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Shippensburg University

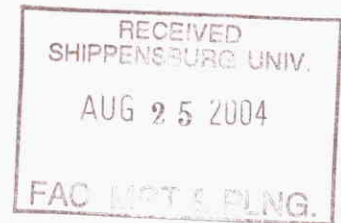
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Electrical Distribution Study



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**ELECTRICAL DISTRIBUTION STUDY
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EXECUTIVE SUMMARY

In order to better maintain the campus electrical distribution system at Shippensburg University, Entech Engineering, Inc. was asked to study the 12.47kV medium voltage distribution system. As part of this study, Entech updated the campus electrical single line drawings and the campus site plan identifying the general location of the ductbanks, manholes, and transformers. As part of this effort, the equipment and manholes were visually inspected and documented. System components in need of repair or upgrade were identified.

In addition, a coordination study of the Campus distribution system was conducted to analyze the coordination of over-current protective devices throughout the campus. Such an analysis is a tool that the University maintenance staff can use to better coordinate the settings on the over-current devices so that unplanned electrical outages are minimized or eliminated.

As part of this study, the campus master plan was reviewed. Electrical distribution system improvements and expansion options were then identified in this study so more informed project decisions can be made in the future.

In general, we find the system is in relatively good condition. Some portions of the electrical distribution system are older and eventually will need some attention. However, the equipment in place appears to be well maintained. From our coordination modeling, we find the system coordination is for the most part acceptable.

There are, however, some areas where upgrades to the system can be made to enable the system to continue to meet the needs of the growing Campus.

The following table lists these upgrade recommendations and the associated cost. These cost projections are in current dollars. Budgets developed using these figures should be escalated to reflect the year the work is actually completed.

UPGRADES/IMPROVEMENTS	ESTIMATED COST
1) Manhole and Utility Duct Upgrades	\$60,000
2) Secondary Upgrades - McCune and Wright Halls	\$85,000
3) Unit Substation and Secondary Upgrades - Harley, McClean, Naugle, Riesner, Old Main, Reed Operations Center, Dauphin Humanities Center, Steam Plant, Rowland and Shearer Halls, and Huber Arts Center	\$750,000
4) Main Transformer 1 Replacement	\$150,000
5) Second Utility Feed	\$250,000
6) MV Feeder Replacement	\$860,000
7) Radial to Loop Distribution Conversion	\$1,126,000
8) Coordination Improvements	\$81,500
Total	\$3,363,000

INTRODUCTION

On October 13, 2003 Entech Engineering, Inc. began work documenting the existing Medium Voltage Distribution System at Shippensburg University. The purpose of this work was to develop an accurate site distribution plan and single-line diagram incorporating known future campus additions from the Campus Master Plan. Also, as a supplement to this study, a system model was developed using SKM Power Tools Software to examine system protection and coordination. The following is a description of the existing system along with recommendations for system renovations and expansions to better serve University and meet service requirements of the growing campus.

SYSTEM DESCRIPTION

The electrical distribution system at Shippensburg University is a 12.47kV radial system with a secondary selective main substation. Although the system is configured in a radial fashion, feeders 1202 and 1203 are routed in a "loop" through the central part of the campus. Attached Drawing E-2, Campus Single-line Diagram, and E-3, Medium Voltage Distribution Site Plan, show the system and routing throughout the campus.

As indicated on the drawings, a single 23kV service feeder from Penelec pole #9-20442 enters the main substation on the west end of Campus and splits to feed two 23kV load interrupter switches. Each of these load interrupter switches feeds a 4000MVA transformer (Transformers 1 and 2). The 12.47kV secondaries of these transformers feed a two-bus 1200A secondary selective switchgear line-up in the main substation. Currently, Main Transformer 1 is not operational because of oil seal problems associated with the tap changer. Main Transformer 2 is feeding both secondary buses. From these buses, Feeders 1201, 1202, 1203, and 1204 branch out and distribute power to the campus buildings through an underground duct and manhole system.

At each of the campus buildings, the 12.47kV power is transformed to low voltage (120/208, 3 Φ ; 120/240, 3 Φ ; 480/277, 3 Φ) for distribution within the building. The following buildings have unit substations with the primary protection, dry-type transformer, and main secondary distribution in a single line-up located indoors.

Reed Operations Center
Shear and Rowland Halls
Harley Hall
Kiefer Hall
Lackhove Hall
Naugle Hall
McLean Hall

Ezra Lehman Library
Dauphin Humanities Center
Riesner Dining Hall (Main)
Riesner Dining Hall (Outdoor)
Math & Computing Technologies Center
Heiges Field House
Cumberland Student Union (Main & Add.)

The following buildings have pad-mounted oil-filled transformers with integral primary protection located outdoors and main secondary distribution located indoors.

McCune Hall
Henderson Gym
Horton Hall
Kriner Dining Room
Huber Arts Center
Memorial Auditorium
Faculty Office Building
Tennis Courts & Multi-Use Field
Steam Plant
Gilbert Hall

Wright Hall
Cora Grove Spiritual Center
Old Main
Shippen Hall
Franklin Science Center
Seth Grove Stadium
Mowery Hall (Main)
Mowery Hall (Fire Pump)
Student Recreation Center
Seavers Apartments

Attachment A included with this report is a listing of campus equipment surveyed as part of this study. The list is sorted by equipment type (High Voltage Protective Device, Transformer, and Low Voltage Protection Device) and by building.

During the field survey, information from medium and low voltage protective devices was recorded. Since information from some of these devices was not accessible during the field surveys, University staff assisted with gathering and compiling this information required for the coordination study.

SYSTEM ASSESSMENT

Based on the visual inspections conducted during our site survey, the underground ductbank and manhole system appear to be in good condition. However, the following deficiencies were observed:

1. Manholes with misaligned throats or flooding.
2. Undersized manholes.
3. Inconsistent labeling of feeders.
4. Abandoned cabling in duct system.

Table 1 below lists these areas and their associated deficiency.

TABLE 1

Area	Deficiency
MH-1	The throat is misaligned and the top opening is exposed.
MH-34	Flooded.
MH-35	Cover is buried. Need throat extension.
MH-25	Manhole is undersized.
MH-29	Lid is deformed and does not seat properly
MH-54	Lid is broken
Cabling from MH-53 to MH-55	Labeling is inconsistent
Duct Bank from MH-9 to Pad near TR1-8	Abandoned cables
Duct Bank from MH-30 to MH-31	Abandoned cables
Duct Bank from MH-25A to MH-9	Abandoned cables
Duct Bank from MH-17 to MH-19	Abandoned cables
Duct Bank from MH-19 to abandoned manhole adjacent to Horton Hall	Abandoned cables
Duct Bank from MH-3 to MH-4	Abandoned cables

The local distribution equipment at buildings (High Voltage Switches, Medium to Low Voltage Transformers, and Low Voltage secondary distribution) is for the most part in good operating condition. Again, there are some areas of the system that, due to age and/or availability of spare parts, require attention.

Both McCune and Wright Halls have unit substations that were originally installed with a 4160V primary section and a 4160V-120/208V transformer. In each case, a new 12.47kV-120/208V outdoor transformer with a fused switch primary was installed and connected to the existing secondary distribution section of the unit substation. Therefore, the associated 4160V primary sections and the 4160V-120/208V transformers are not required. Also, secondary sections appear to be original and over 30 years of age.

Some buildings contain original unit substations built by Federal Pacific Electric Company (FPE). This equipment is most likely over 30 years of age and, since FPE is no longer in business, spare parts are difficult to purchase and in many cases are only available on the second hand market. The buildings containing FPE gear are listed below.

1. Harley Hall.
2. McLean Hall.
3. Naugle Hall.
4. Riesner Hall.

There are other buildings on campus that have dated equipment that is near the end of its useful life. Although the manufacturers may still exist, replacement parts may not be readily available or retrofits may be required to add circuits. These additional buildings containing dated equipment are listed below:

1. Old Main.
2. Reed Operations Center.
3. Dauphin Humanities Center.
4. Steam Plant.
5. Rowland and Shearer Halls.
6. Huber Art Center.

The Main 23 – 12.47kV substation on the west end of Campus and most its equipment are in good and operable condition with the exception of Main Transformer 1 (TX-1). TX-1 has been leaking oil from its casing when in operation and was shutdown. Currently, Main Transformer 2 (TX-2) is carrying all Campus loads. Table 2 below shows load information from August 2002 to July 2003.

TABLE 2

Date	kVA Demand	kW Demand	kVAR Demand	Power Factor
Aug-02	4,414	3,758	2,315	0.851
Sep-02	5,296	4,614	2,600	0.871
Oct-02	5,268	4,568	2,624	0.867
Nov-02	4,028	3,570	1,866	0.886
Dec-02	3,742	3,365	1,638	0.899
Jan-03	3,389	3,046	1,484	0.899
Feb-03	3,684	3,328	1,580	0.903
Mar-03	3,736	3,388	1,575	0.907
Apr-03	3,751	3,388	1,611	0.903
May-03	3,646	3,277	1,597	0.899
Jun-03	3,373	3,000	1,543	0.889
Jul-03	4,234	3,627	2,186	0.856
Avg. =	4,044	3,577	1,885	0.885
Max. =	5,296	4,614	2,624	N/A

On average, the University's current apparent power (kVA) demand is approximately 4050kVA with a maximum demand of 5300kVA occurring in September. Under normal circumstances this would be about 50% of capacity. However, with TX-1 out of service, TX-2 is at full capacity with this loading.

Tables 3 through 6 below list current Campus loads by feeder along with connected kVA.

TABLE 3

Feeder 1201				
Transformer Tag	Rated kVA	Amps @ 12,470V	Feeder	Building Served
TR1-1	112.5	5	1201	McCune Hall
TR1-2	150	7	1201	Reed Operations Center
TR1-3	150	7	1201	Henderson Gym
TR1-4	500	23	1201	Horton Hall
TR1-5	300	14	1201	Kriner Hall
TR1-6	300	14	1201	Huber Art Center
TR1-7	300	14	1201	Memorial Hall
TR1-8	150	7	1201	Faculty Office Building
TR1-9	300	14	1201	Tennis Courts & Multi-Use Field
TR1-10	150	7	1201	Shearer & Rowland
TR1-11	300	14	1201	Steam Plant
TR1-12	150	7	1201	Gilbert Hall
Totals = 2862.5		133 (Connected)		

TABLE 4

Feeder 1202				
Transformer Tag	Rated kVA	Amps @ 12,470V	Feeder	Building Served
TR2-1	300	14	1202	Harley Hall
TR2-2	300	14	1202	Kiefer Hall
TR2-3	300	14	1202	Lockhove Hall
TR2-4	112.5	5	1202	Wright Hall
TR2-5	112.5	5	1202	Tennis Courts
TR2-6	500	23	1202	Naugle Hall
TR2-7	750	35	1202	McLean Hall
TR2-8	225	10	1202	Cora Grove Spiritual Center
TR2-9	750	35	1202	Old Main
Totals = 3350		155 (Connected)		

TABLE 5

Feeder 1203				
Transformer Tag	Rated kVA	Amps @ 12,470V	Feeder	Building Served
TR3-1	750	35	1203	Ezra Lehman Library
TR3-2	750	35	1203	Dauphin Humanities
TR3-3	750	35	1203	Shippen Hall
TR3-4	2000	93	1203	Franklin Science Center
TR3-5	225	10	1203	Reisner Hall (Chiller)
TR3-6	750	35	1203	Reisner Hall (Main)
Totals = 5225		242 (Connected)		

TABLE 6

Feeder 1204				
Transformer Tag	Rated kVA	Amps @ 12,470V	Feeder	Building Served
TR4-1	750	35	1204	Math. & Comp. Tech. Center
TR4-2	1000	46	1204	Grove Hall
TR4-3	750	35	1204	Heige's Field House
TR4-4	300	14	1204	Seth Grove Stadium
TR4-5	500	23	1204	Cumberland Student Union
TR4-6	500	23	1204	Cumberland Addition
TR4-7	750	35	1204	Mowery Hall (Main)
TR4-8	75	3	1204	Mowery Hall (Fire Pump)
TR4-9	300	14	1204	Student Rec. Center
TR4-10	750	35	1204	Seavers' Complex
Totals = 5675		263 (Connected)		

Adding the connected kVA for each feeder, the total connected kVA for the entire Campus is approximately 17,000kVA, or 17MVA. Since the actual demand is around 4050 on average, the diversity for the University is approximately 24%. This means that on average only 24% of the potential distribution capacity is being used. This diversity is typical for a university campus.

Future Expansion

The University has plans for the following additions to the Campus:

1. A new 82,200ft² Instructional Arts Facility.
2. A 34,000ft² addition to the Heiges Field House.
3. A 10,500ft² addition to the Ezra Memorial Library.
4. A 30,000 ft² addition to the Cumberland Student Union.
5. A new 63,500 ft² Recreation Center.

Based on information provided by the University, the 1/0 feeder cables for feeders 1201, 1202, 1203, and 1204 are rated for 195A continuous. With an average demand of 4050kVA and proper balancing, the current loading per feeder should be about 49A. Therefore, with proper balancing of future loads, the existing distribution system should have capacity to support Campus additions well into the future. Attached drawings E-4 and E-5 are a single-line diagram and site plan, indicating known future campus additions.

Using information attained during surveys and from University staff, a coordination study was also conducted. This study was provided as a supplement to this report and is included in Supplement 1 attached. In general, the system is coordinated. However, there are some areas of concern. Supplement 1 contains the details from the study along with concerns and recommendations for improvement.

RECOMMENDATIONS

The following recommendations are based on Entech's survey and assessment of the existing distribution system. Included with each recommendation is an estimate of probable construction cost. Detailed cost estimates are included in Attachment B of this report.

Manholes

As mentioned earlier, there are the following issues with manhole and duct bank system:

1. Manholes with misaligned throats or flooding.
2. Undersized manholes.
3. Inconsistent labeling of feeders.
4. Abandoned cabling in duct system.

The approximate cost to correct these issues is \$60,000.

Unit Substations

During our assessment, it was discovered that both McCune and Wright Halls have original 4,160V to 120/208V unit substations inside their main electrical rooms. Since new transformers with primary fused switches have been installed outdoors, the primary and transformer sections of these unit substations are sitting idle and are not required. Therefore, it is recommended that the unit substation be removed and replaced with new secondary distributions. The cost associated with these upgrades is approximately \$85,000.

The following buildings were found to have unit substations and secondary equipment that is nearing the end of its useful life.

1. Harley Hall
2. Mclean Hall
3. Naugle Hall
4. Riesner Hall
5. Old Main
6. Reed Operations Center
7. Dauphin Humanities Center
8. Steam Plant
9. Rowland and Shearer Halls
10. Huber Arts Center.

Unlike the other buildings listed above, Old Main and the Huber Arts Center have outdoor transformers with fused switch primaries and, as a result, only need upgrades of the secondary distribution. The cost to update the equipment for these buildings, as listed in the Unit Substation and Secondary Upgrades opinion of probable construction cost in Attachment B, is roughly \$750,000.

Main Transformer

Currently, Main Transformer 1 (TX-1) is out of service, due to a leak in the casing. To be properly repaired, the transformer should be removed from the site, drained, pressure tested, repaired, re-filled and recertified. This repair will be quite expensive; therefore, it may be better that TX-1 be replaced with another transformer rather than making the required repairs. The replacement cost is estimated to be \$150,000.

Second Utility Feed

The existing configuration of the Main Substation could readily accept connection to a second utility source with little rearrangement. This would add an addition level of redundancy should a utility source be lost due to a fault outside the Campus system. Typically a double-ended arrangement with two utility feeds from separate substations can provide 99+% reliability. The approximate costs for this an additional utility feed to the campus is \$250,000.

Feeder Cable Upgrade

Although small portions of feeders 1201 and 1202 have been replaced to allow the entire distribution system to be upgraded to 13.2kV in the mid 1990's, almost all of the feeder cabling throughout the campus is original. Therefore, the feeder cabling and many of the splices are over 30 years old. Because of this, there is concern among the electrical and maintenance staff on campus regarding the integrity of the feeder cable insulation and splices within the ductbank and manhole system. To ensure that nuisance issues do not arise and ensure the system's integrity into the future, replacement of the system feeders should be considered. This would require replacement of feeder cabling and splices throughout the campus with new cabling, having up to date insulation and shielding, and modern splicing systems. The approximate cost for this feeder cable modernization would be \$860,000.

Radial to Loop Feeder System Upgrade

As mentioned in the System Description, the distribution system is a radial configuration. However, feeders 1202 and 1203 are routed through the central portion of the campus in a loop configuration. For the purposes of system maintenance and sectionalizing feeders for system additions, etc, a loop system is advantageous. It allows sections of the feeder to be shutdown for work and maintenance without shutting down the entire feeder. Therefore, buildings or parts of the campus not directly associated with maintenance or work activities need not be affected. Since the manhole system is already looped through the central portion of the campus, the entire system could be transformed to a loop system with the addition of loop switches or transformers at each building and the addition of some ductbanks. Attached drawings E-6 and E-7 show how this can be completed in both single-line and plan view, respectively. As the system is converted to a loop configuration, the loads could be re-fed and balanced across all four feeders. Tables 7-10 below demonstrate this balancing of the loads.

PROPOSED LOOP SYSTEM CHANGES

TABLE 7

Feeder 1201				
Transformer Tag	Rated kVA	Amps @ 12,470V	Feeder	Building Served
TR1-1	112.5	5	1201	McCune Hall
TR1-2	150	7	1201	Reed Operations Center
TR1-3	150	7	1201	Henderson Gym
TR1-4	500	23	1201	Horton Hall
TR1-5	300	14	1201	Kriner Hall
TR1-6	300	14	1201	Huber Art Center
TR1-7	300	14	1201	Memorial Hall
TR1-8	150	7	1201	Faculty Office Building
TR1-9	300	14	1201	Tennis Courts & Multi-Use Field
TR1-10	150	7	1201	Shearer & Rowland
TR1-11	300	14	1201	Steam Plant
TR1-12	150	7	1201	Gilbert Hall
TR2-9	750	35	Moved from 1202	Old Main
Totals =	3612.5	168	(Connected)	

TABLE 8

Feeder 1202				
Transformer Tag	Rated kVA	Amps @ 12,470V	Feeder	Building Served
TR2-1	300	14	1202	Harley Hall
TR2-2	300	14	1202	Kiefer Hall
TR2-3	300	14	1202	Lackhove Hall
TR2-4	112.5	5	1202	Wright Hall
TR2-5	112.5	5	1202	Tennis Courts
TR2-6	500	23	Moved to 1203	Naugle Hall
TR2-7	750	35	Moved to 1203	McLean Hall
TR2-8	225	10	Moved to 1203	Cora Grove Spiritual Center
TR3-1	750	35	Moved from 1203	Ezra Lehman Library
TR3-2	750	35	Moved from 1203	Dauphin Humanities
TR3-3	750	35	Moved from 1203	Shippen Hall
TR4-1	750	35	Moved from 1204	Math. & Comp. Tech. Center
TR2-9	750	35	Moved to 1201	Old Main
Totals =	4125	192	(Connected)	

TABLE 9

Feeder 1203				
Transformer Tag	Rated kVA	Amps @ 12,470V	Feeder	Building Served
TR3-1	750	35	Moved to 1202	Ezra Lehman Library
TR3-2	750	35	Moved to 1202	Dauphin Humanities
TR3-3	750	35	Moved to 1202	Shippen Hall
TR2-6	500	23	Moved from 1202	Naugle Hall
TR2-7	750	35	Moved from 1202	McLean Hall
TR2-8	225	10	Moved from 1202	Cora Grove Spiritual Center
TR3-4	2000	93	1203	Franklin Science Center
TR3-5	225	10	1203	Riesner Hall (Chiller)
TR3-6	750	35	1203	Riesner Hall (Main)
Totals =		4450	206 (Connected)	

TABLE 10

Feeder 1204				
Transformer Tag	Rated kVA	Amps @ 12,470V	Feeder	Building Served
TR4-1	750	35	Moved to 1202	Math. & Comp. Tech. Center
TR4-2	1000	46	1204	Grove Hall
TR4-3	750	35	1204	Heiges Field House
TR4-4	300	14	1204	Seth Grove Stadium
TR4-5	500	23	1204	Cumberland Student Union
TR4-6	500	23	1204	Cumberland Addition
TR4-7	750	35	1204	Mowery Hall (Main)
TR4-8	75	3	1204	Mowery Hall (Fire Pump)
TR4-9	300	14	1204	Student Rec. Center
TR4-10	750	35	1204	Seavers' Complex
Totals =		4925	228 (Connected)	

 MOVED TO FEEDER SHOWN

 MOVED FROM FEEDER SHOWN

The cost associated with radial to loop system conversion is \$1,126,000. If possible, this work should be coordinated with other upgrades recommended in this report such as the Feeder Cable Upgrade, Manhole Upgrades, and the Unit Substation and Secondary Upgrades.

Coordination Improvements

Supplement 1 of this report contains a detailed coordination study of the over-current protective devices on throughout the system. The study recommends adjusting the following relay settings:

1. Feeder 1201 circuit breaker over-current protective relay settings
2. Feeder 1202 circuit breaker over-current protective relay settings
3. Feeder 1203 circuit breaker over-current protective relay settings
4. Feeder 1204 circuit breaker over-current protective relay settings
5. Main Substation Bus #1 main circuit breaker over-current protective relay settings
6. Main Substation Bus #2 main circuit breaker over-current protective relay settings
7. McCune Hall Primary Fuses
8. Franklin Science Center secondary main circuit breaker pickup and time delay settings.

The coordination study also recommends replacement of secondary circuit breakers and associated equipment for the following buildings and areas:

1. Henderson Gym
2. Tennis Courts & Multi Use Field
3. Cora Grove Spiritual Center
4. Ezra Lehman Library
5. Cumberland Student Union

The cost associated with these coordination improvements is about \$81,500.

Conclusion

The total cost for system upgrades and additions mentioned above is roughly \$3,363,000. With these improvements, the system should be capable of meeting the need of the growing Campus well into the future. However, as the Campus is expanded, care should be taken to distribute the loading across all four feeders evenly. Since feeders 1203 and 1204 currently have the highest connected load, new loads should be added to feeders 1201 and 1202 to improve system balance.

Attachment A

Building	Primary Protection									Tranformer										Secondary Protection							
	Fused Switch/ Circuit Brkr	Manufacturer	Model	Rating	Feeder	Voltage	Fuses	Fuse Rating	AIC Rating	Tag Name	Manufacturer	Catalog#	Serial#	Voltage	Size	Impedance	Instr. Book	Config.	Freq.	Fused Switch/ Circuit Brkr	Manufacturing	Catalog#	Main Bus	Main Fuse/ Breaker	Fuse#	Voltage	
McCune Hall	Fused Switch	Cutler Hammer			1201	12,470				TR1-1	Cutler Hammer	0064LV07K69A	969001284	12,470-120/208V, 3-Phase	112.5kVA	5.60%		Delta-Wye	60 hz	Circuit Breaker	Square-D					120/208V, 3-Phase	
Reed Operations Center	Fused Switch	Westinghouse	HUPH63480	600A	1201	12,470			40k	TR1-2	Westinghouse			12,470-120/208V, 3-Phase	150kVA			Delta-Wye	60 hz	Circuit Breaker						120/208V, 3-Phase	
Henderson Gym	Fused Switch	Cooper Power Systems			1201	12,470				TR1-3	Cooper Power Systems	0064LV08K70A	969001285	12,470-120/208V, 3-Phase	150kVA	5.60%		Delta-Wye	60 hz	Circuit Breaker	Cutler Hammer	KT3400T	600A	400A		120/208V, 3-Phase	
Hoton Hall	Fused Switch	Cutler Hammer			1201	12,470				TR1-4	Cutler Hammer	00G4P11K86A	137010427	12,470-120/208V, 3-Phase	500kVA	5.40%		Delta-Wye	60 hz	Circuit Breaker	Cutler Hammer	KES3400LS w/ RMS 310 Trip Unit	400A	400A		120/208V, 3-Phase	
Kriner Dining Hall	Fused Switch	Cutler Hammer			1201	12,470				TR1-5	Cutler Hammer	VGAA535LJ9	02J589070	12,470-120/208V, 3-Phase	300kVA	4.82%		Delta-Wye	60 hz	Circuit Breaker	Cutler Hammer	N0312T33W W/ DIGI TRIP RMS 310 TRIP UNIT	1200A	1200A		120/208V, 3-Phase	
Huber Art Center	Fused Switch	Cutler Hammer			1201	12,470				TR1-6	Cutler Hammer	06LV10K71A	969001289	12,470-120/208V, 3-Phase	300kVA	5.40%		Delta-Wye	60 hz	Circuit Breaker	Westinghouse	NP1578002C	1200A	1200A		120/208V, 3-Phase	
Memorial Auditorium	Fused Switch	Cutler Hammer			1201	12,470				TR1-7	Cutler Hammer	0064LV10K71A	969001288	12,470-120/208V, 3-Phase	300kVA	5.50%		Delta-Wye	60 hz	Fused Switch	Siemens SB-3	CBC-1233-S	1200A	1000A	KPP-C-1000 SP, CLASS L	120/208V, 3-Phase	
Faculty Office Building	Fused Switch	Cutler Hammer			1201	12,470				TR1-8	Cutler Hammer		0712374-A	12,470-277/480V, 3-Phase	150kVA	5.20%	7423/24	Delta-Wye	60 hz							277/480V, 3-Phase	
Rowland Hall	Fused Switch	Westinghouse	HUPH63480	600A	1201	12,470			40k	TR1-10	Westinghouse			12,470-120/208V, 3-Phase				Delta-Wye	60 hz	Fused Switch	GE	NP1578002C	600A			120/208V, 3-Phase	
Steam Plant	Fused Switch	Cutler Hammer			1201	12,470				TR1-11	Cutler Hammer	00785V10K18A	966002667	12,470-120/208V, 3-Phase	300kVA	5.70%		Delta-Wye	60 hz	Circuit Breaker	Square-D Power Style (PS-1)	44-52635-1	1000A	900A		120/240V, 3-Phase	
Gilbert Hall	Fused Switch	RTE Corporation			1201	12,470				TR1-12	RTE Corporation	0037MP08W21C	906008076	12,470-120/208V, 3-Phase	150kVA	3.80%		Delta-Wye	60 hz	Circuit Breaker	Siemens S4		600A	600A		120/208V, 3-Phase	
Harley Hall	Fused Switch	Federal Pacific			1202	12,470	Westinghouse BA-200	30E, Standard	20k	TR2-1	Federal Pacific		10682-001	12,470-120/208V, 3-Phase	300kVA	5.00%		Delta-Wye	60 hz	Circuit Breaker	Federal Pacific	NM63100R	800A	800A		120/208V, 3-Phase	
Kieffer Hall	Fused Switch	GE			1202	12,470				TR2-2	GE			12,470-120/208V, 3-Phase	300kVA	5.12%	GEI-64922	Delta-Wye	60 hz	None (MLO Panel Board)	GE, Type CCB		1200A	N/A		120/208V, 3-Phase	
Lackhove Hall	Fused Switch	GE			1202	12,470				TR2-3	GE			12,470-120/208V, 3-Phase	300kVA	5.05%	GEI-64922	Delta-Wye	60 hz	None (MLO Panel Board)	GE, Type CCB		1200A	N/A		120/208V, 3-Phase	
Wright Hall	Fused Switch	Cutler Hammer			1202	12,470				TR2-4 (Note: old 4160V Transformer Inside)	Cutler Hammer	006LV07K69A		12,470-120/208V, 3-Phase	112.5kVA	5.60%		Delta-Wye	60 hz	Circuit Breaker	Square-D		400A	400A		120/208V, 3-Phase	
Tennis Courts & Ground Storage	Fused Switch	Westinghouse			1202	12,470				TR2-5	Westinghouse	603A544G03		12,470-120/208V, 3-Phase	112.5kVA	1.07%		Delta-Wye	60 hz	N/A						120/208V, 3-Phase	
Naugle Hall	Fused Switch	Federal Pacific			1202	12,470	Westinghouse BA-200	50E, Standard		TR2-6	Federal Pacific			12,470-120/208V, 3-Phase	500kVA	6.24%	7700	Delta-Wye	60 hz	Circuit Breaker	Federal Pacific		1600A			120/208V, 3-Phase	
McLean Hall	Fused Switch	Federal Pacific			1202	12,470	Westinghouse BA-200	50E, Standard	20kA	TR2-7	Federal Pacific			12,470-120/208V, 3-Phase	750kVA	5.93%	7700	Delta-Wye	60 hz	Circuit Breaker	Federal Pacific					120/208V, 3-Phase	
Spiritual Center	Fused Switch	ABB			1202	12,470				TR2-8	ABB	VY8A51409J		12,470-120/208V, 3-Phase	225kVA	3.10%		Delta-Wye	60 hz	Circuit Breaker						120/208V, 3-Phase	
Old Main		Westinghouse			1202	12,470				TR2-9	Westinghouse	G65A770TVM	83JJ026201	12,470-120/208V, 3-Phase	750kVA	5.64%		Delta-Wye	60 hz	Circuit Breaker	Westinghouse, Powerline		2500A			120/208V, 3-Phase	
Ezra Library	Fused Switch	Westinghouse (Cutler Hammer)	040-54-M		1203	12,470	ITE-CL1-50E	50E, Standard	40k	TR3-1	Square-D, Power Zone			12,470-277/480V, 3-Phase	750kVA	5.50%	SU-4310	Delta-Wye	60 hz	Circuit Breaker	Square-D, PB 1600		1600A			277/480V, 3-Phase	
Dauphin Humanities Center	Fused Switch	Westinghouse			1203	12,470	Westinghouse BA-200	80E, Standard	12.5kVA	TR3-2	Westinghouse		WEP-63801	12,470-277/480V, 3-Phase	750kVA	5.60%	WEP-638E	Delta-Wye	60 hz	Circuit Breaker	Westinghouse		1200A			277/480V, 3-Phase	
Shippen Hall	Fused Switch	Cutler Hammer				12,470				TR3-3	Cutler Hammer		PFL-1366	12,470-120/208V, 3-Phase	750/862kVA	5.67%		Delta-Wye	60 hz	Fused Switch	Cutler Hammer, POW-R-LINE		2000A			120/208V, 3-Phase	
Franklin Science Center	Fused Switch	Cooper Power Systems			1203	12,470				TR3-4	Cooper Power Systems	00004A65W15A	226001622	12,470-277/480V, 3-Phase	2000kVA	5.90%		Delta-Wye	60 hz	Circuit Breaker	Cutler Hammer (SPB100)	S66LSIG (D)	4000A Frame	4000A			
Reisinger Dining Hall - Chiller	Fused Switch	Westinghouse			1203	12,470				TR3-5	Westinghouse			12,470-277/480V, 3-Phase	225kVA			Delta-Wye	60 hz	Circuit Breaker	Westinghouse	EOP3T07	400A	400A		277/480V, 3-Phase	
Reisinger Dining Hall - Main	Fused Switch	Federal Pacific			1203	12,470	Westinghouse BA-200	65E, Standard		TR3-6	Federal Pacific		12652-001	12,470-120/208V, 3-Phase	750kVA	6.45%	7700	Delta-Wye	60 hz	Circuit Breaker	Federal Pacific	75H1	3000/ 2000A			120/208V, 3-Phase	
Math/ Computing Tech. Center	Fused Switch	Cutler Hammer (Westinghouse)			1204	12,470	Cutler Hammer, 15RBAZ	50E	40k	TR4-1	Cutler Hammer (Westinghouse)	0064LV07K69A	24-35496-01	12,470-277/480V, 3-Phase	750kVA	5.57%	IBXFI-00	Delta-Wye	60 hz	Circuit Breaker	Cutler Hammer (Westinghouse)	12NES1200T w/ Digitrip RMS 310		1200A			277/480V, 3-Phase
Grove Hall	Fused Switch	GE			1204	12,470				TR4-2	GE		05013ZZ-TWK	12,470-277/480V, 3-Phase	1000kVA	5.75%		Delta-Wye	60 hz	Circuit Breaker	GE, Power Break	TP1617TTR	1600A max	1600A		277/480V, 3-Phase	
Heiges Field House	Fused Switch	GE, Break Master Switchgear			1204	12,470				TR4-3	GE	NP195A1398	G-857421	12,470-120/208V, 3-Phase	750/ 1000kVA	5.90%	GEI-65056	Delta-Wye	60 hz	Circuit Breaker	GE		1600A	1200A		120/208V, 3-Phase	
Seth Grove Stadium	Fused Switch	Westinghouse	678C295607			12,470	TYPR CLD-18A	18A		TR4-4	Westinghouse	L6513E53HB1	71J6689	12,470-120/208V, 3-Phase	300kVA	2%		Delta-Wye	60 hz	Fused Switch	FPE			800A		120/208V, 3-Phase	
Cumberland Union Building-Old	Fused Switch	Square-D			1204	12,470	ITE-CL-140E	40E	40kA	TR4-5	Square-D	C-297983	39550	12,470-277/480V, 3-Phase	500kVA	5.30%	SU-4310	Delta-Wye	60 hz	Circuit Breaker	Square-D, I-Line	44-14327	800A	800A		277/480V, 3-Phase	
Cumberland Union Building-New	Fused Switch	Westinghouse	PHC53901		1204	12,470	A1550X65E-10	65E		TR4-6	Square-D	SHT	207836	12,470-277/480V, 3-Phase	500/666kVA	5.8/7.7%	7421-1	Delta-Wye	60 hz	Circuit Breaker	Westinghouse, POW-R-LINE	PH53901	600A	600A		277/480V, 3-Phase	
Mowrey Hall - Main	Fused Switch	Square-D	44036-325-6C	600A	1204	15	A155F10SR0-50E	50E	40k	TR4-7	Square-D	2452882298	980251-VA	12,470-120/208V, 3-Phase	750kVA	5.80%		Delta-Wye	60 hz	Fused Switch	Square-D, BP Switch	BP03630EI	3000A	600V		120/208V, 3-Phase	
Mowrey Hall - Fire Pump	Fused Switch	S&C	Manual PMH 5		1204	15	N/A	N/A	12kA	TR4-8	Cooper	00065POCW81A	137012439	12,470-277/480V, 3-Phase	75kVA	4.8%		Delta-Wye	60 hz	Circuit Breaker			N/A	125A		277/480V, 3-Phase	
Student Recreation Center	Fused Switch	RTE			1204	12,470	RTE 3564020M11	20E		TR4-9	RTE		Q535502-TUN	12,470-277/480V, 3-Phase	300kVA	3.96%		Delta-Wye	60 hz	Circuit Breaker	General Electric, Spectra Hi Break	SPRIC800A600	800A	600A		277/480V, 3-Phase	
Seavers Complex	Fused Switch	Westinghouse			1204	12,470				TR4-10	Westinghouse		76B156112	12,470-277/480V, 3-Phase	750kVA	5.62%		Delta-Wye	60 hz		Westinghouse	BA60460 IT.3	1200A	1200A		277/480V, 3-Phase	

Attachment B

Opinion of Probable Construction Cost

Entech Engineering, Inc.

Date: 15-Mar-04

Page 1 of 1

Project Number:	2184.22	Estimate Type:	Draft
Project Name:	Electrical Distribution Study	Estimate Phase:	Manhole & Ductbank Upgrades
Project Location:	Shippensburg University	Drawing Numbers:	N/A
Estimator:	PLK	G:\Projects\2184.22\ss\Manhole and Ductbank Upgrades 040315.xls	
Checked by:	DMF	Filename:	

Description	# of Units	Unit Measure	Material Cost		Labor Cost		Total Cost
			\$/Unit	Cost	\$/Unit	Cost	
Demolition							
Remove Abandoned Cabling	5000	LF	\$0.00	\$0	\$1.50	\$7,500	\$7,500
New Work							
Throat and Lid Work for MH-6, 35, 40 & 54	1	LS	\$4,500.00	\$4,500	\$6,500.00	\$6,500	\$11,000
MH-34 - Install Drain and Pipe to Daylight	1	LS	\$1,500.00	\$1,500	\$5,000.00	\$5,000	\$6,500
New Riser Pole	100	LF	\$65.30	\$6,530	\$52.00	\$5,200	\$11,730
Verify and Relabel Cable Between MH-19 to MH-22	1	LS	\$30.00	\$30	\$280.00	\$280	\$310
Overhead & Profit							
20%	1	LS	\$7,408.00	\$7,408		\$0	\$7,408
Professional Services							
Engineering (10%)	1	LS	\$4,444.80	\$4,445		\$0	\$4,445
Subtotal							
				\$24,413		\$24,480	\$48,893
15% Contingency							
				\$3,662		\$3,672	\$7,334
TOTAL ELECTRICAL							
				\$28,070		\$28,150	\$56,220

Opinion of Probable Construction Cost

Entech Engineering, Inc.

Date: 15-Mar-04

Page 1 of 1

Project Number: 2184.22
 Project Name: Electrical Distribution Study
 Project Location: Shippensburg University

Estimate Type: Draft
 Estimate Phase: **McCune & Wright Sec. Upgrades**
 Drawing Numbers: N/A

Estimator: PLK
 Checked by: DMF

G:\Projects\2184.22\ss\McCune and Wright Hall Secondary Upgrades 040315.xls
 Filename:

Description	# of Units	Unit Measure	Material Cost		Labor Cost		Total Cost
			\$/Unit	Cost	\$/Unit	Cost	
Demolition							
Remove Unit Substations	1	LS	\$0.00	\$0	\$7,200.00	\$7,200	\$7,200
New Work							
New Secondary SwitchBoards	2	EA	\$20,000.00	\$40,000	\$2,800.00	\$5,600	\$45,600
Terminations & Coordination	1	LS	\$806.00	\$806	\$1,500.00	\$1,500	\$2,306
Overhead & Profit							
20%	1	LS	\$11,021.20	\$11,021		\$0	\$11,021
Professional Services							
Engineering (10%)	1	LS	\$6,612.72	\$6,613		\$0	\$6,613
Subtotal							
				\$58,440		\$14,300	\$72,740
15% Contingency							
				\$8,766		\$2,145	\$10,911
TOTAL ELECTRICAL							
				\$67,210		\$16,450	\$83,660

Opinion of Probable Construction Cost

Entech Engineering, Inc.		Date: 15-Mar-04	Page 1 of 1
Project Number:	2184.22	Estimate Type:	Draft
Project Name:	Electrical Distribution Study	Estimate Phase:	Unit Sub. & Secondary Upgrades
Project Location:	Shippensburg University	Drawing Numbers:	N/A
Estimator:	PLK	G:\Projects\2184.22\ss\Unit Substation and Secondary Upgrades 040315.xls	
Checked by:	DMF	Filename:	

Description	# of Units	Unit Measure	Material Cost		Labor Cost		Total Cost
			\$/Unit	Cost	\$/Unit	Cost	
Demolition							
Remove Unit Substations	8	EA	\$0.00	\$0	\$3,600.00	\$28,800	\$28,800
Remove Secondary Switchboard	2	EA	\$0.00	\$0	\$2,800.00	\$5,600	\$5,600
New Work							
Secondary SwitchBoards	10	EA	\$20,000.00	\$200,000	\$2,800.00	\$28,000	\$228,000
750kVA Outdoor Transformer	3	EA	\$15,500.00	\$46,500	\$1,180.00	\$3,540	\$50,040
300kVA Outdoor Transformer	2	EA	\$8,600.00	\$17,200	\$2,000.00	\$4,000	\$21,200
150kVA Outdoor Transformer	2	EA	\$6,500.00	\$13,000	\$1,500.00	\$3,000	\$16,000
500kVA Outdoor Tranformer	1	EA	\$13,000.00	\$13,000	\$2,500.00	\$2,500	\$15,500
Duct Banks	800	LF	\$65.30	\$52,240	\$52.00	\$41,600	\$93,840
Temp Power	1	LS	\$20,000.00	\$20,000	\$2,500.00	\$2,500	\$22,500
Overhead & Profit							
20%	1	LS	\$96,296.00	\$96,296		\$0	\$96,296
Professional Services							
Engineering (10%)	1	LS	\$57,777.60	\$57,778		\$0	\$57,778
Subtotal							
				\$516,014		\$119,540	\$635,554
15% Contingency							
				\$77,402		\$17,931	\$95,333
TOTAL ELECTRICAL							
				\$593,420		\$137,470	\$730,890

Opinion of Probable Construction Cost

Entech Engineering, Inc.		Date: 15-Mar-04	Page 1 of 1
Project Number:	2184.22	Estimate Type:	Draft
Project Name:	Electrical Distribution Study	Estimate Phase:	Transformer 1 Replacement
Project Location:	Shippensburg University	Drawing Numbers:	N/A
Estimator:	PLK	G:\Projects\2184.22\ss\Transformer 1 Replacment 040315.xls	
Checked by:	DMF	Filename:	

Description	# of Units	Unit Measure	Material Cost		Labor Cost		Total Cost
			\$/Unit	Cost	\$/Unit	Cost	
Demolition							
Remove Exist Trnaformer 1	1	LS	\$0.00	\$0	\$7,200.00	\$7,200	\$7,200
New Work							
New Transformer 1	1	EA	\$75,000.00	\$75,000	\$8,800.00	\$8,800	\$83,800
Transformer Handling	1	EA	\$0.00	\$0	\$3,600.00	\$3,600	\$3,600
Overhead & Profit							
20%	1	LS	\$18,920.00	\$18,920		\$0	\$18,920
Professional Services							
Engineering (10%)	1	LS	\$11,352.00	\$11,352		\$0	\$11,352
Subtotal							
				\$105,272		\$19,600	\$124,872
15% Contingency							
				\$15,791		\$2,940	\$18,731
TOTAL ELECTRICAL							
				\$121,060		\$22,540	\$143,600

Opinion of Probable Construction Cost

Entech Engineering, Inc.		Date: 15-Mar-04	Page 1 of 1
Project Number:	2184.22	Estimate Type:	Draft
Project Name:	Electrical Distribution Study	Estimate Phase:	Second Utility Feed
Project Location:	Shippensburg University	Drawing Numbers:	N/A
Estimator:	PLK	G:\Projects\2184.22\ss\Additional Utility Feed 040315.xls	
Checked by:	DMF	Filename:	

Description	# of Units	Unit Measure	Material Cost		Labor Cost		Total Cost
			\$/Unit	Cost	\$/Unit	Cost	
Demolition							
Remove Cabling between Switches	1	LS	\$0.00	\$0	\$1,800.00	\$1,800	\$1,800
Remove Switches	1	LS	\$0.00	\$0	\$1,800.00	\$1,800	\$1,800
New Work							
Utility Study	1	LS	\$10,000.00	\$10,000	\$0.00	\$0	\$10,000
Utility Overhead Cabling	1	LS	\$60,000.00	\$60,000	\$0.00	\$0	\$60,000
Switchgear & Metering	1	EA	\$42,000.00	\$42,000	\$12,000.00	\$12,000	\$54,000
Raceway and Cabling to New Riser Pole	100	LF	\$65.30	\$6,530	\$52.00	\$5,200	\$11,730
Terminations	1	LS		\$0	\$5,000.00	\$5,000	\$5,000
Testing & Coordination	1	LS		\$0	\$10,000.00	\$10,000	\$10,000
Overhead & Profit							
20%	1	LS	\$30,866.00	\$30,866		\$0	\$30,866
Professional Services							
Engineering (10%)	1	LS	\$18,519.60	\$18,520		\$0	\$18,520
Subtotal							
				\$167,916		\$35,800	\$203,716
15% Contingency							
				\$25,187		\$5,370	\$30,557
TOTAL ELECTRICAL							
				\$193,100		\$41,170	\$234,270

Opinion of Probable Construction Cost

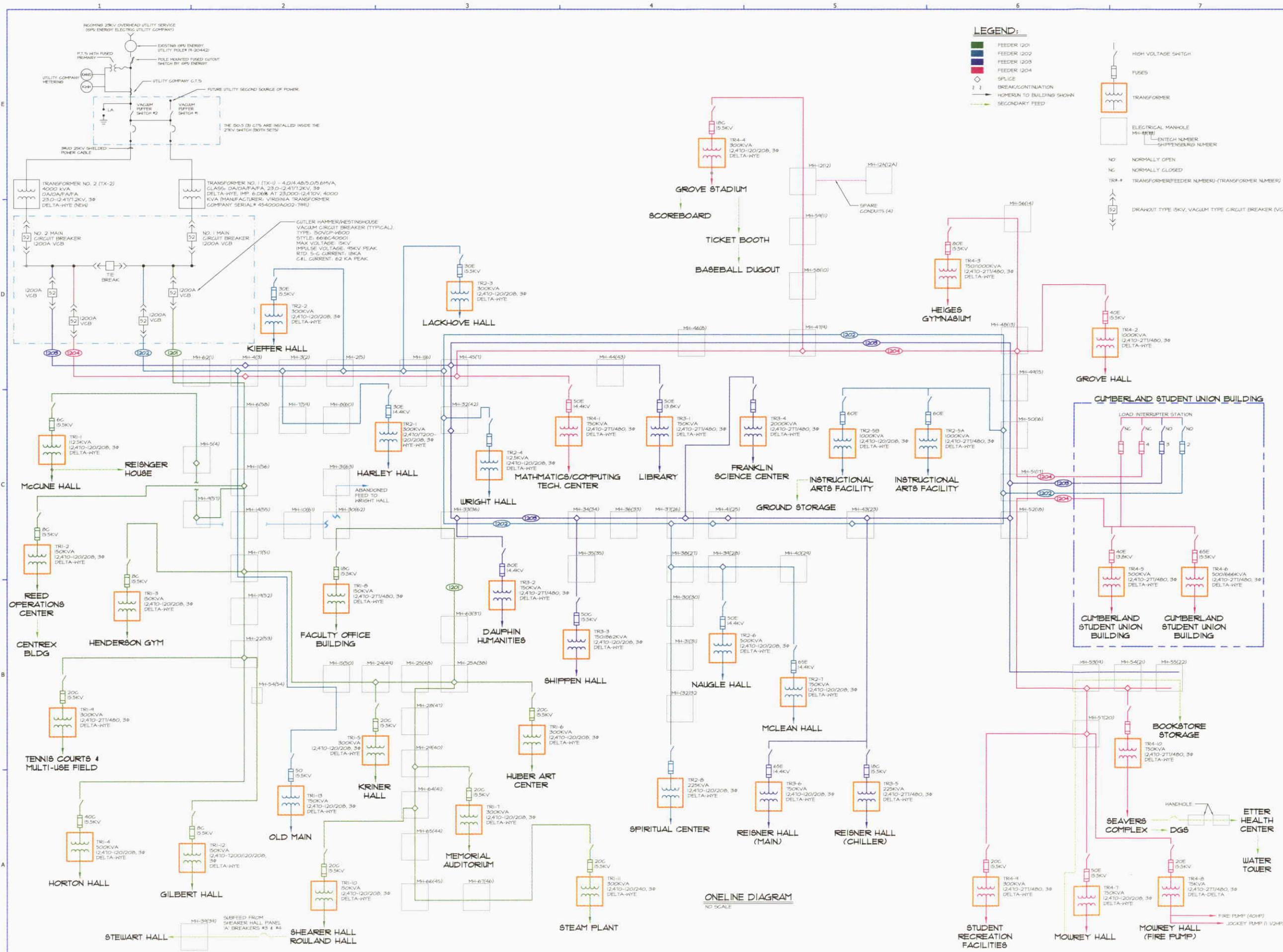
Entech Engineering, Inc.		Date: 15-Mar-04	Page 1 of 1
Project Number:	2184.22	Estimate Type:	Draft
Project Name:	Electrical Distribution Study	Estimate Phase:	MV Feeder Replacement
Project Location:	Shippensburg University	Drawing Numbers:	N/A
Estimator:	PLK	G:\Projects\2184.22\ss\Feeder Replacement Upgrade 040813.xls	
Checked by:	DMF	Filename:	

Description	# of Units	Unit Measure	Material Cost		Labor Cost		Total Cost
			\$/Unit	Cost	\$/Unit	Cost	
Demolition							
Remove Cabling & Splices	45000	LF	\$0.00	\$0	\$1.12	\$50,400	\$50,400
New Work							
Install Feeders	45000	LF	\$3.50	\$157,500	\$2.25	\$101,250	\$258,750
Install Splices	195	EA	\$220.00	\$42,900	\$150.00	\$29,250	\$72,150
Building Terminations	114	EA	\$180.00	\$20,520	\$120.00	\$13,680	\$34,200
Phasing & Equipment	1	LS	\$0.00	\$0	\$80,000.00	\$80,000	\$80,000
Manhole Access	65	EA	\$0.00	\$0	\$300.00	\$19,500	\$19,500
DuctBank	1600	LF	\$15.50	\$24,800	\$14.50	\$23,200	\$48,000
Overhead & Profit							
20%	1	LS	\$112,600.00	\$112,600		\$0	\$112,600
Professional Services							
Engineering (10%)	1	LS	\$67,560.00	\$67,560		\$0	\$67,560
Subtotal							
				\$425,880		\$317,280	\$743,160
15% Contingency							
				\$63,882		\$47,592	\$111,474
TOTAL ELECTRICAL							
				\$489,760		\$364,870	\$854,630

Opinion of Probable Construction Cost

Entech Engineering, Inc.		Date: 15-Mar-04	Page 1 of 1
Project Number:	2184.22	Estimate Type:	Draft
Project Name:	Electrical Distribution Study	Estimate Phase:	Radial to Loop Dist Conversion
Project Location:	Shippensburg University	Drawing Numbers:	N/A
Estimator:	PLK	G:\Projects\2184.22\ss\Radial To Loop Dist Conversion 040813 040813.xls	
Checked by:	DMF	Filename:	

Description	# of Units	Unit Measure	Material Cost		Labor Cost		Total Cost
			\$/Unit	Cost	\$/Unit	Cost	
Demolition							
Remove Cabling & Termination	1800	LF	\$0.00	\$0	\$1.12	\$2,016	\$2,016
New Work							
Duct Back	1800	LF	\$15.50	\$27,900	\$14.50	\$26,100	\$54,000
15kV Terminations	90	EA	\$220.00	\$19,800	\$150.00	\$13,500	\$33,300
Radial Switches	19	EA	\$15,000.00	\$285,000	\$6,500.00	\$123,500	\$408,500
Radial Transformers	10	LS	\$17,000.00	\$170,000	\$6,500.00	\$65,000	\$235,000
Manhole Access	29	EA	\$0.00	\$0	\$300.00	\$8,700	\$8,700
Overhead & Profit							
20%	1	LS	\$148,303.20	\$148,303		\$0	\$148,303
Professional Services							
Engineering (10%)	1	LS	\$88,981.92	\$88,982		\$0	\$88,982
Subtotal							
				\$739,985		\$238,816	\$978,801
15% Contingency							
				\$110,998		\$35,822	\$146,820
TOTAL ELECTRICAL							
				\$850,980		\$274,640	\$1,125,620



LEGEND:

- FEEDER 1200V
- FEEDER 15KV
- FEEDER 20KV
- FEEDER 30KV
- FEEDER 40KV
- FEEDER 60KV
- SPLICE
- BREAK/CONTINUATION
- HOMERUN TO BUILDING SHOWN
- SECONDARY FEED
- HIGH VOLTAGE SWITCH
- FUSES
- TRANSFORMER
- ELECTRICAL MANHOLE
- ENTECH NUMBER
- SHIPPENSBURG NUMBER
- NO: NORMALLY OPEN
- NC: NORMALLY CLOSED
- TR#-# TRANSFORMER/FEEDER NUMBER-(TRANSFORMER NUMBER)
- DRAWOUT TYPE (5KV, VACUUM TYPE CIRCUIT BREAKER (VCB))

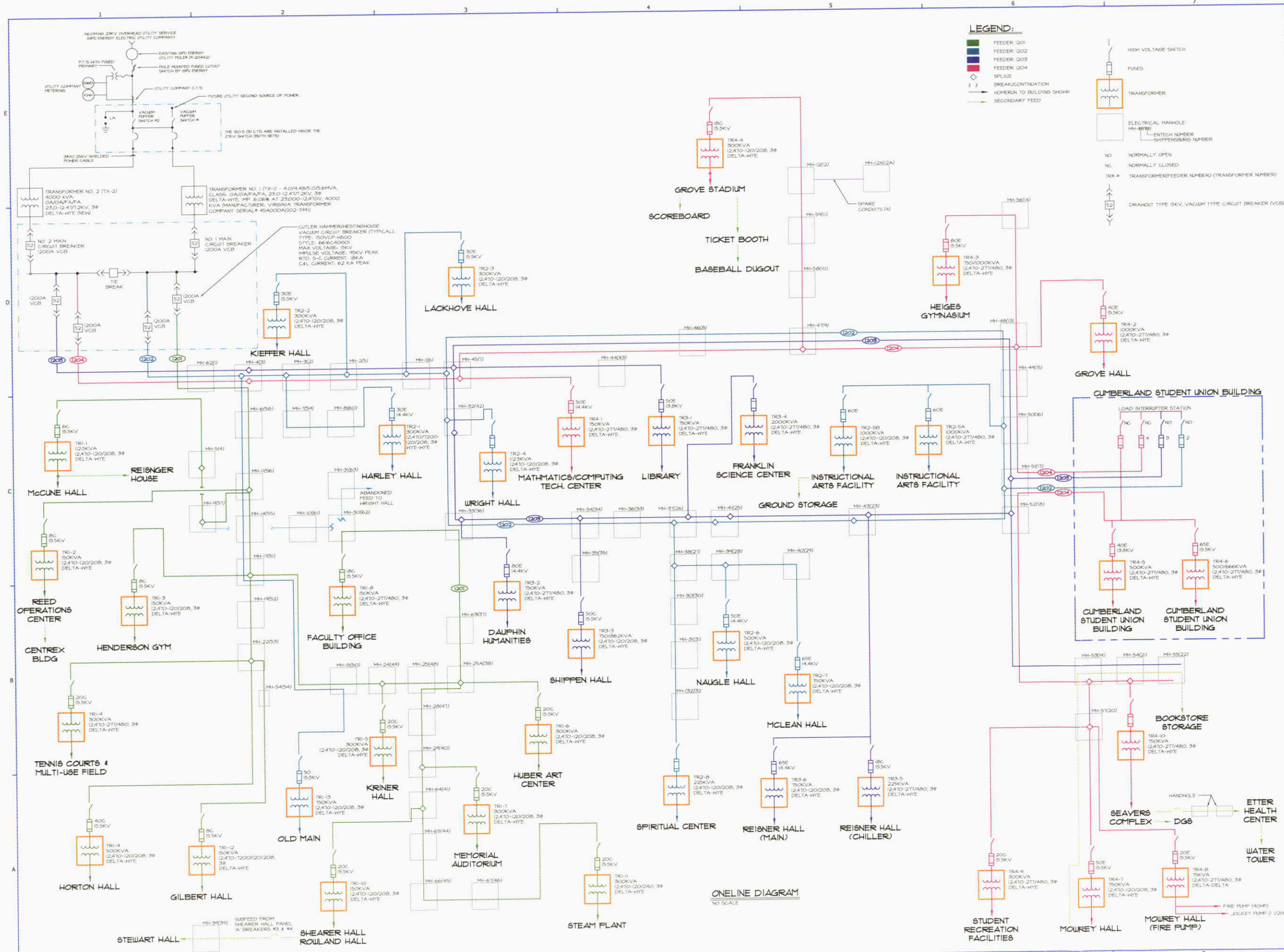
ENTECH
 Entech Engineering Inc.
 4 S. Fourth Street
 Reading, PA 19603
 PH: 610.373.6667
 FX: 610.373.9337
 WWW.ENTENCH.COM



DATE	REV.	BY	APP.

SHIPPENSBURG UNIVERSITY
 SHIPPENSBURG TOWNSHIP, CUMBERLAND COUNTY, PA
 MEDIUM VOLTAGE DISTRIBUTION
 ELECTRICAL - EXISTING
 ONE LINE DIAGRAM

SCALE: NO SCALE
 PREPARED BY: PLK
 CHECKED BY: PLK
 DRAWING NO. E-2
 SHEET 2 OF 7



LEGEND:

- FEEDER 1201
- FEEDER 1202
- FEEDER 1203
- FEEDER 1204
- SPLICE
- BREAK/CONTINUATION
- HOMERUN TO BUILDING SHOWN
- SECONDARY FEED

HIGH VOLTAGE SWITCH
 FUSES
 TRANSFORMER
 ELECTRICAL HANDLE
 ENTECH NUMBER
 SHIPPENSBURG NUMBER
 NO. NORMALLY OPEN
 NC. NORMALLY CLOSED
 TRM-# TRANSFORMER/FEEDER NUMBER (TRANSFORMER NUMBER)
 DRAGOUT TYPE 15KV, VACUUM TYPE CIRCUIT BREAKER (VCA)

ENTECH
 Entech Engineering Inc.
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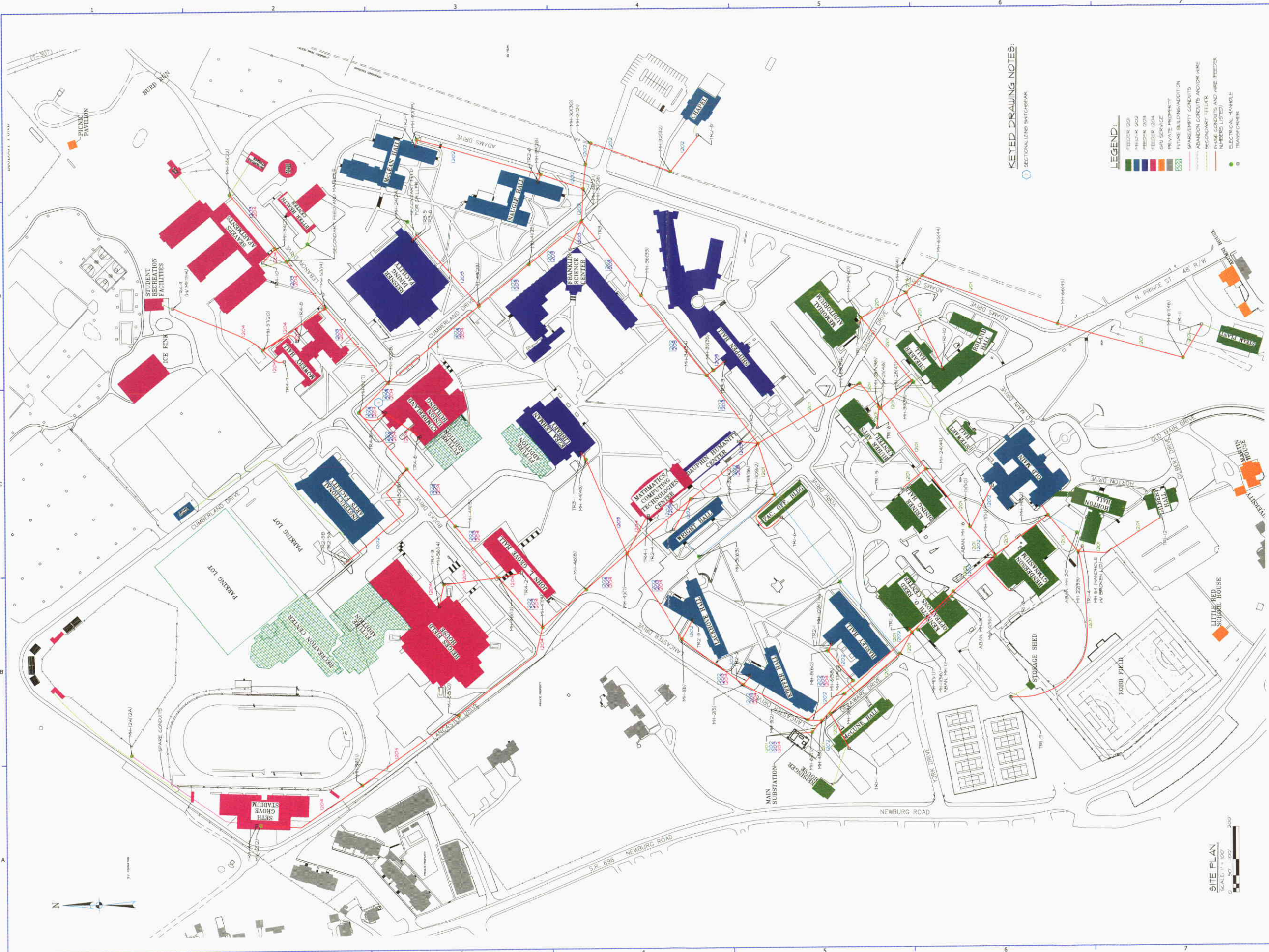


NO.	DATE	REV.	BY	CHK.	APP.

SHIPPENSBURG UNIVERSITY
 SHIPPENSBURG TOWNSHIP, CUMBERLAND COUNTY, PA
 MEDIUM VOLTAGE DISTRIBUTION
 ELECTRICAL
 ONE LINE DIAGRAM - FUTURE

SCALE: NO SCALE
 PREPARED BY: [blank]
 CHECKED BY: [blank]
 APPROVED BY: [blank]
 PROJECT NO: 218422
 DRAWING NO: **E-4**
 SHEET 4 OF 7

ONLINE DIAGRAM
 NO SCALE



KEYED DRAWING NOTES:
SECTIONALIZING SWITCHGEAR

- LEGEND:**
- FEEDER 100
 - FEEDER 102
 - FEEDER 103
 - FEEDER 104
 - GPU SERVICE
 - PRIVATE PROPERTY
 - FUTURE BUILDING/CONDUIT
 - SPARE BUILDING/CONDUIT
 - ABANDON CONDUIT AND/OR WIRE
 - SECONDARY FEEDER
 - IN-USE CONDUIT AND WIRE (FEEDER NUMBERS LISTED)
 - ELECTRICAL HANKLE
 - TRANSFORMER



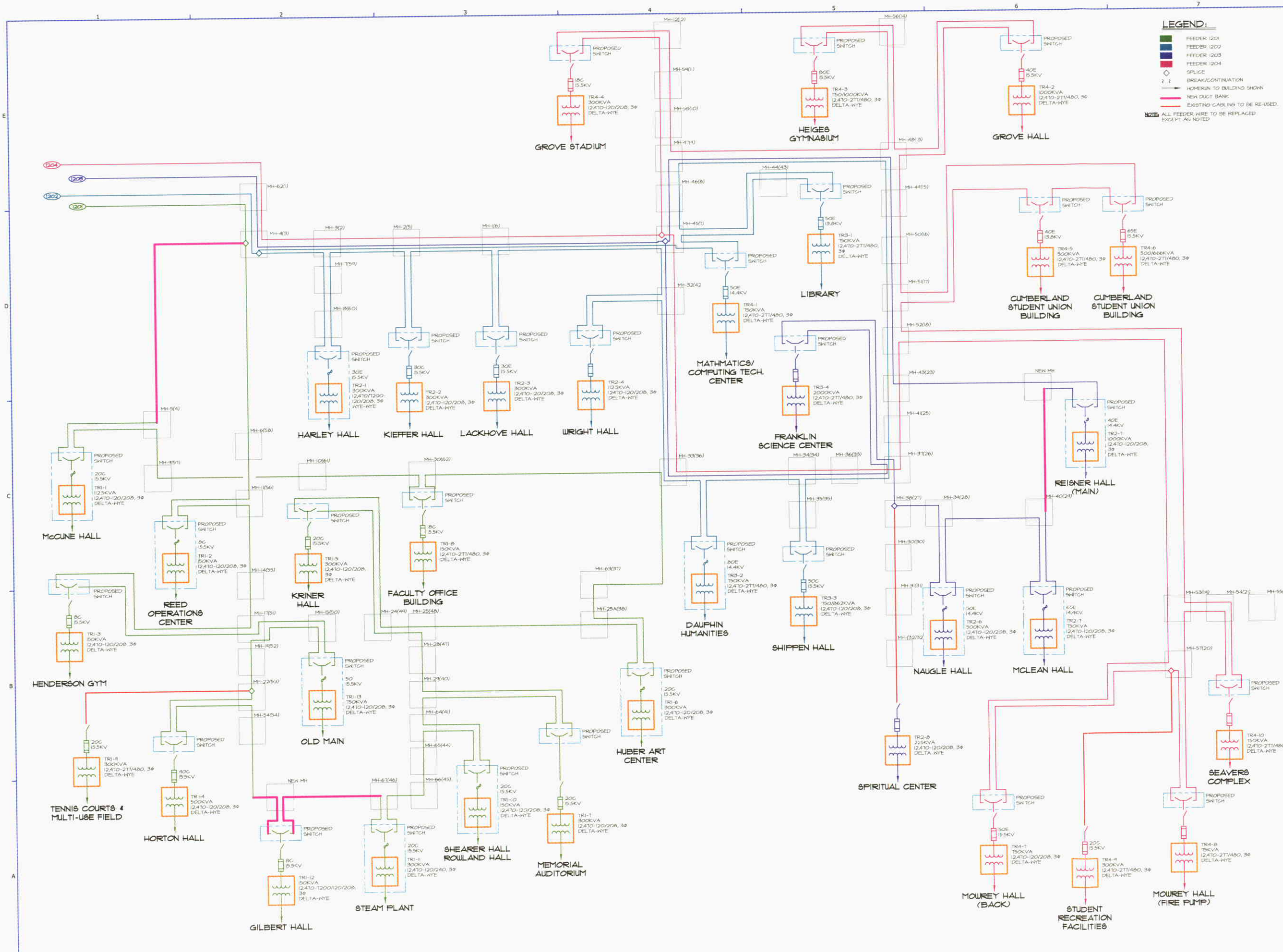
ENTECH
Entech Engineering Inc.
4 S. Fourth Street
Reading, PA 19603
PH: 610.373.6667
FX: 610.373.7537
www.entecheng.com



DATE	REV.	ISSUED FOR/REVISED	CLIENT REVIEW	P.L.C.	APP'D
3/11/04	A				

SHIPPENSBURG UNIVERSITY
SHIPPENSBURG TOWNSHIP, CUMBERLAND COUNTY, PA
MEDIUM VOLTAGE DISTRIBUTION
ELECTRICAL
SITE PLAN - FUTURE

SCALE: 1" = 50'
PREPARED BY: C.J.D.
DESIGNED BY: P.L.C.
APPROVED BY: P.L.C.
PROJECT NO: 12122
DRAWING NO: **E-5**
SHEET 5 OF 7



LEGEND:

- FEEDER 1201
- FEEDER 1202
- FEEDER 1203
- FEEDER 1204
- SPlice
- BREAK/CONTINUATION
- HOMERUN TO BUILDING SHOWN
- NEW DUCT BANK
- EXISTING CABLING TO BE RE-USED

NOTE: ALL FEEDER WIRE TO BE REPLACED EXCEPT AS NOTED.

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 4 S. Fourth Street
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 fx: 610.373.7337
 www.entech.com



NO.	DATE	REV.	BY	CHK.	APP.

SHIPPENSBURG UNIVERSITY
 SHIPPENSBURG TOWNSHIP, CUMBERLAND COUNTY, PA
 MEDIUM VOLTAGE DISTRIBUTION
 ELECTRICAL
 ONE LINE DIAGRAM - FUTURE LOOP SYSTEM

SCALE: NO SCALE
 PREPARED BY: JCD
 CHECKED BY: JCD
 APPROVED BY: JCD
 DRAWING NO: E-6
 SHEET 6 OF 7

