PN. AAN-385
PN 2041

DESIGN REPORT

HELMAND VALLEY ELECTRIC POWER

Agency for International Development

July 1, 1966

HARZA ENGINEERING COMPANY
CONSULTING ENGINEERS
RIVER PROJECTS
400 WEST MADISON STREET
CABLE ADDRESS 'HARZENG CHICAGO' CHICAGO, ILLINOIS 60606 TELEPHONE RANDOLPH 6-3451

July 1, 1966

DESIGN REPORT

HELMAND VALLEY ELECTRIC POWER

USAID Mission in Afghanistan
APO 09668
Kabul, Afghanistan

Gentlemen:

We are pleased to present our Design Report on the Helmand Valley Electric Power System.

The rehabilitation, repair, improvement, and expansion of the Kandahar and Girishk Systems outlined in this report are based on plans resulting from surveys of our own and others and are limited to facilities needed to safely and economically distribute the electric power from existing generating plants and those plants expected to become available during the period of these services.

The Girishk 44 Kv transmission line poles will be repaired and repainted, three new 44 Kv switches will be installed to provide greater operating flexibility, and a portion of the 44 Kv line in Bost will be rerouted to remove it from areas where new houses are to be constructed.

New distribution substations will be erected in Bost and Kandahar, and the existing 400 Kva substation at Bost will be moved to Nad-I-Ali. The Bost and Kandahar distributing stations will be equipped with feeder voltage regulators, and metering equipment will be installed at all distributing stations.

Extensive additions to the distribution systems will be necessary to provide for the anticipated increase in the system demand during the

contract period. These additions are to include additional circuits, replacing conductors with wire of adequate size, adding transformers, relocating existing transformers to more suitable locations, and the rehabilitation and improvement of existing facilities. Primary, secondary, and service conductors will be # 4/0, # 1/0, or # 4ACSR, bare for the primaries and polyethylene jacketed for secondary and service applications. In areas where there is considerable tree interference, # 4/0 and # 1/0 aluminum, 15 Kv polyethylene insulated, spacer type cable will be used. Vehicles, tools, and materials necessary to maintain and operate the distribution systems are to be provided.

The tremendous expansion of the United States electric utility industry in recent years has increased the demands for material and equipment to such an extent that many items are in short supply with long deliveries. Because of this supply situation, material shipments will be delayed; and it will be necessary to delay the start of construction on this project with a resulting delay in completion. The completion Schedule in the Design Report has taken this delay into consideration. We request that this schedule be approved and that (a) Article IF of Contract AID/nesa-209 be amended to require that all work and services to be performed under this contract be completed in thirty-four (34) months from the effective date of the contract, and that (b) Article IB1 b (2) be amended to require that all material and equipment be procured and shipped within twenty-one (21) months from the effective date of this contract.

We would appreciate an early approval of this Design Report so that we may proceed with the preparation of design standards and construction drawings and the purchasing of the required material and equipment.

Very truly yours,

HARZA ENGINEERING COMPANY

Chester E. Bauman
Project Sponsor

DESIGN REPORT

HELMAND VALLEY ELECTRIC POWER
GIRISHK AND KANDAHAR AREAS
AFGHANISTAN

for

AGENCY FOR INTERNATIONAL DEVELOPMENT
U. S. DEPARTMENT OF STATE
WASHINGTON, D. C.

HARZA ENGINEERING COMPANY
CHICAGO, ILLINOIS

JULY 1966

TABLE OF CONTENTS

I. GENERAL

The Agency for International Development, Government of the United States (hereinafter referred to as AID) has entered into an agreement with the Royal Government of Afghanistan (hereinafter referred to as RGA) whereby AID has agreed to provide assistance to RGA in the expansion, rehabilitation, repair, and improvement of the Kandahar and Girishk electric transmission and distribution systems and has entered into Contract No. AID/nesa-209, dated March 3, 1966, with the Harza Engineering Company (hereinafter referred to as the Contractor) in furtherance of this agreement.

II. SCOPE OF WORK

The contract between AID and the Contractor requires that the Contractor shall furnish engineering services in connection with (i) the rehabilitation, repair, and improvement of the existing Kandahar and Girishk electric distribution and transmission systems (hereinafter called "the Systems") and (ii) expansion of the Systems to new loads which are expected to be ready for an electric power supply within 30 months after the effective date of this contract.

The expansion, rehabilitation, repair, and improvement of the Systems shall be based on the future designs outlined in the "Project Planning Report" dated April 1962, the "Power System Report, Girishk Hydro-Electric System" dated March 1963, and the R. W. Beck Report" dated November 1964. The future designs shall be limited to facilities actually needed to safely and economically distribute the electric power and energy available from existing electric generating plants and electric generating plants expected to become available during the period of these services.

The Contractor shall prepare a "Design Report" for submission to USAID for approval prior to proceeding with detailed designs and plans for construction, repair, and improvement of the Systems and the purchasing of materials and equipment to be used in the construction, repair, and improvement.

III. PRESENT POWER SYSTEM

A. Generation

1. Kandahar New Diesel Plant - This plant is located just outside the northwest corner of the walled portion of the city of Kandahar and consists of two 625 kva units which were placed in service in 1957. These units are in good condition and can be relied upon for dependable operation. Power is generated at 3.3 kv and is connected directly into the distribution system.

2. Kandahar Old Diesel Plant - This plant is located behind the old Kandahar Electric Company office close to the center of the north wall in the walled portion of the city of Kandahar and consists of one 320 kva, 50 cycle unit, and one 300 kva, 60 cycle, unit. The 320 kva unit was installed about 30 years ago and still appears to be satisfactory for use during peak power periods although it should not be relied upon for firm power at any other time. The output of this unit is transformed from 400 to 3300 volts and connected through a 400 kva transformer to the 3.3 kv distribution system. The 300 kva, 60 cycle, unit was recently moved here from another location and

is about 20 years old. It is presently under repair; and, when this repair is completed, it can be expected to operate satisfactorily: however, because it is a 60-cycle machine, it cannot be connected to the distribution system and has been used to serve an area within the walled portion of the city.

3. Baba-Wali Hydroelectric Plant - The Baba-Wali Power Plant is located on the Patow Canal approximately seven kilometers northwest of Kandahar and consists of one 330 kva unit. This unit is in poor condition, and the generator voltage and frequency are unstable; therefore, it is not operated in parallel with the remainder of the system. This plant has been derated to about 110 kva and is used during the daytime primarily to supply power to the Manzel Bagh Woolen Mill. Repair parts have been ordered, and it is expected that this plant will soon be capable of supplying its rated output.

4. Filkoh Hydroelectric Plant - The Filkoh Power Plant is located on the South Canal approximately four kilometers northwest of Kandahar and consists of two 350 kva units. This plant was completed in 1962 and is in good condition although its output is governed by availability of water in the canal and the irrigation needs downstream from the plant. Power is generated at 6.3 kv and transmitted at this voltage to the New Diesel Plant site in Kandahar where it is stepped down through an 800 kva transformer to 3.3 kv and fed into the distribution system.

5. Girishk Hydroelectric Plant - The Girishk Power Plant is located on the Boghra Canal approximately 2.5 kilometers northeast of the town of Girishk and consists of two 1500 kva units. This plant was completed in 1958 and has been recently completely reconditioned and repaired. Power is generated at 3.3 kv and stepped up to 44 kv through 3-1000 kva, 1 ϕ, transformers for transmission to the various receiving substations in the area.

6. Bost Diesel Plant - The Bost diesel plant is located adjecent to the Bost distribution station on the east central edge of the city and consists of one 1250 kva unit which was purchased used in 1964. This unit is in satisfactory condition although the feeder breakers are not in use, and there is no means for synchronising with the remainder of the system. The HVA has plans to move this unit to the Girishk hydroelectric plant where it will be operated in synchronism with the hydro units there.

7. Summary

	Rating (kva)
Kandahar New Diesel Plant	1250
Kandahar Old Diesel Plant	320*
Babi-Wali Hydroelectric Plant	330**
Filkoh Hydroelectric Plant	700***
Girishk Hydroelectric Plant	3000
Bost Diesel Plant	1250

* The 300 kva, 60 cycle, unit cannot be used to serve customers having 50 cycle equipment.

** Has been derated to 110 kva until repairs are completed.

***Rating will be reduced during low water periods to about 350 kva.

While the preceding tabulation indicates that the present total generating capacity in the Kandahar area is 1570 kva for diesel-driven plants and 1030 kva for the hydroelectric plants, the continuous total output of the system is much less than this. The operation of the diesel-driven plants has been limited by both the availability of diesel fuel and the lack of repair and maintenance materials. The output of the hydroelectric plants is dependent upon the supply of water in the canals and the irrigation release requirements downstream from the plants.

8. In addition to the generating plants owned and operated by the public utilities, there are a number of privately owned and operated plants. These have been installed by business firms because of the lack of dependable power or because of remoteness from the lines of the public utilities. Many of these will no longer use their own generating units when sufficient power is available; however, for the next 30-month period, we can expect the continuation of private generation for such large loads as the Kandahar International Airport, AHC (now AID) compound, the Manzel Bagh compound in Kandahar, and the cotton gin and oil plant in Bost.

B. Transmission

Power from the generating plants in the Kandahar area is generated or transformed to 3.3 kv and fed directly into the distribution system with the exception of the Filkoh Plant. At the

Filkoh Plant power is generated at 6.3 kv and transmitted to the New Diesel Plant in Kandahar where it is stepped down to 3.3 kv and fed into the distribution system. The 3.3 kv line from Baba-Wali and the 6.3 kv line from Filkoh are on the same structures from Filkoh to the new diesel plant, and the close phase spacing and long spans on this line have resulted in numerous outages during periods when the wind was of moderate velocity.

Power from the Girishk Hydroelectric Plant is generated at 3.3 kv and transformed to 44 kv for transmittal over a 44 kv transmission line running in a southwesterly direction to the towns of Girishk, Chah-I-Anjir, Nad-I-Ali, Bost, and Marja at distances of 2.5, 34, 39, 55, and 65 kilometers, respectively. The transmission line conductor is #2 ACSR, 6/1 stranding, supported by pin type insulators on steel poles spaced approximately 240 meters apart. Most of the poles on this line are in need of painting. Power from the Bost Diesel Plant is generated at 3.3 kv and fed directly into the Bost distribution system.

C. Receiving Substations

The 44 kv transmission line from the Girish Hydroelectric Plant serves the following receiving stations through 44/3.3 kv, 3Ø, transformers sized as shown:

Name	Rating (kva)
Girishk	100
Chah-I-Anjir	400
Nad-I-Ali	*
Bost	1400
Marja	200

* Transformer and associated equipment have been removed.

D. Distribution

The distribution system primary voltage is 3.3 kv, and a typical primary feeder consists of #4 or #2 stranded copper conductor supported by pin type insulators on steel or reinforced concrete poles. The primary system is in general properly installed and maintained although inadequate in extent and capacity. Considerable operating difficulty is experienced due to trees which cannot be trimmed because of local ordinances. Distribution transformers are primarily 15 and 25 kva, oil filled; and most of them are single phase although a few three phase transformers are used in Kandahar to serve the old city. Overload and short circuit protection is provided by indicating or enclosed type fuse cutouts on the primary of each transformer. Lightning arresters are not provided in many installations. Many of the transformer installations, particularly in Kandahar, are a hazard to life and property because of improper installation and maintenance.

The secondaries are 120/240 volt, 120/208 volt two- and three-phase, 220 volt single phase, and 220/380 volt three-phase and are installed on crossarms or secondary racks beneath the primaries. Some of the secondaries are adequate if properly loaded; however, the majority appear to be poorly maintained and are much too long and too small in size. In the walled portion of the city of Kandahar in particular, it is extremely difficult to determine the extent of the secondary runs and their loading without an extensive detailed survey.

Many of the service drops are adequately sized and properly installed and maintained; however, this cannot be said of the majority. In Kandahar most of the service drops in the older portions of the city will have to be replaced or repaired.

IV. POWER MARKET

Power market surveys and estimates in the "Project Planning Report" dated April 1962, the "Power System Report, Girishk Hydroelectric System" dated March 1963, and the "R. W. Beck Report" dated November 1964 make it abundantly clear that the only deterrent to full utilization of electric energy available from existing generating plants and those to become available during the period of this report is the lack of adequate distribution facilities necessary for this full utilization. These surveys have not been repeated; however, during the field investigation in April and May, 1966, they were reviewed to determine the location and magnitude of the loads which can be expected during the period to September 1968 and the distribution facilities required to serve these loads.

Recording and indicating volt-ammeters were used to determine the existing loads on the various feeders, branch feeders, transformers and, in the case of the larger loads, individual services. This data was obtained during relatively light load months and at times when a portion of the load in Kandahar was disconnected due to a lack of generating capacity and can be used only as a guide in determining area load distribution. The Contractor has used this data along with the reports referred to above, consultation with

electric company and USAID personnel, estimates by present and potential customers, and engineering judgment and experience in combining these to arrive at the expected loads which the facilities covered by this Design Report will be required to serve.

V. PROPOSED POWER SYSTEM

A. Generation - Additional diesel generating capacity of 3000 kva is to be installed in the Kandahar area under another contract. Power will be generated at 3.3 kv, stepped up to 13.2 kv, and fed into the distribution system through a new distribution substation at 13.2 and 3.3 kv.

B. Transmission - Reroute the Girishk 44 kv line in Bost and provide a tap to the new Bost receiving substation.

All of the steel poles on the Girishk 44 kv transmission line will be inspected, and those requiring repair will be repaired and repainted.

Sectionalizing switches, along with necessary supporting structures, will be installed in the Girishk 44 kv transmission line as follows:

one immediately south of Nad-I-Ali
one in the Bost tap
one in the Marja tap

Install third crossarm on Filkoh - New Diesel line to provide sufficient phase spacing in midspan to reduce outages due to wind.

C. Substations

1. Install a new receiving substation in Bost with three 333 kva, 1Ø, 44 to 3.3/1.9 kv, transformers, and three 3.3 outgoing feeder positions with ± 10% voltage regulators, load interruptor disconnect switches and power fuses.

2. Install a new distribution substation in Kandahar adjacent to the proposed 3000 kva diesel plant with three 500 kva, 1Ø, 13.2/7.62 to 3.3/1.9 kv transformers, four 3.3 kv and two 13.2 kv outgoing feeder positions with ± 10% voltage regulators, load interruptor disconnect switches and power fuses.

3. Install metering equipment consisting of one voltmeter, one voltmeter switch, three ammeters, and one KWH meter with demand register in a weather proof cabinet at each distribution substation, complete with necessary PT's CT's, and supporting structures.

4. Clean, adjust, and, where necessary, replace the 3.3 kv feeder load interruptor switches in all receiving stations.

5. Move 400 kva substation at Bost to Nad-I-Ali.

D. Distribution

1. Primary

The magnitude of the loads during the period of services required under this contract does not warrant any general change in the existing 3.3 kv primary distribution

system. (Although it will be necessary to utilize 13.2/7.62 kv distribution in Kandahar to serve the area to the west of the city and, when service is required, to the east of the city because of the magnitude of the loads and the distance involved.) As more generation is installed and the system load increases, a time will come when the 3.3 kv distribution voltage will become inadequate to properly serve the Systems; and the designs will anticipate this expansion, wherever possible, by providing for a future primary distribution voltage of 13.2/7.62 kv. When this will occur is dependent upon selection of generation recommended in other reports and is outside the scope of this report. Table I shows 3 Ø distributed loads that can be transmitted various distances with a primary voltage drop not exceeding 3%, and this clearly shows that 3.3 kv is generally adequate now and that 13.2 kv will suffice for the forseeable future.

When the primary distribution voltage is increased to 13.2/7.62 kv, it is logical that the first conversions would be made in the Kandahar area. The materials and equipment rendered surplus by this conversion could then be utilized in the Girishk area until such time as it was found necessary to increase the primary distribution voltage there. In the Girishk area the first town to be converted would naturally be Bost, and this could occur at the same time as the Kandahar area conversions although it appears that Bost would not require conversion for some years after Kandahar because of the relatively concentrated

loads and short distances involved. There seems little necessity to increase the primary system voltage in the remaining towns in the Girishk area for many years, and the 3.3 kv materials and equipment from the Kandahar and Bost areas could be utilized here in the interim. All new materials and equipment, except transformers, will be selected so that they are suitable for use at 13.2/7.62 kv. Existing materials and equipment will not be replaced, and the conductor spacing will not be altered solely to provide for a future primary distribution voltage of 13.2/7.62 kv as the time when this will be required does not fall within the period of services of this contract. New construction or rebuilding of existing facilities will provide for a future voltage of 13.2/7.62.

All new primary conductors will be #4/0, #1/0, and #4 ACSR and will be installed on existing structures or on new steel poles supported by pin type insulators with a BIL of 140 kv. The overhead primary cable will be #4/0 or #1/0 aluminum with 15 kv polyethylene insulation. New switches and cutouts will be suitable for future conversion to the higher distribution voltage.

TABLE I

3Ø DISTRIBUTED LOADS THAT CAN BE
TRANSMITTED VARIOUS DISTANCES
WITH
3% PRIMARY VOLTAGE DROP

Voltage kv	ASCR Wire Size	3Ø Distributed Loads than can be Transmitted (kva) 1km	2km	4km	6km	8km
	#4/0	1,534	767	384	256	192
3.3/1.9	#1/0	988	494	247	165	124
	#4	484	242	121	81	61
	#4/0	24,542	12,272	6,136	4,091	3,068
13.2/7.62	#1/0	15,808	7,904	3,952	2,635	1,976
	#4	7,744	3,872	1,936	1,257	968
	#4/0	88,000	44,000	22,000	14,667	11,000
25/14.4	#1/0	56,600	28,300	14,150	9,433	7,075
	#4	27,760	13,880	6,940	4,627	3,470

2. Transformers

New single-phase transformers shall be oil filled, 3300-110/220 and 7600-110/220 volts, with four 2-1/2% taps below normal and none above. New 3 Ø transformers

shall be oil filled 3300-220/380 volts with 4 - 2-1/2 taps below normal and none above. The transformer installations will be complete with fused primary cutouts and arresters and will provide the full range of service voltages (220 volts, one phase; 220/380 volt, three phase; 120/240 volt, one phase, and 120/208 volt, three phase) by using the proper taps and connections.

3. Secondaries

All new secondary conductors will be #4/0, #1/0, and #4 ACSR, polyethylene jacketed, supported by pin type insulators on crossarms or spool type insulators on racks.

4. Services

All new services shall consist of #4/0, #1/0, and #4 ACSR, polyethylene jacketed.

5. Metering

Metering for all existing and all new customers will be provided by HVA from their own resources.

Reviewed D P Roberts
Chief Engineer

Approved Walter E Bowman
Project Sponsor

VI. ESTIMATED COST

	Stated in US Dollars			
	Foreign Exchange	Afghanis	Pakistani Rupees	Total
Right of Way Procurement & Clearing		$ 1,500		
Poles, Towers, & Fixtures	$290,500	70,000	35,000	395,500
Overhead Conductors & Devices	178,900	35,000	15,000	228,900
Line Transformers	198,700	45,000	5,800	249,500
Services	93,900	24,000	7,000	124,900
Miscellaneous Material	20,000	2,000	1,000	23,000
Metering at Receiving Substations	16,000	3,000	300	19,300
Repair or Replacement of 3.3 kv Switches	1,500	500	100	2,100
Clean and paint 44 kv poles	600	500		1,100
Bost Substations	90,000	20,000	15,000	125,000
Kandahar Substation	123,000	24,000	19,000	166,000
Operating Vehicles	56,000	200	5,000	61,200
Tools & Maintenance	8,000	100	800	8,900
Relocate Equipment & Materials		6,000		6,000
Remove Equipment & Materials		5,000		5,000
Miscellaneous Primary Rehabilitation		5,000		
Miscellaneous Secondary Rehabilitation		8,000		
Miscellaneous Service Rehabilitation		8,000		
US Line Foremen	75,000	8,000		83,000
Total Material	1,013,100	8,200	98,200	1,119,500
Total Equipment	64,000	300	5,800	70,100
Total Labor	60,000*	250,100		307,100
Others	15,000*	9,500	2,000	26,500
Engineering Services	432,878	26,500		459,378
Contingencies	157,900	36,100	14,400	208,400
Totals	1,742,878	330,700	120,400	2,193,978

* US Line Foremen provided by AID

VII. MATERIAL LIST

	Quantity	Cost
H-Frame Structures	2	$ 6,000
Poles, Primary, 40'	500	126,000
Poles, Secondary, 36'	700	99,000
Poles, 44 kv, 52'	10	5,000
Poles, 44 k switch, 45'	3	1,000
Switches, Disconnect, 15 kv, 400 amp	86	9,400
Switches, Disconnect, 44 kv, 3 pole	5	15,000
Crossarms, Primary, Single	1000	5,500
Crossarms, Primary, Double	800	9,700
Crossarms, Secondary	700	3,100
Crossarms, 44 kv	14	300
Crossarms, Filkoh Line	60	500
Pins, Insulator	2430	4,900
Racks, Secondary	1875	8,400
Insulators, Suspension, EEI-NEMA 52-1	1300	4,000
Insulators, Pin Type, EEI-NEMA 55-2	5000	2,800
Insulators, Pin Type, EEI-NEMA 55-5	3000	5,400
Insulators, Spool, EEI-NEMA 53-3	7000	2,200
Insulators, Guy Strain, EEI-NEMA 54-1	500	300
44 Hardware and Insulators, Etc.		2,000
Clamps, Dead End	1300	4,000

VII. MATERIAL LIST (cont'd)

	Quantity	Cost
Anchors	200	$ 4,400
Brackets, Transformer	170	3,800
Brackets, Cable	120	700
Spacers, Cable	2000	6,500
Transformer, 7600-110/220, 100 kva, 1Ø	4	5,200
Transformer, 7600-110/220, 50 kva, 1 Ø	4	3,200
Transformer, 7600-110/220, 25 kva, 1 Ø	45	27,000
Transformer, 7600-110/220, 15 kva, 1 Ø	16	6,400
Transformer, 3300-220/380, 500 kva, 3 Ø	1	4,000
Transformer, 3300-220/380, 15 kva, 3 Ø	8	6,000
Transformer, 3300-110/220, 100 kva, 1 Ø	11	12,100
Transformer, 3300-110/220, 50 kva, 1 Ø	10	8,000
Transformer, 3300-110/220, 25 kva, 1 Ø	205	123,000
Regulators, voltage, 76.2 kva	27	78,000
Cutouts, Porcelain, 7.8 kv	580	13,000
Arresters, 9 kv	600	8,000
Cable, #4/0 Al.	10,600 m	8,000
Cable, #1/0 Al.	8700 m	5,000
Messenger, cable	6500 m	3,000

VII. MATERIAL LIST (cont'd)

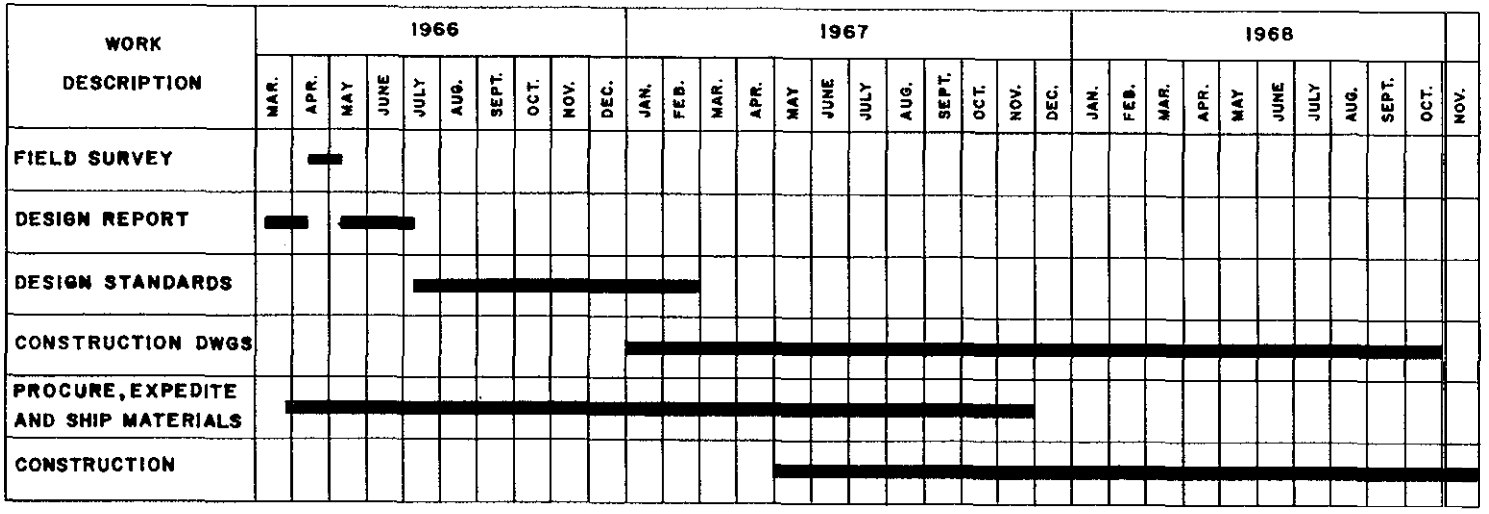
	Quantity	Cost
#4/0 ACSR, bare	37,500 m	$ 15,300
#1/0 ACSR, bare	51,500 m	10,700
#4 ACSR, bare	14,100 m	1,300
#2 ACSR, bare	4,500 m	700
#4/0 ACSR, polyethylene jacket	67,500 m	39,600
#1/0 ACSR, polyethylene jacket	95,600 m	28,800
#4 ACSR, polyethylene jacket	25,000 m	3,400
Service, #4/0 ACSR	303	17,700
Service, #1/0 ACSR	1,300	39,300
Service, #4 ACSR	2,300	30,900
Connectors, Al-Cu, #4/0	1,000	1,500
Connectors, Al-Cu, #1/0	1,000	1,500
Connectors, Al-Cu, #4	1,000	1,100
Connectors, Al-Al, #4/0	2,000	1,600
Connectors, Al-Al, #1/0	4,000	3,200
Connectors, Al-Al, #2	30	100
Connectors, Al-Al, #4	8,000	3,500
Miscellaneous material		20,000
Metering at 44 kv receiving substations		16,000
Repair and replacement of 3.3 kv s.s. switches		1,500
Clean and Paint 44 kv Poles		600
1000 kva Bost Substation		60,000
Kandahar distribution s.s. with 1500 kva, 13.2/3.3 kv transformer		75,000

VII. MATERIAL LIST (cont'd)

	Quantity	Cost
Operating Vehicles		$ 56,000
Tools and Maintenance Material		8,000
	Total	$ 1,077,100

VIII COMPLETION SCHEDULE

HELMAND VALLEY ELECTRIC POWER

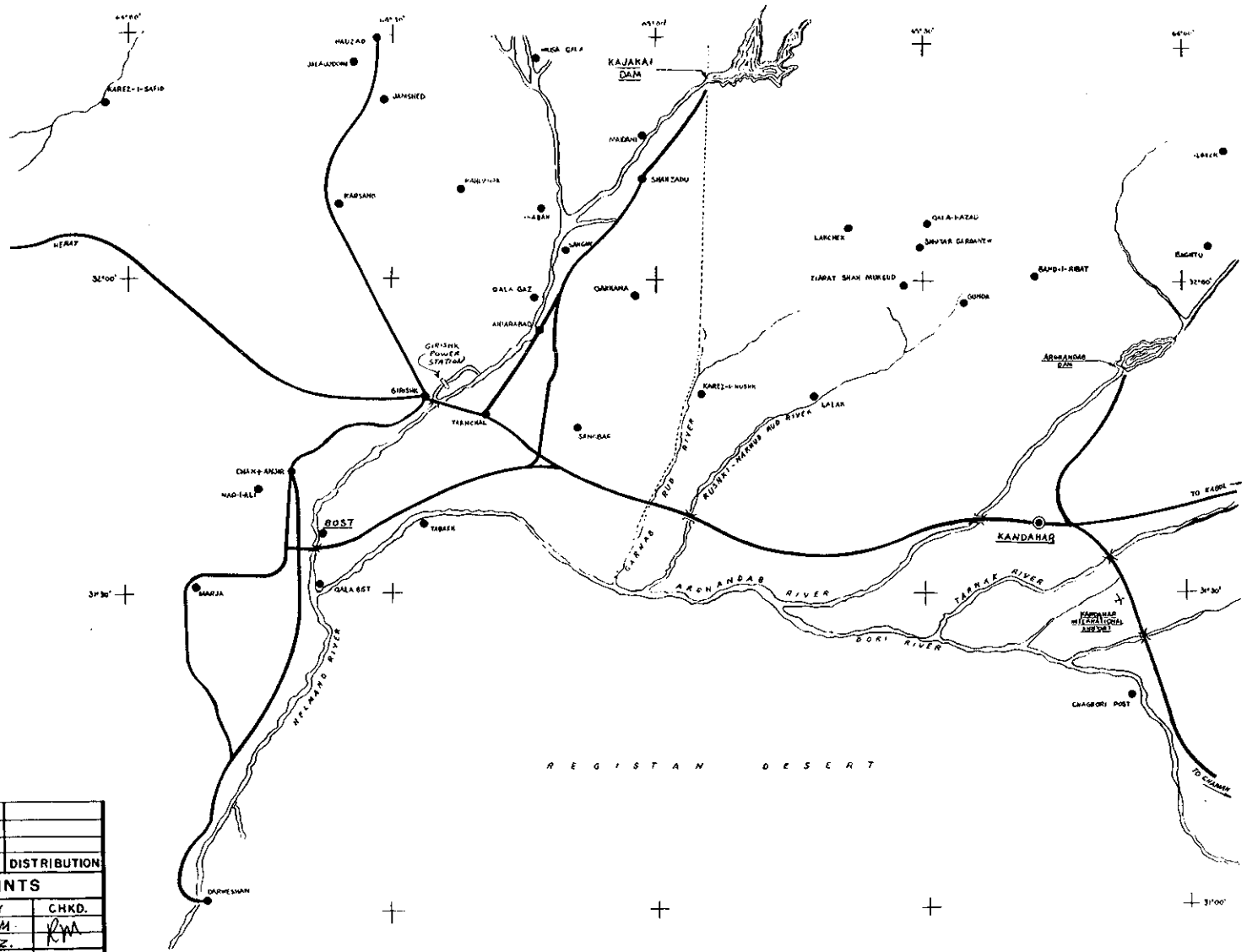


DATE	NO.	DISTRIBUTION
PRINTS		
	BY	CHKD.
DSGN.	R.M.	RM
DWN.	C.Z.	
DEPT.	ENG.	HEAD
CIVIL		
MECH.		
ELECT.		
PLAN.		
STAFF		CH.ENG.

H-E PHOENIX N166

REV. NO.	DATE	NATURE OF REVISION	BY	CHKD.	APPD.

AGENCY FOR INTERNATIONAL DEVELOPMENT
U.S. DEPARTMENT OF STATE
HELMAND VALLEY ELECTRIC POWER
COMPLETION SCHEDULE
HARZA ENGINEERING CO., CHICAGO
APPROVED
DATE 6/24/66
DWG. NO.



DATE	NO.	DISTRIBUTION

PRINTS

	BY	CHKD.
DSGN.	R.M.	
DWN.	C.Z.	
DEPT.	ENG.	HEAD
CIVIL		
MECH.		
ELECT.		
PLAN.		
STAFF		CH. ENG.

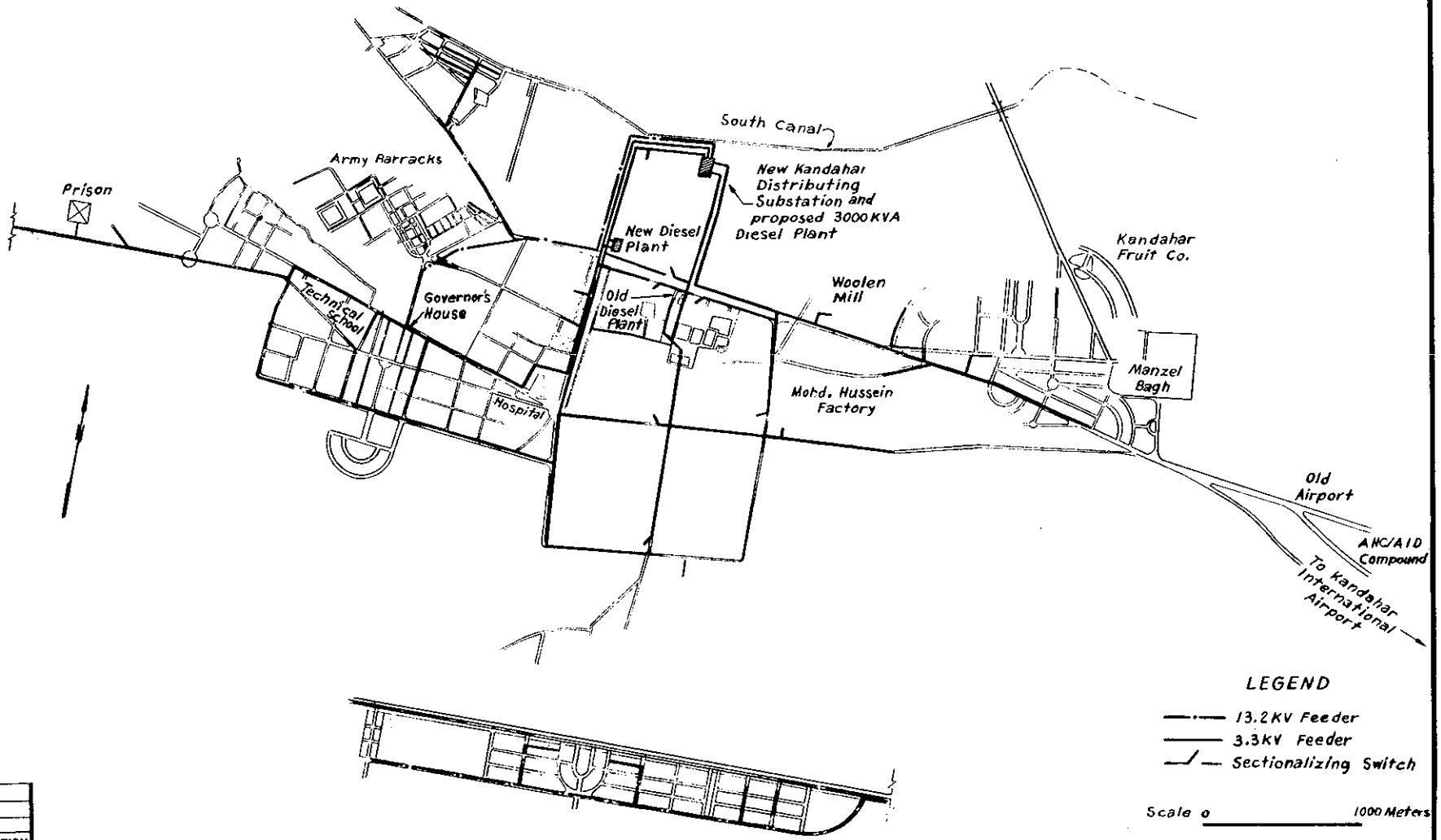
REV. NO.	DATE	NATURE OF REVISION	BY	CHKD.	APPD.

AGENCY FOR INTERNATIONAL DEVELOPMENT
U.S. DEPARTMENT OF STATE
HELMAND VALLEY ELECTRIC POWER

HELMAND VALLEY AREA

HARZA ENGINEERING CO., CHICAGO
APPROVED Chester C. Bauman
DATE 6/29/66 DWG. NO. 394-B1

-21-



DATE	NO.	DISTRIBUTION

PRINTS

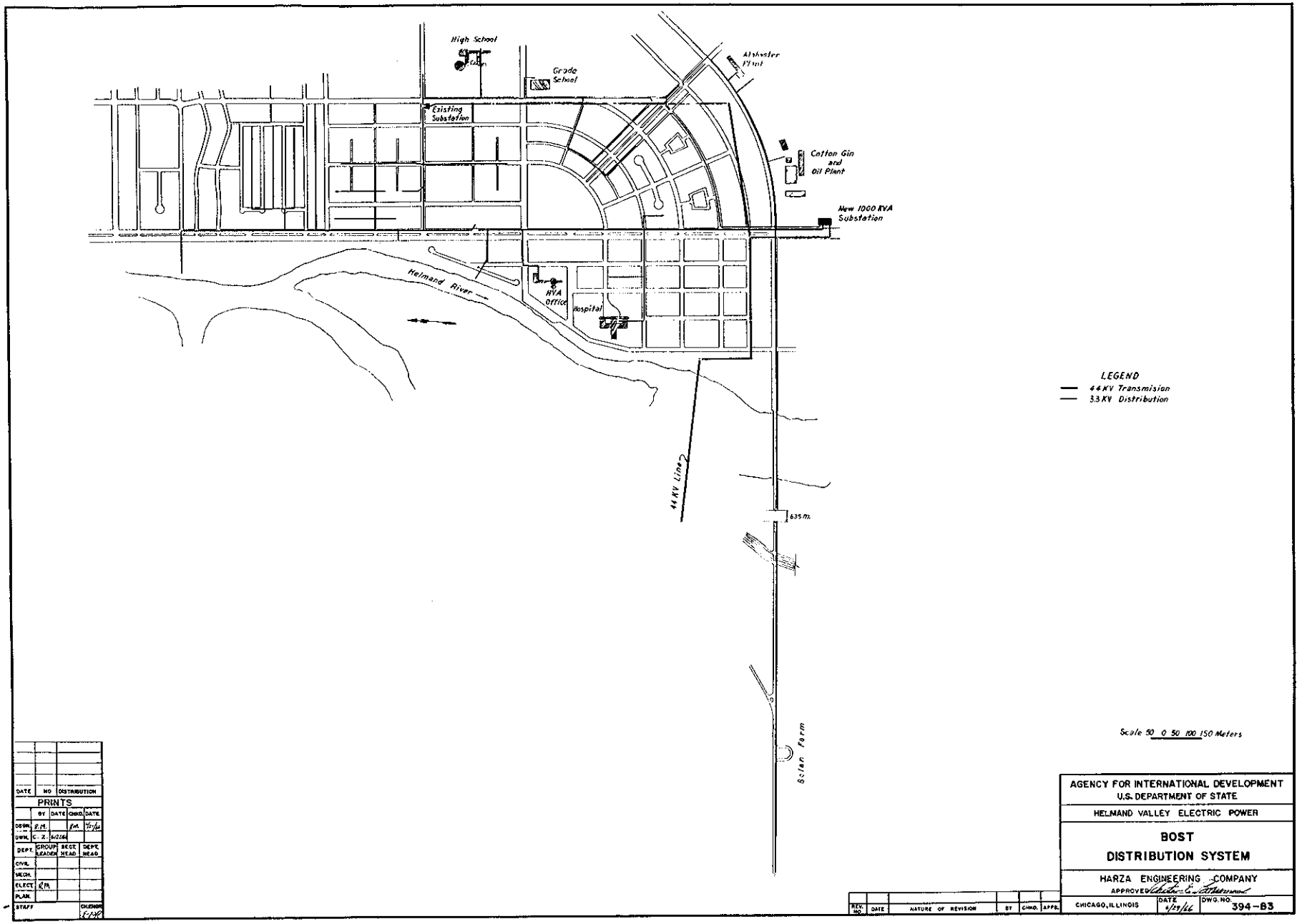
	BY	CHKD.
DSGN.	R.M.	
DWN.	C.Z.	
DEPT.	ENG.	HEAD
CIVIL		
MECH.		
ELECT.		
PLAN.		
STAFF		CH. ENG.

REV. NO.	DATE	NATURE OF REVISION	BY	CHKD.	APPD.

AGENCY FOR INTERNATIONAL DEVELOPMENT
U.S. DEPARTMENT OF STATE
HELMAND VALLEY ELECTRIC POWER
KANDAHAR
DISTRIBUTION SYSTEM
HARZA ENGINEERING CO., CHICAGO
APPROVED Chester L. Brauner
DATE 6/29/66 DWG. NO. 394-B2

-22-

K-E PHOENIX R100



DATE	NO	DISTRIBUTION
PRINTS		
	BY	DATE	CHKD.	DATE
DESN.	E.M.		E.M.	1-7-46
DWN.	C. Z.	6/21/46		
DEPT.	GROUP LEADER	SECT. HEAD	DEPT. HEAD
CIVIL			
MECH.			
ELECT.	E.M.		
PLAN.			
STAFF			CHENEY 6-7-46

AGENCY FOR INTERNATIONAL DEVELOPMENT
U.S. DEPARTMENT OF STATE

HELMAND VALLEY ELECTRIC POWER

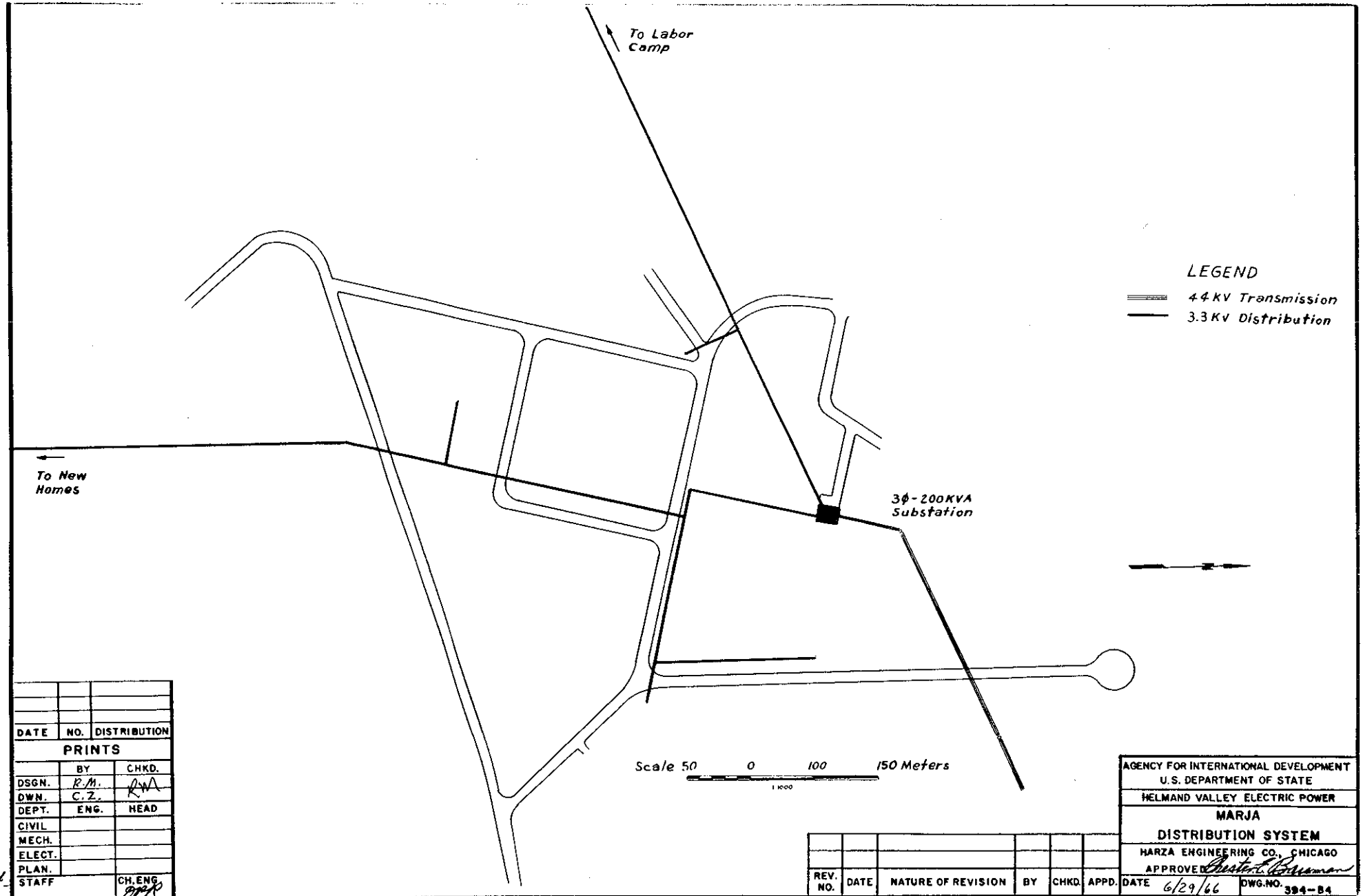
BOST
DISTRIBUTION SYSTEM

HARZA ENGINEERING COMPANY
APPROVED Walter E. Peterson

CHICAGO, ILLINOIS | DATE 6/29/46 | DWG. NO. 394-B3

REV. NO.	DATE	NATURE OF REVISION	BY	CHKD.	APPR.

23-



DATE	NO.	DISTRIBUTION

PRINTS

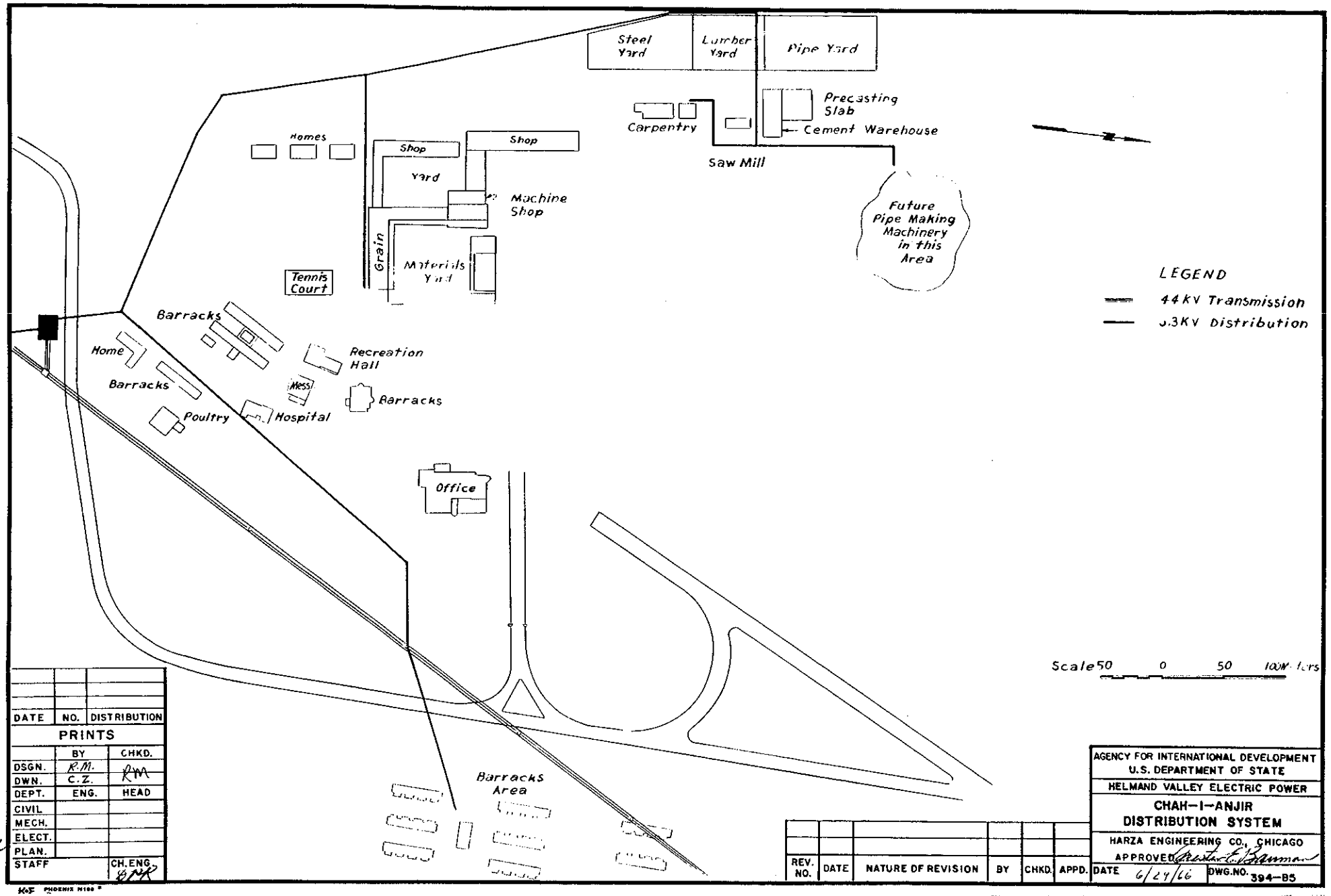
	BY	CHKD.
DSGN.	R.M.	
DWN.	C.Z.	
DEPT.	ENG.	HEAD
CIVIL		
MECH.		
ELECT.		
PLAN.		
STAFF		CH. ENG

REV. NO.	DATE	NATURE OF REVISION	BY	CHKD.	APPD.

AGENCY FOR INTERNATIONAL DEVELOPMENT
U.S. DEPARTMENT OF STATE
HELMAND VALLEY ELECTRIC POWER
MARJA
DISTRIBUTION SYSTEM
HARZA ENGINEERING CO., CHICAGO
APPROVED Chester E. Bowman
DATE 6/29/66 DWG.NO. 394-84

-24-

K-E PHOENIX R100



DATE	NO.	DISTRIBUTION

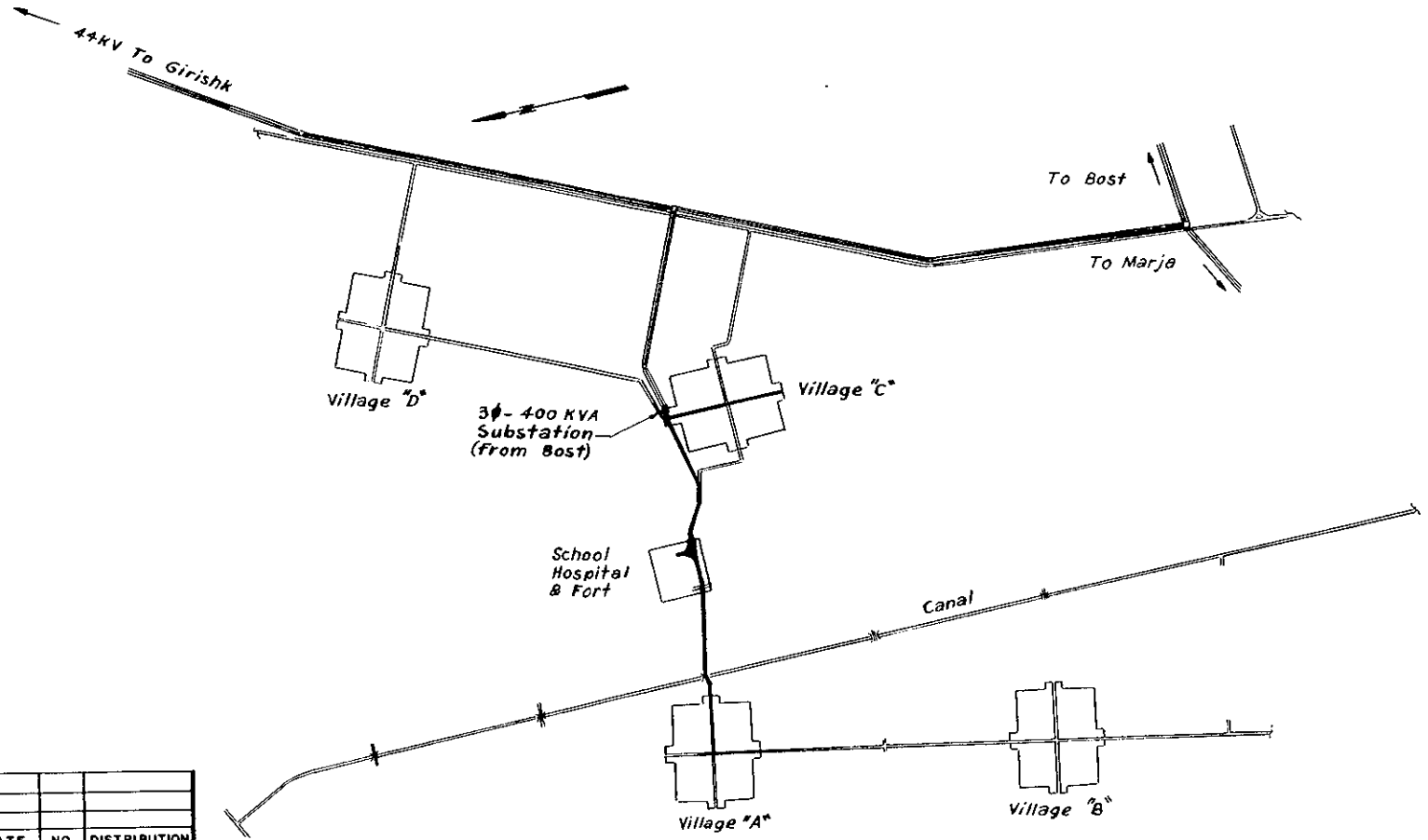
PRINTS

	BY	CHKD.
DSGN.	R.M.	
DWN.	C.Z.	RM
DEPT.	ENG.	HEAD
CIVIL		
MECH.		
ELECT.		
PLAN.		
STAFF		CH. ENG.

25

REV. NO.	DATE	NATURE OF REVISION	BY	CHKD.	APPD.

AGENCY FOR INTERNATIONAL DEVELOPMENT
U.S. DEPARTMENT OF STATE
HELMAND VALLEY ELECTRIC POWER
CHAH-I-ANJIR
DISTRIBUTION SYSTEM
HARZA ENGINEERING CO., CHICAGO
APPROVED
DATE 6/24/66
DWG. NO. 394-B5



LEGEND

44 KV Transmission

3.3 KV Distribution

Scale 500 0 500 2000 Meters

DATE	NO.	DISTRIBUTION

PRINTS

	BY	CHKD.
DSGN.	R.M.	
DWN.	C.Z.	RM
DEPT.	ENG.	HEAD
CIVIL		
MECH.		
ELECT.		
PLAN.		
STAFF		CH.ENG.

REV. NO.	DATE	NATURE OF REVISION	BY	CHKD.	APPD.

AGENCY FOR INTERNATIONAL DEVELOPMENT
U.S. DEPARTMENT OF STATE

HELMAND VALLEY ELECTRIC POWER

NAD-I-ALI
DISTRIBUTION SYSTEM

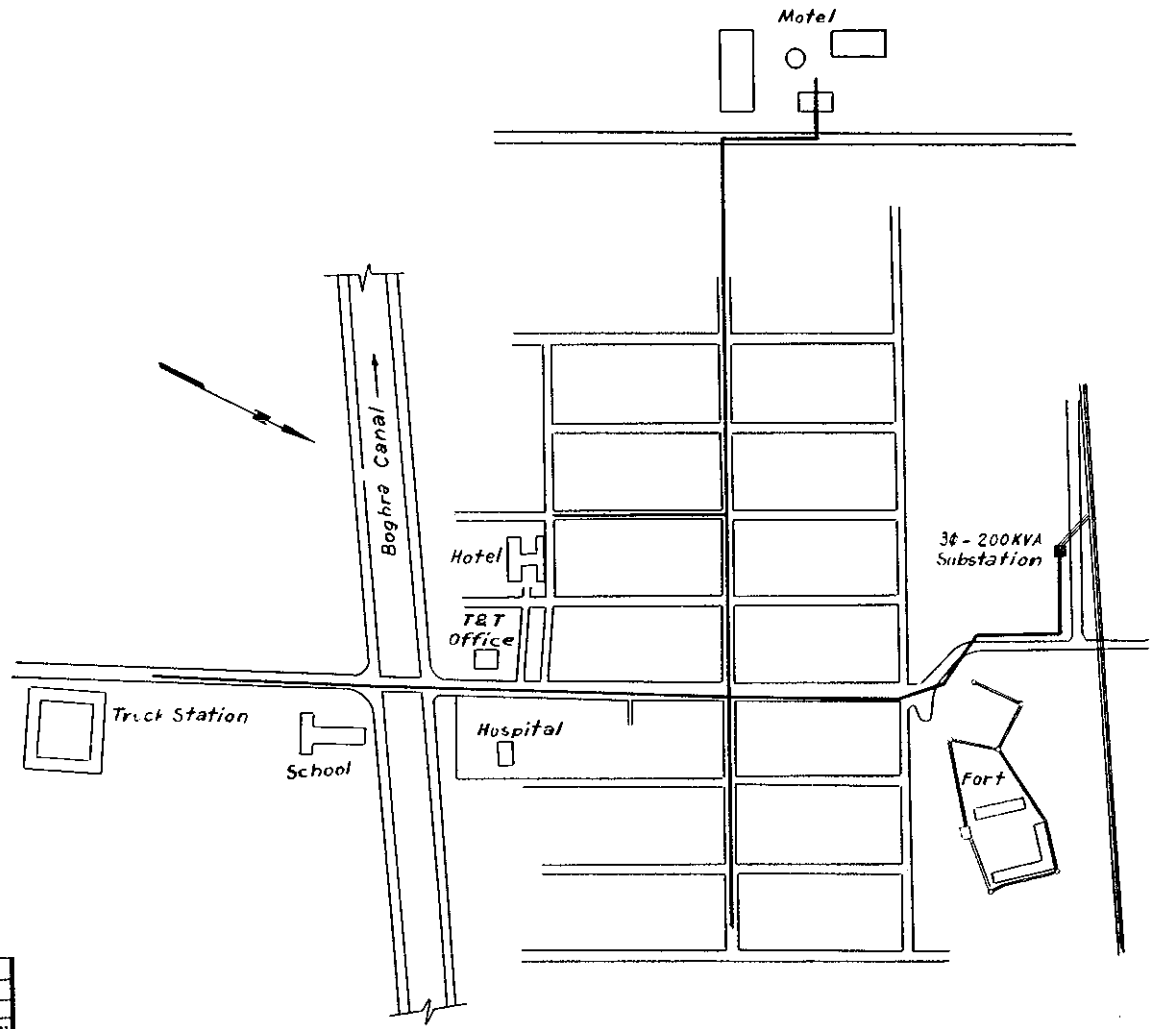
HARZA ENGINEERING CO., CHICAGO

APPROVED Chester C. Bauman

DATE 6/29/66 DWG.NO. 394-B6

-26

K+E PHOENIX M185



LEGEND

44KV Transmission

3.3KV Distribution

Scale 50 0 50 100 150 Meters

DATE	NO.	DISTRIBUTION

PRINTS

	BY	CHKD.
DSGN.	R.M.	RM
DWN.	C.Z.	
DEPT.	ENG.	HEAD
CIVIL		
MECH.		
ELECT.		
PLAN.		
STAFF		CH. ENG.

-37-

REV. NO.	DATE	NATURE OF REVISION	BY	CHKD.	APPD.

AGENCY FOR INTERNATIONAL DEVELOPMENT
U.S. DEPARTMENT OF STATE

HELMAND VALLEY ELECTRIC POWER

GIRISHK
DISTRIBUTION SYSTEM

HARZA ENGINEERING CO., CHICAGO

APPROVED Harza E. Berman

DATE 6-1-66 DWG. NO. 394—B7