ADEQ

A R K A N S A S
Department of Environmental Quality

March 28, 2007

NPDES PERMIT FILE
NPDES # AR0000752
AFIN # 70-00040
Permit PN
✓ Correspondence
Technical Backup
3-28-07 SW Date Scanned

Chuck Campbell, P.E., REM
Principal/Senior Engineer
GBMc & Associates
219 Brown Lane
Bryant, AR 72022

RE: El Dorado Chemical Company – Stormwater Flow Study Report
NPDES Permit No. AR0000752, AFIN 70-00040

Dear Mr. Campbell:

The Department has reviewed the supplemental information submitted in regards to the above mentioned matter. The Department still has concerns about ensuring the water quality of the receiving stream at the requested background flow to effluent flow ratios. The majority of storm events produced lower ratios than those requested in the study. Therefore, in order to fully insure that the water quality is protected, the Deaprtment recommends that one of the following be added to the permit:

**Option #1**

HCR conditions which would only allow a discharge when the effluent flow is less than a set percentage of the flow of the receiving stream;

**Option #2**

Maintain current permit requirements;

**Option #3**

Addition of the following conditions to the permit. The following conditions would only be in effect for November – June since no changes were requested for the months of July thru October.

**Stream Flow Monitoring**

1. The permittee must monitor the flow upstream of Outfalls 006 and 007 in order to minimize the effects of any water which could enter the receiving stream between the outfalls and the monitoring station. The location of the flow measurements must be approved by ADEQ.

2. The permittee shall maintain the approved instream flow monitoring equipment and have the equipment serviced and calibrated on a regular basis. Records shall be kept and available for inspection upon request.
3. The permittee shall submit the following information on the monthly DMRs:
   a. Stream flow;
   b. Effluent flow;
   c. Ratio of effluent flow to stream flow;
   d. Determination if reasonable potential for water quality violations was demonstrated for the metals designated below. An initial determination made be made through a comparison of the effluent flow to measured stream flow and the following trigger ratios:
      Outfall 006: minimum of 53.6:1, Cadmium, Lead, Selenium, Silver, and Zinc
      Outfall 007: minimum of 15:1, Cadmium, Lead, Selenium, Silver, and Zinc
      If the initial comparision shows that the actual ratio is higher than the trigger ratio, no further action will be required.
4. The Department reserves the right to reopen the permit based on information submitted in the quarterly reports. Items which may be modified to reflect stricter limitations included, but are not limited to, the following:
   a. Dilution series for chronic biomonitoring;
   b. Critical dilution for chronic biomonitoring; and
   c. Metals monitoring and/or numerical limits.

Option #3 is similar to that which was proposed in your letter dated February 26, 2007. Also, it is important to note that the Department has not yet made a final determination regarding which metals may be removed or have revised limits in the future.

If you have any questions, please feel free to contact me at shafii@adeq.state.ar.us or call me at (501) 682-0616.

Sincerely,

Mo Shafii
NPDES Permit Branch Manager
Water Division

219 Brown Lane Bryant, AR 72022 (501) 847-7077 (501) 847-7943 fax

February 26, 2007

Mr. Mo Shafii
Technical Assistance Manager
NPDES Permits Branch
Arkansas Department of Environmental Quality
8001 National Drive
Little Rock, AR 72219

RE: El Dorado Chemical Company – Permit No. AR0000752
Supplemental Information, Storm Water Flow Study Report
GBM$^c$ No. 2042-99-010

Dear Mr. Shafii:

Thank you for meeting with Vince Blubaugh, Greg Phillips, and me February 15, 2007 on the above-referenced report dated September 21, 2006. As requested, we are providing additional information to support our findings and recommendations.

*Issue No.1: The time presented for flow measurement at 006B on 3/2/2005 conflicts with the field documentation in Appendix C.*

Response: The time listed in Table 1 of the report is incorrect. The correct time for the 3/2/2005 flow measurement is 3:50 PM.

*Issue No. 2: Please provide the data spreadsheet used to derive the values in Table 3.*

Response: The Arkansas Toxicity Screen data sheets for Outfalls 006 and 007 are attached.

*Issue No. 3: Propose the method and frequency of flow ratio verification.*

Response: EDCC proposes to measure instantaneous flows in Outfalls 006 and 007 using the existing prefabricated flumes, and concurrently determine Background Flow by direct measurement of the unnamed tributary immediately downstream of the confluence of locations 006B and 007B on EDCC property. Background Flow will be determined by the following equation:

Background Flow = Unnamed Tributary Flow – (006 Flow +007 Flow)

Flow ratios for each outfall will be determined by dividing calculated Background Flow by the respective flows measured at the flumes.

EDCC proposes to verify the flow ratios annually during the seasonal (November – June) period for the duration of the permit, and to report those findings to ADEQ no later than July 31 following the end of the period.

*Issue No. 4: Please provide example calculations for flows and ratios.*

Response: Explanations of the calculations and examples are attached.

We appreciate the opportunity to submit additional information regarding the EDCC Storm Water Flow Study Report. If you have any questions, please contact Vince Blubaugh or me at 501-847-7077.

Sincerely,
GBM$^c$ & Associates

Chuck Campbell, PE, REM
Principal/Senior Engineer

cc:
attach Greg Withrow – EDCC
David Sartain – EDCC
Brent Parker – EDCC
John Carver – LSB
Loretta Reiber – ADEQ

## Arkansas Toxicity Screen

**(Evaluated as Dissolved)**

| Toxic Pollutant | Instream Standard. The instream standard for most metals are hardness dependent | | | Stream Concentrations (ug/L). For Source 1, input total concentration as single value or geometric mean in "total" column(s). For additional source, "unhide" columns. If multiple datum, can input actual coefficient of variation (cv), or use default (0.6) | | | | | | Calculated Instream Waste Concentration (IWC). This value multiplies the source concentration (Cd) by the 95th %tile, IWC = ((Cd x 95%tile) x Qd + Cb x Qb) / (Qd + Qb) | | | Criteria Exceeded. Compares each IWC with corresponding instream standard | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Instream Standard (ug/L) | | | Waste Stream Source 1, ug/L | | | | Background Source, ug/L | | Stream IWC, ug/L | | | Acute | Chronic | H. Health |
| | Acute | Chronic | H.Health | total | dissolved | cv | 95th%tile | total | dissolved | Acute | Chronic | H. Health | | | |
| **ARKANSAS STANDARDS** | | | | | | | | | | | | | | | |
| Cadmium | 1.0392651 | 0.43290946 | 1.00E+101 | 1.00 | 0.24 | 0.60 | 2.13 | 0.00 | 0.00 | 0.08 | 0.05 | 0.10 | | | |
| Chromium (III) | 210.27632 | 68.2114631 | 1.00E+101 | 0.00 | 0.00 | 0.60 | 2.13 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | | | |
| Chromium (VI) | 15.712 | 10.582 | 1.00E+101 | | 0.00 | 0.60 | 2.13 | | 0.00 | 0.00 | 0.00 | 0.00 | | | |
| Copper | 5.6444951 | 4.17251959 | 1.00E+101 | 0.00 | 0.00 | 0.60 | 2.13 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | | | |
| Lead | 17.678834 | 0.68891879 | 1.00E+101 | 15.43 | 3.13 | 0.60 | 2.13 | 0.00 | 0.00 | 1.11 | 0.61 | 1.33 | | | |
| Mercury | 2.04 | 0.012 | 1.00E+101 | 0.00 | 0.00 | 0.60 | 2.13 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | | | |
| Nickel | 525.50052 | 58.3610471 | 1.00E+101 | 0.00 | 0.00 | 0.60 | 2.13 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | | | |
| Selenium | 20 | 5 | 1.00E+101 | 4.25 | 4.25 | 0.60 | 2.13 | 0.00 | 0.00 | 1.51 | 0.82 | 1.81 | | | |
| Silver* | 0.4602153 | 1.00E+101 | 1.00E+101 | 2.00 | 0.61 | 0.60 | 2.13 | 0.00 | 0.00 | 0.22 | 0.12 | 0.26 | | | |
| Zinc | 42.42644 | 38.7417734 | 1.00E+101 | 263.94 | 85.57 | 0.60 | 2.13 | 0.00 | 0.00 | 30.45 | 16.61 | 36.54 | | | |
| Cyanide | 22.4 | 5.2 | 1.00E+101 | | 0.00 | 0.60 | 2.13 | | 0.00 | 0.00 | 0.00 | 0.00 | | | |
| Beryllium* | 1.00E+101 | 1.00E+101 | 0.076 | | 0.00 | 0.60 | 2.13 | | 0.00 | 0.00 | 0.00 | 0.00 | | | |
| PCBs* | 1.00E+101 | 0.014 | 0.0004 | | 0.00 | 0.60 | 2.13 | | 0.00 | 0.00 | 0.00 | 0.00 | | | |
| Aldrin* | 3 | 1.00E+101 | 1.00E+101 | | 0.00 | 0.60 | 2.13 | | 0.00 | 0.00 | 0.00 | 0.00 | | | |
| Dieldrin | 2.5 | 0.0019 | 0.0012 | | 0.00 | 0.60 | 2.13 | | 0.00 | 0.00 | 0.00 | 0.00 | | | |
| DDT (& metabolites)* | 1.1 | 0.001 | 1.00E+101 | | 0.00 | 0.60 | 2.13 | | 0.00 | 0.00 | 0.00 | 0.00 | | | |
| Endrin | 0.18 | 0.0023 | 1.00E+101 | | 0.00 | 0.60 | 2.13 | | 0.00 | 0.00 | 0.00 | 0.00 | | | |
| Toxaphene | 0.73 | 0.0002 | 0.0063 | | 0.00 | 0.60 | 2.13 | | 0.00 | 0.00 | 0.00 | 0.00 | | | |
| Chlordane | 2.4 | 0.0043 | 0.005 | | 0.00 | 0.60 | 2.13 | | 0.00 | 0.00 | 0.00 | 0.00 | | | |
| Endosulfan* | 0.22 | 0.056 | 1.00E+101 | | 0.00 | 0.60 | 2.13 | | 0.00 | 0.00 | 0.00 | 0.00 | | | |
| Heptachlor* | 0.52 | 0.0038 | 1.00E+101 | | 0.00 | 0.60 | 2.13 | | 0.00 | 0.00 | 0.00 | 0.00 | | | |
| Hexachlorocyclohexane | 2 | 0.08 | 1.00E+101 | | 0.00 | 0.60 | 2.13 | | 0.00 | 0.00 | 0.00 | 0.00 | | | |
| Pentachlorophenol* | 11.778785 | 7.4357541 | 1.00E+101 | | 0.00 | 0.60 | 2.13 | | 0.00 | 0.00 | 0.00 | 0.00 | | | |
| Chlorpyrifos | 0.083 | 0.041 | 1.00E+101 | | 0.00 | 0.60 | 2.13 | | 0.00 | 0.00 | 0.00 | 0.00 | | | |
| Dioxin (2,3,7,8 TCDD)* | 1.00E+101 | 1.00E+101 | 0.000001 | | 0.00 | 0.60 | 2.13 | | 0.00 | 0.00 | 0.00 | 0.00 | | | |
| Alpha Hexachlorocyclohexane | 1.00E+101 | 1.00E+101 | 0.0373 | | 0.00 | 0.60 | 2.13 | | 0.00 | 0.00 | 0.00 | 0.00 | | | |

Basis for Screen

| Flow: | streams | lakes |
|---|---|---|
| Source 1 | 1.00 | |
| Source 2 | 0.00 | |
| Background: | | |
| 7Q10 | 13.03 | |
| Critical | 15.00 | |
| LTA (for Human Health) | 4.00 | 2.80 |
| ZID (for Acute) | 5.00 | |
| MZ (for Chronic) | 10.00 | |

***(ALL FLOWS NEED TO BE IN THE SAME UNITS!)***

**Variables:**

| | |
|---|---|
| Coeffiecent of variation (default) | 0.60 |
| z for the 95th%tile occurrence | 1.645 |
| Hardness, mg/L | 31.0 |
| TSS, mg/L | 5.5 |
| S for Stream, L for Lake or Reservoir | S |
| Dia. of discharge pipe, ft (for lakes, only) | |
| pH (for pentachlorophenol) | 7.26 |
| Metals: | |
| T for total, D for dissolved | D |

**TOTAL TO DISSOLVED CORRECTION FACTORS AND PARITIONING COEFFICIENTS**

| Metal | Correction Factors | | Partitioning Coefficients | | | |
|---|---|---|---|---|---|---|
| | | | Stream | | Lake | |
| | acute | chronic | Kpo | alpha | Kpo | alpha |
| Arsenic | | | 4.80E+05 | -0.73 | 4.80E+05 | -0.73 |
| Cadmium | 0.993 | 0.958 | 4.00E+06 | -1.13 | 3.52E+06 | -0.92 |
| Chromium(III) | 0.316 | 0.860 | 3.36E+06 | -0.93 | 2.17E+06 | -0.27 |
| Chromium(VI) | 0.982 | 0.962 | | | | |
| Copper | 0.960 | 0.960 | 1.04E+06 | -0.74 | 2.85E+06 | -0.9 |
| Lead | 0.962 | 0.962 | 2.80E+06 | -0.8 | 2.04E+06 | -0.53 |
| Mercury | 0.850 | | 2.90E+06 | -1.14 | 1.97E+06 | -1.17 |
| Nickel | 0.998 | 0.997 | 4.90E+05 | -0.57 | 2.21E+06 | -0.76 |
| Selenium | | | | | | |
| Silver | 0.850 | | 2.40E+06 | -1.03 | 2.40E+06 | -1.03 |
| Zinc | 0.978 | 0.986 | 1.25E+06 | -0.7 | 3.34E+06 | -0.68 |

Ecoregion and Stream Specific Values for Hardness & TSS:

| | Hardness | TSS 15th%tile |
|---|---|---|
| Gulf Coastal | 31 | 5.5 |
| Ouachita Mtns. | 31 | 2 |
| Arkansas River Valley | 25 | 3 |
| Boston Mountain | 25 | 1.3 |
| Ozark Highlands | 148 | 2.5 |
| Delta | 81 | 8 |
| Streams: | | |
| Arkansas River | 125 | ----- |
| Ft. Smith to Dardenelle Dam | | 12 |
| Dardenelle Dame to Terry L&D | | 10.5 |
| Terry L&D to L&D No. 5 | | 8.3 |
| L&D No. 5 to Mouth | | 9 |
| Red River | 211 | 33 |
| Ouachita River | 28 | ----- |
| Above Caddo River | | 2 |
| Below Caddo River | | 5.5 |
| White River | 116 | ----- |
| Above Beaver Lake | | 2.5 |
| Bull Shoals to Black River | | 3.3 |
| Black River to Mouth | | 18.5 |
| St. Francis River | 103 | 18 |

## Arkansas Toxicity Screen

**(Evaluated as Dissolved)**

| Toxic Pollutant | Instream Standard. The instream standard for most metals are hardness dependent | | | Stream Concentrations (ug/L). For Source 1, input total concentration as single value or geometric mean in "total" column(s). For additional source, "unhide" columns. If multiple datum, can input actual coefficient of variation (cv), or use default (0.6) | | | | | | Calculated Instream Waste Concentration (IWC). This value multiplies the source concentration (Cd) by the 95th %tile, IWC = ((Cd x 95%tile) x Qd + Cb x Qb) / (Qd + Qb) | | | Criteria Exceeded. Compares each IWC with corresponding instream standard | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Instream Standard (ug/L) | | | Waste Stream Source 1, ug/L | | | | Background Source, ug/L | | Stream IWC, ug/L | | | Acute | Chronic | H. Health |
| | Acute | Chronic | H.Health | total | dissolved | cv | 95th%tile | total | dissolved | Acute | Chronic | H. Health | | | |
| **ARKANSAS STANDARDS** | | | | | | | | | | | | | | | |
| Cadmium | 1.039265071 | 0.432909463 | 1.00E+101 | 4.90 | 1.17 | 0.60 | 2.13 | 0.00 | 0.00 | 0.13 | 0.07 | 0.50 | | | |
| Chromium (III) | 210.2763157 | 68.21146306 | 1.00E+101 | 0.00 | 0.00 | 0.60 | 2.13 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | | | |
| Chromium (VI) | 15.712 | 10.582 | 1.00E+101 | | 0.00 | 0.60 | 2.13 | | 0.00 | 0.00 | 0.00 | 0.00 | | | |
| Copper | 5.644495088 | 4.172519591 | 1.00E+101 | 0.00 | 0.00 | 0.60 | 2.13 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | | | |
| Lead | 17.67883429 | 0.688918792 | 1.00E+101 | 81.96 | 16.60 | 0.60 | 2.13 | 0.00 | 0.00 | 1.88 | 0.96 | 7.09 | | C | |
| Mercury | 2.04 | 0.012 | 1.00E+101 | 0.00 | 0.00 | 0.60 | 2.13 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | | | |
| Nickel | 525.500516 | 58.36104712 | 1.00E+101 | 0.00 | 0.00 | 0.60 | 2.13 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | | | |
| Selenium | 20 | 5 | 1.00E+101 | 5.00 | 5.00 | 0.60 | 2.13 | 0.00 | 0.00 | 0.57 | 0.29 | 2.13 | | | |
| Silver* | 0.460215262 | 1.00E+101 | 1.00E+101 | 2.00 | 0.61 | 0.60 | 2.13 | 0.00 | 0.00 | 0.07 | 0.04 | 0.26 | | | |
| Zinc | 42.42643986 | 38.7417734 | 1.00E+101 | 1710.16 | 554.42 | 0.60 | 2.13 | 0.00 | 0.00 | 62.74 | 32.22 | 236.73 | A | | |
| Cyanide | 22.4 | 5.2 | 1.00E+101 | | 0.00 | 0.60 | 2.13 | | 0.00 | 0.00 | 0.00 | 0.00 | | | |
| Beryllium* | 1.00E+101 | 1.00E+101 | 0.076 | | 0.00 | 0.60 | 2.13 | | 0.00 | 0.00 | 0.00 | 0.00 | | | |
| PCBs* | 1.00E+101 | 0.014 | 0.0004 | | 0.00 | 0.60 | 2.13 | | 0.00 | 0.00 | 0.00 | 0.00 | | | |
| Aldrin* | 3 | 1.00E+101 | 1.00E+101 | | 0.00 | 0.60 | 2.13 | | 0.00 | 0.00 | 0.00 | 0.00 | | | |
| Dieldrin | 2.5 | 0.0019 | 0.0012 | | 0.00 | 0.60 | 2.13 | | 0.00 | 0.00 | 0.00 | 0.00 | | | |
| DDT (& metabolites)* | 1.1 | 0.001 | 1.00E+101 | | 0.00 | 0.60 | 2.13 | | 0.00 | 0.00 | 0.00 | 0.00 | | | |
| Endrin | 0.18 | 0.0023 | 1.00E+101 | | 0.00 | 0.60 | 2.13 | | 0.00 | 0.00 | 0.00 | 0.00 | | | |
| Toxaphene | 0.73 | 0.0002 | 0.0063 | | 0.00 | 0.60 | 2.13 | | 0.00 | 0.00 | 0.00 | 0.00 | | | |
| Chlordane | 2.4 | 0.0043 | 0.005 | | 0.00 | 0.60 | 2.13 | | 0.00 | 0.00 | 0.00 | 0.00 | | | |
| Endosulfan* | 0.22 | 0.056 | 1.00E+101 | | 0.00 | 0.60 | 2.13 | | 0.00 | 0.00 | 0.00 | 0.00 | | | |
| Heptachlor* | 0.52 | 0.0038 | 1.00E+101 | | 0.00 | 0.60 | 2.13 | | 0.00 | 0.00 | 0.00 | 0.00 | | | |
| Hexachlorocyclohexane | 2 | 0.08 | 1.00E+101 | | 0.00 | 0.60 | 2.13 | | 0.00 | 0.00 | 0.00 | 0.00 | | | |
| Pentachlorophenol* | 11.77878462 | 7.435754097 | 1.00E+101 | | 0.00 | 0.60 | 2.13 | | 0.00 | 0.00 | 0.00 | 0.00 | | | |
| Chlorpyrifos | 0.083 | 0.041 | 1.00E+101 | | 0.00 | 0.60 | 2.13 | | 0.00 | 0.00 | 0.00 | 0.00 | | | |
| Dioxin (2,3,7,8 TCDD)* | 1.00E+101 | 1.00E+101 | 0.000001 | | 0.00 | 0.60 | 2.13 | | 0.00 | 0.00 | 0.00 | 0.00 | | | |
| Alpha Hexachlorocyclohexane | 1.00E+101 | 1.00E+101 | 0.0373 | | 0.00 | 0.60 | 2.13 | | 0.00 | 0.00 | 0.00 | 0.00 | | | |

Basis for Screen

| Flow: | streams | lakes |
|---|---|---|
| Source 1 | 1.00 | |
| Source 2 | 0.00 | |
| Background: | | |
| 7Q10 | 215.19 | |
| Critical | 53.60 | |
| LTA (for Human Health) | 4.00 | 2.80 |
| ZID (for Acute) | 17.87 | |
| MZ (for Chronic) | 35.73 | |

***(ALL FLOWS NEED TO BE IN THE SAME UNITS!)***

**Variables:**

| | |
|---|---|
| Coeffiecent of variation (default) | 0.60 |
| z for the 95th%tile occurrence | 1.645 |
| Hardness, mg/L | 31.0 |
| TSS, mg/L | 5.5 |
| S for Stream, L for Lake or Reservoir | S |
| Dia. of discharge pipe, ft (for lakes, only) | |
| pH (for pentachlorophenol) | 7.26 |
| Metals: | |
| T for total, D for dissolved | D |

**TOTAL TO DISSOLVED CORRECTION FACTORS AND PARITIONING COEFFICIENTS**

| Metal | Correction Factors | | Partitioning Coefficients | | | |
|---|---|---|---|---|---|---|
| | | | Stream | | Lake | |
| | acute | chronic | Kpo | alpha | Kpo | alpha |
| Arsenic | | | 4.80E+05 | -0.73 | 4.80E+05 | -0.73 |
| Cadmium | 0.993 | 0.958 | 4.00E+06 | -1.13 | 3.52E+06 | -0.92 |
| Chromium(III | 0.316 | 0.860 | 3.36E+06 | -0.93 | 2.17E+06 | -0.27 |
| Chromium(VI | 0.982 | 0.962 | | | | |
| Copper | 0.960 | 0.960 | 1.04E+06 | -0.74 | 2.85E+06 | -0.9 |
| Lead | 0.962 | 0.962 | 2.80E+06 | -0.8 | 2.04E+06 | -0.53 |
| Mercury | 0.850 | | 2.90E+06 | -1.14 | 1.97E+06 | -1.17 |
| Nickel | 0.998 | 0.997 | 4.90E+05 | -0.57 | 2.21E+06 | -0.76 |
| Selenium | | | | | | |
| Silver | 0.850 | | 2.40E+06 | -1.03 | 2.40E+06 | -1.03 |
| Zinc | 0.978 | 0.986 | 1.25E+06 | -0.7 | 3.34E+06 | -0.68 |

Ecoregion and Stream Specific Values for Hardness & TSS:

| | Hardness | TSS 15th%tile |
|---|---|---|
| Gulf Coastal | 31 | 5.5 |
| Ouachita Mtns. | 31 | 2 |
| Arkansas River Valley | 25 | 3 |
| Boston Mountain | 25 | 1.3 |
| Ozark Highlands | 148 | 2.5 |
| Delta | 81 | 8 |
| Streams: | | |
| Arkansas River | 125 | ----- |
| Ft. Smith to Dardenelle Dam | | 12 |
| Dardenelle Dame to Terry L&D | | 10.5 |
| Terry L&D to L&D No. 5 | | 8.3 |
| L&D No. 5 to Mouth | | 9 |
| Red River | 211 | 33 |
| Ouachita River | 28 | ----- |
| Above Caddo River | | 2 |
| Below Caddo River | | 5.5 |
| White River | 116 | ----- |
| Above Beaver Lake | | 2.5 |
| Bull Shoals to Black River | | 3.3 |
| Black River to Mouth | | 18.5 |
| St. Francis River | 103 | 18 |

GBMc & Associates
219 Brown Lane
Bryant, AR 72022

Sheet No. 1 of 2
Date 2/16/07
By CDC
Chkd MSR Date 2/22/07
Project No. 2042-99-010

**SUBJECT: Background Flow/Ratio Derivation**

***Background Flow***

Water level measurements from four locations (006, 007, 006B, 007B) were used to derive the background flow conditions for EDCC Outfalls 006/007. The methods and example calculations follow.

The unnamed tributary to Flat Creek is split into two branches near the EDCC property line. The flow monitoring locations selected include storm water from EDCC Outfalls 006 and 007 plus the non-industrial area of the watershed represented by 006B plus 007B. To derive background flow for the receiving stream, the total flow must be measured, then flows from EDCC Outfalls 006 and 007 subtracted. In equation form:

Background Flow = (006B + 007B) – (006 + 007)

Two instruments were installed in the stream to record water levels at 5 minute increments to obtain 006B and 007B flows. Flow/level relationships were determined by direct measurement of flow rates at multiple water levels, then using regression analyses to develop mathematical relationships to predict flow rates for varying observed water levels. The equations to calculate instantaneous flow rates for 006B and 007B are:

$$006B\ (cfs) = 11.286H^3 - 28.13H^2 + 25.05H - 7.2465$$

$$007B\ (cfs) = 0.0856H^{6.9528}$$

where H is water level (ft)

Outfalls 006 and 007 are equipped with prefabricated fiberglass flumes. Tables of published flow rates related to water levels in Appendix C were used to establish discharge flows. The table below shows an example of how background flow was estimated, using data from an event that occurred 3/4/05 from 7:09 – 7:59.

| 006B | H, ft | CFS | 007B | H, ft | CFS | 006 | H, ft | CFS | 007 | H, ft | CFS |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 3/4/2005 7:09 | 0.78 | 0.53 | 3/4/2005 7:11 | 0.82 | 0.022 | 3/4/2005 7:08 | 0.04 | 0.007 | 3/4/2005 7:09 | 0.01 | 0.002 |
| 3/4/2005 7:14 | 0.78 | 0.53 | 3/4/2005 7:16 | 0.82 | 0.022 | 3/4/2005 7:13 | 0.04 | 0.007 | 3/4/2005 7:14 | 0.01 | 0.002 |
| 3/4/2005 7:19 | 0.78 | 0.53 | 3/4/2005 7:21 | 0.82 | 0.022 | 3/4/2005 7:18 | 0.04 | 0.007 | 3/4/2005 7:19 | 0.01 | 0.002 |
| 3/4/2005 7:24 | 0.78 | 0.53 | 3/4/2005 7:26 | 0.82 | 0.022 | 3/4/2005 7:23 | 0.04 | 0.007 | 3/4/2005 7:24 | 0.03 | 0.012 |
| 3/4/2005 7:29 | 0.78 | 0.53 | 3/4/2005 7:31 | 0.83 | 0.023 | 3/4/2005 7:28 | 0.04 | 0.007 | 3/4/2005 7:29 | 0.07 | 0.050 |
| 3/4/2005 7:34 | 0.78 | 0.53 | 3/4/2005 7:36 | 0.82 | 0.022 | 3/4/2005 7:33 | 0.04 | 0.007 | 3/4/2005 7:34 | 0.05 | 0.029 |
| 3/4/2005 7:39 | 0.78 | 0.53 | 3/4/2005 7:41 | 0.83 | 0.023 | 3/4/2005 7:38 | 0.04 | 0.007 | 3/4/2005 7:39 | 0.08 | 0.062 |
| 3/4/2005 7:44 | 0.78 | 0.53 | 3/4/2005 7:46 | 0.82 | 0.022 | 3/4/2005 7:43 | 0.04 | 0.007 | 3/4/2005 7:44 | 0.12 | 0.119 |
| 3/4/2005 7:49 | 0.78 | 0.53 | 3/4/2005 7:51 | 0.83 | 0.023 | 3/4/2005 7:48 | 0.04 | 0.007 | 3/4/2005 7:49 | 0.03 | 0.012 |
| 3/4/2005 7:54 | 0.78 | 0.53 | 3/4/2005 7:56 | 0.83 | 0.023 | 3/4/2005 7:53 | 0.04 | 0.007 | 3/4/2005 7:54 | 0.12 | 0.119 |
| 3/4/2005 7:59 | 0.78 | 0.53 | 3/4/2005 8:01 | 0.83 | 0.023 | 3/4/2005 7:58 | 0.04 | 0.007 | 3/4/2005 7:59 | 0.17 | 0.211 |
| **006B EVENT SUM** | | **5.87** | **007B EVENT SUM** | | **0.246** | **006 EVENT SUM** | | **0.080** | **007 EVENT SUM** | | **0.619** |

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Sheet No. 2 of 2
Date 2/16/07
By CDC
Chkd MSR Date 2/22/07
Project No. 2042-99-010

**SUBJECT: Background Flow/Ratio Derivation**

Using the equation: Background Flow = (006B + 007B) – (006 + 007),
Background Flow = (5.87 +0. 246) – (0.080 + 0.619)
Background Flow = 5.42 CFS

***Background:Outfall Ratio***

To analyze the background-to-outfall flow ratios for the study purposes, discharge events first were defined as precipitation-related and resulting in a quantifiable increase in background flow in the receiving stream concurrent with discharge from outfalls 006 and/or 007. Recorded water levels for all four monitoring locations were assessed to identify discrete discharge events, consisting of time periods where outfall 006 and/or 007 was discharging and background flow was greater than or equal to the total 006 + 007 flow. On an event basis, recorded flows were used in the following equation to determine the respective ratios for background to 006 and background to 007 that were representative of the entire discharge event.

BG:006 (event) = ∑BG/ ∑006 (event)
BG:007 (event) = ∑BG/ ∑007 (event)

In the following table, the same discharge event shown in the previous section is used to demonstrate individual 5-minute incremental flow rates for the duration of the event. Background Flow has been calculated for each recorded time interval using the method described in the first section. Flow ratios for 006 and 007 are determined using the above equations.

| EDCC Date / Time | CALC BG CFS | 006 FLOW CFS | 007 FLOW CFS | EVENT NO | EVENT RATIO BG/006 | EVENT RATIO BG/007 |
|---|---|---|---|---|---|---|
| 3/4/05 7:09 | 0.55 | 0.007 | 0.002 | | | |
| 3/4/05 7:14 | 0.55 | 0.007 | 0.002 | | | |
| 3/4/05 7:19 | 0.55 | 0.007 | 0.002 | | | |
| 3/4/05 7:24 | 0.54 | 0.007 | 0.012 | | | |
| 3/4/05 7:29 | 0.50 | 0.007 | 0.050 | | | |
| 3/4/05 7:34 | 0.52 | 0.007 | 0.029 | | | |
| 3/4/05 7:39 | 0.49 | 0.007 | 0.062 | | | |
| 3/4/05 7:44 | 0.43 | 0.007 | 0.119 | | | |
| 3/4/05 7:49 | 0.54 | 0.007 | 0.012 | | | |
| 3/4/05 7:54 | 0.43 | 0.007 | 0.119 | | | |
| 3/4/05 7:59 | 0.34 | 0.007 | 0.211 | | | |
| SUM | 5.42 | 0.08 | 0.619 | 2 | 67.76 | 8.76 |

BG:006 (event) = 5.42/0.08 = 67.76:1
BG:007 (event) = 5.42/0.619 = 8.76:1

This method was used to identify seventy-seven discharge events and determine flow ratios as summarized in Appendix F of the report. In the Appendix F table, only the event summary data is shown. The full data is provided on the compact disk submitted with the report.