

# **Lower Savannah River Basin, Georgia and South Carolina, Environmental Restoration Project**

## **Post-Construction Monitoring Closeout Report**



**US Army Corps  
of Engineers**  
Savannah District

**Planning Branch  
May 2017**

**Lower Savannah River Basin, Georgia and South Carolina  
Environmental Restoration Project**

**Post-Construction Monitoring Closeout Report**

**Project Background:**

Purpose: The purpose of the project was to help restore flows into Bear Creek which flows into Abercorn Creek. Bear Creek feeds approximately 4,500 acres of lowland hardwoods that was otherwise drying up. This area provides important habitat for wintering waterfowl, wading birds, and endangered species. Abercorn Creek serves as a source of drinking water for the City of Savannah and was experiencing higher chloride levels when flows declined in Bear Creek. The intended benefits of the project include rehydrating about 4,500 acres of bottomland hardwoods, improving overall water quality, and decreasing chloride levels at the City's water intake.

Construction of this project was authorized by the Water Resources Development Act of 1996. It was cost shared with the City of Savannah at 75 percent federal and 25 percent non-federal. The funds to initiate construction were received in 2000 and construction began in September 2001. The work was completed in July 2002.

Five years post construction monitoring was required by the 1996 Environmental Assessment and FONSI. The District has completed that monitoring and this report documents that work and the effectiveness of the project. In addition to confirming the success of the restoration, the report can assist the sponsor in determining when they need to clear and snag the creeks to maintain adequate flow down Bear Creek to the water treatment plant.

The operation and maintenance requirements for this project are low. The City of Savannah is responsible for all normal operation and maintenance activities.

Once construction was complete, Savannah District developed an Operations and Maintenance (O&M) manual and provided it to the non-federal sponsor. The O&M manual states that the "Project Superintendent" is responsible for all of the maintenance, including funding, after the project has been turned over to the non-federal sponsor. The project was completed and turned over to the City of Savannah for operation in April 2003.

## **Monitoring Commitments:**

Page 7 of the O&M Manual for the Lower Savannah River Basin Environmental Restoration Project states the following:

“The US Army Corps of Engineers will monitor the project area at several locations for stream flow and various water quality parameters. The parameters collected at each gaging site are stream stage, dissolved oxygen (DO), temperature, pH, and conductivity. Data is continuously collected at one hour-hour intervals. The stage data will be periodically evaluated by the US Army Corps of Engineers to unveil changes in the flow regime. The water quality data will also be periodically evaluated to assess the benefits associated with water quality. Data will be collected for a period of five years, which will end in the summer of 2006. Savannah District personnel will perform an analysis of the data and provide a summary report of the findings at the end of the data collection period. Data will be archived and made available for analysis at <http://water.sas.usace.army.mil/bear>.”

One year of environmental monitoring was completed in 2004. The flow gage was destroyed in 2005 and was not replaced until additional funds were received. The monitoring remained unfunded from 2005 to 2012. In 2013, new flow gages were installed by USGS under the Cooperative Stream Gage Program to continue with the remaining four years of monitoring. The data recorded from the gages is available online on the following website:

([https://waterdata.usgs.gov/nwis/inventory/?site\\_no=02198759&agency\\_cd=USGS](https://waterdata.usgs.gov/nwis/inventory/?site_no=02198759&agency_cd=USGS)).

The District and sponsor performed annual site visits from 2011 to 2016 when funds were available.

## **Water Quality Monitoring:**

Data was collected in 2 phases. Between 2001 and 2003, Savannah District staff collected the data, focusing on water temperature, pH, conductivity, DO, and velocity. The gage was placed at the downstream end of the project construction footprint. Much of this first phase of data collection occurred during drought conditions. This resulted in periods of low DO and often required the gage to be relocated lower in the water column to prevent it from coming out of the water.

The second phase of data collection was performed by the USGS. That effort extended from late 2013 to late 2016. During that phase, the USGS placed the gage to a position about a quarter mile from the upstream mouth of Bear Creek. The USGS collected the following water quality parameters: precipitation, stream velocity, discharge rate, and gage height. Table 1 summarizes the data collected for the project over the years.

Table 1: Monitoring Data for the Lower Savannah River Ecosystem Restoration Project, Bear Creek

<b>Parameter</b>	<b>Pre-Construction (July-August 2001)</b>	<b>Construction (September 2001 - July 2002)</b>	<b>Post-Construction (2002-2003) / (2013-2016)</b>
<b>Average Water Temperature</b> (2001 - 2003)	27.82 °C	21.19 °C	20.69 °C
<b>Average Conductivity</b> (2001 - 2003)	120.19	135.61	146.37
<b>Average % Dissolved Oxygen</b> (2001 - 2003)	69.20%	44.68%	33.20%
<b>Average pH</b> (2001 - 2003)	7.66	7.06	7.07
<b>Average Dissolved Oxygen</b> (2001 - 2003)	5.43	4.17	3.24
<b>Average Chloride Concentrations (PPM)</b> (1988 - 2003)	10.27	12.48	10.04
<b>Average Stream Velocity</b> (2001 – 2002 by USACE, 2013 – 2016 by USGS)	0.05 feet per second (downstream velocity)	0.04 feet per second (downstream velocity)	0.94 feet per second (downstream velocity)

One of the intended benefits of the project was to decrease chloride concentrations at City of Savannah’s water intake. USACE obtained chloride information from the City for the period from 1988 to 2003, but could not obtain additional data after 2003. Without data to compare the pre- and post-construction conditions, USACE is not able to conclusively determine whether the project had any long term effect on chloride levels at the City’s water intake.

### **Stream Flow:**

The focus of the stream stage analysis is to determine if the project resulted in Bear Creek conveying more water to important downstream resources. There are several factors which potentially affect the ability of Bear Creek to convey water. A blockage at the entrance to Bear Creek is one factor that could potentially impact flow through the creek, as would a blockage further down the creek which restricts flow.

This analysis focused on lower flow periods when the USGS gage at Clyo experienced flows between 5,000 cfs and 8,500 cfs. Those flows represent from 7 to 45 percent of the historic flow frequency distribution at this nearby site in the Savannah River. The data was grouped into 4 ranges of Clyo flow, 5,000-5,500, 6,000-6,500, 7,000-7,500 and 8,000-8,500 cfs. Multiple gages were plotted to identify relationships.

Once the data was grouped into similar flow ranges, the plots reveal changes in flow through Bear Creek between 2013 and 2016. Some variability in the data is likely due to the tidal influence at the site, as well as each flow grouping spanning 500 cfs. Averages for each grouping were plotted to illustrate the trend through time. The data do not indicate a significant change in the conveyance of water through Bear Creek over the last 4 years (Figure 1).

Table 1 indicates that the average flow velocity down Bear Creek increased substantially as a result of the construction. Velocities before the project measured 0.05 feet per second, while those after the construction measured 0.94 feet per second (nearly a 20-fold increase).

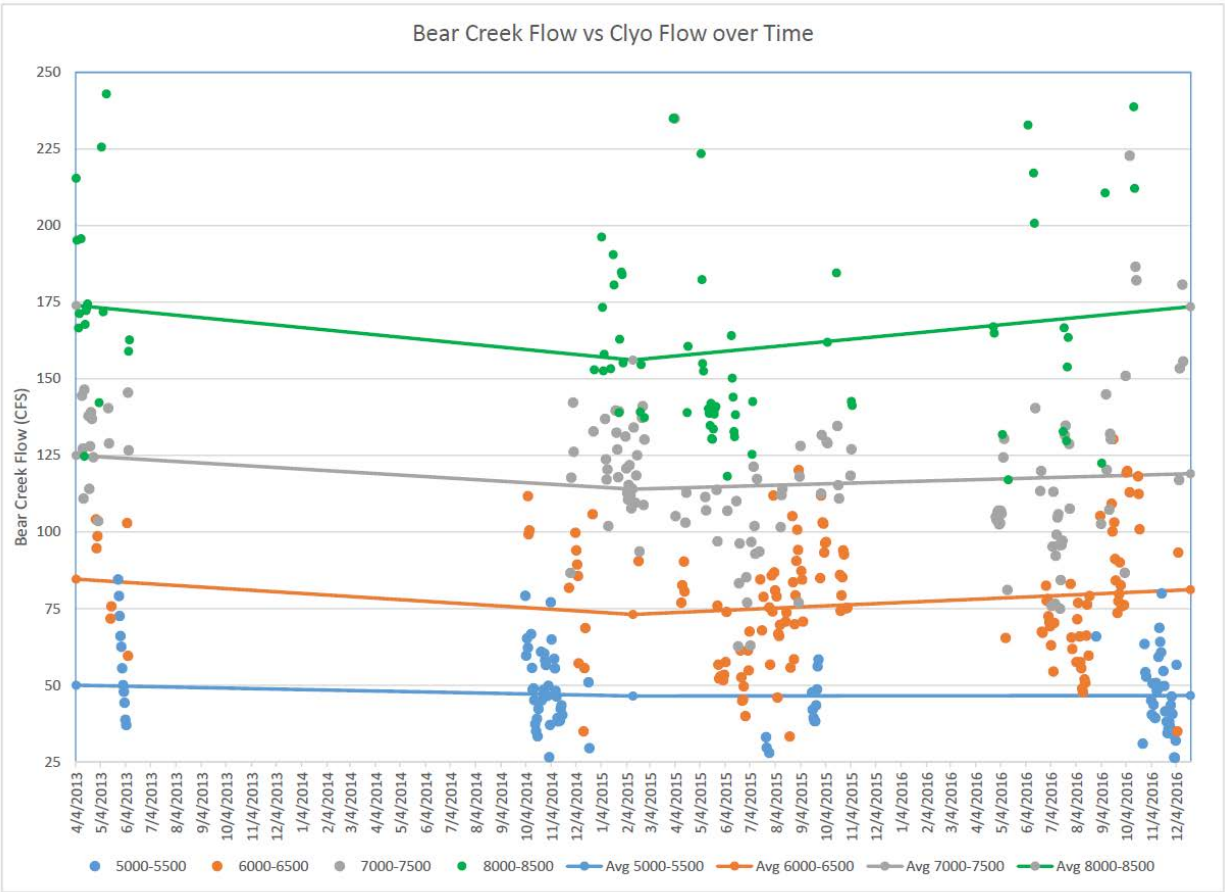


Figure 1: Graph showing Bear Creek flows over time in comparison to Clio

**Conclusions:**

Most of the parameters shown in Table 1 were not collected for an entire 5-year monitoring period. The single parameter that was measured throughout the period was water velocity in Bear Creek. That parameter shows a substantial increase from 0.05 to 0.94 feet per second (nearly a 20-fold increase). Since USACE was not able to obtain recent chloride data from the City of Savannah, it is not able to determine if the project was successful in reducing chloride levels at the City’s water intake. The stream stage data indicate that over the last 4 years Bear Creek has reached a state of equilibrium in which there is little change in flow through the creek. The diversion structure and sill at the upper end of the project are functioning as intended. Flow down Bear Creek will be limited by snags and debris downstream of the project construction area. The project will not reach its full performance until snags and fallen trees that impede flow in the creek downstream of the diversion structure are removed.