Basewide Energy Studies in Support of Energy Engineering Analysis Program

for

St. Louis Area Support Center

Granite City, Illinois

Contract No.- DACA 41-81-C-0108

Final Submittal

Executive Summary

Prepared by

The Benham Group

Oklahoma City, Oklahoma

for

Department of the Army

Kansas City District

Corps of Engineers

February 1983

DEPARTMENT OF THE ARMY
CONSTRUCTION ENGINEERING RESEARCH LABORATORIES, CORPS OF ENGINEERS
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Marie Wakefield,
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EXECUTIVE SUMMARY

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1. PRELIMINARY SUBMITTAL

Volumes 1 through 7 - Dated February, 1982.

-Includes all survey data and lists energy conservation opportunities.

2. INTERIM SUBMITTAL

Volumes 1 through 10 - Dated June 1982.

-Contain ECM analysis and recommendations.

Volumes 11 through 28 -

-Contain computer analysis data (BLAST)

NOTE: Volume 11 through 28 available at Huntsville District and Kansas City District Offices only.

3. FINAL REPORT

Volume 1 - Executive Summary

Volume 2 - Programming documents for projects recommended for implementation - DD forms 1391 and PDB.

Volume 3 - Narrative report and appendix.

NOTE: Preliminary and interim submittal reports already submitted.

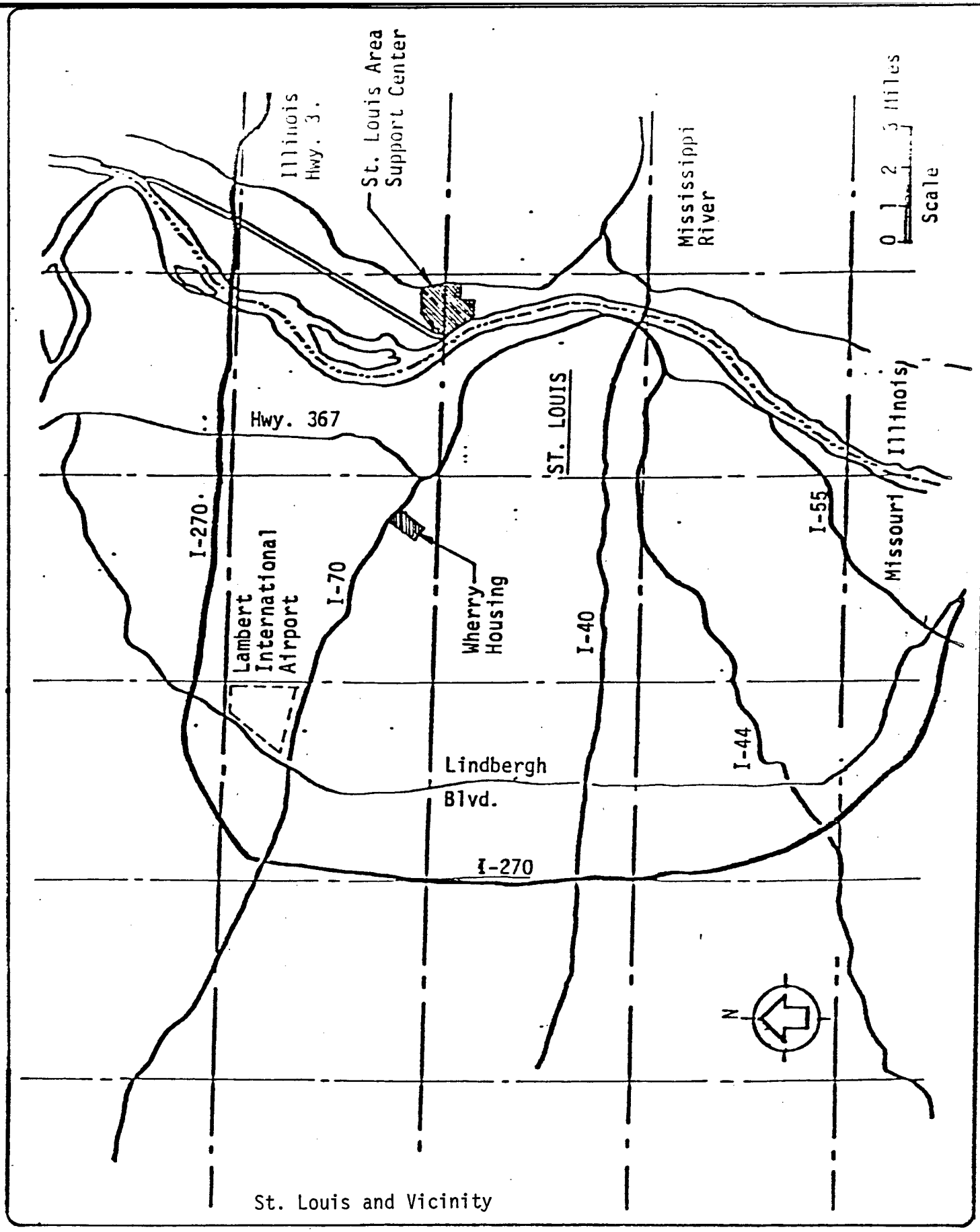
INTRODUCTION

ST. LOUIS AREA SUPPORT CENTER
GRANITE CITY, ILLINOIS

The mission of this facility is to provide administrative and logistic services to Army and other Federal Government elements in the St. Louis area as delineated in support agreements and/or area support assignments.

The St. Louis Area Support Center (SLASC) occupies 895 acres of land adjacent to the Mississippi River in Granite City, Illinois. Plant improvements include 2.4 million square feet of storage facilities, 94,000 square feet of administrative facilities, and 470,000 square feet of housing and community facilities.

SLASC was established as a US Army Engineer Depot in April 1942,with formal activation occurring on 1 August 1942. The facility saw peak activity in this regard during 1943 and 1944. In 1962, the facility was transferred to the US Army Supply and Maintenance Command. In 1970, the facility was deactivated as a depot and was taken over by the US Army Aviation Systems Command. In June of 1977, SLASC became a part of the US Army Troop Support and Aviation Material Readiness Command.



St. Louis and Vicinity

2-15-83

PROJECT								DATE	REF. FROM	INIT
EEAP - St. LOUIS AREA SUPPORT CENTER								11-1-82		FJM
The BenhamGroup — architects / engineers planners / consultants	JOB NO. OFF.	YR.	SEQ.	SUBDIVISION EXT.	DISC.	TYPE E	EXP.	C.	M.F.I.	SHEET	REV. 1
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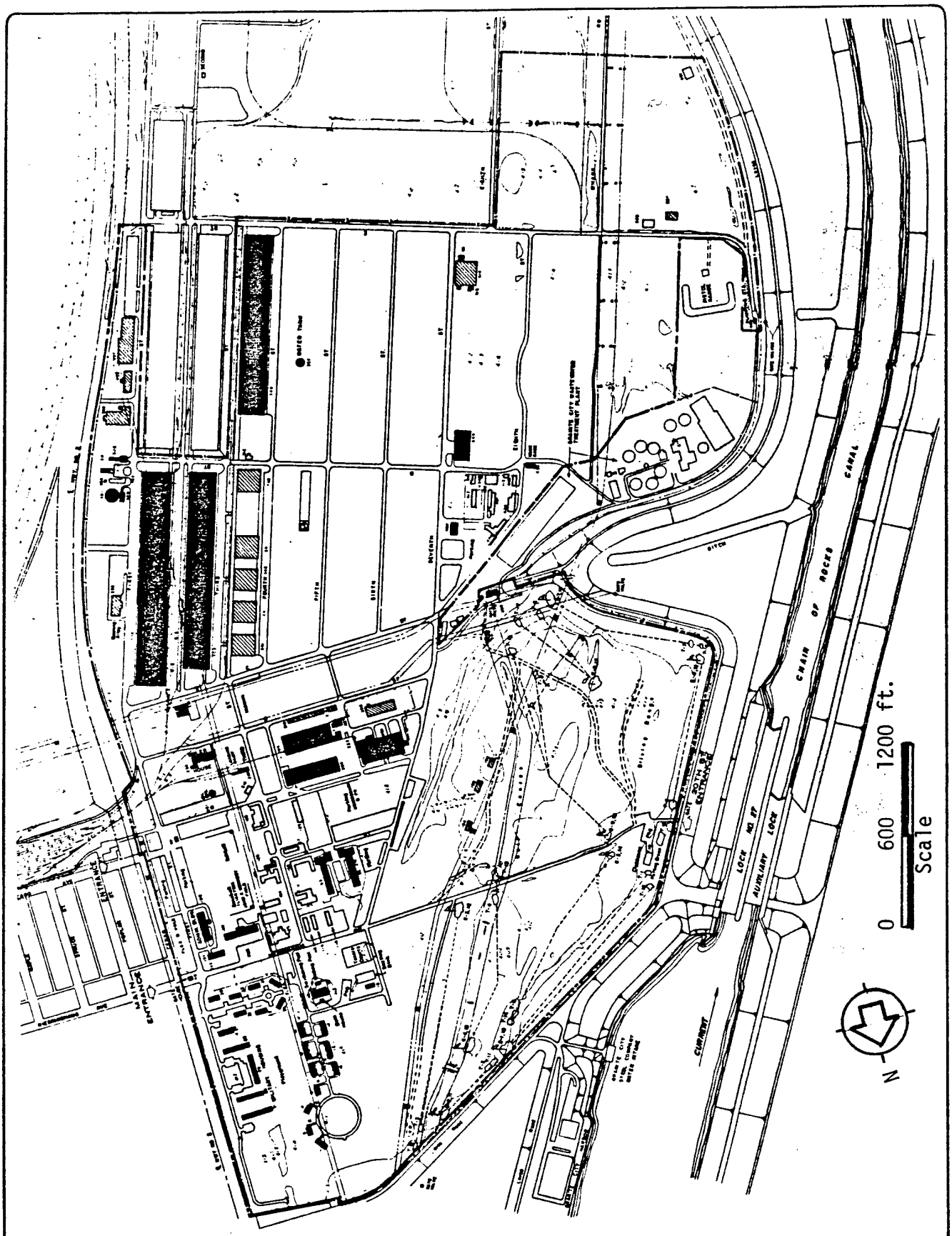

ST. LOUIS AREA SUPPORT CENTER - GRANITE CITY, ILLINOIS

2-15-83

PROJECT		DATE	REF FROM	INIT
EEAP - ST. LOUIS AREA SUPPORT CENTER		11-1-82		FJM

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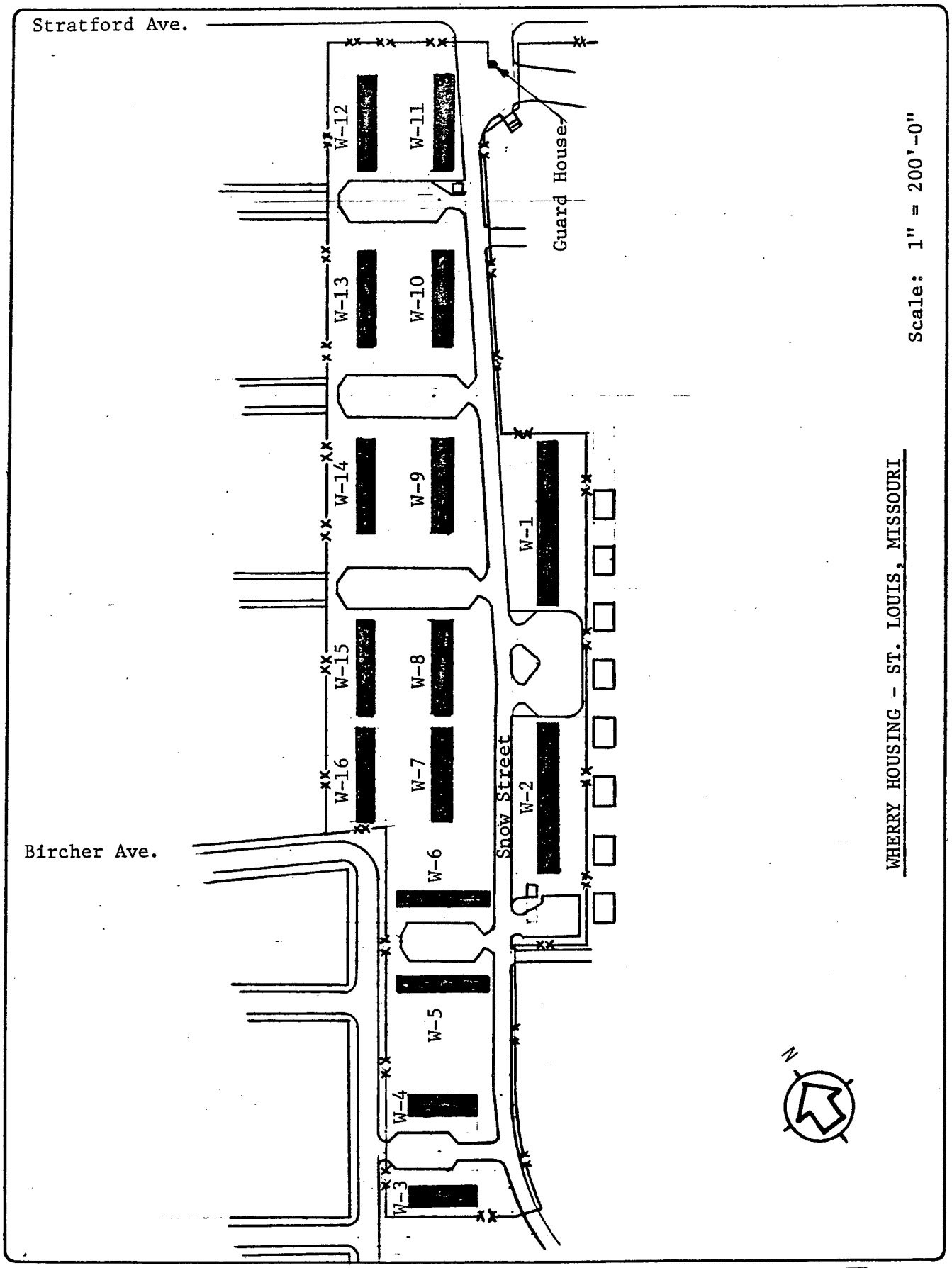

WHERRY HOUSING - ST. LOUIS, MISSOURI

Scale: 1" = 200'-0"

2-15-83

PROJECT		DATE	REF FROM	INIT
EEAP - ST. LOUIS AREA SUPPORT CENTER		11-1-82		FJM

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The basic survey data for this energy engineering analysis was gathered during November 1981, and furnished as an appendix to the preliminary submittal. An executive summary is included as a part of this report. It summarizes and explains the conclusions reached on energy conservation measures that were analyzed under Phase II of the Energy Engineering Analysis Program.

Under Phase II both the technical and economic feasibility of the energy conservation opportunities outlined in the preliminary report were analyzed. BLAST runs were utilized to determine both the baseline energy consumption for each building as well as the energy savings generated if a particular energy conservation measure is implemented.

Both the energy savings generated and the cost to implement it were utilized to run an economic analyses to determine an E/C ratio to be utilized in ranking these ECMs. This analysis was performed on a building basis for each ECM.

The results of this analysis were tabulated on matrix form showing the E/C ratio for each ECM for each applicable building.

Also, a list of all buildings included in this survey along with pertinent data is furnished in the Appendix.

All energy conservation measures that qualify under ECIP criteria have been recommended for implementation. The ones that did not meet the minimum project dollar requirements but are still economically feasible were recommended to the facilities engineer for implementation under Increment "G".

All energy saving measures resulting from maintenance and operational changes are grouped under Increment "F". Increment "F" also includes a list of energy conservation measures implemented since 1975.

Total base energy usage for 1985 has been calculated. Assuming that all energy conservation measures included in this report are implemented.

Under Increment "F" sufficient data has been provided to the facilities engineer that identify energy saving projects. Energy savings, equipment and labor estimates are included.

Under Phase III, programming documents have been prepared for all projects that met ECIP criteria. DD Form 1391 and Project Development Brochures (PDB) have been written for these projects.

EXISTING ENERGY CONSUMPTION

Basewide Consumption FY-1975:

Granite City.....244,313 MMBTU
Wherry Housing.....21,407 MMBTU
Total.....265,720 MMBTU

Source Energy Consumption FY-1981

Granite City

	Consumption	Dollars	BTU
Electricity	9,588,000 KWH	$343,915	$111,221 \times 10^6$
Fuel Oil	639,863 Gals	424,803*	$94,480 \times 10^6$
Natural Gas	None		
Propane	11,848 Gals	2,488*	$1,131 \times 10^6$
SUB TOTAL:		$771,206	$206,832 \times 10^6$ BTU

Wherry Housing

	Consumption	Dollars	BTU
Electricity	1,149,000 KWH	$ 55,000*	$13,328 \times 10^6$
Fuel Oil	None		
Natural Gas	10,850,000 CF	39,500*	$11,176 \times 10^6$
Propane	None		
SUB TOTAL:		$ 94,500	$24,504 \times 10^6$ BTU

BASEWIDE TOTAL FY-1981 $865,706 $231,336 \times 10^6$ BTU

*Estimated

2-15-83

PROJECT								DATE	REF. FROM	INIT
EEAP - ST. LOUIS AREA SUPPORT CENTER								11-1-82		FJM
The BenhamGroup — architects / engineers planners / consultants	JOB NO OFF / YR / SEQ			SUBDIVISION / EXT	DISC	TYPE / E	EXP	C	M F I	SHEET	REV
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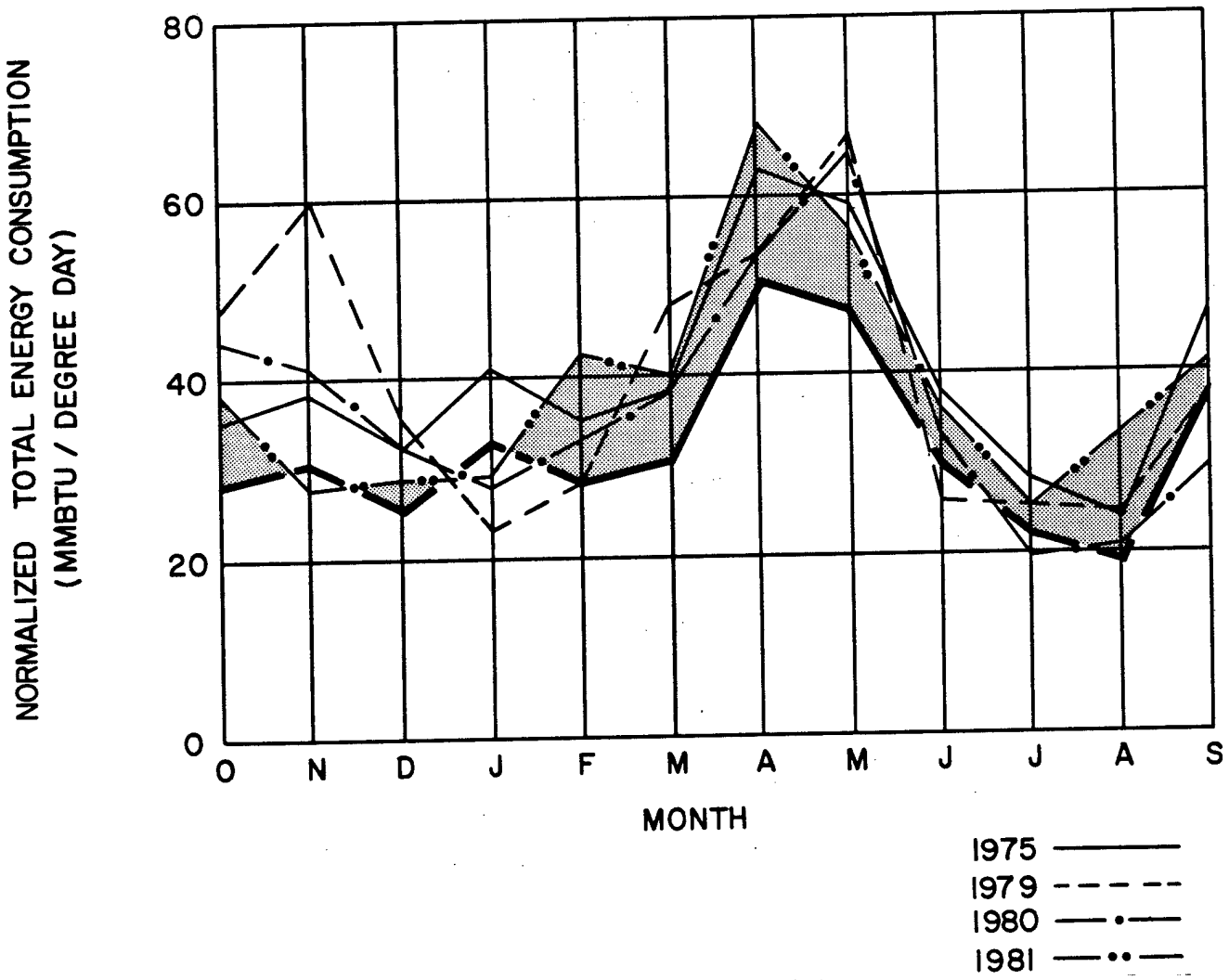


TOTAL MONTHLY ENERGY CONSUMPTION

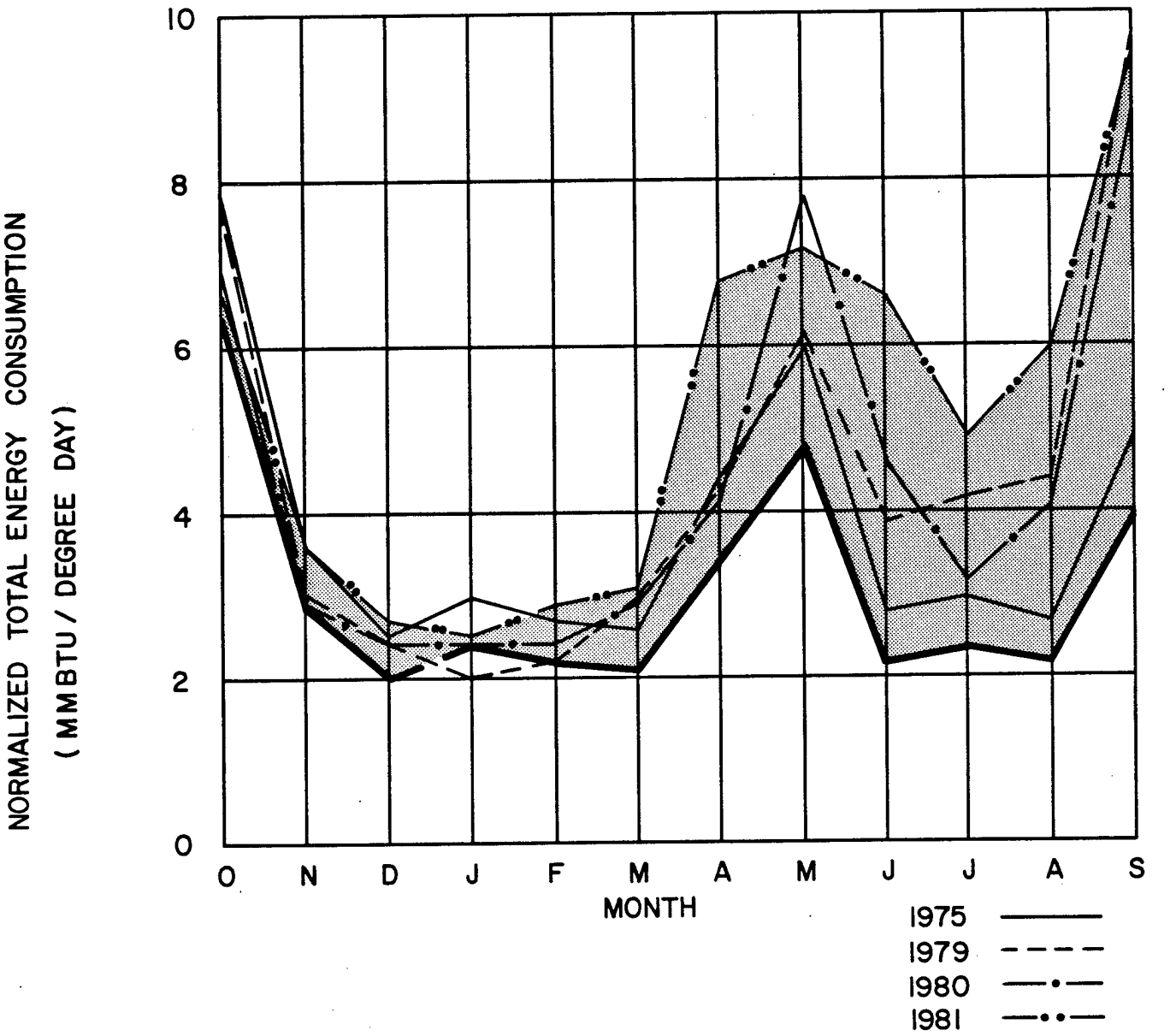
FY-1975, 1979, 1980, 1981 1985 ARMY GOAL

GRANITE CITY

DESCRIPTION: The shaded area indicates the amount of effort required to reduce present energy consumption to the established goal. Spring peaks indicate energy being used when weather is fair. Possible explanation could be use of pumps at sewage lift station.

2-15-83

PROJECT		DATE	REF FROM	INIT
EEAP - ST. LOUIS AREA SUPPORT CENTER — GRANITE CITY		11-1-82		RGW
The BenhamGroup architects / engineers planners / consultants	JOB NO. OFF 108 YR 101 SEQ 380	SUBDIVISION EST	DISC	TYPE E	EXP	C	MAP	SHEET 9	REV 1 R



TOTAL MONTHLY ENERGY CONSUMPTION
FY-1975, 1979, 1980, 1981

1985 ARMY GOAL

WHERRY HOUSING

DESCRIPTION: The shaded area indicates the amount of effort required to reduce present energy consumption to the established goal. Spring and fall peaks indicate times when energy use cannot be directly related to the weather.

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PROJECT														
EEAP-ST. LOUIS AREA SUPPORT CENTER — WHERRY HOUSING											DATE 11-1-82	REF FROM	INIT RGW	
The BenhamGroup architects / engineers planners / consultants	JOB NO. OFF 1 YR 1 SEQ 1 0 8 1 1 0 1 3 8 0	SUBDIVISION EXT	DISC	TYPE E	EXP	C	MAP #	SHEET 1 0	REV 1					

ENERGY CONSERVATION MEASURES DEVELOPED

All energy conservation opportunities that were investigated can be grouped under the following categories:

ECIP PROJECTS

1. Insulation of piping and mechanical equipment was investigated and several buildings have been recommended for upgrading at a total cost of $125,236, an annual energy savings of 12,184 million BTU, and a payback of less than a year.

2. Building insulation was also investigated and it is recommended that insulation for six buildings be increased at a total cost of $647,903, an annual energy savings of 25,724 million BTU and a payback of less than 2 years.

3. An investigation of a basewide installation of an EMCS System indicated an opportunity to save 46,979 million BTU annually at an estimated cost of $2,789,342, with a simple payback of 3.3 years. The installation will include a total of 74 buildings.

4. Investigation of a solar energy opportunity to heat three warehouses resulted in a recommendation to install "Trombe Walls" to these buildings at an estimated cost of $104,744, an energy savings of 1812 million BTU annually, and a payback of less than 7 years.

5. The last project to qualify under ECIP criteria was the replacement of existing light sources with more efficient ones. The estimated annual energy savings are 2,452 million BTU at a cost of $154,423, and a simple payback of a little over 9 years.

INCREMENT "G" PROJECTS

These are projects that are within the funding authority of the facility engineer. The following projects are recommended for implementation.

1. Weatherstripping and caulking was found to be desirable for a total of 45 buildings at an estimated cost of $32,659. This is estimated to produce an annual energy savings of 4,104 million BTU for a simple payback of less than 1 year.

2. Installation of night setback for building temperature is recommended for 58 buildings. Total estimated cost of implementing this item is $85,031, and it is estimated to produce an annual energy savings of 7,301 million BTU for a simple payback of less than 1 year. This project will not be implemented if the addition of an Energy Monitoring and Control System is approved, since night setback is also accomplished by the EMCS.

3. The installation of economizers to the two operating boilers in Building 202 is recommended for implementation. Estimated cost is $44,100, estimated energy savings are 2,175 million BTU for a simple payback of 1.3 years.

4. Steam and condensate lines between Building 203 and central plant Building 202 were found to have no insulation at all, and were buried in mud which was being made mainly by leaks in the condensate line. Heat losses from the steam line was boiling the moisture out of the mud. It is recommended that both pipes be replaced and insulated at an estimated cost of $52,021. This will generate energy savings of 2,198 million BTU for a simple payback of 1.5 years.

5. Installation of economizer controls, weatherproofing of air handling unit dampers and reduction of supply air volumes is recommended. Estimated cost is $48,915 This is estimated to generate annual savings of 1490 million BTU for a simple payback of 1.8 years.

6. Installation of automatic radiator valves for 7 buildings is recommended. Total installed cost is estimated at $41,104. This is estimated to generate an annual energy savings of 1,208 million BTU for a simple payback of 2.2 years.

7. Insulation and operation of the above ground fuel oil storage tank is recommended. Total installation cost is estimated at $22,042. This is estimated to generate annual energy savings of 331 million BTU for a simple payback of 4.25 years.

INCREMENT "F" PROJECTS

The following changes in system operation are recommended for implementation:

1. Installation of water flow restrictors in lavatories and showers. Estimated cost to implement this change is $2,380. It is estimated to generate an annual energy savings of 371 million BTU for a simple payback of 1/2 year.

2. Shut down heat in unoccupied portion of Building 183 is estimated generate an annual energy savings of 371 million BTU for a simple payback of 1/2 year.

3. Installation of automatic controls and night shutdown of air handling unit for library Building 183. Estimated cost to implement $1,071. Annual energy savings 29 million BTU for a simple payback of 3 years.

The following items were to be recommended for implementation but the Facility Engineer has incorporated them already:

Addition of load dock seals and lowering of the domestic hot water temperature.

The following items were analyzed but did not meet ECIP criteria:

1. Addition of solar films to existing east and west windows to minimize air conditioning loads.

2. Blanket replacement of equipment motors with energy efficient motors. This item is recommended only when motors burn out and need to be replaced. See policy recommendations.

4. Shut down domestic hot water heaters when not needed to minimize standby losses.

5. Replacing existing mercury vapor street lights with high pressure sodium.

POLICY CHANGES - RECOMMENDATIONS

The following items should be considered for implementation.

1. When electric motors need to be replaced, use high efficiency motors.

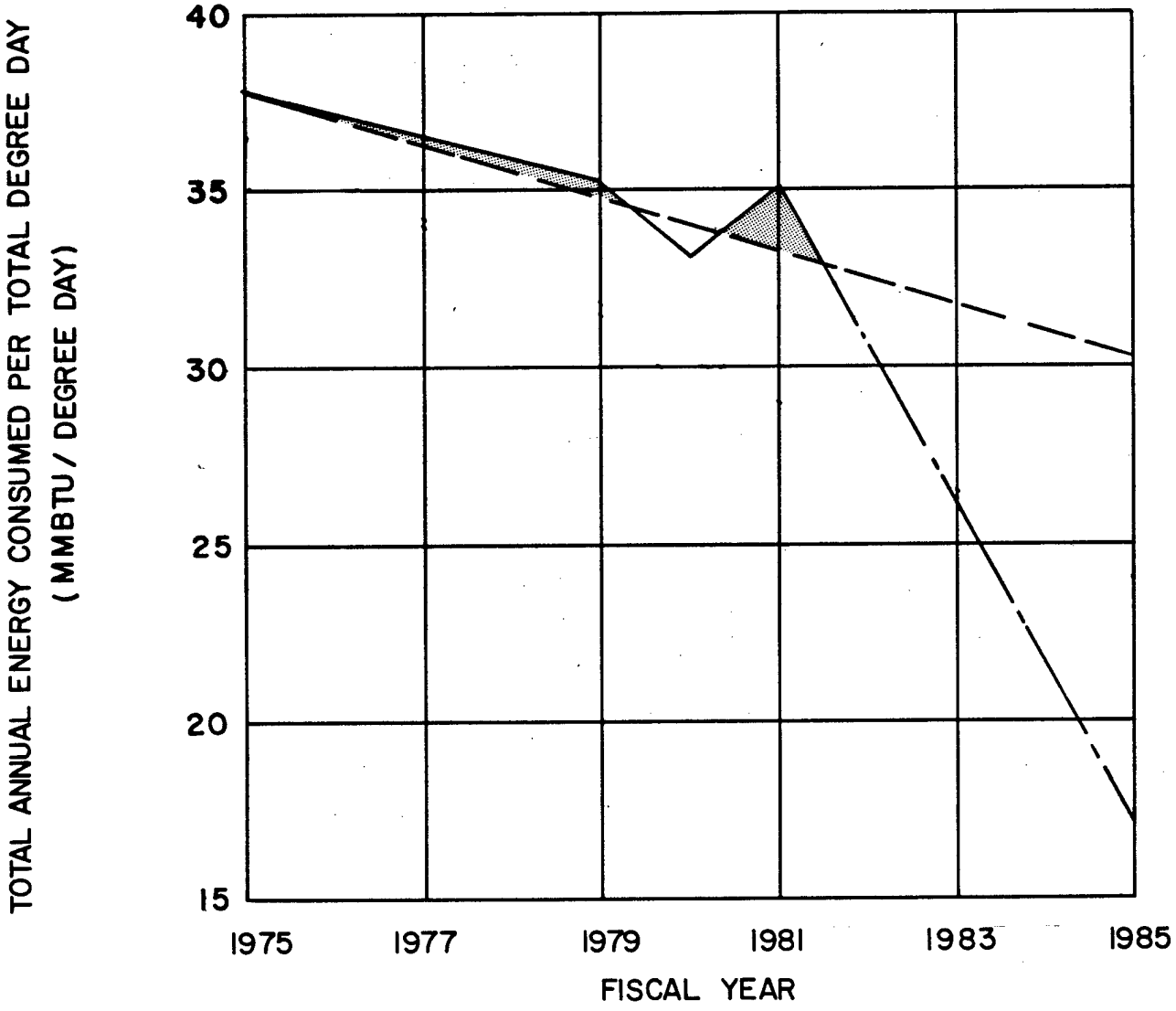
2. As lights and ballasts burn out, replace with energy saving lamps and ballasts.

3. Occupants should be encouraged to turn off lights when leaving their area.

4. Implementation of an energy management campaign to make base personnel aware of energy saving opportunities at home, as well as on the job, will definitely contribute to the overall energy savings.

5. Whenever building areas are no longer required, they should be isolated and energy systems de-activated.

6. When replacing any equipment, energy efficient replacements need to be specified..



ACTUAL ENERGY CONSUMED _____

ARMY ENERGY CONSUMPTION GOAL — — — —

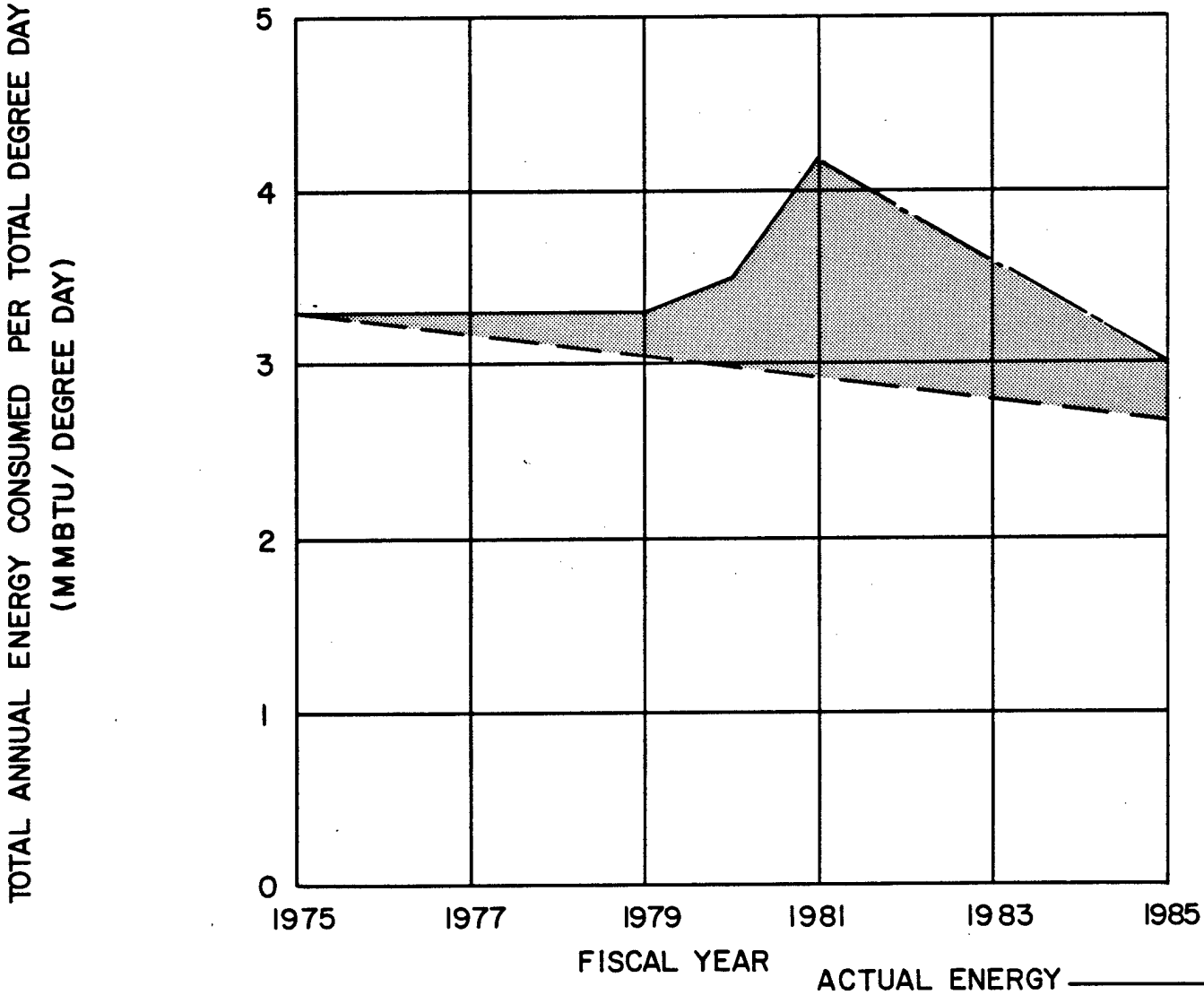
PROJECTED ENERGY CONSUMPTION —·—·—

DESCRIPTION: Shaded areas indicate energy consumption over and above established goals.

PROJECTED ANNUAL ENERGY CONSUMPTION TREND
GRANITE CITY

2-15-83

PROJECT												
EEAP – ST. LOUIS AREA SUPPORT CENTER GRANITE CITY								DATE 11-1-82	REF FROM	INIT FJM
The BanhamGroup architects / engineers planners / consultants	JOB NO. OFF 1 YR 81 SEQ 013	SUBDIVISION EXT 80	DISC	TYPE E	EXP	C	MAP	SHEET 15		REV 1



DESCRIPTION: Shaded areas indicate energy consumption over and above established goals.

PROJECTED ANNUAL ENERGY CONSUMPTION TREND

WHERRY HOUSING

2-15-83

PROJECT	DATE	REF FROM	INIT
EEAP—ST. LOUIS AREA SUPPORT CENTER—WHERRY HOUSING	11-1-82		FJM

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JOB NO.	SUBDIVISION	DISC	TYPE	EXP	C.	SHEET	REV
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PROJECTED ENERGY COSTS

ENERGY SOURCE	ENERGY COSTS (DOLLARS/MMBTU)				
	FY-1981	FY-1982	FY-1983	FY-1984	FY-1985
Heating Steam From Fuel Oil No. 2*	8.12	9.27	10.55	12.03	13.71
Heating Steam From Fuel Oil No. 6	8.67	9.88	11.27	12.84	14.64
Natural Gas					
Wherry	3.53	4.02	4.59	5.23	5.96
Granite City**	4.00	4.56	5.20	5.93	6.76
L.P. Gas	7.94	9.05	10.32	11.76	13.41
Electricity***					
Wherry**	12.01	13.57	15.34	17.33	19.59
Granite City	16.70	18.87	21.32	24.10	27.23
Demand Charge					
Wherry	None	-	-	-	-
Granite City	$4.05/KW	4.58	5.17	5.84	6.60

*Average
**Estimated
***Actual Cost to Support Center, Based on 3413 BTU/KWH

The majority of the energy conservation modifications completed at the St. Louis Area Support Center from FY 1975 to FY 1981 have been difficult to document. A general summary of the modifications during those years is as follows:

- Heating boilers and comfort heating systems have been modified to increase heating efficiencies (FY 1979, 1980).
- Steam and condensate lines have been replaced due to leakage.
- Thermostatic heat controls have been installed in some buildings served by the central steam heating system.
- Storm windows have been added to residential housing.
- Street lighting has been decreased.
- Numerous temporary buildings have been vacated and dismantled.
- Personnel have been instructed how to conserve energy.

Most of the energy conservation modifications requiring large capital expenditures have taken place during FY 1981.
The following is a list of the projects by building:

- Bldg. 198 - Golf Course Club House: Added wall and ceiling insulation.
- Bldg. 114 - Child Care Center: Added wall and ceiling insulation.
- Bldg. 306 - Warehouse #1: Added ceiling fans, heater repairs.
- Bldg. 100 to 101; Replace leaking steam and condensate line.
- Bldg. 231 - Commissary: Added extra roof insulation and new roof.
- Bldg. 204 - Post Exchange: Added extra roof insulation and new roof.
- Bldg. 192, 192 - Barracks: Added extra roof insulation and new roof.
- Bldg. 100 - Headquarters Building: Added new double insulated windows with shades.
- Housing - 50 units: Added new double insulated windows.
- Housing - 14 units: Added wall insulation and aluminum outer skin with vapor barrier.
- Bldg. 302 - Ordinance Administration: Added wall insulation and aluminum outer skin with vapor barrier.

PROPOSED PROJECTS

Project Title	Annual Energy Savings (MMBTUs)	Project Cost ($000)	E/C Ratio	B/C Ratio	Simple Amortization (Years)	Type
Insulate Piping and Mechanical Equipment	12,184.2	125.2	97.3	29.5	0.65	ECIP
Add Building Insulation to Six Buildings	25,724.4	647.9	39.7	12.0	1.60	ECIP
Install a Solar Wall on South Face of Buildings 306, 307 and 309	1,812.0	104.7	17.3	4.1	6.84	ECIP
Install a Basewide Energy Monitoring and Control System	46,978.9	2,789.3	16.8	3.9	3.28	ECIP
Replace Incandescent Lamps with Energy Saving Lamps	2,451.7	154.4	15.9	1.25	9.10	ECIP
SUBTOTAL FOR ECIP PROJECTS	89,151.2	3,821.5	37.4(A)	-	-	ECIP
Weatherstrip and Caulk Windows and Doors in 45 Buildings	4,103.7	32.6	125.7	32.8	.57	Incr."G"
Install Night Setback in 58 Buildings	Accomplished by ECIP Project for Energy Monitoring and Control System					
Install Boiler Economizer in Building 202	2,175.0	44.1	49.3	9.8	1.3	Incr."G"
Replace Buried Steam and Condensate Lines	2,198.0	52.0	42.3	12.8	1.51	Incr."G"
Weatherproof Dampers, Reduce Air, and Install Economizers	1,490.1	48.9	30.46	6.66	1.84	Incr."G"
Install Automatic Radiator Valves	1,208.0	41.1	29.4	5.8	2.2	Incr."G"
Insulate and Operate Above Ground Fuel Oil Storage Tank	330.9	22.1	15.01	4.55	4.25	Incr."G"
SUBTOTAL FOR INCREMENT "G" PROJECTS	11,505.6	240.8	48.70(A)	-	-	Incr."G"

2-15-83

PROJECT		DATE	REF. FROM	INIT
EEAP - ST. LOUIS AREA SUPPORT CENTER		11-1-82		FJM

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JOB NO OFF	YR	SEQ	SUBDIVISION EXT	DISC	TYPE E	EXP	C.	M.F.I.	SHEET	REV
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PROPOSED PROJECTS

Project Title	Annual Energy Savings (MMBTUs)	Project Cost ($000)	E/C Ratio	B/C Ratio	Simple Amortization (Years)	Type
Install Flow Restrictors in Lavatories and Flow Control Heads in Showers	371.3	2.38	156.02	39.26	.52	Incr."F"
Shut Down Heat in Unoccupied Shop of Building 183	80.1	.79	101.5	15.0	.87	Incr.F"
Install Automatic Controls on Library Air Handling Unit for Night Shutdown	29.3	1.07	27.36	4.3	2.99	Incr."F"
SUBTOTAL FOR INCREMENT "F" PROJECTS	480.7	4.24	94.96(A)	-	-	Incr."F"
BASEWIDE TOTAL:	101,137.5	4,066.54	54.6 (A)	-	-	All

NOTE: Total shown under annual energy savings column (101,137.5) indicates the sum of all individual items without considering synergistic effect. For a realistic total savings see Pg. 29. (61,138.77 MMBTU saved). This total is 60.5% of the sum of the savings and would provide a 42% reduction in basewide consumption after all the energy saving recommendations are implemented.

(A) = Average

ENERGY USAGE PER SQUARE FOOT

BLDG. NO.	TITLE	GSF	CURRENT USAGE (BTU/SF/YR)	PROJECTED FY 85 USAGE (BTU/SF/YR)
100	Post Headquarters	27,732	92,788	59,845
101	Bachelor Officers Quarters	7,015	53,300	30,050
102	Administration	10,351	84,388	42,810
103	Supper Club	8,139	103,256	74,407
105	Administration	6,860	109,927	72,487
108	Gen. Education Facility	9,581	80,085	48,937
113	Post Chapel	2,105	112,257	56,057
114	Child Care Center	2,048	111,914	64,600
116	Guest House	2,048	55,371	49,023
127	Thrift Shop	1,967	115,302	68,073
183	Main Library	8,251	66,198	37,486
185	Administration	6,196	80,084	55,024
192	EM Barracks	34,251	95,886	80,538
193	EM Barracks	35,674	92,062	80,546
198	Golf Clubhouse	3,974	152,300	114,283
202	Central Heating Plant	6,604	-	-
203	Maintenance Shop	64,711	85,803	49,437
204	Exchange Main Retail	34,820	64,174	40,230
221	Security	4,960	255,865	166,310
231	Commissary	60,000	126,548	82,448
302	Ordinance Administration	2,257	87,098	44,639
305	Fire Station	3,457	107,969	66,601
306	Warehouse No. 1	305,100	82,917	38,260
307	Warehouse No. 3	305,100	82,917	38,260
309	Warehouse No. 2	262,567	84,314	38,325
331	Administration	29,318	175,940	106,351
332	Auto Self-Help Garage	8,967	48,567	30,913
335	Bowling Center	8,656	86,780	55,423
401	F.E. Maintenance	3,194	148,613	94,239
402	F.E. Maintenance/Boiler	4,913	185,487	122,593
403	F.E. Facility	1,474	102,578	70,624

ENERGY USAGE PER SQUARE FOOT

BLDG. NO.	TITLE	GSF	CURRENT USAGE (BTU/SF/YR)	PROJECTED FY 85 USAGE (BTU/SF/YR)
404	F.E. Maintenance	6,061	96,890	58,645
405	Engineering Administration	5,017	93,813	59,988
411	Heating Plant for Bldg. 414	578	-	-
414	Gymnasium	24,278	165,397	70,286
416	F.E. Facility	1,387	100,433	67,916
1	Family Housing	2,557	116,934	91,357
5	Family Housing	2,207	105,709	81,332
7	Family Housing	2,027	113,962	89,196
9	Family Housing	2,027	113,962	89,196
10	Family Housing	2,810	133,687	105,786
11	Family Housing	3,434	100,812	80,166
12	Family Housing	3,434	109,394	88,748
13	Family Housing	3,434	109,394	88,748
14	Family Housing	2,810	133,687	105,786
15	Family Housing	2,810	133,687	105,786
20	Family Housing	4,132	102,333	78,955
21	Family Housing	4,132	102,333	78,955
22	Family Housing	4,132	102,333	78,955
23	Family Housing	4,132	102,333	78,955
24	Family Housing	4,132	102,333	78,955
25	Family Housing	4,132	102,333	78,955
26	Family Housing	4,132	102,333	78,955
27	Family Housing	4,132	102,333	78,955
28	Family Housing	9,078	113,131	89,061
29	Family Housing	10,364	99,321	77,765
30	Family Housing	9,078	113,008	88,417
31	Family Housing	10,364	99,093	77,538
W-1	Wherry Housing	12,518	99,559	87,492
W-2	Wherry Housing	12,518	99,559	87,492
W-3	Wherry Housing	5,213	200,263	180,376

ENERGY USAGE PER SQUARE FOOT

BLDG. NO.	TITLE	GSF	CURRENT USAGE (BTU/SF/YR)	PROJECTED FY 85 USAGE (BTU/SF/YR)
W-4	Wherry Housing	5,213	200,263	180,376
W-5	Wherry Housing	5,724	178,136	140,746
W-6	Wherry Housing	5,724	178,136	140,746
W-7	Wherry Housing	5,724	178,136	140,746
W-8	Wherry Housing	5,724	178,136	140,746
W-9	Wherry Housing	5,724	178,136	140,746
W-10	Wherry Housing	5,724	178,136	140,746
W-11	Wherry Housing	5,724	178,136	140,746
W-12	Wherry Housing	5,724	178,136	140,746
W-13	Wherry Housing	5,724	178,136	140,746
W-14	Wherry Housing	5,724	178,136	140,746
W-15	Wherry Housing	5,724	178,136	140,746
W-16	Wherry Housing	5,724	178,136	140,746

BLDG.NO.	DESCRIPTION	ECIP PROJECTS: INSULATE PIPING AND MECHANICAL EQUIPMENT	REPLACE INCANDESCENT LAMPS W/FLUORESCENT OR HI-PRESSURE SODIUM	INSTALL SOLAR (TROMBE) WALL	INSTALL ENERGY MONITORING AND CONTROL SYSTEM	ADD INSULATION TO ROOF OR WALLS	WEATHERPROOF DAMPERS
100	POST HEADQUARTERS	172.0	10.4		884.1		
101	BACHELOR OFFICERS QUARTERS	135.8			44.2		
102	ADMINISTRATION GENERAL PURPOSE	63.9			498.8		
103	SUPPER CLUB				302.5		
105	ADMINISTRATION GENERAL PURPOSE				289.2		
108	GEN. EDUCATION FACILITY	79.9	32.7		243.8		
113	POST CHAPEL		18.4		99.9		
114	CHILD CARE CENTER				96.9		
116	GUEST HOUSE				13.0		
127	THRIFT SHOP				92.9		
183	MAIN LIBRARY	52.3	0.8		305.3		
185	ADMINISTRATION GENERAL PURPOSE				171.3		
192	EM BARRACKS	56.8	334.7		124.1		

ACTIONS AND SAVINGS MATRIX

(ENERGY VALUES IN MMBTU/YR.)

INCREMENT 'G' PROJECTS									
INSTALL ENERGY MONITORING AND CONTROL SYSTEM	ADD INSULATION TO ROOF OR WALLS	WEATHERPROOF DAMPERS INSTALL ECONOMIZER CONTROLS - REDUCE SUPPLY AIR VOLUME	WEATHERSTRIP AND CAULK	INSTALL NIGHT SETBACK CONTROLS	INSTALL AUTOMATIC RADIATOR VALVES	ADD ECONOMIZERS TO BOILERS	INSULATE STEAM AND CONDENSATE PIPING TO BUILDING 203	INSULATE AND OPERATE ABOVE GROUND FUEL OIL STORAGE TANK	CURRENT ENERGY CONSUMPTION (MMBTU/YR)
884.1		89.1	30.9	330.6					2573.2
44.2			30.2	49.4	42.4				373.9
498.8			8.4	310.5					873.5
302.5			16.6	162.9					840.4
289.2			45.0						754.1
243.8			28.2	189.3					767.3
99.9				68.6					236.3
96.9				66.5					229.2
13.0				14.3					113.4
92.9			8.7	63.7					226.8
305.3			25.9	262.2	167.2				546.2
171.3			28.8						496.2
124.1			66.9	241.2	338.4				3284.2

2-15-

DATE 11-1-

PROJECT EEAP - ST. LOUIS AREA SUPPORT CENTER

The BenhamGroup architects / engineers planners / consultants

JOB NO.	SUBDIVISION	DISC	TYPE	EXP	C
OFF YR SEQ	EXT		B		
10 8 1 0 13	8 0				

INCREMENT 'G' PROJECTS									
SUPPLY AIR VOLUME	WEATHERSTRIP AND CAULK	INSTALL NIGHT SETBACK CONTROLS	INSTALL AUTOMATIC RADIATOR VALVES	ADD ECONOMIZERS TO BOILERS	INSULATE STEAM AND CONDENSATE PIPING TO BUILDING 203	INSULATE AND OPERATE ABOVE GROUND FUEL OIL STORAGE TANK	CURRENT ENERGY CONSUMPTION (MMBTU/YR)	PROJECTED ENERGY CONSUMPTION FY85 (MMBTU/YR)	PERCENT REDUCTION BY FY85 (%)
9.1	30.9	330.6					2573.2	1659.62	36
	30.2	49.4	42.4				373.9	210.8	44
	8.4	310.5					873.5	443.13	51
	16.6	162.9					840.4	605.6	28
	45.0						754.1	497.26	34
	28.2	189.3					767.3	468.87	39
		68.6					236.3	118.0	50
		66.5					229.2	132.3	42
		14.3					113.4	100.4	12
	8.7	63.7					226.8	133.9	41
	25.9	262.2	167.2				546.2	309.3	44
	28.8						496.2	340.93	31
	66.9	241.2	338.4				3284.2	2758.5	13

2-15-83

PROJECT EEAP - ST. LOUIS AREA SUPPORT CENTER

DATE 11-1-82 | REF FROM | BY FJM

The BenhamGroup — architects / engineers planners / consultants

JOB NO. CITY | YR | SEQ 10 8 1 0 13 | SUBDIVISION 8,0 | DISC | TYPE | EXP | C | WP1 | SHEET 24 | REV 1

BLDG. NO.	DESCRIPTION	ECIP PROJECTS: INSULATE PIPING AND MECHANICAL EQUIPMENT	REPLACE INCANDESCENT LAMPS W/FLUORESCENT OR HI-PRESSURE SODIUM	INSTALL SOLAR (TROMBE) WALL	INSTALL ENERGY MONITORING AND CONTROL SYSTEM	ADD INSULATION TO ROOF OR WALLS	WEATHERPROOF DAMPERS INSTALL ECONOMIZER CONTROLS - REDUCE SUPPLY AIR VOLUME
193	EM BARRACKS	121.0	348.6		129.3		
198	GOLF CLUBHOUSE		0.75		178.8		
202	CENTRAL HEATING PLANT		347.91		1796.4		
203	MAINTENANCE SHOP	376.4	1057.8		1975.0		
204	POST EXCHANGE-HUMAN FACTORS	5.7	27.3		969.4	76.4	231.57
221	SECURITY	183.5			400.5		86.6
231	COMMISSARY		2.5		2334.1		1020.4
302	ORDNANCE ADMINISTRATION	5.9			100.6		
305	FIRE STATION				141.8		
306	WAREHOUSE NO.1			604	8977.1	7712.8	
307	WAREHOUSE NO.3	5370.5		604	8977.1	7712.8	
309	WAREHOUSE NO.2	4632.3		604	7738.8	6637.5	
331	ADMINISTRATION GENERAL PURPOSE	152.7			1495.4	633.7	62.4

(1)

ACTIONS AND SAVINGS MATRIX

(ENERGY VALUES IN MMBTU/YR.)

INCREMENT 'G' PROJECTS								
ADD INSULATION TO ROOF OR WALLS	WEATHERPROOF DAMPERS INSTALL ECONOMIZER CONTROLS - REDUCE SUPPLY AIR VOLUME	WEATHERSTRIP AND CAULK	INSTALL NIGHT SETBACK CONTROLS	INSTALL AUTOMATIC RADIATOR VALVES	ADD ECONOMIZERS TO BOILERS	INSULATE STEAM AND CONDENSATE PIPING TO BUILDING 203	INSULATE AND OPERATE ABOVE GROUND FUEL OIL STORAGE TANK	CURRENT ENERGY CONSUMPTION (MMBTU/YR)	PROJECTED ENERGY CONSUMPTION FY85 (MMBTU/YR)
		69.8	251.2	338.4				3284.22	2873.4
		15.9	143.7					605.24	454.16
					2,175	2,198	330.9		
		83.1						5552.37	3199.12
76.4	231.57	26.8						2234.55	1400.84
	86.6	14.6	171.7	77.2				1269.09	824.9
	1020.4	52.0	706.8					7592.90	4946.85
		22.9	45.4	83.8				196.58	100.75
		52.8						373.25	230.24
7712.8		227.1						25298.0	11673.1
7712.8		227.1						25298.0	11673.1
5637.5		196.1						22138.0	10062.98
633.7	62.4		1420.5					5158.2	3118.0

2-15-83

PROJECT EEAP - ST. LOUIS AREA SUPPORT CENTER

DATE 11-1-82

The Benham Group — architects / engineers planners / consultants

JOB NO 10 13

	INCREMENT 'G' PROJECTS							
	INSTALL NIGHT SETBACK CONTROLS	INSTALL AUTOMATIC RADIATOR VALVES	ADD ECONOMIZERS TO BOILERS	INSULATE STEAM AND CONDENSATE PIPING TO BUILDING 203	INSULATE AND OPERATE ABOVE GROUND FUEL OIL STORAGE TANK	CURRENT ENERGY CONSUMPTION (MMBTU/YR)	PROJECTED ENERGY CONSUMPTION FY85 (MMBTU/YR)	PERCENT REDUCTION BY FY85 (%)
.8	251.2	338.4				3284.22	2873.4	13
.9	143.7					605.24	454.16	25
			2,175	2,198	330.9			
.1						5552.37	3199.12	42
.8						2234.55	1400.84	37
.6	171.7	77.2				1269.09	824.9	35
.0	706.8					7592.90	4946.85	35
.9	45.4	83.8				196.58	100.75	49
.8						373.25	230.24	39
.1						25298.0	11673.1	54
.1						25298.0	11673.1	54
.1						22138.0	10062.98	54
	1420.5					5158.2	3118.0	40

2-15-83

- ST. LOUIS AREA SUPPORT CENTER

DATE 11-1-82

architects / engineers
planners / consultants

JOB NO. 10,810,13

SHEET 1 OF 25

3

BLDG. NO.	DESCRIPTION	ECIP PROJECTS: INSULATE PIPING AND MECHANICAL EQUIPMENT	REPLACE INCANDESCENT LAMPS W/FLUORESCENT OR HI-PRESSURE SODIUM	INSTALL SOLAR (TROMBE) WALL	INSTALL ENERGY MONITORING AND CONTROL SYSTEM	ADD INSULATION TO ROOF OR WALLS	WEATHERPROOF DAMPERS INSTALL ECONOMIZER CONTROLS - REDUCE
332	AUTO SELF-HELP GARAGE	8.6			140.5		
335	BOWLING CENTER	99.6	6.5		389.8		
401	F.E. MAINTENANCE SHOP	41.3			174.1		
402	F.E. MAINTENANCE SHOP	4.7			304.3		
403	F.E. FACILITY PEST SHOP				47.1		
404	F.E. MAINTENANCE SHOP	30.6	5.1		196.1		
405	ENGINEERING ADMINISTRATION	6.0			218.7		
411/414	GYMNASIUM	6.6	258.4		1644.2*	2951.72	
416	F.E. FACILITY PAINT SHOP				45.1		
1	FAMILY HOUSING	7.3			58.1		
5	FAMILY HOUSING	8.1			45.7		
7	FAMILY HOUSING	8.1			42.1		
9	FAMILY HOUSING	8.1			42.1		

* BLD. 411 SAVINGS = 1619.3 MMBTU/YR.

(1)

ACTIONS AND SAVINGS MATRIX
(ENERGY VALUES IN MMBTU/YR)

OJECTS			INCREMENT 'G' PROJECTS							
(TROMBE) WALL	INSTALL ENERGY MONITORING AND CONTROL SYSTEM	ADD INSULATION TO ROOF OR WALLS	WEATHERPROOF DAMPERS INSTALL ECONOMIZER CONTROLS - REDUCE SUPPLY AIR VOLUME	WEATHERSTRIP AND CAULK	INSTALL NIGHT SETBACK CONTROLS	INSTALL AUTOMATIC RADIATOR VALVES	ADD ECONOMIZERS TO BOILERS	INSULATE STEAM AND CONDENSATE PIPING TO BUILDING 203	INSULATE AND OPERATE ABOVE GROUND FUEL OIL STORAGE TANK	CURRENT ENERGY CONSUMPTION (MMBTU/YR)
	140.5				63.1					435.5(
	389.8			32.3	173.3					751.1
	174.1			28.8						474.6
	304.3			27.4						911.3(
	47.1			8.2						151.2(
	196.1			34.2	59.8					587.2
	218.7			28.6		160.6				470.6(
	1644.2*	2951.72		122						4015.5
	45.1									139.3
	58.1				48.6					299.0
	45.7				38.0					233.3
	42.1				35.0					231.0
	42.1				35.0					231.0

TRIP
J/YR)

PROJECT EEAP - ST. LOUIS AREA SUPPORT CENTER

The BoschamGroup architects / engineers planners / consultants

JOB NO | SUBDIVISION | DISC | TYPE | EXP | C

INCREMENT 'G' PROJECTS								
WEATHERSTRIP AND CAULK	INSTALL NIGHT SETBACK CONTROLS	INSTALL AUTOMATIC RADIATOR VALVES	ADD ECONOMIZERS TO BOILERS	INSULATE STEAM AND CONDENSATE PIPING TO BUILDING 203	INSULATE AND OPERATE ABOVE GROUND FUEL OIL STORAGE TANK	CURRENT ENERGY CONSUMPTION (MMBTU/YR)	PROJECTED ENERGY CONSUMPTION FY85 (MMBTU/YR)	PERCENT REDUCTION BY FY85 (%)
	63.1					435.50	277.2	36
32.3	173.3					751.17	479.74	36
28.8						474.67	301.00	37
27.4						911.30	602.3	34
8.2						151.20	104.1	31
34.2	59.8					587.25	355.45	39
28.6		160.6				470.66	300.96	37
122						4015.5	1706.4	58
						139.30	94.2	33
	48.6					299.00	233.60	22
	38.0					233.30	179.5	23
	35.0					231.00	180.8	22
	35.0					231.00	180.8	22

2-15-83

EEAP - ST. LOUIS AREA SUPPORT CENTER

DATE 11-1-82 FJM

architects / engineers
planners / consultants

JOB NO 13 W.O.

SHEET 1

BLDG. NO.	DESCRIPTION	ECIP PROJECTS					
		INSULATE PIPING AND MECHANICAL EQUIPMENT	REPLACE INCANDESCENT LAMPS W/FLUORESCENT OR HI-PRESSURE SODIUM	INSTALL SOLAR (TROMBE) WALL	INSTALL ENERGY MONITORING AND CONTROL SYSTEM	ADD INSULATION TO ROOF OR WALLS	WEATHERPROOF DAMPERS
10	FAMILY HOUSING	8.1			70.3		
11	FAMILY HOUSING	7.9			63.0		
12	FAMILY HOUSING	7.9			63.0		
13	FAMILY HOUSING	7.9			63.0		
14	FAMILY HOUSING	8.1			70.3		
15	FAMILY HOUSING	8.1			70.3		
20	FAMILY HOUSING	14.6			82.0		
21	FAMILY HOUSING	14.6			82.0		
22	FAMILY HOUSING	14.6			82.0		
23	FAMILY HOUSING	14.6			82.0		
24	FAMILY HOUSING	14.6			82.0		
25	FAMILY HOUSING	14.6			82.0		
26	FAMILY HOUSING	14.6			82.0		

ACTIONS AND SAVINGS MATRIX
(ENERGY VALUES IN MMBTU/YR)

(1)

CTS		INCREMENT 'G' PROJECTS							
INSTALL ENERGY MONITORING AND CONTROL SYSTEM	ADD INSULATION TO ROOF OR WALLS	WEATHERPROOF DAMPERS INSTALL ECONOMIZER CONTROLS - REDUCE SUPPLY AIR VOLUME	WEATHERSTRIP AND CAULK	INSTALL NIGHT SETBACK CONTROLS	INSTALL AUTOMATIC RADIATOR VALVES	ADD ECONOMIZERS TO BOILERS	INSULATE STEAM AND CONDENSATE PIPING TO BUILDING 203	INSULATE AND OPERATE ABOVE GROUND FUEL OIL STORAGE TANK	CURRENT ENERGY CONSUMPTION (MMBTU/YR)
70.3				54.8					375.66
63.0				48.8					346.19
63.0				48.8					375.66
63.0				48.8					375.66
70.3				54.8					375.66
70.3				54.8					375.66
82.0				61.3					422.84
82.0				61.3					422.84
82.0				61.3					422.84
82.0				61.3					422.84
82.0				61.3					422.84
82.0				61.3					422.84
82.0				61.3					422.84

2-15-

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PROJECT EEAP - ST. LOUIS AREA SUPPORT CENTER

DATE 11-1-8

The Benham Group

architects / engineers
planners / consultants

JOB NO. | SUBDIVISION | DISC | TYPE | SHT | C | REV

INCREMENT 'G' PROJECTS								
WEATHERSTRIP AND CAULK	INSTALL NIGHT SETBACK CONTROLS	INSTALL AUTOMATIC RADIATOR VALVES	ADD ECONOMIZERS TO BOILERS	INSULATE STEAM AND CONDENSATE PIPING TO BUILDING 203	INSULATE AND OPERATE ABOVE GROUND FUEL OIL STORAGE TANK	CURRENT ENERGY CONSUMPTION (MMBTU/YR)	PROJECTED ENERGY CONSUMPTION FY85 (MMBTU/YR)	PERCENT REDUCTION BY FY85 ( )
	54.8					375.66	297.26	21
	48.8					346.19	275.29	21
	48.8					375.66	304.76	19
	48.8					375.66	304.76	19
	54.8					375.66	297.26	21
	54.8					375.66	297.26	21
	61.3					422.84	326.24	23
	61.3					422.84	326.24	23
	61.3					422.84	326.24	23
	61.3					422.84	326.24	23
	61.3					422.84	326.24	23
	61.3					422.84	326.24	23
	61.3					422.84	326.24	23

2-15-83

BLDG. NO.	DESCRIPTION	ECIP PROJECTS: INSULATE PIPING AND MECHANICAL EQUIPMENT	REPLACE INCANDESCENT LAMPS W/FLUORESCENT OR HI-PRESSURE SODIUM	INSTALL SOLAR (TROMBE) WALL	INSTALL ENERGY MONITORING AND CONTROL SYSTEM	ADD INSULATION TO ROOF OR WALLS	WEATHERPROOF DAMPERS INSTALL ECONOMIZER
27	FAMILY HOUSING	24.3			110.8		
28	FAMILY HOUSING	42.5			176.0		
29	FAMILY HOUSING	47.5			176.0		
30	FAMILY HOUSING	42.5			176.0		
31	FAMILY HOUSING	47.4			176.0		
1	WHERRY HOUSING SEVEN FAMILY	10.3			188.8		
2	WHERRY HOUSING SEVEN FAMILY	10.3			188.8		
3	WHERRY HOUSING FOUR FAMILY	10.9			97.6		
4	WHERRY HOUSING FOUR FAMILY	10.9			97.6		
5	WHERRY HOUSING SIX FAMILY	12.4			240.6		
6	WHERRY HOUSING SIX FAMILY	12.4			240.6		
7	WHERRY HOUSING SIX FAMILY	12.4			240.6		
8	WHERRY HOUSING SIX FAMILY	12.4			240.6		

(1)

ACTIONS AND SAVINGS MATRIX

(ENERGY VALUES IN MMBTU/YR)

TS'

INCREMENT 'G' PROJECTS									
INSTALL ENERGY MONITORING AND CONTROL SYSTEM	ADD INSULATION TO ROOF OR WALLS	WEATHERPROOF DAMPERS INSTALL ECONOMIZER CONTROLS - REDUCE SUPPLY AIR VOLUME	WEATHERSTRIP AND CAULK	INSTALL NIGHT SETBACK CONTROLS	INSTALL AUTOMATIC RADIATOR VALVES	ADD ECONOMIZERS TO BOILERS	INSULATE STEAM AND CONDENSATE PIPING TO BUILDING 203	INSULATE AND OPERATE ABOVE GROUND FUEL OIL STORAGE TANK	CURRENT ENERGY CONSUMPTION (MMBTU./YR)
110.8				76.9					422.84
176.0				122.1					1027.0
176.0				122.1					1029.36
176.0				122.1					1025.89
176.0				122.1					1027.0
188.8			128.9	103.5					1246.28
188.8			128.9	103.5					1246.28
97.6			114.3	65.9					1043.97
97.6			114.3	55.9					1043.97
240.6			171.5	61.3					1019.65
240.6			171.5	61.3					1019.65
240.6			171.5	61.3					1019.65
240.6			171.5	61.3					1019.65

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PROJECT EEAP - ST. LOUIS AREA SUPPORT CENTER

DATE 11-1-

The Benham Group architects / engineers planners / consultants

JOB NO. CPP | YR | BRO 10 | 13 | 8 | 0

SUBDIVISION DISC TYPE B

INCREMENT 'G' PROJECTS								
WEATHERSTRIP AND CAULK	INSTALL NIGHT SETBACK CONTROLS	INSTALL AUTOMATIC RADIATOR VALVES	ADD ECONOMIZERS TO BOILERS	INSULATE STEAM AND CONDENSATE PIPING TO BUILDING 203	INSULATE AND OPERATE ABOVE GROUND FUEL OIL STORAGE TANK	CURRENT ENERGY CONSUMPTION (MMBTU/YR)	PROJECTED ENERGY CONSUMPTION FY85 (MMBTU/YR)	PERCENT REDUCTION BY FY85 (%)
	76.9					422.84	288.24	32
	122.1					1027.0	808.5	21
	122.1					1029.36	805.96	22
	122.1					1025.89	802.65	22
	122.1					1027.0	803.60	22
128.9	103.5					1246.28	1095.23	13
128.9	103.5					1246.28	1095.23	13
114.3	65.9					1043.97	940.3	10
114.3	55.9					1043.97	940.3	10
171.5	61.3					1019.65	805.63	21
171.5	61.3					1019.65	805.63	21
171.5	61.3					1019.65	805.63	21
171.5	61.3					1019.65	805.63	21

2-15-83

EEAP - ST. LOUIS AREA SUPPORT CENTER

DATE 11-1-82 BY FJM

BLDG.NO.	DESCRIPTION	ECIP PROJECTS: INSULATE PIPING AND MECHANICAL EQUIPMENT	REPLACE INCANDESCENT LAMPS W/FLUORESCENT OR HI-PRESSURE SODIUM	INSTALL SOLAR (TROMBE) WALL	INSTALL ENERGY MONITORING AND CONTROL SYSTEM	ADD INSULATION TO ROOF OR WALLS	WEATHERPROOF DAMPERS INSTALL ECONOMIZER CONTROLS - REDUCE
9	WHERRY HOUSING SIX FAMILY	12.4			240.6		
10	WHERRY HOUSING SIX FAMILY	12.4			240.6		
11	WHERRY HOUSING SIX FAMILY	12.4			240.6		
12	WHERRY HOUSING SIX FAMILY	12.4			240.6		
13	WHERRY HOUSING SIX FAMILY	12.4			240.6		
14	WHERRY HOUSING SIX FAMILY	12.4			240.6		
15	WHERRY HOUSING SIX FAMILY	12.4			240.6		
16	WHERRY HOUSING SIX FAMILY	12.4			240.6		
	BASEWIDE TOTAL	12,184.2	2451.7	1812	46,978.9	25,724.4	149

ACTIONS AND SAVINGS MATRIX

(ENERGY VALUES IN MMBTU/YR)

(1)

INCREMENT 'G' PROJECTS									
INSTALL ENERGY MONITORING AND CONTROL SYSTEM	ADD INSULATION TO ROOF OR WALLS	WEATHERPROOF DAMPERS INSTALL ECONOMIZER CONTROLS - REDUCE SUPPLY AIR VOLUME	WEATHERSTRIP AND CAULK	INSTALL NIGHT SETBACK CONTROLS	INSTALL AUTOMATIC RADIATOR VALVES	ADD ECONOMIZERS TO BOILERS	INSULATE STEAM AND CONDENSATE PIPING TO BUILDING 203	INSULATE AND OPERATE ABOVE GROUND FUEL OIL STORAGE TANK	CURRENT ENERGY CONSUMPTION (MMBTU/YR)
240.6			171.5	61.3					1019.65
240.6			171.5	61.3					1019.65
240.6			171.5	61.3					1019.65
240.6			171.5	61.3					1019.65
240.6			171.5	61.3					1019.65
240.6			171.5	61.3					1019.65
240.6			171.5	61.3					1019.65
240.6			171.5	61.3					1019.65
46,978.9	25,724.4	1490.1	4103.7	7301.9	1208.0	2175	2198	330.9	145,778.71

PROJECT: EEAP - ST. LOUIS AREA SUPPORT CENTER

DATE: 11-1-

The Benham Group — architects / engineers / planners / consultants

JOB NO. 10 1 10 13

SUBDIVISION 8.0

INCREMENT 'G' PROJECTS								
WEATHERSTRIP AND CAULK	INSTALL NIGHT SETBACK CONTROLS	INSTALL AUTOMATIC RADIATOR VALVES	ADD ECONOMIZERS TO BOILERS	INSULATE STEAM AND CONDENSATE PIPING TO BUILDING 203	INSULATE AND OPERATE ABOVE GROUND FUEL OIL STORAGE TANK	CURRENT ENERGY CONSUMPTION (MMBTU/YR)	PROJECTED ENERGY CONSUMPTION FY85 (MMBTU/YR)	PERCENT REDUCTION BY FY85 (%)
171.5	61.3					1019.65	805.63	21
171.5	61.3					1019.65	805.63	21
171.5	61.3					1019.65	805.63	21
171.5	61.3					1019.65	805.63	21
171.5	61.3					1019.65	805.63	21
171.5	61.3					1019.65	805.63	21
171.5	61.3					1019.65	805.63	21
171.5	61.3					1019.65	805.63	21
4103.7	7301.9	1208.0	2175	2198	330.9	145,778.71	84,639.94	42

2-15-83

EEAP - ST. LOUIS AREA SUPPORT CENTER

DATE 11-1-82 | BY FJM

architects / engineers
planners / consultants

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