

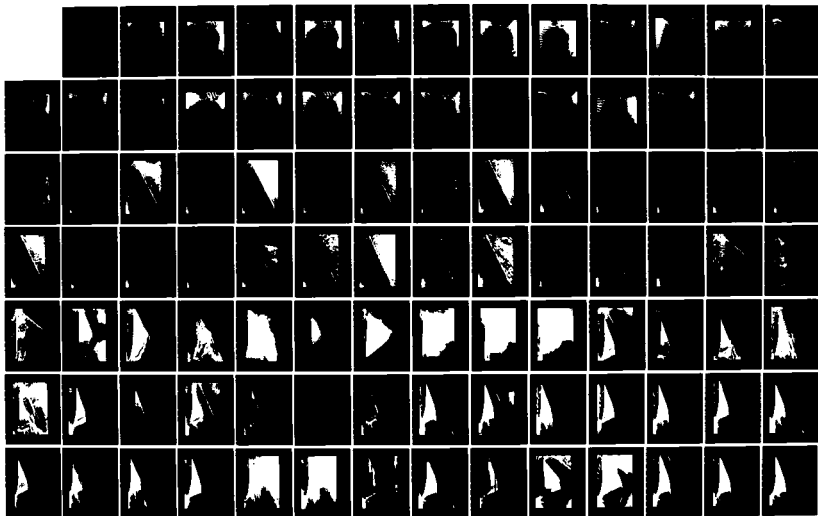
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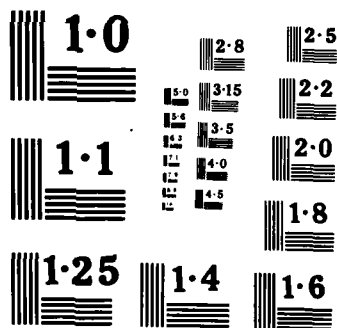
BUHNE POINT HUMBOLDT BAY CALIFORNIA DESIGN FOR THE
PREVENTION OF SHORELIN. (U) COASTAL ENGINEERING
RESEARCH CENTER VICKSBURG MS R R BOTTIN ET AL. NOV 84
CERC-84-5 F/G 13/2

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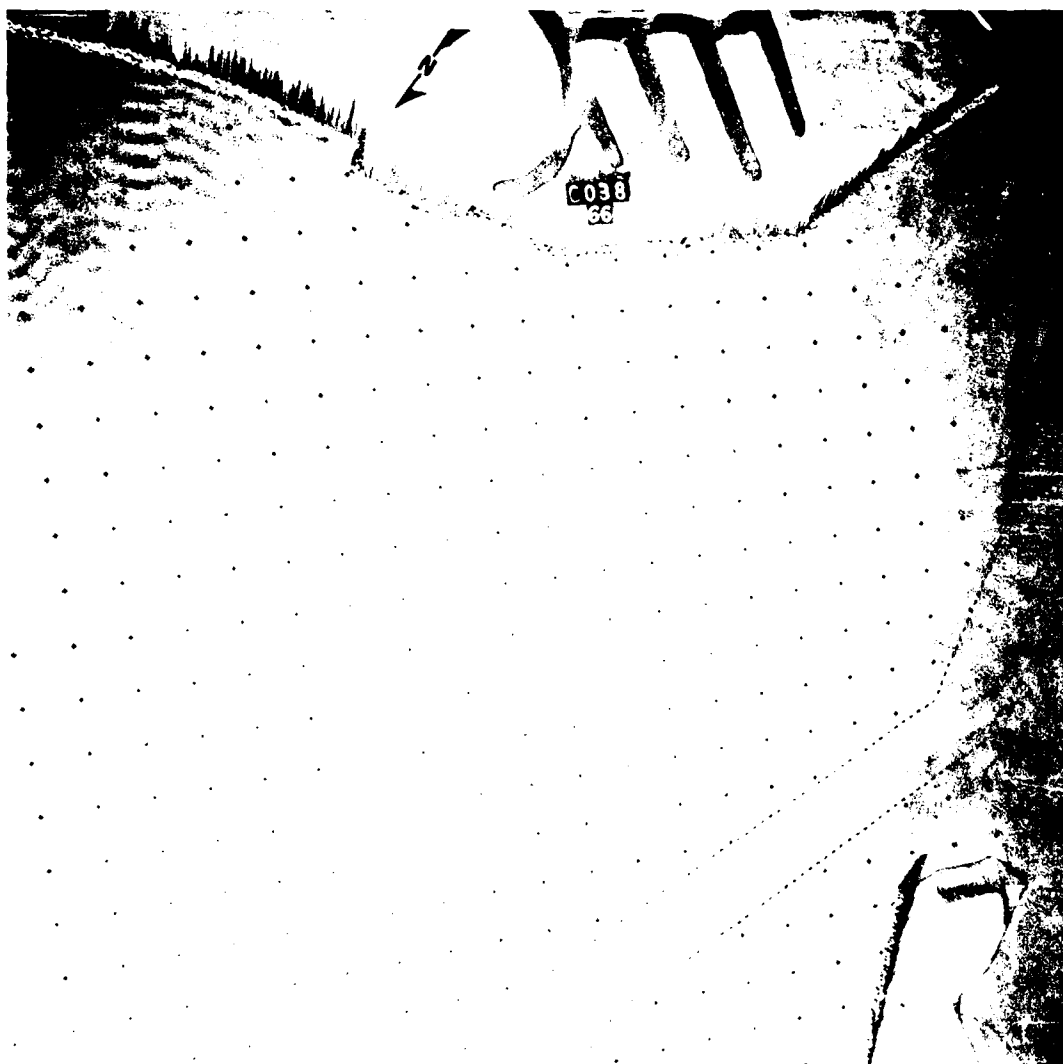


Photo 14. Typical wave patterns approaching Buhne Point for 5-sec,
7-ft waves from northwest for maximum flood; +3.2 ft swl

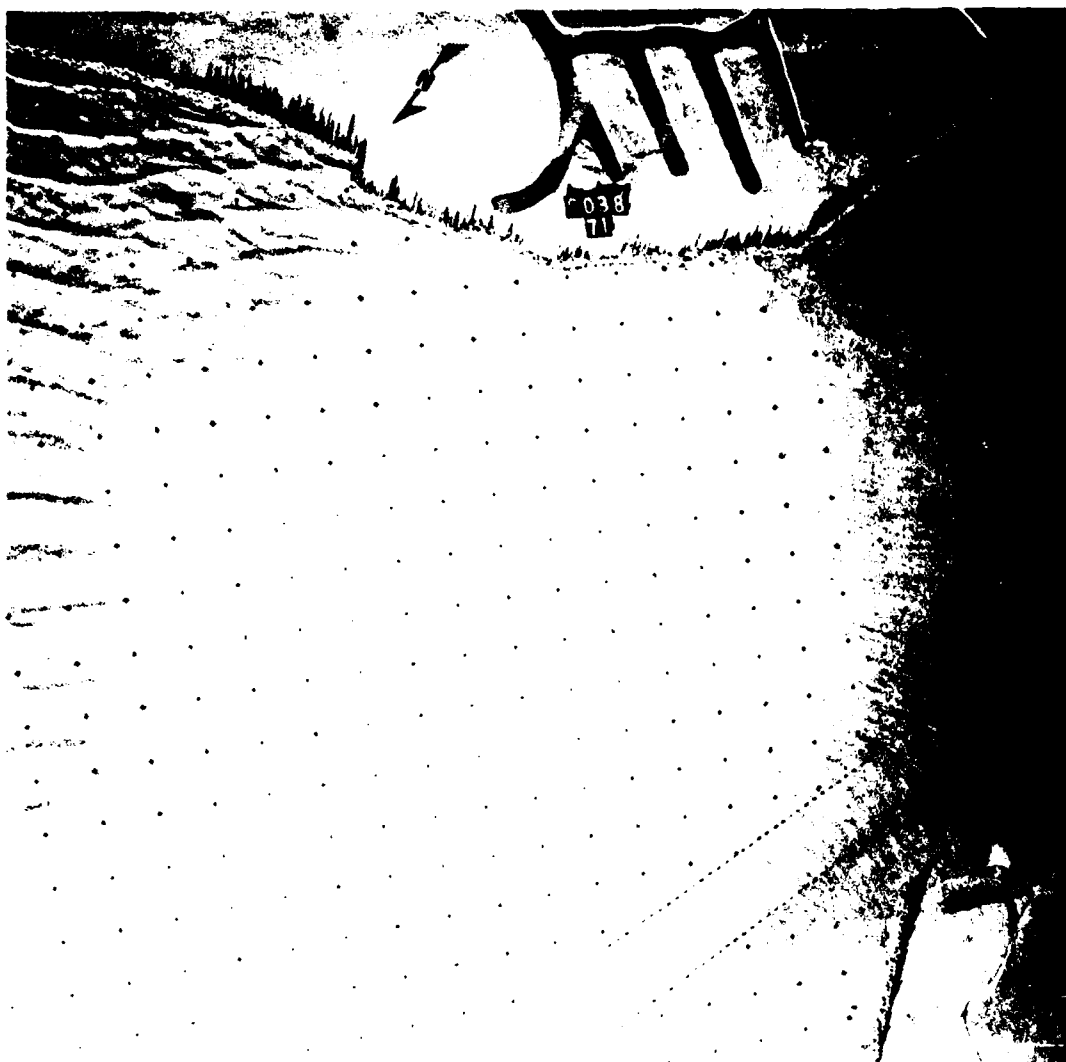


Photo 15. Typical wave patterns approaching Buhne Point for 11-sec, 10-ft waves from northwest for maximum flood; +3.2 ft swl

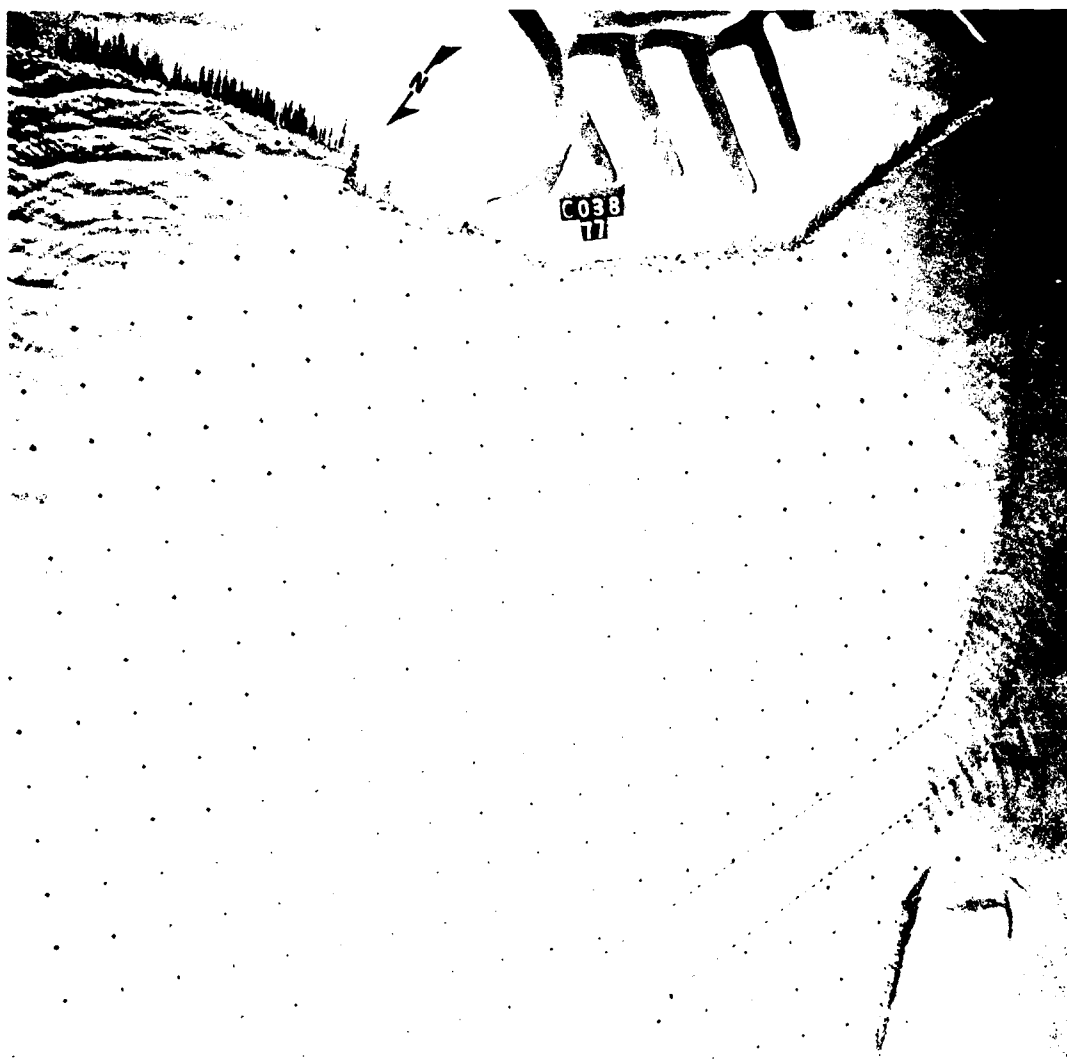


Photo 16. Typical wave patterns approaching Buhne Point for 15-sec, 17-ft waves from northwest for maximum flood; +3.2 ft swl

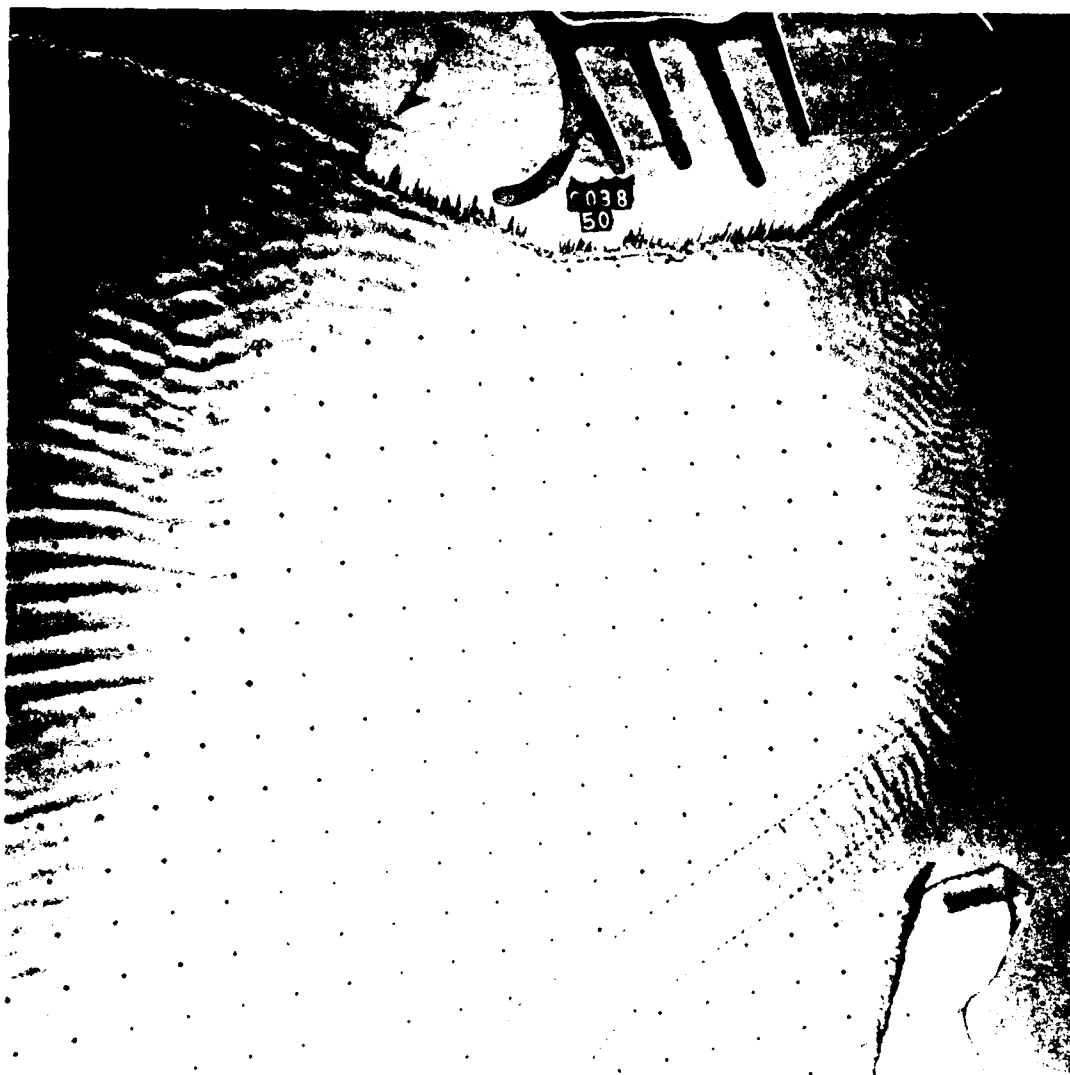


Photo 17. Typical wave patterns approaching Buhne Point for 5-sec, 7-ft waves from northwest for maximum ebb; +3.7 ft swl



Photo 18. Typical wave patterns approaching Buhne Point for 11-sec, 10-ft waves from northwest for maximum ebb; +3.7 ft swl

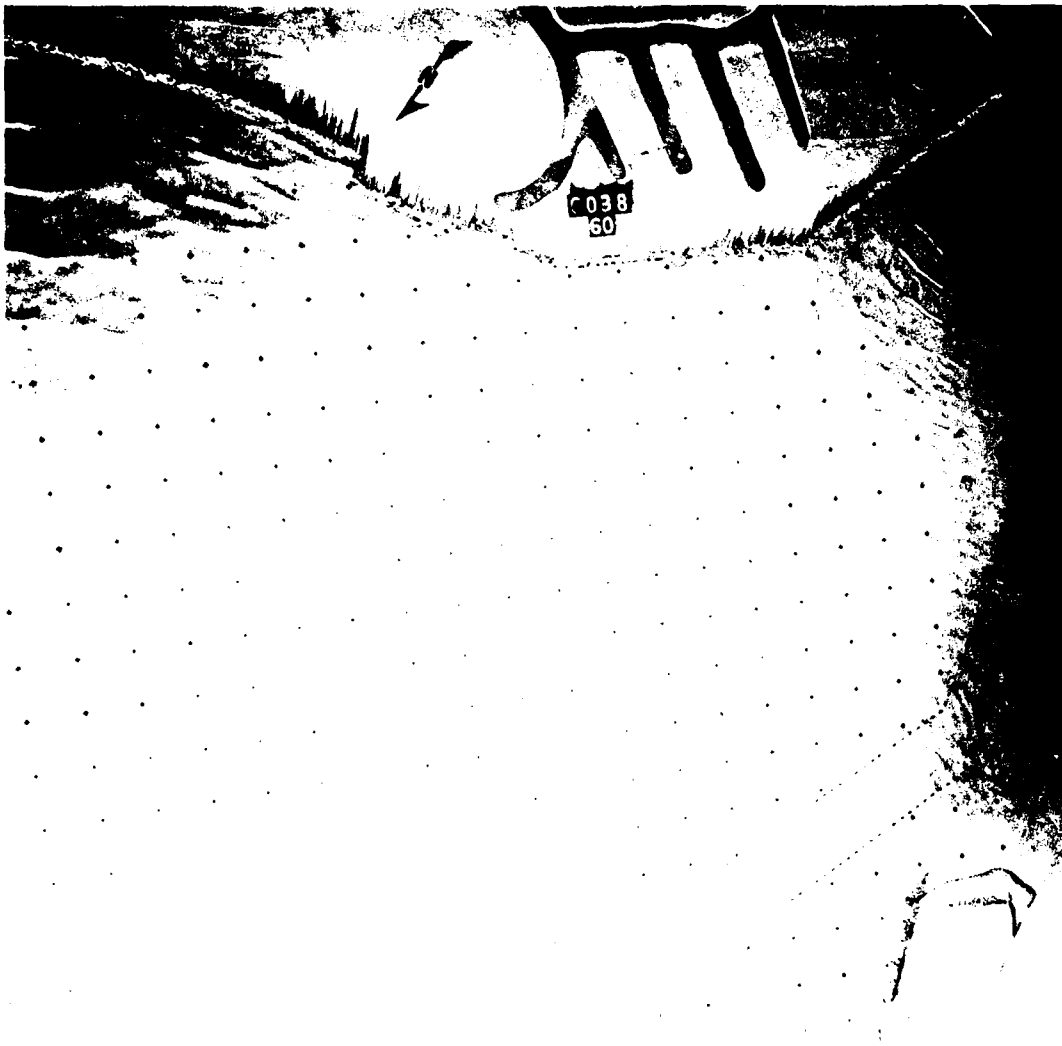


Photo 19. Typical wave patterns approaching Buhne Point for 15-sec, 9-ft waves from northwest for maximum ebb; +3.7 ft swl

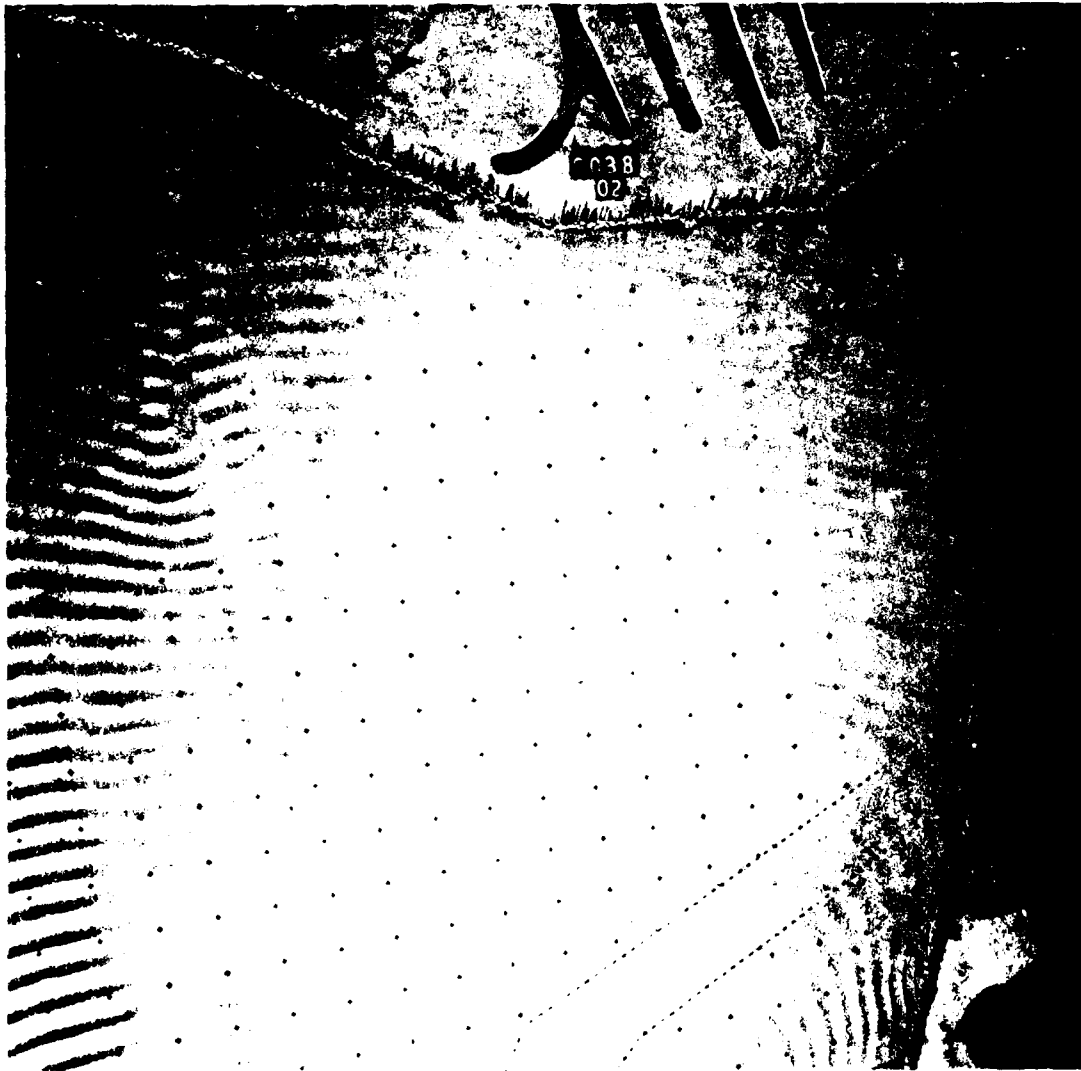


Photo 20. Typical wave patterns approaching Buhne Point for 5-sec,
7-ft waves from northwest; +6.7 ft swl

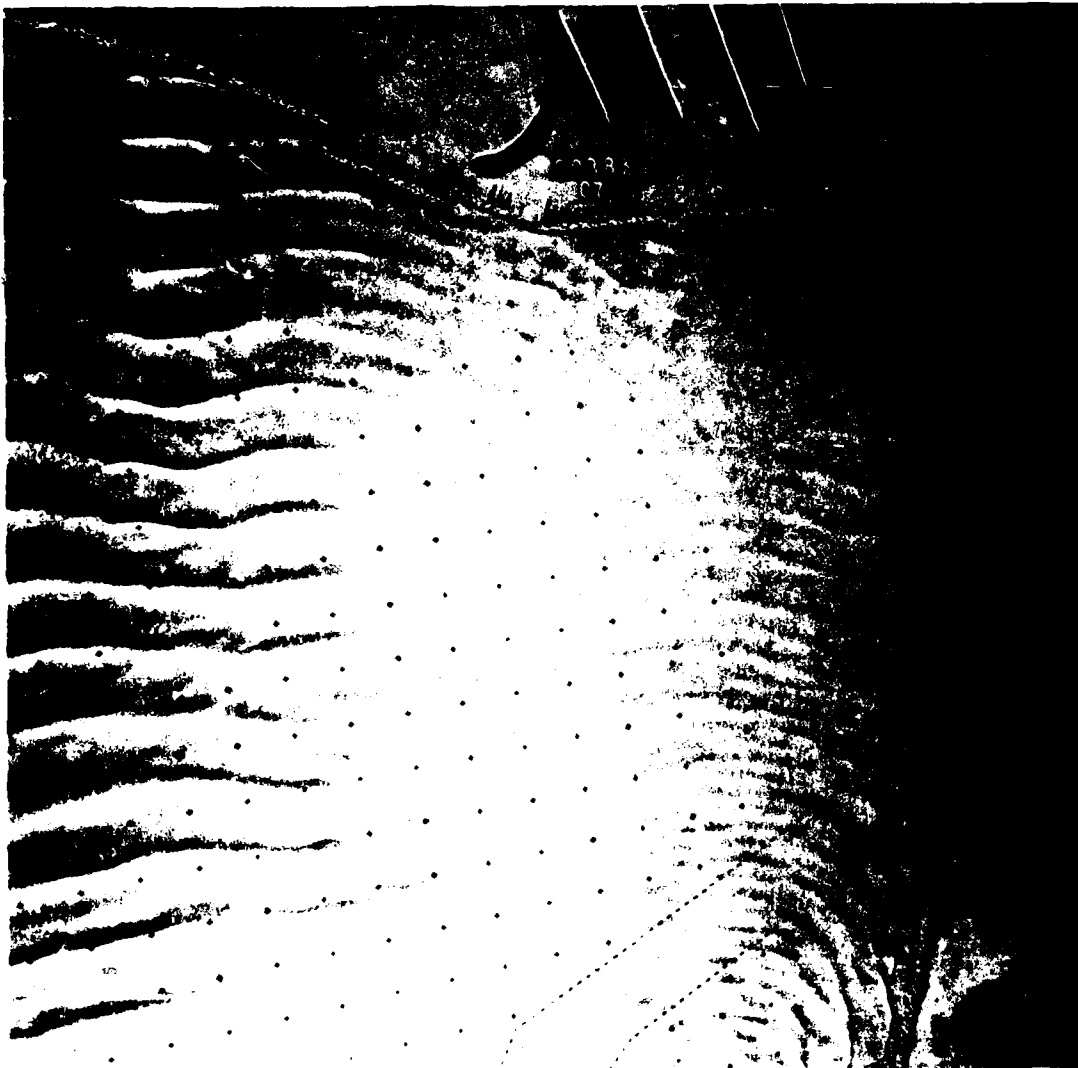


Photo 21. Typical wave patterns approaching Buhne Point for 11-sec,
10-ft waves from northwest; +6.7 ft swl

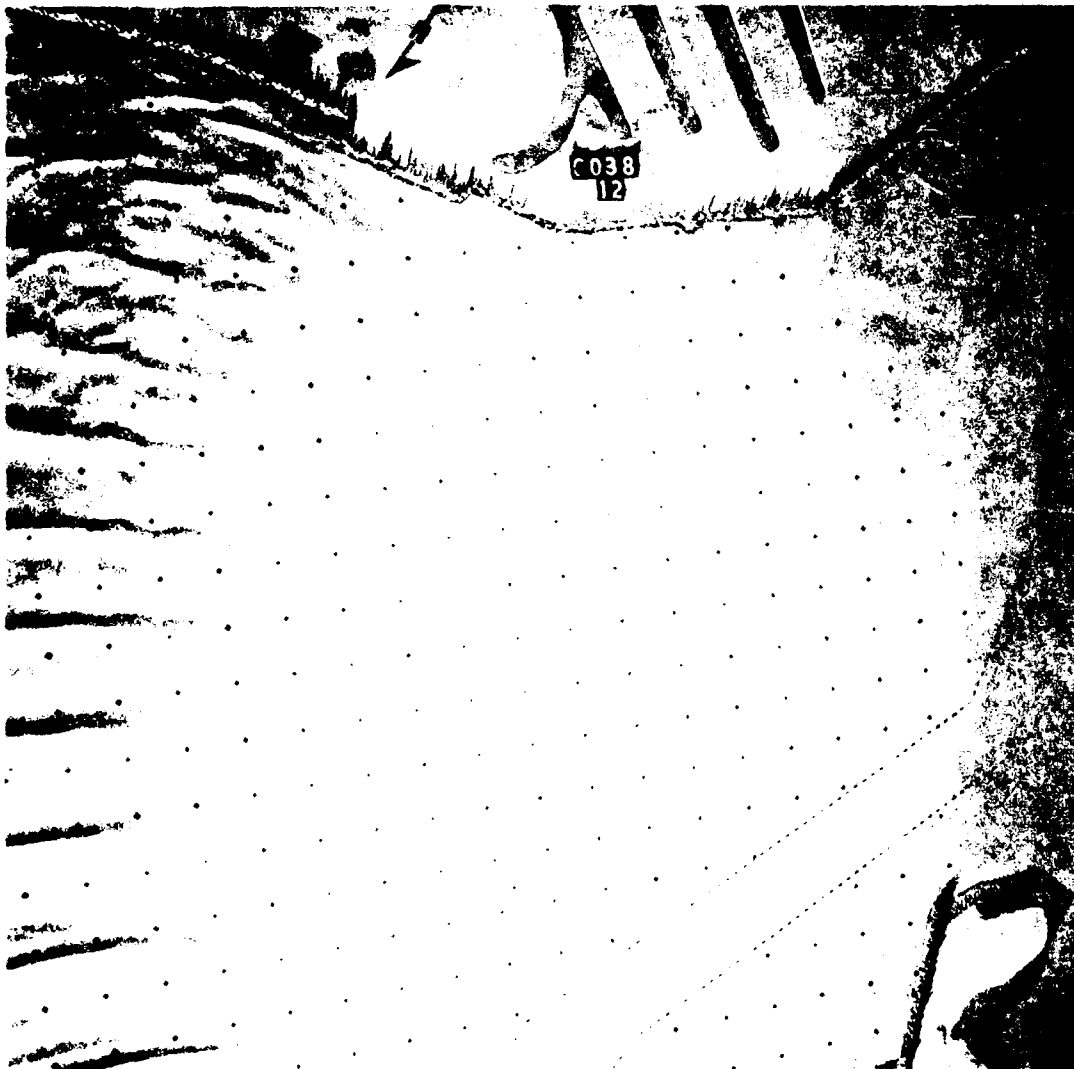


Photo 22. Typical wave patterns approaching Buhne Point for 15-sec,
9-ft waves from northwest; +6.7 ft swl

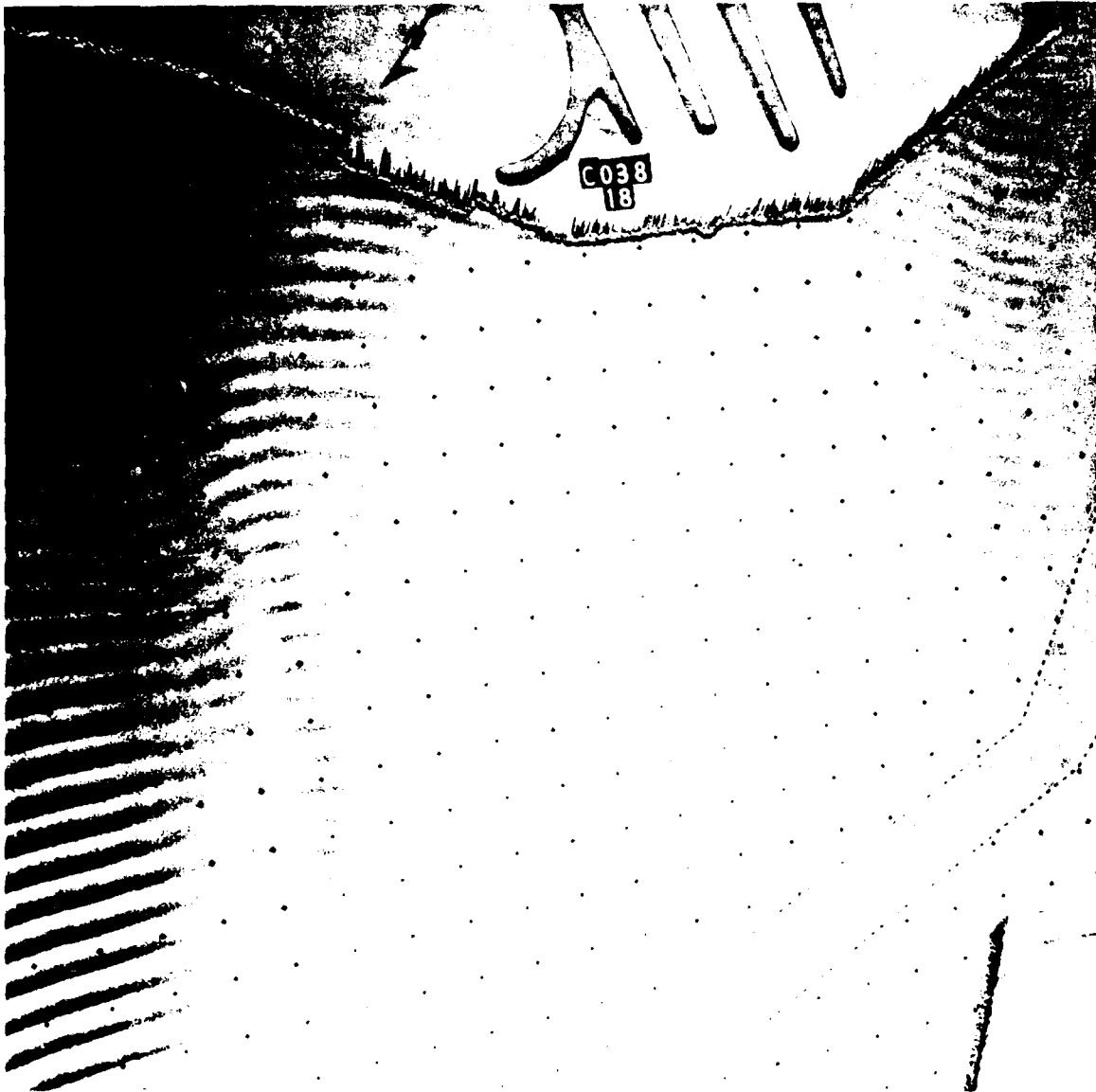


Photo 23. Typical wave patterns approaching Buhne Point for 5-sec,
7-ft waves from northwest; +9.5 ft swl

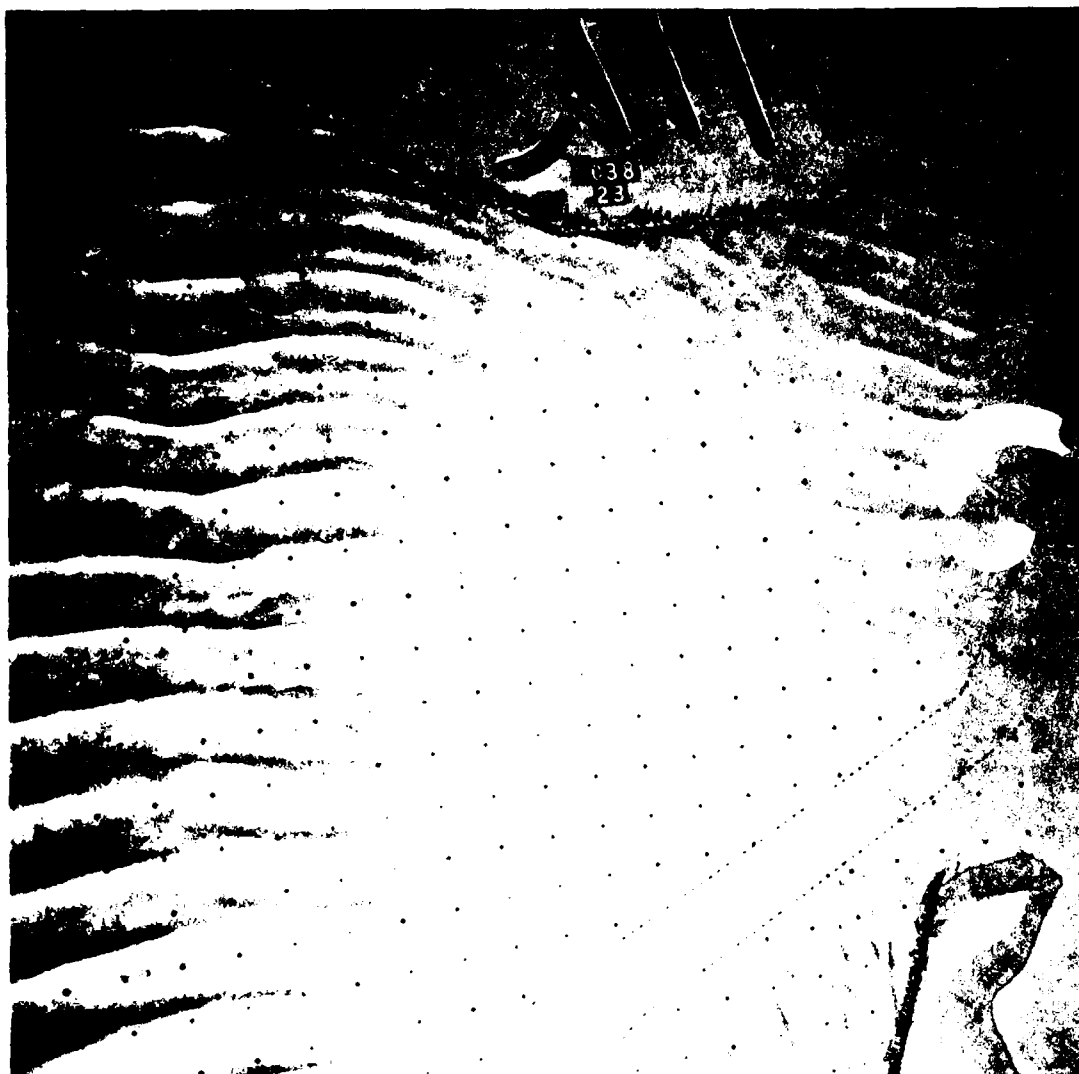


Photo 24. Typical wave patterns approaching Buhne Point for 11-sec,
10-ft waves from northwest; +9.5 ft swl

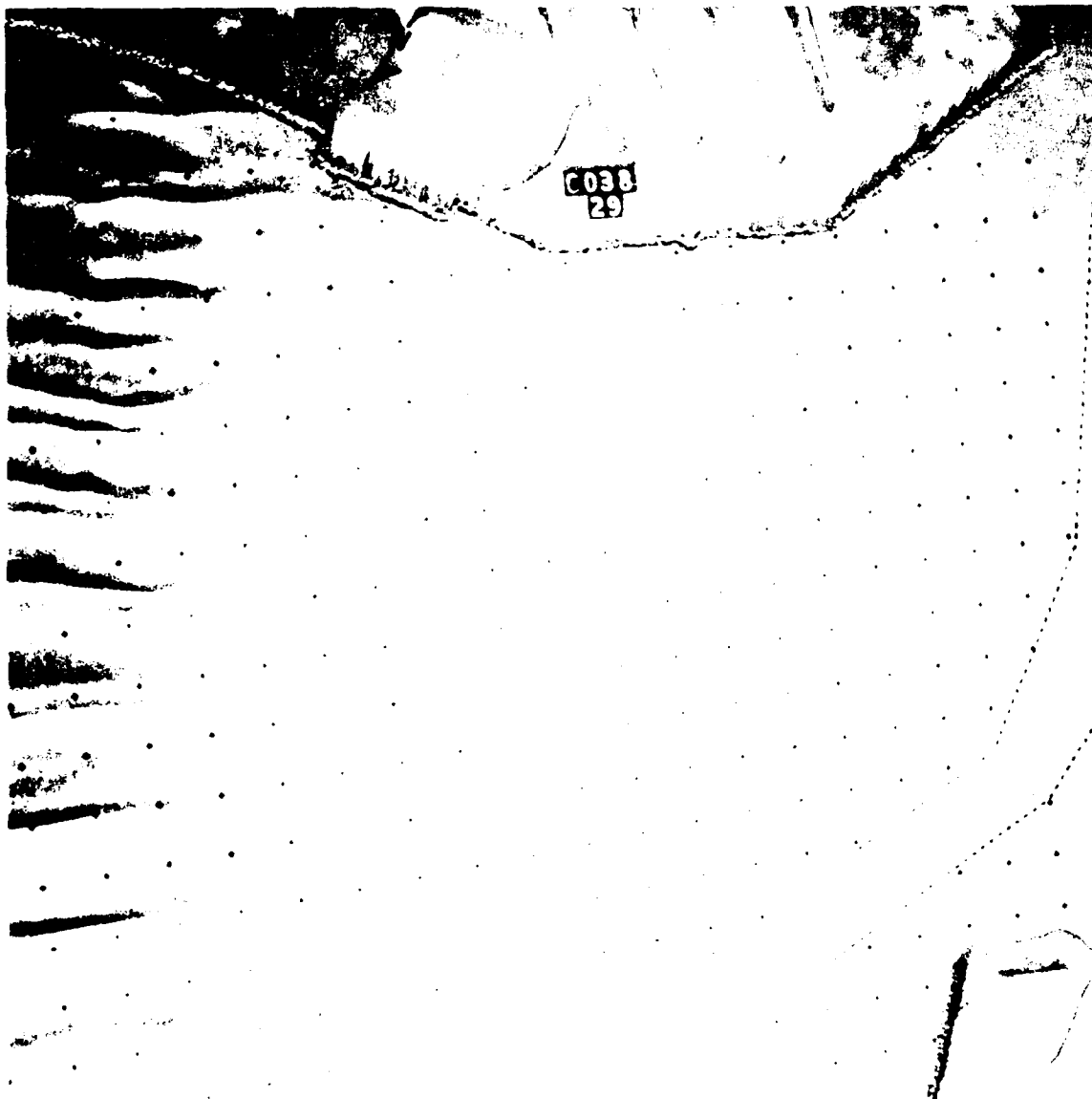


Photo 25. Typical wave patterns approaching Buhne Point for 15-sec,
17-ft waves from northwest; +9.5 ft swl



Photo 39. Typical wave patterns approaching Buhne Point for 11-sec,
10-ft waves from west; +9.5 ft swl

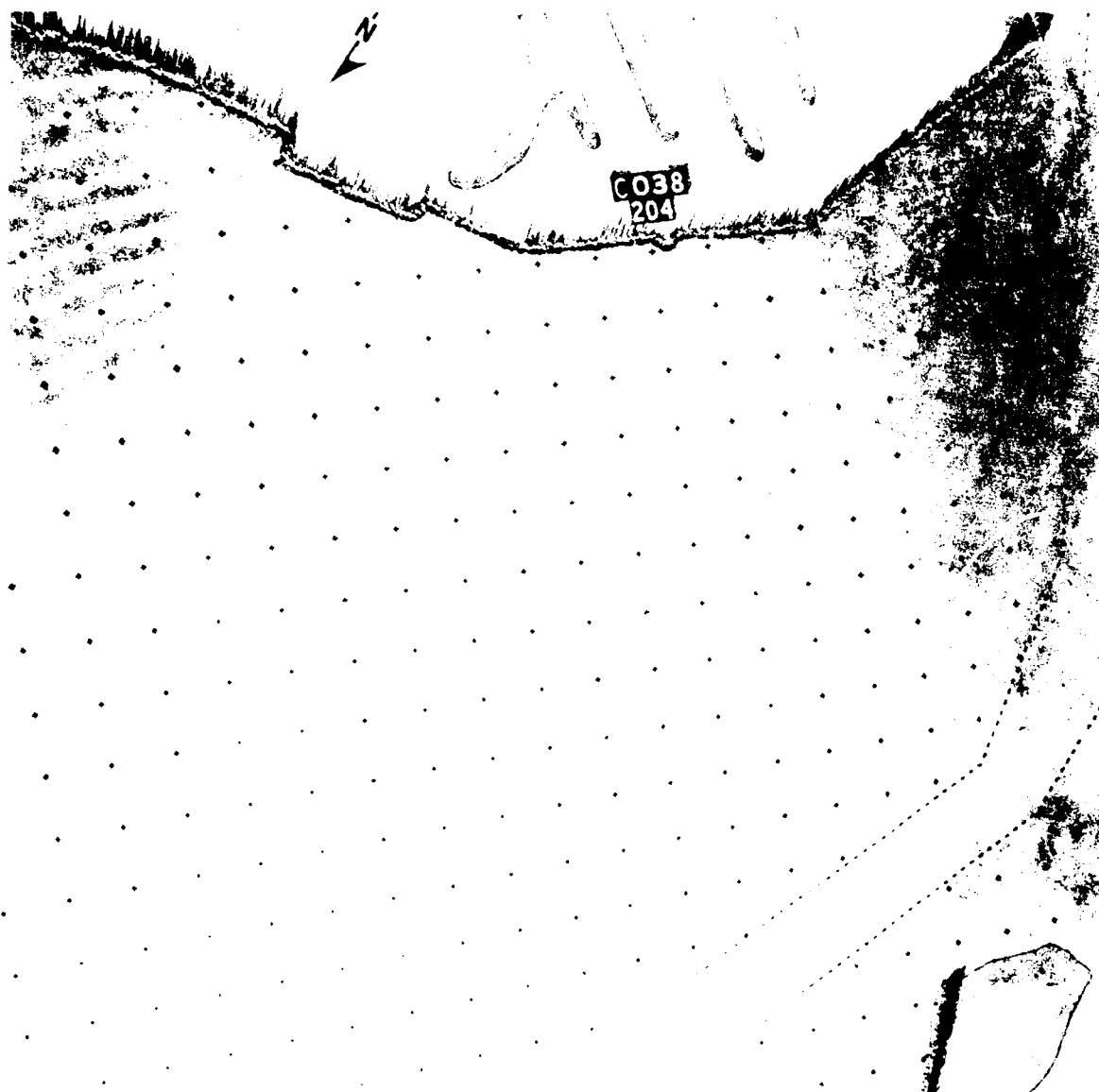


Photo 38. Typical wave patterns approaching Buhne Point for 5-sec,
7-ft waves from west; +9.5 ft swl

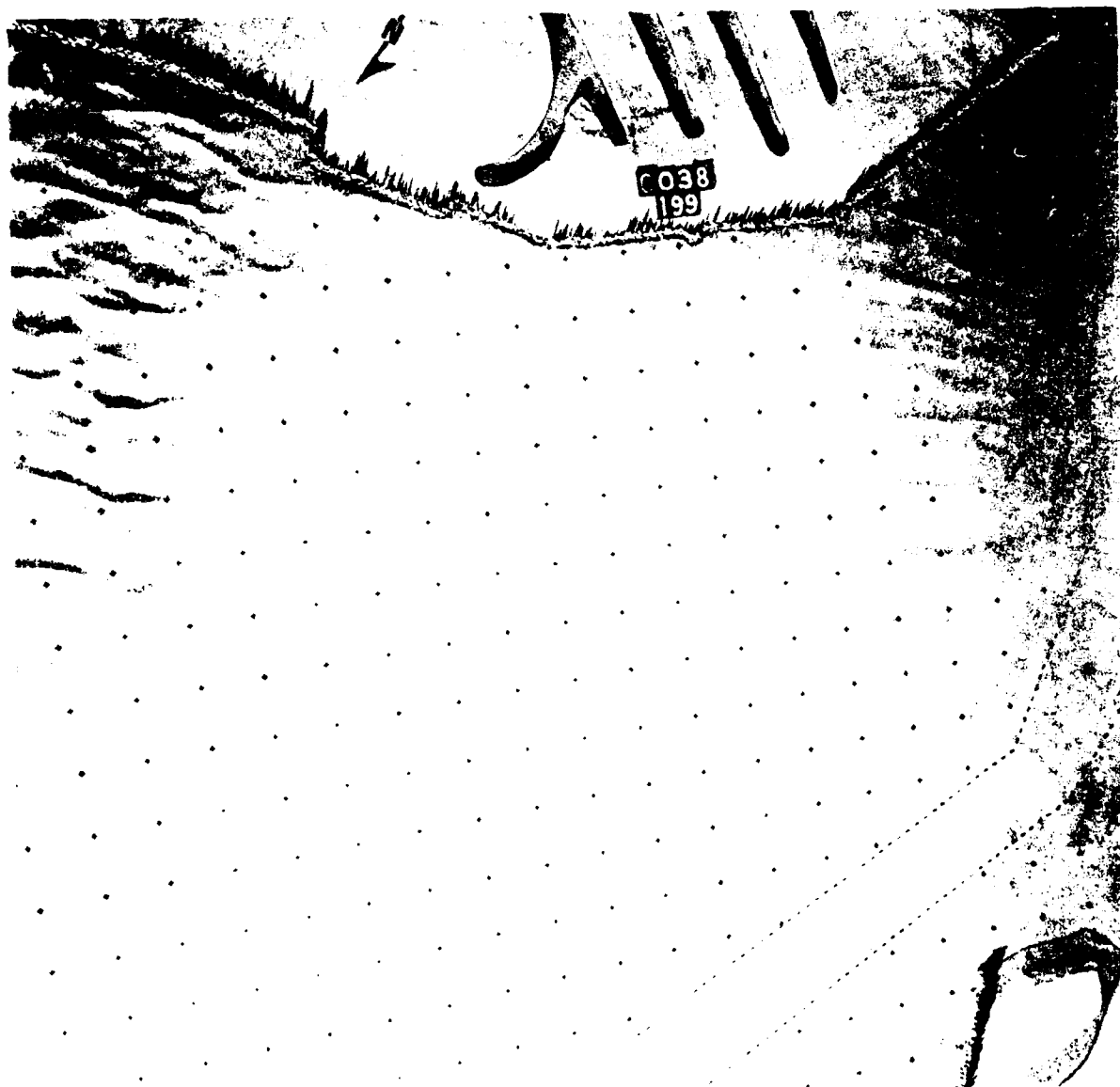


Photo 37. Typical wave patterns approaching Buhne Point for 15-sec,
11-ft waves from west; +6.7 ft swl

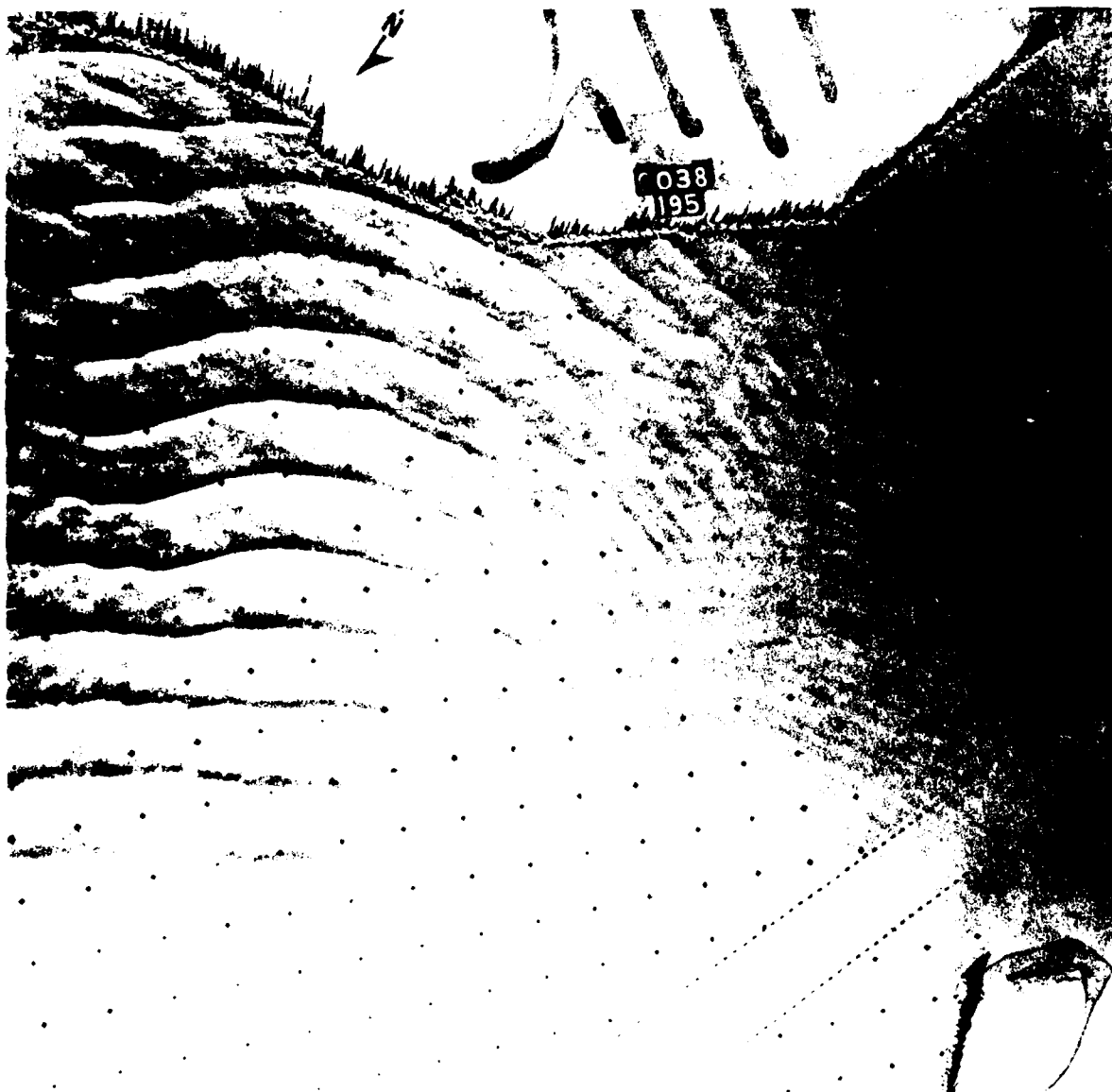


Photo 36. Typical wave patterns approaching Buhne Point for 11-sec,
10-ft waves from west; +6.7 ft swl

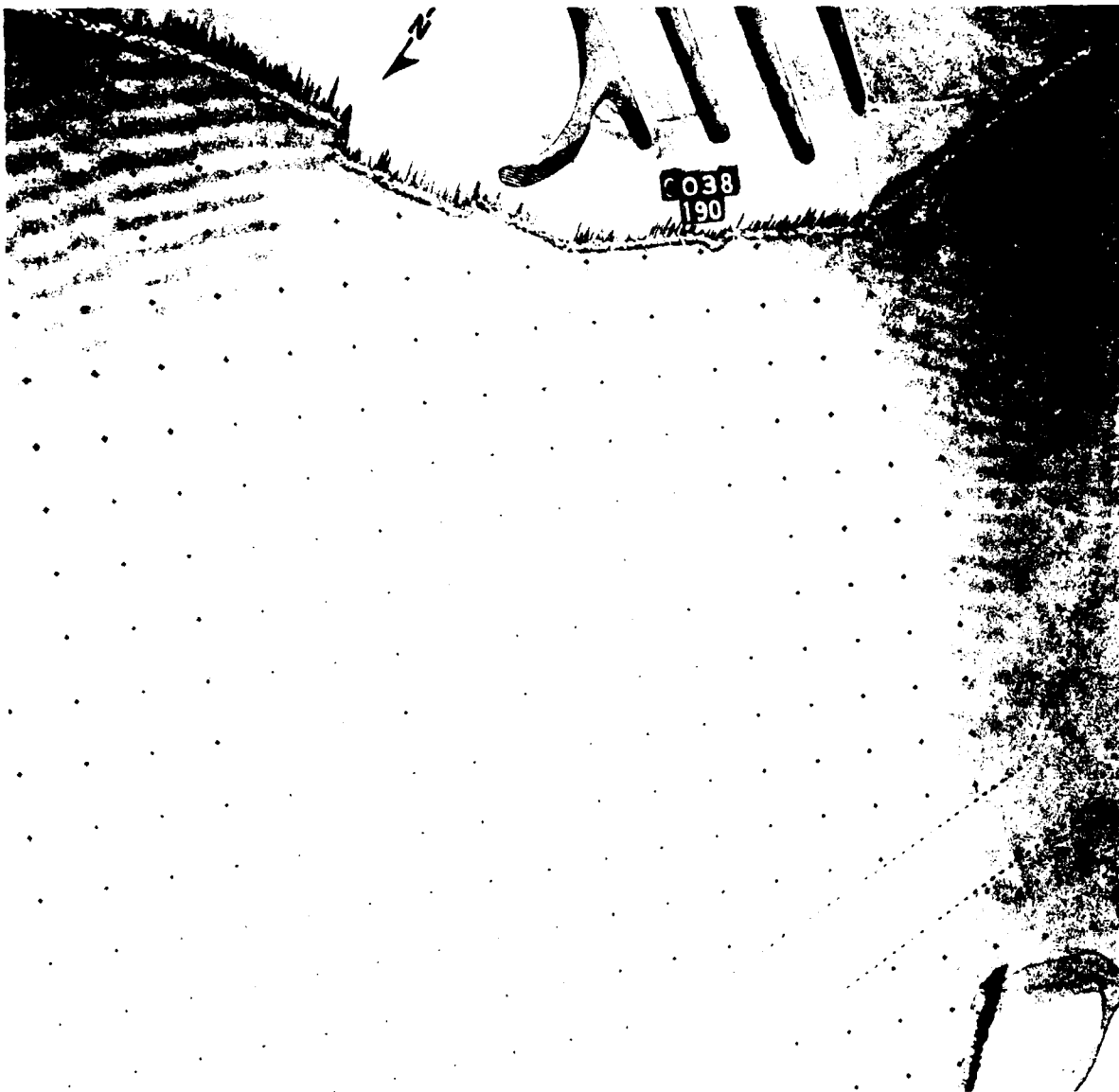


Photo 35. Typical wave patterns approaching Buhne Point for 5-sec,
7-ft waves from west; +6.7 ft swl

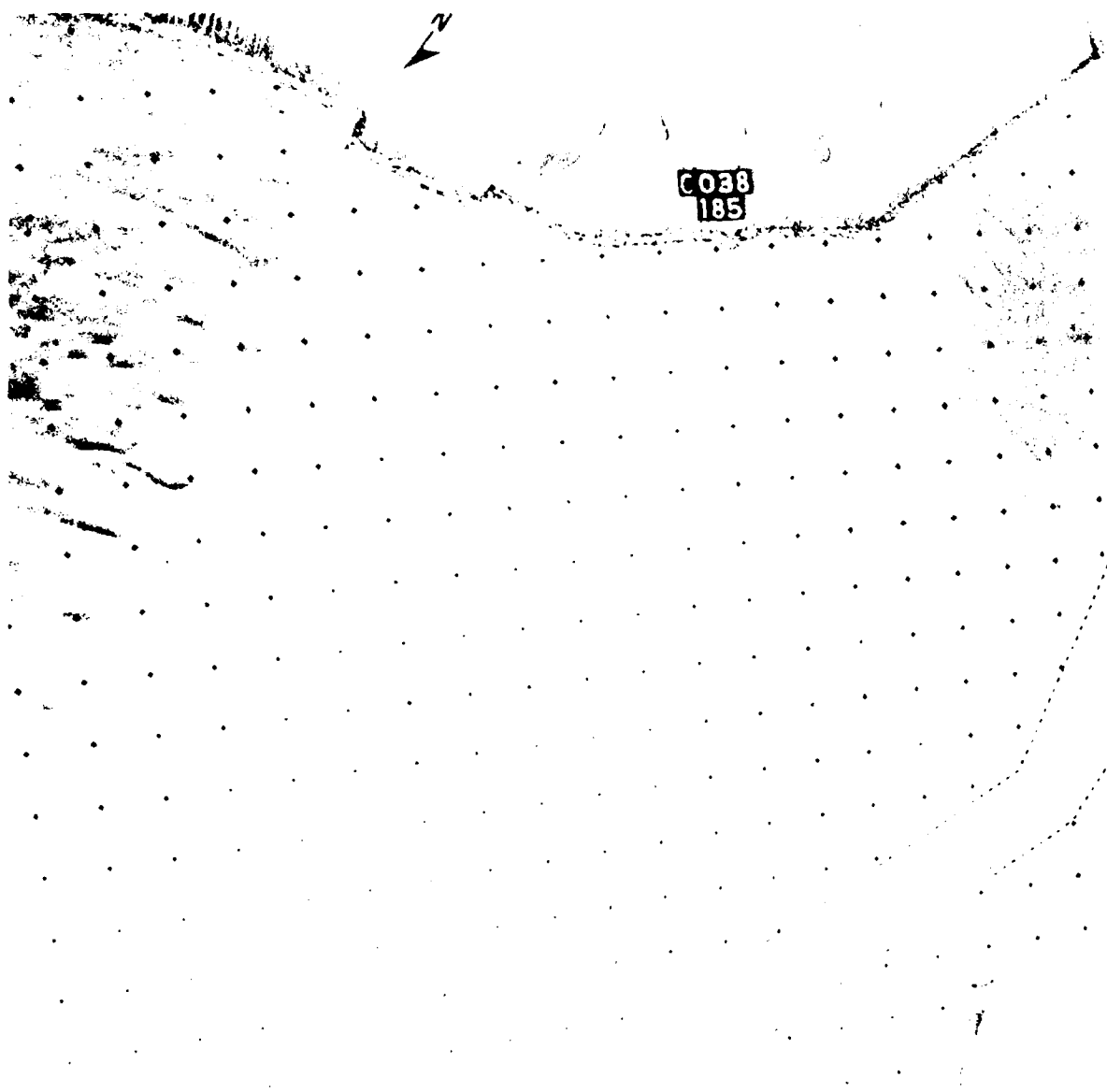


Photo 34. Typical wave patterns approaching Buhne Point for 15-sec, 11-ft waves from west for maximum ebb; +3.7 ft swl

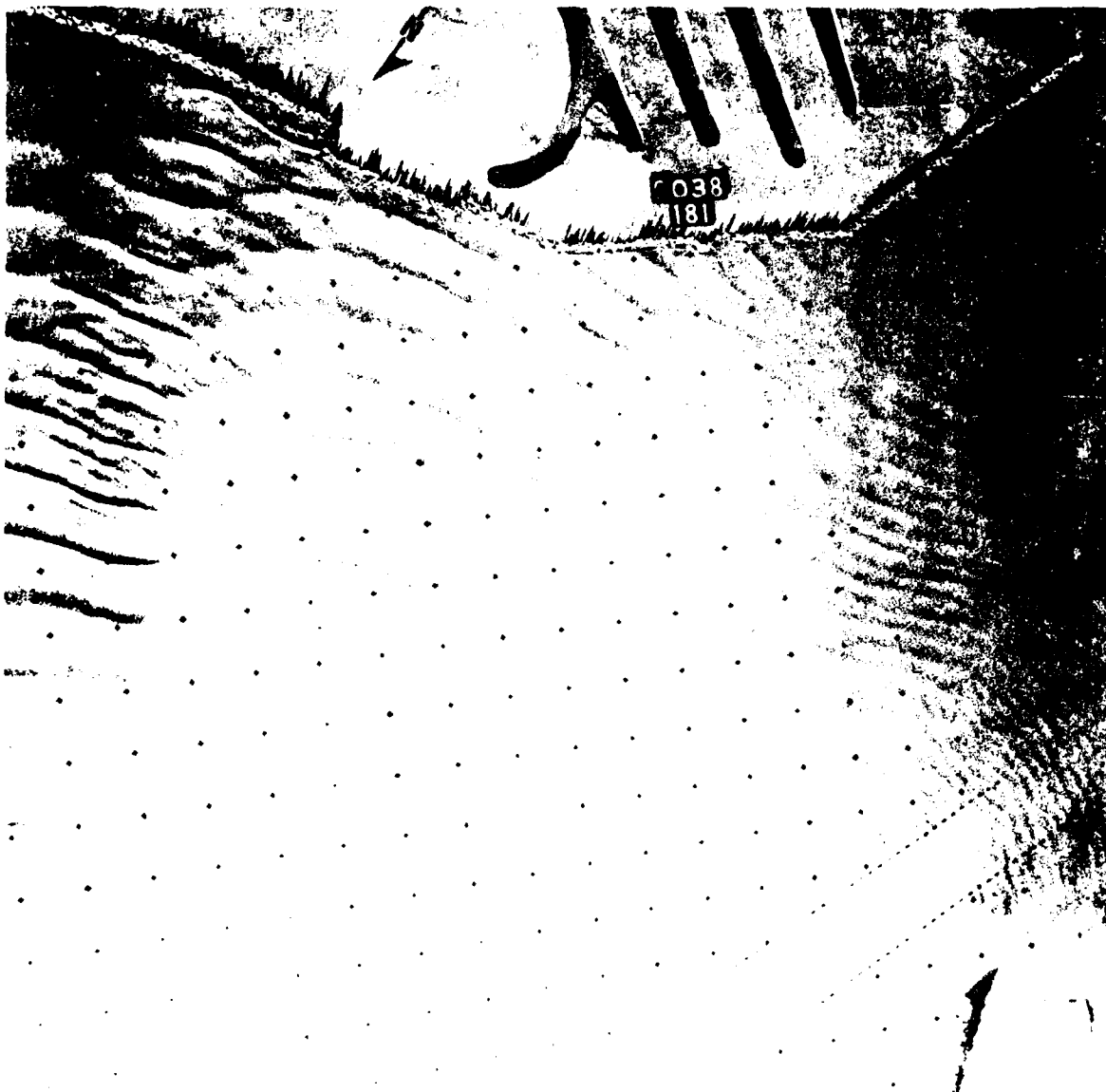


Photo 33. Typical wave patterns approaching Buhne Point for 11-sec,
10-ft waves from west for maximum ebb; +3.7 ft swl

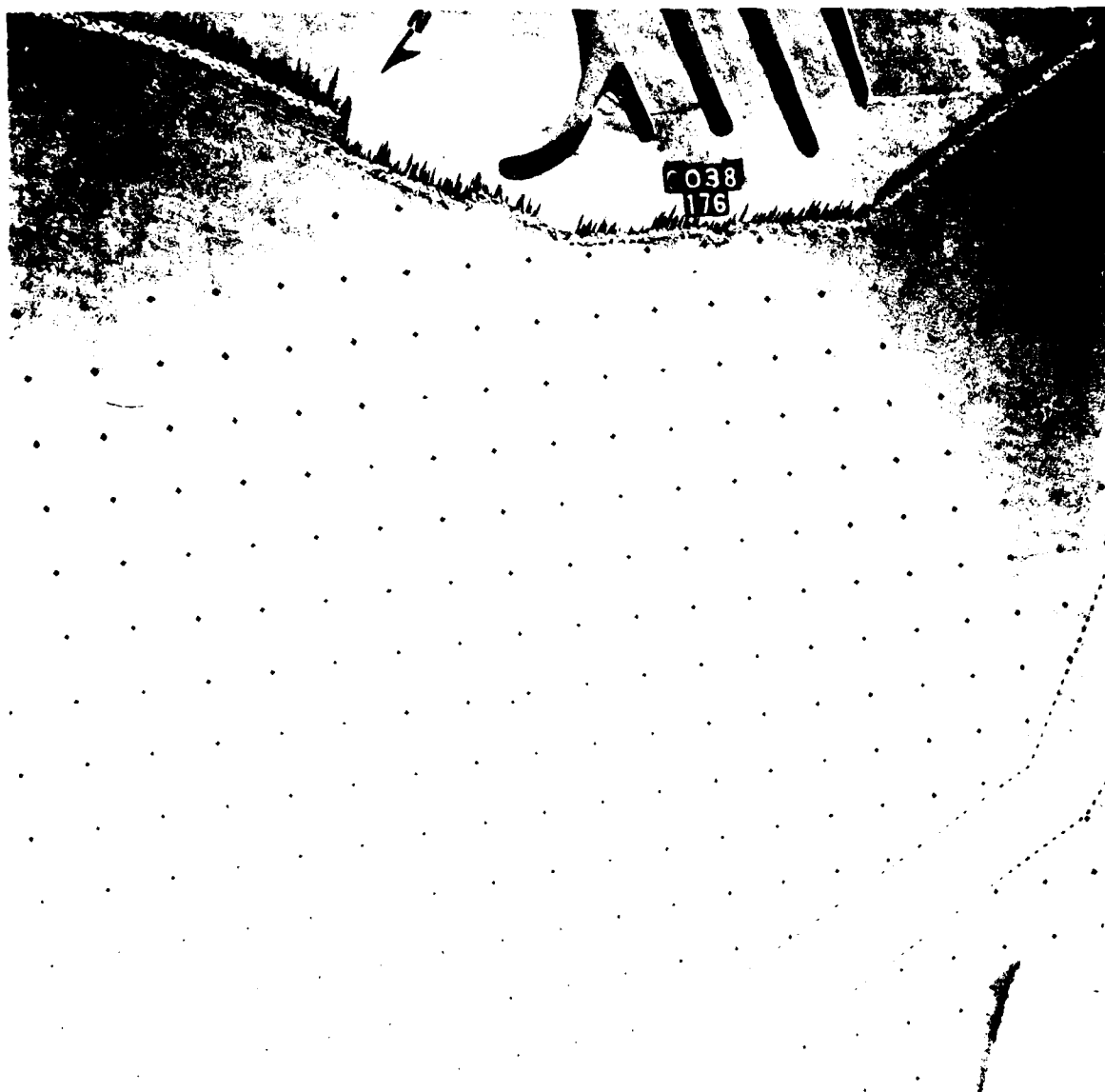


Photo 32. Typical wave patterns approaching Buhne Point for 5-sec,
7-ft waves from west for maximum ebb; +3.7 ft swl

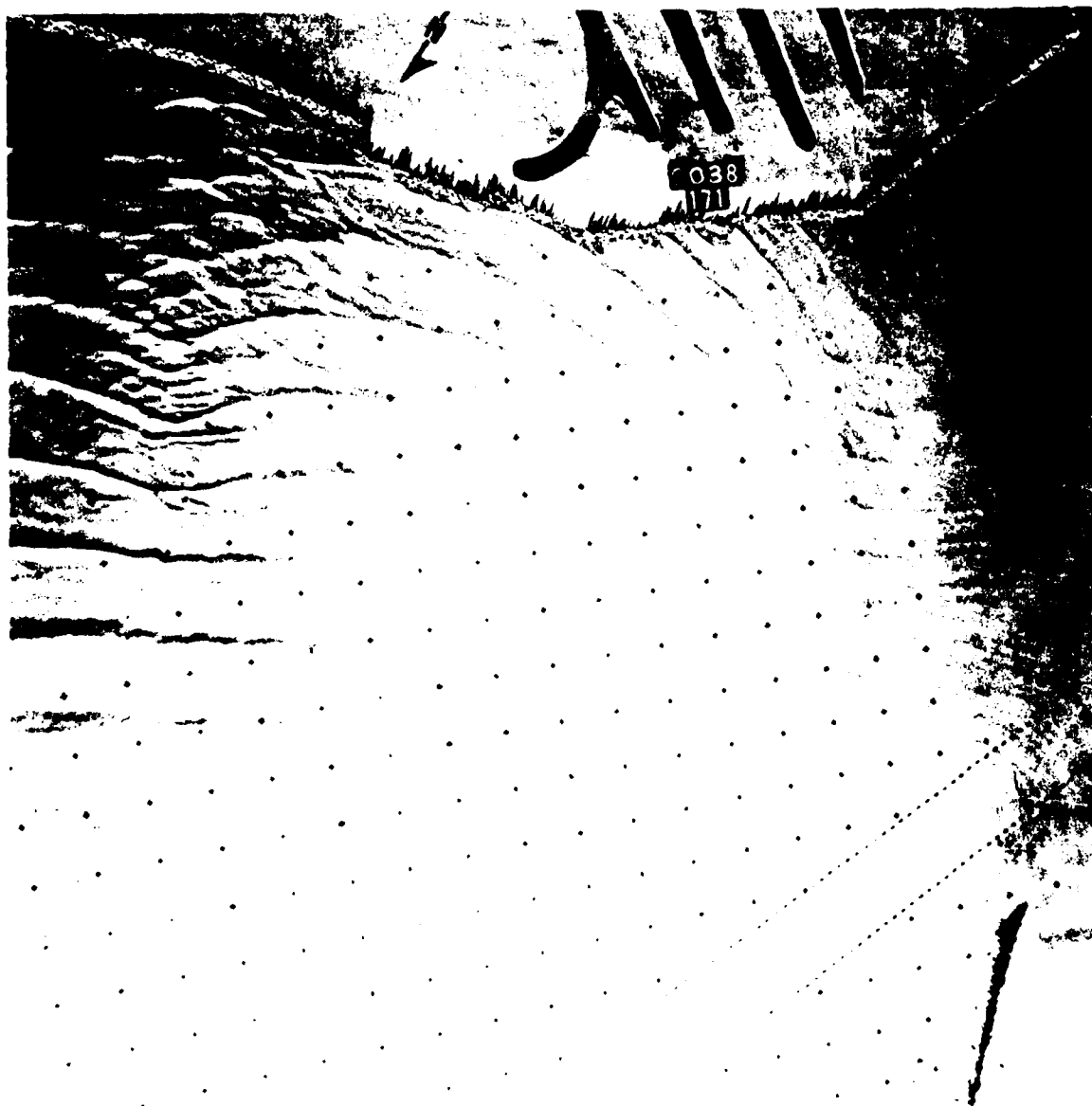


Photo 31. Typical wave patterns approaching Buhne Point for 15-sec, 11-ft waves from west for maximum flood; +3.2 ft swl

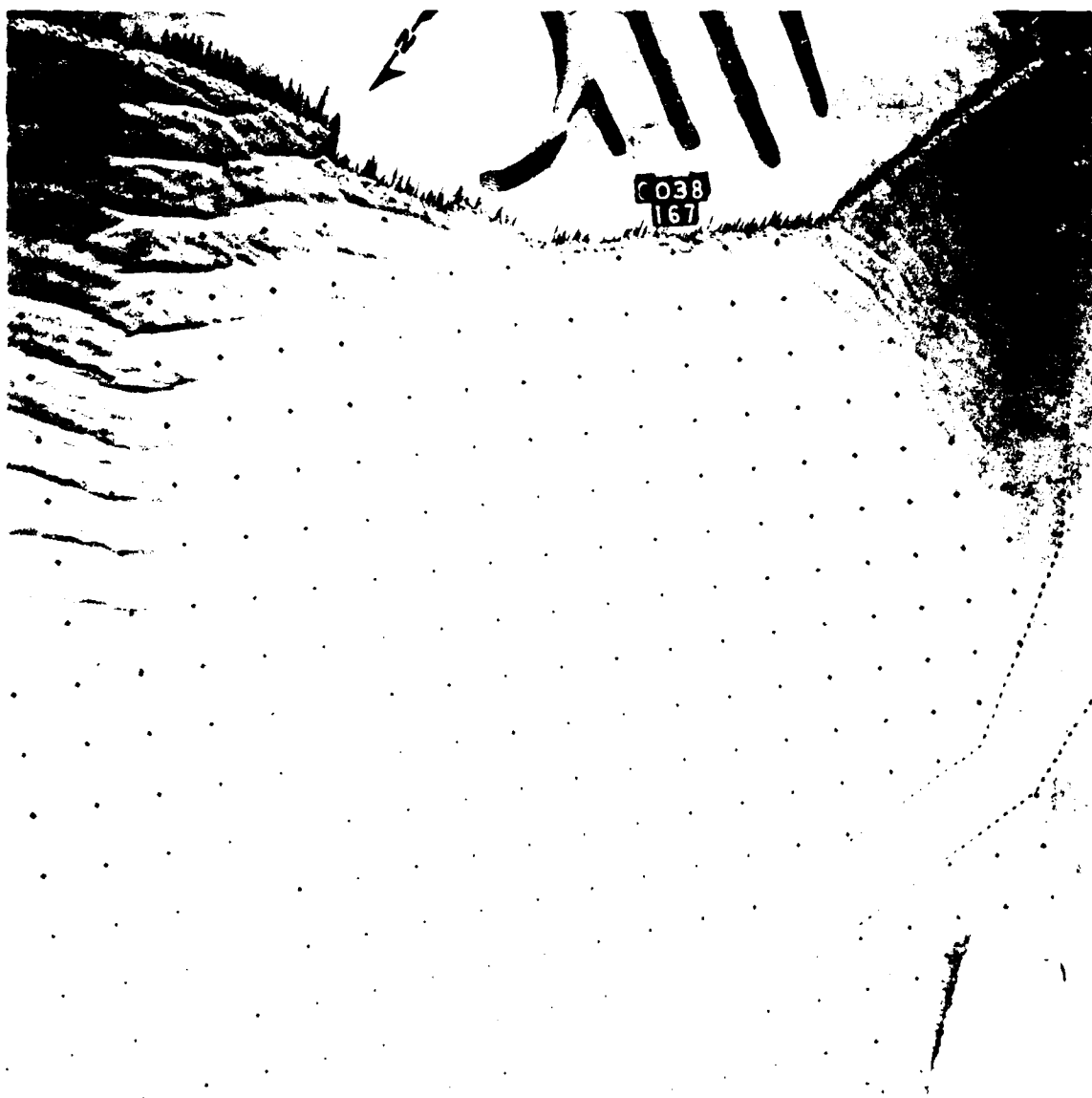


Photo 30. Typical wave patterns approaching Buhne Point for 11-sec,
10-ft waves from west for maximum flood; +3.2 ft swl



Photo 29. Typical wave patterns approaching Buhne Point for 5-sec,
7-ft waves from west for maximum flood; +3.2 ft swl



Photo 28. Typical wave patterns approaching Buhne Point for 15-sec,
11-ft waves from west; 0.0-ft swl

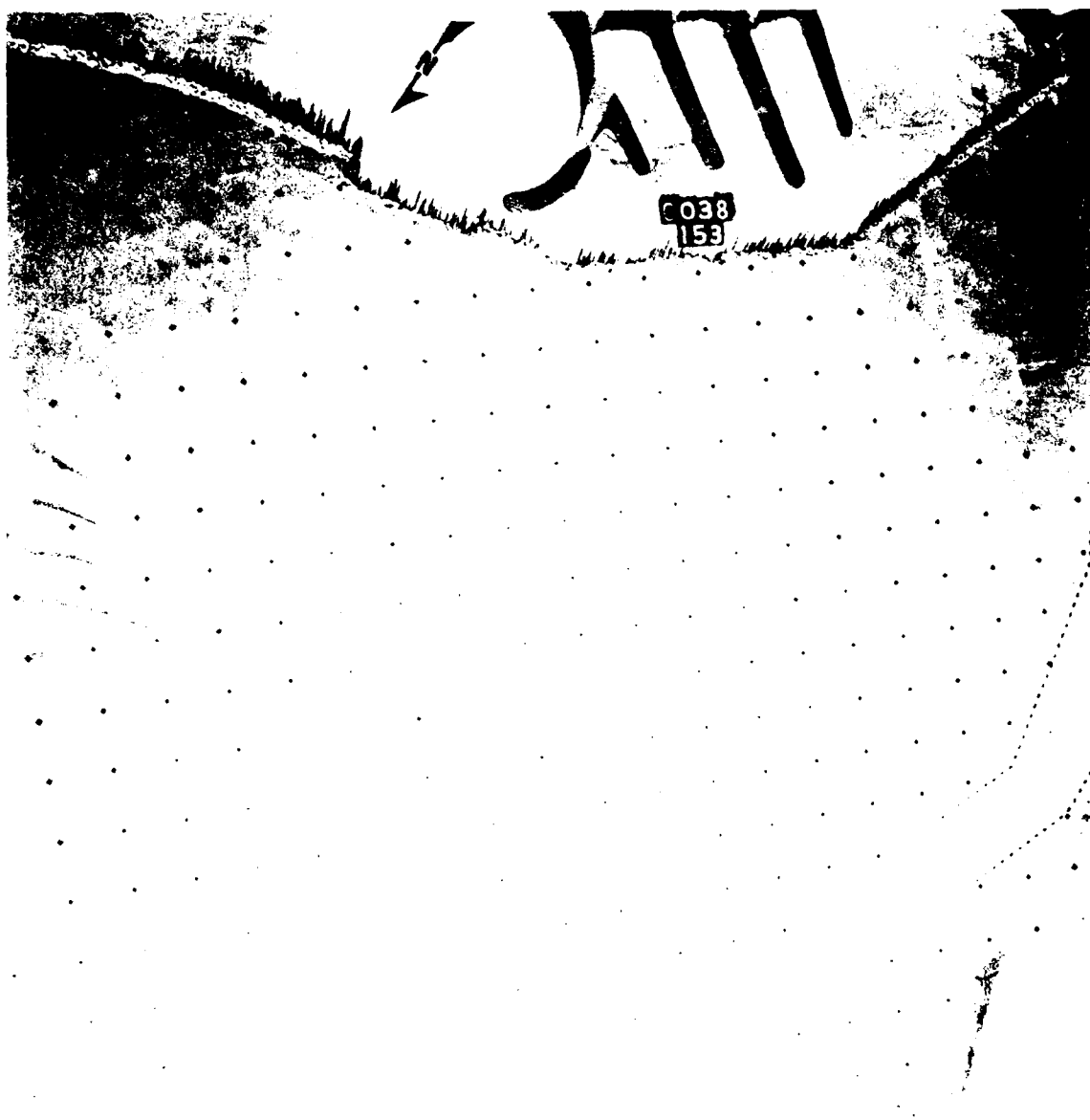


Photo 27. Typical wave patterns approaching Buhne Point for 11-sec,
10-ft waves from west; 0.0-ft swl

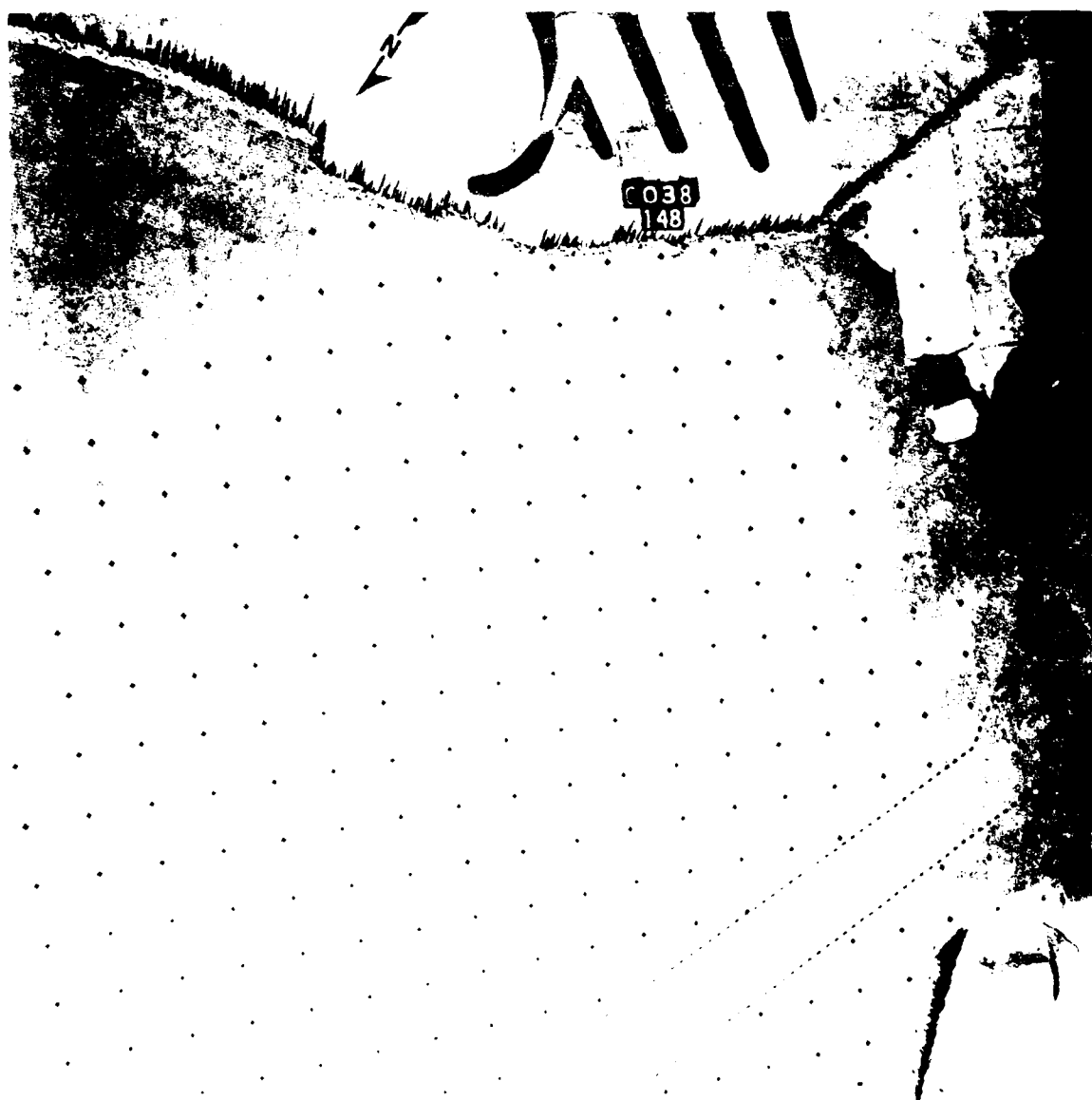


Photo 26. Typical wave patterns approaching Buhne Point for 5-sec,
7-ft waves from west; 0.0-ft swl

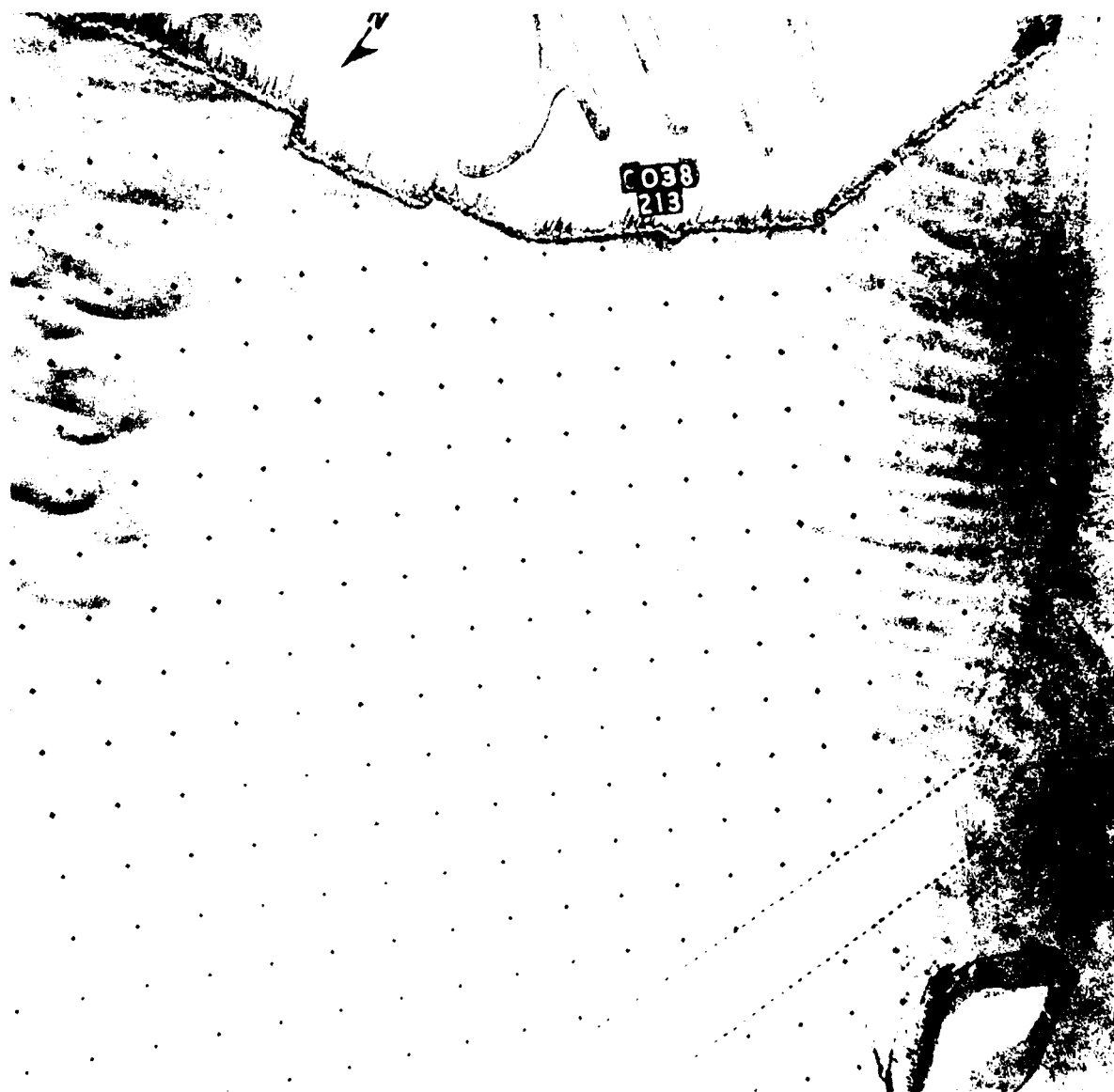


Photo 40. Typical wave patterns approaching Buhne Point for 15-sec,
11-ft waves from west; +9.5 ft swl



* INDICATES NO CURRENT MOVEMENT

Photo 41. Typical wave patterns, current patterns, and current magnitudes (prototype foot per sec. x 0.01) for existing conditions; 9-sec, 19-ft waves from northwest; 0.6-11 sec.



Photo 42. Typical wave patterns, current patterns, and current magnitudes (prototype feet per second) for existing conditions; 11-sec, 10-ft waves from northwest; 0.0-ft swl



Photo 43. Typical wave patterns, current patterns, and current magnitudes (prototype feet per second) for existing conditions; 13-sec, 22-ft waves from northwest; 0.0-ft swl



Photo 44. Typical wave patterns, current patterns, and current magnitudes (prototype feet per second) for existing conditions; 15-sec, 9-ft waves from northwest; 0.0-ft swl

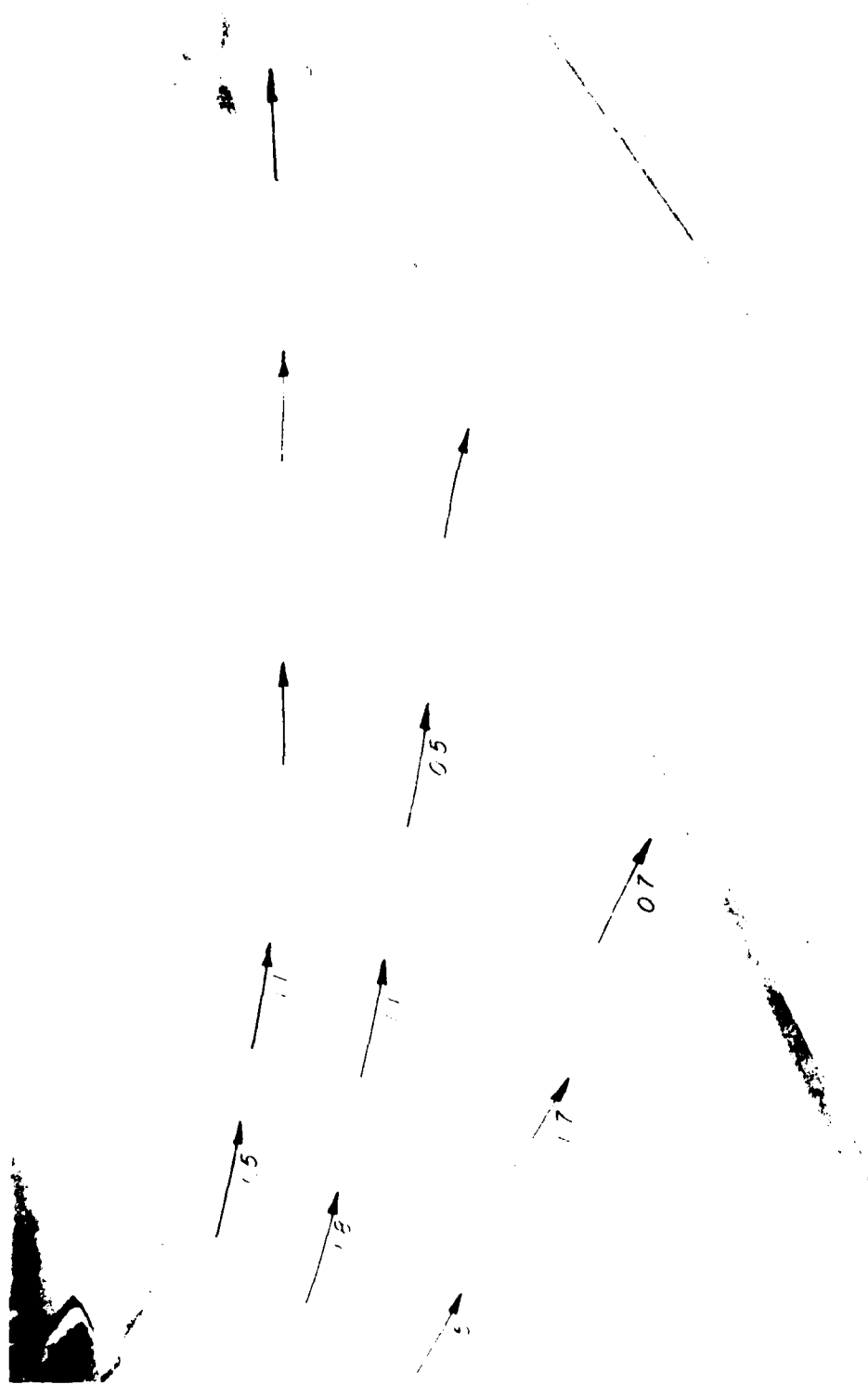


Photo 45. Typical wave patterns, current patterns, and current magnitudes (prototype feet per second) for existing conditions; 17-sec, 8-ft waves; 14-mb fetch; 0.0-11 swl

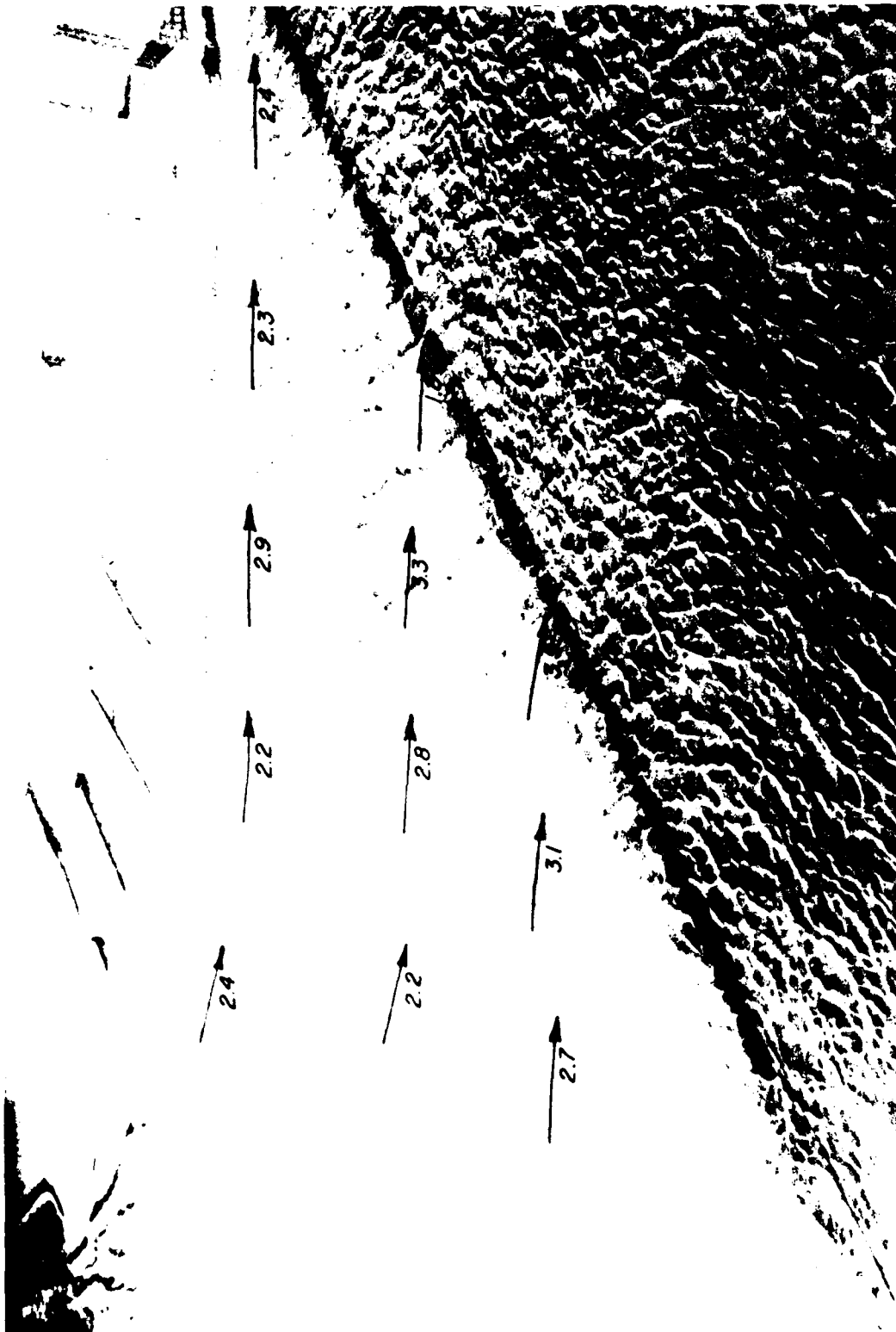


Photo 46. Typical wave patterns, current patterns, and current magnitudes (prototype feet per second) for existing conditions; 9-sec, 19-ft waves from northwest for maximum flood; +3.2 ft swl

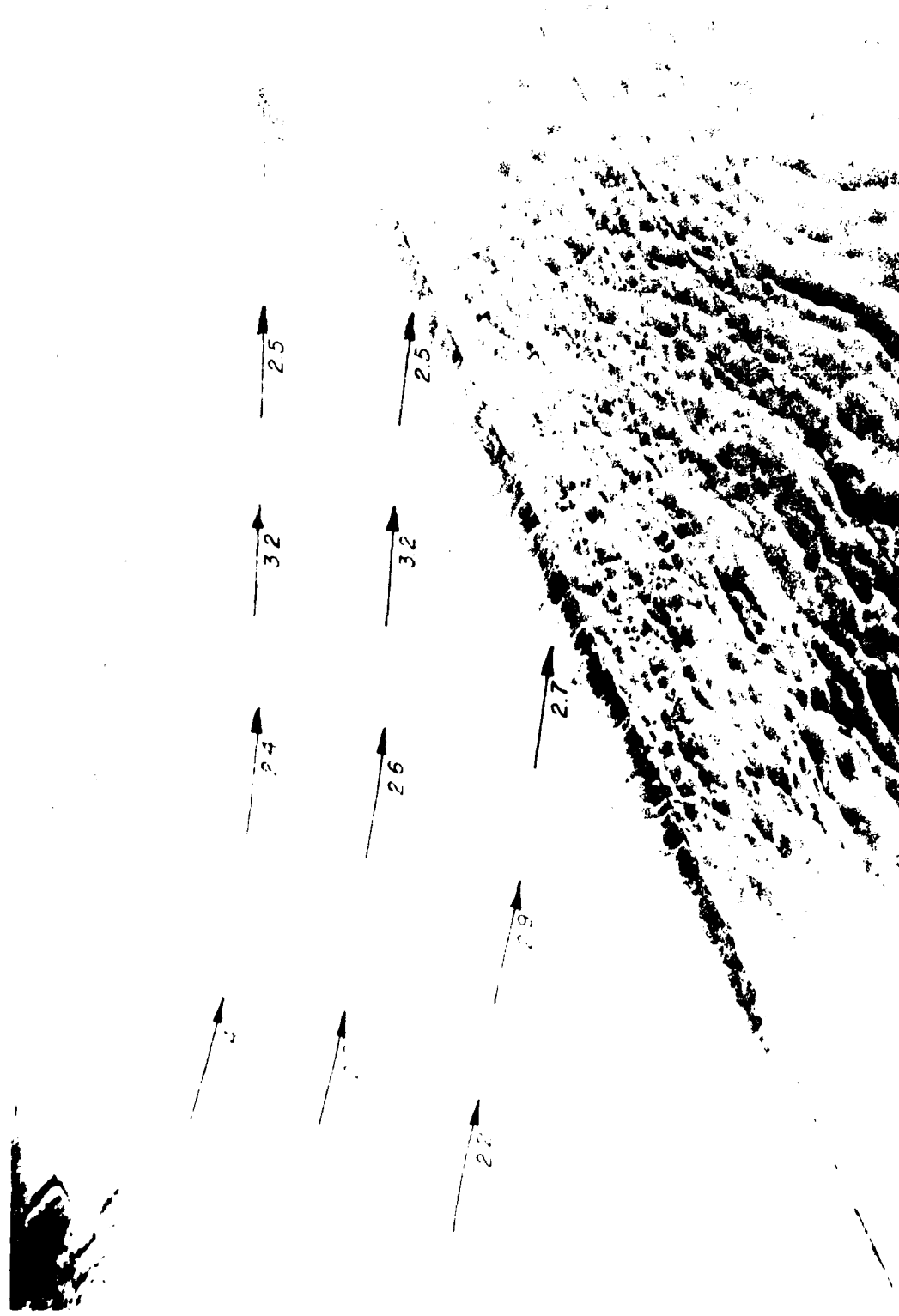


Photo 47. Typical wave patterns, current patterns, and current magnitudes (prototype feet per second) for existing conditions; 11-sec, 10-ft waves from northwest for maximum flood; +4.2 ft tide.



Photo 48. Typical wave patterns, current patterns, and current magnitudes (prototype feet per second) for existing conditions; 13-sec, 22-ft waves from northwest for maximum flood; +3.2 ft swl

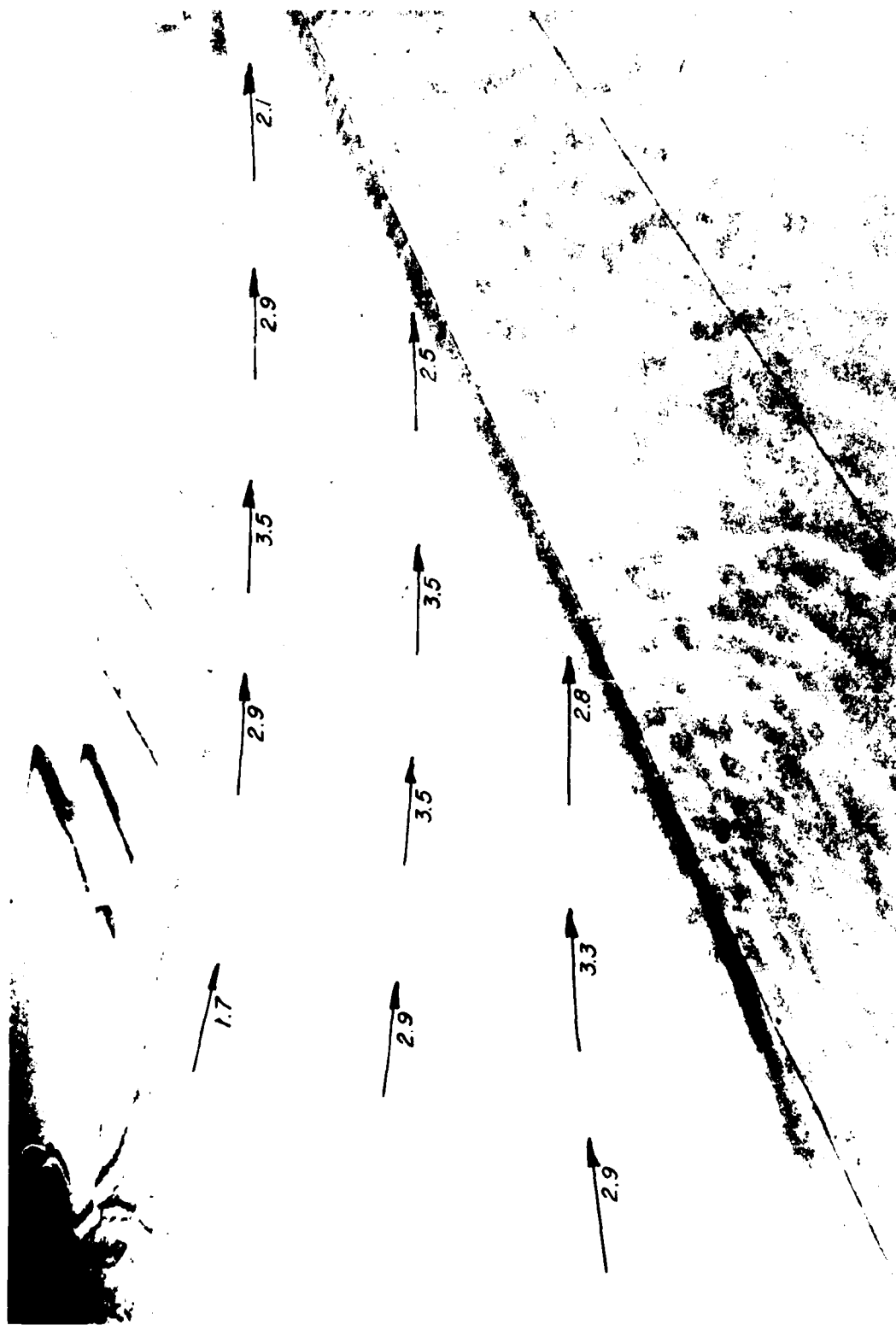


Photo 49. Typical wave patterns, current patterns, and current magnitudes (prototype foot per second) for existing conditions; 15-sec, 9-ft waves from northwest for maximum flood; +3.2 ft low

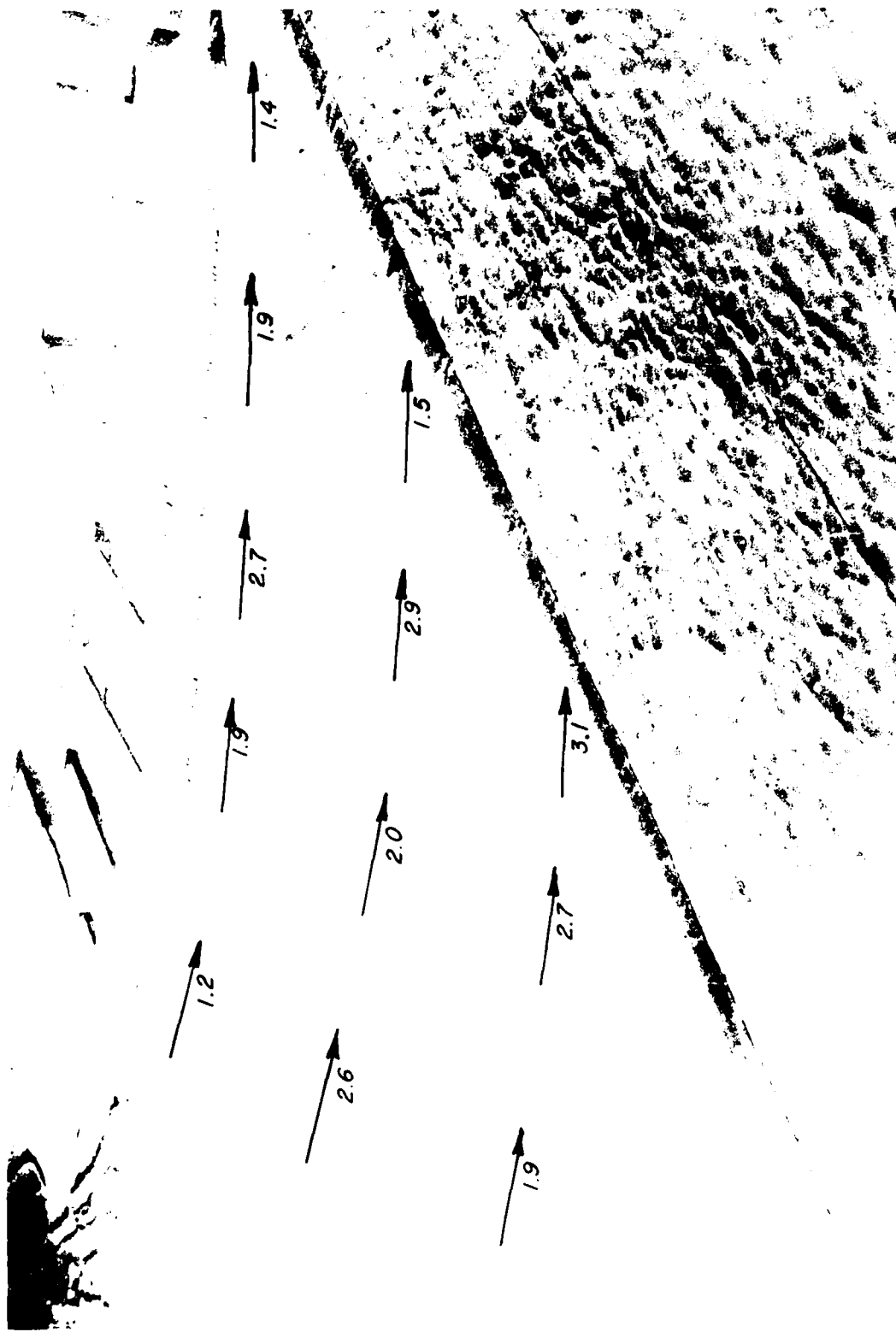


Photo 50. Typical wave patterns, current patterns, and current magnitudes (prototype feet per second) for existing conditions; 17-sec, 8-ft waves from northwest for maximum flood; +3.2 ft swl

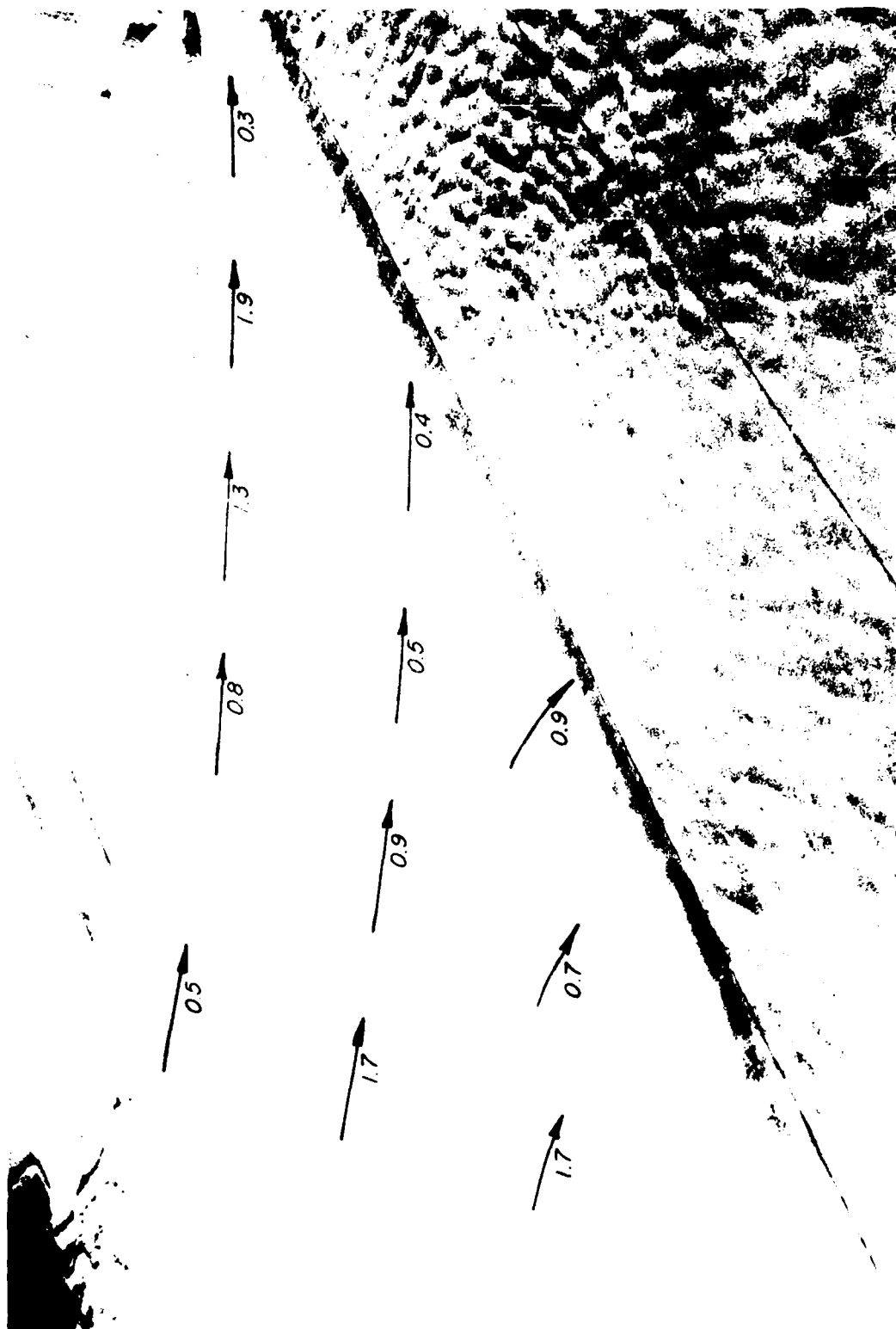


Photo 51. Typical wave patterns, current patterns, and current magnitudes (prototype feet per second) for existing conditions; 9-sec, 19-ft waves from northwest for maximum ebb; +3.7 ft swl

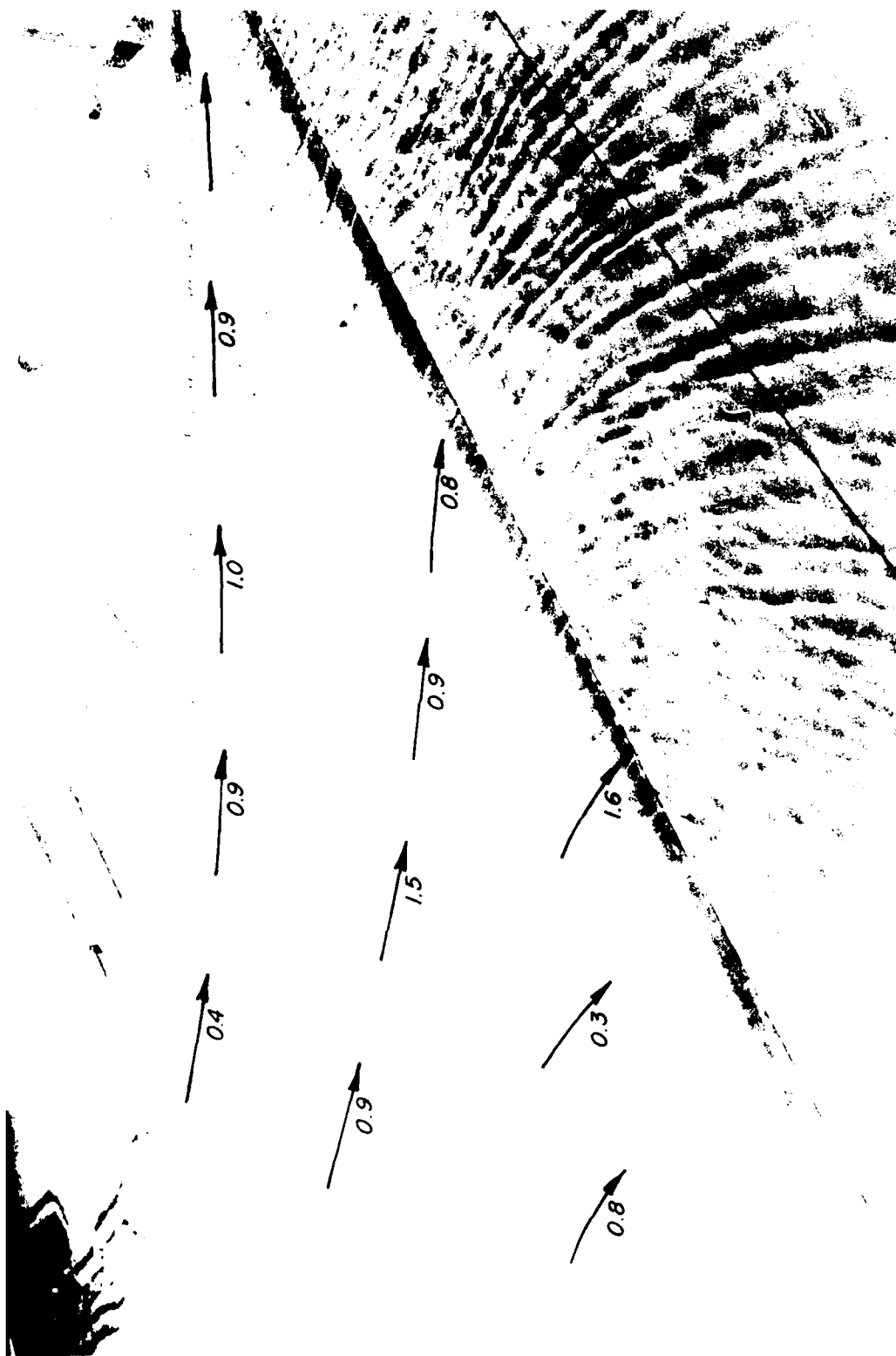


Photo 52. Typical wave patterns, current patterns, and current magnitudes (prototype feet per second) for existing conditions; 11-sec, 10-ft waves from northwest for maximum ebb; +3.7 ft swl

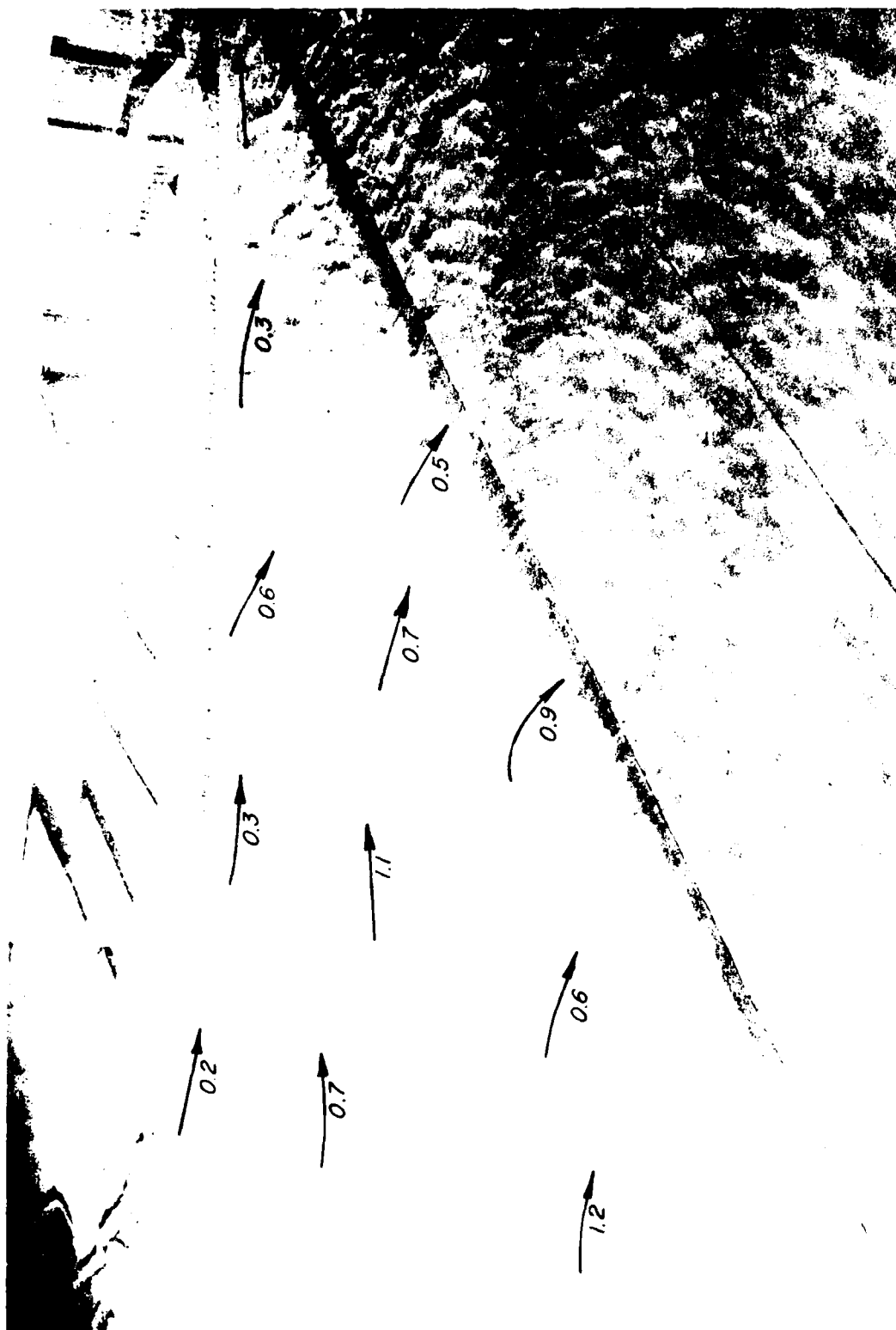


Photo 53. Typical wave patterns, current patterns, and current magnitudes (prototype feet per second) for existing conditions; 13-sec, 22-ft waves from northwest for maximum ebb; +3.7 ft swl



Photo 67. General movement of tracer material and deposits resulting from 11-sec, 10-ft waves for maximum ebb for simulated 1983 conditions; +3.7 ft swl



Photo 66. General movement of tracer material and deposits resulting from 11-sec, 10-ft waves for maximum flood for simulated 1983 conditions; +3.2 ft swl

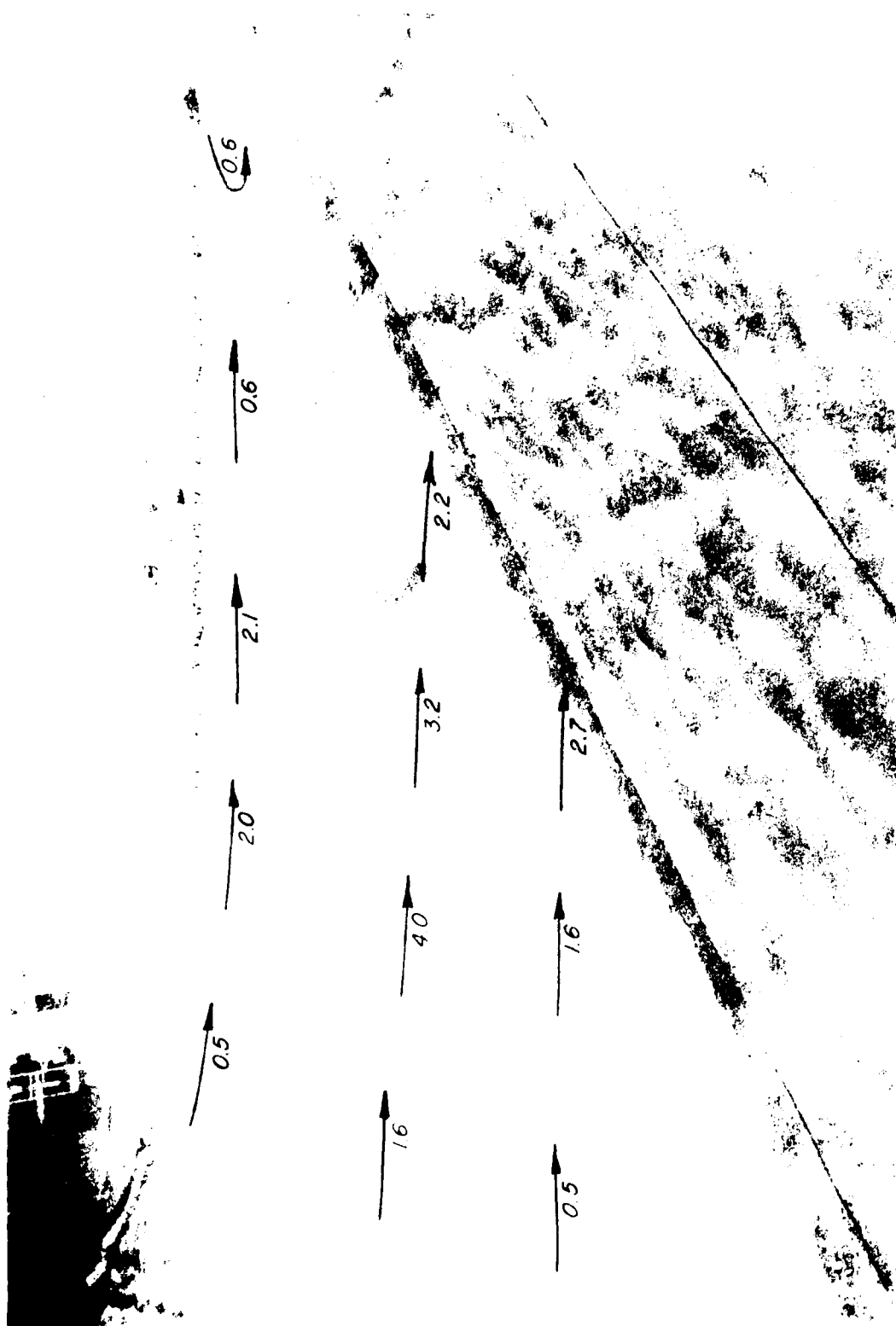


Photo 65. Typical wave patterns, current patterns, and current magnitudes (prototype feet per second) for existing conditions; 17-sec, 8-ft waves from northwest; 49.5 ft swl



Photo 64. Typical wave patterns, current patterns, and current magnitudes (prototype feet per second) for existing conditions; 15-sec, 9-ft waves from northwest; +9.5 ft swl



Photo 63. Typical wave patterns, current patterns, and current magnitudes (phototype from original) for existing conditions; 13-sec, 22-ft waves from northeast; 100 yd (30 m).



Photo 62. Typical wave patterns, current patterns, and current magnitudes (prototype feet per second) for existing conditions; 11-sec, 10-ft waves from northwest; +9.5 ft swl



Photo 61. Typical wave patterns, current patterns, and current magnitudes (prototype feet per second) for existing conditions; 9-sec, 19-ft waves from northwest; +9.5 ft swl



Photo 60. Typical wave patterns, current patterns, and current magnitudes (prototype feet per second) for existing conditions; 17-sec, 8-ft waves from northwest; +6.7 ft swl



Photo 59. Typical wave patterns, current patterns, and current magnitudes (prototype feet per second) for existing conditions; 15-sec, 9-ft waves from northwest; +6.7 ft swl



Photo 58. Typical wave patterns, current patterns, and current magnitudes (prototype feet per second) for existing conditions; 13-sec, 22-ft waves from northwest; +6.7 ft swl



Photo 57. Typical wave patterns, current patterns, and current magnitudes (prototype feet per second) for existing conditions; 11-sec, 10-ft waves from northwest; +6.7 ft SWL



Photo 56. Typical wave patterns, current patterns, and current magnitudes (prototype feet per second) for existing conditions; 9-sec, 19-ft waves from northwest; +6.7 ft swl

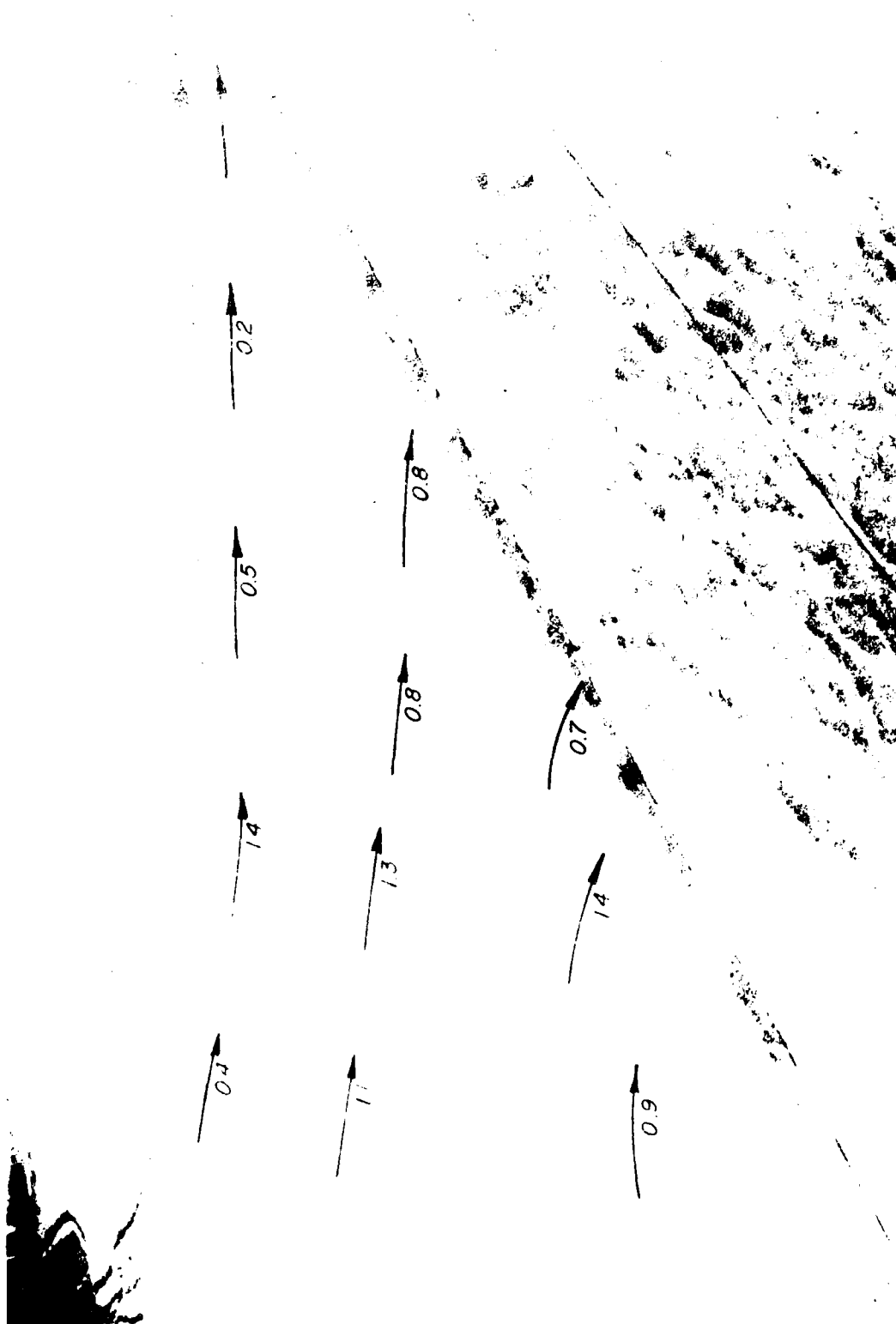


Photo 55. Typical wave patterns, current patterns, and current magnitudes (prototype feet per second) for existing conditions; 17-sec, 8-ft waves from northwest for maximum ebb, +3.5 ft tide.



Photo 54. Typical wave patterns, current patterns, and current magnitudes (prototype feet per second) for existing conditions; 15-sec, 9-ft waves from northwest for maximum ebb; +3.7 ft swl



Photo 68. General movement of tracer material and deposits resulting from 11-sec, 10-ft waves for simulated 1983 conditions; +6.7 ft swl



Photo 69. Placement of tracer material representing the 1966 spit formation at Buhne Point



Photo 70. Initial movement of simulated 1966 spit into navigation channel by 11-sec, 10-ft waves with a +6.7 ft swl



Photo 71. The simulated 1966 spit formation after attack by 11-sec, 10-ft waves with a +9.5 ft swl



Photo 72. The simulated 1966 spit formation after attack by 13-sec, 22-ft waves with a +9.5 ft swl



Photo 73. Placement of victim material representing the 1980 spit formation at Kani...



Photo 74. Closer view of tracer material representing the 1980 spit formation at Buhne Point



Photo 75. The simulated 1980 spit formation after attack by 11-sec, 10-ft waves with a +6.7 ft swl



Photo 76. The simulated 1980 spit formation after attack by 11-sec, 10-ft waves with a +9.5 ft swl

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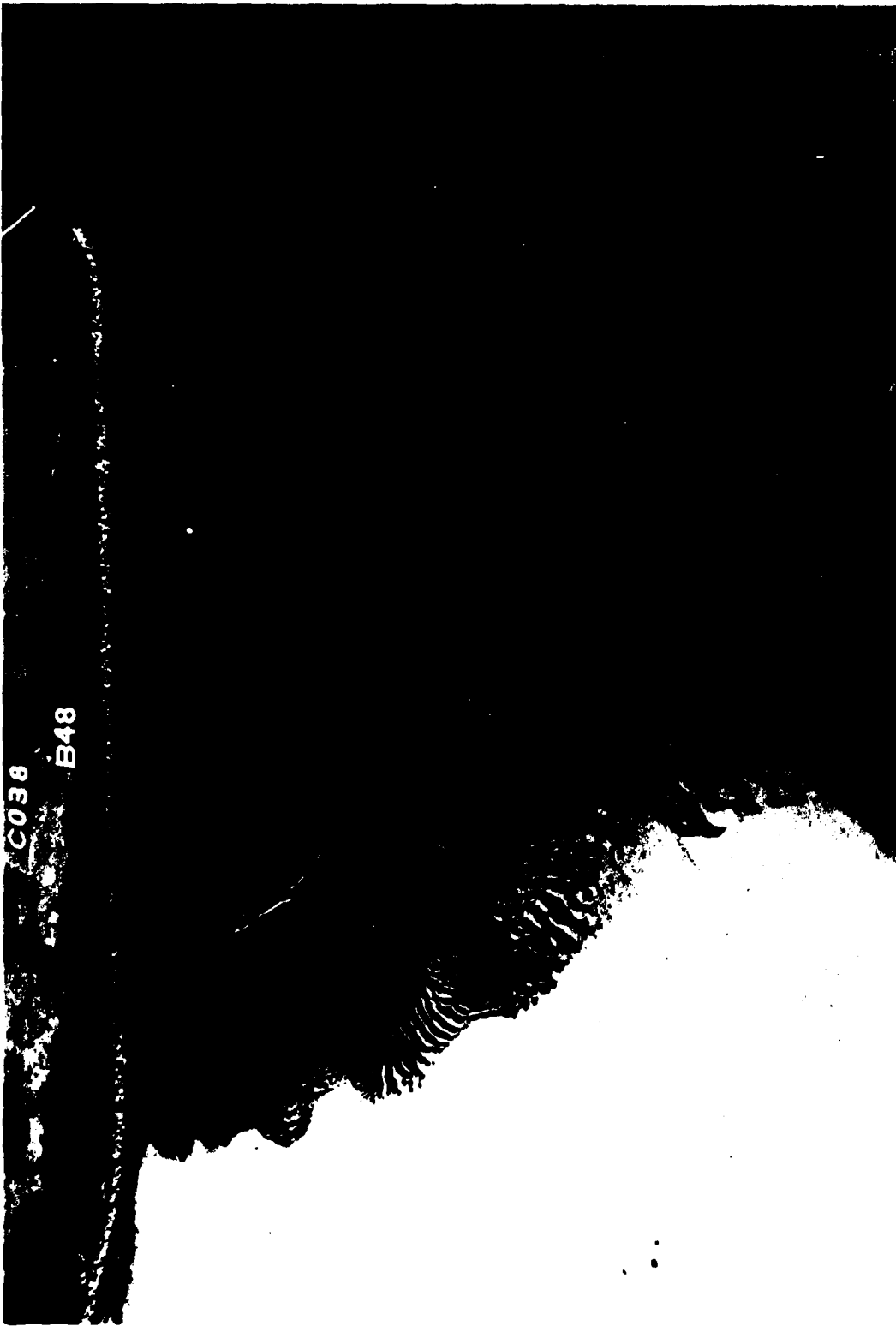


Photo 77. The simulated 1980 spit formation after attack by 13-sec, 22-ft waves with a +9.5 ft swl



Photo 78. View of Plan 1 prior to model testing; +6.7 ft swl



Photo 79. Shoreline configuration for Plan 1 after initial testing with 11-sec,
10-ft test waves; +6.7 ft swl

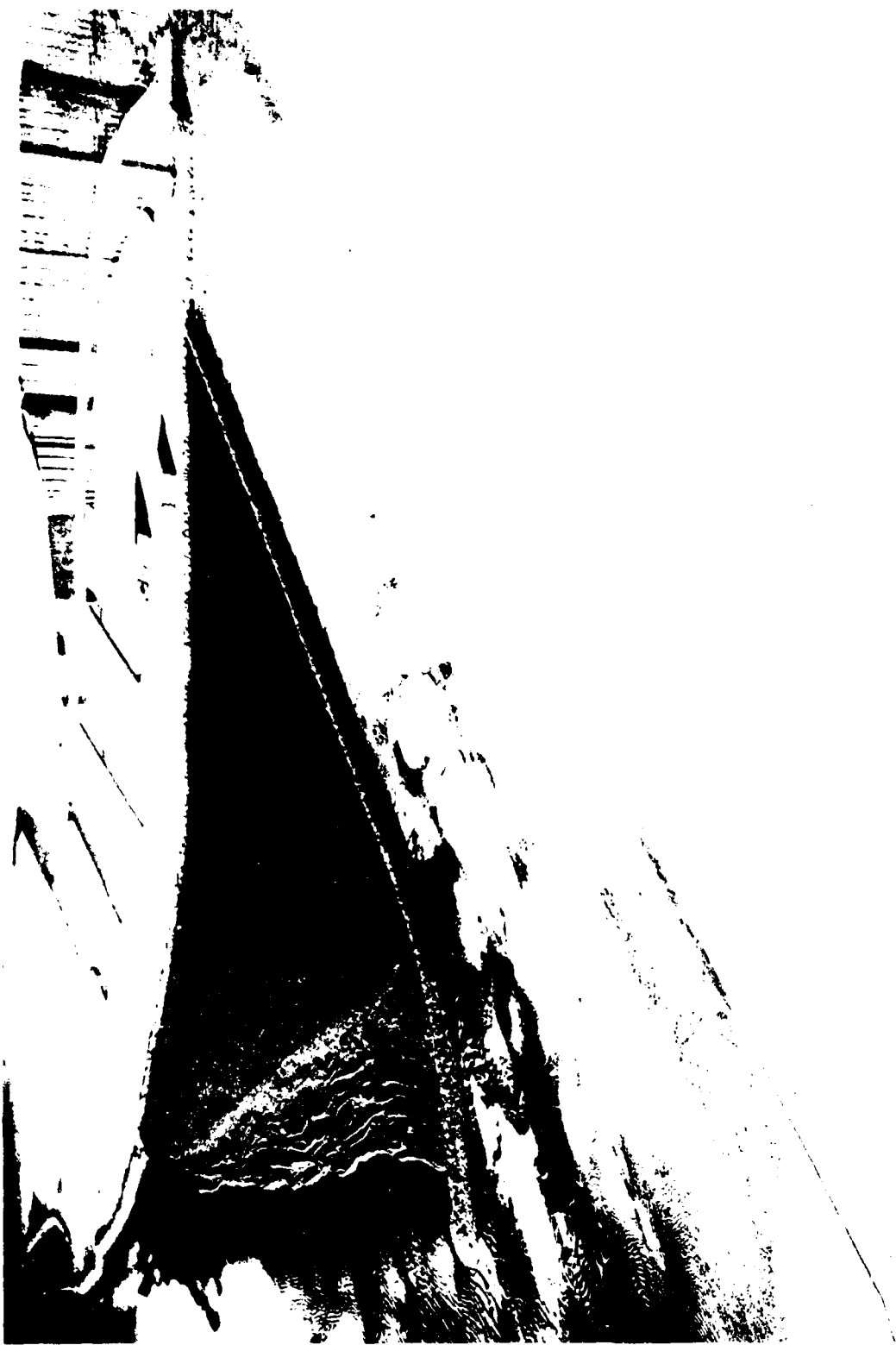


Photo 80. Shoreline configuration after additional testing of Plan 1 with 17-sec,
8-ft and 13-sec, 22-ft test waves; +6.7 ft swl



Photo 81. Shoreline configuration after testing of Plan 1 with test waves for the +6.7 and +9.5 ft swl's



Photo 95. Shoreline configuration for Plan 3B after testing with
11-sec, 10-ft test waves; +6.7 ft swl

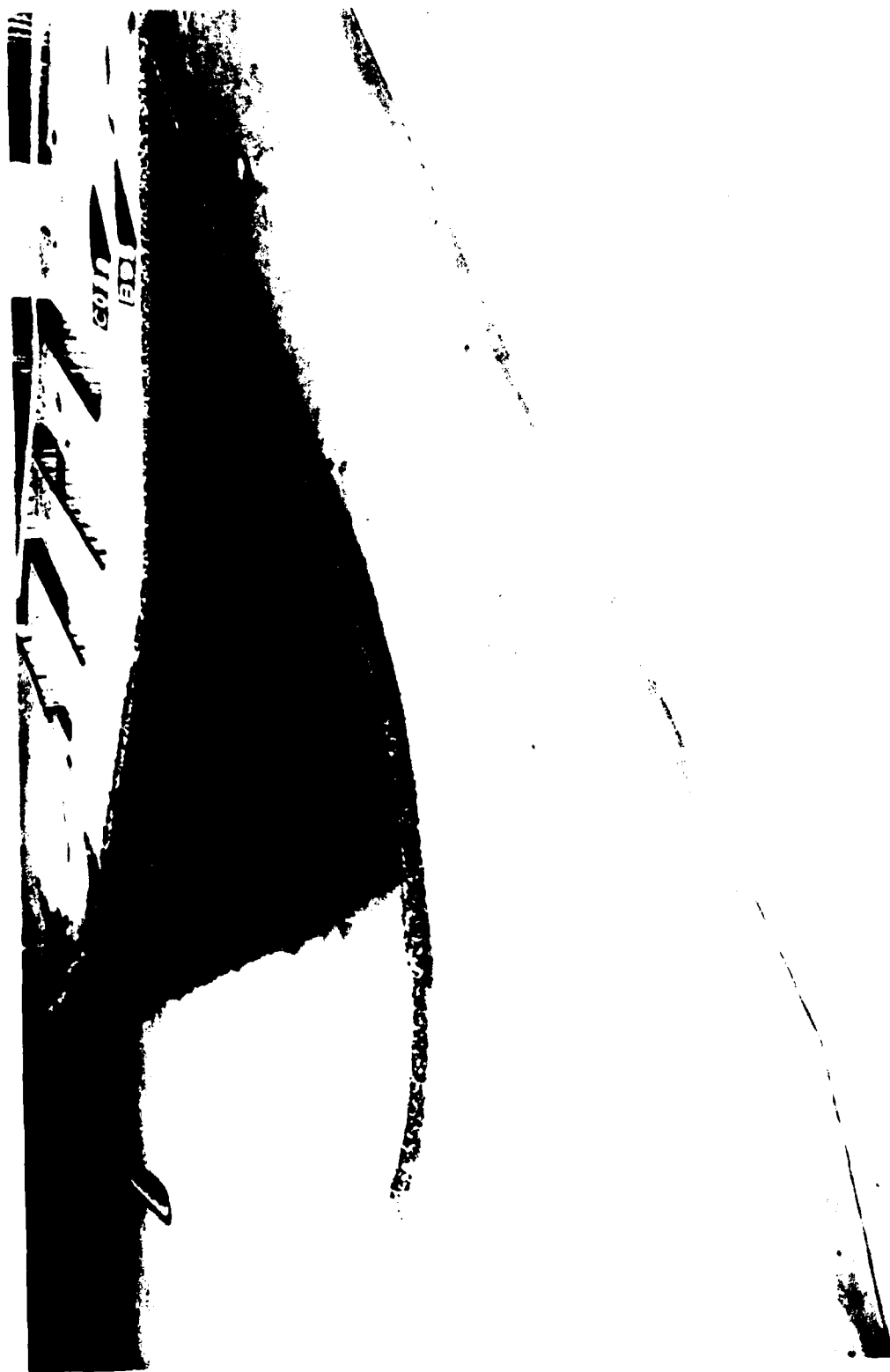


Photo 94. View of Plan 3B prior to model testing; +6.7 ft swl



Photo 93. Shoreline configuration for Plan 3A after testing with
11-sec, 10-ft test waves; +6.7 ft swl



Photo 92. View of Plan 3A prior to model testing; +6.7 ft swl



Photo 91. Shoreline configuration after additional testing of Plan 3 with 11-sec,
10-ft waves with the +9.5 ft swl



Photo 90. Shoreline configuration for Plan 3 after initial testing with 11-sec,
10-ft test waves; +6.7 ft swl



Photo 89. View of Plan 3 prior to model testing; +6.7 ft swl

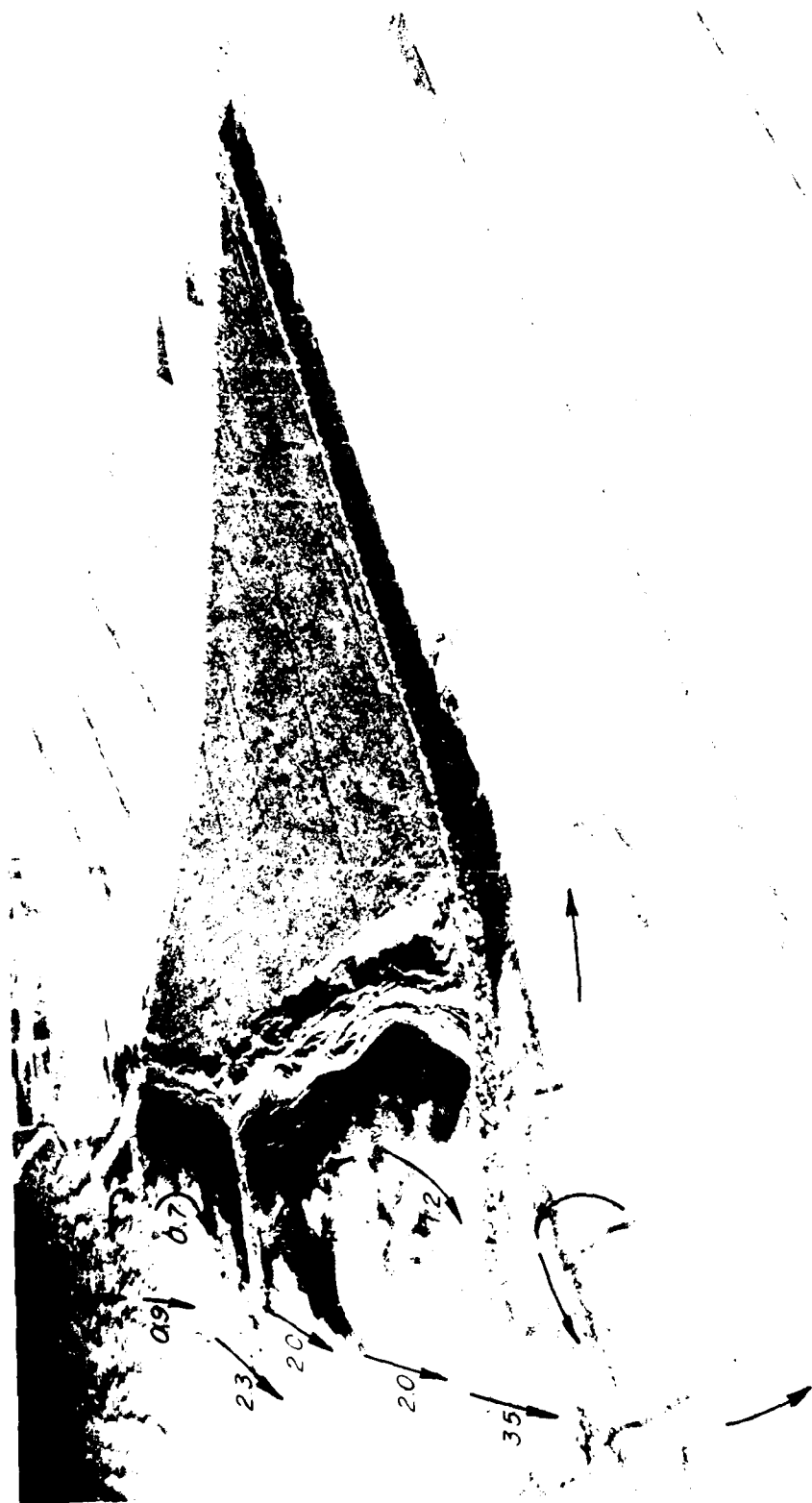


Photo 88. Typical wave patterns, current patterns, and current magnitudes (prototype feet per second) for Plan 2; 11-sec, 10-ft waves from northwest for maximum flood; +3.2 ft swl



Photo 87. Typical wave patterns, current patterns, and current magnitudes (prototype test) for Plan 2; 11-sec, 10-ft waves; +9.5 ft swl



Photo 86. Typical wave patterns, current patterns, and current magnitudes (prototype feet per second) for Plan 2; 11-sec, 10-ft waves; +6.7 ft swl



Figure 85. Shoreline configuration after testing of Plan 2 with test waves for the +6.7 and +9.5 ft swl's



Photo 84. Shoreline configuration for Plan 2 after testing with 11-sec,
10-ft test waves; +6.7 ft swl



Photo 83. View of Plan 2 prior to model testing; +6.7 ft swl



Photo 82. Shoreline configuration after testing of Plan 1 with test waves for the +6.7 and +3.2 ft swl's



Photo 96. View of Plan 3C prior to model testing; +9.5 ft swl



Photo 97. Shoreline configuration for Plan 3C after initial testing with
11-sec, 10-ft test waves; +9.5 ft swl



Photo 98. Shoreline configuration for Plan 3C after testing with 11-sec,
10-ft and 13-sec, 22-ft test waves; +9.5 ft swl



Photo 99. View of Plan 3D prior to model testing; +9.5 ft swl



Photo 100. Shoreline configuration for Plan 3D after initial testing with
11-sec, 10-ft test waves; +9.5 ft swl



Photo 101. Shoreline configuration for Plan 3D after testing with all test waves
for the +9.5 ft swl



Photo 102. View of Plan 3D prior to model testing; 0.0-ft swl



Photo 103. Shoreline configuration for Plan 3D after testing with all test waves
for the 0.0-ft swl



Photo 104. View of Plan 3D prior to model testing; +3.2 ft swl



Photo 105. Shoreline configuration for Plan 3D after testing with all test waves
for the +3.2 ft swl with maximum flood tidal flow



Photo 106. View of Plan 3D prior to model testing; +3.7 ft swl



Photo 107. Shoreline configuration for Plan 3D after testing with all test waves
for the +3.7 ft swl with maximum ebb tidal flow



Photo 108. View of Plan 3D prior to model testing; +6.7 ft swl

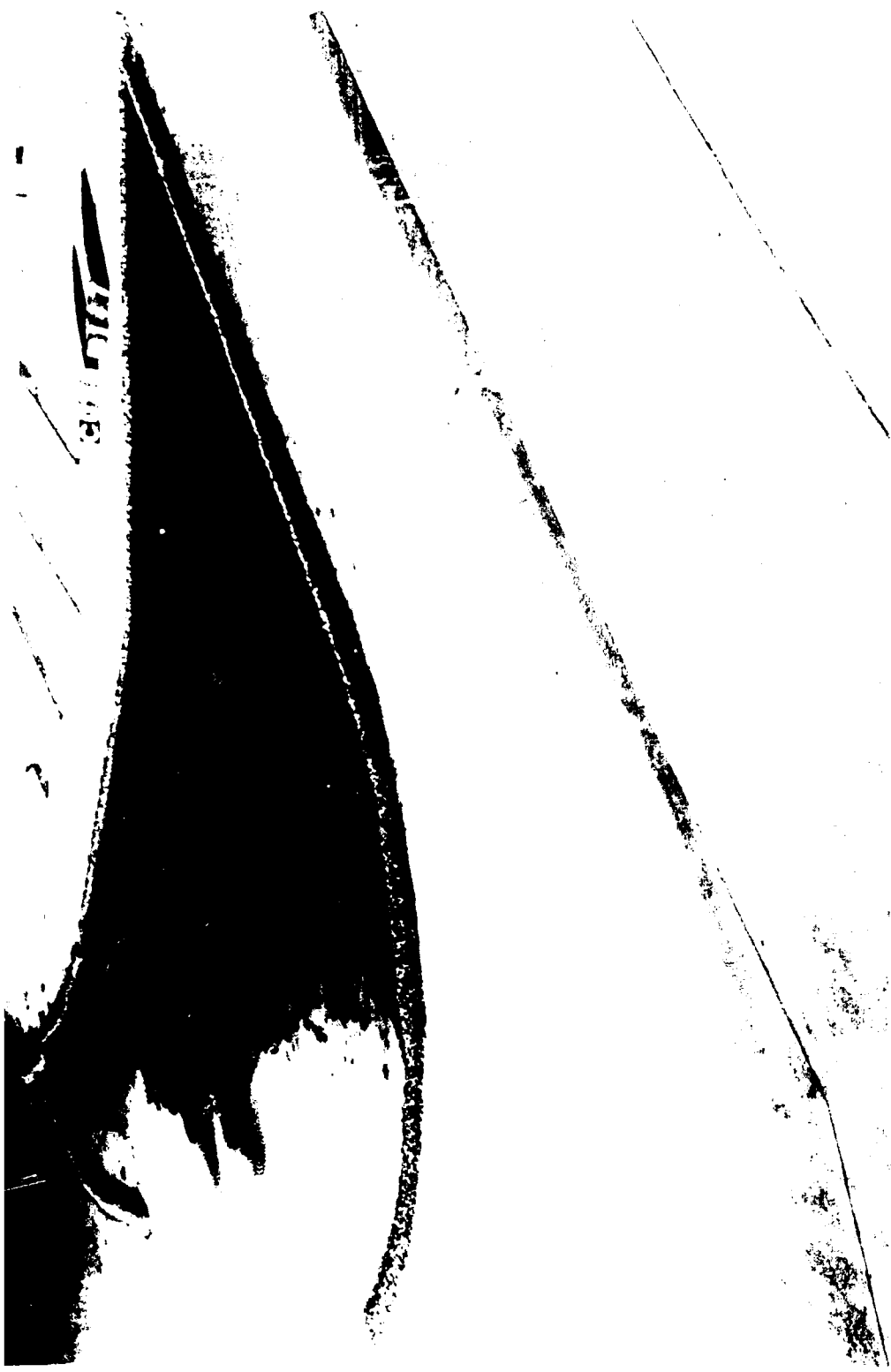
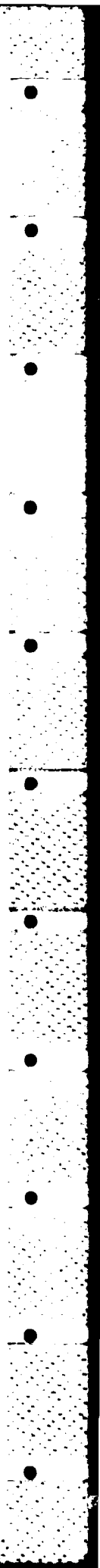


Photo 109. Shoreline configuration for Plan 3D after testing with all test waves
for the +6.7 ft swl



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BUHNE POINT HUMBOLDT BAY CALIFORNIA DESIGN FOR THE
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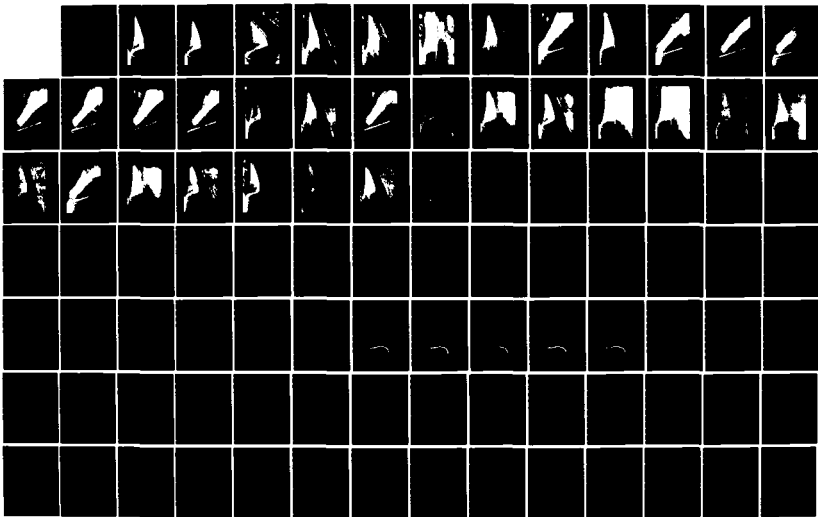
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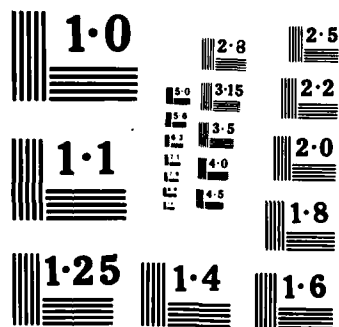
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** INDICATES NO CURRENT MOVEMENT*

Photo 110. Typical wave patterns, current patterns, and current magnitudes (prototype feet per second) for Plan 3D; 11-sec, 10-ft waves; 0.0-ft swl



Photo 111. Typical wave patterns, current patterns, and current magnitudes (prototype foot per second) for Plan 3D; 11-sec, 10-ft waves for maximum flood; +3.2 ft swl



Photo 112. Typical wave patterns, current patterns, and current magnitudes (prototype feet per second) for Plan 3D; 11-sec, 10-ft waves for maximum ebb; +3.7 ft swl



Photo 113. Typical wave patterns, current patterns, and current magnitudes (prototype feet per second) for Plan 3D; 11-sec, 10-ft waves; +6.7 ft swl



Photo 114. Typical wave patterns, current patterns, and current magnitudes (prototype feet per second) for Plan 3D; 11-sec, 10-ft waves; +9.5 ft swl



Photo 115. View of Plan 4 prior to model testing; +9.5 ft swl



Photo 116. Shoreline configuration of Plan 4 after testing with 11-sec,
10-ft waves, +9.5 ft swl



Photo 117. Shoreline configuration in lee of breakwater for Plan 4 after testing with 11-sec, 10-ft waves, +9.5 ft swl



Photo 118. View of Plan 4A prior to model testing; +9.5 ft swl



Photo 119. Shoreline configuration in lee of breakwater for Plan 4A after testing with 11-sec, 10-ft waves, +9.5 ft swl



Photo 120. View of offshore breakwater of Plan 4B prior to model testing; +9.5 ft swl



Photo 121. Shoreline configuration in ice of breakwater for Plan 4B after
testing with 11-sec, 10-ft waves, +9.5 ft owl



Photo 135. View of Plan 4B prior to model testing; +6.7 ft swl



Photo 134. Shoreline configuration for Plan 4B after testing with all test waves for the +3.7 ft sea with maximum ebb tidal flow



Photo 133. View of Plan 4B prior to model testing; +3.7 ft swl

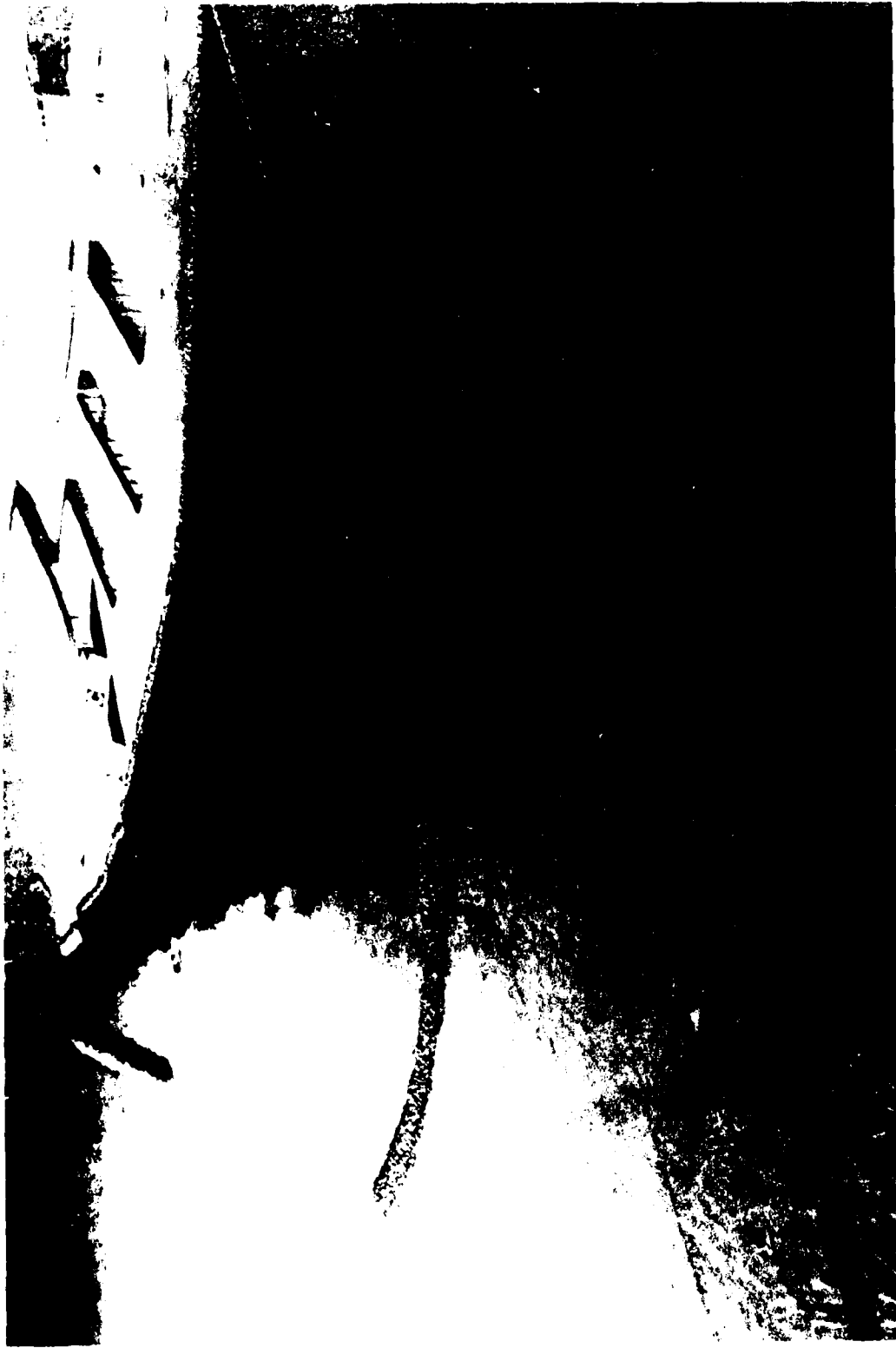


Photo 132. Shoreline configuration for Plan 4B after testing with all test waves for the +3.2 ft swl with maximum flood tidal flow



Photo 131. View of Plan 4B prior to model testing; +3.2 ft swl



Photo 130. Shoreline figuration for Plan 4B after testing with
all test waves for the 0.0-ft swl



Photo 129. View of Plan 4B prior to model testing; 0.0-ft swl



Photo 128. Shoreline configuration in lee of breakwater for Plan 4B after
testing with all test waves for the +9.5 ft swl



Photo 127. Shoreline configuration for Plan 4B after testing with
all test waves for the 49.5 ft swl



Photo 126. View of Plin 4B prior to model testing: +9.5 ft SW



Photo 125. View of offshore breakwater of Plan 4F prior to model testing; +9.5 ft swl

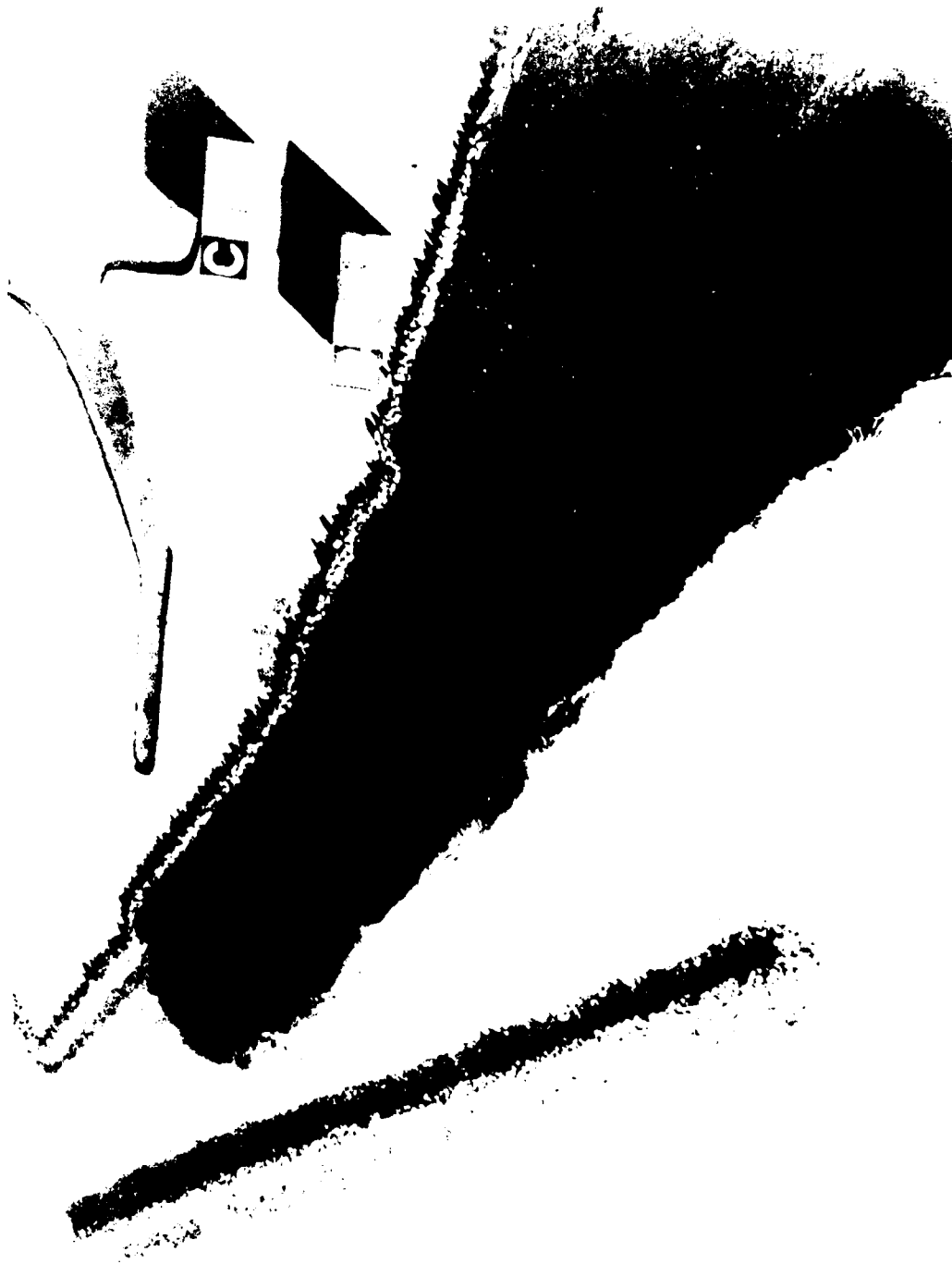


Photo 124. View of offshore breakwater of Plan 4E prior to model testing; +9.5 ft swl



Photo 123. Shoreline configuration in lee of breakwater for Plan 4C after testing with
13-sec, 22-ft and 15-sec, 9-ft test waves; +9.5 ft swl



Photo 122. View of offshore breakwater of Plan 4C prior to model testing; +9.5 ft swl



Photo 136. Shoreline configuration for Plan 4B after testing with all test waves for
the +6.7 ft swl



Photo 137. Shoreline configuration in lee of breakwater for Plan 4B after
testing with all test waves for the +6.7 ft swell



Photo 138. Typical wave patterns, current patterns, and current magnitudes (prototype feet per second) for Plan 4B; 11-sec, 10-ft waves; 0.0-ft swl



Photo 139. Typical wave patterns, current patterns, and current magnitudes (prototype feet per second) for Plan 4B; 11-sec, 10-ft waves for maximum flood; +3.2 ft swl



Photo 140. Typical wave patterns, current patterns, and current magnitudes (prototype feet per second) for Plan 4B; 11-sec, 10-ft waves for maximum ebb; +3.7 ft swl

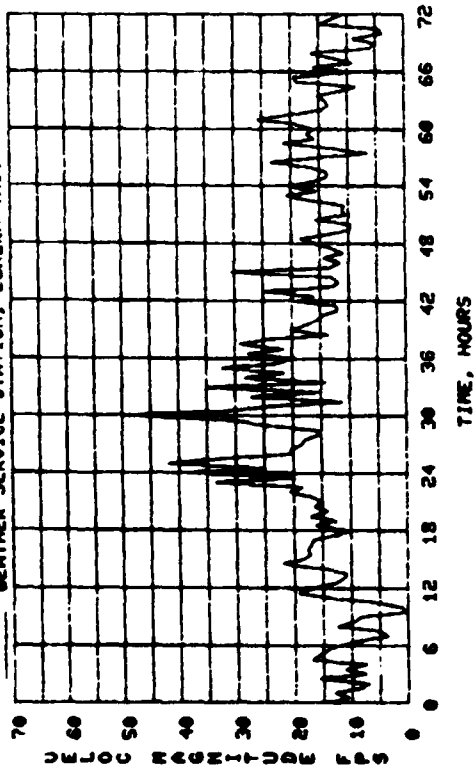


Photo 141. Typical wave patterns, current patterns, and current magnitudes (prototype feet per second) for Plan 4B; 11-m/sec (40 ft/sec) (11 m/sec).

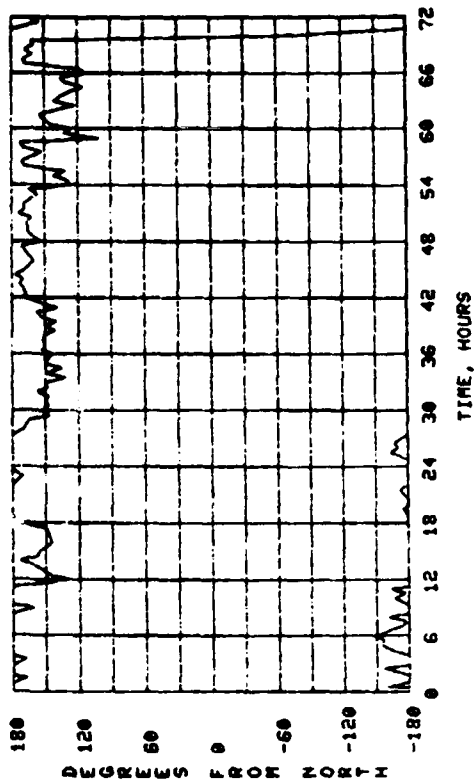
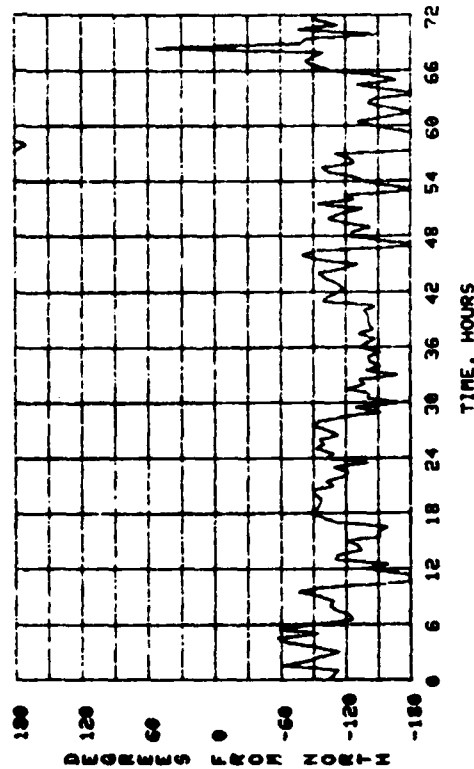
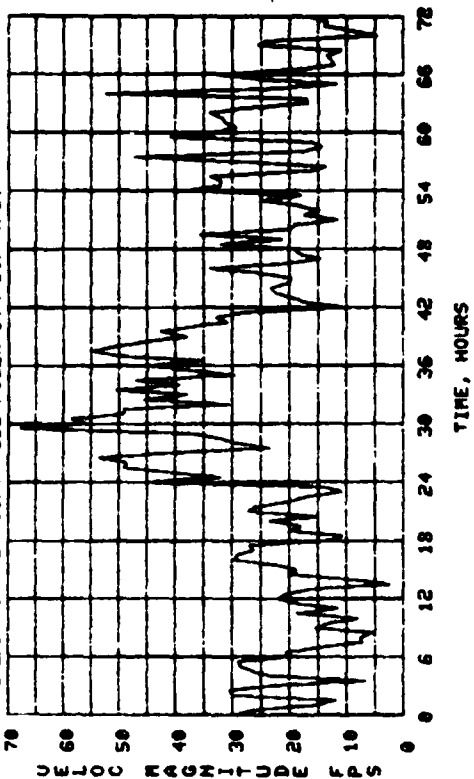


Photo 142. Typical wave patterns, current patterns, and current magnitudes (prototype feet per second) for Plan 48; 11-sec, 10-ft waves; +9.5 ft swl

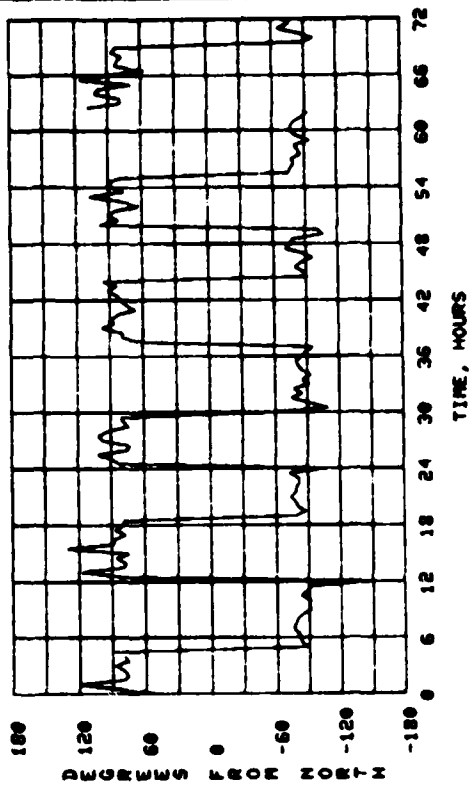
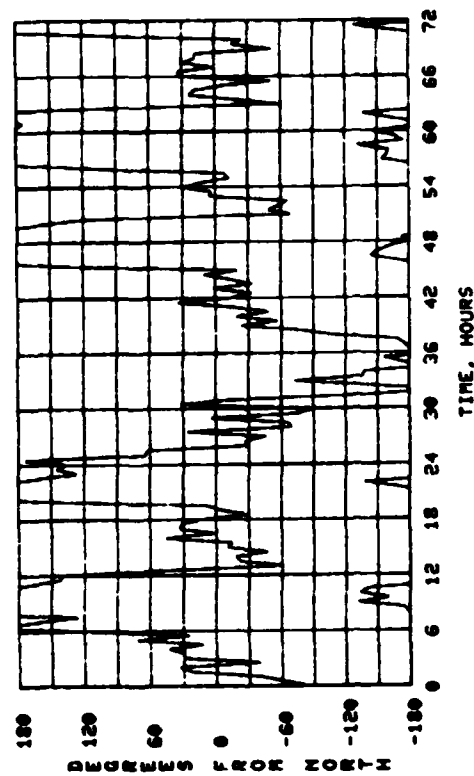
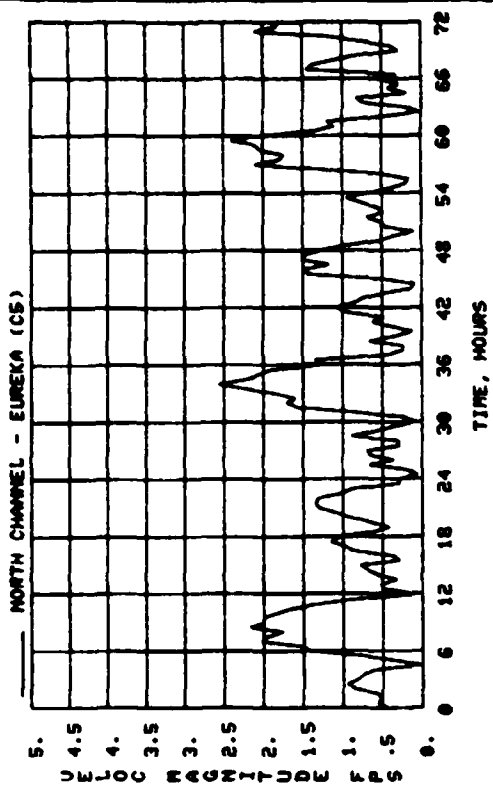
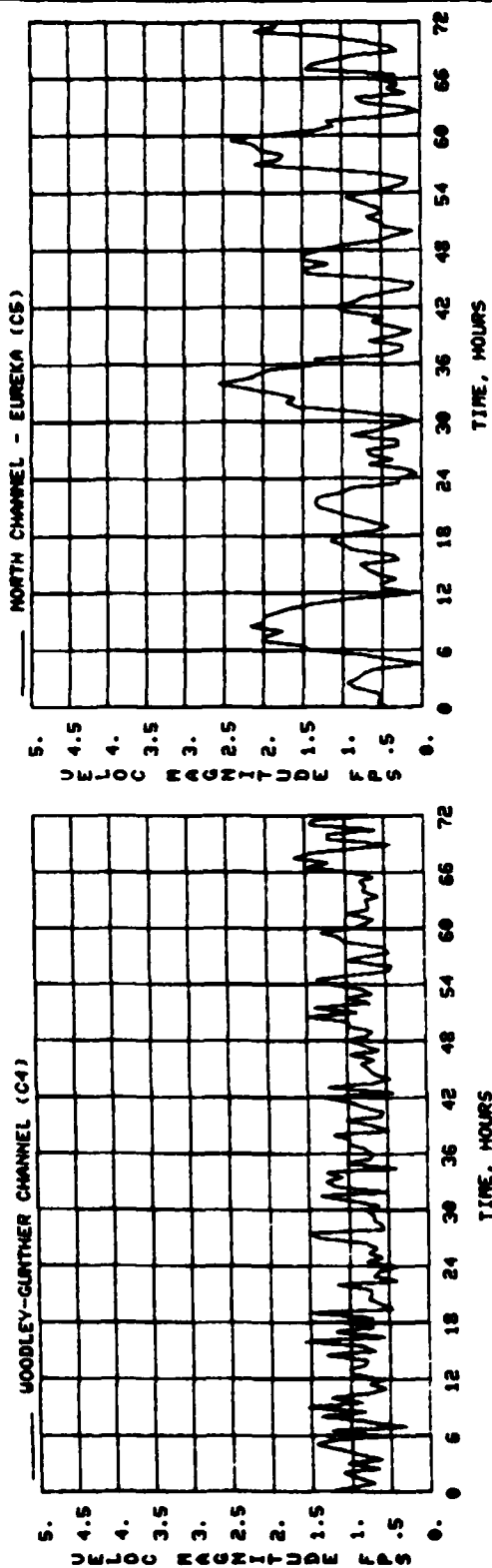
WEATHER SERVICE STATION, EUREKA (A1)



BUNHE POINT PGSE POWER STATION (A3)

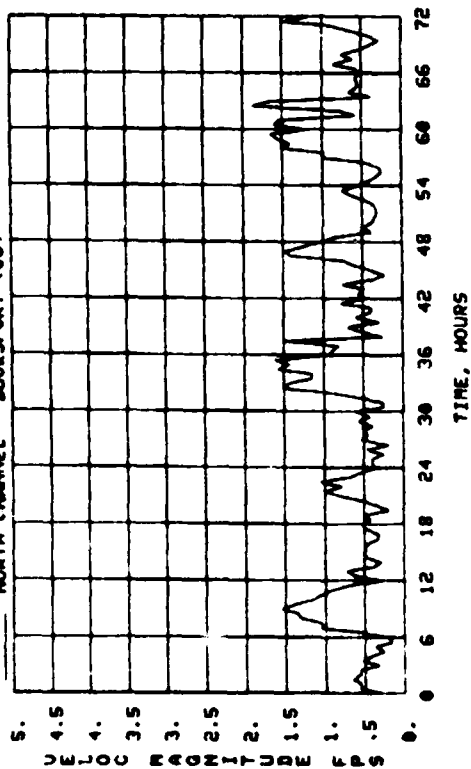


HUMBOLDT BAY PAW WIND DATA (4/1/82 - 4/3/82)

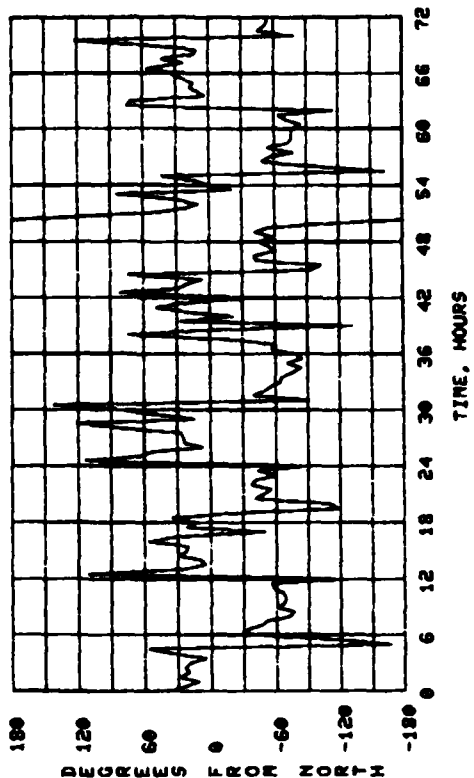
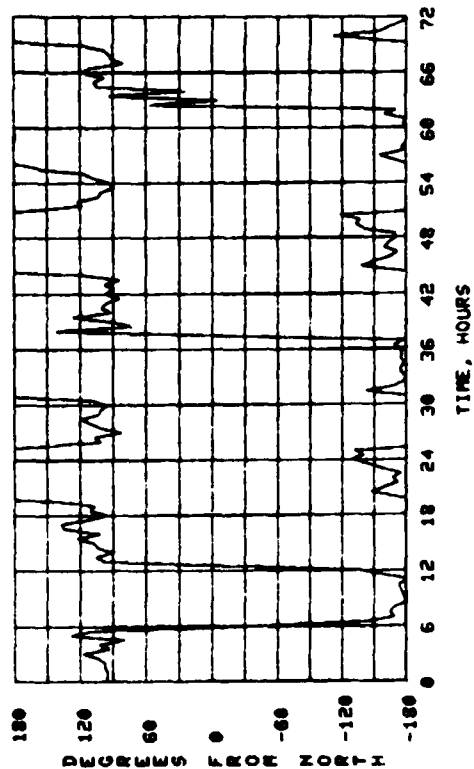
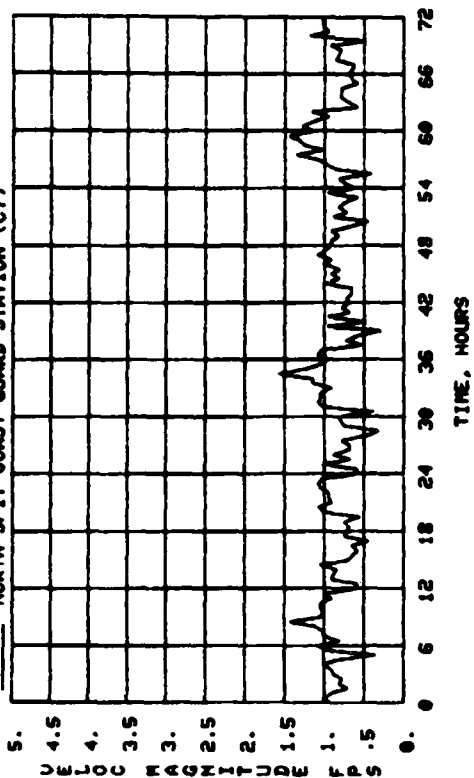


HUMBOLDT BAY RAN CURRENT DATA (4/1/82 - 4/3/82)

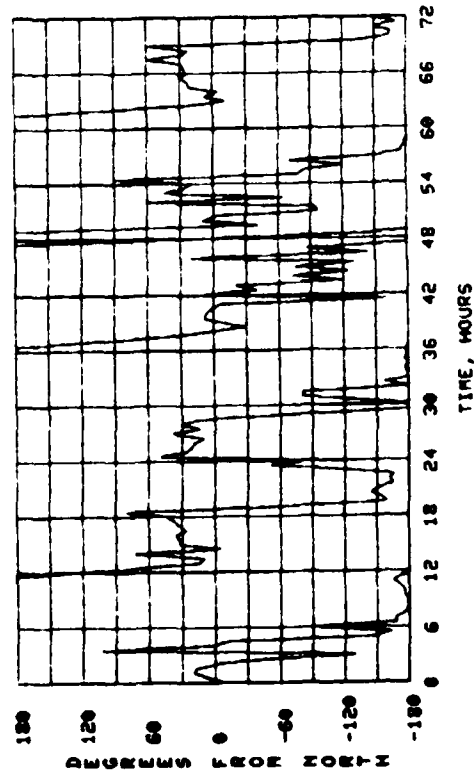
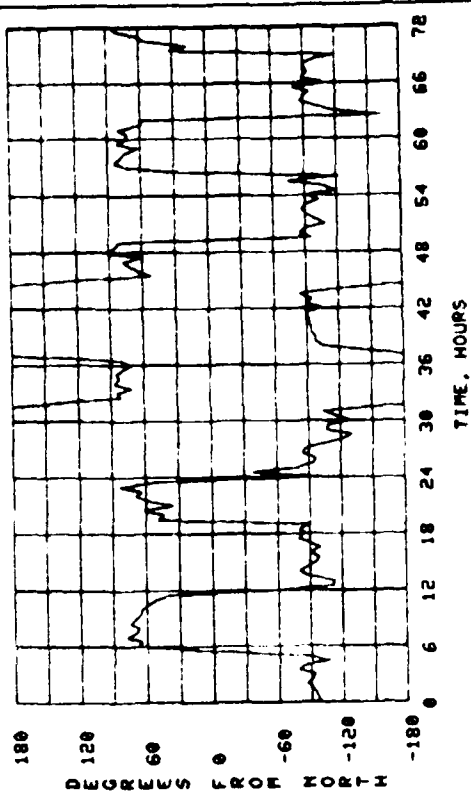
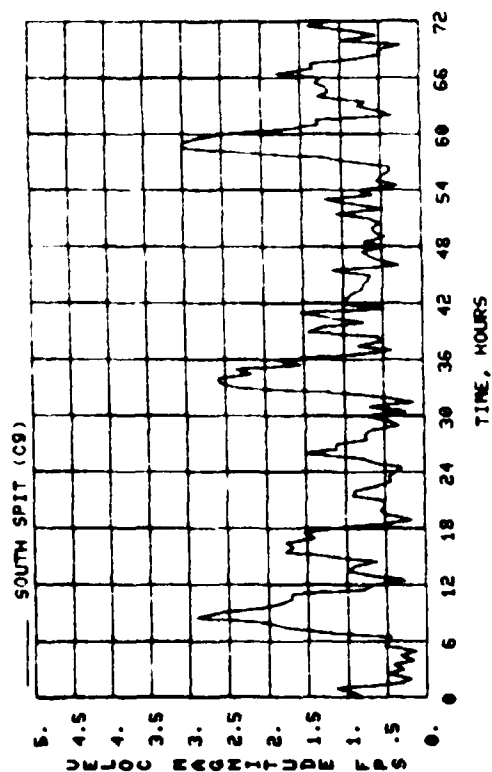
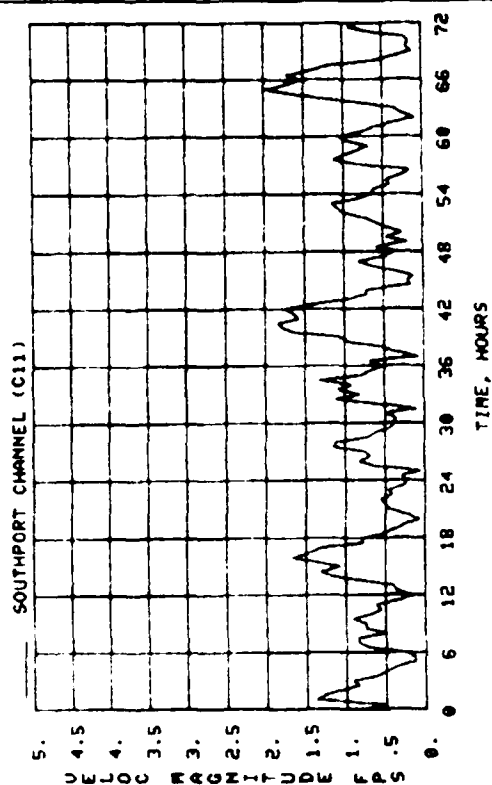
NORTH CHANNEL - BUCKSPORT (C6)



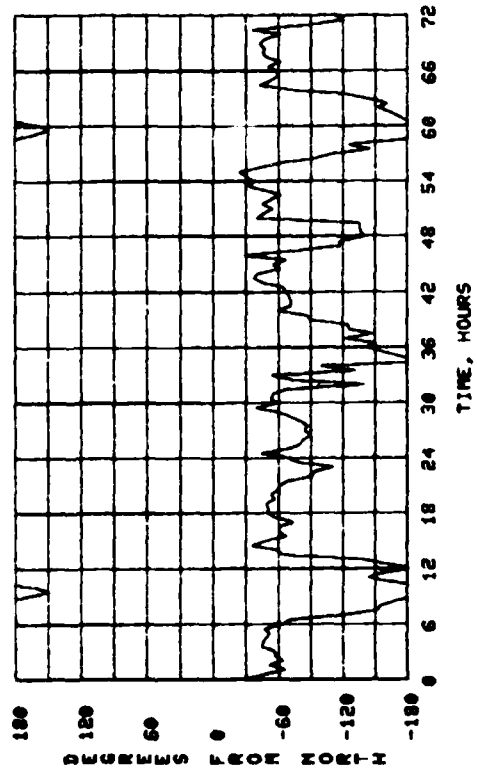
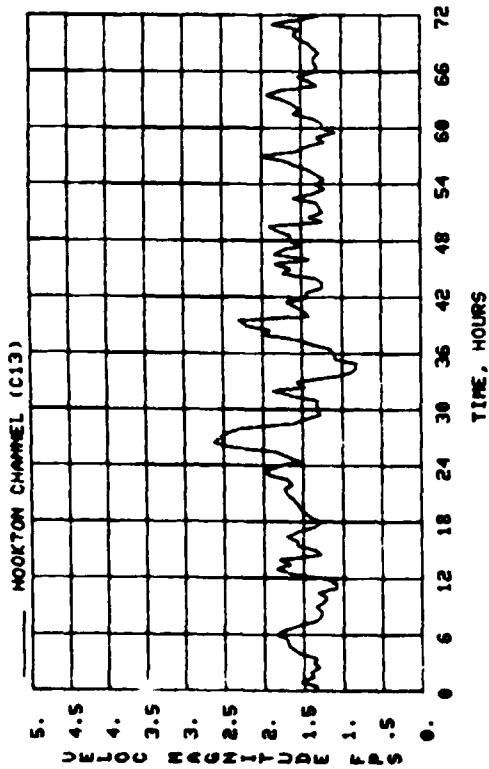
NORTH SPIT COAST GUARD STATION (C7)



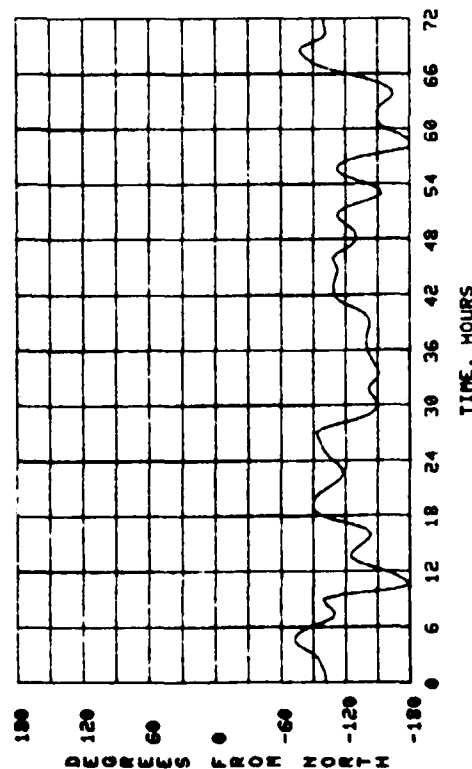
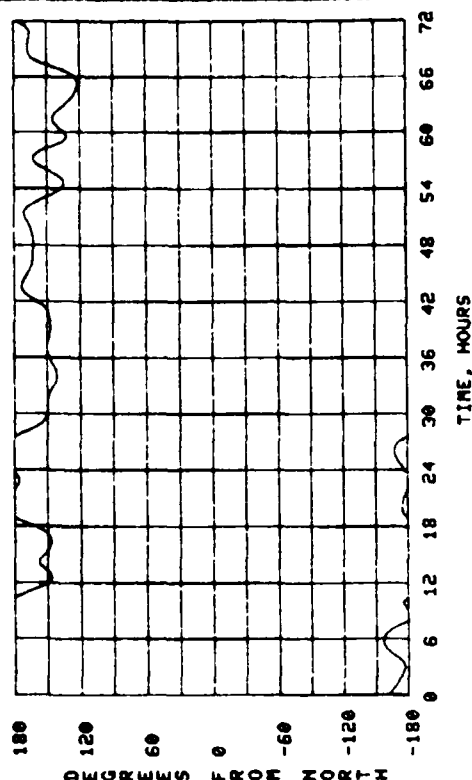
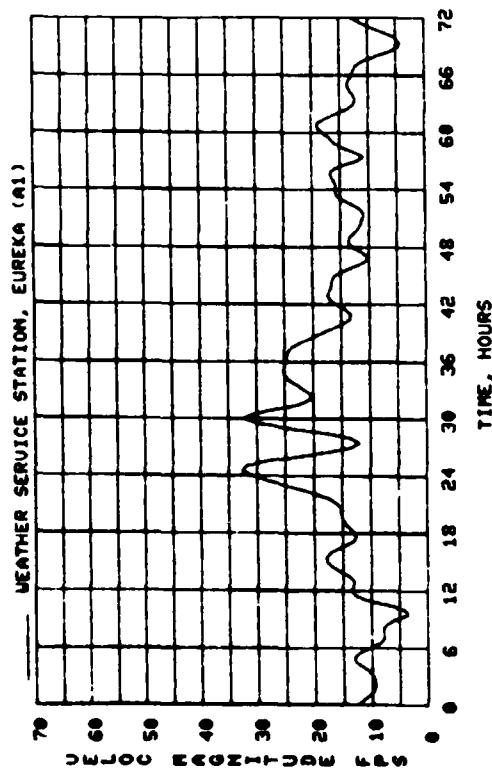
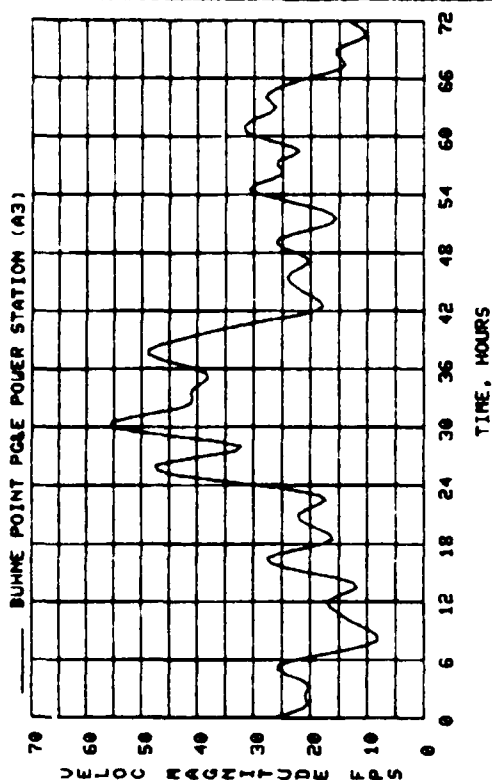
HUBBOLDT BAY RMU CURRENT DATA (4/1/82 - 4/3/82)



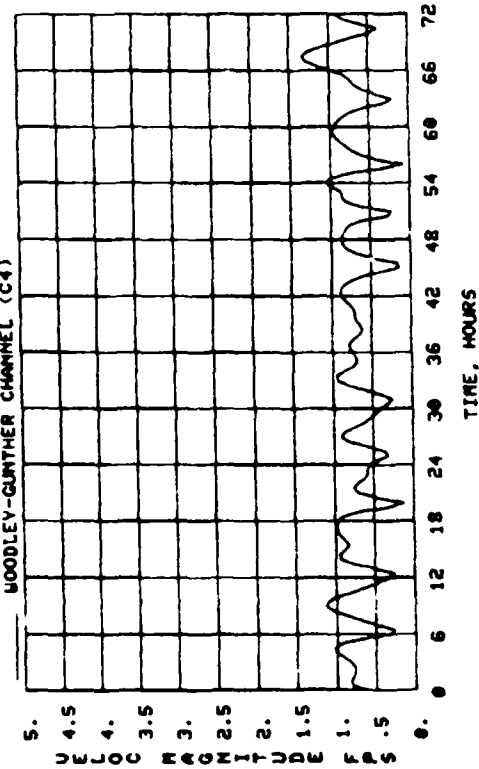
HUMBOLDT BAY RAU CURRENT DATA (4/1/82 - 4/3/82)



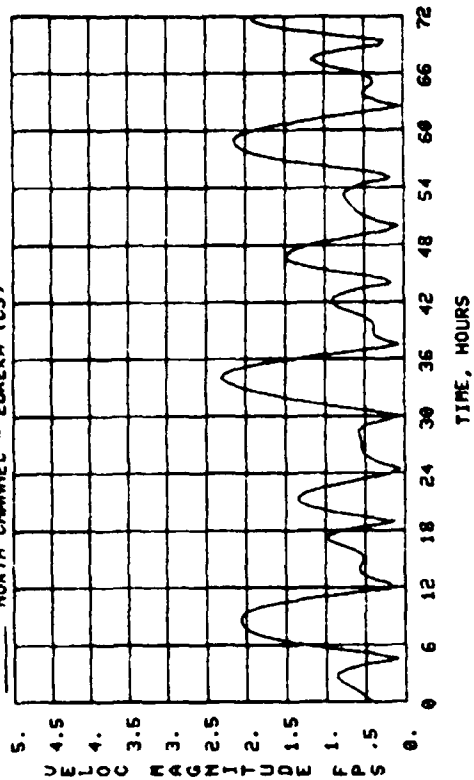
HUMBOLDT BAY RAY CURRENT DATA (4/1/82 - 4/3/82)



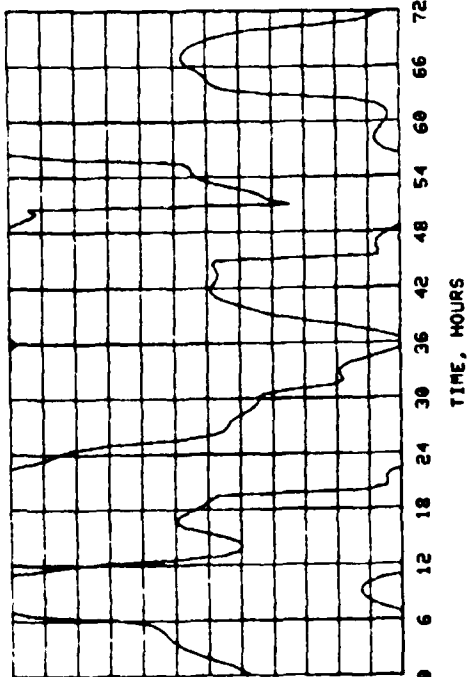
WOODLEY-GUNTHER CHANNEL (C4)



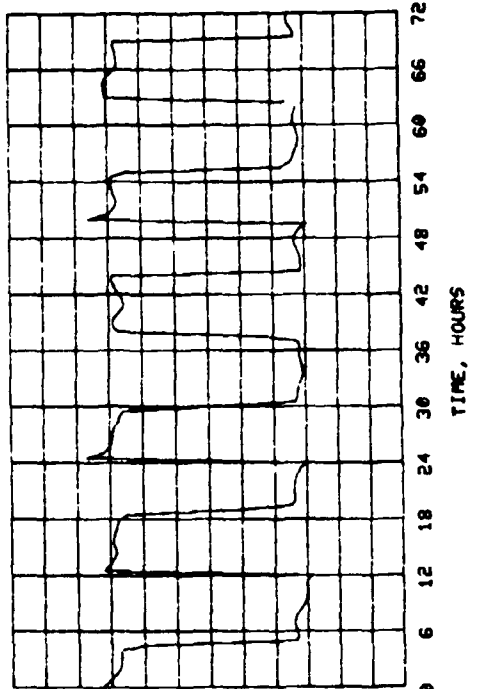
NORTH CHANNEL - EUREKA (C5)

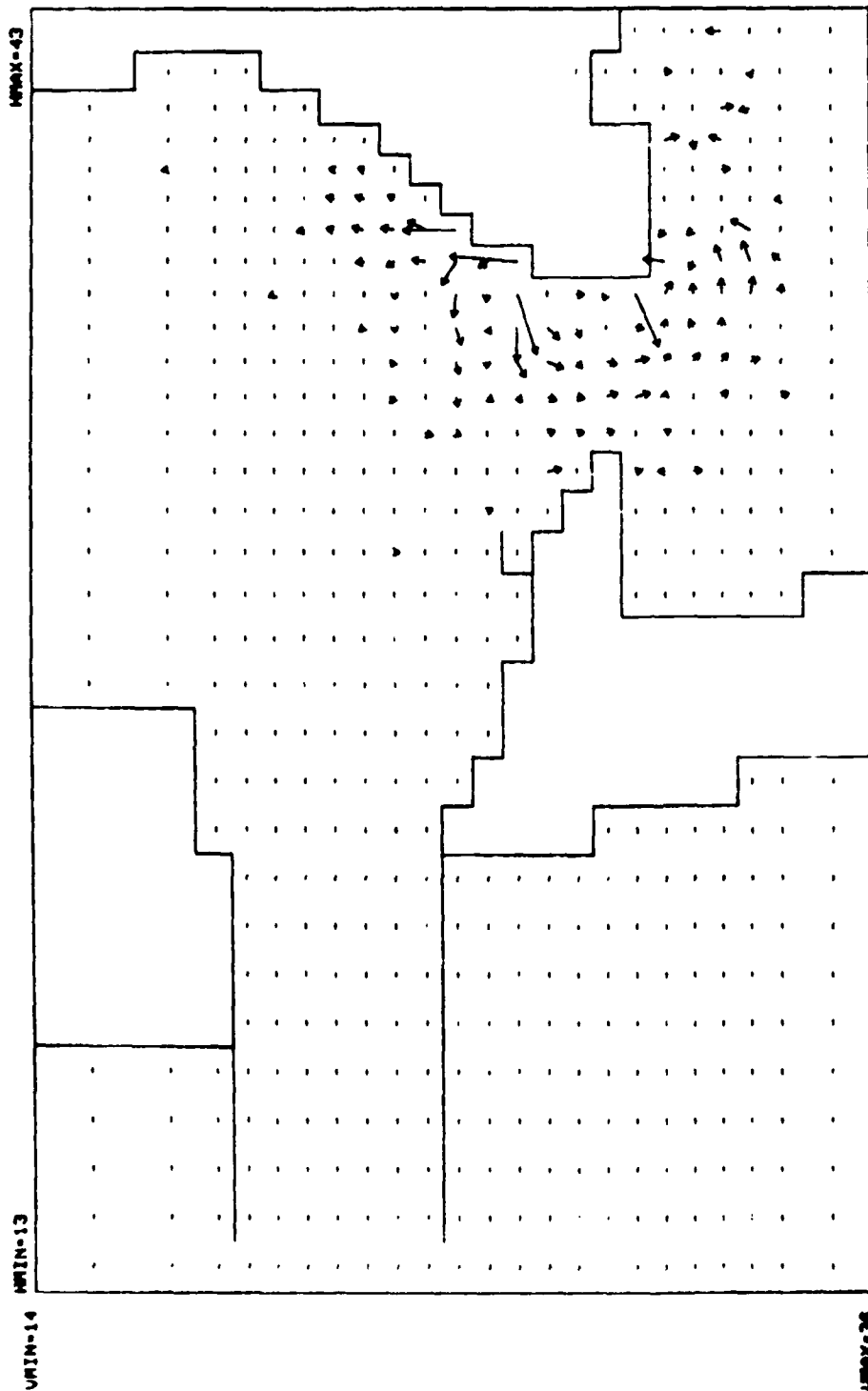


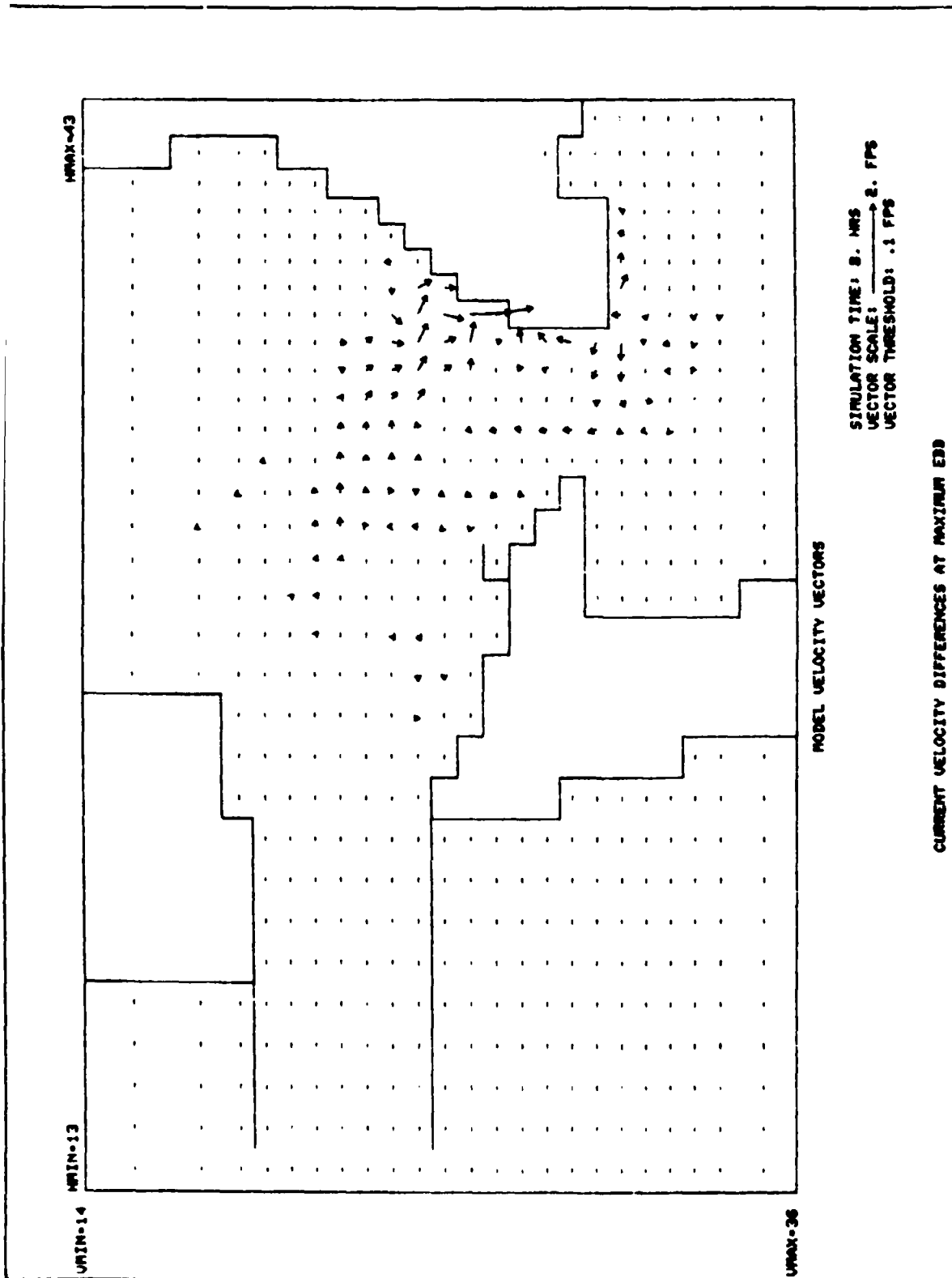
DEGREES FROM NORTH

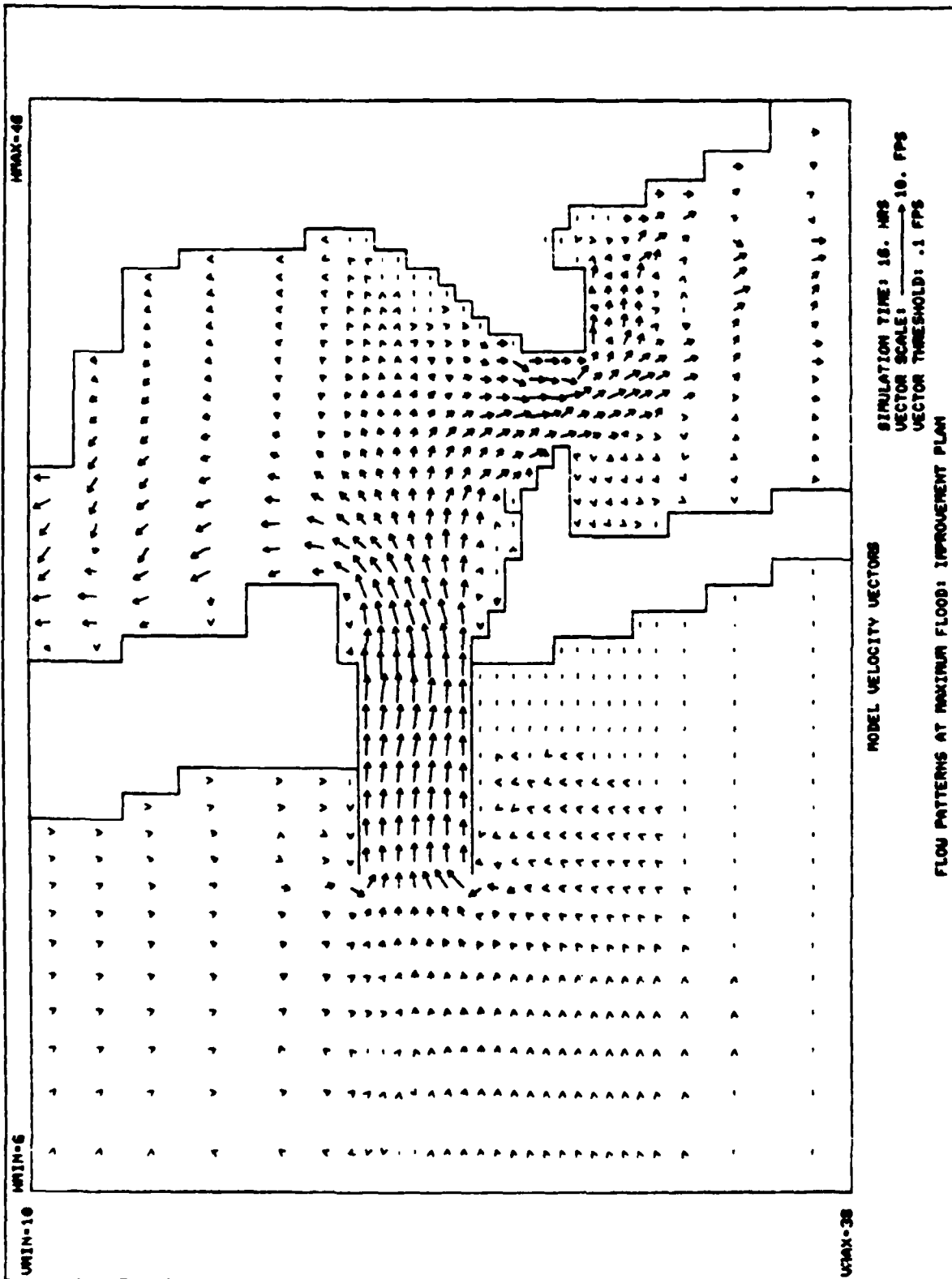


DEGREES FROM NORTH









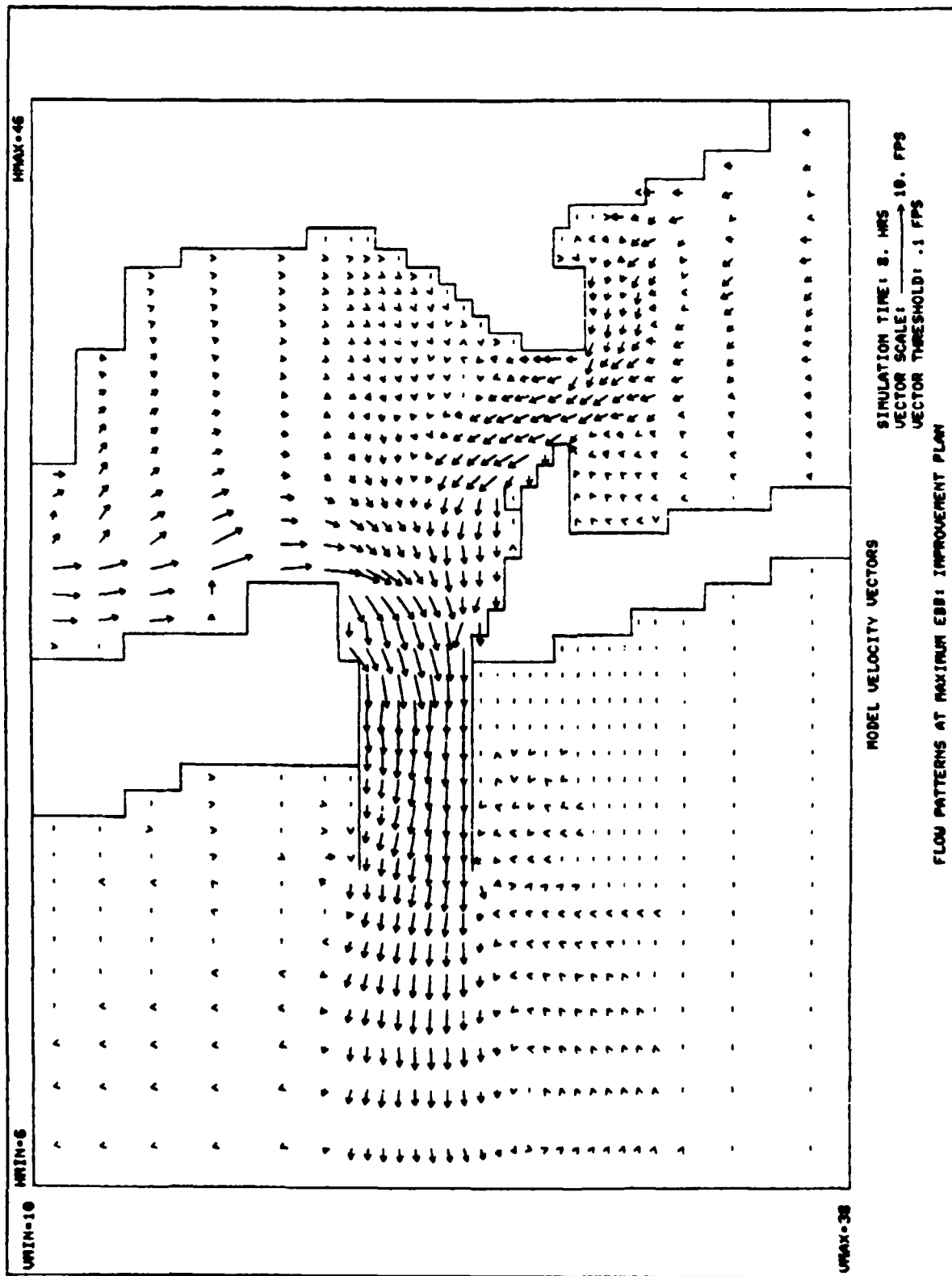
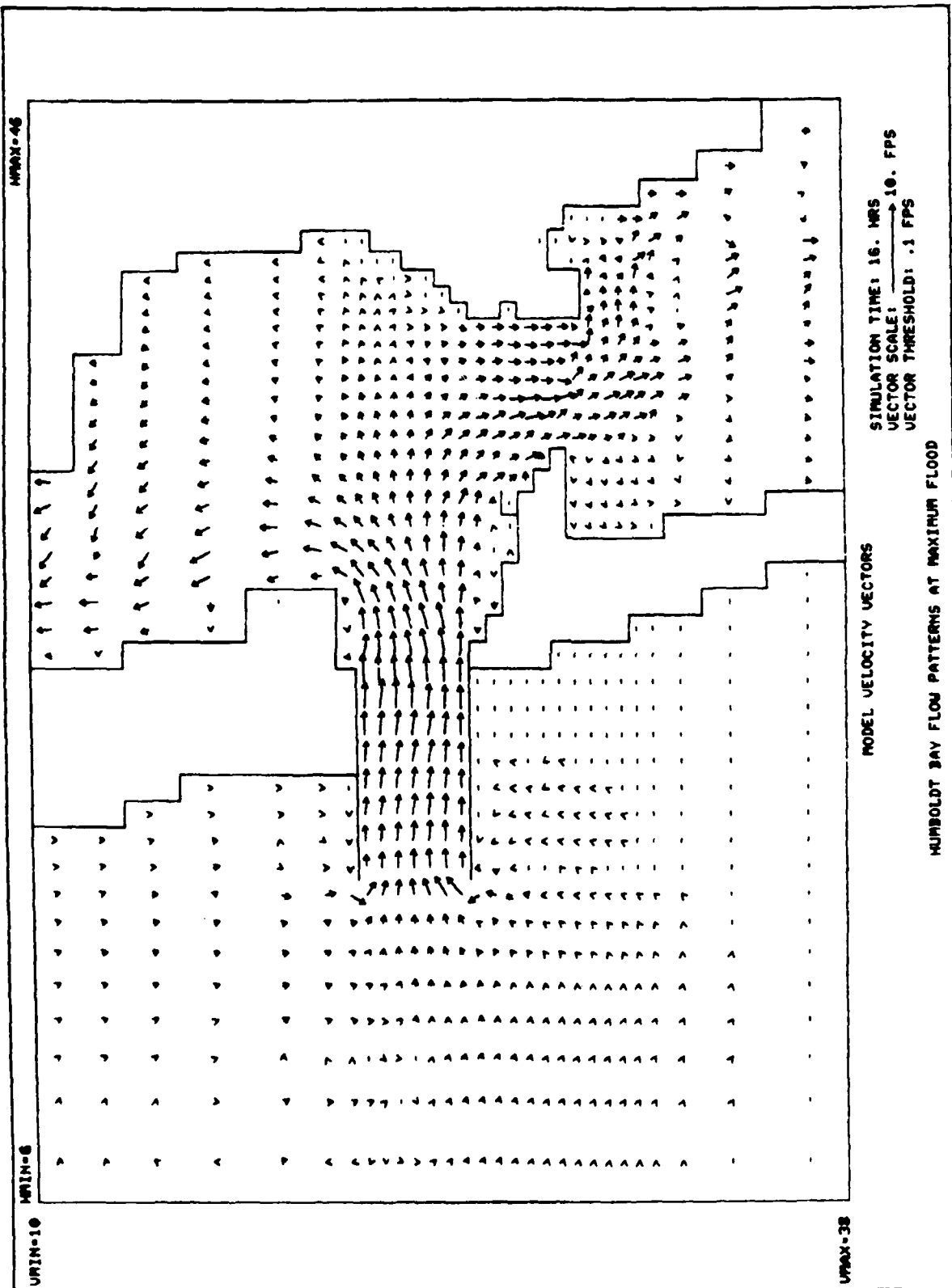


PLATE 18



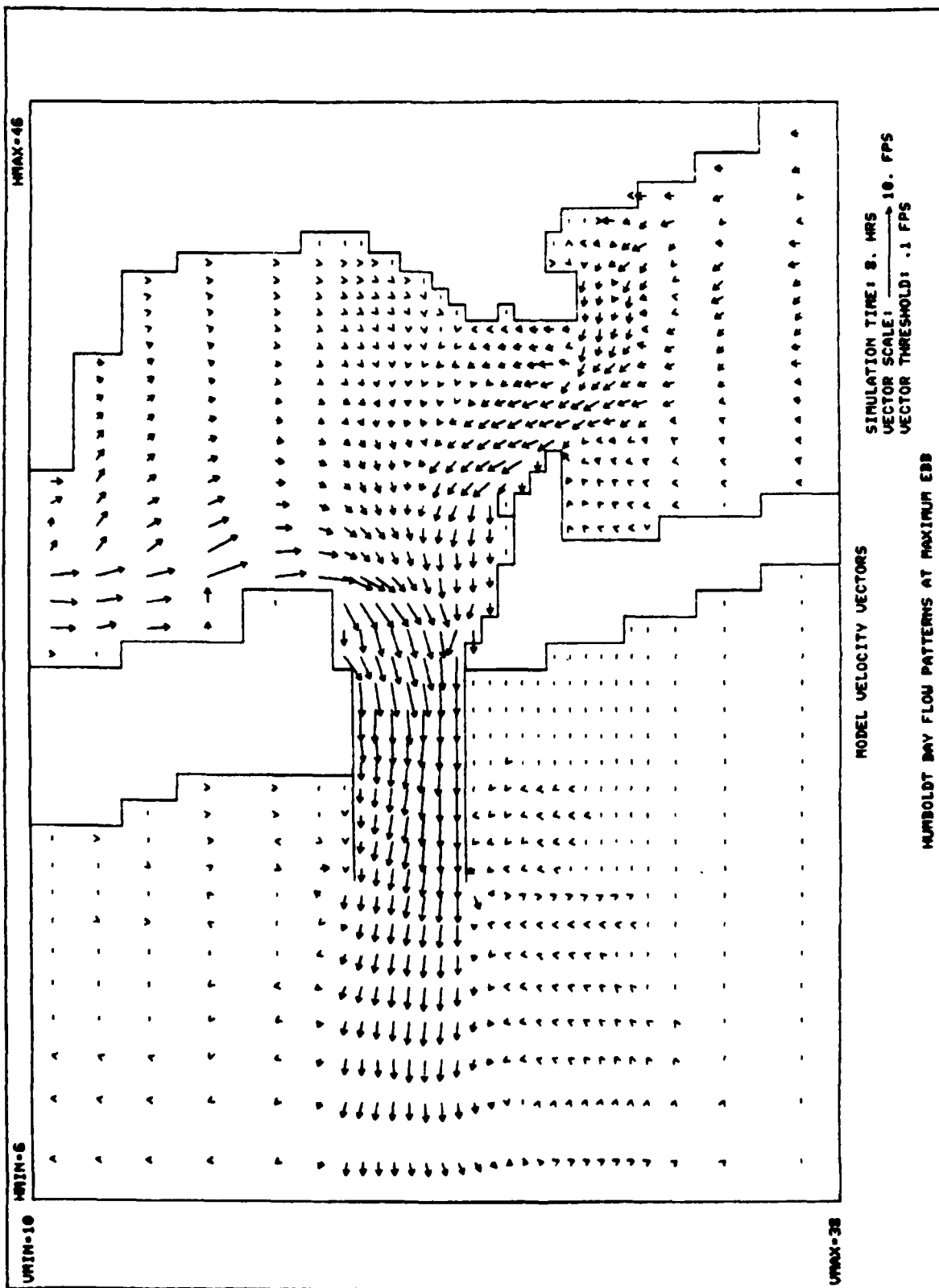


PLATE 16

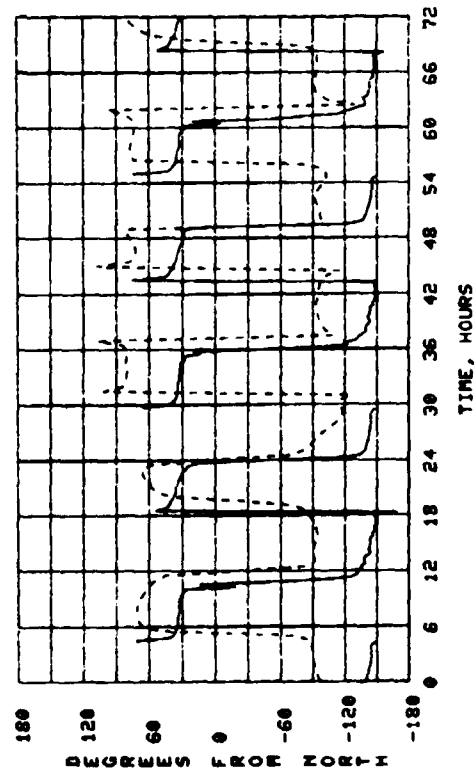
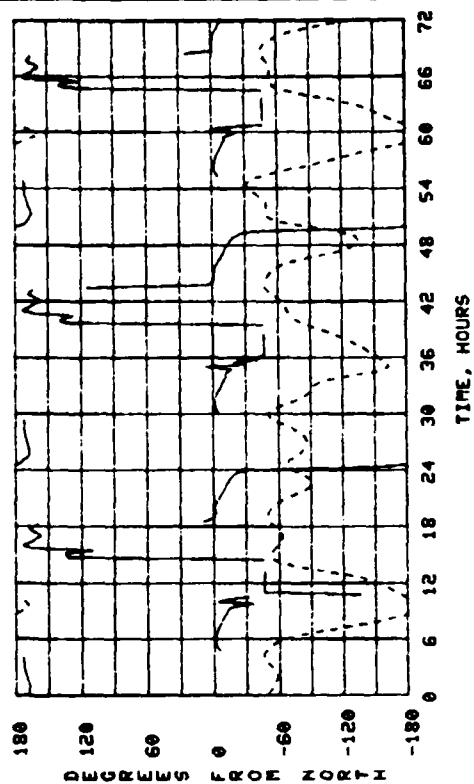
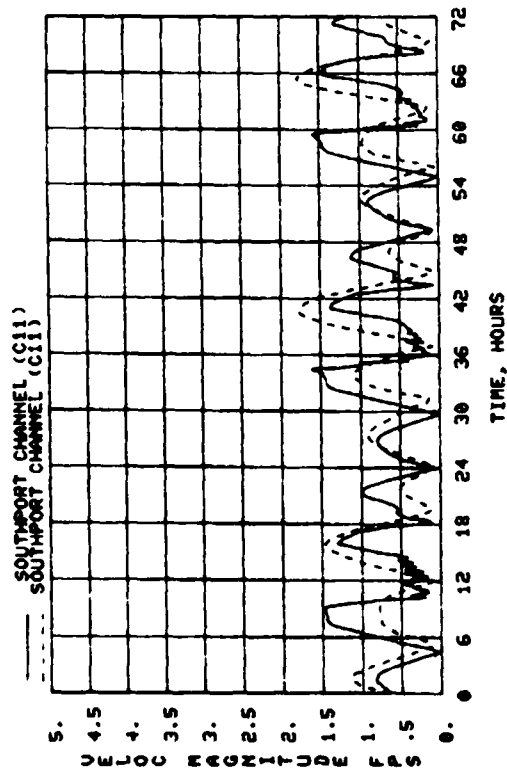
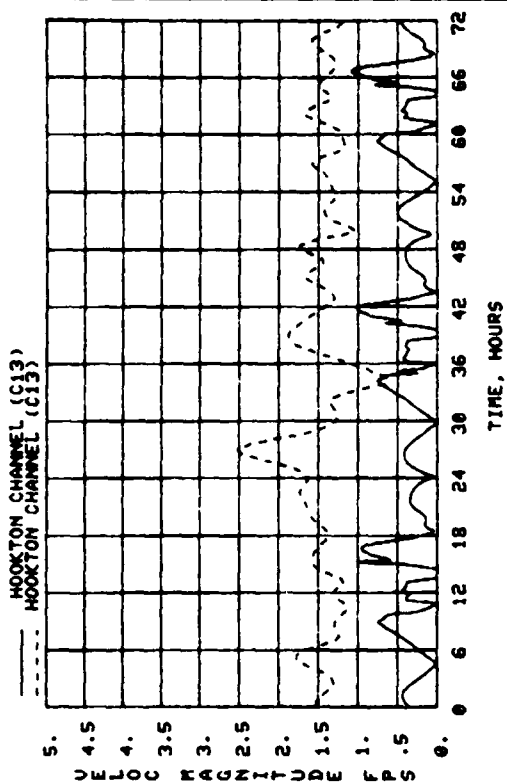
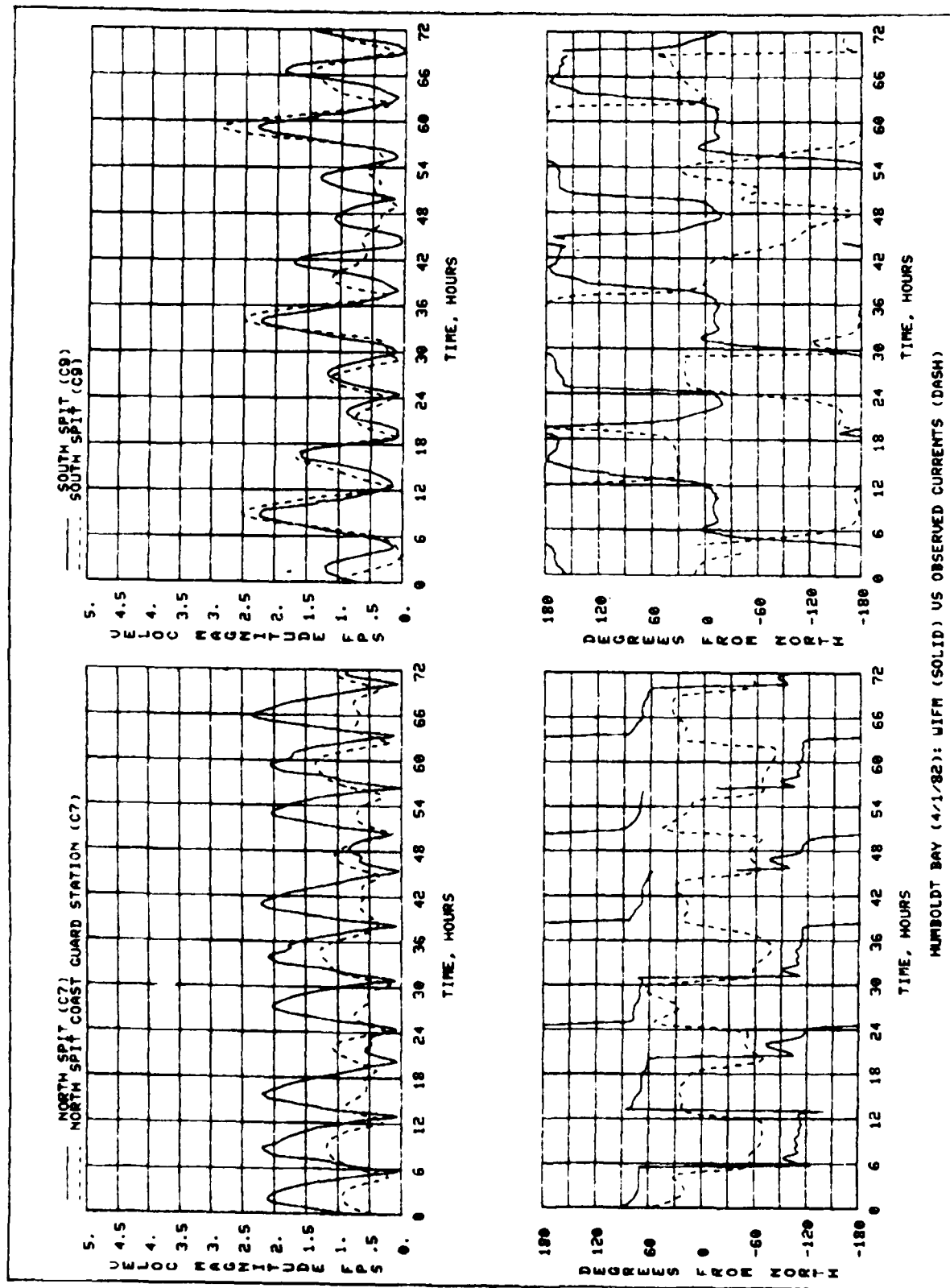
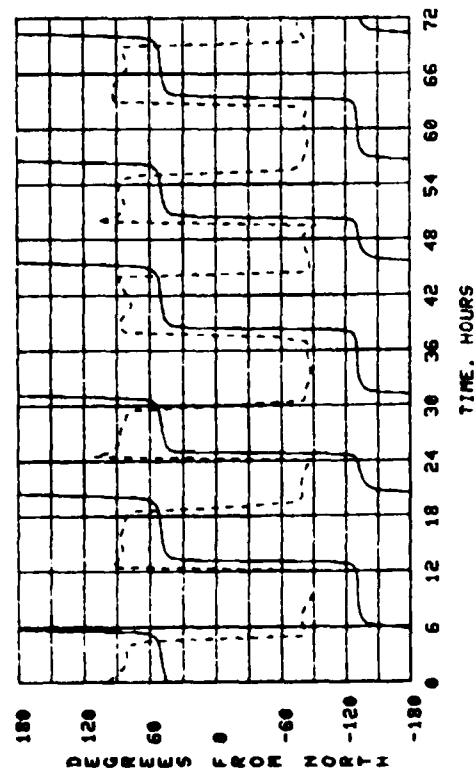
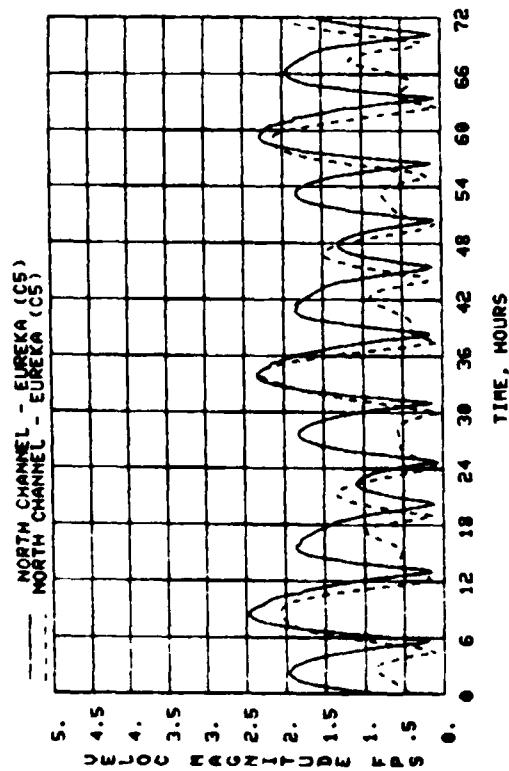
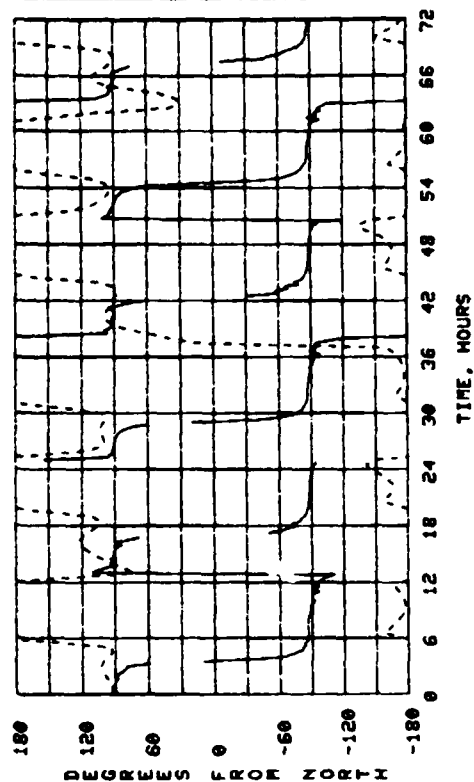
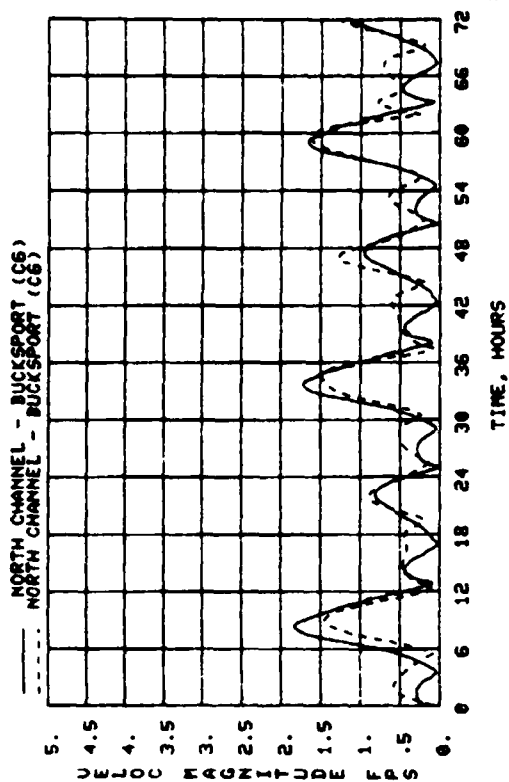


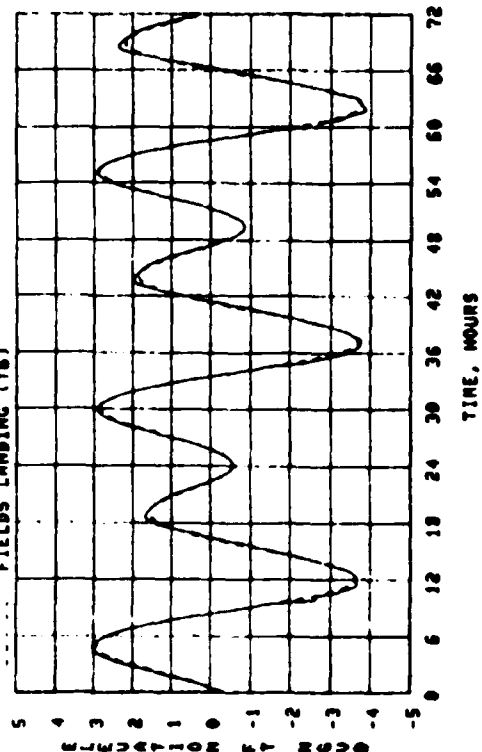
PLATE 14



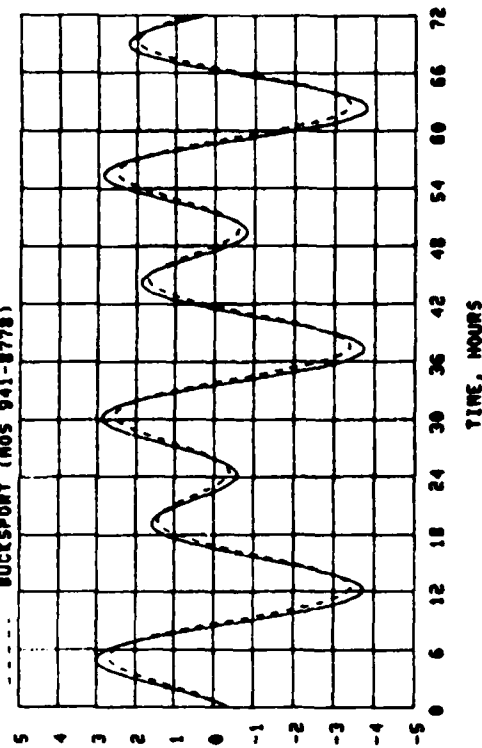


HUMBOLDT BAY (4/1/82) U1FM (SOLID) VS OBSERVED CURRENTS (DASH)

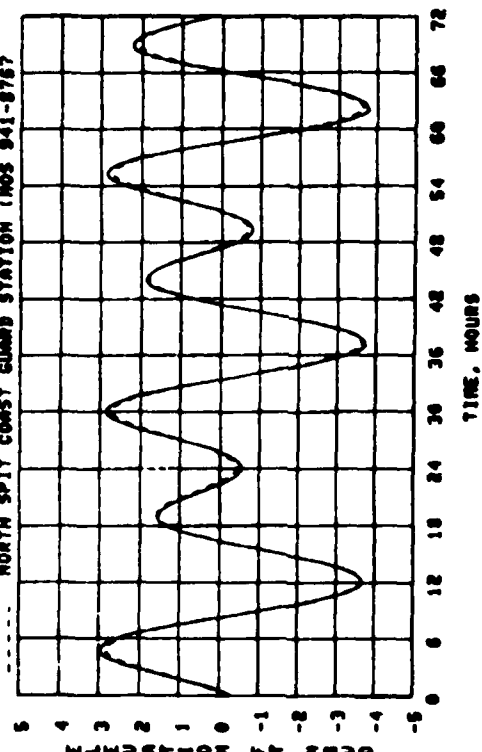
FIELDS LANDING (TS AND NOS 941-8723)
FIELDS LANDING (TS)



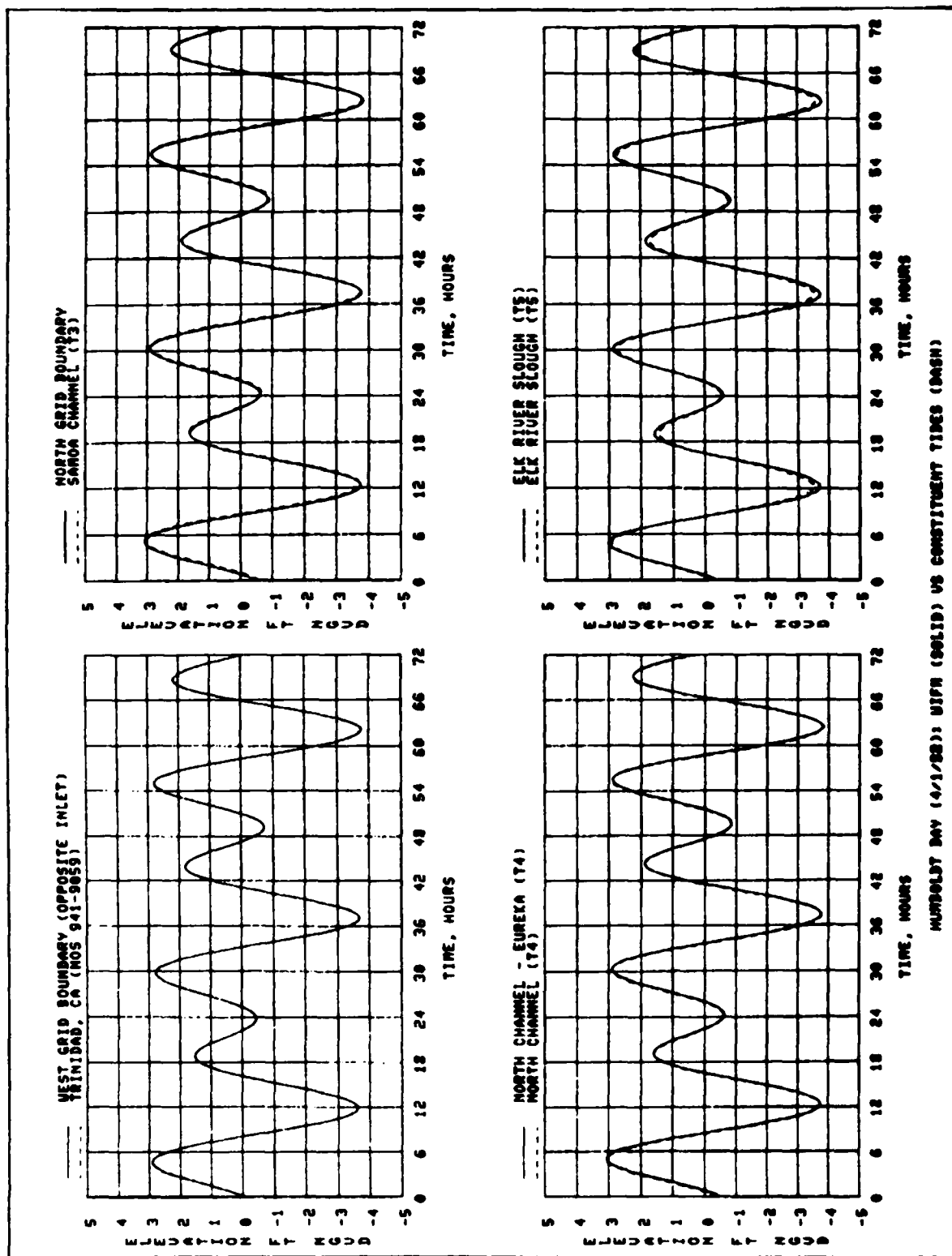
BUCKSPORT (NOS 941-8778)
BUCKSPORT (NOS 941-8778)

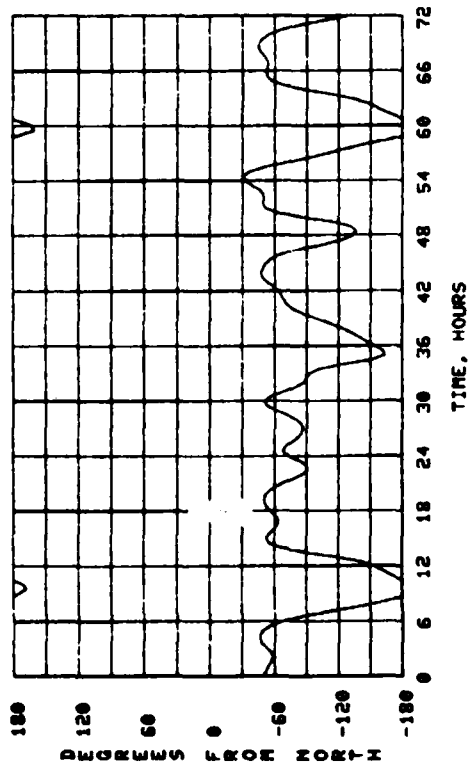
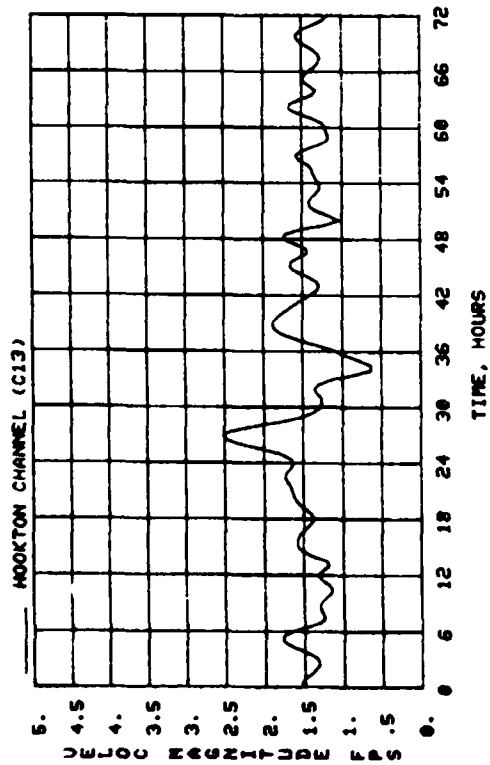


NORTH SPIT COAST GUARD STATION (NOS 941-8787)
NORTH SPIT COAST GUARD STATION (NOS 941-8787)



MURDOCK BAY (4/1/82): WFR (SOLID) VS CONSTITUENT TIDES (DASH)





HUMBOLDT BAY CURRENT DATA, FILTER - 4 HRS (4/1/82 - 4/3/82)

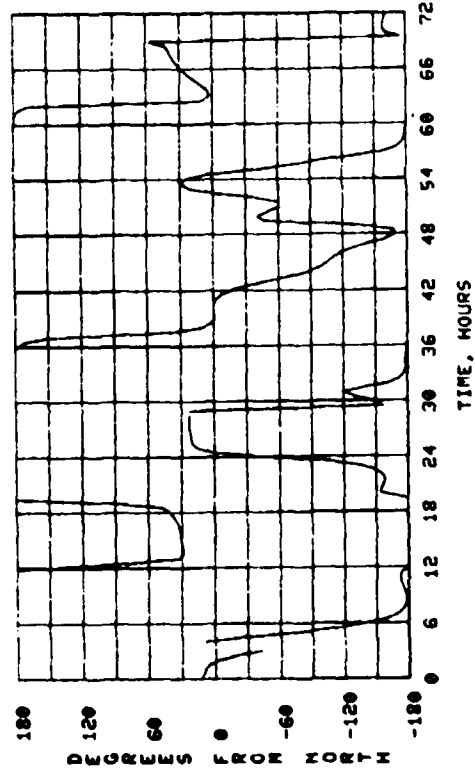
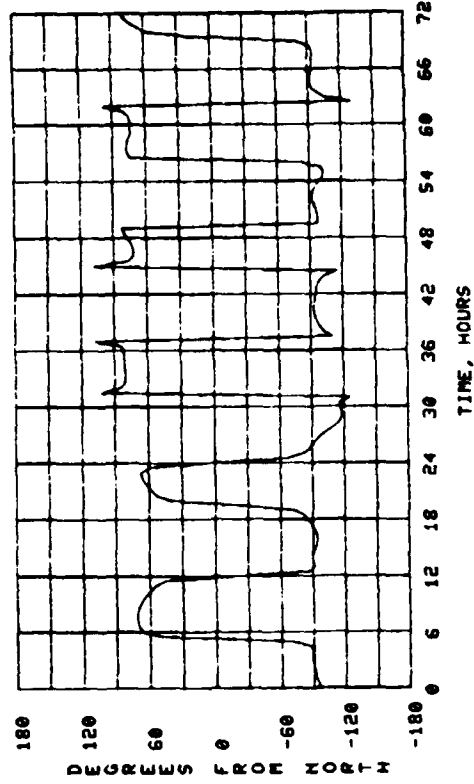
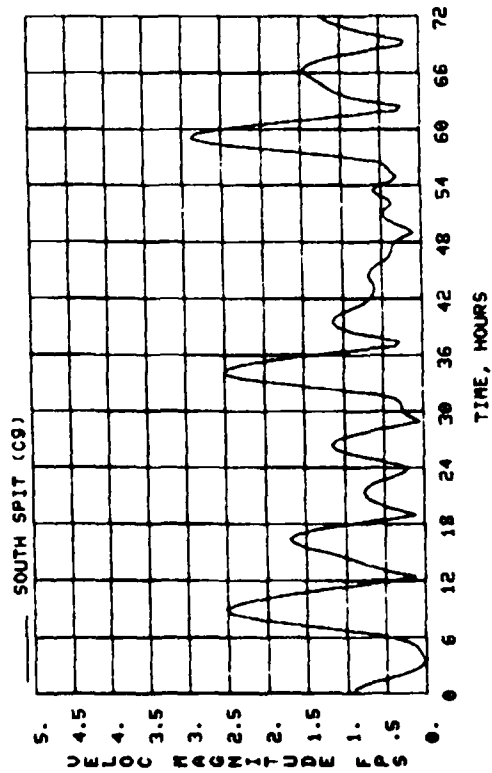
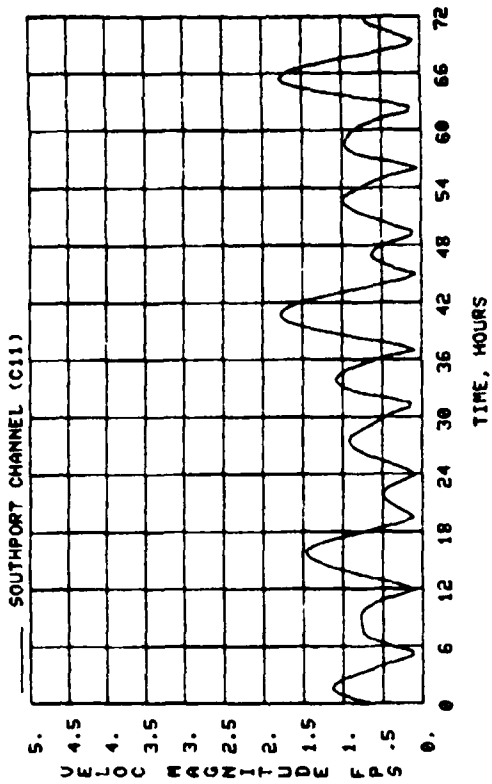
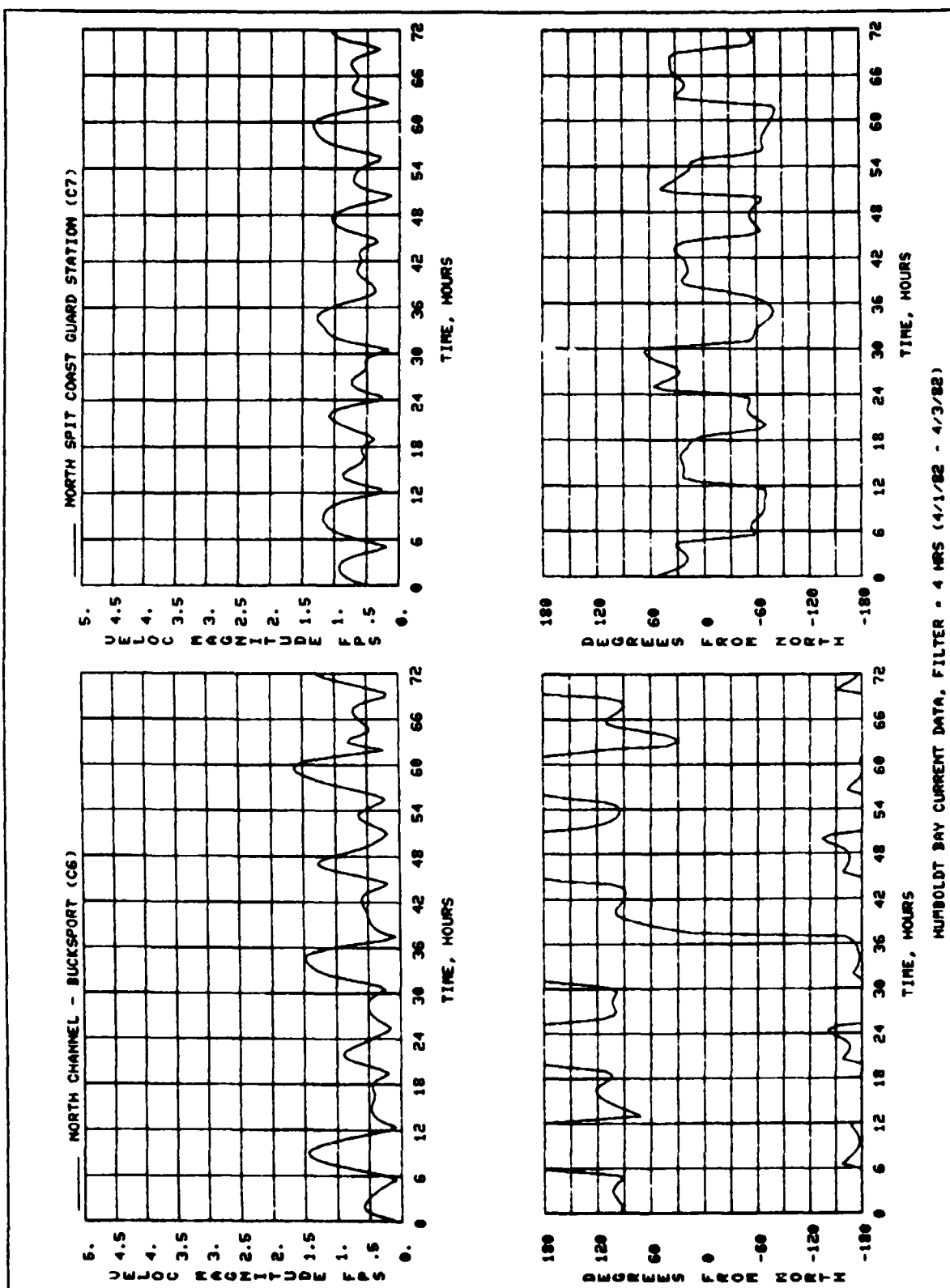


PLATE 8



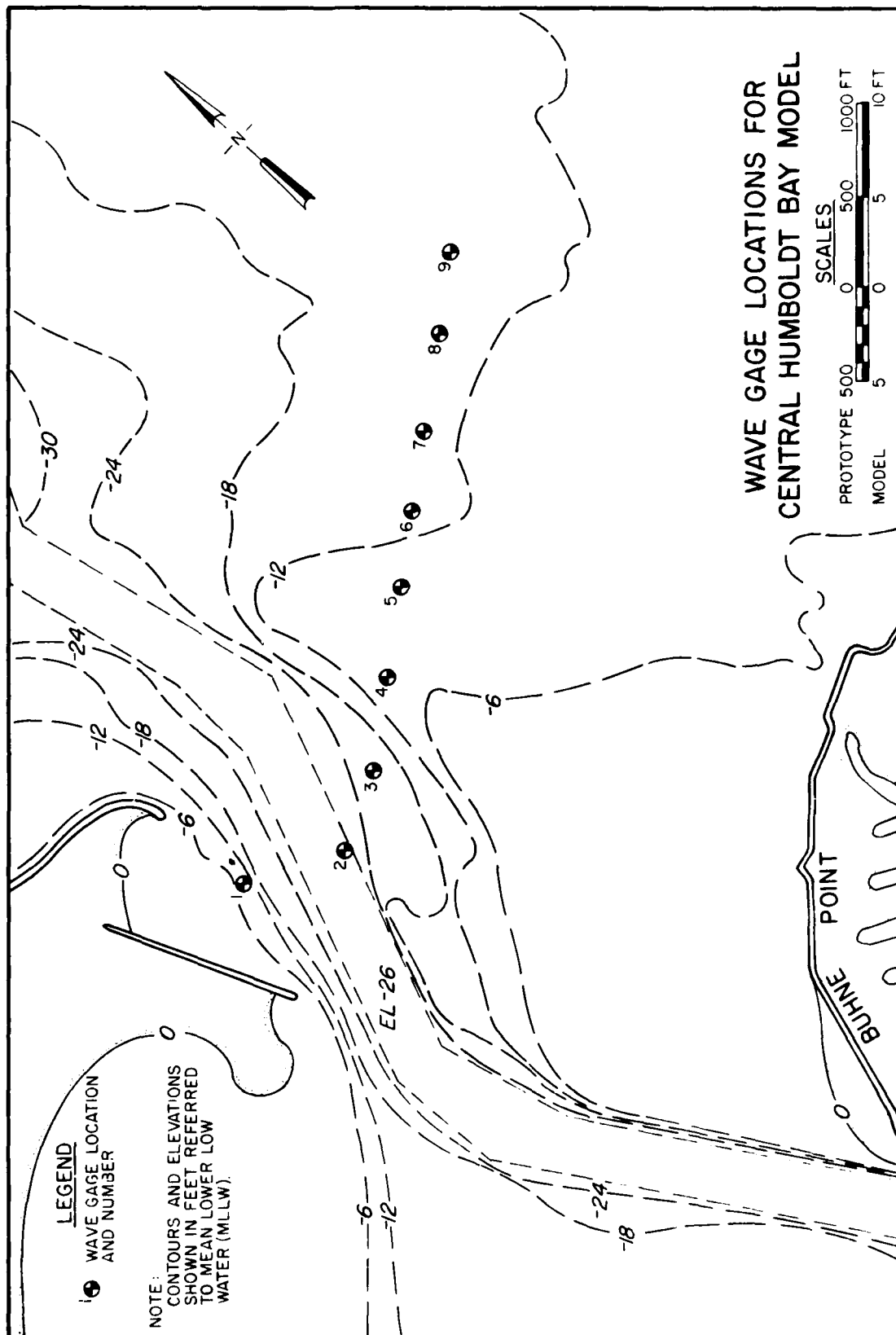


PLATE 22

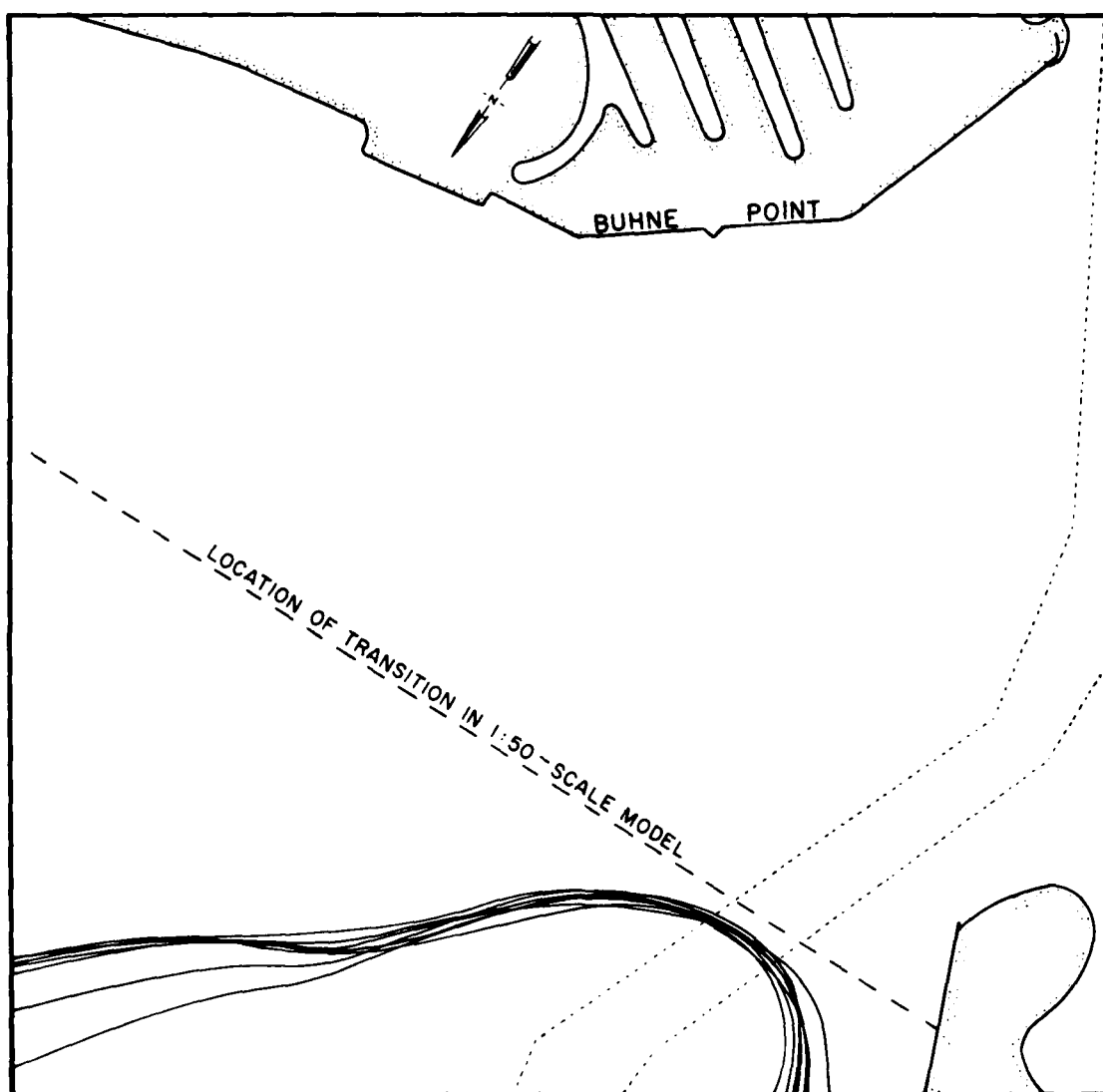


Plate 23. Wave fronts for test waves approaching Buhne Point from north; 0.0-ft swl

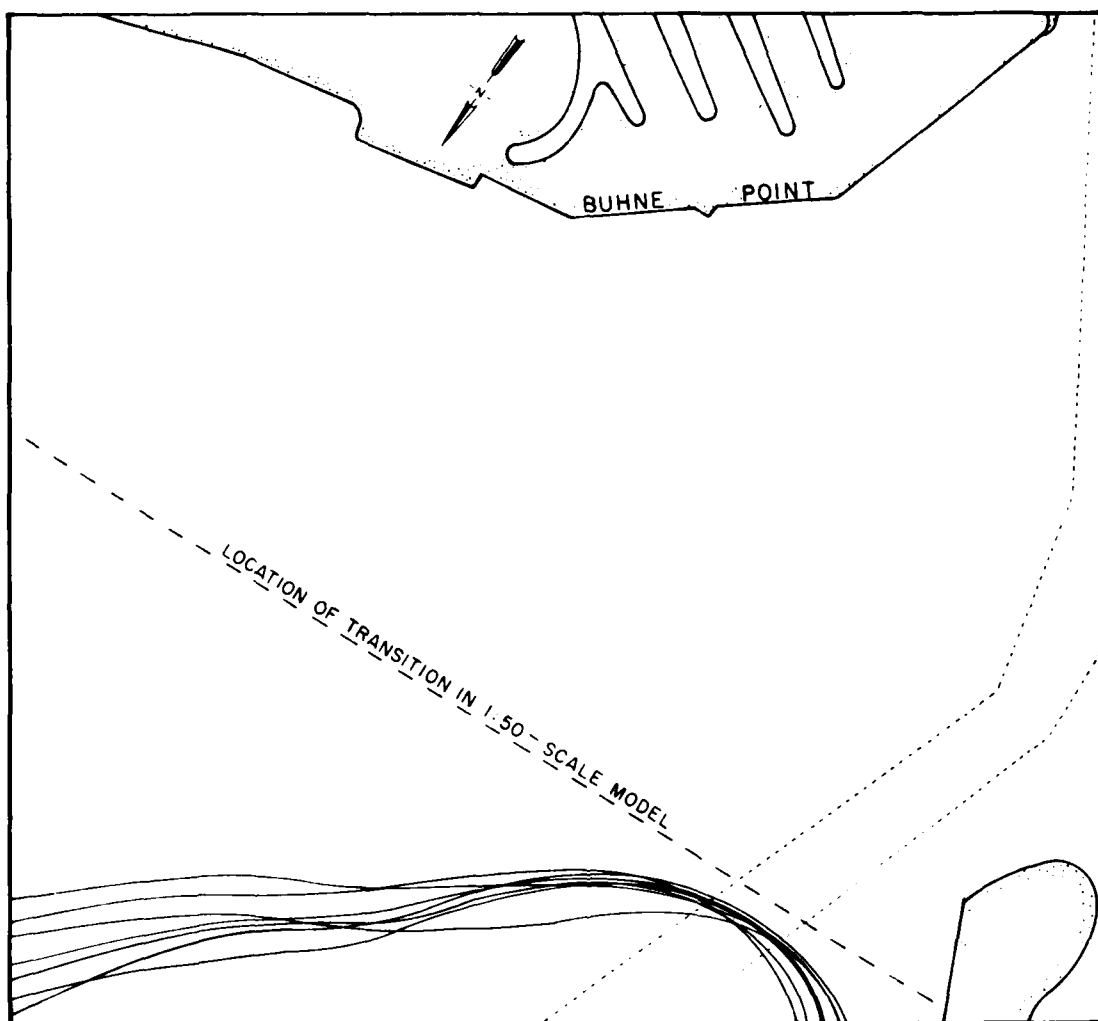


Plate 24. Wave fronts for test waves approaching Buhne Point from north for maximum flood; +3.2 ft swl

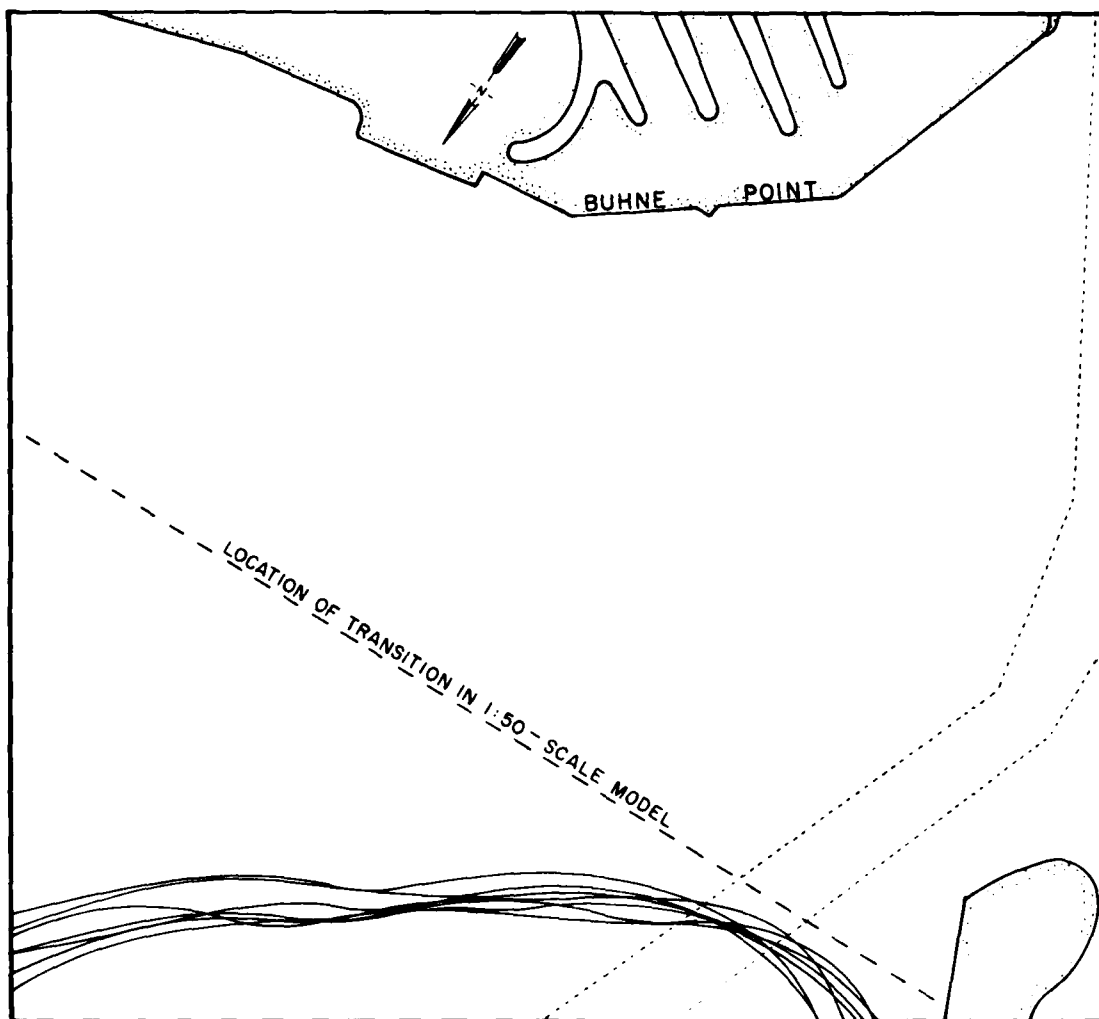


Plate 25. Wave fronts for test waves approaching Buhne Point from north for maximum ebb; +3.7 ft swl

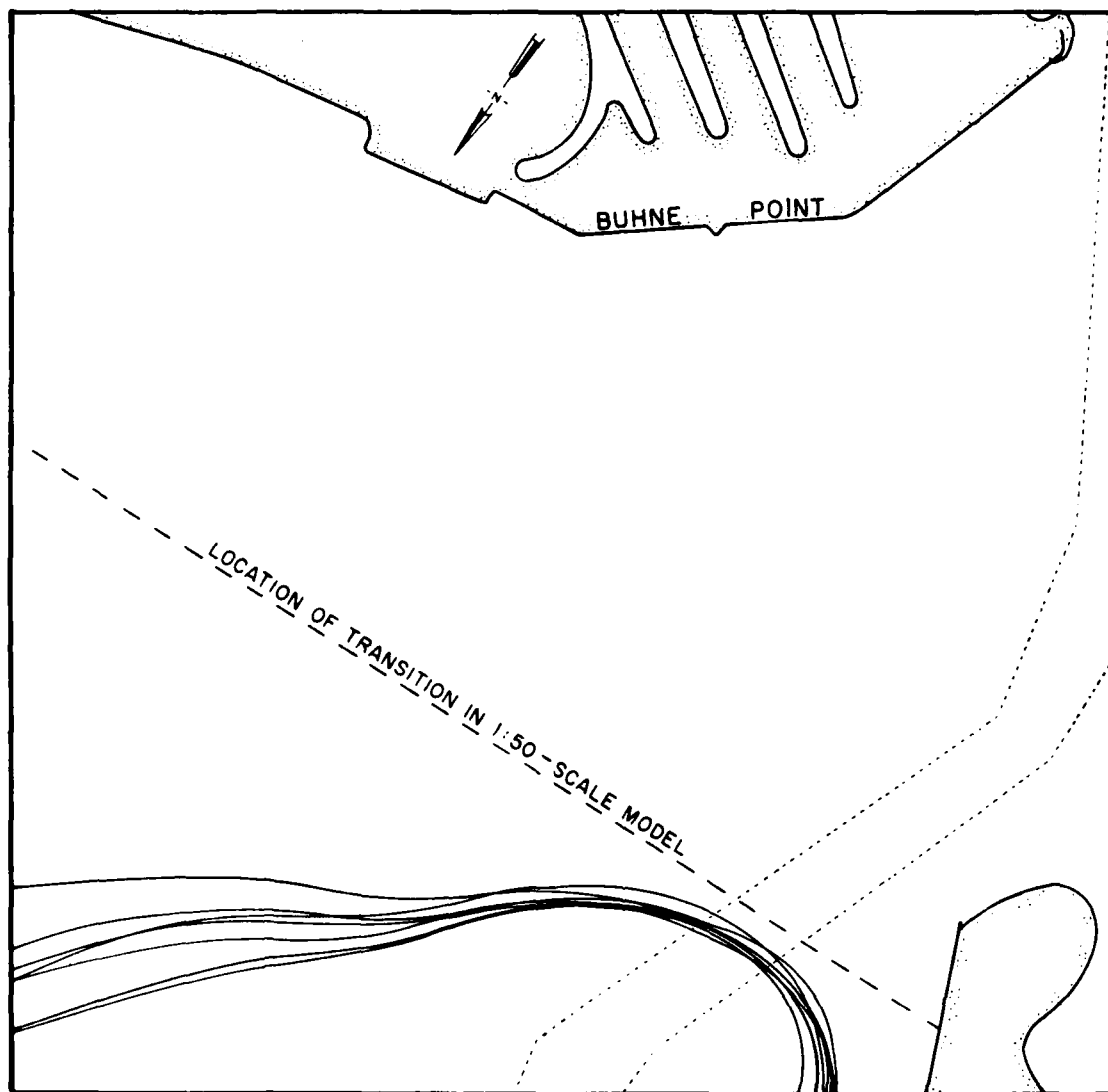


Plate 26. Wave fronts for test waves approaching Buhne Point from north; +6.7 ft swl

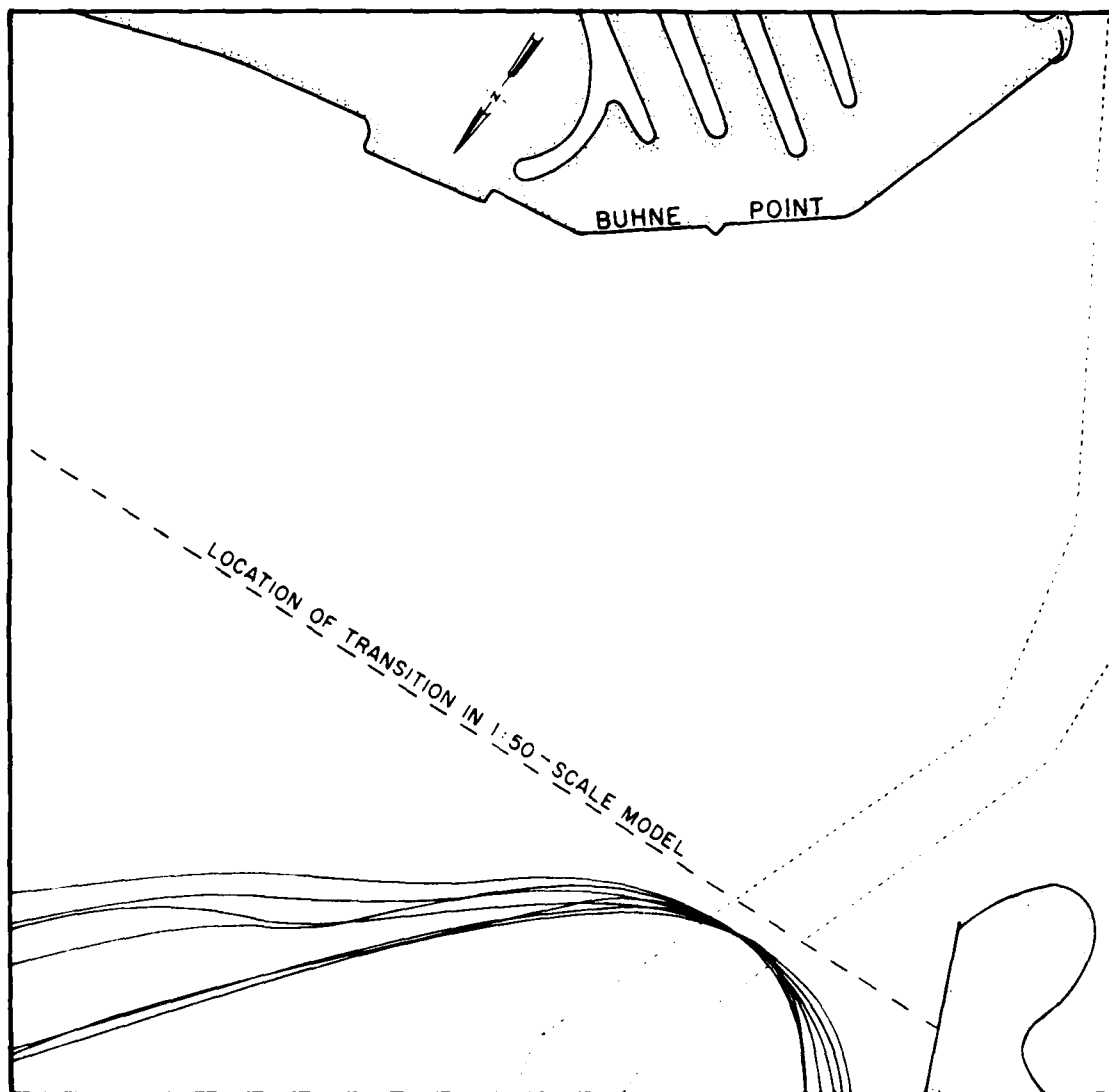


Plate 27. Wave fronts for test waves approaching Buhne Point from north; +9.5 ft swl

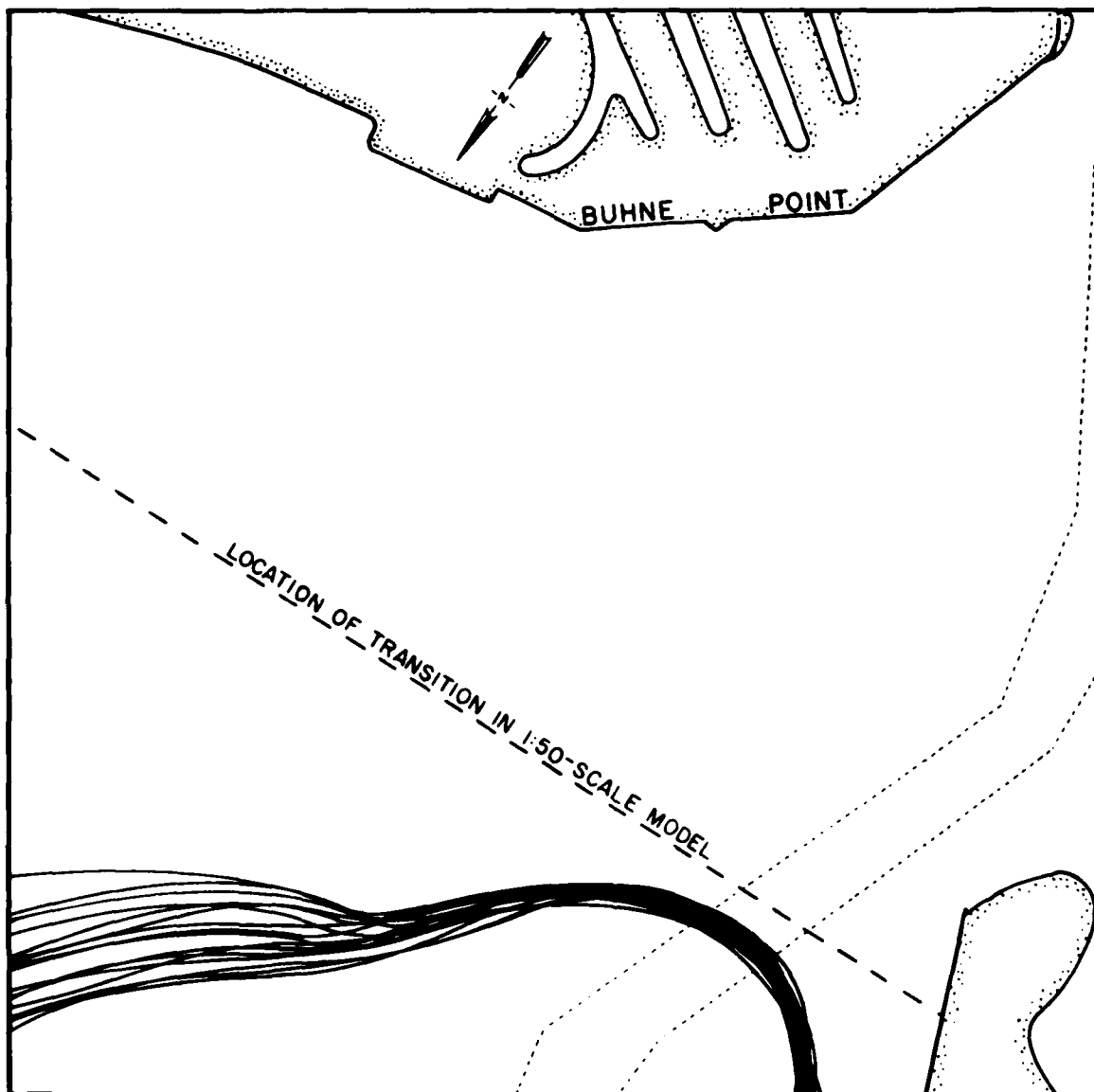


Plate 28. Wave fronts for test waves approaching Buhne Point from northwest; 0.0-ft swl

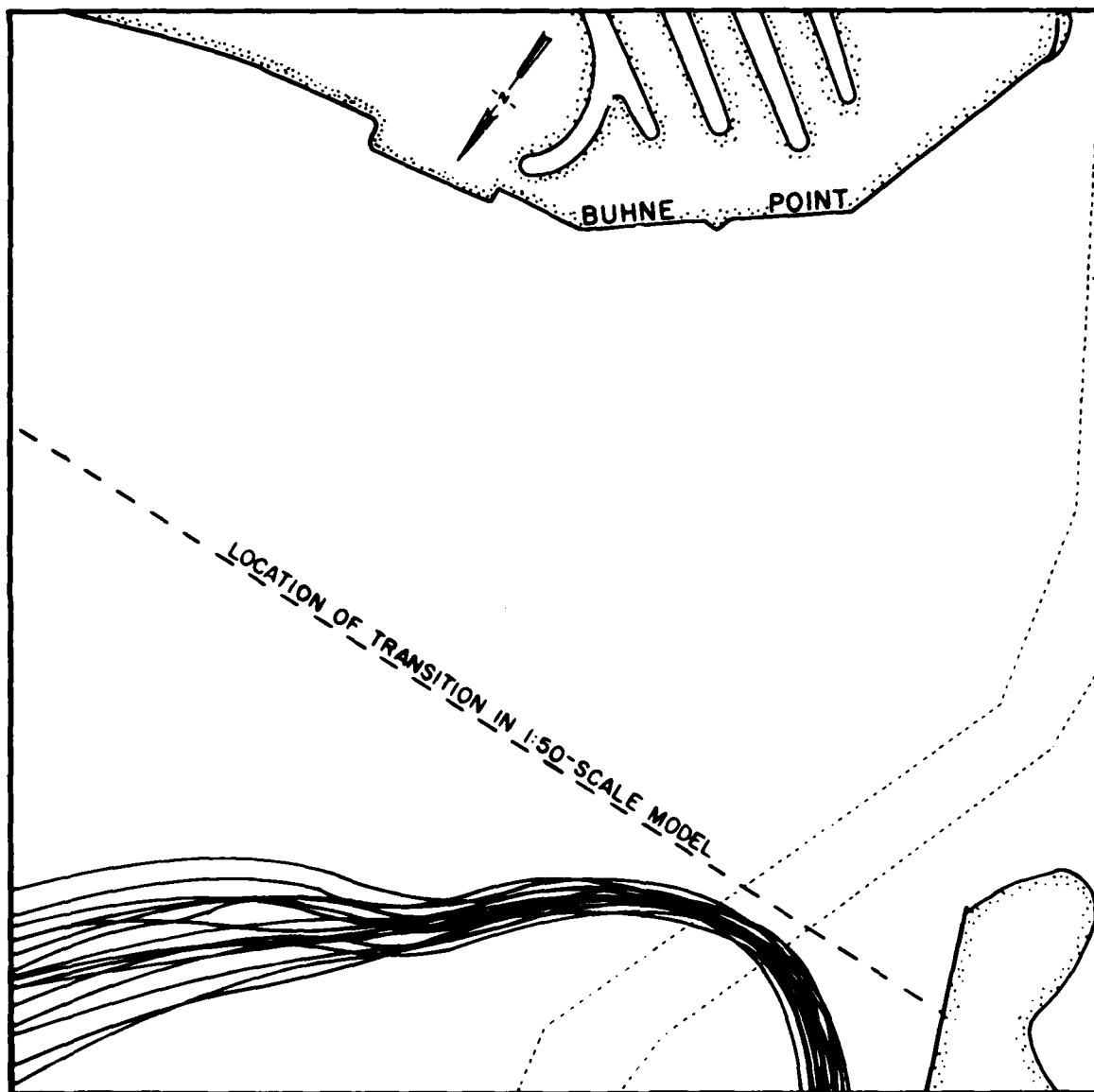


Plate 29. Wave fronts for test waves approaching Buhne Point from northwest for maximum flood; +3.2 ft swl

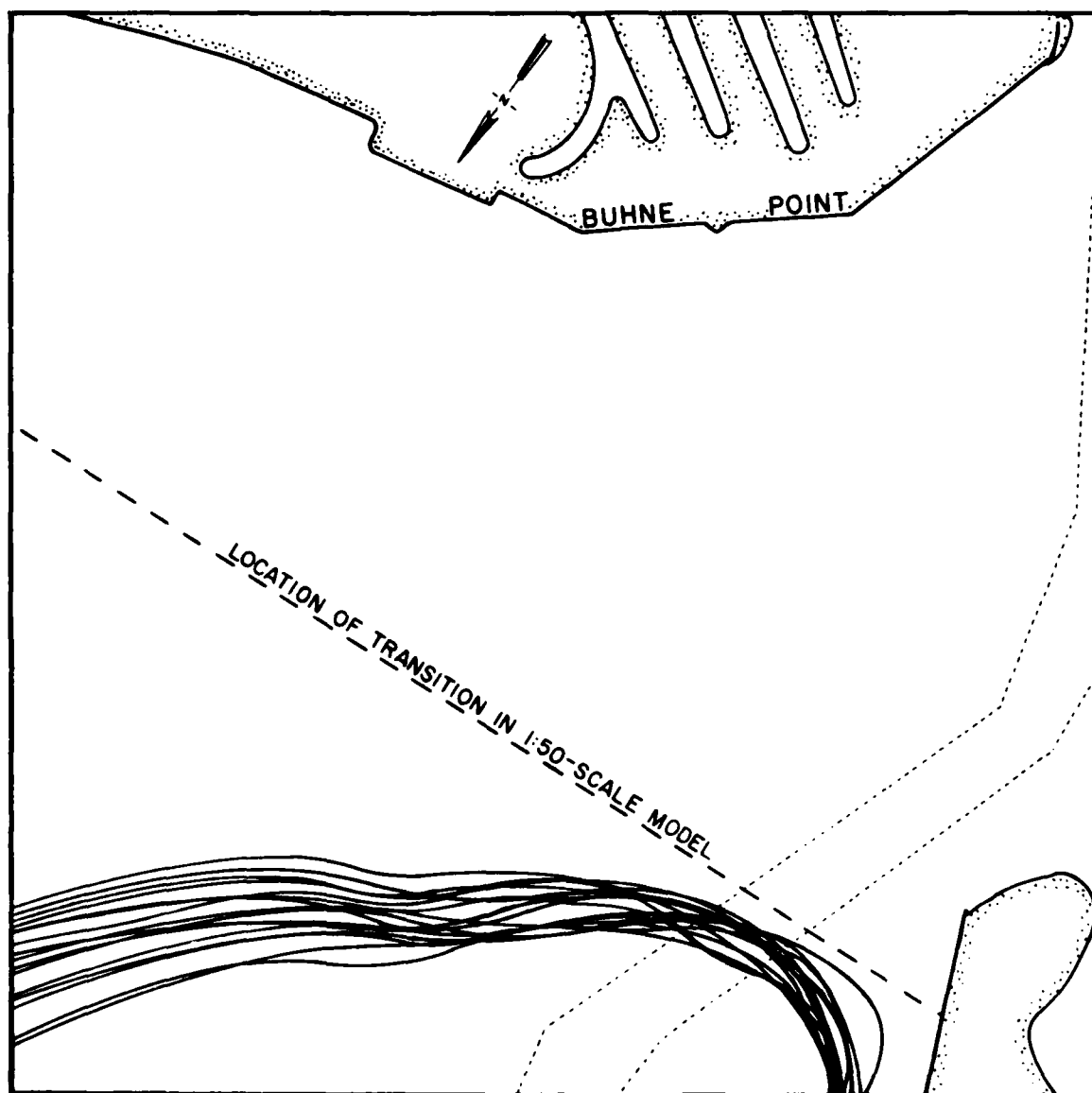


Plate 30. Wave fronts for test waves approaching Buhne Point from northwest for maximum ebb; +3.7 ft swl

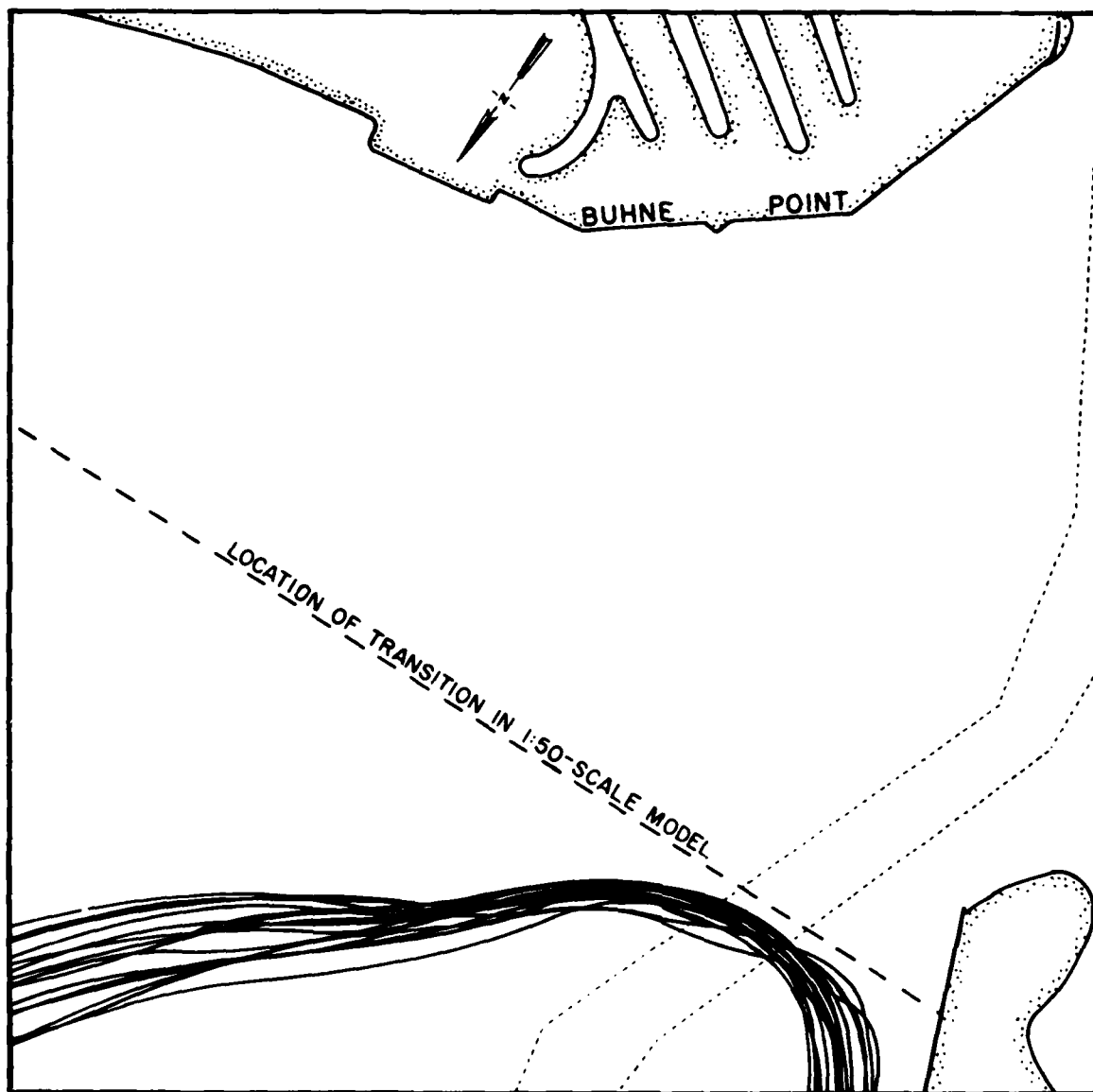


Plate 31. Wave fronts for test waves approaching Buhne Point from northwest; +6.7 ft swl

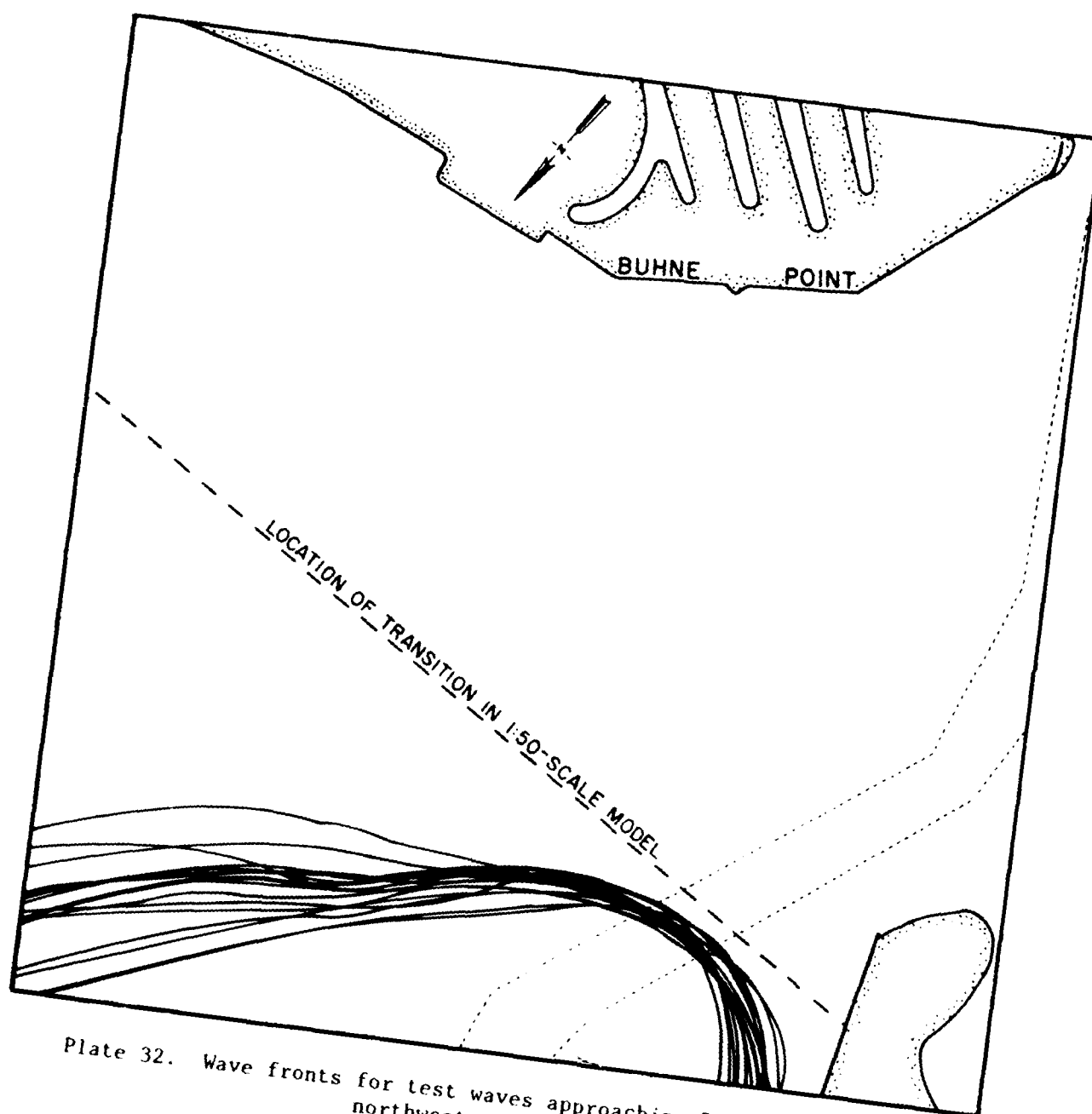


Plate 32. Wave fronts for test waves approaching Buhne Point from northwest; +9.5 ft swl

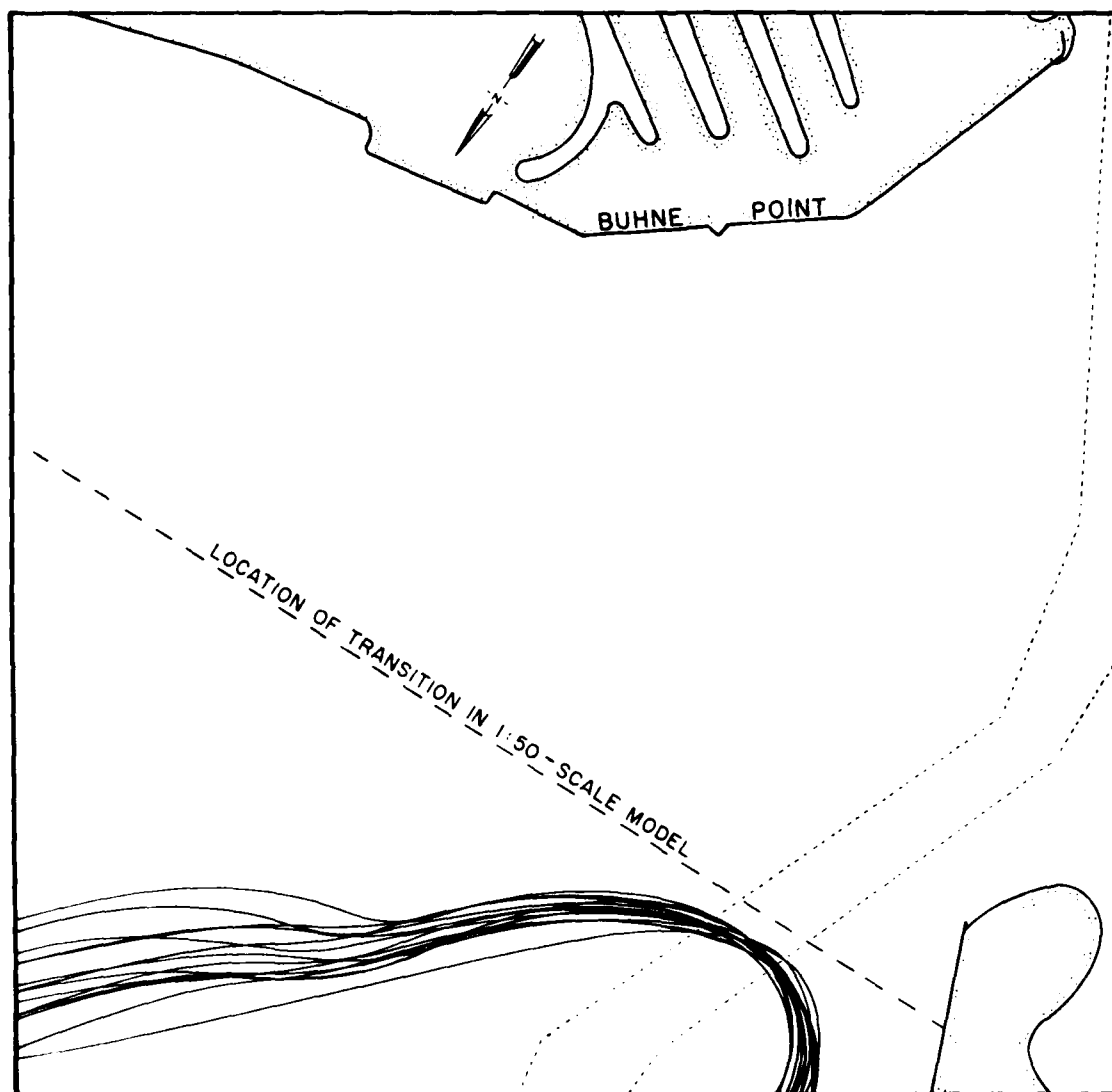


Plate 33. Wave fronts for test waves approaching Buhne Point from west; 0.0-ft swl

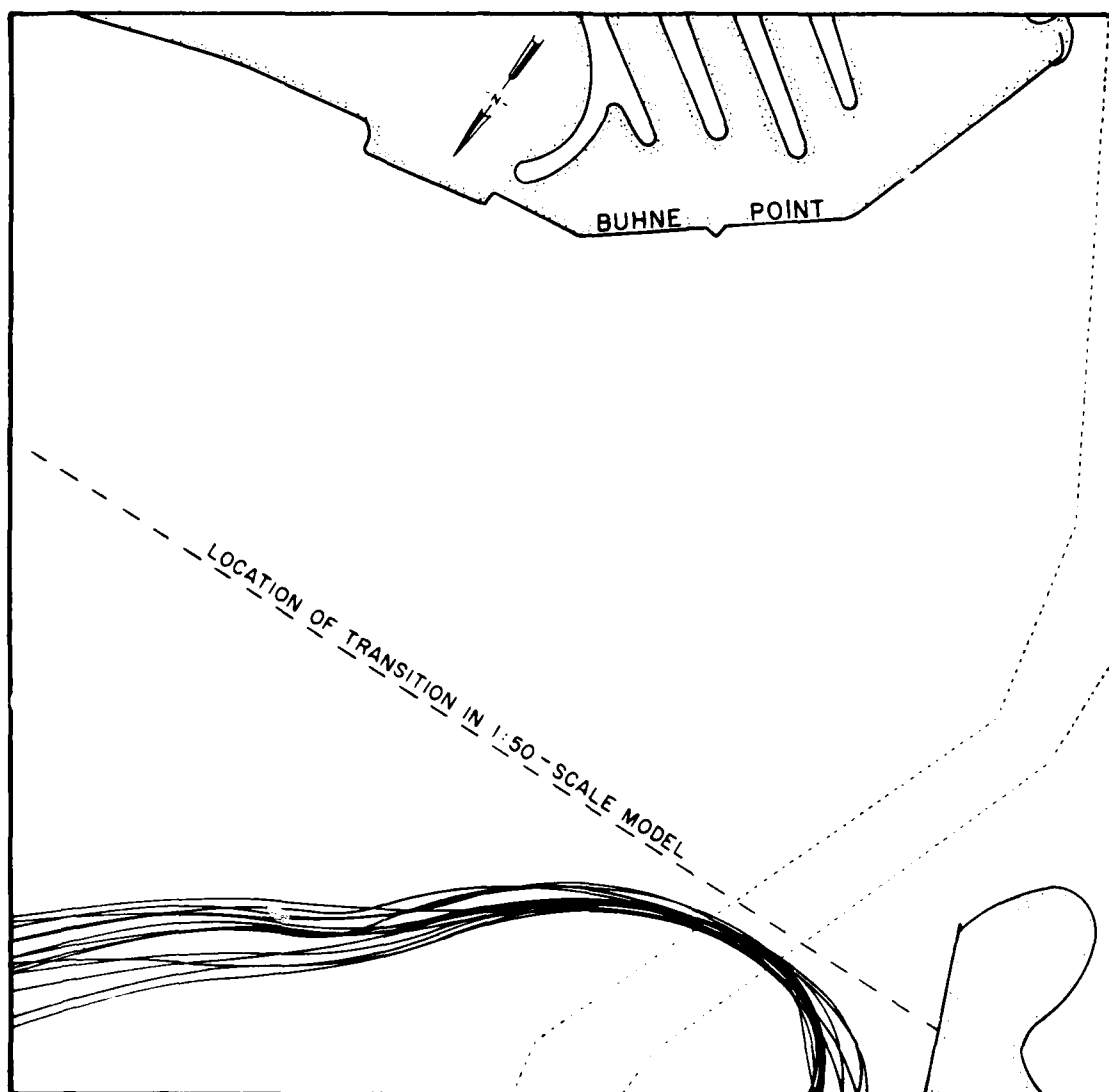


Plate 34. Wave fronts for test waves approaching Buhne Point from west for maximum flood; +3.2 ft swl

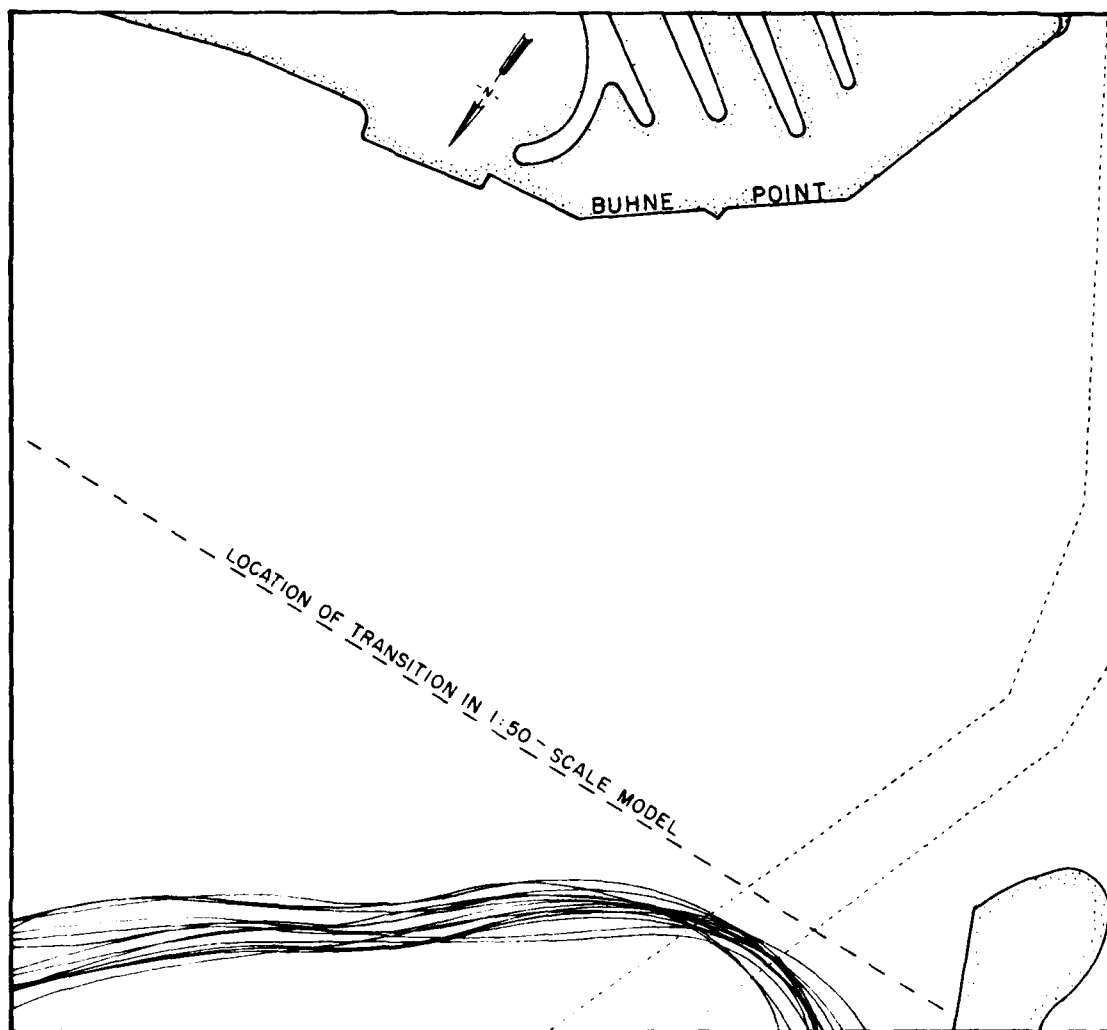
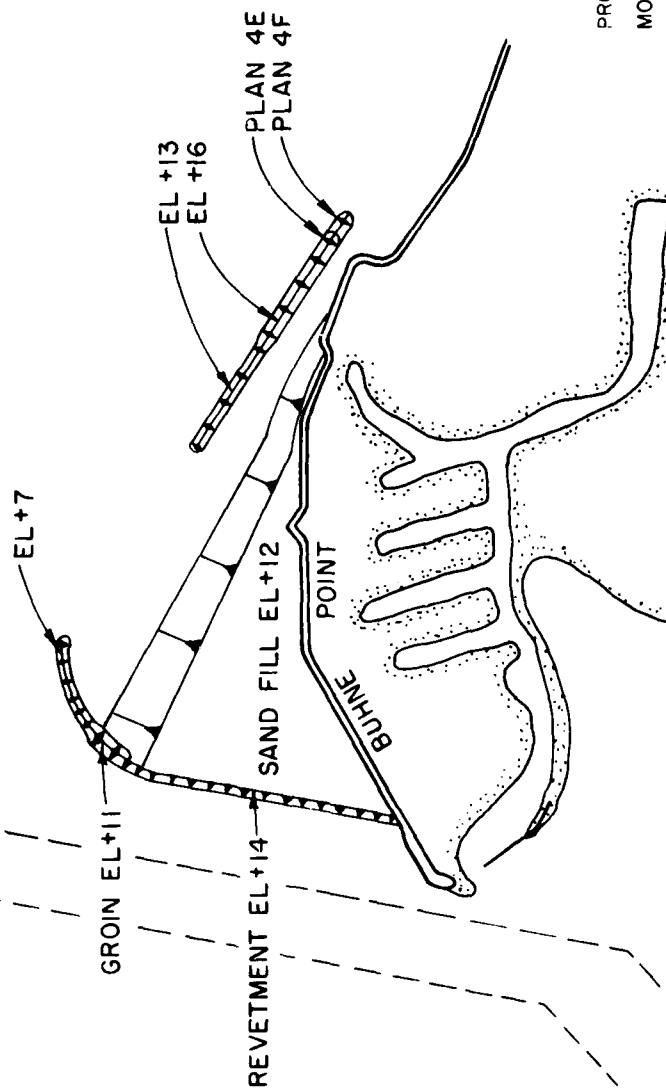
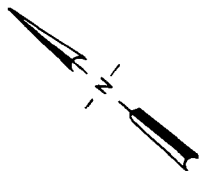
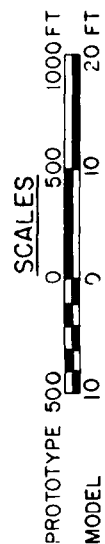


Plate 35. Wave fronts for test waves approaching Buhne Point from west for maximum ebb; +3.7 ft swl

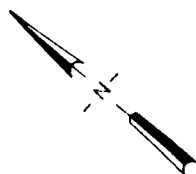
NOTE : CONTOURS AND ELEVATIONS SHOWN
IN FEET REFERRED TO MEAN LOWER
LOW WATER (MLLW)



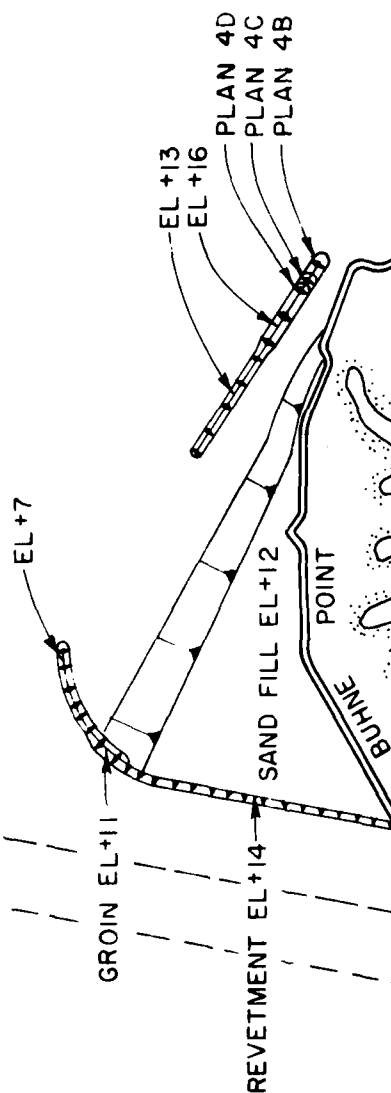
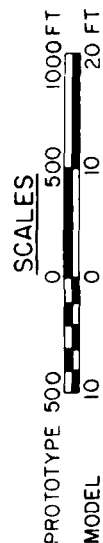
ELEMENTS OF PLANS 4E AND 4F



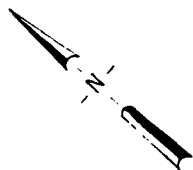
NOTE: CONTOURS AND ELEVATIONS SHOWN
IN FEET REFERRED TO MEAN LOWER
LOW WATER (MLLW)



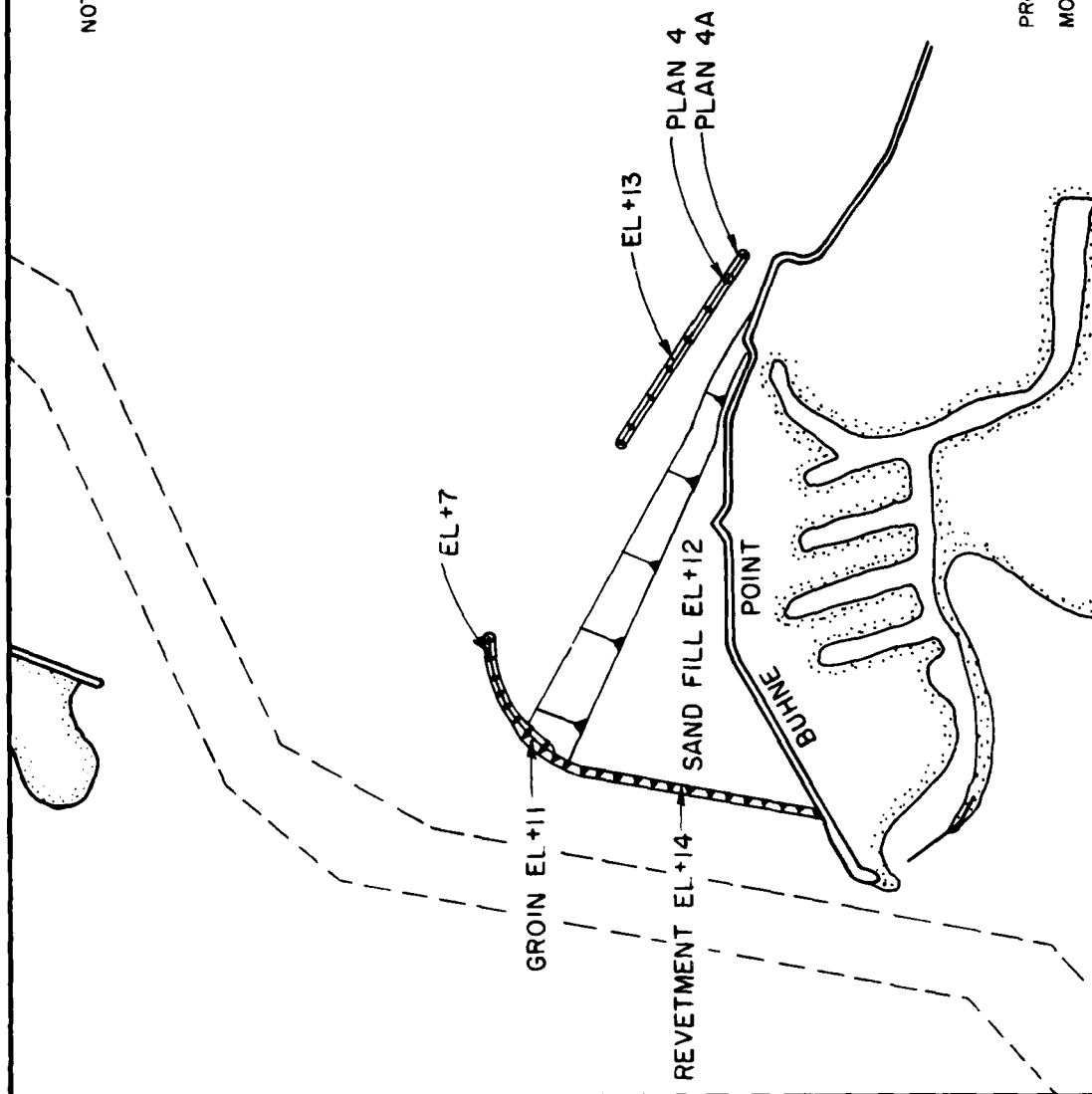
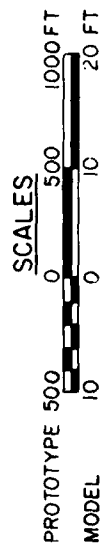
ELEMENTS OF PLANS 4B-4D



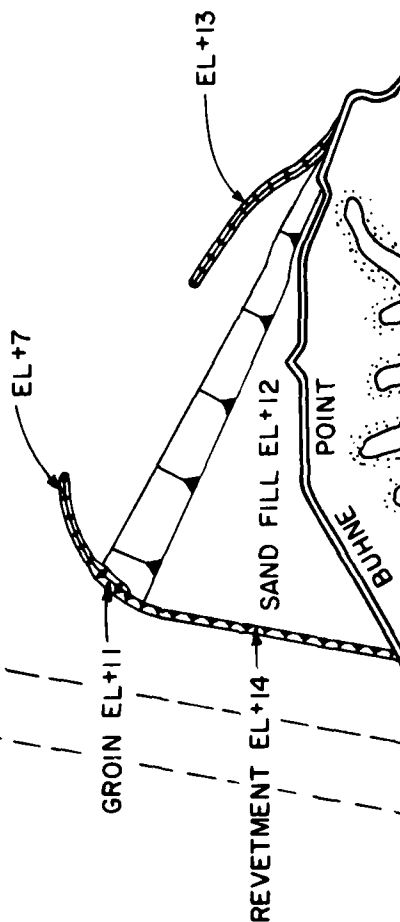
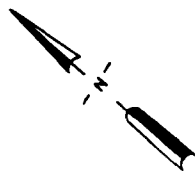
NOTE : CONTOURS AND ELEVATIONS SHOWN
IN FEET REFERRED TO MEAN LOWER
LOW WATER (MLLW)



ELEMENTS OF PLANS 4 AND 4A



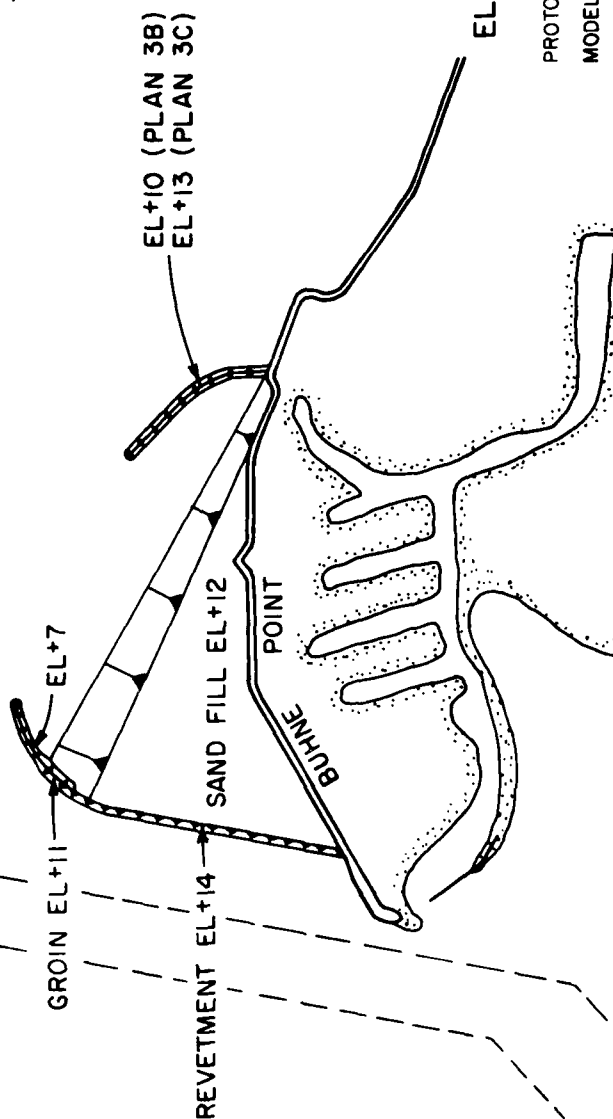
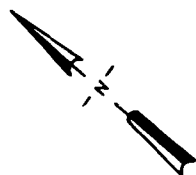
NOTE : CONTOURS AND ELEVATIONS SHOWN
IN FEET REFERRED TO MEAN LOWER
LOW WATER (MLLW)



ELEMENTS OF PLAN 3D



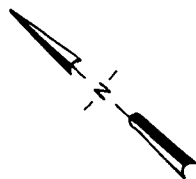
NOTE : CONTOURS AND ELEVATIONS SHOWN
IN FEET REFERRED TO MEAN LOWER
LOW WATER (MLLW)



ELEMENTS OF PLANS 3B AND 3C



NOTE : CONTOURS AND ELEVATIONS SHOWN
IN FEET REFERRED TO MEAN LOWER
LOW WATER (MLLW)



EL+7 (PLAN 3)
EL+10 (PLAN 3A)

EL+7

GROIN EL+11

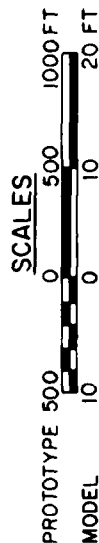
REVELTMENT EL+14

SAND FILL EL+12

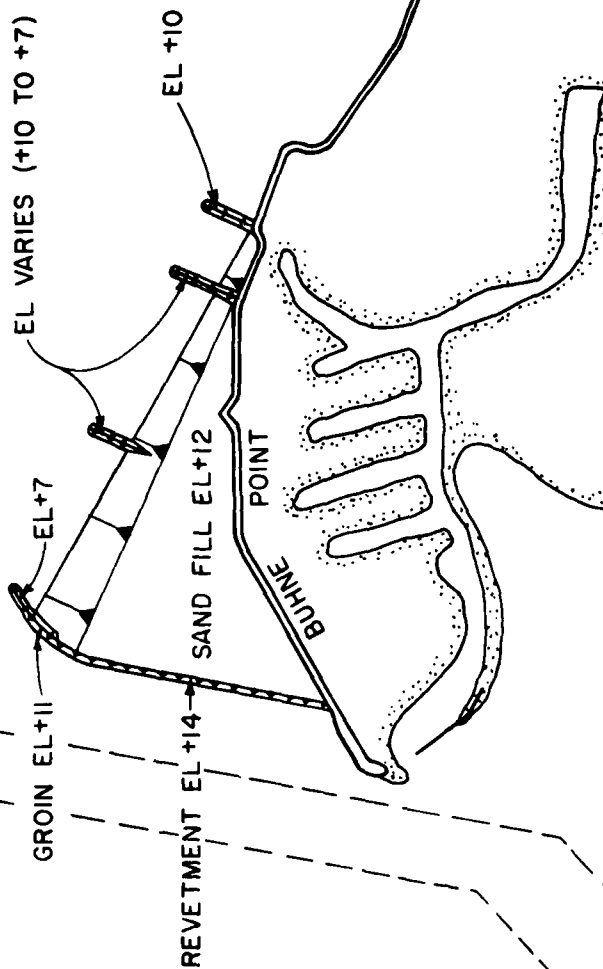
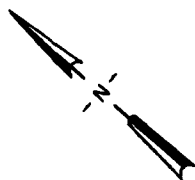
POINT

BUHNE

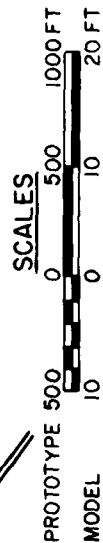
ELEMENTS OF PLANS 3 AND 3A



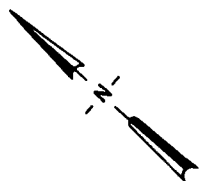
NOTE : CONTOURS AND ELEVATIONS SHOWN
IN FEET REFERRED TO MEAN LOWER
LOW WATER (MLLW)



ELEMENTS OF PLAN 2



NOTE : CONTOURS AND ELEVATIONS SHOWN
IN FEET REFERRED TO MEAN LOWER
LOW WATER (MLLW)



GROIN EL +11

SAND FILL EL +12

POINT

BUHNE

REKETMENT EL +14

ELEMENTS OF PLAN I



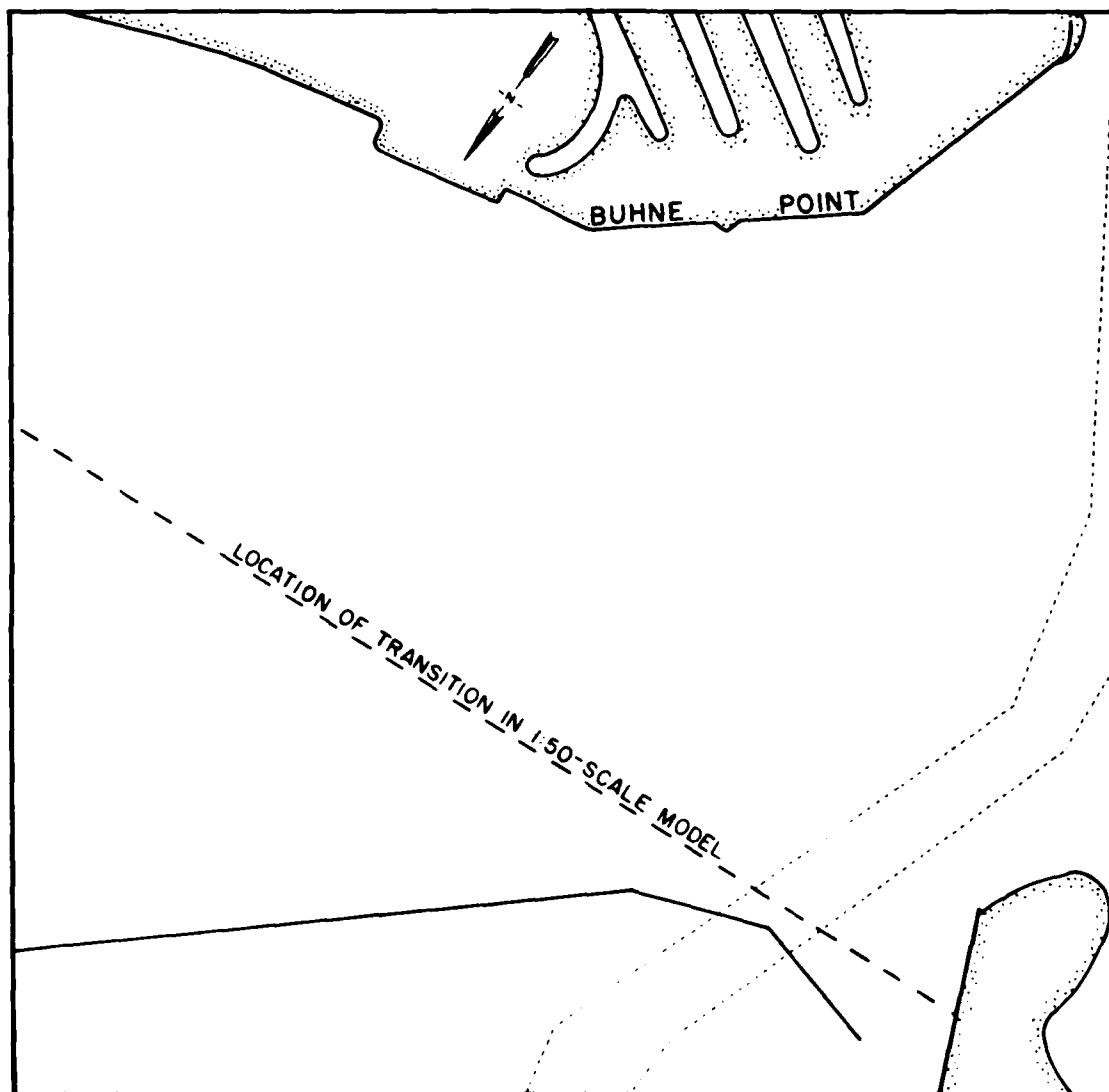
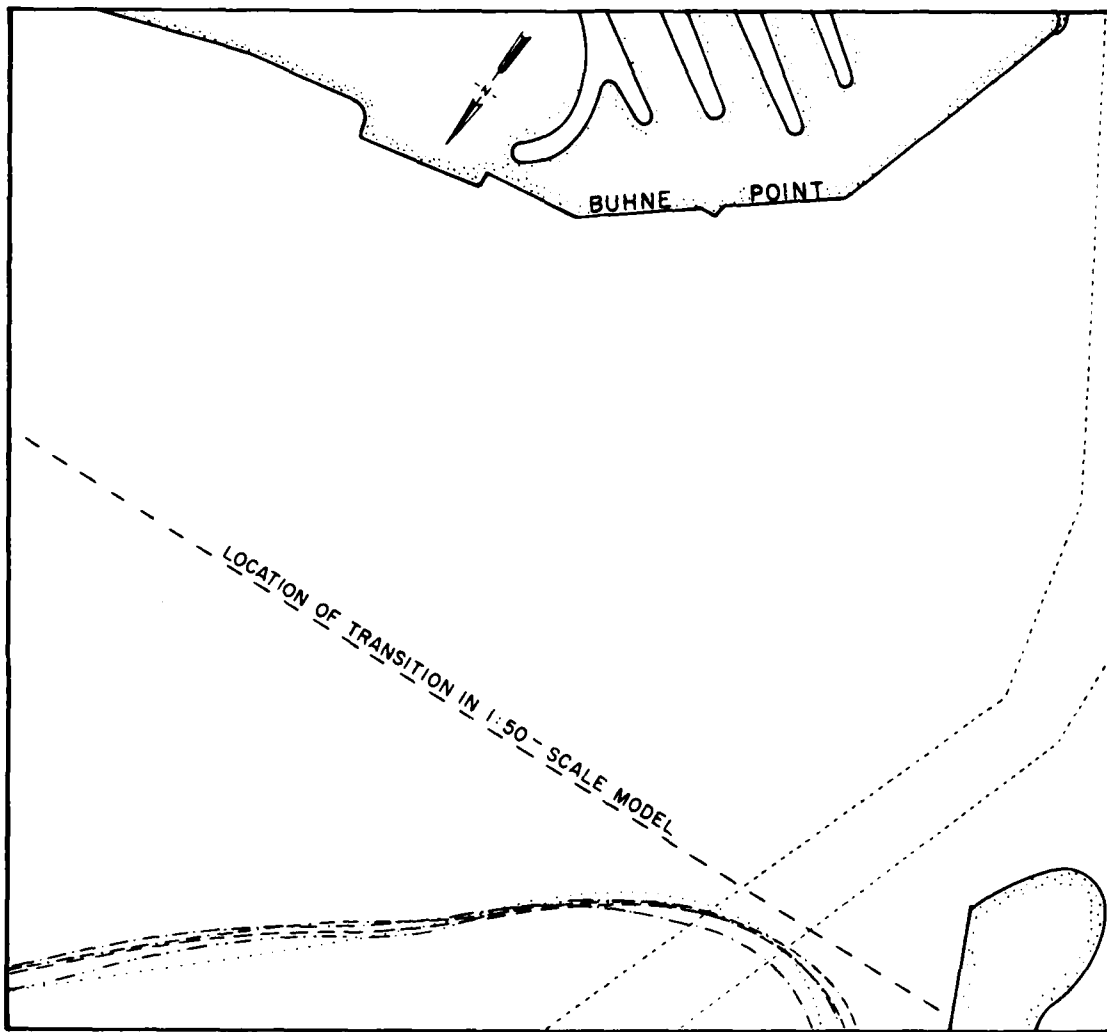


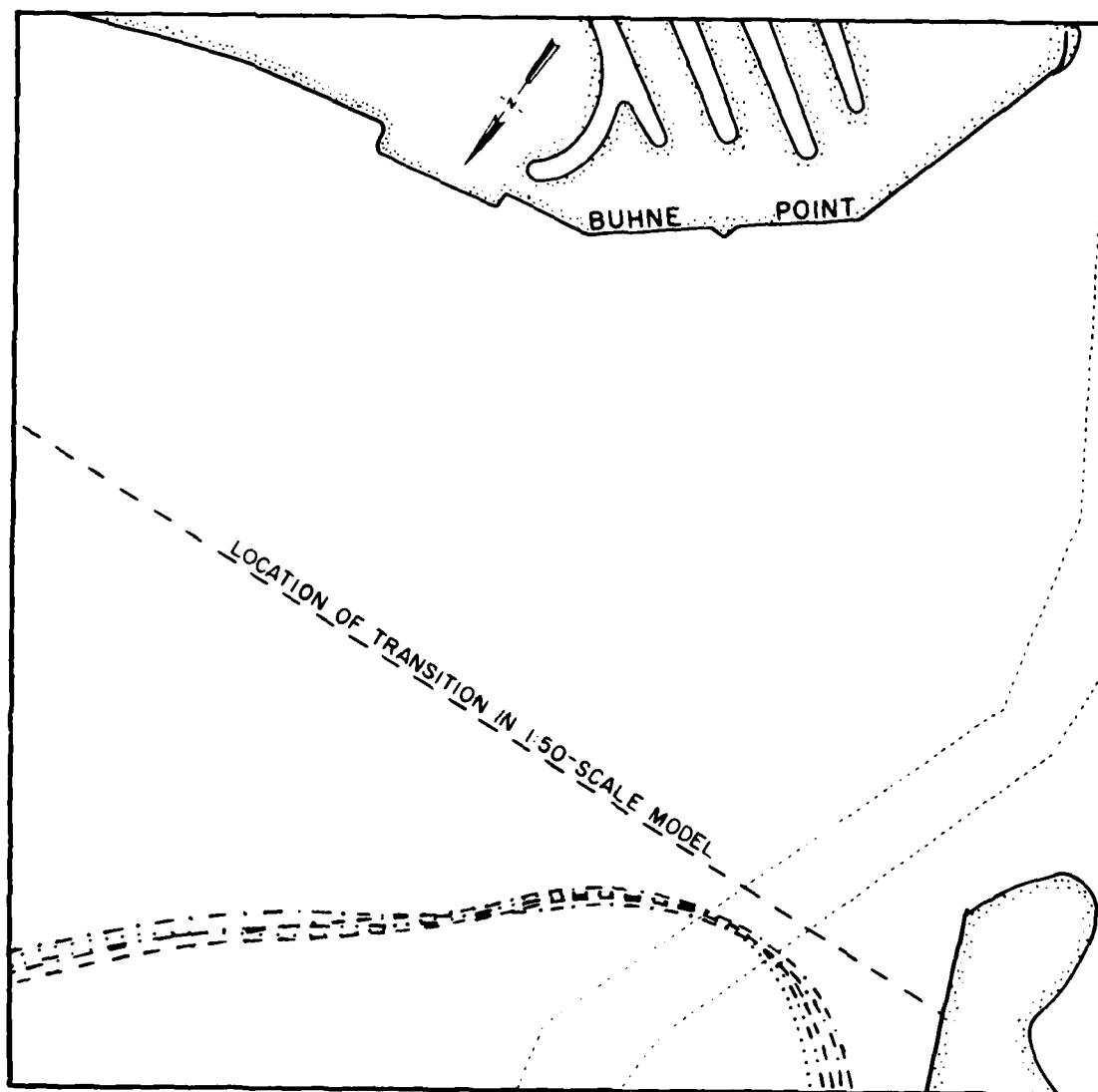
Plate 41. Wave generator angle (wave front) selected for use in the 1:50-scale model



LEGEND

- SWL 0.0 FT
- SWL +3.2 FT
- - - - - SWL +3.7 FT
- . - . - SWL +6.7 FT
- SWL +9.5 FT

Plate 40. Averages of wave fronts approaching Buhne Point from west for various swl's



LEGEND

- SWL 0.0 FT
- SWL +3.2 FT
- SWL +3.7 FT
- SWL +6.7 FT
- SWL +9.5 FT

Plate 39. Averages of wave fronts approaching Buhne Point from northwest for various swl's

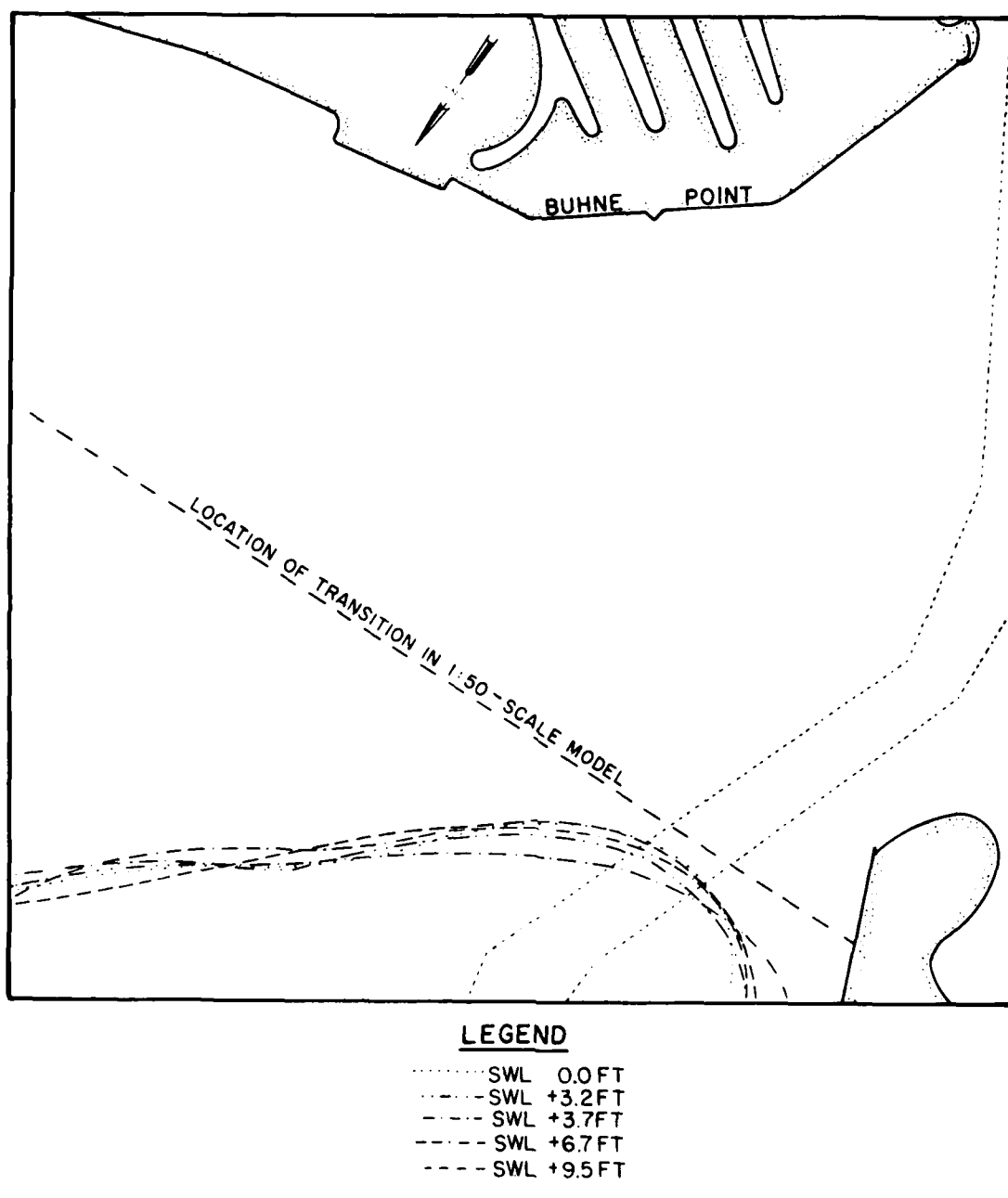


Plate 38. Averages of wave fronts approaching Buhne Point from north for various swl's

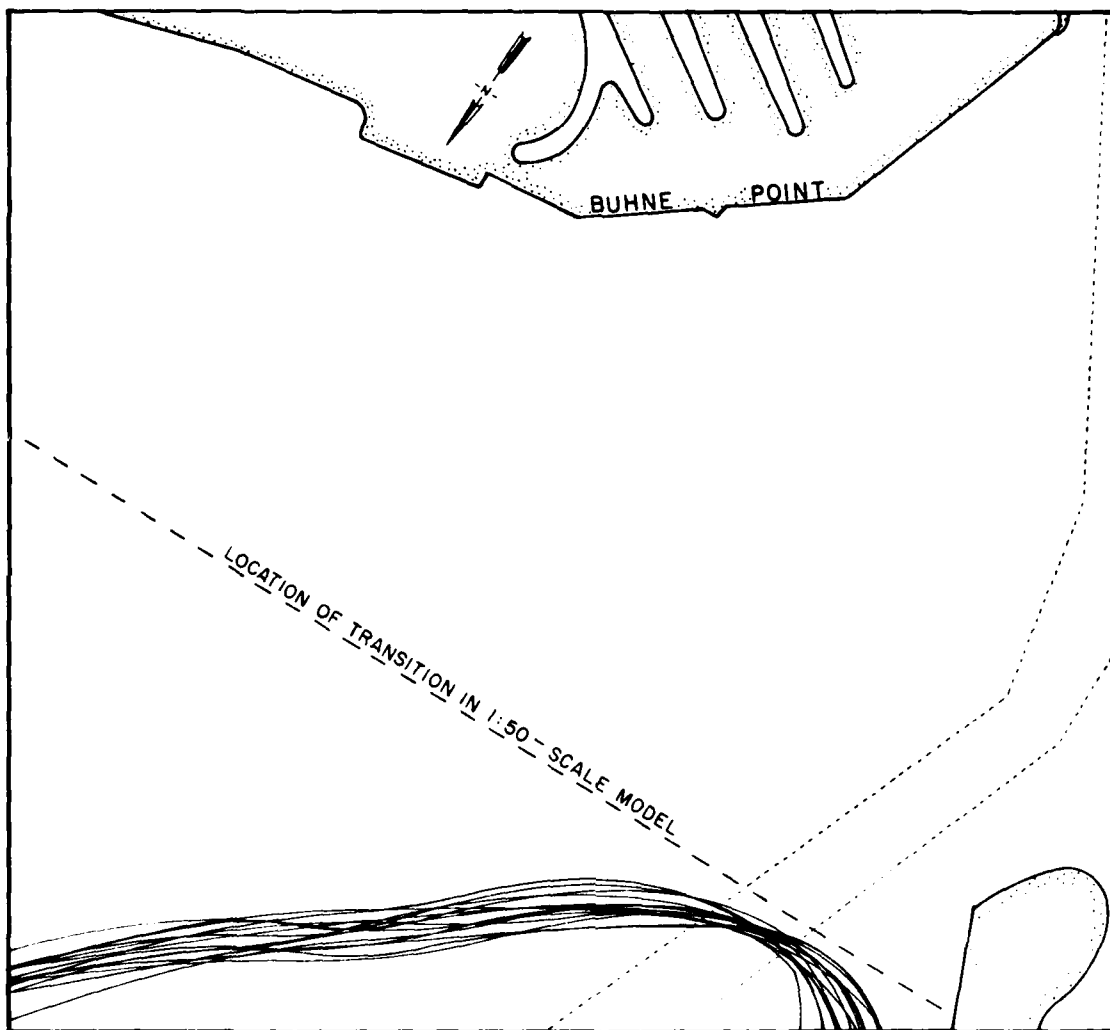


Plate 37. Wave fronts for test waves approaching Buhne Point from west; +9.5 ft swl

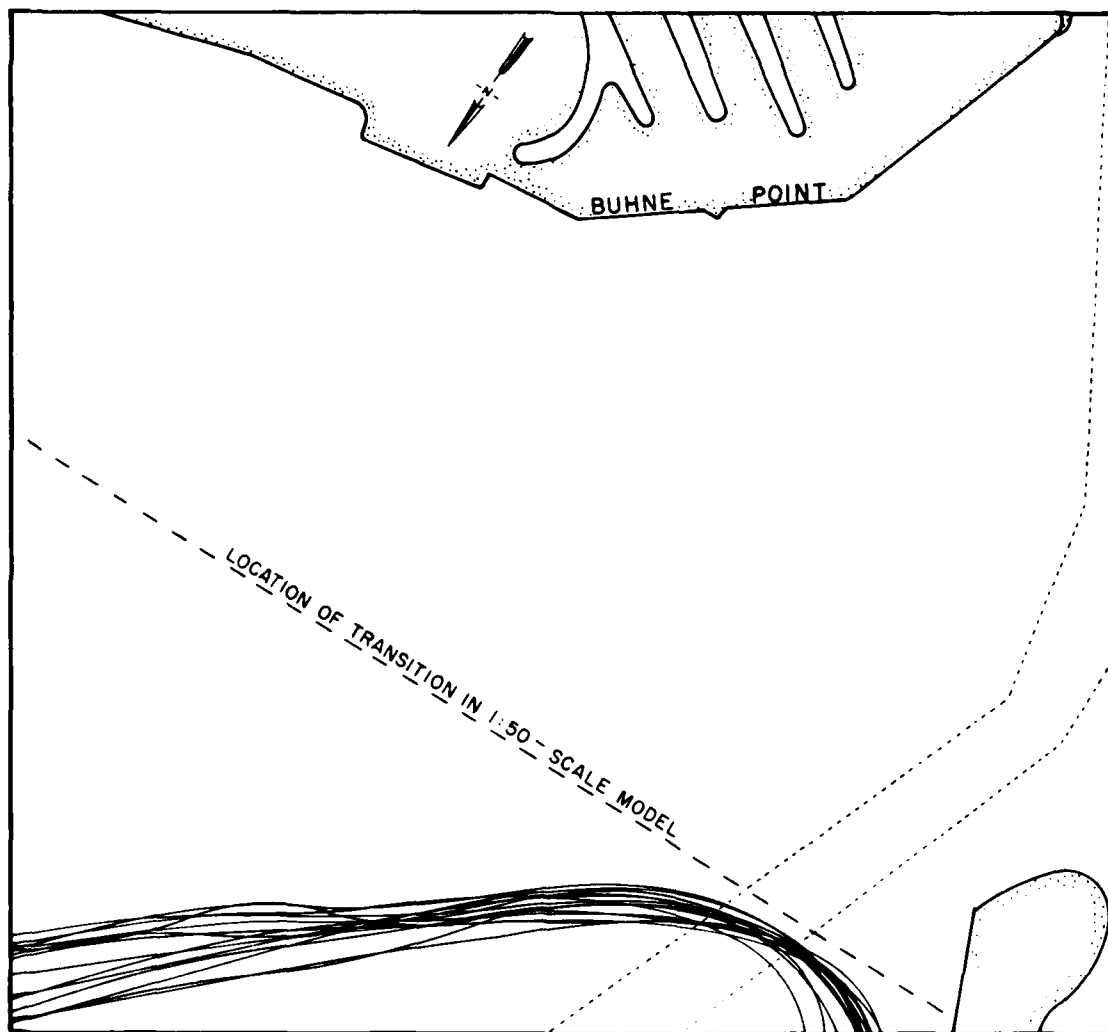
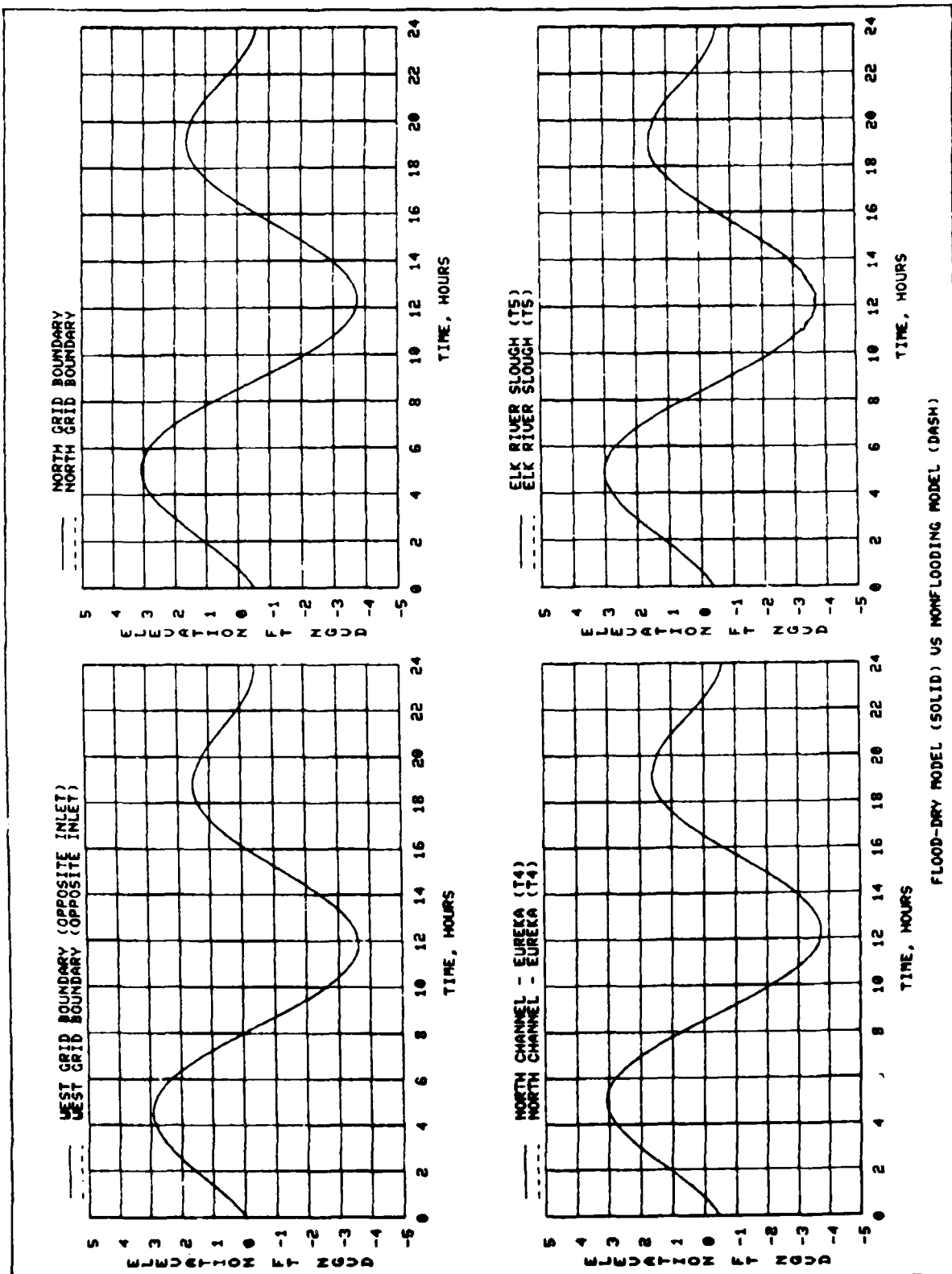
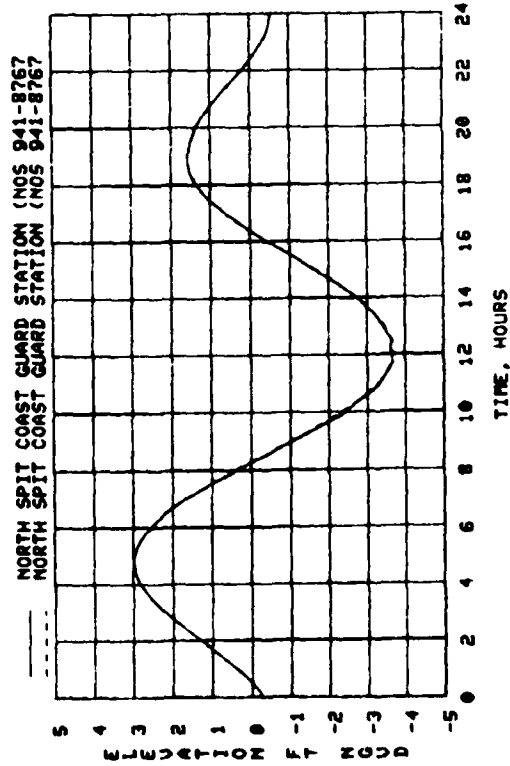
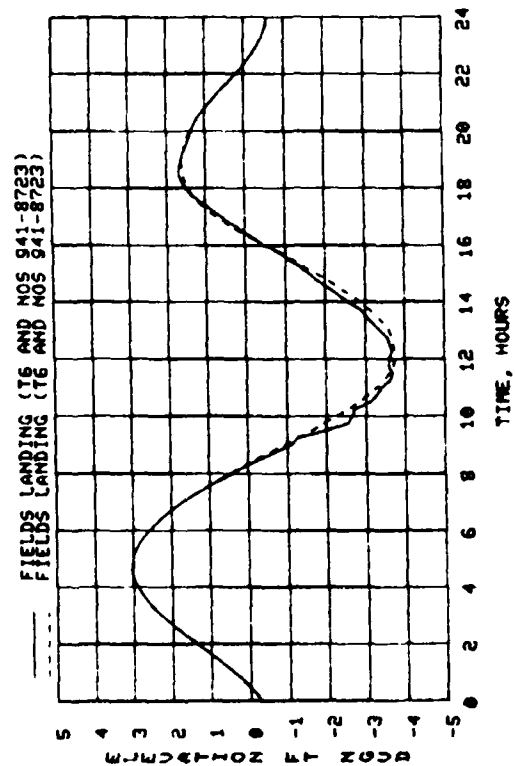
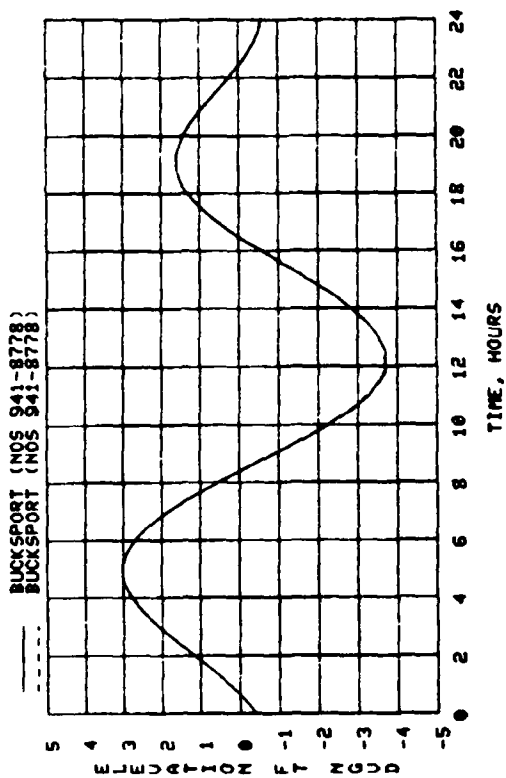
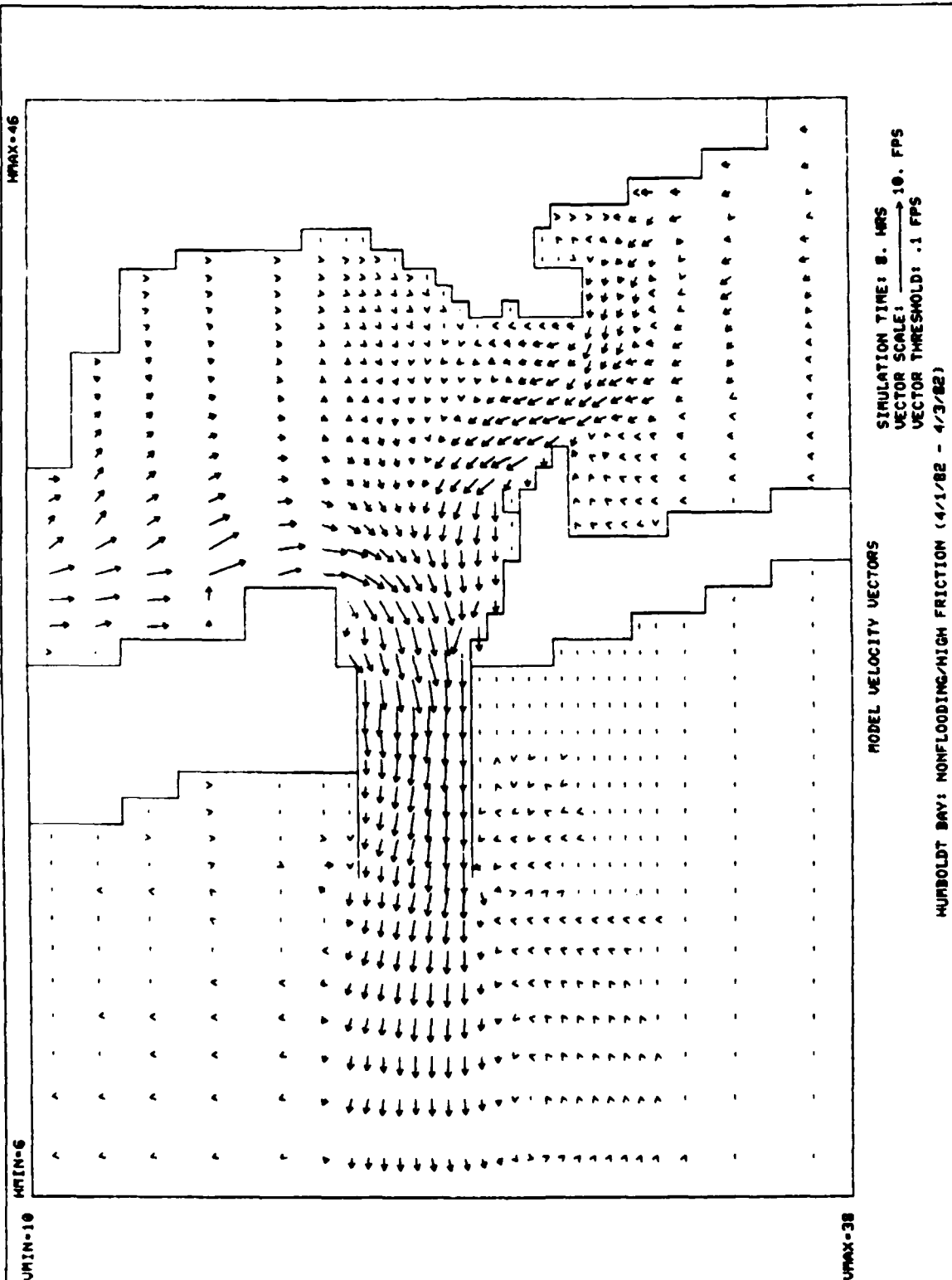


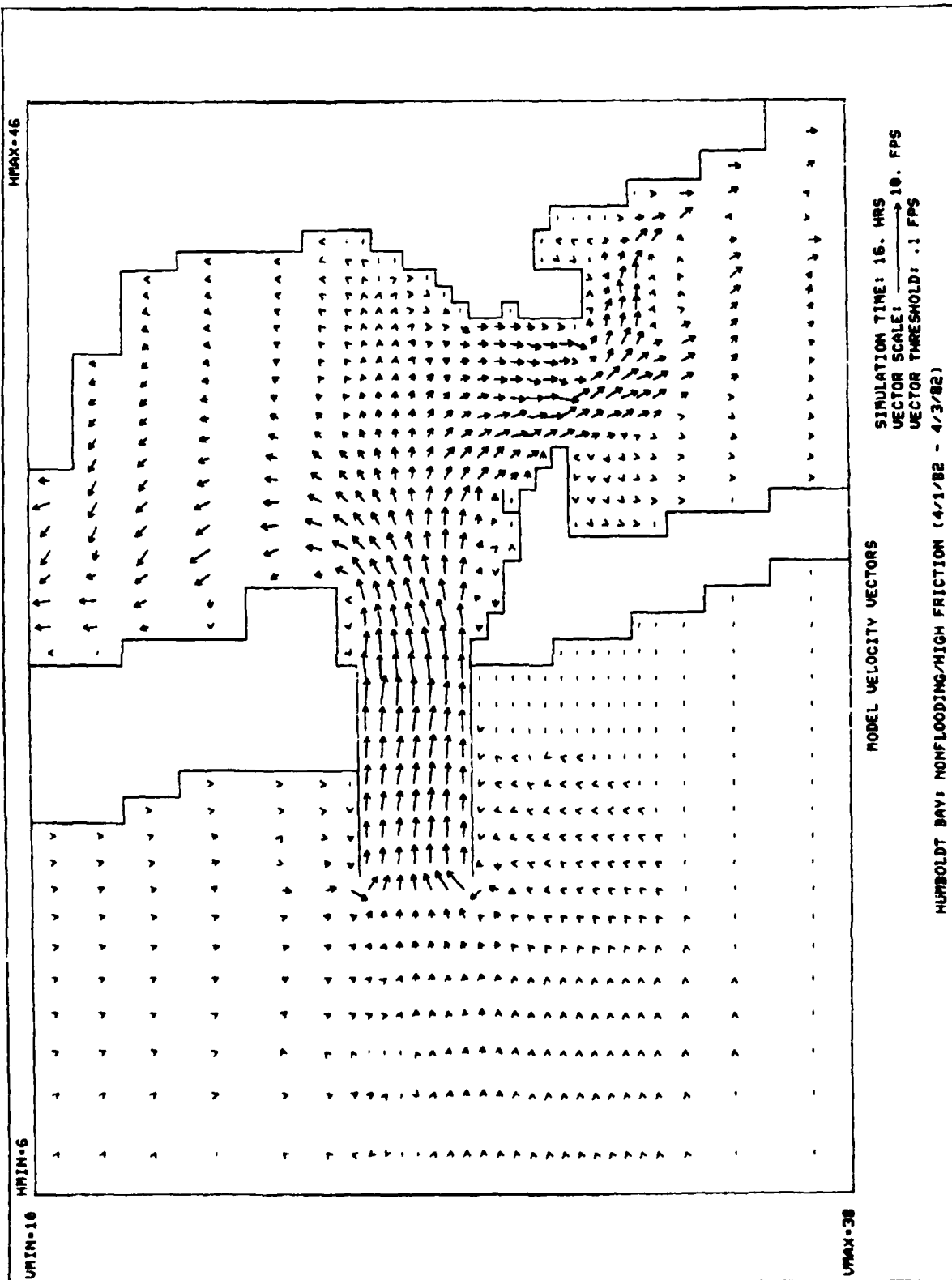
Plate 36. Wave fronts for test waves approaching Buhne Point from west; +6.7 ft swl



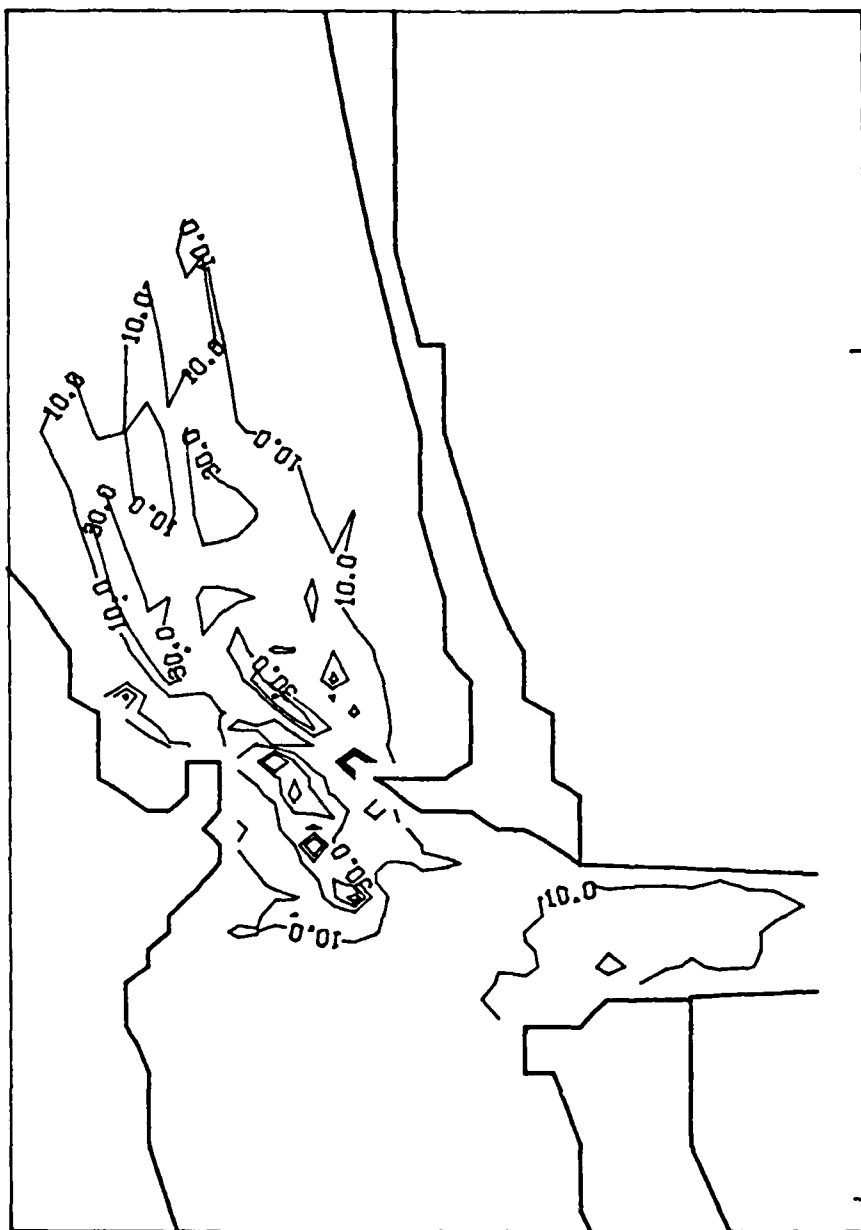


FLOOD-DRY MODEL (SOLID) VS NONFLOODING MODEL (DASH)





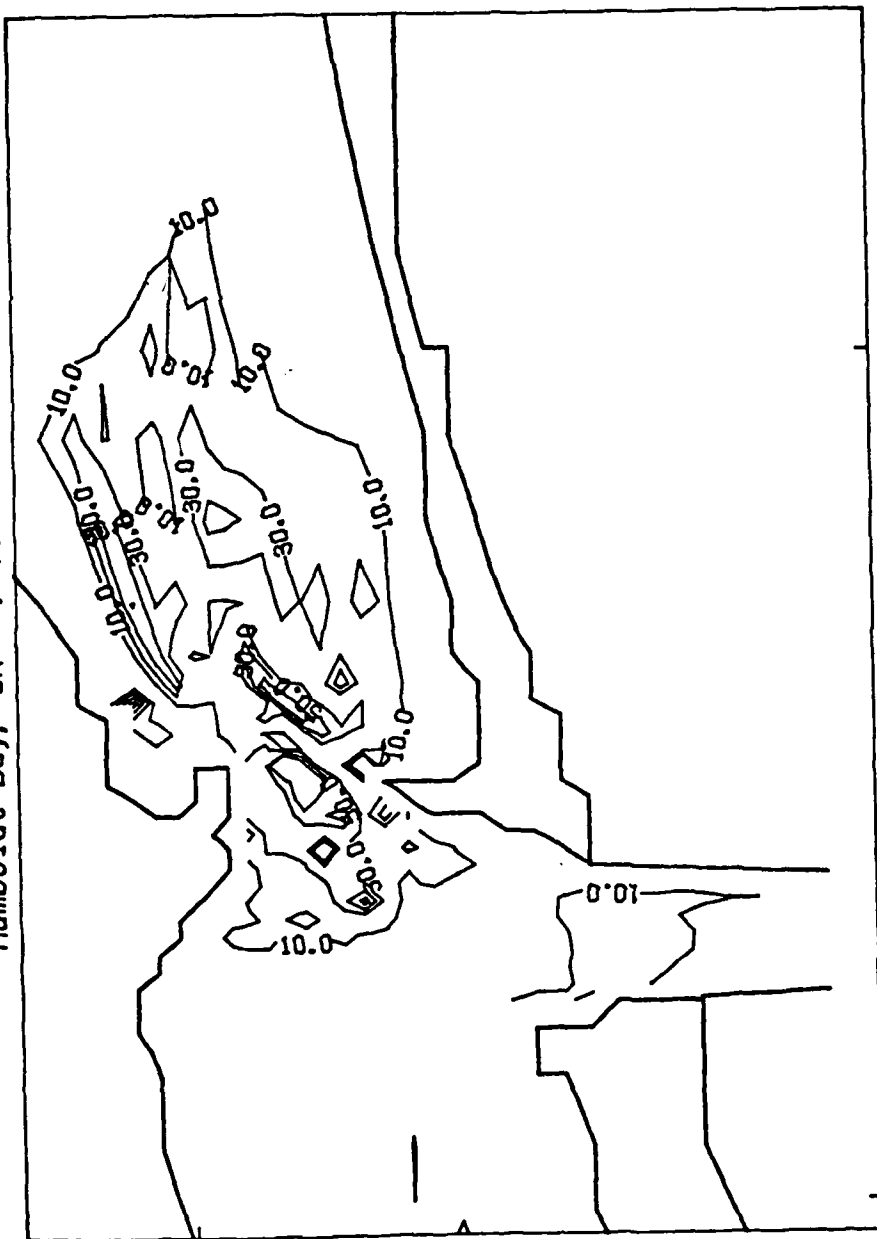
Humboldt Bay, CA : Time 8.0 Hours



4 Contours
Contour Levels from 10. to 70.
Contour Interval of 20.

Plate 54. Bottom stress contours (dyne/cm²) within Humboldt Bay at ebb tide:
existing conditions

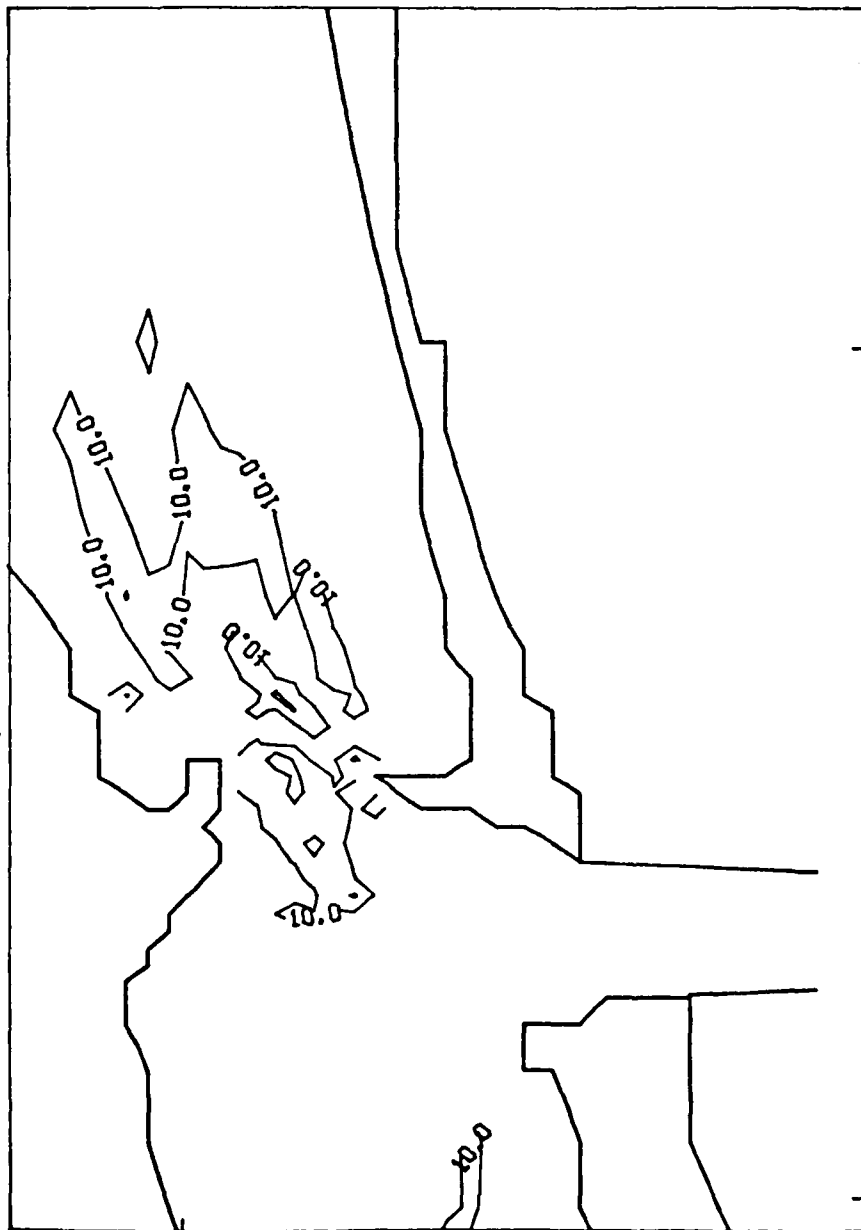
Humboldt Bay, CA : Time 16.0 Hours



4 Contours
Contour Levels from 10. to 70.
Contour Interval of 20.

Plate 55. Bottom stress contours (dyne/cm²) within Humboldt Bay at flood tide:
existing conditions

Humboldt Bay, CA : Time 24.0 Hours



4 Contours
Contour Levels from 10. to 70.
Contour Interval of 20.

Plate 56. Bottom stress contours (dyne/cm²) within Humboldt Bay at slack water:
existing conditions

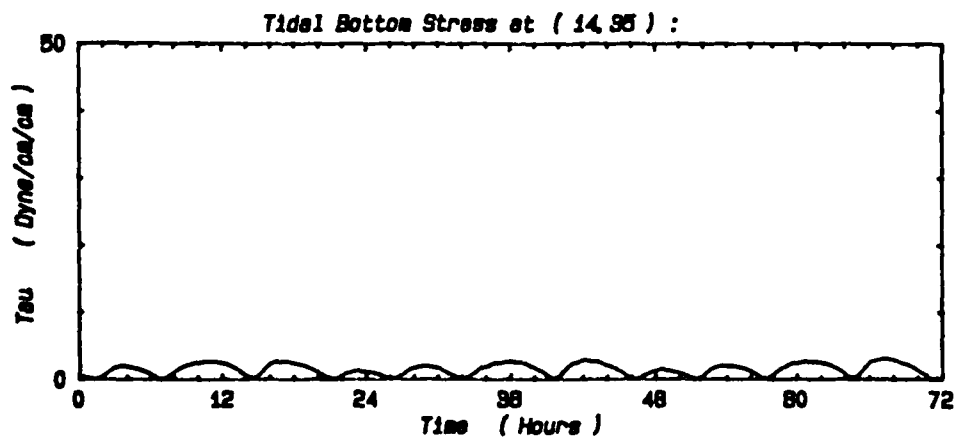
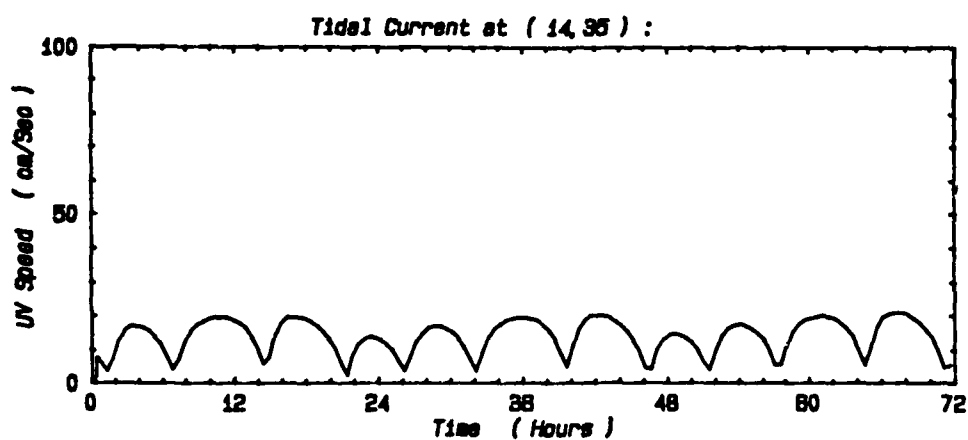
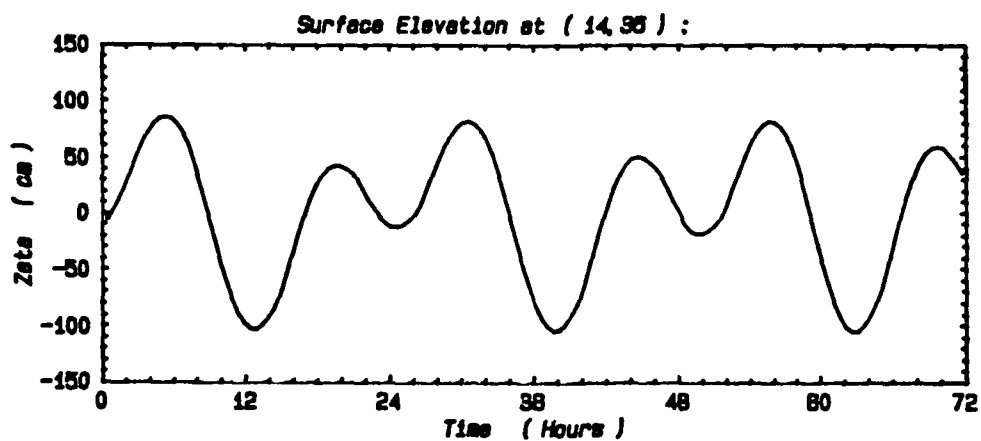


Plate 57. CELC3D computations of surface elevation, tidal currents, and bottom stresses at sta 1 (opposite north spit), 1-3 April 1982

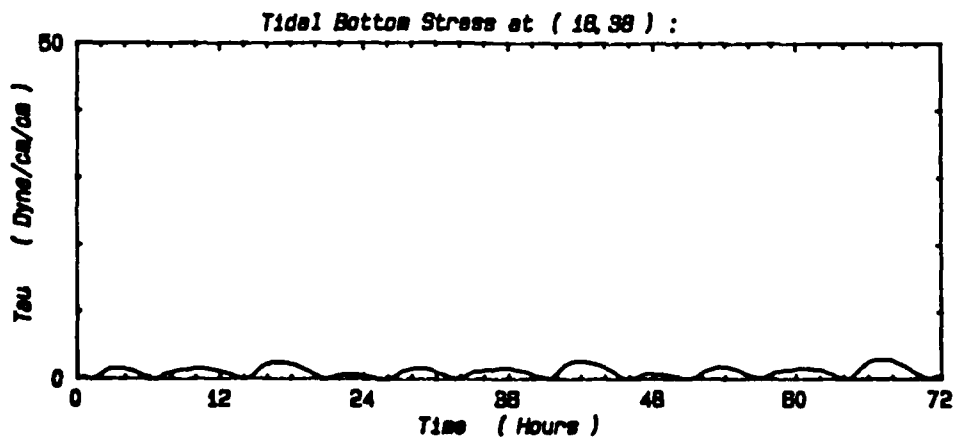
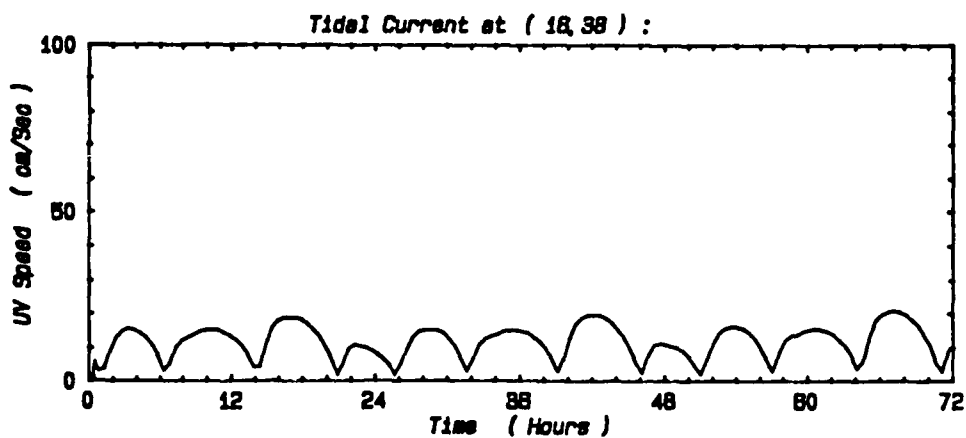
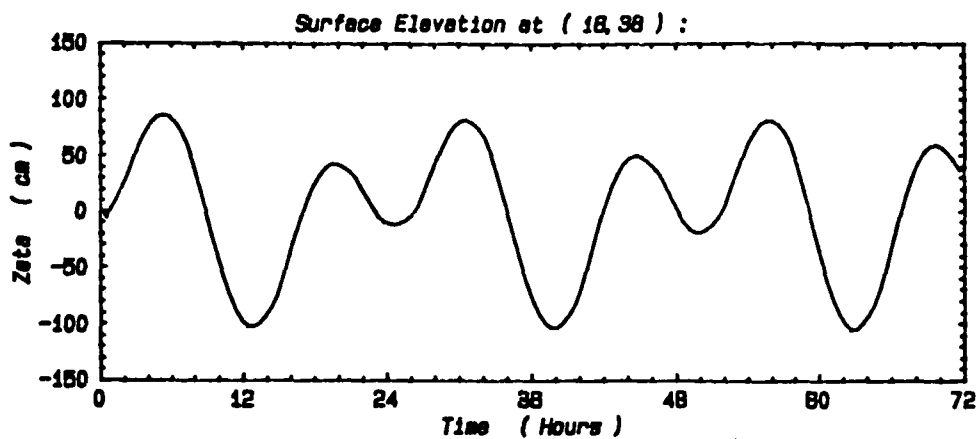


Plate 58. CELC3D computations of surface elevation, tidal currents, and bottom stresses at sta 4 (north of Buhne Point), 1-3 April 1982

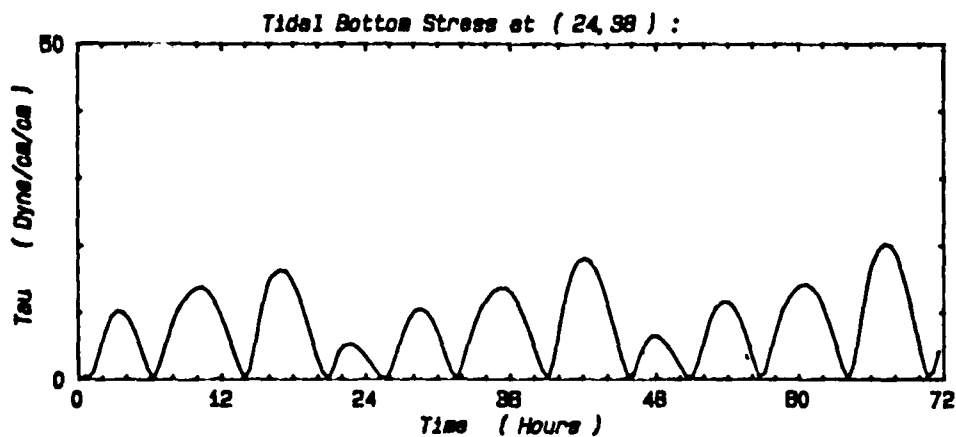
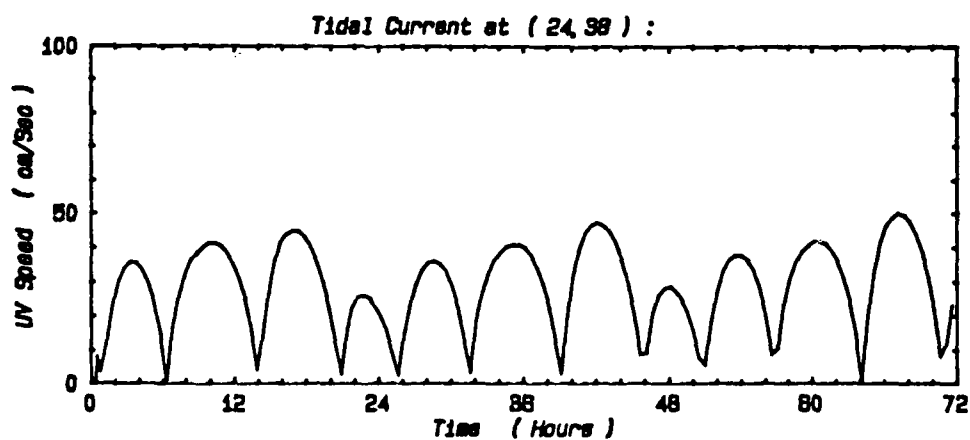
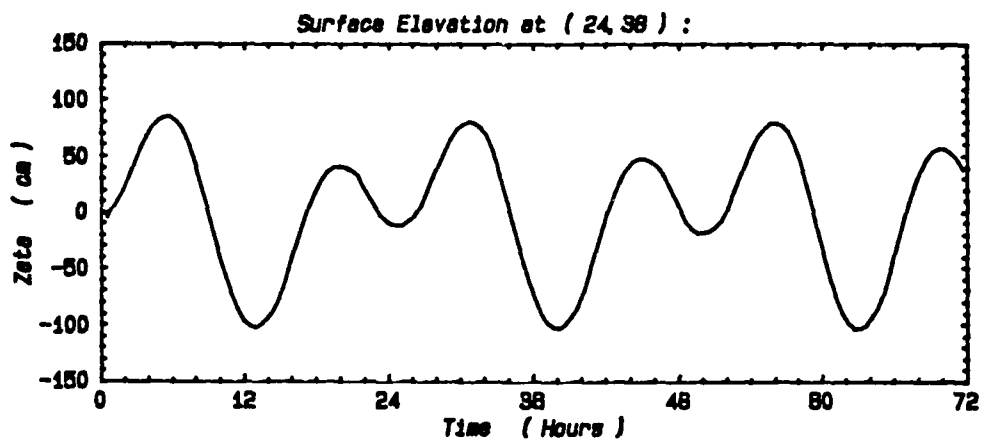


Plate 59. CELC3D computations of surface elevation, tidal currents, and bottom stresses at sta 11 (near Buhne Point), 1-3 April 1982

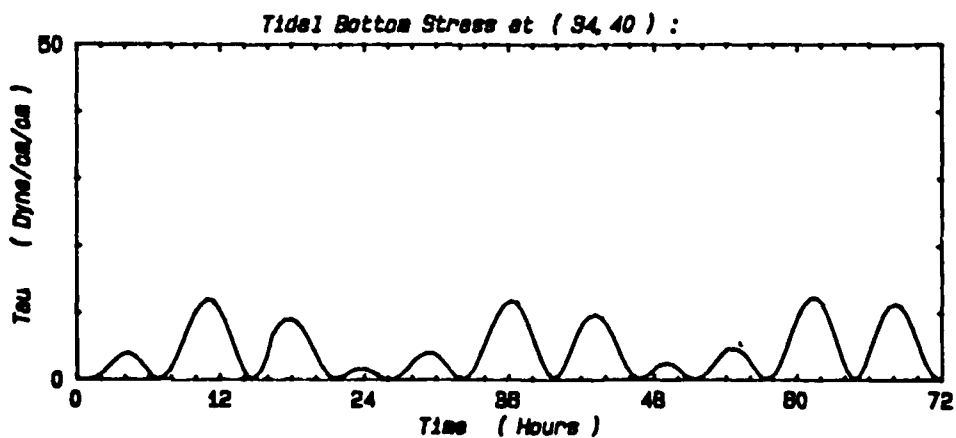
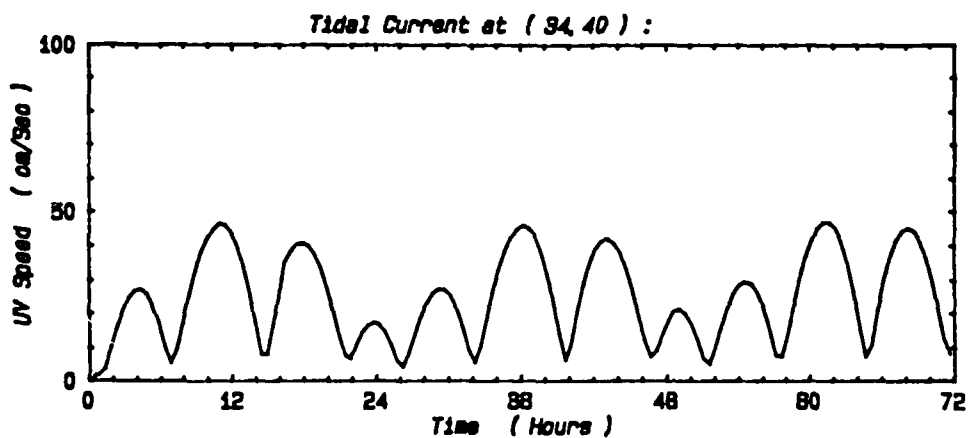
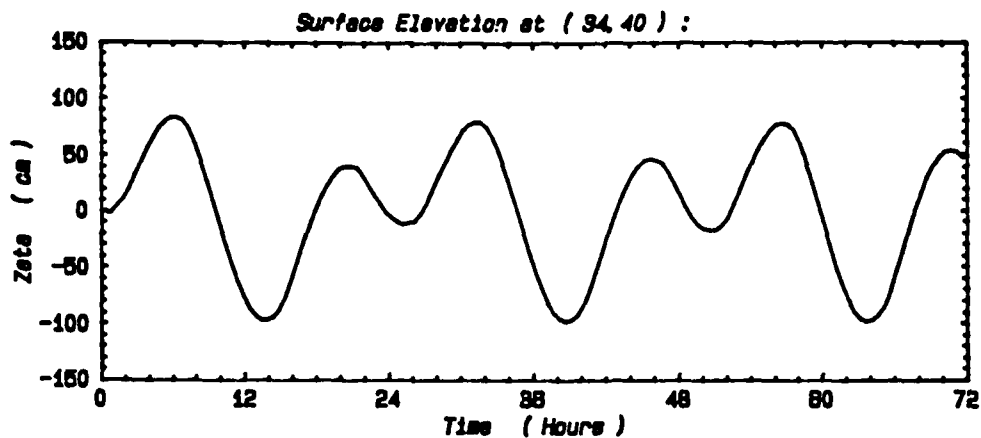


Plate 60. CELC3D computations of surface elevation, tidal currents, and bottom stresses at sta 13 (Fields Landing Channel), 1-3 April 1982

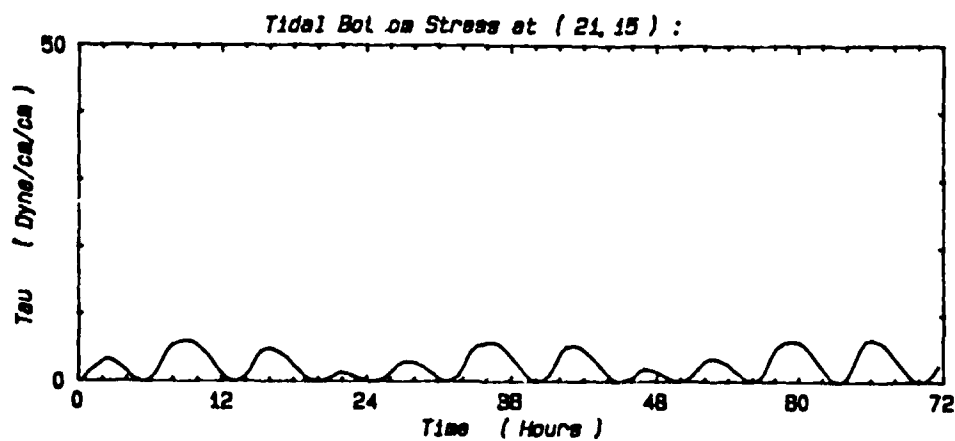
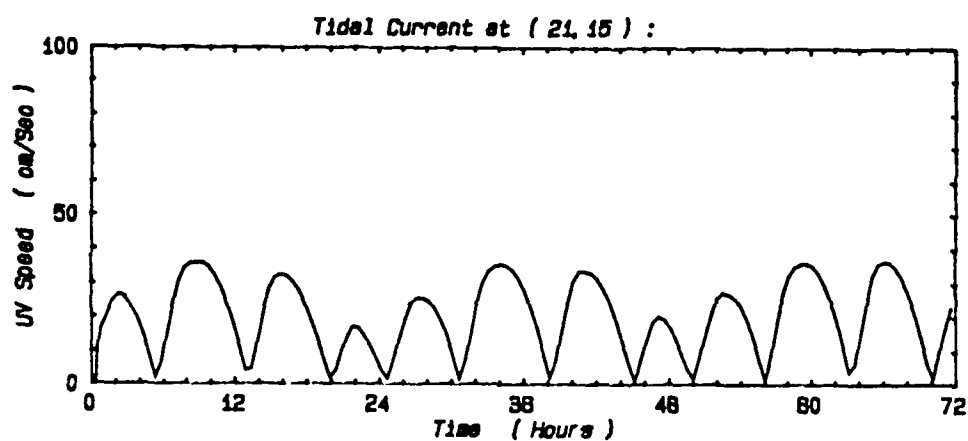
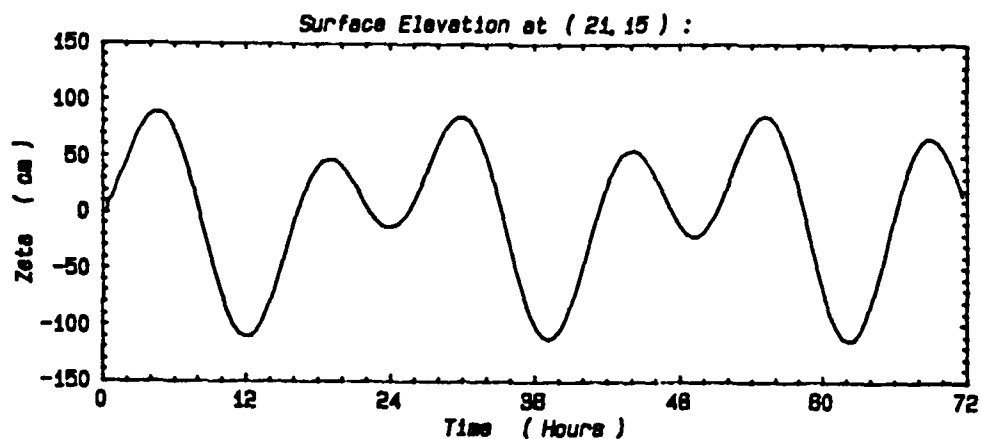
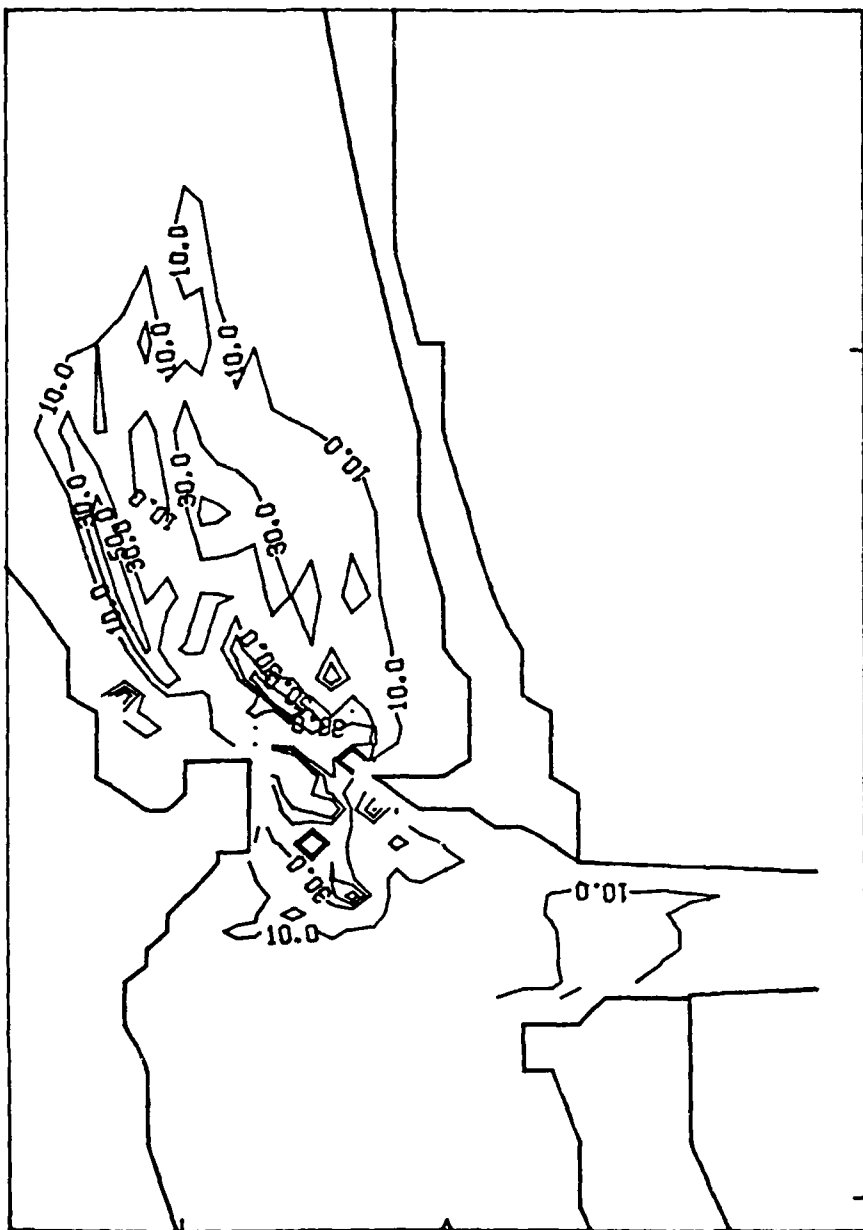


Plate 61. CELC3D computations of surface elevation, tidal currents, and bottom stresses at sta 16 (Humboldt Bay Entrance), 1-3 April 1982

The map shows the coastline of the Gulf of Mexico, with the study site located in the central part of the Gulf. The map includes latitude and longitude coordinates and a scale bar.

4 Contours
Contour Levels from 10. to 70.
Contour Interval of 20.

Plate 62. Bottom stress contours (dyne/cm^2) within Humboldt Bay at ebb tide:
proposed improvement plan



4 Contours
 Contour Levels from 10. to 70.
 Contour Interval of 20.

Plate 63. Bottom stress contours (dyne/cm²) within Humboldt Bay at flood tide:
 proposed improvement plan

AD-A152 327

BUHNE POINT HUMBOLDT BAY CALIFORNIA DESIGN FOR THE
PREVENTION OF SHORELIN. (U) COASTAL ENGINEERING
RESEARCH CENTER VICKSBURG MS R R BOTTIN ET AL. NOV 84
CERC-84-5 F/G 13/2

4/4

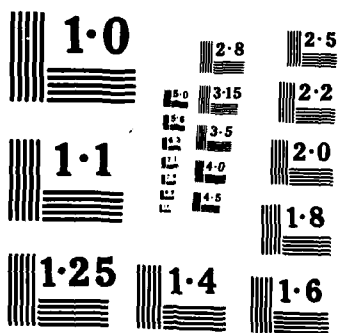
UNCLASSIFIED

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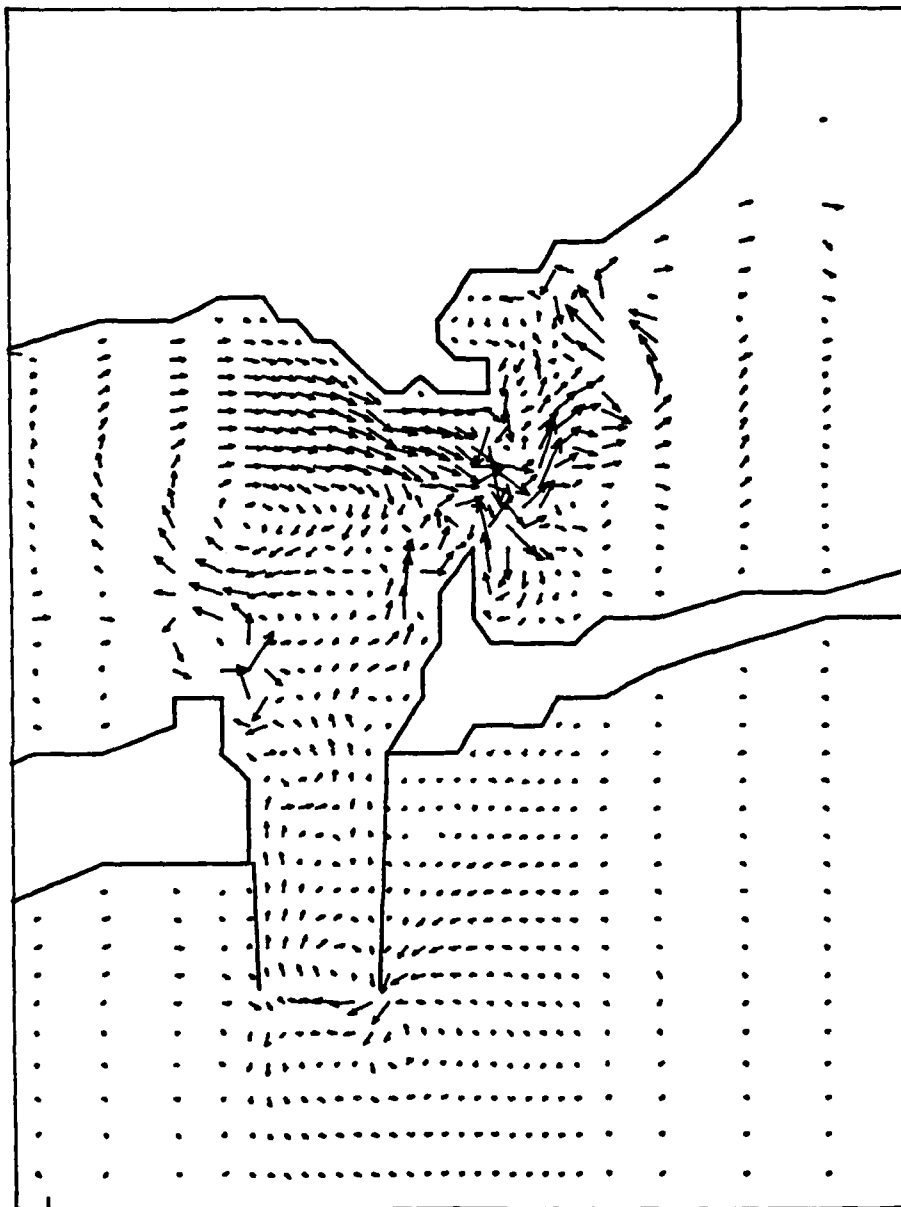
DTIC



A map of Lake Michigan with depth contours labeled "10.0". The contours are shown as solid black lines. There are several diamond-shaped symbols scattered across the lake area. The shoreline is depicted by a jagged line. The map is oriented horizontally, with North at the top.

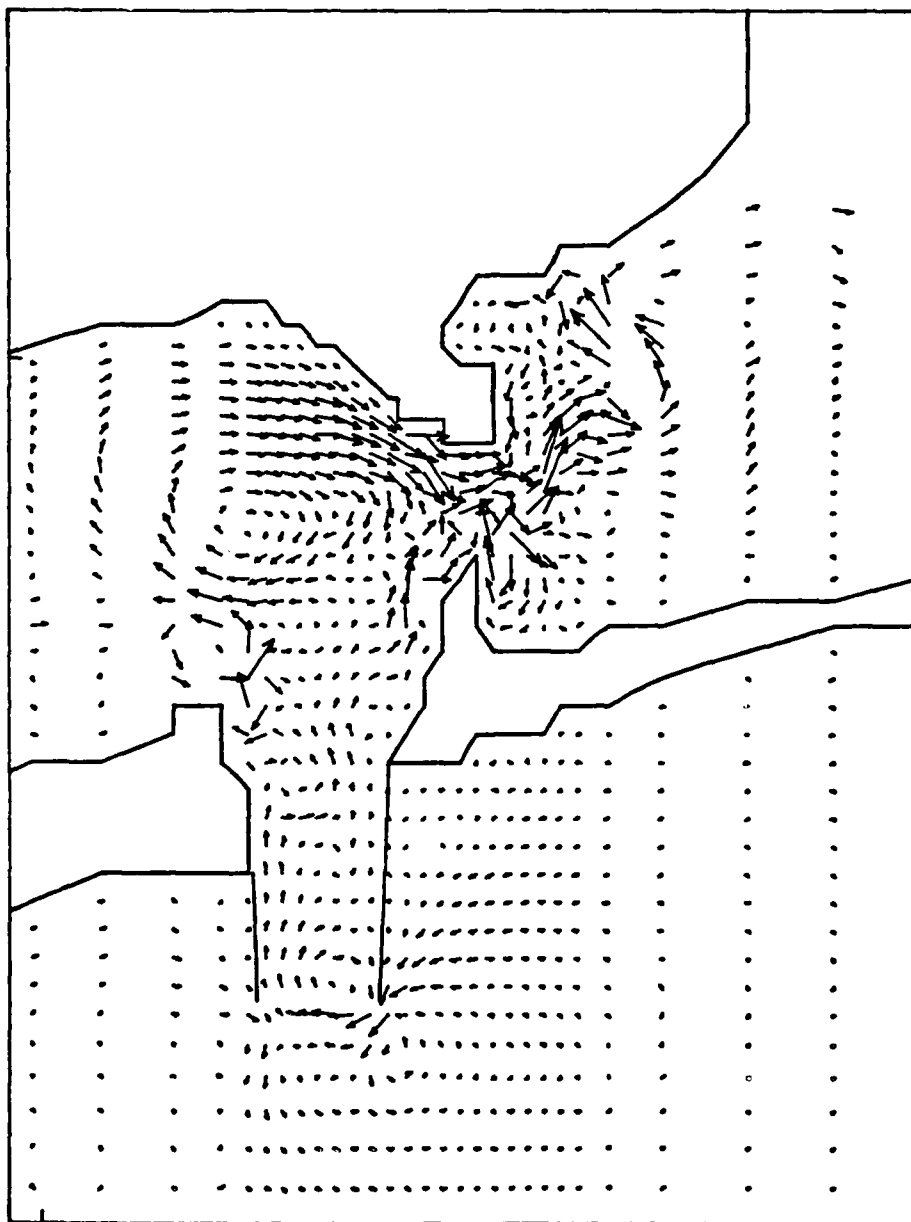
4 Contours
Contour Levels from 10. to 70.
Contour Interval of 20.

Plate 64. Bottom stress contours (dyne/cm²) within Humboldt Bay at slack water: proposed improvement plan



$7.54E+00$ CM/SEC
 $\rightarrow$
 Maximum Vector

Plate 65. Tidally induced residual currents within
 Humboldt Bay, 1-3 April 1982, existing conditions

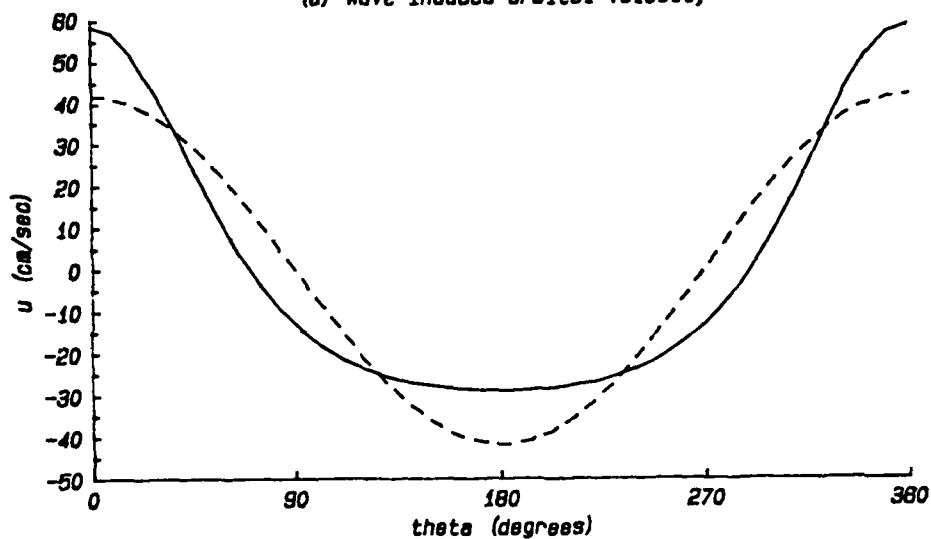


7.40E+00 CM/SEC
→
Maximum Vector

Plate 66. Tidally induced residual currents within Humboldt Bay, 1-3 April 1982, proposed improvement plan

Station 01 (Depth = 3.87 m)

(a) Wave-Induced Orbital Velocity



(b) Wave-Induced Bottom Stress

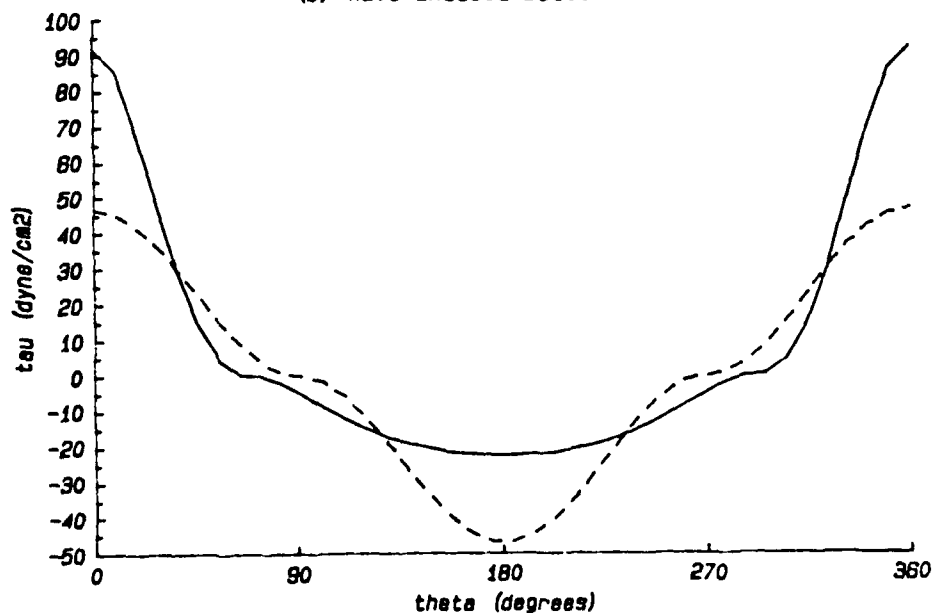
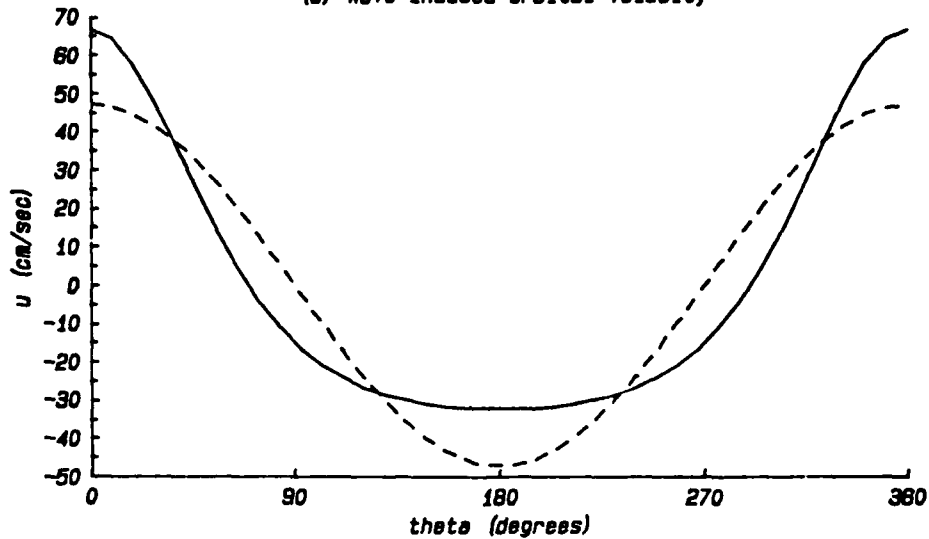


Plate 67. Wave-induced bottom orbital velocity and bottom stress at sta 1; 11-sec, 10-ft waves from the northwest; maximum flood; +3.2 ft swl; cnoidal wave theory (solid lines) and linear wave theory (dashed lines)

Station 04 (Depth = 4.11 m)

(a) Wave-Induced Orbital Velocity



(b) Wave-Induced Bottom Stress

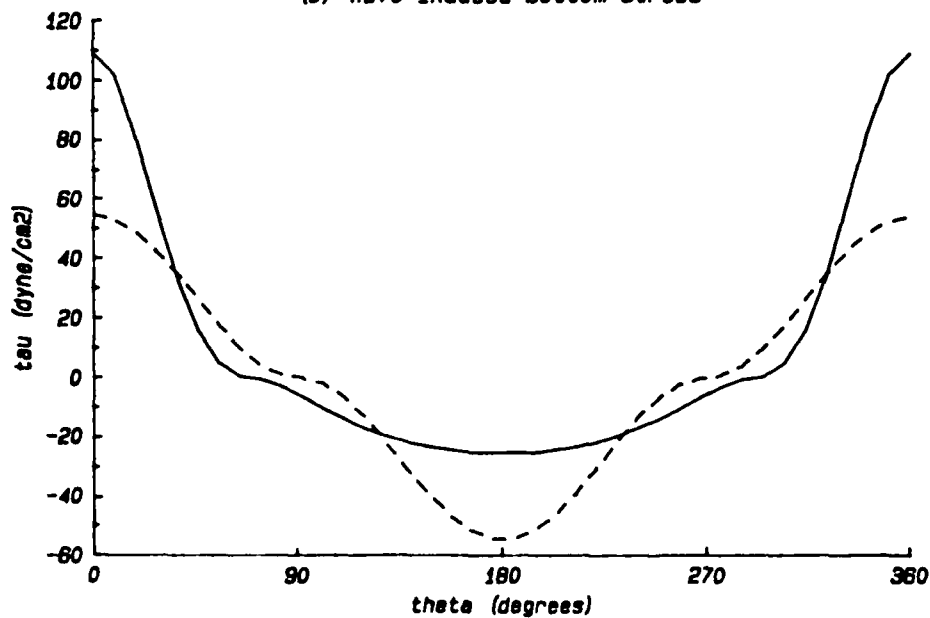
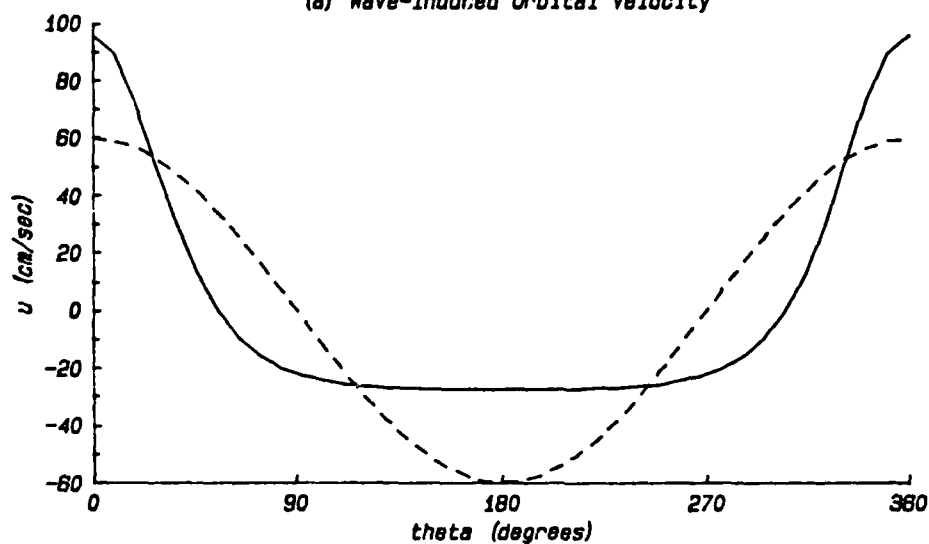


Plate 68. Wave-induced bottom orbital velocity and bottom stress at sta 4; 11-sec, 10-ft waves from the northwest; maximum flood; +3.2 ft swl; cnoidal wave theory (solid lines) and linear wave theory (dashed lines)

Station 11 (Depth = 2.65 m)

(a) Wave-Induced Orbital Velocity



(b) Wave-Induced Bottom Stress

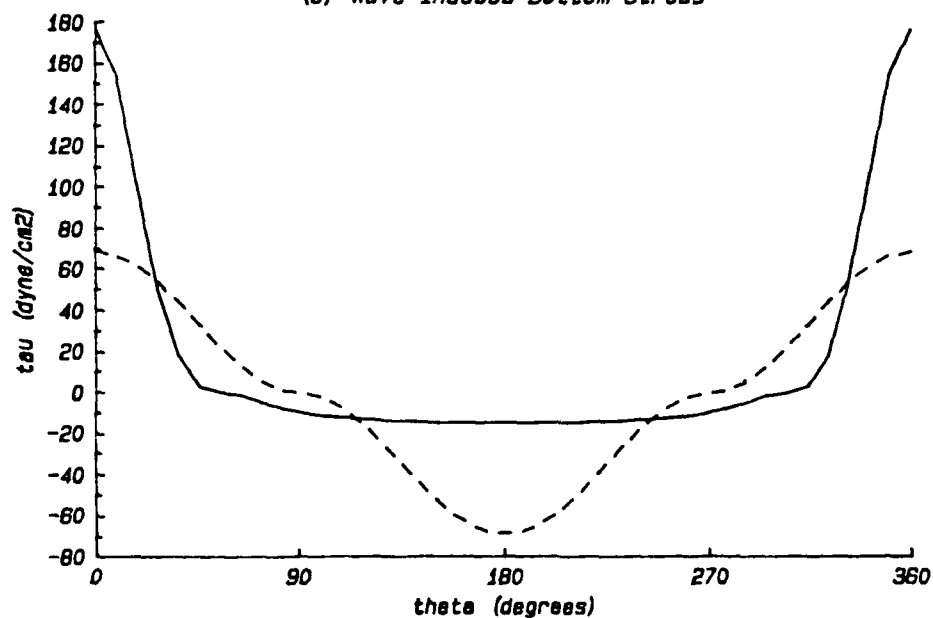
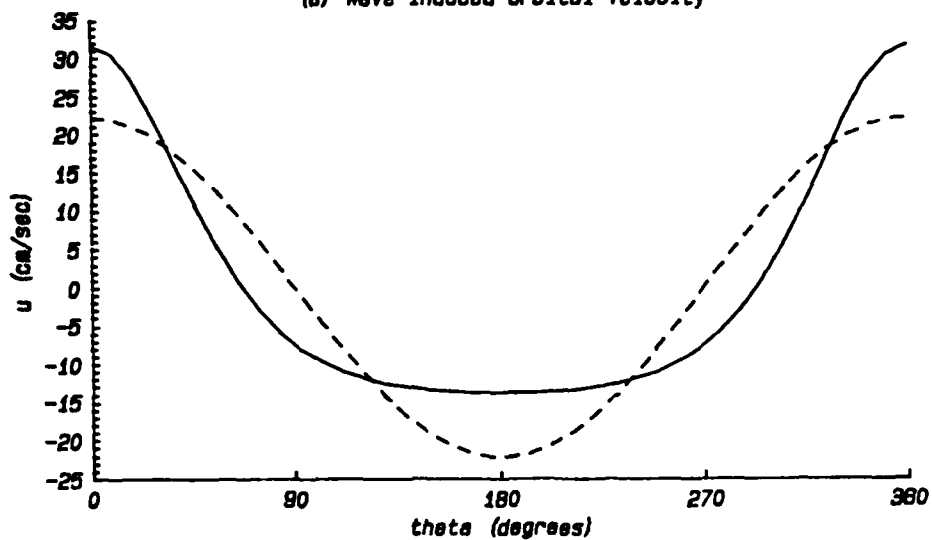


Plate 69. Wave-induced bottom orbital velocity and bottom stress at sta 11; 11-sec, 10-ft waves from the northwest; maximum flood; +3.2 ft swl; cnoidal wave theory (solid lines) and linear wave theory (dashed lines)

Station 12 (Depth = 2.16 m)

(a) Wave-Induced Orbital Velocity



(b) Wave-Induced Bottom Stress

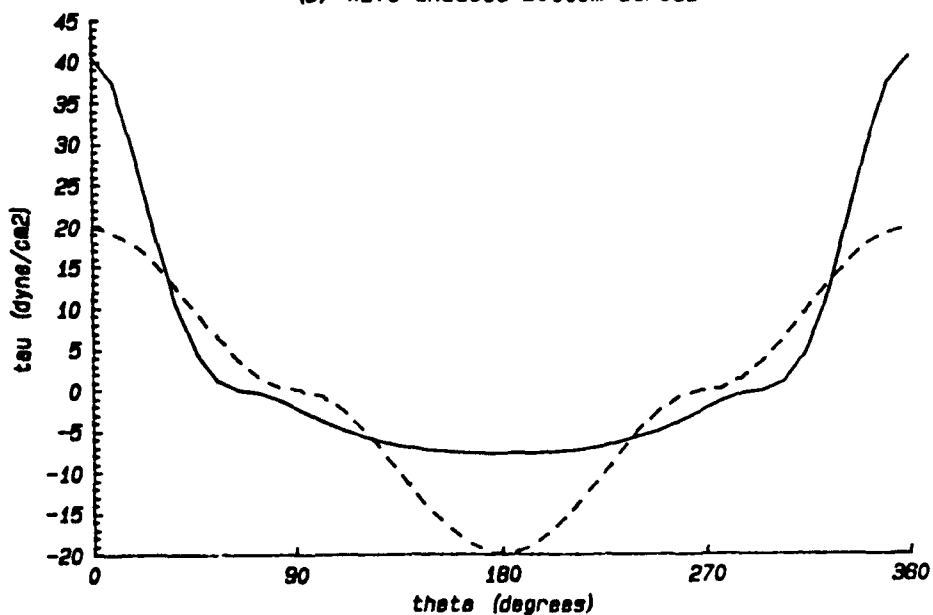
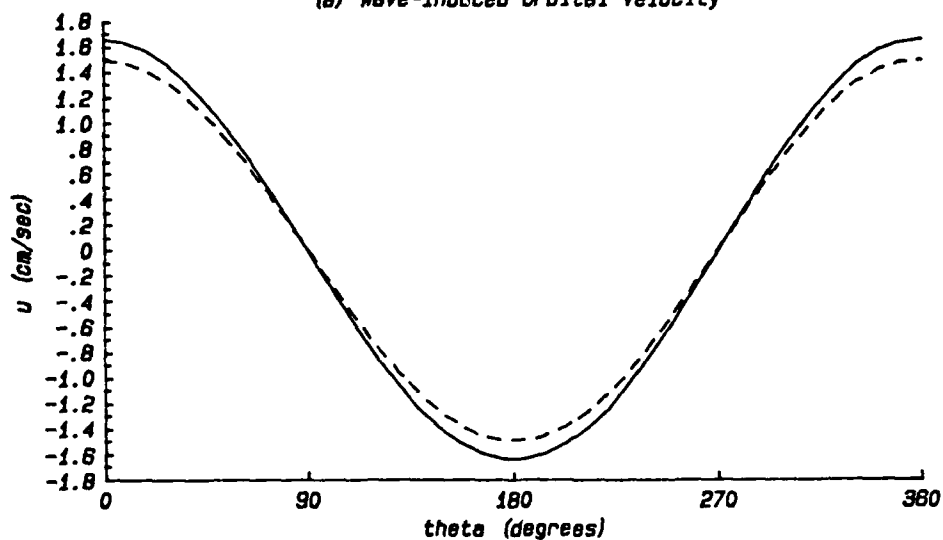


Plate 70. Wave-induced bottom orbital velocity and bottom stress at sta 12; 11-sec, 10-ft waves from the northwest; maximum flood; +3.2 ft swl; cnoidal wave theory (solid lines) and linear wave theory (dashed lines)

Station 13 (Depth = 8.38 m)

(a) Wave-Induced Orbital Velocity



(b) Wave-Induced Bottom Stress

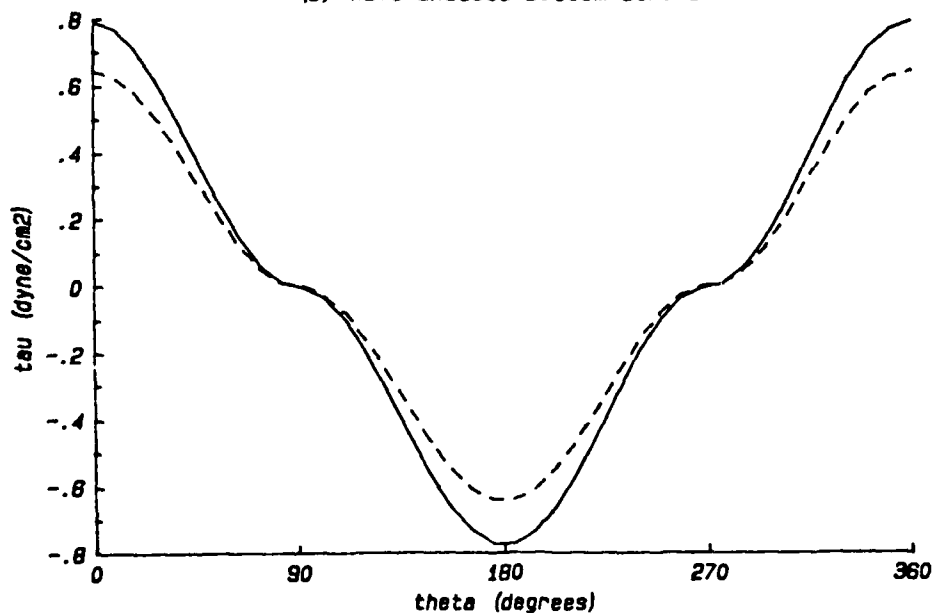
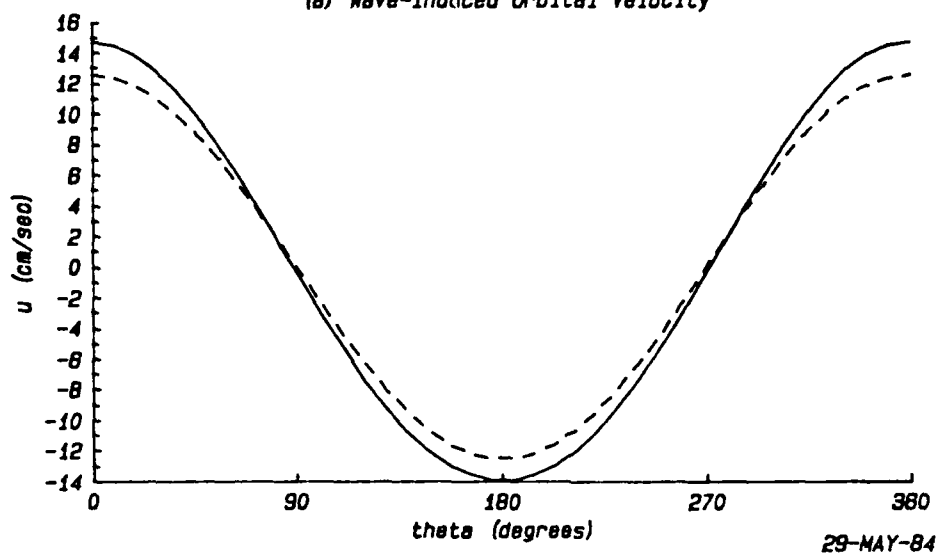


Plate 71. Wave-induced bottom orbital velocity and bottom stress at sta 13; 11-sec, 10-ft waves from the northwest; maximum flood; +3.2 ft swl; cnoidal wave theory (solid lines) and linear wave theory (dashed lines)

Station 15 (Depth = 11.13 m)

(a) Wave-Induced Orbital Velocity



(b) Wave-Induced Bottom Stress

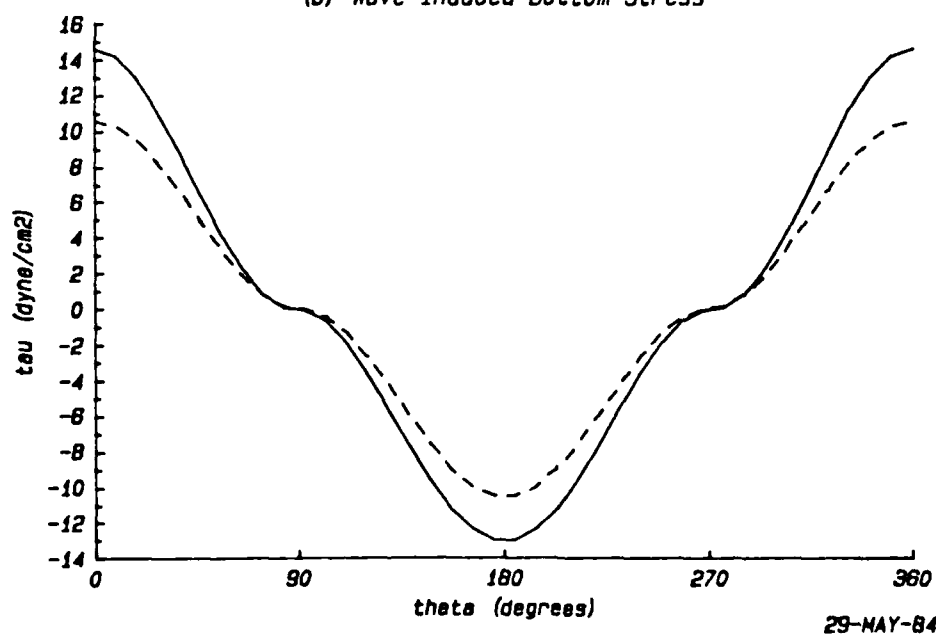
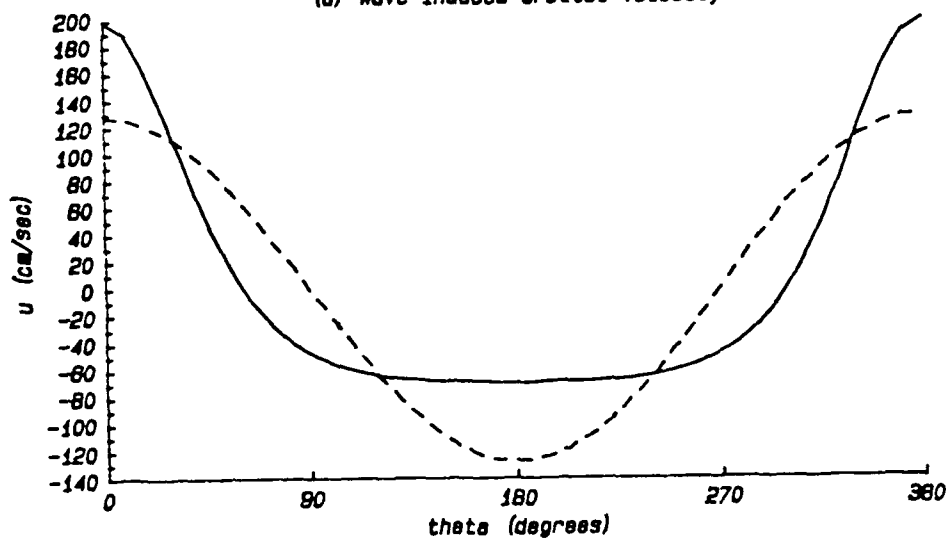


Plate 72. Wave-induced bottom orbital velocity and bottom stress at sta 15; 11-sec, 10-ft waves from the northwest; maximum flood; +3.2 ft swl; cnoidal wave theory (solid lines) and linear wave theory (dashed lines)

Station 01 (Depth = 3.87 m)

(a) Wave-Induced Orbital Velocity



(b) Wave-Induced Bottom Stress

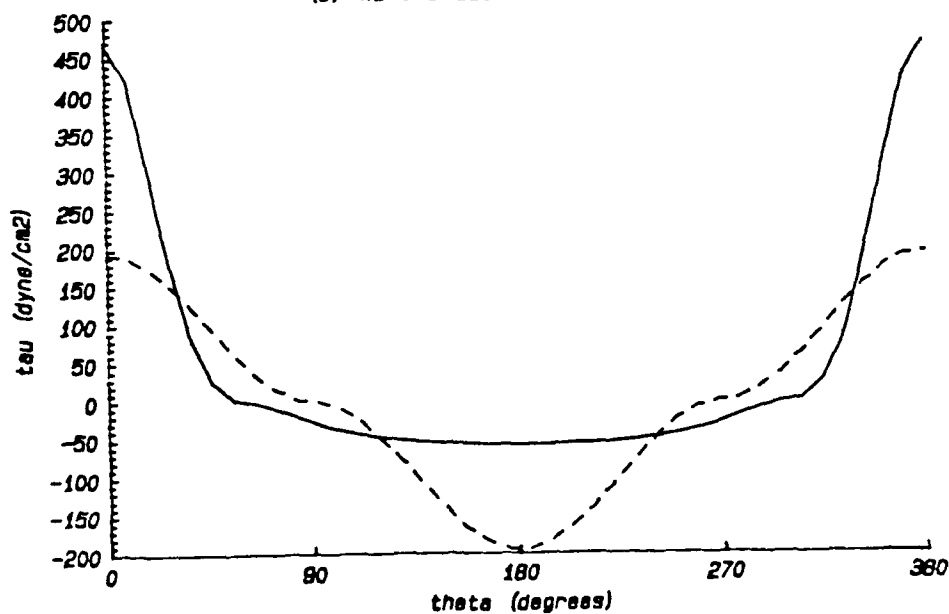
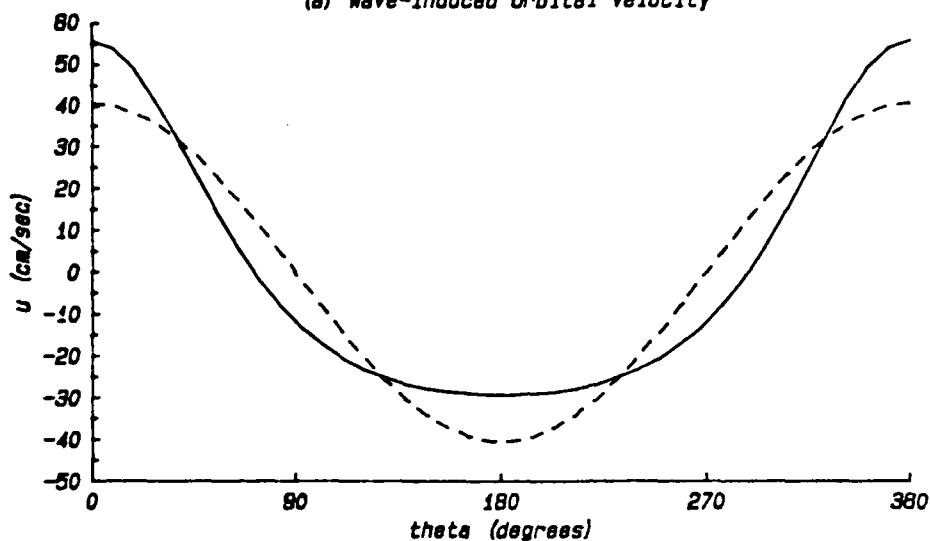


Plate 73. Wave-induced bottom orbital velocity and bottom stress at sta 1; 11-sec, 10-ft waves from the northwest; maximum ebb; +3.7 ft swl; cnoidal wave theory (solid lines) and linear wave theory (dashed lines)

Station 04 (Depth = 4.11 m)

(a) Wave-Induced Orbital Velocity



(b) Wave-Induced Bottom Stress

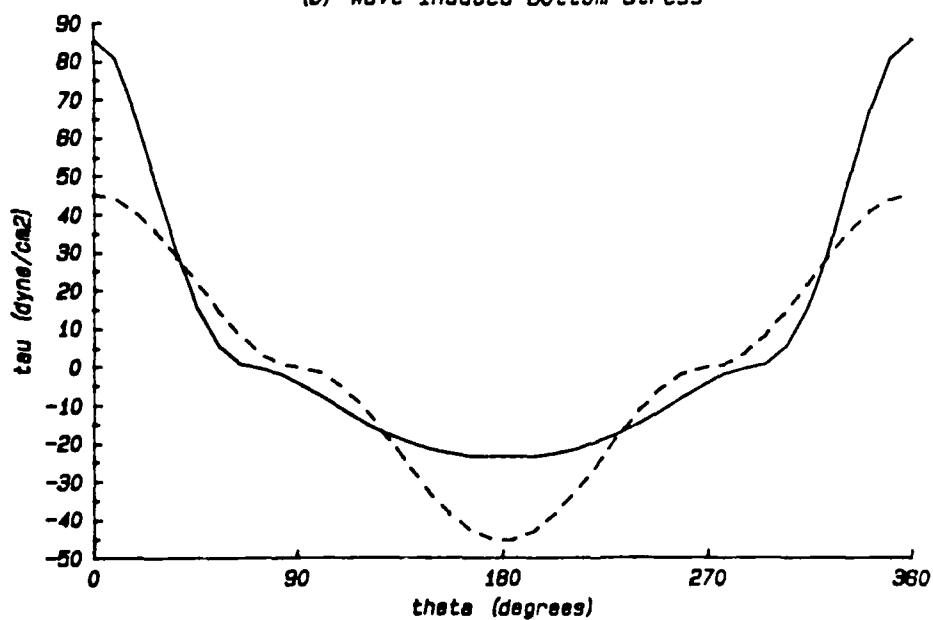
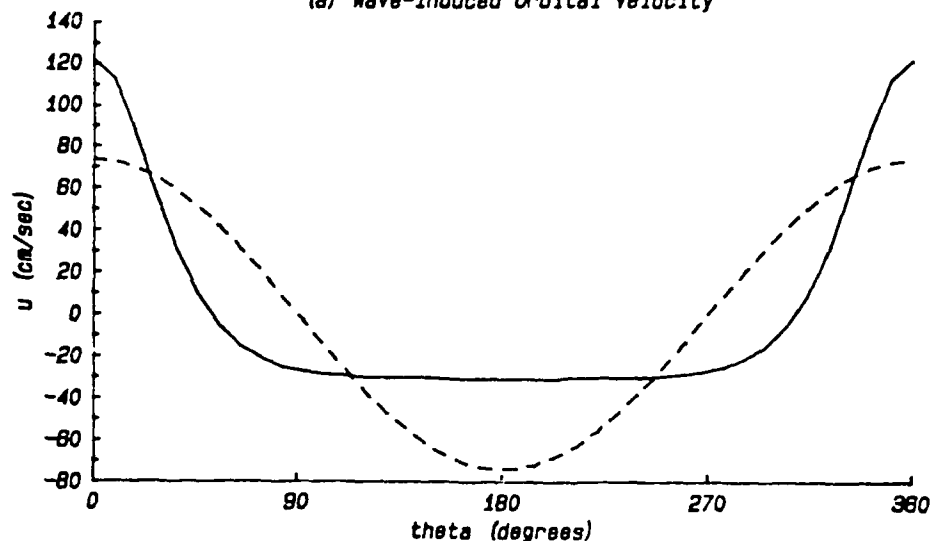


Plate 74. Wave-induced bottom orbital velocity and bottom stress at sta 4; 11-sec, 10-ft waves from the northwest; maximum ebb; +3.7 ft swl; cnoidal wave theory (solid lines) and linear wave theory (dashed lines)

Station 11 (Depth = 2.65 m)

(a) Wave-Induced Orbital Velocity



(b) Wave-Induced Bottom Stress

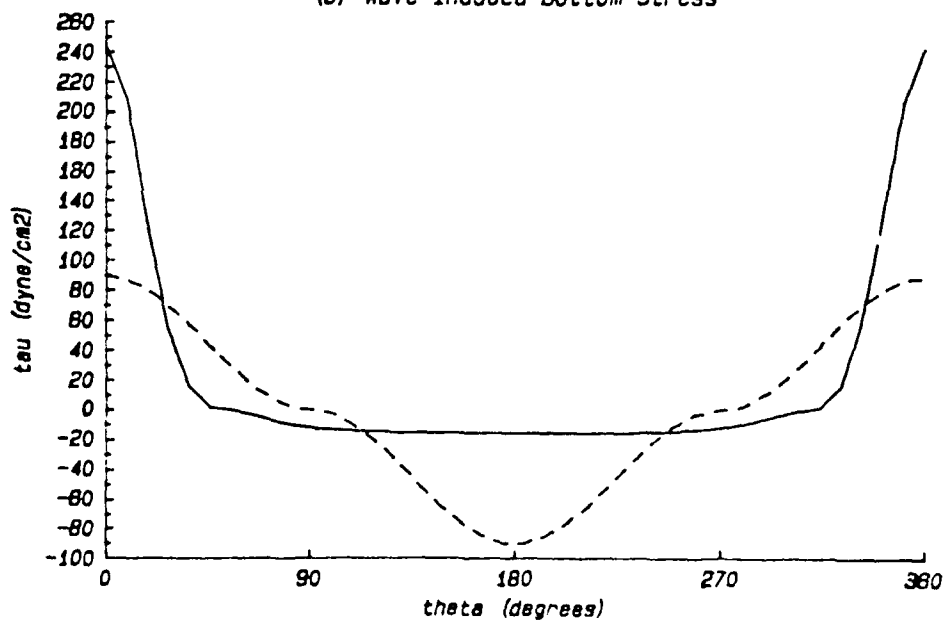


Plate 75. Wave-induced bottom orbital velocity and bottom stress at sta 11; 11-sec, 10-ft waves from the northwest; maximum ebb; +3.7 ft swl; cnoidal wave theory (solid lines) and linear wave theory (dashed lines)

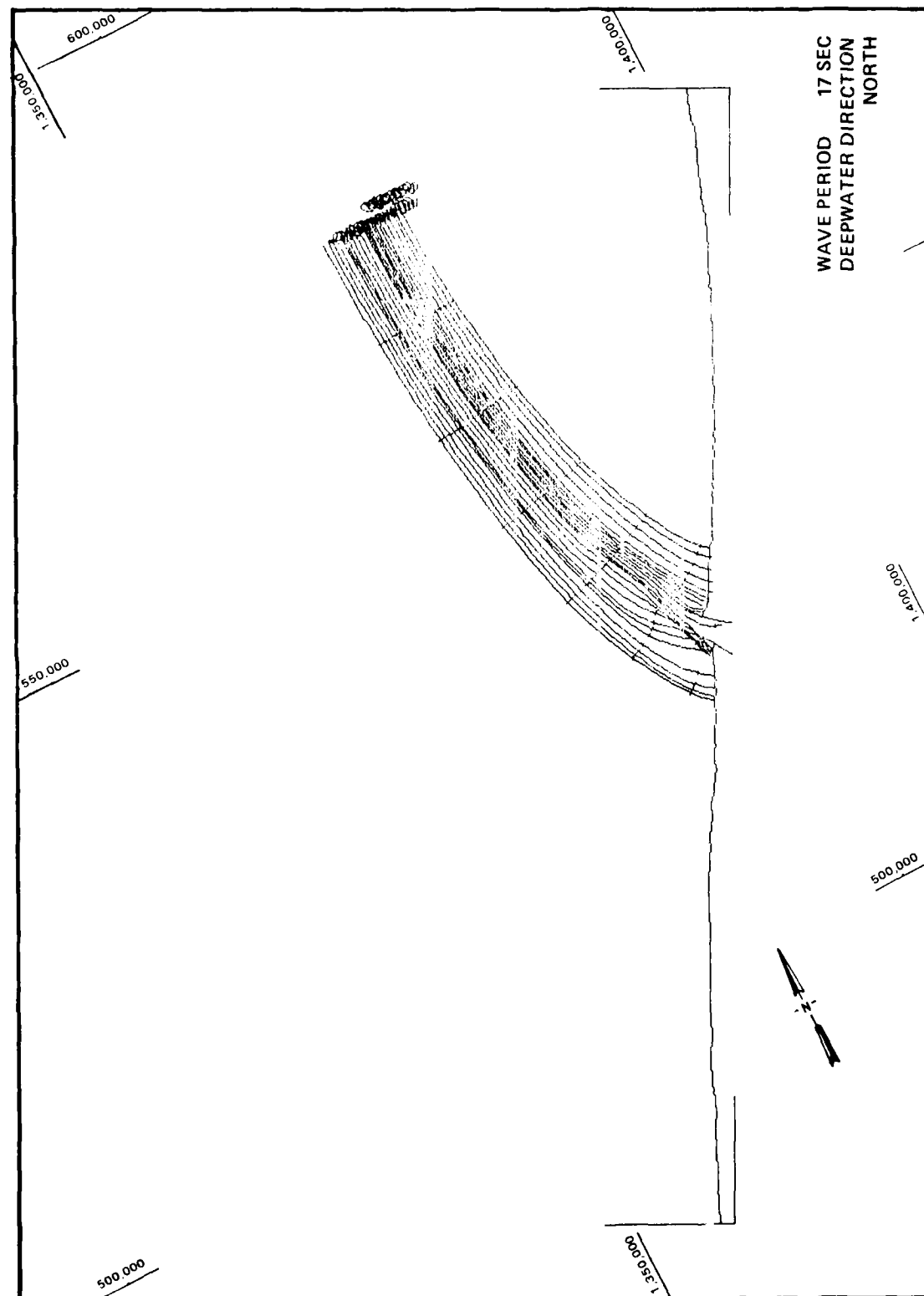


PLATE A8

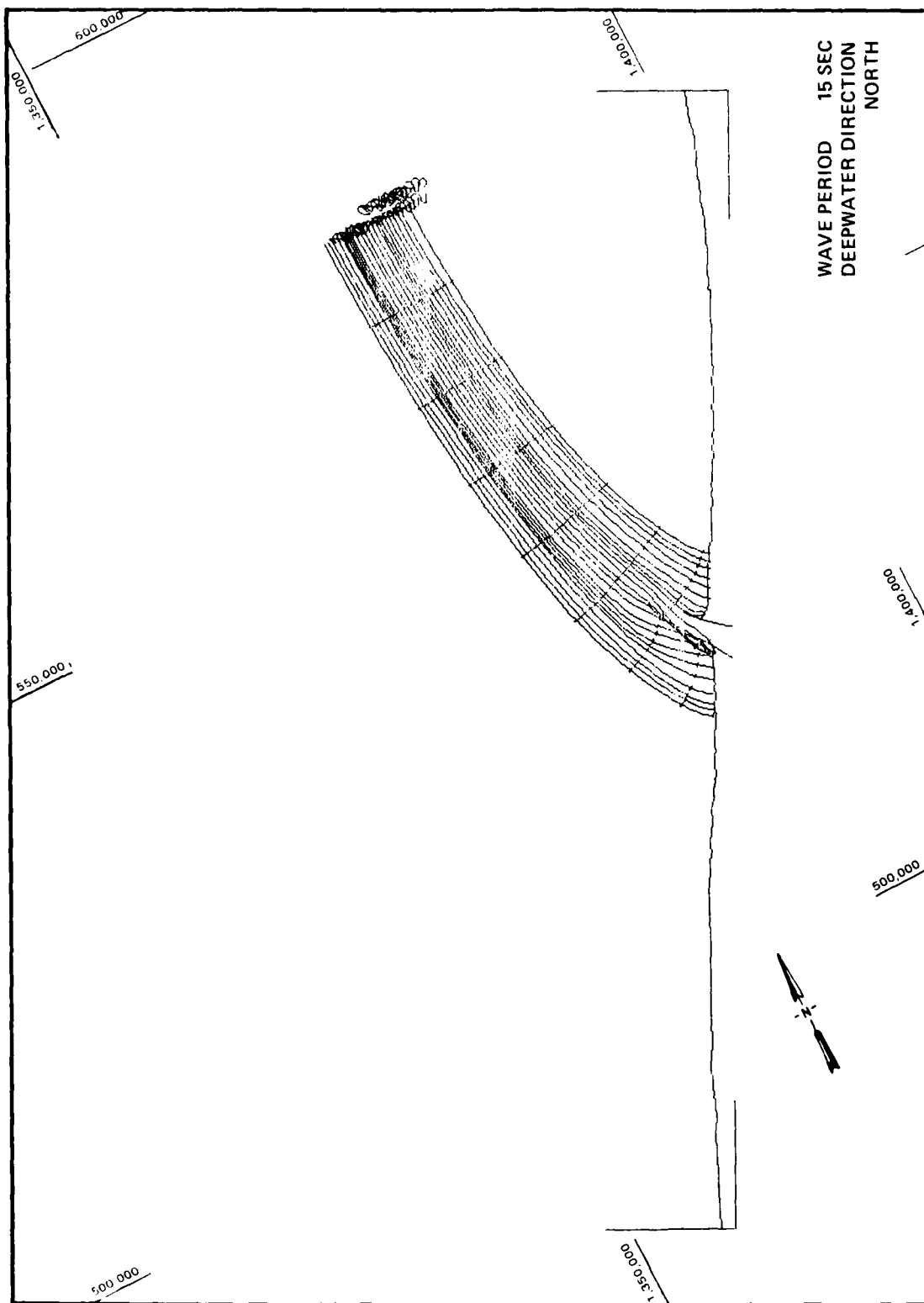


PLATE A7

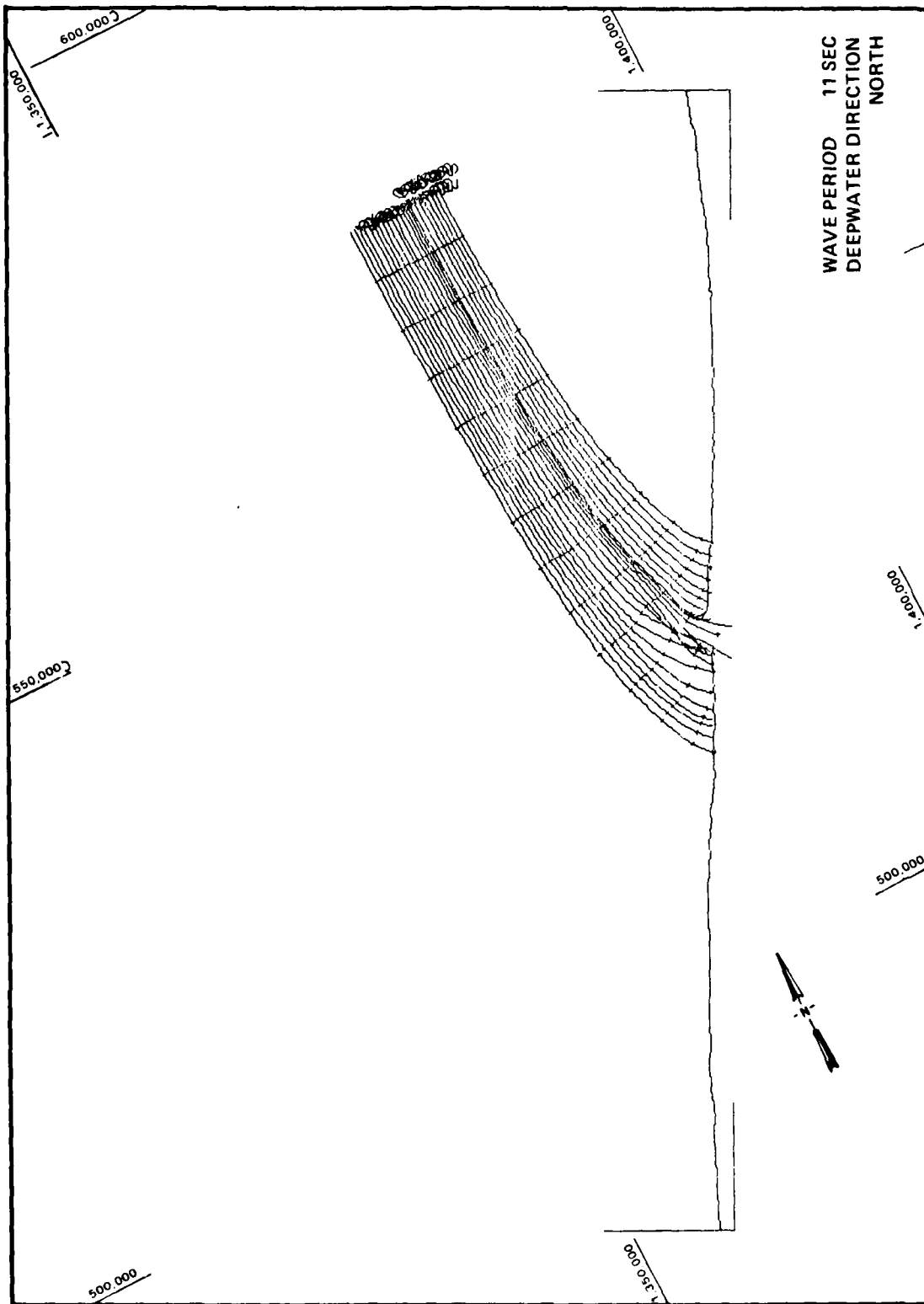


PLATE A5

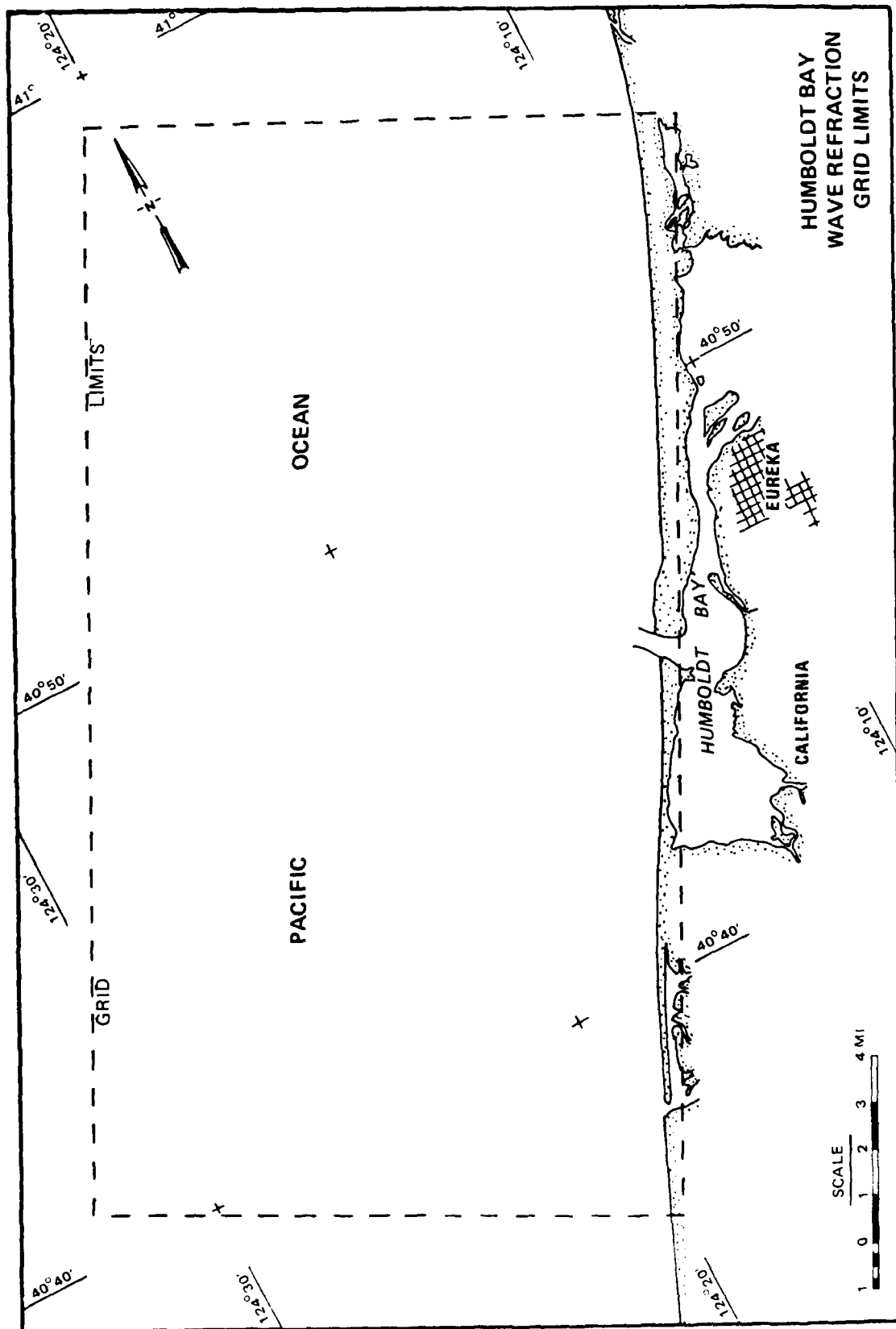


PLATE A1

Table A1
Summary of Refraction and Shoaling Analysis for Humboldt Bay

Deepwater Direction, Azimuth, deg	Wave Period sec	Shallow-Water Direction, Azimuth, deg	Refraction* Coefficient	Shoaling** Coefficient	Wave-Height Adjustment Factor
North (360)	5	359	1.00	1.00	1.00
	7	353	0.99	0.99	0.98
	9	351	0.87	0.94	0.82
	11	346	0.85	0.92	0.78
	13	344	0.83	0.92	0.76
	15	341	0.86	0.93	0.80
	17	340	0.84	0.96	0.81
	19	335	0.85	0.99	0.84
Northwest (315)	5	315	1.02	1.00	1.02
	7	311	1.01	0.99	1.00
	9	308	1.02	0.94	0.96
	11	307	1.04	0.92	0.96
	13	307	1.02	0.92	0.94
	15	307	1.05	0.93	0.98
	17	305	1.02	0.96	0.98
	19	302	1.02	0.99	1.01
West (270)	5	270	1.00	1.00	1.00
	7	271	1.00	0.99	0.99
	9	274	0.98	0.94	0.92
	11	277	0.88	0.92	0.81
	13	280	0.81	0.92	0.75
	15	280	0.88	0.93	0.82
	17	280	0.98	0.96	0.94
	19	282	0.96	0.99	0.95
Southwest (225)	5	226	0.99	1.00	0.99
	7	238	0.93	0.99	0.92
	9	248	0.83	0.94	0.78
	11	255	0.82	0.92	0.75
	13	261	0.85	0.92	0.78
	15	265	1.01	0.93	0.94
	17	267	0.93	0.96	0.89
	19	271	0.75	0.99	0.74

* At approximate location of wave generator in model.

** At 117-ft depth (110-ft pit elevation with 7-ft tide conditions superimposed).

rectangular depth grid 24.8 miles by 12.6 miles which paralleled the shoreline in the vicinity of the project area. Limits of the depth grid used are shown in Plate A1. The grid spacing was 600 ft and depths were taken from the latest hydrographic survey charts. Storm conditions were represented by superimposing a water level of 7.0 ft on the depth grid.

4. Wave orthogonals were produced for 5-, 7-, 9-, 11-, 13-, 15-, 17-, and 19-sec waves from north, northwest, west, and southwest. The plots obtained are shown in Plates A2-A33.

5. Refraction coefficients and shallow-water orthogonal directions obtained for the various wave periods from the four deepwater wave directions are presented in Table A1. These values represent an average of the orthogonals in the immediate vicinity of the harbor site (approximately the location of the wave generator in the model). Shoaling coefficients of 1.00, 0.99, 0.94, 0.92, 0.92, 0.93, 0.96, and 0.99 for 5-, 7-, 9-, 11-, 13-, 15-, 17-, and 19-sec wave periods, respectively, were computed for a 117-ft water depth corresponding to the simulated depth at the model wave generator. The wave-height adjustment factor is obtained by multiplying K_r times K_s and can be applied to any deepwater wave height to obtain the corresponding shallow-water value.

6. Based on the refracted directions secured at the model contours for each wave period, four wave generator positions were available for model testing representing the various deepwater directions. The following tabulation shows the deepwater directions and the corresponding shallow-water test directions.

<u>Deepwater Direction, Azimuth, deg</u>	<u>Corresponding Shallow-Water Test Direction, Azimuth, deg</u>
North, 360	346
Northwest, 315	308
West, 270	277
Southwest, 225	254

The shallow-water wave directions were taken to be the average directions of the refracted waves for the significant wave periods noted from each deepwater direction.

APPENDIX A: WAVE REFRACTION ANALYSIS FOR HUMBOLDT BAY

1. Prior to the hydraulic model investigation of Humboldt Bay, a wave refraction analysis was conducted at the US Army Engineer Waterways Experiment Station (WES) to determine the shallow-water wave height and the refracted wave direction at the model wave generator pit for representative wave periods from the critical directions of deepwater wave approach. This analysis was conducted using a linear wave refraction theory originally developed at Stanford University by Dobson (1967)* and modified by WES in 1971. All computations and plotting were done using an Electronic Associates, Inc. (EAI) Pacer 100 minicomputer and Versatec electrostatic plotter at WES.

2. In this analysis, the effects of both reflection and diffraction are neglected. These assumptions are valid except in convergence areas where caustics occur and linear theory does not apply. Therefore the major assumption in determining the wave height at any point on a wave orthogonal, within the limits of the linear theory, is that no energy is transmitted perpendicular to the orthogonal along the wave crest, in which case the height at any given point is given by

$$H = H_o K_s K_r$$

where

H_o = wave height in deep water

K_s = shoaling coefficient

K_r = refraction coefficient

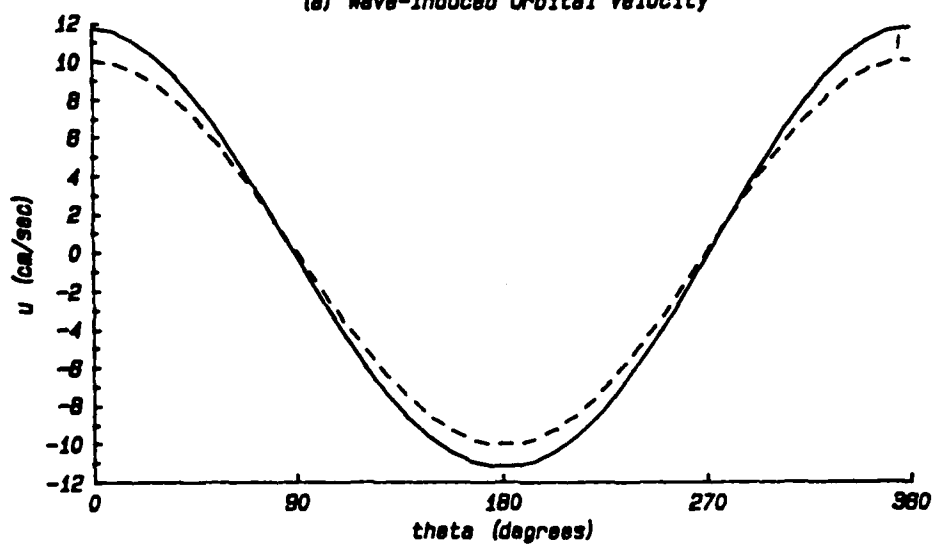
This assumption has been shown to be reasonable for mild slopes which induce only gradual bending of the orthogonals. For areas of extreme refraction, failure to consider the flow of energy along the wave crests can lead to significant errors in the computed wave height. Since previous research at WES by Whalin (1971, 1972) has shown that wave energy will tend to flow along the wave crests in areas of energy concentration, a maximum refraction coefficient of 1.4 and a minimum refraction coefficient of 0.45 were selected as being reasonable values.

3. Refraction diagrams for Humboldt Bay were produced from a

* See References at the end of main text.

Station 15 (Depth = 11.13 m)

(a) Wave-Induced Orbital Velocity



(b) Wave-Induced Bottom Stress

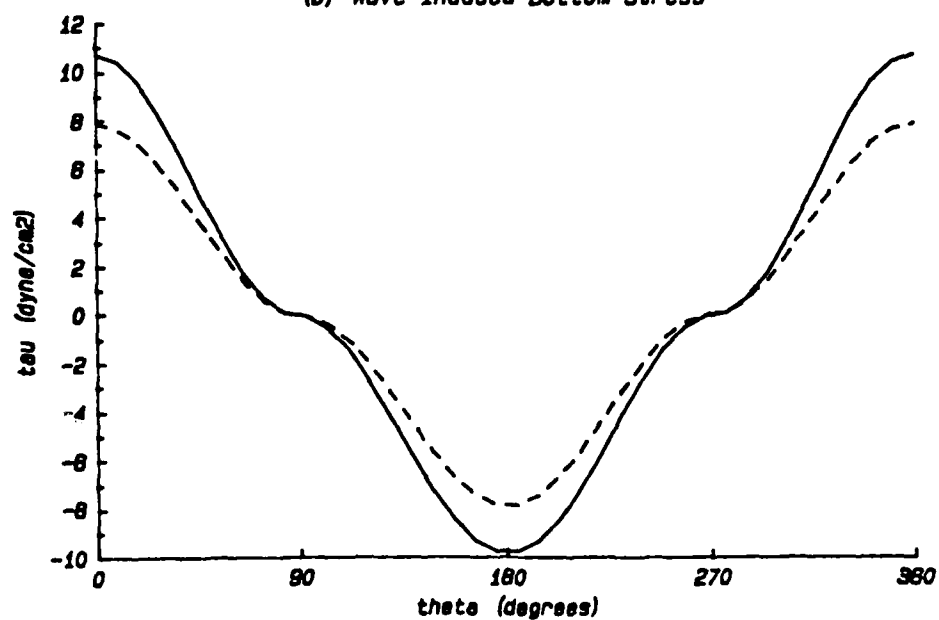
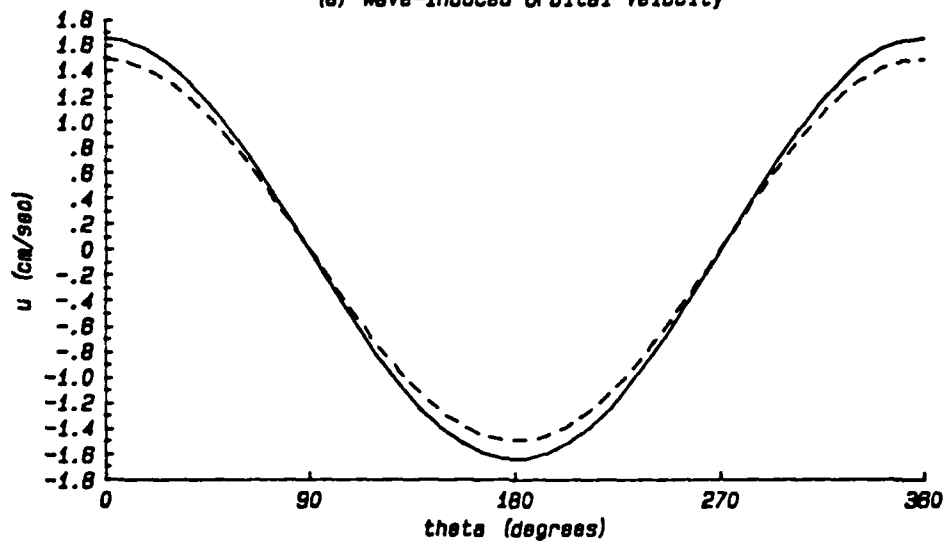


Plate 78. Wave-induced bottom orbital velocity and bottom stress at sta 15; 11-sec, 10-ft waves from the northwest; maximum ebb; +3.7 ft swl; cnoidal wave theory (solid lines) and linear wave theory (dashed lines)

Station 13 (Depth = 8.38 m)

(a) Wave-Induced Orbital Velocity



(b) Wave-Induced Bottom Stress

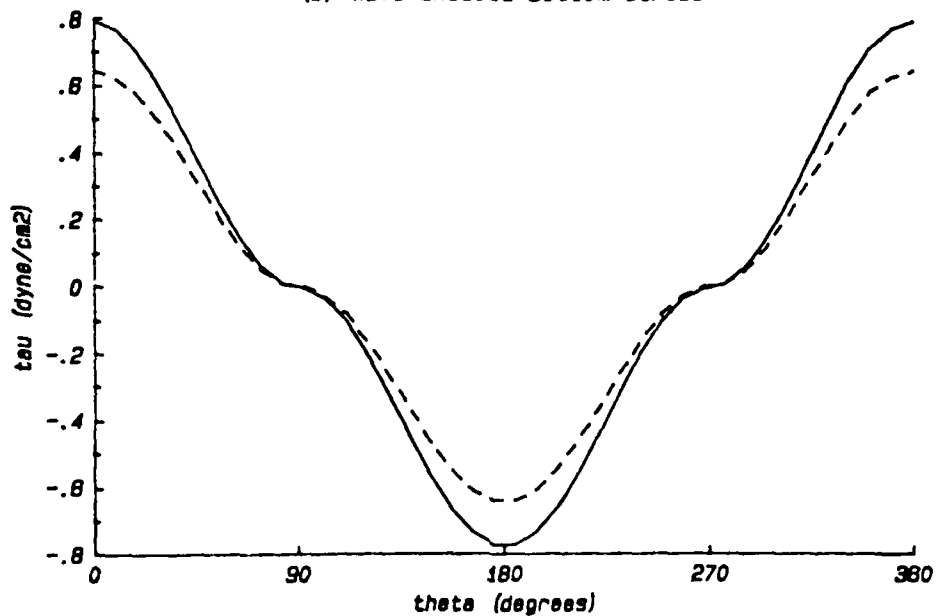
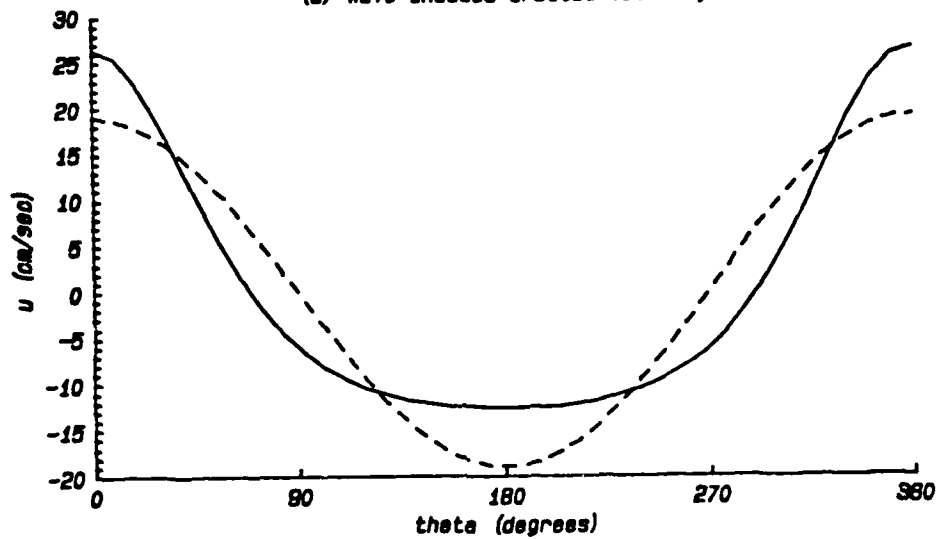


Plate 77. Wave-induced bottom orbital velocity and bottom stress at sta 13; 11-sec, 10-ft waves from the northwest; maximum ebb; +3.7 ft swl; cnoidal wave theory (solid lines) and linear wave theory (dashed lines)

Station 12 (Depth = 2.16 m)

(a) Wave-Induced Orbital Velocity



(b) Wave-Induced Bottom Stress

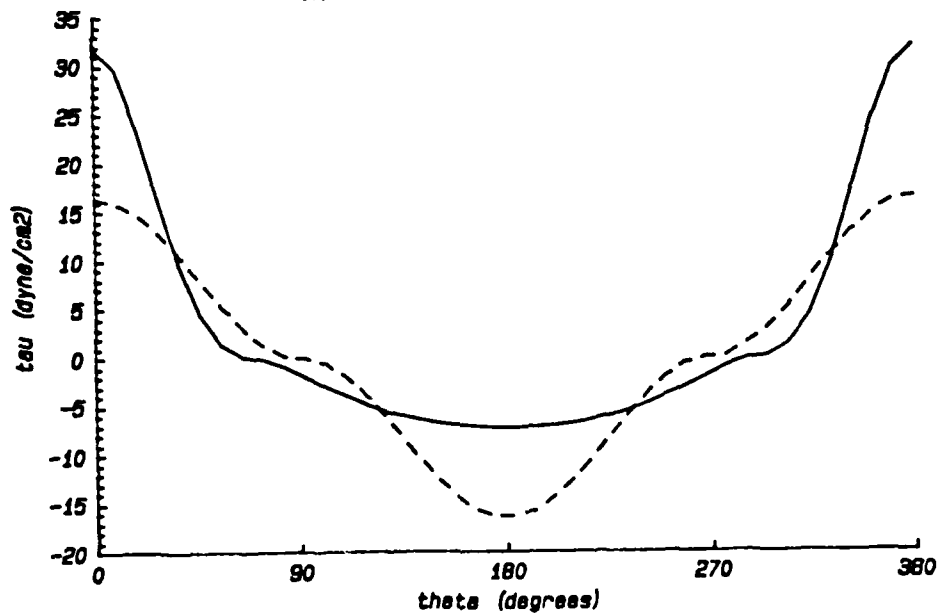


Plate 76. Wave-induced bottom orbital velocity and bottom stress at sta 12; 11-sec, 10-ft waves from the northwest; maximum ebb; +3.7 ft swl; cnoidal wave theory (solid lines) and linear wave theory (dashed lines)

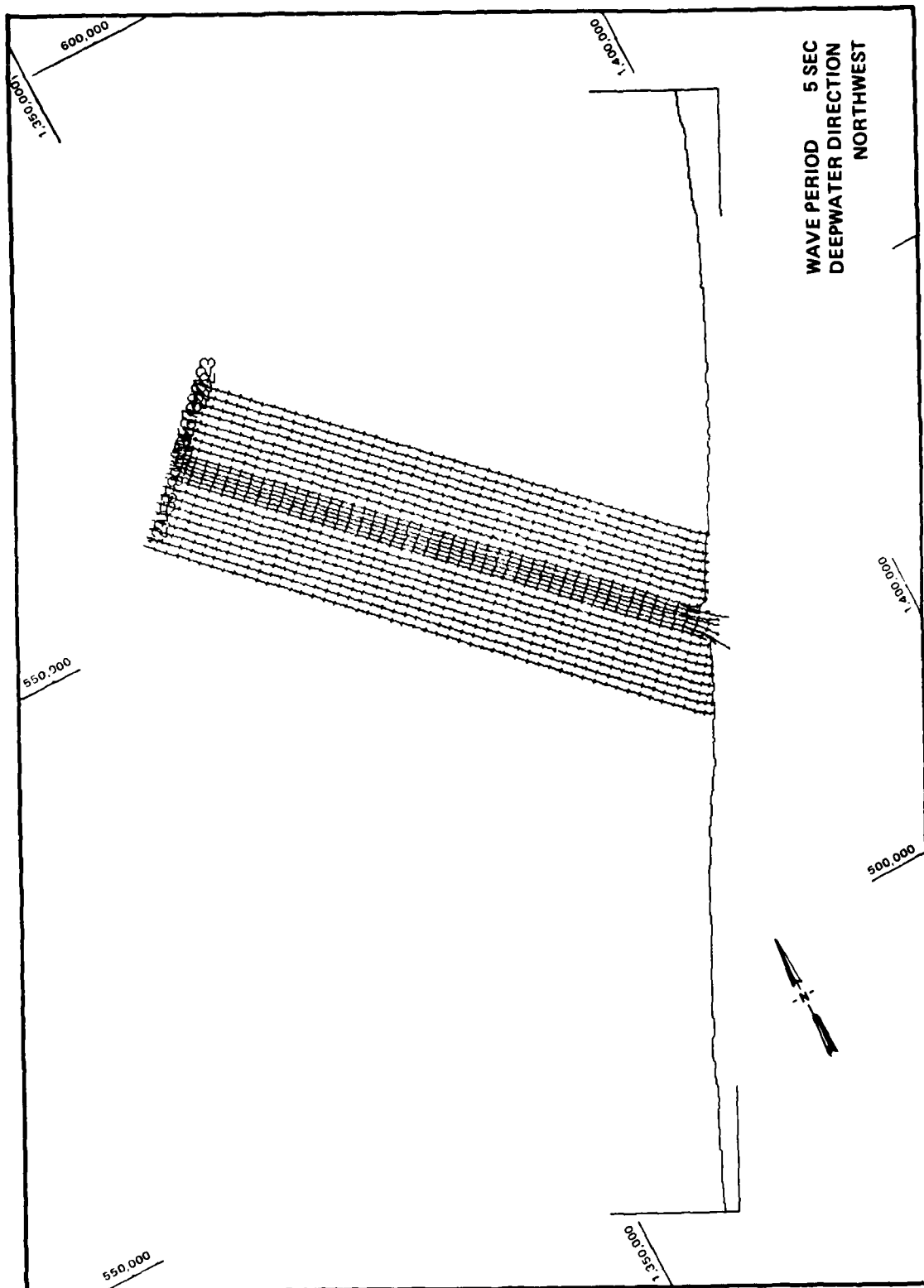


PLATE A10

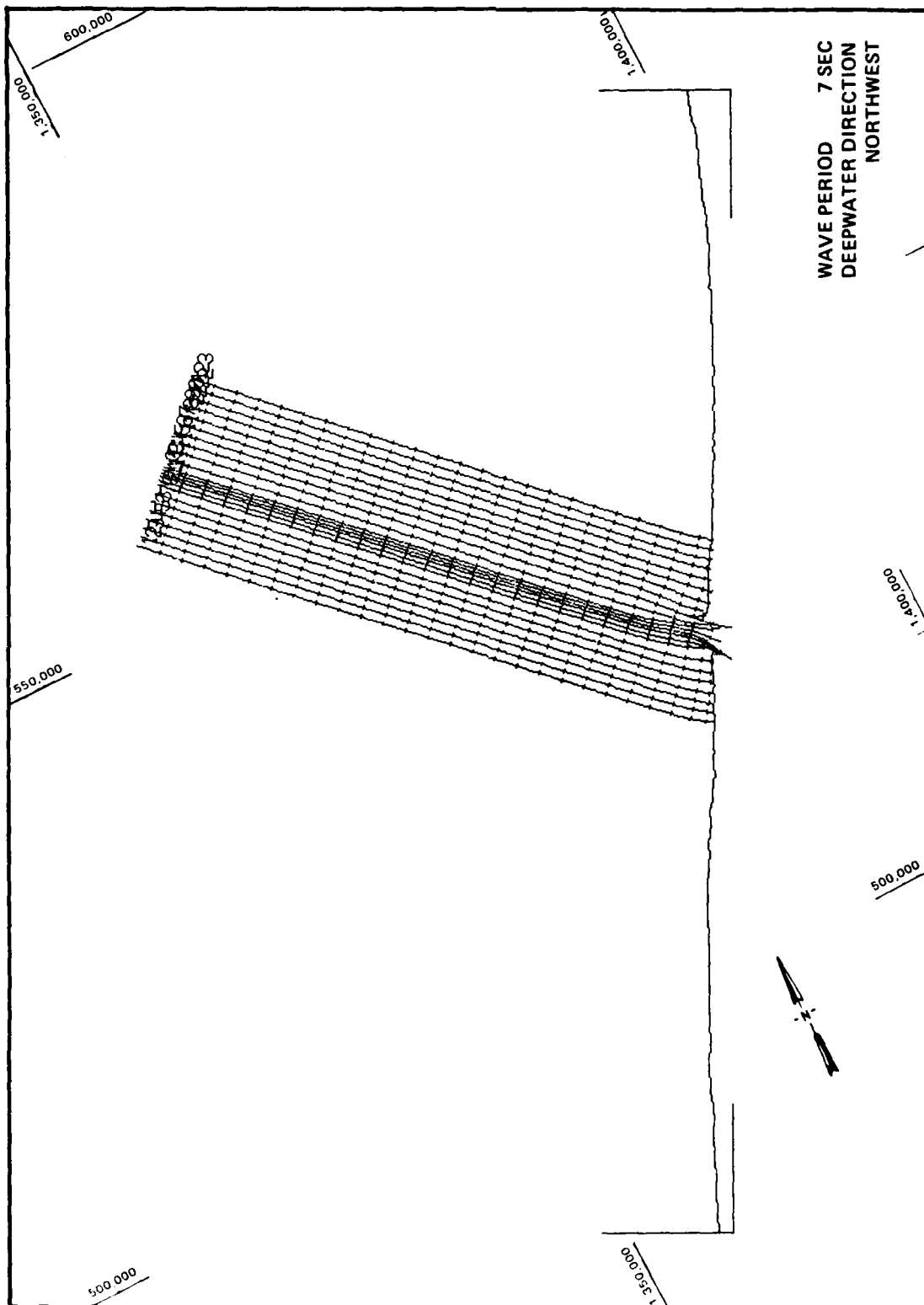


PLATE A11

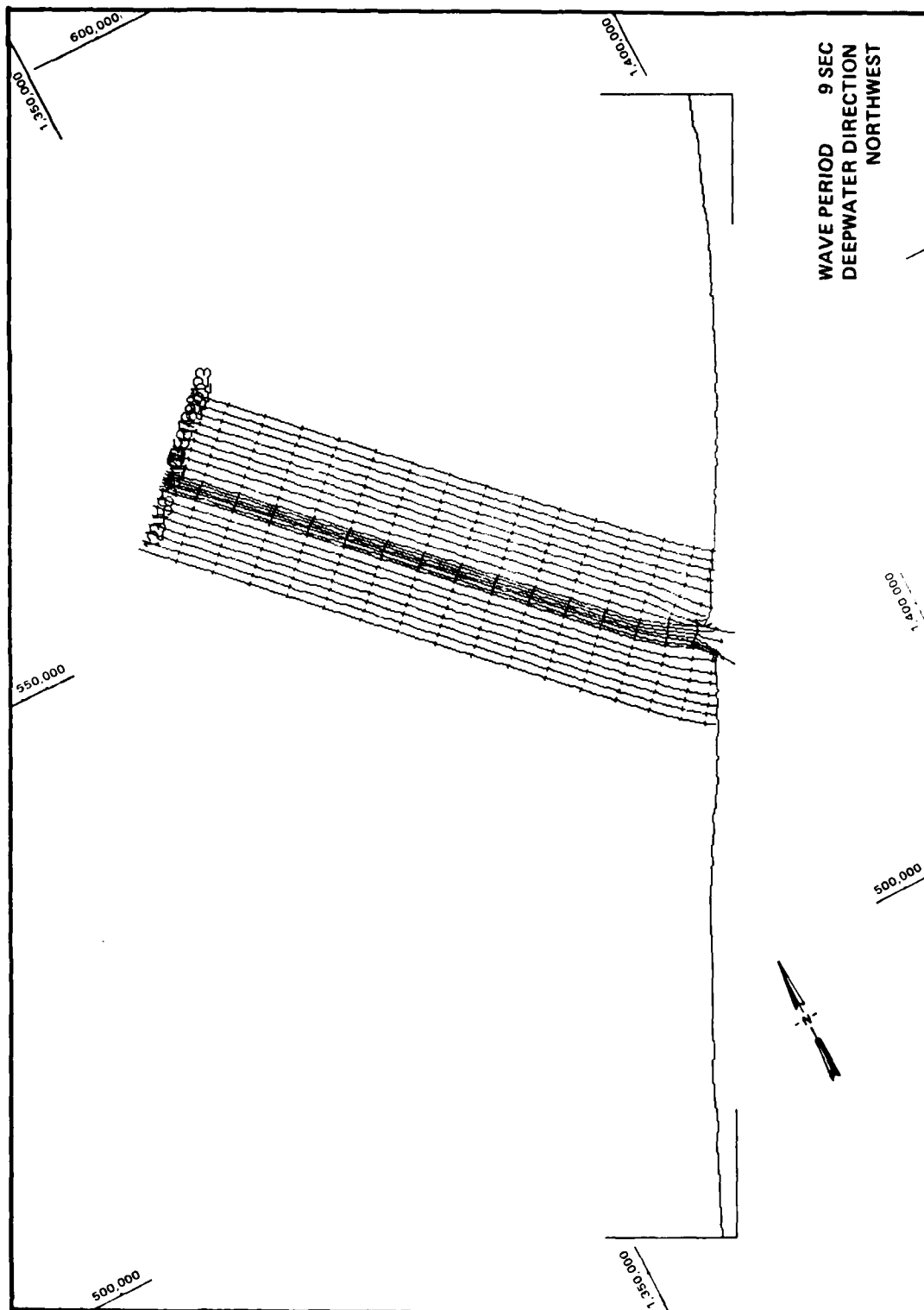


PLATE A12

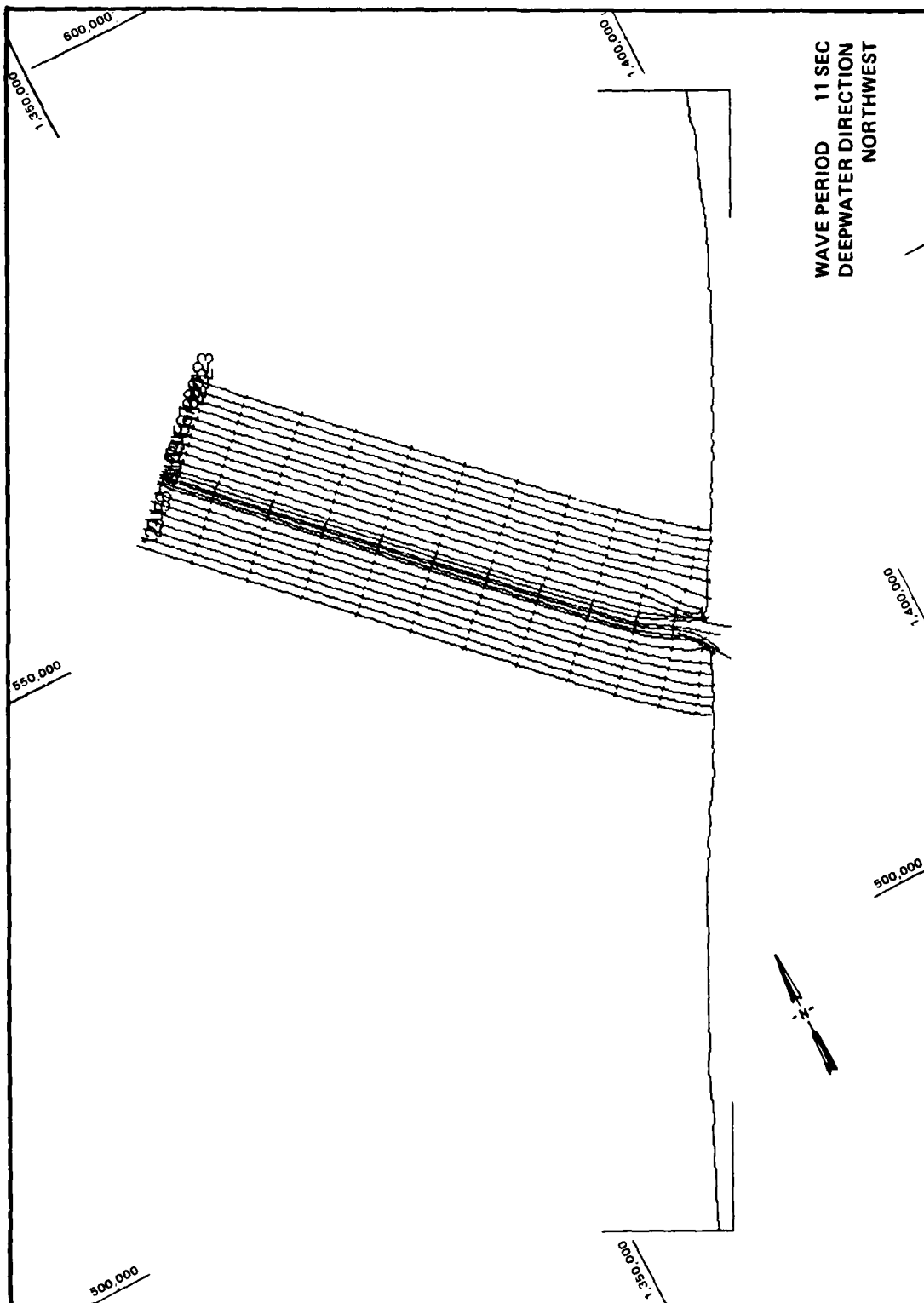


PLATE A13

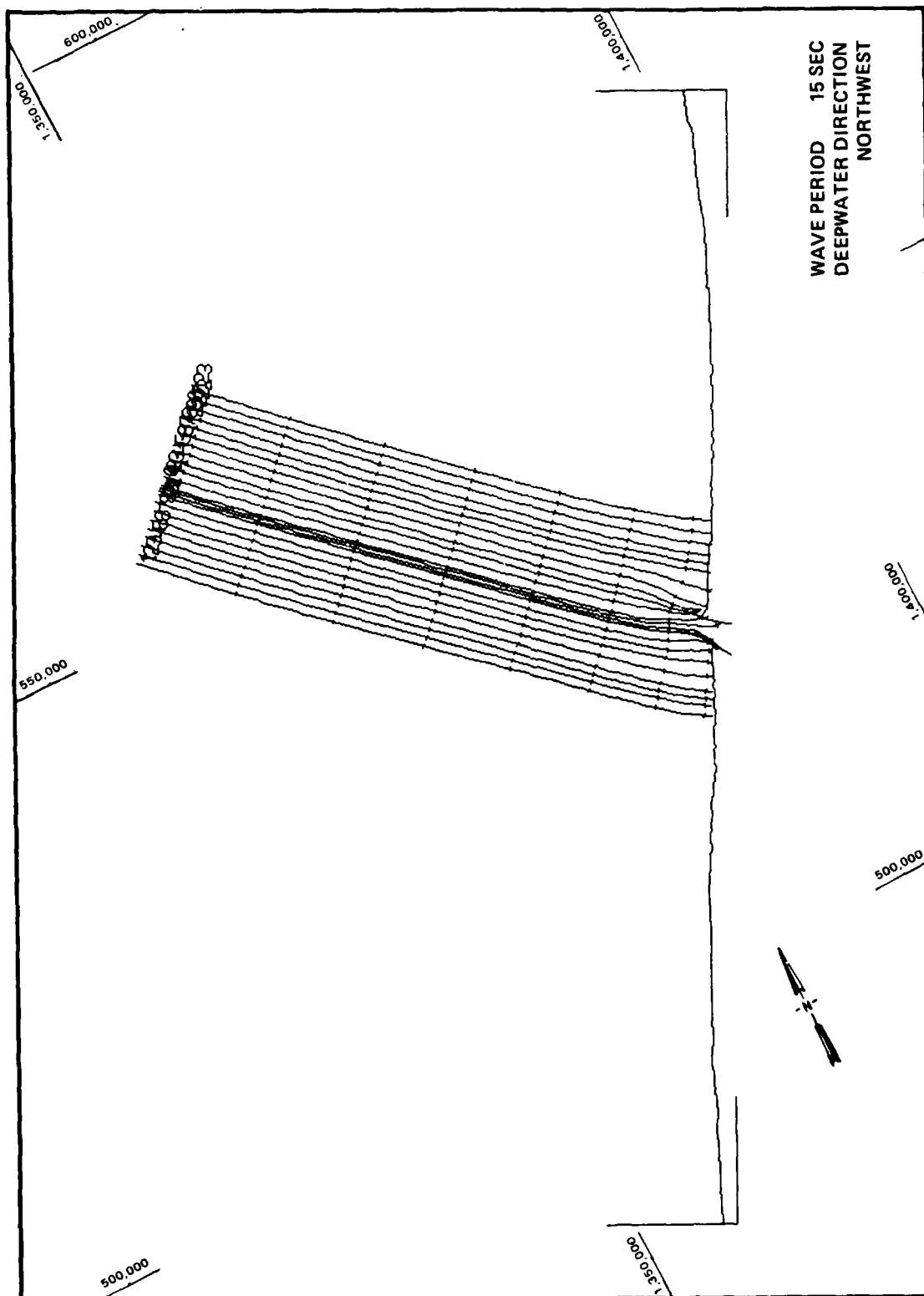


PLATE A15

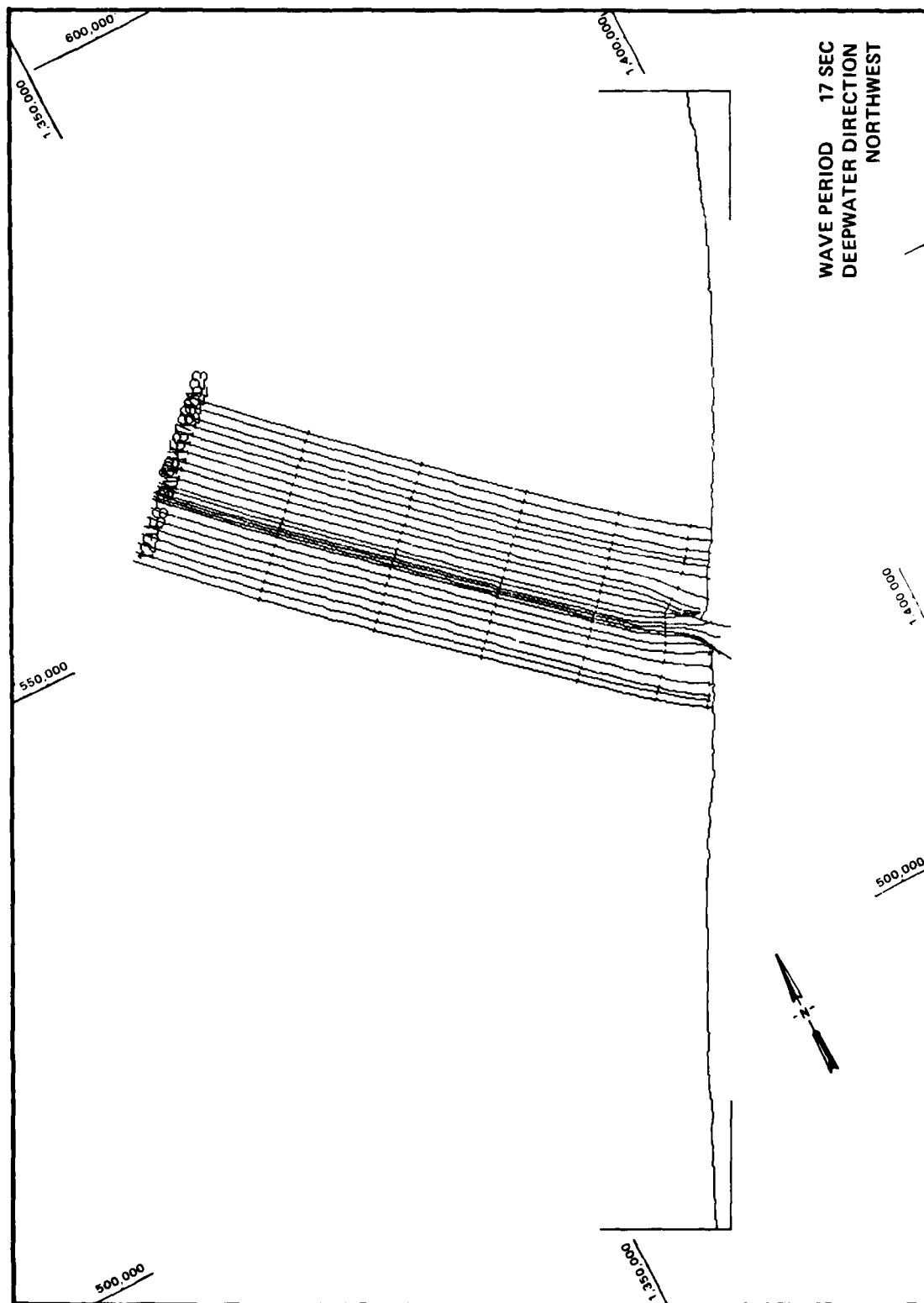


PLATE A16

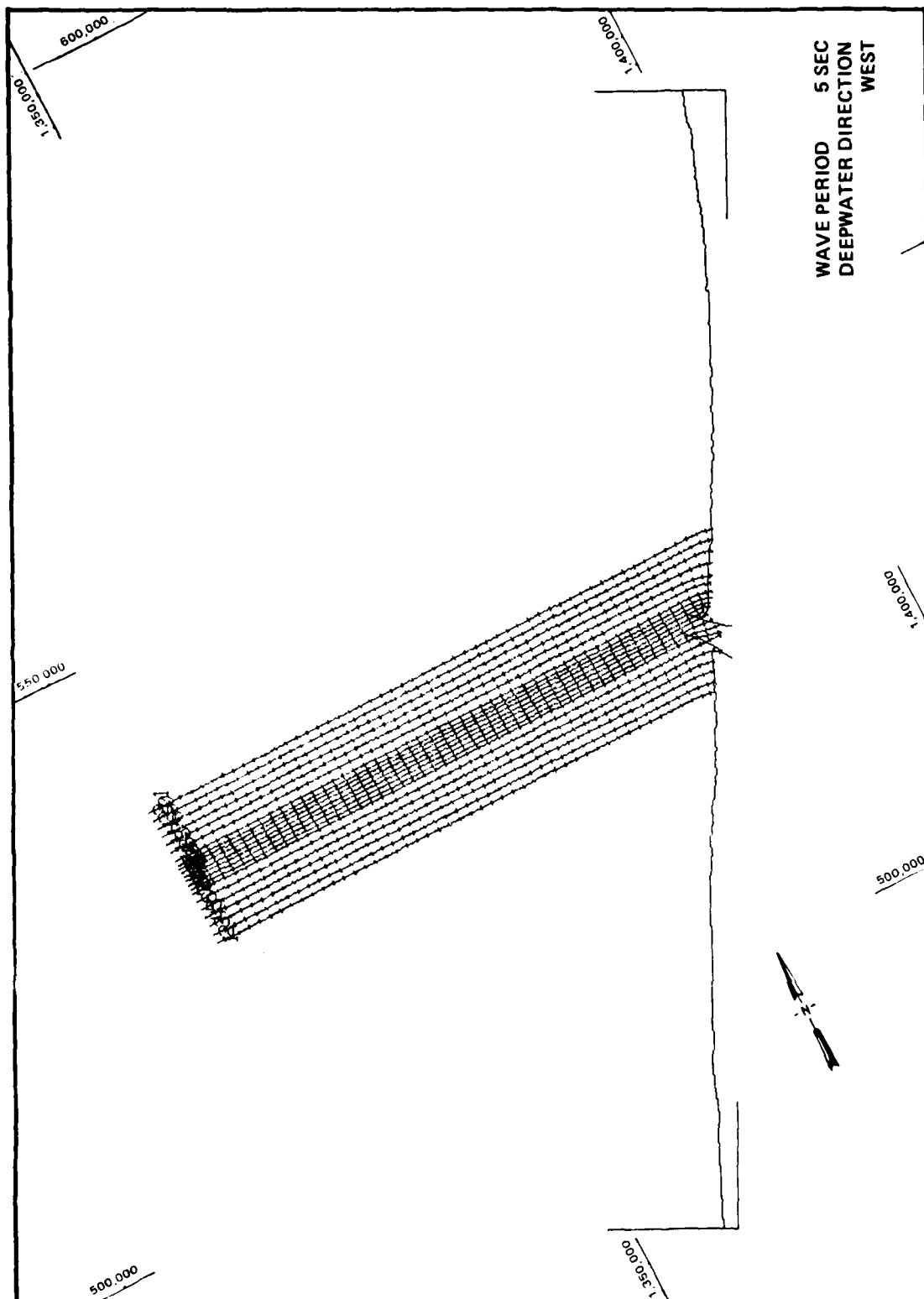


PLATE A18

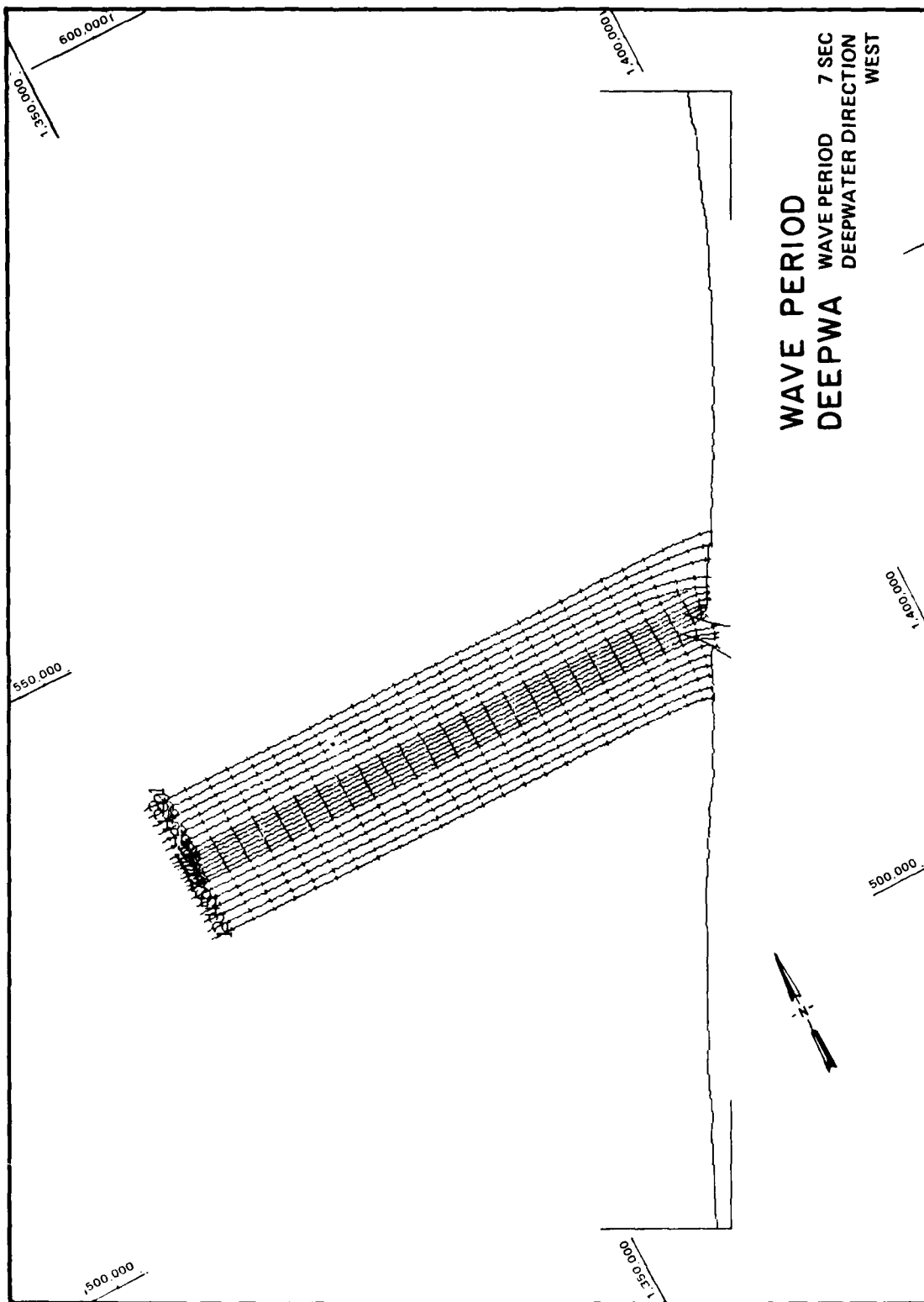


PLATE A19

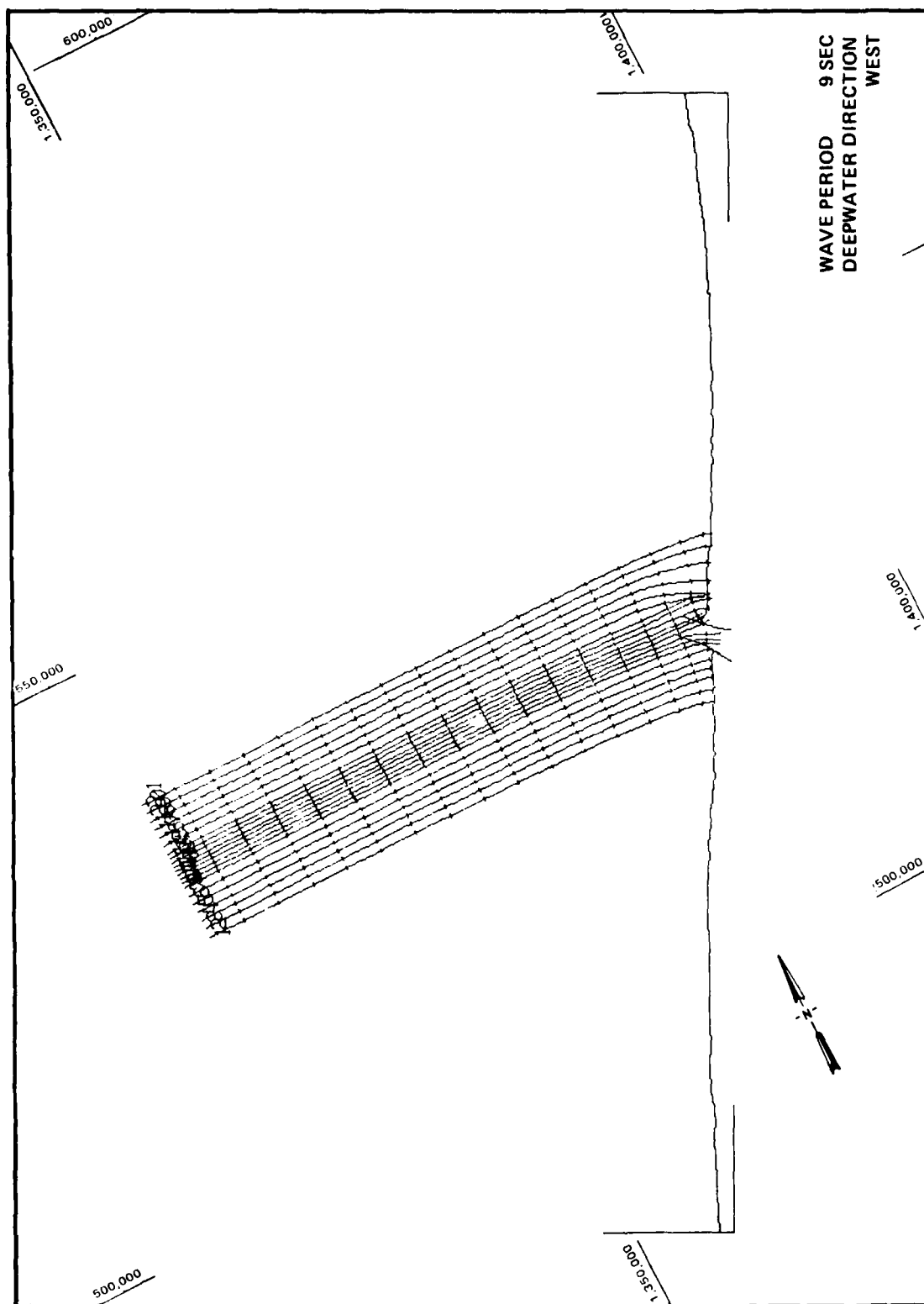


PLATE A20

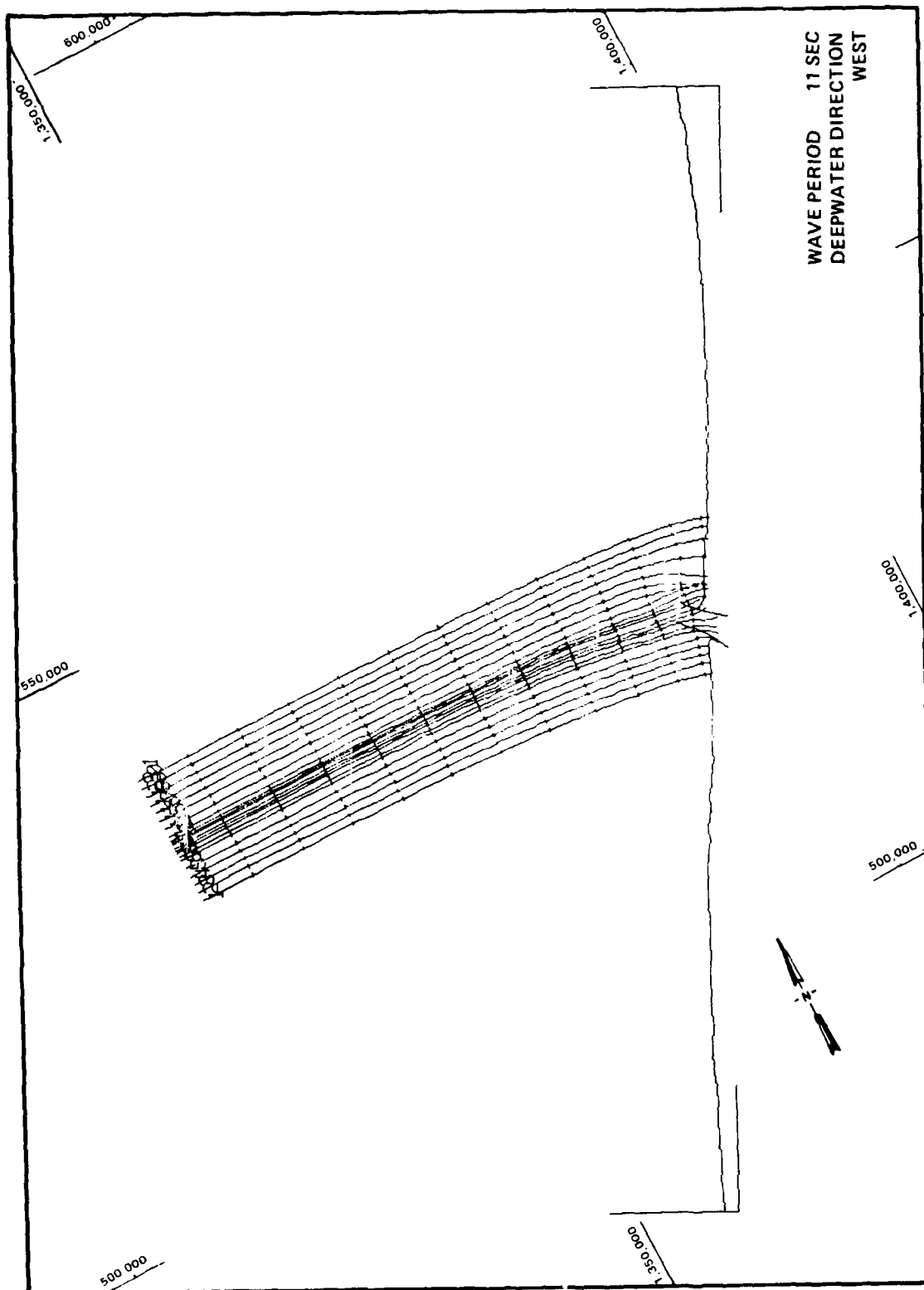


PLATE A21

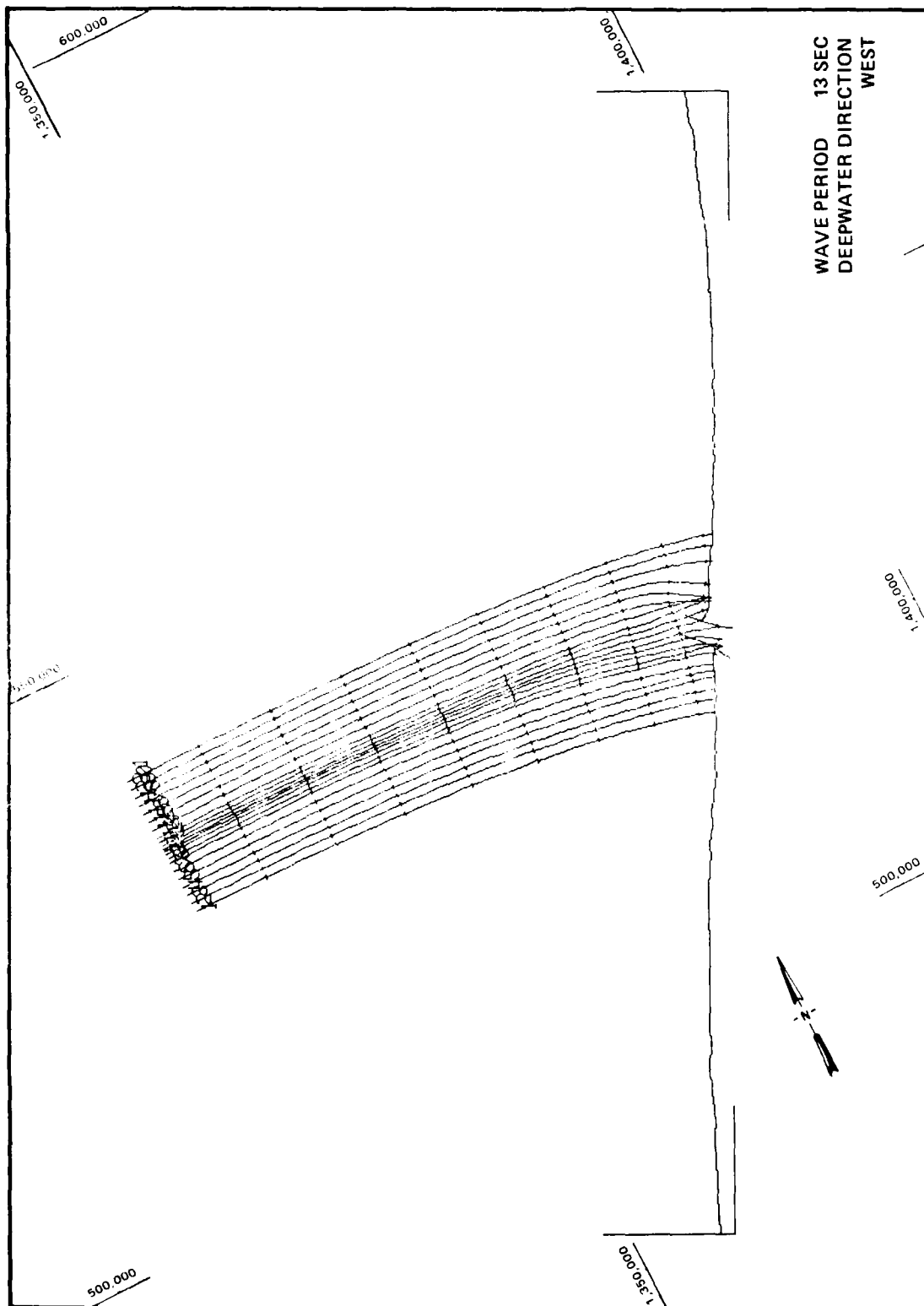


PLATE A22

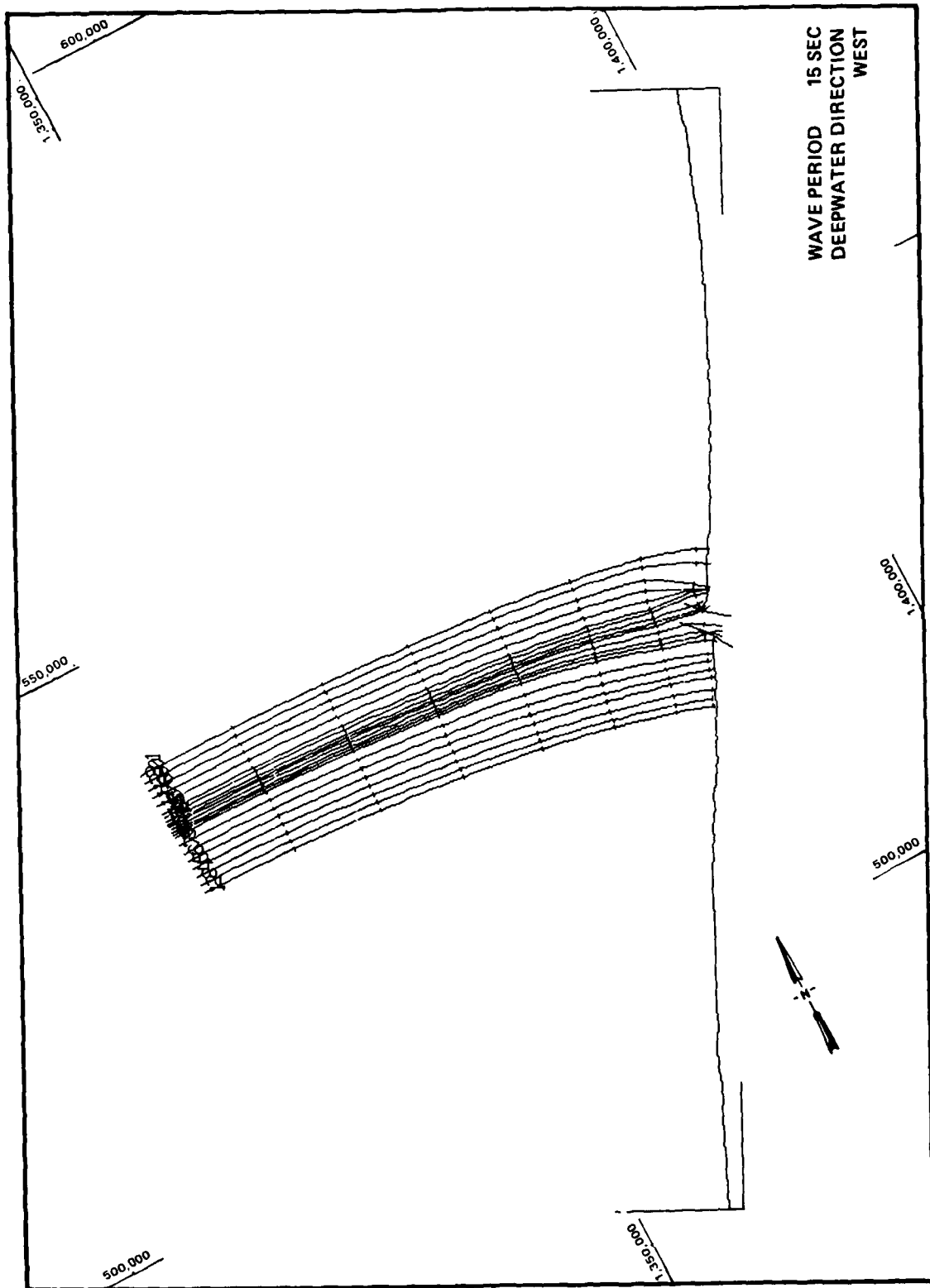


PLATE A23

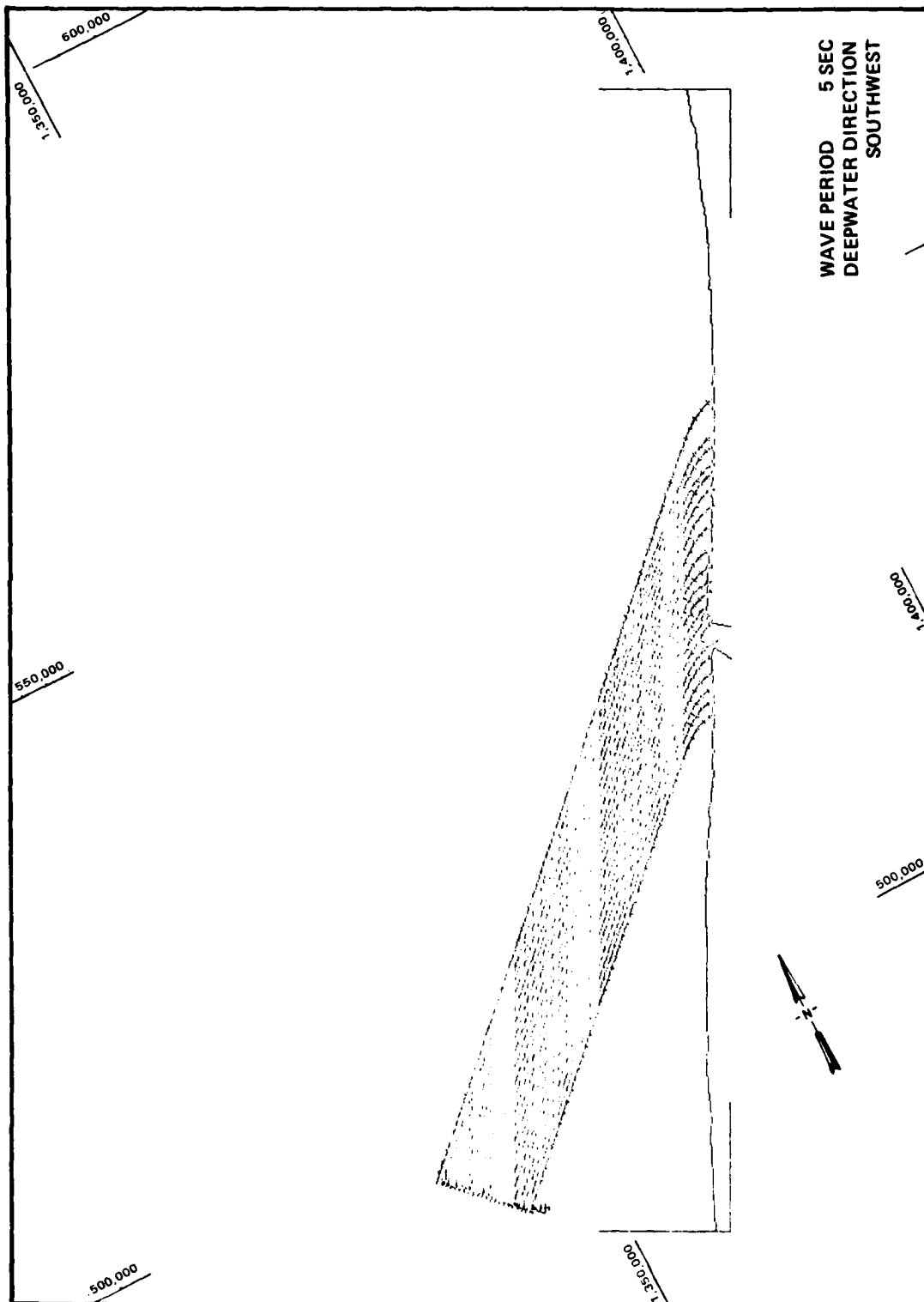


PLATE A26

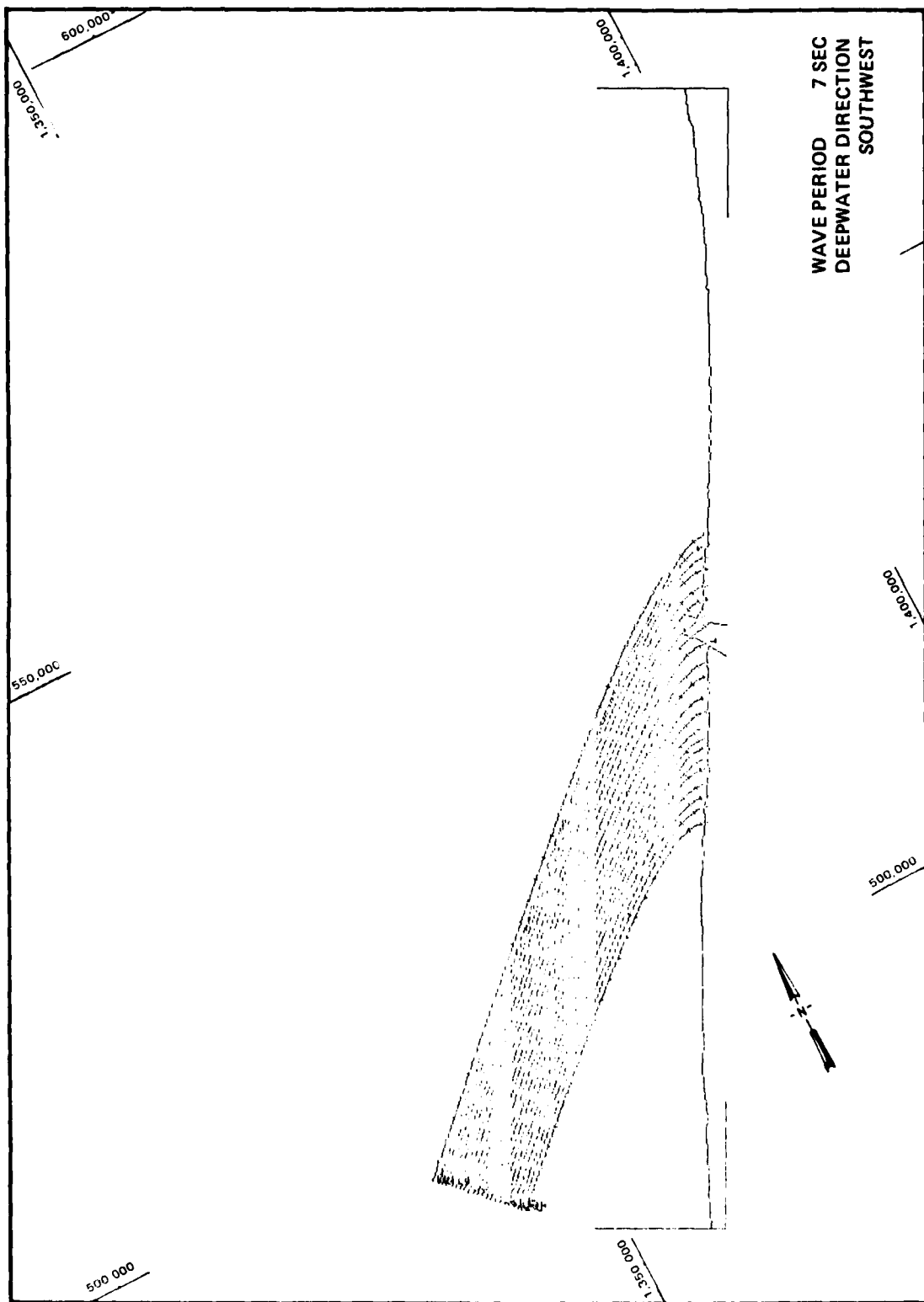


PLATE A27

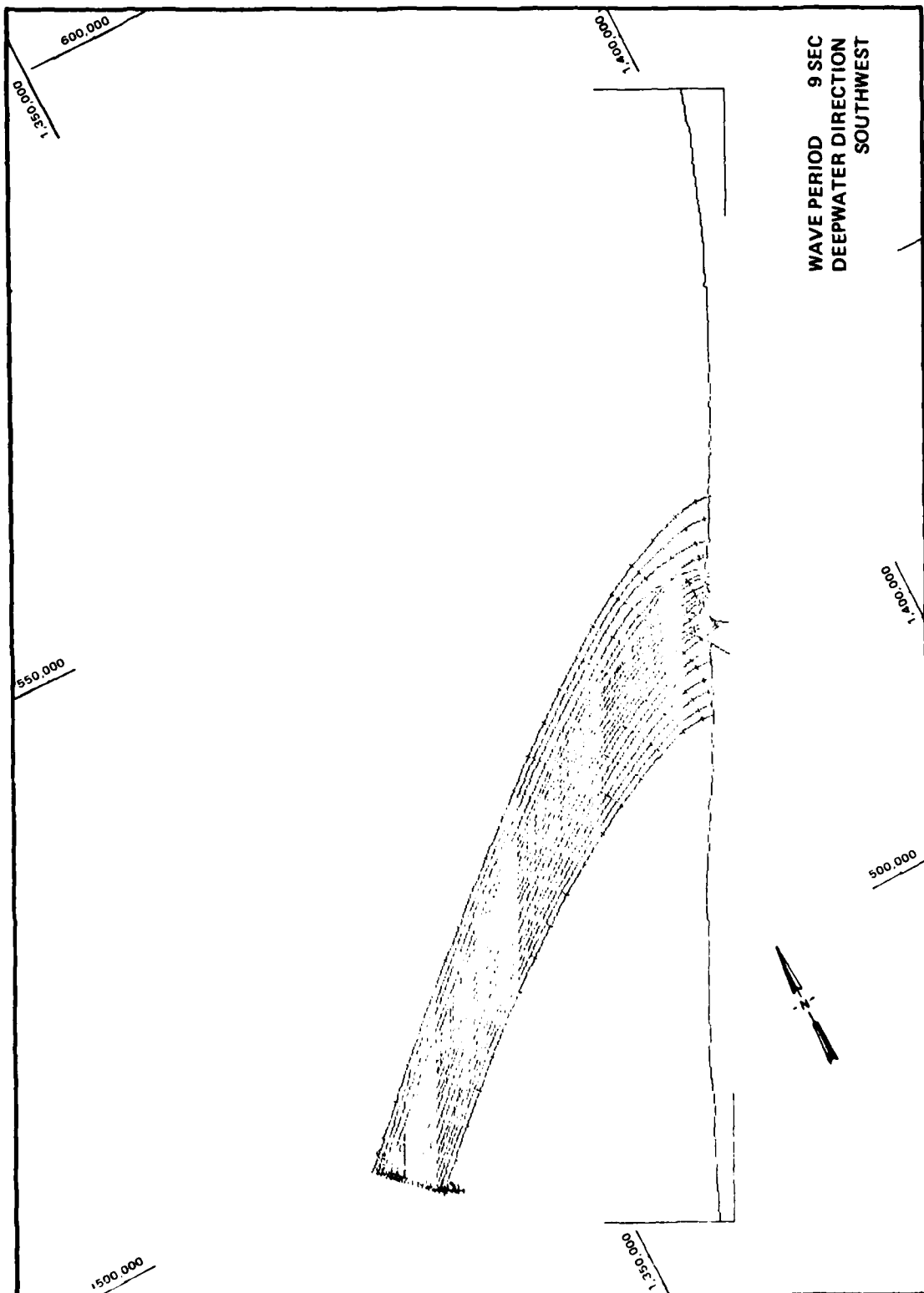


PLATE A28

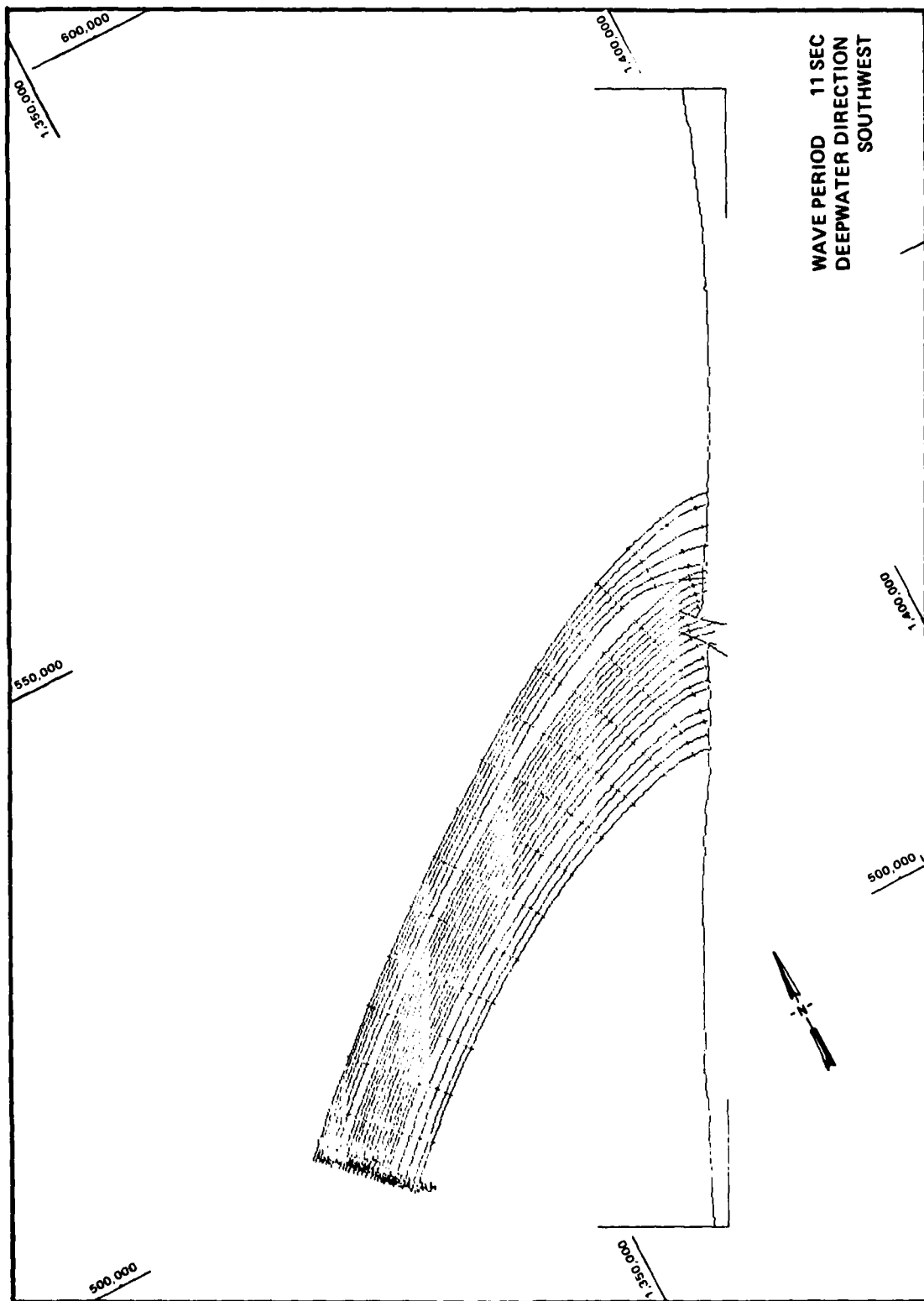


PLATE A29

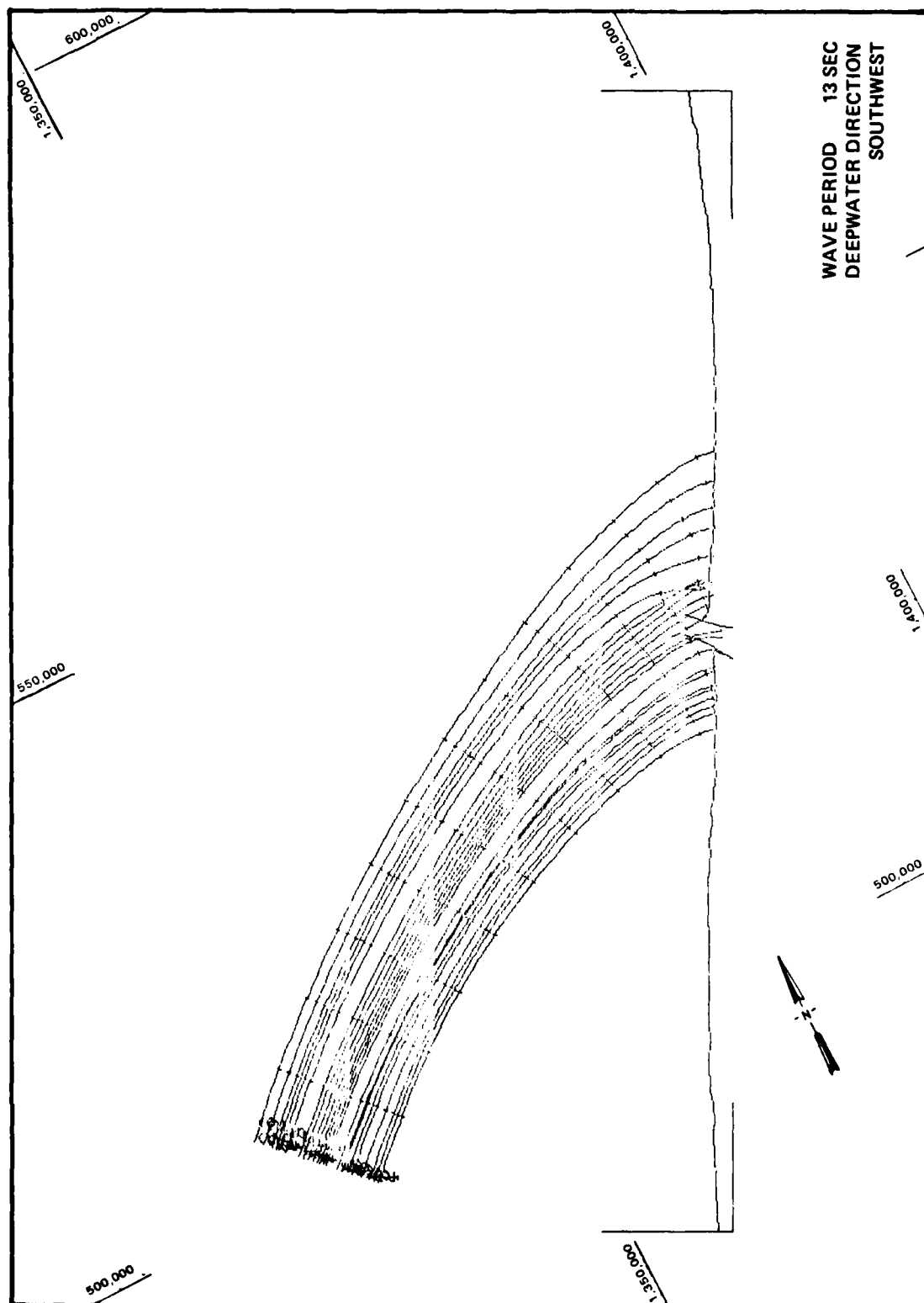
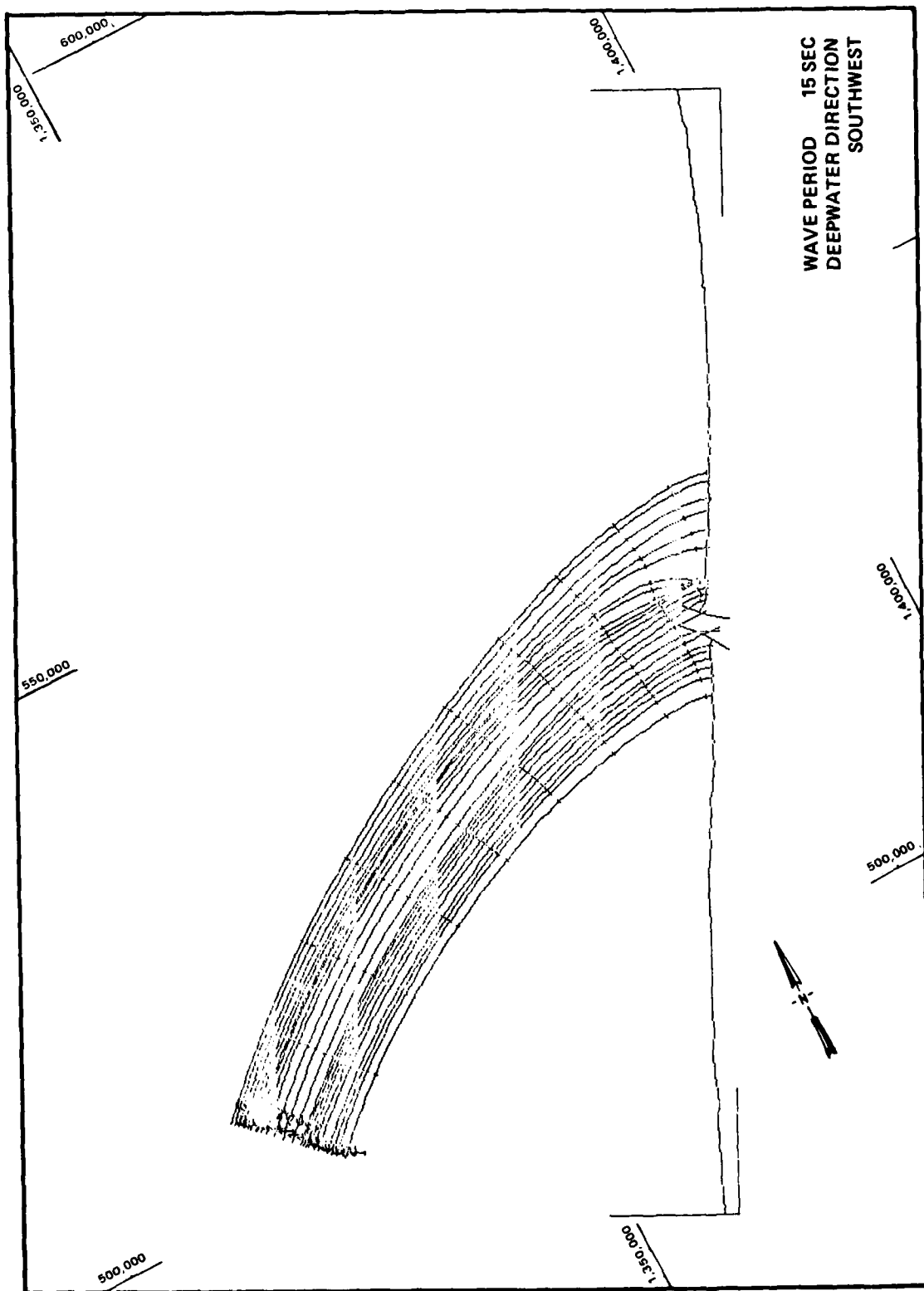


PLATE A30



WAVE PERIOD 15 SEC
DEEPWATER DIRECTION
SOUTHWEST

PLATE A31

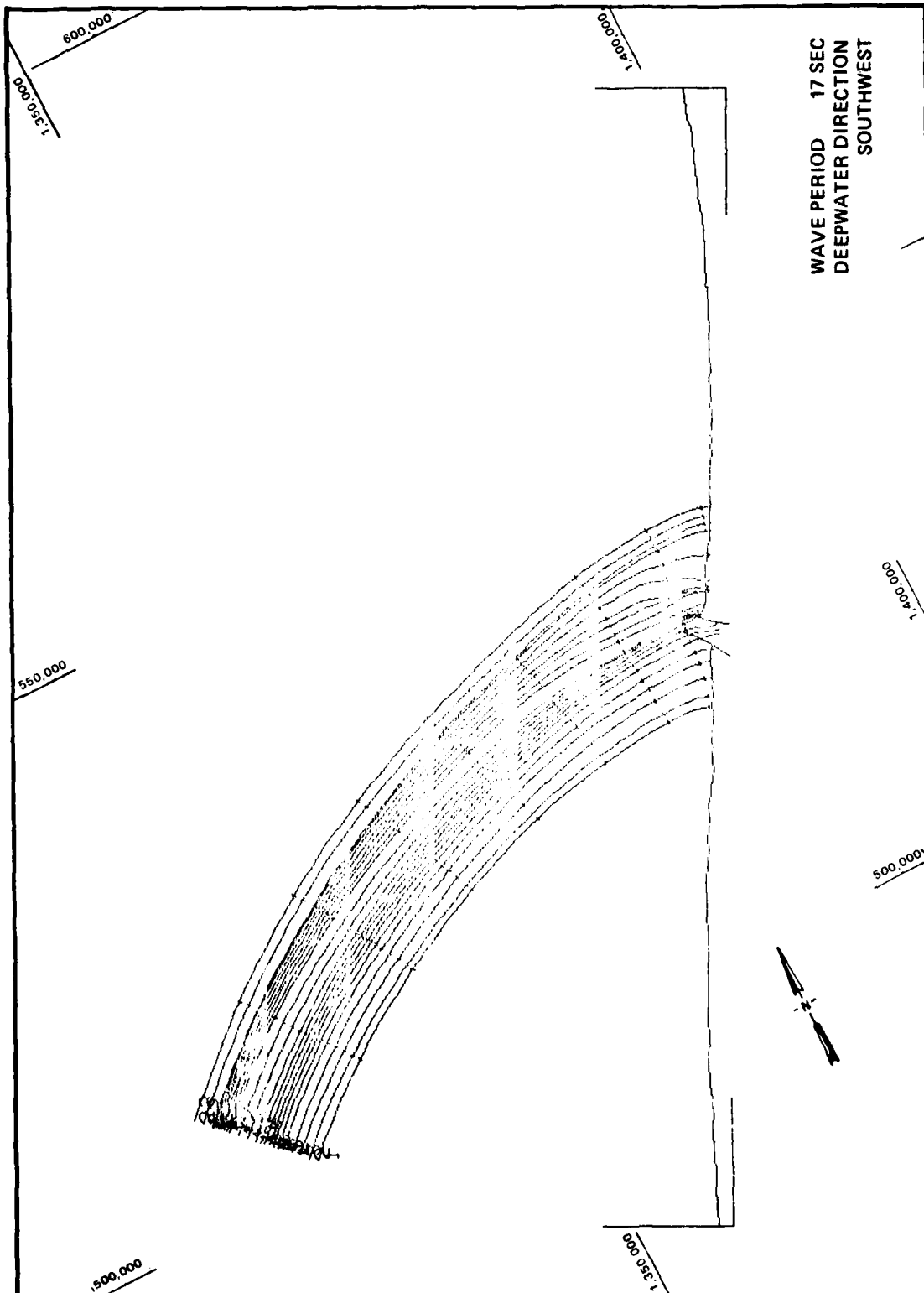


PLATE A32

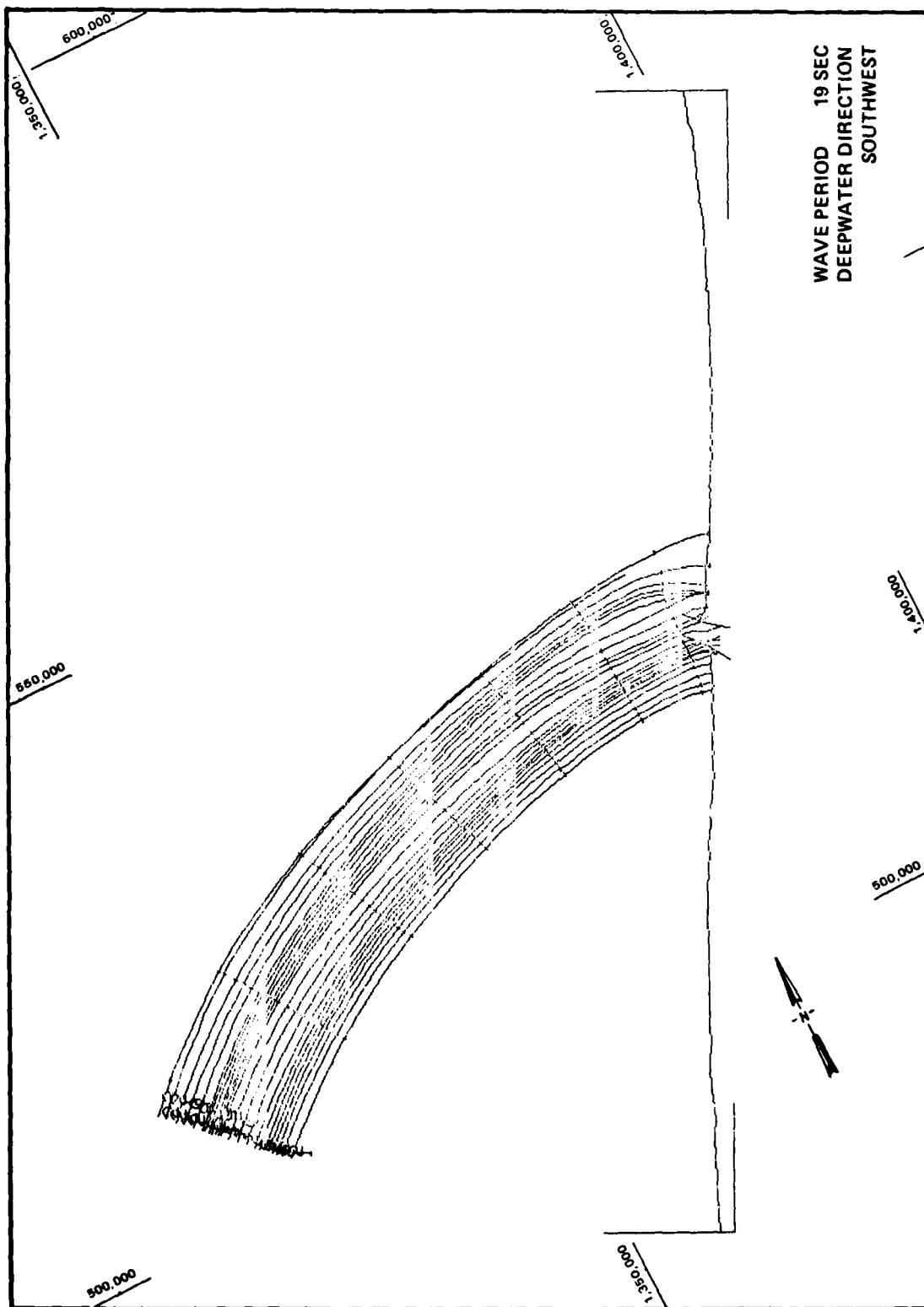


PLATE A33

APPENDIX B: NOTATION

A	Area
b	Shallow-water orthogonal spacing
b_o	Deepwater orthogonal spacing
$(b_o/b)^{1/2}$	Refraction coefficient, K_r
D_{50}	Median particle diameter
H	Shallow-water wave height
H_o	Deepwater wave height
$H_{1/3}$	Significant wave height
K_r	Refraction coefficient
K_s	Shoaling coefficient
L	Length
Q	Discharge
T	Time
V	Velocity
$\bar{V}$	Volume
γ	Specific weight
γ'	Apparent specific weight
η_D	Ratio of median particle diameter
η'_γ	Ratio of apparent specific weights
λ	Horizontal scale
μ	Vertical scale

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