

WATER QUALITY INVESTIGATIONS RELATED TO PROPOSED N.P.D.E.S. PERMIT LIMITS FOR METALS

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BACKGROUND ON METALS LIMITS

Local governments and industries in Georgia and across the United States are facing new requirements to meet water quality standards for toxic substances. The 1987 Amendments to the Clean Water Act (CWA) required states to adopt "criteria" for all toxic substances listed as priority pollutants for which EPA has published national criteria and which are affecting waters in the state [Section 303(c)(2)(B)]. In addition, the amended CWA also requires states and EPA to identify waters which are affected by toxic substances and to develop individual control strategies (ICSs) for point sources contributing toxicants to these waters [Section 304(l)].

Several municipalities, counties, and industries in Georgia were impacted as a result of these requirements of the CWA in early 1990. The Georgia Department of Natural Resources Board adopted EPA National Criteria for most priority pollutants as water quality standards in December 1989 in order to comply with the Section 303(c)(2)(B) requirements. EPA notified Georgia's Environmental Protection Division (EPD) in December 1989 of their intent to make several additions to the Section 304(l) lists of dischargers requiring ICSs for various toxic substances. These additions were based on a petition from the Natural Resources Defense Council, Georgians for Clean Water, and the Georgia Environmental Project.

These added facilities in Georgia included nine publicly owned treatment works (POTWs) and included the following Water Reclamation Facilities (WRFs) in Gwinnett County which discharge to the Yellow River Basin, a tributary of the Altamaha River: Yellow River/Sweetwater Creek, Beaver Ruin Creek, Jackson Creek, Jacks Creek, and No Business Creek.

EPA added these facilities to the 304(l) list in early February 1990 and EPD concurrently issued modified permits for Gwinnett County WRFs to include limits for various metals including copper, lead, silver, and zinc. Permits limits for cadmium, chromium, and cyanide were included in permits for other POTWs in Georgia.

The wastewater facilities in Georgia which were added to the 304(l) lists were those which had any data to indicate that

there was a potential metals problem. For the Gwinnett County WRFs, the 304(l) listing of facilities was based on very little technical data. The metals data used was primarily from pre-treatment reports and was of questionable reliability. The data was not collected for the purpose of regulatory compliance at levels near the method detection limit (mdl) and quality control procedures were inadequate for this purpose. In addition, there was no information to indicate that the discharges were actually causing any impacts on aquatic life in receiving waters as a result of toxic substances. A 1987 study of the Yellow River Basin by EPD concluded that "macroinvertebrate streamlife was indicative of good long-term water quality" (EPD, 1987). Finally, it was not known whether there is available technology to consistently meet the permit limitations in a POTW effluent based on the adopted water quality standards. Table 1 summarizes the WQ standards, proposed effluents limits, and older effluent data used as the basis for the listing as 304(l) facilities.

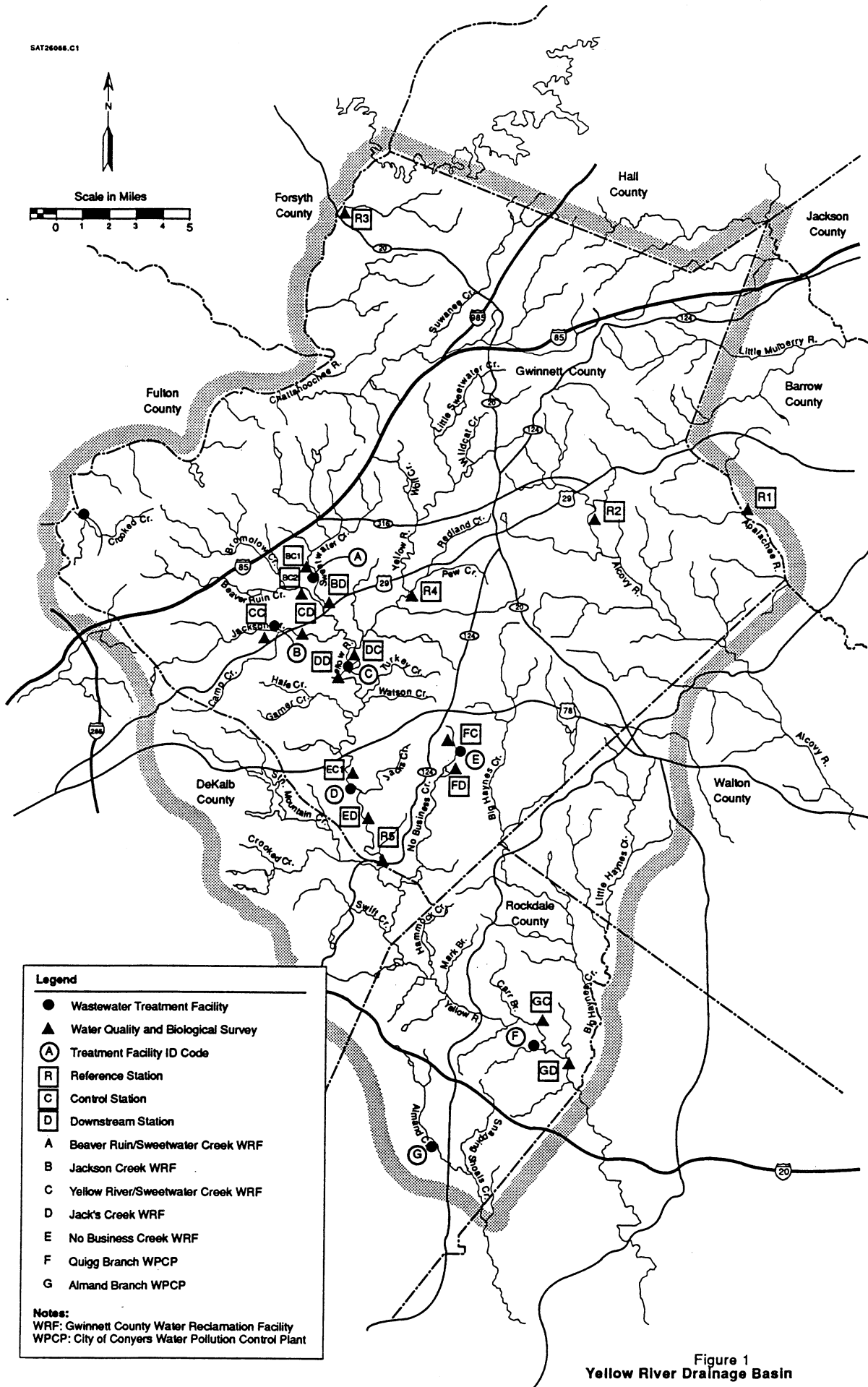
Table 1. Georgia Water Quality Standards and Proposed Gwinnett Effluent Limits

<i>Metal</i> ($\mu\text{g/l}$)	<i>Georgia</i> <i>WQ Standard</i> ($\mu\text{g/l}$)	<i>Gwinnett</i> <i>Effluent</i> <i>Levels</i> ($\mu\text{g/l}$)	<i>Permit Range**</i> <i>Old***</i> ($\mu\text{g/l}$)
Cadmium	0.7	0.8-3.7	2-6
Chromium	120	137-637	5-20
Copper	6.5	7.4-35	10-40
Lead	1.3	1.5-6.9	8-15
Nickel	88	100-467	20-50
Silver	0.12	0.14-0.64	?
Zinc	60	69-318	40-150

*Standard assuming hardness of less than 100 mg/l as CaCO₃

**Calculated permit limits—not proposed for all facilities

***Based on pretreatment data in 1988



Legend

- Wastewater Treatment Facility
- ▲ Water Quality and Biological Survey
- Ⓐ Treatment Facility ID Code
- Ⓡ Reference Station
- Ⓒ Control Station
- Ⓓ Downstream Station
- A Beaver Ruin/Sweetwater Creek WRF
- B Jackson Creek WRF
- C Yellow River/Sweetwater Creek WRF
- D Jack's Creek WRF
- E No Business Creek WRF
- F Quigg Branch WPCP
- G Almand Branch WPCP

Notes:
 WRF: Gwinnett County Water Reclamation Facility
 WPCP: City of Conyers Water Pollution Control Plant

Figure 1
 Yellow River Drainage Basin

DEVELOPMENT OF APPROACH IN GEORGIA

Affected municipalities and counties formed a working group to address these issues. The NPDES permits with metals limitations were appealed and negotiation efforts with EPD are still underway to resolve this issue.

Several technical studies were initiated by the work groups to provide a basis for negotiating permit limitations for metals. These included:

- Development of quality assurance programs for laboratory data
- Characterization of effluent and receiving water metals
- Biosurveys of receiving streams to assess impact of discharges
- Review of technologies to achieve metals limits

This paper provides an overview of issues being addressed by the Gwinnett County Department of Public Utilities (GCDPU) to determine how to respond to proposed limits for metals. Technical study efforts related to laboratory quality assurance and effluent/receiving water characterization will be discussed while the Biosurveys and Technology review are addressed elsewhere (Simpson and Troxler, 1991).

LABORATORY PROCEDURES

As indicated previously, the basis for establishing permit limitation for GCDPU facilities was the County's data collected for the pretreatment program. This data was collected for the purpose of establishing metals levels within the sewer collection system and WRF influent/effluent. The latter data was useful in the determination of removals within the facility. The GCDPU Environmental Laboratory followed established analytical procedures, but because the data was not being collected for regulatory compliance purposes, the data collection, sample custody integrity, analytical techniques, and documentation protocols were not conducted in full accordance with EPA analytical procedures as outlined in 40CRF Part 136. In particular, metals levels were reported to extremely low levels without an established QC criterion, thorough documentation of method development/method detection limit studies, or use of certified standards.

In order to guide the GCDPU Environmental Laboratory in proper procedures, an informal laboratory audit was conducted by CH2M HILL laboratory personnel and a critique of basic laboratory operation pertaining to handling and analysis of metals samples was prepared. In addition a Laboratory Manual was prepared to provide procedures for sample treatment and analysis for selected priority pollutant metals in accordance with approved methods for use for National Pollution Discharge Elimination System (NPDES) permits.

The laboratory procedures include those considered necessary to provide method detection limits approaching the levels of the adopted Georgia water quality standards and proposed permit limits. The goal of the manuals was to provide procedures which would allow consistent, reliable, and repeat-

able results within the operating constraints of acceptable practice for sample preparation and instrument operation. An interesting aspect of the procedures was that some approaches, such as the microwave digestion procedure, which can be used to obtain better recovery of analyte and streamline analysis, could not be included because the methods are not approved by EPA for NPDES purposes.

With the laboratory audit and implementation of procedures outlined in the lab manual, reliable data could be collected on which to base decisions or compliance and for negotiating with EPD. In addition to updating laboratory operations and procedures, GCDPU purchased a new Graphite Furnace/Atomic Adsorption instrument to provide for more automated analysis of the samples to be collected under their data collection program. Table 2 lists instrument detection limits (IDL), method detection limits (mdl), and practical quantitation limits (PQL) for the Gwinnett County laboratory for the metals at issue relative to WRF permits.

Table 2. Gwinnett Co.—Laboratory Detection Levels (ug/l)

<i>Metal</i>	<i>IDL</i>	<i>MDL</i>	<i>PQL</i>
Cadmium	0.1	0.1	0.3
Chromium	0.15	0.3	1
Copper	0.71	0.73	2.4
Lead	0.5	1.3	4.3
Nickel	0.76	1.5	5
Silver	0.015	0.05	0.17
Zinc	4.7	7.6	25

Notes:

IDL = Instrument Detection Limit

MDL = Method Detection Limit

PQL = Practical Quantitation Limit

WATER QUALITY DATA COLLECTION

GCDPU embarked on an extensive data collection program to collect reliable metals data on effluents and receiving waters at detection limits as close as possible to the Georgia Water Quality Standards. The purposes of this effort were as follows:

1. Thoroughly document effluents metals levels to determine whether permits limits were justified and whether compliance was feasible.
2. Document metals levels in receiving waters in the vicinity of the WRFs and in areas unimpacted by point sources to determine the natural variability in metals levels.
3. Obtain data on the partitioning of metals between soluble and total recoverable fractions in effluents and receiving water.
4. Obtain data on other potential sources of metals to the WRF such as the raw and finished water supply and raw wastewater from specific interceptors with industrial contribution.

A sampling plan was developed which addressed sampling locations, field and analytical parameters, field sampling procedure, sample handling and custody, schedule, and quality control protocols. Sampling locations and parameter will be presented briefly.

Three types of surface water stations were included for sampling: (1) reference stations or receiving waters without point source discharges and with primarily rural watersheds, (2) control stations which are located immediately above a wastewater facility discharge (these stations were all in urbanized watersheds; some with upstream WRFs and some without), and (3) stations downstream of WRF discharges. In addition, five WRF effluents were sampled. Figure 1 shows the location of these facilities in Gwinnett County.

Analytical Parameter/Schedule

Table 3 illustrates parameters which were determined for each sampling event. Biweekly sampling was initiated in May 1990 and was continuing as of January 1991. All samples were initially collected as grabs since both total recoverable and filterable (dissolved) metals samples were being collected. Effluent samples were changed to 24-hour composites in October 1990 when sampling for filterable metals was ceased. As of January 1991, data collection was ongoing and thorough data analysis had not been completed.

Table 3. Inorganic Parameters For Field Sampling

<i>Field-Collected Parameters</i>	<i>Laboratory Analysis</i>
Dissolved Oxygen	Total Hardness
Specific Conductance	pH
Temperature	Suspended Solids
pH (optional)	Total Solids
	Turbidity
	Cadmium
	Chromium
	Copper
	Lead
	Nickel
	Silver
	Zinc
	Ammonia-Nitrogen

PERMIT NEGOTIATION

As of January 1991, permit negotiation for Gwinnett DPU facilities was on-going. One major point for negotiation was the basis for determining compliance with permit limits. Table 4 summarizes water quality standards and the Georgia EPD detection limits which are proposed for determining compliance. Proposed permit limits for Gwinnett WRFs were based on the water quality standards, however compliance with permit limitations was to be based on the Georgia EPD detection limits. Resolution of this issue in permits will be included as part of the presentation.

Table 4. Water Quality Standards and State Laboratory Reporting Levels

<i>Metals</i>	<i>WQ Standard (µg/l)</i>	<i>Ga. EPD Reporting Limit (µg/l)</i>
Cadmium	0.7	10
Chromium	120	10
Copper	6.5	20
Lead	1.3	25
Nickel	88	20
Silver	0.12	10
Zinc	60	20

SUMMARY

This paper presents a case history of issues faced by Gwinnett County DPU in dealing with revised water quality based permit limitations for metals. In particular, efforts to improve data reliability and the development of an extensive database on stream and effluent metals levels will be presented.

LITERATURE CITED

- Environmental Protection Division. 1987. A Water Quality Investigation of the Yellow River. Georgia Department of Natural Resources, Atlanta, Georgia.
- T.E. Simpson, and R. Troxler. 1991. Biological Approach to Use Attainability. Proceedings for the 1991 Georgia Water Resources Conference, March 19, 20, 1991, Athens, Georgia.