

Chapter 2 - Analysis of Existing Systems

This chapter provides an overview of the existing utility systems that currently serve the CSULB Campus. A description of each utility system, including current conditions and identified problems is presented in this Chapter. Information on each utility system was obtained through field surveys, existing record documents and discussions with campus staff knowledgeable with utility systems.

Domestic Fire & Water

Network Distribution

The Campus combined Domestic and Fire Water system is served by several Long Beach Water Department (LBWD) mains located in the surrounding streets. There are water meters of various sizes located throughout the Campus that connect the LBWD mains to the Campus water lines. The Campus water system consists of four separate networks. The majority of the Campus is connected to the main Campus loop (Network #1) which is comprised of several 6-inch and 8-inch sub-loops that connect to various LBWD mains in the surrounding streets. The area around Parkside Commons residence hall is served by an 8-inch loop (Network #2) that connects to the 12-inch LBWD main in Atherton. Two individual buildings, Child Development Center (CDC) and Housing & Residential Life (HRL), also have their own meters and services and are separate from Networks 1 and 2. The chart below summarizes which water meters connect to which of the four water Networks.

Water Meter Connections

Meter #	Serves
3839-2300-0	Network 1
3823-2650-1	Network 1
2939-2900-0	Network 1
2939-7604-0	Network 1
3823-3254-0	Network 1
2939-3300-0	Network 1
3923-3240-0	Network 2
3823-3256-0	Child Development Center
3923-3252-0	Housing & Residential Life

Four meters are located along the northern edge of Campus, served by the 12-inch LBWD main in Atherton Drive, including an 8-inch meter and asbestos cement pipe (ACP) service near the CDC building, a 10-inch meter and 12-inch ductile iron pipe (DIP) service near the Dance Center, and two 2-inch meters and services connecting to the individual buildings, Child Development Center and Housing & Residential Life. A 6-inch meter and ACP service is located on the western edge of Campus, served by the 12-inch LBWD main in Bellflower Boulevard near State University Drive. An 8-inch meter and ACP service is located on the southern edge of Campus, served by the 30-inch LBWD main in Seventh Street near Lot 6. Two meters are located in the middle of Campus, served by the 12-inch LBWD main that runs east-west through the Campus in State University Drive, including a 2-inch meter and service near Brotman Hall and an 8-inch meter and DIP service near the Central Plant. And finally, a 6-inch meter and ACP service is located on the eastern edge of Campus, served by the 20-inch main in Palo Verde Avenue near Facilities Management. Sheets WT-1 through WT-3 show the existing domestic and fire water system, as described above.

According to conversations with Campus Facilities staff, most of the Campus water mains date back to the original Campus construction in the 1940's and 1950's, and are comprised of Transite or Asbestos Cement Pipe (ACP) mains. The newer additions to the water system consist of Cast Iron Pipe (CIP) or Polyvinyl Chloride (PVC) water mains. Some of the transite lines are 50 to 60 years old and are nearing the end of their lifespan. Based on discussions with Campus representatives, the water pressure provided by the LBWD is generally between 45-50 psi. Due to low pressures, some of the building sprinkler systems in the southern part of campus are not equipped with backflow preventers, because the head losses caused by the devices would prevent the water from having adequate pressure to properly serve the buildings. Currently, the sprinkler systems in the Library, Psychology, Faculty Office 5, Engineering Technology and Vivian Engineering Center do not have backflow preventers. Plumbing code requires backflow preventers for each building, so those buildings are not up to code. The current water network is also deficient in several areas. There is insufficient pressure in the lines in the southern portion of Campus, which causes sinks and toilets in the upper floors of some buildings to not always function properly.

Based on discussions with representatives from the Campus, the current water network is deficient in several areas. There is insufficient pressure in the lines in the southern portion of Campus, which causes sinks and toilets in the upper floors of some buildings to function improperly at times. There are several contributing factors to the lack of pressure, including the small size of the pipes comprising the water network and the higher elevation of this portion of Campus. The higher elevation, coupled with the multiple story buildings in the area, require higher pressures to deliver the water. The small pipe network, consisting mostly of 6-inch lines, causes significant pressure losses on the way to delivering the water to the buildings, and also limits the available flows. The University is currently in the process of installing a booster pump in the southern portion of Campus to help alleviate the problems with low water pressures, however the specific details of that project were not available and were therefore not included in the water modeling. The desirable ultimate build-out condition for the Campus will not require the use of booster pumps, so not including the proposed booster pump in the model is preferable, both in modeling the existing condition and the ultimate condition.

TABLE 1 - Historical Domestic Water Use - 7/03-6/05

Meter No	Description	Size	Calculated Avg Day (gpd)	In Session			
				Calculated Avg Day (gpd)	Calculated Avg Day (gpm)	Calculated Max Day (gpm)	Calculated Pk Hour (gpm)
3839-2300-0	Campus	6"	68,352	430,618	299	897	1,794
3823-2650-1	Campus	1.5"	3,244	20,435	14	43	85
3823-3256-0	CDC	2"	2,439	15,365	11	32	64
2939-2900-0	Main Campus	8"	40,832	257,243	179	536	1,072
2939-7604-0	Campus	8"	49,088	309,254	215	644	1,289
3823-3254-0	PAC	10"	129,599	816,473	567	1,701	3,402
2939-3300-0	Campus	6"	21,981	138,483	96	289	577
3923-3240-0	Housing	8"	40,077	252,485	175	526	1,052
3923-3252-0	Housing	2"	135	852	1	2	4
Total =			355,747	2,241,208	1,556	4,669	9,338



TABLE 2 - Domestic Water Consumption – 7/04-6/05

Month	Network	Consumption (HCF)	Consumption (Gallons)	Cost	Cost per HCF	Cost per Gallon
Jul-04	Network 1	15,296	11,442,203	\$25,375	\$1.66	\$0.0022
	Network 2	1,250	935,065	\$2,272	\$1.82	\$0.0024
	CDC	152	113,704	\$271	\$1.78	\$0.0024
	HRL	6	4,488	\$45	\$7.50	\$0.0100
Aug-04	Network 1	13,752	10,287,210	\$22,827	\$1.66	\$0.0022
	Network 2	835	624,623	\$1,597	\$1.91	\$0.0026
	CDC	162	121,184	\$283	\$1.75	\$0.0023
	HRL	5	3,740	\$40	\$8.00	\$0.0107
Sep-04	Network 1	17,747	13,275,678	\$29,068	\$1.64	\$0.0022
	Network 2	2,626	1,964,384	\$4,382	\$1.67	\$0.0022
	CDC	147	109,964	\$261	\$1.78	\$0.0024
	HRL	5	3,740	\$41	\$8.20	\$0.0110
Oct-04	Network 1	15,329	11,466,888	\$26,631	\$1.74	\$0.0023
	Network 2	2,909	2,176,083	\$5,071	\$1.74	\$0.0023
	CDC	92	68,821	\$187	\$2.03	\$0.0027
	HRL	5	3,740	\$46	\$9.20	\$0.0123
Nov-04	Network 1	11179	8,362,473	\$19,803	\$1.77	\$0.0024
	Network 2	2,487	1,860,405	\$4,366	\$1.76	\$0.0023
	CDC	18	13,465	\$65	\$3.61	\$0.0048
	HRL	4	2,992	\$42	\$10.50	\$0.0140
Dec-04	Network 1	6872	5,140,613	\$12,884	\$1.87	\$0.0025
	Network 2	1,314	982,940	\$2,478	\$1.89	\$0.0025
	CDC	15	11,221	\$61	\$4.07	\$0.0054
	HRL	3	2,244	\$42	\$14.00	\$0.0187
Jan-05	Network 1	7244	5,418,888	\$13,321	\$1.84	\$0.0025
	Network 2	687	513,912	\$1,430	\$2.08	\$0.0028
	CDC	14	10,473	\$56	\$4.00	\$0.0053
	HRL	5	3,740	\$42	\$8.40	\$0.0112
Feb-05	Network 1	8859	6,626,992	\$18,238	\$2.06	\$0.0028
	Network 2	2,460	1,840,208	\$4,333	\$1.76	\$0.0024
	CDC	16	11,969	\$63	\$3.94	\$0.0053
	HRL	5	3,740	\$45	\$9.00	\$0.0120
Mar-05	Network 1	12990	9,717,195	\$15,721	\$1.21	\$0.0016
	Network 2	686	513,164	\$1,428	\$2.08	\$0.0028
	CDC	15	11,221	\$58	\$3.87	\$0.0052
	HRL	5	3,740	\$42	\$8.40	\$0.0112
Apr-05	Network 1	15780	11,804,260	\$27,141	\$1.72	\$0.0023
	Network 2	2,546	1,904,540	\$4,440	\$1.74	\$0.0023
	CDC	146	109,216	\$270	\$1.85	\$0.0025
	HRL	7	5,236	\$45	\$6.43	\$0.0086
May-05	Network 1	14381	10,757,735	\$24,932	\$1.73	\$0.0023
	Network 2	1,543	1,154,244	\$2,827	\$1.83	\$0.0024
	CDC	56	41,891	\$125	\$2.23	\$0.0030
	HRL	1	748	\$27	\$27.00	\$0.0361
Jun-05	Network 1	12734	9,525,694	\$21,950	\$1.72	\$0.0023
	Network 2	529	395,719	\$920	\$1.74	\$0.0023
	CDC	149	111,460	\$276	\$1.85	\$0.0025
	HRL	7	5,236	\$45	\$6.43	\$0.0086
TOTAL		173,075	129,460,100	\$295,913	\$1.71	\$0.0023



Modeling

Domestic water flows for the existing campus were estimated based on an analysis of existing meter readings over a recent two-year period. Results of this analysis are summarized in Table 1.

In order to be conservative and to account for the fact that the majority of the domestic water system demand occurs during the periods when school is in session, the average annual demand was assumed to be generated over eight months of the year, five days a week and eight hours a day to get the average in-session flow rates. As shown in the table, this results in an in-session, campus-wide average daily flow rate of 1556 gpm. Using a maximum day factor of 3.0 times average day and a peak hour factor of 6.0 times average day, results in flow rates of 4669 gpm and 9338 gpm for maximum day and peak hour, respectively. Methods of estimating water flows and modeling water usage are based on understandings of local requirements and common engineering practices.

A computer model of the existing water network was created with H2ONet Version 6.0 to represent the existing conditions on Campus. The calculated maximum day flows for the Campus, as calculated in Table 1, were applied to the various nodes of the water model based on the square footage of the buildings. A summary of the buildings and the water demands applied to each one is included in the Appendix. The demand was applied equally on a square footage basis, regardless of building occupation, except for the Parking Structure which was excluded from the demand calculations. Because the irrigation for the southern portion of Campus is fed from the domestic water network, irrigation demands were lumped into the overall demand but distributed among all the buildings throughout Campus.

This model was then run for two fireflow scenarios to test the existing system's ability to satisfy the fireflow criteria set forth by the Long Beach Fire Department (LBFD) in conjunction with maximum day demands disbursed throughout the campus based on building square footage. The LBFD requires that buildings conform to the Uniform Fire Code (UFC), Appendix III-A, which dictates the fire flow requirements for new buildings based on square footage. A fireflow demand of 4500 gpm should be adequate to satisfy the requirements of the occupied buildings on Campus, based on their square footages. A residual pressure of 20 psi is required in the network while the fire flow demand is being applied. In the two scenarios the total fire demand was input as 4500 gpm, and was drawn from three adjacent nodes, at 1500gpm each, to simulate a fire with three hydrants being used concurrently. The locations selected for the fireflow scenarios, west of the Library and Liberal Arts buildings and west of the Peterson Halls and Fine Arts buildings, were chosen because they were in areas with relatively low static pressures after the maximum day demand loads were applied to the network. Computer modeling runs for the scenarios are included in the Appendix as attachments. An Exhibit (CSULB-002) showing the existing water network is also included in the Appendix as an attachment, and contains pipe and node reference numbers that correspond with the modeling data output.

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Based upon the criteria in the UFC, the existing water distribution network, as modeled, can not adequately support the existing buildings without significant improvements, which will be discussed at length in the Recommendations section of this report. The most significant problems with the existing distribution system are the limited size of the distribution piping in many locations (i.e. 6-inch mains throughout the Campus).

The existing services have rated flow capacities in the neighborhood of 80 gpm (2-inch service), 1,000 gpm (6-inch service), 1,600 gpm (8-inch service) and 2300 gpm (10-inch service). This is adequate for Network #2 and its 8-inch service, as well as the two individual buildings and their 2-inch services. However, it is inadequate to meet the 9,169 gpm maximum day plus fire flow demand ($3 \times 1,500 + 4669$) for Network #1. The services for Network #1 combine to provide 7580 gpm ($80 + 2 \times 1000 + 2 \times 1600 + 2300$) of rated flow, which is less than the 9,169 gpm demand. The computer model also indicates that pressures drop significantly with the application of the fireflow scenarios, causing the residual pressures to dip below the 20 psi minimum requirement. This is primarily due to lack of a large enough distribution loop and unbalanced service connections.

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Usage and Cost

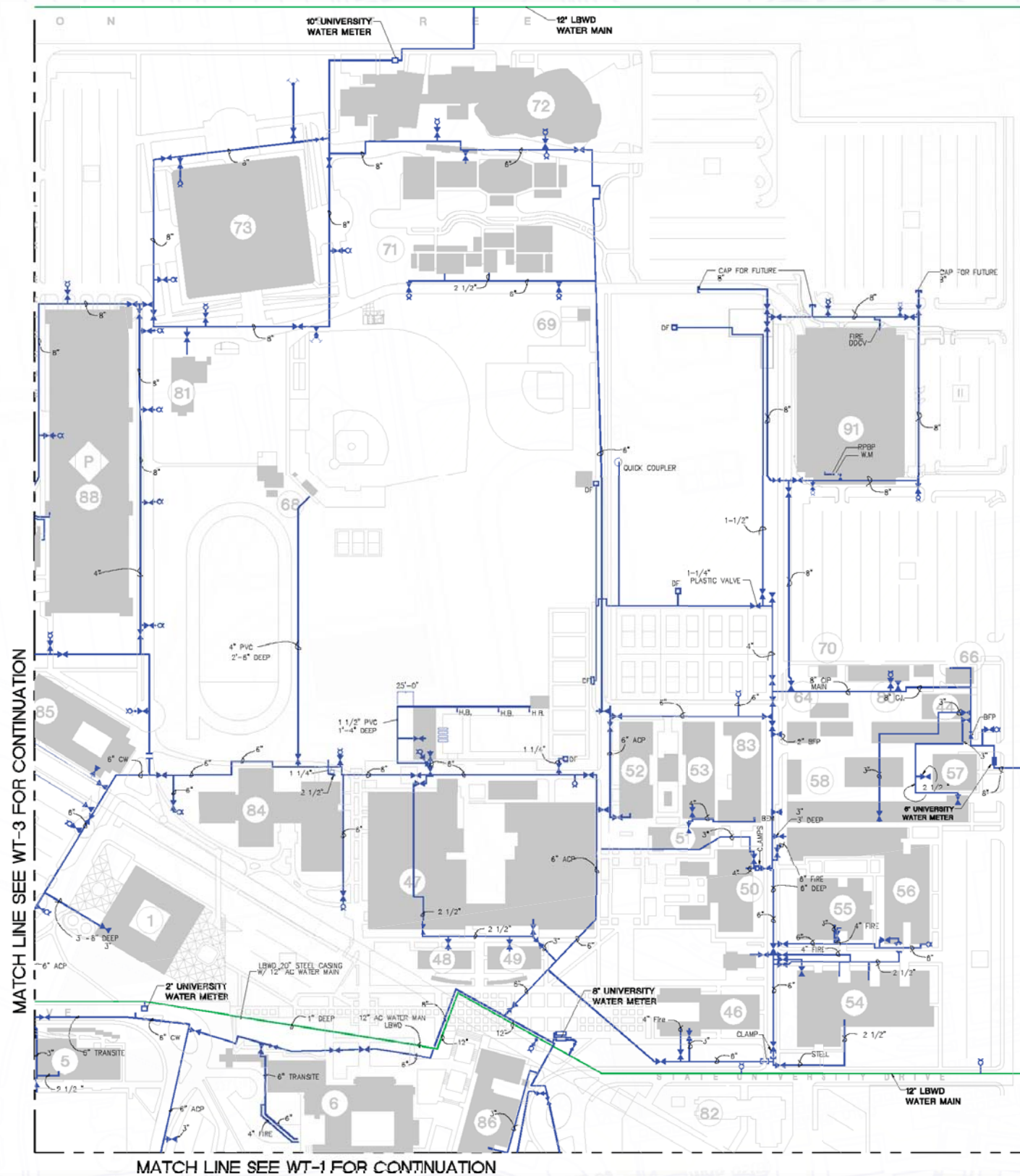
Table 2 shows the domestic water consumption for the most recent school year, July 2004 through June 2005. As shown, monthly consumption ranges from a low of 7,950 HCF (5.9 million gallons) to a high of 20,525 HCF (15.4 million gallons). The cost, per HCF, ranges from \$1.26 to \$2.00, with an average cost of \$1.71/HCF.





NO.	BUILDING DESIGNATION
1	Brotman Hall
5	Family & Consumer Sciences
6	University Student Union
44	Electrical Substation (North)
46	Social Sciences & Public Affairs
47	University Gymnasiums
48	Health & Human Services Classrooms
49	Health & Human Services Offices
50	Vivian Engineering Center
51	Engineering 2
52	Engineering 3
53	Engineering 4
54	Design
55	Human Services & Design
56	Engineering Technology
57	Facilities Management
58	Corporation Yard
64	Greenhouse 3
66	Reprographics
68	Restrooms/Storage
69	Softball Field Restroom
70	Main Distribution Communications Facility MDF B
71	University Music Center
72	Carpenter Performing Arts Center & Dance Center
73	Mike and Arline Walter Pyramid
80	University Police
81	Parking Office Building
82	Outpost Food Service
83	Engineering / Computer Science
84	Steve and Nini Hom Center
85	College of Business
86	Central Plant
88	Parking Structure No. 1
91	Parking Structure No. 2

Building / Boundary Legend

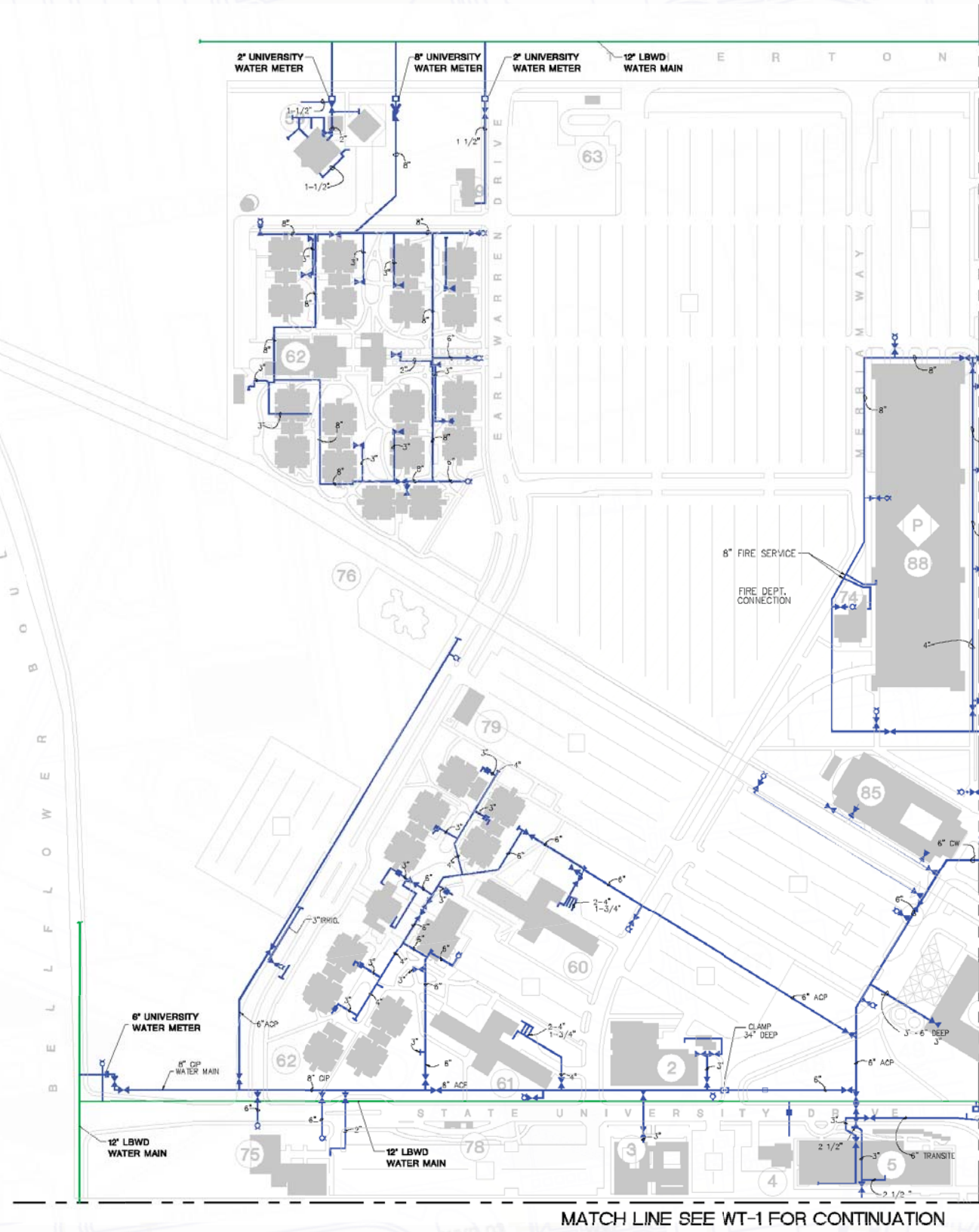


- EXISTING PUBLIC LINE
- EXISTING CAMPUS LINE
- VALVE
- FIRE HYDRANT
- WATER METER
- DRINKING FOUNTAIN
- CLAMP
- BACK FLOW PREVENTER
- SIAMESE FIRE CONN.
- CIP CAST IRON PIPE
- ACP ASBESTOS CEMENT PIPE
- PVC POLYVINYL CHLORIDE PIPE
- LBWD LONG BEACH WATER DEPARTMENT
- BFP BACK FLOW PREVENTER
- HB HOSE BIB
- RPBP REDUCED PRESSURE BACK FLOW PREVENTER
- WM WATER METER
- DDCV DOUBLE DETECTOR CHECK VALVES



NO.	BUILDING DESIGNATION
2	Student Health Services
3	Nursing
4	Soroptomist House
5	Family & Consumer Sciences
59	Patterson Child Development Center
60	Los Alamitos Hall
61	Los Cerritos Hall
62a	Residence Commons
62b	Parkside Commons
63	Recycling Center
74	Parking and Transportation Services
75	International House
76	Earl Burns Miller Japanese Garden
78	Visitor Information Center
79	Main Distribution Communications Facility MDF C
85	College of Business
88	Parking Structure No. 1
89	Housing & Residential Life

Building / Boundary Legend



- EXISTING PUBLIC LINE
- EXISTING CAMPUS LINE
- VALVE
- FIRE HYDRANT
- WATER METER
- DRINKING FOUNTAIN
- CLAMP
- BACK FLOW PREVENTER
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- HB HOSE BIB
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- WM WATER METER
- DDCV DOUBLE DETECTOR CHECK VALVES



WT-3
DOMESTIC AND FIRE WATER EXHIBIT
EXISTING CONDITIONS



Sanitary Sewer

Network Description

The Campus Sewer system is composed of a network of Vitrified Clay Pipe (VCP), Polyvinyl Chloride (PVC) Pipe, Reinforced Concrete Pipe (RCP), Reinforced Polymer Mortar Pipe (RPMP) and Cast Iron Pipe (CIP) of various sizes. The individual building services tie into several mains on Campus which then tie into either Long Beach Water Department (LBWD) or Los Angeles County Sanitation District (LACSD) sanitary sewer mains that run through the Campus and in the streets surrounding the Campus. Due to the topography of the Campus and the layout of the LBWD and LACSD mains through and around the Campus, flows from different portions of the Campus are collected by different mains. Flows from buildings in the southern portion of Campus are collected into mains that run to the northwest, while flows from buildings in the eastern portion are collected into mains that run to the northeast and flows from buildings in the western portion are collected into mains that run to the west. A video inspection of the existing sewer lines was performed in order to provide a full understanding of the condition of the lines. The results of this video inspection are included in the Sewer Video Results binder.

The sewer line between PSY and LA-5 was not video taped due to major offset in the sewer line. In addition, video taping of the sewer manhole on the northwest side of MHB to the sewer manhole northeast of Academic services was also attempted but was not possible due to mainline stoppage with standing water. Several of the lines showed problems with cracking, root intrusion and pipe offsets.

Currently the Campus jets the onsite sanitary sewer lines annually to ensure that they remain functional. Some of the lines are known to have intrusion problems from roots of nearby trees. In ideal conditions, all the existing lines would be adequately sized, would be in good condition and would have adequate slopes and flows so that they would be self-scouring and would not require regular

maintenance. In contrast, the problematic lines mentioned previously are deficient in one or more of these criteria. More detailed descriptions of the lines and their deficiencies are provided below. There are four permitted clarifiers on Campus that remove suspended solids from the sewer flows prior to tying into the Campus mains.

Sheets SS-1 through SS-3 show the existing sanitary sewer system, as described below. Network #1 collects flows from the buildings in the central and eastern portions of Campus. Flows from buildings in the central portion of Campus, including Parking Structure 1, College of Business Administration and the Horn Center, are collected and pumped by a sewage ejector into a 6-inch force main that flows southeast, running parallel to Bouton Creek. The 6-inch force main connects to a manhole and continues flowing southeast into a 6-inch gravity main, which then picks up a 4-inch main from the Track and Field and a 6-inch main from the Engineering buildings and runs south to connect with an 8-inch main serving the Peterson Halls and Central Plant. The lines tie into a 30-inch LACSD main in State University Drive and flow to the east. The eastern portion of Campus also ties into the 30-inch main via several 6-inch Campus mains, one in East Campus Drive and two in Palo Verde Avenue.

Network #2 consists of several lines that feed into the 24-inch VCP LACSD line that runs north from East Campus Drive to a LACSD Pumping Station located near the intersection of Atherton Drive and Palo Verde Avenue. A 6-inch line from Engineering and Computer Sciences and an 8-inch from the University Office Building collect flows and tie into the 24-inch LACSD line.

Network #3 also ties into the 24-inch VCP LACSD line, after collecting flows from the northeastern portion of Campus. A 6-inch main collects flows from the southern portion of the University Music Center and runs east to connect to the 24-inch main. Parallel to the UMC main is another 6-inch line that collects flows from the Sports, Athletics and Recreation Offices, which ties into an 8-inch line that collects flows from the Pyramid, northern portion of the University Music Center, Dance Center and Performing Arts Center and then ties into the 24-inch LACSD main. The 24-inch main then ties into the Pumping Station. From the Pumping Station, the flows are pumped in a pair of LACSD 18-inch HDPE force mains in the sidewalk south of Atherton Drive. The HDPE lines run easterly in Atherton Drive until they reach Earl Warren Drive, where they turn south and connect with a 15-inch VCP gravity line, also maintained by LACSD, carrying flows from the southern portion of Campus. The lines merge and continue flowing to the east in a 24-inch VCP line until it reaches Bellflower Boulevard and turns to the north.

Network #4 is comprised of lines that serve most of the buildings in the southern portion of Campus. Flows are collected into several 6-inch lines which are then combined into a pair of 10-inch lines that flow toward and in West Campus Drive. The two 10-inch lines combine into one 12-inch line which continues flowing north in West Campus Drive. A 6-inch line collects flows from buildings along State University Drive and ties into the 12-inch in West Campus Drive, and the two lines tie into a 12-inch VCP line maintained by LACSD that flows to the northwest. The majority of problems found in existing lines were found in Network #4. Several sections of pipe were previously known to have problems with root intrusion, and upon video inspection, several more were found to suffer similar problems as well as problems with cracking and joint displacement.

Network #5 is comprised of lines that serve buildings in the southwestern portion of Campus. Several 6-inch mains collect flows from the Residence Commons and Student Health Services and tie into an 8-inch Campus main which then ties into the 12-inch LACSD main. The LACSD main becomes a 15-inch main and continues flowing to the northwest where it joins the 18-inch HDPE force mains from the Pumping Station.

Network #6 consists of several 6-inch lines serving the Parkside Commons that flow into an 8-inch line that connects to the 10-inch VCP LBWD main in Atherton Street and continues flowing to the west.



TABLE 1 - Building Sanitary Sewer Loads

Network	Student Population	Occupancy Type	Generation rate (gal/student/day)	Average Flow (gpd)	Peak Factor	Peak Flow (gpd)
1	6,023.5	University Non-Dormitory	20	120,470	2	240,940
	0	University Dormitory	85	0	2	0
2	1,675.2	University Non-Dormitory	20	33,504	2	67,008
	0	University Dormitory	85	0	2	0
3	3,100.2	University Non-Dormitory	20	62,004	2	124,008
	0	University Dormitory	85	0	2	0
4	11,198.1	University Non-Dormitory	20	223,962	2	447,924
	0	University Dormitory	85	0	2	0
5	362.0	University Non-Dormitory	20	7,240	2	14,480
	963.0	University Dormitory	85	81,855	2	163,710
6	91.9	University Non-Dormitory	20	1,838	2	3,676
	1,037.0	University Dormitory	85	88,145	2	176,290
other	2,967.1	University Non-Dormitory	20	59,342	2	118,684
	0	University Dormitory	85	0	2	0
Totals				678,360		1,356,720

TABLE 2 - Sanitary Sewer Usage

Month	Consumption (HCF)	Consumption (Gallons)	Cost	Cost per HCF	Cost per Gallon
Jul-04	16,704	12,494,592	\$3,449	\$0.21	\$0.0003
Aug-04	14,754	11,035,992	\$3,066	\$0.21	\$0.0003
Sep-04	20,525	15,352,700	\$3,983	\$0.19	\$0.0003
Oct-04	18,335	13,714,580	\$3,727	\$0.20	\$0.0003
Nov-04	13,688	10,238,624	\$2,957	\$0.22	\$0.0003
Dec-04	8,204	6,136,592	\$2,040	\$0.25	\$0.0003
Jan-05	7,950	5,946,600	\$2,019	\$0.25	\$0.0003
Feb-05	11,340	8,482,320	\$2,826	\$0.25	\$0.0003
Mar-05	13,696	10,244,608	\$2,247	\$0.16	\$0.0002
Apr-05	18,479	13,822,292	\$3,640	\$0.20	\$0.0003
May-05	15,981	11,953,788	\$3,279	\$0.21	\$0.0003
Jun-05	13,419	10,037,412	\$2,668	\$0.20	\$0.0003
Total	173,075	129,460,100	\$35,901	\$0.21	\$0.0003

HCF=Hundred Cubic Feet

Network Evaluation

An analysis of the existing sewer system and allocation for the existing campus and relevant residential development is included in the Appendix. Methods of estimating sewage generation and modeling flows in sewer lines are based on understandings of local requirements and common engineering practices. The square footage of the Campus buildings was broken up into Dormitory and non-Dormitory buildings and flows were calculated for the populations that used each of these types of facilities, broken out by Network. The student populations were divided amongst the Networks based on the percentage of total Campus square footage that contributes to each Network's flow. According to Campus data, the total student population is approximately 25,418 and the population of the dormitories is roughly 2000. Assuming a sewer generation factor of 20 gpd/student for University Buildings and 85 gpd/student for Dormitory Buildings, the existing average day flow generated on-campus is 678,360 gallons per day (gpd), which is equivalent to an average flow rate of 1.05 cubic feet per second (cfs). Table 1 shows the sewer generation calculations for each Network and for the entire Campus as a whole. Refer to the Appendix for a summary of the buildings and their respective sewer generation calculations, which are based upon building occupancy type and pro-rated on a square footage basis. A calculation of velocities and flow depths for the existing sewer system at peak flow rates is included in the Appendix, as well. A peaking factor of 2 has been used to convert the Average Daily Flow to Peak Daily Flow, resulting in a peak flow rate of 2.10 cfs (1,356,720 gpd).

Sewer information has been taken from drawings provided by CSULB.

To evaluate the existing system a number of investigative measures and engineering analyses were performed, including:

- Assembly and analysis of existing campus and offsite records
- Interview with plumbing personnel
- Subsurface conduit video inspection
- Basic hydraulic analyses

Usage and Cost

Table 2 shows the sanitary sewer costs for the most recent school year, July 2004 through June 2005. The costs are based on monthly domestic water usage amounts due to the correlation between rates of water usage and sewage generation, however the rates will not correlate exactly because of water usage for irrigation, among other factors. As shown, monthly domestic water usage ranges from a low of 7,950 HCF (5.9 million gallons) to a high of 20,525 HCF (15.4 million gallons). The sewer fee, per HCF of water used, ranges from \$0.16 to \$0.25, with an average cost of \$0.21.

Cost Summary

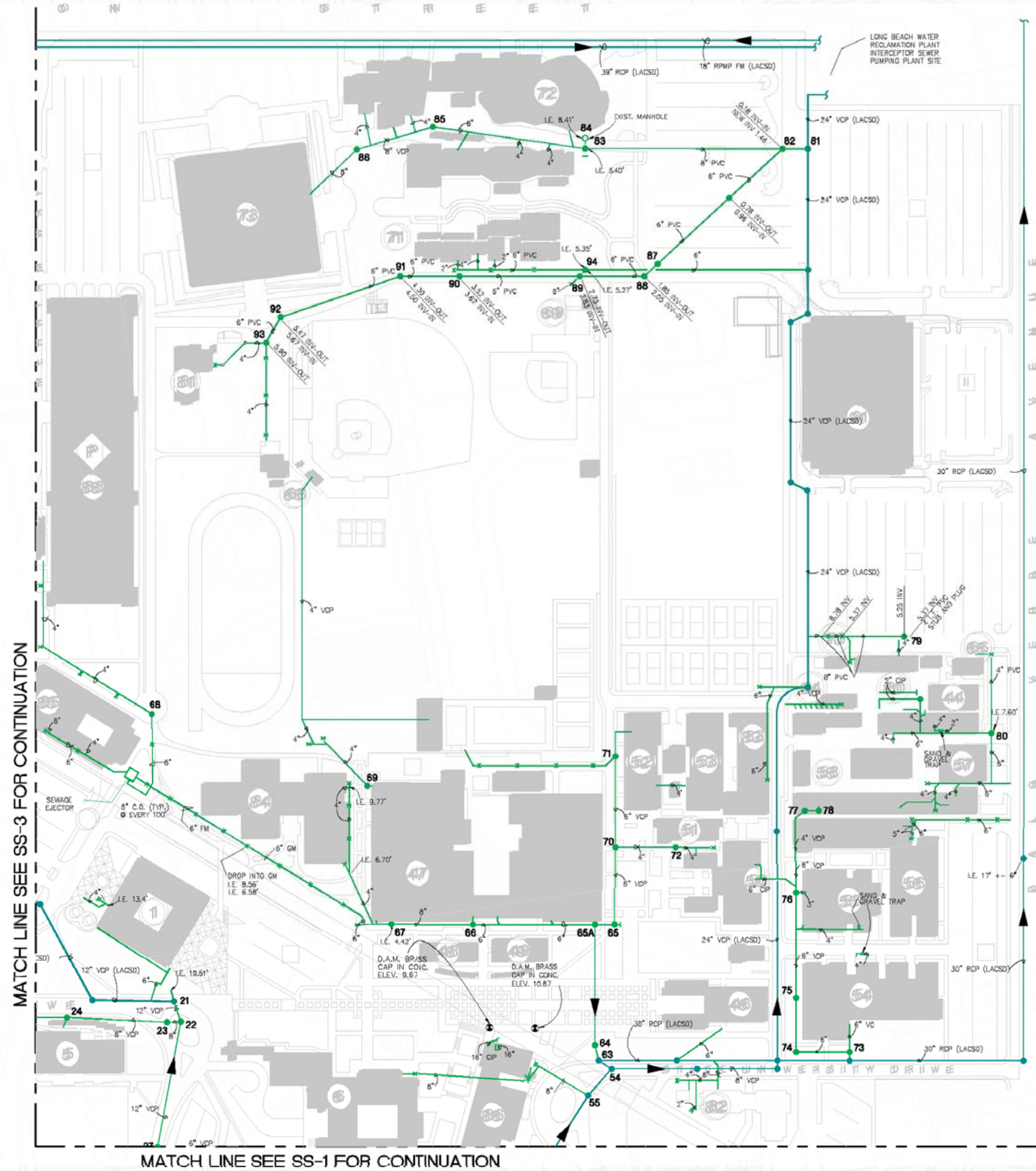
Total: \$35,901
Average: \$2992/month





NO.	BUILDING DESIGNATION
1	Brotman Hall
5	Family & Consumer Sciences
6	University Student Union
44	Electrical Substation (North)
46	Social Sciences & Public Affairs
47	University Gymnasiums
48	Health & Human Services Classrooms
49	Health & Human Services Offices
50	Vivian Engineering Center
51	Engineering 2
52	Engineering 3
53	Engineering 4
54	Design
55	Human Services & Design
56	Engineering Technology
57	Facilities Management
58	Corporation Yard
64	Greenhouse 3
66	Reprographics
68	Restrooms/Storage
69	Softball Field Restroom
70	Main Distribution Communications Facility MDF B
71	University Music Center
72	Carpenter Performing Arts Center & Dance Center
73	Mike and Arline Walter Pyramid
80	University Police
81	Parking Office Building
82	Outpost Food Service
83	Engineering / Computer Science
84	Steve and Nini Hom Center
85	College of Business
86	Central Plant
88	Parking Structure No. 1
01	Parking Structure No. 2

Building / Boundary Legend



- EXISTING PUBLIC LINE
- EXISTING CAMPUS LINE
- SEWER MANHOLE
- SEWER CONNECTION
- SEWER CLEAN OUT
- INVERT ELEVATION
- I.E. 66.0' INVERT ELEVATION
- F.E. 30.0' FLOW ELEVATION
- FLOW DIRECTION
- FM FORCE MAIN
- GM GRAVITY MAIN
- RPMP REINFORCED PLASTIC MORTAR PIPE
- RCP REINFORCED CLAY PIPE
- VCP VITRIFIED CLAY PIPE
- CIP CAST IRON PIPE
- (28) BUILDING NUMBER
- L.B.W.D. LONG BEACH WATER DEPARTMENT
- L.A.C.S.D. LOS ANGELES COUNTY SANITATION DEPARTMENT
- DIVISION OF ARCHITECTURAL MONUMENT
- ABANDONED LINE



SS-2
SANITARY SEWER EXHIBIT
EXISTING CONDITIONS



NO.	BUILDING DESIGNATION
2	Student Health Services
3	Nursing
4	Soroptomist House
5	Family & Consumer Sciences
59	Patterson Child Development Center
60	Los Alamitos Hall
61	Los Cerritos Hall
62a	Residence Commons
62b	Parkside Commons
63	Recycling Center
74	Parking and Transportation Services
75	International House
76	Earl Burns Miller Japanese Garden
78	Visitor Information Center
79	Main Distribution Communications Facility MDF C
85	College of Business
88	Parking Structure No. 1
89	Housing & Residential Life

Building / Boundary Legend



- EXISTING PUBLIC LINE
- EXISTING CAMPUS LINE
- SEWER MANHOLE
- SEWER CONNECTION
- SEWER CLEAN OUT
- INVERT ELEVATION
- I.E. 66.0' INVERT ELEVATION
- F.E. 30.0' FLOW ELEVATION
- FLOW DIRECTION
- FM FORCE MAIN
- GM GRAVITY MAIN
- RPMP REINFORCED PLASTIC MORTAR PIPE
- RCP REINFORCED CLAY PIPE
- VCP VITRIFIED CLAY PIPE
- CIP CAST IRON PIPE
- (28) BUILDING NUMBER
- L.B.W.D. LONG BEACH WATER DEPARTMENT
- L.A.C.S.D. LOS ANGELES COUNTY SANITATION DEPARTMENT
- DIVISION OF ARCHITECTURAL MONUMENT
- ABANDONED LINE

MATCH LINE SEE SS-2 FOR CONTINUATION

MATCH LINE SEE SS-1 FOR CONTINUATION



SS-3
SANITARY SEWER EXHIBIT
EXISTING CONDITIONS



Storm Drain

Network Description

The existing Campus storm drainage system consists of several networks of reinforced concrete pipe (RCP) and polyvinyl chloride (PVC) pipe that were installed from the 1940's to the present. The pipes collect stormwater from catch basins and area drains throughout the Campus and empty into Bouton Creek Channel, a Los Angeles County Flood Control District (LACFCD) channel that runs southeasterly through the Campus. The outlets into the Storm Drain channel range from 8-inch to 42-inch. There is also an area in the southeast portion of Campus that has a network of pipes that directs stormwater to an 18-inch pipe that connects to a 21-inch City of Long Beach Storm Drain line near Seventh Street and East Campus Drive. Sheets SD-1 through SD-3 show the existing storm drainage system, as described below.

In addition to stormwater flows generated onsite, the Campus also receives flows from the adjacent US Veteran's Hospital located to the south and west. A study is currently being performed by Kimley-Horn to determine the size of the flows.

Stormwater from the Parkside Commons residence halls, located in the northwestern portion of Campus, is collected by area drains and routed to a network of pipes that tie into a 15-inch line that empties into the Channel.

Area drains for Parking Lots 14 and 16 collect stormwater into a 24-inch line that ties into a 24-inch line that collects from Parking Lot 13, Parking Structure 1 and portions of the Pyramid. The two 24-inch lines join and empty into the Channel via a 27-inch line.

Stormwater from the portions of the Pyramid is collected into catch basins around the building and flows south, joining a 10-inch line that collects runoff from the baseball and softball fields as well as the Sports, Athletics and Recreation Offices. The line increases to a 12-inch and joins another 10-inch line from the fields and becomes a 20-inch line. The 20-inch line picks up some more flows from catch

basins on the east side of Parking Structure 1 and the College of Business Administration (CBA), then empties into the Channel near the CBA.

A 24-inch line collects stormwater from the network of area drains in the Track and Field and the northern and western sides of the Undergraduate Art Museum (UAM) and Horn Center (HC) and then empties into the Channel near UAM. A 12-inch line collects stormwater from the southern and eastern sides of the UAM and HC and then empties into the Channel near UAM

There is an 18-inch outlet line that collects stormwater from around the PE building, the Pool, Lot 10, the Health and Human Services buildings and the Engineering and Engineering and Computer Science buildings.

The stormwater from the northeastern portion of Campus is collected into a 42-inch line that empties into the Channel. Water from the Dance Center, Performing Arts Center and Lot 12 is collected into an 18-inch line where it joins an 18-inch line carrying water from the University Music Center and another 18-inch line carrying water from Lot 11. The three lines merge into a 33-inch line. Two 15-inch lines from Lot 11 join the 33-inch line, which increases to a 39-inch line at the south end of the parking lot. Other lines from the University Police building, Facilities Management, Mail Services, Shipping/Receiving, Physical Planning, Engineering Technology, Human Services and Design, Design Center, Social Services & Public Affairs and Lot 9 feed into the 39-inch line, which increases to a 42-inch line before it outlets into the Channel.

Stormwater from the buildings on the southern portion of Campus along East Campus Drive drains into a storm drain line that runs in the street up to the Channel. The line varies from a 18-inch to a 24-inch pipe.

Stormwater from the buildings on the southern portion of Campus along West Campus Drive drains into a storm drain line that runs in the street up to the Channel. The line varies from a 15-inch to a 42-inch pipe. A 12-inch line serving Faculty Office 3 and Science Lecture Hall also ties into the 42-inch line before it outlets into the Channel.

Several 6-inch, 8-inch and 10-inch lines collect stormwater from inlets around Lots 3 and 17 and Brotman Hall and outlet into the Channel.

A storm drain line in Merriam Way, ranging from 8-inch to 15-inch, collects water from Lot 17, 18 and 19 and outlets to the Channel.

A storm drain line, ranging from 10-inch to 12-inch, runs through the Residence Commons and Lot 16 before it outlets to the Channel.

A storm drain line in Earl Warren Drive, ranging from 8-inch to 15-inch, collects water from the street, Lot 20 and the Japanese Garden and outlets to the Channel.

Network Evaluation

According to conversations with Campus Facilities staff, the existing storm drainage system generally performs adequately with few problem areas. The area in the athletic fields north of the tennis courts floods when it rains. The storm drain lines south of the tennis courts and the lines to the west of the tennis courts and Engineering 3 are root bound and cause flooding problems. Parking Lot 9 experiences flooding due to the inflow of surface stormwater from Palo Verde and the 8-inch line in was incapable of adequately draining the Lot. The 8-inch line was replaced as part of another project but is unknown whether the replacement line is adequate. The 10-inch line from Lot 9 ties into an 18-inch line to the west of Human Services and Design but there is no manhole at the junction so it is difficult for the Campus to maintain the storm drain lines in that area. The 12-inch line east of Engineering & Computer Science and Vivian Engineering Center experiences some flooding and appears to have some root intrusion from an oak tree west of Receiving.

To evaluate the existing system a number of investigative measures and engineering analyses were performed including:

- Assembly and analysis of existing campus and offsite records
- Interview with plumbing personnel
- Hydrologic and Hydraulic analyses

Through the methods listed above, a number of determinations related to system performance were made and are listed below:

Hydrologic Zone	Numeric Element	Existing Condition Description
I		George H. Allen Field is subject to flooding in heavy rains due to clogged inlet drains and root-bound pipes.



The study performed in this report is of the backbone system of pipes throughout the Campus. It should be noted that some of the local elements have been in service for many years and are constructed of materials that are subject to degradation over time. Minor system elements should be regularly evaluated during maintenance and replaced or repaired as required. Additional pipe videography is recommended prior to design of the new/replacement elements to more clearly identify the complete extent of demolition/replacement.

Hydrology

A preliminary R.O.M. hydrologic study was performed to analyze the existing site topography and storm drainage system. Existing field conditions were analyzed, with the aid of a topographic aerial survey to determine general storm water flow patterns and watersheds. In order to determine the appropriate design flows to be utilized to evaluate existing drainage facilities, the tributary area was divided into appropriate sub-areas according to existing topography. The Campus, consisting of approximately 320 acres, was divided into sub-areas with similar physical characteristics, ground coverage, and discharge points. Flowrates for the storm water were generated using a modeling program from the Los Angeles County Department of Public Works (LACDPW).

Storm water from sub areas 'A', 'C', 'D', 'E', 'F', 'G', 'H', 'I', 'J', 'L', 'M', 'N', 'O', 'P' and 'R', totaling 280.9 acres, is collected by several separate networks of pipes of varying sizes, and directed underground into Bouton Creek Channel. Storm water from sub area 'B' (B1-B7), totaling 28.8 acres, is not collected by campus improvements and drains offsite via surface flows toward the streets surrounding the Campus. Storm water from sub area 'K', totaling 10.3 acres, is collected by a single 21-inch line and is directed into a 24-inch storm drain line in Seventh Street. In addition to the Campus drainage study area, there is also an offsite sub area which is located southwest of Campus property that contributes additional flows to the Campus. Kimley Horn is currently performing a study to determine the volume of these offsite flows.

Calculations showing the flows and times of concentration for each of the sub-areas are included in the Appendix. In performing the storm drain modeling, some general assumptions were made – information on the slopes of the existing pipes was not provided in the existing storm drain maps, so slopes were assumed to be generally parallel to the ground surface. Given the simple topography of the site, this should provide fairly accurate approximations of the pipe slopes.

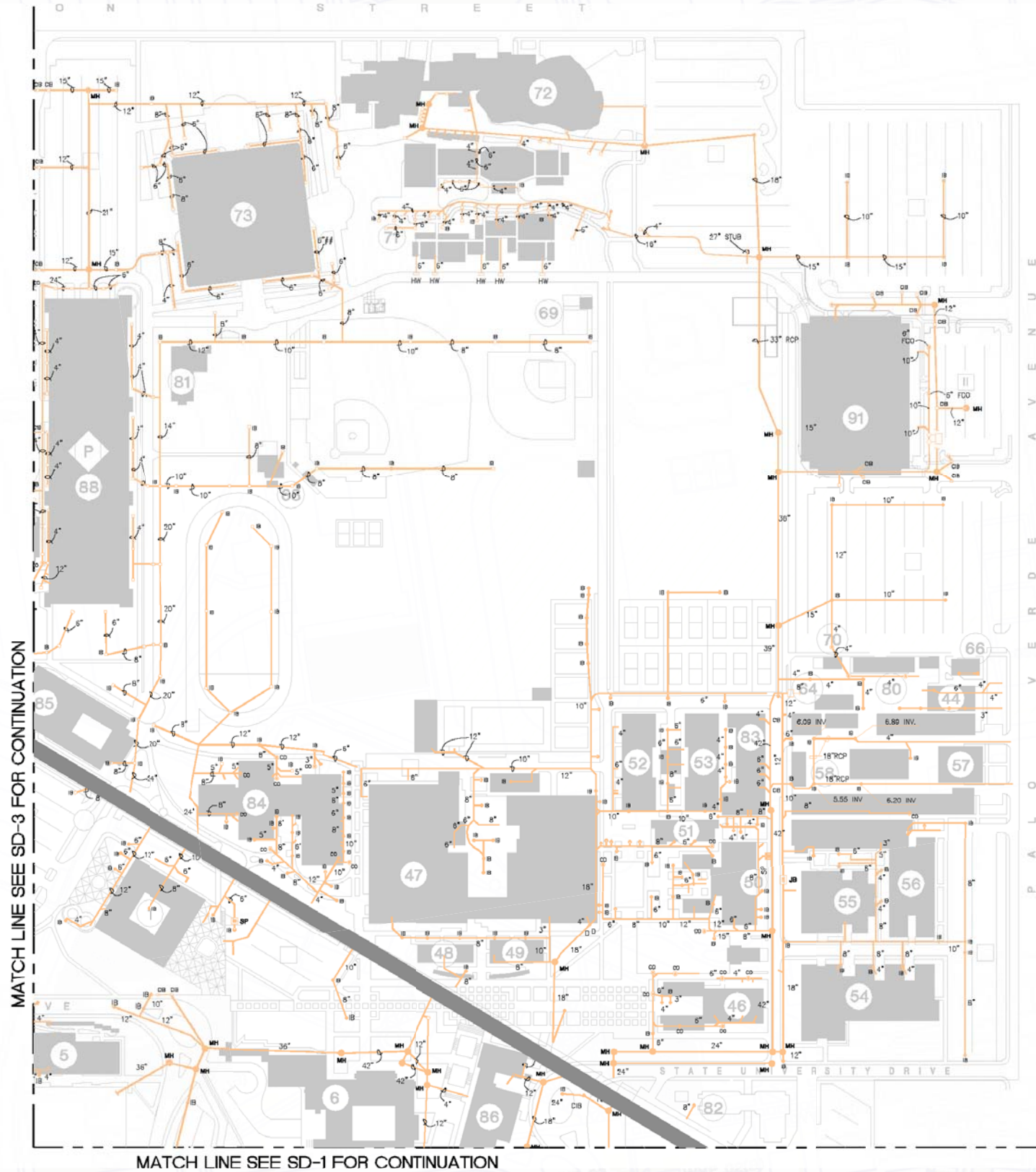
Based on the calculated flow rates generated by the LACDPW hydrology software, the current network of pipes appears to be adequate to accommodate a 10-year storm event. Repairs may be necessary to portions of the network where pipes have deteriorated because of age or other reasons, but the sizing of the network as it is currently configured should be adequate for the Campus' storm water flows.





NO.	BUILDING DESIGNATION
1	Brotman Hall
5	Family & Consumer Sciences
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49	Health & Human Services Offices
50	Vivian Engineering Center
51	Engineering 2
52	Engineering 3
53	Engineering 4
54	Design
55	Human Services & Design
56	Engineering Technology
57	Facilities Management
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66	Reprographics
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72	Carpenter Performing Arts Center & Dance Center
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80	University Police
81	Parking Office Building
82	Outpost Food Service
83	Engineering / Computer Science
84	Steve and Nini Hom Center
85	College of Business
86	Central Plant
88	Parking Structure No. 1
91	Parking Structure No. 2

Building / Boundary Legend



- EXISTING CAMPUS LINE
- MH-MANHOLE
- IB-INLET BASIN
- IB-INLET BASIN
- CO-CLEAN OUT
- SP-SUMP PUMP
- JB-JUNCTION
- ▲ HW-HEADWALL
- CIB CURB INLET BASIN

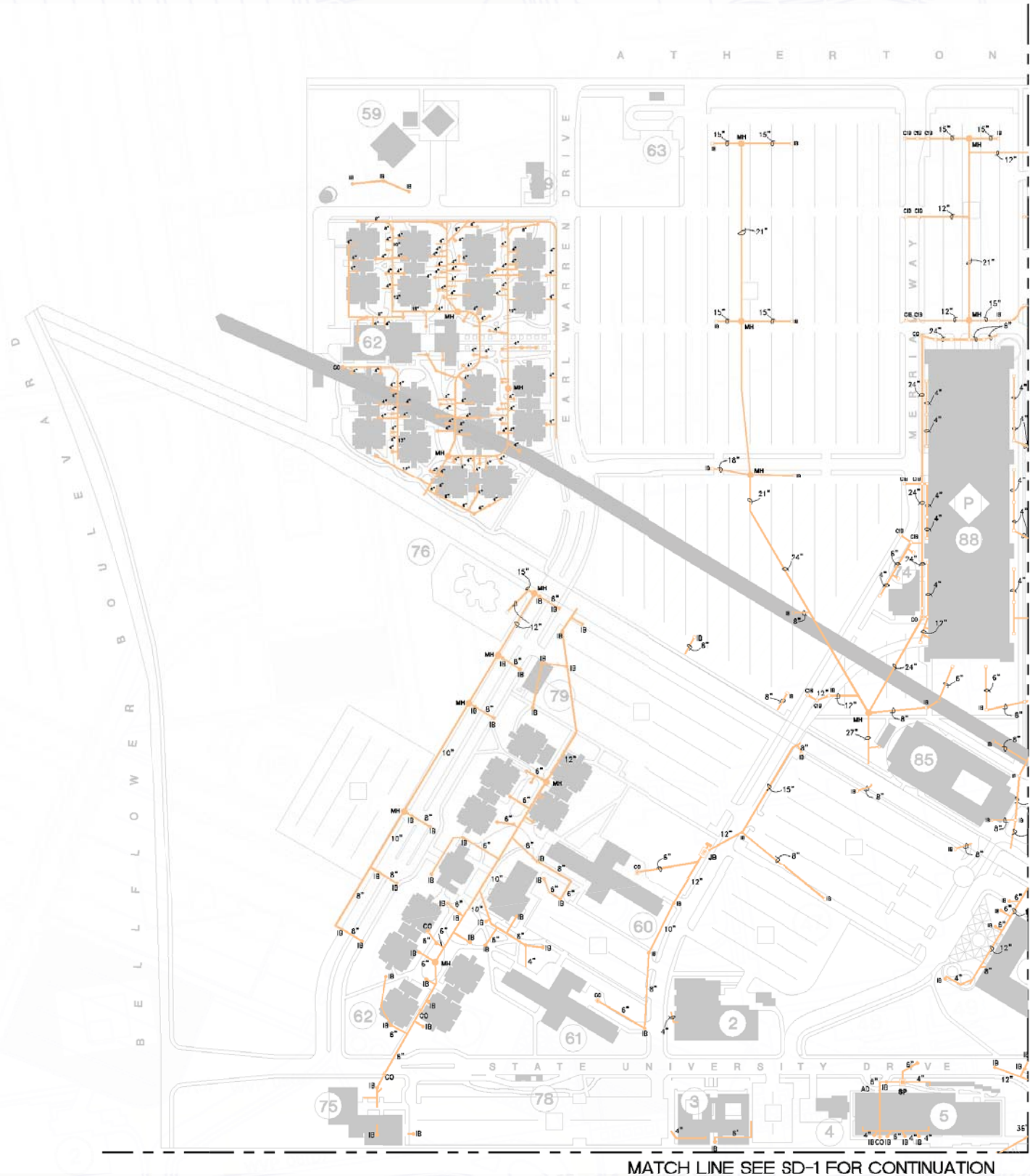


SD-2
STORM DRAIN EXHIBIT
EXISTING CONDITIONS



NO.	BUILDING DESIGNATION
2	Student Health Services
3	Nursing
4	Soroptomist House
5	Family & Consumer Sciences
59	Patterson Child Development Center
60	Los Alamitos Hall
61	Los Cerritos Hall
62a	Residence Commons
62b	Parkside Commons
63	Recycling Center
74	Parking and Transportation Services
75	International House
76	Earl Burns Miller Japanese Garden
78	Visitor Information Center
79	Main Distribution Communications Facility MDF C
85	College of Business
88	Parking Structure No. 1
89	Housing & Residential Life

Building / Boundary Legend



- EXISTING CAMPUS LINE
- MH-MANHOLE
- IB-INLET BASIN
- IB-INLET BASIN
- CO-CLEAN OUT
- SP-SUMP PUMP
- JB-JUNCTION
- HW-HEADWALL
- CIB CURB INLET BASIN

MATCH LINE SEE SD-2 FOR CONTINUATION

MATCH LINE SEE SD-1 FOR CONTINUATION



SD-3
STORM DRAIN EXHIBIT
EXISTING CONDITIONS



Irrigation Water

Network Description

Irrigation Water for the Campus is supplied from two different sources for different portions of the Campus. Reclaimed Water is used to feed a network covering portions of the northern part of Campus while the Domestic network is used to feed small irrigation branches that serve the remainder of the Campus. The reclaimed water network is fed from the 12-inch Reclaimed Water main in Atherton Avenue and consists of 4-inch purple PVC mains. The Campus experiences problems with a lack of pressure and volume for their reclaimed water lines. Sheets RW-1 through RW-3 show the existing irrigation water system, including reclaimed water lines, which are shown in dark blue, and domestic water lines, which are shown in black, and irrigation lines and valves, which are shown in cyan. The portion of the Campus located north of the Bouton Creek Channel receives irrigation water from a 12-inch Reclaimed Water main in Atherton Avenue. The portion of Campus located south of the Bouton Creek Channel receives its water from the domestic water network.

Campus representatives mentioned that there is a lack of pressure and flows in the reclaimed water lines in the northern portion of Campus. There are two points of connection for the reclaimed water lines to the LBWD public lines in Atherton. One of the services is located in the northern part of the Campus, near the Pyramid and the Dance Center, and the other is located in the northeastern portion of Campus, to the north of Parking Lot 12.

Due to the lack of pressure in the domestic water lines in the southern portion of Campus, the irrigation lines generally connect to the water mains via atmospheric vacuum breakers. Backflow preventers are usually required per plumbing code for most installations when connecting irrigation lines to domestic water lines in order to prevent irrigation water from flowing back into the drinking-water system. According to the City of Long Beach Department of Health and Human Services, pressure vacuum breakers (PVB) can be used as long as the breaker is located at least twelve inches above the highest discharge point. There can also be no fertilizer injection or booster pumps downstream of the breaker. Given the topography of the site, with its large differences in elevations, it is doubtful that each of the irrigation sub-networks conforms to these requirements. A thorough study of non-backbone system components is warranted to verify Code compliance.

TABLE 1 - Reclaimed Water Consumption

Month	Consumption (HCF)	Consumption (Gallons)	Cost	Cost per HCF	Cost per Gallon
Jul-04	10,077	7,537,596	\$11,164	\$1.11	\$0.0015
Aug-04	7,238	5,414,024	\$14,474	\$2.00	\$0.0027
Sep-04	7,358	5,503,784	\$8,457	\$1.15	\$0.0015
Oct-04	2,564	1,917,872	\$6,407	\$2.50	\$0.0033
Nov-04	3,053	2,283,644	\$3,710	\$1.22	\$0.0016
Dec-04	1,592	1,190,816	\$2,006	\$1.26	\$0.0017
Jan-05	1,065	796,620	\$1,409	\$1.32	\$0.0018
Feb-05	996	745,008	\$1,331	\$1.34	\$0.0018
Mar-05	342	255,816	\$590	\$1.72	\$0.0023
Apr-05	4,273	3,196,204	\$5,092	\$1.19	\$0.0016
May-05	4,176	3,123,648	\$4,934	\$1.18	\$0.0016
Jun-05	7,531	5,633,188	\$8,962	\$1.19	\$0.0016
TOTAL	50,265	37,598,220	\$68,535	\$1.36	\$0.0018

HCF=Hundred Cubic Feet

System Evaluation

The lack of pressure in the irrigation lines in the southern portion of the Campus is due primarily to the lack of pressure in the water mains from which the the irrigation lines are being served. The irrigation lines should be adequate to serve the Campus's needs provided pressure is increased in the water mains. For a complete discussion of the pressures in the existing domestic and fire water system, please refer to the Domestic and Fire Water Section.

The existing 4-inch reclaimed water distribution systems should be adequate to deliver the necessary flows, however the two separate systems would benefit from being connected. By having two separate reclaimed water networks connected to the public main, there is no redundancy if one of the services goes out of order or requires maintenance. CSULB staff has observed significant loss of pressure during irrigation, which will only be exacerbated as additional landscaped areas and buildings are added to the domestic water system.

Usage and Cost

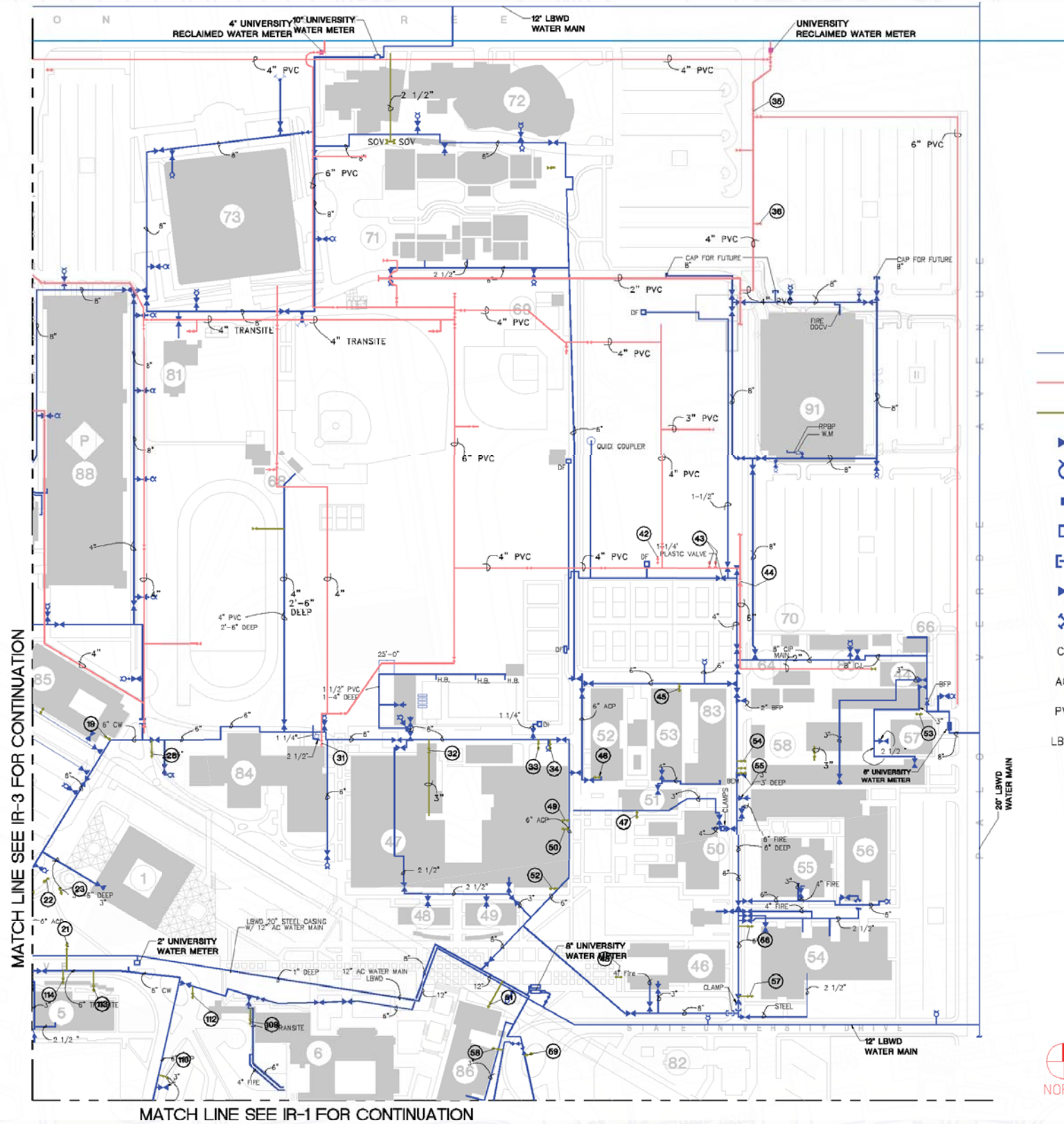
Table 1 shows the reclaimed water consumption for the most recent school year, July 2004 through June 2005. As shown, monthly consumption ranges from a low of 342 HCF (256,000 gallons) to a high of 10,077 HCF (7.5 million gallons). The cost per HCF ranges from \$1.11 to \$2.50, with an average cost of \$1.36/HCF.





NO.	BUILDING DESIGNATION
1	Brotman Hall
5	Family & Consumer Sciences
6	University Student Union
44	Electrical Substation (North)
46	Social Sciences & Public Affairs
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49	Health & Human Services Offices
50	Vivian Engineering Center
51	Engineering 2
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80	University Police
81	Parking Office Building
82	Outpost Food Service
83	Engineering / Computer Science
84	Steve and Nini Hom Center
85	College of Business
86	Central Plant
88	Parking Structure No. 1
91	Parking Structure No. 2

Building / Boundary Legend



- EXISTING WATER LINE
- EXISTING RECLAIMED WATER LINE
- EXISTING IRRIGATION LINE
- VALVE
- FIRE HYDRANT
- WATER METER
- DRINKING FOUNTAIN
- CLAMP
- BACK FLOW PREVENTER
- SIAMESE FIRE CONN.
- CIP CAST IRON PIPE
- ACP ASBESTOS CEMENT PIPE
- PVC POLYVINYL CHLORIDE PIPE
- LBWD LONG BEACH WATER DEPARTMENT

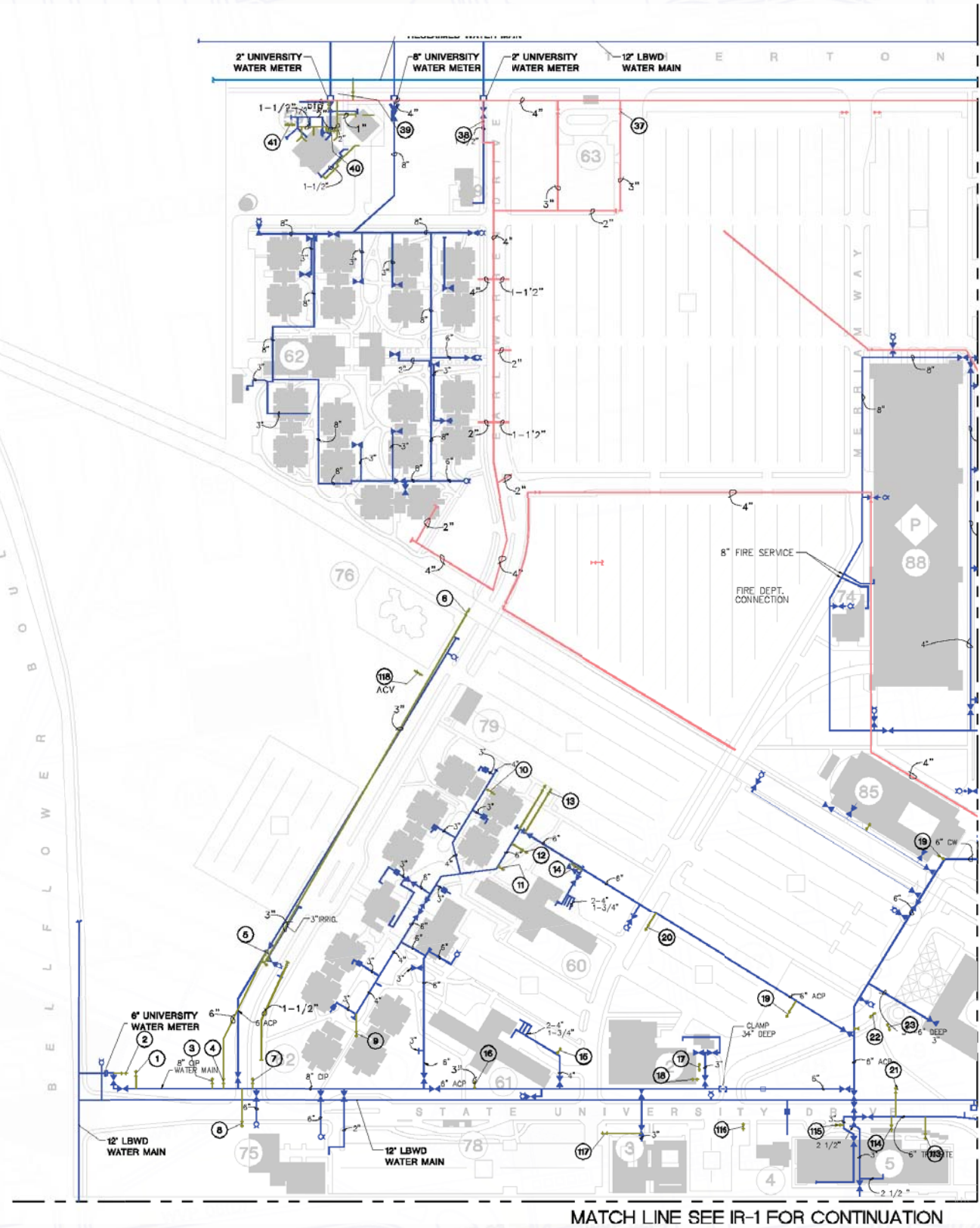


IR-2
IRRIGATION WATER EXHIBIT
EXISTING CONDITIONS



NO.	BUILDING DESIGNATION
2	Student Health Services
3	Nursing
4	Soroptomist House
5	Family & Consumer Sciences
59	Patterson Child Development Center
60	Los Alamitos Hall
61	Los Cerritos Hall
62a	Residence Commons
62b	Parkside Commons
63	Recycling Center
74	Parking and Transportation Services
75	International House
76	Earl Burns Miller Japanese Garden
78	Visitor Information Center
79	Main Distribution Communications Facility MDF C
85	College of Business
88	Parking Structure No. 1
89	Housing & Residential Life

Building / Boundary Legend



- EXISTING WATER LINE
- EXISTING RECLAIMED WATER LINE
- EXISTING IRRIGATION LINE
- VALVE
- FIRE HYDRANT
- WATER METER
- DRINKING FOUNTAIN
- CLAMP
- BACK FLOW PREVENTER
- SIAMESE FIRE CONN.
- CIP CAST IRON PIPE
- ACP ASBESTOS CEMENT PIPE
- PVC POLYVINYL CHLORIDE PIPE
- LBWD LONG BEACH WATER DEPARTMENT



IR-3
IRRIGATION WATER EXHIBIT
EXISTING CONDITIONS



Chilled and Heating Hot Water Systems

The majority of the campus heating and cooling loads are served from a central plant that was completed in 1997. Thermal Energy Storage was incorporated into the Chilled Water system that reduces the peak electrical loads and saves the University substantial costs by load shifting the cooling production to off-peak hours. Since 1997, new buildings have been added and some existing buildings have been connected to this system. Currently 49 buildings are served with heating hot water (HHW) and 36 buildings are served with Chilled Water (CHW). The campus is divided into three distribution loops for the chilled and heating hot water. These are identified as the North Loop, South Loop and West Loop. The chart labeled Existing Cooling and Heating Loads by Building has a column that identifies which building is on which loop. A pipe flow analysis was performed on each of the three main CHW and HHW distribution loops to aid in determining pumping requirements and potential changes to the campus distribution systems. These are identified as the North, South, and West and are shown in the exhibits following this chapter.

Heating System

The heating system at the Central Plant (CP) is comprised of (10) 6,250,000 btu/hr (input) boilers with space and utilities for 2 additional boilers. The Natural Gas fired boilers are piped in a Primary/ Secondary arrangement, with 4 primary pumps and 6 secondary pumps, 2 for each of the 3 distribution loops. The North loop is served by an 8" main and was designed for a maximum of about 670 gpm with the current pumps. The West loop is served by a 6" main and pumps sized for about 380 gpm. The South loop is served by an 8" main that immediately splits into two 6" mains that loops the south campus and was designed for about 1120 gpm.

Five of the campus buildings also have local boilers. AQMD requirements may require some boilers to be removed from service or upgraded if they don't meet air quality requirements.

The Campus currently requires about 44,000 mbh of heating during a peak winter's day. The ten existing boilers can produce up to 54,000 mbh of heat. Therefore 10,000 mbh of heat is available for future expansion.

Building 41 MIC

Three 1,000 mbh HHW boilers

Four 399 mbh steam boilers. The steam boilers are not part of the heating system, rather they serve specialized needs for this building. The 1,000 mbh boilers are difficult to maintain and are rarely used. This building is connected to the Central Plant.

Building 71, UMC

1,630 mbh boiler. This building is planned to be connected to the central plant. Existing boilers then would serve standby and off-hours requirements.

Building 72 DC/CPAC

Two 630.5 mbh boilers. This building is not planned to be connected to the central plant.

Building 73 PYR

Two 2,000 mbh Teledyne Laars boilers. This building is not connected to the Central Plant.

Building 83 ECS

One 301 mbh steam boiler, which is not part of the heating hot water system. This building is connected to the Central Plant.



Chilled Water System

Chilled water is generated at the Central Plant by a combination of Electric Chillers and Electric Ice Harvesting Machines that are part of the Thermal Energy Storage System. Peak electricity rate cooling is completely handled by the Thermal Energy Storage System.

The North loop is served by a 14" main with the pumps sized for 1900 gpm. The West loop is served by a 10" main with the lead pump sized for 1000 gpm. The South loop starts out with a 14" main with two lead pumps and one standby pump each sized at 1930 gpm. List of Central Plant Major Equipment:

(4) 1250 ton Carrier 19EX centrifugal chillers (CH-1 thru 4),

(5) Turbo IGC250LRSC water cooled ice harvesting thermal storage units (IH-1 thru IH-5), Each associated storage tank has a capacity of 26,700 ton-hrs of cooling.

(8) Cooling towers with two speed 40 hp fans (CT-1 thru 8),

(6) Chilled Water primary pumps, 3 serving the Chillers and 3 serving the Thermal Storage Units (CHP-1 thru 6).

(7) Chilled Water secondary pumps. The three campus distribution loops have dedicated pumps all with variable speed drives. Three serve the south loop. The West and North loops each have two pumps for a total of seven (CHP-7 thru CHP-13).

(5) Condenser Water pumps. These are Johnston vertical turbine pumps, 3 are 200 hp and 2 are 100 hp. All of these pumps do not have Variable Speed Drives (CWP-1 thru 5).

(3) Thermal Energy Storage Pumps. These are 125 HP Vertical Turbine Pumps each with a VFD (TESP-1 thru 3).

(2) Plate and Frame heat exchangers.

(4) Cooling Tower water filter and treatment pumps 20 HP each (FLTP-1 thru 4).



Building 41 Boilers



Building 41 Steam Boilers



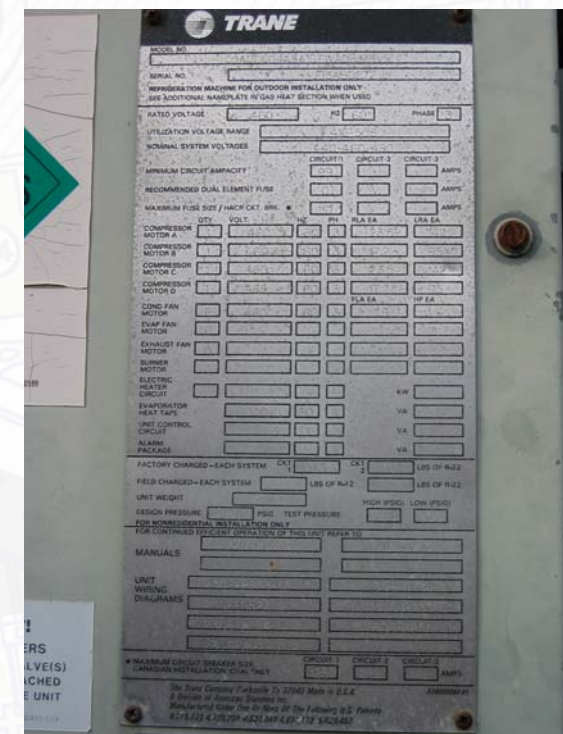
Building 41



Building 50 Chiller



Building 50 Chillers



Building 73 Chiller Nameplate



Building 73 Boiler



Building 73 Boilers



Building 73 Chiller Connection



In addition to the Central Plant, nine buildings also have local chillers. These systems are summarized below.

1. Building 19 LIB – One 500 ton chiller and one 380 ton chiller. This building is connected to the Central Plant.
2. Building 28 UTC – One 40 ton air-cooled chiller that supplies a 300 ton-hr chilled water storage system. This building is connected to the Central Plant.
3. Building 41 MIC – Two 160 ton Trane chillers using R-12 refrigerant. This building is connected to the Central Plant.
4. Building 50 VEC – Two 150 ton York chillers using R-123 refrigerant. This building is connected to the Central Plant.
5. Building 71, UMC – One 120 ton chiller. This building is planned to be connected to the central plant. The existing chiller then could serve standby and off-hours requirements, or be removed from the system.
6. Building 72 DC/CPAC – One 80 ton chiller and one 185 ton chiller. This building is not planned to be connected to the central plant.
7. Building 73 PYR – One 50 ton chiller capable of supporting one air handler during off hours cooling of the Pyramid when the Central Plant is off-line. This building is connected to the Central Plant.
8. Building 83 ECS – Two 535 ton chillers that also supply a 1724 ton-hr Ice on coil thermal energy storage system. This building is connected to the Central Plant.
9. Building 84 HC – Two 100 ton Carrier air-cooled chillers using R-22 refrigerant. This building is connected to the Central Plant.

Term definitions

mbh – Unit of heat = 1000 btu/hr = 1 kbtu/hr

Ton – Unit of cooling = 12,000 btu/hr



Building 83 TES Units



Building 83 Chiller



Building 84 Chillers



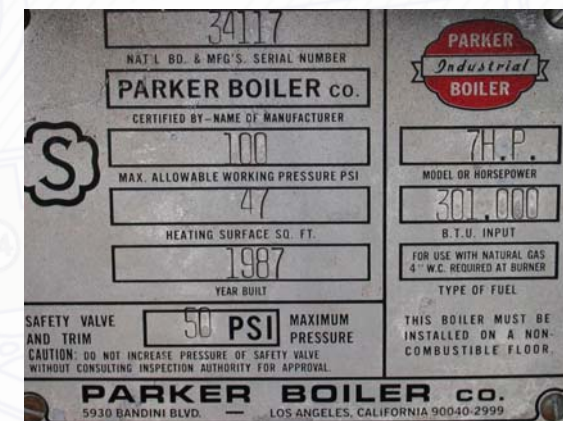
Building 83 Boiler



Building 83 Compressor



Mic Ult Pit - Future Connect



Building 83 Chiller Nameplate



Existing Cooling and Heating Loads by Building

Buildings			Central Plant Service		Cooling				Heating				Remarks	Cond'ed Area (ft ²)
#	Symbol	Name / Description	Loop	Cooling Heating	Calc'd (Tons)	Installed (Tons)	Estimated Diversified CP Load (Tons)	Peak CHW Flow (GPM)	Calc (MBH)	Inst (MBH)	Estimated Diversified CP Load (MBH)	CP HHW Flow (GPM)		
1	BH	Brotman Hall	West	C H	301	360	228	433	2,726	4,184	1816	93		107,200
2	SHS	Studen Health Center	West	C H	63	100	48	91	649	1,059	432	22		19,522
3	NUR	Nursing	West	C H	49	50	37	71	466	445	310	16	HVAC renovated in 1993	12,347
5	FCS	Family Consumer Sciences	West	C H	109	122	82	157	1,034	1,300	689	35	HVAC renovated in 1993	34,970
6	USU	University Student Union	West	C H	452		342	540	7,480		4,983	216	Updated Jan, 06	161,300
9	PSY	Psychology	South	C H	158	120 + 25	120	209	2,200		1,466	FO3	HHW from FO3	48,912
10	LA 5	Liberal Arts - 5	South	C H	105		79	FO3	1,163		775	FO3	CHW/HHW from FO3	36,000
11	LA 4	Liberal Arts - 4	South	H	---	---	0	0	676		450	74		1,058
12	LA 3	Liberal Arts - 3	South	H	---	---	0	0	726	4,150	484	LA4	HHW from LA4	12,165
13	LA 2	Liberal Arts - 2	South	H	---	---	0	0	667		444	LA4	HHW from LA4	10,520
14	LA 1	Liberal Arts - 1	South	C H	88	---	67	116	831	1,675	554	26		18,400
15	FO3	Faculty Office Building	South	C H	68	198	51	228	558	4,640	372	123		19,833
16	FO2	Faculty Office Building	South	H	24	---	0	DX	298		199	LA4	HHW from LA4	4,000
17	LH	Lecture Halls 150/151	South	H	22	22	0	DX	178	250	119	LA4	HHW from LA4	5,592
19	LIB	Library West	South	C H	305	760	231	685	2,531		1,686	84	New Chillers	130,349
20	AS	Academic Services	South	C H	190		144	LIB W	1,534	4,350	1,022	50	CHW from LIB W	71,350
21	MMC	Multi-Media Center	South	C H	24		18	LIB W	207		138	LIB W	CHW/HHW from LIB W	5,155
22	ED1	Education 1	South	C H	73	130	55	96	627	803	418	31		19,699
23	ED2	Education 2	South	C H	71		54	94	1,000	1,008	666	31		12,400
24	MHB	McIntosh Humanities Building	South	C H	75	---	57	99	698		465	24		18,000
25	LAB	Language Arts	South	C H	46	60	35	61	522	1,725	348	16		15,296
26	ST	Studio Theater	South	C H	111	200	84	289	1,334		889	120		32,100
27	UT	University Theater	South	C H	68		51	TA	884	8,184	589	TA	CHW/HHW from TA	13,900
28	UTC	University Telecom	South	C H	40		30	TA	1,600		1,066	TA	CHW/HHW from TA	11,000
32	FA1	Fine Arts 1	South	C H	53		40	70	689	2,112	459	75		9,000
33	FA2	Fine Arts 2	South	H	50	0	0	0	598		398	FA1	HHW from FA1	10,500
34	FA3	Fine Arts 3	South	H	---	---	0	0	683		455	FA1	HHW from FA1	18,410
35	FA4	Fine Arts 4	South	H	---	---	0	0	1,410	1,674	939	44		37,286
37	PH1	Peterson Hall 1	South	H	192		0	0	2,160		1,439	PH3	1994-95 Renovation Scheduled	43,662
38	PH2	Peterson Hall 2	South	H	193		0	0	2,161	4,030	1,440	PH3	HHW from PH3	53,781
39	PH3	Peterson Hall 3	South	H	178		0	0	1,854	4,184	2,787	257		69,744
40	SLH	Science Lecture Hall	South	H	6		0	0	92		61	PH3	Updated Jan, 06 -- Area can be found on "Load Calcs" tab	1,832
41	MIC	Microbiology	South	C H	304	320	230	401	3,043	3,347	2,027	96	24 Hr Operation, local chillers and boilers	34,279



Existing Cooling and Heating Loads by Building (continued)

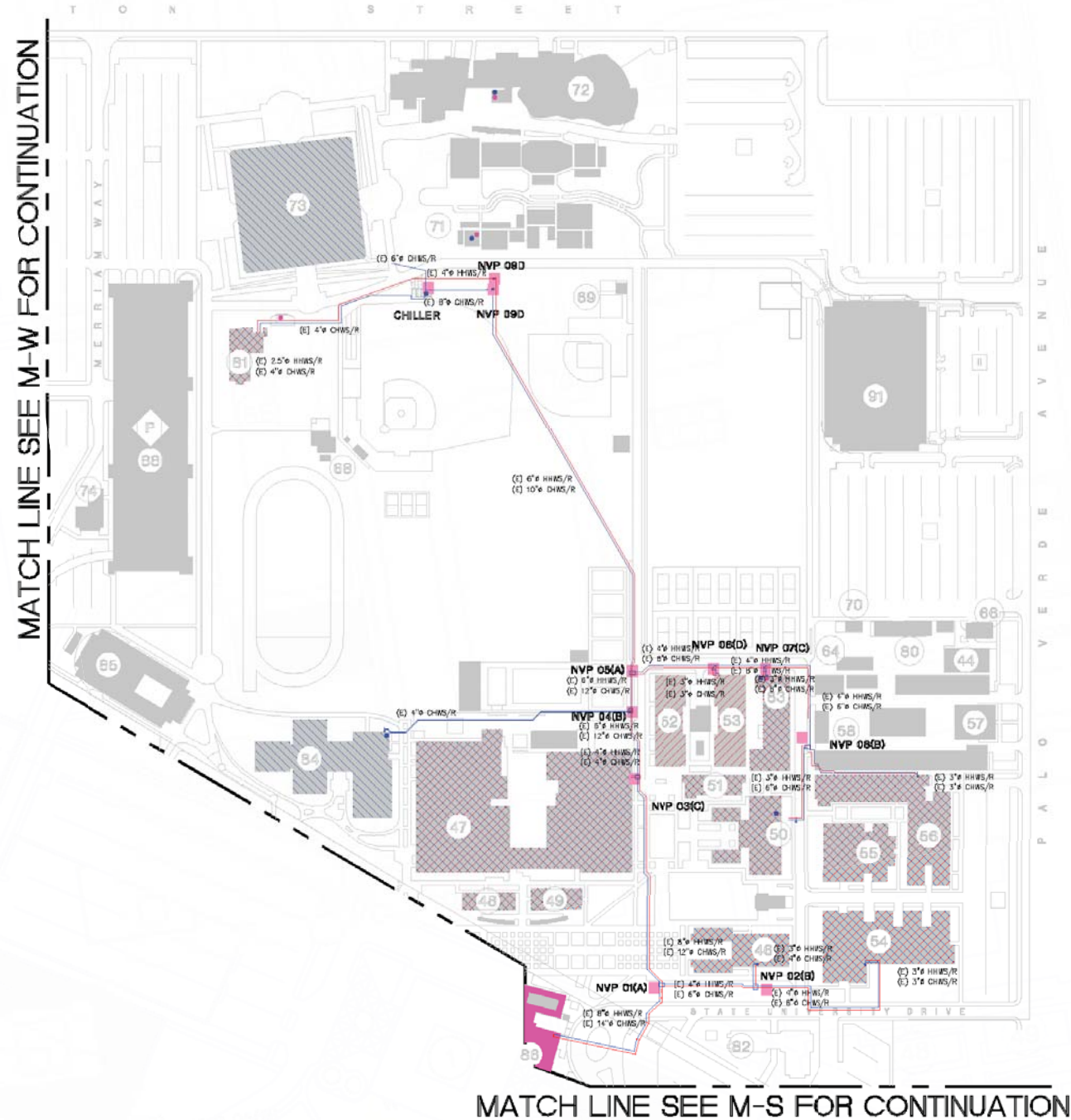
#	Buildings		Central Plant Service		Cooling				HEATING				REMARKS	Cond'ed Area (ft²)
	Symbol	Name / Description	Loop	Cooling-Heating	Calc'd (Tons)	Installed (TONS)	Estimated Diversified CP Load (TONS)	Peak CHW Flow (GPM)	Calc (MBH)	Inst (MBH)	Estimated Diversified CP Load (MBH)	CP HHW Flow (GPM)		
48	HHS1	Health and Human Services Classrooms	North	C H	32		24	PE	236		157	PE	CHW/HHW from PE	6,292
49	HHS2	Health and Human Services Offices	North	C H	22		17	PE	200		133	PE	CHW/HHW from PE	6,630
50	VEC	Vivian Engineering Center	North	C H	193	300	146	363	1,596	4,020	1,063	55	HVAC renovated in 1992	53,524
51	EN2	Engineering 2	North	C H	59		45	EN1	588	2,144	392	EN4	CHW from EN1/HHW from EN4	16,616
52	EN3	Engineering 3	North	H	---	---	0	0	510		340	EN4	HHW from EN4	27,057
53	EN4	Engineering 4	North	H	---	---	0	90	509		339	55	(CHW for Hydraulic Lab)	15,516
54	DESN	Design	North	C H	65		49	173	1,980	2,790	1,319	96		20,328
55	HSD	Human Services Design	North	C H	55	130	42	TE1	809		539	TE1	CHW/HHW from TE1	20,240
56	ET	Engineering Technology	North	C H	100	100	76	144	968	2,000	645	33		37,248
57	FM	Facilities Management	North	N	13	15	0	0	120	122	0	0	Not feasible	9,313
71	UMC	University Music Center	North	F	129	120	0	0	1,190	1,304	0	0	Currently not connected, proposed connection	66,476
72	CPAC	Carpenter Performing Arts Center	North	N	260	260	0	0	1,361	1,261	0	0	Not proposed to be connected	143,897
73	PYR	Pyramid Sports Arena	North	C	524	780	396	630	2,880	3,200	0	--	Completed	157,335
81	PA	Pyramid Annex	North	C H	62	49	47	65	780	300	520	30	Completed	19,510
83	ECS	Engineering/Computer Science	North	C H	350	329	265	504	2,990	1,216	1,992	103	Includes (2) 862 Ton-Hrs TES tanks	65,909
84	HC/UAM	Horn Center	North	C	131	174	99	189	830		0	--	Electric Reheat	43,432
85	CBA	College of Business Administration	N/A	N	---	238	0		1,663	614	0	--	Water Source Heat Pumps	58,072
86	CP	Central Plant	CP	C	47	47	36	48			0	--		34,825
94	MLSC	Molecular and Life Sciences Center	South	C H	327	691	247	436	1,200	840	799	42	Updated Jan, 06	93,159
					5,690		3,800	6,795	72,809		44,000			
		# of building with HHW	49											
		# of building with CHW	36											



NO.	BUILDING DESIGNATION
44	Electrical Substation (North)
46	Social Sciences & Public Affairs
47	University Gymnasiums
48	Health & Human Services Classrooms
49	Health & Human Services Offices
50	Vivian Engineering Center
51	Engineering 2
52	Engineering 3
53	Engineering 4
54	Design
55	Human Services & Design
56	Engineering Technology
57	Facilities Management
58	Corporation Yard
64	Greenhouse 3
66	Reprographics
68	Restrooms/Storage
69	Softball Field Restroom
70	Main Distribution Communications Facility MDF B
71	University Music Center
72	Carpenter Performing Arts Center & Dance Center
73	Mike and Arline Walter Pyramid
74	Parking Transportation Services
80	University Police
81	Parking Office Building
82	Outpost Food Service
83	Engineering / Computer Science
84	Steve and Nini Horn Center
85	College of Business
86	Central Plant
88	Parking Structure No. 1
91	Parking Structure No. 2

Building / Boundary Legend

-  EXISTING BUILDING
-  CHILLED WATER
-  HEATING HOT WATER
-  CHWS
-  HHWS








M-N
CHW / HHW PIPING
NORTH / WEST LOOPS



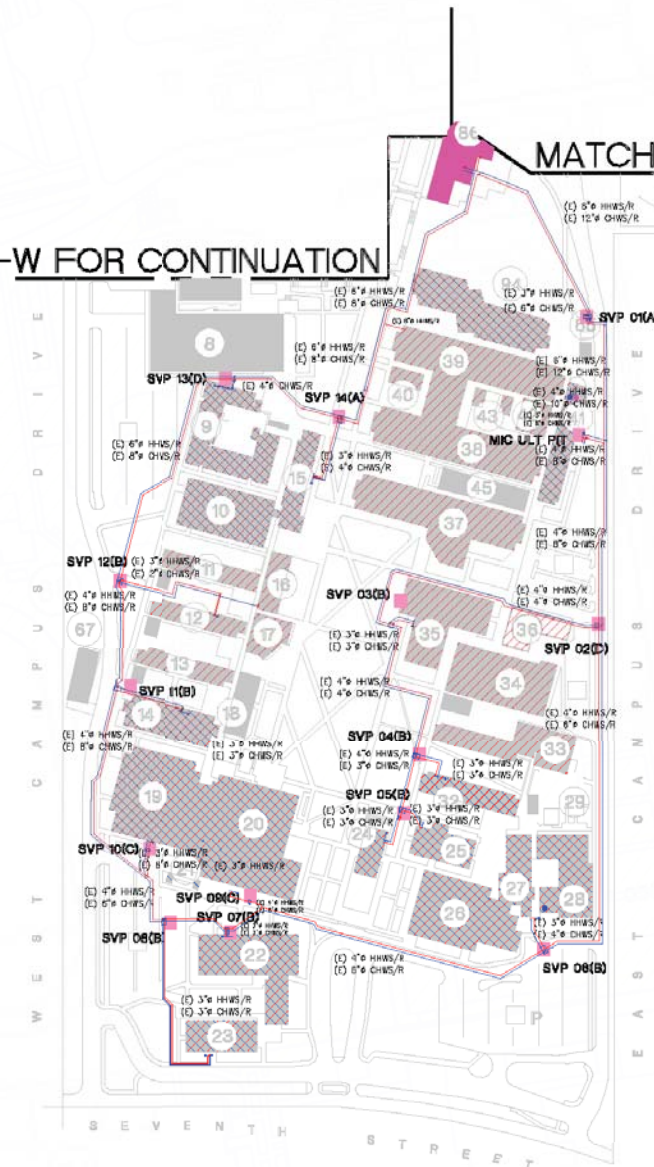
NO.	BUILDING DESIGNATION	NO.	BUILDING DESIGNATION
8	University Bookstore	28	University Telecommunications
9	Psychology	29	Art Annex
10	Liberal Arts 5	32	Fine Arts 1
11	Liberal Arts 4	33	Fine Arts 2
12	Liberal Arts 3	34	Fine Arts 3
13	Liberal Arts 2	35	Fine Arts 4
14	Liberal Arts 1	36	Faculty Office 4
15	Faculty Office 3	37	Peterson Hall 1
16	Faculty Office 2	38	Peterson Hall 2
17	Lecture Halls 150-151	39	Peterson Hall 3
18	Faculty Office 1	40	Science Lecture Hall
19	Library	41	Microbiology
20	Academic Services	42	Animal House
21	Multi-Media Center	43	Greenhouse 1&2
22	Education 1	45	Faculty Office 5
23	Education 2	65	Electrical Substation (South)
24	McIntosh Humanities Building	67	Main Distribution Communication Facility MDF A
25	Language Arts Building	86	Central Plant
26	Studio Theatre	94	Molecular and Life Sciences Center
27	University Theatre		

Building / Boundary Legend

-  EXISTING BUILDING
-  CHILLED WATER
-  HEATING HOT WATER
-  CHWS
-  HHWS

MATCH LINE SEE M-W FOR CONTINUATION

MATCH LINE SEE M-N FOR CONTINUATION








M-S
CHW / HHW PIPING
SOUTH LOOP



NO.	BUILDING DESIGNATION
1	Brotman Hall
2	Student Health Services
3	Nursing
4	Soroptomist House
5	Family & Consumer Sciences
6	University Student Union
7	Cafeteria
59	Patterson Child Development Center
60	Los Alamitos Hall
61	Los Cerritos Hall
62a	Residence Commons
62b	Parkside Commons
63	Recycling Center
75	International House
76	Earl Burns Miller Japanese Garden
78	Visitor Information Center
79	Main Distribution Communications Facility MDF C
86	Central Plant
89	Housing & Residential Life

Building / Boundary Legend

-  EXISTING BUILDING
-  CHILLED WATER
-  HEATING HOT WATER
-  CHWS
-  HHWS



Natural Gas Systems

Existing Natural Gas Distribution

Natural gas is supplied to the University by the City of Long Beach with a long term transportation agreement with the Department of General Services (DGS), which was implemented in 2002. There are seven different natural gas meters on campus with four meters serving the residential buildings, one for the main campus, one serving the Carpenter Performing Arts Center (Building 72) and the Pyramid (Building 73), and the last one for the campus pool. Table 1 provides a summary of the natural gas meters. Figure 1 shows a typical natural gas meter installation on campus.

An 8-inch high pressure gas (HPG) city main is cross connected between Bellflower Blvd and Palo Verde Ave, which is routed along Beach Drive, crossing through mid-campus, and along State University Drive. There is also a natural gas line along Atherton Street serving two meters at the north side of campus, one on the northwest side and one on the northeast side. The northwest meter serves Residence Hall (Building 62B) and the northeast meter serves the Carpenter Performing Arts Center and the Pyramid.

An 8-inch natural gas line is branched from the HPG city main to the main campus natural gas meter. The HPG is reduced to medium pressure gas (MPG) at approximately 5 psig and then is distributed to the campus buildings through a 6-inch main. The residential buildings are also served with MPG with pressure regulators for each building. The Central Plant (Building 86) has a separate 4-inch HPG line because it is the only building that requires HPG at approximately 35 psig.

The main campus meter is essentially located in the middle of the University campus near the 8-inch HPG line northeast of the Central Plant. The main campus gas line has three 6-inch branches to serve the entire University campus. The east branch serves the east side of campus, the south branch serves the south side of campus, and the west branch splits and serves the west and north side of the campus. Figure 2 below shows the campus existing natural gas distribution system.

Since the main campus natural gas distribution system was installed in the 1950s, the majority of the existing main campus natural gas distribution piping material is PVC pipe with some portions retrofitted with PE or steel pipe. PVC pipe is not the recommended plastic pipe material to be used for a natural gas distribution system (2004 ASHRAE – HVAC Systems and Equipment Chapter 41 – Table 8). Toward the end of 2005, approximately the first 530 ft of the pipe branch serving the west side of the campus has been retrofitted from PVC to PE. The first 700 ft of the pipe branch serving the north side of the campus is PE pipe as well as the natural gas piping serving the Carpenter Performing Arts Center and the Pyramid.

The natural gas piping serving the Liberal Arts Buildings (Buildings 11, 12, and 13) and the Education Building (Building 22) is steel pipe, which was serving local boilers for each building. The steel piping has been capped and has not been in use since the completion of the Central Plant and the subsequent removal of local boilers.

Discussions with CSULB representatives revealed that the existing PVC pipes are connected with glue and are breaking down and causing many gas leaks throughout the natural gas distribution system.



FIGURE 1 - Typical Natural Gas Meter



FIGURE 2 - Existing Natural Gas Distribution System



Existing Natural Gas Loads

The natural gas loads were estimated for the entire campus and include all residential buildings, classroom and laboratory buildings, theaters, studios, gyms and recreation centers, and office/administration buildings.

The natural gas loads for the residential buildings were estimated based on the natural gas bill summaries dating back from 1996 – 2005, which shows the consumption load and cost per meter. The peak-load-per-year for each residential meter was averaged to estimate the average load for each meter. Table 1 on this page shows meter names, meter numbers, and the average load per meter. The total existing natural gas load for the campus is approximately 117,000 CFH.

The International House NG meter serves only the International House Residential Building with a NG load of 188 CFH. The pool NG meter serves only the pool at approximately 2,840 CFH. The housing NG meter loads for Residence Hall, Parkside Hall, Los Alamitos Hall, and Los Cerritos Hall was divided by the number of buildings to determine the NG load for each residential building. Each residential building was assumed to have the same building square-footage. Figure 2.5-3 below shows the natural gas meter for Residence Hall.

The main campus buildings' natural gas load was estimated based on domestic hot water demand (since heating hot water was provided by the central plant for most buildings) and gas-fired equipment such as kilns. Some buildings have their own local boiler(s) to provide heating hot water as well as domestic hot water. Buildings not connected to the natural gas distribution system use electric water heaters for domestic hot water service.

The domestic hot water demand was calculated by determining the amount of fixture units based on the number of occupants in the building. Diversity was applied to the fixture units based on the diversified number of occupants, which has a diversity value of 50%. The method used in determining the domestic hot water demand was the instantaneous method (ASHRAE Applications Handbook Chapter 49 – Service Water Heating) since the main parameter used to estimate the domestic hot water demand were fixture units. Title 24 was used to estimate the number of occupants inside the building. Table 3 shows the estimated main campus natural gas load per building.

Existing Natural Gas Model

GEI created natural gas models using AFT Arrow v3.0 which models compressible fluid distribution systems. A natural gas model was created for each meter serving multiple buildings. Meters serving a single building/function were not modeled such as International House and the campus pool. The existing natural gas models were developed based on as-built drawings such as pipe routing, material, and pipe size.

All natural gas models used a 5 psig supply pressure except for the central plant which uses high pressure NG at approximately 35 psig. Since the central plant required high pressure, the central plant was omitted from the existing main campus natural gas distribution model.

There are many pressure regulators shown on the as-built drawings for many buildings in the existing natural gas distribution system, predominantly for Residence Hall Parkside. Figure 1 shows a typical natural gas regulator installed at the campus buildings. The pressure for the PRVs was set at 0.5 psig (14 in. w.c). Table 2 provides a summary of the pressure drop for each existing natural gas model.



FIGURE 1 - Typical Natural Gas Pressure Regulator

TABLE 1 - Meter Loads

Meter Name	Meter No.	Load (CFH)
International House	2939-7574	188
Housing-Residence	3823-3250	1,152
Housing-Parkside	2939-3210	2,112
Housing-LAH, LCH	2939-3220	960
PAC-Pyramid	3823-3258	7,261
Main Campus	7032-5990	102,686
Pool	7070-1010	2,837
Total	-	117,196

TABLE 2 - Pressure Drops

Meter Name	Meter No.	Pressure Drop (psig)
Housing-Residence	3823-3250	0.77
Housing-Parkside	2939-3210	0.5
Housing-LAH, LCH	2939-3220	0.5
PAC-Pyramid	3823-3258	0.5
Main Campus	7032-5990	1.2



Bldg #	Building Name	Bldg ID	SQFT	Building Function	Occupancy Factor (SF/Person) ¹	No. of People ⁷	No. of Fixture Units ²	HW (GPM) ⁴	BTUH ⁵	NG for DHW & Misc Loads (CFH) ⁶	Boiler NG Load (CFH)	CP Connection	Total NG (CFH)	Notes
1	Brotman Hall	BH	127,050	Offices	100	0	0	16	640,000	640		Yes	640	
2	Student Health Services	SHS	38,629	Offices	100	0	0	10	400,000	400		Yes	400	
3	Nursing	NUR	13,307	Treatment Room	240	0	8	5	200,000	200		Yes	200	
5	Family and Consumer Services	FCS	39,860	Student Services	100	0	0	10	400,000	400		Yes	400	
6	University Student Union	USU	161,300	Student Services	100	0	0	19	760,000	760		Yes	760	
7	Cafeteria	CAFÉ	35,305	Dining	15	0	0	23	920,000	920		No	920	
8	Bookstore	BKS	65,922	Student Services	100	0	0	12	480,000	480		No	480	
9	Psychology	PSY	85,147	Classrooms/Offices	60	0	0	17	680,000	680		Yes	680	avg'd classroom (20) and offices (100) together; 60
10	Liberal Arts	LA5	63,220	Classrooms/Offices	60	0	0	15	600,000	600		Yes	600	avg'd classroom (20) and offices (100) together; 60
14	Liberal Arts	LA1	40,230	Classrooms/Offices	60	0	0	11	440,000	440		Yes	440	avg'd classroom (20) and offices (100) together; 60
15	Faculty Office	FO3	33,373	Offices	100	0	0	8	320,000	320		Yes	320	
19/20	Library/Academic Services	LIB/AS	343,046	Offices	100	0	0	27	1,080,000	1,080		Yes	1,080	
24	Mcintosh Humanities Bldg	MHB	42,510	Classrooms/Offices	60	0	0	12	480,000	480		Yes	480	avg'd classroom (20) and offices (100) together; 60
25	Language Arts Bldg	LAB	27,480	Classrooms/Offices	60	0	0	9	360,000	360		Yes	360	avg'd classroom (20) and offices (100) together; 60
26	Studio Theatre	ST	49,236	Student Activities	15	0	0	26	1,040,000	1,040		Yes	1,040	
27	University Theatre	UT	19,598	Student Activities	15	0	0	16	640,000	640		Yes	640	
28	University Telecommunications	UTC	23,600	Student Services	100	0	0	7	280,000	280		Yes	280	
29	Art Annex	ANNEX	1,046	Classrooms/Offices	60	0	0	5	200,000	200		No	200	avg'd classroom (20) and offices (100) together; 60
32	Fine Arts	FA1	15,504	Classrooms/Offices	60	0	0	7	280,000	280		Yes	280	avg'd classroom (20) and offices (100) together; 60
33	Fine Arts	FA2	20,074	Classrooms/Offices	60	0	0	8	320,000	320	7,431	Yes	7,751	avg'd classroom (20) and offices (100) together; 60
34	Fine Arts	FA3	22,910	Classrooms/Offices	60	0	0	8	320,000	320		Yes	320	avg'd classroom (20) and offices (100) together; 60
35	Fine Arts	FA4	83,844	Classrooms/Offices	60	0	0	17	680,000	680		Yes	680	avg'd classroom (20) and offices (100) together; 60
36	Faculty Office	FO4	13,768	Offices	100	0	0	6	240,000	240		No	240	
37	Peterson Hall	PH1	65,000	Laboratories	20	0	0	26	1,040,000	2,080		Yes	2,080	Includes lab cocks
38	Peterson Hall	PH2	80,018	Laboratories	20	0	0	29	1,160,000	2,320		Yes	2,320	Includes lab cocks
39	Peterson Hall	PH3	112,232	Laboratories	20	0	0	32	1,280,000	2,560		Yes	2,560	Includes lab cocks
41	Microbiology	MICRO	47,498	Laboratories							4,995	Yes	4,995	5-Steam Boilers at 399,000 BTU, 3-HW Boilers at 1,000,000 BTU
43	Greenhouse 1 & 2	SGH1 & 2	984		300	0	1	5	200,000	200		N/A	200	considered as warehouse
44		ESN	773	Offices	100	0	0	5	200,000	200		N/A	200	considered as warehouse



Bldg #	Building Name	Bldg ID	SQFT	Building Function	Occupancy Factor (SF/Person) ¹	No. of People ⁷	No. of Fixture Units ²	HW (GPM) ⁴	BTUH ⁵	NG for DHW & Misc Loads (CFH) ⁶	Boiler NG Load (CFH)	CP Connection	Total NG (CFH)	Notes
46	Social Science/Public Admin	SS/PA	57,951	Classrooms/Offices	60	0	0	13	520,000	520		Yes	520	avg'd classroom (20) and offices (100) together; 60
47	GYM	GYM	167,286	Gym	25	0	0	120	4,800,000	4,800		Yes	4,800	Based on UCR Rec Center, doubled values of ucr rec center
48	Health & Human Services (Classrooms)	HHS-1	8,200	Classrooms/Offices	20	0	0	9	360,000	360		Yes	360	
49	Health & Human Services (Offices)	HHS-2	13,034	Offices	100	0	0	5	200,000	200		Yes	200	
50	Vivian Engineering Center	VEC	87,000	Offices	100	0	0	13	520,000	520		Yes	520	
52	Engineering	EN3	24,385	Classrooms/Offices	60	0	0	9	360,000	360		Yes	360	avg'd classroom (20) and offices (100) together; 60
53	Engineering	EN4	16,929	Classrooms/Offices	60	0	0	7	280,000	280		Yes	280	avg'd classroom (20) and offices (100) together; 60
54	Design Center	DESN	44,768	Student Services	100	0	0	9	360,000	360		Yes	360	
55	Human Services and Design	HSD	24,300	Student Services	100	0	0	7	280,000	280		Yes	280	
56	Engineering Technology	ET	67,143	Classrooms/Offices	60	0	0	15	600,000	600		Yes	600	avg'd classroom (20) and offices (100) together; 60
57	Facilities Management	FM	9,313	Offices	100	0	0	5	200,000	200		No	200	
58	Corporation Yard	CORP/FNGH	51,833	Offices	100	0	0	11	440,000	440		No	440	
64		SGH3	2,650	Offices	100	0	0	5	200,000	200		N/A	200	
65		ESS	7,607	Offices	100	0	0	5	200,000	200		N/A	200	
67		MDFA	1,700	Offices	100	0	0	5	200,000	200		No	200	
68		PEFR	720	Offices	100	0	0	5	200,000	200		N/A	200	
70		MDFC	1,200	Offices	100	0	0	5	200,000	200		No	200	
71	University Music Center	UMC	66,476	Student Activities							1,630	No	1,630	1-Boiler at 1,630,000 BTU
79		MDFC	700	Offices	100	0	0	5	200,000	200		No	200	
81		POB	19,510	Offices	100	0	0	6	240,000	240		Yes	240	
82		OUTPOST	5,500	Offices	100	28	4	5	200,000	200		No	200	Connected to HPG line; Has own regulator
83	Engineering/Computer Sciences	ECS	101,607	Classrooms/Offices							301	Yes	301	1-HW Boiler @ 301,000 BTU
84	Horn Center	HC	49,686	Offices	100	0	0	8	320,000	320		Yes	320	
86	Central Plant	CP	41,999	Mechanical							50,000	Yes	50,000	10-5 Million BTUH Boilers
94	Molecular & Life Sciences Center	MLSC	93,159	Laboratories	15	0	0	32	1,280,000	2,560		Yes	2,560	
11	Liberal Arts	LA4	14,210	Classrooms/Offices	60	0	0	7	280,000	280		Yes	280	avg'd classroom (20) and offices (100) together; 60
12	Liberal Arts	LA3	15,689	Classrooms/Offices	60	0	0	7	280,000	280		Yes	280	avg'd classroom (20) and offices (100) together; 60
13	Liberal Arts	LA2	13,708	Classrooms/Offices	60	0	0	7	280,000	280		Yes	280	avg'd classroom (20) and offices (100) together; 60
16	Faculty Office	FO2	11,994	Offices	100	0	0	6	240,000	240		Yes	240	



Bldg #	Building Name	Bldg ID	SQFT	Building Function	Occupancy Factor (SF/Person) ¹	No. of People ⁷	No. of Fixture Units ²	HW (GPM) ⁴	BTUH ⁵	NG for DHW & Misc Loads (CFH) ⁶	Boiler NG Load (CFH)	CP Connection	Total NG (CFH)	Notes
17	Lecture Halls	LH150/151	7,050	Classrooms/Offices	60	0	0	6	240,000	240		Yes	240	avg'd classroom (20) and offices (100) together; 60
18	KKJZ/FM	KKJZ	6,776	Student Activities	100	0	0	5	200,000	200		No	200	
21	Multi-Media Center	MMC	6,728	Student Services	100	0	0	5	200,000	200		Yes	200	
22	Education	ED1	23,447	Classrooms/Offices	60	0	0	9	360,000	360		Yes	360	avg'd classroom (20) and offices (100) together; 60
23	Education	ED2	24,237	Classrooms/Offices	60	0	0	10	400,000	400		Yes	400	avg'd classroom (20) and offices (100) together; 60
40	Science Lecture Hall	SLH-140/141	2,245	Classrooms/Offices	60	0	0	5	200,000	200		Yes	200	avg'd classroom (20) and offices (100) together; 60
42	Animal House	AH	6,683		300	0	0	5	200,000	200		Yes	200	considered as warehouse
45	Faculty Office	FO5	12,306	Offices	100	0	0	5	200,000	200		Yes	200	
51	Engineering	EN2	24,378	Classrooms/Offices	60	0	0	10	400,000	400		Yes	400	avg'd classroom (20) and offices (100) together; 60
59	Child Development Center	CDC	7,892	Day Care	35	0	0	19	760,000	760		No	760	
63	Recycling Center	RECYCLE	7,482	Warehouse	500	0	0	5	200,000	200		N/A	200	
66		REPR	2,400	Offices	100	0	0	5	200,000	200		No	200	
69		SFR	847	Offices	100	0	0	5	200,000	200		N/A	200	
74		PKGADMN	3,627	Offices	100	0	0	5	200,000	200		No	200	
76		JG	382	Offices	100	0	1	5	200,000	200		No	200	
77		TOB	6,859	Offices	100	0	0	5	200,000	200		No	200	
78	Visitor Information Center	VIC	800	Offices	100	0	0	5	200,000	200		N/A	200	
80		UOB	6,000	Offices	100	0	0	5	200,000	200		No	200	
85		COB	87,531	Offices	100	0	0	13	520,000	520		No	520	
89	Housing Administration Office	HAO	3,814	Offices	100	0	0	5	200,000	200		No	200	
		Total	2,934,205							32,560	64,357		96,917	

Note 1: Values from 2005 Title 24

Note 2: 2003 ASHRAE Applications Chapter 49 Table 14

Note 3: Note Used

Note 4: 2003 ASHRAE Applications Chapter 49 Figure 22 and 23

Note 5: BTUH = GPM X (140-60) X 500

Note 6: 1000 BTU/CF






Note 7: Number of people at 50% diversity

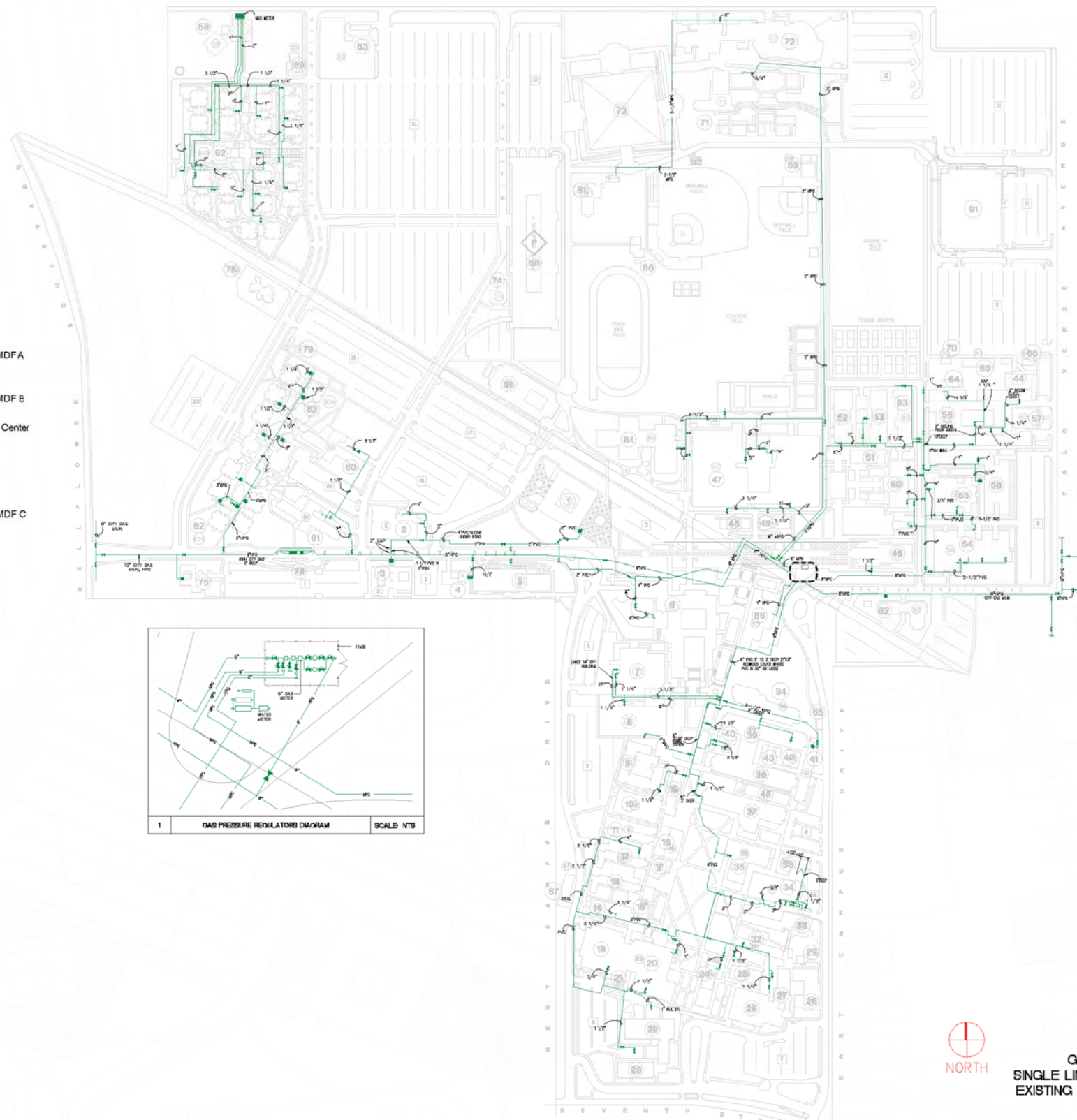
Note 8: Shaded rows represent buildings not connected to the the NG gas distribution. Based on NG distribution drawing.



NO.	BUILDING DESIGNATION	NO.	BUILDING DESIGNATION
1	Brotman Hall	49	Health & Human Services Offices
2	Student Health Services	50	Vivian Engineering Center
3	Nursing	51	Engineering 2
4	Scorptomist House	52	Engineering 3
5	Family & Consumer Sciences	53	Engineering 4
6	University Student Union	54	Design
7	Cafeteria	55	Human Services & Design
8	University Bookstore	56	Engineering Technology
9	Psychology	57	Facilities Management
10	Liberal Arts 5	58	Corporation Yard
11	Liberal Arts 4	59	Patterson Child Development Center
12	Liberal Arts 3	60	Los Alamitos Hall
13	Liberal Arts 2	61	Los Cerritos Hall
14	Liberal Arts 1	62a	Residence Commons
15	Faculty Office 3	62b	Parkside Commons
16	Faculty Office 2	63	Recycling Center
17	Lecture Halls 150-151	64	Greenhouse 3
18	Faculty Office 1	65	Electrical Substation (South)
19	Library	66	Reprographics
20	Academic Services	67	Main Distribution Communications Facility MDF A
21	Multi-Media Center	68	Restrooms/Storage
22	Education 1	69	Softball Field Restroom
23	Education 2	70	Main Distribution Communications Facility MDF B
24	McIntosh Humanities Bldg	71	University Music Center
25	Language Arts Building	72	Carpenter Performing Arts Center & Dance Center
26	Studio Theatre	73	Mike and Arline Walter Pyramid
27	University Theatre	74	Parking Transportation Services
28	University Telecommunications	75	International House
29	Art Annex	76	Earl Burns Miller Japanese Garden
30	Fine Arts 1	78	Visitor Information Center
31	Fine Arts 2	79	Main Distribution Communications Facility MDF C
32	Fine Arts 3	80	University Police
33	Fine Arts 4	81	Parking Office Building
34	Faculty Office 4	82	Outpost Food Service
35	Peterson Hall 1	83	Engineering / Computer Science
36	Peterson Hall 2	84	Steve and Nini Hom Center
37	Peterson Hall 3	85	College of Business
38	Science Lecture Halls	86	Central Plant
39	Microbiology	88	Parking Structure No. 1
40	Animal House	89	Housing & Residential Life
41	Greenhouse 1&2	91	Parking Structure No. 2
42	Electrical Substation (North)	94	Molecular and Life Science Center
43	Faculty Office 5		
44	Social Sciences & Public Affairs		
45	University Gymnasiums		
46	Health & Human Services Classrooms		

Building / Boundary Legend

-  EXISTING BUILDING
-  GAS VALVE OR COCK
-  GAS METER OR REGULATOR
- HPG HIGH PRESSURE GAS
- MPG MEDIUM PRESSURE GAS
- IG INDUSTRIAL GAS
- DC DOMESTIC GAS
- PVC POLY-VINYL CHLORIDE
-  CLAMP
-  GAS LINE



Electrical Service

California State University, Long Beach is currently served from a 66kV transmission service originating from an outdoor switchyard located in the Corporation yard on the north east side of the campus. The campus derives its power from Southern California Edison and purchases its electricity directly from an energy service provider. The 66kV service is transformed to a 12kV service with the help of (2) 10/12 5 mVA 66-12kV transformers located in the outdoor switchyard. Transformer bank #1 was installed in 1965 and bank #2 was installed in 1992. Both of the transformers are served by the same high voltage breaker on the primary side. The secondary side of these transformers serves the main campus 12.47 kV switchgear with the main-tie-main arrangement. The switchgear is located on the northeast side of the campus. The North substation is equipped with two 15kV feeds, a metering sections and 15kV main switchgear comprising of a 2000A main breaker and 1200A feeder breakers. Eight 12kV feeders originating from this switchgear form multiple loops through 15kV selector switches and serve power to various buildings and facilities on campus. Feeders '1' through '6' form loops 'A', 'B' and 'C' and feeders '7' and '8' serve a 15kV switchgear located on the south side of the campus. Feeders '13' and '14' serve the Central Plant. The south switchgear comprises of a 2000A main breaker and 4 1200A feeder breakers. Feeders '9' through '12' originating from these substations form loops 'D' and 'E' through 15kV selector switches and serve each building on the south side of campus. Radial feeders originating from 15kV selector switches serve substation(s) in each building on campus that meet the power demands of the building. An electrical site plan showing locations of substations, manholes and routing of circuits through out the campus is provided at the end of the section. All conduits are sized 4" and are encased in concrete. Table 1 summarizes the installed capacities in kVA on each substation feeder. The University owns and maintains the 66kV-12kV transformers, 15kV substations, 15kV distribution network, and the substations located in each building. A single line diagram of the campus is also enclosed at the end of the section.

The main switchgears are in good condition. However, in April of this year, the main substation experienced a phase-to-ground fault on the secondary side of transformer bank #1. This fault led to an outage on the bus of the main 12.47 kV switchgear. This fault was caused by bird roosting on the secondary rack and led to a total blackout of the campus for a period of time.

The current configuration causes both transformers to lose power during any fault that is detected within the zone of protection. This is due to a common high voltage breaker serving both transformers and sharing the differential relay scheme.

Electrical Distribution System

The campus main 15kV distribution system comprises of 15kV, '3' conductor 250MCM EPR cables installed in concrete encased duct banks that traverse through conduits and manholes to serve 15kV selector switches located on campus. Radial feeders originating from these selector switches and sized to individual building loads serve each building's substation. The campus distribution system was upgraded in 1994 from a 4.16kV to a 12kV system and new 15kV feeders and 12kV transformers were provided. The existing distribution system is in good condition. Following table provides installed capacities in kVA on each of the 12 feeders originating from the 12kV switchgears. Similarly, the existing emergency generators and the facilities they serve are shown in Table 4.

A review of the connected loads on each feeder revealed that the feeders are not balanced and feeders '6' and '3' have maximum loads. Feeder '11' was found to be lightly loaded compared to the other feeders. Remaining feeders were found to be balanced and had an average connected load of approximately 4000-7000kVA. The existing distribution system is adequately sized to meet the current demands of the campus and is in good condition.



FIGURE 1 - Main 12 kV North Switchgear



FIGURE 2 - Main 12 kV South Switchgear

Current Campus Connected load and Demand

Table 3 provides connected distribution load in kVA for each feeder on campus.

The current installed capacity of the campus is 52,000kVA and the maximum demand of the campus is approximately 10,000 kVA which occurs during the months of September and October.

The total energy consumption of the campus per year is approximately 50,000,000kWh.

The campus currently has eleven electrical meters at the campus. Table 2 provides the numbers and the areas each meter serves at the campus.

The charts below provide the KWH variations, main meter peaks and total electrical cost variation from January to December 2005.

TABLE 1 - Installed Capacities by Substation/Feeder

Substation	Feeders	Installed Capacity in KVA
North Substation	Feeder '1'	5,725
	Feeder '2'	5,450
	Feeder '3'	7,625
	Feeder '4'	4,975
	Feeder '5'	4,150
	Feeder '6'	8,025
South Substation	Feeder '9'	6,475
	Feeder '10'	5,013
	Feeder '11'	5,200
	Feeder '12'	4,901



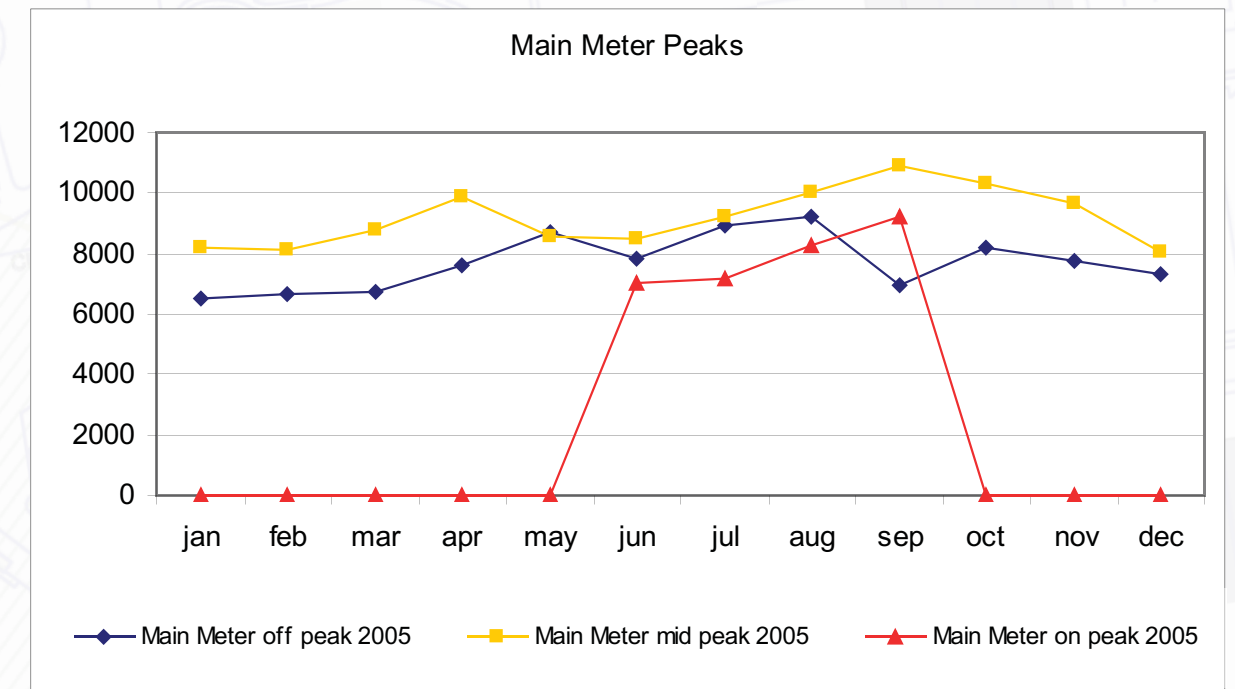
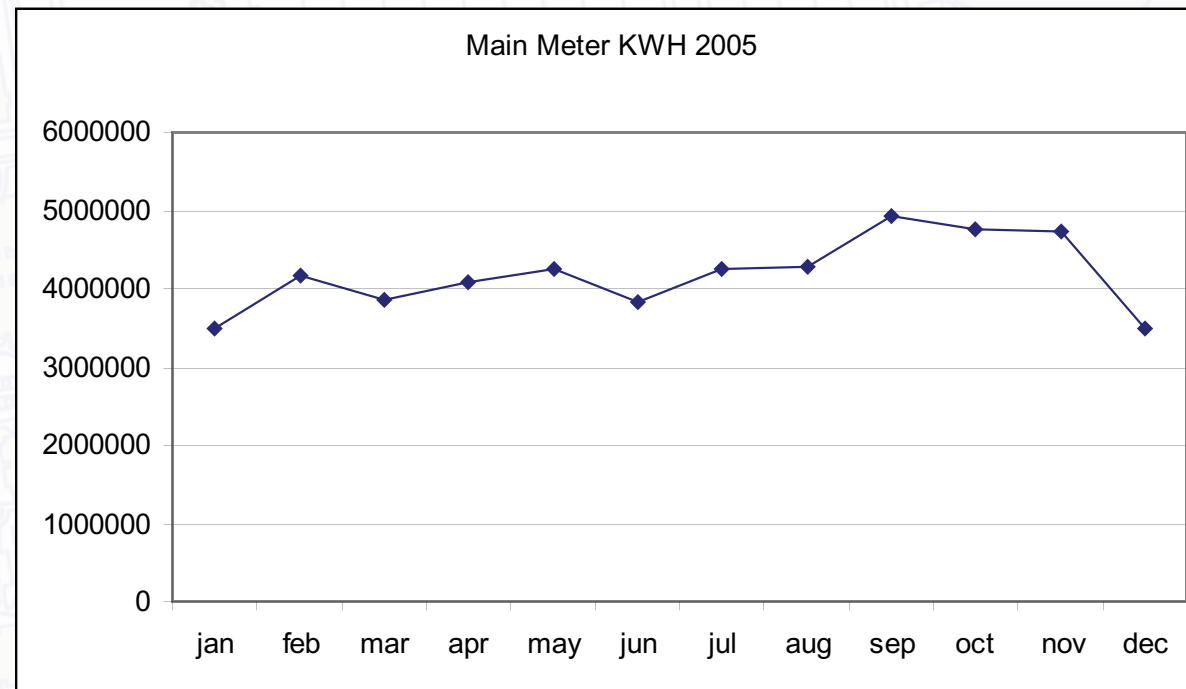


TABLE 2

Location	Meter Number	UDC Account	ESP Account	Tariff
Main Campus	X345P-006153	3001360974	N/A	TOU-8
	X345P-006152	3005076889	N/A	
SCE Sub-Station	8-897575	3004076888	N/A	GS-1
SCE Sub-Station	8-897576	3000001835	N/A	GS-1
CDC	349-015354	3017140504	N/A	GS-2
KKJZ	349-001324	3000001837	N/A	GS-2
Gate, Lot 7	8-099504	3008548821	N/A	GS-1
CDC	O717-004050	3000001840	N/A	GS-2
FO-4	349-015779	3000001839	N/A	GS-2
FO-5	349-016488	3000978453	N/A	GS-2
HOUSING	Y717-023006	3000001843	N/A	GS-2
HOUSING	V349N-002595	3001360974	N/A	GS-2

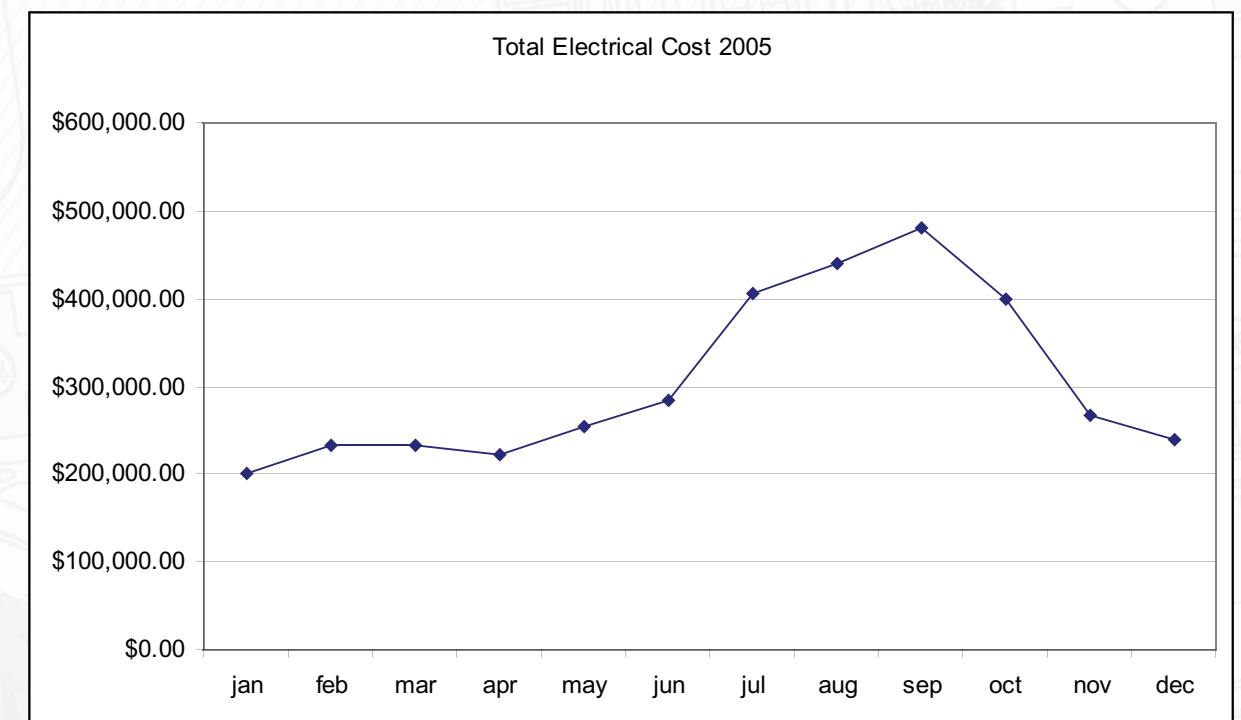


TABLE 3 - Connected Distribution Loads

Building Number	ID	Name	GSF	ASF	in KVA	Served from
46	SSPA	Social Sciences & Pub Affairs	57,951	37,668	750	Substation 'North' Feeder '1'
50	VEC	Vivian Engineering Center	87,000	56,550	1,500	Substation 'North' Feeder '1'
54	DESN	Design	44,768	29,099	750	Substation 'North' Feeder '1'
55	HSD	Human Services and Design	24,300	15,795	500	Substation 'North' Feeder '1'
56	ET	Engineering Technology	67,143	43,643	1,500	Substation 'North' Feeder '1'
57	FM	Facilities Management	24,385	15,850		Substation 'North' Feeder '1'
58	CORP/FNGH	Shipping/Receiving	51,833	33,691	225	Substation 'North' Feeder '1'
66	REPR	University Print Shop	2,400	1,560		Substation 'North' Feeder '1'
80	UOB	University Police	6,000	3,900		Substation 'North' Feeder '1'
82	OUTPOST	Foundation	5,500	3,575		Substation 'North' Feeder '1'
	PL-C	Parking Lot C			500	Substation 'North' Feeder '1'
Substation 'North' Feeder 1 Subtotals			371,280	241,332	5,725	
47	GYM	Physical Education/ Gym	167,286	108,736	2,000	Substation 'North' Feeder '2'
48	HHS-1	Health & Human Services 1 Classrooms	8,200	5,330	300	Substation 'North' Feeder '2'
49	HHS-2	Health & Human Services 2 Offices	13,034	8,472		Substation 'North' Feeder '2'
51	EN2	Engineering 2	24,378	15,846		Substation 'North' Feeder '2'
52	EN3	Engineering 3	24,385	15,850		Substation 'North' Feeder '2'
53	EN4	Engineering 4	16,929	11,004	650	Substation 'North' Feeder '2'
68	PEFR	Restroom/Storage	720	468		Substation 'North' Feeder '2'
84	HC	Horn Center	49,686	32,296	1,000	Substation 'North' Feeder '2'
		Pool Building			500	Substation 'North' Feeder '2'
		PE Field			1,000	Substation 'North' Feeder '2'
Substation 'North' Feeder 2 Subtotals			304,618	198,002	5,450	

Building Number	ID	Name	GSF	ASF	in KVA	Served from
2	SHS	Student Health Services	38,629	25,109	1,200	Substation 'North' Feeder '3'
3	NUR	Nursing	13,307	8,650	300	Substation 'North' Feeder '3'
5	FCS	Family & Consumer Sciences	39,860	25,909	1,250	Substation 'North' Feeder '3'
60	RHLA	Los Cerritos	38,192	24,825	225	Substation 'North' Feeder '3'
61	RHLC	Los Alamitos	38,192	24,825	225	Substation 'North' Feeder '3'
62	RHPS	Residence Commons	111,234	72,302	900	Substation 'North' Feeder '3'
74	PKGADMN	Parking and Transportation Svc	3,627	2,358		Substation 'North' Feeder '3'
75	RHIH	International House	26,855	17,456	150	Substation 'North' Feeder '3'
78	VIC	Visitor Information Center	800	520		Substation 'North' Feeder '3'
81	POB	Pyramid Annex	19,510	12,682	300	Substation 'North' Feeder '3'
85	COB	College of Business Administration	87,531	56,895	1,500	Substation 'North' Feeder '3'
88	PARKST	Parking Building 1	829,065	538,892		Substation 'North' Feeder '3'
	PL-AD	Parking Lot AD			75	Substation 'North' Feeder '3'
	PL-B	Parking Lot B			1500	Substation 'North' Feeder '3'
Substation 'North' Feeder 3 Subtotals			1,246,802	810,421	7,625	
1	BH	Brotman Hall	127,050	82,583	2,000	Substation 'North' Feeder '4'
6	USU	University Student Union	161,300	104,845	2,250	Substation 'North' Feeder '4'
7	CAFÉ	Cafeteria	35,305	22,948	725	Substation 'North' Feeder '4'
Substation 'North' Feeder 4 Subtotals			323,655	210,376	4,975	
64	SGH3	Greenhouse 3	2,650	1,723		Substation 'North' Feeder '5'
70	MDFC	Main Distribution Facility C	1,200	780	150	Substation 'North' Feeder '5'
83	ECS	Engineering/Computer Sciences	101,607	66,045	4,000	Substation 'North' Feeder '5'
Substation 'North' Feeder 5 Subtotals			101,607	66,045	4,150	
69	SFR	Softball Field Restroom	847	551		Substation 'North' Feeder '6'
71	UMC	University Music Center	66,476	43,209	1,500	Substation 'North' Feeder '6'
72	CPAC/DC	Carpenter Performing Arts Center	143,897	93,533	4,000	Substation 'North' Feeder '6'
73	PYR	Pyramid	157,335	102,268	2,500	Substation 'North' Feeder '6'
91		Parking Structure 2			300	Substation 'North' Feeder '6'
		Field Office			225	Substation 'North' Feeder '6'
Substation 'North' Feeder 6 Subtotals			368,555	239,561	8,025	



TABLE 3 Connected Distribution Loads (continued)

Building Number	ID	Name	GSF	ASF	in KVA	Served from
37	PH1	Peterson Hall of Science 1	65,000	42,250	750	Substation 'South' Feeder '9'
38	PH2	Peterson Hall of Science 2	80,018	52,012	1,475	Substation 'South' Feeder '9'
39	PH3	Peterson Hall of Science 3	112,232	72,951	2,000	Substation 'South' Feeder '9'
40	SLH-140/141	Science Lecture Hall	2,245	1,459		Substation 'South' Feeder '9'
41	MICRO	Microbiology	47,498	30,874	2,250	Substation 'South' Feeder '9'
42	AH	Animal House	6,683	4,344		Substation 'South' Feeder '9'
43	SGH1 & 2	Greenhouse 1&2	984	640		Substation 'South' Feeder '9'
45	FO5	Faculty Office 5	12,306	7,999		Substation 'South' Feeder '9'
Substation 'South' Feeder 9 Subtotals			326,966	212,528	6,475	
24	MHB	McIntosh Humanities Bldg	42,510	27,632	300	Substation 'South' Feeder '10'
25	LAB	Language Arts Building	27,480	17,862	500	Substation 'South' Feeder '10'
26	ST	Studio Theatre	49,236	32,003	1,863	Substation 'South' Feeder '10'
27	UT	University Theatre	19,598	12,739	225	Substation 'South' Feeder '10'
28	UTC	University Telecommunications	23,600	15,340		Substation 'South' Feeder '10'
32	FA1	Fine Arts 1	15,504	10,078	375	Substation 'South' Feeder '10'
33	FA2	Fine Arts 2	20,074	13,048	1,000	Substation 'South' Feeder '10'
34	FA3	Fine Arts 3	22,910	14,892		Substation 'South' Feeder '10'
35	FA4	Fine Arts 4	83,844	54,499	750	Substation 'South' Feeder '10'
36	FO4	Faculty Office 4	13,768	8,949		Substation 'South' Feeder '10'
Substation 'South' Feeder 10 Subtotals			318,524	207,041	5,013	
8	BKS	University Bookstore	65,922	42,849	500	Substation 'South' Feeder '11'
9	PSY	Psychology	85,147	55,346	800	Substation 'South' Feeder '11'
10	LA5	Liberal Arts 5	63,220	41,093	750	Substation 'South' Feeder '11'
11	LA4	Liberal Arts 4	14,210	9,237		Substation 'South' Feeder '11'
12	LA3	Liberal Arts 3	15,689	10,198	338	Substation 'South' Feeder '11'
13	LA2	Liberal Arts 2	13,708	8,910		Substation 'South' Feeder '11'
15	FO3	Faculty Office 3	33,373	21,692	450	Substation 'South' Feeder '11'
16	FO2	Faculty Office 2	11,994	7,796	113	Substation 'South' Feeder '11'
17	LH150/151	Lecture Halls 150/151	7,050	4,583		Substation 'South' Feeder '11'
18	KKJZ	Faculty Office 1	6,776	4,404		Substation 'South' Feeder '11'
94	MLSC	Molecular & Life Sciences Center	93,159	60,553	2,250	Substation 'South' Feeder '9'
Substation 'South' Feeder 11 Subtotals			410,248	266,661	5,200	

Building Number	ID	Name	GSF	ASF	in KVA	Served from
14	LA1	Liberal Arts 1	40,230	26,150	500	Substation 'South' Feeder '11'
21	MMC	Multi-Media Center	6,728	4,373		Substation 'South' Feeder '12'
22	ED1	Education 1	23,447	15,241	113	Substation 'South' Feeder '12'
23	ED2	Education 2	24,237	15,754	338	Substation 'South' Feeder '12'
29	ANNEX	Art Annex	1,046	680	113	Substation 'South' Feeder '12'
19/20	LIB/AS	Library	343,046	222,980	3,613	Substation 'South' Feeder '12'
67	MDFA	Main Distribution Facility A	1,700	1,105	225	Substation 'South' Feeder '12'
Substation 'South' Feeder 12 Subtotals			440,434	286,282	4,901	
Grand Total			4,212,689	2,738,248	55,263	

TABLE 4 Emergency Generators

Equip ID	Nomenclature	Type	Building
2182	Natural Gas Generator, ONAN	Generator	BH
B58-CORP-EG1	Building 58 - Corporation Yard, Emergency Generator EG-1	Generator	CORP
3110	Building 54 - Emergency Generator	Generator	DESN
3766	Natural Gas Generator, ONAN	Generator	ET
10140	SPECTRUM 250 Emergency Generator	Generator	FOUND
3790	Diesel Generator, ONAN	Generator	HC
3789	Diesel Generator, ONAN	Generator	LA3
3764	Natural Gas Generator, ONAN	Generator	LIB
B67-EG-EG1	Building 67 MDF-A Emergency Generator EG-1	Generator	MDFA
B70-EG-EG1	Building 70 MDF-B Emergency Generator EG-1	Generator	MDFB
B79-EG-EG1	Building 79 MDF-C Emergency Generator EG-1	Generator	MDFC
3788	Gas Generator, HONDA	Generator	MHB
3767	Diesel Generator, ONAN	Generator	MICRO
EQU000010	Diesel Generator, ONAN/ CUMMINS	Generator	MLSC
2827	Building 02 Emergency Generator EG-1	Generator	SHS
881	Building 71 Diesel Generator	Generator	UMC
2278	Natural Gas Generator, KOHLER	Generator	VEC



FIGURE 3 - 15 kV Selector Switch - Typical



FIGURE 4 - 10 MVA Transformer



MATCH LINE SEE E01-C FOR CONTINUATION

MATCH LINE SEE E01-B FOR CONTINUATION



NO. BUILDING DESIGNATION

- 3 Nursing
- 4 Soroptomist House
- 5 Family & Consumer Sciences
- 6 University Student Union
- 7 Cafeteria
- 8 University Bookstore
- 9 Psychology
- 10 Liberal Arts 5
- 11 Liberal Arts 4
- 12 Liberal Arts 3
- 13 Liberal Arts 2
- 14 Liberal Arts 1
- 15 Faculty Office 3
- 16 Faculty Office 2
- 17 Lecture Halls 150-151
- 18 Faculty Office 1
- 19 Library
- 20 Academic Services
- 21 Multi-Media Center
- 22 Education 1
- 23 Education 2
- 24 McIntosh Humanities Building
- 25 Language Arts Building

NO. BUILDING DESIGNATION

- 26 Studio Theatre
- 27 University Theatre
- 28 University Telecommunicators
- 29 Art Annex
- 32 Fine Arts 1
- 33 Fine Arts 2
- 34 Fine Arts 3
- 35 Fine Arts 4
- 36 Faculty Office 4
- 37 Peterson Hall 1
- 38 Peterson Hall 2
- 39 Peterson Hall 3
- 40 Science Lecture Hall
- 41 Microbiology
- 42 Animal House
- 43 Greenhouse 1&2
- 45 Faculty Office 5
- 46 Social Sciences & Public Affairs
- 65 Electrical Substation (South)
- 67 Main Distribution Communication Facility MDF A
- 75 International House
- 86 Central Plant
- 94 Molecular and Life Sciences Center

Building / Boundary Legend



EXISTING BUILDING

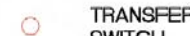
Legend



MANHOLE



PULLBOX



TRANSFER SWITCH



EXISTING

SYMBOL DESCRIPTION

SYMBOL	DESCRIPTION
	1. 1-1/2" C. POWER, 1-3" SPARE
	2. 1-1/2" C. W/ 3-4550 MCM
	3. 2-1/2" C. W/ 3-4050 MCM (9KV) EA, 1-42/0 EA
	4. 2-4" C. W/ 3-4050 MCM (9KV) PDRES. C + D
	5. 2-4" C. W/ 3-4500 MCM (9KV) EA
	FOR C. STANDBY, FER. D NORMAL
	12. 1-1/2" C. W/ 4-41/0
	2-1/4" C.
	13. 4-4" C. W/ 3-4500 MCM (9KV) EA, PDRES. A, B, C, + D
	1-1/2" C. W/ 3-4500 (9KV)
	1-1/2" SPARE, 2-4" SPARE
	15. 1-1/2" C. W/ 3-44 (9KV)
	16. 1-1/2" C. W/ 3-44 (9KV)
	21. 1-1/2" C. W/ 3-44/0
	22. 1-1/2" C. W/ 3-46 VCL (9KV), 1-2" C. SPARE
	26. 1-1/2" C. W/ 3-41/0 VCL (9KV)
	111. 12-1/2" C. W/ 4-41/0
	112. 12-1/2" C. W/ 3-42/0
	113. 1-1/2" C. W/ 3-44 VCL (9KV), 1-3" SPARE
	118. 4-4" C. W/ 3-4500 (9KV) PDRES. A, B, C, + D
	1-4" SPARE
	117. 3-4" C. W/ 3-4500 MCM (9KV) PDRES. A, B, + C
	118. 5-4" C. 3-4500 MCM (9KV)
	119. 1-1/2" C. W/ 3-41/0 (9KV) PDRES. C
	120. 3-46 (9KV) LEAD COVERED
	121. 12-1/2" C. W/ 4-41/0, 2-412
	123. 4-4" C. W/ 3-4500 MCM (9KV) PDRES. A, B, C, + D

SYMBOL DESCRIPTION

SYMBOL	DESCRIPTION
	67. DIRECT BURIAL CABLE
	100. 1-1/2" C. W/ 4-1200 MCM
	1-1/2" C. W/ 3-4050 MCM
	1-2" SPARE, 12-1/2" SPARE
	108. 1-1/2" C. W/ 4-4250 MCM, 1-2" SPARE
	107. 1-1/2" C. W/ 3-4500 MCM
	108. 1-1/2" C. W/ 3-4050 MCM
	12-1/2" SPARE
	109. 1-1/2" C. W/ 4-4250 MCM
	1-2" SPARE
	110. 2-3" C. W/ 304300 MCM
	2-2-1/2" SPARE
	132. 2-4" C. (POWER)
	1-2" C. TELE. PV
	103. 1-1/4" G. PVC POWER C.D.
	1-4" C. PVC
	1-2" PVC TELE. C.D.
	1-4/0 BARE C.U.L. GRD.
	109. 1-2" C. W/ 3-41/0
	110. 2-4" C. (12KV) FROM S. C. E.
	111. 4-4" C. W/ 12-4500 MCM
	112. 5-2" C. W/ 3-41/0
	2-2" C. W/ 3-42/0
	113. 2-2" C. W/ 3-41/0
	114. 3-3" C. W/ 3-41/0
	115. 1-1/2" C. W/ 3-42/0
	112. 2-4" C. W/ 4-4500 MCM, 1-12 (CRD)



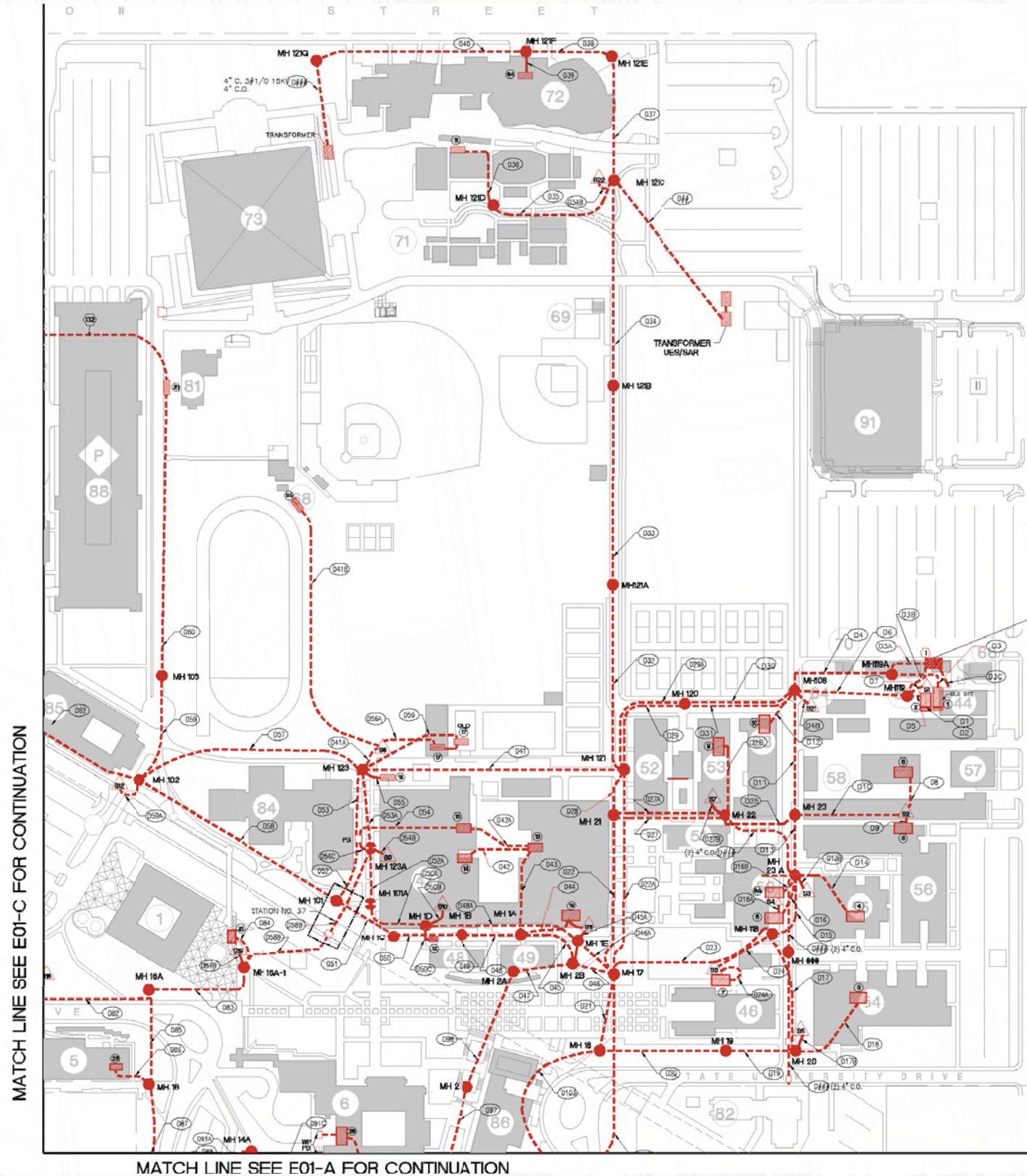
NO.	BUILDING DESIGNATION
1	Brotman Hall
5	Family & Consumer Sciences
6	University Student Union
44	Electrical Substation (North)
46	Social Sciences & Public Affairs
47	University Gymnasiums
48	Health & Human Services Classrooms
49	Health & Human Services Offices
50	Vivian Engineering Center
51	Engineering 2
52	Engineering 3
53	Engineering 4
54	Design
55	Human Services & Design
56	Engineering Technology
57	Facilities Management
58	Corporation Yard
64	Greenhouse 3
66	Reprographics
68	Restrooms/Storage
69	Softball Field Restroom
70	Main Distribution Communications Facility MDF B
71	University Music Center
72	Carpenter Performing Arts Center & Dance Center
73	Mike and Arline Walter Pyramid
80	University Police
81	Parking Office Building
82	Outpost Food Service
83	Engineering / Computer Science
84	Steve and Nini Horn Center
85	College of Business
86	Central Plant
88	Parking Structure No. 1
91	Parking Structure No. 2

Building / Boundary Legend



Legend

- MANHOLE
- PULLBOX
- TRANSFER SWITCH
- EXISTING



SYMBOL	DESCRIPTION
	1. 1-3" C. POWER 1-3" SPARE
	2. 1-3" C. W/ 3-4500 MCM
	3. 2-3-1/2" C. W/ 3-4500 MCM (9KV) EA, 1-42/0 EA
	4. 2-4" C. W/ 3-4500 MCM (9KV) FOR C & D
	5. 2-4" C. W/ 3-4500 MCM (9KV) EA
	FDR C. STANDBY, FDR D. NORMAL
	12. 1-2" C. W/ 4-4/0
	2-1/4" C.
	13. 4-4" C. W/ 3-4500 MCM (9KV) EA, FDRS A, B, C, & D
	1-3" C. W/ 3-4500 (9KV)
	1-3" SPARE, 2-4" SPARE
	15. 1-3" C. W/ 3-44 (9KV)
	16. 1-2" C. W/ 3-44 (9KV)
	21. 1-3" C. W/ 3-44/0
	22. 1-2" C. W/ 3-110 VCL (9KV), 1-2" C. SPARE
	28. 1-3" C. W/ 3-110 VCL (9KV)
	11. 1-2-1/2" C. W/ 4-4/0
	12. 1-2" C. W/ 3-48/0
	13. 1-3" C. W/ 3-84 VCL (9KV), 1-4" SPARE
	14. 4-4" C. W/ 3-4500 (9KV) FDRS A, B, C, & D
	1-4" SPARE
	17. 3-4" C. W/ 3-4500 MCM (9KV) FDRS A, B, & C
	18. 3-4" C. 3-4500 MCM (9KV)
	19. 1-3" C. W/ 3-4/0 (9KV) FDRS C
	120. 3-48 (9KV) LEAD COVERED
	121. 12-1/2" C. W/ 4-4/0, 2-48
	122. 4-4" C. W/ 3-4500 MCM (9KV) FDRS A, B, C, & D

SYMBOL	DESCRIPTION
	67. DIRECT BURIAL CABLE
	105. 1-3" C. W/ 4-4250 MCM
	1-3" C. W/ 3-4500 MCM
	1-2" SPARE, 1-2-1/2" SPARE
	108. 1-3" C. W/ 4-4250 MCM, 1-2" SPARE
	107. 1-3" C. W/ 3-4500 MCM
	108. 1-3" C. W/ 3-4500 MCM
	1-2-1/2" SPARE
	109. 1-3" C. W/ 4-4250 MCM
	1-2" SPARE
	110. 2-3" C. W/ 3-4500 MCM
	2-2-1/2" SPARE
	132. 2-4" C. (POWER)
	1-2" C. TELE. PV
	133. 1-4" C. PVC POWER C.O.
	1-4" C. PVC
	1-2" PVC TELE. C.O.
	1-4/0 BARE CU. GRD.
	139. 1-2" C. W/ 3-4/0
	140. 2-4" C. (9KV) FROM S. C. E.
	141. 4-4" C. W/ 12-1500 MCM
	142. 6-2" C. W/ 3-4/0
	2-2" C. W/ 3-42/0
	143. 2-2" C. W/ 3-4/0
	144. 3-3" C. W/ 3-4/0
	145. 1-2" C. W/ 3-42/0
	152. 2-4" C. W/ 4-1500 MCM, 1-12 (GRD)



E01-B
EXISTING ELECTRICAL PLAN-MDF B



- | NO. | BUILDING DESIGNATION |
|-----|---|
| 2 | Student Health Services |
| 3 | Nursing |
| 4 | Soroptomist House |
| 5 | Family & Consumer Sciences |
| 59 | Patterson Child Development Center |
| 60 | Los Alamitos Hall |
| 61 | Los Cerritos Hall |
| 62a | Residence Commons |
| 62b | Parkside Commons |
| 63 | Recycling Center |
| 74 | Parking and Transportation Services |
| 75 | International House |
| 76 | Earl Burns Miller Japanese Garden |
| 78 | Visitor Information Center |
| 79 | Main Distribution Communications Facility MDF C |
| 85 | College of Business |
| 88 | Parking Structure No. 1 |
| 89 | Housing & Residential Life |

Building / Boundary Legend



Legend

- MANHOLE
- PULLBOX
- TRANSFER SWITCH
- EXISTING



SYMBOL	DESCRIPTION
	1. 1-3" C. POWER 1-3" SPARE
	2. 1-3" C. W/ 3-4500 MCM
	3. 2-3-1/2" C. W/ 3-4500 MCM (SKV) EA. 1-42/0 EA.
	4. 2-4" C. W/ 3-4500 MCM (SKV) FORS. C + D
	5. 2-4" C. W/ 3-4500 MCM (SKV) EA. FORS. C. STANDBY. FORS. D. NORMAL.
	12. 1-2" C. W/ 4-41/0 2-1/2" C.
	13. 4-4" C. W/ 3-4500 MCM (SKV) EA. FORS. A, B, C, + D
	1-3" C. W/ 3-4500 (SKV)
	1-3" SPARES 2-4" SPARES
	15. 1-3" C. W/ 3-41 (SKV)
	16. 1-2" C. W/ 3-41 (SKV)
	17. 1-3" C. W/ 3-41/0
	22. 1-2" C. W/ 3-46 VCL (SKV), 1-2" C. SPARE
	23. 1-3" C. W/ 3-41/0 VCL (SKV)
	24. 1-2-1/2" C. W/ 4-41/0
	25. 1-2-1/2" C. W/ 3-42/0
	13. 1-3" C. W/ 3-14 VCL (SKV), 1-3" SPARE
	15. 4-4" C. W/ 3-4500 (SKV) FORS. A, B, C, + D
	1-4" SPARE
	17. 3-4" C. W/ 3-4500 MCM (SKV) FORS. A, R, + C
	18. 3-4" C. 3-4500 MCM (SKV)
	19. 1-3" C. W/ 3-41/0 (SKV) FORS. C
	120. 3-46 (SKV) LEAD COVERED
	121. 1-2-1/2" C. W/ 4-41/0, 2-1/2
	123. 4-4" C. W/ 3-4500 MCM (SKV) FORS. A, B, C, + D

SYMBOL	DESCRIPTION
	17. DIRECT BURIAL CABLE
	1-3" C. W/ 4-1250 MCM
	1-3" C. W/ 3-1800 MCM
	1-2" SPARE 1-2 1/2" SPARE
	05. 1-3" C. W/ 4-1250 MCM, 1-2" SPARE
	07. 1-3" C. W/ 3-1800 MCM
	08. 1-3" C. W/ 3-1800 MCM
	1-2-1/2" SPARE
	09. 1-3" C. W/ 4-1250 MCM
	1-2" SPARE
	10. 2-3" C. W/ 3-4500 MCM
	2-2-1/2" SPARE
	32. 2-4" C. (POWER)
	1-2" C. TELE. PV
	33. 1-4" C. PVC POWER C.O.
	1-4" C. PVC
	1-2" PVC TELE. C.O.
	1-4/0 BARE C.U. OPD.
	139. 1-2" C. W/ 3-41/0
	140. 2-4" C. (12KV) FROM S. C. E.
	141. 4-4" C. W/ 12-1500 MCM
	142. 2-2" C. W/ 3-41/0
	2-2" C. W/ 3-42/0
	143. 2-2" C. W/ 3-41/0
	144. 3-3" C. W/ 3-41/0
	145. 1-2" C. W/ 3-42/0
	152. 2-4" C. W/ 4-1500 MCM, 1-42 (OPD)

MATCH LINE SEE E01-A FOR CONTINUATION

MATCH LINE SEE E01-B FOR CONTINUATION

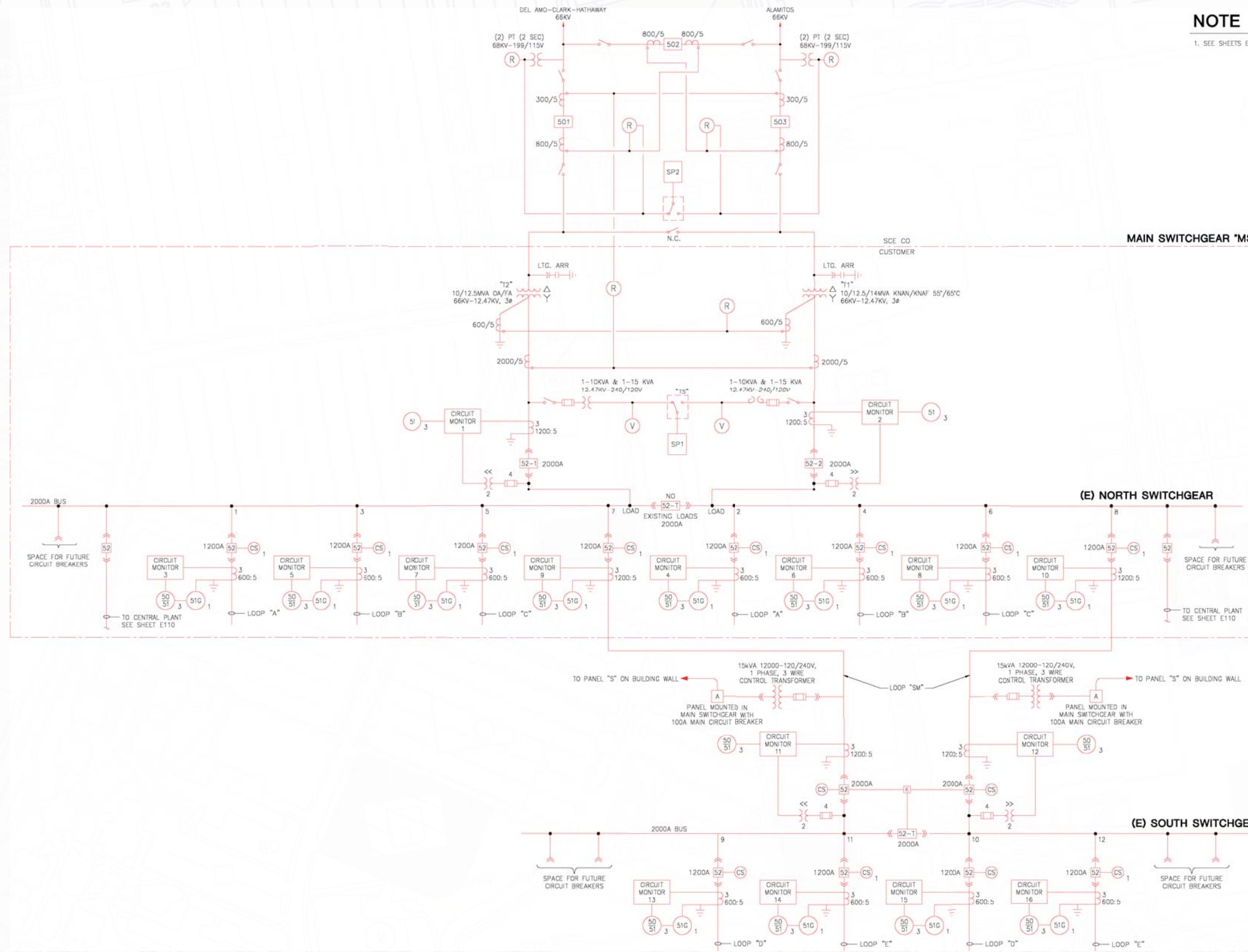


E01-C
EXISTING ELECTRICAL PLAN-MDF C



NOTE

1. SEE SHEETS E102 THRU E106 FOR CONTINUATION OF SINGLE LINE DIAGRAMS.

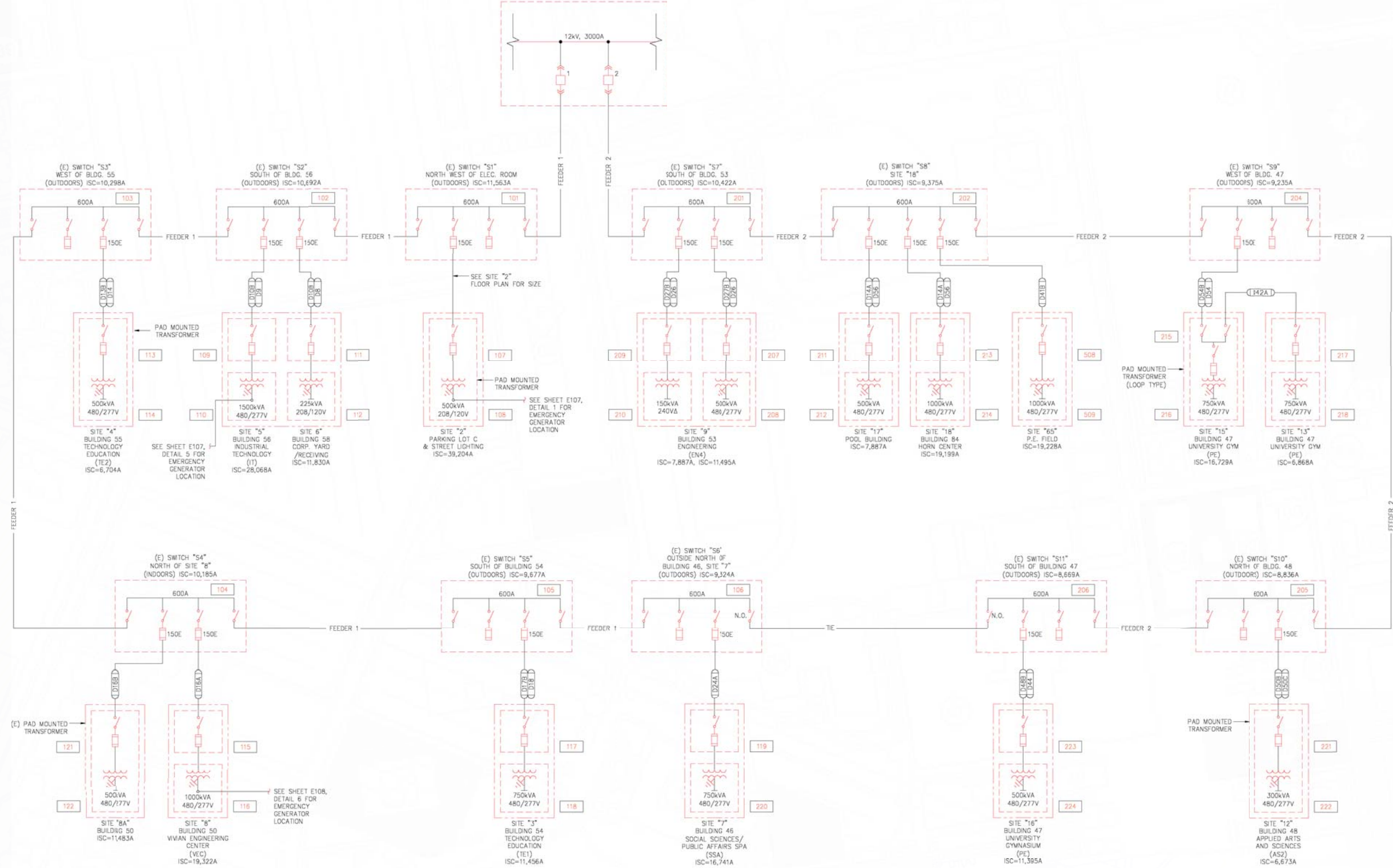


EXISTING METERING AND
RELAY PROTECTION
SINGLE LINE DIAGRAM

E101



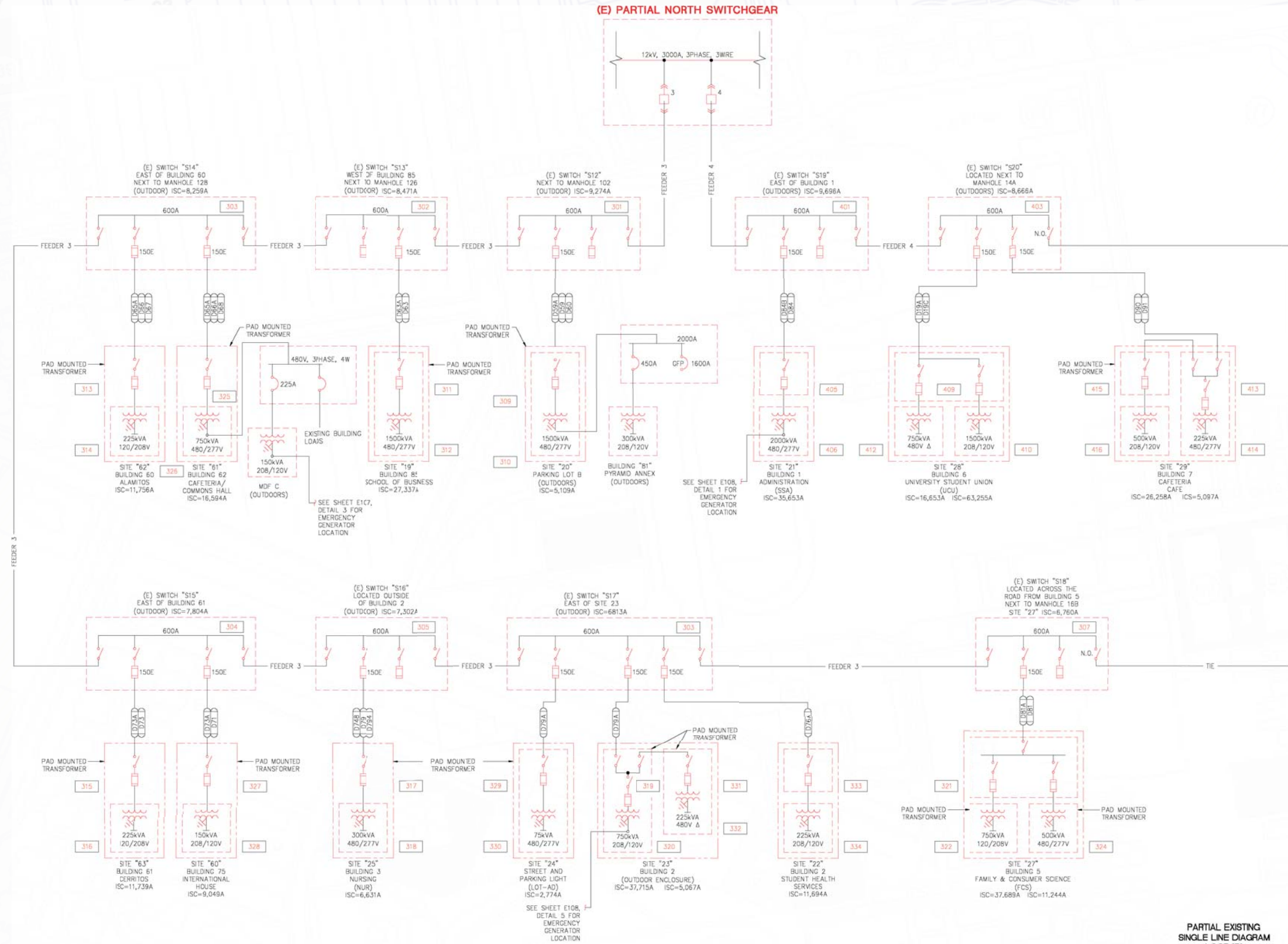
(E) PARTIAL NORTH SWITCHGEAR



PARTIAL EXISTING SINGLE LINE DIAGRAM LOOP "A"

E102

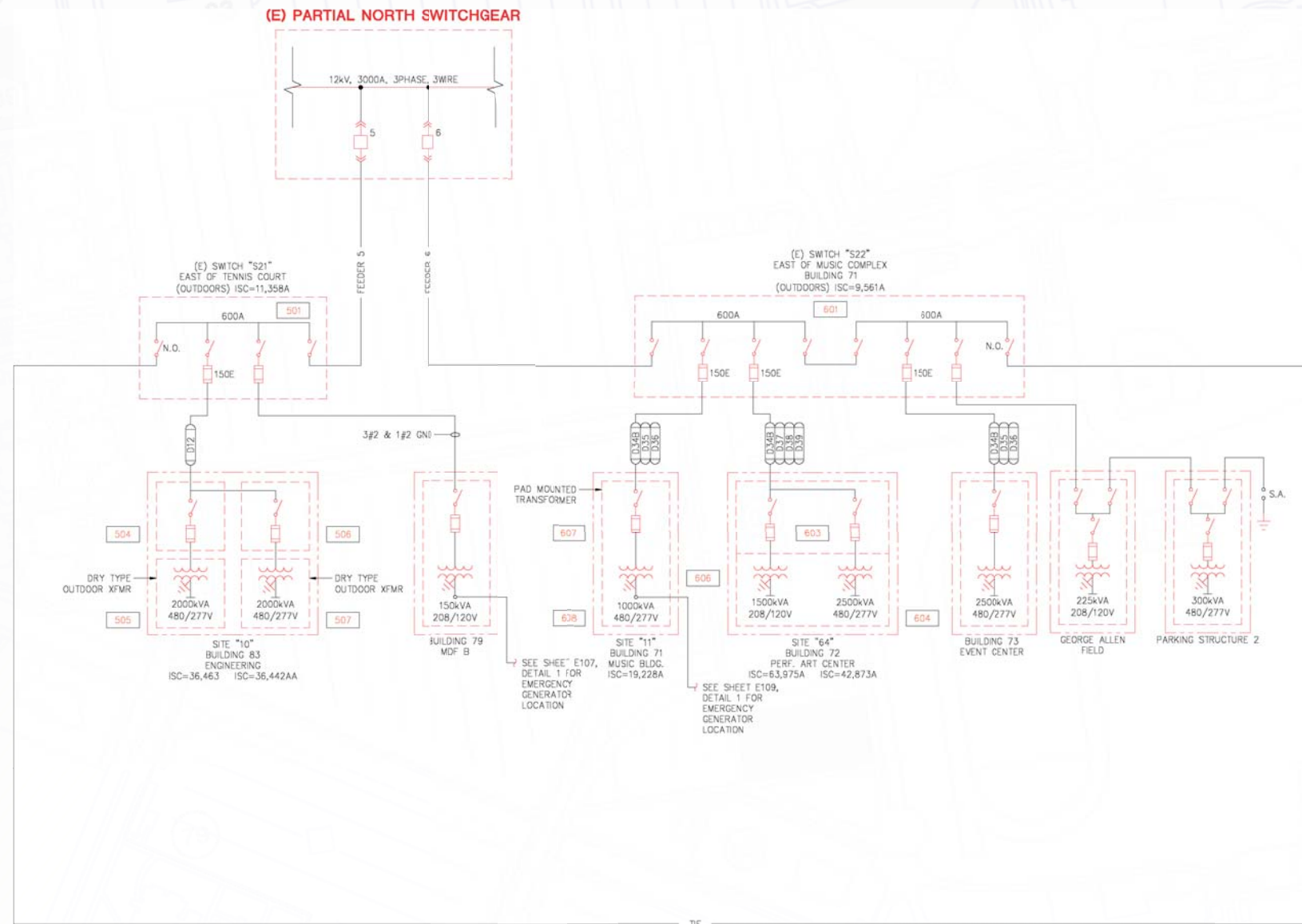




PARTIAL EXISTING SINGLE LINE DIAGRAM LOOP 'B'

E103

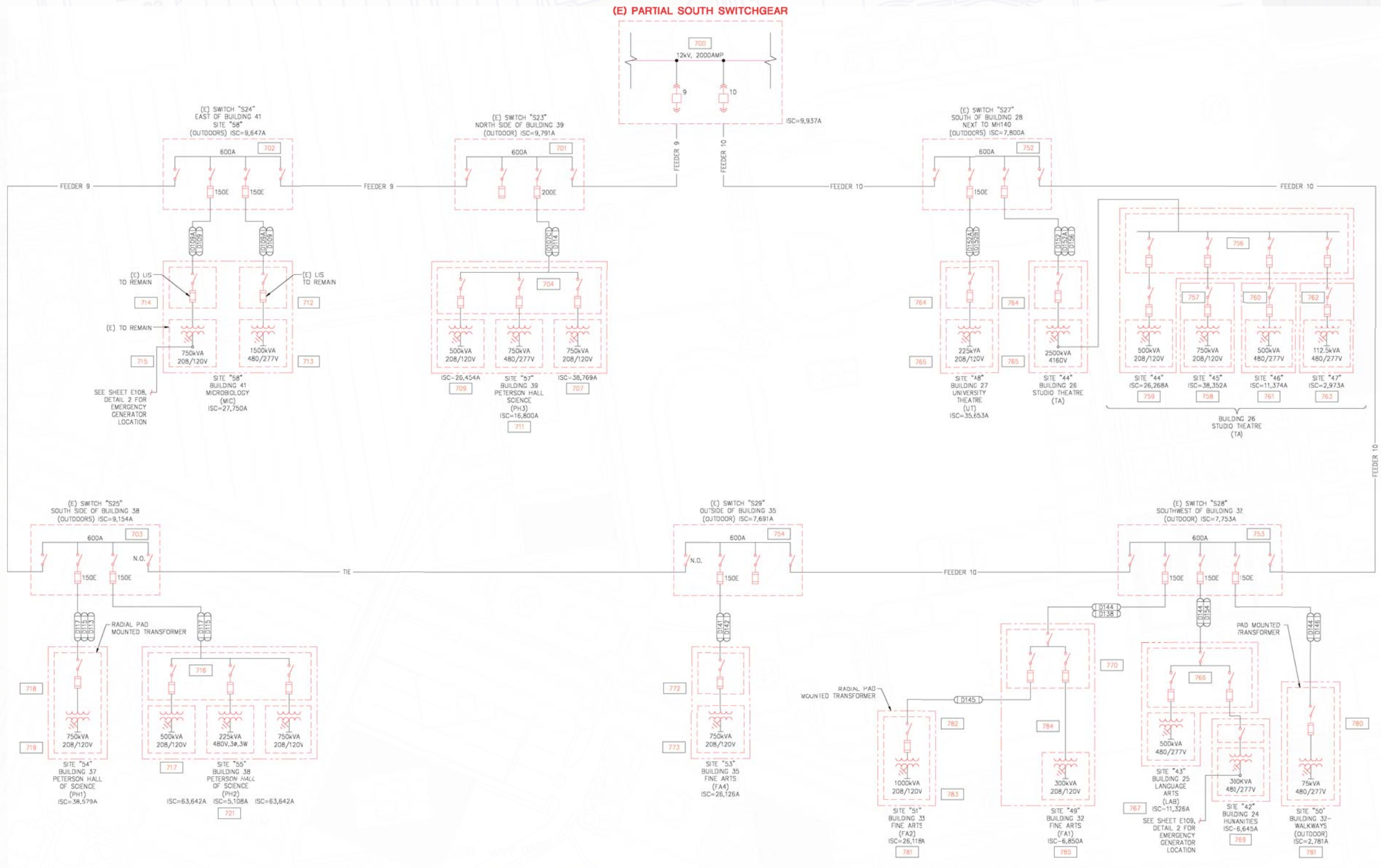




PARTIAL EXISTING
SINGLE LINE DIAGRAM
LOOP 'C'

E104

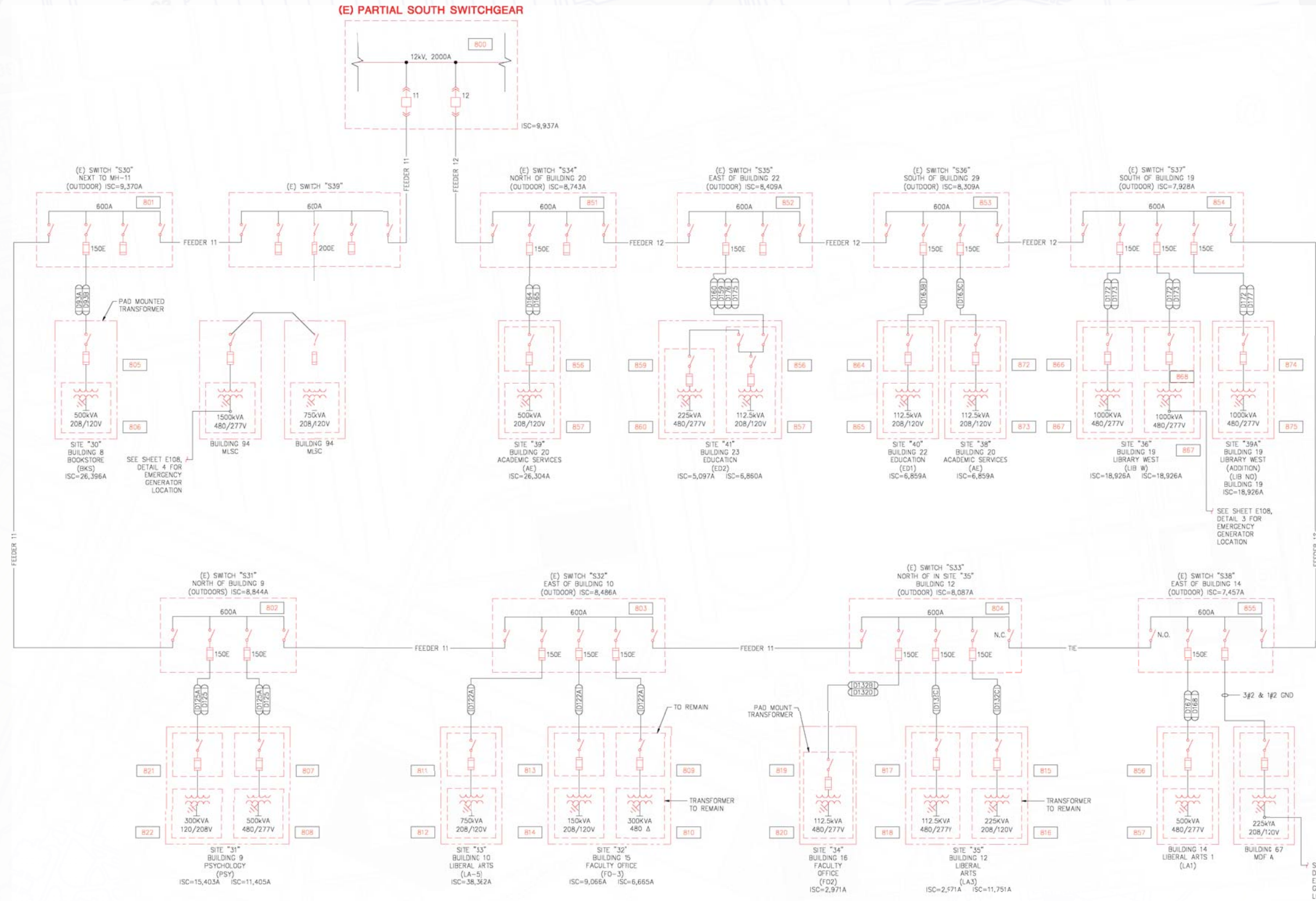




PARTIAL EXISTING SINGLE LINE DIAGRAM LOOP 'D'

E105

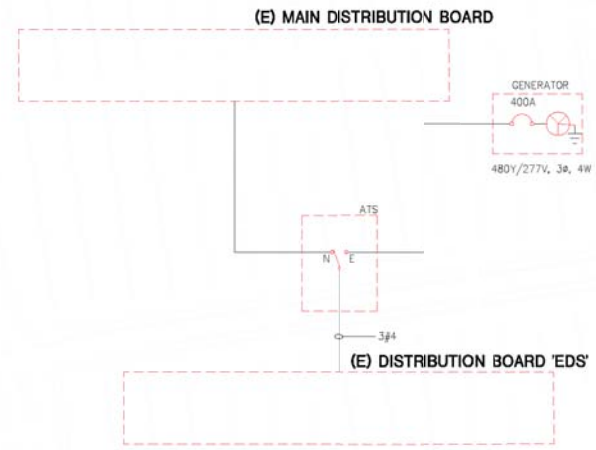




PARTIAL EXISTING SINGLE LINE DIAGRAM LOOP "E"

E106

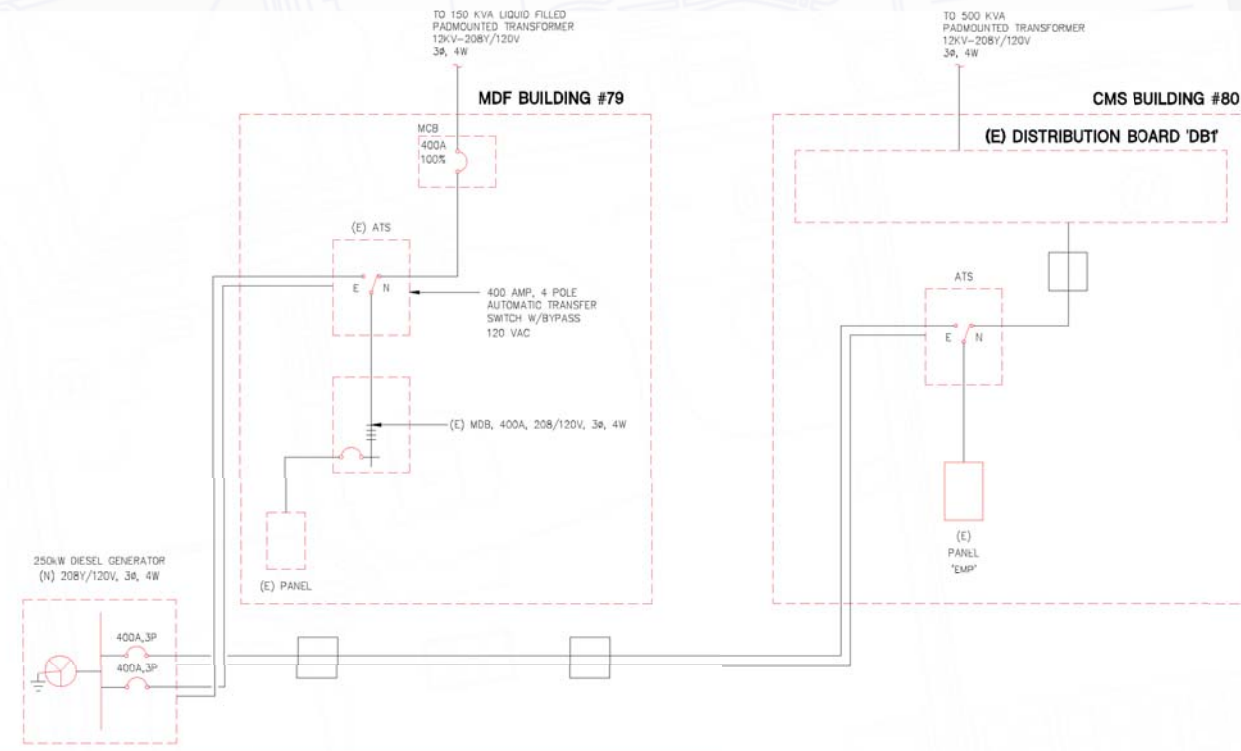




EMERGENCY POWER

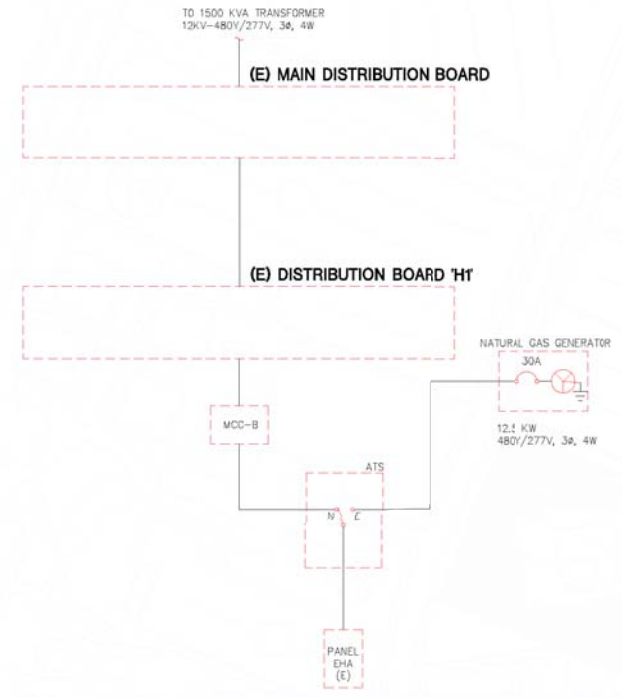
BLDG 82 - FOUNDATION OFFICE
NO SCALE

4 EMERGENCY POWER



BLDG 79 MDF-B & BLDG 80 - CMS
NO SCALE

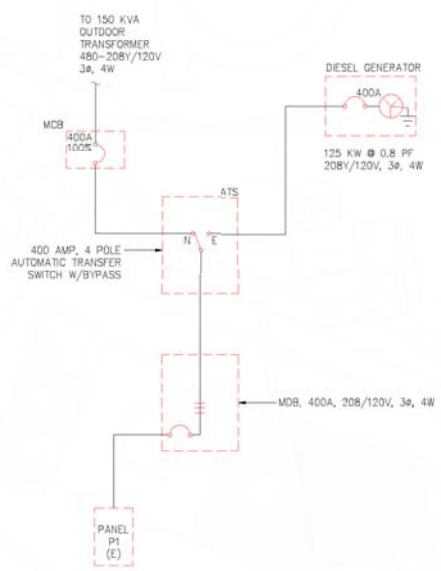
1



EMERGENCY POWER

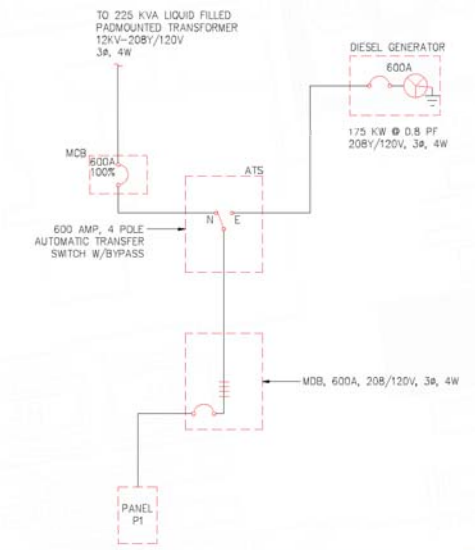
BLDG 56 - ENGINEERING TECHNOLOGY
NO SCALE

5 EMERGENCY POWER



MDF-C
NO SCALE

3 EMERGENCY POWER



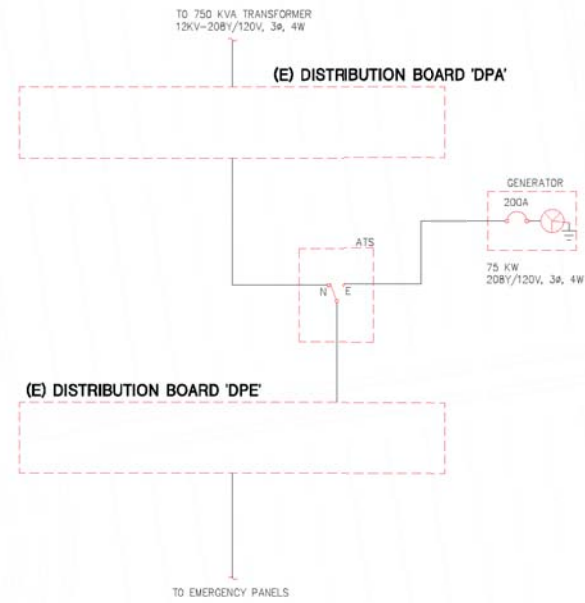
MDF-A
NO SCALE

2

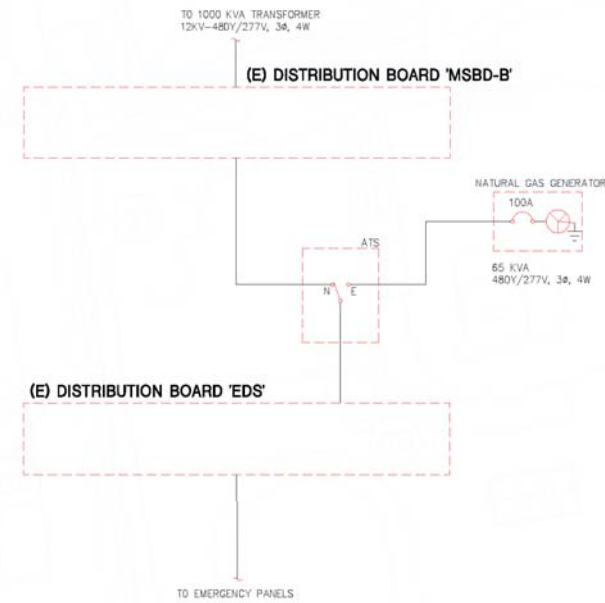
PARTIAL EXISTING
SINGLE LINE DIAGRAM
DETAILS

E107

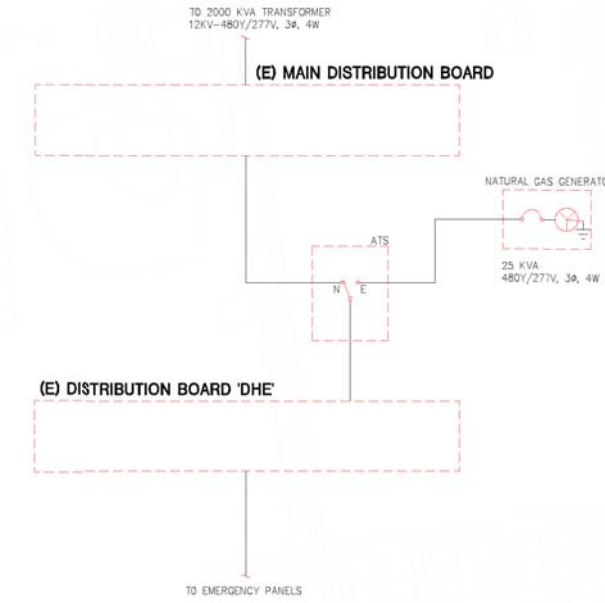




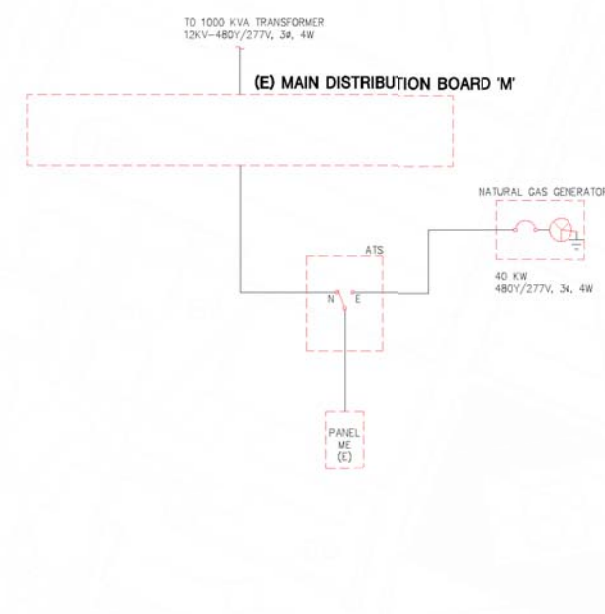
EMERGENCY POWER BLDG 2 - STUDENT HEALTH SERVICES NO SCALE **5**



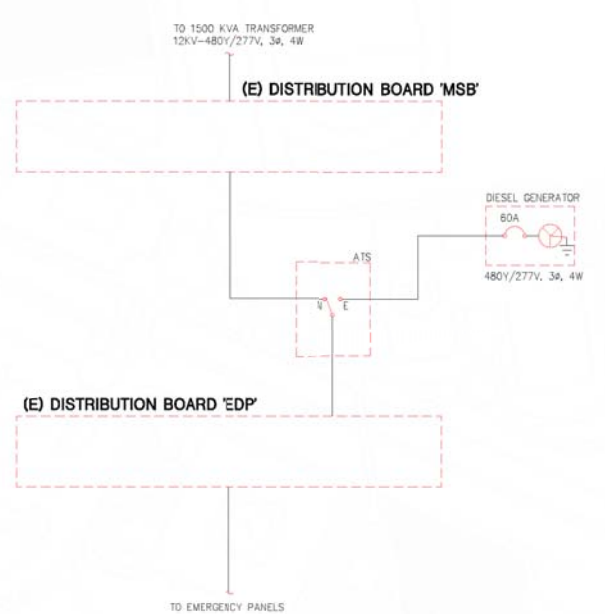
EMERGENCY POWER BLDG 19 - LIBRARY NO SCALE **3**



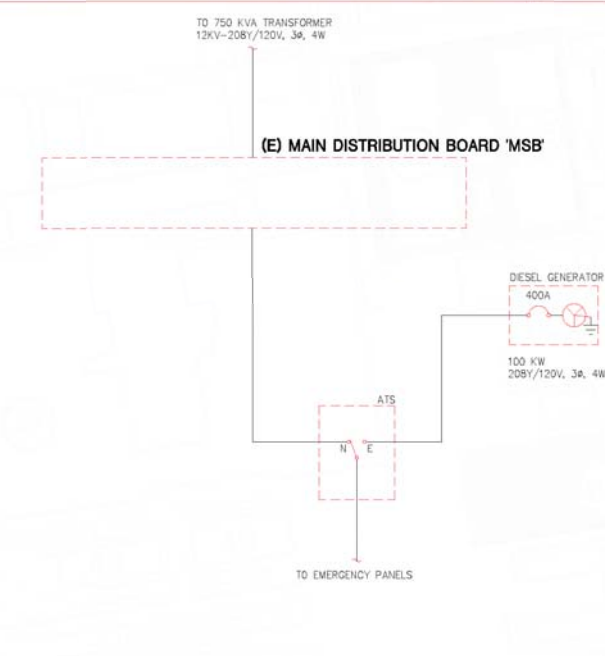
EMERGENCY POWER BLDG 1 - BROTMAN HALL NO SCALE **1**



EMERGENCY POWER BLDG 50 - VEC NO SCALE **6**



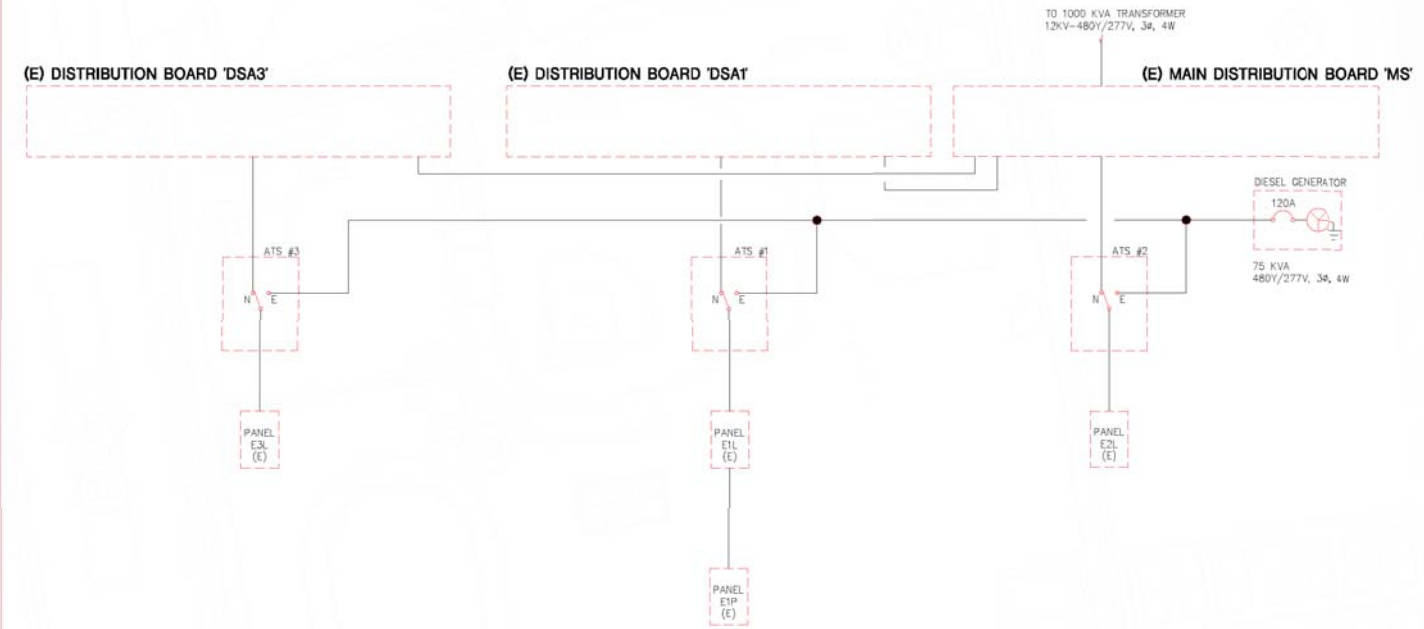
EMERGENCY POWER BLDG 94 - MLSC NO SCALE **4**



EMERGENCY POWER BLDG 41 - MICROBIOLOGY NO SCALE **2**

PARTIAL EXISTING SINGLE LINE DIAGRAM DETAILS E108





EMERGENCY POWER

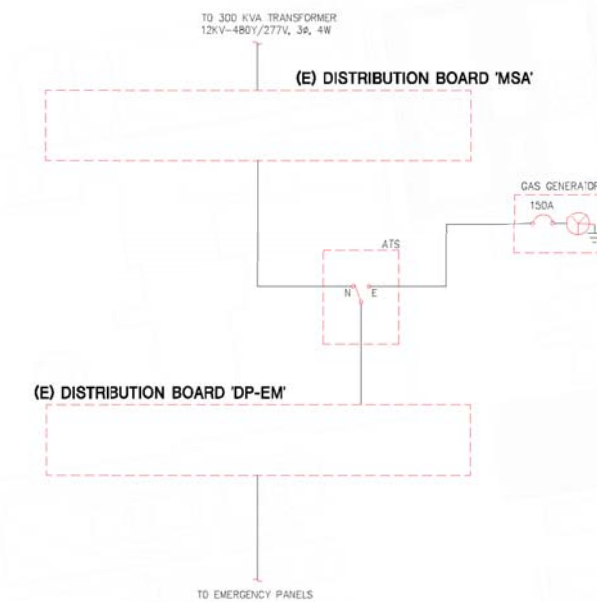
BLDG 54 - DESH
NO SCALE

4

EMERGENCY POWER

BLDG 71 - UMC
NO SCALE

1



EMERGENCY POWER

BLDG. 84 - HORN CENTER
NO SCALE

5

EMERGENCY POWER

BLDG 12 - LIBERAL ARTS 3
NO SCALE

3

EMERGENCY POWER

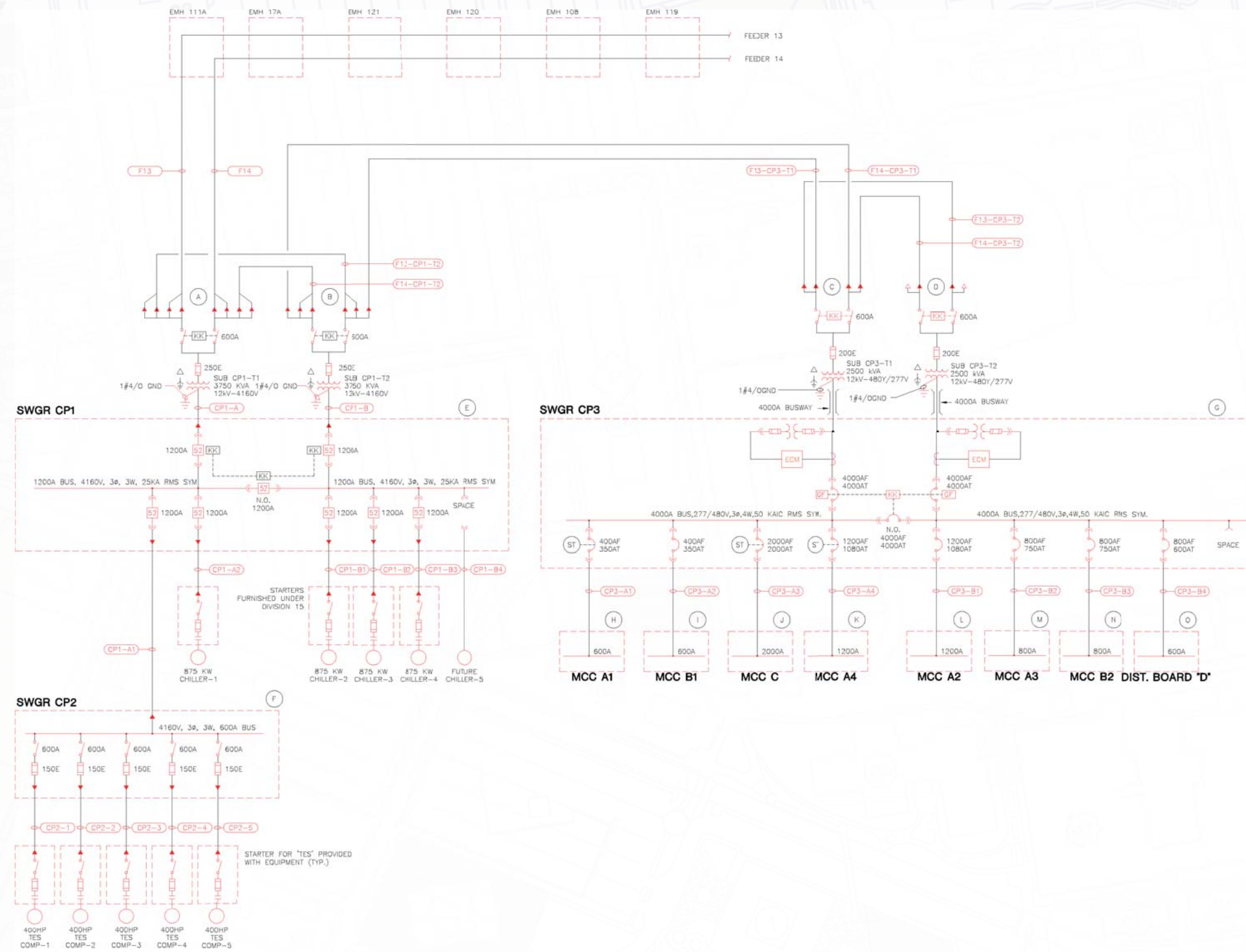
BLDG 24 - MHB
NO SCALE

2

PARTIAL EXISTING
SINGLE LINE DIAGRAM
DETAILS

E109





SYSTEM FAULT CURRENT CALCULATIONS

LOCATION	CALCULATED FAULT CURRENT (AMPS)	MINIMUM EQUIPMENT AIC RATING
A	10,491	25000
B	10,483	25000
C	10,436	25000
D	10,426	25000
E	7,038	25000
F	7,030	12000
G	44,858	65000
H	22,980	50000
I	28,388	50000
J	40,719	50000
K	34,848	50000
L	42,855	50000
M	34,823	50000
N	37,379	50000
O	41,223	50000

FEEDER SCHEDULE

FEEDER	CONDUIT	PH. CONDUCTOR	GND COND.	FROM	TO	REMARKS
15KV FEEDERS						
F13	SEE SHEET 103	6-1/C #350KCMIL	2#4/0	NORTH SUB	SUB CP1-T1	FEEDER 13 W. BUS
F14	SEE SHEET 103	6-1/C #350KCMIL	2#4/0	NORTH SUB	SUB CP1-T1	FEEDER 14 W. BUS
F13-CP1-T2	(2)-5"	3-1/C #350KCMIL/EA	#4/0/EA	SUB CP1-T1	SUB CP1-T2	
F14-CP1-T2	(2)-5"	3-1/C #350KCMIL/EA	#4/0/EA	SUB CP1-T1	SUB CP1-T2	
F13-CP3-T1	5"	6-1/C #350KCMIL	2#4/0	SUB CP1-T2	SUB CP3-T1	
F14-CP3-T1	5"	6-1/C #350KCMIL	2#4/0	SUB CP1-T2	SUB CP3-T1	
F13-CP3-T2	5"	3-1/C #350KCMIL	#4/0	SUB CP3-T1	SUB CP3-T2	
F14-CP3-T2	5"	3-1/C #350KCMIL	#4/0	SUB CP3-T1	SUB CP3-T2	
8KV FEEDERS						
CP1-A	(2)-5"	3-1/C #350KCMIL/EA	#4/0/EA	SUB CP1-T1	SWGR CP1-A	
CP1-A1	5"	3-1/C #350KCMIL	#4/0	SWGR CP1-A	SWGR CP2	
CP1-A2	3"	3-1/C #1/0	#6	SWGR CP1-A	CHILLER 1	
CP1-B	(2)-5"	3-1/C #350KCMIL/EA	#4/0/EA	SUB CP1-T2	SWGR CP1-B	
CP1-B1	3"	3-1/C #1/0	#6	SWGR CP1-B	CHILLER 2	
CP1-B2	3"	3-1/C #1/0	#6	SWGR CP1-B	CHILLER 3	
CP1-B3	3"	3-1/C #1/0	#6	SWGR CP1-B	CHILLER 4	
CP1-B4	3" C.O.			SWGR CP1-B	CHILLER 5	FUTURE
CP2-1	2-1/2"	3-1/C #4	#6	SWGR CP2	TES 1	
CP2-2	2-1/2"	3-1/C #4	#6	SWGR CP2	TES 2	
CP2-3	2-1/2"	3-1/C #4	#6	SWGR CP2	TES 3	
CP2-4	2-1/2"	3-1/C #4	#6	SWGR CP2	TES 4	
CP2-5	2-1/2"	3-1/C #4	#6	SWGR CP2	TES 5	
600V FEEDER						
CP3-A1	3"	3# 500 KCMIL	#2	SWGR CP3	MCC A1	
CP3-A2	3"	3# 500 KCMIL	#2	SWGR CP3	MCC B1	
CP3-A3	(6)-3"	3# 500 KCMIL/EA	250 KCMIL/EA	SWGR CP3	MCC C	
CP3-A4	(3)-3"	3# 500 KCMIL/EA	#3/0/EA	SWGR CP3	MCC A4	
CP3-B1	(3)-3"	3# 500 KCMIL/EA	#3/0/EA	SWGR CP3	MCC A2	
CP3-B2	(2)-3"	3# 500 KCMIL/EA	#3/0/EA	SWGR CP3	MCC A3	
CP3-B3	(2)-3"	3# 500 KCMIL/EA	#3/0/EA	SWGR CP3	MCC B2	
CP3-B4	(2)-3"	4# 350 KCMIL/EA	#1/EA	SWGR CP3	PNL "D"	

PARTIAL EXISTING
SINGLE LINE DIAGRAM
DETAILS

E110



Telecommunications

Introduction

CSULB completed the construction of a campus-wide telecommunications infrastructure upgrade project in compliance with the CSU Telecommunications Infrastructure Planning Standards (TIP) in 2005. This project provided for three new Main Distribution Frame (MDF) buildings and the construction of new underground conduit, copper, and fiber cable systems from each campus building to one of the new MDF buildings. It also included the relocation of the existing voice switching system from eight remote sites to the new MDF buildings. During the completion of the infrastructure project, the University also replaced the data electronics with a Cisco based data network.

The project also provided for telecommunications infrastructure improvements inside the state-owned buildings and the Student Health Center building. It provided new or upgraded telecommunications rooms to house cable terminations and electronic equipment for the voice and data networks. Both copper cable and fiber cable riser systems were provided between the main telecommunications room (BDF) and the satellite rooms (IDFs) in each building. Existing voice and data outlets with obsolete cables were replaced with new outlets containing category 5e horizontal station cables. A baseline criterion for new outlets was implemented in lieu of the CSU TIP standards due to limited funding. Pathway systems consisting of j-hook support hangers, conduits, and wiremold were included to support the new station cables. After each building was cutover from the existing to new infrastructure systems, the obsolete cables and equipment were removed in the abandoned telecommunications rooms inside the buildings and in the underground conduit systems.

Telecommunications Applications

Voice Telephone System

Voice telephone service is provided over a campus owned and operated Ericsson private branch exchange switching system that was first installed over nineteen years ago. During the implementation of telecommunications infrastructure upgrade project, the majority of equipment was reconfigured and relocated to three new Main Distribution Frame (MDF) buildings on campus. The voice switching system currently has more than 8,000 working services. The basic system components consist of a host group switch in building MDF A with Line Interface Modules (LIMs) located in each of the three MDF buildings covering all campus buildings. The LIMs are connected to the host switch with fiber trunk cables in the underground conduit system. There are also three remote switches on campus. One is located in Brotman Hall for special requirements; a second one in the non-state Foundation building #82; and the third is in Building KKJZ. The switching system provides for both analog and digital services and it is operating under the most current software release offered by the switching manufacturer. Since the last upgrade, the system also provides VOIP trunking and end user service.

The voice telephone system provides service to all campus buildings over an outside plant copper cable system. The cable network connects the telephone services in each campus building to the MDF building that houses the switching system using one cable pair for each voice service. There is also a 400 pair, copper screen cable from MDF A Building to MDF Buildings B and C for non-switched circuits from Verizon and other special requirements.

Verizon is the Local Exchange Carrier (LEC) that provides off site service. The interconnection of the campus switching system and the Verizon network occurs in MDF A building through demark equipment called the Minimum Point of Entry (MPOE). Verizon provides T-1, ISDN, and other trunk line services to the University over both copper and fiber cables from the local central office. The Verizon cables are located in the University's underground conduit system entering the campus at two locations. One location is from the conduit system on Bellflower Drive and enters MDF A from the north side. The second location is from the conduit system on Seventh Street and enters MDF A from the south side. Verizon will transport and complete all originating and terminating calls that are in the local service area. Long distance calls, outside the Verizon service area, will be handed off to an inter-exchange carrier.

Emergency Telephone System

The University has an emergency telephone system that is connected to the University Police building for continuous monitoring. The system includes Code Blue emergency telephones mounted in parking lot bollards that can be used to report emergencies. There are also wall mounted emergency telephones normally located in corridors inside the buildings.

Data Communications System

The University's data system originates at the Data Center in Building #1 Brotman Hall, connects to major nodes in the three MDFs, and is distributed to all campus buildings. The major intra-campus network consists of Cisco 6509 and 6513 core switches and smaller 4500 series switches and 2900 series switches in the buildings.

The data network utilizes an existing fiber cable system to interconnect the campus buildings and to interconnect with Verizon for offsite connections.

Video System

The University's campus-wide video system consists of video applications over the data network. It is an Internet Protocol (IP) based system using computers for displaying the images. A few buildings including the Pyramid and Gymnasium receive satellite signals on dishes and the signals are distributed to end users over a coaxial cable distribution network within the building. In this case these signals are displayed over television sets.

The University installed a separate video network to transmit the graduation commencement ceremonies from the main quad to viewers on the internet and in campus lecture halls. The network was established with a dedicated fiber cable from the commencement site to Building 17 Lecture Hall. At Building 17 the video signal was patched to the existing campus fiber optic cable network that passes through MDF A building and terminates in Building 28 University Telecommunications Center.



Centralized Switching Facilities

The centralized switching facilities that support the voice and data networks are located in four buildings. The Data Center in Building 1, Brotman Hall, is the main node for the data system and contains the main core data switches that are connected to switches in three separate MDF buildings A, B, and C. All campus buildings are connected to one of the MDF buildings for connection to the campus wide network. All of the electronic equipment is connected between the buildings with underground fiber optic cables.

The MDF buildings are single-story buildings and constructed with CMU type walls. The buildings are dedicated for housing telecommunications equipment and contain all support systems to operate for 24 hours a day and seven days per week. The buildings are equipped with air conditioning units on the roofs and operate in a scheduled sequence to provide redundancy and to maintain controlled environments. The air conditioning systems are connected the University's Energy Management Control System for continuous environmental monitoring.

The MDF buildings are connected to the campus electrical system that provides AC power to the telecommunications equipment and support systems. Each building has an emergency backup generator with a capacity for operating the equipment up to 72 hours during a power outage.

Each building is also equipped with a FM-200 type fire suppression system for extinguishing fire in an environment with electronic equipment and cabling.

Each of the MDF buildings is further described below:



MDF A, Building #67:

This single-story building has 2,448 square feet of floor space for telecommunications equipment. It is located on the west side of West Campus Drive and west of Building #20, South Library. It has an underground tunnel vault the full length of the building that is ten feet wide and ten feet high. Major ductbanks enter both ends of the vault where the underground cables leave the MDF building and extend to all campus buildings in the southern portion of the campus and to Verizon Communications. The vault also contains underground copper cable splices that join the underground cables with the cables to equipment terminals inside the building.

This building also contains the Minimum Point of Entry (MPOE) that is the demarcation with Verizon Communications. This demarcation provides for the connections with Verizon Communications for completing off-campus telephone calls and making connections with the internet.



MDF B, Building #70:

This single-story building has 1,305 square feet of floor space for telecommunications equipment. It is located on the northern side of the Corporation Yard Complex, Building 58. This building contains all of the voice and data electronics and equipment to serve all of the buildings located in the central and northern portions of the campus. All buildings served from MDF B building are located north of the drainage channel except for Building 86, Central Plant, and Building 82, Foundation.



MDF C, Building #79:

This building has 695 square feet consisting of an original 175 square feet pre-fabricated building with a 520 square feet building addition. It is located in Parking Lot 16, east of Earl Warren Drive, and northeast of the Residence Commons student housing complex. This building serves all of the buildings associated with the housing complex in the western portion of the campus plus buildings #1 Brotman Hall, #2 Student Health Center, #3 Nursing, and #59 Child Development Center.



Interbuilding Pathways

In the portion of campus served from MDFs A and B, a new underground conduit system was constructed on the Telecommunications Infrastructure Upgrade Project that interconnects the MDF buildings with all campus buildings. It also replaces the original conduit system that was congested, obsolete, and installed during the construction of the original campus buildings. The new conduit system meets current CSU standards and it has sufficient capacity to meet the cable requirements for the proposed building additions as well as future growth requirements for the next twenty-five years. However, some of the existing ductbanks are in conflict with proposed building sites that may require re-routing existing conduit and systems. The areas in conflict are addressed in Chapter 4.

The recently installed conduit system was designed and constructed to the following standards:

1. Four inch diameter, PVC type, conduits were installed between new cable vaults. Conduits were encased in 2500 PSI concrete and covered with a minimum 24 inches of slurry or compacted dirt backfill.
2. A minimum of (4), four inch diameter conduits were installed into each existing, non-state, building for cables terminated in new telecommunications rooms. For some buildings, only two new conduits were provided if the existing conduits were reusable.
3. For building entrance conduits, PVC type conduits outside the building transitioned to galvanized rigid conduits (GRC) at a location twenty-four inches from the building foundation. The GRC extended under the building foundation and penetrated the concrete building floor in the telecommunications room.
4. Conduits were terminated in new vaults designed for communications. The standard size vault was 6' wide x 12' long x 7' deep. Each new vault was equipped with traffic rated cover, permanent metal ladder, unistrut cable supports on the side walls, and ground rod.

In the student housing area of the western portion of the campus, there is an obsolete and congested conduit system located through the main quad. Due to multiple cabling systems, the original underground conduit system is very congested and will require significant upgrades in order to provide cables to many of the new buildings. The housing complexes are connected to many telecommunications services in order to provide voice, data, and video services to the housing tenants. They include direct connections to Verizon Communications, Charter Cable Television, plus connections to the University's voice and data networks. Each of these services has separate cabling networks sharing a common underground conduit and vault system. Verizon and Charter CATV cabling systems enter the conduit system from University Drive east of Bellflower Drive. There are also campus copper and fiber cable systems serving all buildings that originate from MDF C. These separate cable networks support voice, data, video, fire alarm, and energy management systems. There are also copper and coaxial cables that originate in the data center of Brotman Hall that are connected to the Child Development Center at the far northern campus boundary. All of these cable networks share the same conduit system causing very complex and congested arrangement of cables in the pull boxes and manholes. The conduits vary in size from two to four inch in diameter and are terminated in four feet square manholes or two feet by three feet underground pull boxes. The existing ductbanks are also in conflict with the proposed building sites and they will need to be relocated. The relocation plans are addressed in Chapter 4.

In 2004 a new telecommunications ductbank was constructed northward from MDF C, crossing the channel and extending northward on Earl Warren Drive, to serve the Child Development Center. This ductbank has spare capacity for cables to serve the new buildings in the Parkside Commons area north of the drainage channel. Another new ductbank from MDF C was constructed eastward towards Brotman Hall. This ductbank is located on the south side of parking lot 16 and adjacent to Residence Commons. It will also be utilized to serve some of the new buildings in the south housing complex.

Interbuilding Copper Cable

In the areas of MDFs A and B, a new underground copper cable system was constructed on the Telecommunications Infrastructure Upgrade Project from each campus building to one of the MDF buildings. This new cable system was required to connect the telephones in each campus building with the centralized switching equipment located in one of the MDF buildings. The copper cable system was designed for two cable pairs for each outlet which was the original CSU design standard. The cables were gel-filled outside plant cables with a polyethylene sheath and manufactured by Superior-Essex Company. Table T1 in this Chapter shows cable sizes for the existing building entrance cables for all campus buildings. All cables in the buildings and the MDFs were terminated on Circa type protector panels with individual gas protectors on each cable pair. The typical installations in the buildings included protector panels wall-mounted on plywood backboards and in the MDFs on floor-mounted equipment racks. For larger cables that were terminated in Building #1 Brotman Hall and Building #20 South Library, the protector panels were mounted in floor mounted equipment racks.

A cable loop was also created between the three MDF buildings with a 400 pair copper, screen type, cable. This cable was installed in the underground conduit system and is used for many types of non-switched voice circuits. Some of the types of services transported on these cables include circuits for alarms, pay phones, fire alarm, elevators, and Verizon direct services.

However, in the western portion of the campus served by MDF C, the copper cable system serving student housing is obsolete, congested with multiple cable systems and will require replacement. Cable relief plans are addressed in Chapter 4.



TABLE T1 - Existing Copper Entrance Cables

Buildings Served From MDF A, Building 67

Bldg #	Name	Abbrev.	Bldg Entrance Cable Size (Pairs)	Comments
4	Soroptomist House	SOR	0	Served From Building 5, FCS with a 25 pair tie cable.
5	Family Consumer Sciences	FCS	300	
6	Univ. Student Union	USU	600	
7	Cafeteria	CAFÉ	300	
8	Bookstore	BKS	200	
9	Psychology	PSY	900	
10	Liberal Arts 5	LA5	300	
11	Liberal Arts 4	LA4	100	
12	Liberal Arts 3	LA3	200	
13	Liberal Arts 2	LA2	0	Served from Building 18
14	Liberal Arts 1	LA1	300	
15	Faculty Office 3	FO3	400	
16	Faculty Office 2	FO2	300	
17	Lecture Hall 151/152	LH	100	
18	Instructional Resources	ITV	300	
20	South Campus Library	SCL	1200	
21	Multi-Media Center	MMC	100	
22	Education 1	ED1	300	
23	Education 2	ED2	300	
24	McIntosh Humanities Bldg	MHB	400	
25	Language Arts Bldg	LAB	300	
26	Studio Theater	ST	200	
27	University Theater	UT	100	
28	University Telecom Center	UTC	300	
30	Art Annex		0	Served From Building 28, UTC with a 25 pair tie cable
32	Fine Arts 1	FA1	200	
33	Fine Arts 2	FA2	200	
34	Fine Arts 3	FA3	300	
35	Fine Arts 4	FA4	600	
36	Faculty Office 4	FO4	300	
37	Peterson Hall I	PH1	600	
38	Peterson Hall II	PH2	900	
39	Peterson Hall III	PH3	900	
40	Science Lecture Hall	SLH	0	Served From Building 39, PH III with a 25 pair tie cable
41	Microbiology	MIC	600	
42	Animal House	AH	0	Served From Building 41, Microbiology BDF
45	Faculty Office 5	FO5	200	
94	Molecular & Life Science	MLS	600	

Sub-total MDF A: 13,200

Buildings Served From MDF B, Building 70

Bldg #	Name	Abbrev.	Bldg Entrance Cable Size (Pairs)
46	Social Sciences/Public Affairs	SS/PA	900
47	Univ. Gymnasium	PE1	300
48	Health & Human Svcs 1 Clr	HHS1	200
49	Health & Human Svcs 2 Offices	HHS2	100
50	Vivian Engineering Center	VEC	900
51	Engineering 2	EN2	300
52	Engineering 3	EN3	100
53	Engineering 4	EN4	100
54	Design Center	DESN	300
55	Human Services and Design	HSD	300
56	Engineering Technology	ET	400
57	Facilities Management	FM	200
58	Corporation Yard		200
63	Recycling Center	RCY	12
66	Reprographics		100
71	Univ. Music Center	UMC	300
72	Carpenter Perf Arts Ctr/Dance Ctr	CPAC/DC	900
73	Pyramid	PYR	600
74	Parking & Transportation Svcs	PTS	100
80	University Police	UP	300
82	Foundation Edu. Center	FEC	200
83	Engr & Computer Sciences	ECS	900
84	Horn Center	HC	400
85	College of Bus. Adm.	CBA	900
86	Central Plant	CP	100

Sub-total MDF B: 9112

Buildings Served From MDF C, Building 79

Bldg #	Name	Abbrev.	Bldg Entrance Cable Size (Pairs)
1	Brotman Hall	BH	1200
2	Student Health Center	SHS	600
3	Nursing	NUR	400
59	Child Dev. Center	CDC	100
60	Los Alamitos Hall		200
61	Los Cerritos Hall		200
62	Residence Housing & Common		2000
75	International House	IH	100
76	E.B. M. Japanese Garden	ECS	6
78	Visitor Information Center	VIC	50
89	Housing Adm. Office	HAO	200

Sub-total MDF C: 5056

TOTAL PAIRS TERMINATED: 27,368



Interbuilding Fiber Cables

In the areas of MDFs A and B, a new underground fiber cable system was constructed under the Telecommunications Infrastructure Upgrade Project from most campus buildings to one of the MDF buildings. Each building was served with an underground hybrid fiber cable containing both singlemode and multimode fibers under one cable sheath. The average size cable was thirty-six optics with 24 singlemode optics and 12 multimode optics (50 micron type). In most cases there were twice the numbers of singlemode optics to multimode optics. Cable sizes varied from 18 optics in the smaller buildings to 144 optics in the larger buildings. Table T2 shows the cable sizes and types for the building entrance fiber cables. The underground fiber cables were Corning, Indoor/Outdoor, Freedom cables. The cables were terminated on Corning, unicom, LC type, duplex connectors mounted on rack mounted fiber terminals. Some patch panels were wall-mounted in smaller buildings. The fiber cables were installed in one inch diameter innerducts in the underground conduit system. Typically, four, one inch diameter innerducts were installed in one, four inch diameter conduit.

Fiber cables were also installed from the Data Center in Brotman Hall to each of the MDF buildings for interconnecting the electronic components for both the voice and data systems. These cables consisted of 144 optics with 96 singlemode optics and 48 multimode optics. A 288 singlemode fiber tie cable was also installed between MDF A and MDF B in order to provide redundancy for managing the data network and to maintain data service during an emergency.

The table below shows fiber cable sizes for the existing building entrance cables for all campus buildings.

There is also an older fiber optic cable system in the original campus underground conduit system that was installed in 1993. The majority of the buildings were cutover from this fiber network to the newer fiber network after the completion of the Telecommunications Infrastructure Upgrade project. Most of the buildings were served from this earlier cable system with a twelve optic, hybrid, cable that consisted of six singlemode optics and 6 multimode optics (62.5 micron type). There were also 24 optic fiber trunk cables (12 singlemode/12 multimode optics) connecting the original campus data nodes located in five buildings. These buildings included Building #1 Brotman Hall, Building #12 Liberal Arts 3, Building #38 Peterson Hall II, and Building #50 Vivian Engineering Center. The campus data network was reconfigured when new Cisco data electronics were installed in 2004/2005 replacing the electronics in the original data nodes. The equipment was removed in the five buildings but the fiber cables are still in the original conduit system and available for future applications.

Existing Fiber Optic Entrance Cables

Buildings Served From MDF A, Building 67

Bldg #	Name	Hybrid Bldg Entrance Cable (SM/MM Optics)	SM	MM	Total Optics	Comments
4	Soroptomist House	None	0	0	0	
5	Family Consumer Sciences	12/6	12	6	18	
6	Univ. Student Union	24/12	24	12	36	
7	Cafeteria	12/6	12	6	18	
8	Bookstore	12/6	12	6	18	
9	Psychology	24/12	24	12	36	
10	Liberal Arts 5	24/12	24	12	36	
11	Liberal Arts 4		0	0	0	Served by 12/6 ca from Bldg. 12
12	Liberal Arts 3	24/12	24	12	36	
13	Liberal Arts 2	0	0	0	0	Served from Bldg. 18
14	Liberal Arts 1	24/12	24	12	36	
15	Faculty Office 3	24/12	24	12	36	
16	Faculty Office 2	12/6	12	6	18	
17	Lecture Hall 151/152	12/6	0	0	0	Served by 12/6 ca from Bldg. 12
18	Instructional Resources	24/12	24	12	36	
20	South Campus Library	96/48	96	48	144	
21	Multi-Media Center	0	0	0	0	Served by 12/6 ca from Bldg. 20
22	Education 1	12/6	12	6	18	
23	Education 2	12/6	12	6	18	
24	McIntosh Humanities Bldg	24/12	24	12	36	
25	Language Arts Bldg	12/6	12	6	18	
26	Studio Theater	12/6	12	6	18	
27	University Theater	12/6	12	6	18	
28	University Telecom Center	12/6	12	6	18	
30	Art Annex	0	0	0	0	Served by 12/6 ca from Bldg. 28
32	Fine Arts 1	96/48	96	48	144	
33	Fine Arts 2	0	0	0	0	Served by two ca from Bldg. 32
34	Fine Arts 3	24/12	24	12	36	
35	Fine Arts 4	24/12	24	12	36	
36	Faculty Office 4	24/12	24	12	36	
37	Peterson Hall I	48/24	48	24	72	
38	Peterson Hall II	48/24	48	24	72	
39	Peterson Hall III	48/24	48	24	72	
40	Science Lecture Hall	0	0	0	0	Served by 6 sm ca from Bldg. 39
41	Microbiology	24/12	24	12	36	
42	Animal House	0				Served from Bldg. 41 BDF
45	Faculty Office 5	24/12	24	12	36	
94	Molecular & Life Science	48/24	48	24	72	
Terminated Optics For MDF A			840	420	1260	



Existing Fiber Optic Entrance Cables (cont.)

Fiber Trunk Cables (From/To)

Name	Hybrid Bldg Entrance Cable (SM/MM Optics)	SM	MM	Total Optics
Bldg 1, Brotman Hall to MDF A	96/48	96	48	144
Bldg 1, Brotman Hall to MDF B	96/48	96	48	144
Bldg 1, Brotman Hall to MDF C	96/48	96	48	144
MDF A to MDF B	288 SM	288	0	288

Buildings Served From MDF B, Building 70

Bldg #	Name	Hybrid Bldg Entrance Cable (SM/MM Optics)	SM	MM	Total Optics	Comments
46	Social Sc./Pub. Affairs	48/24	48	24	72	
47	Univ. Gymnasium	24/12	24	12	36	
48	Health & Human Svcs 1 Clr	12/6	12	6	18	
49	Health & Human Svcs 2 Offices	12/6	12	6	18	
50	Vivian Engineering Center	96/48	96	48	144	
51	Engineering 2	24/12	24	12	36	
52	Engineering 3	12/6	12	6	18	
53	Engineering 4	12/6	12	6	18	
54	Design Center	24/12	24	12	36	
55	Human Services and Design	24/12	24	12	36	
56	Engineering Technology	48/24	48	24	72	
57	Facilities Management	24/12	24	12	36	
58	Corporation Yard	24/12	24	12	36	
63	Recycling Center	None	0	0	0	
66	Reprographics	12/6	12	6	18	
71	Univ. Music Center	12/6	12	6	18	Served with (3), 12/6 cables (1 from MDF B and 2 from Bldg 72)
72	Carpenter Perf Arts Ctr/Dance Ctr	24/12	24	12	36	
73	Pyramid	48/24	48	24	72	
74	Parking & Transportation Svcs	0	0	0	0	Served by 6/6 from Bldg 85
80	University Police	24/12	24	12	36	
81	Parking Office Building	6/6	6	6	12	
82	Foundation Edu. Center	24/12	24	12	36	
83	Engr & Computer Sciences	96/48	96	48	144	
84	Horn Center	48/24	48	24	72	
85	College of Bus. Adm.	48/24	48	24	72	
86	Central Plant	24/12	24	12	36	
Terminated Optics For MDF B			750	378	1128	

Buildings Served From MDF C, Building 79

Bldg #	Name	Hybrid Bldg Entrance Cable (SM/MM Optics)	SM	MM	Total Optics	Comments
2	Student Health Center	24/12	24	12	36	
3	Nursing	24/12	24	12	36	
59	Child Dev. Center	24/12	24	12	36	
60	Los Alamitos Hall	0	0	0	0	Served by ca from Housing
61	Los Cerritos Hall	0	0	0	0	Served by ca from Housing
76	E.B. M. Japanese Garden	None				
78	Visitor Information Center	0	0	0	0	Served by 6 MM from Bldg 3
Terminated Optics For MDF C			72	36	180	

Buildings Served From Brotman Hall, Building 1

Bldg #	Name	Hybrid Bldg Entrance Cable (SM/MM Optics)	SM	MM	Total Optics	Comments
62	Parkside Commons	6-Jun	6	6	12	
62	Residence Commons	6-Jun	6	6	12	
75	International House	6-Jun	6	6	12	
89	Housing Adm. Office	6-Jun	6	6	12	

Terminated Optics For Brotman Hall, Building 1
(Cables prior to Telecom Infra Upgrade Project)



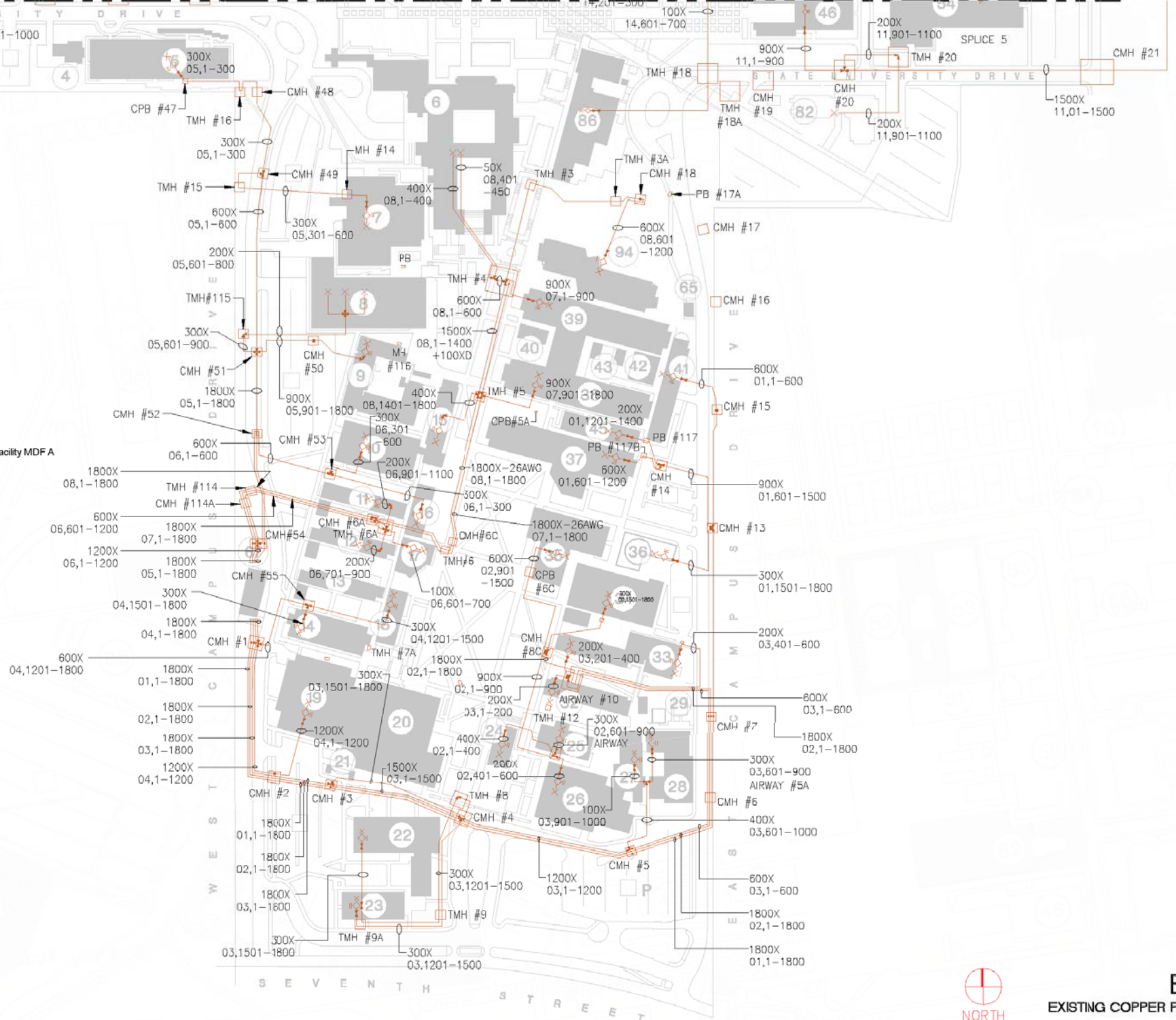
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MATCH LINE SEE EC2-B FOR CONTINUATION

NO.	BUILDING DESIGNATION	NO.	BUILDING DESIGNATION
3	Nursing	26	Studio Theatre
4	Soroptomist House	27	University Theatre
5	Family & Consumer Sciences	28	University Telecommunications
6	University Student Union	29	Art Annex
7	Cafeteria	32	Fine Arts 1
8	University Bookstore	33	Fine Arts 2
9	Psychology	34	Fine Arts 3
10	Liberal Arts 5	35	Fine Arts 4
11	Liberal Arts 4	36	Faculty Office 4
12	Liberal Arts 3	37	Peterson Hall 1
13	Liberal Arts 2	38	Peterson Hall 2
14	Liberal Arts 1	39	Peterson Hall 3
15	Faculty Office 3	40	Science Lecture Hall
16	Faculty Office 2	41	Microbiology
17	Lecture Halls 150-151	42	Animal House
18	Faculty Office 1	43	Greenhouse 162
19	Library	45	Faculty Office 5
20	Academic Services	46	Social Sciences & Public Affairs
21	Multi-Media Center	65	Electrical Substation (South)
22	Education 1	67	Main Distribution Communication Facility MDF A
23	Education 2	75	International House
24	McIntosh Humanities Building	86	Central Plant
25	Language Arts Building	94	Molecular and Life Sciences Center

Building / Boundary Legend

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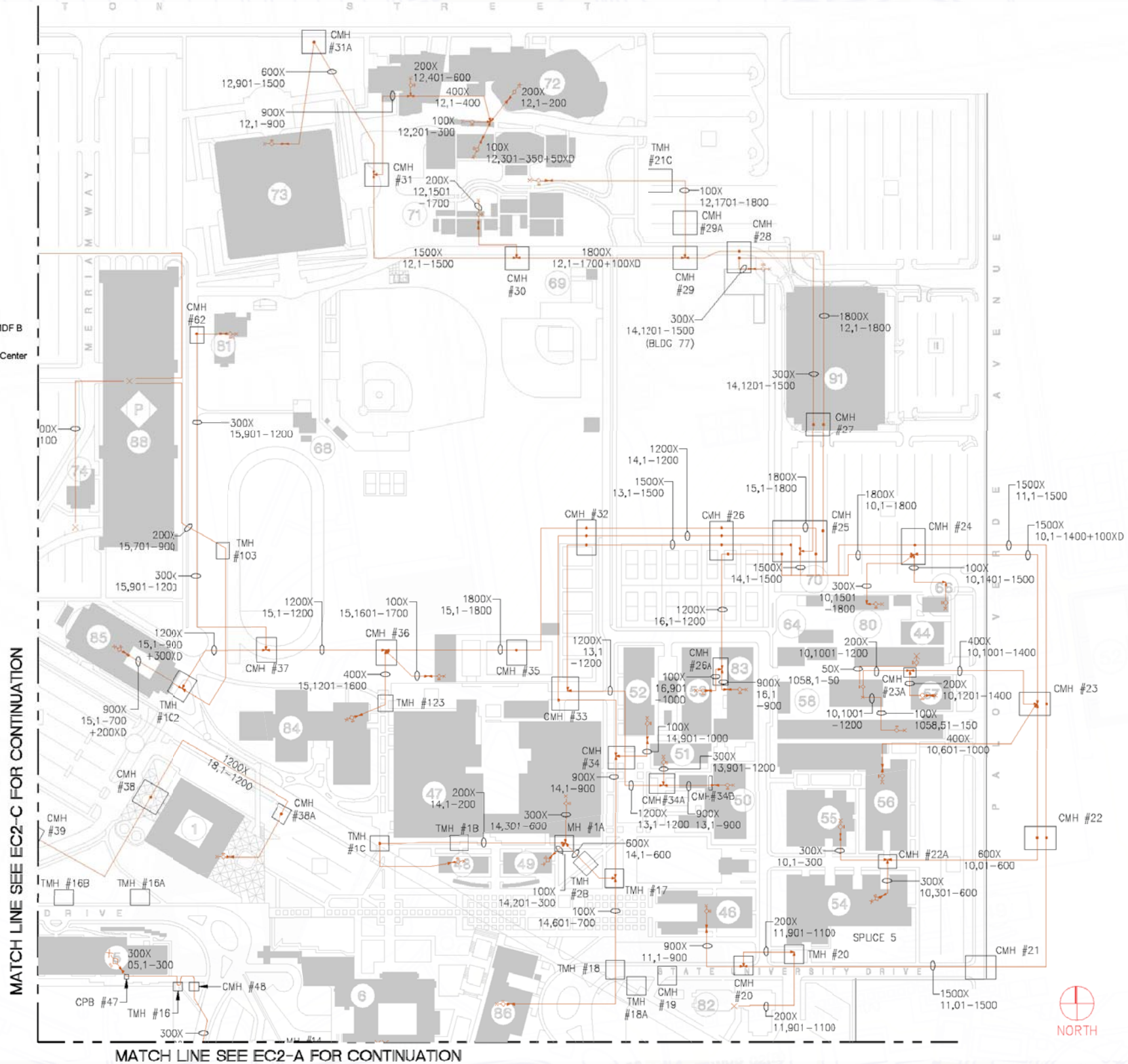
EC2-A
EXISTING COPPER PLAN-MDF A



NO.	BUILDING DESIGNATION
1	Brotman Hall
5	Family & Consumer Sciences
6	University Student Union
44	Electrical Substation (North)
46	Social Sciences & Public Affairs
47	University Gymnasiums
48	Health & Human Services Classrooms
49	Health & Human Services Offices
50	Vivian Engineering Center
51	Engineering 2
52	Engineering 3
53	Engineering 4
54	Design
55	Human Services & Design
56	Engineering Technology
57	Facilities Management
58	Corporation Yard
64	Greenhouse 3
66	Reprographics
68	Restrooms/Storage
69	Softball Field Restroom
70	Main Distribution Communications Facility MDF B
71	University Music Center
72	Carpenter Performing Arts Center & Dance Center
73	Mike and Arline Walter Pyramid
80	University Police
81	Parking Office Building
82	Outpost Food Service
83	Engineering / Computer Science
84	Steve and Nini Horn Center
85	College of Business
86	Central Plant
88	Parking Structure No. 1
91	Parking Structure No. 2

Building / Boundary Legend

-  EXISTING BUILDING
-  EXISTING COPPER



EC2-B
EXISTING COPPER PLAN-MDF B



NO.	BUILDING DESIGNATION
2	Student Health Services
3	Nursing
4	Soroptomist House
5	Family & Consumer Sciences
59	Patterson Child Development Center
60	Los Alamitos Hall
61	Los Cerritos Hall
62a	Residence Commons
62b	Parkside Commons
63	Recycling Center
74	Parking and Transportation Services
75	International House
76	Earl Burns Miller Japanese Garden
78	Visitor Information Center
79	Main Distribution Communications Facility MDF C
85	College of Business
88	Parking Structure No. 1
89	Housing & Residential Life

Building / Boundary Legend

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-  EXISTING COPPER



MATCH LINE SEE EC2-B FOR CONTINUATION

MATCH LINE SEE EC2-A FOR CONTINUATION



EC2-C
EXISTING COPPER PLAN-MDF C



NO.	BUILDING DESIGNATION
1	Brotman Hall
2	Student health Services
3	Nursing
4	Soroptomist House
5	Family & Consumer Sciences
6	University Student Union
7	Cafeteria
8	University Bookstore
9	Psychology
10	Liberal Arts 5
11	Liberal Arts 4
12	Liberal Arts 3
13	Liberal Arts 2
14	Liberal Arts 1
15	Faculty Office 3
16	Faculty Office 2
17	Lecture Halls 150-151
18	Faculty Office 1
19	Library
20	Academic Services
21	Multi-Media Center
22	Education 1
23	Education 2
24	McIntosh Humanities Bldg
25	Language Arts Building
26	Studio Theatre
27	University Theatre
28	University Telecommunications
29	Art Annex
30	Fine Arts 1
31	Fine Arts 2
32	Fine Arts 3
33	Fine Arts 4
34	Faculty Office 4
35	Peterson Hall 1
36	Peterson Hall 2
37	Peterson Hall 3
38	Science Lecture Halls
39	Microbiology
40	Animal House
41	Greenhouse 1&2
42	Electrical Substation (North)
43	Faculty Office 5
44	Social Sciences & Public Affairs
45	University Gymnasiums
46	Health & Human Services Classrooms

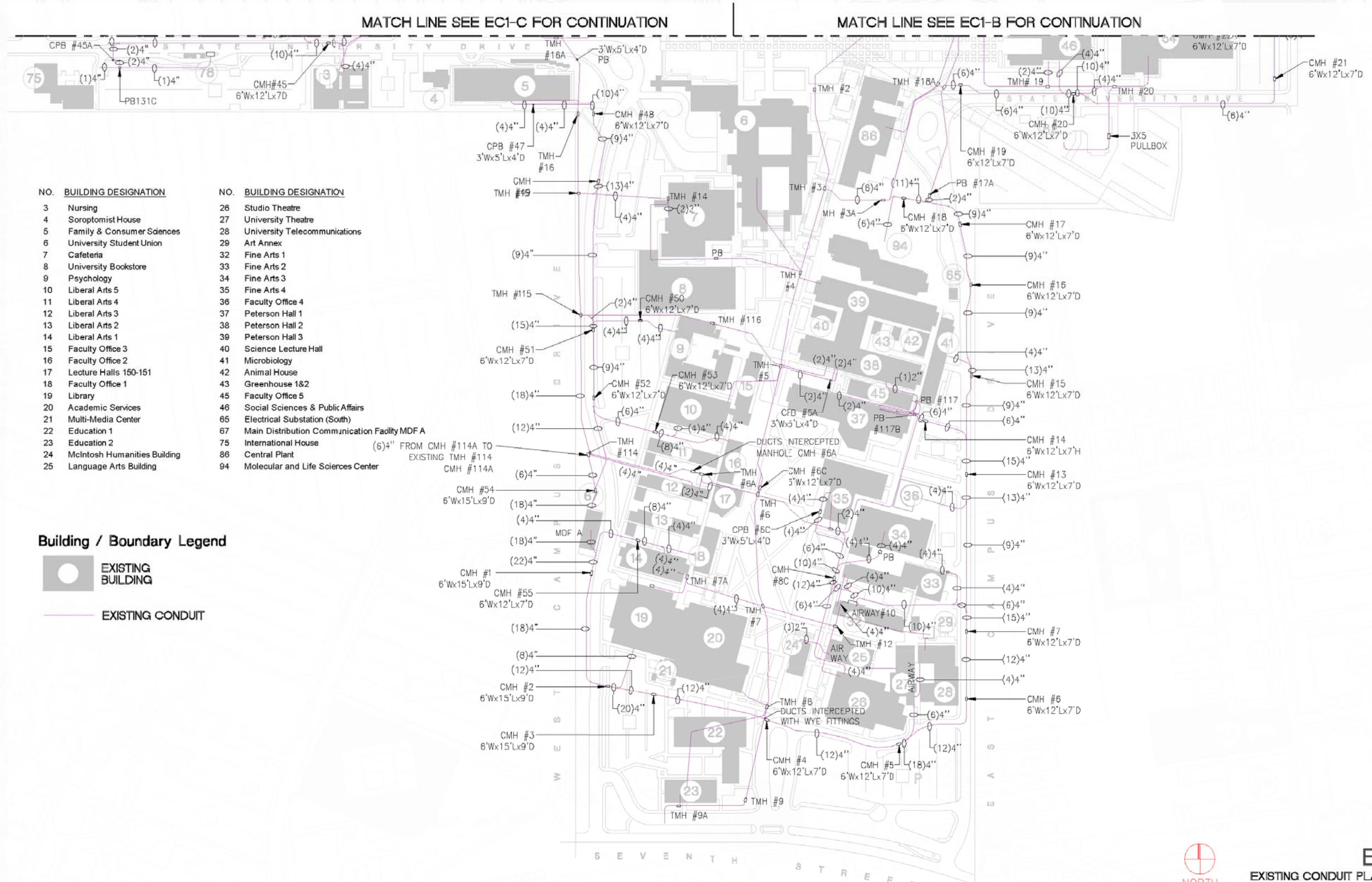
NO.	BUILDING DESIGNATION
49	Health & Human Services Offices
50	Vivian Engineering Center
51	Engineering 2
52	Engineering 3
53	Engineering 4
54	Design
55	Human Services & Design
56	Engineering Technology
57	Facilities Management
58	Corporation Yard
59	Patterson Child Development Center
60	Los Alamitos Hall
61	Los Cerritos Hall
62a	Residence Commons
62b	Parkside Commons
63	Recycling Center
64	Greenhouse 3
65	Electrical Substation (South)
66	Reprographics
67	Main Distribution Communications Facility MDF A
68	Restrooms/Storage
69	Softball Field Restroom
70	Main Distribution Communications Facility MDF B
71	University Music Center
72	Carpenter Performing Arts Center & Dance Center
73	Mike and Arline Walter Pyramid
74	Parking Transportation Services International House
75	Earl Burns Miller Japanese Garden
76	Visitor Information Center
77	Main Distribution Communications Facility MDF C
78	University Police
79	Parking Office Building
80	Outpost Food Service
81	Engineering / Computer Science
82	Steve and Nini Hom Center
83	College of Business
84	Central Plant
85	Parking Structure No. 1
86	Housing & Residential Life
87	Parking Structure No. 2
88	Molecular and Life Science Center



Building / Boundary Legend



-  EXISTING BUILDING
-  EXISTING COPPER





NO.	BUILDING DESIGNATION	NO.	BUILDING DESIGNATION
3	Nursing	26	Studio Theatre
4	Soroptomist House	27	University Theatre
5	Family & Consumer Sciences	28	University Telecommunications
6	University Student Union	29	Art Annex
7	Cafeteria	32	Fine Arts 1
8	University Bookstore	33	Fine Arts 2
9	Psychology	34	Fine Arts 3
10	Liberal Arts 5	35	Fine Arts 4
11	Liberal Arts 4	36	Faculty Office 4
12	Liberal Arts 3	37	Peterson Hall 1
13	Liberal Arts 2	38	Peterson Hall 2
14	Liberal Arts 1	39	Peterson Hall 3
15	Faculty Office 3	40	Science Lecture Hall
16	Faculty Office 2	41	Microbiology
17	Lecture Halls 150-151	42	Animal House
18	Faculty Office 1	43	Greenhouse 1&2
19	Library	45	Faculty Office 5
20	Academic Services	46	Social Sciences & Public Affairs
21	Multi-Media Center	65	Electrical Substation (South)
22	Education 1	67	Main Distribution Communication Facility MDF A
23	Education 2	75	International House
24	McIntosh Humanities Building	86	Central Plant
25	Language Arts Building	94	Molecular and Life Sciences Center

Building / Boundary Legend

-  EXISTING BUILDING
-  EXISTING CONDUIT



NO.	BUILDING DESIGNATION
1	Brotman Hall
5	Family & Consumer Sciences
6	University Student Union
44	Electrical Substation (North)
46	Social Sciences & Public Affairs
47	University Gymnasiums
48	Health & Human Services Classrooms
49	Health & Human Services Offices
50	Vivian Engineering Center
51	Engineering 2
52	Engineering 3
53	Engineering 4
54	Design
55	Human Services & Design
56	Engineering Technology
57	Facilities Management
58	Corporation Yard
64	Greenhouse 3
66	Reprographics
68	Restrooms/Storage
69	Softball Field Restroom
70	Main Distribution Communications Facility MDF B
71	University Music Center
72	Carpenter Performing Arts Center & Dance Center
73	Mike and Arline Walter Pyramid
80	University Police
81	Parking Office Building
82	Outpost Food Service
83	Engineering / Computer Science
84	Steve and Nini Horn Center
85	College of Business
86	Central Plant
88	Parking Structure No. 1
91	Parking Structure No. 2

Building / Boundary Legend

-  EXISTING BUILDING
-  EXISTING CONDUIT



EC1-B
EXISTING CONDUIT PLAN-MDF B



NO.	BUILDING DESIGNATION
2	Student Health Services
3	Nursing
4	Soroptomist House
5	Family & Consumer Sciences
59	Patterson Child Development Center
60	Los Alamitos Hall
61	Los Cerritos Hall
62a	Residence Commons
62b	Parkside Commons
63	Recycling Center
74	Parking and Transportation Services
75	International House
76	Earl Burns Miller Japanese Garden
78	Visitor Information Center
79	Main Distribution Communications Facility MDF C
85	College of Business
88	Parking Structure No. 1
89	Housing & Residential Life

Building / Boundary Legend

-  EXISTING BUILDING
-  EXISTING CONDUIT



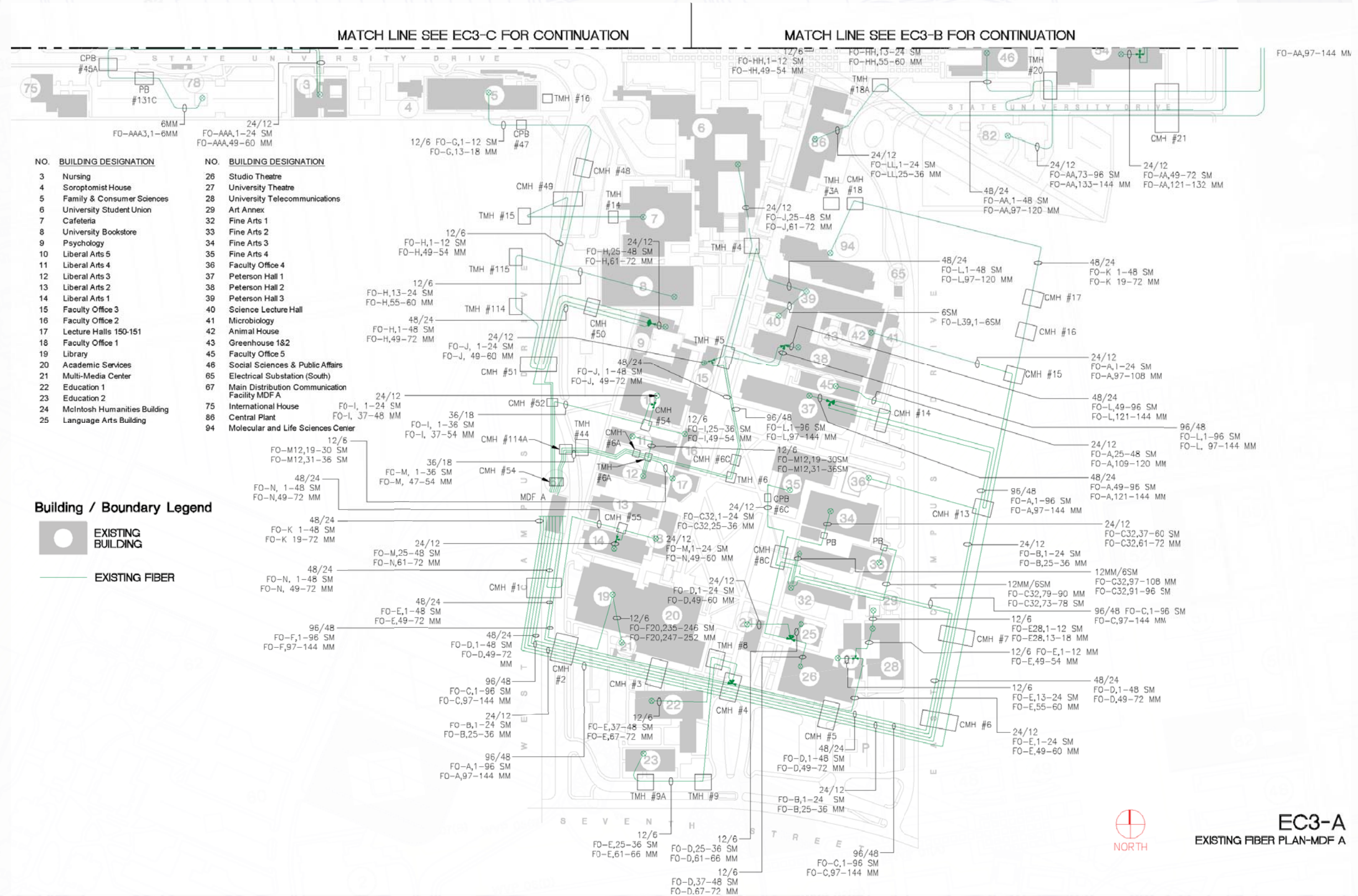
MATCH LINE SEE EC1-A FOR CONTINUATION

MATCH LINE SEE EC1-B FOR CONTINUATION



EC1-C
EXISTING CONDUIT PLAN-MDF C





NO.	BUILDING DESIGNATION
1	Brotman Hall
5	Family & Consumer Sciences
6	University Student Union
44	Electrical Substation (North)
46	Social Sciences & Public Affairs
47	University Gymnasiums
48	Health & Human Services Classrooms
49	Health & Human Services Offices
50	Vivian Engineering Center
51	Engineering 2
52	Engineering 3
53	Engineering 4
54	Design
55	Human Services & Design
56	Engineering Technology
57	Facilities Management
58	Corporation Yard
64	Greenhouse 3
66	Reprographics
68	Restrooms/Storage
69	Softball Field Restroom
70	Main Distribution Communications Facility MDF B
71	University Music Center
72	Carpenter Performing Arts Center & Dance Center
73	Mike and Arline Walter Pyramid
80	University Police
81	Parking Office Building
82	Outpost Food Service
83	Engineering / Computer Science
84	Steve and Nini Hom Center
85	College of Business
86	Central Plant
88	Parking Structure No. 1
91	Parking Structure No. 2

Building / Boundary Legend

-  EXISTING BUILDING
-  EXISTING FIBER



EC3-B
EXISTING FIBER PLAN-MDF E



NO.	BUILDING DESIGNATION
2	Student Health Services
3	Nursing
4	Soroptomist House
5	Family & Consumer Sciences
59	Patterson Child Development Center
60	Los Alamitos Hall
61	Los Cerritos Hall
62a	Residence Commons
62b	Parkside Commons
63	Recycling Center
74	Parking and Transportation Services
75	International House
76	Earl Burns Miller Japanese Garden
78	Visitor Information Center
79	Main Distribution Communications Facility MDF C
85	College of Business
88	Parking Structure No. 1
89	Housing & Residential Life

Building / Boundary Legend

-  EXISTING BUILDING
-  EXISTING FIBER



MATCH LINE SEE EC3-A FOR CONTINUATION

MATCH LINE SEE EC3-B FOR CONTINUATION



EC3-C
EXISTING FIBER PLAN-MDF C



NO.	BUILDING DESIGNATION
1	Brotman Hall
2	Student Health Services
3	Nursing
4	Soroptomist House
5	Family & Consumer Sciences
6	University Student Union
7	Cafeteria
8	University Bookstore
9	Psychology
10	Liberal Arts 5
11	Liberal Arts 4
12	Liberal Arts 3
13	Liberal Arts 2
14	Liberal Arts 1
15	Faculty Office 3
16	Faculty Office 2
17	Lecture Halls 150-151
18	Faculty Office 1
19	Library
20	Academic Services
21	Multi-Media Center
22	Education 1
23	Education 2
24	McIntosh Humanities Bldg
25	Language Arts Building
26	Studio Theatre
27	University Theatre
28	University Telecommunications
29	Art Annex
30	Fine Arts 1
31	Fine Arts 2
32	Fine Arts 3
33	Fine Arts 4
34	Faculty Office 4
35	Peterson Hall 1
36	Peterson Hall 2
37	Peterson Hall 3
38	Science Lecture Halls
39	Microbiology
40	Animal House
41	Greenhouse 1&2
42	Electrical Substation (North)
43	Faculty Office 5
44	Social Sciences & Public Affairs
45	University Gymnasiums
46	Health & Human Services Classrooms

NO.	BUILDING DESIGNATION
49	Health & Human Services Offices
50	Vivian Engineering Center
51	Engineering 2
52	Engineering 3
53	Engineering 4
54	Design
55	Human Services & Design
56	Engineering Technology
57	Facilities Management
58	Corporation Yard
59	Patterson Child Development Center
60	Los Alamitos Hall
61	Los Cerritos Hall
62a	Residence Commons
62b	Parkside Commons
63	Recycling Center
64	Greenhouse 3
65	Electrical Substation (South)
66	Reprographics
67	Main Distribution Communications Facility MDF A
68	Restrooms/Storage
69	Softball Field Restroom
70	Main Distribution Communications Facility MDF B
71	University Music Center
72	Carpenter Performing Arts Center & Dance Center
73	Mike and Arline Walter Pyramid
74	Parking Transportation Services International House
75	Earl Burns Miller Japanese Garden
76	Visitor Information Center
77	Main Distribution Communications Facility MDF C
78	University Police
79	Parking Office Building
80	Outpost Food Service
81	Engineering / Computer Science
82	Steve and Nini Hom Center
83	College of Business
84	Central Plant
85	Parking Structure No. 1
86	Housing & Residential Life
87	Parking Structure No. 2
88	Molecular and Life Science Center



Building / Boundary Legend

-  EXISTING BUILDING
-  EXISTING FIBER









EC3-D
EXISTING FIBER
TRUNK PLAN



NO.	BUILDING DESIGNATION
1	Brotman Hall
2	Student Health Services
3	Nursing
4	Sororist House
5	Family & Consumer Sciences
6	University Student Union
7	Cafeteria
8	University Bookstore
9	Psychology
10	Liberal Arts 5
11	Liberal Arts 4
12	Liberal Arts 3
13	Liberal Arts 2
14	Liberal Arts 1
15	Faculty Office 3
16	Faculty Office 2
17	Lecture Halls 150-151
18	Faculty Office 1
19	Library
20	Academic Services
21	Multi-Media Center
22	Education 1
23	Education 2
24	McIntosh Humanities Bldg
25	Language Arts Building
26	Studio Theatre
27	University Theatre
28	University Telecommunications
29	Art Annex
30	Fine Arts 1
31	Fine Arts 2
32	Fine Arts 3
33	Fine Arts 4
34	Fine Arts 5
35	Fine Arts 6
36	Faculty Office 4
37	Peterson Hall 1
38	Peterson Hall 2
39	Peterson Hall 3
40	Science Lecture Halls
41	Microbiology
42	Animal House
43	Greenhouse 1&2
44	Electrical Substation (North)
45	Faculty Office 5
46	Social Sciences & Public Affairs
47	University Gymnasiums
48	Health & Human Services Classrooms

NO.	BUILDING DESIGNATION
49	Health & Human Services Offices
50	Vivian Engineering Center
51	Engineering 2
52	Engineering 3
53	Engineering 4
54	Design
55	Human Services & Design
56	Engineering Technology
57	Facilities Management
58	Corporation Yard
59	Patterson Child Development Center
60	Los Alamitos Hall
61	Los Cerritos Hall
62a	Residence Commons
62b	Parkside Commons
63	Recycling Center
64	Greenhouse 3
65	Electrical Substation (South)
66	Reprographics
67	Main Distribution Communications Facility MDF A
68	Restrooms/Storage
69	Softball Field Restroom
70	Main Distribution Communications Facility MDF B
71	University Music Center
72	Carpenter Performing Arts Center & Dance Center
73	Mike and Arline Walter Pyramid
74	Parking Transportation Services
75	International House
76	Earl Burns Miller Japanese Garden
78	Visitor Information Center
79	Main Distribution Communications Facility MDF C
80	University Police
81	Parking Office Building
82	Outpost Food Service
83	Engineering / Computer Science
84	Steve and Nini Hom Center
85	College of Business
86	Central Plant
88	Parking Structure No. 1
89	Housing & Residential Life
91	Parking Structure No. 2
94	Molecular and Life Science Center

Building / Boundary Legend

-  EXISTING BUILDING
-  METER DESIGNATION
-  ELECTRICAL METER
-  GAS METER
-  WATER/SEWER METER
-  RECALIMED WATER

