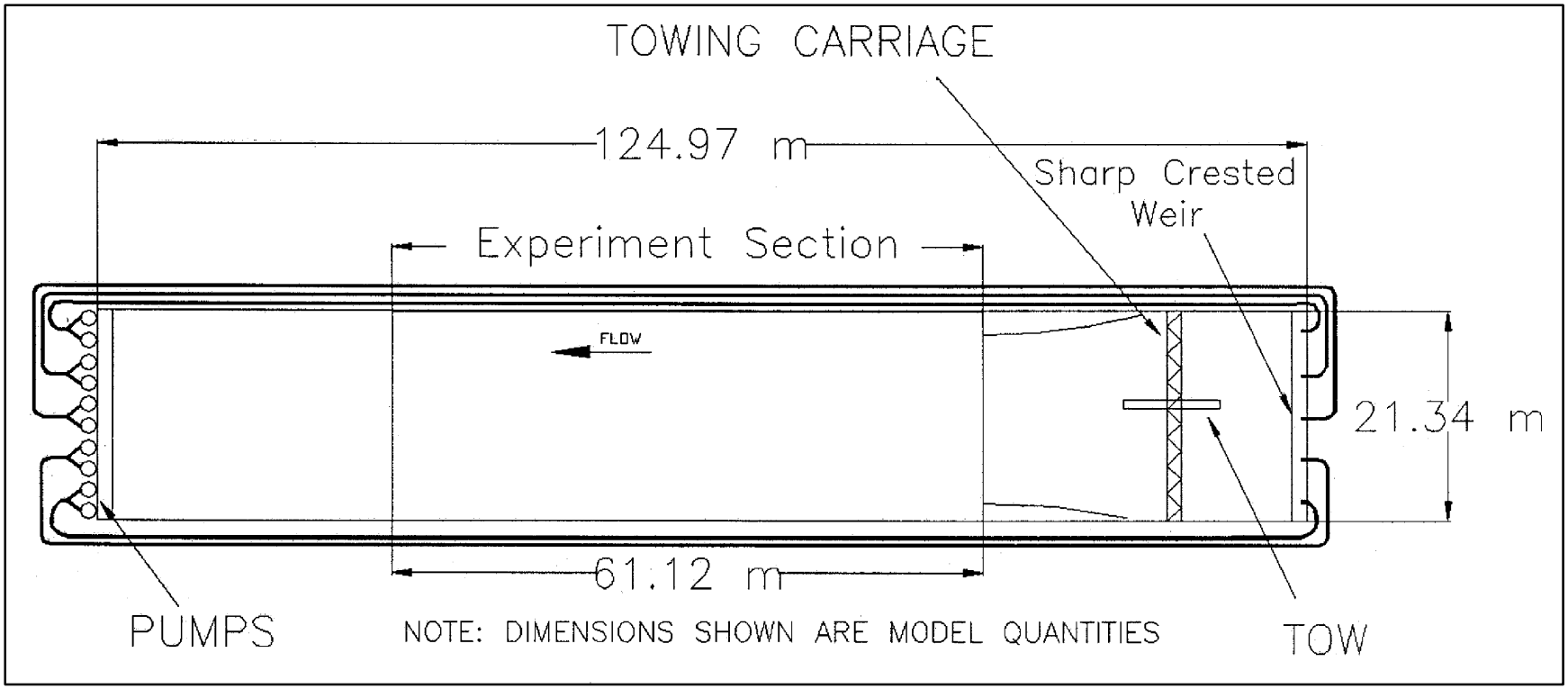


Figure 1. Layout of navigation effects flume

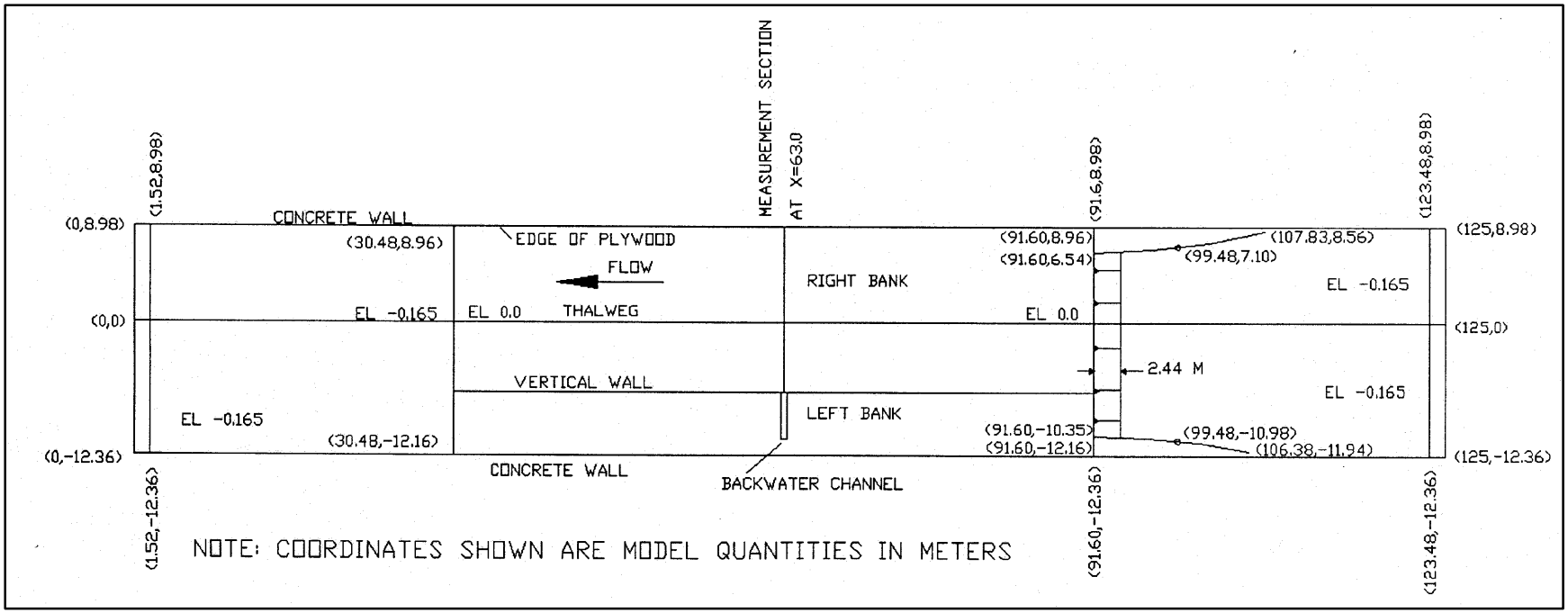


Figure 2. Flume dimensions and location of backwater

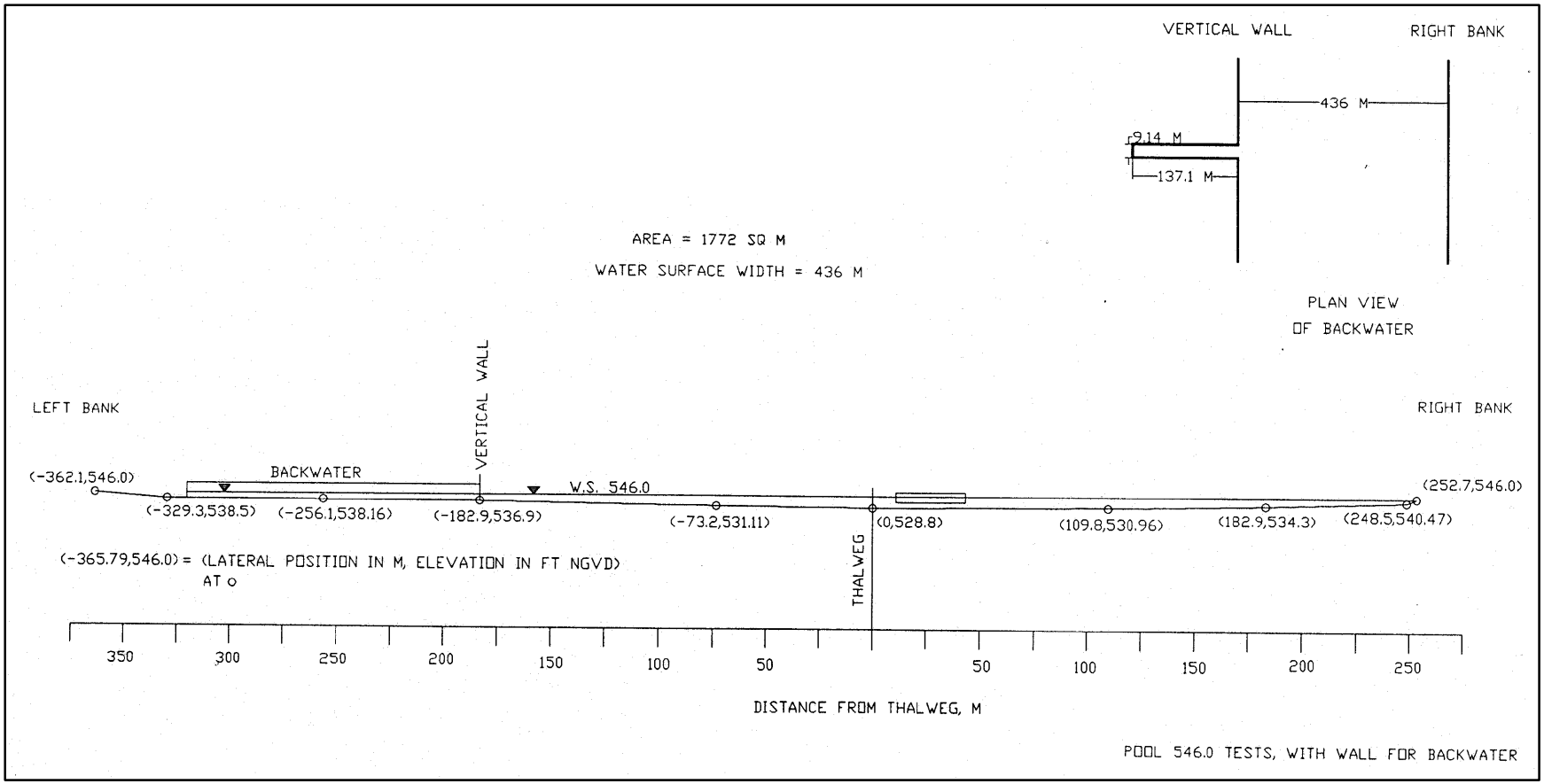


Figure 3. Channel cross-section used in backwater tests

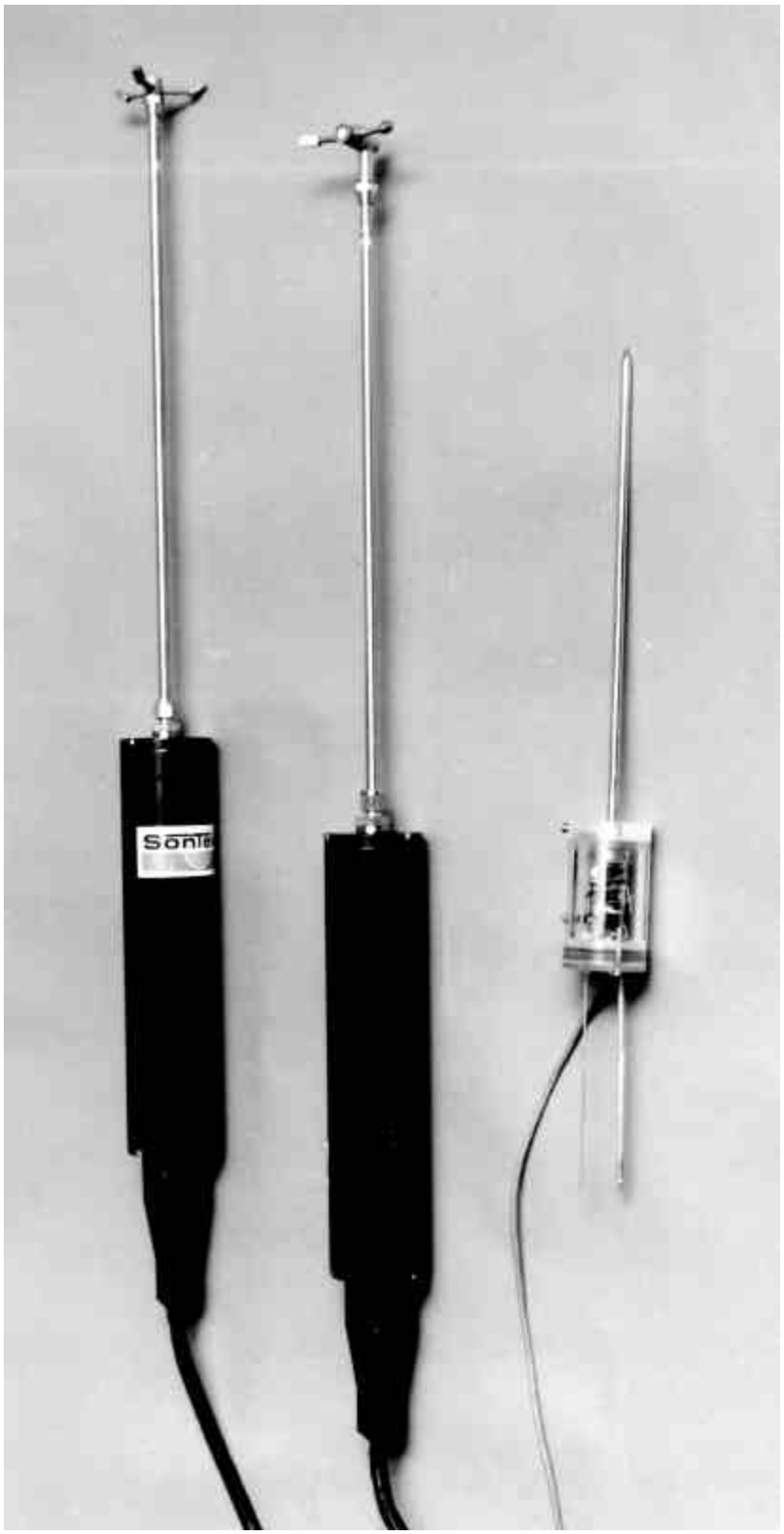


Figure 4. Wave gage and 2D and 3D velocity meters used in physical model backwater

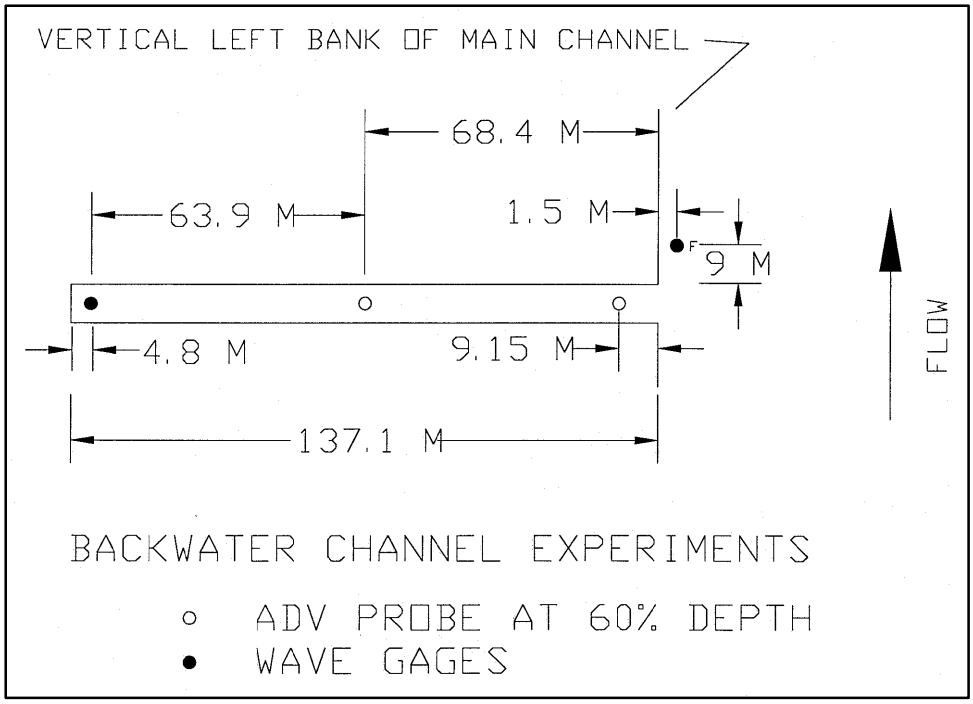
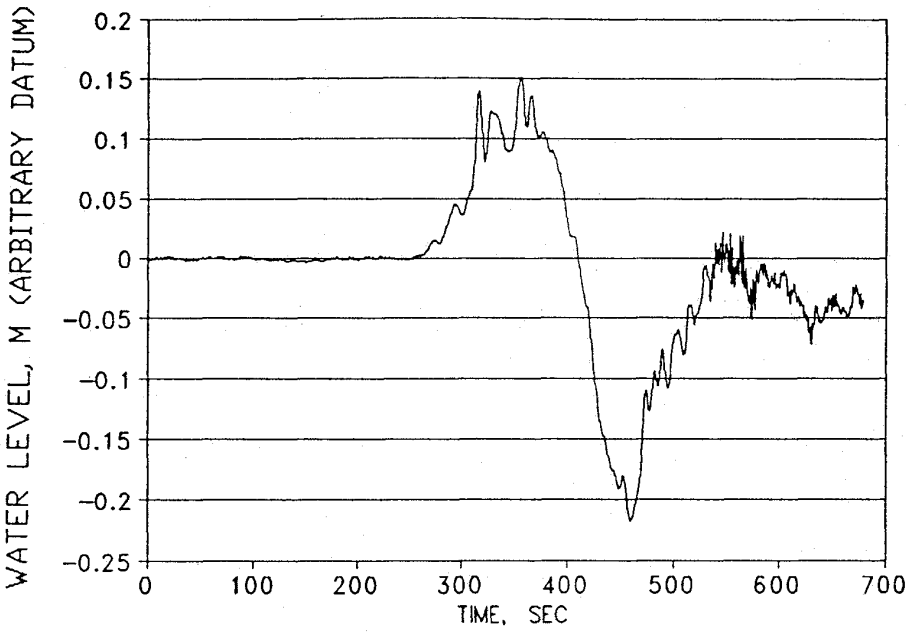
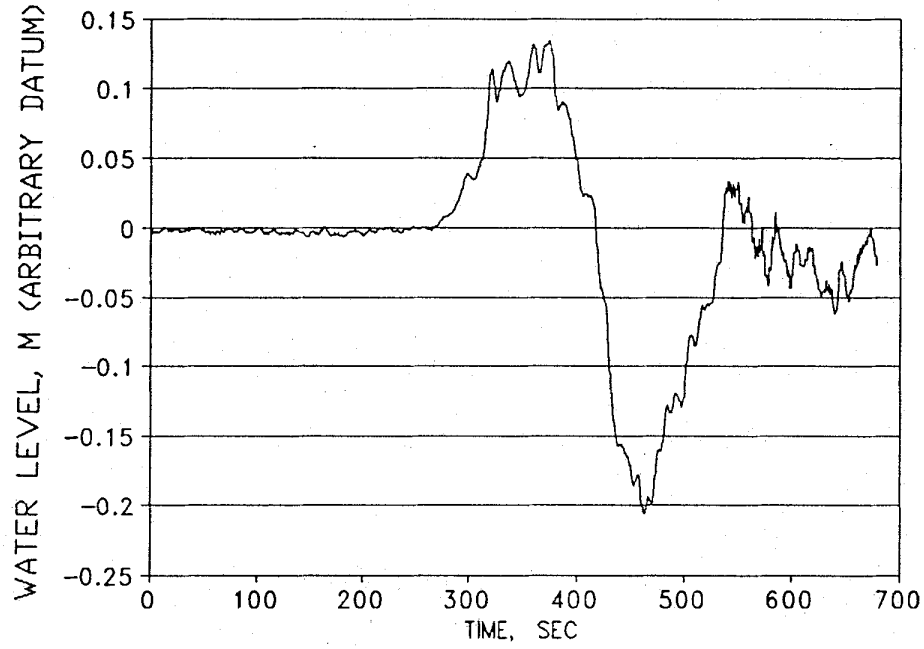


Figure 5. Plan view of physical model backwater and instrument locations



a. Wave gage located outside the backwater channel



b. Wave gage located inside the backwater channel

Figure 6. Comparison of drawdown, inside backwater versus edge of main channel

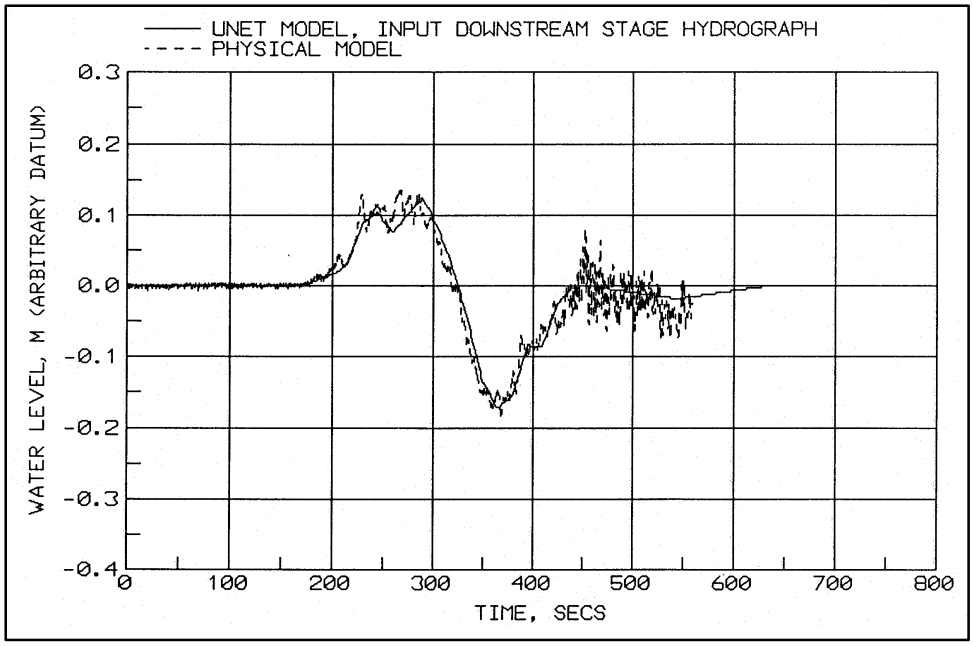


Figure 7. Water level from physical model and UNET input downstream stage hydrograph, mouth of backwater, no flow, vessel speed = 3.95 m/sec

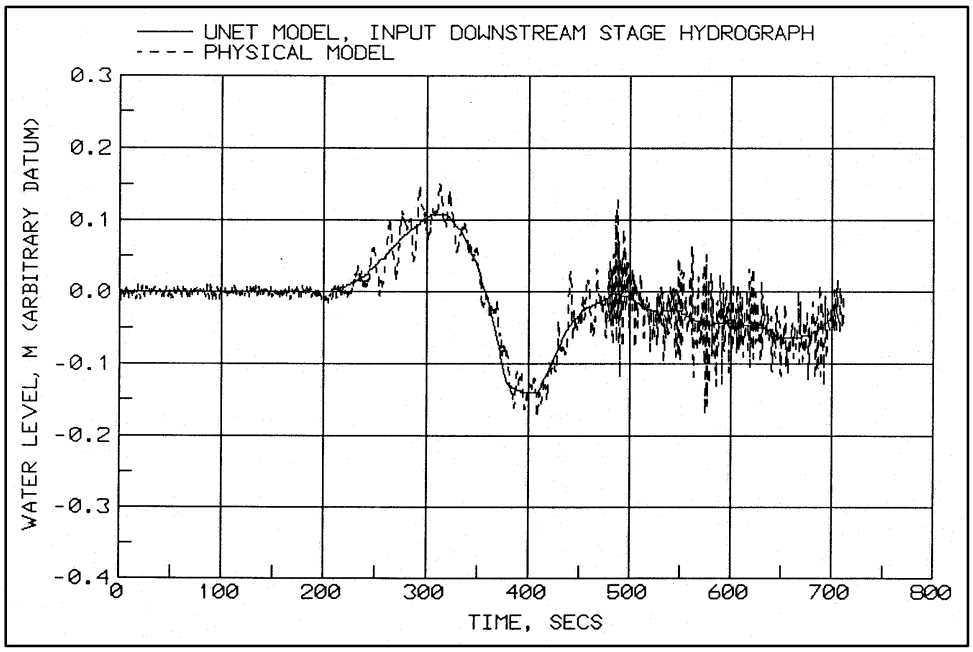


Figure 8. Water level from physical model and UNET input downstream stage hydrograph, mouth of backwater, with flow, vessel speed = 4.27 m/sec

```
PR ON
T1 BACKWATER TEST
T2 WORKSHOP
T3 HEC
*
XK  9999     10              0.50    .003
*
UB
*
NC   .07    .07    .025
*
*   CROSS-SECTION 1
X1  0.00      6   9.99   40.01   15.74   15.74   15.74
GR  102.    0.0   102.   9.99   92.62    10.   92.62    40.   102.   40.01
GR  102.   200.
*
*   CROSS-SECTION 2
X1 0.003      0   9.99   40.01  209.59  209.59  209.59
HY 1 SEC2
*
*   CROSS-SECTION 3
X1 0.043      6   9.99   40.01  194.30  194.30  194.30
GR  102.    0.0   102.   9.99   92.62    10.   92.62    40.   102.   40.01
GR  102.   200.
HY 1 SEC3
*
*   CROSS-SECTION 4
X1 0.079      0   9.99   40.01     30      30      30
GR  102.    0.0   102.   9.99   91.93    10.   91.93    40.   102.   40.01
GR  102.   200.
*
X1 0.085      6   9.99   40.01      0       0       0
GR  102.    0.0   102.   9.99   91.63    10.   91.63    40.   102.   40.01
GR  102.   200.
HY 1 SEC5
*
DB
*
EJ
```

Figure 9. UNET Cross Section input file for physical model backwater

```
WORKSHOP NO. 2
BACKWATER
UNET
*
*  Job control information
*
JOB CONTROL
 T  T  .01666666 .14 -6  F  0.6  T  T  -1  -30MIN
*
*
TIME INCREMENT
.0041667
*
INITIAL FLOW CONDITIONS
1 0.000
*
UPSTREAM FLOW HYDROGRAPH
1 34
0.000
0.000
0.000
0.000
0.000
0.000
0.000
0.000
0.000
0.000
0.000
0.000
0.000
0.000
0.000
0.000
0.000
0.000
0.000
0.000
0.000
0.000
0.000
0.000
0.000
0.000
0.000
0.000
```

Figure 10. UNET input data file for physical model backwater. Downstream stage hydrograph based on experiment series 1 having no flow and vessel speed = 3.95 m/sec (Sheet 1 of 3)

```
0.000
0.000
0.000
0.000
0.000
0.00
0.00
0.00
0.00
0.00
0.00
0.00
*
DOWNSTREAM STAGE HYDROGRAPH
1 34
100.0031
100.0006
100.0242
100.0515
100.0986
100.2932
100.3404
100.2498
100.3329
100.4110
100.2734
100.0862
99.84938
99.56174
99.43651
99.49354
99.72539
99.72291
99.91509
99.99072
100.0
99.99
99.98
99.97
99.96
```

Figure 10. (Sheet 2 of 3)

```
99.95
99.94
99.95
99.96
99.97
99.98
99.99
100.0
100.0
*
*
*  Set maximum number of iterations for Newton Raphson iteration scheme
*
MXITER = 100
*
*  Set stage tolerace to 0.00001 ft, for convergence criteria
*
ZTOL=0.00001
*
*
EJ
```

Figure 10. (Sheet 3 of 3)