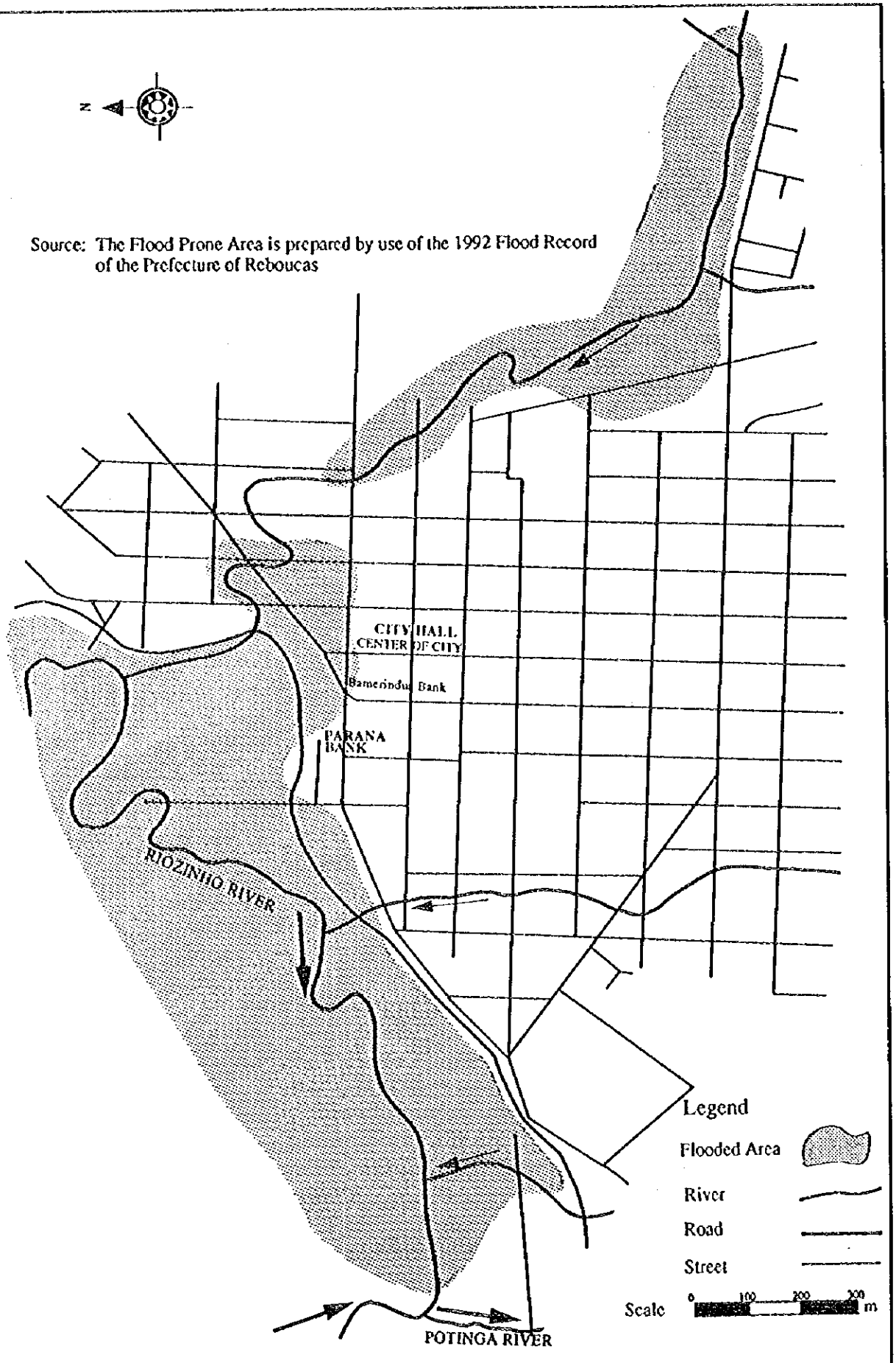
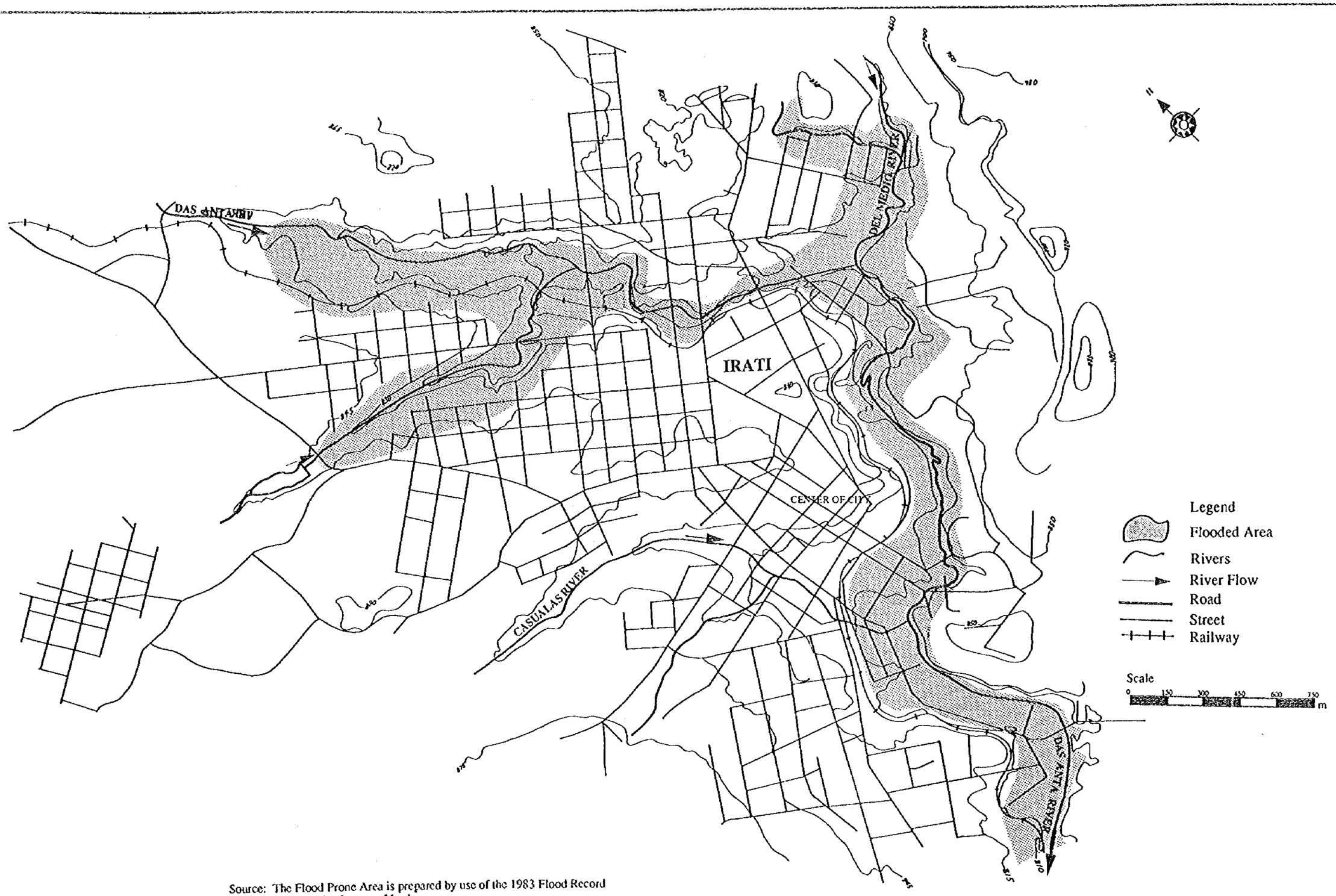
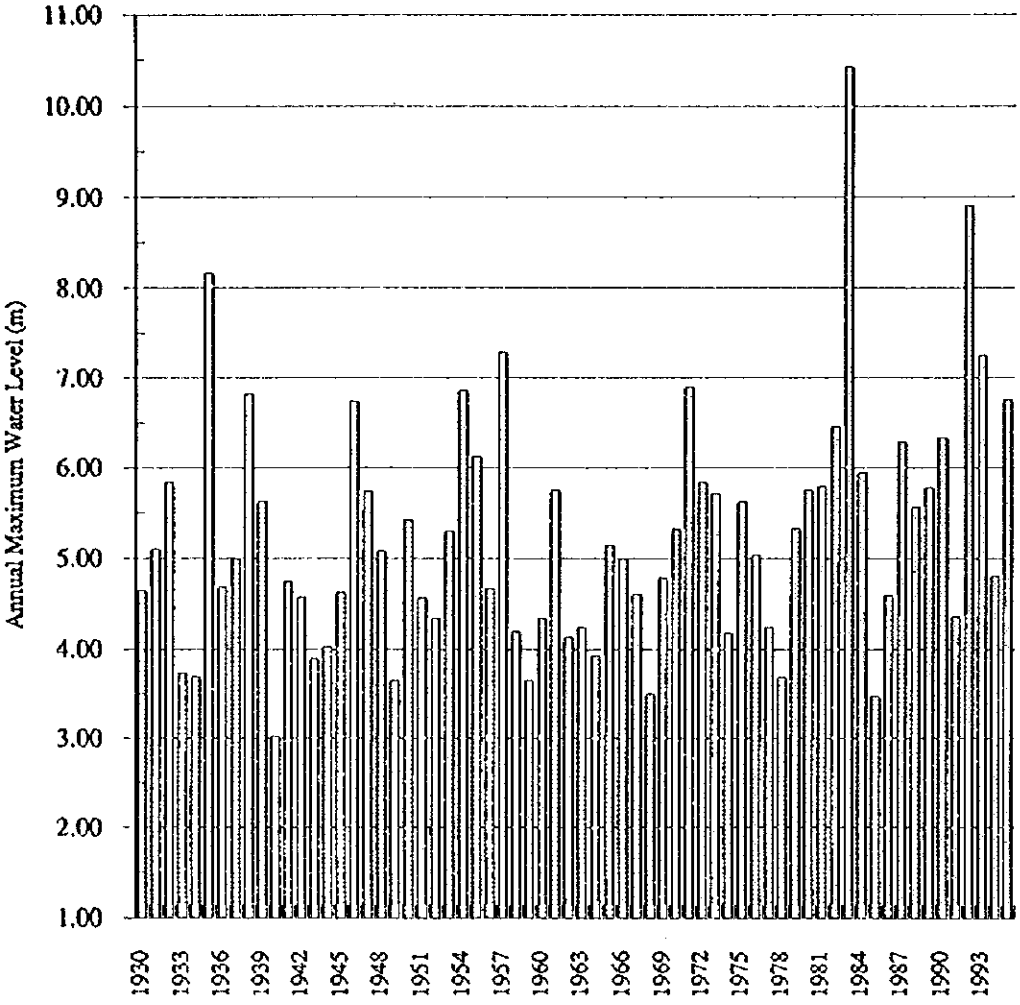


Figure-2.11 Flood Prone Area in Urban Perimeter of Reboucas, Region-3



Source: The Flood Prone Area is prepared by use of the 1983 Flood Record of the the Prefecture of Irati

Figure-2.12 Flood Prone Area in Urban Perimeter of Irati, Region-3



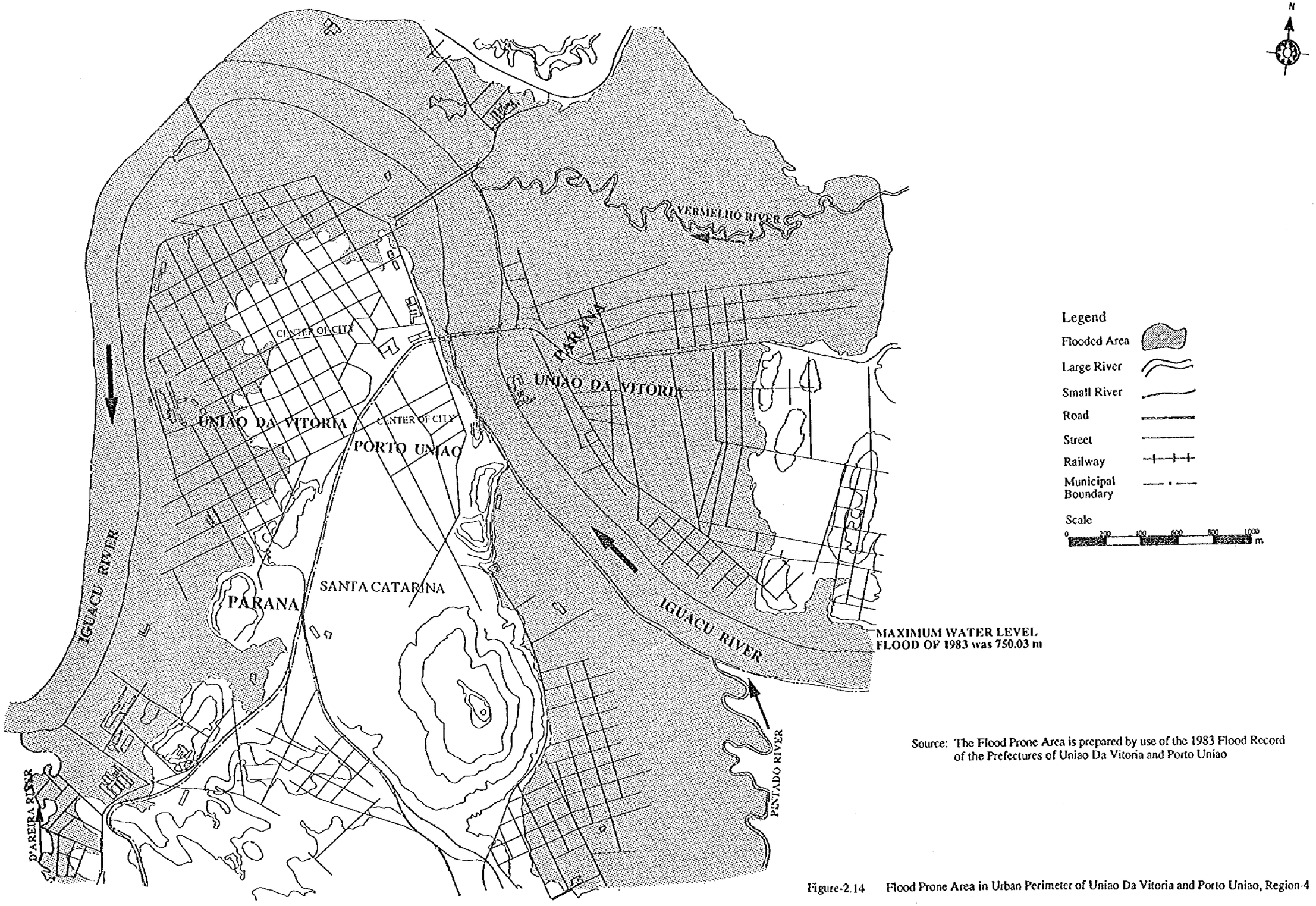
Year	Annual Maximum Gauge Water Level	Year	Annual Maximum Gauge Water Level	Year	Annual Maximum Gauge Water Level	Elevation (m)
		1952	4.34	1974	4.18	
1931	5.10	1953	5.30	1975	5.62	
1932	5.84	1954	6.85	1976	5.03	
1933	3.73	1955	6.12	1977	4.24	
1934	3.69	1956	4.66	1978	3.68	
1935	8.16	1957	7.28	1979	5.33	
1936	4.68	1958	4.20	1980	5.75	
1937	4.99	1959	3.65	1981	5.79	
1938	6.82	1960	4.34	1982	6.45	
1939	5.63	1961	5.75	1983	10.42	750.03
1940	3.02	1962	4.13	1984	5.94	
1941	4.74	1963	4.24	1985	3.47	
1942	4.57	1964	3.92	1986	4.59	
1943	3.89	1965	5.14	1987	6.28	
1944	4.02	1966	4.99	1988	5.56	
1945	4.62	1967	4.60	1989	5.78	
1946	6.73	1968	3.50	1990	6.33	
1947	5.74	1969	4.78	1991	4.36	
1948	5.08	1970	5.32	1992	8.90	748.51
1949	3.65	1971	6.89	1993	7.25	
1950	5.42	1972	5.84	1994	4.80	
1951	4.56	1973	5.71	1995	6.75	

Source: COPEL

unit: meter

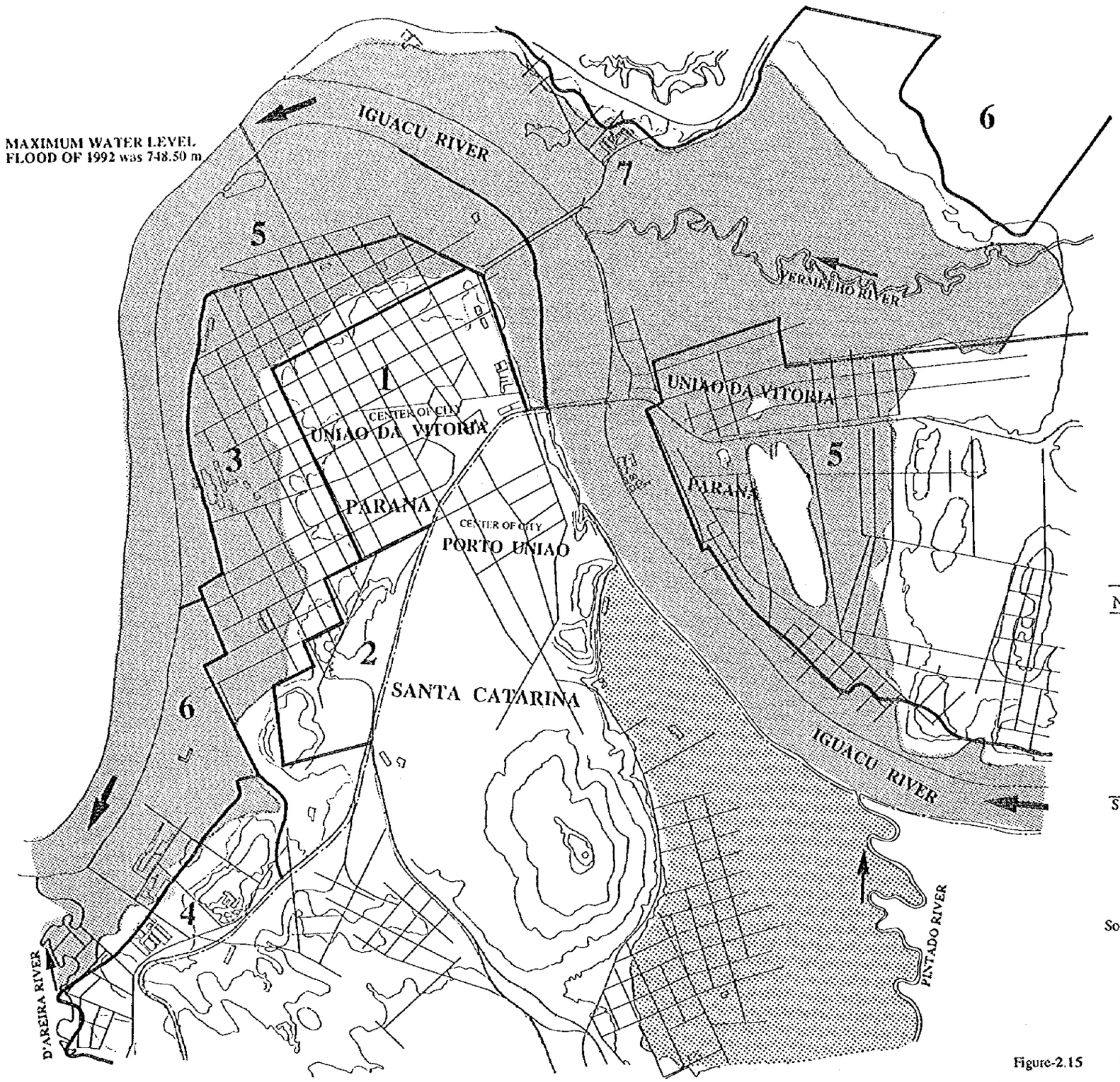
Zero Gauge Level is 739.61 m.

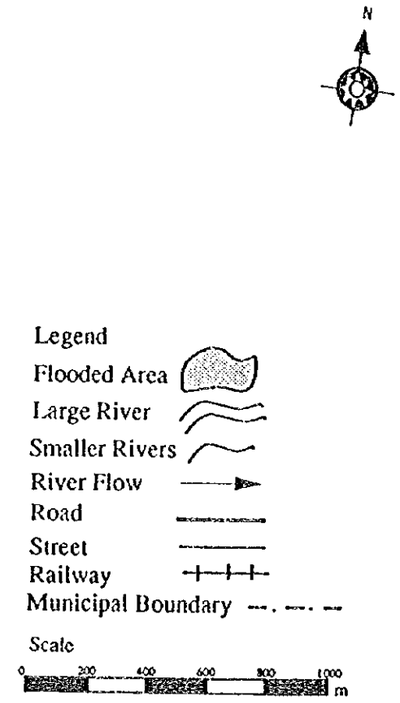
Figure 2.13 Annual Maximum Gauge Water Level at Uniao da Vitoria



Source: The Flood Prone Area is prepared by use of the 1983 Flood Record of the Prefectures of Uniao Da Vitoria and Porto Uniao

Figure-2.14 Flood Prone Area in Urban Perimeter of Uniao Da Vitoria and Porto Uniao, Region-4



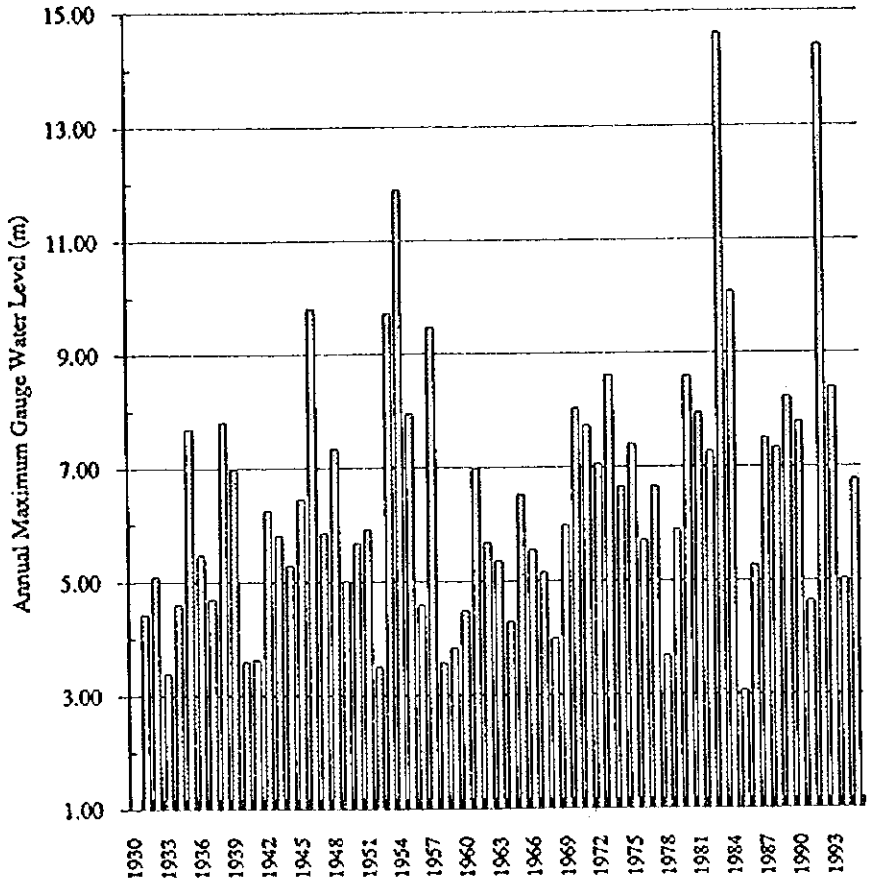


Number of Land Area	Value of Land ($ R per m^2)
1	60.00
2	40.00
3	12.50
4	5.00
5	2.50
6	1.50
7	0.75

Source: Prefecture of Uniao da Vitoria

Source: The Flood Prone Area is prepared by use of the 1992 Flood Record of the Prefecture of Uniao da Vitoria

Figure-2.15 Price of Urban Land in Uniao da Vitoria as Related to the Flood Prone Area

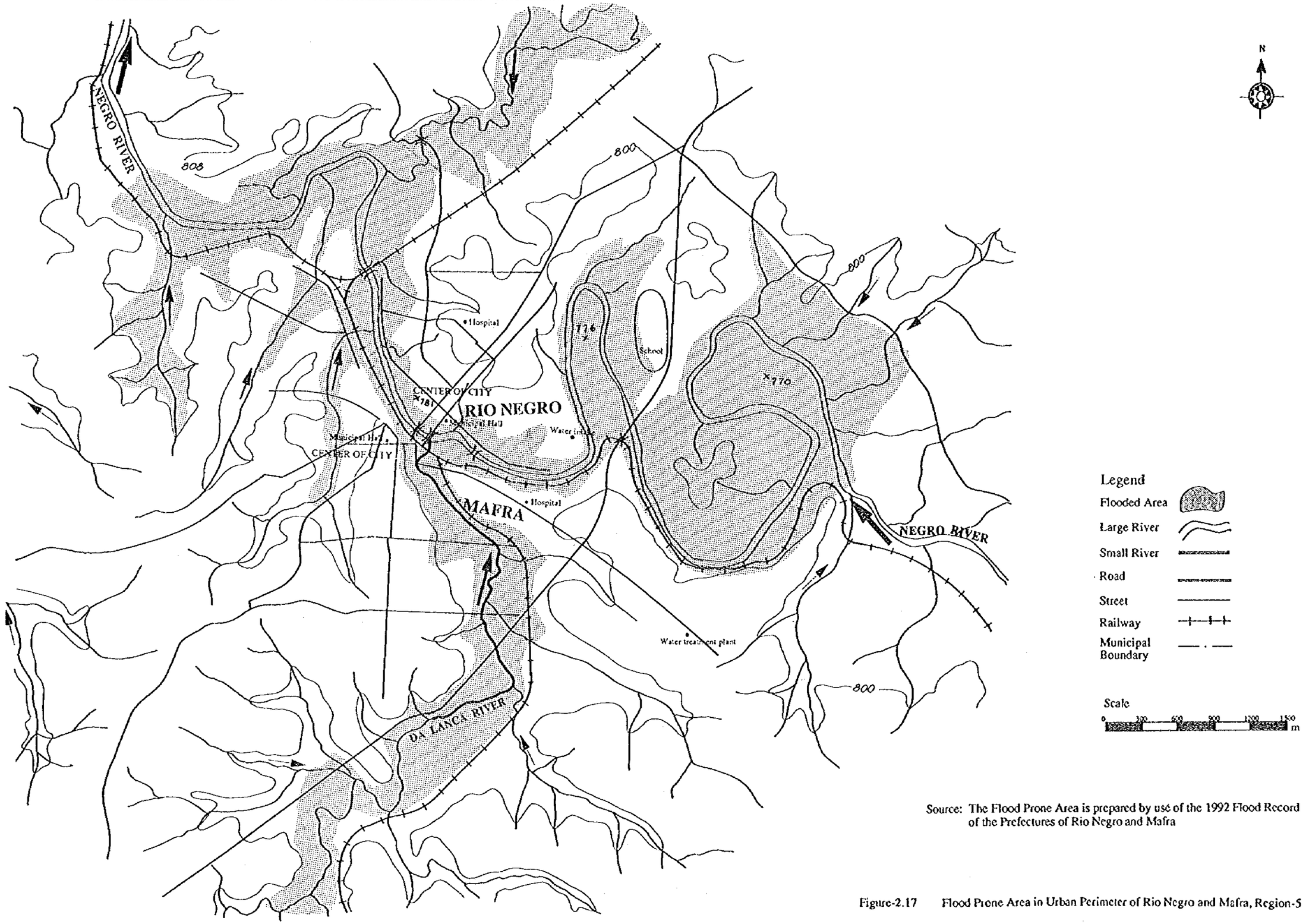


Year	Annual Maximum Gauge Water Level	Year	Annual Maximum Gauge Water Level	Year	Annual Maximum Gauge Water Level	Elevation (m)
1930	na	1952	3.52	1974	6.66	
1931	4.44	1953 *	9.73	1975	7.40	
1932 *	5.10	1954 *	11.90	1976	5.72	
1933 *	3.40	1955 *	7.95	1977	6.66	
1934	4.62	1956	4.60	1978	3.70	
1935 *	7.70	1957	9.48	1979	5.90	
1936	5.48	1958	3.58	1980	8.60	
1937	4.70	1959 *	3.84	1981	7.95	
1938	7.82	1960	4.50	1982	7.28	
1939	6.98	1961	6.98	1983	14.63	780.61
1940	3.60	1962	5.68	1984	10.09	
1941	3.64	1963 *	5.36	1985	3.08	
1942	6.26	1964	4.30	1986	5.28	
1943 *	5.82	1965	6.52	1987	7.50	
1944	5.30	1966	5.56	1988	7.34	
1945	6.46	1967	5.16	1989	8.24	
1946	9.81	1968	4.00	1990	7.79	
1947	5.86	1969	5.98	1991	4.65	
1948	7.34	1970	8.04	1992	14.42	780.4
1949	5.02	1971	7.74	1993	8.40	
1950	5.68	1972	7.06	1994	5.04	
1951	5.92	1973	8.62	1995	6.78	

Source: DNAEE na: no available unit: meter

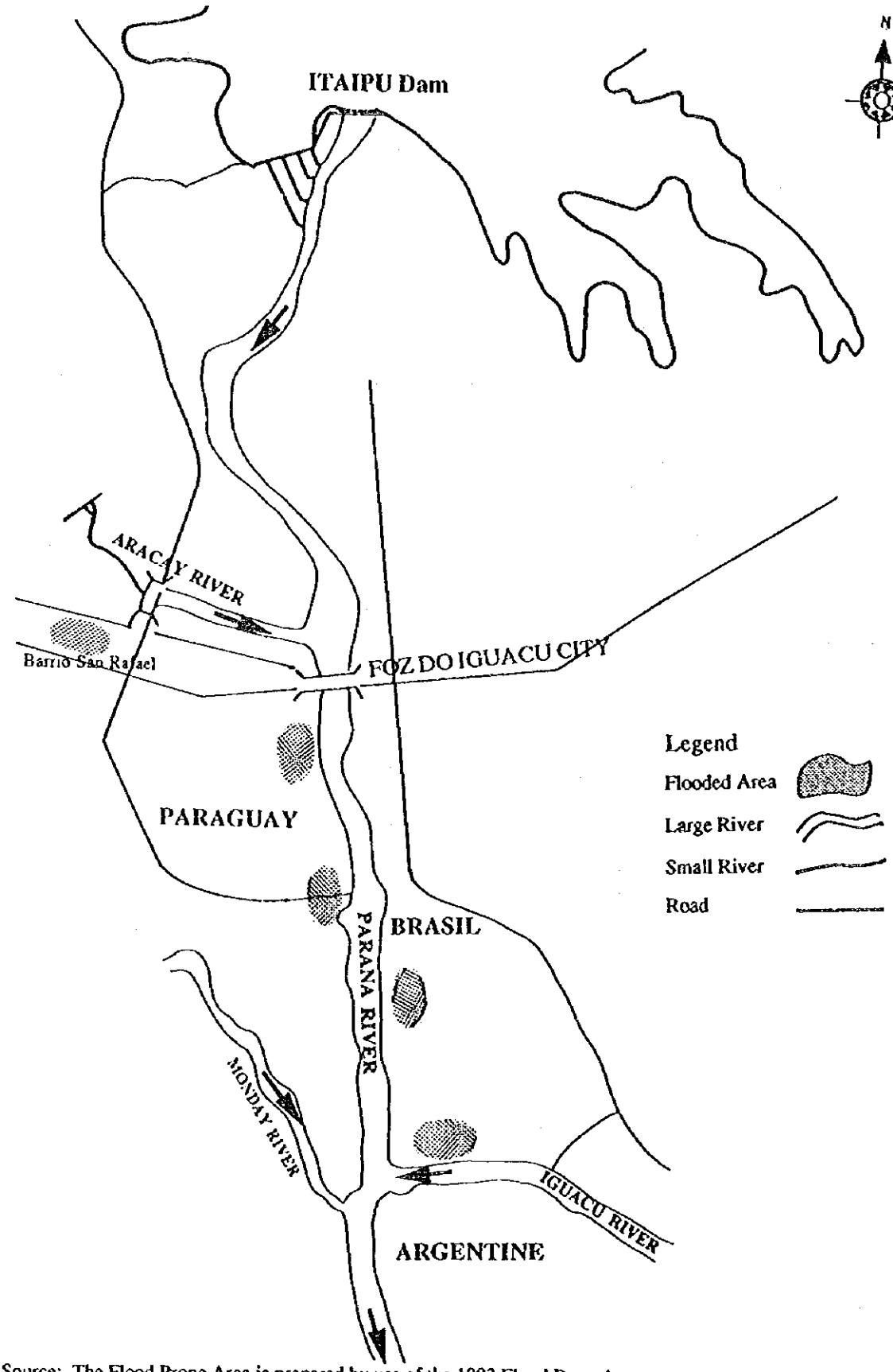
The values with * are provided from COPEL.

Figure 2.16 Annual Maximum Gauge Water Level at Rio Negro



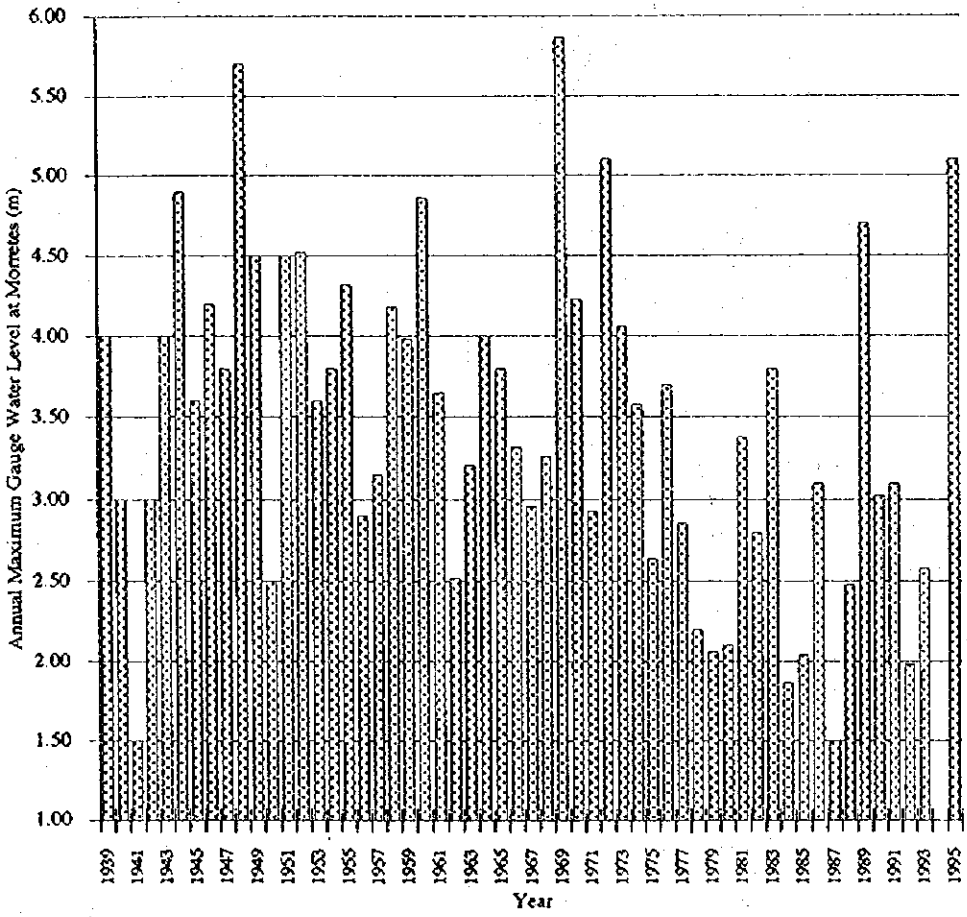
Source: The Flood Prone Area is prepared by use of the 1992 Flood Record of the Prefectures of Rio Negro and Mafra

Figure-2.17 Flood Prone Area in Urban Perimeter of Rio Negro and Mafra, Region-5



Source: The Flood Prone Area is prepared by use of the 1983 Flood Record of Itaipu Binational Dam

Figure-2.18 Location of Flood Prone Area in Foz do Iguacu Municipality and Del Este city,Paraguay, Region-6



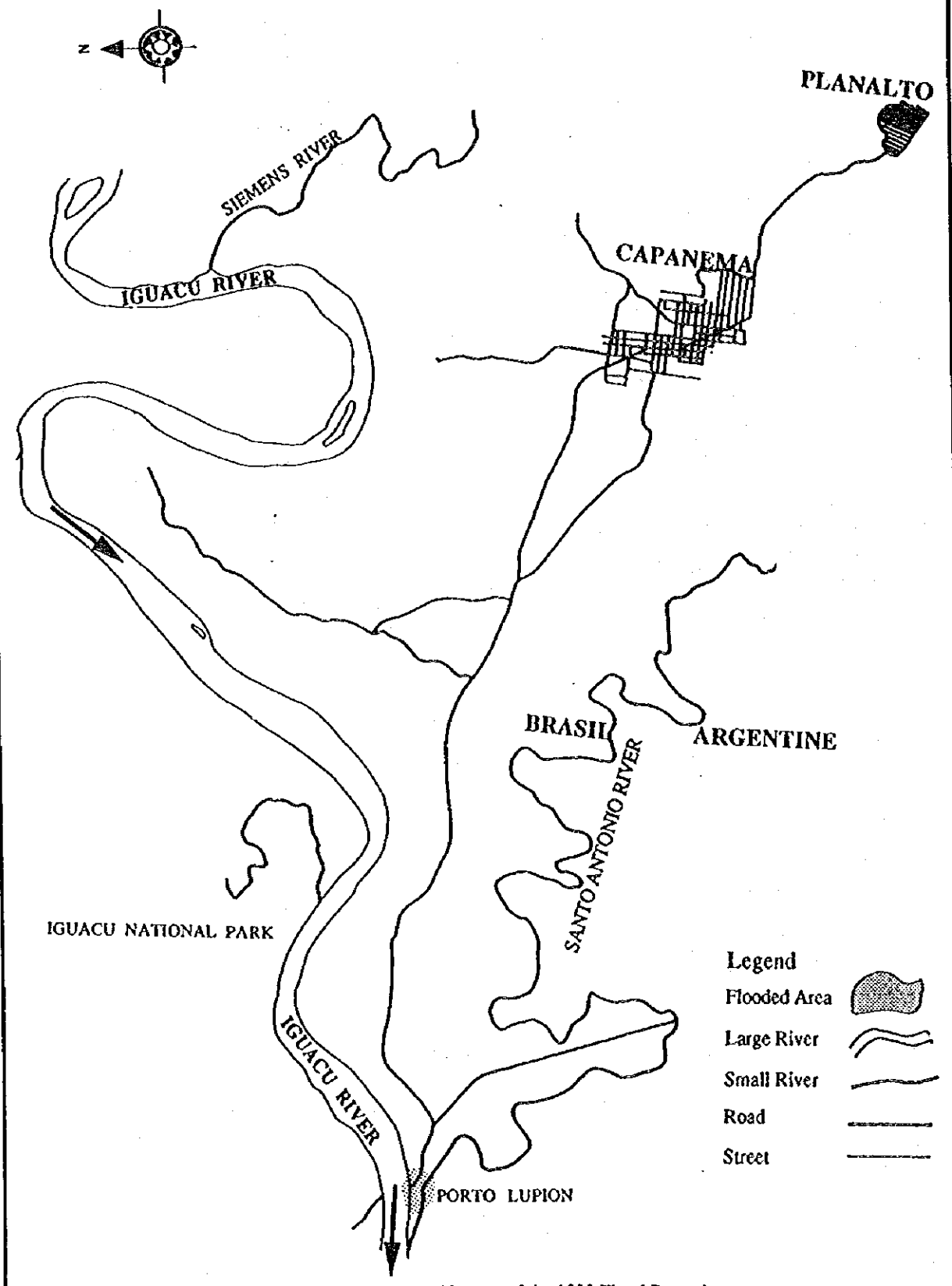
Year	Annual Maximum Gauge Water Level	Year	Annual Maximum Gauge Water Level	Year	Annual Maximum Gauge Water Level
1939	4.00	1958	4.18	1977	2.86
1940	3.00	1959	3.98	1978	2.20
1941	1.50	1960	4.86	1979	2.06
1942	3.00	1961	3.65	1980	2.10
1943	4.00	1962	2.52	1981	3.38
1944	4.90	1963	3.21	1982	2.80
1945	3.60	1964	4.00	1983	3.80
1946	4.20	1965	3.80	1984	1.86
1947	3.80	1966	3.32	1985	2.04
1948	5.70	1967	2.96	1986	3.10
1949	4.50	1968	3.26	1987	1.50
1950	2.50	1969	5.87	1988	2.48
1951	4.50	1970	4.23	1989	4.70
1952	4.52	1971	2.93	1990	3.02
1953	3.60	1972	5.10	1991	3.10
1954	3.80	1973	4.06	1992	1.98
1955	4.32	1974	3.58	1993	2.58
1956	2.90	1975	2.64	1994	na
1957	3.15	1976	3.70	1995	5.10

Source: DNAEE na: no available unit: meter

Figure 2.19 Annual Maximum Gauge Water Level at Morretes

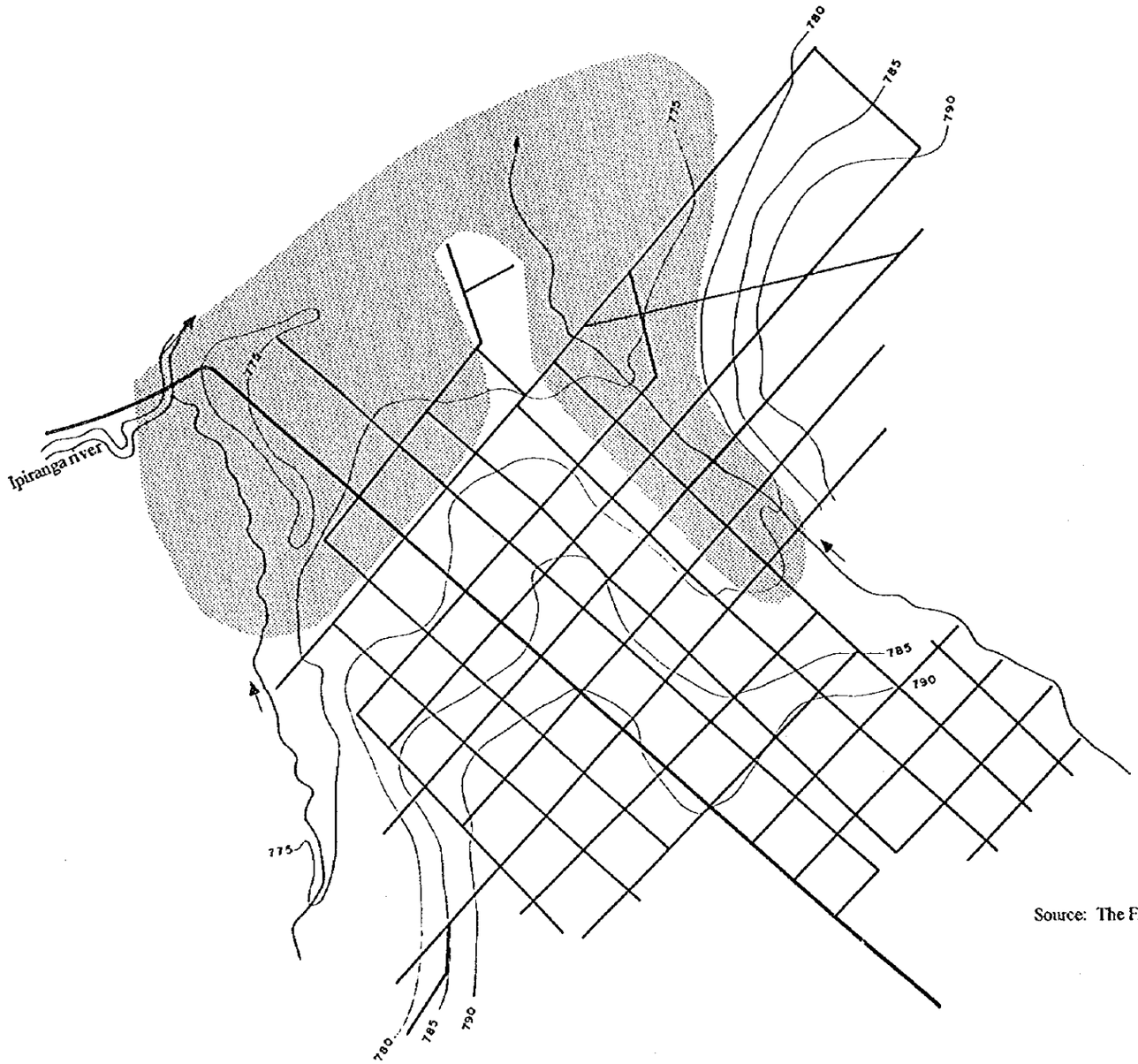
Source: The Flood Prone Area is prepared by use of the 1995 Flood Record of the Prefecture of Morretes

Figure-2.20 Flood Prone Area in Urban Perimeter of Morretes, Region-7



Source: The Flood Prone Area is prepared by use of the 1983 Flood Record of the Prefecture of Capanema

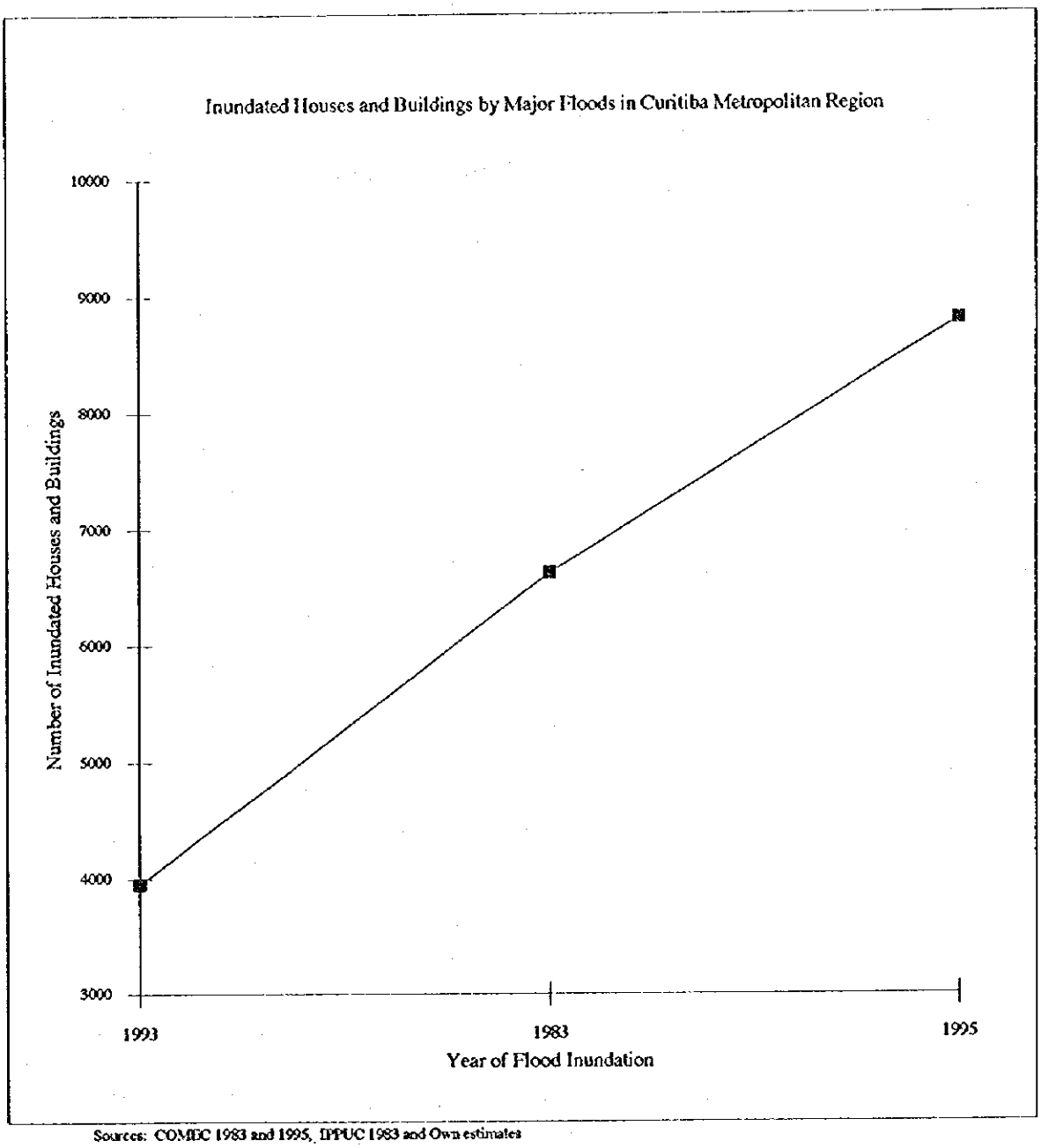
Figure-2.21 Flood Prone Area Identified in the Municipality of Capanema, Region-8



Source: The Flood Prone Area is prepared by use of the 1983 Flood Record of the Prefecture of Ipiranga

Figure-2.22 Flood Prone Area in Urban Perimeter of Ipiranga, Tibagi River Basin

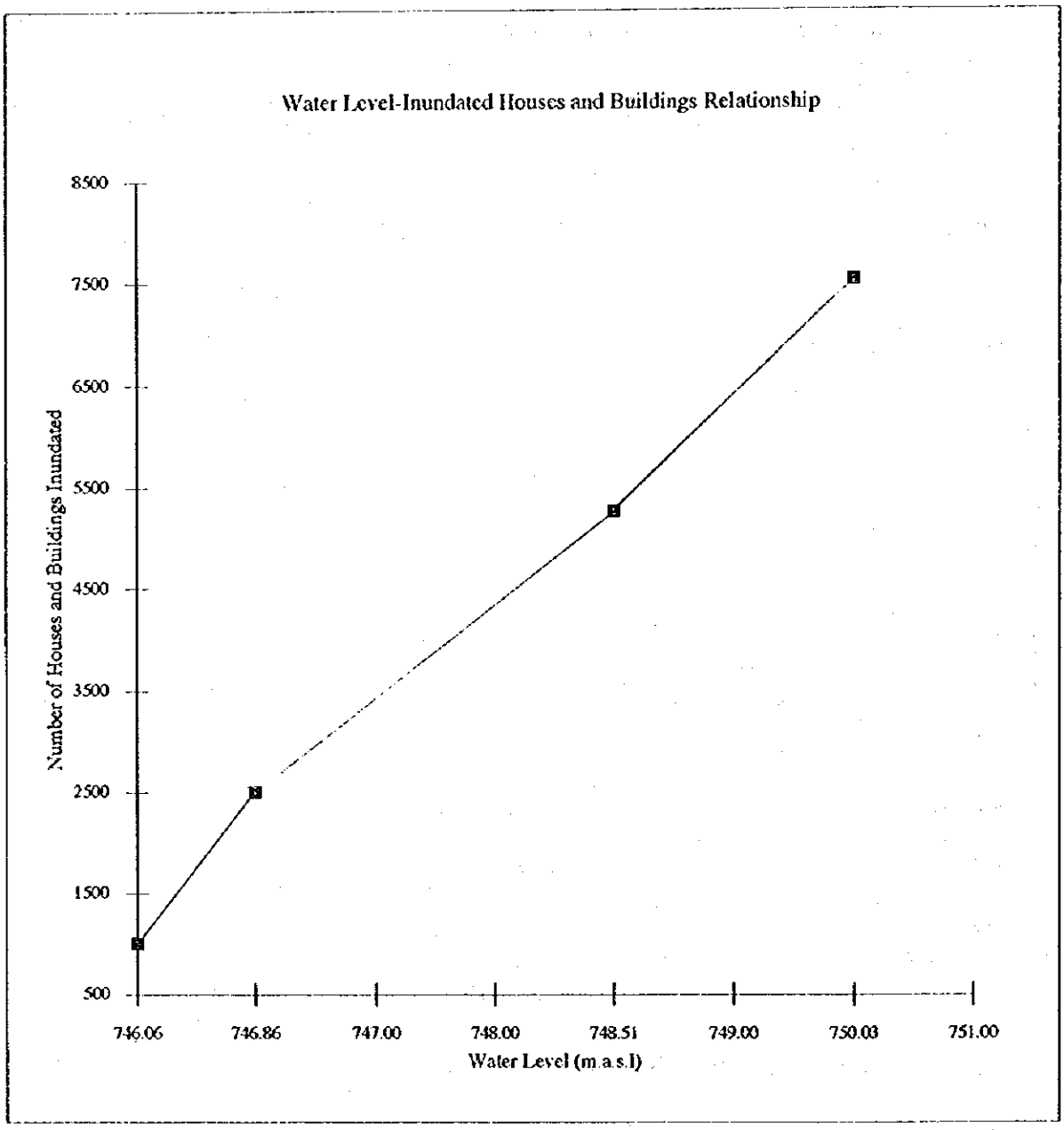
Year	Number of Inundated Houses	Source of Data
1993	3950	IPPUC and Own estimate
1983	6633	IPPUC and COMEC
1995	8800	COMEC and Own estimate



Sources: COMEC 1983 and 1995, IPPUC 1983 and Own estimates

Figure 2.23 Number of Inundated Houses and Buildings in Curitiba Metropolitan Region

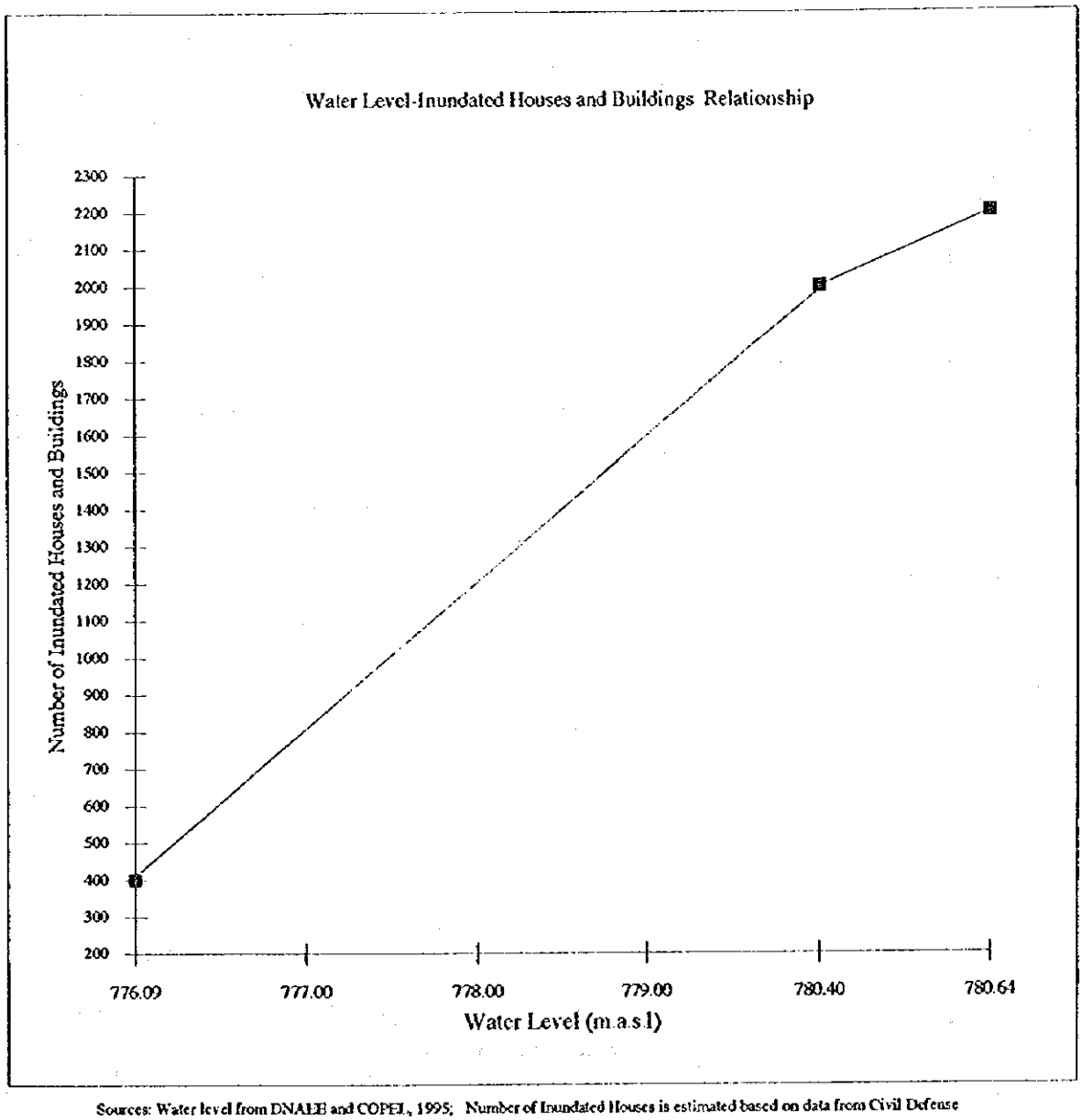
Year	Water Level	Number of Inundated Houses & Buildings
1982	746.06	1000
1993	746.86	2502
	747.00	
	748.00	
1992	748.51	5266
	749.00	
1983	750.03	7537
	751.00	



Sources: Water Level from COPEL; Number of Inundated Houses and buildings from Municipal Civil Defense, CORPRERI and Own estimate

Figure 2.24 Flood Water Level and Number of Inundated Houses at Uniao da Vitoria-Porto Uniao Area

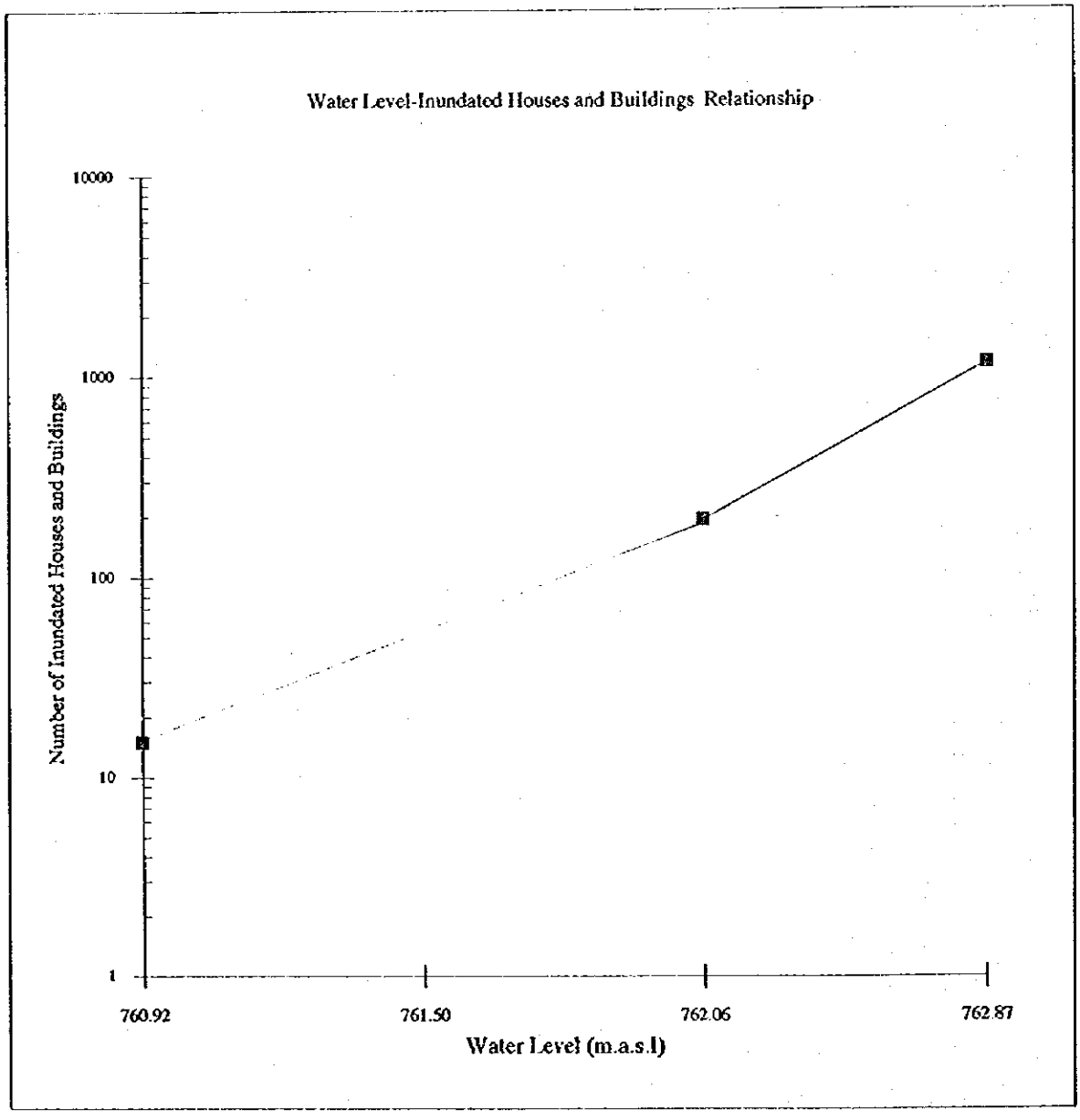
Year	Water Level	Number of Inundated Houses
1984	776.09	400
	777.00	
	778.00	
	779.00	
1992	780.40	2000
1983	780.64	2200
	781.00	



Sources: Water level from DNAEE and COPEL, 1995; Number of Inundated Houses is estimated based on data from Civil Defense

Figure 2.25 Flood Water Level and Number of Inundated Houses and Buildings at Rio Negro-Mafra Area

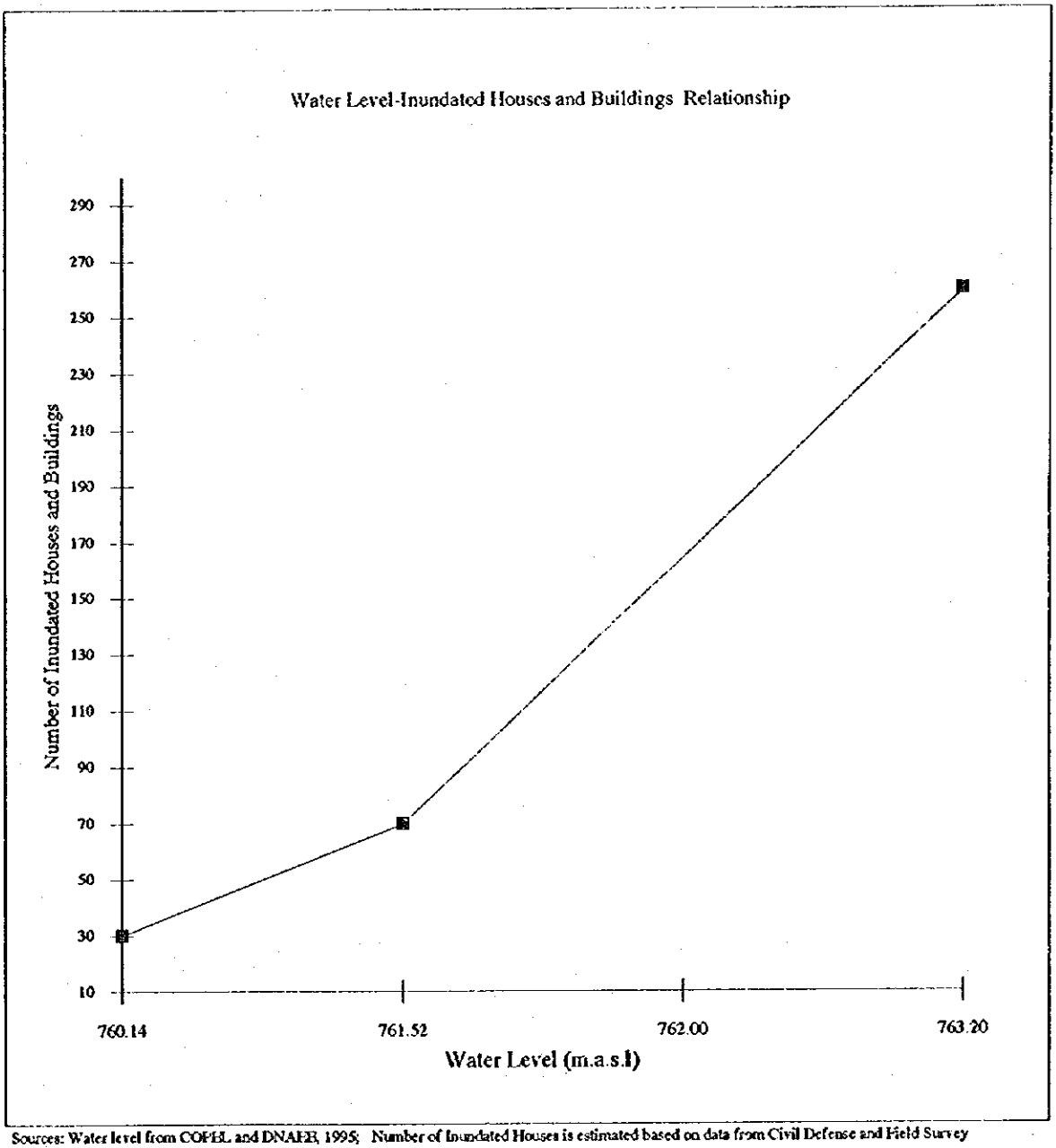
Year	Water Level	Number of Inundated Houses
1993	760.92	15
	761.50	
1992	762.06	194
1983	762.87	1160



Sources: Water level from COPEL and DNAEE, 1995; Number of Inundated Houses is estimated based on data from Civil Defense

Figure 2.26 Flood Water Level and Number of Inundated Houses and Buildings at Sao Mateus do Sul

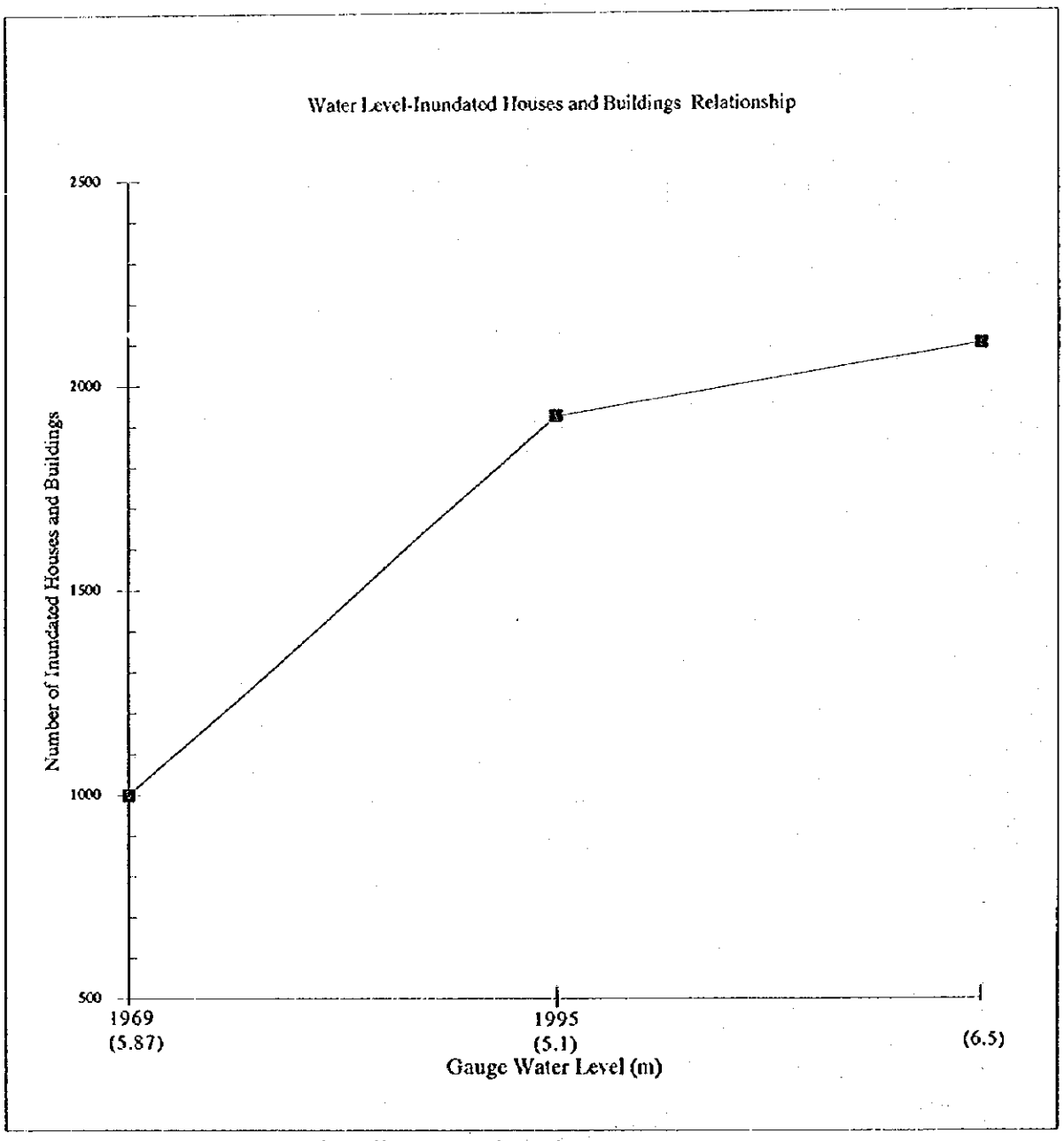
Year	Water Level	Number of Inundated Houses
1993	760.14	30
1992	761.52	70
	762.00	
1983	763.20	260



Sources: Water level from COPEL and DNAEE, 1995; Number of Inundated Houses is estimated based on data from Civil Defense and Field Survey

Figure 2.27 Flood Water Level and Number of Inundated Houses and Buildings at Porto Amazonas

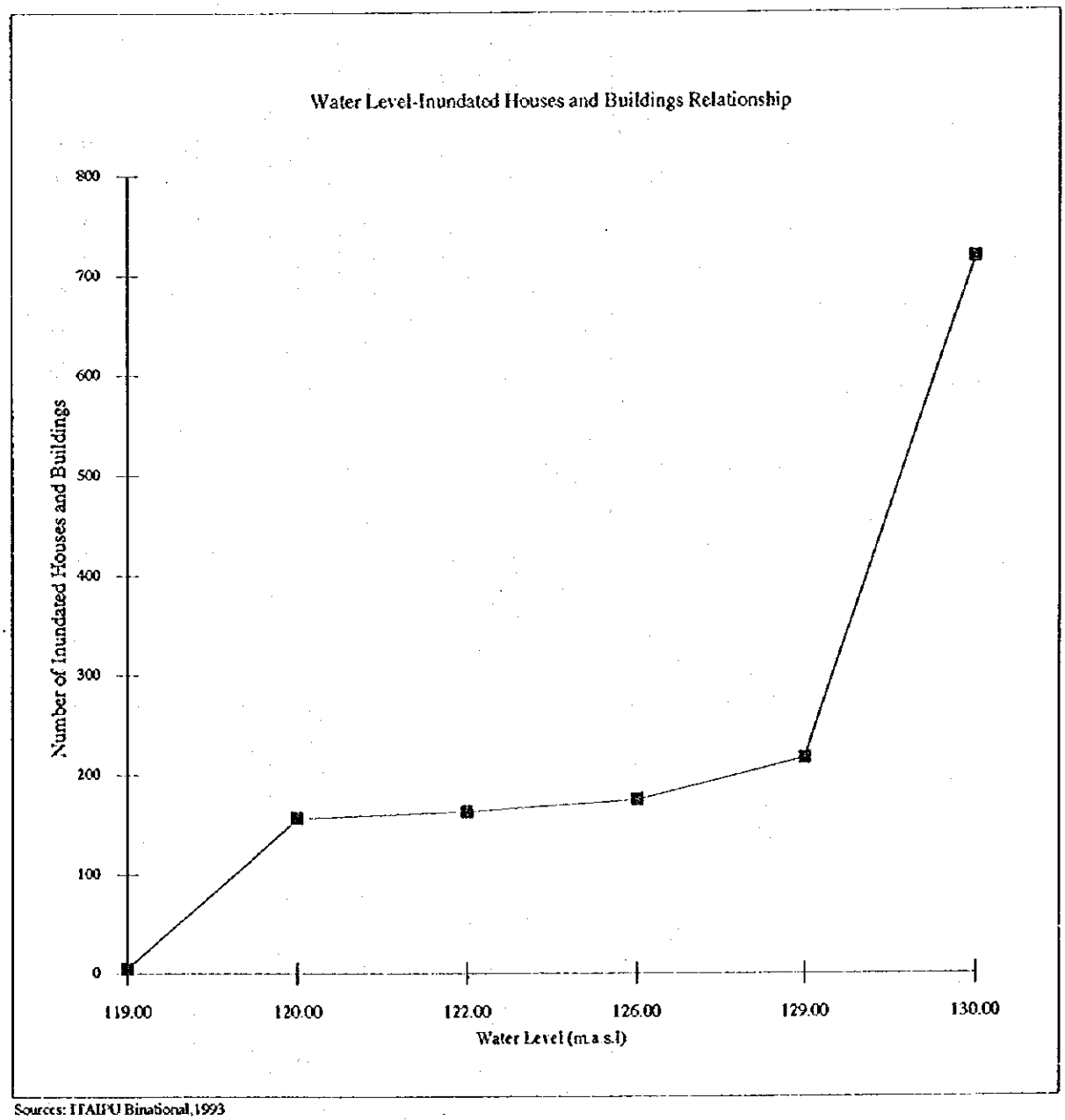
Year	Water Level	Number of Inundated Houses	Source of Data
1969	5.87	1000	Water Level from DNAEE; House estimated based on report of DNOS, 1989
1995	5.10	1925	Water Level from DNAEE; House from Prefecture of Morretes, 1995
	6.50	2100	Extrapolated



Sources: DNOS 1989, DNAEE 1995, Prefecture of Morretes 1995 and Own estimates

Figure 2.28 Flood Water Level and Number of Inundated Houses Relationship at Morretes

Water Level	Number of Inundated Houses	Source of data
119.00	5	ITAIPU Binational
120.00	156	ITAIPU Binational
122.00	163	ITAIPU Binational
126.00	175	ITAIPU Binational
129.00	217	ITAIPU Binational
130.00	717	ITAIPU Binational



Sources: ITAIPU Binational,1993

Figure 2.29 Flood Water Level and Number of Inundated Houses and Buildings at Foz do Iguacu Area

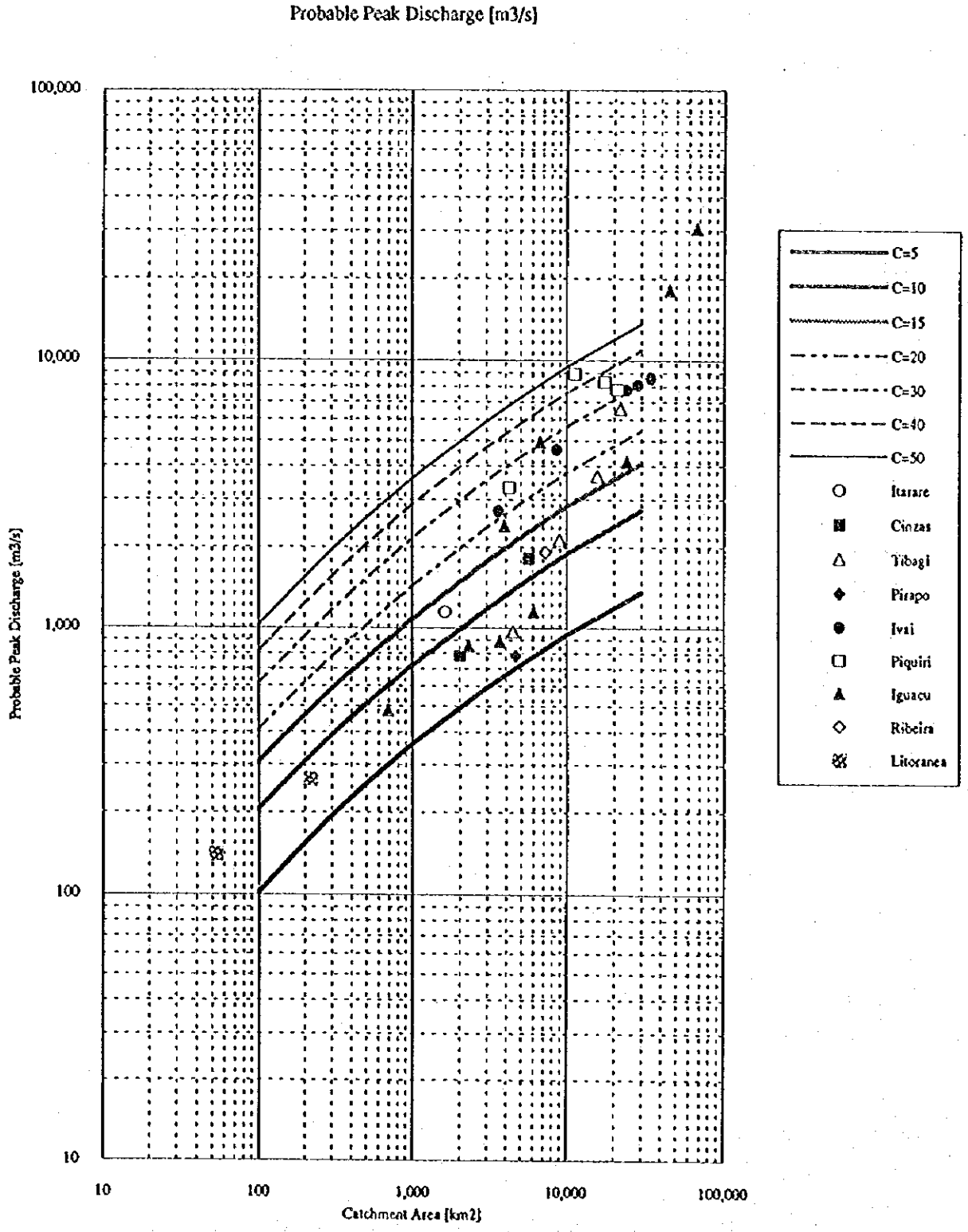


Figure-3.1 100 Year Probable Flood Peak Discharge in Paraná State

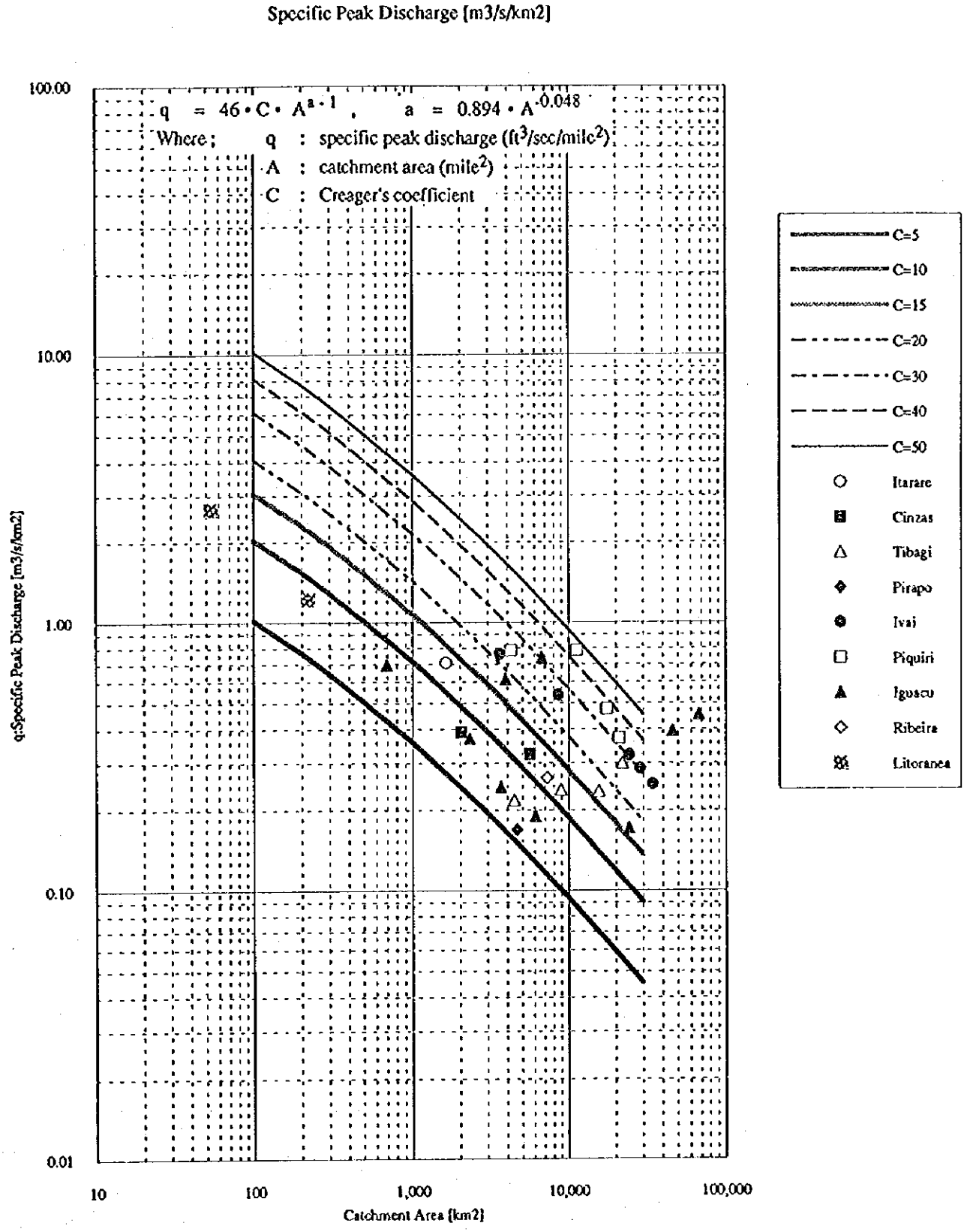
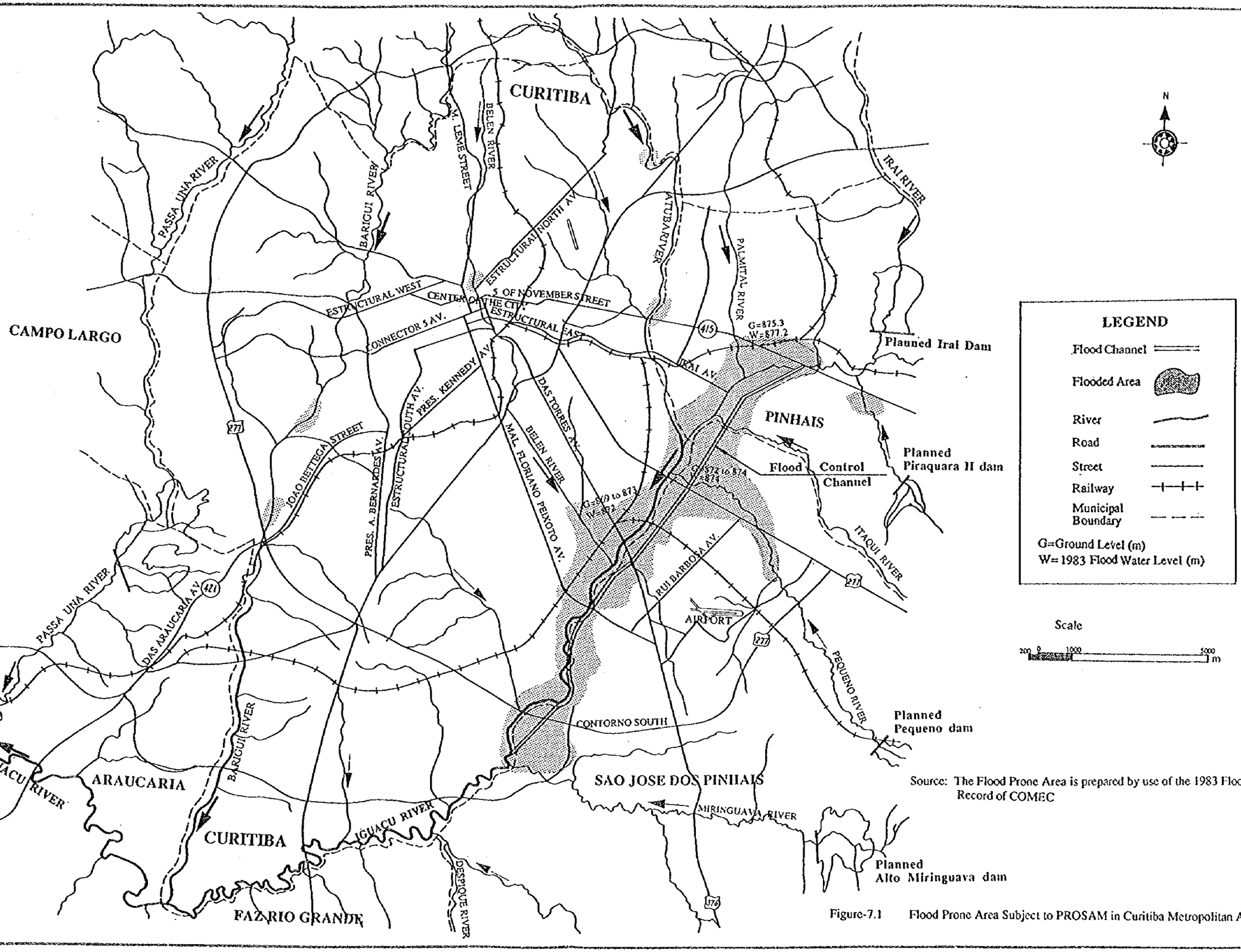
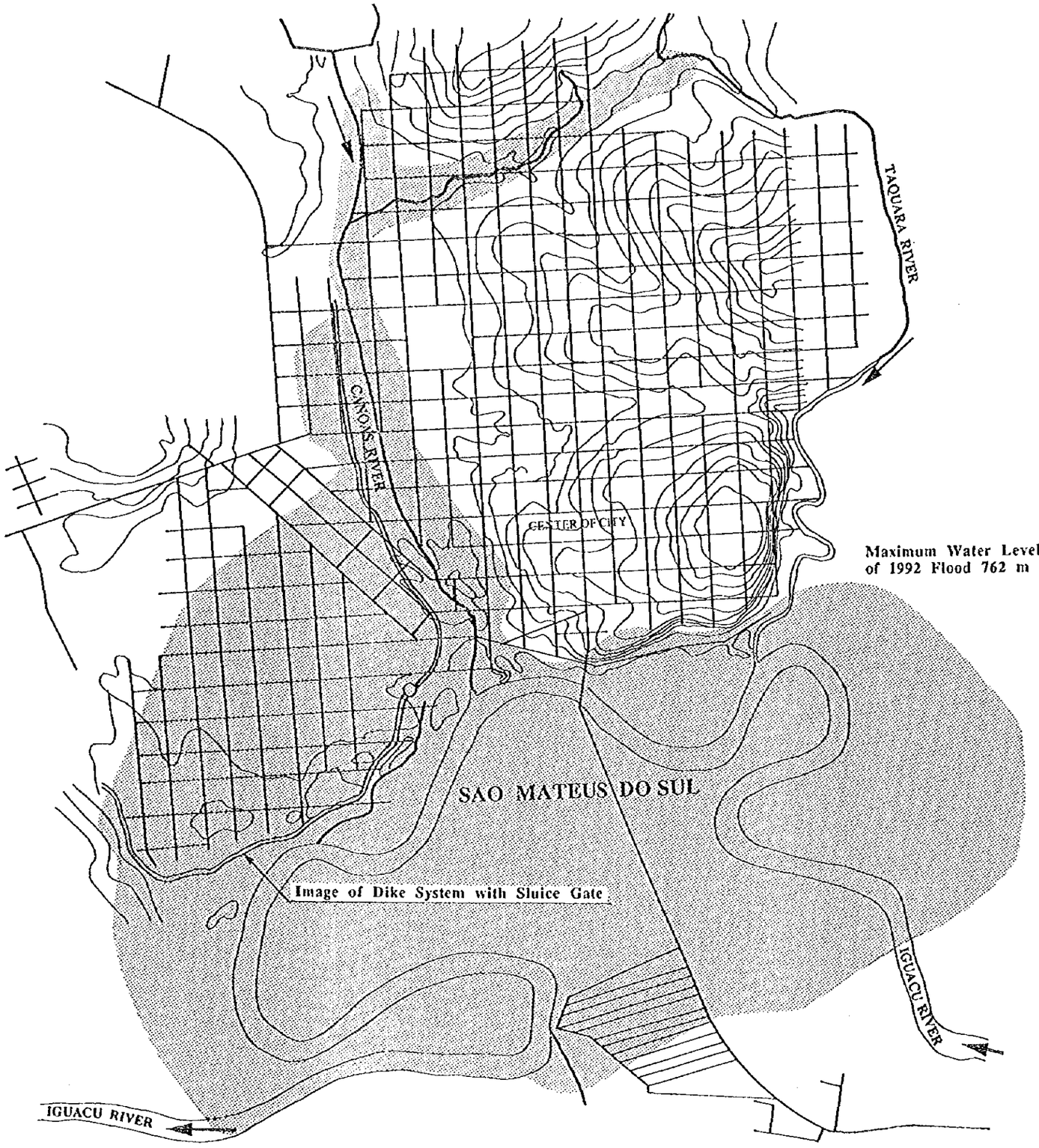


Figure-3.2 Specific Peak Discharge of 100 Year Probable Flood in Paraná State



Source: The Flood Prone Area is prepared by use of the 1983 Flood Record of COMEC

Figure-7.1 Flood Prone Area Subject to PROSAM in Curitiba Metropolitan Area



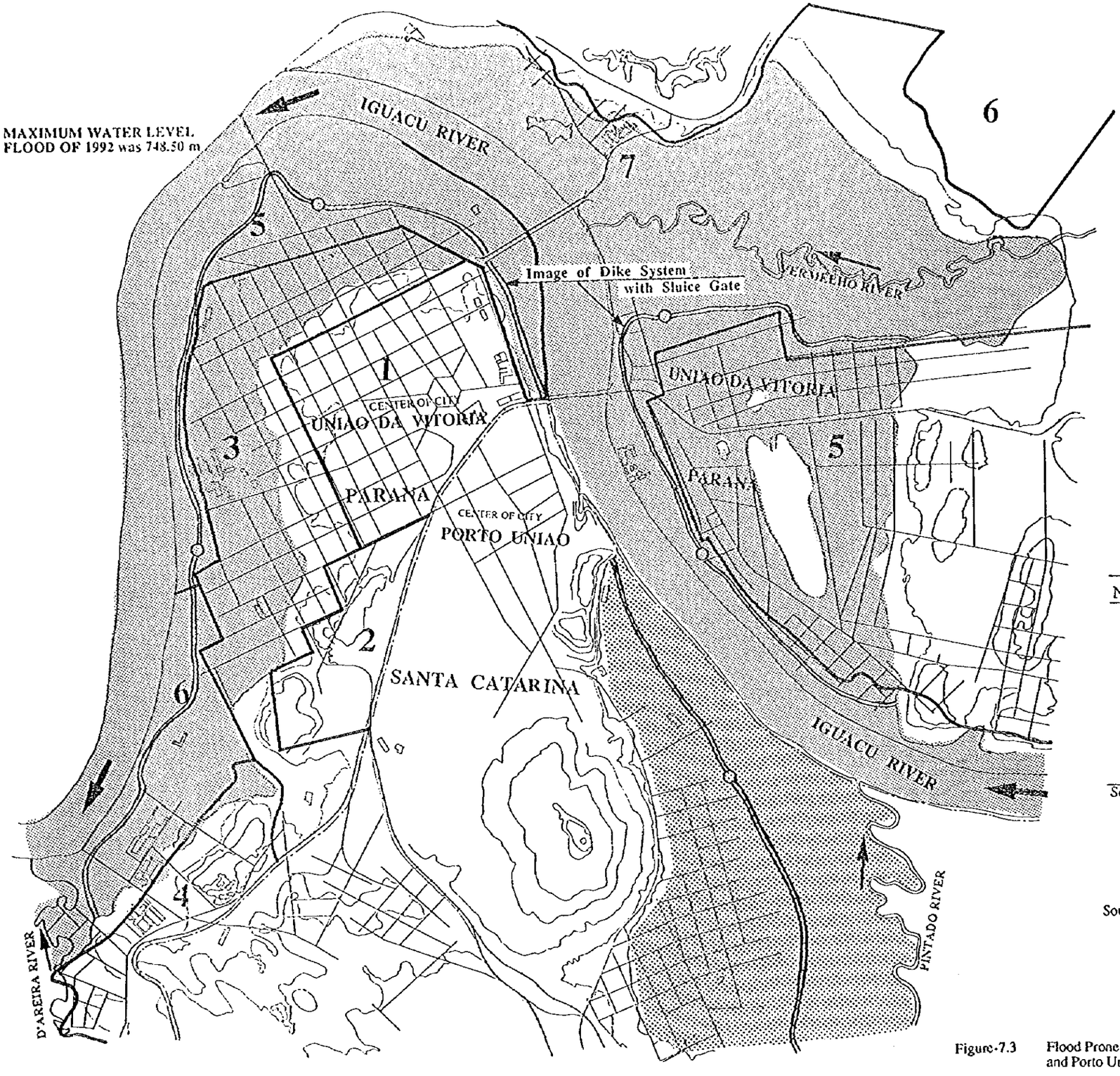
LEGEND

- Image of Dike System with Sluice Gate
- Flooded Area
- Large River
- Small River
- Road
- Street

Scale

Source: The Flood Prone Area is prepared by use of the 1992 Flood Record of the Prefecture of Sao Mateus Do Sul

Figure-7.2 Flood Prone Area and Conceptual Alignment of Flood Control Plan in São Mateus do Sul



LEGEND

- Image of Dike System with Sluice Gate
- Flooded Area
- Large River
- Smaller Rivers
- River Flow
- Road
- Street
- Railway
- Municipal Boundary

Scale

0 200 400 600 800 1000 m

Number of Land Area	Value of Land ($ R per m^2)
1	60.00
2	40.00
3	12.50
4	5.00
5	2.50
6	1.50
7	0.75

Source: Prefecture of Uniao da Vitoria

Source: The Flood Prone Area is prepared by use of the 1992 Flood Record of the Prefecture of Uniao Da Vitoria

Figure-7.3 Flood Prone Area of 1992 and Conceptual Alignment of Dike System in União da Vitoria and Porto União

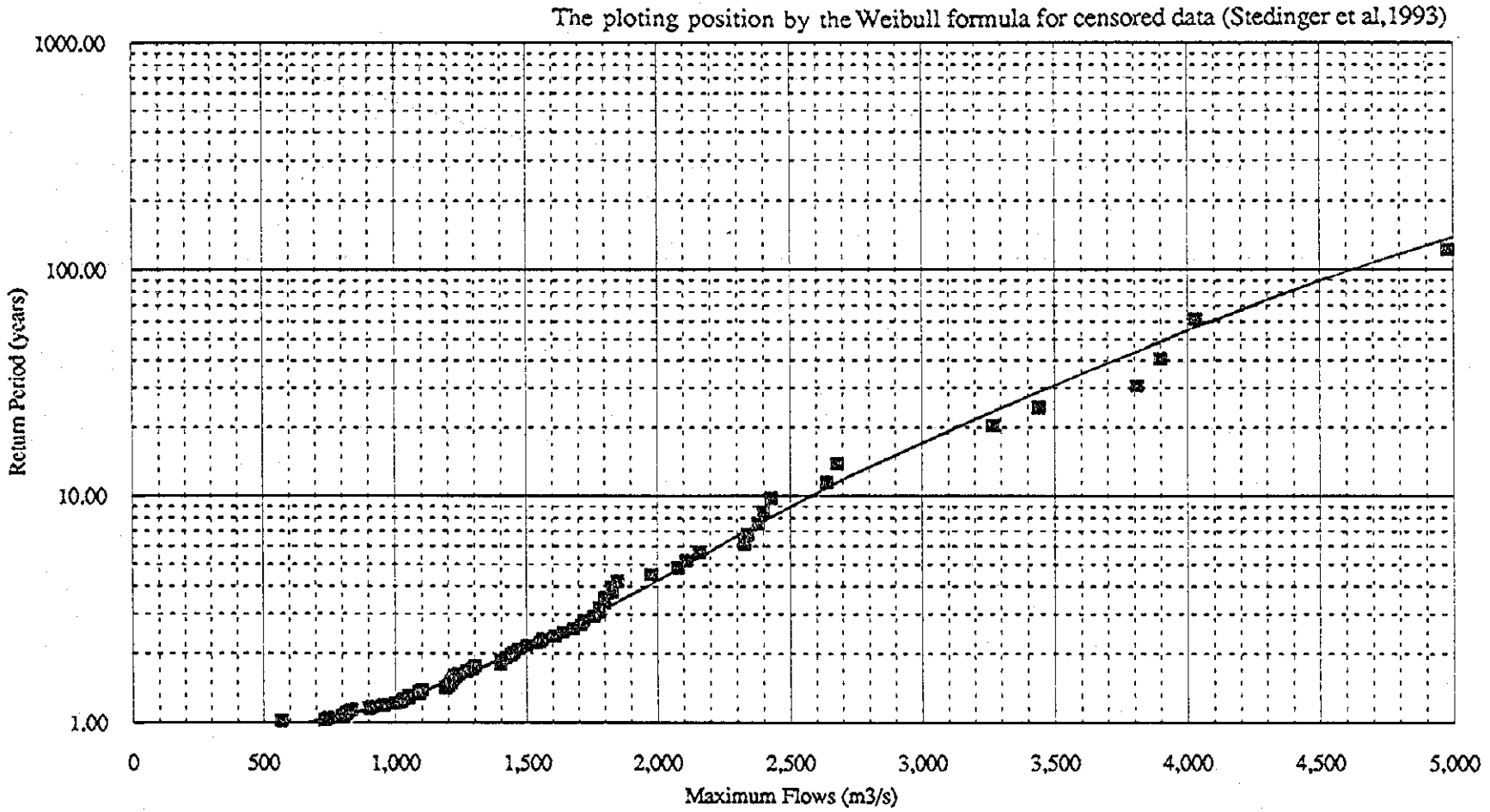


Figure-7.4 Frequency Analysis of Peak Discharges at Uniao da Vitoria

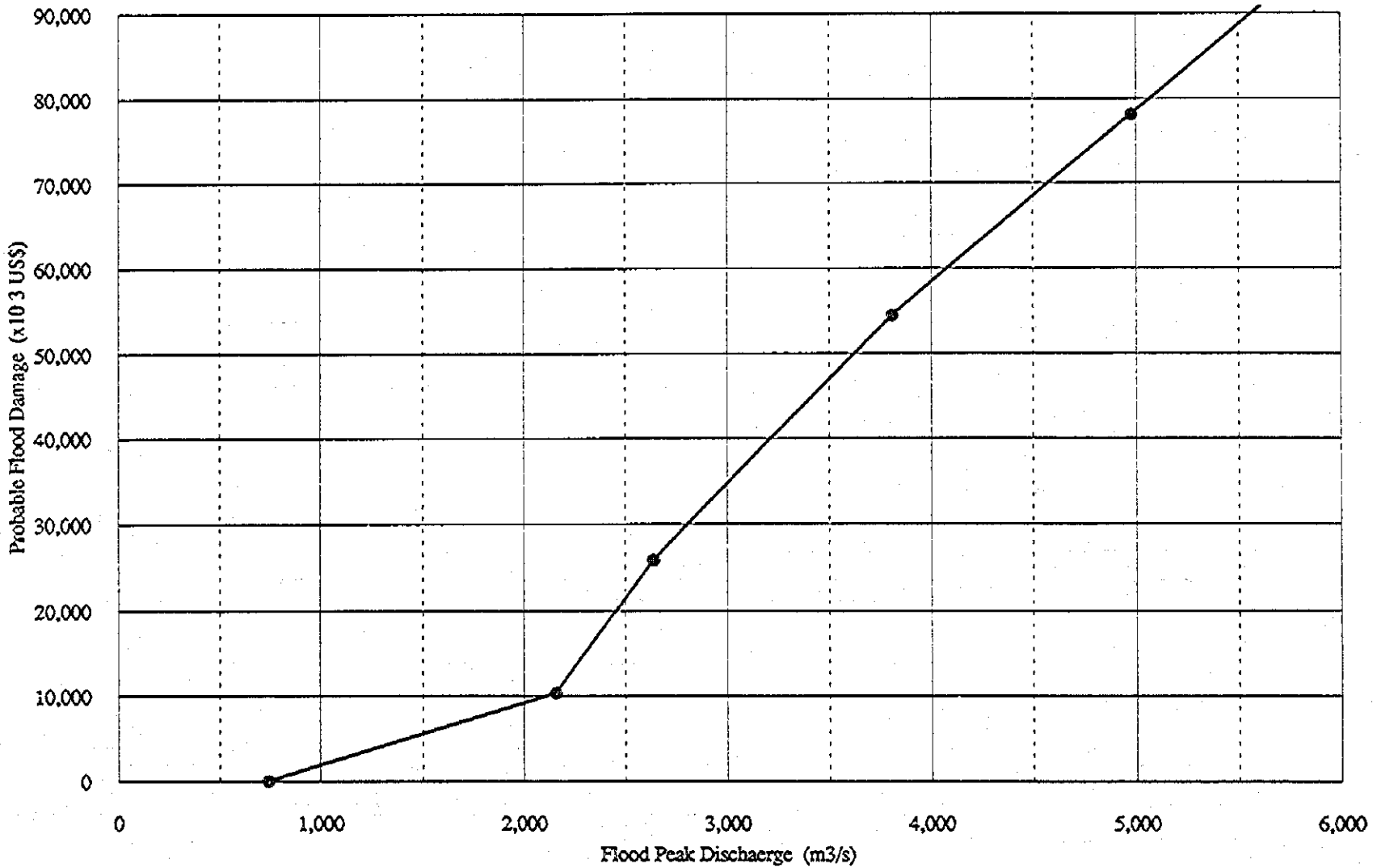


Figure-7.5 Relation between Peak Flood Discharge and Probable Flood Damage

Code No.	DNAEE Station Name	Catchment Area(km²)	Assumed Peak Discharge, Q (m³/s) 1983	1992
65035000	Porto Amazonas	3,662	1,046	725
65060000	Sao Mateus do. Sul	6,065	1,670	1,350
65220000	Fluviopolis	18,300	(3,764)	(2,879)
65310000	Uniao da Vitoria	24,211	4,980	3,809
65365800	Porto Vitoria	24,900	(5,112)	(3,917)
65774402	Usina Foz do Areia	29,900	8,358	6,952

Note: The discharge in parenthesis is interporated in proportion to catchment area.

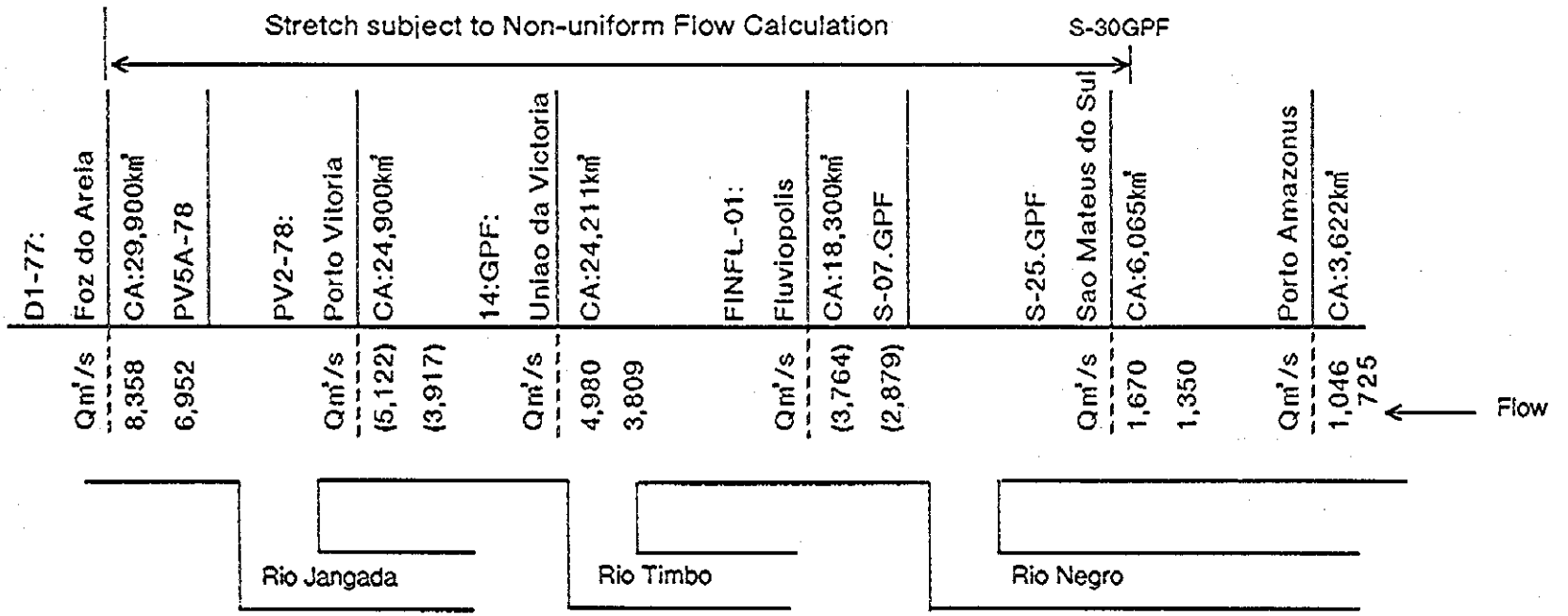


Figure 7.6 Assumed Peak Discharge Distribution for Non-Uniform Flow Calculation

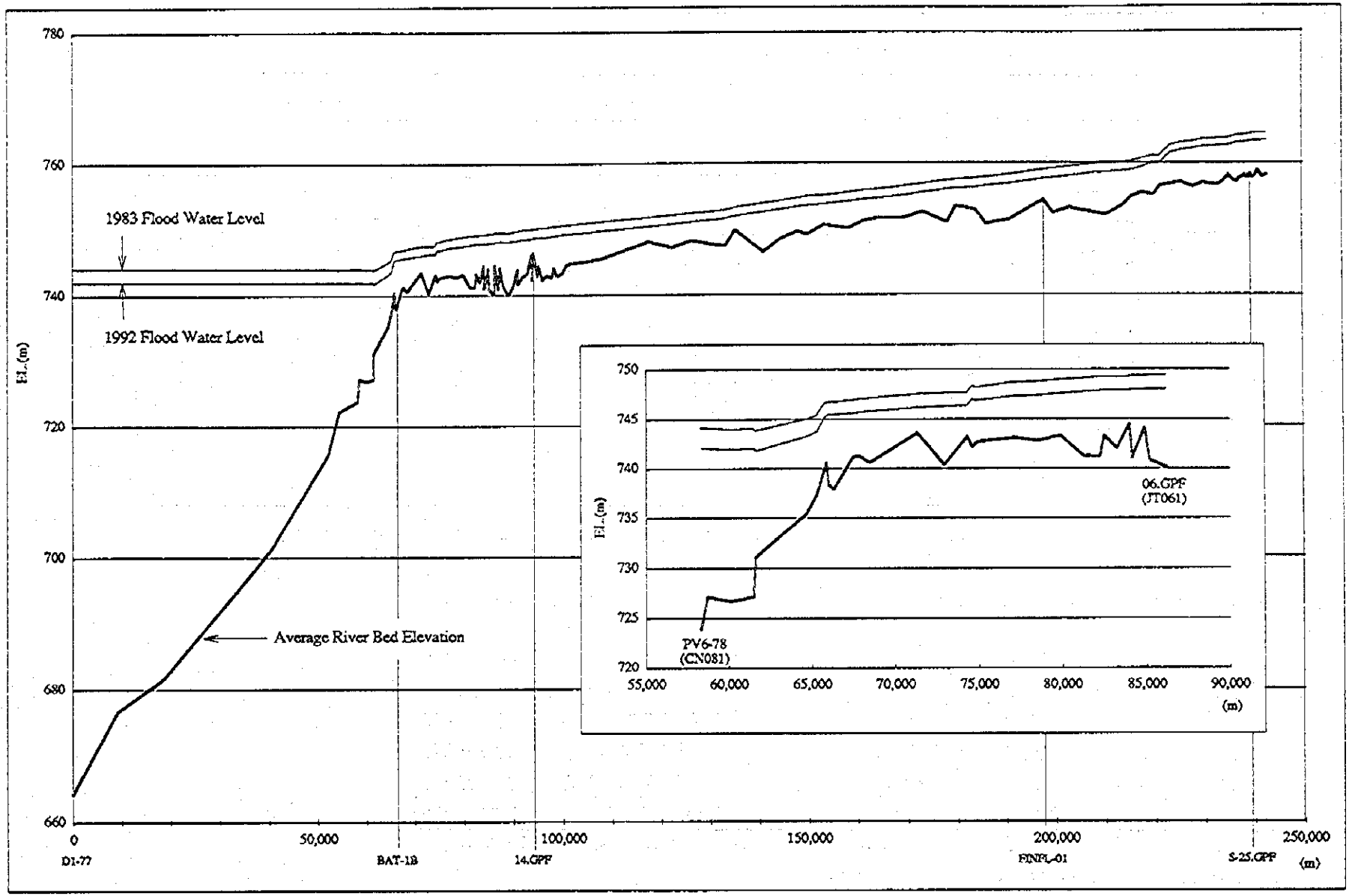


Figure-7.7 Average River Bed Elevation and Calculated Flood Water Level without Excavation

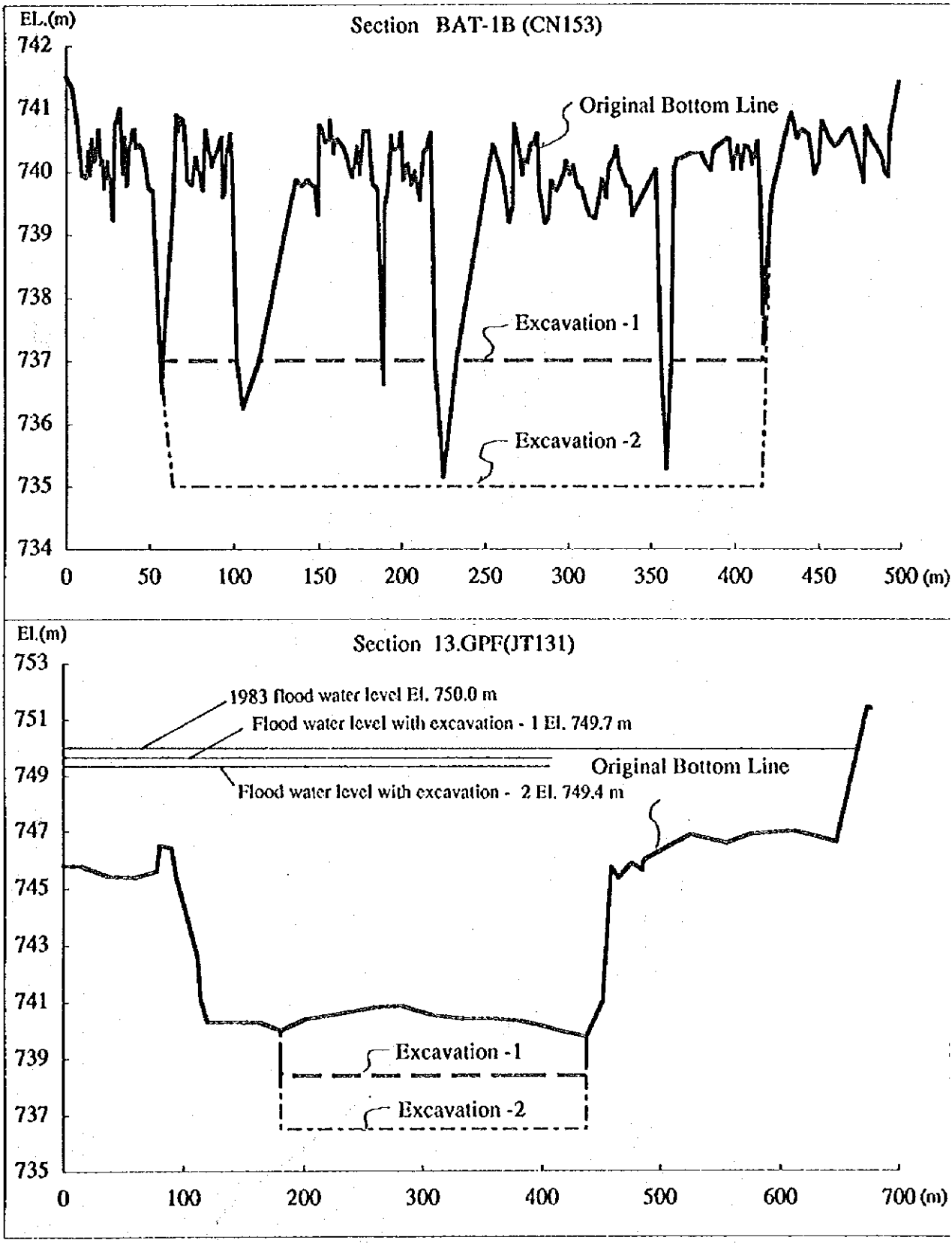


Figure-7.8 Excavation Lines of Cross Section BAT-1B and 13.GPF

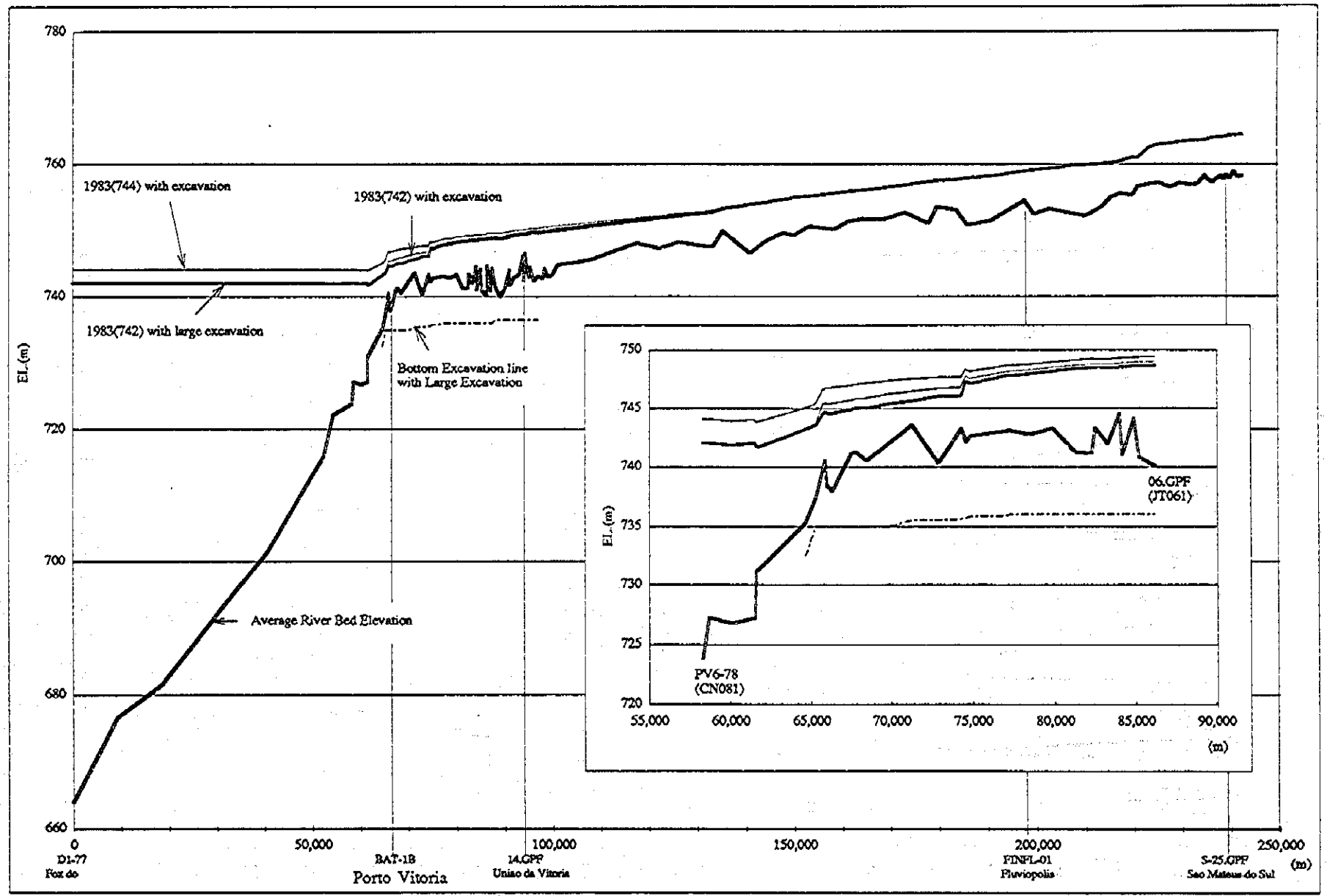


Figure-7.9 Calculated Flood Water Level with Excavations

JICA