

ENERGY SURVEYS OF  
ARMY CENTRAL HEATING  
AND POWER PLANTS

ENERGY ENGINEERING  
ANALYSIS PROGRAM (EEAP)

Volume 1 Executive Summary

FORT WAINWRIGHT

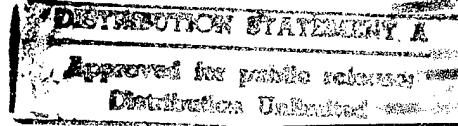
FORT WAINWRIGHT

FORT GREELY

FORT RICHARDSON

SUBMITTED TO

Alaska District Corps of Engineers  
Anchorage, Alaska



SUBMITTED BY

John Graham Company  
Seattle, Washington

Schmidt Associates, Inc.  
Cleveland, Ohio

19971016 185

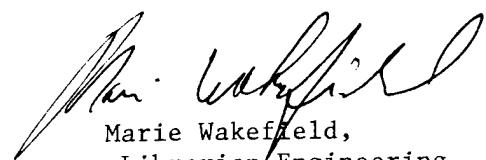


DEPARTMENT OF THE ARMY  
CONSTRUCTION ENGINEERING RESEARCH LABORATORIES, CORPS OF ENGINEERS  
P.O. BOX 9005  
CHAMPAIGN, ILLINOIS 61826-9005

REPLY TO  
ATTENTION OF: TR-I Library

17 Sep 1997

Based on SOW, these Energy Studies are unclassified/unlimited.  
Distribution A. Approved for public release.



A handwritten signature in black ink, appearing to read "Marie Wakefield".

Marie Wakefield,  
Librarian Engineering

## PREFACE

This is a report of the Energy Surveys of Army Central Heating and Power Plant provided under the Energy Engineering Analysis Program (EEAP) for Fort Richardson, Fort Greely and Fort Wainwright, Alaska. This study consists of four volumes for each installation. The four volumes are completely separate reports. Volume 1, Executive Summary, briefs the report summarizing the conclusions and recommendations. Volume 2, Report, includes the executive summary and contains a description of the plants and processes. It also has a narrative discussion and evaluation of the ECOs studied at each power plant with a summary of the economics and recommendations. At the end of this volume is an outline for the operations and maintenance briefing to be provided for each installation. Volume 3, Documentation, contains the funding request documentation forms for the energy conservation opportunities (ECOs) that qualified, and other ECOs that were considered necessary for the continued operation of the central heating and power plants. Volume 4, Appendix, contains the detailed calculations, reference material and other data supporting the report and documentation.

Depending on the project cost and economics, for each viable ECO, documentation for one of the following fund programs were used:

Energy Conservation Investment Program (ECIP),  
1391

Productivity Capital Investment Programs (PECIP  
and QRIP)

## EXECUTIVE SUMMARY

### FORT WAINWRIGHT

SECTION	PAGE
1. INTRODUCTION	1
2. POWER PLANT DESCRIPTION	3
3. FIELD AUDIT WORK	6
4. ENERGY CONSERVATION OPPORTUNITIES AND PREVIOUSLY RECOMMENDED PROJECTS	8
5. DOCUMENTATION	16
6. SUMMARY	18
7. SITE PLAN	22

## EXECUTIVE SUMMARY

### FORT WAINWRIGHT

#### SECTION 1

##### INTRODUCTION

###### 1.1 Authorization

This is the Executive Summary of the energy survey and project documentation that resulted from the Energy Survey of the Central Heating and Power Plant (CHPP) at Fort Wainwright. It is a part of the continuing effort under the Energy Engineering Analysis Program (EEAP). Similar energy surveys and reports have been developed for Fort Richardson and Fort Greely Central Heating and Power Plants concurrently. The Scope of Work of this program was developed by the Huntsville Division Corps of Engineers for use at all Army central heating and power plants.

Representatives from the Huntsville Division of the Corps, U.S. Army Forces Command (FORSCOM) and John Graham Company, Architect-Engineer, visited the Fort Wainwright power plant during the summer of 1984. At that time, a generic General Scope of Work was reviewed. From it, a detailed scope was developed for Fort Wainwright. A complete Scope of Work can be found in Appendix I Volume 4 of this report.

###### 1.2 Purpose of Study

The purpose of this study is to review and study all potential energy conservation opportunities (ECOs) at the Fort Wainwright Central Heating and Power Plant (CHPP). These ECOs would then be developed to determine the economics and feasibility of implementation. The equipment at this plant is over 30 years old. The plant is meeting the requirements of providing steam for heating the base. It is a functional operating plant that will, with proper maintenance and repairs, continue to perform for many more years. With a heating plant of this age there was reason to believe that many energy conservation opportunities do exist. Section 4 describes the ECOs found and studied.

The study also required that the condition and efficiency of the boilers and auxiliaries of the entire plant be evaluated. This was necessary to establish that the plant had the ability to operate efficiently for an expected life that justified the implementation of the recommended improvements. An evaluation was made to compare the existing plant recommended improvements against the cost and economics of a new replacement plant. The study evaluated and found the best method of providing efficient and reliable central heat and power for the future at Fort Wainwright.

The previous studies by Grumman Aerospace Corporation in 1982 and by Black and Veatch, Consulting Engineers in 1978 were reviewed. Items that they recommended but had not been implemented were included as ECOs for further study in this report.

#### 1.3 Energy Survey Contract

The Energy Survey Contract was awarded to John Graham Company, Engineers and Architects, of Seattle and Anchorage. Schmidt Associates, Inc., Consulting Engineers of Cleveland, Ohio worked as sub-consultants to them. Bailey Controls Company was used to calibrate instruments prior to boiler testing.

#### 1.4 Documentation

At meetings with DEH the studied ECOs were selected for grouping into projects for funding documentation to accomplish the energy savings of the heating plants. Volume 2 evaluated each energy conservation opportunity (ECO) found at the Central Heating and Power Plant. The evaluations of the ECOs are discussed in Section 4 of this summary. The ECOs were then reviewed and developed into groups for funding requests. Volume 3 contains the actual funding requests, which includes Energy Conservation Investment Program (ECIP on Form 1391) and Productivity Capital Investment Program (QRIP on DA Form 5108). This volume contains funding documentation for two Energy Conservation Investment Program (ECIP) forms, one military Construction Project Data (DD form 1391) and one Quick Return on Investment Program (QRIP) for funding. The funding requests are discussed in Section 5 of this summary.

## SECTION 2

### POWER PLANT DESCRIPTION

#### 2.1 General

The Fort Wainwright Central Heating and Power Plant (CHPP) is located in building 3595 in the south central area. It is a power generating plant with a capacity of 22 MW. Four of the turbines are extracting condensing and one is an extraction back pressure unit. Two Garrett and Shaeffer boilers are part of an older plant. They have not been fired since 1960 and are not part of this study.

Included in this study were two pump house buildings 3568 and 3594, plus the emergency power station in building 3564. The emergency power station contains 5 diesel engines. The evaluation was to study heating and salvage value of this building.

#### 2.1 Boilers

The current facility built in 1953/54 has six (6) Wickes coal-fired boilers with Detroit Stoker Company spreader stokers with traveling grates.

These six boilers have a capacity of 150,000 PPH steam flow at 425 PSIG and 660 degrees F superheat. This is a heat generation rate of 166 MBTU/Hour. Coal stored in overhead bunkers flows down through coal scales to the feeders on the boiler front. The coal is supplied by Usebeili Coal Mines Inc. of Usebeili, Alaska. This coal has a heating value of 8,825 BTU/LB as fired. the coal is delivered by railroad. During 1984 the plant burned 163,996 tons of coal at a cost of \$46.58/Ton. This coal produced 1,771,416,000 pounds of steam. This steam was used for generating electric power and for heating of most of the buildings on the base. The CHPP generated all the power required by Fort Wainwright and sends power to Fort Greely to meet most of their needs.

The CHPP is now over 30 years old. It is presently meeting the steam heating and power generation requirements. Implementation of the

recommendation of this report will provide another thirty years of efficient operation. A replacement plant cannot be justified on an economic basis.

## 2.2 Controls

The existing Bailey Meter Company Analog Combustion Control Systems was excellent when it was installed in 1954. It was the latest state-of-the-art at the time of installation. When in repair and adjustment it is performing to provide good combustion with these boilers. In 1968 Bailey Controls Inc. stopped manufacture of these controls and made available improved control systems. Parts for these controls are no longer available. Maintenance and repairs have become difficult. Control accuracy will slip as old parts are not replaced.

New controls are recommended. ECO 7.5.12 of this study finds that the cost of new controls will payback in fuel savings in 8.6 years.

## 2.3 Combustion Air Supply

The combustion air for each boiler is drawn in at the roof level through dampers and steam heating coils so that the combustion air is warm when it reaches the grates. The combustion air dampers can be set so that a portion of the warm plant air can be mixed with cold return air. This air flow is metered and then supplied to the grate area by a 100 HP 230 V forced draft fan.

## 2.4 Induced Draft Fan

Each boiler has a 250 HP 2300 Volt induced draft fan for the removal of flue gases. The flue gases pass through a feedwater economizer and a mechanical separator before reaching the ID Fans. Each boiler has its own stack going out the roof.

## 2.5 Cooling Pond

The condenser water from the steam turbine condensers flows to a cooling pond to the southwest of the CHPP. Condenser water cools by surface evaporation in this pond. In the summer the pond warms reducing condenser

capacity. In cold weather the pond produces a fog. In very cold weather most of the pond is covered with ice.

2.6      Coal Handling

Coal is delivered to the site by railroad. The rail cars dump into a pit at the unloading facility on the north side of the boiler house. From this point it is raised by a bucket elevator and by the belt conveyor to coal bunkers over the boilers. If the coal is not required, the bucket elevator can drop it on the outside storage coal pile.

2.7      Emergency Power Plant

The emergency power plant building 3564 was built in 1944 and expanded in 1951. The diesel generators are old but are in good condition. The building is wood construction, temporary type, without insulation. Heating the building to protect the equipment uses considerable energy.

## SECTION 3

### FIELD AUDIT WORK

#### 3.1 General

A field audit team of three engineers spent over six days surveying conditions at the Fort Wainwright Central Heating and Power Plant (CHPP). At times all these engineers plus plant personnel were required to perform boiler tests. At times each engineer pursued different phases of the field audit. Time was required to review original construction plans, specifications, and equipment data in operating manuals.

#### 3.2 Boiler Performance

Boiler performance tests were not required for this CHPP. The plant operators had the results of earlier boiler tests on file and felt that these would be a better source of data. A performance test was run on Boiler No. 5 to obtain data required for the evaluation. Boiler controls were observed, checked and calibrated during this test. Boiler No. 6 was out of service so it was entered. Tubes and refractory were studied and documented. Tubes were ultrasonic tested for thickness. The upper drum was entered to inspect and determine conditions. This boiler furnace area was pressurized to find casing leaks. The boiler forced draft and induced draft fans were studied.

#### 3.4 Pumps and Pumping System

Pump curves were studied and data gathered for implementation of variable speed controls. Pumps were inspected to determine if modifications were possible. Locations for variable speed controls were selected to permit establishing the cost of installation.

#### 3.5 Condenser Water

The condenser water piping was studied to see if piping could be modified. The cooling pond and sump houses were studied for modification.

### 3.6

#### Steam Pressure

The steam turbine extraction was studied to determine how the steam pressure could be modified. The steam distribution system was reviewed with the piping foreman to determine the insulation thickness and the limits of steam pressure changes.

### 3.7

#### Auxiliaries

All plant auxiliaries were studied. The coal system operation was observed. Many hours were spent with the smaller systems in the plant.

## SECTION 4

### ENERGY CONSERVATION OPPORTUNITIES AND PREVIOUSLY RECOMMENDED PROJECTS

#### 4.0 General

The primary purpose of this energy engineering analysis was to study specific energy conservation opportunities in order to recommend power plant improvements and project development. The Scope of Work lists specific ECOs to be investigated and others were developed as a result of the field audit. These ECOs were all investigated and studied. Some were found to be maintenance and operations items and others were combined with related ECOs. The ECO list included items proposed by Black and Veatch, Consulting Engineers in their 1978 study and by Grumman Aerospace Corporation in a 1982 study but not implemented to date.

Energy savings were developed using the best available data. Plant data and meter readings were used when available. The boiler test data became part of the energy use calculation. Costs were developed from "Means Mechanical Cost Data Book" and other sources. Labor costs were escalated for Fort Wainwright using a 2.13 area cost factor index.

The specific ECOs studied are described in this section. They are also listed on summary sheets in Section 6.

#### 4.1 Air Fuel Ratio (Controls for Combustion) ECO • 7.5.1

The present controls do measure air and fuel to attempt proper mixtures. Newly developed oxygen analyzers are capable of measuring oxygen and carbon monoxide in the flue gas to provide accurate air fuel mixing. This type of analyzer can be installed on all six boilers for \$164,820 and will provide a savings in fuel of  $1.45 \times 10^9$  BTU/Year for a cost savings of \$184,210/Year. This provides a payback of less than a year and a SIR of 16.05.

The 1982 Grumman Study also recommended this, showing a construction cost of \$60,000 and a savings of \$26,500/Year for a discounted savings/investment ratio of 11.3.

This modification is recommended but it should not be considered without considering the need for total replacement of all controls discussed in Item 4.12 of this section. The existing controls must be replaced for safety and maintenance reasons.

4.2      Waste Heat Recovery ECO 7.5.2

This ECO required the study of several waste heat streams to see if any had a potential for energy savings. The combustion air heaters were found to be running wild with only manual controls. Restoring the system to the original automatic control system with improved freeze protection would save about 21,000 million BTU/Year or 20,930,000 pounds of steam per year representing \$87,625 per year. At a construction cost of \$137,400 this provides a 1.57 year payback and a SIR of 9.26. This project is recommended.

4.3      Operation and Maintenance Procedures ECO 7.5.3

This ECO studied O&M procedures that would save energy. While many items were studied and discussed no ECO was developed from this study.

4.4      Reduce Excess Air ECO 7.5.4

Leakage in the casing permits hot gases to get behind the refractory tile, destroying the insulation and warping the steel panels. Casing leakage allows air, that is not part of the combustion process, to enter the furnace. This excess air lowers boiler efficiency. Rebuilding of the casings at a cost of \$2,887,140 for the six boilers would increase boiler efficiency by 0.89%. This would result in a savings of 1,457 tons of coal a year or  $2.5 \times 10^{10}$  BTU/Year. The payback is 42 years with a SIR of 0.34. This ECO is not justified by energy savings. While not qualifying for energy savings it is recommended as necessary to increase boiler life avoiding boiler or boiler plant replacement costs.

4.5 Loading Characteristics and Scheduling ECO  
7.5.6

This ECO explores the loading and scheduling of equipment and auxiliaries to operate them to use the minimum amount of energy. The study showed that the equipment was being operated at the best efficient loads. This study did not find an ECO to develop into a project.

4.6 Variable Speed Circulating Pumps ECO 7.5.6

This ECO explored all pumps to find those that work against a throttling condition when speed control would reduce power consumption. The 400 HP Peerless Boiler Feed Pumps showed great potential for energy savings with a variable speed drive. At a cost of \$340,284 all three Peerless feedwater pumps could be converted to variable speed drive. This would result in an annual energy savings of \$60,000 of electrical power per year. This would result in a payback of 5.7 years and a SIR of 2.41. This project is recommended.

The 1982 Grumman Study recommended a half capacity pump to be able to mix and match loads. They did not develop economic data.

4.7 Steam Pressure Reduction ECO 7.5.7

The heat loss in a large steam distribution system is proportional to the steam temperature or steam pressure. The CHPP has lowered the steam pressure to 70 PSIG. A pressure of 60 PSIG would provide sufficient pressure for the system. They cannot lower the pressure below 70 PSIG because that is the lower limit of the steam turbine extraction pressure. Modification of the steam extraction valves would cost \$22,200 for the three extraction turbines. The savings results from lower steam line temperatures resulting in lower heat loss. This would result in an energy savings of 34,402 MBTU/Year for a savings of \$90,789 of steam a year. This provides a payback of 0.24 years for a SIR of 60. This project is recommended.

The 1982 Grumman Study recommended lowering steam pressure from 70 PSIG to 50 PSIG for a savings of \$197,222 per year. At their construction cost of \$100,000 this results in a

half year payback and a discounted savings/investment ratio of 29. Our study indicates that 50 PSIG is not adequate for the hospital.

4.8      Steam Pressure Reduction - Laundry ECO 7.5.8

The laundry located 1200 feet from the CHPP has a dedicated 200 PSIG steam line. The laundry can operate at 125 PSIG steam pressure. Installing a pressure reducing valve to reduce the pressure would cost \$13,630. This would save 3,400 MBTU per year representing a savings of \$8,975/Year. This results in a 1.5 year payback and a SIR of 9.6. This project is recommended.

4.9      Steam Driven Auxiliaries ECO 7.5.9

With large efficient electric generating turbines providing extraction steam at 70 PSIG and back pressure exhaust at 10PSIG there is no need for auxiliary turbine exhaust. There is no need for additional auxiliary turbine drives. The auxiliary turbine drives are only valuable when they contribute to the plant's heat balance.

4.10     Induced Draft Fans ECO 7.5.10

This ECO studied the use of variable speed drives on the induced draft fans. Variable speed drives are very efficient on fans that would normally be dampered, such as these fans, during normal operation. These drives would cost \$426,000 to provide a savings of 2,618,000 KWH/Year representing a cost savings of \$113,000. This represents a 3.8 year payback and a SIR of 3.64. This project is recommended.

The Grumman Study evaluated both the Induced Draft and Forced Draft Fans together. For a cost of \$750,000. They estimated an annual savings of \$97,983. This provided a payback of 7.65 years and a discounted savings/investment ratio of 1.41.

4.11     Forced Draft Fan ECO 7.5.11

Forced draft fans normally are dampered so they can benefit from variable speed drives. The six forced draft fans can be equipped with

variable speed drives at a cost of \$358,000. This will save 3,476 MBH which is equal to 1,018,516 KWH/Year at a savings of \$44,000/Year. This will provide a 8.11 year payback and a SIR of 1.64. This project is recommended.

4.12 Instruments and Controls ECO 7.5.12

This ECO studied the replacement of the existing Bailey Controls with a modern system. This new control system would incorporate air fuel ratio controls discussed in Item one of this section. The replacement of the controls is necessary because parts are no longer available. The controls are becoming a plant safety problem unless replaced.

The new control system would increase boiler efficiency 1.90%. This would save 3,955 tons of coal per year. The savings in not having to repair and maintain the old controls exceeds \$28,000/Year representing 69,800 MBH at a cost savings of \$184,210/Year. This provides a 8.6 year payback with a SIR of 1.89. This project is recommended.

4.13 Cooling Pond Spray ECO 7.5.13

The condenser water from the steam turbine condensers is cooled in a large pond to the southwest of the CHPP. Cooling ponds are very compatible with cold region conditions. They are not damaged by freezing and they produce less fog than cooling towers.

In the summer with extended hours of sunlight this pond warms up and the capacity of the steam turbine generators is reduced. This loss averages over 3.2% during the summer months. This ECO studies methods of reducing the pond or condenser water temperature and restoring generator capacity.

- The original construction drawings showed a cooling pond spray system that was not installed. Pumps that exist in pump house building 3568 that can be modified for use on a pond spray system. Modifying the pumps and installing a pond spray system would cost \$175,000. This would result in a savings of 2,398,412 pounds of steam that represents a \$17,535 savings. The cooling pond is low

maintenance costing about \$1,200 per year, this would provide an 11.4 year payback with a SIR of 1.2. This project is recommended. It represents a low cost method of increasing the ability of the generator to provide full capacity in the summer.

#### 4.14

#### Condensate Heater ECO 7.5.14

This is an ECO that was added to the study as a result of the field audit investigation. The three GE condensing steam turbines have provisions for installing a steam extraction tap just ahead of the last stage. Steam at this point contains only a small amount of energy that can be used for generation but it still has a large amount of energy that can be used for heating.

The installation of a condensate heater using steam extracted from the last turbine stage will save 31,593 MBTU per year representing a savings of 1,790 tons of coal. Such a condensate heater for three turbines will cost \$92,000 resulting in a payback of 1.1 years and a SIR of 13. This project is recommended as it increases plant efficiency while lowering the cooling pond load.

#### 4.15 AND 4.16

The Report Volume 2 reserved studies 7.5.15 and 7.5.16 for ECO studies that did not develop and were not used. To keep the Item numbers identical to the ECO study Item numbers in the report 4.15 and 4.16 are not being used.

#### 4.17

#### Standby Diesel Plant ECO 7.5.17

The diesel generator plant (Building 3564) was built in 1944 as the original base power plant. It is located 1000 feet from the CHPP. The building is non-insulated, temporary type wood construction. The building is costly to heat. The diesel equipment and electrical switch gear is operational but the condition of the old circuit breakers is questionable. This plant is kept in standby condition to provide a cold start ability to the CHPP.

The optimum design of a CHPP would contain either a small steam turbine generator or a diesel engine or gas turbine to provide house

or plant power. Their purpose would be to provide the CHPP with limited operating power should transmission line problems shut down the main generators. The ECO studied the replacement of the standby diesel plant with a gas turbine generator in the CHPP. This installation would be costly and could not be justified.

4.18 Previously Recommended Projects ECO 7.5.18

This Scope of Work Item reviewed projects recommended, but not implemented, in the 1978 Black and Veatch Report and the 1982 Grumman Study. These recommended projects all matched or were similar to other ECOs studied. This section reviews, discusses and references the ECO where the previous improvement was studied as part of an ECO. This section did not result in an ECO in itself.

The Grumman Study did recommend a topping cycle as a method of correcting cooling pond overheating. They estimated a cost of \$8,400,000 for a 1000 PSIG boiler and topping turbine with an energy savings of \$922,000 per year with a 9.1 year payback and a discounted savings/investment ratio of 1.62. The topping cycle did not include the cost of improving the feedwater for the entire plant or for new plant air pollution bag houses. With this the costs become prohibitive compared to other methods of solving cooling pond problems. A topping cycle is not recommended.

4.19 Automatic Tube Cleaning ECO 7.5.19

This item previously recommended in the Grumman Study proposes the installation of automatic cleaning brushes in the steam turbine condenser tubes. This type of automatic tube cleaning by reversing flow has gained acceptance for use in power plants. The cost of installation on three turbine condensers will be \$391, 827 resulting in the savings of 107,427 MBTU/Year that represents a  $6.953 \times 10^7$  pounds of steam per year representing a cost of \$283,500. The automatic tube cleaning system requires some maintenance but the reduced tube cleaning results in a net maintenance savings of about a \$1,000/Year. This results in a payback of 1.38

years for a SIR of 10.53. This project is recommended.

The Grumman Study estimated a cost of \$175,700 and a savings of \$29,592 per year resulting in a 5.9 year payback with a discounted savings/investment ratio of 1.82.

## SECTION 5

### DOCUMENTATION

#### 5.1 General

The purpose of this energy engineering analysis program was not only to find ECOS and necessary maintenance items, but to provide the documents for funding. By providing the funding documents with this study the time required to request funds and implement the improvement projects is shortened. The ECOS have been discussed in technical detail in Section 4.

At the interim review conference in October 1985, the potential list of ECOS and recommended improvements and repairs was reviewed for correction and evaluation with the DEH at each installation, the Alaska District Corps of Engineers representative, the U.S. Army Forces Command representative and others. At this meeting the ECOS were selected for grouping and type of funding. These funding requests are discussed below and summarized in the next section.

#### 5.2 Heat Loss Reduction

This QRIP combines the Waste Heat Recovery, Item 2 and Steam Pressure Reduction, Item 7 into a single piping mechanical work project with a payback of less than a year.

#### 5.3 Automatic Tube Cleaning

This ECIP, Item 19, Section 4, provides for the installation of automatic tube cleaning in the steam turbine condenser tubing. The payback is less than two years.

#### 5.4 Mechanical Improvements

This Form 1391 groups Items 8, 10, 11, 13 and 14 of Section 4 of this summary into one OMA fund package of fan modifications, piping, valves and mechanical work into one project. This group has a payback of four years.

5.5

Variable Speed Drives

This ECIP provides variable speed drives for the boiler feedpumps described in Item 6, Section 4. The payback is less than 6 years.

5.6

Boiler Settings/Controls

This Form 1391 for OMA funding combines Item 4 and 12, Section 4, the Rebuilding of the Boiler Settings and the Replacement of the Boiler Combustion Controls. This work is best done concurrently on each boiler. This project had a SIR of less than one but was considered necessary for the continuing operation of the plant.

## SECTION 6

### SUMMARY

#### 6.1 GENERAL

There are three summary sheets. The first summary sheet lists ECOs that are recommended energy conservation opportunities. All ECOs on this list have savings investment ratios (SIR) above one and are recommended for implementation. They all meet the requirements of the Energy Conservation Investment Program (ECIP). The second summary sheet lists those ECOs that had an SIR of less than one and could not be recommended as energy projects. Some of these ECOs are still recommended as maintenance items that are necessary for plant operation. The third summary sheet lists the ECOs as they have been grouped and documented for funding.

END OF SECTION

TABLE 1

## FORT WAINWRIGHT

## SUMMARY OF RECOMMENDED

## ENERGY CONSERVATION OPPORTUNITIES

## BASE ON FY85

ECO NO.	DESCRIPTION	STR RANK	EXISTING ENERGY USAGE (MBTU/YR)	ESTIM.* ENERGY SAVINGS (MBTU/YR)	ESTIMATED SAVINGS (\$000/YR)	FY85 CONST. (\$000)	SIMPLE PAYBACK PERIOD (YRS)	SAVINGS INVEST. RATIO (SIR)
7.5.7	REDUCE STEAM DISTRIBUTION PRESSURE	1	1,143,374	34,402	91	22	0.24	59.38
7.5.1	AIR FUEL RATIO CONTROLS	2	2,894,529	69,800	184	165	0.89	16.05
7.5.14	CONDENSATE HEATER	3	**	31,593	83	83	1.11	13.11
7.5.19	AUTOMATIC TUBE CLEANING	4	1,806,105	107,427	284	392	1.38	10.53
7.5.8	STEAM PRESSURE REDUCTION-LAUNDRY	5	42,100	3,400	9	14	1.52	9.56
7.5.2	WASTE HEAT RECOVERY (COMB AIR TEMP)	6	1,026,171	33,206	88	137	1.57	9.26
7.5.10	INDUCED DRAFT FANS	7	11,226	8,936	113	426	3.77	3.64
7.5.6A	VARIABLE SPEED CIRCULATION PUMPS	8	10,162	4,721	60	340	5.69	2.41
7.5.12	INSTRUMENTS & CONTROLS	9	1,590,530	69,800	184	1,591	8.63	1.89
7.5.11	FORCED DRAFT FANS	10	4,485	3,476	44	357	8.11	1.64
7.5.13	COOLING POND SPRAY	11	213,691	6,473	15	175	11.4	1.20

\* ALL ENERGY SAVINGS ARE COAL.  
\*\* NEW ITEM OF EQUIPMENT WITH NO COMPARABLE EXISTING ENERGY USAGE.

TABLE 2

FORT WAINWRIGHT  
 SUMMARY OF ENERGY CONSERVATION OPPORTUNITIES  
 NOT ELIGIBLE FOR ENERGY FUNDING

ECO NO.	DESCRIPTION	EXISTING ENERGY USAGE (MBTU/YR)	ESTIM.* ENERGY SAVINGS (MBTU/YR)	ESTIMATED SAVINGS (\$000/YR)	FY85 CONST. COST (\$000)	SIMPLE PAYBACK PERIOD (YRS)	SAVINGS INVEST. RATIO (SIR)
7.5.4	REDUCE EXCESS AIR (BOILER SETTINGS)	2,894,529	25,716	68	2,887	42.54	0.45
7.5.17	STANDBY DIESEL PLANT	N/A	4,865	13	8,109	632.0	0.02

\* ALL ENERGY SAVINGS ARE COAL.

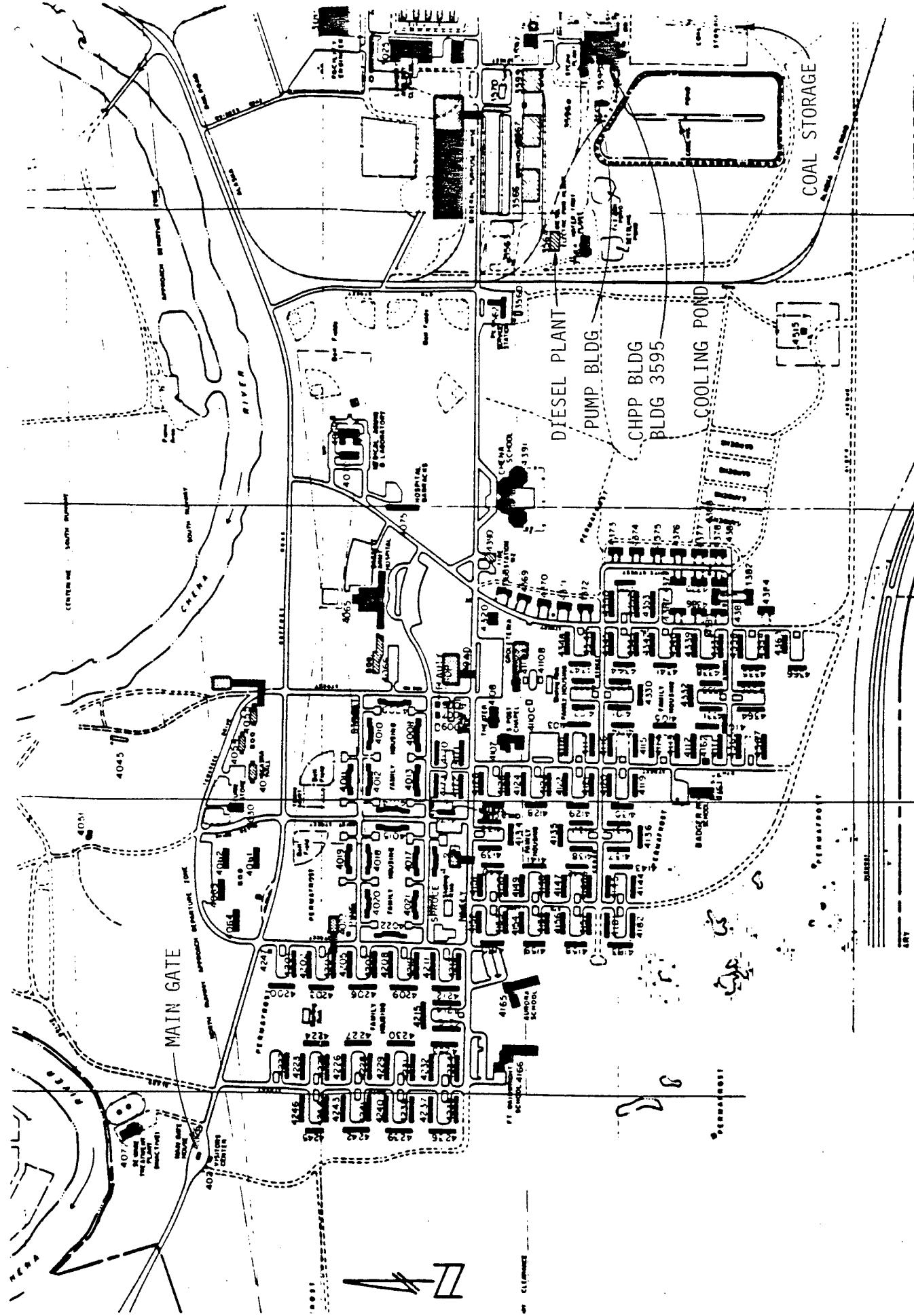
TABLE 3

## FORT WAINWRIGHT

## SUMMARY OF ENERGY CONSERVATION OPPORTUNITIES

## DOCUMENTED FOR FUNDING

ECO NO.	DESCRIPTION	SIR RANK	EXISTING ENERGY USAGE (MBTU/YR)	ESTIM.* ENERGY SAVINGS (\$000/YR)	FY85 CONST. COST (\$000)	SIMPLE PAYBACK PERIOD (YRS)	SAVINGS INVEST. RATIO (SIR)
7.5.2	WASTE HEAT RECOVERY	1	2,169,542	67,605	178	160	0.89
7.5.7	REDUCE STEAM DISTRIBUTION PRESSURE	0SD-PIF					16.23
7.5.19	AUTOMATIC TUBE CLEANING	2 ECIP	1,806,105	107,427	284	392	1.38
7.5.8	STEAM PRESSURE REDUCTION-LAUNDRY				AUTOMATIC TUBE CLEANING		10.53
7.5.10	INDUCED DRAFT FANS						
7.5.11	FORCED DRAFT FANS	3 FORM 1391	271,829	54,049	265	1,064	4.02
7.5.13	COOLING POND SPRAY				MECHANICAL IMPROVEMENTS		3.60
7.5.14	CONDENSATE HEATER						
7.5.6A	VARIABLE SPEED FEED PUMPS	4 ECIP	10,162	4,721	60 VARIABLE SPEED PUMPS	340	5.69
7.5.12	INSTRUMENTS & CONTROLS	5 FORM 1391	1,590,530	69,800	1,84 INSTRUMENTS/CONTROLS	3,019 1,591	8.63
7.5.4	REDUCE EXCESS AIR	6 FORM 1391	2,894,529	25,716	68 BOILER SETTINGS	2,897	42.5
	* ALL ENERGY SAVINGS ARE COAL.						0.45



## FORT WAINWRIGHT SITE PLAN