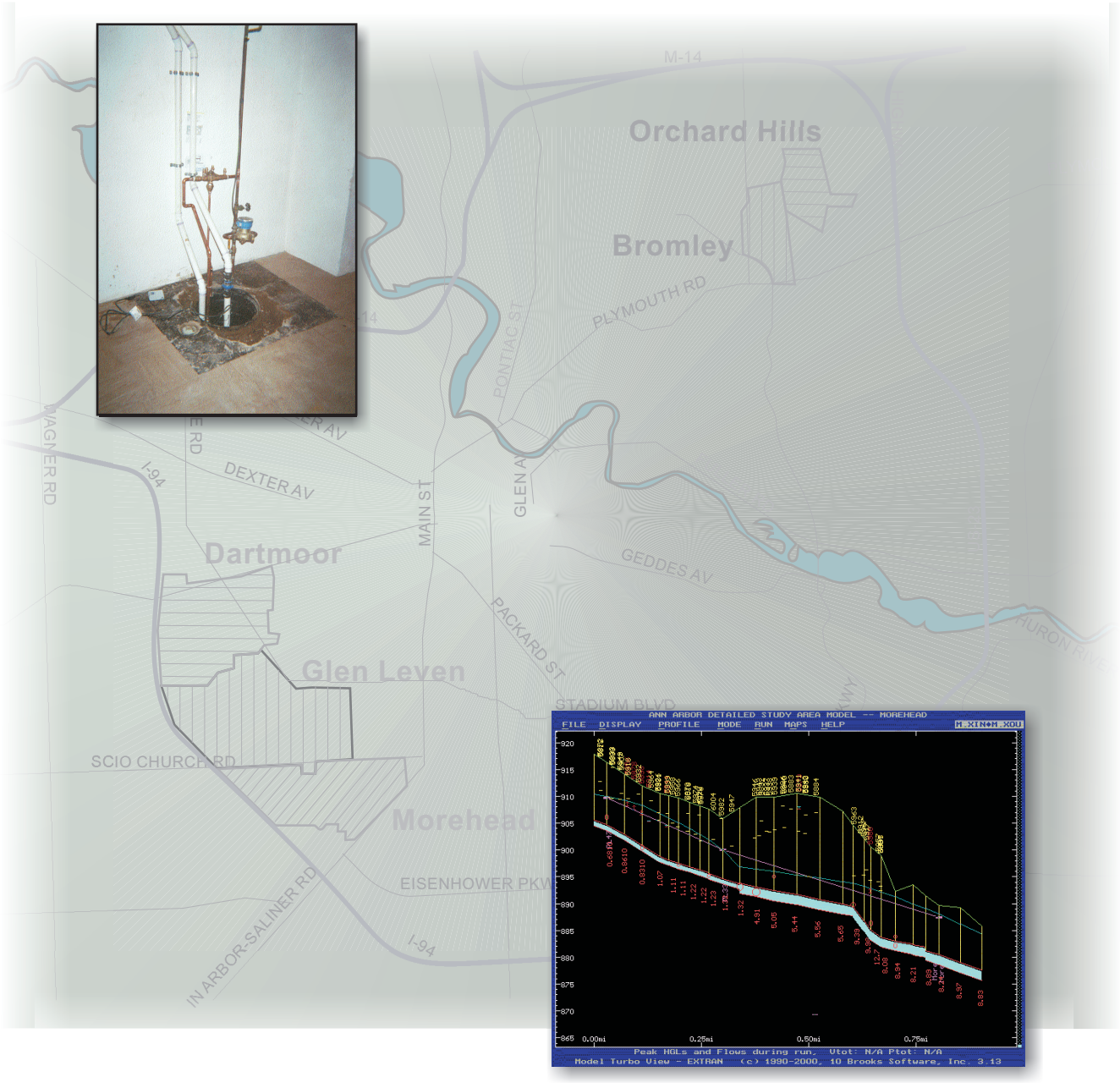
City of Ann Arbor

Sanitary Sewer Overflow Prevention Advisory Task Force



Report
Sanitary Sewer Overflow Prevention Study

CDM Camp Dresser & McKee

June 2001

City of Ann Arbor
Sanitary Sewer Overflow Prevention Advisory Task Force

Sanitary Sewer Overflow Prevention Study

Camp Dresser & McKee
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Appendices (continued)

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Appendix A - Homeowner Survey

A.1 Survey Questionnaire

The survey questionnaire in this appendix is the second version released. This second version included an additional question, number 12, referring to basement depth.

A.2 Summary of Responses

Responses are summarized for questions 2 through 10. This summary is provided subsequent to the survey questionnaire in this appendix. Questions 1, 11 and 13 were not summarized because doing so may potentially violate the homeowner/project team confidentiality. Question number 12 was not summarized because this information pertained to the elevation survey and consequently would provide little or no use unless coupled with the other elevation related information compiled as part of that work.

This survey may also be completed on-line at: **http://www.cdm-mich.com/aa-sso**

Ann Arbor Homeowner Survey

Please respond to each of the following questions by writing in your answer, or circling the number next to the response that best fits. All information will be kept strictly confidential.

1. What is the exact street address of your home in Ann Arbor? *(This information is critical. If you own more than one home in the City, please complete a survey for each home.)*

   _____
   (House number and street)

2. Do you own or rent this home?

   Own 1
   Rent 2

3. How many years have you either owned or lived in this home?

   _____ *years*

4. Do the downspouts on your house drain onto your lawn or into a pipe that goes underground?

   Onto the lawn 1
   Into a pipe in the ground 2
   Other _____ 3

5. What is the style of your foundation?

   Full basement 1
   Partial basement 2
   No basement (Slab foundation) ..... 3 → *If no basement, skip to question 11 on back*

6. Is there a sump pump in your home?

   No 1
   Yes, discharging into your yard 2
   Yes, discharging into a basement drain 3
   Yes, but not sure where it discharges 4

7. Since you have owned or lived in this home, have you experienced dampness in your basement (without flooding or standing water)?

   No 1
   Yes, occasionally 2
   Yes, frequently 3

8. Have you experienced flooding or standing water in the basement of this home?

No..... 1 → *If no flooding, skip to question 10*
Yes 2

9. In the table below is a list of storm dates when the City has received reports of flooding. For each storm event that you experienced, please provide the following information in the chart:
   1. Were there four inches or more of water (flooding) in the street in front of your home?
   2. Were there four inches or more of water (flooding) on your property?
   3. Was there *any* standing water (flooding) in your basement?
   4. If there was water in your basement, did the level reach four inches or more?
   5. Please indicate the approximate number of inches of water there was in your basement.
   6. Please indicate how long (in hours) the water remained in your basement, from the time it first flooded until it was completely drained. *(Do not include time the area remained damp.)*

Date of Storm Event	**a. Street Flooding?**	**b. Property Flooding?**	**c. Basement Flooding?**	**d. Water in basement of 4" + ?**	**e. Water Level (Inches)**	**f. Flooding Duration (Hours)**
August 6, 1998	Yes No	Yes No	Yes No	Yes No		
June 28, 1982	Yes No	Yes No	Yes No	Yes No		
February 16/17, 1976	Yes No	Yes No	Yes No	Yes No		
August 30/31, 1975	Yes No	Yes No	Yes No	Yes No		
June 25, 1968	Yes No	Yes No	Yes No	Yes No		
Other_____ _	Yes No	Yes No	Yes No	Yes No		
Other_____ _	Yes No	Yes No	Yes No	Yes No		
Other_____ _	Yes No	Yes No	Yes No	Yes No		

10. Have you, or a previous owner of the home, taken any of the following actions in an effort to prevent flooding? If so, please indicate the year each action was taken.

	(circle all that apply)	*(year)*
1. Installed a check or gate valve in your sewer line	1	_____
2. Installed a standpipe on your floor drain	1	_____
3. Installed a plug on your floor drain	1	_____
4. Installed a sump pump	1	_____
5. Directed roof drainage away from your house (by extending down-spouts more than 4 feet away from house)	1	_____
6. Other (specify)_____	1	_____

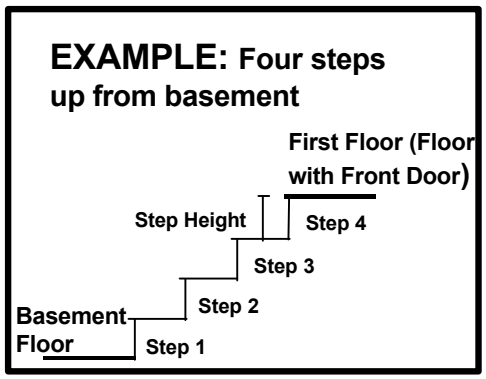
Please Continue on the Back ☞

11. In order to gather more detailed information about flooding problems in the City, a team of engineers will be inspecting the streets and some homes, with permission of the homeowners. If you would be willing to have an engineer from the project team come to your house and conduct a physical inspection of your property, please provide your phone number in the space below, so we may call to set up an appointment that is convenient for you.

_(_____)_____ *phone number*

12. How many steps are there starting at the lowest floor (typically your basement) of your house up to the floor where your front door is located?
_____ *(typically 10 to 13 steps for full basement, 5 to 7 for split level, ignore this question if your house is on a slab)*

Using a ruler or tape measure, what is the height of one of these steps?
_____ *(typically 7 to 8½ inches)*



13. If you have any additional information or comments, please use the space below.

Thank You!

Please return this survey in the postage-paid return envelope provided by ***Friday, June 10, 2000.***
If you did not receive an envelope, you may mail it to:
Camp Dresser & McKee, One Woodward Avenue, Suite 1500, Detroit, MI 48226

Homeowner Survey Question 2 - Summary

Do you own or rent this home?

Answer	Count	As % of All Surveys Submitted	As % of Those Who Answered Question*
Own	385	93.4	97.7
Rent	9	2.2	2.3

* Responses not left blank. Many surveyed did not answer every question. In the case of Questions 6 through 10, respondents were directed to skip one or more of these questions depending on the response to Questions 5 and/or 8.

Homeowner Survey Question 3 - Summary

How many years have you either owned or lived in this home?

Range (yrs)	Count	As % of All Surveys Submitted	As % of Those Who Answered Question*
0 to 2	55	13.3	14.0
2+ to 5	60	14.6	15.3
5+ to 10	59	14.3	15.1
10+ to 20	78	18.9	19.9
20+ to 30	60	14.6	15.3
30+	80	19.4	20.4

* Responses not left blank. Many surveyed did not answer every question.

Homeowner Survey Question 4 - Summary

Do the downspouts on your house drain onto your lawn or into a pipe that goes underground?

Answer	Count	As % of All Surveys Submitted	As % of Those Who Answered Question*
Onto the lawn	356	86.4	95.7
Into a pipe in the ground	9	2.2	2.4
Other (specify)	6	1.5	1.6

* Responses not left blank. Many surveyed did not answer every question. In the case of Questions 6 through 10, respondents were directed to skip one or more of these questions depending on the response to Questions 5 and/or 8.

Homeowner Survey Question 5 - Summary

What is the style of your foundation?

Answer	Count	As % of All Surveys Submitted	As % of Those Who Answered Question*
Full basement	322	78.2	82.8
Partial basement	63	15.3	16.2
No basement	3	0.7	0.8

* Responses not left blank. Many surveyed did not answer every question. In the case of Questions 6 through 10, respondents were directed to skip one or more of these questions depending on the response to Questions 5 and/or 8.

Homeowner Survey Question 6 - Summary

Is there a sump pump in your home?

Answer	Count	As % of All Surveys Submitted	As % of Those Who Answered Question*
Yes, discharging into yard	31	7.5	8.2
Yes, discharging into basement drain	16	3.9	4.2
Yes, discharge location unknown	10	2.4	2.7
No	320	77.7	84.9

* Responses not left blank. Many surveyed did not answer every question. In the case of Questions 6 through 10, respondents were directed to skip one or more of these questions depending on the response to Questions 5 and/or 8.

Homeowner Survey Question 7 - Summary

Since you have owned or lived in this home, have you experienced dampness in your basement (without flooding or standing water)?

Answer	Count	As % of All Surveys Submitted	As % of Those Who Answered Question*
Yes, occasionally	152	36.9	40.9
Yes, frequently	27	6.6	7.3
No	191	46.4	51.3

* Responses not left blank. Many surveyed did not answer every question. In the case of Questions 6 through 10, respondents were directed to skip one or more of these questions depending on the response to Questions 5 and/or 8.

Homeowner Survey Question 8 - Summary

Have you experienced flooding or standing water in the basement of this home?

Answer	Count	As % of All Surveys Submitted	As % of Those Who Answered Question*
Yes	188	45.6	48.7
No	198	48.1	51.3

* Responses not left blank. Many surveyed did not answer every question. In the case of Questions 6 through 10, respondents were directed to skip one or more of these questions depending on the response to Questions 5 and/or 8.

Homeowner Survey Question 9 - Summary

Storm Event: August 6, 1998

Were there four inches or more of water (flooding) in the street in front of your home?

Answer	Count	As % of All Surveys Submitted	As % of Those Who Answered Question*
Yes	35	8.5	39.3
No	54	13.1	60.7

Were there four inches or more of water (flooding) on your property?

Answer	Count	As % of All Surveys Submitted	As % of Those Who Answered Question*
Yes	29	7.0	32.6
No	60	14.6	67.4

Was there any standing water (flooding) in your basement?

Answer	Count	As % of All Surveys Submitted	As % of Those Who Answered Question*
Yes	93	22.6	77.5
No	27	6.6	22.5

If there was water in your basement, did the level reach four inches or more?

Answer	Count	As % of All Surveys Submitted	As % of Those Who Answered Question*
Yes	54	13.1	46.6
No	62	15.0	53.4

Storm Event: June 28, 1982

Were there four inches or more of water (flooding) in the street in front of your home?

Answer	Count	As % of All Surveys Submitted	As % of Those Who Answered Question*
Yes	12	2.9	46.2
No	14	3.4	53.8

Were there four inches or more of water (flooding) on your property?

Answer	Count	As % of All Surveys Submitted	As % of Those Who Answered Question*
Yes	9	2.2	33.3
No	18	4.4	66.7

Was there any standing water (flooding) in your basement?

Answer	Count	As % of All Surveys Submitted	As % of Those Who Answered Question*
Yes	20	4.9	64.5
No	11	2.7	35.5

If there was water in your basement, did the level reach four inches or more?

Answer	Count	As % of All Surveys Submitted	As % of Those Who Answered Question*
Yes	9	2.2	30.0
No	21	5.1	70.0

Storm Event: February 16/17, 1976

Were there four inches or more of water (flooding) in the street in front of your home?

Answer	Count	As % of All Surveys Submitted	As % of Those Who Answered Question*
Yes	9	2.2	40.9
No	13	3.2	59.1

Were there four inches or more of water (flooding) on your property?

Answer	Count	As % of All Surveys Submitted	As % of Those Who Answered Question*
Yes	5	1.2	21.7
No	18	4.4	78.3

Was there any standing water (flooding) in your basement?

Answer	Count	As % of All Surveys Submitted	As % of Those Who Answered Question*
Yes	12	2.9	50.0
No	12	2.9	50.0

If there was water in your basement, did the level reach four inches or more?

Answer	Count	As % of All Surveys Submitted	As % of Those Who Answered Question*
Yes	6	1.5	27.3
No	16	3.9	72.7

Storm Event: August 30/31, 1975

Were there four inches or more of water (flooding) in the street in front of your home?

Answer	Count	As % of All Surveys Submitted	As % of Those Who Answered Question*
Yes	12	2.9	50.0
No	12	2.9	50.0

Were there four inches or more of water (flooding) on your property?

Answer	Count	As % of All Surveys Submitted	As % of Those Who Answered Question*
Yes	8	1.9	33.3
No	16	3.9	66.7

Was there any standing water (flooding) in your basement?

Answer	Count	As % of All Surveys Submitted	As % of Those Who Answered Question*
Yes	15	3.6	57.7
No	11	2.7	42.3

If there was water in your basement, did the level reach four inches or more?

Answer	Count	As % of All Surveys Submitted	As % of Those Who Answered Question*
Yes	8	1.9	33.3
No	16	3.9	66.7

Storm Event: June 25, 1968

Were there four inches or more of water (flooding) in the street in front of your home?

Answer	Count	As % of All Surveys Submitted	As % of Those Who Answered Question*
Yes	13	3.2	61.9
No	8	1.9	38.1

Were there four inches or more of water (flooding) on your property?

Answer	Count	As % of All Surveys Submitted	As % of Those Who Answered Question*
Yes	7	1.7	35.0
No	13	3.2	65.0

Was there any standing water (flooding) in your basement?

Answer	Count	As % of All Surveys Submitted	As % of Those Who Answered Question*
Yes	21	5.1	77.8
No	6	1.5	22.2

If there was water in your basement, did the level reach four inches or more?

Answer	Count	As % of All Surveys Submitted	As % of Those Who Answered Question*
Yes	13	3.2	56.5
No	10	2.4	43.5

* Responses not left blank. Many surveyed did not answer every question. In the case of Questions 6 through 10, respondents were directed to skip one or more of these questions depending on the response to Questions 5 and/or 8.

Homeowner Survey Question 10 - Summary

Have you, or a previous owner of the home, taken any of the following actions in an effort to prevent flooding?

Work Done	Count	As % of All Surveys Submitted
Installed a check or gate valve in your sewer line	6	1.5
Installed a standpipe on your floor drain	6	1.5
Installed a plug on your floor drain	9	2.2
Installed a sump pump	35	8.5
Directed roof drainage away from your house (by extending down-spouts more than 4 feet away from house)	110	26.7
Other (specify)	60	14.6

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Appendix B - Monitoring Information

B.1 Flow Meter Data

The six flow meters installed were either Sigma 910 or 950 Doppler area-velocity flow meters. Monthly raw data plots showing dry weather flows are given. Yearlong flow and level plots showing wet weather peaks are also provided. For the Liberty-Washington meter, a single weeklong plot of the data is given to show the pump station operation.

B.2 Rain Gage Data

The five rain gages installed were tipping bucket models, measuring the volume of rain in inches over a 5-minute period. Plots spanning the data collected at each location are given.

B.3 Footing Drain Study Data

Footing drain flow measurements collected on 9/11/00 are included in this appendix.

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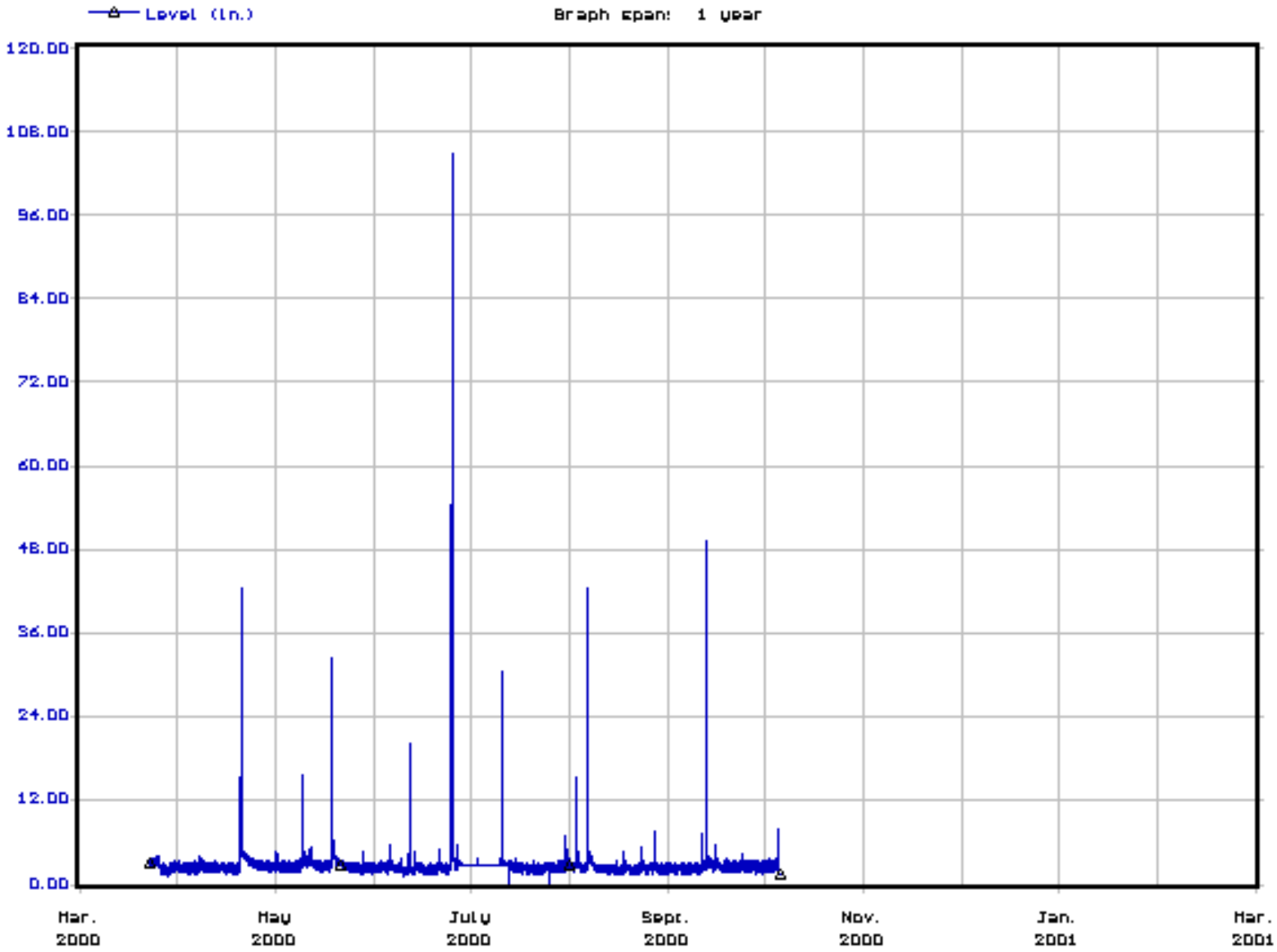

Orchard Hills: 2309 Georgetown

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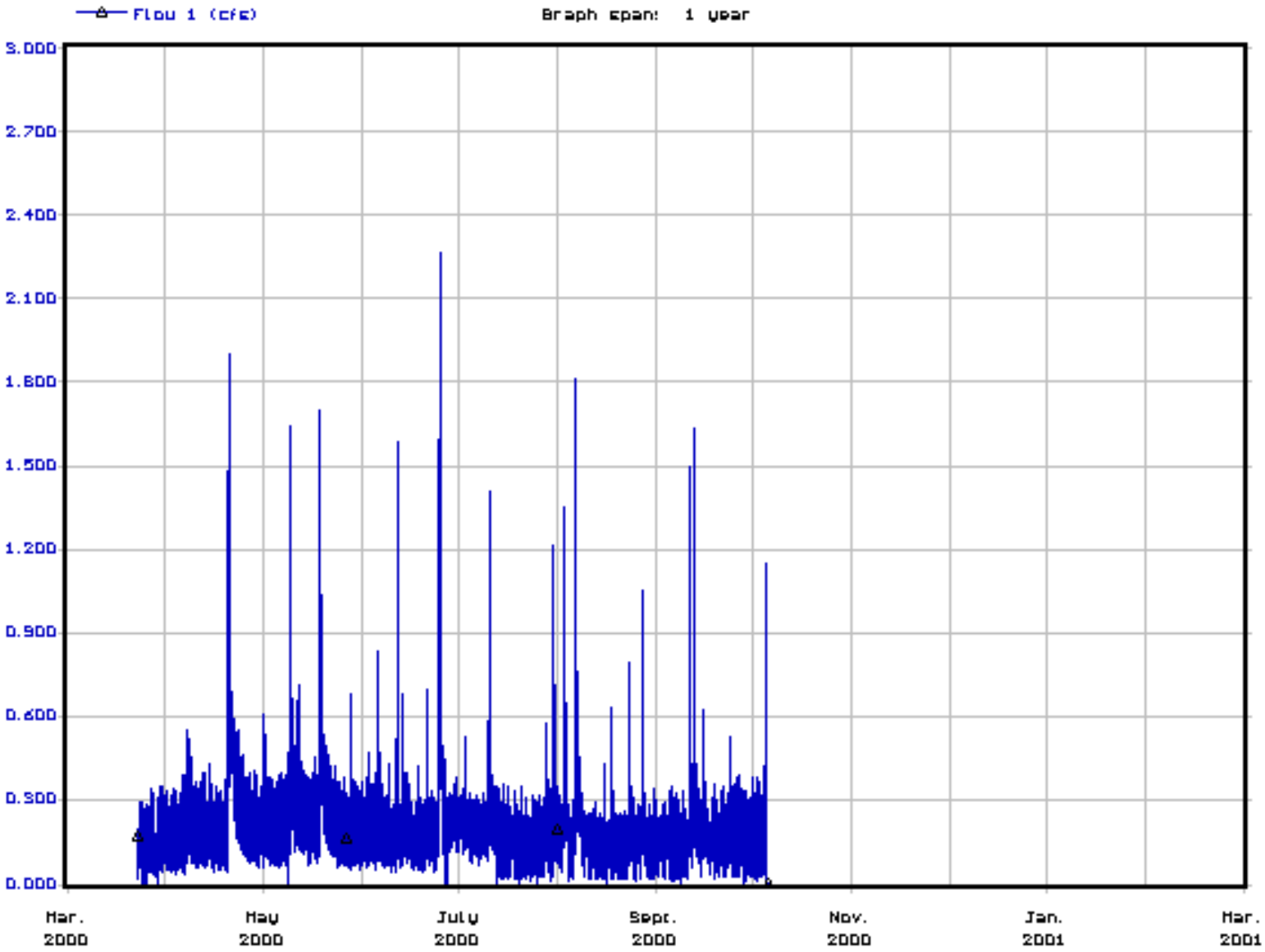

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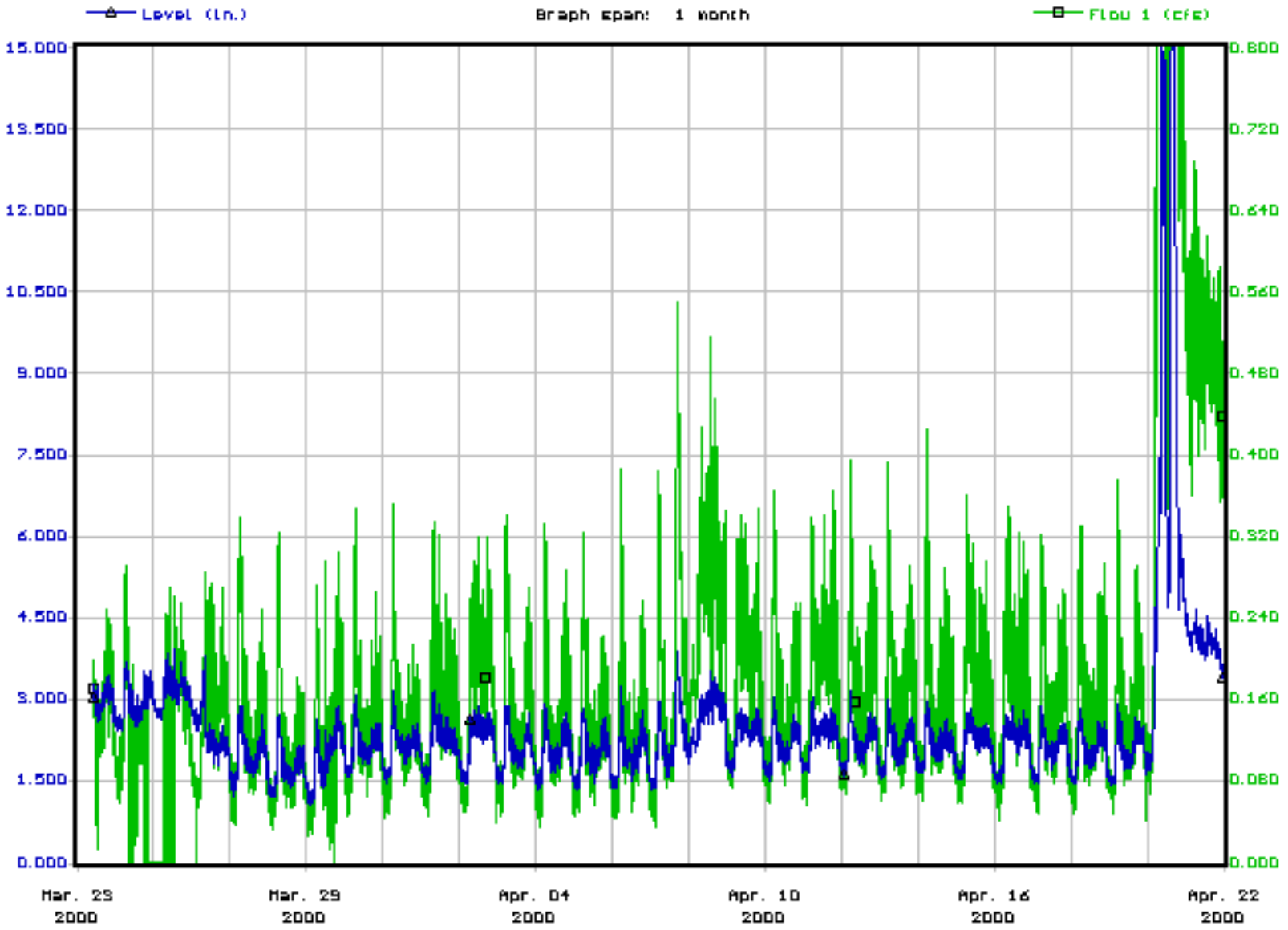

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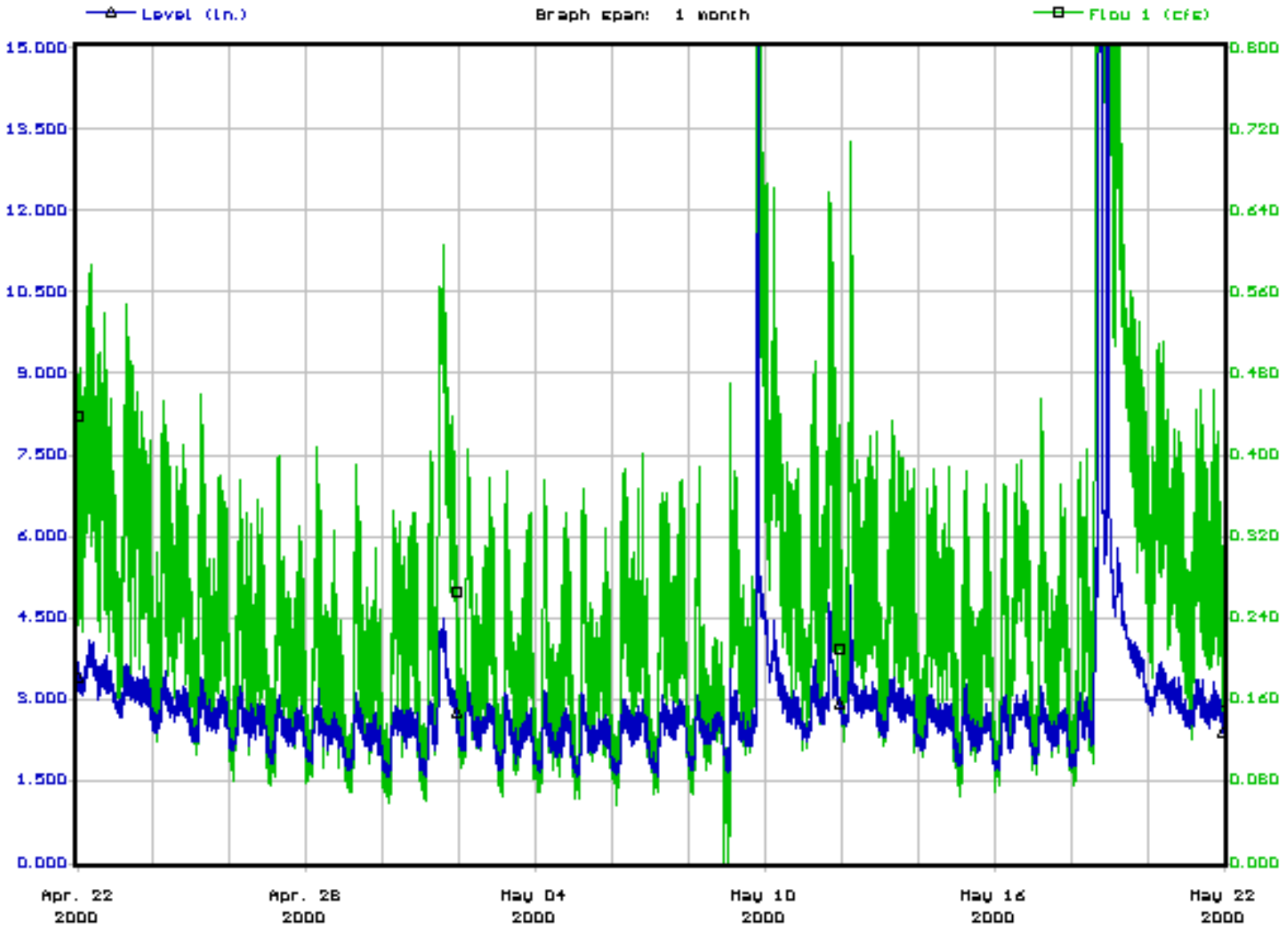

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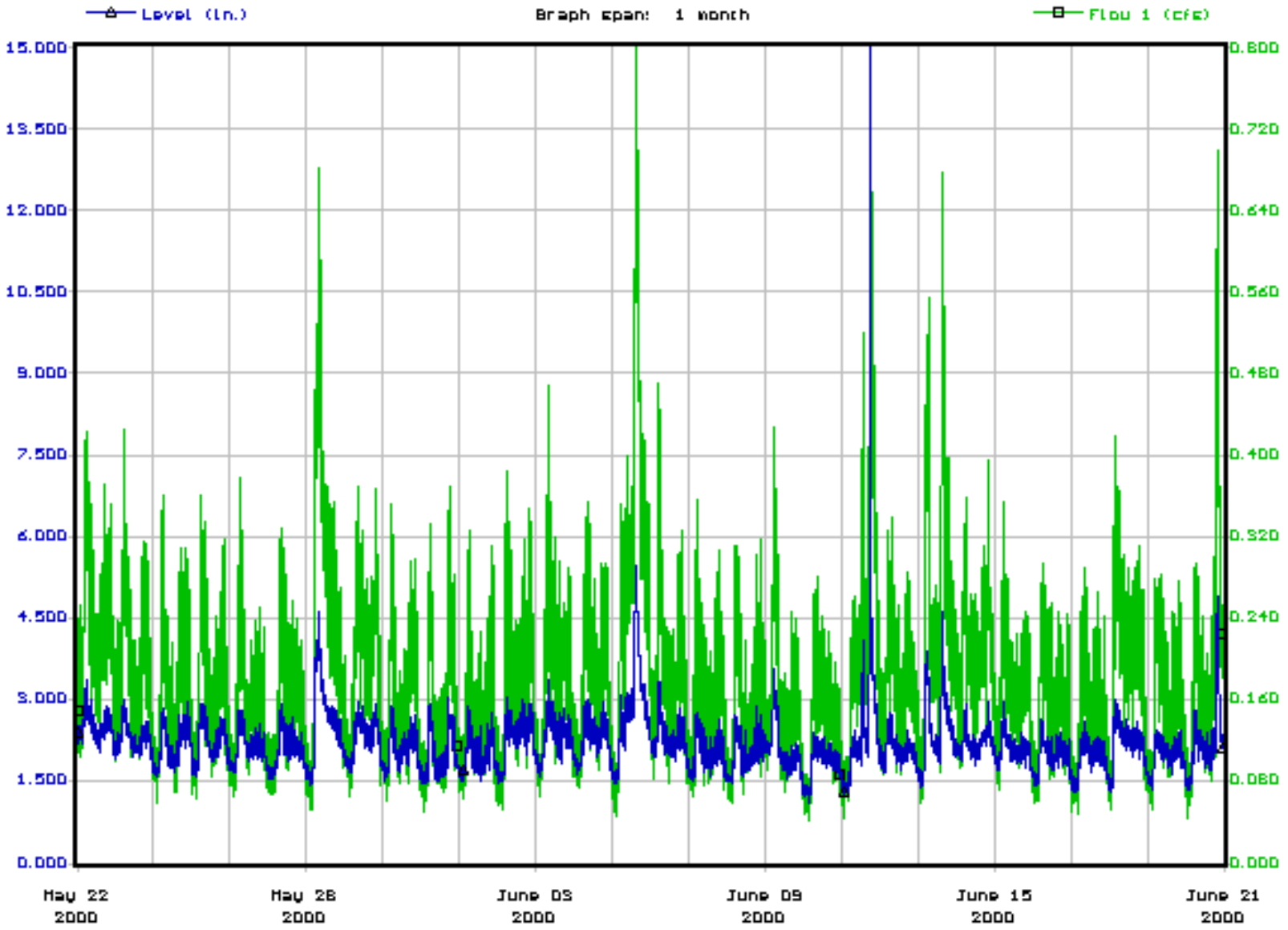

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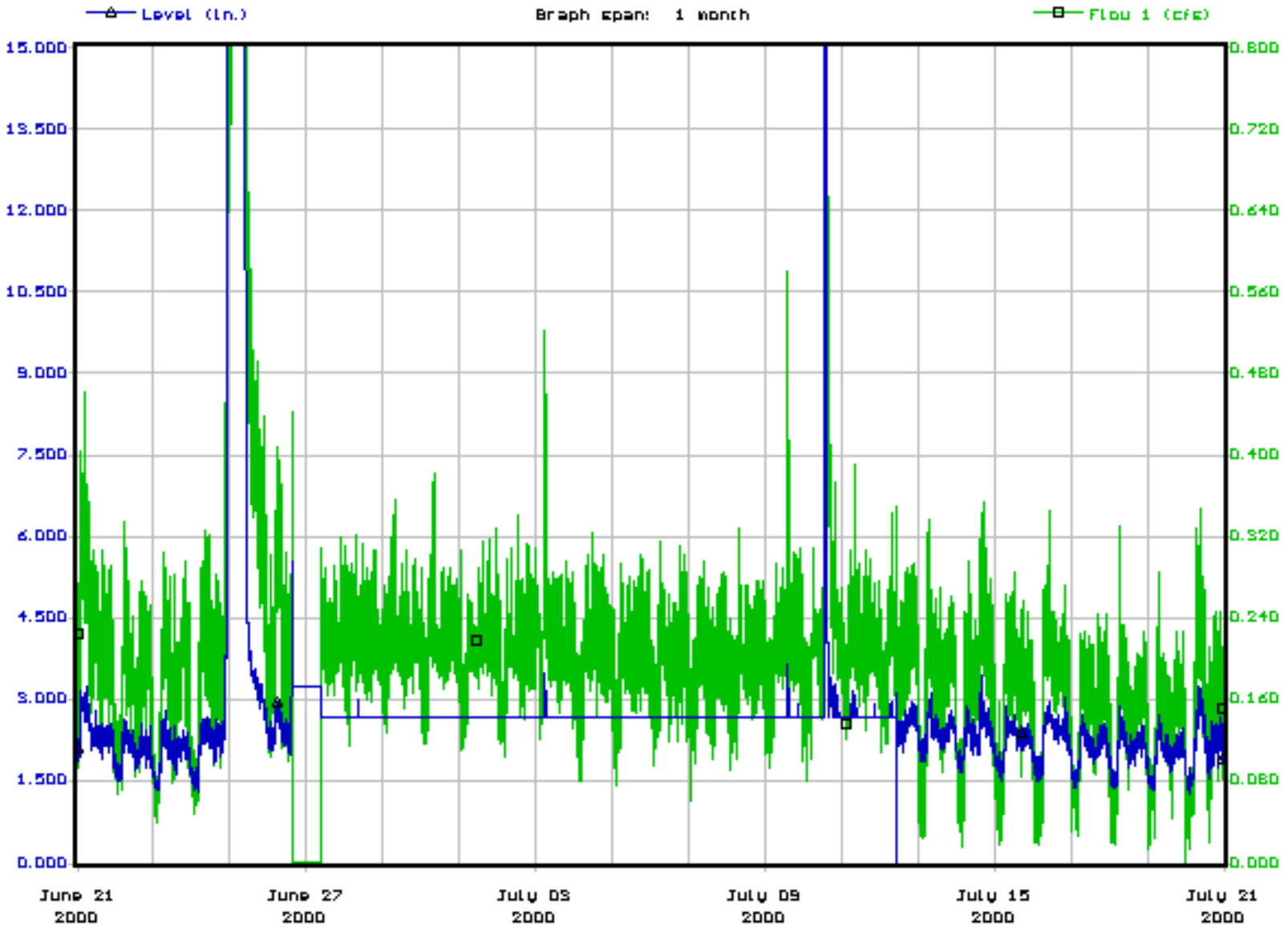

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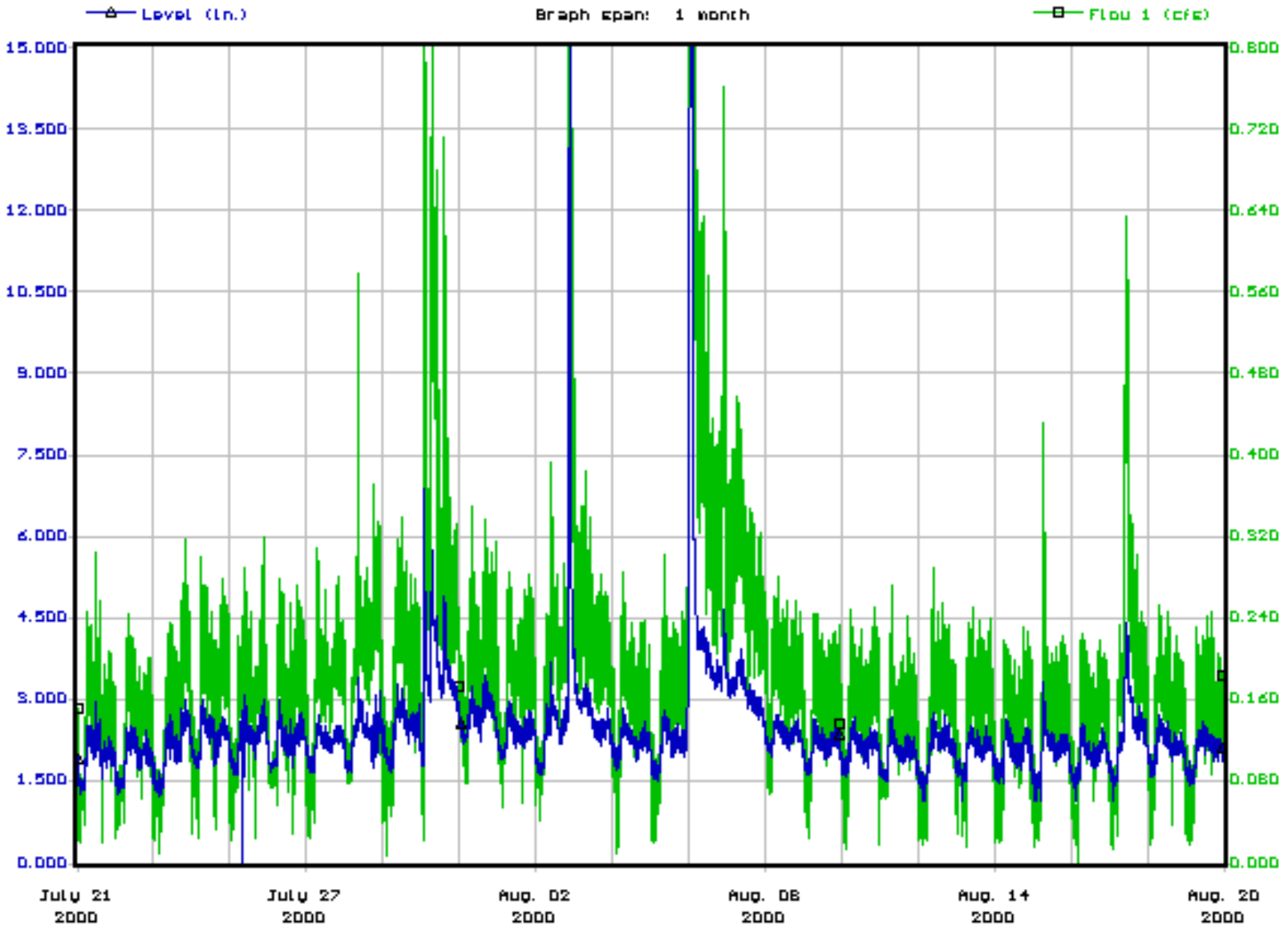

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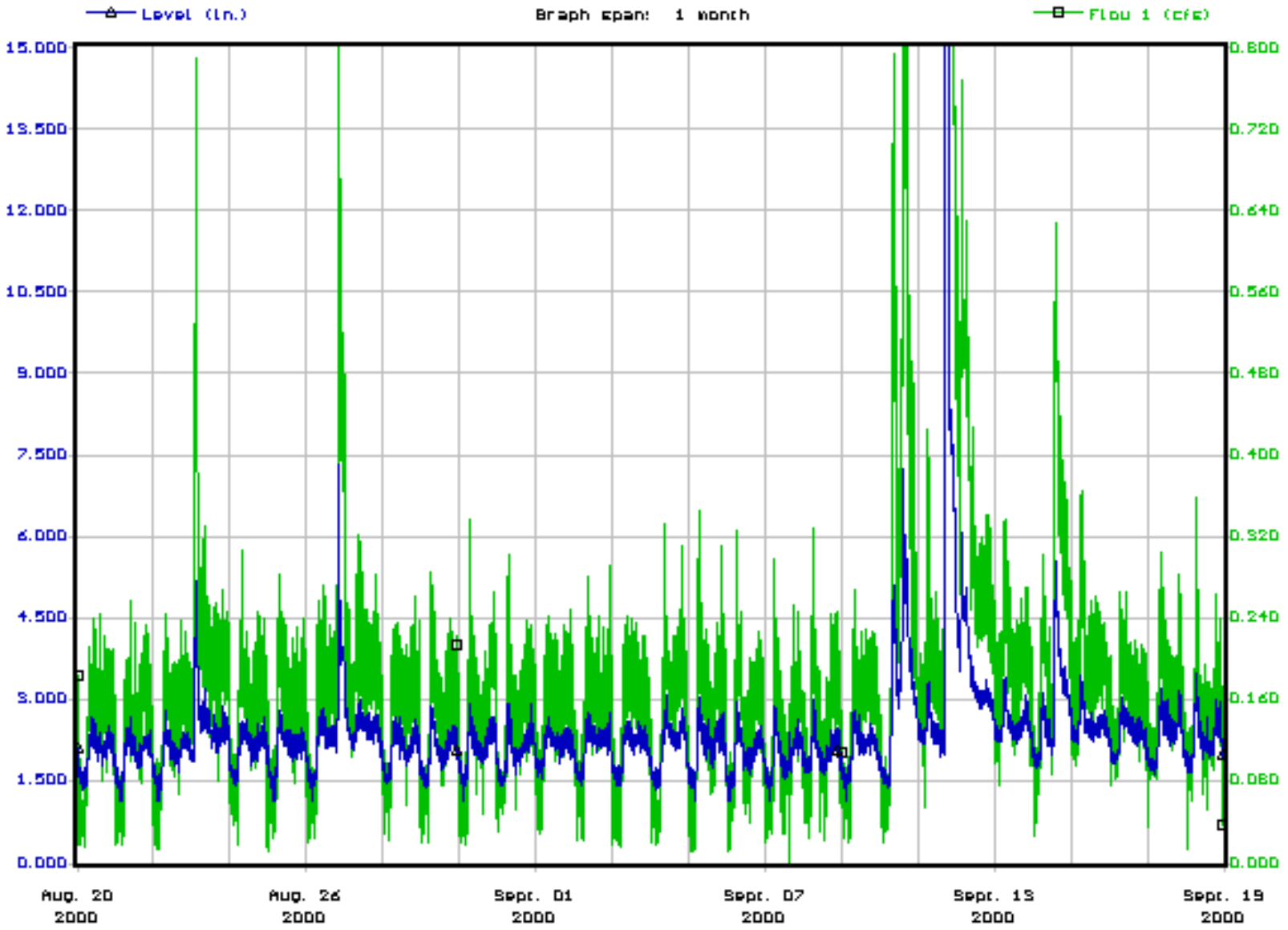

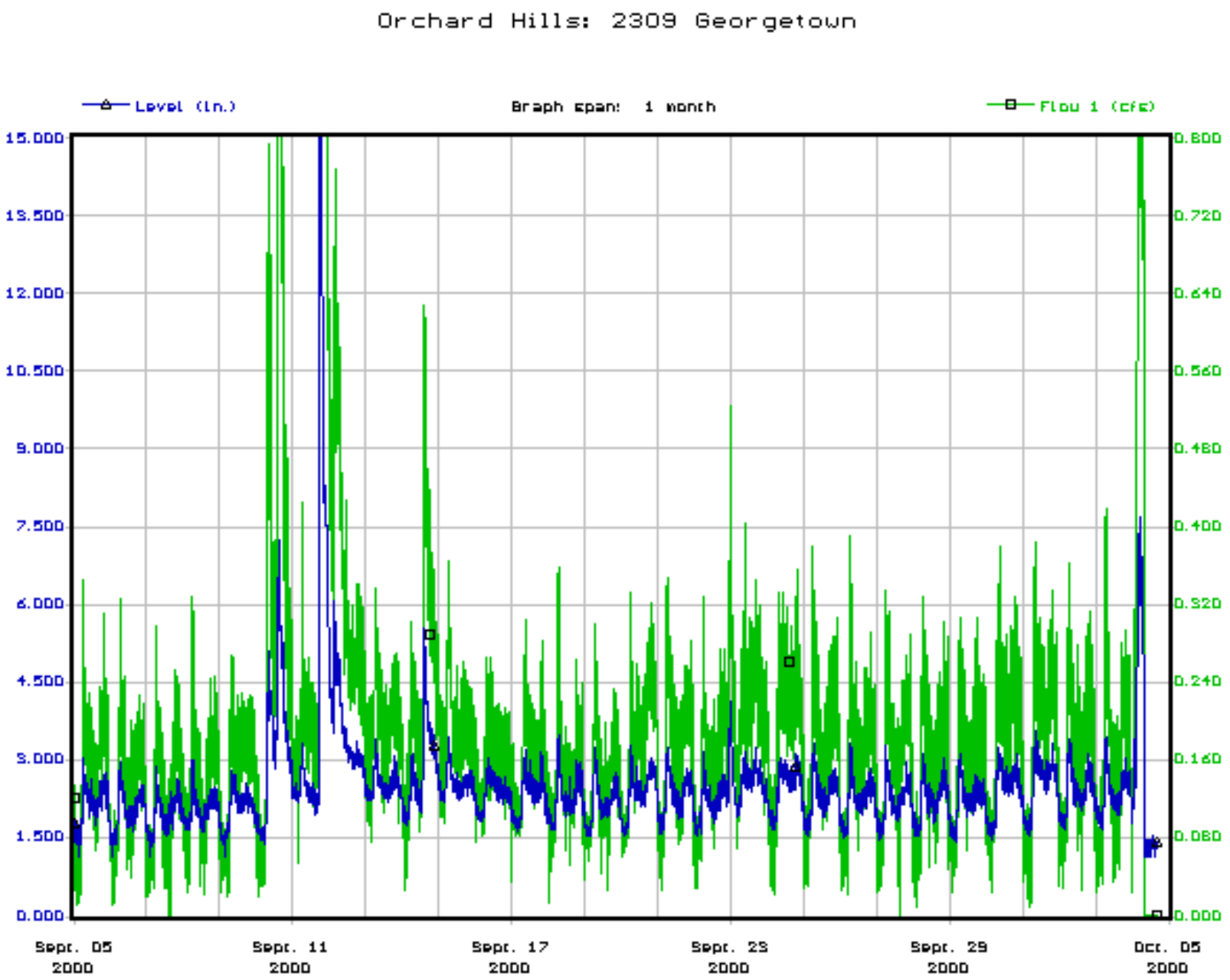
Orchard Hills: 2309 Georgetown
Level (in.)
Graph span: 1 month
Flow 1 (cfs)
15.000
13.500
12.000
10.500
9.000
7.500
6.000
4.500
3.000
1.500
0.000
0.800
0.720
0.640
0.560
0.480
0.400
0.320
0.240
0.160
0.080
0.000
Sept. 05 2000
Sept. 11 2000
Sept. 17 2000
Sept. 23 2000
Sept. 29 2000
Oct. 05 2000

Bromley: Praire and Plymouth Rd.

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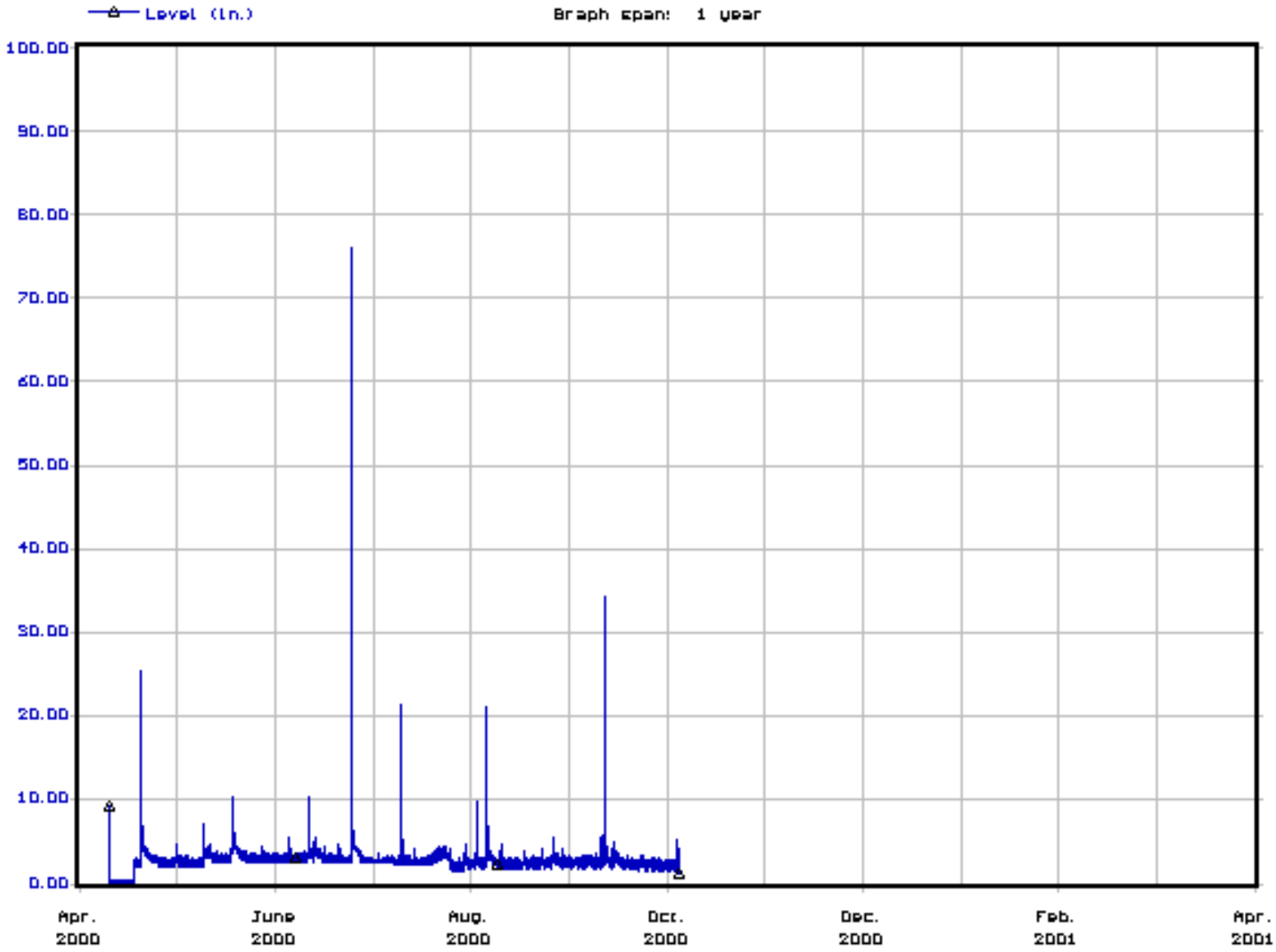

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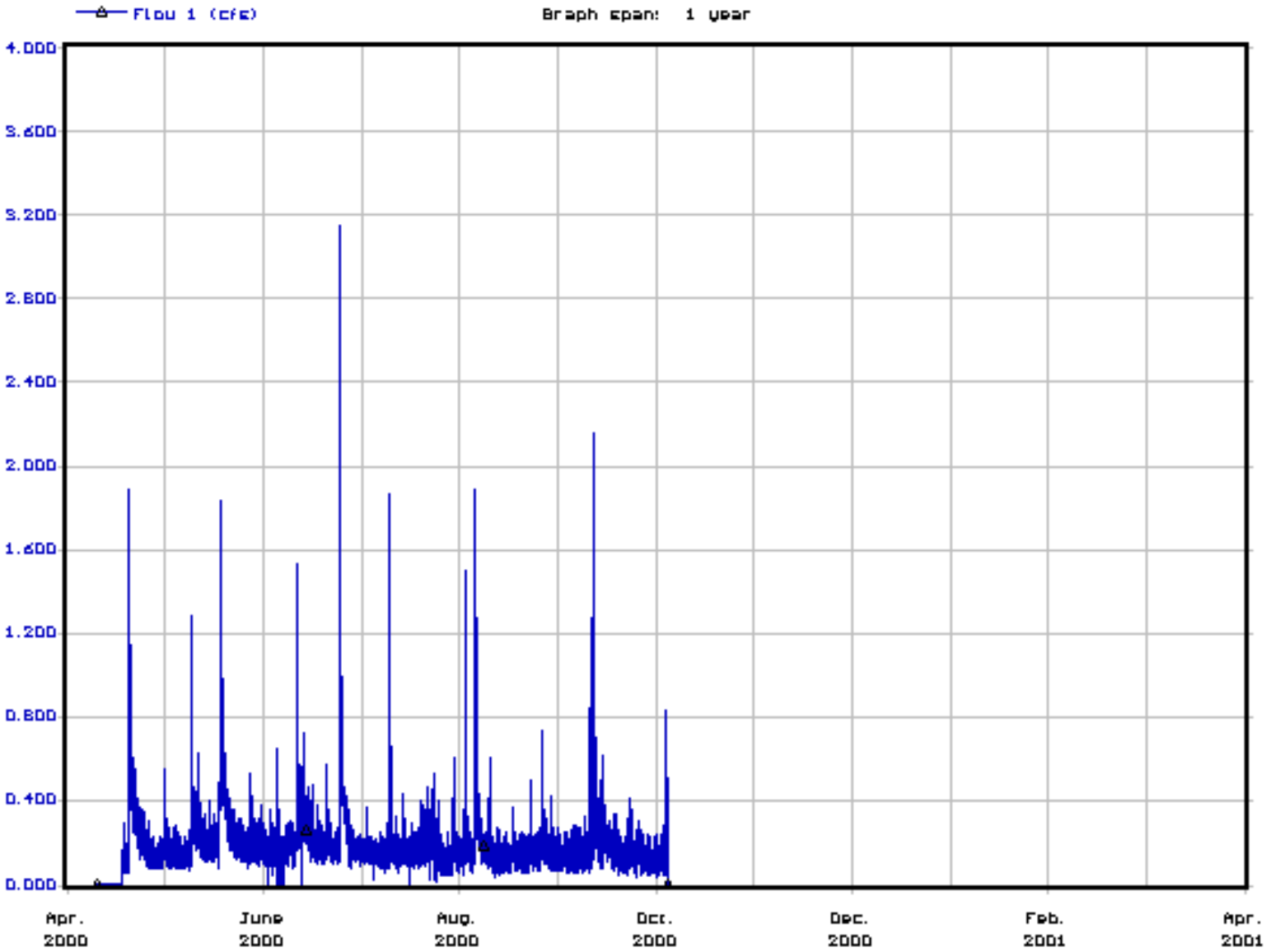

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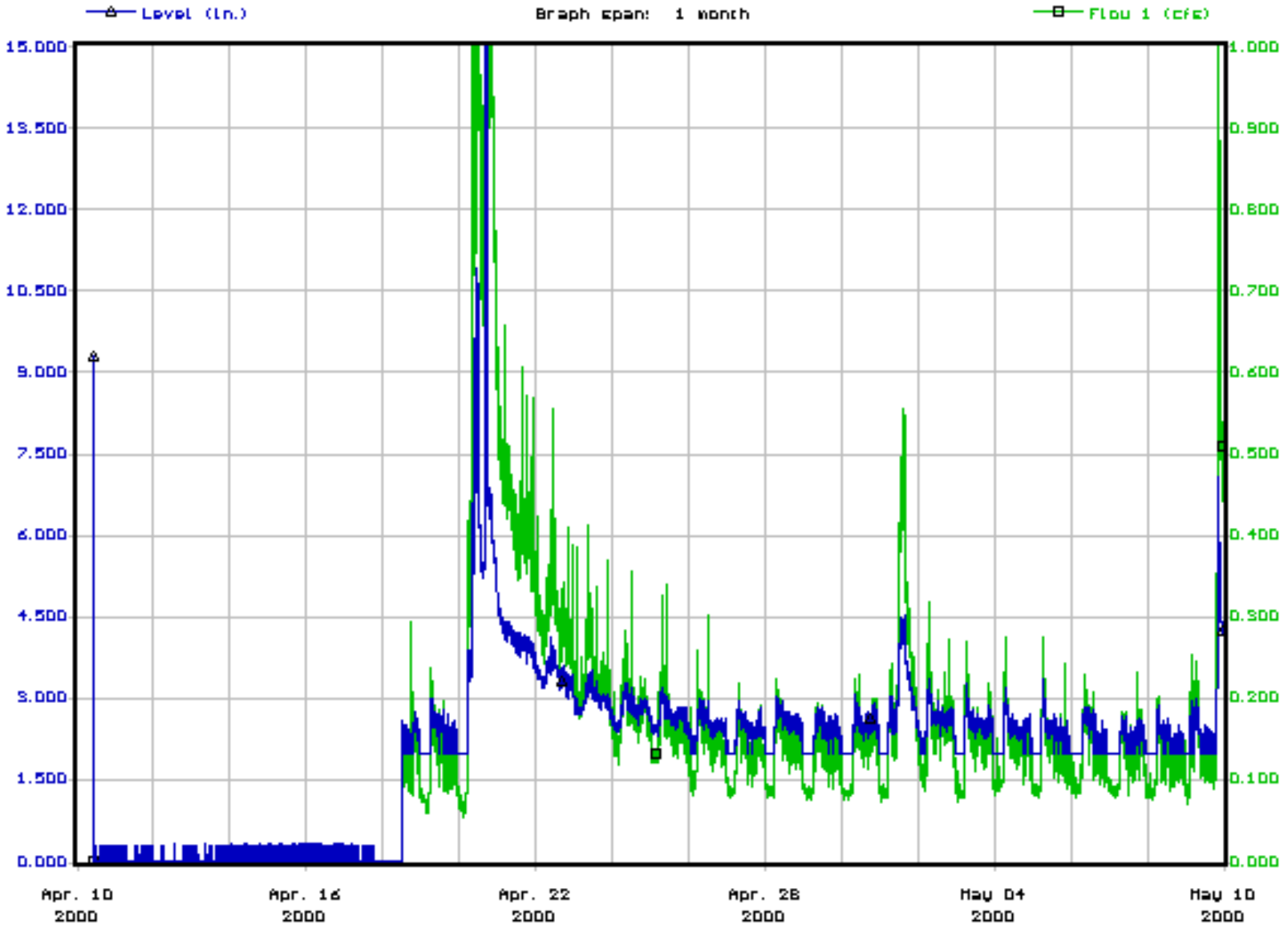

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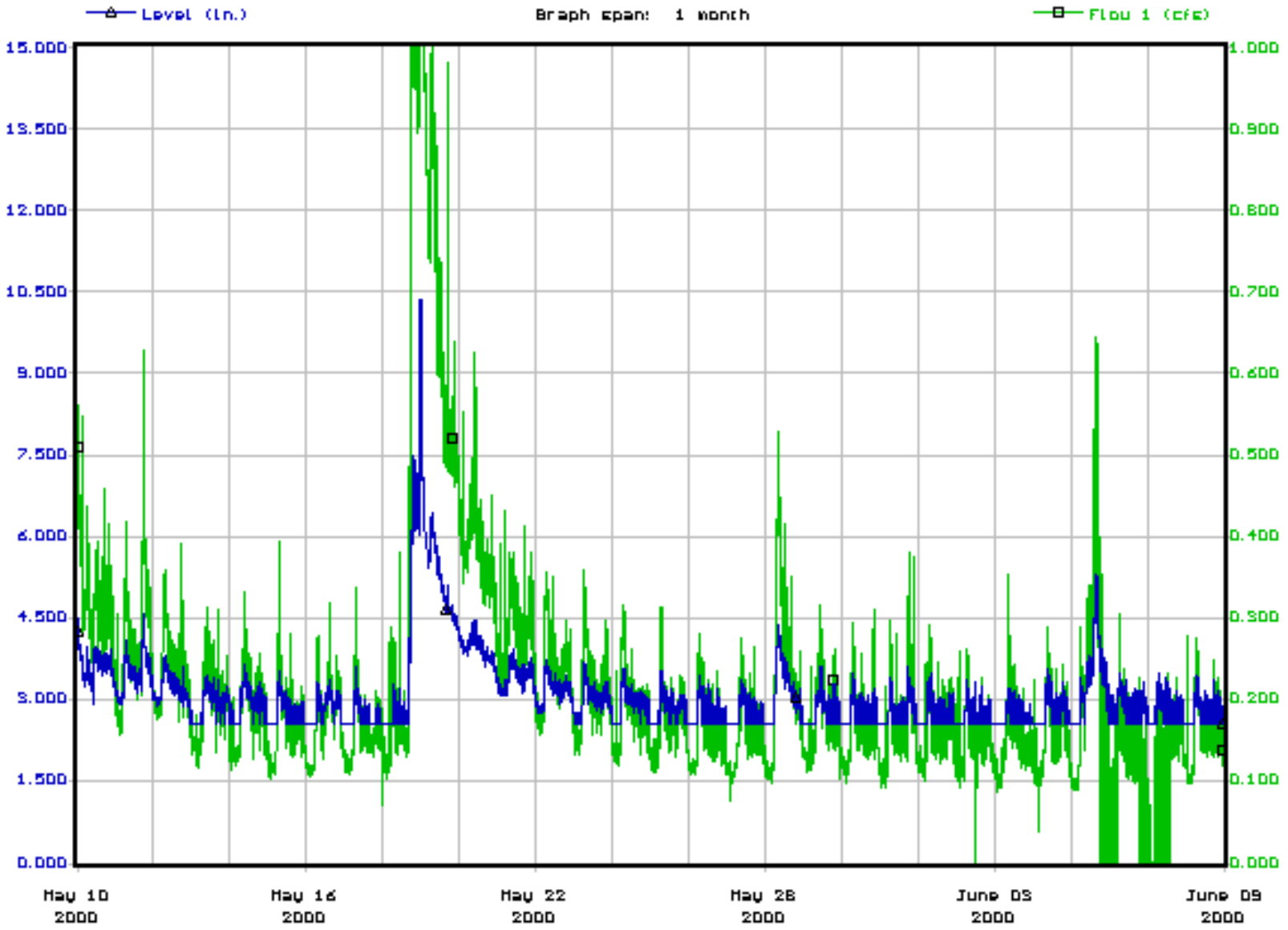

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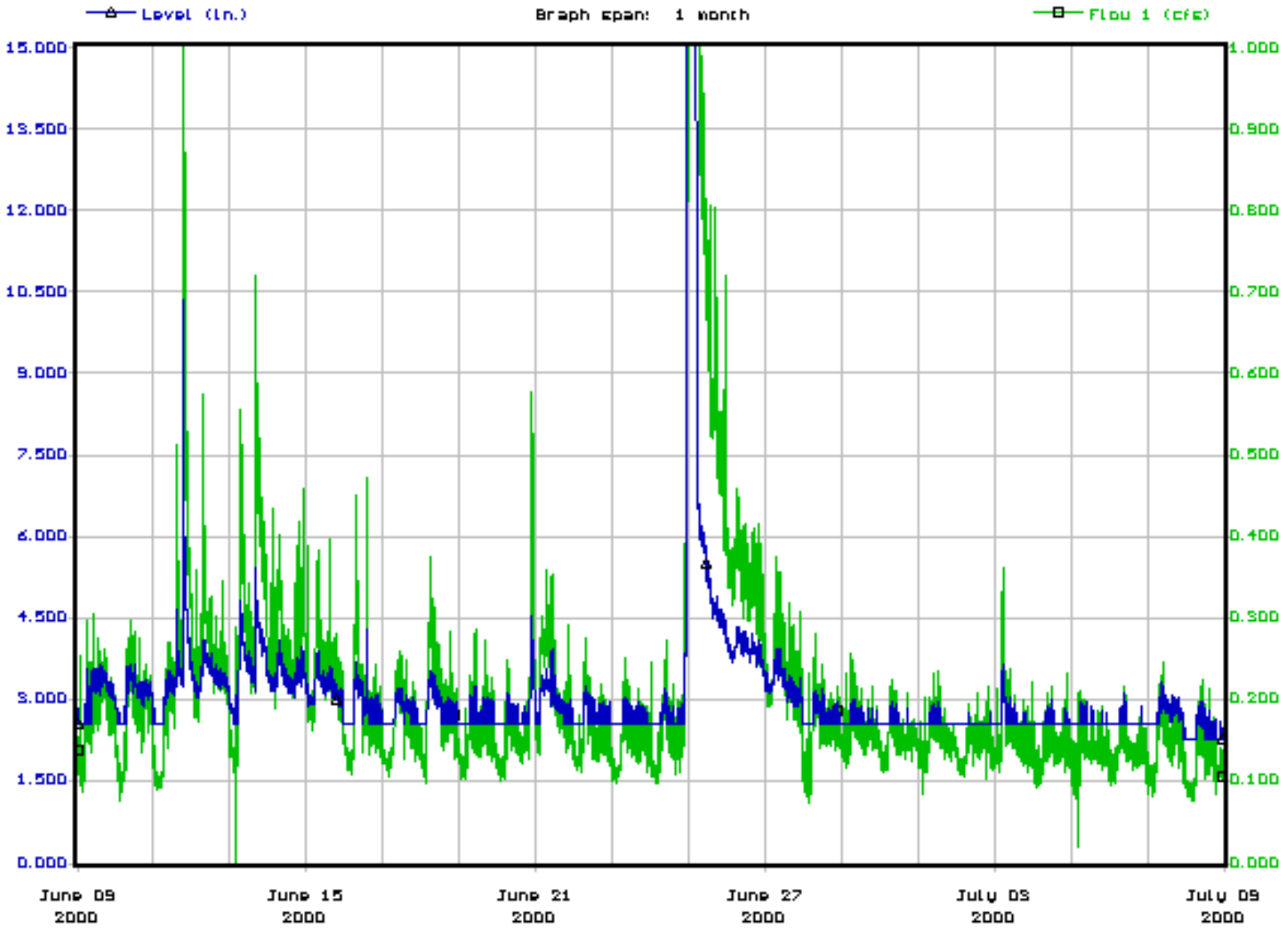

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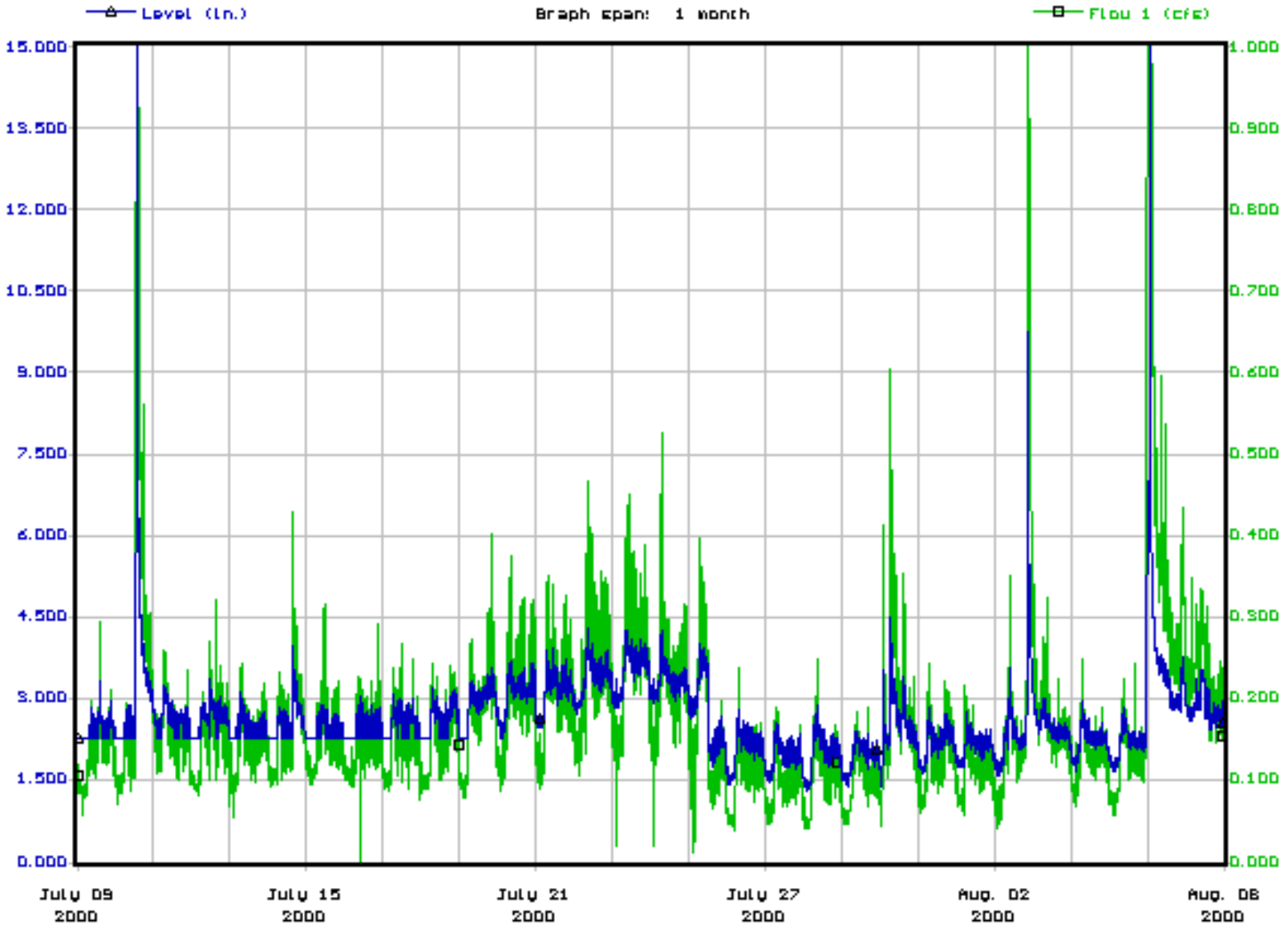

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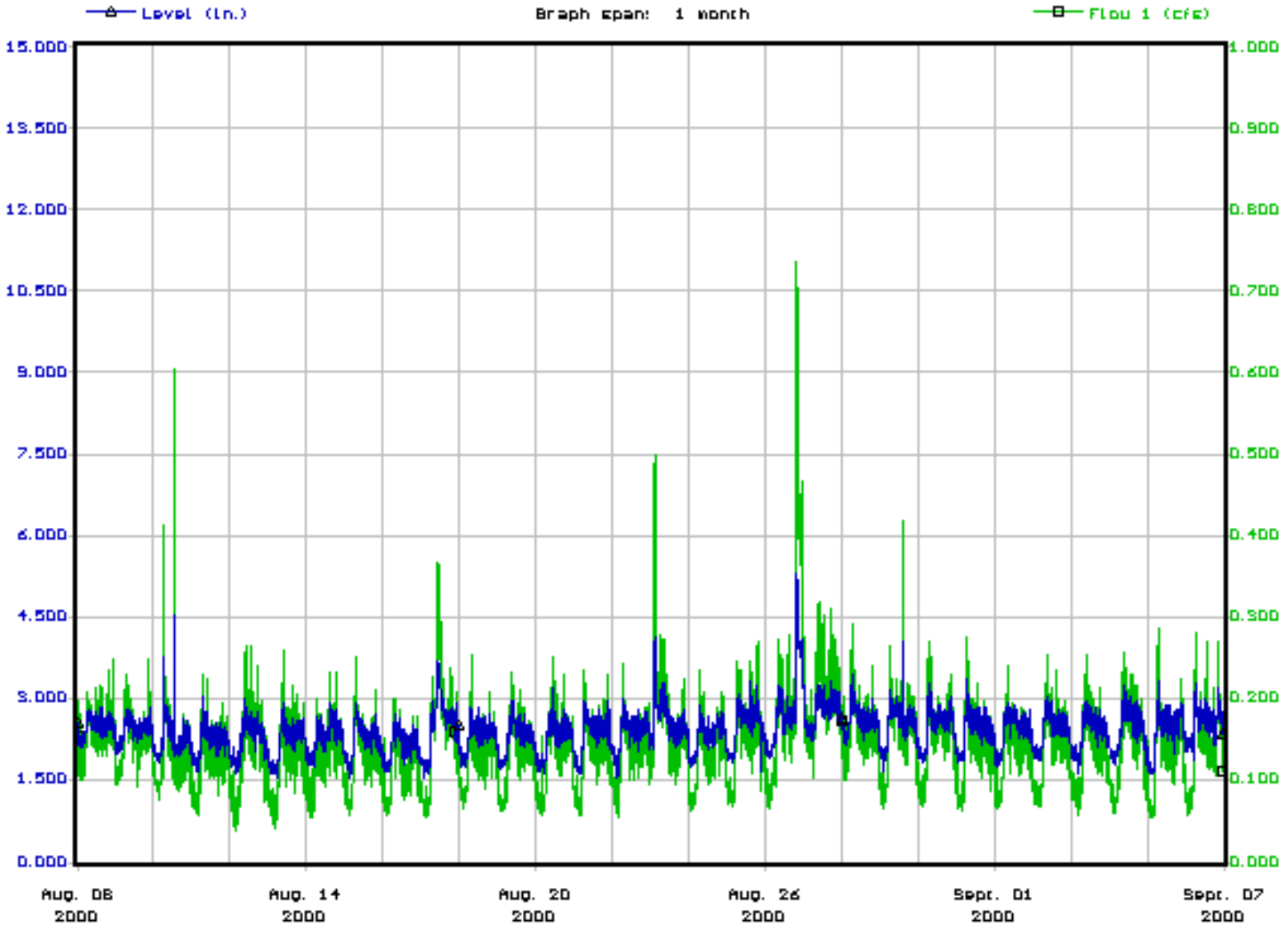

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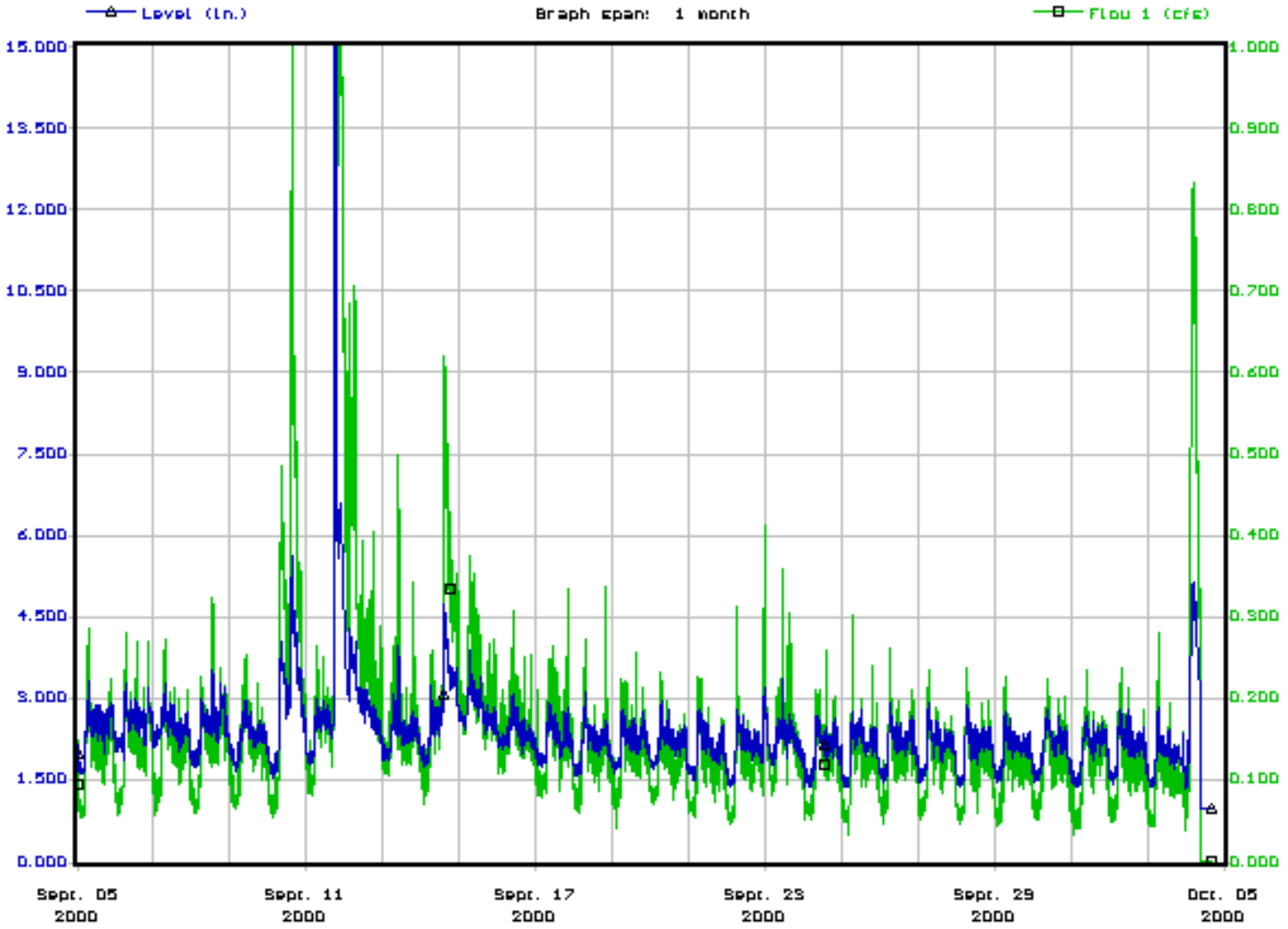

Dartmoor: Dartmoor and Peppermill

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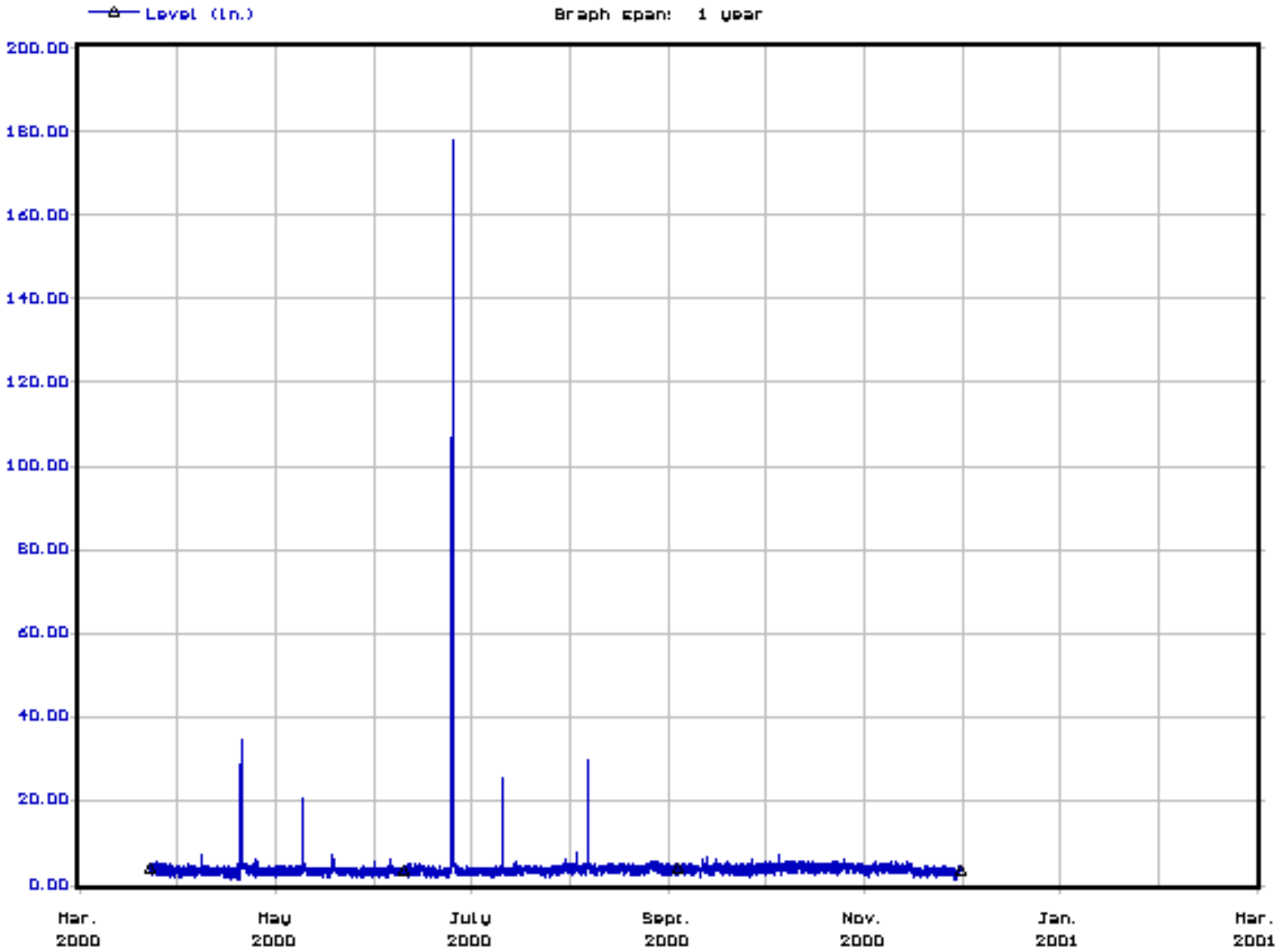

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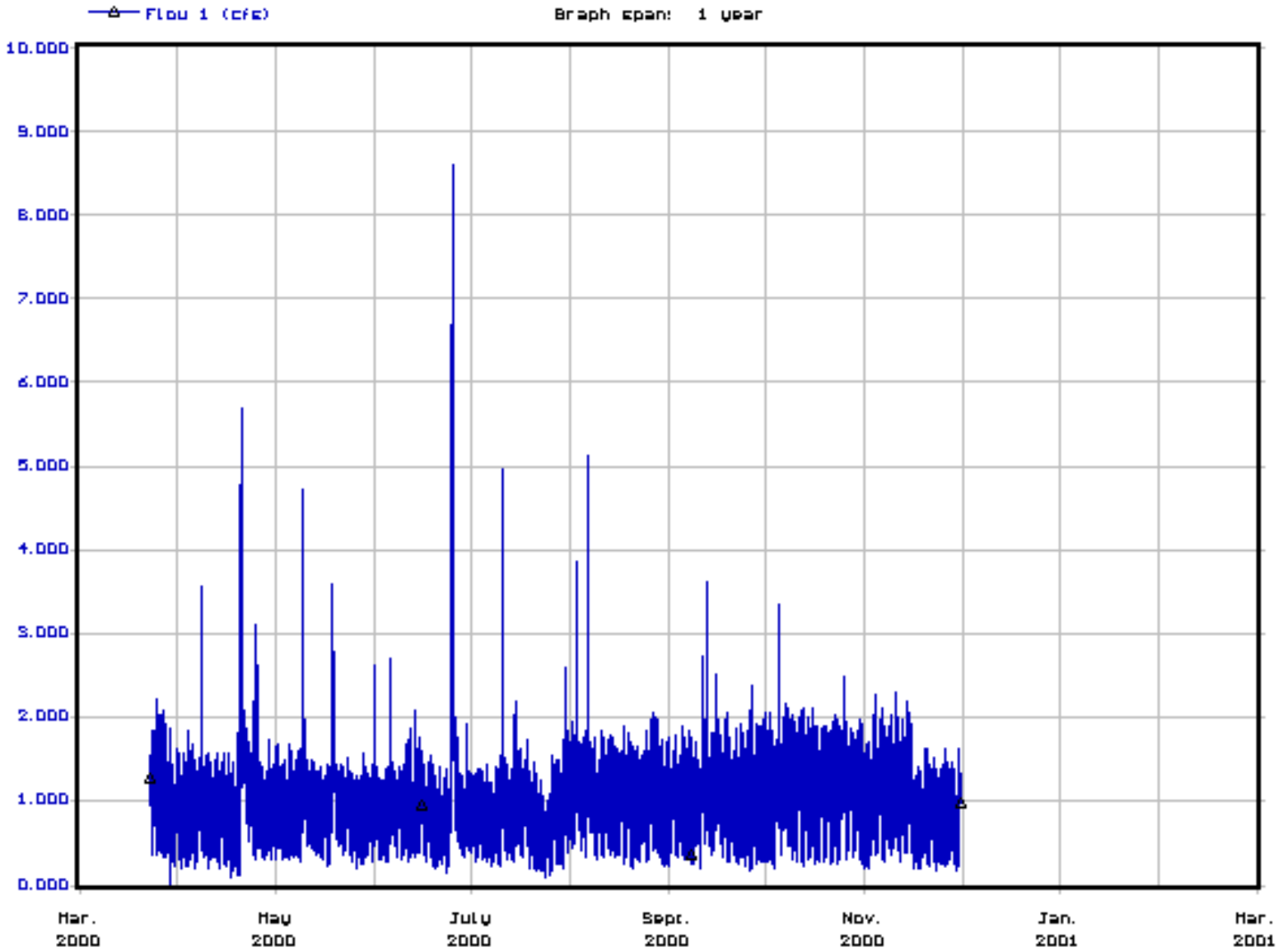

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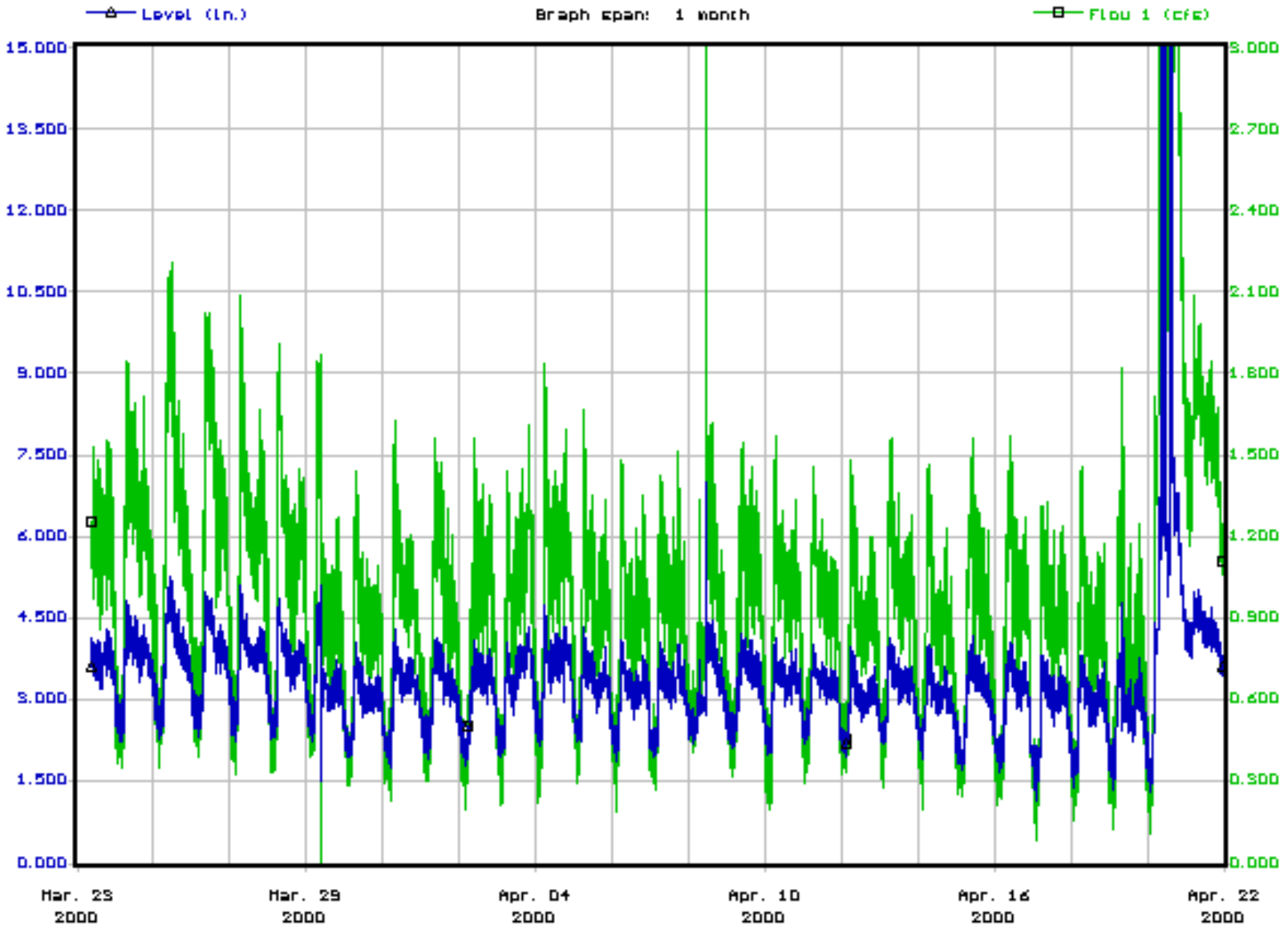
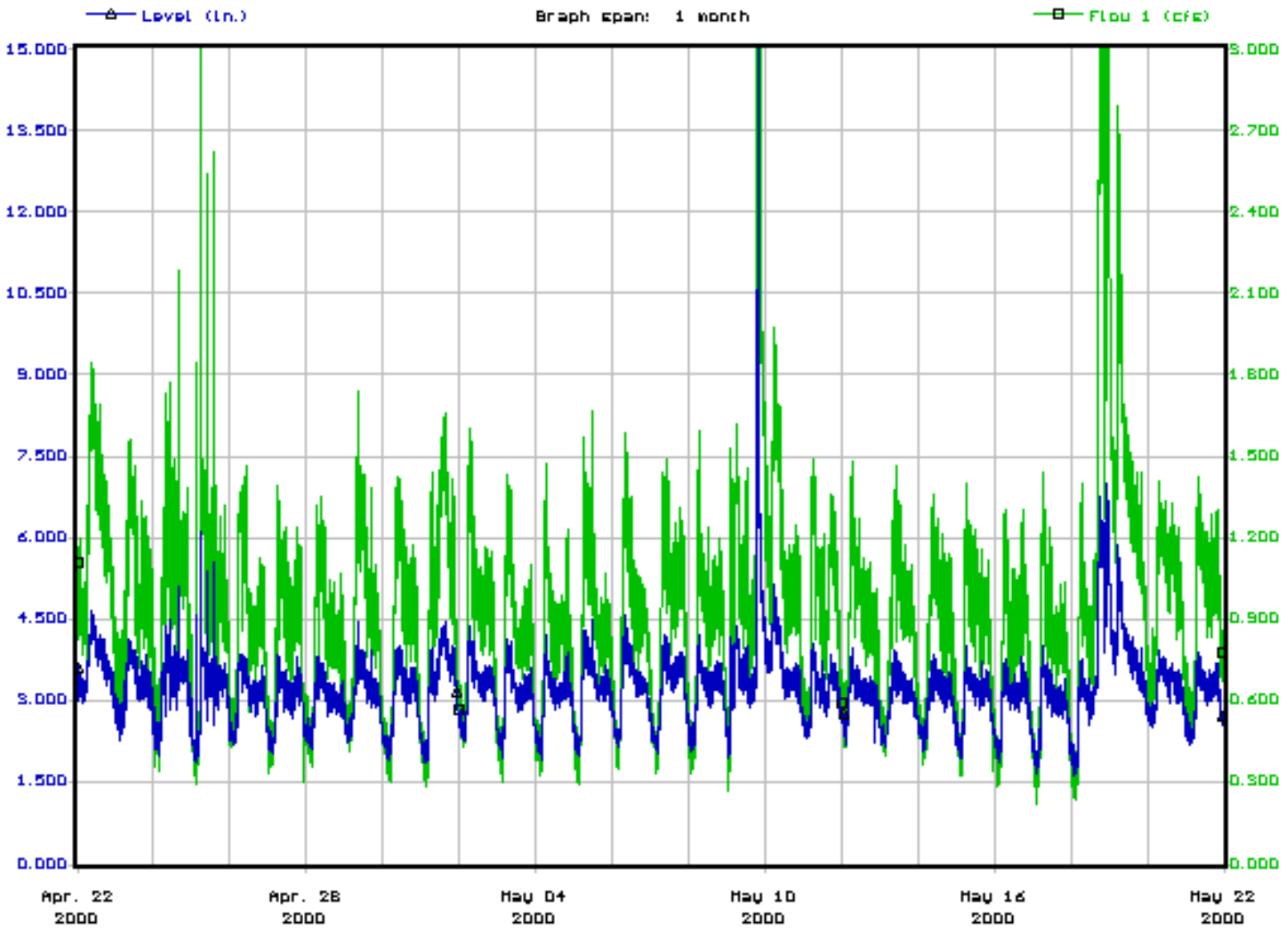
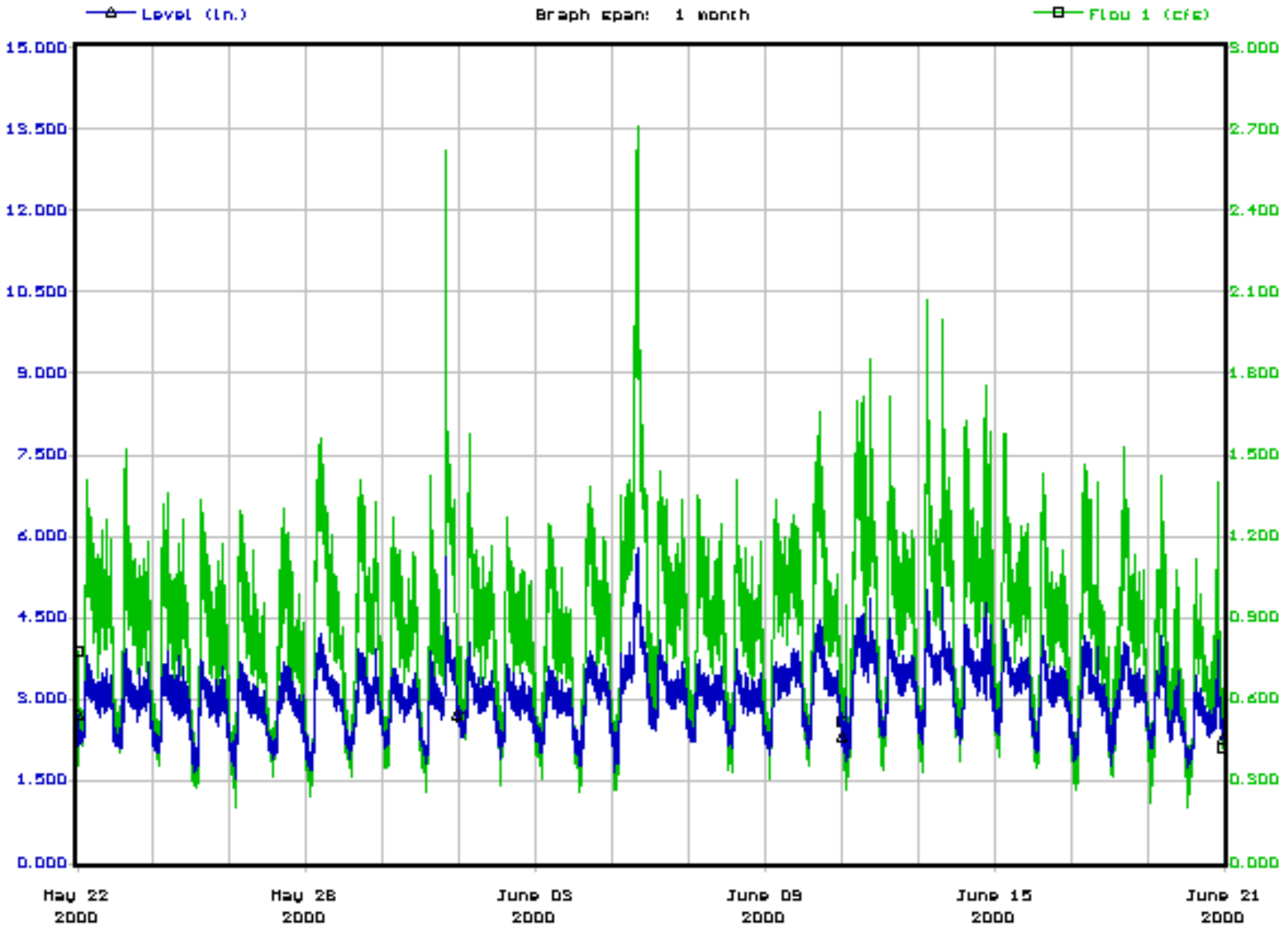
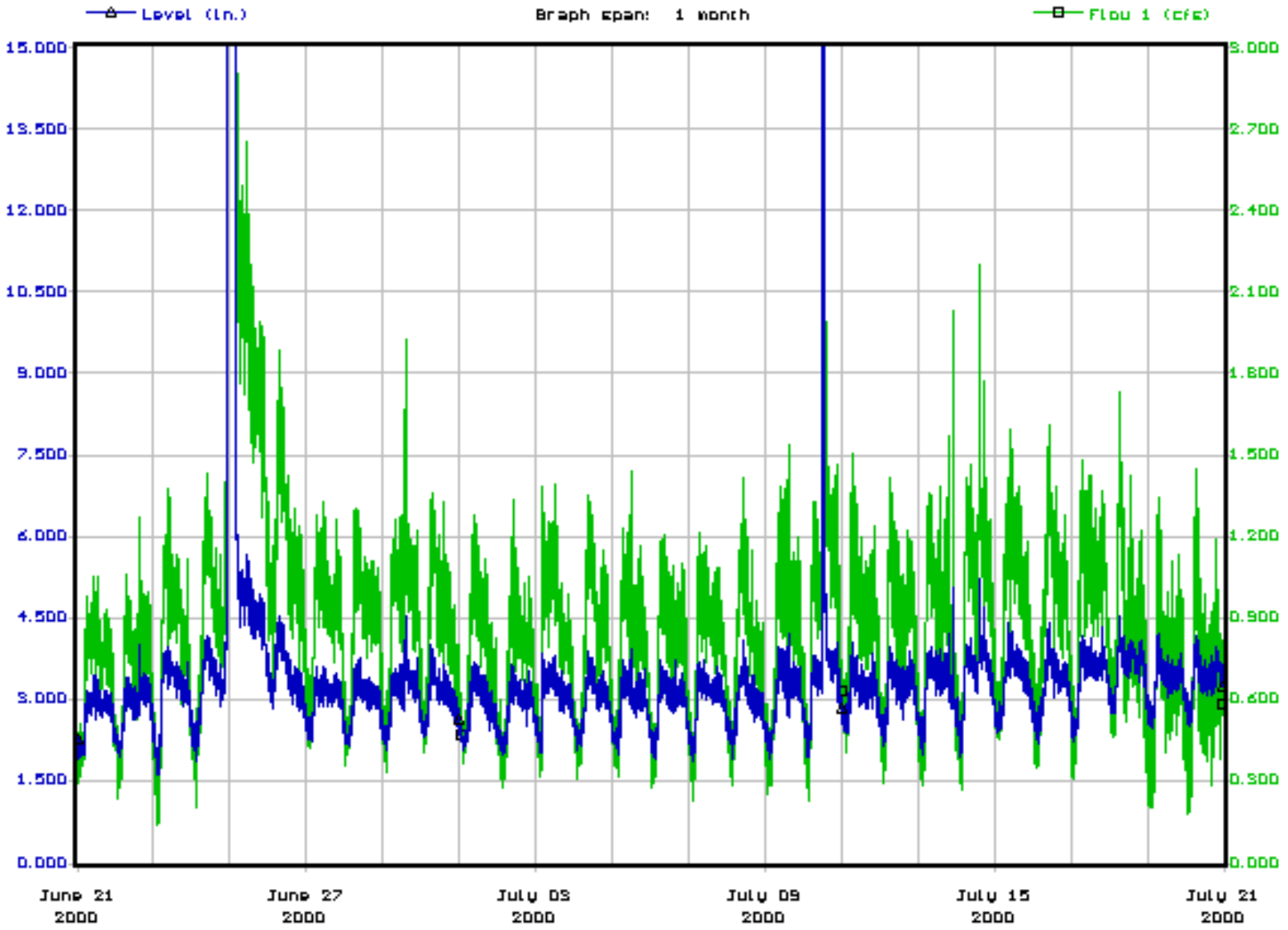



Dartmoor: Dartmoor and Peppermill
Level (in.)
Graph span: 1 month
Flow 1 (cfs)
15.000
13.500
12.000
10.500
9.000
7.500
6.000
4.500
3.000
1.500
0.000
3.000
2.700
2.400
2.100
1.800
1.500
1.200
0.900
0.600
0.300
0.000
Apr. 22
2000
Apr. 28
2000
May 04
2000
May 10
2000
May 16
2000
May 22
2000

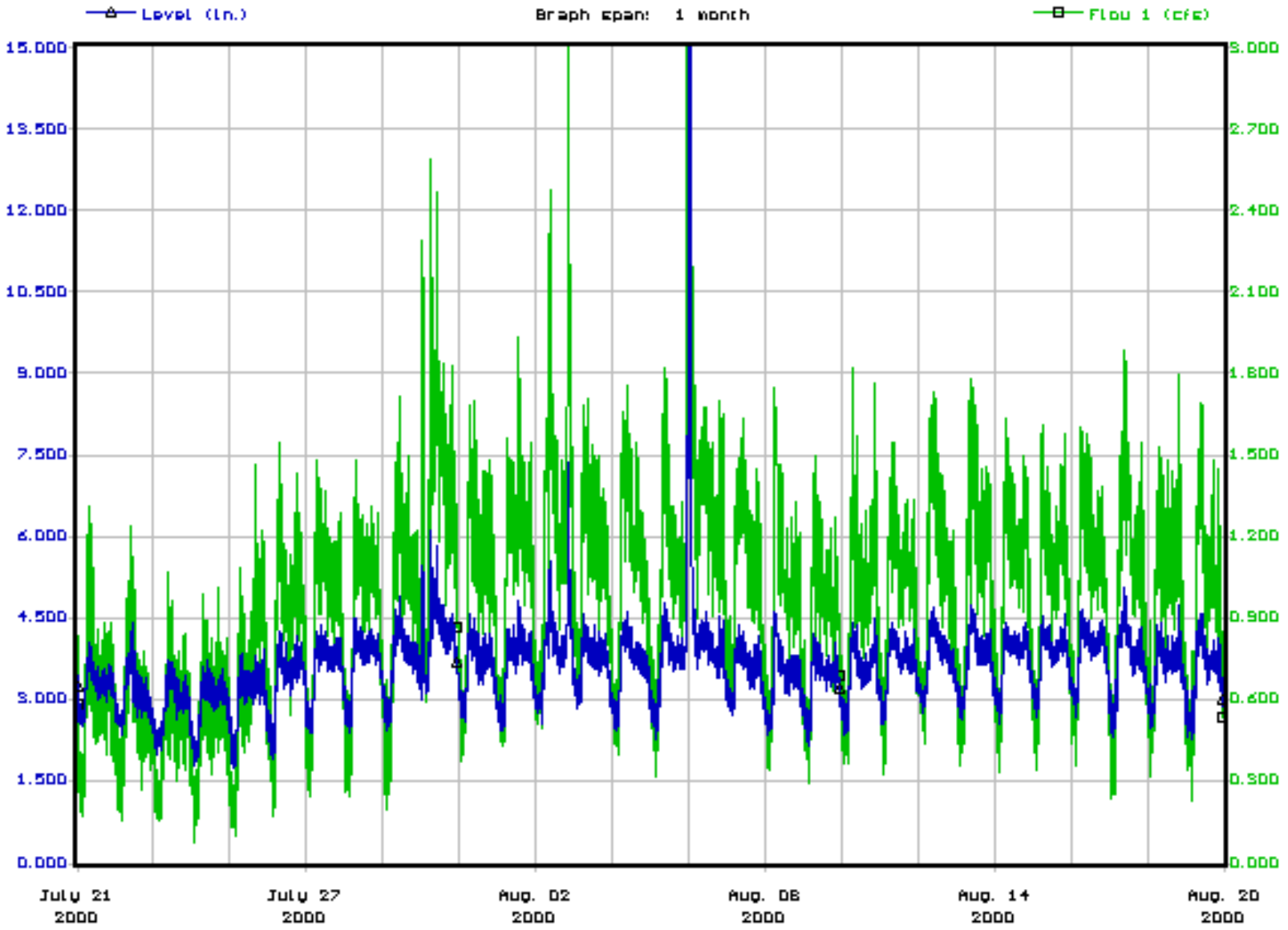
Dartmoor: Dartmoor and Peppermill



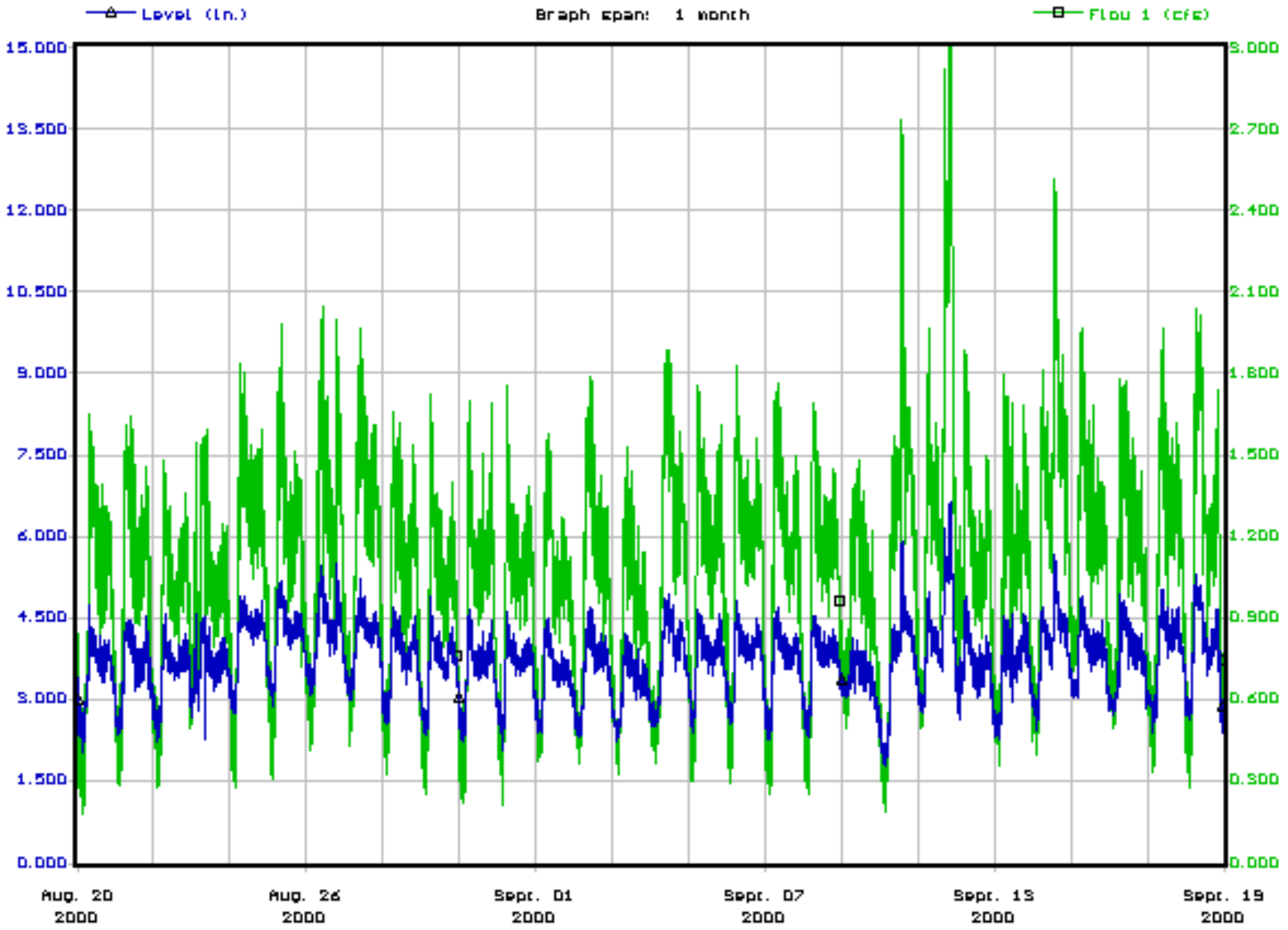
Dartmoor: Dartmoor and Peppermill



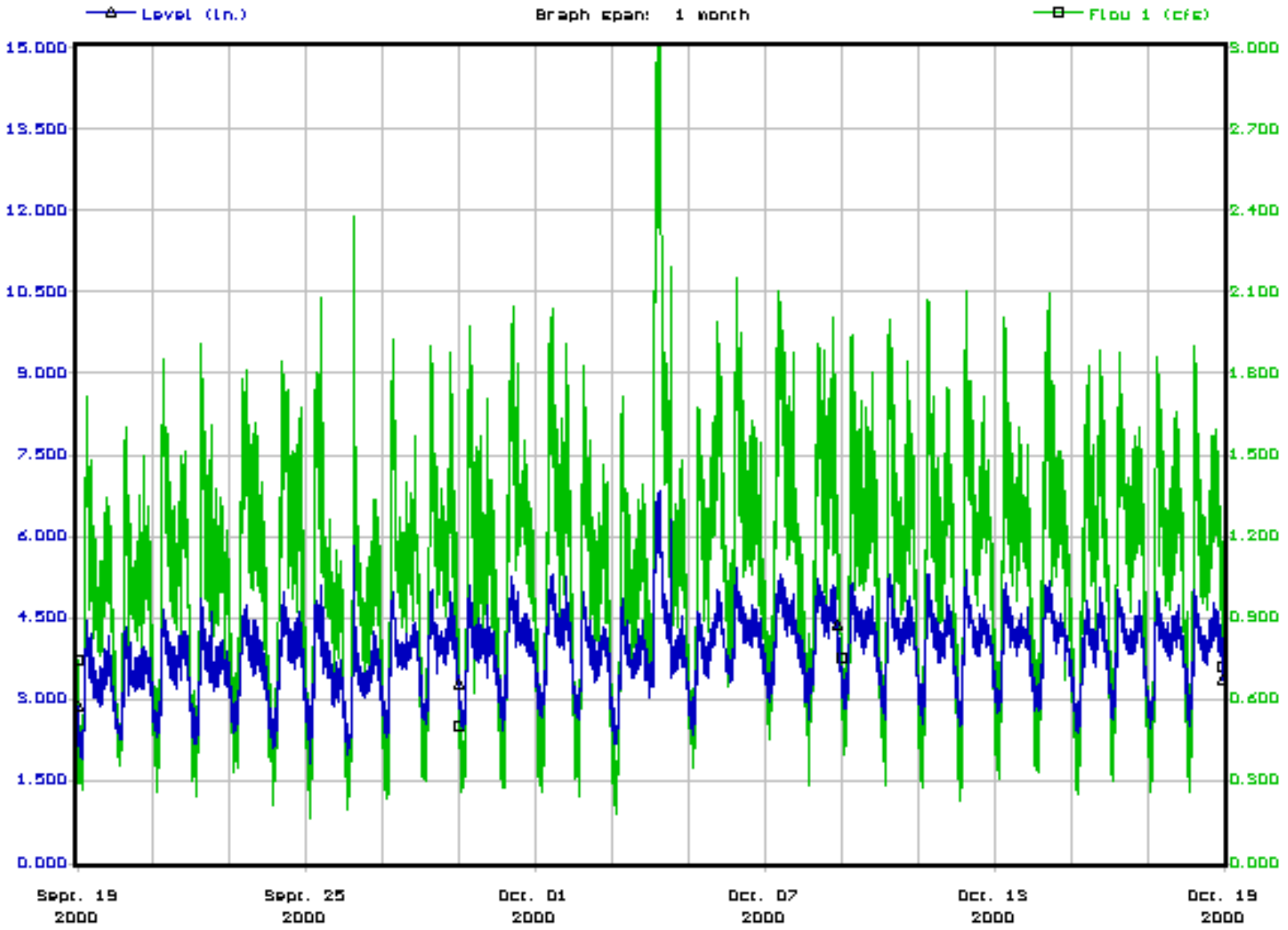
Dartmoor: Dartmoor and Peppermill



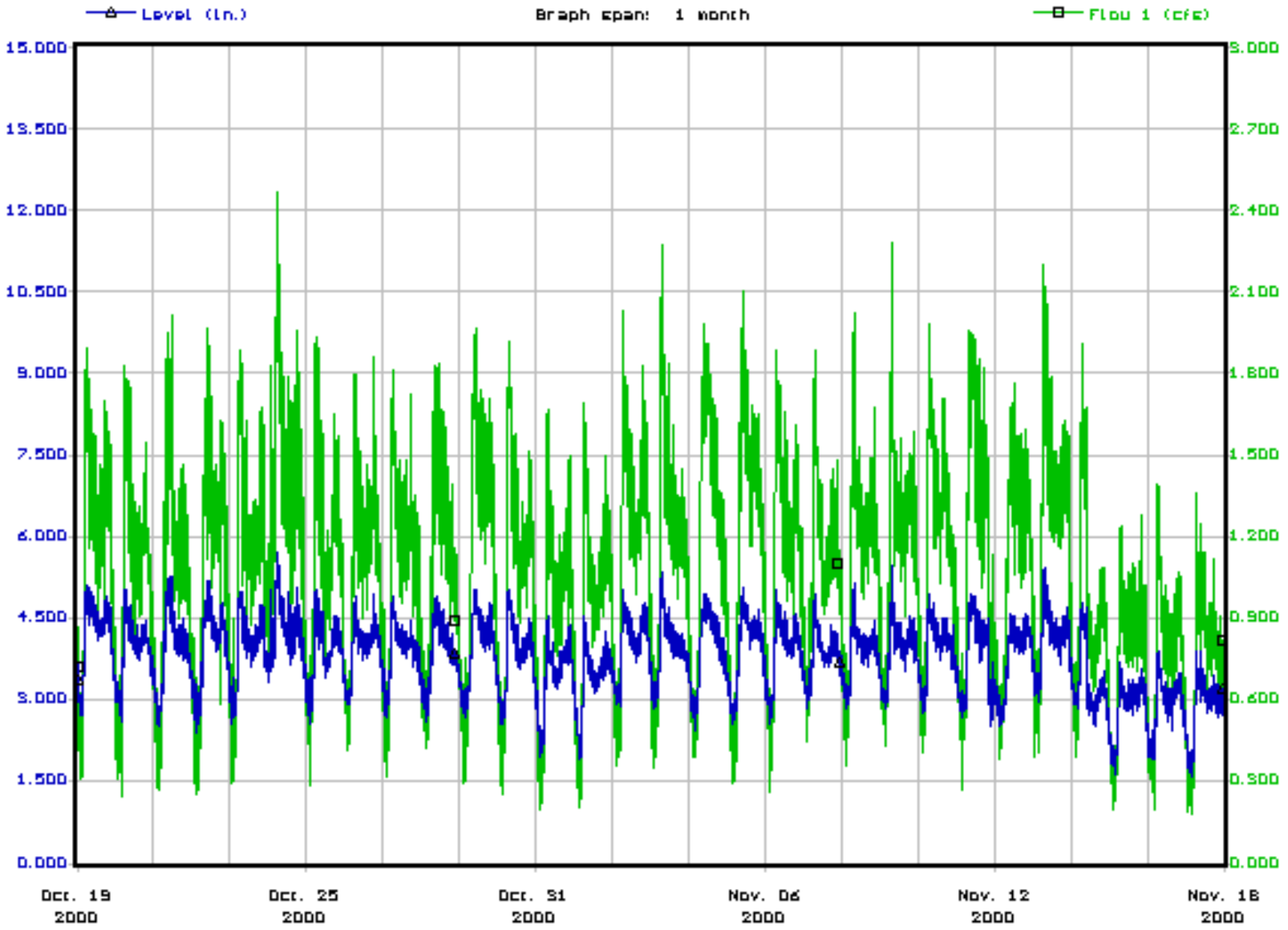
Dartmoor: Dartmoor and Peppermill

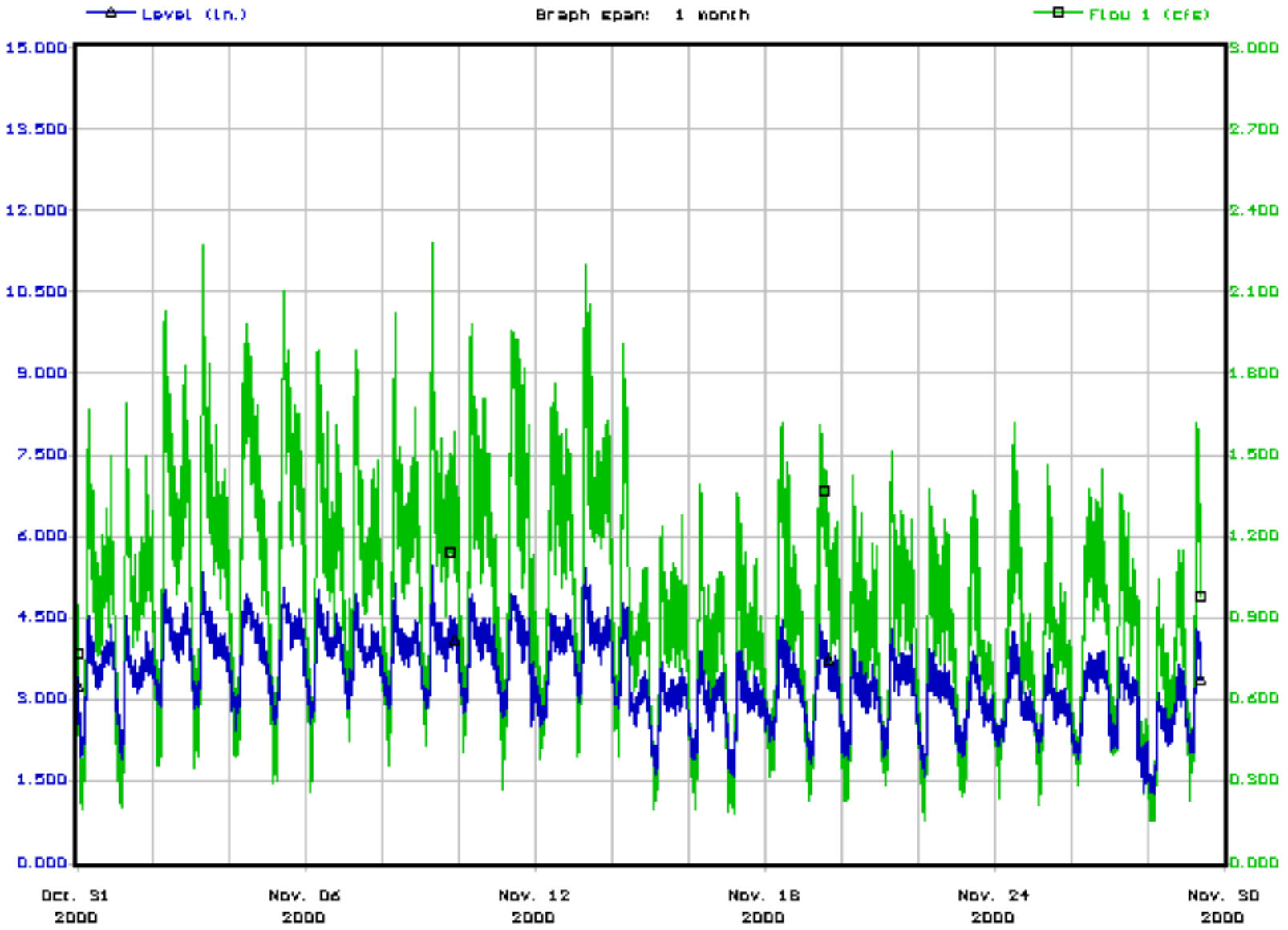


Dartmoor: Dartmoor and Peppermill

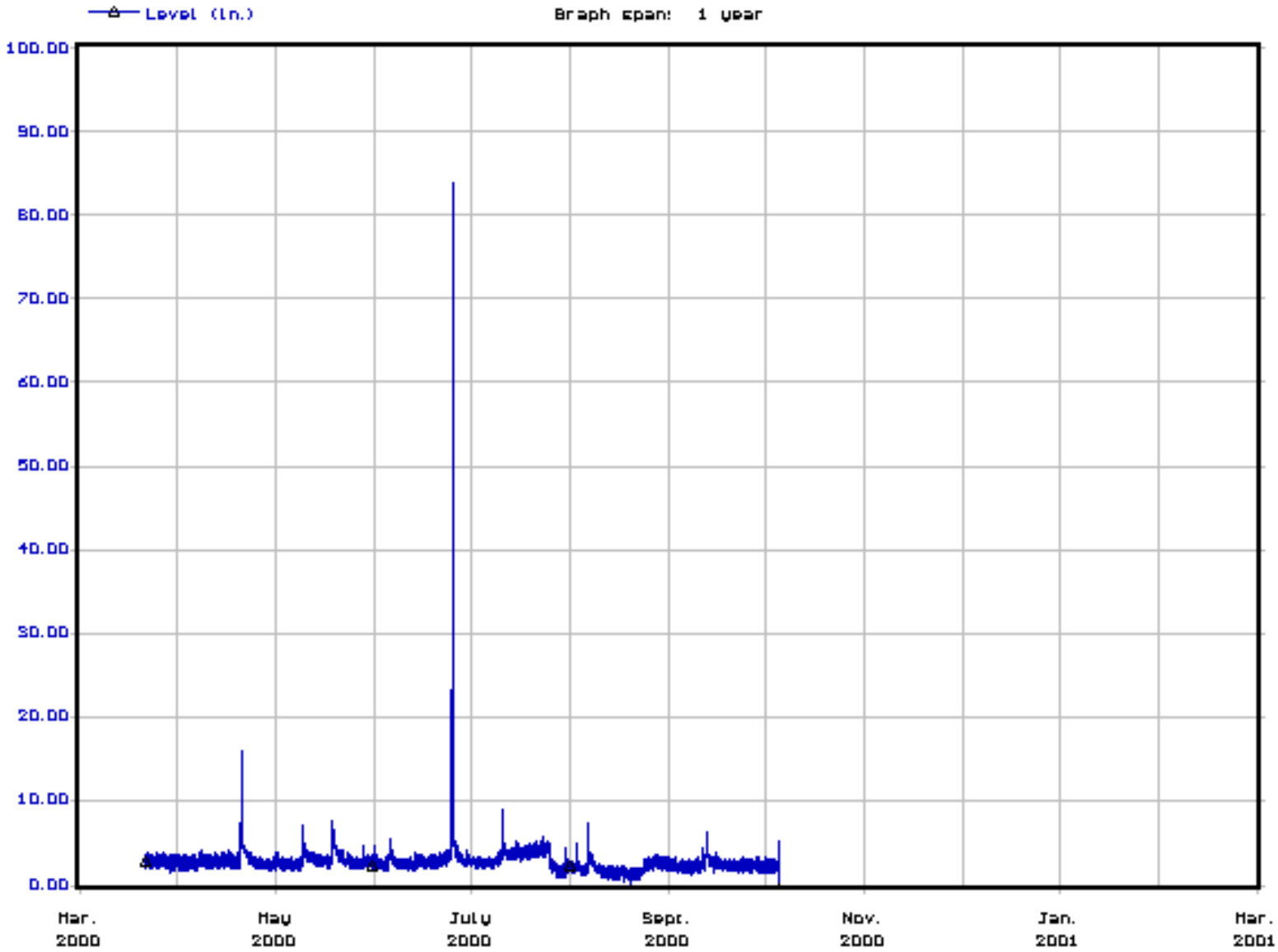


Dartmoor: Dartmoor and Peppermill

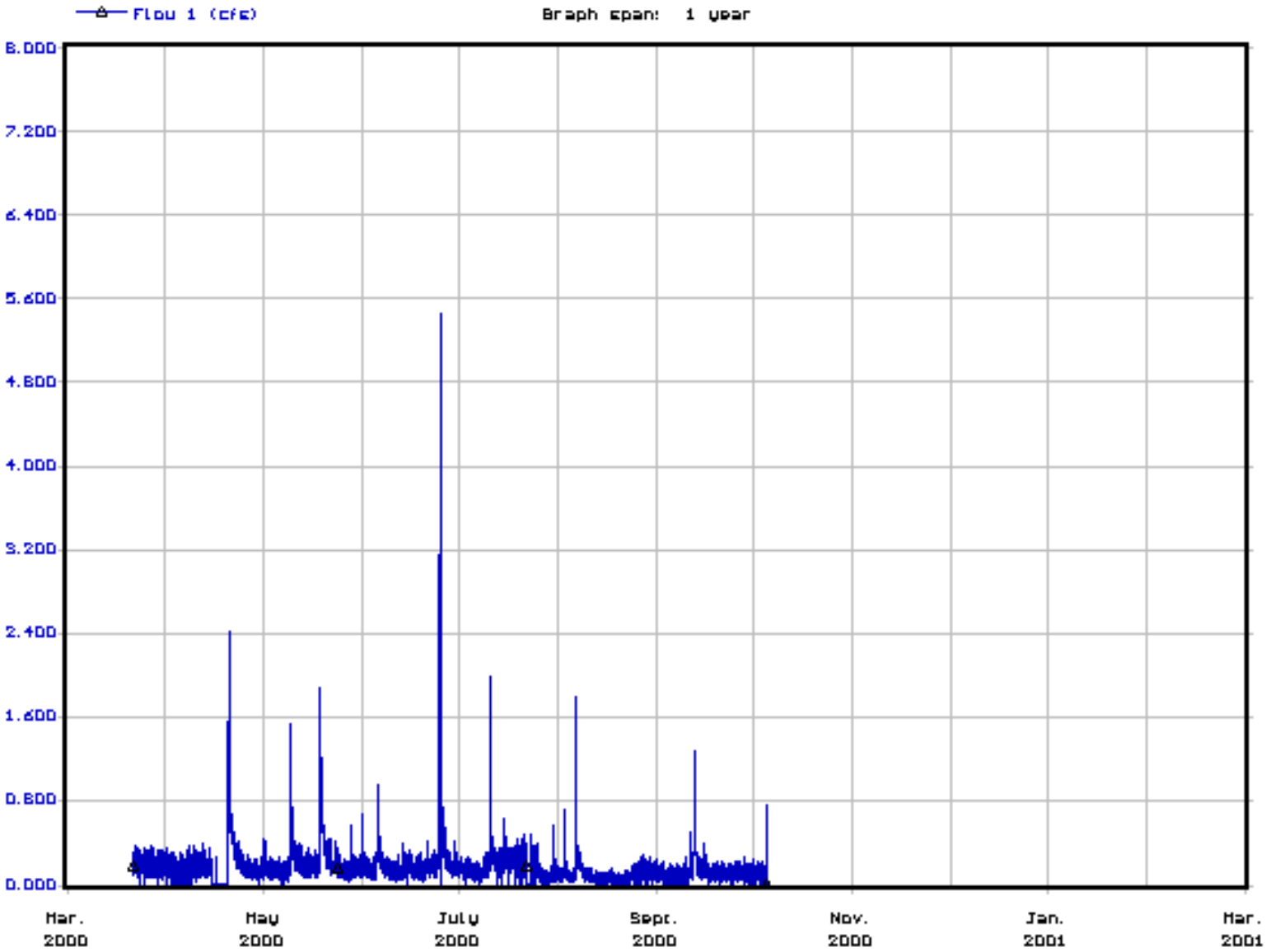



Dartmoor: Dartmoor and Peppermill
Level (in.)
Graph span: 1 month
Flow 1 (cfs)
15.000
13.500
12.000
10.500
9.000
7.500
6.000
4.500
3.000
1.500
0.000
3.000
2.700
2.400
2.100
1.800
1.500
1.200
0.900
0.600
0.300
0.000
Oct. 31
2000
Nov. 06
2000
Nov. 12
2000
Nov. 18
2000
Nov. 24
2000
Nov. 30
2000

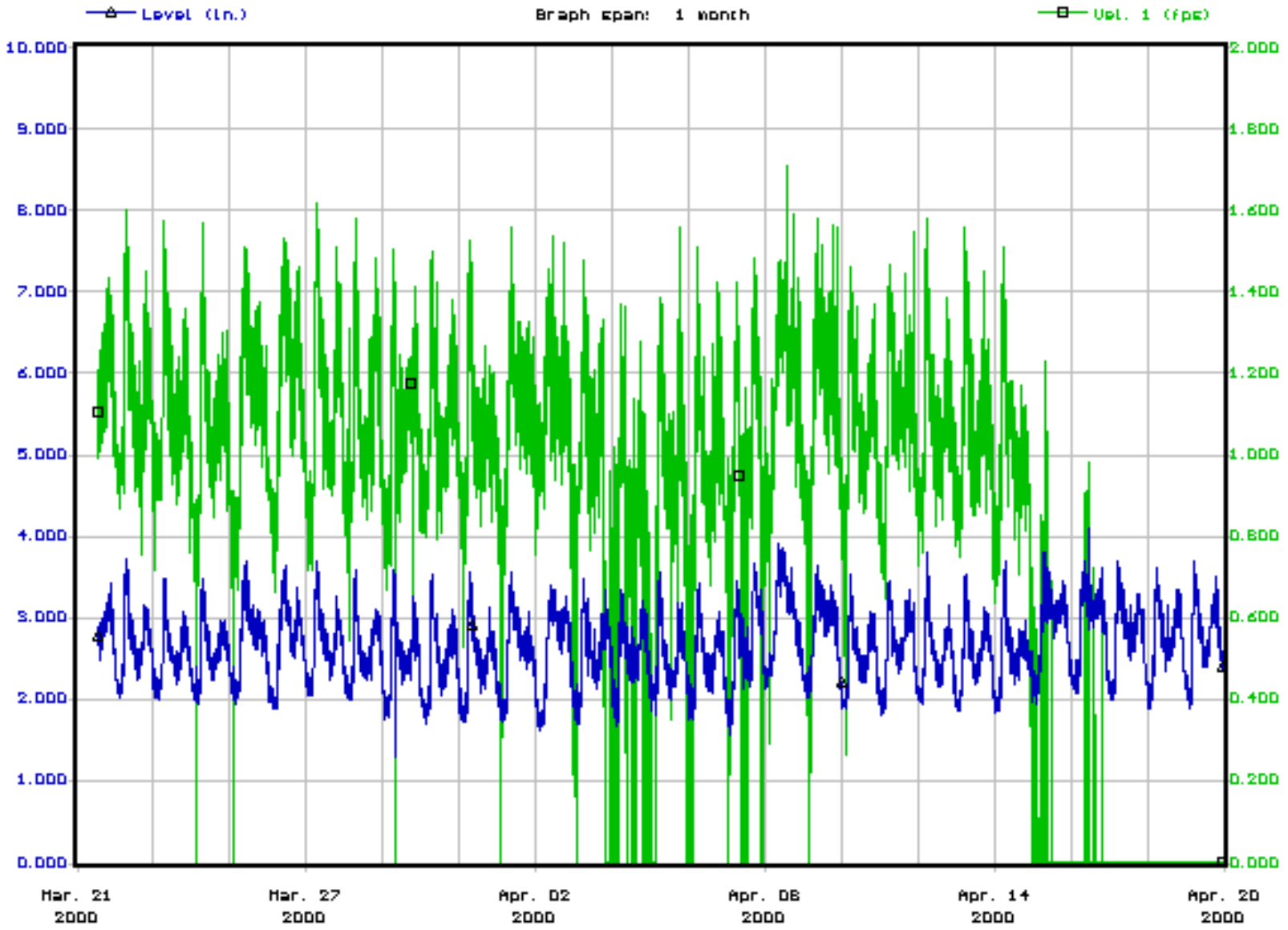
Glen Leven North: Glen Leven



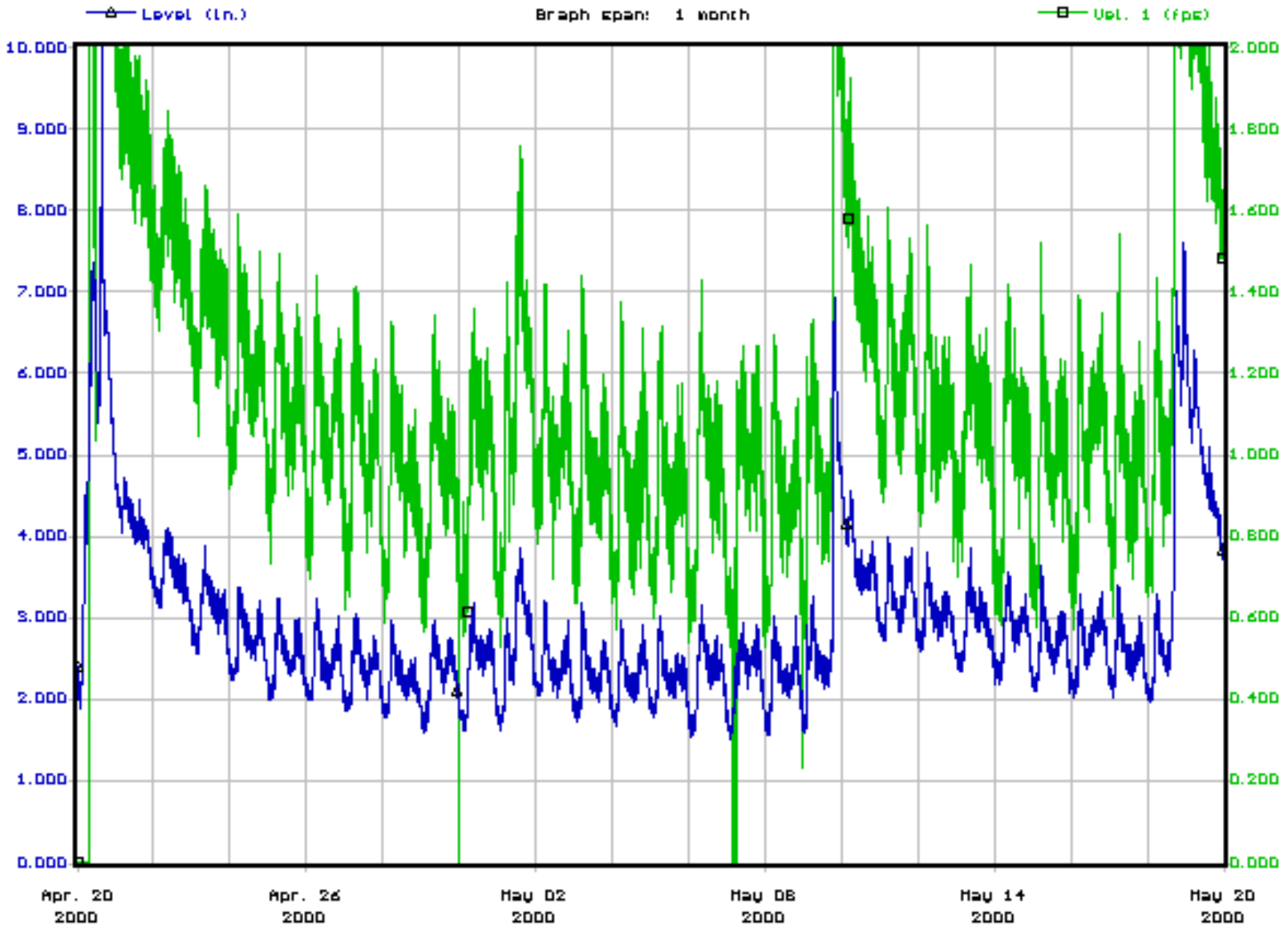
Glen Leven North: Glen Leven

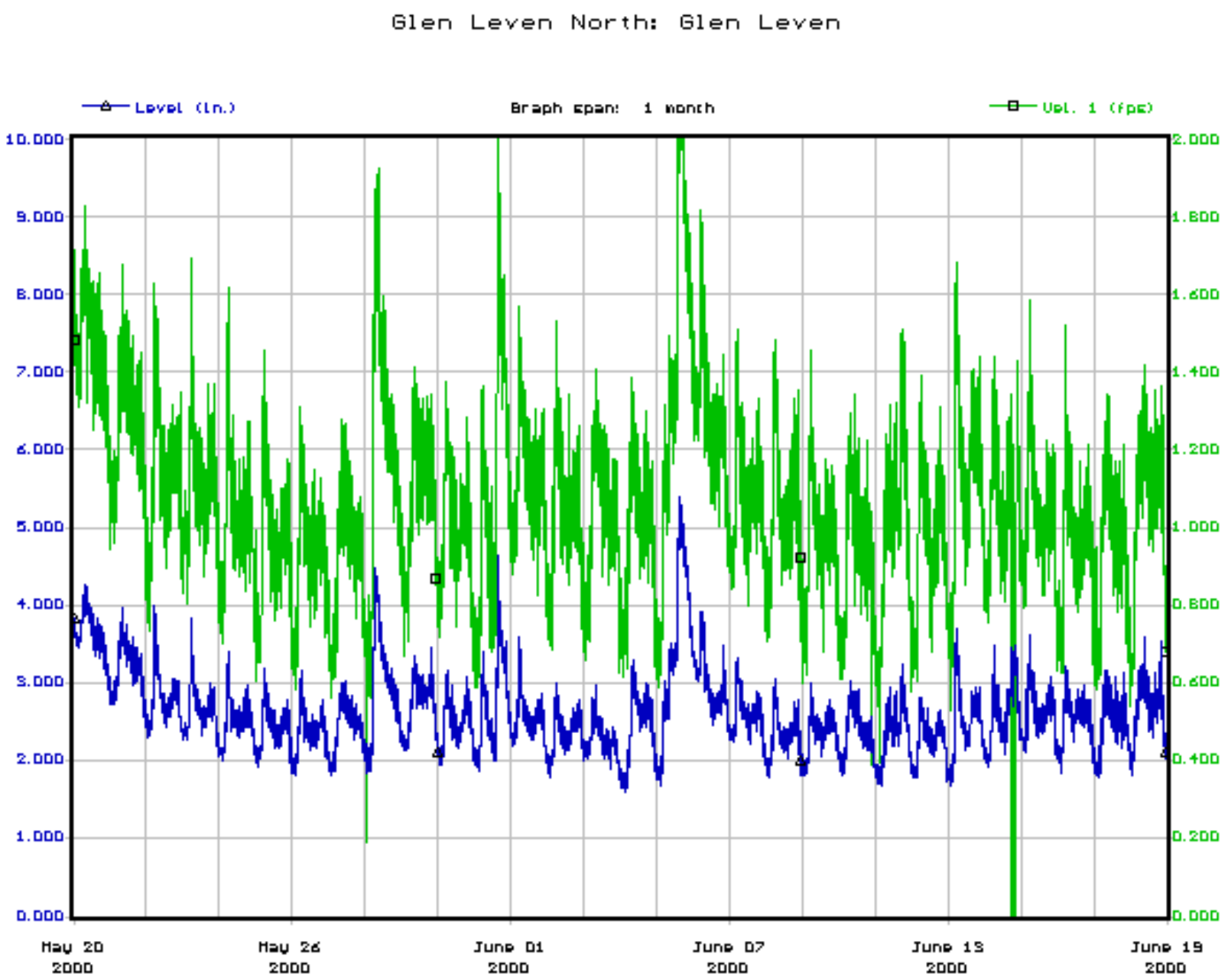


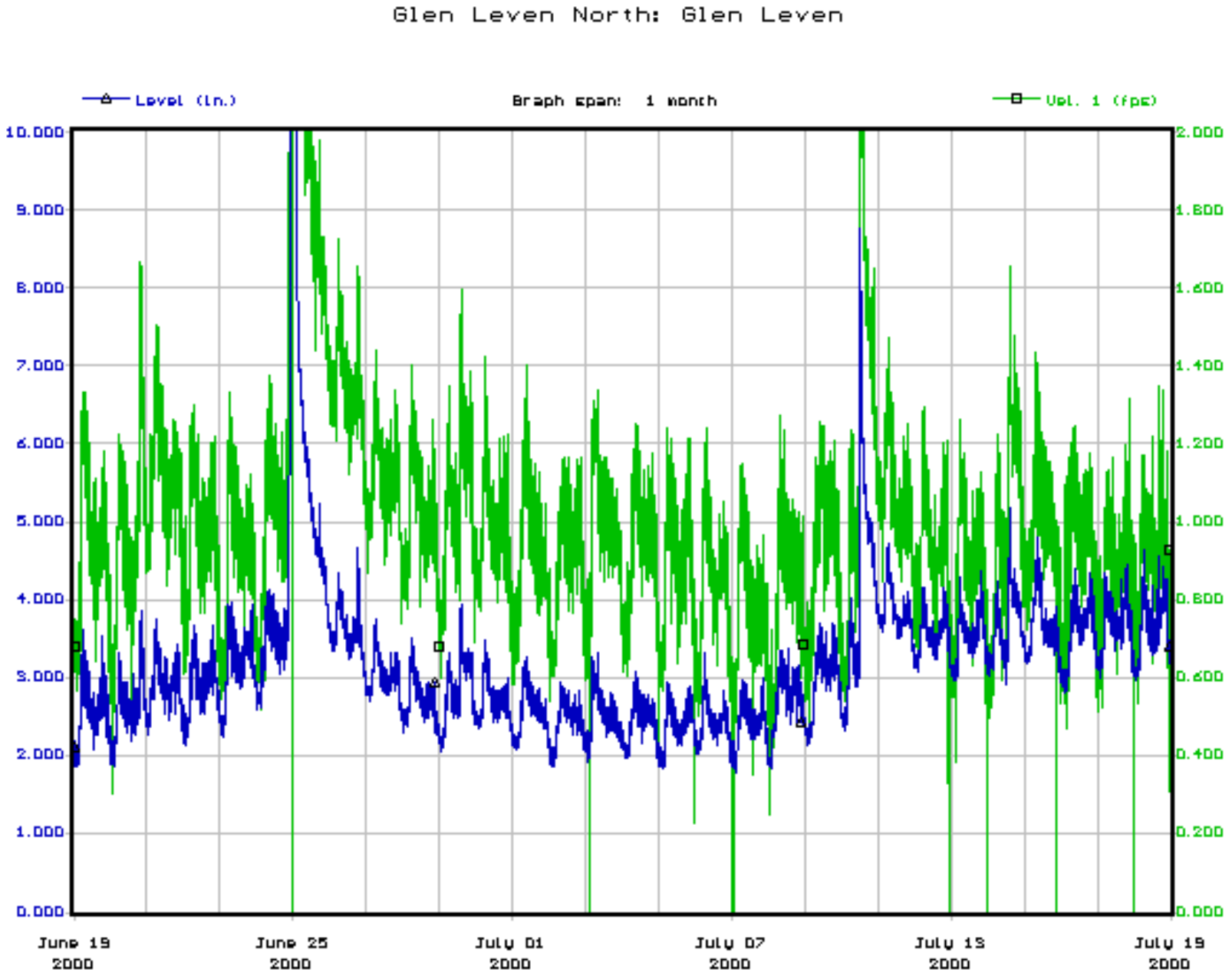
Glen Leven North: Glen Leven



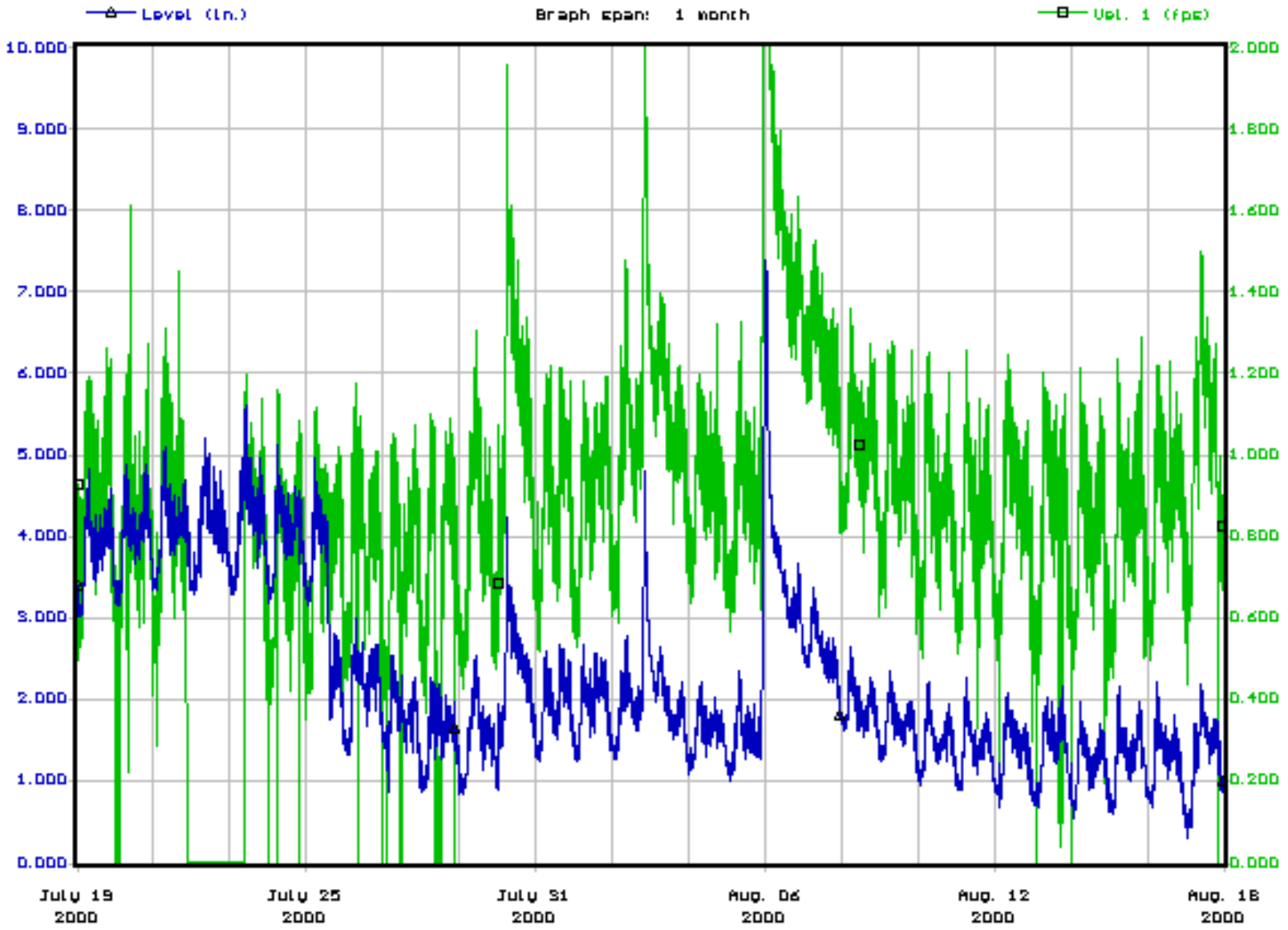
Glen Leven North: Glen Leven



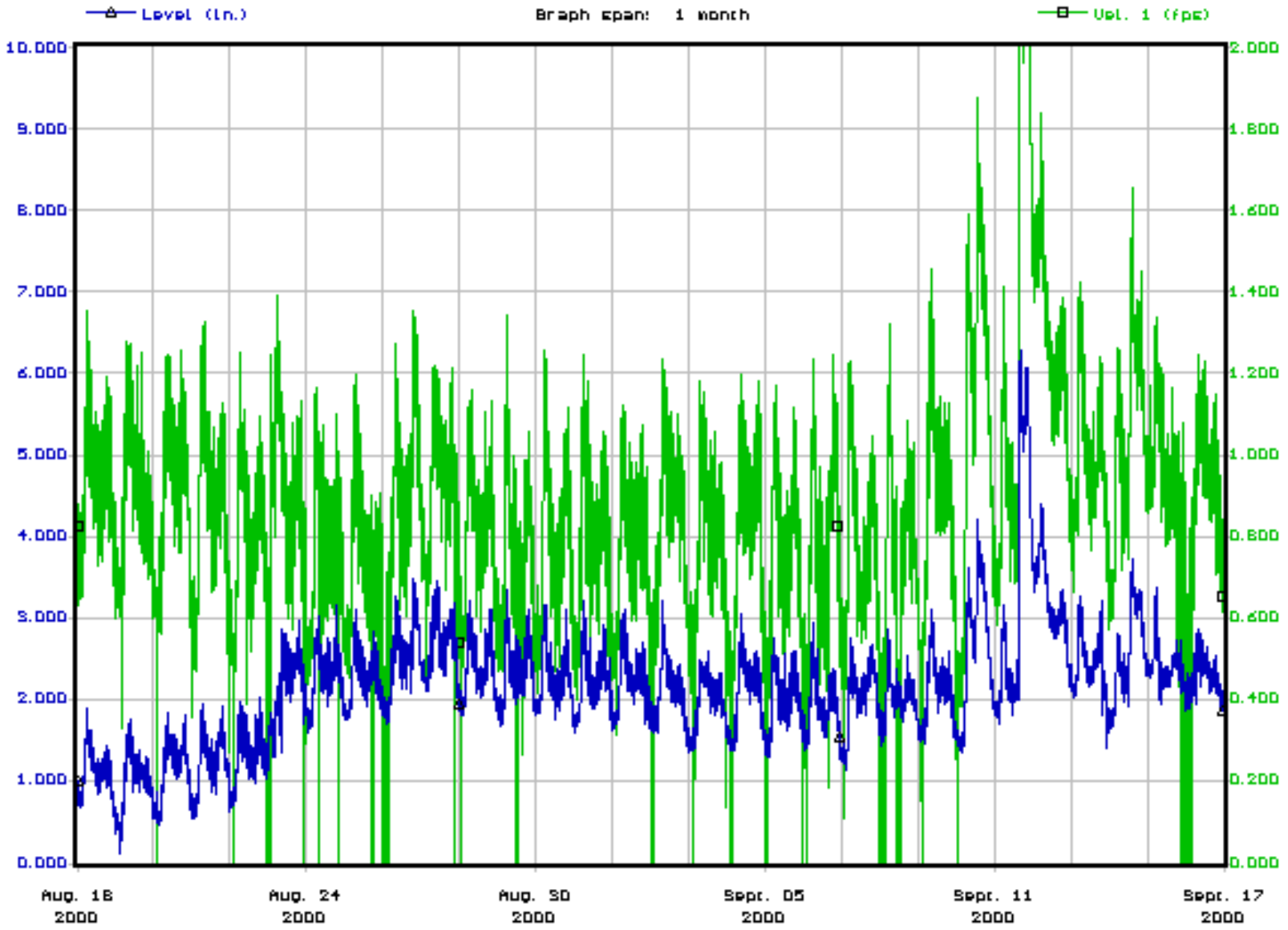

Glen Leven North: Glen Leven
Level (in.)
Graph span: 1 month
Vel. 1 (fps)
10.000
9.000
8.000
7.000
6.000
5.000
4.000
3.000
2.000
1.000
0.000
2.000
1.800
1.600
1.400
1.200
1.000
0.800
0.600
0.400
0.200
0.000
May 20 2000
May 26 2000
June 01 2000
June 07 2000
June 13 2000
June 19 2000


Glen Leven North: Glen Leven
Level (in.)
Graph span: 1 month
Vel. 1 (fps)
10.000
9.000
8.000
7.000
6.000
5.000
4.000
3.000
2.000
1.000
0.000
2.000
1.800
1.600
1.400
1.200
1.000
0.800
0.600
0.400
0.200
0.000
June 19
2000
June 25
2000
July 01
2000
July 07
2000
July 13
2000
July 19
2000

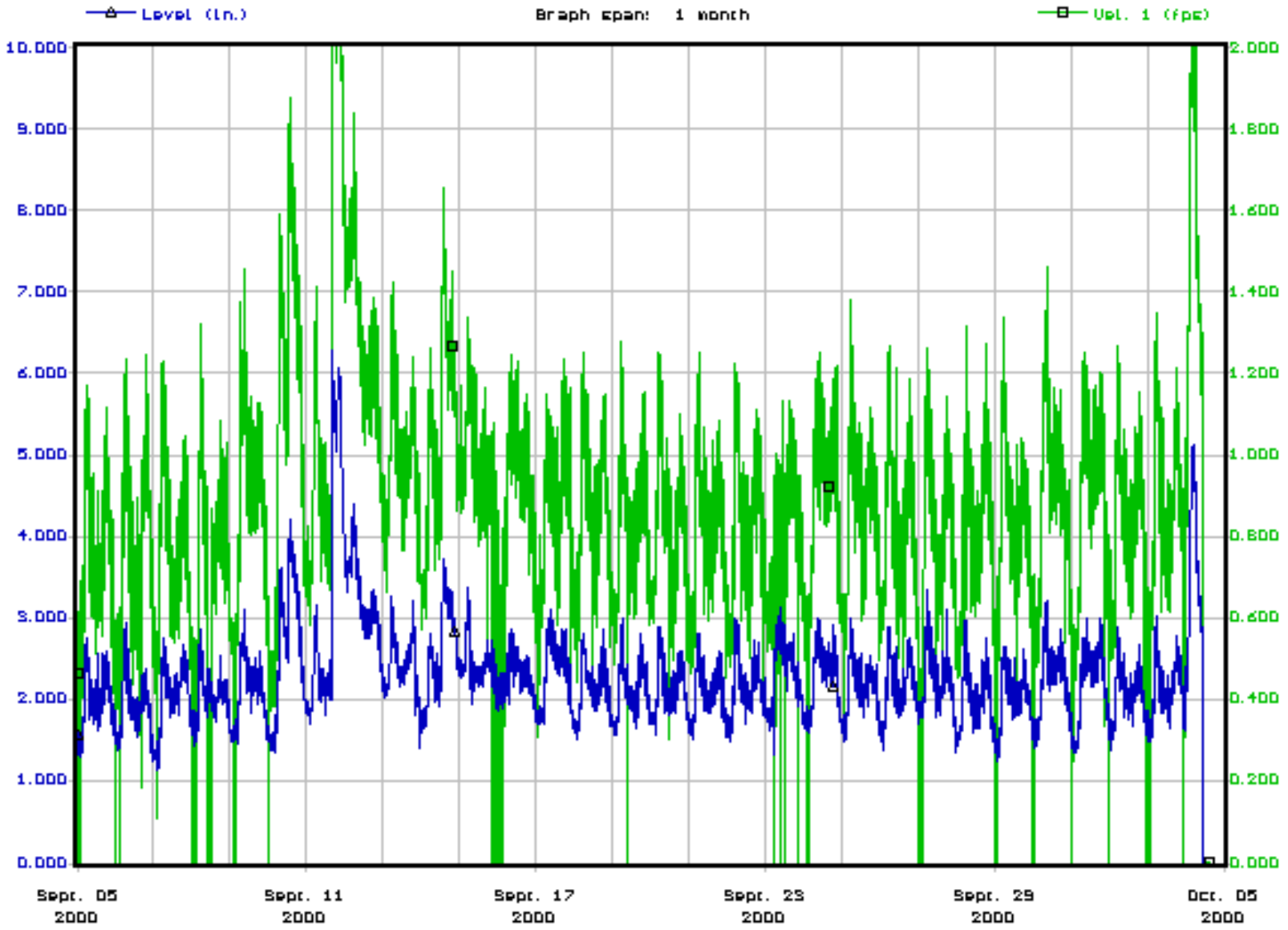
Glen Leven North: Glen Leven



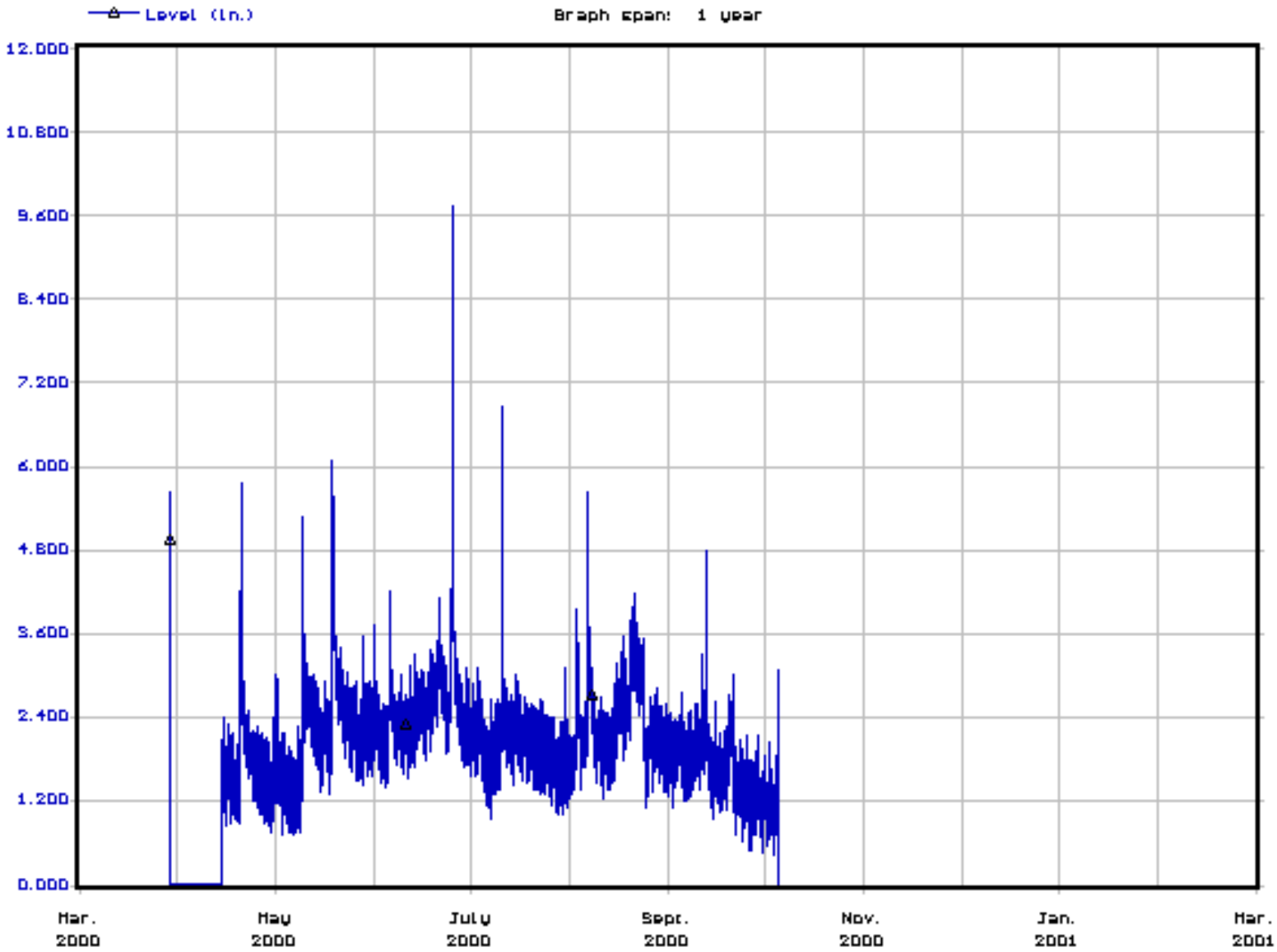
Glen Leven North: Glen Leven



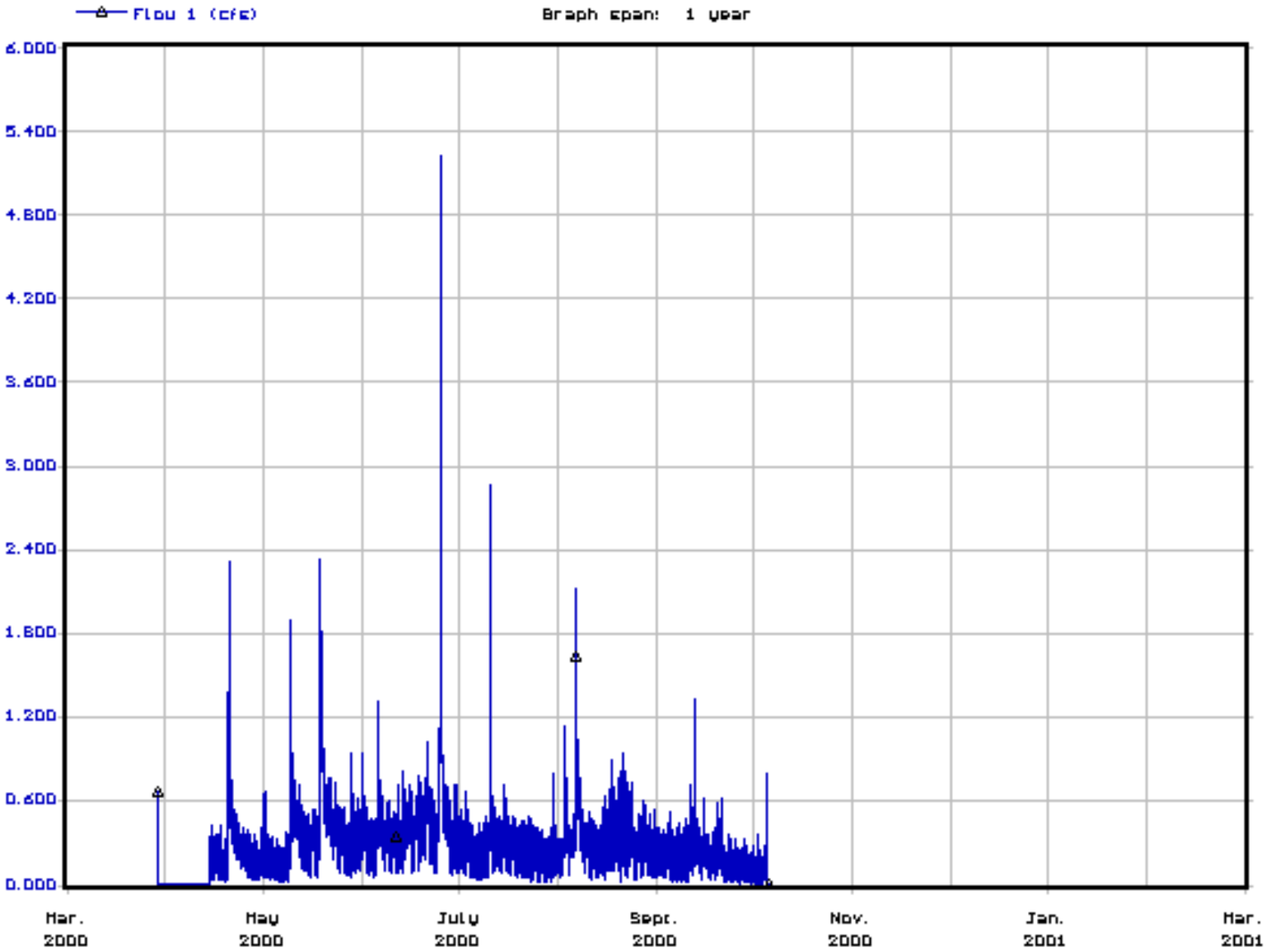
Glen Leven North: Glen Leven



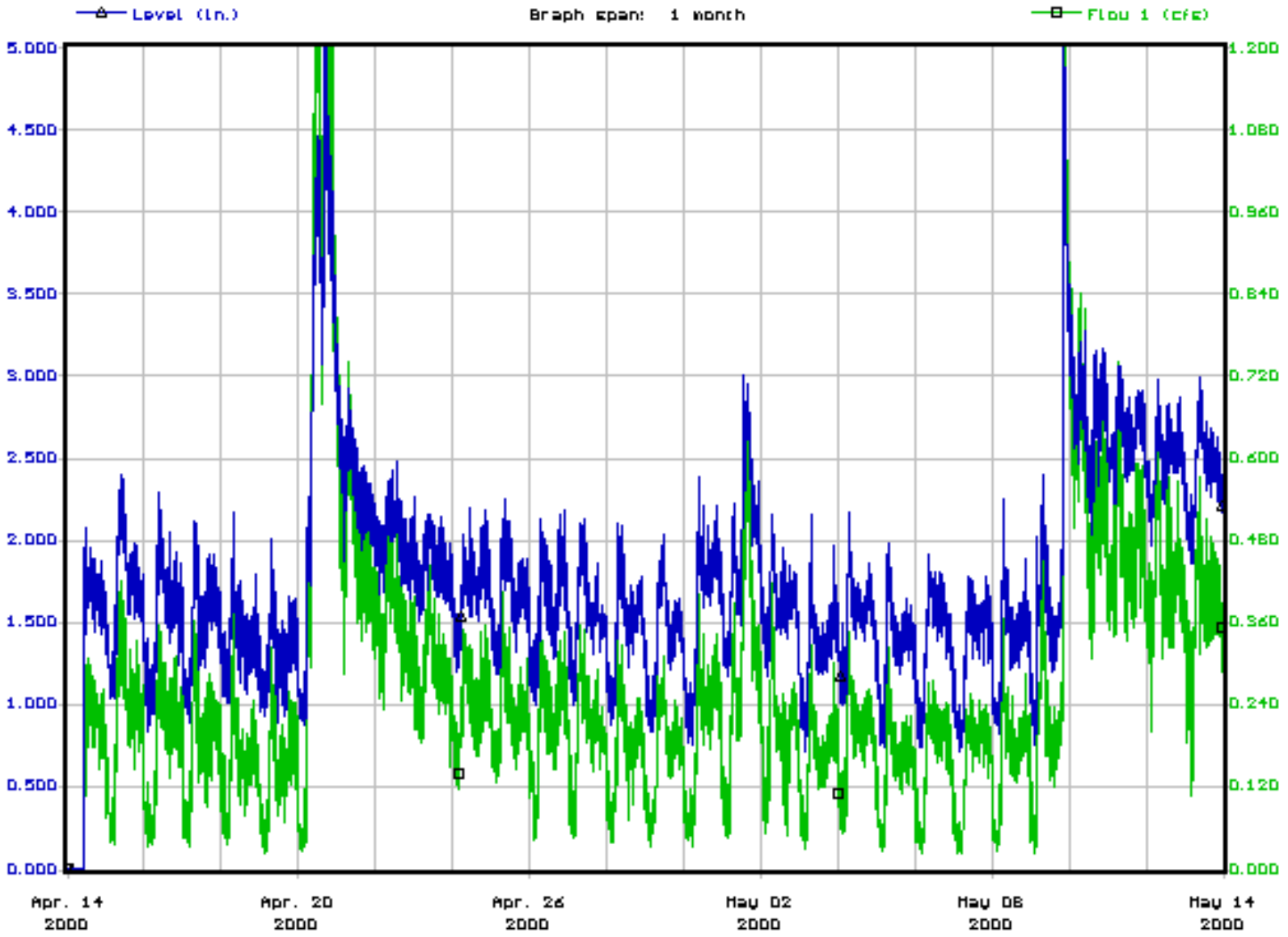
Glen Leven South: 7th and Scio Church



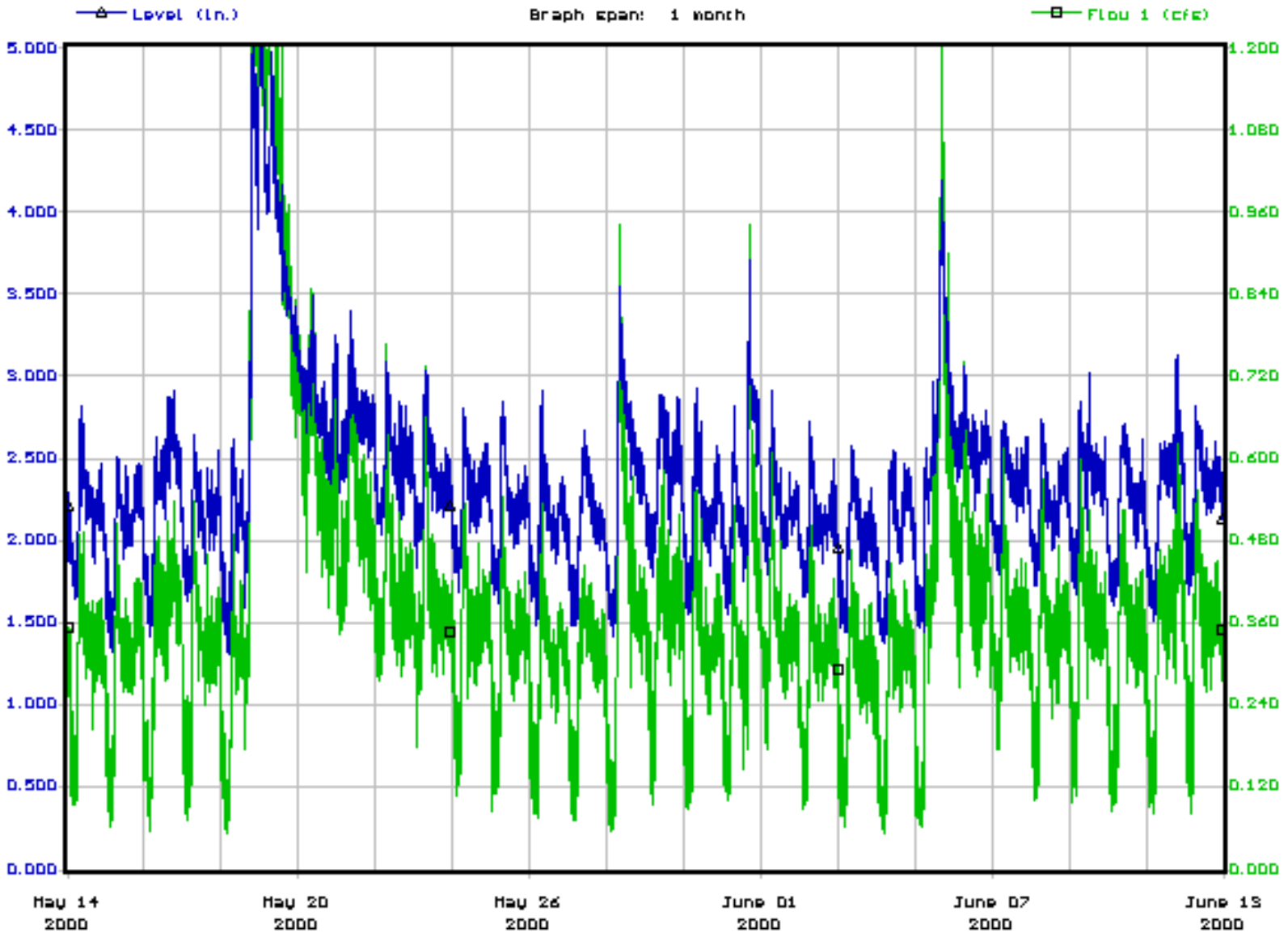
Glen Leven South: 7th and Scio Church



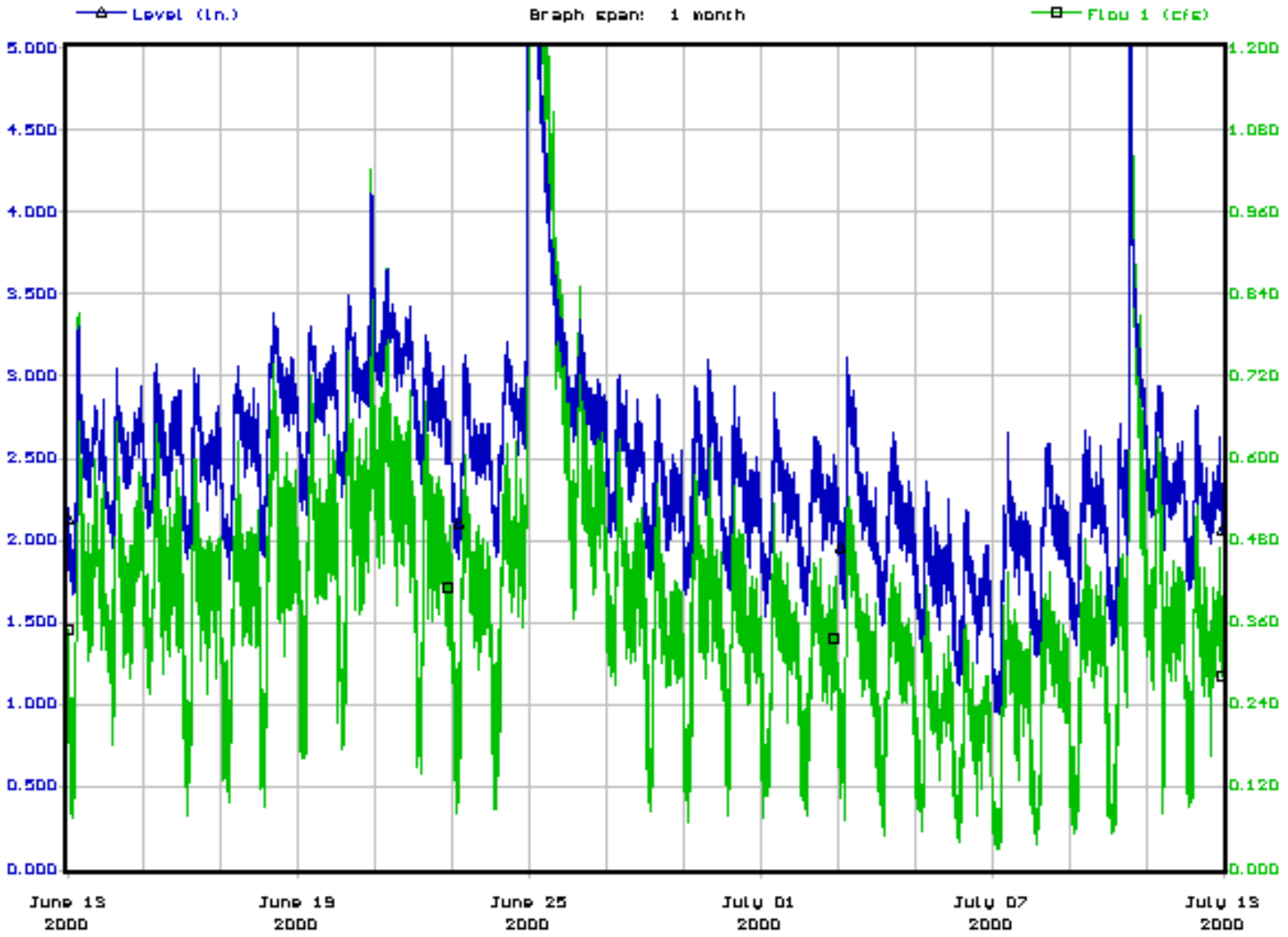
Glen Leven South: 7th and Scio Church



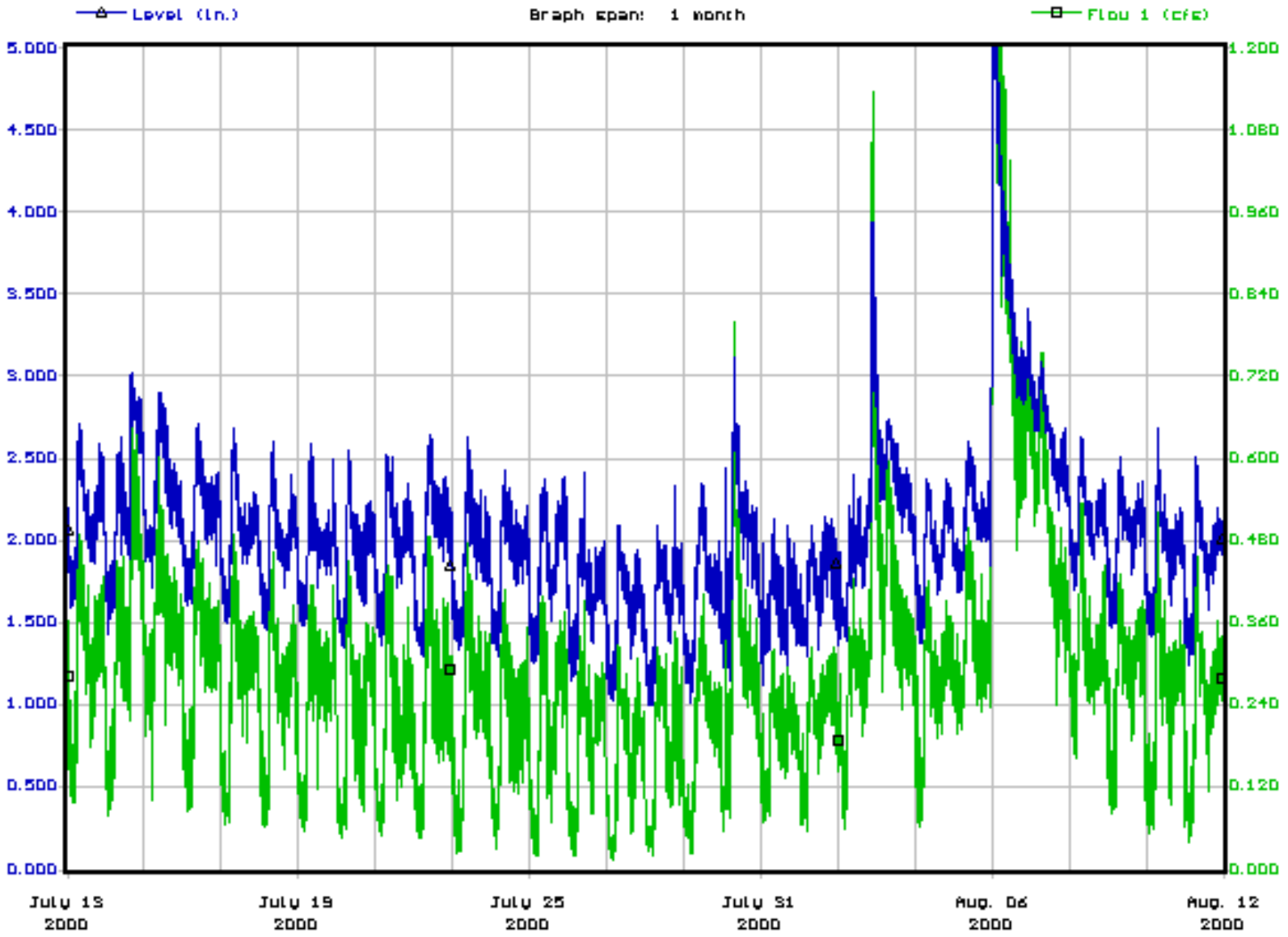
Glen Leven South: 7th and Scio Church



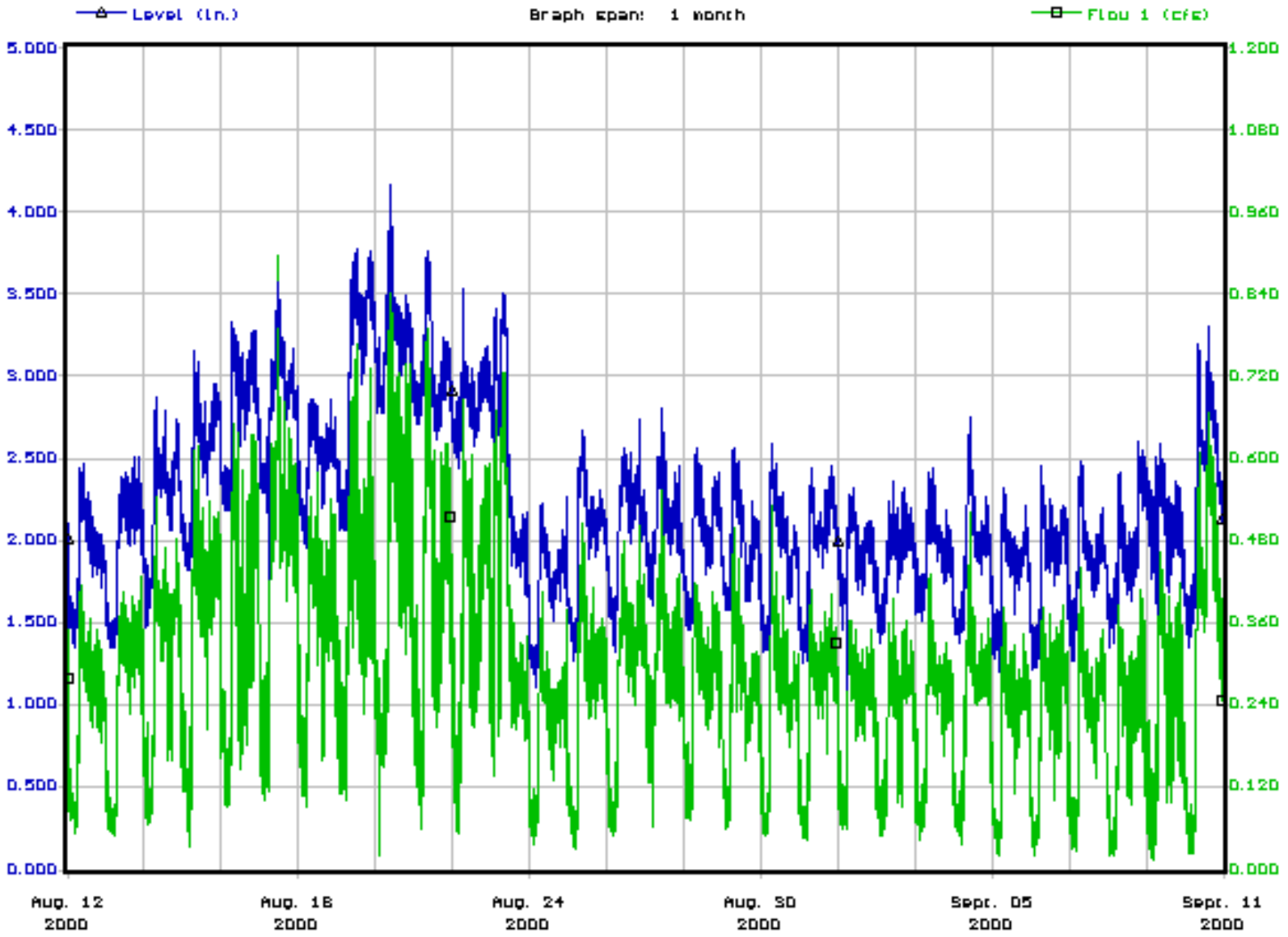
Glen Leven South: 7th and Scio Church



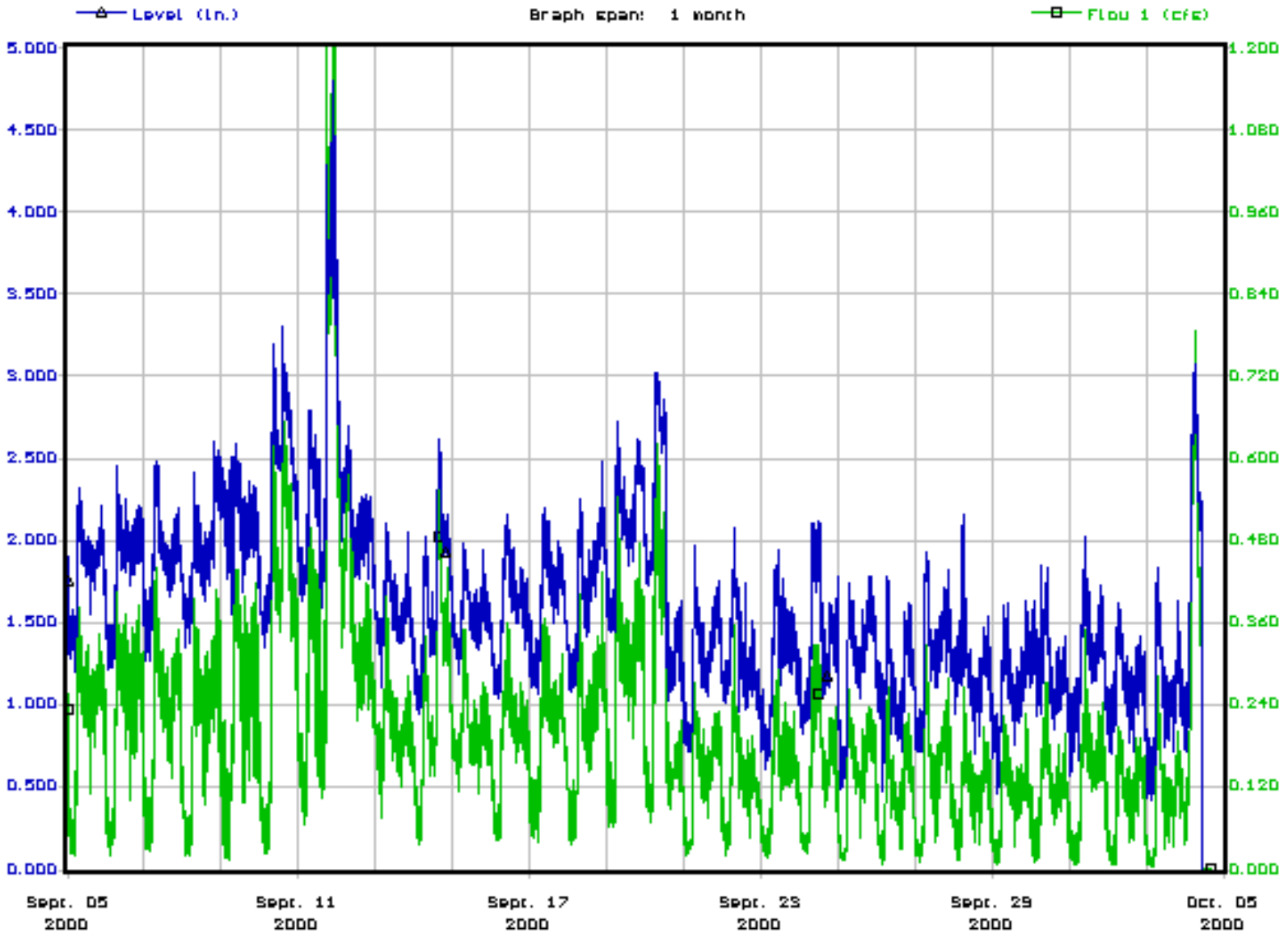
Glen Leven South: 7th and Scio Church



Glen Leven South: 7th and Scio Church

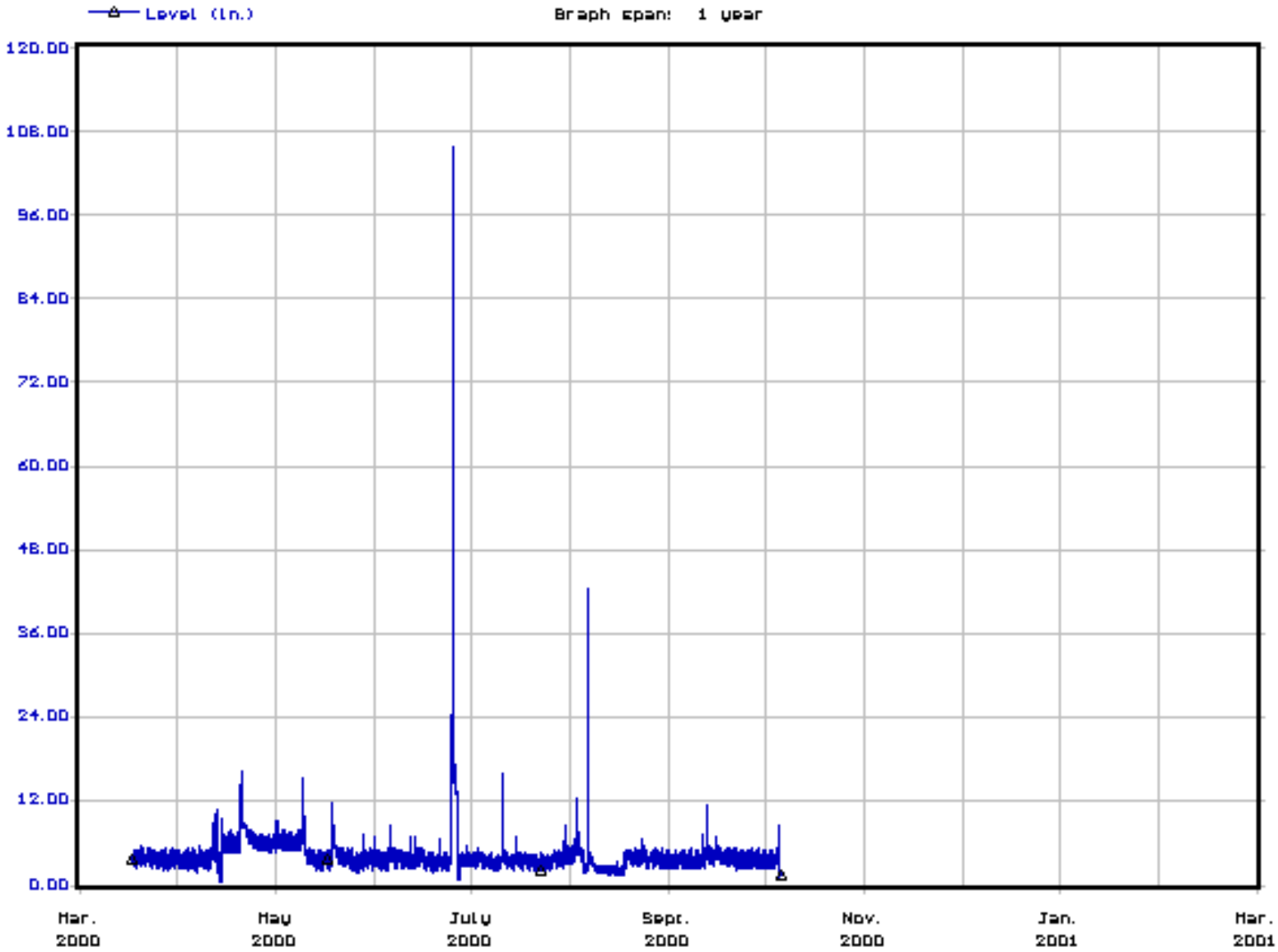


Glen Leven South: 7th and Scio Church



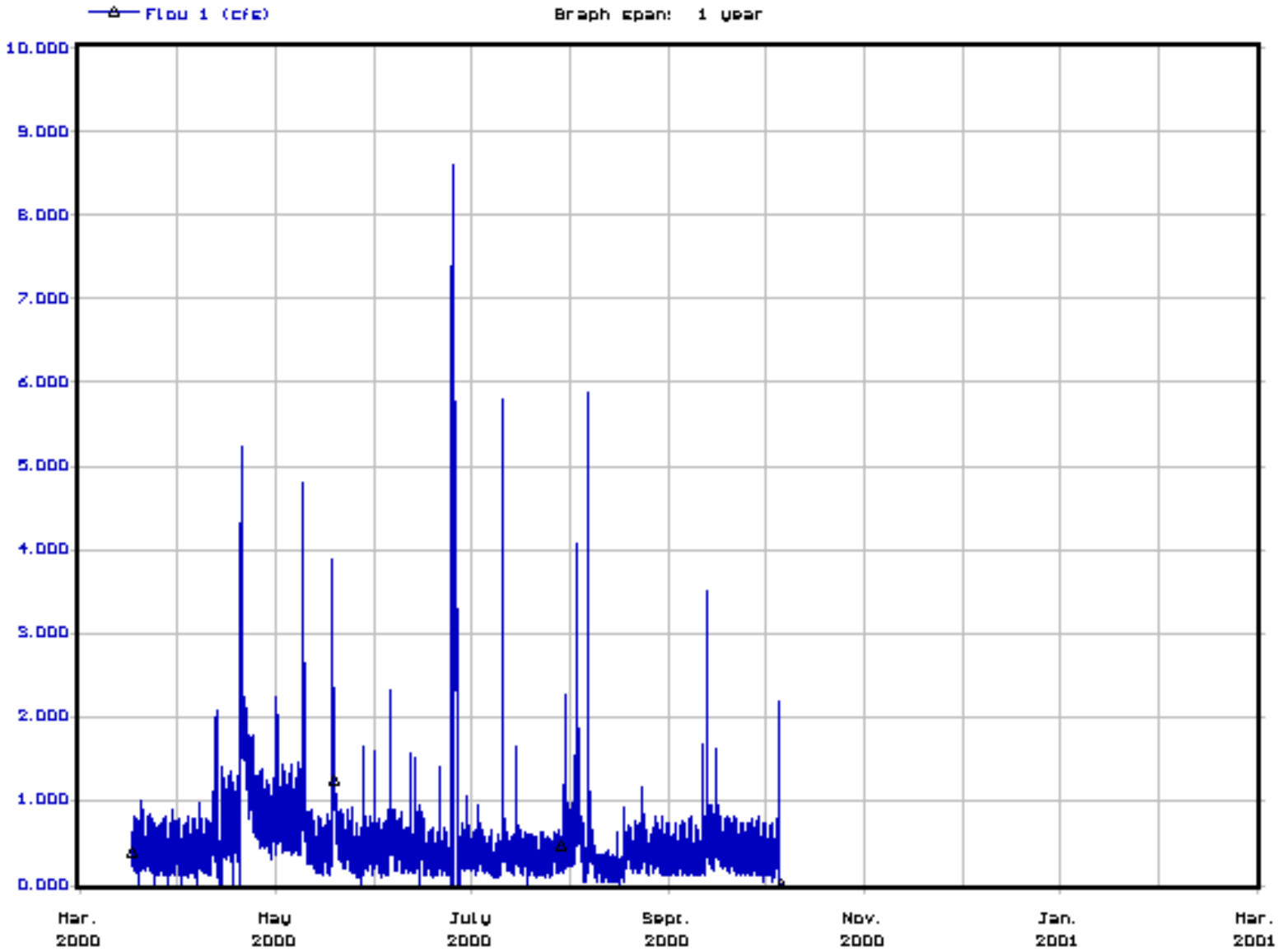
Morehead: Ann Arbor Saline Rd.

Site Id: 00000049 File name: 00000049.000



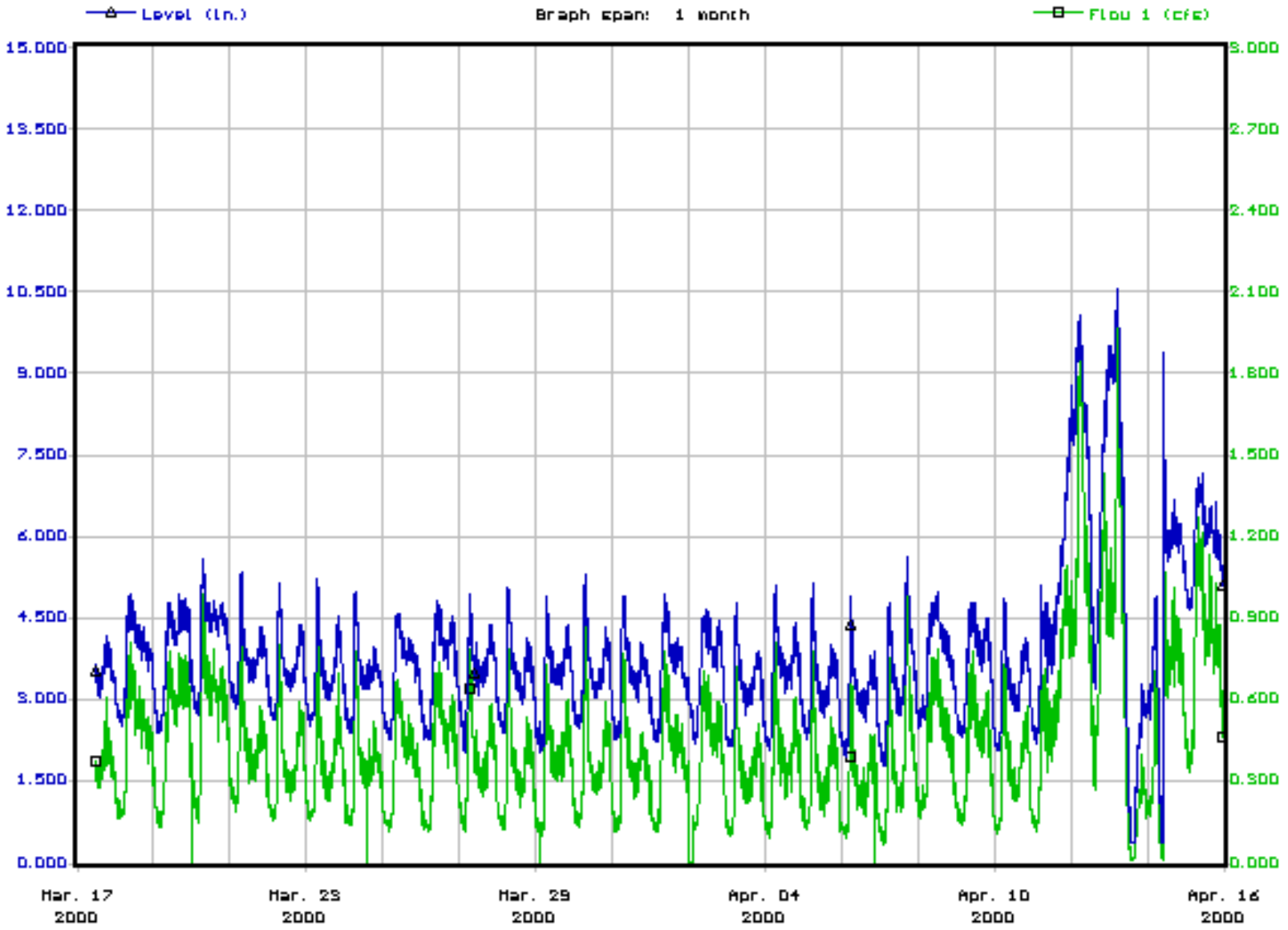
Morehead: Ann Arbor Saline Rd.

Site Id: 00000049 File name: 00000049.000



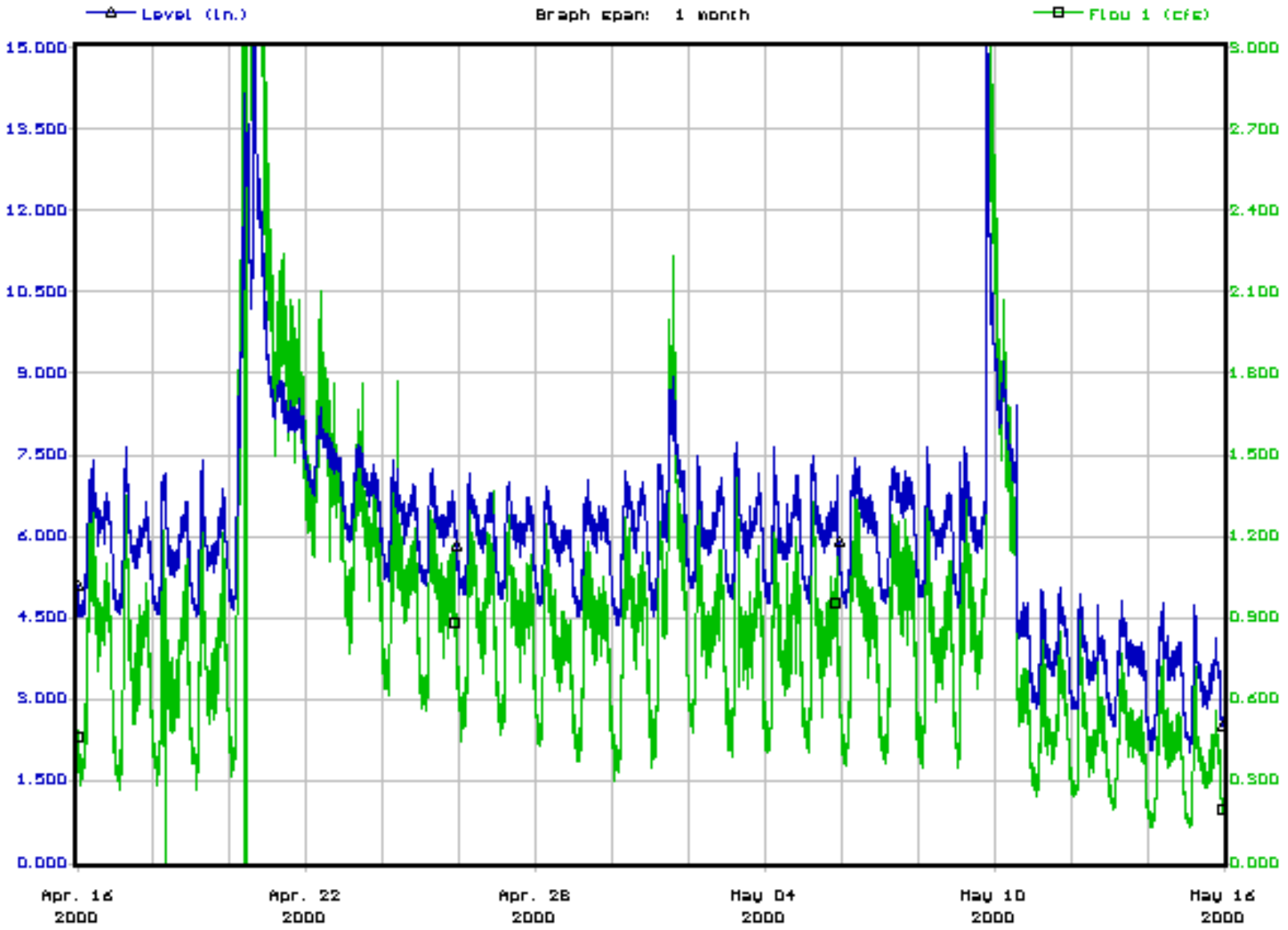
Morehead: Ann Arbor Saline Rd.

Site Id: 00000049 File name: 00000049.000



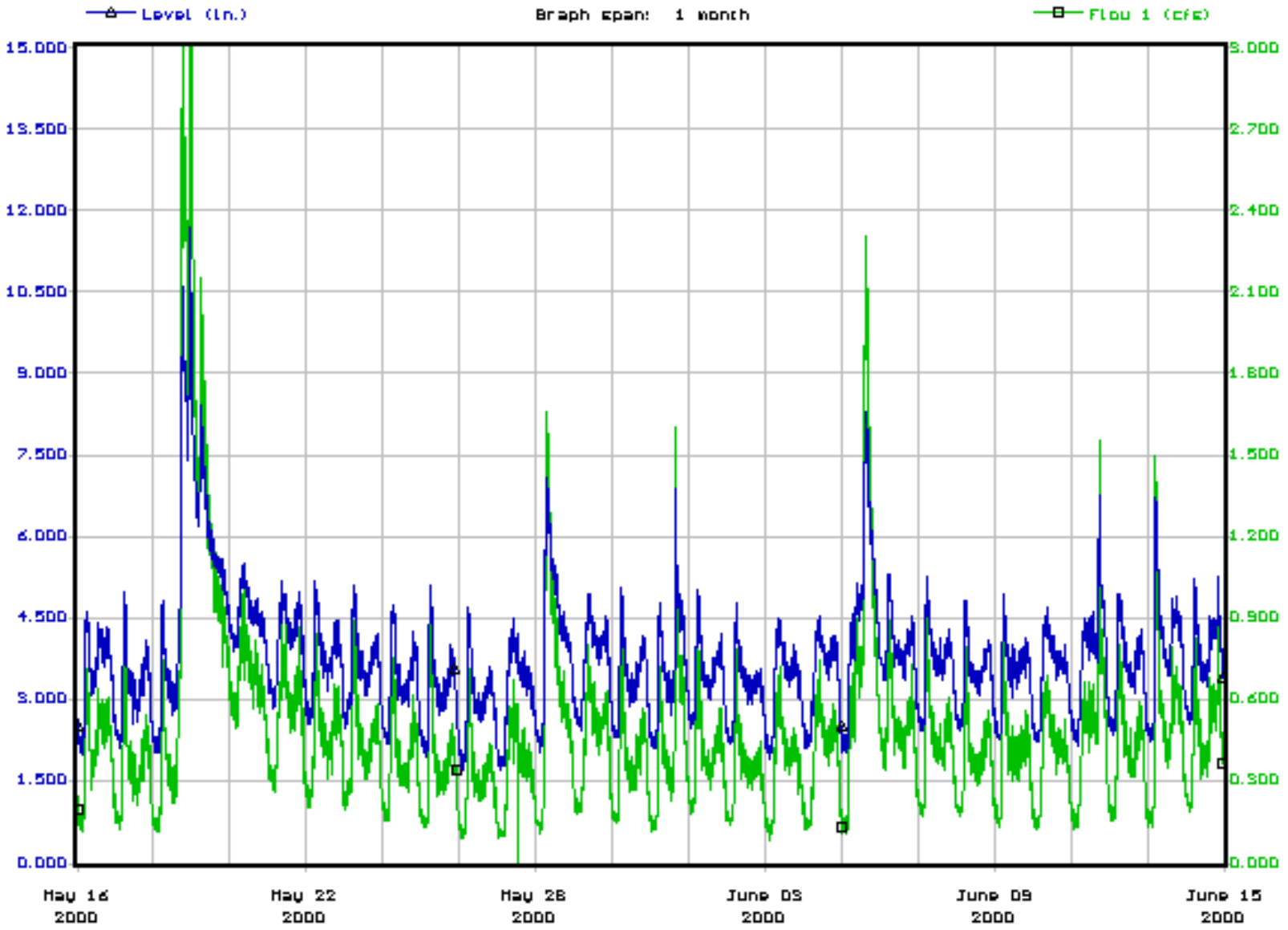
Morehead: Ann Arbor Saline Rd.

Site Id: 00000049 File name: 00000049.000



Morehead: Ann Arbor Saline Rd.

Site Id: 00000049 File name: 00000049.000



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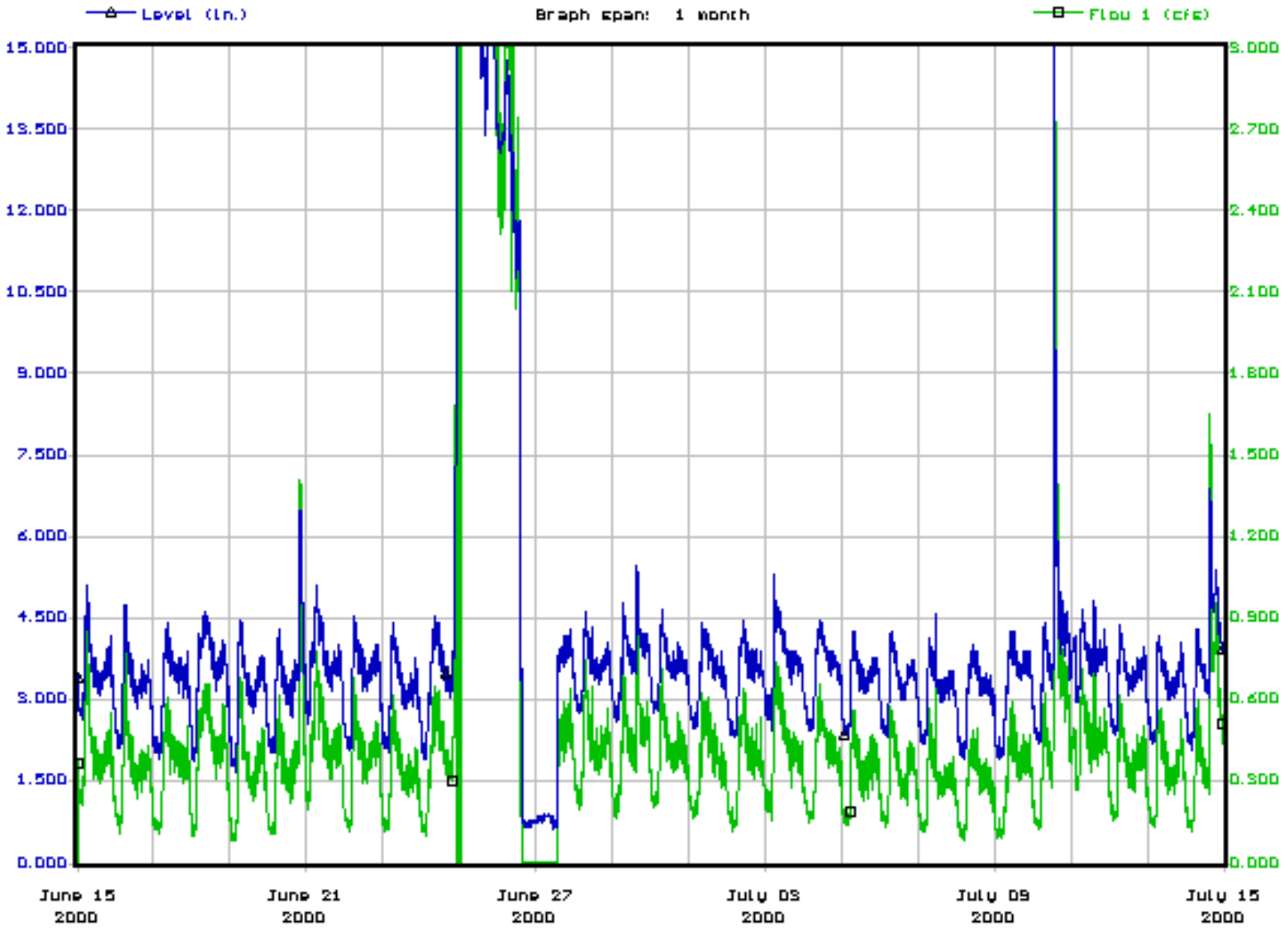
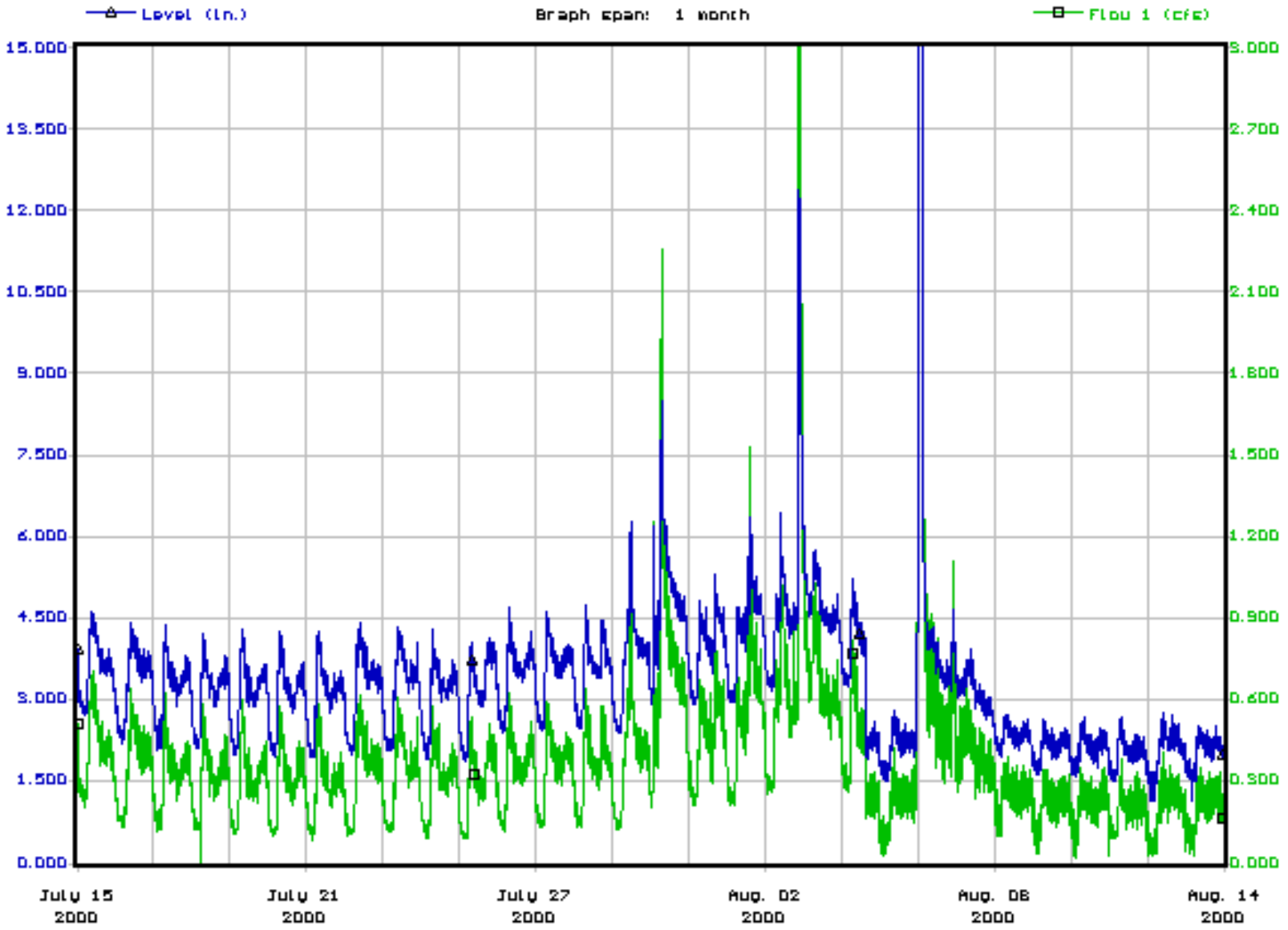
Site Id: 00000049 File name: 00000049.000



Morehead: Ann Arbor Saline Rd.

Site Id: 00000049 File name: 00000049.000



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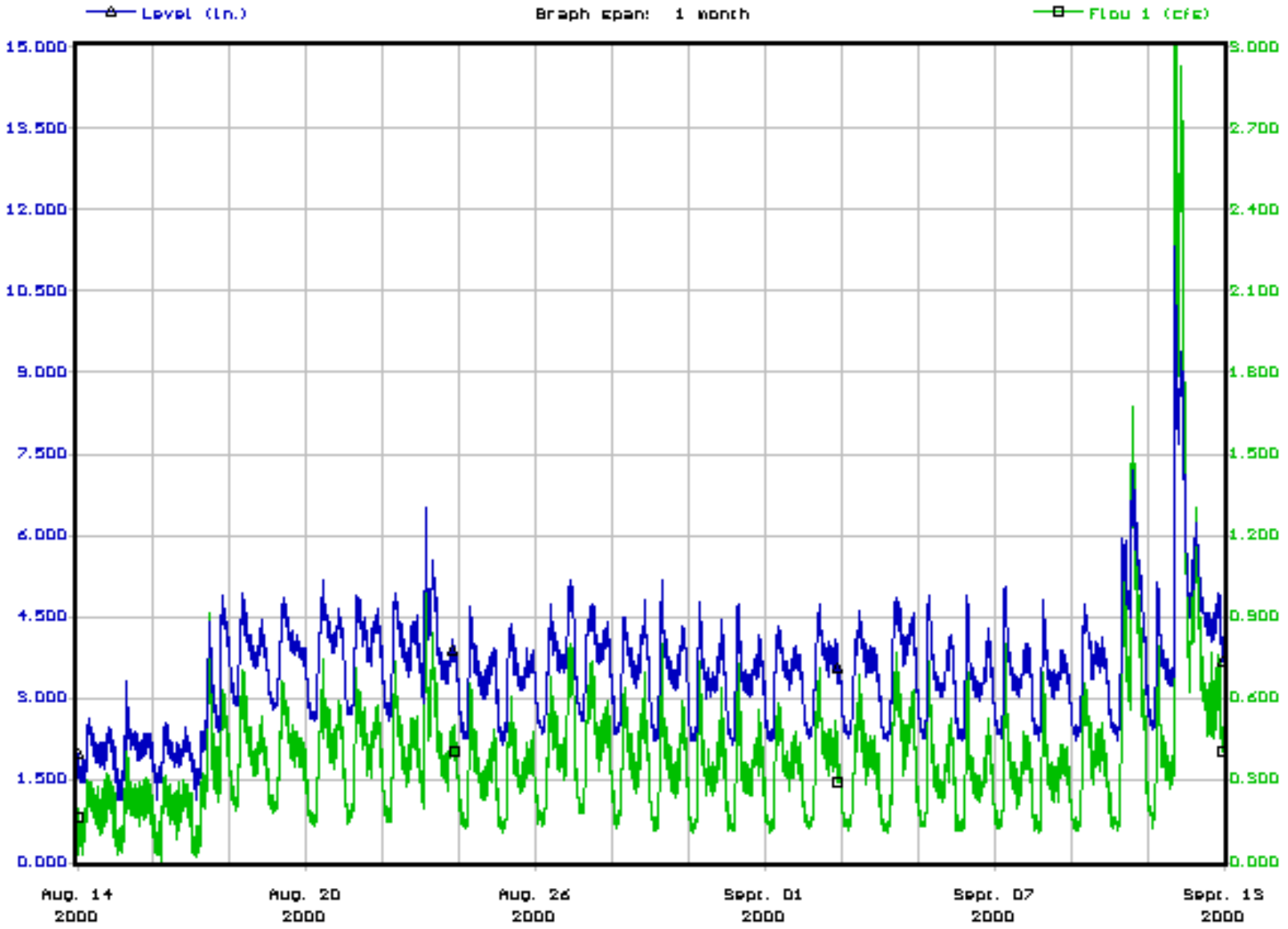
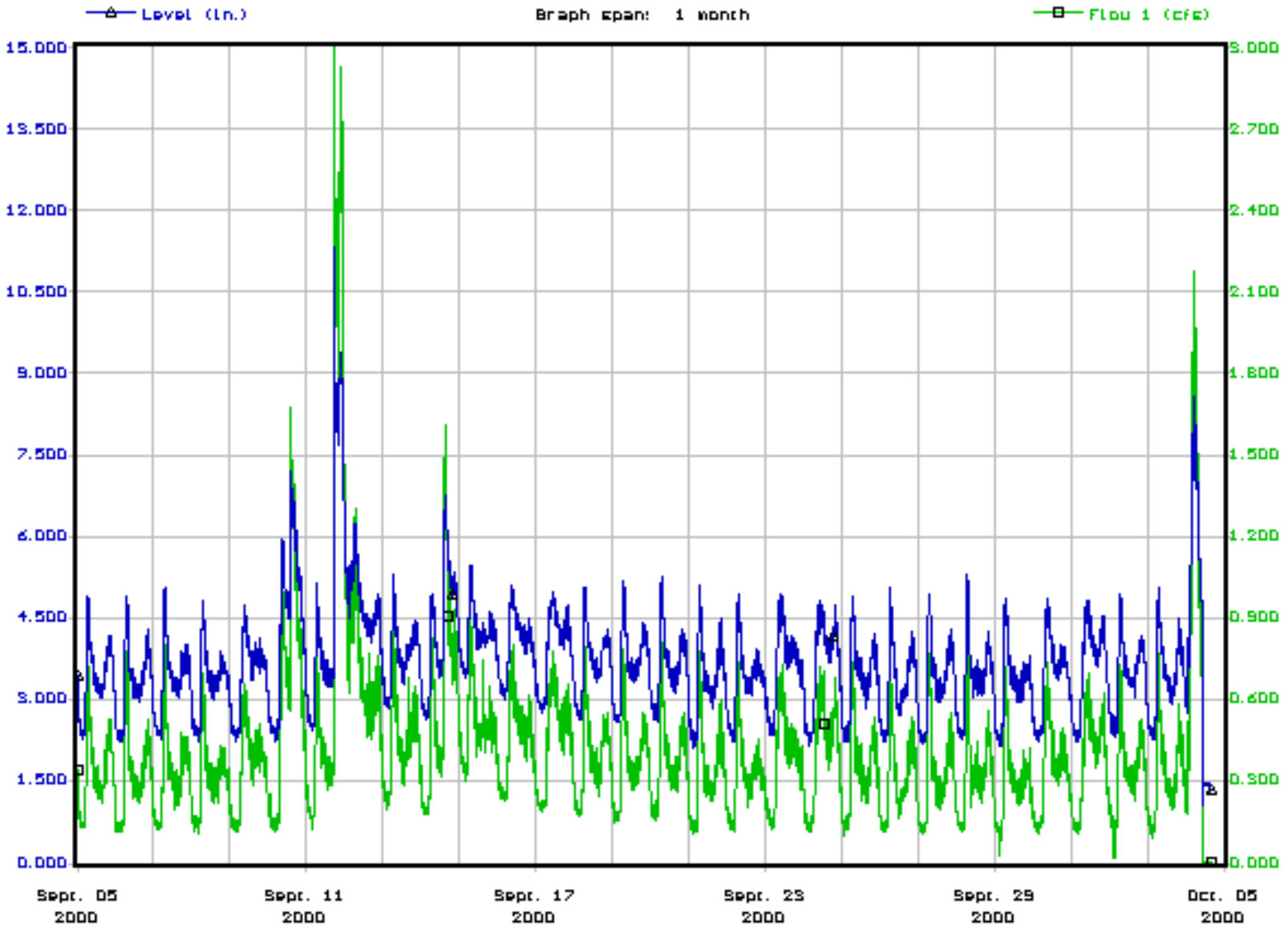


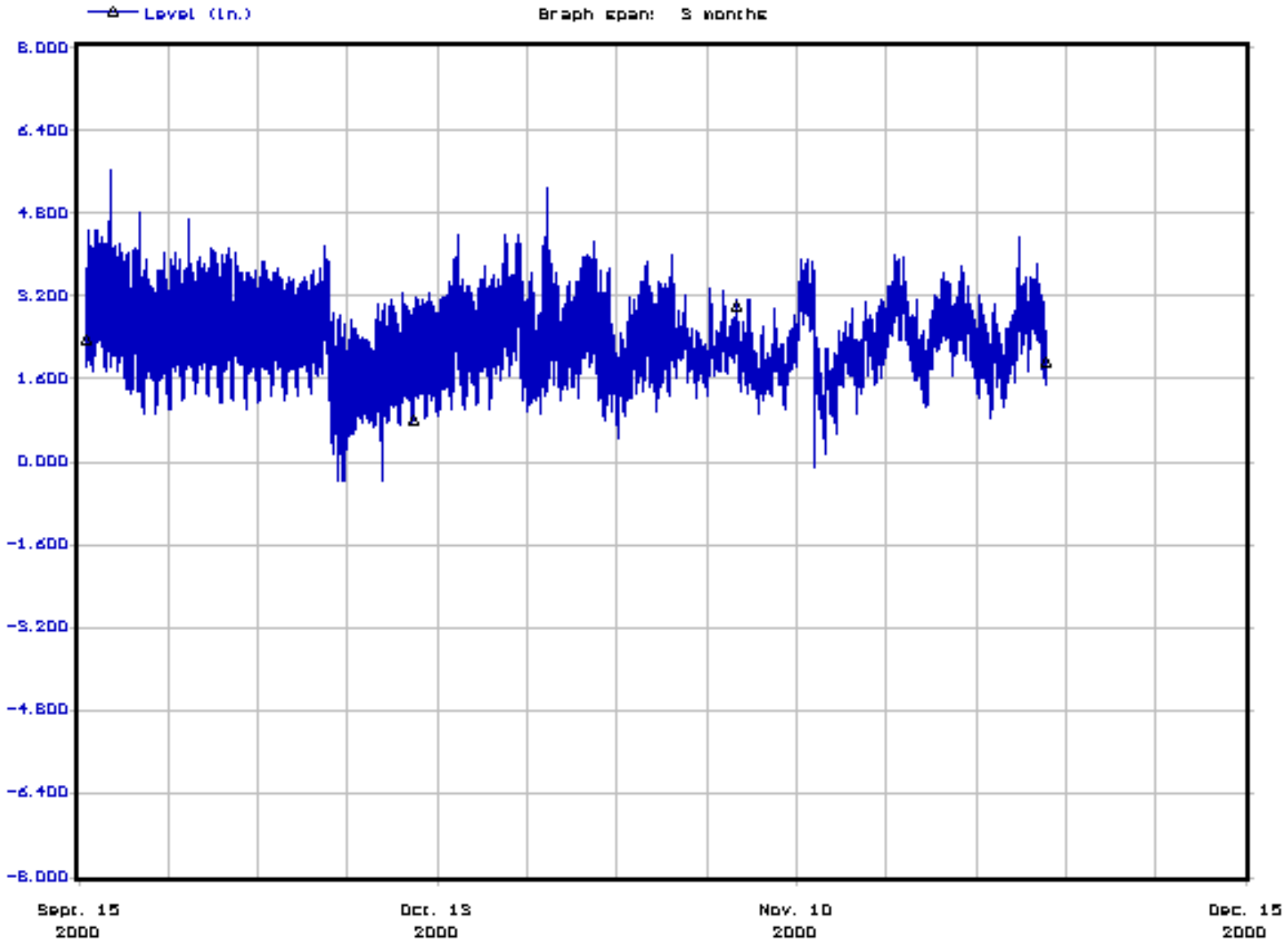
Morehead: Ann Arbor Saline Rd.

Site Id: 00000049 File name: 00000049.000



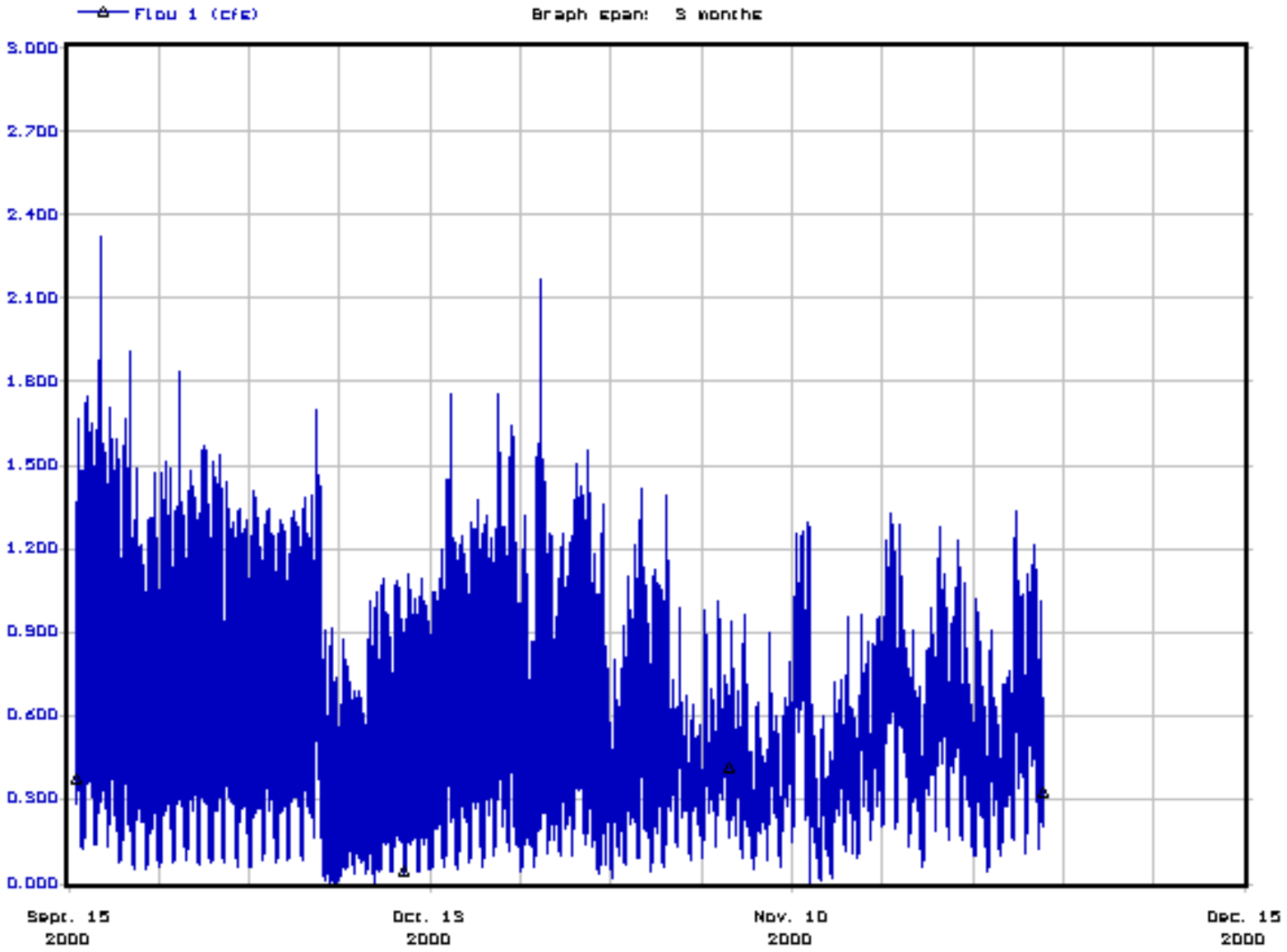
Legacy Park: Westwood

Site Id: 00000012 File name: 00000012.000

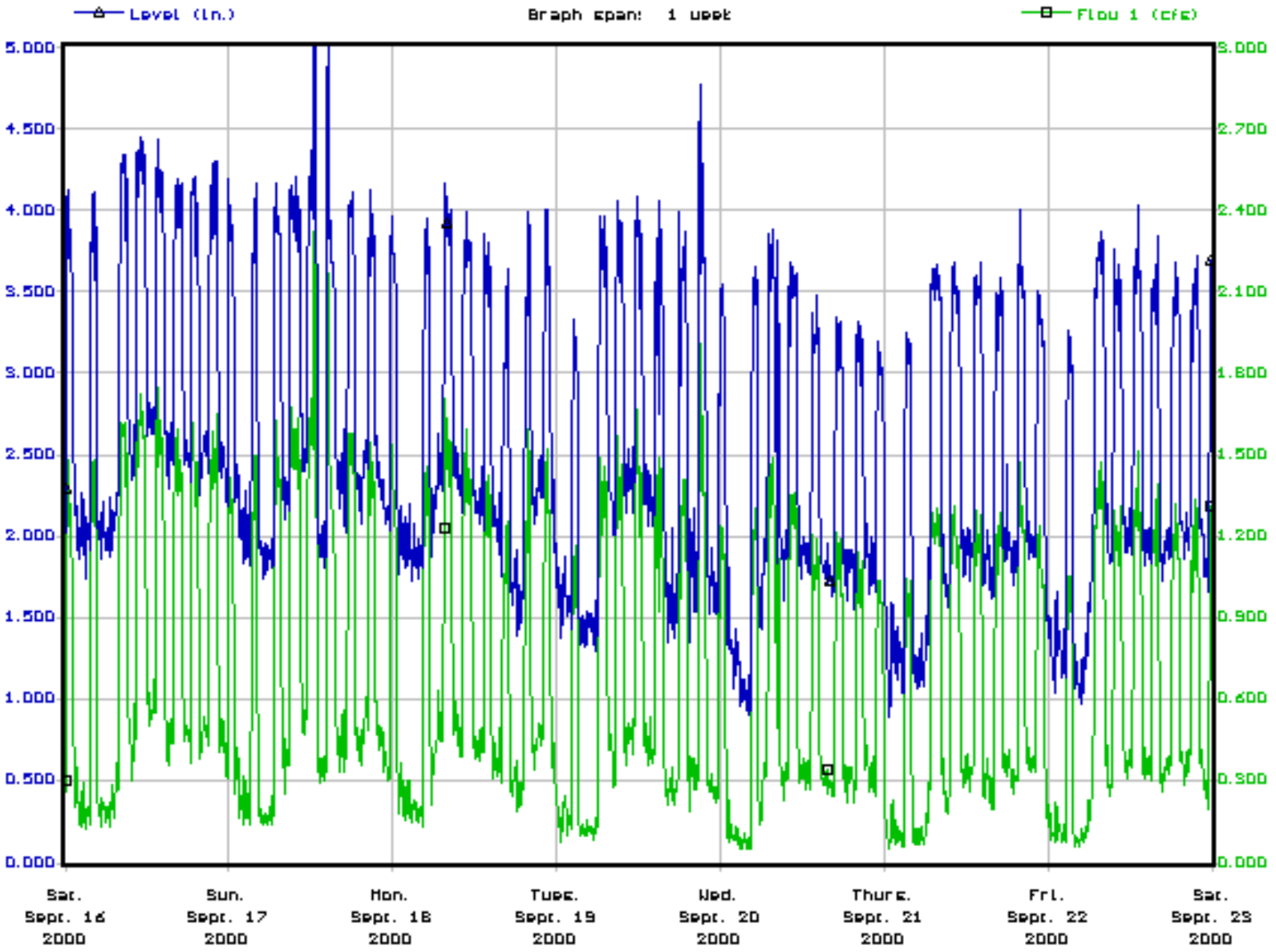


Legacy Park: Westwood

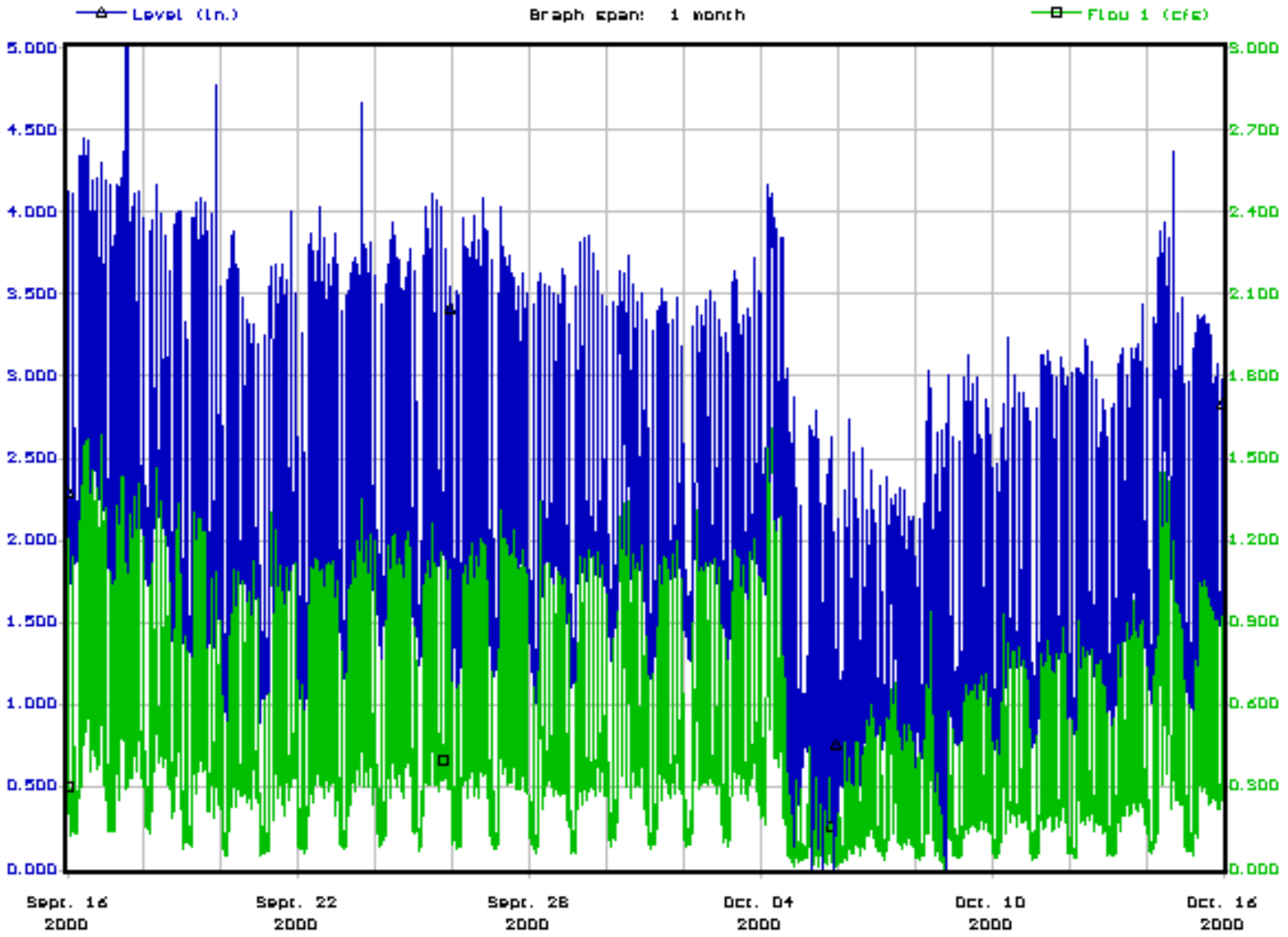
Site Id: 00000012 File name: 00000012.000



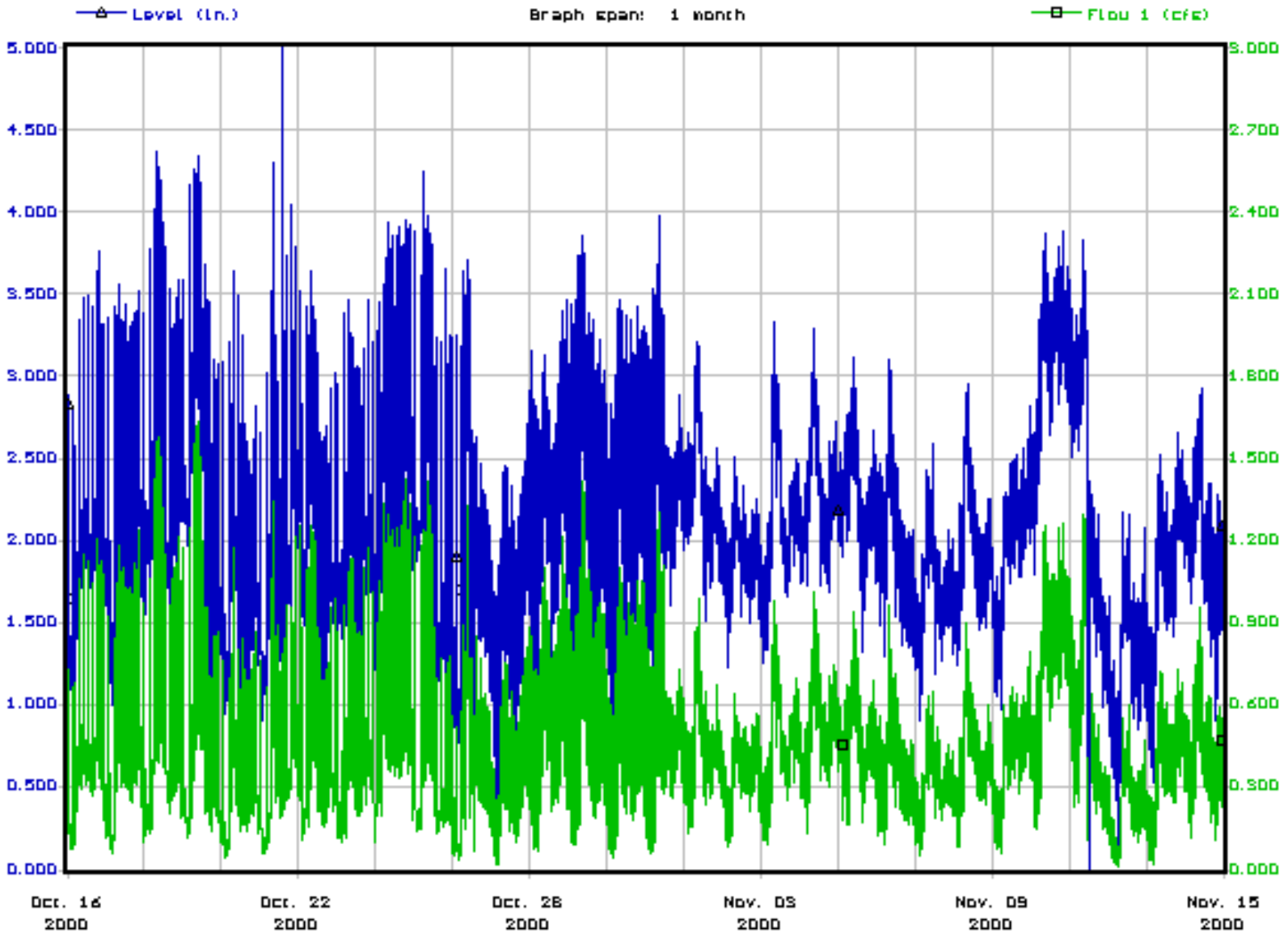
Legacy Park: Westwood



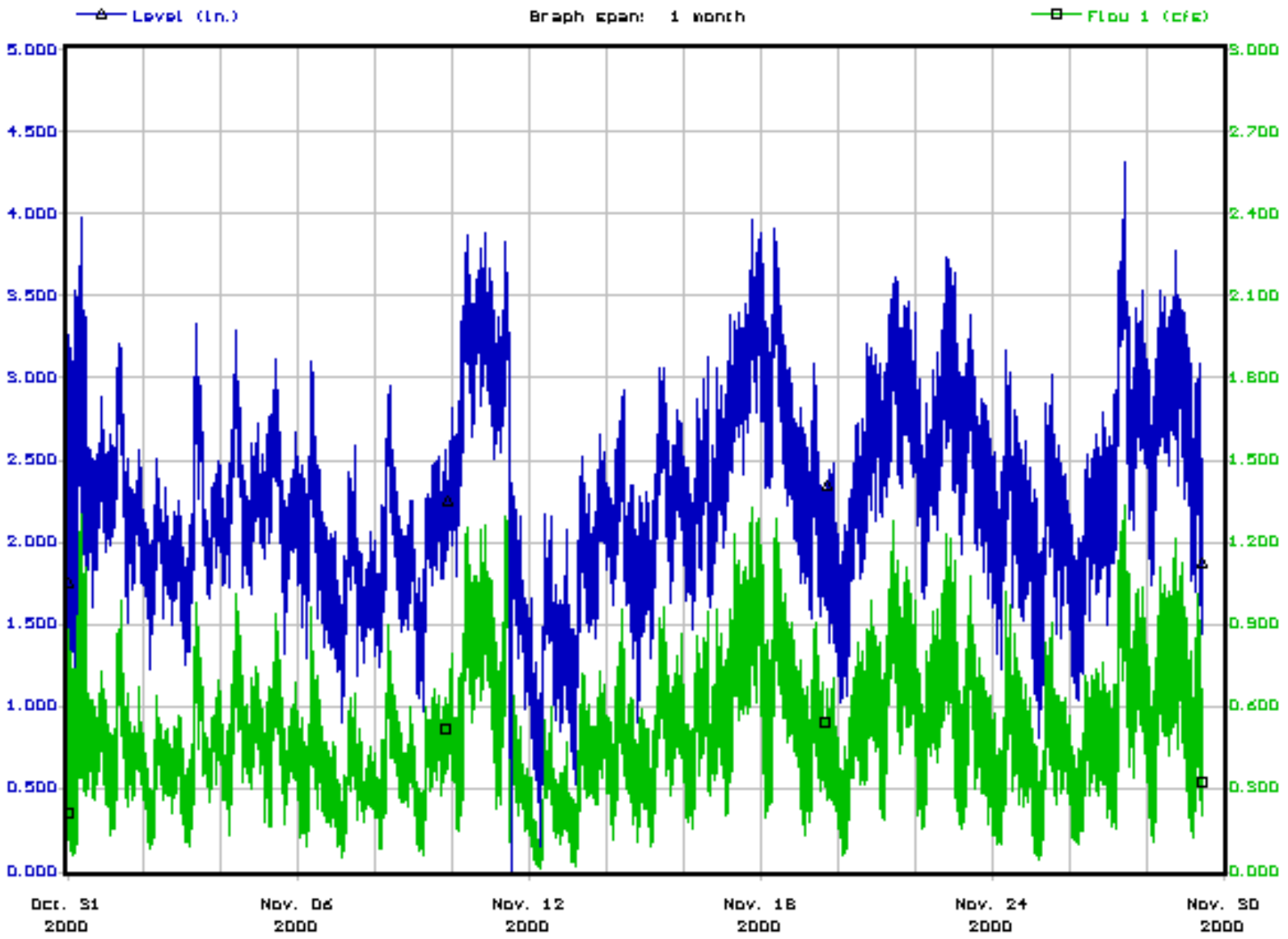
Legacy Park: Westwood

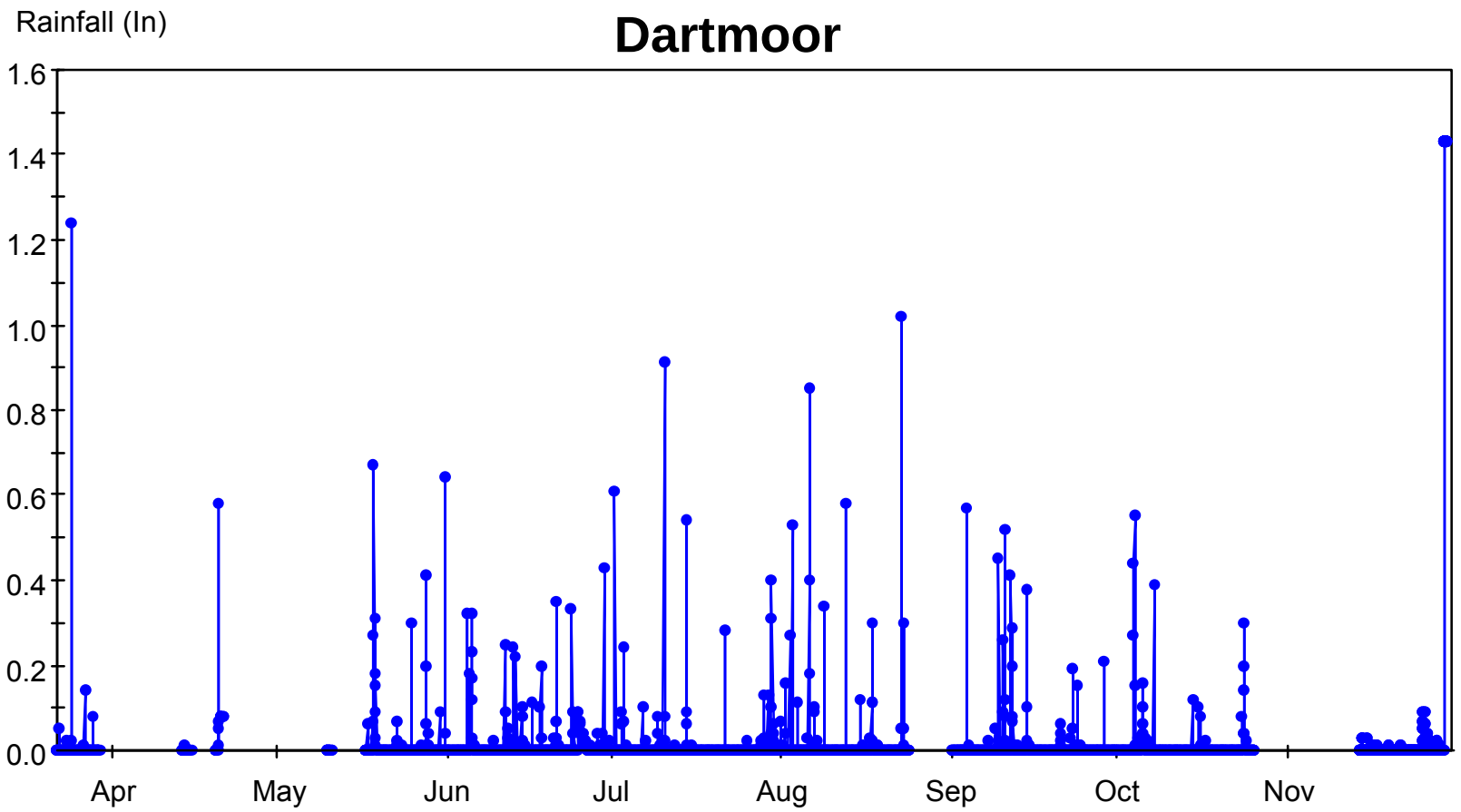


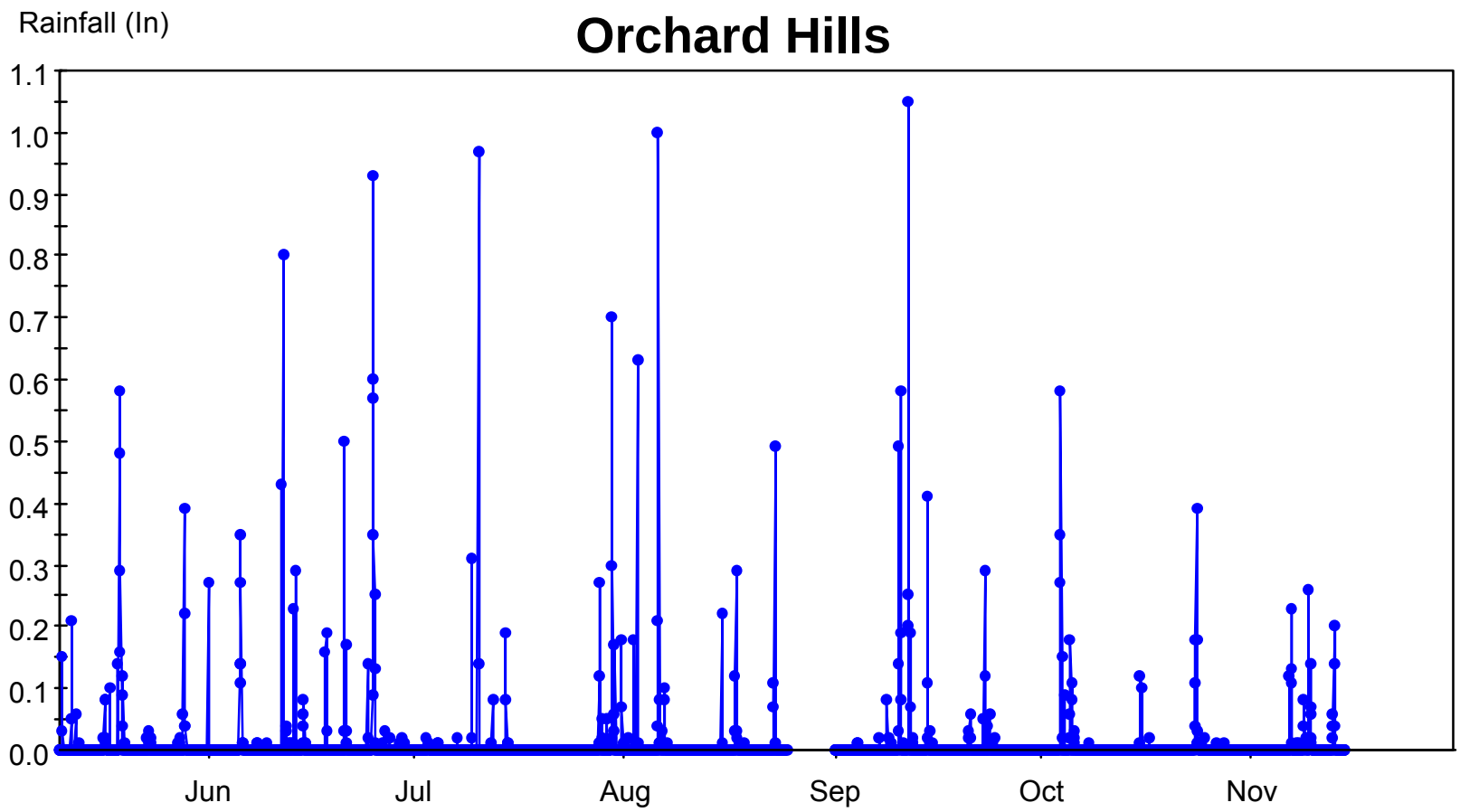
Legacy Park: Westwood

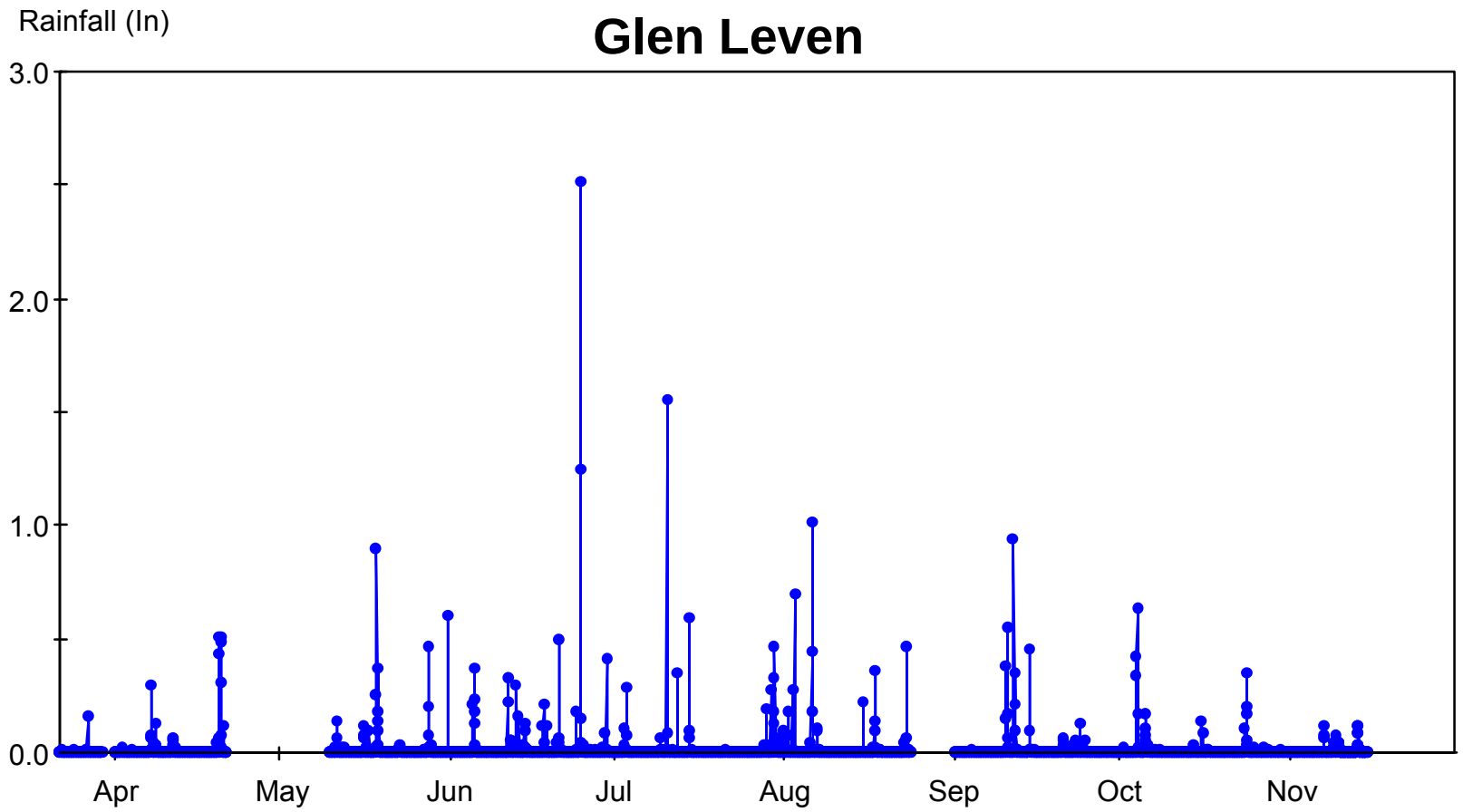


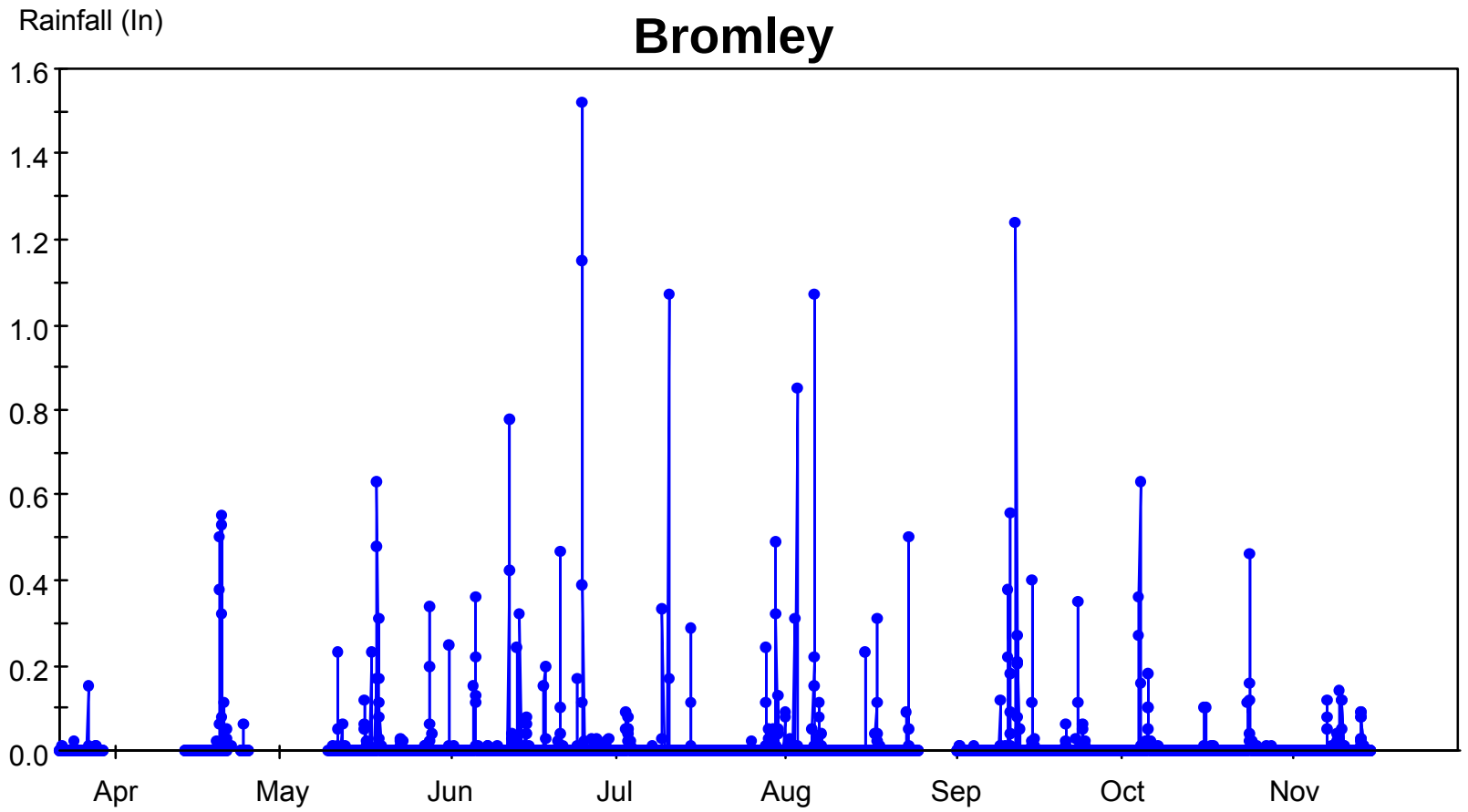
Legacy Park: Westwood

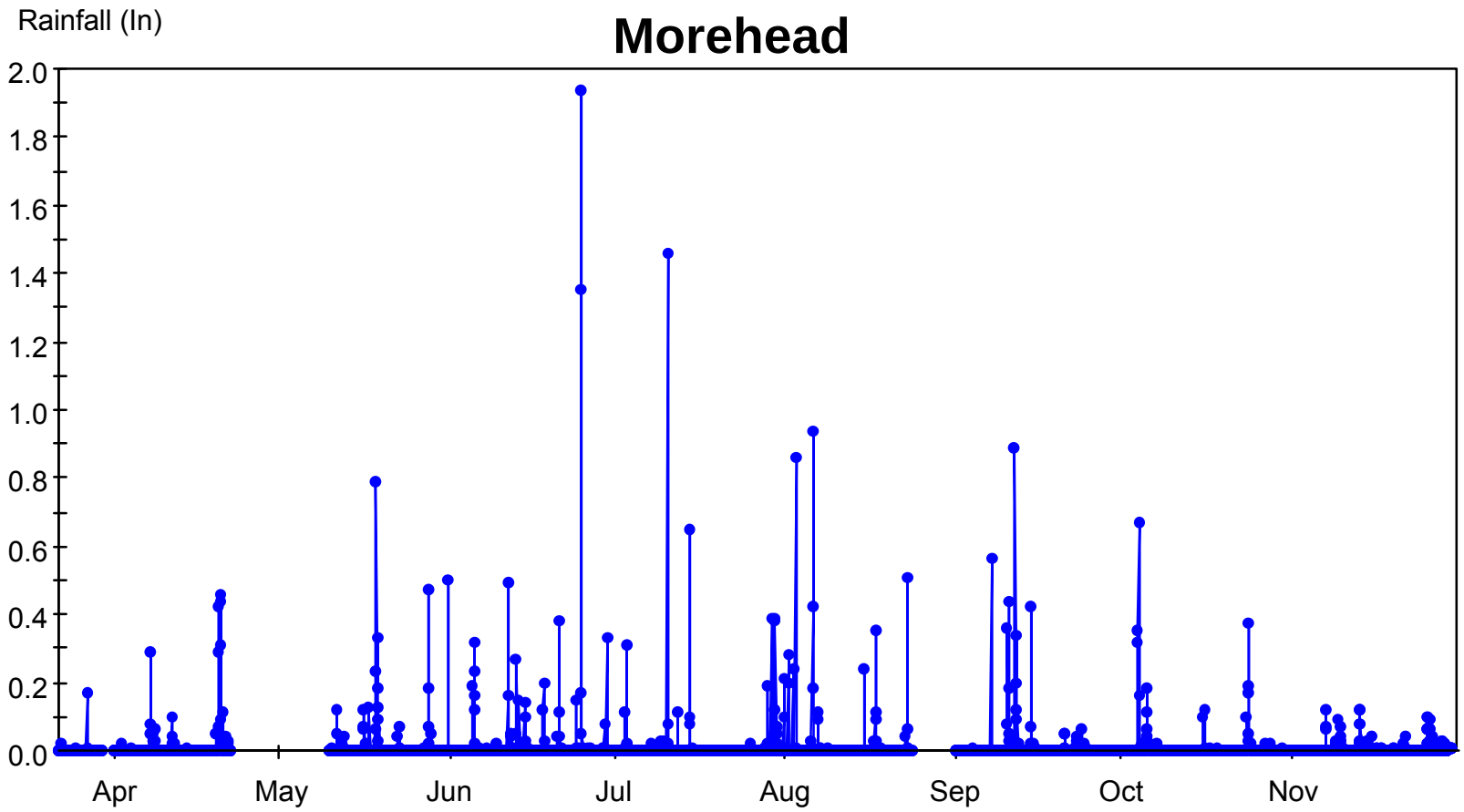



Rainfall (In)
Dartmoor
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov


Rainfall (In)
Orchard Hills
1.1
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
Jun
Jul
Aug
Sep
Oct
Nov


Rainfall (In)
Glen Leven
3.0
2.0
1.0
0.0
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov


Rainfall (In)
Bromley
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov


Rainfall (In)
Morehead
2.0
1.8
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov

Site	Time (pm)	Vol (qts)	Time (sec)	Rate (gpm)	Avg (gpm)	parcels	Q-ftng (cfs)
Morehead							
44	9:42	2.75	18.68	2.21			
		2.25	18.15	1.86			
		2.5	15.22	2.46	2.2	725	3.5
75	9:29	4	30.77	1.95			
		4.5	30.92	2.18			
		5.25	43.07	1.83	2.0	725	3.2
35	9:55	2	29.69	1.01			
		2.25	37.87	0.89			
		2.5	39.53	0.95	1.0	725	1.5
84T	10:46	0.5	41.72	0.18			
		0.66	47.81	0.21			
		1	56.22	0.27	0.2	725	0.4
84B	10:53	0	60	0.00	0.0	725	-
95	10:15	2.5	36.69	1.02			
		6	45.69	1.97			
		3.75	58.98	0.95	1.3	725	2.1
101W	10:26	3.75	20.92	2.69			
		4	24.4	2.46			
		3.5	21.11	2.49	2.5	725	4.1
101E	10.31	3	24.94	1.80			
		3.25	28.77	1.69			
		3.5	33.33	1.58	1.7	725	2.7
				Average	***1.4***	***725***	***2.20***
Glen Leven							
22	10:58	3	15.32	2.94			
		3	30.67	1.47			
		2.75	28.09	1.47	2.0	970	4.2
				Average	***1.8***	***970***	***3.8***
Orchard Hills							
7	9:20	4	60	1.00			
		3	60	0.75	0.9	256	0.5
29	9:30	6	60	1.50			
		5	60	1.25	1.4	256	0.8
4	9:48	5	120	0.63			
	9:50	4	120	0.50	0.6	256	0.3
2	9:58	5	120	0.63			
	10:01	6	120	0.75	0.7	256	0.4
60	10:15	7	50	2.10			
	10:20	8	70	1.71			
	10:23	9	90	1.50			
	10:36	9	80	1.69	1.8	256	1.0
				Average	***1.1***	***256***	***0.6***
Bromley							
49E	11:07	2	45	0.67	0.7	252	0.4
55	10:58	5	30	2.50			
	11:02	5	30	2.50			
	11:06	6	30	3.00	2.7	252	1.5
5E	10:41	7	45	2.33			
	10:47	7	45	2.33			
	10:52	7	45	2.33	2.3	252	1.3
5W	10:41	6.5	45	2.17			
	10:47	6.5	45	2.17			
	10:52	6	45	2.00	2.1	252	1.2
				Average	***1.9***	***252***	***1.1***
				Overall Average	***1.4***	***2,203***	***7.1***

Using the Overall Average of 1.4 gpm

	parcels	cfs
Bromley	252	0.79
Dartmoor	393	1.23
Glen Leven	970	3.03
Morehead	725	2.26
Orchard hills	256	0.80

Appendix C - Pilot Installation Surveys

This appendix contains a copy of the feedback surveys filled out by the homeowners who had a pilot installation in their house. Ten of the eleven homeowners provided feedback. Also included is a summary of the feedback provided.

Pilot Installation Feedback
Ann Arbor SSO Prevention Study
11/14/00

Homeowners:

Address:

Feedback provided by:

Date:

Communication

1. Did you understand what was going to be done at your home?

2. Would additional information not contained in CDM's initial information letter would be helpful in understanding the process? Would a fact sheet that explained the process help?

3. Did CDM respond quickly and appropriately to your questions?

4. Did the plumbers respond quickly and appropriately to your questions?

5. Were the visits scheduled to fit with your schedule?

Construction

6. Did the contractor set appointments and arrive as scheduled?

7. In your opinion, did the contractor provide a quality installation?

8. Is the sump pump discharging to a location that is satisfactory?

9. How much of an inconvenience was the installation work? Was there undue dust and dirt from the installation?

10. Did the contractor work to minimize construction disruption?

11. Did the routing of pipes and electrical meet your expectations?

12. Was the sump placed in a location that works for you?

13. Was the final restoration of the floor up to your expectations?

14. Is the sump pump noisy or disruptive?

Training

15. Do you understand what you need to do to operate and maintain the different components?

16. Would an information sheet on how to make sure the system is operating properly help you?

17. Do you think a summary document indicating how these devices protect you and benefit your community would help in the resale of your home?

Financial

18. If you had to pay for the work being done, what would be the value to you?

19. Do you think this will increase the value of your home (make it more sellable)?

20. As a means for reducing flows to the sanitary system, one possible alternative is to perform similar footing drain disconnections in homes that are **NOT** at risk for flooding. If your home never experienced flooding, would you allow an installation in your home, knowing that it would benefit the community by reducing sanitary overflows and reduce treatment costs at the wastewater treatment, if:

    a. The City of Ann Arbor assumed financial responsibility?

    b. You had to assume full or partial financial responsibility?

Other

22. Can CDM install a logging device (to determine how often the sump pump operates) and visit your home from time to time to retrieve the data?

23. What are the negatives associated with to the work?

24. What are the positives associated with to the work?

25. If you had it to do over again, would you?

26. What could be done to improve the process or any other comments?

Sump Pump Installation Pilot Study
Summary of Survey Results

Surveys Distributed (# of pilot sites)	
Surveys Returned	**11***

* Includes 1 letter

If you had it to do over again, would you?

Unanimous – 11 yes

What are the negatives associated with the work?

Short-term Construction Impacts	Long-term House & Lawn
5	3

- *Mud and dust and lawn. Nothing long term.*
- *Time off work for sump pump installation AND electrician's visit AND tiling; basement clean up.*
- *Location of pump discharge is damaging grass.*
- *Loss of usable space, recurring maintenance, concern about back-up if pump(s) fail.*

What are the positives associated with the work?

Problem fixed/ protection against flooding	4
Peace of mind	4
Resale value	2
Useable basement	1

- *Problem fixed. Peace of mind. Confidence that it will work.*
- *Peace of mind and flexibility – wouldn't go on vacation in summer because of fear of flooding.*
- *Hopefully prevents or minimizes future flooding therefore, allowing basement to be renovated and put back to use.*
- *No longer having to worry about losing possessions; resale value*.

In your opinion, did the contractor provide a quality installation?

Excellent	Good quality	Had problems
3	6	1

- *Top quality, professional*
- *So far, excellent!*
- *Has a problem with lawn*
- *Yes – work was good – incomplete issues are minor*

How much of an inconvenience was the installation work? Was there undue dust and dirt from the installation?

No mess	Mess contained	Very messy/ Inconvenient
2	4	5

- *Not really any.*
- *Not much, only dust in the basement.*
- *They did a good job of containing the dust. The biggest inconveniences were the delays (waiting for a part, the electrician and the tiling).*
- *Fine dust went throughout the house.*
- *Excessive dust but well worth the value.*

Was the final restoration of the floor up to your expectations?

Very Satisfied	Satisfied	Satisfied, but More work needed
2	4	5

- *Final result looks very good.*
- *Good floor finish.*
- *OK for non-finished basement.*
- *Yes – but some sealing around concrete needed.*
- *Yes, but do need to retile around sump and floor drain – no problem where carpet will cover.*

Is the sump pump noisy or disruptive?

No	Minimal noise/ Not disruptive
6	4

- *Do notice, but like other devices.*
- *Barely runs – not disruptive.*
- *Not disruptive, noise not bad.*
- *Some pipes were covered with pipe insulation and it is fine now*.

Do you think this will increase the value of your home (make it more sellable)?

Yes	No	Prevents decrease in value
4	2	4

- *Yes, much more saleable now.*
- *Keep value from being discounted.*
- *Not at all – I just hope not to <u>decrease</u> the value because of past flooding. I hope these devices help!*
- *No, but acts to counter sure reduction from doing nothing.*

If your home never experienced flooding, would you allow an installation in your home, knowing that it would benefit the community by reducing sanitary overflows and reduce treatment costs at the wastewater treatment plant if

a. The City of Ann Arbor assumed financial responsibility?

Yes	Maybe/Probably	No
5	3	1

- *Yes, <u>if locations</u> were in an agreeable location.*
- *Maybe – would be more picky about solution.*
- *No – good point on how water meter resistant to change.*

b. You had to assume full or partial financial responsibility?

Maybe/Probably	No/Probably not
4	6

- *If house potentially at risk.*
- *Could work it into the code for resale.*
- *Hmmm…depends on cost, I'd rather just pay a bit more in taxes for it.*
- *Probably not. (the work was very disruptive in a frequently used part of the basement.)*

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Appendix D - Pilot Installation Specifications/ Drawings

This appendix contains the specification and drawings for the pilot installations performed in 11 homes that have flooded in the past.

SECTION 15010

FOOTING DRAIN DISCONNECTION

PART 1 GENERAL

1.01 SCOPE OF WORK

A. Furnish all labor and materials required and install the following items of plumbing complete as shown on the details and tables and as specified herein:

1. Floor drain with integral check valve
2. Laundry and sink check valve
3. Shower drain with check valve
4. Dual check valves with access pit
5. Footing drain sump
7. Submersible sump pump
8. Backup water-powered sump pump
9. “Torpedo” type sump pump
10. Water alarm

B. For both Contract 1 and Contract 2, two suitable installations for “Torpedo” type pumps shall be identified and installed. All other locations shall have conventional sumps and both submersible and water-powered backup sump pumps provided.

1.02 RELATED WORK

A. Electrical work, concrete work, tile replacement, and trenching as required shall be provided as described below.

B. Contractor is required to apply for and pay for the appropriate permits needed to complete this work.

1.03 SUBMITTALS

A. Submit to the Engineer (Camp Dresser & McKee) a list of materials different than that supplied below along with the product specifications before installation is started. Engineer must approve any variations from the project specifications.

1.04 REFERENCE STANDARDS

A. City of Ann Arbor rules, regulations, and codes are to be followed during the performance of this work.

PART 2 PRODUCTS

2.01 GENERAL

A. The use of a manufacturer's name and model or catalog number is for the purpose of establishing the standard of quality and general configuration desired. Different equipment can be used with notification and approval by the Engineer.

2.02 ELECTRICAL EQUIPMENT

A. Electrical panels and components shall be suitable for the environment and electrical classification for the space they are located in.

2.03 PVC P-TRAP FLOOR DRAIN WITH INTEGRAL VALVE

A. Furnish and install as shown in Detail 1 in the locations provided in the Figures.

B. Unit shall replace existing floor drains and shall be mounted flush with the existing basement floor and connected to the existing basement floor drain plumbing with an appropriate rubber connector. Unit is 2" diameter and shall be of PVC construction.

C. Units shall be the following:

1. Plastic Oddities, Inc, Model PTD200 (Available locally through Lowes UPC 80434 42093)

2.04 VERTICAL BALL CHECK VALVE

A. Furnish and install as shown in Details 2 and 3 in the locations provided in the Figures.

B. Unit shall be placed in vertical installations after the existing sink trap and above the basement floor. Unit shall be connected using appropriate removable rubber connectors so that the unit can be removed for maintenance.

C. Units shall be the following:

1. Plastic Oddities, Inc, Model PBV2330 (Available locally through Lowes UPC 80434 42200)

2.05 HORIZONTAL SEWAGE CHECK VALVE

A. Furnish and install as shown in Detail 2 in the locations provided in the Figures.

B. Unit shall be placed in horizontal installations after the existing sink trap and above the basement floor. Unit shall be connected using appropriate removable rubber connectors so that the unit can be removed for maintenance.

C. Units shall be the following:

1. Flotec, Model FP212-257 (Available locally through Home Depot UPC 22315 14047)

2.06 DOUBLE CHECK VALVE ASSEMBLY

A. Furnish and install as shown in Detail 4 in the locations provided in the Figures.

B. Double check valve unit is to consist of two independent 4” PVC check valves placed inline to provide redundant protection.

C. Units are each to have a removable top to allow maintenance of the check flap and seal.

D. Both units shall be placed in a fiberglass or plastic vault in the basement floor and shall be connected into the existing plumbing system downstream from existing water closets. The plastic vault shall have a removable cover that is mounted flush with the basement floor. The units shall be connected into the existing plumbing system using appropriate removable rubber connectors so that the units can be removed for maintenance.

E. Units shall be the following:

1. 4” check valve manufactured by NDS, Model CV04 (Available through Agri-Drain, Adair, IA)

2. 4” check valve supplied through USA Bluebook, Plastic Backwater Valve PVC Body-New Style with Cleanout and 4" Plastic Lid Model #17106.

2.07 FOOTING DRAIN SUMP

A. Furnish and install as shown in Detail 5 in the locations provided in the Figures.

B. Sump shall be installed to accept flows from the basement footing drains and any house exterior stairwell drains. All existing footing drain connections to the sanitary sewer shall be appropriately disconnected and plugged.

C. Sump shall have either have a cylindrical shape with a minimum diameter of 18” or by conical in shape with minimum outside dimensions of 20” at the top and 14” at the bottom and shall be a minimum of 30” in height.

D. After installation of the sump, concrete shall be replaced around the sump in a workmanlike fashion and the existing floor treatment restored. If tile is used, an approximate tile color match shall be made.

E. Units shall be the following:

1. Munro Model BSB24TS (Available through Munro Supply Inc.).

2. ADS part number 1530-AC with lid 1537-AD (Available through Home Depot).

2.08 SUBMERSIBLE SUMP PUMP

A. Furnish and install as shown in Detail 5 in the locations provided in the Figures.

B. Submersible sump pump shall be provided to discharge flows from the new sump to a location outside of the building. Sump pump shall include all electrical wiring for the unit and discharge piping to the discharge location.

C. Sump pump shall be of cast iron construction and shall use a float type switch.

C. Discharge piping shall include a check valve downstream from the sump pump discharge to limit backflow into the sump.

D. Units shall be capable of pumping at least 2,000 gph with 15’ of discharge head.

E. Units shall be the following:

1. Flotec Model SC3200A (Available through Home Depot)

2.09 BACKUP WATER-POWERED SUMP PUMP

A. Furnish and install as shown in Detail 5 in the locations provided in the Figures.

B. Backup water-powered sump pump shall be provided to discharge flows from the new sump to the discharge piping. This pump will only operate when electrical power is not available to the submersible sump pump. This installation shall include the water piping, backflow preventor, and discharge piping.

C. Unit must be supplied with an integral check valve between the sump pump and the discharge piping to limit backflow into the sump.

D. Unit shall be capable of pumping 350 gph at 15’ discharge head and 50 psi water pressure.

E. Units shall be the following:

1. Basement Buddy & Company backup sump pump (Company located in Hemlock Michigan)

2. Zoeller Home Guard backup sump pump (Available through Home Depot)

2.10 TORPEDO TYPE SUMP PUMP

A. Furnish and install as shown in Detail 6 in the locations provided in the Figures.

B. For this sump pump installation, the sump pump shall be located in the existing footing drain cleanout. Electrical power, discharge piping, and check valve shall be provided.

C. Prior to installation, the connection between the footing drain and the sanitary plumbing shall be blocked with an expandable plug.

D. Units shall be the following:

1. Shellback Torpedo Pump (Available through Shellback Pumps, Hazel Park Michigan)

2.11 HIGH WATER ALARM

A. Furnish and install in each basement next to the sump pumps as shown on the drawings.

B. A new battery powered water alarm shall be installed next to each sump pump.

C. Units shall be the following:

1. Glentronics Model BWD-HWA (Available through Lowes)

PART 3 EXECUTION

3.01 INSTALLATION

A. Install all the items as called for in the Figures and Details.

B. Perform the installations and complete all work within 45 days of the issuance of the contract.

C. Coordinate installation with the individual homeowners to gain access to the homes and perform the work called for in this specification and on the drawings and details.

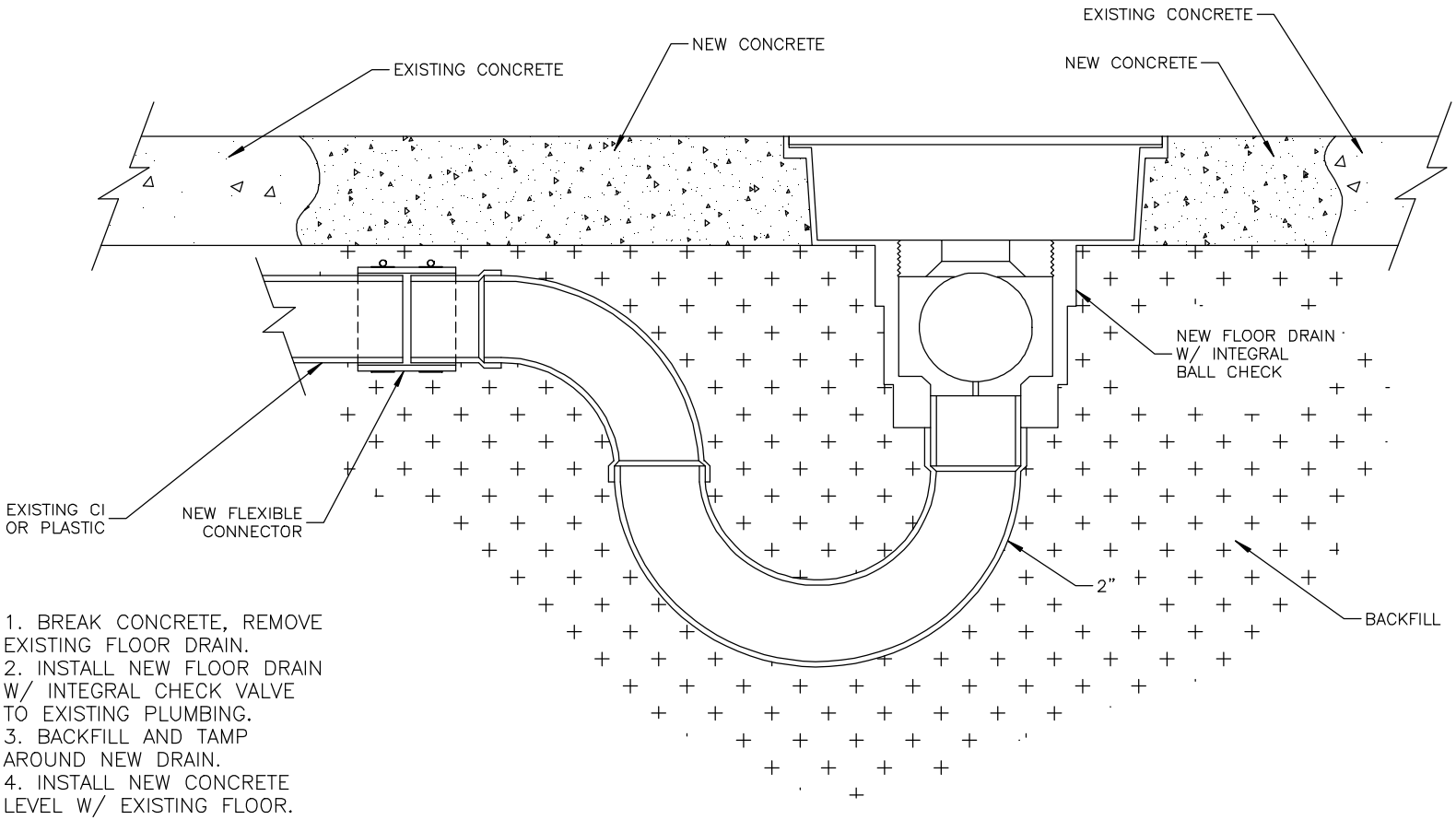
D. After connection of all of the components and prior to placement of the concrete, an inspection by the City of Ann Arbor and by the Engineer must be performed. Provide a minimum of 24-hour notice so that these can be provided in a timely fashion.

E. After placement of concrete, contractor shall restore the floor to similar to existing conditions. Tile shall be provided in locations where currently tiled. Smooth concrete finishes shall be provided in locations where new concrete is installed. New floor drains shall have concrete sloped down to the drain in the area of concrete removed.

3.02 CLEANING

A. Protection against production and tracking of dust through the home shall be provided. After installation is completed, dust, demolition material, and construction debris shall be properly removed. The associated dirt along the access route shall be appropriately cleaned.

END OF SECTION



1. BREAK CONCRETE, REMOVE EXISTING FLOOR DRAIN.
2. INSTALL NEW FLOOR DRAIN W/ INTEGRAL CHECK VALVE TO EXISTING PLUMBING.
3. BACKFILL AND TAMP AROUND NEW DRAIN.
4. INSTALL NEW CONCRETE LEVEL W/ EXISTING FLOOR.
5. REPLACE TILE & RESTORE AROUND DRAIN CONNECTION.

INSTALLATION OF FLOOR DRAIN WITH INTEGRAL CHECK VALVE

FILE LOCATION:
O:\PROJ\28478\D_FIELD\PILOT\DETAILS\DETAIL-1.DWG

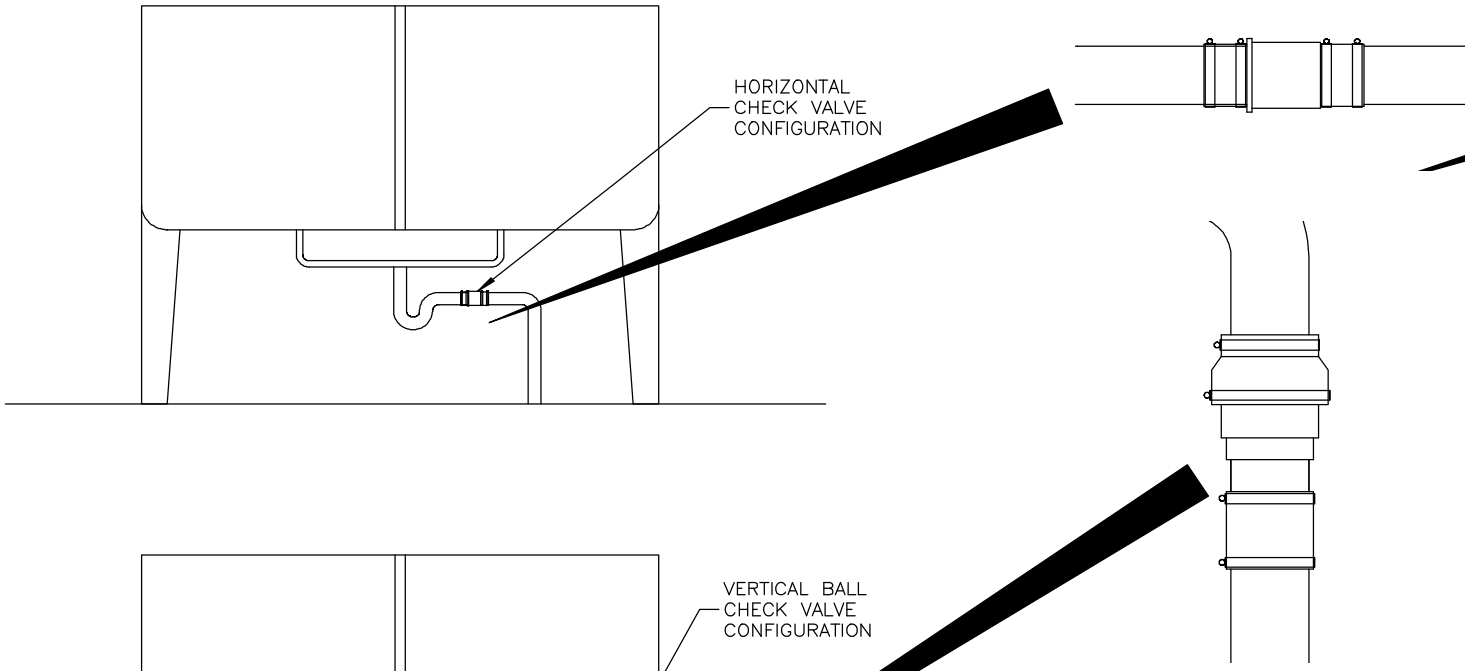
CDM Camp Dresser & McKee
One Woodward Avenue, Suite 1500
Detroit, Michigan 48226

PROJECT: City of Ann Arbor Sanitary Sewer Overflow Prevention Study

DATE: Aug 15, 2000

DETAIL: DETAIL 1

FIGURE 1



INSTALLATION OF LAUNDRY DRAIN (ALT 1 & 2) CHECK VALVE (ALSO USE FOR SINK OR WASHER DRAIN INSTALLATION)

CDM Camp Dresser & McKee
One Woodward Avenue, Suite 1500
Detroit, Michigan 48226

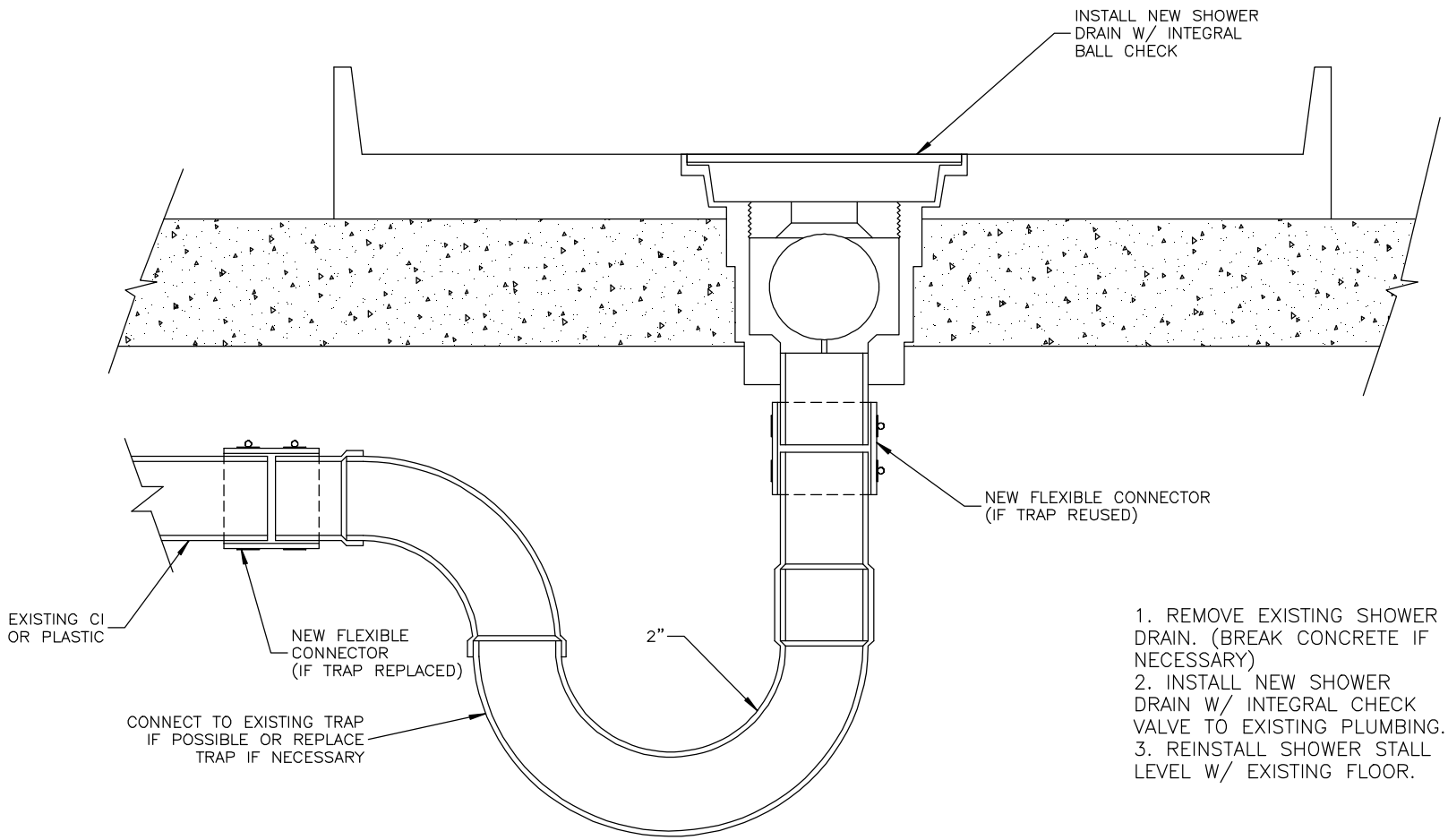
PROJECT: City of Ann Arbor Sanitary Sewer Overflow Prevention Study

DATE: Aug 15, 2000

DETAIL: DETAIL 2

FIGURE 2

FILE LOCATION:
O:\PROJ\28478\D_FIELD\PILOT\DETAILS\DETAIL-2.DWG



1. REMOVE EXISTING SHOWER DRAIN. (BREAK CONCRETE IF NECESSARY)
2. INSTALL NEW SHOWER DRAIN W/ INTEGRAL CHECK VALVE TO EXISTING PLUMBING.
3. REINSTALL SHOWER STALL LEVEL W/ EXISTING FLOOR.

INSTALLATION OF SHOWER DRAIN CHECK VALVE

CDM Camp Dresser & McKee
One Woodward Avenue, Suite 1500
Detroit, Michigan 48226

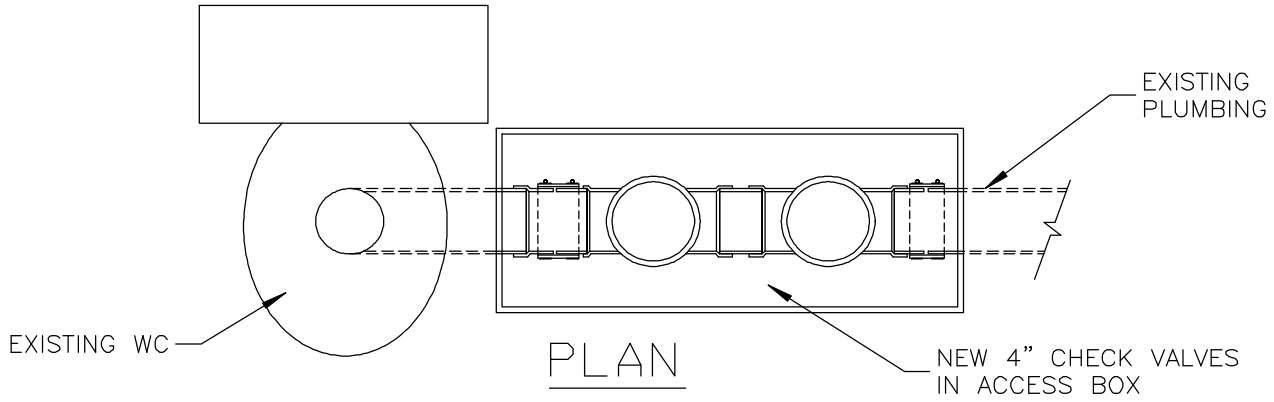
PROJECT: City of Ann Arbor Sanitary Sewer Overflow Prevention Study

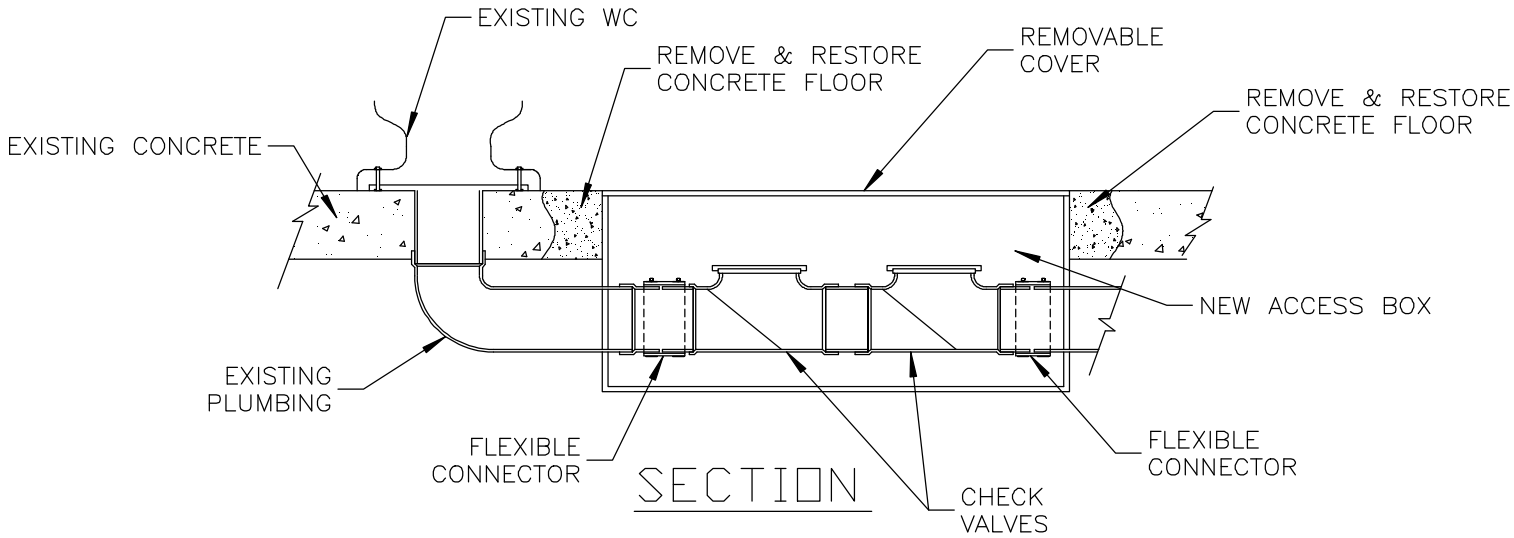
DATE: Aug 15, 2000

DETAIL: DETAIL 3

FIGURE 3

FILE LOCATION: O:\PROJ\28478\D_FIELD\PILOT\DETAILS\DETAIL-3.DWG

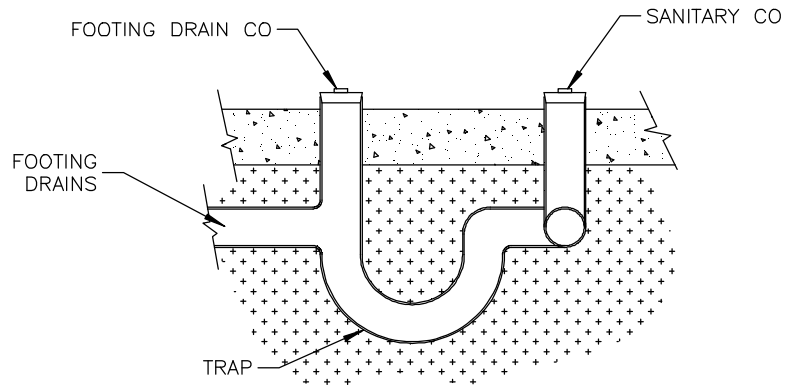




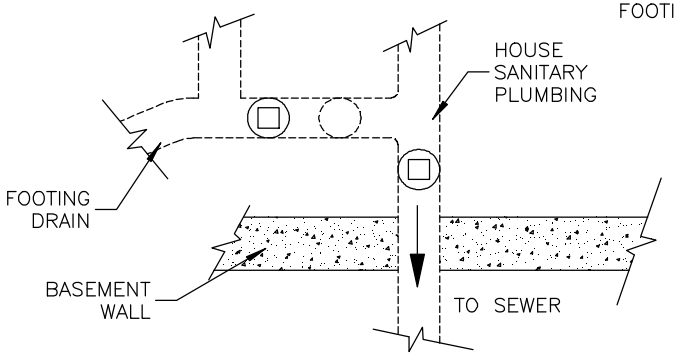
INSTALLATION OF DUAL CHECK VALVE

		CDM Camp Dresser & McKee One Woodward Avenue, Suite 1500 Detroit, Michigan 48226	PROJECT City of Ann Arbor Sanitary Sewer Overflow Prevention Study	DATE Aug 15, 2000 DETAIL DETAIL 4	FIGURE 4

FILE LOCATION:
O:\PROJ\28478\D_FIELD\PILOT\DETAILS\DETAIL-4.DWG

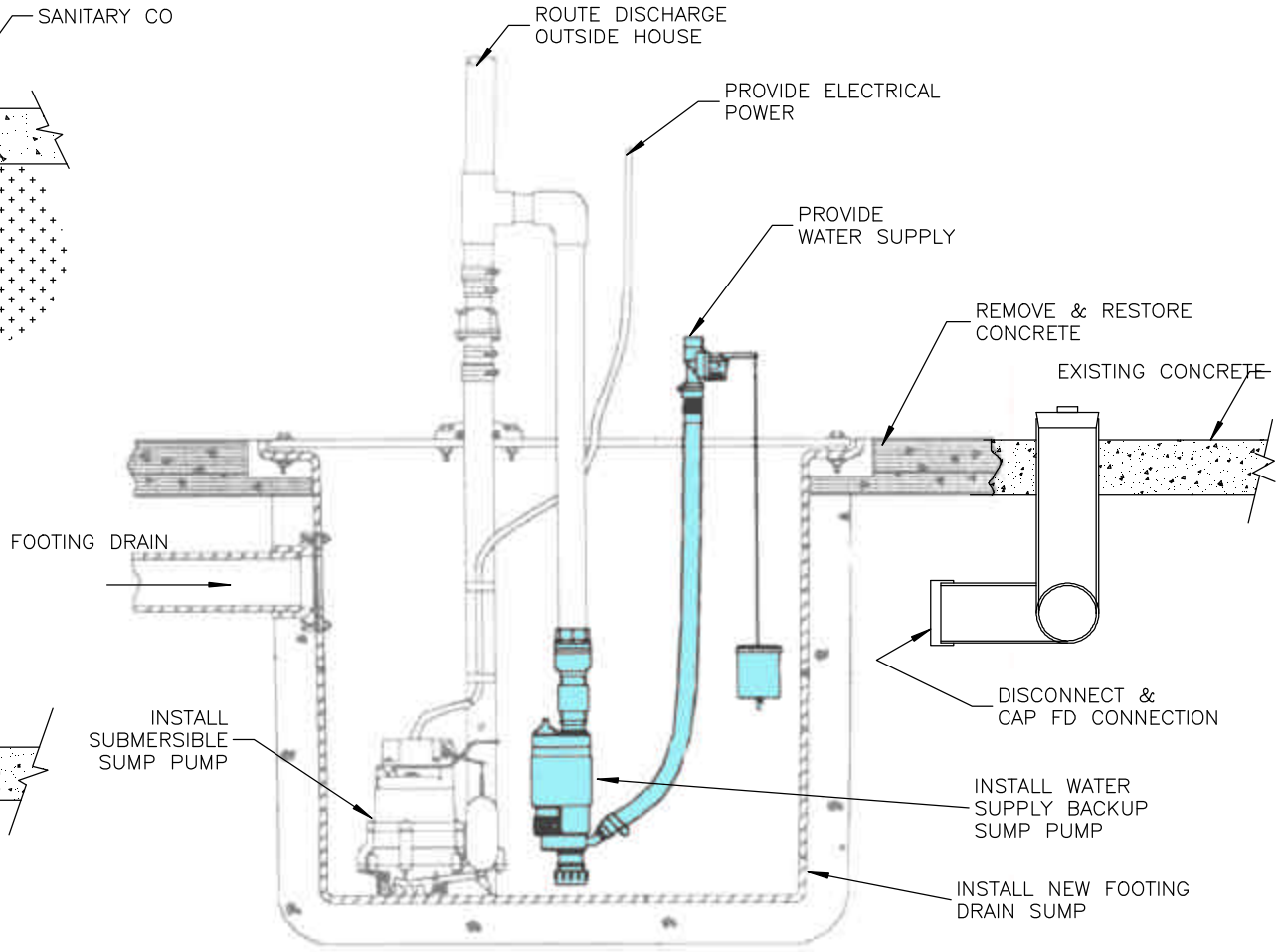


SECTION



PLAN

EXISTING CONDITIONS



NEW INSTALLATION

INSTALLATION OF SUMP AND SUMP PUMPS

CDM Camp Dresser & McKee
One Woodward Avenue, Suite 1500
Detroit, Michigan 48226

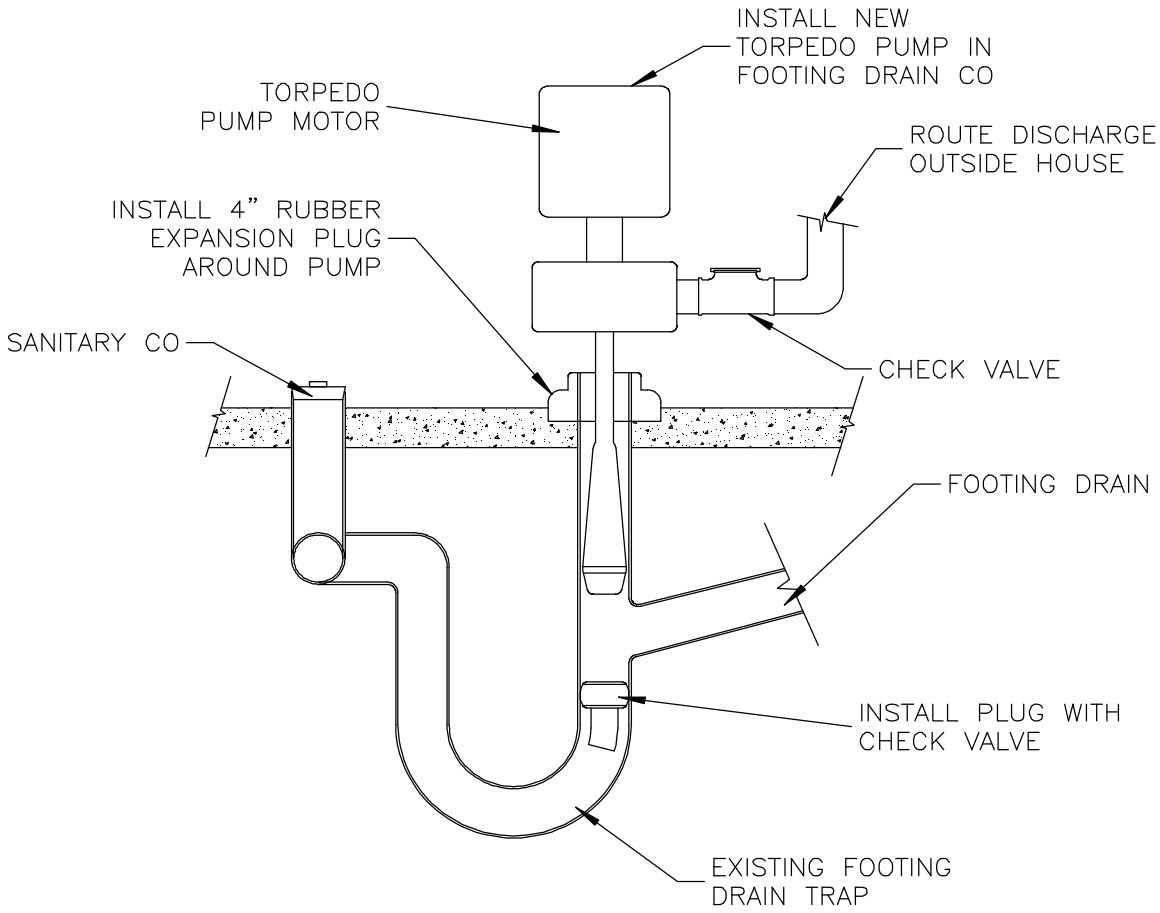
PROJECT City of Ann Arbor Sanitary Sewer Overflow Prevention Study

DATE Aug 15, 2000

DETAIL DETAIL 5

FIGURE 5

FILE LOCATION: :\PROJ\28478\D_FIELD\PILOT\DETAILS\DETAIL-5.DWG



INSTALLATION OF TORPEDO PUMP

FILE LOCATION:
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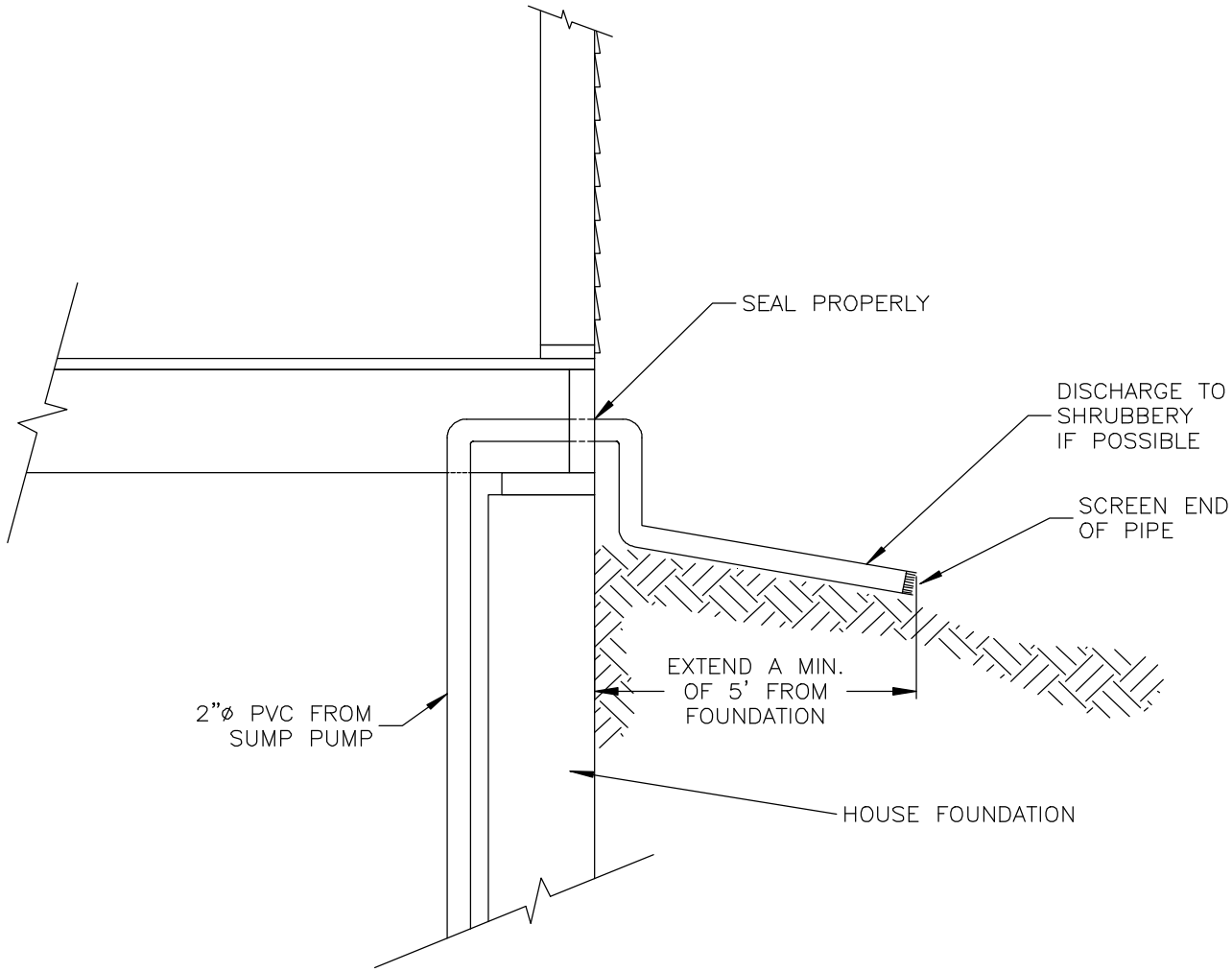
CDM Camp Dresser & McKee
One Woodward Avenue, Suite 1500
Detroit, Michigan 48226

PROJECT City of Ann Arbor Sanitary Sewer Overflow Prevention Study

DATE Aug 15, 2000

DETAIL 6

FIGURE 6



INSTALLATION OF SUMP PUMP DISCHARGE

FILE LOCATION:
O:\PROJ\28478\D_FIELD\PILOT\DETAILS\DETAIL-7.DWG

CDM Camp Dresser & McKee
One Woodward Avenue, Suite 1500
Detroit, Michigan 48226

PROJECT: City of Ann Arbor Sanitary Sewer Overflow Prevention Study

DATE: Aug 15, 2000

DETAIL: DETAIL 7

FIGURE 7

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Appendix E - Modeling Information

This appendix contains a summary of all of the detailed models used during the project. The Storm Water Management Model (SWMM) was used. Models include the "D" Model for the Dartmoor study area, the "G" Model for the Glen Leven study area, the "M" Model for the Morehead study area, the "OB" Model for the Orchard Hills and Bromley study areas, and the "TRUNKMDL" Model for the trunk sewer system.

The Ann Arbor Sanitary Sewer System Study Model consists of a series of models to address the modeling needs of the project. These models are as follows:

Model	Description
D	The D Model contains detailed models of the Dartmoor study area, including all four alternative solutions.
G	The G Model contains detailed models of the Glen Leven study area, including all four alternative solutions.
M	The M Model contains detailed models of the Morehead study area, including all four alternative solutions.
OB	The OB Model contains detailed models of the Orchard Hills and Bromley study areas, including all four alternative solutions.
TRUNKMDL	The TRUNKMDL contains detailed models of the Ann Arbor Trunk Sewer System, including potential downstream impacts caused by the alternative solutions in each of the study areas.

Throughout these sub-directories, there are some common types of files. They are defined below.

File	Abbreviation	Description
Field File	*.FLD	A filed file contains information from rain gauges, peak level recorders, flow monitors, etc. It also contains the rain event data as well.
Run-off Input File	*.RIN	A run-off input file contains information from rain gauges, storage, evaporation, RDI/I factors, and area.
Extran Input File	*.XIN	An Extran input file contains information on conduits, nodes, storage facilities, orifices, weirs, pumps, outfall junctions, and hydrographs.
Coordinate File	*.XYS	A coordinate file contains the x and y coordinates of the nodes in the model.

D Model

The D model contains all of the model runs for the Dartmoor area. The sub-directories include:

BASE-DC1 <DIR>

This directory contains Design Condition 1 run under existing conditions (i.e. pipe diameters).

CALIB <DIR>

This directory contains the final calibration runs for the May 18, 2000, June 24, 2000, and July 10, 2000, storm events.

DISCON <DIR>

This directory contains the runs for the reduction in the RDI/I factor for Dartmoor if enough footing drains are disconnected in order to prevent surcharging.

OVERSIZE <DIR>

This directory contains the model run in which all potential pipes that would need to be upsized or have relief provided under Design Condition 1 were increased (mostly doubled) in diameter. This run was used in order to acquire the peak flows in the oversized pipes.

PAULINE <DIR>

This directory contains the model run used to take a closer look at the Pauline / Stadium reach of sewer surcharges to the ground during the June Calibration Event.

RELIEF <DIR>

A spreadsheet containing the peak flows from the oversized pipes sub-directory was used in order to determine which pipes could handle the peak flows vs. which pipes needed to be upsized and/or have relief provided in order to handle the peak flows under Design Condition 1.

This directory contains the model runs of the pipes that needed to be upsized and/or have relief provided in order to prevent surcharging. An equivalent diameter was calculated. This diameter was entered into the pipes to provide a model check to the spreadsheet calculations.

The relief option of Design Condition 2 contained two separate sub-directories: AUG06'98 and JUN24'00. Simulation was performed for both the August 1998 and June 2000 events in order to determine which was the worst case. The June 2000 event turned out to be the worst case scenario. The June 2000 rainfall event was then used in the relief, storage, and footing drain disconnection options for Design Condition 2.

AUG06'98 <DIR>

This directory contains the Design Condition 2 rainfall event simulated to increase the intensity and effect of the August 6, 1998, rainfall event.

JUN24'00 <DIR>

This directory contains the Design Condition 2 rainfall event simulated to increase the intensity and effect of the June 24, 2000, rainfall event.

ROOTREM <DIR>

This directory contains a simulation that examines root removal in the Dartmoor study area.

STORAGE <DIR>

This directory contains the model runs if storage is placed into the system in order to prevent surcharging. It also contains the upsizing required to move all flow upstream of the storage facility to the facility without surcharging.

G Model

The G model contains all of the model runs for the Glen Leven area. The sub-directories include:

BASE-DC1 <DIR>

This directory contains Design Condition 1 run under existing conditions (i.e. pipe diameters).

CALIB <DIR>

This directory contains the final calibration runs for the May 18, 2000, June 24, 2000, and July 10, 2000, storm events.

DISCON <DIR>

This directory contains the runs for the reduction in the RDI/I factor for Glen Leven if enough footing drains are disconnected in order to prevent surcharging.

OVERSIZE <DIR>

This directory contains the model run in which all potential pipes that would need to be upsized or have relief provided under Design Condition 1 were increased (mostly doubled) in diameter. This run was used in order to acquire the peak flows in the oversized pipes.

RELIEF <DIR>

A spreadsheet containing the peak flows from the oversized pipes was used in order to determine which pipes could handle the peak flows vs. which pipes needed to be upsized and/or have relief provided in order to handle the peak flows under Design Condition 1.

This directory contains the model runs of the pipes that needed to be upsized and/or have relief provided in order to prevent surcharging. An equivalent diameter was calculated. This diameter was entered into the pipes to provide a model check to the spreadsheet calculations.

The relief option of Design Condition 2 contained two separate sub-directories: AUG06'98 and JUN24'00. Simulation was performed for both the August 1998 and June 2000 events in order to determine which was the worst case. The June 2000 event turned out to be the worst case scenario. The June 2000 rainfall event was then used in the relief, storage, and footing drain disconnection options for Design Condition 2.

AUG06'98 <DIR>

This directory contains the Design Condition 2 rainfall event simulated to increase the intensity and effect of the August 6, 1998, rainfall event.

JUN24'00 <DIR>

This directory contains the Design Condition 2 rainfall event simulated to increase the intensity and effect of the June 24, 2000, rainfall event.

STORAGE <DIR>

This directory contains the model runs if storage is placed into the system in order to prevent surcharging. It also contains the upsizing required to move all flow upstream of the storage facility to the facility without surcharging.

There are two storage options. Option 1 (1-STOR) contains one storage basin serving both Glen Leven North and Glen Leven South. Option 2 (2-STOR) contains two storage basins, one for Glen Leven North and one for Glen Leven South.

STORM <DIR>

This directory contains a simulation that gives the amount of storm runoff, for calculating the flow balance of the complete event – storm runoff vs. RDI/I into the sanitary sewer system.

TDRSXN <DIR>

This directory contains the Oversize file, the Relief DC1 file, the Relief DC2 file, the Relief DC3 file, the Storage DC1 file, and the Storage DC2 file, all with flows from Tudor/Saxon.

M Model

The M model contains all of the model runs for the Morehead area. The sub-directories include:

ABANDON <DIR>

This directory contains abandoned alternatives for the Morehead study region.

BASE-DC1 <DIR>

This directory contains Design Condition 1 run under existing conditions (i.e. pipe diameters).

CALIB <DIR>

This directory contains the final calibration runs for the May 18, 2000, June 24, 2000, and July 10, 2000, storm events.

DISCON <DIR>

This directory contains the runs for the reduction in the RDI/I factor for Morehead if enough footing drains are disconnected in order to prevent surcharging.

OVERSIZE <DIR>

This directory contains the model run in which all potential pipes that would need to be upsized or have relief provided under Design Condition 1 were increased (mostly doubled) in diameter. This run was used in order to acquire the peak flows in the oversized pipes.

RELIEF <DIR>

A spreadsheet containing the peak flows from the oversized pipes was used in order to determine which pipes could handle the peak flows vs. which pipes needed to be upsized and/or have relief provided in order to handle the peak flows under Design Condition 1.

This directory contains the model runs of the pipes that needed to be upsized and/or have relief provided in order to prevent surcharging. An equivalent diameter was calculated. This diameter was entered into the pipes to provide a model check to the spreadsheet calculations.

The relief option of Design Condition 2 contained two separate sub-directories: AUG06'98 and JUN24'00. Simulation was performed for both the August 1998 and June 2000 events in order to determine which was the worst case. The June 2000 event turned out to be the worst case scenario. The June 2000 rainfall event was then used in the relief, storage, and footing drain disconnection options for Design Condition 2.

AUG06'98 <DIR>

This directory contains the Design Condition 2 rainfall event simulated to increase the intensity and effect of the August 6, 1998, rainfall event.

JUN24'00 <DIR>

This directory contains the Design Condition 2 rainfall event simulated to increase the intensity and effect of the June 24, 2000, rainfall event.

STORAGE <DIR>

This directory contains the model runs if storage is placed into the system in order to prevent surcharging. It also contains the upsizing required to move all flow upstream of the storage facility to the facility without surcharging.

There are two storage options. The Option 1 sub-directory contains folders for Design Condition 1, Design Condition 2, and Design Condition 3. The Option 2 sub-directory contains folders for Design Condition 1, Design Condition 2, and Design Condition 3.

OB Model

The OB model contains all of the model runs for the Orchard Hills and Bromley areas. The sub-directories include:

BASE-DC1 <DIR>

This directory contains Design Condition 1 run under existing conditions (i.e. pipe diameters).

CALIB <DIR>

This directory contains the final calibration runs for the May 18, 2000, June 24, 2000, and July 10, 2000, storm events.

DISCON <DIR>

This directory contains the runs for the reduction in the RDI/I factor for Orchard Hills and Bromley if enough footing drains are disconnected in order to prevent surcharging.

OVERSIZE <DIR>

This directory contains the model run in which all potential pipes that would need to be upsized or have relief provided under Design Condition 1 were increased (mostly doubled) in diameter. This run was used in order to acquire the peak flows in the oversized pipes.

PFIZER <DIR>

This directory contains the model run used to determine if Pfizer could add 0.4-cfs to the Orchard Hills and Bromley system at Node 2539 in DRY WEATHER FLOW. A device was going to be installed downstream in the system to monitor the flow and STOP the Pfizer flow in periods if wet weather to prevent surcharging. Three analyses were performed.

The first involved adding no flow to the system (PFIZER0.xin). The second involved adding 0.4-cfs to the system (PFIZER04.xin). The third involved a scenario in which added 10 times the requested amount, or 4.0-cfs, to the system (PFIZER40.xin).

RELIEF <DIR>

A spreadsheet containing the peak flows from the oversized pipes was used in order to determine which pipes could handle the peak flows vs. which pipes needed to be upsized and/or have relief provided in order to handle the peak flows under Design Condition 1.

This directory contains the model runs of the pipes that needed to be upsized and/or have relief provided in order to prevent surcharging. An equivalent diameter was calculated. This diameter was entered into the pipes to provide a model check to the spreadsheet calculations.

The relief option of Design Condition 2 contained two separate sub-directories: AUG06'98 and JUN24'00. Simulation was performed for both the August 1998 and June 2000 events in order to determine which was the worst case. The June 2000 event turned out to be the worst case scenario. The June 2000 rainfall event was then used in the relief, storage, and footing drain disconnection options for Design Condition 2.

AUG06'98 <DIR>

This directory contains the Design Condition 2 rainfall event simulated to increase the intensity and effect of the August 6, 1998, rainfall event.

JUN24'00 <DIR>

This directory contains the Design Condition 2 rainfall event simulated to increase the intensity and effect of the June 24, 2000, rainfall event.

STORAGE <DIR>

This directory contains the model runs if storage is placed into the system in order to prevent surcharging. It also contains the upsizing required to move all flow upstream of the storage facility to the facility without surcharging. The equivalent diameters of these pipes can be found in cond_up.xls under the Design Condition 1 sub-directory.

STORM <DIR>

This directory contains a simulation that gives the amount of storm runoff, for calculating the flow balance of the complete event – storm runoff vs. RDI/I into the sewer system.

TRUNKMDL Model

The TRUNKMDL model contains all of the model runs for the trunk sewer system. The sub-directories include:

DETAIL <DIR>

This directory contains model run for DC1, with detailed models input as K-cards. Same as RELIEF folder runs, but without sewers in trunk model being oversized for design.

HUPYALT <DIR>

This directory contains the downstream impacts of a storage alternative for Morehead.

LEGACY <DIR>

This directory contains two runs for conditions in the Legacy Park and Dartmoor areas. LegacyA is run under DC1 and current flow conditions. LegacyB is run under DC1 with a 0.2-cfs flow increase.

N-EAST <DIR>

This directory contains the model runs that look at the capacity in the trunk sewer pipes in order to determine if additional flow from the Orchard Hills and Bromley relief option as well as flow from additional construction upstream can be handled. TFD4NE examines the system under DC1 with current pipes in Orchard Hills and Bromley. TFD5NE examines the system under DC1 with relief pipes and/or upsizing in Orchard Hills and Bromley.

RELIEF <DIR>

This directory contains the model runs used to determine downstream impacts and costs for relief alternatives of detailed models. Option TFD4 includes the relief option for the trunk sewer system downstream of the study areas under Design Condition 1 if relief pipe and/or upsizing were NOT included in the study areas. Option TFD5 includes the relief option for the trunk sewer system downstream of the study areas under Design Condition 1 if relief pipe and/or upsizing were included in the study areas.

TRUNK <DIR>

This directory contains folders for steady state and calibrations.

Appendix F - Unit Cost Table

F.1 Construction Costs

This table contains the unit costs for construction items used in the relief, increased capacity/upsizing, collection system storage, and footing drain removal options. These unit costs were used in cost calculations.

F.2 Operation and Maintenance (O&M) Costs

This table contains the operation and maintenance costs associated with the relief, increased capacity/ upsizing, collection system storage, and footing drain removal options. These unit costs were used in the cost calculations.

Unit Cost Table - City of Ann Arbor SSO Prevention Task Force
Construction Costs

				Depth of Construction						
				Normal Construction			Difficult Construction			
Cost Elements	Dia	Type	Units	5-10 ft	10-15 ft	15-20 ft	5-10 ft	10-15 ft	15-20 ft	20-25 ft
Relief	10	RCSP CL V Sewer	lf	116	167	219	135	197	259	321
	12	RCSP CL V Sewer	lf	120	172	223	138	200	262	323
	15	RCSP CL V Sewer	lf	128	180	232	150	211	278	345
	18	RCSP CL V Sewer	lf	132	184	236	156	218	280	342
	21	RCSP CL V Sewer	lf	145	197	248	162	224	286	348
	24	RCSP CL V Sewer	lf	157	209	261	185	247	309	371
	27	RCSP CL V Sewer	lf	170	221	273	189	251	313	375
	30	RCSP CL V Sewer	lf	228	279	331	264	326	388	450
	48	Manhole	ea	4,148	4,563	5,185	5,185	5,704	6,482	7,778
Pipe Bursting	10	8 to 10 in	lf	165	173	182	182	191	200	220
	12	8 to 12 in	lf	188	197	207	206	217	227	250
	12	10 to 12 in	lf	186	195	205	205	215	226	248
	15	10 to 15 in	lf	218	228	240	239	251	264	290
	15	12 to 15 in	lf	203	213	223	223	234	246	270
	18	12 to 18 in	lf	248	260	273	272	286	300	330
	18	15 to 18 in	lf	240	252	265	264	277	291	320
	21	15 to 21 in	lf	300	315	331	330	347	364	400
		Pit construction	ea	2,250	2,475	2,813	2,813	3,094	3,516	4,219
		Lead pit & connection	ea	1,500	1,650	1,875	1,875	2,063	2,344	2,813
In-line Storage	60	Inline Storage Pipe	lf	233	302	371	266	349	432	452
	48	Inline Storage Pipe	lf	175	244	313	203	285	368	388
		Control connection	ea	3,900	4,290	3,900	3,432	3,432	3,120	2,746
		Discharge connection	ea	3,900	4,290	3,900	3,432	3,432	3,120	2,746
		Access Manholes	ea	3,882	4,725	5,568	4,270	5,198	6,125	7,052
Restoration		Asphalt Restoration	lf	55	(Trench width only)					
		Lawn restoration:								
		Sodding	lf	15	(Trench width only)					
		Seeding	lf	5	(Trench width only)					
Footing Drain Disconnection		House disconnection	ea	3,300	(Includes sump, protective check valves, electrical and restoration)					
		Storm sewer connection	ea	1,500	(Includes connection to storm sewer catchbasin)					
Other Costs		Protect Existing Trees	ea	100						
		Erosion Control	lf	1						
		Traffic Control	lf	2						
		Audiovisual Coverage	lf	1						
		Audiovisual Coverage	ea	50						
Non-Construction		Construction Contingency		8%						
		Engineering, Legal		8%						
		Bidding, Construction Services		7%						
		Testing Services		5%						
		Misc Costs		5%						
		Bond Overhead		7%						
		Total		40%						

Unit Cost Table - City of Ann Arbor SSO Prevention Task Force
O&M Costs

Element	Cost	Units	Description
WWTP Volume Reduction	**896**	/MG	Treatment of flows entering the facility: Suggest using 500 gal/day/in-mi additional flow from new sewers Flows removed through footing drain removal will also be estimated
Basin maintenance	**155**	/year	Based on Orchard Hills for underground facility
Flooding Response	**Varies**	/home/incident	Average response, cleaning, etc, related to each flooded home
Sewer cleaning	**4,000**	/mi/year	Costs to maintain sewers: inspection, cleaning, rehab.

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Appendix G - Alternative Cost Sheets

G.1 Orchard Hills and Bromley

These spreadsheets contain the construction and life-cycle costs for the relief option, the increased capacity/upsizing option, the collection system storage option, and the footing drain removal option, respectively, for the Orchard Hills and Bromley study areas. These are presented together because the two regions were modeled together.

G.2 Dartmoor

These spreadsheets contain the construction and life-cycle costs for the relief option, the increased capacity/upsizing option, the collection system storage option, and the footing drain removal option, respectively, for the Dartmoor study area.

G.3 Glen Leven

These spreadsheets contain the construction and life-cycle costs for the relief option, the increased capacity/upsizing option, the collection system storage option, and the footing drain removal option, respectively, for the Glen Leven study area. Note that the region was divided into two sub-areas, Glen Leven North and Glen Leven South.

G.4 Morehead

These spreadsheets contain the construction and life-cycle costs for the relief option, the increased capacity/upsizing option, the collection system storage option, and the footing drain removal option, respectively, for the Morehead study area.

ORCHARD HILLS

AND

BROMLEY

City of Ann Arbor SSO Prevention Advisory Task Force

Study Area: Bromley

Control Alternative: Relief Sewers

Cost Element	Units	Unit Cost ($)	Cost ($)
Relief			
10" Sewer, 10-15' Depth (lf)	1,637	167	274,169
10" Sewer, 15-20' Depth (lf)	539	219	118,109
12" Sewer, 10-15' Depth (lf)	300	172	51,489
15" Sewer, 10-15' Depth (lf)	214	180	38,504
15" Sewer, 15-20' Depth (lf)	210	232	48,630
18" Sewer, 10-15' Depth (lf)	381	184	70,133
18" Sewer, 15-20' Depth (lf)	155	236	36,537
Manholes, 10-15' Depth (each)	10	4,563	45,630
Manholes, 15-20' Depth (each)	6	5,185	31,111
Subtotal			*714,312*
Restoration			
Asphalt Restoration (lf)	3,596	55	197,780
Lawn Restoration (lf)			0
Subtotal			*197,780*
Footing Drain Disconnection			
House disconnection/protect (each)	70	3,300	231,000
Storm sewer connection (each)	70	1,500	105,000
Subtotal			*336,000*
Other Costs			
Protect Natural Resources			0
Traffic Control (lf)	3,436	2	6,872
Audio Visual Coverage (each)	70	50	3,500
Audio Visual Coverage (lf)	3,436	1	3,436
Erosion Control (each)			0
Erosion Control (lf)	3,436	1	3,436
Subtotal			*17,244*
1/2 Downstream Construction Costs (to be shared with Orchard Hills)			*200,000*
Construction Subtotal			**1,470,000**
Non-Construction			
Construction Contingency		8%	117,600
Engineering, Legal		8%	117,600
Bidding, Construction Services		7%	102,900
Testing Services		5%	73,500
Misc Costs		5%	73,500
Bond Overhead		7%	102,900
Subtotal		*40%*	*588,000*
Total Construction Costs			**2,060,000**
Additional O&M Costs (Present Value)			
Sewer Cleaning*	4,119	0.76	*35,000*
Lifecycle Costs			**2,100,000**

Notes:
*O&M Costs are based on 30 years of sewer cleaning at an 8% interest rate.

City of Ann Arbor SSO Prevention Advisory Task Force

Study Area: Orchard Hills
Control Alternative: Relief Sewers

Cost Element	Units	Unit Cost ($)	Cost ($)
Relief			
10" Sewer, 10-15' Depth (lf)	1,788	167	299,458
12" Sewer, 10-15' Depth (lf)	371	172	63,675
15" Sewer, 10-15' Depth (lf)	315	180	56,677
18" Sewer, 15-20' Depth (lf)	200	184	36,815
18" Sewer, 15-20' Depth (lf)	1,692	236	398,838
18" Sewer, 20-25' Depth (lf)	827	342	282,951
Manholes, 10-15' Depth (each)	17	4,563	77,571
Manholes, 15-20' Depth (each)	7	5,185	36,296
Manholes, 20-25' Depth (each)	3	7,778	23,333
Subtotal			*1,275,615*
Restoration			
Asphalt Restoration (lf)	5,463	55	300,465
Lawn Restoration (lf)			0
Subtotal			*300,465*
Footing Drain Disconnection			
House disconnection/protect (each)	50	3,300	165,000
Storm sewer connection (each)	50	1,500	75,000
Subtotal			*240,000*
Other Costs			
Protect Natural Resources			0
Traffic Control (lf)	5,193	2	10,386
Audio Visual Control (each)	50	50	2,500
Audio Visual Control (lf)	5,193	1	5,193
Erosion Control (each)			0
Erosion Control (lf)	5,193	1	5,193
Subtotal			*23,272*
1/2 Downstream Construction Costs (to be shared with Bromley)			*200,000*
Construction Subtotal			**2,040,000**
Non-Construction			
Construction Contingency		8%	163,200
Engineering, Legal		8%	163,200
Bidding, Construction Services		7%	142,800
Testing Services		5%	102,000
Misc Costs		5%	102,000
Bond Overhead		7%	142,800
Subtotal		*40%*	*816,000*
Total Construction Costs			**2,860,000**
Additonal O&M Costs (Present Value)			
Sewer Cleaning*	5,049	0.76	*43,000*
Lifecycle Costs			**2,900,000**

Notes:
*O&M Costs are based on 30 years of sewer cleaning at an 8% interest rate.

City of Ann Arbor SSO Prevention Advisory Task Force

Study Area: Bromley

Control Alternative: Upsizing and Relief Sewers

Cost Element	Units	Unit Cost ($)	Cost ($)
Pipe Bursting			
10" (8" to 10") 10-15' Depth (lf)	1,098	173	190,229
10" (8" to 10") 15-20' Depth (lf)	539	182	98,051
12" (8" to 12") 10-15' Depth (lf)	839	197	165,178
15" (10" to 15") 10-15' Depth (lf)	214	228	48,872
Pit Construction, 10-15' Depth (each)	4	2,475	9,900
Pit Construction, 15-20' Depth (each)	2	2,813	5,625
Lead Pit&Connection, 10-15' Depth (each)	50	1,650	82,500
Lead Pit&Connection 15-20' Depth (each)	13	1,875	24,375
Subtotal			*624,730*
Relief			
15" Sewer, 15-20' Depth (lf)	210	232	48,630
18" Sewer, 10-15' Depth (lf)	381	184	70,133
18" Sewer, 15-20' Depth (lf)	155	236	36,537
Manholes, 10-15' Depth (each)	2	4,563	9,126
Manholes, 15-20' Depth (each)	2	5,185	10,370
Subtotal			*174,796*
Relief			
Asphalt Restoration (lf)	1,536	55	84,480
Lawn Restoration (lf)			0
Subtotal			*84,480*
Footing Drain Disconnection			
House disconnection/protect (each)	70	3,300	231,000
Storm sewer connection (each)	70	1,500	105,000
Subtotal			*336,000*
Other Costs			
Protect Natural Resources			0
Traffic Control (lf)	3,436	2	6,872
Audio Visual Coverage (each)	70	50	3,500
Audio Visual Coverage (lf)	3,436	1	3,436
Erosion Control (each)			0
Erosion Control (lf)	3,436	1	3,436
Subtotal			*17,244*
1/2 Downstream Construction Costs (to be shared with Orchard Hills)			*185,000*
Construction Subtotal			**1,420,000**
Non-Construction			
Construction Contingency		8%	113,600
Engineering, Legal		8%	113,600
Bidding, Construction Services		7%	99,400
Testing Services		5%	71,000
Misc Costs		5%	71,000
Bond Overhead		7%	99,400
Subtotal		*40%*	*568,000*
Total Construction Costs			**1,990,000**
Additional O&M Costs (Present Value)			
Sewer Cleaning*	746	0.76	*6,000*
Lifecycle Costs			**2,000,000**

Notes:

*O&M Costs are based on 30 years of sewer cleaning at an 8% interest rate.

City of Ann Arbor SSO Prevention Advisory Task Force

Study Area: Orchard Hills

Control Alternative: Upsizing and Relief Sewers

Cost Element	Units	Unit Cost ($)	Cost ($)
Pipe Bursting			
10" (8" to 10") 10-15' Depth (lf)	571	173	98,926
12" (8" to 12") 10-15' Depth (lf)	1,509	197	297,084
12" (10" to 12") 10-15' Depth (lf)	79	195	15,429
15" (10" to 15") 10-15' Depth (lf)	315	240	75,535
Pit Construction, 10-15' Depth (each)	8	2,475	19,800
Lead Pit & Connection, 10-15' Depth (each)	56	1,650	92,400
Subtotal			*599,174*
Relief			
18" Sewer, 10-15' Depth (lf)	200	184	36,815
18" Sewer, 15-20' Depth (lf)	1,692	236	398,838
18" Sewer, 20-25' Depth (lf)	827	342	282,951
Manholes, 10-15' Depth (each)	1	4,148	4,148
Manholes, 15-20' Depth (each)	7	5,185	36,296
Manholes, 20-25' Depth (each)	3	7,778	23,333
Subtotal			*745,567*
Restoration			
Asphalt Restoration (lf)	3,549	55	195,195
Lawn Restoration (lf)			0
Subtotal			*195,195*
Footing Drain Disconnection			
House disconnection/protect (each)	50	3,300	165,000
Storm sewer connection (each)	50	1,500	75,000
Subtotal			*240,000*
Other Costs			
Protect Natural Resources			0
Traffic Control (lf)	5,193	2	10,386
Audio Visual Coverage (each)	50	50	2,500
Audio Visual Coverage (lf)	5,193	1	5,193
Erosion Control (each)			0
Erosion Control (lf)	5,193	1	5,193
Subtotal			*23,272*
1/2 Downstream Construction Costs (to be shared with Bromley)			*185,000*
Construction Subtotal			**1,990,000**
Non-Construction			
Construction Contingency		8%	159,200
Engineering, Legal		8%	159,200
Bidding, Construction Services		7%	139,300
Testing Services		5%	99,500
Misc Costs		5%	99,500
Bond Overhead		7%	139,300
Subtotal		*40%*	*796,000*
Total Construction Costs			**2,790,000**
Additional O&M Costs (Present Value)			
*Sewer Cleaning**	2,719	0.76	*23,000*
Lifecycle Costs			**2,810,000**

Notes:

*O&M Costs are based on 30 years of sewer cleaning at an 8% interest rate.

City of Ann Arbor SSO Prevention Advisory Task Force

Study Area: Bromley

Control Alternative: Upsizing and Storage

Cost Element	Units	Unit Cost ($)	Cost ($)
Pipe Bursting			
10" (8" to 10") 10-15' Depth (lf)	1,098	173	190,229
10" (8" to 10") 15-20' Depth (lf)	539	182	98,051
12" (8" to 12") 10-15' Depth (lf)	839	197	165,178
Pit Construction, 10-15' Depth (each)	3	2,475	7,425
Pit Construction, 15-20' Depth (each)	2	2,813	5,625
Lead Pit & Connection, 10-15' Depth (each)	47	1,650	77,550
Lead Pit & Connection 15-20' Depth (each)	13	1,875	24,375
Subtotal			*568,432*
Storage			
60" In-line Storage Pipe (10-15' Depth) (lf)	428	302	129,162
60" In-line Storage Pipe (15-20' Depth) (lf)	420	371	155,668
Control connection (10-15' Depth) (each)	1	4,290	4,290
Control connection (15-20' Depth) (each)	1	3,900	3,900
Discharge connection (10-15' Depth) (each)	1	4,290	4,290
Discharge connection (15-20' Depth) (each)	1	3,900	3,900
Access Manholes (10-15' Depth) (each)	2	4,725	9,450
Access Manholes (15-20' Depth) (each)	2	5,568	11,136
Subtotal			*321,796*
Restoration			
Asphalt Restoration (lf)	2,476	55	136,180
Lawn Restoration (lf)			0
Subtotal			*136,180*
Footing Drain Disconnection			
House disconnection/protect (each)	70	3,300	231,000
Storm sewer connection (each)	70	1,500	105,000
Subtotal			*336,000*
Other Costs			
Protect Natural Resources			0
Traffic Control (lf)	2,476	2	4,952
Audio Visual Coverage (each)	70	50	3,500
Audio Visual Coverage (lf)	2,476	1	2,476
Erosion Control (each)	1	10,000	10,000
Erosion Control (lf)	2,476	1	2,476
Subtotal			*23,404*
Construction Subtotal			**1,390,000**
Non-Construction			
Construction Contingency		8%	111,200
Engineering, Legal		8%	111,200
Bidding, Construction Services		7%	97,300
Testing Services		5%	69,500
Misc Costs		5%	69,500
Bond Overhead		7%	97,300
Subtotal		*40%*	*556,000*
Total Construction Costs			**1,950,000**
Additional O&M Costs (Present Value)			
Basin Maintenance*	16,642	0.0091	*2,000*
Lifecycle Costs			**1,950,000**

Notes:

*O&M Costs are based on 30 years of basin maintenance at an 8% interest rate.

City of Ann Arbor SSO Prevention Advisory Task Force

Study Area: Orchard Hills

Control Alternative: Upsizing and Storage

Cost Element	Units	Unit Cost ($)	Cost ($)
Pipe Bursting			
10" (8" to 10") 10-15' Depth (lf)	571	173	98,926
12" (8" to 12") 10-15' Depth (lf)	1,509	197	297,084
12" (10" to 12") 10-15' Depth (lf)	79	195	15,429
15" (10" to 15") 10-15' Depth (lf)	315	228	71,938
Pit Construction, 10-15' Depth (each)	8	2,475	19,800
Lead Pit & Connection, 10-15' Depth (each)	56	1,650	92,400
Subtotal			*595,577*
Storage			
60" In-line Storage Pipe (10-15' Depth) (lf)	400	302	120,712
60" In-line Storage Pipe (15-20' Depth) (lf)	998	371	369,898
Control connection (10-15' Depth) (each)	1	4,290	4,290
Control connection (15-20' Depth) (each)	2	3,900	7,800
Discharge connection (10-15' Depth) (each)	1	4,290	4,290
Discharge connection (15-20' Depth) (each)	2	3,900	7,800
Access Manholes (10-15' Depth) (each)	2	4,725	9,450
Access Manholes (15-20' Depth) (each)	4	5,568	22,272
Subtotal			*546,511*
Restoration			
Asphalt Restoration (lf)	3,636	55	199,980
Lawn Restoration (lf)			0
Subtotal			*199,980*
Footing Drain Disconnection			
House disconnection/protect (each)	50	3,300	165,000
Storm sewer connection (each)	50	1,500	75,000
Subtotal			*240,000*
Other Costs			
Protect Natural Resources			0
Traffic Control (lf)	2,474	2	4,948
Audio Visual Coverage (each)	50	50	2,500
Audio Visual Coverage (lf)	2,474	1	2,474
Erosion Control (each)	1	10,000	10,000
Erosion Control (lf)	2,474	1	2,474
Subtotal			*22,396*
Construction Subtotal			**1,600,000**
Non-Construction			
Construction Contingency		8%	128,000
Engineering, Legal		8%	128,000
Bidding, Construction Services		7%	112,000
Testing Services		5%	80,000
Misc Costs		5%	80,000
Bond Overhead		7%	112,000
Subtotal		*40%*	*640,000*
Total Construction Costs			**2,240,000**
Additional O&M Costs (Present Value)			
Basin Maintenance*	27,436	0.0091	*3,000*
Lifecycle Costs			**2,240,000**

Notes:

*O&M Costs are based on 30 years of basin maintenance at an 8% interest rate.

City of Ann Arbor SSO Prevention Advisory Task Force

Study Area: Bromley (100% Participation)

Control Alternative: Footing Drain Disconnection*

Cost Element	Units	Unit Cost ($)	Cost ($)
Footing Drain Disconnection			
House disconnection/protect (each)	70	3,300	231,000
House disconnection (each)	179	2,800	501,200
Storm sewer connection (each)	249	1,500	373,500
Subtotal			*1,105,700*
Other Costs			
Protect Natural Resources			0
Traffic Control (lf)			0
Audio Visual Coverage (each)	249	50	12,450
Audio Visual Coverage (lf)			0
Erosion Control (each)			0
Erosion Control (lf)			0
Subtotal			*12,450*
Construction Subtotal			**1,120,000**
Non-Construction			
Construction Contingency		8%	89,600
Engineering, Legal		8%	89,600
Bidding, Construction Services		7%	78,400
Testing Services		5%	56,000
Misc Costs		5%	56,000
Bond Overhead		7%	78,400
Subtotal		*40%*	*448,000*
Total Construction Costs			**1,570,000**
Additional O&M Costs (Present Value)			
Wastewater Treatment Plant Volume Reduction**			*(225,000)*
Lifecycle Costs			**1,350,000**

Notes:

*Assumes footing drains account for 70% of the infiltration and 100% of the houses participate

**Reduced treatment at plant (32"/yr, 14.0% RDII C, 8% interest and reduced GWI portion of DWF from Bromley by 0.7)

City of Ann Arbor SSO Prevention Advisory Task Force

Study Area: Bromley (78% Participation)

Control Alternative: Footing Drain Disconnection*

Cost Element	Units	Unit Cost ($)	Cost ($)
Footing Drain Disconnection			
House disconnection/protect (each)	70	3,300	231,000
House disconnection (each)	124	2,800	347,200
Storm sewer connection (each)	194	1,500	291,000
Subtotal			*869,200*
Other Costs			
Protect Natural Resources			0
Traffic Control (lf)			0
Audio Visual Coverage (each)	194	50	9,700
Audio Visual Coverage (lf)			0
Erosion Control (each)			0
Erosion Control (lf)			0
Subtotal			*9,700*
Construction Subtotal			**880,000**
Non-Construction			
Construction Contingency		8%	70,400
Engineering, Legal		8%	70,400
Bidding, Construction Services		7%	61,600
Testing Services		5%	44,000
Misc Costs		5%	44,000
Bond Overhead		7%	61,600
Subtotal		*40%*	*352,000*
Total Construction Costs			**1,230,000**
Additional O&M Costs (Present Value)			
Wastewater Treatment Plant Volume Reduction**			*(225,000)*
Lifecycle Costs			**1,010,000**

Notes:

*Assumes footing drains account for 90% of the infiltration and 78% of the houses participate

**Reduced treatment at plant (32"/yr, 14.0% RDII C, 8% interest and reduced GWI portion of DWF from Bromley by 0.7)

City of Ann Arbor SSO Prevention Advisory Task Force

Study Area: Orchard Hills (100% Participation)

Control Alternative: Footing Drain Disconnection*

Cost Element	Units	Unit Cost ($)	Cost ($)
Footing Drain Disconnection			
House disconnection/protect (each)	50	3,300	165,000
House disconnection (each)	325	2,800	910,000
Storm sewer connection (each)	375	1,500	562,500
Subtotal			*1,637,500*
Other Costs			
Protect Natural Resources			0
Traffic Control (lf)			0
Audio Visual Coverage (each)	375	50	18,750
Audio Visual Coverage (lf)			0
Erosion Control (each)			0
Erosion Control (lf)			0
Subtotal			*18,750*
Construction Subtotal			**1,660,000**
Non-Construction			
Construction Contingency		8%	132,800
Engineering, Legal		8%	132,800
Bidding, Construction Services		7%	116,200
Testing Services		5%	83,000
Misc Costs		5%	83,000
Bond Overhead		7%	116,200
Subtotal		*40%*	*664,000*
Total Construction Costs			**2,320,000**
Additional O&M Costs (Present Value)			
Wastewater Treatment Plant Volume Reduction**			*(259,000)*
Lifecycle Costs			**2,060,000**

Notes:

*Assumes footing drains account for 75% of the infiltration and 100% of the houses participate

**Reduced treatment at plant (32"/yr, 10.9% RDII C, 8% interest and reduced GWI portion of DWF from Orchard Hills by 0.7)

City of Ann Arbor SSO Prevention Advisory Task Force

Study Area: Orchard Hills (83% Participation)

Control Alternative: Footing Drain Disconnection*

Cost Element	Units	Unit Cost ($)	Cost ($)
Footing Drain Disconnection			
House disconnection/protect (each)	50	3,300	165,000
House disconnection (each)	261	2,800	730,800
Storm sewer connection (each)	311	1,500	466,500
Subtotal			*1,362,300*
Other Costs			
Protect Natural Resources			0
Traffic Control (lf)			0
Audio Visual Coverage (each)	311	50	15,550
Audio Visual Coverage (lf)			0
Erosion Control (each)			0
Erosion Control (lf)			0
Subtotal			*15,550*
Construction Subtotal			**1,380,000**
Non-Construction			
Construction Contingency		8%	110,400
Engineering, Legal		8%	110,400
Bidding, Construction Services		7%	96,600
Testing Services		5%	69,000
Misc Costs		5%	69,000
Bond Overhead		7%	96,600
Subtotal		*40%*	*552,000*
Total Construction Costs			**1,930,000**
Additional O&M Costs (Present Value)			
Wastewater Treatment Plant Volume Reduction**			*(259,000)*
Lifecycle Costs			**1,670,000**

Notes:

*Assumes footing drains account for 90% of the infiltration and 83% of the houses participate

**Reduced treatment at plant (32"/yr, 10.9% RDII C, 8% interest and reduced GWI portion of DWF from Orchard Hills by 0.7)

DARTMOOR

City of Ann Arbor SSO Prevention Advisory Task Force

Study Area: Dartmoor

Control Alternative: Relief Sewers

Cost Element	Units	Unit Cost ($)	Cost ($)
Relief			
12" Sewer, 15-20' depth (lf)	872	223	194,696
15" Sewer, 15-20' depth (lf)	684	232	158,395
18" Sewer, 15-20' depth (lf)	406	236	95,702
30" Sewer, 15-20' depth (lf)	1,198	331	396,691
Manholes Sewer, 15-20' depth (each)	21	5,185	108,889
Subtotal			*954,374*
Restoration			
Asphalt Restoration (lf)	2,112	55	116,160
Lawn Restoration (lf)	1,258	15	18,870
Subtotal			*135,030*
Footing Drain Disconnection			
House disconnection/protect (each)	31	3,300	102,300
Storm sewer connection (each)	31	1,500	46,500
Subtotal			*148,800*
Other Costs			
Protect Natual Resources			25,000
Traffic Control (lf)	3,160	2	6,320
Audio Visual Coverage (each)	31	50	1,550
Audio Visual Coverage (lf)	3,160	1	3,160
Erosion Control (each)			0
Erosion Control (lf)	3,160	1	3,160
Subtotal			*39,190*
Construction Subtotal			**1,280,000**
Non-Construction			
Construction Contingency		8%	102,400
Engineering, Legal		8%	102,400
Bidding, Construction Services		7%	89,600
Testing Services		5%	64,000
Misc Costs		5%	64,000
Bond Overhead		7%	89,600
Subtotal		*40%*	*512,000*
Total Construction Costs			**1,790,000**
Additional O&M Costs (Present value)			
Sewer Cleaning*	3,160	0.76	*27,000*
Lifecycle Costs			**1,820,000**

Notes:
*O&M Costs are based on 30 years of sewer cleaning at an 8% interest rate.

City of Ann Arbor SSO Prevention Advisory Task Force

Study Area: Dartmoor

Control Alternative: Upsizing and Relief Sewers

Cost Element	Units	Unit Cost ($)	Cost ($)
Pipe Bursting			
18" (12" to 18") 15-20' Depth (lf)	1,556	273	424,584
21" (15" to 21") 15-20' Depth (lf)	406	331	134,285
Pit Construction, 15-20' Depth (each)	3	2,813	8,438
Lead Pit and Connection, 15-20' Depth (each)	39	1,875	73,125
Subtotal			*640,431*
Relief Sewer Construction (Liberty Rd.)			
30" Sewer, 15-20' Depth (lf)	1,198	331	396,691
Manholes, 15-20' Depth (each)	6	5,185	31,111
Subtotal			*427,802*
Restoration			
Asphalt Restoration (lf)	450	55	24,750
Lawn Restoration (lf)	1,258	15	18,870
Subtotal			*43,620*
Footing Drain Disconnection			
House disconnection/protect (each)	31	3,300	102,300
Storm sewer connection (each)	31	1,500	46,500
Subtotal			*148,800*
Other Costs			
Protect Natual Resources			15,000
Traffic Control (lf)	3,160	2	6,320
Audio Visual Coverage (each)	31	50	1,550
Audio Visual Coverage (lf)	3,160	1	3,160
Erosion Control (each)			0
Erosion Control (lf)	3,160	1	3,160
Subtotal			*29,190*
Construction Subtotal			**1,290,000**
Non-Construction			
Construction Contingency		8%	103,200
Engineering, Legal		8%	103,200
Bidding, Construction Services		7%	90,300
Testing Services		5%	64,500
Misc Costs		5%	64,500
Bond Overhead		7%	90,300
Subtotal		*40%*	*516,000*
Total Construction Costs			**1,810,000**
Additional O&M Costs (Present Value)			
Sewer Cleaning*	1,198	0.76	*10,000*
Lifecycle Costs			**1,820,000**

Notes:
*O&M Costs are based on 30 years of sewer cleaning at an 8% interest rate.

City of Ann Arbor SSO Prevention Advisory Task Force

Study Area: Dartmoor

Control Alternative: Upsizing and Storage

Cost Element	Units	Unit Cost ($)	Cost ($)
Pipe Bursting			
18" (12" to 18") 15-20' Depth	1,556	273	424,584
21" (15" to 21") 15-20' Depth	406	331	134,285
Pit Construction, 15-20' Depth (each)	3	2,813	8,438
Lead Pit and Connection, 15-20' Depth (each)	31	1,875	58,125
Subtotal			*625,431*
Replace Existing Sewer (not relief)			
24" Sewer, 15-20' Depth (lf)	387	309	119,662
Manholes, 15-20' Depth (each)	2	6,482	12,963
Subtotal			*132,625*
Storage (North of Liberty Rd.)			
60" In-line Storage Pipe (10-15' Depth) (lf)	2,292	349	800,006
Control connection (10-15' Depth) (each)	1	3,432	3,432
Discharge connection (10-15' Depth) (each)	1	3,432	3,432
Access Manholes (10-15' Depth) (each)	6	5,198	31,185
Subtotal			*838,055*
Restoration			
Asphalt Restoration (lf)	370	55	20,350
Lawn Restoration (lf)	5,011	15	75,160
Subtotal			*95,510*
Footing Drain Disconnection			
House disconnection/protect (each)	31	3,300	102,300
Storm sewer connection (each)	31	1,500	46,500
Subtotal			*148,800*
Other Costs			
Protect Natual Resources			40,000
Traffic Control (lf)	1,962	2	3,924
Audio Visual Coverage (each)	31	50	1,550
Audio Visual Coverage (lf)	1,962	1	1,962
Erosion Control (each)	1	10,000	10,000
Erosion Control (lf)	1,962	1	1,962
Subtotal			*59,398*
Construction Subtotal			**1,900,000**
Non-Construction			
Construction Contingency		8%	152,000
Engineering, Legal		8%	152,000
Bidding, Construction Services		7%	133,000
Testing Services		5%	95,000
Misc Costs		5%	95,000
Bond Overhead		7%	133,000
Subtotal		*40%*	*760,000*
Total Construction Costs			**2,660,000**
Additional O&M Costs (Present Value)			
Basin Maintenance*	45,000	0.0091	*5,000*
Lifecycle Costs			**2,670,000**

Notes:

*O&M Costs are based on 30 years of basin maintenance at an 8% interest rate.

City of Ann Arbor SSO Prevention Advisory Task Force

Study Area: Dartmoor

Control Alternative: Upsizing and Storage (DC2)

Cost Element	Units	Unit Cost ($)	Cost ($)
Pipe Bursting			
18" (12" to 18") 15-20' Depth (lf)	1,556	273	424,584
21" (15" to 21") 15-20' Depth (lf)	406	331	134,285
Pit Construction, 15-20' Depth (each)	3	2,813	8,438
Lead Pit and Connection, 15-20' Depth (each)	31	1,875	58,125
Subtotal			*625,431*
Replace Existing Sewer (not relief)			
24" Sewer, 15-20' Depth (lf)	387	309	119,662
Manholes, 15-20' Depth (each)	2	6,482	12,963
Subtotal			*132,625*
Storage (North of Liberty Rd.)			
60" In-line Storage Pipe (10-15' Depth) (lf)	2,419	349	844,451
Control connection (10-15' Depth) (each)	1	3,432	3,432
Discharge connection (10-15' Depth) (each)	1	3,432	3,432
Access Manholes (10-15' Depth) (each)	6	5,198	31,185
Subtotal			*882,500*
Restoration			
Asphalt Restoration (lf)	370	55	20,350
Lawn Restoration (lf)	5,265	15	78,980
Subtotal			*99,330*
Footing Drain Disconnection			
House disconnection/protect (each)	31	3,300	102,300
Storm sewer connection (each)	31	1,500	46,500
Subtotal			*148,800*
Other Costs			
Protect Natual Resources			40,000
Traffic Control (lf)	2,349	2	4,698
Audio Visual Coverage (each)	31	50	1,550
Audio Visual Coverage (lf)	2,349	1	2,349
Erosion Control (each)	1	10,000	10,000
Erosion Control (lf)	2,349	1	2,349
Subtotal			*60,946*
Construction Subtotal			**1,950,000**
Non-Construction			
Construction Contingency		8%	156,000
Engineering, Legal		8%	156,000
Bidding, Construction Services		7%	136,500
Testing Services		5%	97,500
Misc Costs		5%	97,500
Bond Overhead		7%	136,500
Subtotal		*40%*	*780,000*
Total Construction Costs			**2,730,000**
Additional O&M Costs (Present Value)			
Basin Maintenance*	47,500	0.0091	*5,000*
Lifecycle Costs			**2,740,000**

Notes:

*O&M Costs are based on 30 years of basin maintenance at an 8% interest rate.

City of Ann Arbor SSO Prevention Advisory Task Force

Study Area: Dartmoor (100% Participation)

Control Alternative: Footing Drain Disconnection*

Cost Element	Units	Unit Cost ($)	Cost ($)
Footing Drain Disconnection			
House disconnection/protect (each)	31	3,300	102,300
House disconnection (each)	280	2,800	784,000
Storm sewer connection (each)	311	1,500	466,500
Subtotal			*1,352,800*
Other Costs			
Protect Natual Resources			0
Traffic Control (lf)			0
Audio Visual Coverage (each)	311	50	15,550
Audio Visual Coverage (lf)			0
Erosion Control (each)			0
Erosion Control (lf)			0
Subtotal			*15,550*
Construction Subtotal			**1,370,000**
Non-Construction			
Construction Contingency		8%	109,600
Engineering, Legal		8%	109,600
Bidding, Construction Services		7%	95,900
Testing Services		5%	68,500
Misc Costs		5%	68,500
Bond Overhead		7%	95,900
Subtotal		*40%*	*548,000*
Total Construction Costs			**1,920,000**
Additional O&M Costs (Present Value)			
Wastewater Treatment Plant Volume Reduction**			(410,000)
Lifecycle Costs			**1,510,000**

Notes:

*Assumes footing drains account for 70% of the infiltration and 100% of the houses participate

**Reduced treatment at plant (32"/yr, 4.0% RDII, 8% interest and reduced GWI portion of DWF from Dartmoor by 0.7)

City of Ann Arbor SSO Prevention Advisory Task Force

Study Area: Dartmoor (78% Participation)

Control Alternative: Footing Drain Disconnection*

Cost Element	Units	Unit Cost ($)	Cost ($)
Footing Drain Disconnection			
House disconnection/protect (each)	31	3,300	102,300
House disconnection (each)	212	2,800	593,600
Storm sewer connection (each)	243	1,500	364,500
Subtotal			*1,060,400*
Other Costs			
Protect Natual Resources			0
Traffic Control (lf)			0
Audio Visual Coverage (each)	243	50	12,150
Audio Visual Coverage (lf)			0
Erosion Control (each)			0
Erosion Control (lf)			0
Subtotal			*12,150*
Construction Subtotal			**1,070,000**
Non-Construction			
Construction Contingency		8%	85,600
Engineering, Legal		8%	85,600
Bidding, Construction Services		7%	74,900
Testing Services		5%	53,500
Misc Costs		5%	53,500
Bond Overhead		7%	74,900
Subtotal		*40%*	*428,000*
Total Construction Costs			**1,500,000**
Additional O&M Costs (Present Value)			
Wastewater Treatment Plant Volume Reduction**			*(410,000)*
Lifecycle Costs			**1,090,000**

Notes:

*Assumes footing drains account for 90% of the infiltration and 78% of the houses participate

**Reduced treatment at plant (32"/yr, 4.0% RDII, 8% interest and reduced GWI portion of DWF from Dartmoor by 0.7)

GLEN LEVEN

City of Ann Arbor SSO Prevention Advisory Task Force

Study Area: Glen Leven North

Control Alternative: Relief Sewers

Cost Element	Units	Unit Cost ($)	Cost ($)
Relief			
10" Sewer, 5-10' Depth (lf)	1,773	116	205,668
10" Sewer, 10-15' Depth (lf)	651	167	108,717
12" Sewer, 5-10' Depth (lf)	2,394	120	287,280
12" Sewer, 10-15' Depth (lf)	2,864	172	492,608
18" Sewer, 10-15' Depth (lf)	317	184	58,328
18" Sewer, 15-20' Depth (lf)	179	236	42,244
Manholes, 5-10' Depth (each)	17	4,148	70,516
Manholes, 10-15' Depth (each)	19	4,563	86,697
Manholes, 15-20' Depth (each)	1	5,185	5,185
Subtotal			*1,357,243*
Restoration			
Asphalt Restoration (lf)	5,389	55	296,395
Lawn restoration (lf)	3,159	15	47,385
Subtotal			*343,780*
Footing Drain Disconnection			
House disconnection/protect (each)	76	3,300	250,800
Storm sewer connection (each)	76	1,500	114,000
Subtotal			*364,800*
Other Costs			
Protect Natural Resources			0
Traffic Control (lf)	8,178	2	16,356
Audio Visual Coverage (each)	76	50	3,800
Audio Visual Coverage (lf)	8,178	1	8,178
Erosion Control (each)			0
Erosion Control (lf)	8,178	1	8,178
Subtotal			*36,512*
Construction Subtotal			**2,100,000**
Non-Construction			
Construction Contingency		8%	168,000
Engineering, Legal		8%	168,000
Bidding, Construction Services		7%	147,000
Testing Services		5%	105,000
Misc Costs		5%	105,000
Bond Overhead		7%	147,000
Subtotal		*40%*	*840,000*
Total Construction Costs			**2,940,000**
Additional O&M Costs (Present Value)			
Sewer Cleaning*	8,178	0.76	*70,000*
Lifecycle Costs			**3,010,000**

Notes:
*O&M Costs are based on 30 years of sewer cleaning at an 8% interest rate.

City of Ann Arbor SSO Prevention Advisory Task Force

Study Area: Glen Leven South

Control Alternative: Relief Sewers

Cost Element	Units	Unit Cost ($)	Cost ($)
Relief			
10" Sewer, 10-15' Depth (lf)	467	167	77,989
10" Sewer, 15-20' Depth (lf)	2,021	219	442,599
12" Sewer, 15-20' Depth (lf)	857	223	191,111
Manholes, 10-15' Depth (each)	2	4,563	9,126
Manholes, 15-20' Depth (each)	10	5,185	51,850
Subtotal			*772,675*
Restoration			
Asphalt Restoration (lf)	3,465	55	190,575
Lawn Restoration (lf)			0
Subtotal			*190,575*
Footing Drain Disconnection			
House disconnection/protect (each)	47	3,300	155,100
Storm sewer connection (each)	47	1,500	70,500
Subtotal			*225,600*
Other Costs			
Protect Natural Resources			0
Traffic Control (lf)	3,345	2	6,690
Audio Visual Coverage (each)	47	50	2,350
Audio Visual Coverage (lf)	3,345	1	3,345
Erosion Control (each)			0
Erosion Control (lf)	3,345	1	3,345
Subtotal			*15,730*
Construction Subtotal			**1,200,000**
Non-Construction			
Construction Contingency		8%	96,000
Engineering, Legal		8%	96,000
Bidding, Construction Services		7%	84,000
Testing Services		5%	60,000
Misc Costs		5%	60,000
Bond Overhead		7%	84,000
Subtotal		*40%*	*480,000*
Total Construction Costs			**1,680,000**
Additional O&M Costs (Present Value)			
Sewer Cleaning*	3,345	0.76	*29,000*
Lifecycle Costs			**1,710,000**

Notes:

*O&M Costs are based on 30 years of sewer cleaning at an 8% interest rate.

City of Ann Arbor SSO Prevention Advisory Task Force

Study Area: Glen Leven South

Control Alternative: Relief Sewers with Saxon/Tudor*

Cost Element	Units	Unit Cost ($)	Cost ($)
Relief			
10" Sewer, 10-15' Depth (lf)	467	167	77,989
10" Sewer, 15-20' Depth (lf)	687	219	150,453
12" Sewer, 5-10' Depth (lf)	830	120	99,600
12" Sewer, 10-15' Depth (lf)	105	172	18,060
12" Sewer, 15-20' Depth (lf)	81	223	18,063
15" Sewer, 15-20' Depth (lf)	2,191	232	508,312
Manholes, 5-10' Depth (each)	4	4,148	16,592
Manholes, 10-15' Depth (each)	3	4,563	13,689
Manholes, 15-20' Depth (each)	11	5,185	57,035
Subtotal			*959,793*
Restoration			
Asphalt Restoration (lf)	4,541	55	249,755
Lawn Restoration (lf)			0
Subtotal			*249,755*
Footing Drain Disconnection			
House disconnection/protect (each)	47	3,300	155,100
Storm sewer connection (each)	47	1,500	70,500
Subtotal			*225,600*
Other Costs			
Protect Natural Resources			0
Traffic Control (lf)	4,361	2	8,722
Audio Visual Coverage (each)	47	50	2,350
Audio Visual Coverage (lf)	4,361	1	4,361
Erosion Control (each)			0
Erosion Control (lf)	4,361	1	4,361
Subtotal			*19,794*
Construction Subtotal			**1,450,000**
Non-Construction			
Construction Contingency		8%	116,000
Engineering, Legal		8%	116,000
Bidding, Construction Services		7%	101,500
Testing Services		5%	72,500
Misc Costs		5%	72,500
Bond Overhead		7%	101,500
Subtotal		*40%*	*580,000*
Total Construction Costs			**2,030,000**
Additional O&M Costs (Present Value)			
Sewer Cleaning**	4,361	0.76	*37,000*
Lifecycle Costs			**2,070,000**

Notes:

*This option accounts for the additional costs associated with an increased flow in the Glen Leven sub-area if the Saxon/Tudor portion of the Morehead sub-area is diverted to Glen Leven via a new connection along Scio Church Road.

**O&M Costs are based on 30 years of sewer cleaning at an 8% interest rate.

City of Ann Arbor SSO Prevention Advisory Task Force

Study Area: Glen Leven South

Control Alternative: Relief Sewers and Storage

Cost Element	Units	Unit Cost ($)	Cost ($)
Relief			
10" Sewer, 10-15' Depth (lf)	467	167	77,989
10" Sewer, 15-20' Depth (lf)	2,021	219	442,599
12" Sewer, 15-20' Depth (lf)	857	223	191,111
Manholes, 10-15' Depth (each)	2	4,563	9,126
Manholes, 15-20' Depth (each)	10	5,185	51,850
Subtotal			*772,675*
Storage			
48" In-line Storage Pipe (10-15' Depth) (lf)	277	244	67,588
Control connection (10-15' Depth) (each)	1	4,290	4,290
Discharge connection (10-15' Depth) (each)	1	4,290	4,290
Access Manholes (10-15' Depth) (each)	2	4,725	9,450
Subtotal			*85,618*
Restoration			
Asphalt Restoration (lf)	4,059	55	223,245
Lawn Restoration (lf)			0
Subtotal			*223,245*
Footing Drain Disconnection			
House disconnection/protect (each)	47	3,300	155,100
Storm sewer connection (each)	47	1,500	70,500
Subtotal			*225,600*
Other Costs			
Protect Natural Resources			0
Traffic Control (lf)	3,345	2	6,690
Audio Visual Coverage (each)	47	50	2,350
Audio Visual Coverage (lf)	3,345	1	3,345
Erosion Control (each)	1	20,000	20,000
Erosion Control (lf)	3,345	1	3,345
Subtotal			*35,730*
Construction Subtotal			**1,340,000**
Non-Construction			
Construction Contingency		8%	107,200
Engineering, Legal		8%	107,200
Bidding, Construction Services		7%	93,800
Testing Services		5%	67,000
Misc Costs		5%	67,000
Bond Overhead		7%	93,800
Subtotal		*40%*	*536,000*
Total Construction Costs			**1,880,000**
Additional O&M Costs (Present Value)			
Sewer Cleaning*	3,345	0.76	29,000
Basin Maintenance**	1,108	0.0091	2,000
Subtotal			*31,000*
Lifecycle Costs			**1,910,000**

Notes:
*O&M Costs are based on 30 years of sewer cleaning at an 8% interest rate.
**O&M Costs are based on 30 years of basin maintenance at an 8% interest rate.

City of Ann Arbor SSO Prevention Advisory Task Force

Study Area: Glen Leven South

Control Alternative: Relief Sewers and Storage with Saxon/Tudor*

Cost Element	Units	Unit Cost ($)	Cost ($)
Relief			
10" Sewer, 10-15' Depth (lf)	467	167	77,989
10" Sewer, 15-20' Depth (lf)	687	219	150,453
12" Sewer, 5-10' Depth (lf)	830	120	99,600
12" Sewer, 10-15' Depth (lf)	105	172	18,060
12" Sewer, 15-20' Depth (lf)	81	223	18,063
15" Sewer, 15-20' Depth (lf)	2,191	232	508,312
Manholes, 5-10' Depth (each)	4	4,148	16,592
Manholes, 10-15' Depth (each)	3	4,563	13,689
Manholes, 15-20' Depth (each)	11	5,185	57,035
Subtotal			*959,793*
Storage			
60" In-line Storage Pipe (10-15' Depth) (lf)	831	302	250,962
Control connection (10-15' Depth) (each)	1	4,290	4,290
Discharge connection (10-15' Depth) (each)	1	4,290	4,290
Access Manholes (10-15' Depth) (each)	2	4,725	9,450
Subtotal			*268,992*
Restoration			
Asphalt Restoration (lf)	6,243	55	343,365
Lawin Restoration (lf)			0
Subtotal			*343,365*
Footing Drain Disconnection			
House disconnection/protect (each)	47	3,300	155,100
Storm sewer connection (each)	47	1,500	70,500
Subtotal			*225,600*
Other Costs			
Protect Natural Resources			0
Traffic Control (lf)	4,361	2	8,722
Audio Visual Coverage (each)	47	50	2,350
Audio Visual Coverage (lf)	4,361	1	4,361
Erosion Control (each)	1	20,000	20,000
Erosion Control (lf)	4,361	1	4,361
Subtotal			*39,794*
Construction Subtotal			**1,840,000**
Non-Construction			
Construction Contingency		8%	147,200
Engineering, Legal		8%	147,200
Bidding, Construction Services		7%	128,800
Testing Services		5%	92,000
Misc Costs		5%	92,000
Bond Overhead		7%	128,800
Subtotal		*40%*	*736,000*
Total Construction Costs			**2,580,000**
Additional O&M Costs (Present Value)			
Sewer Cleaning**	4,361	0.76	37,000
Basin Maintenance***	5,194	0.0091	2,000
Subtotal			*39,000*
Lifecycle Costs			**2,620,000**

Notes:

*This option accounts for the additional costs associated with an increased flow in the Glen Leven sub-area if the Saxon/Tudor portion of the Morehead sub-area is diverted to Glen Leven via a new connection along Scio Church Road.

**O&M Costs are based on 30 years of sewer cleaning at an 8% interest rate.

***O&M Costs are based on 30 years of basin maintenance at an 8% interest rate.

City of Ann Arbor SSO Prevention Advisory Task Force

Study Area: Glen Leven North

Control Alternative: Upsizing

Cost Element	Units	Unit Cost ($)	Cost ($)
Pipe Bursting			
10" (8" to 10") 5-10' Depth (lf)	1,773	165	292,545
10" (8" to 10") 10-15' Depth (lf)	325	173	56,225
12" (8" to 12") 10-15' Depth (lf)	135	197	26,595
15" (10" to 15") 5-10' Depth (lf)	1,670	218	364,060
15" (10" to 15") 10-15' Depth (lf)	1,525	228	347,700
15" (12" to 15") 5-10' Depth (lf)	415	203	84,245
15" (12" to 15") 10-15' Depth (lf)	945	213	201,285
21" (15" to 21") 10-15' Depth (lf)	567	315	178,605
21" (15" to 21") 15-20' Depth (lf)	179	331	59,249
Pit Construction, 5-10' Depth (each)	8	2,250	18,000
Pit Construction, 10-15' Depth (each)	10	2,475	24,750
Pit Construction, 15-20' Depth (each)	1	2,813	2,813
Lead Pit & Connection, 5-10' Depth (each)	37	1,500	55,500
Lead Pit & Connection, 10-15' Depth (each)	39	1,650	64,350
Subtotal			*1,775,922*
Restoration			
Asphalt Restoration (lf)	1,140	55	62,700
Lawn Restoration (lf)			0
Subtotal			*62,700*
Footing Drain Disconnection			
House disconnection/protect (each)	76	3,300	250,800
Storm sewer connection (each)	76	1,500	114,000
Subtotal			*364,800*
Other Costs			
Protect Natural Resources			0
Traffic Control (lf)	7,534	2	15,068
Audio Visual Coverage (each)	76	50	3,800
Audio Visual Coverage (lf)	7,534	1	7,534
Erosion Control (each)			0
Erosion Control (lf)	7,534	1	7,534
Subtotal			*33,936*
Construction Subtotal			**2,240,000**
Non-Construction			
Construction Contingency		8%	179,200
Engineering, Legal		8%	179,200
Bidding, Construction Services		7%	156,800
Testing Services		5%	112,000
Misc Costs		5%	112,000
Bond Overhead		7%	156,800
Subtotal		*40%*	*896,000*
Total Construction Costs			**3,140,000**
Additional O&M Costs (Present Value)			0
Lifecycle Costs			**3,140,000**

City of Ann Arbor SSO Prevention Advisory Task Force

Study Area: Glen Leven South

Control Alternative: Upsizing

Cost Element	Units	Unit Cost ($)	Cost ($)
Pipe Bursting			
10" (8" to 10") 10-15' Depth (lf)	467	173	80,791
10" (8" to 10") 15-20' Depth (lf)	301	182	54,782
15" (12" to 15") 15-20' Depth (lf)	738	213	157,194
18" (15" to 18") 15-20' Depth (lf)	1,839	213	391,707
Pit Construction, 10-15' Depth (each)	2	2,475	4,950
Pit Construction, 15-20' Depth (each)	7	2,813	19,691
Lead Pit & Connection, 10-15' Depth (each)	13	1,650	21,450
Lead Pit & Connection 15-20' Depth (each)	17	1,875	31,875
Subtotal			*762,440*
Restoration			
Asphalt Restoration (lf)	480	55	26,400
Lawn Restoration (lf)			0
Subtotal			*26,400*
Footing Drain Disconnection			
House disconnection/protect (each)	47	3,300	155,100
Storm sewer connection (each)	47	1,500	70,500
Subtotal			*225,600*
Other Costs			
Protect Natural Resources			0
Traffic Control (lf)	3,345	2	6,690
Audio Visual Coverage (each)	47	50	2,350
Audio Visual Coverage (lf)	3,345	1	3,345
Erosion Control (each)			0
Erosion Control (lf)	3,345	1	3,345
Subtotal			*15,730*
Construction Subtotal			**1,030,000**
Non-Construction			
Construction Contingency		8%	82,400
Engineering, Legal		8%	82,400
Bidding, Construction Services		7%	72,100
Testing Services		5%	51,500
Misc Costs		5%	51,500
Bond Overhead		7%	72,100
Subtotal		*40%*	*412,000*
Total Construction Costs			**1,440,000**
Additional O&M Costs (Present Value)			0
Lifecycle Costs			**1,440,000**

City of Ann Arbor SSO Prevention Advisory Task Force

Study Area: Glen Leven North

Control Alternative: Upsizing and Storage (Option 1*)

Cost Element	Units	Unit Cost ($)	Cost ($)
Pipe Bursting			
10" (8" to 10") 5-10' Depth (lf)	1,773	165	292,545
10" (8" to 10") 10-15' Depth (lf)	325	173	56,225
12" (8" to 12") 10-15' Depth (lf)	135	197	26,595
15" (10" to 15") 5-10' Depth (lf)	192	218	41,856
15" (10" to 15") 10-15' Depth (lf)	1,191	228	271,548
15" (12" to 15") 5-10' Depth (lf)	134	203	27,202
15" (12" to 15") 10-15' Depth (lf)	625	213	133,125
Pit Construction, 5-10' Depth (each)	5	2,250	11,250
Pit Construction, 10-15' Depth (each)	8	2,475	19,800
Lead Pit & Connection, 5-10' Depth (each)	37	1,500	55,500
Lead Pit & Connection, 10-15' Depth (each)	39	1,650	64,350
Subtotal			*999,996*
Storage			
60" In-line Storage Pipe (10-15' Depth) (lf)	927	302	279,954
Control connection (10-15' Depth) (each)	3	4,290	12,870
Discharge connection (10-15' Depth) (each)	3	4,290	12,870
Access Manholes (10-15' Depth) (each)	6	4,725	28,350
Subtotal			*334,044*
Restoration			
Asphalt Restoration (lf)	2,994	55	164,670
Lawn Restoration (lf)			0
Subtotal			*164,670*
Footing Drain Disconnection			
House disconnection/protect (each)	76	3,300	250,800
Storm sewer connection (each)	76	1,500	114,000
Subtotal			*364,800*
Other Costs			
Protect Natural Resources			0
Traffic Control (lf)	4,375	2	8,750
Audio Visual Coverage (each)	76	50	3,800
Audio Visual Coverage (lf)	4,375	1	4,375
Erosion Control (each)	1	20,000	20,000
Erosion Control (lf)	4,375	1	4,375
Subtotal			*41,300*
Construction Subtotal			**1,900,000**
Non-Construction			
Construction Contingency		8%	152,000
Engineering, Legal		8%	152,000
Bidding, Construction Services		7%	133,000
Testing Services		5%	95,000
Misc Costs		5%	95,000
Bond Overhead		7%	133,000
Subtotal		*40%*	*760,000*
Total Construction Costs			**2,660,000**
Additional O&M Costs (Present Value)			
Basin Maintenance**	5,794	0.0091	*2,000*
Lifecycle Costs			**2,660,000**

Notes:

*A separate storage facility for both Glen Leven North and Glen Leven South

**O&M Costs are based on 30 years of basin maintenance at an 8% interest rate.

City of Ann Arbor SSO Prevention Advisory Task Force

Study Area: Glen Leven South

Control Alternative: Upsizing and Storage (Option 1*)

Cost Element	Units	Unit Cost ($)	Cost ($)
Pipe Bursting			
10" (8" to 10") 10-15' Depth (lf)	467	173	80,791
10" (8" to 10") 15-20' Depth (lf)	301	182	54,782
15" (12" to 15") 15-20' Depth (lf)	738	213	157,194
18" (15" to 18") 15-20' Depth (lf)	1,839	213	391,707
Pit Construction, 10-15' Depth (each)	2	2,475	4,950
Pit Construction, 15-20' Depth (each)	7	2,813	19,691
Lead Pit & Connection, 10-15' Depth (each)	13	1,650	21,450
Lead Pit & Connection 15-20' Depth (each)	17	1,875	31,875
Subtotal			*762,440*
Storage			
48" In-line Storage Pipe (10-15' Depth) (lf)	277	244	67,588
Control connection (10-15' Depth) (each)	1	4,290	4,290
Discharge connection (10-15' Depth) (each)	1	4,290	4,290
Access Manholes (10-15' Depth) (each)	2	4,725	9,450
Subtotal			*85,618*
Restoration			
Asphalt Restoration (lf)	1,074	55	59,070
Lawn Restoration (lf)			0
Subtotal			*59,070*
Footing Drain Disconnection			
House disconnection/protect (each)	47	3,300	155,100
Storm sewer connection (each)	47	1,500	70,500
Subtotal			*225,600*
Other Costs			
Protect Natural Resources			0
Traffic Control (lf)	3,345	2	6,690
Audio Visual Coverage (each)	47	50	2,350
Audio Visual Coverage (lf)	3,345	1	3,345
Erosion Control (each)	1	20,000	20,000
Erosion Control (lf)	3,345	1	3,345
Subtotal			*35,730*
Construction Subtotal			**1,170,000**
Non-Construction			
Construction Contingency		8%	93,600
Engineering, Legal		8%	93,600
Bidding, Construction Services		7%	81,900
Testing Services		5%	58,500
Misc Costs		5%	58,500
Bond Overhead		7%	81,900
Subtotal		*40%*	*468,000*
Total Construction Costs			**1,640,000**
Additional O&M Costs (Present Value)			
Basin Maintenance**	1,108	0.0091	*2,000*
Lifecycle Costs			**1,640,000**

Notes:

*A separate storage facility for both Glen Leven North and Glen Leven South

**O&M Costs are based on 30 years of basin maintenance at an 8% interest rate.

City of Ann Arbor SSO Prevention Advisory Task Force

Study Area: Glen Leven North

Control Alternative: Upsizing and Storage (Option 2*)

Cost Element	Units	Unit Cost ($)	Cost ($)
Pipe Bursting			
10" (8" to 10") 5-10' Depth (lf)	1,773	165	292,545
10" (8" to 10") 10-15' Depth (lf)	325	173	56,225
12" (8" to 12") 10-15' Depth (lf)	135	197	26,595
15" (10" to 15") 5-10' Depth (lf)	499	218	108,782
15" (10" to 15") 10-15' Depth (lf)	1,191	228	271,548
15" (12" to 15") 5-10' Depth (lf)	134	203	27,202
15" (12" to 15") 10-15' Depth (lf)	625	213	133,125
Pit Construction, 5-10' Depth (each)	5	2,250	11,250
Pit Construction, 10-15' Depth (each)	8	2,475	19,800
Lead Pit & Connection, 5-10' Depth (each)	37	1,500	55,500
Lead Pit & Connection, 10-15' Depth (each)	39	1,650	64,350
Subtotal			*1,066,922*
Storage			
60" In-line Storage Pipe (10-15' Depth) (lf)	548	302	165,496
Control connection (10-15' Depth) (each)	2	4,290	8,580
Discharge connection (10-15' Depth) (each)	2	4,290	8,580
Access Manholes (10-15' Depth) (each)	3	4,725	14,175
Subtotal			*196,831*
Restoration			
Asphalt Restoration (lf)	2,186	55	120,230
Lawn Restoration (lf)			0
Subtotal			*120,230*
Footing Drain Disconnection			
House disconnection/protect (each)	76	3,300	250,800
Storm sewer connection (each)	76	1,500	114,000
Subtotal			*364,800*
Other Costs			
Protect Natural Resources			0
Traffic Control (lf)	4,682	2	9,364
Audio Visual Coverage (each)	76	50	3,800
Audio Visual Coverage (lf)	4,682	1	4,682
Erosion Control (each)	1	20,000	20,000
Erosion Control (lf)	4,682	1	4,682
Subtotal			*42,528*
Construction Subtotal			**1,790,000**
Non-Construction			
Construction Contingency		8%	143,200
Engineering, Legal		8%	143,200
Bidding, Construction Services		7%	125,300
Testing Services		5%	89,500
Misc Costs		5%	89,500
Bond Overhead		7%	125,300
Subtotal		*40%*	*716,000*
Total Construction Costs			**2,510,000**
Additional O&M Costs (Present Value)			
Basin Maintenance**	3,425	0.0091	*2,000*
Lifecycle Costs			**2,510,000**

Notes:

* 1-Basin serving Glen Leven North & Glen Leven South

**O&M Costs are based on 30 years of basin maintenance at an 8% interest rate.

City of Ann Arbor SSO Prevention Advisory Task Force

Study Area: Glen Leven South

Control Alternative: Upsizing and Storage (Option 2*)

Cost Element	Units	Unit Cost ($)	Cost ($)
Pipe Bursting			
10" (8" to 10") 10-15' Depth (lf)	467	173	80,791
10" (8" to 10") 15-20' Depth (lf)	301	182	54,782
15" (12" to 15") 15-20' Depth (lf)	738	213	157,194
18" (15" to 18") 15-20' Depth (lf)	1,839	213	391,707
Pit Construction, 10-15' Depth (each)	2	2,475	4,950
Pit Construction, 15-20' Depth (each)	7	2,813	19,691
Lead Pit & Connection, 10-15' Depth (each)	13	1,650	21,450
Lead Pit & Connection 15-20' Depth (each)	17	1,875	31,875
Subtotal			*762,440*
Cross-Connection to Storage			
18" Sewer, 10-15' Depth (lf)	100	184	18,400
Control connection (10-15' Depth) (each)	1	4,290	4,290
Discharge connection (10-15' Depth) (each)	1	4,290	4,290
Access Manholes (10-15' Depth) (each)	1	4,725	4,725
Subtotal			*31,705*
Restoration			
Asphalt Restoration (lf)	710	55	39,050
Lawn Restoration (lf)			0
Subtotal			*39,050*
Footing Drain Disconnection			
House disconnection/protect (each)	47	3,300	155,100
Storm sewer connection (each)	47	1,500	70,500
Subtotal			*225,600*
Other Costs			
Protect Natural Resources			0
Traffic Control (lf)	3,345	2	6,690
Audio Visual Coverage (each)	47	50	2,350
Audio Visual Coverage (lf)	3,345	1	3,345
Erosion Control (each)			0
Erosion Control (lf)	3,345	1	3,345
Subtotal			*15,730*
Construction Subtotal			**1,070,000**
Non-Construction			
Construction Contingency		8%	85,600
Engineering, Legal		8%	85,600
Bidding, Construction Services		7%	74,900
Testing Services		5%	53,500
Misc Costs		5%	53,500
Bond Overhead		7%	74,900
Subtotal		*40%*	*428,000*
Total Construction Costs			**1,500,000**
Additional O&M Costs (Present Value)			0
Lifecycle Costs			**1,500,000**

Notes:

* 1-Basin serving Glen Leven North & Glen Leven South

City of Ann Arbor SSO Prevention Advisory Task Force

Study Area: Glen Leven North (75% Participation)

Control Alternative: Footing Drain Disconnection*

Cost Element	Units	Unit Cost ($)	Cost ($)
Footing Drain Disconnection			
House disconnection/protect (each)	76	3,300	250,800
House disconnection (each)	282	2,800	788,900
Storm sewer connection (each)	358	1,500	536,625
Subtotal			*1,576,325*
Other Costs			
Protect Natural Resources			0
Traffic Control (lf)			0
Audio Visual Coverage (each)	358	50	17,888
Audio Visual Coverage (lf)			0
Erosion Control (each)			0
Erosion Control (lf)			0
Subtotal			*17,888*
Construction Subtotal			**1,590,000**
Non-Construction			
Construction Contingency		8%	127,200
Engineering, Legal		8%	127,200
Bidding, Construction Services		7%	111,300
Testing Services		5%	79,500
Misc Costs		5%	79,500
Bond Overhead		7%	111,300
Subtotal		*40%*	*636,000*
Total Construction Costs			**2,230,000**
Additional O&M Costs (Present Value)			
Wastewater Treatment Plant Volume Reduction**			*(163,000)*
Lifecycle Costs			**2,070,000**

Notes:

*Assumes footing drains account for 70% of the infiltration and 75% of the houses participate

**Reduced treatment at plant (32"/yr, 5.2% RDII C, 8% interest and reduced GWI portion of DWF from Glen Leven North by 0.7)

City of Ann Arbor SSO Prevention Advisory Task Force

Study Area: Glen Leven North (60% Participation)

Control Alternative: Footing Drain Disconnection*

Cost Element	Units	Unit Cost ($)	Cost ($)
Footing Drain Disconnection			
House disconnection/protect (each)	76	3,300	250,800
House disconnection (each)	210	2,800	588,560
Storm sewer connection (each)	286	1,500	429,300
Subtotal			*1,268,660*
Other Costs			
Protect Natural Resources			0
Traffic Control (lf)			0
Audio Visual Coverage (each)	286	50	14,310
Audio Visual Coverage (lf)			0
Erosion Control (each)			0
Erosion Control (lf)			0
Subtotal			*14,310*
Construction Subtotal			**1,280,000**
Non-Construction			
Construction Contingency		8%	102,400
Engineering, Legal		8%	102,400
Bidding, Construction Services		7%	89,600
Testing Services		5%	64,000
Misc Costs		5%	64,000
Bond Overhead		7%	89,600
Subtotal		*40%*	*512,000*
Total Construction Costs			**1,790,000**
Additional O&M Costs (Present Value)			
Wastewater Treatment Plant Volume Reduction**			*(165,000)*
Lifecycle Costs			**1,630,000**

Notes:

*Assumes footing drains account for 90% of the infiltration and 60% of the houses participate

**Reduced treatment at plant (32"/yr, 5.2% RDII C, 8% interest and reduced GWI portion of DWF from Glen Leven North by 0.7)

City of Ann Arbor SSO Prevention Advisory Task Force

Study Area: Glen Leven South (60% Participation)

Control Alternative: Footing Drain Disconnection*

Cost Element	Units	Unit Cost ($)	Cost ($)
Footing Drain Disconnection			
House disconnection/protect (each)	47	3,300	155,100
House disconnection (each)	252	2,800	705,040
Storm sewer connection (each)	299	1,500	448,200
Subtotal			*1,308,340*
Other Costs			
Protect Natural Resources			0
Traffic Control (lf)			0
Audio Visual Coverage (each)	299	50	14,940
Audio Visual Coverage (lf)			0
Erosion Control (each)			0
Erosion Control (lf)			0
Subtotal			*14,940*
Construction Subtotal			**1,320,000**
Non-Construction			
Construction Contingency		8%	105,600
Engineering, Legal		8%	105,600
Bidding, Construction Services		7%	92,400
Testing Services		5%	66,000
Misc Costs		5%	66,000
Bond Overhead		7%	92,400
Subtotal		*40%*	*528,000*
Total Construction Costs			**1,850,000**
Additional O&M Costs (Present Value)			
Wastewater Treatment Plant Volume Reduction**			*(226,000)*
Lifecycle Costs			**1,620,000**

Notes:

*Assumes footing drains account for 70% of the infiltration and 60% of the houses participate

**Reduced treatment at plant (32"/yr, 3.4% RDII C, 8% interest and reduced GWI portion of DWF from Glen Leven South by 0.7)

City of Ann Arbor SSO Prevention Advisory Task Force

Study Area: Glen Leven South (50% Participation)

Control Alternative: Footing Drain Disconnection*

Cost Element	Units	Unit Cost ($)	Cost ($)
Footing Drain Disconnection			
House disconnection/protect (each)	47	3,300	155,100
House disconnection (each)	202	2,800	565,600
Storm sewer connection (each)	249	1,500	373,500
Subtotal			*1,094,200*
Other Costs			
Protect Natural Resources			0
Traffic Control (lf)			0
Audio Visual Coverage (each)	249	50	12,450
Audio Visual Coverage (lf)			0
Erosion Control (each)			0
Erosion Control (lf)			0
Subtotal			*12,450*
Construction Subtotal			**1,110,000**
Non-Construction			
Construction Contingency		8%	88,800
Engineering, Legal		8%	88,800
Bidding, Construction Services		7%	77,700
Testing Services		5%	55,500
Misc Costs		5%	55,500
Bond Overhead		7%	77,700
Subtotal		*40%*	*444,000*
Total Construction Costs			**1,550,000**
Additional O&M Costs (Present Value)			
Wastewater Treatment Plant Volume Reduction**			*(229,000)*
Lifecycle Costs			**1,320,000**

Notes:

*Assumes footing drains account for 90% of the infiltration and 50% of the houses participate

**Reduced treatment at plant (32"/yr, 3.4% RDII C, 8% interest and reduced GWI portion of DWF from Glen Leven South by 0.7)

MOREHEAD

City of Ann Arbor SSO Prevention Advisory Task Force

Study Area: Morehead

Control Alternative: Relief Sewers

Cost Element	Units	Unit Cost ($)	Cost ($)
Relief			
8" Sewer (10-15' Depth) (lf)	2,930	167	490,723
10" Sewer (10-15' Depth) (lf)	1,856	167	310,847
12" Sewer (15-20' Depth) (lf)	1,325	262	346,488
15" Sewer (10-15' Depth) (lf)	172	180	30,947
21" Sewer (10-15' Depth) (lf)	3,505	197	688,801
Manhole, 10-15' Depth (each)	53	4,563	241,838
Manhole, 15-20' Depth (each)	5	6,482	32,408
Subtotal			*2,142,053*
Restoration			
Asphalt Restoration (lf)	10,368	55	570,240
Lawn Restoration (lf)			0
Subtotal			*570,240*
Footing Drain Disconnection			
House disconnection/protect (each)	55	3,300	181,500
Storm sewer connection (each)	55	1,500	82,500
Subtotal			*264,000*
Other Costs			
Protect Natual Resources			5,000
Traffic Control (lf)	9,788	2	19,576
Audio Visual Coverage (each)	55	50	2,750
Audio Visual Coverage (lf)	9,788	1	9,788
Erosion Control (each)			0
Erosion Control (lf)	9,788	1	9,788
Subtotal			*46,902*
Construction Subtotal			**3,020,000**
Non-Construction			
Construction Contingency		8%	241,600
Engineering, Legal		8%	241,600
Bidding, Construction Services		7%	211,400
Testing Services		5%	151,000
Misc Costs		5%	151,000
Bond Overhead		7%	211,400
Subtotal		*40%*	*1,208,000*
Total Construction Costs			**4,230,000**
Additional O&M Costs (Present Value)			
Sewer Cleaning*	9,788	0.76	*83,000*
Lifecycle Costs			**4,310,000**

Notes:

*O&M Costs are based on 30 years of sewer cleaning at an 8% interest rate.

City of Ann Arbor SSO Prevention Advisory Task Force

Study Area: Morehead

Control Alternative: Upsizing

Cost Element	Units	Unit Cost ($)	Cost ($)
Pipe Bursting			
10" (8" to 10") 10-15' Depth (lf)	1,936	173	335,412
12" (8" to 12") 10-15' Depth (lf)	2,433	197	478,997
21" (18" to 21") 15-20' Depth (lf)	1,497	331	495,133
24" (18" to 24") 10-15' Depth (lf)	3,505	347	1,214,483
Pit Construction, 15-20' Depth (each)	12	2,813	33,750
Lead Pit and Connection, 15-20' Depth (each)	96	1,875	180,000
Subtotal			*2,737,774*
Restoration			
Asphalt Restoration (lf)	1,200	55	66,000
Lawn Restoration (lf)			0
Subtotal			*66,000*
Footing Drain Disconnection			
House disconnection/protect (each)	55	3,300	181,500
Storm sewer connection (each)	55	1,500	82,500
Subtotal			*264,000*
Other Costs			
Protect Natual Resources			5,000
Traffic Control (lf)	9,371	2	18,742
Audio Visual Coverage (each)	55	50	2,750
Audio Visual Coverage (lf)	9,371	1	9,371
Erosion Control (each)			0
Erosion Control (lf)	9,371	1	9,371
Subtotal			*45,234*
Construction Subtotal			**3,110,000**
Non-Construction			
Construction Contingency		8%	248,800
Engineering, Legal		8%	248,800
Bidding, Construction Services		7%	217,700
Testing Services		5%	155,500
Misc Costs		5%	155,500
Bond Overhead		7%	217,700
Subtotal		*40%*	*1,244,000*
Total Construction Costs			**4,350,000**
Additional O&M Costs (Present Value)			0
Lifecycle Costs			**4,350,000**

City of Ann Arbor SSO Prevention Advisory Task Force

Study Area: Morehead

Control Alternative: Upsizing and Storage #1 Saxon/Tudor Area

Cost Element	Units	Unit Cost ($)	Cost ($)
Pipe Bursting			
10" (8" to 10") 15-20' Depth (lf)	1,121	182	203,924
12" (8" to 12") 15-20' Depth (lf)	1,187	207	245,375
Pit Construction, 15-20' Depth (each)	2	2,813	5,625
Lead Pit and Connection, 15-20' Depth (each)	34	1,875	63,750
Subtotal			*518,674*
Relief/Reroute Flow from Saxon/Tudor to Glen Leven South			
Cost apportioned to Saxon/Tudor*			*700,000*
Restoration			
Asphalt Restoration (lf)	380	55	20,900
Lawn Restoration (lf)			0
Subtotal			*20,900*
Footing Drain Disconnection			
House disconnection/protect (each)	22	3,300	72,600
Storm sewer connection (each)	22	1,500	33,000
Subtotal			*105,600*
Other Costs			
Protect Natual Resources			1,000
Traffic Control (lf)	2,308	2	4,616
Audio Visual Coverage (each)	22	50	1,100
Audio Visual Coverage (lf)	2,308	1	2,308
Erosion Control (each)			0
Erosion Control (lf)	2,308	1	2,308
Subtotal			*11,332*
Construction Subtotal			**1,360,000**
Non-Construction			
Construction Contingency		8%	108,800
Engineering, Legal		8%	108,800
Bidding, Construction Services		7%	95,200
Testing Services		5%	68,000
Misc Costs		5%	68,000
Bond Overhead		7%	95,200
Subtotal		*40%*	*544,000*
Total Construction Costs			**1,900,000**
Additional O&M Costs (Present Value)			
Cost apportioned to Saxon/Tudor for relief sewers downstream*			10,000
Subtotal			*10,000*
Lifecycle Costs			**1,910,000**

Notes:
*per Glen Leven South simulation

City of Ann Arbor SSO Prevention Advisory Task Force

Study Area: Morehead

Control Alternative: Upsizing and Storage #1 - Area Less Saxon/Tudor

Cost Element	Units	Unit Cost ($)	Cost ($)
Pipe Bursting			
10" (8" to 10") 15-20' Depth (lf)	815	182	148,259
12" (8" to 12") 15-20' Depth (lf)	661	207	136,641
Pit Construction, 15-20' Depth (each)	6	2,813	16,875
Lead Pit and Connection, 15-20' Depth (each)	23	1,875	43,125
Subtotal			*344,900*
Relief from Delaware to Ann Arbor-Saline			
18" Sewer, 15-20' Depth (lf)	317	280	88,813
Manhole, 15-20' Depth (each)	1	6,482	6,482
Subtotal			*95,295*
Storage			
60" In-line Storage Pipe (10-15' Depth) (lf)	204	302	61,478
Control connection (10-15' Depth) (each)	1	4,290	4,290
Discharge connection (10-15' Depth) (each)	1	4,290	4,290
Access Manholes (10-15' Depth) (each)	1	4,725	4,725
Subtotal			*74,783*
Restoration			
Asphalt Restoration (lf)	350	55	19,250
Lawn Restoration (lf)	754	15	11,317
Subtotal			*30,567*
Footing Drain Disconnection			
House disconnection/protect (each)	33	3,300	108,900
Storm sewer connection (each)	33	1,500	49,500
Subtotal			*158,400*
Other Costs			
Protect Natual Resources			2,000
Traffic Control (lf)	1,793	2	3,586
Audio Visual Coverage (each)	33	50	1,650
Audio Visual Coverage (lf)	1,793	1	1,793
Erosion Control (each)	1	10,000	10,000
Erosion Control (lf)	1,793	1	1,793
Subtotal			*20,822*
Construction Subtotal			**720,000**
Non-Construction			
Construction Contingency		8%	57,600
Engineering, Legal		8%	57,600
Bidding, Construction Services		7%	50,400
Testing Services		5%	36,000
Misc Costs		5%	36,000
Bond Overhead		7%	50,400
Subtotal		*40%*	*288,000*
Total Construction Costs			**1,010,000**
Additional O&M Costs (Present Value)			
Sewer Cleaning*	317	0.76	3,000
Basin Maintenance**	4,000	0.0091	2,000
Subtotal			*5,000*
Lifecycle Costs			**1,020,000**

Notes:

*O&M Costs are based on 30 years of sewer cleaning at an 8% interest rate.

**O&M Costs are based on 30 years of basin maintenance at an 8% interest rate.

City of Ann Arbor SSO Prevention Advisory Task Force

Study Area: Morehead

Control Alternative: Upsize/Storage #1 (DC2) - Area Less Saxon/Tudor

Cost Element	Units	Unit Cost ($)	Cost ($)
Pipe Bursting			
10" (8" to 10") 15-20' Depth (lf)	815	182	148,259
12" (8" to 12") 15-20' Depth (lf)	661	207	136,641
Pit Construction, 15-20' Depth (each)	6	2,813	16,875
Lead Pit and Connection, 15-20' Depth (each)	23	1,875	43,125
Subtotal			*344,900*
Relief from Delaware to Ann Arbor-Saline			
18" Sewer, 15-20' Depth (lf)	317	280	88,813
Manhole, 15-20' Depth (each)	1	6,482	6,482
Subtotal			*95,295*
Storage			
60" In-line Storage Pipe (10-15' Depth) (lf)	891	302	268,966
Control connection (10-15' Depth) (each)	1	4,290	4,290
Discharge connection (10-15' Depth) (each)	1	4,290	4,290
Access Manholes (10-15' Depth) (each)	2	4,725	9,450
Subtotal			*286,996*
Restoration			
Asphalt Restoration (lf)	350	55	19,250
Lawn Restoration (lf)	2,130	15	31,943
Subtotal			*51,193*
Footing Drain Disconnection			
House disconnection/protect (each)	33	3,300	108,900
Storm sewer connection (each)	33	1,500	49,500
Subtotal			*158,400*
Other Costs			
Protect Natual Resources			2,000
Traffic Control (lf)	1,793	2	3,586
Audio Visual Coverage (each)	33	50	1,650
Audio Visual Coverage (lf)	1,793	1	1,793
Erosion Control (each)	1	10,000	10,000
Erosion Control (lf)	1,793	1	1,793
Subtotal			*20,822*
Construction Subtotal			**960,000**
Non-Construction			
Construction Contingency		8%	76,800
Engineering, Legal		8%	76,800
Bidding, Construction Services		7%	67,200
Testing Services		5%	48,000
Misc Costs		5%	48,000
Bond Overhead		7%	67,200
Subtotal		*40%*	*384,000*
Total Construction Costs			**1,340,000**
Additional O&M Costs (Present Value)			
Sewer Cleaning	317	0.76	3,000
Basin Maintenance	17,500	0.0091	2,000
Subtotal			*5,000*
Lifecycle Costs			**1,350,000**

Notes:

*O&M Costs are based on 30 years of sewer cleaning at an 8% interest rate.

**O&M Costs are based on 30 years of basin maintenance at an 8% interest rate.

City of Ann Arbor SSO Prevention Advisory Task Force

Study Area: Morehead

Control Alternative: Upsizing and Storage #2 Saxon/Tudor Area

Cost Element	Units	Unit Cost ($)	Cost ($)
Pipe Bursting			
10" (8" to 10") 15-20' Depth (lf)	1,121	182	203,924
12" (8" to 12") 15-20' Depth (lf)	1,772	207	366,306
Pit Construction, 15-20' Depth (each)	3	2,813	8,438
Lead Pit and Connection, 15-20' Depth (each)	42	1,875	78,750
Subtotal			*657,417*
Restoration			
Asphalt Restoration (lf)	480	55	26,400
Lawn Restoration (lf)			0
Subtotal			*26,400*
Footing Drain Disconnection			
House disconnection/protect (each)	22	3,300	72,600
Storm sewer connection (each)	22	1,500	33,000
Subtotal			*105,600*
Other Costs			
Protect Natual Resources			1,000
Traffic Control (lf)	2,893	2	5,786
Audio Visual Coverage (each)	22	50	1,100
Audio Visual Coverage (lf)	2,893	1	2,893
Erosion Control (each)			0
Erosion Control (lf)	2,893	1	2,893
Subtotal			*13,672*
Construction Subtotal			**800,000**
Non-Construction			
Construction Contingency		8%	64,000
Engineering, Legal		8%	64,000
Bidding, Construction Services		7%	56,000
Testing Services		5%	40,000
Misc Costs		5%	40,000
Bond Overhead		7%	56,000
Subtotal		*40%*	*320,000*
Total Construction Costs			**1,120,000**
Additional O&M Costs (Present Value)			0
Lifecycle Costs			**1,120,000**

City of Ann Arbor SSO Prevention Advisory Task Force

Study Area: Morehead

Control Alternative: Upsizing and Storage #2 - Area Less Saxon/Tudor

Cost Element	Units	Unit Cost ($)	Cost ($)
Pipe Bursting			
10" (8" to 10") 15-20' Depth (lf)	815	182	148,259
12" (8" to 12") 15-20' Depth (lf)	661	207	136,641
Pit Construction, 15-20' Depth (each)	6	2,813	16,875
Lead Pit and Connection, 15-20' Depth (each)	23	1,875	43,125
Subtotal			*344,900*
Relief			
12" Sewer, 10-15' Depth (lf)	1,100	172	188,794
18" Sewer, 15-20' Depth (lf)	317	280	88,813
Manhole, 15-20' Depth (each)	5	6,482	32,408
Subtotal			*121,221*
Storage			
48" In-line Storage Pipe (10-15' Depth) (lf)	637	244	155,147
60" In-line Storage Pipe (10-15' Depth) (lf)	407	302	122,956
Control connection (10-15' Depth) (each)	2	4,290	8,580
Discharge connection (10-15' Depth) (each)	2	4,290	8,580
Access Manholes (10-15' Depth) (each)	3	4,725	14,175
Subtotal			*309,438*
Restoration			
Asphalt Restoration (lf)	2,773	55	152,528
Lawn Restoration (lf)	1,172	15	17,578
Subtotal			*170,106*
Footing Drain Disconnection			
House disconnection/protect (each)	33	3,300	108,900
Storm sewer connection (each)	33	1,500	49,500
Subtotal			*158,400*
Other Costs			
Protect Natual Resources			2,000
Traffic Control (lf)	2,893	2	5,786
Audio Visual Coverage (each)	33	50	1,650
Audio Visual Coverage (lf)	2,893	1	2,893
Erosion Control (each)	1	10,000	10,000
Erosion Control (lf)	2,893	1	2,893
Subtotal			*25,222*
Construction Subtotal			**1,130,000**
Non-Construction			
Construction Contingency		8%	90,400
Engineering, Legal		8%	90,400
Bidding, Construction Services		7%	79,100
Testing Services		5%	56,500
Misc Costs		5%	56,500
Bond Overhead		7%	79,100
Subtotal		*40%*	*452,000*
Total Construction Costs			**1,580,000**
Additional O&M Costs (Present Value)			
Sewer Cleaning*	1,417	0.76	12,000
Basin Maintenance**	16,000	0.0091	2,000
Subtotal			*14,000*
Lifecycle Costs			**1,590,000**

Notes:

*O&M Costs are based on 30 years of sewer cleaning at an 8% interest rate.

**O&M Costs are based on 30 years of basin maintenance at an 8% interest rate.

City of Ann Arbor SSO Prevention Advisory Task Force

Study Area: Morehead

Control Alternative: Upsize/Storage #2 (DC2) - Area Less Saxon/Tudor

Cost Element	Units	Unit Cost ($)	Cost ($)
Pipe Bursting			
10" (8" to 10") 15-20' Depth (lf)	815	182	148,259
12" (8" to 12") 15-20' Depth (lf)	661	207	136,641
Pit Construction, 15-20' Depth (each)	6	2,813	16,875
Lead Pit and Connection, 15-20' Depth (each)	23	1,875	43,125
Subtotal			*344,900*
Relief			
12" Sewer, 10-15' Depth (lf)	1,100	172	188,794
18" Sewer, 15-20' Depth (lf)	317	280	88,813
Manhole, 15-20' Depth (each)	5	6,482	32,408
Subtotal			*121,221*
Storage			
48" In-line Storage Pipe (10-15' Depth) (lf)	637	244	155,147
60" In-line Storage Pipe (10-15' Depth) (lf)	891	302	268,966
Control connection (10-15' Depth) (each)	2	4,290	8,580
Discharge connection (10-15' Depth) (each)	2	4,290	8,580
Access Manholes (10-15' Depth) (each)	4	4,725	18,900
Subtotal			*460,174*
Restoration			
Asphalt Restoration (lf)	2,773	55	152,528
Lawn Restoration (lf)	2,140	15	32,093
Subtotal			*184,621*
Footing Drain Disconnection			
House disconnection/protect (each)	33	3,300	108,900
Storm sewer connection (each)	33	1,500	49,500
Subtotal			*158,400*
Other Costs			
Protect Natual Resources			2,000
Traffic Control (lf)	2,893	2	5,786
Audio Visual Coverage (each)	33	50	1,650
Audio Visual Coverage (lf)	2,893	1	2,893
Erosion Control (each)	1	10,000	10,000
Erosion Control (lf)	2,893	1	2,893
Subtotal			*25,222*
Construction Subtotal			**1,290,000**
Non-Construction			
Construction Contingency		8%	103,200
Engineering, Legal		8%	103,200
Bidding, Construction Services		7%	90,300
Testing Services		5%	64,500
Misc Costs		5%	64,500
Bond Overhead		7%	90,300
Subtotal		*40%*	*516,000*
Total Construction Costs			**1,810,000**
Additional O&M Costs (Present Value)			
Sewer Cleaning*	1,417	0.76	12,000
Basin Maintenance**	25,500	0.0091	3,000
Subtotal			*15,000*
Lifecycle Costs			**1,830,000**

Notes:

*O&M Costs are based on 30 years of sewer cleaning at an 8% interest rate.

**O&M Costs are based on 30 years of basin maintenance at an 8% interest rate.

City of Ann Arbor SSO Prevention Advisory Task Force

Study Area: Morehead (75% Participation)

Control Alternative: Footing Drain Disconnection*

Cost Element	Units	Unit Cost ($)	Cost ($)
Footing Drain Disconnection			
House disconnection/protect (each)	55	3,300	181,500
House disconnection (each)	500	2,800	1,400,000
Storm sewer connection (each)	555	1,500	832,500
Subtotal			*2,414,000*
Other Costs			
Protect Natual Resources			0
Traffic Control (lf)			0
Audio Visual Coverage (each)	555	55	30,525
Audio Visual Coverage (lf)			0
Erosion Control (each)			0
Erosion Control (lf)			0
Subtotal			*30,525*
Construction Subtotals			**2,440,000**
Non-Construction			
Construction Contingency		8%	195,200
Engineering, Legal		8%	195,200
Bidding, Construction Services		7%	170,800
Testing Services		5%	122,000
Misc Costs		5%	122,000
Bond Overhead		7%	170,800
Subtotal		*40%*	*976,000*
Total Construction Costs			**3,420,000**
Additional O&M Costs (Present Value)			
Wastewater Treatment Plant Volume Reduction**			*(290,000)*
Lifecycle Costs			**3,130,000**

Notes:

*Assumes footing drains account for 70% of the infiltration and 75% of the houses participate

**Reduced treatment at plant (32"/yr, 4.0% RDII, 13% interest and reduced GWI portion of DWF from Morehead by 0.7)

City of Ann Arbor SSO Prevention Advisory Task Force

Study Area: Morehead (58% Participation)

Control Alternative: Footing Drain Disconnection*

Cost Element	Units	Unit Cost ($)	Cost ($)
Footing Drain Disconnection			
House disconnection/protect (each)	55	3,300	181,500
House disconnection (each)	396	2,800	1,108,800
Storm sewer connection (each)	451	1,500	676,500
Subtotal			*1,966,800*
Other Costs			
Protect Natual Resources			0
Traffic Control (lf)			0
Audio Visual Coverage (each)	451	55	24,805
Audio Visual Coverage (lf)			0
Erosion Control (each)			0
Erosion Control (lf)			0
Subtotal			*24,805*
Construction Subtotal			**1,990,000**
Non-Construction			
Construction Contingency		8%	157,344
Engineering, Legal		8%	157,344
Bidding, Construction Services		7%	137,676
Testing Services		5%	98,340
Misc Costs		5%	98,340
Bond Overhead		7%	137,676
Subtotal		*40%*	*786,720*
Total Construction Costs			**2,780,000**
Additional O&M Costs (Present Value)			
Wastewater Treatment Plant Volume Reduction**			*(290,000)*
Lifecycle Costs			**2,490,000**

Notes:

*Assumes footing drains account for 90% of the infiltration and 58% of the houses participate south of Scio Church Rd. Assumes 100% participation in Saxon/Tudor area with the exception that no disconnection west of Maple assuming no footing drains in that area.

**Reduced treatment at plant (32"/yr, 4.0% RDII, 13% interest and reduced GWI portion of DWF from Morehead by 0.7)

Appendix H - Newsletters

Four newsletters were issued during the course of the project to help keep study-area residents informed. The April, June and October 2000, and the January 2001 newsletters are included in this appendix.

Sanitary Sewer Overflow Prevention Study Newsletter

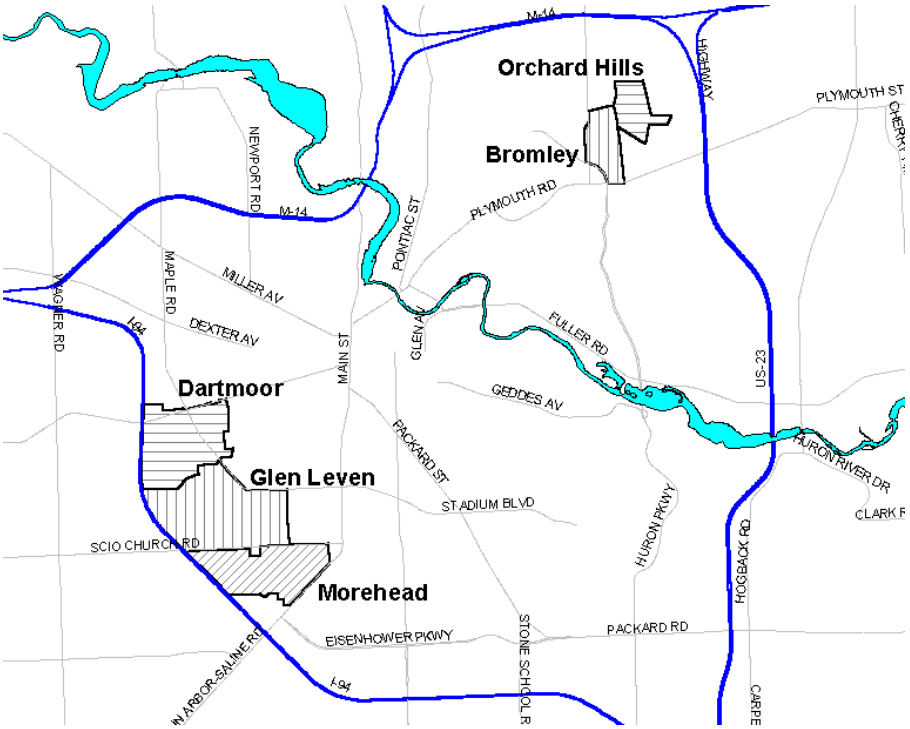
Issue 1 *April 2000*

City Council and Residents Seek Understanding and Remedies for Basement Flooding

The heavy rains of August 1998 resulted in basement flooding in various areas throughout the City of Ann Arbor. Five neighborhoods were particularly hard hit, the Bromley and Orchard Hills areas north of Plymouth Road in Northeastern Ann Arbor, and the Dartmoor, Glen Leven, and Morehead areas located generally south of Liberty and Stadium in southwestern Ann Arbor. Each area is highlighted on the map to the right.

For some homeowners, this was a first time event; for others it was a problem that had extended back many years. Citizens appealed to the City Council for support and the Council responded by appointing a fifteen-member Task Force to investigate the causes and identify possible remedies to the problem. This Task Force consists of City officials, homeowners, engineering and plumbing professionals to bring the needed perspectives and expertise for this challenging issue. The Task Force sees ongoing public involvement as essential for the success of the effort and will be scheduling public forums at critical milestones of the project.

The City Council has approved a contract with an engineering consulting firm to assist with this project.



HELP GUIDE THE TASK FORCE!

First Public Workshops April 18 and 19, 7:00- 8:30 p.m.

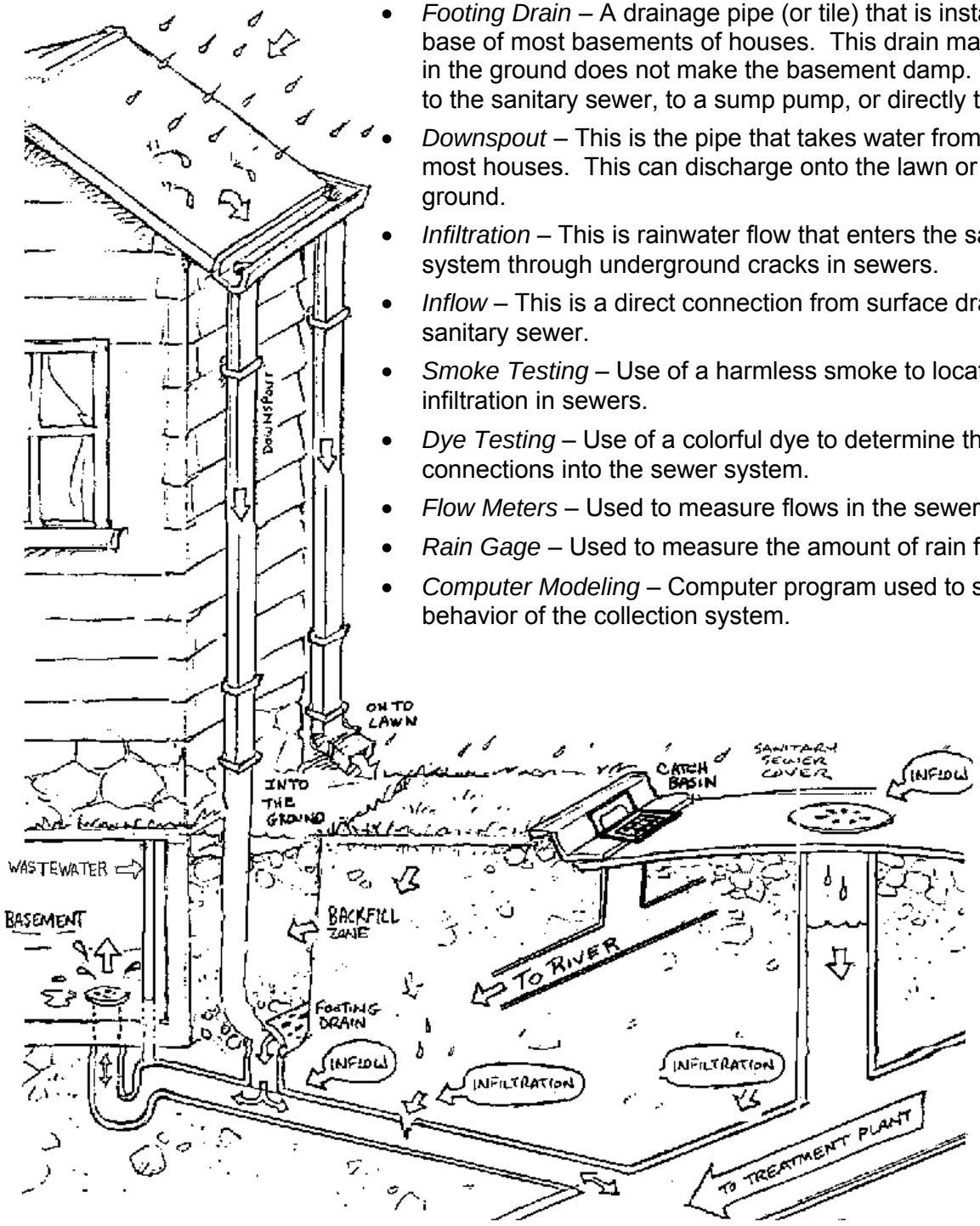
Public workshops are scheduled for Tuesday, April 18 at Lawton Elementary School and on Wednesday, April 19 at Clague Middle School. The workshops have two purposes. They will provide information to the public about the project's objectives, the field activities, and the proposed schedule for the work. The Task Force also hopes to gather information from the homeowners about their flooding experiences and get feedback on the proposed work. Future workshops are scheduled to provide ongoing information to all citizens.

If you received this mailing, your home is either located in an area that has experienced flooding or you reside in an area that may contribute to the flooding. Either way, all residents could be affected by the recommended solutions and will benefit from knowing about the work currently underway. You are invited to attend the workshop that is most convenient for you. If you cannot attend either session please see page 4 for ways to share with us your much needed information.

See you on April 18 or 19!

Glossary of Terms:

- *Wastewater* – The used water that flows down drains in your home.
- *Sanitary Sewer* – Sewer pipe that conveys wastewater to the Ann Arbor Wastewater Treatment Plant.
- *Surface Drainage* – Rainwater that flows down the street or yard to a storm drain or into a creek or river.
- *Storm Sewer* – A different pipe that takes rainwater collected in catch basins located in the street and conveys these flows to a creek or river.
- *Manhole* – This is the access structure that allows field crews to inspect sewers.



- *Footing Drain* – A drainage pipe (or tile) that is installed around the base of most basements of houses. This drain makes sure that water in the ground does not make the basement damp. This is connected to the sanitary sewer, to a sump pump, or directly to the storm sewer.
- *Downspout* – This is the pipe that takes water from the roof gutters in most houses. This can discharge onto the lawn or into a pipe in the ground.
- *Infiltration* – This is rainwater flow that enters the sanitary sewer system through underground cracks in sewers.
- *Inflow* – This is a direct connection from surface drainage into the sanitary sewer.
- *Smoke Testing* – Use of a harmless smoke to locate inflow and infiltration in sewers.
- *Dye Testing* – Use of a colorful dye to determine the locations of connections into the sewer system.
- *Flow Meters* – Used to measure flows in the sewer system.
- *Rain Gage* – Used to measure the amount of rain from storm events.
- *Computer Modeling* – Computer program used to simulate the behavior of the collection system.

WHO IS ON THE TASK FORCE?

1. Sumedh Bahl – City of Ann Arbor Water Utilities and Task Force Co-Chair
2. Jane Book – Homeowner Representative (Bromley)
3. Benjamin Bouchard – Homeowner Representative (Dartmoor)
4. Barbara Bruemmer – Homeowner Representative (Glen Leven)
5. Craig Hupy – City of Ann Arbor Water Utilities Department
6. James Nieters – Homeowner Representative (Morehead)
7. Ron Olson – City of Ann Arbor, Associate Administrator
8. Peter Perala – City of Ann Arbor Water Utilities Department
9. Stephen Rapundalo – Homeowner Representative (Orchard Hills) and Task Force Co-Chair
10. Lee Roberts – Plumbing Professional
11. Laura Rubin – Huron River Watershed Council
12. William Wheeler – City of Ann Arbor Public Services
13. Dennis Wojcik – Washtenaw County Drain Commission
14. Steven Wright – Independent Professional
15. Sabah H. Yousif – City of Ann Arbor Public Services

WHAT WILL BE HAPPENING?

WHO WILL BE DOING IT?

WHEN WILL IT HAPPEN?

The Task Force has contracted with an engineering firm, Camp Dresser & McKee (CDM). CDM will conduct a technical investigation and will work with the Task Force to investigate sources and develop alternative solutions. To do this well, engineers and field workers will be gathering information from homeowners through surveys, interviews and neighborhood observations.

You will see workers measuring rainfall, sewage depth and flow, inspecting sewers, and performing smoke and video inspection of the sewers. Capturing excellent information about our system and reviewing what other communities with similar problems have done will help us select the best solutions for our neighborhoods.

Future public workshops will share this information as it becomes available.

Key Questions

Why do basements flood?

Sanitary sewer systems are designed to convey wastewater and limited amounts of inflow and infiltration to the wastewater treatment plant. A separate stormwater drainage system is constructed to capture and convey the majority of the rainwater directly to streams and rivers that run throughout Ann Arbor. However, there are many locations where rainwater can enter the sanitary sewer system, particularly through foundation footing drains located around many homes. The picture with the Glossary of Terms on page 2 depicts this. If too much rainwater flows into the sanitary sewer system, then there is not adequate room for wastewater to flow to the wastewater treatment plant.

Why do some basements flood and others located next door remain dry?

The sanitary sewer system is designed to keep the level of sewage below all the basement floors of the homes it serves. In some cases, too much rainwater enters the system and the pipes are not large enough to move the sewage to the wastewater treatment plant. As a result, the sewer can backup and sewage can rise above the floors of some basements. The lower a home's basement is, compared to others in the area, the more prone it is to flooding. Downspout locations, landscaping and individually installed pumps also can cause significant differences.

My basement has never flooded, why should I care?

Many of the homeowners that experienced basement flooding in 1998 had never experienced problems before. Because of the intensity of this storm in certain areas, there were additional homes that were affected by the flooding. Also, solutions for currently affected homeowners may require help from those who have not yet been affected, as all these homes share the same system. Changes to this system can affect all homeowners because of possible neighborhood construction and possible costs. Being informed about the available options will help all of us make good choices for solutions to this problem.

PUBLIC WORKSHOPS

TUESDAY, APRIL 18	**LAWTON SCHOOL** 2250 S. Seventh Street	7:00-8:30 P.M.
WEDNESDAY, APRIL 19	**CLAGUE SCHOOL** 2616 Nixon Road	7:00-8:30 P.M.

CAN'T ATTEND BUT YOU WANT TO SHARE YOUR THINKING AND STAY INFORMED?

You can connect with us by email, phone, or mail.

Visit our website: www.cdm-mich.com/aa-sso and leave a note.

Call: Mark TenBroek at: 1.888.CDM.MICH (236.6424), or
Pete Perala at: 734.994.9938
Fran Alexander at: 734.665.6749

Mail your thoughts to: Camp Dresser & McKee
One Woodward Avenue, Suite 1500
Detroit, MI 48226

Please consider:

- What information would be helpful to you regarding the work being done on the Sanitary Sewer Overflow Project?
- What recommendations or ideas do you have for the Task Force to consider in doing this work?
- Please include your name, address and phone number if you would like a call back.

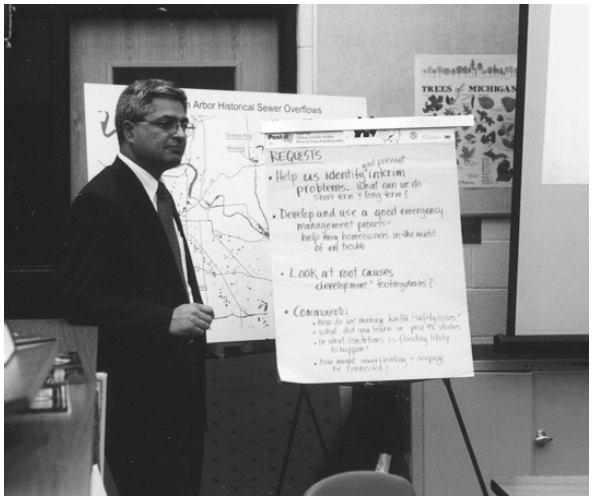
City of Ann Arbor
Water Utilities Department
100 North Fifth Avenue
Ann Arbor, Michigan 48107

Sanitary Sewer Overflow Prevention Study Newsletter 2

Issue 2 *June 2000*

First Workshop Provides Public Input into Program

The Ann Arbor Sanitary Sewer Overflow Prevention Advisory Task Force would like to thank everyone who attended the first public workshop that was held on April 18 and 19, 2000. Your interest and assistance will help make this study a useful and beneficial analysis to better understand the causes of basement flooding in your neighborhood. This understanding is a very important step to developing effective solutions to these problems. The first workshop sessions provided the Task Force with valuable input including:



Co-Chair Sumedh Bahl Reviews Public Input Received at First Workshop

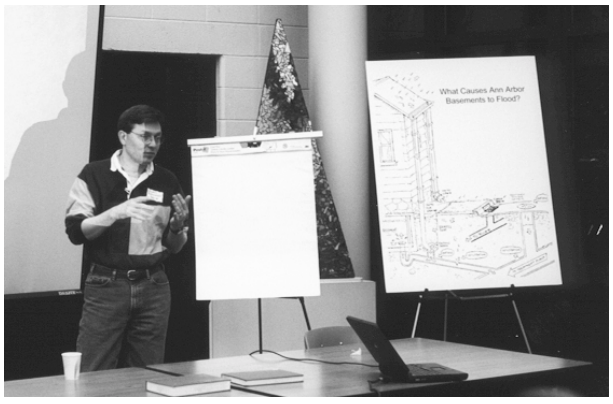
- Homeowners want to make sure that the analysis is done properly so that the real causes of the problem are understood. The field program is focused on identifying specific problems that can be addressed to resolve these issues.

- People who have had past problems want information on what to do between now and full implementation of solutions in order to protect their property. The Task Force is preparing a list of the recommended steps. This will be presented at the next workshop.

- People want to be kept informed on the project status, findings, and recommendations. The upcoming public sessions, newsletters, and the web page will be used to make sure that this information is provided to the public throughout the project.

Detailed information on the project and workshops can be found on our web site at http://www.cdm-mich.com/aa-sso. Contact Pete Perala, Water Utilities Engineer on the City's staff, at 734.994.1760 or call a Camp Dresser & McKee representative at 734.651.7676 to discuss any issue.

Additional workshops will be held on July 12 and July 18. These workshops will provide information on the results of the field efforts, as well as solutions that have been implemented in other communities to reduce basement flooding problems.



Co-Chair Stephen Rapundalo Reviews SSO Advisory Task Force Goals and Objectives

Key Questions at the First Workshop

What weather conditions should have me worried about basement flooding?

Ann Arbor Project Manager Pete Perala
Ponders a Homeowner Question

There is no definite answer to when a homeowner should be concerned about the potential for basement flooding due to sanitary sewer backups. In the past, rainfall events with rain amounting to 2-3 inches in a period of 6-10 hours or less in certain neighborhoods have resulted in a significant number of flooded basements. In addition to heavy rain, there are many contributing factors which can result in basement backups, the most significant being location. Specifics such as basement elevation, sewer depth, and the amount of "inflow and infiltration" into the sanitary sewer are critical factors that contribute to potential basement backups. Soil conditions caused by drought or frequent rains before a heavy rain along with the size and the path a storm travels across the city can also impact sanitary sewer wet weather flows, in some cases resulting in basement flooding.

Task Force Member Jane Book Discusses
Project Issues with Homeowners

What interim measures can we take to protect ourselves?

The first line of defense is knowing when a basement backup may occur. In the past, basement flooding has taken place when heavy rainfalls take place over a short period of time. In general, there is a potential risk when more than 1 inch of rainfall takes place. A moisture detector (used for bedwetting) can be used to indicate water coming up through a floor drain. If water enters the basement through a floor drain, an attempt can be made to stop the flow with a plug, if available, or by limiting the area it covers. Belongings and furnishings that can be moved should be raised off the floor to reduce damage. Recognize that using water in the house (flushing the toilet and so forth) may make the problem worse. If water does enter the house through the basement floor drain or other drains, all surfaces that that come into contact with it must be disinfected using household bleach.

How you can help if your basement is flooding?

If basement flooding occurs, homeowners are encouraged to contact the Ann Arbor Utilities Department (734.994.1760 6AM – 5PM, 734.994.2840 after hours) and/or the City of Ann Arbor Sanitary Sewer Overflow Prevention Task Force (24-hour contact: 734.651.7676). In an effort to obtain "real-time" information, homeowners are asked to (1) record the time and depth of flooding, and (2) record when and how quickly the flooding clears. This information will provide an accurate and fair assessment of causes relative to basement flooding within residential areas.

Key Questions at First Workshop (Continued)

When a solution is developed, how will costs be shared?

This is a question that will be answered ultimately by the Ann Arbor City Council. The Task Force will make recommendations for cost approaches with the recommended "solution package". These decisions will be made following the field study work, after we have had a chance to investigate comparable communities, and following a review of potential solutions. Anticipated timetable is October 2000 through January 2001.

Topics at Future Workshops

Workshop 2

When: July 2000

Objective: Extent of problem and feedback on types of solutions:

- Results of the homeowner survey (Statistics and maps)
- Information on rainfall, flow, and level monitoring efforts to date
- Findings from the manhole inspection, smoke testing (to date), and other investigations
- Peer community and homeowner solutions
- Trunk Sewer Modeling results and findings
- Range of solutions for detailed model evaluation
- Interim steps recommended and public input

Workshop 3

When: October 2000

Objective: Primary causes of the problems and feedback on range of costs for solutions:

- Updated results of monitoring and other investigations for remainder of effort
- Detailed Sewer Modeling determination of primary causes with alternatives analysis and costs/benefits for the range of alternative solutions
- Public input on alternatives

Workshop 4

When: January 2001

Objective: Recommended program cost and schedule:

- Finalized Sewer Modeling with determination of primary causes
- Finalized Modeling alternatives analysis and costs/benefits for the range of alternative solutions
- Task Force recommendations and prioritization of corrective actions
- Implementation schedule and description of projects
- Projected program costs and customer impacts

PUBLIC WORKSHOP NUMBER 2 (Same workshop, two locations)

Wednesday, July 12 Green Brier Apartments Clubhouse 7:00-8:30 P.M.
3615 Green Brier Blvd. (off Green Rd. south of Plymouth)

Tuesday, July 18 Washtenaw Intermediate School District 7:00-8:30 P.M.
1735 South Wagner Road (just north of Liberty)

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City of Ann Arbor
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Sanitary Sewer Overflow Prevention Study Newsletter 3

Issue 3 *October 2000*

Status of the Project

BACKGROUND – The Sanitary Sewer Overflow (SSO) Prevention Advisory Task Force has been working since July of 1999 to understand the causes of the basement flooding problems and develop solutions that can be implemented to resolve them. The Task Force hired an engineering consultant, Camp Dresser & McKee, who has been working since March on this effort. Initial activities, including inspection of the sewer system, gathering of rain, flow, and depth data, analysis of this data, and preparation of computer based sewer system models are completed. These computer models are currently being used to evaluate the causes of the observed problems and to evaluate possible solutions for the collection system.

The project is focusing on five neighborhoods that have had past problems with basement flooding caused by backups in the sanitary sewer. These neighborhoods include Orchard Hills and Bromley in the northeastern side of the City, and Dartmoor, Glen Leven, and Morehead in the southwestern area of the City.

WHAT ARE WE LEARNING ABOUT CAUSES?
Since March of 2000, continuous rainfall, flow, and level data have been recorded in the sanitary sewer systems in these 5 neighborhoods. This information is being used to understand the amount of rainfall that enters the sanitary sewer collection system in each of these areas. A number of factors influence this flow. The SSO Prevention Task Force study will provide neighborhood specific analysis.

Craig Hupy of the Water Utilities Department discusses the extent of the flooding with Councilman Upton

Throughout the entire City and for storms above ½", about 3% of the rain that falls enters the sanitary sewer system. Therefore, the remaining 97% is conveyed to the Huron River through the stormwater drainage system. In the 5 areas included in this study, between 3% and 10%, on average, of the rain falling in those areas enter the sanitary sewers. However, under some conditions, up to 18% of the rainfall can enter the sanitary sewers. These larger amounts are consistent with other communities within Michigan that have similar basement flooding problems. A major source of the flow observed in the sanitary sewer comes from foundation drains that are connected to the sanitary sewer in many areas of the City. Flow data collected for this project suggests that 60% to 90% of the rainwater entering the sanitary sewers in the study areas originate from these foundation drains.

Building codes in Ann Arbor have not allowed foundation drains to be connected to the sanitary sewer system since the 1970s. In four of the five study areas, the majority of the homes have foundation drains that are connected to the sewer system, resulting in significant wet weather sanitary flow and negative impacts.

HOW WILL POSSIBLE SOLUTIONS BE EVALUATED? Homeowners and the Task Force share a common desire to find effective long-term solutions for their neighborhoods that will not have negative impacts elsewhere in the City. The SSO study is using a computer model to help ensure that these objectives are met. This computer model includes the larger pipes, called trunk sewers, for the entire City of Ann Arbor sewer system. The project is also developing models for all the pipes, large and small, within the five study areas. These more detailed models are using the flow data collected since March 2000 to simulate how the system responds to different rainstorms. The engineers will then compare this data to what they actually observed in the system during this past summer. This will ensure that this model is accurate. After the validity of the model is ensured, the study team will then use the models to evaluate different corrective options and evaluate their impact throughout the study areas and in the larger system. These options include larger pipes, storage tanks, and removal of foundation drains from some homes. This analysis is now underway to understand problems, evaluate possible solutions, and develop costs for the different options.

CITY STAFF AND CITY COUNCIL ACTIONS SINCE JULY – Homeowners who came to the July session shared their ideas, concerns and frustrations about the June storm and the resultant flooding. It was hard to hear the stories of more damages and strain for the affected residents. The July discussions resulted in significant actions on the part of City Staff and City Council.

Mayor Sheldon talked with homeowners about the past basement flooding problems and potential solutions

Both City Council and City Staff have expressed confidence that the current SSO study will help the City develop long-term solutions to the sanitary sewer overflow and basement flooding issues within the study areas. However, information from other communities that are solving similar issues show us that implementation can easily extend 3-5 years. In a desire to address both long term solutions and provide near term assistance, the City and the Task Force support the development of improvements in emergency responses and interim protective measures to help both affected homeowners and the City overall. Some of the improvements implemented by the Council and the City include:

- City Council passed a resolution that removed the claim limit for damages incurred as a result of the storm.
- The Insurance Board, which normally meets on a monthly basis, has met weekly to process claims.
- The City Water Utilities staff has worked with the Building Department to evaluate requested building permits to assess potential impact to the sewer system.
- The City Emergency Response Process is being improved to provide accurate information to homeowners more quickly. A packet of information to help homeowners deal with all aspects of basement flooding is under development.
- The Task Force approved use of project funds to implement a pilot program to evaluate the use of check valves and sump pumps to protect individual homes and to reduce flow into the sanitary system.

PILOT PROGRAM – As noted above, one part of the possible recommendations would be to remove the flows from foundation drains in individual homes by installing new sump pumps in homes without sump pumps. These sump pumps discharge this drainage to the ground outside the homes instead of allowing the water to flow into the sanitary sewer. To better understand the local costs and implementation hurdles of these plumbing changes, the project includes a pilot program to make these changes for a small number of homes using local contractors. This effort will establish a range of costs for performing the work and will also help evaluate potential problems with implementing this type of a program on a larger scale. This work is underway and should be completed by the end of October 2000.

Key Questions at the Second Workshop

What was the extent of the basement flooding during the June 24-25, 2000 storm?

A total of 91 homes in the 5 detailed study areas and 204 homes throughout Ann Arbor reported basement flooding. Where these problems took place is shown in the chart to the right. More rainfall took place in the Southeast area of the City. The Dartmoor area was hard hit with significant flooding taking place along the Dartmoor street corridor. While most of the homes that reported flooding had problems before, there were some homes that experienced basement flooding for the first time during this event.

Area	Rainfall	Homes with Reported Flooded
Orchard Hills	2.9"	25
Bromley	3.2"	11
Dartmoor	4.0" *	23
Glen Leven	4.0"	21
Morehead	3.5"	11
Other Areas	--	113
Total	--	204

* Estimated

What is known about the impact of development on the sewer back up problems?

This is very difficult to answer. The Task Force will not have definitive data until late October. Early data from the SSO study suggests that for the Glen Leven, Bromley and Orchard Hills neighborhoods, development has very little or no impact on the basement flooding. In the Morehead and Dartmoor neighborhoods, development may be contributing to what appears to be downstream capacity constraints in those systems.

What are the results of the field inspections?

The inspections of manholes and the connecting sewers inside the study areas have shown that these sewer system components are in very good condition. These inspections have also shown that the sewer system is well maintained by City of Ann Arbor Water Utilities Department staff.

Element	Dartmoor, Glen Leven, & Morehead	Bromley & Orchard Hills [1]	TOTAL	Stats
Single family homes	1,876	511	2,387	100%
Homes Inspected	1,876	511	2,387	100%
Downspouts within 5' of home	815	372	1,187	50%
Downspouts go into ground	161	41	202	8%
Exterior drains	2	6	8	0.3%

Notes:

[1] Previous work and estimated numbers in the project study area.

More recently, inspections have been performed on the remaining homes in the study areas not previously inspected to determine how many have extended roof downspouts away from the foundation. The table to the left summarizes that information.

This data shows that about half of the homes in the study areas have already extended their downspouts the recommended 5' away from their foundations. It was also noticed that the remaining 50% often had no good location to extend the downspouts to. It was also discovered that for all downspouts that had been extended into the ground, the inspections have shown no connections to the sanitary sewer. Instead, these connections have always been found to convey the flows farther from the foundations. The conclusion from the work is that only minimal improvement in the system (reduction of storm flows that enter the sanitary sewer) can be achieved by additional downspout extension work in the five study areas.

How will the claims be handled?

The City of Ann Arbor is committed to providing a more responsive claim process. The City has developed a new claim form that collects the required information in a consistent fashion. This will allow homeowners that have problems to more quickly provide this information to the City for a response. The City of Ann Arbor Insurance Board is also meeting more frequently to address the claims that have been submitted in a timely manner.

PUBLIC WORKSHOP NUMBER 3 (Same workshop, two locations)

Wednesday, Oct 25	Eberwhite Elementary School 800 Soule Blvd	7:00-8:30 P.M.
Thursday, Nov 2	Clague Middle School 2616 Nixon Road	7:00-8:30 P.M.

COME AND JOIN US IN LEARNING:

- **What does all the collected data indicate?**
- **What are the primary causes of basement flooding?**
- **What are the most viable sets of solutions?**

ADD YOUR THINKING:

What are the pros and cons of each set of solutions from a homeowner perspective?

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City of Ann Arbor
Water Utilities Department
100 North Fifth Avenue
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Sanitary Sewer Overflow Prevention Study Newsletter 4

Issue 4 *January 2001*

PROJECT BACKGROUND

The Sanitary Sewer Overflow (SSO) Prevention Advisory Task Force has been working since July of 1999 to understand the causes of the basement flooding problems and develop solutions that can be implemented to resolve them. The Task Force hired an engineering consultant, Camp Dresser & McKee, who has been working since March 2000 on this effort. Initial activities, including inspection of the sewer system, gathering of rain, flow, and sewage depth data, analysis of this data, and preparation of computer based sewer system models are completed. These computer models have been used to evaluate the causes of the observed problems and to evaluate possible solutions.

NEIGHBORHOOD MEETINGS HELD TO REVIEW POSSIBLE SOLUTIONS

The SSO Task Force met with over 55 neighbors on January 11, 12, and 13 to review and receive feedback on 4 possible solutions for the 5 study areas. The four options reviewed were:

- **Install relief sewers** – These are new sewers located next to the existing sewers to convey the high flows downstream. There would also be the need to construct additional sewers in the downstream trunk sewer system to accommodate these higher flows to the Wastewater Treatment Plant (WWTP). In this alternative the foundation footing drains of previously flooded homes will also be disconnected.

- **Upsize the existing sewers** – There is new technology that can be used to break the existing sewer pipe in the ground and insert a larger diameter liner. This method has limitations on how much larger the sewer can be made. This option has the same requirements of potentially constructing additional sewers in the downstream trunk sewer system to accommodate these higher flows. In this alternative the foundation footing drains of previously flooded homes will also be disconnected.

An example of relief sewer construction

- **Provide storage of wet weather flows** – This option will include increasing the size of the pipes in the study areas and will provide a storage facility in a street or park to temporarily store the high flows until they can be discharged to the trunk sewer system. In this alternative the foundation footing drains of previously flooded homes will also be disconnected.

- **Remove footing drain flow sources** – In this alternative, more than half of all the homes in the area would have a sump pump installed in the basement to prevent the flows generated by the foundation footing drain from reaching the sanitary sewer. To be successful, this will require disconnection of footing drains and installation of sump pumps in both at previously flooded homes and in homes where no flooding has taken place.

HOMEOWNER IDEAS, CONCERNS, QUESTIONS

Neighbors raised a variety of ideas, concerns and questions for Task Force consideration. Many are reflected below along with Task Force responses:

- **Homes that have previously flooded need protection before the storm season. Could we arrange to have our basements protected immediately and have the City reimburse us when the program goes into affect?**

  The Task Force shared this idea with the City Council at their working session on 1/29/01.

- **The Task Force says there is less 'certainty' about the 'footing drain disconnect' solution. Why?**

  We have less than complete data on the amount of wet weather flow from the foundation footing drains that gets into the sewer system during storms. Instituting this alternative as a solution will include additional work to complete the data collection to bring the same higher level of certainty as the other solutions. Since all of the alternatives include footing drain disconnection at homes that have previously flooded, flow data collection from these locations will be used to increase the confidence in the flow projections. If the newly collected data does not increase our level of certainty about this remedy, the Task Force would recommend different protection measures for the neighborhood.

  Additionally, this is a fairly new approach to dealing with flooding problems. It will require significant cooperation from homeowners, some of whom have not experienced flooding. Education and incentives must be included in this solution.

- **If the flow from the sump pumps now discharge to the storm drainage system, will this increase surface flooding?**

  Footing drain disconnection could increase the volume of flow discharging to the storm drainage system by up to 3-5%. However, during the largest storms that cause basement flooding, the storm drainage system is not designed to convey these peak flows downstream, but instead temporarily stores some of this stormwater in the streets. The increased stormwater volume from the sump pumps would not be noticeable because this would only increase the depth of the water in the streets by a few percent.

- **What part could active use of flow restricting plumbing fixtures play in the solution?**

  Low flow toilets and other flow restricting fixtures are an effective means of reducing flows to the Wastewater Treatment Plant. This reduces the annual flows that need to be treated and helps to conserve our water resources. They are a good measure for any homeowner to use for those purposes. However, wastewater flows compose only about 5% of the total flow in the sanitary sewer during flooding events. If these flow-restricting fixtures were in use, the reduction in peak flows during these flooding events would only be 1-2% lower and homes would continue to flood. The application of these devices does not provide a solution in itself.

- **What part could active use of rain barrels and rain gardens play in this solution?**

  Rain barrels are an effective means of capturing the flows from roofs during small storms. They will reduce flows to streams and help to protect these natural resources. However, during large storm events that have historically caused basement flooding, only about 10% of the flow from a typical residential rooftop could be captured by these devices (assuming four, one at each corner of the house). At least 90% of the remaining rainwater would continue to flow around the house and would continue to flow into the home foundation footing drains. Homes would continue to flood.

  Rain gardens are effective tools for capturing rainwater and encouraging it to recharge into the groundwater on individual lots. Because rain gardens are intended to increase the infiltration into the soils they could also increase the flows into the foundation footing drains of homes if the rain garden is not properly designed. However, rain gardens are being considered as an alternative location to accept the discharges from sump pumps.

- **If a sump pump is installed in my basement, could my exposure to radon be increased?**

  A new sump could allow release of radon gas into the basement. If sump pumps were to be installed, radon gas samplers would be placed in each home before and after construction. If higher levels were found to exist after construction, the sump would be modified to vent these gasses to the atmosphere.

HOMEOWNER IDEAS, CONCERNS, QUESTIONS

- **Why isn't a new or larger sewer the best solution?**

  While the construction of new relief sewers or larger sewers may seem the best solution in terms of minimizing impacts on homeowners, both of these alternatives would increase peak flows that discharge into the trunk sewer system and reach the Ann Arbor Wastewater Treatment Plant. Within the trunk sewer system, this may cause flooding in locations that currently do not flood because of these increases in flow. To make sure that this does not happen, additional construction would need to be performed for any sections of this system that do not have enough capacity.

  Increasing the rate of flow to the WWTP could also increase the chance that the WWTP would discharge partially treated flow to the Huron River. Pending new regulations limit these discharges and Ann Arbor may have to build additional facilities at the WWTP to address these regulations.

- **Has the Task Force considered impact to natural features? How?**

  The criteria used to evaluate solutions included a review of impact on both park and natural features. Odor potential and other citizen impacts were all part of the 'Quality of Life' criteria applied to all alternatives.

Homeowners discuss concerns with Mark TenBroek, Project Manager with Camp Dresser & McKee, at a recent neighborhood meeting for the Orchard Hills and Bromley study areas

TASK FORCE RECOMMENDATIONS

The Task Force has reviewed homeowner surveys from the last neighborhood meeting and the results are available on the project web-site. Each of the alternative solutions reviewed using the same evaluation criteria. The criteria included weighted ratings as follows; Cost Issues (11 points), Construction Issues (10 points), and Quality of Life Issues (16 points). This analysis led to the following SSO Advisory Task Force recommendations for the 5 study areas presented to City Council on January 29, 2001.

Study Area	Recommended Alternative	Homes	Disconnections	Cost
Orchard Hills	Upsize Pipe and Additional Storage	375	50	$2,200,000
Bromley	Footing Drain Removal	250	250	$1,600,000
Dartmoor	Footing Drain Removal	310	310	$1,900,000
Glen Leven	Footing Drain Removal	975	660	$4,100,000
Morehead	Upsize Pipe and Storage	740	55	$2,900,000
TOTALS		**2,650**	**1,325**	**$12,700,000**

These recommendations will be reviewed and an initial implementation plan will be discussed at the February 13 and 15, 2001 Public Workshops. Please come and bring a neighbor who hasn't experienced flooding so we can discuss implementation issues!

PUBLIC WORKSHOP NUMBER 4 (Same workshop, two locations)

Tuesday, Feb 13	Clague School Media Center 2616 Nixon Road	7:00-8:30 P.M.
Thursday, Feb 15	Lawton School Auditorium 2250 S. Seventh	7:00-8:30 P.M.

COME AND JOIN US IN LEARNING:

- **What alternatives were considered?**
- **What alternative is being recommended?**
- **How might this affect you and your home?**

ADD YOUR THINKING:

How should this be implemented?

CAN'T ATTEND BUT YOU WANT TO SHARE YOUR THINKING AND STAY INFORMED?

You can connect with us by email, phone, or mail.

Visit our website: www.cdm-mich.com/aa-sso and leave a note.

Call: Pete Perala at: 734.994.9938 or
Mark TenBroek at: 1.888.CDM.MICH (236.6424), or
24-hour contact: 734.651-7676

Mail your thoughts to: Camp Dresser & McKee
One Woodward Avenue, Suite 1500
Detroit, MI 48226

City of Ann Arbor
Water Utilities Department
100 North Fifth Avenue
Ann Arbor, Michigan 48107

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Appendix I - Workshops

Four public workshops were held during the course of the project to help keep study-area residents informed and for the project team to solicit input from these residents. The April, July and October/ November 2000, and the February 2001 workshop presentations are included in this appendix. Note that each Workshop was presented two times (one for the Northeast and one for the Southwest area residents). The two locations were chosen for the convenience of the residents and the materials presented were identical with the exception of the February 2001 workshop.

The February 2001 workshop information was assembled specifically for each the Northeast and Southwest meetings, this was necessary because of the large amount of information to be shared. All information was posted to the project's website subsequent to the meetings.

City of Ann Arbor Sanitary Sewer Overflow (SSO) Prevention Advisory Task Force

Co-Chairs:
Sumedh Bahl, P.E.
Stephen Rapundalo

Agenda

- Introductions
- Task Force Mission
  - *Community Feedback*
- History and Issues
- Study Overview
  - *Your Thoughts/Suggestions*

SSO Task Force: What Is It?

- Proposed in March, 1999 by neighborhood groups and residents relative to concerns over the August 1998 sewage backup event.
- Approved in July, 1999 by Mayor/Council.
- 15-member committee representing City Utilities Staff, City Administration, neighborhood residents, engineering professional, Huron River Watershed Council, Drain Commissioner.

Task Force Membership

- Sumedh Bahl, P.E. (Interim City Utilities Director) ð Co-Chair
- Jane Book (Bromley)
- Ben Bouchard (Dartmoor)
- Barb Bruemmer (Glen Leven/Woodland)
- Craig Hupy, P.E. (City Water Utilities Field Division)
- Jim Nieters (Morehead)
- Ron Olson (Associate City Administrator)
- Pete Perala, P.E. (City Water Utilities Field Division) ð Project Manager
- Stephen Rapundalo (Orchard Hills-Maplewood) ð Co-Chair
- Lee Roberts (Professional Plumber)
- Laura Rubin (Huron River Watershed Council)
- Bill Wheeler, P.E. (City Public Services)
- Dennis Wojcik, P.E. (Washtenaw Co. Drain Commissioner's Office)
- Prof. Steve Wright, Ph.D. (Michigan College of Engineering)
- Sabah Yousif, P.E. (City Public Services)

Task Force Mission

- *Define the scope of sanitary sewer overflow or sewage "backup" problems due to wet weather conditions in the City of Ann Arbor, and identify possible effective solutions to eliminate or reduce the impact of future sewage "backup" events through a comprehensive study process.*

Task Force Key Objectives

- Identify critical sewage backup issues.
- Design and implement a comprehensive sewage "backup" prevention engineering study
- Engage the community throughout process.
- Identify solutions and make recommendations to Mayor/City Council and homeowners.

Task Force Opportunities

- **Chance to remedy a recurring health and safety problem for homeowners**
- Build positive relationships between residents, Water Utilities Department, and City leaders
- Demonstrate that Water Utilities Department is service-oriented
- Process of public involvement could serve as model for other citizens-based participation

Task Force Challenges

- Identify effective solutions to remedy chronic backup problems
- Reach consensus on reasonable costs for any recommended solutions
- Recruit current "non-affected" residents to be part of the process and helpful as needed
- Overcome past negative attitudes and cynicism

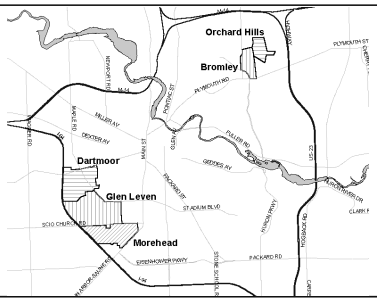
Why Are We Here Today?

- Help public understand the SSO work
- Build connections between Task Force and the community
- Get clear about history of the issue
- Set the stage for good solutions

Introduction and Information?

- Name
- Key information that would be helpful to you.

Where Are You?



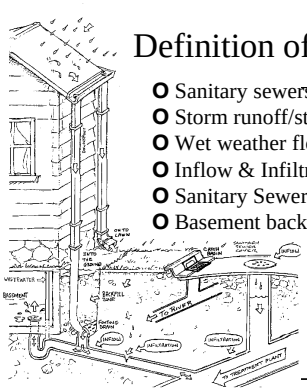
Feedback

- Key Issues

Flooding History and Primary Causes

- What type of problems exist?
- Where have these problems taken place?
- When have these occurred?
- Who is impacted?
- Why is this important?
- Can it be fixed?
- What steps are being taken?

Definition of Terms



- Sanitary sewers
- Storm runoff/storm sewers
- Wet weather flow
- Inflow & Infiltration (I/I)
- Sanitary Sewer Overflow (SSO)
- Basement backup (floor drains)

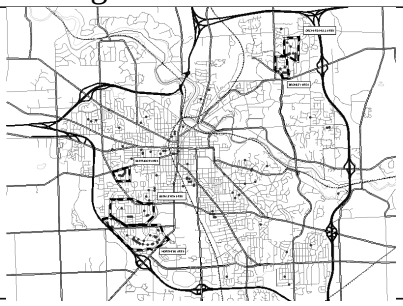
Causes of Basement Flooding

- Poor stormwater drainage around the home (water entering through the windows or walls)
- Failed sump pump
- Blockage in home sewer lead
- **Overloaded sanitary sewer (coming up through the floor drain)**

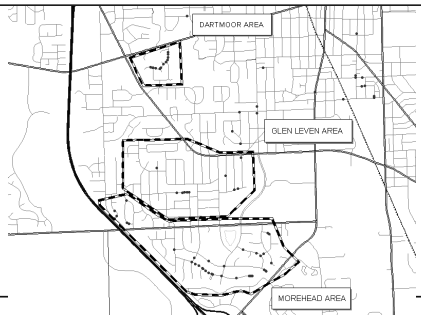
Flooding History

- Basement flooding storms
  - 1964, 1967, 1968, 1969, 1975, 1976, 1982, **1998**
- August 1998 - Nearly 200 homes had basement flooding
- Of the 200 affected homes, 55% were in the 5 neighborhoods

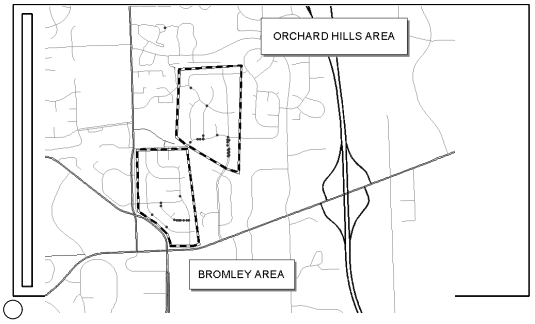
August 1998 Reported Flooding Incidents



Southwest Areas



Northeast Areas



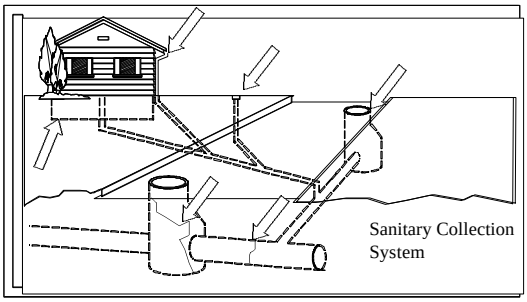
Sanitary Sewer Overloading

- Inflow
  - Footing drain connections
  - Area and other drains
  - Connected downspout connections
  - Submerged manhole covers
- Infiltration
  - Leaking pipe joints
  - Pipe breaks
  - Leaking manhole walls

Field Program Builds the Project Foundation

- Identify problems
  - Basement flooding
  - Discharges to streams and river
- Determine causes of problems
  - Manhole and pipe defects
  - I/I sources
  - Low basement elevations

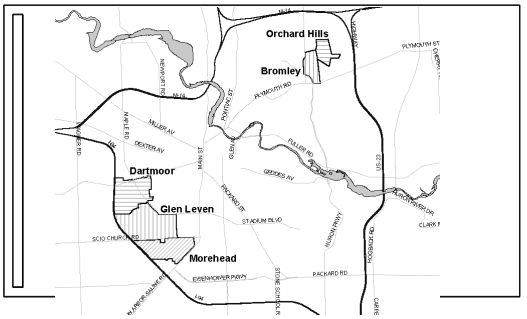
Causes Must be Identified



Sanitary Collection System

Problems Impact the Residents

Where Will Most of the Work Take Place?



Study Includes the Following Items

- Engaging the public
- Gathering historical information
- Monitoring flow/depth/rain
- Inspecting manhole/sewers
- Modeling sewers
- Reviewing alternative solutions
- Making recommendations

Public Engagement For Two-Way Communication

- Continuous communication
- Public workshops
- Homeowner surveys
- Monthly meetings with SSO Task Force

Historical Data Helps Understand the Causes

- Past studies - findings and recommendations
- Inspection efforts
- Peer community response policies and corrective actions
- Review costs/benefits of past projects

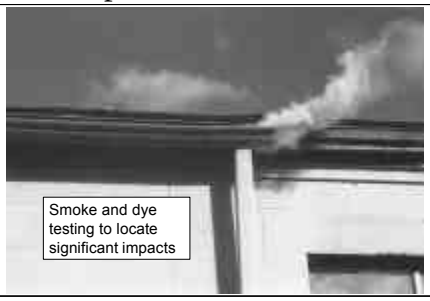
Field Work is Primarily in the Street

Monitoring Flow Needed to Understand Sewer Flows

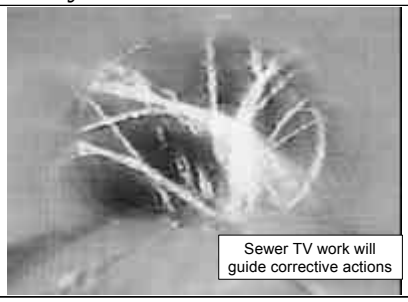
Monitoring Rainfall Needed to Understand I/I

Manhole Inspection Needed to Identify Defects

Smoke Testing Needed to Locate Specific I/I Sources



Sewer TV Work Can Identify Rehab Needs



When Will This Work Take Place?

- Flow/Rain/Level Monitoring (March - Nov)
- Homeowner/Elevation Survey Work (April - June)
- Manhole Inspection (May - June)
- Smoke/Dye Testing/TV Work (June - Aug)

Public Involvement Schedule

- Workshop 2 - Extent of problem and feedback on range of solutions (July)
- Workshop 3 - Primary causes and feedback on range of costs (October)
- Workshop 4 - Recommended program cost and schedule (January)

Survey Gives Data on the Extent of the Problem(s)

- Who has had basement flooding?
- What caused the flooding?
- How frequently has it taken place?
- What conditions vary between houses?
- What have homeowners done to protect their property?
- What I/I sources exist and how removable are they?

What We Need From You

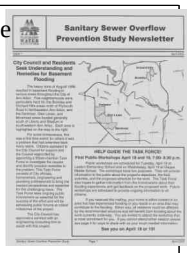
- Take and fill out survey completely (We need your address!)
- **Please** mail back to us
- Take surveys and distribute to your neighbors (Please ask them to mail these in)

Table Check In

- Any clarification needed?
- Additions to the challenges and opportunities of Task Force?
- Important additions to the history of the problem?
- Requests of the Task Force?

Staying Connected/ Getting Help/Thanks

- How to contact the task force
- How you can help
  - Homeowner survey
  - Raising homeowner understanding of the issues
- How to stay informed
  - Newsletters
  - Phone - (734) 651-7676
  - Web site - http://www.cdm-mich.com/aa-sso


Sanitary Sewer Overflow Prevention Study Newsletter

City Council and Residents Seek Understanding and Remedies for Basement Flooding

HELP GUIDE THE TASK FORCE!
First Public Workshops April 19 and 10, 7:30-9:30 p.m.

See you on April 19 or 10!

Thank You!

- Discussion

Presentation to Ann Arbor City Council
Sanitary Sewer Overflow (SSO)
Prevention Advisory Task Force

Co-Chairs:
Sumedh Bahl, P.E.
Stephen Rapundalo

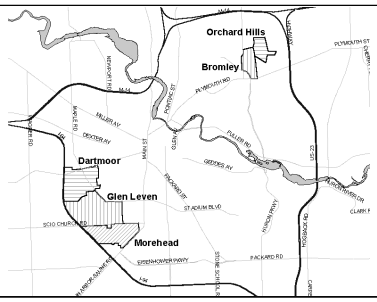
SSO Task Force: What Is It?

- Proposed in March, 1999 by neighborhood groups and residents relative to concerns over the August 1998 sewage backup event
- Approved in July, 1999 by Mayor/Council
- 15-member committee representing City, neighborhood residents, and other professionals
- Task Force directing consultant in carrying out the study

Study Issues

- What type of problems exist?
- Where have these problems taken place?
- When have these occurred?
- Who is impacted?
- How can it be fixed?
- What steps should be taken?

Where are the Primary Study Areas?



Flooding Outside of the Primary Study Areas

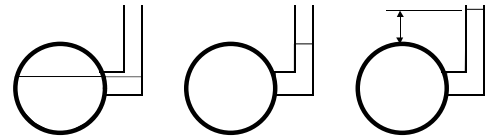
- Selected solutions will not increase incidents of flooding or sanitary sewer problems outside of the primary study areas
  - Collecting flooding statistics throughout Ann Arbor
  - Main sewers throughout the City are modeled and will be evaluated
- Identify and prioritize future study areas
- Much will be learned during this study that can be applied to other areas

Definition of Terms

- Sanitary sewers
- Storm runoff/storm sewers
- Wet weather flow
- Inflow & Infiltration (I/I)
- Sanitary Sewer Overflow (SSO)
- Basement backup (floor drains)
- Surcharge

What is Surcharging?

Surcharging is when the level of water in a sewer is higher than the top of the pipe



Partially full pipe (not surcharged) | Completely full pipe (not surcharged) | Surcharged pipe

Causes of Basement Flooding

- Poor stormwater drainage around the home
  - water entering through the windows or walls
- Failed sump pump
- Blockage in home sewer lead
- **Overloaded sanitary sewer**
  - **coming up through the floor drain**
  - **inability to drain**

June 24-25 Storm

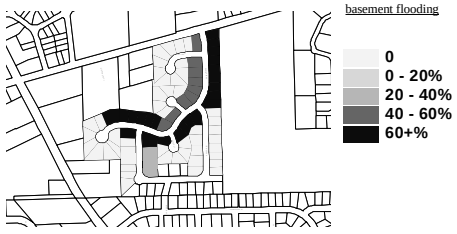
- Produced between 3" and 4" of rainfall
  Heaviest rainfall in Dartmoor and Glen Leven
- Rainfall took place between 10:00 PM (6/24) and 2:00 AM (6/25)
- Caused basement flooding in each of the 5 primary study areas

June 24-25 Storm Statistics

Area	Rainfall	Homes Reported Flooded
Orchard Hills	2.9"	25
Bromley	3.2"	11
Dartmoor	4.0" *	23
Glen Leven	4.0"	21
Morehead	3.5"	11
Other Areas	--	113
Total	--	204

* Estimated

Dartmoor Area Flooded Basements



Actions City has Taken

- City and Task Force members compiling list of flooded homes from multiple sources
  - Water Utilities
  - Project's 24-hour emergency phone number
  - Consultant
  - Internet web site http://www.cdm-mich.com/aa-sso
  - This workshop
- Project adjusting tasks to account for newly identified homes that experienced flooding
  - those that did not report flooding during the 1998 storm

Claim Process

- Inform the Water Utilities Department that a problem took place
- Document the nature of the problem
- Document any possessions that were damaged or destroyed
- Submit a claim letter (within 60 days of the storm)
- Review by Insurance Board (meets monthly)
- Authorization of payment by City Council

Residents' Requests - Previous Workshop

- How do we help and protect ourselves?
  - Searched vendors and internet
  - Met w/ plumbing professionals and City staff
  - Added a pilot study project task
- Develop and use a good emergency management process
  - Educating staff, using checklists, 'scripts'
  - Expanded "Peer Communities Review" task to evaluate other emergency response measures

Residents' Requests - Previous Workshop

- Identify and implement GOOD, WORKABLE SOLUTIONS for the whole system. 'Don't want solution in one area to move problem elsewhere.'
  - The Citywide trunk sewer model will be a basis of for evaluating alternatives
- Keep citizens involved throughout the process.
  - Website, newsletter, surveys, meetings

What can I do to help and protect myself?

- Make sure house lead is well maintained
- Drain downspouts and other surface drainage away from house (at least 5 feet)
- Make sure no outside drains receive storm flows
- Install properly located check valve(s) in combination with sump pump
  - *Basement floor drain plugs and standpipes are not recommended to prevent backups due to the potential for fluid pressure buildup beneath the basement floor causing the floor crack or buckle*
  - *Also, check-valves installed without a sump pump are not recommended for similar reasons*
  - *Drain plugs typically withstand low pressure only (may work under low backup conditions, may fail under severe storms)*

Review of Emergency Response

- City reviewing current procedures and policies
  - Emergency notification - health hazard
  - Clearing and cleaning options
  - Claims
- Educating City staff
- Developing an information package for distribution to homeowners
- Task Force to review and recommend to City Council

Definition of Terms

- Sanitary sewers
- Storm runoff/storm sewers
- Wet weather flow
- Inflow & Infiltration (I/I)
- Sanitary Sewer Overflow (SSO)
- Basement backup (floor drains)
- Surcharge

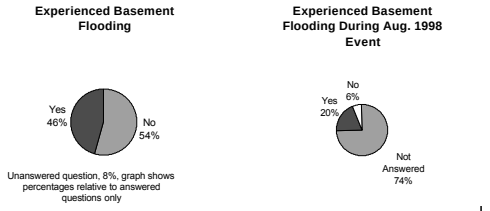
Ongoing Study Activities

- Survey
- Data collection
- System inspection
- I/I investigations
- Computer model
- Alternative analysis
- Peer community information
- Task Force recommendations

Homeowner Door-to-Door Survey

- Only affected zones in primary study areas were surveyed (prior to the June 24-25 storm)
- More than 500 homes in affected zones received surveys
- 396 surveys collected and compiled
  - nearly 80% response, expected 50%
  - still receiving responses by mail & web site
  - approximately 150 surveys were administered by project staff

Survey 2000 Results Summary



Sewer Modeling

- Using dynamic model
- Will evaluate specific storms
- Will model proposed corrective actions
- Evaluate “at risk” homes

Range of Alternatives

- Provide flow protection for “at risk” homes (using check valve and pump)
- Remove the I/I sources (downspouts, stairwell drains, footing drains, sewer improvements, etc.)
- Increase the pipe capacity
- Add storage for peak flow

What have others done?

- Demographics
- Project Focus Areas
- Project Issues
- Findings
- Recommendations
- Implementation of Solution Measures
- Emergency Response Systems

When Will Study Work Take Place?

- Flow/Rain/Level Monitoring (March - Nov)
- Homeowner/Elevation Survey Work (April - August)
- Field I/I Investigations (July - Sept)
- Pilot Installations (August - November)

Summary

- Task Force wants to develop a workable solution that is good for the whole system, long term
- Task Force is working with Council members and City staff to promote interim protection policies, procedures and programs to minimize damage for homeowners
- Task Force commits to maintaining strong connections with homeowners, City staff, and Council

Public Involvement Schedule

- Workshop 3 - Primary causes and feedback on range of alternatives and costs (October)
- Workshop 4 - Feedback on recommended solutions, cost and schedule (January)

Thank You!

- Project website:
  - http://www.cdm-mich.com/aa-sso
- 24-hour project pager:
  - 734.651.7676

Sanitary Sewer Overflow (SSO) Prevention Advisory Task Force Workshop 3 Presentation

October 25, 2000
November 2, 2000

What is the Purpose for this Presentation?

- Review the background of the project
- Provide a status on the project activities
- Show field program findings
- Present problem area assessments
- Identify options for solutions
- Present next steps to a recommendation
- Get your input

SSO Task Force: What Is It?

- Proposed in March, 1999 by neighborhood groups and residents relative to concerns over the August 1998 sewage backup event
- Approved in July, 1999 by City Council
- 15-member committee representing City, neighborhood residents, and other professionals
- Task Force selected and is directing consultant in carrying out the study

SSO Task Force: What are its Objectives?

- Design and conduct a study to determine causes
- Identify possible solutions
- Develop and maintain strong public engagement throughout the process
- Recommend solutions and funding options to City Council

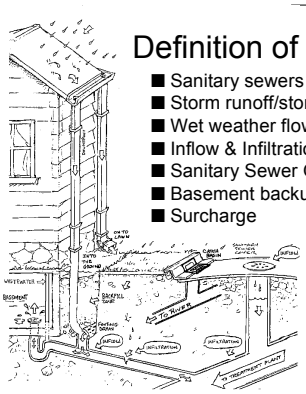
City Council Actions (since July)

- Resolution
- Insurance Board
- Work Session with Task Force

City Staff Actions (since July)

- Insurance Board Support
- Building Permit Process Strengthened
- Emergency Response Education and Packet Development
- Planning Commission and City Council Work Sessions
- Ongoing Support of CDM in SSO Study

Definition of Terms



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What is Sewer Surcharging?

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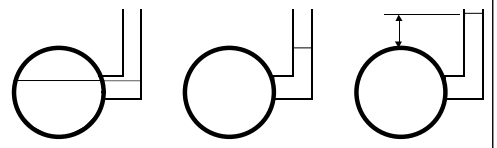
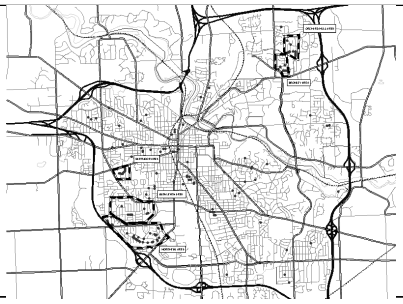
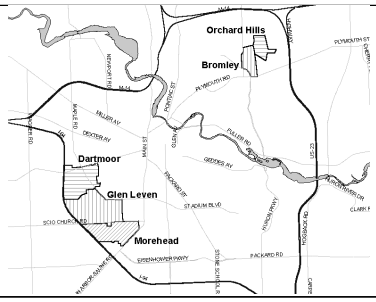


Partially full pipe (not surcharged) | Completely full pipe (not surcharged) | Surcharged pipe

Where have Problems been Observed?



Where are the Primary Study Areas?



5% of the City

50% of the flooding problems

Project Status: Activities Completed

- Existing data gathering and review
- Homeowner survey
- Peer community assessment
- Field efforts:
  - Manhole/sewer inspections
  - Flow and rainfall monitoring
  - Inflow/Infiltration investigations
  - Pilot installations (nearly complete)
- Computer model development

Project Status: Ongoing Activities

- Problem assessment
- Alternatives development
- Determination of costs
- Recommendations
- Implementation plan

What are the Results of the Homeowner Survey?

- Why do a survey?
  - Ensure we know where flooding has occurred
  - Gather data on type of flooding experienced
- What did we learn?
  - People care - We received 400 responses from 500 surveys (80%)
  - We have a good definition of where the problems were experienced
  - Some homeowners flooded in this latest event who had never flooded before

Peer Community Assessment

- Traditional methods of pipe rehabilitation, pipe replacement, and storage widely used
- Work on private property is becoming more common because of the benefits received from removing these sources
- Solutions that remove flow from the sanitary system benefit the users in other ways:
  - Reduced flows requiring treatment
  - Lower costs to manage SSOs

What are the Results of the Manhole Inspections?

- Approximately 750 manholes have been inspected
- 24 manholes/pipes have been identified as requiring minor cleaning (all complete)
- Overall condition of the system has been found to be very good and well maintained
- Questions about how flows are routed within the sewer system have been resolved

What Rainfall was Monitored this Year?

	Number of storms that exceeded		
Area	1"	2"	3"
Orchard Hills	13	2	0
Bromley	13	3	1
Dartmoor	12	2	1
Glen Leven	12	3	1
Morehead	12	2	1

Local information shows that larger and more intense storms are occurring more frequently than in the past

What Happened in the Sewers this Year?

	Biggest Event: 6/24-25/00 Peak Surcharge				Number of Surcharges Recorded	
Area	Rain (in)	Meter (in)	PLR (in)	Peaking Factor*	Meter	PLR
Orchard Hills	2.9	94	88	10	11	9
Bromley	3.2	66	77	18	9	8
Dartmoor	4.0	162	150	10	6	4
Glen Leven N.	4.0	69	87	24	3	4
Glen Leven S.	4.0	-----	-----	27	0	----
Morehead	3.5	-----	81	22	2	4

* equal to the maximum flow rate observed during the event divided by the average daily flow rate

What Observations can be Made from this?

- Frequent surcharging seen in all study areas
- High and variable peaking factors
- Limited wet weather discharge capacity

It is likely that different solutions will be recommended in different areas

How Many Downspouts have been Inspected?

Element	Dartmoor, Glen Leven, & Morehead	Bromley & Orchard Hills[1]	TOTAL	Stats
Single family homes	1,876	511	2,387	100%
Homes Inspected	1,876	511	2,387	100%
Downspouts within 5' of home	815	372	1,187	50%
Downspouts go into ground	161	41	202	8%
Exterior drains	2	6	8	0.3%

Notes:
[1] Previous work and estimated numbers in the project study area.

What does this Tell us?

- Half of the homes have already extended their downspouts more than 5'
- Remaining homes may not be able to extend downspouts away from home
- No downspouts were found connected to the sewer system
- Only two area drains were found to capture significant storm flow
- Additional downspout work unlikely to significantly change basement flooding problem

What Findings came out of the I/I Investigations?

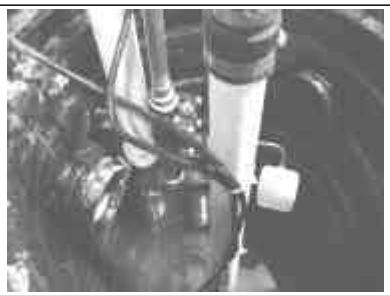
- Previous work suggested that flows up to 5 gpm were possible from foundation drains
- Monitoring of selected foundation drain flows showed substantial variability between individual homes
- This work demonstrated that between 60% and 90% of storm weather I/I comes from foundation drain connections

Foundation Drain Disconnection Pilots

- 25 homes inspected for potential as pilot construction locations
- 12 locations selected for implementation
- The selected contractor is working to complete project by the end of October, 2000
- Work will help determine:
  - Cost for the disconnection work in private homes
  - Hurdles to implement this option on a larger scale

Backflow Prevention

Footing Drain Disconnection



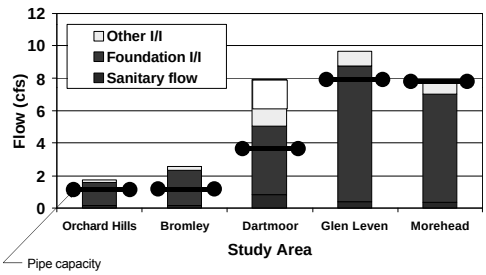
Area Drain Protection

Runoff Routed to Storm Sewer

What is the Status of the Sewer System Modeling?

- Flow data collection complete
- Analysis of flow data complete
- Trunk sewer and study area model development complete
- Model calibration near completion
- Problem assessment underway

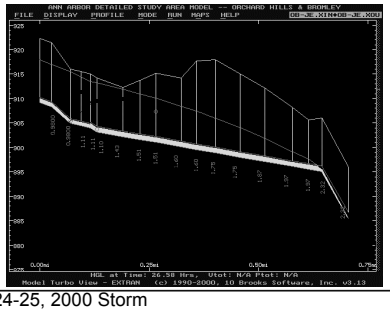
June 24 Storm Response for each Study Area



Specific Findings - Orchard Hills

- Area responds significantly to rainfall (Peak flows are 10 times average flow, or 10x)
- 90% of storm weather I/I is likely from foundation drain sources
- Discharge sewer too small for flows produced during wet weather
- Higher peak flows would be generated if sewer capacity available
- Storage volume available too small to handle storm weather flows generated

Orchard Hills-Sewer Profile Shows Capacity Limitation

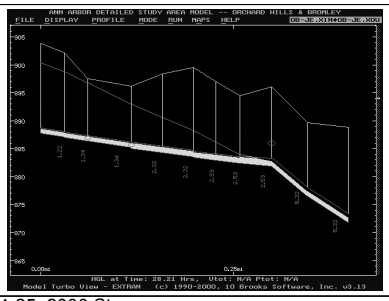


June 24-25, 2000 Storm

Specific Findings - Bromley

- Area responds dramatically to rainfall (18x)
- Discharge sewer under capacity for flows produced during wet weather
- Higher peak flows would be generated if sewer capacity were provided
- 90% of storm weather I/I is likely from foundation drain sources

Bromley-Sewer Profile Shows Capacity Limitation

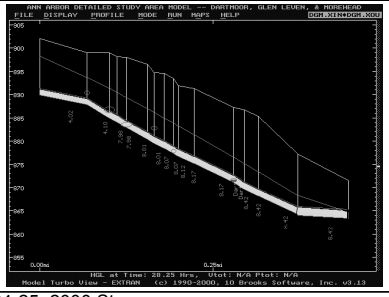


June 24-25, 2000 Storm

Specific Findings - Dartmoor

- Area responds significantly to rainfall (10x)
- 60% of storm weather I/I observed in area is likely from foundation drain sources
- Suburban I/I is significant
- Discharge sewer includes a mildly sloped section - results in loss of capacity during wet weather
- Upstream pumping station impacts peak flows
- High levels downstream from Dartmoor are a potential cause of the high levels in the area

Dartmoor-Pumping Station Impacts Flows



June 24-25, 2000 Storm

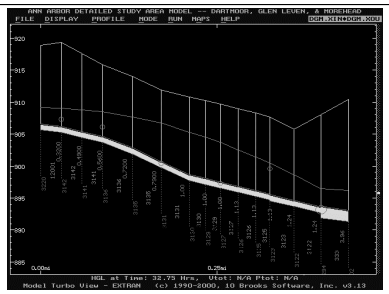
Specific Findings - Glen Leven

- Area responds dramatically to rainfall (25x)
- 90% of storm weather I/I is likely from foundation drain sources
- Two outlets - one with and one without sufficient capacity to pass peak flows
- A number of internal wet weather capacity constraints are under investigation

Specific Findings - Morehead

- Area responds dramatically to rainfall (22x)
- 90% of storm weather I/I is likely from foundation drain sources
- Discharge sewer under capacity for flows produced during wet weather
- Internal sewer wet weather capacity issues also cause high water levels

Morehead-High Levels in Caused by Sewer Limits



Alternatives Development

- Solutions that reduce wet weather flows
  - Remove the I/I sources - downspouts, stairwell drains, footing drains, sewer improvements, etc.
  - Provide flow protection for “at risk” homes - using check valve and sump pump
- Solutions that better manage flows
  - Increase the sewer capacity if required
  - Add storage to reduce peak flows

Range of Solutions

- Remove Footing Drains/Reduce Inflow and Infiltration
  - “Source” removal/control, work on homeowner property
  - Issues: voluntary vs. mandated compliance, backyard vs. storm sewer discharge
- Increase Pipe Capacity/Construct Relief Sewer
  - Treats symptom, construction along streets
  - Issue: downstream impact concerns; method of construction

Range of Solutions (Cont’d)

- Add Storage
  - Treats symptom, localized construction
  - Issue: aesthetics and location

Determination of Costs

- Development of unit construction costs for the various control option components underway
- Costs will be applied to the options evaluated
- Lifecycle costs, including costs of treatment, will be factored into the evaluation
- Cost/benefit analysis will evaluate the viability of each option

Implementation Plan

- Identify construction projects to be included in the recommended program
- Develop phasing of the projects based on priorities developed by Task Force
- Recommend the design and construction method that best meets the budgetary and schedule objectives of the program

Next Steps

- Complete the alternatives analysis (Nov.-Dec.)
- Perform risk analysis (Nov. - Dec.)
- Task Force to evaluate the options (Dec.)
- Gain public input on the plan through neighborhood specific meetings (Dec.)

Next Steps (Cont'd)

- Develop the implementation plan for the selected alternative(s) (Dec. - Jan.)
- Identify the funding options (Jan.)
- Present the recommended program to City Council for action (Jan.)

Solution Considerations

- Confidence in solution: near-term and long-term
- System-wide impacts
- Quality engineering design standards
- Ease of implementation
- Speed of implementation
- Cost (life-cycle and capital)

Homeowner Input

- What additional information will be helpful to you for the next meeting?
- What else do you want the SSO Task Force to consider regarding the possible remedies you have heard about today?

Thank You!

http://www.cdm-mich.com/aa-sso

Mark TenBroek: 888-CDM-MICH (236-6424

Pete Perala: 734-994-9938

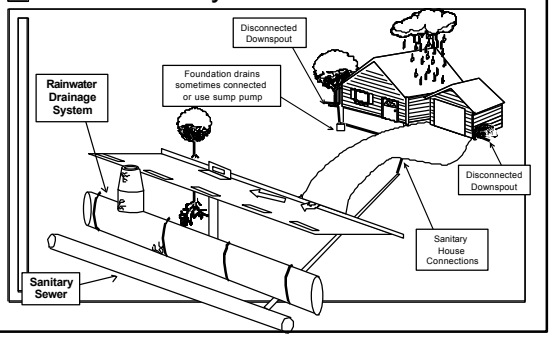
Ann Arbor SSO Task Force
Northeast Alternatives Review
Workshop 4

February 13, 2001

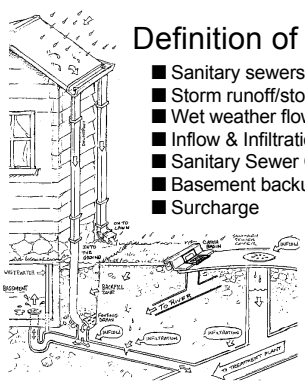
Agenda

- Review study area issues
- Identify problem areas
- Describe correction options available
- Preliminary costs for each option
- Recommended solution(s)
- Implementation plan
- Next steps

Sanitary & Storm Collection Systems

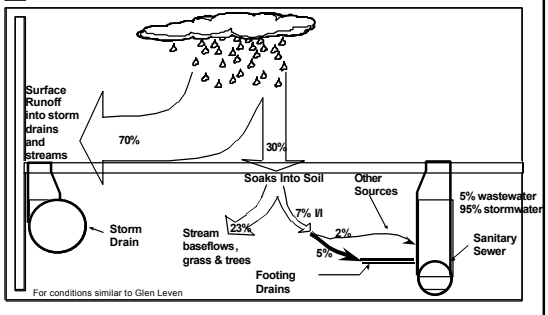


Definition of Terms



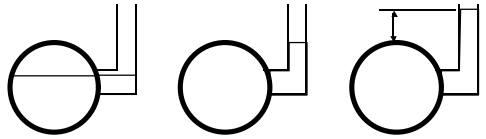
- Sanitary sewers
- Storm runoff/storm sewers
- Wet weather flow
- Inflow & Infiltration (I/I)
- Sanitary Sewer Overflow (SSO)
- Basement backup (floor drains)
- Surcharge

Where Does the Rain Go?



What is Sewer Surcharging?

Surcharging is when the level of water in a sewer is higher than the top of the pipe



Partially full pipe (not surcharged) | Completely full pipe (not surcharged) | Surcharged pipe

Where are the Primary Study Areas?

5% of the City

50% of the flooding problems

Study Area Issues

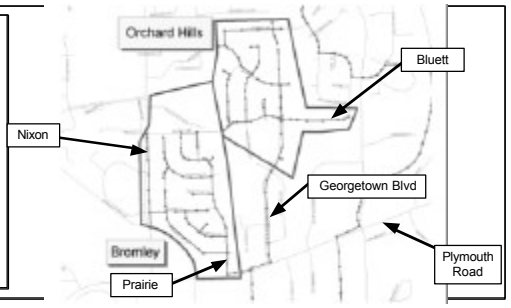
- Orchard Hills
- Bromley

Northeast Areas

- Dartmoor
- Glen Leven
- Morehead

Southwest Areas

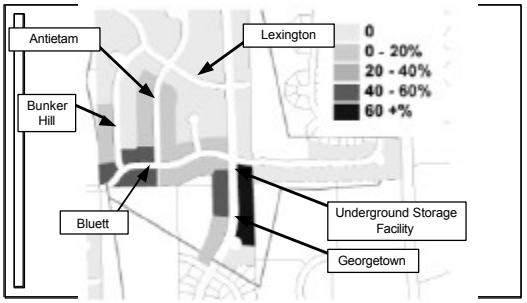
Orchard Hills and Bromley Study Areas



Orchard Hills Study Area Homeowner Issues

- Flooding has been a chronic problem since the 1960s
- Frequent basement flooding in low lying areas
- Capacity bottlenecks from the area
- Inadequate local storage

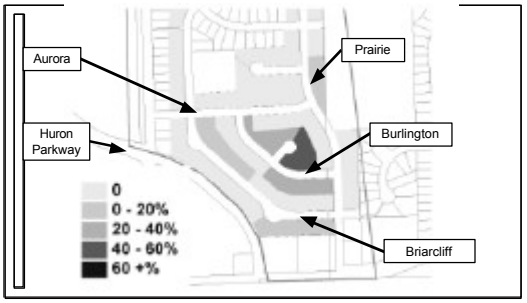
Flooding Locations in Orchard Hills



Bromley Study Area Homeowner Issues

- Flooding has been a chronic problem since the 1960s
- Frequent basement flooding in low lying areas
- Capacity bottlenecks from the area have been identified

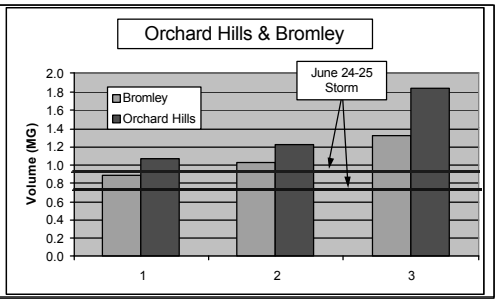
Flooding Locations in Bromley



Steps to Correcting Problems

1 Evaluate rain, flow, and level data
2 Understand wet weather response
3 Calibrate/validate models
4 Identify problems in each study area
5 Select design standard(s)
6 Develop control options
7 Review level of protection provided
8 Make recommendations

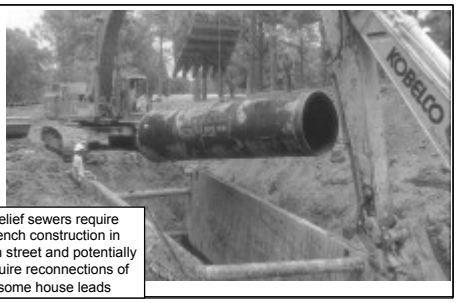
Orchard Hills & Bromley Design Conditions



Corrective Alternatives

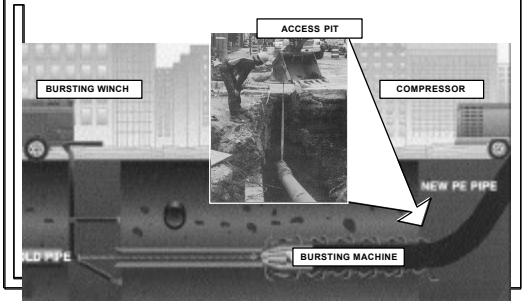
- Install relief sewers
- Upsize the existing sewers
- Provide storage of wet weather flows
- Remove footing drain flow sources

Relief Sewer Construction



Relief sewers require trench construction in each street and potentially require reconnections of some house leads

Upsizing (Pipe-bursting) Construction

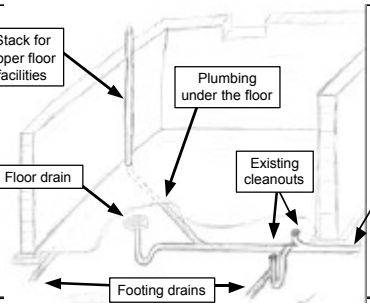


Upsizing/Storage Construction

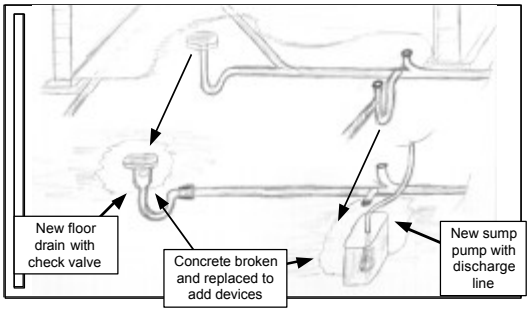
Storage requires underground storage pipes 5 or 6' in diameter that will fill during large storms

Enlarged sewer

Footing Drain Removal Basement Plumbing

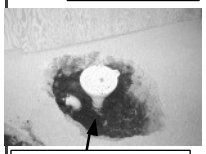


Footing Drain Removal Interior Plumbing Changes

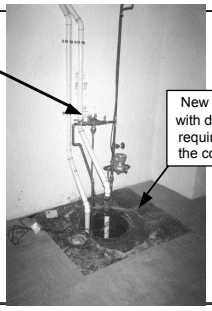


In-home Construction

Backup water powered sump pump requires backflow preventor

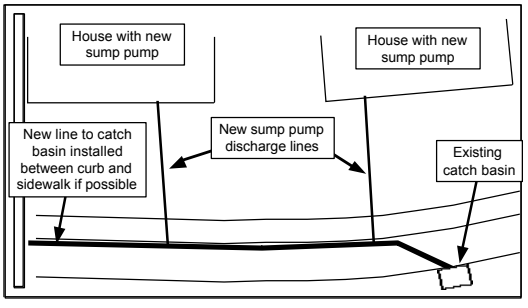


New floor drain with check valve requires breaking the concrete floor



New sump pump with discharge line requires breaking the concrete floor

Footing Drain Removal Exterior Changes



Curb Drain Construction

Trenching of sump pump discharge would be required from each house to the curb drain. Similar trenching would be required along the sidewalk to convey flows to the catch basins.

Ideas from Homeowners

- Low flow fixtures:
  - Shower heads
  - Faucets
  - Toilets
- Rain barrels
- Rain gardens

Low Flow Fixtures

- Can be used to reduce wastewater flow from individual homes
- Should be encouraged to reduce water and wastewater treatment needs
- Would reduce peak flows in these areas by less than 1-2%
- Application would not resolve flooding

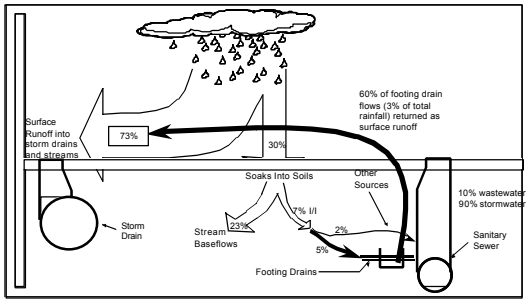
Rain Barrels/Rain Gardens

- Can capture flows from roofs that would normally enter the storm drainage system
- Encourages infiltration for smaller storms
- Would reduce peak flows into storm drainage system by less than 2-4%
- Application would not resolve flooding

Other Concerns Raised

- Increased stormwater flows from sump pump discharges
- Increase in flows from other sources connected to curb drains
- Radon gas from sump pump installations
- Impacts of alternatives on SSO regulations
- Practicality of pipe bursting

Concern of Increased Stormwater Flows



Concern of Radon Gas from Sump Pumps

- Radon gas is present in some Ann Arbor homes
- Basement slab penetrations may provide pathways to living space
- Testing can provide indication of potential problem
- Vented sumps can be used in locations with elevated radon gas levels

Concern of Impacts on SSOs at WWTP

- Pending SSO regulations may make discharges at WWTP more problematic
- Relief and upsizing options may cause more frequent discharges
- These options may require additional facilities (with additional costs) at the WWTP

Concerns about Pipe-bursting Alternatives

- Method has been successfully used in Ann Arbor
- Inexperienced contractors must not be used (prequalification required)
- May provide the opportunity for concurrent replacement of "Orangeburg" pipe used for house connections

Alternative Evaluation Criteria

- All alternatives were evaluated based on consistent criteria
- Categories evaluated included:
  - Quality of life impacts
  - Costs
  - Construction impacts

Quality of Life Issues

- Open/park/school area impacts
- Natural feature impacts
- Receiving water impacts
- Customer impacts (outside)
- Customer impacts (study areas)
- Odor potential
- Maintenance access
- Time to implement
- Certainty of solution

Cost Issues

- Construction cost
- Maintenance cost
- Operational savings
- Future SSO impact

Construction Issues

- Construction constraints
- Contractor availability
- Traffic control
- Construction on private property
- Easement availability
- Construction season impacts

Relative Importance

- Open/park/school area impacts
- Natural feature impacts
- Receiving water impacts
- Customer impacts (outside)
- Customer impacts (study areas)
- Odor potential
- Maintenance access
- Time to implement
- Certainty of solution
- Construction on private property

Orchard Hills Study Area Construction & Lifecycle $

Description	Constr.	Lifecycle
■ Relief[1]	$3.3M	$3.3M
■ Upsizing[2]	$3.2M	$3.2M
■ Upsizing/Storage	$2.2M	$2.2M
■ Disconnect[3]	$1.9-2.3M	$1.7-2.1M

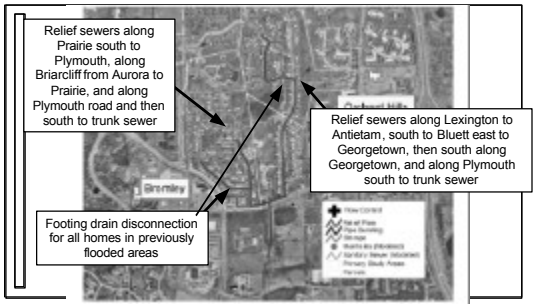
1 - Includes $2.9M of improvements in the study area and additional $0.4M in improvements in the trunk sewer system
2 - Includes $2.8M of improvements in the study area and and additional $0.4M in improvements in the trunk sewer system
3 - Lower costs are from reduced flows at WWTP

Bromley Study Area Construction & Lifecycle $

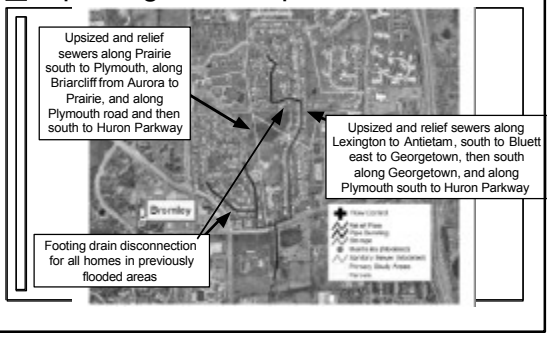
Description	Constr.	Lifecycle
■ Relief[1]	$2.5M	$2.5M
■ Upsizing[2]	$2.4M	$2.4M
■ Upsizing/Storage	$2.0M	$2.0M
■ Disconnect[3]	$1.2-1.6M	$1.0-1.4M

1 - Includes $2.1M of improvements in the study area and additional $0.4M in improvements in the trunk sewer system
2 - Includes $2.0M of improvements in the study area and and additional $0.4M in improvements in the trunk sewer system
3 - Lower costs are from reduced flows at WWTP

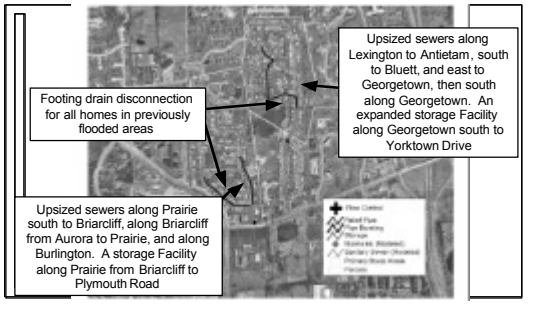
Bromley & Orchard Hills Relief Sewer Option



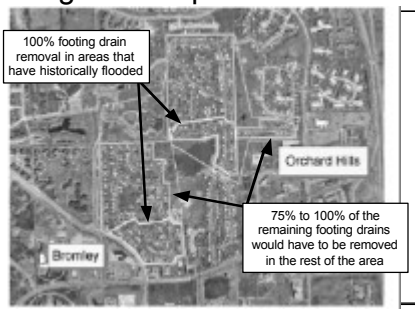
Bromley & Orchard Hills Upsizing/Relief Option



Bromley & Orchard Hills Upsizing/Storage Option



Bromley & Orchard Hills Footing Drain Option



Alternative Evaluation Conclusions

- Alternative viable solutions are available in each study area
- Based on evaluation criteria the upsizing/storage or footing drain removal alternatives are the preferred options in all areas
- Certainty of protection using the footing drain removal option alone is not completely understood at this time

Upsize/Storage - Implementation Issues

- Siting of underground facilities may have public concerns (impacts on open/park and/or natural areas)
- Water Utilities Department has a concern about maintaining many of these facilities throughout the City
- Because of the excavations needed for pipe-bursting, there will be disruptions in the affected neighborhoods

Footing Drain Removal - Implementation Issues

- Work is required on private property in basements and on front lawns
- Gaining participation from non-flooded homeowners who see little benefit may be problematic
- Obtaining additional data on actual removal of I/I in each district is needed before proceeding on a full scale program

Recommended Solutions

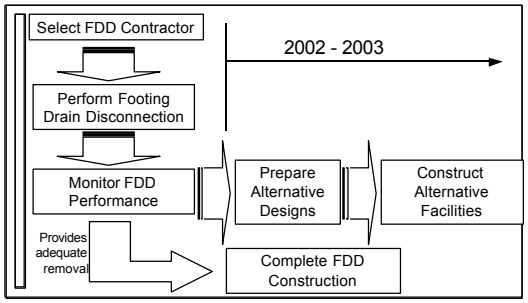
Study Area	Description	Cost
■ Orchard Hills	Upsize/Storage	$2.2M
■ Bromley	Footing Drains	$1.6M
■ **TOTAL**		**$3.8M**

Footing Drain Removal - Northeast Participation

Area	Type	Homes
■ Orchard Hills	Selected[1]	50
■ Bromley	100%	250
TOTAL		**300**

1 - Only homes in areas that have historically flooded will be disconnected

Implementation Plan



What is Planned for Other Areas that Flood?

- Have identified next areas to develop solutions for problems experienced
- Criteria based on:
  - Clustering of past problems (1998 & 2000)
  - Trunk sewer constraints
  - Potential for impact from new development

Pending State Legislation

- Senate Bill 109 - Use of an MDEQ approved plan limits liability
- Senate Bills 105 and 106 - May provide low interest loans to fund solutions
- Other proposed legislation may require disconnection of all homes with connected footing drains

Next Steps:

- SSO Advisory Task Force will finalize recommended alternatives
- Prepare implementation plans
- City Council action on recommendations
- Prepare recommended designs
- Construct required projects
- Develop solutions for other areas with basement flooding problems

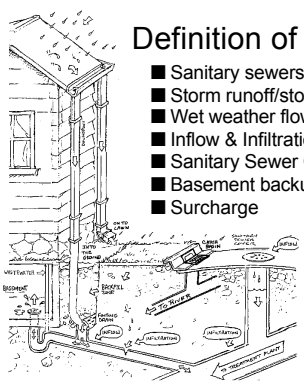
Ann Arbor SSO Task Force Southwest Alternatives Review Workshop 4

February 15, 2001

Objectives

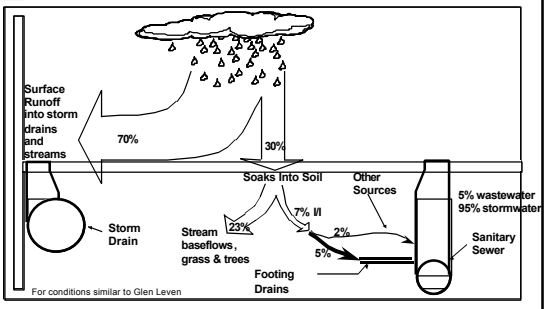
- Review issues/problems
- Describe correction options available
- Show recommended solutions
- Next steps

Definition of Terms



- Sanitary sewers
- Storm runoff/storm sewers
- Wet weather flow
- Inflow & Infiltration (I/I)
- Sanitary Sewer Overflow (SSO)
- Basement backup (floor drains)
- Surcharge

Where Does the Rain Go?

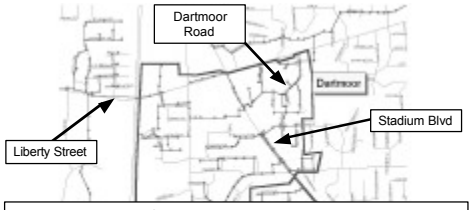


Where are the Primary Study Areas?

5% of the City

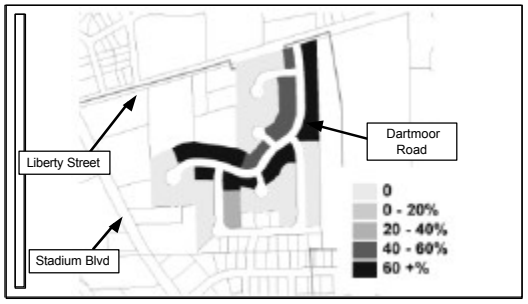
50% of the flooding problems

Dartmoor Study Area

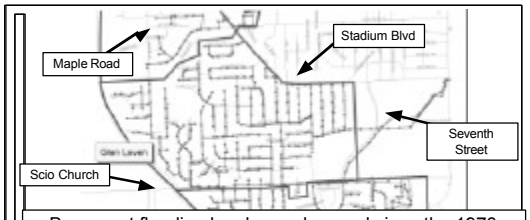


- No basement flooding was observed prior to 1998
- Residents have flooded only along Dartmoor Road
- Concerns have centered on additional flows from recent developments

Dartmoor Study Area Flooding Locations

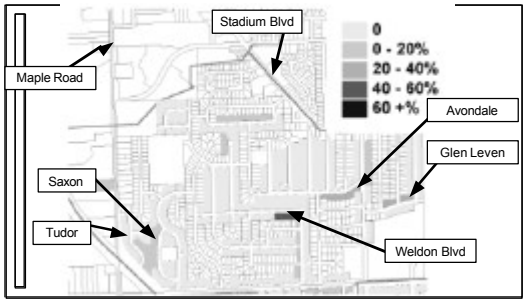


Glen Leven and Morehead Study Areas

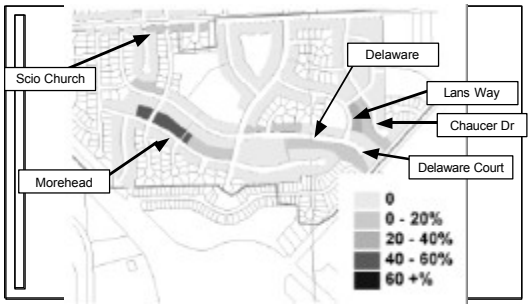


- Basement flooding has been observed since the 1970s
- Past construction has provided relief of some issues
- Concerns include additional flows from recent developments in Morehead

Glen Leven Flooding Locations



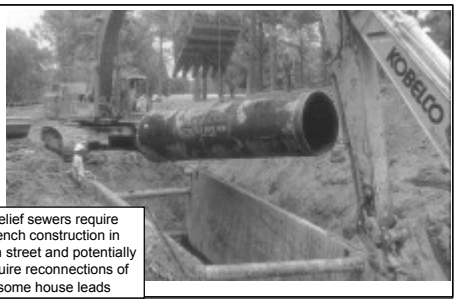
Morehead Flooding Locations



Corrective Alternatives

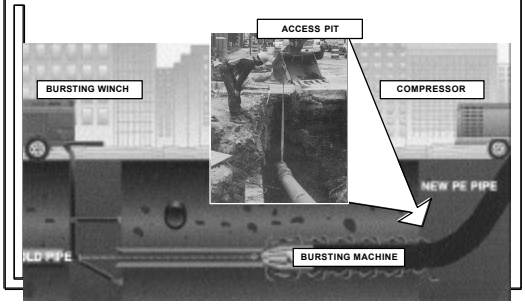
- Install relief sewers
- Upsize the existing sewers
- Provide storage of wet weather flows
- Remove footing drain flow sources

Relief Sewer Construction



Relief sewers require trench construction in each street and potentially require reconnections of some house leads

Upsizing (Pipe-bursting) Construction

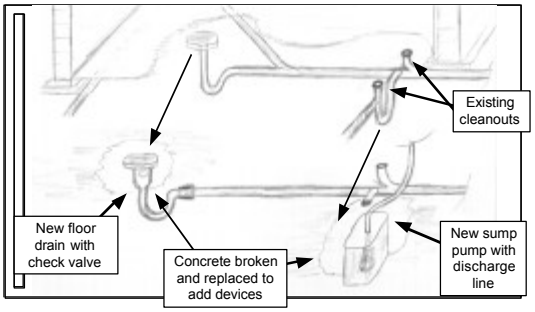


Upsizing/Storage Construction

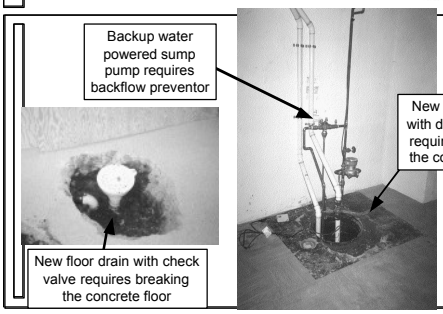
Storage requires underground storage pipes 5 or 6' in diameter that will fill during large storms

Enlarged sewer

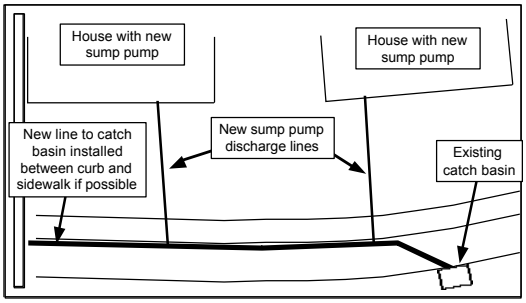
Footing Drain Removal Interior Plumbing Changes



In-home Construction



Footing Drain Removal Exterior Changes



Alternative Evaluation Conclusions

- Alternative viable solutions are available in each study area
- Based on evaluation criteria the upsizing/storage or footing drain removal alternatives are the preferred options in all areas
- Certainty of protection using the footing drain removal option alone is not completely understood at this time

Upsize/Storage - Implementation Issues

- Siting of underground facilities may have public concerns (impacts on open/park and/or natural areas)
- Water Utilities Department has a concern about maintaining many of these facilities throughout the City
- Because of the excavations needed for pipe-bursting, there will be disruptions in the affected neighborhoods

Footing Drain Removal - Implementation Issues

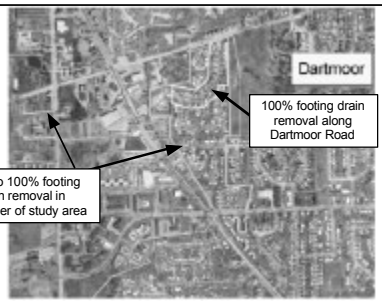
- Work is required on private property in basements and on front lawns
- Gaining participation from non-flooded homeowners who see little benefit may be an issue
- Obtaining additional data on actual removal of I/I in each district is needed before proceeding on a full scale program

Dartmoor Study Area Construction & Lifecycle $

Description	Constr.	Lifecycle
Relief[1]	$4.9M	$4.9M
Upsizing[1]	$4.9M	$4.9M
Upsizing/Storage	$2.8M	$2.8M
Disconnect[2]	$1.5-1.9M	$1.1-1.5M

1 - Includes $1.8M of improvements in the study area and an additional $3.1M in improvements in the trunk sewer system
2 - Lower costs are from reduced flows at WWTP

Dartmoor Study Area Footing Drain Removal

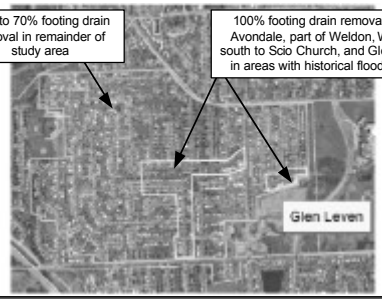


Glen Leven Study Area Construction & Lifecycle $

Description	Constr.	Lifecycle
Relief[1]	$7.0M	$7.0M
Upsizing[1]	$7.0M	$7.0M
Upsizing/Storage #1	$4.3M	$4.3M
Upsizing/Storage #2	$4.0M	$4.0M
Disconnect[2]	$3.3-4.1M	$3.0-3.7M

1 - Includes $4.6M of improvements in the study area and an additional $2.4M in improvements in the trunk sewer system
2 - Lower lifecycle costs are from reduced flows at WWTP

Glen Leven Area Footing Drain Removal Option

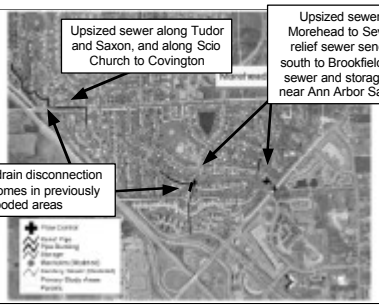


Morehead Study Area Construction & Lifecycle $

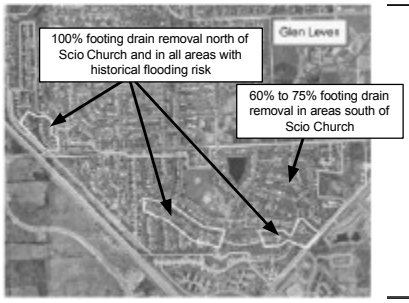
Description	Constr.	Lifecycle
■ Relief[1]	$5.5M	$5.5M
■ Upsizing[2]	$5.7M	$5.7M
■ Upsizing/Storage#1	$3.2M	$3.2M
■ Upsizing/Storage#2	$2.9M	$2.9M
■ Disconnect[3]	$2.8-$3.4M	$2.5-$3.1M

1 - Includes $4.2M of improvements in the study area and an additional $1.3M in improvements in the trunk sewer system
2 - Includes $4.4M of improvements in the study area and an additional $1.3M in improvements in the trunk sewer system
3 - Lower lifecycle costs are from reduced flows at WWTP

Morehead Upsize/Storage Option 2



Morehead Footing Drain Removal Option



Recommended Solutions

Study Area	Description	Cost
■ Dartmoor	Footing Drains	$1.9M
■ Glen Leven	Footing Drains	$4.1M
■ Morehead	Upsize/Storage 2	$2.9M
TOTAL		**$8.9M**

Footing Drain Removal - Southwest Participation

Area	Type	Homes
■ Dartmoor	100%	310
■ Glen Leven	70%	660
■ Morehead	Selected[1]	55
TOTAL		**1,025**

1 - Only homes in areas that have historically flooded will be disconnected

Homeowner Info - Footing Drain Disconnection

- Sump pump installed at City cost
- Backup sump pump provided
- About 2 days needed to complete work in basement
- Sump pump and discharge location is coordinated with homeowner
- Homeowner needs to monitor operation of pump (alarm provided)

Benefits - Footing Drain Disconnection

- Is environmentally responsible, reduces flow to WWTP & environment
- Discharge water could be used for lawn watering if desired
- Helps your neighbors that have flooded resolve their problem
- A successful solution will increase property values in neighborhood

Ideas from Homeowners

- Low flow fixtures:
  - Shower heads
  - Faucets
  - Toilets
- Rain barrels
- Rain gardens

Low Flow Fixtures

- Can be used to reduce wastewater flow from individual homes
- Should be encouraged to reduce water and wastewater treatment needs
- Would reduce peak flows in these areas by less than 1-2%
- Application would not resolve flooding

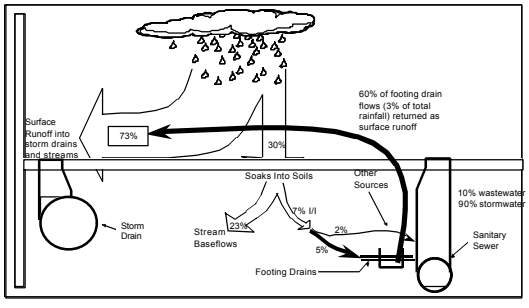
Rain Barrels/Rain Gardens

- Rain barrels capture flows from roofs
- Rain gardens encourage infiltration for smaller storms
- Could reduce peak flows into storm drainage system by less than 2-4%
- Impact on basement flooding would be minimal
- Application would not resolve flooding

Other Concerns Raised

- Flows from sump pumps
- Other flows from curb drains
- Radon gas
- SSO regulations
- Practicality of pipe bursting

Concern of Increased Stormwater Flows



Radon Gas Concerns

- Radon gas is present in some Ann Arbor homes
- Basement slab penetrations may provide pathways to living space
- Testing can show if there are potential problems
- Vented sumps can be used in locations with elevated radon gas levels

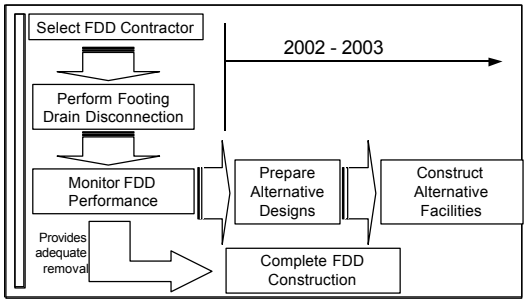
Concern of Impacts on SSOs at WWTP

- Pending SSO regulations may make discharges at WWTP more problematic
- Relief and upsizing options may cause more frequent discharges
- These options may require additional facilities (with additional costs) at the WWTP

Pipe-bursting Concerns

- Method has been successfully used in Ann Arbor
- Inexperienced contractors must not be used (prequalification required)
- May provide the opportunity for concurrent replacement of "Orangeburg" pipe used for house connections

Implementation Plan



What is Planned for Other Areas that Flood?

- Have identified next areas to develop solutions for problems experienced
- Criteria based on:
  - Clustering of past problems (1998 & 2000)
  - Trunk sewer constraints
  - Potential for impact from new development

Pending State Legislation

- Senate Bill 109 - Use of an MDEQ approved plan limits liability
- Senate Bills 105 and 106 - May provide low interest loans to fund solutions
- Other proposed legislation may require disconnection of all homes with connected footing drains

Alternative Evaluation Criteria

- All alternatives were evaluated based on consistent criteria
- Categories evaluated included:
  - Quality of life impacts
  - Costs
  - Construction impacts

Quality of Life Issues

- Open/park/school area impacts
- Natural feature impacts
- Receiving water impacts
- Customer impacts (outside)
- Customer impacts (study areas)
- Odor potential
- Maintenance access
- Time to implement
- Certainty of solution

Cost Issues

- Construction cost
- Maintenance cost
- Operational savings
- Future SSO impact

Construction Issues

- Construction constraints
- Contractor availability
- Traffic control
- Construction on private property
- Easement availability
- Construction season impacts

Relative Importance

- Open/park/school area impacts
- Natural feature impacts
- Receiving water impacts
- Customer impacts (outside)
- Customer impacts (study areas)
- Odor potential
- Time to implement
- Certainty of solution
- Construction on private property

Next Steps:

- SSO Advisory Task Force will finalize recommended alternatives
- Prepare implementation plans
- City Council action on recommendations
- Prepare recommended designs
- Construct required projects
- Develop solutions for other areas with basement flooding problems

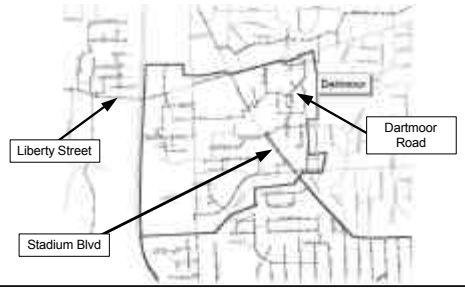
Appendix J - Neighborhood Presentations

Three public neighborhood meetings were held during the course of the project to help provide information regarding proposed solution alternatives and solicit feedback from area residents. The January 2001 presentations are included in this appendix. Note that each presentation was assembled specific to certain areas studied (one for the Bromley/Orchard Hills areas, one for the Dartmoor area, and one for the Morehead/Glen Leven areas). All information was posted to the project's website subsequent to the meetings.

Ann Arbor SSO Task Force Alternatives Review Dartmoor Study Area

January 9, 2001

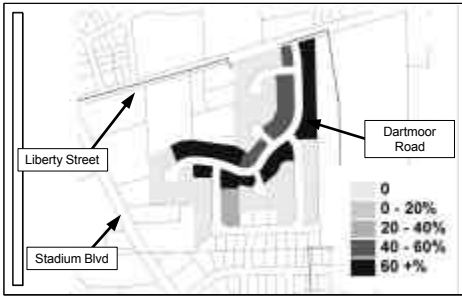
Dartmoor Study Area



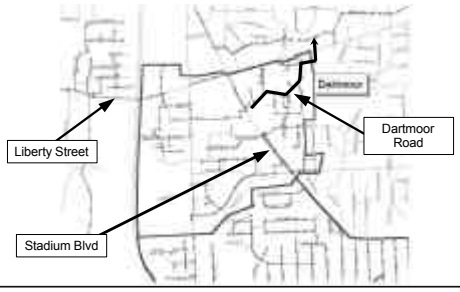
Dartmoor Study Area Homeowner Issues

- No basement flooding was observed prior to 1998
- Residents have flooded only along Dartmoor Road
- Concerns have centered on additional flows from recent developments

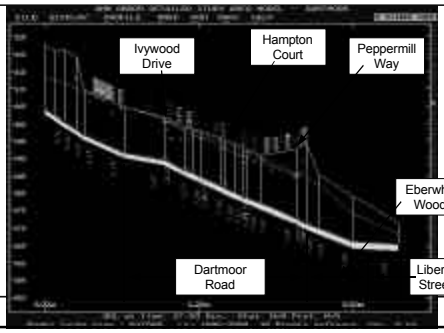
Dartmoor Study Area Flooding Locations



Dartmoor Study Area Sewer Profile



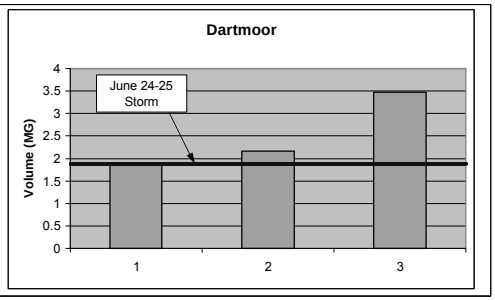
How has this Impacted Dartmoor Homeowners?



Steps to Correcting Problems

1 Evaluate rain, flow, and level data
2 Understand wet weather response
3 Calibrate/validate models
4 Identify problems in each study area
5 Select design standard(s)
6 Develop control options
7 Review level of protection provided
8 Make recommendations

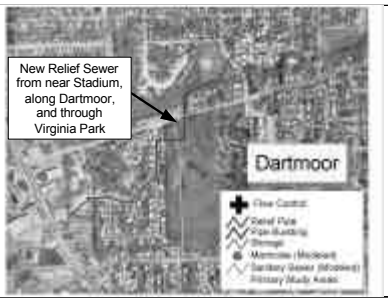
Dartmoor Study Area Design Conditions



Ways to Fix the Problem

- Construct relief sewers
- Upsize the existing sewers
- Provide storage of wet weather flows
- Remove footing drain flows

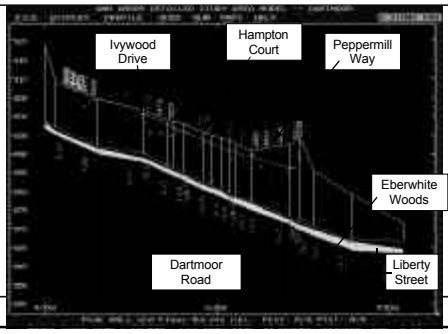
Dartmoor Study Area Relief Sewer Option



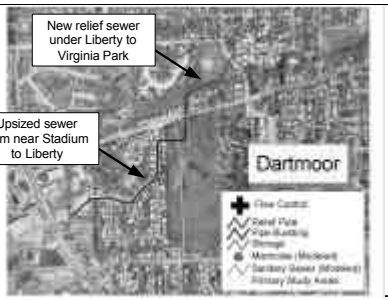
Dartmoor Study Area Relief Sewer Option

- Pros
  - ø Construction is in existing ROW or existing easements
  - ø Contractors are familiar with this construction method
- Cons
  - ø Construction along Dartmoor Road, in Eberwhite Woods, commons area, & Virginia Park
  - ø Larger peak flows would impact the trunk sewer system

Dartmoor Study Area Relief Sewer Option



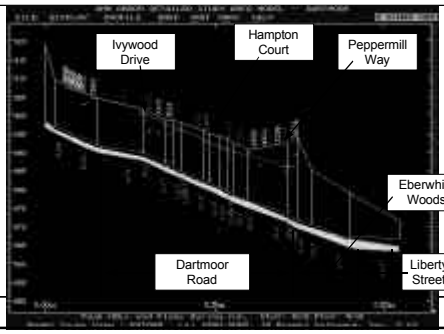
Dartmoor Study Area Relief/Upsize Option



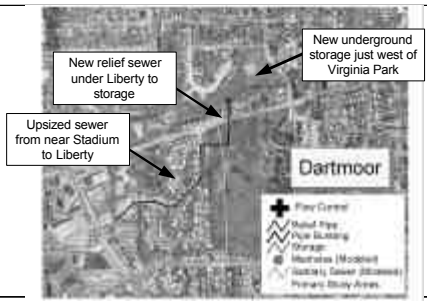
Dartmoor Study Area Relief/Upsize Option

- Pros
  - ø Pipe-bursting used in street areas (less traffic impacts)
  - ø Contractors are familiar with the relief portion of the construction
- Cons
  - ø Access pits will be required in Dartmoor
  - ø Need specialized contractor
  - ø Larger peak flows would impact the trunk sewer system
  - ø Construction in commons area & Virginia Park

Dartmoor Study Area Relief/Upsize Option



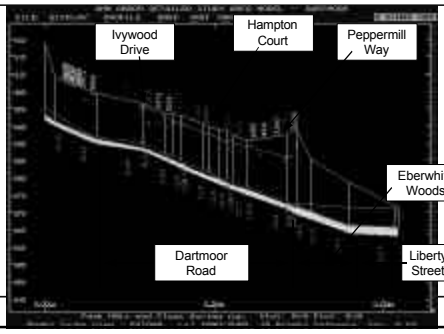
Dartmoor Study Area Upsize/Storage Option



Dartmoor Study Area Upsize/Storage Option

- Pros
  - ø Same as previous options
  - ø Additional peak flows not moved downstream to trunk sewer system
- Cons
  - ø Same as previous options, but requires more construction in commons area
  - ø Requires access to storage for maintenance
  - ø Potential for odors

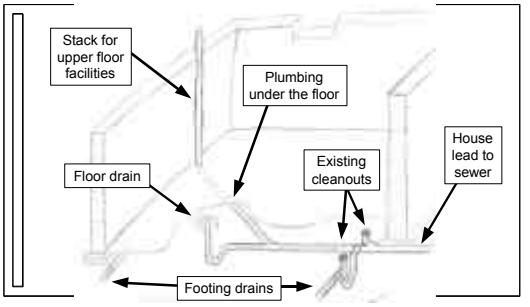
Dartmoor Study Area Upsize/Storage Option



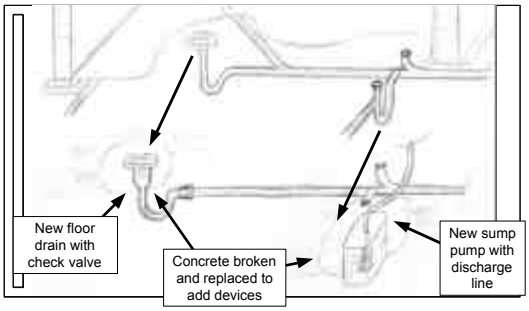
Dartmoor Area Footing Drain Removal Option

- 80% to 100% of homes with footing drains would have to be disconnected
- Approximately 300 homes would have to be included for the program to be successful
- Primarily impacts homes east of Stadium

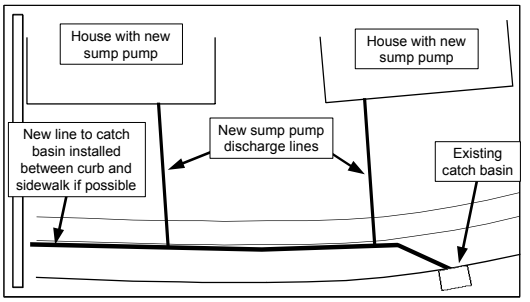
Footing Drain Removal Basement Plumbing



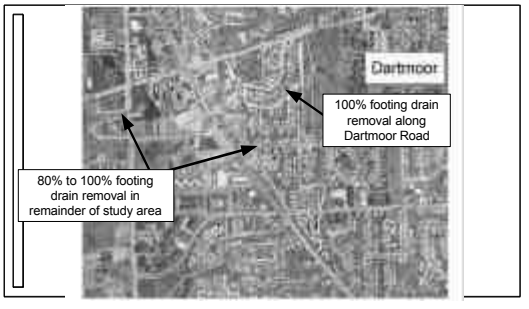
Footing Drain Removal Interior Plumbing Changes



Footing Drain Removal Exterior Changes



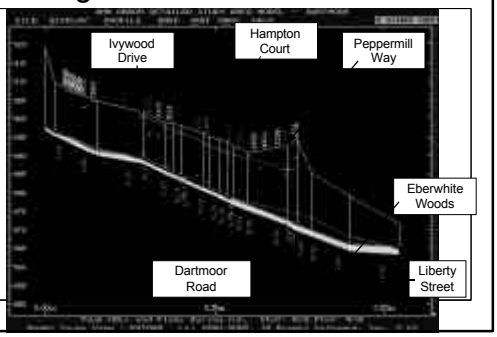
Dartmoor Study Area Footing Drain Removal



Dartmoor Study Area Footing Drain Removal

- Pros
  - ø No construction in street (but will be between sidewalk and street)
  - ø Flows to trunk sewer system and WWTP are reduced
- Cons
  - ø Requires construction in basements and lawns
  - ø Homeowners responsible for maintaining sump pumps
  - ø Sump pumps must be connected to storm system

Dartmoor Study Area Footing Drain Removal



Dartmoor Study Area Construction Costs

Description	DC1	DC2
■ Relief[1]	$1.8M+	same
■ Upsizing[1]	$1.8M+	same
■ Upsizing/Storage	$2.7M	$2.8M
■ Disconnect	$1.5 - 1.9M	same

1 - Includes $1.8M of improvements in the study area and additional improvements in the trunk sewer system (cost under development)

Dartmoor Study Area Lifecycle Costs

Description	DC1	DC2
■ Relief[1]	$1.8M+	same
■ Upsizing[1]	$1.8M+	same
■ Upsizing/Storage	$2.7M	$2.8M
■ Disconnect[2]	$1.1 - 1.5M	same

1 - Includes $1.8M of improvements in the study area and additional improvements in the trunk sewer system (cost under development)

2 - Lower costs are from reduced flows at WWTP

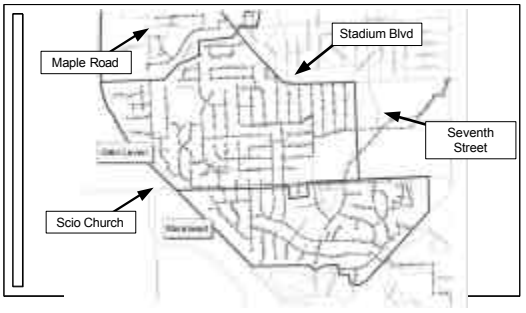
Dartmoor Study Area Conclusions

- Alternative viable solutions are available
- Dartmoor cost ranges from $1.5M to $2.8M (or higher)
- At risk homes are protected under each option
- Certainty of protection for footing drain option not completely understood

Ann Arbor SSO Task Force Alternatives Review - Glen Leven & Morehead Study Areas

January 10, 2001

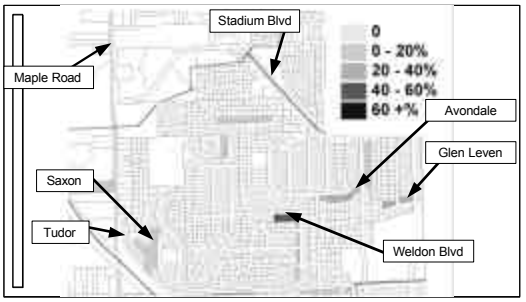
Glen Leven and Morehead Study Areas



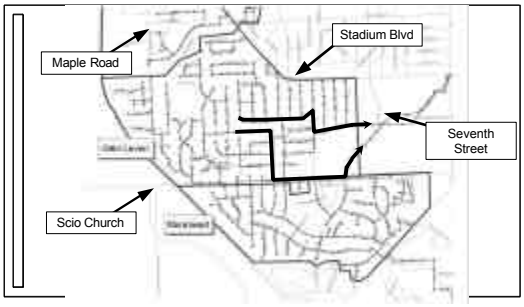
Glen Leven Study Area Homeowner Issues

- Basement flooding has been observed since the 1970s
- Residents have flooded along Glen Leven, Weldon, and Avondale
- Past construction has provided relief of some, but not all issues

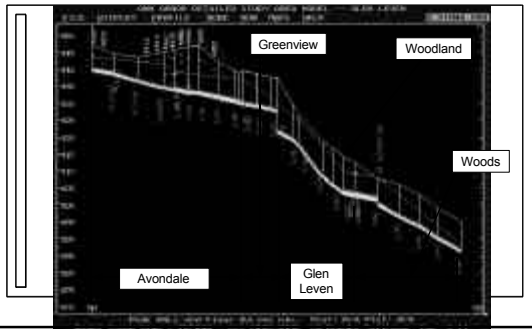
Glen Leven Flooding Locations



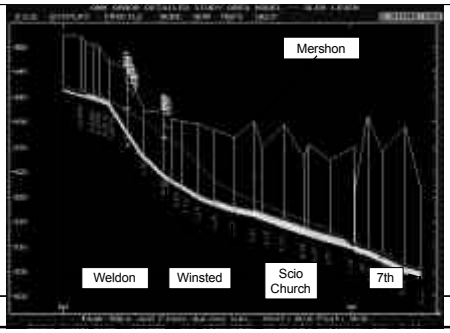
Glen Leven Study Area Profiles



How Has this Impacted Homeowners Glen Leven?



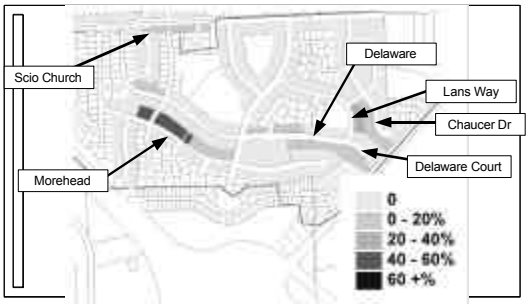
How Has this Impacted Homeowners Glen Leven?



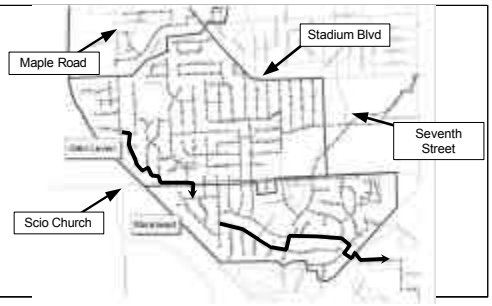
Morehead Study Area Homeowner Issues

- Basement flooding has been observed since the 1970s
- Residents have flooded along Saxon, Tudor, Morehead, Chaucer Drive, Lans Way, and Delaware
- Past construction has provided relief of some, but not all issues
- Concerns include additional flows from recent developments

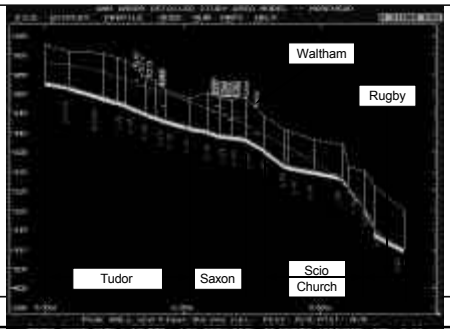
Morehead Flooding Locations



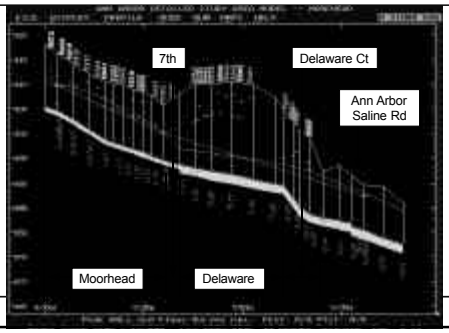
Morehead Study Area Profiles



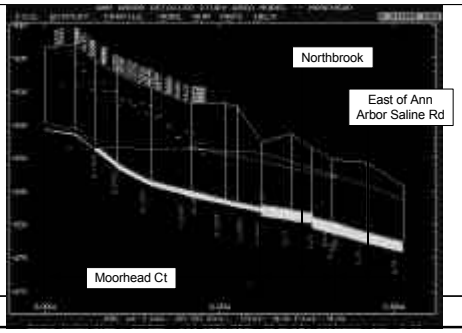
How are Morehead Homeowners Impacted?



How are Morehead Homeowners Impacted?



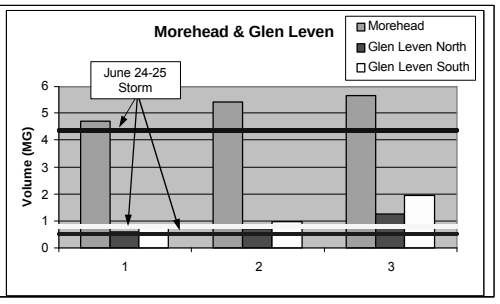
How are Morehead Homeowners Impacted?



Steps to Correcting Problems

1 Evaluate rain, flow, and level data
2 Understand wet weather response
3 Calibrate/validate models
4 Identify problems in each study area
5 Select design standard(s)
6 Develop control options
7 Review level of protection provided
8 Make recommendations

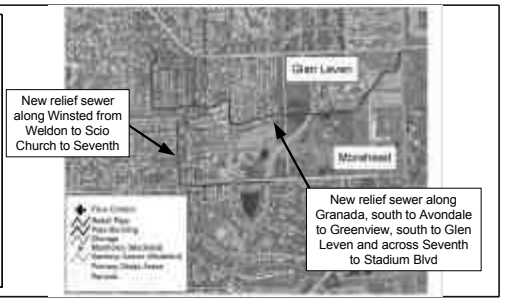
Morehead and Glen Leven Design Conditions



Ways to Fix the Problem

- Install relief sewers
- Upsize the existing sewers
- Provide storage of wet weather flows
- Remove footing drain flow sources

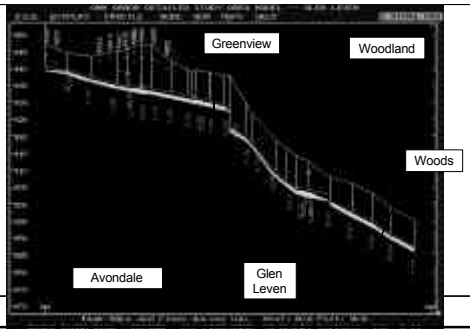
Glen Leven Study Area Relief Sewer Option



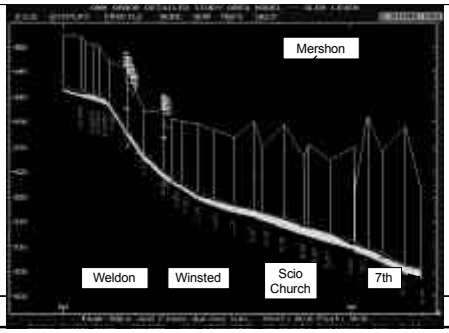
Glen Leven Study Area Relief Sewer Option

- Pros
  - ø Construction is in existing ROW
  - ø Contractors are familiar with this construction method
- Cons
  - ø Construction disruption along streets
  - ø Larger peak flows would impact the trunk sewer system

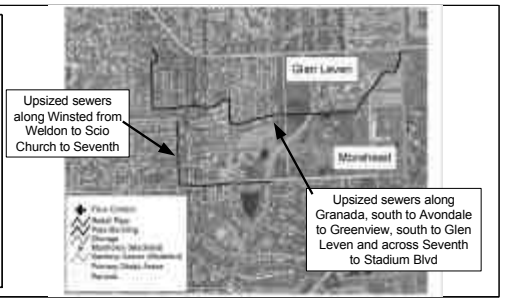
Glen Leven Study Area
Relief Sewer Option



Glen Leven Study Area
Relief Sewer Option



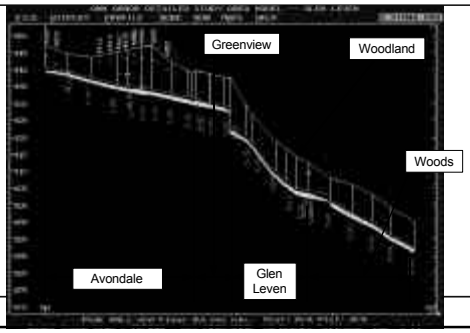
Glen Leven Study Area
Sewer Upsizing Option



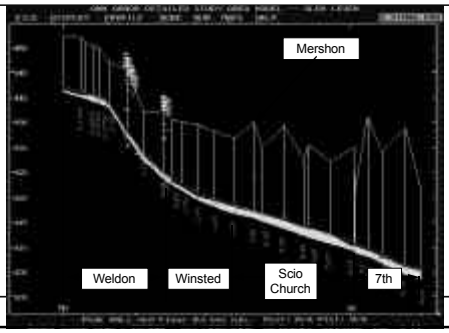
Glen Leven Study Area
Sewer Upsizing Option

- Pros
  - ø Pipe-bursting used in street areas (less traffic impacts)
- Cons
  - ø Access pits will be required in street for each home
  - ø Need specialized contractor
  - ø Larger peak flows would impact the trunk sewer system

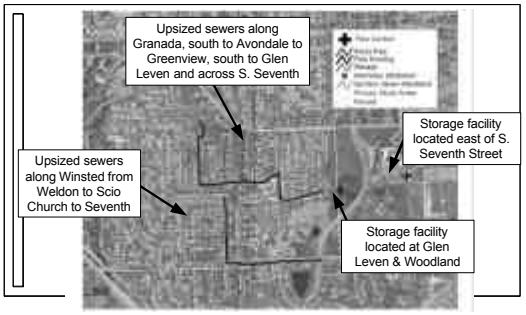
Glen Leven Study Area
Sewer Upsizing Option



Glen Leven Study Area
Sewer Upsizing Option



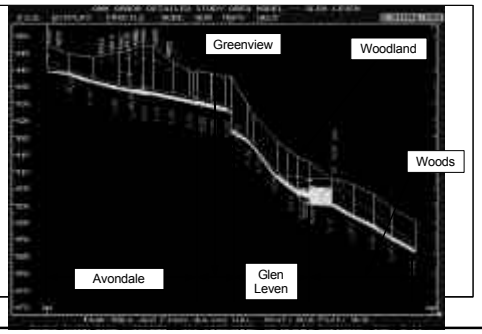
Glen Leven Study Area Upsize/Storage Option 1



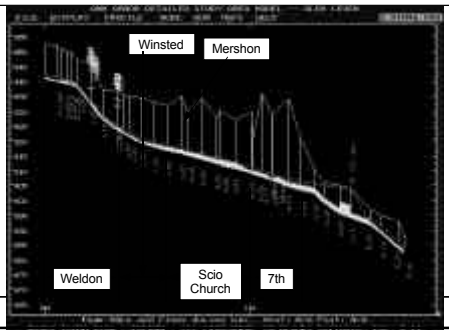
Glen Leven Study Area Upsize/Storage Option 1

- Pros
  - ø Same as previous options
  - ø Additional peak flows not moved downstream to trunk sewer system
- Cons
  - ø Same as previous options
  - ø Require access to storage for maintenance
  - ø Potential for odors

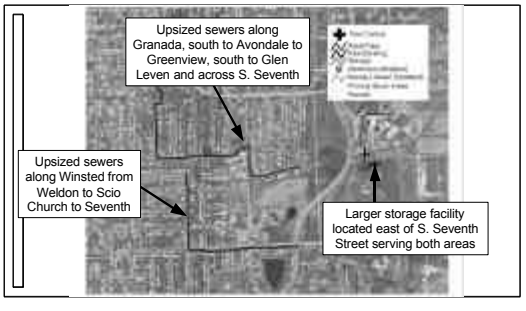
Glen Leven Study Area Upsize/Storage Option 1



Glen Leven Study Area Upsize/Storage Option 1



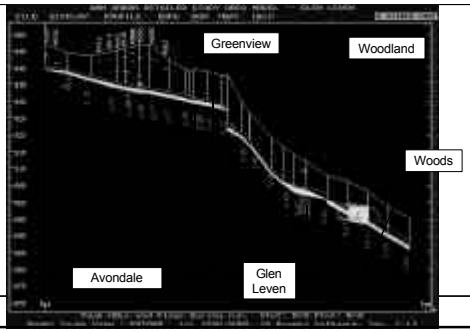
Glen Leven Study Area Upsize/Storage Option 2



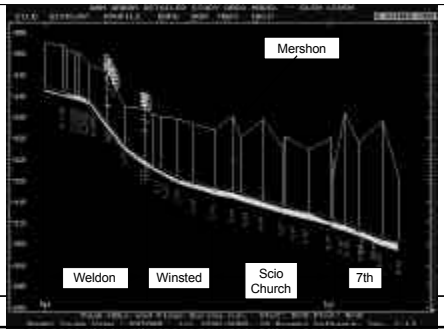
Glen Leven Study Area Upsize/Storage Option 2

- Pros
  - ø Same as previous option storage option
  - ø Single location for storage
- Cons
  - ø Same as previous options

Glen Leven Study Area Upsize/Storage Option 2



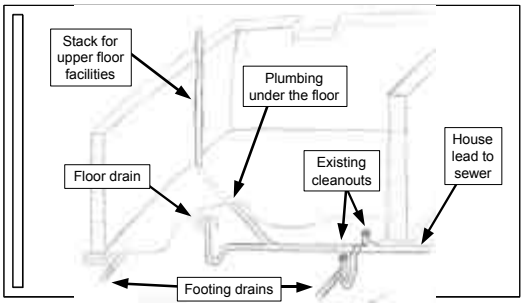
Glen Leven Study Area Upsize/Storage Option 2



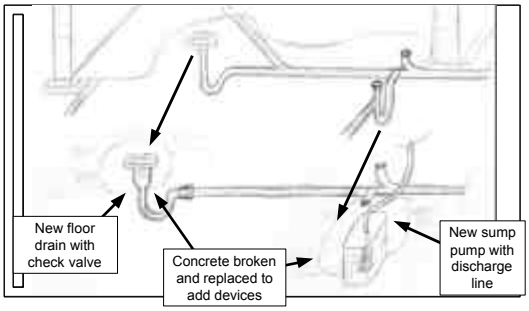
Glen Leven Area Footing Drain Removal Option

- 55% to 70% of homes with footing drains would have to be disconnected
- Approximately 660 homes would have to be included for the program to be successful

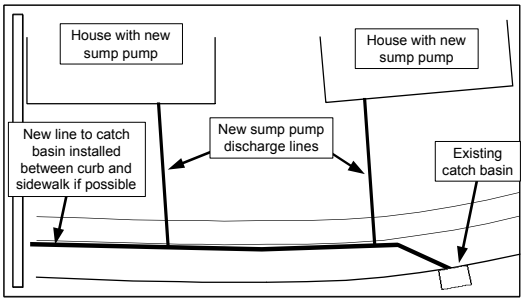
Footing Drain Removal Basement Plumbing



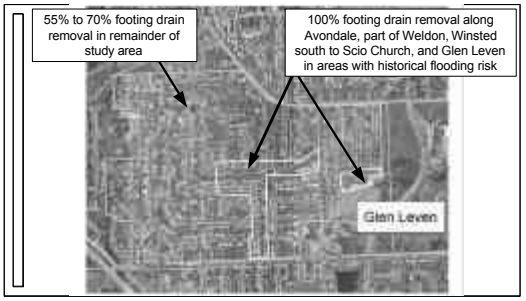
Footing Drain Removal Interior Plumbing Changes



Footing Drain Removal Exterior Changes



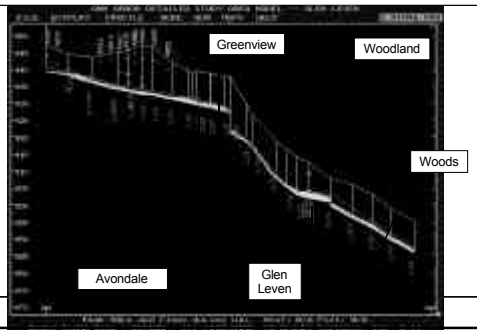
Glen Leven Area Footing Drain Removal Option



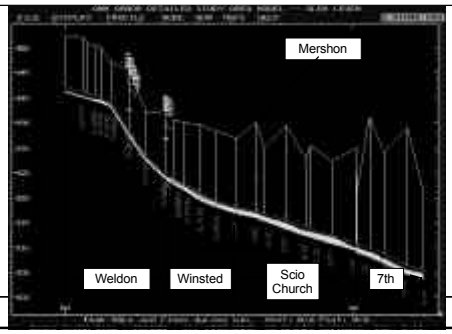
Glen Leven Study Area Footing Drain Removal

- Pros
  - ø Limited construction in street (but will be between sidewalk and street)
  - ø Flows to trunk sewer system and WWTP are reduced
- Cons
  - ø Requires construction in basements and lawns
  - ø Homeowners responsible for maintaining sump pumps
  - ø Sump pumps must be connected to storm system

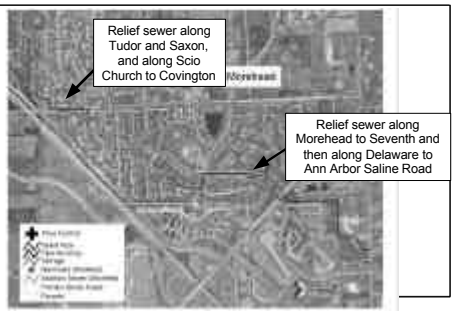
Glen Leven Study Area Footing Drain Removal



Glen Leven Study Area Footing Drain Removal



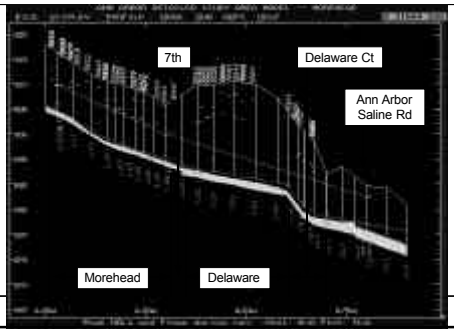
Morehead Study Area Relief Sewer Option



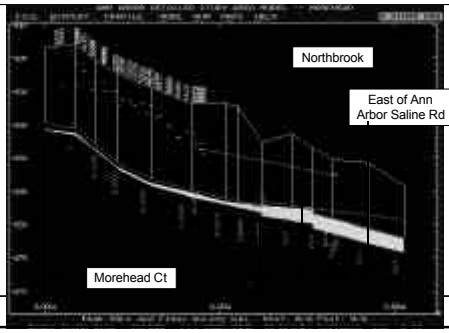
Morehead Study Area Relief Sewer Option

- Pros
  - ø Construction is in existing ROW or existing easements
  - ø Contractors are familiar with this construction method
- Cons
  - ø Construction disruption along streets
  - ø Larger peak flows would impact the trunk sewer system

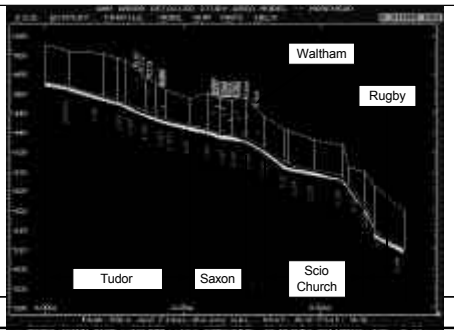
Morehead Study Area
Relief Sewer Option



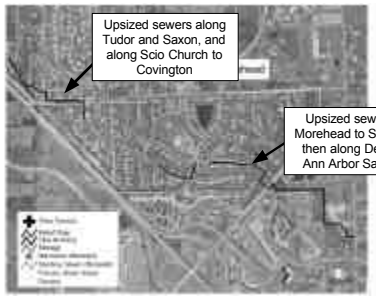
Morehead Study Area
Relief Sewer Option



Morehead Study Area
Relief Sewer Option



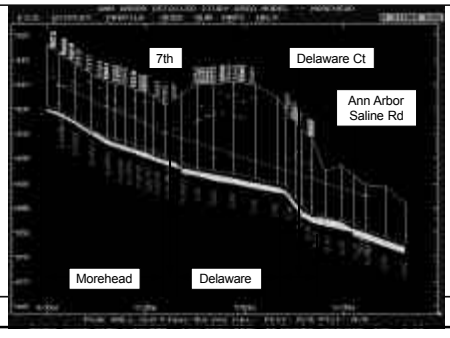
Morehead Study Area
Sewer Upsizing Option



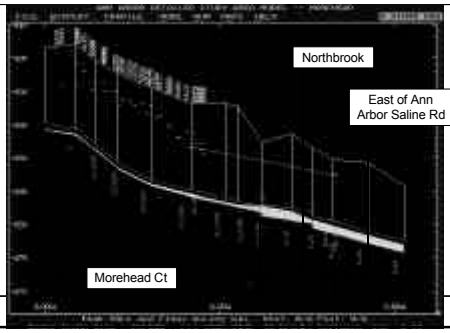
Morehead Study Area
Sewer Upsizing Option

- Pros
  - ø Pipe-bursting used in street areas (less traffic impacts)
- Cons
  - ø Access pits will be required in street for each home
  - ø Need specialized contractor for pipe-bursting work
  - ø Larger peak flows would impact the trunk sewer system

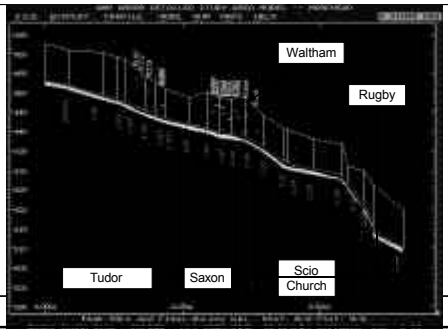
Morehead Study Area
Sewer Upsizing Option



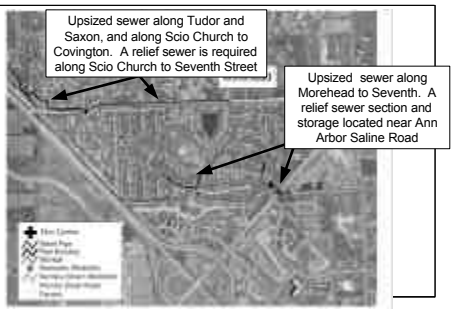
Morehead Study Area Sewer Upsizing Option



Morehead Study Area Sewer Upsizing Option



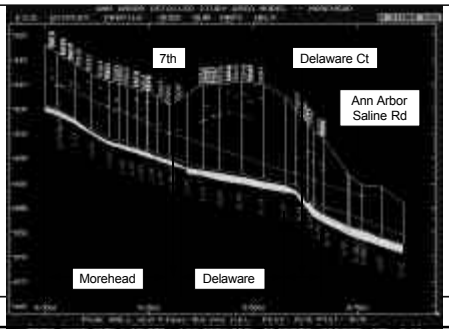
Morehead/Glen Leven Upsize/Storage Option 1



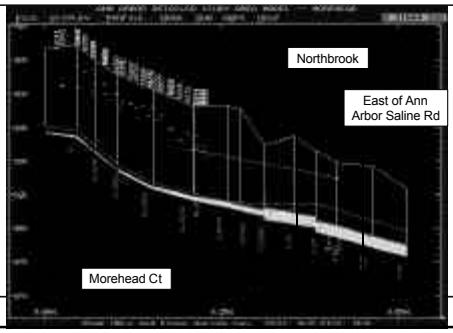
Morehead/Glen Leven Upsize/Storage Option 1

- Pros
  - ø Same as previous options
  - ø Additional peak flows not moved downstream to trunk sewer system
- Cons
  - ø Same as previous options
  - ø Require access to storage for maintenance
  - ø Potential for odors

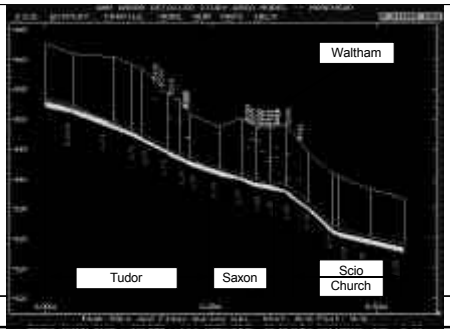
Morehead/Glen Leven Upsize/Storage Option 1



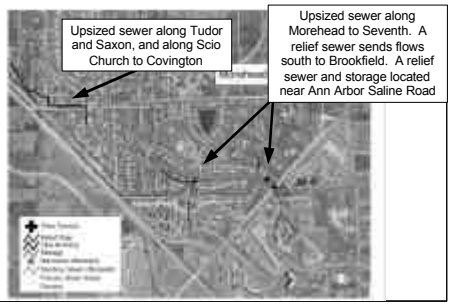
Morehead/Glen Leven Upsize/Storage Option 1



Morehead/Glen Leven Upsize/Storage Option 1



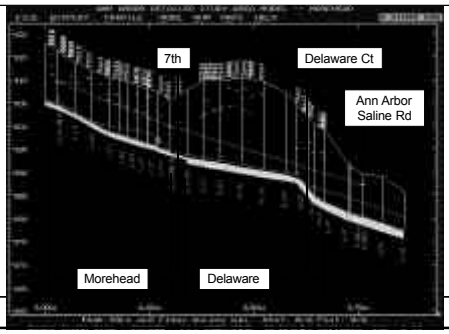
Morehead Upsize/Storage Option 2



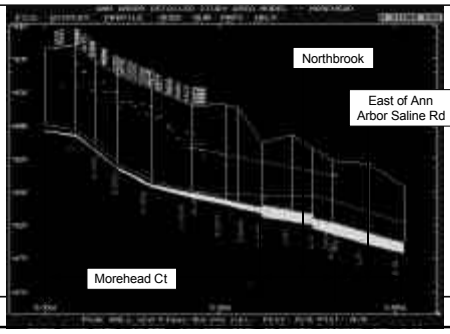
Morehead Upsize/Storage Option 2

- Pros
  - ø Same as previous options
  - ø Additional peak flows not moved downstream to trunk sewer system
- Cons
  - ø Same as previous options
  - ø Requires access to storage for maintenance
  - ø Potential for odors

Morehead Upsize/Storage Option 2



Morehead Upsize/Storage Option 2

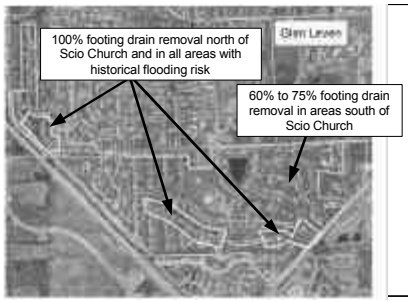


Morehead Upsize/Storage Option 2

Morehead Footing Drain Removal Option

- 60% to 75% of footing drains would have to be disconnected (100% in Saxon/Tudor area)
- This would include 450 to 560 homes
- Does not eliminate risk in the Saxon/Tudor area

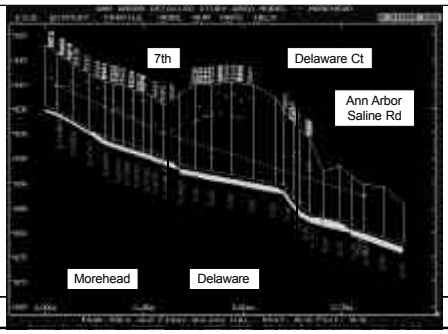
Morehead Footing Drain Removal Option



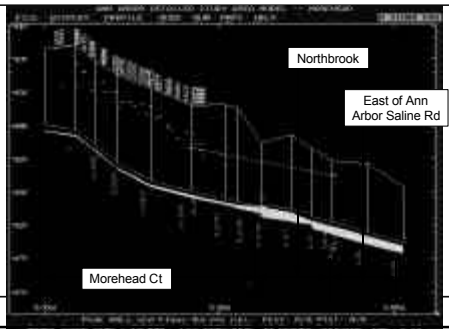
Morehead Footing Drain Removal Option

- Pros
  - ø No construction in street (but will be between sidewalk and street)
  - ø Flows to trunk sewer system and WWTP are reduced
- Cons
  - ø Requires construction in basements and lawns
  - ø Requires homeowner participation (60% to 75% to be effective)
  - ø Sump pumps must be connected to storm system

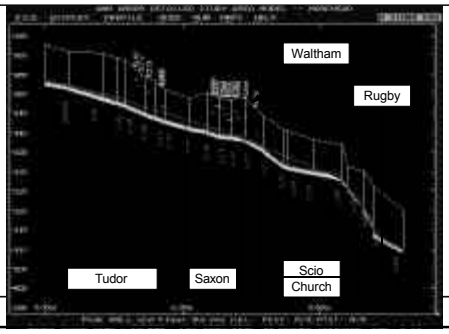
Morehead Footing Drain Removal Option



Morehead Footing Drain Removal Option



Morehead Footing Drain Removal Option



Glen Leven Study Area Construction Costs

Description	DC1	DC2
■ Relief[1]	$4.6M+	same
■ Upsizing[2]	$4.6M+	same
■ Upsizing/Storage #1	$4.3M	same
■ Upsizing/Storage #2	$4.0M	same
■ Disconnect	$3.3 - 4.1M	same

1 - Includes $4.6M of improvements in the study area and additional improvements in the trunk sewer system (cost under development)
2 - Includes $4.6M of improvements in the study area and and additional improvements in the trunk sewer system (cost under development)

Glen Leven Study Area Lifecycle Costs

Description	DC1	DC2
■ Relief[1]	$4.7M+	same
■ Upsizing[2]	$4.6M+	same
■ Upsizing/Storage #1	$4.3M	same
■ Upsizing/Storage #2	$4.0M	same
■ Disconnect[3]	$3.0 - 3.7M	same

1 - Includes $4.6M of improvements in the study area and additional improvements in the trunk sewer system (cost under development)
2 - Includes $4.6M of improvements in the study area additional improvements in the trunk sewer system (cost under development)
3 - Lower costs are from reduced flows at WWTP

Morehead Study Area Construction Costs

Description	DC1	DC2
■ Relief[1]	$4.2M+	same
■ Upsizing[2]	$4.4M+	same
■ Upsizing/Storage#1	$2.9M	$3.2M
■ Upsizing/Storage#2	$2.7M	$2.9M
■ Disconnect	$2.8-$3.4M	same

1 - Includes $4.2M of improvements in the study area additional improvements in the trunk sewer system (cost under development)
2 - Includes $4.4M of improvements in the study area additional improvements in the trunk sewer system (cost under development)

Morehead Study Area Lifecycle Costs

Description	DC1	DC2
■ Relief[1]	$4.3M+	same
■ Upsizing[2]	$4.4M+	same
■ Upsizing/Storage#1	$2.9M	$3.3M
■ Upsizing/Storage#2	$2.7M	$2.9M
■ Disconnect[3]	$2.5-$3.1M	same

1 - Includes $4.1M of improvements in the study area additional improvements in the trunk sewer system (cost under development)
2 - Includes $4.4M of improvements in the study area additional improvements in the trunk sewer system (cost under development)
3 - Lower costs are from reduced flows at WWTP

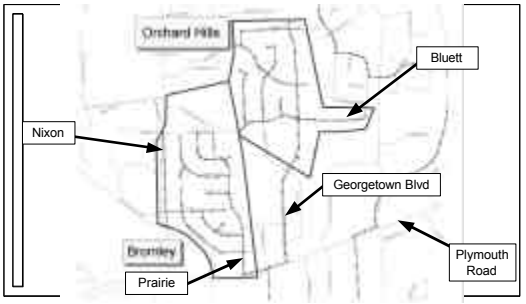
Glen Leven & Morehead Study Area Conclusions

- Alternative viable solutions are available
- Glen Leven cost ranges from $3.3M to $4.6M (or higher)
- Morehead cost ranges from $2.8M to $4.4M (or higher)
- Total cost ranges from $6.1M to $9.0M (or higher)
- Certainty of protection for footing drain option not completely understood

Ann Arbor SSO Task Force Alternatives Review - Bromley & Orchard Hills Areas

January 11, 2001

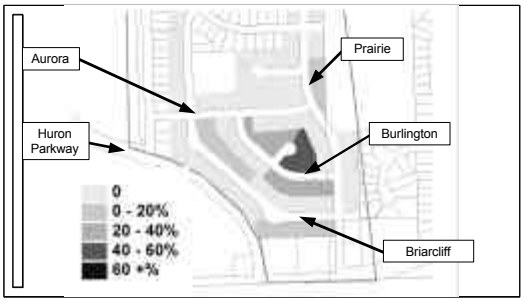
Bromley and Orchard Hills Study Areas



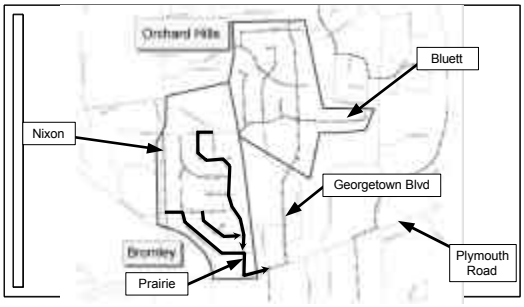
Bromley Study Area Homeowner Issues

- Flooding has been a chronic problem since the 1960s
- Frequent basement flooding in low lying areas
- Capacity bottlenecks from the area have been identified

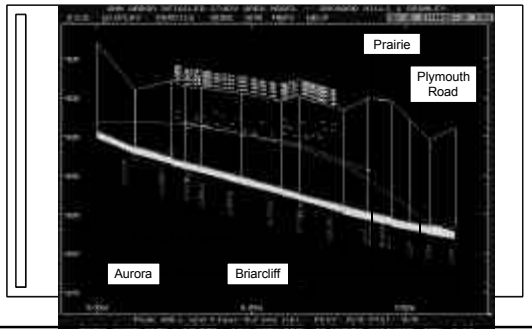
Flooding Locations in Bromley



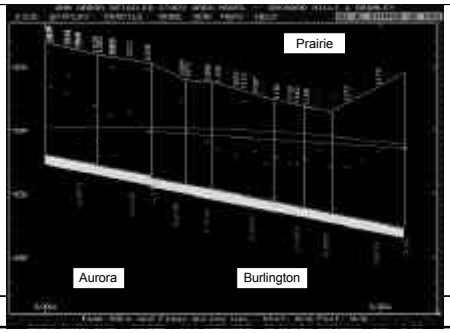
Bromley Sewer Profiles



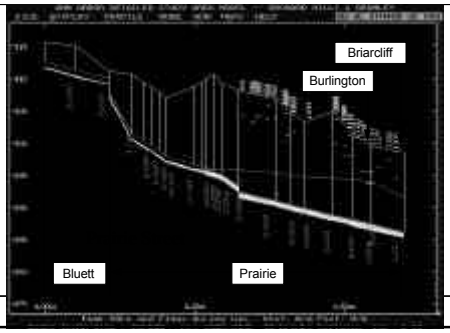
How Has this Impacted Homeowners in Bromley?



How Has this Impacted Homeowners in Bromley?



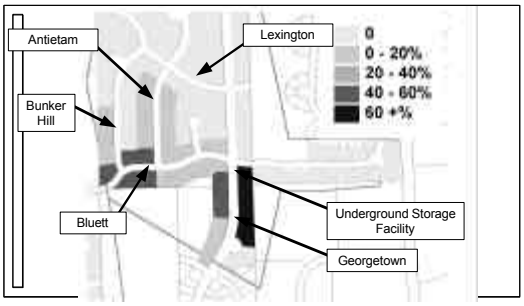
How Has this Impacted Homeowners in Bromley?



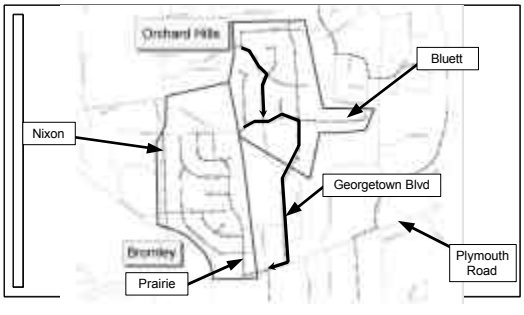
Orchard Hills Study Area Homeowner Issues

- Flooding has been a chronic problem since the 1960s
- Frequent basement flooding in low lying areas
- Capacity bottlenecks from the area
- Inadequate local storage

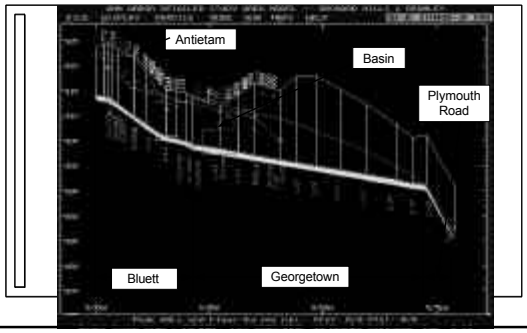
Flooding Locations in Orchard Hills



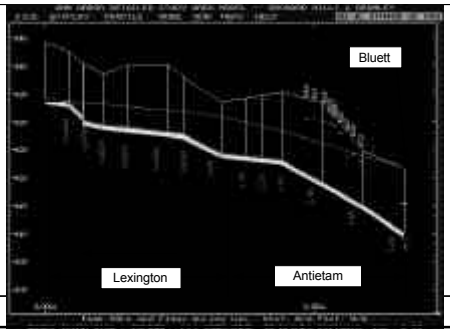
Orchard Hills Sewer Profiles



How are Homeowners Impacted in Orchard Hills?



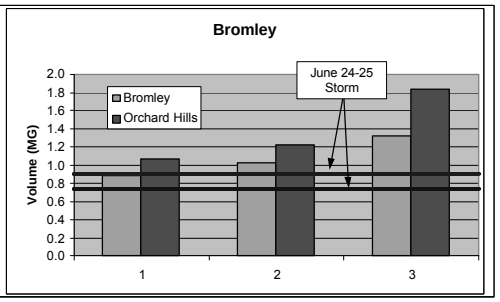
How are Homeowners Impacted in Orchard Hills?



Steps to Correcting Problems

1 Evaluate rain, flow, and level data
2 Understand wet weather response
3 Calibrate/validate models
4 Identify problems in each study area
5 Select design standard(s)
6 Develop control options
7 Review level of protection provided
8 Make recommendations

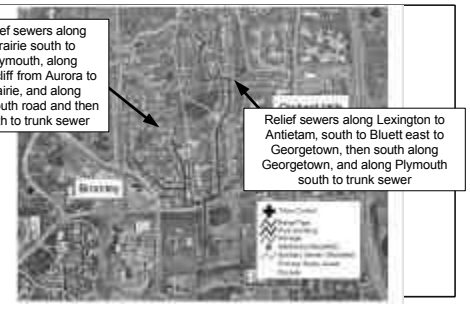
Design Conditions



Ways to Fix the Problem

- Install relief sewers
- Upsize the existing sewers
- Provide storage of wet weather flows
- Remove footing drain flow sources

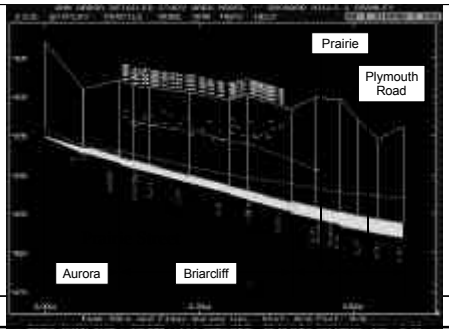
Bromley & Orchard Hills Relief Sewer Option



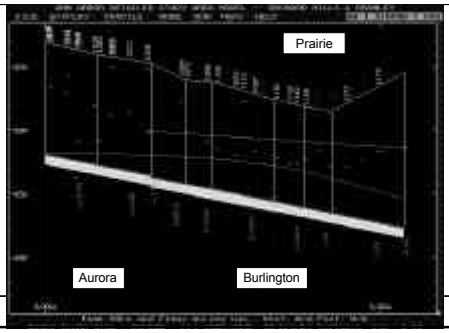
Bromley & Orchard Hills Relief Sewer Option

- Pros
  - ø Construction is in existing ROW and easements
  - ø Contractors are familiar with this construction method
- Cons
  - ø Construction disruption in streets
  - ø Larger peak flows would impact the trunk sewer system

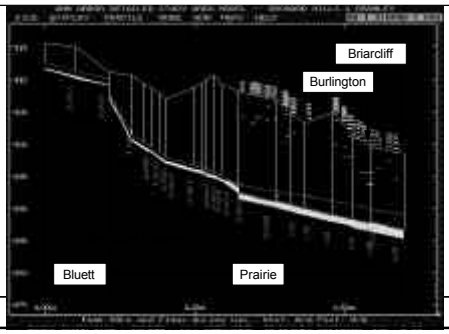
Bromley & Orchard Hills Relief Sewer Option



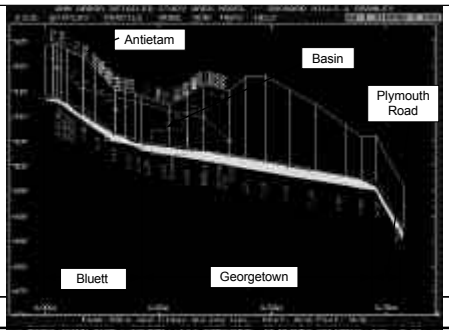
Bromley & Orchard Hills Relief Sewer Option



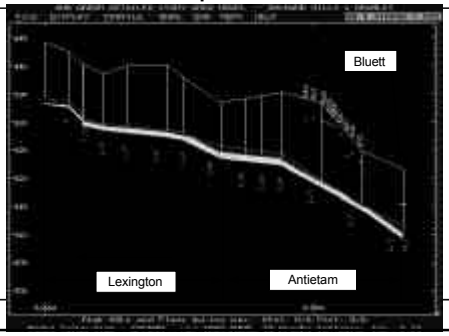
Bromley & Orchard Hills Relief Sewer Option



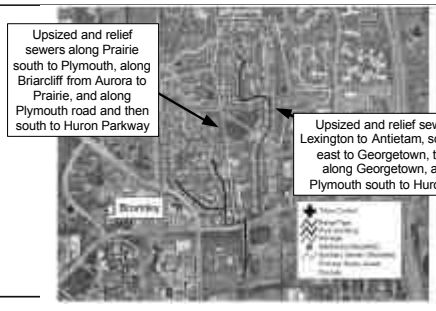
Bromley & Orchard Hills Relief Sewer Option



Bromley & Orchard Hills Relief Sewer Option



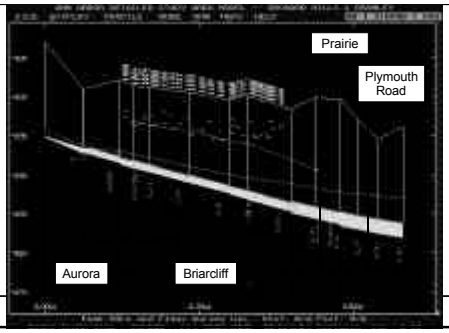
Bromley & Orchard Hills Upsizing/Relief Option



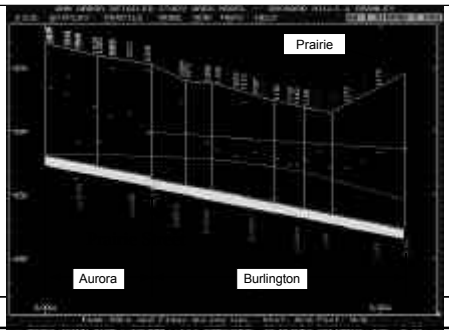
Bromley & Orchard Hills Upsizing/Relief Option

- Pros
  - ø Pipe-bursting used where possible (less traffic impacts)
  - ø Contractors are familiar with the relief portion of the construction
- Cons
  - ø Access pits will be required in street for many homes
  - ø Need specialized contractor for pipe-bursting work
  - ø Larger peak flows would impact the trunk sewer system

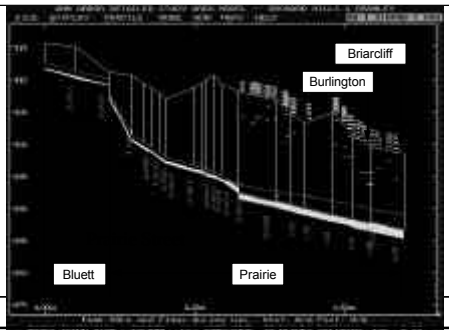
Bromley & Orchard Hills Upsizing/Relief Option



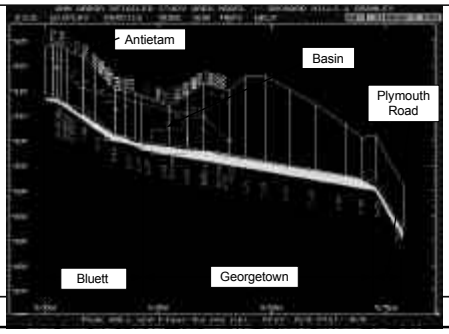
Bromley & Orchard Hills Upsizing/Relief Option



Bromley & Orchard Hills Upsizing/Relief Option



Bromley & Orchard Hills Upsizing/Relief Option



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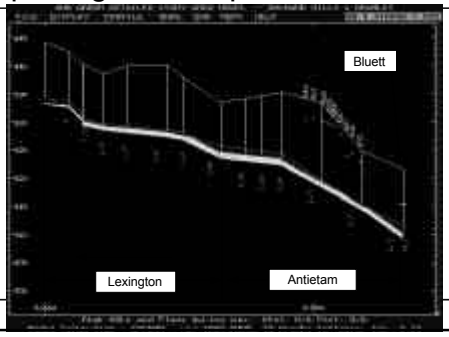
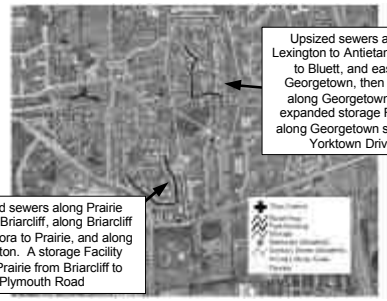


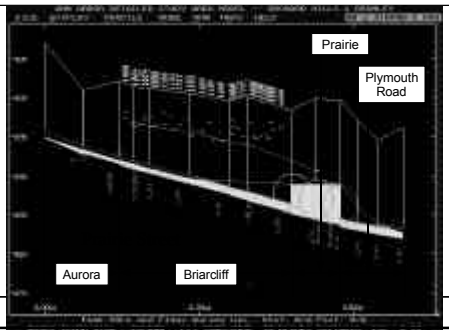
Bromley & Orchard Hills Upsizing/Storage Option



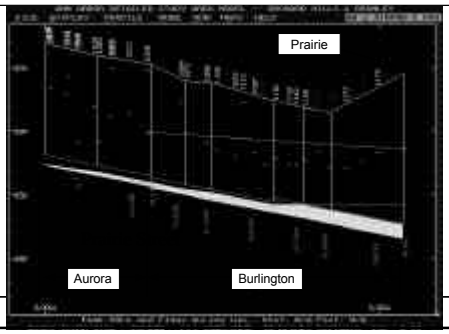
Bromley & Orchard Hills Upsizing/Storage Option

- Pros
  - ø Same as previous options
  - ø Additional peak flows not moved downstream to trunk sewer system
- Cons
  - ø Same as previous options
  - ø Require access to storage for maintenance
  - ø Potential for odors

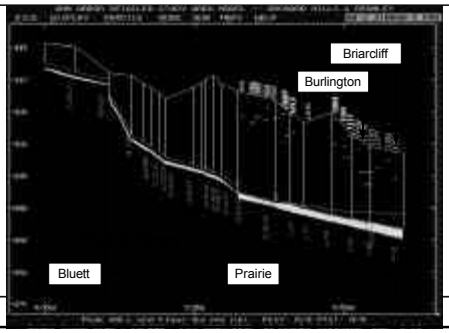
Bromley & Orchard Hills Upsizing/Storage Option



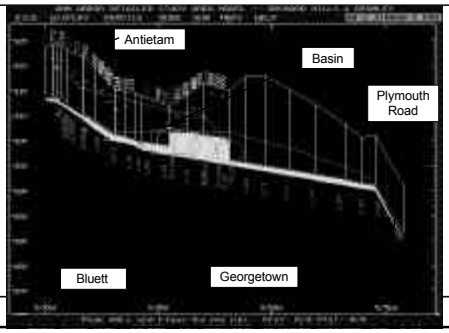
Bromley & Orchard Hills Upsizing/Storage Option



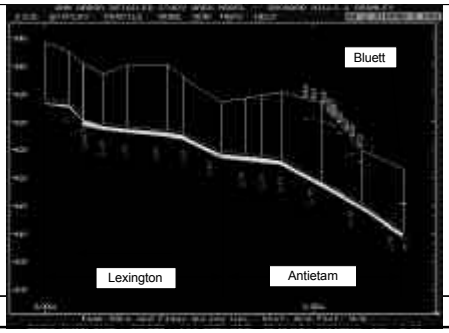
Bromley & Orchard Hills Upsizing/Storage Option



Bromley & Orchard Hills Upsizing/Storage Option



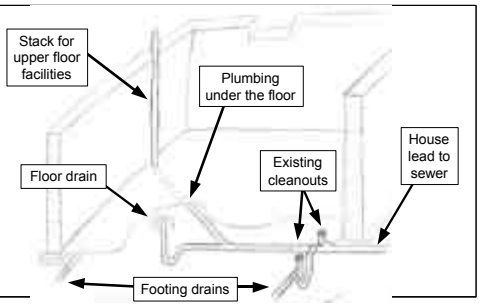
Bromley & Orchard Hills Upsizing/Storage Option



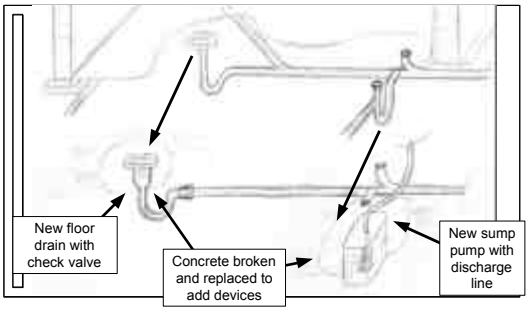
Bromley & Orchard Hills Footing Drain Option

- 75% to 100% of homes with footing drains would have to be disconnected
- Up to 250 homes in Bromley and 375 homes in Orchard Hills would have to be included for the program to be successful
- Includes routing sump pump flows to storm drains

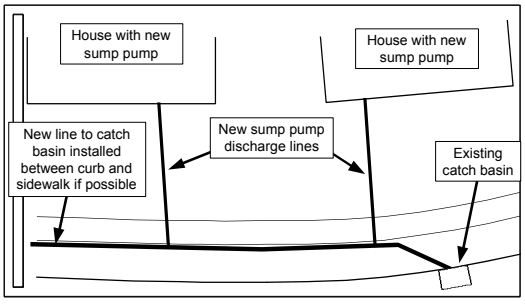
Footing Drain Removal Basement Plumbing



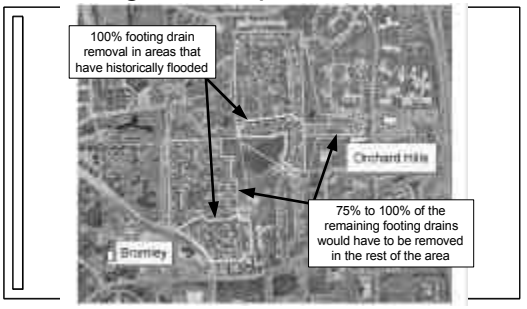
Footing Drain Removal Interior Plumbing Changes



Footing Drain Removal Exterior Changes



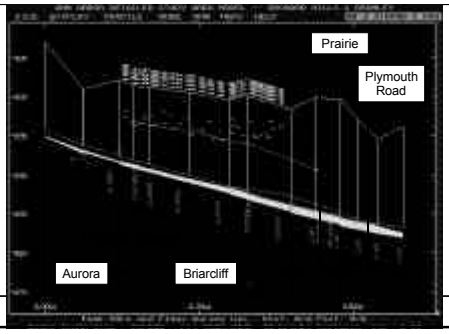
Bromley & Orchard Hills Footing Drain Option



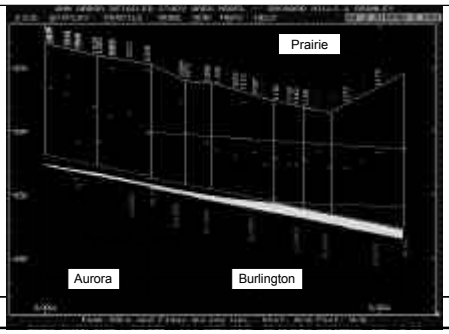
Bromley & Orchard Hills Footing Drain Option

- Pros
  - ø Limited construction in street (but will be between sidewalk and street)
  - ø Flows to trunk sewer system and WWTP are reduced
- Cons
  - ø Requires construction in basements and lawns
  - ø Homeowners responsible for maintaining sump pumps
  - ø Sump pumps must be connected to storm system

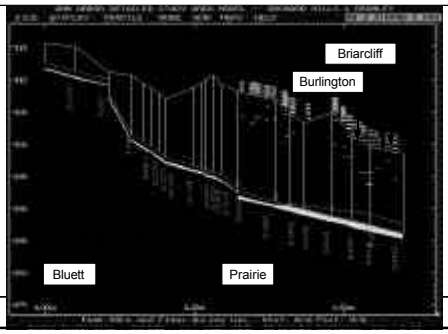
Bromley & Orchard Hills Footing Drain Option



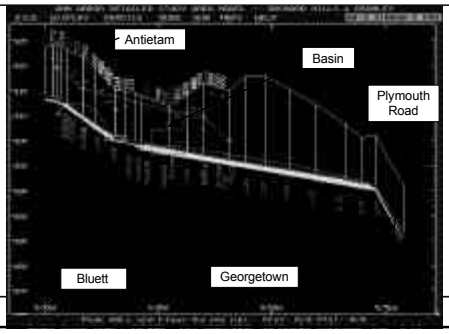
Bromley & Orchard Hills Footing Drain Option



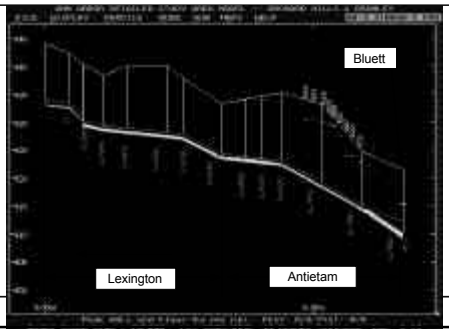
Bromley & Orchard Hills Footing Drain Option



Bromley & Orchard Hills Footing Drain Option



Bromley & Orchard Hills Footing Drain Option



Bromley Study Area Construction Costs

Description	DC1	DC2
■ Relief[1]	$2.1M+	same
■ Upsizing[2]	$2.0M+	same
■ Upsizing/Storage	$2.0M	same
■ Disconnect	$1.2 - 1.6M	same

1 - Includes $2.1M of improvements in the study area and additional improvements in the trunk sewer system (cost under development)
2 - Includes $2.0M of improvements in the study area and and additional improvements in the trunk sewer system (cost under development)

Bromley Study Area Lifecycle Costs

Description	DC1	DC2
■ Relief[1]	$2.1M+	same
■ Upsizing[2]	$2.0M+	same
■ Upsizing/Storage	$2.0M	same
■ Disconnect[3]	$1.0 - 1.4M	same

1 - Includes $2.1M of improvements in the study area and additional improvements in the trunk sewer system (cost under development)
2 - Includes $2.0M of improvements in the study area and and additional improvements in the trunk sewer system (cost under development)
3 - Lower costs are from reduced flows at WWTP

Orchard Hills Study Area Construction Costs

Description	DC1	DC2
■ Relief[1]	$2.9M+	same
■ Upsizing[2]	$2.8M+	same
■ Upsizing/Storage	$2.2M	same
■ Disconnect	$1.9 - 2.3M	same

1 - Includes $2.9M of improvements in the study area and additional improvements in the trunk sewer system (cost under development)
2 - Includes $2.8M of improvements in the study area and and additional improvements in the trunk sewer system (cost under development)

Orchard Hills Study Area Lifecycle Costs

Description	DC1	DC2
■ Relief[1]	$2.9M+	same
■ Upsizing[2]	$2.8M+	same
■ Upsizing/Storage	$2.2M	same
■ Disconnect[3]	$1.7 - 2.1M	same

1 - Includes $2.9M of improvements in the study area and additional improvements in the trunk sewer system (cost under development)
2 - Includes $2.8M of improvements in the study area and and additional improvements in the trunk sewer system (cost under development)
3 - Lower costs are from reduced flows at WWTP

Bromley & Orchard Hills Study Area Conclusions

- Alternative viable solutions are available
- Bromley cost ranges from $1.2M to $2.1M (or higher)
- Orchard Hills cost ranges from $1.9M to $2.9M (or higher)
- Total cost ranges from $3.1M to $5.0M (or higher)
- Certainty of protection for footing drain option not completely understood

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Appendix K - Council Presentations

Two presentations were made to City Council to inform council members about project status, residents' concerns, and proposed solutions. The September 2000 and January 2001 presentations are included in this appendix. Subsequent to the Council meetings, these presentation materials were posted to the project's website.

Sanitary Sewer Overflow (SSO) Prevention Advisory Task Force Presentation to Ann Arbor City Council

September 11, 2000
Council Working Session

What is the Purpose for this Presentation?

- Provide information on what has been learned so far during the project
- Share early information on recommendations being formulated
- Provide feedback on customer issues and concerns
- Help provide a project that is more responsive to citizen and City Council needs and expectations

What is the Agenda?

- SSO Prevention Task Force Objectives
- Description of the Problem
- Project Activity Summary
- Public Workshop Feedback

Task Force Background and Objectives

SSO Task Force: What Is It?

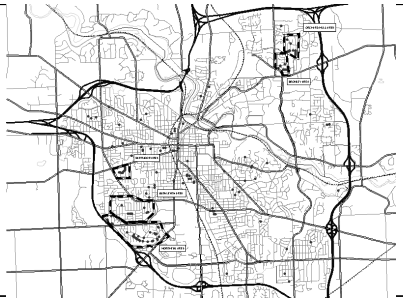
- Proposed in March, 1999 by neighborhood groups and residents relative to concerns over the August 1998 sewage backup event
- Approved in July, 1999 by City Council
- 15-member committee representing City, neighborhood residents, and other professionals
- Task Force selected and is directing consultant in carrying out the study

SSO Task Force: What are its Objectives?

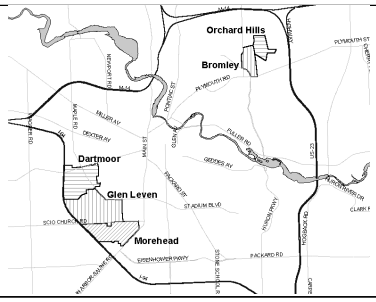
- Design and conduct a study to determine causes
- Identify possible solutions
- Develop and maintain strong public engagement throughout the process
- Recommend solutions and funding options to City Council.

Description of the Problem

Where have Problems been Observed?



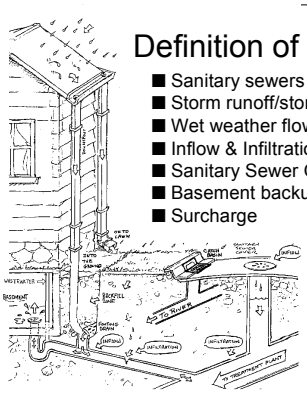
Where are the Primary Study Areas?



5% of the City

50% of the flooding problems

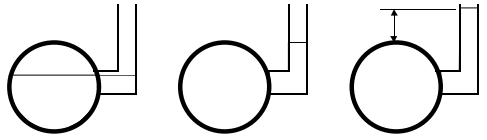
Definition of Terms



- Sanitary sewers
- Storm runoff/storm sewers
- Wet weather flow
- Inflow & Infiltration (I/I)
- Sanitary Sewer Overflow (SSO)
- Basement backup (floor drains)
- Surcharge

What is Sewer Surcharging?

Surcharging is when the level of water in a sewer is higher than the top of the pipe



Partially full pipe (not surcharged) | Completely full pipe (not surcharged) | Surcharged pipe

The June 24-25 Storm: How Big Was it?

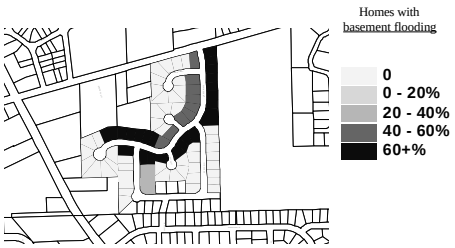
- Produced between 3" and 4" of rainfall
  Heaviest rainfall in Southwest (Dartmoor and Glen Leven)
- Rainfall took place between 10:00 PM (6/24) and 2:00 AM (6/25)
- Caused basement flooding in each of the 5 primary study areas

June 24-25 Storm: How Did it Impact the City?

Area	Rainfall	Homes Reported Flooded
Orchard Hills	2.9”	25
Bromley	3.2”	11
Dartmoor	4.0” *	23
Glen Leven	4.0”	21
Morehead	3.5”	11
Other Areas	--	113
Total	--	204

* Estimated

Dartmoor Area: Where Did Basements Flood?



Project Activity Summary

What are the Study Issues?

- What type of problems exist?
- Where have these problems taken place?
- When have these occurred?
- Who is impacted?
- How can it be fixed?
- What steps are recommended?

What Activities are Ongoing?

- Field efforts
  - Manhole inspections
  - Flow and rainfall monitoring
  - Inflow/Infiltration investigations
- Homeowner survey
- Peer community data collection
- Computer modeling
- Problem assessment
- Schedule and decision points

What are the Results of the Manhole Inspections?

- Approximately 750 manholes have been inspected
- 24 manholes/pipes have been identified as requiring cleaning (all minor)
- Overall condition of the system has been found to be very good and well maintained
- Questions about how flows are routed within the sewer system have been resolved

What Rainfall was Monitored this Year?

Area	Number of storms that exceeded 0.5"	1"	2"	3"
Orchard Hills	10	7	2	0
Bromley	12	7	3	1
Dartmoor	10	6	2	1
Glen Leven	12	6	3	1
Morehead	13	6	2	1

Local information shows that larger and more intense storms are occurring more frequently than in the past

What Happened in the Sewers this Year?

Area	Biggest Event: 6/25/00 Peak Surcharge Rain (in)	Meter (in)	PLR (in)	Peaking Factor*	Number of Surcharges Recorded Meter	PLR
Orchard Hills	2.9	94	88	13	7	4
Bromley	3.2	66	77	23	6	3
Dartmoor	4.0	162	150	7	4	1
Glen Leven N.	4.0	69	87	22	3	2
Glen Leven S.	4.0	-----	-----	37	0	----
Morehead	3.5	-----	81	19	1	1

* equal to the maximum flow rate observed during the event divided by the average daily flow rate
**based on 4 readings after the 4 largest events

What Observations can be Made from this?

- Bromley, Orchard Hills, Dartmoor, and Glen Leven N. surcharge frequently
- Bromley and Orchard Hills have high I/I and may have limited discharge capacity
- Dartmoor may have a downstream constraint/ upstream flows that cause surcharging
- Morehead and Glen Leven may have pipe limitations that cause basement flooding

It is likely that different solutions will be recommended in different areas

What I/I Investigations are Ongoing?

- Sewer system I/I work is complete
- Monitoring selected house leads to quantify footing drain contribution
- Identifying homes with potentially connected downspouts and stairwell drains
- Using dye testing to locate discharge locations
- Performing limited smoke testing
- Piloting homeowner protection and I/I removal options

How Many Downspouts have been Inspected?

Element	Dartmoor, Glen Leven, & Morehead	Bromley & Orchard Hills[1]	TOTAL	Stats
Single family homes	1,876	511	2,387	100%
Homes Inspected	1,876	511	2,387	100%
Downspouts within 5' of home	815	372	1,187	50%
Downspouts go into ground	161	41	202	8%
Exterior drains	2	6	8	0.3%

Notes:
[1] Previous work and estimated numbers in the project study area.

What does this Tell us?

- Half of the homes have already extended their downspouts more that 5'
- Remaining homes may not be able to extend downspouts away from home
- No downspouts were found connected to the sewer system
- Only one area drain found to capture significant storm flow
- Additional downspout work not likely to solve the basement flooding problem

What is the Background of the Pilot Installations?

- Why evaluate residential protection methods?
  - Determine available corrective methods
  - Gather local construction costs
  - Understand implementation hurdles (social costs)
  - Determine effectiveness of different solutions
- What are the best methods to use?
  - Methods to route surface runoff away from stairwell/area drains
  - Best installations of check-valves and sumps
  - Evaluation of different sump pump types

What is the Status of the Pilot Installations?

- Over 25 homes inspected
- Objective criteria used to select 13 homes for piloting different methods
- Working to select contractors to perform work
- Expect to complete installations in October
- Will identify homeowner issues during installation
- Results and cost of performing work will be factored into the recommendations

What are the Results of the Homeowner Survey?

- Why do a survey?
  - Ensure we know where flooding has occurred
  - Gather data on type of flooding experienced
- What did we learn?
  - People care - received 400 responses from 500 surveys
  - We have a good definition of the problems experienced

What are the Results of the Homeowner Survey?

- New information:
  - In the June storm, several homes experienced flooding for the first time
  - This may have been caused by:
    - storm location and intensity
    - new development
    - changes in home plumbing systems in their area
    - others issues

What Have Other Communities Done?

Community	Steps Taken	Lessons Learned
West Lafayette IN	Footing drain removal undertaken at City expense.	While more costly than relief sewers, this was projected to be more cost effective in the long term.
Columbus OH	Relief sewer construction because of downstream constraints	All I/I removal alternatives would not resolve the issue that required additional outlet capacity
Riverview MI	Piloted footing drain removal and rehabilitated and replaced existing sewers	Construction on private property can be an implementation hurdle. Rehab of failing sewers can reduce I/I to acceptable levels.
Canton MI	Removed wet weather flooding drain flows with special sump pumps using Township funding	I/I removal has been very good and implementation on private property well accepted. Homeowner maintenance of sump pumps a potential issue.

What Have We Learned from these Communities?

- No single solution is universally applicable
- Some good technical solutions may not be implementable because of social costs
- There are usually several ways to get to an acceptable solution

What Sewer System Modeling will be Done?

- Project team is using a dynamic model that uses actual system response - flow monitoring
- Project is evaluating specific storms, including recent large storms and their I/I factors
- Will use the model to evaluate proposed corrective action alternatives
- Work will focus on homes prone to flooding so that solutions will not move problems to others

What is the Range of Alternatives?

- Solutions that reduce wet weather flows
  - Remove the I/I sources - downspouts, stairwell drains, footing drains, sewer improvements, etc.
  - Provide flow protection for “at risk” homes - using check valve and sump pump
- Solutions that better manage flows
  - Increase the sewer capacity if required
  - Add storage to reduce peak flows

Public Workshop Feedback

What about Public Involvement?

- Why have it?
  - To help homeowners know about the study as it progresses
  - To help the Task Force to know and be responsive to homeowners' priorities
  - To help build implementation support for the recommendations

What about Public Involvement?

- What does it include?
  - Public workshops at milestones of the study
  - Website provides continuing information on project activities, meeting minutes and follow up from previous public workshops
  - Newsletters sent to 3,100 addresses in 5 study areas
  - 24-hour phone contact available for concerned homeowners

What about Public Involvement?

- When are the workshops?
  - Two workshops held in April and July, 2000
  - Two workshops scheduled for October 2000 and January 2001.

Residents' Requests - Previous Workshop

- Identify and implement GOOD, WORKABLE SOLUTIONS for the whole system. 'Don't want solution in one area to move problem elsewhere.'
  - The Citywide trunk sewer model will be a basis of for evaluating alternatives
- Keep citizens involved throughout the process.
  - Website, newsletter, surveys, meetings being used to ensure this

Residents' Requests - Previous Workshops

- How do we help and protect ourselves?
  - Researched vendors offerings to protect homes
  - Met w/ plumbing professionals and City staff
  - Added a pilot study project task

Residents' Requests - Previous Workshops

- Develop and use a good emergency management process
  - Educating City staff using checklists and 'scripts'
  - Evaluate using a single emergency phone number
- Can Emergency Response be improved?
  - Response in 2000 much improved over 1998
  - City staff working to provide a more unified response for future events
  - Expanded "Peer Communities Review" task to evaluate other emergency response measures

Residents' Requests - Previous Workshops

- What is the impact of development?
  - Development could be affecting flooding in some areas
  - No easy answers. It is work in progress
  - Tools being developed will be only partially helpful in answering this question
  - Project is reviewing impact of new developments near the 5 study areas

Residents' Requests - Previous Workshops

- Can the claims process be streamlined?
  - New claim forms being developed
  - City can help with filling out the new forms
  - Insurance board meeting as required to provide better response to submitted claims
- Will City Council help, now and later?
  - Resolution recently adopted addressed many of current homeowner concerns
  - Homeowners still have concerns about support from Council if costly improvements are needed

Residents' Requests - Previous Workshops

- What can I do to help and protect myself?
  - Make sure house lead is well maintained
  - Drain downspouts and other surface drainage away from house (at least 5 feet)
  - Make sure no outside drains receive storm flows
  - Install properly located check valve(s) in combination with sump pump
    - *Basement floor drain plugs and standpipes are not recommended to prevent backups due to the potential for fluid pressure buildup beneath the basement floor causing the floor crack or buckle.*
    - *Check-valves installed without a sump pump are not recommended for similar reasons.*

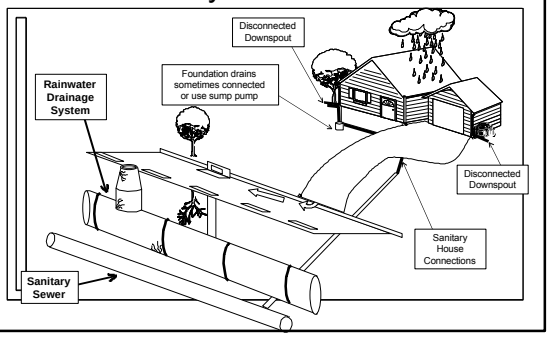
Ann Arbor SSO Task Force Alternatives Review

January 29, 2001

Agenda

- Review study area issues
- Identify problem areas
- Describe correction options available
- Preliminary costs for each option
- Recommended solution(s)
- Implementation plan
- Next steps

Sanitary & Storm Collection Systems



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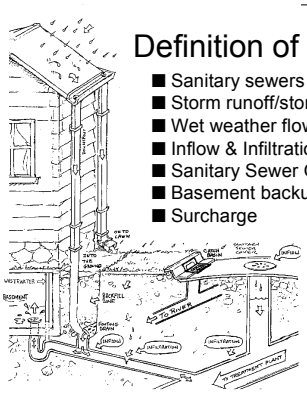

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- Basement backup (floor drains)
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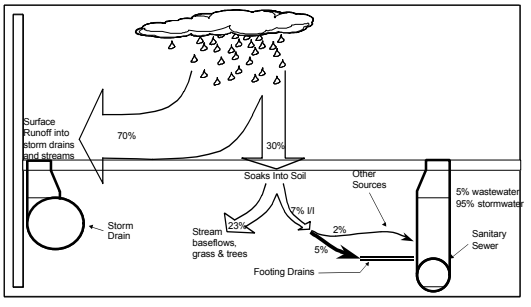
Where Does the Rain Go?



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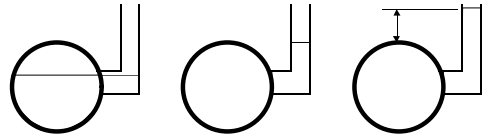
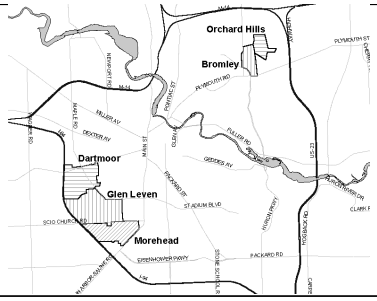


Partially full pipe (not surcharged) | Completely full pipe (not surcharged) | Surcharged pipe

Where are the Primary Study Areas?



5% of the City

50% of the flooding problems

Study Area Issues

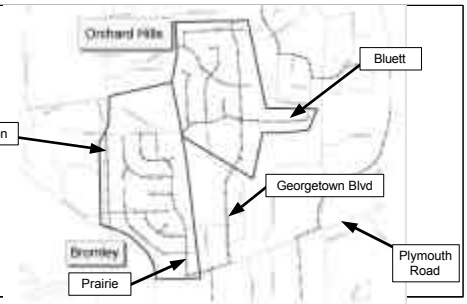
- Orchard Hills
- Bromley

} Northwest Areas

- Dartmoor
- Glen Leven
- Morehead

} Southwest Areas

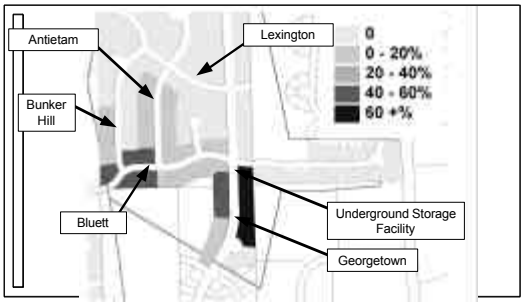
Orchard Hills and Bromley Study Areas



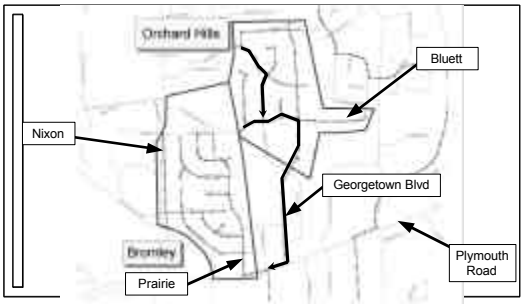
Orchard Hills Study Area Homeowner Issues

- Flooding has been a chronic problem since the 1960s
- Frequent basement flooding in low lying areas
- Capacity bottlenecks from the area
- Inadequate local storage

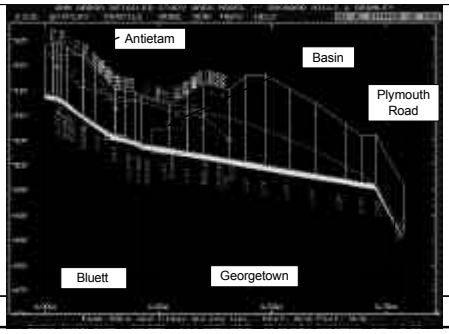
Flooding Locations in Orchard Hills



Orchard Hills Sewer Profiles



How are Homeowners Impacted in Orchard Hills?



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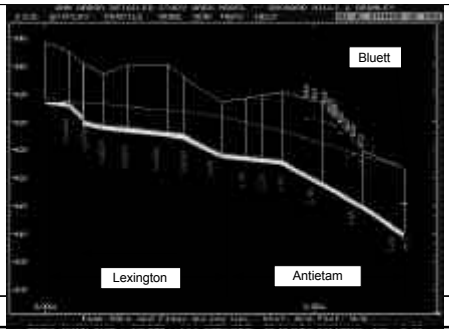
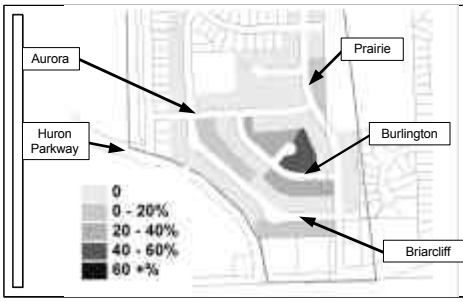


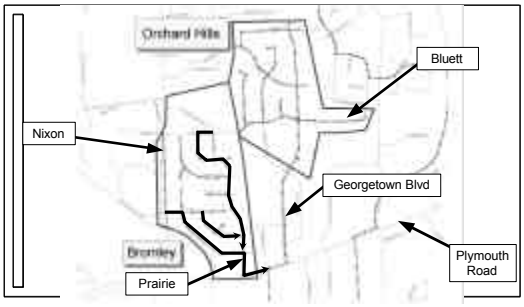
Bromley Study Area Homeowner Issues

- Flooding has been a chronic problem since the 1960s
- Frequent basement flooding in low lying areas
- Capacity bottlenecks from the area have been identified

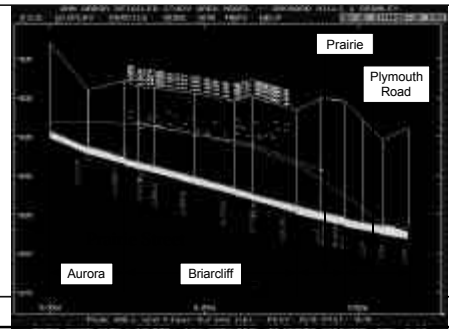
Flooding Locations in Bromley



Bromley Sewer Profiles



How Has this Impacted Homeowners in Bromley?



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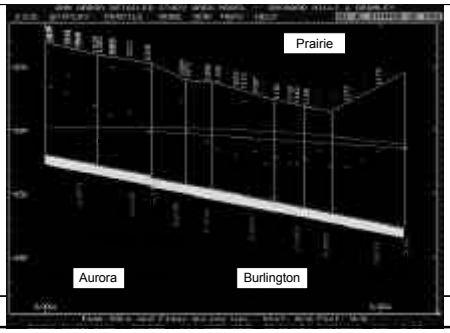

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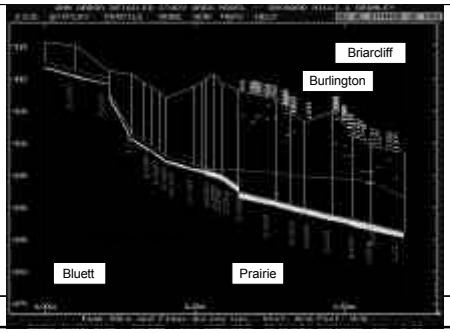
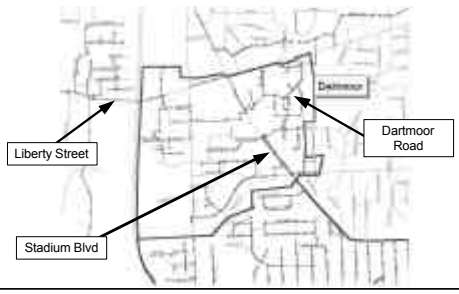


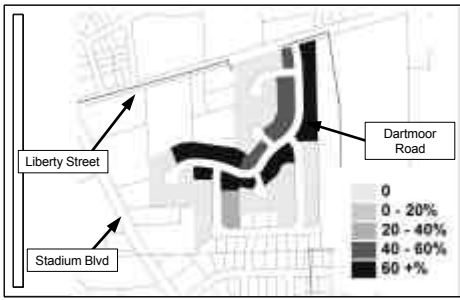
Dartmoor Study Area



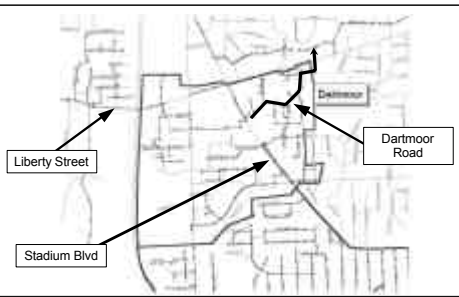
Dartmoor Study Area Homeowner Issues

- No basement flooding was observed prior to 1998
- Residents have flooded only along Dartmoor Road
- Concerns have centered on additional flows from recent developments

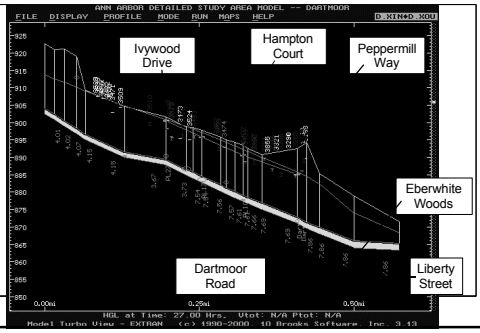
Dartmoor Study Area Flooding Locations



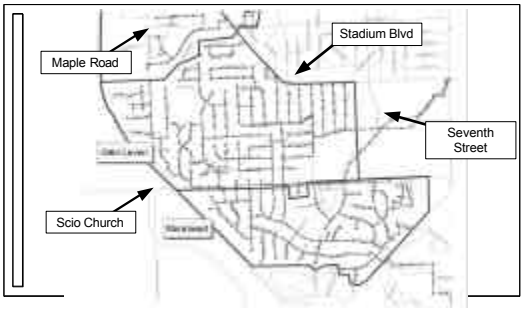
Dartmoor Study Area Sewer Profile



How has this Impacted Dartmoor Homeowners?



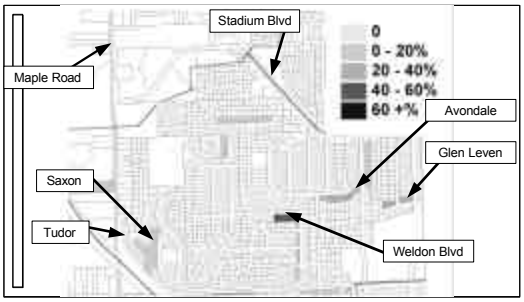
Glen Leven and Morehead Study Areas



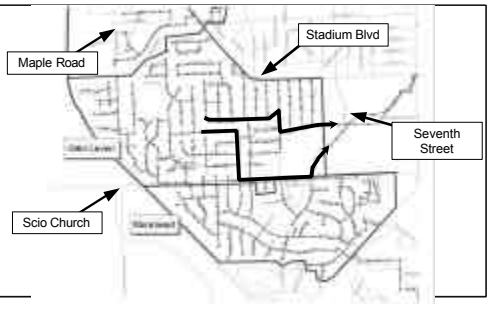
Glen Leven Study Area Homeowner Issues

- Basement flooding has been observed since the 1970s
- Residents have flooded along Glen Leven, Weldon, and Avondale
- Past construction has provided relief of some, but not all issues

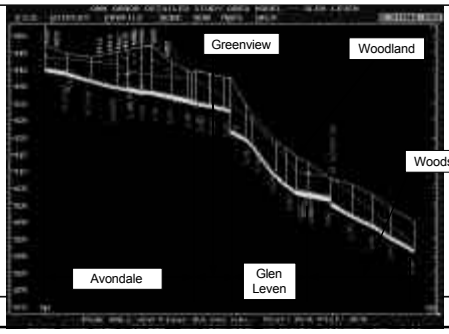
Glen Leven Flooding Locations



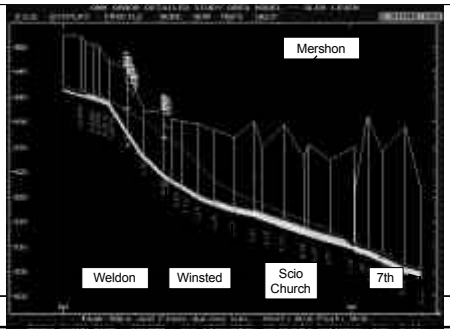
Glen Leven Study Area Profiles



How Has this Impacted Homeowners Glen Leven?



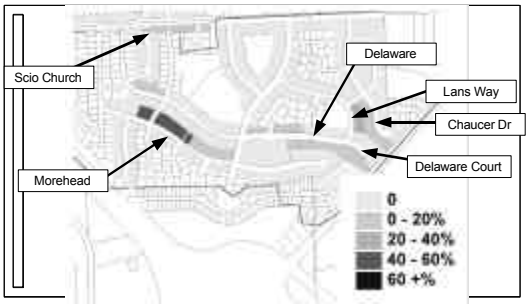
How Has this Impacted Homeowners Glen Leven?



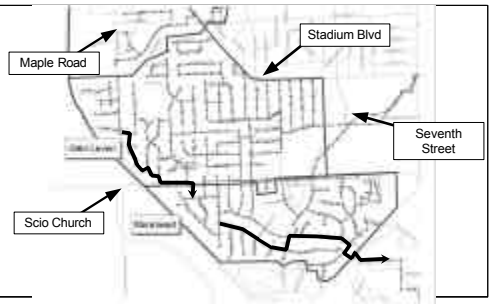
Morehead Study Area Homeowner Issues

- Basement flooding has been observed since the 1970s
- Residents have flooded along Saxon, Tudor, Morehead, Chaucer Drive, Lans Way, and Delaware
- Past construction has provided relief of some, but not all issues
- Concerns include additional flows from recent developments

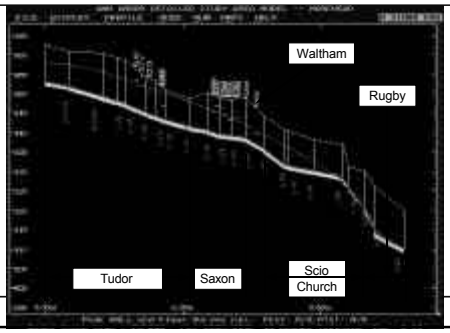
Morehead Flooding Locations



Morehead Study Area Profiles



How are Morehead Homeowners Impacted?



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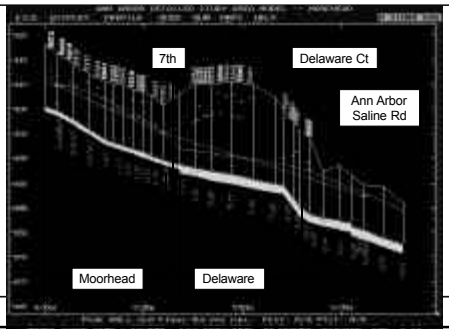

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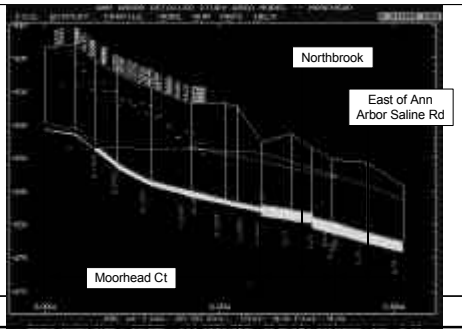
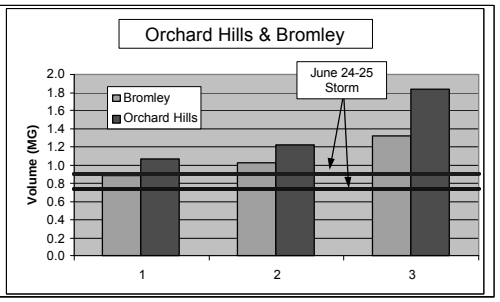


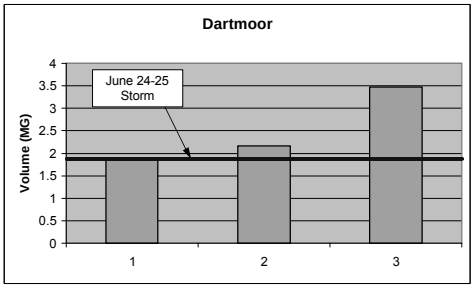
Steps to Correcting Problems

1 Evaluate rain, flow, and level data
2 Understand wet weather response
3 Calibrate/validate models
4 Identify problems in each study area
5 Select design standard(s)
6 Develop control options
7 Review level of protection provided
8 Make recommendations

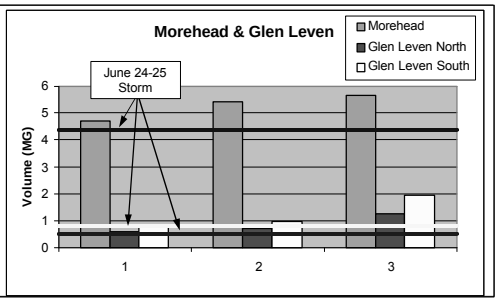
Orchard Hills & Bromley Design Conditions



Dartmoor Study Area Design Conditions



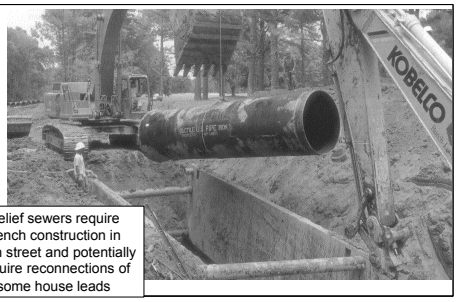
Morehead and Glen Leven Design Conditions



Corrective Alternatives

- Install relief sewers
- Upsize the existing sewers
- Provide storage of wet weather flows
- Remove footing drain flow sources

Relief Sewer Construction

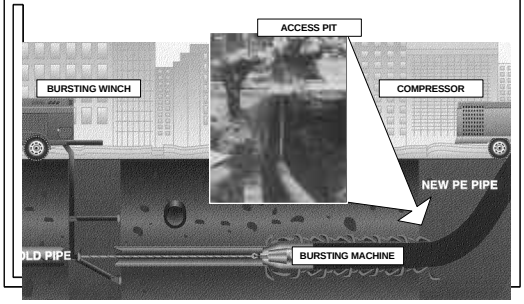


Relief sewers require trench construction in each street and potentially require reconnections of some house leads

Relief Sewer Options

- Pros
  - ø Construction is typically in existing road ROW and existing easements
  - ø Contractors are familiar with this construction method
- Cons
  - ø Construction disruption in streets during construction
  - ø Lower quality street surface after project
  - ø Larger peak flows potentially require trunk sewer system upgrades

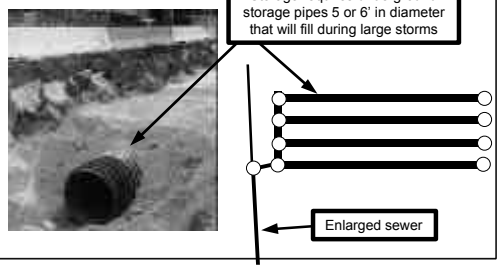
Upsizing (Pipe-bursting) Construction



Upsizing Option

- Pros
  - ø Pipe-bursting has less traffic impacts
  - ø Installations can be done more quickly than open cut construction
- Cons
  - ø Access pits will be required in street for all connected homes
  - ø Need specialized contractor for pipe-bursting work
  - ø Larger peak flows potentially require trunk sewer system upgrades

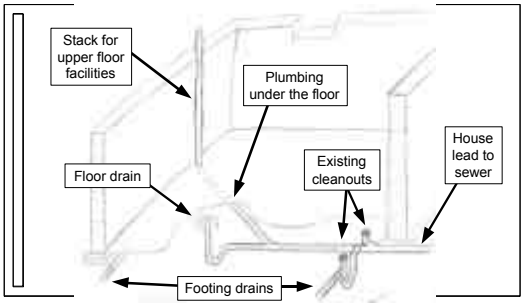
Upsizing/Storage Construction



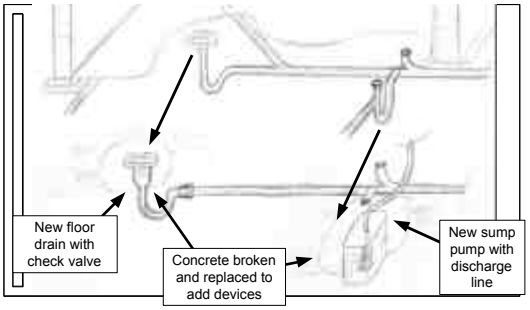
Upsizing (and/or Relief) /Storage Options

- Pros
  - ø Pipe-bursting has less traffic impacts
  - ø Installations can be done more quickly that open cut construction
  - ø Additional peak flows not moved downstream to trunk sewer system
- Cons
  - ø Same as relief or upsizing options
  - ø Require access to storage for maintenance
  - ø Potential for odors

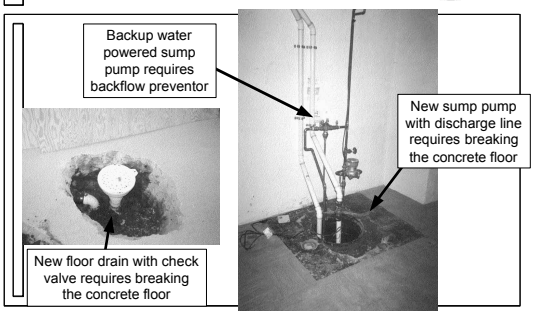
Footing Drain Removal
Basement Plumbing



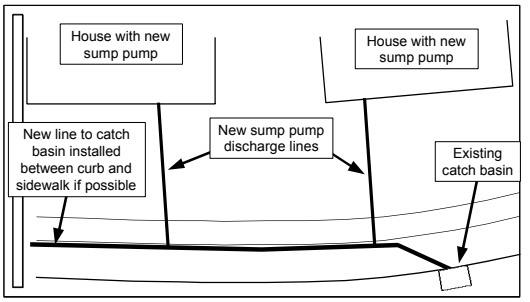
Footing Drain Removal
Interior Plumbing Changes



In-home Construction



Footing Drain Removal
Exterior Changes



Curb Drain Construction

Trenching of sump pump discharge would be required from each house to the curb drain. Similar trenching would be required along the sidewalk to convey flows to the catch basins.

Footing Drain Option

- Pros
  - Limited construction in street (but will be between sidewalk and street)
  - Flows to trunk sewer system and WWTP are reduced
  - Helps homeowners with drainage problems on property
- Cons
  - Requires construction in basements and lawns
  - Homeowners responsible for maintaining sump pumps
  - May require venting of sump for radon gas

Other Alternative Components

- Low flow fixtures:
  - Shower heads
  - Faucets
  - Toilets
- Rain barrels
- Rain gardens

Low Flow Fixtures

- Can be used to reduce wastewater flow from individual homes
- Should be encouraged to reduce water and wastewater treatment needs
- Would reduce peak flows in these areas by less than 1-2%
- Application would not resolve flooding

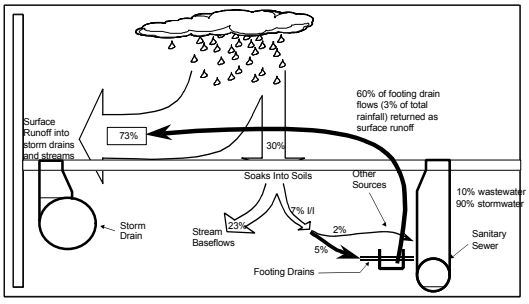
Rain Barrels/Rain Gardens

- Can capture flows from roofs that would normally enter the storm drainage system
- Encourages infiltration for smaller storms
- Would reduce peak flows into storm drainage system by less than 2-4%
- Application would not resolve flooding

Other Concerns Raised

- Increased stormwater flows from sump pump discharges
- Increase in flows from other sources connected to curb drains
- Radon gas from sump pump installations
- Impacts of alternatives on SSO discharge prohibition
- Practicality of pipe bursting

Concern of Increased Stormwater Flows



Concern of Radon Gas from Sump Pumps

- Radon gas is present in some Ann Arbor homes
- Basement slab penetrations may provide pathways to living space
- Testing can provide indication of potential problem
- Vented sumps can be used in locations with elevated radon gas levels

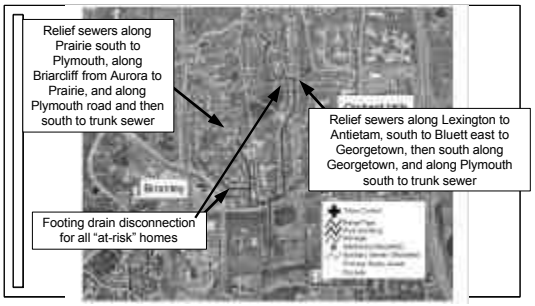
Concern of Impacts on SSOs at WWTP

- Pending SSO regulations may make discharges at WWTP more problematic
- Relief and upsizing options may cause more frequent discharges
- These options may require additional facilities (with additional costs) at the WWTP

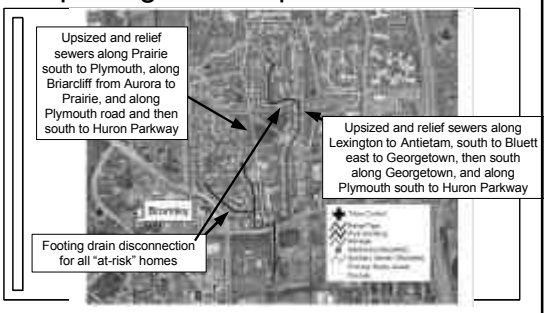
Concerns about Pipe-bursting Alternatives

- Method has been successfully used in Ann Arbor
- Inexperienced contractors must not be used (prequalification required)
- May provide the opportunity for concurrent replacement of "Orangeburg" pipe used for house connections

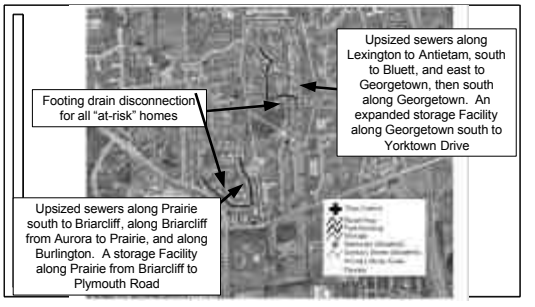
Bromley & Orchard Hills Relief Sewer Option



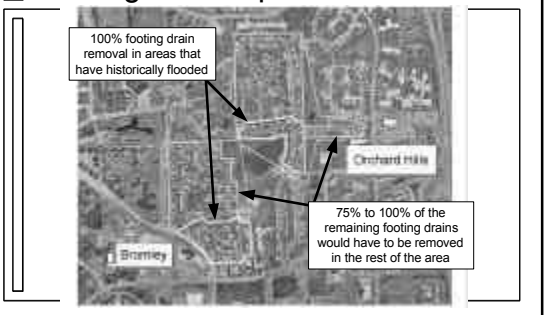
Bromley & Orchard Hills Upsizing/Relief Option



Bromley & Orchard Hills Upsizing/Storage Option



Bromley & Orchard Hills Footing Drain Option



Orchard Hills Study Area Construction & Lifecycle $

Description	Constr.	Lifecycle
■ Relief[1]	$3.3M	$3.3M
■ Upsizing[2]	$3.2M	$3.2M
■ Upsizing/Storage	$2.2M	$2.2M
■ Disconnect[3]	$1.9-2.3M	$1.7-2.1M

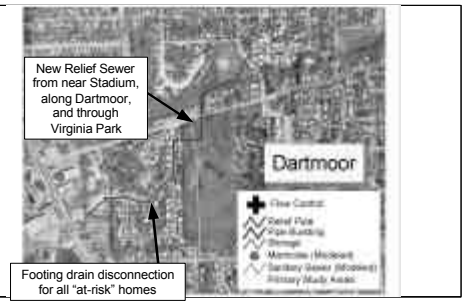
1 - Includes $2.9M of improvements in the study area and additional $0.4M in improvements in the trunk sewer system
2 - Includes $2.8M of improvements in the study area and and additional $0.4M improvements in the trunk sewer system
3 - Lower costs are from reduced flows at WWTP

Bromley Study Area Construction & Lifecycle $

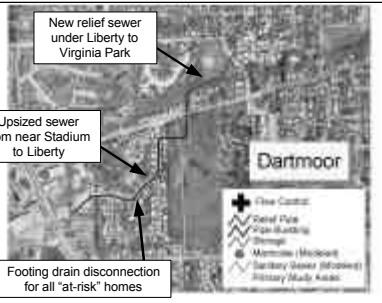
Description	Constr.	Lifecycle
■ Relief[1]	$2.5M	$2.4M
■ Upsizing[2]	$2.4M	$2.4M
■ Upsizing/Storage	$2.0M	$2.0M
■ Disconnect[3]	$1.2-1.6M	$1.0-1.4M

1 - Includes $2.1M of improvements in the study area and additional $0.4M in improvements in the trunk sewer system
2 - Includes $2.0M of improvements in the study area and and additional $0.4M in improvements in the trunk sewer system
3 - Lower costs are from reduced flows at WWTP

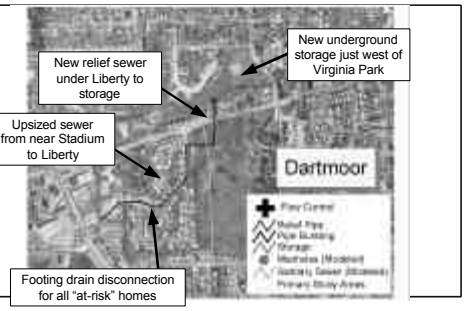
Dartmoor Study Area Relief Sewer Option



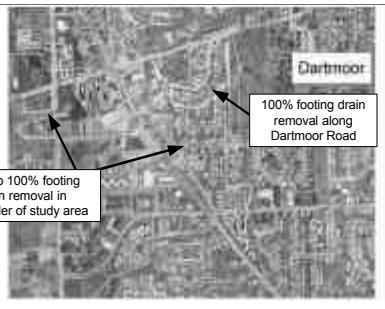
Dartmoor Study Area Relief/Upsize Option



Dartmoor Study Area Upsize/Storage Option



Dartmoor Study Area Footing Drain Removal

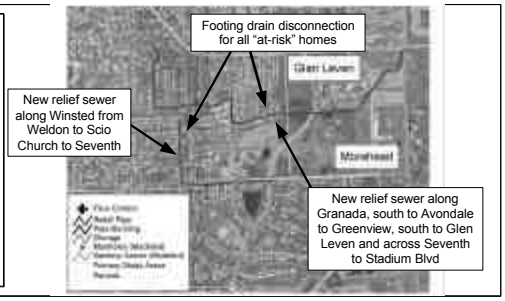


Dartmoor Study Area Construction & Lifecycle $

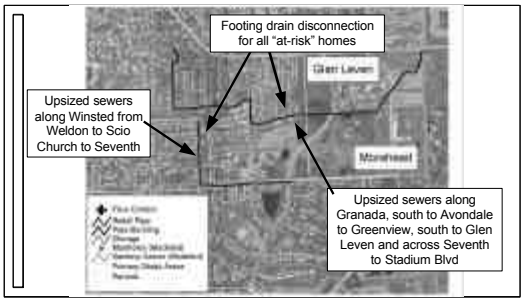
Description	Constr.	Lifecycle
■ Relief[1]	$4.9M	$4.9M
■ Upsizing[1]	$4.9M	$4.9M
■ Upsizing/Storage	$2.8M	$2.8M
■ Disconnect[2]	$1.5-1.9M	$1.1-1.5M

1 - Includes $1.8M of improvements in the study area and an additional $3.1M in improvements in the trunk sewer system
2 - Lower costs are from reduced flows at WWTP

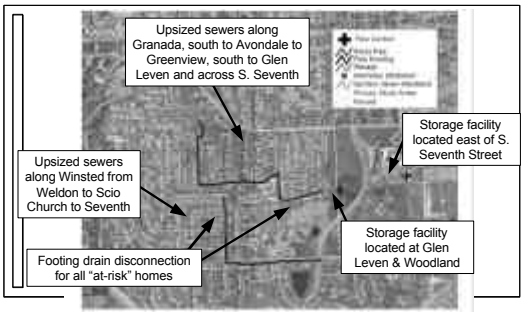
Glen Leven Study Area Relief Sewer Option



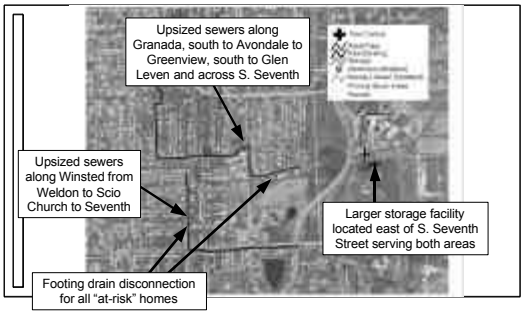
Glen Leven Study Area Sewer Upsizing Option



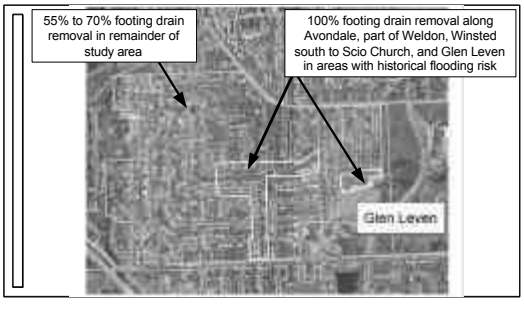
Glen Leven Study Area Upsize/Storage Option 1



Glen Leven Study Area Upsize/Storage Option 2



Glen Leven Area Footing Drain Removal Option

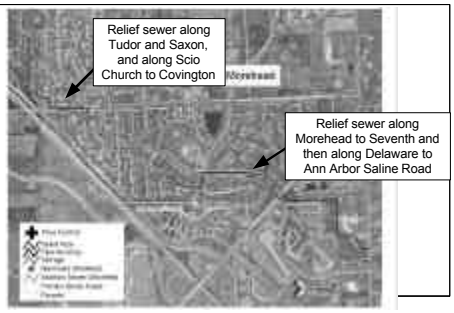


Glen Leven Study Area Construction & Lifecycle $

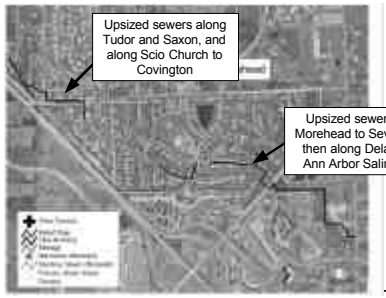
Description	Constr.	Lifecycle
■ Relief[1]	$7.0M	$7.0M
■ Upsizing[1]	$7.0M	$7.0M
■ Upsizing/Storage #1	$4.3M	$4.3M
■ Upsizing/Storage #2	$4.0M	$4.0M
■ Disconnect[2]	$3.3-4.1M	$3.0-3.7M

1 - Includes $4.6M of improvements in the study area and an additional $2.4M in improvements in the trunk sewer system
2 - Lower lifecycle costs are from reduced flows at WWTP

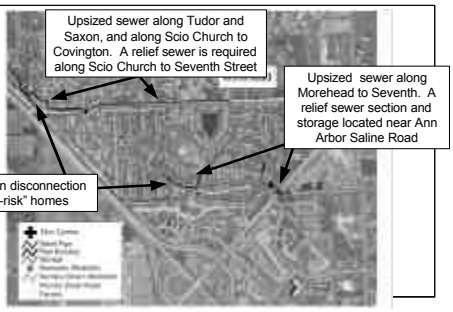
Morehead Study Area Relief Sewer Option



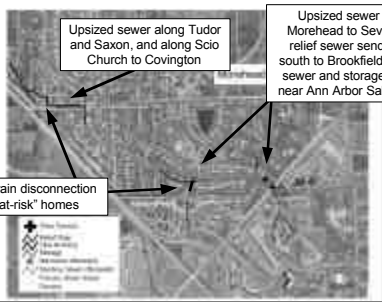
Morehead Study Area Sewer Upsizing Option



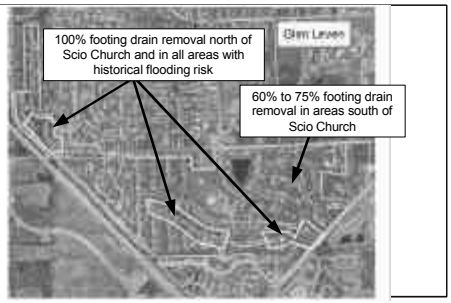
Morehead/Glen Leven Upsize/Storage Option 1



Morehead Upsize/Storage Option 2



Morehead Footing Drain Removal Option



Morehead Study Area Construction & Lifecycle $

Description	Constr.	Lifecycle
■ Relief[1]	$5.5M	$5.5M
■ Upsizing[2]	$5.7M	$5.7M
■ Upsizing/Storage#1	$3.2M	$3.2M
■ Upsizing/Storage#2	$2.9M	$2.9M
■ Disconnect[3]	$2.8-$3.4M	$2.5-$3.1M

1 - Includes $4.2M of improvements in the study area and an additional $1.3M in improvements in the trunk sewer system
2 - Includes $4.4M of improvements in the study area and an additional $1.3M in improvements in the trunk sewer system
3 - Lower lifecycle costs are from reduced flows at WWTP

Upsize/Relief - Implementation Issues

- Size of trunk sewer upsizing dependent on flow requirements from other areas
- May impact ability of WWTP to manage peak flows thereby increasing SSOs
- Phasing time for construction could cause flooding problems for some not currently at risk for basement flooding

Upsize/Storage - Implementation Issues

- Siting of underground facilities may have public concerns (impacts on open/park and/or natural areas)
- Water Utilities Department has a concern about maintaining many of these facilities throughout the City
- Because of the excavations needed for pipe-bursting, there will be disruptions in the affected neighborhoods

Footing Drain Removal - Implementation Issues

- Work is required on private property - in basements and on front lawns
- Gaining participation from non-flooded homeowners who see little benefit may be problematic
- Obtaining additional data on actual removal of I/I in each district is needed before proceeding on a full scale program

Alternative Evaluation Criteria

- All alternatives were evaluated based on consistent criteria
- Categories evaluated included:
  - ø Costs
  - ø Construction impacts
  - ø Quality of life impacts

Cost Issues

	Weight
■ Construction cost	4
■ Maintenance cost	2
■ Operational savings	3
■ Future SSO impact	2

Construction Issues

	Weight
■ Construction constraints	2
■ Contractor availability	2
■ Traffic control	1
■ Construction on private property	3
■ Easement availability	1
■ Construction season impacts	1

Quality of Life Issues

	Weight
■ Open/park area impacts	2
■ Natural feature impacts	2
■ Customer impacts (outside)	2
■ Customer impacts (study areas)	2
■ Odor potential	1
■ Maintenance access	1
■ Time to implement	2
■ Certainty of solution	4

Alternative Evaluation Conclusions

- Alternative viable solutions are available in each study area
- Based on evaluation criteria the upsizing/storage or footing drain removal alternatives are the preferred options in all areas
- Certainty of protection using the footing drain removal option alone is not completely understood at this time

Recommended Solutions

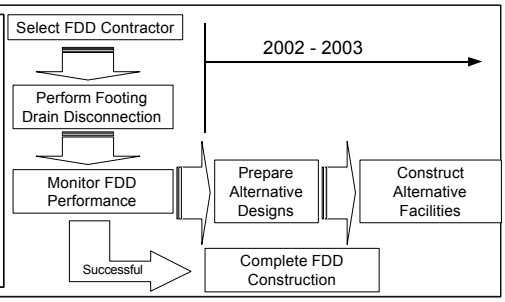
Study Area	Option Desc.	Cost
■ Orchard Hills	Upsize/Storage	$2.2M
■ Bromley	Footing Drains	$1.6M
■ Dartmoor	Footing Drains	$1.9M
■ Glen Leven	Footing Drains	$4.1M
■ Morehead	Upsize/Storage 2	$2.9M
TOTAL		**$12.7M**

Footing Drain Removal - Participation Requirements

Area	Type	Homes
■ Orchard Hills	Selected[1]	50
■ Bromley	100%	250
■ Dartmoor	100%	310
■ Glen Leven	70%	660
■ Morehead	Selected[1]	55
TOTAL		**1,325**

1 - Only homes that have historically flooded will be disconnected

Implementation Plan



Next Steps:

- SSO Advisory Task Force will finalize recommended alternatives (Report)
- Implementation plans for each study area will be completed
- City Council must take action on the recommended plan
- Required engineering and construction projects to be developed

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L Appendix – Neighborhood Meeting and Workshop #4 Questionnaires

L.1 Neighborhood Meeting Questionnaire

The survey questionnaire in this appendix was distributed to attendees of the project's Neighborhood Meetings and via the project's website. Responses were solicited to assist the Task Force in better understanding the thoughts and concerns of the residents as they pertain to proposed solution alternatives.

L.2 Neighborhood Meeting Questionnaire Responses

Responses are summarized and provided subsequent to the survey questionnaire in this appendix.

L.3 Workshop #4 Questionnaire

The survey questionnaire in this appendix was distributed to attendees of the project's fourth workshop. Responses were solicited to assist the Task Force in better understanding the thoughts and concerns of the residents as they pertain to the proposed solution and implementation. Note that many people at the Southwest meeting location received an older copy of the survey that had a different Question 9 than that contained in this appendix (this alternate question was from an older, draft survey form). The alternate Question 9 reads as follows: "Please describe any implementation issues that you would like the Task Force to consider?"

L.4 Workshop #4 Questionnaire Responses

Responses are summarized and provided subsequent to the survey questionnaire in this appendix. Because there were two survey forms distributed, each with a different Question 9, both versions of Question 9 are presented in this summary.

SSO TASK FORCE
JANUARY NEIGHBORHOOD MEETING - Questionnaire

Please circle the description that best matches your thinking.

1. Study Area that you live in:

   Orchard Hills Bromley Dartmoor Glen Leven Morehead None of these

2. Number of previous public workshops(April, July, October or November) you have attended:

   0 1 2 3

3. How did you receive information about scheduled meetings?

   Mail Newspaper Web Sites Neighbors CTN (TV) Other _____

4. Have you experienced basement flooding before:

   Never Once Twice Several times

5. These sessions have helped me understand the dynamics behind the basement flooding:

   Strongly disagree disagree neutral agree strongly agree

6. This session today has helped me understand the possible remedies for this problem.

   Strongly disagree disagree neutral agree strongly agree

7. Following is the list of possible solutions for your neighborhood.

Construct relief sewer (open trench):

Unacceptable Acceptable with considerations Acceptable Preferred

Impact of traffic disruption:

Unacceptable Acceptable with considerations Acceptable

Requires downstream trunk sewer improvements/costs:

Unacceptable Acceptable with considerations Acceptable

Comments:

Upsize sewers (pipe bursting or open trench):

Unacceptable Acceptable with considerations Acceptable Preferred

Impact of traffic disruption:

Unacceptable Acceptable with considerations Acceptable

Requires downstream trunk sewer improvements/costs:

Unacceptable Acceptable with considerations Acceptable

Comments:

(Continued on other side)

Provide storage with Upsized sewers (pipe bursting or open trench):

Unacceptable Acceptable with considerations Acceptable Preferred

Impact of traffic disruption:

Unacceptable Acceptable with considerations Acceptable

Potential for odors:

Unacceptable Acceptable with considerations Acceptable

Minimizes downstream trunk sewer improvements/costs:

Makes more acceptable Does not impact decision

Comments:

Remove footing drains:

Unacceptable Acceptable with considerations Acceptable Preferred

Impact of in-basement and lawn construction on you:

Unacceptable Acceptable with considerations Acceptable

Impact of construction along curb on you:

Unacceptable Acceptable with considerations

Minimizes downstream trunk sewer improvements/costs and treatment costs:

Makes more acceptable Does not impact decision

Comments:

8. Other information that would be helpful for the Task Force, City Staff and/or City Council to consider?

9. Additional information you would like from the Task Force? *Provide name, address & phone if you would like a response.*

Ann Arbor SSO Prevention Study

January Neighborhood Meeting Questionnaire - Responses

Question: 1 Study area that you live in:

Response	Count
Bromley	6
Dartmoor	8
Glen Leven	7
Morehead	7
None of these	1
Orchard Hills	13

Question: 2 Number of previous public workshops you have attended:

Response	Count
0	12
1	6
2	15
3	8

January Neighborhood Meeting Questionnaire - Responses

Question: 3 How did you receive information about scheduled meetings:

Response	Count
flyer	1
mail	22
mail/CDM Phone Call	1
mail/neighbors	4
mail/newspaper	1
mail/newspaper/phone	1
mail/newspapers/Neighbors	1
mail/Phone Call	1
mail/SSO Newsletters	1
neighborhood association	1
newspaper	2
newspaper/neighbors	1
newspaper/web sites	1
postcard	1
web site	2

Question: 4 Have you experienced basement flooding before:

Response	Count
never	10
once	5
several times	11
twice	16

January Neighborhood Meeting Questionnaire - Responses

Question: 5 These sessions have helped me understand the dynamics behind the basement flooding:

Response	Count
disagree	3
neutral	3
agree	24
strongly agree	12

Question: 6 This session today has helped me understand the possible remedies for this problem.

Response	Count
strongly disagree	2
neutral	5
agree	24
strongly agree	10

Question: 7A1 Construct relief sewer (open trench):

Response	Count
unacceptable	6
acceptable with considerations	10
acceptable	15
preferred	6

Question: 7A2 Construct relief sewer (open trench): Impact of traffic disruption:

Response	Count
unacceptable	4
acceptable with considerations	13
acceptable	20

January Neighborhood Meeting Questionnaire - Responses

Question: 7A3 Construct relief sewer (open trench): Requires downstream trunk sewer improvements/costs:

Response	Count
unacceptable	6
acceptable with considerations	15
acceptable	16

Question: 7A4 Construct relief sewer (open trench): Comments:

Response	Count
I strongly prefer this option. It seems to have the most likelihood of succeeding and is a reasonable cost.	1
It sounds like improvement would need to be made all the way to the waste treatment plant for this to work.	1
Our sewer was bypassed in the 90's and relief has been noticed at our residence.	1
Potential disruption to natural features has not been considered. Does not consider source of problem.	1
see below	1
see general comments below	1
Seems ok as a solution, but certainly less elegant and more disruptive than upsizing. Also long term maintenance of two pipes seems like a pain. I also don't like the downstream impact.	1
Would defer to experts (SSO Task Force)	1

Question: 7B1 Upsize sewers (pipe bursting or open trench):

Response	Count
unacceptable	4
acceptable with considerations	9
acceptable	16
preferred	7

Question: 7B2 Upsize sewers (pipe bursting or open trench): Impact of traffic disruption:

Response	Count
unacceptable	2
acceptable with considerations	10
acceptable	22

January Neighborhood Meeting Questionnaire - Responses

Question: 7B3 Upsize sewers (pipe bursting or open trench): Requires downstream trunk sewer improvements/costs:

Response	Count
unacceptable	3
acceptable with considerations	15
acceptable	17

Question: 7B4 Upsize sewers (pipe bursting or open trench): Comments:

Response	Count
Again - I don't want problem moved somewhere else - but it has to be solved. If this is what it takes, then do it.	1
Good solution but downstream effects and cost are a downside	1
Is the capacity increase of this soluton the same as a relief sewer.	1
Less noxious than open trench, but still, potential disruption to natural features is concern. Does not solve problem, treats symptom.	1
This option seems to be risky compared with option 1.	1
Trunk sewers will need upsizing anyway.	1
Unsure of technology (remember orange tiles)	1

Question: 7C1 Provide storage with Upsized sewers (pipe bursting or open trench):

Response	Count
unacceptable	3
acceptable with considerations	7
acceptable	18
preferred	6

Question: 7C2 Provide storage with Upsized sewers (pipe bursting or open trench): Impact of traffic disruption:

Response	Count
unacceptable	1
acceptable with considerations	9
acceptable	21

January Neighborhood Meeting Questionnaire - Responses

Question: 7C3 Provide storage with Upsized sewers (pipe bursting or open trench): Potential for odors:

Response	Count
unacceptable	9
acceptable with considerations	14
acceptable	9

Question: 7C4 Provide storage with Upsized sewers (pipe bursting or open trench): Minimizes downstream trunk sewer improvements/costs:

Response	Count
does not impact decision	10
makes more acceptable	18

Question: 7C5 Provide storage with Upsized sewers (pipe bursting or open trench): Comments:

Response	Count
Destruction of trees in Eberwhite Woods and Liberty Knoll Commons is MAJOR concern.	1
Even though storage may cause odors, this is the best option to eliminate impact to downstream areas.	1
Might be able to put something in a carbon filter on air vents to cut odor potential even more. Much less preferred (the less you depend on homeowners to do stuff, the better.)	1
Proposed location is one house away. I already cannot sell my home. I believe this potential for odor would lower my value.	1
Seems to give a more certain solution than just removing footing drains, although I realize that subsequent info may improve confidence on the footing drain option.	1
very strongly disapprove of this option. See below.	1

Question: 7D1 Remove footing drains:

Response	Count
Unacceptable	5
acceptable with considerations	11
acceptable	16
preferred	4

January Neighborhood Meeting Questionnaire - Responses

Question: 7D2 Remove footing drains: Impact of in-basement and lawn construction on you:

Response	Count
unacceptable	3
acceptable with considerations	20
acceptable	11

Question: 7D3 Remove footing drains: Impact of construction along curb on you:

Response	Count
Unacceptable	3
acceptable with considerations	29
acceptable	1

Question: 7D4 Remove footing drains: Minimizes downstream trunk sewer improvements/costs and treatment costs:

Response	Count
does not impact decision	10
makes more acceptable	20

January Neighborhood Meeting Questionnaire - Responses

Question: 7D5 Remove footing drains: Comments:

Response	Count
All solutions are acceptable - cost dependent.	1
best option with reservations listed below	1
Concern about solving the problem - data needs to be ___	1
Disconnect footing drains & put check valves in all houses that have flooded ASAP. And then upsize sewers & provide storage. This method will not move problem to other homeowners & stored water can be moved to water treatment plant in a regulated manner	1
Does seem more sensible to just get the water out of the santiary sewer. Question at this point is whether that would be enough to totally solve the problem.	1
I can't believe that homeowners w/o direct benefit would be willing to do this.	1
If done the way Mark explained - ok.	1
in at risk area	1
Killing trees with construction - a concern	1
Monkeying with sump pump is not impressive to me; getting enough participation is tricky; not as "permanent" a fix as others. On the other hand, draining backyard would be helpful.	1
Our sewer line is oran_____ and may have to b___ changed at time of connection to street line is pipe bursting to home available?	1
This is the most environmentally friendly option.	1
This would cause problems for homeowners who now don't have problems.	1
Too many unknowns, too much responsibility upon each homeowner, including the unhandy and unmotivated	1

January Neighborhood Meeting Questionnaire - Responses

Question: 8 Other information that would be helpful for the Task Force, City Staff and/or City Council to consider?

Response

Consultant should give us their best recommendation(s) and their reasons for supporting it as well as their least favorite option along with reasons. Can an interim solution be a disconnect for flooded homes before project is initiatied thru out city to protect those affected houses in meantime. I would be willing to fund cost of disconnect as long as I am assured I will be reimbursed in future.

Not sure footing drain removal only will eliminate problem

sent letter 1-18-01

At this point, it seems like the only certainity is that the "at risk" homes will need a check valve/sump pump system installed. I would love to seen this implemented in Spring 2001, even if the larger solution is not completely resolved by that time.

I would be very unhappy if forced by the City to go along with disconnecting the foot drains - especially since it isn't definite that it would work.

Overall, the option to pipe burst seems preferable (storage or not) Uncertainities don't help either.

I wo___ you solve the problem in the street and not by removing footing drains and sump pumps.

What can't combinations of approaches be tried? What about offering rain barrel hook ups to gutter drains, as option to sump pump? What about rain gardens? Can't we keep A2 green?

Health/Safety concerns due to having contaminated sewer water in basements. New development that does not consider impact to sewer system. People who have flooding need to have access to a footing drain operation ASAP. Not wait until 2002 or later.

Mark's comments about providing homeowners a "ca____" to get work done is excellent and a real incentive.

Would like disconnect option early especially for those that have flooded 3 times!

See comment above.

It is vital that disconnects be done for affected homes ASAP. We are paying for a storage unit (139.00/month) for irreplacable items. We live in fear every heavy rain. PLEASE.

Downspout connection done on a basis similar tp sump pump, I.e. permanent collection and transport to catch basin. Not just downspout extensions! Yard based work would add to the value of participating homes. Sump pumps would probably reduce value of homes

January Neighborhood Meeting Questionnaire - Responses

I'm interested in the timing of the potential solutions.

Morehead/Glen Leven upsize/storage option 1 seems to fit best given all the inter-related concerns in the entire neighborhood. + expedite providing the disconnect/pump for the people at risk NOW! Protect us while we're waiting for 2002.

January Neighborhood Meeting Questionnaire - Responses

Question: 9 Additional information you would like from the Task Force? Provide name, address & phone if you would like a response.

Response

George & Norma Johnston 716 Dartmoor 662-5058

Have homeowners w/flooding problems get sumps in 1st w/early reimbursement. Great work, Mark T.!

I would like to know if you consider my home at risk. I would be happy to have you come to install a sump pump and check valve - as soon as possible. Thanks. Sara Schaefer, 3055 Bluett 769-1873

More info on: details of check valve/sump pump system and associated cost. Would like to discuss details of situation at my own house in more depth at some point.

Is my home, which has not flooded, at risk from measures taken by neighbors left and right, whose basements have flooded? I hope not. A. Yu, 2362 Georgetown 665-8414

Would like home elevation info, 2385 Georgetown Blvd. With Spring season coming up, is it possible to start implementation of at risk homes this year. Tim Markel 2385 Georgetown Blvd. 769-5840

Out of all this, is these adequate sewer capacity for the construction on Green, D_____, etc.? If not, the footing drain disconnect will not be adequate. Kevin Olmtead, Ph.D., P.E. kevin.olmsted@ttmps.com

The results from City Council (project approval and which option). Timeline for work to begin.

Why is "traffic disruption" singled out as concern in this survey? Why not natural features, for example. Contact Liberty Knoll and Fair Glen hownowners on Liberty St. and Glendale Circle and Fair Glen homeowners on Glendale Circle about Commons.

David Hing, 1556 Morehead, Ann Arbor 48103

We are not the experts. You are. Which procedures will most likely solve the problem? Which is the most environmentally sound, and which is the most cost effective? We hope with your knowledge and expertise you can make a wise decision. Otherwise, we can only say that on Dartmoor we have been victimized twice in the last two years by sewage. We do not want to be victimized again this time by the city with the invasive procedures mentioned in your literature. We shouldn't have to bear the burden when correcting it. Sincerely, Jan and Bob Bower 633 Dartmoor 662 6139

Paul Kuipers 1585 Greenview Dr., A2 48103

Our basement level relative to sanitary sewer Dick & Marian Williams 1836 Saxon phone (734) 769-5384

January Neighborhood Meeting Questionnaire - Responses

As soon as you have dates for city council or public forums - pass them to us so we can support efforts towards QUICK and EFFECTIVE solution. Oh, and thank you for all you have done. Incredible amount of work on our behalf.

Basement elevation relative to neighbors. Chuck Whitley, 1424 Morehead, 665-3361 day, 662-8395 eve.

More on potential for odors if storage provided, more info on disruption to homes & properties if footing drains removed. To CDM, Please assess the risk of my home to basement flooding. I live at 6 Dover Ct. The basement is 8 feet below the first floor. Please give me a call at (734) 741-8430 if you need additional information. Thanks, Rena Seltzer

Donald MacCallum 809 Dartmoor a2 48103

Please send me any and all specific information about our home that Mark said was available - Jeff and Diane Alson, 2310 Prairie, Ann Arbor, MI 48105. We were lucky enough to be part of the pilot program and believe it has been "fixed". Could we get a write-up about what was done that could be very helpful if we ever sell our home? Really difficult for a lay person to judge the efficiency and pr____ of the different options. It is wonderful to have the opportunity to hear the options and to provide input, but at the end the "experts" will have to make the final decisions.

Do NOT move problem to other areas. Those experts make a recommendation. Homeowner's consensus will be hard to obtain. Michael Schorr, 2225 Delaware 48103 761-7214

SSO TASK FORCE 2/13/01 and 2/15/01
PUBLIC WORKSHOP 4: RECOMMENDATIONS - Questionnaire

Please circle the description that best matches you or your thinking.

1. **Area that you live in:**

   Orchard Hills Glen Leven Morehead

   Bromley Dartmoor Other _____

2. **Number of previous public workshops or neighborhood meetings (April, July, October or November, January) you have attended:**

   0 1 2 3 4

3. **Have you experienced basement flooding before:**

   Never Once Twice Several times

4. **I understand the proposed set of remedies for my neighborhood.**

   Not at all not well somewhat yes very clearly

5. **My confidence level that the proposed remedies for my area will protect my home is:**

   Very low Low moderate good very good

6. **What would increase your confidence level?**

7. **What do you see as the biggest implementation obstacles these remedies face?**

8. **Please share suggestions for ways that we could surmount those implementation obstacles.**

9. **If you are in an area where the selected alternative would include installation of a sump pump and check valve in your home, what best describes your thinking?** *Be aware that legislation is pending that may mandate these disconnects in communities soon.*

   Does not apply . I have very serious concerns about this happening in my home.

   I have concerns and would like more information. I want the sump pump! Let's go.

10. **Other information that would be helpful for the Task Force, the City Staff or City Council to consider?**

Ann Arbor SSO Prevention Study

Workshop #4 Meeting Questionnaire - Responses

Question: 1 **Study area that you live in:**

Response	Count
Briarcliff	1
Bromley	9
Dartmoor	13
Dartmoor Liberty Knoll Commons	1
Dartmoor Liberty Knoll Commons - Glendale Circle	1
Glen Leven	12
Morehead	13
Morehead Glendale Circle	1
None of these	2
None of these Chauer rather near Glen Leven and Morehead	1
None of these Georgetown	1
None of these Miller/Maple	1
Orchard Hills	12
Vernon Downs/Glen Leven Area	1

Question: 2 **Number of previous public workshops (April, July, October/November, January) you have attended:**

Response	Count
0	30
1	11
2	7
3	14
4	7

Workshop #4 Meeting Questionnaire - Responses

Question: 3 **Have you experienced basement flooding before:**

Response	Count
never	28
once	8
twice	14
several times	16

Question: 4 **I understand the proposed set of remedies for my neighborhood.**

Response	Count
not well	2
somewhat	13
yes	39
very clearly	14

Question: 5 **My confidence level that the proposed remedies for my area will protect my home is:**

Response	Count
very low	2
low	4
moderate	26
good	25
very good	9

Workshop #4 Meeting Questionnaire - Responses

Question: **6 What would increase your confidence level?**

Response

act quickly

a 3+" storm

need for larger capacity and/or storage combined with sump pump and storm drain solution.

Having d/c of footing drains. Also - city contracted w/company for mandatory sidewalk replacement, and the work was horrible. The replaced sidewalk is much worse than the original. PLUS some other solution (like pipe bursting).

Moratorium on new connections if there is any chance for additional SS flow during rainy weather.

The speaker was unable to tell me whether my home is part of the group that will initially receive footing drain disconnection/sump pumps. I would like to receive a phone call from someone who can give me this information.

quick action soon as possible time wise

Upsizing/storage construction - linked to solution w/Morehead neighborhood, which is already planned to come up into Scio Church Rd. Area.

nothing @ this point; there are still too many unanswered and incomplete answers and questions.

if it is quickly completed

After your best option is implemented, Ann Arbor would get the worst of all possible storms and my basement remained dry.

did not speak to Liberty Knoll

less importance on cost, and rather good permanent solutions, which is cost effective in the long run.

address root cause by increasing sewer size

get rid of more flows!

to know that the City will really act on the solution soon. I am not willing to wait 3 yrs.to know the problem is solved.

living through more torrential downpours with out flooding

to start work as soon as possible. Keep us informed with the progress of the implemenation of the solutions.

?? The city had lied to us too often in the past.

Workshop #4 Meeting Questionnaire - Responses

Put in a system to handle 20% more than past flooding events without removing footing drains and adding sump pump.

You still don't understand the fundamental problem!.

more timely information, greatly improved communications

that the task force would consider the effect upon downstream stormwater runoff increases

Not a problem

More certainty from experts that the FDD remedy would solve the whole problem.

Many questions with disconnect idea - go for bigger pipes. Use words like "will" instead of "should"

As I understand it, disconnect of all Dartmoor area may not mitigate during "100" year storm

Increase size of stormwater pipes

experience

Confidence level in the solution is fine. I'd like more confidence that Council will get sump pumps in affected homes this spring.

Commitment by City to proceed and support

More storage capacity added to system.

talking to the test home owners in detail

commitment to spend the $

Nothing. Your work is outstanding

adding relief sewers

No storage tanks in Liberty Knoll Common wooded area!!

Study of flows from footing drains. Better understanding of which homes to involve.

Increase overall capacity of sewer and treatment plant system.

Oh . . of course I would prefer a less intrusive solution - such as big pipe far away!!!

more detailed results from previous studies

Data of the pilot project showing ____ wastewater flow out of the neighborhood

more confidence from those presenting proposals.

knowing that trees will remain for Liberty Knoll Commons.

Workshop #4 Meeting Questionnaire - Responses

Would like to see more data on relief/upsize solutions.

Better documentation of footing drain removal.

that something would be done before the next storm season

protect all homes in area

Workshop #4 Meeting Questionnaire - Responses

Question: **7 What do you see as the biggest implementation obstacles these remedies face?**

Response

homeowner resistance to sump pump installation

Involving non-flooded homes.

time

citizen acceptance/compliance

it's not my problem by non-impacted homeowners

If pumps drained into yards that would create a new problem - in our very soggy yard, it would be a huge problem. Concerns about quality and safety of work in homes, risk of dust in my house with young children.

compliance by all 300 homeowners. Impact of construction work in home.

Buy-in from unaffected neighbors to have footing drains d/c.

public fear of construction impact

Skepticism that solutions will actually improve things.

Co-operation of non-flooded home owners.

home owner participation in the homes with no flooding problem.

Definitely by-in-by unflooded homeowners

I'd move quickly under any circumstance

Meeting with all neighbors. Mess in street during construction.

We want to keep the trees in the Common area!! This is private property!!

convincing non-flood homeowners

If large storage is used, what happens to trees? Please do not cut trees!

Homeowners (like me) who have never experienced flooding buying into disruption of their dry basement and taking time off work. (I am single and would need to have installation on a weekend).

making everybody happy - flooded homeowners vs. non flooded

Cost and participation levels.

Getting neighborhood to agree to sump pump.

Workshop #4 Meeting Questionnaire - Responses

I do not want a sump pump!

construction and upkeep in my home

Convince non-flooded neighbors that action is needed.

certainty of solution working.

Cost and run away development of A2.

Lack of cooperation by some homeowners

Other homes still have footing drains connected - will they also agree to disconnect?

Cost, quality problems, availability of reliable contractors.

radon

quality of contractor

Recalcitrant Democratic Council

none

Some neighbors won't cooperate and stall project.

private intrusion

objections by those not flooded; construction on private property

The complicated nature of the problem and the potential solutions.

Compliance and understanding on the part of all homeowners.

Making absolutely sure the city hires best qualified companies to do the work, check previous jobs done.

Nothing significant

Too long time scale + upstaging family life.

timing

signing up homeowners for disconnects. Commitment from City of Ann Arbor.

Getting people who have not been flooded to participate. Their homes contribute to the flow!

timing

Financially, where money is coming from. Time needed to finish proposed projects (solutions).

We've already had sump pump installed as part of pilot program

Workshop #4 Meeting Questionnaire - Responses

Folks who have not had problems will be reluctant to particpate in disconnects.

get around my indoor swimming pool

working w/1300 home owners

Workshop #4 Meeting Questionnaire - Responses

Question: 8 **Please share suggestions for ways that we could surmount those implementation obstacles.**

Response

Door to door on Morehead. Good Planning.

financial incentive (or penalty)

Pipe water out to storm sewers. Choose contractors based on quality work and cleanup, not just lowest cost. Require stringent precautions to keep down dust in homes.

Continues to get message out (but non-flooded homeowners may not come to workshops. Newspaper coverage and a special mailing.)

working very closely with the homeowners

just fix the houses that flooded.

allow each homeowner to do this and bill the city

mix in other benefits.

City ordenance to require disconnects.

Communicate with us on the progress. Be informed with the steps taken to carry out projects.

expedite, ASAP

I like the staging approach in Dartmoor in order to collect data.

go for bigger pipes.

I don't know!

Make participation mandatory! Educate them regarding their contribution. Or deposit flood damaged materials on their lawns after an event.

Raise revenue perhaps through issuing bonds and cost of developing housing.

I would want to see a study of flooding patterns in my neighborhood area along with an elevation study to assist in determining which 50-70% of homes will need sumps. I would also want in writing that if your home is not targeted, and you develop problems after the 50-70% are installed, that the problem would be remedied.

Put in large enough collector sewers and adequate storage facilities.

more storage, bigger pipes, whatever

Keep length of time for process as short as possible.

Workshop #4 Meeting Questionnaire - Responses

PR

continue education process

I expect a decent sewer system without major effort on my part!

Visit individual homes (or invite owners to an office) and discuss and answer questions.

use same to perform study and actual work done

Delicately relate the loss of faith between Council and citizenry for this persistent dereliction of municipal responsibility, and the forbearance of people in putting up with it for so long.

one on one meetings

mini Thurston ponds?

publicity - frequently

personal reassurance and neighbor testimonials

???

Workshop #4 Meeting Questionnaire - Responses

Question: **9.1 Please describe any implementation issues that you would like the Task Force to consider.**

Response

what are tax implications?

If the drain disconnect does not solve the problem within the Dartmoor area, consider storage options under Virginia Park and Road; as well as Liberty Road

What happens to neighborhoods further down the trunk lines and outside study area? Don't send all the excess water to other neighborhoods.

Other actions such as access to collection system by homeowners for removal of roof drain water for improving property use.

Data collection will not lead to solution

Specific letters of info and instructions need before major job done, i.e., pipe bursting, parallel storm pipes. To understand road and home hook up mess and issues.

Increase sewer capacity!

As suggested solutions per area. Timing of construction.

Minimize disruption to street and traffic flow on Morehead.

Have they considered stationary tubs check _____?

Are you absolutely positive the storm drains can handle the additional volume???

An upsize/storage system seems the way to go - minimally instrusive where installed and no access to private property necessary.

location of sump pump in finished basements.

traffic management during construction

A cover letter of sincere contrition should be sent to each flood victim, most of whom have suffered serial flooding, and extensive loss and damage well beyond the pitiful caps the city has historically applied.

See above. Also, be sure not to transfer problem to neighboring homes by including all homes at risk. Please keep back-up pump and alarms in the solution so new problems are not created for those who had not had problems before.

none

Workshop #4 Meeting Questionnaire - Responses

Question:

9.2 If you are in an area where the selected alternative would include installation of a sump pump and check valve in your home, what best describes your thinking? Be aware that legislation is pending that may mandate these disconnects in communities soon.

Response	Count
I have very serious concerns about this happening in my home.	11
I have concerns and would like more information.	4
I want the sump pump! Let's go.	9

Workshop #4 Meeting Questionnaire - Responses

Question: **10 Other information that would be helpful for the City Staff or City Council to consider?**

Response

Need to emphasize that warning light is installed with pump. This is about all that homeowner needs to check on or be aware of related to the pump. Major concern and selling point is the impact of the flooded basements on assessed valuations, sale of house.

My home was a pilot.

I believe the city should pay for this. Residents in our older area did not have a problem before new construction was built. It is not all our problem although my neighborhood has born the brunt. It is fair to spread the cost.

but our house is "at risk"

Quality control assurance of drain d/c work.

Don't let any additional development until existing problems are resolved.

Property values are impacted until work is completed and confidence rebuilt. This is a real problem!

Keep us informed with progress.

Good job / impressive

Consider using the Liberty Road improvements to the best advantage for relief of sewage stormwater problems.

Pilot - already done!

(Basement flooding) including June 2000 storm - 3 inches of sewage and water in basement. Ours was one of at least 3 house in a row on Greenview affected. However, our neighbors didn't report it to the City.

Communication with flood victims outside the study areas is almost non-existant. The very general and infrequent articles in the A2 News are alarming to us. Public meetings are not well advertised. Please create a mailing at regular intervals to all addresses that made a claim against the City for the June 2000 flood. Many homeowners do not own computers. Web sites are great, but do not penetrate the full spectrum of affected residents. We still need to have communications on paper. Involve homeowners outside the study areas now in planning for other neighborhoods.

You need to build a model which is capable of representing and recreating the problem being faced!! Consider MATLAB SIMULINK Call me We are new owners.

(From) Liberty Knoll Commons - Glendale Circle.

Workshop #4 Meeting Questionnaire - Responses

I have not (experienced basement flooding) - but I am a new homeowner. The house has flooded twice ('98 and '00)

we're ready to cooperate with whatever

Could a plan that expedites the upsizing and relief be developed and costed. (confidence) depends on solution

(Basement flooding) Several times in old house, but I recently moved to a trilevel with no problems, so they say . . .

How would they feel wading knee-deep in sewage? [ed., comment lightly crossed out]

Thank you!!!

If sump can be outside.

more public info on o_____.

Not happy with sump pump solution.

Please not in my crawl space!

This smells political - the problem is being pushed back to us tax paying citizens. Solve the problem on city property.

I don't want it, but apparently if I don't go along, flooding will more likely become a problem. Also sump pump would go in the finished part of basement.

Thank you for an excellent informative meeting.

M. Appendix
Peer Community Reviews

The following information was gathered as part of the peer community reviews for this project. Information is provided on the name of the community, the demographics, number of affected customers, the project issues, findings, and recommendations. Information on the implementation and emergency response are also provided.

Review of Community Remedial Projects

Element	Description
Community:	West Lafayette, Indiana
Demographics:	Population: 30,000 full-time plus 35,000 at Purdue University
Households:	12,000
Customers:	15,000
Project Area:	Fully developed area of about 670 homes
Project Issue:	Basement backup problems caused by excessive inflow/ infiltration. The City had routinely used pumps to discharge excessive wet weather flows to the stormwater drainage system. The Indiana Department of Environmental Management (IDEM) brought the City to Court to stop that practice. IDEM required that the City implement a plan of action to eliminate the basement flooding and SSO issues.
Findings:	Inflow/infiltration from basement footing drains were causing basement flooding issues. Different alternatives were evaluated as part of a comprehensive program to correct this problem and resolve the risk of basement flooding. While the footing drain disconnection work was thought to be the most expensive, the work was undertaken because of the advantage it provided in reducing the flows needing wastewater treatment.
Recommendations:	Based on flow projections from footing drains, it was recommended that all basement footing drains in the study area should be disconnected. This disconnection would reduce the risk of basement flooding to acceptable levels and also reduce the operational costs associated with treating this additional wastewater flow. The plan to disconnect the individual homes was scheduled over a 5 year period.
Implementation:	The City signed a consent agreement to follow their footing drain removal program over a 5-year period. The City already had an ordinance in place that does not

allow "freewater" into the sanitary collection system. This was interpreted to include footing drain connections. In almost all cases, the connection between the foundation footing drains and the sanitary house lead was outside of the home.

To eliminate the footing drains for homes that were connected, the City decided to reimburse home owners for the disconnection expense if they undertook the disconnection voluntarily after formal notice of noncompliance. Use of this program limited the City's liability for any of the construction activities on private property.

The City worked with local contractors to develop the program. Each homeowner first contacted the local contractors and obtained an estimate. Then, each resident signed an agreement with the City, which described the terms of the reimbursements, and it released the City from liability that might result from the work. In most cases, a portion of the footing drain removal cost was borne by the homeowner. Initially, each sump pump discharge was routed to the curb in front of each home in part to demonstrate the amount of water removed and also to provide better information on what might be needed to convey that water to a drain. At the end of the homeowner disconnection program, these sump pump discharges were connected to a shallow curb drain that brought all flows to the stormwater system for disposal.

The results of the program were found to be successful because of the reduced risk of basement flooding. About halfway through the disconnection program, the City found that they no longer had basement flooding problems and the pumps previously used to discharge excess flow to the storm drains could be removed.

Disconnection costs averaged $3,500/building and ranged from $11,678 for construction under a porch to $75 to reroute an existing sump pump. Costs of curbside sewers to convey the discharges from the new sump pumps to an available storm catch basin added about $1,500 per disconnection.

The City provided a full-time utility staffer during the 5-year program to coordinate with individual home owners and to approve the reimbursement of the contractors performing the work. It was noted that this coordination effort, along with a public information program, was critical to the success of the program. In addition, the City prepared a set of specifications that guided the contractor work performed during the project life.

Emergency Response: The City had a response that focused on protecting the public by pumping excess sanitary to the storm sewers when it rained using portable pumps. Because of the IDEM consent agreement, Utility Director stopped this practice when sufficient footing drain disconnection work was completed.

Sources: Scott Snyder - City of West Lafayette, Indiana
Bob Molzahn - Camp Dresser & McKee

Element	Description
Community:	Auburn Hills, Michigan
Population:	20,400
Households:	8,400
Project Area:	A single residential neighborhood on the south side of the community that discharges to the Evergreen Farmington district of Oakland County. This neighborhood contains about 350 residences.
Project Issue:	There has been a history of sanitary sewer surcharging and basement backup problems in some neighborhoods within the community. To address this in one neighborhood where there is a significant basement backup problems and also a limitation of the discharge from the district.
Findings:	While the community understands that there is a significant wet weather issue, the City has not focused on the determining the source of the problems through flow monitoring or modeling. City and consultant staff visited the footing disconnection project in West Lafayette Indiana and concluded that footing drain disconnection had all the attributes needed to deal with their basement flooding and capacity issues.
Recommendations:	The recommendation was to proceed with the footing drain disconnection program in the neighborhood with the most basement backup issues.
Implementation:	The City has been working for about 6 months to disconnect homes in the first neighborhood. They have disconnected 150 homes to date. The program is using three plumbing teams to make the disconnections in individual homes. A specialized directional drilling firm is constructing the curb drains to accept the flows from the sump pumps being installed in each home. The connections from each home are also made using boring methods. The drilling and boring methods are being used to minimize the impacts on the surface features including concrete and landscaping. The City has had a high degree of success in reducing damage to private property. The City has an employee managing and coordinating the field efforts. This coordinator meets with individual homeowners, maps out the disconnection strategy, coordinates with the plumbing contractors, and makes decisions in the field. It has been determined that the best method for construction of the curb drain system is to locate and uncover the utilities first, determine their elevations, and then develop the plan for installation of the curb drain system. This flexibility has reduced the need to move utilities and has ensured that these utilities are not damaged during the construction project. The City is paying the cost of the construction program. The construction costs have been averaging about $5,000 per home. This includes all of the cost inside and

outside of the home. The City is also providing the drilling contractor with the use of a Vactor truck to expose utilities and reduce the impacts on private properties.

Emergency Response: Not known

Sources: Ron Moniz - City of Auburn Hills

Element	Description
Community:	Columbus, Ohio
Demographics:	Population: 1,377,419
Households:	524,535
Project Area:	The Francisco/Teteridge project area, which consists of approximately a 3,800 acre sewershed located within the cities of Columbus (3,900 acres) and Upper Arlington (1,900 acres), includes 3,800 residences that were constructed between 1947 and 1970. The majority of homes in this area are believed to have basement foundation footing drains that are connected to the separate sanitary sewer system rather than to a sump pump that discharges this flow to the storm sewer system.
Project Issue:	There has been a history of sanitary sewer surcharging and sanitary sewer overflows (SSOs) in the form of street flooding, river discharges, and water-in-basement (WIB) occurrences along the Evans Run and Clinton #3 Trunk Sewers during heavy rains for decades. Other WIB occurrences have also been documented in this project area; however, they were primarily caused by local conditions such as excessive root intrusion, grease build-up, and collapsed or broken sanitary sewers. These local problems were found to be unrelated to the surcharging of the trunk sewer system and subsequently rectified by the City staff. The primary objectives of this project were to 1) identify cost effective improvements to mitigate the trunk sewer surcharges and consequently sanitary sewer overflows (SSOs) into basements and at manholes and other miscellaneous structures, 2) identify immediate action items that can be implemented prior to capital improvement project recommendations, and 3) recommend a routinely scheduled maintenance program for trunk sewer segments that exhibited higher sedimentation conditions. The problems observed appear to be caused by inadequate maintenance of the system since original construction, pipe segments constructed at a negative slope, basement foundation drains that may still be connected to the sanitary sewer system, private property sewer lateral condition problems, and infiltration entering the trunk sewers through abandoned sewer lateral connections.
Findings:	The field investigation efforts included closed-circuit televising of the main trunk sewer system that documented significant sedimentation problems in some areas that caused the dry-weather flow to take up over 90 percent of the trunk sewer conveyance capacity. Of the 29,000 lineal feet of trunk sewer televised, over 15,000 lineal feet had 20 to 40 percent of the pipe depth occupied by sedimentation and over 5,000 lineal feet had 40 to 60 percent. Removal of this sedimentation during the CCTV process significantly increased the capacity of the trunk sewer system to convey dry weather flows. However, this had a minimal effect on the performance of the system for wet-weather flows.

Even with the removal of the sedimentation in the trunk sewer system, inflow and infiltration from basement footing drains and other sources is still projected to cause WIB occurrences, street flooding, and river discharges. During the eight-month flow monitoring period, it was determined that between 1% and 16% (depending on the season and the location of the flow monitor) of the rainfall falling over the project area found its way into the sanitary sewers. Since the project area (the Evans Run and Clinton #3 Trunk Sewers) discharges to the Olentangy Scioto Interceptor Sewer (OSIS), which is often surcharged, the downstream outlet capacity is believed to be responsible for many of the problems along the trunk sewer system. It was also found that even if half of the wet weather flows were eliminated from the system, the area would still experience the WIB occurrences, street flooding, and river discharges.

Recommendations: To address the sanitary sewer problems in the project area in a manner that is cost effective and least disruptive to the entire community, the City is considering a phased implementation plan that institutes immediate, short term and long term action items based on the priorities within the sewershed. To address the immediate need of solving the WIB occurrences, the City is considering installing grinder pumps on all homes or businesses that are considered to be at risk of flooding. To address the SSOs that cause street flooding and river discharges on a relatively frequent basis, the City is considering a short term solution that involves the construction of a parallel relief sewer and flow equalization/storage. Finally, because of the difficulty of removing I/I sources on private property, the City is considering as a long-term solution, the construction of a sewershed relief trunk sewer. This new relief trunk sewer would serve half of the project area with the existing trunk sewer system providing service to the remaining homes. For this long-term solution to be effective and solve all the problems in the sewershed, the City must also address the surcharge conditions in the OSIS.

In areas where negative sloped pipes are the primary cause of sediment accumulation, the City will consider the cost of replacing these segments with positively sloped sewers versus having a City crew perform preventative maintenance. Based upon which is most cost effective, the City will implement a solution.

Implementation: The City has not implemented any recommendations at this time. Final report on findings and recommendations will be available in August of 2000.

Emergency Response: The current City practice is to respond to basement flooding complaints by dispatching a field crew when the complaint is received. The field crew typically diagnoses the problem by reviewing the condition of the sewer serving the residence. If the sewer is not surcharged, the crew will identify this as a homeowner problem. It was noted that because of the time needed to respond, surcharge conditions within the sewer might have changed.

Sources: Laurie A. Chase, P.E. - City of Columbus
Christopher T. Calpin, P.E. - Camp Dresser & McKee

Element	Description
Community:	Riverview, Michigan
Demographics:	Population: 13,000
Households:	5,000
Customers:	3,500
Project Area:	The entire City of Riverview is composed of 5,000 households with 3,500 customer connections. The area that included a pilot footing drain removal program contained 60 homes.
Project Issue:	As part of a system-wide wet weather evaluation for the collection system that the City of Riverview discharges to, the flows from the City were evaluated. The wet weather response was compared to the available contract capacity that the City has in the collection and treatment system by virtue of existing contracts.
Findings:	The existing contracts for the downstream collection and treatment system were not able to accept peak or wet weather flows from the City of Riverview. Wet weather flows from the community largely exceeded the available capacity of the conveyance and treatment system.
Recommendations:	The engineer recommended that the only method available to achieve compliance with the available contract capacity was to remove all connected footing drain sources in the City. To determine the feasibility of doing this, a 60-home area was piloted for complete removal of home footing drains.
Implementation:	In the pilot area that was selected, all of the footing drain connections on the homes were disconnected by excavating to the connection between the footing drain and sanitary sewer connection that was made just outside of the foundation wall (the exterior side of the basement foundation). The existing footing drain was left in place and connected to the existing sanitary sewer. This sanitary sewer in the street was converted to a part of the storm water drainage system. At each home, new house leads were installed and these were connected to new sanitary sewers that were installed on either side of the street under the sidewalks. Costs for the work included construction of a new storm water and sanitary pumping station to handle these flows. The cost of this program was $5,700/home (1994 costs). The pilot program showed that the construction activities on private property were a significant hurdle to city-wide implementation. Further work was not performed because of these negative implementation issues. In its place, an extensive program of sewer lining and sewer replacement was performed throughout the City and an increase in the City's contract capacity was negotiated with Wayne County. The cost of this implemented program was $12 million for construction and $20 million

for capacity improvement, for a total cost per house of $9,000 (1996 costs).

Emergency Response: A contact number was established at City Hall for residents to call regarding basement flooding problems. A task force was established through the City Manager and Department of Public Works.

Sources: Tim Hennessey - Hennessey Engineers

Element	Description
Community:	Canton, Michigan
Demographics:	Population: 73,000
Households:	26,800
Customers:	12,000
Project Area:	The entire City of Canton is composed of 26,800 households that include about 12,000 customers that are in homes that have connected footing drains.
Project Issue:	Flows generated within the community exceeded the available capacity of their discharge contract with Wayne County during wet weather periods. The City wanted to identify and remove sources of I/I that were also causing basement flooding in some areas.
Findings:	Houses in Canton include large developments that employed very similar construction methods. In most homes constructed before the 1980s, this included foundation footing drains that are connected to the sanitary house lead inside the basement wall. At this connection to the sanitary sewer, a clean-out with a deep trap that is accessible from the basement floor was present in most houses.
Recommendations:	The community determined that footing drain flows needed to be removed to allow the township to live within its contractual limits with Wayne County, its provider of treatment services. Because most of the homes were constructed using the same standards, it was recommended that the footing drain flows generated under wet weather be removed by installing a special sump pump that fits into the footing drain clean-out.
Implementation:	Of the approximately 12,000 homes in Canton Township that have connected footing drains, about 2,500 have been retrofitted as of the end of 2000 as described above because they were at risk of basement flooding and volunteered for the modifications. The Township is continuing to install the sump pump system systems and hope to convert all the homes with footing drain connections at some point in the future. To perform the upgrades, a special sump pump is placed into the footing drain clean-out of the home. The pump is located inside a 4" clean-out and trap and the motor extends above the floor. In most cases, no sump is required and no concrete needs to be broken. A special plug is installed in the connection between the footing drain cleanout and the sanitary sewer. This plug allows small amounts of footing drain flow to discharge by gravity into the sanitary collection system in dry weather. When large footing drain flows are generated in wet weather, the hole does not allow these flows to pass into the collection system and the sump pumps discharges

this flow out of the house and onto the lawn area. A small flap valve is installed on this hole to prevent sanitary wastewater from entering the footing drain system. In addition, a back-flow protector is installed in each floor drain in the basement to prevent flooding if the sanitary sewer in front of the home surcharges.

The costs of installing the sump pumps have been borne by the Township. Township personnel perform the installations, except for the electrical work, which is done by an outside contractor. The cost of materials for the complete installation is about $500/home. The Township also maintains all of the installed sump pumps within the Township.

One problem noted with the installations is that about 5% of the sump pumps fail each year. This is because the pumps only run under wet weather conditions and can be inactive for months at a time. Since the homeowner has the responsibility of performing monthly maintenance on the units that include oiling the unit and starting it once per month, these failures are most often attributable to failure of the homeowner to actually perform the required work.

Emergency Response: Unknown

Sources: Tom Casari - City of Canton Township, Michigan

Element	Description
Community:	Cedar Rapids, Iowa
Demographics:	Population: 142,000
Households:	50,000
Customers:	52,000
Project Area:	85 square miles
Project Issue:	The problem identified was chronic residential basement flooding.
Findings:	The project analysis found that these problems were a result of both inadequate collection system capacity and excessive I/I from foundation footing drain sources.
Recommendations:	The primary recommendation was to perform foundation drain disconnections. It was estimated that this would cost on the order of $3,500 per home.
Implementation:	The foundation drain disconnection program has not been implemented. The City undertook a voluntary inspection program and found that fully 50% of all homes have connected foundation footing drains. They also found that many people would not allow the inspections to take place. Because of problems in gaining the authority to perform the footing drain removal work, the City has been working to design and installed a new relief sewer at a total cost of about $1,000,000 to serve one area. Once this is complete, the City will determine if the relief program is successful. The disconnection program recommendations remain on hold.
Emergency Response:	At the present time, the City has emergency bypass pumping from sanitary to storm.
Sources:	Dave Wallace, City of Cedar Rapids Bob Molzahn, Camp Dresser & McKee

Appendix M

Element	Description
Community:	Lynn, Massachusetts
Demographics:	Households: 3,229
Project Area:	Approximately 1 square mile
Project Issue:	The community was experiencing residential basement flooding thought to be caused by caused by excessive inflow/infiltration during wet weather.
Findings:	An inspection program was used to identify downspouts and sump pumps that were directly connected to the sanitary sewer system. For the homes that were inspected, about 20% had connected downspouts and about 15% were found to have sump pumps directly connected to the sewer system.
Recommendations:	It was recommended that the individual home owners remove these private sources of I/I and the City staff confirm the disconnections.
Implementation:	The City decided to provide a reimbursement program to offset the costs to the home owners. This program covered the costs of the downspout disconnection up to $20 per connection and the cost of sump pump disconnection up to $500. The payment was made after City staff inspected the corrective work. In most cases, the sump pump discharge was not directed into the storm system, but was directed onto the lawns away from areas where nuisance freezing might occur.
Emergency Response:	N/A
Sources:	Paul Demit - Camp Dresser & McKee

N City Services

Contents

N.1 Dealing with Sewer Water In Your Basement

If you experience a sewer backup in your home, please notify the City of Ann Arbor immediately by calling 994-1760 during business hours (7 am-5 pm weekdays) or 994-2840 after hours and holidays. This allows the City to take appropriate action and collect information needed to help resolve the problem. In the event of widespread sewage backups, the City will release emergency notification to the local media and on cable channel 16.

Do not attempt to enter your basement if it is flooded. You run the risk of electrical shock or encountering harmful pathogens in the water. Allow the water to drain out of your basement first. You may wish to contact a plumber if the water is not draining properly.

While the basement is flooded avoid flushing toilets or using other water connected appliances or fixtures, whose discharge would make the basement more difficult to clean.

The aftermath of a flooding event is both distressing and dangerous. Proper attention must be given to items that encountered floodwaters. Please follow the basic guidelines in these instructions to ensure the safety of you and your family.

N.2 Customer Information and Services Guide

This information is given to assist customers who have experienced sanitary sewer back-ups to their property from sewer mains maintained by the City. The services are not provided for any sewer back-up caused by a private sewer system or any part of the house or building lead. In the event of a back-up in the City's sanitary sewer system, the Water Utilities Department will clear the blockage. A City crew or contractor for the City may assist the property owner in sanitizing basements. If the property owner receives assistance with sanitizing the basement, upon completion of the sanitizing the property owner must sign the Customer Satisfaction Form with the Contractor or Water Utilities department. If necessary, with the homeowner's approval and without charge, the City will dispose of damaged items. An inventory prepared by the property owner prior to pick up, listing the items they wish to have disposed of by the City need to be provided to the City.

The following is the property owner's responsibility: Foodstuffs contaminated by the back-up water should be discarded. It is suggested that affected appliances be checked by a qualified appliance service person. Normally, appliances are not damaged by water from back-ups, and need only to be checked, cleaned, and/or dried. Clothing should be professionally laundered or dry cleaned. Rugs and similar goods should be cleaned. Metal and nonporous goods should be thoroughly cleaned by the use of hot water and a good soap or detergent. Bring materials to be disposed of to the curb side from the basement/building.

If you desire to file a claim against the City for consideration by the City's Board of Insurance Administration, it should be filed in writing with the City of Ann Arbor Human Resources Department's, Risk Management Division, within 60 days from the date of occurrence.

Any statements or promises concerning your claim that are made to you by any other City employee or agency are unauthorized, are not binding, and will not alter the Board's decision.

The Risk Management Division has an "Insurance Information Claim" handout and Claim Form that are attached. Their office is located on the 5th floor of City Hall at 100 N. Fifth Avenue. The telephone number is (734) 994-4532, Monday through Friday,

8:00 a.m. to 5:00 p.m. If you call this number after normal business hours, you may leave your name and address to have the information sent to you. Claim information and form are also available on the City's website at www.ci.ann-arbor.mi.us. (The information is available within the Human Resources Department's web page under Risk Management.) Any further questions regarding filing a claim against the City should be directed to the City of Ann Arbor Risk Manager.

What services homeowner can expect from the City Contractor if the City sewers cause the backup. (This is proposed and will be included in the packet when contractors are available).

If it is determined that the back-up is a result of blockage in a sewer main maintained by the City, a representative from Ann Arbor Water Utilities Department will contact one of the contractors for cleaning and sanitizing the basement. The property owner will be provided the name of the contractor that has been contacted and the expected time of arrival. The contractor will perform following work:

- After the floodwater has receded down the floor drain, the Contractor will remove any water left standing on the floor.
- Remove sewage damaged items from basement or other locations to owner agreed location on the premises (for example, garage, back yard or the curb) for pickup by the City.
- NOTE: HOMEOWNER WILL BE REQUIRED TO CONTACT THE CITY AND SCHEDULE CURB SIDE PICKUP IF THIS OPTION IS SELECTED BY OWNER.
- Sanitize floors, stairs, ceilings and walls that came in contact with the water from the sanitary backup. This includes the moving of furniture and appliances so areas behind and under these items can be sanitized properly.
- Cleaning and sanitizing hard surface items (chairs (non-upholstered), tables, sports equipment etc.) that came in contact with the water from the sanitary sewer backup.
- De-watering of area rugs.
- Removal of carpets and padding if not practical to be cleaned and sanitized unless specifically instructed to clean and sanitize by the homeowner and the homeowner signs appropriate documents acknowledging the request and relieving the City and the contractor from any further action.
- Remove all equipment and waste materials resulting from its operations immediately on completion of its services.

Any follow-ups that are requested by the property owner will be coordinated by the Water Utilities Department and appropriate action will be taken.

Sanitizing your own basement

Following are the steps that homeowners can take to sanatize their basements:

- Do not attempt to enter your basement if it is still flooded, you run the risk of electrical shock and encountering harmful pathogens in the water.
- Prevent the tracking of sewage into unaffected portions of the home.
- Always wear protective gloves and boots. Rain gear is also advisable. Avoid contact with raw material, and be particularly careful of your face and eyes. Goggles are recommended when you are using a hose. Protect all cuts and scrapes. Immediately wash any wound that comes in contact with sewage.

- After the sewage has receded, flush the floors and effected walls with water from a hose. Then wash with detergent and hot water. Keep the hose and water away from electrical equipment or wiring unless the electrical power is completely disconnected. Sanitize floors and flooded portions of the walls using a chlorine solution. Mix the chlorine with water per instruction on the chlorine bleach bottle. Normally, this is ½ cup chlorine bleach per gallon of water.

- Non-canned foodstuffs contaminated by the backup water should be discarded. Discard all bottled goods sealed with crimped caps that were in the flood. Canned fruits and vegetables should be thoroughly washed. Wash the outside of the can with soap and hot water, using a brush around the covers and rubber rings. The cans and jars should then be immersed in chlorinated water for at least 15 minutes using the same strength solution as recommended above.

- It is suggested that affected appliances be checked by a qualified appliance service person. Normally, appliances are not damaged by water from backups, and need only to be checked, cleaned, and/or dried.

- Clothing affected by the sewer water should be professionally laundered or dry-cleaned. Rugs and similar goods should be cleaned.

- Metal and nonporous goods should be thoroughly cleaned by the use of hot water and a good soap or detergent. Further sanitation of surfaces can be accomplished by wiping with a diluted solution of chlorine laundry bleach and water. (Follow directions on containers for use of chlorine bleach.)

- Ventilate the basement by circulating fresh air or outside air to assist drying.

- After cleaning the basement, make sure that all clothing and parts of the body, which were in contact with sewage, are thoroughly washed.

Health Hazards of Exposure to Sewage

Exposure to sewage may result in a number of illnesses that include:

- Gastroenteritis, characterized by cramping stomach pains, diarrhea and vomiting

- Hepatitis, characterized by inflammation of the liver and jaundice

- Infection of skin or eyes

- Allergic alveolitis (inflammation of the lung) with fever, breathlessness, dry cough, and aching muscles and joints.

- The routes of exposure of the building occupants to pathogens causing illnesses are contact, ingestion and inhalation. Occupants may be infected by contacting contaminated surfaces, with inadvertent transmission from the hands to mouth, or inhalation of microorganisms due to aerosolization of contamination.

- In addition, the backup may cause in conditions conducive to the growth of nonsewage microorganisms (which exist in various life stages in indoor and outdoor environments). These microorganisms can produce bioaerosols, which are potential sources for disease.

- If property owners want to check for mold spores, services of independent certified testing lab are required to ensure reliable testing and assessment.

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Appendix O - City Services Survey Results

The following results were obtained from the 2001 City Services questionnaire. This survey was sent to Homeowners who reported experiencing basement backups during heavy rains in June and July 2000.

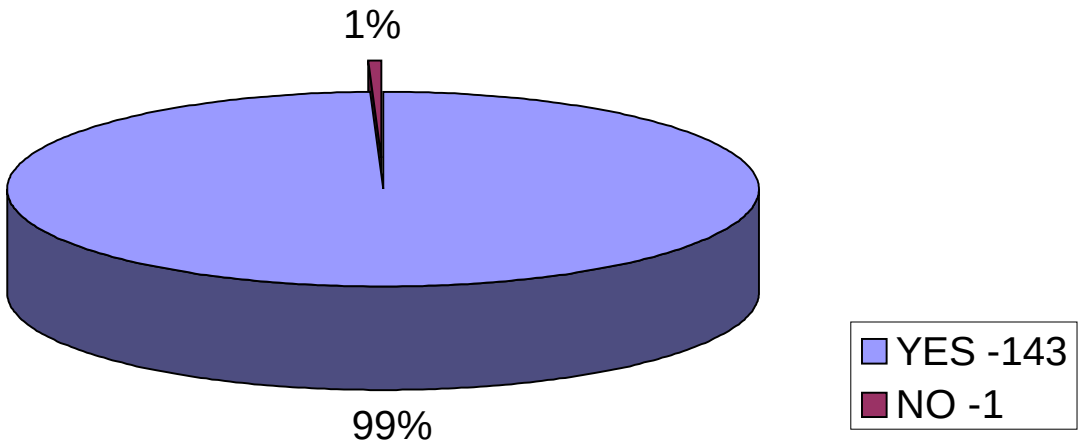
City staff initiated this survey at the direction of City Council. The intent was collect information on quality of City services provided and the type of additional services which could be offered to assist Homeowners for similar incidents in the future.

STORM WATER BACKUP SURVEY, 2000

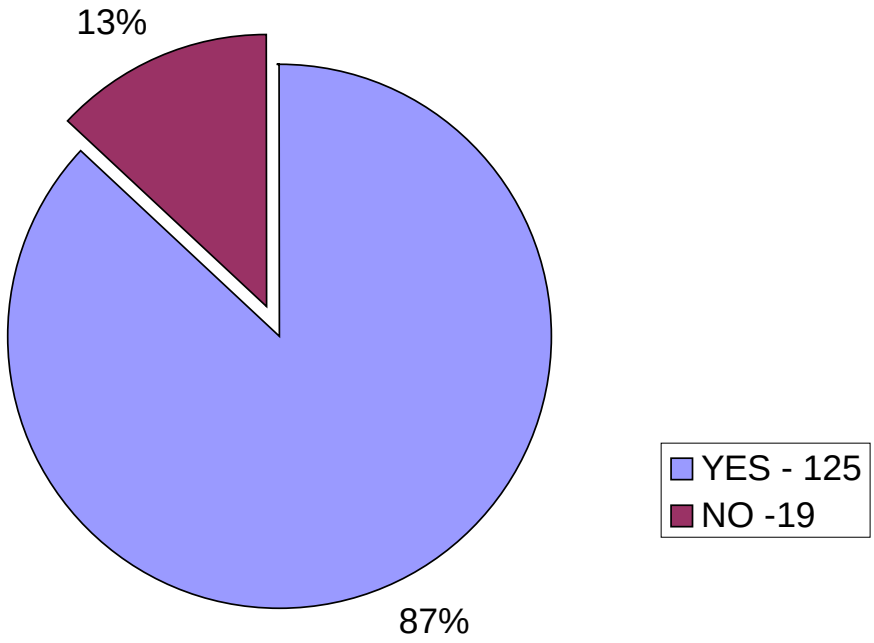
PURPOSE: This survey was sent to Homeowners who reported experiencing basement backups during heavy rains in June and July 2000. The intent was collect information on quality of city services provided and the type of additional services which could be offered to assist Homeowners for similar incidents in the future.

SURVEYS MAILED – 343
SURVEYS COMPLETED – 144 (42%)
SURVEYS RETURNED AS UNDELIVERABLE – 12

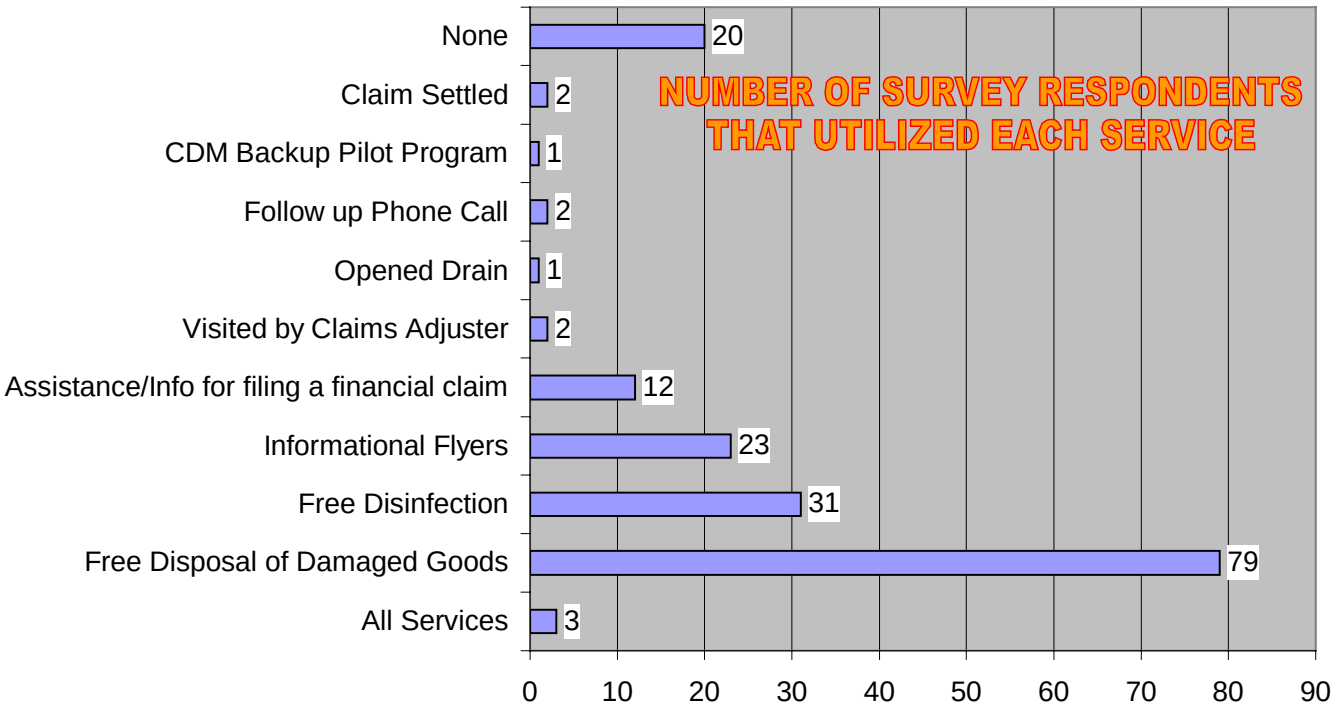
Q1. DID YOUR HOUSEHOLD EXPERIENCE A STORM WATER OR SANITARY SEWER BACKUP THIS SUMMER?



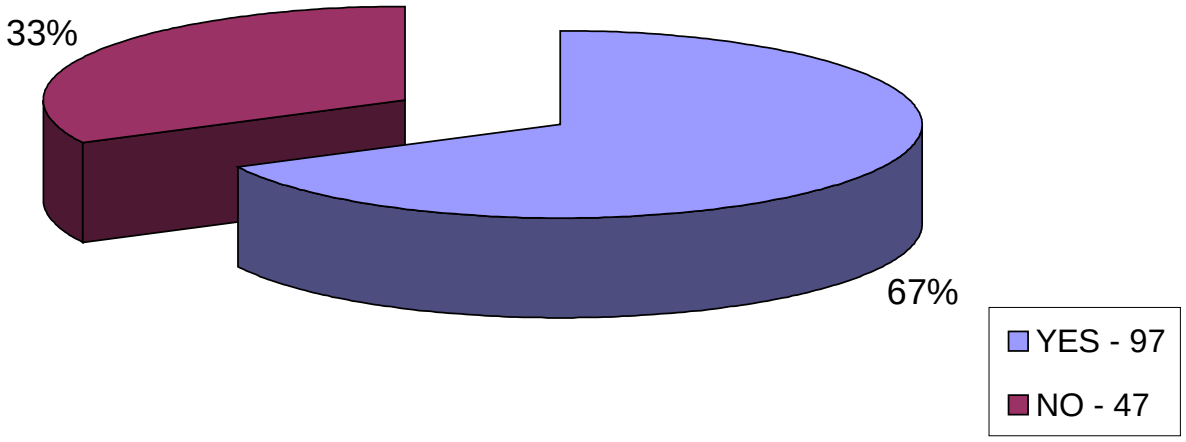
Q2. DID YOU CONTACT THE CITY FOR ASSISTANCE THIS SUMMER WITH A BACKUP PROBLEM?



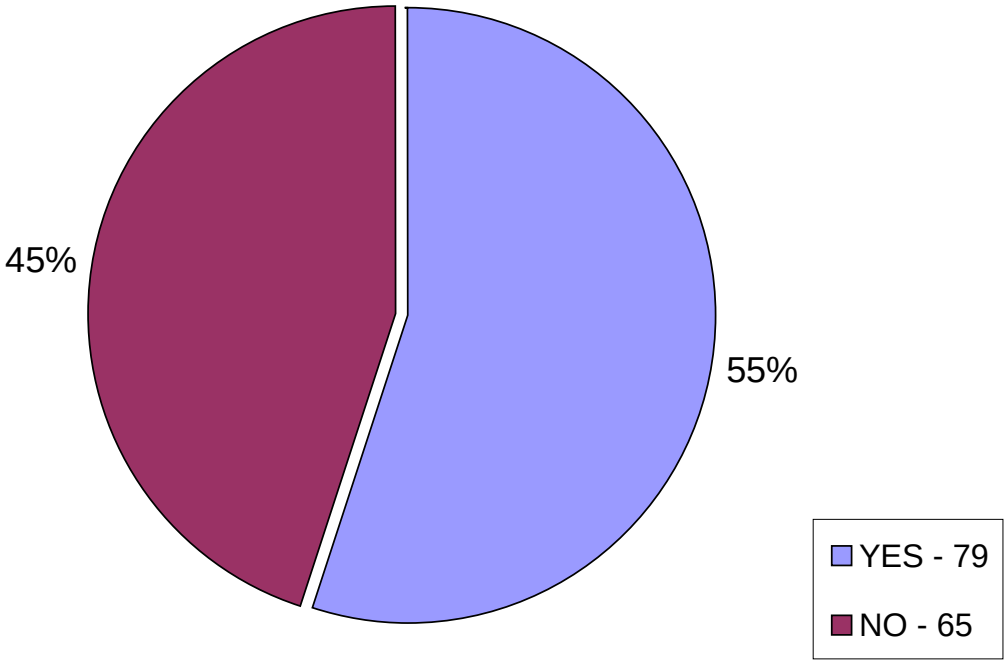
Q3. WHAT SERVICES WERE PROVIDED TO YOU BY THE CITY?



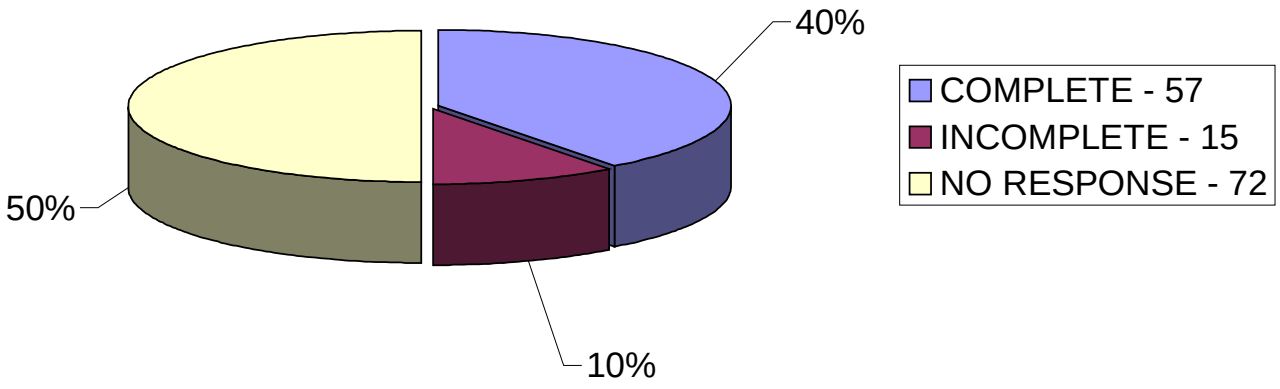
Q4. WERE THERE ADDITIONAL SERVICES THAT YOU WOULD LIKED TO RECEIVE?



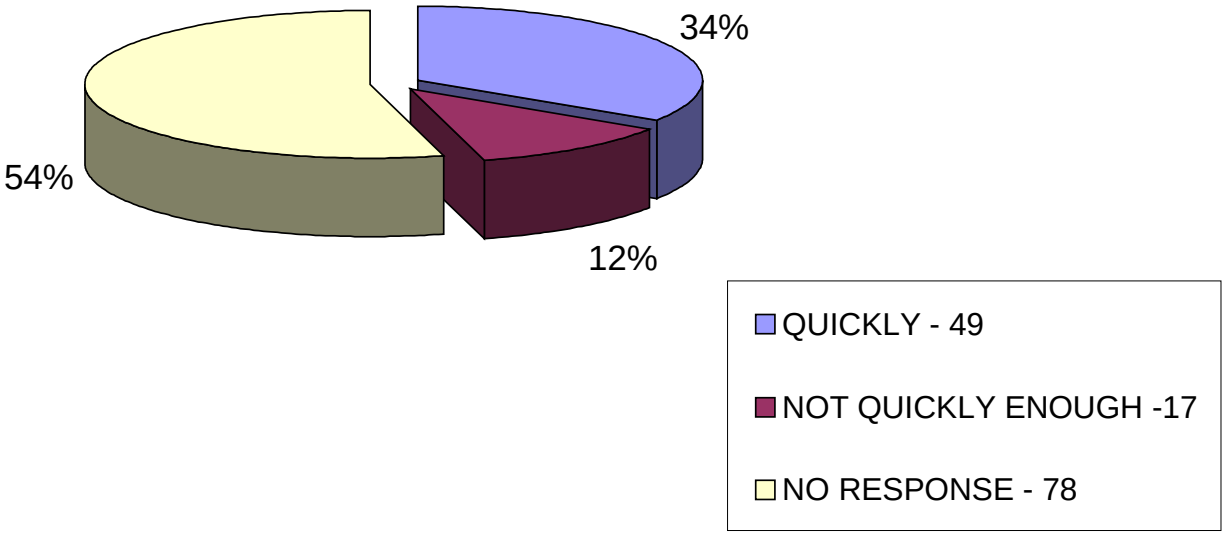
Q5. DID YOU FILE A DAMAGES CLAIM WITH THE CITY?



Q6a. CLAIM INFORMATION WAS:



Q6b. CLAIM WAS PROCESSED:



INDIVIDUAL COMMENTS

Q4. (comments) Were there additional services that you would like to receive? If so, what?
Yes, smell was with us for a while, would have liked more disinfection
Yes, help remove damaged furniture from the basement to the curb. I could not do it myself and I cannot afford to pay the movers to come.
Yes, free disinfection - reimbursement for damaged lost items.
Yes, cost of $2500 to repair and replace everything.
Yes, after 2 months I still had a smell in my sump pump & the drain area made whole house smell of mildew. It seems I could have been told to pick up the septic tank enzymes - I found this out from someone other than the City of Ann Arbor. I bought this at
Yes - those mentioned above and someone to view the damage.
Yes - I'd like the problem solved!
YES - A fix to the problem so I could use my basement.
Would like to have received disinfection but didn't know about it.
We would like the cause of the problem fixed. We are paying $125/month for a storage unit due to the fact we cannot use our basement. We tried to sell our home & could not - people are now educated that Ann Arbor has this problem & to avoid it. Our basement is dry other than being used by the City for sewer water storage.
We want the City to make sure that this does not happen again in future; installation of back-flow preventor valve at least for the time being will be appreciated.
We paid for professional cleaning and were reimbursed - Would like to have had carpet reinstalled.
We knew of these services, but didn't have time to take advantage. We had an open house the next day, so we cleaned up ourselves. We got an offer on the house that day, after 9 hours of cleaning - We are no longer at 2825 Sequoia Parkway.
We had to pay out of pocket for Coach's to extract & disinfect. We moved and cleaned all our belongings & we had to PAY for the City to pickup debris. - Pickup should have been free.
We did not realize these services were available. We did not contact the City for assistance until after solutions of relocation and cleanup had been put in place.
We did not contact the City - we will do so soon. Would like additional information on claim forms or instructions.
Was told to call Michigan Power Rodding & request the drain tiles be cleaned; cost $150 w/no guarantee-Power Rodding did not recommend the process saying it was no doubt a City of AA problem.
Two disinfections (reimbursed for one) – Furnace and other appliances - electrical inspections "post" flooding and have City recommend storm drain plugs for homes.
To replace the damaged goods or provide the services needed to repair the basement.
To fix the problem so I don't get sewer back up in my house.
There was no mention of free disinfection - Also - if they could fix the problem.
The storm drain is bringing more junk and gets clogged more often, needs to be monitored better.
The service that I want is to have the sewer backup problem fixed so that it does not happen again. This is the 3rd or 4th sewer backup that we have had - I want to sell the house - but the value of it has been diminished dramatically because of this condition.
The items in parentheses #3 above - no one ever mentioned those services.
THE DRAINS UPDATED
The crew from the City did an excellent job.
The City responded quickly - determined that City sewer was OK – drain to house was clogged by tree root. Roto-Rooter solved problem.

The City employees were very nice and did a good job.
Take care of the sewer! Clean them.
Support in blocking any additional multiple unit housing in the area. The Legacy Park proposal is preposterous.
Someone to come to our home to actually see the damage and work with you on the insurance claims. Each home I'm sure had individual needs & concerns - We also feel contact should be made to person's who have filed them.
Residents should have been informed of the fact very early regarding the threat of E.Coli infection that was very real
Requested disinfection, but there was a several day wait and we could not wait that long with two small children.
Request a claim form - (Copy to Risk Mgmt. 10/16/00)
Relief from taxes - can't sell a house that floods w/sanitary - no one will buy it.
Procedure pamphlet, Pickup Schedule, Claim log & form.
Prevention
Notified City but did not request assistance.
Nothing that could have been timely. We had to clean up immediately.
Not that we know of
Not enough for the loss and the mess. My disinfection cost $650.00 from Coaches. Disinfection, Reimbursement for loss time & personal items. Repair of system.
Not at this time, however it could cause considerable damage if it happens again as I have had carpeting installed.
None - lived in house since 1963 and no backup problems with sewer or stormwater backup
No other services were provided or offered. Would have liked disinfection, cleaning, placement of back-flow preventor valve.
No flood would be good.
No everything went very smoothly. Thank you
No - The above services were very quick and professional.
My basement was flooded - ruined my carpeting - City did pick up old carpeting - I paid Coaches $1200 for carpeting - used my insurance for all the damage - The City paid my deductible for my insurance that covered my home - $250.
Most of the clean up we did ourselves & certainly expected too, however, the city's disinfection process was unsatisfactory.
More financial assistance - what you offer won't cover our damage. Adequate sanitation services, AN APOLOGY!!, Resolution/update of sewer system.
Monetary compensation.
It's essential for health & comfort of living in affected sewage backup residences that a permanent resolution to this repetitive problem be found in larger pipes for stormwater. Disconnect storm from sewage lines.
Insurance adjuster could come into our house to help with the value of the things we have lost. Also a list of contractor who would give us estimates. We have called five contractors and no estimate.
Information on what could be done in my basement to stop this from happening again, I.e., sump pumps, etc.
Information as to what was happening - why it was happening and what we could do about it.
If we knew in advance that the City would provide free clean-up and disposal, we could have avoided the extremely high rates charged by Coaches.
If I had known about the free disinfection I certainly would have requested it.
I would like to see a new sewer put down. This happens repeatedly.
I would like to have the sewer problem fixed. It will continue to happen and has happened twice

before.
I would have liked it not to happen. The City should provide disinfection services for free - it cost me $1500.
I wish the City would get with the U of M about the parking lot behind us on Kraus between W. Washington and Liberty. They should clear the drains in spring also maybe put up 2 or 3 foot wall to give water time to drain. Maybe check the drainage slope.
I wasn't going to file a claim as the format was complicated and the "evidence" asked for seemed impossible. The ACU consultant appeared 1st to be a lawyer and I appreciated their persistence and help.
I wasn't aware that the City provided free sanitation. Because the rain event occurred on a Sunday, it wasn't possible to call the City offices to get information that day. We, of course, wanted the mess cleaned up that day, so we had to pay someone else
I guess I would have liked it not to have happened at all. But other than that, I wish I had received info immediately after the first backup.
I did not receive free disinfection (did not know this was available) We decided not to even though our damage was extensive. We have new carpeting now.
I did not know until a few days later that this was a city-wide problem. I then reported it on the phone and on a web-site questionnaire. I had already cleaned up the water in the basement -
I did not know that the City would assist. I head from my friend Steve Rapundalo what services were available. A well kept secret??? - I guess I would like to know how we can find out what services are available.
I called the investigation team of the storm water team. Additional services: Financial assistance with damaged goods, clean up and plumber assistance.
Help getting the heavy items and carpet out of the basement
Help cleaning & answers on what you are doing to fix it!
Guarantee that NO NEW "CUSTOMER" will be added to our sewer system until the problem has been identified and remedied. An insurance policy should be taken out BY THE CITY to cover any future damage in a similar circumstance.
Free disposal of damaged goods only after calling on own several city services to get the proper department for pickup. We were very dismayed that the City did not immediately disseminate proper instructions and information on the HEALTH risks involved.
Free Disinfection
Free CLEAN UP of damaged goods.
Follow up disinfection - Loaning of equipment, I.e., fans, dehumidifier, tarps and pumps.
Fixing the sewer system.
FIX THE PROBLEM! We've lived here 25+ years and never had problems until Aug. 98 and this year. Time to fix the sewers.
FIX THE PROBLEM!
Fix the problem (not related to rain water in our case)
Expand the system's capacity. Connect drain tiles to storm sewer.
Do something about the new building construction
Disinfection, assurances it won't happen again.
Disinfection was supposed to have been provided but the City workers never showed up (or we missed them) - The biggest service would be to solve the problem. We are paying taxes on our basement living space, but we don't use this space at all given the unpredictability of backups.
Didn't know free disinfection was available. – Don't want it to happen again.
Didn't know about free disinfection. Can I still have it? Info flyers would have been nice.
Did disposal of damaged goods and disinfection myself. Would like damage assessment for walls.

Dehumidifiers - Knowledge if it happens in the future that the City will still be held liable.
Cleaning Services - Addressing the problem – Paying/installing a backup valve.
Cleaning & Disinfecting; help in getting damaged items out of basement because we are over 80 years old.
Cleaning & checking of affected appliances – water heater, furnace, washer, dryer.
Clean up and disinfection - a basement that is sewer-free!!!
Clean up - this cost $1,500.
City should have contracted with the disaster cleaners to arrange schedule cleaning.
Carpet Cleaning
Better sewer system!! Rental of equipment for sewage back-up?
Better building codes in 1959 which would have recognized the problem or putting one house (ours) lower than all surrounding land. Fixing the problem now will cost approx. $10,000
Arrange for my drains not to back up.
An explanation of why it happened and what has been done to make sure it won't happen again.
Advice/direction on: 1. How to prevent a similar situation from happening again. 2. How to best deal with the condition of 8" of water in my basement.
A sewer system that's not so overloaded that it backs up.
A little kindness and understanding
A boat.

Other Comments
We purchased our house a few days after the large storm that caused a storm water backup in our basement. The seller of the house had the basement cleaned. However, I notified the City of the water problem, so that our neighborhood could be identified as one requiring study.
We had major flooding due to collapsed (or absent) drain tiles which should connect to stormwater drains.
Wasn't made aware that I could claim my time until the claims adjuster told me.
Was told we couldn't file a damage claim with the City.
Thought City should have been more prepared to handle the volume of calls, questions, etc. Voicemail responses from Risk Management was continuous.
This is the third time we have had storm water backup (over 40 years time)
This is the second time this has happened at time City paid nothing - not even for my carpeting - cannot remember what year this was.
This is the second backup - - The first time I didn't get any info for 3 days by which time I had done most of the cleaning and disposal myself.
This is a dental office - The offices of R. & D. Heys, and S.M. Embree
The claim was processed fairly quickly. However, the method the City Administration used (I.e., sending a stranger to the door to "come in and inspect the basement) w/claim forms, etc. was very poor. The individual had NO identification and there was no prior communication sent or put in the Ann Arbor News to alert us that someone was being sent per City administartion.
The claim has not been processed - we would like to hear from the claim as to how things are going.
The City was very helpful, concerned & disposed of the goods promptly. I was very impressed with the service. Most of the damaged goods weren't in use anyhow.
Thank you AA and Camp Dresser for staying on this. (Warren Bovenhech
Susan Campbell was extremely helpful. Thank you
Storm sewers at Liberty end of Dartmoor should be cleaned out after hard rains, the street always floods. The 2 homeowners at the lowest point clean debris from drains. Fall, with all the leaves in street is difficult.
Still in process
Save your (our) money, fix the problem.
Our neighbors told us that unless we saved receipts from our damaged stuff - it was not worth filing a claim; that the City argued with you over the worth of your possessions & then paid practically nothing.
Notarizing of claim form should not be required. Undo extra steps to submit claim.
Not quick enough - although understandable.
No damage claim yet - need estimates.
My insurance company is working with the City toward compensation. I am anxiously awaiting the resolution of this matter.
Mr. Rapandalo was especially helpful in hearing my concerns and directing me to proper offices. Offered to remove damaged carpeting.
It is outrageous that the City is trying to shirk responsibility.
Inconsistent between City of Ann Arbor & ASU group
I'd like assurance the City is resolving this problem and I won't be faced with saturated carpeting etc.
I would like to know how they determined the amount I was awarded.
I would have filed a claim for damages.
I was very satisfied with the speed that my claim was resolved – Thanks

I was not able to get the amount of documentation necessary
I was astounded that the City paid someone to hand deliver claim forms. They are straight-forward - I'm not an idiot - what a waste of money that could to fix the problem.
I submitted a claim that I knew was not complete, as I had not secured 2 estimates for basement renovations. The claim was not settled, as this is as I expected. I received a timely response. I am satisfied with the City's response so far.
I only called the City to make them aware of my problem.
I just sent mine in - (Claim to City)
I filed a lawsuit.
I do not want another sewer backup.
I do not feel that the homeowner should be financially responsible for purchasing insurance against future backups. This is the City's responsibility to keep its sewage out of basements.
I didn't realize we missed the deadline.
I did E-mail info of the backup, received no response.
I called the City to report the backup. I had all of my things up so the water wouldn't damage it.
Have not received a response.
Have not heard anything.
Have not filed a damage claim with the City yet - still having repairs done and haven't gotten all the estimates yet.
Have not filed a claim yet.
Have not filed a claim yet - waiting to see if we need to replace carpeting.
Had major clear water inflow at junction of floor & wall in basement - Neighbor contacted city and when City employee finished there he came to see me. I showed him our problem.
FIX THE PROBLEM!! - City is putting in more and more housing without proper infrastructure - bigger pipes? -Stop wasting time with surveys.
Disposal was offered but we worked through Sun & Mon AM before the call and hauled and disposed of the waste ourselves.
Did not file claim with City - Does not cover cost or fix problem.
Did not file a damages claim yet -
Did not file a damages claim with the City yet.
Did not contact the City for assistance in my house - but Yes, for storm sewers in front of my house and my neighbors.
Claim still pending - incomplete in 2 parts - and not quickly enough
Claim is being processed now.
Can't respond on how satisfied I was with the City's response.
As of this date (11-19-00) we have not yet received compensation.
A man came out and said that the problem was mine, not the City's. He also told me that the "backup" was potentially harmful when it was only storm water.
#2 - Yes, contacted the City - although they came and looked you had to get everything out before they would disinfect the just told me what to use and do it myself.
"Waiver" made it impossible to do anything. Very disturbed by City's attitude to its citizens.

"SURVEY INSTRUMENT DISTRIBUTED"

STORM WATER BACKUP SURVEY

Your Responses Will Help Us Serve You Better

This summer the City of Ann Arbor experienced unusually high rainfall, and many households experienced water and sanitary sewer backups. We would appreciate your help with a short survey to help us understand how we may best assist residents impacted by such backups in the future.

1. Did your household experience a storm water or sanitary sewer backup this summer?
   NO [ ] YES [ ]

2. Did you contact the City for assistance this summer with a backup problem?

3. If so, what services were provided to you by the City? (free disposal of damaged goods, free disinfection, informational flyers, etc.)

4. Were there additional services that you would have liked to receive? If so, what?

5. Did you file a damages claim with the City?
   NO [ ] YES [}

6. If yes, how satisfied were you with the City's response:

Claim information was:	complete	[ ]	incomplete	[ ]
Claim was processed:	quickly	[ ]	not quickly enough	[ ]

Thank you for your assistance - your feedback is gratefully appreciated!

Any Questions Please call 994-2666

To return the completed survey, please use the enclosed stamped, self addressed envelope.

Surveys can be faxed to: 994-8991

Appendix P - Footing Drain Disconnection Cost Components

The funding implications and discussion points of the proposed Footing Drain Disconnection program are provided on the following tables.

FDD Funding Discussion Points

Program Element	Description	Cost Range /Install	Implementation and Funding Considerations	
			Why fund this element?	**Why not fund this element?**
■ Permit Charges	Building/plumbing permit fees	$50 - $100	- Essential element of the program to ensure installation conforms to building codes.	
■ Discharge lines/ Infiltrator Systems	PVC or HDPE lead from sump discharge at the home to curb drain in lawn extension (Infiltrator - Sub-surface retention storage/ground infiltration device installed in series on a homeowners stormwater lead)	$500 - $1200	- Discharge to correct system (stormwater) - Needed to avoid nuisance and safety hazards of open discharge to lawns and streets (Ice during winter) - Utility can determine where the Infiltrator is cost effective to use - Removes stormwater system flow by ground water recharge - Brings together community, environmental and utilities goals	- Funding of storm sewer leads/connections historically has been the responsibility of the homeowner. - Adding flow to a storm system prone to flooding for a ten-year storm - Limited effectiveness in clay soils - Limited effectiveness with saturated ground and high water table
■ Curb drains	PVC pipe in lawn extension connecting to the back of a curb inlet	$600 - $1200	- Discharge to correct system (stormwater) - Needed to avoid nuisance and safety hazards of open discharge to lawns and streets (Ice during winter) - Cost effective option compared to individual homes connecting to stormwater mains	- Funding of storm sewer leads/connections historically has been the responsibility of the homeowner. - Adding flow to a storm system prone to flooding for a ten-year storm
■ Back up sump pump	Pump designed to operate if no electricity to the home, power by city water pressure or a 12-volt battery	$100 - $350	-Existing configuration allows gravity flow of footing drains to sanitary sewer whereas now power outages or sump pump failures result in a new risk for basement flooding	- Exceeds code requirement. New homes not normally equipped with backup system. Customers not requiring disconnect are paying for others to received an advantage beyond their current level of protection., i.e. provide for all or none
■ High water level alarm	Small device placed near the sump, when wet it alarms	$15 - $50	- Provide warning of sump overflowing - Low cost item to lessen risk concerns	- Same as item above
■ Radon pre- & post-testing	Penetrations through the basement floor have the potential for increasing radon exposure in the home testing for background levels and post FDD radon level increases	$30 - $200	- Adding penetration to basement floor increases radon potential - Remove liability for causing/increasing radon exposure - Provide Radon Vent System only as needed	- Homeowners with existing footing drain sumps responsible for this cost. - Customers not requiring disconnect are paying for others to received an advantage beyond their current level of protection., i.e provide for all or none
■ Radon Gas Vent System	Sealing the sump and exhaust fan venting to outside of home	$200 - $500	- Remove cause for increased radon exposure	- Homeowners with existing footing drain sumps responsible for this cost. Customers not requiring disconnect are paying for others to received an advantage beyond their current level of protection., i.e, provide for all or none

* Cost ranges estimates vary due to quality of equipment (residential or commercial grade) installed and level of effort required (typical/reasonable or extreme)

** Shaded rows NOT recommended for funding by Sanitary Sewer Overflow Prevention Advisory Task Force

FDD Funding Discussion Points

Program Element	Description	Cost Range	Implementation and Funding Considerations	
			Why fund this element?	**Why not fund this element?**
■ Check valves (areas needing backup protection)	Install check valves in basement floor drains and all plumbing fixtures in the basement connected to sanitary system i.e. wash tubs, sinks, toilets, and showers	$100 - $500	- Reduce (possibly prevent) future back ups for homes previously flooded or with basement elevations very near previously flooded homes (NOT INSTALLED IN ALL HOMES) - Low cost compared to claims filed - Adds level of protection until sufficient FDD removes enough flow to achieve program effectiveness	- Homeowners outside historical flooding areas may want the same protection, provide for all or none - Homeowners with existing footing drain sumps responsible for this cost if protection is desired , provide for all or none
■ Relocation of installation (allowance)	Typical site location for sump may be impractical due to existing obstructions or aesthetics. Relocating the sump several feet may remove a safety hazard, i.e. tripping over sump at base of stairs	$100 - $500	- Reasonable relocation due to construction difficulties or denying practical use of basement space should be considered - Allowance permits limited funding for outside installation of sumps or check valves for homeowners objecting to interior installations or moving the sump to accommodate finished basement layouts	- Program if implemented should fund only the basic costs, variations to basic installation should be homeowners responsibility
■ Sump area closet or enclosure **	Sump location could be in a finished basement living space and considered desirable to conceal the sump components by possibly building a closet around the FDD equipment	$200 - $1500	- Covers/hides home facility equipment in finished basements - Dampens pump operating noises	- Program if implemented should fund only the basic costs, variations to basic installation should be homeowners responsibility - Homeowners with existing sump pumps will not be offered the same consideration
■ Lawn sod or tree/shrub additions **	Many homeowners desire immediate restoration and consider sod or additional plantings compensation for their inconvenience	$250 - $1000	- Lessens construction disruption restoration completed in shorter time - Incentive for cooperation	- Program if implemented should fund only the basic costs, additions or variations to basic work needed to accomplish project goals should be homeowners responsibility

* Cost ranges estimates vary due to quality of equipment (residential or commercial grade) installed and level of effort required (typical/reasonable or extreme)

** Shaded rows NOT recommended for funding by Sanitary Sewer Overflow Prevention Advisory Task Force

FDD Funding Discussion Points
(Outreach Initiatives)

INTER-SYSTEM OUTREACH INITIATIVES	Description	Cost Range	Implementation and Funding Considerations	
			Why fund this element?	**Why not fund this element?**
■ Rain Barrels **	Barrels placed at roof downspouts to catch rainwater for re-use on lawns and gardens (barrels have spigots and are supplied with covers) Reduce runoff or flow otherwise directed to the stormwater system	$80 - $500	- Removes some flow stormwater system or being redirected to stormwater system - Saves homeowner some water costs when reused for non-potable purposes - Brings together community, environmental and utilities goals	- Objectionable appearance around homes - Uncovered barrels breed mosquitoes - Maintenance issues (using rainwater, winter storage, etc.) - Low cost barrels are red - Efforts will be a stormwater utility initiative, working with the Huron River Watershed Council and involving partial subsides and education to promote their use
■ Rain Gardens **	Grading property to and area designed to infiltrate runoff back to ground water and planted with natural species of plants that are deep-rooted. These plants are hardy to drought and absorb significant runoff amounts	$2000 - $10000	- Removes some flow stormwater system or being redirected to stormwater system - Adds natural areas to city communities - Brings together community, environmental and utilities goals - Encourage use (provide free literature, advice and bill credit)	- Objectionable appearance around groomed yards - Breeding ground for mosquitoes - Winter ice build-up - Cost is significant and each location requires a specific design

* Cost ranges estimates vary due to quality of equipment (residential or commercial grade) installed and level of effort required (typical/reasonable or extreme)

** Shaded rows NOT recommended for funding by Sanitary Sewer Overflow Prevention Advisory Task Force

FDD PROGRAM ELEMENT COST IMPLICATIONS

Program Element	COST RANGE PER SINGLE HOME *			EXTENDED COST RANGES BY PHASE *								
	Average Cost Per Home	Upper Limit Cost Per Home	Lower Limit Cost Per Home	(330 Homes) Average Cost For All Priority 1A Homes	(330 Homes) Upper Limit Cost For All Priority 1A Homes	(330 Homes) Lower Limit Cost For All Priority 1A Homes	(225 Homes) Average Cost For All Priority 1B Homes	(225 Homes) Upper Limit Cost For All Priority 1B Homes	(225 Homes) Lower Limit Cost For All Priority 1B Homes	(20,000 Homes) Average Cost TOTAL FDD Program	(20,000 Homes) Upper Limit Cost TOTAL FDD Program	(20,000 Homes) Lower Limit Cost TOTAL FDD Program
■ BASIC INSTALL - Sump, sump pump, and electrical outlet	$2000	$2500	$1500	$660,000	$825,000	$495,000	$450,000	$562,500	$337,500	$40,000,000	$50,000,000	$30,000,000
■ Permit Charges	$50	$100	$50	$16,500	$33,000	$16,500	$11,250	$22,500	$11,250	$1,000,000	$2,000,000	$1,000,000
■ Discharge line/ Infiltrator System	$800	$1,200	$500	$264,000	$396,000	$165,000	$180,000	$270,000	$112,500	$16,000,000	$24,000,000	$10,000,000
■ Curb drains	$900	$1,200	$600	$297,000	$396,000	$198,000	$202,500	$270,000	$135,000	$18,000,000	$24,000,000	$12,000,000
■ Back up sump pump	$350	$350	$100	$115,500	$115,500	$33,000	$78,750	$78,750	$22,500	$7,000,000	$7,000,000	$2,000,000
■ High water level alarm	$20	$50	$15	$6,600	$16,500	$4,950	$4,500	$11,250	$3,375	$400,000	$1,000,000	$300,000
■ Radon pre- & post-testing	$100	$200	$30	$33,000	$66,000	$9,900	$22,500	$45,000	$6,750	$2,000,000	$4,000,000	$600,000
■ Radon Gas Vent System	$250	$500	$200	$82,500	$165,000	$66,000	$56,250	$112,500	$45,000	$5,000,000	$10,000,000	$4,000,000
■ Check valves (areas needing backup protection)	$350	$500	$100	$115,500	$165,000	$33,000	$78,750	$112,500	$22,500	$7,000,000	$10,000,000	$2,000,000
■ Restoration (floor, yard, etc.)	$400	$500	$100	$132,000	$165,000	$33,000	$90,000	$112,500	$22,500	$8,000,000	$10,000,000	$2,000,000
■ Relocation of installation (allowance)	$50	$500	$100	$16,500	$165,000	$33,000	$11,250	$112,500	$22,500	$1,000,000	$10,000,000	$2,000,000

FDD PROGRAM ELEMENT COST IMPLICATIONS

Program Element	COST RANGE PER SINGLE HOME *			EXTENDED COST RANGES BY PHASE *								
	Average Cost Per Home	Upper Limit Cost Per Home	Lower Limit Cost Per Home	(330 Homes) Average Cost For All Priority 1A Homes	(330 Homes) Upper Limit Cost For All Priority 1A Homes	(330 Homes) Lower Limit Cost For All Priority 1A Homes	(225 Homes) Average Cost For All Priority 1B Homes	(225 Homes) Upper Limit Cost For All Priority 1B Homes	(225 Homes) Lower Limit Cost For All Priority 1B Homes	(20,000 Homes) Average Cost TOTAL FDD Program	(20,000 Homes) Upper Limit Cost TOTAL FDD Program	(20,000 Homes) Lower Limit Cost TOTAL FDD Program
■ Sump area closet or enclosure **	$200	$1500	$200	$66,000	$495,000	$66,000	$45,000	$337,500	$45,000	$4,000,000	$30,000,000	$4,000,000
■ Lawn sod or tree/shrub additions **	$100	$1000	$250	$33,000	$330,000	$82,500	$22,500	$225,000	$56,250	$2,000,000	$20,000,000	$5,000,000
INTER-SYSTEM OUTREACH INITIATIVES												
■ Rain Barrels	$250	$500	$80	$82,500	$165,000	$26,400	$56,250	$112,500	$18,000	$5,000,000	$10,000,000	$1,600,000
■ Rain Gardens **	$5000	$10000	$3000	$1,650,000	$3,300,000	$990,000	$1,125,000	$2,250,000	$675,000	$100,000,000	$200,000,000	$60,000,000
TOTAL COST - NOT - RECOMMENDED ELEMENTS	$5,550	$13,000	$3,530	$1,831,500	$4,290,000	$1,164,900	$1,248,750	$2,925,000	$794,250	$111,000,000	$260,000,000	$70,600,000
TOTAL COST RECOMMENDED ELEMENTS	$5,270	$7,600	$3,295	$1,739,100	$2,508,000	$1,087,350	$1,185,750	$1,710,000	$741,375	$105,400,000	$152,000,000	$65,900,000

* Cost ranges estimates vary due to quality of equipment (residential or commercial grade) installed and level of effort required (typical/reasonable or extreme)

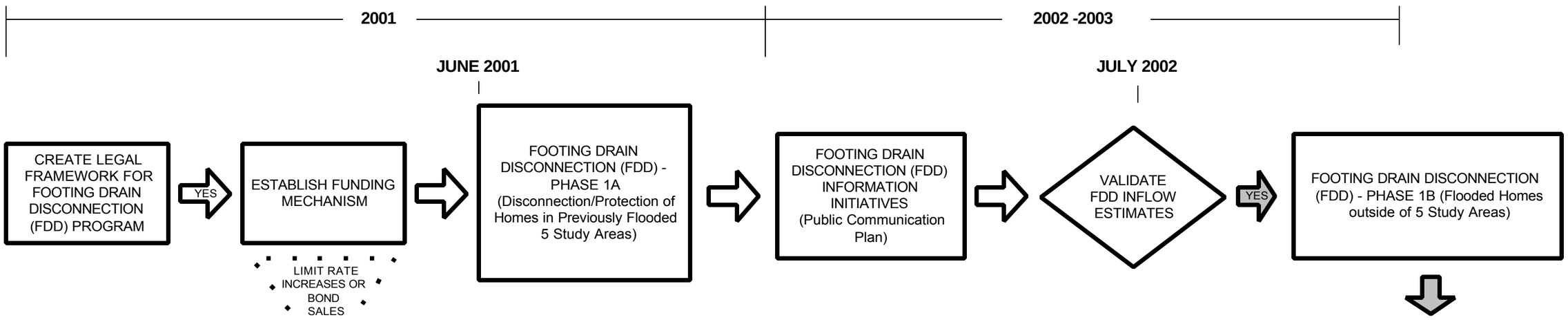
** Shaded rows NOT recommended for funding by Sanitary Sewer Overflow Prevention Advisory Task Force

Appendix Q - Sanitary Sewer Overflow Prevention Advisory Task Force Implementation Plan

The flow chart included in the following page demonstrates a typical implementation plan for undertaking a city-wide Footing Drain Disconnection program. This is included as an example of the steps to initiate the program and the phases to proceed in an organized manner without exceeding available funding or contractor resources.

The second flow chart included here is an example of the steps that a homeowner can expect during the disconnection of a home's footing drains from the sanitary sewer. Not all steps will apply for all homes since some homes may require an external disconnection and sump installation outside of the basement walls. Some steps may also vary as final decisions on implementation are made by City Council.

SANITARY SEWER OVERFLOW PREVENTION ADVISORY TASK FORCE
IMPLEMENTATION PLAN FLOW CHART



WHY FDD?

- Greater protection from sanitary backups caused by storms with more rainfall than design storms.
- Protects waterways (Future SSO's prevented)
- Preserves natural features
- Reduces traffic disruptions of in street construction
- Saves treatment costs for future generations
- Saves dollars and reduces construction disruptions of the sanitary trunk system upsizing for transport and treat options
- Reduces legal/financial liability for larger storms
- Will not require Wastewater Treatment Plant expansion
- Eliminates neighborhood wastewater storage issues

IMPLEMENTATION

The size of this project is such that a deliberate and well-planned approach is needed to prevent excessive expenditure of utility funds, over-commitment of the available contract work force and creating nuisance/hazards by not adequately controlling sump pump discharges. Completion of the program is dependent on commitment of resources, but is realistically expected to last 20-30 years. The FDD program implementation will be accomplished on a block-by block basis in conjunction with construction of the sump discharge collection system.

PROGRAM PHASES

PHASE 1A - Homes within the five study areas that have historically flooded or those with the potential for flooding This would begin in summer 2001 and last approximately one year.

PHASE 1B - Homes outside the five study areas that have historically flooded or those adjacent to homes historically flooded . This would begin late summer 2001 and last several years.

PHASE 2A - Homes that have not historically flooded or those not having the potential for flooding in the five study areas. Schedule to be determined.

PHASE 2B - Homes that have not historically flooded or those not having the potential for flooding outside of the five study areas. Schedule to be determined.

FDD BARRIERS TO SUCCESS?

- Footing drain disconnection flow data does not support FDD implementation
- Public Communicationn initiatives yield lack of support for FDD implementation
- FDD funding restrictions
- Legal restrictions
- Liability issues

Footing Drain Disconnection Process