# DRAFT - CONFIDENTIAL WORK PRODUCT
# The Combined Sewer Overflow Long-Term Control Plan For The City of Macon, Missouri

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**Project No. 200780A**
**CSO Long-Term Control Plan**

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# City of Macon Missouri

# CSO LONG-TERM CONTROL PLAN

## 1.0 Executive Summary

1.1 Purpose and Scope. This report presents a plan for controlling, eliminating and reducing the discharge of combined sewer overflows (CSOs) from the City of Macon, Missouri. As defined in the USEPA's CSO control policy, the long-term control plan (LTCP) should contain the following elements:

- Characterization, monitoring and modeling.
- Public participation.
- Identification of sensitive areas.
- Operational controls.
- Maximization of treatment plant capacity.
- Evaluation of alternatives.
- Cost/performance considerations.
- Implementation schedule.
- Post-construction monitoring program.

1.2 Project Background. Macon's combined sewer system (CSS) was constructed in the late 1800's. The system was designed to convey both sanitary and storm flows. Treatment of the dry weather sanitary flows was provided at a later time. As flows to the combined sewers exceed their capacity to convey water to the treatment system, overflows to the receiving streams were provided.

To deal with the costly issues of combined sewer systems, EPA established in 1994 a CSO control policy which mandated that a long-term control plan be developed to minimize the impacts of CSO discharges on receiving streams.

1.3 Long-Term Control Plan. The Macon, Missouri long-term CSO control plan is based on the City's state operating permit, which requires that the nine minimum controls be implemented and that the efforts regarding these be reported annually to MDNR. The permit requires submission of the Long-Term Control Plan (LTCP) to Missouri Department of Natural Resources (MDNR) by January 31, 2007. The City submitted the LTCP to MDNR in December 2006. The plan was revised on June 8, 2007 and again on August 10, 2007 to address MDNR comments. This June 13, 2008 draft to the plan is submitted to address additional MDNR comments.

A copy of the permit is provided in Appendix A. This LTCP fulfills the permit requirements regarding the LTCP and will supersede previously submitted LTCPs and LTCP schedules.

The previous LTCP submittal were based on the demonstration approach. The demonstration approach allows a permittee to demonstrate that a selected control program is adequate to meet the water-quality based requirements of the Clean Water Act.

This CSO Long-Term Control Plan is a program that is presumed to provide an adequate level of control to meet the water quality-based requirements of the Clean Water Act. The completion of all three phases of the plan will reduce overflow events to less than an average of four events per year. At least 85% by volume of the combined sewage collected in the combined sewage system during precipitation events will be captured for treatment on a system-wide annual average basis. The captured combined sewer flows will receive the equivalent of primary clarification. Disinfection of the plant effluent is proposed. This approach as allowed in EPA CSO policy is the presumption approach.

The LTCP recommends the implementation of Phases 2 and 3 to address compliance with the April 19, 1994, CSO Control Policy.

Phase 2 includes the construction of wastewater disinfection facilities at the existing plant. These facilities will protect human health by removing bacteria and viruses from the treatment plant effluent during the recreational season. The estimated project cost is $1,001,600 (year 2008 construction cost).

Phase 3 includes the construction of an interceptor sewer from the Grit Chamber CSO to the wastewater treatment plant. The sewer will transport the major portion of CSOs to receive primary treatment through the existing overflow basin. A new influent pump station and expanded headworks will be constructed at the plant. The estimated project cost for Phase 3 is $3,007,500 (year 2008 construction cost).

Phase 2 construction will be completed in 2010 and Phase 3 in 2033.

## 2.0 Characterization, Monitoring and Modeling of the Combined Sewer System

2.1. Combined Sewer System. The watershed which encompasses the downtown area is about 350 acres in size and drains to a single 72-inch diameter combined sewer pipe. Figure 1 illustrates the area of the City in which surface water drains into the combined sewer system and main lines.

The combined sewer was originally constructed in the late 19th century with the large diameter sewer made of hand-laid brick and mortar. Before this sewer was constructed, waste was discharged directly into Sewer Creek, which ran through the heart of town. Accordingly, the main combined sewer was laid in this creek channel and it became the drain for the watershed. The estimated capacity of the 72-inch diameter sewer is 135 MGD. The capacity of this sewer and the other combined sewers leading to the wastewater plant are summarized in Table 1.

Table 2 provides a summary of the CSO names and locations. The following describes each CSO location.

*Outfall # 005 - Highway 63 CSO*

On the west side of U.S. Highway 63, the brick sewer transitions to a 6-foot square concrete box which extends beneath the highway. On the east side of the highway, the 6-foot square box reduces to a 48-inch pipe. At this point of restriction, there is a concrete overflow weir about 8 feet long. This weir is situated to allow the 48-inch pipe to flow at 95 percent capacity before the weir overflows. The 48-inch pipe flows to the existing grit chamber. The estimated capacity of this 48-inch pipe is 35 MGD.

*Outfall # 003 - Grit Chamber CSO*

At the grit chamber, the combined sewer capacity is further constricted to a 24-inch pipe between the grit chamber and the wastewater treatment plant. The estimated capacity of this 24-inch pipe is 5 MGD. At the grit chamber, flows which exceed the capacity of the 24-inch interceptor overtop a broad crested weir and flow into the adjacent Sewer Creek. In the period from April 2002 through December 2007 there has been one recorded event where the total flow at the grit chamber and Highway 63 CSOs has exceeded 25 MGD (June 11, 2006, combined total 33 MGD).

*Outfall # 002 - Holding Basin*

A concrete lined holding basin is located at the wastewater treatment plant to receive wastewater flows in excess of the plant capacity. During rainfall events, when the capacity of the holding basing is exceeded, the excess overflows into Sewer Creek upstream of the

treatment plant effluent discharge. The capacity of the holding basin has been reported as 660,000 gallons in the past. Measurements of the basin were taken in February 2008 by SKW to confirm the capacity. The capacity based on these measurements is 929,000 gallons. Its surface area when full is 18,300 square feet. Depth is 9 feet.

**Table 1 - Combined Sewer Capacities**

| Sewer Section | Capacity (MGD) |
|---|---|
| 6' diameter brick | 135 |
| 4' diameter metal pipe | 35 |
| 2' diameter clay pipe | 5 |

**Table 2 - CSO Locations**

| Outfall | Location |
|---|---|
| #003 | Grit Chamber - East of Highway 63 |
| #002 | Holding Basin at Wastewater Plant |
| #005 | Highway 63 |

2.2 Treatment System Characterization. The existing wastewater treatment facility, constructed in 1959, with later upgrades and expansions, is located on 6 acres approximately 1 mile east of Macon. The original facility consisted of a headworks with comminutor and bar rack, one primary sedimentation basin, and two rock media trickling filters followed by two final clarifiers. For sludge dewatering, one 80 square-foot vacuum coil filter was provided. In 1985, a tower style second stage trickling filter with plastic media was added. Since that time the two rock trickling filters have been operated in parallel as a first stage with the tower filter operating as the second stage.

Major improvements, in 1988, included the addition of a new headworks with comminutors, a second primary sedimentation basin, and expansion of the sludge dewatering system. These improvements included the addition of a concrete lined holding basing to handle flows in excess of the plant treatment capacity. A dewatering complex was built and a 100 square-foot vacuum coil filter was added. In

early 2001, the 80 square foot vacuum coil filter was replaced by a 150 square-foot unit. These improvements increased the treatment facility capacity.

Table 3 provides a summary of the original design criteria for the wastewater treatment plant.

**Table 3 - Original Wastewater Treatment Plant Design Criteria**

| | |
|---|---|
| Design Average Daily Flow | 2.14 MGD |
| Peak Hourly Flow | 5.4 MGD |
| Average $BOD_5$ Load | 7,956 lb/day |
| Peak $BOD_5$ Load | 9,800 lb/day |
| Average TSS Load | 6,400 lb/day |
| Average Fats, Oil & Grease Load | 900 lb/day |

$BOD_5$ - 5-day Biochemical Oxygen Demand
TSS - Total Suspended Solids

In January 2002, Shafer, Kline & Warren, Inc. prepared a capacity assessment for the Macon Wastewater Treatment Facility. The assessment concluded that the plant was capable of adequately processing more wastewater than the original design ratings. These conclusions are presented in Table 4.

**Table 4 - Current Wastewater Treatment Plant Capacity**

| | |
|---|---|
| Average Daily Flow | 2.5 MGD |
| Average $BOD_5$ | 10,184 lb/day |
| Average TSS | 8,200 lb/day |

Records of flows indicate that the plant is receiving annual average daily flows that are below the design values of 2.5 MGD. Annual average daily flows for years 2000 through September 2006 are summarized in Table 5.

**Table 5 - Annual Average Daily Flow at Wastewater Treatment Plant**

| Year | Annual Ave. Daily Flow (MGD) |
|---|---|
| 2000 | 1.36 |
| 2001 | 1.59 |
| 2002 | 1.36 |
| 2003 | 1.49 |
| 2004 | 1.83 |
| 2005 | 1.66 |
| 2006 | 1.49 |
| 2007 | 1.66 |

The maximum monthly flow from 2000 through 2006 was 69.9 million gallons in January 2005, which equates to an average daily flow during that month of 2.256 MGD. Peak hourly flows treated by the plant are also below the peak hourly flow capacity of the plant, due to the limited capacity of the headworks facility at the plant.

Records of loadings indicate that the plant is receiving its design average $BOD_5$ and TSS loads. The plant influent loading exceeded the average $BOD_5$ treatment capacity of the plant in the months of June 2002, February 2003, June 2005, December 2006, April 2007 and December 2007. The plant influent loadings exceeded the average TSS treatment capacity of the plant in the months of November 2002, February 2003, December 2003, February 2005, May 2006, September 2006, October 2006, November 2006, December 2006 and March, April, May, July, August, November and December of 2007.

Annual Average $BOD_5$ and TSS influent loads are presented in Table 6:

**Table 6 - Annual Average Influent $BOD_5$ and TSS**

| Year | $BOD_5$ (lbs/day) | TSS (lbs/day) |
|---|---|---|
| 2002 | 7,754 | 4,929 |
| 2003 | 7,523 | 6,418 |
| 2004 | 8,528 | 5,166 |
| 2005 | 6,885 | 5,587 |
| 2006 | 7782 | 7584 |
| 2007 | 8839 | 8439 |

The major industrial discharger served by the Macon Treatment Plant is the ConAgra food processing plant. According to the Industrial User Permit issued by Macon Municipal Utilities, the monthly average and daily maximum discharge limits for ConAgra are:

**Table 7- Monthly Average and Daily Maximum Discharge Limits**

| | $BOD_5$ (lbs/day) | TSS (lbs/day) | Oil & Grease (lbs.day) |
|---|---|---|---|
| Monthly Average | 3,419 | 1,042 | 208 |
| Daily Maximum | 4,353 | 1,042 | 521 |

Average daily flow for ConAgra shall not exceed 400,000 gallons.

ConAgra's monthly average $BOD_5$ limit of 3,419 lbs/day is 34% of the wastewater plant capacity. ConAgra's monthly average TSS limit of 1042 lbs/day lbs/day is 13% of the wastewater plant capacity.

2.3 Monitoring of the Combined Sewer System. A CSO flow monitoring and sampling plan was implemented from September 2002 to August 2004 to provide information needed to prepare the Facility Plan for Wastewater System Improvements.

Equipment needed to implement the plan was purchased and installed during 2002. The engineering firm of Shafer, Kline & Warren, Inc. was retained to develop the monitoring program and to assist with its implementation and evaluation. The information gathered was used to determine the levels of CSO reduction recommended in the facility plan.

2.4 Modeling of the Combined Sewer System. The combined sewer system in Macon is a very simple system compared with those found in larger communities. Modeling efforts are directed toward evaluating the quantity and quality of CSOs and their impact on the receiving streams. MEC Water Resources, Inc. and Macon Municipal Utilities performed a sampling and analysis program in 2006 to establish baseline water quality conditions prior to the completion of the Phase 1 Combined Sewer Overflow separation project. Data from this monitoring program provided input values for a spreadsheet model developed to predict E. coli concentrations in Sewer Creek (Section 6.3.1). The model can be updated as new data are collected prior to and following system improvements. Figure 2 illustrates the CSO locations, monitoring locations and receiving streams. The 2006 monitoring program along with future monitoring efforts will provide the data needed to support the presumption approach and assess attainment of water quality standards.

## 3.0 Public Participation

The City of Macon Board of Public Works (BPW) holds public meetings twice monthly. In order to notify the public about the meetings an agenda is posted in City hall, a public place, and published in the local newspaper. From September 12, 2005 to January 8, 2007 public hearings regarding the Long-Term Control Plan (LTCP) were an agenda item of the meetings. The public hearings provided an opportunity for citizens to be updated on the progress of the LTCP, as well as, articulate any comments or concerns that they may have had. Citizens that attended the public hearings periodically presented concerns regarding combined sewer, wastewater, and storm water issues. While the public hearings have been discontinued, the LTCP and other sewer issues continue to be discussed at the twice monthly BPW meetings. The City will hold additional public hearings after the revised LTCP is approved.

Additionally, in May 2006 the City adopted *"The City of Maples: Planting the Seed for the Future" A Comprehensive Plan for the City of Macon, Missouri*, which involved a great deal of public participation. Nearly eighty people participated in the several month process which established a vision for the community and ways to achieve that vision. An important item of discussion was infrastructure, specifically, the City's sanitary and stormwater sewer system. Citizens expressed concerns regarding the combined sewer system, the possibility of overflow situations, and the capacity of the wastewater treatment plant. There was a consensus that complying with Department of Natural Resources regulations, eliminating the combined sewer system, and ensuring there is sufficient wastewater treatment capacity for future growth are high priorities for the community.

## 4.0 Consideration of Sensitive Areas

The CSO Control Policy requires consideration of certain sensitive areas as the highest priority for controlling overflows. These sensitive areas include:

1. Outstanding National Resource Waters
2. National Marine Sanctuaries
3. Water with threatened or endangered species or their designated critical habitat.
4. Primary contact recreation waters, such as bathing beaches.
5. Public drinking water intakes or their designated protection areas.
6. Shellfish beds.

The stream which currently receives both treated effluent from the wastewater plant and CSOs generated by Macon is Sewer Creek. Sewer Creek is an unclassified stream. The creek above the wastewater plant discharge flows only in wet weather. Sewer Creek flows 2.6 miles from the wastewater treatment plant until it joins Brush Creek. The CSOs at the grit chamber and Highway 63 are 1.4 and 1.6 miles respectively upstream on Sewer Creek from the wastewater plant. Brush Creek is also an unclassified stream. Brush Creek flows approximately 0.5 miles until it joins into the Middle Fork Salt River, a classified water body.

As a classified stream, Middle Fork Salt River has the following designated usage:

- "Protection of Warm Water Aquatic Life and Human Health" (AQL)
- "Livestock and Wildlife Watering" (LWW)
- Category B, Whole Body Contract Recreation (WBC)

A summary table of the sensitive area assessment is provided below.

| | |
|---|---|
| 1. Outstanding State or National Resource Waters | No Outstanding Resource Waters in the Sewer Creek, Brush Creek, Middle Fork Salt River receiving stream system (10 CSR 20-7, Tables D and E) |
| 2. National Marine Sanctuaries | None |
| 3. Water with threatened or endangered species or their designated critical habitat | The Missouri Department of Conservation database (October 2006) did not list any threatened or endangered species in the receiving water system. |
| 4. Primary contact recreation waters, such as bathing beaches | No known bathing beaches in the Sewer Creek, Brush Creek, Middle Fork Salt River receiving stream system. |
| 5. Public drinking water intakes or their designated protection areas | No known drinking water intakes are located in the Sewer Creek, Brush Creek, and Middle Fork Salt River receiving stream system. |
| 6. Shellfish beds | No known shellfish beds |

The Middle Fork Salt River is listed on the 303(d) list due to habitat loss from sedimentation attributed to stream bank erosion and sheet erosion from agricultural lands. US EPA Region 7 developed a Total Maximum Daily Load (TMDL) to address the impairment[1]. The TMDL sites that the Macon CSO's are currently regulated and no additional wasteload allocations were included in the TMDL.

[1] U.S. Environmental Protection Agency (US EPA), (November, 2006). Middle Fork Salt River, Monroe, Randolph, Shelby and Macon Counties, Missouri, Total Maximum Daily Load, http://www.epa.gov/region07/water/pdf/middle_fork_salt_river_final_110106.pdf

## 5.0 Evaluation of Alternate Combined Sewer Options and Recommendations

5.1 Identification of Options. The City of Macon retained the services of Shafer, Kline & Warren, Inc., a consulting engineering firm, for the purpose of identifying alternative solutions to its combined sewer and wastewater treatment needs. Five options were developed for meeting the anticipated State of Missouri's water quality standards and Macon's wastewater treatment needs. Three options were initially presented in a Wastewater System Facilities Plan for the City of Macon, dated June 30, 2003. A fourth option was presented in Addendum No. 1 to the Facility Plan, dated January 21, 2004. The fifth option was included in Addendum No. 2 to the Facility Plan, dated May 5, 2005.

In developing options for the treatment of wastewater, the treatment of base flows (dry weather flows) and the handling of wet weather peak flows (CSO's) were considered together. These two types of flows are combined in the sewer system, therefore the management of these problems must be addressed together for an economical solution.

From the options developed in the Facility Plan, addenda and this LTCP a phased approach was developed to address improvements to the Combined Sewer that is coordinated with possible wastewater treatment plant expansions.

5.2 Evaluation of Alternatives. The evaluation of alternatives for CSOs included both economic and non-economic factors.

Economic factors include:

- Capital Cost
- Operating Cost
- Affordability to the residents of Macon

Non-Economic factors include:

- Process Reliability
- Mechanical Reliability
- Minimizing the water quality, aquatic, biota and human health impacts from CSOs.

5.3 Recommended Option

The recommended option for Macon's CSO improvements is three phased approach, which includes the partial CSS separation in Phase 1 that was completed ahead of the May 2007 required completion date. The second phase protects human health by

providing disinfection of the wastewater plant effluent. The third phase provides the equivalent of primary treatment of at least 85% by volume of the combined sewage collected the combined sewer system during precipitation events on a system-wide annual average basis. These phases are described in detail in Section 6 of this plan.

In an effort to enhance affordability, the improvements are presented in a phased and adaptive approach resulting in the following advantages.

- Utilization of the existing treatment plant to obtain as much use as possible from the existing facilities.
- Perform partial sewer and storm water separation in Phase 1 as a cost-effective means of reducing the CSOs.
- Present the improvements in a phased and adaptive approach to enhance affordability.
- Comply with attainable water quality standards as they are determined.

## 6.0 Cost/Performance Considerations

6.1 Introduction. The phased approach provides CSO improvements in a means that is adaptive to meeting water quality needs and is coordinated with future treatment options. This approach has been developed based on the affordability of residents in the community.

6.2 Phase 1- Sewer Separation. The Phase 1 sewer separation project provided a cost effective means to improve the quality of water discharged from the CSOs.

The specific objectives of Phase 1 were:

- Remove high strength wastewater from the Combined Sewer System (CSS) thereby reducing organic loading and the frequency of the Combined Sewer Overflows (CSO) at the grit chamber.
- Provide storm water improvements that will prevent the surface water from approximately 33 acres from entering the combined sewer system.
- Provide readily implementable improvements to water quality by reducing the sanitary sewer system wastes that are currently discharged at the grit chamber during CSO events.
- To allow future treatment recommendations to be based on the most appropriate alternative to maintain water quality and to meet upcoming regulations.

Phase 1 sanitary sewer improvements included the construction of approximately 4,850 feet of 8-inch through 24-inch gravity sanitary sewer. The gravity sewer discharges directly into the 24" sewer near the outlet of the grit chamber. This allows sanitary sewerage from ConAgra, and the separate sanitary sewer systems in the south and west portions of the city to be sent directly to the treatment plant without being mixed with surface water in the CSS.

Phase 1 storm water improvements included the construction of approximately 1,600 feet of 12-inch through 30-inch storm water pipe. This allows the storm water from approximately 33 acres of the city to be discharged to surface drainage without entering the CSS. These improvements are shown in Figure 1.

6.3 Additional Phases. Additional phases include projects to minimize human health impacts from CSOs and to provide a minimum of primary treatment of all but the largest of CSO events per the presumption approach. These are summarized in 6.3.1 and 6.3.2:

6.3.1 Phase 2 - Disinfect Wastewater Treatment Plant Effluent.

Phase 2 includes the construction of facilities at the existing wastewater treatment plant to disinfect the plant's treated effluent. Ultraviolet light (UV) disinfection is proposed. The plant effluent will be disinfected during the recreational season from May 1 through October 31.

Providing disinfection of the plant effluent will meet the objective of the CSO Control Policy by minimizing human health impacts from wastewater in the receiving streams.

A mass balance water quality spreadsheet model was developed by MEC Water Resources, Inc. (MEC) to demonstrate if disinfecting Macon WWTF effluent without capturing or disinfecting any CSO flow could achieve Missouri's *E. coli* criterion (Whole Body Contact Recreation - Category B (548 colonies/100 mL recreational season geometric mean)). Daily *E. coli* concentrations were calculated at different disinfection design flows (ranging from 0 to 4.5 million gallons per day (MGD)) based on actual WWTF effluent and CSO flow data (2005 through 2007). The modeled *E. coli* concentrations apply immediately downstream of the WWTF prior to Middle Fork Salt River or any other confluence. Model assumptions included the following:

- *E. coli concentration of 5,000,000 colony forming units per 100 mL (cfu/100mL) for all three CSOs (002, 003, and 005)*[1]
- *E. coli concentration of 26, 000 cfu/100 mL for the non-disinfected portion of the WWTF effluent*[2]
- *E. coli concentration of 126 cfu/100 mL for the disinfected portion of the WWTF effluent*[3];
- *No stormwater dilution flow from Sewer Creek;*
- *No dilution flow from any tributaries;*
- *100% mixing of all flows; and*
- *No bacteria die-off.*

Recreational season geometric mean calculated from model output were below the *E. coli* criterion of 548 cfu/100 mL at disinfection design flows of at least 2 MGD for 2005 through 2007 (Figure 1). The model predicted that the City's CSOs were

[1] *E. coli* concentration assumption based on the maximum observed CSO value from a 2006 CSO monitoring study conducted by Macon Municipal Utilities and MEC.

[2] *E. coli* concentration assumption based on the maximum observed WWTF effluent value from a 2006 CSO monitoring study conducted by Macon Municipal Utilities and MEC.

[3] *E. coli* concentration assumption based on SKW review of Trojan Technologies ultraviolet disinfection evaluation conducted for Macon Municipal Utilities, March 2008.

unlikely to contribute to violations of bacteria standards subsequent to the planned WWTF disinfection upgrade.

It is proposed that Phase 2 be constructed and placed into operation by December 31, 2010. The estimated capital cost for Phase 2 is shown in Table 8.

6.3.2 Phase 3 - Divert Combined Sewage to Wastewater Treatment Plant and Overflow Basin.

Phase 3 includes the construction of a 36" diameter sewer from the Grit Chamber CSO to the wastewater treatment plant. The headworks of the wastewater plant will be modified to include a new influent pump station, trash basket/rack, automatic fine screen and compactor. Combined sewer wastewater in excess of the plant's hydraulic capacity will be diverted to the existing 929,000 gallon overflow basin at the plant. The overflow basin will be modified to provide additional facilities to prevent the discharge of floatable materials and to measure and record flows.

When completed, Phase 3 will provide the capacity to transport approximately 25 MGD from the Grit Chamber CSO to the treatment plant and overflow basin. Approximately 3 MGD will be treated in the plant and 22 MGD will receive primary treatment in the overflow basin before discharge to Sewer Creek. Combined sewer flows in excess of 25 MGD will overflow at the Grit Chamber and Highway 63 CSOs.

In the period from April 2002 through December 2007 there has been one recorded event where the total flow from the Grit Chamber and Highway 63 CSOs exceeded 25 MGD (June 11, 2006, combined total 33 MGD).

6.4 Costs.

Table 8 includes the estimated capital costs for Phases 1, 2 and 3. These cost estimates do not include financing costs, allowances for inflation, or the Post-Phase 1 Sampling and Analysis Program, but do include contingencies, engineering, inspection, and allowances for administrative, legal and land expenses.

**Table 8 - Estimated Capital Cost for Phases 1, 2 and 3**

| Phase | Estimated Capital Cost |
|---|---|
| Phase 1 - Sewer Separation | $1,142,500 (1) |
| Phase 2 - Disinfect WWTP Effluent | $1,001,600 (2) |
| Phase 3 - Divert Combined Sewage to Wastewater Treatment Plant and Overflow Basin | $3,007,500 (2) |

(1) Project Completed

(2) Estimated Year 2008 Project Costs

Section 11 of this LTCP addresses the affordability of these projects for the residents of Macon.

## 7.0 Operational Plan to Implement Agreed Upon CSO Controls

The primary purpose of the proposed project's Phase 1 was to significantly reduce the sanitary sewer portion of the CSO at the grit chamber and Highway 63 locations. This was accomplished by constructing gravity sanitary sewers that transport separated sanitary sewer wastewater to the 24" sewer downstream of the grit chamber, thereby reducing the mixing of sanitary waste with storm water discharged from the grit chamber.

The separation of the Con-Agra wastewater stream from the combined sewer system, along with the areas of separate sanitary sewers that currently flow to the CSS, significantly reduces the organic and solids loading at the grit chamber CSO.

It is estimated that after this separation there are 125 homes remaining in the South area and 700 homes and commercial businesses remaining in the North area that contribute to the CSO at the grit chamber and Highway 63.

MEC Water Resources, Inc. and Macon Municipal Utilities completed a sampling and analysis program in 2006 to establish baseline water quality criteria. This information is included in Appendix B.

Future sampling and analysis of CSOs and the receiving streams are scheduled to provide additional information useful in establishing the appropriate level of treatment consistent with water quality standards. It is proposed to complete the post-phase 1 sampling and analysis program starting in the Fall of 2008, and continue for one year through the Fall of 2009.

The following monitoring objectives have been identified for the CSO and receiving stream evaluation:

- Data must be of sufficient quality and quantity to characterize CSO water quality and quantity responses during monitored rainfall events;
- Data must be of sufficient quality and quantity to confirm receiving water attainment of applicable Missouri water quality criteria.

A one-year plan is proposed based on the condition that sufficient data to meet the monitoring objectives can be obtained from the rainfall events during this period. The City of Macon will request additional time to complete the sampling and analysis plan should the monitoring objectives not be met.

## 8.0 Maximizing Treatment at the Wastewater Treatment Plant

The Phase 1 sewer project is designed to maximize the treatment of wastes by collecting sanitary sewer wastewater from the areas described above and directing them to the 24" interceptor that runs to the wastewater treatment plant. This reduces waste load at the CSOs to the level that is anticipated that only 670 lbs/day of BOD and 760 lbs/day TSS from the sanitary sewer will remain in the CSOs at the grit chamber and Highway 63.

Tables 9 and 10 are from the Facility Plan Addendum 2. Table 9 shows the actual quantity of overflows at the grit chamber between September 19, 2002 and August 4, 2004 and calculates the expected BOD and TSS concentration using the anticipated remaining BOD and TSS loadings. Table 10 shows the calculated remaining concentration of BOD and TSS levels for selected overflow events at the grit chamber. Generally, as the volume of the overflow increases, the concentrations of BOD and TSS decrease.

Future sampling and analysis will verify the effectiveness of removing these BOD and TSS contributions from the CSO at the grit chamber and Highway 63.

Phase 3 further maximizes the treatment of wastes by collecting additional CSO wastewater from the Grit Chamber and Highway 63 CSOs and transporting it to the plant overflow basin for primary treatment.

MACON, MISSOURI
CSO STUDY - ADDENDUM NO. 2
TABLE NO. 9

CALCULATED CONCENTRATIONS FROM CSO EVENTS

June 11, 2008

* - Less than 2 months

| Event Date | Maximum Hour Rainfall Inches | Recurrence Interval m-month y-year | Total Event Rainfall Inches | Duration Hours | Recurrence Interval m-month y-year | Overflow Grit Chamber MGAL | Overflow WWTP Basin MGAL | Overflow Highway 63 MGAL | Calculated Concentration resulting from 825 connections remaining on combined sewers: 670 lbs/day BOD lbs | Conc mg/L | 760 lbs/day TSS lbs | Conc mg/L |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 9/19/02 | 0.43 | * | 0.62 | 9 | * | 0.715 | | | 251 | 42.1 | 285 | 47.8 |
| 10/02/02 | 0.18 | * | 0.66 | 6 | * | 0.70468 | | | 168 | 28.5 | 190 | 32.3 |
| 12/18/02 | 0.26 | * | 0.55 | 10 | * | 0.191 | | | 279 | 175.3 | 317 | 198.8 |
| 4/16/03 | 0.47 | * | 1.02 | 14 | * | 0.9293 | | | 391 | 50.4 | 443 | 57.2 |
| 4/19/03 | 0.13 | * | 0.53 | 12 | * | 0.1182 | | | 335 | 339.8 | 380 | 385.5 |
| 4/24/03 | 0.17 | * | 0.67 | 12 | * | 0.30102 | | | 335 | 133.4 | 380 | 151.4 |
| 4/28/03 | 0.44 | * | 0.65 | 2 | * | 1.5852 | | | 56 | 4.2 | 63 | 4.8 |
| 5/1/03 | 0.36 | * | 0.36 | 1 | * | 0.5543 | | | 28 | 6.0 | 32 | 6.9 |
| 5/04-5/05/03 | 0.31 | * | 1.11 | 20 | * | 2.8271 | | | 558 | 23.7 | 633 | 26.9 |
| 5/10/03 | 0.23 | * | 0.51 | 14 | * | 2.278 | | | 391 | 20.6 | 443 | 23.3 |
| 8/19/03 | 0.66 | 2m | 0.66 | 1 | 2m | 0.45 | | | 28 | 7.4 | 32 | 8.4 |
| 8/28/03 | 0.65 | 2m | 1.82 | 7 | 9m | 0.78 | | | 195 | 30.0 | 222 | 34.1 |
| 8/30-9/01/03 | 0.49 | * | 3.08 | 33 | 1-2y | 10.27 | 2.16 | | 921 | 10.8 | 1045 | 12.2 |
| 9/11-9/14/03 | 0.31 | * | 2.77 | 56 | 9m | 5.24 | 0.1152 | | 1563 | 35.8 | 1773 | 40.6 |
| 9/18/03 | 0.26 | * | 0.35 | 3 | * | 0.31 | | | 84 | 32.4 | 95 | 36.7 |
| 9/21/03 | 0.48 | * | 0.66 | 11 | * | 0.86 | | | 307 | 42.8 | 348 | 48.6 |
| 9/26/03 | 0.22 | * | 0.22 | 1 | * | 0.27 | | | 28 | 12.4 | 32 | 14.1 |
| 10/13-10/14/03 | 0.26 | * | 0.98 | 15 | * | 0.1 | | | 419 | 502.1 | 475 | 569.5 |
| 12/9-12/10/03 | 0.36 | * | 2.68 | 21 | 1-2 y | 17.15 | | | 586 | 4.1 | 665 | 4.6 |
| 3/4/04 | 0.26 | * | 1.41 | 15 | 3m | 2.36 | | | 419 | 21.3 | 475 | 24.1 |
| 3/24/04 | 0.96 | 6m | 2.05 | 10 | 9m | 6.9 | | | 279 | 4.9 | 317 | 5.5 |
| 4/20/04 | 0.65 | 2m | 1.67 | 18 | 3-4m | 2.48 | | | 503 | 24.3 | 570 | 27.6 |
| 5/11/04 | 1.6 | 2-5y | 3.42 | 4 | 10-15y | 4.33 | | | 112 | 3.1 | 127 | 3.5 |
| 5/23/04 | 0.25 | * | 0.4 | 3 | * | 0.605 | | | 84 | 16.6 | 95 | 18.8 |
| 5/24-5/25/04 | 0.44 | * | 0.95 | 5 | 2m | 7.12 | | | 140 | 2.4 | 158 | 2.7 |
| 5/27/04 | 0.79 | 3-4m | 0.87 | 3 | 2m | 2.75 | | | 84 | 3.7 | 95 | 4.1 |
| 5/30/04 | 0.9 | 4-6m | 2.1 | 17 | 6-9m | 3.06 | | | 475 | 18.6 | 538 | 21.1 |
| 6/9-6/10/04 | 0.33 | * | 1.27 | 21 | * | 4.75 | | | 586 | 14.8 | 665 | 16.8 |
| 8/4/04 | 0.93 | 4-6m | 2.49 | 14 | 1-2y | 5.44 | | | 391 | 8.6 | 443 | 9.8 |

**MACON, MISSOURI**
**CSO STUDY - ADDENDUM NO. 2**
**TABLE NO. 10**

**CALCULATED CONCENTRATIONS FROM OVERFLOW EVENTS AT GRIT CHAMBER**
(Ranked in Order by Volume of Overflow)

June 11, 2008

| Date | Overflow Grit Chamber MGAL | BOD Conc mg/L | TSS Conc mg/L |
|---|---|---|---|
| 10/13-10/14/03 | 0.1 | 502.1 | 569.5 |
| 04/19/03 | 0.1182 | 339.8 | 385.5 |
| 12/18/02 | 0.191 | 175.3 | 198.8 |
| 09/26/03 | 0.27 | 12.4 | 14.1 |
| 04/24/03 | 0.30102 | 133.4 | 151.4 |
| 09/18/03 | 0.31 | 32.4 | 36.7 |
| 08/19/03 | 0.45 | 7.4 | 8.4 |
| 05/01/03 | 0.5543 | 6.0 | 6.9 |
| 05/23/04 | 0.605 | 16.6 | 18.8 |
| 10/02/02 | 0.70468 | 28.5 | 32.3 |
| 09/19/02 | 0.715 | 42.1 | 47.8 |
| 08/28/03 | 0.78 | 30.0 | 34.1 |
| 09/21/03 | 0.86 | 42.8 | 48.6 |
| 04/16/03 | 0.9293 | 50.4 | 57.2 |
| 04/28/03 | 1.5852 | 4.2 | 4.8 |
| 05/10/03 | 2.278 | 20.6 | 23.3 |
| 03/04/04 | 2.36 | 21.3 | 24.1 |
| 04/20/04 | 2.48 | 24.3 | 27.6 |
| 05/27/04 | 2.75 | 3.7 | 4.1 |
| 5/04-05/05/03 | 2.8271 | 23.7 | 26.9 |
| 05/30/04 | 3.06 | 18.6 | 21.1 |
| 05/11/04 | 4.33 | 3.1 | 3.5 |
| 6/9-6/10/04 | 4.75 | 14.8 | 16.8 |
| 9/11-9/14/03 | 5.24 | 35.8 | 40.6 |
| 08/04/04 | 5.44 | 8.6 | 9.8 |
| 03/24/04 | 6.9 | 4.9 | 5.5 |
| 5/24-5/25/04 | 7.12 | 2.4 | 2.7 |
| 8/30-9/01/03 | 10.27 | 10.8 | 12.2 |
| 12/9-12/10/03 | 17.15 | 4.1 | 4.6 |

## 9.0 Implementation Schedule

The first step in the implementation of the CSO control plan started with the City's decision to proceed with Phase 1. Construction of Phase 1 Improvements has been completed.

A schedule for further implementation of the Macon LTCP is included as Attachment 1.

The Macon LTCP schedule includes a Post Phase 1 Sampling and Analysis plan to demonstrate that water quality standards are being obtained.

## 10. Monitoring Program

MEC Water Resources, Inc. and Macon Municipal Utilities performed a sampling and analysis program in 2006 to establish baseline water quality conditions prior to the completion of the Phase 1 Combined Sewer Overflow separation project. Data from this monitoring program provided input values for a spreadsheet model developed to predict E. coli concentrations in Sewer Creek (Section 6.3.1). The model can be updated as new data are collected prior to and following system improvements. Figure 2 illustrates the CSO locations, monitoring locations and receiving streams. The 2006 monitoring program along with future monitoring efforts will provide the data needed to support the presumption approach and assess attainment of water quality standards.

## 11. CSO Affordability Analysis

The "LTCP-EZ Template: A Planning Tool for CSO Control in Small Communities" states the CSO Control Policy recognizes the need to address the relative importance of environmental and financial issues when developing an implementation schedule for CSO controls. This section of the Macon LTCP addresses the financial capability of the community to afford CSO controls. Macon is considered a small community with a population under 75,000.

The proposed schedule for Macon's CSO control project includes the completion of Phase 2 by 2011 and Phase 3 in 2033. A summary of the project costs and the impact on the sewer rate payers in Macon is included in Table 11 "Affordability Summary".

The census year 2000 median household income (MHI) in Macon is $26,737. The MHI in Table 11 is inflated to $31,782 in the year 2008. Each year's MHI is projected to increase by 2.5%.

Estimated project costs for Phase 2 and Phase 3 are based on year 2008 estimates and then inflated annually by 4 % to represent an average construction cost inflation. Additional operation, maintenance and replacement expenses are estimated for each phase and increased annually for inflation by 4% to the year when the phase is placed into operation.

Debt service is based on financing the estimated project cost in the year the project is built for 20 years at 4.7% interest. The affordability analysis assumes that the project capital costs are paid through loans only.

The current monthly sewer bill for a 5000 gallon residential user is $27.61 which includes a 7% rate increase that was implemented in April 2008. This amount is 1.04% of the estimated year 2008 MHI. It should be noted that the utility is anticipating another rate increase to bring income to a level that covers current expenses. The cost of recent sewer rehabilitation efforts and the preparation of the LTCP have increased the utilities' expenses. A rate of $29.54 per month for a 5000 gallon customer is included in this LTCP. This is an approximate amount based on a 7% rate increase and is subject to utility board approval. This does however illustrate that current sewer utility costs are a significant percentage of MHI..

There are 2,465 sewer customers. This amount is projected to remain stable. No increase in customers is projected in this analysis.

The affordability analysis included in Table 11 concludes the following for a 5000 gallon residential customer:

| | **Monthly rate for 5000 gallon customer** | **% MHI** |
|---|---|---|
| Current | $ 29.54 | 1.12 |
| Current + Phase 2 | $ 35.79 | 1.29 |
| Current + Phases 2 & 3 | $106.51 | 2.17 |

This analysis illustrates that the addition of Phase 2 expenses to the current sewer rate is affordable using the common criteria that sewer that sewer bills should be less than 2% of MHI. The addition of Phase 3 results in an extremely high sewer bill that exceeds the 2% of MHI threshold of affordability.

This analysis is provided to illustrate the effects of spreading the financing and operating costs of the projects equally between all the sewer customers. A 5000 gallon user is commonly used as a basis for comparison of sewer rates with other communities. It should be noted that many customers use less than 5000 gallons per month and this should not be used to represent an average customer's usage.

The cost of implementing Phase 1 (completed) and Phase 2 will push the limits of affordability for Macon ratepayers. Unlike most CSO communities that are significantly larger, the cost of Macon's infrastructure improvements will be borne primarily by its residential and commercial ratepayers as Macon has only one major wastewater producing industry.

Macon Municipal Utilities provides water, sewer, electric and gas service to the residents and businesses in Macon. Residents have been faced with utility rate increases for all these services. They see an ever increasing portion of their income going to pay utilities. Energy costs in the form of electric and gas utility bills have experienced substantial increases, with no relief in sight. The City is also faced with another major infrastructure improvement in the near future, that being a new water treatment plant to replace the current plant that has been in service for 40 plus years. These costs are in addition to future escalating costs needed to comply with changing water quality standards.

Because of the significant percentage of low and fixed income residents in the City, the median household income is lower that the statewide average. Current census data (year 2000) indicate that the median household income for Macon is $26,737, or 65% of the median household income for Missouri. Furthermore, 28.8% of the households have annual income less than $15,000 and 38.4% of households have Social Security income. It should be noted that the anticipated sewer rate for 5000 gallon customer after Phase 2 is placed into operation is $35.79 per month. For 28.8% of Macon's residents earning less than $15,000 annually, this sewer rate represents a minimum of 2.86% of their income. For the 38.4% of households with a mean income of $10,241, this sewer rate represents 4.2% of their income. Other low income indicators in the community are the number of households who rent: in Macon, there are 2,434 households, of which 792 are rental units, with 31% of those households indicating that rent comprised 31% or more of their monthly income. Of the owner-occupied homes, 17% indicated that the monthly owner costs were at 30% or more of the monthly income.

This information indicates that the financial status of the citizens in the community limits the City's ability to afford infrastructure improvements. This LTCP and affordability analysis clearly indicate that the implementation of Phases 1 and 2 push the affordability envelope of the citizens of the community to pay for these improvements. Phase 3, when implemented clearly exceeds the financial ability of the community to pay for these improvements without outside assistance in the form of construction grants. It is for this reason that the Phase 3 project is proposed in year 2033.

# ATTACHMENT 1

# MACON LONG-TERM CONTROL PLAN SCHEDULE

# MACON LONG TERM CONTROL PLAN SCHEDULE

| | PROPOSED SCHEDULE |
|---|---|
| Perform Base Line Sampling and Analysis Program. MEC Water Resources, Inc. and Macon Municipal Utilities are perform the program to establish baseline water quality conditions prior to completion of the Phase 1 Combined Sewer Overflow sewer separation project. | Summer 2006 - 2007 (Completed) |
| Submit Combined Sewer Overflow - Long Term Control Plan to MDNR. | January 31, 2007 (Completed) |
| Complete construction of Phase 1 CSO project. | May 2007 (Completed) |
| Submit Revised Combined Sewer Overflow - Long Term Control Plan to MDNR | August 10, 2007 (Completed)<br>June 15, 2008 |
| Complete construction and place into operation Phase 2 disinfection improvements | December 31, 2010 |
| Complete construction and place into operation Phase 3 improvements | July 2033 |

*Projects/200780a/Correspondence/Rvsd 6-11-08 Macon LTCP Schedule Construction Schedule*

# FIGURE 2

# CSO RECEIVING WATER MONITORING LOCATIONS

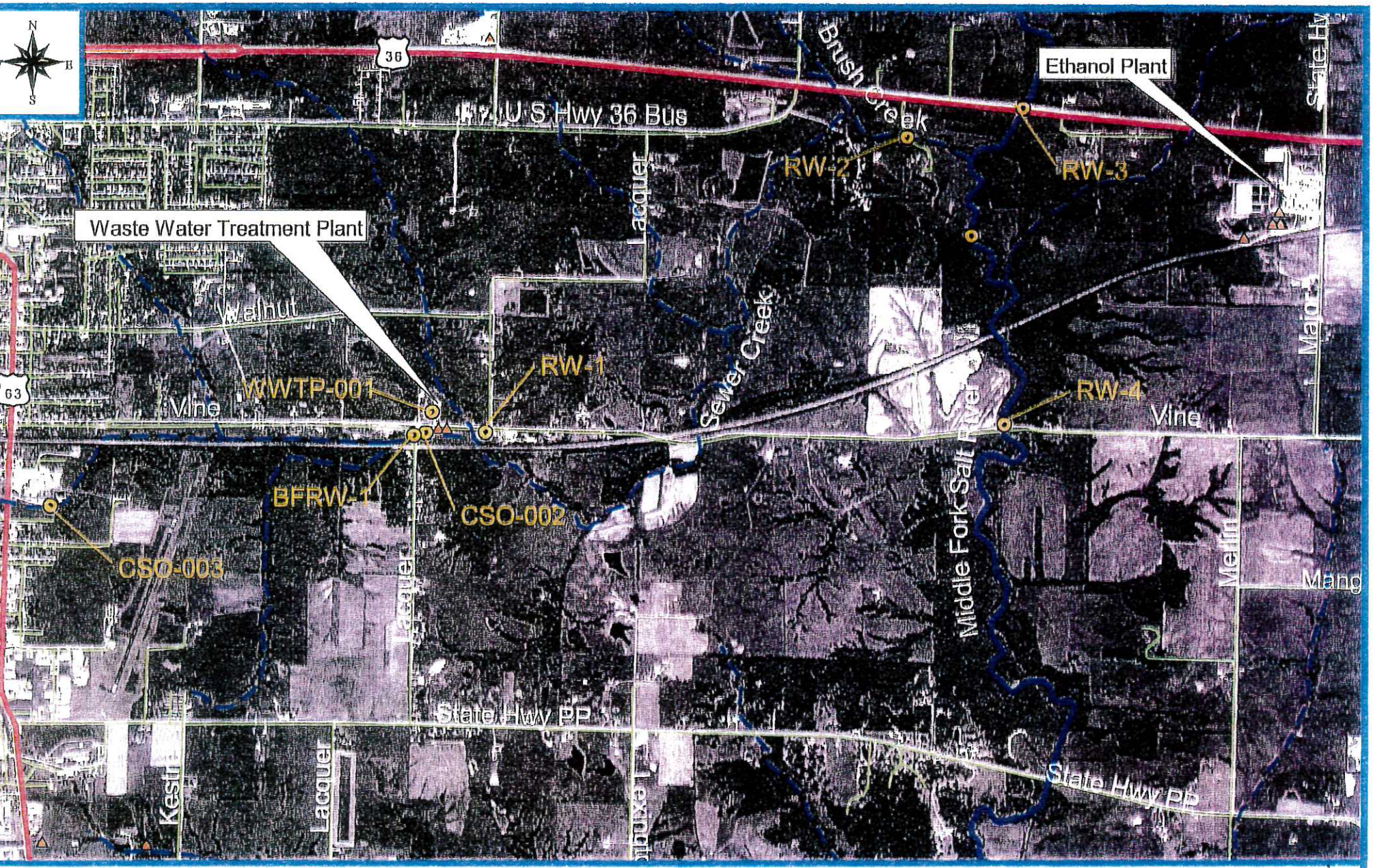


FIGURE 2

City of Macon: CSO Monitoring Plan -
CSO and Receiving Water Monitoring Locations

MEC Water Resources
*The Science of Water Quality*

# FIGURE 3

## RECREATIONAL SEASON GEOMETRIC MEAN
## AT
## DISINFECTION DESIGN FLOWS FOR 2005 THROUGH 2007

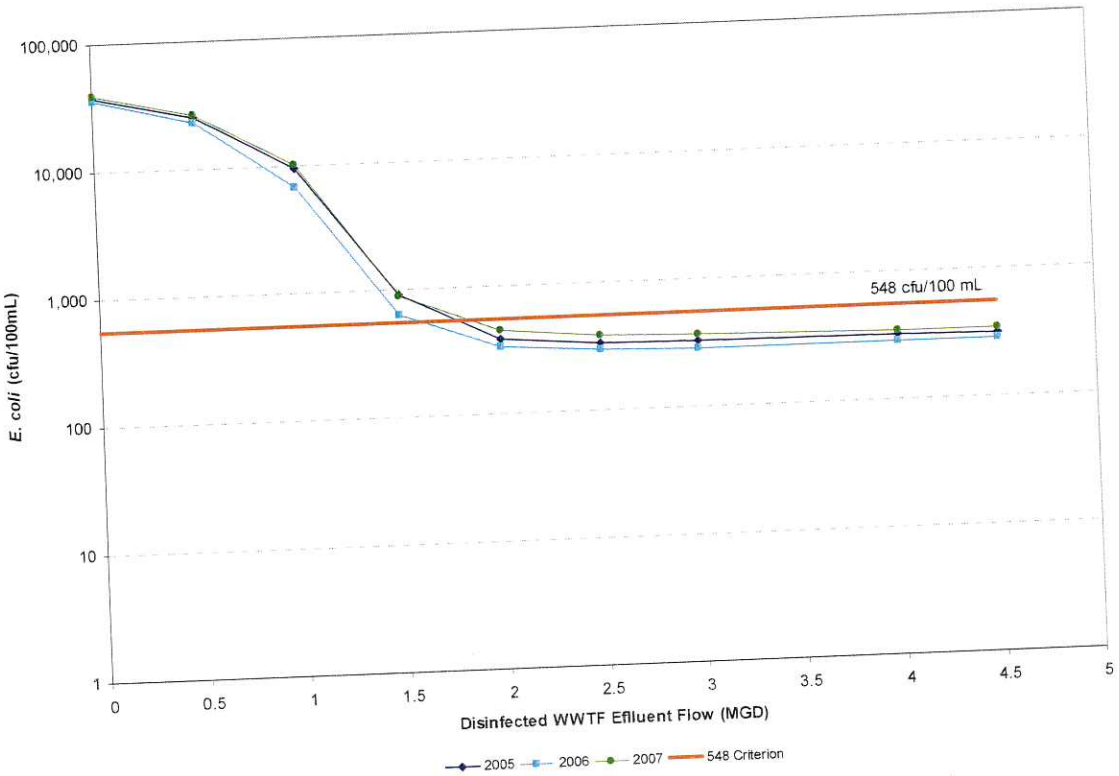


**FIGURE 3**. Recreational Season Geometric Mean at Disinfection Design Flows for 2005 through 2007