pennsylvania
DEPARTMENT OF ENVIRONMENTAL PROTECTION

Bureau of Waterways Engineering
Division of Dam Safety
Rachel Carson State Office Building
P.O. Box 8554 • Harrisburg, PA 17105-8554
Office: (717) 787-8568 • Fax: (717) 772-0409

RECEIVED
BY:
SEP 29 2009

TRANSMITTAL FORM

TO: Mr. Rick Smith	Date: September 25, 2009
East Goshen Township	Dam No. D15-125 (Hershey Mill)
1580 Paoli Pike	Re: Dam Breach Analysis
West Chester, PA 19380	

ATTACHED ARE THE FOLLOWING ITEMS:

- ☐ PLANS
- ☐ SPECIFICATIONS
- ☐ DESIGN CHANGES/COMMENTS
- ☐ ENGINEERS REPORT
- ☐ COPY OF LETTER
- ☐ FACT SHEETS
- ☐ APPLICATION FORMS
- ☐ ENFORCEMENT ACTION
- ☒ _____

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REMARKS:

Rick,

Attached are darker copies of the information you requested.

COPY TO: _____ _____ _____ _____ _____ _____

SIGNED: [signature]

Rev.: 08/2009

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*************************************
                                    *
 FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *
            JUN   1998              *
         VERSION 4.1                *
                                    *
RUN DATE   08SEP06  TIME  10:47:09  *
                                    *
*************************************
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*************************************
*                                   *
*   U.S. ARMY CORPS OF ENGINEERS    *
*   HYDROLOGIC ENGINEERING CENTER   *
*         609 SECOND STREET         *
*      DAVIS, CALIFORNIA 95616      *
*          (916) 756-1104           *
*                                   *
*************************************
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X     X  XXXXXXXX   XXXXX          X
X     X  X        X     X        XX
X     X  X        X               X
XXXXXXX  XXXX     X       XXXXX   X
X     X  X        X               X
X     X  X        X     X         X
X     X  XXXXXXXX   XXXXX        XXX
```

THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1KW.

THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE.
THE DEFINITION OF -AMSKK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN77 VERSION
NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE . SINGLE EVENT DAMAGE CALCULATION. DSS:WRITE STAGE FREQUENCY,
DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL LOSS RATE:GREEN AND AMPT INFILTRATION
KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM

```
     LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

FREE ***
       1           ID   HERSHEY MILL DAM  D15-125       9/08/06
       2           ID    DOWNSTREAM HAZARD EVALUATION
       3           IT       5       0       0     300
       4           ID       5
       5           JP       3
       6           JR    PREC       1    0.44

       7           KK  RUNOFF
       8           BA     1.8
       9           KM       FILE \HEC1\SCSTII
      10           IN       6
      11           PB    8.15
      12           PC       0   0.101   0.202   0.305   0.408   0.513   0.618   0.725   0.832   0.941
      13           PC    1.05   1.161   1.272   1.385   1.498   1.613   1.728   1.845   1.962   2.081
      14           PC    2.20   2.321   2.442   2.565   2.688   2.813   2.938   3.065   3.192   3.321
      15           PC    3.45   3.581   3.712   3.845   3.978   4.113   4.248   4.385   4.522   4.661
      16           PC    4.80   4.941   5.084   5.229   5.376   5.525   5.676   5.829   5.984   6.141
      17           PC    6.30   6.461   6.624   6.789   6.956   7.125   7.296   7.469   7.644   7.821
      18           PC    8.00   8.181   8.364   8.549   8.736   8.925   9.116   9.309   9.504   9.701
      19           PC     9.9   10.10  10.304  10.509  10.716  10.925  11.136  11.349  11.564  11.781
      20           PC      12  12.225   12.46  12.705   12.96  13.225    13.5  13.785   14.08  14.385
      21           PC    14.7   15.02   15.34   15.66   15.98    16.3  16.628  16.972  17.332  17.708
      22           PC    18.1  18.512  18.948  19.408  19.892    20.4   20.94   21.52   22.14    22.8
      23           PC    23.5  24.268  25.132  26.092  27.148    28.3  30.684  35.436  43.079  56.786
      24           PC    66.3  68.196  69.864  71.304  72.516    73.5  74.344  75.136  75.876  76.564
      25           PC    77.2  77.796  78.364  78.904  79.416    79.9   80.36    80.8   81.22   81.62
      26           PC      82  82.367  82.726  83.079  83.424  83.763  84.094  84.419  84.736  85.047
      27           PC   85.35  85.647  85.936   86.22  86.494  86.763  87.024   87.28  87.526   87.77
      28           PC      88  88.229  88.455  88.679    88.9  89.119  89.335  89.549   89.76  89.969
      29           PC  90.175   90.38   90.58   90.78  90.975   91.17   91.36   91.55  91.735  91.919
      30           PC    92.1  92.279  92.455  92.629    92.8  92.969  93.135  93.299   93.46  93.619
      31           PC  93.775   93.93   94.08   94.23  94.375   94.52   94.66    94.8  94.935  95.069
      32           PC    95.2   95.33   95.46   95.59  95.716  95.844   95.97    96.1  96.224   96.35
      33           PC  96.475    96.6  96.724   96.85   96.97  97.094  97.216   97.34   97.46   97.58
      34           PC    97.7   97.82   97.94  98.058  98.176  98.294   98.41  98.528  98.644   98.76
      35           PC  98.875   98.99  99.104   99.22   99.33  99.444  99.556   99.67   99.78   99.89
      36           PC     100
      37           LS       0      64
      38           UD    0.74

      39           KK     DAM
      40           RS       1    ELEV     448
      41           SA       0       7      10
      42           SE     437     448   450.5
      43           SS     448      22     2.7     1.5
      44           ST   450.5     500     2.7     1.5
      45           KP       2
      46           KM   100 YR BREACH
      47           SB  443.25      40       1     0.5  451.64
      48           KP       3
      49           SB   442.7      40       1     0.5  450.08
```

```
LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

  50          KK  GRHLRD
  51          RS       1    ELEV   435.5
  52          SA       0       1     2.6
  53          SE   435.5     440     450
  54          SQ       0    14.4    53.5     136     224     292     359     395
  55          SE   435.5     436     437     438     439     440     441     442
  56          ST     442     500    2.65     1.5
  57          ZZ
```

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*************************************
                                    *
 FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *
            JUN   1998              *
         VERSION 4.1                *
                                    *
RUN DATE   08SEP06  TIME  10:47:09  *
                                    *
*************************************
```

```
*************************************
*                                   *
*   U.S. ARMY CORPS OF ENGINEERS    *
*   HYDROLOGIC ENGINEERING CENTER   *
*         609 SECOND STREET         *
*      DAVIS, CALIFORNIA 95616      *
*          (916) 756-1104           *
*                                   *
*************************************
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                    HERSHEY MILL DAM  D15-125       9/08/06
                     DOWNSTREAM HAZARD EVALUATION

4 IO          OUTPUT CONTROL VARIABLES
                   IPRNT          5  PRINT CONTROL
                   IPLOT          0  PLOT CONTROL
                   QSCAL         0.  HYDROGRAPH PLOT SCALE

 IT           HYDROGRAPH TIME DATA
                    NMIN          5  MINUTES IN COMPUTATION INTERVAL
                   IDATE      1    0  STARTING DATE
                   ITIME       0000  STARTING TIME
                      ND        300  NUMBER OF HYDROGRAPH ORDINATES
                  NDDATE      2    0  ENDING DATE
                  NDTIME       0055  ENDING TIME
                   ICENT         19  CENTURY MARK

             COMPUTATION INTERVAL     .08 HOURS
                  TOTAL TIME BASE   24.92 HOURS

     ENGLISH UNITS
          DRAINAGE AREA         SQUARE MILES
          PRECIPITATION DEPTH   INCHES
          LENGTH, ELEVATION     FEET
          FLOW                  CUBIC FEET PER SECOND
          STORAGE VOLUME        ACRE-FEET
          SURFACE AREA          ACRES
          TEMPERATURE           DEGREES FAHRENHEIT

 JP          MULTI-PLAN OPTION
                   NPLAN          3  NUMBER OF PLANS

 JR          MULTI-RATIO OPTION
                RATIOS OF PRECIPITATION
               1.00       .44
```

PEAK FLOW AND STAGE (END-OF-PERIOD) SUMMARY FOR MULTIPLE PLAN-RATIO ECONOMIC COMPUTATIONS
FLOWS IN CUBIC FEET PER SECOND. AREA IN SQUARE MILES
TIME TO PEAK IN HOURS

					RATIOS APPLIED TO PRECIPITATION	
ATION	STATION	AREA	PLAN		RATIO 1	RATIO 2
					1.00	.44
DGRAPH AT	RUNOFF	1.80	1	FLOW	2098.	323.
				TIME	12.67	12.75
			2	FLOW	2098.	323.
				TIME	12.75	12.75
			3	FLOW	2098.	323.
				TIME	12.75	12.75
ED TO	DAM	1.80	1	FLOW	2075.	179.
				TIME	12.75	13.50
			2	FLOW	2651.	179.
				TIME	13.17	13.50
			3	FLOW	3173.	1417.
				TIME	12.67	14.00
			** PEAK STAGES IN FEET **			
			1	STAGE	451.65	450.09
				TIME	12.75	13.50
			2	STAGE	451.65	450.09
				TIME	12.70	13.50
			3	STAGE	451.22	450.09
				TIME	12.41	13.51
ED TO	GRHLRD	1.80	1	FLOW	2116.	179.
				TIME	12.75	13.58
			2	FLOW	2580.	179.
				TIME	13.17	13.58
			3	FLOW	3018.	1312.
				TIME	12.67	13.92
			** PEAK STAGES IN FEET **			
			1	STAGE	443.17	438.48
				TIME	12.75	13.58
			2	STAGE	443.37	438.48
				TIME	13.17	13.58
			3	STAGE	443.55	442.77
				TIME	12.67	13.92

No breach

breach

breach

100yr 24hr

SUMMARY OF DAM OVERTOPPING/BREACH ANALYSIS FOR STATION DAM
(PEAKS SHOWN ARE FOR INTERNAL TIME STEP USED DURING BREACH FORMATION)

PLAN 1 .....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	448.00	448.00	450.50
STORAGE	26.	26.	47.
OUTFLOW	0.	0.	235.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
1.00	451.65	1.15	59.	2075.	3.75	12.75	.00
.44	450.09	.00	43.	179.	.00	13.50	.00

PLAN 2 .....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	448.00	448.00	450.50
STORAGE	26.	26.	47.
OUTFLOW	0.	0.	235.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
1.00	451.65	1.15	59.	2651.	.95	13.17	12.67
.44	450.09	.00	43.	179.	.00	13.50	.00

PLAN 3 .....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	448.00	448.00	450.50
STORAGE	26.	26.	47.
OUTFLOW	0.	0.	235.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
1.00	451.22	.72	54.	3173.	.45	12.67	12.17
.44	450.09	.00	43.	1417.	.00	14.00	13.50

SUMMARY OF DAM OVERTOPPING/BREACH ANALYSIS FOR STATION GRHLRD
(PEAKS SHOWN ARE FOR INTERNAL TIME STEP USED DURING BREACH FORMATION)

1 .....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	435.50	442.00	442.00
STORAGE	0.	4.	4.
OUTFLOW	0.	395.	395.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
1.00	443.17	1.17	5.	2116.	2.33	12.75	.00
.44	438.48	.00	0.	179.	.00	13.58	.00

2 .....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	435.50	442.00	442.00
STORAGE	0.	4.	4.
OUTFLOW	0.	395.	395.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
1.00	443.37	1.37	6.	2580.	2.42	13.17	.00
.44	438.48	.00	0.	179.	.00	13.58	.00

3 .....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	435.50	442.00	442.00
STORAGE	0.	4.	4.
OUTFLOW	0.	395.	395.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
1.00	443.55	1.55	6.	3018.	2.42	12.67	.00
.44	442.77	.77	5.	1312.	.50	13.92	.00

END OF HEC-1 ***

Soils

GeC - Glenelg B
GnB - Glenville C use B soils
MgC - Manor B
MnF - Manor B

	CN	
15% Homes	65	= 9.75
15% Golf Course	61	= 9.15
35% Woods	55	= 19.25
35% Pasture/Grass	73	= 25.55
		63.7 use CN=64

GREEN HILL ROAD

442

3x6 3x6 - 435.5 36" - 436

EL. 435.5 Q = 0

EL. 436 $\frac{HW}{D} = \frac{.5}{3} = .16$ Q = 2x6.7 = 14.4 cfs

EL. 437 $\frac{HW}{D} = \frac{1.5}{3} = 0.5$ Q = 2x23.5 = 47

$\frac{HW}{D} = \frac{1}{3} = .33$ Q = 6.5 Q_T = 53.5

EL. 438 $\frac{HW}{D} = \frac{2.5}{3} = 0.83$ Q = 2x59 = 118

$\frac{HW}{D} = \frac{2}{3} = .67$ Q = 18 Q_T = 136

EL. 439 $\frac{HW}{D} = \frac{3.5}{3} = 1.17$ Q = 2x95 = 190

$\frac{HW}{D} = \frac{3}{3} = 1$ Q = 34 Q_T = 224

EL. 440 $\frac{HW}{D} = \frac{4.5}{3} = 1.5$ Q = 2x122 = 244

$\frac{HW}{D} = \frac{4}{3} = 1.33$ Q = 48 Q = 292

EL. 441 $\frac{HW}{D} = \frac{5.5}{3} = 1.83$ Q = 2x145 = 290

$\frac{HW}{D} = \frac{5}{3} = 1.67$ Q = 60 Q = 350

EL. 442 $\frac{HW}{D} = \frac{6.5}{3} = 2.17$ Q = 2x162 = 324

$\frac{HW}{D} = \frac{6}{3} = 2$ Q = 71 Q = 395

POINT PRECIPITATION FREQUENCY ESTIMATES FROM NOAA ATLAS 14

Pennsylvania 40.013 N 75.558 W 498 feet

from "Precipitation-Frequency Atlas of the United States" NOAA Atlas 14, Volume 2, Version 3
G.M. Bonnin, D. Martin, B. Lin, T. Parzybok, M.Yekta, and D. Riley
NOAA, National Weather Service, Silver Spring, Maryland, 2004

Extracted: Fri Sep 8 2006

Confidence Limits | Seasonality | Location Maps | Other Info. | GIS data | Maps | Help | Docs

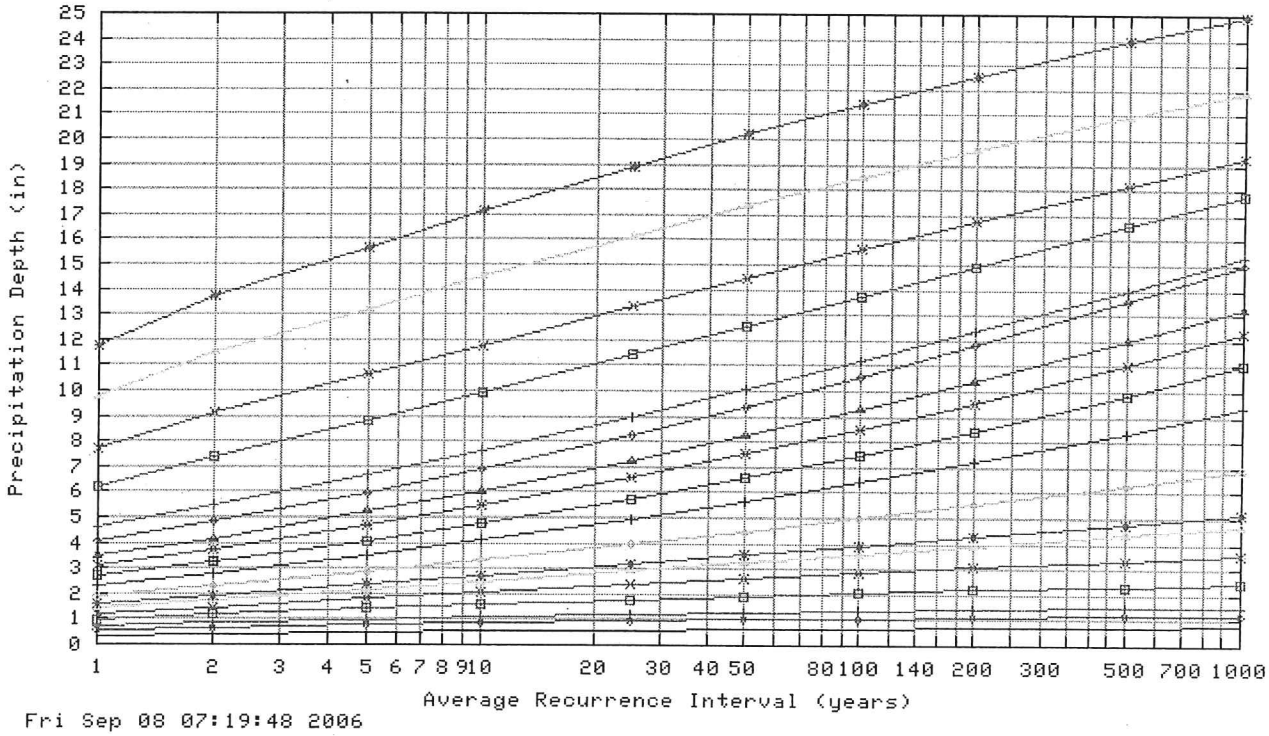
Precipitation Frequency Estimates (inches)

ARI* (years)	5 min	10 min	15 min	30 min	60 min	120 min	3 hr	6 hr	12 hr	24 hr	48 hr	4 day	7 day	10 day	20 day	30 day	45 day	60 day
1	0.35	0.56	0.70	0.96	1.20	1.43	1.55	1.92	2.33	2.69	3.12	3.46	4.04	4.59	6.20	7.71	9.78	11.71
2	0.42	0.67	0.84	1.16	1.46	1.74	1.89	2.32	2.81	3.24	3.76	4.17	4.84	5.48	7.36	9.09	11.49	13.73
5	0.49	0.78	0.99	1.41	1.80	2.16	2.35	2.88	3.52	4.07	4.72	5.20	5.98	6.68	8.78	10.61	13.21	15.67
10	0.54	0.86	1.09	1.58	2.05	2.48	2.70	3.33	4.10	4.76	5.50	6.05	6.92	7.65	9.89	11.77	14.51	17.11
25	0.59	0.95	1.20	1.78	2.37	2.91	3.17	3.96	4.94	5.75	6.62	7.25	8.26	8.99	11.40	13.31	16.15	18.91
50	0.63	1.01	1.28	1.92	2.61	3.24	3.54	4.46	5.64	6.58	7.54	8.24	9.37	10.08	12.57	14.48	17.36	20.22
100	0.67	1.07	1.35	2.06	2.84	3.57	3.91	4.99	6.39	7.48	8.52	9.28	10.55	11.20	13.76	15.62	18.50	21.44
200	0.70	1.11	1.41	2.19	3.07	3.90	4.28	5.54	7.20	8.45	9.56	10.39	11.80	12.37	14.96	16.75	19.59	22.57
500	0.74	1.17	1.47	2.34	3.36	4.35	4.78	6.30	8.37	9.86	11.05	11.98	13.58	14.00	16.57	18.21	20.93	23.96
1000	0.76	1.20	1.51	2.45	3.57	4.69	5.15	6.91	9.34	11.04	12.27	13.27	15.03	15.31	17.80	19.30	21.89	24.93

Text version of table

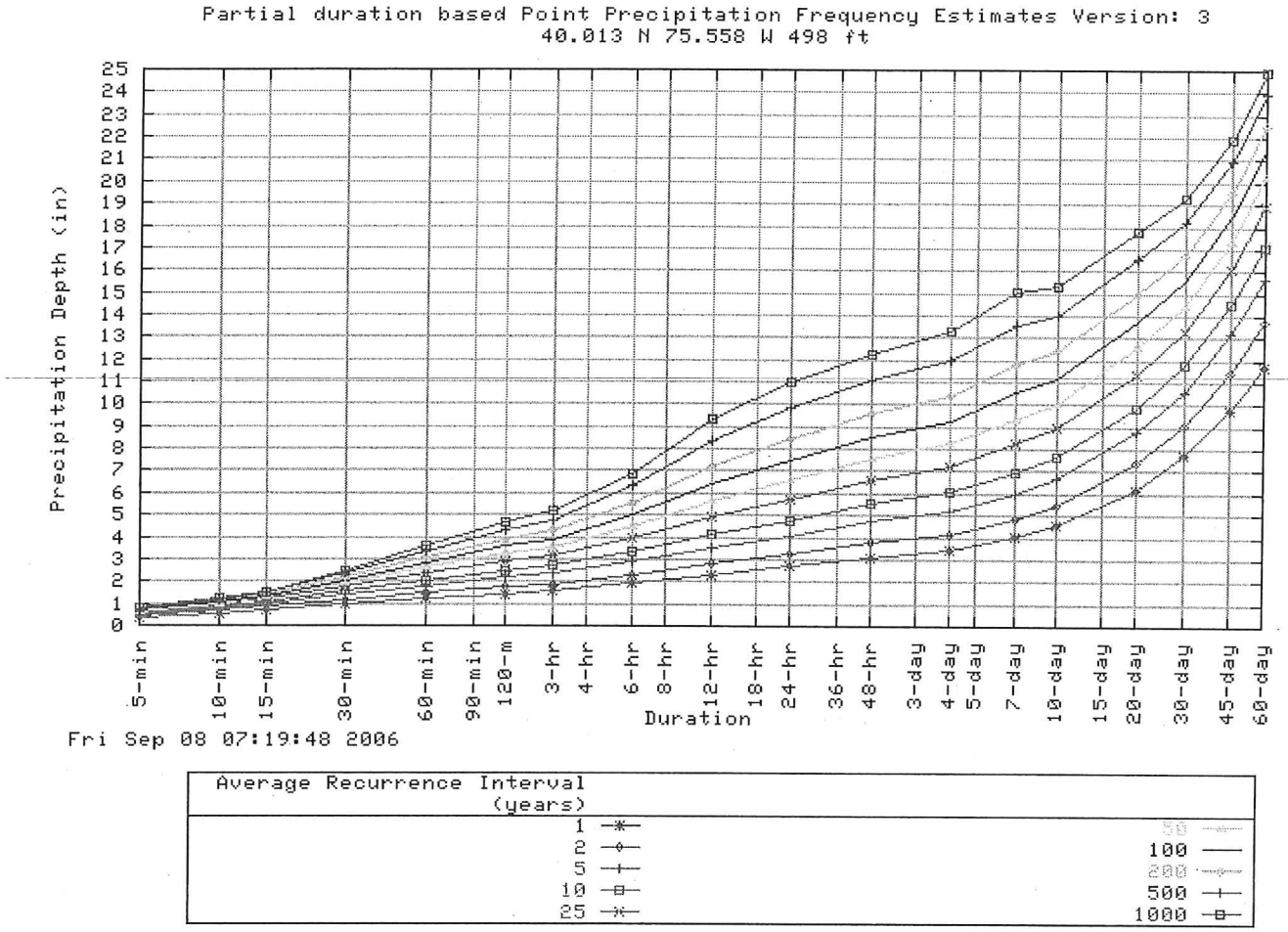
* These precipitation frequency estimates are based on a partial duration series. ARI is the Average Recurrence Interval. Please refer to the documentation for more information. NOTE: Formatting forces estimates near zero to appear as zero.

Partial duration based Point Precipitation Frequency Estimates Version: 3
40.013 N 75.558 W 498 ft



Fri Sep 08 07:19:48 2006

Duration			
5-min	120-min	48-hr	30-day
10-min	3-hr	4-day	45-day
15-min	6-hr	7-day	60-day
30-min	12-hr	10-day	
60-min	24-hr	20-day	



Confidence Limits -

*** Upper bound of the 90% confidence interval Precipitation Frequency Estimates (inches)**

ARI** (years)	5 min	10 min	15 min	30 min	60 min	120 min	3 hr	6 hr	12 hr	24 hr	48 hr	4 day	7 day	10 day	20 day	30 day	45 day	60 day
1	0.38	0.61	0.77	1.05	1.31	1.57	1.71	2.12	2.60	2.95	3.42	3.80	4.40	4.96	6.67	8.19	10.35	12.35
2	0.46	0.73	0.92	1.27	1.59	1.91	2.08	2.56	3.14	3.56	4.13	4.58	5.28	5.93	7.91	9.66	12.15	14.48
5	0.53	0.85	1.08	1.53	1.97	2.38	2.59	3.18	3.91	4.46	5.18	5.72	6.53	7.23	9.43	11.27	13.97	16.52
10	0.59	0.94	1.19	1.72	2.24	2.73	2.98	3.68	4.55	5.20	6.04	6.64	7.54	8.27	10.62	12.50	15.34	18.04
25	0.65	1.03	1.31	1.94	2.58	3.19	3.48	4.36	5.47	6.28	7.25	7.95	9.00	9.71	12.23	14.13	17.08	19.93
50	0.69	1.10	1.39	2.10	2.84	3.56	3.88	4.91	6.23	7.18	8.26	9.03	10.19	10.88	13.49	15.38	18.38	21.32
100	0.73	1.16	1.47	2.25	3.10	3.92	4.29	5.49	7.08	8.15	9.33	10.16	11.46	12.10	14.76	16.60	19.60	22.60
200	0.77	1.22	1.54	2.39	3.35	4.29	4.71	6.09	7.98	9.20	10.47	11.38	12.82	13.36	16.05	17.81	20.74	23.81
500	0.81	1.28	1.61	2.56	3.68	4.79	5.27	6.96	9.29	10.73	12.11	13.13	14.77	15.15	17.81	19.40	22.18	25.29
1000	0.84	1.32	1.66	2.69	3.93	5.18	5.70	7.65	10.37	12.00	13.45	14.55	16.38	16.60	19.17	20.59	23.24	26.34

* The **upper** bound of the confidence interval at 90% confidence level is the value which 5% of the simulated quantile values for a given frequency are **greater** than.
** These precipitation frequency estimates are based on a partial duration series. **ARI** is the Average Recurrence Interval.
Please refer to the documentation for more information. NOTE: Formatting prevents estimates near zero to appear as zero.

*** Lower bound of the 90% confidence interval Precipitation Frequency Estimates (inches)**

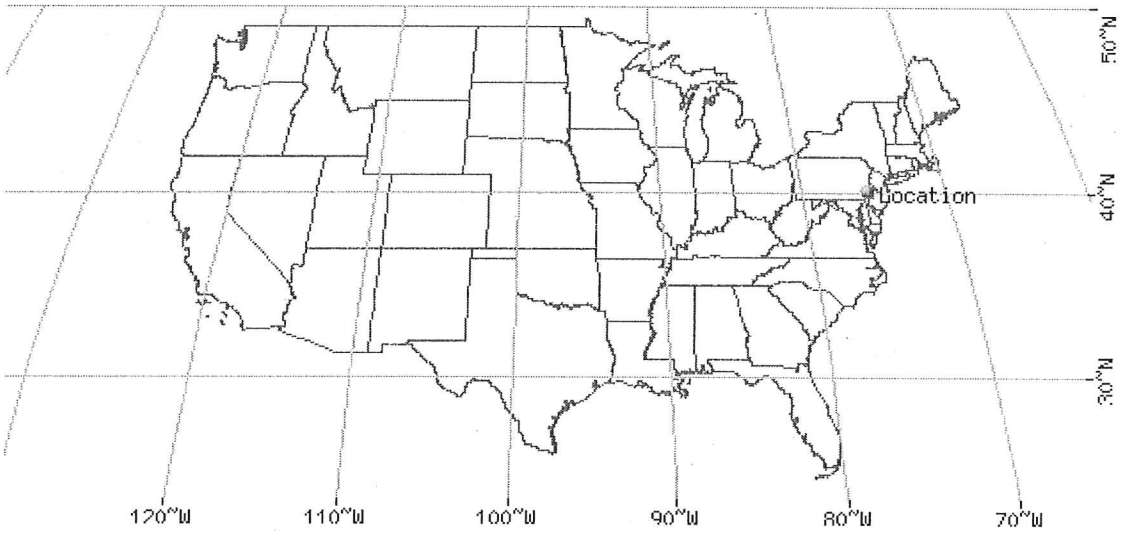
ARI** (years)	5 min	10 min	15 min	30 min	60 min	120 min	3 hr	6 hr	12 hr	24 hr	48 hr	4 day	7 day	10 day	20 day	30 day	45 day	60 day

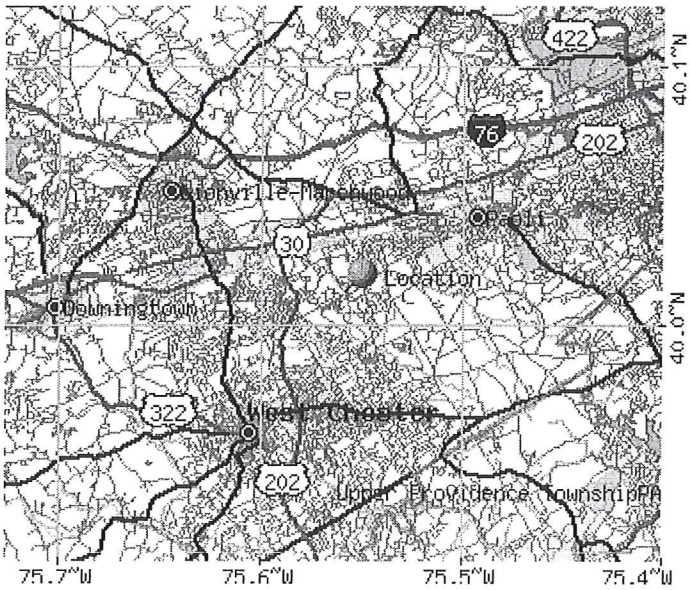
1	0.32	0.52	0.64	0.88	1.10	1.30	1.42	1.75	2.12	2.47	2.85	3.16	3.73	4.26	5.78	7.26	9.27	11.13
2	0.39	0.61	0.77	1.07	1.34	1.58	1.72	2.11	2.56	2.97	3.44	3.81	4.46	5.08	6.86	8.55	10.88	13.04
5	0.45	0.72	0.91	1.29	1.65	1.96	2.13	2.62	3.19	3.72	4.31	4.76	5.51	6.19	8.18	9.97	12.50	14.88
10	0.49	0.79	1.00	1.44	1.88	2.25	2.45	3.02	3.70	4.33	5.01	5.52	6.37	7.07	9.21	11.06	13.72	16.24
25	0.54	0.86	1.09	1.62	2.16	2.62	2.86	3.56	4.41	5.22	6.00	6.58	7.57	8.28	10.59	12.47	15.26	17.93
50	0.57	0.91	1.16	1.74	2.36	2.90	3.17	3.98	4.99	5.95	6.81	7.45	8.54	9.25	11.65	13.55	16.39	19.16
100	0.60	0.96	1.21	1.86	2.56	3.18	3.48	4.42	5.59	6.72	7.65	8.35	9.56	10.24	12.70	14.58	17.44	20.28
200	0.63	1.00	1.26	1.96	2.75	3.45	3.77	4.85	6.22	7.54	8.54	9.30	10.64	11.26	13.76	15.58	18.42	21.33
500	0.66	1.04	1.30	2.08	2.98	3.80	4.16	5.42	7.08	8.71	9.78	10.62	12.13	12.65	15.15	16.86	19.64	22.59
1000	0.67	1.06	1.33	2.16	3.15	4.06	4.45	5.86	7.76	9.65	10.78	11.66	13.32	13.73	16.20	17.80	20.48	23.46

* The **lower** bound of the confidence interval at 90% confidence level is the value which 5% of the simulated quantile values for a given frequency are **less** than.
** These precipitation frequency estimates are based on a partial duration maxima series. **ARI** is the Average Recurrence Interval.

Please refer to the documentation for more information. NOTE: Formatting prevents estimates near zero to appear as zero.

Maps -





These maps were produced using a direct map request from the U.S. Census Bureau Mapping and Cartographic Resources Tiger Map Server.

Please read disclaimer for more information.

LEGEND

- State
- County
- Indian Resv
- Lake/Pond/Ocean
- Street
- Expressway
- Highway
- Connector
- Stream
- Military Area
- National Park
- Other Park
- City
- County

Scale 1:228583 (0 2 4 6 8 mi; 0 2 4 6 8 10 km)
*average--true scale depends on monitor resolution

Other Maps/Photographs -

Worksheet 3: Time of concentration (T_c) or travel time (T_t)

Project Hershey Mill Dam By MP Date 9/8/06

Location D15-125 Checked ____ Date ____

Circle one: (Present) Developed

Circle one: (T_c) T_t through subarea

NOTES: Space for as many as two segments per flow type can be used for each worksheet.

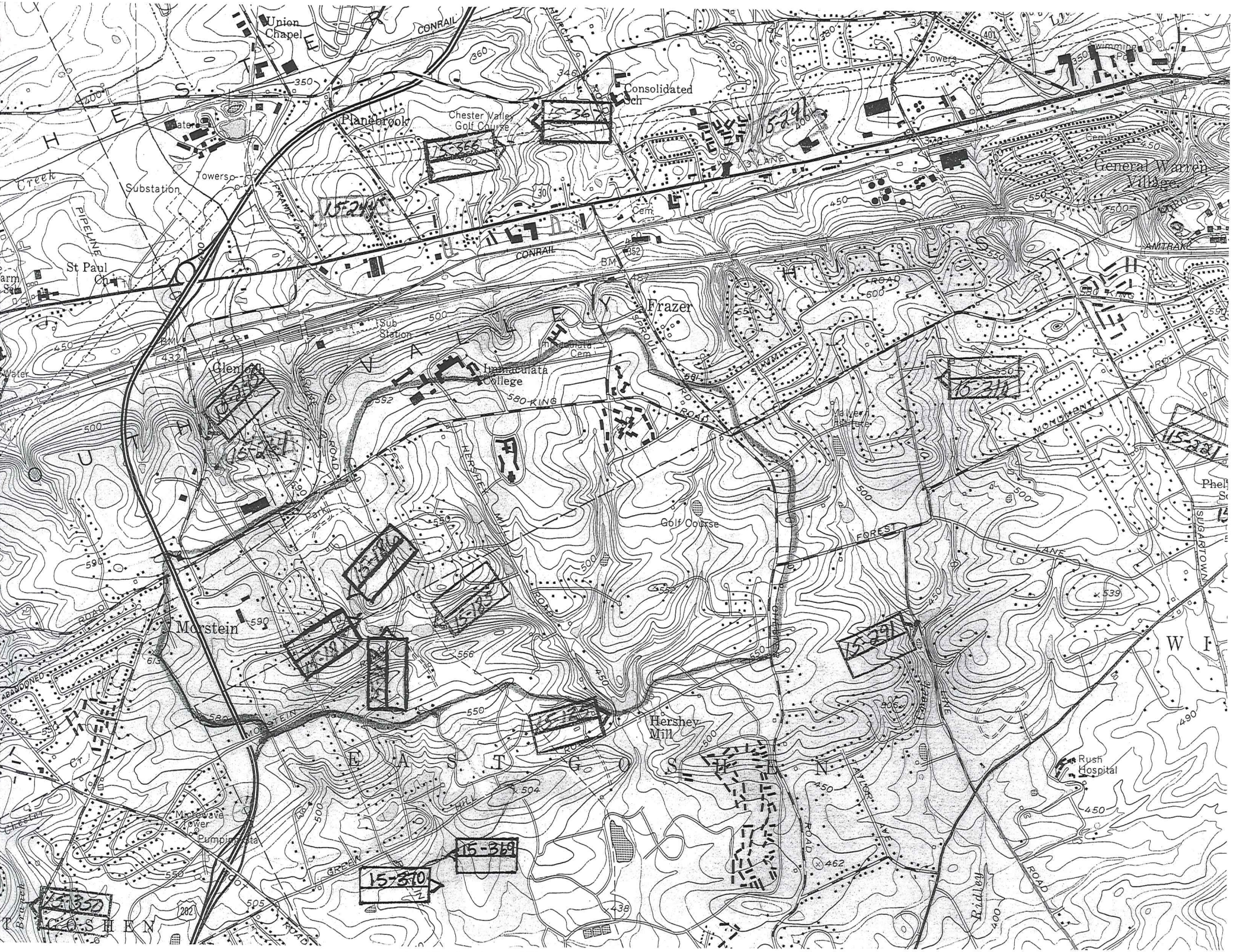
Include a map, schematic, or description of flow segments.

Sheet flow (Applicable to T_c only)		Segment ID		
1. Surface description (table 3-1)		Woods		
2. Manning's roughness coeff., n (table 3-1) ..		0.6		
3. Flow length, L (total L ≤ 300 ft)	ft	150		
4. Two-yr 24-hr rainfall, P_2	in	3.56		
5. Land slope, s	ft/ft	0.017		
6. $T_t = \frac{0.007\ (nL)^{0.8}}{P_2^{0.5}\ s^{0.4}}$ Compute T_t	hr	0.70	+	=

Shallow concentrated flow		Segment ID		
7. Surface description (paved or unpaved)		u/p.		
8. Flow length, L	ft	2000		
9. Watercourse slope, s	ft/ft	0.03		
10. Average velocity, V (figure 3-1)	ft/s	2.8		
11. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr	0.2	+	=

Channel flow		Segment ID		
12. Cross sectional flow area, a	ft^2			
13. Wetted perimeter, p_w	ft			
14. Hydraulic radius, $r = \frac{a}{p_w}$ Compute r	ft	~1		
15. Channel slope, s	ft/ft	0.015		
16. Manning's roughness coeff., n		0.04		
17. $V = \frac{1.49\ r^{2/3}\ s^{1/2}}{n}$ Compute V	ft/s	4.5		
18. Flow length, L	ft	5400		
19. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr	0.33	+	=
20. Watershed or subarea T_c or T_t (add T_t in steps 6, 11, and 19)	hr	1.23		

$T_c = 0.74$



Union Chapel
CONRAIL
Consolidated Sch
Planebrook
Chester Valley Golf Course
15-367
15-366
15-241
15-244
Towers
Substation
PIPELINE
St Paul Ch
General Warren Village
AMTRAK
Frazer
Sub Station
Immaculata Cem
Immaculata College
Glenloch
15-310
15-221
Golf Course
FOREST LANE
SUGARTOWN
Morstein
15-186
15-185
15-291
Hershey Mill
Rush Hospital
Microwave Tower
Pumping Sta
15-369
15-370
15-350
GREEN HILL ROAD
Ridley