



The University of Rochester

River Campus Electrical Distribution Upgrades

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CampusEnergy2019



HILTON NEW ORLEANS RIVERSIDE

February 26 - March 1, 2019 | New Orleans, LA



Agenda



- Introduction to River Campus Electrical System
- River Campus Electrical Distribution Study
- River Campus Re-Cabling (RC²) Master Plan
- Phased Design Process
- Progress, Highlights and Results (2016-2018)
- 2019 and Beyond

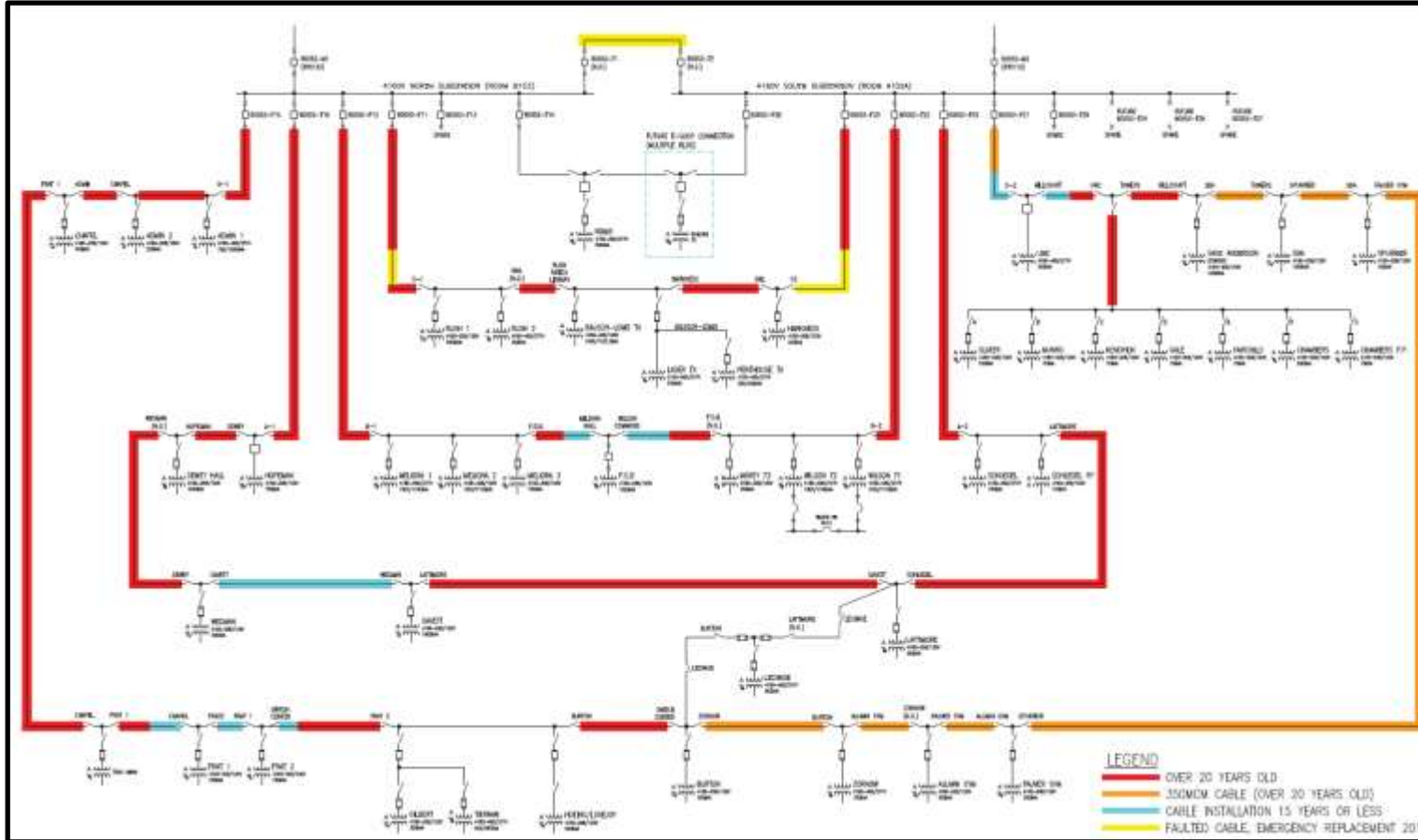
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- Founded in 1854, Private University
 - Central Heating Plant -1924
 - Medical Center – 1926
 - River Campus - 1930
- 158 Buildings, over 12MM gross SF building space
- 10,500 students (graduate and undergraduate)
- 800 bed hospital, regional trauma center
- Central chilled water system - 2 chiller plants (32,000 tons)
 - Mid-campus plant (12,000 tons – 2008/2014)
- Five steam boilers (498,000 lbs/hr)
- Steam & medium temperature hot water distribution systems
- 25MW Steam Turbine Generation (2 units - 2005)
- \$54MM annual utilities budget



River Campus Electrical System



- System Summary

- ~40 Buildings.
- Four 4.16kV loops.
- 8.4MVA parallel transformers.
- M-T-M switchgear (N.O. Tie).
- 500MCM & 350MCM Cables.
- Concrete encased duct banks.
- Electrical Peak of 5.9MVA.
- 2015 C-Loop cable failures.

River Campus Electrical Distribution Study

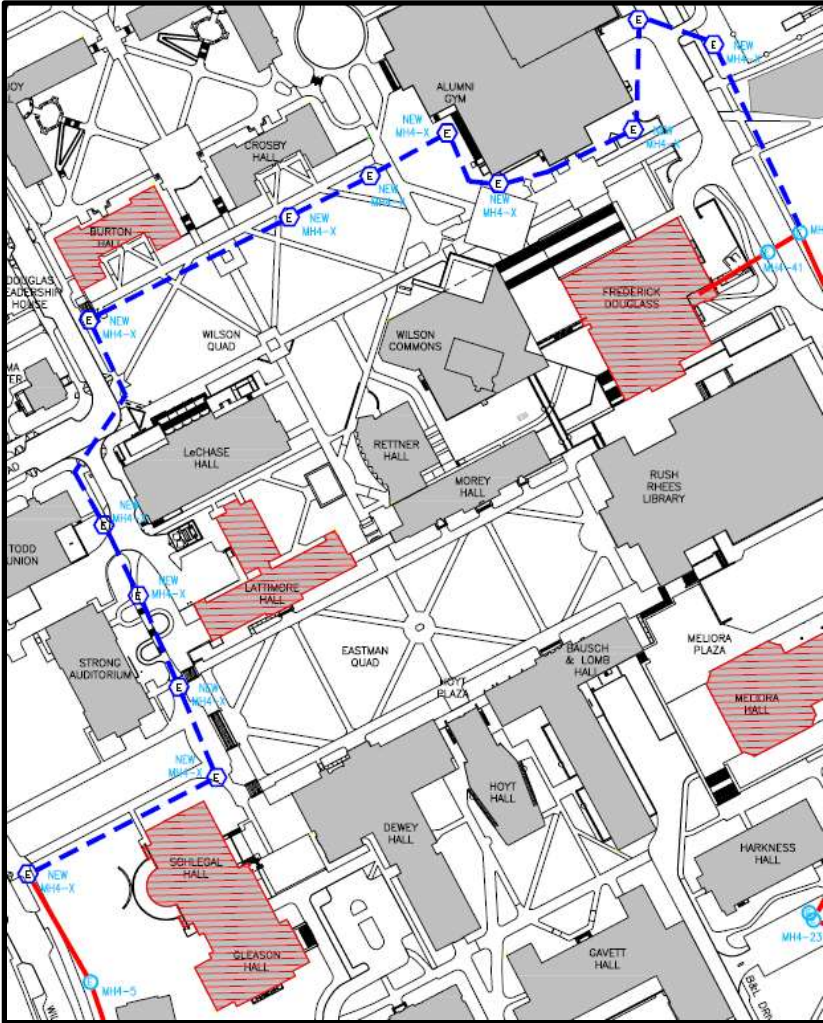
Feeder Loop	Ultimate Peak Load (A)	Cable Ampacity (A)	Reserve Capacity (A)	Reserve Capacity (%)
A1-A2	219	334	115	34%
B1-B2	205	334	129	39%
C1-C2	159	334	175	52%
D1-D2	468	309	-159	-51%



- Study Results

- Cable age of 50+ years.
- High risk loop routing.
- Load imbalance.
- Circuit overload conditions.
- Future building footprint conflicts.
- Loop switches and building service equipment age of 30-60 years.
- PCB filled transformers.
- Low voltage arc flash hazards.

River Campus Re-Cabling (RC²) Master Plan



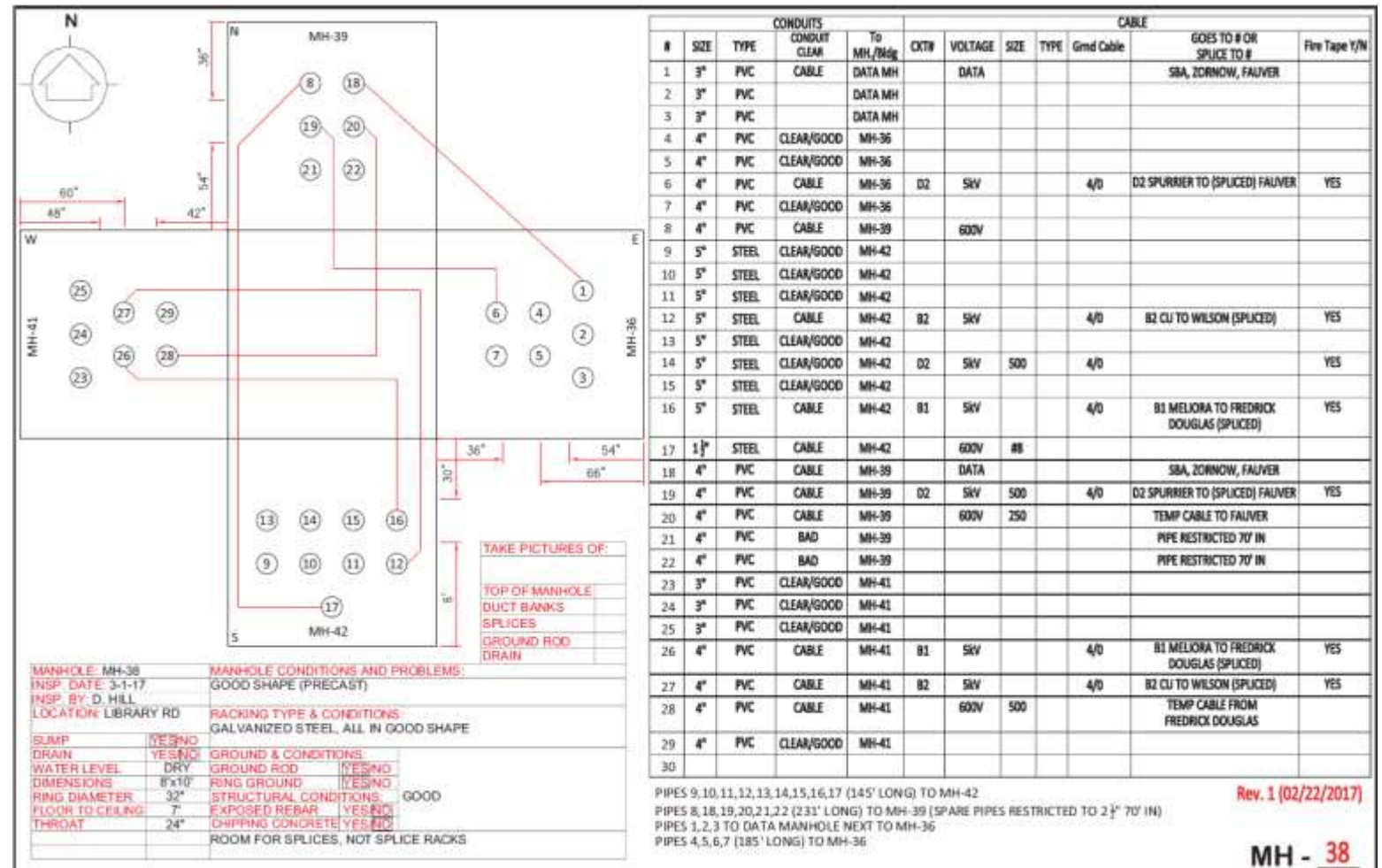
- High Priority Goals
 - 1) Alleviate Overloaded circuit condition (D-Loop).
 - 2) Clear immediate future building footprints.
 - 3) Replace all cable >25 years old.
 - 4) Geographically separate loops (A, B, C).
 - 5) Upgrade loop switches and building E-Room equipment (Project Synergy).
- \$6 M over 6 years
 - 2016-2017: E-Loop creation.
 - 2018: D-Loop relocation.
- Wholistic Approach and Project Synergy.

RC² Design Process

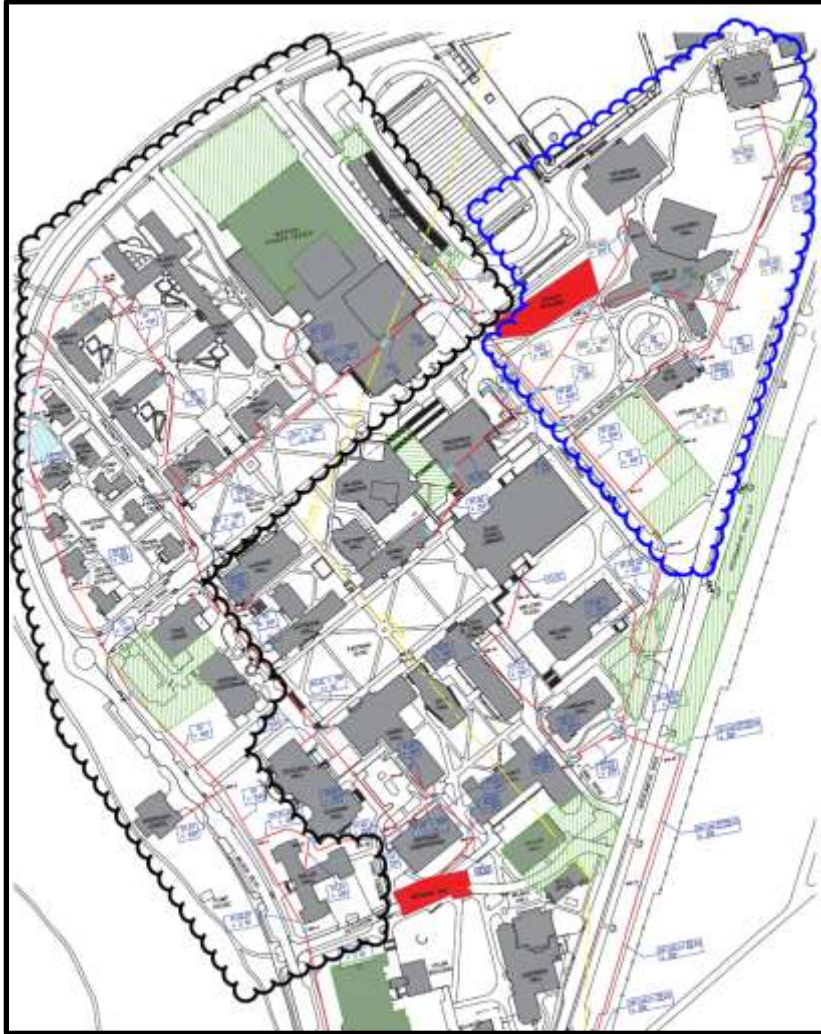


- Pre-Schematic Concept
 - Priority list.
- Existing System Investigation
 - Site survey.
 - Manhole/Duct bank investigation.
 - Potholing plan.
 - Analysis of effected loop switches & transformers.
- Detailed Design
 - Construction phasing sequence.
 - New duct bank design.
 - New building service entrance design.

RC² Design Process

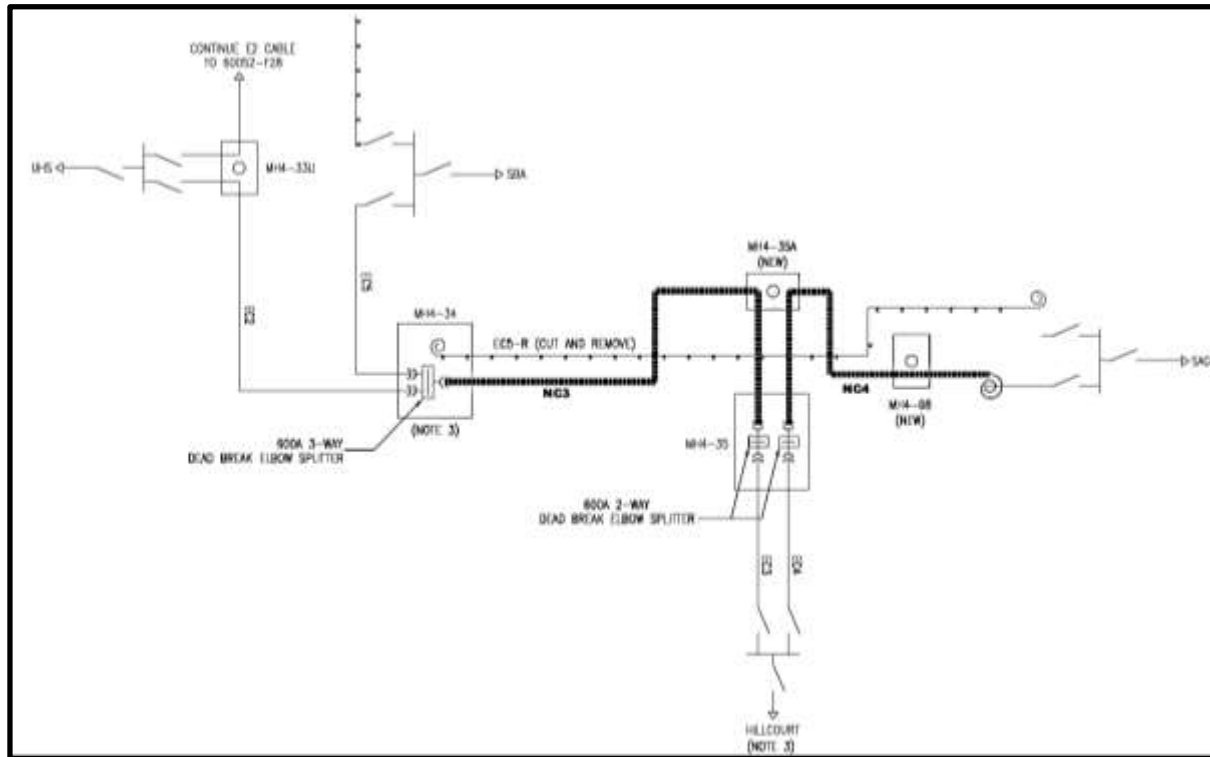


RC² 2016-2017 – E-Loop Creation



- New building Construction in 2017
 - Only geographically available loop was overloaded (D-Loop).
- Wholistic Approach
 - Split D-Loop in half – construct ‘E-Loop’.
 - Geographically separate sides of D-Loop.
 - Eliminate routing through SBA building.
 - Feed new building from E-Loop.
 - Clear footprint of future building.
 - Replace SBA distribution switch:
 - 60 years old, difficult to operate.
 - LV switchgear arc flash ~89cal/cm².

RC² 2016-2017 – E-Loop Creation



- Construction Phasing Sequence
 - Minimized outages.
 - Consistent contractor bids.
 - Educate key stakeholders.

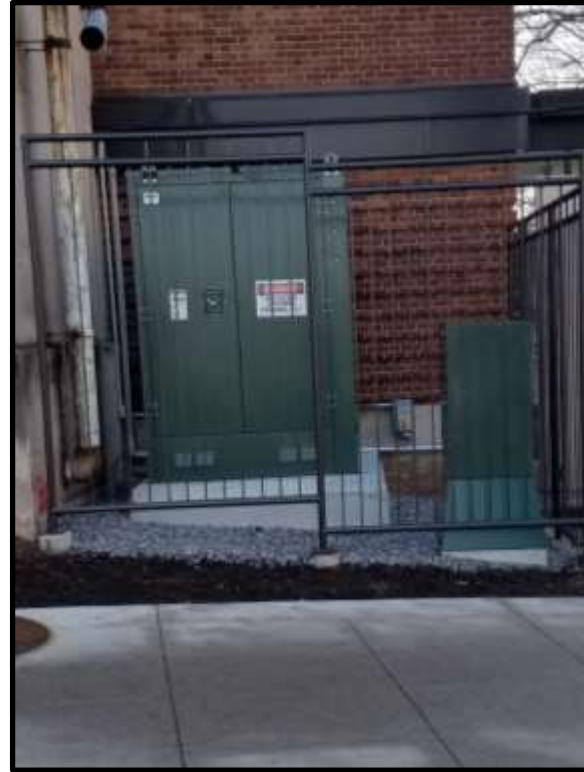
PHASE E-204 – SAGE SWAP

46. CLOSE UHS SWITCH TOWARDS MH4-34, CLOSE HILLCOURT SWITCH TOWARDS UHS.
47. OPEN HILLCOURT SWITCH TOWARDS SAGE, OPEN SAGE SWITCH TOWARDS HILLCOURT TO ISOLATE EC4.
48. CUT EC4 IN MH4-35 AND DISCONNECT EC4 AT THE SAGE SWITCH.
49. CONNECT EC4 TO MH4-35 DB.
50. CONNECT NC4 TO SAGE SWITCH.
51. REMOVE EC4-R.

PHASE E-205 – SBA1 SWAP

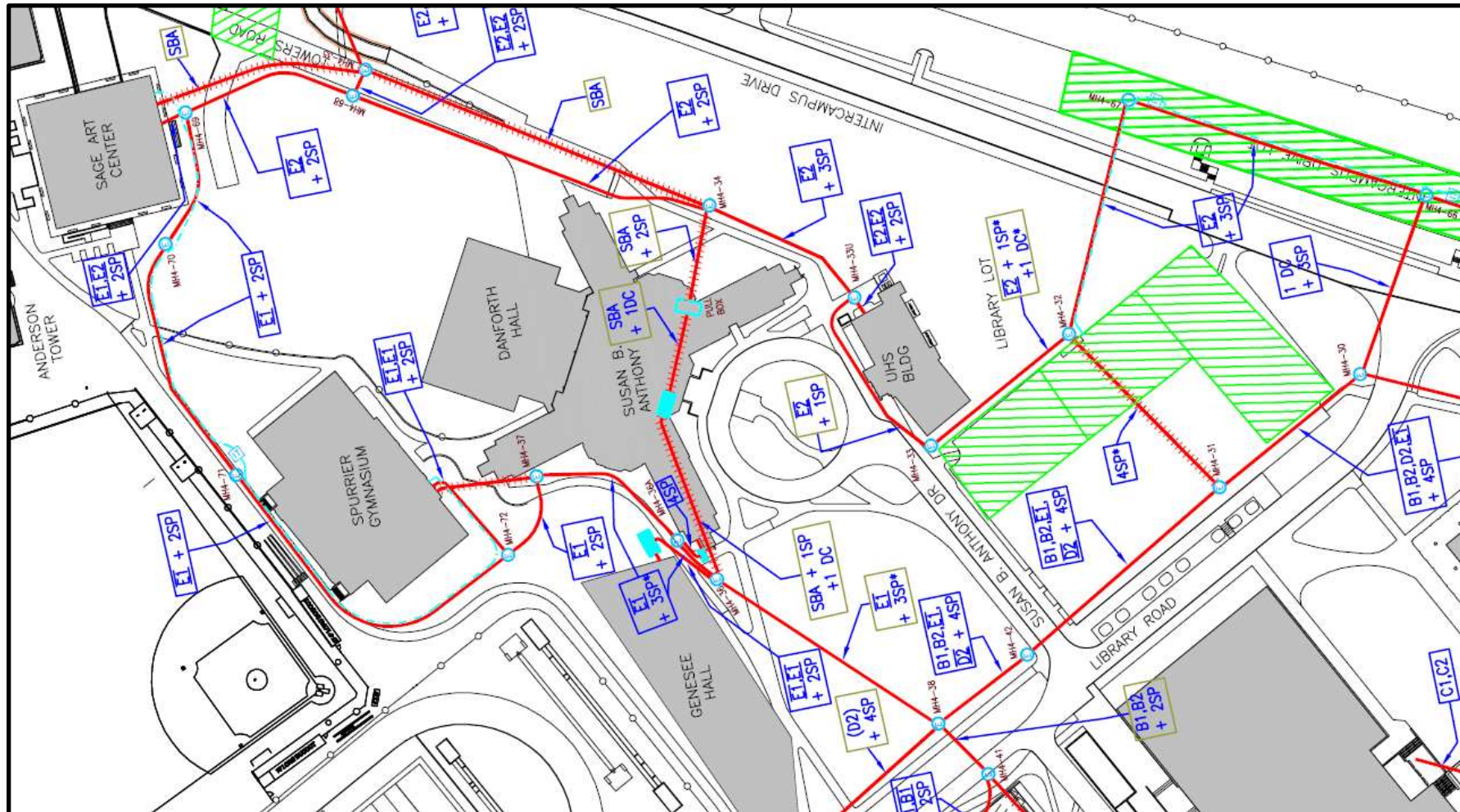
52. CLOSE HILLCOURT SWITCH TOWARDS SAGE, CLOSE SAGE SWITCH TOWARDS HILLCOURT.
53. OPEN SAGE SWITCH TOWARDS SBA, OPEN SBA SWITCH TOWARDS SAGE TO ISOLATE EC5.
54. OPEN UHS SWITCH TOWARDS HILLCOURT.
55. OUTAGE OF HILLCOURT AND SAGE FOR ~ 4 HOURS.
56. CUT EC5 IN MH4-34 AND DISCONNECT EC5 AT THE SAGE SWITCH.
57. CONNECT REMAINING EC5 TO MH4-34 DB TO PROVIDE A TEMPORARY E-LOOP FEED TO SBA.
58. CLOSE UHS SWITCH TOWARDS HILLCOURT.
59. POWER TO HILLCOURT AND SAGE RESTORED – NOW FED FROM THE E-LOOP SOUTH (E2).
60. REMOVE EC5-R.

RC² 2016-2017 – E-Loop Creation

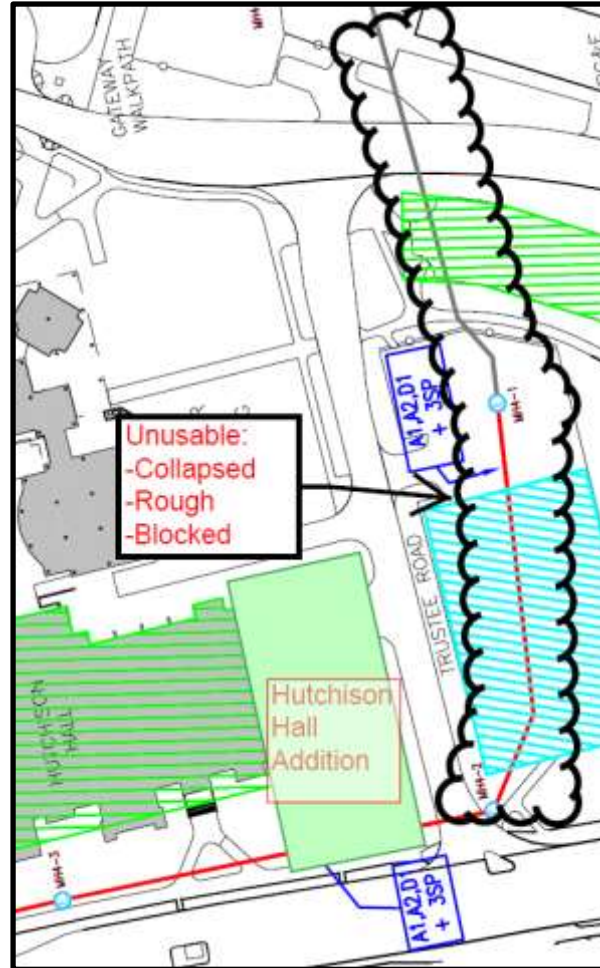


- Results
 - Improved loop reserve capacity:
 - D-Loop – 30%
 - E-Loop – 40%
 - New building fed from E-Loop.
 - E-Loop and D-Loop completely mechanically separated.
 - Abandoned duct bank for future 'Library Lot' building.
 - SBA 5kV switch upgrade:
 - New, safe SF6 switch with SEL relay
 - LV arc flash 16cal/cm²

RC² 2016-2017 – E-Loop Creation



RC² 2018 – D-Loop Relocation

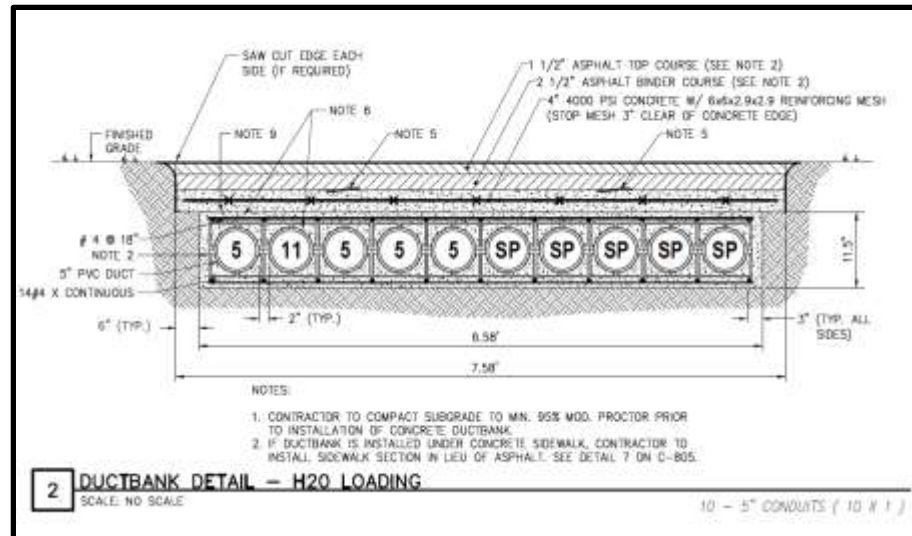
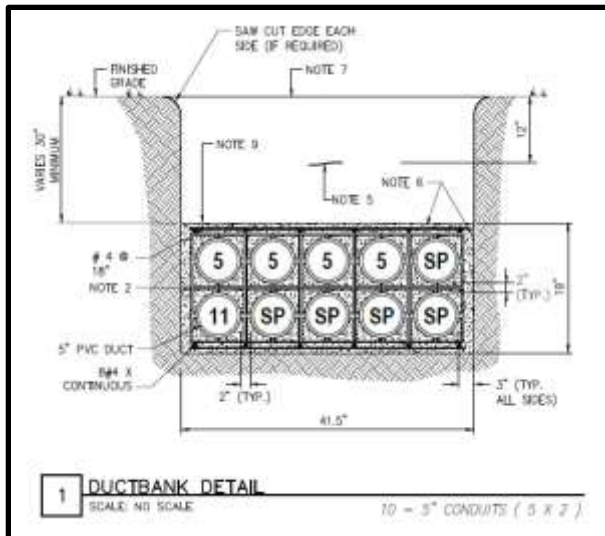


- Multi-Project Synergy
 - Eastman Forecourt Upgrade.
 - New Hutchison Hall Addition.
 - New Sloan Theatre Building.
 - 15kV System Upgrades.
- Major Unusable Duct bank
- Wholistic Approach
 - Wallis Hall E-Room Upgrade.
 - Lattimore E-Room Preparation.

RC² 2018 – D-Loop Relocation



- Existing Utilities
 - CU Lot – Extreme congestion.
 - Transitions to different duct bank configurations.
 - Reinforced shallow duct banks.



RC² 2018 – D-Loop Relocation



- Results

- D-Loop cable ~50% upgraded.
- A-Loop cable ~70% upgraded.
- Cleared footprint for 2019 buildings
- Cleared footprint for future building.
- New duct bank installed in synergy with Eastman Forecourt upgrade.
- Wallis Hall E-Room Upgrade.
- Lattimore Hall E-Room preparation.

RC² 2018 – Electrical Room Upgrades



- Wallis Hall
 - Two new transformers.
 - Two new LV switchboards.
 - One new 5kV distribution switch.
 - New LED lighting.
 - New ventilation system.
 - Two 4 hour outages.



RC² 2018 – Electrical Room Upgrades

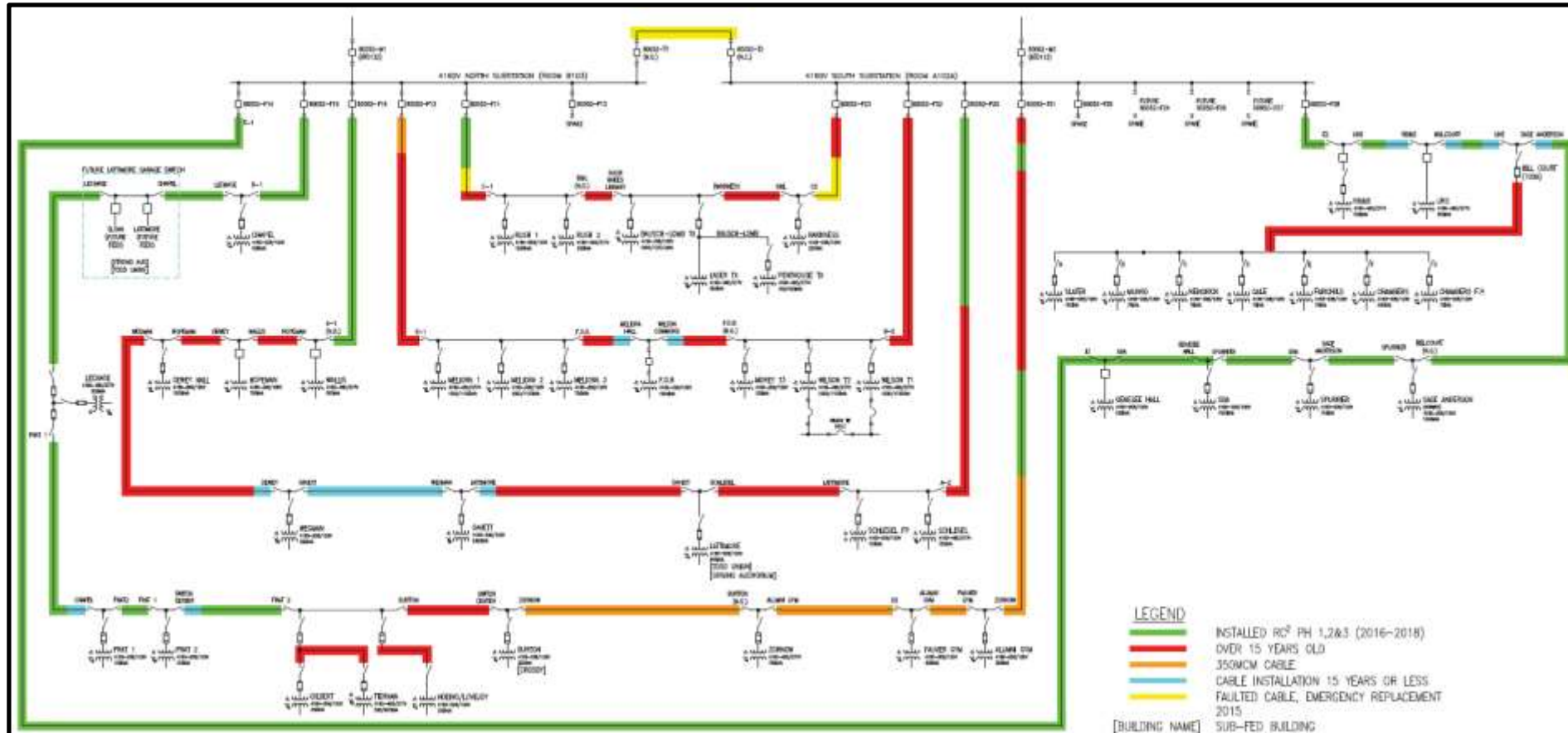


- Lattimore Hall

- Unsafe existing E-Room:
 - Equipment age 50+.
 - Insufficient working space, egress.
 - Exposed bus bar.
- Re-purposed garage for future E-Room.
- Upgrade Summer 2019.



RC² 2016-2018 – Results Summary



- Upgraded Distribution System (2019)
 - 5,000' New Duct Bank
 - 12,000' New Cable

RC² 2019 and Beyond



- 2019
 - Pause River Campus excavation.
 - Replace 3000 circuit feet of cable in existing duct bank infrastructure for B and D Loops.
 - Upgrade two River Campus building electrical rooms (Dewey and Lattimore).
- 2020-2023
 - Install all new remaining duct bank and replace all remaining 5kV distribution cable per Master Plan.
 - Continue upgrading building E-Room equipment at a rate of 2-3 per year.



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River Campus Electrical Distribution Upgrades

Thank you

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