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WATER DESIGN SECTION

HYDROLOGICAL ANALYSIS FOR
THE
LOUISIANA STORM DRAIN

FDA JOB NO. 993.11

PRELIMINARY

MAY, 1989

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I, Fred Denney, hereby certify that
the enclosed documents and drawings were prepared under
my supervision and are true and correct to the best of
my knowledge and belief.


New Mexico Registered Professional
Engineer and Land Surveyor No. 1967



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HYDROLOGICAL ANALYSIS OF THE LOUISIANA STORM DRAIN

HYDROLOGY:

The drainage area of the Louisiana Storm Drain lies roughly around the intersection of Louisiana Boulevard NE, and Montgomery Boulevard NE (see Exhibit I.) From Plate 22.2 D-1 (see Exhibit II), the 6-hour rainfall volume (100-year frequency) is found to be 2.35 inches; and for the 10-year frequency, $0.657 \times 2.35 = 1.55$ inches.

The drainage area was subdivided into five (5) basins, designated A thru E.

Basin A is bounded roughly by Montgomery Boulevard NE on the north; Natalie Avenue NE on the south; Louisiana Boulevard NE on the east; and, Georgia Street NE on the west, and has an area of 13.0 acres. The majority of the basin is developed (strip mall and medical offices, etc., with paved parking lots.) A runoff factor of 0.80 was assigned. The elevation difference is 30 feet and the distance across the basin is 1,500 feet.

$$\text{slope } S = \frac{30}{1500} = 0.02$$

$$T_c = 0.0078 \frac{L^{0.77}}{S^{0.385}} = 0.0078 \times \frac{1500^{0.77}}{0.02^{0.385}} = 9.8 \text{ minutes}$$

Use 10 minutes

$$I_{100 \text{ yr.}} = 2.35 \times 6.84 T_c^{-0.51} = 2.35 \times 6.84 \times 10^{-0.51} = 4.97 \text{ in/hr.}$$

$$I_{10 \text{ yr.}} = 1.55 \times 6.84 T_c^{-0.51} = 1.55 \times 6.84 \times 10^{-0.51} = 3.28 \text{ in/hr.}$$

$$Q_{100 \text{ yr.}} = AIC = 13 \times 4.97 \times 0.8 = 51.7 \text{ cfs.}$$

$$Q_{10 \text{ yr.}} = 13 \times 3.28 \times 0.8 = 34.1 \text{ cfs.}$$

$$V_{100 \text{ yr.}} = 2.35 \times 13 \times 43560/12 = 111,000 \text{ cu-ft.}$$

$$V_{10 \text{ yr.}} = 1.55 \times 13 \times 43560/12 = 73,000 \text{ cu-ft.}$$

$$T_{100 \text{ yr.}} = 2V/Q = 2 \times 111,000/51.7/60 = 71.5 \text{ minutes}$$

$$T_{10 \text{ yr.}} = 2V/Q = 2 \times 73,000/34.1/60 = 71.5 \text{ minutes}$$

CN convex

Basin A - Continued

This basin drains along Natalie Avenue NE. If the Natalie Avenue NE alternate is selected, it would be opportune to include this flow at little additional expense. If the Louisiana Boulevard NE route is selected, this flow will not be included.

Basin B is bounded roughly by Natalie Avenue NE on the north; Kathleen Avenue NE on the south; Carriveau Avenue NE on the east; and, Stardust Drive NE on the west, and has an area of 19.4 acres. The basin is developed single-family residential. A runoff factor of 0.6 was assigned. The elevation difference is 45 feet and the distance across the basin is 1900 feet.

$$\text{slope } S = \frac{45}{1900} = 0.024$$

$$T_c = 0.0078 \frac{L^{0.77}}{S^{0.385}} = 0.0078 \times \frac{1900^{0.77}}{0.024^{0.385}} = 11.0 \text{ minutes}$$

$$I_{100 \text{ yr.}} = 2.35 \times 6.84 T_c^{-0.51} = 2.35 \times 6.84 \times 11^{-0.51} = 4.73 \text{ in/hr.}$$

$$I_{10 \text{ yr.}} = 1.55 \times 6.84 T_c^{-0.51} = 1.55 \times 6.84 \times 11^{-0.51} = 3.12 \text{ in/hr.}$$

$$Q_{100 \text{ yr.}} = AIC = 19.4 \times 4.73 \times 0.6 = 55.1 \text{ cfs.}$$

$$Q_{10 \text{ yr.}} = AIC = 19.4 \times 3.12 \times 0.6 = 36.3 \text{ cfs.}$$

$$V_{100 \text{ yr.}} = 2.35 \times 19.4 \times 43560/12 = 166,000 \text{ cu-ft.}$$

$$V_{10 \text{ yr.}} = 1.55 \times 19.4 \times 43560/12 = 109,000 \text{ cu-ft.}$$

$$T_{100 \text{ yr.}} = 2V/Q = 2 \times 166,000/55.1/60 = 100 \text{ minutes}$$

$$T_{10 \text{ yr.}} = 2V/Q = 2 \times 109,000/36.3/60 = 100 \text{ minutes}$$

This basin discharges onto Louisiana Boulevard NE at Natalie Avenue NE, thence south on Louisiana Boulevard NE to the North Hahn Channel. A side branch of the main line up Natalie Avenue NE with inlets will be needed with either alternate. Only three points of access serve this area: Natalie Avenue NE, Julie NE at Montgomery Boulevard NE, and Julie NE across the North Hahn Channel.

Basin C is bounded roughly by a line from the intersection of Louisiana Boulevard NE and Montgomery Boulevard NE to the intersection of Julie NE and Natalie Avenue NE on the north and east; by Natalie Avenue NE on the south; and, by Louisiana Boulevard NE on the west, and has an area of 10.2 acres. The majority of the basin is developed commercial with a small portion being developed single-family residential. A runoff factor of 0.8 was assigned. The elevation difference is 37 feet and the distance across the basin is 1,700 feet.

$$\text{slope } S = \frac{37}{1700} = 0.022$$

$$T_c = 0.0078 \frac{L^{0.77}}{S^{0.385}} = 0.0078 \times \frac{1700^{0.77}}{0.022^{0.385}} = 10.4 \text{ minutes}$$

$$I_{100 \text{ yr.}} = 2.35 \times 6.84 T_c^{-0.51} = 2.35 \times 6.84 \times 10.4^{-0.51} = 4.87 \text{ in/hr.}$$

$$I_{10 \text{ yr.}} = 1.55 \times 6.84 T_c^{-0.51} = 1.55 \times 6.84 \times 10.4^{-0.51} = 3.21 \text{ in/hr.}$$

$$Q_{100 \text{ yr.}} = AIC = 10.2 \times 4.87 \times 0.8 = 39.7 \text{ cfs.}$$

$$Q_{10 \text{ yr.}} = AIC = 10.2 \times 3.21 \times 0.8 = 26.2 \text{ cfs.}$$

$$V_{100 \text{ yr.}} = 2.35 \times 10.2 \times 43560/12 = 87,000 \text{ cu-ft.}$$

$$V_{10 \text{ yr.}} = 1.55 \times 10.2 \times 43560/12 = 57,400 \text{ cu-ft.}$$

$$T_{100 \text{ yr.}} = 2V/Q = 2 \times 87,000/39.7/60 = 73 \text{ minutes}$$

$$T_{10 \text{ yr.}} = 2V/Q = 2 \times 57,400/26.2/60 = 73 \text{ minutes}$$

This basin discharges onto the east side of Louisiana Boulevard NE between Montgomery Boulevard NE and Natalie Avenue NE. Inlets along this reach into the main line will be possible with either alternate.

Basin D is bounded roughly by Alcazar NE, Prairie Road NE, Heritage Place NE, and Lantern Road NE on the north and west; by the line from the intersection of Louisiana Boulevard NE and Montgomery Boulevard NE to the intersection of Julie NE and Natalie Avenue NE on the south and west; and, by the Julie NE storm sewer and Pennsylvania NE on the east, and has an area of 71.6 acres. The basin is developed single-family residential, park, apartments and commercial.

Basin D - Continued

A runoff factor of 0.65 was assigned to the basin as an average. The northeast 11.4 acres drains to a detention pond which discharges through a 15-inch pipe and drainage way onto Prairie Road NE. The discharge rate was thus excluded from that of the whole basin, but the runoff was included in the volume of runoff for the basin.

The elevation difference is 70 feet and the length across the basin is 3,600 feet.

$$\text{slope } S = \frac{70}{3600} = 0.019$$

$$T_c = 0.0078 \frac{L^{0.77}}{S^{0.385}} = 0.0078 \times \frac{3600^{0.77}}{0.019^{0.385}} = 19.6 \text{ minutes}$$

$$I_{100 \text{ yr.}} = 2.35 \times 6.84 T_c^{-0.51} = 2.35 \times 6.84 \times 19.6^{-0.51} = 3.52 \text{ in/hr.}$$

$$I_{10 \text{ yr.}} = 1.55 \times 6.84 T_c^{-0.51} = 1.55 \times 6.84 \times 19.6^{-0.51} = 2.32 \text{ in/hr.}$$

$$Q_{100 \text{ yr.}} = AIC = (71.6 - 11.4) \times 3.52 \times 0.65 = 137.7 \text{ cfs.}$$

$$Q_{10 \text{ yr.}} = AIC = (71.6 - 11.4) \times 2.32 \times 0.65 = 90.8 \text{ cfs.}$$

$$V_{100 \text{ yr.}} = 2.35 \times 71.6 \times 43560/12 = 611,000 \text{ cu-ft.}$$

$$V_{10 \text{ yr.}} = 1.55 \times 71.6 \times 43560/12 = 403,000 \text{ cu-ft.}$$

$$T_{100 \text{ yr.}} = 2V/Q = 2 \times 611,000/137.7/60 = 148 \text{ minutes}$$

$$T_{10 \text{ yr.}} = 2V/Q = 2 \times 403,000/90.8/60 = 148 \text{ minutes}$$

This basin discharges onto Montgomery Boulevard NE from Louisiana Boulevard NE to the Julie Channel. The Albuquerque Master Drainage Study (Vol. III, AP204) indicates a flow of 148 cfs at Montgomery Boulevard NE and the Julie Channel, and 138 cfs in the Channel leaving 10 cfs. The grade of Montgomery Boulevard NE is 0.0167. This indicates a gutter flow of 3.5 fps for 1,850 feet or 8.8 minutes. Assuming a time of concentration for the basin for AP204 of the Master Drainage Study, an additional 10 cfs was added to the hydrograph of Basin D at 28.8 minutes.

This is the major basin of the project. Flow is mainly on the north side of Montgomery Boulevard NE.

Basin E is bounded by the south boundary of the Elena Gallegos Land Grant on the north; the back lot line of lots lying between Alcazar NE and Chama NE on the south and east; and, Louisiana Boulevard NE on the west, and has an area of 21.4 acres. The basin is developed single-family residential. A runoff factor of 0.60 was assigned. The elevation difference is 41 feet and the distance across the basin is 2,000 feet.

$$\text{slope } S = \frac{41}{2000} = 0.0205$$

$$T_c = 0.0078 \frac{L^{0.77}}{S^{0.385}} = 0.0078 \times \frac{2000^{0.77}}{0.0205^{0.385}} = 12.1 \text{ minutes}$$

$$I_{100 \text{ yr.}} = 2.35 \times 6.84 T_c^{-0.51} = 2.35 \times 6.84 \times 12.1^{-0.51} = 4.51 \text{ in/hr.}$$

$$I_{10 \text{ yr.}} = 1.55 \times 6.84 T_c^{-0.51} = 1.55 \times 6.84 \times 12.1^{-0.51} = 2.97 \text{ in/hr.}$$

$$Q_{100 \text{ yr.}} = AIC = 21.4 \times 4.51 \times 0.6 = 57.9 \text{ cfs.}$$

$$Q_{10 \text{ yr.}} = AIC = 21.4 \times 2.97 \times 0.6 = 38.1 \text{ cfs.}$$

$$V_{100 \text{ yr.}} = 2.35 \times 21.4 \times 43560/12 = 183,000 \text{ cu-ft.}$$

$$V_{10 \text{ yr.}} = 1.55 \times 21.4 \times 43560/12 = 120,000 \text{ cu-ft.}$$

$$T_{100 \text{ yr.}} = 2V/Q = 2 \times 183,000/57.9/60 = 105 \text{ minutes}$$

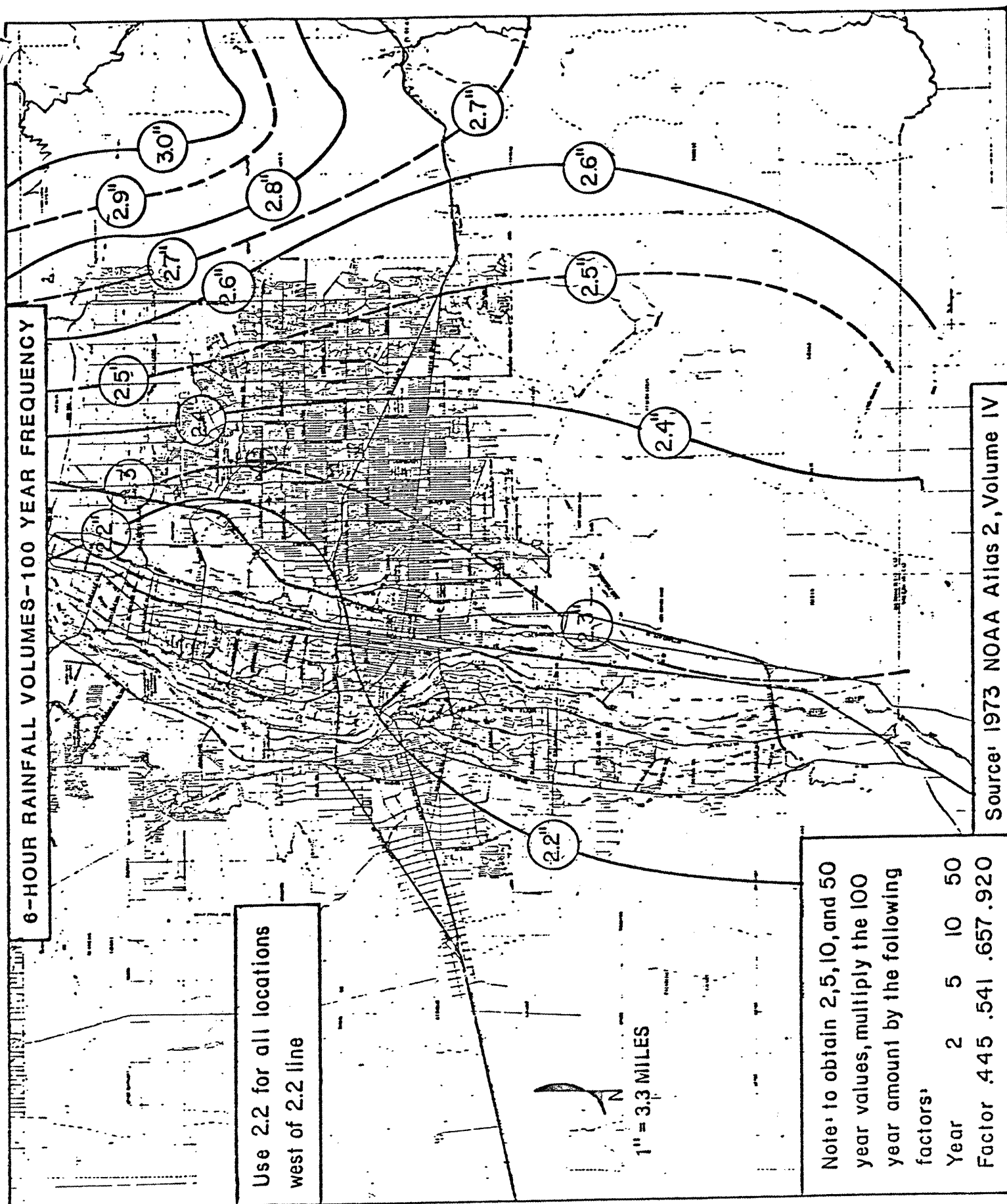
$$T_{10 \text{ yr.}} = 2V/Q = 2 \times 120,000/38.1/60 = 105 \text{ minutes}$$

This basin discharges onto Louisiana Boulevard NE at Alcazar NE and Prairie Road NE (north of Montgomery Boulevard NE), and then drains south along Louisiana Boulevard NE to Montgomery Boulevard NE.

The hydrographs for Basins A thru E are indicated as Exhibits III thru VII; the combined and lagged hydrograph at the intersection of Louisiana Boulevard NE and Montgomery Boulevard NE is included as Exhibit VIII; the hydrographs at the intersection of Louisiana Boulevard NE and Natalie Avenue NE are included as Exhibits IX and X; and, the hydrograph at the northwest corner of Cleveland Middle School's property is included as Exhibit XI. Note that the hydrograph at Louisiana Boulevard NE, and the North Hahn Channel is almost identical to that for the intersection of Louisiana Boulevard NE and Natalie Avenue NE (see Exhibit X), except for a small time lag.

SUMMARY:

	Basin I.D.	A ac.	ΔE ft.	L ft.	T_c min.	I in/hr.	C	Q_{100} yr. cfs.	Q_{10} yr. cfs.
III	A	13.0	30	1,500	10.0	4.97/3.28	0.80	51.7	34.1
IV	B	19.4	45	1,900	11.0	4.73/3.12	0.60	55.1	36.3
V	C	10.2	37	1,700	10.4	4.87/3.21	0.80	39.7	26.2
VI	D	71.6	70	3,600	19.6	3.52/2.32	0.65	137.7	90.8
VII	E	21.4	41	2,000	12.1	4.51/2.97	0.60	57.9	38.1
VIII	D + E	93.0						241.0	124.0
IX	(D+E) + C 0.58 min.	103.2						278.0	150.0
X	(D+E) + B + C 0.58 min.	122.6						333.0	184.0
XI	[(D+E) + B + C] + A 0.58 min. 0.8 min.	135.6						380.0	215.0



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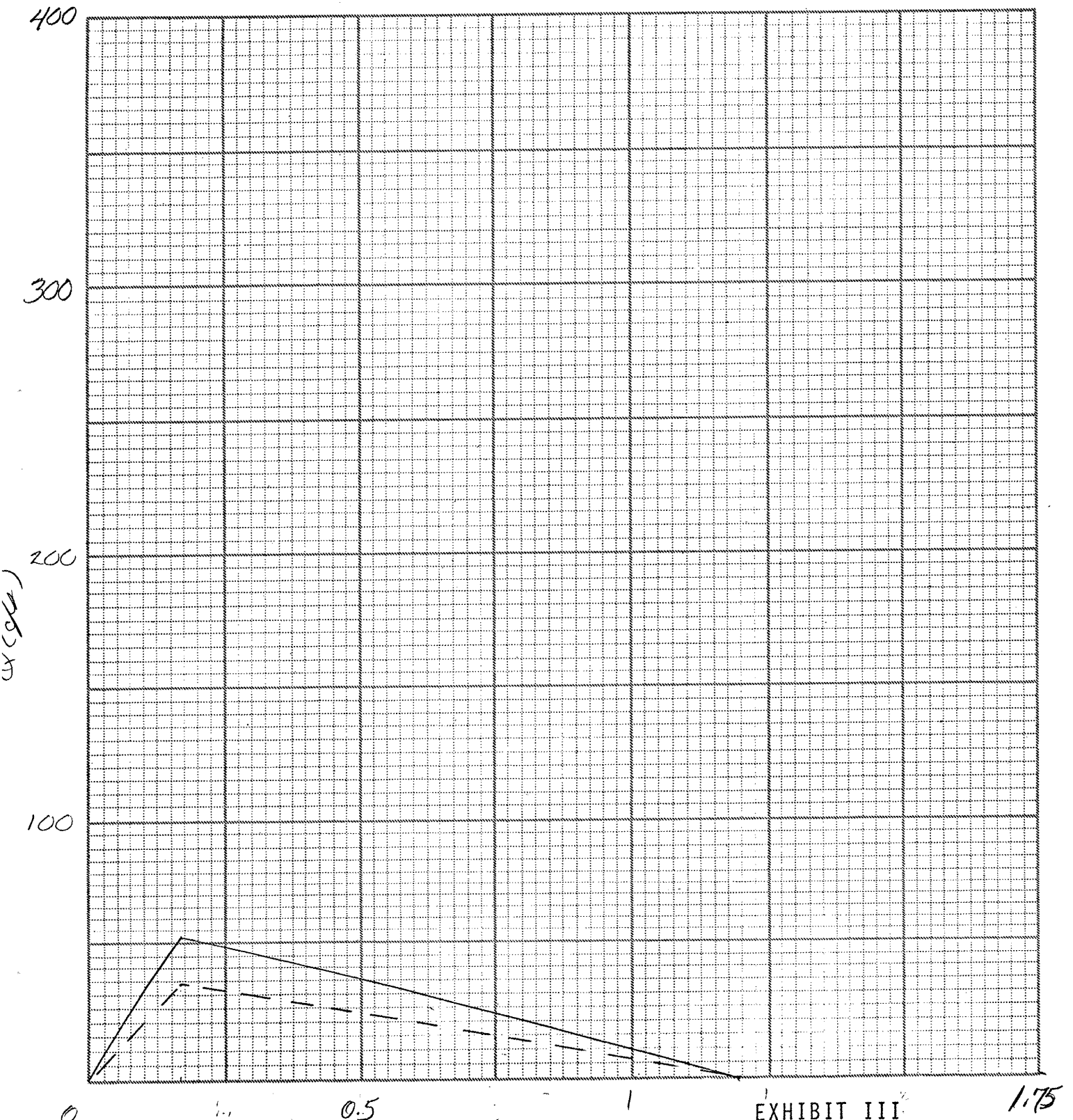
LOCATION Basin A @ NW cor Cleveland

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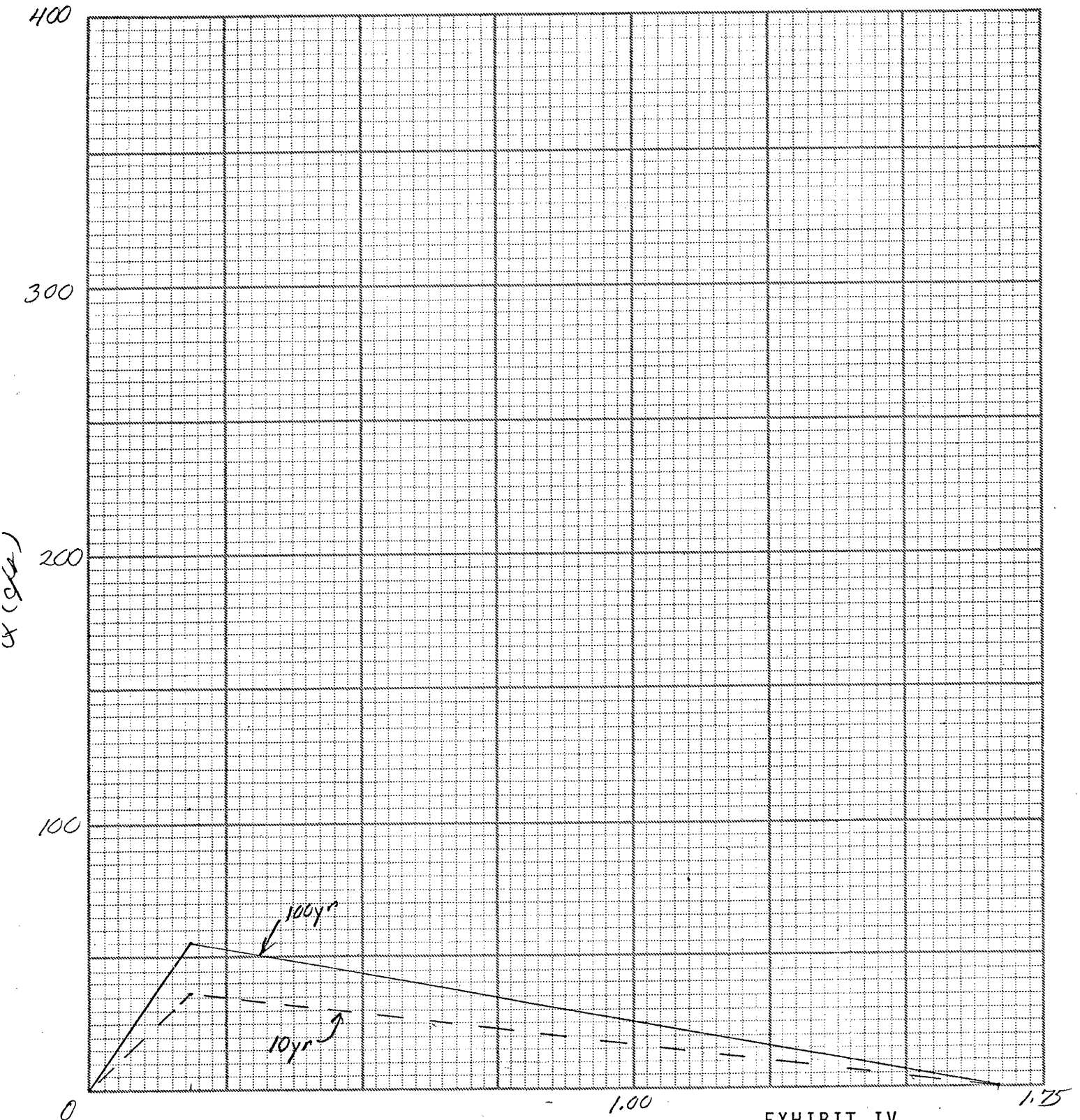
LOCATION Basin B @ Louisa & Natalie

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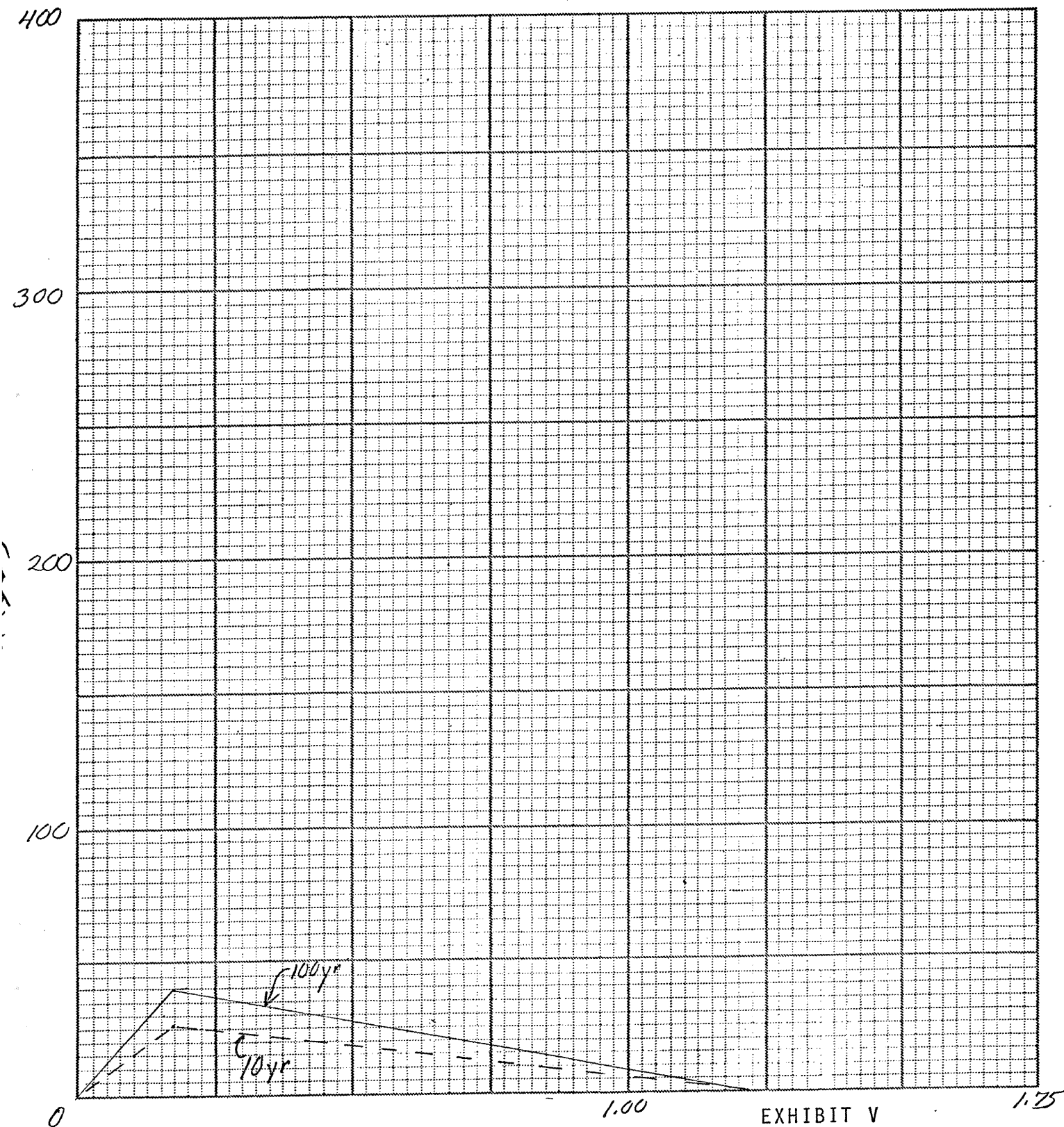
LOCATION Basin C @ Louisiana & Natalie

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DATE 5-15-89

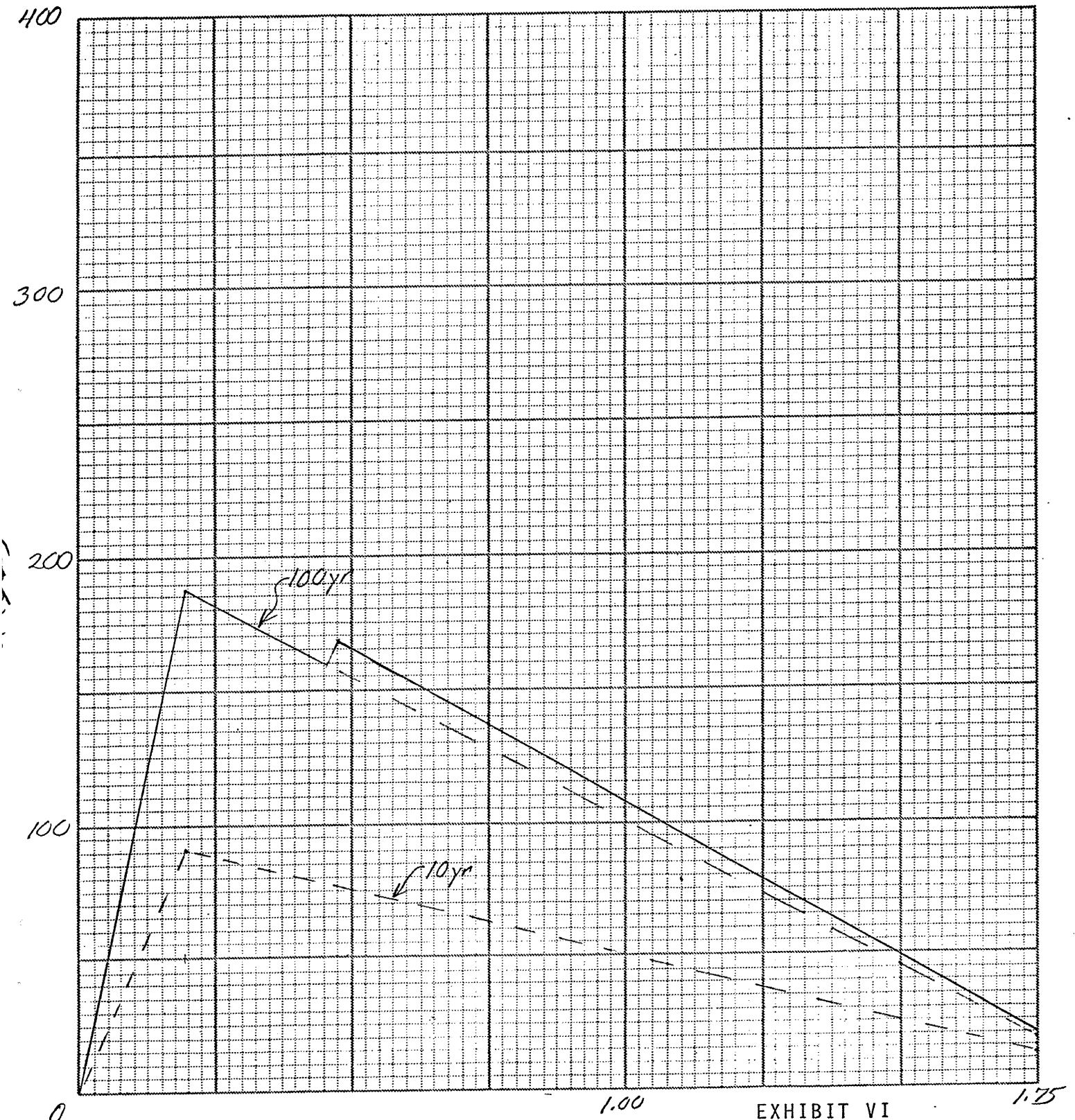
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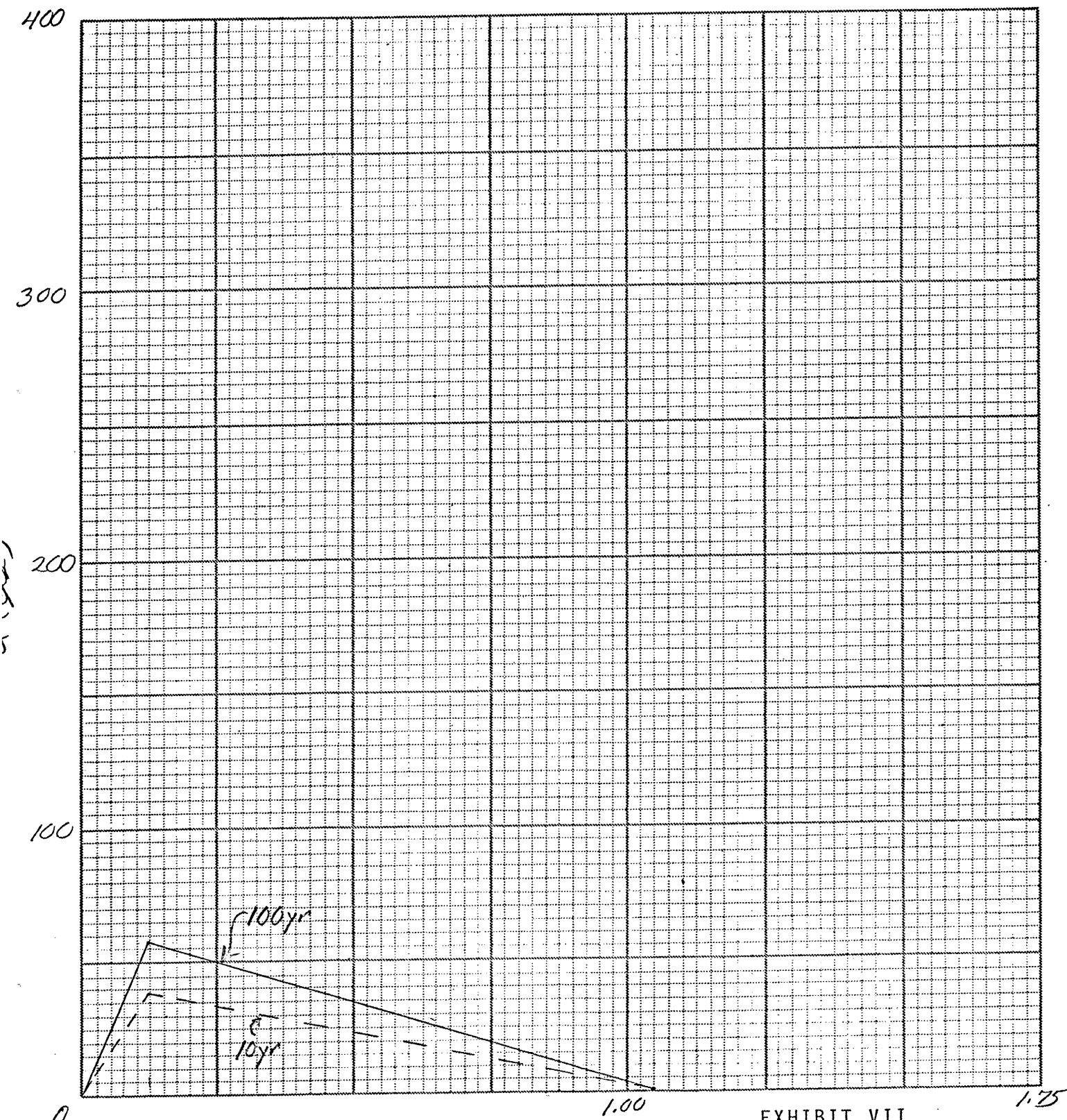
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LOCATION Basin D @ int. Lowman & Mont.
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DATE 5-15-89
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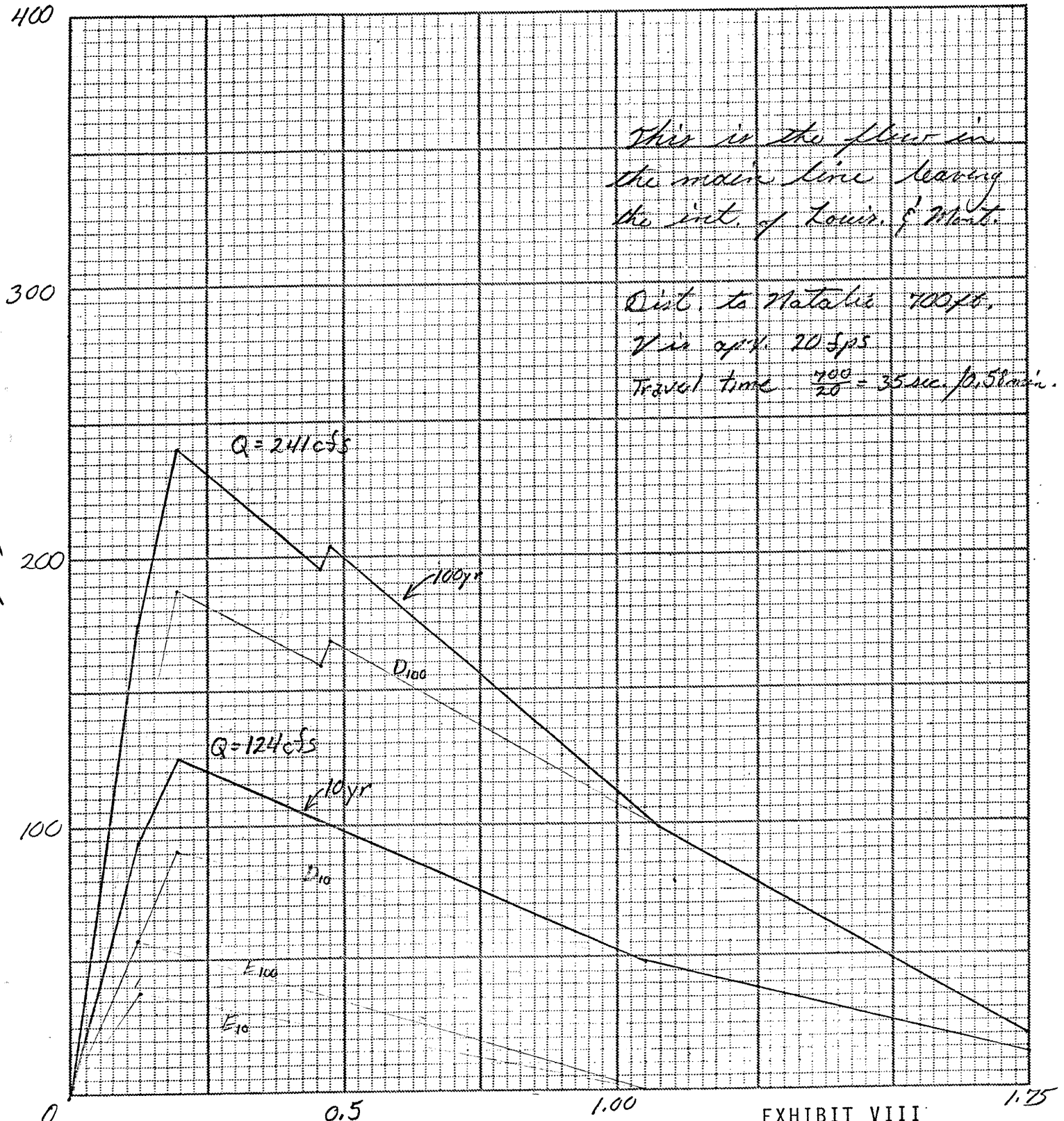
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LOCATION Basin E @ int. Louis. & Montg.
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LOCATION Bosque D+E
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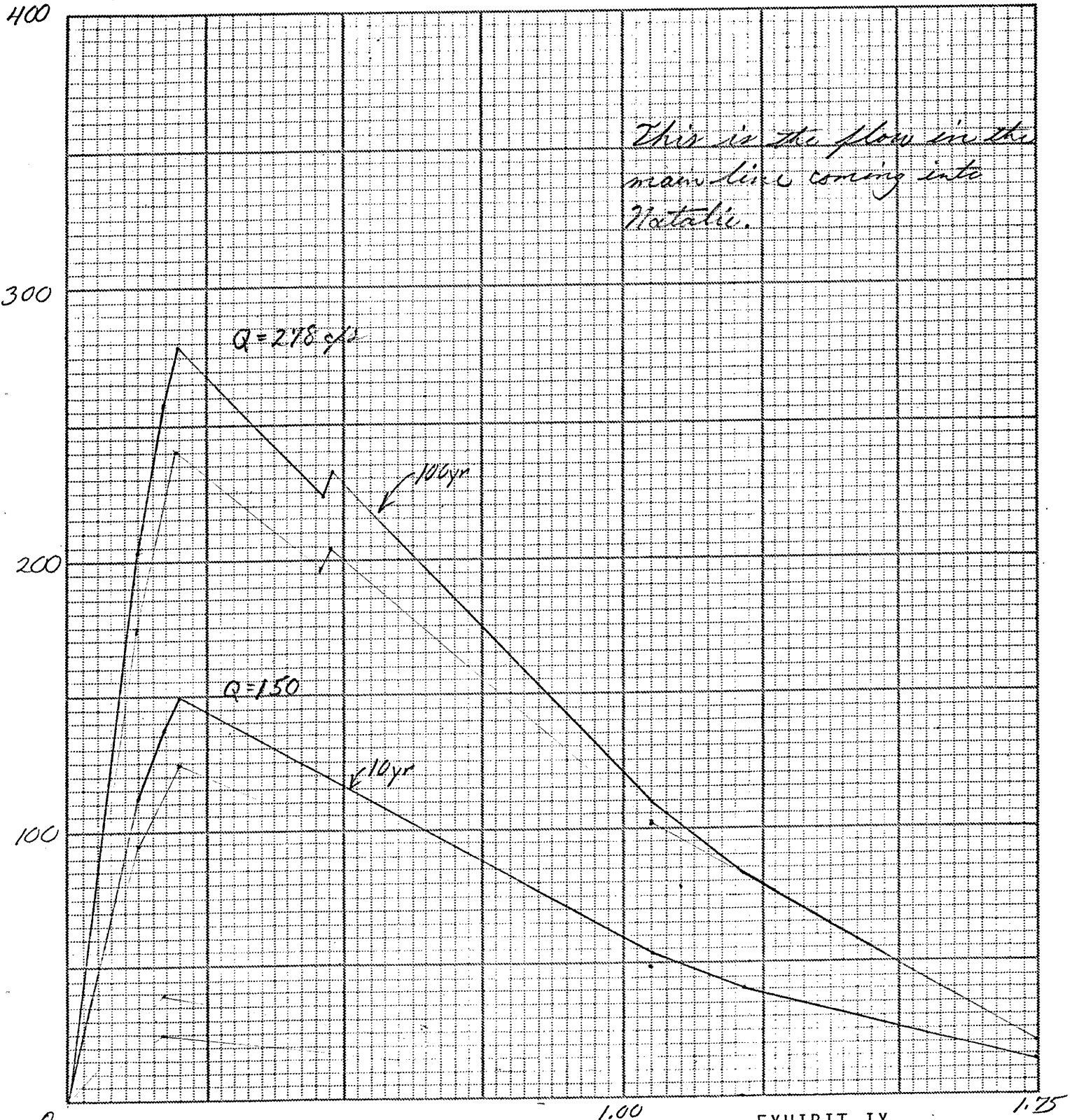
LOCATION (Basins D+E) + Basin C

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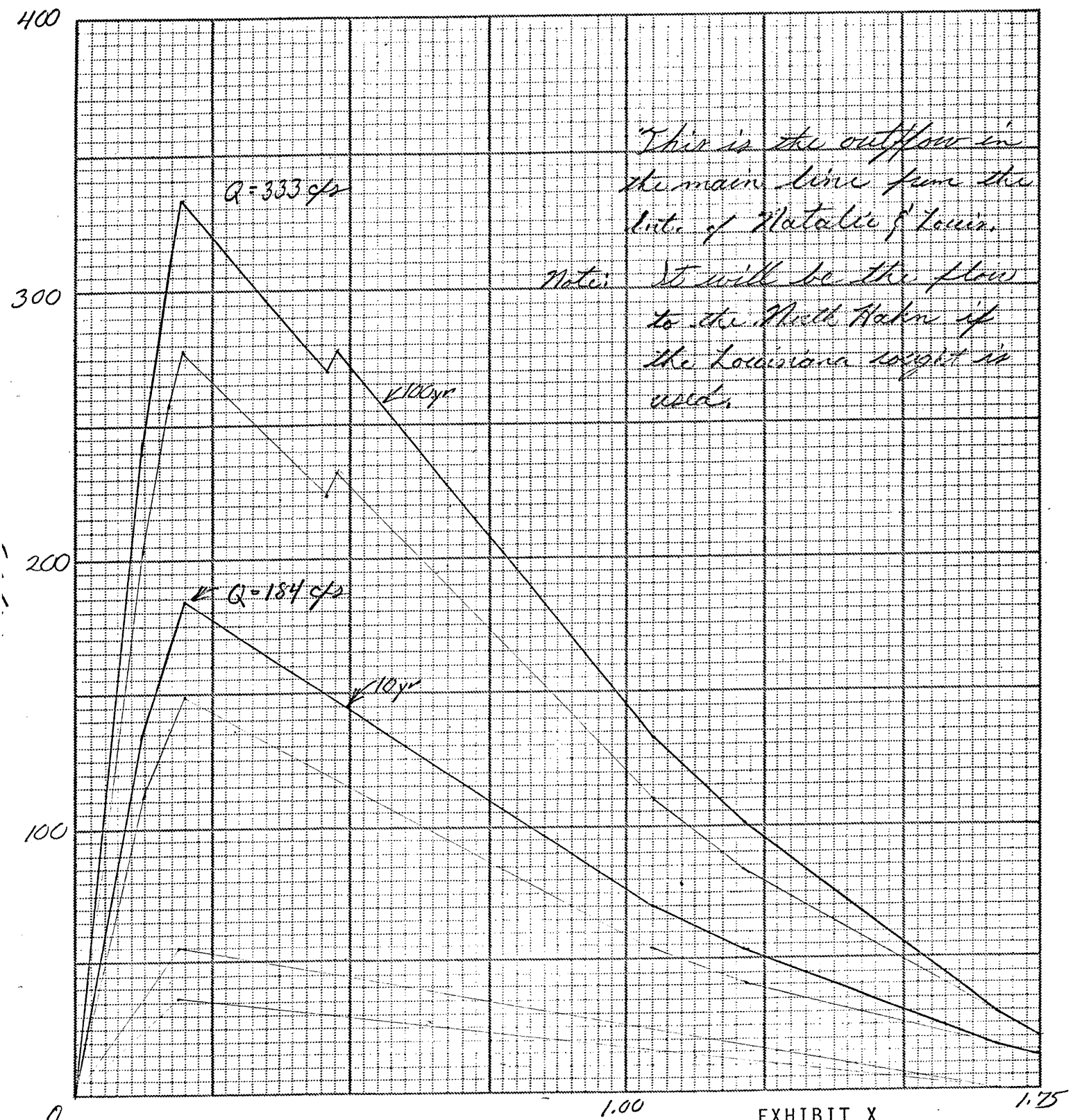
LOCATION (Basins D+E) + Basins (B+C)

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LOCATION All flows @ NW cor. Cleveland

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