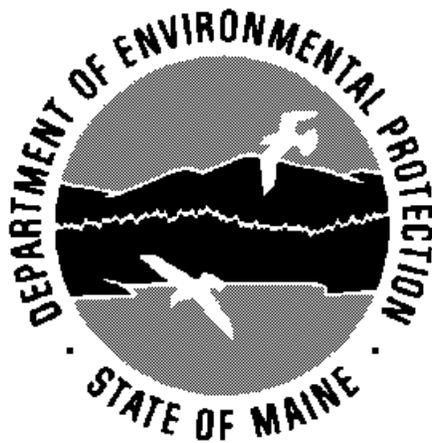


APPENDIX C

Meduxnekeag River 1997 Data Report, December 1997

Meduxnekeag River
1997 Data Report
December 1997



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Introduction

Among the conclusions from MDEP's previous study of the Meduxnekeag River was that non attainment of dissolved oxygen (DO) standards below Houlton Secondary Treatment Plant (STP) outfall is occurring due to attached plant growth resulting from nutrient enrichment (Meduxnekeag River TMDL, May 1996). As recommended in the 1996 report, it was decided to approach the non attainment problem using a pilot study or phased approach in regard to the relicensing of the Houlton STP discharge. As part of this approach, seasonal phosphorous treatment using ferric chloride at the plant along with phosphorous and DO monitoring was performed during 1996 and 1997.

Data Results

During 1996, phosphorous treatment was performed at the Houlton STP from June 26 through September 13 (treatment system problems were experienced during the second week of July). Effluent total phosphorous (TP) monitoring and instream DO monitoring were performed during this time. During 1997 phosphorous treatment was performed from June 9 through August 22. A more intensive instream monitoring effort was made including instream DO and phosphorous sampling, effluent phosphorous monitoring, stream flow measurements (by Staley at the old USGS gage site below the confluence of the South Branch) and increased quality assurance/control (QA/QC). The results are included in the appendix.

Discussion

Based on the results of two summer's worth of treatment for reduction of phosphorous at the Houlton treatment plant, an effluent concentration of 0.25 mg/l TP can probably be achieved on a monthly average basis.

Effluent TP, mg/l*	
Maximum	0.480
Average	0.253
Median	0.240
Minimum	0.160

*1996-1997 data, 7/9-13/96 and 7/4/97 values not included, meter data only

Tables 1 and 2 show the comparison of instream TP and PO₄-phosphorous concentrations among the 1993, 1995 and 1997 datasets. Figure 1 depicts the average TP concentrations for these study periods.

Table 1
Meduxnekeag River Total Phosphorous

		Instream TP, ppb					STP	STP
		mdx1	mdx11	mdx12b	mdx15	mdx17	TP*, ppb	PO4*, ppb
1997 treated	max	15.0	18.0	33.0	21.0	18.0	460	370
	ave	13.0	14.5	20.8	17.8	13.4	338	249
	min	10.0	12.0	16.0	12.0	11.0	220	150
1995 not treated	max	17.0	15.0	110.0	84.0	16.0	3400	3300
	ave	15.3	11.3	92.3	69.7	14.3	3333	3233
	min	13.0	9.0	79.0	52.0	13.0	3200	3200
1993 not treated	max	9.0	9.0	42.0	18.0	12.0	1800	1600
	ave	8.7	8.0	32.0	15.7	10.0	1400	1263
	min	8.0	7.0	22.0	13.0	9.0	1100	990

*lab analyses

Table 2
Meduxnekeag River PO4 Phosphorous

		Instream PO4, ppb					STP	STP
		mdx1	mdx11	mdx12b	mdx15	mdx17	TP*, ppb	PO4*, ppb
1997 treated	max	2.0	2.0	7.0	2.0	2.0	460	370
	ave	<1.2	<1.3	5.0	<1.5	<2	338	249
	min	<1	<1	3.0	<1	<1	220	150
1995 not treated	max	2.0	5.0	92.0	61.0	3.0	3400	3300
	ave	1.3	3.0	76.7	48.0	2.0	3333	3233
	min	1.0	2.0	64.0	32.0	1.0	3200	3200
1993 not treated	max	<1	2.0	16.0	7.0	3.0	1800	1600
	ave	<1	1.3	13.0	5.3	1.7	1400	1263
	min	<1	1.0	7.0	3.0	1.0	1100	990

*lab analyses

The DO data from 1996 and 1997 are tabulated in the appendix. In addition, Figures 2 and 3 depict the morning DO results for 1996 and 1997 respectively. During the 1997 sampling, extensive QA/QC was incorporated into the DO measurements, mainly consisting of "cross checking" of meter readings between morning and afternoon teams, use of backup meters and frequent calibration checks. The results show that DO standards were attained at all times with the lowest reading (at the standard of 7.0 ppm) occurring on August 6, 1997 during the lowest flow of that summer. No flow measurements were made during 1996, but in general that summer was relatively cool and wet. The lowest DO measurement during 1996 was 7.8 ppm.

The appendix also includes 1997 DO data collected by Houlton STP personnel above and below the outfall. These data show significantly lower DO readings

than the river teams' data. The plant personnel were not included in the QA/QC methods, so that the reason for this discrepancy is unclear.

During 1997, Meduxnekeag River flows were monitored by A.E. Staley personnel at the discontinued USGS gage station below the confluence of the South Branch. Flow data for 1996 were not obtained. Figure 4 shows the 1997 river flows.

The data collected during 1997 provide an additional check on the TP allocation method presented in the 1996 TMDL report. A data point representing the 1997 conditions (TP concentration and diurnal DO range) was plotted on the 1996 7Q10 TP allocation chart for Houlton (see Figure 5). The data were taken from the period of August 4 through August 11 representing the period of lowest river flow. The low DO reading of the year, 7.0 ppm, was measured on August 6 at Lowery Bridge, approximately 3 miles below the outfall pipe. Because only one DO sampling event occurred during this period, DO data from the sample events immediately before (July 30) and immediately after (August 14) this low flow period were also used in establishing the average diurnal swing. The average Houlton effluent flow during this period was 0.5 MGD (the flow curve on the allocation chart was changed from 0.55 MGD to 0.5 MGD to reflect this flow). The river flow during this 1997 period was the same as the flow during the 1995 study period (specifically, an average flow of 10.5 cfs below South Branch confluence).

The plotted point matches up well with the 0.5 MGD flow curve on the 7Q10 allocation chart and DO standards were attained. Although 1997 was a low flow summer, 7Q10 low flow was not reached. The allocation chart as well as the 1997 data indicate that an effluent TP concentration of about 0.26 mg/l results in an average diurnal DO swing of about 3.4 ppm below the Houlton discharge and subsequently, attainment of class B DO standards. The fact remains that the discharge flow for these conditions was one third of the licensed flow. In other words, the plant has demonstrated that it can achieve an effluent TP concentration of about 0.25 mg/l and at a performance flow of about 0.5 MGD, DO standards are predicted to be attained (with verification by the 1997 data). The allocation chart indicates that at the licensed flow of 1.5 MGD, DO standards would not be attained, although no data are available to confirm this prediction.

Recommendations

Based on the watershed rotation, the Meduxnekeag River is scheduled for relicensing during 2000. In the spirit of a phased, data collection approach it is recommended that one of the following approaches be used in licensing the Houlton discharge:

- (1) Include a TP license limit
- (2) Specify continued TP treatment and effluent monitoring

In both cases, instream summer monitoring of DO and river flow (and possibly instream TP) should be continued for the term of the license (until 2000). Rigorous QA/QC should be continued and plant personnel should be included. In 2000, all data will be evaluated and a TP license limit established or revised as necessary. At a minimum, TP treatment should be made from June 1 through September 15.

It is recommended that the limit in (1) above include a monthly average mass limit based upon a TP effluent concentration of 0.25 mg/l and performance effluent flow. The mass limit should apply to the months of July through September (15th) with a monthly average concentration limit of 0.25 mg/l for the month of June.

The following table shows average effluent flows for the past 5 years. An unusually high average flow occurred during July 1996 (1996 was a high flow summer):

Table 3
Houlton STP Average Flows 1993-1997

Period	Ave. Flow, MGD
June	1.03
July	0.84
July*	0.58
August	0.54
September	0.54
July-Sept.	0.64
July-Sept.	0.55*
July-Sept.	0.54**

*excluding July 1996

**median, all data

It is recommended to use a flow of 0.6 MGD, resulting in a mass limit of 1.25 lbs/day TP on a monthly average basis ($0.25 \text{ mg/l} \times 8.345 \times 0.6 \text{ MG} = 1.25 \text{ lbs/day}$).

Figure 1
Meduxnekeag River
Instream Total Phosphorous

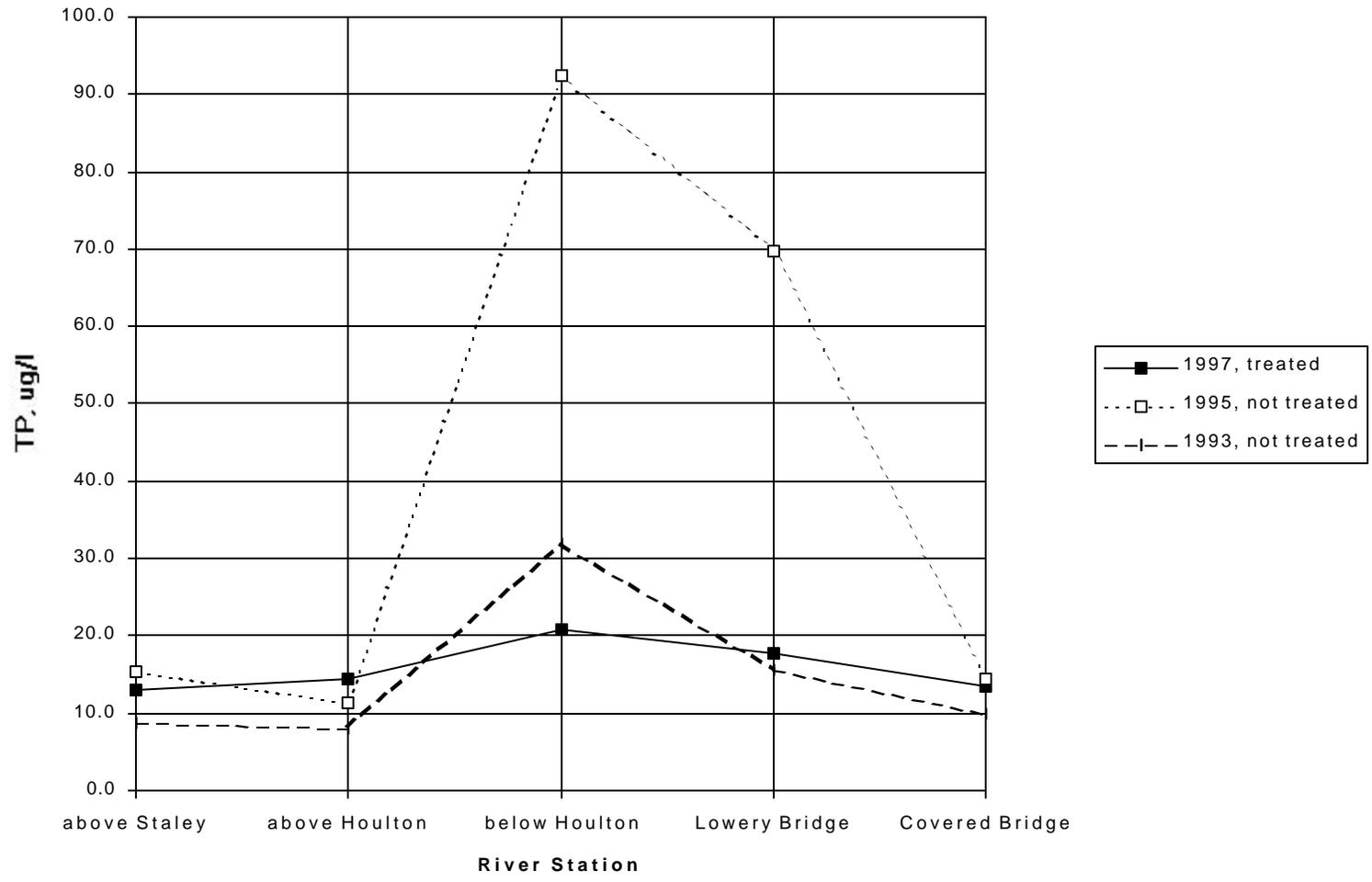


Figure 2
Meduxnekeag River
1996 AM Data

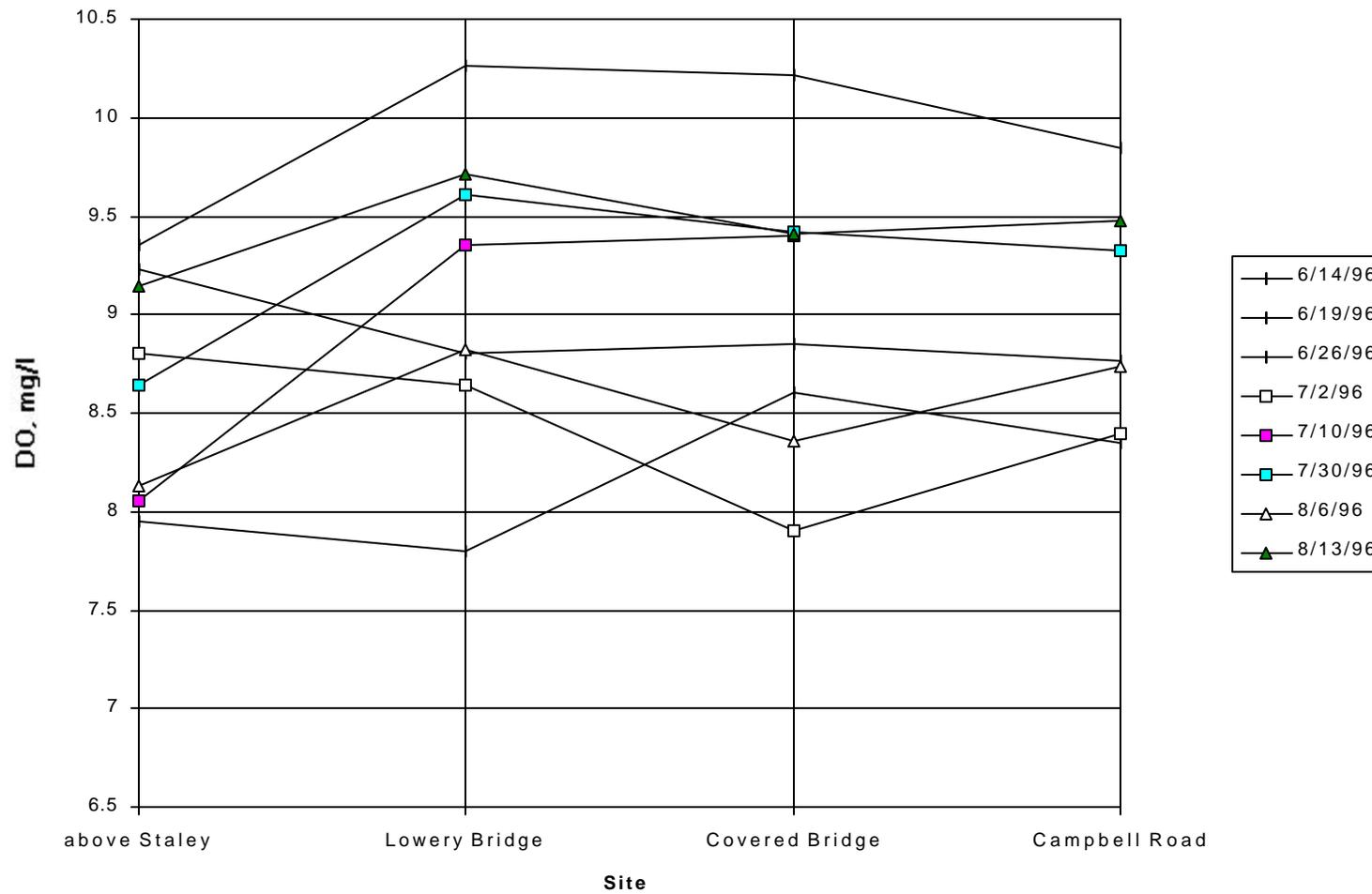


Figure 3
Meduxnekeag River
1997 AM Data

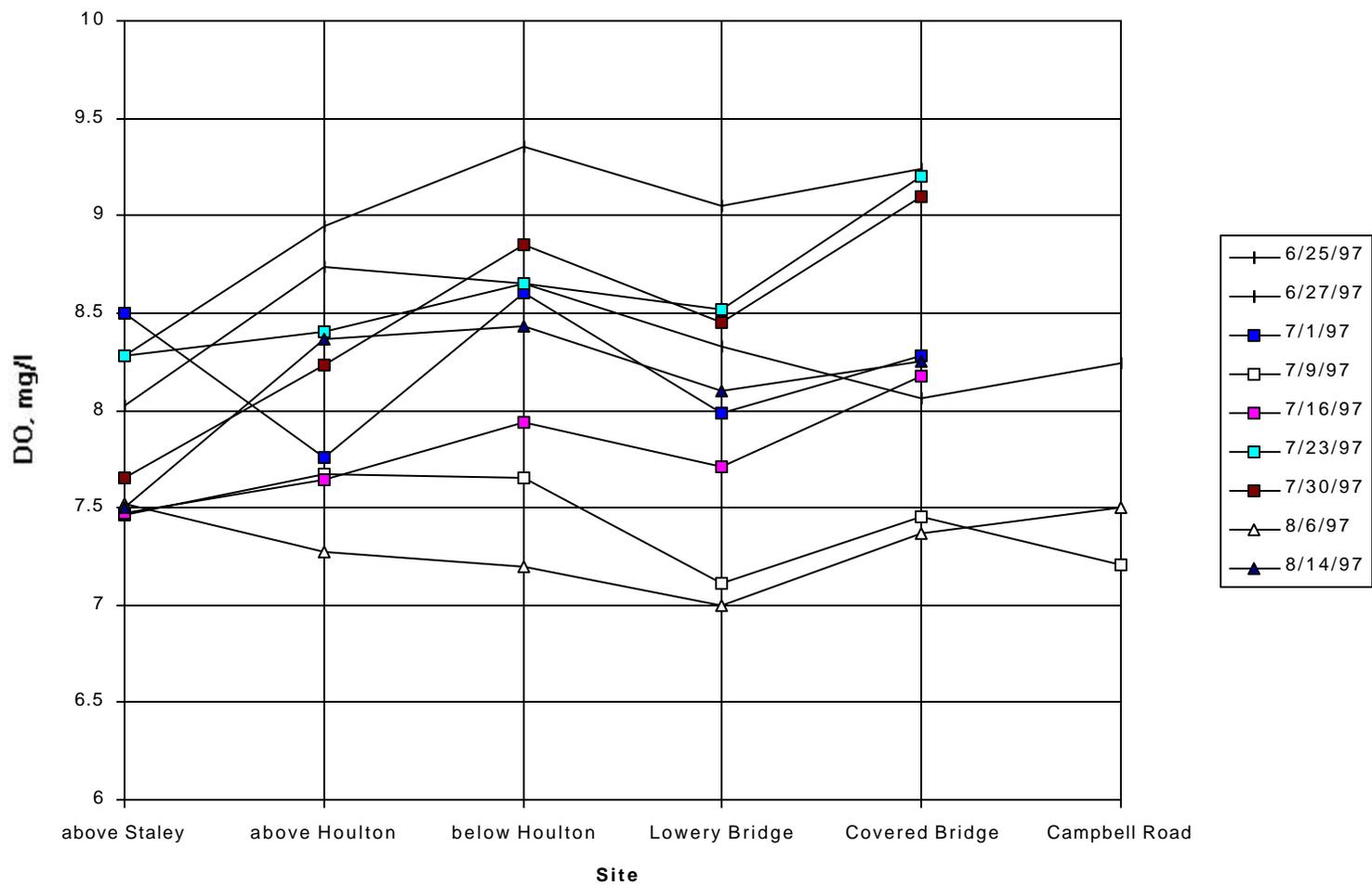


Figure 4
Meduxnekeag River
Flow @ USGS Gage

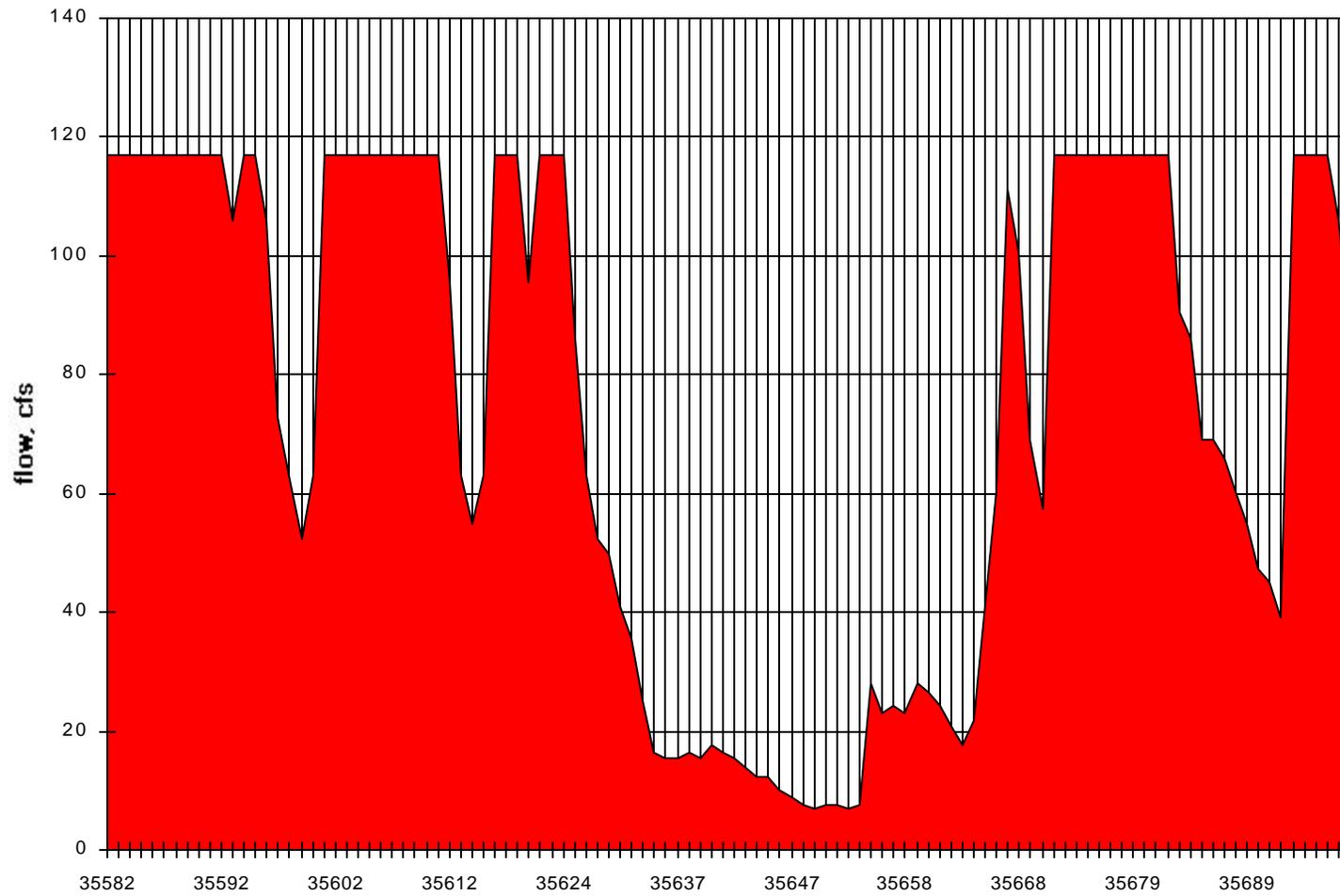
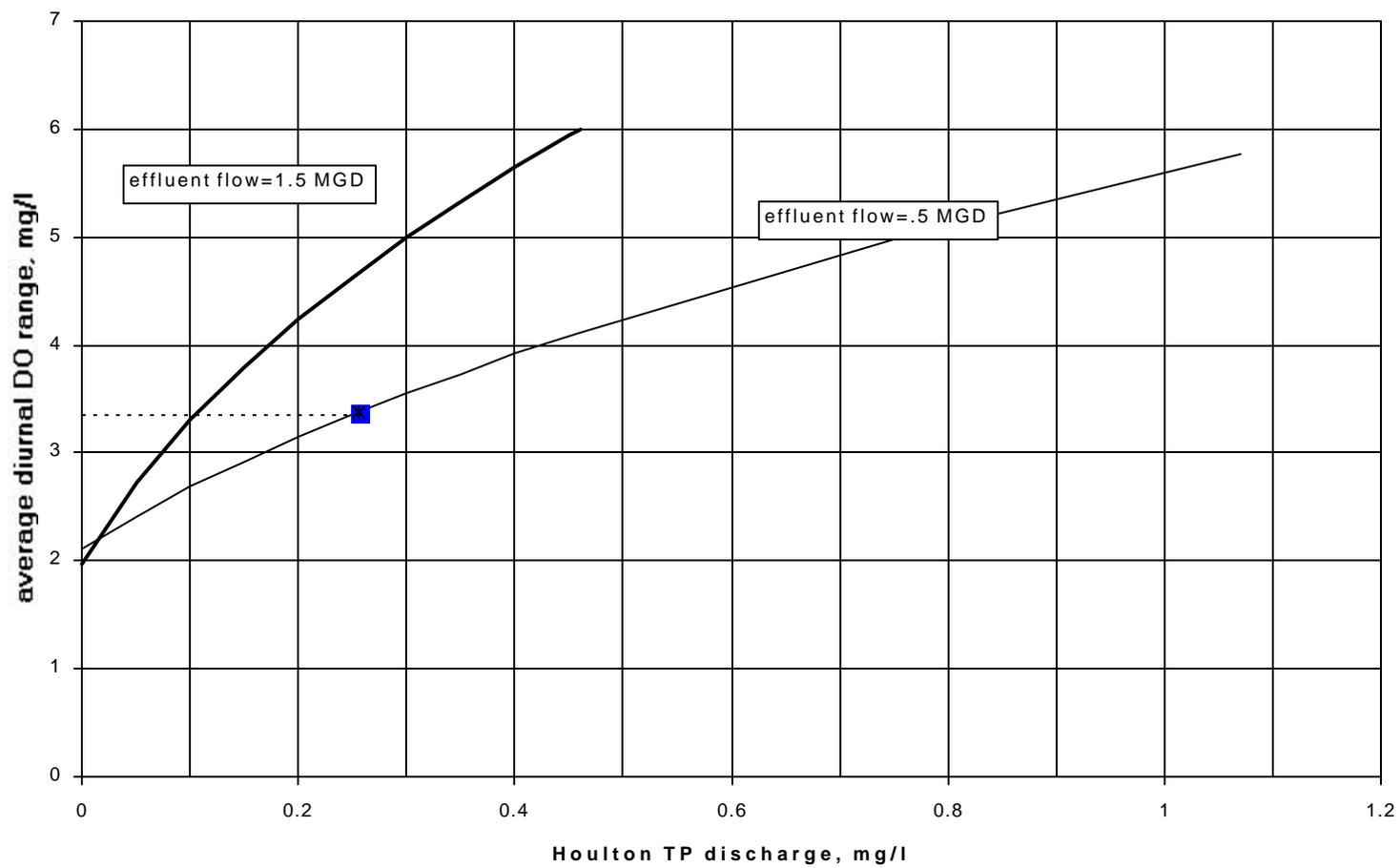


Figure 5
Meduxnekeag River
Houlton TP Allocation
7Q10 Conditions

(Figure 33 of 1996)



Appendix

Date	Effluent TP, ug/l**	Date	Effluent TP, ug/l**	Date	Effluent TP, ug/l**
06/25/96	640	06/01/97	240	07/17/97	200
06/26/96	400	06/02/97	900	07/18/97	210
06/27/96	210	06/03/97	290	07/19/97	220
06/28/96	200	06/04/97	340	07/20/97	220
06/29/96	220	06/05/97	320	07/21/97	280
06/30/96	250	06/06/97	320	07/22/97	220
07/01/96	230	06/07/97	310	07/23/97	220
07/02/96	260	06/08/97	310	07/24/97	230
07/03/96	260	06/09/97	320	07/25/97	230
07/04/96	240	06/10/97	260	07/26/97	270
07/05/96	190	06/11/97	310	07/27/97	240
07/06/96	220	06/12/97	440	07/28/97	320
07/07/96	210	06/13/97	260	07/29/97	210
07/08/96	200	06/14/97	230	07/30/97	270
07/09/96	550*	06/15/97	240	07/31/97	240
07/10/96	570*	06/16/97	230	08/01/97	350
07/11/96	720*	06/17/97	210	08/02/97	360
07/12/96	760*	06/18/97	330	08/03/97	190
07/13/96	530*	06/19/97	410	08/04/97	200
07/14/96	320	06/20/97	280	08/05/97	160
07/15/96	310	06/21/97	290	08/06/97	330
07/16/96	200	06/22/97	240	08/07/97	170
07/17/96	200	06/23/97	220	08/08/97	210
07/18/96	180	06/24/97	200	08/09/97	210
07/19/96	240	06/25/97	210	08/10/97	210
07/20/96	200	06/26/97	250	08/11/97	240
07/21/96	190	06/27/97	200	08/12/97	260
07/22/96	260	06/28/97	240	08/13/97	210
07/23/96	180	06/29/97	240	08/14/97	210
07/24/96	200	06/30/97	240	08/15/97	230
07/25/96	180	07/01/97	280	08/16/97	210
07/26/96	200	07/02/97	270	08/17/97	260
07/27/96	280	07/03/97	290	08/18/97	230
07/28/96	180	07/04/97	910	08/19/97	220
07/29/96	190	07/05/97	280	08/20/97	200
07/30/96	200	07/06/97	400	08/21/97	290
07/31/96	280	07/07/97	340	08/22/97	240
08/01/96	180	07/08/97	260	08/23/97	440
08/02/96	210	07/09/97	320	08/24/97	280
		07/10/97	340	08/25/97	720
		07/11/97	350	08/26/97	780
		07/12/97	400	08/27/97	660
		07/13/97	270	08/28/97	920
		07/14/97	480	08/29/97	1280
		07/15/97	460	08/30/97	1530
		07/16/97	410	08/31/97	1650

*no treatment

**Houlton STP meter

**Houlton STP meter

Date	Acheron Lab				STP Meter	
	Influent TP ug/l	Influent PO4 ug/l	Effluent TP ug/l	Effluent PO4 ug/l	Influent TP ug/l	Effluent TP ug/l
05/13/97	1410	700	630	560	-	-
05/19/97	1280	650	490	420	-	-
06/11/97	3750	2500	460	330	2800	310
06/24/97	2150	1250	220	150	1890	200
07/02/97	-	-	420	270	2870	270
07/09/97	-	-	390	290	1340	320
07/09/97*	-	-	400	280	-	-
07/16/97	-	-	440	370	2950	410
07/23/97	-	-	260	200	2810	220
07/30/97	-	-	250	200	3600	280
08/13/97	-	-	260	190	2770	220
08/20/97	-	-	280	210	3960	210

*MDEP split sample

Station	Date	Time	PO4 ug/l	TP ug/l
MDX1 (above Staley)	06/25/97	09:16	2	15
	07/01/97	07:58	1	-
	07/09/97	13:45	<1	10
	07/16/97	06:20	1	-
	07/23/97	06:20	<1	14
	07/30/97	06:45	1	-
	08/06/97	15:50	<10	13
MDX11 (above Houlton)	06/25/97	08:05	1	15
	07/01/97	07:25	<1	-
	07/09/97	14:15	<1	18
	07/16/97	06:45	<1	-
	07/23/97	06:52	<1	12
	07/23/97**	06:52	<1	-
	07/30/97	07:32	1	-
08/06/97	15:30	2	13*	
MDX12b (below Houlton)	06/25/97	08:35	5	17
	07/01/97	07:40	5	-
	07/09/97	15:10	NA	33
	07/16/97	07:10	7	-
	07/23/97	07:05	4	16
	07/30/97	08:14	3	-
	08/06/97	15:05	6	17
08/06/97**	15:05	-	9*	
MDX15 (Lowery Bridge)	06/25/97	07:40	2	18
	06/25/97**	07:40	2	-
	07/01/97	07:04	1	-
	07/09/97	16:05	1	21
	07/16/97	07:25	1	-
	07/23/97	07:24	<1	12
	07/30/97	09:00	<1	-
08/06/97	14:29	2	20*	
MDX17 (Covered Bridge)	06/25/97	07:15	2	18
	07/01/97	06:55	2	-
	07/09/97	15:30	<1	13
	07/09/97**	15:30	-	13
	07/16/97	07:40	2	-
	07/23/97	07:35	<1	11
	07/30/97	09:25	1	-
08/06/97	14:49	3	12	
STP	07/09/97	14:50	280	400
	08/06/97	15:15	160	240

*smaller than routine sample volume

**duplicate

Date: 6/14/96		DO	Temp	% Sat
Station	Time	mg/l	C	
MDX1	07:20	8.0	21.5	90%
	15:25	9.2	22.9	107%
MDX15	06:56	7.8	20.3	86%
	14:20	11.0	22.6	127%
MDX17	06:22	8.6	20.4	95%
	14:30	11.3	22.3	130%
Campbell Rd.	06:06	8.4	20.6	93%
	14:45	11.5	22.9	134%

Date: 6/19/96		DO	Temp	% Sat
Station	Time	mg/l	C	
MDX1	07:53	9.2	19.1	100%
	14:40	10.4	23.1	122%
MDX15	07:28	8.8	17.0	91%
	13:50	14.8	22.4	170%
MDX17	06:51	8.9	16.8	91%
	14:00	16.0	22.9	186%
Campbell Rd.	06:35	8.8	16.7	90%
	14:10	15.8	23.2	184%

Date: 6/26/96		DO	Temp	% Sat
Station	Time	mg/l	C	
MDX1	07:30	9.4	13.9	91%
	14:55	10.6	14.1	103%
MDX15	07:06	10.3	13.0	97%
	14:00	11.6	13.5	111%
MDX17	06:34	10.2	12.9	97%
	14:10	12.1	13.6	116%
Campbell Rd.	06:19	9.9	12.9	93%
	14:20	12.0	13.5	115%

Date: 7/2/96		DO	Temp	% Sat
Station	Time	mg/l	C	
MDX1	07:25	8.8	18.5	94%
	15:05*	9.2	21.4	104%
MDX15	08:06	8.6	19.9	95%
	14:05*	12.4	20.1	137%
MDX17	06:56	7.9	18.5	84%
	14:15*	12.2	20.2	135%
Campbell Rd.	06:42	8.4	18.1	89%
	14:30*	10.7	20.1	118%

*7/3/96

Date: 7/10/96				
Station	Time	DO mg/l	Temp C	% Sat
MDX1	06:57	8.1	17.0	83%
	15:00	9.0	18.7	96%
MDX15	07:25	9.4	16.4	96%
	14:10	9.9	18.3	105%
MDX17	08:02	9.4	16.4	96%
	14:18	9.8	18.4	104%
Campbell Rd.	x	x	x	x
	14:29	9.7	18.5	103%

Date: 7/30/96				
Station	Time	DO mg/l	Temp C	% Sat
MDX1	08:42	8.6	18.8	93%
	16:14	8.8	21.6	100%
MDX15	08:14	9.6	16.7	99%
	15:02	9.8	21.0	109%
MDX17	07:26	9.4	16.7	97%
	15:11	9.9	21.3	111%
Campbell Rd.	07:13	9.3	16.7	96%
	15:27	9.6	21.2	108%

Date: 8/6/96				
Station	Time	DO mg/l	Temp C	% Sat
MDX1	09:25	8.1	22.5	94%
	15:05	8.5	26.1	105%
MDX15	08:51	8.8	20.2	97%
	14:15	9.5	25.0	114%
MDX17	08:41	8.4	19.9	92%
	14:25	10.0	25.3	121%
Campbell Rd.	08:00	8.7	19.7	96%
	14:36	9.8	25.4	120%

Date: 8/13/96				
Station	Time	DO mg/l	Temp C	% Sat
MDX1	08:26	9.1	20.0	101%
	15:03	9.4	23.0	110%
MDX15	08:00	9.7	17.6	102%
	14:06	11.7	22.0	134%
MDX17	07:29	9.4	17.5	98%
	14:14	11.3	22.3	130%
Campbell Rd.	07:15	9.5	17.4?	99%
	14:30	11.0	22.3	126%

Date: 06/04/97		Depth m	DO mg/l	Temp C	% Sat
Station	Time				
MDX1	15:17	<1	9.4	17.3	97%
MDX15	14:12	<1	10.6	16.1	107%
MDX17	14:26	<1	10.4	16.2	106%
Campbell	14:45	<1	10.5	16.2	107%

Date: 06/11/97		Depth m	DO mg/l	Temp C	% Sat
Station	Time				
MDX1	15:00	<1	9.1	23.1	106%
MDX15	14:00	<1	9.9	22.4	114%
MDX17	14:17	<1	9.7	22.8	112%
Campbell	14:35	<1	10.2	22.7	119%

Date: 06/18/97		Depth m	DO mg/l	Temp C	% Sat
Station	Time				
MDX1	16:12	<1	9.9	20.9	111%
MDX15	14:30	<1	10.6	19.5	116%
MDX17	15:03	<1	10.5	19.9	115%
Campbell	14:51	<1	10.7	19.7	117%

Date: 06/25/97		Depth m	DO mg/l	Temp C	% Sat
Station	Time				
MDX1	09:16	1	8.3	18.8	89%
MDX11	08:05	1	9.0	17.2	93%
MDX12b	08:35	1	9.4	17.1	97%
MDX15	07:40	1	9.1	17.1	94%
MDX17	07:15	1	9.2	16.8	95%

Date: 06/27/97		Depth m	DO mg/l	Temp C	% Sat
Station	Time				
MDX1	06:10	<1	8.0	19.4	87%
	15:25	<1	9.8	21.8	111%
MDX11	06:40	<1	8.7	18.2	93%
	14:55	<1	10.2	21.3	115%
MDX12b	07:00	<1	8.7	18.2	92%
	14:35	<1	10.4	21.4	117%
MDX15	05:12	<1	8.3	18.6	89%
	14:00	<1	10.7	21.2	120%
MDX17	05:30	<1	8.1	18.6	86%
	14:10	<1	10.7	21.2	121%
Campbell	05:45	<1	8.2	18.6	88%

Date: 07/01/97		Depth m	DO mg/l	Temp C	% Sat
Station	Time				
MDX1	07:58	1	8.5	24.8	102%
	15:25	<1	9.5	28.6	122%
MDX11	07:25	1	7.8	22.3	89%
	15:00	<1	10.0	28.0	128%
MDX12b	07:40	1	8.6	22.4	99%
	16:10	<1	9.5	28.1	121%
MDX15	07:04	1	8.0	22.4	92%
	14:10	<1	10.8	28.2	138%
MDX17	06:55	1	8.3	22.2	95%
	14:25	<1	10.6	28.0	135%
Campbell	14:35	<1	10.78	28.60	139%

Date: 07/09/97		Depth m	DO mg/l	Temp C	% Sat
Station	Time				
MDX1	07:20	<1	7.5	20.3	83%
	13:45	1	8.5	21.6	97%
MDX11	07:40	<1	7.7	19.9	84%
	14:15	0	9.0	19.4	98%
		1	8.9	19.4	97%
MDX12b	06:55	<1	7.7	20.2	84%
	15:10	1	9.4	19.4	102%
MDX15	06:10	<1	7.1	20.7	79%
	16:05	0	10.4	19.8	114%
		1	10.5	19.3	113%
MDX17	06:20	<1	7.5	19.9	82%
	15:30	0	10.4	19.4	113%
		1	10.2	19.2	110%
Campbell	?AM	<1	7.21	20.20	80%

Date: 07/16/97		Depth m	DO mg/l	Temp C	% Sat
Station	Time				
MDX1	06:20	<1	7.5	21.6	85%
	15:40	<1	9.7	24.4	116%
MDX11	06:45	<1	7.6	19.9	84%
	16:00	<1	9.6	23.1	112%
MDX12b	07:10	<1	7.9	19.8	87%
	15:00	<1	9.7	21.6	110%
MDX15	07:25	<1	7.7	20.0	85%
	14:10	<1	12.3	21.5	139%
MDX17	07:40	<1	8.2	19.2	89%
	14:20	<1	11.3	20.9	126%
Campbell	14:35	<1	11.60	21.20	131%

Date:		Depth	DO	Temp	% Sat
Station	Time				
MDX1	06:20	0	8.3	16.9	85%
		1	8.3	17.2	86%
	14:15	<1	9.5	25.6	116%
MDX11	06:52	<1	8.4	16.1	85%
	15:35	<1	10.3	23.4	120%
MDX12b	07:05	<1	8.7	15.7	87%
	14:44	<1	12.9	23.6	152%
MDX15	07:24	<1	8.5	15.4	85%
	13:43	<1	12.1	23.0	141%
MDX17	07:35	0	9.3	14.7	91%
		1	9.2	15.0	91%
	13:57	<1	10.5	23.3	123%
Campbell	14:10	<1	10.31	23.50	121%

Date:		Depth	DO	Temp	% Sat
Station	Time				
MDX1	06:45	<1	7.7	18.0	81%
	14:56	<1	9.3	26.0	114%
MDX11	07:32	0	8.2	16.6	84%
		1	8.2	16.5	84%
	15:17	<1	10.6	24.2	126%
MDX12b	08:11	<1	8.9	16.5	91%
	14:25	<1	11.1	23.9	132%
MDX15	09:00	0	8.7	17.2	90%
		1	8.5	17.0	87%
	13:30	<1	12.3	24.2	146%
MDX17	09:25	0	9.6	18.0	101%
		1	9.1	17.7	96%
	13:45	<1	10.6	25.2	129%
Campbell	14:06	<1	10.26	24.70	123%

Date:	08/06/97	Depth	DO	Temp	% Sat
Station	Time	m	mg/l	C	
MDX1	06:21	<1	7.5	18.9	81%
	15:50	0	10.1	25.2	123%
		1	10.3	25.3	125%
		2	10.2	25.5	125%
MDX11	06:30	<1	7.3	19.4	79%
	15:30	0	11.0	24.0	131%
		1	10.9	24.0	129%
MDX12b	05:37	<1	7.2	18.9	77%
	15:05	<1	12.9	23.7	152%
MDX15	04:39	<1	7.0	19.2	76%
	14:29	<1	11.9	24.7	144%
MDX17	04:50	<1	7.4	18.4	78%
	14:49	<1	10.9	25.4	133%
Campbell	05:03	<1	7.5	18.4	80%

Date:	08/14/97	Depth	DO	Temp	% Sat
Station	Time	m	mg/l	C	
MDX1	06:38	<1	7.5	18.2	80%
	15:12	<1	10.5	20.8	118%
MDX11	07:00	<1	8.4	17.0	87%
	15:32	<1	11.6	20.0	128%
MDX12b	07:21	<1	8.4	16.9	87%
	14:45	<1	12.3	19.4	133%
MDX15	07:35	<1	8.1	16.8	83%
	13:51	<1	10.8	18.8	116%
MDX17	07:45	0	8.4	16.6	86%
		1	8.3	16.9	85%
	14:03	<1	10.5	19.1	113%
Campbell	14:13	<1	10.5	19.5	114%

Date	River below Outfall*			River above Outfall*		
	Time	Temp C	DO mg/l	Time	Temp C	DO mg/l
07/18/97	07:00	20.0	7.09	07:00	20.3	6.83
	16:00	25.0	8.37	16:00	25.7	7.85
07/23/97	07:00	16.0	7.98	07:00	16.4	7.7
	15:30	23.8	9.53	15:30	23.9	8.61
07/28/97	07:00	22.5	6.15	07:30	22.6	5.98
	15:40	25.7	8.64	15:40	26.3	8.02
07/31/97	07:00	19.1	6.76	07:30	19.2	6.83
	16:00	25.9	9.51	16:00	26.2	8.79
08/06/97	07:00	18.3	6.87	07:00	18.5	6.68
	16:00	24.0	10.66	16:00	24.9	9.26
08/08/97	07:00	18.5	6.6	07:00	18.5	6.66
	16:00	25.7	11.25	16:00	26.6	9.09
08/12/97	07:00	18.8	5.99	07:00	19.0	6.2
	16:00	24.2	9.49	16:00	24.4	8.51
08/14/97	07:00	16.8	6.73	07:00	16.9	6.85
	16:00	19.5	10.1	16:00	19.7	9.4
08/19/97	07:00	17.0	7.1	07:00	17.0	7
	16:00	20.0	10	16:00	20.0	9.4
08/21/97	07:00	17.0	7	07:00	17.2	6.9
	16:00	21.0	10.1	16:00	21.0	9.4
08/27/97	07:00	17.1	7.27	07:00	17.1	7.45
	16:00	22.0	9.09	16:00	22.3	8.62
08/29/97	07:00	17.1	7.7	07:00	17.1	7.67
	16:00	18.1	8.35	16:00	18.9	8.29
09/03/97	07:00	17.9	12.7	07:00	17.9	12.89
	16:00	17.8	14	16:00	17.9	13.82

*Houlton STP staff

River Flow
USGS gage site

Date	Time	Stage	Flow, cfs	
			USGS site	Houlton
06/01/97	08:00	3.44	117	154.4
06/02/97	08:30	3.44	117	154.4
06/03/97	08:30	3.24	117	154.4
06/04/97	08:30	3.15	117	154.4
06/05/97	07:15	3.1	117	154.4
06/06/97	08:35	3.05	117	154.4
06/07/97	09:45	2.98	117	154.4
06/08/97	10:00	2.93	117	154.4
06/09/97	07:30	2.8	117	154.4
06/10/97	08:30	2.85	117	154.4
06/11/97	08:45	2.81	117	154.4
06/12/97	07:30	2.78	105.9	139.8
06/13/97	09:00	2.8	117	154.4
06/14/97	09:30	2.8	117	154.4
06/15/97	09:00	2.78	105.9	139.8
06/16/97	08:30	2.71	72.98	96.3
06/17/97	08:30	2.68	63.07	83.3
06/18/97		2.64	52.27	69.0
06/19/97	08:30	2.68	63.07	83.3
06/20/97	08:45	2.84	117	154.4
06/21/97	08:45	3	117	154.4
06/22/97	09:15	2.85	117	154.4
06/23/97	09:00	3.77	117	154.4
06/24/97	08:45	3.6	117	154.4
06/25/97	08:30	3.28	117	154.4
06/26/97	07:30	3.21	117	154.4
06/27/97	08:15	3.16	117	154.4
06/28/97	08:45	3.18	117	154.4
06/29/97	09:10	2.92	117	154.4
06/30/97	08:30	2.85	117	154.4
07/01/97	08:30	2.76	95.52	126.1
07/02/97	08:30	2.68	63.07	83.3
07/03/97	07:45	2.65	54.84	72.4
07/04/97	09:15	2.68	63.07	83.3
07/05/97	09:30	3.08	117	154.4
07/06/97	15:00	2.98	117	154.4
07/07/97	09:00	2.87	117	154.4
07/08/97	09:30	2.76	95.52	126.1
07/11/97	09:00	3.1	117	154.4
07/12/97	09:15	2.95	117	154.4
07/13/97	09:00	2.83	117	154.4
07/14/97	10:00	2.74	85.96	113.5
07/15/97	08:30	2.68	63.07	83.3
07/16/97	13:00	2.64	52.27	69.0
07/17/97	12:30	2.63	49.78	65.7

River Flow
USGS gage site

Date	Time	Stage	Flow, cfs	
			USGS site	Houlton
07/18/97	11:00	2.59	40.96	54.1
07/19/97	14:00	2.56	35.75	47.2
07/22/97	05:30	2.49	25.35	33.5
07/23/97	20:00	2.41	16.55	21.8
07/25/97	17:30	2.4	15.6	20.6
07/26/97	09:30	2.4	15.6	20.6
07/27/97	09:00	2.41	16.55	21.8
07/28/97	10:45	2.4	15.6	20.6
07/29/97	08:40	2.42	17.52	23.1
07/30/97	08:45	2.41	16.55	21.8
07/31/97	08:45	2.4	15.6	20.6
08/01/97	08:00	2.38	13.88	18.3
08/02/97	09:15	2.36	12.26	16.2
08/03/97	09:30	2.36	12.26	16.2
08/04/97	09:00	2.33	10.11	13.3
08/05/97	07:30	2.31	8.812	11.6
08/06/97	09:00	2.29	7.621	10.1
08/07/97	08:00	2.28	7.06	9.3
08/08/97	08:40	2.29	7.621	10.1
08/09/97	10:00	2.29	7.621	10.1
08/10/97	09:40	2.28	7.06	9.3
08/11/97	09:00	2.29	7.621	10.1
08/12/97	08:20	2.51	28.01	37.0
08/13/97	08:45	2.47	22.94	30.3
08/14/97	09:50	2.48	24.13	31.9
08/16/97	11:30	2.47	22.94	30.3
08/17/97	11:30	2.51	28.01	37.0
08/18/97	07:45	2.5	26.6	35.1
08/19/97	08:10	2.48	24.13	31.9
08/20/97	09:30	2.45	20.68	27.3
08/21/97	09:00	2.42	17.52	23.1
08/22/97	10:15	2.46	21.79	28.8
08/23/97	11:30	2.59	40.96	54.1
08/24/97	11:30	2.67	60.24	79.5
08/25/97	08:15	2.79	111.2	146.8
08/26/97	07:40	2.77	100.6	132.8
08/27/97	07:40	2.7	69	91.1
08/28/97	07:30	2.66	57.5	75.9
08/29/97	08:40	3.03	117	154.4
08/30/97	10:00	3.21	117	154.4
08/31/97	09:45	3.08	117	154.4
09/02/97	07:30	2.87	117	154.4
09/03/97	08:45	3.32	117	154.4
09/04/97	08:40	3.55	117	154.4
09/05/97	08:30	3.42	117	154.4

River Flow
 USGS gage site

Date	Time	Stage	Flow, cfs	
			USGS site	Houlton
09/06/97	10:30	3.17	117	154.4
09/07/97	09:30	3.01	117	154.4
09/08/97	08:40	2.89	117	154.4
09/09/97	07:40	2.81	117	154.4
09/10/97	08:50	2.75	90.64	119.6
09/11/97	07:45	2.74	85.96	113.5
09/12/97	08:30	2.7	69	91.1
09/13/97	09:30	2.7	69	91.1
09/14/97	11:30	2.69	65.99	87.1
09/15/97	08:40	2.67	60.24	79.5
09/16/97	07:45	2.65	54.84	72.4
09/17/97	08:30	2.62	47.38	62.5
09/18/97	09:00	2.61	45.05	59.5
09/19/97	09:00	2.58	39.18	51.7
09/21/97	11:30	2.8	117	154.4
09/22/97	08:45	2.84	117	154.4
09/24/97	09:45	2.9	117	154.4
09/25/97	09:20	2.88	117	154.4
09/27/97	10:30	2.78	105.9	139.8
09/28/97	09:30	2.74	85.96	113.5