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FORT BELVOIR REGIONAL ENERGY SURVEY.(U)
JUL 76 H D HOLLIS, C A KUKIELKA, P E BAUM

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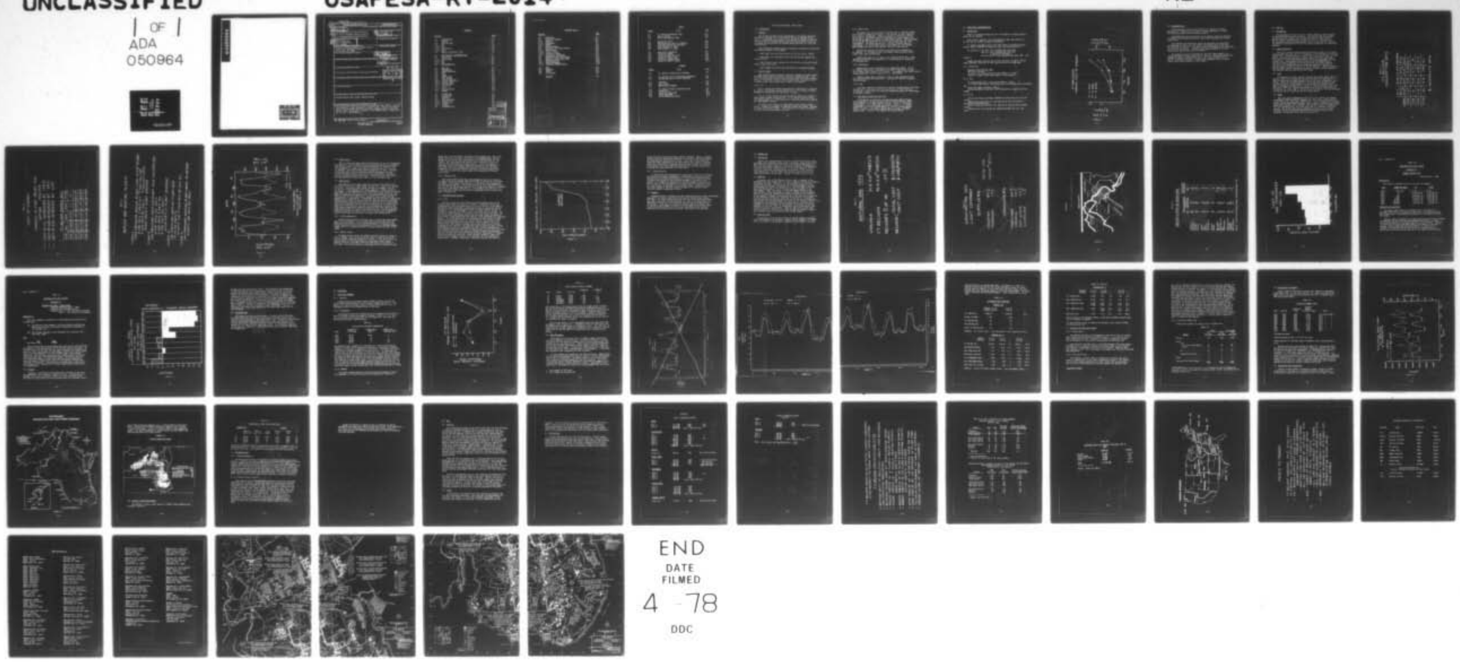

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Each energy source crossing Ft. Belvoir's boundry has been studied. The major areas examined included consumption, supply and cost. From this information opportunities have been identified that offer tangible return on investment. General remarks appear below followed by a more indepth review. Backup data may be found in the Appendix.

409 266

CONTENTS

CONTENTS (Cont.)

TABLES

FIGURES

FORT BELVOIR REGIONAL ENERGY SURVEY

1.0 INTRODUCTION

1.1 Purpose.

One of the resulting actions recommended at the Energy Conference held at Williamsburg, VA., 12-13 January 1976 was a regional energy survey. The purpose of the survey is to develop the prospects, perspective, and status of energy supply, conditions and criteria, as well as to enhance the perspicacity of relevant energy decisions for the fixed installations.

The information obtained supplies background information and provides relationship answers as for example:

- What impact does the installation have on the locale, region?

- What impact or contribution could the installation make on the locale, region?

- What relation exists between the installation and regional energy supply, usage, and costs?

- What changes in factors would contribute to increased economy?

1.2 Area of Study.

Each energy source crossing Ft. Belvoir's boundary has been studied. The major areas examined included consumption, supply and cost. From this information opportunities have been identified that offer tangible return on investment. General remarks appear below followed by a more in depth review. Backup data may be found in the Appendix.

1.2.1 Oil.

Oil is source and refinery dominated but transportation unlimited. Ft. Belvoir and Northern Virginia obtain oil by rail, truck, or tanks depending on convenience and location of refinery.

Oil is used for general heating and process loads at Ft. Belvoir's major plants, laundry, hospital, etc. If Ft. Belvoir adds buildings, the heating supply will undoubtably be oil since the addition of natural gas loads appears doubtful.

Oil prices will probably be established by and conform to OPEC policy. Crude oil at present is imported at about $11.50/BBL. Refinery oil sells from $15 to $17/BBL. This figures out to around an average of $\$2.25/10^6$ BTU's but depends on grade.

1.2.2 Natural Gas.

The natural gas for the Northern Virginia area is pipeline limited with controls on quantity and cost. Price controls are most important to Ft. Belvoir consumption. Affecting controls is political climate and policies. The direct supplier, Washington Gas Light Company, will add no new customers as a result of curtailments imposed. The curtailment of natural gas for the winter of '75-'76 for Virginia was 14% of the requirements. The winter was mild so a critical situation was not encountered. If a hard winter occurs, curtailments will be imposed. When deregulation occurs (free market), the price could double.

Residences, Hospital and Clubs, are primarily the consumers on Ft. Belvoir. It is doubtful that curtailments would seriously affect either other than inconvenience.

Natural gas costs for Ft. Belvoir are around $1.88/10^6$ BTU. These costs are artifically low compared to oil costs because of regulation of interstate gas.

1.2.3 Electrical.

Electricity is price dominated but in adequately supply. All of Ft. Belvoir electricity is purchased from VEPCO. Electricity is used for virtually every process on Ft. Belvoir. The greatest load occurs during summer months and is due to compressive air conditioning.

Electric rates should continue to rise, to cover escalating fuel cost and to finance new construction. Currently Ft. Belvoir is paying 18.8 mills/Kwh.

1.2.4 Coal.

Coal only indirectly influences Ft. Belvoir through electric rate and fuel oil bills. No plans exist to use coal now or in the future on Ft. Belvoir. Coal's role as an electrical generating source is diminishing, in Northern Virginia.

1.3 Fort Belvoir Statistics for FY75.

8,419,000 ft^2 of facilities representing about 2900 buildings. 17,811 population; 86,775,000 Kwhrs used at 18.8 mills/Kwhrs gross; 422,642 MBTU's in 3.5 MBTU capacity boilers - Class 1, - 6 plants; 113,532 MBTU's in 3.5 MBTU capacity heating - Class 2, - 17 plants; 8,880 MBTU's gas fired; 180,275 MBTU's in .750 to 3.5 MBTU heating plants - Class 3, - 95 plants; 368,450 MBTU's in under .750 MBTU heating plant - Class 4, - 612 plants, 107,175 gas fired.

2.0 CONCLUSIONS RECOMMENDATIONS

2.1 Conclusions.

There is no overall energy plan for the Virginia or energy supplier region for Ft. Belvoir.

Each utility, supplier, or service performs their own planning or for gas and oil, reacts to supply fluctuations.

Ft. Belvoir consumes 0.16% of the total energy, excluding transportation, used in Virginia including oil, gas, coal and electricity.

Ft. Belvoir's - oil bill, has increased 134% since 1972.
- gas bill, has increased 42% since 1972. (consumption decreased)
- electricity bill, has increased 125% since 1973. See Figure 2.1.

Sewage and water could be the critical utilities in the Ft. Belvoir region (Northern Virginia) for the future both near and long term.

2.1.1 Electricty

Adequate supply through 1980.
Cost will increase.
Ft. Belvoir air conditioning load has doubled in 3 years.
Chance of ratchet clause being added to rate schedule.

2.1.2 Gas

If deregulation occurs, price could double or triple.
If a cold winter occurs, restrictions could be imposed on non-residential use.
Long term supply uncertain, 1985 on.
No new additions by suppliers until deregulation increases pipeline supply.

2.1.3 Oil

Price and inflation increases expected for both short and long term future.
Heating fuel restriction in long term future with allocation of petroleum to transportation.
Boiler plants not utilized at Ft. Belvoir to capacity during summer months.
Heating load at Ft. Belvoir has remained constant for last five years.

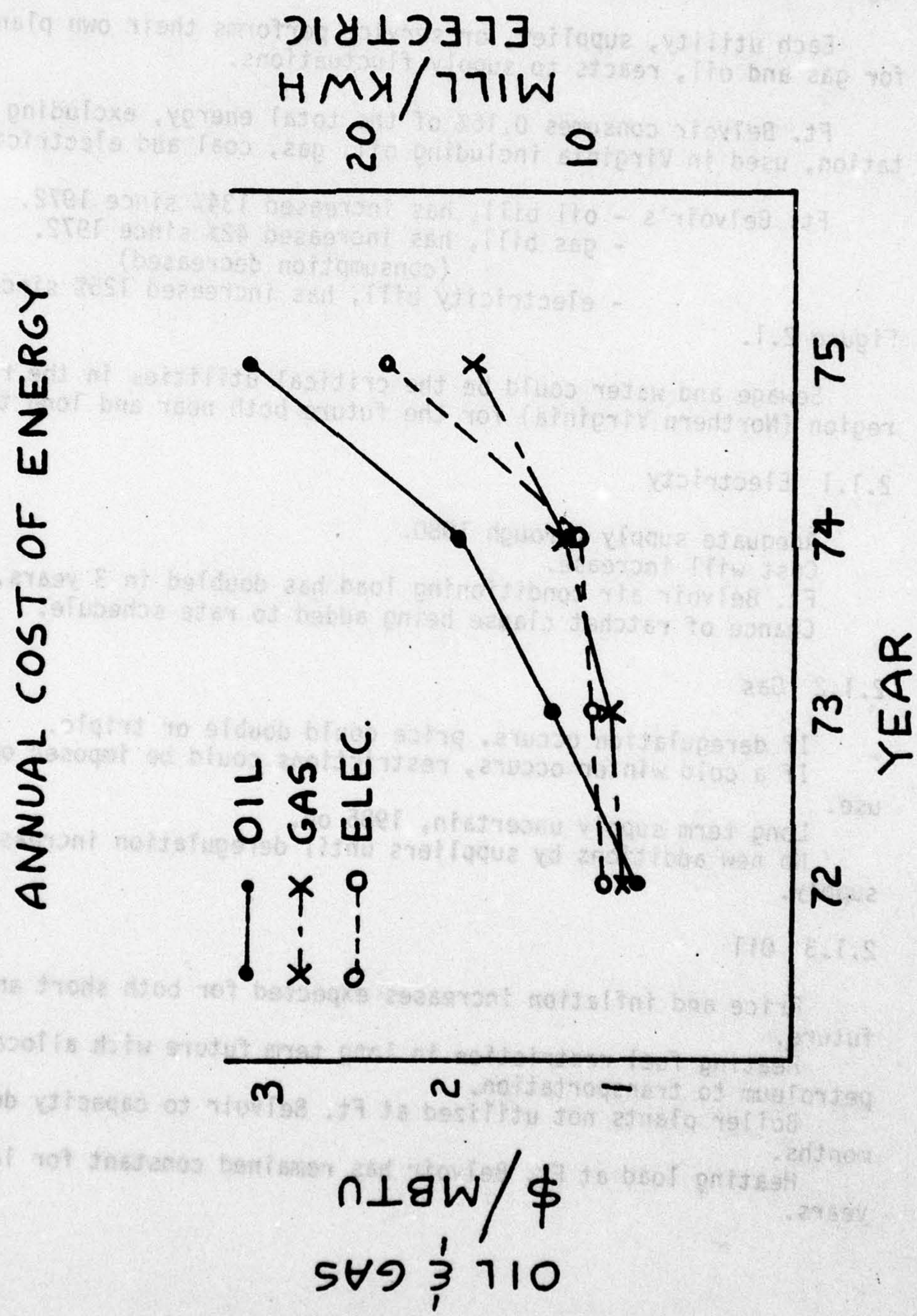

FT. BELVOIR'S
ANNUAL COST OF ENERGY
OIL
GAS
ELEC
OIL & GAS
$/MBTU
1
2
3
ELECTRIC
MILL/KWH
10
20
72
73
74
75
YEAR

FIGURE 2.1

2.2 Recommendations.

The utilization of the boiler plants at Ft. Belvoir for either absorptive air conditioning or steam for turbine generators to reduce the electrical summer peak should be evaluated.

Interconnecting the boiler plants at Ft. Belvoir should be evaluated to benefit from increased efficiency, operational advantages and backup capabilities.

The economics and feasibility should be evaluated of constructing and operating a central coal and refuse fired energy plant to heat and air condition Ft. Belvoir. The present plants are planned to be retrofitted over the next five years. A central plant study performed in the near future could evaluate the costs and benefits.

An evaluation should be performed on the long range prospects for sewage treatment and water supply for Ft. Belvoir. Moratoriums on building created by sewage treatment limitations could create problems for Ft. Belvoir's capacity and growth. Future water treatment costs for public supply could create problems or limit supply.

3.0 FUEL OIL

3.1 Consumption.

The consumption of fuel oil at Ft. Belvoir makes up a major portion of the energy used in terms of dollars. The cost for fuel oil consumed was about two (2) times as much as electricity and ten (10) times as much as natural and propane gas. (Tables 3-1 & 3-2). Therefore fuel oil conservation measures would probably result in the most cost savings, in addition to any possible electricity and gas savings due to conservation measures.

3.2 Steam Production.

Fuel oil is used for general heating and process loads at Ft. Belvoir and the energy from the fuel oil is produced in four different size plants. (Table 3-3). High pressure boiler plants with a capacity of over 3.5 X 10^6 BTU/hr, of which there are four, produce steam at a central point and distribute it to the surrounding area for use in space and water heating, laundry, etc. These central boiler plants serve the MERADCOM area, Davidson Airfield, Mechanical and Training Areas, and DeWitt Hospital. The rest of the heating and process loads are supplied by central low pressure heating plants of over 3.5 X 10^6 BTU capacity. These low pressure heating plants usually only supply hot water for space and water heating, but sometimes they can provide for other needs.

3.3 Fuel.

The largest part of Ft. Belvoir's boilers and heating plants use No. 2 and No. 6 fuel oil, or about two-fifths of the total for each, and No. 5 fuel oil making up the remaining one-fifth of the total consumption. No. 5 and No. 6 fuel oil are used primarily in the high pressure boiler plants, with No. 5 and No. 2 used primarily in the low pressure heating plants. Small individual buildings use No. 2 fuel oil almost exclusively with some using No. 5 fuel oil. Typical consumption of a large office building at Ft. Belvoir is .5 gals fuel oil per sq ft of floor space, with some buildings running as high as 1.2 gals per sq ft of floor space.

3.4 Usage.

The total yearly consumption of fuel oil at Ft. Belvoir was reduced considerably after the 1972 oil embargo, but it has been climbing back up to pre 1972 levels since then. (Figure 3.1). This is probably due to either colder winters, additional buildings, and/or a general relaxation of previous conservation measures at Ft. Belvoir. Ft. Belvoir's yearly consumption of fuel oil represents only .3% of the total fuel oil consumed in Virginia, and only .16% of the total energy consumed in Virginia, but we should continue to renew and maintain existing conservation measures, and in addition, find new ways to cut down on our fuel bill.

TABLE 3-1

FT. BELVOIR CONSUMPTION DATA

YEAR	OIL BTU $\times 10^{12}$	ELEC. KWH $\times 10^{7}$	N.GAS BTU $\times 10^{10}$	PROPANE BTU $\times 10^{6}$
1972	1.47	8.95	12.28	26.5
1973	*	9.23	12.21	*
1974	1.12	8.16	10.50	16.4
1975	1.25	9.16	9.04	16.1

* INCOMPLETE DATA

TABLE 3-2

COST OF ENERGY

CHANGES IN FUEL PRICES FOR NATION 1973-1975

— COST OF OIL INCREASED BY 158%
— COST OF GAS INCREASED BY 78%
— COST OF ELEC. INCREASED BY 60%

FT. BELVOIR ENERGY BILL

YEAR	OIL	GAS	ELEC.	TOTAL
1972	$1.34M	$.12M	—	—
1973	$1.01M	$.13M	$.83M	$1.97M
1974	$2.14M	$.14M	$1.11M	$3.39M
1975	$3.14M	$.17M	$1.25M	$4.56M

TABLE 3-3

BOILER AND HEATING PLANTS

CLASS 1

HIGH PRESSURE BOILER PLANT OVER 3.5×10^6 BTU/HR

3 USE NO. 6 & NO. 5 OIL # 332, 1152, 1332

3 USE NO. 5 OIL ONLY # 1422, 2117, 2457

70,439 MBTU'S PLANT AVERAGE

CLASS 2

LOW PRESSURE HEATING PLANT OVER 3.5×10^6 BTU/HR

10 USE NO. 5 OIL ONLY

3 USE NO. 5 & NO. 2 OIL

4 USE NO. 2 OIL ONLY

6,678 MBTU'S PLANT AVERAGE

CLASS 3

LOW PRESSURE HEATING PLANT OVER .75 TO 3.5 MBTU'S

PLANTS USE EITHER NO. 5 OR NO. 2 OIL

CLASS 4

LOW PRESSURE HEATING PLANT UNDER .75 MBTU/HR

PLANTS USE NO. 2 OIL ONLY

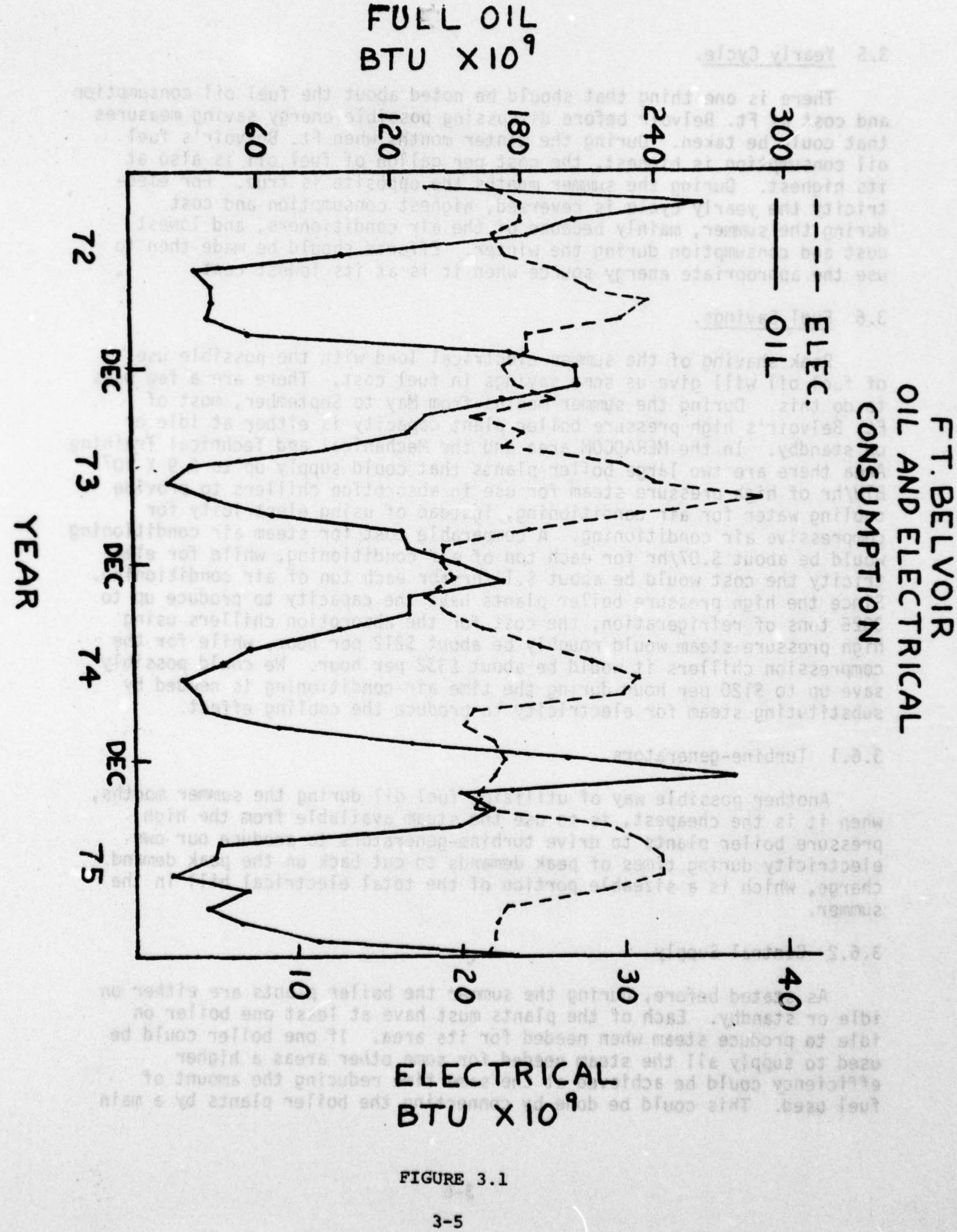

FT. BELVOIR
OIL AND ELECTRICAL
CONSUMPTION
ELEC
OIL
FUEL OIL
BTU X10^9
60
120
180
240
300
72
DEC
73
DEC
74
DEC
75
YEAR
10
20
30
40
ELECTRICAL
BTU X10^9

FIGURE 3.1

3.5 Yearly Cycle.

There is one thing that should be noted about the fuel oil consumption and cost at Ft. Belvoir before discussing possible energy saving measures that could be taken. During the winter months when Ft. Belvoir's fuel oil consumption is highest, the cost per gallon of fuel oil is also at its highest. During the summer months the opposite is true. For electricity the yearly cycle is reversed, highest consumption and cost during the summer, mainly because of the air conditioners, and lowest cost and consumption during the winter. Efforts should be made then to use the appropriate energy source when it is at its lowest cost.

3.6 Fuel Savings.

Peak shaving of the summer electrical load with the possible use of fuel oil will give us some savings in fuel cost. There are a few ways to do this. During the summer months from May to September, most of Ft. Belvoir's high pressure boiler plant capacity is either at idle or on standby. In the MERADCOM area and the Mechanical and Technical Training Area there are two large boiler plants that could supply up to 6.9×10^7 BTU/hr of high pressure steam for use in absorption chillers to provide cooling water for air conditioning, instead of using electricity for compressive air conditioning. A comparable cost for steam air conditioning would be about \$.07/hr for each ton of air conditioning, while for electricity the cost would be about \$.11/hr for each ton of air conditioning. Since the high pressure boiler plants have the capacity to produce up to 3026 tons of refrigeration, the cost for the absorption chillers using high pressure steam would roughly be about \$212 per hour, while for the compression chillers it would be about \$332 per hour. We could possibly save up to \$120 per hour during the time air conditioning is needed by substituting steam for electricity to produce the cooling effect.

3.6.1 Turbine-generators.

Another possible way of utilizing fuel oil during the summer months, when it is the cheapest, is to use the steam available from the high pressure boiler plants to drive turbine-generators to produce our own electricity during times of peak demands to cut back on the peak demand charge, which is a sizeable portion of the total electrical bill in the summer.

3.6.2 Central Supply.

As stated before, during the summer the boiler plants are either on idle or standby. Each of the plants must have at least one boiler on idle to produce steam when needed for its area. If one boiler could be used to supply all the steam needed for some other areas a higher efficiency could be achieved at the same time reducing the amount of fuel used. This could be done by connecting the boiler plants by a main steam line, or by building a new central boiler plants near a main line. Boiler plants No. 332 and No. 1422 serving the MERADCOM area, and the Mechanical and Traing area, respectively, are good candidates for this scheme. Both are large plants, usually with one boiler on idle, and they are only separated by a couple of miles. Since the steam and condensate lines are presently undergoing renovation, the additon of a main line into the two systems might not pose too much of a problem. A complete life cycle cost analysis would have to be performed to see if the cost of installing a main steam line is amortized in the fuel cost savings.

3.6.3 Storage Tanks.

During the summer months when the consumption and cost of fuel oil is lowest, the use of storage tanks would allow us to buy fuel oil during the summer at the lower price and use it in the winter when consumption and cost are the highest. The savings in fuel oil cost should offset the cost of building the storage tanks for this scheme to be feasible. Although this idea is not energy conservative, it could reduce the total fuel oil cost, especially since fuel oil prices are expected to keep rising in the future. (Figure 3.2).

3.7 Alternate Energy Sources.

3.7.1 Coal

The use of fuel oil in the heating and boiler plants makes up the largest single usage of energy at Ft. Belvoir. Since the price of oil is expected to rise, the substitution of coal for fuel oil in the heating and boiler plants could mean a substantial savings in the energy cost at Ft. Belvoir. For the Washington, DC area the sulfur content in coal is limited to 1.0%, and this grade of coal is available for Ft. Belvoir. So the idea of converting the oil fired plants to coal fired looks good. But of all the boiler and heating plants only the larger boiler and heating plants have a large enough total BTU capacity to be considered for conversion to coal. In an inventory taken of the heating and boiler plants at Fort Belvoir only three were felt to be large enough for the savings in fuel cost to offset the conversion cost to coal. One of these, a 3.8×10^6 BTU/hr boiler plant contains package type boilers which are not readily converted to coal burning. The other two could be converted over a period of 30 months at a cost of approximately $1.18M. There is presently no coal burning or handling facilities at these plants, and once new facilities are installed additional labor would be needed to operate the equipment. Also the railroad spurs and trestles would require replacement or extensive repairs to handle the coal cars. Other equipment needed to comply with air pollution abatement regulations for burning coal are electrostatic precipitators, scrubbers, and/or dust collectors, and the facilities to

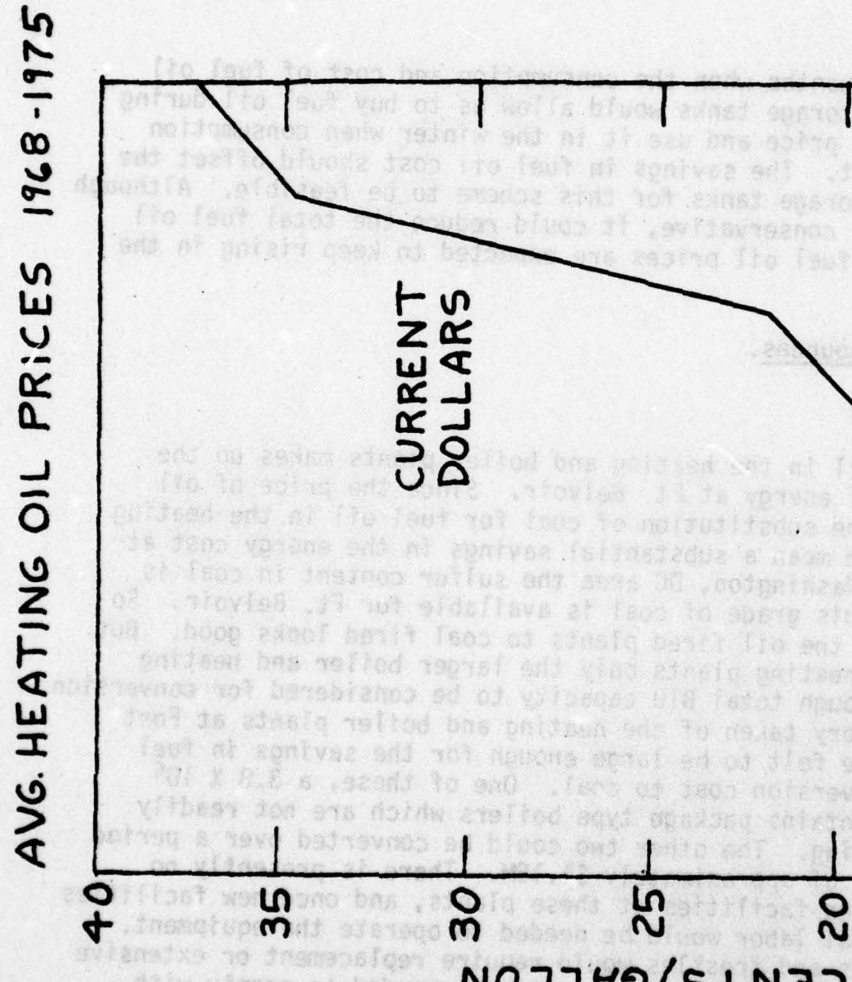

AVG. HEATING OIL PRICES 1968-1975
CURRENT
DOLLARS
CENTS/GALLON
40
35
30
25
20
15
68
69
70
71
72
73
74
75

FIGURE 3.2

handle the waste from the pollution control equipment. Again, a complete analysis would be required to determine the life cycle cost effectiveness of converting the boiler plants to coal. Since most of the plants are slated for major renovations in the near future, this analysis should be done soon to determine if changing the plants over to coal, or building a new central coal fired plant and tying into the existing system would be better than renovating the oil fired plants.

3.7.1 Refuse Burning.

If the boilers were considered for conversion to coal, or if new coal fired boilers are being considered for installation, the possibility of burning refuse and other waste materials in the boilers should be looked into before selecting any coal handling equipment or new coal fired boilers. For example, at present there are many wooden structures on Ft. Belvoir that are due for demolition, and the scrap wood could be used to fire the boilers, in addition to the burnable refuse. Although it would be a small amount of the total energy consumed at Ft. Belvoir, every little bit saved is beginning to count.

3.8 Summary.

Renewed efforts to implement new and strengthen existing energy conservation measures at Ft. Belvoir could help to bring this installation's energy bill down. The ideas setforth previously are not to be considered as the best way or only way to conserve energy, but only to show that there are other possibilities for saving money by reducing energy consumption at Ft. Belvoir. Even though Ft. Belvoir's energy usage has a minimal impact on the surrounding Northern Virginia area, any energy saving measures taken will be of value to the Ft. Belvoir installatiion, and the Army.

4.0 NATURAL GAS

4.1 Consumption.

Natural gas provides nearly one-third of the nation's primary energy and takes care of one-half of our nation's industrial energy requirements. The natural gas industry sells more than three times as much energy, in BTU's, as the electric industry. But here at Ft. Belvoir, the consumption of natural and LP-gas is only 8 percent of the total energy in terms of fuel oil, electricity, and natural gas, and 6 percent of Ft. Belvoir's total energy bill. Fuel oil takes up 62 percent, and electricity the remaining 32 percent of the cost. (Figure 2.1, Tables 3-1, 3-2 & 4-1).

4.2 Supplier.

The natural gas for the Northern Virginia area is supplied by the Washington Gas Light Company (WGL Co.) and is pipeline limited with controls on quantity and cost. The WGL Co. in turn receives its gas from the Columbia Gas Transmission Corporation and the Transcontinental Gas Pipe Line Corporation. (Table 4-2 & Figure 4.1). The curtailment of natural gas during the winter of '75-'76 for Virginia was 14 percent of the requirements, (Table 4-3) and as a result the company cannot add any new customers. Since the company is unable to accept any new customers, there is no additional growth to help offset the effects of inflation on the company's earnings. Earnings were well below the levels authorized by the regulatory commissions, especially in the District of Columbia, and were continuing to decline, while the cost of the gas purchased from both Columbia and Transcontinental were continuing to increase. (Figure 4.2). Consequently the company has filed for higher rates in the District of Columbia, and rate increases are also planned for Maryland and Virginia sometime in late 1976. Also, if deregulation occurs (free market), the price of natural gas could double. These are some factors that could raise Fort Belvoir's gas bill, but should not have any immediate effects on our present supply of natural gas from the WGL Company.

4.3 Rate Structure.

Natural gas service for Fort Belvoir by the WGL Company is supplied under two different rate schedules. General service Schedule "A", (Table 4-4) is available for any purpose and cannot be interrupted at any time.

TABLE 4-1

NATURAL GAS 1975

VIRGINIA		31.5×10^6 MBTU'S
FT. BELVOIR		90.4×10^3 MBTU'S
BELVOIR'S % OF VA.		.29 %
BELVOIR	TOTAL COST	$170,000/YR
	UNIT COST	$1.88/MBTU

TABLE 4-2

WASHINGTON GAS LIGHT COMPANY

SUPPLIERS

COLUMBIA	83%
TRANSCONT.	17%

TOTAL 1975

1.05×10^{14} BTU'S

CONSUMERS

MARYLAND	44%
VIRGINIA	30%
DIST. of COLM.	25%
W. VIRGINIA	1%

Pipelines

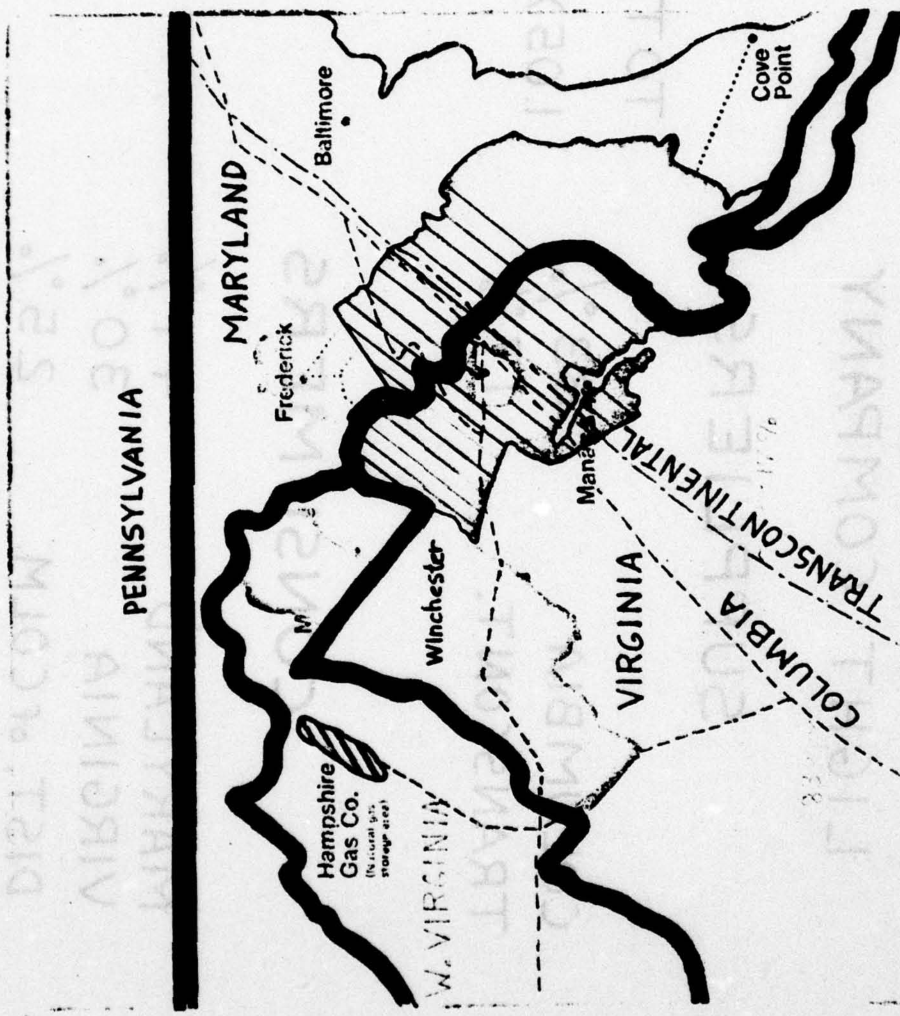


FIGURE 4.1

TABLE 4-3

PROJECTIONS OF NATURAL GAS SHORTAGE DURING
WINTER OF 1975-1976 IN MOST-AFFECTED STATES

	Total Curtailments		Increase Over Last Winter
	Bcf	Percent of Requirements	Bcf
Arizona	22	24	2
California	370	34	46
Delaware	1	12	0
Florida	50	49	10
Georgia	63	29	11
Indiana	17	6	5
Iowa	36	18	4
Kansas	60	23	5
Kentucky	13	10	6
Maryland/D.C.	14	12	1
Missouri	35	15	5
Nevada	24	51	6
New Jersey	21	11	(-10)
New York	41	10	6
North Carolina	41	46	6
Ohio	78	12	11
Pennsylvania	37	9	10
South Carolina	59	55	4
Tennessee	31	22	9
Virginia	12	14	(-1)
West Virginia	12	13	3

Source: FEA/FPC Distributor Survey, updated December 1975

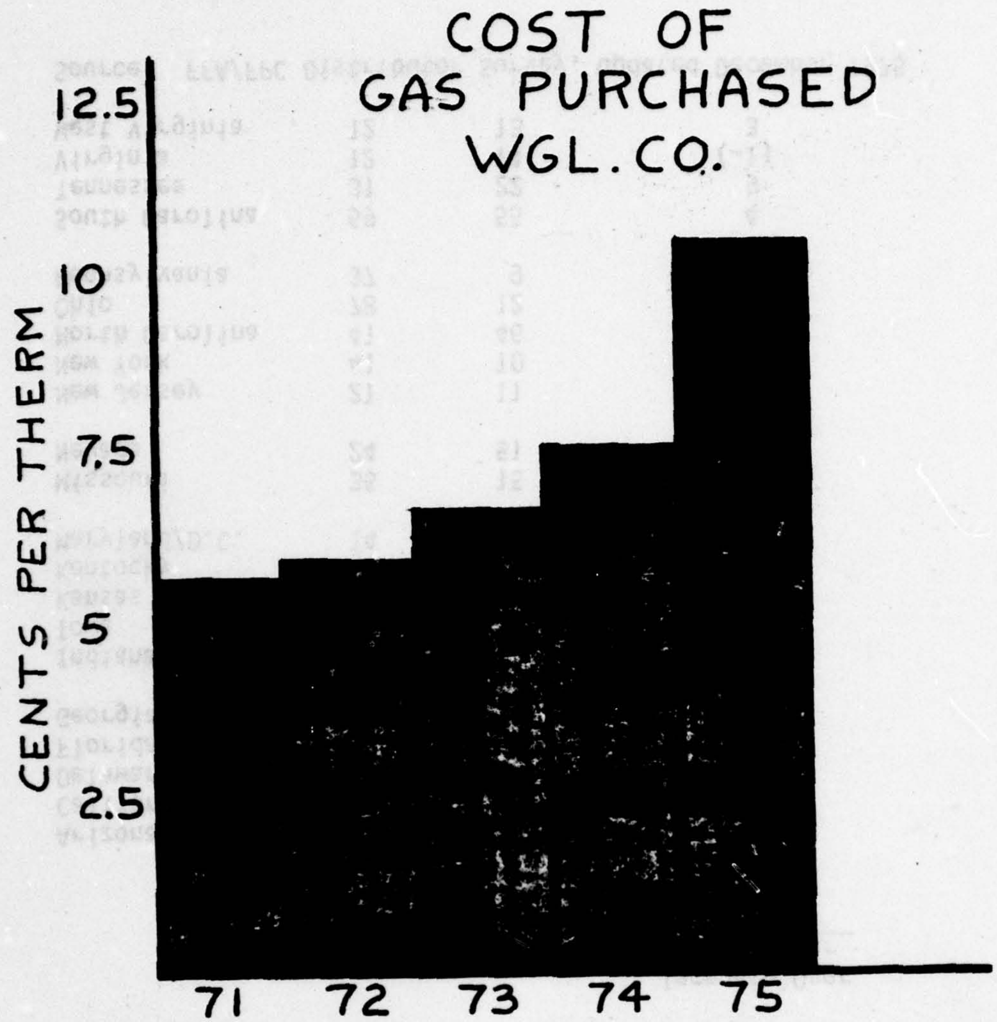

COST OF
GAS PURCHASED
WGL. CO.
CENTS PER THERM
12.5
10
7.5
5
2.5
71
72
73
74
75

FIGURE 4.2

4.3.1 Schedule "A".

TABLE 4-4

WASHINGTON GAS LIGHT COMPANY

SCHEDULE "A"

GENERAL SERVICE RATE

Effective July 1, 1964

AVAILABILITY

This rate is available for gas service for any purpose.

RATE	THERMS PER MONTH	NET	GROSS
First	5 or less	$ 1.50	$ 1.60
Next	10	16.0¢ per Th.	17.5¢ per Th.
Next	15	14.6¢ per Th.	15.6¢ per Th.
Next	570	13.0¢ per Th.	13.5¢ per Th.
Next	5,400	10.6¢ per Th.	10.7¢ per Th.
Next	94,000	9.5¢ per Th.	9.5¢ per Th.
Next	100,000	9.0¢ per Th.	9.0¢ per Th.
Over	200,000	8.5¢ per Th.	8.5¢ per Th.

PURCHASED GAS ADJUSTMENT

The charges specified in this schedule shall be subject to an adjustment per therm for increases or decreases in the supplier's rate for purchased gas, in accordance with Section 16 of the General Service Provisions.

The main users of Schedule "A" on this installation are family housing, the hospital, the NCO Club, and some MERADCOM laboratories, and they constitute 95 percent of the natural gas used at Fort Belvoir. This gas is used mainly for space and water heating, and cooking in the family housing. Large volume interruptible Schedule "I", (Table 4-5) is available for interruptible gas service to any customer with the restriction that the gas can be shut off at any time with prior notice.

4.3.2 Schedule "I".

TABLE 4-5

WASHINGTON GAS LIGHT COMPANY

SCHEDULE "I"

INTERRUPTIBLE RATE - LARGE VOLUME
initially effective June 1, 1962;
PURCHASED GAS ADJUSTMENT revised
effective April 1, 1971 (Maryland & Virginia)
April 7, 1971 (District of Columbia)

AVAILABILITY

This rate schedule is available for interruptible gas service to any customer when:

(a) The capacity of the Company's facilities and the available gas supply are sufficient to provide the quantities requested by the customer; and

(b) The customer executes a Sales Agreement for a period of not less than 1 year.

RATE

	Net	Gross
Per Therm	5.5¢	5.775¢

At Ft. Belvoir the two consolidated mess halls are the only buildings on Schedule "I" and they make up 1.6% of the total natural gas usage. In the past the gas to the mess halls has been interrupted for a week to ten days at a time, and presently the WGL Company expects to be able to serve most of the requirements of its firm customers under normal weather conditions. For the fifth consecutive year, weather during the heating months has been warmer than the Weather Bureau's historical norm, but if a hard winter occurs, further curtailments could be imposed which means that gas to the mess halls could be interrupted for longer than two weeks. (Figure 4.3). The mess halls can change over to fuel oil on short notice, so an interruption in the gas supply would not be much of an inconvenience.

4.4 Propane.

Propane or liquified gas constitutes about 14 percent of the total gas requirements at Ft. Belvoir. (Table 3-1 & 3-2). The propane gas is brought in by trucks and stored in tanks at various locations around Fort Belvoir, usually next to the units they serve, but sometimes central

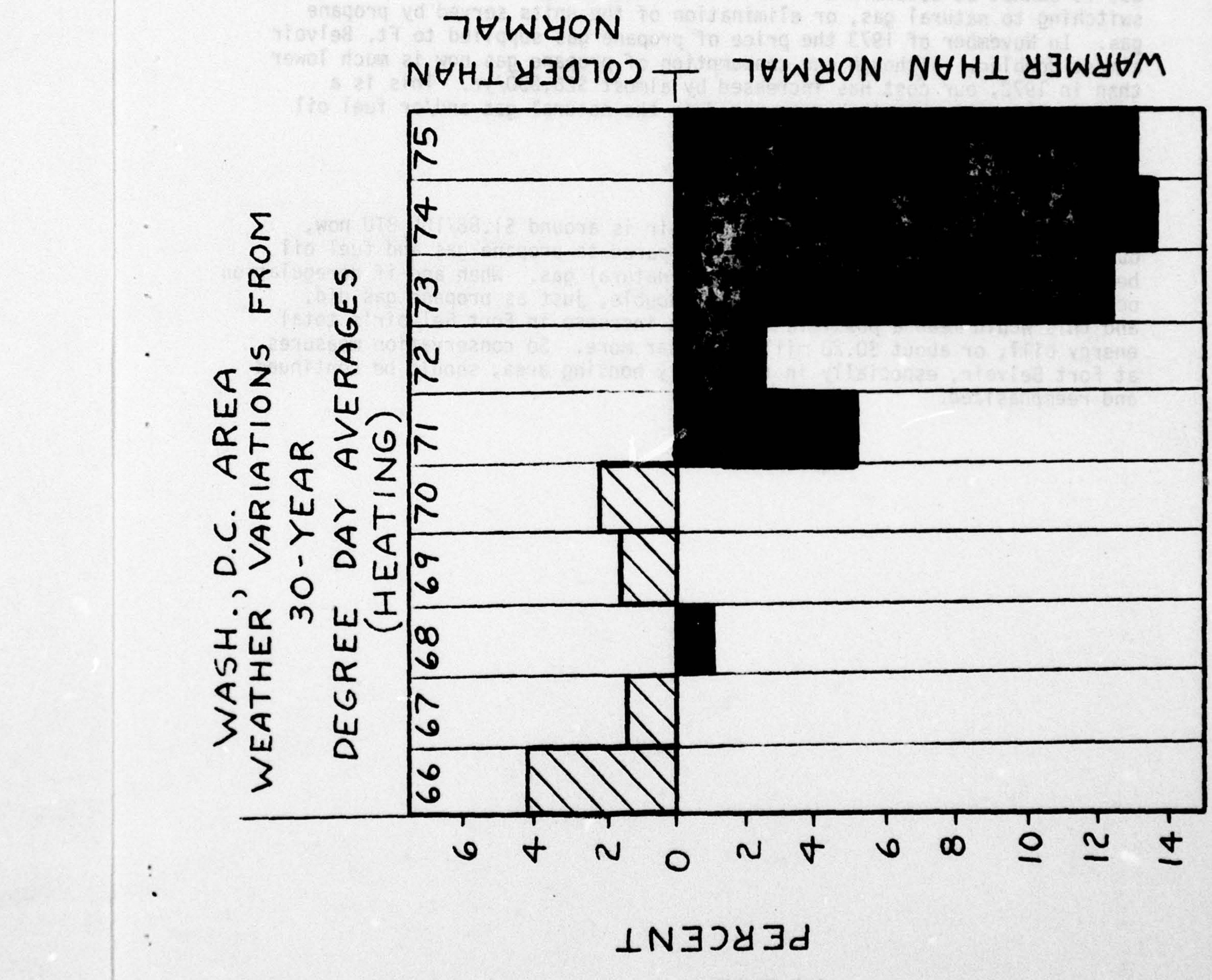

WASH., D.C. AREA
WEATHER VARIATIONS FROM
30-YEAR
DEGREE DAY AVERAGES
(HEATING)
66
67
68
69
70
71
72
73
74
75
WARMER THAN NORMAL
COLDER THAN NORMAL
6
4
2
0
2
4
6
8
10
12
14
PERCENT

FIGURE 4.3

storage tanks may serve several units. The majority of the propane gas is used for cooking in the enlisted men's mess and the rest is used for cooking, heating and other needs wherever needed and where natural gas lines do not exist to service the buildings. The total consumption of propane gas at Fort Belvoir has declined since 1972 to its present level, but it cannot be determined if this is due to energy conservation measures, switching to natural gas, or elimination of the units served by propane gas. In November of 1973 the price of propane gas supplied to Ft. Belvoir almost doubled. Although our consumption of propane gas now is much lower than in 1972, our cost has increased by almost $26,000/yr. This is a relatively small amount when compared to the natural gas and/or fuel oil cost increases.

4.5 Projected Cost.

The natural gas cost for Fort Belvoir is around $1.88/10^6$ BTU now, but these costs are artificially low compared to propane gas and fuel oil because of the regulation of interstate natural gas. When and if deregulation occurs, the price of natural gas could double, just as propane gas did, and this would mean a possible 5 percent increase in Fort Belvoir's total energy bill, or about $0.28 million a year more. So conservation measures at Fort Belvoir, especially in the family housing area, should be continued and reemphasized.

5.0 ELECTRICAL

5.1 Historical Summary.

5.1.1 Supplier.

Virginia Electric and Power Company (VEPCO) supplies the military installation of Fort Belvoir with all electric power requirements. Fort Belvoir is primarily military schools, offices and residences, thus its consumption curves is the superposition of the three.

5.1.2 Consumption.

Fort Belvoir electrical consumption was on a downward trend from 1972 until 1974 when it once again began to increase (Figure 5.1). The gain was 10% over the previous year and 7% with respect to a 1971 base, the following table gives supporting data.

TABLE 5-1

FORT BELVOIR HISTORICAL CONSUMPTION

YEAR	CONSUMPTION X 10^6 KWH	CHANGE OVER BASE %	CHANGE OVER PREVIOUS YEAR %
1971	83.74	Base	--
1972	89.51	7	7
1973	92.04	10	3
1974	80.85	-3	-10
1975	89.25	7	10

The downward trend, commencing in 1972 may be a result of the Arab oil embargo, voluntary energy conservation measures, a moderation of weather conditions, or perhaps a combination of all three. A period of particular interest falls between November of 73 and May of 74. It represents the lowest valley on the consumption curve for the years surveyed, and probably accounts for the savings achieved in 73 and 74. Assuming resistive heating for space and water accounts for the minor winter peaks, one may speculate, the winter of 73-74 was rather mild since the consumption curve is nearly flat compared to other winter curves. This period also coincides with the Arab oil embargo and the government mandatory energy alocation policy. If a correlation can be drawn between the above observations one may conclude that great energy savings are available from a directed conservation program.

5.1.3 Demands.

The highest demand peaks were realized during the months of August and September, and can be found below with accompanying information.

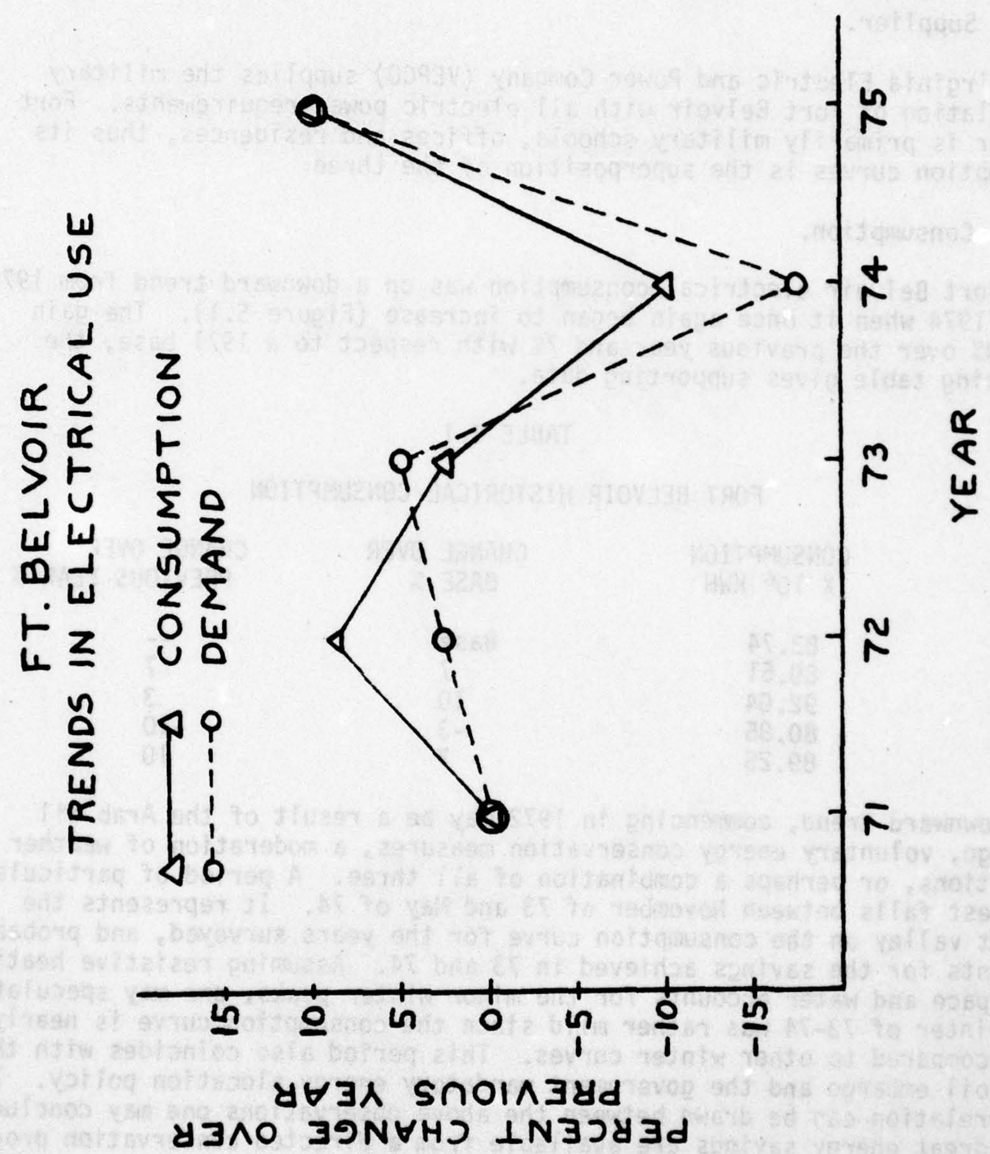

FT. BELVOIR
TRENDS IN ELECTRICAL USE
CONSUMPTION
DEMAND
PERCENT CHANGE OVER
PREVIOUS YEAR
15
10
5
0
-5
-10
-15
71
72
73
74
75
YEAR

FIGURE 5.1

TABLE 5-2

FORT BELVOIR HISTORICAL DEMAND

YEAR	MONTH	PEAK (KW)	% INCREASE 1.	% INCREASE 2.
71	August	21480	1.00	--
72	August	21960	1.02	1.02
73	September	23160	1.08	1.05
74	September	19180	.89	.83
75	September	21158	.99	1.10

The variability of the demand peaks during the summer months indicates the high functionality of demand with respect to weather during this period. On the other hand the extremely minor peak during winter months imply the minimual effect of weather on demand. Coupling these two, one may conclude compressive air conditioning is primarily responsible for the sharp demand peaks during the cooling season on Fort Belvoir. This assumes that non-climate control use of electricity on Fort Belvoir is constant with respect to weather.

Prior to the winter of 74-75 the demand curve was always above the consumption curve (Figure 5.2). Subsequent winters and including 74-75, the demand curve dropped below the consumption curve. This indicates for winter periods the peak demand to consumption ratio is dropping, unfortunately this is not the case for the high electrical consuming summer months.

5.2 Rate Structure.

VEPCO supplies Fort Belvoir with all electric power requirements (excluding emergency power capacity). Currently Fort Belvoir is under Schedule MS for the main post; Schedule #6 for the proving grounds, and Schedule #5 for the reserve units. VEPCO wishes to replace Schedule MS with Schedule #6 when the present contract expires this fall (Sept 30). The Army has yet to concur. A historical summary of electric rates can be found below, the total schedule appears in the Appendix. A few points may be helpful when considering the rate schedules.

The terms demand and consumption are often confusing. Demand refers to the electricity used during a specific interval, usually the metering period (15, 30, 60 minutes). The demand charge is set by applying the rate schedule to the peak demand over the billing period. It is the instantaneous energy required (demanded) of the electric company by the consumers and thus is a power term (kw or Kwh/h). Consumption on the other hand is the amount of electricity used (consumed) over the billing

1. With respect to 1971 base.
2. With respect to previous year.

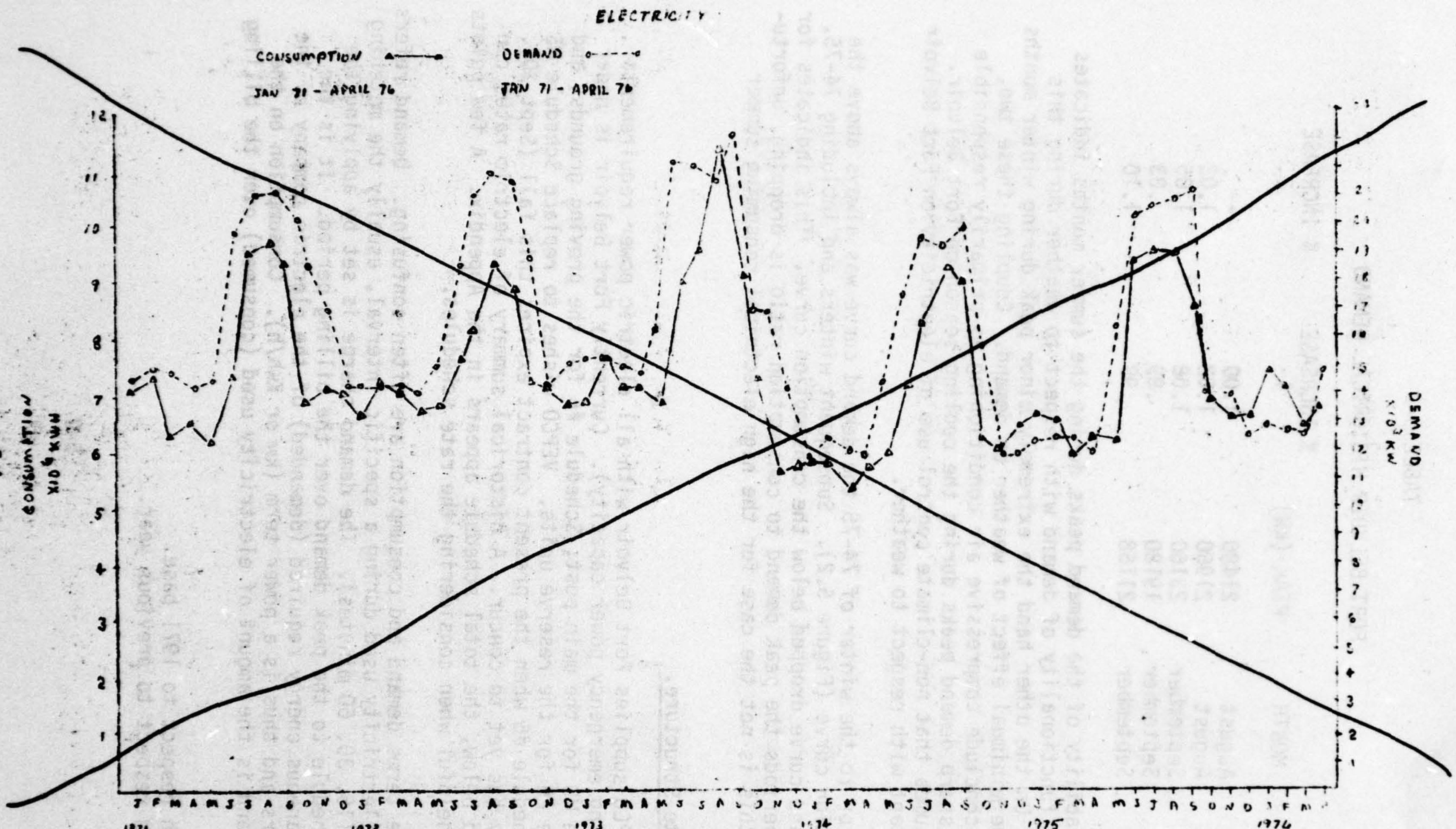

ELECTRICITY
CONSUMPTION
JAN 71 - APRIL 76
DEMAND
JAN 71 - APRIL 76
CONSUMPTION
X10^6 KWH
DEMAND
X10^3 KW
1971
1972
1973
1974
1975
1976

FIGURE 5.2

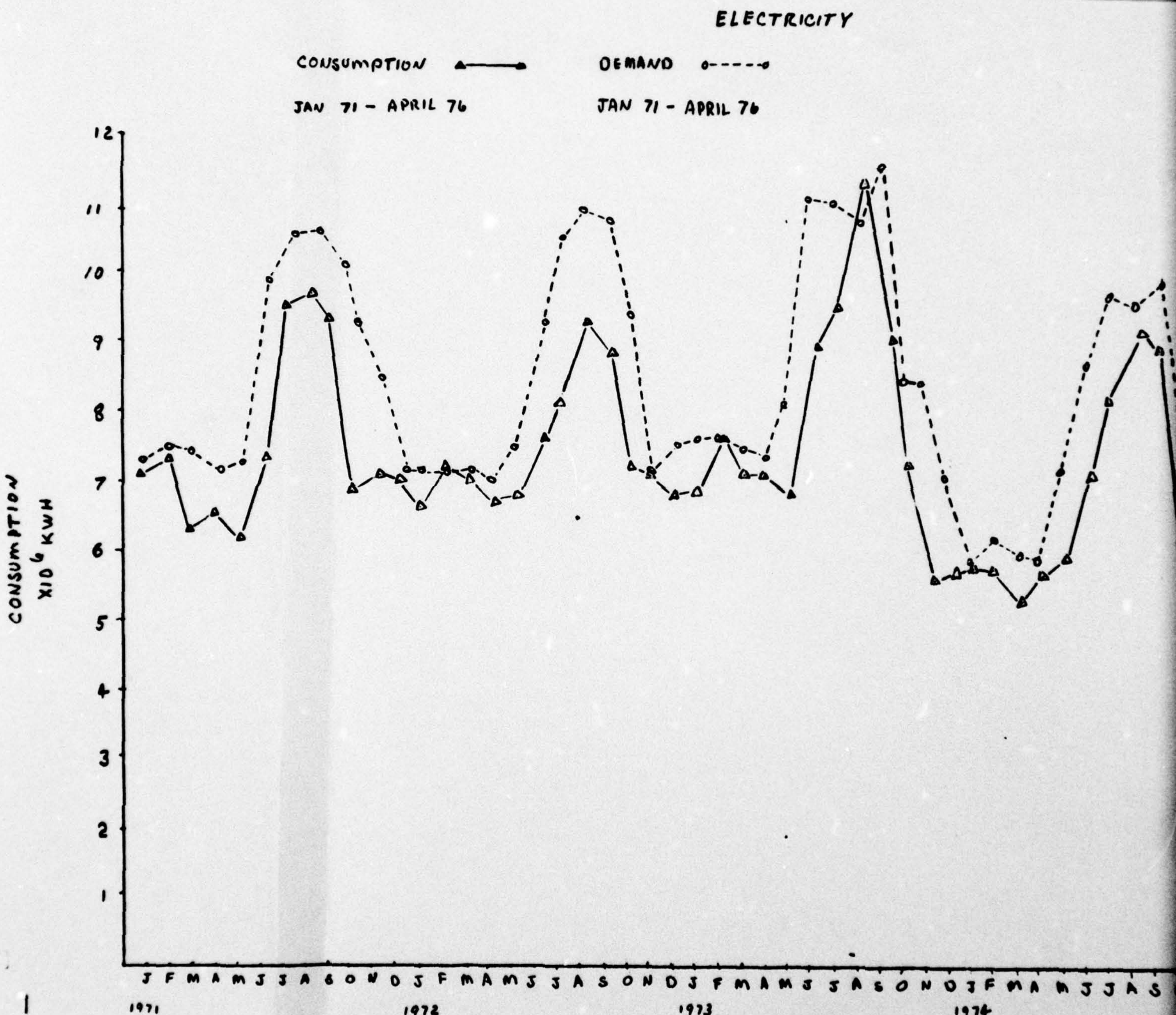

ELECTRICITY
CONSUMPTION
DEMAND
JAN 71 - APRIL 76
JAN 71 - APRIL 76
CONSUMPTION
X10^6 KWH
12
11
10
9
8
7
6
5
4
3
2
1
J F M A M J J A S O N D J F M A M J J A S O N D J F M A M J J A S O N D J F M A M J J A S
1971
1972
1973
1974

FIGURE 5.2

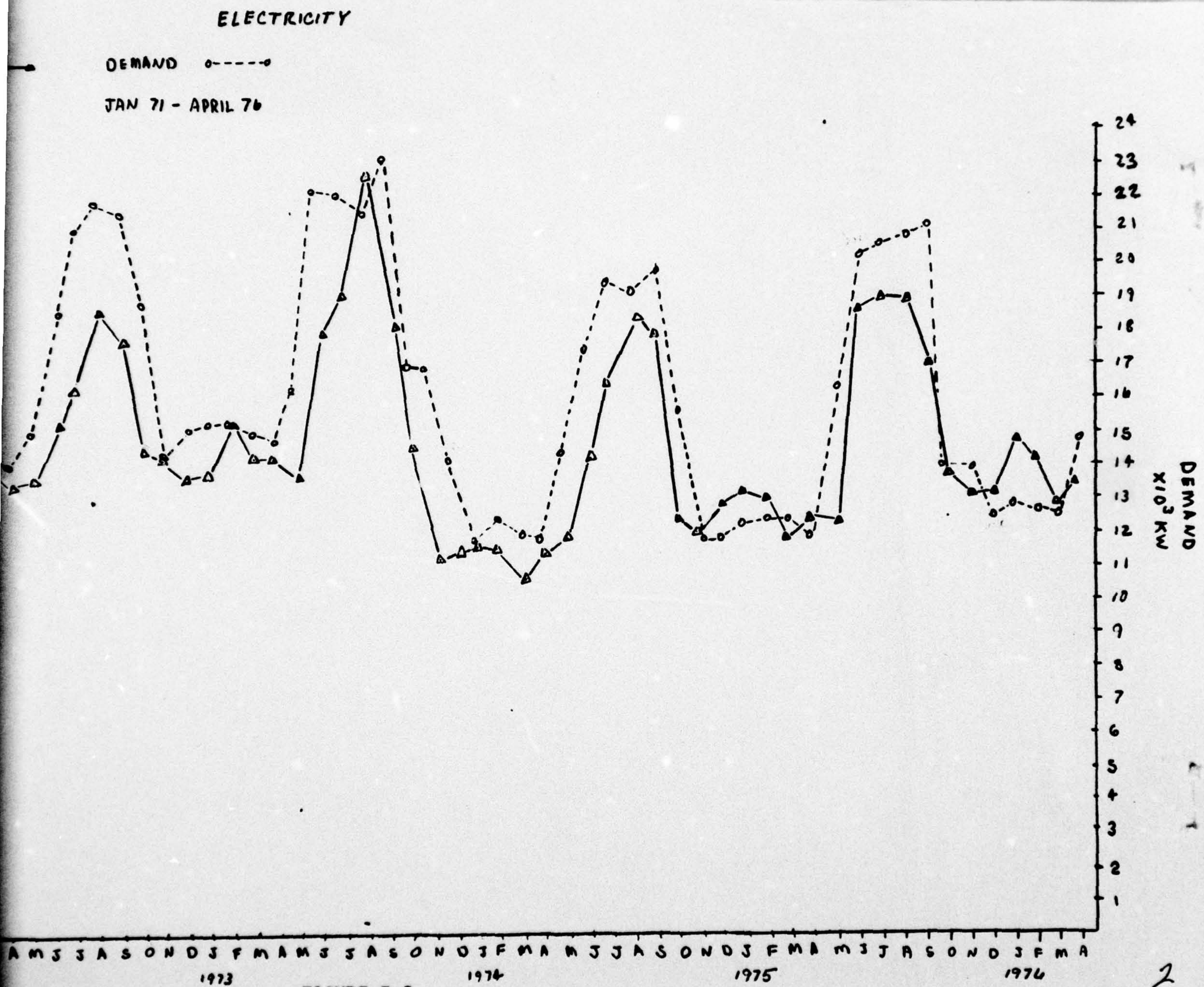

ELECTRICITY
DEMAND o-----o
JAN 71 - APRIL 76
DEMAND
X10^3 KW
24
23
22
21
20
19
18
17
16
15
14
13
12
11
10
9
8
7
6
5
4
3
2
1
A M J J A S O N D J F M A M J J A S O N D J F M A M J J A S O N D J F M A M J J A S O N D J F M A
1973
1974
1975
1976

FIGURE 5.2

2

period and thus is an energy term (Kwh). A ratchet is a clause in a contract which allows the utility to set the demand charge for future billing periods (usually 11) by a previously registered peak, thus the highest peak sets the demand charge for the next eleven months. Utilities finance expansion through demand payments. Only Schedule MS is ratchet free.

TABLE 5-3

HISTORICAL RATE STRUCTURE

SCHEDULE MS

	ADOPTED 2-1-68 EXPIRED 10-2-74	10-1-74 9-30-75	%
1st 1500 KW($)	3,000.00	5,055.50	53.2
Excess of 1500K	2.00	3.06	"
1st 250,000 Kwhr	.42	.64	"
2nd 250,000 Kwhr	.40	.61	"
Excess of 500,000 Kwhr	.38	.58	"

Comments: No ratchet clause. Fuel adjustment clause effective 10-1-74.

SCHEDULE NO. 6

ADOPTED EXPIRED	7-1-72 7-1-74	7-1-74 10-2-75	%	10-2-75 10-2-76	%
1st 50 Kws ($)	216.00	219.30	1.4	326.55	48.9
Next 650 Kws($/KW)	2.70	2.67	-1.1	4.31	61.4
Next 4300 Kws($/KW)	2.37	2.34	-1.3	3.98	70.1
Additional Kw($/KW)	2.28	2.25	-1.3	3.89	72.9
1st 24,000Kwh(¢/Kwh)	1.041	1.041	0	2.005	92.6
Next 186,000kw(¢/Kwh)	.739	.739	0	1.635	121.2
Additional Kwh (¢/Kwh)	.539	.539	0	1.391	134.5

Comments: Eleven (11) month ratchet clause. Fuel adjustment clause.

TABLE 5-3 (cont'd)

SCHEDULE NO. 5

	ADOPTED 7-1-72 / EXPIRED 7-1-74	7-1-74 / 10-2-75	%	10-2-75 / 10-2-76	%
1st 210Kw(¢/Kwh)	5.490	5.70	3.8	7.98	40.0
Next 300Kwh(¢/Kwh)	4.439	4.64	4.5	6.72	44.5
Next 2490Kwh*(¢/Kwh)	3.239	3.52	8.7	5.32	51.1
	2.864	2.70	-5.9	4.32	60.0
Next 1950Kwh*(¢/Kwh)	1.599	1.85	15.7	3.24	75.1
	--	1.60	--	2.94	83.4
Additional Kwh	1.039	1.15	10.7	2.41	109.6

*First entry for July through October, second entry November through June, 10-2-75, 2500Kwh and 2000Kwh.

[1]11 month ratchet clause on demand; add 200 Kwh to each demand 10-30Kw; 100 for each over 30.

5.3 Business and Territory Served.[1]

5.3.1 Service Area.

The electric business of the Company is conducted in most of Virginia and in parts of North Carolina and West Virginia. In its service area it sells electricity to retail customers (including governmental agencies) and at wholesale to rural electric cooperatives and municipalities.

Gas service is provided only in the Norfolk-Newport News area (except Portsmouth) and in the area extending from Newport News to and including Williamsburg. Curtailments of service by the Company's suppliers have been approved by FPC. As a consequence, the Company has virtually eliminated new connections.

5.3.2 Plans and Policy.

The Company's proposal, made in response to an inquiry from rural electric cooperatives, to sell them an undivided interest in all present and currently planned generating facilities (other than existing hydro facilities and leased combustion turbines) amounting to between 5.54%

[1]Supplied by VEPCO.

and 7.32% of generating capability, at a price in excess of original cost depreciated, has been rejected by the cooperatives and they have made a counter proposal to purchase an interest in selected facilities. Nothing definitive has yet evolved. The Company has also entered into discussions with its municipal wholesale customers which are interested in developing their own generating facilities. They have made a proposal to purchase the Company's principal existing hydro facilities, and the Company has indicated that this does not seem to be desirable; however, the Company is to hear the municipals' reasons and justifications for the offer. One cooperative is pursuing discussions with other wholesale customers of the Company as to participation by them in a proposed pumped storage facility on the Staunton River with associated steam generation, and an application for a preliminary permit has been filed by the cooperative with the FPC. Whether the proposal would be financially and otherwise feasible is not known by the Company. Legislation has been enacted in North Carolina and proposed in Virginia that would permit certain local governmental entities to join together to finance, construct and operate generating and transmission facilities. A list of VEPCO's generating units is located in the Appendix.

5.3.3 Sources of Energy Used.

Kilowatt-hour output, by energy source is shown below:

TABLE 5-4

Source	Actual 1974 Per Cent	1975 Per Cent	Estimated 1976 Per Cent
Nuclear	18%	26%	29%*
Fossil			
Coal			
Mt. Storm (mine-mouth) .	19	19	29
Other	5	7	17
Oil	47	43	22
Combustion turbines . . .	2	1	1
Hydro	2	3	2
Purchased and Interchanged . .	7	1	--
	100%	100%	100%

*Full operation of North Anna Units 1 & 2 (planned for initial commercial operation in 1977) is expected to increase nuclear to 50%. (See Construction Program, Figure 5.5).

5.4 Consumption and Demand.

Between 1965 and 1973 VEPCO's annual sale's grew at a compounded growth rate of 9%. In 1974 sales fell by .3%. During the same period peaks grew at the same pace but continued into 1975. A summary since 1965 can be found below.

TABLE 5-5

HISTORICAL SUMMARY VEPCO

YEAR	PEAK KW	CAPACITY* (KW)	ACTUAL** RESERVE At time of Peak	Sales
1965	2900	3290	13.4%	13.3 Billion kWh
1966	3320	4092	23.2%	15.0 " "
1967	3499	3962	13.2%	16.9 " "
1968	4253	4331	1.8%	19.0 " "
1969	4639	4876	5.1%	21.0 " "
1970	4852	5323	9.7%	23.5 " "
1971	5295	5932	12.0%	24.7 " "
1972	6232	6762	8.5%	26.9 " "
1973	6900	7585	9.9%	30.0 " "
1974	6734	7714***	14.5%	29.9 " "

*Includes purchase.

**Desired Range of Peak is 15 to 18 per cent.

***Yorktown Unit #3 (818 MW) added in December 1974, bring capacity to 8532.

Monthly peaks have been plotted in Figure 5.3. One may speculate the increase in peak demand will greatly exceed past growth rates since the minor winter peaks was substantual. If consumption fails to grow or grows at a slower pace, electrical rates will undoubtful rise according i.e., to finance peakers and to pay for idle capacity. This scenario is most unfortunate for facilities with limited monetary resources since greater portions of an already strained budget must go to maintaining present utility services. Such a situation stymies any hope for relief through conservation by ironically demanding funds that could otherwise ameliorate the devasting effects of time on facilities.

5.5 Generation and Distribution.

Figure 5.4 shows VEPCO's distribution system. Almost 71% (1977 productions) of its capacity is supplied by either nuclear plants or mine mouth operations; the remaining by coal, oil or hydro. Since

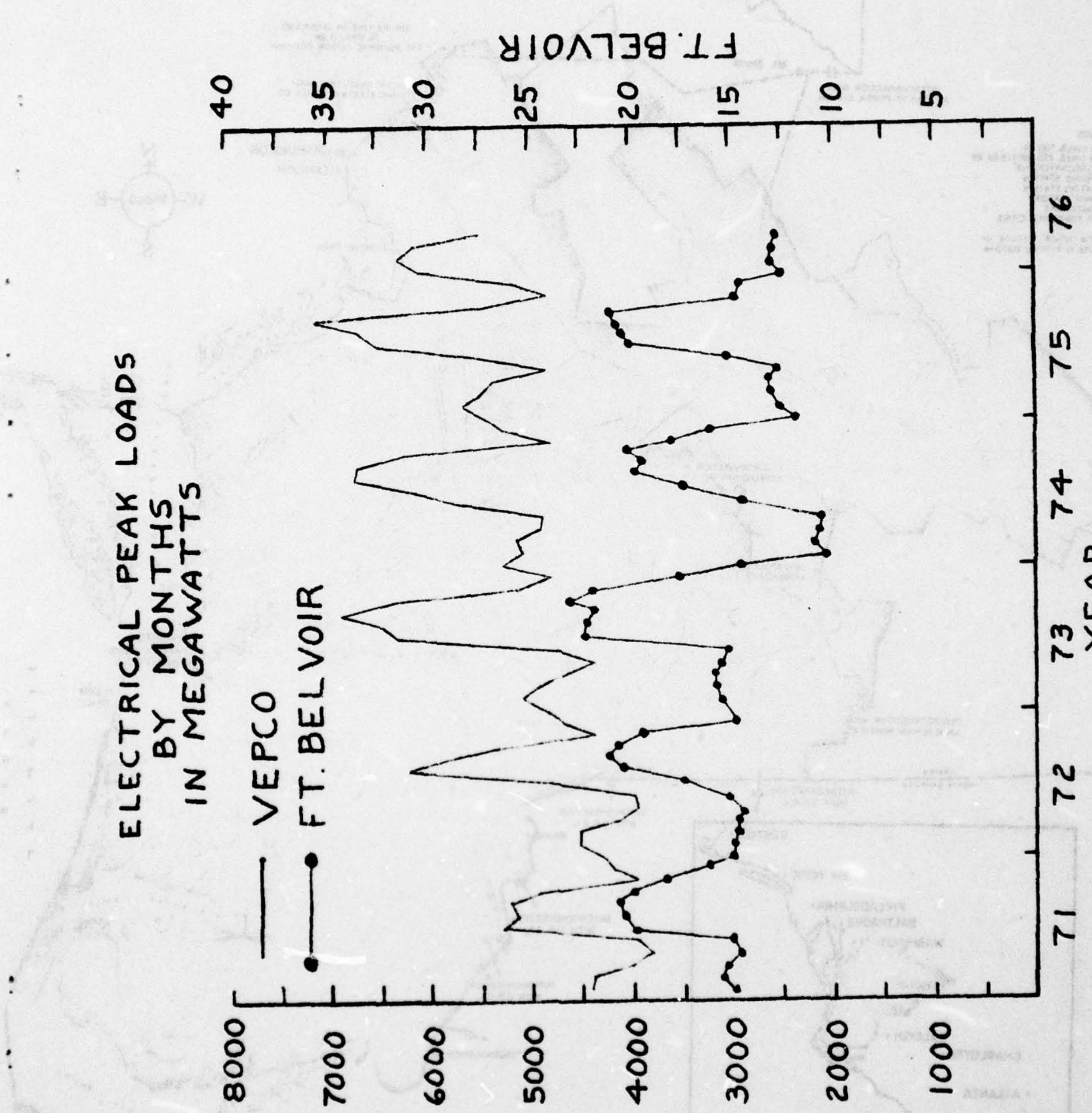

ELECTRICAL PEAK LOADS
BY MONTHS
IN MEGAWATTS
VEPCO
FT. BELVOIR
VEPCO
8000
7000
6000
5000
4000
3000
2000
1000
FT. BELVOIR
40
35
30
25
20
15
10
5
71
72
73
74
75
76
YEAR

FIGURE 5.3

SYSTEM MAP
VIRGINIA ELECTRIC AND POWER COMPANY

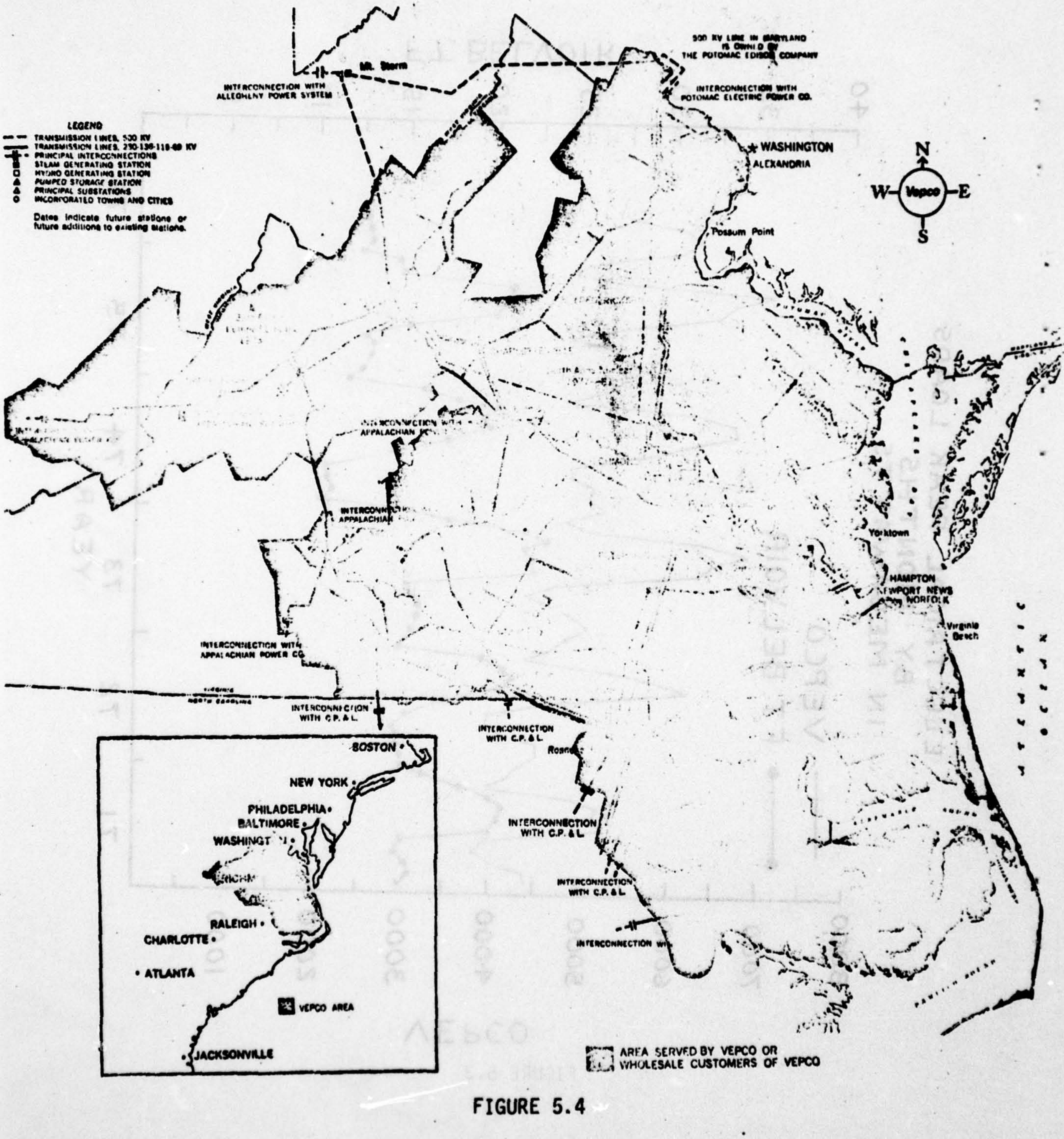
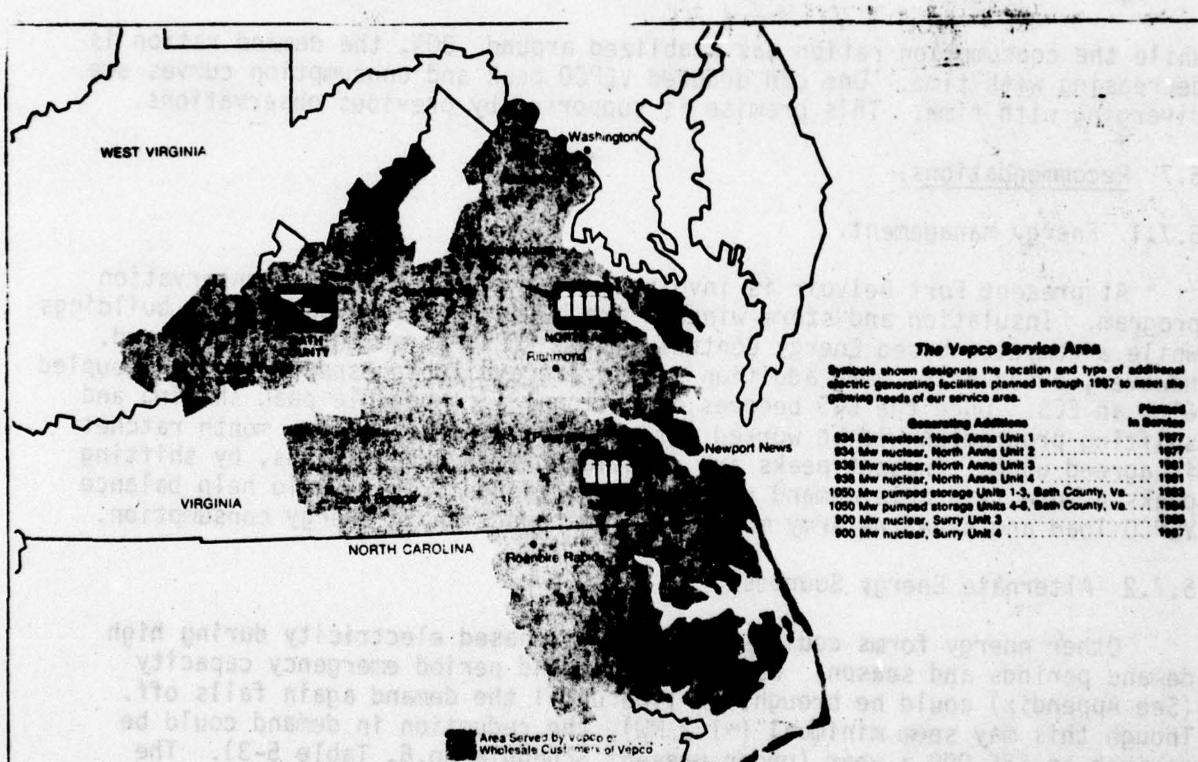


FIGURE 5.4

most of the plants are fueled on site, a transportation strike would have a limited effect on VEPCO's generating capacity, thus reducing a possible bottleneck. Figure 5.5 displays VEPCO's future generating plants. The vast increase use of nuclear energy liberate VEPCO's the debilitating chains of an OPEC cartile.

FIGURE 5.5

FUTURE GENERATING PLANTS



5.6 Belvoir's Effect Upon VEPCO.

Fort Belvoir is only a small percent of VEPCO's total market as can be seen in Table 5-6.

TABLE 5-6

COMPARISON OF FORT BELVOIR AND VEPCO

CONSUMPTION				DEMAND		
	Belvoir Kwh X 10^6	VEPCO Kwh X 10^9	% of VEPCO	Belvoir MW	VEPCO MW	%
71	83.74	24.7	.16	21.5	5295	.41
72	89.51	26.9	.33	22.0	6232	.35
73	92.04	30.0	.31	23.1	6900	.33
74	80.25	29.9	.27	19.2	6737	.28

While the consumption ration has stablized around .30%, the demand ration is decreasing with time. One can deduced VEPCO peak and consumption curves are diverging with time. This premise is supported by previous observations.

5.7 Recommendations.

5.7.1 Energy Management.

At present Fort Belvoir is involved in a rigorious energy conservation program. Insulation and storm windows are being installed on several buildings while a computer based Energy Control System (ECS) is on the drawing board. However, areas exist were addition saving are available especially when coupled with an ECS. Once the ECS becomes operational a compatible peak shaving and shifting program should be worked out, especially if an eleven month ratchet is agreed upon. Present peaks are coincident with VEPCO's thus, by shifting peaks a more favorable demand rate may be obtained. This would help balance VEPCO load and save the Army money with no reduction in energy consumption.

5.7.2 Alternate Energy Sources.

Other energy forms could supplement purchased electricity during high demand periods and season. During peak demand period emergency capacity (See Appendix) could be brought on line until the demand again falls off. Though this may seem minimual (~1.2 MW), the reduction in demand could be as much as $56,000 a year (under present Schedule No.6, Table 5-3). The majority of Ft. Belvoir's boiler capacity is idle during peak electrical consuming summer months. As stated earlier, a large percentage of the summer load is compressive air conditioning. The boilers could be brought on line to power absorption units in the buildings served by the central plants. An economically optimum mix of compressive and absorption air conditioning could be employed thus reducing summer electrical peaks and avoid the exorbitant demand charge that accompany them.

Though Fort Belvoir is making strides in reducing its energy consumption the above ideas should be considered since a real possibility for saving exist, though one must proceed with caution, because in some cases the cost of implementing the program can never be recovered in saving achieved.

6.0 COAL

6.1 Overview.

Coal production has been on the decline since the turn of the century. In 1900 coal accounted for 90% of the U.S. energy needs, by 1972 it contributed only 17%. A combination of keenner competition from other sources and environmental concerns has been the major impetus behind this trend. Oil cut into coal's energy monolopy initially through the automobile boom then later becoming more popular with industry and utilities. Oil is much easier to handle and treat than coal thus in some areas of the country oil proved to be more economical. As the population became aroused over environmental questions the push was towards oil since it is cleaner burning. Nuclear power is replacing coal as the prime mover for large central power stations. Nuclear plants, though capital intensive, produce electricity much cheaper than equivalent coal plants do. Its unblemished safety record coupled with the above economic considerations, render utilities with a safe and reliable source of electricity, without a disastrous effects on the surroundings environmental quality.

Since the 1973 oil embargo coal is regaining capacity lost to oil. Where possible, oil fired plants have been converted to coal, and greater considerations is being given to coal in new projects. Unfortunately two constraints have stymied the substitution of coal for oil; one, the enormous capital cost for conversion of existing plants and two, the lead time involved in new construction plants. Coal is expected to see its greatest growth rate between 1985-1990, then return to a declining growth rate.

At today's consumption rate U.S. coal reserves are expected to last 300 years. In the East both high and low sulfur deposits exist while low sulfur coal is generally found in the West. Eastern utilities are usually out bid by industry for the low sulfur grades, thus they must find alternate sources. If high sulfur coal can be bought at prices low enough to justify a scrubber, this avenue is usually followed, otherwise low sulfur western coal and foreign oil are weighed along with the above alterative as to which is the most economically favorable.

6.2 VEPCO.

In 1975 VEPCO fired 1900 MW with coal, 88% being produced at the Mt. Storm mine mouth operation. Coal accounted for approximately 27% of VEPCO total output. In 1976 coals expected contributed is 47%. Continual base loading of the plants is partly responsible for this increase. The 1977 predictions show coal declining by 17% (30% of the total). This is due to the big nuclear plants scheduled to come on line at North Anna, not a reduction in coal capacity. VEPCO's long range plans call for increase use of nuclear energy for base loading, and oil for intermediates and peakers with coal being slowly phased out.

6.3 Fort Belvoir.

Oil has replaced coal as a fuel on Fort Belvoir. Central boiler plants can be converted to coal, but at exorbitant cost. No new boiler plants are being planned in the near future. Thus the coal has no direct effect on Fort Belvoir, though it directly influences the electricity rates Fort Belvoir pays and has an indirectly influence on oil prices. The effect of a coal crisis would have minimal effect on Fort Belvoir.

APPENDIX

VEPCO'S GENERATING PLANTS

BREMO

Unit 3	71.7 MW	1950	Coal
Unit 4	164.0 MW	1958	Coal
	235.7 MW	- Cost - $37.7 Million	

CHESTERFIELD

Unit 1	56 MW	1944	--
Unit 2	73 MW	1949	--
Unit 3	100 MW	1952	Oil
Unit 4	166 MW	1960	
Unit 5	33 MW	1964	
Unit 6	658 MW	1969	
	1,386 MW	- Cost - $169.4 Million	

GASTON

Units 1-4	225 MW	1963	$43.7 Million-Hydro

MOUNT STORM

Unit 1	553 MW	1965	$ 76.8 Million-Coal
Unit 2	553 MW	1966	49.7 Million
Unit 3	560 MW	1973	107.9 Million
	1,666 MW		$209.5 Million

PORTSMOUTH

Unit 1	101 MW	1953	
Unit 2	101 MW	1954	Oil
Unit 3	162 MW	1959	
Unit 4	233 MW	1962	
	597 MW	- Cost - $75.5 Million	

POSSUM POINT

Unit 1	74.0 MW	1948	
Unit 2	69.2 MW	1951	
Unit 3	101.0 MW	1955	
Unit 4	232.9 MW	1962	
	477.1 MW	- Cost - $59.9 Million	

ROANOKE RAPIDS

Units 1-4	100 MW	1955	$30.6 Million-Hydro

VEPCO'S GENERATING PLANTS
(Cont'd)

SURRY

Unit 1	788 MW	1972	
Unit 2	788 MW	1973	$402 Million-Nuclear
	1,576 MW		

YORKTOWN

Unit 1	166 MW	1957	
Unit 2	170 MW	1958	
Unit 3	818 MW	1974	Oil
	1,154 MW	- Cost - $214.2 Million	

NOTE: Cost figures from Page 432-FPC No. 1 1974.

FT. BELVOIR RANKS 24 th IN TOTAL ENERGY CONSUMED WITH RESPECT TO CONUS ARMY INSTALLATIONS

FT. BELVOIR STATISTICS FOR FY 75

- 8,419,000 SQ.FT. OF FACILITIES – ABOUT 2900 BUILDINGS
- 17,811 EFFECTIVE POPULATION
- 86,775,000 KWHRS USED AT 18.8 MILS/KWHR GROSS
- 422,642 MBTU'S IN 6 CLASS-1 BOILER PLANTS
- 113,532 MBTU'S IN 7 CLASS-2 HEATING PLANTS
  8,800 MBTU'S GAS FIRED
- 180,275 MBTU'S IN 95 CLASS-3 HEATING PLANTS
- 368,450 MBTU'S IN 612 CLASS-4 HEATING PLANTS
  107,175 MBTU'S GAS FIRED
- 2670 TONS OF AC – 18 SYSTEMS OVER 100 TONS
- 2425 TONS OF AC – 81 SYSTEMS 20 TO 100 TONS
- 170 HP OF COLD STORAGE – 26 WALK IN SYSTEMS
- 383,000 CU.YDS. OF REFUSE – 1 LANDFILL

1985 UTILITY COAL* CONSUMPTION BY CENSUS REGIONS**
REFERENCE SCENARIO, $13 OIL IMPORTS
(Million Tons)

Region	1974	1985	Absolute Increase	Compounded Annual Percent Growth Rate
Northeast	2	15	+ 13	20.1
Middle Atlantic	42	105	+ 63	8.7
South Atlantic	78	136	+ 58	5.2
East North Central	133	194	+ 61	3.5
East South Central	61	77	+ 16	2.1
West North Central	37	90	+ 53	8.4
West South Central	5	42	+ 37	21.3
Mountain	27	46	+ 19	5.0
Pacific	3	10	+ 7	11.6
National	388	715	+327	5.7

* Excludes anthracite.
** Figure IV-4 gives a map of the census regions.

LONG-TERM CONTRACT DELIVERED COAL PRICES TO THE ELECTRIC UTILITY SECTOR
1985 REFERENCE SCENARIO, $13 OIL IMPORTS
($/Million Btu, 1975 Dollars)

Regions	1985 Low Sulfur	1985 High Sulfur	Average Contract Price, August 1975*
Northeast	1.40	.90	1.21
Middle Atlantic	1.25	.75	1.05
South Atlantic	1.25	.80	1.01
East North Central	1.15	.65	.80
East South Central	1.15	.60	.77
West North Central	.95	.65	.57
West South Central	1.00	.70	.24
Mountain	.55	.45	.32
Pacific	--	.80	.59

* Source: FPC Form 423.

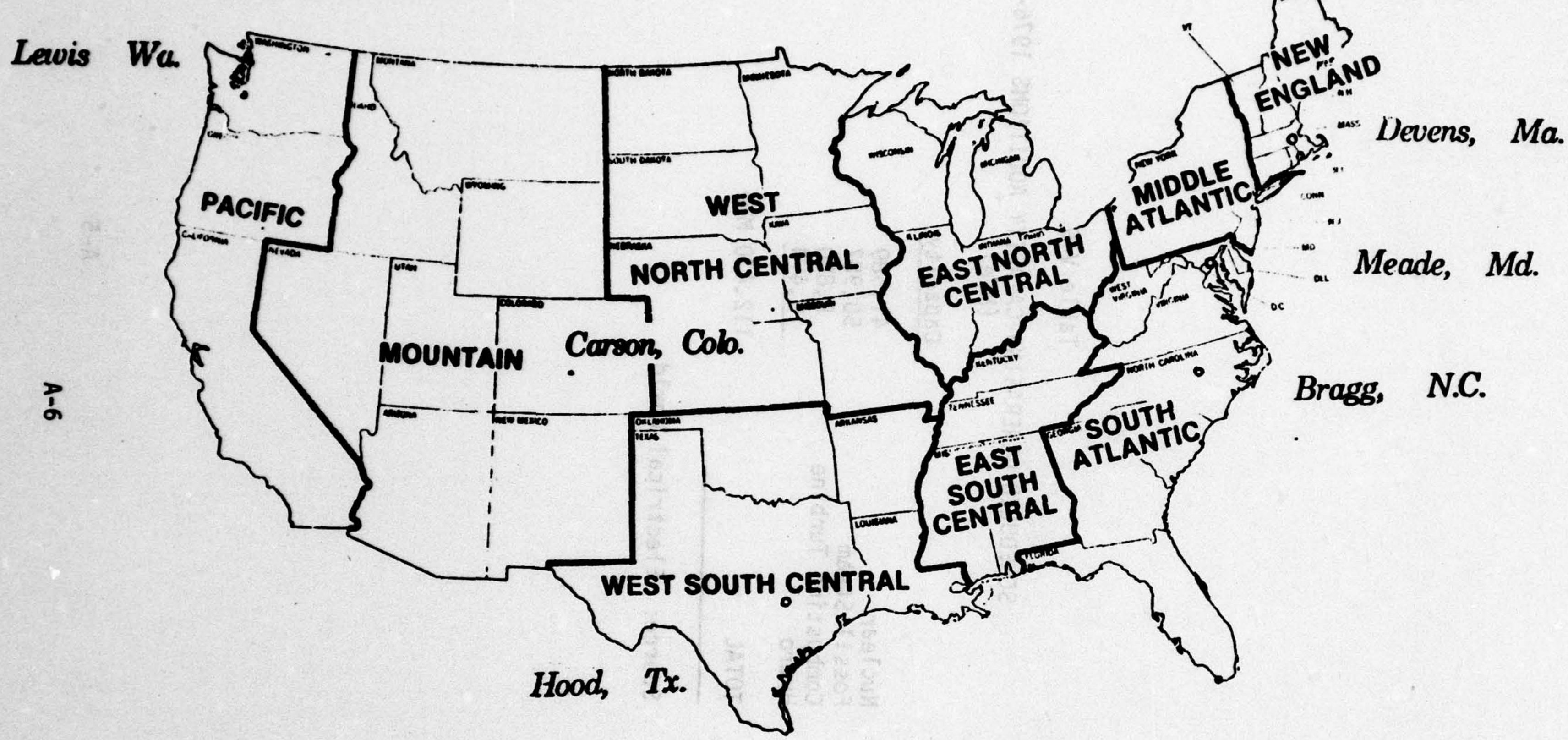
Table V-9

SCHEDULED GENERATING CAPACITY ADDITIONS 1976-79
(MWe)

	Capacity	Percent
Nuclear	41,589	37.0 %
Fossil Steam	50,987	45.3
Combustion Turbine	8,880	7.9
Hydro	10,474	9.8
TOTAL	112,430 MWe	100.0 %

Source: Electrical World

CENSUS REGIONS



POINTS TO PONDER

- FT. BELVOIR CONSUMES .09% TOTAL ENERGY IN VIRGINIA (OIL, GAS, ELECTRICITY)
- OIL — BOILER PLANTS NOT USED IN SUMMER (ABSORPTION A.C., TURBINE-GENERATORS)
  - HEATING LOAD SAME LAST FIVE YEARS
  - BILL HAS INCREASED BY 164% SINCE 1972
- ELEC. - CHANCE OF RATCHET CLAUSE BEING ADDED TO RATE SCHEDULE
  - A.C. LOAD HAS DOUBLED IN 3 YEARS
  - BILL HAS INCREASED BY 200% SINCE 1972
- GAS - PRIMARILY FOR FAMILY HOUSING
  - BILL HAS DECREASED BY 37% SINCE 1973
  - IF DEREGULATION OCCURS, PRICE COULD DOUBLE

Emergency Generators (Fort Belvoir)

Building	Name	Unit Size	Fuel
1157	Switching St.	2-60KW	Diesel
Antina	Davison Airfield	30KW	Diesel
1359	Davison Airfield	15KW	Gasoline
3015	Davison Airfield	75KW	Diesel
721	MP Station	75KW	Diesel
681	Sludge Plant	15KW	Diesel
808	DeWitt Hospital	150KW	Diesel
2592	Topographic Lab	17KW	Diesel
246	Signal Bldg	150KW	Diesel
20	MacKenzie Hall	30-45KW	Butane
	Future Replacements for Hospital (150 KW) & Davision Airfield (15 KW)		
808	DeWitt Hospital	2-300KW	Diesel
1359	Davison Airfield	60KW	Diesel

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Louisville, KY 40201

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USA Engr Div, Missouri River
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Chicago, IL 60605

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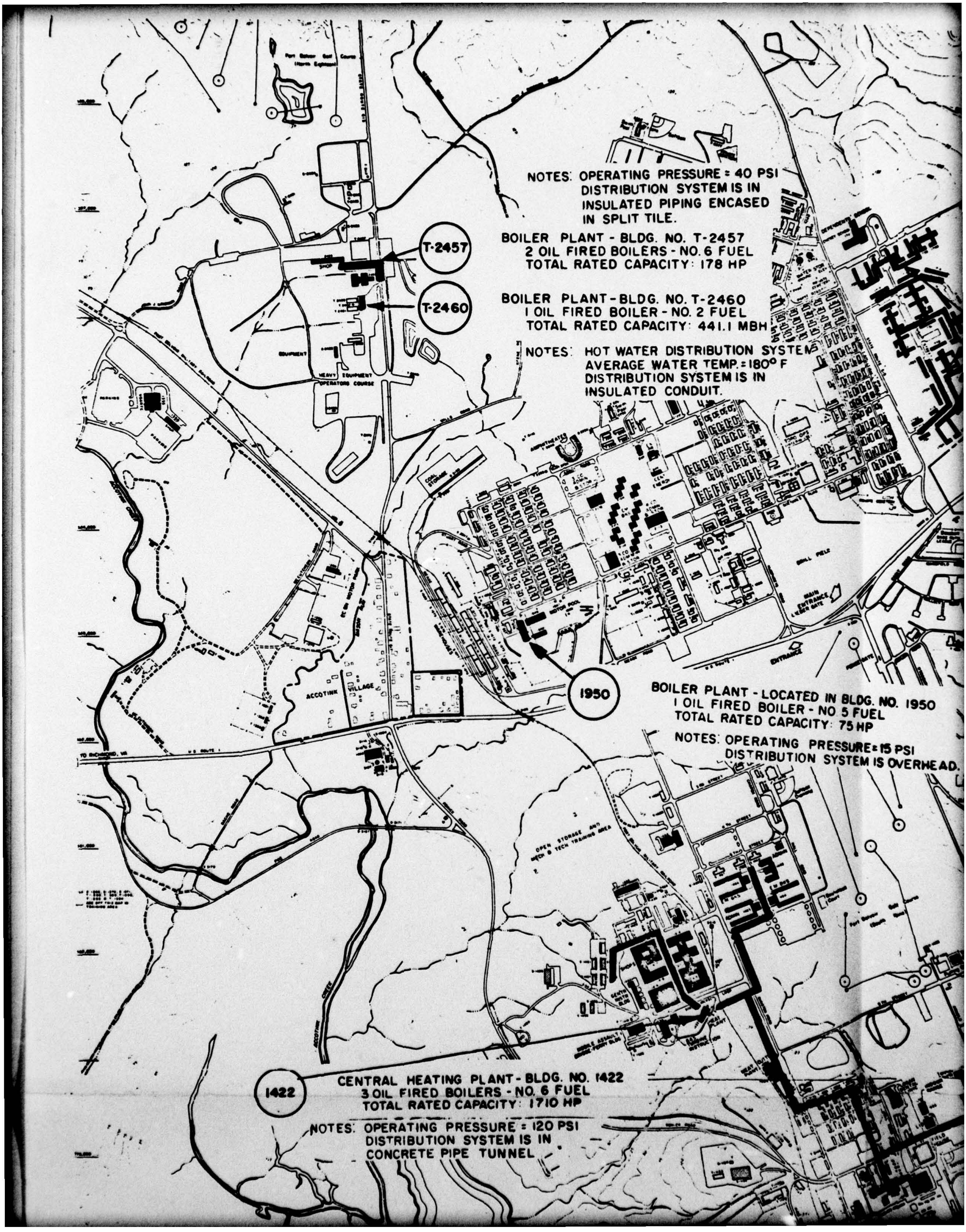
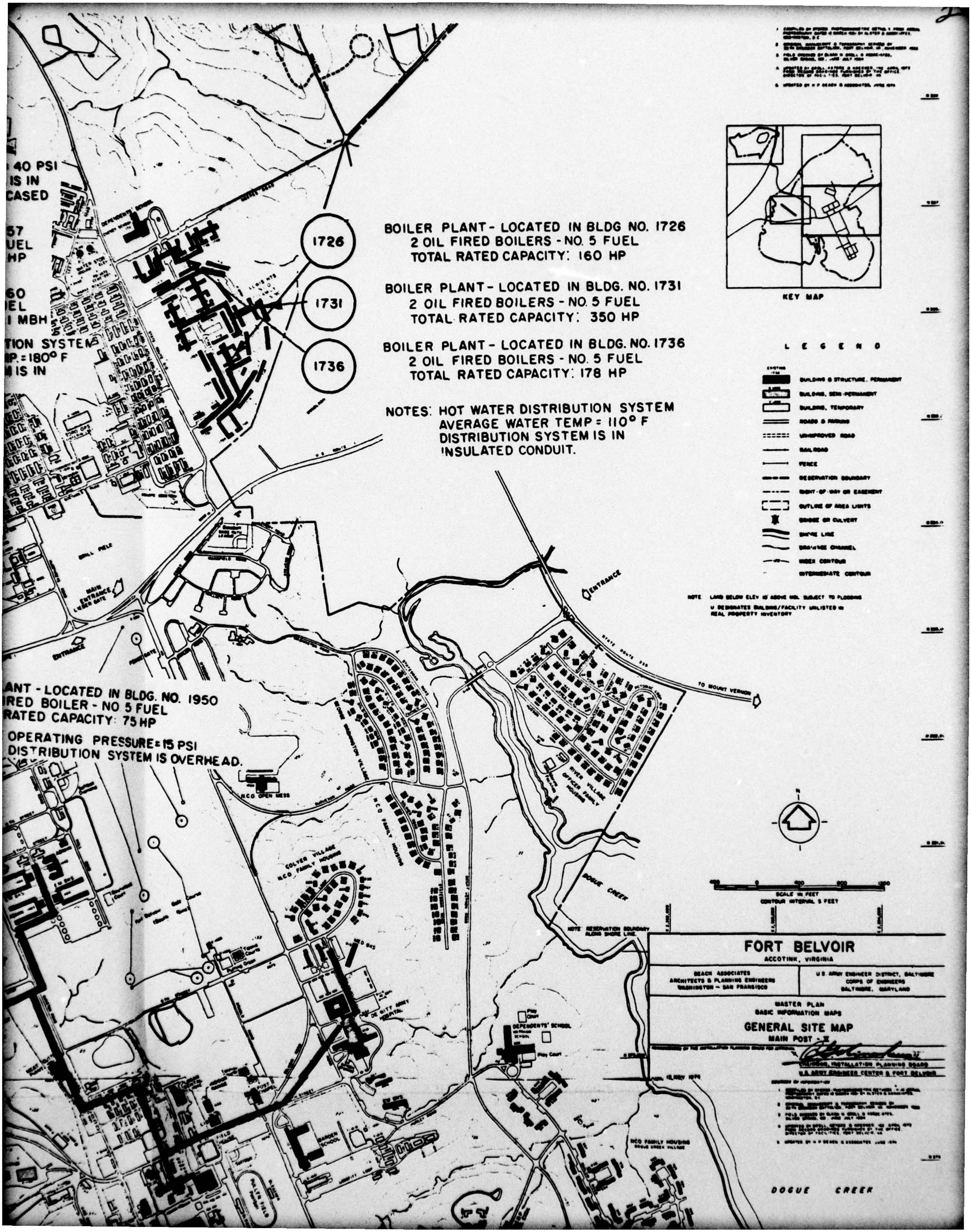
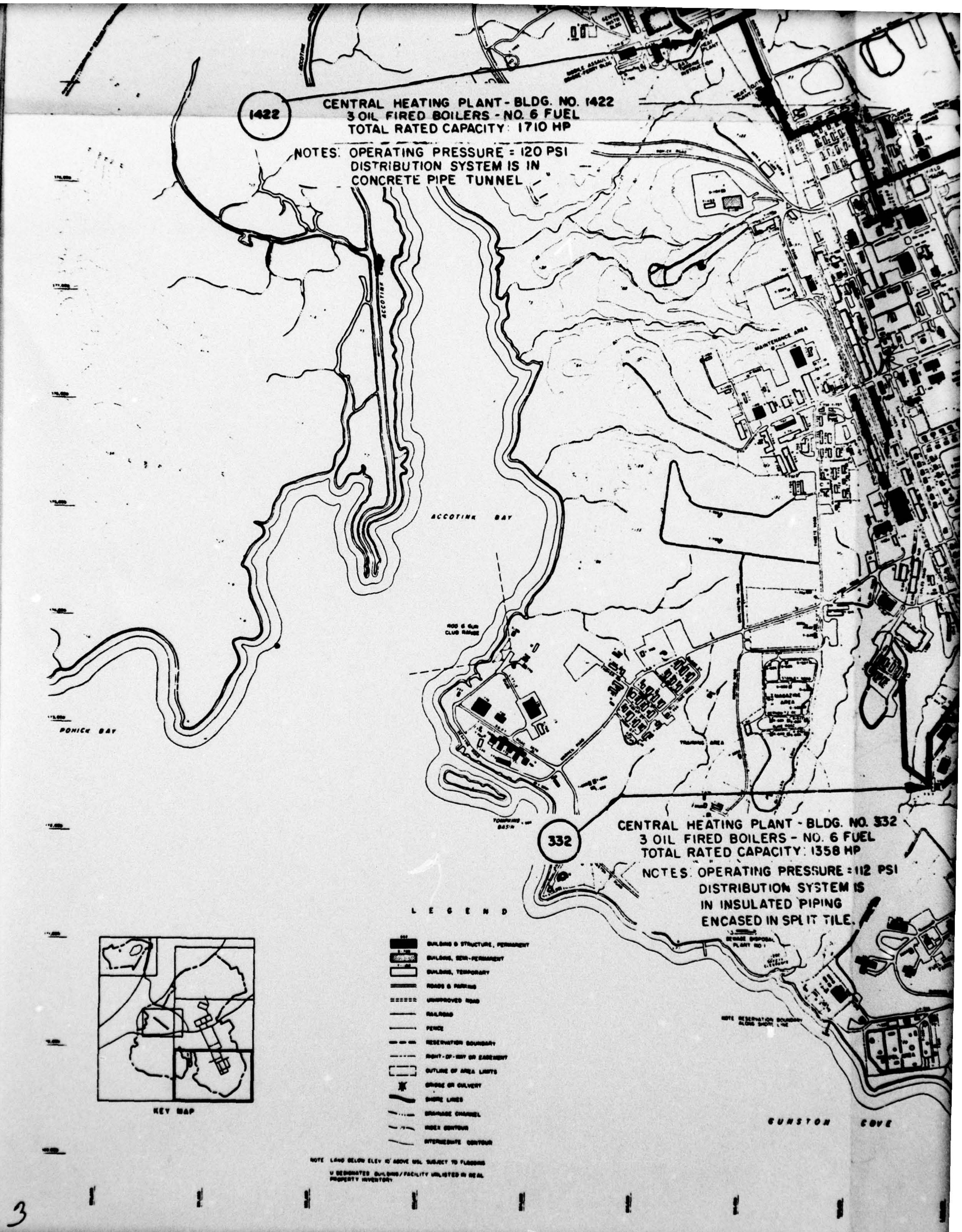
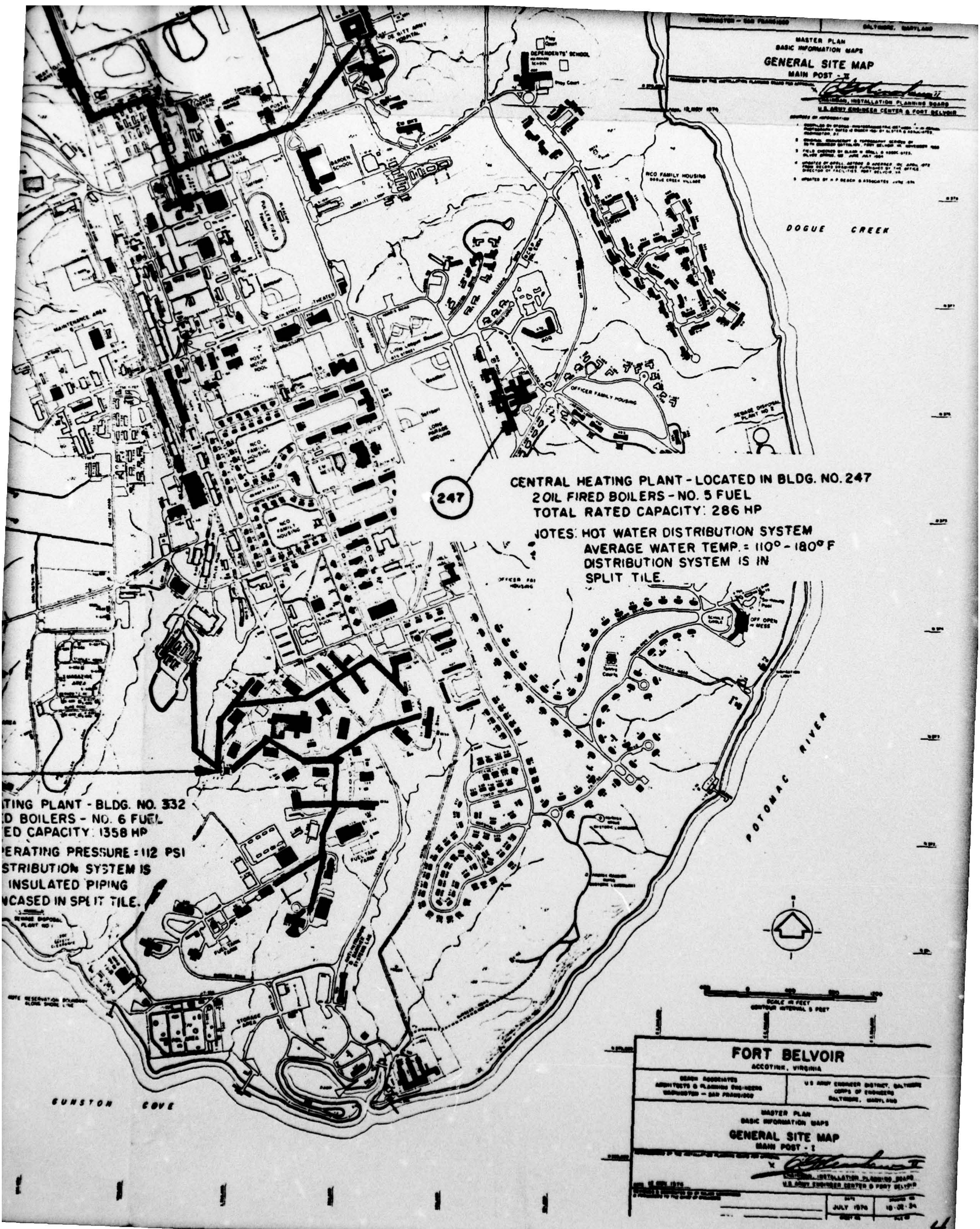
D—77,571—AG—Ft Belvoir


NOTES: OPERATING PRESSURE = 40 PSI
DISTRIBUTION SYSTEM IS IN
INSULATED PIPING ENCASED
IN SPLIT TILE.
BOILER PLANT - BLDG. NO. T-2457
2 OIL FIRED BOILERS - NO. 6 FUEL
TOTAL RATED CAPACITY: 178 HP
T-2457
BOILER PLANT - BLDG. NO. T-2460
1 OIL FIRED BOILER - NO. 2 FUEL
TOTAL RATED CAPACITY: 441.1 MBH
T-2460
NOTES: HOT WATER DISTRIBUTION SYSTEM
AVERAGE WATER TEMP. = 180° F
DISTRIBUTION SYSTEM IS IN
INSULATED CONDUIT.
ACCOTINK VILLAGE
1950
BOILER PLANT - LOCATED IN BLDG. NO. 1950
1 OIL FIRED BOILER - NO 5 FUEL
TOTAL RATED CAPACITY: 75 HP
NOTES: OPERATING PRESSURE = 15 PSI
DISTRIBUTION SYSTEM IS OVERHEAD.
1422
CENTRAL HEATING PLANT - BLDG. NO. 1422
3 OIL FIRED BOILERS - NO. 6 FUEL
TOTAL RATED CAPACITY: 1710 HP
NOTES: OPERATING PRESSURE = 120 PSI
DISTRIBUTION SYSTEM IS IN
CONCRETE PIPE TUNNEL


BOILER PLANT - LOCATED IN BLDG NO. 1726
2 OIL FIRED BOILERS - NO. 5 FUEL
TOTAL RATED CAPACITY: 160 HP
BOILER PLANT - LOCATED IN BLDG. NO. 1731
2 OIL FIRED BOILERS - NO. 5 FUEL
TOTAL RATED CAPACITY: 350 HP
BOILER PLANT - LOCATED IN BLDG. NO. 1736
2 OIL FIRED BOILERS - NO. 5 FUEL
TOTAL RATED CAPACITY: 178 HP
NOTES: HOT WATER DISTRIBUTION SYSTEM
AVERAGE WATER TEMP = 110° F
DISTRIBUTION SYSTEM IS IN
INSULATED CONDUIT.
1726
1731
1736
40 PSI
IS IN
CASED
57
UEL
HP
60
EL
I MBH
TION SYSTEM
P: = 180° F
M IS IN
ANT - LOCATED IN BLDG. NO. 1950
IRED BOILER - NO 5 FUEL
RATED CAPACITY: 75 HP
OPERATING PRESSURE = 15 PSI
DISTRIBUTION SYSTEM IS OVERHEAD.
KEY MAP
LEGEND
BUILDING & STRUCTURE, PERMANENT
BUILDING, SEMI-PERMANENT
BUILDING, TEMPORARY
ROADS & PARKING
UNIMPROVED ROAD
RAILROAD
FENCE
RESERVATION BOUNDARY
RIGHT-OF-WAY OR EASEMENT
OUTLINE OF AREA LIMITS
BRIDGE OR CULVERT
SHORE LINE
DRAINAGE CHANNEL
INDEX CONTOUR
INTERMEDIATE CONTOUR
ENTRANCE
MAIN ENTRANCE
TO MOUNT VERNON
DOGUE CREEK
NCO OPEN MESS
NCO FAMILY HOUSING
DEPENDENTS' SCHOOL
NCO FAMILY HOUSING DOGUE CREEK VILLAGE
SCALE IN FEET
CONTOUR INTERVAL 5 FEET
NOTE: RESERVATION BOUNDARY ALONG SHORE LINE.
FORT BELVOIR
ACCOTINK, VIRGINIA
BEACH ASSOCIATES
ARCHITECTS & PLANNING ENGINEERS
WASHINGTON — SAN FRANSISCO
U S ARMY ENGINEER DISTRICT, BALTIMORE
CORPS OF ENGINEERS
BALTIMORE, MARYLAND
MASTER PLAN
BASIC INFORMATION MAPS
GENERAL SITE MAP
MAIN POST - II
CHAIRMAN, INSTALLATION PLANNING BOARD
U.S. ARMY ENGINEER CENTER & FORT BELVOIR
DOGUE CREEK


1422
CENTRAL HEATING PLANT - BLDG. NO. 1422
3 OIL FIRED BOILERS - NO. 6 FUEL
TOTAL RATED CAPACITY: 1710 HP
NOTES: OPERATING PRESSURE = 120 PSI
DISTRIBUTION SYSTEM IS IN
CONCRETE PIPE TUNNEL
ACCOTINK BAY
POHICK BAY
MAINTENANCE AREA
TRAINING AREA
TOMPKINS BASIN
332
CENTRAL HEATING PLANT - BLDG. NO. 332
3 OIL FIRED BOILERS - NO. 6 FUEL
TOTAL RATED CAPACITY: 1358 HP
NOTES: OPERATING PRESSURE = 112 PSI
DISTRIBUTION SYSTEM IS
IN INSULATED PIPING
ENCASED IN SPLIT TILE.
L E G E N D
BUILDING & STRUCTURE, PERMANENT
BUILDING, SEMI-PERMANENT
BUILDING, TEMPORARY
ROADS & PARKING
UNIMPROVED ROAD
RAILROAD
FENCE
RESERVATION BOUNDARY
RIGHT-OF-WAY OR EASEMENT
OUTLINE OF AREA LIMITS
BRIDGE OR CULVERT
SHORE LINES
DRAINAGE CHANNEL
INDEX CONTOUR
INTERMEDIATE CONTOUR
KEY MAP
NOTE LAND BELOW ELEV 10' ABOVE MSL SUBJECT TO FLOODING
U DESIGNATED BUILDING/FACILITY UNLISTED IN REAL PROPERTY INVENTORY
GUNSTON COVE

3



MASTER PLAN
BASIC INFORMATION MAPS
GENERAL SITE MAP
MAIN POST - II
DOGUE CREEK
DEPENDENTS' SCHOOL
NCO FAMILY HOUSING
OFFICER FAMILY HOUSING
THEATER
POST MOTOR POOL
MAINTENANCE AREA
247
CENTRAL HEATING PLANT - LOCATED IN BLDG. NO. 247
2 OIL FIRED BOILERS - NO. 5 FUEL
TOTAL RATED CAPACITY: 286 HP
NOTES: HOT WATER DISTRIBUTION SYSTEM
AVERAGE WATER TEMP. = 110° - 180° F
DISTRIBUTION SYSTEM IS IN
SPLIT TILE.
ATING PLANT - BLDG. NO. 332
D BOILERS - NO. 6 FUEL
ED CAPACITY: 1358 HP
PERATING PRESSURE = 112 PSI
STRIBUTION SYSTEM IS
INSULATED PIPING
NCASED IN SPLIT TILE.
POTOMAC RIVER
GUNSTON COVE
FORT BELVOIR
ACCOTINK, VIRGINIA
U.S. ARMY ENGINEER DISTRICT, BALTIMORE
CORPS OF ENGINEERS
BALTIMORE, MARYLAND
MASTER PLAN
BASIC INFORMATION MAPS
GENERAL SITE MAP
MAIN POST - I
JULY 1970

4