the team leaders. The laboratory data shall be verified by Mr. Randy Hummer of FMWRD. Field and laboratory data shall be archived by DEI or WEDA staff.

In the case of the data verification process resulting in a change to the data or if data accuracy, reliability or usability has been reduced as the result of errors in stored data or corrupted files, the Project Manager and/or the Project Quality Assurance Officer shall inform all data users and make corrections.

4.3 User Requirements

The execution of the project shall follow the procedures outlined in this QAPP. The QAPP shall be reviewed after six months by the persons on the cover page. The review shall determine if the objectives are being met. If modification of the project is required, any changes shall require the approval of the persons listed on the approval page. All changes shall be documented in a memorandum that will be distributed to all participants in the project. The QAPP shall be updated to reflect any changes.

5.0 REFERENCES

Edwards, T.K. and G.D. Glysson. 1999. Field Methods for Measurement of Fluvial Sediment, Book 3, Chapter C2. Techniques of Water-Resources Investigations of the United States Geological Survey, U.S. Government Printing Office, Washington, D.C.

FISP. Operator's Manual for the US DH-2 Depth-Integrating Collapsible Beg Suspended-Sediment Water Quality Sampler.

Hach. Instruction Manual for the Sension6 Portable Dissolved Oxygen Meter.

Omega. Operator's Manual for the pH/Conductivity Pocket Pal Meter.

Rantz, S.E. et al. 1982. Measurement and computation of stream flow - v. 1, Measurement of stage, and v. 2, Computation of discharge. U.S. Geological Survey Water - Supply Paper 2175. United Sates Department of Interior, U.S. Geological Survey. Washington D.C. 631 p.

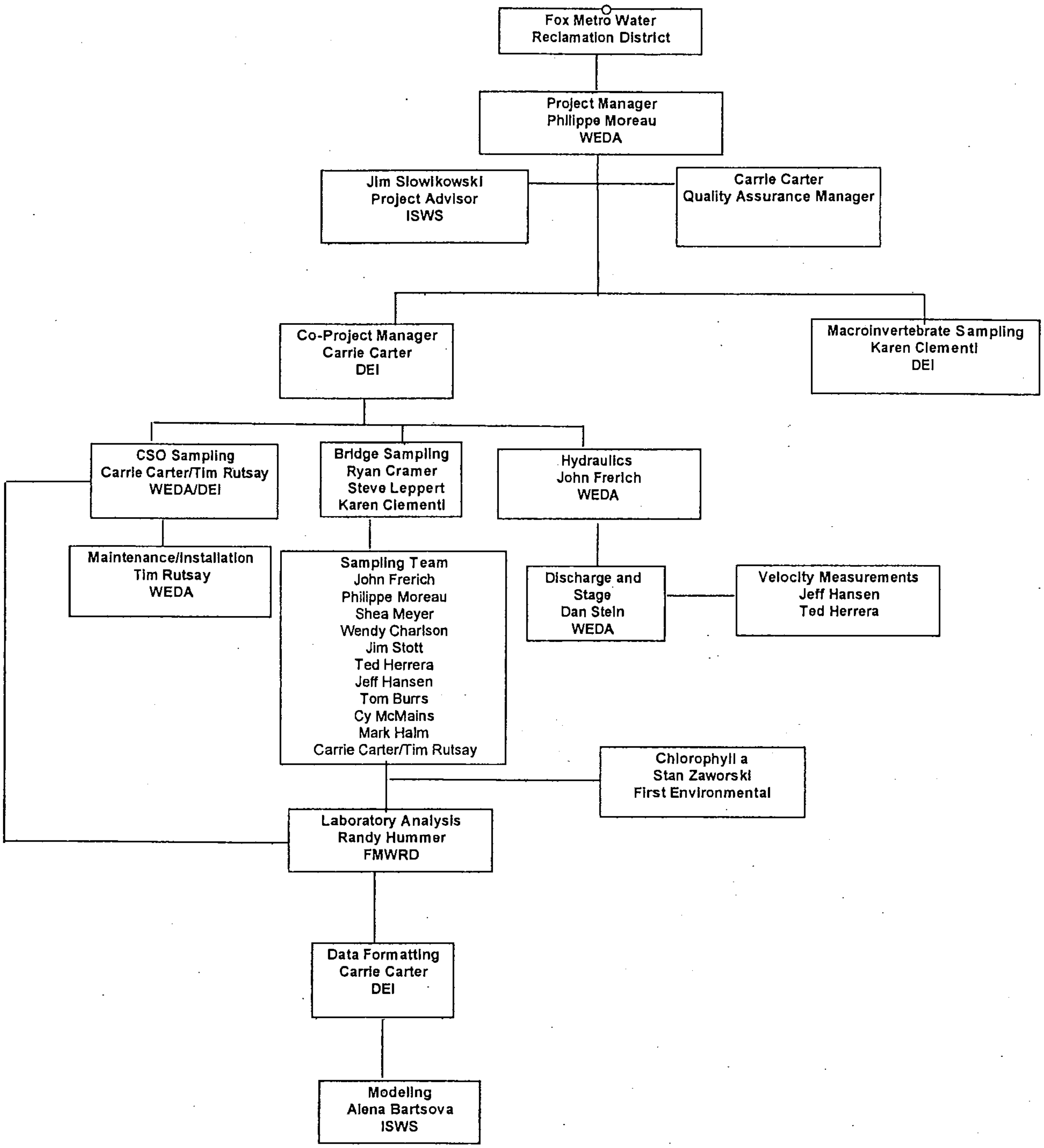
Teledyne ISCO. 1994, revised 2006. 3700 Portable Samplers: Installation and Operation Guide.

YSI Incorporated, "Environmental Monitoring Systems Operations Manual (6-Series).

APPENDIX A

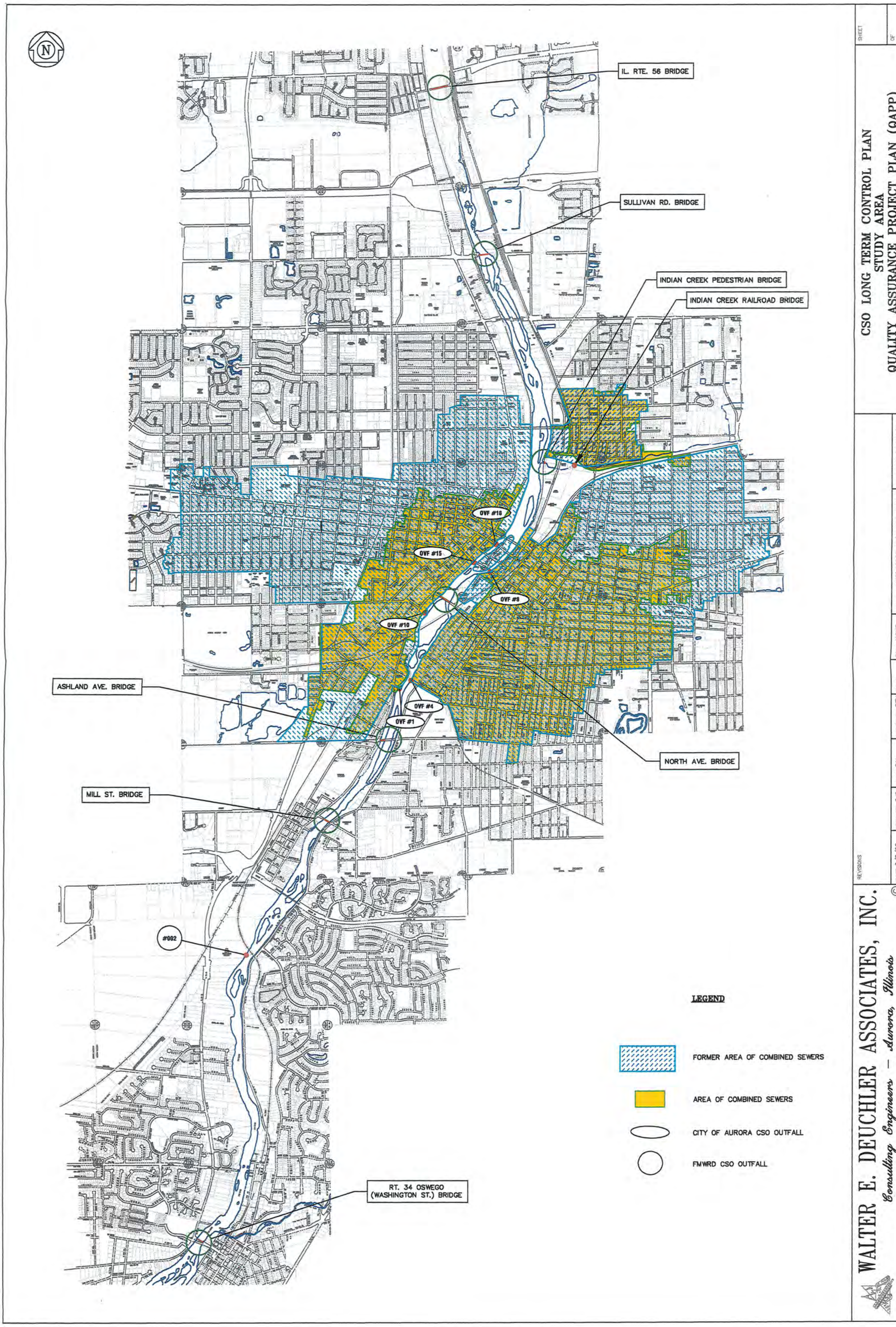
ORGANIZATION CHART

CSO Long Term Control Plan
Sampling/Modeling
Organization Chart



APPENDIX B

MAP OF STUDY AREA


IL. RTE. 56 BRIDGE
SULLIVAN RD. BRIDGE
INDIAN CREEK PEDESTRIAN BRIDGE
INDIAN CREEK RAILROAD BRIDGE
OVF #18
OVF #15
OVF #8
OVF #10
OVF #4
OVF #1
ASHLAND AVE. BRIDGE
NORTH AVE. BRIDGE
MILL ST. BRIDGE
#002
RT. 34 OSWEGO
(WASHINGTON ST.) BRIDGE
LEGEND
FORMER AREA OF COMBINED SEWERS
AREA OF COMBINED SEWERS
CITY OF AURORA CSO OUTFALL
FMWRD CSO OUTFALL
CSO LONG TERM CONTROL PLAN
STUDY AREA
QUALITY ASSURANCE PROJECT PLAN (QAPP)
WALTER E. DEUCHLER ASSOCIATES, INC.
Consulting Engineers — Aurora, Illinois
DATE 2/8/08
DESIGNED CJC
DRAWN SAL
APPROVED PEM
SCALE NONE
CAD DWG. ASD\06060-00\COMB-SEW2
JOB NO. 111/06060/00
REVISIONS
SHEET
OF

APPENDIX C

AGENDA FOR TRAINING SESSION

2008 CSO LTCP Sampling Training

- Project overview – Carrie
  - Purpose
  - Teams

- Notification – Phil
  - Timing of Sample Event
  - Duration of Sample Event
  - Phone List

- ISCO sampling – Carrie and Tim

- Bridge sampling – Karen
  - Changes to 2008 Sampling Protocol
  - Composite vs Grabs
  - Use of DH-2 Sampler
  - Use of Van-Dorn Sampler
  - Field Trip to North Avenue Bridge (weather permitting)

- Velocity Measurements – Ryan

- Equipment use – Carrie
  - pH meters
  - DO meters

- Sampling Protocols – Karen and Carrie
  - Filling Bottles
  - Labeling Bottles
  - Coolers and Ice
  - Distilled Water
  - Gloves
  - Record Keeping
  - Sample Delivery to FMWRD
  - Sample Delivery to First Environmental

- Safety Issues – Carrie
  - Safety Vests
  - Traffic Issues
  - Rain Gear

AGENDA
2007 CSO LTCP Sampling Training
August 20, 2007

- Project overview – Karen
  - Purpose
  - Teams (see back of agenda)
- Notification – Phil
  - Timing of Sample Event
  - Duration of Sample Event
  - Phone List
- ISCO sampling – Carrie and Tim
- Bridge sampling – Karen
  - Field Trip to North Avenue Bridge (weather permitting)
- Equipment use – Carrie
  - pH meters
  - DO meters
- Sampling Protocols – Karen and Carrie
  - Filling Bottles
  - Labeling Bottles
  - Coolers and Ice
  - Distilled Water
  - Gloves
  - Record Keeping
  - Sample Delivery to FMWRD
- Safety Issues – Carrie
  - Safety Vests
  - Traffic Issues
  - Rain Gear

APPENDIX D

FMWRD LABORATORY SPREADSHEET

CSO Project: Walter E Deuchler Associates
Fox Metro Laboratory Data Summary

Sample Date: September 26, 2007

Stream Sampling Locations

Test Parameters	1 Sullivan A	2 Sullivan B	3 Sullivan C	4 Indian Cr. B	5 North Ave. A	6 North Ave. C	7 Ashland A	8 Mill St. A	9 Mill St. C	10 Route 34 A	11 Route 34 C
pH (units)	6.27	6.40	6.43	6.15	6.25	6.48	6.34	6.25	6.40	6.43	6.48
Conductivity	730	870	870	870	890	870	880	900	880	920	870
Temperature ©	21.2	21.2	21.2	18.1	20.8	22.1	21.7	21.6	21.8	23.4	23.4
DO (mg/L)	5.7	5.8	6.1	6.5	6.8	6.6	6.6	6.8	7.0	8.2	8.1
BOD (mg/L)	< 2	< 2	< 2	4	2	< 2	3	2	2	3	3
TSS (mg/L)	23	25	36	15	24	26	27	24	26	21	25
Fecal Coliforms (#/100mL)	300	350	200	67000	340	540	640	748	757	600	793
TKN (mg/L)	4.62	6.53	8.85	9.69	2.68	3.79	2.06	2.03	8.83	5.89	5.94
Ammonia N (mg/L)	0.07	0.06	0.06	0.10	0.04	0.04	0.03	0.02	0.02	1.15	0.02
Nitrate N (mg/L)	1.17	1.12	1.09	< 0.18	1.03	1.06	1.05	1.03	1.01	1.52	0.83
Nitrite N (mg/L)	< 0.05	< 0.05	< 0.05	< 0.10	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Organic N (mg/L)	4.55	6.47	8.79	9.59	2.64	3.75	2.03	2.01	8.81	ND	5.92
Total P (mg/L)	0.35	0.34	0.34	0.16	0.33	0.33	0.33	0.32	0.31	0.32	0.29
Dissolved P (mg/L)	0.23	0.22	0.21	0.04	0.19	0.19	0.20	0.20	0.18	0.21	0.17
Chloride (mg/L)	127	126	126	116	126	126	127	128	128	146	126
Fluoride (mg/L)	0.23	0.23	0.21	0.26	0.20	0.21	0.24	0.22	0.21	0.38	0.20
Turbidity (NTU)	16	17	10	5.9	12	16	15	15	15	12	14

CSO Discharge Samples

Test Parameters	Rathbone 1	Rathbone 2	Rathbone 3	West Benton 1	West Benton 2	West Benton 3	West Benton 4
pH (units)	6.09	6.05	6.31	5.70	5.84	6.24	5.95
Conductivity	560	570	580	730	20	20	330
Temperature ©	23.1	22.1	22.4	20.9	21.0	21.3	20.9
DO (mg/L)	0.6	0.8	0.8	0.5	1.1	0.8	1.1
BOD (mg/L)	120	100	82	167	108	191	130
TSS (mg/L)	120	120	120	740	640	920	500
Fecal Coliforms (#/100mL)	TNTC	TNTC	TNTC	TNTC	TNTC	TNTC	TNTC
TKN (mg/L)	19.4	18.8	18.7	19.1	20.0	20.5	15.0
Ammonia N (mg/L)	5.84	6.80	5.88	0.90	0.72	0.21	1.42
Nitrate N (mg/L)	< 0.36	< 0.09	< 0.09	< 0.09	< 0.09	< 0.09	0.20
Nitrite N (mg/L)	< 0.20	< 0.05	< 0.05	0.09	0.18	0.26	0.14
Organic N (mg/L)	13.6	12.0	12.8	18.2	19.3	20.3	13.6
Total P (mg/L)	3.02	3.16	2.98	3.83	3.90	5.49	3.97
Dissolved P (mg/L)	1.11	1.27	1.06	0.41	0.40	0.40	0.49
Chloride (mg/L)	61	74	73	51	40	37	27
Fluoride (mg/L)	0.30	0.41	0.25	0.41	0.17	0.55	0.13
Turbidity (NTU)	100	100	100	270	220	240	170

Cell Color Key: ▒ = Tributary Sampling Point
☐ = Fox River Sampling Point

Abbreviations: NS = No Sample; ND = Not Determined; AF = Analysis Failure; CG = Confluent Growth; TNTC = Too Numerous to Count

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APPENDIX E

STANDARD OPERATING PROCEDURES

Fox Metro Water Reclamation District
Combined Sewer Overflow Long Term Control Project

Procedures for Equipment Cleaning

1.0 Introduction

1.1 Purpose

To ensure effective cleaning of sampling equipment prior to use in the field in order to prevent cross-contamination between sites.

1.2 Definitions

Cross-contamination - Contamination of a sample by the sampler due to poor decontamination practices.

Native Rinse - Refers to collecting water from the same source as the intended sample prior to sampling, for use as a rinse of the sampling equipment. The purpose is to further remove trace residue of any constituents in the containers.

2.0 Health and Safety Considerations

Care should be taken to avoid injury during all field activities and the project personal protective equipment should be worn during all activities. This includes closed toed shoes, gloves and safety vests for all field personnel. Field personnel working around manholes or with heavy objects should include steel-toed boots.

3.0 Personnel Qualifications

3.1 Personnel will be trained in all sampling equipment procedures by an experienced sampler before initiating the sampling procedure.

3.2 All personnel shall be responsible for complying with the Quality Assurance Project Plan for the Fox Metro Water Reclamation District (FMWRD) Combined Sewer Overflow Long Term Control Project.

4.0 Materials

4.1 Sample collection equipment (DH-2 samplers, horizontal beta bottles)

4.2 Stainless steel buckets with lids

4.3 Latex gloves

4.4 10% HCl Solution

4.5 4% Liquinox Solution

5.0 Pre-cleaning procedures

5.1 Obtain all necessary equipment

6.0 Cleaning Procedures

6.1 Office cleaning of sampling equipment prior to sampling activities.

6.1.1 Put on disposable gloves and soak all equipment including samplers and stainless steel buckets with lids using 4% Liquinox solution.

6.1.2 Rinse equipment with distilled water. Be sure to swirl the DI water in the equipment to rinse out residues.

6.1.3 Rinse the equipment with 10% hydrochloric solution.

6.1.4 Rinse equipment with distilled water. Be sure to swirl the water in the equipment to rinse out residues.

6.1.5 Allow containers to dry.

6.2 Field cleaning of sample equipment between sites.

6.2.1 Upon arrival at the sampling site, rinse the samplers and stainless steel bucket with distilled water.

6.2.2 Do a native rinse of the equipment prior to collecting the next sample using native rinse water.

7.0 Sample Handling, Preservation, Storage

Not Applicable

8.0 Chain of Custody

Not Applicable

9.0 Quality Control/Quality Assurance and Decontamination

9.1 All QC requirements in the QAPP must be followed.

Fox Metro Water Reclamation District
Combined Sewer Overflow Long Term Control Project

Procedures for Chain of Custody

1.0 Introduction

1.1 Purpose

The purpose of this Standard Operating Procedure is to provide a framework for the Chain of Custody (COC) procedures as part of this project. These are specific instructions for completing and handling the COCs associated with the FRSG LTCP monitoring project.

1.2 Definitions

1.2.1 Chain of Custody: The protocol that provides a record of the persons having control and access to a sample. The chain of custody begins when the sample is collected and ends when the sample is disposed. If the analytical results for a project are questioned, the chain of custody documentation is the record that proves the sample was collected and handled according to specifications and that the sample can be directly linked to the analytical results.

2.0 Health and Safety Considerations

Not applicable

3.0 Interferences

3.1 If Chain of Custody protocols are not properly followed, results may be challenged or invalidated.

4.0 Personnel Qualifications

4.1 Personnel will be pre-trained in COC procedures by an experienced sampler before initiating the COC procedure.

4.2 All personnel shall be responsible for complying with the Quality Assurance Project Plan for the Fox Metro Water Reclamation District (FMWRD) Combined Sewer Overflow Long Term Control Project.

5.0 Materials

5.1 COC Form

5.2 Field book

5.3 Pen

6.0 Pre-sampling

6.1 Obtain necessary equipment

6.2 Prepare a schedule and coordinate with staff

7.0 Procedures

7.1 Procedure for field personnel.

7.1.1 The field personnel is required to complete the following information on the COC form (Appendix G).

7.1.1.1 Project Number

7.1.1.2 Sample location

7.1.1.3 Date and time of sample collection

7.1.1.4 Sampler's signature and remarks

7.1.1.5 Signature of person relinquishing sample custody

7.1.1.6 Date and time relinquished

7.1.1.7 Laboratory parameters

7.1.2 The COC must be filled out completely and legibly in ink. Corrections will be made if necessary, by drawing a single line through and initialing and dating the error. The corrected information is then recorded in ink. All COC form in the "Relinquished by" and "Received by" sections

7.1.3 If samples are to be transported by courier, the person hand carrying the samples is the sample custodian. If the carrier is a different person than the one who filled out the COC and packaged the samples, then that person must transfer custody to the carrier by signing and dating each form in the "relinquished by" section and the laboratory sample custodian must sign and date each form in the "received by" section.

7.2 Laboratory Sample Receipt and Inspection

7.1.2.1 Upon sample receipt, the coolers are inspected for general condition. The coolers are then opened and each sample inspected for damage.

7.1.2.2 Sample containers are removed from the cooler and the sample labels are verified against the COC form.

7.1.2.3 The COC form is completed by signing and recording the date and time of receipt.

7.1.2.4 The Project Manager will be notified immediately of any breakage, temperature exceedences, or discrepancies between the COC paperwork and the samples.

8.0 Sample Handling and Preservation

After fill of the coolers, the cooler will be closed.

9.0 Chain of Custody

Not applicable

10.0 Data Management

10.1 All data and information shall be recorded on the COC

10.2 The chain of custody form is signed over to the laboratory. A copy is kept with the sampling records.

10.3 The sampling data is stored at WEDA's office for at least 5 years.

11.0 Quality Control/Quality Assurance and Decontamination

11.1 The records generated in the procedure are subject to review during data validation, in accordance with QAPP.

12.0 Routine Maintenance

None applicable.

Fox Metro Water Reclamation District
Combined Sewer Overflow Long Term Control Project

Procedures for Continuous Dissolved Oxygen Monitoring

1.0 Introduction

1.1 Purpose

The purpose of this Standard Operating Procedure is to provide a framework for monitoring dissolved oxygen and temperature using YSI 6600 EDS sondes as part of FMWRD Long Term Control Project. These procedures include detailed instruction on sonde calibration, selection of sonde deployment locations.

1.2 Definitions

1.2.1 Dissolved Oxygen: A relative measure of the amount of oxygen dissolved in water.

1.2.2 In-situ: In place. Measurements are taken in the field without collection of a sample for laboratory analysis.

1.2.3 Sonde: Water quality monitoring device that can be equipped with multiple probes to continuously record stream data.

2.0 Health and Safety Considerations

All personnel are required to wear closed toed shoes, orange reflective vests and latex gloves. When wading in a stream a personal flotation device should be worn. There shall be no less than two people deploying or retrieving a sonde.

3.0 Interferences

Interferences can occur during an unattended deployment. Physical damage may occur to the probes due to debris such as leaves, plastic bags and sediment. Physical tampering may occur from recreational users of the stream. The sonde may become entangled in a fishing line, people may remove it from the water or physically remove the sonde.

4.0 Personnel Qualifications

4.1 Personnel will be trained in all sampling equipment procedures by an experienced sampler before initiating the sampling procedure.

4.2 All personnel shall be responsible for complying with the Quality Assurance Project Plan for the Fox Metro Water Reclamation District (FMWRD) Combined Sewer Overflow Long Term Control Project.

5.0 Materials

5.1 6600 EDS Sonde
5.2 Distilled water
5.3 Disposable Gloves
5.4 Protective cup for sonde
5.5 Protective case for sonde
5.6 Hach Sension6 DO/Temperature Meter
5.7 Laptop
5.8 Sonde communication cable
5.9 Padlocks
5.10 Keys for padlocks
5.11 Duplicate set of keys
5.12 Bolt cutter
5.13 Stream flow meter
5.14 Wadders
5.15 Personal flotation jacket
5.16 Disinfectant wipes/hand sanitizer
5.17 Clipboard
5.18 Field book
5.19 Calibration log
5.20 Pen

6.0 Pre-sampling

6.1 Obtain necessary equipment
6.2 Prepare a schedule and coordinate with staff
6.3 Inspect and calibrate sonde using procedures outlined below.
6.4 All instrument probes must be calibrated before they are deployed. Before performing any calibration procedure the sonde must be stabilized for at least ten minutes.

7.0 Procedures

7.1 Office sonde calibration procedures.

7.1.1 Temperature

For instrument probes that rely on temperature such as dissolved oxygen, the sonde temperature sensor needs to be checked for accuracy against a thermometer that is traceable to the NIST. The reference thermometer's accuracy check will be performed once a year and the date and results of the check will be kept with the instrument. Temperature measurements made by the sonde will be verified with each calibration using the following procedure:

7.1.1.1 Allow a container filled with water and the sonde to come to room temperature.

7.1.1.2 Place reference thermometer into the water and wait for both temperature readings to stabilize. Compare the two measurements. The instrument's temperature sensor must agree with the reference thermometer within the accuracy of the sensor (+/- 0.15^{0} C). If the measurements do not agree, the instrument may not be working correctly and the manufacturer should be contacted.

7.1.2 DO

7.1.2.1 Clean all the probes on the sonde with tap water then shake off excess water.

7.1.2.2 Place approximately 1/8 inch of water in the bottom of the calibration cup. Place the probe end of the sonde into the cup and loosely screw on the calibration cup to ensure that the DO probe is vented to the atmosphere. Make sure the DO probe is not immersed in water . Wait for approximately 10 minutes for the probe to equilibrate with the atmosphere.

7.1.2.3 From the calibration menu select the "Dissolved Oxygen" option, then the "DO%" option.

7.1.2.4 Read and record the atmospheric pressure obtained from the office.

7.1.2.5 Press enter to accept the calibration. Press enter again to return to the calibration menu.

7.1.3 Date and Time

7.1.3.1 To verify that the time is correct from the systems menu select "date/time". Press enter to accept. Date and time are set on Central standard time.

7.2 Procedure for selecting sonde deployment locations.

7.2.1 Mount the velocity meter and DO meter on the bridge board.

7.2.2 At each sampling site, measure the stream width.

7.2.3 After the total stream width is determined, divide the stream into 10 equal sections.

7.2.4 At each equal distant location, measure the total stream depth using a wadiong rod

7.2.5 Depending on the stream depth, measure DO, temperature and velocity at the appropriate depths below the water surface.

7.2.5.1.1.1 If the depth is less than 2 feet, measure DO, temperature and velocity at mid-depth.

7.2.5.1.1.2 If the depth is greater than 2 feet but equal to or less than 3 feet, measure DO, temperature and velocity at 1-foot below surface and 2 feet below surface

7.2.5.1.1.3 If the depth is greater than 3 feet but equal to or less than 4 feet, measure DO, temperature and velocity at 1-foot below surface, 2 feet below surface and 3 foot below surface.

7.2.5.1.1.4 If the depth is greater than 4 feet but equal to or less than 5 feet, measure DO, temperature and velocity at 1-foot below surface, 2 feet below surface and 4 foot below surface.

7.2.5.1.1.5 If the depth is greater than 5 feet but equal to or less than 6 feet, measure DO, temperature and velocity at 1-foot below surface, 3 feet below surface and 5 foot below surface.

7.2.5.1.1.6 If the depth is greater than 6 feet but equal to or less than 7 feet, measure DO, temperature and velocity at 1-foot below surface, 3 feet below surface and 6 foot below surface.

7.2.6 Record DO, temperature, and velocity on the field logs.

7.2.7 Data will be analyzed using Excel in order to determine the deployment location at site that is most representative of the entire stream width.

7.3 Sondé deployment procedure.

7.3.1 Replace the calibration cup with the protective cup.

7.3.2 For the Route 34 Bridge and Ashland Avenue Bridge, place the cable around the bridge pole nearest the selected deployment location. Lock cable attach sonde to other end of cable with lock. Gently lower into the river.

7.3.3 At the Sullivan Road Bridge, find the cable attached to the abutment. Lock the sonde on the cable and place in the appropriate location.

7.3.4 Complete information in the log book.

8.0 Sample Handling and Preservation

All sample measurements are performed *in-situ*, therefore there is no need for sample handling, preservation or storage.

9.0 Chain of Custody

All sample measurements are performed *in-situ*, therefore there is no need for chain of custody procedures.

10.0 Data Management

10.1 All data and information shall be recorded in the field book for the dissolved oxygen meters.

11.0 Quality Control/Quality Assurance and Decontamination

11.1 The records generated in the procedure are subject to review during data validation, in accordance with QAPP.

12.0 Routine Maintenance

12.1 Cleaning Guidelines

At the end of each sample season the units should be thoroughly cleaned. Batteries should be removed from each sonde to prevent corrosion. Sondes should be stored with the probes in place. A moist sponge should be placed in the base of the calibration cup and the calibration cup should be placed at the end of the probe to prevent damage.

13.0 References

YSI Incorporated, "YSI Environmental Operations Manual" (6-Series).

Fox Metro Water Reclamation District
Combined Sewer Overflow Long Term Control Project

Procedures for Discrete Water Quality Sampling

1.0 Introduction

1.1 Purpose

The Standard Operating Procedure (SOP) provides the framework for collecting representative discrete water quality samples as part of the Fox Metro Water Reclamation District Long Term Control Plan.

1.2 Summary of Methods

This SOP described the procedures for the collection of representative water samples via bridges using depth integrated and point samplers.

1.3 Definitions

1.3.1 Depth-Integrating Sampler: The depth integrating sampler collects and accumulates a velocity or discharge weighted sample as it is lowered into and raised back to the surface of the stream.

1.3.2 Discharge: The volume of water that passes a given river cross-section in a given period of time.

1.3.3 Equal-Width-Increment Sampling: A method used to collect a series of water quality samples to represent a single stream cross-section. The stream width is divided into a number of equal-width intervals which are sampled. In this case, the EWI method is used during sampling conditions where a discharge measurement is not made before sampling.

1.3.4 Transit Rate: The transit rate is the speed of lowering and raising the sampler in the sampling vertical.

2.0 Health and Safety Considerations

2.1 Proper personal protective clothing must be worn including gloves and closed toes shoes.

2.2 Field personnel must wear a reflective safety vest.

2.3 Care should be taken when using chemicals in the field to prevent spillage on the skin or splatter in the eyes.

3.0 Interferences

3.1 Interference may result from using contaminated equipment, solvents, reagents or sample containers.

3.2 Cross contamination problems can be eliminated or minimized through the use of dedicated sampling equipment. Clean and decontaminate all sampling equipment prior to use and between each sampling site. See the SOP for

Laboratory Cleaning of Sampling Equipment and Field Cleaning of Equipment for details on the cleaning and decontamination procedures.

3.3 Interference can come when using a depth integrated sampler if the orifice becomes clogged with debris, the sampler disturbs bottom sediment or improper transit rates are used.

4.0 Personnel Qualifications

4.1 Personnel will be trained in all sampling equipment and calibration procedures by an experienced sampler before initiating the sampling procedure.

4.2 All personnel shall be responsible for complying with the Quality Assurance Project Plan for the Fox Metro Water Reclamation District (FMWRD) Combined Sewer Overflow Long Term Control Project.

5.0 Materials

5.1 Distilled water

5.2 Sample collection equipment (DH-2 samplers and Van Dorn samplers).

5.3 Safety Vests

5.4 Calibration standard of 1000 mS

5.5 Clean Nalgene sampling bottles

5.6 Laboratory supplied amber bottles

5.7 Sterile 100 ml bacteria bottles.

5.8 Coolers

5.9 Field Logs

5.10 Pen

5.11 Chain of Custody Forms

5.12 Gloves

6.0 Pre-sample Collection

6.1 Determine the number of samples and quality control (QC) samples specified in the QAPP.

6.2 Obtain necessary sampling equipment.

6.3 Decontaminate or pre-clean equipment and ensure that it is in working condition. See the SOP for Laboratory Cleaning and Field Cleaning of Sampling Equipment for details on the cleaning and decontamination procedures.

6.4 Ensure all sampling locations are pre-marked with tape.

7.0 Procedures for Identifying Sampling Locations

7.1 Procedures for determining equal-width-increment sampling locations.

7.1.1 A minimum of 10 verticals will be used for streams over five feet wide. For streams less than 5 feet wide, as many verticals as possible should be used as long as they are spaced a minimum of 3 inches apart to allow for discrete sampling of each vertical and to avoid overlaps. The width of the increments to be sampled or the distance between the verticals is determined by dividing the stream width by the number of verticals necessary to collect a discharge-weighted suspended-sediment sample representative of the sediment concentration of the flow in the cross section. For example if the stream width at the sample cross-section is determined to be 130 feet and the number of verticals necessary is 10, than the width (W) of each sample increment would be 13 feet. To reduce sampling time by the discrete sampling crews, the equal-width-increments will be pre-determined before the sampling period.

7.2 Procedures for identifying the equal-width-increment sampling locations along the bridges.

7.2.1 At all bridge sites on the main stem of the Fox River the equal-width-increments have been pre-measured and marked on the bridge using pink and green duct tape. Each bridge has been marked into ten equal increments based on the total cross-section of the channel.

7.3 Procedures for identifying discrete sampling locations at tributary sites.

7.3.1 At each tributary site the width of the stream will be pre-measured using a graduated tape measure. Each stream cross section will be pre-marked into appropriate increments on a using red tape.

8.0 Procedures for Discrete Water Sampling

8.1 Water quality samples on the main stem of the Fox River will be collected using the pre-marked locations for the Equal-Width-Increment Method as described in Edwards and Glysson (USGS, 1999). This sampling method requires that all verticals be traversed using the transit rate (Table 1) established at the highest velocity of the cross section. The descending and ascending transit rates must be equal during the sampling traverse of each vertical and they must all be the same verticals. By using this equal transit rate technique with a depth integrating sampler at each vertical, a volume of water proportional to the flow in the vertical will be collected. The method used to collect suspend sediment samples will be dependent on the flow conditions and particle size of the suspended sample of the suspended sediment being transported. For sampling in the main stem, based on previous field observations it is assumed that velocities will be between 2 and 12.0 ft/s and depths will be less than 15 feet which are considered Category 2 conditions.

8.1.1 Take the nozzle and nozzle holder. Check to see that there are no obstructions in the nozzle or air-exhaust tube. Select a bag and place the bag opening over the rear of the nozzle holder. Gather the bag around the rear of the nozzle holder. Secure the bag by cinching it down with the Velcro strap. Slide the nozzle holder into the back of the nose-piece. Align the lug on the nozzle holder with the slot in the nose. Insert the nozzle through the hole in the front of the nose-piece and screw it into the nozzle holder. Hand tighten only. Lay the nose piece with nozzle, nozzle-holder, and bag on a flat surface. Starting at the rear of the bag use one hand to hold the bag and the other hand to flatten and push the air out of the bag through the nozzle. Fold the bag in half along the longitudinal center line and push air out of the bag. Insert the bag into the sampler cavity. Place the bottom of the nose-piece into the bottom of the sampler cavity and snap into place.

8.1.2 Lower sampler to water surface so that the nozzle is above the water and the lower tail vane or back of the sampler is in the water for proper upstream-downstream orientation. After orientation of the sampler, depth integration is accomplished by traversing the full depth and returning to the surface with the sampler at a constant transit rate. When the bottom of the sampler touches the streambed, immediately reverse the sampler direction and raise the sampler to clear the surface of the flow at a constant transit rate.

8.1.3 The minimum transit rate is one at which the sample volume does not exceed 1 liter. The minimum transit rate can be calculated using the sampling time from the table and the total distance to be transited. For example, if the total sampling time is 30 seconds, the minimum transit rate should such that it takes 15 seconds to descend from the surface to the bottom and 15 seconds to return to the surface. The stream is 5 feet deep, then the transit rate would be 3 seconds per feet.

8.1.4 Once the sample is collected, remove the nose piece by grabbing it at the sample body indentations and popping it out. Make sure to support the bag with sample as it is removed from the sampler. Do not pour the sample back through the nozzle. The sample may then be transferred to the container for compositing. Plastic bags should be discarded after use.

8.1.5 The tightness of fit of the nose-piece in the sampler body can be adjusted by removing the O-ring and adding or removing Teflon plumber's tape in the groove and replacing the O-ring.

8.1.6 Always transport the sampler in the shipping box to prevent damage to the sampler.

8.2 Sampling on Indian Creek

Indian Creek is a shallow stream and in general is less than two feet in depth. Since access down to the stream is difficult, a Van Dorn (Wildco Horizontal Beta Bottle) will be used.

8.3 General Sampling Procedures

8.3.1 Upon collecting the required vertical samples, begin processing the samples.

8.3.2 Put on the lid for the stainless steel bucket and gently invert three times to ensure proper mixing. Label all sample bottles to be filled. One amber bottle and two Nalgene bottles should be collected. Place samples back in the cooler.

8.3.3 From the remaining sample in the bucket measure pH, conductivity, temperature and dissolved oxygen.

9.0 Sample Handling, Preservation and Storage

9.1 Don necessary safety equipment.

9.2 Fill the bottles with the composite water sample from the bucket and cap the bottles.

9.3 Load all samplers in the cooler.

10.0 Chain of Custody

10.1 Follow the chain of custody SOP.

10.2 Chain of custody forms should stay with the samples at all times. When samples are not in custody of the sampler, the samples should be locked inside the building.

11.0 Data Management

11.1 Complete the field logs.

11.2 The chain of custody form is signed over to the laboratory. A copy is kept with the sampling records.

11.3 The sampling data is stored at WEDA's office for at least 5 years.

12.0 Quality Control/Quality Assurance and Decontamination

12.1 Representative samples are required. The sampler will evaluate the site specific conditions to assure the sample will be representative.

12.2 All sampling equipment must be decontaminated between sampling sites. See the SOPs for cleaning equipment.

11.2 All field QC sample requirements in the QAPP must be followed.

13.0 Routine Maintenance

12.1 pH and conductivity electrodes should be changed once a year.

12.2. DO membrane should be changed at least once a year or more frequently if needed.

14. References

14.1 Federal Interagency Sedimentation Project. Date Unknown. *Operator's Manual for the US DH-2 Depth-Integrating Collapsible-Bag Suspended-Sediment/Water Quality Sampler*.

14.2 Edwards T.K., and G.D. Glysson, 1999. *Field Methods for Measurement of Fluvial Sediment, Book 3, Chapter C2.* Techniques of Water Resources Investigations of the United States Geological Survey, U.S. Government Printing Office, Washington, D.C.

Fox Metro Water Reclamation District
Combined Sewer Overflow Long Term Control Project

Procedures for Calibrating Handheld Meters

1.0 Introduction

1.1 Purpose

The Standard Operating Procedure (SOP) provides the framework for calibrating the Hach Sension6 and the Omega Pocket Pal meters used to measure dissolved oxygen, temperature, pH and conductivity as part of the discrete water quality sampling portion of the Fox Metro Water Reclamation District Long Term Control Plan.

1.2 Summary of Methods

This SOP described the procedures for the calibration and field measurement programming for the Hach Sension6 and the Omega Pocket Pal.

1.3 Definitions

1.3.1 Buffer: A solution that can maintain a nearly constant pH is it is diluted, or if strong acids or bases are added.

1.3.2 Conductivity: The ability of an aqueous solution to carry an electrical current.

1.3.3 Dissolved Oxygen (DO): A relative measure of the amount of oxygen dissolved in water.

1.3.4 In-situ: In place. An *in-situ* environmental measurement is one that is taken in the field, without removal of a sample to the laboratory.

1.3.5 Material Safety Data Sheets (MSDS): A compilation of information required under the Occupation Safety and Health Agency Communication Standard on the identity of hazardous chemicals, health and physical hazards, exposure limits and precautions.

1.3.6 pH: A measure of acidity or alkalinity of a solution

2.0 Health and Safety Considerations

2.1 Proper personal protective clothing must be worn including gloves and closed toes shoes.

2.2 The standard solutions for calibrating conductivity contain iodine and potassium chloride. When using the standards, avoid inhalation, skin contact, eye contact or ingestion. If skin contact occurs remove contaminated clothing immediately. Wash the affected areas thoroughly with large amounts of water. If inhalation, eye contact or ingestion occurs, consult the MSD for prompt action and seek medical attention as necessary.

2.3 All standard solutions for calibrating pH contain the following compounds:

pH 7 Solutions: sodium phosphate (dibasic), potassium phosphate (monobasic), water

pH 10 Solutions: potassium borate (tetra) potassium carbonate, potassium hydroxide, sodium (di) ethylenediamine, tetra-acetate, water

2.4 Avoid inhalation, skin contact, eye contact or ingestion. If skin contact occurs remove contaminated clothing immediately. Wash the affected areas thoroughly with large amounts of water. If inhalation, eye contact or ingestion occurs, consult the MSD for prompt action and seek medical attention as necessary.

3.0 Interferences

3.1 Interference may result from using contaminated equipment, solvents, reagents or sample containers.

3.2 Cross contamination problems can be eliminated or minimized through the use of dedicated sampling equipment. Clean and decontaminate all sampling equipment prior to use and between each sampling site. See the SOP for Laboratory Cleaning of Sampling Equipment and Field Cleaning of Equipment for details on the cleaning and decontamination procedures.

4.0 Personnel Qualifications

4.1 Personnel will be trained in all sampling equipment and calibration procedures by an experienced sampler before initiating the sampling procedure.

4.2 All personnel shall be responsible for complying with the Quality Assurance Project Plan for the Fox Metro Water Reclamation District (FMWRD) Combined Sewer Overflow Long Term Control Project.

5.0 Materials

5.1 Distilled water

5.2 Hach Sension6

5.3 Omega pH/Conductivity Pocket Pal Meter

5.4 Calibration standard of 1000 mS

5.5 pH 7.0 Buffer

5.6 pH 10.0 Buffer
5.7 Plastic cups
5.8 Calibration Logs
5.9 Pen

6.0 Calibration
6.1 Obtain necessary equipment
6.2 Decontaminate or pre-clean equipment and ensure that it is in working condition. See the SOP for Laboratory Cleaning and Field Cleaning of Sampling Equipment for details on the cleaning and decontamination procedures.
6.3 Prepare a schedule and coordinate with staff

7.0 Calibration Procedures
7.1 These methods are based on the manufacturer prescribed calibration procedures for the Hach Sension6. Calibration should be completed on a daily basis prior to use.
7.1.1 Turn the instrument on by pushing the "exit" key.
7.1.2 Ensure that the sponge inside the instrument's calibration chamber is wet. Insert the probe into the calibration chamber which is attached to the probe cable.
7.1.3 Allow ten minutes for the atmosphere in the chamber to reach steady-state.
7.1.4 To enter the calibration mode, press the "cal" key located in the lower left corner of the keypad.
7.1.5 The main display will show the current value of the barometric pressure. If the meter has been moved to a different elevation or if the barometric pressure has changed, enter the new value.
7.1.6 Press the "READ/enter" key.
7.1.7 The display will show the current value of the altitude. This should read "0".
7.1.8 Press the "READ/enter" key.
7.1.9 The main display will show % salinity. This should read "0".
7.1.10 Press the "READ/enter" key.
7.1.11 The main display should show 100%.
7.1.12 Press the "READ/enter" key.
7.1.13 The stabilizing icon will flash during calibration.
7.1.14 When calibration is complete, the meter will beep and will return to read mode.

7.2 Calibrating the Omega Pocket Pal Meter should occur on a daily basis prior to use.

7.2.1 pH mode

7.2.1.1 Organize calibration buffer standards in the two designiatedglass jars.

7.2.1.2 Press the "On/Off" button to turn the instrument on.

7.2.1.3 Dip the end of the probes in the 7.0 buffer solution.

7.2.1.4 Slide back the battery compartment door to the first stop to expose the potentiometers.

7.2.1.5 After the readout stabilizes, adjust the meter to read 7.00 ± 0.02 using the "CAL" potentiometer. Rinse with tap water and insert in the 10.0 buffer solution

7.2.1.6 Adjust the "SLOPE" potentiometer until the display reads 10.00 ± 0.02.

7.2.1.7 Repeat this sequence until the readings are stable.

7.2.2 Conductivity mode

7.2.2.1 Rinse electrodes in distilled water.

7.2.2.2 Wipe off conductivity electrode and allow to dry.

7.2.2.3 When dry conductivity should read "0" in air.

7.2.2.4 Adjust "ZERO" potentiometer if electrode does not read zero.

7.2.2.5 Immerse electrode in a 1000 mS calibration solution., Adjust "SPAN" potentiometer to read 1000.

7.2.2.6 Rinse electrodes and return pH to its storage chamber.

8 Sample Handling and Preservation

All sample measurements are performed *in-situ*, therefore there is no need for sample handling, preservation, or storage.

9 Chain of Custody

Not applicable

10 Data Management

10.1 All data and information shall be recorded on the calibration log section of the field sheet.

10.2 The sampling data is stored at WEDA's office for at least 5 years.

11 Quality Control/Quality Assurance and Decontamination

11.1 All sampling equipment must be decontaminated between sampling sites. See the SOPs for cleaning equipment.

11.2 The records generated in the procedure are subject to review during data validation, in accordance with QAPP.

12 Routine Maintenance

12.1 pH and conductivity electrodes should be changed once a year.

12.2. DO membrane should be changed at least once a year or more frequently if needed.

13. References

13.1 Omega pH/Conductivity Pocket Pal Meter Operator's Manual.

13.2 Hach Sension6 Portable Dissolved Oxygen Meter Instruction Manual.

Fox Metro Water Reclamation District
Combined Sewer Overflow Long Term Control Project

Procedures for Collecting Benthic Macroinvertebrates using a Hester-Dendy Sampler

1.0 Introduction

1.1 Purpose

The purpose of this SOP is to provide a framework for the collection of benthic macroinvertebrates using the Hester-Dendy (H-D) artificial substrate sampler. These procedures include detailed instruction on selection of deployment locations, deployment, retrieval and sample handling.

1.2 Definitions

Macroinvertebrates - Small organisms lacking a backbone. In the case of sampling using H-D samplers, all macroinvertebrates will be aquatic; that is found living in water

Artificial Substrate - A constructed version of the natural habitat of various aquatic life.

2.0 Health and Safety Considerations

All personnel are required to wear closed toed shoes and latex gloves. Field crew members wading in streams must wear a safety vest.

3.0 Personnel Qualifications

3.1 Personnel will be trained in all sampling equipment procedures by an experienced sampler before initiating the sampling procedure.

3.2 All personnel shall be responsible for complying with the Quality Assurance Project Plan for the Fox Metro Water Reclamation District (FMWRD) Combined Sewer Overflow Long Term Control Project.

4.0 Materials

4.1 14-plate round H-D samplers
4.2 16-inch diameter round concrete stepping stones
4.3 1/8" Galvanized Wire Rope
4.4 Carriage Bolts
4.5 Nuts

4.6 Rod Coupling Nuts
4.7 Cable Clamp
4.8 Wire Rope Thimble
4.9 Washers
4.10 Iron Stakes
4.11 Drill with concrete bit
4.12 Wire cutters
4.13 Wire pliers
4.14 Heavy leather gloves
4.15 Spray paint
4.12 Hammer
4.16 Waders
4.17 1-Gallon Freezer Bags with zipper
4.18 500-Micron D-Frame Dip Net

5.0 Procedures

5.1 Location Selection

5.1.1 Choose collection sites as stated in the QAPP.

5.1.2 Within the sites decide on a location to place the H-D sampler.

5.1.3 The H-D sampler should be placed in an area in which low water will not expose the sampler.

5.2 Deployment

3.2.1 Drill a hole in the center of round stepping stone.

3.2.2 Place the carriage bolt through a washer and then the concrete stepping stone.

3.2.3 Cut a length of wire rope of sufficient length to anchor the stepping stone to the bank of the river or stream. Place a washer over the top of the carriage bolt. Then place the wire rope around the carriage bolt using a wire rope simple. Secure the short end of the wire rope with cable clamps.

3.2.4 Place a washer followed by a nut over the top of the carriage bolt and secure with the pliers.

3.2.5 Attach a rod coupling nut to the top of the carriage bolt.

3.2.6 Attach the H-D sampler to the rod coupling nut securely.

3.2.6 Pound an iron stake into the ground and secure the other end of the wire rope to the stake.

3.2.7 Place the concrete stone with the attached H-D sampler into the water such that it:

3.2.7.1 remains submerged the entire duration of the deployment (4-6 weeks),

3.2.7.2 will be exposed to flow velocity of at least 0.2 feet per second for the duration of the deployment,

3.7.3 will be in a location that will be accessible should the depth in the stream rise,

3.7.4 is not easily visible from the bank, and

3.7.5 will not be tampered with by recreational users of the river.

3.2.8 Spray paint the location of the iron stake. It may be advisable to using flagging tape in the area.

5.3 Retrieval Procedures

5.3.1 Enter the stream being sure not to disturb the areas around the H-D samplers.

5.3.2 Place the 500-micron D-Frame net downstream of the H-D sampler to catch any organisms that may detach during removal of the H-D.

5.3.3 Carefully detach the H-D sampler from the carriage bolt.

5.3.4 Place the H-D sampler and any material from the net into a labeled plastic bag with zipper. Carefully add river water to the bag and seal. Place this sealed sample bag into another bag, seal and place on ice.

5.3.5 Repeat same procedure with other locations.

6.0 Sample Handling, Preservation, Storage

6.1 Don appropriate safety equipment and latex gloves.

6.2 Place the H-D sampler and any material from the net into a labeled plastic bag with zipper.

6.3 Use river water for transporting the H-D sampler. Be sure to label and seal the bag.

6.4 Place this sealed sample bag into another labeled bag and seal.

6.5 Store all samples on ice.

6.6 Record all information on the field log.

7.0 Chain of Custody

7.1 Follow the chain of custody SOP.

7.2 Chain of custody forms should stay with samples at all times. When samples are not in the custody of the sampler or designated person, the samples should be stored in a secure location.

8.0 Quality Control/Quality Assurance and Decontamination

9.1 All QC requirements in the QAPP must be followed.

9.0 References

California Department of Pesticide Regulation Environment Branch. 2005. Hester-Dendy Standard Operating Procedure.

H-D Sampler Source: Forestry Suppliers Inc.
205 West Rankin Street
P.O. Box 8397
Jackson, MS 39284-8397
800-647-5368
www.forestry -suppliers.com

Fox Metro Water Reclamation District
Combined Sewer Overflow Long Term Control Project

Instructions for Operating ISCO® Samplers when Collecting Combined Sewer Overflows

1.0 Introduction

1.1 Purpose

The purpose of this SOP is to provide standardized instruction for the operation of the ISCO ® model 3700 Standard and 3700 Compact Portable Samplers when sampling combined sewer overflow events. This document will provide specific instructions for instrument set-up, calibration and collection of CSO events with an automatic sampler. This document is designed for the collection of up to 24 separate (discrete) sequential samples using an actuator to trigger the sampling. The samples are collected using a purge and fill sequence that can be programmed for each site.

These are general instructions for setting up the ISCO samplers. Refer to the operation and installation manual for a more detailed programming guide and maintenance routine.

2.0 Health and Safety Considerations

All personnel are required to wear steel toed shoes, orange reflective vests and latex gloves. Since both the manhole covers and sampling equipment are heavy (40 pounds or more) proper lifting techniques should be used to avoid back injury. Be extremely careful to stay away from the manhole to avoid accidentally stepping into it. Since most of the manholes are located in heavy traffic and there is the risk of stepping in the manhole, there will be no retrievals after dark.

Only personnel authorized for confined space entry may enter the manholes.

3.0 Personnel Qualifications

3.1 Personnel will be trained in all sampling equipment procedures by an experienced sampler before initiating the sampling procedure.

3.2 All personnel shall be responsible for complying with the Quality Assurance Project Plan for the Fox Metro Water Reclamation District (FMWRD) Combined Sewer Overflow Long Term Control Project.

4.0 Materials

4.1 Model 3700 Standard and Model 3700 Compact ISCO samplers
4.2 3/8" Teflon tubing
4.3 Sample Strainer
4.4 24 500 ml polypropylene bottles (Compact Sampler)
4.5 24 1000 ml polypropylene bottles (Standard Sampler)
4.6 Polyethylene foam lined caps
4.7 12 V DC battery
4.8 Base and Retaining Ring
4.9 Distilled Water
4.10 Disposable Gloves
4.11 ISCO ProHanger with Suspension Harness
4.12 Model 1640 ISCO Liquid Level Sample Actuator
4.13 Lifting Hook
4.14 Heavy leather gloves
4.15 Spray paint

5.0 Procedures

5.1 Prior to the samplers being samplers being used at each location the following must be done:

5.1.1 Place strainer at depth of the overflow threshold which is different for each overflow location and secure with clamps. Attach the vinyl tubing along the side of the pipe and up the side of the manhole to approximately two feet below ground level.

5.1.2 Cut the vinyl tubing to a sufficient length to allow the sampler to be lifted out of the manhole and to be place approximately three to five feet away from the manhole.

5.1.3 Set up the 1640 actuator sensor such that it will detect liquid at the overflow threshold. Note that in most cases this is not the bottom of the manhole.

5.1.4 Secure the cable for the actuator along the pipe, up through the manhole to the surface. Make sure there is sufficient slack to attach the actuator to the sampler.

5.1.5 Once the strainer, tubing and actuator have been installed secure the tubing and cable with cable ties until the sampler is attached. If there will be a significant time period between the two events. Cover the connector plug for the actuator and the open end of the coupler with electrical tape.

5.2 System set-up for Model 3700 Standard and Model 3700 Compact

5.2.1 Place sampler near the manhole and attach the ProHanger to the sampler using the suspension cables.

5.2.2 Attach the suction line by slipping the free end of the vinyl tubing into the pump tubing using the tube coupling and securing with the attached nylon clamp. The suction tubing extends from the sampler pump to the liquid source of the sample. The vertical distance between the liquid level and the pump should be as short as possible but no more than 26 feet of lift.

5.2.3 Attach the Liquid Level Actuator by plugging the connector end of the sensor into the flow meter connector on the back of the control box. Screw finger tight. Set the actuator switch to "toggle" which will stop the sampler from sampling if the water level drops below the sensor. Whenever the control box is re-set flip the sensor switch once or twice so that the computer recognizes that the sensor is in use. Once the program is started , the display should read "No Water Detected – Sampling Halted".

5.2.4 Attach the external power source (12V battery) by plugging in the connector end of the battery cable into the "12 VDC" connector on the back of the control box. Screw finger tight.

5.2.5 Install sample bottles

<u>Model 3700 Standard</u>

Remove the top portion of the sampler so that the bottom tub is open. Remove the retaining ring. Wearing disposable gloves, place 24 of the 1000 ml wide-mouth, wedge-shaped polypropylene bottles. Make sure that all bottles are fitted in properly then replace the retaining ring and secure it with the attached elastic draw cords. Note that the bottle numbers are molded into the bottom of the base. Place the top portion of the sampler back on and secure. Note there is only one way the top portion can be secured to the bottom portion.

<u>Model 3700 Compact</u>

Remove the top portion of the sampler so that the base is exposed. The compact model has a sleeve which is numerically coded. This sleeve is keyed into the base of the sampler and will only fit one way. Detach the retaining ring from the base by disconnecting the elastic draw cords from the hooks on the retaining ring. Wearing disposable gloves, place 24 of the 500 ml wide-mouth, wedge-shaped polyethylene bottles in the sleeve. Make sure that all bottles are fitted in properly, then set the sleeve back in the base such that it is seated properly and securely. Place the retaining ring back on the slanted part of the bottles and pull the elastic draw cord over the hooks.

5.3 Configuring of Model 3700 Standard and Model 3700 Compact

Both samplers should be Configured as follows:

5.3.1 LIQUID DETECTOR: *Enable*

5.3.2 RINSE CYCLES: *0*

5.3.3 ENTER HEAD MANUALLY: *No*

5.3.4 RETRY: *1*

5.3.5 PROGRAMMING MODE: *Extended*

5.3.6 LOAD STORED: *None*

5.3.7 SAVE PROGRAM: *None*

5.3.8 FLOW MODE SAMPLING: SAMPLE START TIME: *No*
SAMPLE TIME SWITCH: *No*

5.3.9 NONUNIFORM TIME: *Minutes*

5.3.10 CALIBRATE SAMPLER: *Disable*

5.3.11 SAMPLING STOP/RESUME: *Disable*

5.3.12 START TIME DELAY: *0 Minutes*

5.3.13 ENABLE PIN: MASTER/SLAVE: *No*

5.3.14 SAMPLE UPON DISABLE: *No*

5.3.15 SAMPLE UPON ENABLE: *Yes*

5.3.16 RESET SAMPLE INTERVALS: *No*

5.3.17 INHIBIT COUNTDOWN: *No*

5.3.18 END MARK: *Continuous*

5.3.19 RESET PUMP COUNTER: *No*

5.4 Manual programming of Model 3700 Standard and Model 3700 Compact

Be sure to change the battery every two weeks to ensure the sampler will operate correctly when required. Once a program has been configured, it will remain in the memory unless the internal battery dies. Therefore, if programming for a similar sampling event, many steps have already been completed and you may surpass the steps by pressing the START SAMPLING key.

5.4 .1 Press the ON key.

5.4.2 Press the ENTER/PROGRAM key.

5.4.3 Select *Time* and press ENTER key.

5.4.4 Select *Nonuniform* and press ENTER key.

5..4.5 Select *No* for Modify Sequence and press ENTER key

Note if *Yes* is selected the following sequence should be displayed:

Take *12* Samples

Quantity at Interval:

1. *1* at *5*

2. *1* at *10*
3. *1* at 15
4. *1* at *20*
5. *1* at *30*
6. *1* at *45*
7. *1* at *60*
8. *1* at *120*
9. *1* at *180*
10. *1* at *240*
11. *1* at *300*

Press ENTER key

Not e the first sample is collected at 0 minutes when the actuator detects water and signals the sampler to start the program

5.4.5 Change Bottles Based On - Select *Samples* press ENTER key

5.4.6 Select 1Bottle Per Sample Event (for Standard Sampler) press ENTER key
Select 2Bottles Per Sample Event (for Compact Sampler) press ENTER key

5.4.7 Sample Continuously Select *No* ENTER key

5.4.8 Sample Volume *1000* (for Standard Sampler) press ENTER key
Sample Volume *500* (for Compact Sampler)

5.4.9 Enter Start Time? *No* press ENTER key

5.4.10 This will bring up *Programming Sequence Complete*

6. Sample Handling and Preservation

6.1 Don appropriate safety equipment and latex gloves.

6.2 Press DISPLAY STATUS key

6.3 Select *Review* press enter key

6.4 Select *Results* press enter key

6.5 Display will indicate when the Sampler was started and at what time each sample was collected. Record this information in the log book and on a chain of custody.

6.6 Label each bottle with the location, bottle number, time and date collected, and initial.

6.7 Place a cap on each bottle.

6.8 Store all bottles on ice.

7 Chain of Custody

7.1 Follow the chain of custody SOP.

7.2 Chain of custody forms should stay with samples at all times. When samples are not in the custody of the sampler or designated person, the samples should be stored in a secure location.

8 Quality Control/Quality Assurance and Decontamination

9.1 All QC requirements in the QAPP must be followed.

9 Routine Maintenance

9.1 Cleaning Guidelines

At the end of each sample season the units should be thoroughly cleaned. All internal tubing should be replaced and suction lines should be replaced in the manholes.

9.1.1 Wash the samplers inside and out using warm, soapy water. The machines may also be sprayed with a hose as long as the water is kept from the control box and power source connectors.

9.1.2 Clean the strainer with a brush and soapy water. Rinse thoroughly.

9.1.3 Replace the bags of dessicant in the control box as indicated by the humidity indicator at the top of the box.

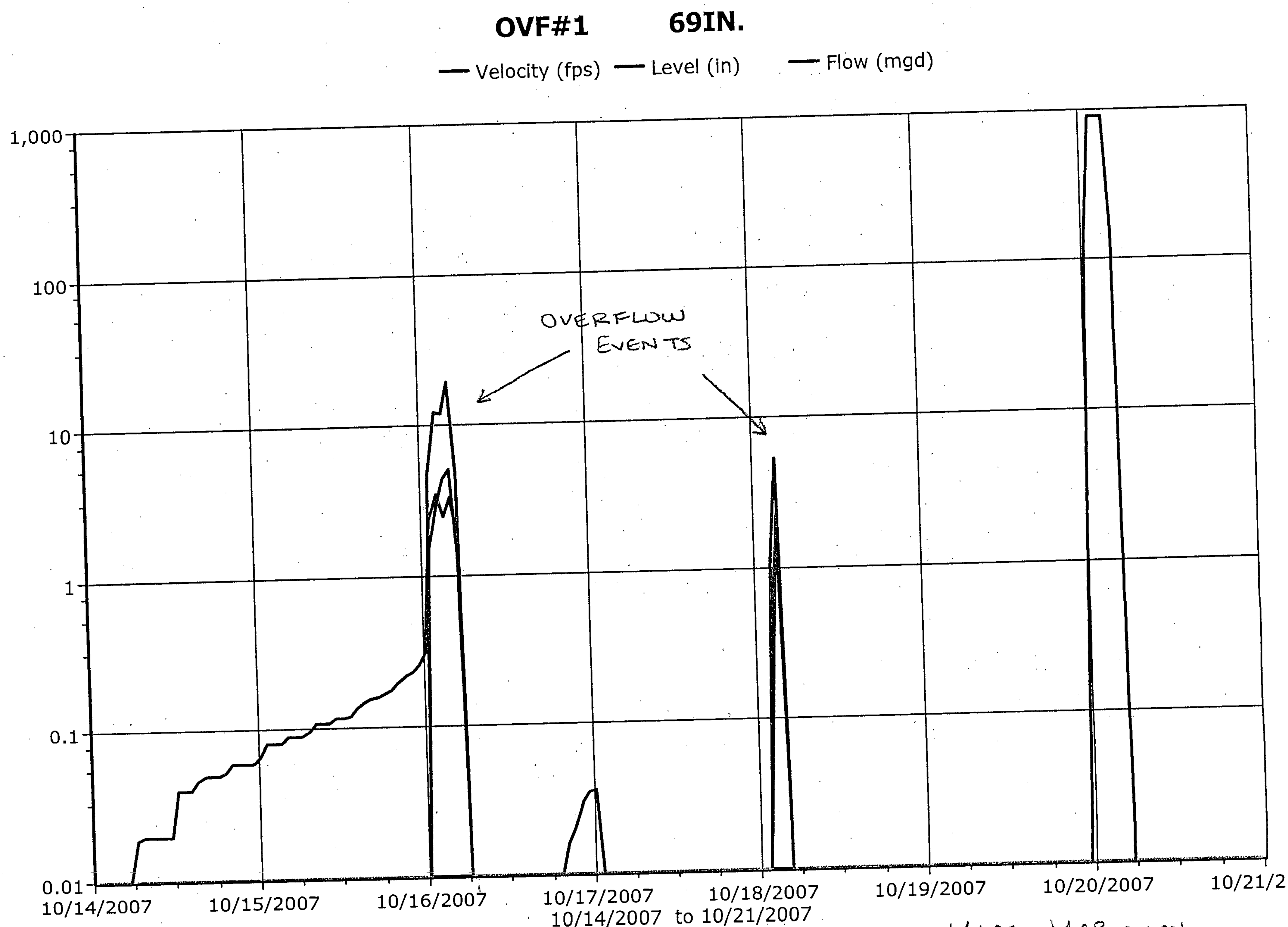
10 References

California Department of Pesticide Regulation Environment Branch. Instructions for Operating ISCO Samplers when Collecting Surface Water.

Teledyne ISCO. 3700 Portable Samplers Installation and Operation Guide

APPENDIX F

MARSH MCBIRNEY GRAPH OF OVERFLOW EVENT



MARSH MCBIRNEY PRINTOUT

APPENDIX G

BRIDGE SAMPLING FIELD DATA SHEET

FMWRD CSO STUDY
BRIDGE SAMPLING

FIELD SAMPLE COLLECTION DATA:

Sample Collectors ______________________

Sampling Location ______________________

Date and Time ______________ Arrival: ______________ Departure: ______________

Weather Observations ______________________

Water Temperature °C ______________ pH (S.U.) ______________

Conductivity (μS/cm) ______________ D.O. (mg/L) ______________

Transect or Grab Sample ______________

Number of transect samples composited ______________

Samplers comments ______________________

____

____

____

CHAIN OF CUSTODY:

Relinquished By	Date / Time	Received By	Date / Time
Relinquished By	Date / Time	Received By	Date / Time
Relinquished By	Date / Time	Received By	Date / Time
Relinquished By	Date / Time	Received By	Date / Time

TRANSPORT TEAM COMMENTS:

____

____

____

____

____

APPENDIX H

CSO OUTFALL SAMPLING FIELD DATA SHEET

2008 CSO Sampling

Location: East Benton (OVF No. 8) (Compact Sampler)

Date/Time: ______________________________

Personnel: ______________________________

Parameter Bottle No.	Initial 1-2	5 min. 3-4	10 min. 5-6	15 min. 7-8	30 min. 9-10	45 min. 11-12	1 hr. 13-14	2 hr. 15-16	3 hr. 17-18	4 hr. 19-20	5 hr. 21-22	6 hr. 23-24
Date/Time of Collection												
pH (units)												
Conductivity (μS)												

Worklist:

Review "Display Status" should tell you when the sample was collected.
Replace bottles
To Restart Program, first toggle switch on the actuator.
Press "Start Sampling"
Press "Enter" when Sample 1 displayed. Should respond with "Sampling Inhibited."

Field Observations:

____

Chain of Custody

Relinquished By	Date/Time	Received By	Date/Time
Relinquished By	Date/Time	Received By	Date/Time

2008 CSO Sampling

Location: First (OVF No. 10) – Prairie at First (Compact Sampler)

Date/Time:______________________________________

Personnel: ___________________________________

Parameter Bottle No.	Initial 1-2	5 min. 3-4	10 min. 5-6	15 min. 7-8	30 min. 9-10	45 min. 11-12	1 hr. 13-14	2 hr. 15-16	3 hr. 17-18	4 hr. 19-20	5 hr. 21-22	6 hr. 23-24
Date/Time of Collection												
pH (units)												
Conductivity (μS)												

Worklist:

Review "Display Status" should tell you when the sample was collected.
Replace bottles
To Restart Program, first toggle switch on the actuator.
Press "Start Sampling"
Press "Enter" when Sample 1 displayed. Should respond with "Sampling Inhibited."

Field Observations:

____

Chain of Custody

Relinquished By	Date/Time	Received By	Date/Time
Relinquished By	Date/Time	Received By	Date/Time

2008 CSO Sampling

Location: Fox Metro (Standard Sampler)

Date/Time:

Personnel:

Parameter Bottle No.	Initial 1	5 min. 2	10 min. 3	15 min. 4	30 min. 5	45 min. 6	1 hr. 7	2 hr. 8	3 hr. 9	4 hr. 10	5 hr. 11	6 hr. 12
Date/Time of Collection												
pH (units)												
Conductivity (µS)												

Worklist:

Review "Display Status" should tell you when the sample was collected.
Replace bottles
To Restart Program, first toggle switch on the actuator.
Press "Start Sampling"
Press "Enter" when Sample 1 displayed. Should respond with "Sampling Inhibited."

Field Observations:

Chain of Custody

Relinquished By	Date/Time	Received By	Date/Time
Relinquished By	Date/Time	Received By	Date/Time

2008 CSO Sampling

Location: Rathbone (Standard Sampler)

Date/Time:

Personnel:

Parameter Bottle No.	Initial 1	5 min. 2	10 min. 3	15 min. 4	30 min. 5	45 min. 6	1 hr. 7	2 hr. 8	3 hr. 9	4 hr. 10	5 hr. 11	6 hr. 12
Date/Time of Collection												
pH (units)												
Conductivity (µS)												

Worklist:

Review "Display Status" should tell you when the sample was collected.
Replace bottles
To Restart Program, first toggle switch on the actuator.
Press "Start Sampling"
Press "Enter" when Sample 1 displayed. Should respond with "Sampling Inhibited."

Field Observations:

Chain of Custody

Relinquished By	Date/Time	Received By	Date/Time
Relinquished By	Date/Time	Received By	Date/Time

2008 CSO Sampling

Location: Hazel (OVF No. 4) (Standard Sampler)

Date/Time:

Personnel:

Parameter Bottle No.	Initial 1	5 min. 2	10 min. 3	15 min. 4	30 min. 5	45 min. 6	1 hr. 7	2 hr. 8	3 hr. 9	4 hr. 10	5 hr. 11	6 hr. 12
Date/Time of Collection												
pH (units)												
Conductivity (µS)												

Worklist:

Review "Display Status" should tell you when the sample was collected.
Replace bottles
To Restart Program, first toggle switch on the actuator.
Press "Start Sampling"
Press "Enter" when Sample 1 displayed. Should respond with "Sampling Inhibited."

Field Observations:

Chain of Custody

Relinquished By	Date/Time	Received By	Date/Time

Relinquished By	Date/Time	Received By	Date/Time

2008 CSO Sampling

Location: West Benton (OVF No. 15) – (Compact Sampler)

Date/Time: ____________________

Personnel: ____________________

Parameter Bottle No.	Initial 1-2	5 min. 3-4	10 min. 5-6	15 min. 7-8	30 min. 9-10	45 min. 11-12	1 hr. 13-14	2 hr. 15-16	3 hr. 17-18	4 hr. 19-20	5 hr. 21-22	6 hr. 23-24
Date/Time of Collection												
pH (units)												
Conductivity (µS)												

Worklist:

Review "Display Status" should tell you when the sample was collected.
Replace bottles
To Restart Program, first toggle switch on the actuator.
Press "Start Sampling"
Press "Enter" when Sample 1 displayed. Should respond with "Sampling Inhibited."

Field Observations:

____

Chain of Custody

Relinquished By	Date/Time	Received By	Date/Time
Relinquished By	Date/Time	Received By	Date/Time

2008 CSO Sampling

Location: West Galena (OVF No. 18) – (Compact Sampler)

Date/Time: ____________________

Personnel: ____________________

Parameter Bottle No.	Initial 1-2	5 min. 3-4	10 min. 5-6	15 min. 7-8	30 min. 9-10	45 min. 11-12	1 hr. 13-14	2 hr. 15-16	3 hr. 17-18	4 hr. 19-20	5 hr. 21-22	6 hr. 23-24
Date/Time of Collection												
pH (units)												
Conductivity (µS)												

Worklist:

Review "Display Status" should tell you when the sample was collected.
Replace bottles
To Restart Program, first toggle switch on the actuator.
Press "Start Sampling"
Press "Enter" when Sample 1 displayed. Should respond with "Sampling Inhibited."

Field Observations:

____

Chain of Custody

Relinquished By	Date/Time	Received By	Date/Time
Relinquished By	Date/Time	Received By	Date/Time

FMWRD CSO STUDY
BRIDGE SAMPLING

FIELD SAMPLE COLLECTION DATA:

Sample Collectors ______________________________

Sampling Location ______________________________

Date and Time ____________ Arrival: ____________ Departure: ____________

Weather Observations ______________________________

Water Temperature °C ____________ pH (S.U.) ____________

Conductivity (µS/cm) ____________ D.O. (mg/L) ____________

Transect or Grab Sample ____________

Number of transect samples composited ______________________________

Samplers comments ______________________________

____

____

____

CHAIN OF CUSTODY:

Relinquished By	Date / Time	Received By	Date / Time
Relinquished By	Date / Time	Received By	Date / Time
Relinquished By	Date / Time	Received By	Date / Time
Relinquished By	Date / Time	Received By	Date / Time

TRANSPORT TEAM COMMENTS:

____

____

____

____

____

2008 CSO Sampling

Location: East Benton (OVF No. 8) (Compact Sampler)

Date/Time:____

Personnel: ____

Parameter Bottle No.	**Initial 1-2**	**5 min. 3-4**	**10 min. 5-6**	**15 min. 7-8**	**30 min. 9-10**	**45 min. 11-12**	**1 hr. 13-14**	**2 hr. 15-16**	**3 hr. 17-18**	**4 hr. 19-20**	**5 hr. 21-22**	**6 hr. 23-24**
Date/Time of Collection												
pH (units)												
Conductivity (µS)												

Worklist:

Review "Display Status" should tell you when the sample was collected.
Replace bottles
To Restart Program, first toggle switch on the actuator.
Press "Start Sampling"
Press "Enter" when Sample 1 displayed. Should respond with "Sampling Inhibited."

Field Observations:

____

Chain of Custody

Relinquished By	Date/Time	Received By	Date/Time
Relinquished By	Date/Time	Received By	Date/Time

2008 CSO Sampling

Location: First (OVF No. 10) – Prairie at First (Compact Sampler)

Date/Time: ______________________________

Personnel: ______________________________

Parameter Bottle No.	Initial 1-2	5 min. 3-4	10 min. 5-6	15 min. 7-8	30 min. 9-10	45 min. 11-12	1 hr. 13-14	2 hr. 15-16	3 hr. 17-18	4 hr. 19-20	5 hr. 21-22	6 hr. 23-24
Date/Time of Collection												
pH (units)												
Conductivity (µS)												

Worklist:

Review "Display Status" should tell you when the sample was collected.
Replace bottles
To Restart Program, first toggle switch on the actuator.
Press "Start Sampling"
Press "Enter" when Sample 1 displayed. Should respond with "Sampling Inhibited."

Field Observations:

____

Chain of Custody

Relinquished By	Date/Time	Received By	Date/Time
Relinquished By	Date/Time	Received By	Date/Time

2008 CSO Sampling

Location: Fox Metro (Standard Sampler)

Date/Time:

Personnel:

Parameter Bottle No.	**Initial 1**	**5 min. 2**	**10 min. 3**	**15 min. 4**	**30 min. 5**	**45 min. 6**	**1 hr. 7**	**2 hr. 8**	**3 hr. 9**	**4 hr. 10**	**5 hr. 11**	**6 hr. 12**
Date/Time of Collection												
pH (units)												
Conductivity (µS)												

Worklist:

Review "Display Status" should tell you when the sample was collected.
Replace bottles
To Restart Program, first toggle switch on the actuator.
Press "Start Sampling"
Press "Enter" when Sample 1 displayed. Should respond with "Sampling Inhibited."

Field Observations:

Chain of Custody

Relinquished By	Date/Time	Received By	Date/Time
Relinquished By	Date/Time	Received By	Date/Time

2008 CSO Sampling

Location: Rathbone (Standard Sampler)________________________

Date/Time:____

Personnel: ____

Parameter Bottle No.	Initial 1	5 min. 2	10 min. 3	15 min. 4	30 min. 5	45 min. 6	1 hr. 7	2 hr. 8	3 hr. 9	4 hr. 10	5 hr. 11	6 hr. 12
Date/Time of Collection												
pH (units)												
Conductivity (µS)												

Worklist:

Review "Display Status" should tell you when the sample was collected.
Replace bottles
To Restart Program, first toggle switch on the actuator.
Press "Start Sampling"
Press "Enter" when Sample 1 displayed. Should respond with "Sampling Inhibited."

Field Observations:

____

Chain of Custody

Relinquished By	Date/Time	Received By	Date/Time

Relinquished By	Date/Time	Received By	Date/Time

2008 CSO Sampling

Location: Hazel (OVF No. 4) (Standard Sampler)

Date/Time:

Personnel:

Parameter Bottle No.	**Initial 1**	**5 min. 2**	**10 min. 3**	**15 min. 4**	**30 min. 5**	**45 min. 6**	**1 hr. 7**	**2 hr. 8**	**3 hr. 9**	**4 hr. 10**	**5 hr. 11**	**6 hr. 12**
Date/Time of Collection												
pH (units)												
Conductivity (µS)												

Worklist:

Review "Display Status" should tell you when the sample was collected.
Replace bottles
To Restart Program, first toggle switch on the actuator.
Press "Start Sampling"
Press "Enter" when Sample 1 displayed. Should respond with "Sampling Inhibited."

Field Observations:

Chain of Custody

Relinquished By	Date/Time	Received By	Date/Time

Relinquished By	Date/Time	Received By	Date/Time

2008 CSO Sampling

Location: West Benton (OVF No. 15) – (Compact Sampler)

Date/Time:____

Personnel: ______________________________________

Parameter Bottle No.	**Initial 1-2**	**5 min. 3-4**	**10 min. 5-6**	**15 min. 7-8**	**30 min. 9-10**	**45 min. 11-12**	**1 hr. 13-14**	**2 hr. 15-16**	**3 hr. 17-18**	**4 hr. 19-20**	**5 hr. 21-22**	**6 hr. 23-24**
Date/Time of Collection												
pH (units)												
Conductivity (µS)												

Worklist:

Review "Display Status" should tell you when the sample was collected.
Replace bottles
To Restart Program, first toggle switch on the actuator.
Press "Start Sampling"
Press "Enter" when Sample 1 displayed. Should respond with "Sampling Inhibited."

Field Observations:

____

Chain of Custody

Relinquished By	Date/Time	Received By	Date/Time
Relinquished By	Date/Time	Received By	Date/Time

2008 CSO Sampling

Location: West Galena (OVF No. 18) – (Compact Sampler)

Date/Time:______________________________

Personnel: ______________________________

Parameter Bottle No.	**Initial 1-2**	**5 min. 3-4**	**10 min. 5-6**	**15 min. 7-8**	**30 min. 9-10**	**45 min. 11-12**	**1 hr. 13-14**	**2 hr. 15-16**	**3 hr. 17-18**	**4 hr. 19-20**	**5 hr. 21-22**	**6 hr. 23-24**
Date/Time of Collection												
pH (units)												
Conductivity (μS)												

Worklist:

Review "Display Status" should tell you when the sample was collected.
Replace bottles
To Restart Program, first toggle switch on the actuator.
Press "Start Sampling"
Press "Enter" when Sample 1 displayed. Should respond with "Sampling Inhibited."

Field Observations:

____

Chain of Custody

Relinquished By	Date/Time	Received By	Date/Time
Relinquished By	Date/Time	Received By	Date/Time

QUALITY ASSURANCE PROJECT PLAN

(AMENDMENTS FOR 2009 SAMPLING)

For the Combined Sewer Overflow Long Term Control Project

NPDES Permit No. IL0020818, Special Condition 14

(2009 Intensive River Sampling During Rain Events, Fish Monitoring, Modifications to the Macroinvertebrate Program and Modifications to the Dissolved Oxygen Sampling Program)

Refer to Original QAPP for all SOPs

Prepared by

Walter E. Deuchler Associates, Inc. AND Deuchler Environmental, Inc.

for the Fox Metro Water Reclamation District

February 1, 2009

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TABLES

APPENDICES

1.0 PROJECT MANAGEMENT

1.1 Distribution

Data collection and management for this project will be the responsibility of Walter E. Deuchler Associates, Inc. (WEDA) and Deuchler Environmental, Inc. (DEI). Laboratory analysis will be provided by Fox Metro Water Reclamation District (FMWRD), First Environmental Laboratories (Naperville, Illinois) and Suburban Laboratories (Hillside, IL). Model selection, calibration and validation will be the responsibility of the Illinois State Water Survey (ISWS).

Table 1 shows the distribution list for a copy of the amendments to the QAPP.

TABLE 1
Distribution List

Individual	Organization
Philippe Moreau, Project Manager	WEDA
Carrie Carter, Project Engineer and Project Quality Assurance Officer	DEI
Karen Clementi, Project Scientist	DEI
Jared Woodcock, Fish Biologist/Bridge Team 1 Captain	DEI
Ryan Cramer, Project Engineer	WEDA
Steve Leppert, Project Technician/Bridge Team 2 Captain	WEDA
Tim Rutsay, Project Technician	WEDA
Cy McMains, Project Engineer/Bridge Team 3 Captain	WEDA
Ted Herrera, Surveyor/Indian Creek Captain	WEDA

1.2 Project/Task Organization

An organizational chart describing lines of communication and responsibilities for the FMWRD CSO study can be seen in **Appendix A.** **Table 2** lists individuals that will participating in this study and the role that each participant will have in this project.

TABLE 2
Roles and Responsibilities

Individual	Organization	Role	Responsibility
Philippe Moreau	WEDA	Project Manager	General oversight of project Review and revise QAPP
Carrie Carter	DEI	QA Officer	Ensure the quality of all aspects of the project
Carrie Carter	DEI	Co-project manager/CSO Lead	Supervision of sample collection Review and revise QAPP Technical Support Manage ISCO Samplers Format data for modeling by ISWS
Karen Clementi	DEI	Macroinvertebrates	Macroinvertebrate sampling and analysis
Jared Woodcock	DEI	Fish Studies	Fish sampling and analysis
John Frerich	WEDA	Hydraulics Manager	General Oversight of Hydraulics Calculations
Dan Stein	WEDA	Discharge Measurements Leader	Supervision of stream gauging/velocity measurements
Randy Hummer	FMWRD	Laboratory Manager	Analyze all CSO and bridge samples (except chlorophyll a) QA/QC all laboratory data Provide data to DEI in excel format
Jared Woodcock	DEI	Bridge Team 1 Captain	General oversight of Sullivan bridge sampling.
Steve Leppert	WEDA	Bridge Team 2 Captain	General oversight of Mill Street bridge sampling.
Cy McMains	WEDA	Bridge Team 3 Captain	General oversight of Route 34 bridge sampling.
Ted Herrera	WEDA	Indian Creek Captain	General oversight of Indian Creek bridge sampling.
Alena Bartosova	ISWS	Project Manager Modeling Team	Provide guidance in data collection/develop models
Will Gillepsie	ISWS	Assistant Project Manager Modeling Team	Provide guidance in data collection/develop models

1.3 Project Background

The Illinois Environmental Protection Agency (IEPA) *Illinois Water Quality Report 2000* (IEPA, 2000) listed parts of the Fox River in McHenry and Kane Counties as impaired. The IEPA 2002 report listed the entire length of the Fox River in Illinois as impaired. The IEPA included the Fox River on its list of impaired waters, commonly called the 303(d) list (IEPA, 2008). The most prevailing causes for the listing were flow alterations, habitat, sedimentation/siltation, dissolved oxygen, suspended solids, excess algal growth, fecal coliform and polychlorinated biphenyls. The most prevailing potentials for the listings were hydromodification and flow regulation, urban runoff and combined sewer overflows.

The City of Aurora (COA) began installing separate storm sewers in the mid-1960's, for the purpose of reducing sewage backups into residential basements and reducing combined sewer overflows into the Fox River during rain storm events. Currently, there are 14 permitted CSO outfalls (Rathbone, E. Illinois, Hazel, Third, E. Benton, First, W. Benton, Clark, Stolp, W. Galena, W. Park, Superior, W. Illinois and Pierce) discharging to the Fox River and one CSO discharging to Indian Creek (Dearborn-Trask) within the City of Aurora. There is one permitted CSO outfall at the FMWRD facility. In 1997, the COA and FMWRD built a CSO primary treatment facility for storing combined sewer overflows and treating excess flows from four of the previously mentioned CSOs prior to discharge to the river. The CSO facility is located at 400 North Broadway on the east side of Aurora.

FMWRD NPDES Permit (#IL0020818) was renewed in February 2007. As part of its permit, the FMWRD is required to develop a Long Term CSO Control Plan (LTCP). Two of the components of the LTCP are to characterize, monitor and model the Fox River and the combined sewer system.

1.4 Project Description

This project seeks to collect data in support of characterizing possible impacts to the Fox River from the COA and FMWRD combined sewer and storm overflows. Previous data collected has been used to develop and calibrate a model to describe impacts to the Fox River from CSO discharges as well as simulate potential treatment alternatives. Incorporated by reference is the Quality Assurance Project Plan dated March 28, 2008 (2008 QAPP) which details this previous sampling. This amended QAPP serves to document modifications to the existing 2008 QAPP for the 2009 sampling year. The same bridges along the Fox River will be used for additional sample collection, however modifications to the sampling protocol for these bridges will be implemented in order to collect additional data. To summarize, these include (1.) the sampling of four locations along Indian Creek during monthly sample collections on the Fox River, specifically: two upstream of CSO OVF No. 25 and two downstream of this overflow; (2.) the quantifying of impacts from storm sewers by the use of flow monitoring and sampling; (3.) more frequent sampling of bridges during rain events - specific bridge locations will be sampled several times an hour in order to capture data for modeling the peak impacts from the overflows; (4.) one additional sonde will be used to continuously monitor river conditions at Mill Street; and (5.) expansion of biological sampling including macroinvertebrate sampling and the addition of fish monitoring and mussel sampling. **Appendix B** includes a map of the Aurora area that shows the sampling locations for the LTCP project and Tables 3 through 5 list specific sampling locations for each area of study.

Sampling methods will remain the same for collecting river water. Samples will continue to be collected from the bridges using either a DH-2A depth integrating sampler or the RH-V2 or RH-V3 which are modified depth integrating samplers of differing lengths. A Van-Dorn horizontal sampler will be used for Indian Creek sampling or when the mainstem is too shallow for a depth integrating sampler.

The second Wednesday of the month transect samples will be collected along five bridges on the Fox River and grab samples will be collected at four locations along Indian Creek.

After a review of all river and CSO data collected during the 2007 and 2008 sampling years, it was determined that the duration of the impacts to the river from combined sewer overflows were a few hours in length. In addition, as part of the modeling effort, the ISWS also wanted to confirm that impacts could be quantified by sampling from the midpoint of the bridge. In order to determine the duration of the impacts and to confirm the quality of the sample collected at the mid-point, an intensive sampling protocol for 2009 has been developed. Bridge sampling during rain events will continue to be coordinated with the collection of water samples from the seven previously identified CSOs outfalls and three storm sewers in order determine the concentration and loading of pollutants originating from the CSOs and storms during overflow events. However the sampling of the Fox River and Indian Creek will be modified to collect samples every 15 to 20 minute from three locations on three bridges (Sullivan, Mill Street and Route 34) and the abandoned railroad bridge at Indian Creek. Samples will be collected from the onset of the rain event to two to three hours after the end of the rain event. Due to the large quantity of samples that could be potentially collected (maximum of 200) a third laboratory, Suburban Laboratories will be used for analysis of the Fox River and Indian Creek sampling.

Since 2006, Hester-Dendy samplers have been used to collect data on quantity and quality of the macroinvertebrate population within the Fox River. Seven to nine locations are utilized per sample cycle. Sampling locations vary slightly from year to year depending on river conditions, past vandalism and access to the locations. In 2009 Hester-Dendy samplers will be used in 15 locations (**Table 6**) to collect samples every six weeks from May through October. In addition grab samples will be collected on Indian Creek and Waubonsee Creek on a monthly basis from May to October.

Fish monitoring was initiated in August 2008 as part of the river monitoring. This monitoring will continue in 2009.

Since 2005, continuous dissolved oxygen data has been collected from April to October at several locations along the Fox River using a YSI sondes. In 2007 and 2008 there were three locations: Sullivan Bridge, Ashland Bridge, and the Route 34 Bridge. In 2009 a fourth location will be added at the Mill Street Bridge. In addition, pH and conductivity will be monitored on a continuous basis.

Data from the gauging stations installed by WEDA in 2008 will continue to be downloaded on a monthly basis. These gauging stations are located just below the North Aurora dam, at the mill race whose inlet is just above this dam. A third gauging station is located on Indian Creek.

The ISWS is the process of calibrating the model based on the data collected in 2007 and 2008. The data collected from the intensive sampling events in 2009 will be used to validate the model.

All data (with the exception of the macroinvertebrate and fish study) continues to be managed using Microsoft Excel and Microsoft Access. The database has been updated frequently as data is gathered.

Table 3
Sample Locations – Fox River

Category	Site Name/Location	Continuous DO/Temp Sampling	Discrete Sampling	Discharge and Stage Measurement
Mainstem	Fox River – North Aurora Dam			Continuous (Gauging Station)
Mainstem	Fox River – Sullivan Road Bridge	Every 30 minutes (2008-Present)	Monthly; 2009 Intensive	
Mainstem	Fox River – North Avenue		Biweekly/Monthly; Prior, During, After Rain Events	
Mainstem	Fox River – Park Avenue		None	
Mainstem	Fox River – Ashland Bridge	Every 30 minutes (2008-Present)	Monthly;	Continuous (USGS Station) Downstream at Montgomery Dam
Mainstem	Fox River – Mill Street Bridge	Every 30 minutes (2009)	Monthly; 2009 Intensive	
Mainstem	Fox River – Route 34 Bridge	Every 30 minutes (2008-2009)	Monthly; 2009 Intensive	

Table 4
Sample Locations – Indian Creek

Category	Site Name/Location	Discrete Sampling	Discharge and Stage Measurement
Tributary	Indian Creek – Pedestrian	Biweekly; (2007 only); Prior, During, After Rain Events (2007 Only)	
Tributary	Indian Creek – Abandoned railroad bridge	Biweekly/Monthly (2008-2009); Prior, During, After Rain Events (2008); 2009 Intensive	Continuous (Gauging Station)
Tributary	Indian Creek – Downstream of OVF #25	Biweekly/Monthly (2008-2009);	
Tributary	Indian Creek – Upstream of OVF #25	Biweekly/Monthly (2008-2009);	
Tributary	Indian Creek – Reckinger Road Pump Station	Biweekly/Monthly (2008-2009);	
Tributary	Indian Creek – Abandoned railroad bridge	Biweekly/Monthly (2008-2009); Prior, During, After Rain Events (2008); 2009 Intensive	

Table 5
Sample Locations - Combined Sewer Overflows/Storm Sewers

Category	Site Name/Location	Flow Monitoring	Water Quality Sampling
CSO – Mainstem	Rathbone – OVF 1	Continuous	When discharging
CSO – Mainstem	Hazel – OVF 4	Continuous	When discharging
CSO – Mainstem	East Benton – OVF 8	Continuous	When discharging
CSO – Mainstem	Prairie & River –OVF 10	Continuous	When discharging
CSO – Mainstem	W. Benton – OVF 15	Continuous	When discharging
CSO – Mainstem	W. Galena – OVF 18	Continuous	When discharging
CSO – Mainstem	FMWRD – OVF 002	Continuous	When discharging
SS-Mainstem	NE Corner Route 25 and Hartway	Continuous (Spring 2009 to present)	When discharging (2008 to present)
SS-Mainstem	River Street near Park Avenue	Continuous (Spring 2009 to present)	When discharging (2008 to present)
SS-Mainstem	Cleveland between Archer and Prairie	Continuous (Spring 2009 to present)	When discharging (2008 to present)

Table 6
2009 Macroinvertebrate
Sampling Locations

Sullivan Rd.	Mill St. – West
U.S. Of Ill. Ave. W. Bank	Mill St. - East
Pierce St.	FMWRD
Indian Creek (Grab)	Millstone Park - West
West Park Ave – West	Mill St. - West
West Park Ave – East	Millstone Park – East
North Ave. – West	Waubonsee Creek (Grab)
North Ave - East	Rte. 34 - West
Ashland Ave - West	Rte. 34 East

All locations are sampled using Hester-Dendy sample plates unless otherwise indicated.

1.5 Quality Objectives and Criteria for Measurement Data

The purpose of this project is to provide data in order to characterize potential impacts to the Fox River from storm and combined sewer overflows as well as develop baseline conditions for the Fox River and determine impacts to the Fox from Indian Creek. Field measurements have changed since the last QAPP and are incorporated into Table 7.

1.5.1 Field Measurements and Observations

Preventative maintenance and calibration of equipment is part of the quality control procedures for this project. **Table 7** shows the parameter and meter specifications for the field measurement equipment. **Table 8** shows the calibration procedures and frequency to be used for the project.

TABLE 7
Parameter and Meter Specifications

Discrete Monitoring				
Parameter	Meter	Meter Range	Accuracy	Resolution
Water Temperature	Hach Sension 6	0 to 50° C.	± 1°C	0.01°C
DO	Hach Sension 6	0 to 20 mg/L 0-200% saturation	± 1% of full scale	0.01 mg/L 0.01 %
pH	Omega PHH-60BMS	0 to 14 units	± 2 % of span	10 ppm
Conductivity	Omega PHH-60BMS	0 to 19990 ppm	± 2 % of span	10 ppm
Water Temperature	600 XL Sonde	-5 to 70 °C	± 0.15 °C	0.01 °C
DO	600 XL Sonde (Rapid Pulse-Clark Type)	0 to 50 mg/L	0 to 20 mg/L ± 2% or 0.2 mg/L 20 to 50 mg/L ± 6%	0.01mg/L
pH	600 XL Sonde	0 to 14 units	± 0.2 units	0.01 units
Conductivity	600 XL Sonde	0 to 100mS/cm	± 0.5% of reading + 0.001 mS/cm	0.001 mS/cm to 0.1 mS/cm
Continuous Monitoring				
DO (2004-2006)	YSI 6600 EDS (Rapid Pulse-Clark Type)	0 to 50 mg/L	0 to 20 mg/L ± 2% or 0.2 mg/L 20 to 50 mg/L ± 6%	0.01mg/L
DO (2007 – 2010)	YSI 6600 EDS (Optical Sensor)	0 to 50 mg/L	0 to 20 mg/L ± 1% or 0.1 mg/L 20 to 50 mg/L ± 15%	0.01mg/L
Water Temperature	YSI 6600 EDS	-5 to 45 °C	+0.15 °C	0.1 °C
pH (2009)	YSI 6600 EDS	0 to 14 units	+ 0.2 units	0.01 units
Conductivity (2009)	YSI 6600 EDS	0 to 100mS/cm	+ 0.5% of reading + 0.001 mS/cm	0.001 mS/cm to 0.1 mS/cm

TABLE 8
Calibration Requirements

Parameter	Unit	Laboratory Calibration	Frequency	Field Calibration/ Preparation	Frequency
Discrete Monitoring					
Water Temperature	^0C	Factory Calibration	NA	NA/Rinse with DI Water	Daily/Between Sites
DO	mg/L	Air Calibration Chamber	Daily	Air Calibration Chamber	Daily/Between Sites
pH	Standard Units	2 points; 7 and 10 standards	Daily	NA/Rinse with Distilled Water	Daily/Between Sites
Conductivity	µS	1 point; 1000 µS	Daily	NA/Rinse with Distilled Water	Daily/Between Sites
Water Temperature	^0C	Factory Calibration	NA	NA/Rinse with DI Water	Daily- When in Use
DO	mg/L	Air Calibration Chamber	Daily	Air Calibration Chamber	Daily- When in Use
pH	Standard Units	2 points; 7 and 10 standards	Daily	NA/Rinse with Distilled Water	Daily- When in Use
Conductivity	µS	1 point; 1000 µS	Daily	NA/Rinse with Distilled Water	Daily- When in Use
Continuous Monitoring					
Water Temperature	^0C	Factory Calibration	NA	NA/Rinse with Distilled Water	Each Site Visit
DO (Optical Sensor)	mg/L	Air Calibration Chamber	As required	Air Saturated Water	Each Site Visit Check Calibration – Recalibrate as Needed
pH	Standard Units	2 points; 7 and 10 standards	As required	NA/Rinse with Tap Water	Each Site Visit Check Calibration – Recalibrate as Needed
Conductivity	µS	1 point; 1000 µS	As required	NA/Rinse with Tap Water	Each Site Visit Check Calibration – Recalibrate as Needed

1.5.2 Physical and Chemical Analytical Samples

To ensure good quality analytical data, sampling, preservation, and transport methods will be followed exactly.

For the intensive bridge sampling, one opaque, plastic, one-liter bottles supplied by Suburban Laboratories (Hillside, IL) will be used to collect samples from each separate bridge location. These bottles will be used to collect a sample for analysis of all parameters with the exception of fecal coliform. Fecal coliform samples will be a grab sample and will be collected using sterile 300-ml locking plastic bottles. **Table 9** shows the sampling, handling, and storage requirements for the samples to be analyzed during the intensive bridge sampling event.

TABLE 9
Sampling, Transport, and Storage Requirements
2009 Intensive Sampling Event

Parameter	Sample Container	Transport/Storage in Field	Holding Time
CBOD5	1 L plastic opaque wide mouth bottle	Ice (Temp. <6°C)	48 hours
Total Suspended Solids	1 L plastic opaque wide mouth bottle	Ice (Temp. <6° C)	7 days
Ammonia Nitrogen	1 L plastic opaque wide mouth bottle	Ice (Temp. <6° C)	28 days
Total Phosphorus	1 L plastic opaque wide mouth bottle	Ice (Temp. <6° C)	28 days
Fecal Coliform	300 ml sterile bottle	Ice (Temp. <6° C)	6 hours

Samples from the CSO overflows will be collected in plastic bottles which are designed to fit in the ISCO samplers. When a standard size sampler is used, a 1 one-liter plastic bottle will be poured into a 1, one-liter plastic Nalgene bottle. These samples will be labeled and transported to the laboratory. When a compact sampler is used two 500 milliliter plastic bottles will be collected per sample which will then be composited into 1, one-liter plastic Nalgene bottle for transport to the laboratory.

In order to characterize the macroinvertebrate population upstream and within the areas of CSO discharges, round multiple plate Hester-Dendy samplers will be used to collect benthic macroinvertebrates. These samplers will be left in the river for four to six weeks. Once removed from the river, each sampler will be placed in a zip-loc bag with river water and will be labeled with time, date, location of sampler, company and field personnel. The samples are placed in zip-loc bag with river water, labeled with the time, date, location of sampler, company and field personnel. Since 2008, the plates have been taken back to the WEDA office where the macroinvertebrates are removed from the plates and placed in preservative within 24 to 48 hours for future identification.

Since both the data sondes and the velocity meter are in-situ measuring devices, there is no additional handling.

1.5.3 Data Quality Indicators

Refer to the original QAPP for data quality indicators.

1.6 Special Training

Special training sessions will be conducted in April 2009 to ensure all WEDA and DEI personnel who may be involved with the intensive sampling project are familiar with the changes to the techniques and procedures to accommodate the intensive sampling events.

Only staff members who have completed training will participate in this project. A sample agenda for the training sessions is included as **Appendix C.**

1.7 Documents and Records

Ms. Carrie Carter and Ms. Karen Clementi of DEI will be responsible for managing the QAPP, including version control, updates, distribution, and disposition. In the case of a revision, all appropriate project personnel will receive a revised version by hard copy.

Ms. Carrie Carter of DEI will be responsible for managing and archiving all data, including the sampling and analytical procedures, field data sheets, calibration logs, and laboratory analytical results pertaining to this project. Hard copies of these files will be stored at the DEI offices. FMWRD will provide all analytical results including field data in an excel spreadsheet form using their Laboratory Information Management System (LIMS). FMWRD will be responsible for storing all analytical data and QA/QC in their system.

First Environmental Laboratories, Inc. (Naperville, IL) will provide a hard copy of chlorophyll results and these will be added to the spreadsheets provided by FMWRD. The Excel spreadsheets will be formatted by DEI and imported to an Access database suitable for use in the FoxDB when permitted. See **Appendix D** for examples of the spreadsheet received from FMWRD.

Suburban Laboratories, Inc. (Hillside, IL) is used as a backup laboratory when FMWRD has received as many samples as they can process. Suburban Laboratories will provide a hard copy of results when used for sampling events. Suburban Laboratories provides an excel spreadsheet of all data analysis. This spreadsheet is reformatted for importing to the Access database.

2.0 SAMPLE DESIGN

2.1 Sample Locations

The sampling locations are shown on the map in **Appendix B**. There are several sampling activities involved in this project including bridge sampling, combined sewer overflow sampling, macroinvertebrate sampling, fish monitoring, dissolved oxygen monitoring, and stream gauging.

Refer to original QAPP for sampling protocols in 2008. Discussions below include changes or additions to the 2009 sampling events.

2.1.1 Discrete Water Quality Sampling Locations

Fox River - Intensive Sampling

As was stated previously, in order to determine peak impacts and mixing zones in the river from CSO and storm sewer discharges, intensive sampling during rain events will be completed in 2009. The three locations for this sampling event include:

Sullivan Road Bridge as the upstream locations because it is not impacted by combined sewer overflows. For the 2009 sampling event, three (3) stations will be marked on the bridge. The three (3) stations are approximately equidistant from one another and divide the river into thirds. Each location will be sampled and analyzed separately. Samples will be collected every 15 to 20 minutes at each location.

Bridge construction on the I-88 Tollway began in September 2007 and continues in 2009, this construction has included temporarily filling in the Fox River on both the east and west banks thereby channeling the flow toward the center and therefore, these samples maybe impacted by these upstream construction activities.

The next sampling location for this is the Mill Street Bridge in Montgomery. There are no CSO discharges between Ashland Avenue and Mill Street. In addition Mill Street serves as a upstream boundary condition for Fox Metro's CSO outfall (Outfall 002). The purpose of this sampling location is to gauge the persistence of the CSO impact, if any, to the water quality of the Fox River. Three sampling stations will be located on the Mill Street Bridge. Each location will be sampled and analyzed separately.

The final sampling location is the Route 34 Bridge in Oswego. This bridge is the closest bridge downstream of the FMWRD STP Headworks CSO outfall, located at the wastewater treatment plant facility. There will be three sampling stations on this bridge. It should be noted that this sampling location is slightly downstream of the Waubonsie Creek tributary. While this tributary is not part of the sampling plan it may have some minor impacts to this sample location. **Table 10** lists the approximate sample locations on the bridges during the intensive sampling events.

Indian Creek - 2009 Intensive Sampling
In order to measure impacts coming from Indian Creek, grab samples will be collected every fifteen to twenty minutes at an abandoned railroad bridge upstream from the confluence of Indian Creek and the Fox River.

TABLE 10
Bridge Sampling Stations
2009 Intensive Sampling

Bridge Name/Station Location	**Latitude**	**Longitude**
Sullivan Road		
West Pt - 1+21.1	41°47'19.62"N	88°19'03.96"W
Mid Pt - 2+76.8	41°47'19.10"N	88°19'03.41"W
East Pt - 4+32.5	41°47'20.01"N	88°18'59.22"W
Indian Creek Foot Bridge	41°46'07.33"N	88°18'33.13"W
Mill Street		
West Pt - 0+69	41°43'46.20"N	88°20'21.06"W
Mid Pt - 1+41	41°44'00.59"N	88°20'02.06"W
East Pt - 2+13	41°43'45.60"N	88°20'19.38"W
Route 34 Oswego		
West Pt - 0+40.0	41°41'06.54"N	88°21'24.54"W
Mid Pt - 1+46.8	41°41'04.91"N	88°21'21.57"W
East Pt. - 2+53.6	41°41'05.94"N	88°21'22.20"W

Indian Creek - Monthly Sampling
Indian Creek travels several miles through a highly urbanized and industrialized area of Aurora before it terminates at the Fox River. In addition, there is an existing combined sewer overflow structure (OVF No. 25 - Dearborn-Trask) located approximately 1 mile upstream of the confluence of Indian Creek and the Fox River that discharges several times during the year. Therefore Indian Creek may have a significant impact on the Fox River. In order to characterize this impact several locations along Indian Creek have been added to the monthly sampling schedule. These locations are described below. See **Appendix B** for a map of these locations.

In 2007, the Fox River Trail pedestrian bridge located above the confluence of Indian Creek and the Fox River was a sample location for bi-weekly sampling as well as during rain events. OVF No. 25 is located approximately one (1) mile upstream on Indian Creek. Samples were collected at the midpoint of the stream.

During the extremely high river conditions of 2008, it was obvious that there were influences from the Fox River at this sampling site. A new site was selected further east at an abandoned railroad bridge which is approximately ¼ mile upstream of the pedestrian bridge. This location now serves as a monitoring station for stream gauging, a monthly sample location and a sample location during rain events.

The next upstream location along Indian Creek is on the Ohio Street Bridge approximately 300 feet downstream of OVF No. 25. A grab sample is collected from the center of the bridge on a monthly basis. During sample collection, this station is monitored for field parameters including dissolved oxygen, pH, conductivity and temperature.

Moving further upstream along Indian Creek, the next sample location is at Austin Avenue approximately 3/4 mile upstream of OVF No. 25. A grab sample is collected from the center of the bridge on a monthly basis. This station is monitored for field parameters including dissolved oxygen, pH, conductivity and temperature on a monthly basis.

The final sampling point along Indian Creek is located where Reckinger Road passes over the creek. This is the most upstream location that is sampled. A grab sample is collected from the center of the bridge on a monthly basis. This station is monitored for field parameters including dissolved oxygen, pH, conductivity and temperature on a monthly basis.

CSO Outfalls

Please refer to the 2008 QAPP since sampling locations and protocol for the combined sewer outfalls has not changed.

Storm Sewers

After some modeling of the CSO impacts to the river, it appeared that there were storm impacts to the Fox River as well as combined sewer overflows. Therefore, storm sewer sampling at three locations within the area of combined sewers has been added in order to determine the concentration of pollutants originating from storm sewers and their resultant impact on the river. In 2008, an ISCO sampler was installed in a manhole connected to the storm sewer. Flow monitors will be installed in 2009 in order to quantify impacts to the Fox River.

The three storm locations are as follows: there is one downstream location in Montgomery, one in the middle of the study area at Cleveland between Prairie and Archer (part of the Turkey Creek Tributary) and an upstream location along River Street in Aurora. **Table 11** summarizes the new storm sampling locations.

TABLE 11
Storm Sewer Sampling Locations

Storm Sewer Name	Storm Sewer Number	Latitude	Longitude
Hartway at Route 25 - Montgomery	#5010	41°43'56.22"N	88°19'58.26"W
Cleveland between Archer and Prairie	#5020	41°45'50.94"N	88°18'44.03"W
River Street north of West Park Avenue	#5030	41°45'13.43"N	88°19'57.54"W

2.1.2 Benthic Macroinvertebrate Locations

To analyze impacts from CSO discharges on biological populations in the Fox River macroinvertebrate sampling continues to be conducted on the Fox through the area of CSO discharges using Hester-Dendy samplers. In 2009 a greater number of locations are added and samplers are rotated on a 6 week basis from May through October. See **Table 6.**

2.1.3 Fish Monitoring Locations

Fish monitoring locations have been selected in order to provide a long-term assessment of the overall trends of the fish species in the Fox River specifically focusing on the area of combined sewer discharges for Aurora and FMWRD located between the northern limits of Aurora (downstream of Sullivan Road Bridge) and the southern limits of Oswego (at the Route 34 Bridge). The mainstem has been divided into four segments for sampling purposes. These segments are mapped and can be viewed in **Attachment E.** There is a separate QAPP which details fish monitoring activities.

2.1.3 Continuous Water Quality Sampling Locations

Since, 2007 a data sonde has been located at the Sullivan Road Bridge in an area that is not heavily used, the monitor lies horizontally in the river at this location.

The Ashland Avenue Bridge is the division line between Montgomery and Aurora and serves as the monitoring location downstream of the City of Aurora CSO discharges. In 2008 the sonde hung vertically from the bridge but due to tampering issues this sonde will remain attached to the bridge but will now be oriented in a horizontal position.

Mill Street will be added as a monitoring location in 2009. This sonde is tethered to a bridge pier and lies in a vertical position along the bottom of the river.

In 2009 at the downstream location, the Route 34 Bridge in Oswego, the monitoring orientation will be changed from a vertical location to a horizontal location.

2.1.4 Velocity and Stage Measurements

The gauging stations remain in place as described in the 2008 QAPP. Data from each of the Sutron Constant Flow Bubble Gauge/Recorder is downloaded on a monthly basis, converted to an excel spreadsheet and flow quantities are determined by the rating curve that has been developed with the 2008 data collected. Velocities and elevations continue to be collected on an as needed basis.

2.2 Sample Frequency and Duration

Bridges

A review of previous data collected from 2007 and 2008, indicates that the plume of contamination created by CSO discharges, moves down the river at a much faster rate than originally anticipated. Therefore, to capture the peak impacts to the river from the CSO and storm discharges, sampling of the bridges will be modified in 2009 to increase the frequency of sampling before, during and after the discharging of CSO and storm sewers to the rivers.

After a period of dry weather as previously described in the 2008 QAPP, based on the weather forecast, sample teams will be placed on alert. At the onset of the storm, sampling teams will be immediately dispatched to their respective bridges. Each team will collect three samples along the bridge at fifteen to twenty minute intervals. Each sample will be analyzed separately in order that the data can be inputted into the model to determine mixing zones and peak impacts.

CSO Outfalls

A significant change to the 2008 sample QAPP is that the flow meters which measured duration and quantities of overflow, have been switched from Marsh-McBirney to ISCOs. The ISCO flow meters can be programmed to trigger the ISCO samplers to sample if levels in the CSO manhole reach a pre-determined threshold. Samples will continue to be collected as previously described in the 2008 QAPP.

Storm Sewers

Three storm sewers were equipped with ISCO samplers in 2008. There were no flow meters installed with these samplers so data collected could not quantify loading to the river only the quality of the discharge. In 2009 an ISCO flow meter will be installed along with the ISCO samplers to determine loads from storm sewers to the Fox River based on concentrations and flow.

2.2.1 Benthic Macroinvertebrate Sampling

Benthic macroinvertebrate sampling will occur at four to six week intervals from May to October 2009.

2.2.2 Continuous Water Sampling

Dissolved oxygen levels will be collected every thirty minutes from April to October (river conditions permitting) using YSI data sondes.

2.2.3 Velocity and Stage Measurements

Velocity and stage measurements will continue to be collected as needed to verify stage curves that were developed in 2008. Measurements will be collected a minimum of six times during each year.

2.3 Sample Methods

Standard operating procedure (SOP) have been developed detailing the step-by-step sampling process to be utilized in the field and are found in the original QAPP. There are some changes for the intensive sampling event which can be found in **Appendix E** of this document. The sections below discuss the general field sampling methods.

2.3.1 2009 Intensive Sampling

Bridges

There will be four bridge sample crews consisting of two to three people set up for the 2009 intensive sampling events to conduct sample collection. Several types of sample equipment will be available for collecting samples at these locations depending on the depth of the river or Indian Creek at the time of sampling. These samples are detailed in the 2008 QAPP and include the RH-V2 and RH-V3 used during various river sampling events, the Van-Dorn horizontal beta sampler which is normally used at Indian Creek and can also be used to sample the river when it becomes too shallow for other methods.

CSO Outfall Sampling

One sample team of two people will be used for collecting samples from the ISCO samplers located at CSO manholes.

The 3700 Compact samplers will remain in use at the following overflow locations: West Galena, East Benton, West Benton, and First (Prairie). The 3700 Standard samplers will remain at Hazel, Rathbone, and the STP Headworks. With the exception of the locations at the STP Headworks, Hazel and Rathbone, all manholes have been equipped with two permanent clips on the side from which a metal rod is placed. The sampers are suspended from these bars beneath the cover. Cables suspend the sampler in the manhole and keep the sampler vertical. At the Hazel location, the sampler will be suspended by cables from a bolt connected to the side of the siphon chamber. At the STP headworks, the sampler will sit outside next to the manhole to be sampled. At Rathbone there is a device which straddles the manhole at four points.

The ISCO flow meters are programmed to trigger the ISCO samplers to begin sampling at a certain threshold. The 3700 Standard sampler are now programmed to collect one 1-liter bottle at the following intervals: initiation (0 minutes), 5 minutes, 10 minutes, 15 minutes, 20 minutes, 30 minutes, 45 minutes, 1 hour, 2 hours, 3 hours and 4 hours. Since overflows may occur during late night or early morning hours, sample retrieval occurs as soon as possible in the morning. Samples are mixed and poured into a labeled 1-liter nalgene bottle and then placed on ice for delivery to the laboratory.

In order to ensure sufficient sample for laboratory analysis, the 3700 Compact sampler are programmed to collect two 500 ml bottles at the following times: initiation (0 minutes), 5 minutes, 10 minutes, 15 minutes, 20 minutes, 30 minutes, 45 minutes, 1 hour, 2 hours, 3 hours and 4 hours. The two bottles from the compact sampler are combined in one 1-liter nalgene bottle and placed on ice for delivery to the laboratory.

On both the Compact and Standard sampler, information regarding the time and date of the sample collection are retrieved and recorded at the same time the samples are collected.

All ISCO flow meters are maintained by WEDA. These meters continuously log velocity and levels using an AV sensor which is equipped with a pair of ultrasonic pressure transducers for velocity measurements and an internal differential pressure transducer which is a small piezo-resistive chip to measure levels.

Strainers remain located at the depth of the start of presumed overflow (see previous description of strainer location) recorded overflow data from the ISCO sampler can be compared with data downloaded and viewed from the flow meters.

2.3.2 Benthic Macroinvertebrate Community

The mainstem of the river and Indian Creek continue to be sampled to characterize the effect of discharges on the macroinvertebrate community. See the 2008 QAPP for details on how the Hester-Dendys are set up.

2.3.3 Continuous Water Quality Monitoring

Early in the spring the YSI EDS sondes will be re-deployed at previously determined location as shown in **Table 3**. These sondes will continue to be maintained as discussed in the 2008 QAPP and as amended in this document.

In addition to DO and temperature, pH and conductivity measurements will be collected at 30 minute intervals and logged in a data recorder. The sondes calibration will be checked on a bi-weekly basis against either a calibrated YSI meter for all parameters or a Hach Sension 6 for DO and temperature and an Omega Pocket Pal for pH and conductivity. All calibration data and deployment data will continue to be recorded in a field book dedicated to DO monitoring.

2.3.4 Velocity and Stage Measurements

As part of verifying and maintaining the discharge curves that have been developed previously, velocity and stage measurements will continue to be collected at the gauging stations at North Aurora dam mainstem, the mill race and Indian Creek. These measurements will be collected six times per year or more often if necessary.

2.4 Sample Handling

2.4.1 Discrete Water Quality Monitoring

Bridge Sampling
During the 2009 intensive sampling event, samples collected will be recorded with the station location, date, and time on the appropriate sampling form. Copies of the sampling forms for the bridge sampling are provided in **Appendix F.** All samples will be labeled and transferred to an ice-filled cooler immediately following completion of sampling at a bridge. Samples will be transported to Suburban Laboratories (Hillside, IL) as soon as possible to meet holding times.

Since all bridge sampling locations on the Fox River are equipped with continuous reading sondes, field measurements will not be collected during intensive sampling events. Indian Creek does not have a data sondes and therefore, field measurements will be collected every fifteen minutes at this location. All field measurements will be performed in-situ and in accordance with EPA recognized methods as shown on **Table 12.** Suburban Laboratories will use approved methods listed in the most current editions of "Standard Methods" of 40 CFR 136.

TABLE 12
Field Measurement Methods

Meter	Parameter	Method
Hach Sension 6	DO	Standard Method 4500-O G
Hach Sension 6	Temperature	Standard Method 2550
Omega PHH-60MBS	pH	Standard Method 4500
Omega PHH-60MBS	Conductivity	Standard Method 2510

CSO/Storm Monitoring
As samples are collected, the sample number, date, and time are recorded on the appropriate sampling form. Copies of the sampling forms for the ISCO samplers are provided in **Appendix G.** All samples will be transferred to an ice-filled cooler immediately following completion of sampling at the CSO outfall location. Samples will be transported to the FMWRD laboratory as soon as possible to meet holding times.

2.4.2 Benthic Macroinvertebrate Community Monitoring

When the deployment period is complete, the Hester-Dendy samplers will be retrieved using a 500-micron, D-frame net to prevent loss of organisms. Each Hester-Dendy will be removed from its ballast and the Hester-Dendy will be double packaged in zip-loc bags containing river water, placed on ice, and mailed to a lab with appropriate chain of custody procedures. Observations regarding the sample location will be recorded.

2.4.3 Dissolved Oxygen Monitoring

All sample measurements will continue to be performed at the sample location (i.e. in-situ) therefore there is no sample collection, preservation, shipment or storage.

2.4.4 Velocity and Stage Measurements

All sample measurements continue to be performed at the sample location (i.e. in-situ) therefore there is no sample collection, preservation, shipment or storage.

2.5 Analytical Methods

2.5.1 2009 Intensive Sampling

All 2009 samples collected during the 2009 Intensive events will be analyzed by EPA recognized methods. Methods for field measurements can be found in **Table 12**. Samples at the bridges will be analyzed by Suburban Laboratories and samples collected from CSO and storm sewers will be analyzed by FMWRD. Parameters to be analyzed and method analysis can be found in **Table 13.**

TABLE 13
Intensive Sampling
Laboratory and Method Analysis

Parameter	Method
CBOD5[1,2]	Std Method 5210B
Total Suspended Solids[1,2]	Std Method 2540D
Ammonia Nitrogen[1,2]	Std Method 4500-NH3-E
Total Kjedahl Nitrogen[2]	Std Method 4500-N org B
Organic Nitrogen[2]	Calculated Value (TKN-NH_3)
Total Phosphorus[1,2]	Std Method 4500 – P B&E
Fecal Coliform[1,2]	Std Method 9222D

1- Analysis performed on bridge samples
2- Analysis performed on CSO/storm sewer samples

2.5.2 Continuous Water Quality Monitoring

All field measurement methodologies used are EPA recognized methods. Methods for field measurements can be found in **Table 12**. All monitoring is performed at the point of the sample collection and therefore there is no laboratory analysis.

2.6 Instruments and Equipment

2.6.1 Testing, Inspection, and Maintenance

To ensure that all data collected under this project is of sufficient quality, all instruments and equipment used that are owned by WEDA and DEI e maintained on a regular basis by Ms. Carrie Carter of DEI. Records of all maintenance activities are documented and stored at the DEI office. A kit, which includes replacement parts for each of the pieces of equipment to be used as well as tools to conduct this maintenance, is present at the DEI office.

The pH and conductivity probes on the Omega PHH-60 MBS are replaced yearly. The DO membrane for the Hach Sension 6 will be changed at least yearly but more frequently if it appears that calibration is drifting. Tubing connecting the strainer to the pump will be replaced on a yearly basis. Tubing for the peristaltic pump will be changed on a yearly basis.

2.6.2 Calibration and Frequency

All calibrations are conducted as recommended by the manufacturer. Calibration procedures and frequency for this project can be found in **Table 5** of **Section 1.5**. If during the time of collection any values seem to fall outside of the expected range, these values will be noted and a calibration check will be conducted upon completion of the sampling to verify the validity of the measurements taken. Calibrations will be checked again at the end of each day during field activities.

2.7 Quality Control

2.7.1 Field Measurement and Sample Collection

Field QA/QC will be obtained by using trained staff for field measurements and sample collection. Only those individuals who have read this QAPP and associated SOPs prior to sample collection will conduct measurements and sample collection.

All equipment used for field measurements will be properly maintained and decontaminated as described in the SOPs. Logbooks of calibration and maintenance of equipment will be kept, documenting all procedures conducted on equipment throughout the sampling season.

Prior to the start of the discrete water quality sampling all equipment utilized will be decontaminated by placing the equipment in a detergent bath. The equipment will be removed and triple rinsed with distilled water. Subsequently the equipment will be rinsed with distilled water. Following the field sampling activities at each location, the equipment will be rinsed with distilled water and stream/river water obtained from the next sampling site to be sampled.

2.7.2 QA/QC Samples

See 2008 QAPP for details on QA/QC samples.

2.8 Data Management

WEDA and DEI staff will manage all data generated by this project. Refer to the 2008 QAPP for further details.

3.0 ASSESSMENT AND OVERSIGHT

3.1 Assessment and Response Reactions

Performance evaluations of the sampling/sample transport teams shall be performed periodically. The teams will be evaluated to ensure that established protocols have been followed. The FMWRD laboratory will maintain all internal QA documents. Any noncompliance issues shall be reported to the project managers. No data will be released that has failed to meet all QA/QC requirements as established in this QAPP or in the internal QA plans of the laboratories. Samples that have not met the QA/QC requirements will be retested if possible or rejected.

3.2 Reports to Management

Mr. Philippe Moreau will receive notification of any non-compliance issues and reports related to quality control issues.

4.0 DATA VALIDATION AND USABILITY

4.1 Data Review

All data shall be reviewed by Ms. Carrie Carter, Project Quality Assurance Officer, and Mr. Philippe Moreau, Project Manager to determine its usability.

Sonde Drift During Deployment
Throughout the summer the data sondes will be field checked as previously described to assure that each sondes remains in calibration. DO and temperature will be measured with both the sondes and hand-held Hach Sension6 to verify that the sondes has held its calibration and that dissolved oxygen readings are within 0.7 mg/L of each instrument. Data not meeting this criteria will be flagged accordingly.

Data Reduction and Processing
Analytical data quality will be assessed to determine if the objectives have been met. In addition data will be reviewed by QA/QC Officer for indications of interference to results caused by sample matrices, cross contamination during sampling or in the laboratory and storage anomalies. For instance holding times may be exceeded for samples collected by the ISCO samplers since outfalls may be discharging in the late evening or early morning hours.

4.2 Verification and Validation Methods

Sample collection and field measurements are verified by the sampling teams with records kept by the team leaders. Laboratory data for intensive sampling is verified by Mr. Randy Hummer of FMWRD or the laboratory manager for Suburban Laboratories. Field and laboratory data are archived by DEI or WEDA staff.

In the case of the data verification process resulting in a change to the data or if data accuracy, reliability or usability has been reduced as the result of errors in stored data or corrupted files, the Project Manager and/or the Project Quality Assurance Officer shall inform all data users and make corrections.

4.3 User Requirements

The execution of the project shall follow the procedures outlined in the 2008 QAPP and the 2009 amended QAPP herein. The QAPP shall be reviewed after six months by the persons on the cover page. The review shall determine if the objectives are being met. If modification of the project is required, any changes shall require the approval of the persons listed on the approval page. All changes shall be documented in an amended QAPP and summarized on a sample sheet both of which are distributed to all participants in the project. An amendment to the QAPP will be issued to reflect changes.

5.0 REFERENCES

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Rantz, S.E. et al. 1982. Measurement and computation of stream flow - v. 1, Measurement of stage, and v. 2, Computation of discharge. U.S. Geological Survey Water - Supply Paper 2175. United Sates Department of Interior, U.S. Geological Survey. Washington D.C. 631 p.

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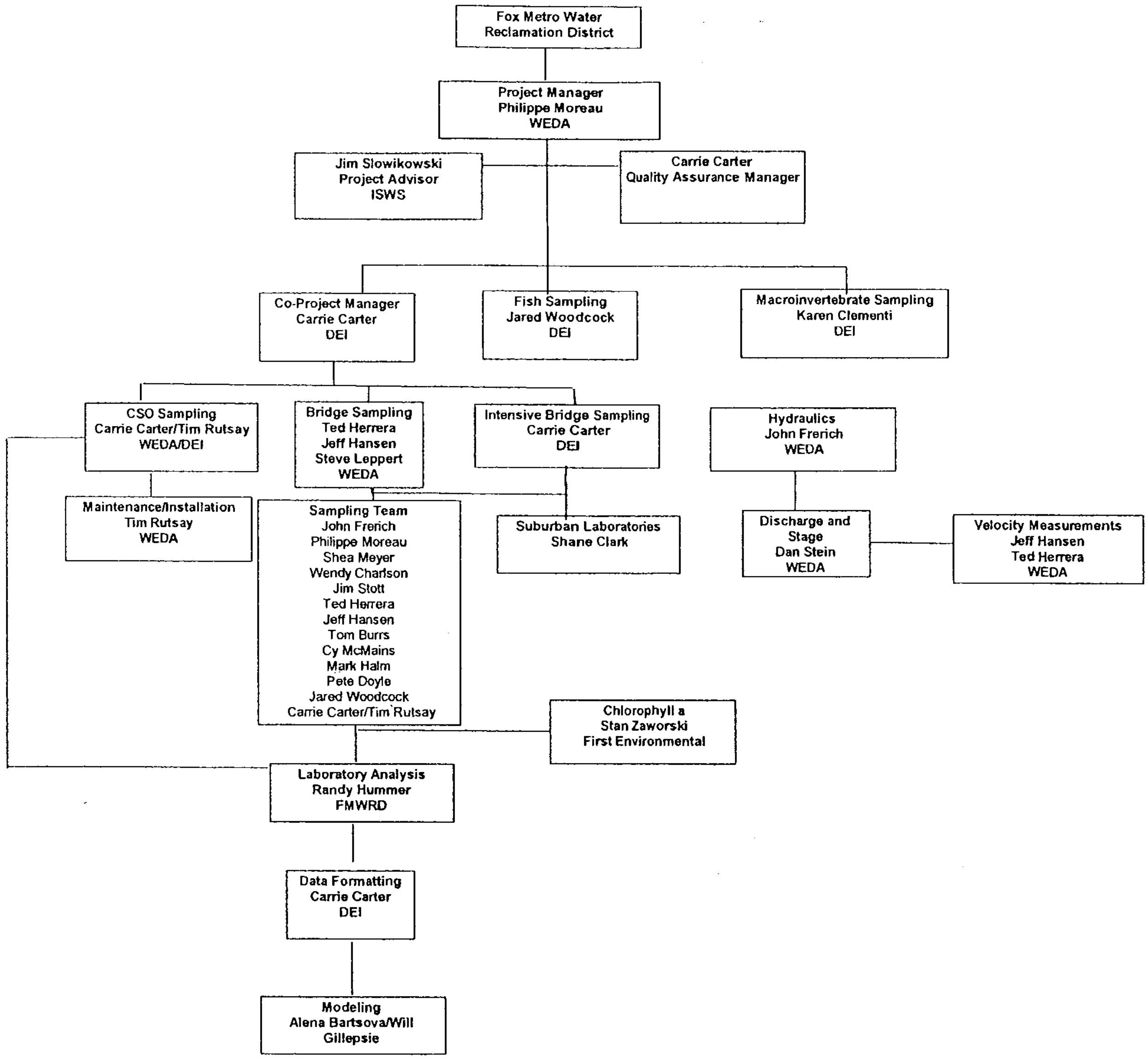
YSI Incorporated, "Environmental Monitoring Systems Operations Manual (6-Series).

APPENDIX A

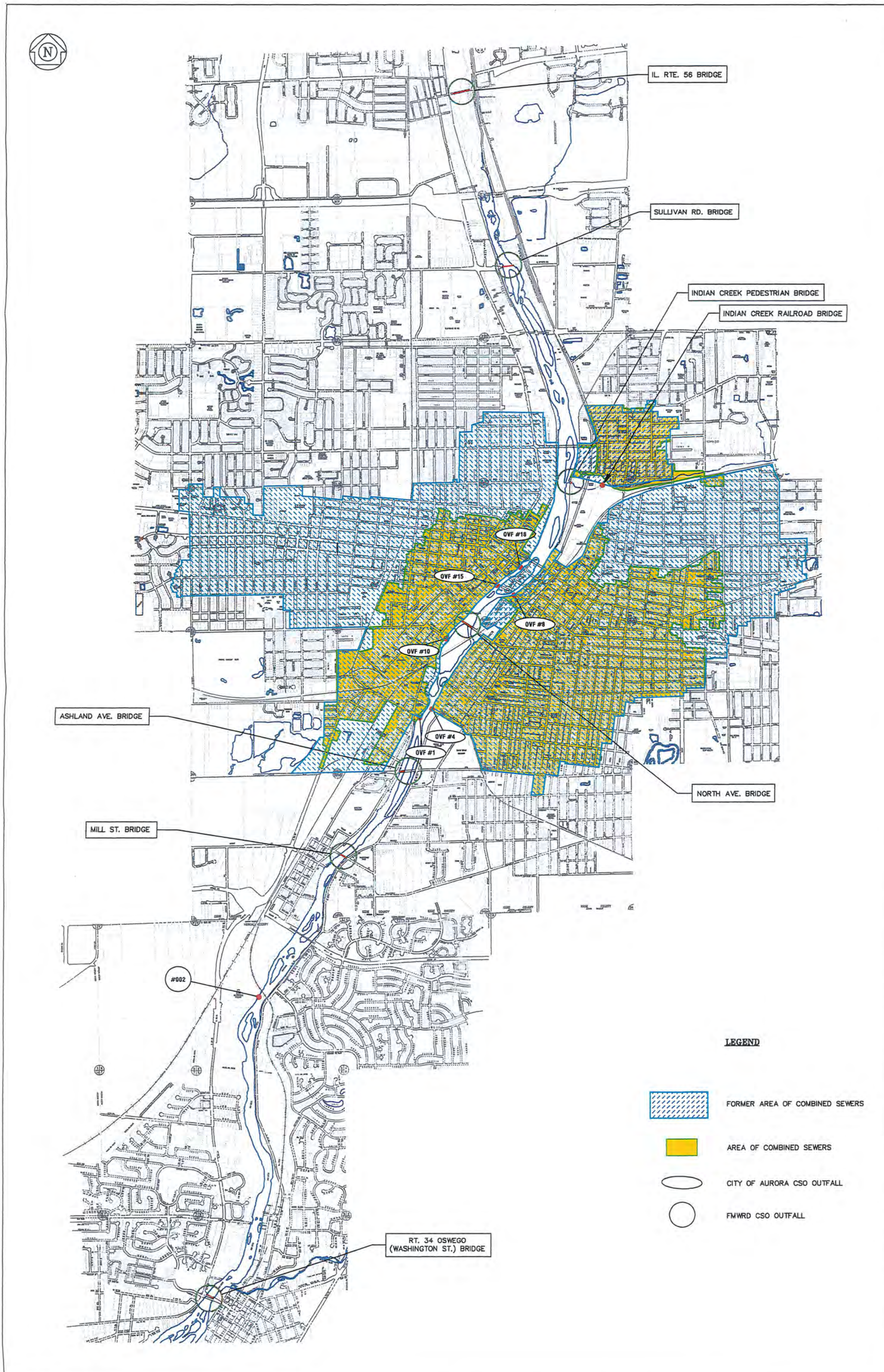
ORGANIZATION CHART

CSO Long Term Control Plan
Sampling/Modeling
Organization Chart



APPENDIX B

MAPS OF STUDY AREA



CSO LONG TERM CONTROL PLAN
STUDY AREA
QUALITY ASSURANCE PROJECT PLAN (QAPP)

SHEET OF

REVISIONS

WALTER E. DEUCHLER ASSOCIATES, INC.
Consulting Engineers — Aurora, Illinois

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APPENDIX C

AGENDA FOR TRAINING SESSION

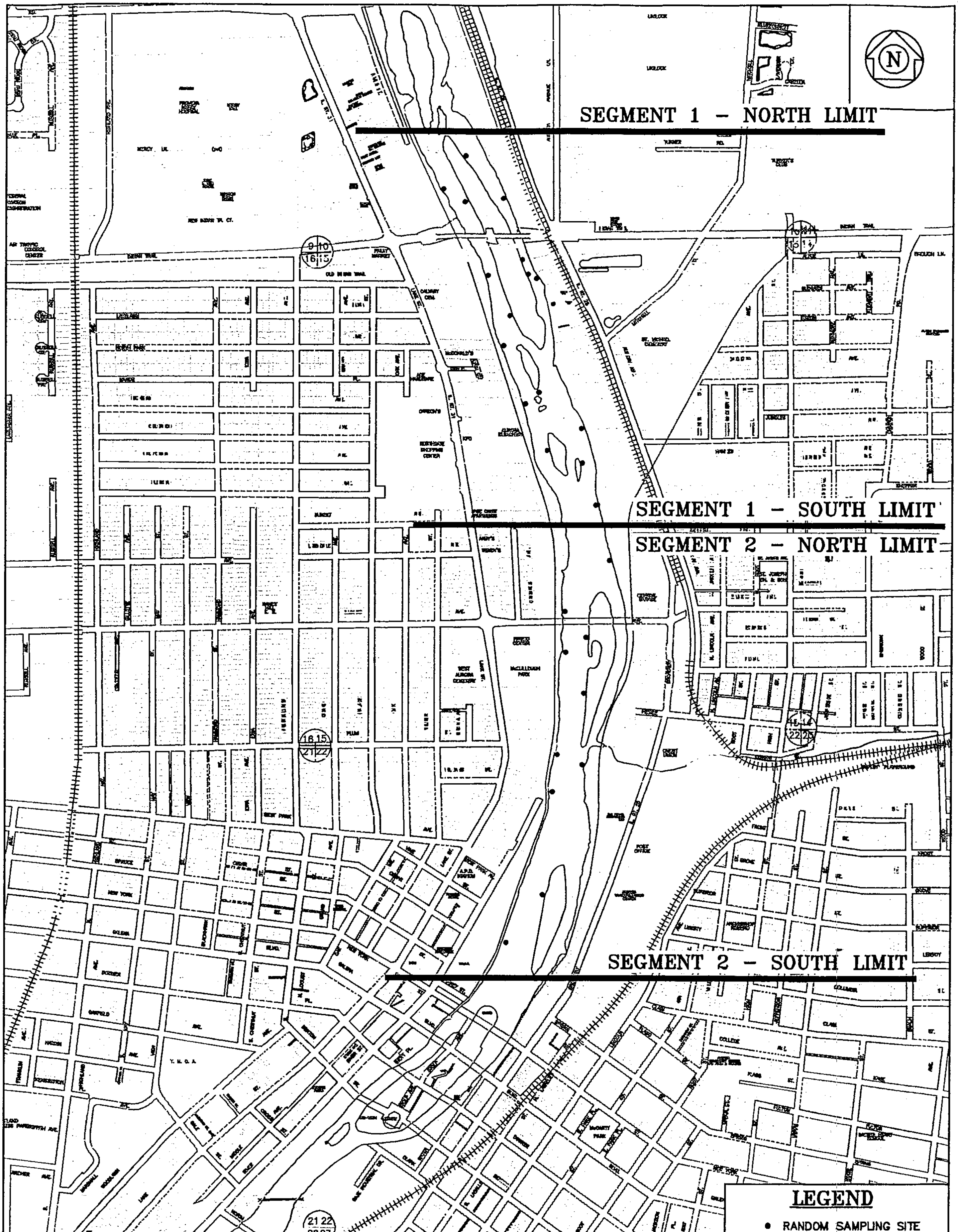
2009 INTENSIVE RAIN EVENT ORGANIZATIONAL MEETING

- Project overview – John/Philippe
    - We will be collecting multiple samples within an 8 to 10 hour time period at Sullivan, Ashland, Mill, Route 34 and Indian Creek bridge locations during two to three rain events. These intensive sampling events will determine future sampling protocols.
    - Crews have been broken up into sample teams with truck assignments (Pass out contact list and crew assignments)
    - Carrie is the project coordinator, if she is ill or on vacation, Karen will be project coordinator, in the unlikely event that both Karen and Carrie are unavailable, Tim Rutsay will be the project coordinator
- Notification – John/Philippe
    - John, Karen, Phil and Carrie will make a decision as to whether a rain event suitable for sampling is in the immediate forecast.
    - If a rain event is imminent everyone is on call.
    - John or Phil will be notifying personnel if they are required to come in.
    - Please let Phil, John and Carrie know when you are planning on taking vacation so we can plan accordingly.
- Training Schedule - Carrie
    - For those who are new to river sampling or anyone who wants a refresher there will be an introductory meeting scheduled to be held on April 6th at 9:00 am
    - Field training for new personnel will be held on April 8th. These include Cy, Lee, Ryan and Calvin.
    - A brief review of the sampling event on April 8th will be held on April 9th to discusss questions and concerns.
    - April 10th we will have a meeting to discuss the intensive sampling events with everyone and we will be prepared to go out anytime starting April 13th.
- Safety Issues – Carrie
    - Everyone must wear a safety vests
    - Cones and flashers need to be used when parked on the bridge
    - Ponchos will be provided

- Miscellaneous
    - Each sample team will be assigned buckets, meters (if required), sample boxes and trucks if required. The team is responsible for letting Tim or Carrie know if there is missing or malfunctioning equipment. The team is responsible for keeping their vehicle gassed up and prepared for each sampling event.

APPENDIX E

FISH STUDY AREA



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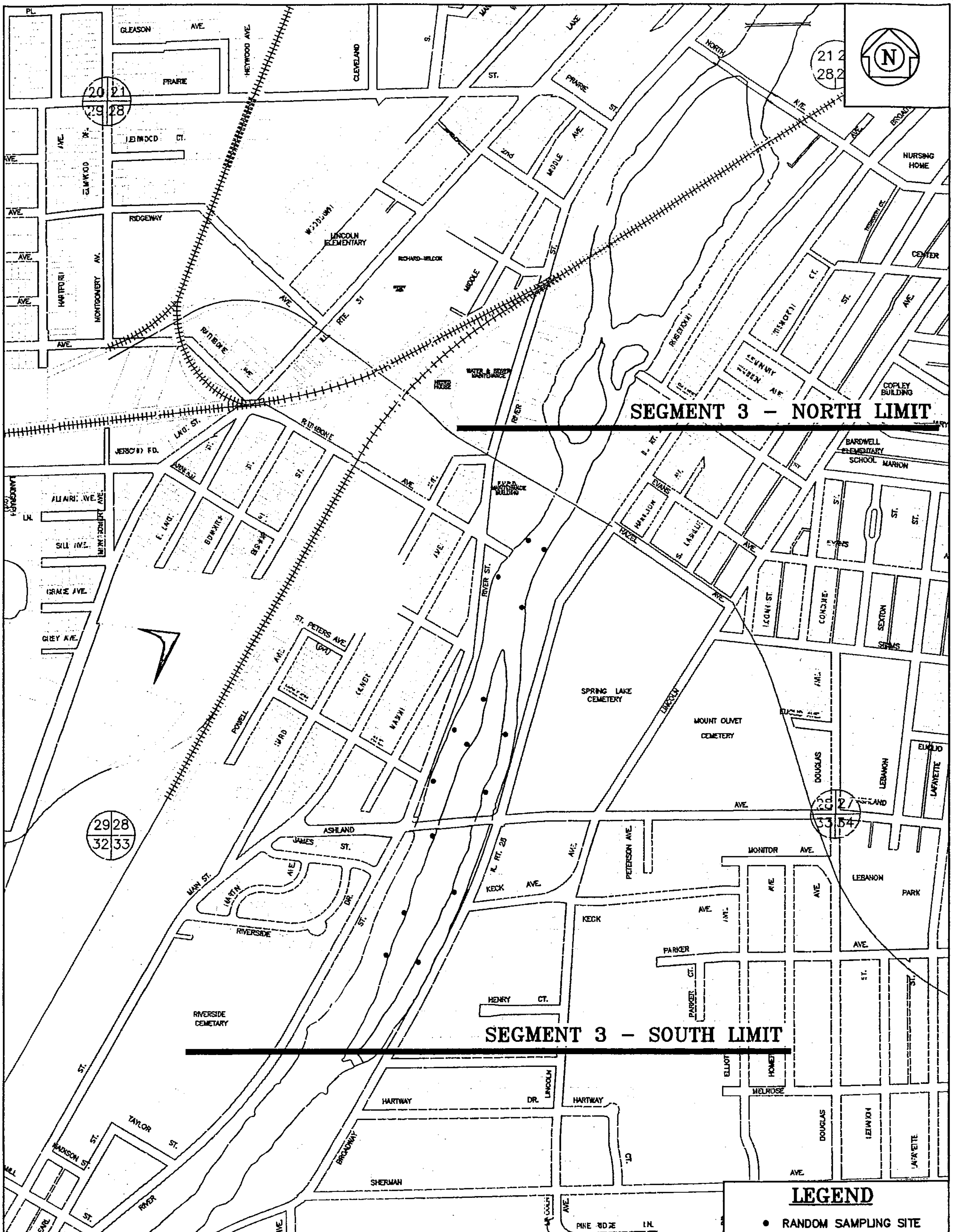
FOX RIVER – FISH STUDY

SHEET 1 OF 3



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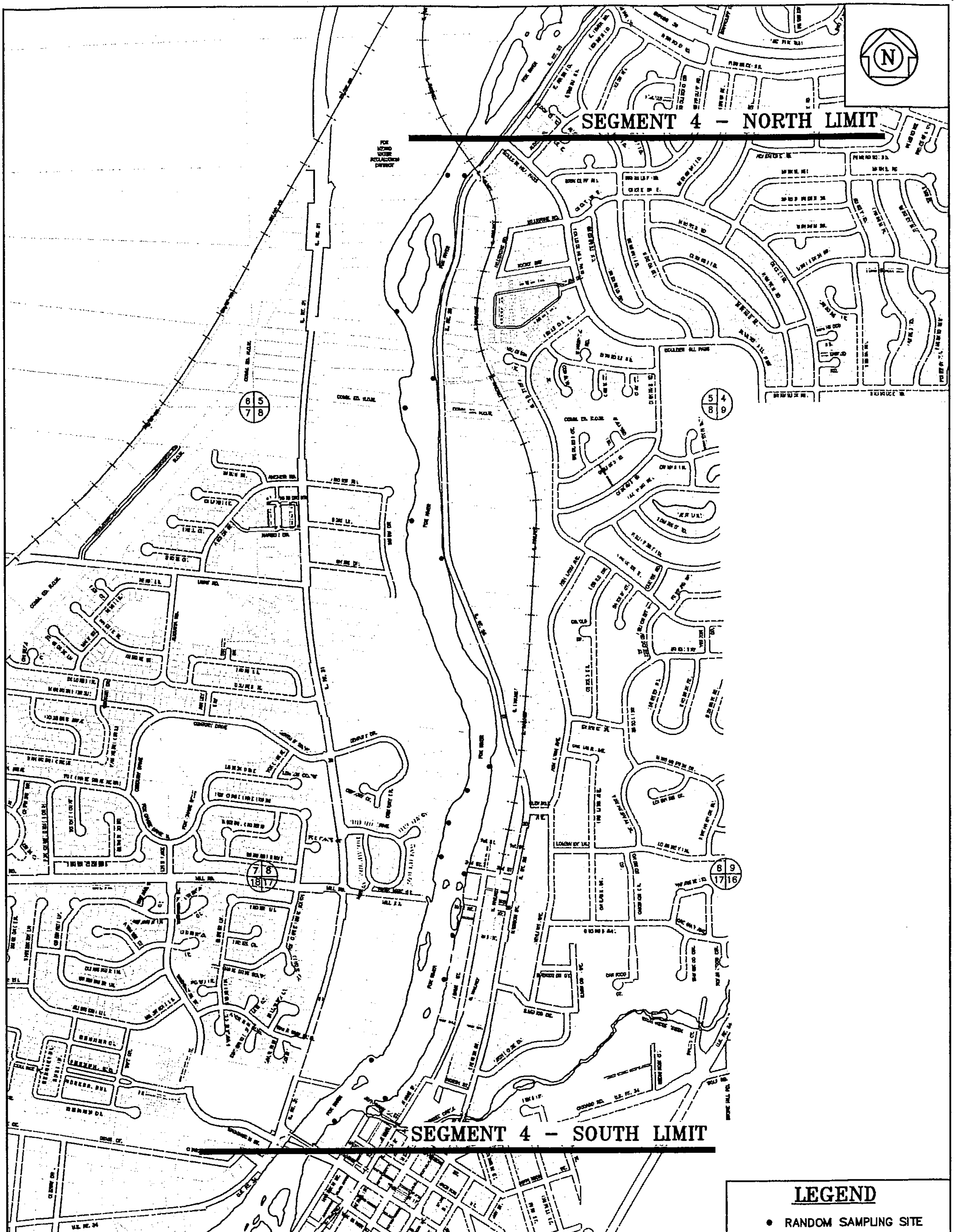
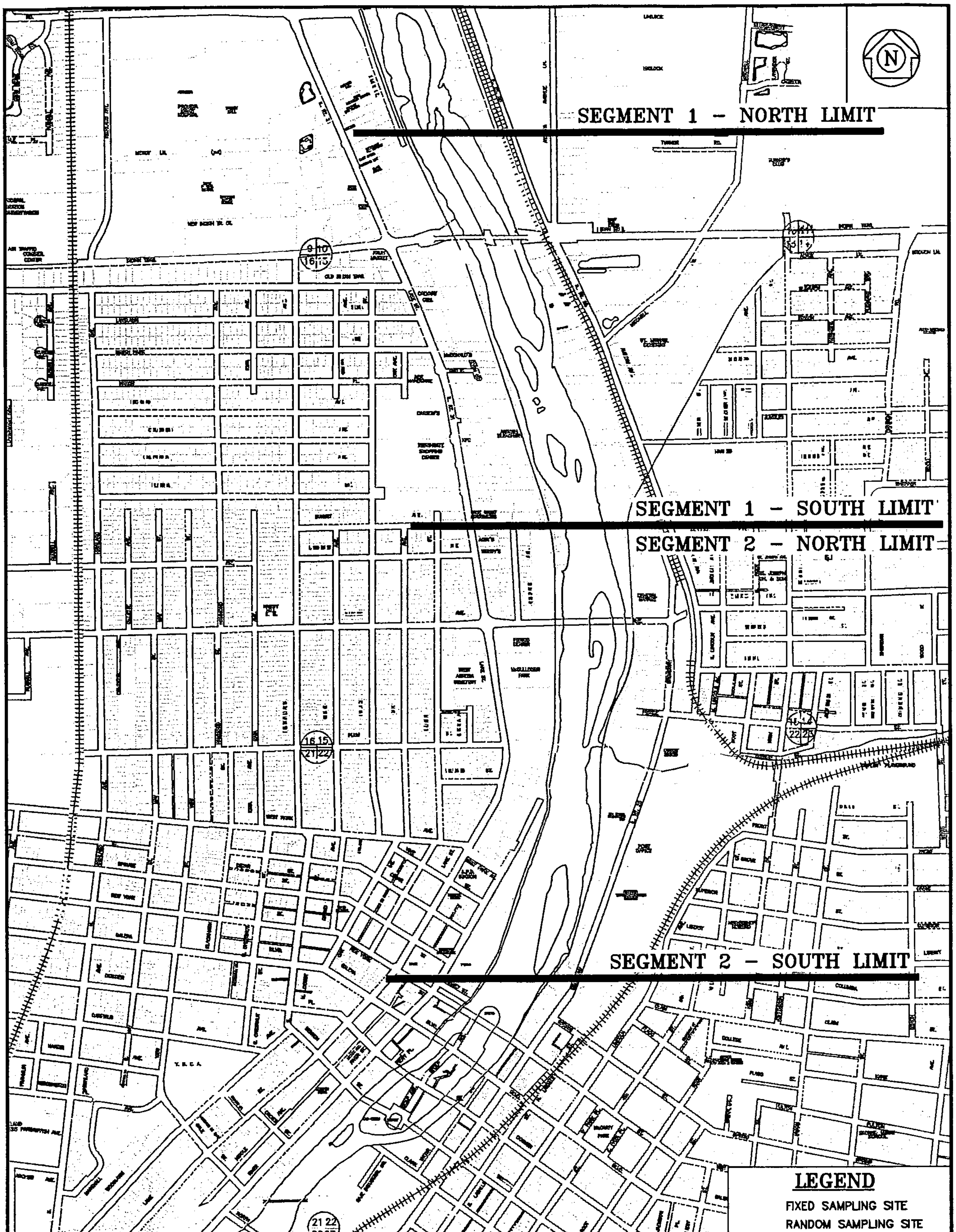
FOX METRO WATER RECLAMATION DISTRICT
MINNOW SEINE - SEG 3
FOX RIVER - FISH STUDY

SHEET 2 OF 3



WALTER E. DEUCHLER ASSOCIATES, INC. *Consulting Engineers - Aurora, Illinois* ©	REVISIONS DATE 11/19/09 · DESIGNED JW · DRAWN SAL · APPROVED PFM · BOOK SCALE NTS · CAD DWG F:\ASD\04039\AREAS · JOB NO. 111/04039/02	FOX METRO WATER RECLAMATION DISTRICT **MINNOW SEINE - SEG 4** FOX RIVER - FISH STUDY	SHEET **3** OF 3	



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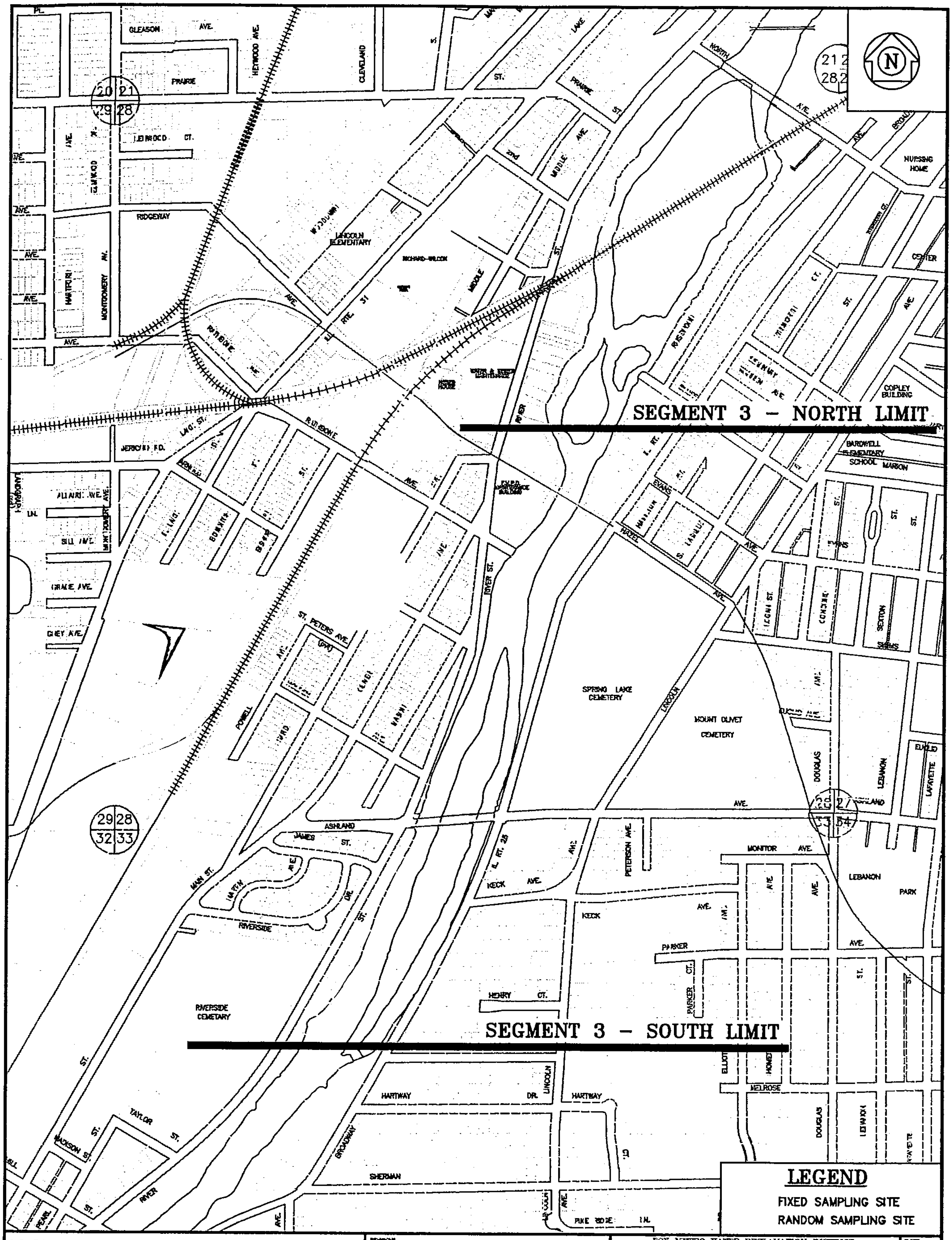
FOX METRO WATER RECLAMATION DISTRICT

TRAP NETS – SEG 1&2

FOX RIVER – FISH STUDY

SHEET 1 OF 3



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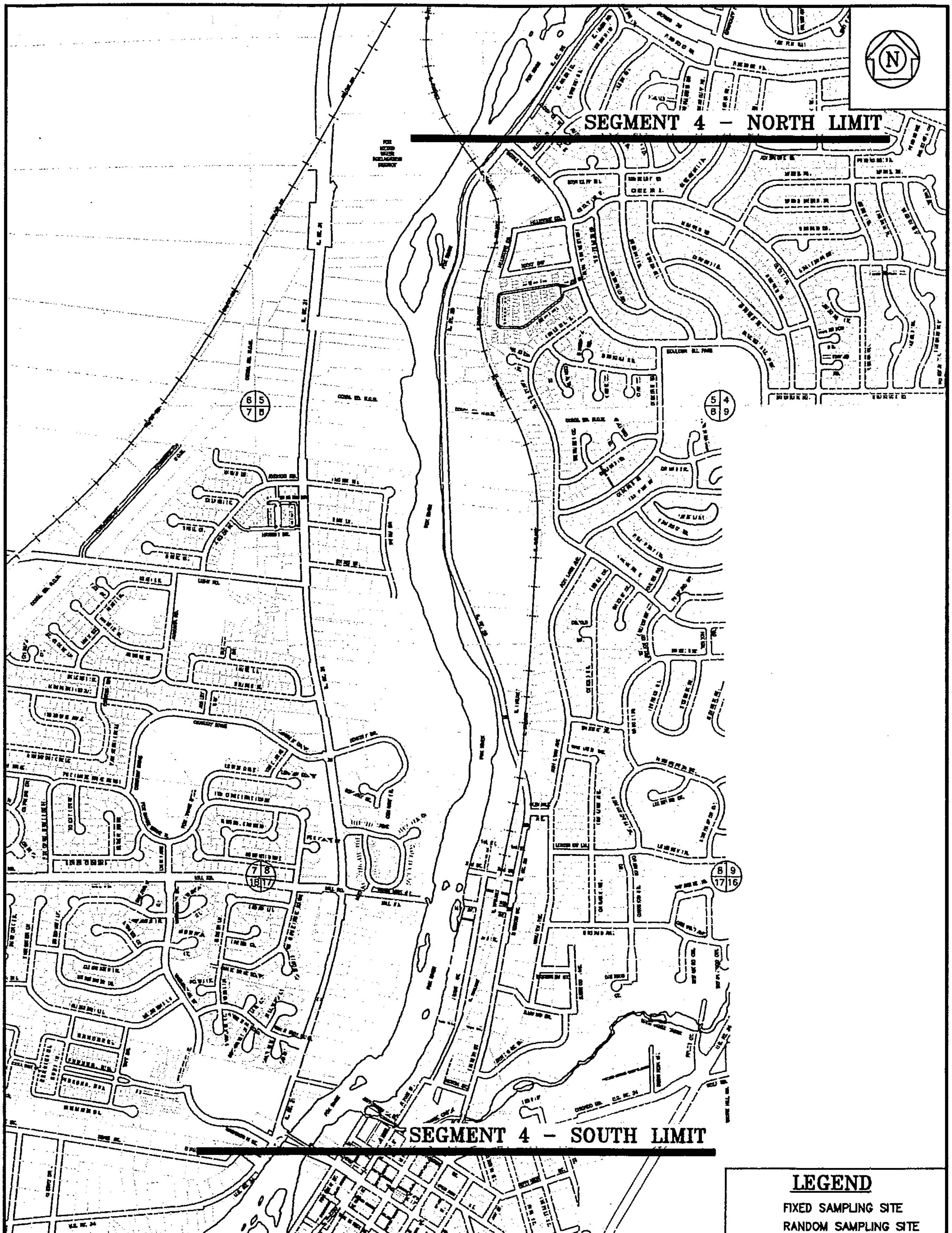
FOX METRO WATER RECLAMATION DISTRICT
TRAP NETS - SEG 3
FOX RIVER - FISH STUDY

SHEET 2 OF 3



WALTER E. DEUCHLER ASSOCIATES, INC.
Consulting Engineers - Aurora, Illinois

FOX METRO WATER RECLAMATION DISTRICT
TRAP NETS - SEG 4
FOX RIVER - FISH STUDY

SHEET 3 OF 3

APPENDIX F

INTENSIVE BRIDGE SAMPLING

FIELD DATA SHEETS

Sullivan Road Bridge

Sample Team: ______________________________

Weather:

Date/Time Arrival Page

Sample No.	Date	Time	Location on Bridge	Station
1			West	1+21.1
			Mid-Point	2+76.8
			East	4+32.5
2			West	1+21.1
			Mid-Point	2+76.8
			East	4+32.5
3			West	1+21.1
			Mid-Point	2+76.8
			East	4+32.5
4			West	1+21.1
			Mid-Point	2+76.8
			East	4+32.5
5			West	1+21.1
			Mid-Point	2+76.8
			East	4+32.5
6			West	1+21.1
			Mid-Point	2+76.8
			East	4+32.5
7			West	1+21.1
			Mid-Point	2+76.8
			East	4+32.5
8			West	1+21.1
			Mid-Point	2+76.8
			East	4+32.5
9			West	1+21.1
			Mid-Point	2+76.8
			East	4+32.5
10			West	1+21.1
			Mid-Point	2+76.8
			East	4+32.5
11			West	1+21.1
			Mid-Point	2+76.8
			East	4+32.5
12			West	1+21.1
			Mid-Point	2+76.8
			East	4+32.5

Sullivan Road Bridge

Sample Team: ______________________________

Weather:

Date/Time Arrival Page

Sample No.	Date	Time	Location on Bridge	Station
13			West	1+21.1
			Mid-Point	2+76.8
			East	4+32.5
14			West	1+21.1
			Mid-Point	2+76.8
			East	4+32.5
15			West	1+21.1
			Mid-Point	2+76.8
			East	4+32.5
16			West	1+21.1
			Mid-Point	2+76.8
			East	4+32.5
17			West	1+21.1
			Mid-Point	2+76.8
			East	4+32.5
18			West	1+21.1
			Mid-Point	2+76.8
			East	4+32.5
19			West	1+21.1
			Mid-Point	2+76.8
			East	4+32.5
20			West	1+21.1
			Mid-Point	2+76.8
			East	4+32.5
21			West	1+21.1
			Mid-Point	2+76.8
			East	4+32.5
22			West	1+21.1
			Mid-Point	2+76.8
			East	4+32.5
23			West	1+21.1
			Mid-Point	2+76.8
			East	4+32.5
24			West	1+21.1
			Mid-Point	2+76.8
			East	4+32.5

Mill Street Bridge

Sample Team: ____________________

Weather:

Date/Time Arrival   Page

Sample Set No.	Date	Time	Location on Bridge	Station
1			West	0+69
			Mid-Point	1+41
			East	2+13
2			West	0+69
			Mid-Point	1+41
			East	2+13
3			West	0+69
			Mid-Point	1+41
			East	2+13
4			West	0+69
			Mid-Point	1+41
			East	2+13
5			West	0+69
			Mid-Point	1+41
			East	2+13
6			West	0+69
			Mid-Point	1+41
			East	2+13
7			West	0+69
			Mid-Point	1+41
			East	2+13
8			West	0+69
			Mid-Point	1+41
			East	2+13
9			West	0+69
			Mid-Point	1+41
			East	2+13
10			West	0+69
			Mid-Point	1+41
			East	2+13
11			West	0+69
			Mid-Point	1+41
			East	2+13
12			West	0+69
			Mid-Point	1+41
			East	2+13

Mill Street Bridge

Sample Team: ______________________________

Weather:

Date/Time Arrival **Page**

Sample No.	Date	Time	Location on Bridge	Station
13			West	0+69
			Mid-Point	1+41
			East	2+13
14			West	0+69
			Mid-Point	1+41
			East	2+13
15			West	0+69
			Mid-Point	1+41
			East	2+13
16			West	0+69
			Mid-Point	1+41
			East	2+13
17			West	0+69
			Mid-Point	1+41
			East	2+13
18			West	0+69
			Mid-Point	1+41
			East	2+13
19			West	0+69
			Mid-Point	1+41
			East	2+13
20			West	0+69
			Mid-Point	1+41
			East	2+13
21			West	0+69
			Mid-Point	1+41
			East	2+13
22			West	0+69
			Mid-Point	1+41
			East	2+13
23			West	0+69
			Mid-Point	1+41
			East	2+13
24			West	0+69
			Mid-Point	1+41
			East	2+13

Oswego - Route 34 Bridge

Sample Team: ____________________

Weather:

Date/Time Arrival   Page

Sample Set No.	Date	Time	Location on Bridge	Station
1			West	0+40.0
			Mid-Point	1+46.8
			East	2+53.6
2			West	0+40.0
			Mid-Point	1+46.8
			East	2+53.6
3			West	0+40.0
			Mid-Point	1+46.8
			East	2+53.6
4			West	0+40.0
			Mid-Point	1+46.8
			East	2+53.6
5			West	0+40.0
			Mid-Point	1+46.8
			East	2+53.6
6			West	0+40.0
			Mid-Point	1+46.8
			East	2+53.6
7			West	0+40.0
			Mid-Point	1+46.8
			East	2+53.6
8			West	0+40.0
			Mid-Point	1+46.8
			East	2+53.6
9			West	0+40.0
			Mid-Point	1+46.8
			East	2+53.6
10			West	0+40.0
			Mid-Point	1+46.8
			East	2+53.6
11			West	0+40.0
			Mid-Point	1+46.8
			East	2+53.6
12			West	0+40.0
			Mid-Point	1+46.8
			East	2+53.6

Oswego - Route 34 Bridge

Sample Team: ______________________________

Weather:

Date/Time Arrival

Page

Sample No.	Date	Time	Location on Bridge	Station
13			West	0+40.0
			Mid-Point	1+46.8
			East	2+53.6
14			West	0+40.0
			Mid-Point	1+46.8
			East	2+53.6
15			West	0+40.0
			Mid-Point	1+46.8
			East	2+53.6
16			West	0+40.0
			Mid-Point	1+46.8
			East	2+53.6
17			West	0+40.0
			Mid-Point	1+46.8
			East	2+53.6
18			West	0+40.0
			Mid-Point	1+46.8
			East	2+53.6
19			West	0+40.0
			Mid-Point	1+46.8
			East	2+53.6
20			West	0+40.0
			Mid-Point	1+46.8
			East	2+53.6
21			West	0+40.0
			Mid-Point	1+46.8
			East	2+53.6
22			West	0+40.0
			Mid-Point	1+46.8
			East	2+53.6
23			West	0+40.0
			Mid-Point	1+46.8
			East	2+53.6
24			West	0+40.0
			Mid-Point	1+46.8
			East	2+53.6

Indian Creek

Sample Team: ____________________

Weather:

Date/Time Arrival   Page

Sample Set No.	Date	Time	pH	Conductivity	Dissolved Oxygen	Temp
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						
11						
12						
13						
14						
15						
16						
17						
18						
19						
20						
21						
22						
23						

Indian Creek

Sample Team: ______________________________

Weather:

Date/Time Arrival

Page

Sample Set No.	Date	Time	pH	Conductivity	Dissolved Oxygen	Temp
24						
25						
26						
27						
28						
29						
30						
31						
32						
33						
34						
35						
36						
37						
38						
39						
40						
41						
42						
43						
44						
45						
46						

APPENDIX G

CSO and STORM OUTFALL SAMPLING FIELD DATA SHEET

2009 CSO Sampling

Location: Rathbone (OVF No. 1) (Standard Sampler)

Date/Time:

Personnel:

Parameter Bottle No.	Initial 1	5 min. 2	10 min. 3	15 min. 4	20 min. 5	30 min. 6	45 min. 7	1 hr. 8	2 hr. 9	3 hr. 10	4 hr. 11	5 hr. 12
Date/Time of Collection												
pH (units)												
Conductivity (µS)												

Worklist:

Review "Display Status" should tell you when the sample was collected.
Replace bottles
To Restart Program, first toggle switch on the actuator.
Press "Start Sampling"
Press "Enter" when Sample 1 displayed. Should respond with "Sampling Inhibited."

Field Observations:

Chain of Custody

Relinquished By	Date/Time	Received By	Date/Time
Relinquished By	Date/Time	Received By	Date/Time

2009 CSO Sampling

Location: Hazel (OVF No. 4) (Standard Sampler)

Date/Time:

Personnel:

Parameter Bottle No.	**Initial 1**	**5 min. 2**	**10 min. 3**	**15 min. 4**	**20 min. 5**	**30 min. 6**	**45 min. 7**	**1 hr. 8**	**2 hr. 9**	**3 hr. 10**	**4 hr. 11**	**5 hr. 12**
Date/Time of Collection												
pH (units)												
Conductivity (µS)												

Worklist:

Review "Display Status" should tell you when the sample was collected.
Replace bottles
To Restart Program, first toggle switch on the actuator.
Press "Start Sampling"
Press "Enter" when Sample 1 displayed. Should respond with "Sampling Inhibited."

Field Observations:

Chain of Custody

Relinquished By	Date/Time	Received By	Date/Time
Relinquished By	Date/Time	Received By	Date/Time

2009 CSO Sampling

Location: East Benton (OVF No. 8) (Compact Sampler)

Date/Time:____

Personnel: ____

Parameter Bottle No.	**Initial 1-2**	**5 min. 3-4**	**10 min. 5-6**	**15 min. 7-8**	**20 min. 9-10**	**30 min. 11-12**	**45 min. 13-14**	**1 hr. 15-16**	**2 hr. 17-18**	**3 hr. 19-20**	**4 hr. 21-22**	**5 hr. 23-24**
Date/Time of Collection												
pH (units)												
Conductivity (µS)												

Worklist:

Review "Display Status" should tell you when the sample was collected.
Replace bottles
To Restart Program, first toggle switch on the actuator.
Press "Start Sampling"
Press "Enter" when Sample 1 displayed. Should respond with "Sampling Inhibited."

Field Observations:

____

Chain of Custody

Relinquished By	Date/Time	Received By	Date/Time
Relinquished By	Date/Time	Received By	Date/Time

2009 CSO Sampling

Location: First (OVF No. 10) – Prairie at River(Compact Sampler)

Date/Time:____________________________________

Personnel: __________________________________

Parameter Bottle No.	**Initial 1-2**	**5 min. 3-4**	**10 min. 5-6**	**15 min. 7-8**	**20 min. 9-10**	**30 min. 11-12**	**45 min. 13-14**	**1 hr. 15-16**	**2 hr. 17-18**	**3 hr. 19-20**	**4 hr. 21-22**	**5 hr. 23-24**
Date/Time of Collection												
pH (units)												
Conductivity (µS)												

Worklist:

Review "Display Status" should tell you when the sample was collected.
Replace bottles
To Restart Program, first toggle switch on the actuator.
Press "Start Sampling"
Press "Enter" when Sample 1 displayed. Should respond with "Sampling Inhibited."

Field Observations:

____

Chain of Custody

Relinquished By	Date/Time	Received By	Date/Time
Relinquished By	Date/Time	Received By	Date/Time

2009CSO Sampling

Location: West Benton (OVF No. 15) – (Compact Sampler)

Date/Time:______________________________

Personnel: ______________________________

Parameter Bottle No.	**Initial 1-2**	**5 min. 3-4**	**10 min. 5-6**	**15 min. 7-8**	**20 min. 9-10**	**30 min. 11-12**	**45 min. 13-14**	**1 hr. 15-16**	**2 hr. 17-18**	**3 hr. 19-20**	**4 hr. 21-22**	**5 hr. 23-24**
Date/Time of Collection												
pH (units)												
Conductivity (µS)												

Worklist:

Review "Display Status" should tell you when the sample was collected.
Replace bottles
To Restart Program, first toggle switch on the actuator.
Press "Start Sampling"
Press "Enter" when Sample 1 displayed. Should respond with "Sampling Inhibited."

Field Observations:

____

Chain of Custody

Relinquished By	Date/Time	Received By	Date/Time
Relinquished By	Date/Time	Received By	Date/Time

2009 CSO Sampling

Location: West Galena (OVF No. 18) – (Compact Sampler)

Date/Time:____

Personnel: ______________________________________

Parameter Bottle No.	**Initial 1-2**	**5 min. 3-4**	**10 min. 5-6**	**15 min. 7-8**	**20 min. 9-10**	**30 min. 11-12**	**45 min. 13-14**	**1 hr. 15-16**	**2 hr. 17-18**	**3 hr. 19-20**	**4 hr. 21-22**	**5 hr. 23-24**
Date/Time of Collection												
pH (units)												
Conductivity (μS)												

Worklist:

Review "Display Status" should tell you when the sample was collected.
Replace bottles
To Restart Program, first toggle switch on the actuator.
Press "Start Sampling"
Press "Enter" when Sample 1 displayed. Should respond with "Sampling Inhibited."

Field Observations:

____

Chain of Custody

Relinquished By	Date/Time	Received By	Date/Time
Relinquished By	Date/Time	Received By	Date/Time

2009 CSO Sampling

Location: Fox Metro (Standard Sampler)

Date/Time:

Personnel:

Parameter Bottle No.	**Initial 1**	**5 min. 2**	**10 min. 3**	**15 min. 4**	**20 min. 5**	**30 min. 6**	**45 min. 7**	**1 hr. 8**	**2 hr. 9**	**3 hr. 10**	**4 hr. 11**	**5 hr. 12**
Date/Time of Collection												
pH (units)												
Conductivity (µS)												

Worklist:

Review "Display Status" should tell you when the sample was collected.
Replace bottles
To Restart Program, first toggle switch on the actuator.
Press "Start Sampling"
Press "Enter" when Sample 1 displayed. Should respond with "Sampling Inhibited."

Field Observations:

Chain of Custody

Relinquished By	Date/Time	Received By	Date/Time
Relinquished By	Date/Time	Received By	Date/Time

2009 CSO Sampling

Location: N. River Street (Storm Sewer) – (Standard Sampler)

Date/Time:____

Personnel: _____________________________________

Parameter Bottle No.	**Initial 1**	**5 min. 2**	**10 min. 3**	**15 min. 4**	**20 min. 5**	**30 min. 6**	**45 min. 7**	**1 hr. 8**	**2 hr. 9**	**3 hr. 10**	**4 hr. 11**	**5 hr. 12**
Date/Time of Collection												
pH (units)												
Conductivity (µS)												

Worklist:

Review "Display Status" should tell you when the sample was collected.
Replace bottles
To Restart Program, first toggle switch on the actuator.
Press "Start Sampling"
Press "Enter" when Sample 1 displayed. Should respond with "Sampling Inhibited."

Field Observations:

____

Chain of Custody

Relinquished By	Date/Time	Received By	Date/Time
Relinquished By	Date/Time	Received By	Date/Time

2009 CSO Sampling

Location: Cleveland (Storm Sewer) – (Compact Sampler)

Date/Time:____

Personnel: ____

Parameter Bottle No.	Initial 1-2	5 min. 3-4	10 min. 5-6	15 min. 7-8	20 min. 9-10	30 min. 11-12	45 min. 13-14	1 hr. 15-16	2 hr. 17-18	3 hr. 19-20	4 hr. 21-22	5 hr. 23-24
Date/Time of Collection												
pH (units)												
Conductivity (µS)												

Worklist:

Review "Display Status" should tell you when the sample was collected.
Replace bottles
To Restart Program, first toggle switch on the actuator.
Press "Start Sampling"
Press "Enter" when Sample 1 displayed. Should respond with "Sampling Inhibited."

Field Observations:

____

Chain of Custody

Relinquished By	Date/Time	Received By	Date/Time
Relinquished By	Date/Time	Received By	Date/Time

2009 CSO Sampling

Location: Hartway (Storm Sewer) – (Standard Sampler)

Date/Time:____________________________________

Personnel: __________________________________

Parameter Bottle No.	**Initial 1**	**5 min. 2**	**10 min. 3**	**15 min. 4**	**20 min. 5**	**30 min. 6**	**45 min. 7**	**1 hr. 8**	**2 hr. 9**	**3 hr. 10**	**4 hr. 11**	**5 hr. 12**
Date/Time of Collection												
pH (units)												
Conductivity (µS)												

Worklist:

Review “Display Status” should tell you when the sample was collected.
Replace bottles
To Restart Program, first toggle switch on the actuator.
Press “Start Sampling”
Press “Enter” when Sample 1 displayed. Should respond with “Sampling Inhibited.”

Field Observations:

____

Chain of Custody

Relinquished By	Date/Time	Received By	Date/Time
Relinquished By	Date/Time	Received By	Date/Time

APPENDIX E

BRIDGE SAMPLING ANALYTICAL SUMMARY (2008-2009)

BI-WEEKLY STREAM STUDY 2008
Fox Metro Laboratory Data Summary

Sample Dates: April 29 and April 30, 2008

Test Parameters	Discrete Stream Sampling Locations											
	Mainstem										Tributary	
	Sullivan Rd.		North Ave.		Ashland Ave.		Mill Street		Route 34		Indian Cr.	
	Trans	Grab	Trans	Grab	Trans	Grab	Trans	Grab	Trans	Grab	Trans	Grab
Temperature (°C)	13.3	11.9	12.1	12.4	11.9	12.0	13.0	12.8	14.3	13.7	NS	11.5
D.O. (mg/L)	9.79	9.35	9.64	9.93	9.25	10.40	9.77	10.80	10.77	10.70	NS	9.06
pH (S.U.)	7.22	7.97	8.16	7.60	8.00	7.78	6.24-OUT	7.93	8.20	8.15	NS	7.61
Conductivity (uS/cm)	970	890	760	ND	800	830	ND	ND	740	1010	NS	ND
BOD (mg/L)	3	3	4	3	4	4	4	4	4	4	NS	< 2
TSS (mg/L)	40	41	43	41	32	38	37	36	36	41	NS	9
Fecal Coliforms (#/100mL)	ND	136	ND	109	ND	71	ND	46	ND	66	NS	90
TKN (mg/L)	1.66	1.66	1.51	1.83	1.78	1.47	1.40	1.37	1.54	1.56	NS	0.57
Ammonia N (mg/L)	0.03	0.03	0.03	0.03	0.05	0.03	0.02	0.02	0.02	0.02	NS	0.04
Nitrate N (mg/L)	1.00	1.00	1.02	1.03	0.99	0.99	0.99	1.01	1.08	0.99	NS	0.23
Nitrite N (mg/L)	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	NS	< 0.05
Organic N (mg/L)	1.63	1.63	1.48	1.80	1.73	1.44	1.38	1.35	1.52	1.54	NS	0.53
Total P (mg/L)	0.24	0.26	0.24	0.25	0.21	0.22	0.22	0.21	0.25	0.22	NS	0.06
Dissolved P (mg/L)	0.06	0.06	0.06	0.06	0.05	0.05	0.04	0.05	0.05	0.05	NS	0.03
Chloride (mg/L)	113	113	119	119	119	119	122	122	130	121	NS	307
Fluoride (mg/L)	0.17	0.16	0.17	0.17	0.16	0.16	0.16	0.18	0.18	0.99	NS	0.19
Fox Metro Sample ID Number	AD03924	AD03925	AD03927	AD03928	AD03972	AD03973	AD03974	AD03975	AD03976	AD03977	--	AD03926
Chlorophyll a (mg/L)	28.3	31.7	31.6	31.2	37.8	37.8	28.3	35.9	36.3	35.0	NS	8.6
First Sample ID Number	8-1779-001	8-1779-002	8-1779-004	8-1779-005	8-1793-001	8-1793-002	8-1793-003	8-1793-004	8-1793-005	8-1793-006	--	8-1779-003

Data Qualifiers: NS = No Sample
OUT = Outlier
ND = Not Determined

Walter E. Deuchler Associates, Inc. and Deuchler Environmental, Inc.

BI-WEEKLY STREAM STUDY 2008

Fox Metro Laboratory Data Summary

Sample Date: May 14, 2008

Test Parameters	Discrete Stream Sampling Locations													
	Mainstem										Tributary			
	Sullivan Rd.		North Ave.		Ashland Ave.		Mill Street		Route 34		Indian Creek Grabs			
	Trans	Grab	Trans	Grab	Trans	Grab	Trans	Grab	Trans	Grab	Bridge	Upstream	Downst.	Reckinger
Temperature (^oC)	15.5	15.6	15.9	15.6	15.9	16.0	15.9	16.1	15.8	15.7	15.6	15.0	15.0	15.7
D.O. (mg/L)	6.02	6.69	6.93	6.68	7.40	7.18	7.05	6.51	6.90	7.12	8.30	7.47	8.50	6.57
pH (S.U.)	7.78	8.19	8.15	7.83	7.92	8.01	7.80	7.81	7.91	8.03	7.15	7.15	7.09	7.24
Conductivity (uS/cm)	870	1060	890	970	880	870	880	940	950	870	990	880	1110	880
BOD (mg/L)	4	4	4	4	4	4	4	4	4	4	2	2	2	2
TSS (mg/L)	41	40	35	36	39	40	35	34	38	41	34	32	32	32
Fecal Coliforms (#/100mL)	ND	80	ND	20	ND	60	ND	40	ND	60	100	700	200	200
TKN (mg/L)	1.63	1.65	1.70	1.60	1.56	1.60	1.64	1.67	1.65	1.63	0.92	0.99	0.95	0.88
Ammonia N (mg/L)	0.03	0.03	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.07	0.06	0.06	0.05
Nitrate N (mg/L)	1.02	1.04	1.04	1.00	1.09	1.00	0.99	0.99	1.12	0.87	0.43	0.41	0.40	0.40
Nitrite N (mg/L)	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	0.27	< 0.05	<0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Organic N (mg/L)	1.60	1.63	1.68	1.58	1.54	1.58	1.62	1.65	1.63	1.61	0.85	0.93	0.89	0.83
Total P (mg/L)	0.30	0.30	0.29	0.30	0.28	0.32	0.28	0.29	0.30	0.30	0.12	0.13	0.14	0.13
Dissolved P (mg/L)	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Chloride (mg/L)	140	141	141	140	143	140	141	142	148	142	205	206	200	202
Fluoride (mg/L)	0.18	0.24	0.24	0.27	0.18	0.17	0.17	0.17	0.18	0.17	0.16	0.22	0.16	0.24
Fox Metro Sample ID Number	AD04609	AD04610	AD04611	AD04612	AD04613	AD04614	AD04615	AD04616	AD04617	AD04618	AD04605	AD04606	AD04607	AD04608
Chlorophyll a (mg/L)	46.6	47.7	51.7	47.4	49.5	48.0	29.6	40.6	57.0	52.2	6.0	8.5	8.6	8.3
First Sample ID Number	8-2052-001	8-2052-002	8-2052-003	8-2052-004	8-2052-005	8-2052-006	8-2052-007	8-2052-008	8-2052-009	8-2052-010	8-2052-011	8-2052-012	8-2052-013	8-2052-014

Data Qualifiers:
NS = No Sample
OUT = Outlier
ND = Not Determined

Walter E. Deuchler Associates, Inc. and Deuchler Environmental, Inc.

BI-WEEKLY STREAM STUDY 2008

Fox Metro Laboratory Data Summary

Sample Date: May 28, 2008

Test Parameters	Discrete Stream Sampling Locations											
	Mainstem										Tributary	
	Sullivan Rd.		North Ave.		Ashland Ave.		Mill Street		Route 34		Indian Creek Grabs	
	Trans	Grab	Trans	Grab	Trans	Grab	Trans	Grab	Trans	Grab	Bridge	Brdg Dupl	Upstream	Downstr	Equip Blnk	Rockinger
Temperature (^{o}C)	15.2	16.2	18.5	18.0	19.7	17.5	25.0	20.9	20.5	21.5	16.3	14.7	12.6	13.1	ND	15.6
D.O. (mg/L)	7.24	7.60	7.92	7.47	8.07	7.83	8.01	8.55	10.12	8.52	7.21	7.45	6.84	6.88	ND	6.74
pH (S.U.)	7.93	7.69	7.91	6.99	7.65	7.40	7.92	8.25	8.26	8.25	7.11	7.28	7.35	7.04	ND	7.44
Conductivity (uS/cm)	1250	1170	960	980	900	960	850	870	950	860	1150	1140	950	980	ND	1220
BOD (mg/L)	5	4	4	4	5	4	5	5	5	5	< 2	< 5	< 3	< 3	< 3	< 2
TSS (mg/L)	43	34	36	38	41	36	40	39	37	35	9	10	9	26	< 2	11
Fecal Coliforms (#/100mL)	ND	32	ND	92	ND	88	ND	48	ND	80	280	300	360	220	0	120
TKN (mg/L)	1.64	1.62	1.69	1.62	1.54	1.72	1.47	1.52	1.51	1.49	0.67	0.69	0.71	0.78	< 0.17	0.66
Ammonia N (mg/L)	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	0.02	0.02	0.04	0.04	0.02	0.03
Nitrate N (mg/L)	1.11	1.11	1.14	1.12	1.13	1.17	1.05	1.04	1.37	1.02	0.24	0.24	0.21	0.24	< 0.09	0.16
Nitrite N (mg/L)	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Organic N (mg/L)	1.64	1.62	1.69	1.62	1.54	1.72	1.47	1.52	1.51	1.49	0.65	0.67	0.67	0.74	< 0.17	0.63
Total P (mg/L)	0.27	0.28	0.27	0.28	0.27	0.30	0.28	0.27	0.34	0.27	0.07	0.07	0.06	0.09	0.27	0.04
Dissolved P (mg/L)	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Chloride (mg/L)	155	153	158	156	158	152	152	148	163	153	211	213	213	213	0.3	220
Fluoride (mg/L)	0.19	0.19	0.30	0.20	0.23	0.25	0.25	0.20	0.21	0.19	0.18	0.17	0.15	0.20	< 0.03	0.15
Fox Metro Sample ID Number	AD05135	AD05136	AD05143	AD05144	AD05157	AD05145	AD05158	AD05159	AD05160	AD05161	AD05137	AD05138	AD05139	AD05140	AD05142	AD05141
Chlorophyll a (mg/L)	30.7	28.8	50.8	33.6	29.2	35.3	35.9	37.8	37.1	38.8	4.0	3.4	3.2	3.4	<1.0	3.3
First Sample ID Number	8-2301-007	8-2301-008	8-2301-009	8-2301-010	8-2301-011	8-2301-012	8-2301-013	8-2301-014	8-2301-015	8-2301-016	8-2301-001	8-2301-006	8-2301-002	8-2301-003	8-2301-005	8-2301-004

Data Qualifiers: NS = No Sample
OUT = Outlier
ND = Not Determined

Walter E. Deuchler Associates, Inc. and Deuchler Environmental, Inc.

BI-WEEKLY STREAM STUDY 2008

Fox Metro Laboratory Data Summary

Sample Date: June 11, 2008

Test Parameters	Discrete Stream Sampling Locations										
	Mainstem					Tributary					
	Sullivan Rd.	North Ave.	Ashland Ave.	Mill Street	Route 34	Indian Creek Grabs					
						Bridge	Upstream	Downstream	Rockfinder	Rock Dunk	Equip Blank
Temperature (°C)*	25.0	26.3	27.3	27.6	26.2	23.0	NS	23.7	23.7	24.3	28.8
D.O. (mg/L)*	6.31	6.71	6.33	6.73	6.32	7.32	NS	6.05	5.28	5.78	5.40
pH (S.U.)*	6.91	7.19	7.16	6.92	6.99	7.67	NS	7.62	7.54	7.44	7.51
Conductivity (uS/cm)*	820	740	600	660	650	750	NS	770	780	700	80
BOD (mg/L)	3	3	< 3	< 3	3	< 3	NS	< 3	< 3	< 3	< 3
TSS (mg/L)	49	55	58	60	77	5	NS	15	10	10	< 1
Fecal Coliforms (#/100mL)*	232	276	274	258	232	670	NS	480	520	500	0
TKN (mg/L)	1.55	1.75	1.81	1.84	ND	0.61	NS	0.60	0.65	0.68	< 0.17
Ammonia N (mg/L)	0.04	0.08	0.08	0.07	0.06	0.05	NS	0.06	0.04	0.04	0.04
Nitrate N (mg/L)	1.42	1.49	1.42	1.41	1.54	0.28	NS	0.27	0.20	0.17	< 0.09
Nitrite N (mg/L)	0.19	0.26	0.28	0.25	0.29	< 0.05	NS	< 0.05	< 0.05	< 0.05	< 0.05
Organic N (mg/L)	1.51	1.67	1.73	1.77	ND	0.56	NS	0.54	0.61	0.64	< 0.13
Total P (mg/L)	0.26	0.31	0.31	0.32	0.37	0.10	NS	0.10	0.08	0.09	< 0.01
Dissolved P (mg/L)	0.10	0.10	0.10	0.10	0.12	0.04	NS	0.05	0.04	0.04	< 0.01
Chloride (mg/L)	98	100	100	100	105	192	NS	192	190	192	0.4
Fluoride (mg/L)	0.16	0.18	0.25	0.15	0.20	0.16	NS	0.18	0.16	0.17	< 0.03
FMWRD ID Number-Transect	AD05685	AD05706	AD05708	AD05710	AD05712	–	–	–	–	–	–
FMWRD ID Number-Grab	AD05686	AD05707	AD05709	AD05711	AD05713	AD05687	–	AD05688	AD05689	AD05690	AD05691
Chlorophyll a (mg/L)	22.3	26.5	24.9	22.9	27.4	1.8	NS	2.3	2.8	4.1	< 1.0
First Sample ID Number	8-2553-004	8-2553-005	8-2553-006	8-2553-007	8-2553-008	8-2553-002	–	8-2553-001	8-2553-003	8-2553-009	8-2553-010

*Note: Grab Samples Only

Data Qualifiers:
NS = No Sample
OUT = Outlier
ND = Not Determined

Walter E. Deuchler Associates, Inc. and Deuchler Environmental, Inc.

BI-WEEKLY STREAM STUDY 2008

Fox Metro Laboratory Data Summary

Sample Date: June 25, 2008

Test Parameters	Discrete Stream Sampling Locations										
	Mainstem					Tributary					
	Sullivan Rd.	North Ave.	Ashland Ave.	Mill Street	Route 34	Indian Creek Grabs					
						Bridge	Upstream	Downstream	Rockinger	Duplicate	Equip Blank
Temperature (^{o}C)*	24.5	23.6	22.7	22.5	NS	21.2	21.8	NS	22.4	NS	NS
D.O. (mg/L)*	OUT	OUT	OUT	OUT	NS	7.90	OUT	NS	OUT	NS	NS
pH (S.U.)*	7.40	7.41	7.35	7.55	NS	7.35	7.09	NS	7.16	NS	NS
Conductivity (uS/cm)*	730	640	640	760	NS	990	970	NS	1040	NS	NS
BOD (mg/L)	< 2	2	3	2	NS	4	3	NS	4	NS	NS
TSS (mg/L)	38	44	50	48	NS	6	12	NS	21	NS	NS
Fecal Coliforms (#/100mL)*	156	192	232	236	NS	3690	1650	NS	TNTC	NS	NS
TKN (mg/L)	1.44	1.29	1.44	1.52	NS	0.80	0.75	NS	0.91	NS	NS
Ammonia N (mg/L)	0.04	0.04	0.04	0.05	NS	0.08	0.09	NS	0.17	NS	NS
Nitrate N (mg/L)	0.44	0.40	0.40	0.40	NS	0.36	0.25	NS	0.22	NS	NS
Nitrite N (mg/L)	0.16	< 0.05	< 0.05	< 0.05	NS	< 0.05	< 0.05	NS	< 0.05	NS	NS
Organic N (mg/L)	1.40	1.25	1.40	1.47	NS	0.72	0.66	NS	0.74	NS	NS
Total P (mg/L)	0.20	0.22	0.25	0.25	NS	0.11	0.11	NS	0.13	NS	NS
Dissolved P (mg/L)	0.08	0.08	0.09	0.09	NS	0.06	0.05	NS	0.08	NS	NS
Chloride (mg/L)	64	65	66	65	NS	198	165	NS	153	NS	NS
Fluoride (mg/L)	0.14	0.15	0.16	0.14	NS	0.22	0.21	NS	0.17	NS	NS
FMWRD ID Number-Transect	AD06222	AD06224	AD06237	AD06239	–	–	–	–	–		
FMWRD ID Number-Grab	AD06223	AD06225	AD06238	AD06240	–	AD06226	AD06227	–	AD06228		
Chlorophyll a (mg/L)	34.4	28.8	30.0	31.0	NS	3.2	1.2	NS	1.8	NS	NS
First Sample ID Number	8-2752-004	8-2752-005	8-2752-006	8-2752-007	–	8-2752-003	8-2752-002	–	8-2752-001	–	–

*Note: Grab Samples Only

Data Qualifiers:
NS = No Sample
OUT = Outlier, Data Not Used
ND = Not Determined
TNTC = Too Numerous To Count

Walter E. Deuchler Associates, Inc. and Deuchler Environmental, Inc.

BI-WEEKLY STREAM STUDY 2008

Fox Metro Laboratory Data Summary

Sample Date: July 7, 2008

Test Parameters	Discrete Stream Sampling Locations															
	Mainstem										Tributary (Collected 7/8/08)					
	Sullivan Rd.		North Ave.		Ashland Ave.		Mill Street		Route 34		Indian Creek Grabs					
	Trans	Grab	Trans	Grab	Trans	Grab	Trans	Grab	Trans	Grab	Bridge (7/7)	Bridge (7/8)	Upstream	Up Outf	Equip Blank	Background
Temperature (°C)*	ND	24.9	ND	25.1	ND	27.2	ND	26.0	ND	28.1	22.1	24.6	25.0	24.6	26.5	25.1
D.O. (mg/L)*	ND	OUT	ND	OUT	ND	OUT	ND	OUT	ND	7.54	OUT	8.83	OUT	OUT	OUT	OUT
pH (S.U.)*	ND	7.67	ND	7.01	ND	7.47	ND	7.88	ND	8.29	6.89	7.58	7.04	7.42	8.31	7.15
Conductivity (uS/cm)*	ND	790	ND	690	ND	650	ND	700	ND	650	1140	1170	870	860	60	1110
BOD (mg/L)	8	6	6	6	6	8	6	6	7	7	< 2	< 2	< 2	4	< 2	4
TSS (mg/L)	22	24	27	27	25	25	27	30	31	31	3	3	9	7	< 1	8
Fecal Coliforms (#/100mL)*	ND	72	ND	88	ND	84	ND	96	ND	88	107	5600	5200	3600	2	16300
TKN (mg/L)	1.72	1.76	1.86	1.67	1.78	1.76	1.78	1.81	1.81	1.80	0.50	0.61	0.84	0.86	< 0.17	1.05
Ammonia N (mg/L)	0.04	0.02	0.02	0.03	0.03	0.02	0.02	0.02	0.02	0.02	0.02	0.03	0.06	0.06	0.05	0.22
Nitrate N (mg/L)	< 0.09	0.16	< 0.09	< 0.09	< 0.09	< 0.09	< 0.09	< 0.09	0.34	< 0.09	0.09	0.25	0.54	0.52	< 0.09	0.24
Nitrite N (mg/L)	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Organic N (mg/L)	1.69	1.74	1.84	1.65	1.75	1.74	1.76	1.79	1.79	1.78	0.48	0.58	0.78	0.80	BDL	0.83
Total P (mg/L)	0.22	0.22	0.22	0.20	0.25	0.22	0.22	0.23	0.31	0.23	0.04	0.06	0.12	0.12	0.01	0.15
Dissolved P (mg/L)	0.06	0.06	0.06	0.05	0.06	0.07	0.07	0.06	0.17	0.07	0.03	0.04	0.06	0.06	0.01	0.08
Chloride (mg/L)	94	95	97	94	97	97	99	99	105	98	219	184	144	144	< 0.1	174.0
Fluoride (mg/L)	0.19	0.24	0.15	0.15	0.17	0.17	0.18	0.20	0.19	0.18	0.29	0.27	0.20	0.23	< 0.03	0.18
FMWRD ID Number-Transect	AD06637		AD06640		AD06646		AD06647		AD06649		—	—	—	—	—	—
FMWRD ID Number-Grab	AD06638		AD06641		AD06642		AD06648		AD06650		AD06639	AD06690	AD06691	AD06692	AD06693	AD06694
Chlorophyll a (mg/L)	48.3	57.6	63.4	63.6	65.0	60.9	66.5	70.2	65.6	68.7	6.1	5.3	1.4	1.1	< 1.0	2.0
First ID Number-Transect	8-2938-001		8-2938-004		8-2938-006		8-2938-008		8-2938-010		—	—	—	—	—	—
First ID Number-Grab	8-2938-002		9-2938-005		8-2938-007		8-2938-009		8-2938-011		8-2938-001	8-2948-001	8-2948-002	8-2948-004	8-2948-005	8-2948-006

*Note: Grab Samples Only

Data Qualifiers:
NS = No Sample
OUT = Outlier, Data Not Used
ND = Not Determined

TNTC = Too Numerous To Count
BDL = Below Detection Limit

Walter E. Deuchler Associates, Inc. and Deuchler Environmental, Inc.
BI-WEEKLY STREAM STUDY 2008
Fox Metro Laboratory Data Summary

Sample Date: July 23, 2008

Test Parameters	Discrete Stream Sampling Locations									
	Mainstem							Tributary		
	Sullivan Rd.	North Ave.	Ashland Ave.	Mill Street	Mill Dupl.	Mill Blank	Route 34	Indian Creek Grabs		
								Bridge	Upstream	Reckinger
Temperature (°C)*	22.8	26.6	26.6	26.5	25.5	26.2	27.3	20.8	23.6	25.2
D.O. (mg/L)*	6.84	7.63	7.72	8.31	7.79	6.08	9.06	OUT	OUT	OUT
pH (S.U.)*	8.45	8.60	8.35	8.45	8.85	9.45	8.75	7.69	7.87	7.79
Conductivity (uS/cm)*	730	720	690	660	650	650	670	820	790	800
BOD (mg/L)	5	5	5	3	6	< 2	8	2	2	< 2
TSS (mg/L)	25	25	29	26	28	< 1	32	9	15	11
Fecal Coliforms (#/100mL)*	80	88	96	92	84	0	72	800	TNTC	TNTC
TKN (mg/L)	1.82	1.87	1.79	1.83	1.77	< 0.20	1.78	0.82	0.89	0.77
Ammonia N (mg/L)	0.02	0.02	0.02	0.02	0.02	0.06	0.02	0.04	0.04	0.04
Nitrate N (mg/L)	< 0.09	< 0.09	< 0.09	< 0.09	< 0.09	< 0.09	0.14	0.14	< 0.09	0.12
Nitrite N (mg/L)	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Organic N (mg/L)	1.80	1.85	1.77	1.81	1.75	BDL	1.76	0.78	0.85	0.73
Total P (mg/L)	0.12	0.12	0.13	0.12	0.12	0.01	0.17	0.08	0.09	0.07
Dissolved P (mg/L)	0.04	0.05	0.05	0.05	0.05	0.01	0.10	0.04	0.04	0.04
Chloride (mg/L)	94	96	97	95	95	0.2	101	164	166	165
Fluoride (mg/L)	0.16	0.15	0.16	0.15	0.19	< 0.03	0.17	0.19	0.19	0.18
FMWRD ID Number-Transect	AD07345	AD07350	AD07352	AD07360	AD07362	–	AD07365	–	–	–
FMWRD ID Number-Grab	AD07346	AD07351	AD07353	AD07361	AD07363	AD07364	AD07366	AD07347	AD07348	AD07349
Chlorophyll a (mg/L)	97.8	95.5	91.7	87.4	82.5	< 1.0	96.2	9.2	11.9	7.9
First ID Number	8-3225-001	8-3225-002	8-3225-003	8-3225-004	8-3225-009	8-3225-010	8-3225-005	8-3225-006	8-3225-007	8-3225-008

*Note: Grab Samples Only

Data Qualifiers:
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OUT = Outlier, Data Not Used
ND = Not Determined
TNTC = Too Numerous To Count
BDL = Below Detection Limit

Walter E. Deuchler Associates, Inc. and Deuchler Environmental, Inc.

BI-WEEKLY STREAM STUDY 2008

Fox Metro Laboratory Data Summary

Sample Date: August 20, 2008

Test Parameters	Discrete Stream Sampling Locations										
	Mainstem							Tributary			
	Sullivan Rd.	North Ave.	Ashland Ave.	Ashland Dupl.	Equip. Blank	Mill St.	Route 34	Indian Creek Grabs			
								Bridge	Upstream	Downstream	Rockgap
Temperature (°C)*	ND	25.1	25.5	25.5	ND	24.8	ND	27.7	22.4	24.0	23.7
D.O. (mg/L)*	6.00	6.24	6.71	6.71	ND	6.30	9.50	8.42	7.7	7.3	5.8
pH (S.U.)*	7.88	7.80	8.38	8.02	ND	8.00	8.35	7.15	6.86	6.93	7.10
Conductivity (uS/cm)*	960	900	820	880	ND	840	870	950	810	860	900
BOD (mg/L)	3	2	3	3	< 2	3	4	< 2	< 2	< 2	< 2
TSS (mg/L)	18	17	26	30	1	24	22	< 2	3	4	32
Fecal Coliforms (#/100mL)*	60	84	104	76	0	88	56	160	347	560	1200
TKN (mg/L)	1.68	1.63	1.63	1.62	< 0.20	1.59	1.51	0.55	1.29	0.71	1.22
Ammonia N (mg/L)	0.26	0.11	0.08	0.07	0.06	0.06	0.03	0.04	0.09	0.06	0.41
Nitrate N (mg/L)	0.91	0.91	0.86	0.27	< 0.09	0.88	1.89	0.15	0.42	0.23	< 0.09
Nitrite N (mg/L)	< 0.05	< 0.05	< 0.05	0.27	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Organic N (mg/L)	1.42	1.52	1.55	1.55	ND	1.53	1.48	0.51	1.20	0.65	0.81
Total P (mg/L)	0.37	0.37	0.37	0.39	0.01	0.37	0.63	0.06	0.09	0.12	0.18
Dissolved P (mg/L)	0.26	0.25	0.26	0.26	0.01	0.25	0.50	0.03	0.05	0.07	0.05
Chloride (mg/L)	140	143	141	142	< 0.2	142	153	167	148	175	173
Fluoride (mg/L)	0.25	0.24	0.22	0.26	0.22	0.22	0.30	0.29	0.32	0.25	0.18
FMWRD ID Number-Transect	AD08528	AD08534	AD08549	AD08550	--	AD08552	AD08554	--	--	--	--
FMWRD ID Number-Grab	AD08529	AD08535	AD08536	AD08537	AD08551	AD08553	AD08555	AD08530	AD08531	AD08532	AD08533
Chlorophyll a (mg/L)	19.7	19.8	16.0	19.1	< 1.0	22.8	19.4	6.0	1.4	1.6	1.7
First ID Number	8-3794-001	8-3794-002	8-3794-003	8-3794-010	8-3794-011	8-3794-004	8-3794-005	8-3794-009	8-3794-007	8-3794-008	8-3794-006

*Note: Grab Samples Only

Data Qualifiers:
NS = No Sample
OUT = Outlier, Data Not Used
ND = Not Determined
TNTC = Too Numerous To Count
BDL = Below Detection Limit

Walter E. Deuchler Associates, Inc. and Deuchler Environmental, Inc.

BI-WEEKLY STREAM STUDY 2008

Fox Metro Laboratory Data Summary

Sample Date: September 24, 2008

Test Parameters	Discrete Stream Sampling Locations										
	Mainstem					Tributary					
	Sullivan Rd.	North Ave.	Ashland Ave.	Mill St.	Route 34	Indian Creek Grabs					
						Bridge	Upstream	Downstream	Downstr. Dupl	Equip. Blank	Reckinger
Temperature (°C)*	21.2	21.1	21.1	21.2	21.6	ND	ND	ND	ND	ND	ND
D.O. (mg/L)*	8.59	8.25	8.73	9.63	10.70	ND	ND	ND	ND	ND	ND
pH (S.U.)*	7.54	6.92	7.73	7.71	7.94	6.96	6.99	6.67	7.12	6.63	6.55
Conductivity (uS/cm)*	800	610	670	ND	730	650	600	610	630	30	710
BOD (mg/L)	3	2	4	2	4	< 2	2	< 2	< 2	< 2	< 2
TSS (mg/L)	34	40	41	41	41	10	11	8	6	< 1	16
Fecal Coliforms (#/100mL)*	60	304	264	476	88	2520	200	340	44	0	220
TKN (mg/L)	1.68	1.64	1.68	1.63	1.73	0.77	0.73	0.72	0.68	< 0.20	0.67
Ammonia N (mg/L)	0.02	0.02	0.02	0.02	0.02	0.09	0.03	0.05	0.05	0.06	0.03
Nitrate N (mg/L)	0.71	0.76	0.73	0.72	1.05	0.18	< 0.09	0.14	0.12	< 0.09	< 0.09
Nitrite N (mg/L)	0.15	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Organic N (mg/L)	1.66	1.62	1.66	1.61	1.71	0.68	0.70	0.67	0.63	ND	0.64
Total P (mg/L)	0.22	0.24	0.24	0.23	0.34	0.08	0.08	0.08	0.08	< 0.01	0.09
Dissolved P (mg/L)	0.06	0.07	0.07	0.07	0.19	0.03	0.02	0.03	0.03	< 0.01	0.04
Chloride (mg/L)	108	77	113	110	119	88	78	85	84	< 0.2	77
Fluoride (mg/L)	0.20	0.15	0.19	0.16	0.19	0.18	0.15	0.14	0.14	< 0.03	0.15
FMWRD ID Number-Transect	AD09907	AD09915	AD09917	AD09919	AD09921	--	--	--	--	--	--
FMWRD ID Number-Grab	AD09908	AD09916	AD09918	AD09920	AD09922	AD09909	AD09910	AD09911	AD09912	AD09913	AD09914
Chlorophyll a (mg/L)	57.2	57.8	58.7	63.7	63.2	9.0	7.5	4.1	5.8	< 1.0	8.3
First ID Number	8-4348-001	8-4348-002	8-4348-003	8-4348-004	8-4348-005	8-4348-006	8-4348-007	8-4348-008	8-4348-010	8-4348-011	8-4348-009

*Note: Grab Samples Only

Data Qualifiers:
NS = No Sample
OUT = Outlier, Data Not Used
ND = Not Determined

Walter E. Deuchler Associates, Inc. and Deuchler Environmental, Inc.

BI-WEEKLY STREAM STUDY 2008

Fox Metro Laboratory Data Summary

Sample Date: October 7, 2008

Test Parameters	Discrete Stream Sampling Locations										
	Mainstem							Tributary			
	Sullivan Rd.	North Ave.	Ashland Ave.	Mill St.	Rt. 34	Rt. 34 Dupl.	Equip. Blank	Indian Creek Grabs			
								Bridge	Upstream	Downstream	Fockinger
Temperature (°C)*	14.7	14.8	14.8	14.8	15.1	15.1	ND	13.9	14.8	14.6	15.1
D.O. (mg/L)*	10.14	11.13	11.35	11.88	13.89	13.89	ND	7.19	7.78	7.66	6.96
pH (S.U.)*	7.57	7.77	6.99	7.76	7.86	8.24	ND	6.72	6.60	6.52	6.44
Conductivity (uS/cm)*	870	810	800	790	890	790	ND	750	610	670	600
BOD (mg/L)	< 2	< 2	< 2	< 2	2	< 2	< 2	< 2	< 2	< 2	< 2
TSS (mg/L)	22	23	15	19	17	18	< 1	7	7	7	18
Fecal Coliforms (#/100mL)*	125	110	135	145	155	125	0	120	80	280	300
TKN (mg/L)	1.18	1.17	1.15	1.16	1.15	1.14	0.09	0.55	0.58	0.67	0.67
Ammonia N (mg/L)	0.03	0.02	0.02	0.02	0.02	0.02	0.05	0.04	0.03	0.03	0.05
Nitrate N (mg/L)	1.61	1.51	1.49	1.40	1.84	1.33	< 0.09	0.14	0.10	0.25	< 0.09
Nitrite N (mg/L)	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Organic N (mg/L)	1.15	1.15	1.13	1.14	1.13	1.12	0.04	0.51	0.55	0.64	0.62
Total P (mg/L)	0.27	0.26	0.25	0.25	0.41	0.24	0.02	0.05	0.07	0.07	0.09
Dissolved P (mg/L)	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Chloride (mg/L)	148	146	146	147	155	144	0.6	129	125	122	113
Fluoride (mg/L)	0.32	0.21	0.26	0.19	0.24	0.19	< 0.03	0.20	0.16	0.16	0.16
FMWRD ID Number-Transect	AD10341	AD10347	AD10351	AD10353	AD10355	—	—	—	—	—	—
FMWRD ID Number-Grab	AD10342	AD10348	AD10352	AD10354	AD10356	AD10357	AD10358	AD10343	AD10344	AD10345	AD10346
Chlorophyll a (mg/L)	19.3	20.2	19.0	20.0	18.7	19.8	< 1.0	13.4	4.0	4.6	5.1
First ID Number	8-4523-001	8-4523-003	8-4523-005	8-4523-007	8-4523-009	8-4523-012	8-4523-011	8-4523-016	8-4523-014	8-4523-015	8-4523-013

*Note: Grab Samples Only

Data Qualifiers:
NS = No Sample
OUT = Outlier, Data Not Used
ND = Not Determined

Walter E. Deuchler Associates, Inc. and Deuchler Environmental, Inc.

BI-WEEKLY STREAM STUDY 2008

Fox Metro Laboratory Data Summary

Sample Date: October 22, 2008

Test Parameters	Discrete Stream Sampling Locations								
	Mainstem					Tributary			
	Sullivan Rd.	North Ave.	Ashland Ave.	Mill St.	Rt. 34	Indian Creek Grabs			
						Bridge	Upstream	Downstream	Reckinger
Temperature (^oC)*	10.8	10.9	11.0	11.1	11.6	8.4	8.1	8.1	9.4
D.O. (mg/L)*	10.93	11.32	11.63	10.32	15.41	8.34	8.56	7.53	6.94
pH (S.U.)*	7.95	8.04	8.04	7.95	8.13	ND	ND	ND	ND
Conductivity (uS/cm)*	700	650	670	670	680	ND	ND	ND	ND
BOD (mg/L)	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2
TSS (mg/L)	13	17	18	17	14	3	9	8	6
Fecal Coliforms (#/100mL)*	70	80	110	115	170	360	360	AF	80
TKN (mg/L)	1.44	1.01	0.99	1.00	1.13	0.54	0.62	0.71	0.59
Ammonia N (mg/L)	0.09	0.04	0.04	0.04	0.10	0.04	0.04	0.04	0.04
Nitrate N (mg/L)	1.70	1.72	1.74	1.76	2.05	0.29	0.12	0.33	< 0.09
Nitrite N (mg/L)	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Organic N (mg/L)	1.35	0.97	0.95	0.96	1.03	0.50	0.58	0.67	0.55
Total P (mg/L)	0.28	0.28	0.27	0.27	0.45	0.06	0.09	0.09	0.05
Dissolved P (mg/L)	0.20	0.19	0.20	0.19	0.37	0.02	0.03	0.04	0.02
Chloride (mg/L)	139	143	144	144	152	127	170	142	147
Fluoride (mg/L)	0.23	0.19	0.20	0.19	0.22	0.19	0.16	0.16	0.14
FMWRD ID Number-Transect	AD10965	AD10971	AD10973	AD10975	AD10977	--	--	--	--
FMWRD ID Number-Grab	AD10966	AD10972	AD10974	AD10976	AD10978	AD10967	AD10968	AD10969	AD10970
Chlorophyll a (mg/L)	14.2	12.8	11.7	12.5	13.1	1.1	1.3	1.2	1.7
First ID Number	8-4807-005	8-4807-006	8-4807-007	8-4807-008	8-4807-009	8-4807-002	8-4807-003	8-4807-004	8-4807-001

*Note: Grab Samples Only

Data Qualifiers:
NS = No Sample
OUT = Outlier, Data Not Used
ND = Not Determined

Walter E. Deuchler Associates, Inc. and Deuchler Environmental, Inc.

BI-WEEKLY STREAM STUDY 2008

Fox Metro Laboratory Data Summary

Sample Date: November 13, 2008

Test Parameters	Discrete Stream Sampling Locations								
	Mainstem					Tributary			
	Sullivan Rd.	North Ave.	Ashland Ave.	Mill St.	Rt. 34	Indian Creek Grabs			
						Bridge	Upstream	Downstream	Rockinger
Temperature (^{o}C)*	6.5	6.5	6.7	6.8	7.2	7.5	10.8	7.3	7.0
D.O. (mg/L)*	13.44	13.86	15.12	14.10	17.24	11.52	7.10	10.93	10.66
pH (S.U.)*	ND	ND	ND	ND	ND	ND	ND	ND	ND
Conductivity (uS/cm)*	ND	ND	ND	ND	ND	ND	ND	ND	ND
BOD (mg/L)	< 2	< 2	< 2	< 2	< 2	< 2	3	< 2	< 2
TSS (mg/L)	6	5	4	3	2	4	6	5	12
Fecal Coliforms (#/100mL)*	568	488	468	396	276	280	460	240	440
TKN (mg/L)	0.62	1.53	1.26	1.20	0.62	< 0.20	< 0.20	< 0.20	0.25
Ammonia N (mg/L)	0.14	0.13	0.12	0.12	0.09	0.04	0.03	0.05	0.10
Nitrate N (mg/L)	1.76	1.90	1.92	1.91	2.14	0.26	0.19	0.19	0.16
Nitrite N (mg/L)	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Organic N (mg/L)	0.48	1.40	1.14	1.08	0.53	< 0.16	< 0.17	< 0.15	0.15
Total P (mg/L)	0.22	0.24	0.24	0.24	0.28	0.06	0.08	0.07	0.09
Dissolved P (mg/L)	0.19	0.20	0.20	0.21	0.26	0.03	0.03	0.03	0.02
Chloride (mg/L)	124	126	126	127	134	134	141	131	137
Fluoride (mg/L)	0.25	0.19	0.18	0.18	0.20	0.16	0.12	0.17	0.15
FMWRD ID Number-Transect	AD11659	AD11665	AD11667	AD11669	AD11671	—	—	—	—
FMWRD ID Number-Grab	AD11660	AD11666	AD11668	AD11670	AD11672	AD11661	AD11662	AD11663	AD11664
Chlorophyll a (mg/L)	2.0	2.8	3.1	2.1	4.2	3.8	5.7	6.3	6.7
First ID Number	8-5225-005	8-5225-006	8-5225-007	8-5225-008	8-5225-009	8-5225-004	8-5225-002	8-5225-003	8-5225-001

*Note: Grab Samples Only

Data Qualifiers:
NS = No Sample
OUT = Outlier, Data Not Used
ND = Not Determined

Walter E. Deuchler Associates, Inc. and Deuchler Environmental, Inc.

BI-WEEKLY STREAM STUDY 2008

Fox Metro Laboratory Data Summary

Sample Date: December 10, 2008

Test Parameters	Discrete Stream Sampling Locations										
	Mainstem							Tributary			
	Sullivan Rd.	Sullivan Dupl.	Equip. Blank	North Ave.	Ashland Ave.	Mill St.	Rt. 34	Indian Creek Grabs			
								Bridge	Upstream	Downstream	Rockinger
Temperature (^{o}C)*	ND	ND	ND	ND	ND	ND	ND	ND	0.1	ND	0.0
D.O. (mg/L)*	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
pH (S.U.)*	ND	ND	ND	7.33	7.43	7.06	7.21	6.12	6.00	6.20	6.04
Conductivity (uS/cm)*	1140	1140	ND	ND	860	ND	880	1110	1070	410	1180
BOD (mg/L)	3	2	< 2	< 2	< 2	< 2	3	4	4	3	4
TSS (mg/L)	5	7	2	10	8	16	13	28	29	25	32
Fecal Coliforms (#/100mL)*	460	520	1	316	265	160	120	500	560	640	720
TKN (mg/L)	0.84	0.78	< 0.20	0.77	0.84	0.81	0.85	1.07	0.90	1.00	0.90
Ammonia N (mg/L)	0.07	0.06	0.03	0.06	0.05	0.05	0.05	0.13	0.13	0.13	0.11
Nitrate N (mg/L)	2.31	2.45	< 0.09	2.36	2.37	2.35	2.45	0.49	0.44	0.46	0.42
Nitrite N (mg/L)	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Organic N (mg/L)	0.77	0.72	0.17	0.71	0.79	0.76	0.80	0.95	0.77	0.87	0.79
Total P (mg/L)	0.23	0.23	0.01	0.22	0.22	0.22	0.23	0.14	0.16	0.15	0.18
Dissolved P (mg/L)	0.17	0.18	0.01	0.17	0.17	0.17	0.16	0.06	0.07	0.06	0.07
Chloride (mg/L)	179	181	1	176	179	179	193	168	189	167	186
Fluoride (mg/L)	0.28	0.28	< 0.03	0.17	0.20	0.18	0.19	0.14	0.11	0.13	0.11
FMWRD ID Number-Transect	AD12401	AD12402	NS	AD12405	AD12407	AD12409	AD12411	–	–	–	–
FMWRD ID Number-Grab	AD12403	AD12413	AD12404	AD12406	AD12408	AD12410	AD12412	AD12387	AD12388	AD12389	AD12390
Chlorophyll a (mg/L)	7.6	7.0	< 1.0	6.9	10.3	9.7	12.6	6.7	7.0	6.6	7.1
First ID Number	8-5640-001	8-5640-010	8-5640-011	8-5640-002	8-5640-003	8-5640-004	8-5640-005	8-5640-009	8-5640-007	8-5640-008	8-5640-006

*Note: Grab Samples Only

Data Qualifiers:
NS = No Sample
OUT = Outlier, Data Not Used
ND = Not Determined
AF = Analysis Failure

Walter E. Deuchler Associates, Inc. and Deuchler Environmental, Inc.

MONTHLY STREAM STUDY 2009

Fox Metro Laboratory Data Summary

Sample Date: February 10, 2009

Test Parameters	Discrete Stream Sampling Locations										
	Main stem					Indian Creek					
	Sullivan Rd.	North Ave.	Ashland Ave.	Mill St.	Rt. 34	Bridge	Upstream	Downstream	Reckinger	Reck. Dupl.	Field Blank
Temperature (^{o}C)*	NS	NS	0.2	0.2	0.3	3.9	2.5	4.0	4.0	4.0	14.6
D.O. (mg/L)*	NS	NS	6.09	7.26	7.02	16.61	15.32	15.64	14.30	14.30	9.20
pH (S.U.)*	NS	NS	7.10	7.13	7.25	5.5(OUT)	5.5(OUT)	5.7(OUT)	5.96(OUT)	5.5(OUT)	5.16
Conductivity (uS/cm)*	NS	NS	990	1120	1240	ND	ND	ND	ND	ND	ND
BOD (mg/L)	NS	NS	3	< 2	< 2	5	3	4	3	3	< 2
TSS (mg/L)	NS	NS	16	15	10	16	18	15	16	14	< 1
Fecal Coliforms (#/100mL)*	NS	NS	190	215	235	300	133	267	17	50	0
TKN (mg/L)	NS	NS	1.14	1.07	1.02	0.94	0.89	0.93	0.88	0.89	< 0.20
Ammonia N (mg/L)	NS	NS	0.22	0.23	0.25	0.22	0.21	0.23	0.20	0.20	0.06
Nitrate N (mg/L)	NS	NS	1.90	1.97	1.98	0.76	1.73	0.61	0.60	0.67	< 0.09
Nitrite N (mg/L)	NS	NS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Organic N (mg/L)	NS	NS	0.92	0.84	0.77	0.72	0.68	0.70	0.68	0.69	ND
Total P (mg/L)	NS	NS	0.19	0.18	0.45	0.13	0.12	0.13	0.13	0.13	0.01
Dissolved P (mg/L)	NS	NS	0.12	0.12	0.40	0.07	0.07	0.07	0.07	0.08	0.02
Chloride (mg/L)	NS	NS	193	197	220	297	315	313	346	332	< 0.2
Fluoride (mg/L)	NS	NS	0.14	0.12	0.15	0.12	AF	0.12	0.08	0.21	< 0.03
FMWRD ID Number-Transect	—	—	AE01164	AE01166	AE01151	—	—	—	—	—	—
FMWRD ID Number-Grab	—	—	AE01165	AE01167	AE01152	AE01153	AE01154	AE01155	AE01156	AE01157	AE01158
Chlorophyll a (mg/L)	NS	NS	4.6	3.9	2.2	1.7	1.4	2.6	2.3	2.0	<1.0
First ID Number-Transect	—	—	9-0437-007	9-0437-006	9-0437-005	9-0437-001	9-0437-003	9-0437-002	9-0437-004	9-0437-008	9-0437-009

*Note: Grab Samples Only

Data Qualifiers:
NS = No Sample
OUT = Outlier, data not consistent with historical record.
ND = Not Determined
AF = Analysis Failure

Walter E. Deuchler Associates, Inc. and Deuchler Environmental, Inc.
MONTHLY STREAM STUDY 2009
Fox Metro Laboratory Data Summary

Sample Date: March 12, 2009

Test Parameters	Discrete Stream Sampling Locations										
	Mainstem							Indian Creek			
	Sullivan Rd.	North Ave.	North Av. Dup	Field Blank	Ashland Ave.	Mill St.	Rt. 34	Bridge	Upstream	Downstream	Reckinger
Temperature (^oC)*	2.9	2.9	2.9	ND	2.9	3.1	3.4	ND	ND	ND	ND
D.O. (mg/L)*	10.90	12.42	12.42	ND	9.82	10.83	10.74	ND	ND	ND	ND
pH (S.U.)*	5.90	6.22	6.03	ND	6.01	6.29	6.37	6.08	6.12	6.69	6.20
Conductivity (uS/cm)*	930	730	770	ND	730	760	770	790	850	770	780
BOD (mg/L)	< 2	< 2	< 2	< 2	< 2	< 2	2	< 2	< 2	< 2	2
TSS (mg/L)	20	9	19	< 1	31	22	12	26	22	24	26
Fecal Coliforms (#/100mL)*	240	220	230	0	270	200	555	180	120	360	0
TKN (mg/L)	0.92	0.93	0.93	< 0.2	0.97	0.98	1.05	0.78	0.72	1.03	0.74
Ammonia N (mg/L)	0.11	0.09	0.10	0.05	0.09	0.09	0.14	0.05	0.05	0.05	0.05
Nitrate N (mg/L)	1.64	1.58	1.60	< 0.09	1.61	1.60	1.67	0.53	0.42	0.49	0.43
Nitrite N (mg/L)	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Organic N (mg/L)	0.81	0.84	0.83	ND	0.88	0.90	0.91	0.73	0.67	0.98	0.69
Total P (mg/L)	0.16	0.15	0.16	0.02	0.16	0.16	0.22	0.14	0.13	0.14	0.12
Dissolved P (mg/L)	0.09	0.09	0.09	0.02	0.09	0.09	0.12	0.06	0.06	0.06	0.06
Chloride (mg/L)	114	112	114	< 0.2	114	114	120	156	155	156	156
Fluoride (mg/L)	0.13	0.09	0.09	< 0.03	0.10	0.09	0.11	0.21	0.09	0.06	0.07
FMWRD ID Number-Transect	AE02131	AE02147	AE02149	--	AE02152	AE02154	AE02156	--	--	--	--
FMWRD ID Number-Grab	AE02132	AE02148	AE02150	AE02151	AE02153	AE02155	AE02157	AE02133	AE02134	AE02135	AE02136
Chlorophyll a (mg/L)	7.4	7.6	8.4	<1.0	8.4	9.8	9.8	7.6	5.3	5.9	6.1
First ID Number-Transect	9-0871-005	9-0871-006	9-0871-010	9-0871-011	9-0871-007	9-0871-008	9-0871-009	9-0871-004	9-0871-002	9-0871-003	9-0871-001

*Note: Grab Samples Only

Data Qualifiers:
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OUT = Outlier, data not consistent with historical record.
ND = Not Determined
AF = Analysis Failure

Walter E. Deuchler Associates, Inc. and Deuchler Environmental, Inc.

MONTHLY STREAM STUDY 2009

Fox Metro Laboratory Data Summary

Sample Date: April 9, 2009

Test Parameters	Discrete Stream Sampling Locations										
	Mainstem					Indian Creek					
	Sullivan Rd.	North Ave.	Ashland Ave.	Mill St.	Rt. 34	Bridge	Upstream	Upstr. Dupl.	Field Blank	Downstream	Reckinger
Temperature (°C)*	7.5	7.6	8.2	8.3	8.8	8.7	7.4	7.4	ND	7.4	8.1
D.O. (mg/L)*	15.01	15.34	ND	18.41	19.59	12.30	11.75	11.75	ND	12.00	10.25
pH (S.U.)*	6.67	6.51	6.35	6.37	6.55	6.25	6.47	6.38	ND	6.40	6.63(OUT)
Conductivity (uS/cm)*	790	700	700	710	740	1070	1050	1070	ND	1060	1180
BOD (mg/L)	2	2	2	2	2	< 2	< 2	< 2	< 2	< 2	< 2
TSS (mg/L)	14	13	13	12	10	3	7	6	< 2	6	9
Fecal Coliforms (#/100mL)*	95	15	40	30	0	0	120	60	0	40	20
TKN (mg/L)	0.91	0.98	0.99	0.99	0.97	0.48	0.49	0.50	< 0.2	0.50	0.52
Ammonia N (mg/L)	0.04	0.06	0.03	0.02	0.03	0.03	0.03	0.03	0.04	0.03	0.03
Nitrate N (mg/L)	1.63	1.67	1.67	1.67	1.86	0.16	0.17	0.19	< 0.09	0.16	0.19
Nitrite N (mg/L)	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Organic N (mg/L)	0.87	0.92	0.96	0.97	0.94	0.45	0.46	0.47	ND	0.47	0.49
Total P (mg/L)	0.16	0.14	0.12	0.13	0.16	0.09	0.09	0.06	0.02	0.06	0.07
Dissolved P (mg/L)	0.06	0.07	0.06	0.07	0.11	0.04	0.04	0.03	0.03	0.04	0.04
Chloride (mg/L)	126	134	134	135	141	230	240	242	< 0.2	238	248
Fluoride (mg/L)	0.15	0.16	0.16	0.16	0.16	0.15	0.13	0.17	< 0.03	0.18	0.15
FMWRD ID Number-Transect	AE03063	AE03076	AE03077	AE03079	AE03081	–	–	–	–	–	–
FMWRD ID Number-Grab	AE03064	AE03071	AE03078	AE03080	AE03082	AE03065	AE03066	AE03067	AE03068	AE03069	AE03070
Chlorophyll a (mg/L)	12.8	15.1	12.8	17.1	13.0	8.4	5.4	5.4	5.4	5.5	6.1
First ID Number-Transect	9-1257-005	9-1257-006	9-1257-007	9-1257-008	9-1257-009	9-1257-004	9-1257-002	9-1257-010	9-1257-011	9-1257-003	9-1257-001

*Note: Grab Samples Only

Data Qualifiers: NS = No Sample
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Walter E. Deuchler Associates, Inc. and Deuchler Environmental, Inc.

MONTHLY STREAM STUDY 2009

Fox Metro Laboratory Data Summary

Sample Date: May 14, 2009

Test Parameters	Discrete Stream Sampling Locations										
	Mainstem							Indian Creek			
	Sullivan Rd.	North Ave.	North Av. Dup	Field Blank	Ashland Ave.	Mill St.	Rt. 34	Bridge	Upstream	Downstream	Reckinger
Temperature (°C)*	16.0	16.0	16.0	ND	16.8	17.0	17.4	15.1	14.9	15.3	15.4
D.O. (mg/L)*	7.28	7.76	7.76	ND	8.23	5.02(OUT)	5.08(OUT)	9.48	8.26	8.48	6.77
pH (S.U.)*	7.84	11.51(OUT)	11.45(OUT)	ND	9.58(OUT)	7.90	8.01	6.80(OUT)	6.75(OUT)	6.90(OUT)	7.00(OUT)
Conductivity (uS/cm)*	930	800	840	ND	770	790	790	980	1010	980	1460
BOD (mg/L)	< 2	3	2	< 2	2	3	3	2	< 2	3	< 2
TSS (mg/L)	42	35	37	3	41	42	36	25	19	28	14
Fecal Coliforms (#/100mL)*	160	80	90	0	80	AF	AF	1850	20	1660	1700
TKN (mg/L)	1.34	1.32	1.33	< 0.2	1.31	1.30	1.44	0.95	0.84	1.01	0.76
Ammonia N (mg/L)	0.06	0.06	0.07	0.03	0.07	0.07	0.12	0.06	0.05	0.06	0.04
Nitrate N (mg/L)	0.93	0.91	0.91	< 0.09	0.92	0.95	1.01	0.24	0.16	0.21	0.13
Nitrite N (mg/L)	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Organic N (mg/L)	1.28	1.27	1.26	ND	1.24	1.23	1.32	0.89	0.79	0.95	0.72
Total P (mg/L)	0.20	0.21	0.19	0.02	0.19	0.19	0.22	0.14	0.14	0.16	0.11
Dissolved P (mg/L)	0.07	0.07	0.07	0.02	0.07	0.07	0.10	0.04	0.05	0.05	0.05
Chloride (mg/L)	99	106	104	< 0.2	103	106	111	115	144	118	161
Fluoride (mg/L)	0.18	0.16	0.19	< 0.03	0.16	0.16	0.18	0.16	0.14	0.18	0.14
FMWRD ID Number-Transect	AE04255	AE04264	AE04263	--	AE04266	AE04268	AE04270	--	--	--	--
FMWRD ID Number-Grab	AE04256	AE04261	AE04262	AE04265	AE04267	AE04269	AE04271	AE04257	AE04258	AE04259	AE04260
Chlorophyll a (mg/L)	12.3	11.8	10.6	<1.0	12.3	14.4	10.3	10.2	2.6	6.4	2.4
First ID Number-Transect	9-1884-005	9-1884-006	9-1884-010	9-1884-011	9-1884-007	9-1884-008	9-1884-009	9-1884-004	9-1884-002	9-1884-003	9-1884-001

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Walter E. Deuchler Associates, Inc. and Deuchler Environmental, Inc.
MONTHLY STREAM STUDY 2009
Fox Metro Laboratory Data Summary

Sample Date: June 10, 2009

Test Parameters	Discrete Stream Sampling Locations										
	Mainstem					Indian Creek					
	Sullivan Rd.	North Ave.	Ashland Ave.	Mill St.	Rt. 34	Bridge	Upstream	Downstream	Down. Dup.	Field Blank	Reckinger
Temperature (°C)*	19.6	19.7	19.7	19.7	20.7	17.4	17.4	17.7	17.7	18.8	19.2
D.O. (mg/L)*	8.40	8.83	8.85	9.14	9.18	8.52	7.23	7.61	7.61	8.88	(6.21)OUT
pH (S.U.)*	7.20	7.35	7.14	7.83	7.57	ND	(6.39)OUT	AF	AF	6.90	(6.40)OUT
Conductivity (uS/cm)*	920	820	810	800	850	1180	760	(1230)OUT	850	30	870
BOD (mg/L)	< 2	< 2	< 2	< 2	< 2	< 2	<2	< 2	< 2	< 2	< 2
TSS (mg/L)	30	24	22	20	22	4	6	6	6	< 2	9
Fecal Coliforms (#/100mL)*	270	395	345	335	290	640	420	718	618	0	500
TKN (mg/L)	1.22	1.09	1.09	0.94	0.99	0.66	0.62	0.64	0.68	< 0.2	0.61
Ammonia N (mg/L)	0.13	0.12	0.12	0.12	0.10	0.05	0.05	0.07	0.08	0.05	0.05
Nitrate N (mg/L)	1.48	1.50	1.52	1.49	1.63	0.20	< 0.09	0.16	0.16	< 0.09	< 0.09
Nitrite N (mg/L)	0.18	0.27	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Organic N (mg/L)	1.09	0.97	0.97	0.83	0.89	0.61	0.57	0.57	0.60	ND	0.56
Total P (mg/L)	0.22	0.23	0.23	0.24	0.30	0.08	0.09	0.10	0.10	0.02	0.08
Dissolved P (mg/L)	0.13	0.13	0.15	0.15	0.21	0.06	0.05	0.06	0.06	0.03	0.04
Chloride (mg/L)	117	121	121	121	127	125	128	119	120	122	122
Fluoride (mg/L)	0.17	0.21	0.17	0.18	0.20	0.23	0.16	0.21	0.16	0.17	0.17
FMWRD ID Number-Transect	AE05224	AE05243	AE05244	AE05246	AE05248	--	--	--	--	--	--
FMWRD ID Number-Grab	AE05225	AE05226	AE05245	AE05247	AE05249	AE05227	AE05228	AE05229	AE05230	AE05231	AE05232
Chlorophyll a (mg/L)	4.2	4.3	4.5	5.7	5.2	3.0	1.4	1.9	1.4	1.1	2.4
First ID Number-Transect	9-2314-005	9-2314-006	9-2314-007	9-2314-008	9-2314-009	9-2314-004	9-2314-002	9-2314-003	9-2314-011	9-2314-010	9-1884-001

*Note: Grab Samples Only

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Walter E. Deuchler Associates, Inc. and Deuchler Environmental, Inc.

MONTHLY STREAM STUDY 2009

Fox Metro Laboratory Data Summary

Sample Date: July 8, 2009

Test Parameters	Discrete Stream Sampling Locations																
	Mainstem													Indian Creek			
	Sullivan Rd.		North Ave.		Ashland Ave.		Ashland Ave. Dupl.		Field Blank	Mill St.		Rt. 34		Bridge	Upstream	Downstream	Reckinger
	Comp	*Grab*	*Comp*	*Grab*	*Comp*	*Grab*	*Comp*	*Grab*	*Grab*	*Comp*	*Grab*	*Comp*	*Grab*	*Grab*	*Grab*	*Grab*	*Grab*
Temperature (°C)*	ND	22.8	ND	22.8	ND	22.0	ND	22.0	ND	ND	21.8	ND	22.5	18.7	19.0	19.5	20.8
D.O. (mg/L)*	ND	7.52	ND	7.39	ND	7.87	ND	7.87	ND	ND	8.16	ND	8.85	8.24	6.58	6.33	4.23
pH (S.U.)*	ND	7.84	ND	7.30	ND	ND	ND	7.00	ND	ND	7.31	ND	7.30	7.81	7.20	7.43	6.91
Conductivity (uS/cm)*	ND	1050	ND	830	ND	ND	ND	1280	ND	ND	800	ND	940	670	650	640	650
BOD (mg/L)	7	3	5	3	4	3	4	ND	< 2	4	4	4	5	< 2	< 2	3	< 2
TSS (mg/L)	26	30	30	37	27	35	31	ND	< 1	36	31	33	32	6	9	8	43
Fecal Coliforms (#/100mL)*	ND	48	ND	104	ND	144	ND	140	0	ND	148	ND	164	530	540	700	TNTC
TKN (mg/L)	1.54	1.57	1.56	1.57	1.58	1.60	1.67	ND	< 0.2	1.62	1.54	1.53	1.66	0.59	0.67	0.79	0.81
Ammonia N (mg/L)	0.02	0.02	0.02	0.02	0.02	0.02	0.02	ND	0.03	0.02	0.03	0.02	0.02	0.08	0.06	0.07	0.10
Nitrate N (mg/L)	1.16	1.14	1.03	1.06	1.04	1.07	1.04	1.04	< 0.09	1.04	1.14	1.23	1.05	0.25	0.26	0.15	< 0.09
Nitrite N (mg/L)	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Organic N (mg/L)	1.52	1.55	1.54	1.55	1.56	1.58	1.65	ND	ND	1.60	1.51	1.51	1.64	0.52	0.61	0.72	0.71
Total P (mg/L)	0.22	0.24	0.23	0.23	0.24	0.23	0.23	ND	0.01	0.23	0.23	0.34	0.24	0.07	0.08	0.12	0.11
Dissolved P (mg/L)	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Chloride (mg/L)	102	102	96	96	98	97	97	97	< 0.2	98	99	107	100	175	154	183	157
Fluoride (mg/L)	0.20	0.21	0.18	0.17	0.16	0.21	0.20	0.16	0.04	0.17	0.20	0.23	0.18	0.31	0.24	0.24	0.21
FMWRD ID Number-Transect	AE06182	–	AE06184	–	AE06186	–	AE06188	–	–	AE06194	–	AE06196	–	–	–	–	–
FMWRD ID Number-Grab	–	AE06183	–	AE06185	–	AE06187	–	AE06189	AE06190	–	AE06195	–	AE06197	AE06171	AE06172	AE06173	AE06174
Chlorophyll a (mg/L)	30.3	–	37.7	–	39.8	–	39.5	–	<1.0	38.3	–	39.8	–	6.2	<1.0	4.2	<1.0
First ID Number-Transect	9-2710-005	–	9-2710-006	–	9-2710-007	–	9-2710-10	–	9-2710-011	9-2710-008	–	9-2710-009	–	9-2710-004	9-2710-002	9-2710-003	9-2710-001

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Walter E. Deuchler Associates, Inc. and Deuchler Environmental, Inc.
MONTHLY STREAM STUDY 2009
Fox Metro Laboratory Data Summary

Sample Date: August 12, 2009

Test Parameters	Discrete Stream Sampling Locations										
	Mainstem					Indian Creek					
	Sullivan Rd.	North Ave.	Ashland Ave.	Mill St.	Rt. 34	Bridge	Bridge Dupl.	Blank	Upstream	Downstream	Reckinger
Temperature (°C)*	24.60	24.58	24.97	25.13	26.71	19.80	19.80	23.90	20.44	23.50	20.72
D.O. (mg/L)*	5.92	9.56	10.44	10.81	13.76	10.22	10.22	7.01	9.57	ND	6.42
pH (S.U.)*	7.93	8.53	8.53	8.48	8.71	8.03	8.03	ND	8.08	7.44	8.03
Conductivity (uS/cm)*	950	943	952	955	981	874	874	ND	834	780	856
BOD (mg/L)	3	3	3	4	5	< 2	4	< 2	< 2	2	< 2
TSS (mg/L)	43	43	40	42	46	5	10	< 2	13	19	24
Fecal Coliforms (#/100mL)*	300	108	240	260	424	190	240	0	350	820	1390
TKN (mg/L)	1.91	2.05	2.00	2.06	2.20	0.78	0.83	< 0.2	0.74	1.35	0.91
Ammonia N (mg/L)	0.03	0.02	0.02	0.02	0.02	0.03	0.03	0.04	0.06	0.02	0.09
Nitrate N (mg/L)	1.10	0.94	0.97	0.94	1.10	0.16	0.20	< 0.09	0.31	0.16	< 0.09
Nitrite N (mg/L)	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Organic N (mg/L)	1.88	2.03	1.98	2.04	2.18	0.75	0.80	ND	0.68	1.33	0.82
Total P (mg/L)	0.11	0.40	0.39	0.39	0.50	0.11	0.04	0.13	0.16	0.15	0.39
Dissolved P (mg/L)	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Chloride (mg/L)	155	149	149	150	153	129	129	< 0.2	217	176	154
Fluoride (mg/L)	0.34	0.22	0.32	0.24	0.25	0.27	0.28	0.15	0.30	0.26	0.17
FMWRD ID Number-Transect	AE07445	AE07453	AE07462	AE07464	AE07466	—	—	—	—	—	—
FMWRD ID Number-Grab	AE07446	AE07454	AE07463	AE07465	AE07467	AE07447	AE07448	AE07449	AE07450	AE07451	AE07452
Chlorophyll a (mg/L)	49.9	51.2	53.9	52.8	50.8	16.2	19.9	<1.0	1.4	25.6	1.8
First ID Number-Transect	9-3304-001	9-3304-002	9-3304-003	9-3304-004	9-3304-005	9-3304-009	9-3304-010	9-3304-011	9-3304-007	9-3304-0008	9-3304-006

*Note: Grab Samples Only

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Walter E. Deuchler Associates, Inc. and Deuchler Environmental, Inc.
MONTHLY STREAM STUDY 2009
Fox Metro Laboratory Data Summary

Sample Date: September 9, 2009

Test Parameters	Discrete Stream Sampling Locations										
	Mainstem							Indian Creek			
	Sullivan Rd.	North Ave.	Ashland Ave.	Mill St.	Mill St. Dupl.	Mill St. Blank	Rt. 34	Bridge	Upstream	Downstream	Reckinger
Temperature (°C)*	21.2	21.8	21.9	22.0	22.0	ND	23.0	18.7	18.9	20.0	19.7
D.O. (mg/L)*	6.80	8.30	7.55	11.73	11.73	ND	10.19	7.55	6.70	5.77	8.07
pH (S.U.)*	8.33	8.45	8.45	8.50	8.50	ND	8.62	8.11	8.19	7.36	8.18
Conductivity (uS/cm)*	878	878	883	882	882	ND	894	948	753	950	762
BOD (mg/L)	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2
TSS (mg/L)	26	25	25	23	20	< 1	23	2	9	4	53
Fecal Coliforms (#/100mL)*	92	105	95	95	105	0	96	770	280	580	1690
TKN (mg/L)	1.43	1.36	1.33	1.29	1.29	< 0.2	1.39	0.49	0.57	0.68	0.80
Ammonia N (mg/L)	0.04	0.02	0.02	0.02	0.02	0.03	0.03	0.03	0.04	0.03	0.09
Nitrate N (mg/L)	1.18	1.12	1.06	1.03	1.03	< 0.09	1.30	< 0.09	0.19	< 0.09	< 0.09
Nitrite N (mg/L)	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Organic N (mg/L)	1.39	1.34	1.31	1.27	1.27	ND	1.37	0.46	0.53	0.65	0.71
Total P (mg/L)	0.26	0.25	0.25	0.24	0.24	0.01	0.37	0.05	0.07	0.07	0.25
Dissolved P (mg/L)	0.15	0.14	0.14	0.14	0.14	0.01	0.28	0.02	0.03	0.04	0.14
Chloride (mg/L)	126	134	135	133	134	< 0.2	141	183	153	141	134
Fluoride (mg/L)	0.21	0.23	0.23	0.21	0.21	< 0.03	0.25	0.24	0.20	0.28	0.23
FMWRD ID Number-Transect	AE08356	AE08362	AE08364	AE08368	AE08369	–	AE08370	–	–	–	–
FMWRD ID Number-Grab	AE08357	AE08363	AE08365	AE08366	AE08367	AE08370	AE08372	AE08358	AE08359	AE08360	AE08361
Chlorophyll a (mg/L)	49.9	51.2	53.9	52.8	50.8	16.2	19.9	<1.0	1.4	25.6	1.8
First ID Number-Transect	9-3777-001	9-3777-006	9-3777-007	9-3777-008	9-3777-009	9-3777-010	9-3777-011	9-3777-002	9-3777-004	9-3777-005	9-3777-003

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Walter E. Deuchler Associates, Inc. and Deuchler Environmental, Inc.

MONTHLY STREAM STUDY 2009

Fox Metro Laboratory Data Summary

Sample Date: October 14, 2009

Test Parameters	Discrete Stream Sampling Locations										
	Mainstem					Indian Creek					
	Sullivan Rd.	North Ave.	Ashland Ave.	Mill St.	Rt. 34	Bridge	Upstream	Downstream	Reckinger	Reckinger	Field Blank
Temperature (°C)*	8.67	9.11	9.23	9.32	9.77	8.29	7.72	7.10	7.98	7.98	ND
D.O. (mg/L)*	9.98	11.08	11.35	12.06	12.46	9.35	9.27	9.81	8.85	8.85	ND
pH (S.U.)*	7.74	7.98	8.15	8.13	8.41	7.92	7.43	6.83	7.50	7.50	ND
Conductivity (uS/cm)*	687	704	708	709	715	850	662	1140	680	680	ND
BOD (mg/L)	< 2	< 2	< 2	< 2	< 2	< 2	3	< 2	< 2	3	< 2
TSS (mg/L)	9	9	9	8	6	4	14	4	12	11	< 2
Fecal Coliforms (#/100mL)*	80	53	87	80	60	80	320	240	160	100	0
TKN (mg/L)	0.90	0.88	0.89	0.88	0.88	0.51	0.65	0.55	0.59	0.59	< 0.2
Ammonia N (mg/L)	0.07	0.07	0.07	0.06	0.05	0.04	0.03	0.04	0.05	0.05	0.05
Nitrate N (mg/L)	1.72	1.62	1.63	1.58	1.96	0.13	0.09	0.19	0.09	0.10	< 0.09
Nitrite N (mg/L)	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Organic N (mg/L)	0.83	0.81	0.82	0.82	0.83	0.47	0.62	0.51	0.54	0.54	ND
Total P (mg/L)	0.21	0.21	0.23	0.22	0.39	0.05	0.09	0.05	0.07	0.06	0.03
Dissolved P (mg/L)	0.20	0.19	0.19	0.19	0.37	0.04	0.05	0.05	0.05	0.05	0.03
Chloride (mg/L)	134	130	131	130	139	168	126	215	137	138	< 0.2
Fluoride (mg/L)	0.22	0.22	0.20	0.28	0.24	0.25	0.18	0.20	0.17	0.18	< 0.03
FMWRD ID Number-Transect	AE09591	AE09607	AE09609	AE09611	AE09613	–	–	–	–	–	–
FMWRD ID Number-Grab	AE09592	AE09608	AE09610	AE09612	AE09614	AE09593	AE09594	AE09595	AE09596	AE09597	AE09598
Chlorophyll a (mg/L)	1.8	1.6	1.8	1.9	2.0	3.5	4.0	3.3	2.8	3.3	<1.0
First ID Number	9-4321-007	9-4321-008	9-4321-009	9-4321-010	9-4321-011	9-4321-001	9-4321-005	9-4321-006	9-4321-002	9-4321-003	9-4321-004

Data Qualifiers:
NS = No Sample
OUT = Outlier, data not consistent with historical record.
ND = Not Determined
AF = Analysis Failure

Walter E. Deuchler Associates, Inc. and Deuchler Environmental, Inc.

MONTHLY STREAM STUDY 2009

Fox Metro Laboratory Data Summary

Sample Date: November 12, 2009

Test Parameters	Discrete Stream Sampling Locations										
	Mainstem							Indian Creek			
	Sullivan Rd.	North Ave.	Ashland Ave.	Mill St.	Rt. 34	Rt. 34 Dupl.	Rt. 34 Blank	Bridge	Upstream	Downstream	Reckinger
Temperature (°C)*	8.70	8.70	8.72	8.82	9.34	ND	ND	6.2	5.5	5.7	6.0
D.O. (mg/L)*	14.62	13.71	14.28	14.44	15.76	ND	ND	13.56	11.50	12.40	10.10
pH (S.U.)*	7.72	8.20	8.25	8.28	8.36	ND	ND	ND	ND	ND	ND
Conductivity (uS/cm)*	900	666	666	667	675	ND	ND	ND	ND	ND	ND
BOD (mg/L)	< 2	< 2	< 2	< 2	2	< 2	< 2	< 2	< 2	< 2	<2
TSS (mg/L)	8	12	7	11	8	7	< 1	2	8	2	18
Fecal Coliforms (#/100mL)*	76	108	108	96	44	36	ND	180	260	120	380
TKN (mg/L)	0.94	0.96	0.98	0.94	0.90	0.91	<0.2	0.52	0.57	0.54	0.63
Ammonia N (mg/L)	0.07	0.09	0.06	0.05	0.05	0.04	0.03	0.02	0.02	0.02	0.04
Nitrate N (mg/L)	2.14	2.23	2.25	2.25	2.63	2.50	< 0.09	0.28	0.26	0.33	0.26
Nitrite N (mg/L)	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Organic N (mg/L)	0.87	0.87	0.92	0.89	0.85	0.87	ND	0.50	0.55	0.52	0.59
Total P (mg/L)	0.16	0.16	0.16	0.16	0.28	0.23	0.03	0.04	0.05	0.05	0.07
Dissolved P (mg/L)	0.12	0.12	0.13	0.14	0.25	0.19	0.01	0.01	0.01	0.02	0.01
Chloride (mg/L)	128	134	136	137	144	143	< 0.2	159	129	146	116
Fluoride (mg/L)	0.23	0.26	0.22	0.25	0.23	0.22	< 0.03	0.23	0.16	0.20	0.19
FMWRD ID Number-Transect	AE10580	AE10596	AE10597	AE10599	AE10601	AE10603	–	–	–	–	–
FMWRD ID Number-Grab	AE10581	AE10586	AE10598	AE10600	AE10602	AE10604	AE10605	AE10582	AE10583	AE10584	AE10585
Chlorophll a (mg/L)	0.23	0.26	0.22	0.25	0.23	0.22	< 0.03	0.23	0.16	0.20	0.19
First ID Number-Transect	AE10580	AE10596	AE10597	AE10599	AE10601	AE10603	–	–	–	–	–

*Note: Grab Samples Only

Data Qualifiers:
NS = No Sample
OUT = Outlier, data not consistent with historical record.
ND = Not Determined
AF = Analysis Failure

APPENDIX F

TABLE OF ALL FISH SPECIES CAUGHT

IN SEGMENTS 3 & 4

Total number of each species collected in Segment 3 and Segment 4; all gear types.
DO sensitive (*) and pollution intolerant species (+) are highlighted.

Species	Segment 3	Segment 4
black crappie	28	1
black redhorse * +	5	5
blackstripe topminnow	36	25
bluegill	1060	37
bluntnose minnow	948	85
brook silverside	70	
bullhead minnow	86	2
channel catfish	43	77
common carp	55	170
common shiner *		3
creek chub	3	4
emerald shiner	131	38
flathead catfish	4	4
freshwater drum	30	24
gizzard shad		2
golden redhorse		3
golden shiner	31	1
green sunfish	12	
highfin carpsucker +	33	48
johnny darter	2	1
largemouth bass	12	
northern hog sucker * +		2
orangespotted sunfish	82	4
pugnose minnow +	3	
pumpkinseed	12	2
quillback	47	17
redfin shiner	4	9
river carpsucker	12	8
sand shiner	33	17
shorthead redhorse	4	313
silver redhorse *	2	2
smallmouth bass * +	131	85
spotfin shiner	374	207
spottail shiner	1	1
walleye	3	5
white bass	8	1
white crappie	7	
white sucker		3
yellow bass	1	
Total Fish	3313	1206
Total Species	34	33
Total DO species (*)	3	5
Total DO individuals	138	97
Proportion of DO individuals	0.042	0.080
Total Pollution Intolerant species (+)	4	4
Total Pollution Intolerant individuals	172	140
Proportion of Pollution Intolerant individuals	0.052	0.116

Total number of each species collected in Segment 3 and Segment 4, boat electrofishing only, including catch rates (no. fish/hr). DO sensitive (*) and pollution intolerant species (+) are highlighted.

Species	**Segment 3**	**Segment 4**
black crappie	1	1
black redhorse * +	5	5
bluegill	288	17
bluntnose minnow	30	7
bullhead minnow		1
channel catfish	8	76
common carp	40	167
emerald shiner	51	4
flathead catfish		4
freshwater drum	26	24
golden redhorse		3
golden shiner	18	
green sunfish	12	
highfin carpsucker +	33	48
largemouth bass	11	
northern hog sucker * +		2
orangespotted sunfish	29	1
pumpkinseed		2
quillback	47	17
redfin shiner	4	9
river carpsucker	12	8
sand shiner	1	
shorthead redhorse	4	313
silver redhorse *	2	2
smallmouth bass * +	118	66
spottail shiner		1
walleye	1	5
white bass	2	1
white sucker		3
yellow bass	1	
Total Fish	744	787
Total Species	23	25
Total DO species (*)	3	4
Total DO individuals	125	75
Proportion of DO individuals	0.168	0.095
Total Pollution Intolerant species (+)	3	4
Total Pollution Intolerant individuals	156	121
Prop. of Pollution Intolerant individuals	0.210	0.154
Sampling Time (hrs); boat electrofishing only	5.0	4.3
No. fish (all species) sampled per hour	149.3	181.5
No. DO fish sampled per hour	25.1	17.3
No. Pollution Intolerant fish sampled per hour	31.3	27.9

Total number of each species collected in Segment 3 and Segment 4; minnow seine only. DO sensitive (*) and pollution intolerant species (+) are highlighted.

Species	**Segment 3**	**Segment 4**
blackstripe topminnow	25	25
bluegill	192	18
bluntnose minnow	638	77
brook silverside	70	
bullhead minnow	58	1
common carp		1
common shiner *		3
creek chub	3	4
emerald shiner	38	34
golden shiner	4	1
johnny darter		1
orangespotted sunfish	12	3
pugnose minnow +	2	
pumpkinseed	12	
sand shiner	30	17
smallmouth bass * +	10	19
spotfin shiner	316	207
Total Fish	1410	411
Total Species	14	14
Total DO species (*)	1	2
Total DO individuals	10	22
Proportion of DO individuals	0.007	0.054
Total Pollution Intolerant species (+)	2	1
Total Pollution Intolerant individuals	12	19
Proportion of Pollution Intolerant individuals	0.009	0.046