PN-ABC-368

contracting corporation of America

DAMAGE ASSESSMENT

FINAL REPORT

PREPARED FOR THE

AGENCY FOR INTERNATIONAL DEVELOPMENT

EL SALVADOR

DECEMBER 6, 1982

CONTRACTING CORPORATION OF AMERICA
AID CONTRACT NUMBER: 519-0177-C-00-2046-00

The views expressed herein are the views of the contractor and are not necessarily the views of USAID.

Denver Office
820 Acoma Street
Denver, Colorado 80204
(303) 825-6017

Washington Office:
1140 Connecticut Avenue N W
Suite 309
Washington D C 20036
(202) 293-3685

Chicago Office:
25 West Chicago Avenue
Suite 200
Chicago, Illinois 60610
(312) 649-5950

contracting corporation of America

December 6, 1982

Mr.
CHUCK BRADY
AID/GDO

Reference: Contract AID 519-0177-C-00-2046-00
Damage Assessment Study

Dear Mr. Brady:

This represents our final report under the referenced contract. Under the contract we have delivered five reports as follows:

Report	Date
Helicopter Assistance Study	October 29, 1982
Project Loan Status/Evaluation	November 15, 1982
Procurement Study	November 15, 1982
Report No. 1	November 15, 1982
Report No. 2	November 30, 1982

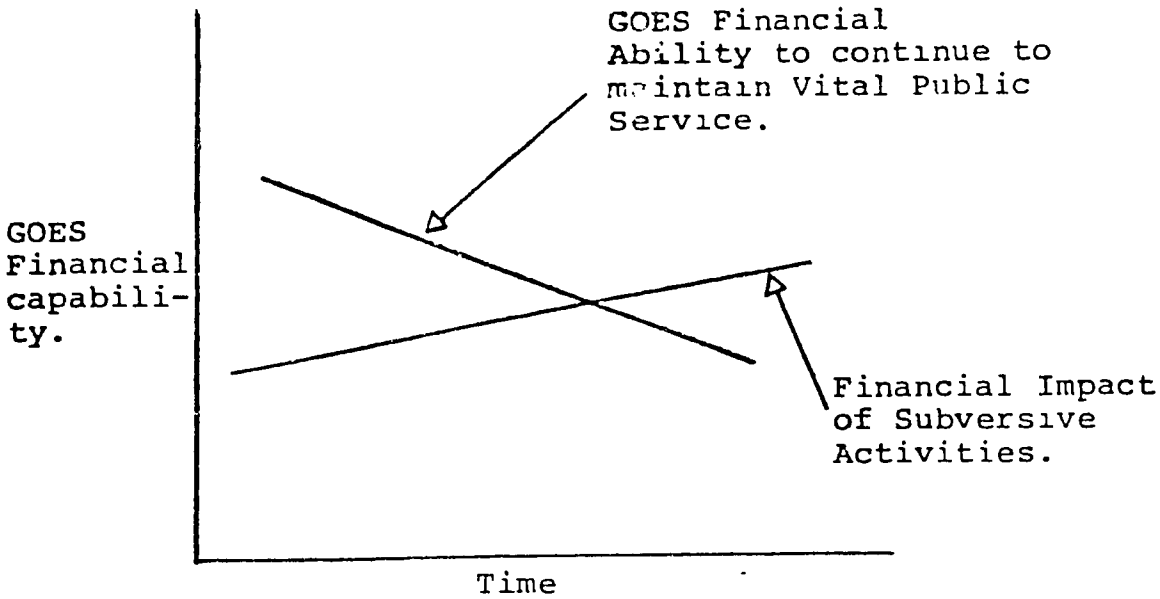
As discussed during our presentation in November 1982 with M. Dagata, B. Sogge, P. Buckles, C. Brady, and members of our team, there are several extremely important questions that remain unanswered.

Perhaps the most important question, in view of the substantial decline in economic trends and the apparent increasing level of subversive activities (both in terms of number of incidents and impact on the economy), is: How long can the GOES continue to internally finance the maintenance of public vital services? The following chart demonstrates these trends:

Denver Office
820 Acoma Street
Denver, Colorado 80204
(303) 825-6017

Washington Office
1140 Connecticut Avenue N.W.
Suite 309
Washington, D.C. 20036
(202) 293-3685

Chicago Office:
25 West Chicago Avenue
Suite 200
Chicago, Illinois 60610
(312) 649-5950



When the two above trend lines cross, the GOES's situation may be described as a "crisis", where public services will have to be restricted to those areas considered most critical or additional external assistance provided. With the exception of IMF credits, the AID is the GOES only major source of external assistance potentially available.

Based on our preliminary data, we believe the intersection of the above two trend lines may occur in 1983. The GOES may have limited options to to augment internal resources, but we are unsure of the extent of these options, or their political acceptability.

We do believe this issue warrants AID concern as well as a high priority for the GOES planning activity. To our knowledge, neither MINPLAN nor any of the responsible institutions, i.e. CEL, has attempted formal evaluations of the above nor are there any contingency plans should the situation develop as the current trends suggest.

In Section III of this report, we have proposed an approach for developing projections that would serve as a basis for developing appropriate contingency plans for maintaining the vital public services.

Very truly yours,

JERRY ZAHOUREK
Coordinator

DAMAGE ASSESSMENT STUDY

FINAL REPORT

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FINAL REPORT

1. INTRODUCTION

This report is a consolidation of our preliminary Reports No. 1 and No. 2. In addition, as a result of our analysis, it was generally recognized that further study is required in the area of determining that point in time when the individual agencies and the GOES exhaust their resources for maintaining the vital public services.

This report is presented in three sections, including:

Section I - Damage Verification Summary

This sections presents a geographic overview of the damage reported and verified by our engineers and an overview of the public institutions responsible for maintaining public services.

Section II - Economic Justification for Additional Investment

This section presents an analysis of political, economic, and security trends, a comparative analysis of damage to the economy, and a specific proposal for immediate expenditure of funds for the AID.

Section III - Proposed Damage Evaluation - Phase II

This section presents a follow-on effort to develop a planning document to estimate the point in time at which the GOES can no longer absorb additional damage costs without reducing current levels of public services.

SECTION I - DAMAGE VERIFICATION SUMMARY

1. Section Overview

The objective of this Section is to provide a verified summary of damage to the GOES infrastructure. In the following sections we present:

- An overview of El Salvador, the individual zones used to identify the geographic areas of the damage; and

- A damage assessment summary where we present the total damage estimates, our review methodologies, and sub-sector analyses;

2. Geographic Overview

For purposes of analysis, we have divided El Salvador into three sone: the Western, Central and Eastern Zones.

The impact of the subversive action combined with the economic recession varied throughout the country. In the Western Zone (comprised of the provinces of Ahuachapan, Santa Ana, and Sonsonate), where agriculture is the most important activity, the damage to the public services has been relatively slight, and the economy of the region, based on the production of coffee, sugar cane, and basic grains has continued almost unchanged. 21% of the total population lives in the Western Zone.

The Central Zone (made up of San Salvador, La Libertad, Chalatenango, Cuscatlan, La Paz, Cabanas and San Vicente) is the most important in terms of contribution to national production. This is due to the inclusion of the metropolitan area of San Salvador which has the bulk of the industrial, commercial, and financial activities of the nation. In this Zone the damage to public services has been considerable. It has 51% of the total population.

The Eastern Zone (which includes Usulutan, San Miguel, Morazan and La Union) has experienced the highest levels of guerrilla and terrorist activity. The economy of this zone is mainly agricultural.

The Eastern Zone has two well defined sub-regions. The northern mountainous region is low-productivity land used mainly for growing the basic food grains at the family level; the region south of the Pan American Highway reaching to the Pacific Ocean is highly productive land dedicated to two important export crops, cotton and to a lesser extent, sugar cane.

The Eastern Zone has been affected by the displacement of the major part of the population of its northern region towards its southern region as a consequence of guerrilla actions in damaging the infrastructure and public services. 28% of the total population is located in this zone.

3. Damage Overview

This Section presents a summary review of the subversive action damages by geographic area, an analysis of reported damage by public service area, the methodology used in the verification process, and a consolidation of the estimated damage cost requiring reconstruction/repair by GOES agency.

Based on the damage reports prepared by each of the GOES public service institutions, the estimated cost of damage to the national infrastructure from 1979 through the present is $33,750 thousand. This estimate excludes the September 1982 storm damage to the Western Zone roads and bridges.

A breakdown of the reported damage by public service shows that estimated cost of repair is as follows:

Public Service Area	($000's)	%
Electrical	$ 5,976	18
Bridges	16,399	48
Telephones	4,933	15
Railroads	5,458	16
Water Systems	984	3
Total	$ 33,750.	100

The estimated cost of damages includes the Puente de Oro under the above bridges category for a replacement value of $9,512. This is a GOES estimate based replacement of the original bridge. Replacement of this bridge is a complex issue involving fundamental design questions regarding the type, size, and kind of bridge; the existence of the San Lorenzo hydroelectric facility scheduled for operation in 1984 will substantially change water flow data and, possibly, the replacement bridge configuration.

The GOES value of the Puente de Oro has been included in all of our comparative analysis in the following sections. It is important, however, to recognize the impact the bridge replacement cost has on the total reported damage; for example the schedule below reflects the public service damage excluding the bridge:

Public Service Area	($000's)	%
Electrical	$ 5,976	25
Bridges	6,887	28
Telephones	4,933	20
Railroad	5,458	23
Water Systems	984	4
Total	$ 24,238	100

The conclusion from the above shows that the estimated cost for the damage is approximately the same for each public service, with exception of the water systems where damage values are relatively insignificant.

3.1 Geographic Distribution

As noted above the various zones of the Country have experienced different levels of damage. The following analysis shows that the Central Zone, which as noted above, contains 51% of the population, has experienced damage approximating $17,748 thousand representing 53% of the estimated damage, as follows:

ESTIMATED INFRASTRUCTURE DAMAGE

Zone	Population Percentage	Damage ($000's)	Percentage
Central	51%	$ 17,748	53%
Eastern	28%	14,529	43%
Western	21%	1,473	4%
Total	100%	$ 33,750	100%

The above represent estimated cost of replacement for the physical damage, not the estimated losses to the general economy.

As noted in the above schedule the impact of the damage to the infrastructure in relation to the population distribution shows that the Eastern Zone damage is one and one-half times greater than the Central Zone.

The breakdown of the physical damage by public service area is as follows:

SUMMARY SCHEDULE OF DAMAGE ($000's)

Public Services	Central	Eastern	Western	Total
Electrical	3,487	1,567	922	5,976
Bridges	4,035	12,058	306	16,399
Telephones	4,225	515	193	4,933
Railroads	5,130	328		5,458
Water Systems	871	61	52	984
Total	$17,748	$14,529	$1,473	$33,750

When the estimated Puente de Oro cost of $9,512 thousand is separated from the above the relative impact on the Central, as opposed to the Eastern Zone, increases substantially, as follows:

Zone	($000's)	%
Central	$ 17,748	73
Eastern (excluding Puente de Oro)	5,017	21
Western	1,473	6
Total	$ 24,238	100%

The above demonstrates that the Central Zone has, by far, sustained the greatest portion of infrastructure damage.

3.2 Damage Analysis by GOES Agency

The above reported damage was developed by each of the responsible GOES public service agencies. We reviewed the damage summaries and verified that the estimated repair/replacement costs were reasonable. Our review included site visits, and aerial surveys; in terms of the number of sites and monetary value, we verified substantially more than 10% of the reported damage and, in our opinion, with exception of the questions regarding the Puente de Oro, the reported repair/replacement costs are reasonably accurate. (Note: We believe the GOES has generally underestimated the damage costs; however this underestimate does not represent a material amount.)

Based on our analysis of reported damage, it was noted that much of the subversive action damage has already been repaired by the responsible GOES agency. The total estimated cost of damage pending repair/reconstruction is $24,442 thousand as follows:

GOES Agency	TOTAL ($000's) DAMAGE	REPAIRED	TOTAL
Comision Ejecutiva Hidroelectrica del Rio Lempa (CEL)	$ 5,976		$ 5,976
Ministerio de Obras Publicas (MOP)	16,399	$ 565	15,834
Administracion Nacional de Telecomunicaciones (ANTEL)	4,933	4,433	500
Comision Ejecutiva Portuaria Autonoma (CEPA)	5,458	3,627	1,831
Administracion Nacional de Acueductos y Alcantarillados (ANDA)	984	683	301
Total	$33,750	$ 9,308	$24,442

The above schedules contain two items requiring clarification. First, the CEL generally follows a policy of making temporary repairs rather than permanent replacement; this is generally accomplished by substituting posts for electric lines as opposed to towers; this repair technic is substantially less expensive and reduces the financial impact of repeat subversive actions (several key towers have been attacked as many as 8 times over the past two years). Additionally, CEL's repair time using temporary replacement is considerably reduced.)

The second item is the impact of the Puente de Oro on the total pending construction. As noted, the GOES estimate is $9,512 thousand and there are fundamental design issues which are as yet unresolved regarding the replacement. The modified total cost of reconstruction, excluding the Puente de Oro, equals $14,930 thousand.

The above reconstruction does not include, as noted, the estimated costs of the September 1982 storm damage to the roads and bridges in the Western Zone. Estimates for this repair have ranged as high as $10 million; confidential estimates by the MOP representatives indicate that repair costs are considerably less. Until a detailed listing of damage is available, we are unable to judge these repair costs; however, based on our aerial survey, we believe the total repair costs will be substantial and represent a true emergency for the economy of the damaged areas. (The MOP is treating the damage as an emergency and has concentrated its resources on making repairs.)

3.3 Estimated Financial Impact on GOES Agencies

The reported financial impact of the damage on the individual GOES agencies includes various factors including: (1) cost of repairs/reconstructions; (2) lost revenues; and (3) other additional operating costs due exclusively to subversive activities. The financial impact is discussed in Section II and an overview, by agency is presented in the Annex to this report.

Economically, however, the El Salvador situation has seriously deteriorated. The gains in the political process may very well be lost if the economic trends continue.

In addition to the world-wide economic recession, the Central American region is experiencing continued foreign exchange deficits resulting from the poor commodity prices for the region's export products. Additionally, the El Salvador September 1982 storms have been classified as the greatest natural disaster since an earthquake in 1965; the floods reportedly killed over 700 persons and destroyed significant portions of the coffee production, which is the country's main export product; estimates are that as much as 30% of the export crops for 1982/83 were lost.

Unemployment represents possibly the most single serious problem facing the country. Prior to the September 1982 storms, the urban unemployment was at an estimated 40%, and as high as 70% in some rural areas. The agricultural production losses from the storm will decrease the rural employment opportunities which are traditionally centered around the coffee and cotton industries.

The country's business and manufacturing sectors are equally hard pressed and continuing to deteriorate, due to the lack of foreign exchange for raw materials. Based on discussions with representatives of the key industrial sectors, the manufacturing sector is operating at an estimated 15% of capacity; and there are no signs that this will improve.

These are indications that the business community is entering a phase where there is a disappearing market for their goods and, there is little or no further borrowing capacity for continuing operations. The number of bankruptcies is expected to substantially increase in 1983; in fact, the business procedures associated with bankruptcy actions have ceased to function. The Assembly is considering special legislation to address this problem.

Over 50% of the business loans from the country's financial sector are estimated to be in default; this is also expected to substantially increase next year. The nationalized banking system has neither the resources nor the expertise to respond to what may be the financial collapse of the country's business community.

The financial projections for the GOES are equally poor. The financial base of the country cannot indefinitely continue to support the economic demands. In real terms the GOES's sources of funds are rapidly disappearing. The traditional sources of government revenues, i.e. export/import taxes are drastically declining; and the business community, as a source of tax revenue, has effectively disappeared.

Simultaneous with a marked decline in the GOES source of revenues, there has been increasing financial requirements for maintaining the country's economic order and security. The military requirements are absorbing increasingly greater portions of the national budgets; estimated at a 24% increase in 1981 and a even greater increase in 1982. The non-military requirements such as the maintenance of vital public services, are increasing while the GOES resources are declining.

military security increase, there are fewer resources available to support the country's non-military needs. The GOES declining resources will result in a marked decrease in the government's ability to, for example: (a) maintain vital public service; (b) provide the support required for the social and economic changes in the agricultural sector; and (c) a wide range of other critical programs.

In conclusion, although El Salvador's political situation appears to be improving, the economic conditions have seriously deteriorated and the trends and implications for 1983 are ominous.

2. Security Situation

The level of military activity has intensified during 1982. Evidence exists showing that the leftists are far better organized and equipped than previously. Further, the subversive strategies and activities appear to be better organized and coordinated, which is putting additional pressures on the ability to respond. (For example, in a recent attack on the electrical system serving the San Salvador area, the leftists simultaneously attacked the three northern, western and southern transmission lines providing power to the metropolitan San Salvador area resulting a temporary total outages followed by severe rationing.)

Not only have the subversive activities becomes better coordinated, the number of incidents directed toward damaging the economy are increasing. For example, in the electrical supply area, which is by far the most critical public service for El Salvador, the average number of attacks per month has increased as follows:

	Attacks/Month
1980	4
1981	18
1982	20

As noted, the damage to the electrical system resulting from the 1982 attacks has been considerably greater; the damage to the economy would also have been significantly greater had it not been for the GOES's ability to rapidly make temporary repairs through the use of the AID financed helicopter and replacement plant equipment. (It is important to note that among the international financing institutions, only the AID has been directly responding to the GOES damage related requirements.)

There is no evidence to suggest that the security situation will improve. In fact, the trends indicate just the opposite, and the GOES is entering 1983 with limited resources and/or prospects of maintaining its economy or even the public services that are considered vital to the GOES's creditability.

3. Extent and Nature of Existing Damage

The economic and financial impact on El Salvador resulting from (1) the subversive activities since 1979, and (2) the 1982 natural disaster has been monumental for the country. When the impact of this damage is coupled with the economic repercussions of the world-wide recession on the Central American region in general, it is a tribute to the GOES and the Salvadoreans that they have been able manage as well as they have.

3.1 Economic Impact of Damage

Since 1979, the constant attacks on public services and industries have produced a substantial deceleration of the GNP and has created increasing deficits in its foreign reserves, as follows:

	GNP Growth Rate 1978 Contant Prices	Net Foreign Exchange Reserves (Millions of $)
1978	4.0%	234
1979	-1.5	126
1980	-9.6	(70)
1981	-8.0	(149)
1982	-5.0 estimate	(105)

Since 1979, the Government of El Salvador has incurred deficits in its operating budget which limits its ability to increase investment to offset current economic conditions as follow:

	($ 000,000's)
1980 (deficit)	(46)
1981	(85)
1982	(150)

In the area of public services, the subversive attacks have had a major negative impact in the declining GNP, as well on the individual institutions responsible for maintaining those services. For example, using the World Bank standard that one KWH represents $2 of economic production, El Salvador lost over $115 million from electrical outages during the war period. The damage to El Salvador's electrical plant represents

only one public service area; an equal amount of plant damage has been experienced by the country's communications and transportation systems; and the other public service areas have been affected to a lesser extent.

3.2 Financial Impact on the Institutions

The financial impact of the subversive activities on the individual institutions has effectively changed the character of the country's infrastructure. Prior to 1979, El Salvador's electrical, communications and transportation systems were recognized as being the best and most modern throughout the region. This has changed dramatically; in fact the institutions are generally focusing their resources on making only those repairs critical to the maintenance of services. In certain areas, due to the high levels of military activity and limited resources, the public services are erratic, or simply no longer exist. In the Eastern part of the country, for example, there has been only sporadic electrical service for the last 18 months. Transportation passes through rivers during the dry season, and must take lengthy and expensive detours during the high water seasons.

The continuing impact of the subversive activies on the individual institutions is devastating, as follows:

Electrical Since 1979 CEL, which is responsible for providing electricity, has incurred over $20 million in damage related costs relating solely to maintaining power; this excludes the cost of replacing the damaged plant. The impact on CEL operations are obvious when it is recognized that CEL's total revenues approximate only $40 million per year. The situation is even worse when it is recognized that the reported revenues include increasingly large amounts which CEL will be unable to collect, because the electrical distribution companies are becoming incapable of maintaining cash flows due to damage repair costs and the general economic situation of their customers.

Currently, CEL is forced to spend in excess of 25% of its monthly cash flow in damage related repair and maintenance. If present trends continue, this percent will increase as revenues decline; should there be a substantial increase in subversive activities, other areas of the country will lose power supplies with a substantial negative economic and political impact for the country.

Transportation In addition to the 55 damaged bridges the subversive activities have substantially reduced the country's transportation system. The rail system, due to a lack of locomotives, has had to eliminate all passenger travel. For example, in 1981 CEPA, which operated the rail system, had 19 locomotives; as of October 1982 there were 11 operational units and the reliability of these units has been substantially reduced. (During this period there were 33 separate attacks on the system's locomotives.) CEPA has effectively exhausted its working capital and is depending on GOES subsidies to maintain its freight transport capability.

Communication El Salvador's communication system has reported 249 subversive attacks since 1979. It has been able to direct investment program funds to cover most repairs. ANTEL, the telecommunications company, currently estimates average monthly repair costs for the continuing subversive activities at $185 thousand; this excludes system damages estimated at $4.9 million.

The Annex to this report presents a summary of damage for each of the individual institutions responsible for maintaining public services.

4. Justification for Immediate Expenditures

A two part obligation is proposed. Part 1 contains two critical requirements for maintaining El Salvador's vital public services for which an immediate expenditure is proposed. Part 2 represents a lesser priority procurement for the same objective.

Part 1 proposed requirements include: (a) the provision of helicopter services to the GOES for the primary purpose of maintaining the electrical systems; and (b) the procurement of a generator with supporting infrastructure for El Salvador's Eastern region which has been an area having extreme subversive activity.

We recently evaluated the helicopter requirement of the GOES and concluded that: (1) the helicopter facility was absolutely critical to the maintenance of the national electrical systems; (2) the benefits to the economy from having reliable power supplies and the fuel cost savings to CEL far exceeds the costs of the service; and (3) the proposed Bell 205-A-1 unit is the most appropriate type of unit for the requirement.

The Part 2 proposal for the generator and supporting infrastructure for the Eastern region is presented below.

4.1 Background

As noted, maintaining electrical supply represents the single most important public service for the Salvadorean economy. From August of 1980 through November of 1982, El Salvador experienced over 5,000 power interruptions nationwide. During 1982, statistics indicate a power interruption rate 20 percent higher than 1981. In general, however, the negative economic impact of the power failures has been reduced by rapid repairs. However, in the Eastern region the impact of the power interruptions has been particularly devastating. Terrorist attacks on the power system are not only more numerous in this area, but their effects are more damaging, as repairs take longer due to continuous terrorist presence and activity in strategic areas through which transmission lines pass.

It should be noted that, in comparison with the rest of the country, the Eastern region has been a primary area of subversive activities. Although the Eastern region

contains only 28% of the population, it has experienced 43% of the total estimated cost of all subversive damage; since 1979 the damage cost per capita ratio for the Eastern region equals 2.2 times the losses per capita in the San Salvador area, which has the second highest loss/per capita ratio in the country.

The technical problem of providing electricity to the East is not the result of limitations in the quantity of electrical power produced, but rather the location of power sources for the region. All present sources are situated in the Western and North-Central regions, and electricity must be transmitted to the East via long distance high voltage lines. The long distance lines transmit 115 KV of power, and frequently pass through remote areas. Short distance lines (10-25 miles in length) transmit 46 KV of power from the main long distance line to the more remote areas in the region normally along existing roadways.

There is one major 115 KV line loop network with three major line sections installed in the East. The system is designed such that any one line section is capable of meeting the entire region's needs should one or two of

the sections become inoperable. Two of the line sections are now permanently out of service because of their location is in areas of continuous terrorist presence, which prevents repairs. The one remaining high voltage line section, while accessible to repair teams, is still subject to frequent terrorist attacks.

4.2 Economic Impact

In 1981, there were 21 power failures in the East longer than one day in duration; one outage lasted longer than a month. The region was without electricity for a total of 135 days during 1981. Total energy not delivered during this period is estimated at 26 million kilowatt hours. Using World Bank production loss estimates of $2 per KWH, the electrical shortages had a cumulative negative impact on production of $52 million.

In the first seven months of 1982, and despite rapid repair capabilities, there were 32 full days without electrical power, at an estimated loss of $20 million.

The Eastern Region is predominantly an agricultural based economy where, agriculture represents approximately 60% the region's contribution to GNP. According to the Central Reserve Bank estimatess the agricultural outputs in the area approximated $2,6 million in 1979, compared with a 1981 production of $170 million; a decrease of approximately 36% in two years, which is substantially more than national average.

4.3 Conclusion for Immediate Expenditure

Providing reliable electrical power to the Eastern region represents a high priority to the GOES in its effort to maintain vital public services as well as the support of the approximately 1.3 million persons living in that area. The Eastern Region is presently the only major area without a reliable source of power.

The above economic impact analysis shows that the loss of electrical power is costing the economy far more than the estimated cost of providing reliable power.

Additionally there are important social and political justifications which warrant immediate expenditures for providing a reliable source of power. For example, the economic situation in the Eastern region is resulting in a substantial migration to the Central region; many of these families are abandoning their homes and seeking employment in the San Salvador area which is further burdening the precarious employment situation and the city's social services.

4.4 Examination of Alternatives

The security situation in the East is such that normal operations of the 115 KV lines over the near to medium term is not a viable alternative. After serious study of the problem, the national electric company (CEL) has concluded and USAID concurs that the best solution for a reliable electricity supply in the East under the present circumstances is a local source of electricity approximating 24 MW to feed a network of short-distance 46 KV lines. The advantage of this solution is that 46 KV lines strung along roadways are accessible, easily constructed, and rapidly repaired.

CEL has considered several options for a 24 MW source of power including: (1) a geothermal unit in Usulutan but the 20 months for installation was unacceptable; (2) placing a generator on a barge in La Union but this option would require new high voltage lines from the port to the major urban areas; (3) using three smaller generators that could become available except that these units would require a custom-made transformer with an approximate one year lead time to purchase; and (4) a single 24 MW gas turbine generator which can be installed within a maximum of six months.

Following this analysis, CEL selected option (4) above since it was the only option that meet the urgent time requirements. The AID subsequently contracted with EBASCO Corporation for an evaluation of the various options. The EBASCO recommendations were (1) a local source of power was urgently need for the Eastern region; and (2) CEL should transfer a similar electrical generator from the Soyapango power plant which has provided back-up service to the San Salvador area. The rationale for the transfer was based on historical usage requirements.

We conducted a subsequent analysis of the trends of subversive actions and reviewed the general impact on the economy. Our analysis showed that:

1. The level and effectiveness of the subversive activities is increasing, rather than declining or even remaining static;
2. The general condition of the country's electrical transmission and distribution systems are steadily deteriorating due to the multiple repairs with the result that the present network is a much weaker system with declining levels of reliability;
3. The general economic situation has continued to decline making it more difficult for the GOES to constantly be repairing vital public services; and
4. The stategic importance of the greater metropolitan area in and around San Salvador outweighs all other areas of the country and that no action should be taken that would weaken the electrical supply system for that area.

85% of the national electrical demand is in the San Salvador area, and recent subversive attacks on transmission lines and substations to San Salvador has necessitated use of all Soyapango generators on a frequent and recurring basis. For example, although CEL has developed a rapid repair capacity which has reduced the outages per incident, the October 1982 requirements for fossil fuel to operate the Soyapango generators averaged $121 thousand per week, as opposed to an average of $107 thousand per week for the preceeding 18 months; this represents a 14% increase in emergency usage.

Moreover, peak demand requirements for the San Salvador area are currently requiring these generators on a regular basis. The current peak demand requirements for the San Salvador are equal to the 1979 pre-war levels; this is due to a shift in the working operations of many industrial firms which have essentially programmed their operations during the normal work hours, rather than early shifts and night shifts. These industrial firms have made this change due to the frequent electrical outages that occur regularly during the evening and early morning hours. The normal trend is that the towers are sabotaged at night and the power supplies are rationed, or not available, until the CEL helicopter supported crews repair the damage, which is usually before the normal work day begins.

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Furthermore, the distribution limitations for the San Salvador area effectively and unequivocably require the Soyapango #3 unit as a back-up when either of the two remaining substations serving the area are out. The following presents the San Salvador substation configuration for the distribution of electricity including (1) the rated capacities of the substations, (2) designed normal operational capacity, and (3) current operations based on actual demand, as follows:

	Capacity (MW)		
Substation	Rated	Normal	Current Actual (MW)
(1) Nejapa	60	30	(destroyed-October 1982)
(2) San Antonio Abad	100	50	90
(3) Soyapango	100	50	70
	260	130	160

All electricity distributed in El Salvador passes through substations (2) and/or (3) above; or is generated by the units located at the Soyapango substation. It is obvious that when either or both of the substations are out; the Soyapango generators must come on-line to meet the average current demand of 160 MW.

In conclusion the only viable alternative for the Eastern region is the purchase and installation of an appropriate generator from the U.S. at the earliest date possible.

5. Financial Plan

The financial plan for this program approximates $11 million as follows:

	($ 000,000's)
1. Priority/Immediate Procurement	8
2. Priority/Future Procurement	3
Total	$11

The financial plan for the above proposed priority immediate expenditure amounting to $8 million follows:

Description	($ 000,000)
(1) 24 MW Gas Turbine Generator	4.6
(2) Installation costs/facilities	1.4
(3) Construction of supporting 46 KV lines	1.0
(4) Helicopter Services (1983)	1.0
	$8.0

The 24 MW gas turbine generator, installation and construction of the supporting 46 KV lines represent a total immediate investment requirement of $7 million.

Approximately 125 Kms. pf 46 KV line will be installed to provide service as follows:

a. El Delirio - Usulutan (57 km)

b. El Delirio - La Union (32 km)

c. San Miguel - La Estancia (12 km)

d. Chapeltique - San Francisco Gotera (24 km)

The total cost of the above 46 KV lines will approximate $2.5 million; $1.0 million representing dollar requirements and $2.5 million representing colones which will be provided from some other source.

The priority/future procurement financial plan equals $3 million and consists of priority electrical plant components required to replace damaged plant and/or other additional plant assets required to strengthen the electrical system. These components include:

- Mobile substations 46/13.2 KW, 5 MVA: and a 115/46-23 KV, 20 MVA
- A 46 KV substation for San Lorenzo
- Inventory requirements including transformers, insulators, connectors, and other hardware required for line maintenance.

SECTION III - PROPOSED DAMAGE EVALUATION - PHASE II

1. Background

Under the Damage Assessment Evaluation program we completed Phase I of a macro planning strategy required by the AID. We verified and documented: (1) existing damages; (2) the costs to repair the damage on provisional basis; and (3) the cost to reconstruct the facility following termination of the subversive activities.

Additionally, we established the priority requirements of the GOES for the maintenance of basic public services, based on economic analyses of the higher priority needs of each of the institutions responsible for public services.

In terms of the GOES maintaining public services, the evaluation revealed that certain immediate priorities exist that are far more important than reconstructing past damage. Over the past three years the GOES has used its reserves to maintain public sector services; the foreign assistance in this area has been minimal when compared to the overall financial impact on the GOES.

There is clear evidence that subversive activities are continuing and, in terms of effect on the Nation's public service infrastructure, it appears to be increasing. The GOES's ability to continue to respond to continued attacks is declining while real costs of maintaining public services are increasing. These trends can not continue, if basic public services are to be maintained.

Based on the probabilities that the above trends will continue into 1983, it is essential that the AID/ES be prepared for these contingencies. An essential step at this time is gain a better understanding of the potential problems and to identify the various alternative solutions. Specifically, a comprehensive study is required on a crash basis to address the key issues including, for example:

1. What can be expected in terms of future damage; this projection should be developed on at least two assumptions including: (1) straight-line projections based on past trends; and (2) a projection based on an assumed increased level of effectiveness which is a reasonable assumption in view of the reported up-grading of the guerrilla forces.

These projections are considered critical for each of the vital public services, i.e. electricity, communications, transportation, etc.

2. What are the real costs to the GOES in maintaining basic public services, and what are capacities of the responsible institutions for maintaining operations under the projected conditions.

Determining the financial capacities of the key institutions to continue to maintain public services requires an in-depth review of: (a) working capital including cash, inventories and program inputs currently in the pipe-line; (b) working conditions and status of existing plant, e.g. CEL reports certain areas of its electrical transmission network are nearing the status becoming non-repairable on a temporary basis and major reconstruction will soon be required or alternative lines constructed; and (c) the capacity of these key institutions to finance the projected requirements including the potential for acquiring new capital.

3. Recommended Level of Effort

The project will require a professional staff of 4 persons including:

1	Economist	60 work days
1	Engineer	60 work days
1	Financial Analyst	60 work days
1	Coordinator	30 work days

This step will force each of the institutions to prepare projected operating plans which will help identify the critical priority projects under different assumed conditions, as well as serve as a basis for identifying not only the potential 'crisis' areas but also when the crisis might occur. (Note: Based on CCA's evaluation, not even CEL, which is the most sophisticated of the institutions, has formally developed this type of planning on a comprehensive basis.)

3. Based on the projections under 1 and 2 above, a shortfall of resources will be identified for both projected levels of subversive activity. The next step is to determine the GOES financial ability to provide the needed resources. This determination should include all potential sources, including internal generation, and foreign assistance (including AID, BID, etc.). Additionally, these shortfalls are required in terms of dollars and local currency resources.

The above information is considered critical for the GOES planning, as well as for the AID programming. Since this study is a continuation of our Damage Assessment Evaluation,

It is recommended that that contract be amended to include a Phase II comprehensive review of the possible future GOES requirements for maintaining vital public services for 1983/84. Our personnel are uniquely qualified and are prepared to continue this review; moreover, in view of the potential urgency of the survey conclusions, we are able to immediately begin working productively with each of the key organizations since we have already established the working relationships necessary for this type of in-depth data.

2. Proposed Scope of Work

Contractor is to provide a series of preliminary draft reports for each vital public services sector covering points 1 and 2 above. Following these reports, the Contractor will prepare a consolidation of the data and include analyses as described in point 3 above and present a draft consolidated report with appropriate presentations to GOES and AID personnel as directed by the AID.

It is estimated that the entire study will be completed within a three month period; the preliminary draft reports by sector will be presented at the beginning of the third month; following review and consolidation the final report will be delivered at the end of the third month.

ANNEX

This Annex presents an analysis of the individual GOES agencies as follows:

1 CEL

2. CAESS

3. MOP

4 ANTEL

5 CEPA

6 ANDA

1. CEL

The nation's electrical power is generated 92% by the autonomous government institution CEL (Comision Ejecutiva Hidroelectrica del Rio Lempa) and the rest is generated by private electric companies. The private companies, however, distribute 90% of the electrical consumption. They supply urban areas under government-regulated tariffs by buying electricity from CEL, while CEL distributes the rest to small rural populations under subsidy from the government. See section 4.1.1 below on distribution system.

El Salvador has sufficent installed capacity to produce electricity entirely through low cost hydroelectric/geothermic sources and still be a net exporter of power. However, subversive activity has semi-permanently reduced by half the transmission capacity from Cerron Grande (the largest power plant until San Lorenzo Dam is inaugurated in 1984) since only one of the double circuits can be repaired for any length of time. When sabotage damage forces dependence on fossil fuels for turbine and steam generators, the added fuel costs have exceeded $100,000 per day, on occasion, and have averaged $15,000 per day for more than the last two years (August 1980 to November 1982). Rural electrification plans, which had objectives of increasing agricultural development, decentralizing industry and slowing rural migration to urban areas, are similarly affected.

Damage to CEL transmission lines and installations by zone as of November 4, 1982, is presented below:

CEL
CLASSIFICATION OF DAMAGE BY ZONE
($000's)

CATEGORY	ZONE CENTRAL	EASTERN	WESTERN	TOTAL
Towers and Structures	2,813	1,115	922	4,850
Substations/Other Equipment	674	452		1,126
Total	$3,487	$1,567	$922	$ 5,976
Percentage	58%	26%	16%	100%

The above towers and structures category includes 235 115-KV towers which have an average replacement cost of $24,000. As noted above, this category represents the major losses for CEL, approximately 71% of the total damage. The substation and other equipment include damage at nine different substations, two repeaters, and a gas plant at Soyapango. (Note: CEL is losing towers and temporary poles on practically a daily basis, in fact on November 12, 1982, a coordinated attack at three locations eliminated power transmission from the hydroelectric and geothermic plants for a few hours and San Salvador was receiving power from the Soyapango generators on a rationed basis for a few hours.)

CEL is following a policy of concentrating resources on temporary repairs, as opposed to permanent replacement. This is due to the risk of multiple attacks (several towers have been sabotaged as many as five times since 1980) and CEL has neither the time nor resources to attempt permanent replacement at this time; furthermore, as subversive activities against the electrical system continue, CEL's options are effectively limited to their current modus operandi.

(Should the level of subversive activities intensify, as the current trend seems to indicate, it may be appropriate to conduct an independent study of CEL's continuing financial capacity to maintain the electrical supply.)

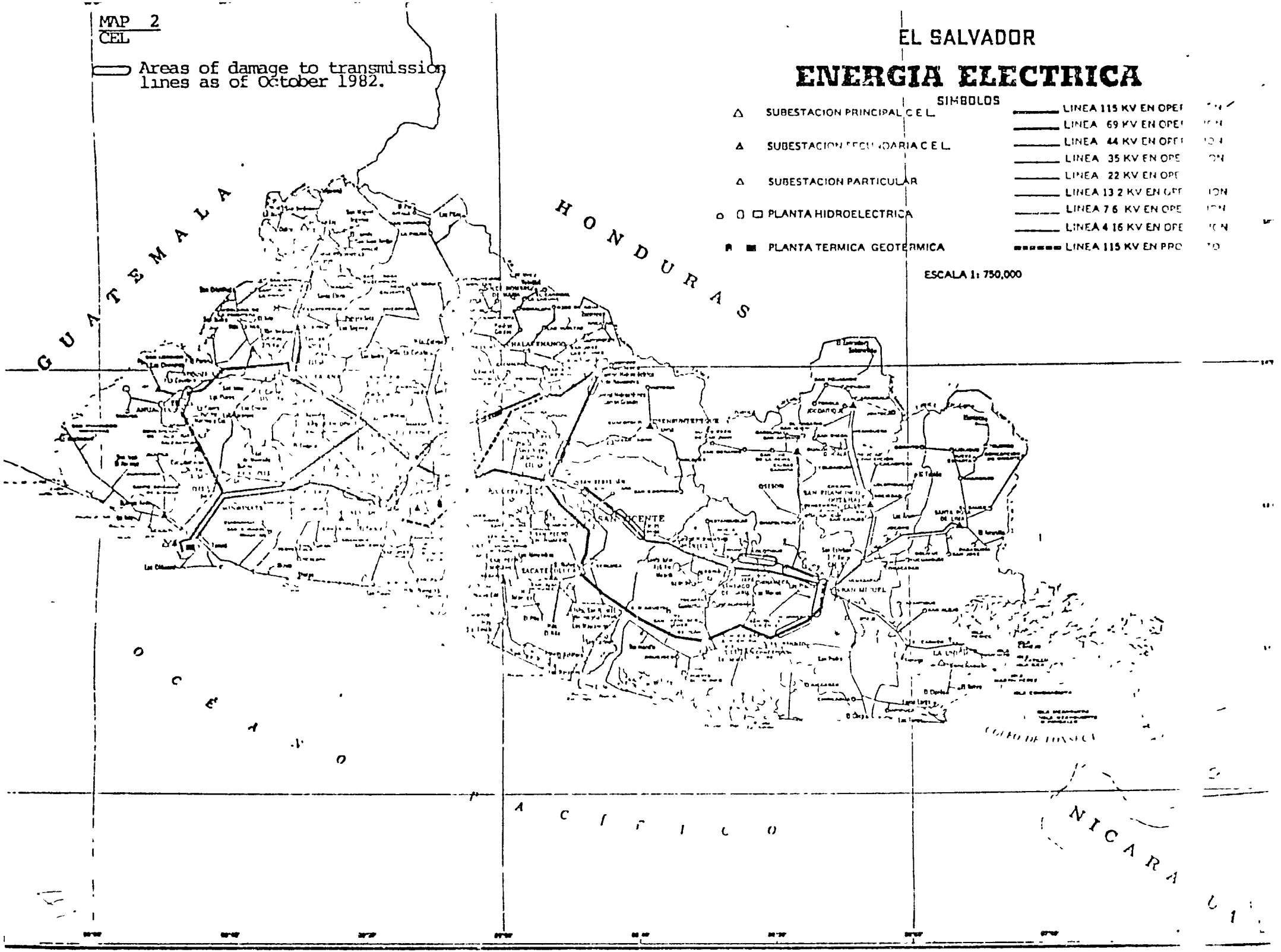
The subversive action financial impact on CEL's operations has been substantial; far worse than the accumulated economic impact on the other institutions surveyed. As of the November 4, 1982, the additional direct costs incurred by CEL resulting from subversive action equals $12.9 million as follows:

	[illegible]
Fuel for generation	12,052
Temporary repair	851
Total	$12,903

The financial impact on CEL's operations has been considerable, in fact, the additional cost of operations over the three years is almost twice the reconstruction cost of the damaged plant; most of this is due to the cost of fuel and the costs of providing security for repairs.

MAP 2
CEL

Areas of damage to transmission lines as of October 1982.



2. Electrical Distribution-CAESS

CEL produces most of the El Salvador power requirements. Additionally, CEL distributes approximately 10% of the power, generally to those less populated rural areas where distribution costs are higher.

The remaining 90% of the electrical power is distributed by eight private companies which are regulated by the GOES under a concessionary agreement expiring in 1985; the GOES is negotiating the purchase of those companies through CEL.

The private companies and number of customes are as follow:

Companies	Number of Customers 000's	%
CAESS	221.3	64
CLESA	40.0	12
CEL	43.6	12
CLES	17.5	5
CLEA	6.2	2
DEUSEM	13.4	4
DESSEM	2.0	1
RM. Co.	1.5	
Total	345.1	100

The principal distribution company is CAESS (Compania de Alumbrado Electrico de San Salvador, S.A.) servicing major portions of the central geographical zone of the country and has 64% of the total number of consumers. This company distributes also within the San Miguel and La Union municipalities within the Eastern Zone. CAESS distributes 73% of the power produced by CEL and, additionally, has small hydroelectric and steam-powered generating plants of its own.

An analysis of the distribution by type of consumer shows the following:

Type	Number of Consumers (000's)	%
Residential	299	86
Commercial	35	10
Industrial	6	2
Government	5	2
Total	345	100

The above data is as of 1980. Several of the companies require subsidies. For example, DEUSEM, operating in the Eastern Zone distributes 3% of the total power consumed and is receiving subsidies. Several of the others are also requiring Government assistance.

With exception of CAESS, damage information is not available at this date.

The CAESS preliminary estimated subversive damage cost to CAESS approximates $1,596 thousand as follows:

	($000's)
Damage from January 1982 to present:	
Substations and power plants	$ 294
Transportation/communication equipment	120
Rural distribution system	80
Urban distribution system	72
	566
Damage from January 1979 to December 31, 1981	1,030
Total	$ 1,596

We have not received the supporting detail for the above damage and did not inspect any of the damaged plant.

3. MOP

The Ministerio de Obras Publicas is responsible for several agencies, the more important of which include:

-Direccion General de Urbanismo y Arquitectura - urban roads, etc.

-Direccion General de Caminos - rural roads, bridges

-Oficina de Recursos Especiales - AID employment operation

The MOP maintains one of Central America's better road systems with over 260 bridges to maintain.

The estimated damages for the MOP are limited to those caused by subversive action. Based on aerial reconnaissance the September 1982 storm damages to secondary roads and bridges in the Western Zone are substantially greater than the estimated costs of subversive action damage.

The MOP's identified subversive action damage from 1979 to August 1982 consist of bridge and equipment losses. The following schedule presents a summary of these estimates.

MOP
CLASSIFICATION OF DAMAGE BY ZONE
($000's)

CATEGORY	CENTRAL	EASTERN	WESTERN	TOTAL
Bridges				
Others	$ 3,240	$ 2,167	$ 252	$ 5,659
Puente de Oro	--	9,512	--	9,512
Vehicles/Equipment	795	379	54	1,228
Total	$ 4,035	$ 12,058	$ 306	$16,399
Percentage	25%	74%	1%	100%

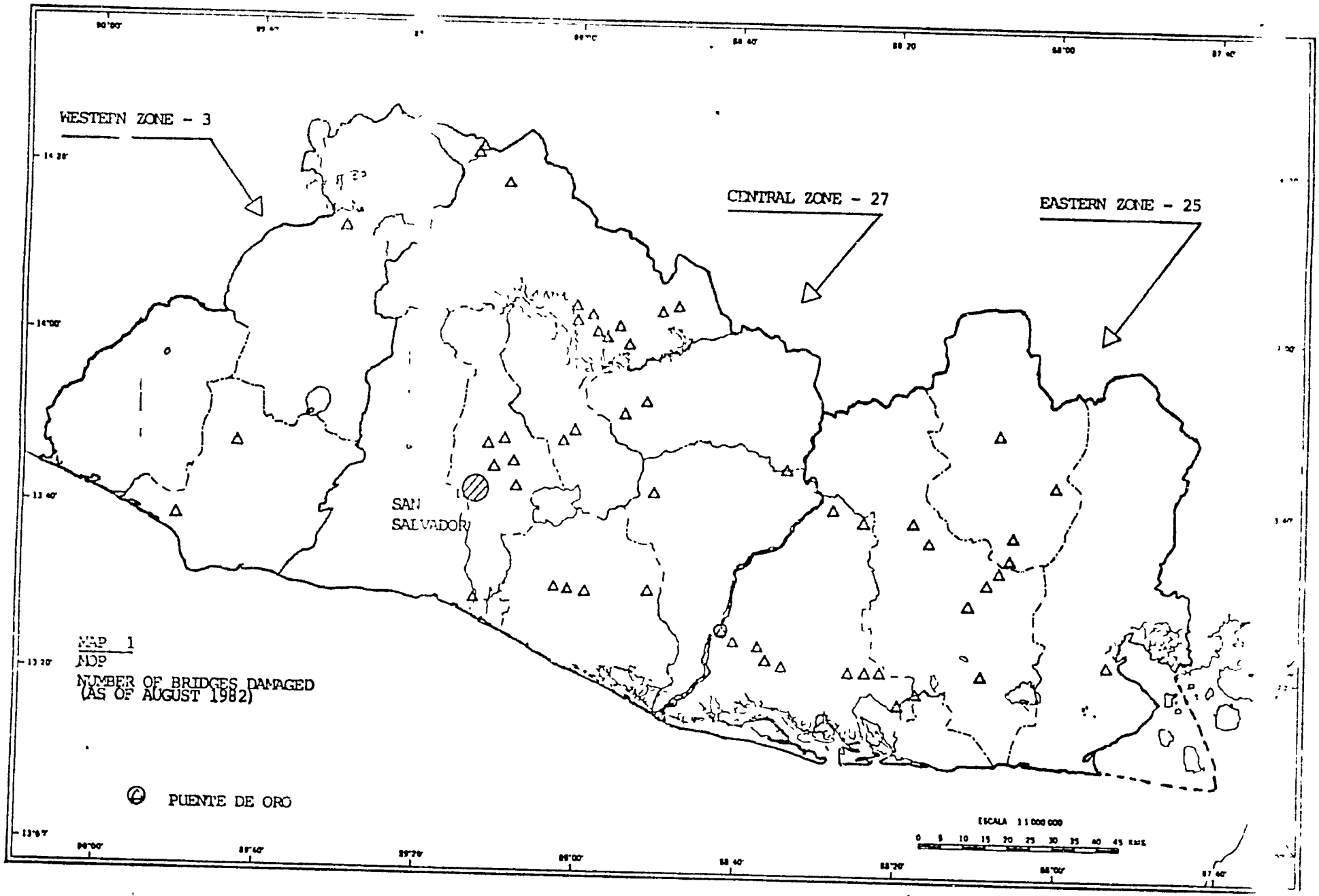
The above shows 74% of the estimate value of the damage is in the Eastern Zone. This unusually high percentage results from the MOP estimated cost of repair to the Puente de Oro, which equals $9.5 million and represents a loss 1.7 times greater than the total of all other bridges. It is noted that there are currently several reviews of the Puente de Oro situation regarding GOES's options, i.e. constructing a temporary crossing, replacing the previous facility, etc.

Including the Puente de Oro, there are 55 damaged bridges with reconstruction estimates of approximately $15 million; 27 of those bridges have been repaired at a reported cost of $565 thousand. The estimated cost of reconstructing the remaining 27 bridges, excluding the Puente de Oro, is estimated at $5,094 thousand. (The Map on the following page identifies the grographic locations of damaged bridges.)

The MOP equipment losses of $1,228 thousand represent losses as follows:

	US$ 000's	%
DUA	$ 315	26
CAMINOS	833	68
Others	80	6
Total	$ 1,228	100

The impact of the above damages to the MOP primarily has reduced its ability to maintain the Nation's roads. Economically, the cost to the MOP is basically limited to the cost of reconstruction; the cost to the general economy is, however, extremely significant, especially in those areas where there are no other alternative transportation routes. Even with alternative routes, the longer distances and poor condition of the roads substantially increases the transportation cost of goods and services; shortens the service life of the transportation equipment; and increases the demand for imported spare parts.


WESTERN ZONE - 3
CENTRAL ZONE - 27
EASTERN ZONE - 25
SAN SALVADOR
MAP 1
MOP
NUMBER OF BRIDGES DAMAGED
(AS OF AUGUST 1982)
PUENTE DE ORO
ESCALA 1:1 000 000

Reconstruction/repair activities have been limited in the Eastern Zone during recent months.

The economic impact on ANTEL resulting from the subversive action damage is estimated at $ 1,160 thousand as follows:

	($000's)
Revenue losses	$ 960
Additional insurance costs	200
	$1160

ANTEL's ability to maintain telecommunication has been excellent with only limited periods of service outages. We estimate that, with the exception of certain areas in the Eastern Zones, there has been only minor impact on the general economy.

4. ANTEL

The Administracion Nacional de Telecomunicaciones is an autonomous institution responsible for the national telecommunications network. ANTEL's operating budget approximates $45 million per year. ANTEL maintains over 65,000 lines with automatic control switching provides services to 261 municipalities and maintain over 5,346 Km. of telephone lines.

The damage to ANTEL's plant resulting from subversive action is presented below. There is no data yet available on storm or earthquake damages.

ANTEL
CLASSIFICATION OF DAMAGE BY ZONE
($000's)

CATEGORY	CENTRAL	EASTERN	WESTERN	TOTAL
Structures/ Furnishings	$ 760	$ 370	$ 113	$ 1,243
Dist. Boxes/Manholes	506	8	20	534
Switching/Office Equipment	815			815
Line	1,262			1,262
Others	882	137	60	1,079
Total	$ 4,225	$ 515	$ 193	$ 4,933
Percentage	86%	10%	4%	100%

As noted, 86% of the ANTEL's subversive damage has occurred in the Central Zone. The above calculations include 697 Km. of telephone lines stolen from 1979 to August 1982; in view of the fact that the quantity involved is substantially more than normal, ANTEL has included this item as subversive action damage.

ANTEL's damage lists include 249 separate projects all but 23 of which have already been repaired. Additionally, ANTEL losses include 13 equipment units.

As noted, ANTEL has repaired and/or replaced all damaged assets with the exception of an estimated amount to be reconstructed of $1,472 thousand, including $500 thousand of repair projects pending for which we were not able to classify by Zone.

5. ANDA

The Administracion Nacional de Acueductos y Alcantarillados is responsible for providing water and sewage services to urban areas; the Ministerio de Salud Publica y Asistencia Social provides these services to the rural areas. The breakdown of services in terms of the percentage of the total population served for the two is as follows:

	ANDA	MSP	TOTAL SERVED
Water	29%	22%	51%
Sewage	20%	29%	49%

The ANDA annual budget approximates $22 million. ANDA has developed damages estimates resulting from subversive actions, the September 1982 storm and the June 1982 earthquake. A summary of the damages follows:

ANDA
CLASSIFICATION OF DAMAGE BY ZONE
($000's)

CATEGORY DAMAGE	CENTRAL	EASTERN	WESTERN	TOTAL
Subversive action	$ 712	$ 61	$ 7	$ 780
Storm	141		45	186
Quake	18			18
Total	$ 871	$ 61	$ 52	$ 984
Percentage	[illegible]	6%	5%	100%

The geographical statistics demonstrate the general trends of damage. For example, there is little subversive action damage in the Western Zone, as opposed to the Eastern Zone; and the reverse is true for the storm damages, which were concentrated in the Western Zone.

In total ANDA's damages are relatively small when compared with the other public institutions; and, as with the other organizations, most of the damage is in the Central Zone.

ANDA damage list consists of 112 individual repair/reconstruction projects and 32 destroyed equipment units. All but 27 of the individual projects have been repaired; 20 of the individual projects result from subversive action.

The estimated cost of repair of the 27 individual projects requiring reconstruction equals $301 thousand; $221 for terrorist damages and $80 for storm damages.

The financial impact of the damages to ANDA's operations is basically the costs to repair the damaged plant. ANDA has experienced several incidents of subversive action resulting in financial losses such as robbery, lost revenues due to electrical outage, etc. These losses are estimated by ANDA to equal $78,022.

The magnitude of ANDA's total losses appear relatively insignificant and these does not appear to have been a major impact on the general economy. We recognize that these may have been social costs, i.e. additional sickness, disease, etc. from contaminated food supplies; however, we are unable to effectively estimate the significance of this possibility.

6. CEPA

The Comision Ejecutiva Portuaria Autonoma has administrative responsibilities for the railroad system throughout El Salvador. Total track for the country approximates 602 Km. In 1981 CEPA operated 19 locomotives and 660 units of rolling stock.

The railroad system track and rolling stock are functional for present uses. However, the track is narrow gauge and light weight and rolling stock is so old that (since the spare parts stock has been so depleted by terrorist activity) new spare parts must be manufactured to specifications which is both costly and time-consuming.

Comparative to systems in developed countries, El Salvador's railroad is expensive and probably not a long term economic system for the country.

There are currently two proposals for improving the system including: (1) acquiring light-weight motorcars for passenger service and cargo (40,000 lbs.); and (2) electrification of the rail system. Currently the BCIE is making a feasibility study of electrification alternatives to take advantage of the projected hydroelectric generated power that will be available.

Most of the repairs have been made through depleting spare parts inventories and cannibalizing. Through advances on the $1.6 million of funds allocated by the AID (Project 0279), additional parts have been ordered. It is recognized that the rail system is at risk as long as subversive activities continue and this limits prospects for major new investment.

The damages reported for CEPA are all related to terrorist activities. The railroad rolling stock covers wide sections of the country and a subversive action is relatively easy to accomplish.

CEPA
CLASSIFICATION OF DAMAGE BY ZONE
($000's)

CATEGORY	CENTRAL	EASTERN	WESTERN	TOTAL
Locomotives	$ 3,675	$ 235		$ 3,910
Other	1,455	93		1,548
Total	$ 5,130	$ 328	0	$ 5,460
Percentage	94%	6%		100%

In the above analysis, locomotives amount for 72% of the total CEPA damage costs. The other 28% represents damages to other rolling stock, equipment, and other asset damages. The distribution of the damage was based on an analysis of the incidents involving the locomotives and the percentage was used for the other category.

As of November 12, 1982, CEPA has eleven locomotives operating, two under repair, and three that are non-repairable.

Further analysis of the damage sustained by CEPA showed interesting trends which, although beyond the control of CEPA, should be given further attention. For example, the damage caused by dynamite to the following equipment occurred in essentially the same locations:

Date	Location	Locomotive	Damage
2/13/81	Km 166 - Tehuacan	#854	$875,000
8/ 9/81	Km 171 - Tehuacan	#863	215,000
3/18/82	Km 164 - Tehuacan	#858	4,000
4/30/82	Km 170 - Tehuacan	#802	3,400
5/23/82	Km 171 - Tehuacan	#862	2,000
7/ 5/82	Km 171 - Tehuacan	#851	4,000
7/20/82	Km 170 - Tehuacan	#860	8,000

The incidents at the above location account for 21% of the total reports of damage to locomotives. In total there were 33 incidents of locomotive damage, many of which involve the same units repeatedly; for example #863, in addition to the above, has been dynamited on four other separate occasions.

In terms of the total incidents, CEPA has repaired all locomotive damage with the exception of: (1) two units beyond repair (#854 and #855); and (2) four units that have sustained major damage estimated at $657 thousand which are currently under repair.

The other CEPA repairs are generally of a less important nature individually; of 143 incidents, there are 99 requiring repair with an estimated costs of $1,174 thousand.

The subversive actions on the railroads have had a major impact on its operations, and the rail system in critical to selected parts of the economy. For example, the Port of Cutuco which handles principally coffee and cotton, is accessible only by rail. Therefore, it is imperative that the GOES maintain rail service for those dependent on this form of transport.