MONTHLY MONITORING DATA AND INTEGRATED DATA BASES AS MANAGEMENT TOOLS

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I. INTRODUCTION

In April 1985, a report was submitted to the U.S. Environmental Protection Agency (EPA - Region III) which developed a method for using routinely collected water quality data (dissolved oxygen) in water quality management. Statistical methods were used to identify field observations which varied significantly from historical water quality conditions. For any of the stations examined, it was possible to examine a dissolved oxygen reading and see whether it was statistically unusual. This was developed at both the upper and lower ends, to include both oxygen deficient and supersaturated conditions.

A primary purpose of this supplemental report is to use the ambient water quality data screening model results in combination with discharger information. The statistical techniques developed may be used throughout the basin. This report will concentrate on the original stations examined and provide more in depth information on what is affecting water quality at the particular site. The U.S. EPA, through their Water Quality Analysis Branch (WQAB), has developed an integrated data base which is quite useful for prompt access to site information. Effluent data, flow gages, and water quality monitoring stations are on-line and available for use in graphical or numerical retrievals. The focusing on point sources upstream of the water quality stations dramatically show what is entering the water body in the area defined by the user. For those periods which were flagged down as being statistically significant outliers, the point source performance levels will be examined. Prior to the development of this system, a geographic or stream reach location of a discharger was difficult to obtain, in relation to water quality monitoring stations. The discharge data for oxygen demanding loads (biochemical oxygen and chemical oxygen demands) are ranked by year for the station on the South River in Virginia where the discharge monitoring data was most readily available. A relationship between these rankings of permitted discharges and ambient water quality flagged down by the statistical techniques was developed.

The objective in this supplemental project has been to present information which will be used in conjunction with the statistical screening model. Discharge monitoring reports (DMR's) and permit violations will be accessible at some time in the future with the Permit Compliance System. At this time, the discharge monitoring reports for time periods showing outliers have been obtained from the Virginia computerized data base for DMR's and permit limitations. Future work will further analyze the impacts of the point source discharges on the South River, as well as analyze the other stations in Maryland. The state of Maryland has put some of their data on PCS. Maryland data was retrieved manually. DMR's are generally monthly reportings. Some smaller dischargers report on a quarterly basis.

The techniques developed may easily be incorporated into water quality management programs. The method requires Four (4) steps:

1. Obtaining flow and dissolved oxygen data from a water quality monitoring station. Dissolved oxygen data are sufficient since it was shown in the preliminary report that flow and dissolved oxygen are not correlated. Dissolved oxygen is one of the most commonly sampled parameters in both geographic coverage and historical record.

2. Statistically analyzing the data to get outliers.

3. Using the Reach file with the WQAB to further describe the location plus all the dischargers of interest.

4. Either manually or using the PCS, obtaining discharge monitoring reports. Future work will attempt a correlation between permit violations and the periods of flagged outliers.

A violation during the period of a flagged outlier implies that point sources are controlling water quality. It is not necessarily a cause and effect relationship, however the methods developed here provide a faster technique to incorporate water quality with permit discharge data. Distance from a point source, flow of the river and type of violation all must be considered in this analysis. For the most part, data from the WQAB integrated data base are used in an interactive environment and information is available promptly. Therefore, immediately after obtaining a reading for dissolved oxygen, it is possible to see whether it is an outlier (above or below the expected range), using the statistical techniques developed and then using the WQAB to see what may be affecting the quality.

Development of an easily implemented water quality management tool was the objective of this project. A manager could collect data and flag outliers, and obtain potential discharge violaters in a short period of time. From the time a sample is taken, the analysis of water quality impacts begins. In a future project, permit information will be obtained for the outliers' dates.

II. REACH FILE

The Reach File is a data base that identifies and subdivides streams and shorelines to provide a hydrological framework for organizing water resource data and for performing water quality analyses. The Reach Files uses the Federal Information Processing Standards (FIPS) Hydrologic Unit drainage basin codes. These Hydrologic Units are delineated by the U.S. Geological Survey (USGS). A two digit number is used to identify the hydrologic region and two additional numbers are

appended to identify each successively smaller basin size. The code for a cataloging unit, the smallest basin defined within the Hydrologic Unit scheme is eight digits in length. The hydrologic unit code for the Potomac Basin is:

region: 02 (Mid Atlantic)
subregion: 07
accounting unit 00
cataloging unit: xx

The HUC for any portion of the Potomac Basin is 020700xx. The cataloging unit (the last two digits) further defines the region.

In addition to the HUC, the Reach Files appends three additional numbers onto the 8 digit value to produce an 11 digit reach number which represents linear sections of streams.

For example, the North Branch Potomac River, near the Fairfax Stone, the HUC is 02070002. The reach number is 02070002-025. This type of designation is nationally consistent and may be used for any basin and stream reach in the country.

a. North Branch Potomac

-UPSTREAM- LAT	LONG	09/82 SEQNO	DSNO	LENGTH (MI.)	NAME
39.21	79.49	2907	2909	17.0	POTOMAC R, N BR
39.21	79.26	2908	2909	13.7	STONY R
39.33	79.28	2909	2911	7.0	POTOMAC R, N BR
39.20	79.23	2910	2911	18.5	ABRAM CR
39.38	79.21	2911	2913	17.2	POTOMAC R, N BR
39.69	78.96	2912	2913	25.9	SAVAGE R
39.48	79.07	2913	2915	1.7	POTOMAC R, N BR
39.66	78.94	2914	2915	17.3	GEORGES CR
39.48	79.05	2915	2917	5.9	POTOMAC R, N BR
39.25	79.15	2916	2917	18.1	BEN CR
39.44	78.97	2917	2925	24.0	POTOMAC R, N BR
39.78	78.91	2918	2920	20.7	WILLS CR
39.95	78.75	2919	2920	14.7	LITTLE WILLS CR
39.82	78.73	2920	2922	11.3	WILLS CR
39.68	78.94	2921	2922	10.7	JENNINGS RUN
39.70	78.79	2922	2924	2.2	WILLS CR
39.61	78.90	2923	2924	9.7	BRADDUCK RUN
39.67	78.79	2924	2925	1.8	WILLS CR
39.65	78.77	2925	2927	4.2	POTOMAC R, N BR
39.93	78.59	2926	2927	30.7	EVITTS CR
39.63	78.75	2927	2929	9.1	POTOMAC R, N BR
39.68	78.65	2928	2929	10.5	COLLIER RUN
39.57	78.73	2929	2931	0.3	POTOMAC R, N BR
39.11	79.08	2930	2931	44.7	PATTERSON CR
39.56	78.73	2931	2935	8.1	POTOMAC R, N BR

REACH NO	CHK DIG	TYP	LEVEL 1 2 3 4 5 6 7 8 9
02070002-025	1	S	025
02070002-026	5	S	026
02070002-024	7	R	024
02070002-028	3	S	028
02070002-023	3	R	023
02070002-022	9	S	022
02070002-021	5	R	021
02070002-020	1	S	020
02070002-019	0	R	019
02070002-029	7	S	029
02070002-018	6	R	018
02070002-015	4	S	015
02070002-014	0	S	014
02070002-013	6	R	013
02070002-016	8	S	016
02070002-012	2	R	012
02070002-017	2	S	017
02070002-011	8	R	011
02070002-010	4	R	010
02070002-009	3	S	009
02070002-008	9	R	008
02070002-007	5	S	007
02070002-006	1	R	006
02070002-030	8	S	030
02070002-005	7	R	005

b. South River

STREAM- LAT	LONG	09/82 SEQNO	DSNO	LENGTH (MI.)	NAME	REACH NO	CHK DIG	TYP	LEVEL 1	2	3	4	5	6	7	8	9
38.08	79.20	3037	3038	8.5	RIDSON CR	02070005-022	0	S				022					
38.18	79.16	3038	3040	4.7	MIDDLE R	02070005-018	7	R			018						
38.25	79.29	3039	3040	13.2	DRY BK	02070005-017	3	S				017					
38.22	79.13	3040	3042	4.2	MIDDLE R	02070005-016	9	R			016						
38.31	79.19	3041	3042	9.9	HOFFETT CR	02070005-015	5	S				015					
38.25	79.09	3042	3044	10.8	MIDDLE R	02070005-014	1	R			014						
38.12	79.13	3043	3044	12.3	*B	02070005-023	4	S				023					
38.19	78.97	3044	3048	8.0	MIDDLE R	02070005-013	7	R			013						
38.05	79.14	3045	3047	8.1	CHRISTIANS CR	02070005-026	6	S				026					
38.06	79.18	3046	3047	10.4	FOLLY HILLS CR	02070005-025	2	S					025				
38.08	79.04	3047	3048	13.5	CHRISTIANS CR	02070005-024	8	R				024					
38.19	78.93	3048	3056	15.3	MIDDLE R	02070005-012	3	R			012						
38.45	79.26	3049	3051	18.1	NORTH R	02070005-010	5	S				010					
38.44	79.23	3050	3051	8.7	LITTLE R	02070005-009	4	S					009				
38.36	79.17	3051	3053	14.1	NORTH R	02070005-008	0	R				008					
38.52	79.21	3052	3053	25.4	DRY R	02070005-007	6	S					007				
38.39	78.99	3053	3055	0.9	NORTH R	02070005-006	2	R				006					
38.28	79.08	3054	3055	11.7	*A	02070005-011	9	S					011				
38.38	78.98	3055	3056	15.5	NORTH R	02070005-005	8	R				005					
38.28	78.85	3056	3060	4.9	MIDDLE R	02070005-004	4	R			004						
37.97	79.20	3057	3059	19.4	SOUTH R	02070005-028	4	S				028					
37.90	79.03	3058	3059	13.2	BACK CR	02070005-029	8	S					029				
38.04	78.93	3059	3060	24.8	SOUTH R	02070005-027	0	R				027					
38.30	78.81	3060	3062	21.8	SHENANDOAH R, S FK	02070005-003	0	R			003						
38.49	78.46	3061	3062	11.7	NAKED CR	02070005-030	9	S				030					

c. Monocacy

-UPSTREAM- LAT	LONG	09/82 SEQNO	DSNO	LENGTH (MI.)	NAME	REACH NO	CHK DIG	TYP	LEVEL 1 2 3 4 5 6 7
39.62	77.37	3085	3086	11.7	MIDDLE CR	02070009-031	1	S	031
39.69	77.30	3086	3087	4.4	TOMS CR	02070009-030	7	R	030
39.64	77.28	3087	3099	6.8	MONOCACY R	02070009-022	8	R	022
39.67	76.91	3088	3090	14.2	BIG PIPE CR	02070009-020	0	S	020
39.71	77.02	3089	3090	6.3	SILVER RUN	02070009-021	4	S	021
39.67	77.11	3090	3092	4.1	BIG PIPE CR	02070009-019	9	R	019
39.63	77.01	3091	3092	8.3	BIG PIPE CR, BEAR BR	02070009-018	5	S	018
39.63	77.14	3092	3094	0.7	BIG PIPE CR	02070009-017	1	R	017
39.60	77.01	3093	3094	9.4	BIG PIPE CR, MEADOW BR	02070009-016	7	S	016
39.62	77.14	3094	3098	10.1	BIG PIPE CR	02070009-015	3	R	015
39.59	77.01	3095	3097	14.6	LITTLE PIPE CR	02070009-014	9	S	014
39.47	77.08	3096	3097	12.1	SAMS CR	02070009-013	5	S	013
39.57	77.19	3097	3098	7.1	LITTLE PIPE CR	02070009-012	1	R	012
39.60	77.27	3098	3099	1.5	BIG PIPE CR	02070009-011	7	R	011
39.60	77.29	3099	3101	4.5	MONOCACY R	02070009-010	3	R	010
39.66	77.48	3100	3101	15.7	OWENS CR	02070009-033	9	S	033
39.58	77.33	3101	3105	20.2	MONOCACY R	02070009-009	2	R	009
39.43	77.12	3102	3104	8.0	LINGANORE CR, S FK	02070009-007	4	S	007
39.46	77.10	3103	3104	8.4	LINGANORE CR, TALBOT BR	02070009-008	8	S	008
39.45	77.23	3104	3105	10.3	LINGANORE CR	02070009-006	0	R	006
39.41	77.37	3105	3109	11.5	MONOCACY R	02070009-005	6	R	005
39.34	77.20	3106	3108	13.7	BENNETT CR	02070009-004	2	S	004
39.28	77.23	3107	3108	10.3	LITTLE BENNETT CR	02070009-003	8	S	003
39.29	77.37	3108	3109	5.6	BENNETT CR	02070009-002	4	R	002
39.30	77.44	3109	3110	6.8	MONOCACY R	02070009-001	0	R	001

U.S. ENVIRONMENTAL PROTECTION AGENCY

III. WQAB OUTPUT

The Water Quality Analysis Branch (WQAB) has developed an integrated data system using STORET and various other EPA data bases to enable the use of water quality data with other discharge, gage, and water supply data. Data files accessible using this system include the Industrial Facilities Discharge File (IFD) (58,000 facilities), the Gage File (18,000 gages), the Water Supply File (8,000 surface water systems), the City File (25,000 cities and population areas), and the Reach Structure File (62,000 reaches). For additional information on the use of the WQAB, contact EPA at (202) 382-7046.

In this report, the WQAB system was extensively used, especially "PATHSCAN." The need to coordinate ambient water quality with discharge data was a necessary part of this project. "PATHSCAN" is an interactive procedure for retrieving NPDES and drinking water facilities upstream or downstream form a specified location. Requesting data downstream from a point produces main stem stations only. A request upstream includes data from tributary streams and the main stem. This is extremely useful for locating dischargers upstream from ambient water monitoring stations which could affect quality. Only the dischargers upstream of the monitoring station would affect water quality and permit investigation may be further limited by concentrating only on the potential impacting facilities.

From the WQAB "PATHSCAN" file:

1. North Branch Potomac, near Cumberland, Maryland

```
S T A R T I N G  P O I N T  O R  E N D :  <r = 0 2 0 7 0 0 0 2 0 1 8>
U P / D O W N ( U / D ) ?  <d>
L E V E L =  <-3>
MILES= <30>
REPORT ON DRINKS(Y/N)? <y>
DATE 860618   TIME 144315
        9 REACHES
       13 PIPES
        4 PLANTS-INTAKES-SOURCES
DETAIL(Y/N)? <y>

    0.00  02070002018/000.00  TYPE R  LEV 1  LENGTH  24.00  NAME POTOMAC R, N BR
                              6 DISCHARGES
    0.00 GAGE WEG02070002018       ?                    STCD    -1 DA    -1 ?   MI   932 LF    66
    0.00 DRINK MD0002550 LUKE-WESTVACO          POP    1000 ?     30 TGD TYPE P1     TREATMENT PLANT      SOURCE ?
    0.00 DRINK MD0002550 LUKE-WESTVACO          POP    1000 ?      0 TGD TYPE P111   POTOMAC RIVER -      SOURCE 0
    0.00 DRINK MD0002663 BEL AIR-PINTO UTILIT POP    1600 ?     80 TGD TYPE P1     TREATMENT PLANT      SOURCE ?
    0.00 DRINK MD0002663 BEL AIR-PINTO UTILIT POP    1600 ?      0 TGD TYPE P111   TRIPLE LAKES        SOURCE 0
    0.00 PIPE  1 NPDES# MD0022748 PINTO UTILITIES          ON   FLOW(TGD)   -1.00 -P SIC  4952   -1   -1
    0.00 PIPE  1 NPDES# MD0023213 RAWLINGS, TOWN OF        OFF  FLOW(TGD)  250.00 -P SIC  4952   -1   -1
    0.00 PIPE  1 NPDES# MD0024163 YODER LOCKET PLANT       OFF  FLOW(TGD)  305.00 -P SIC  2511   -1   -1
    0.00 PIPE  1 NPDES# MD0053031 PHILLIPS COAL,INC.       OFF  FLOW(TGD)   50.00 -P SIC  1211   -1   -1
    0.00 PIPE  1 NPDES# WV0020371 HERCULES INC., ALLEGANY SHOP FLOW(TGD)   50.00 -P SIC  2892   -1   -1
    0.00 PIPE  1 NPDES# WV0024376 RIDGELEY, TOWN OF        ON   FLOW(TGD)  100.00 -P SIC  4952   -1   -1

    0.00  02070002010/000.00  TYPE R  LEV 1  LENGTH   4.20  NAME POTOMAC R, N BR
                              6 DISCHARGES
    4.20 GAGE WEG02070002010       ?                    STCD    -1 DA    -1 ?   MI  1071 LF    81
    4.20 PIPE  1 NPDES# MD0000663 CELANESE FIBERS AMCELLE  ON   FLOW(TGD)30000.00 -P SIC  2823   -1   -1
    4.20 PIPE  2 NPDES# MD0000663 CELANESE FIBERS AMCELLE  ON   FLOW(TGD) 1000.00 -P SIC  2823   -1   -1
    4.20 PIPE  3 NPDES# MD0000663 CELANESE FIBERS AMCELLE  ON   FLOW(TGD) 1200.00 -P SIC  2823   -1   -1
    4.20 PIPE  1 NPDES# MD0002216 PPG INDUSTRIES INC       ON   FLOW(TGD)  280.00 -P SIC  3211   -1   -1
    4.20 PIPE  1 NPDES# MD0022659 ALLEGANY COUNTY SAN.COMM.-ON  FLOW(TGD)   75.00 -P SIC  4952 9511   -1
    4.20 PIPE  1 NPDES# WV0045012 SHERWOOD ACRES           OFF  FLOW(TGD)    3.00 -P SIC  4952   -1   -1

    4.20  02070002008/000.00  TYPE R  LEV 1  LENGTH   9.10  NAME POTOMAC R, N BR
                              0 DISCHARGES
   13.30 GAGE WEG02070002008       ?                    STCD    -1 DA    -1 ?   MI  1374 LF    99

   13.30  02070002006/000.00  TYPE R  LEV 1  LENGTH   0.30  NAME POTOMAC R, N BR
                              0 DISCHARGES
   13.60 GAGE WEG02070002006       ?                    STCD    -1 DA    -1 ?   MI  1401 LF   105

   13.60  02070002005/000.00  TYPE R  LEV 1  LENGTH   8.10  NAME POTOMAC R, N BR
                              1 DISCHARGE
   21.70 GAGE WEG02070002005       ?                    STCD    -1 DA    -1 ?   MI  1621 LF   119
   21.70 PIPE  1 NPDES# MD0052981 KOPPERS CO-FOREST PRODUCTSOFF  FLOW(TGD)    7.93 -P SIC  2491   -1   -1

   21.70  02070002001/000.00  TYPE R  LEV 1  LENGTH   1.00  NAME POTOMAC R, N BR
                              0 DISCHARGES
   22.70 GAGE WEG02070002001       ?                    STCD    -1 DA    -1 ?   MI  1668 LF   130

   22.70  02070003011/000.00  TYPE R  LEV 1  LENGTH   1.00  NAME POTOMAC R
                              0 DISCHARGES
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This downstream request only retrieves main stem data.

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ATTEMPTING ENTRY TO WATER QUALITY ANALYSIS
BRANCH SOFTWARE PACKAGE - PATHSCAN

VERSION ACTIVE 2 OCTOBER 1984


STARTING POINT OR END: (r=02070002008)
UP/DOWN(U/D)?  (u)
LEVEL= (+3)
MILES= (30)
REPORT ON DRINKS(Y/N)?  (y)
DATE 870105    TIME 095221
        11 REACHES
        35 PIPES
        14 PLANTS-INTAKES-SOURCES
DETAIL(Y/N)?

    0.00  02070002008/000.00  TYPE R  LEV 1  LENGTH   9.10  NAME POTOMAC  R, N BR
                              0 DISCHARGES
    0.00 GAGE WEG02070002008       ?                    STCO    -1 DA  -1 ?   MF(CFS)   1374 LF(CFS)     99

    9.10  02070002009/000.00  TYPE S  LEV 2  LENGTH  30.70  NAME EVITTS CR
                              1 DISCHARGE
     9.10 GAGE WEG02070002009       ?                    STCO    -1 DA  -1 ?   MF(CFS)     79 LF(CFS)     12
     9.10 DRINK MD0010008 CUMBERLAND-EVITTS CR POP   40000 ?  12500 TGD TYPE P1     TREATMENT PLANT      SOURCE ?
     9.10 DRINK MD0010008 CUMBERLAND-EVITTS CR POP   40000 Y     13 TGD TYPE P1I1   LAKE GORDON          SOURCE S
     9.10 DRINK MD0010008 CUMBERLAND-EVITTS CR POP   40000 Y      0 TGD TYPE P1I1S1 LAKE KOON            SOURCE ?
     9.10 DRINK ?         EVITTS CREEK WATER C POP    4600 ? 180000 TGD TYPE P1     TREATMENT PLANT      SOURCE ?
     9.10 DRINK ?         EVITTS CREEK WATER C POP    4600 ?    180 TGD TYPE P1I1    EVITTS CREEK         SOURCE S
     9.10 PIPE  1 NPDES# PA0110744 CITY OF CUMBERLAND, MARYLAOFF  FLOW(TGD)     550.00 -P SIC  4952   -1   -1

     9.10  02070002010/000.00  TYPE R  LEV 1  LENGTH   4.20  NAME POTOMAC R, N BR
                              6 DISCHARGES
     9.10 GAGE WEG02070002010       ?                    STCO    -1 DA -1 ?   MF(CFS)   1271 LF(CFS)     81
     9.10 PIPE  1 NPDES# MD0000663 CELANESE FIBERS AMCELLE   ON   FLOW(TGD)   30000.00 -B SIC  2823   -1   -1
     9.10 PIPE  2 NPDES# MD0000663 CELANESE FIBERS AMCELLE   ON   FLOW(TGD)    1000.00 -P SIC  2823   -1   -1
     9.10 PIPE  3 NPDES# MD0000663 CELANESE FIBERS AMCELLE   ON   FLOW(TGD)    1200.00 -P SIC  2823   -1   -1
     9.10 PIPE  1 NPDES# MD0002216 PPG INDUSTRIES INC        ON   FLOW(TGD)     280.00 -P SIC  3211   -1   -1
     9.10 PIPE  1 NPDES# MD0022659 ALLEGANY COUNTY SAN.COMM.-ON   FLOW(TGD)      75.00 -P SIC  4952 9511   -1
     9.10 PIPE  1 NPDES# WV0045012 SHERWOOD ACRES            OFF  FLOW(TGD)       3.00 -P SIC  4952   -1   -1

    13.30  02070002011/000.00  TYPE R  LEV 2  LENGTH   1.80  NAME WILLS CR
                              6 DISCHARGES
     13.30 GAGE WEG02070002011       ?                    STCO    -1 DA  -1 ?   MF(CFS)    329 LF(CFS)     13
     13.30 DRINK WV3302923 RIDGELEY WATER DEPT  POP    1215 ?     -1 TGD TYPE P1     CUMBERLAND MD WD     SOURCE ?
     13.30 DRINK WV3302923 RIDGELEY WATER DEPT  POP    1215 ?     -1 TGD TYPE P1I1    LAKE KOON           SOURCE S
     13.30 DRINK WV3302923 RIDGELEY WATER DEPT  POP    1215 ?     -1 TGD TYPE P1I2   LAKE GORDON          SOURCE S
     13.30 PIPE  1 NPDES# MD0000337 KELLY SPRINGFIELD TIRE CO ON   FLOW(TGD)    1700.00 -B SIC  3011   -1   -1
     13.30 PIPE  2 NPDES# MD0000337 KELLY SPRINGFIELD TIRE CO ON   FLOW(TGD)   10800.00 -B SIC  3011   -1   -1
     13.30 PIPE  3 NPDES# MD0000337 KELLY SPRINGFIELD TIRE CO ON   FLOW(TGD)       4.00 -B SIC  3011   -1   -1
     13.30 PIPE  1 NPDES# MD0021598 CUMBERLAND,CITY OF       ON   FLOW(TGD)   11300.00 -P SIC  4952   -1   -1
     13.30 PIPE  1 NPDES# MD0022471 ALLEGANY COUNTY SAN COMM-CON  FLOW(TGD)     200.00 -P SIC  4952   -1   -1
     13.30 PIPE  1 NPDES# YCRCLA143 LIMESTONE ROAD SITE      OFF  FLOW(TGD)      -1.00 -? SIC  8999   -1   -1

    15.10  02070002017/000.00  TYPE S  LEV 3  LENGTH   9.70  NAME BRADDUCK RUN
                              2 DISCHARGES
     15.10 GAGE WEG02070002017       ?                    STCO    -1 DA -1 ?   MF(CFS)     39 LF(CFS)      1
     15.10 PIPE  1 NPDES# MD0051110 WINNER BROS. COAL CO. INC OFF  FLOW(TGD)       0.50 -P SIC  1211   -1   -1
     15.10 PIPE  1 NPDES# MD0057941 JOHN DUCKWORTH COAL.CO.   OFF  FLOW(TGD)       1.00 -P SIC  1211   -1   -1

    15.10  02070002012/000.00  TYPE R  LEV 2  LENGTH   2.20  NAME WILLS CR
                              0 DISCHARGES
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This upstream request retrieves both main stem and tributary data.

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 15.10 GAGE WEG02070002012       ?                    STCO   -1 DA  -1 ?   MF(CFS)    285 LF(CFS)     11

 17.30  02070002016/000.00  TYPE S  LEV 3  LENGTH  10.70  NAME JENNINGS RUN
                          13 DISCHARGES
 17.30 GAGE WEG02070002016       ?                    STCO    -1 DA -1 ?   MF(CFS)     43 LF(CFS)      2
 17.30 PIPE  1 NPDES# MD0000272 KAISER ALUMINUM FROSTBURG OFF  FLOW(TGD)      2.75 -B SIC  3255   -1   -1
 17.30 PIPE  1 NPDES# MD0050521 BUFFALO COAL CO.INC.PERMITOFF  FLOW(TGD)     30.00 -P SIC  1211   -1   -1
 17.30 PIPE  1 NPDES# MD0050571 G.& H. COAL COMPANY      OFF  FLOW(TGD)      3.00 -P SIC  1211   -1   -1

* DATE 870105    TIME 095315  R=02070002008 U LEVEL=+3 MILES=30
 17.30 PIPE  1 NPDES# MD0050733 BESSEMER IRON AND COAL CO OFF  FLOW(TGD)      5.00 -P SIC  1211   -1   -1
 17.30 PIPE  1 NPDES# MD0051764 BESSEMER IRON & COAL CO   ON  FLOW(TGD)      0.50 -P SIC  1211   -1   -1
 17.30 PIPE  1 NPDES# MD0053929 PHILLIPS COAL,INC         ON  FLOW(TGD)     40.00 -P SIC  1211   -1   -1
 17.30 PIPE  1 NPDES# MD0055875 PHILLIPS COAL INC ECKHART ON  FLOW(TGD)     -1.00 -P SIC  1211   -1   -1
 17.30 PIPE  1 NPDES# MD0055891 SENEC MINING CORPORATION  OFF  FLOW(TGD)     30.00 -P SIC  1211   -1   -1
 17.30 PIPE  1 NPDES# MD0056006 FETTEROLF MINING INC      ON  FLOW(TGD)      2.50 -P SIC  1211   -1   -1
 17.30 PIPE  1 NPDES# MD0056022 JOHN DUCKWORTH COAL CO    OFF  FLOW(TGD)      1.00 -P SIC  1211   -1   -1
 17.30 PIPE  1 NPDES# MD0056251 T L MORAN INC             OFF  FLOW(TGD)      5.00 -P SIC  1211   -1   -1
 17.30 PIPE  1 NPDES# MD0056260 FETTEROLF MINING          OFF  FLOW(TGD)      1.50 -P SIC  1211   -1   -1
 17.30 PIPE  2 NPDES# MD0056260 FETTEROLF MINING          ON   FLOW(TGD)      3.00 -P SIC  1211   -1   -1

 17.30  02070002013/000.00  TYPE R  LEV 2  LENGTH  11.30  NAME WILLS CR
                          0 DISCHARGES
 27.56 GAGE WEG02070002013       ?                    STCO    -1 DA -1 ?   MF(CFS)    233 LF(CFS)      9

 28.60  02070002014/000.00  TYPE S  LEV 3  LENGTH  14.70  NAME LITTLE WILLS CR
                          0 DISCHARGES
 28.60 GAGE WEG02070002014       ?                    STCO    -1 DA  -1 ?   MF(CFS)     58 LF(CFS)      2
 28.60 DRINK PA4050003 HYNDMAN BORO WATER C POP    1100 ?     91 TGD TYPE P1     TREATMENT PLANT      SOURCE ?
 28.60 DRINK PA4050003 HYNDMAN BORO WATER C POP    1100 ?      0 TGD TYPE P1I1   LAUREL RUN           SOURCE S

 28.60  02070002015/000.00  TYPE S  LEV 2  LENGTH  20.70  NAME WILLS CR
                          1 DISCHARGE
 28.60 GAGE WEG02070002015       ?                    STCO    -1 DA  -1 ?   MF(CFS)    127 LF(CFS)      5
 28.60 PIPE  1 NPDES# PA0020851 HYNDMAN BOROUGH MUNICIPAL ON   FLOW(TGD)     92.00 -P SIC  4952   -1   -1

 13.30  02070002018/000.00  TYPE R  LEV 1  LENGTH  24.00  NAME POTOMAC R, N BR
                          6 DISCHARGES
 13.30 GAGE WEG02070002018       ?                    STCO    -1 DA -1 ?   MF(CFS)    932 LF(CFS)     66
 13.30 DRINK MD0002550 LUKE-WESTVACO         POP    1000 ?     30 TGD TYPE P1     TREATMENT PLANT      SOURCE ?
 13.30 DRINK MD0002550 LUKE-WESTVACO         POP    1000 ?      0 TGD TYPE P1I1    POTOMAC RIVER -     SOURCE S
 13.30 DRINK MD0002663 BEL AIR-PINTO UTILIT POP    1600 ?     80 TGD TYPE P1     TREATMENT PLANT      SOURCE ?
 13.30 DRINK MD0002663 BEL AIR-PINTO UTILIT POP    1600 ?      0 TGD TYPE P1I1    TRIPLE LAKES        SOURCE S
 13.30 PIPE  1 NPDES# MD0022748 PINTO UTILITIES          ON   FLOW(TGD)     -1.00 -P SIC  4952   -1   -1
 13.30 PIPE  1 NPDES# MD0023213 RAWLINGS, TOWN OF        OFF  FLOW(TGD)    250.00 -P SIC  4952   -1   -1
 13.30 PIPE  1 NPDES# MD0024163 YODER LOCKER PLANT       OFF  FLOW(TGD)    305.00 -P SIC  2011   -1   -1
 13.30 PIPE  1 NPDES# MD0053031 PHILLIPS COAL,INC.       OFF  FLOW(TGD)     50.00 -P SIC  1211   -1   -1
 13.30 PIPE  1 NPDES# WV0020371 HERCULES INC., ALLEGANY BAON  FLOW(TGD)     50.00 -B SIC  2892   -1   -1
 13.30 PIPE  1 NPDES# WV0024376 RIDGELEY, TOWN OF         ON   FLOW(TGD)    100.00 -P SIC  4952   -1   -1
```

2. **South River, near Waynesboro, Virginia**

```
A T T E M P T I N G   E N T R Y   T O   W A T E R   Q U A L I T Y   A N A L Y S I S
B R A N C H   S O F T W A R E   P A C K A G E   -   P A T P S C A N

V E R S I O N   A C T I V E   2   O C T O B E R   1 9 8 4


STARTING POINT OR END: <r=02070005028>
UP/DOWN(U/D)?  <d>
LEVEL= <-3>
MILES= <25>
REPORT ON DRINKS(Y/N)? <y>
DATE 860618    TIME 144148
       3 REACHES
      12 PIPES
       0 PLANTS-INTAKES-SOURCES
DETAIL(Y/N)?  <y>

   0.00  02070005028/000.00  TYPE S  LEV 4  LENGTH  19.40  NAME SOUTH R

                                 0 DISCHARGES
   0.00 GAGE WEG02070005028        ?                 STCO    -1 DA    -1 ?  MF    79 LF    13

   0.00  02070005027/000.00  TYPE R  LEV 4  LENGTH  24.80  NAME SOUTH R

                                12 DISCHARGES
   24.80 GAGE WEG02070005027        ?                STCO    -1 DA    -1 ?  MF   231 LF    42
   24.80 PIPE  1 NPDES# VA0001767 REYNOLDS METALS CO  GROTTOON  FLOW(TGD) 2370.00 -P SIC  3079   -1   -1
   24.80 PIPE  1 NPDES# VA0001856 THIOKOL FIBERS DI         ON  FLOW(TGD)  383.00 -P SIC  2297   -1   -1
   24.80 PIPE  1 NPDES# VA0001899 CROMPTON-SHENANDOAH-WAYNESON  FLOW(TGD) 1270.00 -P SIC  2261   -1   -1
   24.80 PIPE  1 NPDES# VA0002160 DUPONT WAYNESBORO         ON  FLOW(TGD) 5300.00 -P SIC  2821 2823 2824
   24.80 PIPE  2 NPDES# VA0002160 DUPONT WAYNESBORO         ON  FLOW(TGD)   30.00 -C SIC  2821 2823   -1
   24.80 PIPE  3 NPDES# VA0002160 DUPONT WAYNESBORO         ON  FLOW(TGD) 3300.00 -C SIC  2823   -1   -1
   24.80 PIPE  4 NPDES# VA0002160 DUPONT WAYNESBORO         ON  FLOW(TGD) 6000.00 -C SIC  2821 2823 2824
   24.80 PIPE  1 NPDES# VA0002402 GENERAL ELECTRIC WAYNESBORON  FLOW(TGD)  300.00 -C SIC  3662   -1   -1
   24.80 PIPE  1 NPDES# VA0025151 WAYNESBORO DEPT OF UTILITION  FLOW(TGD) 2740.00 -P SIC  4952   -1   -1
   24.80 PIPE  1 NPDES# VA0027901 HARRISTON SERVICE CORPORATON  FLOW(TGD)   41.00 -P SIC  4952   -1   -1
   24.80 PIPE  1 NPDES# VA0054771 GREENVILLE CAR WASH      OFF  FLOW(TGD)   -1.00 -P SIC  7542   -1   -1
   24.80 PIPE  1 NPDES# VA0065374 GROTTOES TOWN OF          ON  FLOW(TGD)  200.00 -P SIC  4952   -1   -1

   24.80  02070005003/000.00  TYPE R  LEV 3  LENGTH  21.90  NAME SHENANDOAH R
                                 0 DISCHARGES
```

3. Monocacy River at Dickerson, Maryland

```
STARTING POINT OR END: <RP=02070009005>
UP/DOWN(U/D)? <D>
LEVEL= <-3>
MILES= <35>
REPORT ON DRINKS(Y/N)? <N>
DATE 860619   TIME 103204
        9 REACHES
       11 PIPES
        0 PLANTS-INTAKES-SOURCES
DETAIL(Y/N)?

    0.00  02070009005/000.00  TYPE R  LEV 2  LENGTH  11.50  NAME MONOCACY R
                              5 DISCHARGES
    0.00 GAGE WEG02070009005      ?                  STCD   -1 DA    -1 ?  MF   990 LF   50
    0.00 PIPE  1 NPDES# MD0002039 ALPHA PORTLAND CEMENT CO  OFF  FLOW(TGD)   50.00 -0 SIC  3241  -1  -1
    0.00 PIPE  1 NPDES# MD0020753 FREDERICK CO METRO DIST-APRON  FLOW(TGD)  100.00 -P SIC  4952  -1  -1
    0.00 PIPE  1 NPDES# MD0021580 FREDERICK COUNTY METROPOLITON  FLOW(TGD) 6000.00 -P SIC  4952  -1  -1
    0.00 PIPE  1 NPDES# MD0021610 FREDERICK CITY WASTE WATER PO  FLOW(TGD) 5000.00 -P SIC  4952  -1  -1
    0.00 PIPE  1 NPDES# MD0021822 FREDERICK CO METRO COMM-BADN  FLOW(TGD) 2000.00 -P SIC  4952  -1  -1

    0.00  02070009001/000.00  TYPE R  LEV 2  LENGTH   6.80  NAME MONOCACY R
                              0 DISCHARGES
    6.80 GAGE WEG02070009001      ?                  STCD   -1 DA    -1 ?  MF  1116 LF   78

    6.80  02070008013/000.00  TYPE R  LEV 1  LENGTH  11.80  NAME POTOMAC R
                              6 DISCHARGES
   18.60 GAGE WEG02070008013      ?                  STCD   -1 DA    -1 ?  MF 10528 LF  696
   18.60 PIPE  1 NPDES# MD0002640 PEPCO DICKERSON          ON  FLOW(TGD)89000.00 -B SIC  4911  -1  -1
   18.60 PIPE  2 NPDES# MD0002640 PEPCO DICKERSON          ON  FLOW(TGD)    0.10 -0 SIC  4911  -1  -1
   18.60 PIPE  1 NPDES# MD0023795 POTOMAC ELECTRIC POWER CO-ON  FLOW(TGD)   30.00 -0 SIC  4911  -1  -1
   18.60 PIPE  1 NPDES# MD0057594 POTOMAC ELECTRIC POWER CO-OFF  FLOW(TGD)  -1.00 -P SIC  4911  -1  -1
   18.60 PIPE  2 NPDES# MD0057594 POTOMAC ELECTRIC POWER CO-ON  FLOW(TGD)  -1.00 -P SIC  4911  -1  -1
   18.60 PIPE  3 NPDES# MD0057594 POTOMAC ELECTRIC POWER CO-ON  FLOW(TGD)  -1.00 -P SIC  4911  -1  -1

   18.60  02070008012/000.00  TYPE R  LEV 1  LENGTH   2.80  NAME POTOMAC R
                              0 DISCHARGES
   21.40 GAGE WEG02070008012      ?                  STCD   -1 DA    -1 ?  MF 10999 LF  898

   21.40  02070008011/000.00  TYPE R  LEV 1  LENGTH   4.40  NAME POTOMAC R
                              0 DISCHARGES
   25.80 GAGE WEG02070008011      ?                  STCD   -1 DA    -1 ?  MF 10951 LF  991

   25.80  02070008010/000.00  TYPE R  LEV 1  LENGTH   1.20  NAME POTOMAC R
                              0 DISCHARGES
   27.00 GAGE WEG02070008010      ?                  STCD   -1 DA    -1 ?  MF 11029 LF  898

   27.00  02070008006/000.00  TYPE R  LEV 1  LENGTH   3.00  NAME POTOMAC R
                              0 DISCHARGES
   30.00 GAGE WEG02070008006      ?                  STCD   -1 DA    -1 ?  MF 11164 LF  905

   30.00  02070008004/000.00  TYPE R  LEV 1  LENGTH   2.20  NAME POTOMAC R
                              0 DISCHARGES
   32.20 GAGE WEG02070008004      ?                  STCD   -1 DA    -1 ?  MF 11215 LF  905

   32.20  02070008002/000.00  TYPE R  LEV 1  LENGTH   5.90  NAME POTOMAC R
                              0 DISCHARGES
```

4. Monocacy River near Frederick Maryland

```
STARTING POINT OR END: <r=02070009010>
UP/DOWNKU/D)? <d>
LEVEL= <-3>
MILES= <40>
REPORT ON DRINKS(Y/N)? <y>
DATE 860619    TIME 103008
       5 REACHES
      20 PIPES
      10 PLANTS-INTAKES-SOURCES
DETAIL(Y/N)?

    0.00  02070009010/000.00  TYPE R  LEV 2  LENGTH   4.50  NAME MONOCACY R
                              0 DISCHARGES
     0.00 GAGE WEG02070009010      ?                  STCO    -1 DR     -1 ?   MF   654 LF    36

    0.00  02070009009/000.00  TYPE R  LEV 2  LENGTH  20.20  NAME MONOCACY R
                              15 DISCHARGES
   20.20 GAGE WEG02070009009      ?                   STCO    -1 DR     -1 ?   MF   796 LF    38
   20.20 DRINK MD0100015 FREDERICK           POP   28000 ?     3000 TGD TYPE P2     MONOCACY RIVER PLNT  SOURCE ?
   20.20 DRINK MD0100015 FREDERICK           POP   28000 Y        4 TGD TYPE P2I1   MONOCACY RIVER       SOURCE S
   20.20 DRINK MD0100015 FREDERICK           POP   28000 ?        0 TGD TYPE P3     FISHING CR TRMT PLT  SOURCE ?
   20.20 DRINK MD0100015 FREDERICK           POP   28000 Y        0 TGD TYPE P3I1   FISHING CREEK RESER  SOURCE S
   20.20 DRINK MD0100015 FREDERICK           POP   28000 ?        0 TGD TYPE P4     TUSCARORA TRTMT PLT  SOURCE ?
   20.20 DRINK MD0100015 FREDERICK           POP   28000 N        0 TGD TYPE P4I1   TUSCARORA CREEK      SOURCE S
   20.20 DRINK MD0002852 FT. DETRICK         POP    2000 ?       -1 TGD TYPE P1     TREATMENT PLANT      SOURCE ?
   20.20 DRINK MD0002852 FT. DETRICK         POP    2000 ?       -1 TGD TYPE P1I1   MONACY RIVER         SOURCE S
   20.20 DRINK 00000000  WALKERSVILLE WA     POP    1300 ?       -1 TGD TYPE P1     TREATMENT PLANT      SOURCE ?
   20.20 DRINK 00000000  WALKERSVILLE WA     POP    1300 ?       -1 TGD TYPE P1I1   RESERVOIR #1         SOURCE S
   20.20 PIPE  1 NPDES# MD0000761 LEHIGH PORT CEMENT - MOODSOFF  FLOW(TGD) 1850.00 -B SIC  3295  -1  -1
   20.20 PIPE  2 NPDES# MD0000761 LEHIGH PORT CEMENT - MOODSOFF  FLOW(TGD)    6.00 -P SIC  3295  -1  -1
   20.20 PIPE  1 NPDES# MD0022683 CRESTVIEW SERVICES, INC.  OFF  FLOW(TGD)   25.00 -P SIC  4952  -1  -1
   20.20 PIPE  1 NPDES# MD0022888 LAKE SPRING WATER COMPANY ON   FLOW(TGD)   10.00 -P SIC  4952  -1  -1
   20.20 PIPE  1 NPDES# MD0023558 FREDERICK CO METRO COMM-OLOFF  FLOW(TGD)   21.00 -P SIC  4952  -1  -1
   20.20 PIPE  1 NPDES# MD0025089 WHITE ROCK COMMUNITY-FREDEOFF  FLOW(TGD)   50.00 -P SIC  4952  -1  -1
   20.20 PIPE  1 NPDES# MD0052132 PACKAGING CORPORATION OF AOFF  FLOW(TGD)  150.00 -C SIC  3079  -1  -1
   20.20 PIPE  2 NPDES# MD0052132 PACKAGING CORPORATION OF AOFF  FLOW(TGD)  100.00 -C SIC  3079  -1  -1
   20.20 PIPE  3 NPDES# MD0052132 PACKAGING CORPORATION OF AOFF  FLOW(TGD)  158.00 -C SIC  3079  -1  -1
   20.20 PIPE  4 NPDES# MD0052132 PACKAGING CORPORATION OF AOFF  FLOW(TGD)    0.25 -B SIC  3079  -1  -1
   20.20 PIPE  5 NPDES# MD0052132 PACKAGING CORPORATION OF AOFF  FLOW(TGD)  150.00 -C SIC  3079  -1  -1
   20.20 PIPE  1 NPDES# MD0052183 MCCUTCHEON APPLE PRODUCTS,OFF  FLOW(TGD)    1.00 -P SIC  2033  -1  -1
   20.20 PIPE  2 NPDES# MD0052205 JENKINS FOODS CORP        OFF  FLOW(TGD)   10.00 -C SIC  2033  -1  -1
   20.20 PIPE  1 NPDES# MD0052469 WALKERSVILLE-BURGESS & COMOFF  FLOW(TGD)   50.00 -P SIC  4941  -1  -1
   20.20 PIPE  1 NPDES# MD0052981 WALKERSVILLE-BURGESS&COMMIOFF  FLOW(TGD)    6.00 -P SIC  4952  -1  -1

   20.20  02070009005/000.00  TYPE R  LEV 2  LENGTH  11.50  NAME MONOCACY R
                              5 DISCHARGES
   31.70 GAGE WEG02070009005      ?                   STCO    -1 DR     -1 ?   MF   996 LF    50
   31.70 PIPE  1 NPDES# MD0002038 ALPHA PORTLAND CEMENT CO  OFF  FLOW(TGD)   50.00 -C SIC  3241  -1  -1
   31.70 PIPE  1 NPDES# MD0020753 FREDERICK CO METRO DIST-ARON   FLOW(TGD)  100.00 -P SIC  4952  -1  -1
   31.70 PIPE  1 NPDES# MD0021580 FREDERICK COUNTY METROPOLION   FLOW(TGD) 6000.00 -P SIC  4952  -1  -1
   31.70 PIPE  1 NPDES# MD0021610 FREDERICK CITY WASTE WATERON   FLOW(TGD) 5000.00 -P SIC  4952  -1  -1
   31.70 PIPE  1 NPDES# MD0021822 FREDERICK CO METRO COMM-BAON   FLOW(TGD) 2000.00 -P SIC  4952  -1  -1

   31.70  02070009001/000.00  TYPE R  LEV 2  LENGTH   6.80  NAME MONOCACY R
                              0 DISCHARGES
   38.50 GAGE WEG02070009001      ?                   STCO    -1 DR     -1 ?   MF  1116 LF    58

   38.50  02070008013/000.00  TYPE R  LEV 1  LENGTH  11.80  NAME POTOMAC R
                              0 DISCHARGES
```

IV. MAPS from LOC

Plotting of data from the water quality files and the IHS files was available on a Calcomp plotter. Using the "TAGS" keyword, the dischargers and water quality stations are designated alphanumerically. Preceding the plots are the first page of the tag listings. Ambient water quality stations are designated alphabetically. The monitoring station used in the statistical screening model is shown by an arrow. Designation of water supplies, gages, and NPDES permitted dischargers are numerical. The plots show all water quality monitoring stations, as well as pipes, drinks and gages. Pipes are NPDES dischargers, drinks are water supply intakes and gages are flow gages. There is a maximum number of 300 tags and five maps per retrieval to avoid overprinting. Plots were done at different scales to determine the best presentation of the data. Scales selected were 1:250,000 and 1:1,000,000. Each of the areas analyzed is presented at these two scales to show both the larger overview, as well as the detailed location of the dischargers in relation to the monitoring station.

1. North Branch Potomac River

```
Jul 25 09:40 1986  cumber.250 Page 3

821  **    END MAP  #02   KMB90     7/16/86  8:02:31.30 PM JES 2590  FOREGROUND POINTS   80    BACKGROUND POINTS  11231
822  **    ---------------------------------------------------------------------------------------------------------------
823  **    END MAP  #03   KMB90     7/16/86  8:02:35.57 PM JES 2590  FOREGROUND POINTS   51    BACKGROUND POINTS  11231
824  **    ---------------------------------------------------------------------------------------------------------------
825  **    END MAP  #04   KMB90     7/16/86  8:02:38.63 PM JES 2590  FOREGROUND POINTS   35    BACKGROUND POINTS  11231
826  **    ---------------------------------------------------------------------------------------------------------------
827  **    END MAP  #05   KMB90     7/16/86  8:02:40.86 PM JES 2590  FOREGROUND POINTS   14    BACKGROUND POINTS  11231
828  **    ---------------------------------------------------------------------------------------------------------------
829  **
830  **       4 SITES WERE EXCLUDED FROM THE ABOVE MAPS DUE TO THE HIGH DENSITY OF TAGS IN THE AREA TO BE MAPPED
831  **
832  **    ---------------------------------------------------------------------------------------------------------------
833  **    END JOB          KMB90     7/16/86  8:02:40.87 PM JES 2590
834  **    ---------------------------------------------------------------------------------------------------------------
835 PGM=LOC (STORPLT) . . . . . . . . . . . . . . . . . . . . . NORMAL END
836
837 STORET RETRIEVAL DATE 86/07/16          PGM=LOC  -  VERSION OF FEB 28,1985
838
839 #101                    GAGE USGS0160000  0          N     39 33 59.0   78 50 25.0
840 #102                    DRIN MD0002550    LUKE-WESTVA     39 36  0.0   78 47  0.0
841 #103                    DRIN MD0002550    LUKE-WESTVA     39 36  0.0   78 47  0.0
842 #104                    DRIN MD0002663    BEL AIR-PIN     39 34  0.0   78 47  0.0
843 #105                    DRIN MD0002663    BEL AIR-PIN     39 36  0.0   78 47  0.0
844 #106                    PIPE  1 NPDES# M  D0022748 PI     39 34  0.0   78 50  0.0
845 #107                    PIPE  1 NPDES# M  D0033213 RA     39 32  0.0   78 53  0.0
846 #108                    PIPE  1 NPDES# M  D0024163 YO     39 34  5.0   78 50 41.0
847 #109                    PIPE  1 NPDES# M  D0053031 PH     39 33  0.0   78 50  0.0
848 #110                    PIPE  1 NPDES# W  V0020371 HE     39 38 20.0   78 46 40.0
849 #111                    PIPE  1 NPDES# W  V0024376 RI     39 38 20.0   78 46 10.0
850 #112                    GAGE USGS0160300  0          N     39 37 16.0   78 46 24.0
851 #113                    PIPE  1 NPDES# M  D0000663 CE     39 36  5.0   78 48 50.0
852 #114                    PIPE  2 NPDES# M  D0000663 CE     39 35 40.0   78 49  0.0
853 #115                    PIPE  3 NPDES# M  D0000663 CE     39 36 25.0   78 48 45.0
854 #116                    PIPE  1 NPDES# M  D0002216 PF     39 34 56.0   78 48  7.0
855 #117                    PIPE  1 NPDES# M  D0022659 AL     39 34 50.0   78 44 50.0
856 #118                    PIPE  1 NPDES# W  V0045012 SH     39 38  0.0   78 45  0.0
857 A0     112WRD  39062B079175901   39 06 28.0 079 17 59.0 2     0 WEIMER RN-A AB STONEY R DAM WVA  54057  WEST VIRGINIA   MINERAL
858 B0     112WRD  01595135          39 06 28.0 079 17 59.0 2     0 WYMER RN AB STONY R DAM LAKE WV  54057  WEST VIRGINIA   MINERAL
859 C0     112WRD  390640079181501  39 06 40.0 079 18 15.0 2     0 UP FDT STRIP MINE PIT AB STONY R 54057  WEST VIRGINIA   MINERAL
860 D0     112WRD  390640079181502  39 06 40.0 079 18 15.0 2     0 STRIP MINE PIT AB STONY R DAM WV 54057  WEST VIRGINIA   MINERAL
861 E0     112WRD  390645079181701  39 06 45.0 079 18 17.0 2     0 WEIMER RN-B AT STONEY R DAM WVA  54057  WEST VIRGINIA   MINERAL
862 F0     112WRD  01595140          39 06 45.0 079 18 17.0 2     0 WYMER RN AT STONY R DAM LAKE WV  54057  WEST VIRGINIA   MINERAL
863 G0     112WRD  391131079242401  39 11 31.0 079 24 24.0 2     0 ELK RN TREAT EFFL NR HENRY WV    54057  WEST VIRGINIA   MINERAL
864 H0     112WRD  391140079242001  39 11 40.0 079 24 20.0 2     0 S PR ELK RN NR HENRY WV          54057  WEST VIRGINIA   MINERAL
865 I0     112WRD  392616079120501  39 12 05.0 079 26 17.0 2     0 RT PRONG THREE FORKS RN-B NR VIN 24023  MARYLAND        GARRETT
866 J0     112WRD  01595547          39 12 05.0 079 26 17.0 2     0 TR PRG THREE FORKS RN NR E VINDE 24023  MARYLAND        GARRETT
867 K0     1113UPENPOTOMAC 024       39 12 25.0 079 25 44.0 2     0 ALP COAL DEAKIN CR.MOUTH AT POTO 54000  WEST VIRGINIA
868 L0     21WV7IW0550891            39 12 58.8 079 16 54.0 2     0 STONY RIVER BELOW MOUNT STORM DA 54023  WEST VIRGINIA   GRANT
869 M0     112WRD  01594916          39 13 08.0 079 28 42.0 2     0 LAUREL RN AT KEMPTON MD          24023  MARYLAND        GARRETT
870 N0     21WV7IW0550556            39 13 13.0 079 25 46.0 2     0 ELK RUN NEAR HENRY               54023  WEST VIRGINIA   GRANT
871 O0     1113NBMDNB POTOMAC 055    39 13 24.0 079 25 14.0 2     0 DOBBINS RUN RTE.90 BR. HENRY,WVA 54000  WEST VIRGINIA
872 P0     1113NBMDNB POTOMAC 003    39 13 29.0 079 25 25.0 2     0 ELK RUN RTE.90 BR.HENRY,WVA      54000  WEST VIRGINIA
873 Q0     112WRD  01594918          39 13 31.0 079 27 58.0 2     0 LAUREL RN NR KEMPTON MD          24023  MARYLAND        GARRETT
874 R0     1113NBMDNB POTOMAC 002    39 13 32.0 079 25 33.0 2     0 NB.PO.R. LOCAL BR.HENRY,WVA      54000  WEST VIRGINIA
875 S0     1113NBMDNB POTOMAC 012    39 13 52.0 079 13 00.0 2     0 ABRAM CR. RTE.42 BR. SE MT.STORM 54000  WEST VIRGINIA
876 T0     112WRD  391410079172801   39 14 10.0 079 17 28.0 2     0 C2-A-C STONY RIVER TRIB NR MT. S 54023  WEST VIRGINIA   GRANT
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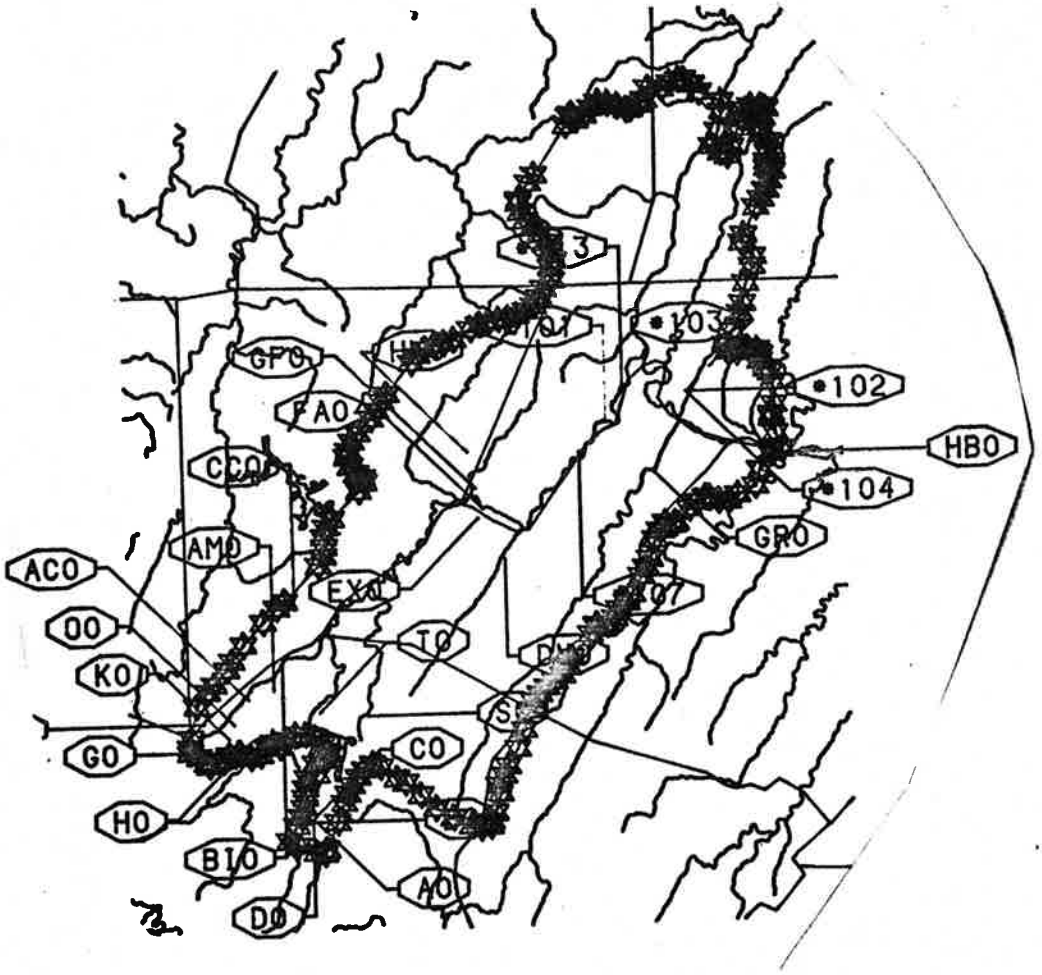

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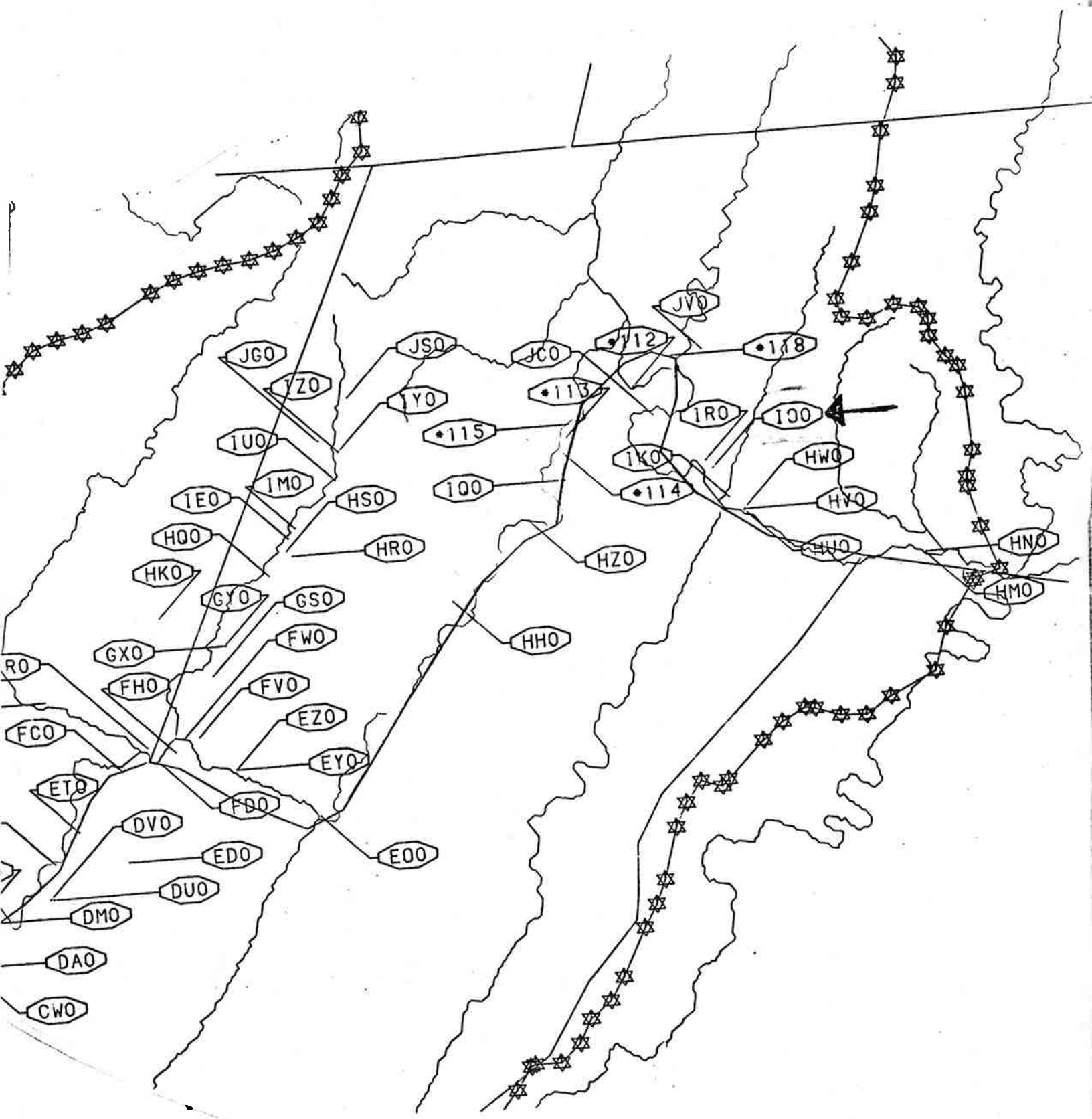

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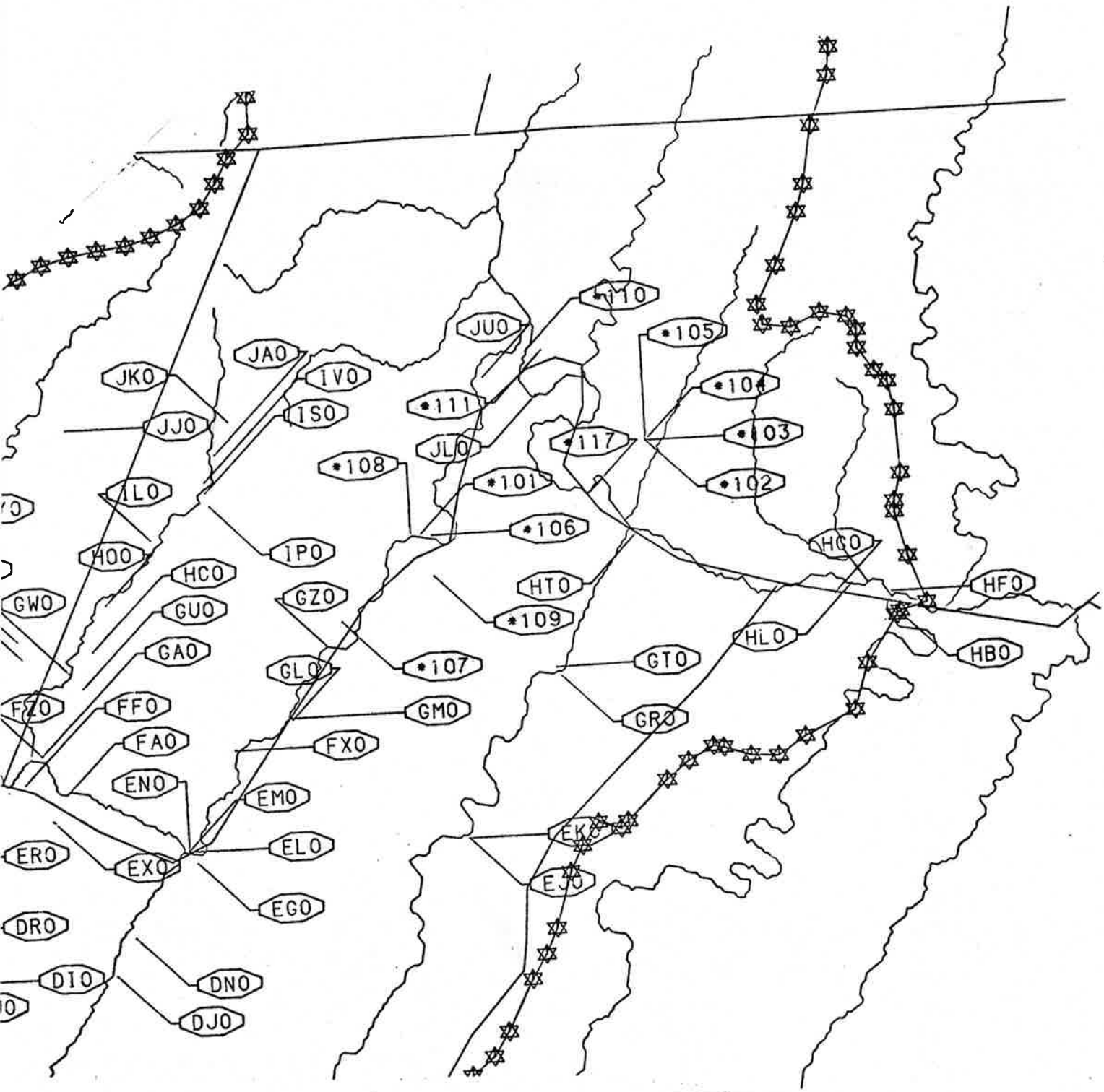

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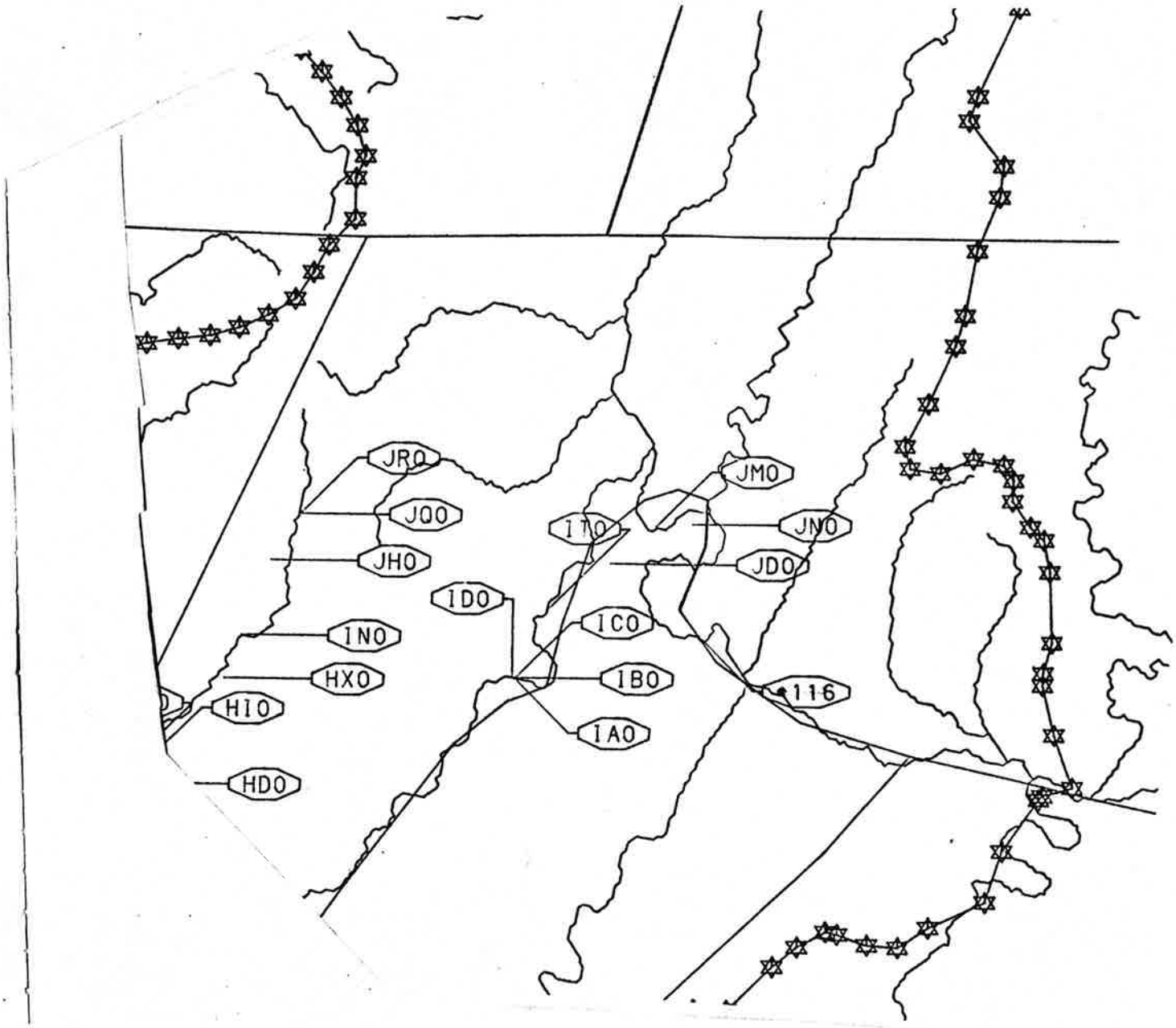

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2. South River

```
Jul  2 13:08 1986  south.scale Page 3

809  **
810  **   END MAP  #04  KMB80   7/ 1/86  8:31:58.02 PM JES 7480  FOREGROUND POINTS   8   BACKGROUND POINTS  16722
811  **
812  **   END JOB           KMB80     7/ 1/86  8:31:58.02 PM JES 7480
813  **
814 PGM=LOC (STORPLT). . . . . . . . . . . . . . . . . . .  NORMAL END
815
816 STORET RETRIEVAL DATE 86/07/01          PGM=LOC  -  VERSION OF FEB 28,1985
817
818 *101                      GAGE USGS0162600  0          S      38  3 27.0   78 54 30.0
819 *102                      GAGE USGS0162650  0          S      38  3 35.0   78 53 59.0
820 *103                      GAGE USGS0162730  0          S      38 12 10.0   78 50 10.0
821 *104                      PIPE  1 NPDES# V  A0001767 RE      38 15 30.0   78 48 30.0
822 *105                      PIPE  1 NPDES# V  A0001856 TH      38  3 34.0   78 53 20.0
823 *106                      PIPE  1 NPDES# V  A0001899 CR      38  3 47.0   78 53  9.0
824 *107                      PIPE  1 NPDES# V  A0002160 DU      38  3 31.0   78 53 28.0
825 *108                      PIPE  2 NPDES# V  A0002160 DU      38  3 34.0   78 53 20.0
826 *109                      PIPE  3 NPDES# V  A0002160 DU      38  3 36.0   78 53 14.0
827 *110                      PIPE  4 NPDES# V  A0002160 DU      38  3 38.0   78 53 12.0
828 *111                      PIPE  1 NPDES# V  A0002402 GE      38  5  0.0   78 52  0.0
829 *112                      PIPE  1 NPDES# V  A0025151 JA      38  4 47.0   78 52 27.0
830 *113                      PIPE  1 NPDES# V  A0027901 HA      38 13  0.0   78 50  0.0
831 *114                      PIPE  1 NPDES# V  A0054771 GR      38 15  0.0   78 50  0.0
832 *115                      PIPE  1 NPDES# V  A0065374 GR      38 16  0.0   78 50  0.0
833 A0    21VASWCB1BSTH033.50      38 00 49.0 078 59 54.0 1     0 SOUTH RIVER                      51015  VIRGINIA      AUGUSTA
834 B0    21VASWCB1BSTH030.80      38 02 24.0 078 57 06.0 1     0 SOUTH RIVER                      51015  VIRGINIA      AUGUSTA
835 C0    21VASWCB1BSTH038.50      38 02 36.3 079 01 57.1 1     0 SOUTH RIVER                      51015  VIRGINIA      AUGUSTA
836 D0    112WRD  01624660         38 02 38.0 079 05 17.0 2     0 CHRISTIANS CREEK NEAR STUARTS DR 51015  VIRGINIA      AUGUSTA
837 E0    21VASWCB1BSTH028.51      38 02 51.0 078 55 16.0 1     0 SOUTH RIVER                      51015  VIRGINIA      AUGUSTA
838 F0    21VASWCB1BSTH027.10      38 03 26.0 078 54 29.0 1     0 SOUTH RIVER                      51820  VIRGINIA      WAYNESB
839 G0    112WRD  01626000         38 03 27.0 078 54 30.0 2     0 SOUTH RIVER NEAR WAYNESBORO, VA  51820  VIRGINIA      WAYNESB
840 H0    1113PPWQPOTOMAC 060      38 03 38.0 078 53 44.0 2     0 SOUTH R. JAYNE ST.BR WAYNESBORO  51000  VIRGINIA
841 I0    1112A9WQUP-POT-059       38 03 38.0 078 53 49.0 2     0 SOUTH RIV AT RT 664 059          51013  VIRGINIA      ARLINGT
842 J0    21VASWCB1BSTH025.83      38 03 39.0 078 53 44.0 1     0 SOUTH RIVER                      51820  VIRGINIA      WAYNESB
843 K0    1113PENPOTOMAC 048       38 03 40.0 078 53 10.0 2     0 DUPONT CO. WAYNESBORO UPSTREAM   51000  VIRGINIA
844 L0    21VASWCB1BSTH025.27      38 03 40.0 078 53 15.0 1     0 SOUTH RIVER                      51820  VIRGINIA      WAYNESB
845 M0    112WRD  01626500         38 03 40.0 078 53 50.0 2     0 SOUTH RIVER AT WAYNESBORO, VA    51820  VIRGINIA      WAYNESB
846 N0    21VASWCB1BSTH024.73      38 04 05.0 078 53 05.0 1     0 SOUTH RIVER                      51820  VIRGINIA      WAYNESB
847 O0    1112A9WQUP-POT-060       38 04 09.0 078 53 06.0 2     0 SOUTH RIV AT BROAD WAYNESBORO 60 51013  VIRGINIA      ARLINGT
848 P0    1112A9WQER33             38 04 10.0 078 50 30.0 4     0 SOUTH R. AT RTE 250 WAYNESBORO,V 51015  VIRGINIA      AUGUSTA
849 Q0    21VASWCB1BSTH023.70      38 04 10.0 078 53 37.7 1     0 SOUTH RIVER                      51015  VIRGINIA      AUGUSTA
850 R0    21VASWCB1BSTH023.73      38 04 44.0 078 52 34.0 1     0 SOUTH RIVER                      51820  VIRGINIA      WAYNESB
851 S0    21VASWCB1BSTH022.19      38 05 21.0 078 52 38.0 1     0 SOUTH RIVER                      51015  VIRGINIA      AUGUSTA
852 T0    21VASWCB1BCST016.20      38 05 34.8 079 01 53.6 1     0 CHRISTIANS CREEK                 51015  VIRGINIA      AUGUSTA
853 U0    112WRD  01624670         38 05 42.0 079 05 15.0 2     0 FOLLY MILLS CREEK NEAR STAUNTON, 51015  VIRGINIA      AUGUSTA
854 V0    112WRD  01626900         38 05 46.0 078 48 38.0 2     0 SAWMILL RUN NEAR DOOMS, VA       51015  VIRGINIA      AUGUSTA
855 W0    1113PPWQPOTOMAC 061      38 06 26.0 078 51 45.0 2     0 SOUTH R. RTE 611 BR COINERS MILL 51000  VIRGINIA
856 X0    1112A9WQUP-POT-061       38 06 26.0 078 51 47.0 2     0 SOUTH RIV RT 611 DOOMS           51013  VIRGINIA      ARLINGT
857 Y0    21VASWCB1BSTH018.50      38 06 40.0 078 52 08.7 1     0 SOUTH RIVER                      51015  VIRGINIA      AUGUSTA
858 Z0    21VASWCB1BCST012.55      38 07 43.0 078 59 41.0 1     0 CHRISTIANS CREEK                 51015  VIRGINIA      AUGUSTA
859 AA0   21VASWCB1BCST006.43      38 08 01.9 078 57 56.0 1     0 CHRISTIANS CREEK                 51015  VIRGINIA      AUGUSTA
860 AB0   112WRD  01627000         38 08 36.0 078 48 54.0 2     0 MINE BRANCH NEAR CRIMORA, VA     51015  VIRGINIA      AUGUSTA
861 AC0   21VASWCB1BLEW007.06      38 09 00.8 079 03 37.5 1     0 LEWIS CREEK                      51790  VIRGINIA      STAUNTO
862 AD0   21VASWCB1BLEW006.93      38 09 04.8 079 03 33.3 1     0 LEWIS CREEK                      51790  VIRGINIA      STAUNTO
863 AE0   1112A9WQUP-POT-066       38 09 05.0 079 02 27.0 2     0 LEWIS CK RT 254 STAUNTON 066     51013  VIRGINIA      ARLINGT
864 AF0   21VASWCB1BLEW006.78      38 09 07.0 079 03 24.0 1     0 LEWIS CREEK                      51015  VIRGINIA      AUGUSTA
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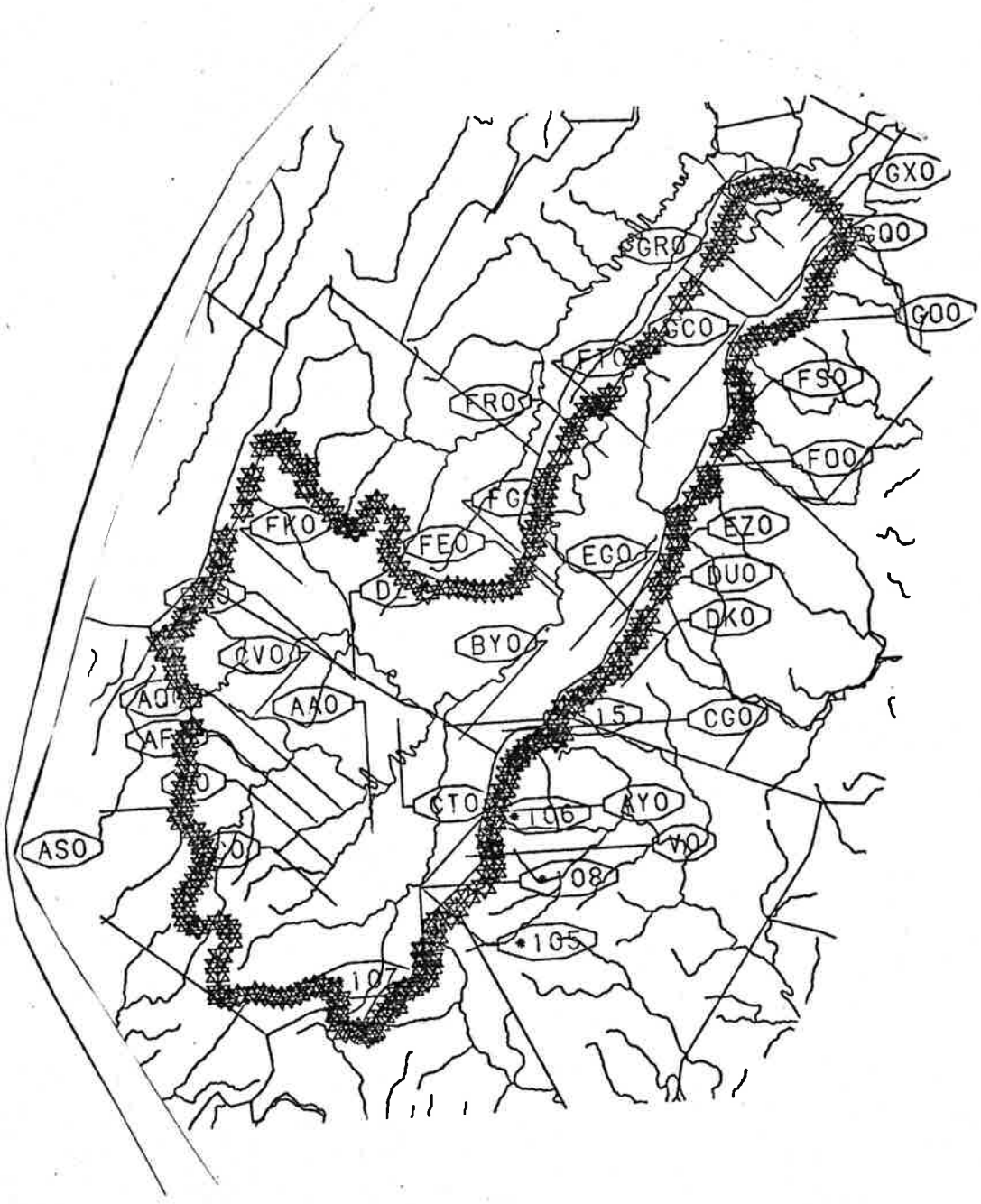

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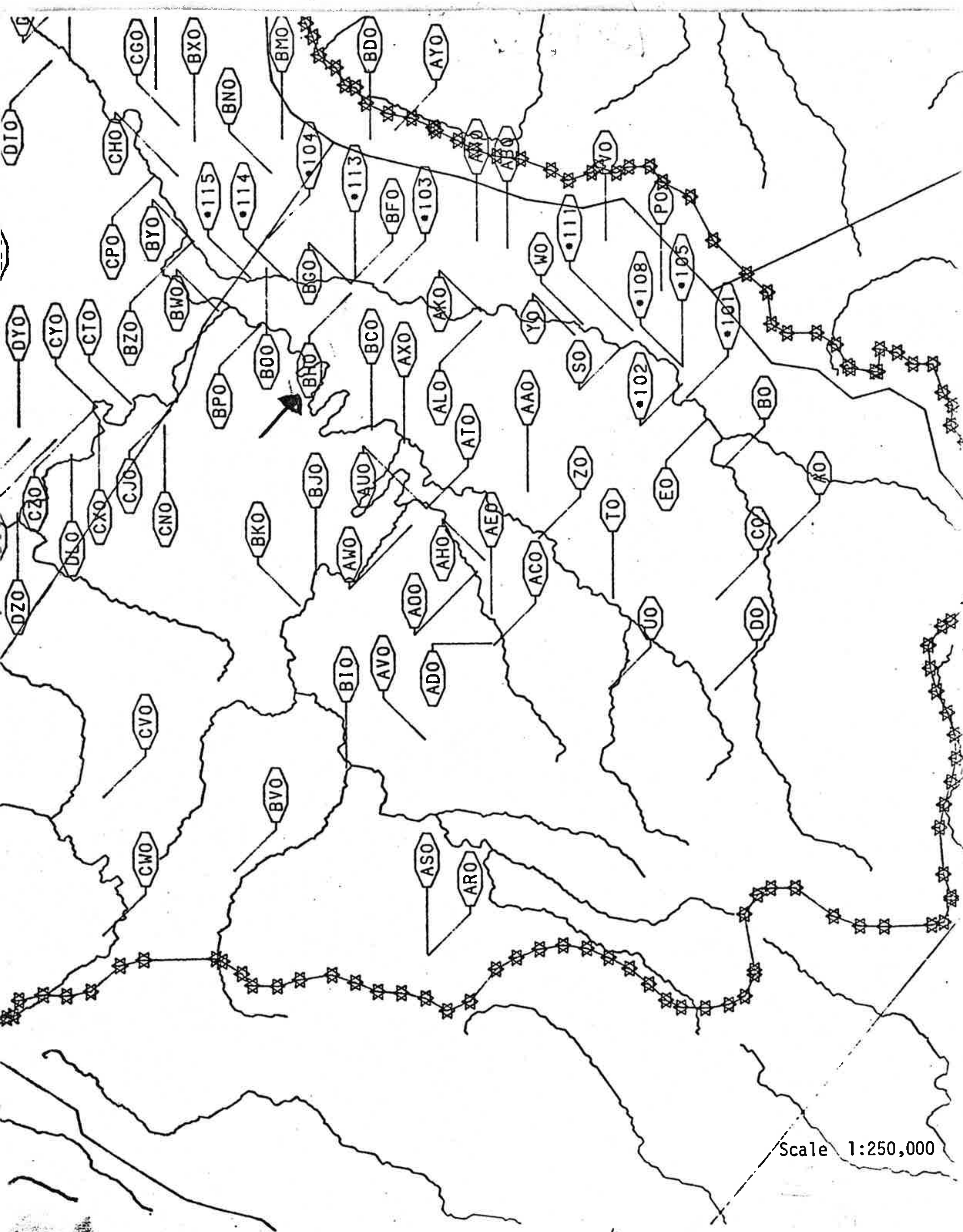
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ATO
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RO
CZO
CXO
CJO
CNO
BKO
BJO
AUO
AEO
TO
CO
DLO
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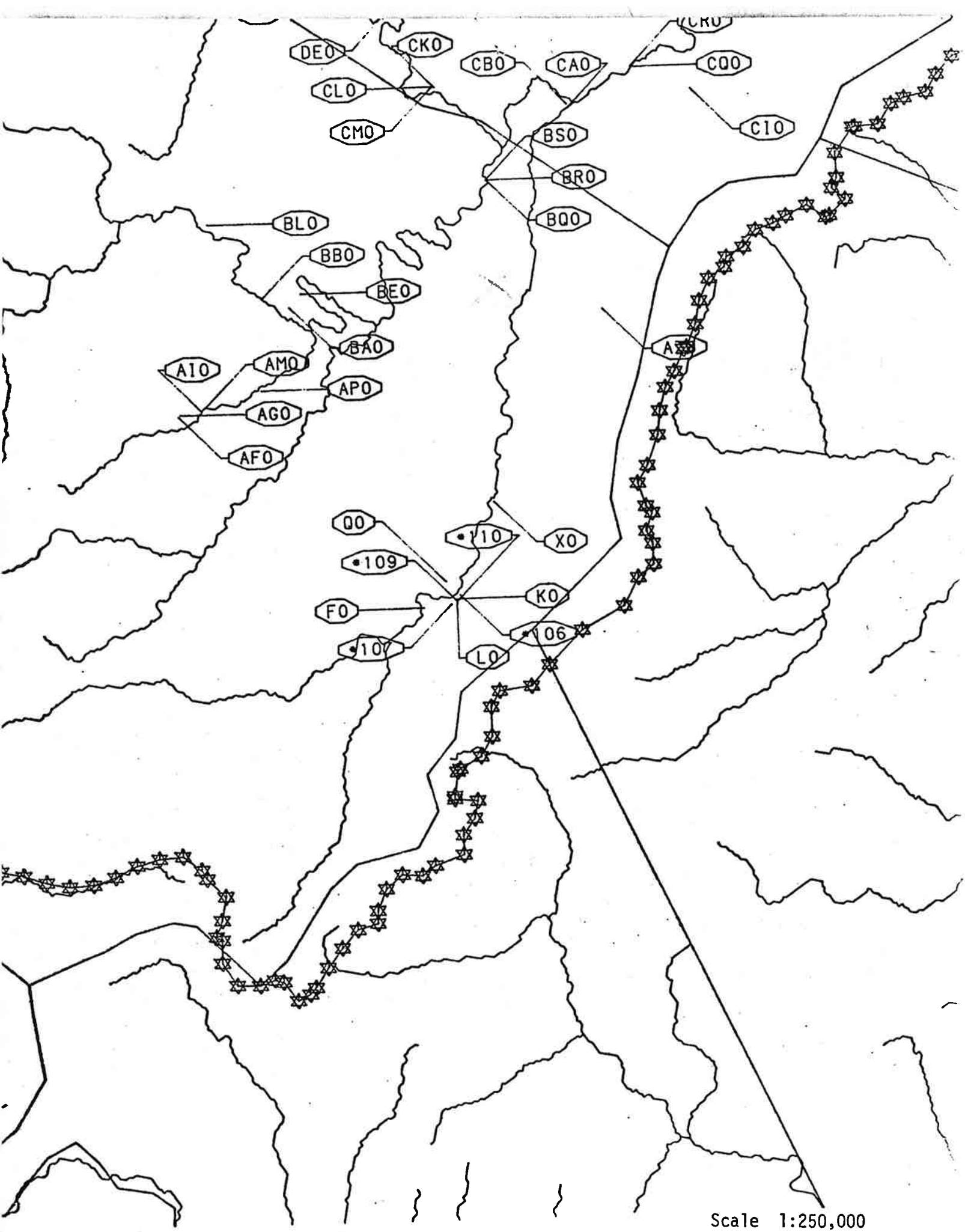
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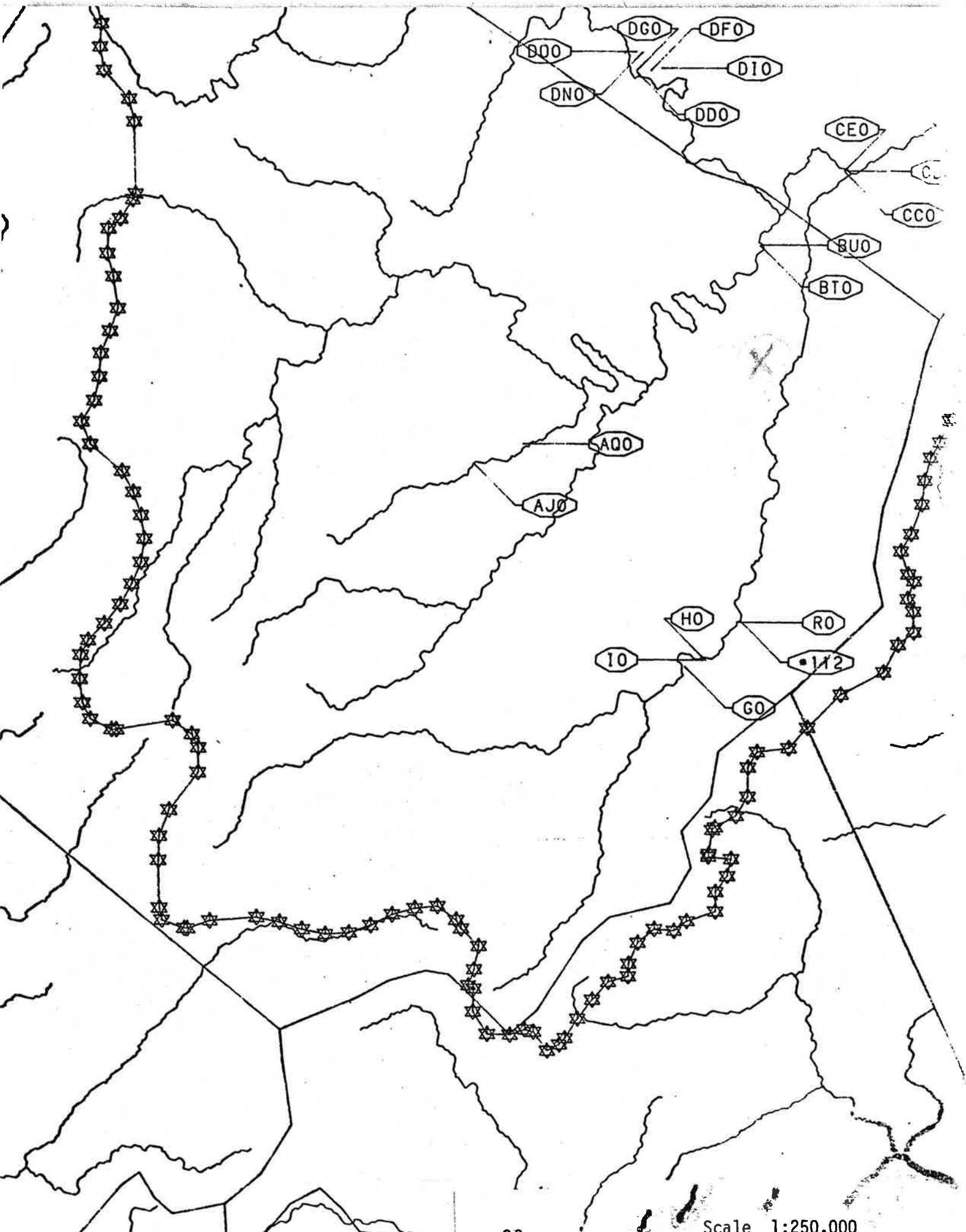

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3. Monocacy at Dickerson, Maryland

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Jul 18 13:20 1986  mondicr.250 Page 3

815  **   ------------------------------------------------------------
816  **    END MAP  #[illegible]   KMB27     7/16/86  8:08:14.55 PM JES 2627  FOREGROUND POINTS     63     BACKGROUND POINTS   6056
817  **   ------------------------------------------------------------  ------------------------------------------------------------
818  **    END MAP  #[illegible]3  KMB27     7/16/86  8:08:18.78 PM JES 2627  FOREGROUND POINTS     21     BACKGROUND POINTS   6056
819  **   ------------------------------------------------------------  ------------------------------------------------------------
82[illegible] **    END MAP  #[illegible]   KMB27     [illegible]  [illegible]:12 PM JES 2627  FOREGROUND POINTS     [illegible]     BACKGROUND POINTS   [illegible]
[illegible]  [illegible]   ------------------------------------------------------------  ------------------------------------------------------------
[illegible]  [illegible]   END MAP  [illegible]            [illegible]  [illegible] PM JES 2627  FOREGROUND POINTS     [illegible]     BACKGROUND POINTS   6056
[illegible]  [illegible]   ------------------------------------------------------------  ------------------------------------------------------------
[illegible]        END JOB  [illegible]              [illegible]  8:00:27.62 PM JES 2627
[illegible]  **   ------------------------------------------------------------
[illegible]  [illegible] ESTIMATE
82[illegible]                     * * * * * * * * * * * *   * * * *  NORMAL END
82[illegible] STORET RETRIEVAL DATE 86/07/16          PGM=LOC  -  VERSION OF FEB 28,1985
[illegible]
830 *101                        [illegible]  0        M     39 2[illegible] [illegible]    77 22 48.0
831 *10[illegible]                        [illegible]  5        B     39 21 [illegible]    77 25  1.0
832 *10[illegible]                        PIPE  1 NPDES# M  D0002038 AL    39 21  0.0    77 25  0.0
833 *104                        PIPE  1 NPDES# M  D0020753 FR    39 26  0.0    77 25  0.0
834 *105                        PIPE  1 NPDES# M  D0021580 FR    39 20  0.0    77 20  0.0
835 *106                        PIPE  1 NPDES# M  D0021610 FR    39 25 36.0    77 22 40.0
83[illegible] *10[illegible]                        PIPE  1 NPDES# M  D0021822 FR    39 21 50.0    77 24 34.0
837 *108                        GAGE USGS0164358  0        M     39 14 11.0    77 26 25.0
838 A0    112WRD  01643580      39 14 11.0 077 26 25.0 2  0 MONOCACY R NR DICKERSON, MD        24021  MARYLAND       FREDERI
839 B0    31POTOMAMON 0020      39 14 15.0 077 26 00.0 5  0                                    24021  MARYLAND       FREDERI
840 C0    1112A9WQUP-POT-113    39 14 38.0 077 26 26.0 2  0 MONOCACY RIV AT RT 28 MOUTH  113   24021  MARYLAND       FREDERI
841 D0    1112MDSTMD LITE SVY P33  39 14 40.0 077 26 20.0 2  0 MONOCAY RIVER AT FURNACE FORD  24000  MARYLAND
842 E0    11121TWRPOT-DON8-P33  39 14 40.0 077 26 20.0 2  0 MONOCACY RIVER AT FURNACE FORD    24000  MARYLAND
843 F0    21MDDEP MON0020       39 14 40.0 077 26 27.0 4  0 BRIDGE ON MD. ROUTE 28             24021  MARYLAND       FREDERI
844 G0    1113PPWQPOTOMAC 079   39 14 40.0 077 26 30.0 2  0 MONOCACY R. RTE 28 FURNACE FORD    24000  MARYLAND
845 H0    1112A9WQUP-POT-[illegible]  39 15 03.0 077 15 27.0 2  0 EVITTS RUN AT CLIPPS MILL    101   54021  WEST VIRGINIA  GILMER
846 I0    21MDEXP MON0004       39 15 25.4 077 27 16.0 1  0 C&O AQUEDUCT                       24021  MARYLAND       FREDERI
847 J0    21MDMONT70[illegible]         39 15 36.0 077 1[illegible] 11.0 2  0 L BENNETT CK AT KINGSLEY RD FORD  24031  MARYLAND       MONTGOM
848 K0    21MDEXP MON0041       39 15 51.1 077 26 22.9 1  0 BRIDGE ON PARK MILLS RD            24021  MARYLAND       FREDERI
849 L0    21MDMONT70040         39 16 13.0 077 15 03.0 2  0 LITTLE BENNETT CR AT ROUTE 121     24031  MARYLAND       MONTGOM
850 M0    21MDEXP MON00[illegible]        39 16 17.7 077 26 30.7 1  0 BRIDGE ON MARYLAND ROUTE 28        24021  MARYLAND       FREDERI
851 N0    21MDEXP UDP0005       39 1[illegible] 20.5 077 27 12.7 1  0 GREENFIELD ROAD BRIDGE, 1.0 MILE   24021  MARYLAND       FREDERI
852 O0    21MDMONT700[illegible]        39 16 24.0 077 17 34.0 2  0 UNK TRB LTL BENET C HYTSTN ML RD   24031  MARYLAND       MONTGOM
853 P0    21MDMONT70010         39 16 41.0 077 19 27.0 2  0 LITTLE BENNETT CR AT ROUTE 109     24031  MARYLAND       MONTGOM
854 Q0    1112A9WQUP-POT-135    39 16 47.0 077 16 23.0 2  0 STP CHARLESTOWN                    54037  WEST VIRGINIA  JEFFERS
855 R0    21MDMONT70070         39 16 55.0 077 17 07.0 2  0 LITTLE BENNETT WST OF LUSDALE RD   24031  MARYLAND       MONTGOM
856 S0    21MDEXP MON0062       39 17 34.9 077 26 21.0 1  0 LILY PONDS BRIDGE ON OLAND ROAD    24021  MARYLAND       FREDERI
857 T0    112WRD  01643500      39 17 40.0 077 24 30.0 2  0 BENNETT C AT PARK MILLS, MD        24021  MARYLAND       FREDERI
858 U0    21MDEXP UDI0003       39 17 40.7 077 26 46.5 1  0 OLAND ROAD BRIDGE, 0.5 MILE W LI   24021  MARYLAND       FREDERI
859 V0    21MDEXP BEN0010       39 18 00.8 077 25 23.9 1  0 MONOCACY BOTTOM RD CROSSING (IN    24021  MARYLAND       FREDERI
860 W0    21MDMONT70050         39 18 20.0 077 15 23.0 2  0 BENNETT CREEK AT BARNES ROAD       24031  MARYLAND       MONTGOM
861 X0    21MDEXP MON0096       39 19 33.8 077 24 55.2 1  0 BRIDGE ON MARYLAND ROUTE 80        24021  MARYLAND       FREDERI
862 Y0    1113PPWQPOTOMAC 080   39 19 35.0 077 24 48.0 2  0 MONOCACY R. RTE 80 BR E BUKYSTWN   24000  MARYLAND
863 Z0    21MDEXP RFR0001       39 19 52.4 077 25 37.3 1  0 ABOVE MOUTH OF STREAM ALONG MARY   24021  MARYLAND       FREDERI
864 AA0   112WRD  01643110      39 21 37.0 077 22 09.0 2  0 BUSH C AT REELS MILL MD            24021  MARYLAND       FREDERI
865 AB0   21MDEXP MON0128       39 21 47.3 077 24 36.9 1  0 250 YDS ABOVE MOUTH OF BALLENGER   24021  MARYLAND       FREDERI
866 AC0   21MDEXP BNG0005       39 21 51.1 077 25 06.2 1  0 BRIDGE ON US ROUTE 15              24021  MARYLAND       FREDERI
867 AD0   112WRD  01643125      39 21 52.0 077 25 01.0 2  0 BALLENGER C NR LIME KILN MD        24021  MARYLAND       FREDERI
868 AE0   1112A9WQUP-POT-112    39 21 53.0 077 24 00.0 2  0 MONOCACY RIV AT RT 7 DS            24021  MARYLAND       FREDERI
869 AF0   21MDEXP BSC0087       39 22 07.5 077 16 07.7 1  0 300 YARDS ABOVE UFH AND MONROVIA   24021  MARYLAND       FREDERI
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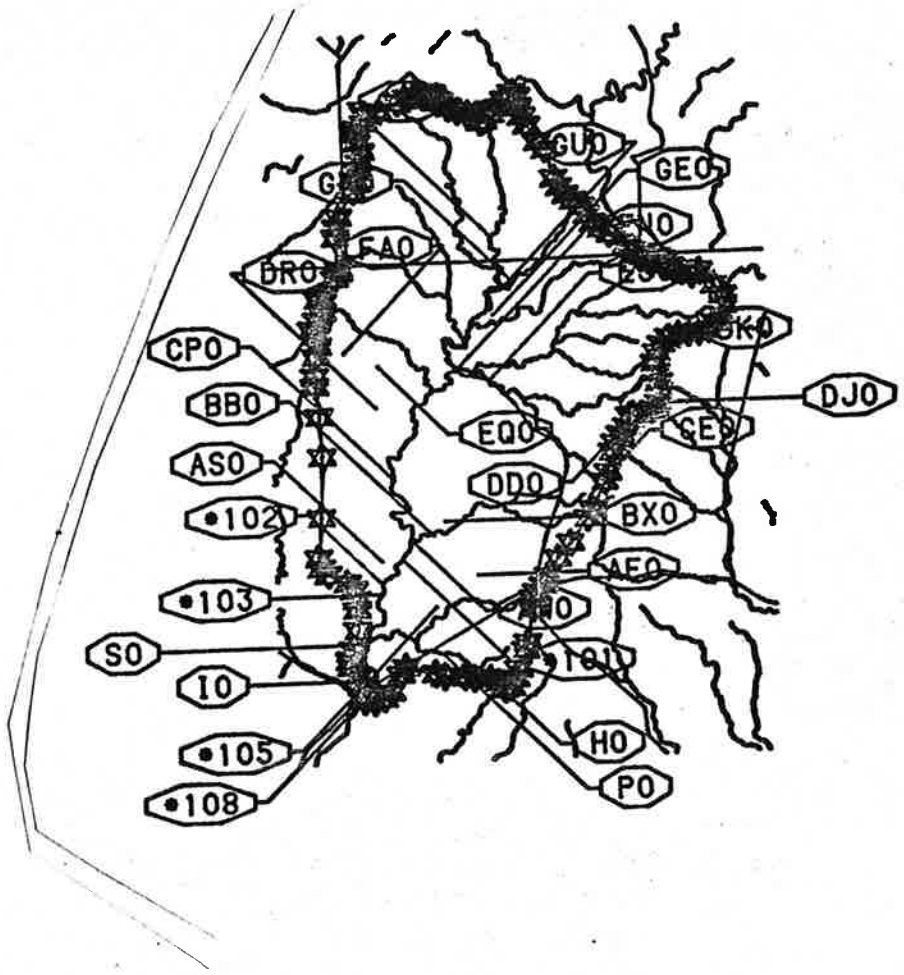

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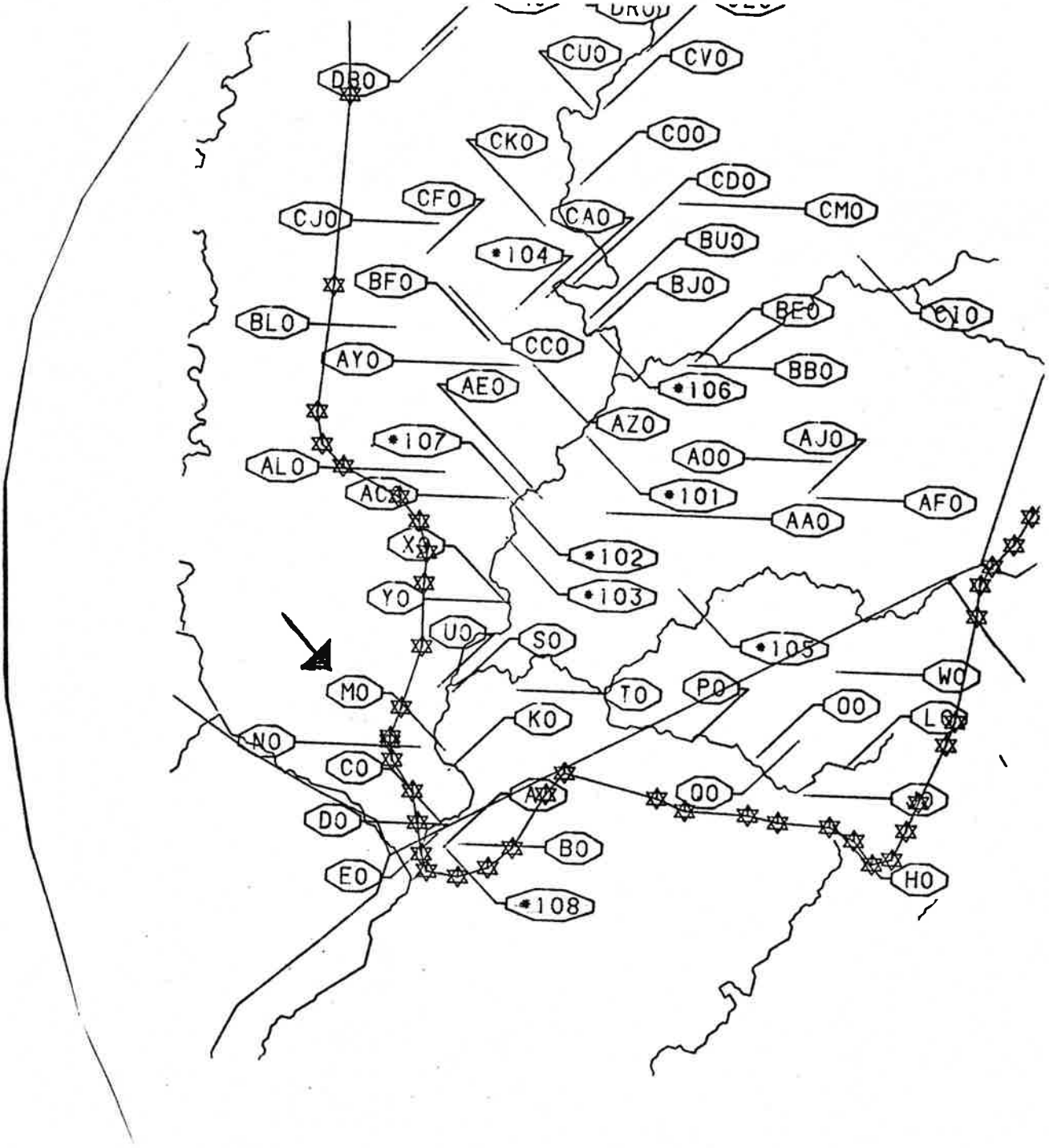

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4. Monocacy near Frederick, Maryland

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Aug  6 11:03 1986  monoc.2502 Page 3

818   **
819   **    END MAP  #02   KMB75     8/ 5/86  9:32:04.67 PM JES 5875  FOREGROUND POINTS   71    BACKGROUND POINTS  6056
820   **
821   **    END MAP  #03   KMB75     8/ 5/86  9:32:05.96 PM JES 5875  FOREGROUND POINTS   30    BACKGROUND POINTS  6056
822   **
823   **    END MAP  #04   KMB75     8/ 5/86  9:32:07.10 PM JES 5875  FOREGROUND POINTS   16    BACKGROUND POINTS  6056
824   **
825   **    END MAP  #05   KMB75     8/ 5/86  9:32:08.01 PM JES 5875  FOREGROUND POINTS    5    BACKGROUND POINTS  6056
826   **
827   **  END JOB          KMB75     8/ 5/86  9:32:08.02 PM JES 5875
828   **
829 PGM=LOC (STORPLT). . . . . NORMAL END
830
831 STORET RETRIEVAL DATE 86/08/05        PGM=LOC  -  VERSION OF FEB 28,1985
832
833 *101                    GAGE USGS0164100  0         H     39 35 40.0   77 23 50.0
834 *102                    GAGE USGS0164150  0         F     39 31 35.0   77 28  0.0
835 *103                    DRINK MD0100015   FREDERICK      39 26 37.0   77 23 33.0
836 *104                    DRINK MD0100015   FREDERICK      39 26 33.0   77 23 33.0
837 *105                    DRINK MD0100015   FREDERICK      39 31 30.0   77 27 43.0
838 *106                    DRINK MD0100015   FREDERICK      39 31 30.0   77 27 45.0
839 *107                    DRINK MD0100015   FREDERICK      39 28 50.0   77 27 35.0
840 *108                    DRINK MD0100015   FREDERICK      39 28 50.0   77 27 35.0
841 *109                    DRINK MD0002852   FT. DETRICK    39 27  0.0   77 26  0.0
842 *110                    DRINK MD0002852   FT. DETRICK    39 28  0.0   77 23  0.0
843 *111                    DRINK 00000000    WALKERSVILL    39 28 33.0   77 17  4.0
844 *112                    DRINK 00000000    WALKERSVILL    39 28 33.0   77 17  4.0
845 *113                    PIPE  1 NPDES# M  D0000761 LE    39 31 40.0   77 18  0.0
846 *114                    PIPE  2 NPDES# M  D0000761 LE    39 30 20.0   77 18  0.0
847 *115                    PIPE  1 NPDES# M  D0022683 CR    39 30 30.0   77 26 10.0
848 *116                    PIPE  1 NPDES# M  D0022888 LA    39 23 50.0   77 22  0.0
849 *117                    PIPE  1 NPDES# M  D0023558 FR    39 30 30.0   77 24  0.0
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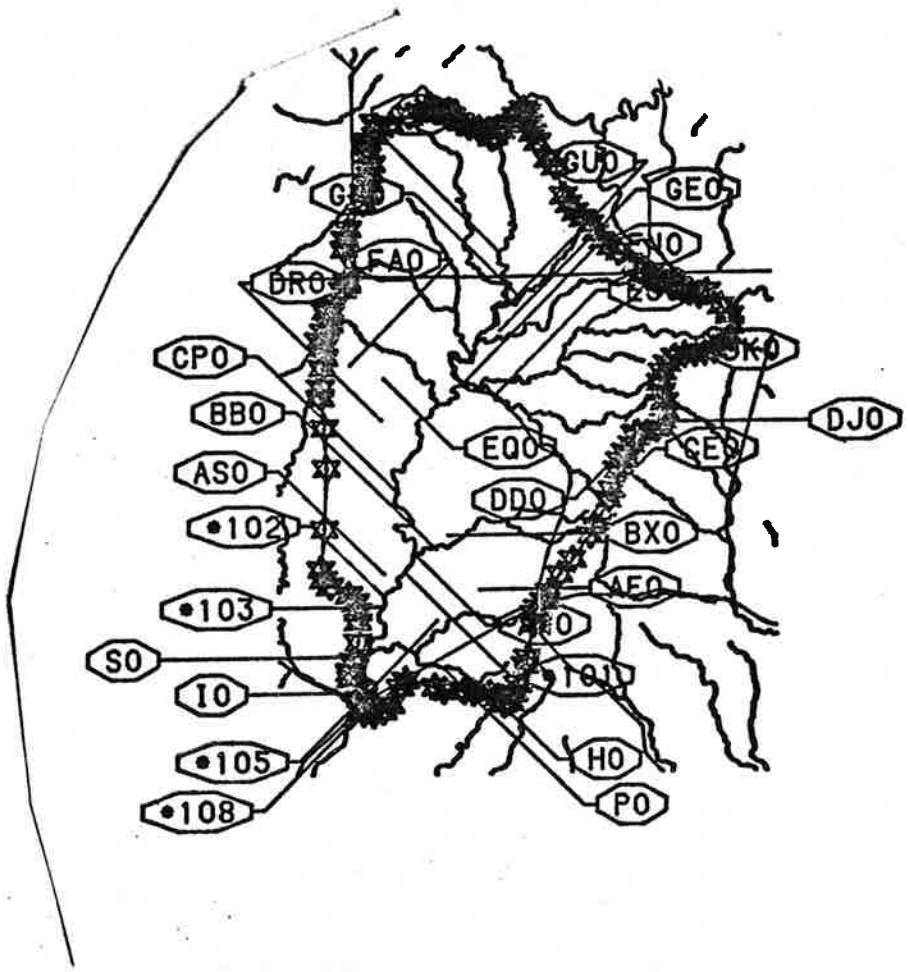
852 *120                    PIPE  2 NPDES# M  D0052132 PA    39 24 45.0   77 24 35.0
853 *121                    PIPE  3 NPDES# M  D0052132 PA    39 24 45.0   77 24 35.0
854 *122                    PIPE  4 NPDES# M  D0052132 PA    39 24 45.0   77 24 35.0
855 *123                    PIPE  5 NPDES# M  D0052132 PA    39 24 40.0   77 24 30.0
856 *124                    PIPE  1 NPDES# M  D0052183 MC    39 24 40.0   77 24 30.0
857 *125                    PIPE  2 NPDES# M  D0052205 JE    39 24 40.0   77 24 30.0
858 *126                    PIPE  1 NPDES# M  D0052469 WA    39 29 20.0   77 21 20.0
859 *127                    PIPE  1 NPDES# M  D0052981 WA    39 29  0.0   77 21  0.0
860 *128                    GAGE USGS0164300  0         M     39 23 16.0   77 22 48.0
861 *129                    GAGE USGS0164312  5         B     39 21 52.0   77 25  1.0
862 *130                    PIPE  1 NPDES# M  D0002038 AL    39 21  0.0   77 25  0.0
863 *131                    PIPE  1 NPDES# M  D0020753 FR    39 26  0.0   77 25  0.0
864 *132                    PIPE  1 NPDES# M  D0021580 FR    39 20  0.0   77 20  0.0
865 *133                    PIPE  1 NPDES# M  D0021610 FR    39 25 36.0   77 22 40.0
866 *134                    PIPE  1 NPDES# M  D0021822 FR    39 21 50.0   77 24 34.0
867 A0     112WRD  01643580          39 14 11.0 077 26 25.0 2     0 MONOCACY R NR DICKERSON, MD     24021  MARYLAND      FREDERI
868 B0     31POTOMAMON 0020          39 14 15.0 077 26 00.0 5     0                                 24021  MARYLAND      FREDERI
869 C0     1112A9UQUP-POT-113        39 14 38.0 077 26 26.0 2     0 MONOCACY RIV AT RT 28 MOUTH  113 24021  MARYLAND      FREDERI
870 D0     1113MCSTMC SITE SVY P33   39 14 40.0 077 26 20.0 2     0 MONOCAY RIVER AT FURNACE FORD   24000  MARYLAND
871 E0     11121TWQPOT-COMS-D331     39 14 40.0 077 26 20.0 2     0 MONOCACY RIVER AT FURNACE FORD  24000  MARYLAND
872 F0     21KDOEP MON0020           39 14 40.0 077 26 27.0 4     0 BRIDGE ON MD. ROUTE 28          24021  MARYLAND      FREDERI
873 G0     1113PPUQPOTOMAC 079       39 14 40.0 077 26 30.0 2     0 MONOCACY R. RTE 28 FURNACE FORD 24000  MARYLAND
```



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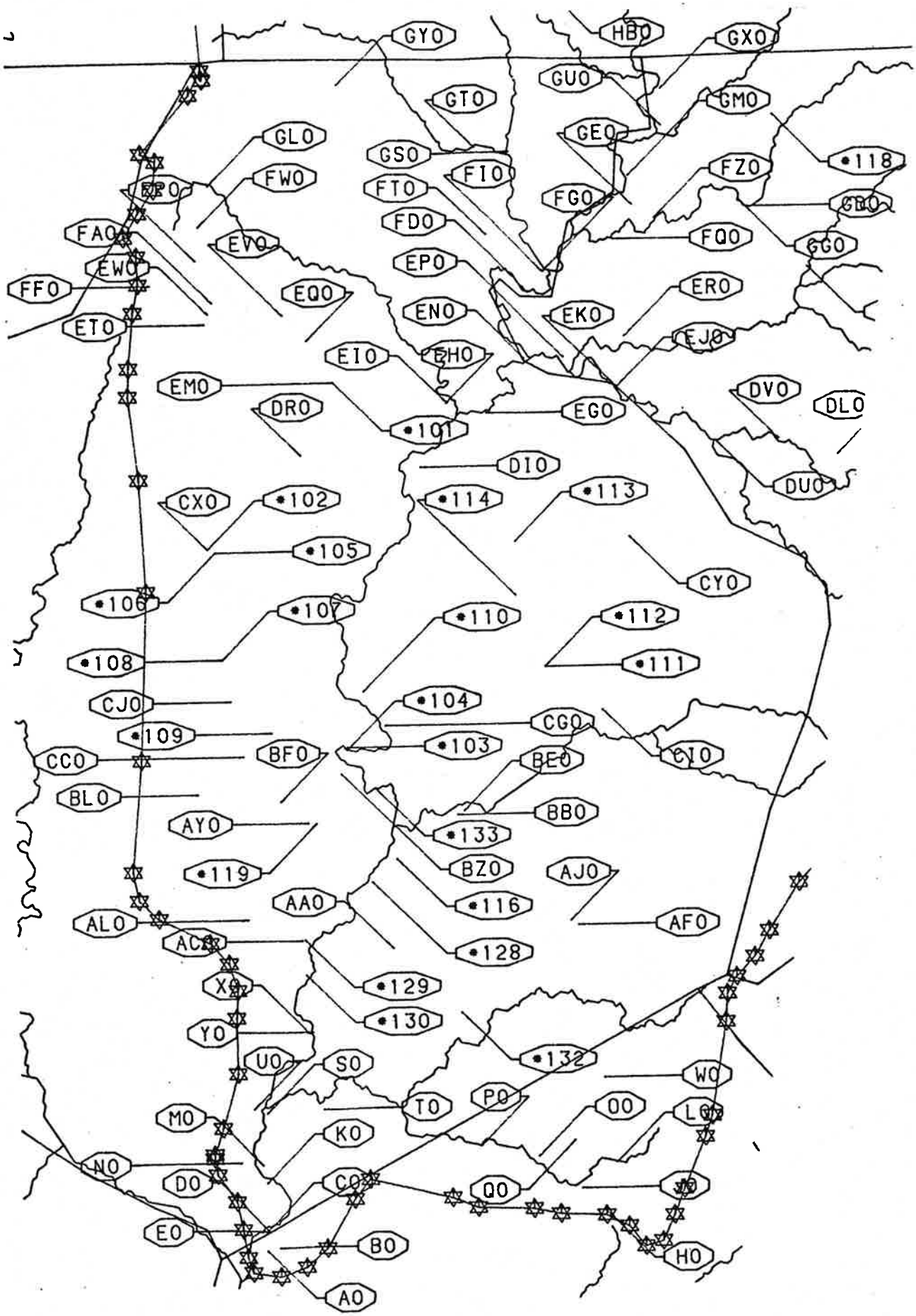

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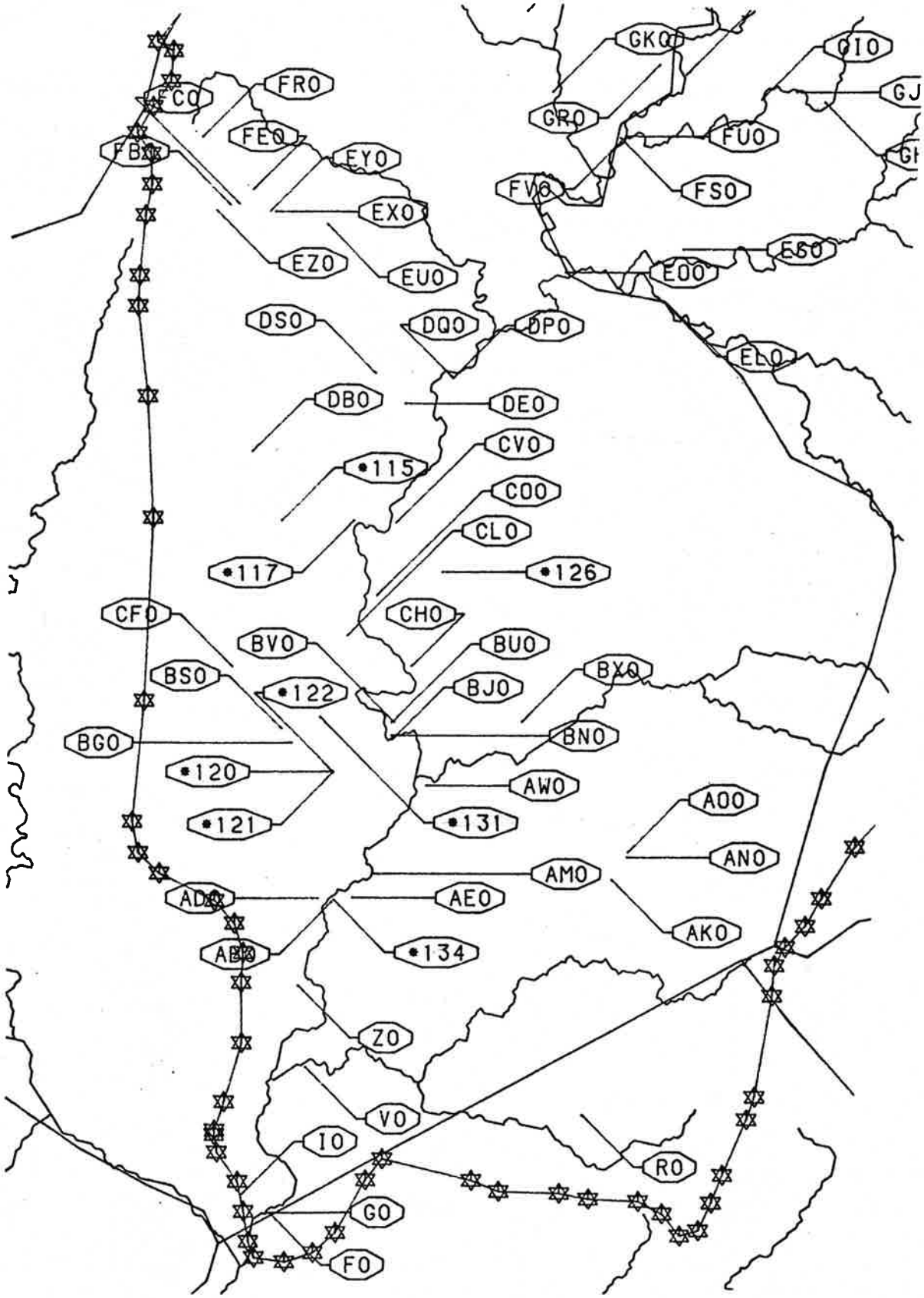

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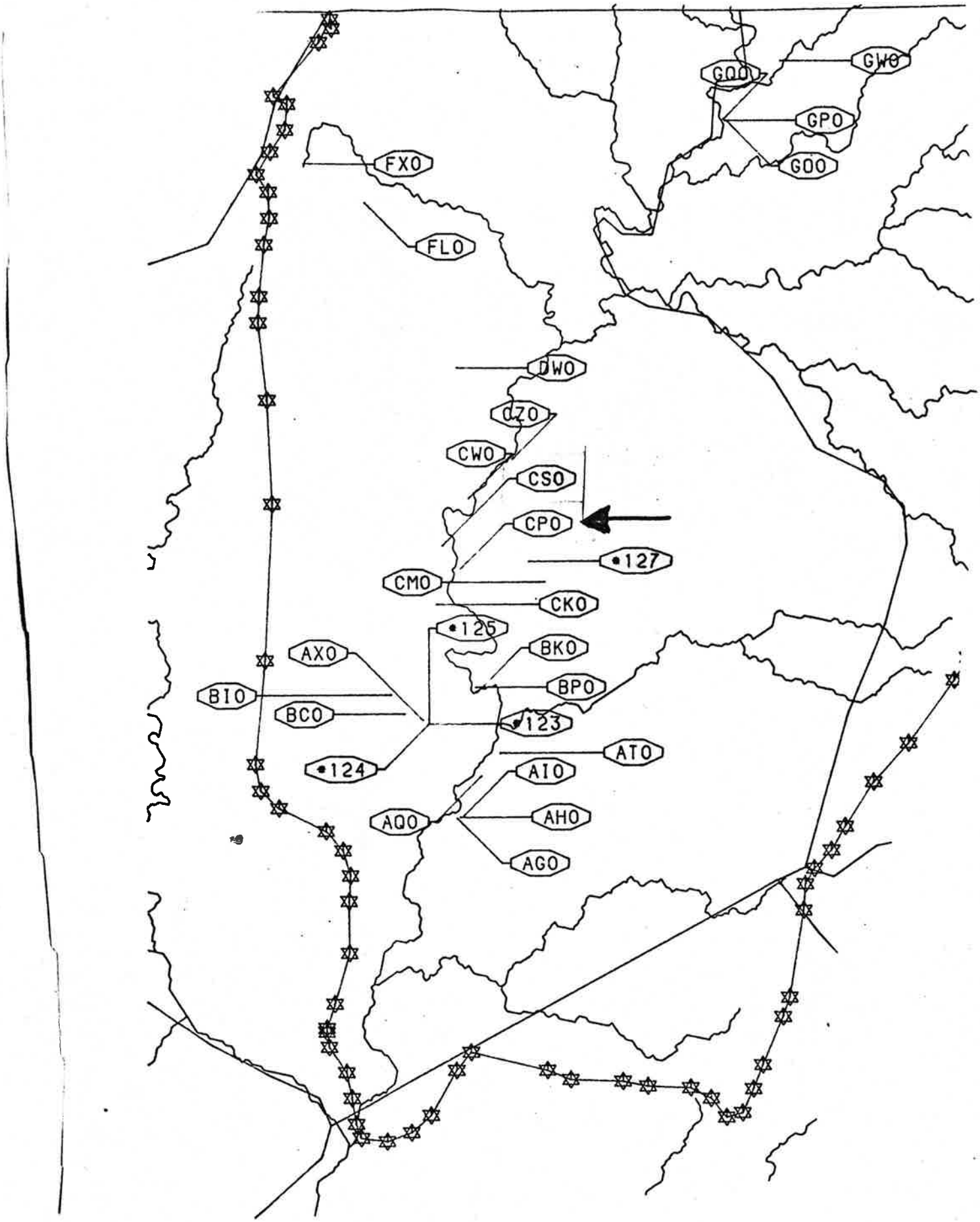

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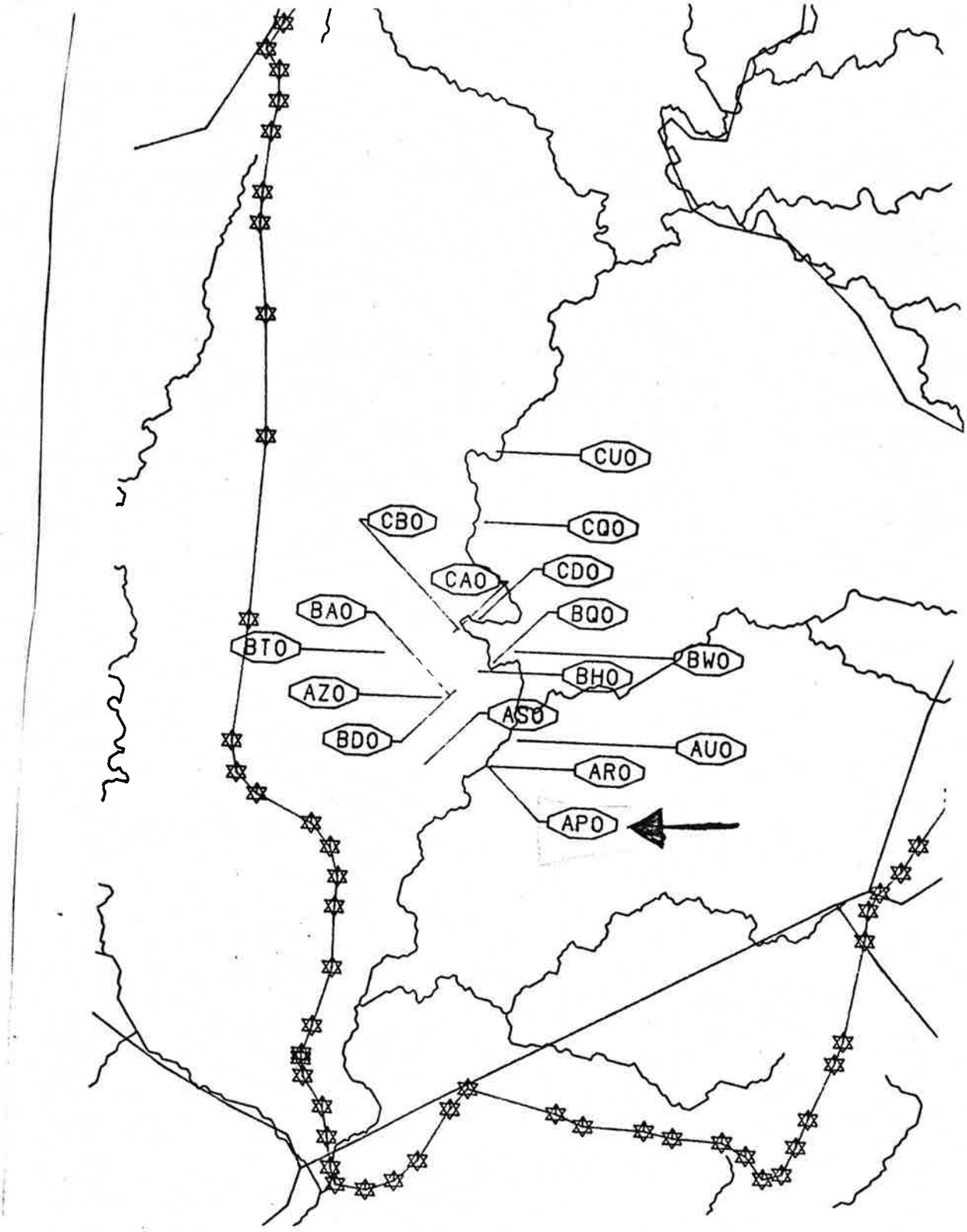

Scale 1:250,000

V. DISSOLVED OXYGEN OUTLIERS FROM PREVIOUS REPORT
(See April 1985 Report for full listing)

***** = deviations from standard error of regression (with flow)
+++++ = standardized distance from mean of previous observations (independent of flow)

Values flagged are greater than two standard deviations from the expected value. The listing of outliers includes--date, time, dissolved oxygen concentration (mg/l) and which method flagged the value. For the regression and standard normal residual analyses, please see the April 1985 report.

1. North Branch Potomac

74/08/19	1100	4.4	***** +++++
75/01/21	0945	13.2	+++++
78/02/21	0945	13.0	*****
78/05/16	0915	9.4	*****
79/12/17	1025	5.2	*****
81/01/20	0900	11.9	*****

2. South River

70/03/02	1215	14.0	***** +++++
71/03/08	1350	14.6	***** +++++
72/02/27	1115	11.6	*****
72/05/02	1730	4.4	***** +++++
74/05/17	1135	6.2	*****
77/02/01	1315	15.0	***** +++++
79/10/04	1115	8.8	*****
81/12/21	1315	14.2	***** +++++
82/12/16	1400	10.4	*****
83/01/18	1340	14.9	***** +++++
83/04/11	1415	11.0	*****

3. Monocacy at Dickerson

66/08/02	1140	7.1	*****
74/09/11	1300	15.5	***** +++++
75/02/11	1145	14.6	***** +++++
75/05/05	1110	7.8	*****
77/06/20	1750	5.0	*****
78/12/13	1020	13.6	***** +++++
79/03/12	1030	10.4	*****
79/04/10	1050	12.0	*****
79/12/03	1005	13.6	***** +++++
80/08/26	1135	11.9	*****

4. Monocacy Above Frederick

79/12/03	1225	15.0	***** +++++
83/01/27	0955	14.2	***** +++++

5. Monocacy Below Frederick

78/12/13	1320	13.5	***** +++++
79/12/03	1255	15.2	***** +++++
81/09/01	0935	5.4	*****
81/12/03	0950	12.1	*****
82/02/23	1030	11.6	*****
82/06/17	1155	7.8	*****

VI. DISCHARGE MONITORING REPORTS DATA

Monthly discharge monitoring reports were easily available from the state of Virginia. For each discharger on the South River, monthly DMR's were obtained and monthly values were ranked within the year. Parameters examined and ranked were BOD (Biological Oxygen Demand) and COD (Chemical Oxygen Demand). Months with ambient water quality outliers from the previous section are designated with two asterisks (**). The relationship between ambient water quality and permitted discharges is shown by an increased level of dissolved oxygen with a low level of discharge of selected parameters (BOD and COD). A ranking of 1 is the lowest concentration or load of the oxygen demanding substances. A load of 9999.00 indicates no data for that particular month. Daily operating logs would provide more accurate information, however these are not readily accessible and the monthly discharge monitoring reports provide sufficient detail for water management purposes at this beginning level. The data retrieved manually from the DMR's of Maryland include monthly average, maximum and minimum values. Future work will examine peak loads, in addition to the monthly averages, for all stations. Enforcement and other management activities would require a greater level of detail.

South River near Waynesboro

1977 (2/77)

COLUMN	NAME	COUNT	
C1	reybod	12	Reynolds Metals
C2	waynbod	12	Wayn-Tex
C3	wayncod	12	
C4	dupbod	12	Dupont
C5	dupcod	12	
C6	wborbod	12	Waynesboro STP

CONSTANTS USED: NONE

ROW	reybod	C7	(LBS/D)	
1	42.35	4		
2	32.56	2	**	
3	73.81	11		
4	65.59	8		
5	4399.00	12		
6	71.23	10		
7	53.73	7		
8	65.74	9		
9	49.39	6		
10	30.44	1		
11	40.47	3		
12	47.47	5		

ROW	waynbod	C8	(LBS/D)	
1	31.9	7		
2	18.2	2	**	
3	12.2	1		
4	26.9	4		
5	39.1	10		
6	27.2	5		
7	49.4	11		
8	77.0	12		
9	28.6	6		
10	34.8	8		
11	18.7	3		
12	38.1	9		

ROW	wayncod	C9	(LBS/D)	
1	746.0	12		
2	353.0	5	**	
3	431.0	7		
4	313.0	2		
5	474.0	9		
6	268.0	1		
7	457.0	8		
8	581.1	11		
9	336.5	3		
10	522.0	10		
11	351.6	4		
12	382.3	6		

ROW	dupbod	C10	(LBS/D)	
1	230	10.5		
2	230	10.5	**	
3	275	12.0		
4	136	4.5		
5	181	8.0		
6	150	6.0		

7	113	2.0
8	112	1.0
9	136	4.5
10	120	3.0
11	157	7.0
12	182	9.0

ROW	dupcod	C11	(LBS/D)
1	2713	11	
2	2235	3	**
3	2467	9	
4	2176	2	
5	2786	12	
6	2356	5	
7	2295	4	
8	2031	1	
9	2389	6	
10	2471	10	
11	2405	7	
12	2419	8	

ROW	wborbod	C12	(KG/D)
1	298.00	8	
2	265.00	6	**
3	464.00	11	
4	315.00	9	
5	523.00	12	
6	3.97	1	
7	352.00	10	
8	209.00	3	
9	222.00	4	
10	235.80	5	
11	143.10	2	
12	296.00	7	

1979 (10/79)

COLUMN	NAME	COUNT
C1	reybod	12
C2	waynbod	12
C3	dupbod	12
C4	dupcod	12
C5	wborbod	12
C6		12

C7	12
C8	12
C9	12
C10	12

CONSTANTS USED: NONE

ROW	reybod	C6	(LBS/D)
1	43.44	4.5	
2	32.56	2.0	
3	73.81	10.0	
4	65.59	8.0	
5	4399.00	12.0	
6	71.23	9.0	
7	55.28	7.0	
8	44.77	6.0	
9	76.05	11.0	
10	30.44	1.0	**
11	37.84	3.0	
12	43.44	4.5	

ROW	waynbod	C7	(LBS/D)
1	9999.0	9.5	
2	9999.0	9.5	
3	9999.0	9.5	
4	9999.0	9.5	
5	9999.0	9.5	
6	9999.0	9.5	
7	49.4	5.0	
8	77.0	6.0	
9	28.6	2.0	
10	34.8	3.0	**
11	18.7	1.0	
12	38.1	4.0	

ROW	dupbod	C8	(LBS/D)
1	230	9.5	
2	230	9.5	
3	275	11.0	
4	136	3.0	
5	181	8.0	
6	150	5.0	
7	600	12.0	
8	137	4.0	
9	114	2.0	
10	96	1.0	**
11	165	6.0	
12	166	7.0	

ROW	dupcod	C9	(LBS/D)
1	2713.0	11.0	
2	2235.0	5.0	
3	2467.0	7.5	
4	2176.0	3.0	
5	2786.0	12.0	
6	2356.0	6.0	
7	1163.3	2.0	
8	2467.0	7.5	
9	2529.0	9.0	
10	397.0	1.0	**
11	2610.0	10.0	
12	2212.0	4.0	

ROW	wborbod	C10	(KG/D)
1	298.00	7	
2	9999.00	12	
3	464.00	10	
4	315.00	8	
5	523.00	11	
6	3.97	1	
7	352.00	9	
8	232.00	3	
9	249.00	4	
10	274.20	6	**
11	143.10	2	
12	262.00	5	

1981 (12/81)

COLUMN	NAME	COUNT
C1	waynbod	12
C2	waynbod	12
C3	wayncod	12
C4	dupbod	12
C5	dupcod	12
C6	dup2cod	12
C7	dup3cod	12
C8	wborbod	12
C9	wbor2bod	12
C10		12
C11		12

```
C12                     12
C13                     12
C14                     12
C15                     12
C16                     12
C17                     12
C18                     12

CONSTANTS USED: NONE

 ROW    waynbod     C10   (KG/D)

   1    9999.00     9.5
   2    9999.00     9.5
   3    9999.00     9.5
   4    9999.00     9.5
   5    9999.00     9.5
   6    9999.00     9.5
   7      10.77     4.0
   8      14.27     6.0
   9       9.02     2.0
  10      10.62     3.0
  11      12.90     5.0
  12       7.10     1.0 **

 ROW   waynbod     C11   (LBS/D)

   1      16.6     3.0
   2      11.7     2.0
   3       7.0     1.0
   4      21.2     5.0
   5      19.5     4.0
   6      25.1     6.0
   7    9999.0     9.5
   8    9999.0     9.5
   9    9999.0     9.5
  10    9999.0     9.5
  11    9999.0     9.5
  12    9999.0     9.5 **

 ROW    wayncod     C12   (KG/D)

   1    9999.00     9.5
   2    9999.00     9.5
   3    9999.00     9.5
   4    9999.00     9.5
   5    9999.00     9.5
   6    9999.00     9.5
   7     101.50     3.0
   8     130.80     6.0
   9     100.10     2.0
  10     103.84     4.0
  11     108.20     5.0
  12      44.40     1.0 **
```

ROW	dupbod	C13	(KG/D)
1	9999.0	9.5	
2	9999.0	9.5	
3	9999.0	9.5	
4	9999.0	9.5	
5	9999.0	9.5	
6	9999.0	9.5	
7	41.8	4.0	
8	31.0	1.0	
9	35.0	2.0	
10	43.0	5.0	
11	53.0	6.0	
12	40.0	3.0	**

ROW	dupbod	C14	(LBS/D)
1	102	5.0	
2	126	6.0	
3	82	2.0	
4	83	3.0	
5	73	1.0	
6	88	4.0	
7	9999	9.5	
8	9999	9.5	
9	9999	9.5	
10	9999	9.5	
11	9999	9.5	
12	9999	9.5	**

ROW	dup2cod	C15	(KG/D)
1	9999	9.5	
2	9999	9.5	
3	9999	9.5	
4	9999	9.5	
5	9999	9.5	
6	9999	9.5	
7	936	5.0	
8	859	3.0	
9	976	6.0	
10	876	4.0	
11	783	2.0	
12	625	1.0	**

ROW	dup3cod	C16	(LBS/D)
1	2248	6.0	
2	2101	4.0	
3	1966	2.0	
4	2207	5.0	
5	1999	3.0	
6	1938	1.0	

```
  7      9999      9.5
  8      9999      9.5
  9      9999      9.5
 10      9999      9.5
 11      9999      9.5
 12      9999      9.5 **

 ROW   wborbod     C17   (MG/L)

  1        31     10.5
  2        30      9.0
  3        31     10.5
  4        25      7.5
  5        18      3.0
  6        14      1.0
  7        17      2.0
  8        20      5.0
  9      9999     12.0
 10        25      7.5
 11        19      4.0
 12        21      6.0 **

 ROW   wbor2bod    C18   (KG/D)

  1       235       9
  2       307      11
  3       242      10
  4       196       7
  5       154       3
  6       124       1
  7       161       4
  8       178       5
  9      9999      12
 10       213       8
 11       153       2
 12       180       6 **


1983 (1/83  and  4/83)

    12 ROWS READ

COLUMN     NAME        COUNT
C1         reybod         12
C2         waybod         12
C3         dupbod         12
C4         dupcod         12
C5         harrbod        12 Harriston STP
C6         harrbod5       12
C7         wborbod        12
C8         wborbod5       12

CONSTANTS USED: NONE
```

ROW	reybod	C9	(KG/D)
1	56.05	12	**
2	37.59	9	
3	34.51	8	
4	2.63	1	**
5	40.09	10	
6	33.94	7	
7	30.59	6	
8	20.89	5	
9	40.53	11	
10	14.72	4	
11	10.07	2	
12	12.68	3	

ROW	waybod	C10	(KG/D)
1	2.50	1	**
2	11.07	11	
3	8.03	10	
4	7.39	8	**
5	5.54	5	
6	5.74	6	
7	7.87	9	
8	4.93	4	
9	4.19	3	
10	15.28	12	
11	7.24	7	
12	3.55	2	

ROW	dupbod	C11	(KG/D)
1	35	8.0	**
2	41	11.5	
3	38	10.0	
4	37	9.0	**
5	27	4.0	
6	41	11.5	
7	22	1.0	
8	31	7.0	
9	27	4.0	
10	24	2.0	
11	28	6.0	
12	27	4.0	

ROW	dupcod	C12	(KG/D)
1	344	2	**
2	766	7	
3	791	8	
4	852	9	**
5	987	11	
6	151	1	
7	937	10	

8	995	12	
9	677	5	
10	393	3	
11	513	4	
12	684	6	

ROW	harrbod	C13	(MG/L)
1	13.4	1	**
2	27.7	8	
3	33.1	10	
4	9999.0	12	**
5	125.0	11	
6	22.0	3	
7	23.7	4	
8	14.0	2	
9	25.8	6	
10	24.3	5	
11	27.5	7	
12	28.8	9	

ROW	harrbod5	C14	(KG/D)
1	0.86	2	**
2	2.41	8	
3	2.38	7	
4	9999.00	12	**
5	8.90	11	
6	2.83	9	
7	1.53	3	
8	0.74	1	
9	1.76	6	
10	1.56	4	
11	1.67	5	
12	3.49	10	

ROW	wborbod	C15	(MG/L)
1	25	11.0	**
2	21	7.0	
3	19	5.5	
4	19	5.5	**
5	17	2.0	
6	16	1.0	
7	18	3.5	
8	23	9.0	
9	18	3.5	
10	22	8.0	
11	26	12.0	
12	24	10.0	

ROW	wborbod5	C16	(KG/D)
1	236	6	**
2	337	9	
3	354	10	**
4	415	11	
5	213	4	
6	149	1	
7	160	2	
8	229	5	
9	163	3	
10	270	7	
11	305	8	
12	435	12	

VII. CONCLUSIONS

The WQAB integrated data base system is a powerful tool for locating dischargers and their spatial location in relation to the fixed monthly ambient water quality monitoring stations. By being able to graphically show where the dischargers are in a very short period of time, one is able to use the statistical outliers of water quality and pinpoint which dischargers were potential problems during the period of record and which would be likely degraders of quality in the future. For those periods of statistical outliers, the discharge monitoring reports provide useful information for what point sources are entering the stream being analyzed.

The DMR data are reported as monthly averages, as well as with maximum and minimum monthly values. This frequency of reporting may not be sufficiently detailed to pinpoint the cause of outliers in the ambient quality. The operating logs of each facility often have daily reporting, but access to these is much more limited than the monthly values. Even without a laborious search of past daily data reports, the information provided by the techniques developed in this report is valuable. If a dissolved oxygen values comes up which is an outlier, it is easy to obtain a quick listing of dischargers on the stream reach which could affect the quality. The date of the outlier will be compared with discharge data for a similar time period. Violations of permit requirements will be one of the initial data files examined. This will provide the data manager with a relatively small number of permits to cross reference with outlier information. By eliminating all dischargers who are not on the reach in question, the water quality manager would have reduced his sleuthing tasks to a manageable number. Therefore, what comes from this technique is immediate use of water quality monitoring data.

As previously stated, and extremely important, the dischargers are not necessarily the only cause of water quality degradation (ie: outliers), but they provide a good starting point. If the dischargers are shown to all be in compliance during outlier events, two possibilities exist. The first is that the cause is from a non-permitted facility, most likely nonpoint pollution sources. The second possibility is that the permits on the stream reach of interest are not satisfactorily addressing the water quality issues. If the number of outliers is small and wide spread, then the permits are probably satisfactory. However, if there is suddenly change and outliers are grouped together, something is amiss and should be investigated further. Analysis using the statistical outlier looks at more than water quality standard violations. If a dissolved oxygen reading is above a standard, such as 4.0 mg/l,

there may be a degradation of water quality which isn't noticed. Using the statistical outlier tool and the historic record, a change in quality would be noted much earlier than if the manager waited for values to fall below the 4.0 mg/l standard. With a minimum of additional work, it is possible to anticipate water quality violations and determine whether a discharger is having difficulties. Trends may be established which would not be readily discovered using other methods of water quality analysis.

By using readily available data bases (Storet and the WQAB system) and simple statistics, a manager may use the techniques developed here without any major change in daily operation of tracking water quality in his or her area. The output from the process is gross, however it permits the use of data already available to be used in another manner to provide additional analysis.