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**TECHNICAL
RESEARCH
REPORT**

Estimated Probability Density Functions for the
Times Between Flashes in the Storms of
9/12/75, 8/26/75, and 7/13/76

by

S. A. Tretter
Co-Principal Investigator

Prepared for NASA Grant NSG 5048

(NASA-CR-154126) ESTIMATED PROBABILITY
DENSITY FUNCTIONS FOR THE TIMES BETWEEN
FLASHES IN THE STORMS OF 12 SEPTEMBER 1975,
26 AUGUST 1975, AND 13 JULY 1976 (Maryland
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**DEPARTMENT OF
ELECTRICAL ENGINEERING**

UNIVERSITY OF MARYLAND

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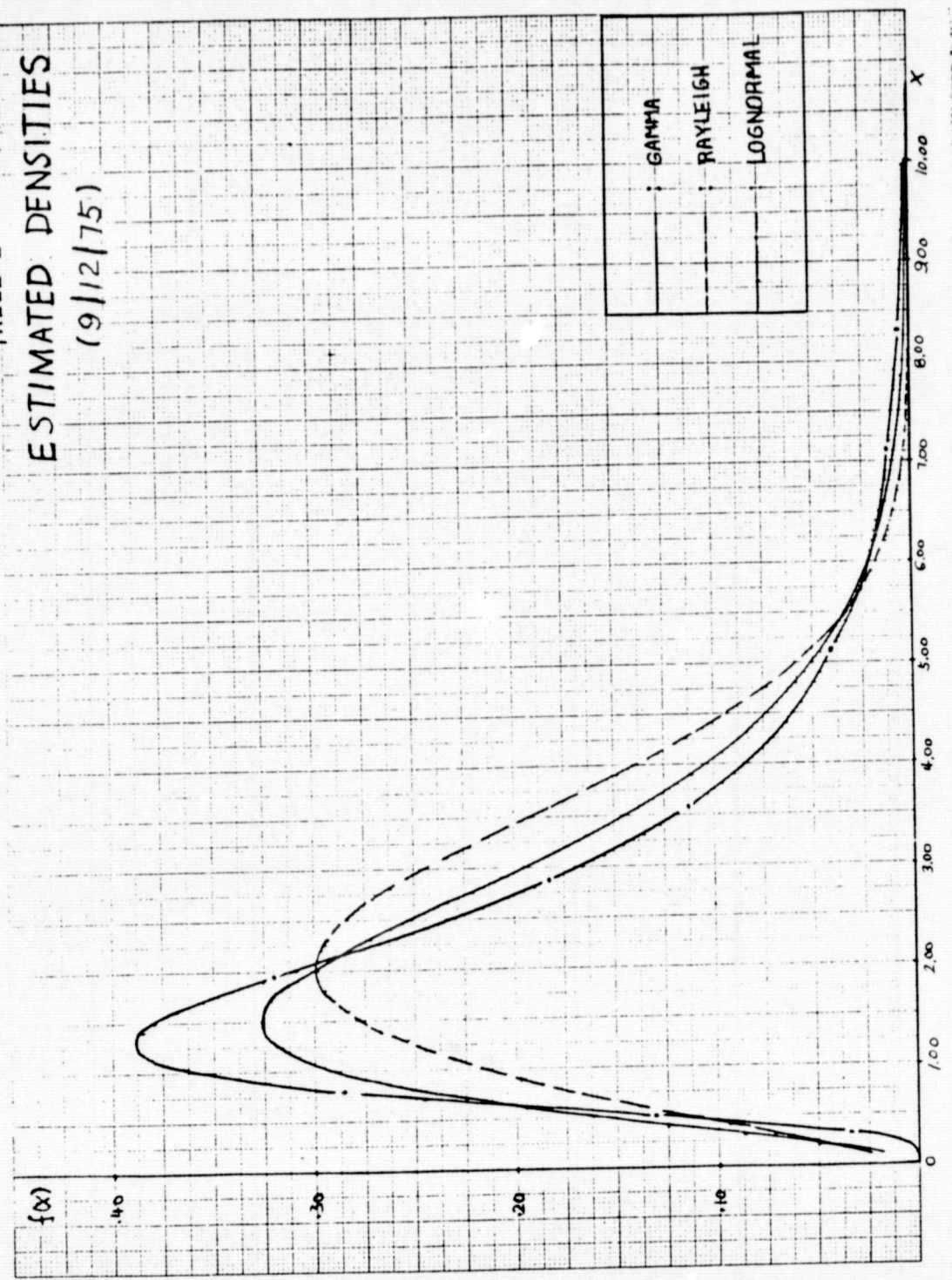
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Estimated Probability Density Functions for the
Times Between Flashes in the Storms of
9/12/75, 8/26/75, and 7/13/76

This report supplements the progress report of June 17, 1977. In that progress report gamma, lognormal, and Rayleigh probability density functions were fitted to the times between lightning flashes in the storms of 9/12/75, 8/26/75, and 7/13/76 by the maximum likelihood method. The goodness of fit was checked by the Kolmogorov-Smirnov test. Plots of the estimated densities along with normalized histograms are included in this report to provide a visual check on the goodness of fit. The labels on the top right hand sides of the graphs refer to the tables in the progress report.

From the figures it can be seen that the lognormal densities are the most peaked and have the highest tails. This results in the best fit to the normalized histogram in most cases. The Rayleigh densities have too broad and rounded peaks to give good fits. In addition, they have the lowest tails. The gamma densities fall inbetween and give the best fit in a few cases.

TABLE 8 TAPE I
ESTIMATED DENSITIES
(9/12/75)

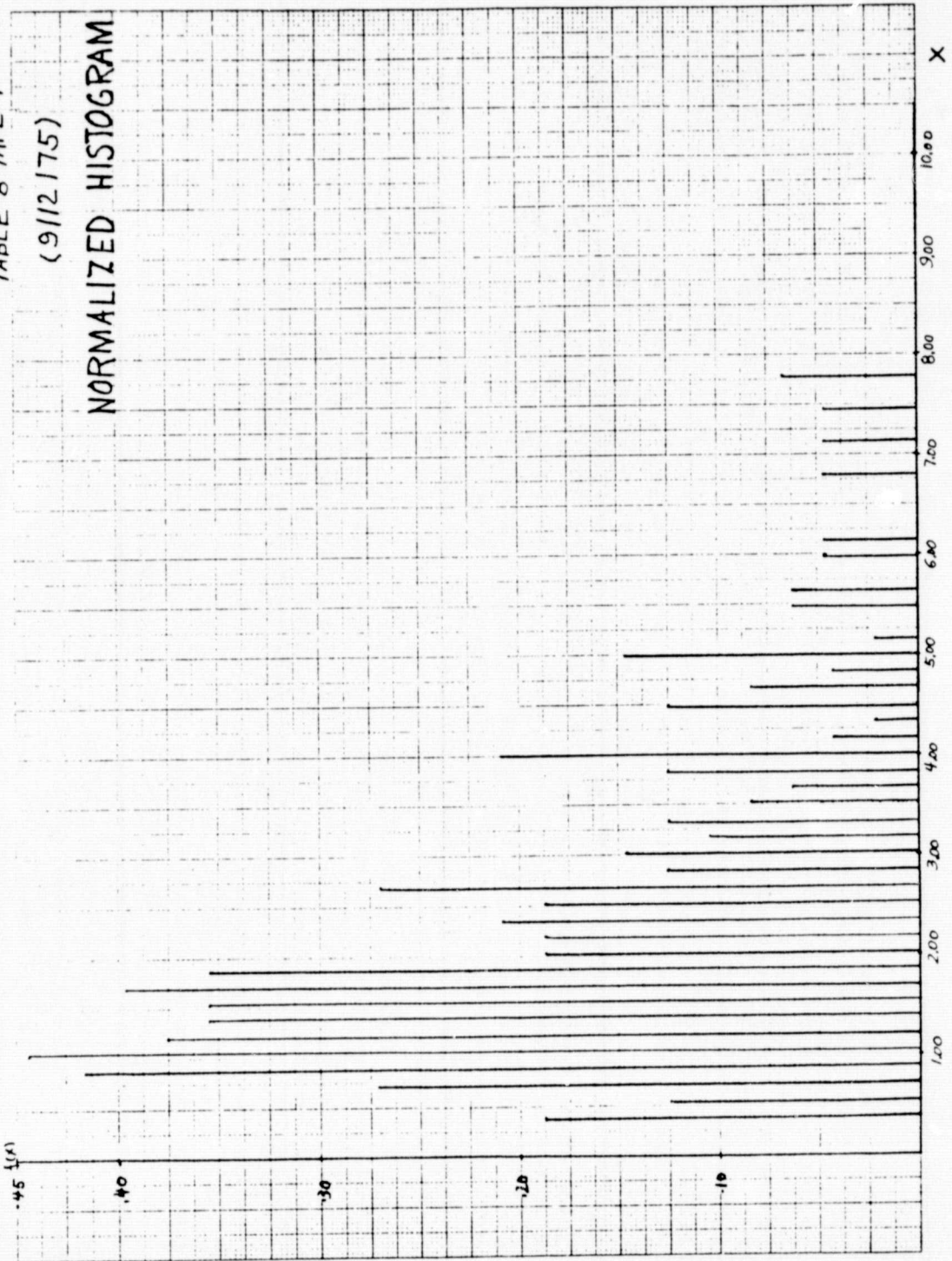


10 Millimeters to the Centimeter

Fig. 1. Storm of 9/12/75 (Tape 1) - Estimated Densities



TABLE 8 TAPE 1
(9/12/75)



10 Millimeters to the Centimeter

Fig. 2. Storm of 9/12/75 (Tape 1) - Normalized Histogram

TABLE 8 TAPE 2
ESTIMATED DENSITIES

(9/12/75)

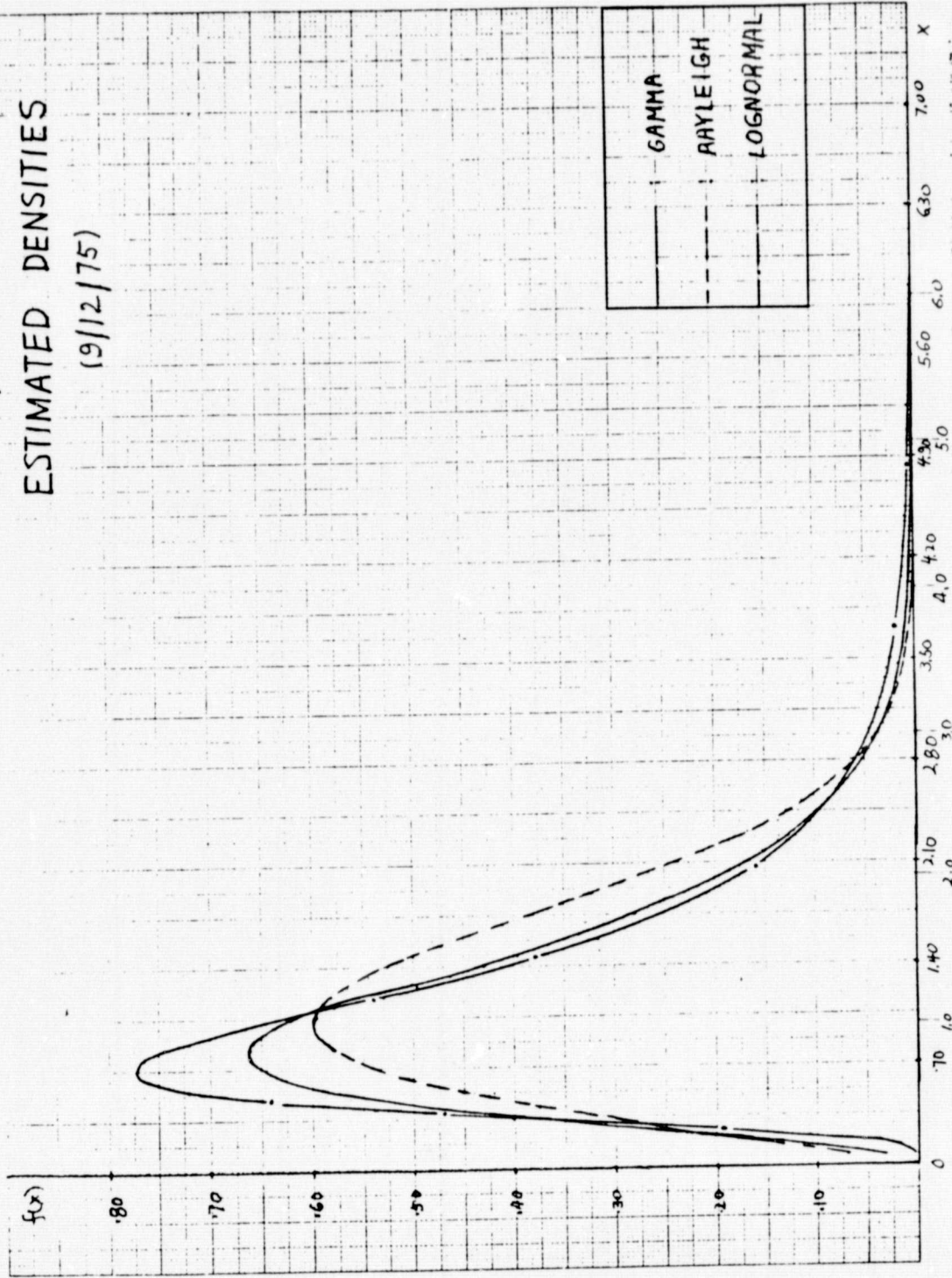


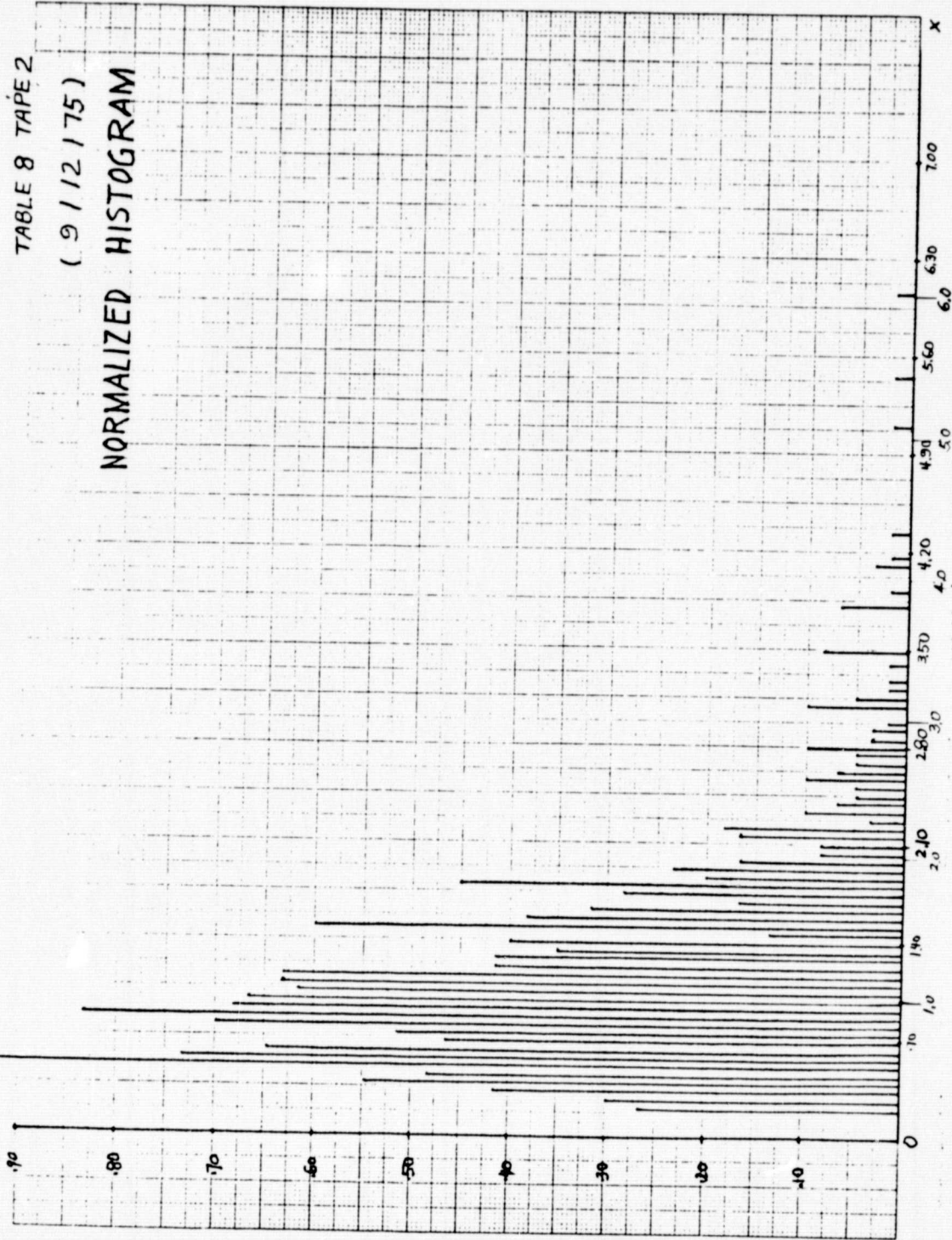
Fig. 3. Storm of 9/12/75 (Tape 2) - Estimated Densities

10 Millimeters to the Centimeter

TABLE 8 TAPE 2

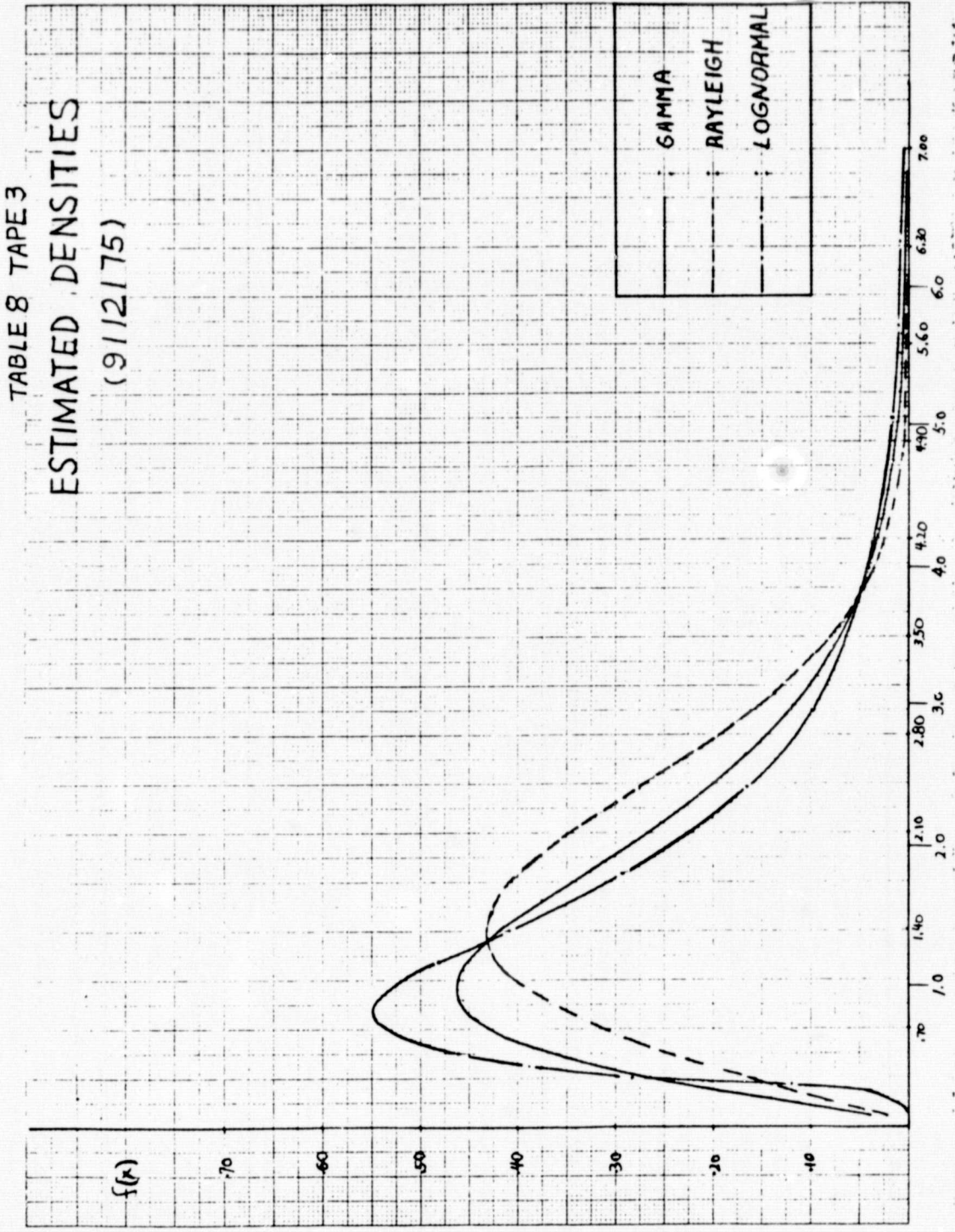
(9 / 12 / 75)

NORMALIZED HISTOGRAM



10 Millimeters to the Centimeter

Fig. 4. Storm of 9/12/75 (Tape 2) - Normalized Histogram



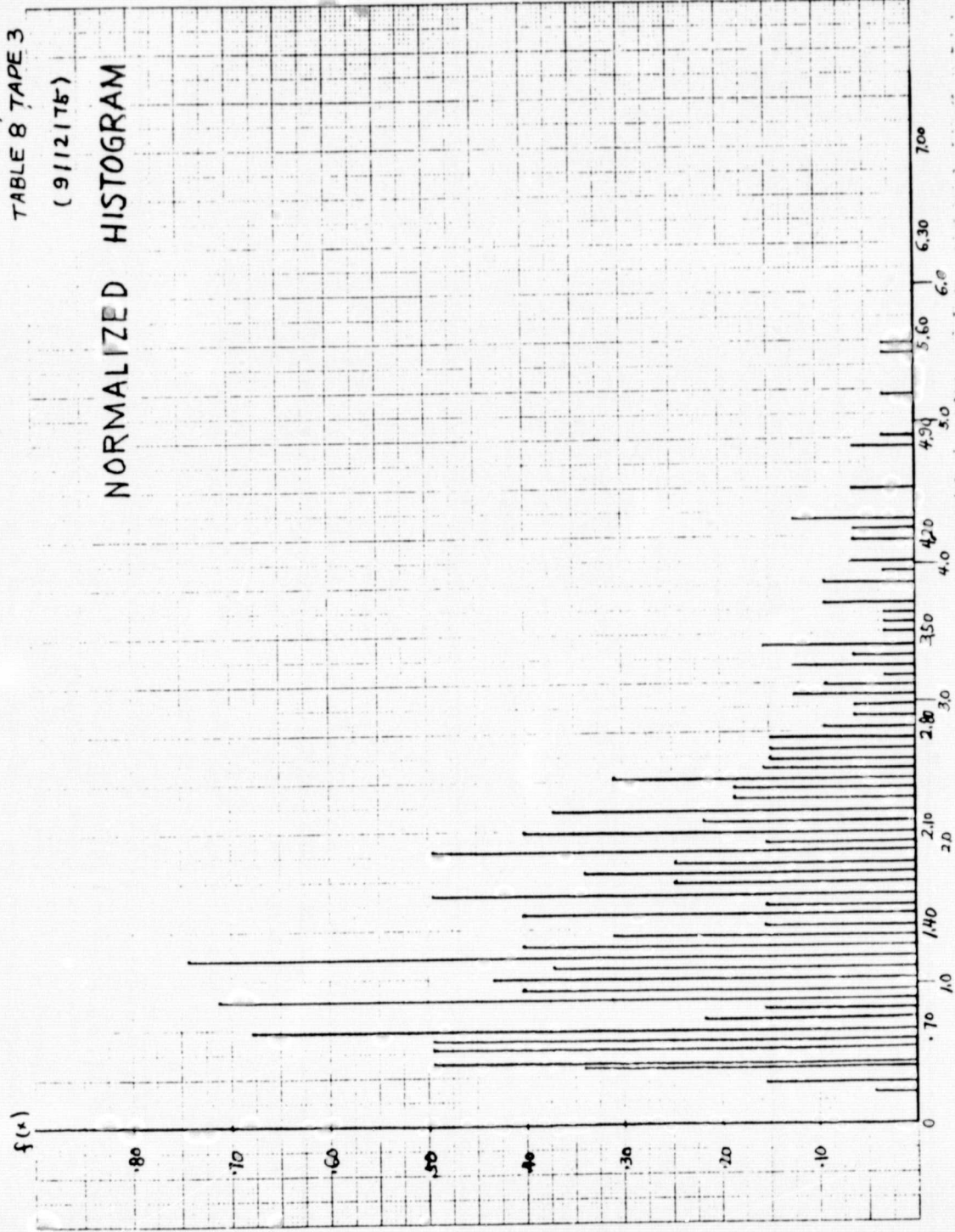
10 Millimeters to the Centimeter

Fig. 5. Storm of 9/12/75 (Tape 3) - Estimated Densities



TABLE 8 TAPE 3
(9/12/75)

NORMALIZED HISTOGRAM



10 Millimeters to the Centimeter

Fig. 6. Storm of 9/12/75 (Tape 3) - Normalized Histogram

TABLE 8 TAPE 4
 ESTIMATED DENSITIES
 (9/12/75)

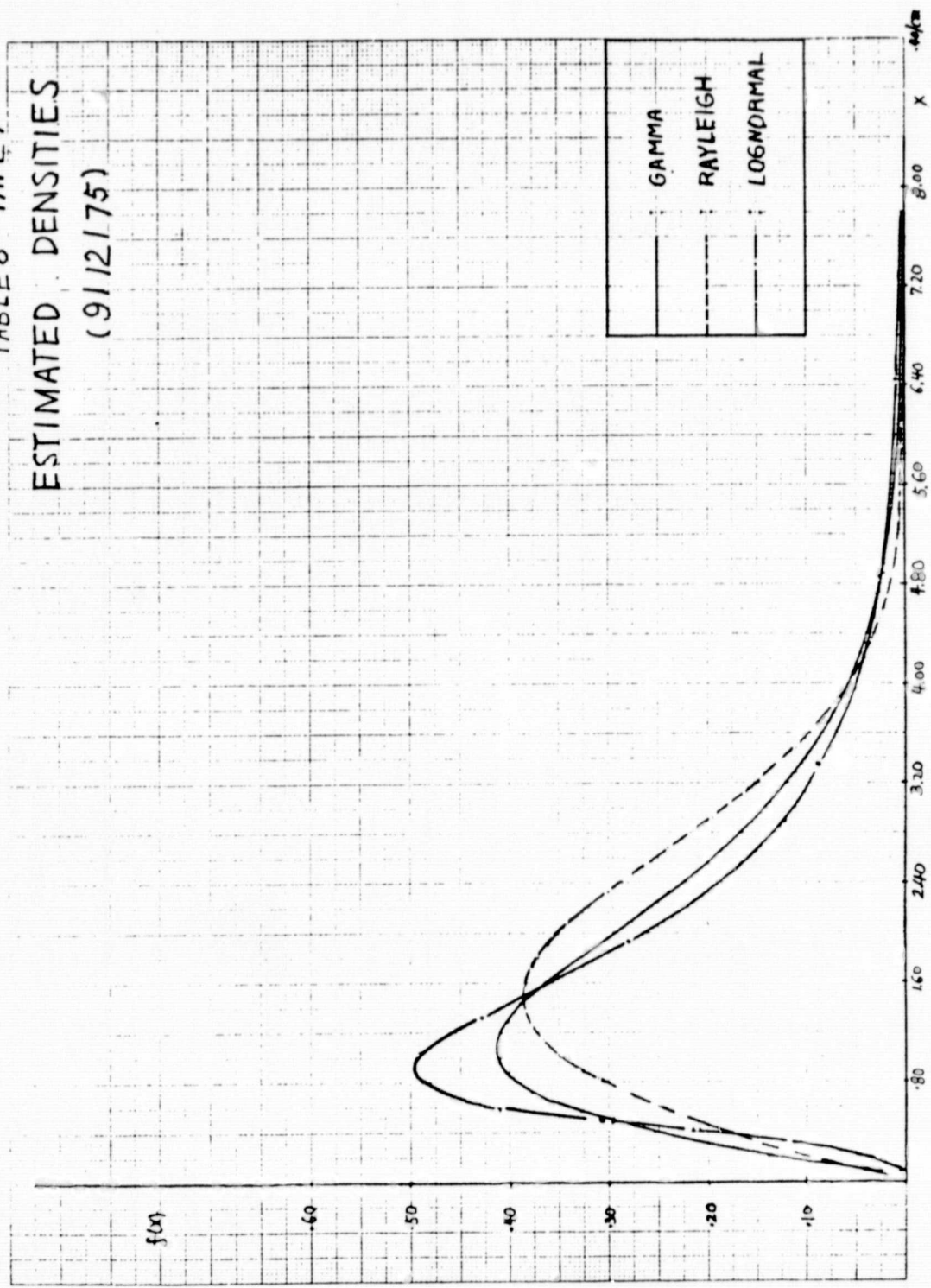
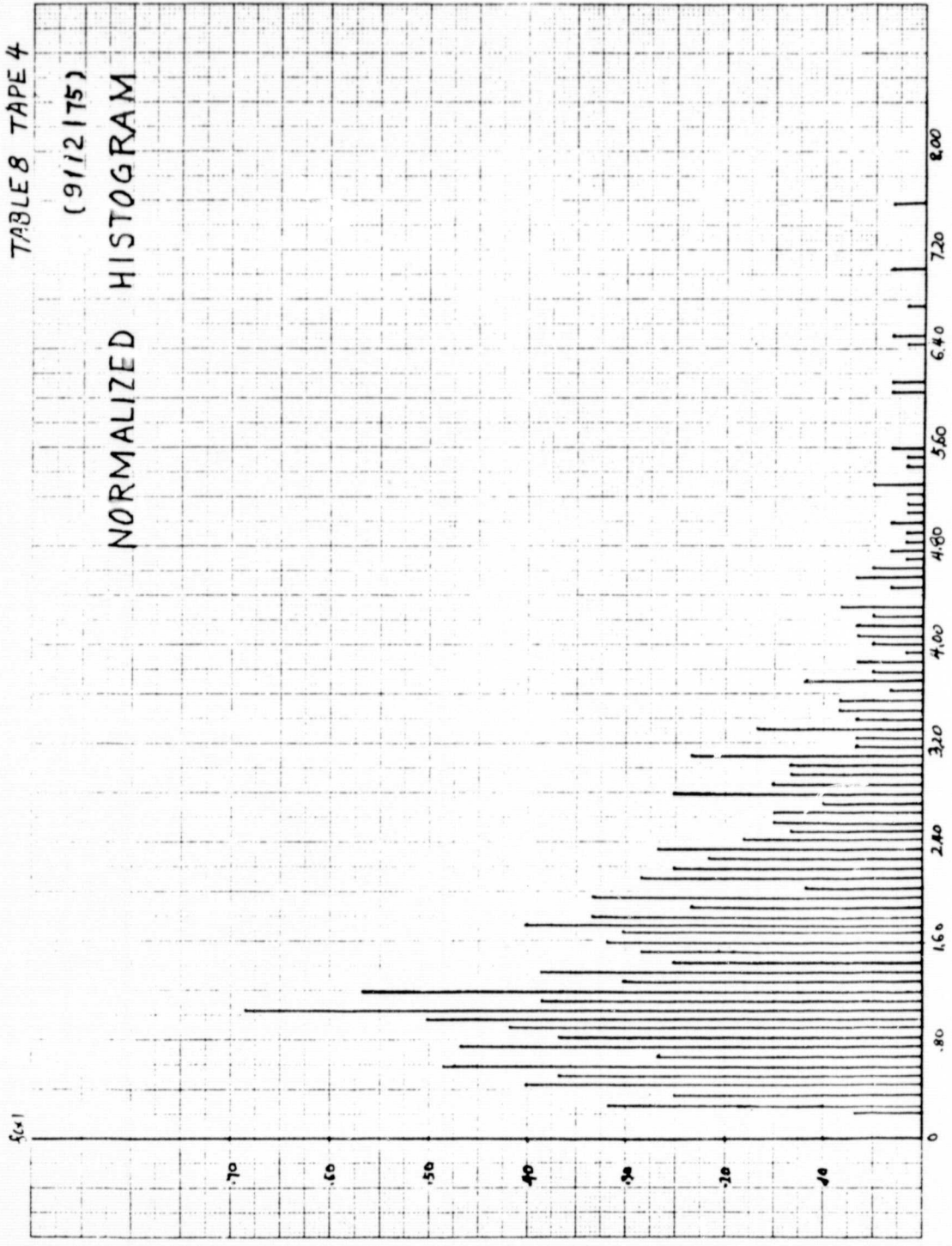


FIG. 7. Storm of 9/12/75 (Tape 4) - Estimated Densities

TABLE 8 TAPE 4

(9/12/75)

NORMALIZED HISTOGRAM



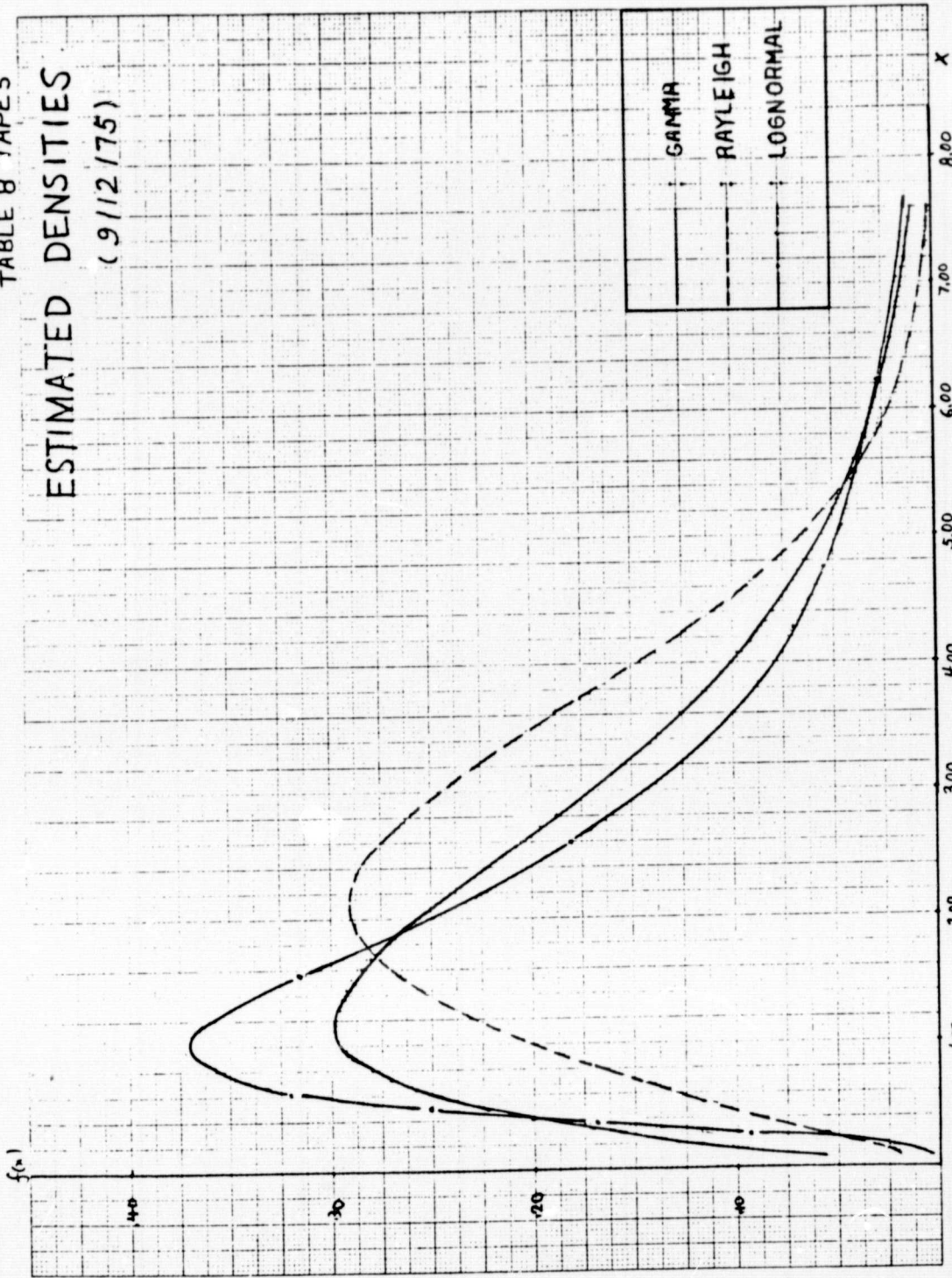
10 Millimeters to the Centimeter

Fig. 8. Storm of 9/12/75 (Tape 4) - Normalized Histogram

TABLE 8 TAPE 5

ESTIMATED DENSITIES

(9/12/75)



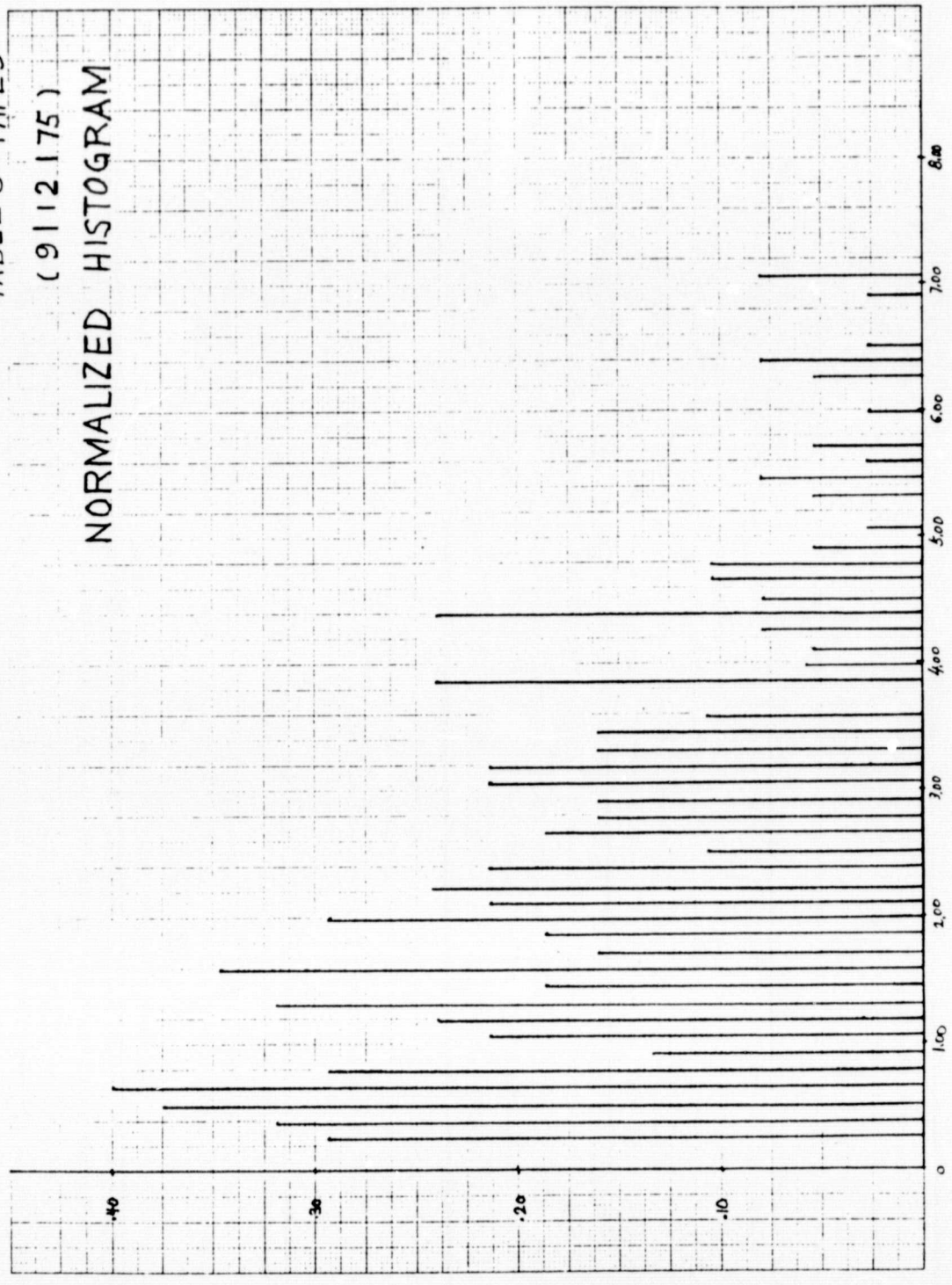
10 Millimeters to the Centimeter

Fig. 9. Storm of 9/12/75 (Tape 5) - Estimated Densities



TABLE 8 TAPE 5
(9112175)

NORMALIZED HISTOGRAM

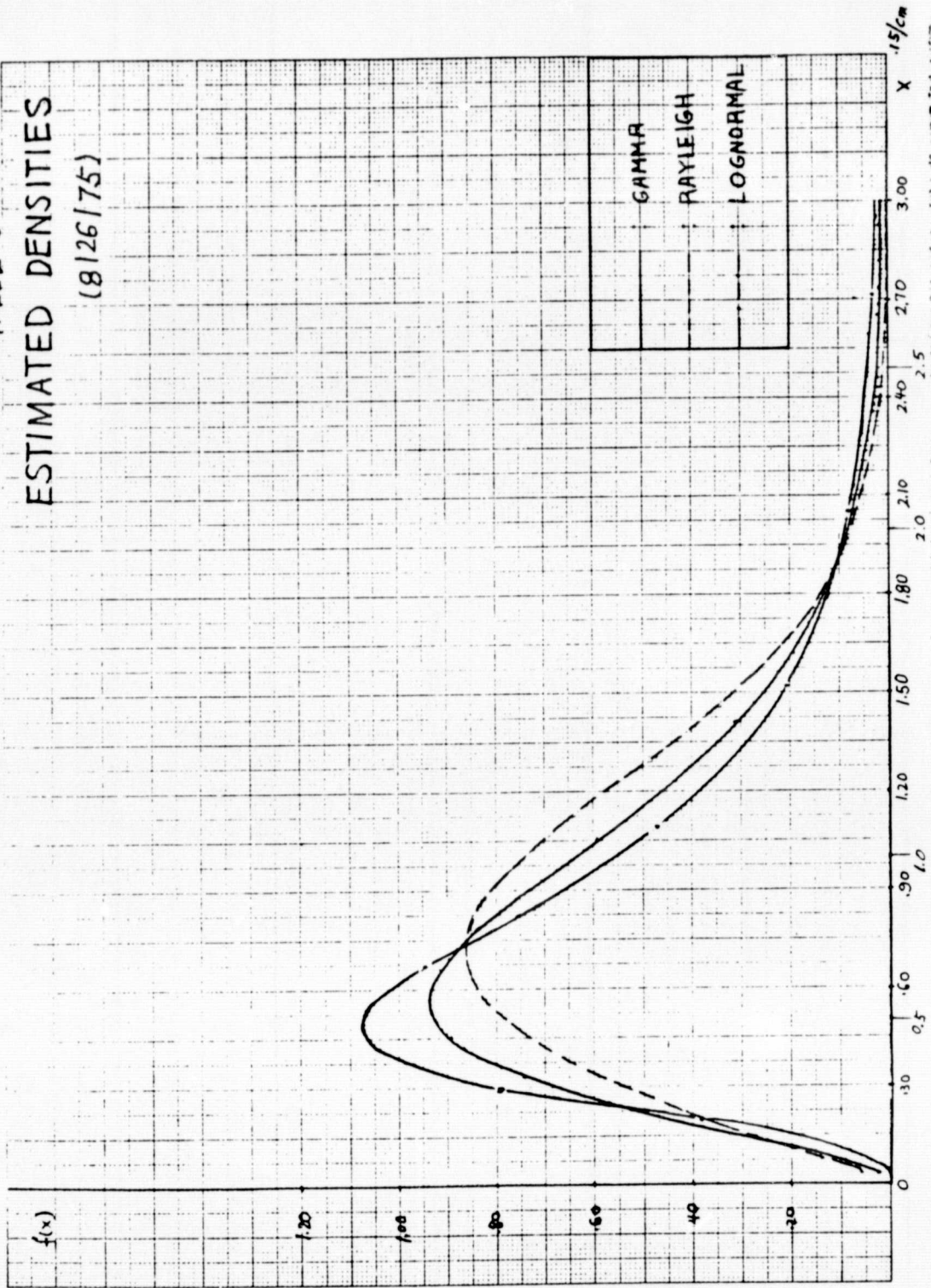


10 Millimeters to the Centimeter

Fig. 10. Storm of 9/12/75 (Tape 5) - Normalized Histogram



TABLE 9 TAPE 1
ESTIMATED DENSITIES
(8/26/75)



10 Millimeters to the Centimeter

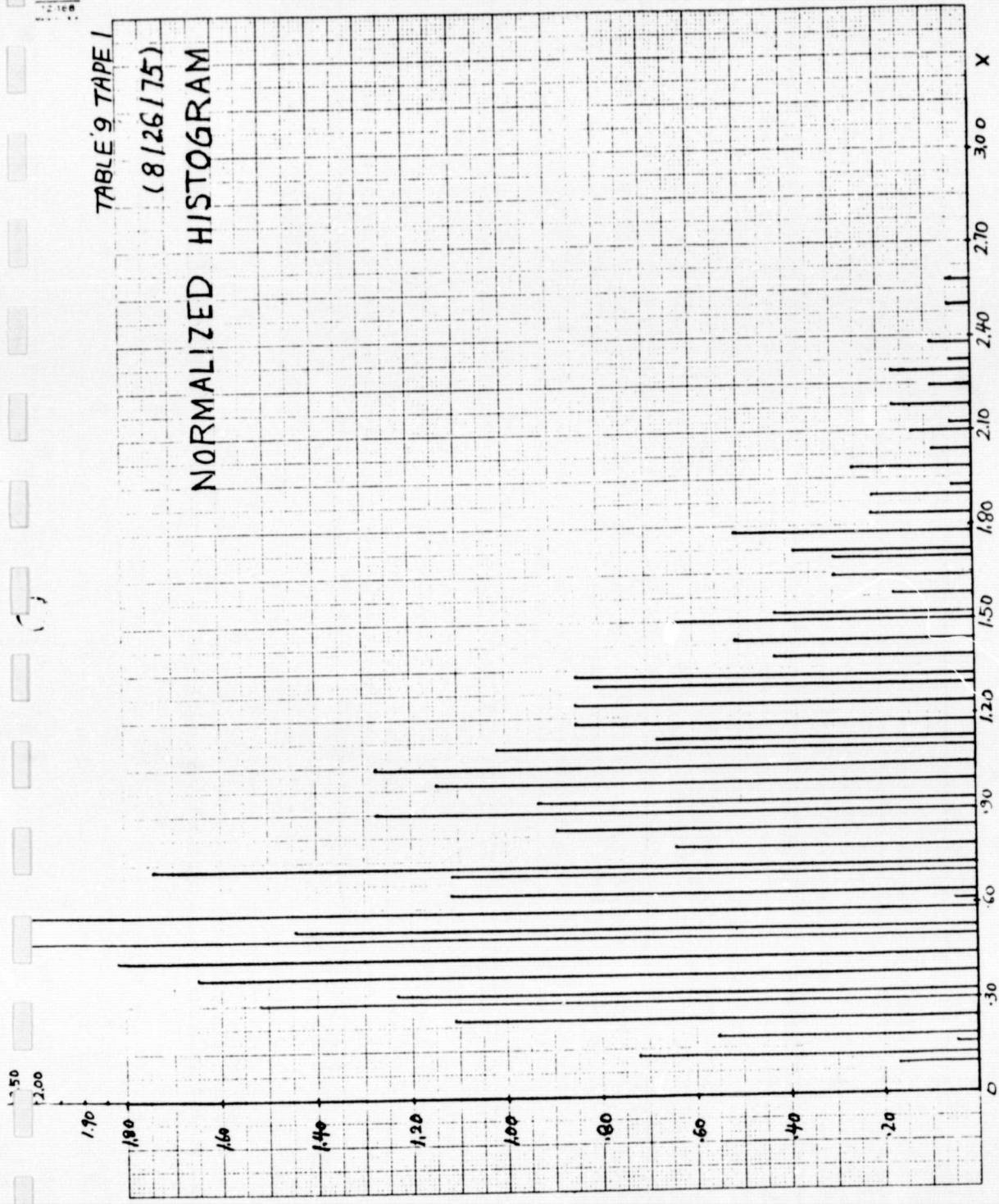
Fig. 11. Storm of 8/26/75 (Tape 1) - Estimated Densities



TABLE 9 TAPE 1

(8/26/75)

NORMALIZED HISTOGRAM



10 Millimeters to the Centimeter

Fig. 12. Storm of 8/26/75 (Tape 1) - Normalized Histogram



TABLE 9 TAPE 2

ESTIMATED DENSITIES
(8/26/75)

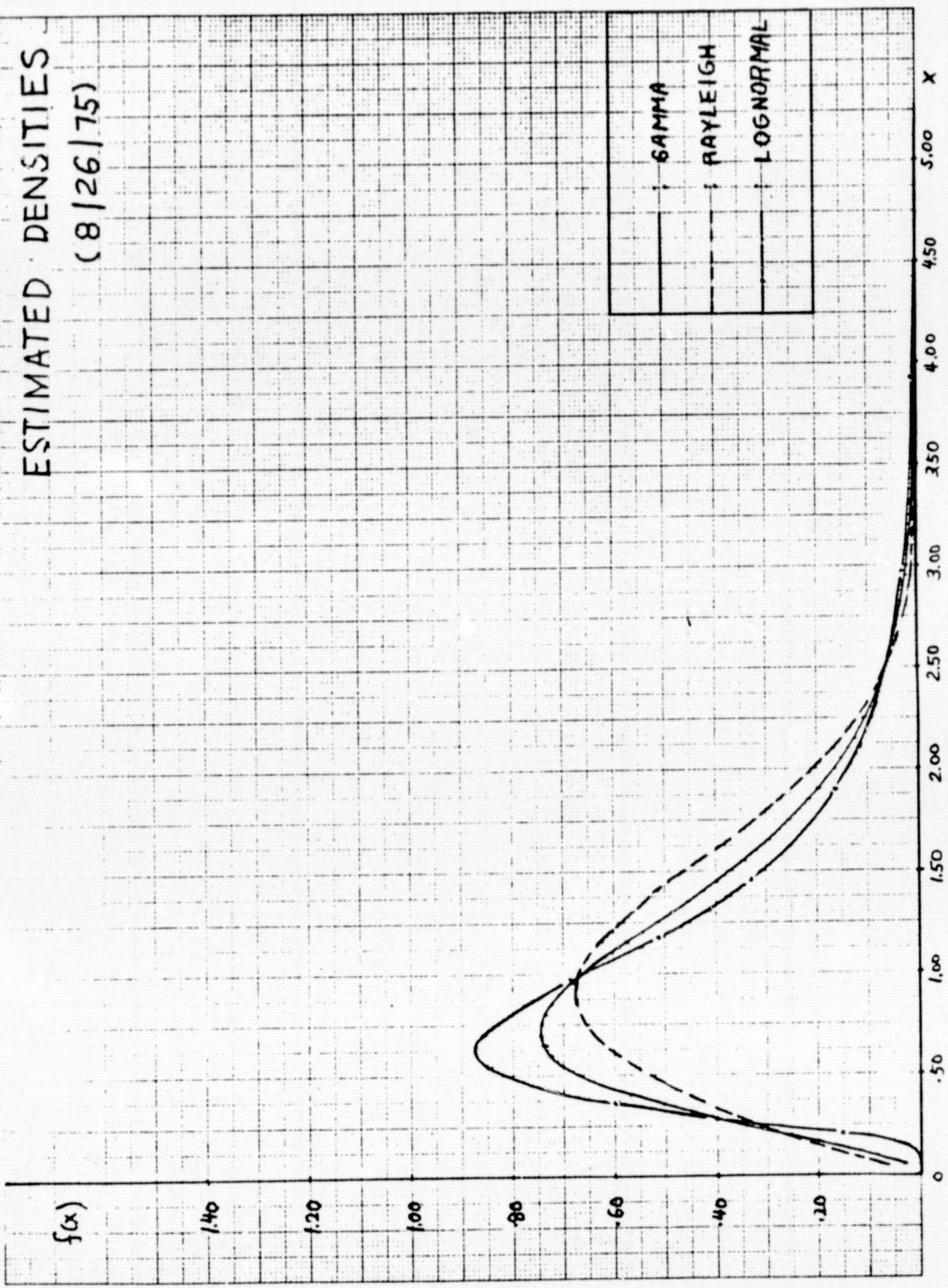


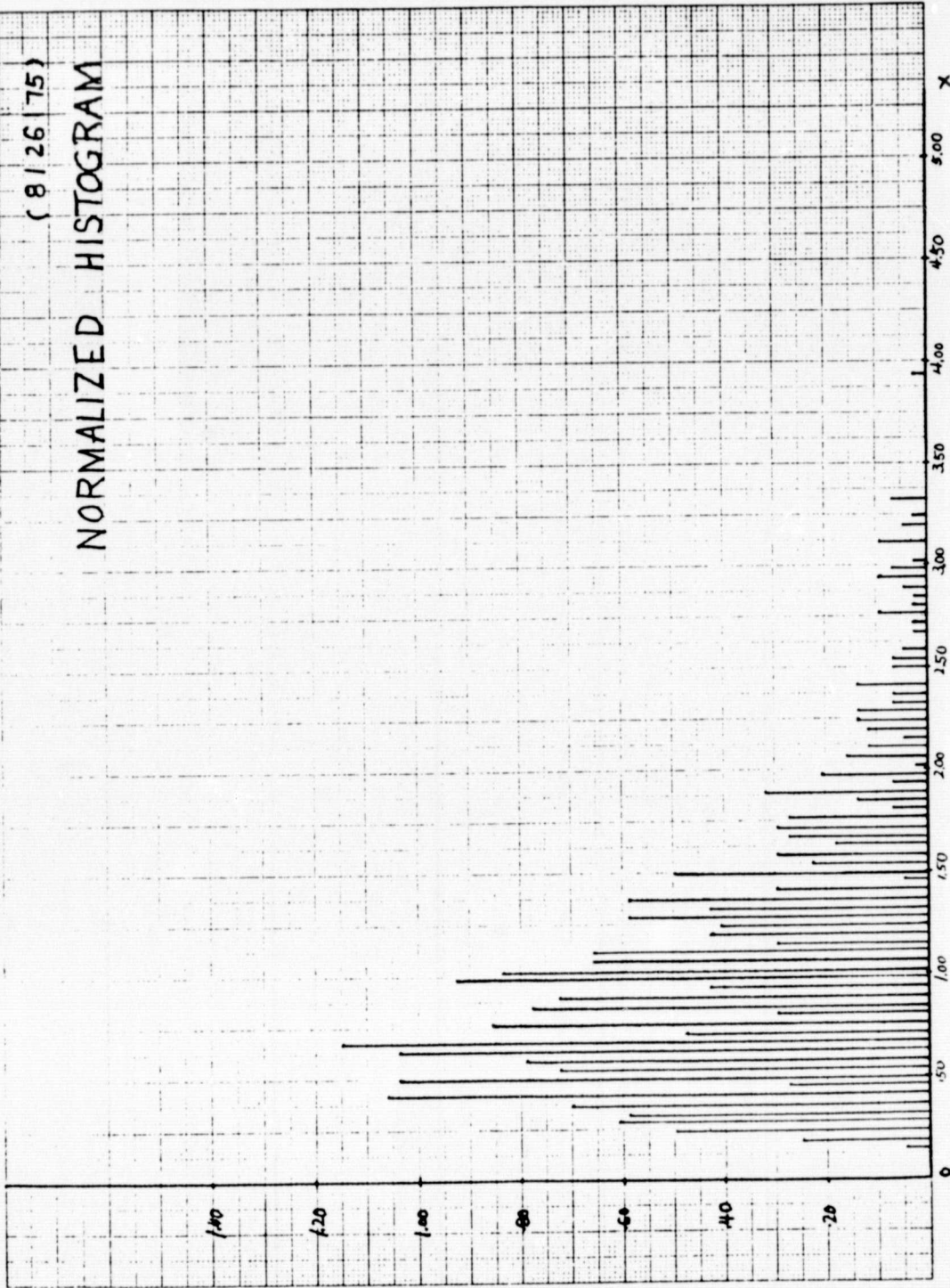
Fig. 13. Storm of 8/26/75 (Tape 2) - Estimated Densities

10 Millimeters to the Centimeter

TABLE 9 TAPE 2

(8 | 26 | 75)

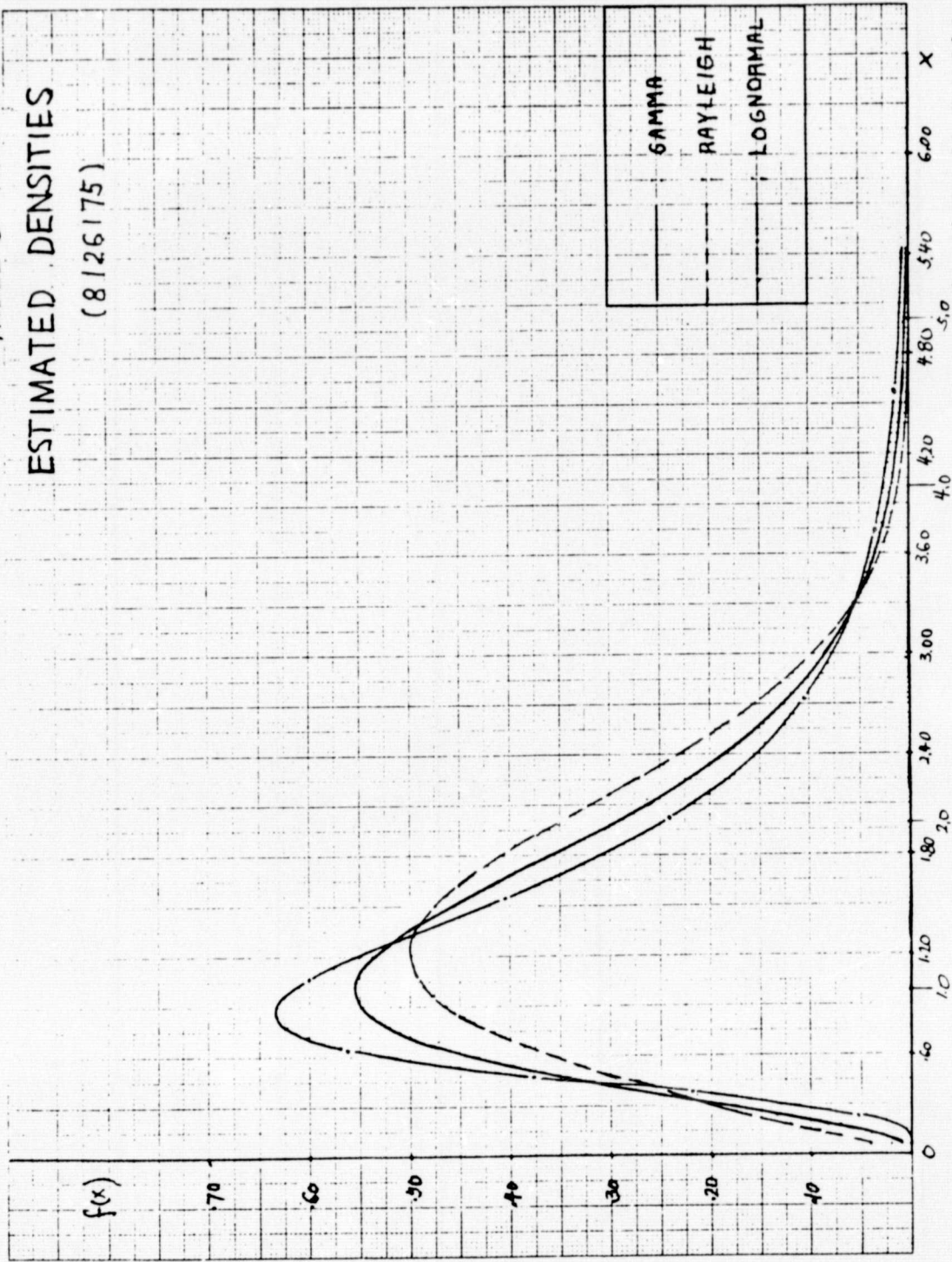
NORMALIZED HISTOGRAM



10 Millimeters to the Centimeter

Fig. 14. Storm of 8/26/75 (Tape 2) - Normalized Histogram

TABLE 9 TAPE 3
 ESTIMATED DENSITIES
 (8126175)



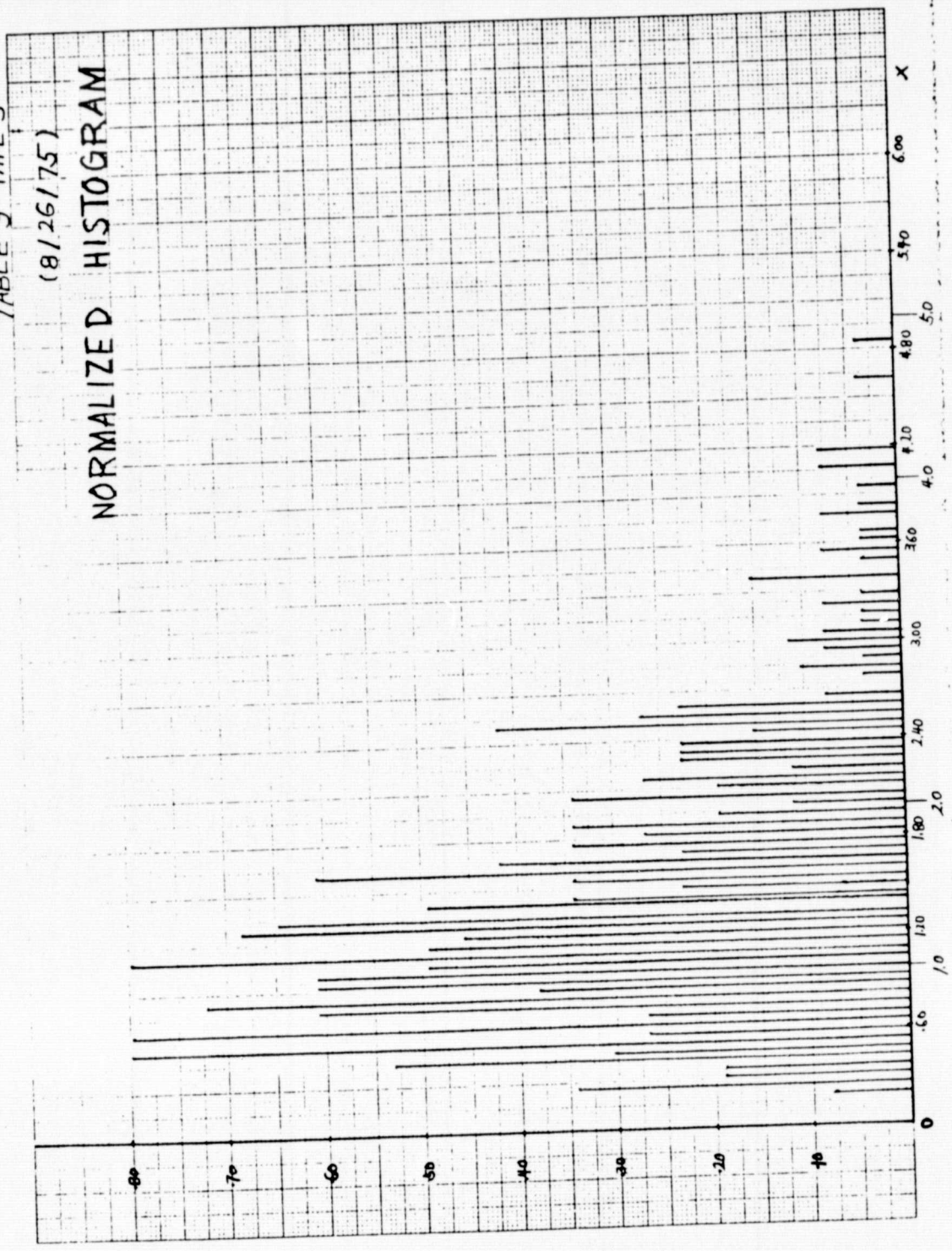
10 Millimeters to the Centimeter

Fig. 15. Storm of 8/26/75 (Tape 3) - Estimated Densities



TABLE 9 TAPE 3
(8/26/75)

NORMALIZED HISTOGRAM

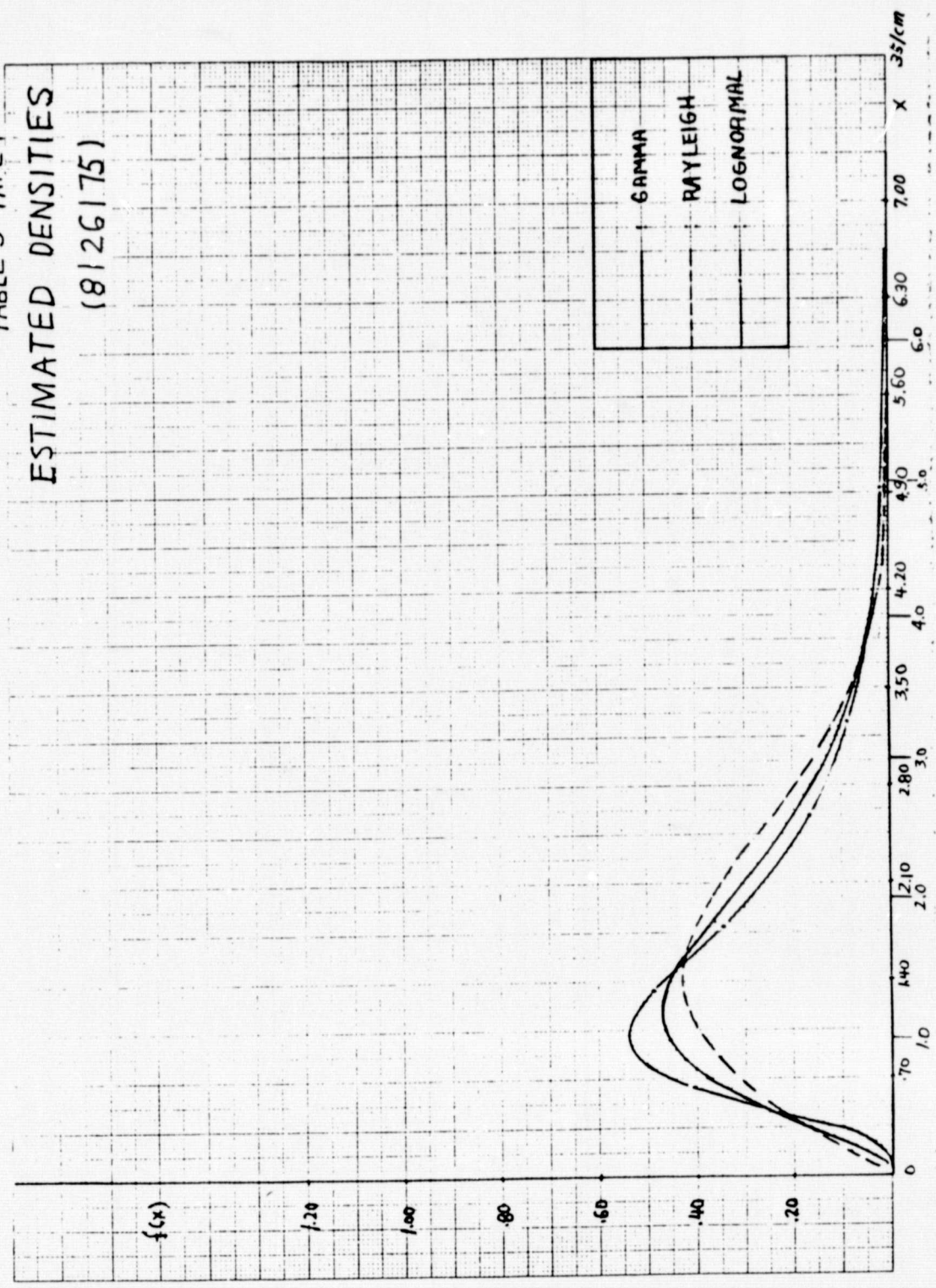


10 Millimeters to the Centimeter

Fig. 16. Storm of 8/26/75 (Tape 3) - Normalized Histogram



TABLE 9 TAPE 4
ESTIMATED DENSITIES
(8126175)



10 Millimeters to the Centimeter

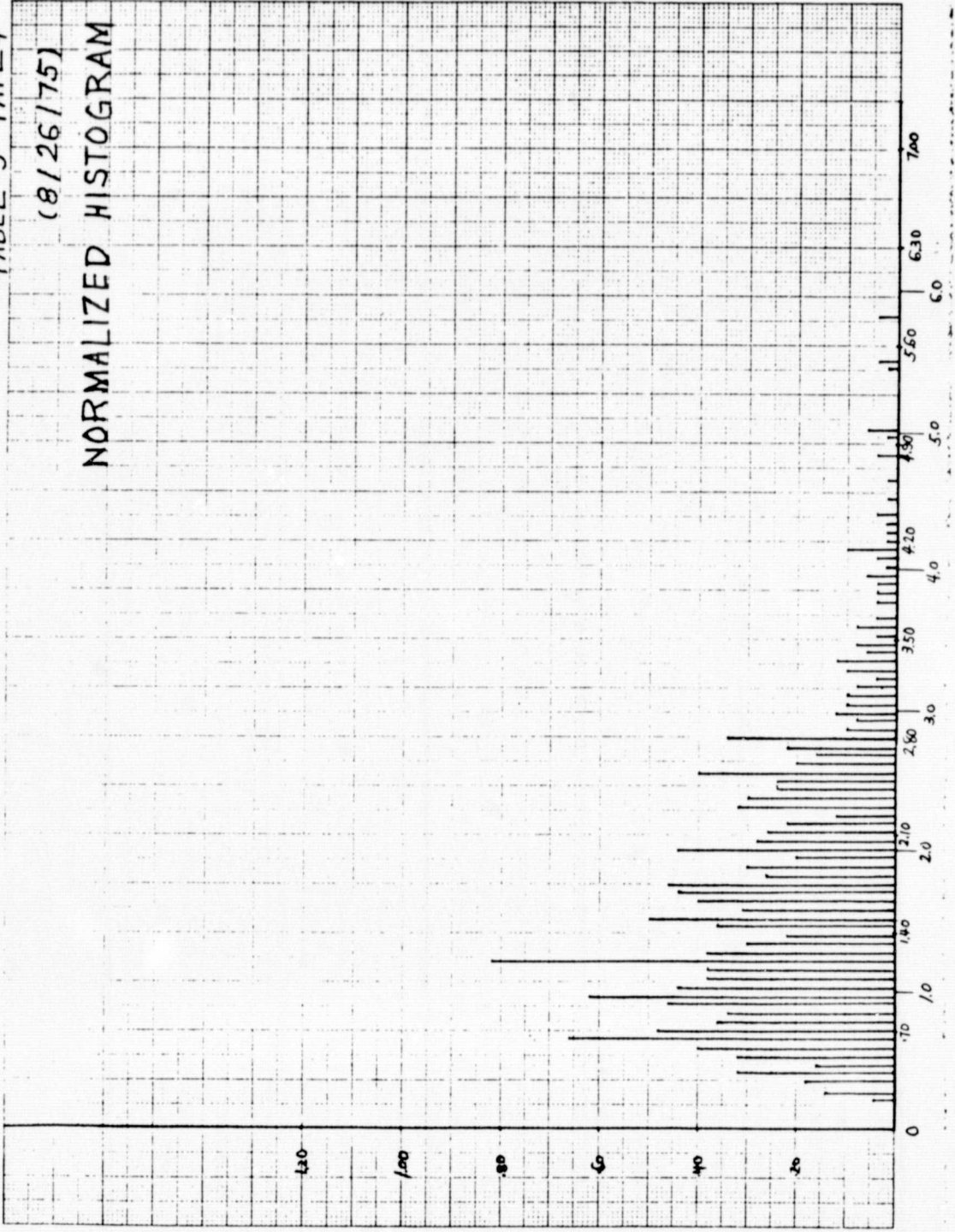
Fig. 17. Storm of 8/26/75 (Tape 4) - Estimated Densities



TABLE 9 TAPE 4

(8/26/75)

NORMALIZED HISTOGRAM



10 Millimeters to the Centimeter

Fig. 18. Storm of 8/26/75 (Tape 4) - Normalized Histogram

TABLE 10 TAPE 1

ESTIMATED DENSITIES

(ALL FLASHES, 7/13/76)

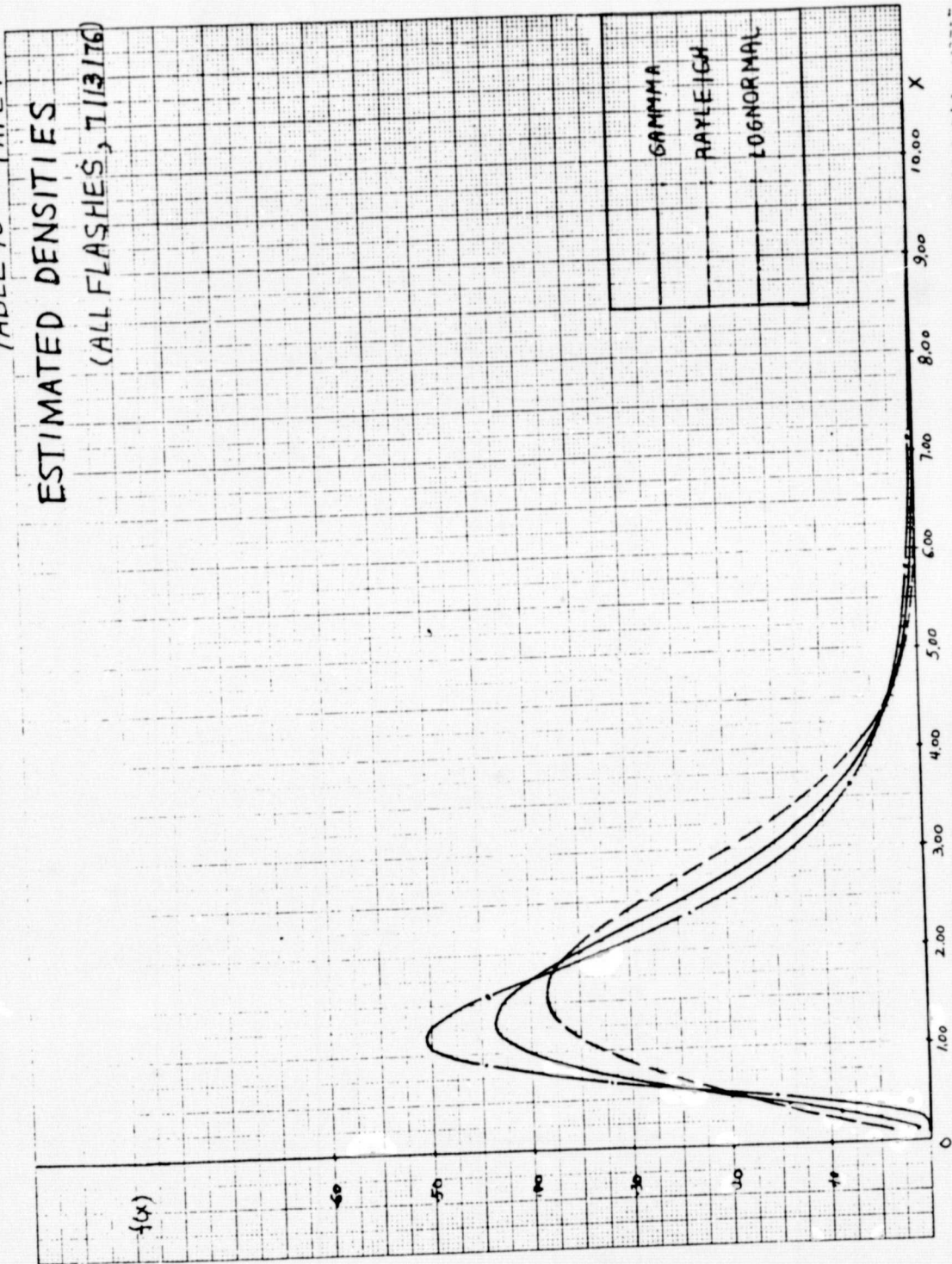


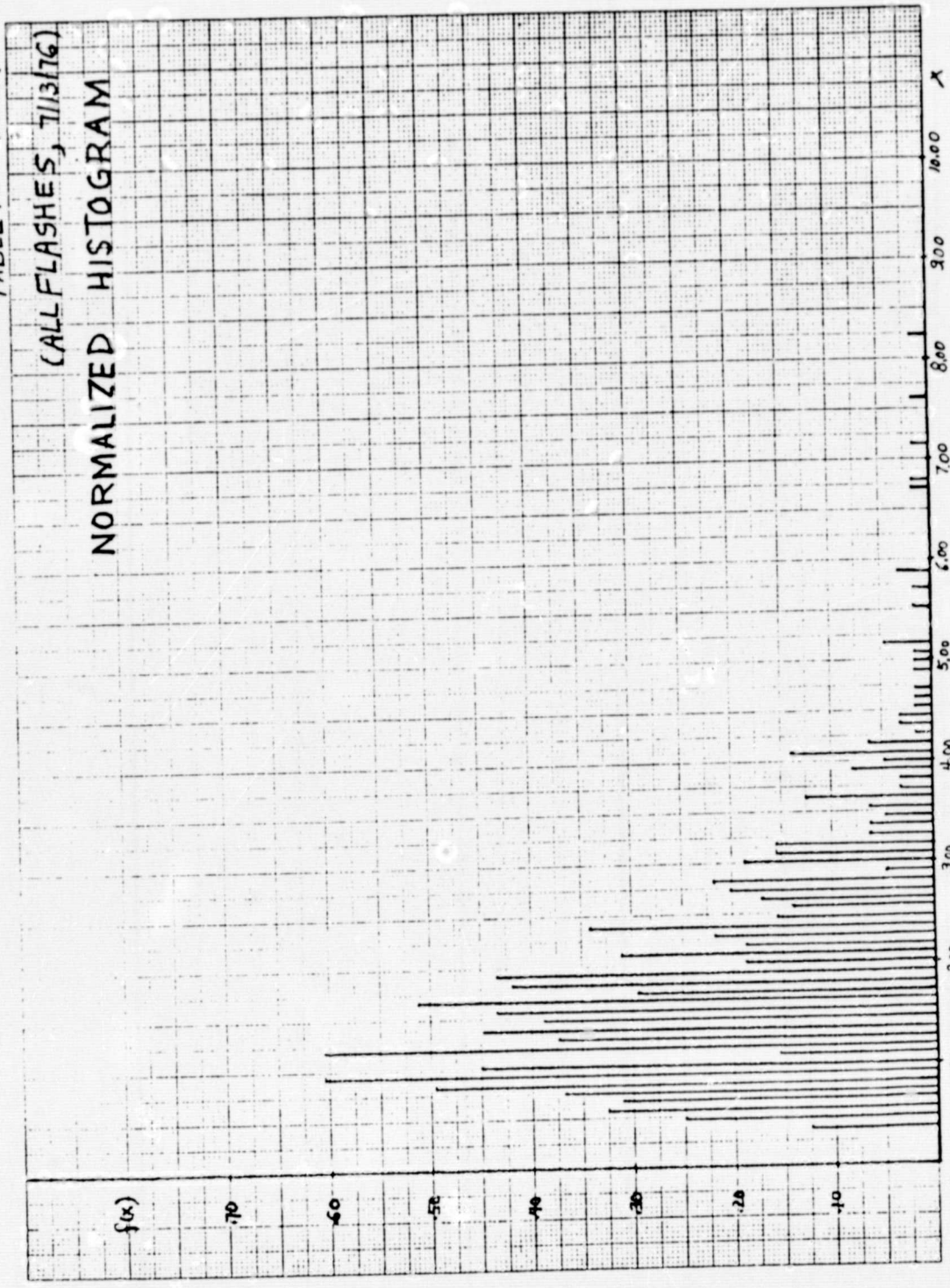
Fig. 19. Storm of 7/13/76 (Tape 1) - Estimated Densities (All Flashes)

10 Millimeters to the Centimeter

TABLE 10 TAPE I

(ALL FLASHES, 7/13/76)

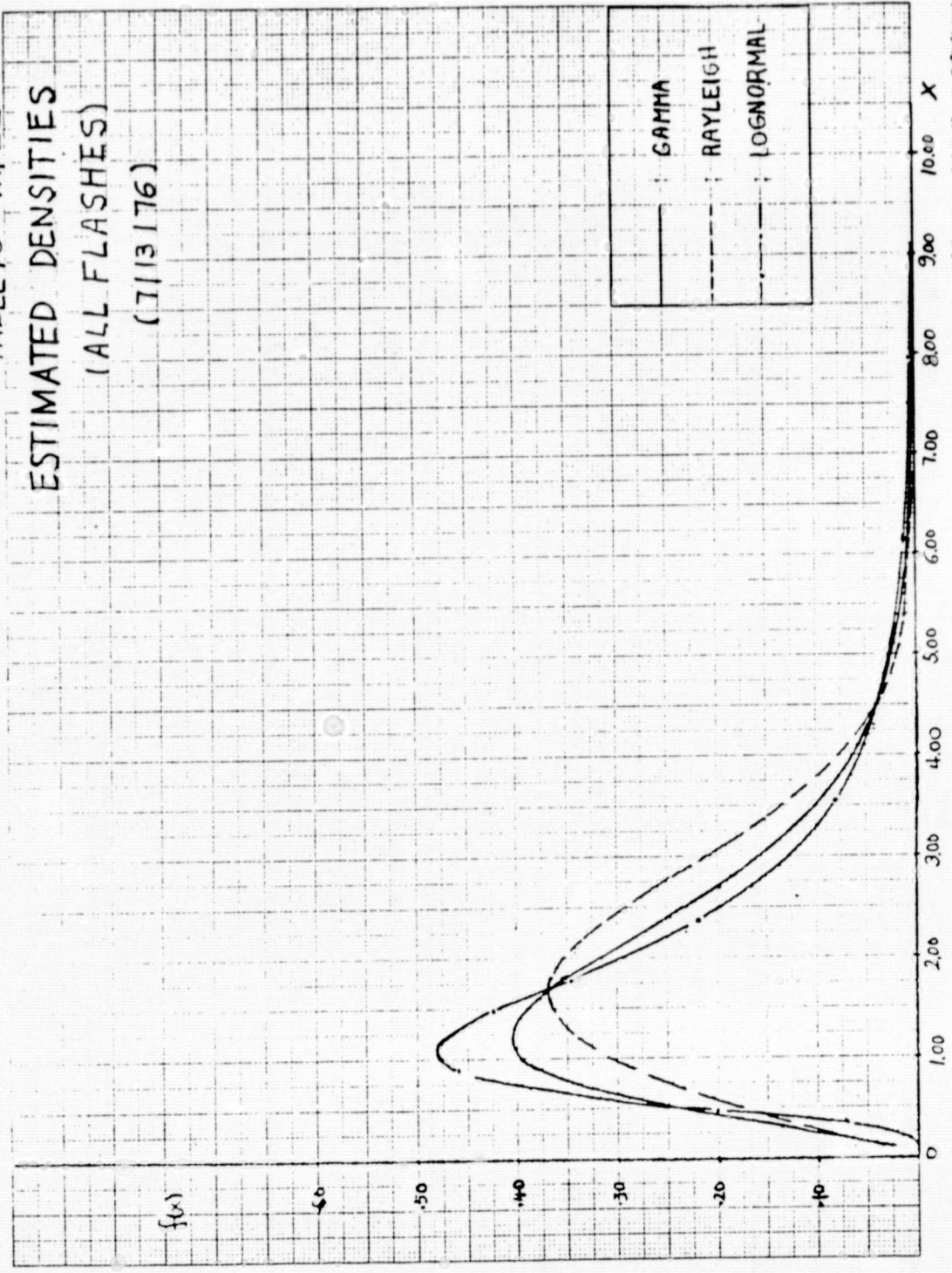
NORMALIZED HISTOGRAM



10 Millimeters to the Centimeter

Fig. 20. Storm of 7/13/76 (Tape I) - Normalized Histogram (All Flashes)

TABLE 10 TAPE 2
ESTIMATED DENSITIES
(ALL FLASHES)
(7/13/76)



10 Millimeters to the Centimeter

FIG. 21. Storm of 7/13/76 (Tape 2) - Estimated Densities (All Flashes)

TABLE 10 TAPE 2
(ALL FLASHES, 7/13/76)
NORMALIZED HISTOGRAM

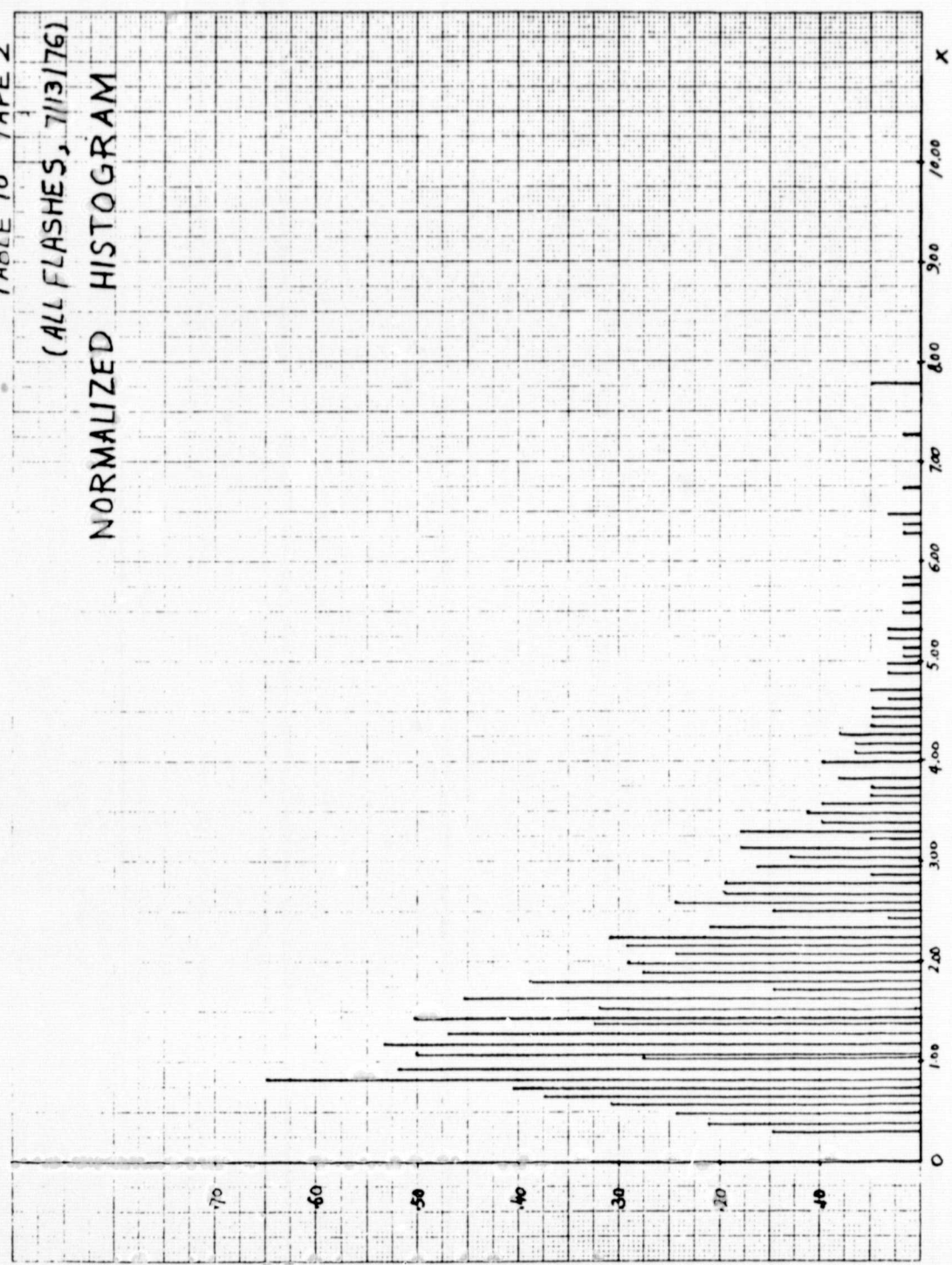


Fig. 22. Storm of 7/13/76 (Tape 2) - Normalized Histogram (All Flashes)

TABLE 10 TAPE 3

ESTIMATED DENSITIES
(ALL FLASHES, 7/13/76)

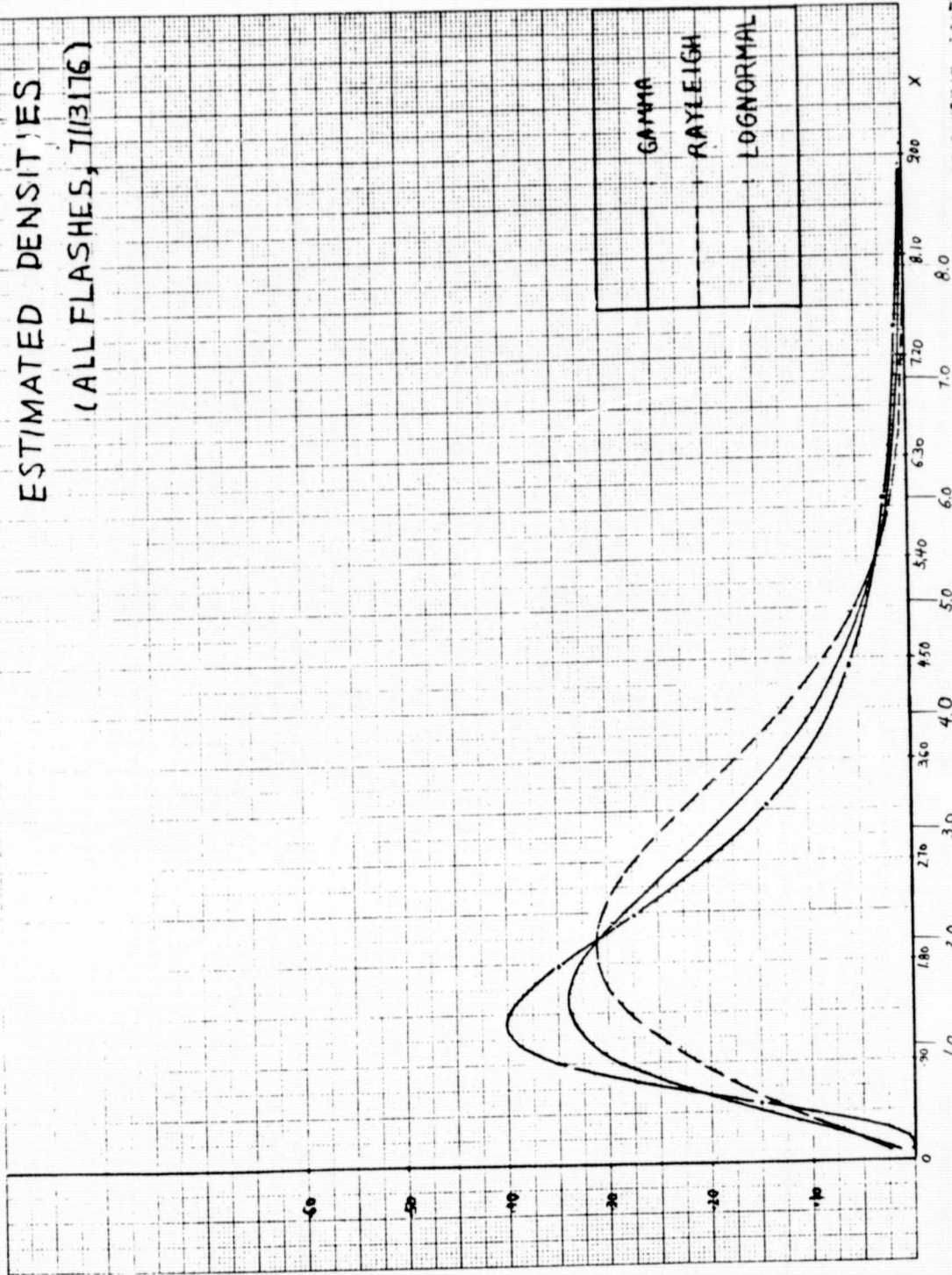


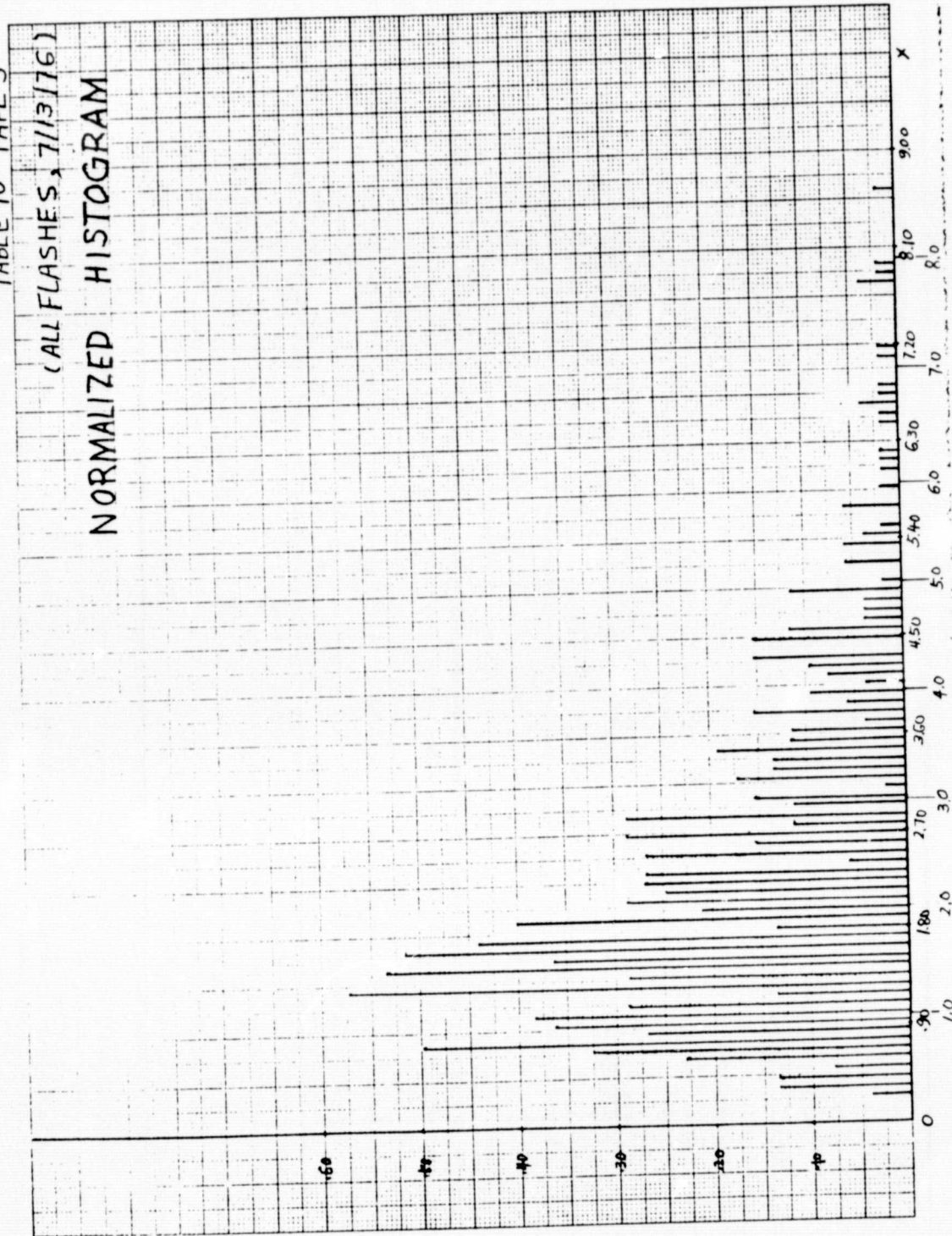
Fig. 23. Storm of 7/13/76 (Tape 3) - Estimated Densities (All Flashes)

10 Millimeters to the Centimeter

TABLE 10 TAPE 3

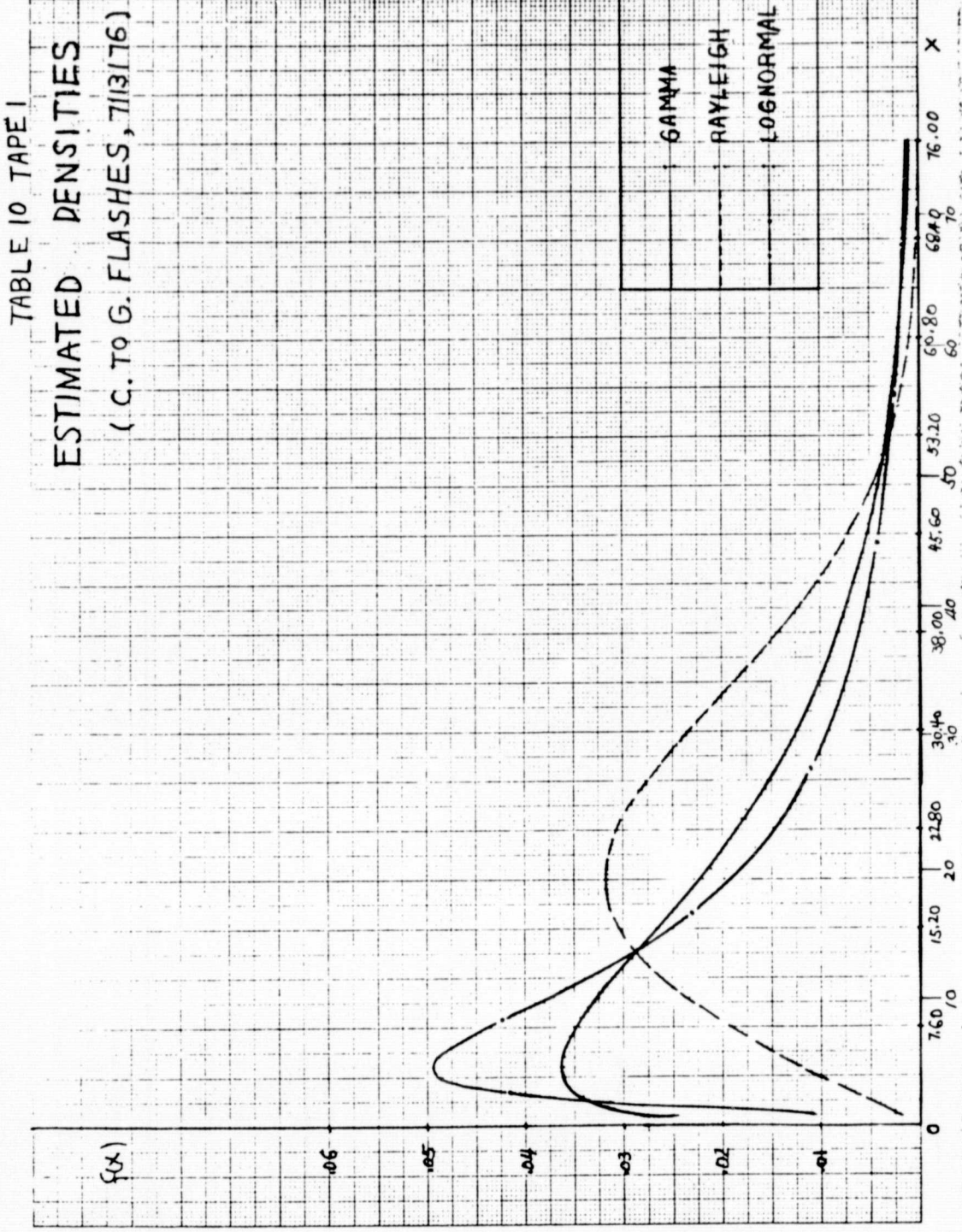
(ALL FLASHES, 7/13/76)

NORMALIZED HISTOGRAM



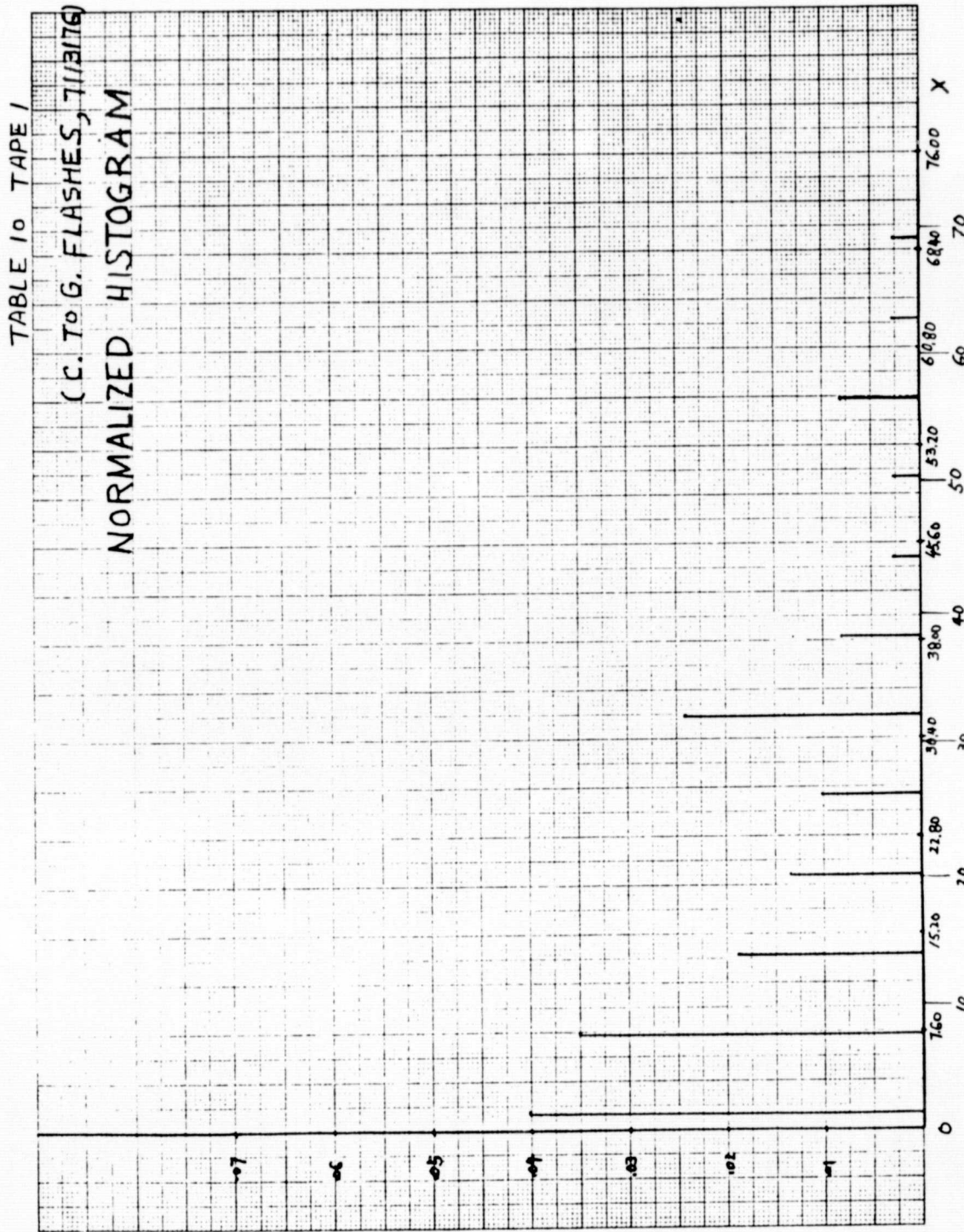
10 Millimeters to the Centimeter

Fig. 24. Storm of 7/13/76 (Tape 3) - Normalized Histogram (All Flashes)



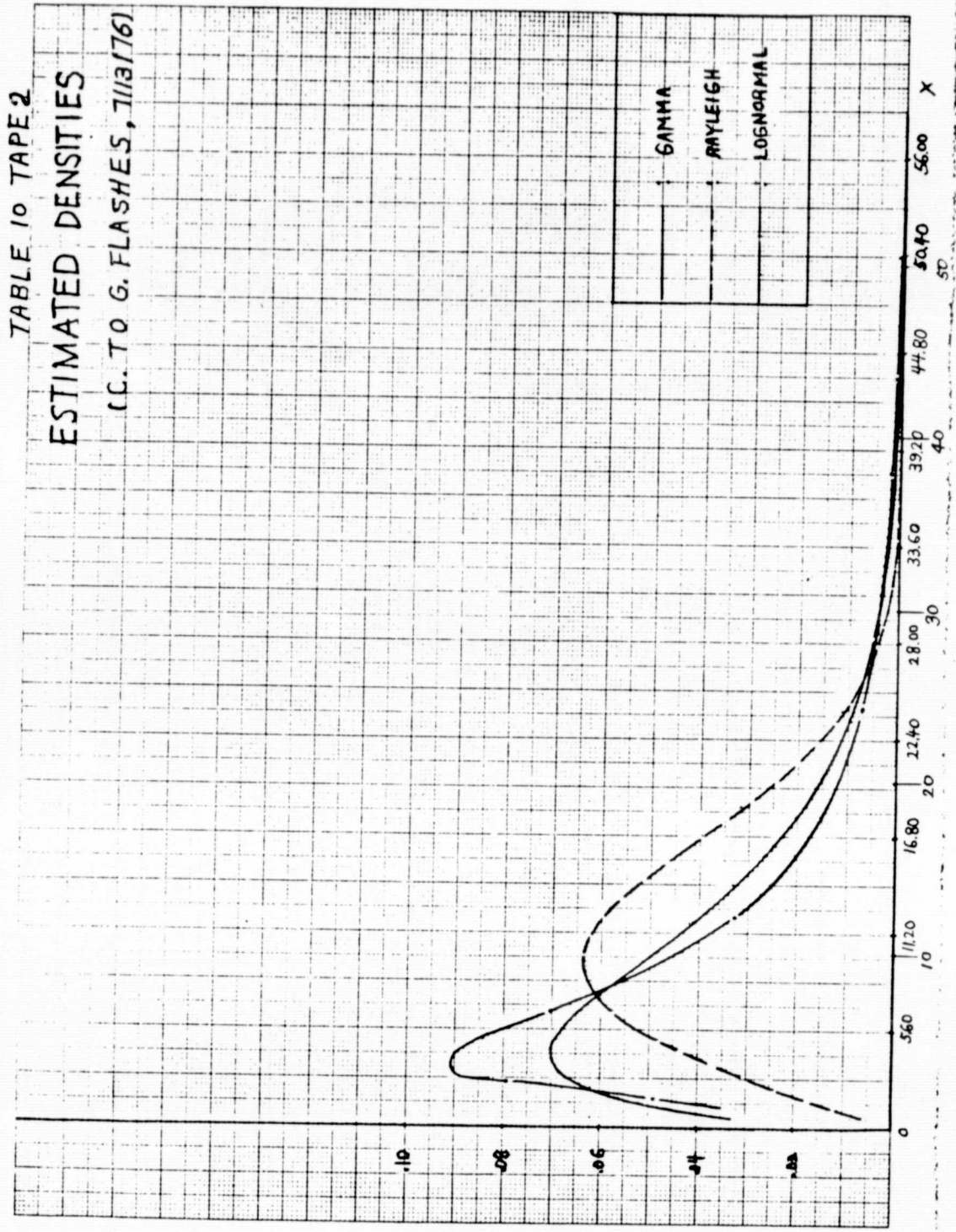
10 Millimeters to the Centimeter

Fig. 25. Storm of 7/13/76 (Tape 1) - Estimated Densities (Cloud to Ground Flashes)



10 Millimeters to the Centimeter

Fig. 26. Storm of 7/13/76 (Tape 1) - Normalized Histogram (Cloud to Ground Flashes)



10 Millimeters to the Centimeter

Fig. 27. Storm of 7/13/76 (Tape 2) - Estimated Densities (Cloud to Ground Flashes)

TABLE 10 TAPE 2

(C. TO G. FLASHES, 7/13/76)

NORMALIZED HISTOGRAM

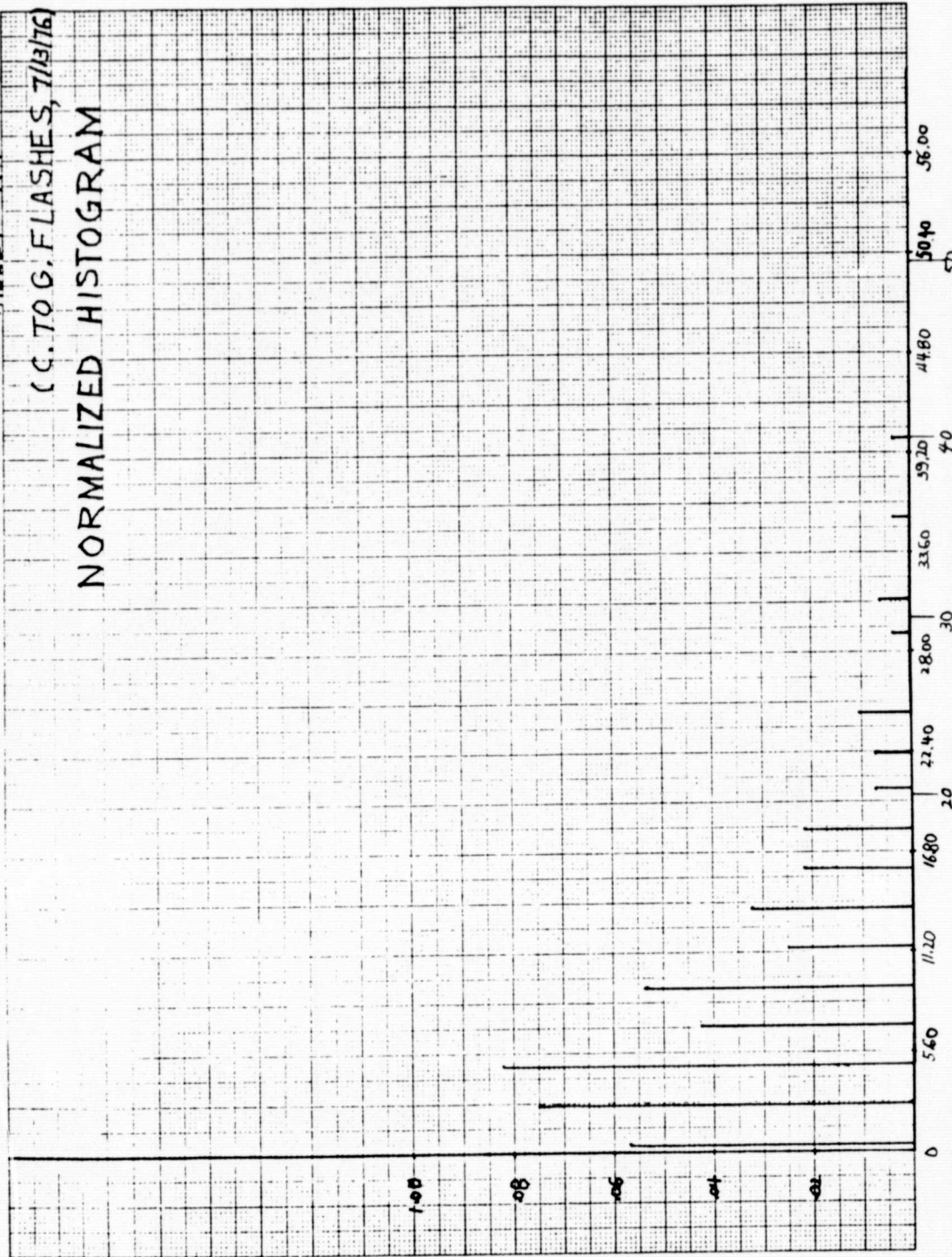
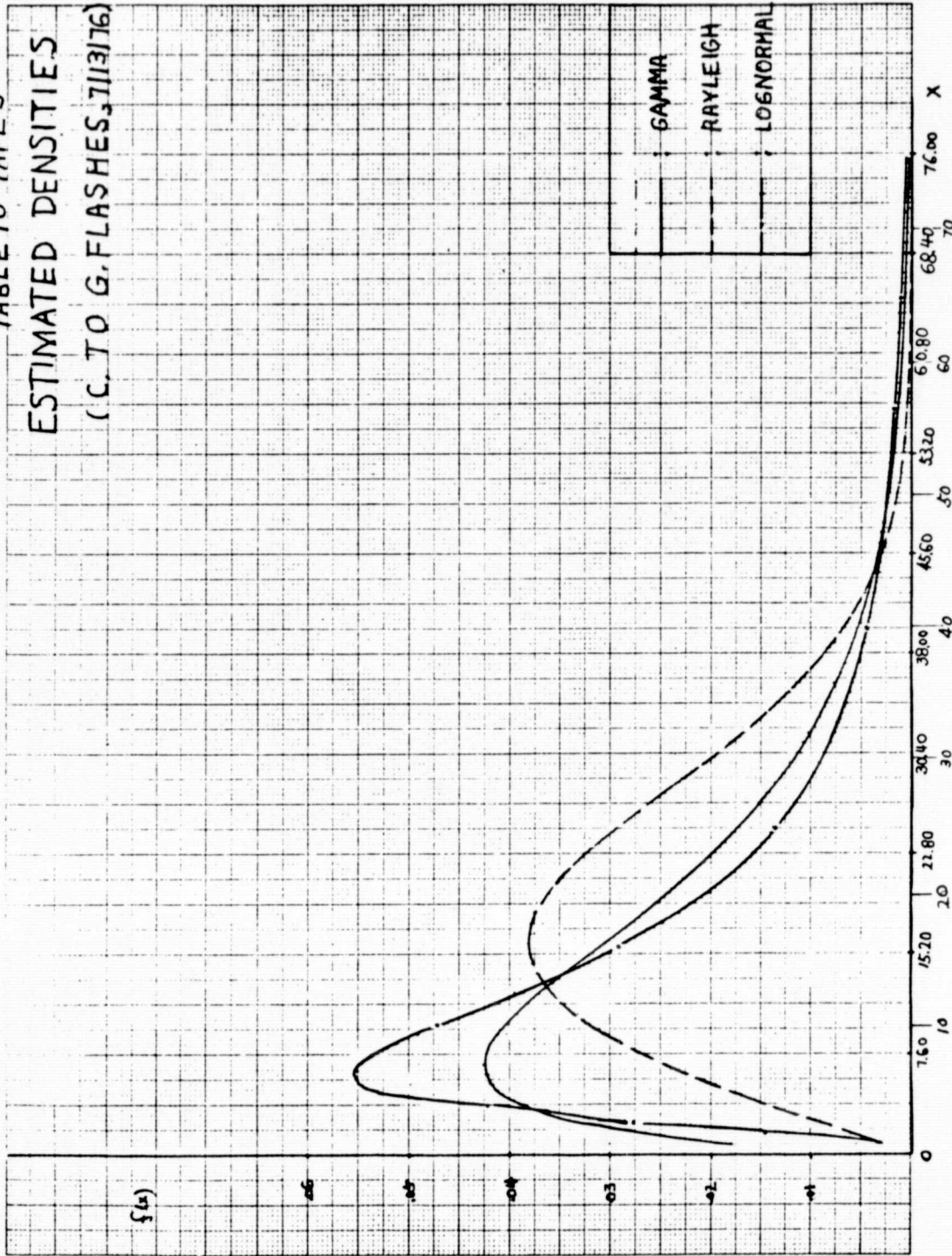


Fig. 28. Storm of 7/13/76 (Tape 2) - Normalized Histogram (Cloud to Ground Flashes)

10 Millimeters to the Centimeter

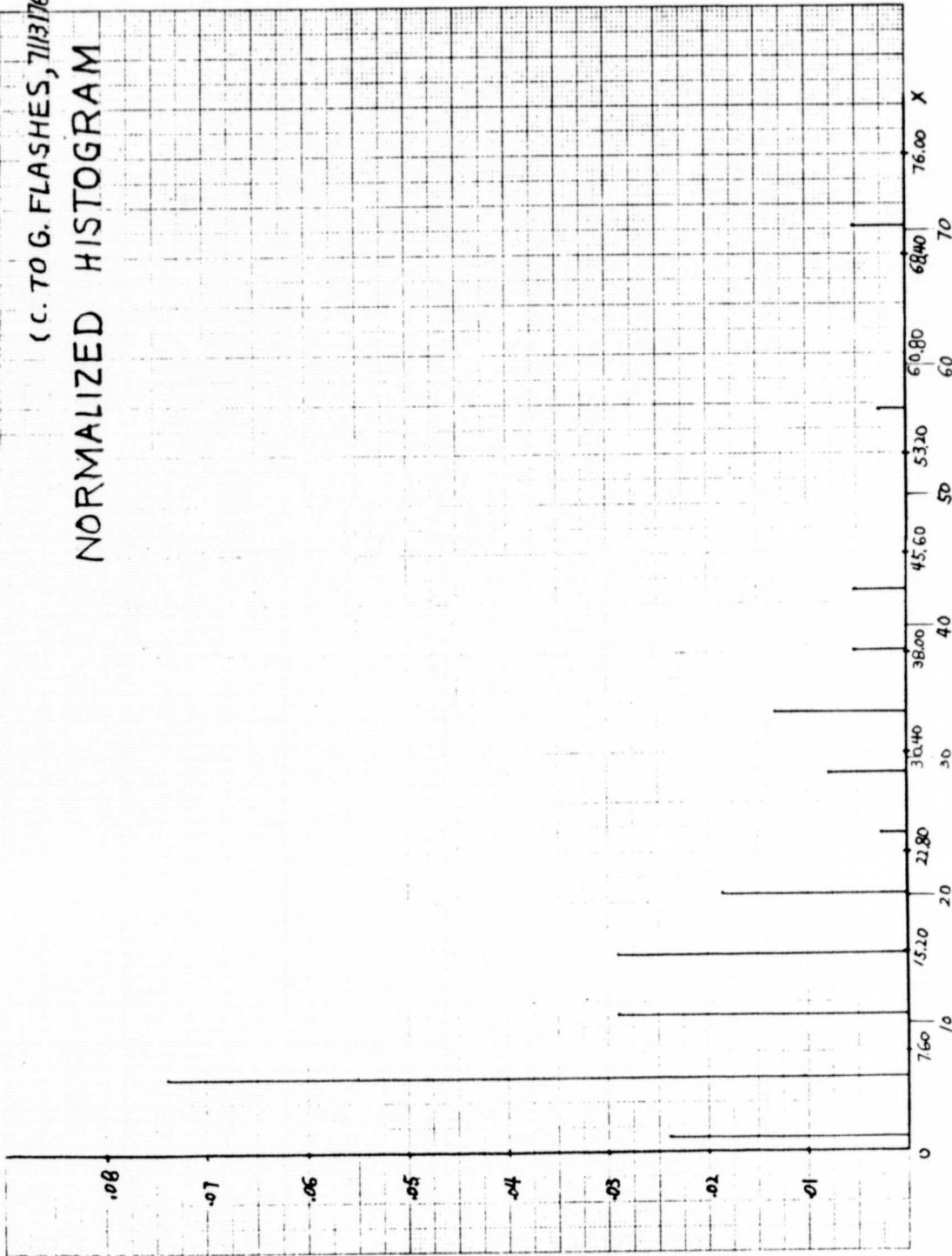
TABLE 10 TAPE 3
ESTIMATED DENSITIES
(C. TO G. FLASHES, 7/13/76)



10 Millimeters to the Centimeter

Fig. 29. Storm of 7/13/76 (Tape 3) - Estimated Densities (Cloud to Ground Flashes)

TABLE 10 TAPE 3
(C. TO G. FLASHES, 7/13/76)
NORMALIZED HISTOGRAM



10 Millimeters to the Centimeter

Fig. 30. Storm of 7/13/76 (Tape 3) - Normalized Histogram (Cloud to Ground Flashes)