

Environmental Technology Verification (Summary)

Report

Stormwater Source Area Treatment Device

CrystalStream Model 1056

Griffin, Ga.

<http://www.epa.gov/etv/verifications/vcenter9-9.html>



REMOVAL RESULTS

| | |
|------------|---------------------|
| 89% | SUSPENDED SEDIMENTS |
| 98% | SAND SIZE PARTICLES |
| 40% | PHOSPHORUS |
| 50% | NITRITES |
| 25% | NITRATES |
| 13% | TKN |

The following data and evaluation has been taken from the Verification Report and Joint Verification Statement published by the Environmental Protection Agency (EPA) and NSF International, operator of the Water Quality Protection Center (WQPC). These results are posted on the EPA's website at the above URL.

Independent third party testing was performed on a CrystalStream Model 1056 Water Quality Vault treating approximately 4 acres including a highway, other roadways and parking areas in Griffin, Georgia known as the TEA-21 Project Area. Testing consisted of 15 qualifying events recording flow data and collecting samples using automated composite sampling. These samples were evaluated by

Event Mean Concentration (EMC) and Sum of Loads (SOL) analysis. All testing was subject to QA/QC audits as well as an audit of the overall management plan.

The CrystalStream device for this project is engineered to target the most common pollutants found in urban runoff including trash and debris, sediment, oil and hydrocarbons, and vegetative materials that contribute to over-nutrication. This device was sized to meet the hydrology provided for the site and to provide removal rates meeting the local and federal guidelines for urban runoff. The engineering staff at CrystalStream will answer any questions you have related to the design and application of this technology.



The table below summarizes the removal rates for the pollutants evaluated in this study. The removal rates are based on the sum of loads calculations and the preferred SSC testing method to determine suspended sediment removal over the entire range of particle sizes. The results track with the suspended sediment removal estimates produced in CrystalStream's engineering department which are based on the particle size distribution and flow rates for this site.

| Event No. | Date | Runoff Vol. | SSC Inlet | SSC Outlet | Phosphorus Inlet | Phosphorus Outlet | Nitrate Inlet | Nitrate Outlet | Nitrite Inlet | Nitrite Outlet | TKN Inlet | TKN Outlet |
|--------------|---------|-------------|-----------|------------|------------------|-------------------|---------------|----------------|---------------|----------------|-----------|------------|
| 1 | 3/26/03 | 13,800 | 16 | 22 | 0.00 | 0.02 | 0.056 | 0.075 | 0.002 | 0.002 | 0.127 | 0.138 |
| 2 | 5/5/03 | 32,900 | 1,215 | 28 | 0.16 | 0.04 | 0.055 | 0.027 | NA | NA | 0.357 | 0.384 |
| 3 | 1/25/04 | 2,890 | NA | NA | 0.01 | 0.00 | 0.007 | 0.013 | 0.000 | 0.000 | 0.031 | 0.029 |
| 4 | 4/13/04 | 20,240 | 26 | 20 | 0.05 | 0.04 | 0.061 | 0.061 | 0.003 | 0.001 | 0.405 | 0.337 |
| 5 | 4/26/04 | 10,600 | 21 | 12 | 0.02 | 0.02 | 0.019 | 0.017 | 0.002 | 0.002 | 0.124 | 0.141 |
| 6 | 4/30/04 | 16,600 | 21 | 13 | 0.01 | 0.02 | NA | NA | NA | NA | 0.083 | 0.069 |
| 7 | 6/25/04 | 4,265 | 5 | 4 | 0.01 | 0.01 | NA | NA | NA | NA | 0.082 | 0.046 |
| 8 | 6/28/04 | 9,730 | 17 | 4 | 0.01 | 0.01 | 0.028 | 0.017 | ND | ND | 0.097 | 0.089 |
| 9 | 6/30/04 | 44,800 | 14 | 13 | 0.12 | 0.09 | 0.034 | 0.026 | ND | ND | 0.373 | 0.336 |
| 10 | 7/12/04 | 9,040 | 17 | 6 | 0.02 | 0.01 | 0.024 | 0.020 | 0.002 | 0.000 | 0.106 | 0.098 |
| 11 | 7/17/04 | 9,700 | 9 | 6 | 0.02 | 0.01 | 0.053 | 0.035 | 0.002 | 0.000 | 0.121 | 0.121 |
| 12 | 7/25/04 | 22,400 | 33 | 10 | 0.04 | 0.02 | 0.067 | 0.047 | ND | ND | 0.373 | 0.261 |
| 13 | 8/5/04 | 15,400 | 150 | 4 | 0.03 | 0.01 | 0.078 | 0.042 | 0.003 | 0.001 | 0.270 | 0.154 |
| 14 | 8/12/04 | 17,100 | 46 | 11 | 0.02 | 0.02 | 0.050 | 0.026 | ND | ND | 0.086 | 0.086 |
| 15 | 8/21/04 | 5,870 | 12 | 3 | 0.01 | 0.01 | 0.020 | 0.012 | 0.001 | 0.001 | 0.069 | 0.049 |
| Total | | | 1,602 | 157 | 0.52 | 0.32 | 0.55 | 0.42 | 0.016 | 0.008 | 2.703 | 2.340 |
| Removal Rate | | | | 89% | | 40% | | 25% | | 50% | | 13% |

Note: Samples were split and the total suspended sediments were measured by both the TSS test method and the SSC test method. Both methods attempt to measure the suspended solids in mg/L, to determine the sediment removal rates for the device. The SSC method was determined to be the most representative for measuring Total Suspended Sediments (TSS), per the preliminary report (Quoting verbatim): "The data show that laboratory precision was generally maintained throughout the course of the verification program with the exception of one nitrate sample and TSS samples. The TSS data showed lower precision, with some of the precision data outside the RPD limits established in the test plan. For many TSS samples, the data were skewed by low and not detected concentrations."



The significance of an 89% removal efficiency for the entire range of sediments and the supporting flow data underscore the strength of the CrystalStream Strategy of on-line treatment. Larger intensities resulting from higher flows carry the bulk of the pollutant load and performance over the entire range of storms is critical to success in gross pollutants removal. The small storms with low intensities carry small amounts of pollutants that are not targeted by water quality vault systems. In addition, the unit was cleaned on a regular basis as is required by federal and state ordinance to assure effectiveness. CrystalStream Technologies is committed to external and internal testing on an ongoing basis with an emphasis on proper application and site specific engineering.

PERFORMANCE TESTING