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Romania
Flood Recovery Project
Evaluation of Flood Damages

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Europe, Middle East and North Africa

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CURRENCY EQUIVALENT

Except where otherwise indicated, all figures are quoted in Romanian Lei. For all calculations, the following conversion rate has been used:

US$1	= Lei 20
Lei 1	= US$0.05
Lei 1,000	= US$50.00

WEIGHTS AND MEASURES

All weights and measures are in metric units

1 Metric Ton (t)	= 1,000 Kilograms (kg)
1 Metric Ton (t)	= 2,204.6 Pounds
1 Kilometer (km)	= 0.62 Miles
1 Hectare (ha)	= 2.47 Acres
1 Cubic Meter (m^3)	= 35.3 Cubic Feet

ABBREVIATIONS

IB	Investment Bank
BAFI	Bank for Agriculture and Food Industry
ISPIF	Institute for Land Reclamation and Designing
NWC	National Water Council
MAIA	Ministry of Agriculture and Food Industry
IMH	Institute of Meteorology and Hydrology
IDR	Institute of Design and Research of the National Water Council

ROMANIAN FISCAL YEAR

January 1 - December 31

ROMANIA

FLOOD RECOVERY PROJECT

EVALUATION OF FLOOD DAMAGES

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This report has been prepared by Messrs. R. Sadove, R. Mulligan, S. Niaz, H. Kohli, T. Haile-Mariam and N. Noon who visited Romania in July 1975.

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MAPS

IBRD 11829
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11846

ROMANIA

FLOOD RECOVERY PROJECT

EVALUATION OF FLOOD DAMAGES

I. INTRODUCTION

1.01 During the first ten days of July 1975, serious floods caused extensive economic and other damage in Romania. On July 10, Romania requested assistance from the Bank, which organized an interdisciplinary mission to survey flood damages and explore the possibilities of a flood rehabilitation project. The mission arrived in Bucharest on July 21 with Mr. Munir Benjenk, Vice-President of the Bank, and worked in Romania until July 30. This report on evaluation of flood damages has been prepared by Messrs. Sadove (mission chief), Mulligan, Niaz, Kohli, Haile-Mariam and Noon who participated in the mission.

1.02 While Romania has experienced a series of relatively local floods in recent years, the 1975 floods were more widespread and caused more serious economic damage than any earlier floods. Five major river basins with contiguous headwaters near the junction between the eastern and southern Carpathian mountains were seriously affected as described in Chapter II. There was also some flood damage along the Danube and in a number of other river basins. Flash floods in the upper reaches of each river basin and on the Transylvanian plateau, and numerous landslides, caused extensive damage to industry and transport. Low-lying agricultural land further down in the basins was innundated with resulting damage to crops, agricultural assets and some industry. Rain and flood water collected in relatively flat and poorly drained agricultural land between river basins and also caused extensive damage to crops.

1.03 Total losses directly attributed to the floods in agriculture, industry, transport and flood protection works have been estimated at about $793 million. In addition to these quantified economic losses, about 1,300 villages, 65 towns, and portions of Bucharest were flooded, where there was extensive damage to housing and public facilities and sixty-two people lost their lives. The Bank mission also reviewed the Government's program for flood recovery, and that review has provided the basis for the Flood Recovery Project for which a lending of US$60 million is proposed.

II. BACKGROUND

A. General

2.01 Romania is endowed with abundant natural resources, a good climate, fertile soils, and an ample supply of land relative to the population of some 21 million people. Of the total land area of 237,500 km^2, about 15 million ha (63%) are suitable for agriculture and about 6.3 million ha (27%) are covered by forests. About 9.7 million ha are cultivated each year with field crops, 4.5 million ha are covered by permanent pastures and meadows and the remaining area is under vineyards and orchards. The Carpathian mountains, with elevations exceeding 2,500 m, dominate the central part of the country; their three distinct ranges - the eastern, the southern and the western - encircle the relatively flat area of the Transylvania region. Almost all Romanian rivers originate from the Carpathian mountains, flowing in all directions and eventually draining into the Danube River, which forms Romania's southern boundary with Yugoslavia and Bulgaria. Although there is considerable variation in rainfall ranging from around 95 mm to 280 mm between March and June (a critical period for cereal growth), annual levels above 1,000 mm and nearly 1,500 mm are common in the mountains. Despite risks of seasonal drought and annual flooding in various parts of the country, water resources abound with many low-lying valleys which are drained by numerous rivers and basins.

2.02 Romania's continental climate is influenced from the north by the polar winds and from the south by the milder Mediterranean climate. Persistent dry summer wind from the south, however, can give the southeast severe drought with resulting crop failure. Considerable variations in the climate within the country are masked by the average figures, which indicate a mean annual temperature of 11°C in the Danube plains and the Black sea region and 6°C in the mountainous areas. Almost the entire country receives snow during winter.

B. The River Basins

2.03 The water resources of the country are dominated by the Danube, and virtually all the country's rivers are tributaries to the Danube (Annex 1, Table 1). Among the most important rivers are the western (the Somes, the Mures), the southern (the Jiu, the Olt, the Arges and the Ialomita) and the eastern (the Siret and the Prut) groups (Map 11833). These rivers together drain about 74% (172,000 km^2) of the Romanian part of the Danube catchment. The Romanian rivers are short in length flowing through narrow and steep valleys; most tributaries do not exceed 200 km and the major stems vary from 300 km to 500 km, and are liable to flash floods during periods of heavy rainfall. The situation worsens rapidly if a storm covers a large mountainous

area causing the flood peaks of the tributaries of a river basin to synchronize and contiguous river basins to be flooded simultaneously. Thus Romania's substantial water resources must be regulated to modify the effects of seasonal and sudden changes in discharge, and to ensure regular supplies of drinking and industrial water to the towns and cities. The cost of such infrastructure is increased by the lack of large lakes to act as natural reservoirs and regulators.

2.04 Systematic hydrologic observations on the rivers were started in 1924, although observations on some rivers date back to 1870. The hydrologic network is very extensive with several hundred rainfall and discharge observation stations. In each major basin, as many as 70 to 80 discharge observation stations are maintained, where daily measurements are made.

2.05 The Danube. The catchment area of the Danube lies in 12 countries of central and eastern Europe and amounts to 813,000 km^2 (Annex 1, Table 2), of which 28% lies in Romania. The normal flow in the Danube varies from an average high of about 13,000 m3/sec to a low of about 3,000 m3/sec. The highest discharge ever recorded in the Danube at Turnu Severin (upper reach), Oltenita (middle reach) and Braila (lower reach) corresponded to about 100 year flood of 16,500 m^3/sec (in 1940), 18,000 m^3/sec (in 1897) and 20,000 m^3/sec (in 1897) respectively. The high flow in the Danube generally corresponds to the periods of snow melt and any intensive rain storms that may cover a substantial portion of its catchment. Normally, the high flow period extends from mid-March to mid-June, after which the flow starts receding quickly. Low flows occur during September and October. Over 1,000 km of levees along the left bank have been constructed during the past 70 years and are designed to contain a 100-year flood. They protect industrial and urban areas and important agricultural lands from river floods. Before a high flood enters the Romanian part of the Danube, adequate warning is available to organize a strict watch on the levees. As a result, the Romanians are able to identify and repair weak points in the levees before they become major problems. Strict maintenance standards and adequate warning has reduced serious flooding along the Danube. Future projects planned for the Danube include hydroelectric and irrigation schemes, which will not include any flood control storage, but will involve substantial raising of levees along the river.

The Rivers Particularly Important in the 1975 Flood

2.06 The Mures River, has a catchment of 27,800 km^2, and concentrations of population and economic activity at many locations along its course. It is a particularly important river which is subject to significant flooding. It originates in Transylvania (central Romania) and flows westward until it joins the Tisa (a major tributary of the Danube) in Hungary. Two of its main tributaries join the Mures at Alba Iulia. Although the normal maximum annual flow at this location is only about 500 m^3/sec, a peak of 2,450 m^3/sec was recorded in 1970.

2.07 In the Mures basin, about 2.1 million ha of agricultural land exists, or over 20% of the country's total, of which only about 128,000 ha are irrigated. The principal rail and road links to Hungary and Western Europe pass through the Mures valley and several important industrial and agricultural towns. Some of these towns have for many years been protected from river overflows by embankments, but during high floods in 1970, these embankments were breached causing extensive flooding, with serious damage to urban houses, industrial property, roads, railway lines, and agricultural enterprises. Although some locations in the valley are flooded every year, the 1970 flood was the largest ever recorded and it was nearly equalled in 1975.

2.08 The Olt River, with the catchment area of 24,000 km^2, drains the western and northern slopes of the Carpathian range where rainfall is particularly heavy. The normal maximum flow of the river is 400 m^3/sec but the record flow of 1,700 m^3/sec was experienced during the 1975 floods. The upper reaches of this river flow parallel to the Mures through a scenic narrow valley, highly valued as a tourist attraction as well as for its orchards and vineyards. Its basin contains about 1.4 million ha of agricultural area, of which about 130,000 ha are irrigated. Important national roads and railway lines serve several industrial towns along the valley close to the river for much of its length.

2.09 The Arges River, which lies to the south and east of the Olt basin, has a catchment area of about 12,600 km^2. One of its tributaries, the Dimbovita, drains about 1,100 km^2 and passes through Bucharest. The normal maximum flow of the Arges is around 250 m^3/sec at Budesti but, prior to the 1975 floods (when a peak of 1,800 m^3/sec was reached), the maximum peak recorded was 1,650 m^3/sec in 1941. The Arges basin contains about 800,000 ha of agricultural land, of which about 150,000 ha are irrigated. Due to its proximity to Bucharest, a number of national roads and railway lines pass through its basin and several industrial plants are also located in this area.

2.10 The Ialomita River originates from the southern slopes of the Carpathian mountains, flows in a southeasterly direction and joins the Danube River downstream of Slobozia. The normal annual maximum flow is around 200 m^3/sec, but the maximum peak recorded prior to the 1975 peak of 1,400 m^3/sec, was 1,170 m^3/sec in 1972. The Ialomita basin covering 10,400 km^2 has an agricultural area of about 600,000 ha, of which about 160,000 ha are irrigated. Like other river basins, several industrial plants and agricultural enterprises are located within the Ialomita valley. National roads and railway lines linking Bucharest with Slobozia and Constanta pass through the basin, close to the river in several reaches.

2.11 The Buzau River, a tributary of the Siret River, has a total catchment area of about 5,600 km^2. This river originates from the eastern slopes of the Carpathian mountains near Brasov and after flowing eastward for about 300 km joins the Siret River. The Buzau is well-known for its flash floods along the narrow valley in its upper reaches. The normal annual high flows are of the order of 300 m^3/sec; but during 1971, a peak of 1,320 m^3/sec was

recorded at Nehoiu compared to a new peak of 1,500 m^3/sec in 1975. As in other rivers, the peak normally lasts for less than 24 hours.

C. Floods Prior to 1975

2.12 Although the numerous Romanian rivers are vulnerable to frequent flooding, such floods normally have occurred in isolated river basins. Widespread concurrent flooding of a large number of river basins with maximum flows has been recorded only once before in May and June 1970, when floods of serious magnitude occurred in the western rivers of Transylvania, followed by those of Moldavia, raising the Danube to high levels. These floods were caused by heavy rainfall when the ground was already saturated with above normal rainfall in earlier months. The Mures river and its tributaries, and the Somes, the Crasna and the Cris rivers experienced their worst floods on record. Other rivers were also in high floods at that time: namely the Olt, the Trotus, the Prut, the Siret, the Bahlui and the Arges, and even the Danube.

D. The 1975 Floods

2.13 The June Flood - Northeastern Romania. Rainfall in Romania had been above normal for most of the early months of 1975. In the northeastern part of Romania, which consists of the basins of the Prut, the Bahlui, the Trotus and the Siret (Map 11832), rainfall during the months of April and May 1975 exceeded the normal for these two months by 50% to 100% (Annex 1, Table 3). This resulted in saturation of the catchment areas as well as the river beds.

2.14 During the first ten days of June a low pressure disturbance settled over northeastern Romania and resulted in heavy rainfall. During the ten day period, several stations recorded a total rainfall of 100 mm to over 150 mm, about one-half of which fell during the 24 hour period from 8 a.m. on June 7 to 8 a.m. on June 8. Isohyets for this storm are illustrated in Map 11832. Heavy showers of June 7/8, coupled with saturated ground and river beds, produced flash floods in almost all rivers in the northeastern part of the country. Because of the high rainfall in their small catchment areas, the Bahlui and Trotus had record floods of 270 m^3/sec and 2,025 m^3/sec (Annex 1, Table 4). These discharges were respectively 69% and 35% higher than the previous records of 1969. The Siret (43,900 km^2), being a much larger river, was not flooded to the same extent as the Bahlui and the Trotus. Damage in this northeast area was significant but relatively localized.

2.15 The July Flood. As a result of the storm that covered the northeastern part of Romania in the first ten days of June, appreciable rainfall was also received by the rest of the country. Total rainfall in the five

basins of the Mures, Olt, Arges, Ialomita and Buzau during April-June 1975 exceeded the normal figures for this period by 50% to 75%. Consequently, the river basins were saturated and the rivers were flowing with above normal discharges prior to the storm of July 1975.

2.16 On June 30, 1975, a heavy storm moved quickly from northwest to southeast over central Europe and covered almost the whole of Romania by July 1/2. This storm slowed down as it moved southeast and was virtually stationary over the central and southeastern parts of Romania for over two days. On July 4, it slowly started moving northeast and cleared the Romanian territory by July 11. Total rainfall during these 11 days at several stations in the five basins ranged from 100 mm to 245 mm, of which about 70% to 90% fell in the first three days (July 1 to July 3) and, at certain stations, 107 mm to 140 mm fell in 24 hours from July 1 to July 2 (Annex 1, Table 5). The rainstorm centered around Sinaia, about 40 km south of Brasov, and covered almost the whole country. The intense rainfall during 24 hours of July 1/2, the short lengths of the tributaries of these basins, the saturated ground, and the storm pattern all contributed to produce flash floods in the five rivers and their tributaries. In most of these, flood peaks were the highest ever recorded. In others the peaks were just below the highest recorded in earlier years. Table 4 in Annex 1 lists the flood peaks observed in 1975 and also summarizes the previously recorded peaks and the years of their occurrence. It will be noted from this table that the Olt, the Arges, the Dimbovita (the tributary of the Arges flowing through Bucharest), the Ialomita and the Buzau experienced their worst floods on record. The areas affected by flooding are shown on Map 11833.

III. GENERAL IMPACT OF THE 1975 FLOODS

3.01 The 1975 floods have dealt a serious blow to the Romanian economy. It will take one or two years to complete rehabilitation of flood damages and several years for the economy to recover fully. The $793 million in estimated direct losses was split about evenly between production losses (including crops) and asset losses. The production loss represents about 2.4 percent of the national income, and the asset loss 6.2 percent of gross domestic investment in 1974. These global figures give only a partial appreciation, however, of the disruptive effect of the floods as there was also considerable damage to about 250 local industrial enterprises, housing, and community facilities in 1,300 villages and 65 towns which were flooded.

Losses in the River Basins

3.02 The measured impact of the floods in each of the river basins discussed in Chapter II, and on each of the key economic sectors, is summarized in the following table, and detailed at Annex 2, Table 1:

Summary of Losses by River Basins
(Million $)

Sectors	Mures	Olt	Arges	Ialomita	Buzau	Danube /1	Others /2	Total
Agriculture	101.1	66.1	59.1	50.9	17.1	-	90.0	384.3
Irrigation, drainage and flood protection	2.5	1.5	3.5	0.9	0.8	4.1	2.6	15.9
Electric power	0.9	3.3	0.6	0.9	1.9	-	5.2	13.0
Mining and petroleum	4.9	2.4	2.7	1.5	0.4	-	22.1	33.8
Industry/3	67.7	22.2	25.2	13.4	10.3	1.1	18.6	158.6
Transport	46.6	45.3	31.6	23.9	25.1	6.3	8.9	187.5
TOTAL	223.7	140.8	122.7	91.5	55.6	11.5	147.4	793.2
% of Total	(28.2)	(17.8)	(15.5)	(11.5)	(7.0)	(1.4)	(18.6)	(100.0)

/1 Basin excluding the Mures, Olt, Arges, Ialomita and Buzau, which are treated separately.
/2 Includes agricultural and some industrial damages in the Danube basin which cannot be given separately.
/3 Asset and production losses.

3.03 Flooding in the Mures basin, which drains the Transylvanian plateau through western Romania, was especially serious and accounted for over 25 percent of all losses from the 1975 floods. Losses of crops, agricultural facilities and transport works in the Mures basin were serious, but industry was damaged more seriously than anywhere else in the country. Over 40 percent of

industrial damage was concentrated in this region, especially where the Tirnava Mare, Tirnava Mica and upper Mures tributaries converge to form the main channel of the Mures. Chemical and textile and other light industries in this area were particularly hard hit.

3.04 With a few exceptions, the distribution of losses for each sector among the remaining river basins was in proportion to total damage in each basin. The Olt basin had exceptional losses to transport, largely because of the railways and national roads located for long stretches beside the river in the narrow valleys which characterize the upper Olt. Relatively high transport losses also occurred in the Buzau basin. There were also significant agricultural losses in other basins. These losses are attributed to both flooding along the Danube and to heavy rains and poor drainage in a number of smaller basins.

Types of Losses

3.05 About half ($407 million), of all flood losses were crops and industrial production. The distribution of types of damage among the key economic sectors is summarized in the table below, and detailed at Annex 2, Table 2:

Summary of Losses by Type
(million $)

Sectors	Crops and Production	Raw Materials and Other Inventory	Buildings	Other Infra-structure	Machinery and Equipment	Other	Total
Agriculture	323.8	-	26.5/1	34.0	-	-	384.3
Irrigation, drainage and flood protection	-	-	-	15.0	0.9	-	15.9
Electric power	4.2	2.5	0.1	1.4	0.4	4.4	13.0
Mining and petroleum	4.8	12.6	1.8	0.7	5.0	9.0	33.8
Industry	74.2	27.7	2.9	5.6	44.3	3.9	158.6
Transport	-	-	-	185.1	2.4	-	187.5
TOTAL	407.0	42.8	31.3	241.8	53.0	17.3	793.2
% of Total	(51.3)	(5.4)	(4.0)	(30.5)	(6.7)	(2.2)	(100.0)

/1 Includes some machinery and equipment.

This table accounts only for the first order effects of the flood, and it has not been possible to quantify the linkages between these losses and their indirect effect on the economy. Nonetheless, the impact of these first order effects alone on export earnings and on funds available for investment are serious and are discussed in paragraphs 3.06 and 3.07 below. In addition, about a third of all flood losses resulted from damage to buildings and other infrastructure which must now be replaced or rehabilitated; the major portion of these losses was in transportation. Only a relatively small proportion of total losses were to machinery and equipment. Concentration of much of the equipment loss in industry, however, resulted in the estimated $74 million loss of industrial production noted above.

Export Losses

3.06 Production losses from the flood are serious because of their negative impact on Romania's balance of trade, particularly on convertible currency earnings. Romania has relied heavily on agriculture to provide about 50 percent of convertible currency earnings which are essential to the industrial investment program. As a result of the flood, Romania can be expected to lose about US$225 million in export earnings from agriculture, about US$125 million of which in convertible currency. (The mission was not able to quantify the loss of export earnings for industry.) The lost agricultural exports are equivalent to 4.6 percent of 1974 exports. A shortfall of exports in 1975 will make it particularly difficult for Romania to recover from the US$191 million overall trade deficit posted in 1974. Romania is now likely to have to curtail its investment dependent upon convertible currency earnings.

Planned Investment

3.07 As a result of the flood, a significant amount of investment planned for 1975 and 1976 will have to be deferred because of (a) resources being diverted for about US$386 million of quantified and a substantial amount of rehabilitation which could not be quantified by the mission and (b) the US$407 million in crop and production losses which will reduce both funds available for investment and domestic consumption. In agriculture alone, the US$324 million crop loss will result in about US$205 million reduction in funds available for agricultural investment in 1976, while rehabilitation of damaged assets will divert about US$60 million. The resulting US$265 million reduction represents 19 percent of agricultural investments planned for 1976. A similar situation prevails for industry where the US$127 million loss of convertible currency earnings from agriculture noted above will further constrain imports of necessary equipment.

IV. INDUSTRIAL SECTORS INCLUDING POWER, MINING AND PETROLEUM

A. Background

4.01 All important and large industrial units in Romania are state-owned and managed by the national government through nine ministries. Two of these ministries manage the Power sector and the Mining, Petroleum and Geological sector. National industrial undertakings in other fields (henceforth called Industry Sector) are managed by seven ministries: (i) Ministry of Forestry and Building Materials; (ii) Ministry of Light Industry; (iii) Ministry of Chemicals; (iv) Ministry of Industrial Construction; (v) Ministry of Heavy Machinery (including automobiles); (vi) Ministry of Machine Tools and Electro-Technics; and (vii) Ministry of Metallurgy. 1/ However, in addition to the national enterprises, there are a large number of smaller industrial units owned by local governments at the judet and municipal level. Since the mission was in field within three weeks of the floods, and because these enterprises are decentralized, it was not feasible to obtain information on the substantial damage suffered by over 250 of the total 500 local enterprises. Consequently, only damage to the national enterprises, and its consequences, are discussed here (Annex 4, Tables 1 to 3).

4.02 This Chapter consists of four sections; the first three discuss the impact of the floods on the Power, Mining and Petroleum and Industry Sectors and the fourth discusses the cost of the flood rehabilitation program in these sectors.

B. Power Sector

4.03 The floods caused extensive damage to the power sector. The damage this year is much more extensive than that caused by any previous flood, including the 1970 flood. The main reason for this large damage is the combination of three factors: (a) sudden simultaneous overflowing of most of the rivers which inundated many low-lying electric power installations; (b) a large number of landslides caused by the floods which damaged or carried away power facilities; and (c) accumulation of large volumes of mud which damaged equipment.

4.04 Most of the damage was to the transmission and distribution facilities. As detailed in Annex 4, Table 4, the main transmission lines were damaged at 378 locations (some 700 km of lines were down) while 3,946 transformer stations were put out of commission. The national power grid was affected in many areas (see Map 11831), interrupting power supplies to numerous cities and industrial units. In addition, many access roads and bridges

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1/ Since September 1975, the number of ministries in the sector has been reduced to six. A new Ministry of Machine Building Industry combines the Ministries of Heavy Machinery, and Machine Tools and Electro-Technics.

leading to power installations were either washed away or seriously damaged. Although no damage was reported by any operating hydroelectric plant, some infrastructure facilities near Vilcea Hydroelectric plant were affected, and materials and equipment at a few hydroelectric projects under construction suffered extensive losses. Only one Thermal Power Station, at Tirnaveni, was affected as flood waters damaged equipment like pumps, electric motors, boiler accessories and transmission facilities.

4.05 The total damage to the assets belonging to the Ministry of Electric Energy this year is estimated at Lei 175 million compared to about Lei 77.5 million during the 1970 floods. Over one-half of the losses in 1975 (Lei 88 million) are due to the damage to the transmission lines. Loss of materials and inventories, and damage to projects under execution total Lei 49.9 million (28.5% of total). Detailed breakdown of the losses are given in Annex 4, Table 5 and summarized below:

Power Sector

Summary Breakdown of Losses
(million Lei)

Total	Transmission Lines	Inventory	Infrastructure	Equipment and Machinery	Buildings
175.1	88.1	49.9	28.2	7.7	1.2
(100%)	(50.3%)	(28.5%)	(16.1%)	(4.4%)	(0.7%)

4.06 The maximum damage to the power sector was in the Olt basin (Lei 66.8 million or 38.2% of the total) and not in the Mures basin which suffered maximum overall damage during the 1975 floods. Estimates of damage to power installations in different basins are detailed in Annex 4, Table 5 and summarized below:

Power Sector

Summary of Estimated Damage by Basins
(million Lei)

Total	Mures	Olt	Arges	Ialomita	Buzau	Others
175.1	18.9	66.8	12.7	17.9	38.2	20.6
(100%)	(10.8%)	(38.2%)	(7.2%)	(10.2%)	(21.8%)	(11.8%)

4.07 Immediately after the floods were reported, the Ministry of Electric Energy took urgent remedial steps to restore power supplies to all parts of the country. A three-step action program was drawn up. The first step involved restoring emergency power supply to all consumers, particularly public services and industrial units. The second step aimed at making temporary provisions to restore supplies at the pre-flood level, by using all available reserve capacity. And, the third step would involve repairing all damaged facilities to ensure supply on a permanent basis by redeveloping the necessary reserve capacity. To put this action program into immediate operation, a coordination committee was formed in the Ministry. This committee assigned to each of the affected areas a senior official to take all possible corrective measures. The work at the most seriously affected places was supervised on site by some of these officials. In addition, the coordinating committee receives regular status reports from each enterprise and provides necessary support to them; immediately after the floods, reports were received three times a day, but by end of July frequency was reduced to one a day.

4.08 These efforts have paid off handsomely. Power supplies were quickly restored to most locations and the national grid is operational again, though supplies were still not completely normal by end July. Of 378 breaks in the transmission lines, only 14 remained to be fixed, while only 127 of 3,946 transformer stations were still to be repaired; some of the repairs were temporary and further work is necessary to restore power supplies on a permanent basis. This is a very creditable achievement by any measure. The Ministry is currently consolidating the plans developed by individual enterprises to complete steps two and three of the rehabilitation program mentioned above. In addition, engineers from its Design Institute are currently in field to ascertain if any route changes are necessary to minimize similar flood damage in future. Current estimates of the cost of rehabilitation of the damage are discussed in para. 4.32.

C. Mining, Petroleum and Geological Sector

4.09 The mining, petroleum and geology sector, another key sector in the Romanian economy, also suffered extensive damage. Since the 1975 floods were sudden and appeared after the normal spring flood season, many mining and petroleum enterprises could not take adequate flood protection measures in time. As a result, several open mines and quarries were flooded and later covered with mud; water also entered some underground mines. Large amounts of materials were washed away, substantial measuring and control instruments and earthmoving equipment at mines were damaged, gas supplies were interrupted, and some petroleum drilling and extraction equipment was affected. Fortunately, the extent of the damage was restricted due to the round-the-clock work undertaken by the workers and authorities to save the facilities as soon as flood warnings were received.

4.10 Floods damaged 15 out of about 100 mines in the country (Map 11846). Most of these were open mines for extracting non-ferrous and non-metallic ores like zinc, copper, lead, silver, coal, lignite and salt. A few quarries were flooded with up to 3-5 meters of water. The concentrates factories at Copsa

Mica and Baia Borsa were also flooded and suffered heavy inventory losses as large quantities of processed concentrates and ores were washed away. Landslides in some quarries carried down earthmoving machinery (e.g. excavators) and other equipment. All this interrupted production for a few days at most facilities; production loss was particularly serious in mines and related facilities near Medias and Sighisoara. Total production loss during July 1975 is roughly estimated at Lei 95 million. The cumulative production losses will continue to increase, though at a slower rate, until all affected facilities are repaired and reach full production again.

4.11 Flood damage in the mining, petroleum and geology sector is estimated at Lei 580 million; about Lei 200 million in the petroleum sector and the remaining Lei 380 million in the mining and geology sector. As detailed below, the largest loss, totalling Lei 205 million (35.3%) was in finished goods inventory, mainly at the Copsa Mica and Baia Borsa factories. Equipment losses totalled Lei 100 million (17%), of which Lei 80 million was in petroleum equipment. Damage caused to mines and wells would require expenditures of about Lei 180 million to restore the facilities to their pre-flood state. This work includes making necessary structural changes in the flooded underground mines and removing up to one meter deep mud left by the flood waters in the open mines. Fortunately, damage to buildings (Lei 36 million) and infrastructure (Lei 14 million), and the loss of inventories was relatively limited as summarized below and detailed in Annex 4, Table 6:

Mining, Petroleum and Geology Sector

Summary of Estimated Damage to Assets
(million Lei)

	Total	Finished Goods Inventory	Other Inventory	Buildings & Infra-structure	Equipment and Machinery	Repair of Flood Damage to Facilities
Total	580	205	45	50	100	180
Mining & Geology	(380)	(185)	(35)	(15)	(20)	(125)
Petroleum	(200)	(20)	(10)	(35)	(80)	(55)

4.12 As indicated in Map 11846, these losses are distributed in practically all flood-affected basins. The largest losses were in the Mures basin (Lei 97 million), Arges basin (Lei 53 million) and Olt basin (Lei 47 million). A breakdown of losses by various basins is summarized below and detailed in **Annex 4, Table 6.**

Mining, Petroleum and Geology Sector

Estimated Damage by Basins
(million Lei)

Total	Mures	Olt	Arges	Ialomita	Buzau	Others
580 (100%)	97 (16.7%)	47 (8.1%)	53 (9.1%)	30 (5.1%)	7 (1.2%)	346 (59.7%)

4.13 Some of the locations affected by the latest floods were also damaged by 1970 floods. After 1970, the authorities had initiated a number of flood protection measures, which included moving of warehouses to higher levels, construction of water channels and dykes around some flood-prone facilities, and participation in the national flood protection works like regulation of water flows and construction of dams. Even though all of the proposed protective measures were not fully completed, the efforts made during the last few years helped prevent higher losses in 1975. The Ministry and the enterprises are currently reviewing the existing flood control plans in light of the experience during the latest floods. However, it will take some time to complete the ongoing studies and to coordinate the action program with the local and national water control authorities. Future flood protection plans are discussed in Chapter VI.

D. Industry Sector

4.14 The floods affected 152 (or 21%) of some 722 national industrial enterprises under seven ministries which manage national enterprises in this sector (para. 4.01). The largest number of affected enterprises are in the Ministry of Light Industry (46 out of 254), Ministry of Forestry and Building Materials (36 out of total 101), Ministry of Industrial Construction (20 out of 60), and Ministry of Chemicals (19 out of 97). As a result, about half a million workers, whose wages are linked to production, lost part of their earnings. Details of enterprises and workers affected are given in Annex 4, Table 1, and summarized below:

Industry Sector

Summary of Enterprises and Workers Affected

Ministry	Total Enterprises	Affected Enterprises	Number of Workers Affected
Total	722	152	495,000
Forestry & Building Materials /1	101	36	200,000
Light Industry	254	46	100,000
Chemicals	97	19	70,000
Industrial Construction	60	20	110,000
Heavy Machinery	100	14	N.A.
Machine Tools	50	14	15,000
Metallurgy	60	3	N.A.

/1 Excluding 19 enterprises, which are discussed under Transport Sector.

4.15 The total book value of assets lost in these 152 enterprises is estimated at Lei 1,688 million (over US$85 million); the actual losses would be higher as more detailed physical inventory of the damage is completed and unit prices are changed to reflect replacement costs. Unlike some other sectors, the most serious damage in the industry sector was to equipment and machinery (Lei 892 million or 53%), though substantial inventory losses were also incurred both in raw materials and other inventory (Lei 425 million) and finished goods (Lei 197 million). Details of losses are given in Annex 4, Tables 2 and 7 to 13 and summarized below:

Industry Sector

Summary of Estimated Damage to Assets
(million Lei)

Ministry	Total	Finished Goods	Raw Materials & Inventory	Bldgs. & Infrastructure	Machinery and Equipment	Other
Total	1,687.8	197.3	425.2	120.4	892.5	52.4
Forestry & Building Materials	561.1	50.6	135.6	60.2	314.7	-
Light Industry	310.0	17.0	82.0	20.0	185.0	6.0
Chemicals	486.0	34.6	89.7	22.0	339.7	-
Industrial Construction	188.7	76.1	34.6	11.1	20.4	46.4
Heavy Machinery, Machine Tools & Metallurgy	142.0	19.0	83.3	7.1	32.7	-

4.16 The largest loss of Lei 561 million (Annex 4, Table 7), was in the Ministry of Forestry and Building Materials, because a large number of its wood processing plants (e.g. furniture factories) are located in mountain valleys and were damaged by the flash floods. Similar circumstances damaged facilities at four cement factories. Chemicals Industry also suffered heavy losses (Lei 486 million) due to the direct and indirect effects of the floods. High water damaged electrical equipment, controls and instrumentations. In addition, reaction of water with chemicals set off explosions at two locations causing serious damage to equipment and machinery (see para. 4.24 below). Many units (e.g. textile mills) in the Ministry of Light Industries had delicate and, at some places, automated equipment which was particularly susceptible to damage due to flood waters and mud. As a result, this Ministry suffered losses totalling Lei 310 million (para 4.23 and Annex 4, Table 8). Fortunately, losses in three ministries -- Heavy Machinery, Machine Tools and Metallurgy -- were relatively light because: (a) the number of units flooded were relatively limited due to their location; (b) many units located in flooded areas had taken effective precautionary measures since 1970; and (c) they had relatively smaller proportion of electrical and other delicate equipment.

4.17 Losses by Basin. The breakdown of losses by basins is detailed in Annex 4, Table 3, and summarized below; details for individual ministries are given in Annex 4, Tables 7 to 13. The Mures Basin suffered by far the largest losses, totalling Lei 733 million (43% of total country), though the industries located in the Arges basin (Lei 269 million) and the Olt basin (Lei 235 million) also suffered heavy losses. Map 11846 shows the location of industrial units in different ministries most seriously affected by floods.

Industry Sector

Summary of Damage to Assets by Basins
(million Lei)

Ministry	Total	Mures	Arges	Olt	Ialomita	Buzau	Other
Total	1,687.8	733.1	268.8	235.3	142.0	110.4	198.2
Forestry & Building Materials	561.1	108.4	73.1	106.1	36.2	78.6	158.7
Light Industry	310.0	210.0	20.0	30.0	15.0	30.0	5.0
Chemicals	486.0	268.0	136.0	57.0	25.0	-	-
Industrial Construction	188.7	59.2	24.4	13.1	57.6	1.8	32.6
Heavy Machinery, Machine Tools & Metallurgy	142.0	87.5	15.3	29.1	8.2	-	1.9

4.18 Production Losses. Due to the widespread damage to assets, production was interrupted at least for a few days at practically all 152 affected enterprises. Estimates of the resultant production losses, prepared at the end of July, total Lei 1.5 billion (US$75 million). As detailed in table below, the largest losses were reported by the Ministry of Chemicals (Lei 400 million). While practically all affected factories have started partial production, most of them are operating at between 50 to 80% of normal capacity due to the equipment damage and loss of automatic controls. But a few factories (e.g. textiles factory at Medias, ceramics unit at Sighisoara, etc.) are still totally inoperational and cannot restart production until critical spare parts and supplies are received. Even the units put back into production have done so by finding temporary solutions and by often disregarding normal safety considerations, and therefore cannot continue like this indefinitely. Consequently, production losses and the resultant effects on other parts of the economy will become more serious unless necessary spares, supplies and replacement equipment are urgently provided. The estimates below do not take into account losses due to production cutbacks much beyond July or their effects on other parts of the economy.

Industry Sector

Summary of Production Losses in July 1975

Industry	(million Lei)	%
Total	1,486	100.0
Forestry and Building Materials	106	7.1
Light Industry	227	15.3
Chemicals	400	27.0
Industrial Construction	179	12.1
Heavy Machinery, Machine Tools & Metallurgy	574	38.5

4.19 The numbers alone do not reflect the full impact of the damage. Some of the factories affected supply basic inputs to other parts of the economy, while others are the only ones of their kind in the country. Any disruption in their operations could have serious indirect effects on the economy. For example, the Chemicals Enterprise at Tirnaveni is the only producer of calcium carbide, a product widely used in the chemicals, petrochemicals and engineering industries. The production losses at Tirnaveni forced many factories in these industries to cut production. Similar production losses in other basic industries like mining, heavy machinery and machine tools will be multiplied due to linkages. Similarly, the silk factory at Sighisoara, the only one of its type, affects other units solely dependent on it for supplies. Finally, the floods may severely curtail exports of some commodities and thus hurt the whole economy, as a substantial portion of production of many units (e.g. textile factory at Medias, furniture factories

at Buzau and Tirnaveni, four cement plants) was destined for exports. A brief description of losses in individual subsectors is given below.

4.20 Forestry and Building Materials. Since a large number of enterprises in this sector are located in mountain valleys and along rivers, they suffered relatively heavy losses. About one-third (36) of total 101 enterprises (excluding the Central for Forest Exploitation) were affected by flood; 15 of the damaged enterprises manufacture wood products like furniture, 4 are cement plants, and the balance 17 are engaged in the production of construction materials like bricks, prefabricated concrete parts, concrete pipes, ceramics, etc. Substantial losses were also incurred as swollen rivers carried away large quantities of wood. Two export-oriented furniture factories, in Nehoiu and Medias, were totally washed away resulting in large losses of inventories and equipment. Other factories producing wood products, particularly those with automated equipment, also suffered heavy losses as floods damaged electrical lines and equipment and put auxiliary facilities like water and gas supply systems out of commission. Most of these units were new and exported 60-70% of their production, mainly to West Germany, France, Sweden, Austria, Hungary, Poland and USSR.

4.21 Four of the 10 cement plants in Romania were damaged. These plants are also located in the valleys and, as a result, some facilities came under 2-2.5 meters of water. At three of these locations, thermal power plants were partially damaged. At all four sites, conveyors bringing raw materials to the main plant were affected, electrical equipment and controls were rendered inoperative and large quantities of raw materials like limestone were lost. The authorities were able to restart the affected plants at 60-75% of normal capacity by making temporary power connections, but full production cannot be achieved until necessary spare parts and replacements are received.

4.22 Seventeen of the total 26 enterprises producing construction materials suffered similar damage due to high waters. Fortunately, due to their safer location no major damage is reported from paper and pulp factories and from units producing equipment for forest industries.

4.23 Light Industry. This industry includes textiles, glassware, leather and other consumer goods plants. In all, 46 enterprises under the Ministry of Light Industry were damaged. Of these, 7 were most seriously affected; 6 of these are located in the Mures basin cities of Sighisoara (3), Medias (2) and Tirnaveni (1), and one in the Prahova valley -- the sand mine for glass production at Valeni de Munte. The factories at Sighisoara, Medias and Tirnaveni were flooded with up to 3 meters of water. When water finally subsided, up to one meter of mud was left behind. As a result, raw materials and finished products inventories were heavily damaged. Most of these factories, being export-oriented, had modern and automated equipment, and flood water played havoc to their electronic controls and instrumentations. The two textile factories and one silk weaving factory at Sighisoara, all equipped with precision machinery, suffered additional damage as flood waters brought chemicals from nearby chemical stores and thus corroded equipment. The Consumer Products plant at Medias and the glass factory at Tirnaveni suffered damage when water entered high-temperature furnaces before they could be cooled and

damaged refractories and furnace walls. The damage in this industry would have been even higher if authorities had not taken timely action in dismantling and removing to safety sensitive equipment from about 20 plants in Arad, Deva, Alba Iulia and Bucharest areas.

4.24 Chemical Industry. In all, 19 chemical plants were affected by the floods. All except 6 were recommissioned within a few days. The most common reason for temporary production stoppage was the sudden increase in the impurities and suspended matter in river waters, which clogged and damaged the water purifying and pumping stations. As a result, water supplies to thermal power stations and main chemical plants for cooling or other production purposes were stopped, resulting in complete plant shutdowns. Fortunately, no serious permanent damage was suffered in the main facilities at most of the plants and therefore production could start as soon as water supplies were restored, either on a temporary or permanent basis.

4.25 However, six plants suffered much more serious damage, of which the worst affected is at Tirnaveni. This plant produces calcium carbide, other chemical materials and ceramics and suffered a total damage of about Lei 200 million. On July 3, flood waters, after breaking the protective dykes around the city, suddenly entered the plant and rose to 2-3 meters height within two hours. The water stayed above floor level for two days before receding, leaving large quantities of mud in and around the machinery. As a result, most of the electrical machinery, instrumentation and automatic controls were permanently lost, and large quantities of materials and supplies were destroyed. Finally, flood water permanently damaged the refractories in ovens and the instrumentation in the ceramics plant. However, extensive damage was caused by the severe explosion set off when water entered the calcium carbide store (located in the center of the factory) and produced acetylene and tremendous heat. As a result of this explosion, a number of buildings were blown up and equipment damaged. Another seriously affected unit is the Petrochemicals Plant at Pitesti, which produces about 300,000 tons of petrochemicals annually and includes a refinery. It suffered permanent damage, totalling Lei 150 million, when both its water treatment plants were suddenly flooded, cutting off cooling water supplies to the main plant. As a result, boilers, gas-turbines, a liquified gas plant, rectifiers and many other facilities were damaged. Similarly, the Carbon Black plant at Copsa Mica incurred heavy losses when up to 2 meters high water stayed in for 3-4 days, damaging electrical equipment and instrumentation, water and gas systems, granulation and polymerization facilities, as well as many structures and foundations. Similar, though less serious, damage was suffered at the Chemical Complex at Turda, Enamel Factory at Medias and Chemical Equipment plant at Gaesti.

4.26 Industrial Construction. The Ministry of Industrial Construction is responsible for the construction of all new national industrial plants. It operates through 21 construction trusts and 4 industrial centrals which manage 60 enterprises engaged in supplying construction materials. In mid-1975, construction trusts were working on some 300 construction sites. By the very nature of the work, the construction sites have large volumes of

work-in-progress, materials and equipment in the open, which can suffer serious damages by flash floods. The 1975 floods affected about 150 or one-half of the construction sites, most of which are located either in the Mures basin (mainly around Medias, Alba Iulia, Tirnaveni and Tg. Mures) or the Ialomita basin. At most sites, flash floods brought up to 2-3 meters high water, which caused substantial damage (exceeding Lei 60 million) to civil works already completed (Annex 4, Table 12). In addition, construction materials (e.g. cement, lime, pipes) stockpiled for further work were lost. Some of the construction and earthmoving equipment and much of the electricals (e.g. electric motors) on site were damaged. In addition, some equipment delivered to sites for erection was also damaged though such losses are not charged to this Ministry. But, the setbacks in the construction schedules will reduce revenues and force the enterprises to borrow additional funds for their extra working capital needs (about Lei 90 million) on which interest charges will have to be paid. Twenty of the 60 enterprises under industrial centrals were also affected by floods. Most of these enterprises operate sites for producing construction materials like sand, gravel, etc.

4.27 The Ministry has already taken urgent measures to expedite the reconstruction effort. A special department has been formed in the Ministry to consolidate the estimates of losses and to provide assistance to the enterprises. It has already approached the Investment Bank for the financing needed to execute the reconstruction program. Another department is coordinating the allocation of supplies to various enterprises. In consultation with other involved ministries, priorities are being assigned to various construction sites for the resumption of work and for recouping some of the lost time. The same department is also coordinating with other ministries responsible for supplying materials and equipment needed by the enterprises. While much still remains to be done in this area, the Ministry has made a credible start in organizing and coordinating the help needed by the construction trusts and production enterprises in rehabilitating the flood damage.

4.28 Heavy Machinery, Machine Tools and Metallurgy. The flood damage in these three subsectors was relatively limited because: (a) a large number of plants are located in areas which were not seriously flooded; (b) many plants had erected effective flood protection works after the 1970 floods; and (c) most of the equipment in the affected plants is mechanical which is less prone to permanent damage than electrical equipment.

4.29 In the Ministry of Heavy Machinery, only 14 of about 100 enterprises suffered flood damage, of which the most seriously affected enterprise is the Automechanica factory in Medias which produces refrigerators. The factory, located on the river bank, was inundated by high water and equipment and materials worth Lei 50 million (60% of total damage in the ministry) were lost (Annex 4, Table 10). Temporary arrangements had enabled the factory to start production at about 50% of normal capacity by end-July, but full production cannot be resumed until necessary spares are received.

4.30 In the Ministry of Machine Tools and Electro Technics, fourteen of total 50 enterprises were affected. In these enterprises, only ancillary units

(e.g., gas supplies, electrical supplies) were damaged and the main equipment was not affected. Major damage was at the Electrical Equipment plant in Titu, where high waters damaged inventories. The damage to equipment and machinery in all the affected units was limited to Lei 5 million and the total damage in the Ministry to Lei 26 million (Annex 4, Table 11).

E. Cost of Reconstruction Program

4.31 The authorities are still assessing the cost of restoring the affected facilities to their pre-flood status, since immediately after the floods first priority was given to cleaning the facilities and restarting at least partial production. It was only in the last week of July that the enterprises started drawing medium- and long-term reconstruction plans and estimating the resources needed to achieve them. Therefore, firm cost estimates of the reconstruction efforts were not available to the Bank mission.

4.32 It is estimated that the Power sector will require about Lei 102 million to repair buildings, structures and infrastructure facilities, in order to restore its capabilities to the pre-flood level, including Lei 73 million for structures and facilities associated with transmission lines (Annex 4, Table 14). In addition, approximately Lei 168 million would be needed for purchasing necessary spares, machinery and equipment (Annex 4, Table 15); this estimate includes Lei 65 million (38.6%) for transport and earthmoving equipment, Lei 74.5 million (44.2%) for machinery and materials, Lei 17.9 million (10.6%) for electrical equipment and Lei 11.0 million (6.5%) for spare parts. Total cost of rehabilitation is estimated at Lei 270.2 million (para. 4.35).

4.33 In the Mining, Petroleum and Geology sector, the total cost of rehabilitation is likely to exceed the estimated damage of Lei 580 million because actual replacement cost of assets will be higher than the book value on which the damage estimates are based and because additional equipment (e.g. earthmoving machinery) is required to clean up the after-effects of the floods. It is estimated that spare parts, machinery and equipment worth Lei 201.8 million would be required to repair the damage, including Lei 43.0 million for spare parts, Lei 105.9 million for transport and earthmoving machinery and Lei 25.5 million for electricals, instrumentations and controls. In addition, it would cost about Lei 180 million to bring mines and oil wells to their pre-flood physical state and another Lei 60.1 million to repair buildings and infrastructure (including Lei 1.8 million for cement and Lei 1.7 million for steel). A summary of the rehabilitation costs, excluding the cost of replacing inventories (over Lei 250 million), is summarized in para. 4.35 below and detailed in Annex 4, Tables 14 and 15.

4.34 For the Industry sector, first estimates indicate that over Lei 214 million (including Lei 13 million for cement and Lei 34 million for steel) would be needed for buying materials and supplies to repair damages to sites,

buildings and infrastructure. In addition, spares and equipment totalling Lei 897 million would be needed to repair damage to fixed assets. These estimates exclude the cost of labor, most of which would be in-house. Thus, as summarized below, the total cost (excluding labor) of repairing fixed assets in the Industry sector would exceed Lei 1,111 million. In addition, the Government would have to replace inventories whose book value exceeds Lei 425 million (para. 4.15).

4.35 The estimated total cost of rehabilitating the fixed assets in the Power, Mining and Petroleum and Industry sectors exceeds Lei 1,822 million, as detailed in Annex 4, Tables 14 and 15 and summarized below:

Power, Mining, Petroleum, and Industry Sectors

Summary of Cost of Rehabilitation of Fixed Assets
(million Lei)

Industry	Total	Repairing Mines etc.	Spare Parts	Electricals & Controls	Machinery and Equipment	Transport, Earthmoving Eqpmt.	Buildings & Infrastructure
Total	1,823.1	180.0	236.5	155.6	582.4	292.4	376.2
Power Sector	270.2	-	11.0	17.9	74.5	65.0	101.8
Mining, Petroleum & Geology Sector	441.9	180.0	43.0	25.5	27.4	105.9	60.1
Industry Sector:	1,111.0	-	182.5	112.2	480.5	121.5	214.3
Of which:							
Forestry & Bldg. Materials	458.1	-	40.0	80.0	79.7	115.0	143.4
Light Industry	198.1	-	4.2	-	180.8	-	13.1
Chemicals	361.7	-	123.1	19.2	197.4	-	22.0
Industrial Construction	50.5	-	5.2	-	13.0	6.5	25.8
Heavy Machinery, Machine Tools & Metallurgy	42.6	-	10.0	13.0	9.6	-	10.0

The above figures underestimate the financing needs because: (a) they are based on book values and not the replacement costs; (b) these are the first estimates and as a complete physical inventory of losses is taken the losses may increase; and (c) they do not take into account any permanent loss in the productivity of the salvaged equipment due to its prolonged immersion in water and mud, an important factor in facilities with precision equipment. Also these estimates cover the fixed assets only and do not take into account inventory losses of about Lei 920 million.

V. TRANSPORT AND TELECOMMUNICATIONS SECTORS

A. Background

5.01 This chapter evaluates the flood damage and the Government's rehabilitation program in the Transport and Telecommunications Sectors. The evaluation is based on the substantial amount of information concerning the sectors, particularly on traffic flows in different parts of the country, provided to the mission. The mission also received detailed information on damages caused to local roads in five judets, though it was not possible to obtain such data for all flood-affected judets when the mission was in the field due to the decentralized management of these roads. However, it was not considered necessary to include a detailed discussion of the traffic flow data or of the data on local roads in this report.

5.02 This Part consists of four more sections; the first discusses the impact of 1975 floods on the Transport and Telecommunications Sectors. The second section gives a background of the Romanian transport network and describes the physical damage caused to it. The third section discusses the Government's Rehabilitation Program, and the last evaluates the organization available for carrying out the reconstruction program.

B. Main Impact of the Floods

5.03 Damage to transportation facilities was caused in two principal ways. First, the sustained rains brought river flows in most of the major basins to unprecedented peaks. Many of the river valleys are deeply indented; flood flows were therefore deep and fast, topping and in some cases destroying bridges. Road and rail links along these narrow valleys were also flooded and cut.

5.04 Second, the prolonged rains had so saturated and loosened the soils that in hilly terrain land-slides occurred which breached road and rail alignments. Telecommunications facilities also suffered in these ways.

5.05 Damage was severest in the basins of the Mures and Olt rivers as the following table indicates:

Total Losses by River Basins /1
(million Lei)

Sector	Mures	Olt	Arges	Ialomita	Buzau	Danube	Others	Total
Transport & Telecoms.:								
National Roads	82	121	47	43	86	3	56	438
Local Roads	502	648	507	369	185	67	-	2,278
Forestry Roads	39	95	21	26	64	-	108	353
Railways	297	22	55	33	165	55	6	633
Telecommunications	12	19	2	6	2	-	7	48
	932	905	632	477	502	125	177	3,750

/1 **Contingency of 10% included to cover quantity uncertainty.**

C. Transportation and Telecommunications Networks

5.06 In the past railways have been the major mode in Romania's transport system; the 11,000 km network is so evenly spread that no point in the country is far from one of the two thousand or more railway stations (Map 11830). Additionally there are good connections to Western Europe through Hungary and Austria, to the USSR, and to Romania's Black Sea port of Constanta. About 2,500 km of the network is double-tracked, and about 1,200 km electrified. The railways carry a major share of total freight; in 1973, nearly 57 billion ton-km, on an average haul of about 250 km. In consequence the July 1975 floods which resulted in a large loss of assets (Annex 5, Table 1) (Lei 634 million or about US$31.5 million replacement value) in destroyed embankments, track and bridges, signalling and control equipment, also caused a major interruption to the economy, a measure of which is indicated in Annex 5, Table 2, where the magnitudes of average daily freight flows for the disrupted rail sections are shown. About 2,625 km of track (24% of the network) were affected by flooding in about 390 locations, of which 275 km of rail bed and permanent way were destroyed, as well as 20 bridges.

5.07 Roads are assuming increasing importance as a transportation mode. **Traffic, already considerable on many of the national roads (Annex 5, Table 3** and Map 11829), is presently growing at about 10% annually. Some roads are already congested and investments to increase capacity are planned.

5.08 There are nearly 13,000 km of national roads administered by the Ministry of Transport and Telecommunications. Of this total length about 12,200 km are asphalted, the remainder have gravel or macadam surfaces. About 500 km of the asphalted network has 4-lane carriageways, the remainder are two-lane with 7 m carriageway and shoulders of 1-2 m.

5.09 Traffic was disrupted for about 3,400 km, or 25% of this network, by flooding or landslides caused by saturated soil conditions. Nearly 120 km of road were destroyed in over 730 locations (Annex 5, Table 3). Also 18 bridges were destroyed and 19 badly damaged. Replacement value of the assets destroyed is about Lei 430 million (US$21.5 million). No attempt has been made to quantify the loss to the economy through interrupted traffic flows, although some indication of this loss can be found in the average daily traffic figures for the affected road sections shown in Annex 5, Table 3.

5.10 The 63,000 km network of district and village roads, about 15% of which are asphalted, also suffered severe damage (Annex 5, Table 4). These roads are administered by 39 county authorities of which 19 suffered flood damage. In all, about 1,120 km of district roads, 1,170 km of village roads (about 4% of the network) and nearly 680 bridges were destroyed. The estimated cost of rehabilitation is about Lei 2.28 billion (US$114 million).

5.11 Of the 25,000 km of exploitation roads administered by the Forestry Industry about 1,500 bridges and 6,000 km of road were damaged. The principal timber extraction roads follow the streams in the predominantly hilly country where forestry is exploited, and although some damage is caused annually by flooding, there has been none comparable to that caused by the 1975 floods and landslides totalling about Lei 320 million (US$16 million).

5.12 The telecommunications network, where lines generally follow rail and road alignments also suffered considerable damage (Annex 5, Table 5). About 250 km of overhead line, 100 km of underground cable between towns and 90 km of underground cable within towns, were destroyed in over 600 locations. Rehabilitation is expected to cost about Lei 46 million (US$2.3 million).

D. Government's Rehabilitation Program

5.13 The Ministry of Transport and Telecommunications has detailed the damage caused to road, rail and telecommunications facilities as a result of the flooding and prolonged heavy rain. The Ministry prepared detailed cost analyses of works required for railways and national roads, examples of which are shown in Annex 5, Tables 6 and 7. In addition much detailed information on repair costs of district and village roads was provided. These data form the bases of the other tables of Annex 5. Unit costs used are those prepared in 1963 and updated in 1973. As domestic prices have been largely protected from foreign inflation, and as the foreign inputs to the work of rehabilitating communications facilities will be small, no allowance for escalation has been made, and the only contingency allowance is 10% to cover possible quantity increases.

5.14 Romania produces the materials needed for this reconstruction work - cement, reinforcing steel, telecommunications cables and construction equipment. The foreign exchange cost of the rehabilitation works is expected to be about 5%.

5.15 The estimated costs of Government's rehabilitation program are as follows:

	---- Lei million ---			---- US$ million ----			%
	Local	Foreign	Total	Local	Foreign	Total	F.E.
Transport Rehabilitation:							
(a) National roads	409	21	430	20.5	1.0	21.5	5
(b) District roads	2,163	114	2,277	108.1	5.7	113.8	5
(c) Forestry roads	335	18	353	16.8	0.9	17.7	5
(d) Railways	603	32	634	30.1	1.6	31.7	5
(e) Telecommunications	45	3	48	2.2	0.2	2.4	5
Total	3,554	188	3,742	177.7	9.4	187.1	

E. Organization for Reconstruction

5.16 There are two Institutes of Design in the Ministry of Transport and Telecommunications, one responsible for railways, the other for national roads and other civil works. Each Institute is presently concentrating on the design of works needed to bring the rail and national road networks into its condition prior to the flooding and, where feasible to include a safety factor against further damage by comparable floods. For district and village roads this work is done by each district administration; the 19 districts affected by the 1975 flooding are giving priority to this redesign work. The Forestry Exploitation Central in the Ministry of Forests is also concentrating on rehabilitation work.

5.17 All civil works construction in Romania is carried out by State enterprises. Within the Ministry there are two Trusts for Construction, one for railways, and the other for civil works; they have independent organizations within the Ministry and are responsible directly to the Minister. Both Trusts are deployed geographically into seven regional enterprises which carry out all works in those regions as would a contractor, but on the basis of negotiated prices in a Bill of Quantities.

5.18 The Rail Construction Trust has an annual construction capacity of about Lei 2.5 billion (US$125 million), and the Trust for national roads about Lei 1.3 billion (US$63 million). Both Trusts appear capably managed and effective. Each of the 39 district authorities is responsible for the execution of its own civil works. The 19 districts in which transportation facilities were affected by the July floods each has on average a construction capability of about Lei 200 million (US$10 million) per year. Similarly the construction of telecommunications facilities is also handled by a Central within the Ministry. All agencies concerned with the rehabilitation of transport and communications facilities damaged by the flooding have the capacity and capability to reconstruct them without contractual assistance from outside the country, albeit at the expense of capacity diverted from their development programs.

5.19 Immediately after the floods subsided, all agencies concerned with transport and communications began an immediate action program to open as many links as possible if even on a temporary basis. By the time of the mission's first field visit, July 22, road traffic could pass on the principal routes in most of the worst affected areas, and rail traffic was also able to use most of the affected links if even under severe restrictions. With temporary accommodation of traffic secured, efforts are being diverted to full scale rehabilitation works. As planning for each individual project is completed the construction Trust concerned deploys its resources to implement it.

VI. AGRICULTURE AND WATER SECTORS

Background

6.01 This chapter evaluates the flood damages and rehabilitation programs in the Agriculture and Water Sectors (Irrigation, Drainage and Flood Protection Works), and also discusses the long-term programming for water control. It consists of four sections - the first two deal with agricultural sector damages and their impact on the Romanian economy, and the next two deal with the water sector - the first describes the damages to irrigation, drainage and flood protection works and their repair; and the second discusses Government's efforts towards long-term programming for water control with a view to provide permanent protection against floods.

A. Losses in Agricultural Sector

6.02 Cropped areas which were flooded are estimated at 1.1 million ha, or about 10% of the total cultivated lands in the country. Of these, 55% were used to grow cereals, 27% fodders and pastures, 4% vegetables and potatoes, 3% sugar beets and the balance oilseeds, fruits and other crops. The floods, excessive ground moisture and hails resulted in losses of 75-90% of the planned production of crops in the affected areas. Furthermore, about 190,000 heads of livestock and 3 million poultry were drowned, 6,500 ha of tree crops were permanently destroyed, 18,000 tons of stocked cereals valued at about Lei 20 million (US$1.0 million) and about Lei 100 million (US$5 million) worth of livestock products were lost; damages to farm buildings and equipment are estimated at about Lei 530 million. About 30% of the flooded areas and the livestock and poultry drowned were owned by the State Agricultural Enterprises and the balance by the Agricultural Cooperatives. These losses would cost the economy an estimated Lei 7.7 billion (US$384 million). The agricultural losses by river basins are summarized in Annex 3, Table 1. Details of flooded cropped areas by river basins, and crop and livestock-products losses are in Annex 3, Table 2. Details of permanently damaged tree crops, livestock losses, and damages to farm buildings and equipment are presented in Annex 3, Table 3.

6.03 **The total volume** of cereals lost represents about 8% of the planned national production of these crops in 1975. The corresponding percentage losses for other crops are: 10% each for sugar beets and vegetables, 6% for oilseeds, and less that 3% each for grapes and fruits. Similarly, the numbers of drowned livestock and poultry represent about 1% and 5% respectively of the total national population of livestock and poultry. Although the losses are small by national standards, they are devastating to farmers who are seriously affected by them, particularly to members of the cooperatives.

Crop Losses

6.04 Cereals. About 602,000 ha of the flooded areas were used to grow maize, wheat and barley. The normal harvesting season for maize is September 10-October 20; July 1-20 for wheat; and June 20-30 for barley. Most of the damages to the young maize plants were caused by hail and excessive ground moisture. The mature wheat and barley crops were lodged and mixed with mud by the rains and floods so that harvesting became difficult and un uneconomical. It was possible to recover some crops from less seriously damaged fields, but losses would still represent about 78% of the planned production of each crop in the affected areas. The volumes of these losses are estimated at 932,000 tons of maize, 493,000 tons of wheat and 161,000 tons of barley. In addition, 18,000 tons of stocked cereals were lost. The value of these losses is estimated at about Lei 3.1 billion (US$155 million).

6.05 Fodders and Pastures. Most of the fodder crop damaged by flood was standing silage maize. The pasture fields comprised mainly of alfalfa. About 110,800 ha and 181,900 ha of the flooded areas were used to grow fodders and pastures respectively. Losses amounted to 478,000 tons of dry matter equivalent silage maize and 561,000 tons hay equivalent of alfalfa with a total value of Lei 519 million (US$25 million).

6.06 The silage maize plants destroyed were young and were expected to be harvested during September 1 - October 30. Some of these young plants were damaged by excessive hail and moisture while others were lodged, covered with mud or washed off. A few plants in the partially affected areas have grown to maturity but yields from such fields would be reduced to about half of those which were expected before the flood and total harvests are not expected to exceed 15% of the planned production.

6.07 The damage to pastures was caused by settling mud which completely or partially buried the plants. About 50,000 ha equivalent of scattered pasture fields out of 181,900 ha were destroyed. It is a general practice in Romania to establish pasture in mountainous and marginal lands and to reserve more productive agricultural lands for use in the production of high value crops. Of an estimated 4.5 million ha under pastures, only about 0.5 million are located in flat low lands. The flood inflicted little or no damage to pasture lands in the mountainous area. Most of the damaged fields were scattered in low flat lands, where it was not economical to grow other crops, and consisted of parts of large fields attached to organized livestock farms owned and operated by the State Agricultural Enterprises and the Agricultural Cooperatives.

6.08 Vegetables and Potatoes. Romania produces large amounts of vegetables in large-scale commercial green houses but all of the damaged crops were grown in open fields. The floods came at a time when the plants were in their early growing stages as harvests were not expected before October. The excessive rains and hail arrested growth of the plants in large areas of the affected farms while productivity of surviving plants was reduced in others. Tomatoes, potatoes and other vegetables occupied 46,000 ha and no harvests were expected from 33,600 ha (73%).

6.09 About 69,000 tons of tomatoes and other vegetables, and 49,000 tons of potatoes were expected to be recovered from less seriously affected areas but losses would represent about 85% of the planned production of tomatoes and other vegetables and 90% of potatoes. The total value of the losses is estimated at Lei 1.1 billion (US$57 million).

6.10 Sugar beets. These were grown on 30,000 ha of the flooded lands and planned harvest from these areas was expected to exceed a million tons. The plants were young and growing and harvesting was not expected until September and October. The damages were caused by growth -arresting excessive hails and ground moisture. Only about 264,000 tons would be recovered from the partially damaged cropped areas but loss represented 75% of the planned output. This was equivalent to 110,000 tons of refined sugar with a value of about Lei 341 million (US$17 million).

6.11 Oilseeds. Sunflower, soybean, linseed, castor, and other oilseeds occupied 82,000 ha of which 33,600 ha were completely destroyed; the plants were maturing and were expected to be harvested beginning late August. Yields on the balance 49,000 ha were reduced by about half primarily due to hails and excessive ground moisture. About 52,000 tons of oilseeds might have been harvested from the partially damaged areas but these would represent no more than 25% of the planned output of 193,000 tons. The total value of the losses is estimated at Lei 648 million (US$32 million).

6.12 Fruits and Other Crops. These included grapes, peaches, apricots, cherries, hops, rice, tobacco and various other crops which were grown on 43,700 ha of the flooded area. About 10,200 ha were under grapes and 7,500 ha under various fruits; no more than 15% of planned production of grapes and fruits were expected to be recovered from partially affected areas. The value of harvests foregone amounts to about Lei 629 million (US$31 million).

Livestock Losses

6.13 About 10,000 heads of cattle, 80,000 pigs, 100,000 sheep and 3 million poultry were drowned. Most of the livestock were able to swim to safety but those which were drowned were either too young and/or were confined in buildings which were flooded. The losses were worth about Lei 195 million (US$10 million). The quantitative losses are insignificant compared with national populations of 5.9 million cattle, 9.0 million pigs, 14.3 million sheep and 66.5 million poultry, but, the qualitative damages could be substantial because some of the lost cattle, pigs and sheep were used for breeding and their losses could hamper the planned development of the livestock sub-sector in the next few years.

Permanent Damages to Tree Crops

6.14 Permanent damages have been done to scattered vineyards, orchards and hops fields, particularly to trees which were grown on hilly areas. Most of the damages occurred because of landslides and falling trees caused by extreme erosion. These damages are equivalent to 3,000 ha each of grapes and

fruits and 500 ha of hops with a total value of about Lei 486 million (US$24 million). The value of the loss is obtained by discounting at 10% the net values of harvests from the permanently damaged trees assuming these trees would have had 20 more years of productive lives.

Damages to Farm Buildings and Equipment

6.15 The flood has caused about Lei 530 million (US$26 million) worth of damages to farm buildings and equipment. Some of the buildings were old and the flood induced the collapse of portions of their walls; others are not as seriously affected, but the cumulative cost of repairing minor damages to many farm buildings which are scattered over 1.1 million hectares of flooded area is substantial. Equipment which was damaged or lost included pumps, sprinklers, movable irrigation pipes, vegetable and fruit grading machines and electrical installations.

B. Impact of Agricultural Losses on the Economy

General

6.16 The direct impact on the economy of the lost output of crops and livestock products would be to reduce the national income by about Lei 6.5 billion (US$325 million) or about 2% of the national income in 1974; this excludes damages to capital assets. However, the total direct and indirect impact may be much greater because of the complex inter-relationships among different sectors and sub-sectors of the economy. Some of the commodities which were lost would have been exported to earn convertible foreign exchange which is badly needed to import new technology. Furthermore, the income foregone would deprive the economy of domestic investment resources and may seriously hamper planned investments and economic growth in the next few years.

Foreign Trade Impact

6.17 The foreign trade effect of the loss in crop production would be to reduce exports rather than to induce imports of food and feed. The country is a net exporter of virtually all of the commodities which have been damaged by flood. The foreign exchange foregone as a result of reduced volume of

exports of crops alone is estimated at about Lei 4.5 billion (about US$225 million). 1/

6.18 The export losses may reduce the country's capacity to import capital goods and slow investments in sectors such as industry whose growth and development is constrained by shortage of convertible foreign exchange. The industrial sector needs rapid and timely inflow of new technology to help improve the quality of fast growing output. A substantial amount of convertible foreign currency is required to achieve such an objective.

6.19 The economy would lose about Lei 2.5 billion (US$125 million) in convertible foreign exchange as a direct result of foregone exports of agricultural products. The indirect impact of such a loss on national income is not known but it would be substantial.

Impact on Investments

6.20 The current loss in production would have a significant influence on the achievement of planned investments. The planned national investments in agriculture and agro-industry in 1976 would cost about Lei 26.6 billion. About Lei 14.9 billion was expected to be financed from the State budget, Lei 6.9 billion from "depreciation funds", 2/ Lei 2.2 billion by loans from the Bank for Agriculture and Food Industry and Lei 2.6 billion from the Agricultural Cooperatives savings.

6.21 The flood losses would have no effect on financial flows from BAFI and from "depreciation allowances" but would reduce the planned flow of funds from the State budget and the Cooperatives' savings by a total of about Lei 4.1 billion (US$205.0 million).

1/ The volume and value of export losses are estimated as follows: (volume in '000 tons, price in Lei/ton and value in Lei million):

Crop	Volume	FOB Price	Value
Wheat	493	3,200	1,578.0
Maize	500	2,300	1,150.0
Tomatoes and Other Vegetables	200	2,800	560.0
Potatoes	150	1,300	195.0
Sugar beets	110	500	55.0
Fruits	30	2,800	84.0
Grapes	51	2,600	133.0
Oilseeds	143	5,000	715.0
Total	-	-	4,470.0 (US$224 million)

2/ This refers to depreciation on investments in the State Agricultural Enterprises. They are paid by the beneficiary enterprises to separate account kept by BAFI and used as a source of financing future investments.

6.22 The State would have earned the revenues which are required for investment financing by buying agricultural commodities at low farmgate prices and selling them at higher world prices, and from profits earned by the State Agricultural Enterprises. Revenues from these sources which would be lost as a result of flood damages would amount to about Lei 2.4 billion (US$120.0 million).

6.23 Normally, surplus production in the Agricultural Cooperatives (i.e. net of all production costs and incomes to members) is deposited with BAFI to be used as an important source of investment financing in these farms. The flood damages are not expected to affect the incomes to members of the co-operatives but would reduce the investment funds from these farms by about Lei 1.7 billion (US$85.0 million).

6.24 In the past, investment in agriculture has been low compared to the sector's size and scope for development. Partly because of this, agriculture has lagged behind other sectors and labor productivity in agriculture is about one-third of that in industry. This may have a long-run retarding effect on the growth and development of the economy. The flood induced shortages of investment funds could worsen the situation by slowing agricultural investments in the next few years.

6.25 Although damages to capital assets in agriculture are substantial, most of the flood losses represent foregone harvests of crops. Of an estimated Lei 7.7 billion (US$384 million) damages, Lei 1.2 billion (US$60 million) represent losses to capital assets and Lei 6.5 billion (US$325 million) to crops, stocked cereals and to livestock products. The crop losses alone would reduce the planned investment program for 1976 by about Lei 4.1 billion (US$205 million).

6.26 The Lei 1.2 billion (US$60 million) damages to capital assets are scattered among a large number of farms and localities throughout the flooded areas. Government is capable of carrying out all necessary repairs or reconstruction of damaged assets and intends to finance the repair of these damages through its existing agencies in cooperation with the local Governments. This, however, would involve use of funds which were intended to be utilized for financing investments planned to be implemented in 1975 and 1976, bringing the total of investments to be deferred as a result of the floods to Lei 5.3 billion (US$265 million).

C. Losses to Irrigation, Drainage and Flood Protection Works

6.27 Irrigation Works. The floods of 1975 caused extensive damages in the river basins of the Mures, the Olt, the Arges, the Ialomita, the Buzau, the Trotus and the Bahlui. Substantial damage was also caused in the Siret River basin as well as in areas along the Danube. About 1.2 million ha is irrigated from these rivers. Most of this area is served by schemes, which consist of small check dams in the river beds and a pumping plant to lift water to the irrigated area. A few storage dams and barrages on the Olt, the

Arges and the Ialomita provide water for irrigation in addition to other uses, and two barrages on the Mures provide water mainly for industrial use. Several pumping stations along the Danube, provide water either for irrigation or for urban and industrial water supply. Of the aforementioned works, the larger schemes have suffered smaller damage, while the smaller have suffered relatively large damages. The total value of the loss is estimated at Lei 101.5 million (US$5.1), of which damage to earthwork is about 57%, to concrete and masonry about 32% and to equipment (pumps and transformers) about 11% (Annex 3, Table 5). Of the total loss, maximum damage was to the Danube schemes (63%), and to the works in the Arges basin (21%) and the Ialomita basin (6%). All damage is of such a nature that it can be repaired in a short time and before the next irrigation season (April 1976).

6.28 Drainage Works. Small surface drainage schemes are located in the river basins affected by floods, mostly in the irrigated areas. The open drains overflowed their banks causing extensive damage to the channels and to some masonry works on these channels. Total damage to drainage works is estimated at Lei 51.7 million (US$2.6 million), of which about 73% was to earthwork, 23% to structures and 4% to equipment (Annex 3, Table 5). Relatively high damage was suffered by the drainage works in the Olt basin (31%) and the Arges basin (26%), while other basins suffered minor damages. These damages are also of a minor nature and can be repaired quickly.

6.29 Flood Protection Works. Because of floods that were experienced several times in the past 50 years in many river basins of Romania, dykes or levees were constructed along many reaches of these rivers and their tributaries to protect urban and industrial property and in the case of the Danube, also to protect large agricultural areas. Along the Mures, the Olt, the Arges (including the Dimbovita), the Ialomita (including the Prahova), and the Buzau rivers, about 160 km of flood protection dykes exist, whereas along the Danube river, over 1,000 km of levees have been constructed in the past. The 1975 floods have caused extensive damage to the dykes along the smaller rivers and lesser damage to the Danube levees. Total cost of repairing this damage is estimated at Lei 164.5 million (US$8.2 million), of which about 86% was distributed in the basins of the Mures (27%), the Arges (21%), the Bahlui (12%), the Siret (10%), the Danube (8%) and the Buzau (8) (Annex 3, Table 5). A part of the damaged dykes will be restored to their original design (mostly along the Danube), but a larger part will be reconstructed to improved design in accordance with the currently available long-term plans for flood protection.

D. Long-Term Programming for Water Control

Need for a National Water Control Program

6.30 The 1975 floods have demonstrated the need for a national program for water control, and the Government has already begun a major reorganization of responsibilities for water management in Romania. Full responsibility for this work has now been assigned to the National Water Council (NWC). This agency used to be under the Ministry of Agriculture and Food Industry (MAIA),

but from July 1975, its control has been shifted to the Council of Ministers. Other tasks of NWC include preparation of five-year development plans, in accordance with the approved long-term programs; coordination and control of all activities related to water management and licensing and monitoring all construction activity in the water sector including licensing of operation and regualtion procedures for completed water projects.

6.31 The Institute of Meteorology and Hydrology (IMH) and the Institute of Design and Research (IDR), both of which are under NWC, assist NWC in its planning tasks. Its five regional offices and 39 sub-offices (one in each Judet or district) carry out the water management functions. IMH is responsible to maintain and operate all meteorological and hydrological data observation stations, to analyze the collected data and to feed all necessary data to the planning staff of NWC and other institutes. IDR is the main technical organization, which carries out all studies and prepares the long-term plans and programs. Whenever necessary for its work, IDR seeks assistance from other specialized institutes such as the survey and design institutes for land reclamation works, hydroelectric works, hydraulic research, etc. These institutes and agencies appear to be staffed with qualified and experienced engineers, scientists, economists and other specialists. The reports produced by NWC and other institutes on water development projects appear to be quite comprehensive as indicated by a list of chapters (Annex 3, Table 6) that are included in such reports, but the mission was unable to appraise fully the quality of the planning efforts underway.

6.32 After a report is finalized by IDR, with assistance from other institutes, it is cleared by NWC through a committee on which all concerned ministries are represented. It is then presented to the Council of Ministers, after whose approval the plan is ready for implementation.

6.33 The Government is currently concentrating its efforts on preparing flood protection plans for basins (excluding the Danube basin) which are most flood prone, including the Mures, Olt, Arges, Ialomita, and Buzau which were hardest hit in the 1975 floods. The Mures Basin planning effort is the most comprehensive that has yet been carried out, and will soon be available for Bank review. Other plans are in varying stages of preparation for each of the major river basins in the country.

6.34 The Government has also included in its flood program about $2 million of hydrometeorological equipment consisting of a flood warning and data gathering system. This equipment includes: automatic stations to transmit data on precipitations and air temperatures at 74 isolated points; automatic stations to transmit data on water levels, precipitations and air temperatures at 70 isolated points; radio relay stations at 20 points to secure radio connections between installation points of the automatic stations and the collection and warning centers (control centers); and other related equipment, plus testing apparatus for checking and repair of electronic installations. This equipment is needed to support the planning operations of NWC outlined above.

Flood Protection Plans for Basins Most Damaged in 1975

6.35 General. Since 1970, NWC and other design institutes are engaged on preparing long-term development programs for all river basins in Romania with a view to ultimately provide up to 85% protection from a 100-year (in some cases a 200-year) flood. Priority is being given to those river basins, where economic losses from the past floods have been higher and where damaging floods have occurred more frequently. For some basins (like the Upper Mures), planning has been completed, while for others it is in various stages of completion. The proposed works consist of storage dams (both multipurpose and for flood control only), river channel improvement (widening of river channel and protection of its banks against erosive action of the floods) and flood protection dykes. Construction of complete programs will be spread over 15 to 25 years, but in order to provide as much protection to valuable industrial and urban centers as is possible in the period prior to completion of storage dams, river channel improvement and protection dykes are planned to be constructed in several reaches of many rivers in the next five years (1976-1980). These works, which are a part of the long term program, by themselves would provide protection against floods of a lesser magnitude (varying from 20 years to 50 years).

6.36 The Mures Basin Program. The Mures river (para 2.06) has a catchment area of 27,800 km^2, of which the area of the upper basin above Alba Iulia, where its three main tributaries - Tirnava Mare, Tirnava Mica and Aries join, is 19,200 km^2 or 69%. Of this about 200,000 ha are subjected to flooding from the rivers, 85,000 ha require drainage facilities and 850,000 ha need soil erosion control works. Because its tributaries are located in an area of high rainfall (1,000 mm to 1,300 mm), the Mures river gets substantially high floods every 3rd or 4th year. In 1970, the river and its tributaries experienced the worst flood on record, when a peak flow of 2,450 m^3/sec was observed at Alba Iulia; almost all tributaries also carried the highest discharge on record. This flood caused an extensive damage to industrial, urban and agricultural areas and destroyed long stretches of lines of communication. Directly recorded losses amounted to Lei 1,700 million (US$85.0 million), of which 64% was in industry. The indirect losses were of about the same magnitude. After this flood, Government decided to undertake a comprehensive study of the Upper Mures basin and to prepare an overall development plan including flood control and flood protection works for important urban and industrial areas. Government also requested UNDP to provide technical assistance for this study, because its complexity called for the application of advanced techniques. UNDP approved an assistance program of US$1.0 million, and by now has provided specialized hydrologic, flood forecasting and office equipment; specialist technical advice in the fields of hydrology and flood forecasting, water resources planning, including use of simulated models, soil and water conservation and land reclamation, agricultural, agro-industrial and forestry development and water pollution control. With this assistance, Government has finalized a long term program for the overall development of the Mures basin, which has been phased over five 5-year development plans and will be realized by year 2000.

6.37 The long-term program for the upper Mures basin consists of:

(a) 16 storage dams with a total capacity of 1,095 Mm^3, of which six (949 Mm^3) are multipurpose (including hydroelectric power) and the remaining basically for flood control;

(b) two reservoirs in natural depressions (capacity 43 Mm^3);

(c) river channel improvement and flood protection works in 14 reaches, protecting 16 major urban and industrial centers and 27 rural communities, with partial protection to 29 other rural communities. These works will also protect 127 km of national highways and 78 km of railroad track; and

(d) other works comprising drainage facilities; soil erosion control, water supply, fish development and anti-pollution works.

These works are estimated to cost about Lei 14,500 million (US$725 million). The storage dams, when fully operational, will reduce the peak volume of a 100-year flood by 46% (equivalent to 270 Mm^3). All flood control and protection works are expected to reduce the flood damages, such as those suffered in 1970 or 1975, by 95%. During 1976-1980, five storage dams, one reservoir in a natural depression (listed at Annex 3, Table 7) and channel improvement and flood protection works in several river reaches totalling 117 km (listed at Annex 3, Table 8) are planned for construction. The cost of these works, which are illustrated in Map 11833, is estimated at Lei 2,850 million (US$142.5 million), of which the cost of channel improvement and flood protection works to be completed in 1976 and 1977 amounts to Lei 596 million (US$29.8 million).

6.38 The Olt Basin Program. The Olt river (para 2.08) has a catchment area of 24,000 km^2, of which about 13,000 km^2 (54%) lies in the upper part of the basin above Turnu Rosu. NWC, with assistance from other institutes especially ISPH has also prepared a long-term program of development in this basin. No flood control work has so far been carried out in this basin, although about 58,000 ha are subjected to floods. About 240,000 ha require surface drainage works and about 220,000 ha need soil erosion control works. During 1976-1980, two multipurpose storage dams (capacity 43 Mm^3) (Annex 3, Table 7) are planned for construction, and 130 km of flood protection dikes and channel improvement (Annex 3, Table 8) will be carried out. Total cost of this five year program is estimated at Lei 622 million (US$31.1 million), of which the cost of channel improvement works and dikes, which are to be constructed in 1976 and 1977, is Lei 200 million (US$10 million).

6.39 The Arges Basin Program. The Arges river (para 2.09) has a catchment of 12,600 km^2, of which about 145,000 ha are subjected to floods, 175,000 ha require drainage works and 140,000 ha need soil erosion control works. A long range development program for this basin has been completed by NWC and other institutes. Four storage dams, without any capacity for flood control, have already been completed. During the next five years (1976-1980), 4 storage dams (capacity 227 Mm^3) are planned for construction, of which 3 will have

a flood control capacity of 39 Mm^3 (Annex 3, Table 7). In addition channel improvement works and flood protection dikes (length 315 km) are planned (Annex 3, Table 8). Total cost of these works is estimated at Lei 3,962 million (US$198.1 million), of which Lei 172 million (US$8.6 million) will be spent on flood protection works to be completed in 1976 and 1977.

6.40 The Ialomita Basin Program. The Ialomita river (para 2.10) has a catchment of 10,400 km^2, of which about 66,000 ha are subjected to floods, 397,000 ha need drainage and 146,000 ha require soil erosion control works. A long range development program for this basin has been completed by NWC. Two storage dams (capacity 65 Mm^3), without any capacity allocation for flood control, have already been completed; one of these needs some repairs, which are planned to be carried out in 1976. During 1976-1980, one storage dam (capacity 98 Mm^3) with a flood control capacity of 23 Mm^3 will be constructed. In addition channel improvement and flood protection works will be carried out in river reaches totalling 84 km, and drainage works in 60,000 ha. Total cost of this program is estimated at Lei 1,569 million (US$78.5 million) (Annex 3, Tables 7 and 8), of which the channel improvement and flood protection works to be carried out in the first 2 years (1976-1977) will cost Lei 208 million (US$10.4 million).

6.41 The Buzau Basin Program. The Buzau river (para 2.11) has a catchment of 5,600 km^2, of which about 140,000 ha need drainage and 210,000 ha require soil erosion control works. During 1976-1980, only one dam with a capacity of 110 Mm^3 is planned. Construction of this dam, which has a flood control capacity of 36 Mm^3, was started in early 1975 prior to the floods. Total cost of this project is estimated at Lei 767 million (US$38.4 million) (Annex 3, Table 7). No channel improvement and flood protection works are planned for this river basin during the next 5 years.

Summary of Programs for 1976-1980

6.42 For the five river basins of the Mures, the Olt, the Arges, the Ialomita and the Buzau, the work program planned for the next five years (1976-1980) is listed in Annex 3, Tables 7 and 8 and summarized below:

Works Planned to be Constructed in 1976 - 1980 on Five River Basins	Estimated Cost (Lei million)	Estimated Cost (US$ million)
Storage Dams	5,964	298.2
Channel Improvement and Flood Protection Works (1976-1977)	1,176	58.8
Channel Improvement and Flood Protection Works (1978-1980)	2,330	116.5
Total	9,470	473.5

Total cost amounts to Lei 9,470 million (US$473.5 million), of which the cost of works related to channel improvement and flood protection, to be undertaken in 1976 and 1977 amounts to Lei 1,176 million (US$58.8 million).

ANNEX 1
Table 1

ROMANIA

FLOOD RECOVERY PROJECT

Data on Romanian Rivers

River Group	River Basin and River	Catchment Area (km^2)	Tributary of
North	Viseu	1,600	Tisa
	Iza	1,300	Tisa
	Tur	1,200	Tisa
West	Somes	15,000	Tisa
	Crisul Alb	4,200	Tisa
	Mures	27,800	Tisa
	Tirnava Mica	2,600	Mures
	Tirnava Mare	3,700	Mures
	Aries	2,400	Mures
Southwest	Timis	5,800	Danube
	Caras	1,300	Danube
	Nera	1,400	Danube
	Cerna	1,400	Danube
South	Jiu	10,100	Danube
	Olt	24,000	Danube
	Vedea	5,500	Danube
	Arges	12,600	Danube
	Dimbovita	1,100	Arges
	Ialomita	10,400	Danube
	Prahova	3,700	Ialomita
East	Siret	43,900	Danube
	Buzau	5,500	Siret
	Birlad	7,300	Siret
	Trotus	4,100	Siret
	Bistrita	7,000	Siret
	Moldova	4,300	Siret
	Prut	28,400	Danube
	Bahlui	1,500	Prut
	Jijia	5,900	Prut

August 1975

ROMANIA

FLOOD RECOVERY PROJECT

Data on the Danube River

A. Catchment Area

Country	Area Contributing to the Danube River (km^2)	Percent of Total (%)
Romania	231,500	28.4
Yugoslavia	186,000	22.9
Hungary	93,000	11.4
Austria	83,100	10.2
Czechoslovakia	71,500	8.8
West Germany	58,500	7.2
Bulgaria	46,200	5.7
U.S.S.R.	41,200	5.1
Switzerland	1,700	0.2
Poland	500)	
Italy	300)	0.1
Albania	100)	
Total	813,600	100.0

B. Flood Data

Reach and Station	Maximum Flood Discharge (m^3/sec)	Maximum Flood Stage (cm)	Maximum Flood Year	1970 Flood Discharge (m^3/sec)	1970 Flood Stage (cm)	1975 Flood Discharge (m^3/sec)	1975 Flood Stage (cm)
Upper Reach							
Tr. Severin	16,500	843	1940	13,800	820	11,862	730
Middle Reach							
Oltenita	18,000	784	1897	14,300	772	12,320	651
Lower Reach							
Braila	20,000	693	1897	15,030	639	13,035	591

August 1975

ROMANIA

FLOOD RECOVERY PROJECT

Rainfall During Storm of June 1-10, 1975 Compared with Normal Rainfall

River Basin	Normal Rainfall over Long Term Record of 30-50 years (mm)			Rainfall During 1975 (mm)			Rainfall During Storm of June 1975 (mm)	
	April	May	Total	April	May	Total	June 7-8	June 1-10
Siret								
Radauti	48	83	131	68	80	148	18	108
Tg. Neamt	54	58	112	73	139	212	66	133
Bacau	44	60	104	70	94	164	35	77
Trotus								
Tg. Ocna	47	83	130	49	98	147	20	51
Bahlui								
Cotnari	44	55	99	39	75	114	62	134
P. Iloaiei	-	-	-	64	118	182	74	154
Iasi	40	52	92	87	99	186	47	108

August 1975

ANNEX 1
Table 3

ROMANIA

FLOOD RECOVERY PROJECT

Data on Flood Peaks

River and Gauging Station	Verified Period of Record	Peak Flood Discharges Recorded Prior to 1975 in Descending Order and Year of Occurrence (m^3/sec)					Peak Flood of 1975 (m^3/sec)	Estimated Period of Return of 1975 Flood (years)
		1	2	3	4	5		
Northeastern Rivers								
Bahlui								
Iasi	1951-1975	160 (1969)	108 (1971)	106 (1973)	90 (1965)	88 (1970)	270	70
Trotus								
Radrana	1952-1975	1,503 (1969)	1,464 (1971)	1,213 (1970)	870 (1953)	850 (1960)	2,025	100
Siret								
Racatau	1931-1975	2,350 (1969)	2,010 (1941)	1,950 (1940)	1,942 (1971)	1,806 (1970)	1,675	50
Central and Southern Rivers								
Mures								
Alba Iulia	1931-1975	2,450 (1970)	1,670 (1932)	1,075 (1974)	957 (1933)	870 (1941)	2,200	100
Olt								
Fagaras	1931-1975	1,150 (1932)	900 (1970)	710 (1948)	665 (1933)		1,700	100
Arges								
Malu Spart	1952-1975	1,120 (1972)	1,056 (1973)	647 (1970)	593 (1957)		1,380	100
Budesti	1931-1975	1,650 (1941)	1,540 (1972)	1,130 (1942)	1,005 (1947)	990 (1948)	1,800	100
Dimbovita								
Contesti	1950-1975	300 (1972)	248 (1973)	175 (1960)			600	150
Ialomita								
Cosereni	1931-1975	1,170 (1972)	990 (1940)	915 (1971)	815 (1933)	715 (1960)	1,400	80
Buzau								
Nehoiu	1931-1975	1,320 (1971)	1,120 (1969)	700 (1941)			1,500	150

ANNEX 1
Table 4

August 1975

ROMANIA

FLOOD RECOVERY PROJECT

Rainfall during Storm of July 1-11, 1975 compared with Normal Rainfall

River Basin and Raingauge Station	Normal Rainfall Over Long Term Record of 30-50 years (mm)				Rainfall During 1975 (mm)				Rainfall during Storm of July 1975	
	April	May	June	Total	April	May	June	Total	July 1-3	July 1-11
Mures										
Toplita	49	70	90	209	59	82	92	233	9	26
Joseni	47	76	99	222	49	53	148	250	21	50
Sarmas	NA	-	-	-	66	97	104	267	88	105
Tg. Mures	53	76	96	225	67	74	152	293	119	125
Dumbraveni	53	76	99	228	78	161	159	398	91	115
Turda	44	69	89	202	55	69	117	241	100	112
Blaj	42	64	78	184	45	126	140	311	71	94
Olt										
Miercurea Ciuc	40	69	88	197	52	81	98	231	88	139
Baraolt	47	83	81	211	62	142	130	334	136	178
Sfintu Gheorghe	42	67	98	207	75	75	115	265	128	179
Brasov	59	88	125	272	85	119	128	332	118	141
Fagaras	52	93	104	249	90	140	122	352	124	178
Sibiu	55	80	113	248	69	144	198	411	60	84
Voineasa	59	97	103	259	72	135	212	419	99	135
Arges										
Vf. Omu	98	93	173	364	202	165	132	499	68	148
Cimpulung	56	94	110	260	36	141	275	452	112	189
Curtea de Arges	62	89	113	264	52	179	164	415	113	144
Tirgoviste	51	70	83	204	46	153	132	331	159	184
Titu	45	63	85	193	55	103	115	273	125	143
Bucuresti	44	64	92	200	74	52	126	252	147	212
Ialomita										
Predeal	77	113	142	332	111	233	132	476	134	205
Sinaia	57	104	126	287	76	190	181	447	132	214
Cimpina	60	101	97	258	49	138	156	343	139	180
Ploiesti	41	67	88	196	41	108	59	208	159	170
Urziceni	40	63	77	180	50	98	65	123	56	62
Buzau										
I. Buzaului	48	93	94	235	72	110	74	256	113	191
Patir-lagele	43	86	97	226	29	102	69	200	193	245
Buzau	43	57	80	180	41	85	63	189	35	46

August 1975

ANNEX 1
Table 5

ANNEX 2
Table 1

ROMANIA

FLOOD RECOVERY PROJECT

1975 Flood Damages by Sectors and Basins

Sectors	Mures	Olt	Arges	Ialomita	Buzau	Danube[1]	Others	Total
	US$ Million							
A. Agriculture	101.1	66.1	59.1	50.9	17.1	-	90.0[2]	384.3
Of which:								
Crops and Livestock Products	84.9	56.3	50.5	44.2	12.7	-	75.1	323.7
Assets	16.2	9.8	8.6	6.7	4.4	-	14.9	60.6
B. Irrigation, Drainage and Flood Protection	2.5	1.5	3.5	0.9	0.8	4.1	2.6	15.9
C. Industry	67.7	22.2	25.2	13.4	10.3	1.1	18.6	158.6
Of which:								
Forest Industry and Building Materials	5.4	5.3	3.7	1.8	3.9	-	7.9	28.1
Chemical Industry	13.4	2.9	6.8	1.3	-	-	-	24.3
Light Industry	10.5	1.5	1.0	0.8	1.5	-	0.3	15.5
Other Industry	6.7	2.1	2.0	3.3	0.1	0.6	1.7	16.5
Production Losses[3]	31.7	10.4	11.8	6.3	4.8	0.5	8.7	74.2
D. Mining and Petroleum	4.9	2.4	2.7	1.5	0.4	-	22.1	33.8
E. Electric Power	0.9	3.3	0.6	0.9	1.9	-	5.2	13.0
F. Transport & Telecommunications	46.8	45.3	31.6	23.9	25.1	6.3	8.9	187.5
Of which:								
Railways	14.9	1.1	2.8	1.7	8.3	2.8	0.3	31.9
National Roads	4.2	6.1	2.4	2.2	4.3	0.2	2.8	21.9
County Roads	25.1	32.4	25.4	18.5	9.3	3.4	-	113.9
Forestry Roads	2.0	4.8	1.1	1.3	3.2	-	5.4	17.7
Telecommunications	0.6	1.0	0.1	0.3	0.1	-	0.4	2.4
Total	223.7	140.8	122.7	91.5	55.6	11.5	147.4	793.2
% of Total	(28.2)	(17.8)	(15.5)	(11.5)	(7.0)	(1.4)	(18.6)	(100.0)

/1 Basin excluding the Mures, Olt, Arges, Ialomita and Buzau which are treated separately.

/2 Includes agricultural damages in the Danube basin.

/3 Data on locations of production losses incomplete and will be revised at negotiations. This presentation assumes production losses in proportion to asset losses in each basin.

Annex 2
Table 2

ROMANIA

FLOOD RECOVERY PROJECT

1975 Flood Damage by Sectors and Types of Damage

Sectors	Crops and Production	Raw Materials and Other Inventory	Buildings	Other Infra-structure/1	Machinery and Equipment	Other	Total
				US$ million			
A. Agriculture	323.8	-	26.5/2	34.0	-	-	384.3
B. Irrigation, Drainage and Flood Protection	-	-	-	15.0	0.9	-	15.9
C. Industry	74.2	27.7	2.9	5.6	44.3	3.9	158.6
Of which:							
Forest Industry and Building Materials	5.3	9.3	0.8	2.2	15.7	-	33.3
Chemical Industry	20.0	6.2	0.9	0.3	17.0	-	44.4
Light Industry	11.3	5.0	0.8	0.3	9.3	0.3	27.0
Other Industry	37.6	7.2	0.5	2.9	0.7	3.6	52.5
D. Mining and Petroleum	4.8	12.6	1.8	0.7	5.0	9.0	33.8
E. Electric Power	4.2	2.5	0.1	1.4	0.4	4.4	13.0
F. Transport & Telecommunications	-	-	-	185.1	2.4	-	187.5
Of which:							
Railways	-	-	-	31.7	-	-	31.7
National Roads	-	-	-	21.9	-	-	21.9
County Roads	-	-	-	113.9	-	-	113.9
Forestry Roads	-	-	-	17.7	-	-	17.7
Telecommunications	-	-	-	-	2.4	-	2.4
Total	407.0	42.8	31.3	241.8	53.0	17.3	793.2
% of Total	(51.3)	(5.4)	(4.0)	(30.5)	(6.7)	(2.2)	(100.0)

/1 Livestock, orchards, vineyards, roads, railways, bridges, etc.

/2 Includes some equipment damage.

ANNEX 3
Table 1

ROMANIA

FLOOD RECOVERY PROJECT

Summary of Agricultural Losses By River Basins, 1975
(Lei Million)

Item	Mures	Arges	Olt	Ialomita	Buzau	Others	Total
Crops	1,688	1,002	1,118	878	253	1,438	6,376
Livestock Products	11	9	8	6	1	65	100
Livestock and Poultry	54	32	37	30	6	36	195
Trees	131	70	70	52	67	96	486
Buildings and Equipment	138	69	90	53	16	165	531
Total	2,022	1,182	1,323	1,019	343	1,800	7,688

ROMANIA

FLOOD RECOVERY PROJECT

Crop and Livestock Products Losses By River Basins, 1975

(Area in '000 ha, Output/quantity in '000 tons, Price in Lei/ton and Value in Lei Million)

Category	Mures				Arges				Olt			
	Area Flooded	Planned Output	Loss Quantity	Loss Value	Area Flooded	Planned Output	Loss Quantity	Loss Value	Area Flooded	Planned Output	Loss Quantity	Loss Value
Crops /1												
Wheat	53.0	159.0	125.0	375.0	41.5	136.0	107.0	321.0	33.0	101.0	80.0	240.0
Maize	82.0	304.0	240.0	384.0	60.5	238.0	188.0	301.0	38.0	155.0	122.0	195.0
Barley	20.3	61.0	49.0	47.0	5.7	19.0	15.0	14.0	14.0	43.0	35.0	33.0
Sunflower	8.5	20.0	16.0	82.0	5.0	12.0	9.0	46.0	2.0	4.0	4.0	20.0
Other Oilseeds	10.9	28.0	21.0	83.0	3.1	8.0	6.0	24.0	7.6	20.0	15.0	60.0
Sugar beets	13.5	490.0	388.0	167.0	1.5	61.0	47.0	20.0	5.5	266.0	212.0	91.0
Potatoes	7.0	126.0	100.0	80.0	1.5	27.0	21.0	17.0	10.5	189.0	149.0	118.0
Vegetables	6.0	115.0	92.0	183.0	4.5	180.0	78.0	155.0	4.0	82.0	71.0	141.0
Silo Maize	24.0	132.0 /2	109.0	54.0	13.5	74.0	62.0	31.0	23.0	126.0	104.0	52.0
Pasture	51.0	204.0 /2	164.0	82.0	3.0	12.0	10.0	5.0	40.0	160.0	129.0	64.0
Grapes	2.0	9.0	7.0	24.0	1.5	8.0	6.0	20.0	2.0	9.0	6.0	21.0
Fruits	2.0	9.0	7.0	18.0	1.5	6.0	5.0	13.0	1.0	3.0	3.0	8.0
Others /3	7.8	17.0	13.0	104.0	2.2	5.0	4.0	32.0	5.0	12.0	9.0	72.0
Stocked Cereals	-	-	4.7	5.0	-	-	2.3	3.0	-	-	3.0	3.0
Livestock Products	-	-	-	11.0	-	-	-	9.0	-	-	-	8.0
Total	288.0	-	-	1,699.0	145.0	-	-	1,011.0	185.0	-	-	1126.0

/1 From current production
/2 Dry matter or hay equivalent
/3 Includes mainly beans, rice, tobacco and hops

August, 1975

ROMANIA

FLOOD RECOVERY PROJECT

Crop and Livestock Production By River Basins, 1975
(continued)

Category	Ialomita				Buzau				Others			
	Area Flooded	Planned Output	Loss Quantity	Loss Value	Area Flooded	Planned Output	Loss Quantity	Loss Value	Area Flooded	Planned Output	Loss Quantity	Loss Value
Crops												
Wheat	29.0	110.0	88.0	264.0	3.0	13.0	10.0	30.0	54.8	109.0	83.0	249.0
Maize	36.0	176.0	139.0	222.0	9.0	46.0	36.0	58.0	92.4	263.0	211.0	336.0
Barley	8.1	31.0	25.0	24.0	1.8	8.0	6.0	6.0	20.1	40.0	32.0	30.0
Sunflower	6.0	16.0	12.0	60.0	3.5	9.0	7.0	35.0	19.6	32.0	21.0	107.0
Other Oil seeds	4.3	11.0	8.0	32.0	1.0	3.0	2.0	8.0	11.1	29.0	22.0	88.0
Sugar beets	3.0	127.0	99.0	43.0	0.5	19.0	17.0	7.0	5.7	93.0	30.0	12.0
Potatoes	1.5	24.0	21.0	17.0	0.5	9.0	8.0	6.0	5.0	93.0	120.0	96.0
Vegetables	3.0	85.0	56.0	111.0	1.0	23.0	20.0	39.0	2.1	14.0	85.0	170.0
Silo Maize	14.0	77.0	64.0	32.0	4.0	22.0	18.0	9.0	32.3	122.0	120.0	60.0
Pasture	4.0	16.0	12.0	6.0	4.5	18.0	13.0	6.0	79.4	227.0	233.0	114.0
Grapes	1.0	6.0	5.0	17.0	2.0	12.0	10.0	35.0	2.2	11.0	16.0	56.0
Fruits	1.0	4.0	3.0	8.0	0.5	2.0	2.0	5.0	2.0	8.0	10.0	26.0
Others	3.1	7.0	5.0	40.0	0.7	1.0	1.0	8.0	6.8	14.0	11.0	88.0
Stocked Cereals	-	-	1.8	2.0	-	-	0.5	1.0	-	-	5.6	6.0
Livestock Products	-	-	-	6.0	-	-	-	1.0	-	-	-	65.0
Total	114.0	-	-	884.0	32.0	-	-	254.0	333.3	-	-	1503.0

August, 1975

ROMANIA

FLOOD RECOVERY PROJECT

Crop and Livestock-Products Losses By River Basins, 1975
(continued)

Category	Area Flooded	Total Planned Output	Farmgate Prices /1	Losses Quantity	Losses Value
Crops					
Wheat	214.3	628.0	3,000	493.0	1,479.0
Maize	317.9	1,182.0	1,600	932.0	1,490.0
Barley	70.0	202.0	950	161.0	153.0
Sunflower	44.6	94.0	5,100	69.0	352.0
Other Oilseeds	38.0	99.0	4,000	74.0	296.0
Sugar beets	29.7	1,057.0	430	793.0	341.0
Potatoes	26.0	468.0	800	419.0	335.0
Vegetables	20.6	471.0	2,000	402.0	802.0
Silo Maize	110.8	554.0	500	478.0	239.0
Pasture	181.9	637.0	500	561.0	280.0
Grapes	10.2	56.0	3,500	51.0	178.0
Fruits	7.5	34.0	2,600	30.0	67.0
Others	26.0	64.0	8,000	43.0	344.0
Stocked Cereals			1,100	18.0	20.0
Livestock Products					100.0
Total	1,097.5				6,476.0

/1 Prices of tradeable commodities refer to the weighted averages of world price equivalent for exportable portions and domestic prices for quantities which would have been consumed domestically.

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ROMANIA

FLOOD RECOVERY PROJECT

Asset Losses to Tree Crops Livestock and Farm Buildings and Equipment By River Basins, 1975

(Area in '000 ha, numbers in '000 and value in million Lei)

Category	Mures		Arges		Olt		Ialomita		Buzau		Others		Grand Total	
Tree Crops /1	Area	Value	Area	Value	Area	Value	Area	Value	Area	Value	Area	Value	Area	Value
Grapes	0.6	57.0	0.4	37.0	0.4	37.0	0.4	37.0	0.6	57.0	0.6	57.0	3.0	282.0
Fruits	0.8	39.0	0.7	33.0	0.2	10.0	0.3	15.0	0.2	10.0	0.8	39.0	3.0	146.0
Hops	0.3	35.0	-	-	0.2	23.0	-	-	-	-	-	-	0.5	58.0
Livestock	Numbers	Value	Numbers	Value	Numbers	Value	Numbers	Value	Numbers	Value	Numbers	Value	Numbers	Value
Cattle	2.4	10.0	2.0	8.0	1.9	7.0	1.2	5.0	0.5	2.0	2.0	8.0	10.0	40.0
Pigs	21.0	21.0	12.5	13.0	16.0	16.0	15.0	15.0	2.0	2.0	13.5	13.0	80.0	80.0
Sheep	31.0	9.0	16.0	5.0	20.0	6.0	12.0	4.0	4.0	1.0	17.0	5.0	100.0	30.0
Poultry	930.0	14.0	480.0	7.0	530.0	8.0	360.0	6.0	60.0	1.0	640.0	9.0	3,000.0	45.0
Farm Buildings and Equipment		138.0		69.0		90.0		53.0		16.0		165.0		531.0
Total		323.0		172.0		197.0		135.0		89.0		296.0		1,212.0

/1 Losses of tree crops are estimated by discounting at 10% the net values of annual harvests from the permanently destroyed trees assuming these trees would have had 20 more years of productive lives.

August 1975

ANNEX 3
Table 3

ROMANIA

FLOOD RECOVERY PROJECT

Estimated Cost of Repairing Flood Damages
to Irrigation, Drainage and Flood Protection Works

River Basin	Estimated Cost of Repairing Damages				
	Earthwork	Concrete and Masonry	Installed Equipment	Total	Total (US$ million)
	----------Lei Million----------				
Mures					
Irrigation Works	1.1	0.1	1.2	2.4	0.12
Drainage Works	2.4	0.3	-	2.7	0.14
Flood Protection Works	24.9	20.0	0.2	45.1	2.25
Subtotal	28.4	20.4	1.4	50.2	2.51
Olt					
Irrigation Works	1.0	1.9	0.1	3.0	0.15
Drainage Works	13.2	2.7	-	15.9	0.80
Flood Protection Works	5.8	4.2	0.1	10.1	0.50
Subtotal	20.0	8.8	0.2	29.0	1.45
Arges					
Irrigation Works	11.8	6.5	3.3	21.6	1.08
Drainage Works	9.0	3.0	1.5	13.5	0.68
Flood Protection Works	20.1	11.5	2.9	34.5	1.72
Subtotal	40.9	21.0	7.7	69.6	3.48
Ialomita					
Irrigation Works	3.7	0.9	1.3	5.9	0.30
Drainage Works	1.6	0.7	0.1	2.4	0.12
Flood Protection Works	4.4	4.8	-	9.2	0.46
Subtotal	9.7	6.4	1.4	17.5	0.88
Buzau					
Irrigation Works	0.7	0.5	0.5	1.7	0.09
Drainage Works	1.9	-	-	1.9	0.09
Flood Protection Works	10.7	2.1	0.1	12.9	0.65
Subtotal	13.3	2.6	0.6	16.5	0.83
Other Basins/1					
Irrigation Works	39.3	22.8	4.8	66.9	3.34
Drainage Works	9.7	5.3	0.3	15.3	0.77
Flood Protection Works	34.7	17.0	1.0	52.7	2.63
Subtotal	83.7	45.1	6.1	134.9	6.74
All Basins					
Irrigation Works	57.6	32.7	11.2	101.5	5.08
Drainage Works	37.8	12.0	1.9	51.7	2.59
Flood Protection Works	100.6	59.6	4.3	164.5	8.22
Total	196.0	104.3	17.4	317.7	15.89

/1 Includes lake Rezelm and rivers Danube, Siret, Somes, Timis, Bega, Jiu, Calmatsui, Bahlui, Trotus, Prut.

Source: Romanian Estimate

August 1975

ANNEX 3
Table 5

ROMANIA

FLOOD RECOVERY PROJECT

Romanian Reports on Long Term Water Development Projects
A Typical List of Contents

CHAPTER I. Description of River Basin and its Water Resources

CHAPTER II. Present Water Uses and Future Development Potential

CHAPTER III. Possibility of Developing Hydro-Electric Power

- A. Potential
- B. Plan of Development

CHAPTER IV. Possibility of Developing Inland Navigation

CHAPTER V. Analysis of Destructive Effects of Water and Protective Works Proposed

CHAPTER VI. Quality of Water, Pollution and Wastewater Treatment

CHAPTER VII. Possibility of Water Storage and Diversions for Irrigation and Other Uses

CHAPTER VIII. Water Balance Calculations and Water Management

CHAPTER IX. Proposed Development Plan and Economic Evaluation

- A. Phasing of Development
  1. 1976 to 1990
  2. Beyond 1990
- B. Evaluation of Investment and Economic Effect

CHAPTER X. Informational System for Water and Project Management

CHAPTER XI. Conclusions and Problems Connected with Implementation

ANNEX 3
Table 6

ROMANIA

FLOOD RECOVERY PROJECT

Flood Control and Protection Works Planned for Construction During 1976-1980
Storage Dams

River Basin and Proposed Dam	Total Storage Capacity (Mm3)	Storage Capacity for Flood Control (Mm3)	Estimated Total Cost (lei Million)	Estimated Total Cost (US$ Million)
Mures				
Bezid /1	30	10	30.0	1.5
Vinatori /1	25	25	168.0	8.4
Nomsu	8	8	46.0	2.3
Zetea /2	55	35	620.0	31.0
Mihoesti /2	80	30	800.0	40.0
Mica-Balauseri	30	30	300.0	15.0
Subtotal	228	138	1,964.0	98.2
Olt				
Cibin /1	16	2	182.0	9.1
Plesita	27	2	240.0	12.0
Subtotal	43	4	422.0	21.1
Arges				
Golesti /2	83	20	560.0	28.0
Rivsor /2	49	4	780.0	39.0
Maracineni /2	17	17	300.0	15.0
Calinesti /2	78	15	310.0	15.5
Subtotal	227	56	1,950.0	97.5
Ialomita				
Paltinu /3	55	-	111.0	5.5
Pantoiu /1	98	23	750.0	37.5
Subtotal	153	23	861.0	43.0
Buzau				
Siriu /4	110	36	767.0	38.4
Total	761	257	5,964.0	298.2

/1 Construction to be started in 1976 and to be completed in 1977.
/2 Construction to be started in 1978 and to be completed in 1980.
/3 Repairs to existing dam.
/4 Construction started in 1975.

August 1975

ROMANIA

FLOOD RECOVERY PROJECT

Flood Control and Protection Works Planned for Construction During 1976 - 1980
Channel Improvement and Protection Levees

River Basin and Locality	Length of Reach for Channel Improvement and Levee Construction (km)	Estimated Total Cost (lei million)	Estimated Total Cost (US$ million)
Works to be completed in 1976-1977			
Mures			
Tg. Mures	22	165.0	8.3
Sighisoara (Part)	5	100.0	5.0
Alba Iulia (Part)	4	80.0	4.0
Gurghiu-Reghin	18	72.0	3.6
Tirnaveni	20	67.0	3.3
Copsa Mica (Part)	6	42.0	2.1
Dumbraveni	16	70.0	3.5
Subtotal	91	596.0	29.8
Olt			
Hirtibaciu	40	140.0	7.0
Sinpetru-Racos	90	60.0	3.0
Subtotal	130	200.0	10.0
Arges			
Pitesti	-	70.0	3.5
Bascov-Pitesti	6	34.0	1.7
Potopu-Rastoaca	15	68.0	3.4
Subtotal	21	172.0	8.6
Ialomita			
Urziceni	33	128.0	6.4
Pantoiu-Urziceni	16	60.0	3.0
Slobozia	5	20.0	1.0
Subtotal	54	208.0	10.4
Total (1976-77)	296	1,176.0	58.8
Works to be completed in 1978-1980			
Mures			
Sighisoara	16	190.0	9.5
Alba Iulia	10	60.0	3.0
Copsa Mica	-	40.0	2.0
Subtotal	26	290.0	14.5
Arges			
Rastoaca-Ogrezeni	300	1,840.0	92.0
Ialomita			
Urziceni-Tandarei-Dunare	30	200.0	10.0
Total (1978-80)	356	2,330.0	116.5
Grand Total (1976-80)	652	3,506.0	175.3

August 1975

ROMANIA

FLOOD RECOVERY PROJECT

SUMMARY OF ESTIMATED IMPACT OF 1975 FLOODS
ON MINING, INDUSTRY AND POWER SECTORS

	ENTERPRISES		EMPLOYMENT		PRODUCTION		
	TOTAL	AFFECTED IN 1975 FLOODS	TOTAL	AFFECTED BY FLOODS	PLANNED FOR 1975	EXPECTED FLOOD LOSSES /1	%
TOTAL	900 /3	193	2,100,000	N.A.	N.A.	1,664,350	N.A.
A. INDUSTRY	722	141	1,910,000	500,000 /3	N.A.	1,485,550	
1. Forest Industries & Building Materials /2	101	31	500,000	200,000	N.A.	106,000	
2. Light Industry	254	42	500,000	100,000	2,137,000	227,000	11
3. Chemicals	97	19	150,000	70,000	13,024,300	400,000	3.1
4. Heavy Machinery	100 /3	14	350,000	N.A.	N.A.	161,650	
5. Machine Tools & Electro-Technics	50 /3	12	80,000	15,000 /3	N.A.	350,000	
6. Industrial Construction	60 /3	20	160,000	110,000	4,178,500	179,100	4.3
7. Metallurgy	60 /3	3	170,000	N.A.	N.A.	61,800	
B. MINING							
8. Mining, Petroleum & Geology	100 /3	39	N.A.	N.A.	5,597,000	95,000	1.7
C. POWER							
9. Power	73	13	N.A.	N.A.	2,255,600	83,800	3.7

/1 Mostly for the month of July.
/2 Except Forest Exploitation.
/3 Approximate.

Industrial Projects Department
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ANNEX 4
Table 1

ROMANIA

FLOOD RECOVERY PROJECT

SUMMARY OF ESTIMATED DAMAGE IN MINING, INDUSTRIAL AND POWER SECTORS
BY CATEGORY OF LOSSES
('000 Lei)

SECTOR	TOTAL	FINISHED GOODS INVENTORY	RAW MATERIALS & OTHER INVENTORY	BUILDINGS	INFRA-STRUCTURE	EQUIPMENT & MACHINERY	OTHER
TOTAL MINING, INDUSTRY & POWER SECTORS	2,442,872/1	402,255	520,068	95,095	104,808	1,000,119	320,527
A. INDUSTRY	1,687,741	197,255	425,208	57,866	62,578	892,422	52,412
1. Forest Industries & Building Materials/2	561,067	50,545	135,590	15,502	44,700	314,730	-
2. Light Industry	310,000	17,000	82,000	15,000	5,000	185,000	6,000
3. Chemicals	486,000/3	34,600	89,700	17,000	5,000	339,700	-
4. Heavy Machinery	76,330/4	19,000	27,110	7,120	-	23,100	-
5. Machine Tools & Electro-Technics	26,000	-	21,000	-	-	5,000	-
6. Industrial Construction	188,684	76,110/7	34,648	3,244	7,878	20,392	46,412
7. Metallurgy	39,660	-	35,160	-	-	4,500	-
B. MINING	580,000	205,000	45,000	36,000	14,000	100,000	180,000
8. Mining, Petroleum & Geology	580,000	205,000	45,000	36,000	14,000	100,000	180,000/5
C. POWER	175,131	-	49,860	1,229	28,230	7,697	88,115
9. Power	175,131	-	49,860	1,229	28,230	7,697	88,115/6

ANNEX 4
Table 2

/1 May reach Lei 3.0 billion.
/2 Except forest roads which are included under Transportation.
/3 Likely to be Lei 600 million.
/4 Includes data from only 8 of 14 affected enterprises; total likely to exceed Lei 100 million.
/5 Mostly cost of restoring facilities to pre-flood status, e.g., removing mud from mines.
/6 Electric cables and conductors.
/7 Including Lei 69.651 million for work-in-progress.

Industrial Projects Department
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ROMANIA

FLOOD RECOVERY PROJECT

SUMMARY OF ESTIMATED DAMAGE IN MINING, INDUSTRIAL AND POWER SECTORS
BY BASIN
('000 Lei)

SECTOR	TOTAL ALL BASINS	BREAKDOWN BY BASIN						
		MURES	OLT	ARGES	IALOMITA	BUZAU	DANUBE	OTHERS
TOTAL MINING INDUSTRY & POWER SECTORS	2,442,872/1	848,979	349,177	334,444	189,902	155,564	12,729/2	552,077 /2
A. INDUSTRY	1,687,741	733,060	235,325	268,764	142,042	110,364	12,729	185,457
1. Forest Industries & Building Materials /3	561,067	108,374	106,098	73,119	36,201	78,621	/2	158,654
2. Light Industry	310,000	210,000	30,000	20,000	15,000	30,000	/2	5,000
3. Chemicals	486,000	268,000	57,000	136,000	25,000	-	/2	-
4. Heavy Machinery	76,330	63,610	5,300	5,240	230	-	/2	1,950
5. Machine Tools & Electro-Technics	26,000	8,000	-	10,000	8,000	-	/2	-
6. Industrial Construction	188,684	59,212	13,131	24,405	57,611	1,743	12,729	19,853
7. Metallurgy	39,660	15,864	23,796	-	-	-	-	-
B. MINING	580,000	97,000	47,000	53,000	30,000	7,000	/2	346,000
8. Mining, Petroleum & Geology	580,000	97,000	47,000	53,000	30,000	7,000	/2	346,000
C. POWER	175,131	18,919	66,852	12,680	17,860	38,200	/2	20,620
9. Power	175,131	18,919	66,852	12,680	17,860	38,200	/2	20,620

ANNEX 4
Table 3

/1 Tentative estimate. Revised estimate may reach Lei 3.0 billion.
/2 Except for Ministry of Industrial Construction, estimates for Danube Basin are included in the estimates for Other Basins.
/3 Excluding Forest Exploitation.

Industrial Projects Department
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ROMANIA

FLOOD RECOVERY PROJECT

Damage to Electric Power System

	Installations Damaged in 1975 Floods		Installations Repaired by end-July		Installations Still to be Repaired	
	Points In Transmission Lines	Transformer Stations	Points In Transmission Lines	Transformer Stations	Points In Transmission Lines	Transformer Stations
Total All Basins	378	3,946	364	3,819	14	127
Mures	110	1,031	107	1,015	3	16
Olt	72	468	70	458	2	10
Arges	71	598	66	585	5	13
Ialomita	65	1,038	65	1,018	-	20
Buzau	13	356	9	291	4	65
Danube	13	138	13	137	-	1
Others	34	317	34	315	-	2

ANNEX 4
Table 4

August 1975

ROMANIA

FLOOD RECOVERY PROJECT

SUMMARY OF ESTIMATED LOSSES OF ASSETS
MINISTRY OF ELECTRICAL ENERGY
('000 Lei)

	TOTAL ALL BASINS	BREAKDOWN BY BASIN					
		MURES	OLT	ARGES	IALOMITA	BUZAU	OTHERS
Total Ministry	175,131	18,919	66,852	12,680	17,860	38,200	20,620
Finished Products	-	-	-	-	-	-	-
Inventory & Materials	49,860	5,450	33,580	2,270	340	7,200	1,020
Equipment & Machinery	7,697	234	7,063	-	100	300	-
Buildings	1,229	685	374	-	170	-	-
Infrastructure	28,230	2,650	15,520	2,810	750	5,000	1,500
Power Lines	88,115	9,900	10,315	7,600	16,500	25,700	18,100

ANNEX 4
Table 5

August 1975

ROMANIA

FLOOD RECOVERY PROJECT

SUMMARY OF ESTIMATED LOSS OF ASSETS
MINISTRY OF MINING, GEOLOGY AND PETROLEUM
(000 Lei)

	TOTAL ALL BASINS	BREAKDOWN BY BASIN					
		MURES	OLT	ARGES	IALOMITA	BUZAU	OTHERS
Total Ministry	580,000	97,000	47,000	53,000	30,000	7,000	346,000
Finished Products	205,000						
Inventory & Raw Materials	45,000						
Machinery & Equipment	100,000						
Buildings	36,000						
Infrastructure	14,000						
Restoration of Facilities	165,000						
Flood Protection Cost	15,000						

Industrial Projects Department
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ANNEX 4
Table 6

ROMANIA

FLOOD RECOVERY PROJECT

SUMMARY OF ESTIMATED LOSSES OF ASSETS
MINISTRY OF FORESTRY AND BUILDING MATERIALS
('000 Lei)

	TOTAL ALL BASINS	BREAKDOWN BY BASIN					
		MURES	OLT	ARGES	IALOMITA	BUZAU	OTHERS /2
Total Ministry /1	561,067	108,374	106,098	73,119	36,201	78,621	158,654
Finished Products	50,545	8,790	9,313	15,070	2,550	6,020	8,802
Inventories & Raw Materials	135,590	25,027	29,348	10,686	8,493	21,220	40,816
Equipment & Machinery	314,730	62,605	62,337	32,963	21,158	45,881	89,786
Buildings	15,502	5,952	600	200	-	1,500	7,250
Infrastructure	44,700	6,000	4,500	14,200	4,000	4,000	12,000

/1 Except for the Central for Forest Exploitation, which is included under Forest Roads in Transportation.

/2 Including Danube Basin.

Industrial Projects Department
August 5, 1975

ANNEX 4
Table 7

ROMANIA

FLOOD RECOVERY PROJECT

SUMMARY OF ESTIMATED LOSS OF ASSETS
MINISTRY OF LIGHT INDUSTRIES
('000 Lei)

	TOTAL ALL BASINS	BREAKDOWN BY BASIN					
		MURES	OLT	ARGES		BUZAU	OTHERS
Total Ministry	310,000	210,000	30,000	20,000	15,000	30,000	5,000
Finished Products	17,000					5,000	
Inventories & Raw Materials	82,000					20,000	
Equipment & Machinery	185,000	185,000	-	-	-	-	-
Buildings	15,000					4,000	
Infrastructure	5,000					1,000	
Other	6,000					-	

Industrial Projects Department
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ANNEX 4
Table 8

ROMANIA

FLOOD RECOVERY PROJECT

SUMMARY OF ESTIMATED LOSS OF ASSETS
MINISTRY OF CHEMICALS
('000 Lei)

	TOTAL ALL BASINS	BREAKDOWN BY BASIN					
		MURES	OLT	ARGES	IALOMITA	BUZAU	OTHERS
Total Ministry	486,000	268,000	57,000	136,000	25,000	-	-
Finished Products	34,600	30,600	2,000	-	2,000	-	-
Inventories & Raw Materials	89,700	54,600	11,500	13,600	10,000	-	-
Equipment & Machinery	339,700	160,800	43,500	122,400	13,000	-	-
Buildings	17,000	17,000	-	-	-	-	-
Infrastructure	5,000	5,000	-	-	-	-	-

Industrial Projects Department
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ANNEX 4
Table 9

ROMANIA

FLOOD RECOVERY PROJECT

SUMMARY OF ESTIMATED LOSSES OF ASSETS
MINISTRY OF HEAVY MACHINERY
('000 Lei)

	TOTAL ALL BASINS	BREAKDOWN BY BASIN					
		MURES	OLT	ARGES	IALOMITA	BUZAU	OTHERS
Total Ministry	76,330	63,610	5,300	5,240	230	-	1,950
Finished Products	19,000	19,000	-	-	-	-	-
Inventory & Materials	27,110	25,430	580	440	210	-	450
Equipment	23,100	18,300	-	3,300	-	-	1,500
Buildings	7,120	880	4,720	1,500	20	-	-
Infrastructure	-	-	-	-	-	-	-
Production Losses	161,650						

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ANNEX 4
Table 10

ROMANIA

FLOOD RECOVERY PROJECT

SUMMARY OF ESTIMATED LOSSES OF ASSETS
MINISTRY OF MACHINE TOOLS AND ELECTROTECHNICS
('000 Lei)

	TOTAL ALL BASINS	BREAKDOWN BY BASIN					
		MURES	OLT	ARGES	IALOMITA	BUZAU	OTHERS
Total Ministry	26,000	8,000	-	10,100	7,900	-	-
Finished Products	-	-	-	-	-	-	-
Inventory & Materials	21,000	6,500	-	8,100	6,400	-	-
Equipment	5,000	1,500	-	2,000	1,500	-	-
Buildings	-	-	-	-	-	-	-
Infrastructure	-	-	-	-	-	-	-
Production Losses	35,000						

August 1975

ANNEX 4
Table 11

ROMANIA

FLOOD RECOVERY PROJECT

SUMMARY OF ESTIMATED LOSSES OF ASSETS
MINISTRY OF INDUSTRIAL CONSTRUCTION
('000 Lei)

	TOTAL ALL BASINS	BREAKDOWN BY BASIN						
		MURES	OLT	ARGES	IALOMITA	BUZAU	DANUBE	OTHER
Total Ministry	188,684	59,212	13,131	24,405	57,611	1,743	12,729	19,853
Finished Products	6,459							
Work under Progress	69,651							
Inventory & Materials	34,648							
Equipment & Machinery	20,392							
Buildings	3,244							
Infrastructure	7,878							
Flood Damage Repair	20,788							
Other	25,624							

August 1975

ANNEX 4
Table 12

ROMANIA

FLOOD RECOVERY PROJECT

SUMMARY OF ESTIMATED LOSSES OF ASSETS
MINISTRY OF METALLURGY
('000 Lei)

	TOTAL ALL BASINS	BREAKDOWN BY BASIN					
		MURES	OLT	ARGES	IALOMITA	BUZAU	OTHERS
Total Ministry	39,660	15,864	23,796	-	-	-	-
Finished Products	-	-	-	-	-	-	-
Inventory & Materials	35,160	14,064	21,096	-	-	-	-
Equipment	4,500	1,800	2,700	-	-	-	-
Buildings	-	-	-	-	-	-	-
Infrastructure	-	-	-	-	-	-	-
Production Losses	61,800	-	-	-	-	-	-

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ANNEX 4
Table I3

ROMANIA

FLOOD RECOVERY PROJECT

SUMMARY OF ESTIMATED COSTS OF REHABILITATION OF MACHINERY AND EQUIPMENT
INDUSTRY, MINING AND POWER SECTORS
('000 Lei)

	TOTAL	SPARE PARTS	ELECTRICALS	INSTRUMENTATION & CONTROLS	OTHER MACHINERY & MATERIALS	TRANSPORT, CONSTRUCTION & EARTH-MOVING EQUIPMENT
TOTAL INDUSTRY, MINING & POWER SECTORS	1,266,858	236,522	102,740	52,920	582,348	292,328
A. INDUSTRY	896,698	182,539	67,000	45,200	480,481	121,478
1. Forest Industry & Building Materials /1	314,730	40,000	50,000	30,000	79,730	115,000
2. Light Industry	185,000	4,237	-	-	180,763	-
3. Chemicals	339,700	123,100	10,000	9,200	197,400	-
4. Heavy Machinery	23,100	8,000	6,000	6,000	3,100	-
5. Machine Tools & Electro-Technics	5,000	2,000	1,000	-	2,000	-
6. Industrial Construction	24,668	5,202	-	-	12,988	6,478
7. Metallurgy	4,500	-	-	-	4,500	-
B. MINING & PETROLEUM	201,790	43,000	17,820	7,720	27,400	105,850
8. Mining, Petroleum & Geology	201,790	43,000	17,820	7,720	27,400	105,850
C. POWER	168,370	10,983	17,920	-	74,467	65,000
9. Power	168,370	10,983	17,920	-	74,467	65,000

ANNEX 4
Table 14

/1 Excluding Central for Forest Exploitation.

August 1975

ROMANIA

FLOOD RECOVERY PROJECT

SUMMARY OF ESTIMATED COSTS OF REHABILITATION OF BUILDINGS AND INFRASTRUCTURE
INDUSTRY, MINING AND POWER SECTORS
('000 Lei)

SECTOR	TOTAL	BUILDINGS & STRUCTURES /1				INFRASTRUCTURE
		Cement	Steel	Timber	Other Materials & Costs	
TOTAL INDUSTRY, MINING & POWER SECTORS	376,285	15,584	46,945	21,459	159,988	132,309
A. INDUSTRY	214,316	12,875	33,770	17,479	95,033	55,159
1. Forest Industry & Building Materials /2	143,400	4,500	27,000	9,400	57,800	44,700
2. Light Industry	13,089	1,288	1,825	345	4,172	5,459
3. Chemicals	22,000	5,000	2,000	7,000	3,000	5,000
4. Heavy Machinery	-	-	-	-	-	-
5. Machine Tools & Electro-Technics	10,000	-	-	-	10,000	-
6. Industrial Construction	25,827	2,087	2,945	734	20,061	-
7. Metallurgy	-	-	-	-	-	-
B. MINING & PETROLEUM	60,136	1,800	1,745	380	52,211	4,000
8. Mining, Petroleum & Geology	60,136	1,800	1,745	380	52,211	4,000
C. POWER	101,833	909	11,430	3,600	12,744	73,150
9. Electrical Energy	101,833	909	11,430	3,600	12,744	73,150

/1 Including power lines and Industrial Construction sites.
/2 Except Central for Forest Exploitation.

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ANNEX 4
Table 15

ROMANIA

FLOOD RECOVERY PROJECT

Summary of Damage to Rail Network

River Basin	Route	Number of Damaged Locations	Length Damaged Km	Principal Quantities			Estimated Costs		
				Crushed Stone ton	Ballast ton	Rail ton	Temp. Repairs	Final Repairs	Total
								Lei x 1,000,000	
Arges	Bucarest	10	1.5						
	Craiova	31	5.8						
	Total	41	7.3	16,000	5,000	-	9	47	56
Lalomita	Bucarest	26	220	14,000	10,000	-	7	26	33
Buzau	Galati	32	30	15,000	10,000	4,500	33	132	165
Olt	Craiova	11	5.0						
	Timisoara	3	0.5						
	Brasov	48	45.5						
	Total	62	51.0	18,000	2,500	-	6	17	23
Mures	Brasov	52	15.1						
	Cluj	72	97.3						
	Timisoara	91	50.6						
	Total	215	163.0	60,000	15,000	2,000	51	246	297
Jiul	Craiova	4	1.0	-	-	-	2	3	5
Danube	Bucarest	2	-	-	-	-	3	52	55
	Total	388	273.0	123,000	42,500	6,500	111	523	634

ANNEX 5
Table 1

ROMANIA

FLOOD RECOVERY PROJECT

Railways

1974 Freight Flows on Sections of Railway Damaged by Flooding

River Basin		Number of Section	Rail Section	Length Km	Total Traffic 1974 ton. km x 100	Average Daily Traffic (ton)
Arges	1.	1005	Chiajna - Videle	42	1572577l	104,000
	2.	2001	Chitila - Titu	39	12469356	99,000
	3.	2011	Titu - Pietroaia	30	7759093	72,000
	4.	2013	Pietroaia - Golesti	22	4385983	55,000
	5.	2071	Golesti - Cimpulung	55	4227760	21,200
	6.	2101	Pitesti - C. Arges	38	1301679	9,500
Ialomita	1.	3021	Cimpina - Predeal	48	25218806	143,000
	2.	3051	Buda - Slanic	34	1421885	11,000
	3.	6011	Caciulati - Armasesti	37	6236701	47,000
	4.	6017	Armasesti - Urziceni	7	3034691	120,000
Buzau	1.	5003	V.Calugareasca - Buzau	58	22947276	111,000
	2.	5031	Buzau - Nehoiasi	73	3267395	12,400
	3.	6101	Urziceni - Faurei	68	10264713	42,900
	4.	6131	Buzau - Faurei	40	7847645	54,000
	5.	6201	Faurei - Tecuci	93	15424800	46,000
Olt	1.	2201	Govora - Podul Olt	89	11393797	36,000
	2.	2303	Podul Olt - Sibiu	22	6987074	88,000
	3.	2323	Brasov Tj. - Bartolomeu	6	1076667	50,000
	4.	2351	Sercaia - Podul Olt	77	15409076	55,000
	5.	3103	Predeal - Brasov Tj.	27	8866074	89,000
	6.	2123	Brasov Tj. - Rupea	77	21359845	76,000
	7.	3131	Bartolomeu - Zarnesti	24	680292	7,900
	8.	3155	Sf.Gheorgte - Ciceu	71	8362364	33,000
Mures	1.	2463	Teius - Coslariu	4	1390270	94,000
	2.	2471	Coslariu - Vintul de Jos	25	7824111	86,000
	3.	2501	Vintul de Jos - Sibot	15	6634226	124,000
	4.	2503	Sibot - Simeria	29	9519320	120,000
	5.	2523	Simeria - Mintia	16	5964259	103,000
	6.	2525	Mintia - Ilia	17	5117731	83,000
	7.	2701	Savirsin - Radna	50	8081825	46,000
	8.	2731	Ilia - Lugoj	83	10094854	35,000
	9.	2811	Arad - Curtici - Lokos	28	2635891	26,000
	10.	2831	Radna - Timisoara E	64	1694342	7,100
	11.	3125	Rupea - Vinatori	44	12802883	81,000
	12.	3301	Vinatori - Sighisoara	10	3026133	84,000
	13.	3311	Sighisoara - Copsa M	50	15918013	89,000
	14.	3433	Blaj - Tirnaveni	36	1955827	15,000
	15.	3501	Teius - Razboieni	34	12996442	106,000
	16.	3521	Razboieni - Cimpia Turzii	17	5987160	98,000
	17.	4307	Ghearghieni - Deda	78	13507177	48,000
	18.	4331	Deda - Tg. Mures	54	4043677	21,000
	19.	4351	Tg. Mures - Luaus	40	3348217	23,000
Danube	1.	8187	Giurgiu N. - Russa	16	1265049	22,000

ROMANIA

FLOOD RECOVERY PROJECT

Summary of Damage to National Roads

River Basin	Road No. (See Map)	Number of Damaged Locations	Principal Quantities: Earthwork cm	Pavement km	Structures m	Estimated Cost Lei x 1,000	To be Completed (Year)	1974 Daily Traffic (Vehicles/24 hours): Average	Maximum
Ialomita	1	14	21,000	1.5	6	12,700	1975	4460	12,210
	1B	1	1,200	-	-	125	1975	3930	7,040
	1D	1	1,300	0.4	-	640	1975	1925	3,090
	1A	52	19,000	10.6	-	22,260	1976	2190	4,300
	2A	17	6,400	-	57	2,490	1975	4500	9,020
	2C	1	-	-	10	290	1975	1800	2,340
	21	1	-	-	28	920	1976	1080	2,900
	71	1	1,900	1.0	-	2,780	1975		
	72	1	-	-	-	200	1975		
		89	50,800	13.5	104	42,405			
Mures	1	34	15,400	1.26	10	3,790	1975	3320	7,590
	6	1	3,000	-	-	190	1975	-	-
	7	7	27,400	0.07	-	4,550	1975	2710	10,830
	13	33	12,600	1.26	80	8,710	1976	1970	6,220
	13A	6	3,100	-	-	1,010	1975	1400	2,660
	14	32	3,000	4.16	20	15,130	1976	1630	3,920
	14A	20	8,800	1.57	-	8,250	1976	860	2,750
	14B	6	4,900	0.49	-	1,150	1976	585	1,060
	15	9	4,500	0.11	-	2,430	1975	1055	4,980
	15A	1	700	-	-	70	1975	830	1,440
	16	3	2,000	-	-	2,120	1975	730	-
	66	3	28,100	0.07	-	1,720	1975	1070	4,650
	67C	26	6,000	-	59	5,390	1975	780	1,770
	74	38	23,200	1.0	-	3,580	1975	1190	4,030
	74A	7	2,000	-	-	1,580	1975	790	-
	75	45	14,000	0.8	-	10,530	1976	455	805
	76	7	2,400	1.25	-	2,410	1975	140	3,970
		278	161,100	12.04	169	72,610			
Arges	1A	3	1,100	0.20	-	340	1975	5090	9,130
	4	2	200	0.02	-	40	1975	1260	4,800
	5	1	300	0.10	-	160	1976	4300	9,910
	6	3	8,600	-	50	2,760	1976	3650	12,490
	7	26	11,100	0.13	24	1,420	1975	3800	7,490
	7C	22	23,000	6.00	100	15,040	1976	1300	2,010
	72	2	800	-	-	590	1976	-	-
	72A	25	43,130	11.8	-	27,470	1976	-	-
		84	88,230	18.25	174	47,820			
Olt	1	19	26,250	7.7	457	21,220	1976	2560	11,250
	1A	10	12,100	3.9	-	10,930	1976	-	-
	7	11	15,600	0.6	60	8,810	1976	2600	7,440
	7A	14	32,000	9.3	86	20,540	1976	1095	1,800
	10	2	900	0.3	-	720	1975	920	2,500
	12	8	1,400	0.9	8	2,340	1975	1045	4,375
	12C	5	1,400	0.5	-	1,620	1975	340	540
	13	9	1,300	2.4	86	7,700	1976	1770	5,510
	13A	2	850	0.3	-	930	1975	1150	2,850
	67B	5	22,000	1.7	16	8,230	1976	570	1,065
	73	3	1,400	0.5	-	1,150	1975	3220	6,900
	73A	10	18,400	5.8	-	19,970	1976	-	-
	73C	11	11,400	0.8	68	16,730	1976	-	-
		109	145,000	34.7	781	120,890			
Buzau	10	45	424,300	6.3	100	73,240	1976	4860	10,480
	11	6	3,450	2.42	-	4,210	1975	1770	5,500
	12A	3	500	-	-	1,010	1975	-	-
	12B	12	5,100	0.12	-	2,420	1975	-	-
	15	1	700	-	-	360	1975	1050	4,980
	22	1	2,200	0.20	-	2,200	1976	-	-
	24	1	2,200	1.43	1	2,520	1975	-	-
		69	438,450	10.47	101	85,960			
Danube	5C	3	4,000	0.29	-	560	1975	580	1,410
	54	4	-	5.0	-	460	1975	420	730
	56A	1	400	0.15	-	280	1975	-	-
	57	3	400	-	-	1,630	1975	740	2,080
	57A	1	3,000	-	-	390	1975	190	540
		12	7,800	5.44	-	3,320			
Other Basins									
Prut	24	1	13,000	-	-	1,360	1975	-	-
	24C	3	100	-	-	190	1975	-	-
	28	1	-	-	-	160	1975	-	-
		5	13,100	-	-	1,710			
Gris	1	31	8,800	2.52	-	4,280	1975	1830	4,720
	74	23	44,000	-	-	3,750	1975	1190	4,030
		54	52,800	2.52	-	8,030			
Nera	57B	3	18,000	-	-	1,610	1975	830	1,600
Somes	1C	2	10,000	-	-	1,220	1975	3220	7,130
Timis	58	1	2,700	0.4	-	690	1975	835	-
	58A	1	3,500	-	2	970	1975	-	-
	59	3	3,500	6.0	10	9,380	1976	-	-
		5	9,700	6.4	12	11,040			
Jiul	7A	7	41,150	1.0	-	5,480	1975	1095	1,800
	67C	8	16,000	4.1	4	11,630	1976	780	1,770
	67D	6	32,450	8.5	-	15,610	1976	-	-
		21	89,600	13.6	4	32,720			
Totals		731	1,084,580	116.92	1,345	429,335			

ROMANIA

FLOOD RECOVERY PROJECT

Inventory of Damage to District and Village Roads

River Basin	District	District Roads Length Damaged (Km)	District Roads Cost Lei x 1,000	Village Roads Length Damaged (Km)	Village Roads Cost Lei x 1,000	Bridges Number Damaged	Bridges Length m	Cost Lei x 1,000	Total Cost Lei x 1,000
Mures	Alba	90.7	75,425	48.0	26,400	45	935	30,855	132,680
	Arad	20.0	16,370	23.0	12,650	2	21	695	29,715
	Cluj	43.0	35,000	31.5	17,670	26	453	14,950	67,620
	Harghita	62.4	51,480	19.7	10,835	49	1,173	38,710	101,025
	Hunedoara	69.0	56,925	75.8	46,690	14	108	3,565	107,180
	Mures	31.6	25,900	30.5	17,110	29	630	20,790	63,800
		316.7	261,100	228.5	131,355	165	3,320	109,565	502,020
Olt	Brasov	26.8	22,110	66.9	37,530	34	224	7,390	67,030
	Covasna	20.0	16,545	15.0	8,085	45	490	16,170	40,800
	Olt	102.0	83,700	164.0	90,200	42	405	13,365	187,265
	Sibeu	148.6	122,595	105.3	56,755	40	1,282	42,305	221,655
	Teleorman	23.6	19,420	1.8	990	3	188	6,205	26,615
	Vilcea	42.0	47,260	35.0	19,250	20	1,200	38,565	105,075
		363.0	311,630	388.0	212,810	184	3,789	124,000	648,440
Arges	Arges	40.0	36,295	289.0	190,685	117	2,848	93,985	320,965
	Prahova	67.5	51,990	88.0	54,310	49	2,405	79,365	185,665
		107.5	88,285	377.0	244,995	166	5,253	173,350	506,630
Ialomita	Dimbovita	103.0	87,455	91.0	50,215	106	3,242	90,420	228,090
	Ialomita	23.5	19,130	13.5	7,130	2	140	4,620	30,880
	Ilfov	69.0	56,925	50.0	32,450	30	602	19,865	109,240
		195.5	163,510	154.5	89,795	138	3,984	114,905	368,210
Buzau	Buzau	66.0	114,410	17.0	31,835	22	1,157	38,180	184,425
Danube	Caras Severin	75.0	61,875	6.0	3,170	3	57	1,880	66,925
	TOTAL	1,123.7	1,000,810	1,171.0	713,960	678	17,560	561,880	2,276,650

ANNEX 5
Table 4

ROMANIA

FLOOD RECOVERY PROJECT

Damage to Telecommunications Network

Basin	Rehabilitation and Repair Works	Unit	Quantity	Rate	Value	Material	Labour	Equipment	Other	Year of Completion	Number of Disruptions	Remarks
Arges	Replacing underground telephone cables between towns	km	4.750	212.7	1,010	798	172	-	40	1975	10	Cables broken by earth slides
	Replacement of overhead line	km	15.5	13.9	215	170	36	-	9	1975	55	
	Replacing underground telephone cables within towns	km	4.0	112.5	450	342	90	-	18	1975	85	
	TOTAL				1,675	1,310	298	-	67			
Buzau	Replacing overhead lines	km	37.0	13.5	500	395	85	-	20	1975	20	
	Replacing underground telephone cables within towns	km	6.0	50	300	237	51	-	12	1975	30	
	TOTAL				800	632	136	-	32			
Ialomita	Replacing underground telephone cables between towns	km	2.050	151.2	310	245	53	-	12	1975	2	
	Replacing overhead lines	km	47.7	10.3	490	387	83	-	20	1976	77	Complete flooding of Urziceni railway station damaged high frequency and exchange equipment which needs replacement.
	Replacing underground telephone cables within towns	km	15.0	49.3	740	562	148	-	30	1975	21	
	Replacing and repair of telephone equipment	buc.	600	0.4	240	5	5	230	-	1975	-	
	Replacing high frequency telephone transmission and relay equipment	buc.	84	32.0	3,000	-	-	3,000	-	1975		
	TOTAL				4,780	1,199	289	3,230	62			
Mures	Replacing underground telephone cables between towns	km	4.2	112.1	471	372	80	-	19	1975	12	Overhead lines broken by floods, washed-out bridges and culverts.
	Replacing overhead lines	km	59.0	20.0	1,220	964	207	-	49	1976	44	
	Replacing underground telephone cables within towns	km	56.0	94.6	5,300	4,188	900	-	212	1975	26	
	Replacing and repair of telephone equipment	buc.	9800	0.4	3,920	78	78	3,764	-	1975		
	TOTAL				10,911	5,602	1,265	3,764	280			
Olt	Replacing underground telephone cables between towns	km	56.5	197.1	11,137	8,799	1,893	-	445	1975/1976	21	Cables broken by earth slides, washed out bridges and culverts.
	Replacing overhead lines	km	55.1	13.1	725	573	123	-	29	1975-1976	80	
	Rebuilding urban cable ducts	km	21.0	171.5	3,600	2,736	720	-	144	1975	65	
	Replacement and repair of telephone equipment	buc.	5600	0.4	2,240	45	45	2,150	-	1975		
	TOTAL				17,702	12,153	2,781	2,150	618			
Prahova	Replacing and repairing underground cables between towns	km	30.8	151.6	4,670	3,689	794	-	187	1976	15	Earth slides and flooding destroyed telephone cables.
	Replacing overhead lines	km	30.0	14.0	420	333	71	-	16	1975	30	
	Replacing underground telephone cables within towns	km	8.0	62.5	500	380	100	-	20	1975	20	
	TOTAL:				5,590	4,402	965	-	223			
	SUB TOTAL FOR ALL BASINS:				41,458	25,298	5,734	9,144	1,262		613	
	Contingencies		10%		4,147	2,532	571	916	128			
	TOTAL				45,605	27,830	6,305	10,060	1,410			

ANNEX
Table

ROMANIA

FLOOD RECOVERY PROJECT

Damage to National Roads and Bridges

Basin of the Ialomita River

Road Number	Description of Work	Unit	Quantity	Rate	Cost Lei x 1,000	Cost Breakdown: Materials	Labor	Equipment	Other	Equipment Needed for Execution	Year to be Completed	Number of Disruptions	Remarks
1	Damages to roads, bridges				11,554	6,006	2,283	1,327	1,938	Drilling rig for bored piles			Ialomita and Prahova rivers scoured the road embankment, damaged 4 culverts, numerous walls, stone pitched slopes, canals etc.
	Embankment	mc	20,950	31	650	21	167	356	106				
	Retaining Walls	mc	540	554	299	108	84	38	69	1 Sheeps foot roller			
	Protection Walls	mc	21,400	390	8,346	4,173	1,819	792	1,562				
	Culverts	ml	6	26	156	93	26	16	21	1 Compressor	1975	14	
	Pavement	km	1.5	1,360,000	2,040	1,580	171	123	166	4 PT and tracked			
	Ditches	mp	220	68	15	11	2	-	2				
	Drainage	mc	135	360	48	20	14	2	12	2 Asphalt mixers			
1B	Damages to bridges				114	41	27	26	20	2 Pavers			The increasing level of the Cricov river affected the decks and abutments of the bridge.
	Embankment	mc	1,200	31	37	1	10	20			1975	1	
	Riprap	mp	90	210	19	10	4	1	4	4 PT rollers			
	Protection Walls	mc	150	390	58	30	13	5	10	2 Vibrating rollers			
1D	Damages to roads				584	421	56	55	52	1 Hydraulic excavator			Road was washed out by the Lalomita flooding.
	Embankment	mc	1,300	31	40	1	10	22	7	2 Front end loaders (PT)	1975	1	
	Pavement	km	0.4	1,360,000	544	420	16	33	45	15 Tipper trucks			
1A	Damages to roads				20,237	13,271	2,782	1,764	2,420	2 Plate vibrators			Catastrophic river flows resulting from the prolonged rains caused massive earthslides which carried away the road. The Teleajen river also damaged the flood protection works.
	Embankment	mc	18,850	31	584	19	152	320	93	4 Vibrating rollers	1975-1976	52	
	Protection walls	mc	2,140	390	835	417	182	79	157				
	Retaining walls	mc	6,630	554	3,673	1,326	1,028	464	855	2 Horizontal drilling m/i.(hydraulic)			
	Drainage	mc	1,660	360	598	249	197	30	122	1 Motorgrader			
	Ditches, etc.	mp	1,930	68	131	98	15	2	16	6 Conveyor belts			
	Pavement	km	10.6	1,360,000	14,416	11,162	1,208	869	1,177	4 Concrete mixers			
2A	Damages to roads, bridges				2,258	1,178	413	341	326				Ialomita river changed its course in Slobozia from its old bed causing major damage to the National roads in this region.
	Embankment	mc	6,360	31	197	6	51	108	32				
	Protection walls	mc	900	390	351	175	77	33	66				
	New bridges	ml	57	30,000	1,710	997	285	200	228		1975	17	
2C	New bridge	ml	10	26,000	260	155	44	27	34		1975	1	To avoid further flooding of the town of Slobozia new bridges are needed.
21	New bridge	ml	28	30,000	840	490	140	98	112		1975-1976	1	
71	Road damage				2,523	1,692	420	245	366				River Lalomita and the smaller Ialomicioara washed out the road embankment in three places and destroyed retaining walls and culverts etc.
	Embankment	mc	1,900	31	59	2	15	32	10		1975	1	
	Protection wall	mc	700	390	273	137	59	26	51				
	Retaining wall	mc	1,500	554	831	300	232	105	194				
	Pavement	km	1.0	1,360,000	1,360	1,053	114	82	111				
72	Bridge damage				182	74	29	43	36				The increased level of the Cricov river weakened the bridge structure.
	Protection blocks	mc	280	400	112	39	14	36	23		1975	1	
	Protection walls	mc	180	390	70	35	15	7	13				
	TOTAL				38,552	23,128	6,194	3,926	5,304			89	

ANNEX 5
Table 6

ROMANIA

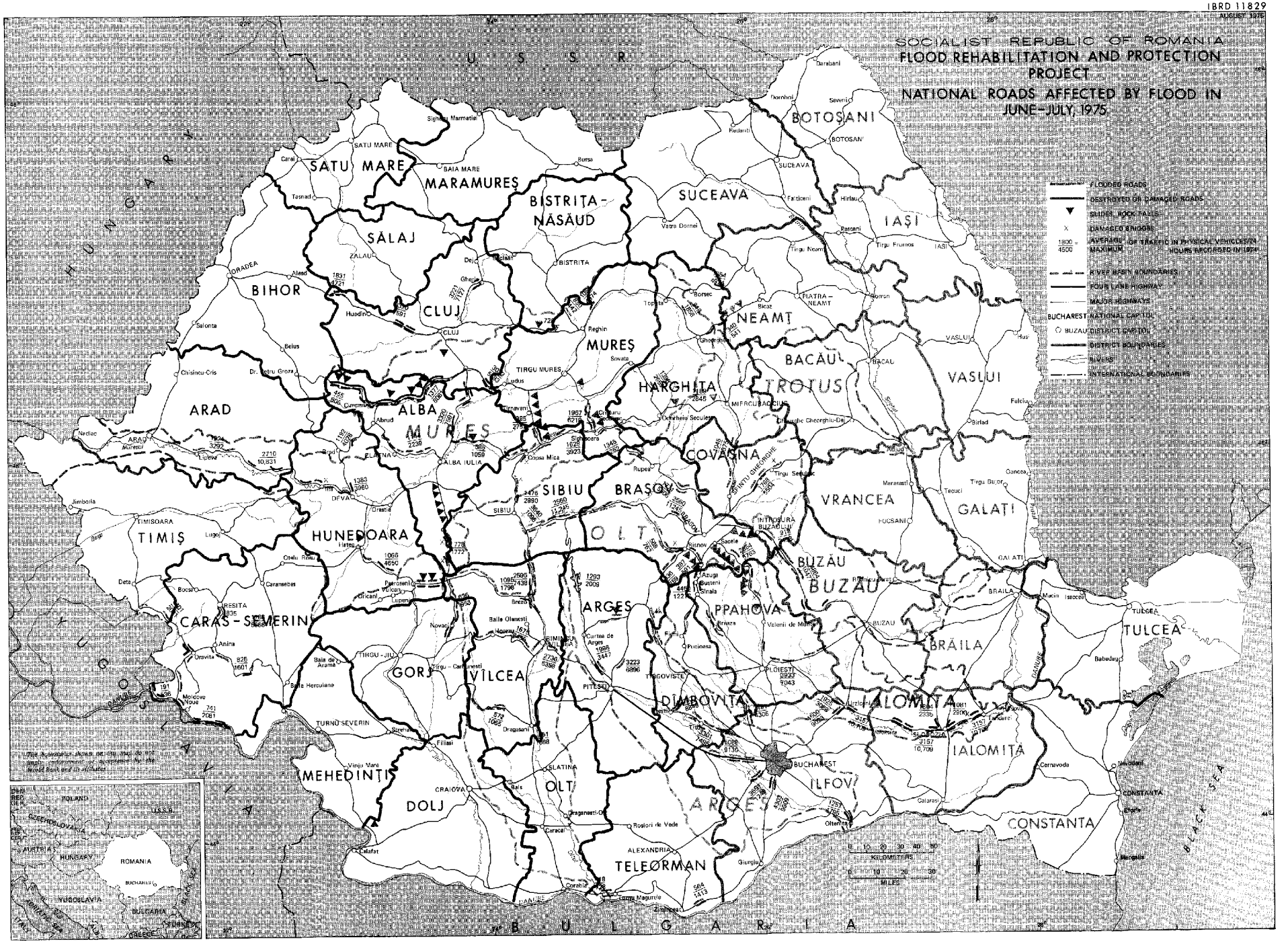
FLOOD RECOVERY PROJECT

Railways
Details of Damage in Basin of Arges River

Hydrographic Basin	Rail Section at Location of Damage	Length (km)	Description of Work	Unit	Quantity	Unit Cost Lei	Total Cost Lei x 1,000	Breakdown of Cost (Lei x 1,000) Materials	Labour	Equipment	Miscellaneous	Type of equipment needed	Year of completion	No. of Damaged sections	Remarks
Arges	Railroad Track		Embankment ballast	mc	5000	70	350	-	50	275	25	Tipper trucks 13 - 15 t	1975		Track damaged
	Bucuresti - Pitesti km 34.000 - 45.000		Embankment from waste material	cm	3000	60	180	-	30	135	15	Ballast screens (150 cm/hour)			Track damaged
	Bucuresti - Giurgiu km 22.900 - 23.100		Protection dykes	cm	3000	280	840	660	60	90	30				Track damaged
	Golesti - C.Lung - Argestel km 112.200 - 163.200		New embankment and track	km	0500	1,300,000	650	558	19	19	54				Track destroyed
	Pitesti - C. Arges km 129.050 - 138.920		Partial replacement of embankment & track	km	6000	390,000	2340	2010	66	66	198	Track laying machine Bulldozer 250-400 H.P.		38	Track destroyed
	Km	6.980													
	Rebuilding Bridges		Embankment ballast	cm	12000	70	840	-	120	560	60	Sheepsfoot roller 800 - 2000 kg			Track destroyed
	Bucuresti - Rosiori km 8.250 - Chiajna		New Superstructure	km	12000	1,300,000	1560	1340	45	45	130				
	Golesti - C.Lung km 107.698		Partial replacement of Embankment & track	km	5200	390,000	2040	1774	57	57	172	Compressor 10-30 cm/min			Track destroyed
			Protection dykes	cm	3000	280	840	660	60	90	30	Bulldozer 250 - 400 H. P.	1975/76		Track destroyed
			Temporary bridges	ml	120	5,000	600	300	156	96	48				
			Temporary bridges (timber)	ml	40	16,000	640	240	64	272	64	Excavator 0.5 - 1.5 cm			
			Temporary bridges to be part of Final structure	ml	168	5,000	840	420	218	134	68	Tipper trucks			
			Permanent works in concrete	cm	1400	800	1120	660	250	112	98	Mobile crane 80-125 t			
			Reinforcement concrete, superstructure	ml	72	15,500	1120	760	130	130	100	Pumps and concrete mixers			
			Steel Superstructure (bridges)	t	205	11,100	2280	1850	230	100	100				
			Slope protection	ml	500	5,500	2750	1750	600	45	405				
			Sleepers	ml	300	2,800	840	540	180	3	117				
	Km	0.120	Protection dykes	cm	500	280	140	110	10	15	5			2	
	Protection Works		Gabions	cm	1500	1,500	225	150	45	-	30	Excavator hydraulic 1cm			Floodwaters have loosened the abutment and piles have destroyed the left wing wall and damaged the embankment.
	Golesti - Pitesti km 103.300 - pod		Slope protection	ml	700	5,500	3850	2380	840	63	567	Front end loader	1975/76		
			Sleepers	ml	1200	2,800	3360	2160	720	12	468	Tipper trucks			
			Canal excavation	cm	50000	25	1250	-	300	800	150	Concrete mixers			
	Km	0,200												1	
	Earthwork Compaction		Retaining walls	cm	13000	400	5200	1820	975	390	2015	Drilling rig for bored piles			Embankment was saturated, weakened and collapsed.
	C.Lung. - Argesel km 155.000 - 170.000		R. L. Columns	ml	1800	2,400	4320	3656	288	2160	216				
			Drains	cm	10000	330	3300	2800	800	100	600	Mobile cranes 5-16 t.	1975/77		
	Increasing Bridge Freeboard		Infrastructure	cm	3000	800	2400	1410	540	240	210				Floodwaters have topped the bridge, eroded the embankment and destroyed the line behind the abutment.
	Titu - Golesti Km 54.663 : 45 m		Temporary bridges	ml	280	5,000	1400	700	364	224	112				
	Titu - Golesti km 57.385 : 40 m		Steel Superstructure	to	350	11,100	3880	3150	380	175	175				
	Titu - Golesti km 82.275 : 20 m		Reinforced concrete superstructure	ml	80	15,500	1240	840	144	144	112	Tipper trucks	1975/76		
	Titu - Golesti km 92.564 : 20 m						50385	29468	7751	5652	6314			41	
	Total	km 7.300													
			Contingencies 10%				5039	2947	774	565	631				
			Total				55420	32635	8525	7315	6945				

AGRICULTURE

IBRD 11829
AUGUST 1975



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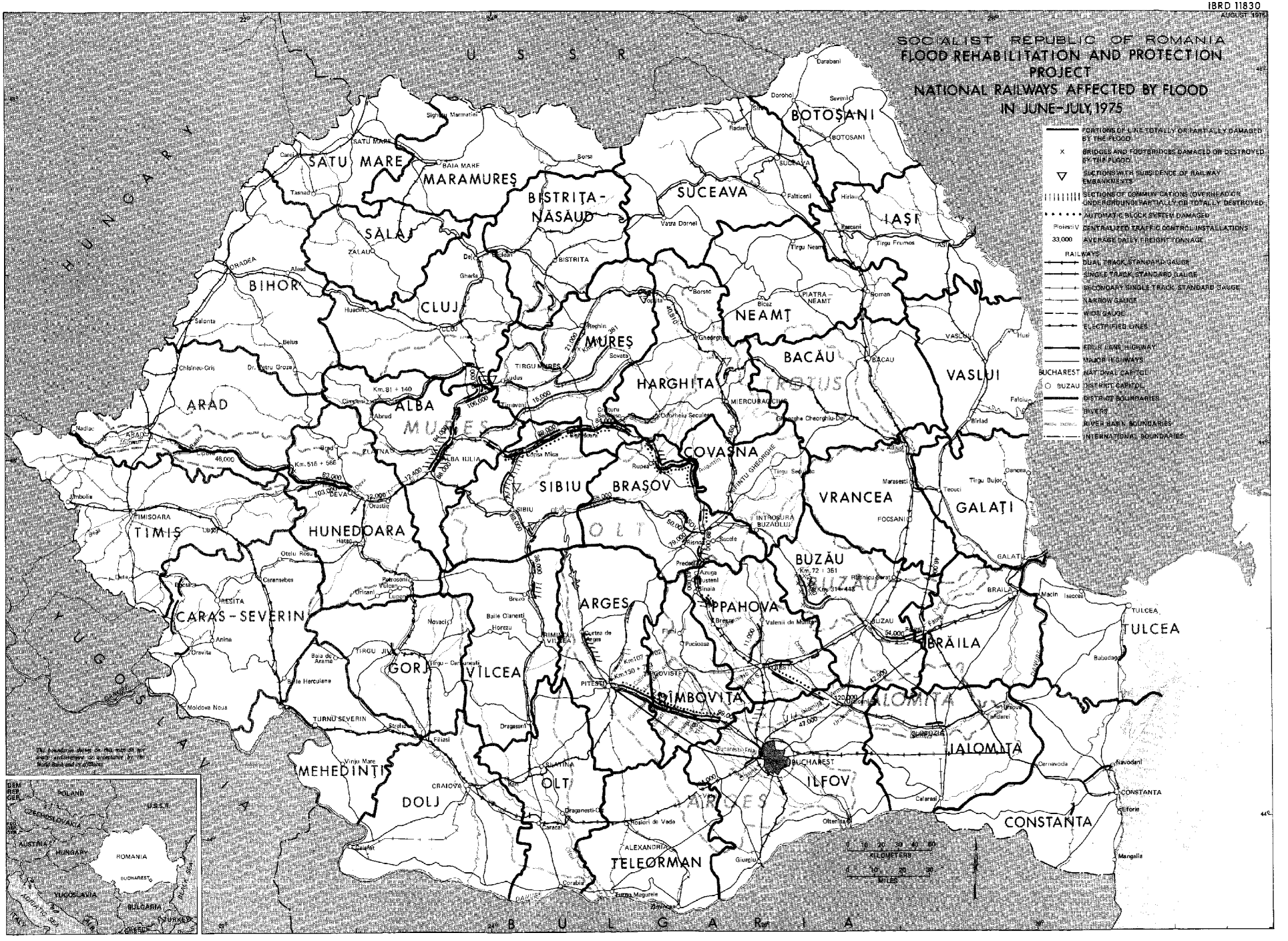
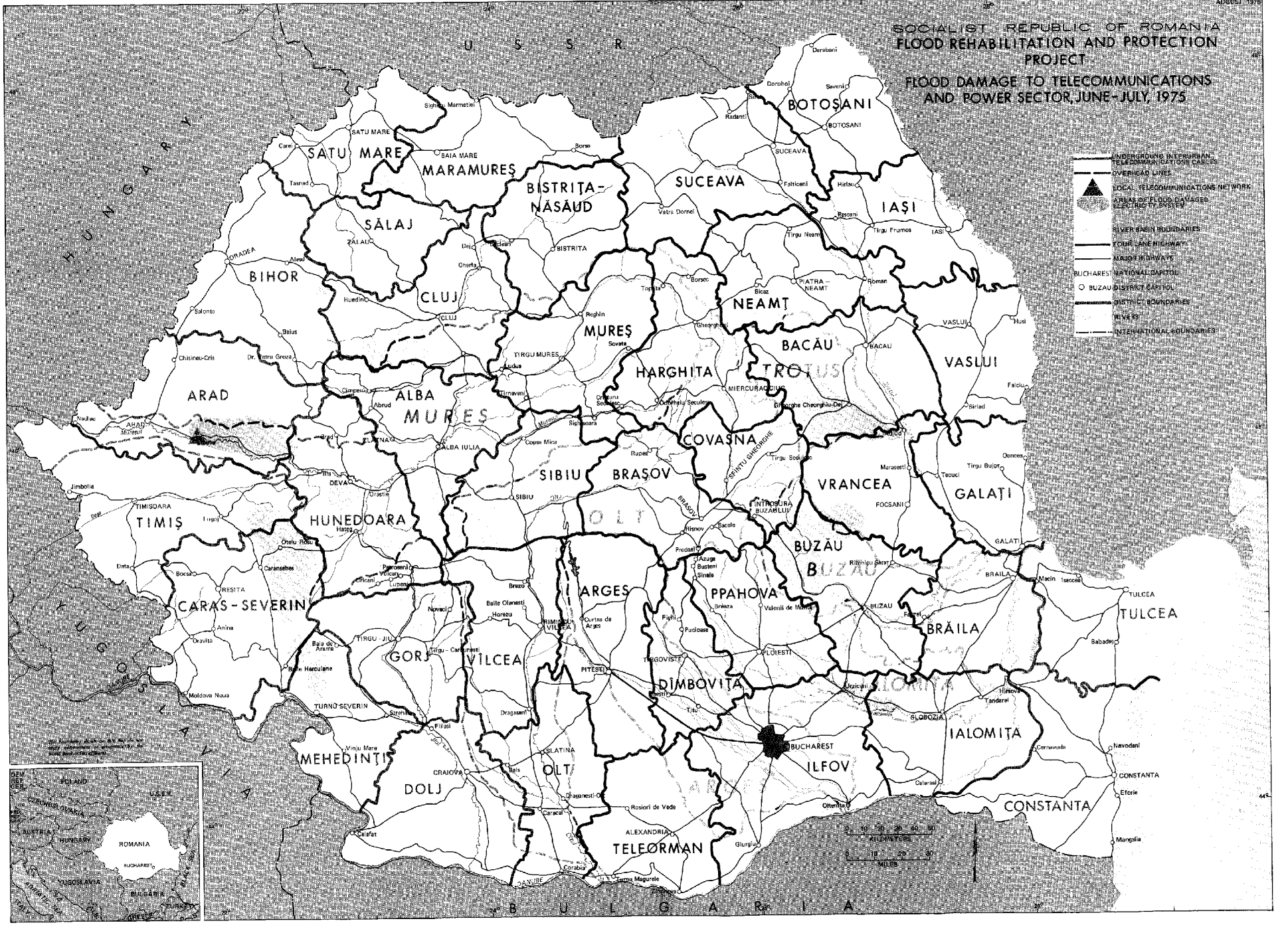
AUGUST 1975



IBRD 11831
AUGUST 1975

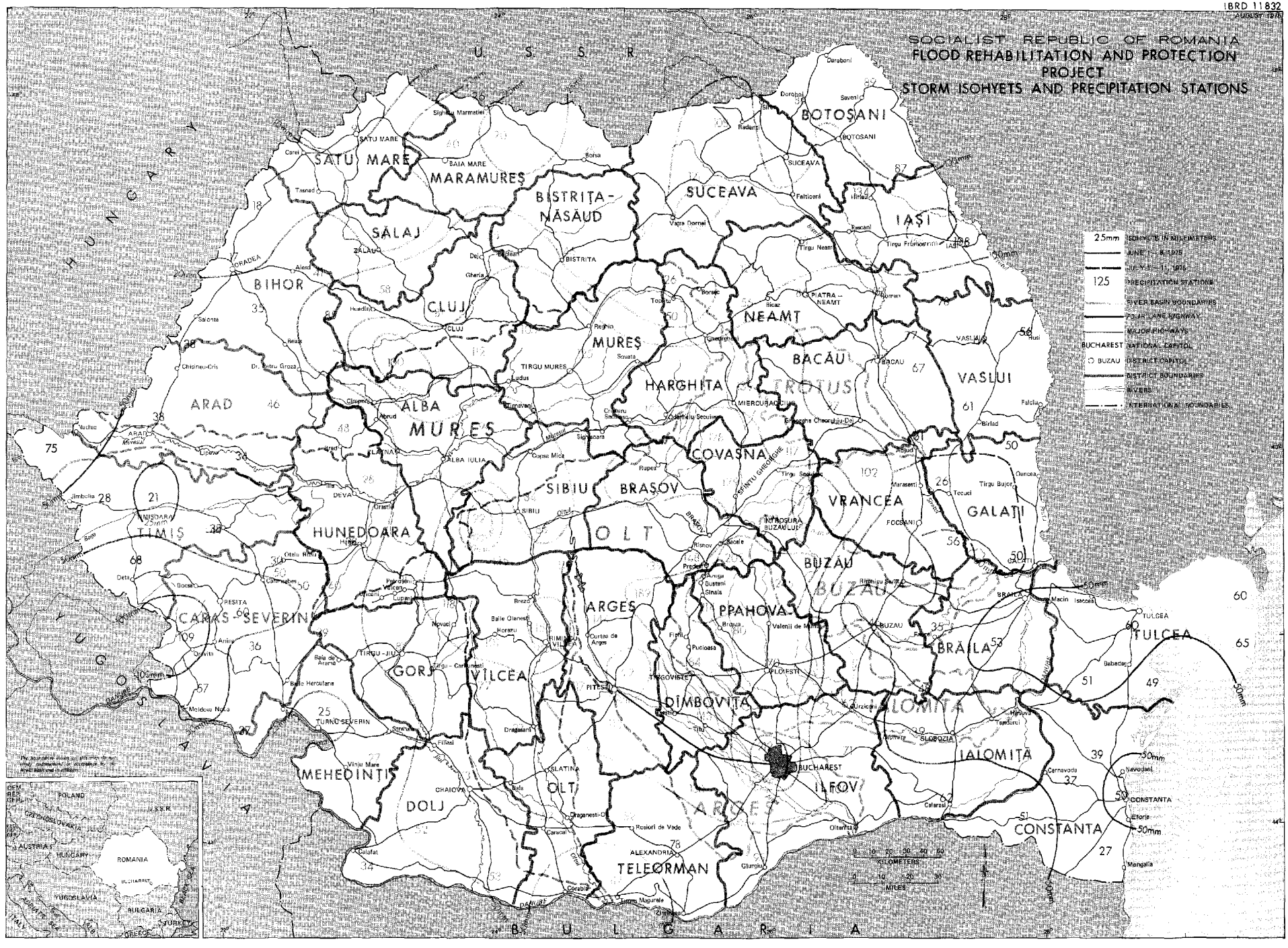
SOCIALIST REPUBLIC OF ROMANIA
FLOOD REHABILITATION AND PROTECTION PROJECT
FLOOD DAMAGE TO TELECOMMUNICATIONS AND POWER SECTOR, JUNE - JULY, 1975



IBRD 11832

AUGUST 1978

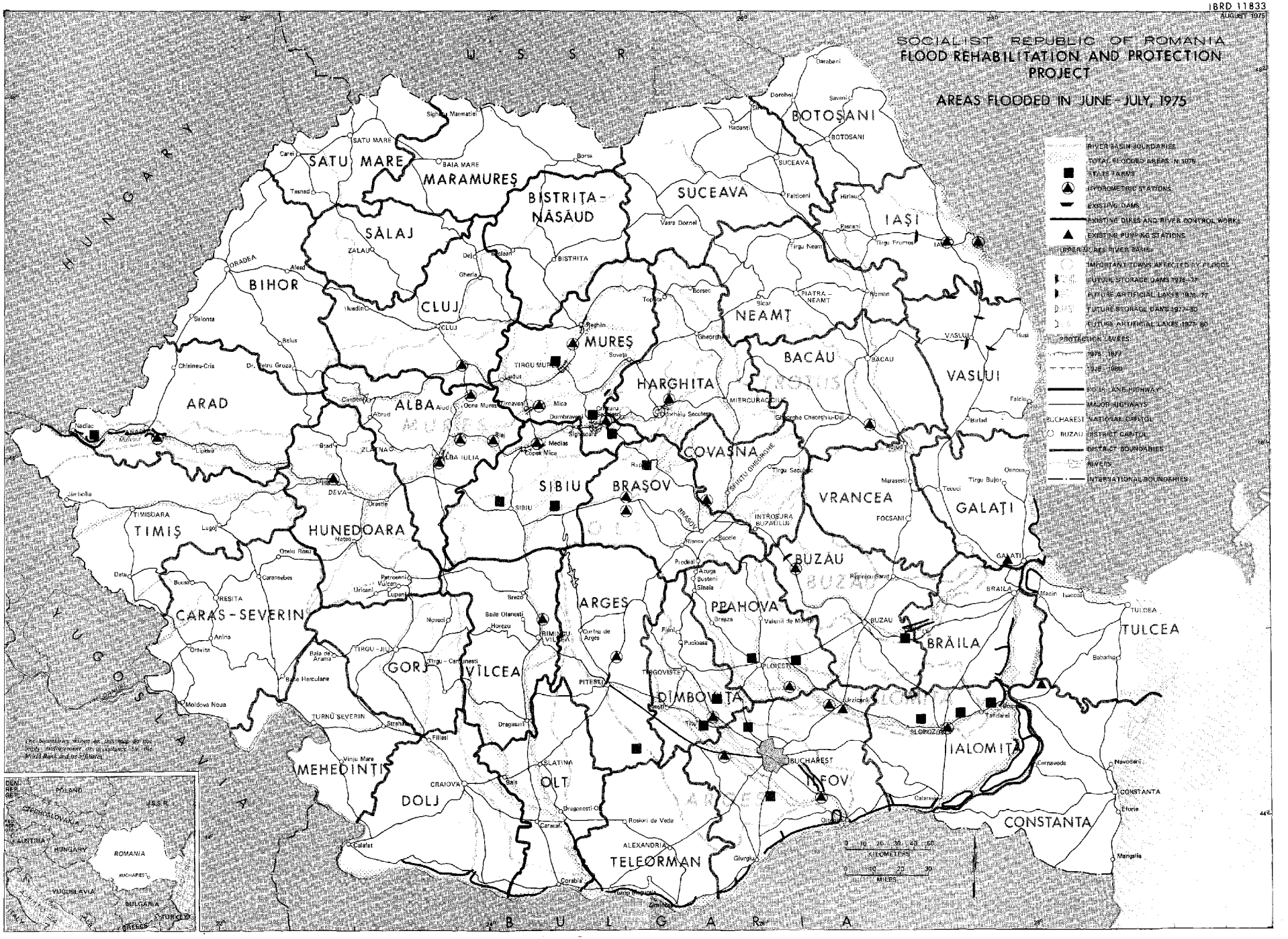
SOCIALIST REPUBLIC OF ROMANIA
FLOOD REHABILITATION AND PROTECTION PROJECT
STORM ISOHYETS AND PRECIPITATION STATIONS



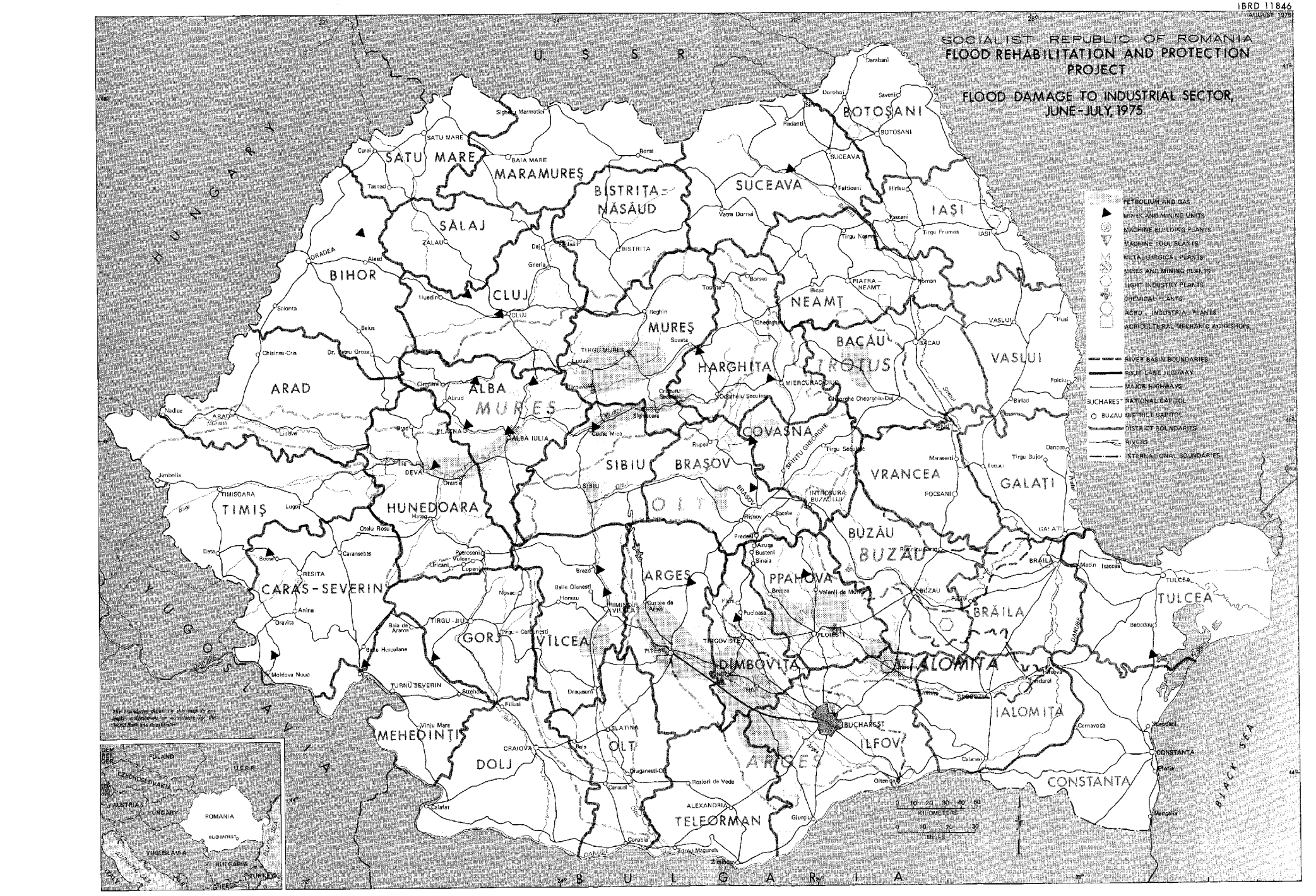
IBRD 11833
AUGUST 1975

SOCIALIST REPUBLIC OF ROMANIA
FLOOD REHABILITATION AND PROTECTION PROJECT

AREAS FLOODED IN JUNE - JULY, 1975



IBRD 11846
AUGUST 1975

SOCIALIST REPUBLIC OF ROMANIA
FLOOD REHABILITATION AND PROTECTION PROJECT

FLOOD DAMAGE TO INDUSTRIAL SECTOR, JUNE-JULY, 1975