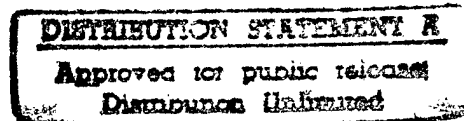


WALSON ARMY COMMUNITY HOSPITAL  
FORT DIX, NEW JERSEY  
ENERGY ENGINEERING ANALYSIS PROGRAM

FOR  
DEPARTMENT OF THE ARMY  
BALTIMORE DISTRICT CORPS OF ENGINEERS

1984



- Einhorn Yaffee Prescott, P.C  
The Argus Building  
Broadway at Beaver  
Albany, NY 12207
- W.S. Fleming & Associates, Inc.  
55 Colvin Avenue  
Albany, NY 12206

DWG QUALITY INSPECTED

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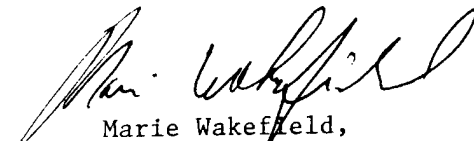


DEPARTMENT OF THE ARMY  
CONSTRUCTION ENGINEERING RESEARCH LABORATORIES, CORPS OF ENGINEERS  
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Marie Wakefield,  
Librarian Engineering

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## A. INTRODUCTION

### PURPOSE

In September of 1984, the firm of Einhorn Yaffee Prescott, P.C. was retained by the Army Corps of Engineers to perform energy conservation services for the Walson Army Community Hospital at Fort Dix and the Ainsworth Clinic at Fort Hamilton. The architectural/engineering/health planning field team studied the existing heating, ventilating, air conditioning, and electrical systems, results of all prior or ongoing energy conservation studies, projects, and designs or plans, the facilities operation and environment, and past energy usage. A comprehensive report has been prepared which documents the work accomplished, the results and the recommendations. This report reflects a joint effort between the field investigation team and the hospital staff. The scope of this study included the following objectives:

- o Perform a complete energy audit and analysis of the entire hospital facility.
- o Identify all energy conservation opportunities, including low cost/no cost items and perform complete evaluations of each.
- o Prepare programming documentation for all energy conservation investment program projects including DD Form 1391, a life cycle cost analysis summary sheet with backup calculations and a Project Development Brochure.
- o Prepare implementation documentation for all justifiable energy conservation opportunities.
- o List and prioritize all recommended energy conservation opportunities.

## APPROACH

The methodology through which this study was conducted consisted of several steps:

1. The field investigation team began with a review of existing building plans and previous energy studies and projects provided by the Corps of Engineers, hospital staff, and Directorate of Engineering and Housing (DEH). The documents reviewed include:
  - o Energy Engineering Analysis Program, Fort Dix, New Jersey; Increment F, January 1984. Prepared for the Baltimore District Corps of Engineers by PRC Systems Services Company, Cocoa Beach, Florida.
  - o Department of the Army Productivity Improvement Program, regulation AR 5-4, August 1, 1982.
  - o ETL 1110-3-282, February 10, 1978, Energy Conservation.
  - o ETL 1110-3-326, September 25, 1981, General Criteria for Medical Facilities.
  - o ETL 1110-3-332, March 22, 1982, Economic Studies.
  - o ETL 1110-3-335, November 22, 1982 General Planning/Design Criteria for Medical Facilities.
  - o ETL 1110-3-344, October 4, 1983, Interior Mechanical Design Criteria for Medical Facilities.
  - o ETL 1110-3-345, October 14, 1983, Heat Transfer Valves.
  - o TM5-785, July 1, 1978, Weather Data (in part).
  - o Army Facilities Energy Plan, November 17, 1983.
  - o Applicable codes including Joint Committee for Accreditation of Hospitals (JCAH), Occupational Safety and Health Act (OSHA) and the National Fire Protection Association (NFPA) Life Safety Code.
2. A field team consisting of architects, electrical and mechanical engineers, control specialists, health planners, and energy audit technicians spent two weeks in the field gathering data and inspecting the facility. The results of this audit are documented in this report.
3. With the above information, a list of potential energy conservation opportunities was developed. These measures were computer analyzed using the Building Loads Analysis and Systems Thermodynamic (BLAST) program. This program incorporates field survey data, weather data, occupancy schedules, building construction data, energy distribution and systems data into a model of the total facility.

Fort Dix Energy Audit

4. A comprehensive report was prepared, meeting the objectives of this study and providing the Fort Dix Walson Army Community Hospital with a useful instrument for reducing energy consumption.

## GENERAL BUILDING CHARACTERISTICS

The Fort Dix Walson Army Community Hospital was constructed in 1961. The building consists of nine floors and a basement in the original hospital area and two floors and a basement in the newer clinic area. The walls are a brick and block construction with a 1/2 inch of interior insulation. The roof is flat and consists of built-up roofing covered with stone on the original structure and built-up roofing with stone and 2 inches of rigid insulation above the clinic section. The ceilings are suspended tile or plaster. The windows are primarily double glazed and tinted.

The primary heating and air conditioning system is a two-pipe induction air system. This system consists of two roof mounted built-up air handling units that supply 100% fresh air to the induction units via medium pressure ductwork. The induction units are equipped with filters, coils and two-way control valves. Chilled water is provided to the air handling and induction units from a chiller plant remote from the building. Domestic hot water and heating hot water are provided by heat exchangers utilizing steam from a remote boiler facilities. Automatic temperature controls are pneumatic with dual pressure heating/cooling control capability.

The operating rooms are equipped with individual air conditioning systems consisting of air handling units, spray systems for humidification, air-cooled chillers, and filtration equipment. The units are designed to operate on 100% fresh air.

Clinic heating and air conditioning is provided by a constant volume, reheat system utilizing steam for reheat.

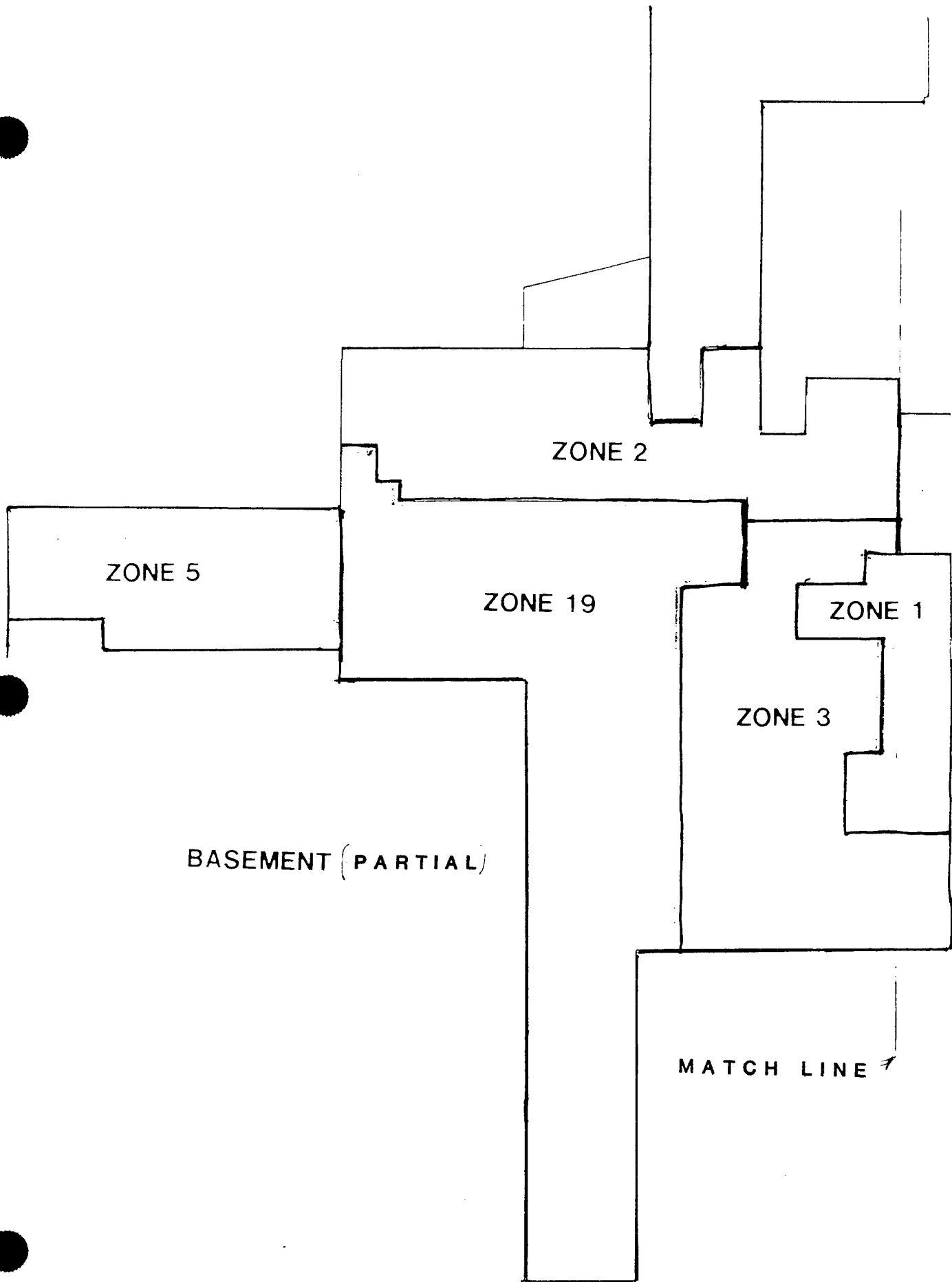
## ZONE DESCRIPTIONS AND DIAGRAMS

It was necessary to divide the building into unique zones for modeling purposes. Zones were specified on the basis of areas served by each system, or group of systems with similar characteristics and control strategies. The table on page A-6 provides a list of zones and equipment parameters. The area served is listed as shown on the original building zoning schedules. Use of several areas has since changed. Zone numbers refer to the zoning diagrams in this report. Simplified floor plans showing the zone boundaries are found on pages A-7 through A-13.



| <u>ZONE NO.</u> | <u>AREA SERVED</u>   | <u>SYSTEM NO.</u> | <u>TYPE</u>  | <u>CFM</u> | <u>HOURS OF OPERATION</u> |
|-----------------|----------------------|-------------------|--------------|------------|---------------------------|
| 1               | Dishwashing          | BL1               | Supply       | 5,620      | 0600-1700                 |
| 2               | Interior Areas       | BL2               | Supply       | 14,350     | 24 HR.                    |
| 3               | Dining Room          | BL3               | Supply       | 15,160     | 24 HR.                    |
|                 |                      | EXH29             | Return       | 7,100      | 24 HR.                    |
|                 |                      | EXH3              | Exhaust      | 13,375     | 24 HR.                    |
| 4               | Kitchen              | BL4               | Exhaust      | 17,375     | 0600-1900                 |
|                 |                      | E4                | Exhaust      | 17,375     | 0600-1700                 |
| 5               | Assembly Areas       | BL5               | Supply       | 14,940     | 24 HR.                    |
|                 |                      | EXH5              | Return       | 10,455     | 24 HR.                    |
| 6               | OPD and Old Clinic   | BL6               | Supply       | 46,540     | 24 HR.                    |
|                 |                      | EXH6              | Return       | 36,600     | 24 HR.                    |
| 7               | Corridors            | BL7               | Supply       | 9,620      | 24 HR.                    |
| 8               | Operating Rooms 1&2  | BL8               | Supply       | 1,260      | 24 HR.                    |
|                 |                      | EXH8              | Exhaust      | 1,260      | 24 HR.                    |
| 9               | Operating Rooms 3&4  | BL9               | Supply       | 1,880      | 24 HR.                    |
|                 |                      | EXH9              | Exhaust      | 1,830      | 24 HR.                    |
| 10              | Operating Rooms 5&6  | BL10              | Supply       | 2,260      | 24 HR.                    |
|                 |                      | EXH10             | Exhaust      | 2,310      | 24 HR.                    |
| 11              | Minor Operating Room | BL11              | Supply       | 1,260      | 24 HR.                    |
|                 |                      | EXH11             | Exhaust      | 1,170      | 24 HR.                    |
| 12              | Central material     | BL12              | Supply       | 3,610      | 24 HR.                    |
|                 |                      | EXH12             | Exhaust      | 4,145      | 24 HR.                    |
| 13              | Surgical             | BL13              | Supply       | 3,395      | 24 HR.                    |
|                 |                      | EXH13             | Exhaust      | 2,115      | 24 HR.                    |
| 14              | Recovery             | BL14              | Supply       | 1,470      | 24 HR.                    |
|                 |                      | EXH14             | Exhaust      | 1,915      | 24 HR.                    |
| 15              | Obstetrical          | BL15              | Supply       | 4,140      | 24 HR.                    |
|                 |                      | EXH15             | Exhaust      | 3,330      | 24 HR.                    |
| 16              | Nursery              | BL16              | Supply       | 3,960      | 24 HR.                    |
|                 |                      | EXH16             | Exhaust      | 3,820      | 24 HR.                    |
| 17 & 18         | Wards                | BL17              | Supply       | 22,800     | 24 HR.                    |
|                 |                      | BL18              | Supply       | 18,600     | 24 HR.                    |
|                 |                      | EXH17             | Exhaust      | 1,750      | 24 HR.                    |
|                 |                      | EXH18             | Exhaust      | 1,750      | 24 HR.                    |
|                 |                      | EXH19             | Exhaust      | 32,100     | 24 HR.                    |
|                 |                      | EXH25             | Hood Exhaust | 100        | 24 HR.                    |
|                 |                      | EXH26             | Hood Exhasut | 500        | 24 HR.                    |
| 19              | New Clinic           | AC1               | Supply       | 27,900     | 24 HR.                    |
| 20              | New Addition         | AC2               | Supply       | 6,300      | 24 HR.                    |

1700, 1800, 1801 These zones are part of zone 17 and 18 and are uniquely described for specific ECO analyses.



ZONE 5

ZONE 2

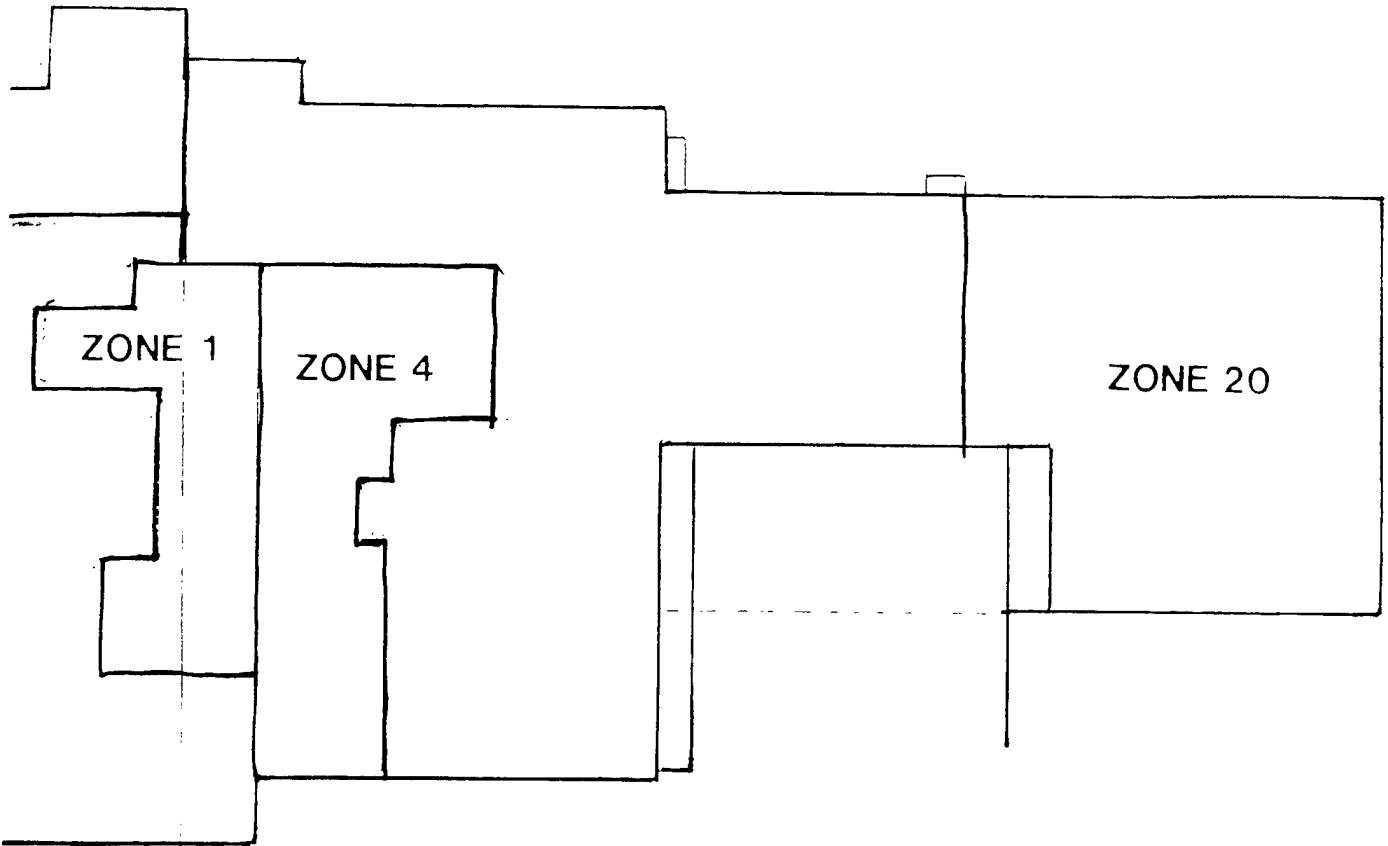
ZONE 19

ZONE 1

ZONE 3

BASEMENT (PARTIAL)

MATCH LINE ↗



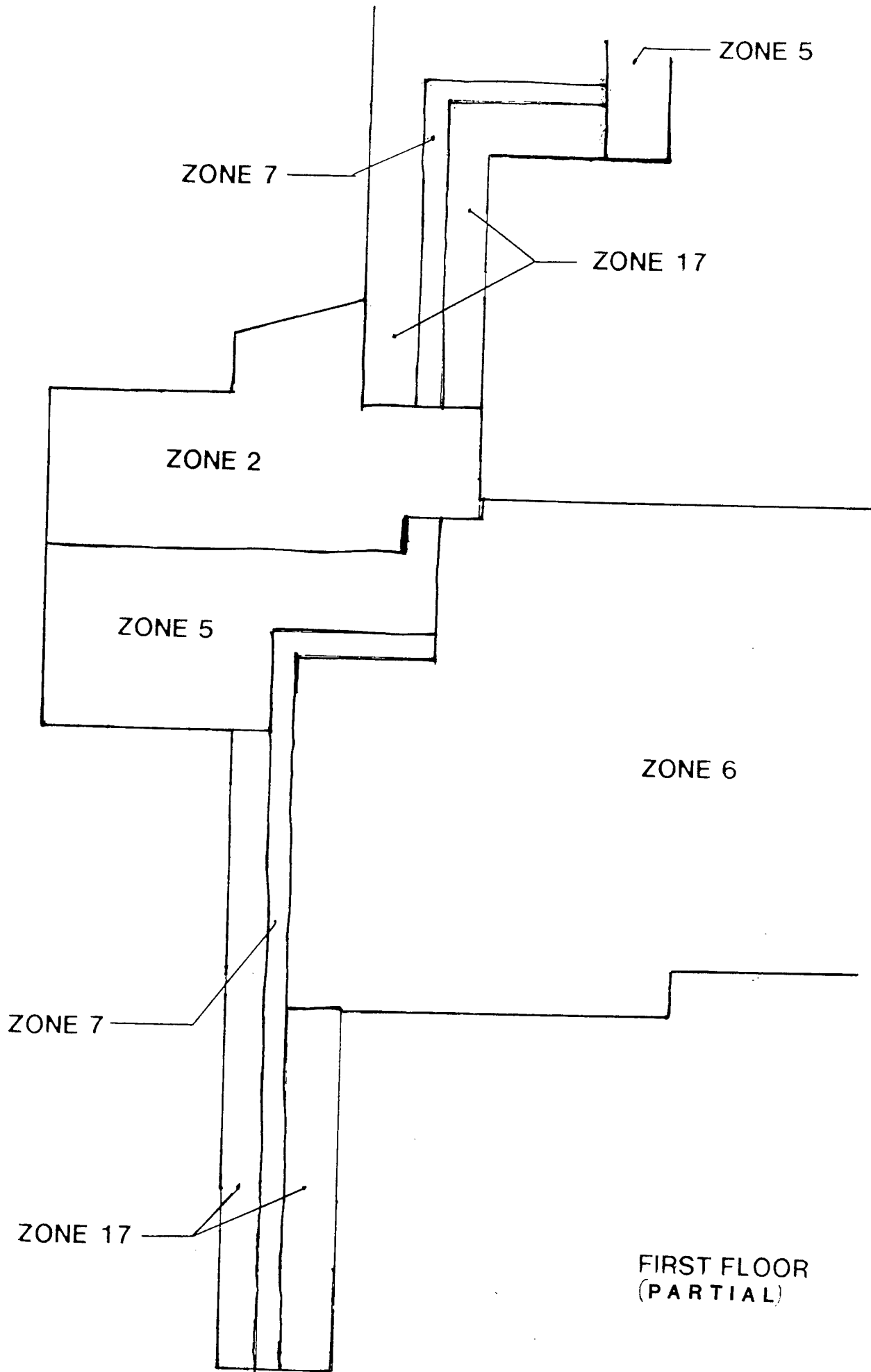
ZONE 1

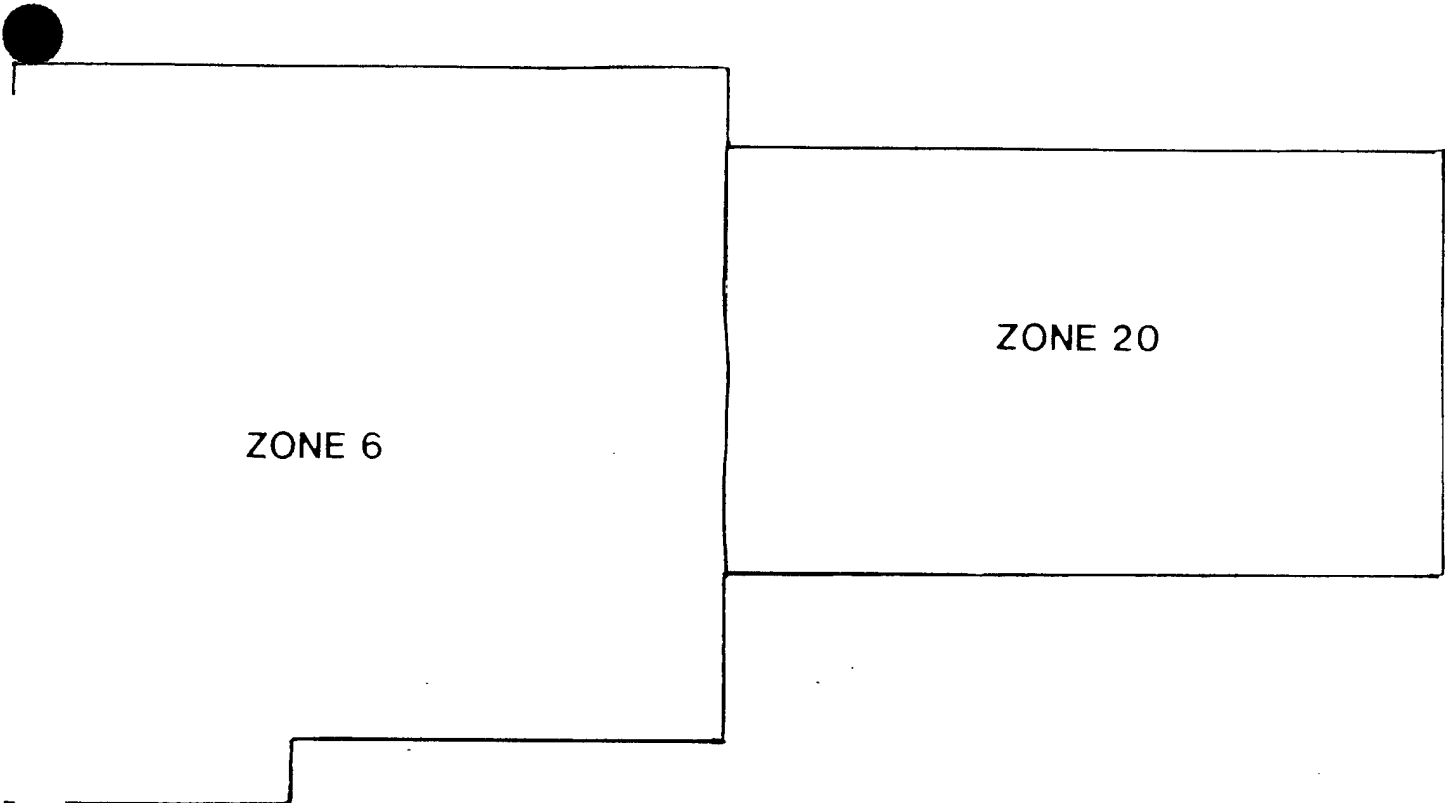
ZONE 4

ZONE 20

← MATCH LINE

BASEMENT (PARTIAL)

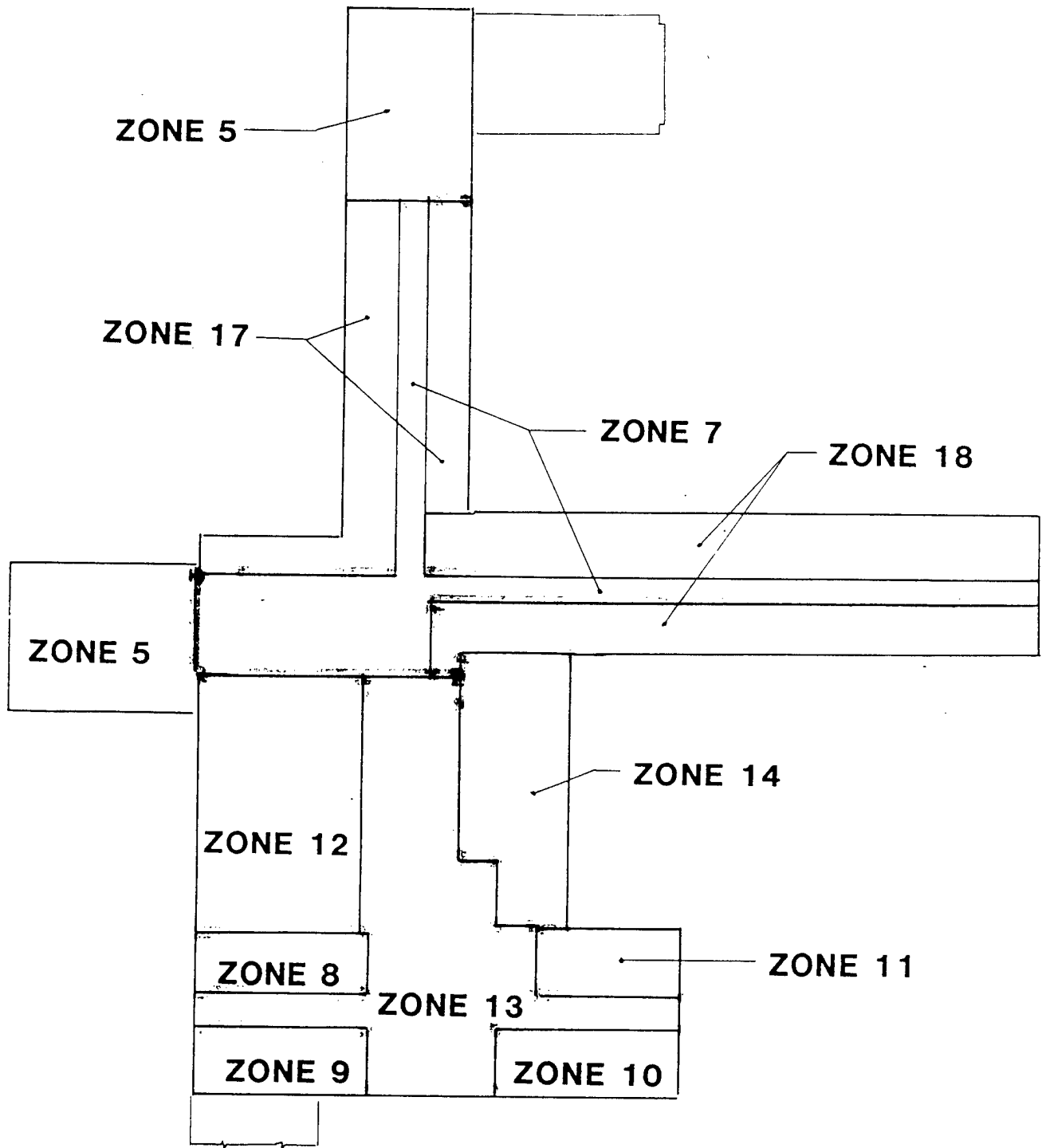




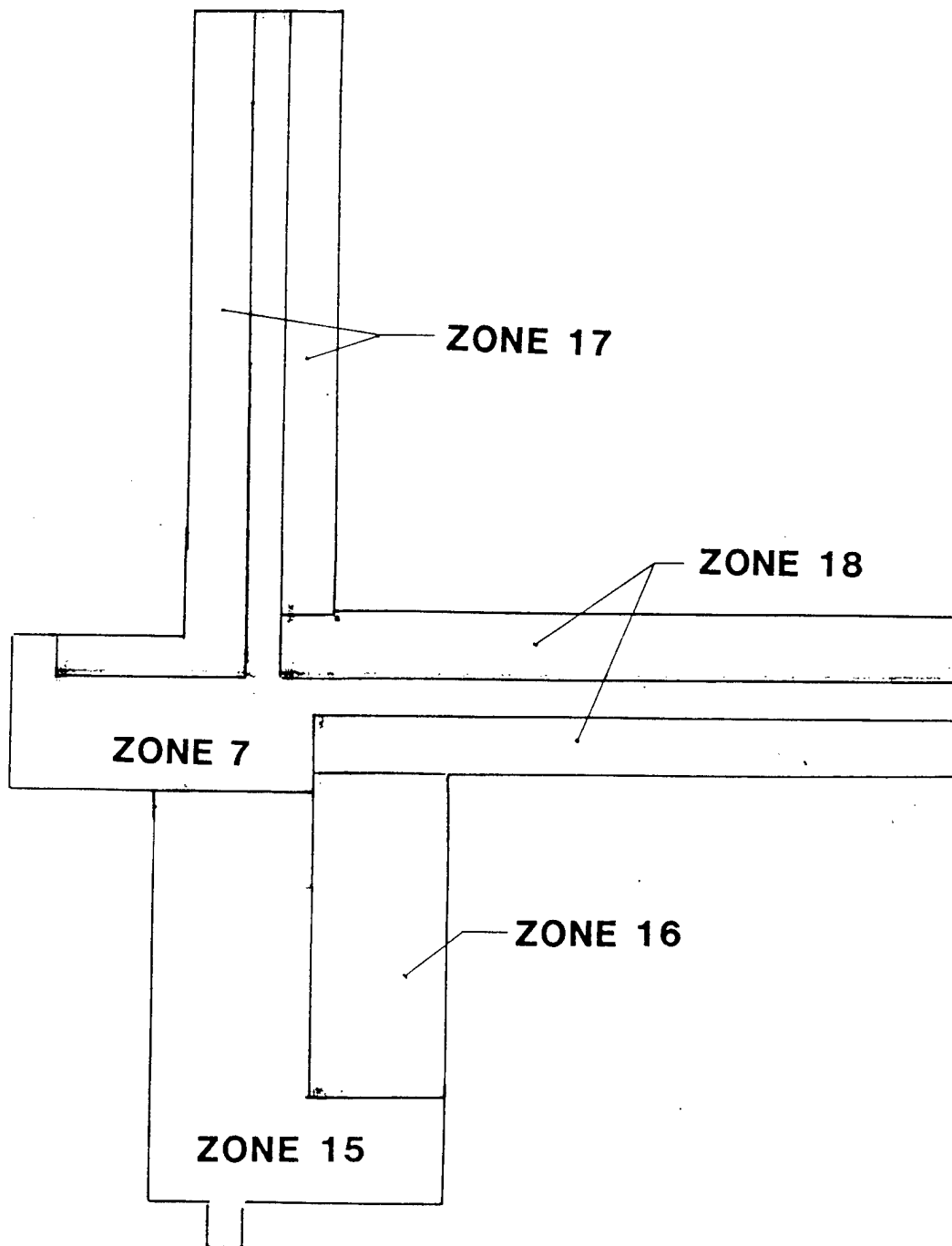
ZONE 6

ZONE 20

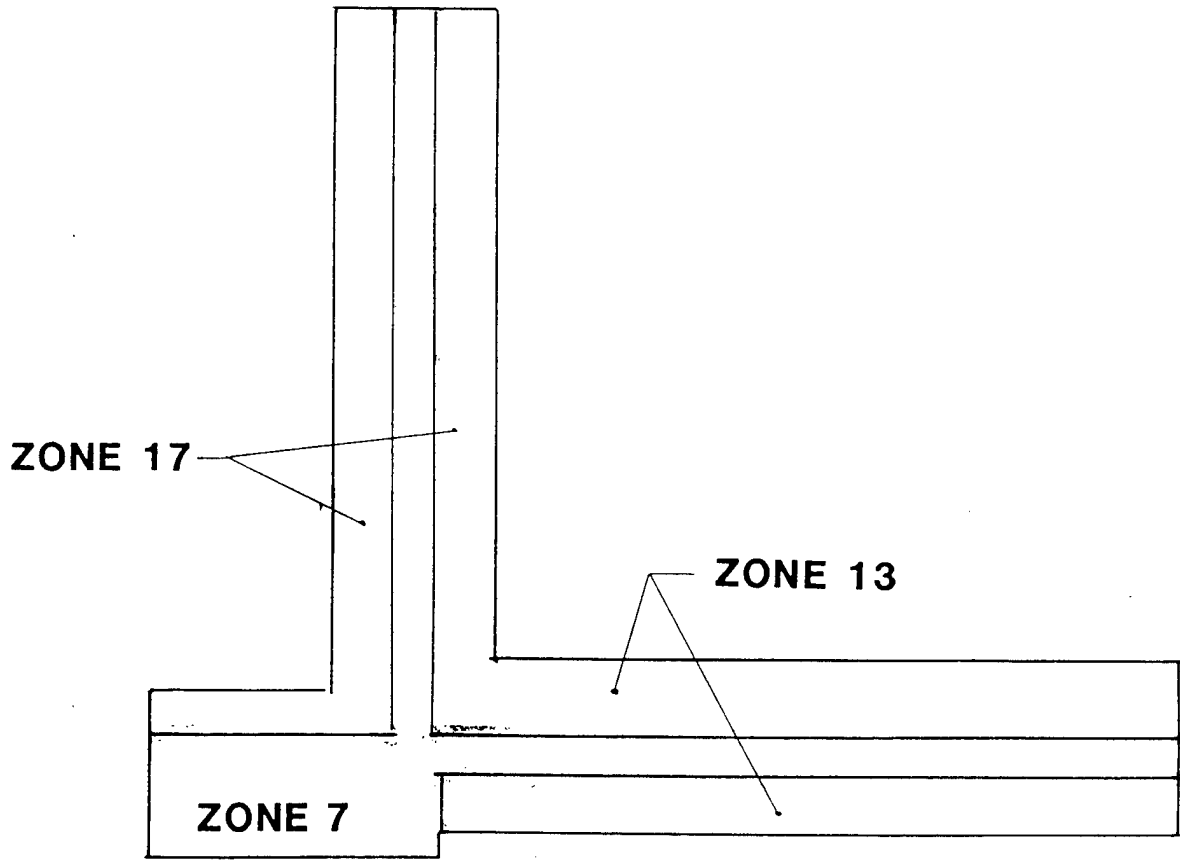
FIRST FLOOR  
(PARTIAL)



**SECOND FLOOR**



**THIRD FLOOR**



**FOURTH THROUGH NINTH FLOORS**



## B. PRESENT ENERGY CONSUMPTION TOTAL ANNUAL ENERGY USED (THEORETICAL)

The annual energy requirements of Walson Army Hospital are presented in the table below and the bar charts on the following pages. The bar charts and load profiles were developed with the Building Loads Analysis and Systems Thermodynamic (BLAST) program. This information is used as a theoretical baseline of energy usage in the analysis of energy conservation measures.

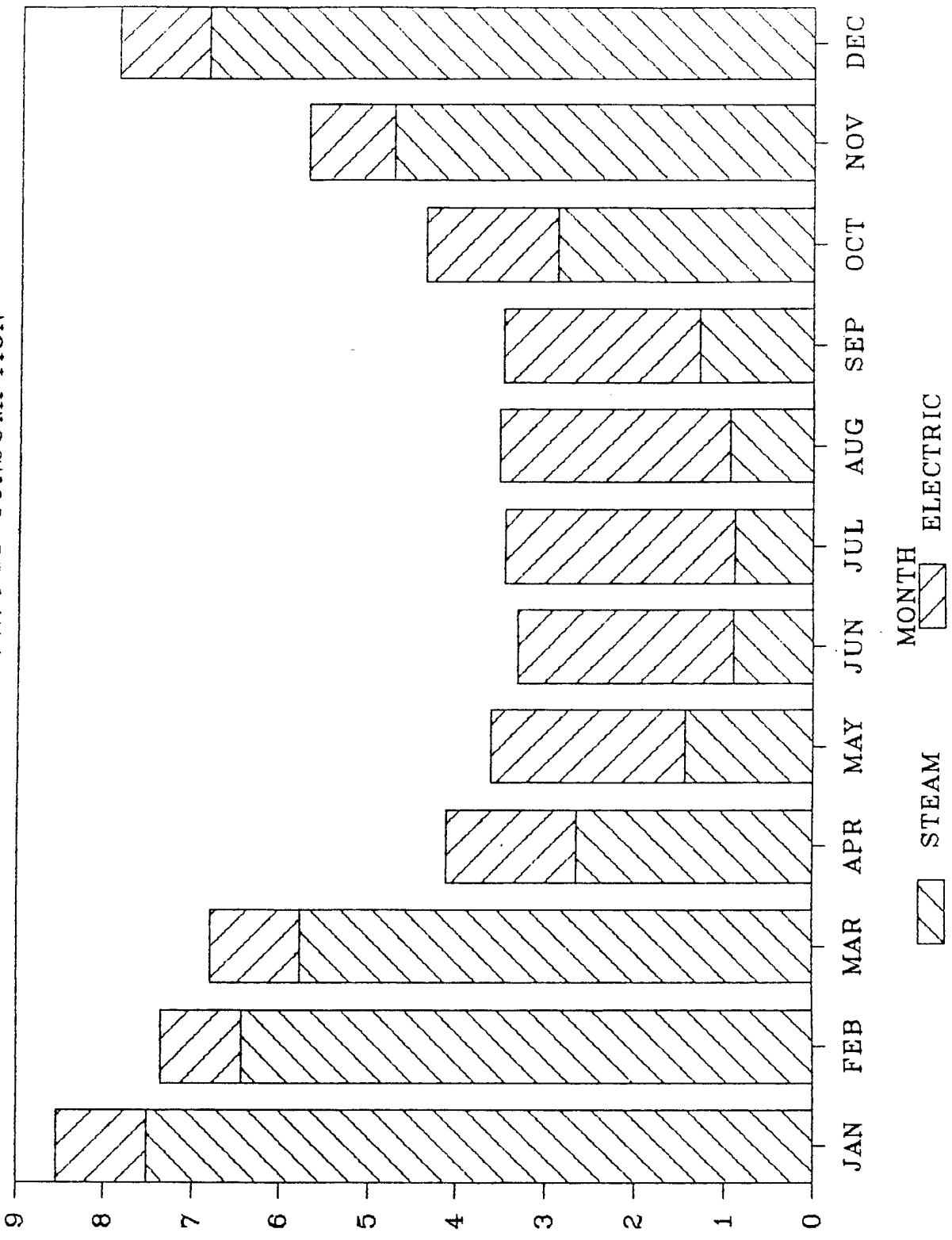
|           | Steam  |           | Electric |           |
|-----------|--------|-----------|----------|-----------|
|           | MBTU   | \$        | MBTU     | \$        |
| January   | 7,516  | - 49,015  | 1,022    | - 5,665   |
| February  | 6,433  | - 41,952  | 920      | - 5,100   |
| March     | 5,779  | - 41,952  | 1,016    | - 5,632   |
| April     | 2,656  | - 37,687  | 1,464    | - 8,115   |
| May       | 1,443  | - 9,410   | 2,179    | - 12,078  |
| June      | 907    | - 5,915   | 2,417    | - 13,398  |
| July      | 884    | - 5,765   | 2,581    | - 14,307  |
| August    | 936    | - 6,104   | 2,593    | - 14,373  |
| September | 1,282  | - 8,360   | 2,198    | - 12,184  |
| October   | 2,884  | - 18,808  | 1,490    | - 8,251   |
| November  | 4,758  | - 31,029  | 959      | - 5,316   |
| December  | 6,877  | - 44,848  | 1,018    | - 5,643   |
| Total     | 42,355 | - 276,215 | 19,857   | - 110,069 |

Energy rates used in the economic analysis of each energy conservation conservation opportunity were provided by DEH, Fort Dix, New Jersey. The rates are as follows:

Electric: \$5.5431/MBTU  
 Fuel Oil: \$6.5214/MBTU of Steam  
 Steam: \$8.7387/1,000 lbm steam

# WALSON ARMY COMMUNITY HOSPITAL

## THEORETICAL ENERGY CONSUMPTION

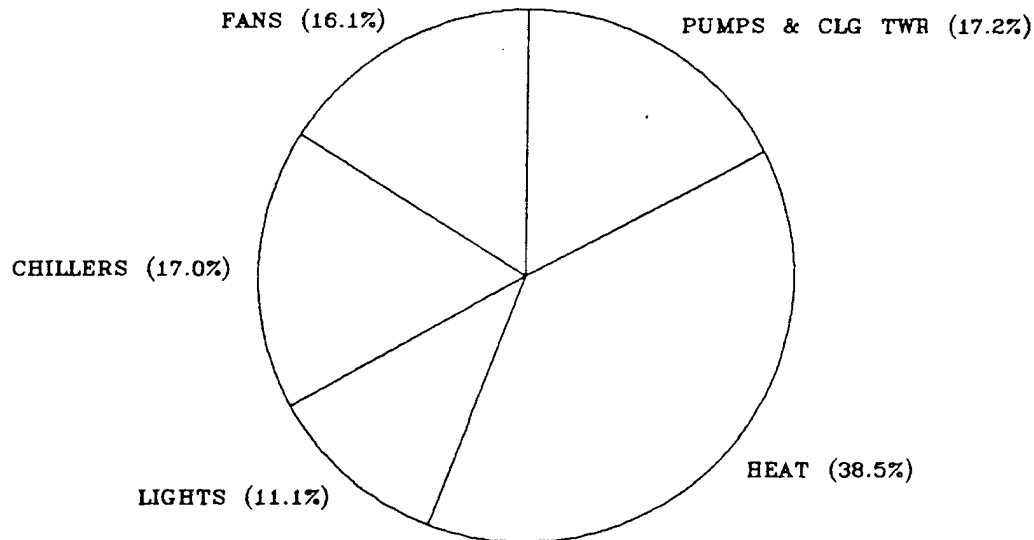


MILLIONS OF BTU  
(THOUSANDS)

## SOURCE ENERGY CONSUMPTION

The table and pie chart presented below show a breakout of energy consumption (MBTU) at Walson Army Community Hospital. Information is derived from the BLAST base run output and represents source energy consumption.

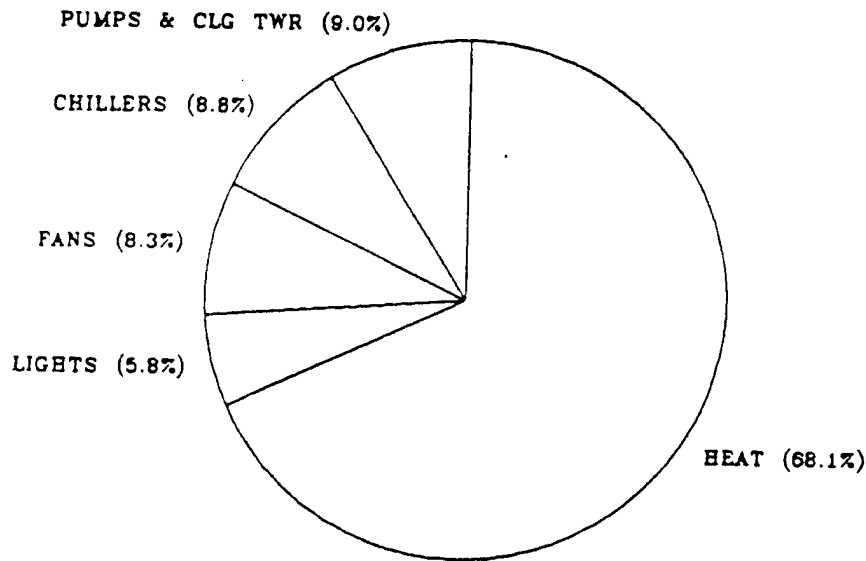
|                         | Source<br>(MBTU) | Electric<br>(KWH) | Steam<br>(1,000 lbs) |
|-------------------------|------------------|-------------------|----------------------|
| Heating                 | 42,335           |                   | 31,593               |
| Lights                  | 12,222           | 1,053,619         |                      |
| Fans                    | 17,646           | 1,521,242         |                      |
| Chillers                | 18,690           | 1,611,192         |                      |
| Pumps and Cooling Tower | 18,931           | 1,631,995         |                      |
| Total                   | 109,824          | 5,818,049         | 31,593               |



Fort Dix Energy Audit

The table and pie chart presented below show a breakout of energy consumption (BMTU) at Walson Army Community Hospital. Information is derived from the BLAST base run output and represents site energy consumption.

|                         | <u>Site<br/>MBTU</u> | <u>Electric<br/>(KWH)</u> | <u>Steam<br/>(1,000 lbs)</u> |
|-------------------------|----------------------|---------------------------|------------------------------|
| Heating                 | 42,335               |                           | 31,593                       |
| Lights                  | 3,596                | 1,053,619                 |                              |
| Fans                    | 5,192                | 1,521,242                 |                              |
| Chillers                | 5,499                | 1,611,192                 |                              |
| Pumps and Cooling Tower | <u>5,570</u>         | <u>1,631,995</u>          |                              |
| Total                   | 62,192               | 5,818,049                 | 31,593                       |



## C. HISTORIC ENERGY CONSUMPTION

Electrical consumption for the past three years (FY-82, FY-83, and FY-84) was supplied by DEH, Fort Dix, New Jersey and is presented in the table below and in graphic form on the following page. Historical data on steam consumption is not available.

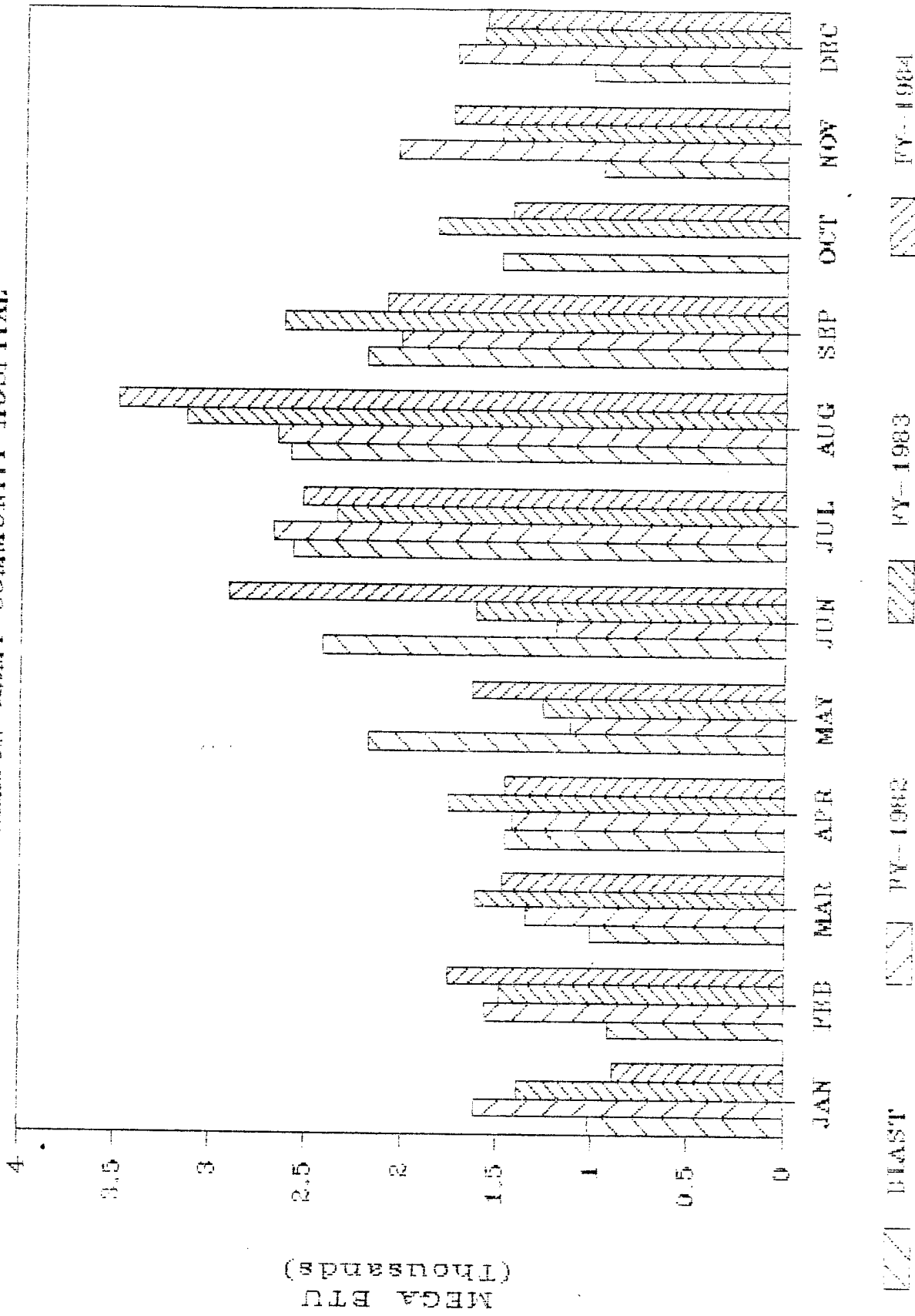
### Walson Army Community Hospital Electrical Consumption

|   | FY-82  |           | FY-83  |           | FY-84  |           |
|---|--------|-----------|--------|-----------|--------|-----------|
|   | MBTU   | KWH       | MBTU   | KWH       | MBTU   | KWH       |
| O |        |           | 1,833  | 537,000   | 1,434  | 420,143   |
| N | 2,044  | 598,888   | 1,499  | 439,290   | 1,758  | 515,000   |
| D | 1,735  | 508,240   | 1,596  | 467,697   | 1,583  | 463,946   |
| J | 1,615  | 473,225   | 1,389  | 407,000   | 893    | 261,764   |
| F | 1,563  | 457,882   | 1,488  | 435,876   | 1,755  | 520,115   |
| M | 1,355  | 397,000   | 1,614  | 473,029   | 1,474  | 431,923   |
| A | 1,421  | 416,400   | 1,756  | 514,560   | 1,460  | 427,740   |
| M | 1,222  | 328,845   | 1,265  | 370,667   | 1,633  | 478,578   |
| J | 1,195  | 350,040   | 1,612  | 472,438   | 2,909  | 852,420   |
| J | 2,679  | 785,075   | 2,350  | 688,634   | 2,526  | 740,000   |
| A | 2,666  | 781,200   | 3,143  | 921,000   | 3,502  | 1,026,000 |
| S | 2,018  | 591,291   | 2,629  | 770,370   | 2,096  | 614,000   |
|   | 19,413 | 5,688,086 | 22,176 | 6,497,561 | 23,023 | 6,751,629 |

A comparison between the historical data and the consumption profile developed with BLAST shows a close correlation.

# ELECTRICAL ENERGY CONSUMPTION

WALSON ARMY COMMUNITY HOSPITAL



## D. ENERGY CONSERVATION ANALYSIS

### ENERGY CONSERVATION

#### OPPORTUNITIES RECOMMENDED

In December of 1984 the A/E conducted a field survey of the hospital. At this time they investigated the possibility of each of the ECO's found in Annex A. A checklist was developed to facilitate this survey. The results of the survey are summarized on this checklist and may be found at the end of this report, beginning on page G-74. If an ECO was deemed inappropriate, a brief note explaining why it was dropped from further consideration will be found on the checklist. Any ECO not eliminated by the field survey is discussed further on the following pages.

Due to the lapse in time between the interim submittal and the subsequent review process the Fort Dix and Walson Hospital staff have taken independent action on several of the most promising ECO's. The discussion which follows pertains to our original findings. The table at the top of page D-3 summarizes our original recommendations while the table at the bottom of the page, those ECO's which have yet to have action taken which would represent a significant energy savings to Walson Army Community Hospital.

The following energy conservation opportunities have been recommended based on our December 1984 findings. A detailed analysis of these ECO's can be found on the following pages.

Elevator Room Heat Recovery System: Warm air from elevator shafts and heat from elevator equipment is presently exhausted outdoors by elevator room exhaust systems. This project will provide an elevator room heat recovery system to recover heat from the exhaust fans. Rendered infeasible by actions taken since December 1984.

Heat Recovery System: General exhaust, kitchen exhaust and toilet exhaust systems discharge room temperature air outdoors, without heat reclamation at present time. An equal amount of fresh air is supplied to the building for air handling balance, consuming energy preheating. This project will provide a run-around glycol loop for exhaust systems and the induction unit make-up air system in order to recover the heat from exhausted air and preheat the outside air in the make-up air units.

Low Speed Hood Exhaust: Operating hours of the kitchen and bakery facilities vary with production load and differ from hospital operation. The scheduling of the ventilation equipment is performed by facilities not involved in kitchen operation. This project will provide two speed fan motors and remote controls for cafeteria ventilators in order to allow kitchen personnel to match the ventilation schedule with cafeteria load.

Night Setback: The hospital building is presently equipped with a two pipe inducting system that provides the required heating and cooling. There is currently no provision for night setback. The administrative areas are not occupied around the clock and energy may be saved by reducing night time temperatures to 55° during the heating season.

Bypass Ductwork for O.R.: The existing operating and recovery room air conditioning units operate with 100% outside air in both occupied and unoccupied modes. The current applicable codes allow 75% air recirculation during the unoccupied mode. This project will provide bypass ductwork on all operating and recovery room A/C units in order to recirculate 75% of the air during the unoccupied mode.

Rebalance HVAC Systems: The original HVAC systems have not been balanced since the original installation. Unbalanced air and water flow as well as an excessive amount of outside air supplied to the building increase the energy consumption. This project will rebalance all HVAC systems according to the latest code requirements.

Provide Chilled Water from Main Plant to O.R. Units: The operating room and recovery room air conditioning units are equipped with a self-contained air-cooled chiller. This project will connect chilled water piping from the chiller plant system to the operating and recovery room air conditioning units during the summer months and provide necessary controls in order to utilize the existing air-cooled chiller as stand-by. This will result in lower electric consumption due to the higher efficiency of the central plant chillers.



Fort Dix Energy Audit

Summary of Energy and Cost Savings - Recommended based on December 1984 information.

| <u>Item</u>                 | <u>Construction Cost (\$)</u> | <u>First Year Savings (\$)</u> | <u>Electric Savings (MBTU)</u> | <u>Electric Savings (KWH)</u> | <u>Steam Savings (MBTU)</u> | <u>SIR</u> | <u>SPB</u> |
|-----------------------------|-------------------------------|--------------------------------|--------------------------------|-------------------------------|-----------------------------|------------|------------|
| Low Speed Hood Exhaust      | 4,797                         | 3,352                          | 31                             | 2,672                         | 468                         | 8.19       | 1.4        |
| Heat Recovery System        | 67,407                        | 43,721                         | 129                            | 11,212                        | 6,243                       | 7.63       | 1.5        |
| Elevator Room Heat Recovery | 9,361                         | 4,776                          | (84)                           | (7,328)                       | 1,018                       | 6.72       | 2.0        |
| Rebalance HVAC Systems      | 105,300                       | 68,551                         | 4,887                          | 421,293                       | 3,596                       | 6.71       | 1.5        |
| Night Setback               | 8,124                         | 3,841                          | 0                              | 0                             | 589                         | 5.65       | 2.1        |
| Bypass Ductwork for O.R.    | 14,517                        | 5,624                          | 68                             | 5,862                         | 847                         | 4.62       | 2.6        |
| Provide C.W. to O.R.        | 8,667                         | 3,500                          | 177                            | 15,259                        | 0                           | 3.73       | 2.5        |

Summary of Energy and Cost Savings - Recommended on 1987 Conditions

| <u>Item</u>            | <u>Construction Cost (\$)</u> | <u>First Year Savings (\$)</u> | <u>Electric Savings (MBTU)</u> | <u>Electric Savings (KWH)</u> | <u>Steam Savings (MBTU)</u> | <u>SIR</u> | <u>SPB</u> |
|------------------------|-------------------------------|--------------------------------|--------------------------------|-------------------------------|-----------------------------|------------|------------|
| Low Speed Hood Exhaust | 4,797                         | 3,352                          | 31                             | 2,672                         | 468                         | 8.19       | 1.4        |
| Heat Recovery System   | 67,407                        | 43,721                         | 129                            | 11,212                        | 6,243                       | 7.63       | 1.5        |
| Rebalance HVAC Systems | 105,300                       | 68,551                         | 4,887                          | 421,293                       | 3,596                       | 6.71       | 1.5        |
| Night Set Back         | 8,124                         | 3,841                          | 0                              | 0                             | 589                         | 5.65       | 2.1        |
| Synergistic Effects    | 185,628                       | 91,371                         | 5,020                          | 432,849                       | 9,744                       | 6.50       | 1.7        |

Note: 1 Except where otherwise noted synergistic effects are not considered on these tables.

2 \$ based on FY 1988

3 ( ) denotes a negative value

## OPPORTUNITIES INVESTIGATED/NOT RECOMMENDED

The following energy conservation opportunities were identified during the field survey. Further analysis has shown them to be uneconomical at this time. A detailed analysis of each opportunity can be found on the following pages.

Install Roof Insulation: Install 3.5 inches of exterior, rigid roof insulation to the hospital roof.

Eliminate Air Leakage: The existing pneumatic control system (controllers and piping) are in poor operating condition, which results in extensive loss of compressed air. Elimination of air leakage from the pneumatic system will result in a reduction of compressor motor electric consumption.

Replace Weatherstripping on all Double Doors: Replace the worn felt insert weatherstripping between all double doors.

Solar Energy Applications: No applications of solar energy appear to be feasible or economical at this time. A quantitative analysis is not required.

FORT DIX ENERGY AUDIT

Summary of Energy and Cost Savings - Not Recommended

| <u>Item</u>              | <u>Construction<br/>Cost (\$)</u> | <u>First Year<br/>Savings (\$)</u> | <u>Electric Savings<br/>(MBTU)</u> | <u>Electric Savings<br/>(KWH)</u> | <u>Steam<br/>Savings<br/>(MBTU)</u> | <u>SIR</u> | <u>SPB</u> |
|--------------------------|-----------------------------------|------------------------------------|------------------------------------|-----------------------------------|-------------------------------------|------------|------------|
| Replace Weatherstripping | 979                               | 117                                | 3                                  | 259                               | 15                                  | 0.96       | 8.4        |
| Unoccupied Shutdown      | 206,725                           | 9,932                              | 78                                 | 6,724                             | 1,155                               | 0.54       | 20.9       |
| Eliminate Air Leakage    | 34,755                            | 424                                | -0-                                | -0-                               | 65                                  | 0.15       | 82.3       |
| Roof Insulation          | 322,335                           | 2,280                              | 126                                | 10,862                            | 181                                 | 0.08       | 141.9      |

Note: 1. Synergistic effects are not considered in this table.

2. \$ based on FY88.

## **ECIP PROJECTS DEVELOPED**

The energy conservation opportunities recommended have been combined and developed into one project and DD 1391. The total investment for this project is \$185,628 and will provide \$91,371 in annual energy cost savings. Implementation of these measures will provide \$63,545 MBTU savings in steam and \$5,020 MBTU savings in electric. Complete project documentation for this project has been developed and is separately bound in the Programming Documents Report.

## OTHER ENERGY CONSERVATION OPPORTUNITIES

A Final Report was previously prepared by PRC Systems Services Company and submitted under increment F of the Energy Engineering Analysis Program. The report reviews and comments on energy conservation projects proposed by Carter Engineering, Inc. under contract to the General Accounting Office.

This section contains a review and summary of the energy conservation measures recommended in this past study. Where applicable, back-up calculations from the previous study have been included in the appendix to this report.

Eight projects have been recommended under increment F of the Energy Engineering Analysis Program and are presented

|  | <u>Construction Cost</u> | <u>Annual Energy Savings Type</u> | <u>Annual Savings</u> |                       | <u>Simple Payback SIR</u> | <u>Payback (Yrs)</u> | <u>Analysis Date</u> |
|--|--------------------------|-----------------------------------|-----------------------|-----------------------|---------------------------|----------------------|----------------------|
|  |                          |                                   | <u>Amount (MBTU)</u>  | <u>Dollar Savings</u> |                           |                      |                      |
| 1. Repair/replace steam traps            | 514                      | Resid.                            | 3,379                 | 20,544                | 571.0                     | 0.025                | 9/9/83               |
| 2. Pipe insulation                       | 1,150                    | Resid.                            | 412                   | 2,500                 | 33.8                      | 0.46                 | 9/9/83               |
| 3. Replace incandescent with fluorescent | 47,000                   | Elect.                            | 10,877                | 60,912                | 15.2                      | 0.77                 | 9/9/83               |
| 4. Condensing unit waste heat recovery   | 7,574                    | Elect.<br>Resid.                  | -31.6<br>1,197        | -176<br>7,278         | 13.1                      | 1.07                 | 9/9/83               |
| 5. Automatic radiator valves             | 9,690                    | Resid.                            | 1,153                 | 7,010                 | 10.0                      | 1.38                 | 9/9/83               |
| 6. High efficiency fluorescent lighting  | 5,221                    | Elect.                            | 1,489                 | 8,338                 | 5.9                       | 0.63                 | 9/9/83               |
| 7. Duct insulation                       | 2,670                    | Elect.<br>Resid.                  | 45<br>120             | 258<br>730            | 5.3                       | 2.70                 | 9/9/83               |
| 8. Heat recovery at sixth floor          | 106,670                  | Elect.<br>Resid.                  | -322<br>3,178         | -1,803<br>19,322      | 2.3                       | 6.09                 | 9/9/83               |

Fort Dix Energy Audit

1. Repair/Replace Steam Traps - Install heat sensitive strips on 200 steam traps. The heat sensitive strips will enable earlier discovery of trap failures and earlier repair. Status: This energy conservation measure has not been implemented.
2. Pipe Insulation - Repair or replace all defective pipe insulation. Status: This measure is being undertaken by base maintenance personnel on an ongoing basis.
3. Replace Incandescent with Fluorescent - Replace the incandescent fixtures, located primarily in the corridors, with fluorescent fixtures and energy efficient fluorescent lamps. Status: Incandescent fixtures are gradually being replaced with fluorescent fixtures as funds allow.
4. Condensing Unit Waste Heat Recovery - Provide a heat recovery system to recover heat from the ten water-cooled condensing units in the basement. These units presently dump all cooling water to the drain and operate all year long to cool the kitchen equipment. Status: This energy conservation measure has not been implemented.
5. Automatic Radiator Valves - Install 114 self-contained automatic radiator valves to reduce overheating. Heating in the wings is presently controlled by a single zone thermostat. Status: Self-contained radiator valves are gradually being installed as funds allow.
6. High Efficiency Fluorescent Lighting - Replace 3,756 four ft. 40 watt fluorescent tubes with 34 watt fluorescent tubes and new low power factor ballasts. Status: Energy efficient 34 watt tubes are currently not installed at Walson Army Community Hospital.
7. Duct Insulation - Repair all duct insulation failures. Through years of use and abuse, many sheet metal ducts are now bare. Status: This energy conservation measure has not been implemented.
8. Heat Recovery at Sixth Floor - Provide a heat recovery system to recover heat from air exhausted by nine fans at the sixth floor. The recovered heat can be used in the nearby outside air intakes for six air handlers. Status: This energy conservation measure has not been implemented. Similar heat recovery options are analyzed in this report as an alternative to this measure.

## ENERGY SAVING PROJECTS NOT ANALYZED

### Energy Monitoring and Control System

As a part of this overall review of the Walson Army Community Hospital Energy using system, the A/E has considered the capabilities of the new EMCS.

In most hospital installations the EMCS is not cost effective strictly from an energy savings point of view. This results from the limited scheduling possibilities due to the twenty-four hour nature of much of the space and use. This in no way detracts from the many other non-conservation functions of the EMCS.

The most current information available to the A/E indicates the system is a rather complete monitoring and control system. The updated points list (pages D-10 to D-17) indicates control points for the following:

- o scheduled start/stop
- o optimum start/stop
- o duty cycling
- o demand limiting
- o summer/winter changeover
- o day/night setback
- o economizer control
- o ventilation/recirculation
- o hot/cold deck reset
- o hot water outside air reset
- o chiller optimization
- o chilled water reset

Based on this review no changes are recommended for the EMCS.

BLDG. DESCR. **HOSPITAL**

BLDG. CAT. NO.

BLDG. NO. **5250**

**KITCHEN SUB-BSMT M.E.R.**

| SYSTEM                             | POINT DESCRIPTION        |
|------------------------------------|--------------------------|
| VAC (G)<br>20,21<br>(SCHEM#G)      | SUPPLY FAN               |
| EXH. FAN (G)<br>20,21<br>(SCHEM#G) | EXH. FAN                 |
|                                    | COMMERCIAL RTH M. E.M.R. |

| SOFTWARE | INPUT TO ENCS |        | ALARM   |        | APPLICATION PROGRAMS |                    |              |                 |               |                   |            |          |                           |                      |                   |                           |                               |             |                      |                     |                       |                      |                  |                |  |  |
|----------|---------------|--------|---------|--------|----------------------|--------------------|--------------|-----------------|---------------|-------------------|------------|----------|---------------------------|----------------------|-------------------|---------------------------|-------------------------------|-------------|----------------------|---------------------|-----------------------|----------------------|------------------|----------------|--|--|
|          | DIGITAL       | ANALOG | DIGITAL | ANALOG | Scheduled Start/Stop | Optimum Start/Stop | Duty Cycling | Demand Limiting | Summer/Winter | Day/Night Setback | Economizer | Enthalpy | Ventilation/Recirculation | Mult/Cold Deck Reset | Reheat Coil Reset | Steam Boiler Optimization | Hot Water Boiler Optimization | HW DA Reset | Chiller Optimization | Chilled Water Reset | Condenser Water Reset | Chiller Demand Limit | Lighting Control | Failure Mode * |  |  |
|          |               |        |         |        |                      |                    |              |                 |               |                   |            |          |                           |                      |                   |                           |                               |             |                      |                     |                       |                      |                  |                |  |  |

DWG. # 7705-3857 FOR SCHEMATIC #  
PROVIDE GRAPHIC DISPLAY

\* C - LAST COMMAND    0 - ON (OPEN)  
H - HIGH VALUE        1 - OFF (CLOSED)  
L - LOW VALUE        N - LOCAL LOOP



ADDG. DESCR. HOSPITAL

ADDG. CAT. NO.

ADDG. NO. 5250

BASEMENT MER. 'B'

SYSTEM POINT DESCRIPTION

HW PUMP  
 HW SUPPLY  
 HW RETURN  
 HW ALARM  
 (SEE GEN'L NOTE 2)  
 SUPPLY FAN  
 SPACE  
 SUPPLY AIR  
 WASH UP/COOL DN  
 COOLING VALVE  
 EXH. FAN  
 CHW PUMPS  
 CHW S+R TEMP.  
 SEC. PUMPS  
 SEC. S+R TEMP.

| SOFTWARE | INPUT TO ENCS |        | ALARMS  |        | APPLICATION PROGRAMS |                    |              |                 |               |                   |            |          |                           |                     |                   |                           |                               |             |                      |                     |                       |                      |                  |              |   |   |
|----------|---------------|--------|---------|--------|----------------------|--------------------|--------------|-----------------|---------------|-------------------|------------|----------|---------------------------|---------------------|-------------------|---------------------------|-------------------------------|-------------|----------------------|---------------------|-----------------------|----------------------|------------------|--------------|---|---|
|          | DIGITAL       | ANALOG | DIGITAL | ANALOG | Scheduled Start/Stop | Optimum Start/Stop | Duty Cycling | Demand Limiting | Summer/Winter | Day/Night Setback | Economizer | Enthalpy | Ventilation/Recirculation | Hot/Cold Deck Reset | Reheat Coil Reset | Steam Boiler Optimization | Hot Water Boiler Optimization | HW DA Reset | Chiller Optimization | Chilled Water Reset | Condenser Water Reset | Chiller Demand Limit | Lighting Control | Failure Mode |   |   |
| 1        | 2             | 1      | 2       | 1      | 2                    | 2                  | 2            | 2               | 2             | 2                 | 2          | 2        | 2                         | 2                   | 2                 | 2                         | 2                             | 2           | 2                    | 2                   | 2                     | 2                    | 2                | 2            | 2 | 2 |
| 6        | 6             | 6      | 6       | 6      | 6                    | 6                  | 6            | 6               | 6             | 6                 | 6          | 6        | 6                         | 6                   | 6                 | 6                         | 6                             | 6           | 6                    | 6                   | 6                     | 6                    | 6                | 6            | 6 | 6 |
| 4        | 4             | 4      | 4       | 4      | 4                    | 4                  | 4            | 4               | 4             | 4                 | 4          | 4        | 4                         | 4                   | 4                 | 4                         | 4                             | 4           | 4                    | 4                   | 4                     | 4                    | 4                | 4            | 4 | 4 |
| 2        | 2             | 2      | 2       | 2      | 2                    | 2                  | 2            | 2               | 2             | 2                 | 2          | 2        | 2                         | 2                   | 2                 | 2                         | 2                             | 2           | 2                    | 2                   | 2                     | 2                    | 2                | 2            | 2 | 2 |

SEE DWG. # 7705-3857 FOR SCHEMATIC #

PROVIDE GRAPHIC DISPLAY

C - LAST CONTROL    O - ON (OPEN)  
 H - HIGH VALUE      F - OFF (CLOSED)  
 L - LOW VALUE       M - LOCAL LOOP

BUILDING DESCR: HOSPITAL

BUILDING CAT. NO.

BUILDING NO. 5250

4<sup>th</sup> FLOOR M.E.R.

SYSTEM POINT DESCRIPTION

FANS (4)  
8, 9, 12, 13, 16  
MEM # 2

SUPPLY FAN  
ZONE SPACE  
SUPPLY AIR  
WARMUP/COOL-DN  
COOLING VALVE

FANS (6)  
9, 11, 15, 16  
MEM # 2

EXH. FAN

| SYSTEM                                  | INPUT TO PLC |      |        |          | ALARMS  |                 |            |           | APPLICATION PROGRAMS |                      |                    |              |                 |               |                   |         |                           |                     |                   |                           |                               |             |                      |                     |                       |                      |                  |              |   |
|---|--------------|------|--------|----------|---------|-----------------|------------|-----------|----------------------|----------------------|--------------------|--------------|-----------------|---------------|-------------------|---------|---------------------------|---------------------|-------------------|---------------------------|-------------------------------|-------------|----------------------|---------------------|-----------------------|----------------------|------------------|--------------|---|
|   | DIGITAL      |      | ANALOG |          | DIGITAL |                 | ANALOG     |           | APPLICATION PROGRAMS |                      |                    |              |                 |               |                   |         |                           |                     |                   |                           |                               |             |                      |                     |                       |                      |                  |              |   |
|   | Pressure     | Temp | Flow   | Position | Flow    | Contact Closure | High Limit | Low Limit | Run Time             | Scheduled Start/Stop | Optimum Start/Stop | Duty Cycling | Demand Limiting | Summer/Winter | Day/Night Setback | Economy | Ventilation/Recirculation | Hot/Cold Deck Reset | Reheat Coil Reset | Steam Boiler Optimization | Hot Water Boiler Optimization | HM QA Reset | Chiller Optimization | Chilled Water Reset | Condenser Water Reset | Chiller Demand Limit | Lighting Control | Failure Mode |   |
| FANS (4)<br>8, 9, 12, 13, 16<br>MEM # 2 |              |      |        |          |         |                 | 5          | 5         | 5                    | 5                    | 5                  | 5            | 5               | 5             | 5                 | 5       | 5                         | 5                   | 5                 | 5                         | 5                             | 5           | 5                    | 5                   | 5                     | 5                    | 5                | 5            | M |
| FANS (6)<br>9, 11, 15, 16<br>MEM # 2    |              |      |        |          |         |                 | 5          | 5         | 5                    | 5                    | 5                  | 5            | 5               | 5             | 5                 | 5       | 5                         | 5                   | 5                 | 5                         | 5                             | 5           | 5                    | 5                   | 5                     | 5                    | 5                | 5            | M |
| EXH. FAN                                |              |      |        |          |         |                 |            |           |                      | 4                    | 4                  | 4            | 4               | 4             | 4                 | 4       | 4                         | 4                   | 4                 | 4                         | 4                             | 4           | 4                    | 4                   | 4                     | 4                    | 4                | 4            | M |

NO. 7705-3857 FOR SCHEMATIC #  
INCLUDE GRAPHIC DISPLAY

\* C - LAST CONTROL  
O - ON (OPEN)  
H - HIGH VALUE  
F - OFF (CLOSED)  
L - LOW VALUE  
M - LOCAL LOOP

PLANT DESCR. HOSPITAL

PLANT CAT. NO.

PLANT NO. 5A50

5<sup>TH</sup> FLOOR M.E.R.

POINT DESCRIPTION

(6)  
7, 12, 13, 14, 15  
SUPPLY FAN  
ZONE SPACE  
SUPPLY AIR  
WABBY HP/COOL-DIN  
COOLING VALVE

EXH. FAN

(6)  
12, 13, 14, 15  
EXH. FAN  
(M #2)

| POINT NO. | INPUT TO ERCS |        | ALARMS  |        | APPLICATION PROGRAMS |                    |              |                 |               |                   |            |          |                           |                     |                   |                           |                               |             |                      |                     |                       |                      |                  |              |  |  |
|-----------|---------------|--------|---------|--------|----------------------|--------------------|--------------|-----------------|---------------|-------------------|------------|----------|---------------------------|---------------------|-------------------|---------------------------|-------------------------------|-------------|----------------------|---------------------|-----------------------|----------------------|------------------|--------------|--|--|
|           | DIGITAL       | ANALOG | DIGITAL | ANALOG | Scheduled Start/Stop | Optimum Start/Stop | Duty Cycling | Demand Limiting | Summer/Winter | Day/Night Setback | Economizer | Enthalpy | Ventilation/Recirculation | Hot/Cold Deck Reset | Reheat Coil Reset | Steam Boiler Optimization | Hot Water Boiler Optimization | MW DA Reset | Chiller Optimization | Chilled Water Reset | Condenser Water Reset | Chiller Demand Limit | Lighting Control | Failure Mode |  |  |
| 6         |               |        |         |        |                      |                    |              |                 |               |                   |            |          |                           |                     |                   |                           |                               |             |                      |                     |                       |                      |                  |              |  |  |
| 7         |               |        |         |        |                      |                    |              |                 |               |                   |            |          |                           |                     |                   |                           |                               |             |                      |                     |                       |                      |                  |              |  |  |

PLANT # 7705-3857 FCR SCHEMATIC #  
PROVIDE GRAPHIC DISPLAY

C - LAST CONTROL  
H - HIGH VALUE  
L - LOW VALUE  
O - ON (OPEN)  
F - OFF (CLOSED)  
M - LOCAL LOOP



BLDG. DESCR. HOSPITAL

BLDG. CAT. NO.

BLDG. NO. 5250

AIR EVACUATION WING

POINT DESCRIPTION

HW PUMPS  
HW SUPPLY  
PRV ALARM  
(SEE GENL NO 2)  
SUPPLY IAN  
ZONE SPACE  
HOT & COLD DECK  
WARM UP / COOL DN  
REFRIG COMP.

UNIT UL-23  
CHEM 117

| SYSTEM                       | INPUT TO LINC'S |        |        | ALARMS  |        | APPLICATION PROGRAMS |           |          |                      |              |                 |               |                   |         |                           |                     |                   |                           |                               |             |                      |                     |                       |                      |                  |              |  |  |
|------------------------------|-----------------|--------|--------|---------|--------|----------------------|-----------|----------|----------------------|--------------|-----------------|---------------|-------------------|---------|---------------------------|---------------------|-------------------|---------------------------|-------------------------------|-------------|----------------------|---------------------|-----------------------|----------------------|------------------|--------------|--|--|
|                              | DIGITAL         | ANALOG | ANALOG | DIGITAL | ANALOG | High Limit           | Low Limit | Run Time | Scheduled Start/Stop | Duty Cycling | Demand Limiting | Summer/Winter | Day/Night Setback | Economy | Ventilation/Recirculation | Hot/Cold Lock Reset | Reheat Coil Reset | Steam Boiler Optimization | Hot Water Boiler Optimization | HW OA Reset | Chiller Optimization | Chilled Water Reset | Condenser Water Reset | Chiller Demand Limit | Lighting Control | Failure Mode |  |  |
| HW PUMPS                     | 2               |        |        | 3       |        |                      |           | 3        |                      |              |                 |               |                   |         |                           |                     |                   |                           |                               |             |                      |                     |                       |                      |                  |              |  |  |
| HW SUPPLY                    |                 |        |        |         |        |                      |           |          |                      |              |                 |               |                   |         |                           |                     |                   |                           |                               |             |                      |                     |                       |                      |                  |              |  |  |
| PRV ALARM<br>(SEE GENL NO 2) |                 |        |        |         |        |                      |           |          |                      |              |                 |               |                   |         |                           |                     |                   |                           |                               |             |                      |                     |                       |                      |                  |              |  |  |
| SUPPLY IAN                   |                 |        |        |         |        |                      |           |          |                      |              |                 |               |                   |         |                           |                     |                   |                           |                               |             |                      |                     |                       |                      |                  |              |  |  |
| ZONE SPACE                   |                 |        |        |         |        |                      |           |          |                      |              |                 |               |                   |         |                           |                     |                   |                           |                               |             |                      |                     |                       |                      |                  |              |  |  |
| HOT & COLD DECK              |                 |        |        |         |        |                      |           |          |                      |              |                 |               |                   |         |                           |                     |                   |                           |                               |             |                      |                     |                       |                      |                  |              |  |  |
| WARM UP / COOL DN            |                 |        |        |         |        |                      |           |          |                      |              |                 |               |                   |         |                           |                     |                   |                           |                               |             |                      |                     |                       |                      |                  |              |  |  |
| REFRIG COMP.                 |                 |        |        |         |        |                      |           |          |                      |              |                 |               |                   |         |                           |                     |                   |                           |                               |             |                      |                     |                       |                      |                  |              |  |  |

FIG DWG # 7705-3857 FOR SCHEMATIC #  
PROVIDE GRAPHIC DISPLAY

C - LAST COMMAND  
O - ON (OPER)  
F - OFF (CLOSED)  
H - HIGH VALUE  
L - LOW VALUE  
M - LOCAL LOOP



### Ice Storage

Our scope of work did not include a survey or analysis of the chilled water plant serving the hospital.

During a brief walk-through of the plant, however, a potential opportunity for significant energy savings was discovered. The existing chilled water plant consists of two 500-ton centrifugal chillers. The chillers are presently operated primarily during the day when the electric consumption rate is \$.06/Kwh and electric demand is at a maximum. A considerable savings in energy costs may be realized utilizing an ice storage concept in the existing operation.

The concept of ice storage is rapidly regaining popularity. Utility companies are consistently raising their rates, especially demand charges. Consequently, many air conditioning designers are shifting power requirements to nighttime consumption in order to utilize off-peak rates (\$.04/Kwh at Fort Dix) and to avoid daytime demand penalties. Ice storage equipment is designed to form ice on the surface of the evaporator tubes and to store it until chilled water is needed for cooling. During the daytime, the ice is melted, providing the chilled water necessary for air conditioning.

The expected energy cost reduction will consist of:

- . Off-peak electric rate at nighttime.
- . Reduced demand charges during the daytime.
- . Operation of the chillers at full load and at maximum efficiency.

We recommend that an additional study be undertaken to determine the feasibility of this option.

## E. ENERGY AND COST SAVINGS

Each energy conservation opportunity investigated has been evaluated independently, i.e., possible duplication of savings between related projects is not considered. In addition, the recommended energy conservation opportunities have been analyzed for synergistic effects. The results of the synergistic evaluation are presented in this section.

Energy savings were determined by computing the baseline BLAST analysis with a similar analysis with the appropriate individual ECO input changes having been made. The synergistic energy savings were determined by computing the baseline BLAST run to a final conditions BLAST run, where all ECO modifications have been modeled.

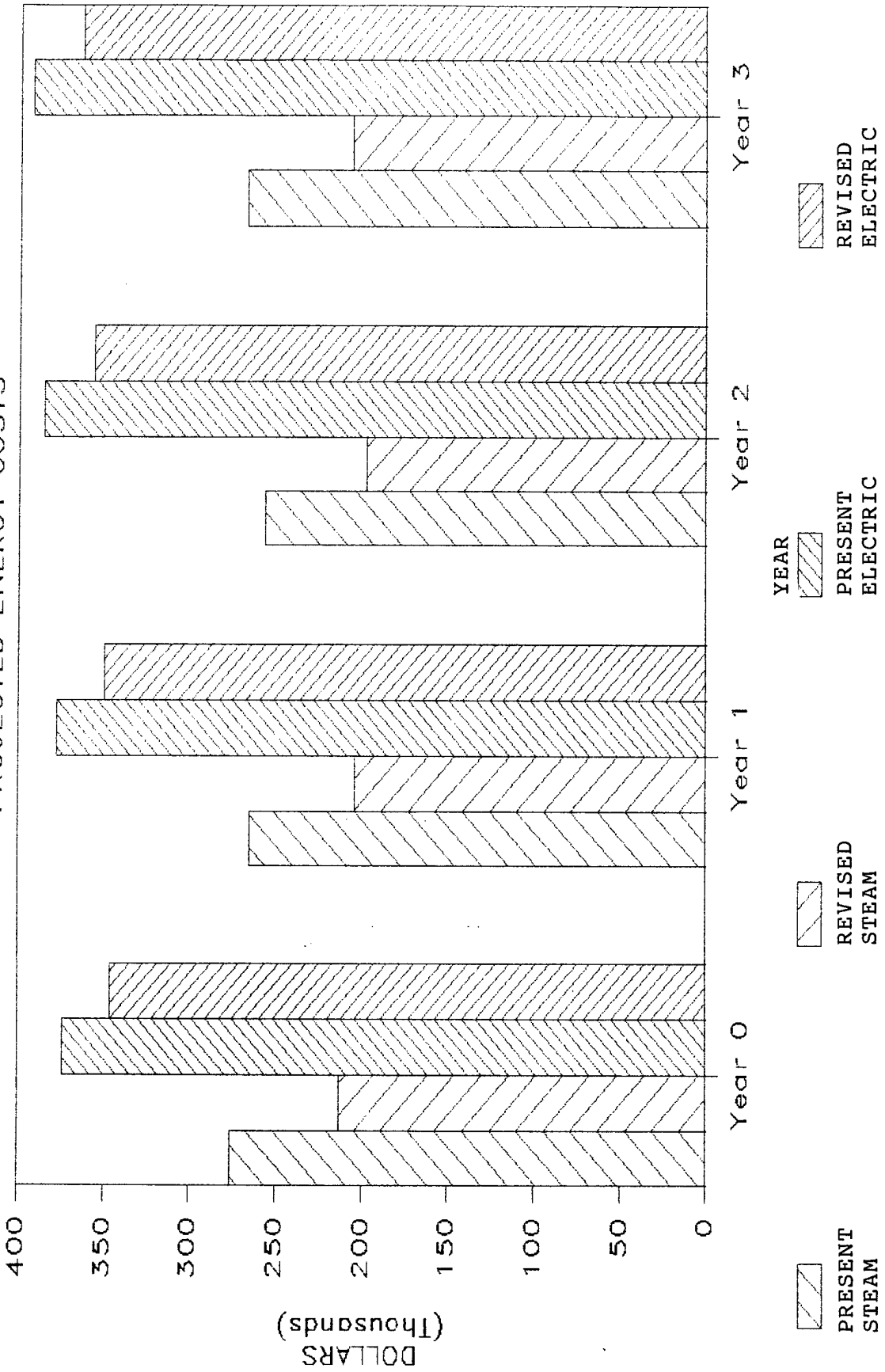
Implementation of the cost effective energy conservation opportunities recommended in this report will provide a total energy savings of 14,764 MBTUs per year, consisting of 9,744 MBTUs of steam and 5,020 of electricity. The total annual cost savings will be \$91,370. This represents a 20% reduction in energy usage compared to 1984 consumption levels.

The following three graphs provide a comparison of energy consumption, in dollars, between that which is currently used, and the estimated consumption after the implementation of the recommended ECO's. The first graph compares the existing and revised energy consumption on a monthly basis, for one year, showing both steam and electric. The second graph shows a comparison of the electric costs between the existing and revised usage, and projects those costs for a three year period using DOE escalation rates. The third graph is similar to the second graph but shows the differences for the costs associated with steam consumption.



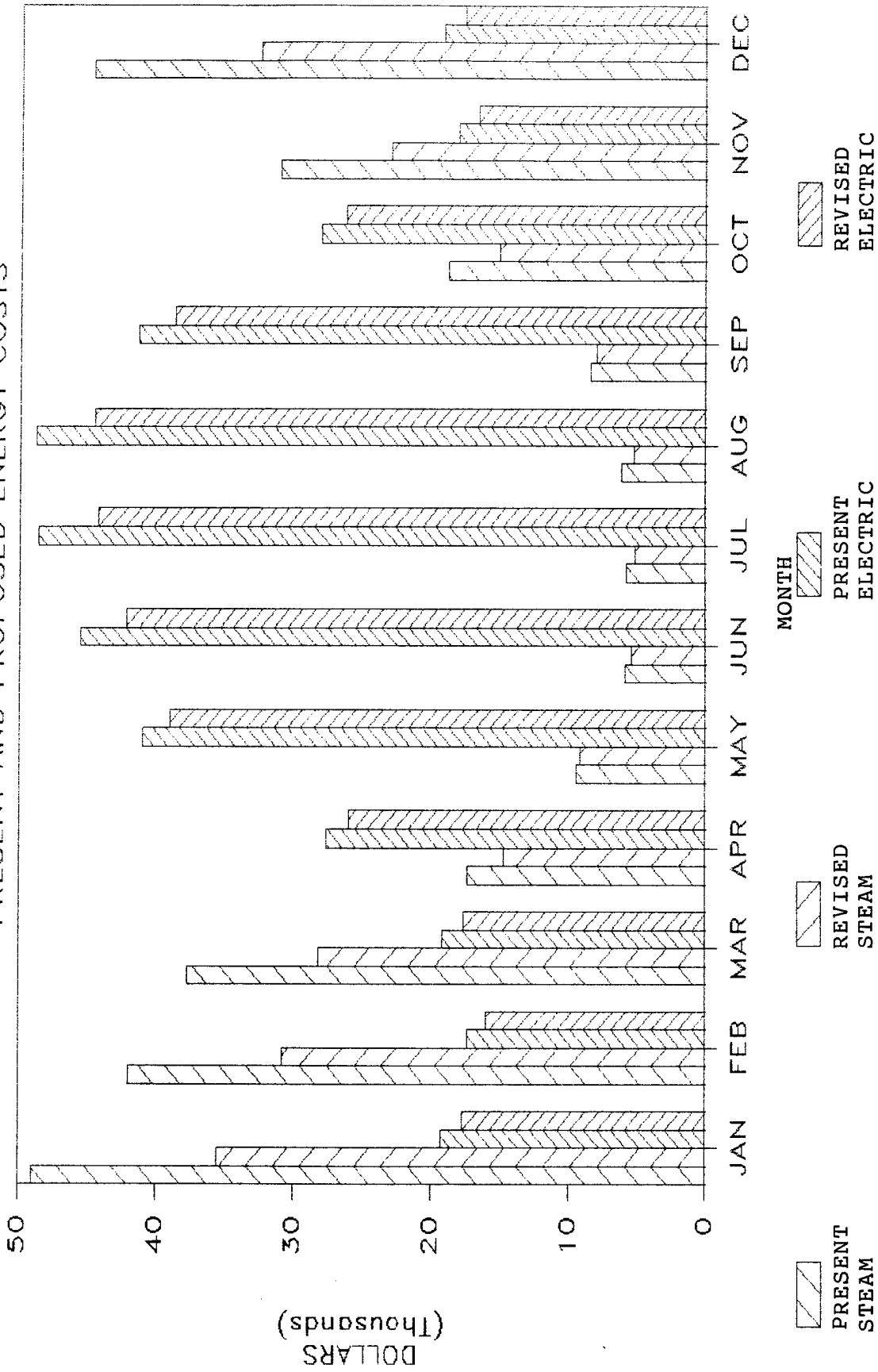
# WALSON ARMY COMMUNITY HOSPITAL

## PROJECTED ENERGY COSTS



# WALSON ARMY COMMUNITY HOSPITAL

## PRESENT AND PROPOSED ENERGY COSTS



## F. ENERGY PLAN

The energy conservation opportunities recommended in this report have been combined into a single Energy Conservation Project for funding purposes. A form DD1391 Programming Document has been prepared, and is separately bound.

A summary report is presented on the following page. This report provides existing and revised energy consumption data for the combined effect of implementing all recommended energy conservation opportunities. In addition, a life cycle cost analysis is provided for the combined cost effective opportunities.

The overall savings to investment ratio (SIR) is 6.50. The combined simple payback period is 1.7 years.

Fort Dix Energy Audit

Summary Report - Combined Cost Effective ECO's

Existing Building

| Plant | Site<br>Electric<br>(MBTU) | Steam<br>(MBTU) | Source Electric<br>(MBTU) |
|-------|----------------------------|-----------------|---------------------------|
| 10-1  | 4,285                      | 5,040           | 14,564                    |
| 10-2  | 14,514                     | 36,099          | 49,330                    |
| 20    | 1,058                      | 1,196           | 3,596                     |
| Total | 19,857                     | 42,335          | 67,489                    |

Revised Building

| Plant | Site<br>Electric<br>(MBTU) | Steam<br>(MBTU) | Source Electric<br>(MBTU) |
|-------|----------------------------|-----------------|---------------------------|
| 10-1  | 4,285                      | 5,040           | 14,564                    |
| 10-2  | 13,037                     | 26,355          | 44,310                    |
| 20    | 1,058                      | 1,196           | 3,596                     |
| Total | 18,380                     | 32,591          | 62,469                    |

Plant Summary

|          | Site<br>Electric<br>(MBTU) | Steam<br>(MBTU) | Source Electric<br>(MBTU) |
|----------|----------------------------|-----------------|---------------------------|
| Existing | 19,857                     | 42,335          | 67,489                    |
| Revised  | 18,380                     | 32,591          | 62,469                    |
| Savings  | 1,477                      | 9,744           | 5,020                     |

Cost Summary

|          | Electric Use<br>(K\$) | Electric<br>Demand (K\$) | Total<br>Electric (K\$) | Total<br>Steam (K\$) |
|----------|-----------------------|--------------------------|-------------------------|----------------------|
| Existing | 374.1                 | 164.8                    | 538.9                   | 276.1                |
| Revised  | 346.3                 | 143.9                    | 490.2                   | 212.5                |
| Savings  | 27.8                  | 20.9                     | 48.7                    | 63.5                 |

Fort Dix Energy Audit

LIFE CYCLE COST ANALYSIS SUMMARY  
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

LOCATION \_\_\_\_\_ FT. DIX, NEW JERSEY BUILDING NAME--WALSON ARMY COMM. HOSPITAL  
REGION NO. \_\_\_\_\_ 2 \_\_\_\_\_ ECONOMIC LIFE--15 YEARS  
PROJECT TITLE \_\_\_\_\_ COMBINED COST EFFECTIVE ECO'S

|    |                                     |  |  |           |           |
|----|-------------------------------------|--|--|-----------|-----------|
| 1. | Investment Costs                    |  |  |           |           |
|    | A. Construction Cost                |  |  | \$185,628 |           |
|    | B. SIOH (5 ½%)                      |  |  | \$ 10,210 |           |
|    | C. Design Cost (6%)                 |  |  | \$ 11,138 |           |
|    | D. Energy Credit Calc (1A+1B+1C)X.9 |  |  | \$186,278 |           |
|    | E. Total Investment                 |  |  |           | \$186,278 |

2. Energy Savings (+) / Cost (-)  
Analysis Date Annual Savings, Unit Cost & Discounted Savings

| FUEL |       | COST<br>\$/MBTU | SAVINGS<br>MBTU/YR | ANNUAL<br>SAVINGS | DISCOUNT<br>FACTOR | DISCOUNTED<br>SAVINGS |
|------|-------|-----------------|--------------------|-------------------|--------------------|-----------------------|
| A.   | Elec  | \$5.5431        | 5,020              | \$27,826          | 9.72               | \$270,471             |
| B.   | Dist  |                 |                    |                   |                    |                       |
| C.   | Resid | \$6,5214        | 9,744              | \$63,545          | 11.99              | \$761,899             |
| D.   | NG    |                 |                    |                   |                    |                       |
| E.   | Coal  |                 |                    |                   |                    |                       |
| F.   | Total |                 | 14,764             | \$91,371          | -----              | \$1,032,370           |

3. Non Energy Savings (+) / Cost (-)

|    |                            |      |                          |
|----|----------------------------|------|--------------------------|
| A. | Annual Recurring (+ / =)   |      | \$20,874 (Demand Saving) |
|    |                            |      | -1,292.0 (Maintenance)   |
|    | (1) Discount Factor        | 9.11 |                          |
|    | (2) Discounted Saving/Cost |      | 178,390                  |

B. Non Recurring Savings (+) / Cost (-)

| Item | Savings (+)<br>Cost (-) | Year of<br>Occurrence | Discount<br>Factor | Discounted<br>Savings/Cost |
|------|-------------------------|-----------------------|--------------------|----------------------------|
| a.   |                         |                       |                    |                            |
| b.   |                         |                       |                    |                            |
| c.   | TOTAL                   |                       |                    |                            |

C. Total Non Energy Discounted Savings (+) / Cost (-) \$178,390

D. Project Non Energy Qualification Test

- (1) 25% Max. Non Energy Calc. (.33 Times \$340,682  
Discounted Energy Savings)
- If 3D(1) is Greater Than 3C go to Item 4
  - If 3D(1) is Less Than 3C Calculates Sir Using 3D - N/A
  - If 3D1b is Greater Than 1.0 go to Item 4
  - If 3D1b is Less Than 1.0 Project Does Not Qualify

|    |                              |             |
|----|------------------------------|-------------|
| 4. | First Year Dollar Savings    | \$110,953   |
| 5. | Total Net Discounted Savings | \$1,210,760 |
| 6. | Discounted Savings Ratio     | 6.50        |
| 7. | Simple Payback Period        | 1.7         |