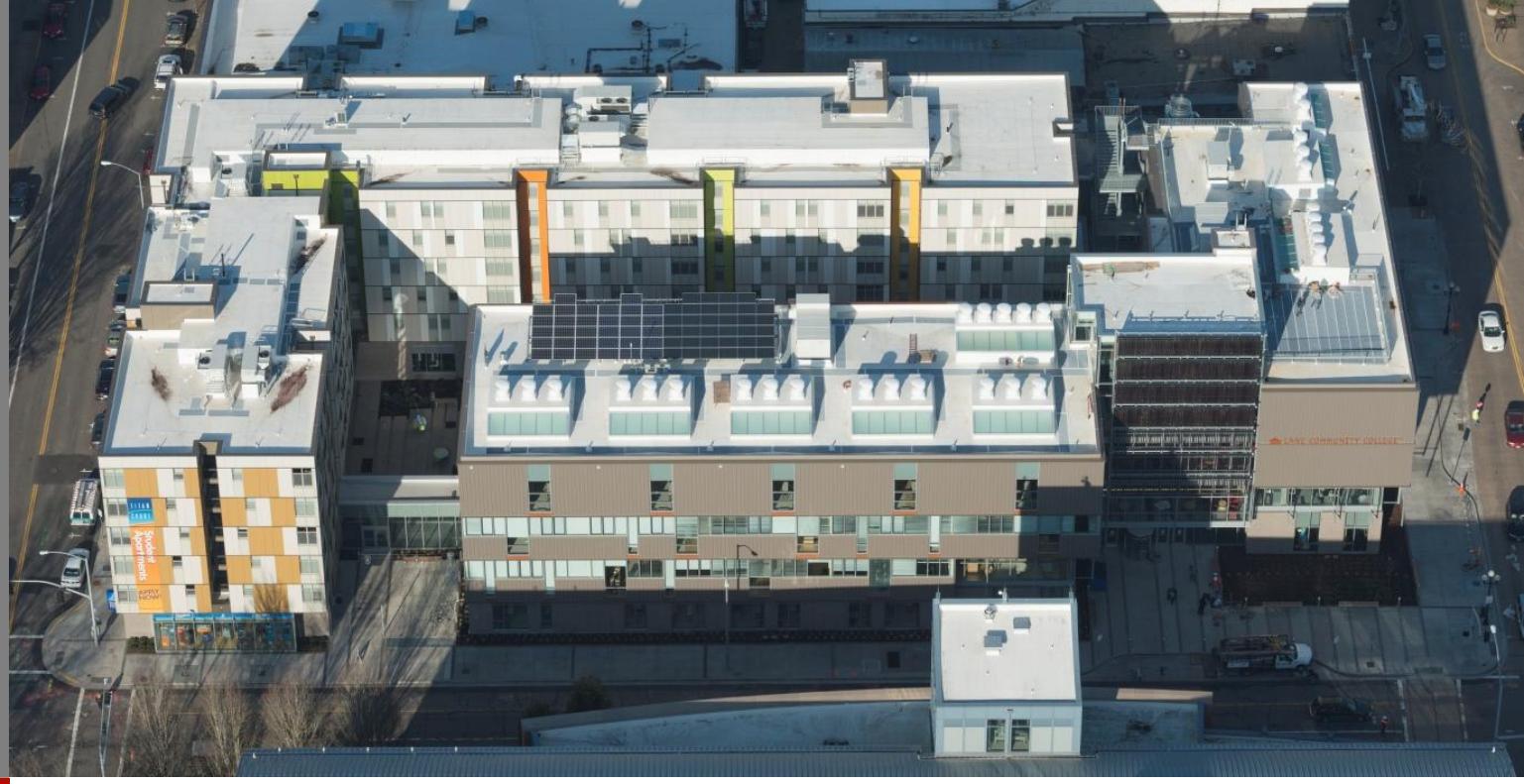


PAE CONSULTING ENGINEERS, INC.

LANE COMMUNITY COLLEGE DOWNTOWN CAMPUS

Electrical Basis of Design

PRESENTED TO: Lane Community College

PRESENTED BY: Brett Cournoyer, PE, LEED BC+D

PRESENTATION OVERVIEW

Building Power System

Power Monitoring

Lighting Design Strategies

ELECTRICAL

Design Criteria

	Goals
Lighting power densities (W/sf)	20% below code (0.8W/sf)
Lighting power energy use (kWh/yr)	50% less than a typical building
Plug load power density (W/sf)	~2W/sf
Plug load energy use	70% less than a typical building

ELECTRICAL BASIS OF DESIGN

Power System

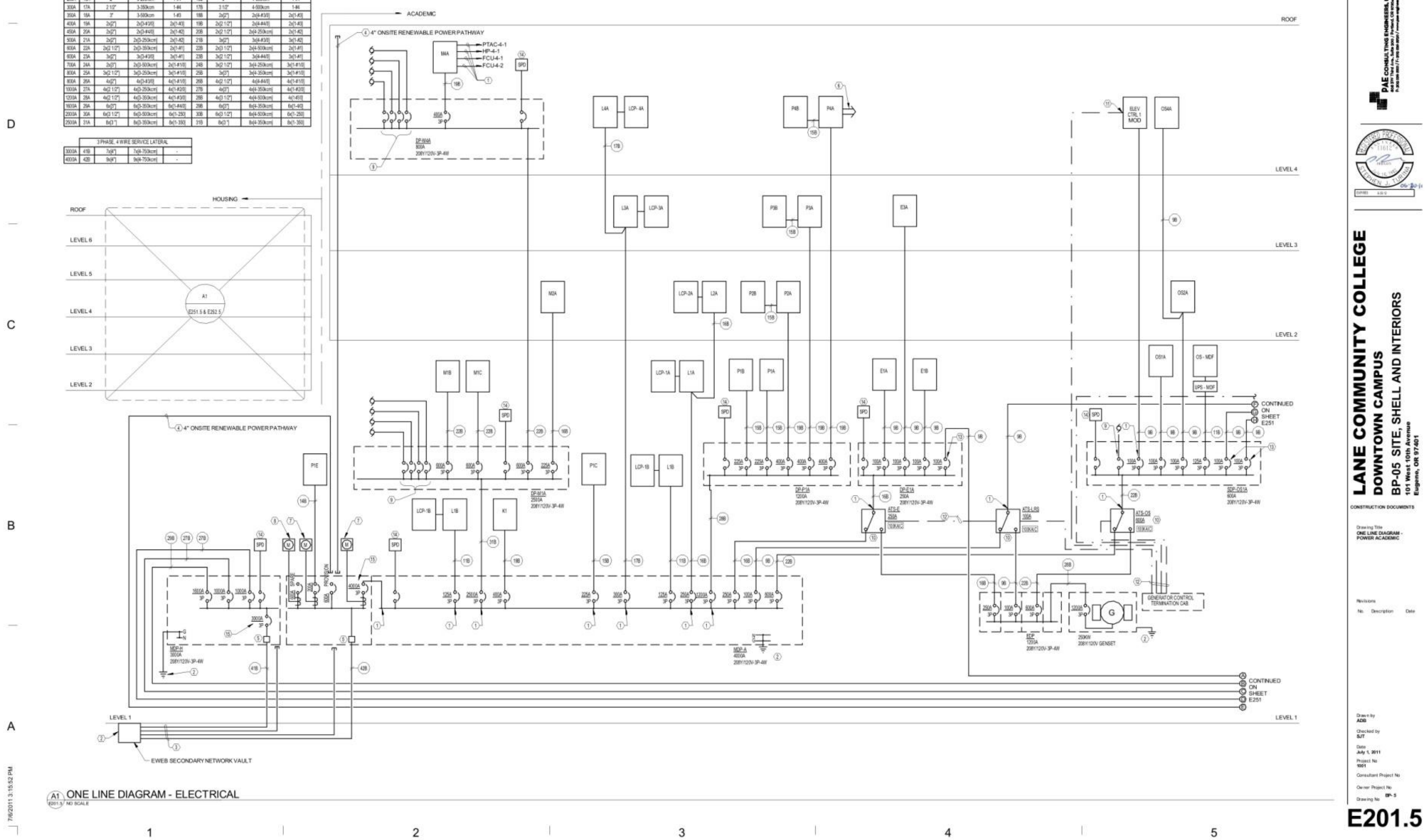
ELECTRICAL BASIS OF DESIGN

Power System: Academic Infrastructure

	3 PHASE, 3 WIRE + GROUND				3 PHASE, 4 WIRE + GROUND (CURRENT CARRYING NEUTRAL)			
AMPS	MARK	CONDUIT SIZE	PHASE CONDUCTORS	GROUND	MARK	CONDUIT SIZE	PHASE, NEUTRAL CONDUCTORS	G[illegible]
20A	1A	1/2"	3-#12	1-#12	1B	1/2"	4-#12	1-#12
30A	2A	1/2"	3-#10	1-#10	2B	1/2"	4-#10	1-#10
40A	3A	3/4"	3-#8	1-#10	3B	3/4"	4-#8	1-#10
50A	4A	3/4"	3-#8	1-#10	4B	1"	4-#6	1-#10
60A	5A	3/4"	3-#6	1-#10	5B	1"	4-#6	1-#10
70A	6A	1"	3-#4	1-#8	6B	1 1/4"	4-#4	1-#8
80A	7A	1"	3-#4	1-#8	7B	1 1/4"	4-#3	1-#8
90A	8A	1 1/4"	3-#3	1-#8	8B	1 1/4"	4-#2	1-#8
100A	9A	1 1/4"	3-#3	1-#8	9B	1 1/4"	4-#2	1-#8
110A	10A	1 1/4"	3-#2	1-#6	10B	1 1/2"	4-#1	1-#6
125A	11A	1 1/4"	3-#1	1-#6	11B	1 1/2"	4-#1/0	1-#6
150A	12A	1 1/2"	3-#1/0	1-#6	12B	2"	4-#2/0	1-#6
175A	13A	1 1/2"	3-#2/0	1-#6	13B	2"	4-#3/0	1-#6
200A	14A	2"	3-#3/0	1-#6	14B	2 1/2"	4-#4/0	1-#6
225A	15A	2"	3-#4/0	1-#4	15B	2 1/2"	4-250kcm	1-#4
250A	16A	2"	3-250kcm	1-#4	16B	3"	4-350kcm	1-#4
300A	17A	2 1/2"	3-350kcm	1-#4	17B	3 1/2"	4-500kcm	1-#4
350A	18A	3"	3-500kcm	1-#3	18B	2x(2")	2x(4-#3/0)	2x(1-#3)
400A	19A	2x(2")	2x(3-#3/0)	2x(1-#3)	19B	2x(2 1/2")	2x(4-#4/0)	2x(1-#3)
450A	20A	2x(2")	2x(3-#4/0)	2x(1-#2)	20B	2x(2 1/2")	2x(4-250kcm)	2x(1-#2)
500A	21A	2x(2")	2x(3-250kcm)	2x(1-#2)	21B	3x(2")	3x(4-#3/0)	3x(1-#2)
600A	22A	2x(2 1/2")	2x(3-350kcm)	2x(1-#1)	22B	2x(3 1/2")	2x(4-500kcm)	2x(1-#1)
600A	23A	3x(2")	3x(3-#3/0)	3x(1-#1)	23B	3x(2 1/2")	3x(4-#4/0)	3x(1-#1)
700A	24A	2x(3")	2x(3-500kcm)	2x(1-#1/0)	24B	3x(2 1/2")	3x(4-250kcm)	3x(1-#1/0)
800A	25A	3x(2 1/2")	3x(3-250kcm)	3x(1-#1/0)	25B	3x(3")	3x(4-350kcm)	3x(1-#1/0)
800A	26A	4x(2")	4x(3-#3/0)	4x(1-#1/0)	26B	4x(2 1/2")	4x(4-#4/0)	4x(1-#1/0)
1000A	27A	4x(2 1/2")	4x(3-250kcm)	4x(1-#2/0)	27B	4x(3")	4x(4-350kcm)	4x(1-#2/0)
1200A	28A	4x(2 1/2")	4x(3-350kcm)	4x(1-#3/0)	28B	4x(3 1/2")	4x(4-500kcm)	4x(1-#3/0)
1600A	29A	6x(3")	6x(3-350kcm)	6x(1-#4/0)	29B	6x(3")	6x(4-350kcm)	6x(1-4/0)
2000A	30A	6x(3 1/2")	6x(3-500kcm)	6x(1-250)	30B	6x(3 1/2")	6x(4-500kcm)	6x(1-250)
2500A	31A	8x(3 ")	8x(3-350kcm)	8x(1-350)	31B	8x(3 ")	8x(4-350kcm)	8x(1-350)

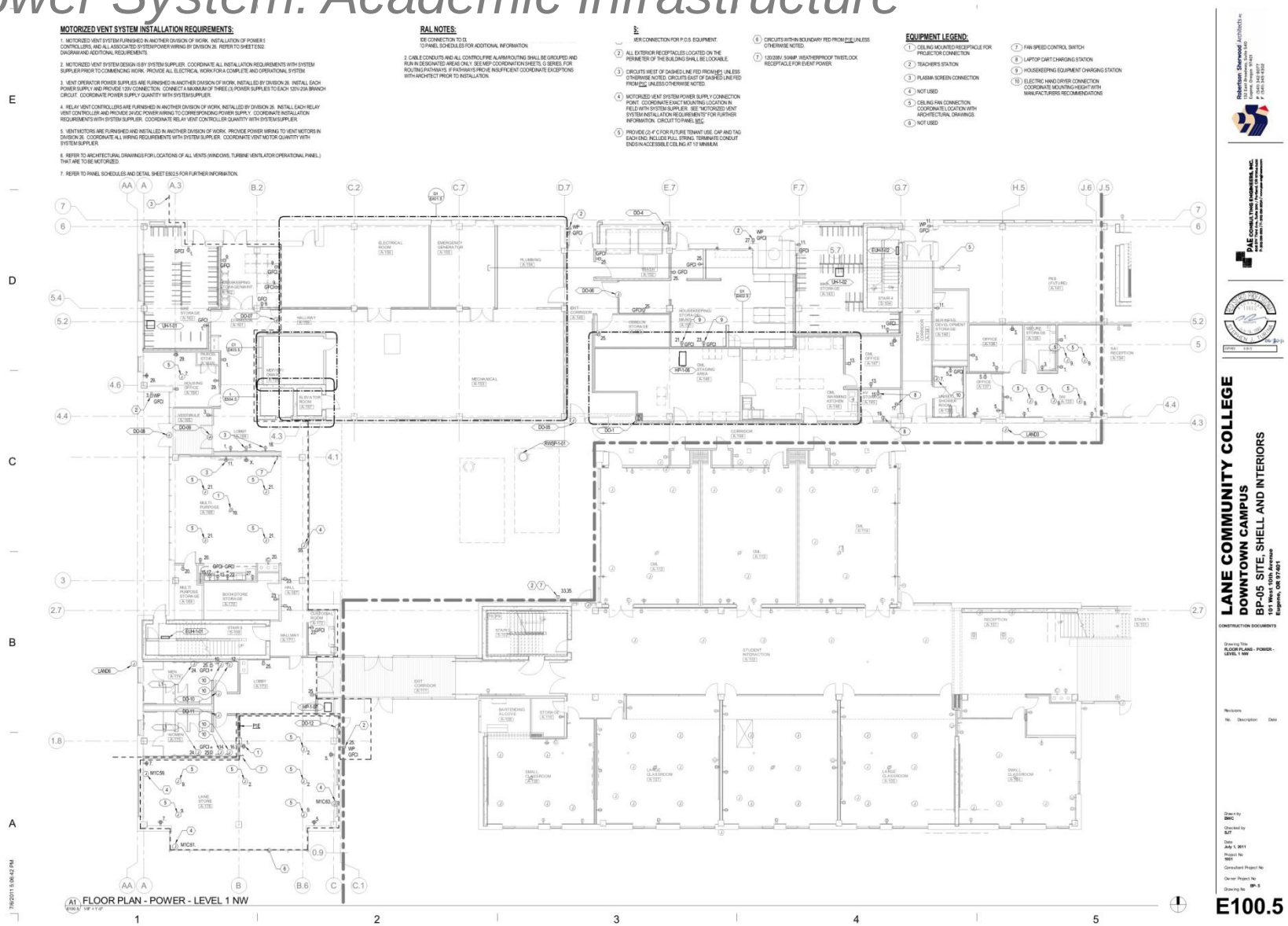
	3 PHASE, 4 WIRE SERVICE LATERAL			
3000A	41B	7x(4")	7x(4-750kcm)	-
4000A	42B	9x(4")	9x(4-750kcm)	-

1. ENERGY METERING POINT. ENERGY METERS SHALL BE NETWORKED TOGETHER AND SHALL BE INTEGRATED INTO THE CAMPUS SCADA SYSTEM AND DDC SYSTEM. SEE SPECIFICATIONS FOR FURTHER DETAILS.
2. SEE GROUNDING RISER DIAGRAM AND SYSTEM DETAIL ON SHEET E203 FOR FURTHER DETAIL.
3. PROVIDE (20) 4" CONDUITS FORM VAULT TO MAIN DISTRIBUTION GEAR (10) CONDUIT TO EACH ACTIVE CONDUITS AND SERVICE LATERALS AS INDICATED BY FEEDER TAG. UNUSED CONDUIT SHALL BE TAGGED AS SPARE AND PROVIDED WITH PULL STRING.
4. STUB PV CONDUIT WITHIN ELECTRICAL ROOM AT ACCESSIBLE LOCATION, CAP, LABEL AND PROVIDE PULL STRING.
5. CABLE LIMITERS FURNISHED BY EWEB. INSTALLED BY ELECTRICAL CONTRACTOR. COORDINATE SIZE, AND SCHEDULING WITH EWEB PRIOR TO CONSTRUCTION.
6. CIRCUITS SERVING A-432 & A-424 SHALL HAVE BRANCH CIRCUIT METERING AND SHALL BE NETWORKED TOGETHER AND INTEGRATED INTO THE CAMPUS SCADA SYSTEM. REFER TO PANEL SCHEDULES AND FLOOR PLANS FOR MONITORED BRANCH CIRCUITS. PROVIDE METERING FOR ADDITIONAL (8) BRANCH CIRCUITS IN ADDITION TO CIRCUITS INDICATED.
7. EWEB ELECTRICAL UTILITY METER, COORDINATE METER REQUIREMENTS WITH EWEB.
8. PROVISIONED FOR FUTURE EWEB METER.
9. MOTORS SHOWN GENERICALLY. REFER TO M&E COORDINATION AND PANEL SCHEDULES FOR FEEDER AND OVERCURRENT PROTECTION INFORMATION.
10. 4 POLE, OPEN TRANSITION ATS.
11. 100A ELEVATOR CONTROL MODULE WITH INTEGRAL SHUNT TRIP AND FIRE ALARM INTERFACE. SEE E501.5 FOR FURTHER INFORMATION. COORDINATE FUSE SIZING WITH ELEVATOR INSTALLER.
12. 1" CONDUIT FOR CONTROL WIRING.
13. ALTERNATE: ENERGY METERING POINT. WHERE INDICATED FOR HOUSE PANELS. INTENT IS FOR METERS SERVING A COMMON FLOOR IN HOUSING BUILDING TO BE VIRTUALLY AGGREGATED INTO ONE METER POINT PER FLOOR.
14. SPD BREAKER SHALL BE SIZED PER MANUFACTURER'S PUBLISHED RECOMMENDATIONS. REFER TO SPECIFICATION SECTION 264313 FOR ADDITIONAL INFORMATION.
15. BREAKER SHALL BE 100% RATED.



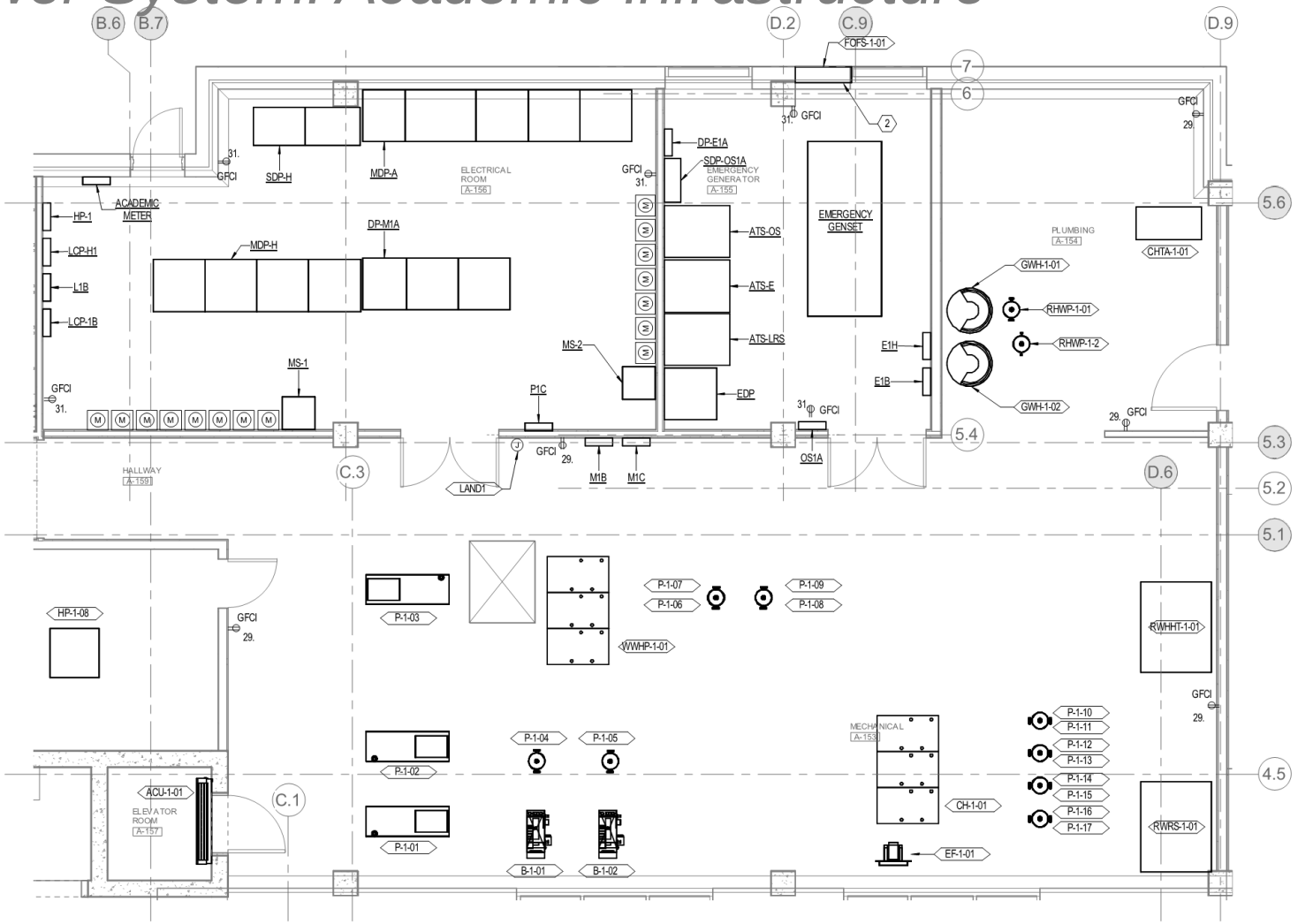
ELECTRICAL BASIS OF DESIGN

Power System: Academic Infrastructure



ELECTRICAL BASIS OF DESIGN

Power System: Academic Infrastructure

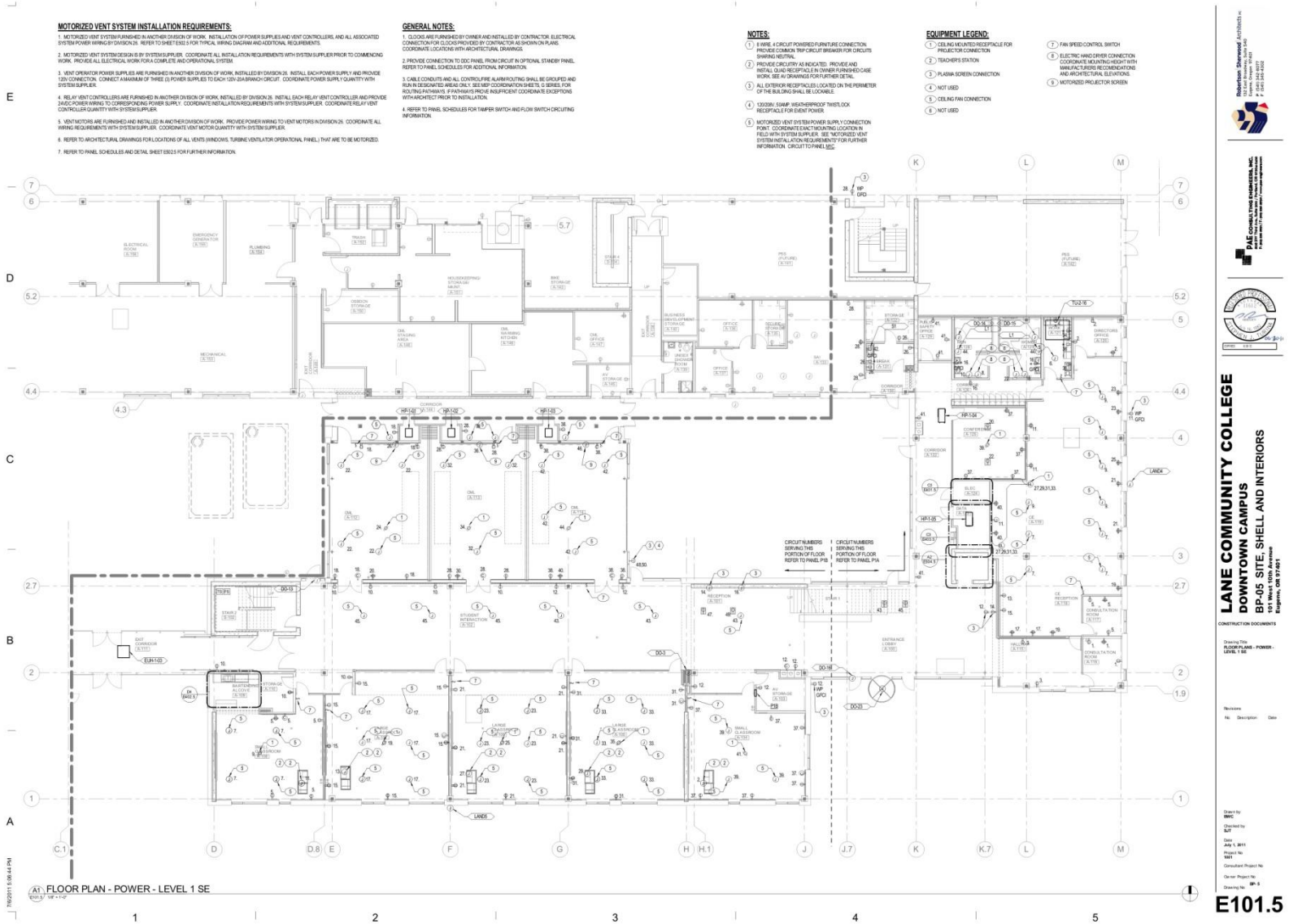


D1 E401.5 ENLARGED ELECTRICAL AND MECHANICAL ROOMS - POWER

1/4" = 1'-0"

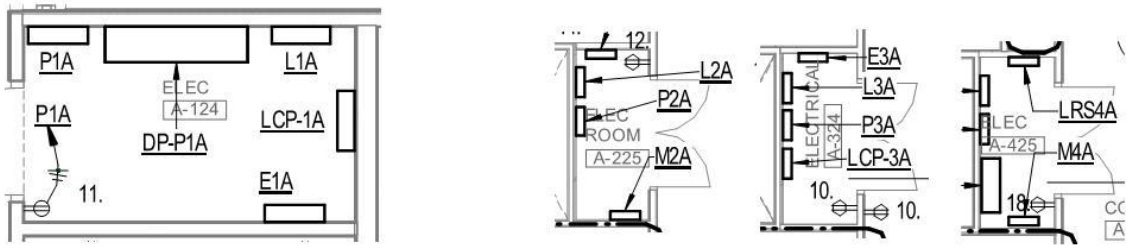
ELECTRICAL BASIS OF DESIGN

Power System: Academic Infrastructure



ELECTRICAL BASIS OF DESIGN

Power System: Academic Infrastructure

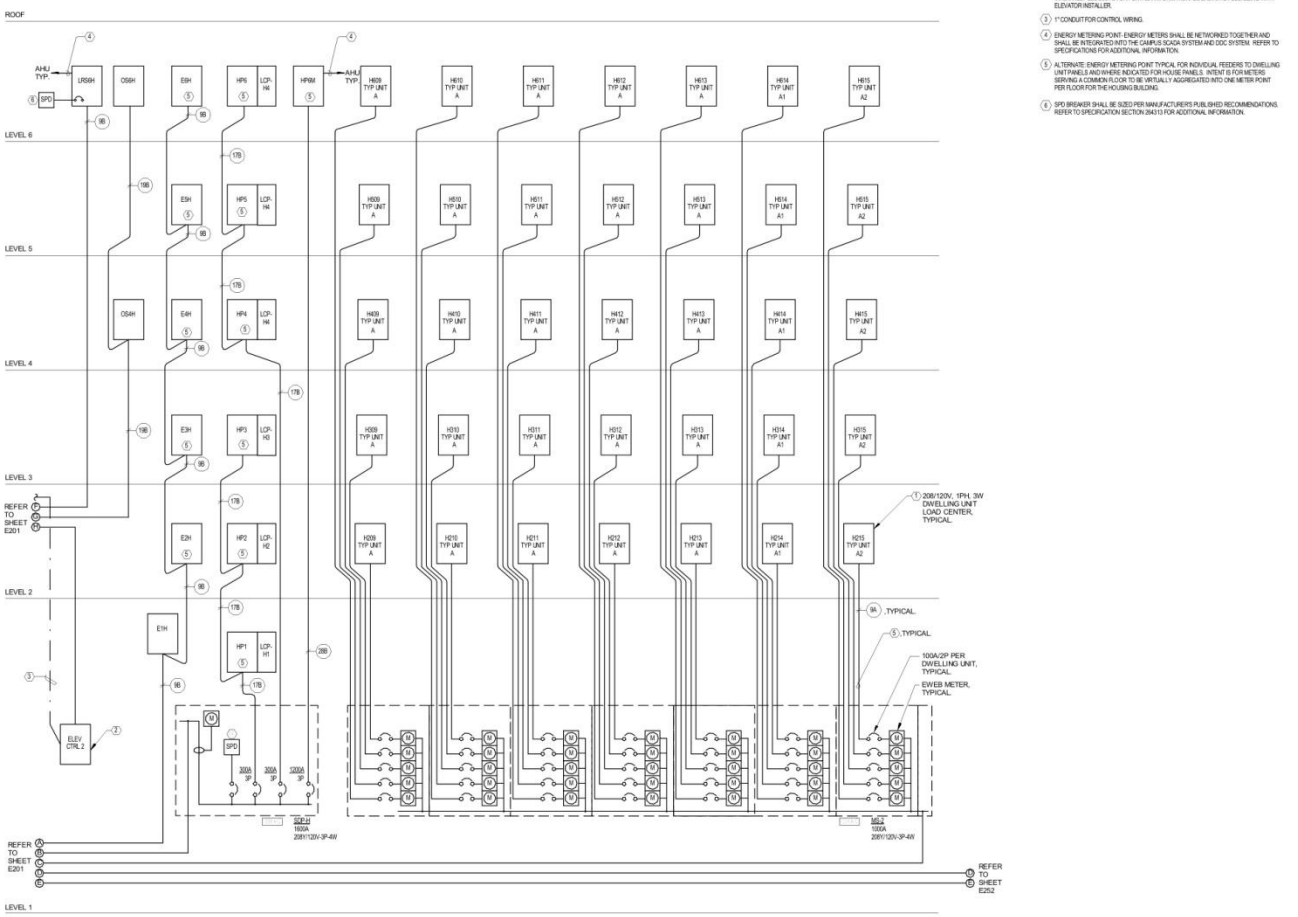


C3 ENLARGED PLAN - LEVEL ONE ELECTRICAL ROOM

E401.5 1/4" = 1'-0"

ELECTRICAL BASIS OF DESIGN

Power System: Residential Infrastructure



NOTES:

1. SINGLE PHASE PANEL IN HOUSING DWELLING UNIT. PANEL DESIGNATION CORRESPONDS TO UNIT NUMBER ON ARCHITECTURAL PLANS. FOR CIRCUITING INFORMATION REFER TO TYPICAL PANEL SCHEDULES ACCORDING TO UNIT TYPE. REFER TO 16704.5 FOR AVAILABLE FAULT CURRENT, PANEL BRACING AND PANEL PHASE INFORMATION.
2. 100A ELEVATOR CONTROL MODULE WITH INTEGRAL SHUNT TRIP AND FIRE ALARM INTERFACE. SEE E501.5 FOR FURTHER INFORMATION. COORDINATE FUSE SIZING WITH ELEVATOR INSTALLER.
3. 1" CONDUIT FOR CONTROL WIRING.
4. ENERGY METERING POINT- ENERGY METERS SHALL BE NETWORKED TOGETHER AND SHALL BE INTEGRATED INTO THE CAMPUS SCADA SYSTEM AND DDC SYSTEM. REFER TO SPECIFICATIONS FOR ADDITIONAL INFORMATION.
5. ALTERNATE- ENERGY METERING POINT TYPICAL FOR INDIVIDUAL FEEDERS TO DWELLING UNIT PANELS AND WHERE INDICATED FOR HOUSE PANELS. INTENT IS FOR METERS SERVING A COMMON FLOOR TO BE VIRTUALLY AGGREGATED INTO ONE METER POINT PER FLOOR FOR THE HOUSING BUILDING.
6. SPD BREAKER SHALL BE SIZED PER MANUFACTURER'S PUBLISHED RECOMMENDATIONS. REFER TO SPECIFICATION SECTION 264313 FOR ADDITIONAL INFORMATION.

A1 ONE LINE DIAGRAM - POWER
E251.5 NO SCALE

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BP-05 SITE, SHELL AND INTERIORS
101 West 10th Avenue
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CONSTRUCTION DOCUMENTS

Drawing Title: ONE LINE DIAGRAM - POWER - HOUSING

Revisions
No. Description Date

Drawn by: ADS
Checked by: BWC
Date: July 1, 2011
Project No: 1001
Consultant Project No:
Owner Project No:
Drawing No: BP- 5

E251.5

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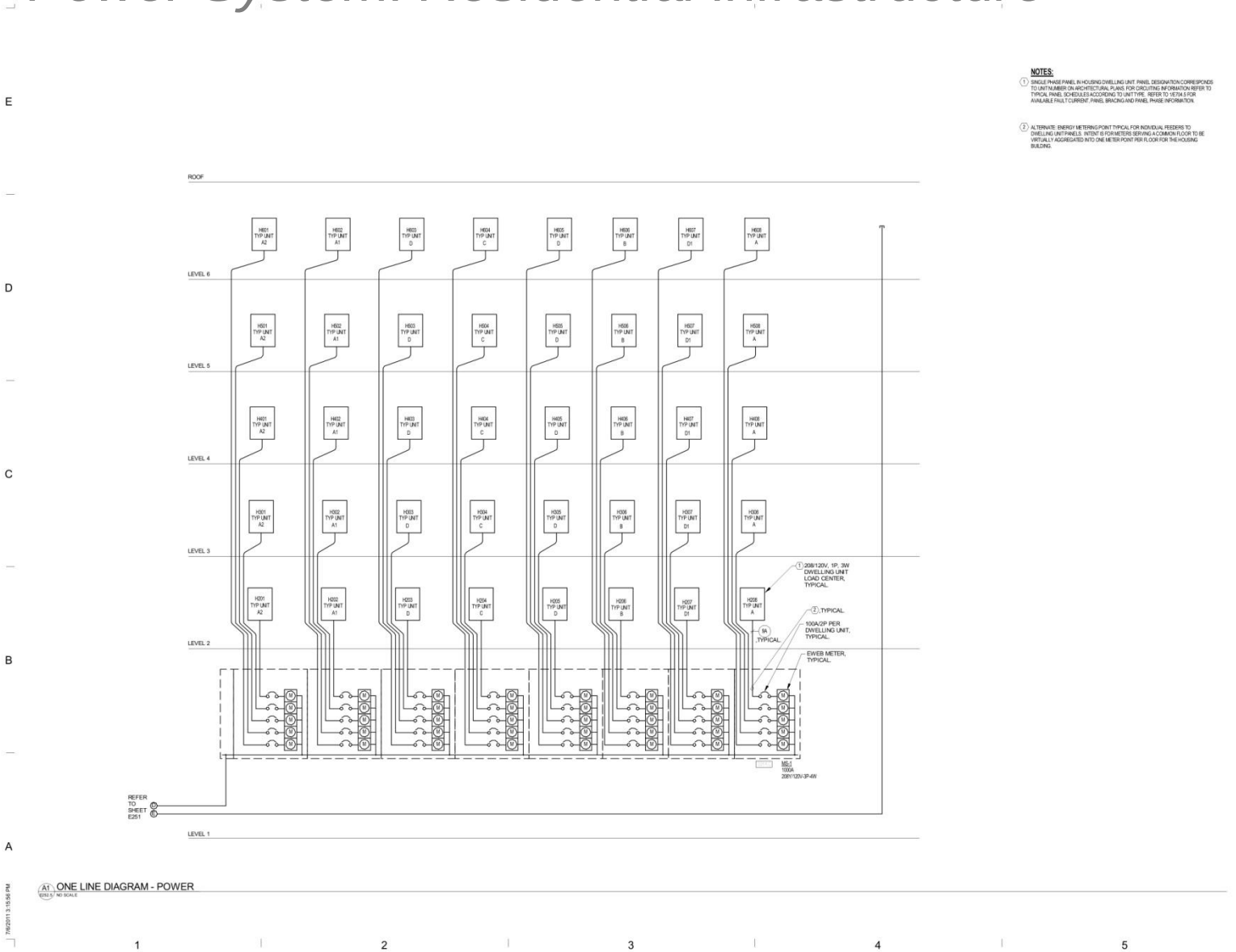
1 2 3 4 5

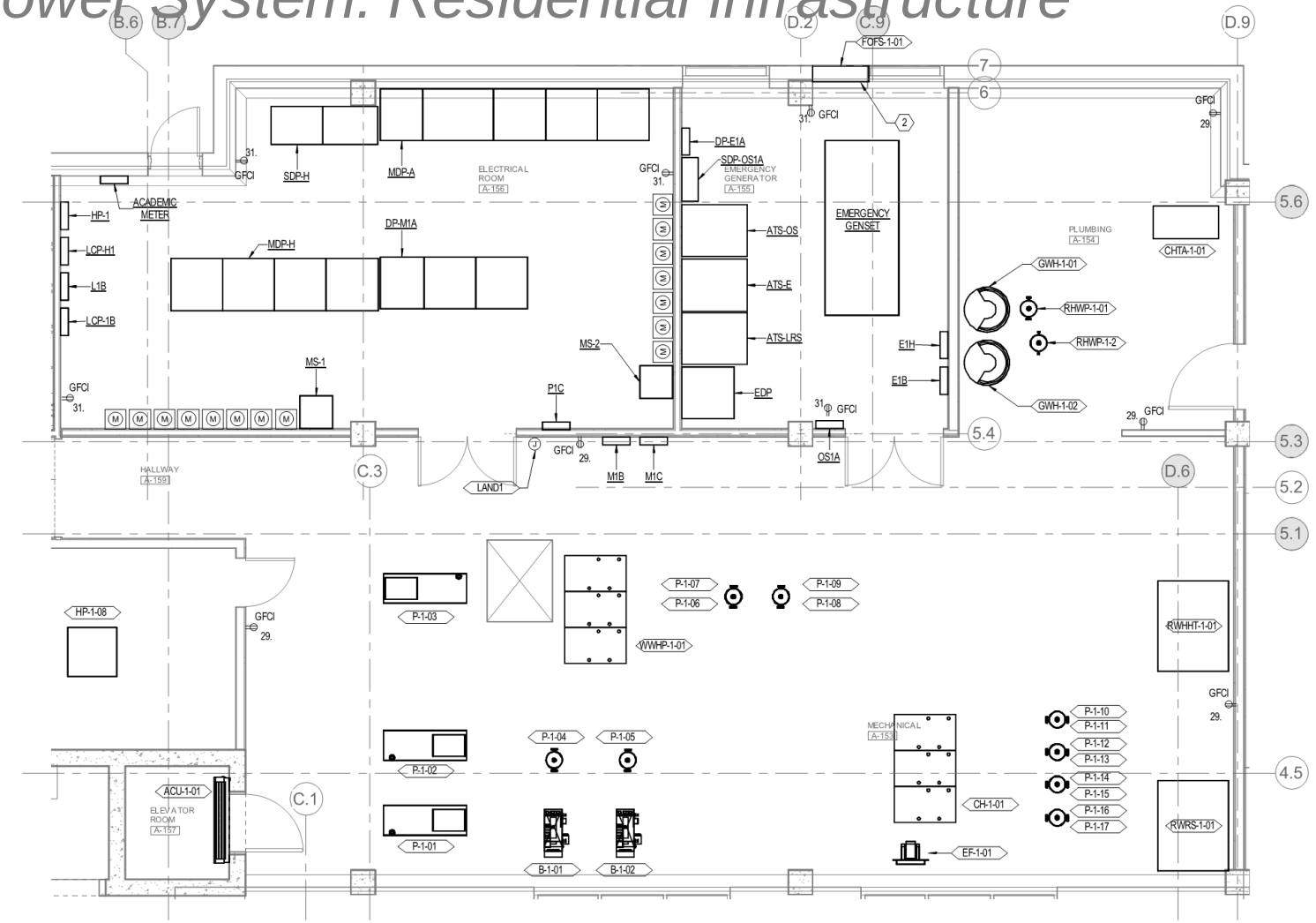
ELECTRICAL BASIS OF DESIGN

Power System: Residential Infrastructure



ELECTRICAL BASIS OF DESIGN

Power System: Residential Infrastructure

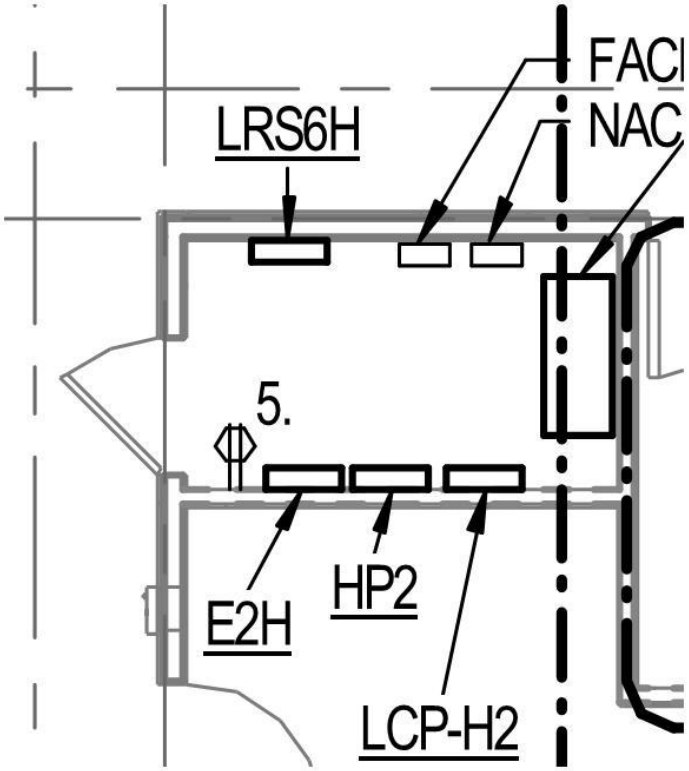


D1 E401.5 ENLARGED ELECTRICAL AND MECHANICAL ROOMS - POWER

1/4" = 1'-0"

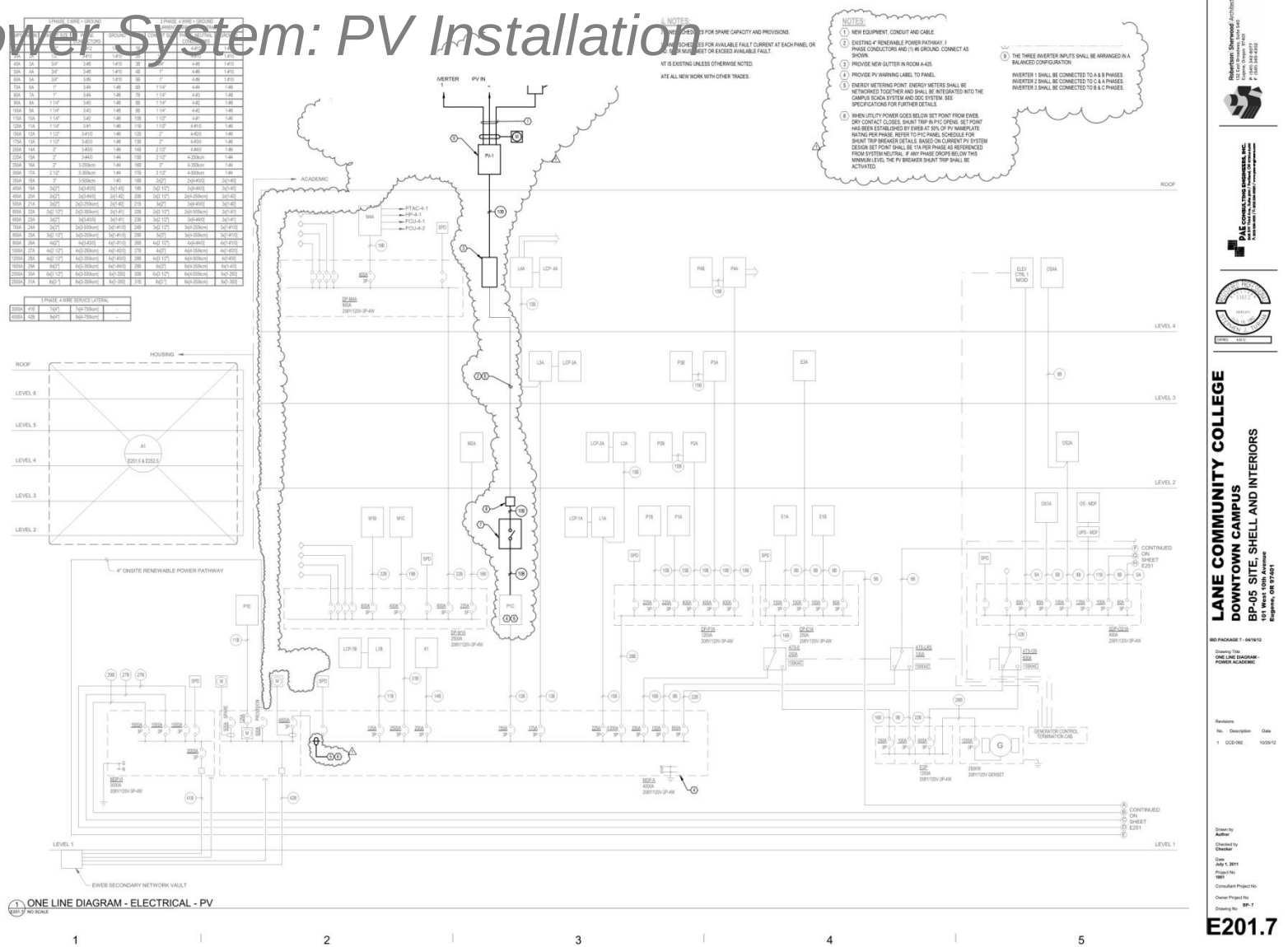
ELECTRICAL BASIS OF DESIGN

Power System: Residential Infrastructure



ELECTRICAL BASIS OF DESIGN

Power System: PV Installation



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BID PACKAGE 7 - 04/16/12

Drawing Title: ONE LINE DIAGRAM - POWER ACADEMIC

Revisions
No. Description Date
1 CCD 082 10/25/12

Drawn by: Author
Checked by: Checker
Date: July 1, 2011
Project No: 1001
Consultant Project No:
Owner Project No:
Drawing No: BP- 7

E201.7

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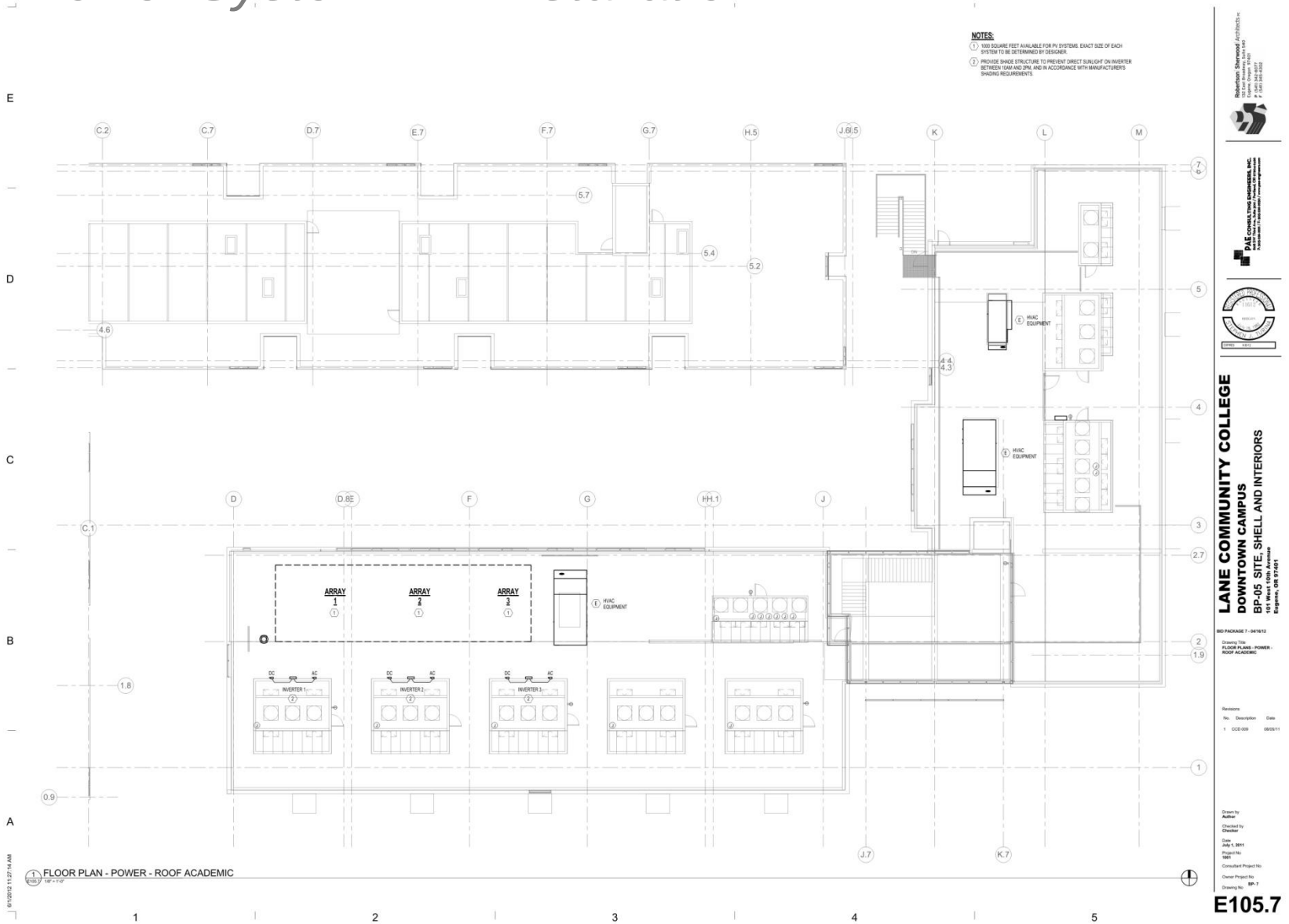
ELECTRICAL BASIS OF DESIGN

Power System: PV Installation



ELECTRICAL BASIS OF DESIGN

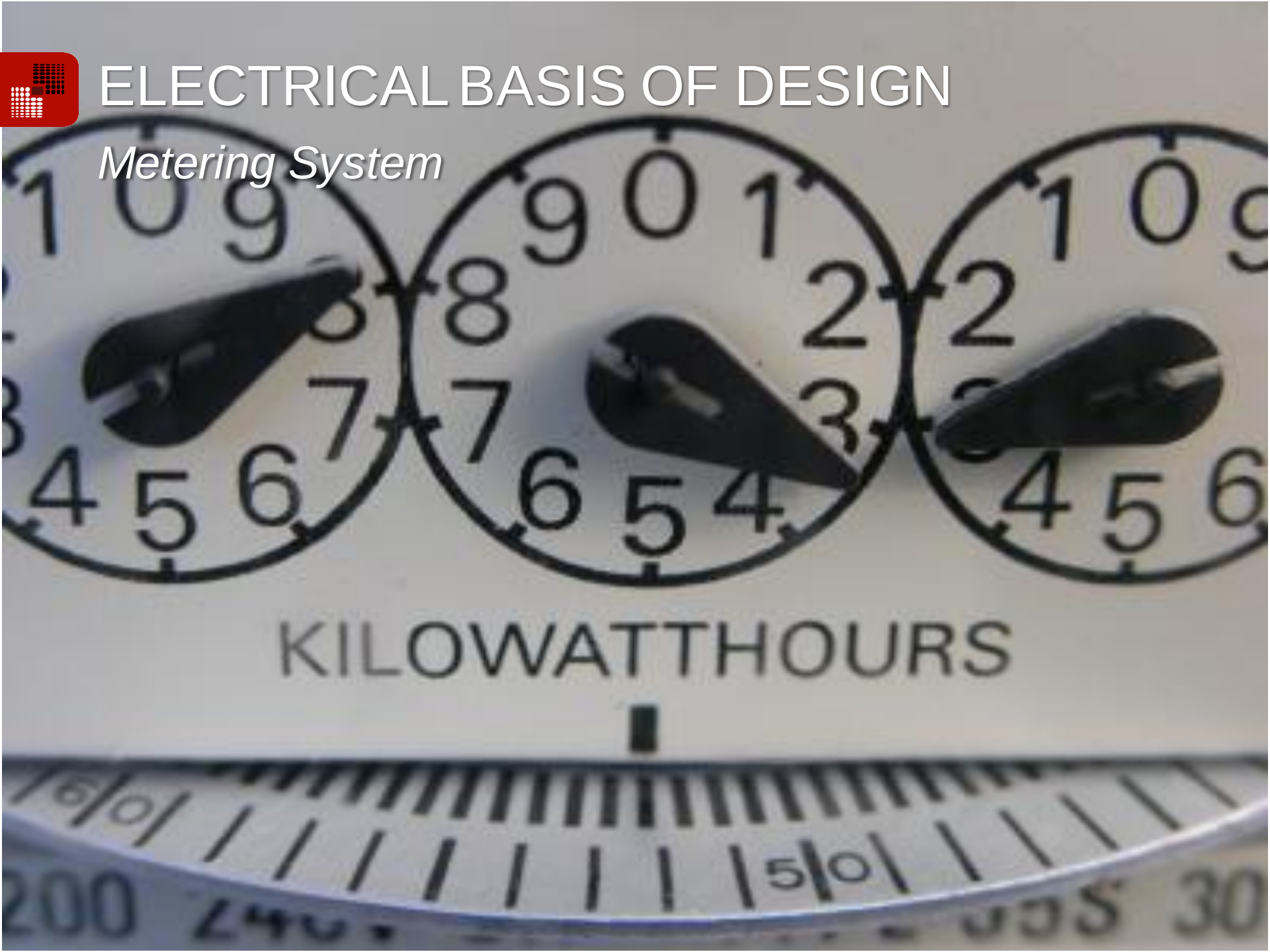
Power System: PV Installation

Photovoltaic Array

Image courtesy of SRG Partnership

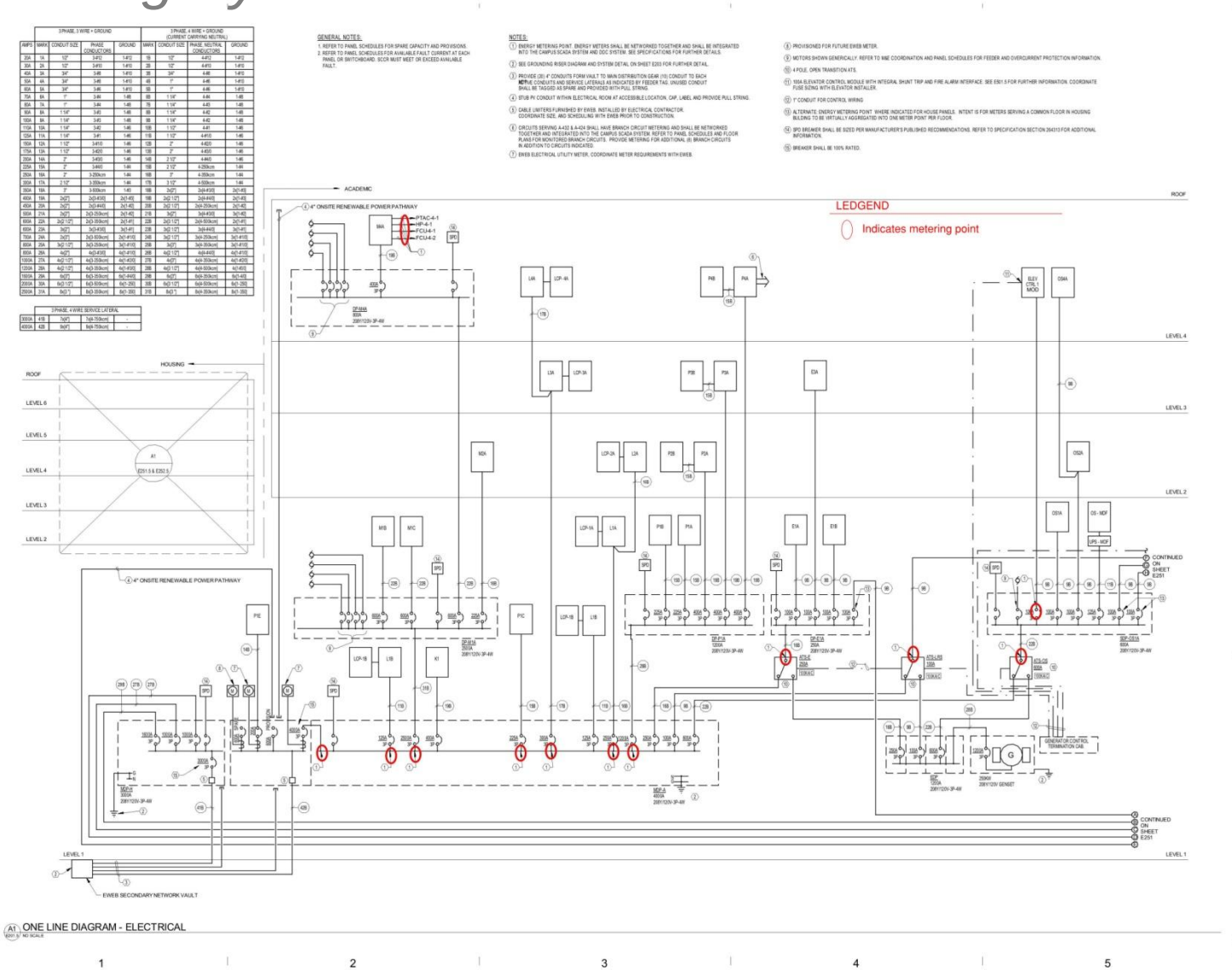
ELECTRICAL BASIS OF DESIGN

Metering System



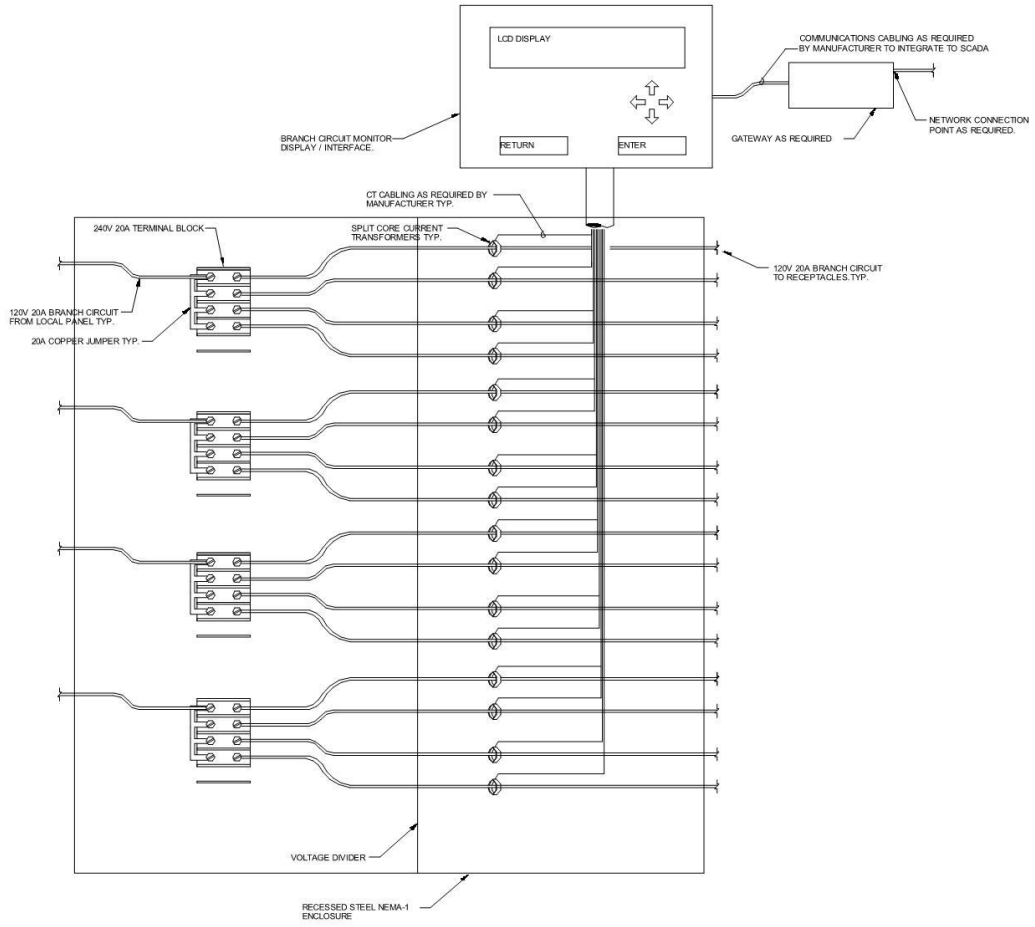
ELECTRICAL BASIS OF DESIGN

Metering System



ELECTRICAL BASIS OF DESIGN

Metering System



A3 E502.5 NO SCALE

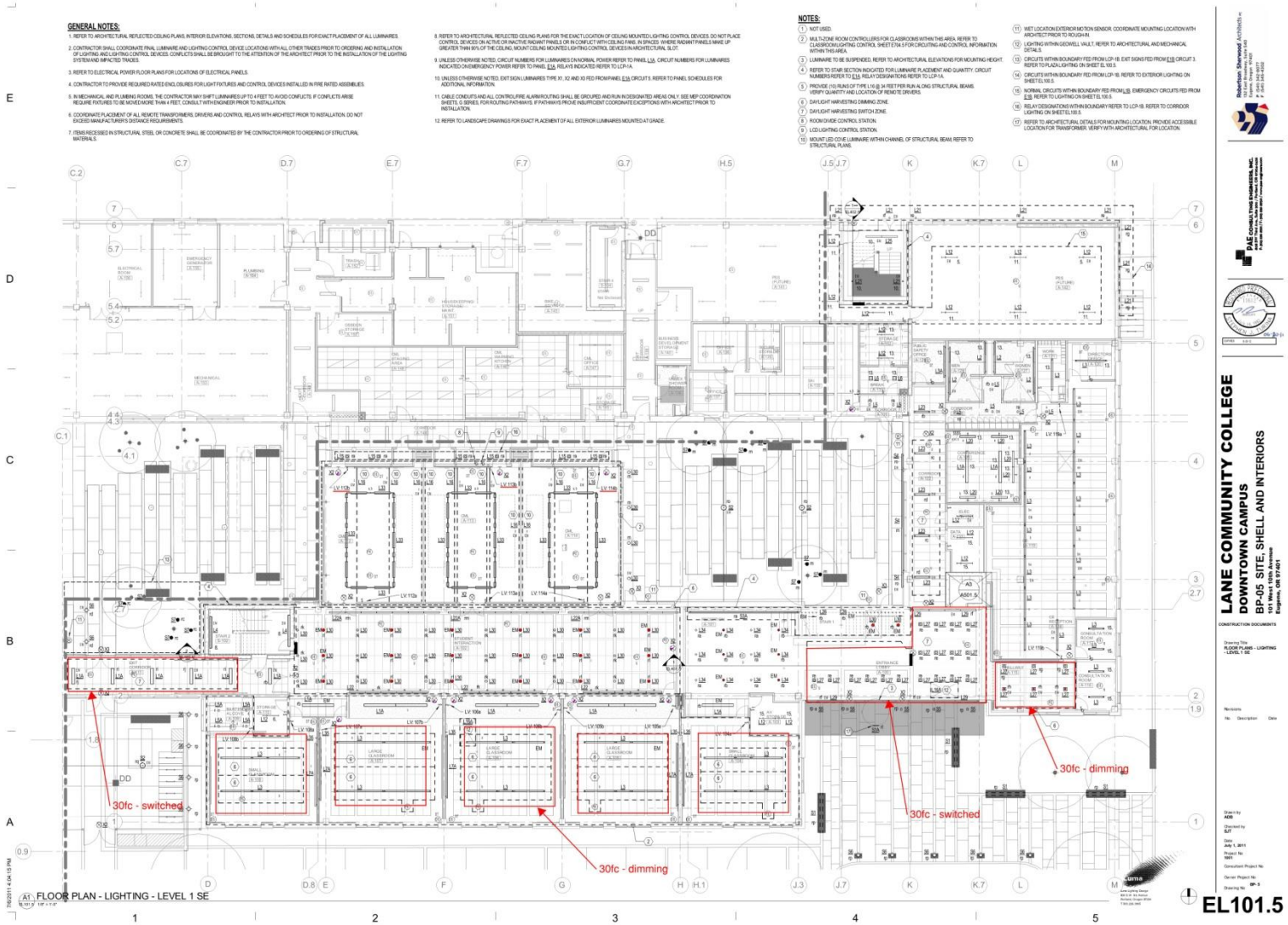
RECEPTACLE LEVEL METERING

ELECTRICAL BASIS OF DESIGN

Lighting System

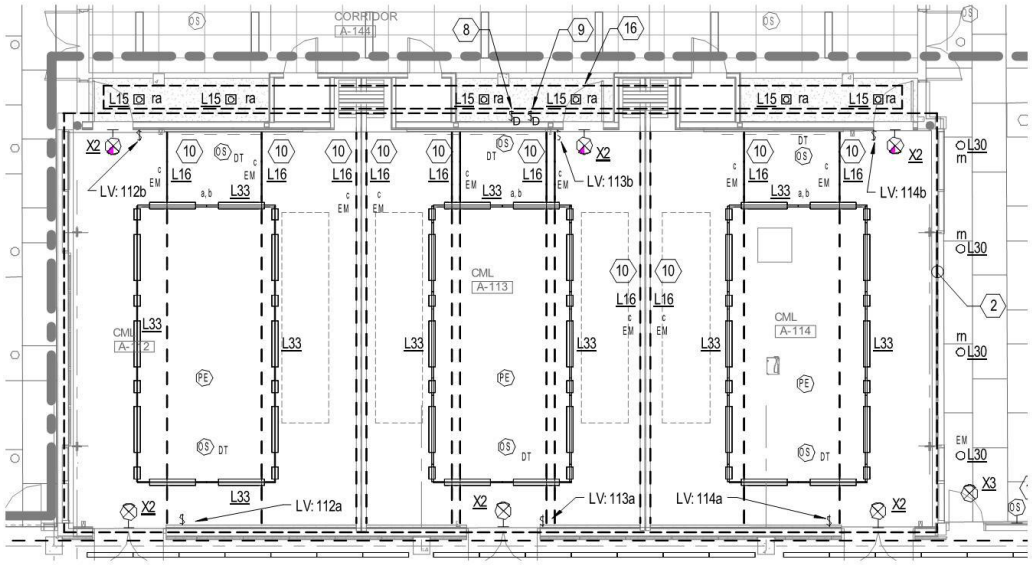
ELECTRICAL BASIS OF DESIGN

Academic Strategies and Control



ELECTRICAL BASIS OF DESIGN

Academic Strategies and Control



NOTES:

1. NOT USED.
2. MULTI-ZONE ROOM CONTROLLERS FOR CLASSROOMS WITHIN THIS AREA. REFER TO CLASSROOM LIGHTING CONTROL SHEET E704.5 FOR CIRCUITING AND CONTROL INFORMATION WITHIN THIS AREA.
3. LUMINAIRE TO BE SUSPENDED. REFER TO ARCHITECTURAL ELEVATIONS FOR MOUNTING HEIGHT.
4. REFER TO STAIR SECTION INDICATED FOR LUMINAIRE PLACEMENT AND QUANTITY. CIRCUIT NUMBERS REFER TO E1A. RELAY DESIGNATIONS REFER TO LCP-1A.
5. PROVIDE (10) RUNS OF TYPE L16 @ 34 FEET PER RUN ALONG STRUCTURAL BEAMS. VERIFY QUANTITY AND LOCATION OF REMOTE DRIVERS.
6. DAYLIGHT HARVESTING DIMMING ZONE.
7. DAYLIGHT HARVESTING SWITCH ZONE.
8. ROOM DIVIDE CONTROL STATION.
9. LCD LIGHTING CONTROL STATION.
10. MOUNT LED COVE LUMINAIRE WITHIN CHANNEL OF STRUCTURAL BEAM. REFER TO STRUCTURAL PLANS.
11. WET LOCATION EXTERIOR MOTION SENSOR. COORDINATE MOUNTING LOCATION WITH ARCHITECT PRIOR TO ROUGH-IN.
12. LIGHTING WITHIN GEOWELL VAULT. REFER TO ARCHITECTURAL AND MECHANICAL DETAILS.
13. CIRCUITS WITHIN BOUNDARY FED FROM LCP-1B. EXIT SIGNS FED FROM E1B CIRCUIT 3. REFER TO PLAZA LIGHTING ON SHEET EL100.5.
14. CIRCUITS WITHIN BOUNDARY FED FROM LCP-1B. REFER TO EXTERIOR LIGHTING ON SHEET EL100.5.
15. NORMAL CIRCUITS WITHIN BOUNDARY FED FROM L1B. EMERGENCY CIRCUITS FED FROM E1B. REFER TO LIGHTING ON SHEET EL100.5.
16. RELAY DESIGNATIONS WITHIN BOUNDARY REFER TO LCP-1B. REFER TO CORRIDOR LIGHTING ON SHEET EL100.5.
17. REFER TO ARCHITECTURAL DETAILS FOR MOUNTING LOCATION. PROVIDE ACCESSIBLE LOCATION FOR TRANSFORMER. VERIFY WITH ARCHITECTURAL FOR LOCATION.

ELECTRICAL BASIS OF DESIGN

Academic Strategies and Control

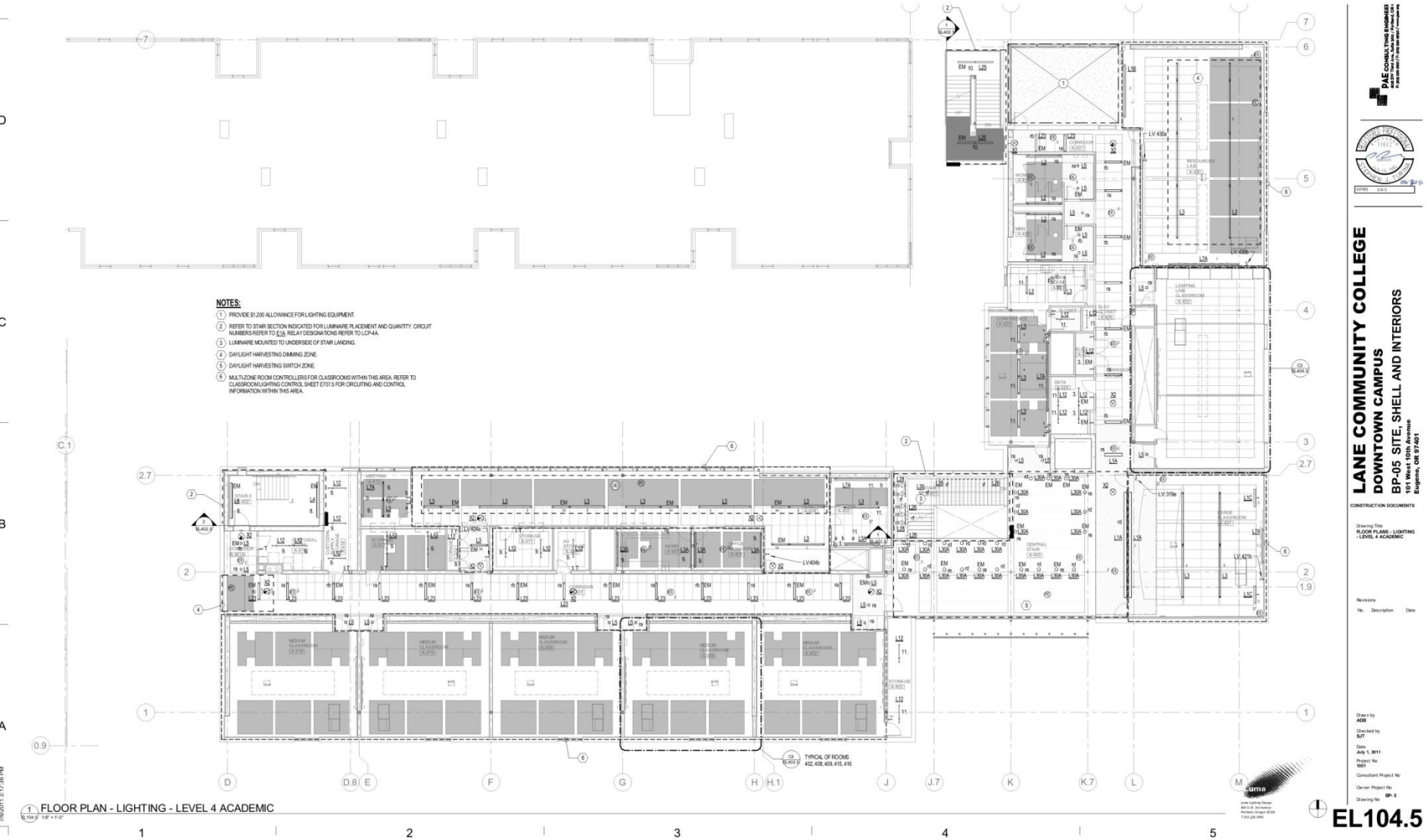
CML LIGHTING CONTROL UNITS																
SYSTEM CONTROL INPUTS																
Room/Area	Switch Plate/Input	Switch	Switch Description	Control Unit ID	Relay											Notes
					a	b	c	d	e	ae	be	ce	de	Shade Ctrl	HVAC	
A-112																
	Photo Cell	-	PE Cell Daylight Dimming	112	X	X										3.
	Occupancy Sensor	-	Manual On/Auto Off	112	X	X	X							X	X	1,2,5.
	Occupancy Sensor	-	Manual On/Auto Off	112	X	X	X							X	X	1,2,5.
	LV112a	S112aa	Relay a Dim Raise/Lower	112	X											4,
	LV112a	S112ab	Relay b Dim Raise/Lower	112		X										4,
	LV112a	S112ac	Relay c Dim Raise/Lower	112			X									4,
	LV112b	S112ba	Relay a Dim Raise/Lower	112	X											4,
	LV112b	S112bb	Relay b Dim Raise/Lower	112		X										4,
	LV112b	S112bc	Relay c Dim Raise/Lower	112			X									4,
A-113																
	Photo Cell	-	PE Cell Daylight Dimming	113	X	X										3.
	Occupancy Sensor	-	Manual On/Auto Off	113	X	X	X							X	X	1,2,5.
	Occupancy Sensor	-	Manual On/Auto Off	113	X	X	X							X	X	1,2,5.
	LV113a	S113aa	Relay a Dim Raise/Lower	113	X											4,
	LV113a	S113ab	Relay b Dim Raise/Lower	113		X										4,
	LV113a	S113ac	Relay c Dim Raise/Lower	113			X									4,
	LV113b	S113ba	Relay a Dim Raise/Lower	113	X											4,
	LV113b	S113bb	Relay b Dim Raise/Lower	113		X										4,
	LV113b	S113bc	Relay c Dim Raise/Lower	113			X									4,
A-114																
	Photo Cell	-	PE Cell Daylight Dimming	114	X	X										3.
	Occupancy Sensor	-	Manual On/Auto Off	114	X	X	X							X	X	1,2,5.
	Occupancy Sensor	-	Manual On/Auto Off	114	X	X	X							X	X	1,2,5.
	LV114a	S114aa	Relay a Dim Raise/Lower	114	X											4,
	LV114a	S114ab	Relay b Dim Raise/Lower	114		X										4,
	LV114a	S114ac	Relay c Dim Raise/Lower	114			X									4,
	LV114b	S114ba	Relay a Dim Raise/Lower	114	X											4,
	LV114b	S114bb	Relay b Dim Raise/Lower	114		X										4,
	LV114b	S114bc	Relay c Dim Raise/Lower	114			X									4,

Notes:

1) Occupancy sensor shall control HVAC system with Auto On/Auto Off sequence.
2) Occupancy Sensor to turn Off all lights. Presets unaffected.
3) Photocell shall Dim or Switch fixtures as indicated on floor plans as fixtures within daylighting zone.
4) When rooms divisions are collapsed by room control station shown on EL101.5 switch shall control relay of same designation in adjoining space. When room dividers are in place, switch shall resume control of local relay only. Provide 5 button present wall station at each switch bank.
5) Provide control wiring from relay indicated to shade controller. Coordinate controller location in field with system provider.

ELECTRICAL BASIS OF DESIGN

Academic Strategies and Control

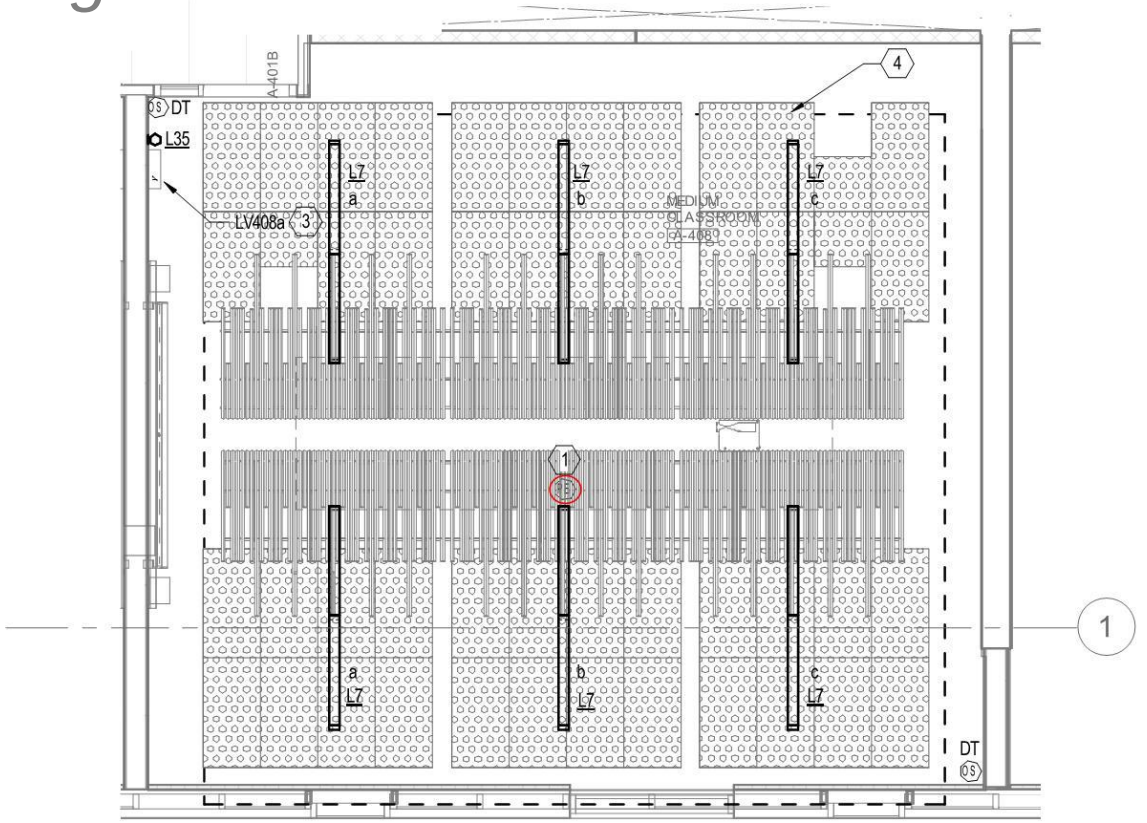


ELECTRICAL BASIS OF DESIGN

Academic Strategies and Control

NOTES:

1. OPEN LOOP PHOTOCELL. MOUNT IN SKYLIGHT WELL.
2. MOUNT ABOVE REFLECTOR PER ARCHITECTURAL DETAIL.
3. MULTI-ZONE CONTROLLER DIMMER STATION.
4. DAYLIGHT HARVEST DIMMING ZONE.

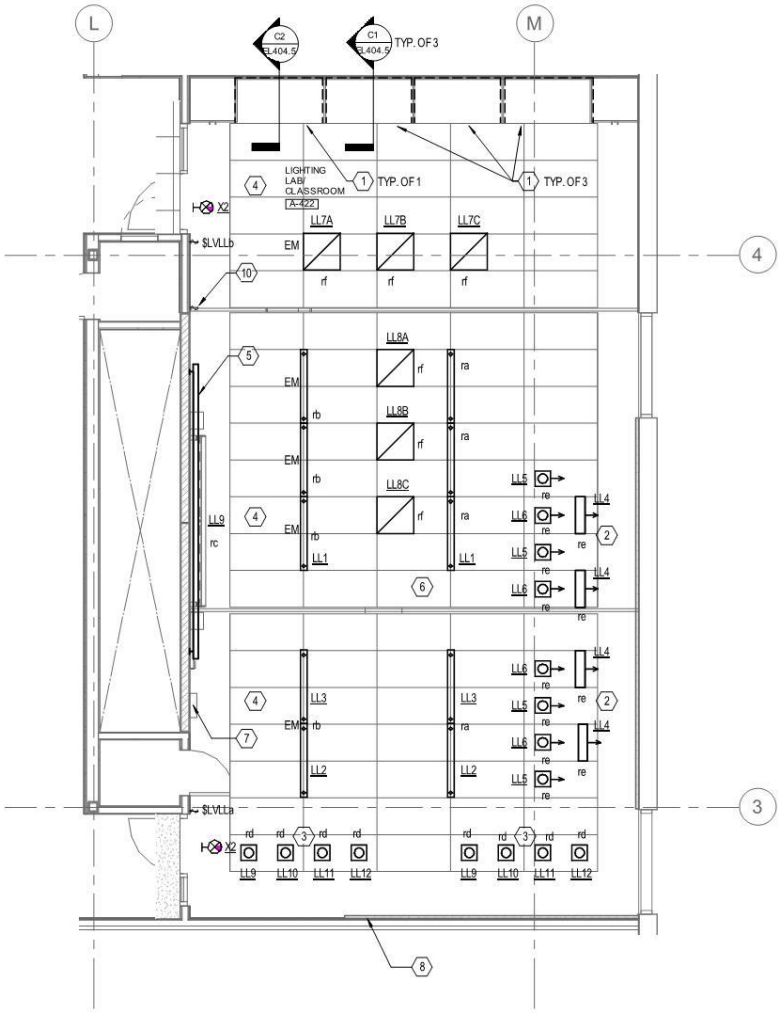


C4 PARTIAL PLAN - LEVEL 4 ACADEMIC - TYPICAL CLASSROOM - LIGHTING

EL403.5 1/4" = 1'-0"

ELECTRICAL BASIS OF DESIGN

Academic Strategies and Control



NOTES:

1. REFER TO LIGHT BOX SECTION DETAILS AS INDICATED ON PLAN.
2. FIXED WALL WASH DISPLAY.
3. FIXED DOWNLIGHT DISPLAY.
4. PLUG STRIPS LOCATED ABOVE SUSPENDED CEILINGS FOR DEMONSTRATION LUMINAIRES. REFER TO LCP-LL SCHEDULE FOR CIRCUITING AND CONTROL.
5. HALF OF WALL TO BE WIRED TO RECEIVE (30) LAMP/BALLAST DISPLAYS.
6. PROVIDE POWER AND CIRCUITING FOR 24 ZONES OF CONTROL WITH A LOW VOLTAGE WALL STATION FOR INDEPENDENT CONTROL OF EACH ZONE. PROVIDE 24 LITHONIA RE-LOC CONNECTIONS IN CEILING. REFER TO LCP-LL SCHEDULE FOR CIRCUITING AND CONTROL. PROVIDE RE-LOC CABLE AND CONNECTIONS AS REQUIRED.
7. LIGHTING CONTROL PANEL LPC-LL. REFER TO SCHEDULE ON E708.5.
8. PROVIDE LARGE FORMAT LCD OR PLASMA DISPLAY SCREEN HERE.
9. TYPE LL15 NEEDS REQUIRED CABLING FROM SOLAR COLLECTOR ON ROOF TYPE S9. REFER TO EL105.5 FOR LOCATION.
10. LOW VOLTAGE SWITCH BANK WITH THE FOLLOWING SWITCHES:

$LVLLab
$LVLLc
$LVLLd
$LVLLe
$LVLLf
$LVLLg
$LVLLh
$LVLLi
$LVLLj
$LVLLk
$LVLLl
$LVLLm
$LVLLn
$LVLLo
$LVLLp
$LVLLq
$LVLLr
$LVLLs
$LVLLt
$LVLLu
$LVLLv
$LVLLw
$LVLLx
$LVLLy
$LVLLz
$LVLLaa
$LVLLbb
$LVLLcc
$LVLLdd
$LVLLee
$LVLLff

GENERAL NOTES:

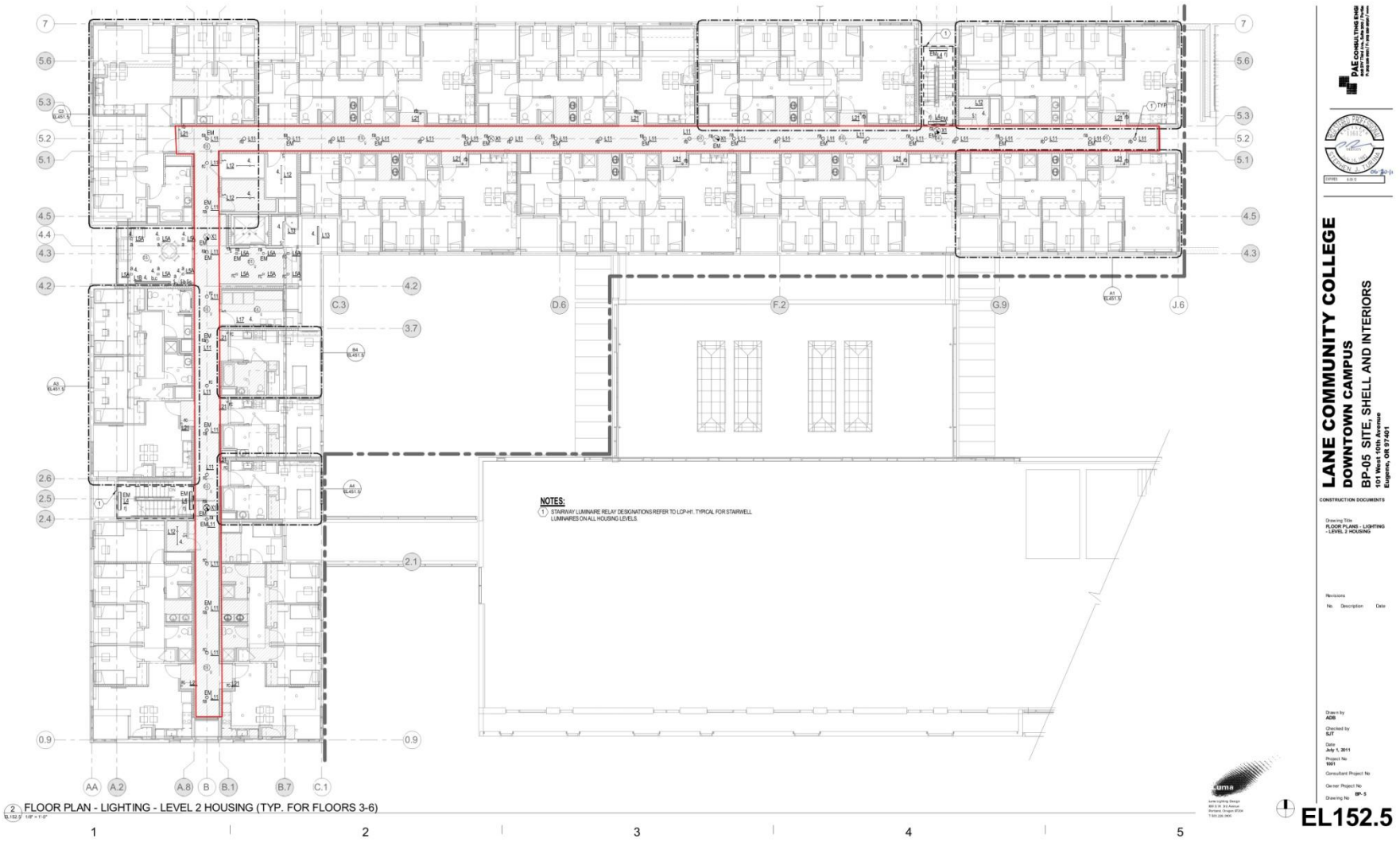
1) RELAY DESIGNATIONS REFER TO LCP-LL.

2) EXIT SIGN LUMINAIRES FED FROM PANEL E3A CIRCUIT 13.

C3 ENLARGED PLAN - LIGHTING LAB/CLASSROOM
EL.404.5 1/4" = 1'-0"

ELECTRICAL BASIS OF DESIGN

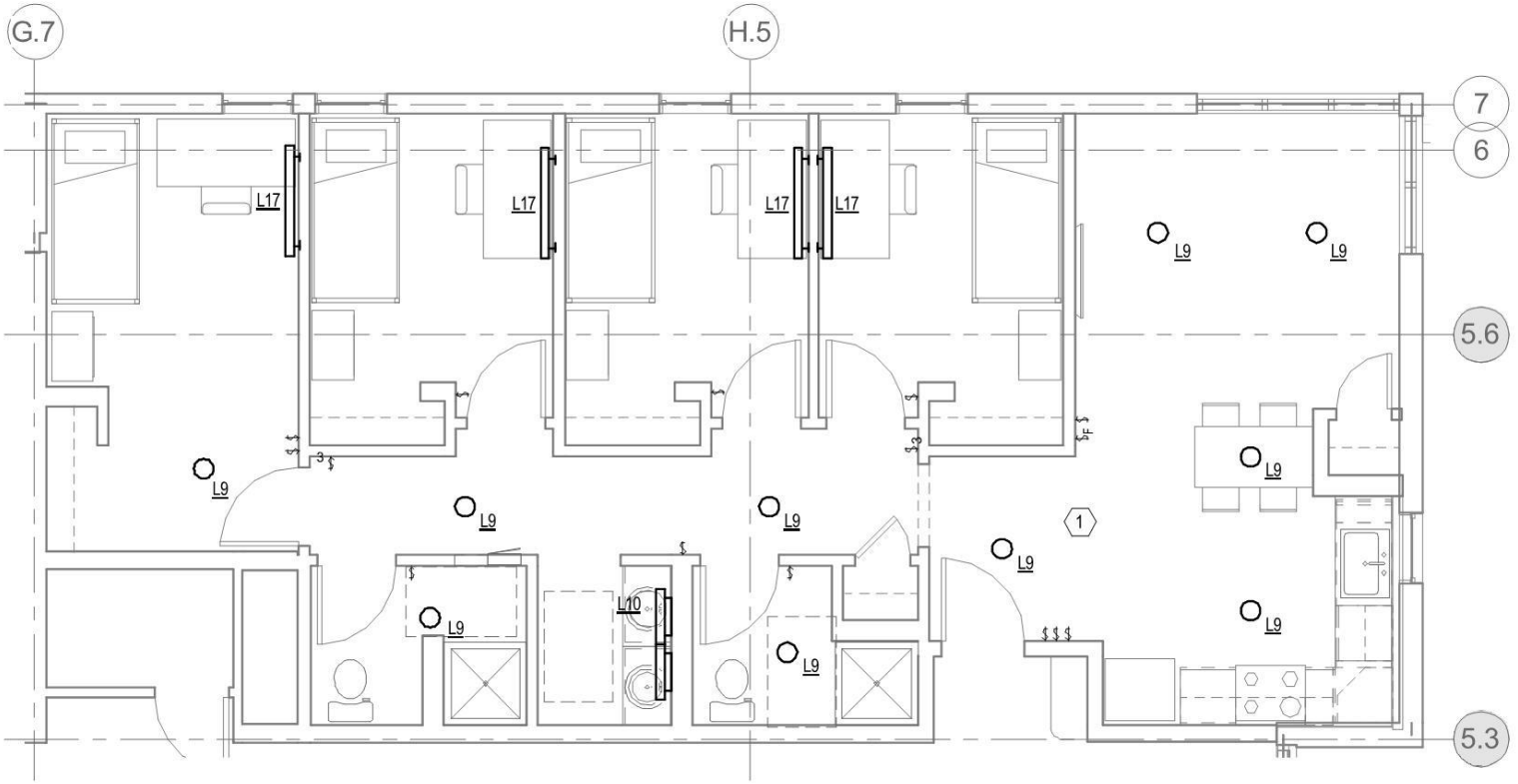
Residential Strategies and Control



2 FLOOR PLAN - LIGHTING - LEVEL 2 HOUSING (TYP. FOR FLOORS 3-6)

ELECTRICAL BASIS OF DESIGN

Residential Strategies and Control



B1 EL451.5 PARTIAL PLAN - UNIT TYPE A1 - LIGHTING

1/4" = 1'-0"

ELECTRICAL BASIS OF DESIGN

Any questions?