Mauvaise Terre Creek Watershed TMDL

Prepared for Illinois Environmental Protection Agency

January 2011 Revision

Mauvaise Terre Creek (IL_DD-04): Fecal Coliform

Mauvaise Terre Lake (IL_SDL): Total Phosphorus, Manganese, Nitrate

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INTRODUCTION

Section 303(d) of the 1972 Clean Water Act requires States to define impaired waters and identify them on a list, which is referred to as the 303(d) list. The State of Illinois recently issued the 2006 303(d) list, which is available on the web at: http://www.epa.state.il.us/water/tmdl/303d-list.html. Section 303(d) of the Clean Water Act and EPA's Water Quality Planning and Management Regulations (40 CFR Part 130) require states to develop Total Maximum Daily Loads (TMDLs) for water bodies that are not meeting designated uses under technology-based controls. The TMDL process establishes the allowable loading of pollutants or other quantifiable parameters for a water body based on the relationship between pollution sources and instream conditions. This allowable loading represents the maximum quantity of the pollutant that the waterbody can receive without exceeding water quality standards. The TMDL also takes into account a margin of safety, which reflects scientific uncertainty, as well as the effects of seasonal variation. By following the TMDL process, States can establish water quality-based controls to reduce pollution from both point and nonpoint sources, and restore and maintain the quality of their water resources (USEPA, 1991).

Mauvaise Terre Creek (IL_DD-04) and Mauvaise Terre Lake (IL_SDL) are listed on the 2006 Illinois Section 303(d) List of Impaired Waters (IEPA, 2006) as waterbodies that are not meeting their designated uses. As such, they have been targeted as high priority waterbodies for TMDL development. This document presents the TMDLs designed to allow these waterbodies to fully support their designated uses. The report covers each step of the TMDL process and is organized as follows:

- Problem Identification
- Required TMDL Elements
- Watershed Characterization
- Description of Applicable Standards and Numeric Targets
- Development of Water Quality Model
- TMDL Development
- Public Participation and Involvement
- Adaptive Implementation Process

Illinois EPA revised the original TMDL document to include a more accurate representation of the NPDES dischargers in the watershed. A notice was sent out for a public meeting that was held in the watershed on August 31, 2010 and the comment period ended September 30, 2010. No comments were received.

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1 PROBLEM IDENTIFICATION

The impairments in waters of the Mauvaise Terre Creek Watershed addressed in this report are summarized below, with the parameters (causes) that they are listed for, and the impairment status of each designated use, as identified in the 303(d) list (IEPA, 2006). TMDLs for Mauvaise Terre Creek and Mauvaise Terre Lake are included in this report. TMDLs for North Fork Mauvaise Terre Creek (IL_DDC) for dissolved oxygen and manganese will be conducted after additional data needed for the analysis have been collected. While TMDLs are currently only being developed for pollutants that have numerical water quality standards (indicated below with bold font), many controls that are implemented to address TMDLs for these pollutants will reduce other pollutants as well. For example, any controls to reduce phosphorus loads from watershed sources (stream bank erosion, runoff, etc.) would serve to reduce not only phosphorus, but also sediment loads to Mauvaise Terre Lake, as phosphorus Best Management Practices (BMPs) are often the same or similar to sediment BMPs. Furthermore, any reduction of phosphorus loads, either through implementation of watershed controls or dredging of lake sediments, is expected to work towards reducing algae concentrations, as phosphorus is the nutrient most responsible for limiting algal growth.

Mauvaise Terre Creek	
Assessment Unit ID	IL_DD-04
Size (length)	36.71
Listed For	**Fecal Coliform**
Use Support[1]	Aquatic life (F), Fish consumption (F), Primary contact (N), Secondary contact (X), Aesthetic quality (X)

[1] F = fully supporting, N=not supporting, X = not assessed

Mauvaise Terre Lake	
Assessment Unit ID	IL_SDL
Size (Acres)	172
Listed For	**Manganese, Phosphorus, Nitrate,** total suspended solids, aquatic algae
Use Support[1]	Aquatic life (N), Fish consumption (F), Public and food processing water supplies (N), Primary contact (X), Secondary contact (X), Aesthetic quality (N),

[1] F = fully supporting, N=not supporting, X = not assessed

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2 REQUIRED TMDL ELEMENTS

USEPA Region 5 guidance for TMDL development requires TMDLs to contain eleven specific components. Each of those components is summarized below, by waterbody.

Mauvaise Terre Creek (IL_DD-04)

1. **Identification of Waterbody, Pollutant of Concern, Pollutant Sources, and Priority Ranking:** Mauvaise Terre Creek, HUC 0713001104. The pollutant of concern addressed in this TMDL is fecal coliform. Potential sources contributing to the listing of Mauvaise Terre Creek include: runoff from pastureland and animal feeding operations, private sewage disposal systems, municipal point sources, and combined sewer overflows. Mauvaise Terre Creek is reported on the 2006 303(d) list as being in category 5, meaning available data and/or information indicate that at least one designated use is not being supported or is threatened, and a TMDL is needed (IEPA, 2006).

2. **Description of Applicable Water Quality Standards and Numeric Water Quality Target:** The IEPA guidelines (IEPA, 2006) for identifying fecal coliform as a cause of impairment in streams state that fecal coliform is a potential cause of impairment of the primary contact use if the geometric mean of all samples collected during May through October (minimum five samples) is greater than 200 cfu/100 ml, or if greater than 10% of all samples exceed 400 cfu/100 ml (cfu = colony forming units). For the Mauvaise Terre Creek TMDL for fecal coliform, the target is set at meeting 200 cfu/100 ml across the entire flow regime during May-October.

3. **Loading Capacity – Linking Water Quality and Pollutant Sources:** A load capacity calculation was completed to determine the maximum fecal coliform loads that will maintain compliance with the fecal coliform standard for May through October under a range of flow conditions:

Flow Percentile Range	Median Observed Mauvaise Terre Creek Flow (cfs)	Load Capacity (cfu/day)
60-100	1.56	7.63E+09
30-60	35.1	1.72E+11
0-30	139	6.81E+11

4. **Load Allocations (LA):** Load allocations designed to achieve compliance with the above TMDL are calculated for the May-October period by the following equation:

Load allocation = load capacity – MOS – ΣWLAs

Flow Percentile Range	Median Observed Mauvaise Terre Creek Flow (cfs)	Load Allocation (LA) (cfu/day)
60-100	1.56	0
30-60	35.1	1.14E+11
0-30	139	2.28E+11

5. **Wasteload Allocations (WLA):** The WLA for the three point source dischargers of fecal coliform in the Mauvaise Terre Creek watershed was calculated from the current permitted flows and a fecal coliform concentration consistent with the TMDL target (200 cfu/100 ml). The WLA for these facilities equals 5.84E+10 cfu/day for designed average flow conditions and 1.17E+11 for maximum design flow conditions, during periods of no CSO discharge and applies at the point where the segment impairment begins. The Jacksonville STP also has a permit for three combined sewer overflows (CSOs) that may discharge during wet weather: outfalls 002, 003 and 004. The CSO WLA is based on the maximum primary treatment capacity of 57.93 MGD that can discharge through outfall 004 and the average combined discharge of 1.5 MGD from outfalls 002 and 003. The total WLA for the CSOs equals 4.5E+11 cfu/day and must not exceed an average of four overflow events per year.

6. **Margin of Safety:** The TMDL contains an implicit margin of safety for fecal coliform, through the use of multiple conservative assumptions. The TMDL target (no more than 200 cfu/100 ml at any time) is more conservative than the more restrictive portion of the fecal coliform water quality standard (geometric mean of 200 cfu/100 ml for all samples collected May through October). An additional implicit Margin of Safety is provided via the use of a conservative model to define load capacity. The model assumes no decay of bacteria that enter the river, and therefore represents an upper bound of expected concentrations for a given pollutant load.

7. **Seasonal Variation:** The TMDL was conducted with an explicit consideration of seasonal variation. The approach used for the TMDL evaluated seasonal loads because only May through October water quality data were used in the analysis, consistent with the specification that the standard only applies during this period. The fecal coliform standard will be met regardless of flow conditions in the applicable season because the load capacity calculations specify target loads for the entire range of flow conditions that are possible to occur at any given point in the season where the standard applies.

8. **Reasonable Assurances:** In terms of reasonable assurances for point sources, Illinois EPA has the NPDES permitting program for treatment plants, stormwater permitting and CAFO permitting. The permits for the point source dischargers in the watershed will be modified if necessary as

part of the permit review process (typically every 5 years), to ensure that they are consistent with the applicable wasteload allocation.

In terms of reasonable assurances for nonpoint sources, Illinois EPA is committed to:

- Convene local experts familiar with nonpoint sources of pollution in the watershed
- Ensure that they define priority sources and identify restoration alternatives
- Develop a voluntary implementation plan that includes accountability.

Local agencies and institutions with an interest in watershed management will be important for successful implementation of this TMDL. Detail on watershed activities is provided in the Stage 1 Report.

9. **Monitoring Plan to Track TMDL Effectiveness:** A monitoring plan will be prepared as part of the implementation plan.

10. **Transmittal Letter:** A transmittal letter has been prepared and is included with the TMDL.

11. **Public Participation:** Numerous opportunities were provided for local watershed institutions and the general public to be involved. The Agency and its consultant met with local municipalities and agencies in summer 2004 to gather and share information and initiate the TMDL process. A number of phone calls were made to identify and acquire data and information (listed in the Stage 1 Report). As quarterly progress reports were produced, the Agency posted them to their website. In March 2005, a public meeting was conducted in Jacksonville, Illinois to present the results of the Stage 1 characterization work. In July 2006, a second public meeting was conducted in Jacksonville, Illinois to present the TMDL. A future meeting will be held for this revision process.

Mauvaise Terre Lake (IL_SDL)

1. **Identification of Waterbody, Pollutant of Concern, Pollutant Sources, and Priority Ranking:** Mauvaise Terre Lake, HUC 0713001104. The pollutants of concern addressed in this report are **total phosphorus, manganese, and nitrate**. Potential sources contributing to the listing of Mauvaise Terre Lake include: lake bottom sediments, recreational activities (i.e., golf courses) and agricultural sources for total phosphorus, natural background sources for manganese, and agricultural runoff and recreational activities (i.e., golf courses) for nitrate. Mauvaise Terre Lake is reported on the 2006 303(d) list as being in category 5, meaning available data and/or information indicate that at least one designated use is not being supported or is threatened, and a TMDL is needed (IEPA, 2006).
2. **Description of Applicable Water Quality Standards and Numeric Water Quality Target:** The water quality standard for **total phosphorus** to protect aquatic life and aesthetic quality uses in Illinois lakes is 0.05 mg-P/l. For the Mauvaise Terre Lake phosphorus TMDL, the target is set at the water quality criterion for total phosphorus of 0.05 mg-P/l.

   The water quality standard for **manganese** in Illinois waters designated as public and food processing water supplies is 150 ug/l. For the Mauvaise Terre Lake TMDL, the target is set at the water quality criterion for manganese of 150 ug/l.

   The water quality standard for **nitrate** in Illinois waters that serve as public and food processing water supplies is 10 mg-N/l. For the Mauvaise Terre Lake nitrate TMDL, the target is set at the water quality criterion for nitrate of 10 mg-N/l.
3. **Loading Capacity – Linking Water Quality and Pollutant Sources:** The water quality model BATHTUB was applied to determine that the maximum phosphorus load that will maintain compliance with the phosphorus standard is 60.8 kg-P/month (2.03 kg-P/day).

   A load capacity calculation was completed to determine the maximum manganese and nitrate loads that will maintain compliance with their respective water quality standards for a range of flow conditions. This calculation is based on flow multiplied by the water quality standard of 150 ug/l for manganese, and 10 mg/l for nitrate.

Mauvaise Terre River Flow (cfs)	Allowable Manganese Load (kg/day)	Allowable Nitrate Load (kg-N/day)
0.5	0.18	12.2
1	0.37	24.5
2	0.73	48.9
5	1.84	122.3
10	3.67	244.7
20	7.34	489.4
30	11.01	734.1
40	14.68	978.7
50	18.35	1223.4

4. **Load Allocations (LA):** The Load Allocation designed to achieve compliance with the above TMDL is as follows:

   Total phosphorus: 54.72 kg-P/month (1.827 kg-P/day)
   Manganese and nitrate (see table below)

Mauvaise Terre River Flow (cfs)	Manganese LA (kg/day)	Nitrate LA (kg-N/day)
0.5	0.17	11.0
1	0.33	22.0
2	0.66	44.0
5	1.65	110.1
10	3.30	220.2
20	6.61	440.4
30	9.91	660.6
40	13.21	880.9
50	16.52	1101.1

5. **Wasteload Allocations (WLA):** There are no point source dischargers in the Mauvaise Terre Lake watershed; therefore the wasteload allocation is not calculated.

6. **Margin of Safety:** The TMDL contains an explicit margin of safety (MOS) of 10% for total phosphorus. The phosphorus value was set to reflect the uncertainty in the BATHTUB model predictions. The resulting MOS for total phosphorus is 6.08 kg-P/month (0.203 kg-P/day).

   The manganese and nitrate TMDLs contain an implicit Margin of Safety and an explicit MOS. The implicit MOS is provided via the use of a conservative model to define load capacity. The model assumes no loss of manganese or nitrate that enters the lake, and therefore represents an upper bound of expected concentrations for a given pollutant load. The TMDLs also contain an explicit margin of safety of 10%. This 10% margin of safety was included in addition to the implicit margin of safety to address potential uncertainty in the effectiveness of load reduction alternatives. This margin of safety can be reviewed in the future as new data are developed.

The following table provides the MOS for manganese and nitrate:

Mauvaise Terre River Flow (cfs)	Manganese MOS (kg/day)	Nitrate MOS (kg-N/day)
0.5	0.02	1.2
1	0.04	2.4
2	0.07	4.9
5	0.18	12.2
10	0.37	24.5
20	0.73	48.9
30	1.10	73.4
40	1.47	97.9
50	1.84	122.3

7. **Seasonal Variation:** The TMDL was conducted with an explicit consideration of seasonal variation. The BATHTUB model used for the phosphorus TMDL is designed to accommodate the evaluation of monthly loads. The monthly loading analysis is appropriate due to the short nutrient residence time. The monthly duration for the loading was determined based on a calculation of a phosphorus residence time in Mauvaise Terre Lake on the order of weeks.

   The load capacity calculations for manganese and nitrate take into account seasonal variations by specifying target loads for the entire range of flow conditions that are possible to occur in any given year.

8. **Reasonable Assurances:** There are no point source dischargers in the watershed, so reasonable assurances are not discussed for point source dischargers.

   In terms of reasonable assurances for nonpoint sources, Illinois EPA is committed to:
   - Convene local experts familiar with nonpoint sources of pollution in the watershed
   - Ensure that they define priority sources and identify restoration alternatives
   - Develop a voluntary implementation plan that includes accountability.

   Local agencies and institutions with an interest in watershed management will be important for successful implementation of this TMDL. Detail on watershed activities is provided in the Stage 1 Report.

9. **Monitoring Plan to Track TMDL Effectiveness:** A monitoring plan will be prepared as part of the implementation plan.

10. **Transmittal Letter:** A transmittal letter has been prepared and is included with this TMDL.

11. **Public Participation:** Numerous opportunities were provided for local watershed institutions and the general public to be involved. The Agency and its consultant met with local municipalities and agencies in summer 2004 to gather and share information and initiate the TMDL process. A number of phone calls were made to identify and acquire data and information (listed in the Stage 1 Report). As quarterly progress reports were produced, the Agency posted them to their website. A public meeting was conducted in Jacksonville, Illinois in March 2005 to present the results of the Stage 1 characterization work. A second public meeting was conducted in Jacksonville, Illinois in July 2006 to present the TMDL. Another meeting will be held at a later date to present the implementation plan.

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3 WATERSHED CHARACTERIZATION

The Stage 1 Report presents and discusses information describing the Mauvaise Terre Creek watershed to support the identification of sources contributing to the listed impairments as applicable. The Stage 1 Report is divided into four sections, called Quarterly Progress Reports. The watershed characterization is discussed in the First Quarterly Progress Report. Watershed characterization activities were focused on gaining an understanding of key features of the watershed, including geology and soils, climate, land cover, hydrology, urbanization and population growth, point source discharges and watershed activities.

The impaired waterbodies addressed in this report are in the Mauvaise Terre Creek watershed, located in Morgan and Scott counties in west-central Illinois. The two waterbodies of concern are Mauvaise Terre Lake (IL_SDL) and Mauvaise Terre Creek downstream of Town Brook (IL_DD-04). Mauvaise Terre Lake lies in Morgan County, while Mauvaise Terre Creek flows through both Morgan and Scott Counties. Mauvaise Terre Lake was constructed by damming the upper part of Mauvaise Terre Creek (above the North Fork). The lake has a surface area of 172 acres and serves as a source of drinking water for Jacksonville and several surrounding communities. Most of the water supply, however, comes from wells located 26 miles from the Jacksonville (City of Jacksonville, 2004). Mauvaise Terre Lake is approximately “L” shaped, with an arm extending west from the inlet, and a second arm extending north to the dam. Mauvaise Terre Lake is connected near the corner of the “L” to a smaller lake called Morgan Lake.

Figure 1 shows a map of the watershed, and includes some key features such as waterways, impaired waterbodies, public water intakes and other key features. The map also shows the locations of point source discharges that have a permit to discharge under the National Pollutant Discharge Elimination System (NPDES).

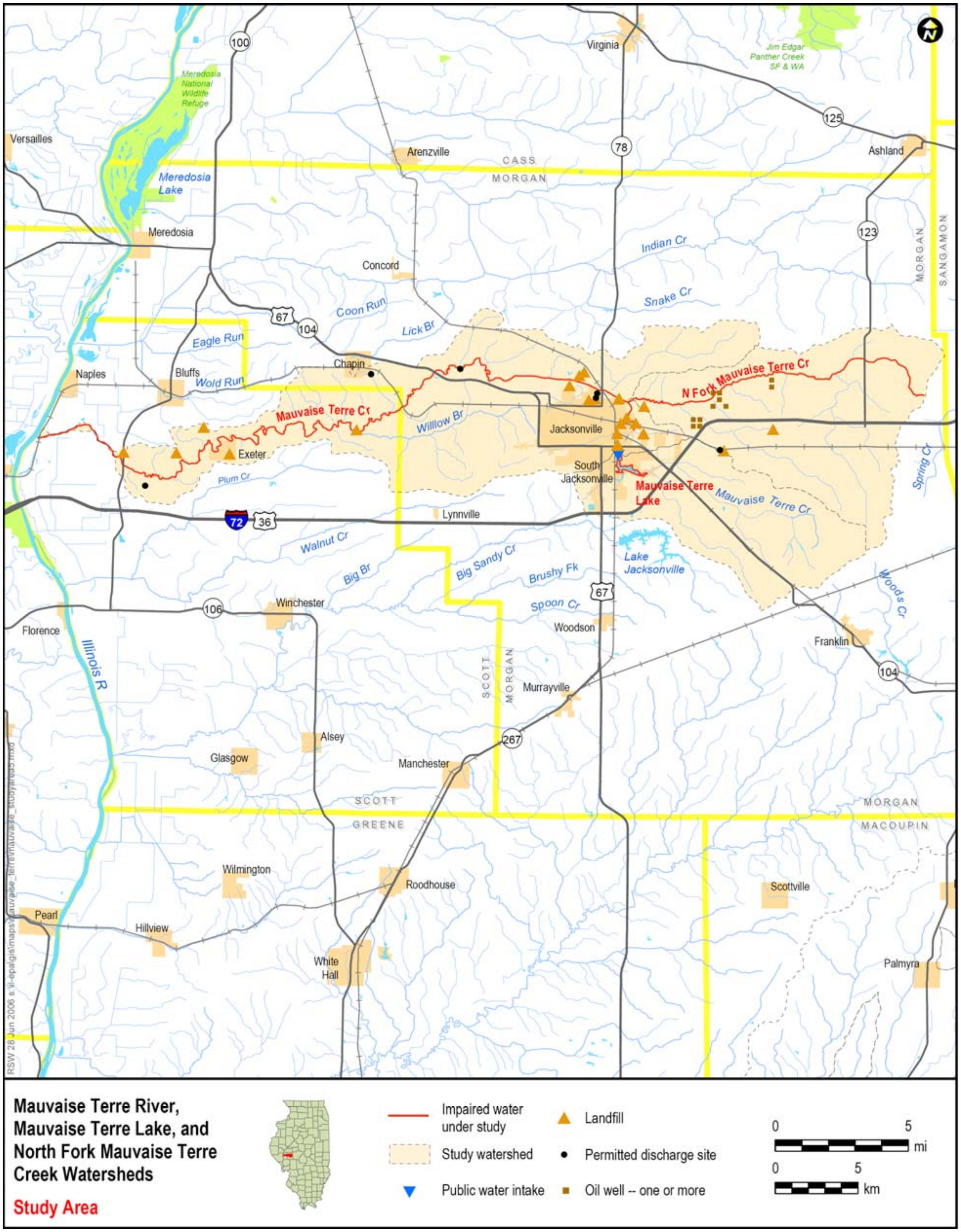

Figure 1. Mauvaise Terre Creek Watershed

4 DESCRIPTION OF APPLICABLE STANDARDS AND NUMERIC TARGETS

A water quality standard includes the designated uses of the waterbody, water quality criteria to protect designated uses, and an antidegradation policy to maintain and protect existing uses and high quality waters. Water quality criteria are sometimes in a form that are not directly amenable for use in TMDL development and may need to be translated into a target value for TMDLs. This section discusses the applicable designated uses, use support, criteria and TMDL targets for waterbodies in the Mauvaise Terre Creek watershed that are addressed in this report.

4.1 DESIGNATED USES AND USE SUPPORT

Water quality assessments in Illinois are based on a combination of chemical (water, sediment and fish tissue), physical (habitat and flow discharge), and biological (macroinvertebrate and fish) data. Illinois EPA conducts its assessment of water bodies using a set of seven designated uses: aquatic life, aesthetic quality, indigenous aquatic life (for specific Chicago-area waterbodies), primary contact (swimming), secondary contact, public and food processing water supply, and fish consumption (IEPA, 2006). For each water body, and for each designated use applicable to the water body, Illinois EPA's assessment concludes one of two possible "use-support" levels:

- Fully Supporting (the water body attains the designated use); or
- Not Supporting (the water body does not attain the designated use).

Water bodies assessed as "Not Supporting" for any designated use are identified as impaired. Waters identified as impaired based on biological (macroinvertebrate, macrophyte, algal and fish), chemical (water, sediment and fish tissue), and/or physical (habitat and flow discharge) monitoring data are placed on the 303(d) list. Potential causes and sources of impairment are also identified for impaired waters (IEPA, 2006).

Following the U.S. EPA regulations at 40 CFR Part 130.7(b)(4), the Illinois Section 303(d) list was prioritized on a watershed basis. Illinois EPA watershed boundaries are based on the USGS ten-digit hydrologic units to provide the state with the ability to address watershed issues at a manageable level and document improvements to a watershed's health (IEPA, 2006).

4.2 WATER QUALITY CRITERIA

Illinois has established water quality criteria and guidelines for allowable concentrations of total phosphorus, manganese, nitrate and fecal coliform under its CWA Section 305(b) program, as summarized below. A comparison of available water quality data to these criteria is provided in the Stage 1 Report.

4.2.1 Total Phosphorus

The IEPA guidelines (IEPA, 2006) for identifying total phosphorus as a cause of impairment in lakes greater than 20 acres in size, state that phosphorus is a potential cause of impairment of the aesthetic quality use if there is at least one exceedance of the applicable standard (0.05 mg/L) during the most recent year of data from the Ambient

Lake Monitoring Program or the Illinois Clean Lakes Program. The available data support the listing of phosphorus as a cause of impairment in Mauvaise Terre Lake, as discussed in the Stage 1 Report.

4.2.2 Manganese

The water quality standard for manganese in Illinois waters designated as public and food processing water supplies is 150 ug/l. The public and food processing water supply guidelines for inland lakes indicate impairment if more than 10% of the observations measured since 1999 exceed 150 ug/L. The available data confirm that the listing of Mauvaise Terre Lake for manganese is appropriate based on IEPA's guidelines, as discussed in the Stage 1 Report.

4.2.3 Nitrate

The IEPA guidelines (IEPA, 2006) for identifying nitrate as a cause of impairment in waterbodies used for public and food processing water supply, state that nitrate is a potential cause of impairment of the public and food processing water supply use if more than 10% of the observations exceed the applicable nitrate standard (10 mg-N/l) for raw water. The available data support the listing of nitrate as a cause of impairment in Mauvaise Terre Lake, as discussed in the Stage 1 Report.

4.2.4 Fecal Coliform

The IEPA guidelines (IEPA, 2006) for identifying fecal coliform as a cause of impairment in streams state that fecal coliform is a potential cause of impairment of the primary contact use if the geometric mean of all samples collected during May through October (minimum five samples) is greater than 200/100 ml, or if greater than 10% of all samples exceed 400/100 ml. The available data support the listing of fecal coliform as a cause of impairment in Mauvaise Terre Creek (IL_DD-04), as discussed in the Stage 1 Report.

4.3 DEVELOPMENT OF TMDL TARGETS

The TMDL target is a numeric endpoint specified to represent the level of acceptable water quality that is to be achieved by implementing the TMDL. Where possible, the water quality criterion for the pollutant of concern is used as the numeric endpoint. When appropriate numeric standards do not exist, surrogate parameters must be selected to represent the designated use.

4.3.1 Total Phosphorus

For the Mauvaise Terre Lake phosphorus TMDL, the target is set at the water quality criterion for total phosphorus of 0.05 mg-P/l.

4.3.2 Manganese

For the Mauvaise Terre Lake manganese TMDL, the target is set at the water quality criterion for manganese of 150 ug/l.

4.3.3 Nitrate

For the Mauvaise Terre Lake nitrate TMDL, the target is set at the water quality criterion for nitrate of 10 mg-N/l.

4.3.4 Fecal Coliform

For Mauvaise Terre Creek (IL_DD-04) fecal coliform TMDL, the target was set at 200 cfu/100 ml.

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5 DEVELOPMENT OF WATER QUALITY MODELS

Water quality models are used to define the relationship between pollutant loading and resulting water quality. The TMDL for phosphorus is based upon the BATHTUB model. The TMDLs for fecal coliform, manganese and nitrate utilize a Load Duration Curve method in addition to a Load Capacity Calculation. The development of the BATHTUB model and the Load Duration Curve Approach are described in this section. The load capacity calculation is described in Section 6. Section 5 includes information on:

- Model selection
- Modeling approach
- Model inputs
- Model calibration (only for BATHTUB)/Analysis (for load duration)

5.1 BATHTUB MODEL

The BATHTUB water quality model was used to define the relationship between external phosphorus loads and the resulting concentrations of total phosphorus in Mauvaise Terre Lake.

5.1.1 Model Selection

A detailed discussion of the model selection process for the Mauvaise Terre Creek watershed is provided in the Stage 1 Report.

Of the models discussed , the BATHTUB model (Walker, 1985) was selected to address phosphorus impairments to Mauvaise Terre Lake. The BATHTUB model was selected because it does not have extensive data requirements (and can therefore be applied with existing data), yet still provides the capability for calibration to observed lake data. BATHTUB has been used previously for several reservoir TMDLs in Illinois, and has been cited as an effective tool for lake and reservoir water quality assessment and management, particularly where data are limited (Ernst et al., 1994).

BATHTUB was used to predict the relationship between phosphorus load and resulting in-lake phosphorus concentrations.

5.1.2 Modeling Approach

The approach selected for the phosphorus TMDL is based upon discussions with IEPA and the Scientific Advisory Committee. The approach consists of using existing empirical data to define current loads to the lake, and using the BATHTUB model to define the extent to which these loads must be reduced to meet water quality standards. This approach corresponds to Alternative 1 in the detailed discussion of the model selection process provided in the Stage 1 Report. Implementation plans for agricultural sources will require voluntary controls, applied on an incremental basis. The approach taken for these TMDLs, which requires no additional data collection and can be conducted immediately, will expedite these implementation efforts.

Determination of existing loading sources and prioritization of restoration alternatives may be conducted by local experts as part of the implementation process (see Section 8). Based upon their recommendations, a voluntary implementation plan can be developed that includes both accountability and the potential for adaptive management.

5.1.3 Model Inputs

This section provides an overview of the model inputs required for BATHTUB application, and how they were derived. The following categories of inputs are required for BATHTUB:

- Model Options
- Global Variables
- Reservoir Segmentation
- Tributary Loads

5.1.3.1 Model Options

BATHTUB provides a multitude of model options to estimate nutrient concentrations in a reservoir. Model options were entered as shown in Table 1, with the rationale for these options discussed below. No conservative substance was being simulated, so this option was not needed. The second order available phosphorus option was selected for phosphorus, as it is the default option for BATHTUB. Nitrogen was not simulated, because phosphorus is the nutrient of concern. Similarly, transparency and chlorophyll a are not simulated.

The Fischer numeric dispersion model was selected, which is the default approach in BATHTUB for defining mixing between lake segments. Phosphorus calibrations were based on lake concentrations. No nitrogen calibration was required. The use of availability factors was not required, and estimated concentrations were used to generate mass balance tables.

Table 1. BATHTUB Model Options for Mauvaise Terre Lake

MODEL	MODEL OPTION
Conservative substance	Not computed
Total phosphorus	2nd order, available phosphorus
Total nitrogen	Not computed
Chlorophyll-a	Not computed
Transparency	Not computed
Longitudinal dispersion	Fischer-numeric
Phosphorus calibration	Concentrations
Nitrogen calibration	None
Error analysis	Not computed
Availability factors	Ignored
Mass-balance tables	Use estimated concentrations

5.1.3.2 Global Variables

The global variables required by BATHTUB consist of:

- The averaging period for the analysis
- Precipitation, evaporation, and change in lake levels
- Atmospheric phosphorus loads

BATHTUB is a steady state model, whose predictions represent concentrations averaged over a period of time. A key decision in the application of BATHTUB is the selection of the length of time over which inputs and outputs should be modeled. The length of the appropriate averaging period for BATHTUB application depends upon the nutrient residence time, which is the average length of time that phosphorus spends in the water column before settling or flushing out of the lake. Guidance for the BATHTUB model recommends that the averaging period used for the analysis be at least twice as large as nutrient residence time for the lake of interest. For lakes such as Mauvaise Terre Lake, which have a nutrient residence time on the order of weeks, a monthly averaging period is recommended. The averaging period used for this analysis was set to the monthly period.

Precipitation inputs were taken from the observed long-term annual average precipitation data and scaled for the monthly simulation period. This resulted in a total monthly precipitation value of 3.3 inches. Evaporation was set equal to precipitation and there was no assumed increase in storage during the modeling period, to represent steady state conditions. The values selected for precipitation and change in lake levels have little influence on model predictions. Atmospheric phosphorus loads were specified using default values provided by BATHTUB.

5.1.3.3 Reservoir Segmentation

BATHTUB provides the capability to divide the reservoir under study into a number of individual segments, allowing prediction of the change in phosphorus concentrations over the length of the reservoir. The segmentation scheme selected for Mauvaise Terre Lake was designed to provide one segment for each of the primary lake sampling stations. The lake was divided into the segments as shown in Figure 2. The areas of segments and watersheds for each segment were determined by Geographic Information System (GIS).

BATHTUB requires that a range of inputs be specified for each segment. These include segment surface area, length, total water depth, and depth of thermocline and mixed layer. Segment-specific values for segment depths were calculated from lake monitoring data, while segment lengths and surface areas were calculated using GIS. A complete listing of all segment-specific inputs is provided in Attachment 1.

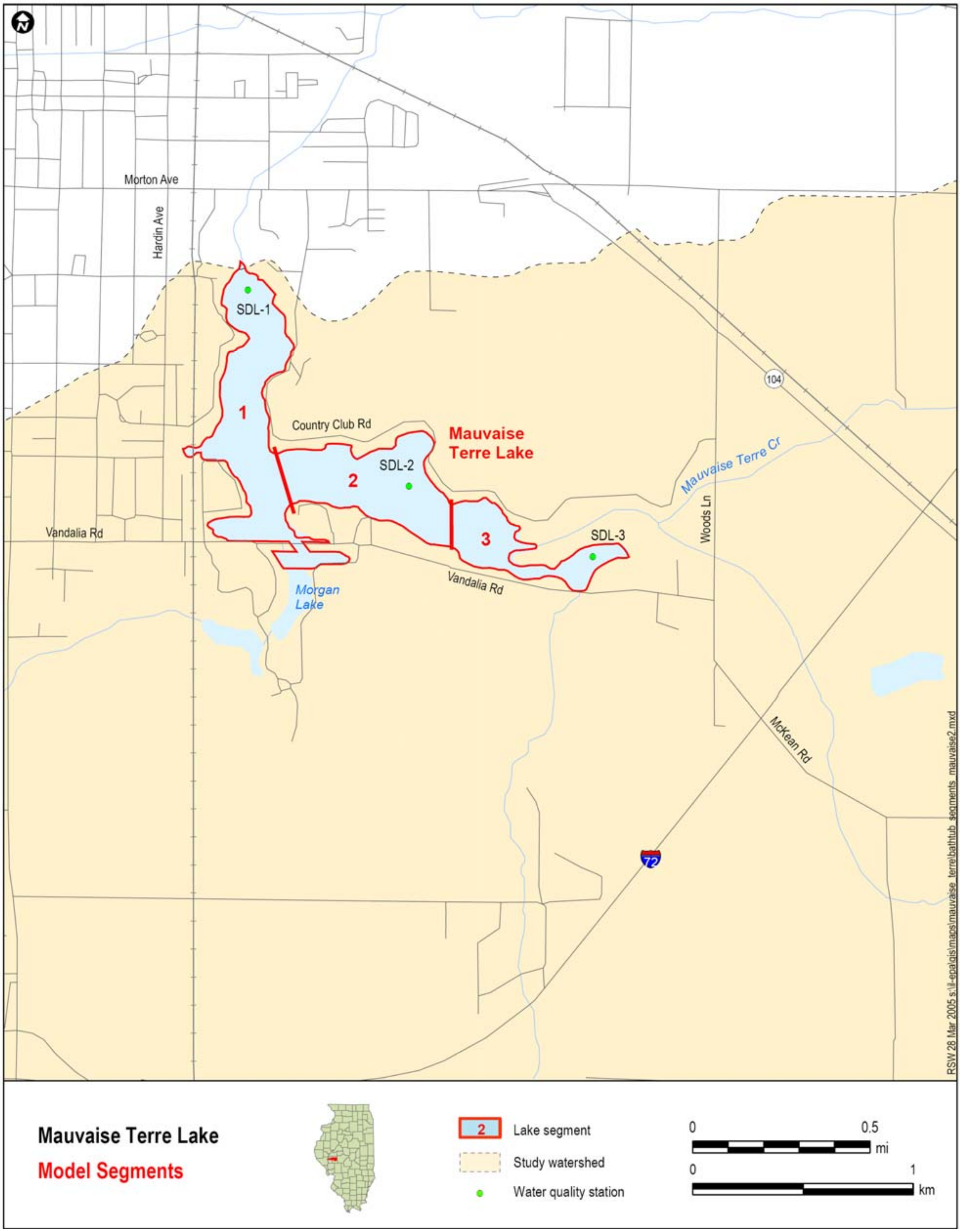

Figure 2. Mauvaise Terre Lake Segmentation Used in BATHTUB

5.1.3.4 Tributary Loads

BATHTUB requires information describing tributary flow and nutrient concentrations into each reservoir segment. The approach used to estimate flows is described below. Total phosphorus concentrations for each major lake tributary were based upon springtime measurements taken near the headwaters of the lake. Concentrations for small tributaries were set equal to the assumed concentration for the major tributary. A complete listing of all segment-specific flows and tributary concentrations is provided in Attachment 1.

Flows to each segment were estimated using observed flows at USGS gaging stations adjusted through the use of drainage area ratios as follows:

Flow into segment = Flow at USGS gage x Segment-specific drainage area ratio

$$\text{Drainage area ratio} = \frac{\text{Drainage area of watershed contributing to model segment}}{\text{Drainage area of watershed contributing to USGS gage}}$$

The USGS gage on Spring Creek at Springfield, IL (#05577500) was used in this analysis.

Segment-specific drainage area ratios were calculated using the watershed boundaries provided in GIS.

5.1.4 BATHTUB Calibration

BATHTUB model calibration consists of:

1. Applying the model with all inputs specified as above
2. Comparing model results to observed phosphorus data
3. Adjusting model coefficients to provide the best comparison between model predictions and observed phosphorus data.

The BATHTUB model was initially applied with the model inputs as specified above. Observed data for the year 1992 were used for calibration purposes, as this year provided the most robust data set. The August in-lake data from this year were used for calibration, as these data best reflect the steady state conditions assumed for the BATHTUB model.

Model results in segments 1, 2, and 3 initially under-predicted the observed phosphorus data. Phosphorus loss rates in BATHTUB reflect a typical “net settling rate” (i.e. settling minus sediment release) observed over a range of reservoirs. Under-prediction of observed phosphorus concentrations can occur in cases of elevated phosphorus release from lake sediments. The mismatch between model and data were corrected during the calibration process via the addition of an internal phosphorus load of 170 mg/m^2/day in segment 3 to reflect resuspension of phosphorus from the lake bottom sediments in this segment. The resulting predicted lake average total phosphorus concentration was 275.4 ug/l, compared to an observed average of 277.1 ug/l. This comparison represents an acceptable model calibration. A complete listing of all the observed data used for calibration purposes, as well as a comparison between model predictions and observed data, is provided in Attachment 1.

5.2 LOAD DURATION CURVE APPROACH

A load duration curve approach was used in the manganese and nitrate analysis for Mauvaise Terre Lake. A load duration curve approach was also used in the fecal coliform analysis for Mauvaise Terre Creek. A load duration curve is a graphical representation of observed pollutant load compared to maximum allowable load over a range of flow conditions. The load duration curve provides information to:

- Help identify the issues surrounding the problem and differentiate between point and nonpoint source problems, as discussed immediately below;
- Address frequency of deviations (how many samples lie above the curve vs. those that plot below); and
- Aid in establishing the level of implementation needed, by showing the magnitude by which existing loads exceed standards for different flow conditions.

5.2.1 Model Selection

The load duration curve approach was selected for fecal coliform, manganese and nitrate because it is consistent with the selected level of TMDL implementation for this TMDL and it can be applied with the existing data. The load duration curve approach identifies broad categories of sources over the entire range of flows, and the extent of control required from these source categories to attain water quality standards.

5.2.2 Approach

The load duration curve approach uses stream flows for the period of record to gain insight into the flow conditions under which exceedances of the water quality standard occur. A load-duration curve is developed by: 1) ranking the daily flow data from lowest to highest, calculating the percent of days these flows were exceeded, and graphing the results; 2) translating the flow duration curve (produced in step 1) into a load duration curve by multiplying the flows by the TMDL target; and 3) plotting observed pollutant loads (measured concentrations times stream flow) on the same graph. Observed loads that fall above the load duration curve exceed the maximum allowable load, while those that fall on or below the line, do not exceed the maximum allowable load. An analysis of the observed loads relative to the load duration curve provides information on whether the pollutant source is point or nonpoint in nature. A more complete description of the load duration curve approach is provided in the Stage 1 Report.

5.2.3 Data Inputs

The load duration curve approach requires a long-term flow record and concentration measurements that are paired to flows. Data used for the load duration curve approach are discussed below.

5.2.3.1 Manganese and Nitrate

Manganese data are available for a single location (SDL-1) in the lake, which was monitored in 2002. All available manganese data were used in the analysis. These data were collected by IEPA between April and October 2002 as part of IEPA's ambient water quality monitoring program.

Nitrate data are available for three locations in Mauvaise Terre Lake between 1992 and 202. All available nitrate data collected by the IEPA at the most upstream lake station (SDL-3) between 1992 and 2002 were used in the analysis. The data were collected as part of IEPA's ambient water quality monitoring program.

The load duration curve approach requires a matching of flows to water quality data for the recent period. Daily flows were not available for Mauvaise Terre Lake for recent years. Instead, daily average flows measured at the USGS gage on nearby Spring Creek at Springfield, Illinois (05577500) were used in the analysis. Flows are available for the period 1948-2004. The flows measured on Spring Creek were adjusted for the size of the drainage area (i.e., they were multiplied by 0.3 because the watershed for the lake is 70% smaller than the watershed for the Spring Creek gage).

5.2.3.2 Fecal coliform

Fecal coliform data collected by IEPA between 1990 and 2004 were used in the analysis. The data were collected as part of IEPA's ambient water quality monitoring program. Only data for the months of May-October were used because the water quality standard applies during this period.

The load duration curve approach requires a matching of flows to water quality data for the recent period. Daily flows were not available for Mauvaise Terre Creek for recent years. Instead, daily average flows measured at the USGS gage on nearby Spring Creek at Springfield, Illinois (05577500) were used in the analysis. Flows are available for the period 1948-2004. The flows measured on Spring Creek were adjusted for the size of the drainage area (i.e., they were multiplied by 1.3 because the watershed for IL_DD-04 is 30% larger than the watershed for the Spring Creek gage).

5.2.4 Analysis

Load duration curves were developed for manganese, nitrate and fecal coliform, to characterize pollutant problems over the entire flow regime and gain an understanding of manganese and nitrate impairments in Mauvaise Terre Lake and fecal coliform impairments in Mauvaise Terre Creek.

5.2.4.1 Manganese

A flow duration curve was generated by ranking daily flow data from lowest to highest, calculating the percent of days these flows were exceeded, and graphing the results. A load duration curve for manganese was generated by multiplying the flows in the duration curve by the water quality standard of 150 ug/l for manganese. This is shown with a solid line in Figure 3. Observed pollutant loads (measured concentrations multiplied by corresponding stream flow), were plotted at triangles on the same graph. The worksheet for this analysis is provided in Attachment 2.

The load duration curve for manganese shows that elevated concentrations are observed only at low flows. This indicates that groundwater/natural sources are likely contributors to manganese exceedances.

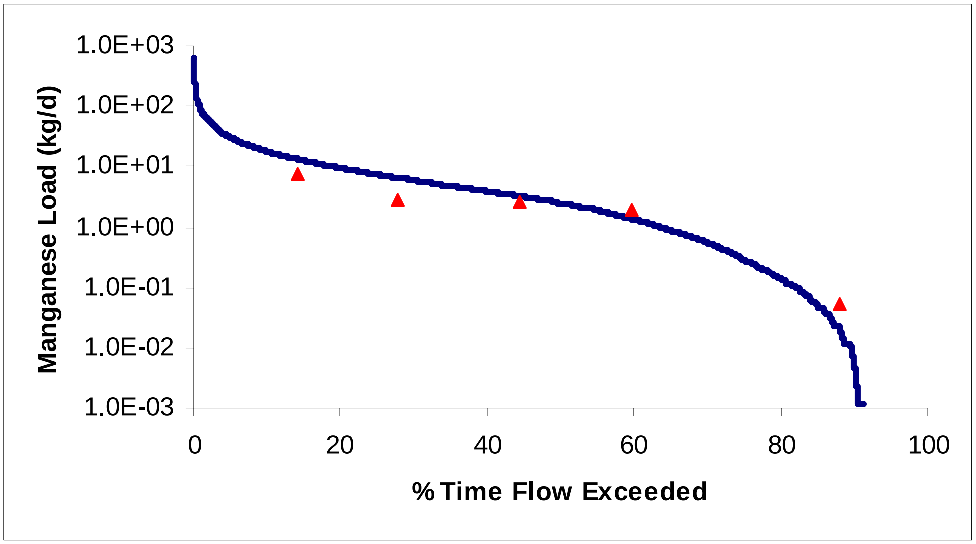

Figure 3. Manganese load duration curve for Mauvaise Terre Lake with observed loads (triangles)

5.2.4.2 Nitrate

A flow duration curve was generated by ranking daily flow data from lowest to highest, calculating the percent of days these flows were exceeded, and graphing the results. A load duration curve for nitrate was generated by multiplying the flows in the duration curve by the water quality standard of 10 mg-N/l for nitrate. This is shown with a solid line in Figure 4. Observed pollutant loads (measured concentrations multiplied by corresponding stream flow), were plotted on the same graph. The worksheet for this analysis is provided in Attachment 3.

The load duration curve shows that nitrate loads at higher flows fall above the curve, indicating that nonpoint sources are significant contributors to nitrate exceedances. During lower flows, nitrate loads fall below the curve, indicating compliance with the standard during drier conditions. This information can be used to look at potential implementation opportunities. Because it will not be feasible to eliminate all nonpoint source loadings of nitrate in the watershed, the implementation plan (addressed in a separate report) will need to define practical activities that will reduce loadings as much as is feasible and practical.

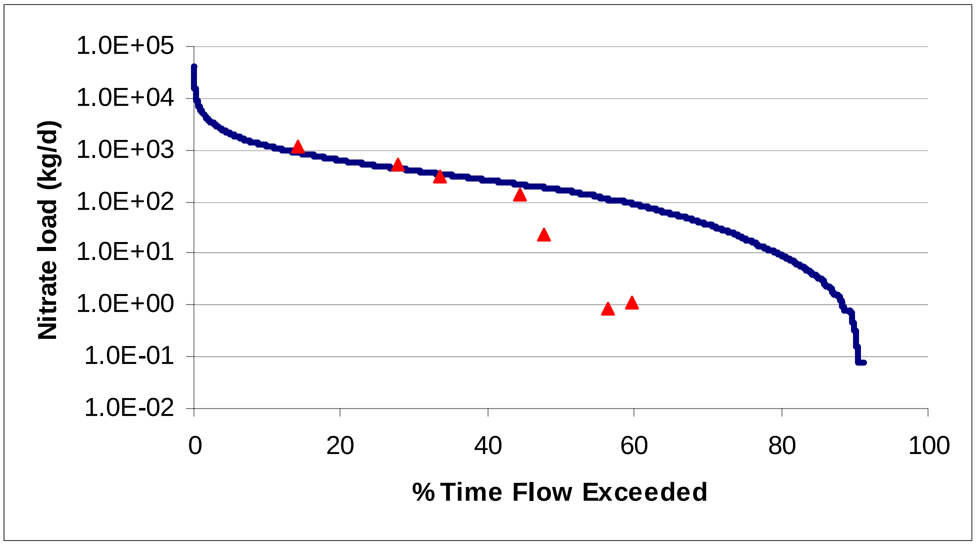

Figure 4. Nitrate load duration curve for Mauvaise Terre Lake with observed loads (triangles)

5.2.4.3 Fecal coliform

A flow duration curve was generated by ranking daily flow data from lowest to highest, calculating the percent of days these flows were exceeded, and graphing the results. A load duration curve for fecal coliform was generated by multiplying the flows in the duration curve by the TMDL target of 200 cfu/100 ml for fecal coliform bacteria. This is shown with a solid line in Figure 5. Observed pollutant loads (measured concentrations multiplied by corresponding stream flow), were plotted on the same graph. The worksheet for this analysis is provided in Attachment 4.

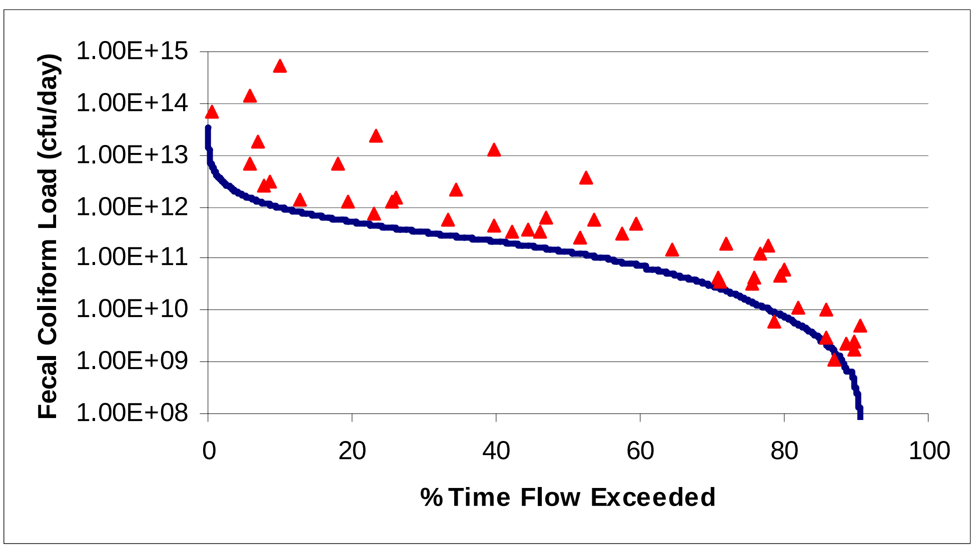

Figure 5. Fecal coliform load duration curve for Mauvaise Terre Creek with observed loads (triangles)

Fecal coliform concentration data are available for a wide range of flows and exceedences are observed over the range of flows examined. This indicates that wet and dry weather sources are significant contributors to fecal coliform exceedences in this segment.

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6 TMDL DEVELOPMENT

This section presents the development of the total maximum daily load for the impaired waterbodies in Mauvaise Terre Creek watershed. It begins with a description of how the total loading capacity was calculated, and then describes how the loading capacity is allocated among point sources, non-point sources, and the margin of safety. A discussion of critical conditions and seasonality considerations is also provided.

6.1 PHOSPHORUS (MAUVAISE TERRE LAKE)

The BATHTUB model was developed to define the relationship between phosphorus loads and resulting phosphorus concentrations in Mauvaise Terre Lake and to calculate the loading capacity.

6.1.1 Calculation of Loading Capacity

The loading capacity is defined as the maximum pollutant load that a waterbody can receive and still maintain compliance with water quality standards.

The loading capacity was determined by running the BATHTUB model repeatedly, reducing the tributary nutrient concentrations for each simulation until model results demonstrated attainment with the TMDL target. The maximum tributary concentration that results in compliance with water quality standards was used as the basis for determining the lake's loading capacity. The tributary concentration was then converted into a loading rate through multiplication with the tributary flow.

Initial BATHTUB load reduction simulations indicated that Mauvaise Terre Lake phosphorus concentrations would exceed the water quality standard regardless of the level of tributary load reduction, due to the elevated internal phosphorus loads from lake sediments. This internal phosphorus flux is expected to decrease in the future in response to external phosphorus load reductions, reverting back to more typical conditions. This reduction in future sediment phosphorus release was represented in the model by eliminating the additional sediment phosphorus source for scenarios where the tributary phosphorus concentrations were less than 100 ug-P/l. The resulting tributary phosphorus load that led to compliance with water quality standards was 60.8 kg-P/month (2.03 kg-P/day). This allowable load corresponds to an approximately 57% reduction from existing tributary loads (estimated as 142.8 kg-P/month or 4.76 kg-P/day). Loads are expressed on a monthly basis because model results indicate that the phosphorus residence time in Mauvaise Terre Lake is on the order of several weeks. Loads entering the lake in the fall through early spring period do not directly affect summer phosphorus concentrations, and therefore were excluded from the TMDL analysis.

6.1.2 Allocation

A TMDL consists of waste load allocations (WLAs) for point sources, load allocations (LAs) for nonpoint sources, and a margin of safety (MOS). This definition is typically illustrated by the following equation:

$$TMDL = WLA + LA + MOS$$

Since no point sources are located in the Mauvaise Terre Lake watershed, the WLA will be set to zero. The remainder of the loading capacity is given to the load allocation for nonpoint sources and the margin of safety. The load allocation is not divided into individual source categories for purposes of this TMDL, as it is the intent of the implementation plan to provide detail on the contributions of specific sources to the overall phosphorus load. Given a loading capacity of 60.8 kg-P/month (2.03 kg-P/day) and an explicit margin of safety of 10% (discussed below) results in a load allocation for Mauvaise Terre Lake of 54.72 kg-P/month (1.827 kg-P/day).

6.1.3 Critical Condition

TMDLs must take into account critical environmental conditions to ensure that the water quality is protected during times when it is most vulnerable. Critical conditions were taken into account in the development of this TMDL. The critical environmental conditions for Mauvaise Terre Lake correspond to the middle to late summer period, when observed phosphorus concentrations in the lake are highest. The BATHTUB model simulations upon which this TMDL is based were conducted to represent this critical middle to late summer period.

6.1.4 Seasonality

These TMDLs were conducted with an explicit consideration of seasonal variation. The BATHTUB model was applied to evaluate phosphorus over a range of seasonal periods, with TMDL results being based upon the most critical period as described above.

6.1.5 Margin of Safety

The phosphorus TMDL contains an explicit margin of safety of 10%. The 10% margin of safety is considered an appropriate value based upon the generally good agreement between the BATHTUB water quality model predicted values and the observed values. Since the model reasonably reflects the conditions in the watershed, a 10% margin of safety is considered to be adequate to address the uncertainty in the TMDL, based upon the data available. The resulting explicit phosphorus load allocated to the margin of safety is 6.08 kg-P/month (0.203 kg-P/day).

6.2 MANGANESE (MAUVAISE TERRE LAKE)

A load capacity calculation approach was applied to support development of a manganese TMDL for Mauvaise Terre Lake.

6.2.1 Calculation of Loading Capacity

The loading capacity is defined as the maximum pollutant load that a waterbody can receive and still maintain compliance with water quality standards. The loading capacity was defined over a range of specified flows based on expected flows for the watershed. The allowable loading capacity was computed by multiplying flow by the water quality standard (150 ug/l for manganese). The manganese loading capacity is presented in Table 2. The percent reduction in manganese load was calculated by comparing the observed and allowable manganese loads over a range of flows. The observed manganese load was calculated from observed in-lake concentrations (averaged by flow class) and flows estimated from the Spring Creek gage near Springfield. A 53% reduction from current manganese loads is required for Mauvaise Terre River flows less than 5 cfs.

Table 2. Manganese Loading Capacity

Mauvaise Terre River Flow (cfs)	Manganese Loading Capacity (kg/day)
0.5	0.18
1	0.37
2	0.73
5	1.84
10	3.67
20	7.34
30	11.01
40	14.68
50	18.35

6.2.2 Allocation

A TMDL consists of waste load allocations (WLAs) for point sources, load allocations (Las) for nonpoint sources, and a margin of safety (MOS).

Because there are no point sources located in the Mauvaise Terre Lake watershed, the WLA for manganese is set at zero. The remainder of the loading capacity is given to the load allocation for nonpoint sources and the margin of safety (Table 3). The load allocation is not divided into individual source categories for purposes of this TMDL, as it is the intent of the implementation plan to provide detail on the contributions of specific sources to the overall manganese load.

Table 3. Manganese TMDL Allocation[1]

Mauvaise Terre River Flow (cfs)	Manganese Loading Capacity (kg/day)	Manganese LA (kg/day)	Manganese MOS (kg/day)
0.5	0.18	0.17	0.02
1	0.37	0.33	0.04
2	0.73	0.66	0.07
5	1.84	1.65	0.18
10	3.67	3.30	0.37
20	7.34	6.61	0.73
30	11.01	9.91	1.10
40	14.68	13.21	1.47
50	18.35	16.52	1.84

[1] Due to rounding, numbers may not add up exactly.

6.2.3 Critical Condition

TMDLs must take into account critical environmental conditions to ensure that the water quality is protected during times when it is most vulnerable. Critical conditions were taken into account in the development of this TMDL. Manganese naturally occurs in soils; therefore, surface runoff contains manganese that is transported into the lake via rain events. TMDL development based on the load duration curve approach considers the entire range of flows that could occur in any given year; which includes flow from rain events. Therefore critical conditions were addressed during TMDL development.

6.2.4 Seasonality

This TMDL was conducted with an explicit consideration of seasonal variation. By specifying the allowable loading capacity as a function of stream flow, the TMDL considers all possible seasonal variation.

6.2.5 Margin of Safety

Total maximum daily loads are required to contain a Margin of Safety (MOS) to account for any uncertainty concerning the relationship between pollutant loading and receiving water quality. The MOS can be either implicit (e.g., incorporated into the TMDL analysis through conservative assumptions), or explicit (e.g., expressed in the TMDL as a portion of the loading), or expressed as a combination of both. The manganese TMDL contains an explicit margin of safety of 10% to address potential uncertainty in the effectiveness of load reduction calculations. A relatively low margin of safety was chosen by IEPA because the load duration curve (LDC) analysis, used to develop the loadings, provides good information on the relationship between pollutant loadings and the receiving water quality. The LDC method has few assumptions in it, compared to more complex models. It provides a simple context for evaluating monitoring data across the entire range of flow conditions (i.e. a period of 56 years from 1948-2004), thus reducing the uncertainty in the flows (and related loads). Since duration curves calculated loads at various flows and used the WQS as the TMDLs target, the method allowed IEPA to have a better understanding of when the exceedences occurred in the waterbody and under what conditions. This will help reduce uncertainty in the effectiveness of the implementation efforts, and the likelihood of meeting the appropriate WQS/designated use.

6.3 NITRATE (MAUVAISE TERRE LAKE)

A load capacity calculation approach was applied to support development of a nitrate TMDL for Mauvaise Terre Lake.

6.3.1 Calculation of Loading Capacity

The loading capacity is defined as the maximum pollutant load that a waterbody can receive and still maintain compliance with water quality standards. The loading capacity for nitrate was defined over a range of specified flows based on expected flows for the watershed. The allowable loading capacity was computed by multiplying flow by the water quality standard (10 mg-N/l for nitrate). The nitrate loading capacity is presented in Table 4.

The percent reduction in nitrate load was calculated by comparing the observed and allowable nitrate loads over a range of flows. The observed nitrate load was calculated from observed in-lake concentrations and flows estimated from the Spring Creek gage near Springfield. To calculate the observed nitrate loads, the observed in-lake nitrate concentrations were regressed against the flows and this relationship was applied to calculate observed nitrate loads for the flows presented in Table 4. No reduction is needed at lower watershed flows, as the observed load is less than the allowable loading capacity. At higher flows (i.e., 50 cfs), a 57% reduction in nitrate is required.

Table 4. Nitrate Loading Capacity

Mauvaise Terre River Flow (cfs)	Nitrate Loading Capacity (kg/day)
0.5	12.2
1	24.5
2	48.9
5	122.3
10	244.7
20	489.4
30	734.1
40	978.7
50	1,223.4

6.3.2 Allocation

A TMDL consists of waste load allocations (WLAs) for point sources, load allocations (LAs) for nonpoint sources, and a margin of safety (MOS).

Because there are no point sources located in the Mauvaise Terre Lake watershed, the WLA for nitrate is set at zero. The remainder of the loading capacity is given to the load allocation for nonpoint sources and the margin of safety (Table 5). The load allocation is not divided into individual source categories for purposes of this TMDL, as it is the intent of the implementation plan to provide detail on the contributions of specific sources to the overall nitrate load.

Table 5. Nitrate TMDL Allocation[1]

Mauvaise Terre River Flow (cfs)	Nitrate Loading Capacity (kg-N/day)	Nitrate LA (kg-N/day)	Nitrate MOS (kg-N/day)
0.5	12.2	11.0	1.2
1	24.5	22.0	2.4
2	48.9	44.0	4.9
5	122.3	110.1	12.2
10	244.7	220.2	24.5
20	489.4	440.4	48.9
30	734.1	660.6	73.4
40	978.7	880.9	97.9
50	1223.4	1101.1	122.3

[1]Due to rounding, numbers may not add up.

6.3.3 Critical Condition

TMDLs must take into account critical environmental conditions to ensure that the water quality is protected during times when it is most vulnerable. Critical conditions were taken into account in the development of this TMDL. Nitrate in this watershed was shown to be significantly higher in spring. TMDL development based on the load duration curve approach considers the entire range of flows that could occur in any given year; which includes spring. Therefore critical conditions were addressed during TMDL development.

6.3.4 Seasonality

This TMDL was conducted with an explicit consideration of seasonal variation. By specifying the allowable loading capacity as a function of stream flow, the TMDL considers all possible seasonal variation.

6.3.5 Margin of Safety

Total maximum daily loads are required to contain a Margin of Safety (MOS) to account for any uncertainty concerning the relationship between pollutant loading and receiving water quality. The MOS can be either implicit (e.g., incorporated into the TMDL analysis through conservative assumptions), or explicit (e.g., expressed in the TMDL as a portion of the loading), or expressed as a combination of both. The nitrate TMDL contains an explicit margin of safety of 10% to address potential uncertainty in the effectiveness of load reduction calculations. A relatively low margin of safety was chosen by IEPA because the load duration curve (LDC) analysis, used to develop the loadings, provides good information on the relationship between pollutant loadings and the receiving water quality. The LDC method has few assumptions in it, compared to more complex models. It provides a simple context for evaluating monitoring data across the entire range of flow conditions (i.e. a period of 56 years from 1948-2004), thus reducing the uncertainty in the flows (and related loads). Since duration curves calculated loads at various flows and used the WQS as the TMDLs target, the method allowed IEPA to have a better understanding of when the exceedences occurred in the waterbody and under what conditions.

6.4 FECAL COLIFORM (MAUVAISE TERRE CREEK)

A load capacity calculation approach was applied to support development of a fecal coliform TMDL for Mauvaise Terre Creek.

6.4.1 Calculation of Loading Capacity

The loading capacity is defined as the maximum pollutant load that a waterbody can receive and still maintain compliance with water quality standards. The loading capacity was defined over the range of observed flow conditions. The allowable loading capacity was computed by multiplying flow by the TMDL target (200 cfu/100 ml). The fecal coliform loading capacity is presented in Table 6.

Table 6. Mauvaise Terre Creek Fecal Coliform Loading Capacity

Flow Percentile Range	Median Observed Mauvaise Terre Creek Flow (cfs)	Load Capacity (cfu/day)[1]
60-100	1.56	7.63E+09
30-60	35.1	1.72E+11
0-30	139	6.81E+11

The maximum fecal coliform concentrations were examined for different flow intervals (Table 7) and compared to the 200 cfu/100 ml target to estimate the percent reduction needed to meet the water quality target. An approximately 99% reduction in fecal coliform loading is required to meet the TMDL target over the range of flows observed in the creek. Exceedances of the target were previously illustrated in Figure 5.

Table 7. Required Reductions in Existing Loads under Different Flow Conditions

Flow Percentile Interval	Mauvaise Terre Creek Flow (cfs)	Maximum fecal concentration (cfu/100 ml)	Percent reduction to meet target
60-100	0 - 14	110,000	99.8%
30-60	14 - 65	20,000	99.0%
0-30	65-6916	15,700	98.7%

6.4.2 Allocation

A TMDL consists of waste load allocations (WLAs) for point sources, load allocations (LAs) for nonpoint sources, and a margin of safety (MOS). This definition is typically illustrated by the following equation:

$$TMDL = WLA + LA + MOS$$

There are three NPDES permitted point source dischargers of fecal coliform in the Mauvaise Terre Creek watershed. The WLA for these point sources was calculated using their permitted flow rates and a concentration consistent with meeting the TMDL target (200 cfu/100 ml). Wasteload allocations for these facilities are presented in Table 8. The total WLA for these three facilities equals 5.84E+10 using the design average flow (DAF) and 1.17E+11 using the design maximum flow (DMF). The DAF WLA will be used at average flow periods and the DMF WLA will be used at high flows. By including the DMF, all flow periods that the facilities are permitted to discharge will be represented in allocations.

In addition to the dischargers presented in Table 8, the Jacksonville STP also has a permit for three combined sewer overflows (CSOs) that may discharge during wet weather: outfalls 002, 003, and 004. The CSO WLA is based on the maximum primary treatment capacity of 57.93 MGD that can discharge through outfall 004 and the average combined discharge of 1.5 MGD from outfalls 002 and 003. The total WLA for the CSOs equals 4.5E+11 cfu/day and must not exceed an average of four overflow events per year. The WLA and CSO WLA are based on the fecal coliform standard of 200 cfu/100 ml.

Table 8. Permitted Dischargers and WLAs

NPDES ID	Facility Name	Disinfection Exemption	Design Flow (MGD)	Flow Type (MGD)	Permit Expiration	WLA (cfu/day)[1]
IL0055085	Marnico Village	Year-round*	0.041 0.102	Average Maximum	2-28-08	3.10E+08 7.72E+08
ILG580166	Chapin STP	Year-round*	0.1 0.25	Average Maximum	12-31-07	7.58E+08 1.89E+09
IL0021661	Jacksonville STP	No	7.57 15	Average Maximum	10-31-09	5.73E+10 1.14E+11
*These facilities will have the year-round disinfection exemption revoked and be granted a seasonal exemption						5.84E+10 1.17E+11

The remainder of the loading capacity is given to the load allocation for nonpoint sources as presented in Table 9. The load allocation is not divided into individual source categories for purposes of this TMDL, as it is the intent of the implementation plan to provide detail on the contributions of specific sources to the overall fecal coliform load.

Table 9. Fecal Coliform TMDL for Mauvaise Terre Creek (IL_DD-04)[1]

Flow Percentile Range	Median Obs. Mauvaise Terre Creek Flow (cfs)	Load Capacity (cfu/day)	Observed Load (cfu/day)[3]	Wasteload Allocation (WLA) (cfu/day)[2]	Estimated CSO Load (cfu/day)	CSO WLA (cfu/day)[4]	Load Allocation (LA) (cfu/day)
60-100	1.56	7.63E+09	5.99E+11	7.63E+09		0	0
30-60	35.1	1.72E+11	1.72E+13	5.84E+10		0	1.14E+11
0-30	139	6.81E+11	3.74E+14	1.17E+11	5.86E+11	4.5 E+11	1.14E+11

1 An implicit margin of safety is used in this TMDL

2 A lower WLA is used during the unique case where all of the stream flow is from the treatment plant flow.

3 Observed load calculated using maximum fecal concentration and median observed flows

4 For purposes of this table, CSOs discharge only during high flows. The facility must meet their long-term control plan requirements.

Table 10. CSO Estimated Duration

Outfall	MGD	MG/hr	Mean (hr/yr) *	hr/day
002 CSO	34.3000	1.4292	5.0000	0.0139
004 CSO	3.7000	0.1542	121.6700	0.3380

*used average facility CSO data from 2003-2008. Outfall 003 did not discharge.

Table 11. Current CSO Estimated Wasteloads

CSO	gal/hr	L/gal	ml/L	cfu/ml	hr/day	cfu/day
Outfall 002-	1429166.6667	3.785	1000	2150	0.0139	1.62E+11
Outfall 004-	154166.6667	3.785	1000	2150	0.3380	4.24E+11
						5.86E+11

Table 10 contains the estimated duration of discharge for outfalls 002 and 004. This information was taken from Jacksonville Wastewater Treatment Plant's Long Term Control Plan- CSO Disinfection, October 2008. Please refer to Attachment 6 for this document. Table 11 has the current CSO estimated wasteloads for outfalls 002 and 004. A fecal coliform concentration of 215,000 cfu/100ml was used for the current estimated CSO wasteloads. This is the median value from the EPA document- Report to Congress, Impacts and Control of CSOs and SSOs (EPA 2004). The maximum wasteload allocation from CSO outfalls is 4.5E+11 while the current estimate wasteload is 5.86E+11. A 23% reduction in CSO loads is required during higher flows, when CSOs are discharging. This percent reduction is based on the estimated CSO load and the CSO WLA. The facility must comply with its permit and long-term control plan requirements.

Marnico Village and Chapin STP will have their year-round disinfection exemption revoked and instead be granted seasonal disinfection exemptions. They will be expected to meet the geometric mean of 200 cfu/100 ml during the months of May through October at their outfall. Jacksonville STP outfall currently has the limit of 400 cfu/100 ml and during permit renewal will be given a geometric mean of 200 cfu/100 ml. Jacksonville STP is currently in compliance with their permit limit.

6.4.3 Critical Condition

TMDLs must take into account critical environmental conditions to ensure that the water quality is protected during times when it is most vulnerable. Critical conditions were taken into account in the development of this TMDL. The standard for fecal coliform only applies during May 1 through October 31 when humans will be in contact with the water. Water quality data and streamflow data from May 1 through October 31 were used in the load duration curve. Therefore critical conditions were addressed during TMDL development.

6.4.4 Seasonality

This TMDL was conducted with an explicit consideration of seasonal variation. The approach used for the TMDL evaluated seasonal loads because only May through October water quality data were used in the analysis, consistent with the specification that the standard only applies during this period. The fecal coliform standard will be met regardless of flow conditions in the applicable season because the load capacity calculations specify target loads for the entire range of flow conditions that are possible to occur at any given point in the season where the standard applies.

6.4.5 Margin of Safety

Total maximum daily loads are required to contain a Margin of Safety (MOS) to account for any uncertainty concerning the relationship between pollutant loading and receiving water quality. The MOS can be either implicit (e.g., incorporated into the TMDL analysis through conservative assumptions), or explicit (e.g., expressed in the TMDL as a portion of the loading), or expressed as a combination of both. The fecal coliform TMDL contains an implicit margin of safety, through the use of multiple conservative assumptions. First, the TMDL target (no more than 200 cfu/100 ml at any point in time) is more conservative than the more restrictive portion of the fecal coliform water quality standard (geometric mean of 200 cfu/100 ml for all samples collected May through October). An additional implicit Margin of Safety is provided via the use of a conservative model to define load capacity. The model assumes no decay of bacteria that enter the river, and therefore represents an upper bound of expected concentrations for a given pollutant load. This margin of safety can be reviewed in the future as new data are developed.

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7 PUBLIC PARTICIPATION AND INVOLVEMENT

The TMDL process included numerous opportunities for local watershed institutions and the general public to be involved. The Agency and its consultant met with local municipalities and agencies in Summer 2004 to notify stakeholders about the upcoming TMDLs, and initiate the TMDL process. A number of phone calls were made to identify and acquire data and information (see Stage 1 Report). As quarterly progress reports were produced during the first stage of the TMDL process, the Agency posted them to their website for public review.

In January 2005, a public meeting was announced for presentation of the Stage 1 findings. This announcement was mailed to everyone on the previous TMDL mailing list and published in local newspapers. The public meeting was held at 6:30 pm on Tuesday, March 1, 2005 at the Jacksonville Municipal Building in Jacksonville, Illinois. In addition to the meeting's sponsors, nine (9) individuals attended the meeting. Attendees registered and listened to an introduction to the TMDL Program from Illinois EPA and a presentation on the Stage 1 findings by Limno-Tech, Inc. (LTI). This was followed by a general question and answer session.

In July 2005, a public meeting was announced for presentation of the Stage 3 findings. This announcement was mailed to everyone on the previous TMDL mailing list and published in local newspapers. The public meeting was held at 6:00 pm on Wednesday, July 26, 2006 at the Jacksonville Municipal Building in Jacksonville, Illinois. In addition to the meeting's sponsors, nine (9) individuals attended the meeting. Attendees registered and listened to a presentation on the Stage 3 findings by Limno-Tech, Inc. (LTI). This was followed by a general question and answer session.

A responsiveness summary is included in Attachment 5. This responsiveness summary addresses substantive questions and comments received during the public comment period.

In August 2010, a public meeting was announced for the presentation of the Mauvaise Terre Creek Watershed TMDL July 2010 Revision report. A public notice was sent to individuals on the mailing list and published in the local newspaper. The meeting was held at 2:00 pm on Tuesday, August 31, 2010 at the Jacksonville Municipal Building in Jacksonville, Illinois. Eight individuals attended the meeting. The presentation included all modifications to the original TMDL for the segment of Mauvaise Terre Creek (DD-04). The public comment period ended September 30, 2010 and no comments were received.

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8 ADAPTIVE IMPLEMENTATION PROCESS

The approach to be taken for TMDL implementation is based upon discussions with Illinois EPA and its Scientific Advisory Committee. The approach consists of the following steps:

1. Use existing data to define overall existing pollutant loads, as opposed to developing a watershed model that might define individual loading sources.
2. Apply relatively simple models (e.g. BATHTUB) to define the load-response relationship and define the maximum allowable pollutant load that the lake can assimilate and still attain water quality standards
3. Compare the maximum allowable loading capacity to the existing load to define the extent to which existing loads must be reduced in order to meet water quality standards
4. Develop a voluntary implementation plan that includes both accountability and the potential for adaptive management.
5. Carry out adaptive management through the implementation of a long-term monitoring plan designed to assess the effectiveness of pollution controls as they are implemented, as well as progress towards attaining water quality standards.

This approach is designed to accelerate the pace at which TMDLs are being developed for sites dominated by nonpoint sources, which will allow implementation activities (and water quality improvement) to begin sooner. The approach also places decisions on the types of nonpoint source controls to be implemented at the local level, which will allow those with the best local knowledge to prioritize sources and identify restoration alternatives. Finally, the adaptive management approach to be followed recognizes that models used for decision-making are approximations, and that there is never enough data to completely remove uncertainty. The adaptive process allows decision-makers to proceed with initial decisions based on modeling, and then to update these decisions as experience and knowledge improve.

Steps 1-3 correspond to TMDL development and have been completed, as described in Section 5 of this document. Steps 4 and 5 correspond to implementation.

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REFERENCES

Ernst, M. R., W. Frossard, and J. L. Mancini. 1994. Two Eutrophication Models make the Grade. *Water Environment and Technology* 6 (11), pp 15-16.

Illinois Environmental Protection Agency (IEPA), 2006. Illinois Integrated Water Quality Report and Section 303(d) list-2006. Illinois EPA Bureau of Water. April 2006. IEPA/BOW/04-005 http://www.epa.state.il.us/water/watershed/reports/303d-report/2006/303d-report.pdf

U.S. Environmental Protection Agency (EPA), 1991. *Guidance for Water Quality-based Decisions: The TMDL Process.* EPA 440/4-91-001. Office of Water, Washington, DC.

U.S. Environmental Protection Agency (EPA), 2004. *Report to Congress, Impacts and Control of CSOs and SSOs.* EPA 833-R-04-001. Office of Water, Washington, DC.

Walker, W. W., 1985. *Empirical Methods for Predicting Eutrophication in Impoundments; Report 3, Phase III: Model Refinements*. Technical Report E-81-9, U.S. Army Engineer Waterways Experiment Station, Vicksburg, MS.

Attachment 1

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Mauvaise Terre Lake

Predicted & Observed Values Ranked Against CE Model Development Dataset

Segment: 4 Area-Wtd Mean

	Predicted Values--->			Observed Values--->		
Variable	**Mean**	**CV**	**Rank**	**Mean**	**CV**	**Rank**
TOTAL P MG/M3	275.4		97.4%	277.1		97.4%
CHL-A MG/M3				63.4		99.3%
SECCHI M				0.3		4.0%
ANTILOG PC-1				5079.5		99.0%
ANTILOG PC-2				8.4		69.2%
TURBIDITY 1/M	2.1		91.7%	2.1		91.7%
ZMIX * TURBIDITY	2.8		44.0%	2.8		44.0%
ZMIX / SECCHI				5.4		58.0%
CHL-A * SECCHI				18.3		79.5%
CHL-A / TOTAL P				0.2		60.3%
FREQ(CHL-a>10) %				99.5		99.3%
FREQ(CHL-a>20) %				93.4		99.3%
FREQ(CHL-a>30) %				80.7		99.3%
FREQ(CHL-a>40) %				66.0		99.3%
FREQ(CHL-a>50) %				52.4		99.3%
FREQ(CHL-a>60) %				41.0		99.3%
CARLSON TSI-P	85.0		97.4%	85.1		97.4%
CARLSON TSI-CHLA				71.2		99.3%
CARLSON TSI-SEC				78.3		96.0%

Segment: 1 Near Dam

	Predicted Values--->			Observed Values--->		
Variable	**Mean**	**CV**	**Rank**	**Mean**	**CV**	**Rank**
TOTAL P MG/M3	237.4		96.2%	260.0		97.0%
CHL-A MG/M3				68.0		99.5%
SECCHI M				0.3		6.6%
ANTILOG PC-1				4428.2		98.6%
ANTILOG PC-2				10.1		80.5%
TURBIDITY 1/M	1.2		78.4%	1.2		78.4%
ZMIX * TURBIDITY	2.7		41.6%	2.7		41.6%
ZMIX / SECCHI				6.4		69.5%
CHL-A * SECCHI				23.3		87.9%
CHL-A / TOTAL P				0.3		67.5%
FREQ(CHL-a>10) %				99.7		99.5%
FREQ(CHL-a>20) %				95.2		99.5%
FREQ(CHL-a>30) %				84.4		99.5%
FREQ(CHL-a>40) %				70.7		99.5%
FREQ(CHL-a>50) %				57.4		99.5%
FREQ(CHL-a>60) %				45.7		99.5%
CARLSON TSI-P	83.0		96.2%	84.3		97.0%
CARLSON TSI-CHLA				72.0		99.5%
CARLSON TSI-SEC				75.4		93.4%

Mauvaise Terre Lake

Predicted & Observed Values Ranked Against CE Model Development Dataset

Segment: 2 Middle

Variable	Predicted Values---> Mean	CV	Rank	Observed Values---> Mean	CV	Rank
TOTAL P MG/M3	284.3		97.6%	250.0		96.7%
CHL-A MG/M3				53.0		98.8%
SECCHI M				0.3		2.8%
ANTILOG PC-1				4624.9		98.8%
ANTILOG PC-2				6.8		53.9%
TURBIDITY 1/M	2.6		95.1%	2.6		95.1%
ZMIX * TURBIDITY	3.4		54.6%	3.4		54.6%
ZMIX / SECCHI				5.2		55.9%
CHL-A * SECCHI				13.5		65.2%
CHL-A / TOTAL P				0.2		54.9%
FREQ(CHL-a>10) %				99.1		98.8%
FREQ(CHL-a>20) %				89.7		98.8%
FREQ(CHL-a>30) %				72.8		98.8%
FREQ(CHL-a>40) %				55.7		98.8%
FREQ(CHL-a>50) %				41.4		98.8%
FREQ(CHL-a>60) %				30.5		98.8%
CARLSON TSI-P	85.6		97.6%	83.8		96.7%
CARLSON TSI-CHLA				69.5		98.8%
CARLSON TSI-SEC				79.7		97.2%

Segment: 3 Upper Pool

Variable	Predicted Values---> Mean	CV	Rank	Observed Values---> Mean	CV	Rank
TOTAL P MG/M3	355.4		98.7%	370.0		98.8%
CHL-A MG/M3				71.0		99.6%
SECCHI M				0.2		1.4%
ANTILOG PC-1				7556.6		99.6%
ANTILOG PC-2				6.9		55.2%
TURBIDITY 1/M	3.2		97.0%	3.2		97.0%
ZMIX * TURBIDITY	1.9		26.5%	1.9		26.5%
ZMIX / SECCHI				3.0		21.6%
CHL-A * SECCHI				14.3		68.5%
CHL-A / TOTAL P				0.2		48.7%
FREQ(CHL-a>10) %				99.8		99.6%
FREQ(CHL-a>20) %				95.8		99.6%
FREQ(CHL-a>30) %				86.0		99.6%
FREQ(CHL-a>40) %				73.1		99.6%
FREQ(CHL-a>50) %				60.1		99.6%
FREQ(CHL-a>60) %				48.5		99.6%
CARLSON TSI-P	88.8		98.7%	89.4		98.8%
CARLSON TSI-CHLA				72.4		99.6%
CARLSON TSI-SEC				83.0		98.6%

Mauvaise Terre Lake

Segment Mass Balance Based Upon Predicted Concentrations

Component: TOTAL P **Segment: 1 Near Dam**

Trib	Type	Location	Flow hm^3/yr	Flow %Total	Load kg/yr	Load %Total	Conc mg/m^3
1	1	Trib 1	1.2	10.3%	181.6	2.9%	155
PRECIPITATION			0.3	2.8%	9.5	0.2%	30
TRIBUTARY INFLOW			1.2	10.3%	181.6	2.9%	155
ADVECTIVE INFLOW			9.9	86.9%	2808.6	44.4%	284
NET DIFFUSIVE INFLOW			0.0	0.0%	3320.5	52.5%	
***TOTAL INFLOW			11.4	100.0%	6320.2	100.0%	556
ADVECTIVE OUTFLOW			11.1	97.2%	2623.2	41.5%	237
***TOTAL OUTFLOW			11.1	97.2%	2623.2	41.5%	237
***EVAPORATION			0.3	2.8%	0.0	0.0%	
***RETENTION			0.0	0.0%	3697.0	58.5%	

Hyd. Residence Time = 0.0633 yrs
Overflow Rate = 34.8 m/yr
Mean Depth = 2.2 m

Component: TOTAL P **Segment: 2 Middle**

Trib	Type	Location	Flow hm^3/yr	Flow %Total	Load kg/yr	Load %Total	Conc mg/m^3
2	1	Trib 2	0.1	1.4%	21.7	0.4%	155
PRECIPITATION			0.2	2.3%	6.9	0.1%	30
TRIBUTARY INFLOW			0.1	1.4%	21.7	0.4%	155
ADVECTIVE INFLOW			9.7	96.3%	3461.3	67.6%	355
NET DIFFUSIVE INFLOW			0.0	0.0%	1629.8	31.8%	
***TOTAL INFLOW			10.1	100.0%	5119.7	100.0%	506
ADVECTIVE OUTFLOW			9.9	97.7%	2808.6	54.9%	284
***TOTAL OUTFLOW			9.9	97.7%	2808.6	54.9%	284
***EVAPORATION			0.2	2.3%	0.0	0.0%	
***RETENTION			0.0	0.0%	2311.1	45.1%	

Hyd. Residence Time = 0.0309 yrs
Overflow Rate = 42.8 m/yr
Mean Depth = 1.3 m

Component: TOTAL P **Segment: 3 Upper Pool**

Trib	Type	Location	Flow hm^3/yr	Flow %Total	Load kg/yr	Load %Total	Conc mg/m^3
3	1	Trib 3	0.5	4.6%	69.9	0.7%	155
4	1	Trib 4	9.3	94.1%	1439.9	15.4%	155
PRECIPITATION			0.1	1.3%	3.8	0.0%	30
INTERNAL LOAD			0.0	0.0%	7808.5	83.8%	
TRIBUTARY INFLOW			9.7	98.7%	1509.7	16.2%	155
***TOTAL INFLOW			9.9	100.0%	9322.0	100.0%	945
ADVECTIVE OUTFLOW			9.7	98.7%	3461.3	37.1%	355
NET DIFFUSIVE OUTFLOW			0.0	0.0%	4950.3	53.1%	
***TOTAL OUTFLOW			9.7	98.7%	8411.6	90.2%	864
***EVAPORATION			0.1	1.3%	0.0	0.0%	
***RETENTION			0.0	0.0%	910.4	9.8%	

Hyd. Residence Time = 0.0079 yrs
Overflow Rate = 77.3 m/yr
Mean Depth = 0.6 m

Mauvaise Terre Lake

Overall Water & Nutrient Balances

Overall Water Balance — **Averaging Period = 0.08 years**

Trb	Type	Seg	Name	Area km^2	Flow hm^3/yr	Variance (hm3/yr)^2	CV -	Runoff m/yr
1	1	1	Trib 1	9.4	1.2	0.00E+00	0.00	0.12
2	1	2	Trib 2	1.1	0.1	0.00E+00	0.00	0.12
3	1	3	Trib 3	3.6	0.5	0.00E+00	0.00	0.12
4	1	3	Trib 4	74.8	9.3	0.00E+00	0.00	0.12
PRECIPITATION				0.7	0.7	0.00E+00	0.00	1.02
TRIBUTARY INFLOW				89.0	11.1	0.00E+00	0.00	0.12
***TOTAL INFLOW				89.7	11.7	0.00E+00	0.00	0.13
ADVECTIVE OUTFLOW				89.7	11.1	0.00E+00	0.00	0.12
***TOTAL OUTFLOW				89.7	11.1	0.00E+00	0.00	0.12
***EVAPORATION					0.7	0.00E+00	0.00	

Overall Mass Balance Based Upon Component: **Predicted TOTAL P** — **Outflow & Reservoir Concentrations**

Trb	Type	Seg	Name	Load kg/yr	%Total	Load Variance (kg/yr)^2	%Total	CV	Conc mg/m^3	Export kg/km^2/yr
1	1	1	Trib 1	181.6	1.9%	0.00E+00		0.00	155.0	19.2
2	1	2	Trib 2	21.7	0.2%	0.00E+00		0.00	155.0	19.2
3	1	3	Trib 3	69.9	0.7%	0.00E+00		0.00	155.0	19.3
4	1	3	Trib 4	1439.9	15.1%	0.00E+00		0.00	155.0	19.2
PRECIPITATION				20.3	0.2%	0.00E+00		0.00	29.5	30.0
INTERNAL LOAD				7808.5	81.8%	0.00E+00		0.00		
TRIBUTARY INFLOW				1713.0	18.0%	0.00E+00		0.00	155.0	19.2
***TOTAL INFLOW				9541.8	100.0%	0.00E+00		0.00	812.9	106.4
ADVECTIVE OUTFLOW				2623.2	27.5%	0.00E+00		0.00	237.4	29.3
***TOTAL OUTFLOW				2623.2	27.5%	0.00E+00		0.00	237.4	29.3
***RETENTION				6918.6	72.5%	0.00E+00		0.00		

Overflow Rate (m/yr)	16.4	Nutrient Resid. Time (yrs)	0.0312
Hydraulic Resid. Time (yrs)	0.0978	Turnover Ratio	2.7
Reservoir Conc (mg/m3)	275	Retention Coef.	0.725

Mauvaise Terre Lake

Hydraulic & Dispersion Parameters

Seg	Name	Outflow Seg	Net Inflow hm^3/yr	Resid Time years	Overflow Rate m/yr	Velocity km/yr	Dispersion--------> Estimated km^2/yr	Numeric km^2/yr	Exchange hm^3/yr
1	Near Dam	0	11.1	0.0633	34.8	18.3	71.0	10.6	0.0
2	Middle	1	9.9	0.0309	42.8	26.6	167.0	10.9	70.8
3	Upper Pool	2	9.7	0.0079	77.3	86.2	448.2	29.3	69.6

Morphometry

Seg	Name	Area km^2	Zmean m	Zmix m	Length km	Volume hm^3	Width km	L/W -
1	Near Dam	0.3	2.2	2.2	1.2	0.7	0.3	4.2
2	Middle	0.2	1.3	1.3	0.8	0.3	0.3	2.9
3	Upper Pool	0.1	0.6	0.6	0.7	0.1	0.2	3.7
Totals		0.7	1.6			1.1		

Mauvaise Terre Lake

Segment & Tributary Network

--------Segment:	1	Near Dam		
Outflow Segment:	0	Out of Reservoir		
Tributary:	1	Trib 1	Type:	Monitored Inflow
--------Segment:	2	Middle		
Outflow Segment:	1	Near Dam		
Tributary:	2	Trib 2	Type:	Monitored Inflow
--------Segment:	3	Upper Pool		
Outflow Segment:	2	Middle		
Tributary:	3	Trib 3	Type:	Monitored Inflow
Tributary:	4	Trib 4	Type:	Monitored Inflow

Mauvaise Terre Lake
Description:
Single reservoir (172 acres)
3 segments

Global Variables	Mean	CV
Averaging Period (yrs)	0.0833	0.0
Precipitation (m)	0.0846	0.0
Evaporation (m)	0.0846	0.0
Storage Increase (m)	0	0.0

Atmos. Loads (kg/km^2-yr)	Mean	CV
Conserv. Substance	0	0.00
Total P	30	0.50
Total N	1000	0.50
Ortho P	15	0.50
Inorganic N	500	0.50

Model Options	Code	Description
Conservative Substance	0	NOT COMPUTED
Phosphorus Balance	1	2ND ORDER, AVAIL P
Nitrogen Balance	0	NOT COMPUTED
Chlorophyll-a	0	NOT COMPUTED
Secchi Depth	0	NOT COMPUTED
Dispersion	1	FISCHER-NUMERIC
Phosphorus Calibration	2	CONCENTRATIONS
Nitrogen Calibration	0	NONE
Error Analysis	0	NOT COMPUTED
Availability Factors	0	IGNORE
Mass-Balance Tables	1	USE ESTIMATED CONCS
Output Destination	2	EXCEL WORKSHEET

Segment Morphometry

		Outflow		Area	Depth	Length	Mixed Depth (m)		Hypol Depth		Non-Algal Turb (m^{-1})		Internal Loads (mg/m2-day) Conserv.		Total P		Total N	
Seg	Name	Segment	Group	km^2	m	km	Mean	CV	Mean	CV	Mean	CV	Mean	CV	Mean	CV	Mean	CV
1	Near Dam	0	1	0.318	2.2	1.16	2.2	0	0	0	1.215452	0	0	0	0	0	0	0
2	Middle	1	1	0.231	1.32	0.82	1.32	0	0	0	2.612008	0	0	0	0	0	0	0
3	Upper Pool	2	1	0.126	0.61	0.68	0.61	0	0	0	3.175495	0	0	0	169.67	0	0	0

Segment Observed Water Quality

	Conserv		Total P (ppb)		Total N (ppb)		Chl-a (ppb)		Secchi (m)		Organic N (ppb)		TP - Ortho P (ppb)		HOD (ppb/day)		MOD (ppb/day)	
Seg	Mean	CV	Mean	CV	Mean	CV	Mean	CV	Mean	CV	Mean	CV	Mean	CV	Mean	CV	Mean	CV
1	0	0	260	0	0	0	68	0	0.343	0	0	0	0	0	0	0	0	0
2	0	0	250	0	0	0	53	0	0.254	0	0	0	0	0	0	0	0	0
3	0	0	370	0	0	0	71	0	0.202	0	0	0	0	0	0	0	0	0

Segment Calibration Factors

	Dispersion Rate		Total P (ppb)		Total N (ppb)		Chl-a (ppb)		Secchi (m)		Organic N (ppb)		TP - Ortho P (ppb)		HOD (ppb/day)		MOD (ppb/day)	
Seg	Mean	CV	Mean	CV	Mean	CV	Mean	CV	Mean	CV	Mean	CV	Mean	CV	Mean	CV	Mean	CV
1	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0
2	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0
3	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0

Mauvaise Terre Lake
Tributary Data

Trib	Trib Name	Segment	Type	Dr Area km^2	Flow (hm^3/yr) Mean	Conserv. CV	Conserv. Mean	Total P (ppb) CV	Total P (ppb) Mean	Total N (ppb) CV	Total N (ppb) Mean	Ortho P (ppb) CV	Ortho P (ppb) Mean	Inorganic N (ppb) CV	Inorganic N (ppb) Mean	CV
1	Trib 1	1	1	9.431433	1.1713	0	0	0	155	0	0	0	0	0	0	0
2	Trib 2	2	1	1.130026	0.1403	0	0	0	155	0	0	0	0	0	0	0
3	Trib 3	3	1	3.630549	0.4509	0	0	0	155	0	0	0	0	0	0	0
4	Trib 4	3	1	74.80244	9.2894	0	0	0	155	0	0	0	0	0	0	0

Model Coefficients	Mean	CV
Dispersion Rate	1.000	0.70
Total Phosphorus	1.000	0.45
Total Nitrogen	1.000	0.55
Chl-a Model	1.000	0.26
Secchi Model	1.000	0.10
Organic N Model	1.000	0.12
TP-OP Model	1.000	0.15
HODv Model	1.000	0.15
MODv Model	1.000	0.22
Secchi/Chla Slope (m^2/mg)	0.025	0.00
Minimum Qs (m/yr)	0.100	0.00
Chl-a Flushing Term	1.000	0.00
Chl-a Temporal CV	0.620	0
Avail. Factor - Total P	0.330	0
Avail. Factor - Ortho P	1.930	0
Avail. Factor - Total N	0.590	0
Avail. Factor - Inorganic N	0.790	0

Attachment 2

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Data for Manganese Load Duration Curves

Flow (cfs)	% of Time Exceeded	Manganese load (kg/day)
0.0	100.00	0.00
0.0	99.99	0.00
0.0	99.45	0.00
0.0	98.95	0.00
0.0	98.45	0.00
0.0	97.95	0.00
0.0	97.45	0.00
0.0	96.95	0.00
0.0	96.45	0.00
0.0	95.95	0.00
0.0	95.45	0.00
0.0	94.95	0.00
0.0	94.45	0.00
0.0	93.95	0.00
0.0	93.45	0.00
0.0	92.95	0.00
0.0	92.45	0.00
0.0	91.95	0.00
0.0	91.45	0.00
0.0	90.95	0.00
0.0	90.46	0.00
0.0	89.96	0.01
0.0	89.46	0.01
0.0	88.96	0.01
0.0	88.46	0.01
0.1	87.96	0.02
0.1	87.46	0.02
0.1	86.96	0.03
0.1	86.46	0.04
0.1	85.96	0.04
0.1	85.46	0.05
0.1	84.96	0.05
0.2	84.46	0.06
0.2	83.96	0.07
0.2	83.46	0.07
0.2	82.96	0.08
0.3	82.46	0.09
0.3	81.96	0.10
0.3	81.46	0.11
0.3	80.96	0.12
0.4	80.46	0.13
0.4	79.96	0.14
0.4	79.46	0.15
0.4	78.96	0.16
0.5	78.46	0.18
0.5	77.96	0.19
0.5	77.46	0.20
0.6	76.96	0.21
0.6	76.46	0.24
0.7	75.96	0.25
0.7	75.46	0.27
0.8	74.96	0.29
0.9	74.46	0.32

Observed Data

Date	Flow (cfs)	Mn (ug/l)	Percentile	Manganese load (kg/day)
4/11/2002	35.65	90	14.3	7.85
6/7/2002	17.66	67	27.9	2.90
7/10/2002	8.67	120	44.5	2.55
8/15/2002	3.53	220	59.6	1.90
10/17/2002	0.05	420	88.1	0.05

Data for Manganese Load Duration Curves

Flow (cfs)	% of Time Exceeded	Manganese load (kg/day)
0.9	73.96	0.34
1.0	73.46	0.37
1.1	72.96	0.39
1.1	72.47	0.41
1.2	71.97	0.44
1.3	71.47	0.46
1.3	70.97	0.49
1.4	70.47	0.52
1.5	69.97	0.54
1.6	69.47	0.59
1.7	68.97	0.61
1.7	68.47	0.64
1.8	67.97	0.67
1.9	67.47	0.71
2.0	66.97	0.73
2.1	66.47	0.77
2.2	65.97	0.80
2.3	65.47	0.84
2.4	64.97	0.87
2.5	64.47	0.92
2.6	63.97	0.94
2.7	63.47	1.00
2.9	62.97	1.05
3.0	62.47	1.10
3.1	61.97	1.14
3.2	61.47	1.18
3.2	60.97	1.18
3.5	60.47	1.30
3.5	59.97	1.30
3.9	59.47	1.41
3.9	58.97	1.41
4.2	58.47	1.53
4.2	57.97	1.53
4.5	57.47	1.65
4.5	56.97	1.65
4.5	56.47	1.65
4.8	55.97	1.77
4.8	55.47	1.77
5.1	54.97	1.89
5.1	54.48	1.89
5.5	53.98	2.00
5.8	53.48	2.12
5.8	52.98	2.12
6.1	52.48	2.24
6.1	51.98	2.24
6.4	51.48	2.36
6.4	50.98	2.36
6.7	50.48	2.47
6.7	49.98	2.47
7.1	49.48	2.59
7.1	48.98	2.59
7.4	48.48	2.71
7.4	47.98	2.71
7.7	47.48	2.83
7.7	46.98	2.83

Data for Manganese Load Duration Curves

Flow (cfs)	% of Time Exceeded	Manganese load (kg/day)
8.0	46.48	2.95
8.3	45.98	3.06
8.3	45.48	3.06
8.7	44.98	3.18
9.0	44.48	3.30
9.0	43.98	3.30
9.3	43.48	3.42
9.3	42.98	3.42
9.6	42.48	3.54
10.0	41.98	3.65
10.0	41.48	3.65
10.3	40.98	3.77
10.6	40.48	3.89
10.6	39.98	3.89
10.9	39.48	4.01
11.2	38.98	4.12
11.6	38.48	4.24
11.6	37.98	4.24
11.9	37.48	4.36
12.2	36.98	4.48
12.5	36.48	4.60
12.5	35.99	4.60
12.8	35.49	4.71
13.2	34.99	4.83
13.5	34.49	4.95
13.5	33.99	4.95
13.8	33.49	5.07
14.1	32.99	5.19
14.5	32.49	5.30
14.8	31.99	5.42
15.1	31.49	5.54
15.4	30.99	5.66
15.7	30.49	5.77
16.1	29.99	5.89
16.7	29.49	6.13
17.0	28.99	6.25
17.3	28.49	6.36
17.7	27.99	6.48
18.0	27.49	6.60
18.6	26.99	6.84
18.9	26.49	6.95
19.3	25.99	7.07
19.6	25.49	7.19
19.9	24.99	7.31
20.6	24.49	7.54
21.2	23.99	7.78
21.5	23.49	7.90
22.2	22.99	8.13
22.5	22.49	8.25
23.1	21.99	8.49
23.8	21.49	8.72
24.4	20.99	8.96
25.0	20.49	9.19
25.7	19.99	9.43
26.3	19.49	9.66

Data for Manganese Load Duration Curves

Flow (cfs)	% of Time Exceeded	Manganese load (kg/day)
27.3	18.99	10.02
27.9	18.49	10.25
28.6	18.00	10.49
29.2	17.50	10.72
30.5	17.00	11.20
31.5	16.50	11.55
32.4	16.00	11.90
33.4	15.50	12.26
34.4	15.00	12.61
35.3	14.50	12.96
36.6	14.00	13.43
37.9	13.50	13.91
39.2	13.00	14.38
40.5	12.50	14.85
41.7	12.00	15.32
43.4	11.50	15.91
45.0	11.00	16.50
46.9	10.50	17.21
48.8	10.00	17.91
50.7	9.50	18.62
53.3	9.00	19.56
55.6	8.50	20.39
58.1	8.00	21.33
61.0	7.50	22.39
64.2	7.00	23.57
68.4	6.50	25.10
72.6	6.00	26.63
77.7	5.50	28.52
83.5	5.00	30.64
90.2	4.50	33.12
97.6	4.00	35.83
108.9	3.50	39.95
122.0	3.00	44.78
137.4	2.50	50.44
157.4	2.00	57.75
188.8	1.50	69.29
231.5	1.00	84.97
321.1	0.50	117.85
1708.4	0.00	626.95

Attachment 3

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Data for Nitrate Load Duration Curves

Flow (cfs)	% of Time Exceeded	Nitrate load (kg/d)
0.0	100	0.00
0.0	100	0.00
0.0	99	0.00
0.0	98	0.00
0.0	98	0.00
0.0	97	0.00
0.0	97	0.00
0.0	96	0.00
0.0	96	0.00
0.0	95	0.00
0.0	95	0.00
0.0	94	0.00
0.0	94	0.00
0.0	93	0.00
0.0	93	0.00
0.0	92	0.00
0.0	92	0.00
0.0	91	0.00
0.0	91	0.08
0.0	90	0.16
0.0	90	0.39
0.0	89	0.71
0.0	89	0.79
0.0	88	0.94
0.1	88	1.41
0.1	87	1.57
0.1	87	1.89
0.1	86	2.36
0.1	86	2.59
0.1	85	3.14
0.1	85	3.46
0.2	84	3.93
0.2	84	4.48
0.2	83	4.71
0.2	83	5.50
0.3	82	6.21
0.3	82	6.52
0.3	81	7.15
0.3	81	7.86
0.4	80	8.64
0.4	80	9.43
0.4	79	10.21
0.4	79	11.00
0.5	78	11.78
0.5	78	12.57
0.5	77	13.36
0.6	77	14.14
0.6	76	15.71
0.7	76	16.50
0.7	75	18.07

Observed Data

Date	Flow (cfs)	Nitrate (mg/l)	Percentile	Nitrate load (kg/d)
4/15/1992	13.81	9.3	33.5	314.18
6/3/1992	7.39	1.3	47.8	23.49
7/2/1992	4.50	0.08	56.4	0.88
8/25/1992	0.00	0.01	91.3	0.00
4/11/2002	35.65	13	14.3	1133.69
6/7/2002	17.66	12	27.9	518.53
7/10/2002	8.67	6.68	44.5	141.70
8/15/2002	3.53	0.13	59.6	1.12

Data for Nitrate Load Duration Curves

Flow (cfs)	% of Time Exceeded	Nitrate load (kg/d)
0.8	75	19.64
0.9	74	21.21
0.9	74	22.78
1.0	73	24.36
1.1	73	25.93
1.1	72	27.50
1.2	72	29.07
1.3	71	30.64
1.3	71	33.00
1.4	70	34.57
1.5	70	36.14
1.6	69	39.28
1.7	69	40.85
1.7	68	42.43
1.8	68	44.78
1.9	67	47.14
2.0	67	48.71
2.1	66	51.07
2.2	66	53.42
2.3	65	55.78
2.4	65	58.14
2.5	64	61.28
2.6	64	62.85
2.7	63	66.78
2.9	63	69.92
3.0	62	73.07
3.1	62	76.21
3.2	61	78.56
3.2	61	78.56
3.5	60	86.42
3.5	60	86.42
3.9	59	94.28
3.9	59	94.28
4.2	58	102.13
4.2	58	102.13
4.5	57	109.99
4.5	57	109.99
4.5	56	109.99
4.8	56	117.85
4.8	55	117.85
5.1	55	125.70
5.1	54	125.70
5.5	54	133.56
5.8	53	141.42
5.8	53	141.42
6.1	52	149.27
6.1	52	149.27
6.4	51	157.13
6.4	51	157.13
6.7	50	164.99
6.7	50	164.99
7.1	49	172.84

Data for Nitrate Load Duration Curves

Flow (cfs)	% of Time Exceeded	Nitrate load (kg/d)
7.1	49	172.84
7.4	48	180.70
7.4	48	180.70
7.7	47	188.56
7.7	47	188.56
8.0	46	196.41
8.3	46	204.27
8.3	45	204.27
8.7	45	212.13
9.0	44	219.98
9.0	44	219.98
9.3	43	227.84
9.3	43	227.84
9.6	42	235.69
10.0	42	243.55
10.0	41	243.55
10.3	41	251.41
10.6	40	259.26
10.6	40	259.26
10.9	39	267.12
11.2	39	274.98
11.6	38	282.83
11.6	38	282.83
11.9	37	290.69
12.2	37	298.55
12.5	36	306.40
12.5	36	306.40
12.8	35	314.26
13.2	35	322.12
13.5	34	329.97
13.5	34	329.97
13.8	33	337.83
14.1	33	345.69
14.5	32	353.54
14.8	32	361.40
15.1	31	369.25
15.4	31	377.11
15.7	30	384.97
16.1	30	392.82
16.7	29	408.54
17.0	29	416.39
17.3	28	424.25
17.7	28	432.11
18.0	27	439.96
18.6	27	455.68
18.9	26	463.53
19.3	26	471.39
19.6	25	479.25
19.9	25	487.10
20.6	24	502.82
21.2	24	518.53
21.5	23	526.38

Data for Nitrate Load Duration Curves

Flow (cfs)	% of Time Exceeded	Nitrate load (kg/d)
22.2	23	542.10
22.5	22	549.95
23.1	22	565.67
23.8	21	581.38
24.4	21	597.09
25.0	20	612.81
25.7	20	628.52
26.3	19	644.23
27.3	19	667.80
27.9	18	683.51
28.6	18	699.23
29.2	17	714.94
30.5	17	746.37
31.5	16	769.94
32.4	16	793.51
33.4	15	817.07
34.4	15	840.64
35.3	14	864.21
36.6	14	895.64
37.9	13	927.07
39.2	13	958.49
40.5	12	989.92
41.7	12	1021.34
43.4	11	1060.63
45.0	11	1099.91
46.9	10	1147.05
48.8	10	1194.19
50.7	9	1241.33
53.3	9	1304.18
55.6	9	1359.17
58.1	8	1422.02
61.0	8	1492.73
64.2	7	1571.30
68.4	7	1673.43
72.6	6	1775.57
77.7	6	1901.27
83.5	5	2042.69
90.2	5	2207.67
97.6	4	2388.37
108.9	4	2663.35
122.0	3	2985.47
137.4	3	3362.58
157.4	2	3849.68
188.8	2	4619.61
231.5	1	5664.53
321.1	1	7856.49
1708.4	0	41796.51

Attachment 4

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Data for Fecal Coliform Load Duration Curves

Flow (cfs)	% of Time Exceeded	Load (cfu/day)
0.0	100.00	0.00E+00
0.0	99.99	0.00E+00
0.0	99.45	0.00E+00
0.0	98.95	0.00E+00
0.0	98.45	0.00E+00
0.0	97.95	0.00E+00
0.0	97.45	0.00E+00
0.0	96.95	0.00E+00
0.0	96.45	0.00E+00
0.0	95.95	0.00E+00
0.0	95.45	0.00E+00
0.0	94.95	0.00E+00
0.0	94.45	0.00E+00
0.0	93.95	0.00E+00
0.0	93.45	0.00E+00
0.0	92.95	0.00E+00
0.0	92.45	0.00E+00
0.0	91.95	0.00E+00
0.0	91.45	0.00E+00
0.0	90.95	1.27E+08
0.0	90.46	2.54E+08
0.1	89.96	6.36E+08
0.1	89.46	1.15E+09
0.1	88.96	1.27E+09
0.2	88.46	1.53E+09
0.2	87.96	2.29E+09
0.3	87.46	2.54E+09
0.3	86.96	3.05E+09
0.4	86.46	3.82E+09
0.4	85.96	4.20E+09
0.5	85.46	5.09E+09
0.6	84.96	5.60E+09
0.7	84.46	6.36E+09
0.7	83.96	7.25E+09
0.8	83.46	7.63E+09
0.9	82.96	8.91E+09
1.0	82.46	1.01E+10
1.1	81.96	1.06E+10
1.2	81.46	1.16E+10
1.3	80.96	1.27E+10
1.4	80.46	1.40E+10
1.6	79.96	1.53E+10
1.7	79.46	1.65E+10
1.8	78.96	1.78E+10
2.0	78.46	1.91E+10
2.1	77.96	2.04E+10
2.2	77.46	2.16E+10
2.3	76.96	2.29E+10
2.6	76.46	2.54E+10
2.7	75.96	2.67E+10
3.0	75.46	2.93E+10
3.3	74.96	3.18E+10
3.5	74.46	3.44E+10
3.8	73.96	3.69E+10
4.0	73.46	3.94E+10

Observed Data

Date	Flow (cfs)	Fecal coliform (cfu/100 ml)	Percentile	Load (cfu/day)
5/31/1990	20.80	500	54.5	2.54E+11
7/12/1990	167.70	11000	12.1	4.51E+13
8/23/1990	37.70	6200	43.0	5.72E+12
10/10/1990	24.70	20000	51.6	1.21E+13
5/2/1991	16.90	2400	57.5	9.92E+11
5/30/1991	0.14	110000	88.5	3.85E+11
7/8/1991	6.63	600	69.0	9.73E+10
8/27/1991	54.60	1400	33.9	1.87E+12
10/2/1991	4.29	650	72.8	6.82E+10
6/2/1992	241.80	410	7.7	2.43E+12
7/20/1992	7.02	2040	68.4	3.50E+11
8/18/1992	11.57	700	62.9	1.98E+11
9/17/1992	24.70	760	51.6	4.59E+11
10/28/1992	0.17	140	88.3	5.79E+08
5/6/1993	3.12	360	75.0	2.75E+10
6/3/1993	67.60	430	29.1	7.11E+11
8/9/1993	28.60	420	48.6	2.94E+11
9/16/1993	35.10	2800	44.5	2.40E+12
5/11/1994	3.12	440	75.0	3.36E+10
6/23/1994	18.20	540	56.4	2.40E+11
7/27/1994	10.92	280	63.5	7.48E+10
9/14/1994	42.90	3500	39.9	3.67E+12
10/20/1994	2.60	1200	76.2	7.63E+10
5/4/1995	0.00	400	91.3	0.00E+00
6/21/1995	6.24	12000	69.6	1.83E+12
9/7/1995	36.40	3500	43.7	3.12E+12
9/25/1995	45.50	920	38.5	1.02E+12
5/15/1996	8.45	900	66.4	1.86E+11
7/1/1996	65.00	1400	29.9	2.23E+12
8/12/1996	23.40	440	52.5	2.52E+11
9/4/1996	422.50	280	3.6	2.89E+12
5/12/1997	5.59	820	70.6	1.12E+11
6/23/1997	0.00	1000	91.3	0.00E+00
8/12/1997	236.60	1750	7.9	1.01E+13
9/22/1997	65.00	1300	29.9	2.07E+12
7/6/1998	53.30	660	34.6	8.61E+11
9/30/1998	66.30	1600	29.5	2.60E+12
10/25/2001	28.60	400	48.6	2.80E+11
5/14/2002	92.30	2200	22.2	4.97E+12
7/8/2002	24.70	360	51.6	2.18E+11
8/1/2002	45.50	320	38.5	3.56E+11
9/16/2002	390.00	15700	4.1	1.50E+14
10/24/2002	132.60	140	15.7	4.54E+11
7/2/2003	13.00	780	60.7	2.48E+11
8/7/2003	107.90	640	19.3	1.69E+12
9/17/2003	884.00	485	1.1	1.05E+13
5/4/2004	1.05	330	82.1	8.50E+09
6/1/2004	23.40	1600	52.5	9.16E+11
6/30/2004	45.50	700	38.5	7.79E+11

Data for Fecal Coliform Load Duration Curves

Flow (cfs)	% of Time Exceeded	Load (cfu/day)
4.3	72.96	4.20E+10
4.6	72.47	4.45E+10
4.8	71.97	4.71E+10
5.1	71.47	4.96E+10
5.5	70.97	5.34E+10
5.7	70.47	5.60E+10
6.0	69.97	5.85E+10
6.5	69.47	6.36E+10
6.8	68.97	6.62E+10
7.0	68.47	6.87E+10
7.4	67.97	7.25E+10
7.8	67.47	7.63E+10
8.1	66.97	7.89E+10
8.5	66.47	8.27E+10
8.8	65.97	8.65E+10
9.2	65.47	9.03E+10
9.6	64.97	9.42E+10
10.1	64.47	9.92E+10
10.4	63.97	1.02E+11
11.1	63.47	1.08E+11
11.6	62.97	1.13E+11
12.1	62.47	1.18E+11
12.6	61.97	1.23E+11
13.0	61.47	1.27E+11
13.0	60.97	1.27E+11
14.3	60.47	1.40E+11
14.3	59.97	1.40E+11
15.6	59.47	1.53E+11
15.6	58.97	1.53E+11
16.9	58.47	1.65E+11
16.9	57.97	1.65E+11
18.2	57.47	1.78E+11
18.2	56.97	1.78E+11
18.2	56.47	1.78E+11
19.5	55.97	1.91E+11
19.5	55.47	1.91E+11
20.8	54.97	2.04E+11
20.8	54.48	2.04E+11
22.1	53.98	2.16E+11
23.4	53.48	2.29E+11
23.4	52.98	2.29E+11
24.7	52.48	2.42E+11
24.7	51.98	2.42E+11
26.0	51.48	2.54E+11
26.0	50.98	2.54E+11
27.3	50.48	2.67E+11
27.3	49.98	2.67E+11
28.6	49.48	2.80E+11
28.6	48.98	2.80E+11
29.9	48.48	2.93E+11
29.9	47.98	2.93E+11
31.2	47.48	3.05E+11
31.2	46.98	3.05E+11
32.5	46.48	3.18E+11
33.8	45.98	3.31E+11
33.8	45.48	3.31E+11
35.1	44.98	3.44E+11

Data for Fecal Coliform Load Duration Curves

Flow (cfs)	% of Time Exceeded	Load (cfu/day)
36.4	44.48	3.56E+11
36.4	43.98	3.56E+11
37.7	43.48	3.69E+11
37.7	42.98	3.69E+11
39.0	42.48	3.82E+11
40.3	41.98	3.94E+11
40.3	41.48	3.94E+11
41.6	40.98	4.07E+11
42.9	40.48	4.20E+11
42.9	39.98	4.20E+11
44.2	39.48	4.33E+11
45.5	38.98	4.45E+11
46.8	38.48	4.58E+11
46.8	37.98	4.58E+11
48.1	37.48	4.71E+11
49.4	36.98	4.83E+11
50.7	36.48	4.96E+11
50.7	35.99	4.96E+11
52.0	35.49	5.09E+11
53.3	34.99	5.22E+11
54.6	34.49	5.34E+11
54.6	33.99	5.34E+11
55.9	33.49	5.47E+11
57.2	32.99	5.60E+11
58.5	32.49	5.73E+11
59.8	31.99	5.85E+11
61.1	31.49	5.98E+11
62.4	30.99	6.11E+11
63.7	30.49	6.23E+11
65.0	29.99	6.36E+11
67.6	29.49	6.62E+11
68.9	28.99	6.74E+11
70.2	28.49	6.87E+11
71.5	27.99	7.00E+11
72.8	27.49	7.13E+11
75.4	26.99	7.38E+11
76.7	26.49	7.51E+11
78.0	25.99	7.63E+11
79.3	25.49	7.76E+11
80.6	24.99	7.89E+11
83.2	24.49	8.14E+11
85.8	23.99	8.40E+11
87.1	23.49	8.52E+11
89.7	22.99	8.78E+11
91.0	22.49	8.91E+11
93.6	21.99	9.16E+11
96.2	21.49	9.42E+11
98.8	20.99	9.67E+11
101.4	20.49	9.92E+11
104.0	19.99	1.02E+12
106.6	19.49	1.04E+12
110.5	18.99	1.08E+12
113.1	18.49	1.11E+12
115.7	18.00	1.13E+12
118.3	17.50	1.16E+12
123.5	17.00	1.21E+12
127.4	16.50	1.25E+12

Data for Fecal Coliform Load Duration Curves

Flow (cfs)	% of Time Exceeded	Load (cfu/day)
131.3	16.00	1.29E+12
135.2	15.50	1.32E+12
139.1	15.00	1.36E+12
143.0	14.50	1.40E+12
148.2	14.00	1.45E+12
153.4	13.50	1.50E+12
158.6	13.00	1.55E+12
163.8	12.50	1.60E+12
169.0	12.00	1.65E+12
175.5	11.50	1.72E+12
182.0	11.00	1.78E+12
189.8	10.50	1.86E+12
197.6	10.00	1.93E+12
205.4	9.50	2.01E+12
215.8	9.00	2.11E+12
224.9	8.50	2.20E+12
235.3	8.00	2.30E+12
247.0	7.50	2.42E+12
260.0	7.00	2.54E+12
276.9	6.50	2.71E+12
293.8	6.00	2.88E+12
314.6	5.50	3.08E+12
338.0	5.00	3.31E+12
365.3	4.50	3.58E+12
395.2	4.00	3.87E+12
440.7	3.50	4.31E+12
494.0	3.00	4.83E+12
556.4	2.50	5.45E+12
637.0	2.00	6.23E+12
764.4	1.50	7.48E+12
937.3	1.00	9.17E+12
1300.0	0.50	1.27E+13
6916.0	0.00	6.77E+13

Attachment 5

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Mauvaise Terre Responsiveness Summary

1. During the presentation, it was stated that the computer model BATHTUB used for Mauvaise Terre Lake indicated that "internal" phosphorus loading from sediment was the primary source (of phosphorus?). It was stated that the external (tributary) phosphorus loads were quantified using a scenario where internal loading was not occurring. Could you please indicate what percentage of the potential phosphorus load is external versus internal loading? I assume that the release of phosphorus from the lake sediment would occur only when the oxygen is depleted in the lake. How often or how severe is the oxygen depleted within the lake? Are there any trends?

Response: Internal phosphorus loading from the bottom sediments is the primary source of phosphorus to the water column. Model results indicate 18% of the phosphorus load is from external sources and 82 % from an internal source. Phosphorus data collected at different water depths show higher concentrations of phosphorus near the lake bottom. Mauvaise Terre Lake is shallow and dissolved oxygen does not approach zero at any of the three monitoring stations (data collected in1992, 1993 and 2005). The higher phosphorus concentrations measured deeper in the water column suggest resuspension of in-place sediments as a source. The range of phosphorus concentrations measured over 12 years is constant; no trends were observed.

2. During the presentation, a question from the public was received regarding the number of sample points (and locations) related to fecal coliform. Please confirm that there was only one sampling station 1.5 miles Northeast of Merritt used for fecal coliform with approximately 45 samples collected during the summer months between 1990 through 2004. It is my understanding that the load duration curve for Mauvaise Terre Creek was established using flows from Spring Creek (near Springfield) since there are no flow data available for Mauvaise Terre Creek at the single sampling point. It did not seem like there was much difference between low flow and high flow conditions. Is there a quantitative correlation between the City's CSO discharges (presumably occurring during high flow conditions) and the sampling of data points for fecal coliform? There seems to be several potential sources of fecal coliform contamination upstream of the sampling point near Merritt.

Response: Data collected at the sampling station 1.5 miles Northeast of Merritt was used to develop the load duration curve. 49 samples collected at this location between May and October were used for the load duration curve. The dataset covered the period May 1990 to June 2004. You are correct that flows were not available for Mauvaise Terre Creek and that flows measured on Spring Creek were used to synthesize a flow record for Mauvaise Terre Creek. As part of the Stage 1 report, potential sources of fecal coliform were identified and included CSOs, livestock operations, municipal sewage disposal, private sewage disposal systems and runoff from manure-fertilized cropland. We do not have instream fecal coliform measurements collected on the same date of the known occurrence of CSOs. While we do have monthly DMR data that summarizes whether a CSO occurred in a given month, we do not have information on which day(s) of the month the overflow occurred. Such data could be obtained and analyzed to see if there was a trend towards higher instream concentrations during periods of CSO discharge.

This information would be useful, but not necessarily conclusive because it does not take into consideration the effect that wet weather has on other potential sources.

3. During the presentation in July, it was stated that one sampling point for fecal coliform was used in Mauvaise Terre Creek near Exeter. I wonder if additional monitoring points would be advisable; perhaps both upstream and downstream of the Jacksonville Wastewater Treatment Plants, and during high and low water conditions.

Response: A Plan of Study for CSO Assessment has been submitted to the Agency by the City of Jacksonville. In this plan, the city proposes monitoring for fecal coliform and E. coli during dry and wet weather both upstream and downstream of CSO discharges. The Agency is currently reviewing this plan with the goal of having an approved monitoring plan so that monitoring can be done during the spring of 2007.

4. Mauvaise Terre Lake is a secondary public water supply source for the city. Does the standard still apply when we do not use this source often?

Response: Yes, the standard still applies. If there is the potential for the city to use this water for drinking water purposes, the public water supply standard applies.

5. The City is working with the Army Corps of Engineers for a dredging project on Mauvaise Terre Lake. We are attempting to develop a plan to dredge, or otherwise remove, some of the approximately 2.1 million cubic yards of silt, which has accumulated in the lake. I wonder how the City's plans to remove silt from the Lake Mauvaise Terre would affect the TMDL study for that body of water. Should we be working with Illinois EPA on this project and keep you informed? We have been setting aside money for dredging for the last fifteen years. The Army Corps has done a preliminary study, but they have not informed us if they are going to continue on. We really want to get this project done and would like to know if the state can contribute some funds toward this.

Response: In the TMDL Report, we state that "the lake phosphorus concentrations would still exceed the water quality standard regardless of reducing the tributary load due to elevated internal phosphorus loads from lake sediment. This internal phosphorus flux is expected to decrease in the future in response to external phosphorus load reductions, reverting back to more typical conditions." This can be a long process and while dredging takes care of the internal phosphorus load, it does not decrease the external load which caused the internal load to begin with. If the external load is not reduced, the internal source would build up once again. Illinois EPA does have 319 Nonpont Source funds to use for projects in watersheds. Because of the high costs of dredging, 319 funds are rarely used for this kind of work. 319 funds can be used on projects in the watershed to reduce runoff (external loads). More information on 319 funds and other implementation activities will be available in the Implementation Plan. Another meeting will be held in the watershed to discuss this. If you would like any information on the 319 program before this meeting, please call the Illinois EPA 319 Coordinator, Amy Walkenbach, at 217/782-3362.

6. One of the sources of fecal coliform could be septic system failures. How are you going to deal with septic problems?

Response: Household septic systems are currently regulated by the Illinois Department of Public Health and local health departments. In the TMDL Implementation Plan, we will work with these entities to provide information on septic system evaluation, testing and maintenance. If you are aware of any failures or have any questions on failing septic systems, please contact your local county health department for information. Call the Illinois Department of Public Health at (217) 782-4977 or go the website at http://www.idph.state.il.us/local/alpha.htm for county health department websites and phone numbers.

7. Is there any concern for a rural landowner who is trying to build in this watershed and add to the septic load? Does the health department check these septic systems?

Response: Individual septic systems are regulated by the Illinois Department of Public Health through local health departments. Landowners are required to comply with the regulations and ordinances of these entities. Permitting and inspections of these systems are performed by the local health department. Sewage treatment facilities with a surface discharge are required by federal law to obtain an NPDES issued by Illinois Environmental Protection Agency. Properly designed, maintained and operated septic systems should not increase the fecal coliform load to nearby streams.

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Attachment 6

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Long Term Control Plan – CSO Disinfection

Jacksonville Wastewater Treatment Plant

Jacksonville, IL

Prepared For:

City of Jacksonville
200 West Douglas Ave.
Jacksonville, IL 62650

Prepared By:

Benton & Associates, Inc.
1970 West Lafayette, Ave
Jacksonville, IL 62650

Sub-Consultant:

Camp, Dresser, & McKee
100 North Tucker, Suite 550
St. Louis, MO 63101

October 2008

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1.0 Introduction

NPDES Permit No. IL0021661[1] issued on September 29, 2004 contained modifications that included provisions for the City of Jacksonville (City) to develop and implement a CSO Control Plan (Appendix A). The City submitted a CSO Plan of Study (POS) to the IEPA on April 29, 2005[2] (Appendix B). During the review of the CSO POS, the Total Maximum Daily Load (TMDL) for Mauvaise Terre Creek was finalized[3]. The TMDL listed the creek for excessive levels of fecal coliform and provided a load allocation for the City's CSO discharges of 5.72×10^{10} colony forming units (cfu) of fecal coliform per day. A review letter received November 29, 2006[4] from IEPA indicated that the TMDL findings should be incorporated in the POS. Upon receipt of this review letter the City, Engineers, and IEPA representatives met on January 19th, 2007 to discuss further refinement of the POS and potential alternatives to meet the TMDL limits in Mauvaise Terre Creek for fecal coliform (see Appendix C for IEPA Correspondence). The major result from this meeting was the City's decision to forgo the completion of the POS and proceed directly with a Long Term Control Plan (LTCP) with emphasis on fecal coliform. This approach was formally approved by IEPA in an August 8, 2007 letter[5].

The following paragraph provides a summary of the CSO facilities previously provided in the POS. The City owns and operates a combined sewer system that contains three points that discharge to Mauvaise Terre Creek. A description of the discharges is given below:

- 002: "North" CSO Pump Station
- 003: "East" / Johnson St. CSO Pump Station
- 004: POTW Discharge – covered under the City's NPDES Permit, the flow enters Mauvaise Terre Creek either by gravity or pumped after receiving primary treatment – total capacity = 57.9 mgd.

Figure 1.0 on the following page shows the CSO facilities located within the City's Publicly Owned Treatment Works (POTW). In addition to these facilities, and as described in the POS, the Johnson St. CSO Pumping Station contains a CSO discharge (004) and under normal operations (all but extreme flooding conditions) combined sewage is either pumped or flows by gravity to the POTW.

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[1] NPDES Permit No. IL0021661 – Effective Date: 11/01/04, Expiration Date: 10/31/09
[2] Mauvaise Terre Creek TMDL Report – August 2007
[3] Plan of Study for CSO Assessment – CDM, April 2005
[4] IEPA Letter from Mr. Garretson – November 29, 2006 RE: POS for CSO Assessment
[5] IEPA Letter from Mr. Garretson – January 25, 2007 RE: POS for CSO Assessment

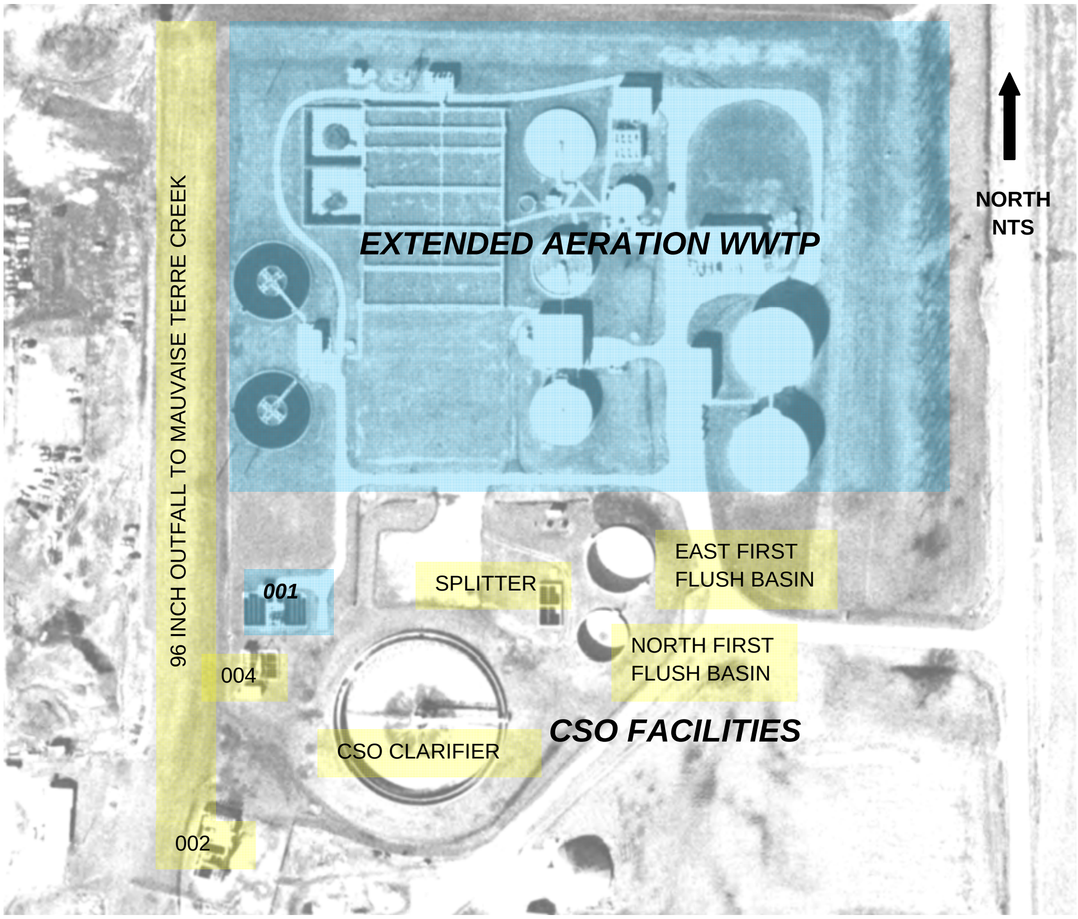


Figure 1.0 – City CSO Facilities @ POTW

In accordance with USEPA Guidelines[6] and as described in the current IEPA NPDES Permit, the following sections of this LTCP contain the required nine elements (listed below):

- Characterization, Monitoring, & Modeling
- Public Participation
- Consideration of Sensitive Areas
- Evaluation of Alternatives
- Cost/Performance Considerations
- Operational Plan
- Maximizing Treatment at the Treatment Plant
- Implementation Schedule
- Post-Construction Compliance Monitoring Program

[6] Combined Sewer Overflows: Guidance for Long-Term Control – September 1995

2.0 Characterization, Monitoring, & Modeling

The City operates a well maintained Combined Sewer System (CSS) and has taken a proactive approach in reducing CSO events. Through close coordination with the IEPA, the City has successfully implemented the Nine Minimum Controls (NMC) and continues an aggressive stormwater separation program. The City of Jacksonville has made significant capital investments for treating & managing its CSO flows, including a major investment at the onset in the 1988/1990 timeframe when the three CSO outfalls were constructed.

The City has continued to maintain its commitment to reducing CSO overflows and has invested significant capital in storm separation projects throughout the Community. A summary of the storm separation projects[7] and their capital costs as constructed over the past decade is presented in Table 2.0 below:

Storm Separation Project	Implementation Timeframe	Capital Cost
Church St. Phase I	1997/98	$640,000
Walnut St. Phase I	1998/99	$285,000
Town Brook Relief	1999/2000	$710,000
Walnut St. Phase II	2001/02	$1,100,000
Church St. Phase II	2006/07	$445,000

Table 2.0 – City Major Stormwater Separation Projects

2.1 Facilities Description

As part of the System Characterization and understanding of the CSS, a thorough description of the CSO Facilities (facility capacities and operations) is provided herein. The City CSO facilities are unique in that the two remote CSO outfalls (002 & 003) discharge by pumping only. Additionally, the main CSO outfall, 004, is monitored in accordance with the NPDES Permit. Therefore, for every overflow event, the City has a record of event duration and can estimate the volume of CSO discharge for all three outfalls. Since the completion of the CSO facilities in 1992, the City has taken careful records of pump run times for outfalls 002 & 003 and duration and volume of discharge for 004.

Located on the POTW site are the existing CSO Treatment facilities. A layout of these facilities can be found in Appendix D and Figure 1.0, above. The CSO treatment facility consists of two (2) first flush basins identified as the northside first flush basin and the eastside first flush basin. These basins are connected to a rectangular flow splitter box. A weir structure exists inside the

[7] CSS Separation Projects – Provided by City, September 2008

splitter box allowing flow to the CSO clarifier. The CSO clarifier discharges via a series of manholes to the Effluent Pump Station. The Effluent Pump Station is the main CSO discharge point within the Jacksonville system, outfall 004. There is a second pump station located to the north of the Effluent Pump Station. This pump station is identified as the CSO North Pump Station. Discharge from this facility occurs when the capacity of the first flush basins are exceeded along with the CSO Clarifier. The control of CSO overflow within the CSO North Pump Station is achieved via a weir wall within the structure. As flow increases in this facility, CSO material is released across the weir and is discharged to the Creek via the “trash pumps” located in this facility. A third CSO pump station is located off-site to the east of the POTW. This CSO is called the CSO East Pump Station or Johnson Street Pump Station. Activation of the pumps in this facility is controlled similar to the CSO North Liftstation, as the flow exceeds the capacity of the first flush basins and the CSO clarifier, the excess flow is released across a weir to a pump wet well associated with this structure. As with the North Pump Station, the trash pumps discharge into Mauvaise Terre Creek. Therefore, the City of Jacksonville has three CSO discharge points within its City limits.

2.2 Water Quality Monitoring

2.2.1 Monitoring Objectives

The City of Jacksonville established a two-year monitoring program to evaluate the impacts of CSO discharges on Mauvaise Terre Creek, and to develop a baseline data set to determine the effectiveness of CSO control strategies. The primary pollutant of concern is fecal coliform bacteria. A TMDL (IEPA 2006) identified fecal coliform bacteria as causing the source of impairment in Mauvaise Terre Creek and developed load allocations that will achieve compliance of the fecal coliform standard in the stream. The TMDL goal is for a 99% reduction in fecal coliform from CSOs in order to meet the in stream target of 5.72E+10 colony forming units *per day*.

2.2.2 Selection of Monitoring Stations

Six sampling locations were located in the Mauvaise Terre Creek watershed (Figure 2.1 and Table 2.2.1). At each of these locations, two dry weather events were conducted to determine background levels of fecal coliform, and identify other contributors of fecal pollution to the mainstem of Mauvaise Terre Creek. Additionally, two wet weather surveys were conducted to determine fecal coliform levels in the creek to evaluate the impacts to the receiving water from non-point and point source discharges, including CSO discharges.

Figure 2.1 Fecal Coliform Sampling Locations

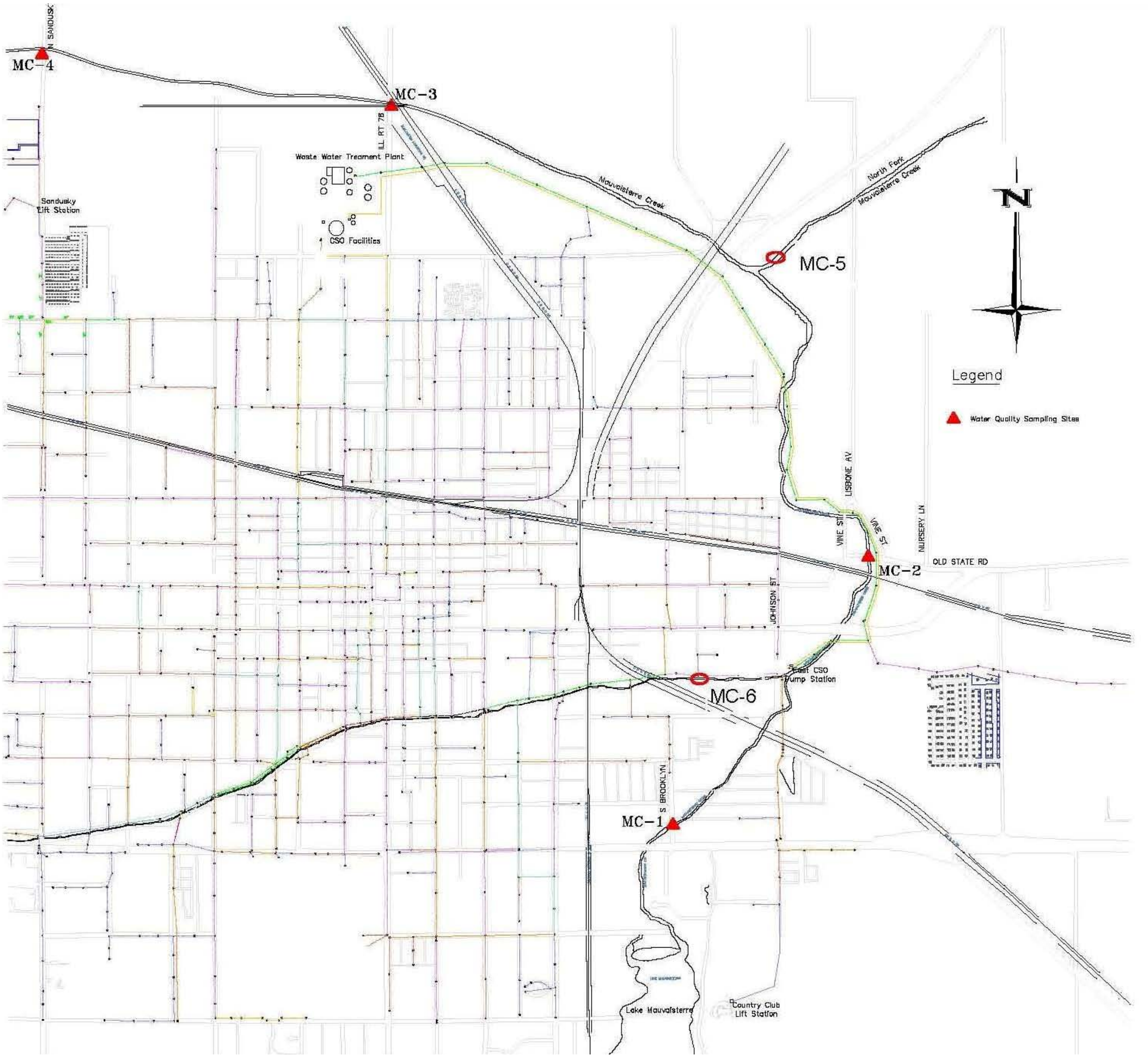


Table 2.2.1 Fecal Coliform Sampling Locations

Sampling Location	Description
MC-1	Mauvaise Terre Creek 1,500 feet downstream of Mauvaise Terre Lake (near Brooklyn Avenue)
MC-2	Mauvaise Terre Creek northside of East State Street Bridge
MC-3	Mauvaise Terre Creek off of IL Route 76 Bridge, upstream of POTW discharge
MC-4	Mauvaise Terre Creek 5800 feet downstream of sampling location MC-3 (downstream of POTW discharge) off of Sandusky Road Bridge
MC-5	North Fork Mauvaise Terre Creek, 200 feet upstream of confluence with Mauvaise Terre Creek
MC-6	Town Brook Branch 1,100 feet upstream of S Johnson Street Bridge

2.2.3 Monitoring Schedule

Dry weather sampling was conducted in July and September 2007, while two wet weather events were collected in June and September 2007, and two in April and June of 2008. In April 2008, two wet weather sampling events (April 10 and April 15) were conducted to determine when the receiving waterbody recovers after a wet weather event.

2.2.4 Monitoring Parameters

Samples were collected for fecal coliform and flow at each of the sampling locations shown in Figure 2.1. At each sampling location during dry weather events, two fecal coliform bacteria samples were collected during a 24 hour period. During wet weather events, fecal coliform bacteria were collected at 6 and 12 hours after the CSO overflow. If the CSO did not overflow, one wet weather sample was collected from each of the location. In addition to the collection at the six in stream sites, fecal coliform bacteria samples were collected from the first flush basins during a wet weather event, and six to twelve hours after the initial inflow event. The goal of these samples was to help approximate the fecal coliform concentrations in the North and East CSO Lift Stations.

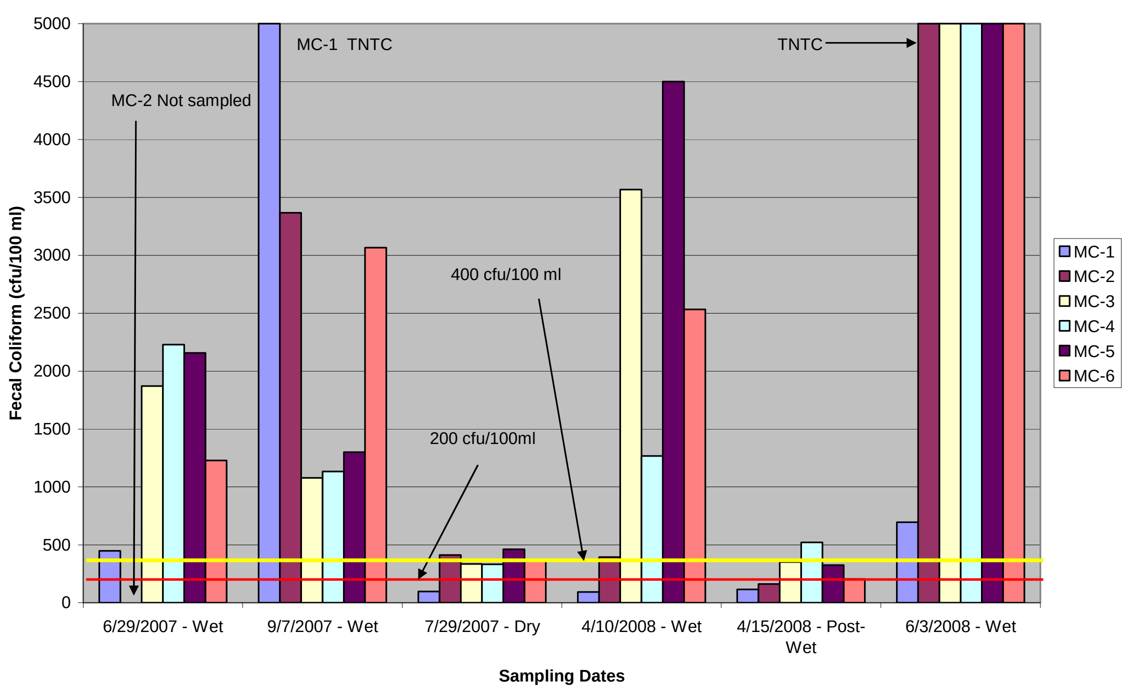
2.2.5 Monitoring Results

Dry Weather

The results from the first dry weather event (July 29th, 2007) show fecal coliform levels exceeding the primary contact recreation level of 200 cfu/100 ml (30 day average) at all sampling locations except MC-1 which is directly downstream of Mauvaise Terre Lake (Figure 2.1). The primary contact recreation fecal coliform instantaneous standard (400 cfu/100 ml) was exceeded at MC-2 and MC-5. The fecal coliform data from MC-4 (just downstream of CSO Outfalls 002 and 004) were slightly higher than the closest upstream location (MC-3). Fecal coliform data on North Fork Mauvaise Terre Creek (background concentration) was similar to MC-3, which is upstream of the two CSOs identified above. The lowest concentration of fecal coliform was at the sampling location (MC-1) just downstream of Lake Mauvaise Terre. Table 2.2.5.1 shows the stream flows during this sampling event.

Table 2.2.5.1 Stream Flows- Dry Weather Event (July 29, 2007)	
Sampling Location	**Flow (cfs)**
MC-1	2.74
MC-2	2.26
MC-3	1.35
MC-4	3.41
MC-5	0.04
MC-6	0.02

Figure 2.X- Fecal Coliform Sampling Results for Mauvaise Terre Creek



Wet Weather

Figure 2.2 shows the results from the four wet weather sampling events conducted in 2007 and 2008. During the June 29th, 2007 wet weather event, the fecal coliform average and instantaneous standards were exceeded at all locations, however, the lowest fecal coliform levels were observed at MC-1. Average precipitation during this event was 0.45 inches. Due to unsafe stream conditions, no samples were collected at MC-2. Stream flows during this event are shown in Table 2.2.5.2. There were no CSOs discharging during this wet weather event.

Table 2.2.5.2 Stream Flows- Wet Weather Event (June 29, 2008)	
Sampling Location	**Flow (cfs)**
MC-1	64.94
MC-2	N/A
MC-3	36.39
MC-4	135.49
MC-5	15.98
MC-6	0.02

During the wet-weather event on September 7th, 2007, approximately 0.25 inches of rain was recorded in the Jacksonville area. All sampling locations exceeded both the fecal coliform average and instantaneous standard for primary contact recreation. Unlike the first wet weather event on June 29th, 2007, MC-1 had the highest fecal coliform levels. Flows during this sampling event were significantly lower than the June 29th, 2007 wet-weather event. No CSOs were discharging to Mauvaise Terre Creek during this wet weather event (Table 2.2.5.3).

Table 2.2.5.3 Stream Flows- Wet Weather Event (September 7, 2007)	
Sampling Location	**Flow (cfs)**
MC-1	1.50
MC-2	0.96
MC-3	2.05
MC-4	7.58
MC-5	0.03
MC-6	0.10

In 2008, samples were collected from two wet weather events, one in April and one in June. In April, wet weather sampling was conducted on April 10th, and post-wet weather was conducted on April 15th. The purpose of this sampling event was to determine the condition and recovery of the creek four days after the wet weather event. Figure 2.2 shows that the stream is reflective of dry weather conditions four days after the wet weather event occurred. Precipitation during this event was 1.1 inches (April 9 and 10). Flows for this sampling event are shown on Table 2.2.5.4. Except for MC-1, all locations exceeded the fecal coliform average and instantaneous stream standard. CSO outfall 004 was discharging.

Table 2.2.5.4 Stream Flows- Dry Weather Event (April 10, 2008)	
Sampling Location	**Flow (cfs)**
MC-1	1273
MC-2	N/A
MC-3	720
MC-4	1049
MC-5	376
MC-6	23.00

On April 15th, 2008 fecal coliform and flow data were collected to determine if the fecal coliform bacteria levels were reduced to levels similar to those observed in the dry weather sampling event. Excluding MC-1, all sites were above the fecal coliform average standard, and MC-4 was the only location above the instantaneous standard. Flow data for this wet weather event is shown in Table 2.2.5.5.

Table 2.2.5.5 Stream Flows- Dry Weather Event (April 15, 2008)	
Sampling Location	**Flow (cfs)**
MC-1	243.90
MC-2	6.48
MC-3	400.00
MC-4	185.00
MC-5	21.12
MC-6	6.30

The second wet weather event in 2008 was conducted June 3rd. Except for MC-1, fecal coliform levels were Too Numerous To Count (TNTC) (Figure 2.2). Both CSOs #002 and #004 were discharging during this time period. The volume of flow coming from Outfall #002 was approximately 2.5 million gallons in a four hour period. In Outfall #004, the volume of flow was estimated at 25 million gallons, with the duration unknown. Precipitation during this event (May 31 through June 3) was 4.13 inches. Flow data was not collected during this event.

2.2.6. Conclusions/Recommendations

The data show that even during dry weather events, the fecal coliform levels in Mauvaise Terre Creek (except MC-1) are above the 200 and 400 cfu/100 ml standards that protect for primary contact recreation. Other background sources are significantly adding to the fecal coliform pollution in Mauvaise Terre Creek.

The data collected from the wet weather sampling events shows that the levels of fecal coliform in Mauvaise Terre Creek are above the water quality standards to protect for primary contact recreation and that fecal coliform loading is originating from sources other than the City's CSOs, even when CSOs are not overflowing. The creek appears to recover to dry weather conditions four days after a wet weather event.

2.3 CSO Flow Data Analysis / Modeling

Previously mentioned in this report, the Jacksonville CSO facilities are well suited for simple hydraulic analysis. Since all three points are monitored, discharge volumes can be estimated and rainfall records can be compared to CSO flow data to estimate system response for various storm events

2.3.1 Pump Station Flow Records

Pump station flow records[8] from January 1994 through July 2008 were provided by the City for the Johnson Street CSO Pump Station (003) and the North CSO Pump Station (002). These records included total trash pump run time for both pump stations. Summarized in Figure 2.3 below, is the annual run time for the two remote outfalls.

[8] Trash Pump Run Times – City of Jacksonville, July 2008 (1997 contains incomplete data)

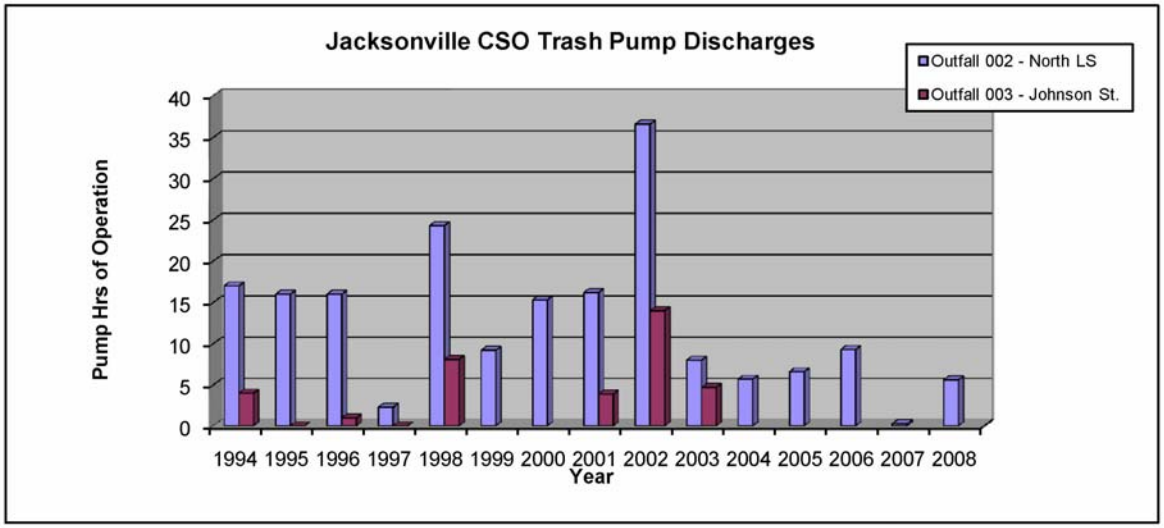


Figure 2.3 – Trash Pump Run Times

The above figure shows a total run time for the Johnson St. trash pumps (Outfall 003) of 36 hrs since the pumps were installed. Obviously, CSO discharges at this location are extremely infrequent and occur only during “extreme” events. The North Pump Station discharges more frequently with a total run time of close to 200 hrs for the trash pumps at Outfall 002. The reported run times were checked against the totalizing run time meter at each of the pump stations. These numbers were in good agreement with differences attributed to power failures, pump start-up, and testing.

2.3.2 Treatment Plant Records Review

Treatment plant flow records from January 1994 through July 2008 were reviewed and CSO discharge events, durations, and volumes were compiled and calculated. First, the number of CSO discharges was compiled and Figure 2.3.1 shows that the number of annual discharge events[9] varied from less than 5 to close to 20 for Outfall 004. The number of events decreased sharply from 2003 to 2008. It is theorized that this decrease can be attributed to dry weather as well as the City’s completion of major CSS separation projects.

[9] CSO Events are defined as a day or group of consecutive days when CSO Discharge occurred

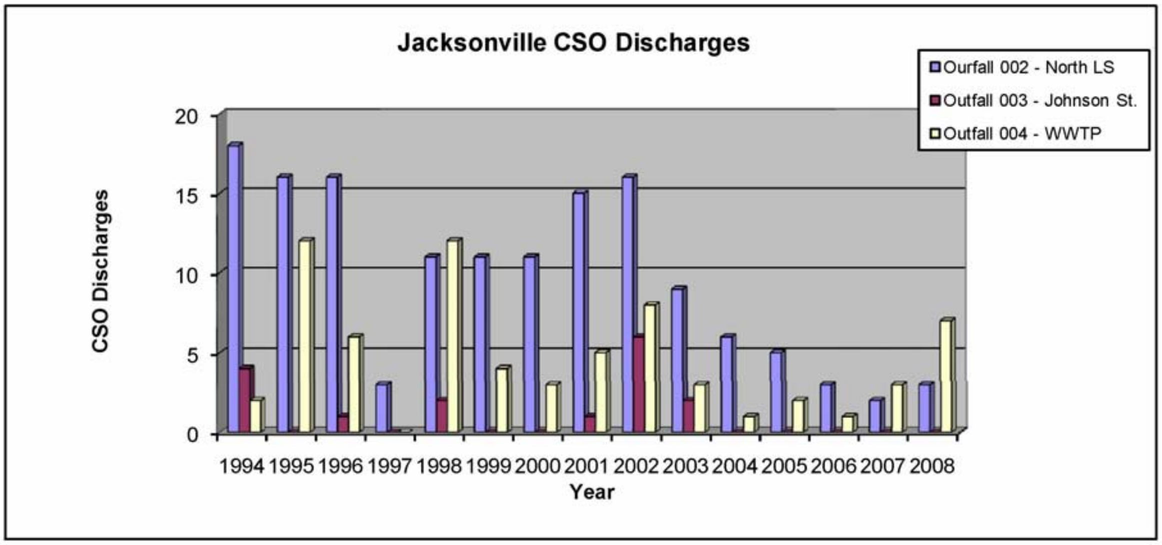


Figure 2.3.1 – CSO Discharge Events

Next, the total volume for each overflow was estimated for the data period of record noted above. The City maintains a CSO operational spreadsheet that includes total volume of flow entering and the volume drained from the first flush basins, CSO clarifier, 36 inch forcemain, and pump station wet wells. These records along with the NPDES required CSO monthly volume estimates were compared and utilized to calculate total flow discharged through Outfall 004. Additionally, recorded trash pump hours for 002 & 003 were multiplied by the rated pump capacity to yield annual CSO volumes discharged through the remote outfalls. Figure 2.3.2 below shows the results for this analysis. Total annual CSO volumes have ranged from less than 5 million gallons to over 250 million gallons. 2002 had a noticeably higher discharge volume than other years. <u>Additionally, for the last five years (2003-2008) less than 10 million gallons per year were discharged</u>.

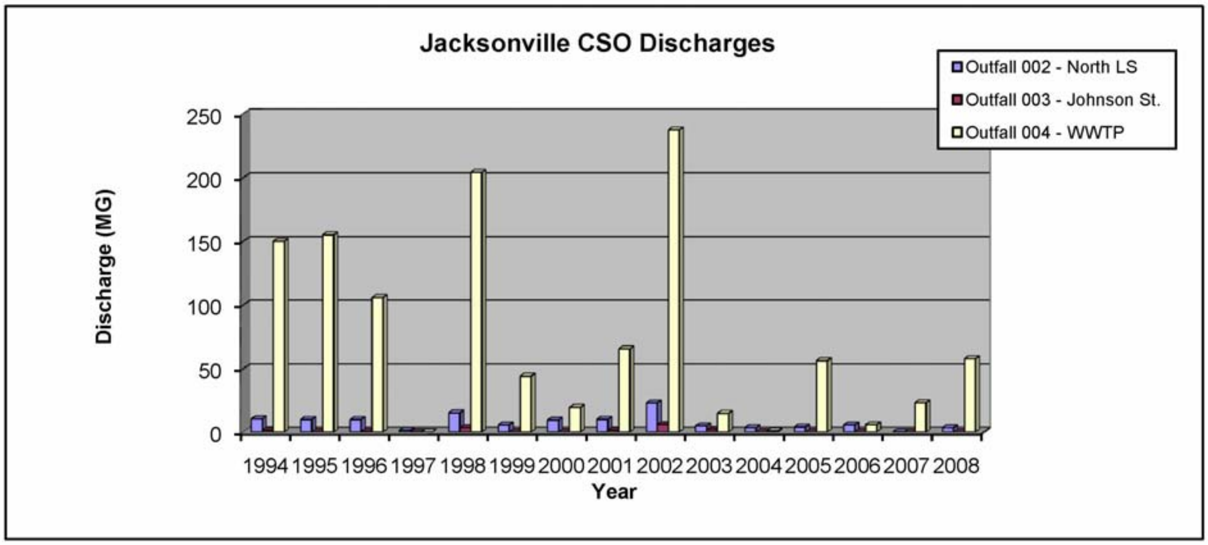


Figure 2.3.2 – CSO Discharge Events

Finally, from this data, the percentage of CSO flow that receives primary treatment (clarification & no disinfection) can be calculated. <u>Figure 2.3.3 shows that approximately 90% of the CSO volume has received primary treatment for the period of record</u>. It should be noted that 1997 contains incomplete data and for the years where 004 represents less than 70% of the flow volume, the total volumes for all outfalls were so small that small infrequent events at the remote sites influenced their percent contribution, but were insignificant in terms of volume discharged.

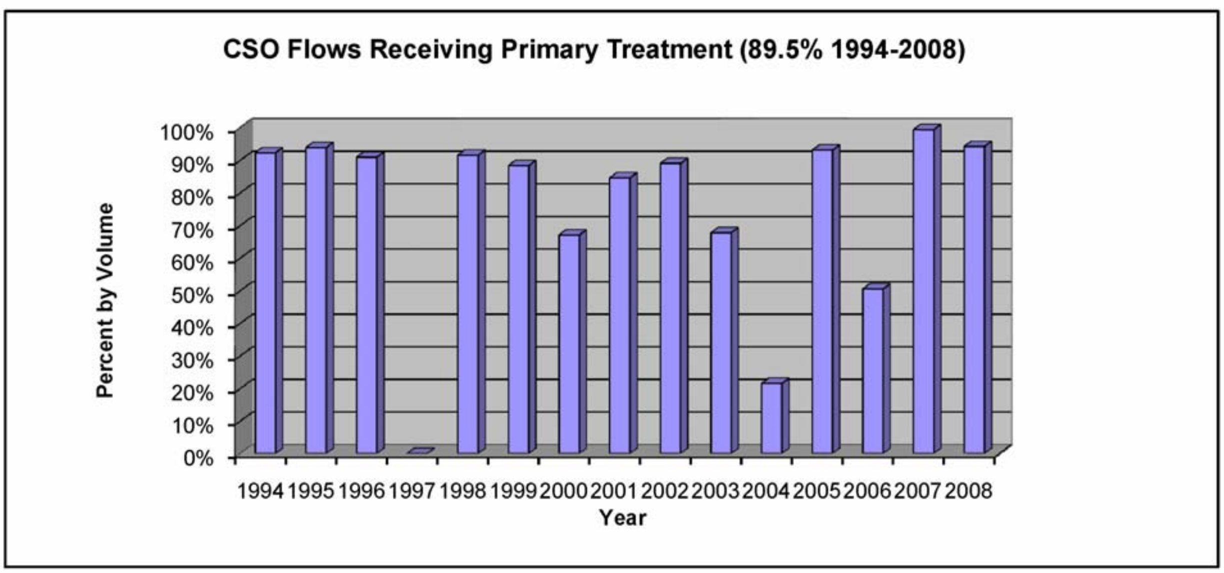


Figure 2.3.2 – CSO Discharge Events

As can be seen in the above graphs, the City has done an excellent job in controlling CSO events and providing primary treatment during events. However, the graphs do show that the City would not qualify under the "Presumption Approach" for CSO control. The 90% volume of

CSO receiving primary treatment is the discharged volume, not as required in Criterion ii of the LTCP guidance document. This criterion required elimination of the capture for treatment of no less than 85% by volume of the combined sewage collected in the CSS during precipitation events on a system-wide annual average basis. Additionally, the City would not meet Criterion i, no more than an average of four overflow events per year, or Criterion iii, elimination of no less than the mass of the pollutants identified as causing water quality impairment.

2.3.3 First Flush Storm Analysis

Utilizing rainfall records identified previously in the preliminary POS, the CSS system could be reviewed to determine the response to the first flush design storm, or 1.2 inches in 1 hour. From review of hourly rainfall records and rainfall intensity recorded at the POTW, twelve (12) rainfall events were identified as meeting or exceeding the first flush design storm intensity. Table 2.3.3 below shows the results of a detailed mass balance analysis for each of these twelve storms.

DATE	Storm Information		Antecedent Conditions					Outfall Locations			
	Intensity (Inch / hr)	Event Total (Inch)	Previous 3 Days	Previous 5 Days	Clarifier Empty	FF Basins Empty	36 Inch FM Empty	004 Discharge	004 Volume (MG)	002 Volume (MG)	003 Volume (MG)
6/23/2007	1.3	1.6	0.8	1.3	YES	NO	NO	YES	10.8	0.1	0.0
8/8/2006	1.7	2.2	0.3	1.7	YES	YES	YES	NO	0	0.0	0.0
7/12/2006	1.7	2	1.2	1.2	NO	NO	NO	NO	0	0.0	0.0
3/12/2006	1.4	1.5	1.9	2.2	NO	NO	NO	YES	5.4	1.4	0.0
8/6/2002	1.8	1.9	1.4	3.3	NO	NO	NO	YES	5	1.3	0.3
4/24/2002	1.3	1.4	2	2.8	NO	NO	NO	YES	21	1.2	0.0
6/6/2001	1.6	3.4	1.3	1.3	NO	NO	NO	YES	39.5	3.5	0.7
8/12/1999	1.3	1.8	1.5	1.7	YES	YES	YES	NO	0	0.6	0.0
6/29/1998	1.5	2.1	2.6	4.4	NO	NO	NO	YES	48	2.5	1.3
6/18/1998	1.4	1.6	0.8	2.6	YES	NO	NO	YES	27	1.7	0.3
8/8/1995	1.4	2.9	0.7	3.4	no data	no data	no data	no data	no data	no data	no data
7/2/1994	1.2	1.4	0.5	0.8	YES	YES	YES	NO	0	1.3	0.0

Full Secondary Treatment of Flow

Near Full Treatment of Flow

Table 2.3.3

The results from the first flush analysis show that with dry antecedent rainfall conditions and empty CSO facilities, the City's CSO system can store and treat (secondary treatment) the first flush storm. The July and August 2007 events illustrate just that, and previous events in 1999 and 1994 show that the CSO facilities provided full treatment for all but 13% and 29% of the flow volume, respectively. These two events occurred prior to major CSS separation projects and it is assumed the small discharges from Outfall 002 would have since been eliminated. Other events identified as representing the first flush storm that caused a discharge were either due to high total rainfall, high rainfall intensity, high antecedent rainfall / moisture conditions, or full / partially full CSO facilities (CSO forcemain, CSO first flush basins, and CSO clarifier). Additionally, for simplification of the project, hourly rainfall totals were utilized in this study. The available 15 minute rainfall data were reviewed and showed some extremely high intensities within the 1 hour duration that could have contributed to several of the discharges shown in the table.

2.3.4 "10 x Average Dry Weather" Flow Analysis

The original facilities were sized to provide primary treatment for flows equal to 10 times the Average Dry Weather (ADWF) wastewater flows. An updated review of flows is necessary to ensure the CSO facilities are still meeting this design requirement. Analysis of the previous five years of NPDES DMR data, shows that average dry weather flows are approximately 3.4 MGD. The data were selected based on the following factors:

- Flow Data for July – September (2002 – 2007)
- Dry Antecedant Moisture Conditions (No Precip 3 days prior)

Flows meeting these criteria were tabulated and then averaged. Again, based on the last five years of flow into the POTW, the estimated ADWF is 3.4 MGD. Therefore, the CSO facilities, with a design capacity of 57.9 MGD for primary treatment should have adequate capacity to for treatment of the "10 x ADWF", currently estimated at 34 MGD.

2.4 TMDL Review

2.4.1 TMDL Summary

A Total Maximum Daily Load (TMDL) was finalized in August of 2007 for Mauvaise Terre Creek.

Summarized below are the findings from the TMDL for Mauvaise Terre Creek affecting the City's CSO outfalls:

Identification of Waterbody, Pollutant of Concern, Pollutant Sources, and Priority Ranking: *Mauvaise Terre Creek, HUC 0713001104. The pollutant of concern addressed in this TMDL is fecal coliform. Potential sources contributing to the listing of Mauvaise Terre Creek include: runoff from pastureland and animal feeding operations, private sewage disposal systems, municipal point sources, and combined sewer overflows. Mauvaise Terre Creek is reported on the 2006 303(d) list as being in category 5, meaning available data and/or information indicate that at least one designated use is not being supported or is threatened, and a TMDL is needed (IEPA, 2006).*

2.4.2 Mauvaise Terre Creek Water Quality Information

The TMDL confirmation of causes and sources of pollution for Mauvaise Terre Creek, verified the impairment of Fecal Coliform as follows:

Mauvaise Terre Creek is listed on the 303(d) list as impaired by fecal coliform bacteria. The available data support this listing. Data are available for a single sampling location, station DD04. Of the 97 fecal coliform samples collected at this station, 49 were collected between May and October. An analysis of the May – October fecal data revealed that 36 of the 49 fecal samples (73%) were greater than 400 cfu/100 ml.

Other pollutants not listed in the 303d list were not reviewed in the TMDL. Even though this LTCP focus is on Fecal Coliform, the resulting plans for CSO control and maximization of primary and secondary effluent will help to lower the City's contribution of other pollutants to Mauvaise Terre Creek, including suspended solids, BOD, nutrients, low dissolved oxygen, and heavy metals. Detailed analysis of receiving water and water quality modeling will not be performed in this LTCP. A degradation analysis or die-off of Fecal Coliform is not necessary and will prove fruitless, given the results from the monitoring program. Additionally, the TMDL has provided the information necessary to focus on the single largest pollutant in the stream segment, fecal coliform.

2.4.3 CSO Load Allocation Review

Below is narrative from the TMDL applicable to CSO wet weather loading criteria:

A TMDL consists of waste load allocations (WLAs) for point sources, load allocations (LAs) for nonpoint sources, and a margin of safety (MOS). This definition is typically illustrated by the following equation:

TMDL = WLA + LA + MOS

There are three NPDES permitted point source dischargers of fecal coliform in the Mauvaise Terre Creek watershed. The WLA for these point sources was calculated using their permitted flow rates and a concentration consistent with meeting the TMDL target (200 cfu / 100ml) at the point where the segment impairment begins. ……the Jacksonville STP also has a permit for three combined sewer overflows (CSO) that may discharge during wet weather: outfall 002, outfall 003, and outfall 004 (a treated combined sewage outfall). The WLA for the CSOs is calculated based on the reported 2003 average overflow volume per event for the three overflows and a concentration of 200 cfu/100 ml, consistent with the TMDL target. The WLA for the CSOs equals 5.72E+10 cfu/day and applies at the point where the segment impairment begins, not at the end of the pipe. ***This number may be refined as the results from a monitoring study proposed by Jacksonville are reported.***

The WLA of 5.72×10^{10} cfu/day corresponds to a "daily" flow of approximately 7.6 MGD (see below):

- 5.72×10^{10} cfu/day = FLOW x 200 cfu/100ml x 3785.4 ml/gal / 1,000,000
- Therefore, FLOW = 7.56 MGD
- Analysis of flow records indicates this daily flow for CSO's has been exceeded several times (see Figure 2.4 below) [10]

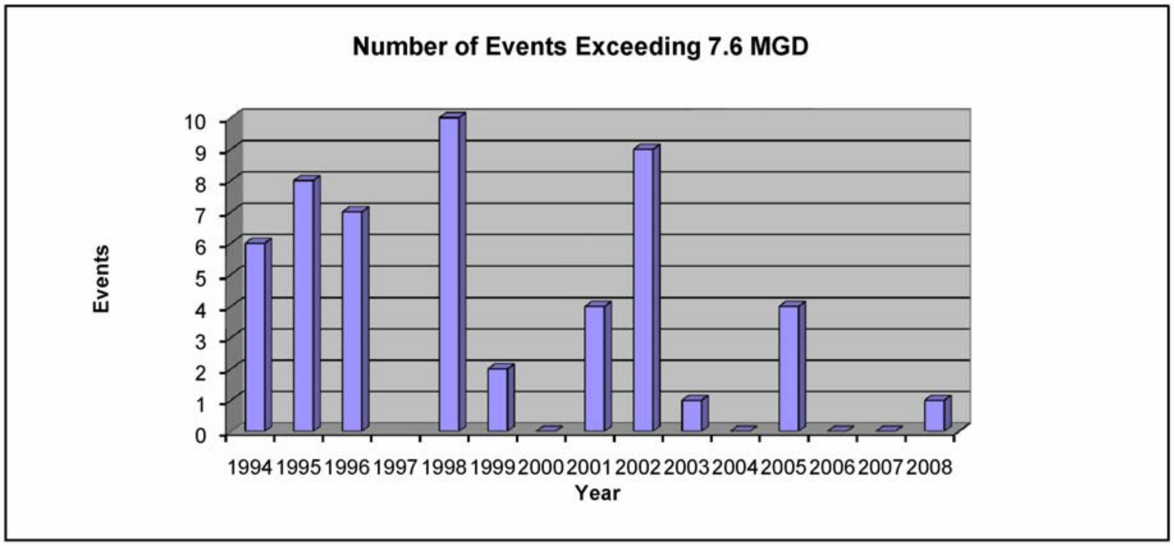


Figure 2.4 – Events Exceeding TMDL Basis Flow

The total capacity for primary clarification of CSO's is approximately 57.93 MGD. The flow provided in the TMDL is approximately 13% of the design capacity. The WLA calculation methodology seems illogical and based on only a single year of data. Additionally, from analysis of the CSO data for 2003, replication of the WLA contained in the TMDL was impossible (see below):

- Outfall 002 Avg Discharge Volume / Day = 0.5 MG
- Outfall 003 Avg Discharge Volume / Day = 1.0 MG
- Outfall 004 Avg Discharge Volume / Day = 5.0 MG
- Total Avg Daily Discharge = 6.5 MGD

Also, there is no definition of an "event" in the TMDL. It is assumed, because the TMDL WLA is a daily allocation, each event was divided by the average days per event to yield the daily loading. Finally, the TMDL states that the WLA applies at the point where the segment impairment begins, not at the end of the pipe. Given the previous discussion of monitoring efforts, the fact that the beginning of stream segment impairment is upstream of all CSO discharges, and the elevated background levels of fecal coliform, the TMDL will be unattainable

[10] It should be noted that 2008 data is only through July, and several events in Sept 2008 have exceeded 7.6 MGD

unless loads from other sources are drastically reduced. Additionally, it can be safely hypothesized that future post-construction compliance monitoring will show wet-weather fecal coliform concentrations and daily loads exceeding the 5.72×10^{10} cfu/day regardless of City efforts to reduce discharge volume and fecal coliform loading.

Given this above information, particularly the wet weather natural high background concentrations of fecal coliform, and as outlined in the LTCP CSO Guidance Manual, it is requested the permitting authority consider the City's proposed efforts as a demonstration of the maximum fecal coliform reduction benefits reasonably attainable, explained in following sections of this report.

2.4.4 Conclusions / Recommendations

From above it can be concluded that although the TMDL has been finalized, clarification and re-evaluation of the WLA for CSO's is necessary. Additionally, the background levels of fecal coliform in Mauvaise Terre Creek prevent the attainment of this value for the foreseeable future. If, indeed future NPDES permits are to incorporate fecal coliform permit modifications as laid out in the TMDL and shown below, the WLA and compliance monitoring should be thoroughly understood and of sound justification:

The permits for the point source dischargers in the watershed will be modified if necessary as part of the permit review process (typically every 5 years), to ensure that they are consistent with the applicable wasteload allocation.

A logical fecal coliform load limit in the NPDES permit would correspond to meeting water quality standards at the main CSO outfall (200 cfu/100 ml) with the goal of meeting a reasonable WLA. A reasonable WLA could be considered all or a percentage of the primary CSO treatment capacity (see calculation below):

59.7 MGD x 200 cfu/100 ml x 3785.4 ml/gal = 4.52×10^{11} cfu/day

2.5 FLOW ANALYSIS CONCLUSIONS & RECOMMENDATIONS

As part of their due diligence and commitment to the water quality of Mauvaise Terre Creek, it is the City's goal to eliminate the August 9, 1990 disinfection exemption[11], and construct disinfection facilities to treat the primary CSO overflow, outfall 004. As previously shown, disinfection of flows discharged through 004 would account for approximately 90% of the CSO discharge volume. However, these efforts alone will not ensure compliance with the TMDL for fecal coliform. With the long-term goal of meeting an attainable load allocation and water quality standards during wet weather flows on Mauvaise Terre Creek, the City proposes these additional long-term control measures:

- Continued Monitoring of Mauvaise Terre Creek (flow data and fecal coliform concentrations)

[11] AS 90-1 Adjusted Standard, Illinois Pollution Control Board, 8/09/90

- Continued Capital Investment in the CSS Separation Program
- Reassessment of the TMDL Load Allocation for CSO – Fecal Coliform

3.0 Public Participation

The City of Jacksonville proactively encourages public participation in coordination with Regulatory Agency interface as part of its decision-making process to select its long-term CSO control which may or may not involve significant expenditures of public funds. An informed public is the key to support (or at least the minimization of opposition) of the City's goals and requirements pertaining to the development of a Long-Term Control Plan.

The City Council is the public body comprised of elected officials who facilitate public input and representation in the development of the City's policy and commitments. The City conducts Council Workshops which are open to the public prior to each City Council meeting whereby action/Council approvals are obtained. The City Council also has a sub-committee (known as the Utility Committee) whereby specified Council members are appointed by the Mayor's office to primarily focus (i.e. emphasize) the City's interest related to water and sewer utility infrastructure as part of planning and development of recommendations for City Council consideration. The City's Superintendent of Administration, Superintendent of Operations and the POTW Superintendent have been a part of the City's development of the Long-Term Control Plan.

In July 2005, the City, in conjunction with the IEPA, held a Public Meeting at City Hall to allow for public input related to the development of the TMDL for Mauvaise Terre Creek. Several citizens participated in addition to City personnel and the newspaper covered the meeting with an article presenting relevant findings, conclusions and recommendations. The issue of fecal coliform in Mauvaise Terre Creek was pertinent and established the need for action. The TMDL and the City's NPDES Permit for POTW Discharge into Mauvaise Terre Creek established the timeline for the City's consideration of development of a Long-Term Control Plan related to the City's Wastewater Treatment/CSO discharge facilities.

The City, and its consulting engineers, has been working closely with the Illinois EPA over the past 3½ years through meetings, site/field visits and correspondence to develop the proposed Long-Term Control Plan with opportunity for public involvement at each decision making point involving the City Council. Listed below is a compilation of the chronology documenting the development of the proposed Long-Term Control Plan:

- **January 10, 2005** – City Council Workshop followed by City Council Meeting approving Engineering Agreement for Plan of Study (POS) for CSO assessment
- **April 29, 2005** – Letter sent to IEPA by the City presenting the proposed Plan of Study (POS) for Agency consideration

- **July 27, 2005** – Public meeting held by City as part of NPDES Compliance Activities involving:

    1) Pollution Prevention Plan
    2) CSO Operational and Maintenance Plan
    3) Public Notification Program

- **July 26, 2006** – TMDL public meeting (conducted by IEPA representatives)
- **September 19, 2006** – TMDL approved by USEPA
- **November 29, 2006** – IEPA response to April 29, 2005 letter indicating that with recent TMDL approval (by USEPA) the POS approach may be outdated and suggest LTCP development be initiated
- **January 19, 2007** – Meeting with IEPA and City to understand TMDL impact to proposed POS and clarification/understanding of key elements in developing Long-Term Control Plan approach with "Adaptive Management" procedures
- **January 25, 2007** – IEPA site visit at POTW as part of CSO non-sampling inspection
- **February 6, 2007** – IEPA letter documenting January 25, 2007 field visit
- **February 23, 2007** – City response to IEPA letter of November 29, 2006 with proposed LTCP approach in lieu of POS
- **April 9, 2007** – City Council Workshop followed by City Council approval of Amendment No. 1 to Engineering Services Agreement for LTCP activities involving monitoring/sampling program and LTCP development.
- **August 8, 2007** – Acceptance letter from IEPA regarding City's proposed LTCP development approach (***NOTE: Due November 1, 2008)***
- **August 4, 2008** – Meeting between IEPA and City to present initial findings of monitoring and sampling program with discussion regarding initial LTCP development recommendations
- **August 22, 2008** – IEPA field meeting at POTW to discuss (1) anticipated level of CSO disinfection (treating 90±% CSO discharge) and (2) preliminary facility modifications/improvements for disinfection
- **October 13, 2008** – City Council Workshop presentation related to "Preliminary LTCP Recommendations"

The City remains committed to involving and notifying the general public of the need to develop a LTCP and its Implementation Plan. Upon acceptance by IEPA/USEPA of the City's proposed LTCP, the City will be taking action towards authorizing implementation activities whereby City

Council Workshop/City Council Meetings will be conducted to reinforce the general public awareness of its commitment (both technical and financial).

In terms of

4.0 Consideration of Sensitive Areas

In accordance with the CSO Control Policy, receiving waters which are considered "sensitive" should be given the highest priority in controlling overflows. Sensitive areas are identified by the NPDES issuing authority are any waters likely to be impacted by a CSO discharge which meet one or more of the following criteria (pursuant to Section II.C.3 of the federal CSO Control Policy of 1994):

1. Outstanding national resource waters
2. Shellfish beds
3. Threatened or endangered aquatic specifies or their habitat
4. Primary contact recreation, or
5. Protection areas for drinking water intake structures.

Included in the City's NPDES Permit No. IL0021661 is the Illinois Environmental Protection Agency's (IEPA) determination that none of the outfalls listed in the Permit discharge to sensitive areas. After reanalysis of the criteria, the City of Jacksonville concurs with this determination.

5.0 Evaluation of Alternatives

On February 23, 2007, IEPA reviewed a CSO Assessment Response prepared by Benton & Associates for the City of Jacksonville. On August 8, 2007 the IEPA responded to this submittal and concurred that the City can proceed with the development of their CSO long-term control plan with the emphasis of meeting the load allocation for fecal coliform required by the Total Maximum Daily Load (TMDL) for the Mauvaise Terre Creek Watershed (see Appendix C for correspondence).

In response to this direction, Benton and Associates, Inc hosted a meeting on August 4, 2008 with City of Jacksonville staff and key members of the IEPA staff. This meeting had four main objectives. They were as follows:

1. Discuss the Monitoring Program Results (Figure 2-X above)
2. Get IEPA Inputs on key parameters associated with a Long Term Control Plan and related Development
3. Discuss Disinfection Options and Potential points of Application (see summary report of disinfection alternative options in Appendix D)
4. LTCP formulation and related follow-up activities

Currently, the City of Jacksonville uses gas chlorine for effluent disinfection at their POTW. As part of a general discussion with IEPA, IEPA indicated that should chlorine be used as a primary means of disinfection for the CSO, a contact time (CT) of fifteen (15) minutes would be required. IEPA officials also indicated that de-chlorination of disinfected CSO flows would not be required. Each of the three CSO discharges was then discussed to determine how feasible this approach would be (see Figure 2.3.1: Historic CSO Discharge Events per Year).

The East CSO Facility had not discharged since 2003. This was a result of ongoing I/I improvements work carried out by the City of Jacksonville. Also, it should be noted here that rain events one (1) inch or less do not result in CSO activity as the main CSO Clarifier has the capacity to store such rain events. Such rain events are then sent to the head of the POTW for treatment prior to discharge. As a result of this, the discussion focused on the two (2) remaining CSO discharge points at the POTW.

Upon review and analysis of these potential chlorine feed points and in follow-up discussions with IEPA, it was indicated that chlorination into any of the 96" RCCP though possible would not be optimal due to difficulty in confirming/measuring chlorine residual. Also, modeling the chlorine contact time during high water events on Mauvaise Terre Creek would be difficult. This difficulty is related to high water events in the creek which result in the creek backing-up into the discharge pipe resulting in additional flow and unwanted material resulting in an unwanted chlorine demand. Given these uncertainties associated with application to the 96" RCCP, a more controlled point of application is favored.

The more favorable application point is in the flow splitter box associated with the Plant CSO Facility which controls flow to the main CSO clarifier. There are multiple advantages associated with this point of application some of which are as follows:

1. Ease to meet the fifteen (15) minutes of required Chlorine Contact Time
2. Chlorination of CSO material only i.e. no external non-CSO flows
3. Multiple points to sample treated CSO material for chlorine residual prior to discharge into the Creek

6.0 Cost/Performance Considerations

This section of the report shall describe how disinfection of the Plant CSO can be achieved using the existing chlorination facilities. The sizing of the chlorine system is based on a demand curve generated for the Plant CSO. This curve is shown in Figure 6.0 below.

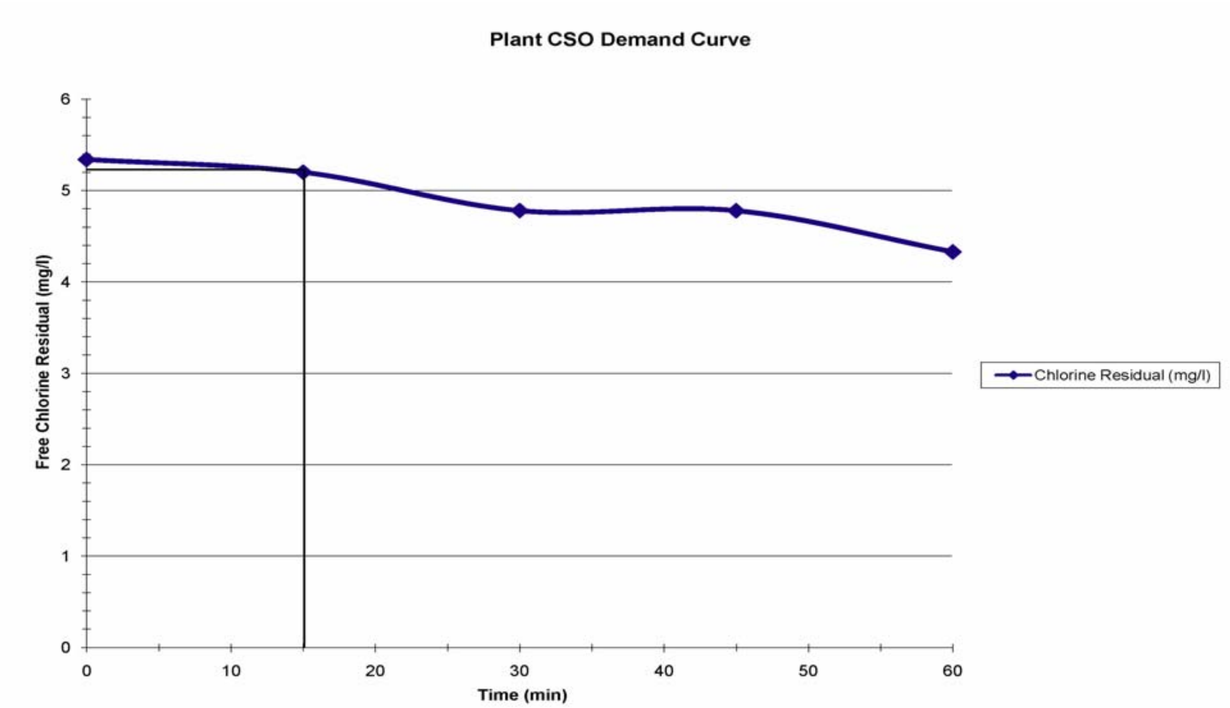


Figure 6.0

Only one demand curve was generated for this report. As part of a design phase of this project additional demand curves will be generated to be reflective of different CSO strengths. None the less this one demand curve aids in the development of preliminary design concepts utilizing chlorine as a disinfectant for the City of Jacksonville LTCP.

The intent of the design is to have a residual of chlorine prior to the CSO leaving the POTW. Dosing with 5 mg/l of chlorine resulted in a residual. Therefore, amount of chlorine needed is as follows:

Maximum CSO Flow = 34.5 MGD

Demand at 15 minutes Detention is 5.34 mg/l - 5.2 mg/l = 0.14 mg/l

Residual at 15 minutes = 5.2mg/l

Chlorine Demand = (0.14*8.34)*34.5 = 40.28lbs of chlorine per day

Chlorine Dose = (5.4*8.34)*34.5 = 1,553 lbs per day

The IEPA has requested that a minimum of 15 minutes of contact time is required should chlorine be used. This can be achieved as follows:

Maximum Flow of CSO = 34.5 MGD

Volume of CSO Clarifier = 2.5 million gallons

Contact time = 102 minutes

At lower flows the contact time will increase.

The intent is to use the existing chlorine facility to provide chlorine to disinfect the CSO. As determined above, the minimum amount of chlorine required is 1,553 lbs per day based on the demand curve generated by the City of Jacksonville. Chlorinators are available in the following sizes (lbs/day): 1,000, 1,500, 2,000, 3,000 and 4,000. Each size has a turndown ratio of 20:1. Currently, at the facility there are two, non-operative chlorinators rated for 4,000 lbs of chlorine per day each. Given that the infrastructure was designed to feed 8,000 lbs of chlorine per day and we currently have calculated a demand of 1,553 lbs of chlorine per day, there is capacity in the existing system to treat this CSO. Therefore, the design would be to have one chlorinator duty and one standby. Based on the chlorine demand, the chlorinators would be sized to provide 2,000 lbs of chlorine per day. With a turndown ratio of 20:1, this would allow a minimum feed of 100 lbs of chlorine per day.

The chlorine application point for the CSO is the flow splitter box controlling the flow to the CSO clarifier. Chlorine would not be applied to the first flush basin portion of the flow splitter box as these flows are sent to the head of the plant for treatment when the CSO event is over.

To control the application of chlorine a compound loop control system will be developed. The loop control system will have two components. The first component is a course adjustment of chlorine based on a flow pace across the flow splitter box weir. To achieve this, an ultrasonic level indicator would have to be installed at the flow splitter box. This level indicator would detect the flow of water into the CSO portion of the flow splitter box. At this point the level indicator would send a signal to the chlorinators to begin the flow of chlorine. The second component of the compound loop control is to install a total chlorine analyzer above the center well of the clarifier. This analyzer would monitor the chlorine residual on a continuous basis. Based in the value measured, this signal would act as a fine tune for the chlorine feed. The analyzer's feed tube would have to be placed inside a stilling well to protect it from unwanted material clogging. Signals from the ultrasonic and the analyzer would control the pace of chlorine from the chlorinators. Each signal would be tied back to the plant SCADA system. Therefore, chlorine can be applied to meet a specific demand and/or a desired residual.

The cost for such a system is shown on the following page:

1.	Removal and Installation of Operational Chlorinators	$75,000
2.	Modification of Piping inside Existing Building	$25,000
3.	Directional Bore of Piping to Flow Splitter Box	$45,000
4.	Modification of Flow Splitter Box	$10,000
5.	Furnish and install chlorine Analyzer (inc. Power)	$10,000
6.	Furnish and install Ultrasonic Level Indicator (Inc. Power)	$10,000
7.	SCADA Upgrade	$50,000
8.	Engineering, Permitting and Construction Management	$75,000
9.	Sub-total	$300,000
10.	Contingency (15%)	$45,000
	Project Estimate:	**$345,000**

7.0 Operational Plan – Disinfection Facilities

The operation and control of the CSO facility shall be SCADA driven. SCADA control shall be achieved using a compound loop control system. This system shall have two controls each of which shall control the application of chlorine solution. The first control point shall be a flow pace control system utilizing an ultrasonic level indicator. This level indicator shall be located on the flow splitter box controlling the overflow from the first flush basin to the CSO clarifier. Flow pacing shall be achieved by measuring flows across a standard size weir. The variation in flow height across the weir can be calibrated to the CSO discharge. Based on this measured reading, the chlorinators will be activated to flow pace chlorine as needed. Flow pace can be achieved using an actuated flow control valve located on the chlorine discharge flow from the chlorinator. This valve shall be controlled by a 4-20ma signal from the ultrasonic level indicator.

The second control shall be located on the clarifier walkway. This control shall be an online continuous chlorine monitor. The monitor shall take samples during a CSO event and read chlorine residual on a continuous basis. Based on this level of chlorine a second signal shall be sent to the chlorinators to increase or decrease dose to maintain a desired residual. This control point is considered a “fine tune” control point.

The chlorine application point shall be at the flow splitter box. Turbulent mixing shall be achieved inside the flow splitter box. Additionally, hydraulic mixing shall be achieved across the weir. Finally, additional turbulent mixing shall be achieved in the connecting pipe between the flow splitter box and the clarifier and at the discharge point inside the clarifier. Presence of the chlorine residual can be confirmed by the onsite operator by taking a grab sample from the manhole directly at the discharge of the CSO clarifier (see Appendix D).

Maintenance of the CSO chlorination system is non-labor intensive. The primary maintenance issues with this system include; calibration of the ultrasonic level indicators, calibration of the chlorine sampling unit, and finally confirmation of the 4-20ma signal controlling the flow control valve. SCADA shall have automatic alarms to notify the operator on-call or on-duty of the following:

1. Activation of the CSO system
2. Malfunction of the ultrasonic level indicator
3. Malfunction of the chlorine analyzer
4. Loss in chlorine vacuum or low levels of chlorine in the one (1) ton cylinders

Should one or more of the alarms be activated, operator assistance will be required.

As the CSO chlorination system is an extension of the existing chlorination system, current maintenance practices used on the plant system shall be transferable to the CSO system. At the end of each CSO event, the CSO clarifier shall be drained and cleaned in anticipation of the next CSO event. Quarterly at a minimum or as determined by the City of Jacksonville, at the end of each CSO event the collection system pump stations and related pipes shall be inspected to confirm that all are available for service at a future point in time. Inspection shall be visual.

Additional Owner preference maintenance may involve removal and storage of the chlorine analyzer during the non recreational portion of the season. Heavy debris shall be removed on an as needed basis.

8.0 Maximizing Treatment at the Treatment Plant

The City of Jacksonville continues to strive for maximization of treatment of CSO flows at the treatment plant / POTW. As part of the nine minimum controls, the City has taken steps for maximization of flow to the POTW, by implementing an aggressive CSS separation program, almost totally eliminating bypasses at Outfall 003, thus allowing CSO flows to continue to the POTW for primary and possibly secondary treatment. The hydraulic analysis contained in this report shows a reduction in CSO by-passes and that 90% of the CSO volume receives primary treatment. Additionally, CSO facilities, such as pump station wet wells and trash racks are routinely cleaned. Also, the 36 inch forcemain from the east CSO pump station to the POTW is drained as quickly as possible in order to provide additional CSO storage. Sewer mains are also routinely inspected and jetted / cleaned of deposits, thereby maximizing storage in the collection system.

Once CSO flows reach the POTW, records indicate the City's dedication to the treatment of CSO flows. Review of over 14 years of accurate and detailed records support a commitment to maximizing treatment of CSO through timely draining of CSO facilities (first flush basins and clarifier) back to the headworks of the POTW for secondary treatment. By draining these facilities in such a timely manner, the full CSO storage volume is quickly ready to receive potential flows from future rainfall events.

Additionally, flow records from the POTW indicate the extended aeration system has consistently operated in "wet weather" mode, utilizing the full hydraulic capacity while meeting discharge requirements. Data indicates the City has a thorough understanding of treatment plant operations and how plant performance responds to wet weather conditions. Data demonstrates that the City has shown consistent anticipation of wet weather conditions and rapid response / readying of equipment for wet weather flows. Such operations include increased cleaning of bar screens, drawing down sludge blankets, altering treatment processes (sludge recycle / wasting rates), and ensuring that adequate disinfection capacity is available.

9.0 Implementation Schedule

The timeline below is the recommended schedule to continue the City's efforts of CSS separation and to meet the recommendations contained in this LTCP (with emphasis on disinfection):

ACTION	DATE
Submit LTCP	Nov. 2008
Select CSS Sewer Separation Project	Mar. 2009
Initiate Design of CSS Separation Project	June 2009
Approval / Adoption of LTCP – IEPA / USEPA	Nov. 2009
Continue Background Monitoring	Nov. 2009- July 2013
Jacksonville NPDES Permit Renewal	Nov. 2009
Complete Design of CSS Separation Project	Nov 2009
Secure Funding for CSS Separation Project	Dec 2009

Receive IEPA Permit for Separation Project..Jan. 2010

Initiate Const. of CSS Separation Project..June 2010

Complete Construction of CSS Separation Project ....Dec. 2010

Implementation Schedule (cont.)

ACTION	DATE
Initiate Design of Chlorination Facilities	Jan. 2010
Complete Design of Chlorination Facilities	June 2010
Receive IEPA Permit for Chlorination Facilities (Const. & Operation)	October 2010
Bidding of Chlorination Facilities	Jan. 2011
Construction Completion of Chlorination Facilities	Sept. 2011
Pilot Testing / Operation of Chlorination Facilities	Oct. 2011 – Nov. 2014
Presentation of Monitoring / WLA Recommendation to IEPA	Oct. 2013
NPDES Permit Renewal w/ Fecal Coliform Limit for CSO's	Nov. 2014

10.0 Post-Construction Compliance Monitoring

Post-construction stream monitoring at the locations shown in Figure 2.1 should be implemented after CSO remedial strategies are in place. It is suggested that one dry weather event and two wet weather events be collected each year to monitor the effectiveness of any structural improvements (stormwater separation, upgrades to City's CSO basin, etc) and other non-structural improvements (e.g street sweeping) within the City.

Post-construction monitoring for the pilot study for disinfection of CSO flows at the POTW will include monitoring of chlorine residual and fecal coliform at Outfall 004

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APPENDIX A – Jacksonville STP NPDES Permit

NPDES Permit No. IL0021661

Illinois Environmental Protection Agency

Division of Water Pollution Control

1021 North Grand Avenue East

Post Office Box 19276

Springfield, Illinois 62794-9276

NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM

Reissued (NPDES) Permit

Expiration Date: October 31, 2009

Issue Date: September 29, 2004
Effective Date: November 1, 2004

Name and Address of Permittee:

City of Jacksonville
Municipal Building
200 West Douglas Avenue
Jacksonville, IL 62650

Facility Name and Address:

Jacksonville STP
Rural Route 3
Jacksonville, IL
(Morgan County)

Receiving Waters: Mauvaisterre Creek

In compliance with the provisions of the Illinois Environmental Protection Act, Title 35 of the Ill. Adm. Code, Subtitle C, Chapter I, and the Clean Water Act (CWA), the above-named Permittee is hereby authorized to discharge at the above location to the above-named receiving stream in accordance with the standard conditions and attachments herein.

Permittee is not authorized to discharge after the above expiration date. In order to receive authorization to discharge beyond the expiration date, the Permittee shall submit the proper application as required by the Illinois Environmental Protection Agency (IEPA) not later than 180 days prior to the expiration date.

Alan Keller, P.E.
Manager, Permit Section
Division of Water Pollution Control

SAK:PNM:04062302.dlk

NPDES Permit No. IL0021661

Effluent Limitations, Monitoring, and Reporting

FINAL

Discharge Number(s) and Name(s): 001 STP Outfall

Load limits computed based on a design average flow (DAF) of 7.57 MGD (design maximum flow (DMF) of 15.0 MGD).

Excess flow facilities (if applicable) shall not be utilized until the main treatment facility is receiving its maximum practical flow.

From the effective date of this Permit until the expiration date, the effluent of the above discharge(s) shall be monitored and limited at all times as follows:

	LOAD LIMITS lbs/day DAF (DMF)*			CONCENTRATION LIMITS MG/L				
Parameter	Monthly Average	Weekly Average	Daily Maximum	Monthly Average	Weekly Average	Daily Maximum	Sample Frequency	Sample Type
Flow (MGD)							Continuous	RIT
$CBOD_5$**	631 (1251)		1263 (2502)	10		20	2 Days/Week	Composite
Suspended Solids	758 (1501)		1515 (3002)	12		24	2 Days/Week	Composite
Dissolved Oxygen	Shall not be less than 6 mg/L						2 Days/Week	Grab
pH	Shall be in the range of 6 to 9 Standard Units						2 Days/Week	Grab
Fecal Coliform***	Daily Maximum shall not exceed 400 per 100 mL (May through October)						5 Days/Week	Grab
Chlorine Residual***						0.05	5 Days/Week	Grab
Ammonia Nitrogen as (N)								
April-May/Sept.-Oct.	95 (188)	461 (913)	682 (1351)	1.5	7.3	10.8	2 Days/Week	Composite
June-August	95 (188)	297 (588)	682 (1351)	1.5	4.7	10.8	2 Days/Week	Composite
Nov.-Feb.	215 (425)		568 (1126)	3.4		9.0	2 Days/Week	Composite
March	183 (363)	461 (913)	568 (1126)	2.9	7.3	9.0	2 Days/Week	Composite

*Load limits based on design maximum flow shall apply only when flow exceeds design average flow.
**Carbonaceous BOD_5 ($CBOD_5$) testing shall be in accordance with 40 CFR 136.
***See Special Condition 8.

Flow shall be reported on the Discharge Monitoring Report (DMR) as monthly average and daily maximum.

Fecal Coliform shall be reported on the DMR as daily maximum.

pH shall be reported on the DMR as a minimum and a maximum.

Chlorine Residual shall be reported on DMR as daily maximum.

Dissolved oxygen shall be reported on DMR as minimum.

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Effluent Limitations, Monitoring, and Reporting

FINAL

Discharge Number(s) and Name(s): 004 Treated Combined Sewage Outfall

These flow facilities shall not be utilized until the main treatment facility is receiving its maximum practical flow.

From the effective date of this Permit until the expiration date, the effluent of the above discharge(s) shall be monitored and limited at all times as follows:

Parameter		CONCENTRATION LIMITS mg/L Monthly Average	Sample Frequency	Sample Type
Total Flow (MG)	See Below		Daily When Discharging	Continuous
BOD_5		Report	Daily When Discharging	Grab
Suspended Solids		Report	Daily When Discharging	Grab
pH	Shall be in the range of 6 to 9 Standard Units		Daily When Discharging	Grab
Fecal Coliform	See Below		Daily When Discharging	Grab

Total flow in million gallons shall be reported on the Discharge Monitoring Report (DMR) in the quantity maximum column.

Report the number of days of discharge in the comments section of the DMR.

pH shall be reported on the DMR as a minimum and a maximum.

BOD_5 and Suspended Solids shall be reported on the DMR as a monthly average concentration.

Fecal Coliform shall be reported on the DMR as a monthly average (geometric mean) and as a daily maximum.

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Influent Monitoring, and Reporting

The influent to the plant shall be monitored as follows:

Parameter	Sample Frequency	Sample Type
Flow (MGD)	Continuous	
BOD_5	2 Days/Week	Composite
Suspended Solids	2 Days/Week	Composite

Influent samples shall be taken at a point representative of the influent.

Flow (MGD) shall be reported on the Discharge Monitoring Report (DMR) as monthly average and daily maximum.

BOD_5 and Suspended Solids shall be reported on the DMR as a monthly average concentration.

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Special Conditions

SPECIAL CONDITION 1. This Permit may be modified to include different final effluent limitations or requirements which are consistent with applicable laws, regulations, or judicial orders. The IEPA will public notice the permit modification.

SPECIAL CONDITION 2. The use or operation of this facility shall be by or under the supervision of a Certified Class 1 operator.

SPECIAL CONDITION 3. The IEPA may request in writing submittal of operational information in a specified form and at a required frequency at any time during the effective period of this Permit.

SPECIAL CONDITION 4. The IEPA may request more frequent monitoring by permit modification pursuant to 40 CFR § 122.63 and Without Public Notice in the event of operational, maintenance or other problems resulting in possible effluent deterioration.

SPECIAL CONDITION 5. The effluent, alone or in combination with other sources, shall not cause a violation of any applicable water quality standard outlined in 35 Ill. Adm. Code 302.

SPECIAL CONDITION 6. Samples taken in compliance with the effluent monitoring requirements shall be taken at a point representative of the discharge, but prior to entry into the receiving stream.

SPECIAL CONDITION 7. This Permit may be modified to include requirements for the Permittee on a continuing basis to evaluate and detail its efforts to effectively control sources of infiltration and inflow into the sewer system and to submit reports to the IEPA if necessary.

SPECIAL CONDITION 8. Fecal Coliform limits for discharge point 001 are effective May thru October. Sampling of Fecal Coliform is only required during this time period.

The total residual chlorine limit is applicable at all times. If the Permittee is chlorinating for any purpose during the months of November through April, sampling is required on a daily grab basis. Sampling frequency for the months of May through October shall be as indicated on effluent limitations, monitoring and reporting page of this Permit.

SPECIAL CONDITION 9. The Permittee shall monitor the effluent and report concentrations (in mg/L) of the following listed parameters eighteen (18) months prior to the expiration date and again at twelve (12) months prior to the expiration date. The sample shall be a 24-hour effluent composite except as otherwise specifically provided below and the results shall be submitted on Discharge Monitoring Report Forms to IEPA unless otherwise specified by the IEPA. The parameters to be sampled and the minimum detection limits to be attained are as follows:

STORET CODE	PARAMETER	Minimum detection limit
01002	Arsenic	0.05 mg/L
01007	Barium	0.5 mg/L
01027	Cadmium	0.001 mg/L
01032	Chromium (hexavalent) (grab)	0.01 mg/L
01034	Chromium (total)	0.05 mg/L
01042	Copper	0.005 mg/L
00718	Cyanide (grab) (weak acid dissociable)	5.0 ug/L
00720	Cyanide (grab not to exceed 24 hours) (total)	5.0 ug/L
00951	Fluoride	0.1 mg/L
01045	Iron (total)	0.5 mg/L
01046	Iron (Dissolved)	0.5 mg/L
01051	Lead	0.05 mg/L
01055	Manganese	0.5 mg/L
71900	Mercury (Using USEPA Method 1631 or equivalent)	1.0 ng/L*
01067	Nickel	0.005 mg/L
00556	Oil (hexane soluble or equivalent) (Grab Sample only)	5.0 mg/L
32730	Phenols (grab)	0.005 mg/L
01147	Selenium	0.005 mg/L
01077	Silver (total)	0.003 mg/L
01092	Zinc	0.025 mg/L

Unless otherwise indicated, concentrations refer to the total amount of the constituent present in all phases, whether solid, suspended or dissolved, elemental or combined, including all oxidation states.

*1.0 ng/L = 1 part per trillion.

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Special Conditions

SPECIAL CONDITION 10. The Permittee shall monitor the effluent for the following parameters monthly for a period of six (6) consecutive months, beginning three (3) months from the effective date of this Permit. This Permit may be modified with public notice to establish effluent limitations if appropriate, based on information obtained through sampling. The sample shall be a 24-hour effluent composite except as otherwise specifically provided below and the results shall be submitted on the DMR's to IEPA. The parameters to be sampled and the minimum detection limits to be attained are as follows:

STORET CODE	PARAMETER	Minimum detection limit
00718	Cyanide (grab) (weak acid dissociable)	5.0 ug/L
01067	Nickel	0.005 mg/L
01077	Silver (total)	0.003 mg/L
01092	Zinc	0.025 mg/L

Unless otherwise indicated, concentrations refer to the total amount of the constituent present in all phases, whether solid, suspended or dissolved, elemental or combined, including all oxidation states.

SPECIAL CONDITION 11. The Permitee may collect data in support of developing a site-specific metals translator for Nickel and Zinc. Total and dissolved metals for a minimum of twelve weekly samples need to be collected from the effluent and at a downstream location indicative of complete mixing between the effluent and the receiving water to determine a metal translator for these parameters. The IEPA will review submitted sample data and may reopen and modify this Permit to eliminate or include revised effluent limitations for these parameters based on the metal translator determined from the collected data.

SPECIAL CONDITION 12.

Schedule for Implementing the POTW Pretreatment Program

Under the authority of Sections 307(b) and 402(b)(8) of the Clean Water Act, and implementing regulations 40 CFR 403, the Permittee may be required to develop a Pretreatment Program. If it is necessary to develop a Pretreatment Program, the Permittee will be notified in writing by the Approval Authority after submittal of the industrial inventory discussed in the schedule below. This program, if required, shall enable the Permittee to detect and enforce against violations of Pretreatment Standards promulgated under Sections 307(b) and 307(c) of the Clean Water Act, prohibitive discharge standards as set forth in 40 CFR § 403.5, and state and local limits.

The Permittee should submit a copy of each activity to the IEPA and to USEPA, Region 5.

The schedule for the development of this Pretreatment Program is as follows:

	ITEM	COMPLETION DATE
1.	Develop an industrial user inventory pursuant to 40 CFR § 403.8(f)(2)(i-iii), including identification of industrial users and the character and volume of pollutants contributed to the publicly owned treatment works (POTW) by the industrial users. The inventory shall include a list of all industrial users (Ius) discharging to the Permittee that are subject to categorical pretreatment standards under 40 CFR § 403.6 and 40 CFR Chapter I, Subchapter N, or would otherwise be considered significant under 40 CFR § 403.3(t).	6 months from the effective date of this Permit
2.	Submit a proposed Pretreatment Program consistent with 40 CFR §§ 403.8 and 403.9(f). The proposed Pretreatment Program shall contain the following elements: a. A statement from an official representative of the Permittee or their legal counsel regarding the adequacy of the Permittee's legal authority;	12 months from the date of notification by the Approval Authority that development of a Pretreatment Program is necessary

b. A sewer use ordinance or other authorities to be relied upon by the POTW for administration of the Pretreatment Program;

c. An Enforcement Response Plan (with monitoring and inspection program procedures);

d. Local limitations developed pursuant to 40 CFR 403.5(c) and USEPA guidance;

e. A description of the Permittee's organization which will administer the Pretreatment Program; and

f. A description of funding and resources available to implement the Pretreatment Program.

Upon approval by the Regional Administrator or the Director, when appropriate, of the Pretreatment Program, this Permit will be modified or, alternatively, upon request, revoked and reissued to incorporate the conditions of that Pretreatment Program.

This Permit may be modified to eliminate the requirement to develop a Pretreatment Program should further developments during the preparation of the program warrant its discontinuance.

All items in the schedule shall be sent to IEPA and USEPA at the following addresses:

Illinois Environmental Protection Agency
Division of Water Pollution Control
1021 North Grand Avenue East
P.O. Box 19276
Springfield, Illinois 62794-9276

Attention: Compliance Assurance Section

United States Environmental Protection Agency
Region 5
NPDES Support and Technical Assistance Branch
77 West Jackson Boulevard
Chicago, Illinois 60604-3950

Attention: Pretreatment Coordinator WN-16J

Removal Allowances

Any application for authority to revise categorical pretreatment standards to reflect POTW removal of pollutants must be submitted to the Approval Authority in accordance with 40 CFR § 403.7(c).

SPECIAL CONDITION 13. The Permittee has previously undergone a Monitoring Reduction review and the influent and effluent sample frequency has been reduced for BOD_5, CBOD5, Suspended Solids, pH and ammonia nitrogen due to sustained compliance. The IEPA will require that the influent and effluent sampling frequency for these parameters be increased to 5 days/week if effluent deterioration occurs due to increased wasteload, operational, maintenance or other problems. The increased monitoring will be required Without Public Notice when a permit modification is received by the Permittee from the IEPA.

SPECIAL CONDITION 14.. During January of each year the Permittee shall submit annual fiscal data regarding sewerage system operations to the Illinois Environmental Protection Agency/Division of Water Pollution Control/Compliance Assurance Section. The Permittee may use any fiscal year period provided the period ends within twelve (12) months of the submission date.

Submission shall be on forms provided by IEPA titled "Fiscal Report Form For NPDES Permittees".

SPECIAL CONDITION 15. The Permittee shall conduct biomonitoring of the effluent from Discharge Number(s) 001.

Biomonitoring

1. Acute Toxicity - Standard definitive acute toxicity tests shall be run on at least two trophic levels of aquatic species (fish, invertebrate) representative of the aquatic community of the receiving stream. Testing must be consistent with Methods for Measuring the Acute Toxicity of Effluents and Receiving Waters to Freshwater and Marine Organisms (Fifth Ed.) EPA/821-R-02-012. Unless substitute tests are pre-approved; the following tests are required:

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Special Conditions

a. Fish - 96-hour static LC_{50} Bioassay using fathead minnows (Pimephales promelas).

b. Invertebrate 48-hour static LC_{50} Bioassay using Ceriodaphnia.

2. Testing Frequency - The above tests shall be conducted using 24-hour composite samples unless otherwise authorized by the IEPA. Samples must be collected in the 18th, 15th, 12th, and 9th month prior to the expiration date of this Permit.

3. Reporting - Results shall be reported according to EPA/821-R-02-012, Section 12, Report Preparation, and shall be submitted to IEPA, Bureau of Water, Compliance Assurance Section within one week of receipt from the laboratory. Reports are due to the IEPA no later than the 16th, 13th, 10th, and 7th month prior to the expiration date of this Permit.

4. Toxicity Reduction Evaluation - Should the results of the biomonitoring program identify toxicity, the IEPA may require that the Permittee prepare a plan for toxicity reduction evaluation and identification. This plan shall be developed in accordance with Toxicity Reduction Evaluation Guidance for Municipal Wastewater Treatment Plants, EPA/833B-99/002, and shall include an evaluation to determine which chemicals have a potential for being discharged in the plant wastewater, a monitoring program to determine their presence or absence and to identify other compounds which are not being removed by treatment, and other measures as appropriate. The Permittee shall submit to the IEPA its plan for toxicity reduction evaluation within ninety (90) days following notification by the IEPA. The Permittee shall implement the plan within ninety (90) days or other such date as contained in a notification letter received from the IEPA.

The IEPA may modify this Permit during its term to incorporate additional requirements or limitations based on the results of the biomonitoring. In addition, after review of the monitoring results, the IEPA may modify this Permit to include numerical limitations for specific toxic pollutants. Modifications under this condition shall follow public notice and opportunity for hearing.

SPECIAL CONDITION 16. For the duration of this Permit, the Permittee shall determine the quantity of sludge produced by the treatment facility in dry tons or gallons with average percent total solids analysis. The Permittee shall maintain adequate records of the quantities of sludge produced and have said records available for IEPA inspection. The Permittee shall submit to the IEPA, at a minimum, a semi-annual summary report of the quantities of sludge generated and disposed of, in units of dry tons or gallons (average total percent solids) by different disposal methods including but not limited to application on farmland, application on reclamation land, landfilling, public distribution, dedicated land disposal, sod farms, storage lagoons or any other specified disposal method. Said reports shall be submitted to the IEPA by January 31 and July 31 of each year reporting the preceding January thru June and July thru December interval of sludge disposal operations.

Duty to Mitigate. The Permittee shall take all reasonable steps to minimize any sludge use or disposal in violation of this Permit.

Sludge monitoring must be conducted according to test procedures approved under 40 CFR 136 unless otherwise specified in 40 CFR 503, unless other test procedures have been specified in this Permit.

Planned Changes. The Permittee shall give notice to the IEPA on the semi-annual report of any changes in sludge use and disposal.

The Permittee shall retain records of all sludge monitoring, and reports required by the Sludge Permit as referenced in Standard Condition 23 for a period of at least five (5) years from the date of this Permit.

If the Permittee monitors any pollutant more frequently than required by the Sludge Permit, the results of this monitoring shall be included in the reporting of data submitted to the IEPA.

Monitoring reports for sludge shall be reported on the form titled "Sludge Management Reports" to the following address:

Illinois Environmental Protection Agency
Bureau of Water
Compliance Assurance Section
Mail Code #19
1021 North Grand Avenue East
Post Office Box 19276
Springfield, Illinois 62794-9276

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Special Conditions

SPECIAL CONDITION 17.

AUTHORIZATION OF
COMBINED SEWER AND TREATMENT PLANT DISCHARGES

The IEPA has determined that at least a portion of the collection system consists of combined sewers. References to the collection system and the sewer system refer only to those parts of the system which are owned and operated by the Permittee unless otherwise indicated. The Permittee is authorized to discharge from the overflow(s)/bypass(es) listed below provided the diversion structure is located on a combined sewer and the following terms and conditions are met:

Discharge Number	Location	Receiving Water
002	North CSO Lift Station at the Plant	Mauvaisterre Creek
003	East CSO Lift Station at the East Johnson St.	Mauvaisterre Creek

Treatment Requirements

1. All combined sewer overflows and treatment plant bypasses shall be given sufficient treatment to prevent pollution and the violation of applicable water quality standards. Sufficient treatment shall consist of the following:

   a. All dry weather flows, and the first flush of storm flows shall meet all applicable effluent standards and the effluent limitations as required for the main STP outfall;

   b. Additional flows, but not less than ten times the average dry weather flow for the design year, shall receive a minimum of primary treatment; and,

   c. Additional flows, shall be treated to the extent necessary to comply with applicable water quality standards and the federal Clean Water Act, including any amendments made by the Wet Weather Water Quality Act of 2000.

2. All CSO discharges authorized by this Permit 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 below the applicable water quality standards.

3. Overflows during dry weather are prohibited. Dry weather overflows, if discovered, shall be reported to the IEPA pursuant to Standard Condition 12(e) of this Permit (24-hour notice).

4. The collection system shall be operated to optimize transport of wastewater flows and to minimize CSO discharges.

5. The treatment system shall be operated to maximize treatment of wastewater flows.

Nine Minimum Controls

6. The Permittee shall comply with the nine minimum controls contained in the National CSO Control Policy published in the Federal Register on April 19, 1994. The nine minimum controls are:

   a. Proper operation and maintenance programs for the sewer system and the CSOs (Compliance with this Item shall be met through the requirements imposed by Paragraph 8 of this Special Condition);

   b. Maximum use of the collection system for storage (Compliance with this Item shall be met through the requirements imposed by Paragraphs 1, 4, and 8 of this Special Condition);

   c. Review and modification of pretreatment requirements to assure CSO impacts are minimized (Compliance with this Item shall be met through the requirements imposed by Paragraph 9 of this Special Condition);

   d. Maximization of flow to the POTW for treatment (Compliance with this Item shall be met through the requirements imposed by Paragraphs 4, 5, and 8 of this Special Condition);

e. Prohibition of CSOs during dry weather (Compliance with this item shall be met through the requirements imposed by Paragraph 3 of this Special Condition);

f. Control of solids and floatable materials in CSOs (Compliance with this item shall be met through the requirements imposed by Paragraphs 2 and 8 of this Special Condition);

g. Pollution prevention programs which focus on source control activities (Compliance with this item shall be met through the requirements imposed by Paragraph 6 of this Special Condition, See Below);

h. Public notification to ensure that citizens receive adequate information regarding CSO occurrences and CSO impacts (Compliance with this item has been met through Paragraphs 7 and 12 of this Special Condition); and,

i. Monitoring to characterize impacts and efficiency of CSO controls (Compliance with this item shall be met through the requirements imposed by Paragraphs 10 and 11 of this Special Condition).

A pollution prevention plan was approved by the IEPA for this collection/treatment system on July 18, 1997. The pollution prevention plan shall be presented to the general public at a public information meeting conducted by the Permittee within nine (9) months of the effective date of this Permit. The Permittee shall submit documentation that the pollution prevention plan complies with the requirements of this Permit and that the public information meeting was held. Such documentation shall be submitted to the IEPA within twelve (12) months of the effective date of this Permit and shall include a summary of all significant issues raised by the public, the Permittee's response to each issue, and two (2) copies of the "CSO Pollution Prevention Plan Certification" one (1) with original signatures. Following the public meeting, the Permittee shall implement the pollution prevention plan within one (1) year and shall maintain a current pollution prevention plan, updated to reflect system modifications, on file at the sewage treatment works or other acceptable location and made available to the public. The pollution prevention plan shall be submitted to the IEPA upon written request.

Sensitive Area Considerations

7. Sensitive areas are any water likely to be impacted by a CSO discharge which meet one or more of the following criteria: (1) designated as an Outstanding National Resource Water; (2) found to contain shellfish beds; (3) found to contain threatened or endangered aquatic species or their habitat; (4) used for primary contact recreation; or, (5) within the protection area for a drinking water intake structure.

The IEPA has determined that none of the outfalls listed in this Special Condition discharge to sensitive areas. However, if information becomes available that causes the IEPA to reverse this determination, the IEPA will notify the Permittee in writing. Within three (3) months of the date of notification, or such other date contained in the notification letter, the Permittee shall submit two (2) copies of either a schedule to relocate, control, or treat discharges from these outfalls. If none of these options are possible, the Permittee shall submit adequate justification at that time as to why these options are not possible. Such justification shall be in accordance with Section II.C.3 of the National CSO Control Policy.

Operational and Maintenance Plans

8. The IEPA reviewed and accepted a CSO operational and maintenance plan "CSO O&M plan" on June 4, 1997 prepared for this sewerage system. The Permittee shall review and revise, if needed, the CSO O&M plan to reflect system changes.

The CSO O&M plan shall be presented to the general public at a public information meeting conducted by the Permittee within nine (9) months of the effective date of this Permit. The Permittee shall submit documentation that the CSO O&M plan complies with the requirements of this Permit and that the public information meeting was held. Such documentation shall be submitted to the IEPA within twelve (12) months of the effective date of this Permit and shall include a summary of all significant issues raised by the public, the Permittee's response to each issue, and two (2) copies of the "CSO Operational Plan Checklist and Certification", one (1) with original signatures. Following the public meeting, the Permittee shall implement the CSO O&M plan within one (1) year and shall maintain a current CSO O&M plan, updated to reflect system modifications, on file at the sewage treatment works or other acceptable location and made available to the public. The CSO O&M plan shall be submitted to the IEPA upon written request.

The objectives of the CSO O&M plan are to reduce the total loading of pollutants and floatables entering the receiving stream and to ensure that the Permittee ultimately achieves compliance with water quality standards. These plans, tailored to the local governments's collection and waste treatment systems, shall include mechanisms and specific procedures where applicable to ensure:

a. Collection system inspection on a scheduled basis;

b. Sewer, catch basin, and regulator cleaning and maintenance on a scheduled basis;

c. Inspections are made and preventive maintenance is performed on all pump/lift stations;

d. Collection system replacement, where necessary;

e. Detection and elimination of illegal connections;

f. Detection, prevention, and elimination of dry weather overflows;

g. The collection system is operated to maximize storage capacity and the combined sewer portions of the collection system are operated to delay storm entry into the system; and,

h. The treatment and collection systems are operated to maximize treatment.

Sewer Use Ordinances

9. The Permittee, within six (6) months of the effective date of this Permit, shall review and where necessary, modify its existing sewer use ordinance to ensure it contains provisions addressing the conditions below. If no ordinance exists, such ordinance shall be developed and implemented within six (6) months from the effective date of this Permit. Sewer use ordinances are to contain specific provisions to:

a. prohibit introduction of new inflow sources to the sanitary sewer system;

b. require that new construction tributary to the combined sewer system be designed to minimize and/or delay inflow contribution to the combined sewer system;

c. require that inflow sources on the combined sewer system be connected to a storm sewer, within a reasonable period of time, if a storm sewer becomes available;

d. provide that any new building domestic waste connection shall be distinct from the building inflow connection, to facilitate disconnection if a storm sewer becomes available;

e. assure that CSO impacts from non-domestic sources are minimized by determining which non-domestic discharges, if any, are tributary to CSOs and reviewing, and, if necessary, modifying the sewer use ordinance to control pollutants in these discharges; and,

f. assure that the owners of all publicly owned systems with combined sewers tributary to the Permittee's collection system have procedures in place adequate to ensure that the objectives, mechanisms, and specific procedures given in Paragraph 8 of this Special Condition are achieved.

Upon completion of the review of the sewer use ordinance(s), the Permittee shall submit two (2) copies of a completed Certification of Sewer Use Ordinance Review, one (1) with original signatures. The Permittee shall submit copies of the sewer use ordinance(s) to the IEPA upon written request.

The Permittee shall enforce the applicable sewer use ordinances.

Long-Term Control Planning and Compliance with Water Quality Standards

10. a. Pursuant to Section 301 of the federal Clean Water Act, 33 U.S.C. § 1311 and 40 CFR § 122.4, discharges from the CSOs, including the outfalls listed in this Special Condition and any other outfall listed as a "Treated Combined Sewage Outfall", shall not cause violations of applicable water quality standards or cause use impairment in the receiving waters. In addition, discharges from CSOs shall comply with all applicable parts of 35 Ill. Adm. Code 306.305(a), (b), (c), and (d).

b. The Permittee shall develop and implement a CSO Control Plan for assuring that the discharges from the CSOs authorized in this Permit comply with 10.a above, including the following steps:

NPDES Permit No. IL0021661

Special Conditions

1. The Permittee shall develop and submit a Plan of Study (POS) for CSO Assessment within six (6) months of the effective date of this Permit. Such POS shall incorporate the provisions of Title 35, Subtitle C, Chapter II, Part 375, Subpart D and shall include provisions to determine what percentage of the first flush for a 1.2-inch storm with a one hour duration is currently being treated by the Permittee. The POS shall also contain provisions to measure compliance with 35 Ill. Adm. Code 306.305(b) and to demonstrate compliance with water quality standards pursuant to the "demonstration approach" under Section II.C.4.b of the federal CSO Control Policy of 1994.

   The requirements of Section II.C.4.b of the federal CSO Control Policy of 1994 are:

   a. The CSO controls are adequate to meet water quality standards and protect designated uses, unless water quality standards or uses cannot be met as a result of natural background conditions or pollution sources other than CSOs;

   b. The CSO discharges do not preclude the attainment of water quality standards or the receiving waters' designated uses are not met in part because of natural background conditions or pollution sources other than CSOs;

   c. The CSO control program provides the maximum pollution reduction reasonably attainable; and,

   d. The CSO control program has been designed to allow cost effective retrofitting if additional controls are subsequently determined to be necessary to meet water quality standards or designated uses.

2. The Permittee shall respond to an IEPA review letter in writing within ninety (90) days of the date of such an initial review letter, within thirty (30) days of any subsequent review letter(s), if any, and shall implement the POS and submit a CSO Assessment Report within eighteen (18) months of the IEPA approval for the POS or by such date as indicated in the IEPA approval letter for the POS.

3. If the CSO Assessment Report indicates that the discharges from the CSOs authorized in this Permit fully comply with the applicable parts of 35 Ill. Adm. Code 306.305 and do not cause or contribute to violations of water quality standards (including recreational uses), IEPA may make a determination that no additional CSO control is required.

4. Unless the IEPA determines that no additional CSO control is required, the Permittee shall complete a CSO Control Plan for complying with such regulations and bringing flows from all of its CSOs (treated and untreated) into compliance with applicable standards, including water quality standards. Two (2) copies of this plan shall be submitted to the IEPA within forty-eight (48) months from the effective date of this Permit and shall contain a schedule for its implementation and provisions for re-evaluating compliance with applicable standards and regulations after implementation. The control plan shall be consistent with the "demonstration approach" under Section II.C.4.b of the federal CSO Control Policy of 1994.

   Required components of the LTCP include the following:

   a. Characterization, monitoring, and modeling of the Combined Sewer System (CSS);
   b. Consideration of Sensitive Areas;
   c. Evaluation of alternatives;
   d. Cost/Performance considerations;
   e. Revised CSO Operational Plan;
   f. Maximizing treatment at the treatment plant;
   g. Implementation schedule;
   h. Post-Construction compliance monitoring program; and
   i. Public participation.

Monitoring, Reporting and Notification Requirements

11. The Permittee shall monitor the frequency of discharge (number of discharges per month) and estimate the duration (in hours) of each discharge from each outfall listed in this Special Condition. Estimates of storm duration and total rainfall shall be provided for each storm event.

Special Conditions

For frequency reporting, all discharges from the same storm, or occurring within 24 hours, shall be reported as one. The date that a discharge commences shall be recorded for each outfall. Reports shall be in the form specified by the IEPA and on forms provided by the IEPA. These forms shall be submitted to the IEPA monthly with the DMRs and covering the same reporting period as the DMRs. Parameters (other than flow frequency), if required in this Permit, shall be sampled and reported as indicated in the transmittal letter for such report forms.

12. A public notification program in accordance with Section II.B.8 of the federal CSO Control Policy of 1994 shall be developed employing a process that actively informs the affected public. The program shall include at a minimum public notification of CSO occurrences and CSO impacts, with consideration given to including mass media and/or Internet notification. The Permittee shall also consider posting signs in waters likely to be impacted by CSO discharges at the point of discharge and at points where these waters are used for primary contact recreation. Provisions shall be made to include modifications of the program when necessary and notification to any additional member of the affected public. The program shall be presented to the general public at a public information meeting conducted by the Permittee. The Permittee shall conduct the public information meeting within nine (9) months of the effective date of this Permit. The Permittee shall submit documentation that the public information meeting was held, shall submit a summary of all significant issues raised by the public and the Permittee's response to each issue and shall identify any modifications to the program as a result of the public information meeting. The Permittee shall submit the public information meeting documentation to the IEPA and implement the public notification program within twelve (12) months of the effective date of this Permit.

13. If any of the CSO discharge points listed in this Special Condition are eliminated, or if additional CSO discharge points, not listed in this Special Condition, are discovered, the Permittee shall notify the IEPA in writing within one (1) month of the respective outfall elimination or discovery. Such notification shall be in the form of a request for the appropriate modification of this NPDES Permit.

Summary of Compliance Dates in this CSO Special Condition

14. The following summarizes the dates that submittals contained in this Special Condition are due at the IEPA (unless otherwise indicated):

Submission of CSO Monitoring Data (Paragraph 11)	15th of every month
Elimination of a CSO or Discovery of Additional CSO Locations (Paragraph 13)	1 month from discovery or elimination
Certification of Sewer Use Ordinance Review (Paragraph 9)	6 months from the effective date of this Permit
Conduct Pollution Prevention, OMP, and PN Public Information Meeting (Paragraphs, 6, 8 and 12) **No Submittal Due with this Milestone**	9 months from the effective date of the Permit
Submit Pollution Prevention Certification, OMP, and PN Information Meeting Summary (Paragraphs, 6, 8 and 12)	12 months from the effective date of the Permit
Submit CSO Assessment Report (Paragraph 10)	18 months from the date of IEPA POS approval
CSO Control Plan (Paragraph 10)	48 months from the effective date of this Permit

All submittals listed in this paragraph shall be mailed to the following address:

Illinois Environmental Protection Agency
Division of Water Pollution Control
1021 North Grand Avenue East
Post Office Box 19276
Springfield, Illinois 62794-9276

Attention: CSO Coordinator, Compliance Assurance Section

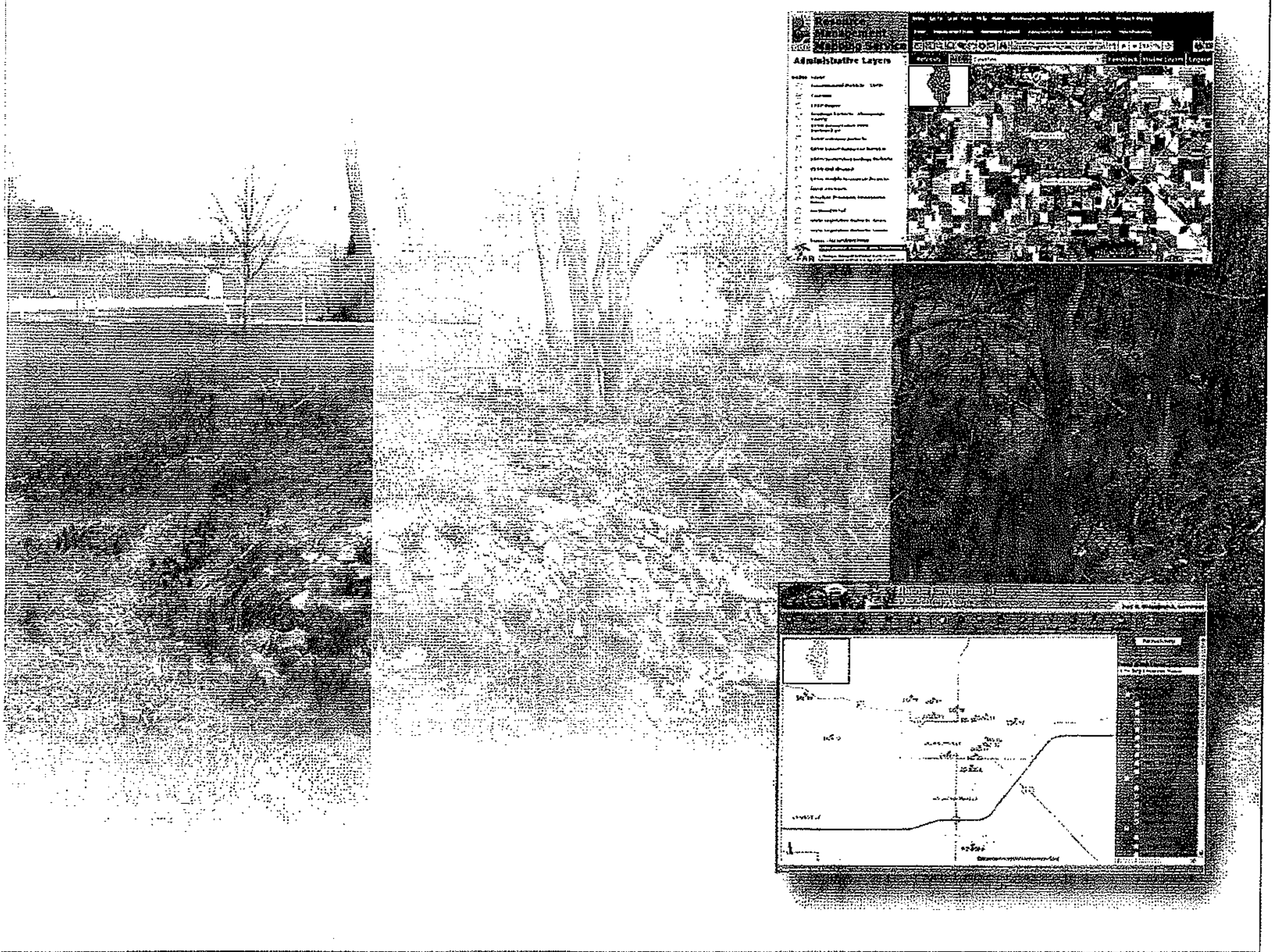
All submittals hand carried shall be delivered to 1021 North Grand Avenue East.

APPENDIX B – Plan of Study for CSO Assessment

Jacksonville, IL

CDM

Plan of Study for CSO Assessment



Report

April 2005

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Executive Summary

Background

On November 1, 2004 IEPA issued a modified NPDES permit for the City of Jacksonville. The proposed modifications to the NPDES permit include requirements for the City to develop and implement a CSO Control Plan according to the following steps:

- Develop and submit a Plan of Study for CSO Assessment (POS) within six months of the modification date of the permit (due date is May 1, 2005). The plan shall include provisions to determine what percentage of a 1.2-inch storm with a one-hour duration is currently being treated by the City. The plan shall also contain provisions to measure compliance with Illinois Administrative Code Title 35, Section 306.305 (b) which requires that not less than ten times the average dry weather flow receive a minimum of primary treatment and disinfection. It is also important to note that flow in excess of ten times the average dry weather flow shall be treated, to the extent necessary, to prevent accumulation of sludge deposits, floating debris and solids as well as to prevent depression of oxygen levels in the receiving waters.

- In addition, the permit requires the POS to measure and demonstrate compliance with water quality standards pursuant to the demonstration approach under the Federal CSO Control Policy of 1994.

- Upon approval by IEPA, the City shall implement the POS and submit a CSO Assessment Report within 18 months.

- If the CSO Assessment Report indicates that discharges from the outfalls fully comply with Illinois Administrative Code and do not cause or contribute to violations of water quality standards, IEPA may make a determination that no additional CSO control is required.

- Otherwise, the City shall complete a CSO Control Plan for complying with such regulations and submit to IEPA within forty-eight (48) months of the effective date of the permit (due date is November 1, 2008). The CSO Control Plan shall be consistent with the demonstration approach as outlined in the Federal CSO Control Policy.

Plan of Study Objectives

The following specific objectives were considered in developing the POS based on the modified NPDES permit issued to the City of Jacksonville:

- Develop a thorough understanding of the various sewer system components (e.g., CSO pump station, treatment facilities, etc.) and their operations through records review and discussions with City staff.

- Characterize the hydraulic response of the CSO's to rainfall events through the use of historical precipitation records and operational data.
- Collect water quality data and conduct a physical inspection of receiving water to assess the impact of CSOs on water quality.
- Support an evaluation of the impacts of CSO's on receiving water quality.
- Support screening evaluation and selection of long-term CSO control alternatives.

CSO Assessment Strategy

The City of Jacksonville's collection system is unique in that the CSO pumping stations must be operated in order for a CSO event to occur. Most municipalities have traditional CSO regulators that divert dry weather flows to the treatment plant while discharging combined sewage to the receiving waters during rain events. For these other municipalities, it is difficult to determine the capacity of these regulators as well as to predict the frequency and volume of overflows. The City of Jacksonville maintains records on the operation of the pump stations which means they have a large amount of data related to the frequency and volume of CSO events over the past several years. The following subsections describe how the City proposes to use this CSO data, along with historical precipitation records, to address the modified NPDES permit requirements.

The City proposes to use the existing historical precipitation records along with the pump station operational data to determine:

- Percentage of the 1.2 inch storm event with one hour duration (first flush storm event) that is currently being treated
- Number of overflow events on an average annual basis
- Percentage of combined sewage captured and treated on an average annual basis

The City will begin by compiling precipitation and temperature records from the Jacksonville 2E climate station. This rainfall information is available in 15-minute increments from 1974 to present. An analysis of this historical record will be performed to identify a series of rainfall events that approximate the first flush scenario (1.2 inches of rainfall in one hour). The historical records will also allow for a proper analysis of the antecedent moisture conditions which has a significant impact on the peak flow and total volume of runoff from a rainfall event. The City will then analyze the operational data from the North and East CSO pump station. This analysis will include both the CSO pumps and the trash pumps as far back as the records allow (facilities were placed online in 1992).

The same set of data will also be used to characterize the response of the CSO's over longer periods of records (instead of event storm) which will assist in demonstrating compliance with the modified NPDES permit. Instead of selecting the first flush scenario, the City will examine the entire period of record and develop an estimate of the number of overflow events per year as well as the total volume of combined sewage collected and treated on an average annual basis.

The City proposes to gather flow data at the influent lines to the North and East CSO pump stations to verify the projections of average dry weather flow made in the 1987 Basis of Design report. The City also proposes to use WWTP influent records to assess the seasonal variation in the ADWF not captured during the proposed flow monitoring period. The data obtained from these meters will allow the City to measure compliance with IEPA's requirement that not less than ten times the average dry weather flow receive primary treatment and disinfection.

Water Quality Assessment Strategy

The objectives established for the water quality portion of the POS include assessment of:

- The condition of the receiving water bodies through physical inspection,
- The dissolved oxygen and bacteria (*E. coli* and fecal coliform) concentrations upstream of the City of Jacksonville CSOs on Mauvaisterre Creek,
- The presence and extent (if present) of dissolved oxygen depletion directly resulting from the City of Jacksonville CSOs in the Mauvaisterre Creek,
- The bacteria (*E. coli* and fecal coliform) concentrations directly resulting from the City of Jacksonville CSOs on Mauvaisterre Creek; and,
- The relative impact of each CSO location on receiving water quality using overflow data obtained from operational records.

The City proposes to conduct a physical inspection of the receiving water bodies and near stream properties to assess their environmental condition and public usage, if any. The goal of this inspection is to assess; the presence and extent (if present) of sludge deposits, floating debris, solids, stream hydraulics and morphological factors as well as examine the topography, land use and access points of the side stream properties.

Flow and Water Quality Monitoring Plan

The City will conduct a temporary flow monitoring program to support the CSO Assessment. The City has established a temporary flow monitoring plan to accomplish the average dry weather flow assessment. This plan includes:

- A total of two (2) temporary flow monitors will be used to measure dry weather flow tributary to the East and North CSO pump stations labeled FM-1 and FM-2, respectively.

The water quality monitoring plan includes the use of sampling sites located both upstream and downstream of CSO outfall locations to determine their impact on Mauvaisterre Creek. The main parameters of interest are dissolved oxygen (DO) and bacteria (*E. coli* and fecal coliform).

Based on the study area maps and taking into account the available water quality data, the City has established a water quality monitoring plan to assess the CSO impacts on receiving waters. This plan includes:

- A total of two (2) dry weather surveys are proposed at sampling sites MC-1, MC-2, MC-3, and MC-4. See Figure 4-1. The dry weather surveys will provide information on the background levels of pollution in Mauvaisterre Creek upstream of the City's CSO's and will serve to isolate the contribution from the North Fork of Mauvaisterre Creek. Each dry weather survey will include two (2) samples/readings of DO and bacteria (*E. coli* and fecal coliform) taken at each site on the same day. Portable monitors are proposed at these sites in lieu of continuous monitors due to a low base flow in both creeks, especially during dry weather.

- A total of two (2) wet weather surveys will be conducted at the same sampling sites MC-1, MC-2, MC-3, and MC-4. Each wet weather survey will be comprised of frequent readings for both dissolved oxygen and bacteria (*E. coli* and fecal coliform) taken during an overflow event and between six and twelve hours after the overflow has ceased.

- The water quality data collection outlined in this section will be conducted during the spring of 2006.

Characterization of Pollutant Loads

The pollutant loads, including bacterial loadings, are proposed to be estimated based on the overflow volumes generated using the pump station records, pollutant concentration data obtained at the WWTP, and the pollutant sampling data from the Nationwide Urban Runoff Program (NURP). The City WWTP data will be used to define the wastewater component of CSO pollutants and the NURP data will be used to define the stormwater component.

The basic premise of the methodology is that the average chemical composition of combined sewage is the result of the dilution of sanitary sewage by stormwater. Thus, if the aquatic chemistry of both the sanitary sewage and the stormwater, and relative amounts of each as they are found in the combined sewage are known, reliable estimates can be made of the chemistry of combined sewer overflows. The composition of sanitary sewage in a locality can be fairly well approximated by the results of chemical analysis performed on the local WWTP influent. The composition of stormwater runoff, however, cannot be characterized as easily using only locally collected data.

Section 1 Introduction

1.1 Introduction

The City of Jacksonville developed this report, Plan of Study for CSO Assessment (POS), to describe the City's approach to assessing their combined sewer overflows (CSO's) and associated receiving water impacts through analysis of historical precipitation records, existing operational data, review of existing water quality data, and collection of water quality samples from Mauvaisterre Creek. This section includes background information regarding the City's NPDES permit, goals and objectives of the assessment effort, overall strategy for CSO assessment, and an overview of various elements of the proposed Plan of Study (POS).

1.2 Background

The City of Jacksonville owns and operates a combined sewer collection system that conveys wastewater to the Jacksonville Wastewater Treatment Plant (WWTP). The combined sewer system (CSS) has two CSOs that discharge to Mauvaisterre Creek. One is located at the North CSO Pump Station (discharge number 002) and the other is at the East CSO Pump Station (discharge number 003). At the WWTP, the City will periodically discharge to Mauvaisterre Creek when influent flows exceed the first flush treatment system storage capacity. This discharge is covered under the City's current NPDES permit for discharge number 004. See Figure 1-1 for an overview of the City's collection system and the location of the CSOs.

CSOs are point source discharges to the waters of the United States and are subject to the Clean Water Act and the National Pollutant Discharge Elimination System (NPDES). Like all other discharges, CSOs are subject to both the technology-based and water-quality based requirements in the Clean Water Act. The United States Environmental Protection Agency (USEPA) CSO Control Policy issued in April 1994 established the national direction and approach to addressing and controlling CSO impacts.

The minimum technology-based controls are the nine minimum controls (NMCs) which the national CSO Control Policy requires all communities with CSOs to implement. The Illinois Environmental Protection Agency (IEPA) determines whether the NMCs satisfy the technology-based requirements of the Clean Water Act and regulates discharges from the City of Jacksonville CSOs.

On November 1, 2004 IEPA issued a modified NPDES permit for the City of Jacksonville. The proposed modifications to the NPDES permit include requirements for the City to develop and implement a CSO Control Plan according to the following steps:

- Develop and submit a Plan of Study for CSO Assessment (POS) within six months of the modification date of the permit (due date is May 1, 2005). The plan shall include provisions to determine what percentage of a 1.2-inch storm with a one-hour duration is currently being treated by the City. The plan shall also contain provisions to measure compliance with Illinois Administrative Code Title 35, Section 306.305 (b) which requires that not less than ten times the average dry weather flow receive a minimum of primary treatment and disinfection. It is also important to note that flow in excess of ten times the average dry weather flow shall be treated, to the extent necessary, to prevent accumulation of sludge deposits, floating debris and solids as well as to prevent depression of oxygen levels in the receiving waters.

- In addition, the permit requires the POS to measure and demonstrate compliance with water quality standards pursuant to the demonstration approach under the Federal CSO Control Policy of 1994.

- Upon approval by IEPA, the City shall implement the POS and submit a CSO Assessment Report within 18 months.

- If the CSO Assessment Report indicates that discharges from the outfalls fully comply with Illinois Administrative Code and do not cause or contribute to violations of water quality standards, IEPA may make a determination that no additional CSO control is required.

- Otherwise, the City shall complete a CSO Control Plan for complying with such regulations and submit to IEPA within forty-eight (48) months of the effective date of the permit (due date is November 1, 2009). The CSO Control Plan shall be consistent with the demonstration approach as outlined in the Federal CSO Control Policy.

1.3 Goals and Objectives

The City's goal for the POS is to develop methodologies for evaluation of the "first flush" requirement (1.2 inch storm with a one-hour duration), evaluation of the ten times average dry weather flow requirement, and determination of CSO impacts on receiving stream water quality.

The following specific objectives were considered in developing the POS based on the modified NPDES permit issued to the City of Jacksonville:

- Develop a through understanding of the various sewer system components (e.g., CSO pump station, treatment facilities, etc.) and their operations through records review and discussions with City staff.

- Characterize the hydraulic response of the CSO's to rainfall events through the use of historical precipitation records and operational data.

- Collect water quality data and conduct a physical inspection of receiving water to assess the impact of CSOs on water quality.
- Support an evaluation of the impacts of CSO's on receiving water quality.
- Support screening evaluation and selection of long-term CSO control alternatives.

1.4 Overall Strategy for CSO Assessment

The technical approach for assessing the City of Jacksonville CSO's is based mainly on analysis of existing data. This is due, in part, to the configuration of the City's collection system and the records maintained at the two CSO locations. The two CSO's within the City's system (North CSO Lift Station at the Plant and East CSO Lift Station at the East Johnson Street) can only activate through the operation of a series of pumps which are recorded by City staff during operation. From these records it is possible to determine the frequency of occurrence as well as the volume of flow bypassed for a given rain event. The operational data at both CSO's can be compared to precipitation records collected at a nearby National Weather Service climate station in order to develop a characterization of each CSO's response to rainfall events. From these historical records it will be possible to calculate the percent of the first-flush storm event that is captured and treated by the City.

The configuration of the City's system will also allow the "ten times dry weather flow" requirement to be assessed using a combination of temporary flow monitoring data and recent flow records from the WWTP. The collection of this data will allow the City to verify the assumptions made regarding average dry weather flow when the CSO conveyance and treatment facilities were originally designed.

The same set of data will also be used to characterize the response of the CSO's over longer periods of records (instead of event storm) which will assist in demonstrating compliance with the modified NPDES permit. Instead of selecting the first flush scenario, the City will examine the entire period of record and develop an estimate of the number of overflow events per year as well as the total volume of combined sewage collected and treated on an average annual basis.

The City will gather receiving water data to assess the impact of the City's CSO on the receiving waters by collecting data samples/readings of DO and bacteria (*E. coli* and fecal coliform) during dry and wet weather.

1.5 Organization of Report

This report, Plan of Study for CSO Assessment, includes the following three sections covering key elements necessary to develop a successful combined sewer system assessment plan:

- **Section 2, Records Review** – This section provides a summary of the City's CSO conveyance and treatment facilities designed in the late 1980's, precipitation records obtained from the U.S. National Weather Service climate stations, CSO pump station operational records, treatment plant records, and existing water quality information. The extent and detail of this information was evaluated thoroughly to define the level of additional monitoring and data collection proposed in the POS.

- **Section 3, Approach to CSO Assessment** - This section includes an overview of the existing CSO facilities and defines the approach the City will take towards assessment of their CSOs. This section also defines the approach to the water quality assessment which will provide the basis for related data collection efforts proposed in Section 4.

- **Section 4, Proposed Data Collection** – This section explains the City's approach to collecting additional flow monitoring data at the North and East CSO Pump Stations as well as water quality samples in Mauvaisterre Creek. This section includes the number of sites, site selection criteria, duration of monitoring expected, and the water quality parameters of interest.

Section 2
Records Review

An important step in preparing the POS was to identify and review available records pertaining to the combined sewer system and its operation. This information can be of assistance in identifying data needs that will need to be addressed as part of the CSO Assessment. The following subsections summarize the previous design reports, existing climate data, operational records, treatment plant data, and existing water quality data available for use in the CSO Assessment.

2.1 Facilities Design Report

In the mid-1980's the City of Jacksonville embarked upon a data collection and study effort that was focused on upgrading the City's wastewater treatment facilities to meet more stringent discharge limitations required by IEPA. One of those studies was the "Phase III – Combined Sewer Overflow Exception Application" (a.k.a. CSO Study) that summarized five months of CSO related flow monitoring preformed in 1985. The CSO Study established the design criteria used at the East Pump Station CSO and the North Pump Station CSO, referred to in the report as "Overflow V" and "Overflow VII". The study used a design storm intensity of 1.2 inches per hour along with a number of assumptions to correct for storm intensity, and future collection system modifications to generate runoff hydrographs for both CSO locations. From these hydrographs the study calculated the first flush volume (gallons), maximum first flush flow rate (mgd), and the peak flow rate (mgd) required as part of the IEPA permit.

The design criteria generated by the CSO Study was then modified as part of the "Basis of Design, Wastewater Treatment Improvements" dated July 1987 to include flow from the City of South Jacksonville. This increased criteria formed the basis for design of the CSO conveyance and treatment facilities currently in use by the City. Table 2-1 summarizes the basis of design criteria:

Table 2-1. Basis of Design for Jacksonville CSO Facilities

	East Pump Station CSO	North Pump Station CSO
Average Dry Weather Flow		
Jacksonville	3.28	2.36
South Jacksonville	1.03	-
	4.31	2.36
First Flush Volume[1] (gal)	727,083	368,750
Peak Flow Rate[1] (mgd)	34.3	18.4
CSO Treatment Capacity[2] (mgd)	34.3[3]	23.6

(1) Based on a design storm of 1.2 in/hour for 1 hour

(2) Ten times the average dry weather flow

(3) Revised from original "Basis of Design" value of 43.1 mgd, based on letter from City to IEPA dated October 31, 1989

The information shown in Table 2-1 was the basis for the report recommending the construction of two new pumping stations (East and North) with a firm capacity of 24 mgd and 34 mgd (revised from original 43 mgd) in order to transfer the first flush volume and peak flow rate to the WWTP. Construction of these facilities was completed in July 1992.

The City has recently completed (2002) several combined sewer separation projects mainly within the area tributary to the North CSO Pump Station. The City staff have noted a reduction in the number of overflow events at the North CSO Pump Station as a result. The City has plans for additional combined sewer separate projects on the south side of the City which is tributary to the East CSO Pump Station.

After review of the Basis of Design and discussions with City staff, the following information related to the conveyance, storage and treatment capacities of the combined sewer system can be summarized as follows:

Wastewater Treatment Plant

- Average flow 7.57 mgd
- Daily maximum flow 15.0 mgd

CSO Facilities

- East Pump Station capacity of 34.3 mgd, first flush storage capacity of 0.727 MG
- North Pump Station capacity of 23.6 mgd, first flush storage capacity of 0.369 MG
- Total primary treatment capacity of 57.93 mgd

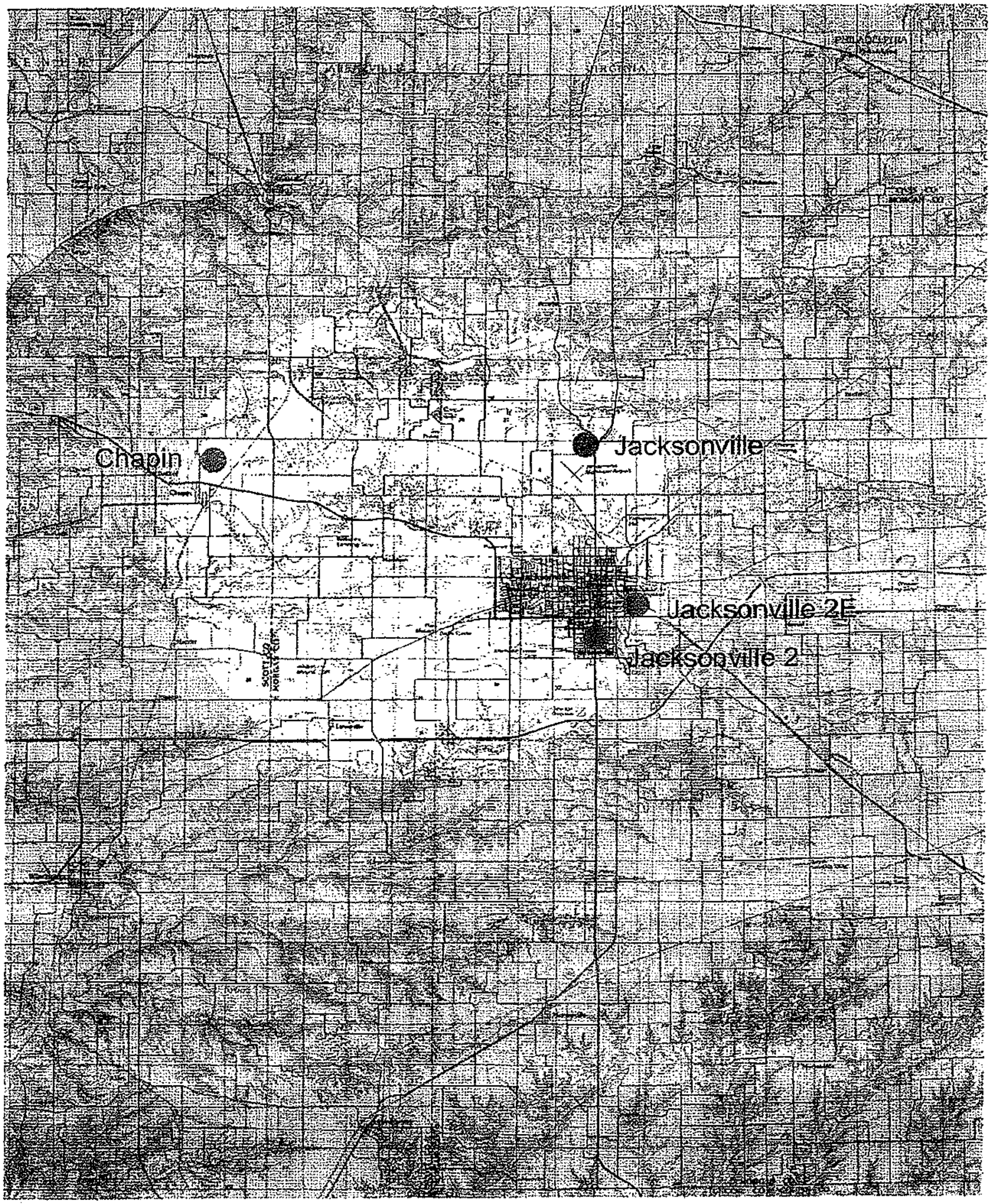
Changes or modifications to these values based on new information will be documented in the CSO Assessment, if necessary.

2.2 Precipitation Records

The City conducted a review of the available precipitation records in order to evaluate the feasibility of performing an analysis that will correlate rainfall records to the CSO operations using existing data. The purpose of this effort is to determine the extent and detail of the available climate data for Jacksonville, Illinois.

2.2.1 Data Acquisition

National Weather Service meteorological data for the Jacksonville area were identified to assess their applicability to the POS. Figure 2-1 shows current and former National Weather Service COOP network stations in the vicinity of Jacksonville, IL. Table 2-2 lists relevant data for each of these stations.



CDM

Climate Station Locations
City of Jacksonville, IL
Plan of Study for CSO Assessment

Figure 2-1

Table 2-2. Climate Stations in Vicinity of Jacksonville, IL

COOP ID	Station Name	County	Elevation	Data Type	Start	End
114442	Jacksonville 2E	Morgan	610 ft	15 minute	1974#	present
114447	Jacksonville 2	Morgan	600 ft	Hourly	1948	present
111430	Chapin 4e	Morgan	592 ft	Daily	2003	present
SARWS	Jacksonville	Morgan	Unknown	TBD	1971	1980

Hourly precipitation data available from 1963 to 1974

In addition to the data from the National Weather Service, the City also maintains climate records at the wastewater treatment plant. This data includes two observations of wind direction at 7:00 a.m. and 7:00 p.m. as well as a daily precipitation amounts.

2.2.2 Data Review

The climate stations listed in Table 2-2 were reviewed and evaluated to determine which station(s) have both sufficient data and closely represent the precipitation and temperature in the Jacksonville combined sewer area. The Jacksonville 2E weather station, located on the east side of the city, maintained good 15-minute records of precipitation from 1974 through the present. There are some data gaps during the spring of 2001 and fall of 2002 but a consistent record from December 2002 until present. This station will likely be selected as the main source of data based upon the long period of detailed records and the station's proximity to the Jacksonville combined sewer area.

There are periods of time in the Jacksonville 2E records where gaps in the data occur due to gauge errors or malfunctions. Those data gaps will be filled primarily with hourly data from the Jacksonville 2 station located approximately 1 mile southwest of the Jacksonville 2E site. The Jacksonville 2 station will also be the primary source of precipitation data from 1948 to 1963, if necessary. In both cases, the hourly rainfall data would need to be desegregated into 15-minute data using standard techniques.

Table 2-3 and 2-4 summarize the source of precipitation and temperature data obtained for the Jacksonville Plan of Study. Note that daily maximum temperatures are available at the Jacksonville 2E station from 1901 to present.

Table 2-3. Precipitation Data Obtained for Jacksonville Plan of Study

Station	Element	15-Min	Hourly	Daily	Start	End	Source
Jacksonville 2	Precipitation		✓		1948	1963	COOP
Jacksonville 2E	Precipitation		✓		1963	1974	COOP
Jacksonville 2E	Precipitation	✓			1974	present	COOP

Table 2-4: Temperature Data Obtained for Jacksonville Plan of Study

Station	Element	15-Min	Hourly	Daily	Start	End	Source
Jacksonville 2E	Temperature			✓	1901	present	COOP

2.3 Pump Station Operational Records

The City operates and maintains the pumping stations at both CSO locations that are summarized in Table 2-5:

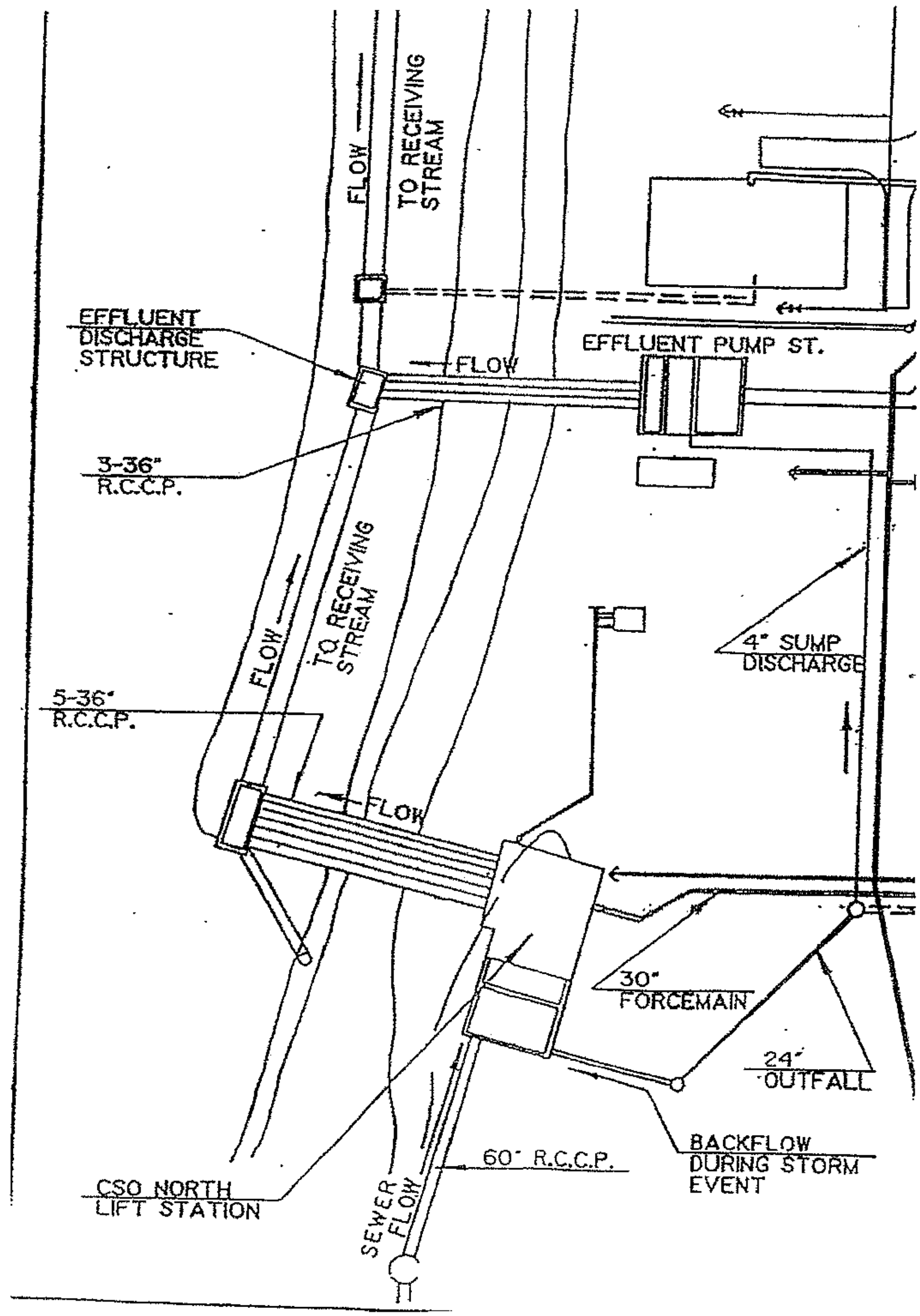
Table 2-5. CSO Locations

Name	Discharge Number	Receiving Water
North CSO Lift Station at the Plant	002	Mauvaisterre Creek
East CSO Lift Station at the East Johnson Street	003	Mauvaisterre Creek

At each of the locations in Table 2-5 the City maintains records on the operation of the pumps that discharge to the treatment plant as well as those that discharge directly to Mauvaise Terre River. The pumps that discharge to the CSO treatment facilities are referred to as "CSO pumps" while the pumps that discharge to the receiving stream are referred to as "trash pumps". Simply stated, when the trash pumps are operated a CSO event has occurred. The City is very consistent in their approach to gathering meter readings from the CSO pump as well as the trash pumps after each rain event.

Refer to Figure 2-2 and 2-3 for a plan view of the East and North CSO Pump Stations.

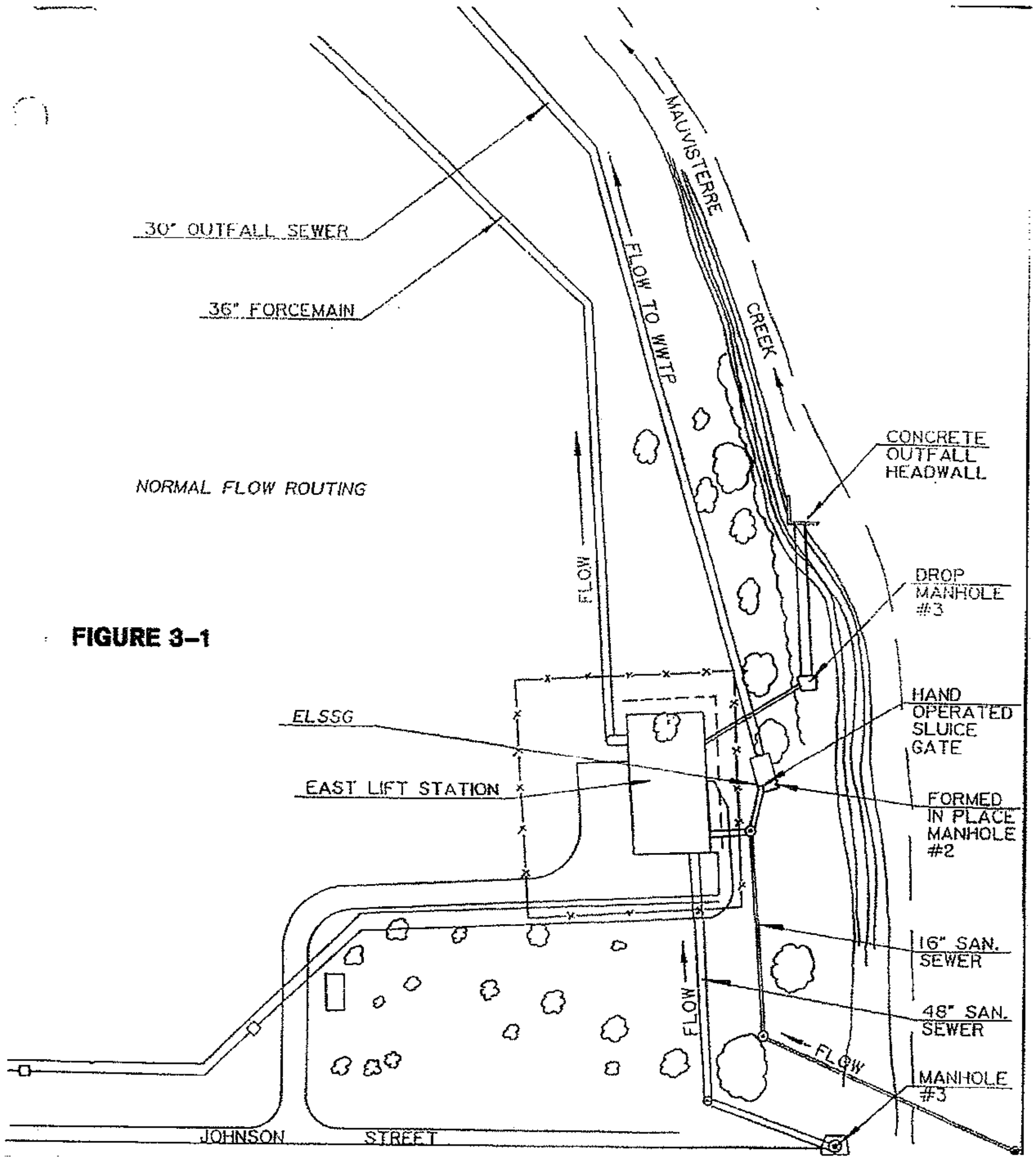
In summary, the City can use the pump station operational data to determine which pumps were operating when and for how long. From this it is also possible to estimate the total volume of flow discharged to the WWTP and the receiving stream.



North CSO Pump Station Plan View
City of Jacksonville, IL
Plan of Study for CSO Assessment

CDM

Figure 2-2



East CSO Pump Station Plan View
City of Jacksonville, IL
Plan of Study for CSO Assessment

CDM

Figure 2-3

2.4 Treatment Plant Records

The City maintains flow records within the plant which are taken after bar screening but before grit removal. The City measures and records the influent flow continuously during both dry and wet weather. Once the capacity of the first flush storage basins has been exceeded, the flow directed to the CSO clarifier is also measured and recorded.

The City also water quality data via grab sample as the CSO clarifier overflows. The data collected on this discharge is both BOD (mg/L) and TSS (mg/L). Recent changes to the City's NPDES permit requires them to gather additional water quality data in the form of fecal coliform (col/100 ml) samples.

The treatment plant maintains records of the influent quality parameters for reporting to IEPA. The influent is sampled as a composite over twenty-four hours in a refrigerated sampler with 100 ml sampling every 15 minutes. The City maintains records of the influent BOD (mg/L), BOD (lbs/day), TSS (mg/L), TSS (lbs/day) and pH.

2.5 Water Quality Records

The City conducted a review of the available water quality records and reports in order to develop the most effective approach to assessing the Mauvaisterre Creek water quality during the CSO Assessment. There are two main sources of information on the water quality in Mauvaisterre Creek, data collected by City staff as required under their current NPDES permit, and data assembled as part of the Total Maximum Daily Load (TMDL) study currently being performed by IEPA. The City has conducted a review of these records as part of the POS to identify any missing information that will need to be collected as part of the CSO Assessment.

2.5.1 NPDES Permit Data

The City has approximately fifteen years worth of water quality data taken upstream and downstream of the WWTP outfall location on Mauvaisterre Creek as required under their current NPDES permit. The period of record begins in August 1990 and continues monthly through the present. The water quality parameters recorded during the monthly readings include dissolved oxygen (DO) and temperature. Periodic recordings of NH3-N, pH and BOD are also available. The City has recently begun collecting monthly records of fecal coliform and total coliform as measured in Mauvaisterre Creek downstream of the WWTP outfall. These records date back approximately five months to November 2004 when the most recent NPDES permit was modified.

There are several NPDES point source discharge sites (in addition to the City CSOs) that are located within the study area. The City will request the discharge monitoring reports for these sites as part of the CSO Assessment to determine the impact, if any, on the location of proposed water quality monitoring sites.

2.5.2 Total Maximum Daily Load Study

Section 303 (d) of the 1972 Clean Water Act requires states to define impaired waters and identify them on a list, which is referred to as the 303 (d) list. The State of Illinois recently issued a draft 2004 303 (d) list that includes several water bodies near the project area. ***Note that the TMDL study has assigned slightly different names for the waterbodies in the project area. For the purposes of this report, the receiving stream for the City of Jacksonville CSO's is listed as Mauvaisterre Creek.*** Refer to Table 2-6 for a summary of the 303 (d) listed waterbodies in the project area.

Table 2-6. 303 (d) Listed Waters in Vicinity of Project Area

Waterbody Segment	Waterbody name	Size (miles/acres)	Year Listed	Listed for[1]
SDL	Mauvaise Terre Lake	172.0	1994	**Manganese, Phosphorus, Nitrate,** total suspended solids, excess algal growth
DDC	N. Fork Mauvaise Terre Creek	14.0	2004	**Manganese, low dissolved oxygen,** total nitrogen, total suspended solids
DD04	Mauvaisse Terre River	36.6	1998	**Fecal coliform**

(1) Bold font indicates that the cause will be addressed as part of the ongoing TMDL study

The Clean Water Act requires that a Total Maximum Daily Load (TMDL) be completed for each pollutant listed for an impaired waterbody. The TMDL's are prepared by the state and submitted to U.S. EPA and they establish the greatest amount of a given pollutant that a waterbody can receive without exceeding water quality standards. The IEPA is currently involved in preparation of a TMDL for the "Mauvaise Terre River Watershed". The following reports related to the TMDL development are available through IEPA and include:

First Quarterly Progress Report, Mauvaise Terre River Watershed, August 2004

Second Quarterly Progress Report, Mauvaise Terre River Watershed, October 2004

Third Quarterly Progress Report, Mauvaise Terre River Watershed, October 2004

The First Quarterly Progress Report included data collected at sampling location DD04 located approximately one mile downstream of the Jacksonville WWTP. The only parameter tested for at this location was fecal coliform. Of the 97 fecal coliform samples collected at this station, 86 had paired TSS data. An analysis of this paired data revealed that 15 of the 41 fecal samples (37%) that were collected when TSS was greater than or equal to 56 mg/l (50^{th} percentile) were greater than 400 cfu/100 ml. For those samples where TSS was less than or equal to the 50^{th} percentile concentration, fecal concentrations exceed the criteria between 200 and 7,600 cfu/100 ml. A comparison of fecal coliform levels to total suspended solids concentrations was included in the report and it showed that fecal coliform increases with increasing suspended solids concentration.

The First Quarterly Report reached some conclusions concerning the potential source of the high fecal concentrations along segment DD04. The report suggests that agricultural runoff in particular is a likely source of impairment. This assessment is based on the apparent relationship in the data between fecal coliform and total suspended solids which suggests a watershed source (such as runoff from livestock operations) for the fecal coliform. The report also noted that several municipal sewage discharges to the creek as well as private systems may be contributing to the impairment.

The City will review these reports and the flow monitoring data collected as part of this effort and incorporate the data, as needed, into the CSO Assessment.

2.6 Sensitive Areas

Included in the City's NPDES permit No. IL0021661 is the Illinois Environmental Protection Agency's (IEPA) determination that none of the outfalls listed in the permit discharge to sensitive areas.

Section 3
Approach to CSO Assessment

3.1 Conveyance and Treatment Facilities

Understanding of how the City of Jacksonville currently operates their wastewater collection and treatment system is important to the overall approach to CSO Assessment. A detailed discussion of the City's combined sewer conveyance and treatment facilities is included in the following subsections.

3.1.1 CSO Pumping Stations

The purpose of the East CSO Pump Station is to convey sewage flows to the WWTP under normal and storm flow conditions. Figure 2-2 shows the site layout and piping of the East side CSO Pump Station. The building is located on East Johnson Street in Jacksonville adjacent to the Mauvaisterre Creek. The piping mains consist of one 48-inch reinforced concrete gravity influent line, one 30-inch reinforced concrete gravity outfall, one 24-inch ductile iron forcemain, and one 36-inch ductile iron forcemain.

Under normal conditions flow enters the lift station from the sewage system through the 48-inch influent pipe, routes to the 30-inch outfall sewer, and is conveyed to the WWTP by gravity. These conditions require no mechanical operations. Under storm conditions flow enters the lift station from the sewage system through the 48-inch influent pipe and flow also backs into the station via the 30-inch outfall line due to surcharging of the WWTP. Once flow backs up into the station it is routed through the mechanical bar screen, through the building basement, and into the pump wet-well.

The volume of flow will build up in the wet well until float switches are activated by the high water elevations. As the flow continues to build, a series of float switches (3) activate the CSO pumps. The CSO pumps that activate transmit flow through the 36-inch forcemain to the splitter structure at the WWTP. If the flow continues to build up beyond the capacity of the CSO pumps, a series of float switches (2) are activated which automate operation of the trash pumps. The trash pumps that activate transmit flow through the 24-inch forcemain to Mauvaisterre Creek.

The configuration of the North Lift Station is similar to that of the East Station. Figure 2-3 shows the site layout and piping of the North side CSO Pump Station. The building is located on the south side of the WWTP adjacent to the Mauvaisterre Creek. The piping mains consist of one 60-inch reinforced concrete gravity influent line, one 24-inch reinforced concrete gravity outfall, one 30-inch ductile iron forcemain, and five 36-inch reinforced concrete outfall forcemains.
Under normal conditions flow enters the lift station from the sewage system through the 60-inch influent pipe, routes to the 24-inch outfall sewer, and is conveyed to the WWTP by gravity. These conditions require no mechanical operations. Under storm conditions flow enters the lift station from the sewage system through the 60-inch influent pipe and flow also backs into the station via the 24-inch outfall line due to

surcharging of the WWTP. Once flow backs up into the station it is routed through the mechanical bar screen, through the building basement, and into the pump wet-well.

The volume of flow will build up in the wet well until float switches are activated by pre-set elevations. As the flow continues to build, a series of float switches (3) activate the CSO pumps. The CSO pumps that activate transmit flow through the 30-inch forcemain to the splitter structure at the WWTP. If the flow continues to build up beyond the capacity of the CSO pumps, a series of float switches (3) are activated which automate operation of the trash pumps. The trash pumps that activate will transmit flow through the five 36-inch forcemains to Mauvaisterre Creek.

3.1.2 CSO Treatment Facilities

There are two first flush basins, the East first flush basin, EFFB, and the North first flush basin, NFFB, located at the WWTP. The first flush basins are designed to capture the initial volume of CSO flows that require full treatment of the WWTP. The first flush volume is contained in the basins until the WWTP has the capacity to process the wastewater.

The EFFB accepts flow from the East CSO Pump Station via the splitter structure as noted in section 3.2.1. Likewise, the NFFB accepts flow from the North CSO Pump Station via the splitter structure. As each lift station transmits flow into the front cells of the splitter structure, flow will transfer by gravity to each respective first flush basin. Once the first flush basins have reached capacity, flow will transmit over the weir in the splitter structure to a third cell which will convey flow by gravity to the CSO clarifier. Flow is discharged from the CSO clarifier to the effluent pump station which then pumps the flows to the effluent discharge structure which finally discharges to Mauvaisterre Creek. The flow discharged from the CSO clarifier is not disinfected based on relief granted to the City by the Illinois Pollution Control Board in ruling AS90-1.

After the storm event when the WWTP is able to process the first flush volume, the basins are drained. The EFFB may be drained by opening plug valve PV-1 on the North side of the EFFB. The NFFB may be drained by opening plug valve PV-2 on the West side of the NFFB. The front cells of the splitter structure also drain during this operation. The flows travel by gravity to the head of the WWTP and receive full treatment.

3.2 CSO Assessment Strategy

The City of Jacksonville's collection system is unique in that the CSO pumping stations must be operated in order for a CSO event to occur. Most municipalities have traditional CSO regulators that divert dry weather flows to the treatment plant while discharging combined sewage to the receiving waters during rain events. For these other municipalities, it is difficult to determine the capacity of these regulators as well as to predict the frequency and volume of overflows. As noted in Section 2, the City of Jacksonville maintains records on the operation of the pump stations which means they have a large amount of data related to the frequency and volume of CSO events over the past several years. The following subsections describe how the City proposes to use this CSO data, along with historical precipitation records, to address the modified NPDES permit requirements.

3.2.1 Utilization of Existing Data

The City proposes to use the existing historical precipitation records along with the pump station operational data to determine:

- Percentage of the 1.2 inch storm event with one hour duration (first flush storm event) that is currently being treated
- Number of overflow events on an average annual basis
- Percentage of combined sewage captured and treated on an average annual basis

The City will begin by compiling precipitation and temperature records from the Jacksonville 2E climate station. Note: This is the same station used as part of the IEPA TMDL study for Mauvaisterre Creek. This rainfall information is available in 15-minute increments from 1974 to present. An analysis of this historical record will be performed to identify a series of rainfall events that approximate the first flush scenario (1.2 inches of rainfall in one hour). The historical records will also allow for a proper analysis of the antecedent moisture conditions which has a significant impact on the peak flow and total volume of runoff from a rainfall event.

The City will then analyze the operational data from the North and East CSO pump station. This analysis will include both the CSO pumps and the trash pumps as far back as the records allow (facilities were placed online in 1992). The pump station operational data will allow the City to quantify the following information on an average annual basis or specific to individual rain events:

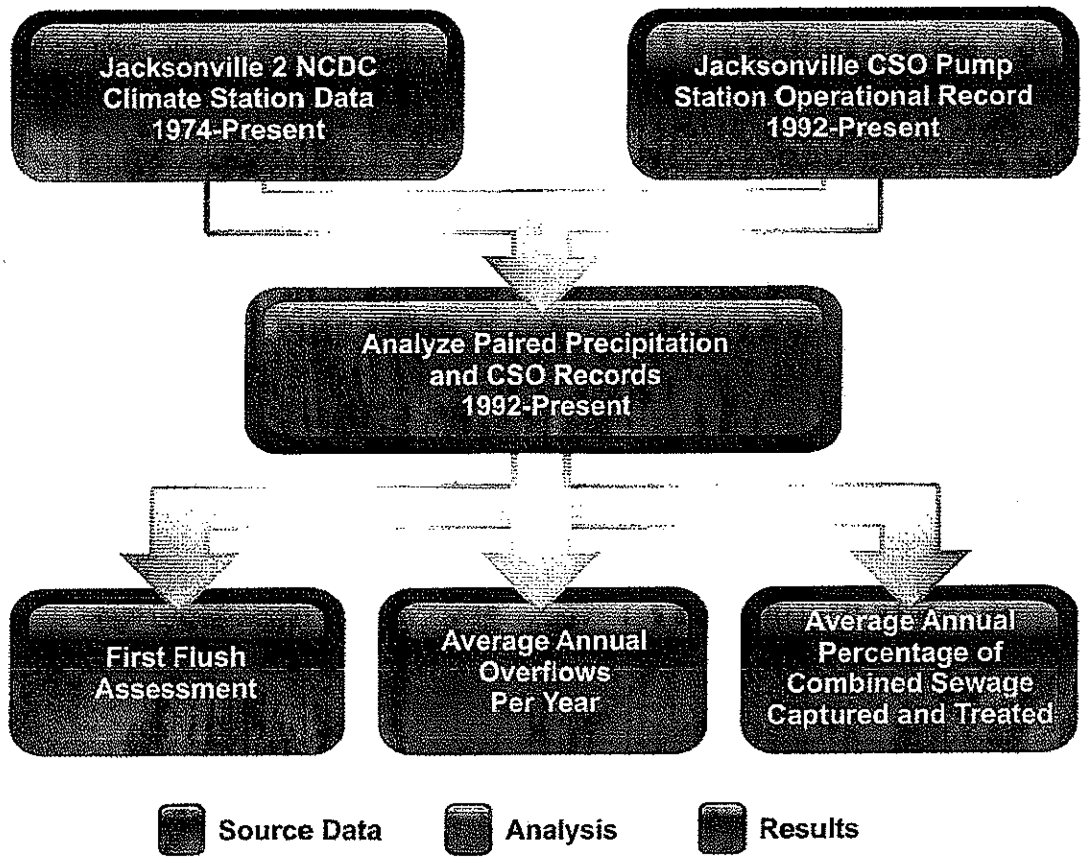
- Frequency of operation of the CSO pumps
- Total amount of flow pumped to CSO treatment facilities
- Frequency of operation of the trash pumps
- Total amount of flow pumped to receiving stream

Overlaying the CSO pump station operational data onto the historical rainfall records it will be possible to choose several storm events that approximate the first flush storm event and determine the amount of flow pumped to the treatment plant and the amount discharged to Mauvaisterre Creek, if any.

The same set of data will also be used to characterize the response of the CSO's over longer periods of records (instead of event storm) which will assist in demonstrating compliance with the modified NPDES permit. Instead of selecting the first flush scenario, the City will examine the entire period of record and develop an estimate of the number of overflow events per year as well as the total volume of combined sewage collected and treated on an average annual basis.

Figure 3-1 summarizes how the City will utilize existing data to assess compliance with IEPA's first flush requirement as well as characterize the CSO's response to rain events.

Figure 3-1: Plan for Utilizing Exiting Data in CSO Assessment

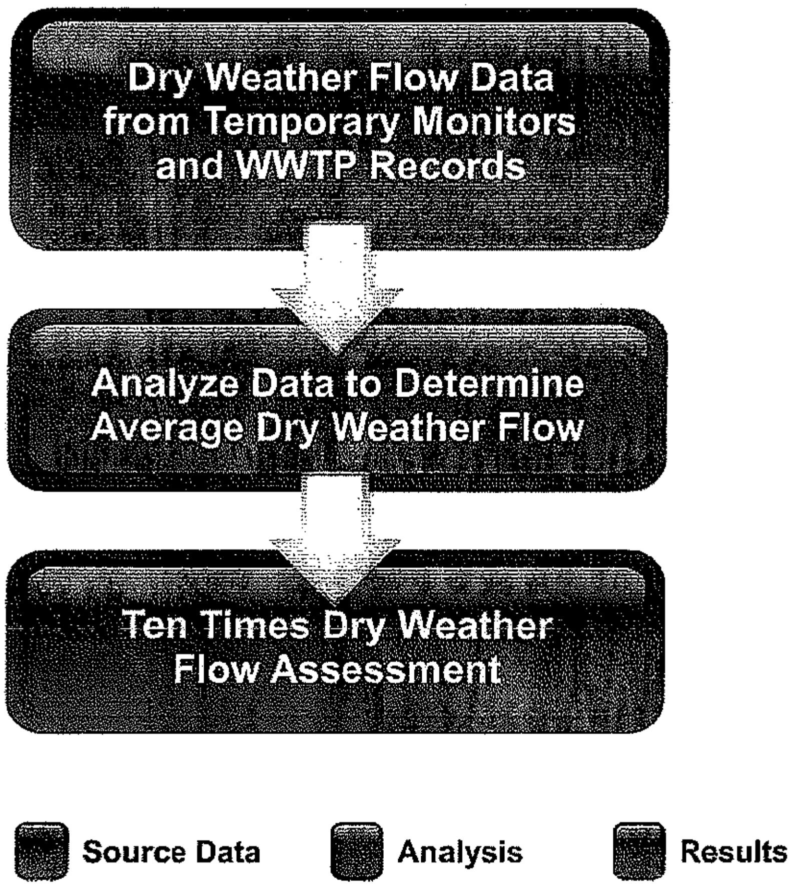


3.2.2 Utilization of New Data

The City proposes to gather flow data at the influent lines to the North and East CSO pump stations to verify the projections of ADWF made in the 1987 Basis of Design report. For more details on the location and duration of monitoring for the proposed meters, see Section 4 Proposed Data Collection. The data obtained from these meters will allow the City to measure compliance with IEPA's requirement that not less than ten times the average dry weather flow receive primary treatment and disinfection.

The City also proposes to use WWTP influent records to assess the seasonal variation in the ADWF not captured during the proposed flow monitoring period. The City will gather treatment plant influent records for the previous five years (2000 – 2004). The City will then extract the average monthly flow rate for the months May – September and use that information, along with the temporary flow monitoring data, to develop a more complete assessment of average dry weather flow rates. Figure 3-2 summarizes how the City will utilize the temporary monitors and WWTP records to assess compliance with IEPA's ten times dry weather flow requirement.

Figure 3-2: Plan for Assessing Ten Times Average Dry Weather Flow Requirement



3.3 Water Quality Assessment

The objectives established for the water quality portion of the POS include assessment of:

- The condition of the receiving water bodies through physical inspection,
- The dissolved oxygen and bacteria (*E. coli* and fecal coliform) concentrations upstream of the City of Jacksonville CSOs on Mauvaisterre Creek,
- The presence and extent (if present) of dissolved oxygen depletion directly resulting from the City of Jacksonville CSOs in the Mauvaisterre Creek,
- The bacteria (*E. coli* and fecal coliform) concentrations directly resulting from the City of Jacksonville CSOs on Mauvaisterre Creek; and,
- The relative impact of each CSO location on receiving water quality using overflow data obtained from operational records.

Table 3-1 summarizes the Jacksonville CSOs, their receiving streams, the IEPA assessed use and the applicable water quality standards. This information is important to the overall water quality monitoring plan because the water quality standard is a benchmark for establishing whether or not the CSOs are causing in-stream dissolved oxygen or bacteria concentrations to fall below the standard.

Table 3-1: Receiving Waters for Jacksonville CSOs

CSO Location	Receiving Stream	Designated Use	Applicable Water Quality Standards
North CSO Pump Station	Mauvaisterre Creek	Aquatic Life and Fish Consumption	General Use
East CSO Pump Station	Mauvaisterre Creek	Aquatic Life and Fish Consumption	General Use

Source: Illinois Water Quality Report 2004, Illinois Environmental Protection Agency, Bureau of Water

The General Use water quality standard for dissolved oxygen and bacteria (fecal coliform) are currently:

"Dissolved oxygen shall not be less than 6.0 mg/l during at least 16 hours of any 24 hour period, nor less than 5.0 mg/l at any time."

and

"During the months of May through October, based on a minimum of five samples taken over more than a 30 day period, fecal coliform shall not exceed a geometric mean of 200 per mL, nor shall more than 10% of the samples during any 30 day period exceed 400 per 100 mL in protected waters."

Comparing the results from water quality monitors located upstream of the Jacksonville CSOs to the water quality standards quoted above, it will be possible to determine if the water quality standards are being met prior to receiving CSO discharges from the City.

Section 4
Proposed Data Collection

4.1 Flow Monitoring Plan

The City will conduct a temporary flow monitoring program to support the CSO Assessment. Using the study area mapping and the current understanding of sewer system hydraulics, the City has established a temporary flow monitoring plan to accomplish the average dry weather flow assessment. See Figure 4-1. This plan includes:

- A total of two (2) temporary flow monitors will be used to measure dry weather flow tributary to the East and North CSO pump stations labeled FM-1 and FM-2, respectively.

- The flow monitoring program will be conducted in spring of 2006 for up to three weeks or until an adequate number of dry weather days have been captured. Flow data will be collected continuously at the selected locations at five minute intervals throughout the monitoring period.

4.2 Water Quality Monitoring Plan

The water quality monitoring plan includes sampling sites located both upstream and downstream of CSO outfall locations to determine their impact on the receiving waters. The main parameters of interest are dissolved oxygen (DO) and bacteria (*E. coli* and fecal coliform). The monitoring and sampling locations were chosen with the following objectives in mind:

- Secure sites for equipment deployment and field personnel access

- Sites representative of well-mixed stream flow (e.g. not located immediately downstream of a NPDES point discharge)

- Ability to bracket the CSOs discharges

- Collection of data reflective of "background" conditions

Based on the study area maps and taking into account available water quality data, the City has established a water quality monitoring plan to assess the CSO impacts on receiving waters. This plan includes:

- A total of two (2) dry weather surveys are proposed at sampling sites MC-1, MC-2, MC-3, and MC-4. See Figure 4-1. The dry weather surveys will provide information on the background levels of pollution in Mauvaisterre Creek upstream of the City's CSO's and will serve to isolate the contribution from the North Fork of Mauvaisterre Creek. Each dry weather survey will include two (2) samples/readings of DO and bacteria (*E. coli* and fecal coliform) taken at each site on the same day. Portable monitors are proposed at these sites in lieu of continuous monitors due to a low base flow in both creeks, especially during dry weather. As noted in Section 2, the City has good long-term bacteriological data on the Mauvaisterre Creek at station DD04. This data will be utilized in conjunction with proposed dry weather surveys to establish the background levels of bacteria currently in the Mauvaisterre Creek.

- A total of two (2) wet weather surveys will be conducted at the same sampling sites MC-1, MC-2, MC-3, and MC-4. Each wet weather survey will be comprised of frequent readings for both dissolved oxygen and bacteria (*E. coli* and fecal coliform) taken during an overflow event and between six and twelve hours after the overflow has ceased.

- The water quality data collection outlined in this section will be conducted during the spring of 2006.

4.3 Characterization of Pollutant Loads

In a letter to the City from IEPA dated August 2, 2004, it was noted that IEPA anticipated that bacterial monitoring of the discharges from CSO Discharge Number 002 and 003 will be necessary to meet the requirements of draft permit Special Condition 16.10. It is the City's opinion that sampling of these discharges will not be an effective use of the City's resources in determining compliance with the modified NPDES permit. A discussion of the characterization of pollutant load from the City's CSOs is presented as an alternative to bacterial monitoring at the North and East CSOs.

The pollutant loads, including bacterial loadings, are proposed to be estimated based on the overflow volumes generated using the pump station records, pollutant concentration data obtained at the WWTP, and the pollutant sampling data from the Nationwide Urban Runoff Program (NURP). The City WWTP data will be used to define the wastewater component of CSO pollutants and the NURP data will be used to define the stormwater component.

The central underlying concept behind using NURP data to define the stormwater component of CSO pollutant concentrations is that statically reliable results based on locally-collected data can only be obtained with a large body of data that would require massive data collection efforts taking years and being prohibitively expensive. This situation results from the extreme variability observed in pollutant concentrations in stormwater. Note that there is a large degree of risk in pollutant loading assessments based on small data sets, lacking statistical confidence, which will have just as much chance of producing very high (inaccurate) load estimates as it will of producing very low (equally inaccurate) load estimates. The important CSO planning decisions that will be made during the development of the LTCP (if necessary) require load estimates that are more reliable than those which could be produced from limited local datasets.

Instead of relying upon locally-collected data for load estimation, an alternative approach will be incorporated into pollutant load analysis using NURP data, which consists of data collected from existing major national and some locally-collected water quality databases. This approach has been used in CSO studies elsewhere in the United States, and has become accepted as the most reliable means to obtain local estimates for use in the LTCP process for CSO's. Further description of NURP is presented in the following section.

4.3.1 Methodology

The basic premise of the methodology is that the average chemical composition of combined sewage is the result of dilution of sanitary sewage by stormwater. Thus, if the aquatic chemistry of both the sanitary sewage and the stormwater, and relative amounts of each as they are found in the combined sewage are known, reliable estimates can be made of the chemistry of combined sewer overflows. The composition of sanitary sewage in a locality can be fairly well approximated by the results of chemical analyses performed on the local treatment plan influent. The composition of stormwater runoff, however, cannot be characterized as easily using only locally collected data.

The realization, in the 1970's, that stormwater pollution was a significant fraction of the total pollution load in receiving waters, led to EPA's development of the NURP. NURP funding was applied on runoff pollution research in 28 American cities. Data collected during the EPA NURP study provided the event mean concentration (EMC) estimates for as many as 10 constituents for 1,690 storm events for 75 urban sites in metropolitan areas. Statistical analyses performed on the monitoring results indicated that the variability in EMC's among sites was greater than any observable variability among geographic regions, thus making the development of land-use specific or regionalized EMC estimates infeasible. Large confidence intervals for EMC's grouped by land use and/or regionally were, in some part, exacerbated by the limited degrees of freedom available for the analyses. As a result, the best available EMC estimates for cities in the continental United States are those that result from averaging all of the available data. This concept is the central analytical result of the NURP studies and form the basis for most stormwater watershed loading assessments performed today.

The central message of the above discussion is that, even with a major field data collection effort, and large expenditure of funds, it is impractical for the City of Jacksonville or any other single city to collect enough CSO discharge data to adequately characterize the CSO pollutant loadings from their system. The sanitary sewage contribution is not the problem because the sanitary sewage component of the combined sewerage is well known. However, the results of many years and many millions of dollars applied to stormwater runoff research, point to the variability of the rainfall-runoff pollution process as the underlying problem. In short, using the average or median EMC discharge concentration of the stormwater portion is as reliable an estimate of the expected pollutant discharge concentration of the stormwater portion of the combined sewage as any other method. Clearly, the degree of EMC variability reduction that might be afforded by a local data collection effort (in addition to the limited data collected during the CSO monitoring and sampling program) in the City could never justify the effort.

4.3.2 Pollutant Load Data Collection

The selected approach to estimate average annual pollutant loadings relies upon three basic pieces of information: the mean concentration of sanitary sewage in the influent at the WWTP, the stormwater EMC's derived from the NURP, and the relative flow rates of sanitary sewage and stormwater in the combined sewer overflows as estimated by the calibrated hydraulic model. The concentrations are applied to the respective flow rates and the resulting loading rates for sanitary and storm components are weighted-averaged to produce composite loading estimates for CSO discharge.

Wastewater EMC's

The monthly operational records from the WWTP will be obtained for a period of 12-months. Based on these records, average monthly dry weather flow concentrations will be determined. The dry-weather days will be selected based on the review of daily precipitation records and minimum antecedent dry-weather conditions for two to seven days.

Stormwater EMC's

The stormwater EMC's will be obtained from the NURP data. These values along with the wastewater EMC's are applied to the stormwater and wastewater volume components of the CSO's to estimate the pollutant load discharged to the receiving streams.

Wastewater and Stormwater Components of CSO's

The wastewater and stormwater components of CSO's at each outfall and the combined sewer flow generated in the upstream drainage areas will be estimated based on the dry-weather flow rates.

4.4 Physical Inspection of Receiving Waters

The City proposes to conduct a physical inspection of the receiving waters and near stream properties to assess their environmental condition and public usage, if any. The receiving waters will include Mauvaisterre Creek in the vicinity (upstream and downstream) of the North and East Pump Station CSO. The goal of this inspection is to assess the following:

- Presence and extent of sludge deposits,
- Floating debris,
- Solids,
- Stream hydraulics and morphological factors,
- Side stream properties (topography, land use, public access points); and,
- Existing stream usage.

The assessment will consist of a visual inspection of the receiving waters after a CSO event and will be recorded using photographs and sketches to document the findings. A description of the physical inspection will be prepared and included as part of the CSO Assessment Report.

APPENDIX C – Agency Correspondence

ILLINOIS ENVIRONMENTAL PROTECTION AGENCY

1021 NORTH GRAND AVENUE EAST, P.O. BOX 19276, SPRINGFIELD, ILLINOIS 62794-9276 – (217) 782-3397
JAMES R. THOMPSON CENTER, 100 WEST RANDOLPH, SUITE 11-300, CHICAGO, IL 60601 – (312) 814-6026

ROD R. BLAGOJEVICH, GOVERNOR DOUGLAS P. SCOTT, DIRECTOR

217/782-9720

November 29, 2006

CERTIFIED MAIL #7004 2510 0001 8588 7091
RETURN RECEIPT REQUESTED

John Calise, P.E.
Benton and Associates, Incorporated
1970 Lafayette Avenue
Jacksonville, Illinois 62650

Re: Plan of Study for CSO Assessment—Review Letter
City of Jacksonville
NPDES Permit No. IL0021661, Special Condition 17, Paragraph 10
Log No. CSO-0001-2005

Dear Mr. Calise:

On April 29, 2005, the Agency received a CSO Plan of Study (POS) for CSO assessment for the City of Jacksonville prepared by Benton and Associates. Prior to commenting on that document, I would like to apologize and express my regret for the long delay in preparing our response. Since the submission of the POS, a Total Maximum Daily Load (TMDL) for fecal coliform for Mauvaise Terre Creek has been completed and was approved by the U.S. Environmental Protection Agency on September 19, 2006. As such, circumstances have changed to the point that your original plan of study may be outdated. The CSO POS has been reviewed by the Agency in light of the recent federally-approved TMDL. This final TMDL report is available online at http://www.epa.state.il.us/water/tmdl/report/mauvaise/mauvaise-stage3-tmdl.pdf.

The approved TMDL provides an allocation for fecal coliform loading to Mauvaise Terre Creek from point sources and non-point sources. In the Mauvaise Terre Creek Watershed TMDL, the point source loading allocation for CSO discharges is 5.72×10^{10} colony forming units (cfu) of fecal coliform per day. This load limit is for the combined flows from Discharge Numbers 002, 003 and 004 and will apply on days when any of these outfalls discharge.

In order to comply with water quality standards and the fecal coliform load allocation for CSOs, it may be necessary to disinfect flows from Discharge Numbers 002, 003, and 004. The City should consider examining data from Discharge Number 004 and calculating the bacteria loading from this outfall. Fecal coliform data should also be collected for flows from Discharge Numbers 002 and 003 and the aggregate loading from all three outfalls compared to the load limit given above. The POS should be revised to ensure that adequate data is collected to determine whether or not additional treatment for bacteria is necessary at some or all of these outfalls. In the event that the bacterial load limits cannot consistently be achieved without additional treatment for bacteria, the CSO long-term control plan (LTCP) pursuant to Special Condition 17.10.b.4 of the City's NPDES permit, would need to address this issue.

The Agency is aware of the adjusted standard granted to the City by the Illinois Pollution Control Board on August 9, 1990 in AS 90-1. However, the adjusted standard does not grant relief from the applicable fecal coliform water quality standard and does not grant relief from the requirements of the federal Clean Water Act.

The Agency also has concerns regarding the use of data from the Nationwide Urban Runoff Program (NURP) for combined sewage. How will this data be used in estimating pollutant concentration in CSO discharges? Since a percentage of the combined sewage reaches the treatment plant and is treated and ultimately discharged through outfall 004, wouldn't the influent just prior to treatment for these flows provide an estimate of pollutant concentrations that are discharged through outfalls 002 and 003?

Pursuant to Special Condition 17.10.b.2 of the City NPDES permit, a written response to this review letter is due 90 days from the date of this letter. Upon receipt of a satisfactory response to these comments, the Agency will finalize the review of the POS.

Should you have questions, comments or desire to arrange a meeting, please contact Gary Forsee at the phone number given above. Once again, I apologize for the delay in responding to your April 29, 2005 submission. In light of the TMDL and change in circumstances brought about by its completion, it may be prudent for the City and Agency to meet and review current conditions prior to proceeding with further efforts to modify and implement the Plan of Study.

Sincerely,

Michael S. Garretson, Manager
Compliance Assurance Section
Bureau of Water

MG:DJS:j:\docs\permits\statecon\cso\pos\jacksonvilleposreview letter.doc

cc: Jack Casner, Superintendent of Utilities, City of Jacksonville
City Clerk, Jacksonville

bcc: Records Unit (Divisional
File,w/plan & supplemental
info
Springfield Regional Office
(w/original plan if not
previously sent
Tim Kluge
DWPC, Permit SEction
CSO Binder
Gary Forsee, CAS
DJS (for TMDL file)

ILLINOIS ENVIRONMENTAL PROTECTION AGENCY

1021 NORTH GRAND AVENUE EAST, P.O. BOX 19276, SPRINGFIELD, ILLINOIS 62794-9276 – (217) 782-3397
JAMES R. THOMPSON CENTER, 100 WEST RANDOLPH, SUITE 11-300, CHICAGO, IL 60601 – (312) 814-6026

217/782-9720 ROD R. BLAGOJEVICH, GOVERNOR DOUGLAS P. SCOTT, DIRECTOR

August 8, 2007

John Calise, P.E.
Benton & Associates, Incorporated
1970 Lafayette Avenue
Jacksonville, Illinois 62650

Re: City of Jacksonville
CSO Assessment
NPDES Permit No. IL0021661

Dear Mr. Calise:

The Agency received the CSO Assessment response prepared by Benton & Associates for the City of Jacksonville on February 23, 2007. The Agency has reviewed the response and concurs that the City can proceed with the development of their CSO long-term control plan (LTCP) with the emphasis of meeting the load allocation for fecal coliform required by the Total Maximum Daily Load (TMDL) for the Mauvaise Terre Creek Watershed. As discussed in the January 25, 2007 meeting, the use of Adaptive Management procedures may be considered in the design of any proposed disinfection facilities. The Agency also offers the following for the City's consideration during the development of its LTCP:

In the City's development of its LTCP the following elements should also be included:

1. Characterization, monitoring, and modeling of the combined sewer system
2. Public participation
3. Consideration of sensitive areas
4. Evaluation of alternatives
5. Cost/performance considerations
6. Operational plan
7. Maximizing treatment at the existing wastewater treatment plant
8. Implementation schedule
9. Post-construction compliance monitoring program.

In closing, I want to apologize for the Agency's delay in sending you this response. If you have questions regarding this letter please contact Jim Miles at (217) 786-6892.

Sincerely,

Mike Garretson

Michael S. Garretson, Manager
Compliance Assurance Section
Bureau of Water

APPENDIX E – Evaluation of CSO Disinfection Alternatives

CDM

Memorandum

To: *John Calise, P.E. - Benton & Associates*

From: *David Eike, P.E. - CDM*

Date: *December 11, 2007*

Subject: *City of Jacksonville, Illinois*
Combined Sewer Overflow Disinfection Alternatives Analysis

The Illinois Environmental Protection Agency (IEPA) is requiring that the City of Jacksonville (City) provide disinfection of the combined sewer overflows (CSOs) at the City's two permitted outfalls.

The purpose of this technical memorandum is to provide an overview of disinfection options available and a recommendation of disinfection design most appropriate for the City.

Disinfection Options

There are numerous means for disinfecting CSOs. Most of these have been used for disinfecting wastewater effluent and have been adapted to the new role of CSO disinfection.

Ultraviolet (UV) Light

Ultraviolet light disinfection involves exposing the CSO discharge to UV light. UV light in the 200 to 320 nm wavelength alters the genetic material in microbial cells and prevents them from reproducing.

To achieve inactivation, UV radiation must be absorbed into the microorganism. Anything that prevents the UV light from reaching the microorganism will decrease the disinfection efficiency. There are many factors that influence disinfection efficiency, including chemical and biological films that develop on the lamp surfaces, dissolved organics and inorganics in the wastewater (especially iron), clumping or aggregation of microorganisms, turbidity, color, and insufficient exposure caused by poor mixing.

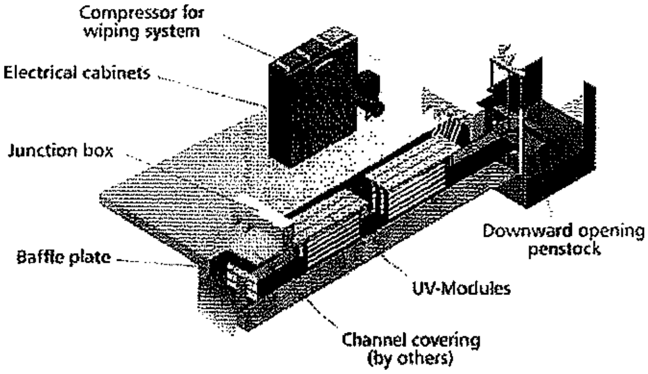


Figure 1 - Open channel ultraviolet disinfection system (Courtesy of ITT Wedeco)

Low-pressure, low-intensity lamps are most commonly used in disinfection of wastewater. Almost 85% of this lamp's output is 254 nm, which is the most effective germicidal wavelength. However, due to their low-intensity, the number of lamps required is relatively large. This may make UV systems impractical for high-rate applications such as disinfecting CSOs. Medium-pressure, high-intensity lamps are becoming more widely available and may be more appropriate for CSO applications. With higher intensity, fewer bulbs are required, which makes these systems more economical for CSO applications.

UV technologies fall into two categories - closed systems and open channel systems. Closed systems consist of UV lamps encased in quartz tubes inside the contact unit where wastewater flows around the UV lamp. Open channel systems consist of submerged UV lamps suspended either horizontally or vertically within an open channel. Both systems come in modular designs allowing them to be used in a wide range of flows.

Advantages

UV offers the following advantages:

- Shorter detention time requirements compared to other disinfection options.
- There are no chemicals required to be transported, handled, or stored.
- There are no known potentially toxic byproducts formed during use nor are there any toxic residuals.

Disadvantages

UV has the following disadvantages:

- UV systems have high capital costs.
- A backup power source would be required to ensure uninterrupted operation.
- Depending on future electric power costs, operating costs may be higher.
- UV transmittance can vary significantly, impacting the effectiveness of disinfection.

Ozone

John, I was made aware of this option just recently. While I don't think it works for this project, I'll be providing a summary write-up similar to the other options in this space.

Advantages

Ozone has the following advantages:

- More powerful disinfectant than most chlorine compounds.
- Will oxidize phenols with no negative residuals such as trihalomethane production.
- Degenerates into oxygen, which can elevate oxygen levels in treated water. It also does not alter water pH.
- Requires a short contact time.

Disadvantages

Ozone has the following disadvantages:

- Ozone systems have high capital costs.
- A backup power source would be required to ensure uninterrupted operation.
- Depending on future electric power costs, operating costs may be higher.

Peracetic Acid (PAA)

Peracetic acid ($C_2H_4O_3$), also known as peroxyacetic acid or PAA, is a mixture of acetic acid and hydrogen peroxide in an aqueous solution. It is a clear, colorless liquid and a very strong oxidizing agent that is commonly used in the food processing industry as a sanitizer and disinfectant. It is commercially available as a quaternary equilibrium mixture of acetic acid, hydrogen peroxide, peracetic acid (15%), and water. It is available in bulk in 55-gallon drums or 330-gallon totes with a shelf life of about 1 year.

Used for many years in Europe, PAA was recognized as an acceptable disinfectant for wastewater by the USEPA in 1999.

European installations feed a 12% solution at rates of 15-20 mg/l and 2 minutes of contact time to be an effective bactericide. For viral inactivation, much higher doses and contact times are required (100 mg/l and 30 minutes of contact time). Like chlorine, PAA constituents are known to have toxic and mutagenic effects. But rapid reaction times and dissipation mean that significant residuals are unlikely to occur. The highly oxidative nature of PAA also makes it capable of reacting with organic compounds that may be present in the wastewater. There is a concern over the possible formation of epoxides and, through free chlorine formation by peroxide radicals, chlorinated organic compounds.

Pilot studies using PAA for disinfection of wastewater effluent have been successfully completed in Erie County, Ohio and Lathrop and Geyserville, California. A CSO disinfection pilot study using PAA was also completed for the Detroit Baby Creek CSO[*].

Although capital costs for PAA are low, the high feed chemical costs may be up to six times those of chlorine per gallon of treated wastewater.

Advantages

PAA offers the following advantages:

- Easy to implement treatment with low capital investment.
- Broad spectrum of disinfectant activity even in the presence of heterogenous organic matter.
- Absence of persistent toxic or mutagenic residuals or by-products resulting in no quenching requirement.
- Small dependence on pH.
- No color, odor, or taste impact when used at recommended concentrations.

- With breakdown into acetic acid and water, compatible with waste treatment systems.
- Low risk to operating personnel when supplied pre-mixed.
- Non-corrosive at use concentrations.

Disadvantages

PAA also has the following disadvantages:

- Limited field and pilot testing experience in the United States. Full-scale operating facilities, especially CSO systems, are even more limited.
- Increase in organic content of treated effluent due to acetic acid.
- Compared to other disinfectants, relatively long contact time requirement.
- Few available suppliers due to limited worldwide production capacity.
- Limited product demand keeps prices high.

Chlorination

The use of chlorine for disinfection dates back to the earliest days of wastewater treatment. It is a very effective and relatively inexpensive disinfectant. The City currently uses chlorine to disinfect its wastewater effluent. Because the current NPDES permit requires a maximum daily chlorine residual of 0.05 mg/l, the City is also required to dechlorinate their wastewater effluent (Outfall 001) to meet that requirement. This is achieved by using sulfur dioxide (SO_2) gas. While dechlorination of wastewater effluent must continue under the terms of the NPDES permit, IEPA has indicated that dechlorination of disinfected CSO discharges (Outfalls 002, 003, and 004) will not be required. This makes chlorination a viable and competitive disinfection option.

Chlorination can be achieved by several methods.

Gaseous Chlorine
Chlorine gas is generally supplied in either 150-pound or 1-ton cylinders.

When added to wastewater, gaseous chlorine undergoes hydrolysis and forms a mixture of hypochlorous acid (HOCl) and hypochloric acid (HCl). Some of the HOCl further dissociates to hypochlorite ion (OCl^-). Hypochlorous acid and hypochlorite ion generally provide the majority of the disinfection. With ammonia generally present in most wastewater effluent, chloramines are also formed.

Bulk Sodium Hypochlorite
Sodium hypochlorite (NaOCl), or bleach, is a clear, yellow liquid available in strengths from 1% to 16%, but typically provided at 12.5% available chlorine. It is available in quantities ranging from 55-gallon drums to 12,000-gallon truckloads.

Hypochlorination disinfection works under the same principal as gaseous chlorination except that hypochlorous acid predominates with hypochlorite ion less so.

On-Site Generation of Sodium Hypochlorite
Sodium hypochlorite can also be generated electrochemically from salt brine solution in concentrations of less than 1%.

Chlorine Dioxide
Chlorine dioxide (ClO_2) is applied to wastewater as a gas that is generated on-site using excess chlorine. On-site generation of chlorine dioxide may be accomplished by combining sodium chlorite with either aqueous or gaseous chlorine. Chlorine dioxide can also be produced by combining sodium chlorite with hydrochloric acid.

Although it is relatively easy and economical to produce, chlorine dioxide is unstable and reactive.

Chlorine dioxide is effective at oxidizing phenols, but does not react with aquatic humus to produce trihalomethanes (THMs). However, any excess chlorine remaining from the generation of chlorine dioxide would react with THM precursors and form THMs. Therefore, operations must be carefully monitored to use the correct amounts of chlorine when generating chlorine dioxide. And while chlorine dioxide will not react with wastewater to form chloramines, it can produce potentially toxic byproducts such as chlorite and chlorate.

Advantages

Chlorination offers the following advantages:

- Easy to implement treatment with low capital investment. Existing WWTP chlorination equipment may be used.
- Gaseous chlorine has a low cost relative to disinfectant effectiveness and is widely available.
- All chlorination technologies are well-developed.

Disadvantages

Chlorination also has the following disadvantages:

- Gaseous chlorine is a significant safety hazard and requires a Risk Management Plan.
- Bulk sodium hypochlorite concentration will decay in strength over time. This issue is especially significant for CSO operations which operate infrequently and could result in long storage times.
- Chlorination can result in the formation of disinfection by-products.
- In the presence of ammonia, the resultant chloramines are less effective disinfectants.
- Future possibility of dechlorination requirements may require result in future capital and operating costs.

Design Recommendations

To assist with making a decision on which option or options look most promising, a ranking table was prepared for each disinfection options:

	Effectiveness	Safety	Capital	Operating	Total
UV	2	4	1	1	8
Ozone	5	2	1	1	9
PAA	4	3	4	2	13
On-Site Hypo	3	3	2	3	11
Bulk Hypo	4	3	2	3	12
Chlorine Gas	4	1	5	5	15
Chlorine Dioxide	4	4	3	3	14

Based on CDM's evaluation of the presented options, we recommend that the City move forward with the design of the chlorine gas system.

cc: Ron French - CDM
File 19802-59710

APPENDIX F – CSO Discharge Data

JACKSONVILLE POTW - CSO FACILITIES REPORT

CSO EVENT
CSO EVENT

Date	Precip at POTW	MG into FM	MG into First Flush		MG into Clarifier	Discharge Time	
			North	East		Start	End
7/2/1992	2.54	0.79	0.421	0.801	4.121		
7/11/1992	0.36	0	0	0	0		
7/16/1992	0.34	0	0	0	0		
7/23/1992	0.57	0.79	0.421	0.502	0.474		
7/24/1992	0.47	0	0	0	0		
8/26/1992	0.6	0	0.019	0	0		
9/4/1992	0.43	0	0	0	0		
9/9/1992	0.75	0	0.36	0	0		
9/20/1992	0.98	0.67	0.421	0	0.088		
10/8/1992	0.25	0	0	0	0		
10/19/1992	0.2	0	0	0	0		
10/31/1992	1.5	0	0.162	0	0		
11/3/1992	0.86	0	0	0	0		
11/10/1992	1.37	0.79	0.421	0.23	0.004		
11/12/1992	1.07		0.415	0.415	0.412		
11/17/1992	1.17	0.79		0.801	1.352		
11/18/1992	0.21				0.624		
11/20/1992	0.8		0.421		1.369		
11/22/1992	1.5				5.509		
12/15/1992	0.59	0.79	0.421	0.801	7.839		
12/16/1992	0.96				0.531		
12/29/1992	0.15	0	0	0	0		
3/6/1994	0.5	0	0.116	0	0		
3/12/1994	0.1	0	0	0	0		
3/26/1994	0.9	0.384	0.121	0	0		
4/2/1994	0.5		0.008	0	0		
4/5/1994	0.3		0	0	0		
4/9/1994	0.98	0.79	0.421	0.019	0.188		
4/10/1994	1.5		0.421	1.038	4.03	5:30 AM	
4/11/1994	4.75				38.632		
4/12/1994	0.2				38.12		
4/13/1994					19.956		
4/14/1994	0.45				11.212		
4/15/1994					10.505		
4/16/1994					4.729		
4/17/1994					3.334		
4/18/1994					2.858		
4/19/1994					1.93		
4/20/1994	0.03				0.976		1:30 AM
4/21/1994	0.5		0.421		3.34	8:30 AM	2:00 AM
4/27/1994	0.2	0	0	0	0		
4/28/1994	0.55	0.79	0.225	0.513	0		
4/30/1994	0.75	0.79	0.421	0.377	2.042		
5/6/1994	1.5	0.79	0.421	0.801	2.785	3:30 AM	
5/7/1994	0.1				4.816		
5/8/1994					1.012		
5/9/1994					0.0571		3:30 AM

JACKSONVILLE POTW - CSO FACILITIES REPORT

CSO EVENT
CSO EVENT

Date	Precip at POTW	MG into FM	MG into First Flush		MG into Clarifier	Discharge Time	
			North	East		Start	End
5/10/1994							
5/11/1994	0.05						
5/14/1994	0.1	0	0	0	0		
5/24/1994	0.5	0.48	0.421	0	0.02		
6/1/1994	1.5	0.79	0.421	0.801	1.716		
6/2/1994	0.4				4.952	7:00 AM	6:30 PM
6/8/1994	0.6	0.144	0.191	0	0		
6/23/1994	1.9	0.79	0.421	0.176	0.176		
6/25/1994	0.4		0.056	0	0		
6/26/1994	0.5	0.5	0.406	0	0		
7/2/1994	1.75	0.79	0.421	0.801	2.51		
7/16/1994	0.2	0.144	0.223				
8/1/1994	1.2	0.79	0.421	0.381	0.101		
8/3/1994	0.3	0.048	0.125				
8/4/1994	0.2	0.096					
8/28/1994	0.3						
8/30/1994	1.4	0.79	0.421	0.518	0.462		
11/3/1994	0.4	0	0	0	0		
11/4/1994	0.5	0.48	0.395	0	0		
11/5/1994	4.5	0.31	0.026	0.801	12.851	6:00 PM	
11/6/1994					1.483		1:00 PM
11/8/1994	0.3	0	0.041	0	0		
11/9/1994	0.75	0.529	0.38	0.801	1.433		
11/13/1994	0.05	0	0	0	0		
11/19/1994	0.04	0	0	0	0		
11/20/1994	1.1	0.789	0.421	0.801	1.277		
11/21/1994	0.1	0	0	0	0		
11/26/1994	0.2	0	0	0	0		
11/27/1994	0.5	0.336	0.131	0	0		
12/6/1994	1.5	0.79	0.421	0.801	0.266		
12/8/1994	0.2	0	0	0	0		
12/14/1994	0.1	0	0	0	0		
12/16/1994	0.75	0.79	0.421	0.307	0.009		
12/19/1994	0.1	0	0	0	0		
12/20/1994	0.05	0	0	0	0		
12/31/1994	0.1	0	0	0	0		
1/4/1998	1	0.79	0.421	0.262	0.418		
1/5/1998	0.4	0	0	0	0		
1/6/1998	0.3	0	0	0	0		
1/7/1998	1.1	0.79	0.195	0.122	0		
1/8/1998	0.5		0.103	2.471	1.792		
1/14/1998	0.3	0	0	0	0		
1/16/1998	0.4	0	0	0	0		
1/23/1998	0.3	0	0	0	0		
2/10/1998	1.5	0.79	0.421	0.02	0.34		
2/11/1998	1.25			0.781	11.538	11:15 AM	
2/12/1998	0				1.366		10:00 PM

JACKSONVILLE POTW - CSO FACILITIES REPORT

CSO EVENT
CSO EVENT

Date	Precip at POTW	MG into FM	MG into First Flush		MG into Clarifier	Discharge Time	
			North	East		Start	End
2/16/1998	0.3		0	0.363	0		
2/17/1998	0.5		0.053	0.438	0.409		
2/18/1998	0.1		0	0	0		
2/19/1998	0.3	0	0	0	0		
2/20/1998	0.1	0	0	0	0		
2/26/1998	1	0.79	0.421	0.801	0.723		
3/7/1998	0.5	0	0	0	0		
3/8/1998	1.2	0.79	0.421	0.801	6.89	4:30 PM	
3/9/1998					3.743		
3/10/1998					0.312		3:00 PM
3/16/1998	0.6	0	0	0	0		
3/17/1998	1.5	0.79	0.421	0.801	8.192	6:30 PM	
3/18/1998	0.5				4.806		
3/19/1998	0.5				3.578		
3/20/1998	0.5				10.301		
3/21/1998					5.352		
3/22/1998					2.203		
3/23/1998					0.99		3:00 AM
3/24/1998	0.1			0.313			
3/25/1998				0.028			
3/26/1998							
3/27/1998	0.5		0.16	0	0		
3/28/1998							
3/29/1998							
3/30/1998	0.1	0	0	0	0		
3/31/1998	0.3	0	0	0	0		
4/3/1998	1.5	0.79	0.421	0.801	3:45 PM		
4/4/1998						3:00 PM	
4/7/1998	0.4		0	0			
4/9/1998	0.3	0	0	0			
4/13/1998	0.7	0.336	0.292	0			
4/14/1998	0.3	0.048	0.101	0			
4/21/1998	0.25	0	0	0			
4/22/1998	0.25	0	0	0			
4/28/1998	1.1	0.79	0.421	0.648			
5/1/1998	0.2	0	0	0	0		
5/6/1998	1.1	0	0.239	0	0		
5/7/1998	0.2	0	0	0	0		
5/12/1998	0.5	0	0.017	0	0		
5/15/1998	0.2	0	0	0	0		
5/20/1998	0.5	0	0.168	0	0		
5/21/1998	1	0	0.421	0	0.073		
5/22/1998	1.1	0.79		0.801	2.925	3:00 AM	4:00 AM
5/23/1998	0.3				0.061	2:30 AM	2:40 AM
5/25/1998	0.4		0.296		2.999	7:45 PM	
5/26/1998					0.13		10:00 AM
6/3/1998	0.15	0	0.031	0	0		

JACKSONVILLE POTW - CSO FACILITIES REPORT

CSO EVENT
CSO EVENT

Date	Precip at POTW	MG into FM	MG into First Flush		MG into Clarifier	Discharge Time	
			North	East		Start	End
6/4/1998	0.75	0	0	0	0		
6/5/1998	0.1	0	0	0	0		
6/8/1998	1	0.79	0.421	0.669	0.278		
6/10/1998	0.3		0.371	0.097	0		
6/11/1998	2.02		0.05	0.035	16.37	11:00 AM	
6/12/1998					5.618		
6/13/1998					0.769		10:30 PM
6/14/1998	0.6		0.371		2.7	6:30 AM	12:00 AM
6/15/1998	0.5		0.336	0.378	0		
6/16/1998				0.104	1.324	6:00 AM	2:00 PM
6/18/1998					14.722		
6/20/1998	1.5				9.627		
6/21/1998					9.886		
6/22/1998	1				20.501		
6/23/1998					6.845		
6/24/1998					1.997		
6/25/1998				0.337	0.304		11:00 AM
6/26/1998				0.11			
6/28/1998	1.75	0.79	0.421	0.801	2.542	5:30 AM	
6/29/1998	2.5				21.257		
6/30/1998					17.366		
7/1/1998					5.092		
7/2/1998					1.655		
7/3/1998	0.2			0.445	0.324		12:00 AM
7/4/1998				0.058			
7/10/1998	0.9	0.79	0.421	0.801	0.928		
7/30/1998	1	0.096	0.264	0			
8/4/1998	0.5	0	0	0	0		
8/5/1998	0.1	0	0	0	0		
8/31/1998	0.4	0.096	0.421	0	0.104		
9/1/1998	0.1	0	0	0	0.013		
9/13/1998	0.5	0	0	0	0		
9/14/1998	0.5	0	0	0	0		
9/24/1998	1.6	0.79	0.421	0	0.421		
9/25/1998				0.012			
9/29/1998	0.25	0	0	0	0		
9/30/1998	0.25	0	0	0	0		
10/4/1998	0.8	0.144	0.306	0	0		
10/5/1998	0.7	0	0.112	0	0		
10/6/1998	0.17	0	0	0	0		
10/16/1998	0.7	0	0.245	0	0		
10/17/1998	0.5	0.048	0.143	0	0		
10/21/1998	0.1	0	0	0	0		
10/27/1998	0.7	0.048	0.284	0	0		
10/28/1998	0.1	0	0	0	0		
11/1/1998	0.2	0	0	0	0		
11/2/1998	2.1	0.79	0.421	0.801	1.751		

JACKSONVILLE POTW - CSO FACILITIES REPORT

CSO EVENT
CSO EVENT

Date	Precip at POTW	MG into FM	MG into First Flush North	MG into First Flush East	MG into Clarifier	Discharge Time Start	Discharge Time End
11/3/1998	1.2				3.071	1:45 PM	9:30 PM
11/7/1998	0.5	0	0	0	0		
11/9/1998	0.7	0	0	0	0		
11/30/1998	0.1	0	0	0	0		
12/6/1998	0.3	0	0	0	0		
12/18/1998	0.4	0	0	0	0		
12/21/1998	0.1	0	0	0	0		
12/30/1998	0.1	0	0	0	0		
1/1/1999	0.75	0	0	0	0		
1/2/1999	0.25	0	0	0	0		
1/8/1999	0.5	0	0	0	0		
1/17/1999	0.6	0	0	0	0		
1/21/1999	0.4	0	0	0	0		
1/23/1999	0.3	0.79	0.152	0.618	0		
1/31/1999	0.62	0.79	0.279	0.82	0.019		
2/6/1999	1.38	0.79	0.421	0.801	1.089		
2/7/1999	0.5				9.127	8:00 PM	
2/8/1999					0.891		10:00 PM
2/11/1999	0.6	0.198	0.421	0.407	0.197		
2/16/1999	0.4	0	0	0	0		
2/22/1999	0.15	0	0	0	0		
2/23/1999	0.3	0	0	0	0		
3/5/1999	0.5	0	0	0	0		
3/8/1999	0.7	0	0	0	0		
4/3/1999	2.2	0.79	0.421	0.801	2.976	1:30 PM	10:00 PM
4/8/1999	0.25	0	0	0	0		
4/14/1999	0.75	0	0	0	0		
4/15/1999	1.9	0.79	0.421	0.801	7.147	5:00 PM	
4/16/1999	0.75				11.266		
4/17/1999					6.445		
4/18/1999					2.446		11:30 PM
4/27/1999	1	0.79	0.421	0.551	0.373		
4/28/1999				0.25	0.126		
5/4/1999	0.75	0.336	0.421	0	0.13		
5/12/1999	2.25	0.79	0.421	0.801	5.446	7:00 PM	
5/13/1999	0				0.122		7:00 AM
5/17/1999	1.1	0.79	0.421	0.474	0.474		
5/21/1999	0.4	0.048	0.421	0.01	0.01		
5/31/1999	0.1	0	0	0	0		
6/1/1999	0.2	0	0	0	0		
6/4/1999	0.5	0	0.312	0	0		
6/10/1999	0.1	0	0	0	0		
6/11/1999	0.38	0	0	0	0		
6/12/1999	1.25	0.79	0.421	0.332	0.99		
6/13/1999	0.25			0.373	0.359		
6/30/1999	0.9	0.192	0.421	0	0.09		
7/1/1999	0.1	0	0	0	0		

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CSO EVENT

Date	Precip at POTW	MG into FM	MG into First Flush		MG into Clarifier	Discharge Time	
			North	East		Start	End
7/16/1999	0.4	0	0.002	0	0		
7/26/1999	0.1	0	0	0	0		
7/28/1999	1	0.598	0.421	0.077	0.097		
8/7/1999	0.7	0	0.403	0	0		
8/12/1999	2.5	0.79	0.421	0.647	0.969		
8/18/1999	0.25	0	0.01	0	0		
8/23/1999	0.7	0.336	0	0	0.087		
9/12/1999	0.2	0	0	0	0		
9/19/1999	0.4	0	0	0	0		
9/28/1999	1.5	0.24	0.421	0	0.261		
10/2/1999	0.1	0	0	0	0		
10/3/1999	1	0	0.145	0	0		
10/8/1999	0.25	0	0	0	0		
10/16/1999	0.25	0	0	0	0		
12/3/1999	0.2	0	0	0	0		
12/4/1999	1.5	0.24	0.421	0	0.225		
12/5/1999	0.3	0	0	0	0		
12/9/1999	0.3	0	0	0	0		
12/11/1999	0.1	0	0	0	0		
1/3/2000	0.1	0	0	0	0		
1/22/2000	0.1	0	0	0	0		
1/29/2000	0.3	0	0	0	0		
1/30/2000	0.1	0	0	0	0		
2/17/2000	1	0	0.359	0	0		
2/23/2000	0.2	0	0	0	0		
2/29/2000	0.3	0	0	0	0		
3/10/2000	0.1	0	0	0	0		
3/11/2000	0.4	0	0	0	0		
3/15/2000	0.5	0	0	0	0		
3/18/2000	0.3	0	0	0	0		
3/19/2000	1	0	0	0	0		
3/20/2000	0.25	0	0	0	0		
3/26/2000	0.75	0.79	0.421	0.07	0.079		
4/7/2000	0.2	0	0	0	0		
4/10/2000	0.1	0	0	0	0		
4/16/2000	1.25	0.79	0	0.09	0		
4/19/2000	0.4	0	0.201	0	0		
4/20/2000	0.4	0	0.22	0	0.067		
4/23/2000	0.2	0	0	0	0		
4/27/2000	0.1	0	0	0	0		
4/28/2000	0.05	0	0	0	0		
5/8/2000	0.1	0	0.027	0	0		
5/17/2000	0.3	0	0.228	0	0		
5/26/2000	2	0.79	0.421	0.106	0.469		
6/4/2000	0.2	0	0	0	0		
6/11/2000	2.5	0.79	0.421	0.801	2.534		
6/12/2000	0.2						

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CSO EVENT

CSO EVENT

Date	Precip at POTW	MG into FM	MG into First Flush		MG into Clarifier	Discharge Time	
			North	East		Start	End
6/13/2000	0.3						
6/14/2000	0.5	0	0.185	0	0		
6/20/2000	2.7	0.79	0.421	0.801	5.687	10:30 PM	4:00 AM
6/23/2000	2.5	0.09	0.421	0.801	5.121	3:00 AM	
6/24/2000	2				5.101		
6/25/2000	1				4.006		
6/26/2000	0.1				3.181		11:00 PM
7/2/2000	0.25	0	0	0	0		
7/4/2000	0.7	0.768	0.421	0	0.055		
7/5/2000	0.75	0.022		0.497	0.544		
7/10/2000	2	0.79	0.421	0.801	2.348		
7/11/2000					2.597	7:30 AM	3:00 PM
7/17/2000	0.15	0	0	0	0		
7/18/2000	0.2	0	0	0	0		
7/27/2000	0.2	0	0	0	0		
7/31/2000	0.05	0	0	0	0		
8/2/2000	0.5	0	0.247	0	0		
8/4/2000	0.8	0	0	0	0		
8/5/2000	0.3	0	0	0	0		
8/6/2000	0.15	0	0	0	0		
8/8/2000	1	0.79	0.421	0.169	0.165		
8/17/2000	0.4	0	0.283	0	0		
8/19/2000	0.1	0	0	0	0		
8/22/2000	0.3	0	0	0	0		
8/23/2000	0.6	0	0.3	0	0		
9/11/2000	1	0.79	0.421	0.014	0.229		
9/14/2000	0.5	0	0.016	0	0		
9/20/2000	0.3	0	0	0	0		
9/21/2000	0.2	0	0	0	0		
9/23/2000	1	0	0.11	0	0		
9/24/2000	0.5	0	0	0	0		
10/3/2000	0.2	0	0	0	0		
10/4/2000	1	0	0	0	0		
10/5/2000	0.75	0.288	0.169	0	0		
10/14/2000	0.75	0	0.162	0	0		
10/16/2000	0.3	0	0	0	0		
10/23/2000	0.2	0	0	0	0		
11/6/2000	1.3	0.336	0.421	0	0.159		
11/8/2000	0.5	0	0	0	0		
11/9/2000	0.2	0	0	0	0		
11/24/2000	0.3	0	0	0	0		
11/25/2000	0.5	0	0	0	0		
12/5/2000	0.1	0	0	0	0		
12/10/2000	0.5	0	0	0	0		
12/11/2000	0.2	0	0	0	0		
12/13/2000	0.5	0	0	0	0		
12/18/2000	0.2	0	0	0	0		

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CSO EVENT

CSO EVENT

Date	Precip at POTW	MG into FM	MG into First Flush North	MG into First Flush East	MG into Clarifier	Discharge Time Start	Discharge Time End
12/19/2000	0.2	0	0	0	0		
12/20/2000	0.1	0	0	0	0		
12/28/2000	0.2	0	0	0	0		
12/29/2000	0.1	0	0	0	0		
1/13/2001	0.3	0	0	0	0		
1/26/2001	0.1	0	0	0	0		
1/28/2001	1.75	0.79	0.421	0.801	0.762		
1/29/2001	1.5				14.844	9:30 AM	
1/30/2001	0.2				1.802		9:30 PM
2/9/2001	0.75	0.192	0.278	0	0		
2/13/2001	0.2	0	0	0	0		
2/23/2001	0.5	0	0	0	0		
2/24/2001	1.5	0.79	0.421	0.801	10.053	5:30 PM	
2/25/2001					3.217		4:00 AM
2/26/2001					0.151	10:00 AM	3:30 PM
2/27/2001	0.2						
2/28/2001							
3/11/2001	0.1	0	0	0	0		
3/14/2001	0.8	0.096	0.03	0	0		
3/15/2001	1.25	0.694	0.162	0.739	0		
3/16/2001	0.2		0	0.329	0		
3/31/2001	0.1		0	0	0		
4/5/2001	0.25	0	0.372	0	0		
4/9/2001	0.25	0	0	0	0		
4/10/2001	0.7	0	0.376	0	0		
4/11/2001	0.5	0.79	0.421	0.557	0.018		
4/20/2001	0.4	0.048	0.18	0	0		
4/21/2001	0.3	0	0	0	0		
4/27/2001	0.2	0	0	0	0		
5/5/2001	0.2	0	0	0	0		
5/6/2001	0.7	0.192	0.421	0	0.076		
5/13/2001	0.1	0	0	0	0		
5/14/2001	0.2	0	0	0	0		
5/17/2001	0.5	0	0	0	0		
5/18/2001	0.2	0	0	0	0		
5/20/2001	0.5	0	0.184	0	0		
5/21/2001	0	0	0	0	0		
5/23/2001	0.1	0	0	0	0		
5/24/2001	0.1	0	0	0	0		
5/25/2001	0.3	0	0	0	0		
5/26/2001	0.4	0	0	0	0		
5/28/2001	0.2	0	0	0	0		
5/30/2001	1.5	0.79	0.128	0.2	0		
5/31/2001	0.3		0	0.216	0		
6/1/2001	0.3	0	0	0	0		
6/3/2001	0.75	0.79	0.421	0.105	0.172		
6/4/2001	0.5			0.696	1.317		

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CSO EVENT

Date	Precip at POTW	MG into FM	MG into First Flush		MG into Clarifier	Discharge Time	
			North	East		Start	End
6/5/2001	3.5		0.421	0.801	9.572		
6/6/2001	0.2				26.128	6:00 AM	
6/7/2001					5.442		
6/8/2001				0.132	0.854		8:00 PM
6/9/2001				0.077			
6/14/2001	1	0.79	0.421	0.801	0.788		
6/20/2001	0.4	0.5	0.29	0	0		
7/12/2001	0.1	0	0	0	0		
7/17/2001	1.4	0.79	0.421	0.466	0.368		
7/18/2001	0.75			0.119	0.33		
7/19/2001	0.5		0.314	0.042	0		
8/2/2001	0.5	0.16	0.314	0	0		
8/15/2001	0.4	0	0	0	0		
8/22/2001	3	0.79	0.421	0.801	3.698	5:30 AM	7:00 AM
8/23/2001	0.3		0.107	0.04	0		
8/24/2001	0.3	0	0	0	0		
9/6/2001	0.3	0	0	0	0		
9/8/2001	0.2	0	0.095	0	0		
9/18/2001	1.5	0.79	0.421	0.361	0.283		
9/20/2001	0.4	0	0	0	0		
10/4/2001	0.7	0	0	0	0		
10/5/2001	0.5	0	0	0	0		
10/9/2001	0.5	0	0	0	0		
10/10/2001	0.25	0	0	0	0		
10/11/2001	1	0	0	0	0		
10/12/2001	0.1	0	0	0	0		
10/13/2001	0.8	0.79	0.421	0.489	0.381		
10/14/2001	0.1		0	0	0		
10/15/2001	0.75	0	0	0.213	0		
10/16/2001	0.3	0	0	0	0		
10/22/2001	0.5	0.096	0.142	0	0		
10/23/2001	0.1	0	0	0	0		
10/24/2001	0.3	0	0	0	0		
11/1/2001	0.25	0	0	0	0		
11/18/2001	0.2	0	0	0	0		
11/23/2001	1.5	0.79	0.421	0.734	0.413		
11/24/2001	0.1			0	0		
11/26/2001	0.2	0	0	0	0		
11/28/2001	0.2	0	0	0	0		
11/29/2001	0.6	0	0	0	0		
12/5/2001	0.1	0	0	0	0		
12/11/2001	0.3	0	0	0	0		
12/12/2001	0.75	0.24	0.273	0	0		
12/13/2001	0.2	0	0	0	0		
12/14/2001	0.4	0	0	0	0		
12/15/2001	0.3	0	0	0	0		
12/16/2001	0.7	0	0	0	0		

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CSO EVENT

Date	Precip at POTW	MG into FM	MG into First Flush		MG into Clarifier	Discharge Time	
			North	East		Start	End
12/22/2001	0.3	0	0	0	0		
1/18/2002	0.3	0	0	0	0		
1/23/2002	0.2	0	0	0	0		
1/29/2002	0.7	0	0	0	0		
1/30/2002	2.5	0.79	0.421	0.801	6.982	1:00 AM	
1/31/2002	0.5				7.24		
2/1/2002		0	0	0	0.629		8:15 PM
2/9/2002	0.5	0	0	0	0		
2/10/2002	0.2	0	0	0	0		
2/18/2002	0.1	0	0	0	0		
2/19/2002	0.75	0	0.047	0	0		
2/25/2002	0.3	0	0	0	0		
3/1/2002	0.5	0	0	0	0		
3/2/2002	0.3	0	0	0	0		
3/8/2002	0.75	0.79	0.14	0.045	0		
3/19/2002	0.25	0	0	0	0		
3/24/2002	0.5	0.19	0.004	0	0		
3/25/2002	0.2	0	0	0	0		
4/7/2002	0.3	0	0	0	0		
4/8/2002	0.9	0.79	0.421	0.454	0.335		
4/19/2002	0.4	0	0	0	0		
4/20/2002	1.5	0.79	0.421	0.801	2.767		
4/21/2002	0.5				2.008	7:30 AM	
4/22/2002					0.786		2:00 PM
4/23/2002							
4/24/2002	2		0.421	0.801	17.336	2:00 PM	
4/25/2002					3.076		
4/26/2002					0.468		5:00 PM
4/27/2002	2.95			0.801	27.417	8:00 AM	
4/28/2002					9.73		
4/29/2002					3.263		
4/30/2002					1.456		
5/1/2002	1				6.624		
5/2/2002					1.676		
5/3/2002					0.514		5:00 AM
5/4/2002							
5/5/2002	1.5		0.421	0.427	0.205	2:00 PM	
5/6/2002	1.8				13.856		
5/7/2002	0.1				7.51		
5/8/2002	0.7				9.92		
5/9/2002					3.938		
5/10/2002	0.2				1.5		
5/11/2002	2				10.76		
5/12/2002	1.4				32.761		
5/13/2002					33.63		
5/14/2002					5.046		
5/15/2002	0.4				2.203		

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CSO EVENT

Date	Precip at POTW	MG into FM	MG into First Flush		MG into Clarifier	Discharge Time	
			North	East		Start	End
5/16/2002	0.8				4.601		
5/17/2002	0.5				4.451		
5/18/2002					1.466		5:30 AM
5/19/2002							
5/20/2002							
5/21/2002							
5/22/2002							
5/27/2002	0.75	0.336	0.421		0.11		
5/28/2002					0.136		
6/4/2002	0.1	0	0	0	0		
6/5/2002	0.2	0	0	0	0		
6/11/2002	3.2	0.79	0.421	0.801	11.867	6:00 PM	
6/12/2002	0.6				5.166		
6/13/2002					5.823		
6/14/2002					1.427		6:00 AM
6/26/2002	0.2						
7/12/2002	0.4	0	0	0	0		
7/22/2002	0.2	0	0	0	0		
7/26/2002	2.6	0.79	0.421	0.801	2.899	11:00 AM	12:00 PM
8/5/2002	2.9	0.79	0.421	0.801	3.09	4:00 AM	7:00 AM
8/6/2002					0.305		
8/13/2002	1.5	0.79	0.421	0.758	0		
8/14/2002	0.4			0.043	0.09		
8/15/2002							
8/16/2002	0.2			0	0		
8/18/2002	0.5	0.768	0.421		0.244		
8/19/2002	1	0.022		0.545	0.729		
8/23/2002	1.3	0.79	0.255	0.7	0		
9/14/2002	0.5	0	0.074	0	0		
9/15/2002	1.1	0.79	0.421	0.548	0.548		
9/19/2002	0.2	0	0	0	0		
10/2/2002	0.5	0	0	0	0		
10/4/2002	0.3	0	0	0	0		
10/12/2002	0.2	0	0	0	0		
10/18/2002	1.75	0.79	0.421	0.401	1.211		
10/24/2002	0.4	0	0	0	0		
10/25/2002	0.2	0	0	0	0		
10/28/2002	0.5	0	0	0	0		
10/29/2002	0.1	0	0	0	0		
10/30/2002	0.25	0	0	0	0		
11/3/2002	0.01	0	0	0	0		
11/5/2002	0.4	0	0	0	0		
11/14/2002	0.01	0	0	0	0		
11/21/2002	0.01	0	0	0	0		
12/17/2002	1.5	0	0	0	0		
12/18/2002	0.5	0.79	0.421	0.428	0.655		
12/24/2002	0.4	0	0	0	0		

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Date	Precip at POTW	MG into FM	MG into First Flush		MG into Clarifier	Discharge Time	
			North	East		Start	End
1/1/2003	0.2	0	0	0	0		
1/15/2003	0.3	0	0	0	0		
1/25/2003	0.1	0	0	0	0		
2/10/2003	0.3	0	0	0	0		
2/13/2003	0.2	0	0	0	0		
2/14/2003	1	0	0.421	0	0.013		
2/15/2003	0.5	0	0	0	0		
2/21/2003	0.1	0	0	0	0		
2/23/2003	0.2	0	0	0	0		
3/12/2003	0.5	0	0	0	0		
3/18/2003	0.8	0	0.087	0	0		
3/19/2003	1.3	0.79	0.334	0.801	2.384		
3/24/2003	0.25	0	0	0	0.48		
3/27/2003	0.2	0	0	0	0		
3/28/2003	0.6	0	0	0	0		
4/3/2003	0.1	0	0	0	0		
4/4/2003	0.3	0	0	0	0		
4/6/2003	1.25	0.79	0.421	0.474	0.324		
4/16/2003	1.25	0.79	0.421	0.801	0.724		
4/17/2003	0.1	0	0	0	0		
4/19/2003	0.1	0	0	0	0		
4/23/2003	0.1	0	0	0			
4/24/2003	1.25	0.79	0.421	0	0.268		
4/25/2003	0.5			0.801	1.066		
4/28/2003	0.4	0.79	0.099	0.143	0		
4/29/2003	0.2	0	0	0	0		
5/6/2003	0.1						
5/8/2003	0.05						
5/9/2003	0.3						
5/10/2003	0.7	0.79	0.364	0.801	0.785		
5/14/2003	0.05						
5/16/2003	0.5	0.144	0.176	0			
5/24/2003	0.75						
6/2/2003	1	0.789	0.262	0.187			
6/6/2003	0.5						
6/9/2003	0.5		0.421		0.108		
6/10/2003	0.2	0.789	0.186	0.411			
6/13/2003	0.3						
6/18/2003	0.1						
6/25/2003	1.4	0.789	0.494	0.064	0.073		
7/8/2003	1.05	0.79	0.214	0.801	0.039		
7/9/2003	0.75		0.421	0.594	0.173		
7/17/2003	0.5						
7/18/2003	2.3	0.79	0.421	0.801	6.331	12:00 PM	10:00 PM
7/27/2003	0.05		0.112				
7/28/2003	0.08	0.79	0.309	0.181	0.393		
8/3/2003	0.4	0.576	0.421	0	0.068		

JACKSONVILLE POTW - CSO FACILITIES REPORT

CSO EVENT

CSO EVENT

MGD

Date	Precip at POTW	MG into FM	MG into First Flush		MG into Clarifier	Discharge Time	
			North	East		Start	End
8/28/2003	0.4	0.79	0.421	0.219	0.634		
8/31/2003	3.6		0.421	0.801	6.42	7:00 PM	
9/1/2003	1.1	0.79	0.421	0.801	0.388		7:30 PM
9/21/2003	0.75	0.192	0.394	0	0		
9/26/2003	0.75	0.79	0.421	0	0.195		
10/9/2003	1	0.288	0.382	0	0		
10/11/2003	0.15		0	0	0		
10/13/2003	1.4	0.79	0.421	0.801	1.814		
10/24/2003	0.4	0	0	0	0		
10/25/2003	0.3	0	0	0	0		
10/27/2003	0.1	0	0	0	0		
11/4/2003	0.6	0	0	0			
11/17/2003	2.8	0.79	0.421	0.801	8.44	12:00 AM	
11/18/2003	0.04				1.79		5:00 PM
12/4/2003	0.1	0	0	0	0		
12/9/2003	0.75	0	0.126	0	0		
12/13/2003	0.2	0	0	0	0		
12/22/2003	1	0.528	0.12	0	0		
12/27/2003	0.2	0	0	0	0		
1/3/2004	0.5	0	0	0	0		
1/4/2004	0.6	0.144	0.145	0	0		
1/16/2004	0.1	0	0	0	0		
1/17/2004	0.5	0	0	0	0		
1/25/2004	0.05	0	0	0	0		
1/26/2004	0.1	0	0	0	0		
1/29/2004	0.1	0	0	0	0		
2/2/2004	0.07	0	0	0	0		
2/4/2004	0.1	0	0	0	0		
2/5/2004	0.1	0	0	0	0		
2/6/2004	0.03	0	0	0	0		
3/4/2004	1.7	0.79	0.421	0.801	1.561		
3/13/2004	0.1	0	0	0	0		
3/23/2004	0.25	0	0	0	0		
3/24/2004	0.1	0	0	0	0		
3/25/2004	0.7	0	0.037	0	0		
3/26/2004	0.4	0	0	0	0		
3/28/2004	0.75	0.672	0.394	0	0		
3/29/2004	0.2	0	0	0	0		
4/20/2004	0.8	0	0.124	0	0		
4/22/2004	0.7	0.144	0.284	0	0		
4/24/2004	1.5	0.789	0.421	0.801	1.348		
4/29/2004	0.1	0	0	0	0		
4/30/2004	0.2	0	0	0	0		
5/1/2004	0.2	0	0	0	0		
5/2/2004	0.2	0	0	0	0		
5/4/2004	0.3	0	0	0	0		
5/10/2004	0.7	0.288	0.385	0	0		

JACKSONVILLE POTW - CSO FACILITIES REPORT

CSO EVENT
CSO EVENT

Date	Precip at POTW	MG into FM	MG into First Flush North	MG into First Flush East	MG into Clarifier	Discharge Time Start	Discharge Time End
5/11/2004				0	0		
5/12/2004	0.1		0.298	0	0		
5/13/2004	0.75	0.576	0.337	0	0		
5/14/2004	0			0	0		
5/15/2004				0	0		
5/18/2004	0.8	0.79	0.421	0.026	0.123		
5/19/2004							
5/20/2004							
5/23/2004	0.3		0.145				
5/24/2004	0.75	0.48	0.276		0.544		
5/26/2004	0.2						
5/27/2004	0.1						
6/9/2004	0.1	0	0	0	0		
6/10/2004	0.75	0	0.023	0	0		
6/11/2004							
6/14/2004	0.05	0.096		0	0		
6/15/2004	1	0.576	0.421	0	0.2		
6/17/2004							
6/21/2004	0.3		0	0	0		
6/24/2004	0.7		0.242	0	0		
7/2/2004	0.5	0	0	0	0		
7/3/2004	0.4	0	0	0	0		
7/4/2004	0.2	0	0	0	0		
7/5/2004	0.2	0	0	0	0		
7/6/2004	1.5	0.48	0.139	0	0		
7/7/2004	0	0.309	0.128	0.171	0		
7/8/2004	0.4	0			0		
7/9/2004					0		
7/10/2004	0.7	0			0		
7/11/2004	0.5	0	0.111	0	0		
7/24/2004	0.1	0	0	0	0		
7/29/2004	0.75	0	0	0	0		
7/30/2004	0.1	0	0	0	0		
8/3/2004	0.1	0	0	0			
8/9/2004	0.5	0	0	0			
8/19/2004	0.3	0	0	0			
8/20/2004	0.7	0	0	0			
8/23/2004	0.5	0	0.083	0			
8/24/2004		0					
8/25/2004	3.5	0.789	0.421	0.801	3.771	6:00 PM	9:00 PM
8/26/2004							
8/27/2004	1		0.421	0	0.063		
8/28/2004	0.1	0	0	0			
9/15/2004	0.1	0	0	0	0		
10/1/2004	0.1	0	0	0	0		
10/7/2004	0.1	0	0	0	0		
10/8/2004	0.3	0	0	0	0		

JACKSONVILLE POTW - CSO FACILITIES REPORT

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CSO EVENT

Date	Precip at POTW	MG into FM	MG into First Flush		MG into Clarifier	Discharge Time	
			North	East		Start	End
10/12/2004	0.75	0	0	0	0		
10/14/2004	1	0	0	0	0		
10/17/2004	0.75	0.24	0.148	0	0		
10/18/2004	0.7	0.096	0.184	0	0		
10/20/2004	0			0	0		
10/22/2004	0.1			0	0		
10/26/2004	1	0.096	0.148	0	0		
10/29/2004	0.3			0	0		
10/31/2004	1.5	0.528	0.411	0	0		
11/1/2004	1	0.789	0.421	0.768	0.201		
11/2/2004	0.5	0	0	0	0		
11/3/2004	0.7	0	0	0	0		
11/18/2004	0.4	0	0	0	0		
11/21/2004	0.1	0	0	0	0		
11/23/2004	1	0	0	0	0		
11/24/2004	0.4	0	0.003	0	0		
11/26/2004	0.2	0	0	0	0		
11/27/2004	0.4	0	0.08	0	0		
11/28/2004	0.1	0	0	0	0		
11/29/2004	0.4	0.789	0.041	0.079	0		
11/30/2004	0.6	0	0	0	0		
12/5/2004	0.5		0.365	0.624	0		
12/6/2004	0.5		0.147	0.816	0.015		
12/7/2004	0.5		0.421	0	0.276		
12/10/2004	0.5			0.672	0.018		
1/1/2005	0.3	0	0	0	0		
1/2/2005	0.5	0	0	0	0		
1/3/2005	1	0.789	0.421	0.801	1.039		
1/4/2005	1.5				8.52	6:00 PM	
1/5/2005	0.9				15.756		
1/6/2005					2.912		
1/7/2005	0.1				0.99		
1/8/2005	0				0.127		
1/9/2005	0				0.107		5:00 AM
1/10/2005							
1/11/2005	0.3	0	0	0	0		
1/12/2005	2	0.789	0.421	0.801	10.398	12:00 AM	
1/13/2005	0.5				15.362		
1/14/2005					4.813		
1/15/2005	0				1.377		
1/16/2005			0		0.503		10:30 AM
1/17/2005				0.08	0		
1/21/2005							
1/28/2005	1.5	0	0	0	0		
1/31/2005	0.5	0	0	0	0		
2/6/2005	0.25	0	0	0	0		
2/7/2005	0.4	0	0	0	0		

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CSO EVENT

Date	Precip at POTW	MG into FM	MG into First Flush		MG into Clarifier	Discharge Time	
			North	East		Start	End
2/8/2005	0.5	0	0	0	0		
2/9/2005	0.3	0	0	0	0		
2/12/2005	0.3	0	0	0	0		
2/13/2005	1	0.789	0.421	0.499	1.216		
2/14/2005				0.097	0.557		
2/15/2005			0	0	0		
2/16/2005			0	0	0		
2/17/2005			0	0	0		
2/19/2005	0.2	0	0	0	0		
2/27/2005	0.3	0	0	0	0		
3/22/2005	1.2	0.789	0.307	0.245	0		
3/24/2005	0.2	0	0	0	0		
3/25/2005	0.1	0	0	0	0		
4/6/2005	0.2	0	0	0	0		
4/11/2005	0.75	0	0.228	0	0		
4/12/2005	1	0.789	0.193	0.417	0.401		
4/22/2005	0.5	0	0	0	0		
4/25/2005	0.3	0	0	0	0		
5/8/2005	0.1	0	0	0	0		
5/11/2005	0.5	0.79	0.421	0.131	0.043		
5/12/2005	0.2	0	0	0	0		
5/18/2005	0.3	0	0	0	0		
5/19/2005	0.5	0	0	0	0		
6/8/2005	0.5	0	0	0	0		
6/11/2005	0.7	0.432	0.421	0	0.019		
6/12/2005							
6/13/2005	1	0.144	0.346	0	0.079		
7/4/2005	0.2	0	0	0	0		
7/11/2005	0.5	0	0	0	0		
7/12/2005	0.3	0	0	0	0		
7/13/2005	0.2	0	0	0	0		
7/26/2005	0.6	0	0	0	0		
7/27/2005	0	0	0.4	0	0		
8/5/2005	0.4	0	0	0	0		
8/11/2005	0.2	0	0	0	0		
8/12/2005	0.5	0	0.363	0	0		
8/13/2005					0		
8/14/2005	0.5	0	0	0	0		
8/15/2005	0.25	0.288	0	0	0		
8/16/2005	0.4	0	0	0	0		
8/18/2005	0.45	0	0.06	0	0		
8/19/2005		0	0	0	0		
8/22/2005	0.9	0	0.293	0	0		
8/25/2005					0		
8/26/2005	0.3	0	0.215	0	0		
8/29/2005							
9/8/2005	0.4	0	0	0	0		

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CSO EVENT

Date	Precip at POTW	MG into FM	MG into First Flush North	MG into First Flush East	MG into Clarifier	Discharge Time Start	Discharge Time End
9/13/2005	0.7	0	0.178	0	0		
9/14/2005	0						
9/15/2005	0.4	0	0	0	0		
9/18/2005	0.5	0	0.214	0	0		
9/21/2005	1	0.789	0.421	0.01	0.126		
9/22/2005							
9/23/2005	0.2	0	0	0	0		
9/25/2005	0.6	0	0	0	0		
9/28/2005	0.3	0	0	0	0		
10/19/2005	0.4	0	0	0	0		
10/20/2005	1.2	0.096	0.237	0	0		
10/21/2005							
10/23/2005	0.1	0	0	0	0		
10/24/2005							
10/31/2005	0.75	0	0	0	0		
11/5/2005	1.2	0.79	0.421	0.2	0.121		
11/6/2005					0		
11/7/2005					0		
11/12/2005	0.2	0	0	0	0		
11/14/2005	0.8	0.35	0.109	0	0		
11/15/2005		0.44	0.245	0.045	0		
11/16/2005					0		
11/17/2005					0		
11/26/2005	0.1				0		
11/27/2005	1.25	0.336	0.408	0	0		
11/28/2005							
12/8/2005	0.2	0	0	0	0		
12/13/2005	0.25	0	0	0	0		
12/15/2005	0.05	0	0	0	0		
12/17/2005	0.05	0	0	0	0		
12/18/2005	0.05	0	0	0	0		
12/24/2005	0.75	0	0	0	0		
12/30/2005	0.3	0	0	0	0		
1/1/2006	1.2	0	0	0	0		
1/2/2006	0.2	0.79	0.421	0.304	0.59		
1/10/2006	0.1	0	0	0	0		
1/12/2006	0.6	0	0	0	0		
1/13/2006	0.2	0	0	0	0		
1/28/2006	1.5	0.79	0.421	0.146	0.783		
3/5/2006	0.2	0	0	0	0		
3/7/2006	0.3	0	0	0	0		
3/8/2006	0.5	0	0	0	0		
3/9/2006	0.5	0	0	0	0		
3/11/2006	1.2	0.789	0.421	0.229	0.321		
3/12/2006	1.5			0.572	6.013	12:00 AM	
3/13/2006	0				1.833		8:00 PM
3/14/2006	0				0		

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CSO EVENT

Date	Precip at POTW	MG into FM	MG into First Flush		MG into Clarifier	Discharge Time	
			North	East		Start	End
3/15/2006	0						
3/16/2006	0						
3/27/2006	0.2	0	0	0	0		
3/30/2006	0.4	0	0	0	0		
4/2/2006	0.9	0	0.421	0	0.001		
4/5/2006	0.8	0.789		0.395	0.844		
4/6/2006	0.4			0.406	0.674		
4/7/2006	0						
4/8/2006	0						
4/15/2006	1.1	0.789	0.421	0.064	0.304		
4/17/2006							
4/18/2006	0.03						
4/20/2006							
4/30/2006	0.2		0.018	0	0		
5/3/2006	0.15						
5/4/2006	1.5	0.288	0.421	0	0.048		
5/10/2006	0.2						
5/12/2006	0.2						
5/14/2006	0.2						
5/15/2006	0.5						
5/16/2006	0.5						
5/24/2006	0.3		0.1				
5/30/2006	0.1						
5/31/2006	0.5		0.045				
6/1/2006	1.3		0.421	0.345	0.935		
7/3/2006	0.2	0	0	0	0		
7/4/2006	0.2	0	0.085	0	0		
7/10/2006	0.3	0	0	0	0		
7/11/2006	0.75	0.789	0.421	0.53	0.9		
7/12/2006	2.5	0.789	0.421	0.801	1.817		
7/19/2006	2	0.789	0.421	0.325	0.506		
7/20/2006	0.1	0	0	0	0		
7/21/2006	0.1	0	0	0	0		
7/26/2006	0.2	0	0	0	0		
7/27/2006	0.1	0	0	0	0		
8/7/2006	2.5	0.789	0.421	0.801	2.785		
8/8/2006	0.3	0	0	0	0		
8/18/2006	0.3	0	0	0	0		
8/19/2006	0.2	0	0	0	0		
8/25/2006	1	0	0.421	0	0.059		
8/26/2006	0.2	0	0	0	0		
8/28/2006	0.1	0	0	0	0		
9/3/2006	0.3	0	0	0	0		
9/11/2006	1.9	0.789	0.421	0.147	0.756		
9/12/2006	0.1	0	0	0	0		
9/13/2006	0	0	0	0	0		
9/14/2006	0	0	0	0	0		

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CSO EVENT

Date	Precip at POTW	MG into FM	MG into First Flush		MG into Clarifier	Discharge Time	
			North	East		Start	End
9/17/2006	0.1	0	0	0	0		
9/22/2006	0.2	0	0	0	0		
10/10/2006	1	0	0	0	0		
10/16/2006	1.4	0	0	0	0		
10/18/2006	0.1	0	0	0	0		
10/25/2006	0.5	0	0	0	0		
10/26/2006	0.3	0	0	0	0		
11/10/2006	1.3	0	0.421	0	0.875		
11/12/2006	0.2	0	0	0	0		
11/13/2006	0	0	0	0	0		
11/15/2006	0.8	0	0	0	0		
11/29/2006	2	0	0.421	0	1.205		
11/30/2006	1.5	0	0	0	0		
12/17/2006	0.1	0	0	0	0		
12/20/2006	1	0	0.18	0	0		
12/21/2006	0.2	0	0	0	0		
12/31/2006	0.5	0	0	0	0		
1/4/2007	0.6	0	0	0	0		
1/5/2007	0.02	0	0	0	0		
1/12/2007	0.8	0	0	0	0		
1/13/2007	0.02	0	0	0	0		
1/14/2007	0.9	0.789	0.421	0.801	1.951		
1/15/2007	0				0.392		
1/16/2007	0				0.504	12:00 AM	12:00 PM
1/20/2007	0.5	0	0	0	0		
2/6/2007	0.2	0	0	0	0		
2/12/2007	0.5	0	0	0	0		
2/13/2007	0.5	0	0	0	0		
2/16/2007	0.01	0	0	0	0		
2/24/2007	1.5	0.789	0.421	0.801	4.608	y	
2/25/2007	0.1				3.849	y	
2/26/2007					0.157	y	
2/27/2007							
2/28/2007	0.4		0.079	0.035			
3/1/2007	1	0.789	0.421	0.801	5.794	3:00 PM	
3/2/2007	0.1				2.327		3:00 PM
3/9/2007	0.2						
3/18/2007	0.2						
3/20/2007	0.3						
3/22/2007	0.5						
4/3/2007	0.6						
4/5/2007	0.75	0	0				
4/11/2007	0.75	0	0	0	0		
4/14/2007	0.03	0	0	0	0		
4/24/2007	0.03	0	0	0	0		
4/25/2007	0.04	0	0	0	0		
4/26/2007	0.01	0	0	0	0		

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Date	Precip at POTW	MG into FM	MG into First Flush		MG into Clarifier	Discharge Time	
			North	East		Start	End
5/2/2007	0.5	0	0	0	0		
5/3/2007	0.02	0	0	0	0		
5/4/2007	0.8	0	0.235	0	0		
5/5/2007							
5/26/2007	0.5	0	0	0	0		
5/28/2007	0.65	0.789	0.399	0.077	0		
5/31/2007	0.04	0	0	0	0		
6/3/2007	0.01	0	0	0	0		
6/4/2007	0.03	0	0	0	0		
6/7/2007	0.5	0	0.321	0	0		
6/8/2007							
6/18/2007	0.01	0	0	0	0		
6/21/2007	0.8		0.074				
6/22/2007	0.6		0.184				
6/23/2007	1.2	0.789	0.163	0.801	7.08	12:00 PM	7:45 AM
6/25/2007							
6/26/2007							
6/27/2007	0.01			0.324			
6/28/2007	0.9		0.065	0.477	2.215		
7/2/2007	0	0.789	0.065	0.269	0		
7/12/2007	0.02	0	0	0	0		
7/17/2007	0.7		0.068	0	0		
8/4/2007	0.4	0	0	0	0		
8/12/2007	0.2	0	0	0	0		
8/16/2007	0.5	0	0.18	0	0		
8/18/2007	0.01	0	0	0	0		
8/19/2007	0.4	0	0.091	0	0		
8/20/2007	0.5	0	0	0	0		
8/21/2007	0.25	0	0	0	0		
8/24/2007	0.4	0	0	0	0		
9/5/2007	0.2	0	0	0	0		
9/6/2007	0.3	0	0	0	0		
9/7/2007	0.15	0	0	0	0		
9/10/2007	0.1	0	0	0	0		
9/25/2007	0.3	0	0	0	0		
9/30/2007	1.5	0	0.421	0	0.436		
10/2/2007	1.5	0.789	0.421	0.313	0.523		
10/13/2007	0.2	0	0	0	0		
10/17/2007	0.5	0	0	0	0		
10/18/2007	0.1	0	0	0	0		
10/22/2007	0.4	0	0	0	0		
10/25/2007	0.2	0	0	0	0		
10/26/2007	0.5	0	0	0	0		
11/12/2007	0.5	0	0	0	0		
11/20/2007	0.75	0	0.315	0	0		
11/21/2007	1.2	0	0.057	0	0		
11/25/2007	0.3	0	0	0	0		

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CSO EVENT

CSO EVENT

Date	Precip at POTW	MG into FM	MG into First Flush		MG into Clarifier	Discharge Time	
			North	East		Start	End
12/1/2007	0.2	0	0	0	0		
12/2/2007	0.8	0	0	0	0		
12/6/2007	1.5	0	0	0	0		
12/7/2007	0.2	0	0	0	0		
12/8/2007	1	0	0	0	0		
12/9/2007	0.4	0	0	0	0		
12/10/2007	0.6	0	0	0	0		
12/11/2007	0.6	0	0	0	0		
12/14/2007	0.4	0	0	0	0		
12/15/2007	0.2	0	0	0	0		
12/20/2007	0.2	0	0	0	0		
12/26/2007	0.4	0	0	0	0		
12/28/2007	0.3	0	0	0	0		
1/4/2008	0.3	0	0	0	0		
1/7/2008	3.75	0.789	0.421	0.801	8.133	9:30 PM	6:00 AM
1/8/2008	0.4	0	0	0	7.167	8:00 AM	
1/9/2008	0	0	0	0.239	0		11:00 AM
1/23/2008	0.01	0	0	0	0		
1/29/2008	0.4	0	0	0	0		
1/31/2008	0.5	0	0	0	0		
2/3/2008	0.3	0	0	0	0		
2/4/2008	0.6	0.789	0.421	0.801	1.125		
2/5/2008	1.8	0	0	0	1.66	1:00 AM	2/7/2008 21:00
2/6/2008	0.1	0	0	0	0		
2/12/2008	0.1	0	0	0	0		
2/16/2008	1.6	0.789	0.421	0.3	2.553		
2/17/2008	0.3	0	0	0	0.232		7:00 PM
2/22/2008	2	0	0	0	0		
2/25/2008	0.3	0	0	0	0		
2/26/2008	0.1	0	0	0	0		
2/28/2008	0.2	0	0	0	0		
3/2/2008	0.3	0	0	0	0		
3/3/2008	0.2	0	0	0	0		
3/13/2008	0.3	0	0	0	0		
3/14/2008	0.1	0	0	0	0		
3/17/2008	1	0.789	0.421	0.521	0.211		
3/18/2008	0.7	0	0	0	0		
3/23/2008	0.4						
3/27/2008	0.5	0	0.06	0	0		
3/30/2008	0.8	0.789	0.421	0.112	0.199		
3/31/2008	0.9	0.789	0.421	0.302	0		
3/31/2008	0.1	0.789	0.421	0.621	0.2		
4/3/2008	0.1		0	0	0		
4/8/2008	1.4		0	0	0		
4/9/2008	1		0.421	0.086	0.017	5727000	
4/10/2008	1		0	0.715	2.768	2253000	
4/11/2008	0.1		0	0	0		

JACKSONVILLE POTW - CSO FACILITIES REPORT

CSO EVENT

CSO EVENT

Date	Precip at POTW	MG into FM	MG into First Flush North	MG into First Flush East	MG into Clarifier	Discharge Time Start	Discharge Time End
4/12/2008	0.2		0	0	0		
4/18/2008	1		0.384	0.469	0		
4/19/2008	0.2		0	0	0		
4/22/2008	0.4		0	0	0		
4/24/2008	0.5		0	0	0		
4/25/2008	0.5		0.098	0	0		
4/28/2008	0.3		0	0	0		
5/2/2008	0.4	0	0	0	0		
5/7/2008	0.15	0	0	0	0		
5/10/2008	1.2	0.789	0.421	0.139	0.11		
5/11/2008	0.4	0	0	0.156	0		
5/12/2008	0	0	0	0	0		
5/13/2008	0.1	0	0	0	0		
5/14/2008	0	0	0	0	0		
5/15/2008	0.5	0	0	0	0		
5/19/2008	0.25	0	0	0	0		
5/24/2008	0.2	0	0	0	0		
5/25/2008	0.4	0	0	0	0		
5/26/2008	0.2	0	0	0	0		
5/29/2008							
5/30/2008	1.2	0.789	0.421	0.801	0.692		
5/30/2008							
6/2/2008	1.1	0.789	0.421	0.106	0.107		
6/3/2008	2.2	0	0	0	2.647	12:30	6/6/2008
6/8/2008	0.7	0	0	0	0	6/8/2008	6/9/2008
6/13/2008	0.4	0	0	0	0		
6/18/2008	0.03	0	0	0	0		
6/24/2008	0.2	0	0	0	0		
6/25/2008	0.75	0	0	0	0		
6/26/2008	0.1	0	0	0	0		
6/27/2008	0.4	0	0	0	0		
7/2/2008	0.4	0	0	0	0		
7/8/2008	2	0.789	0.421	0.801	0.984		
7/10/2008	0.1	0	0	0	0		
7/11/2008	2	0.789	0.421	0.801	1.801	2:00 AM	9:00 AM
7/12/2008	0.25	0	0	0	0		
7/18/2008	0.5	0	0	0	0		
7/21/2008	2.1	0.789	0.421	0.801	1.36		
7/24/2008	0.15	0	0	0	0		
7/27/2008	1.5	0.789	0.421	0.801	0.7		
7/29/2008	0.2	0	0	0	0		
8/3/2008	0.02	0	0	0	0		
8/5/2008	1.2	0.789	0.421	0.513	0.262		
8/9/2008	0.3	0	0	0	0		
8/21/2008	1	0.789	0.421	0.106	0.067		
8/28/2008	1.9	0.789	0.421	0.801	0.597		

66.67 MG / 18 days = 3.7 MGD Average

JACKSONVILLE - CSO FIRST FLUSH EVENTS

004

COOPID	STATION NAME	YEAR	MO	DA	HOUR09	HOUR10	HOUR11	HOUR12	HOUR13	HOUR14	HOUR15	HOUR16
114442	JACKSONVILLE 2E	1991	5	4	0	0	0	0	0	0	0	0
114442	JACKSONVILLE 2E	1991	10	31	0	0	0	0	0	0	0	0
114442	JACKSONVILLE 2E	1991	12	31	0	0	0	0	0	0	0	0
114442	JACKSONVILLE 2E	1993	9	22	30	20	20	10	0	0	0	40
114442	JACKSONVILLE 2E	1994	7	2	0	0	0	0	0	0	0	0
114442	JACKSONVILLE 2E	1995	8	8	0	0	0	0	0	0	0	0
114442	JACKSONVILLE 2E	1998	6	18	0	0	0	0	0	0	0	0
114442	JACKSONVILLE 2E	1998	6	29	0	0	0	0	0	0	0	0
114442	JACKSONVILLE 2E	1999	8	12	0	0	0	0	0	0	0	0
114442	JACKSONVILLE 2E	2001	6	6	160	70	30	0	0	0	0	0
114442	JACKSONVILLE 2E	2002	4	24	0	0	0	0	0	0	130	10
114442	JACKSONVILLE 2E	2002	8	6	0	0	0	0	0	0	0	0
114442	JACKSONVILLE 2E	2006	3	12	0	0	0	0	0	0	0	0
114442	JACKSONVILLE 2E	2006	7	12	0	0	0	0	0	10	170	10
114442	JACKSONVILLE 2E	2006	8	8	0	10	0	10	0	0	0	0
114442	JACKSONVILLE 2E	2007	6	23	0	0	0	10	0	130	10	0

JACKSONVILLE - CSO FIRST FLUSH EVENTS

COOPID	STATION NAME	YEAR	MO	DA	HOUR17	HOUR18	HOUR19	HOUR20	HOUR22	HOUR23	HOUR24	TOTAL
114442	JACKSONVILLE 2E	1991	5	4	0	0	0	0	140	20	0	160
114442	JACKSONVILLE 2E	1991	10	31	0	0	0	0	0	0	160	160
114442	JACKSONVILLE 2E	1991	12	31	0	0	0	0	0	0	170	170
114442	JACKSONVILLE 2E	1993	9	22	150	50	70	40	0	0	0	440
114442	JACKSONVILLE 2E	1994	7	2	10	120	10	0	0	0	0	140
114442	JACKSONVILLE 2E	1995	8	8	0	0	0	0	0	0	0	290
114442	JACKSONVILLE 2E	1998	6	18	0	0	20	140	0	0	0	160
114442	JACKSONVILLE 2E	1998	6	29	0	150	10	10	0	0	0	210
114442	JACKSONVILLE 2E	1999	8	12	0	0	0	0	0	0	50	180
114442	JACKSONVILLE 2E	2001	6	6	0	0	0	0	0	0	0	340
114442	JACKSONVILLE 2E	2002	4	24	0	0	0	0	0	0	0	140
114442	JACKSONVILLE 2E	2002	8	6	0	0	0	0	0	0	0	190
114442	JACKSONVILLE 2E	2006	3	12	0	0	0	140	0	0	0	150
114442	JACKSONVILLE 2E	2006	7	12	0	0	0	0	0	0	0	200
114442	JACKSONVILLE 2E	2006	8	8	0	0	0	0	0	0	0	220
114442	JACKSONVILLE 2E	2007	6	23	0	0	0	10	0	0	0	160

3310

2069 per yr
17.2 hours per month

last 6 yrs.
730 per yr.
121.67 per yr
10.14 per mo
.338 per day

Jacksonville CSO - Trash Pump Hours

Date	002	003
4/1/1994	5.0	3.0
5/1/1994	2.0	
6/1/1994	2.0	
7/1/1994	2.0	
8/1/1994	3.0	
11/1/1994	3.0	1.0
12/1/1994	1.0	
1/1/1995	1.0	
4/1/1995	1.0	
5/1/1995	6.0	
7/1/1995	3.0	
8/1/1995	5.0	
2/1/1996	1.0	
3/1/1996	2.0	
4/1/1996	1.0	
5/1/1996	7.0	1.0
6/1/1996	2.0	
7/1/1996	1.0	
8/1/1996	1.0	
10/1/1996	1.0	
6/1/1997	2.0	
7/27/1997	53.5 1.5	
8/3/1997	0.8	
4/3/1998	0.2	
4/28/1998	0.2	
5/21/1998	0.3	
5/22/1998	2.9	
5/25/1998	2.2	
6/11/1998	2.6	
6/18/1998	4.3	
6/18/1998		1.5
6/20/1998	2.0	
6/22/1998	1.8	
6/28/1998	1.0	
6/29/1998	6.4	
6/29/1998		6.6
7/10/1998	0.4	
9/24/1998	1.1	
2/11/1999	26.9 0.7	
4/3/1999	1.3	
4/27/1999	0.6	
5/12/1999	0.9	
5/17/1999	1.0	
5/21/1999	0.5	
6/12/1999	1.7	
6/13/1999	0.1	
7/28/1999	0.3	
8/12/1999	1.5	
8/23/1999	0.4	
9/28/1999	0.1	
12/4/1999	0.1	
4/16/2000	2.0	
4/18/2000	10.6 0.1	

Jacksonville CSO - Trash Pump Hours

Date	002	003
5/17/2000	0.1	
5/26/2000	1.2	
6/1/2000	2.3	
6/20/2000	1.8	
6/23/2000	2.4	
6/24/2000	0.3	
6/25/2000	1.1	
7/5/2000	1.3	
7/10/2000	1.7	
8/8/2000	0.2	
9/11/2000	0.8	
1/29/2001	0.9	
2/24/2001	0.4	
4/11/2001	0.2	
4/20/2001	0.2	
5/6/2001	0.2	
6/3/2001	15.7 0.6	
6/5/2001	8.7	
6/5/2001		3.9
6/14/2001	0.8	
6/20/2001	0.3	
7/17/2001	1.1	
7/18/2001	0.1	
7/19/2001	0.3	
8/2/2001	0.2	
8/22/2001	1.8	
9/18/2001	0.1	
10/13/2001	0.2	
11/23/2001	0.1	
1/30/2002	0.9	
4/20/2002	1.3	
4/24/2002	3.1	
4/24/2002		0.2
4/28/2002	4.3	
4/28/2002		4.5
5/1/2002	1.6	
5/5/2002	4.6	
5/6/2002	0.2	
5/11/2002	7.8	
5/11/2002		5.6
5/27/2002	0.7	
6/11/2002	4.8	
6/11/2002		1.4
6/12/2002	0.3	
7/26/2002	2.6	
7/26/2002		0.9
8/5/2002		1.4
8/5/2002	3.4	
8/13/2002	0.6	
8/19/2002	0.4	
8/23/2002	0.4	
10/18/2002	0.5	
5/10/2003	49.9	4.3

35.3

Jacksonville CSO - Trash Pump Hours

Date	002	003
5/10/2003	1.3	
6/9/2003	0.5	
7/8/2003	1.1	
7/9/2003	0.5	
7/18/2003	1.8	
7/18/2003		0.4
8/31/2003	1.3	
9/1/2003	0.1	
9/26/2003	0.4	
10/13/2003	0.7	
11/17/2003	0.3	
3/5/2004	0.2	
4/24/2004	0.3	
5/11/2004	1.0	
6/14/2004	0.7	
7/22/2004		
8/25/2004	3.2	
8/27/2004	0.3	
1/5/2005	3.0	
1/13/2005	2.3	
5/11/2005	0.3	
6/11/2005	0.4	
9/19/2005	0.6	
1/28/2006	0.1	
3/12/2006	3.6	
8/27/2006	5.6	
6/6/2007	0.1	
6/23/2007	0.2	
1/7/2008		
1/8/2008		
2/11/2008	0.1	
6/2/2008	2.4	
6/3/2008	1.6	
6/9/2008	32 1.5	
7/9/2008		

20

188.6 35.7

1.1 hr/month .2 hr/month

7/2003 - 7/2008

30.2 hr/6yrs .4/6yrs

5hr/yr. .067 hr/yr.

.42 hr/mo. .006 hr/mo

.014 hr/day