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Electrical Vault Rehabilitation Lessons Learned

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Agenda Topics

01

LIT Airfield
Layout

02

LED Lighting
Improvements

03

Fire Event

04

Pop Quiz

05

Science
Experiment

06

Outside the
Box

07

Safety
Improvements

08

Resiliency
Improvements

09

Questions

LIT Airfield Layout



LED Lighting Improvements

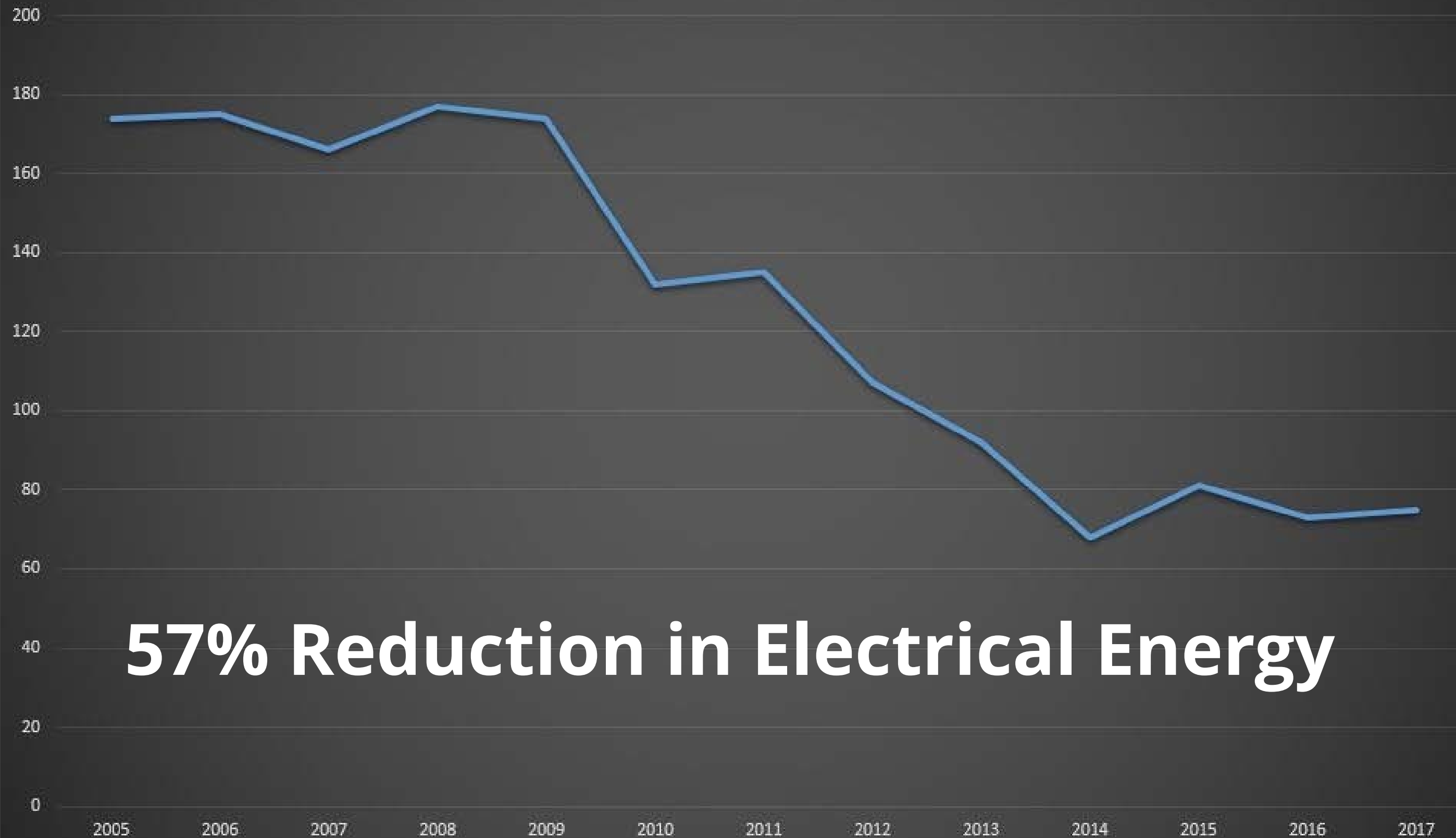
Multiple Projects Over Several Years (2009 – Present)

- Reduced Operational and Maintenance Costs
- Reduced Power Load
- Reduced Energy Costs

Project by Project



Average Metered Kilowatts
of Electrical Energy per Year



57% Reduction in Electrical Energy



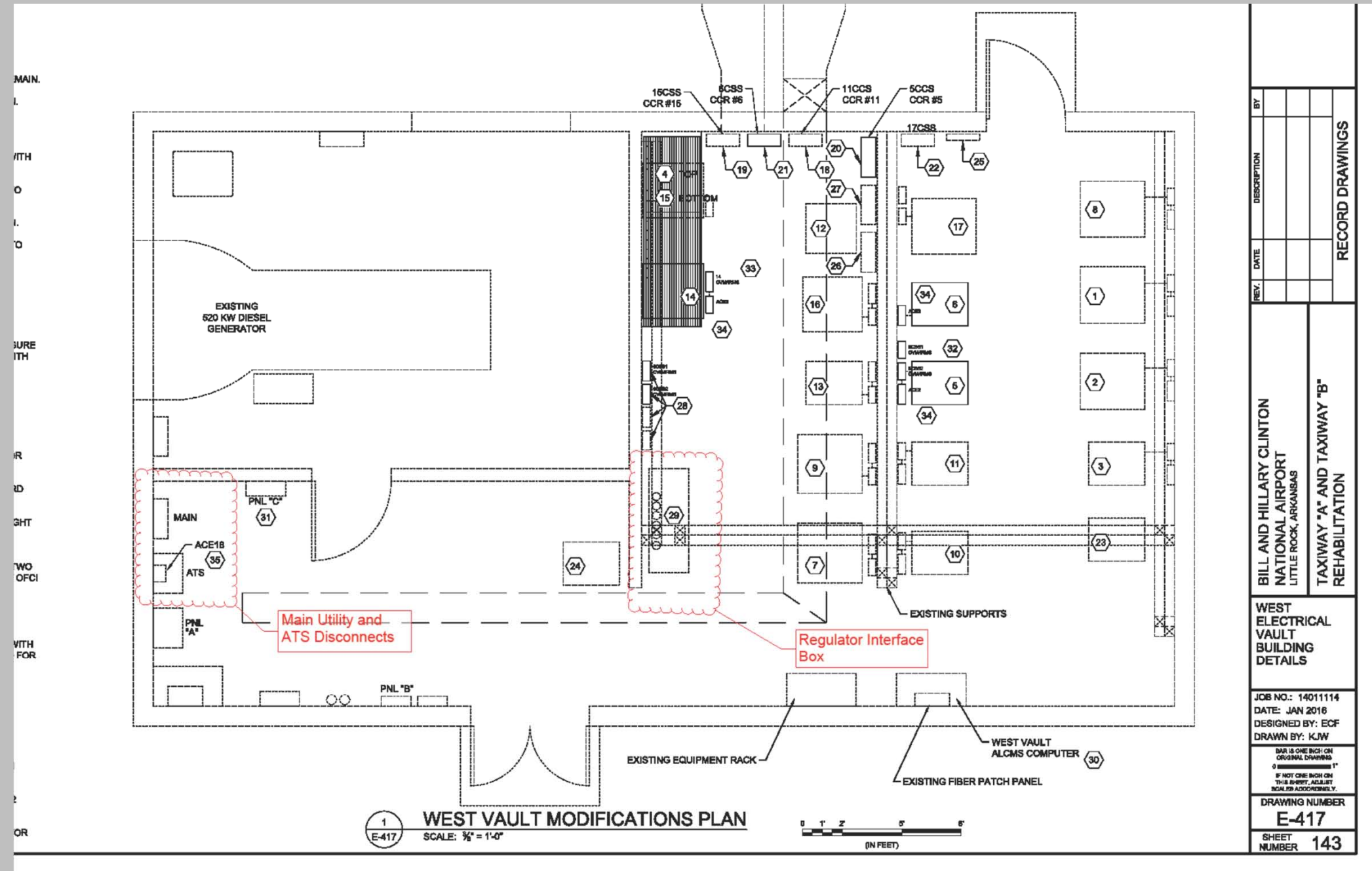
All is good, then something unforeseen happens...

West Electrical Vault

Fire Event – June 2014

Quick Background

- Fire Originated in the Regulator Interface Box
- ALCMS Circuit Alarms / Ops
- ARFF Quick Arrival, Limited Damage, But Utilized Water Agent to Extinguish
- Existing Power Disconnects at that time were within Vault





Regulator Interface Box



ACE Control Enclosures

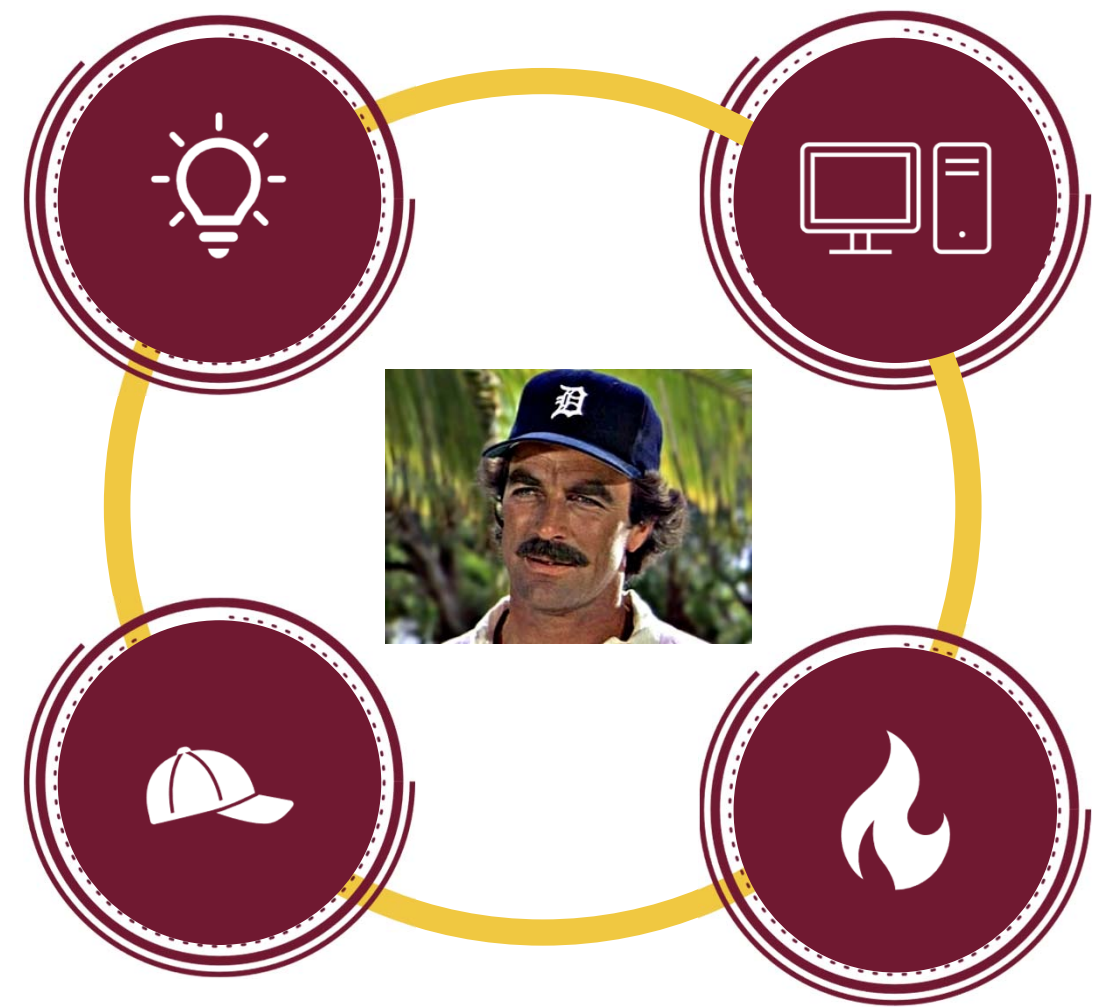


Forensic Investigation

Limited knowledge to determine the cause

- Listen to our Little Voice / Thinking Cap
- ALCMS Circuit Warnings Showed the Order
- Originated within Interface Box and Spread Quickly / Evidence Burned Up & Removed

We are in Detroit so...





Pop Quiz Time!

Will a constant current regulator shut down when there is an 'open' in the series circuit?



Determine the Cause

Electrical Arcing Fault Can Generate that Heat

- ALCMS Circuit Alarm Warning / Quick Fire
- L-823 Connector Kit – Plug and Receptacle
- Had it ‘Snapped’ into Place? Could it Retract?
- Acquire Equipment for a Science Experiment



Science Experiment

North Little Rock Airport Test Setup

- **Airport Manager Approval**
- **Notified Fire Department / Extinguishers**
- **L-823 Connector – Incorrectly Installed, No Snap, Retracted, But Receptacle/Plug Touching**

[Click on the image below to view the splice kit test experiment video.](#)



[Be sure your PDF reader is set to open PDF hyperlinks in your web browser and disable the PDF/A mode of view.](#)

- **Smoke ~7 seconds**
- **Visible fire ~35 seconds**
- **Arc visible to metal ~11 minutes**
- **CCR never shut off as there was a circuit**



Lesson Learned



#1

Check Connector Kits

Policies, Objectives, Targets, Goals - Safety

- L-823 Connector Kits – Ensure Correct Installation
- Check Existing/New Regulator Interface Box, Other Locations
- Power is OFF – Whether Vault or Field Work - Tie a Ribbon
- L-108-2.5 Splicer Quals, Teaching & Example Installations
- Enhanced L-823 Connector Kits – Show and Tell





Electrical Vault Rehabilitation



Outside the Box – Creative Thinking

- Standards, Guidelines, Current Technology
- Recommendations for Both Existing Vaults
- Propose Improvements/Costs for Power and Special Systems
- Airport to Review and Schedule Two Improvement Projects to Implement/Construct these Changes
- **Safer for the Public and Airport Staff, Protecting the Infrastructure, and Providing Resiliency.**



Engineer's Report



Prime Objectives and Goals – Basis/Why

- Utility Power, Standby Power, Setup/Disconnects for Each
- One Generator to Three Generators – Natural Gas
- Fire Alarm Detection and Suppression
- CCTV Cameras for Inside Observation
- Power Loss & Transitions – Uninterruptible Power Systems
- **Safety and Resilience.**

Electrical Vault Rehab – Phase 1



Improvements at Each Vault - Safety

- Exterior Utility and Generator Power Shut Off Stations
- Replace Automatic Transfer Switch / Add Docking Station
- Install Fire Alarm System with Enhanced Early Warning Detection
- Install Fire Suppression System
- Install CCTV Cameras Inside Building
- **Warning Procedure Signage, Testing, Training – LIT and ARFF**

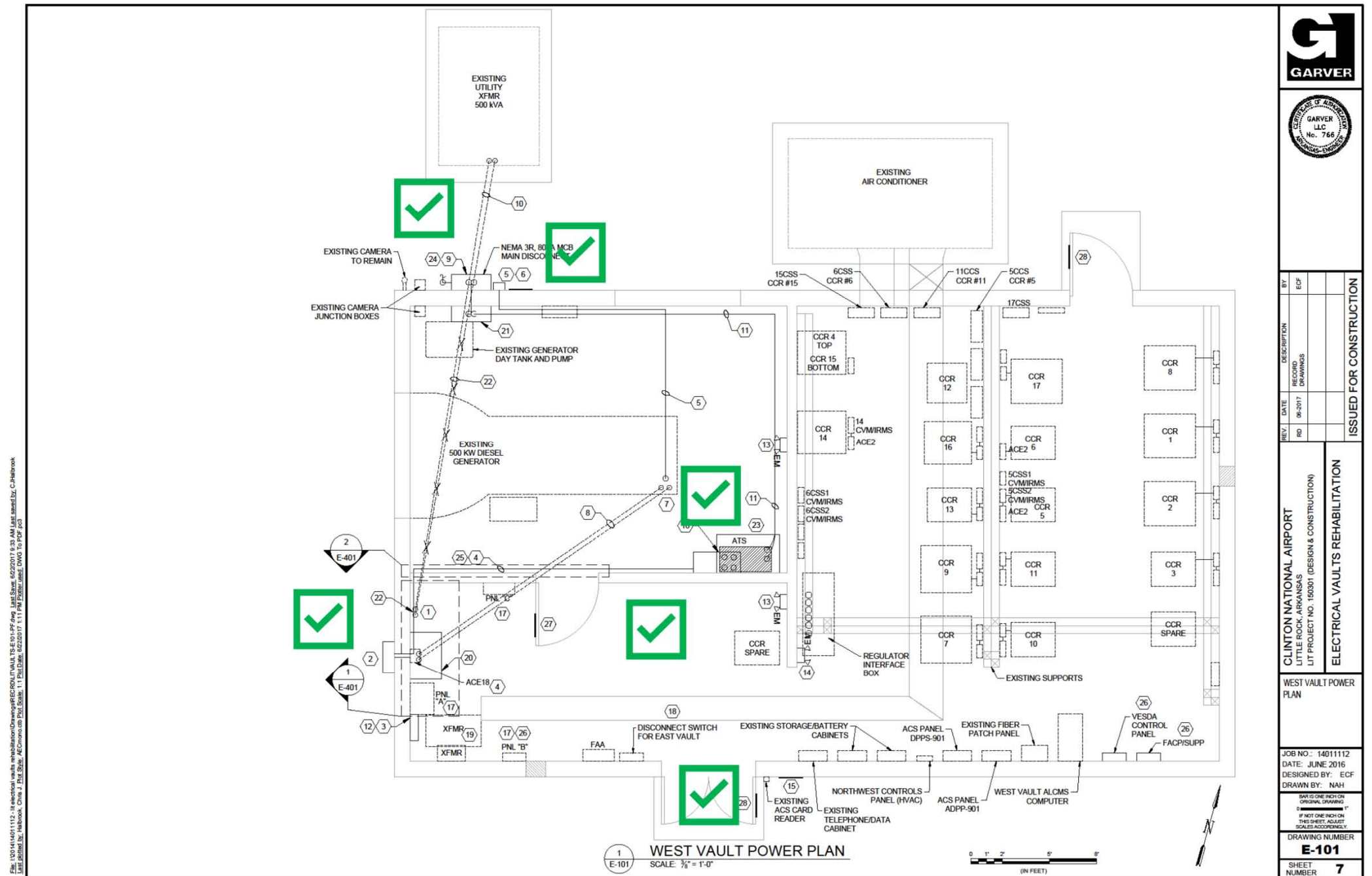
Phase 1

Genset/UPS

Power/Fire

Phase 2

- Exterior Utility Disconnect
- Generator Shutoff Station
- ATS Replacement
- Docking Station
- Building Load Meter
- ALCMS Updates
- Signage with Procedures



West Electrical Vault

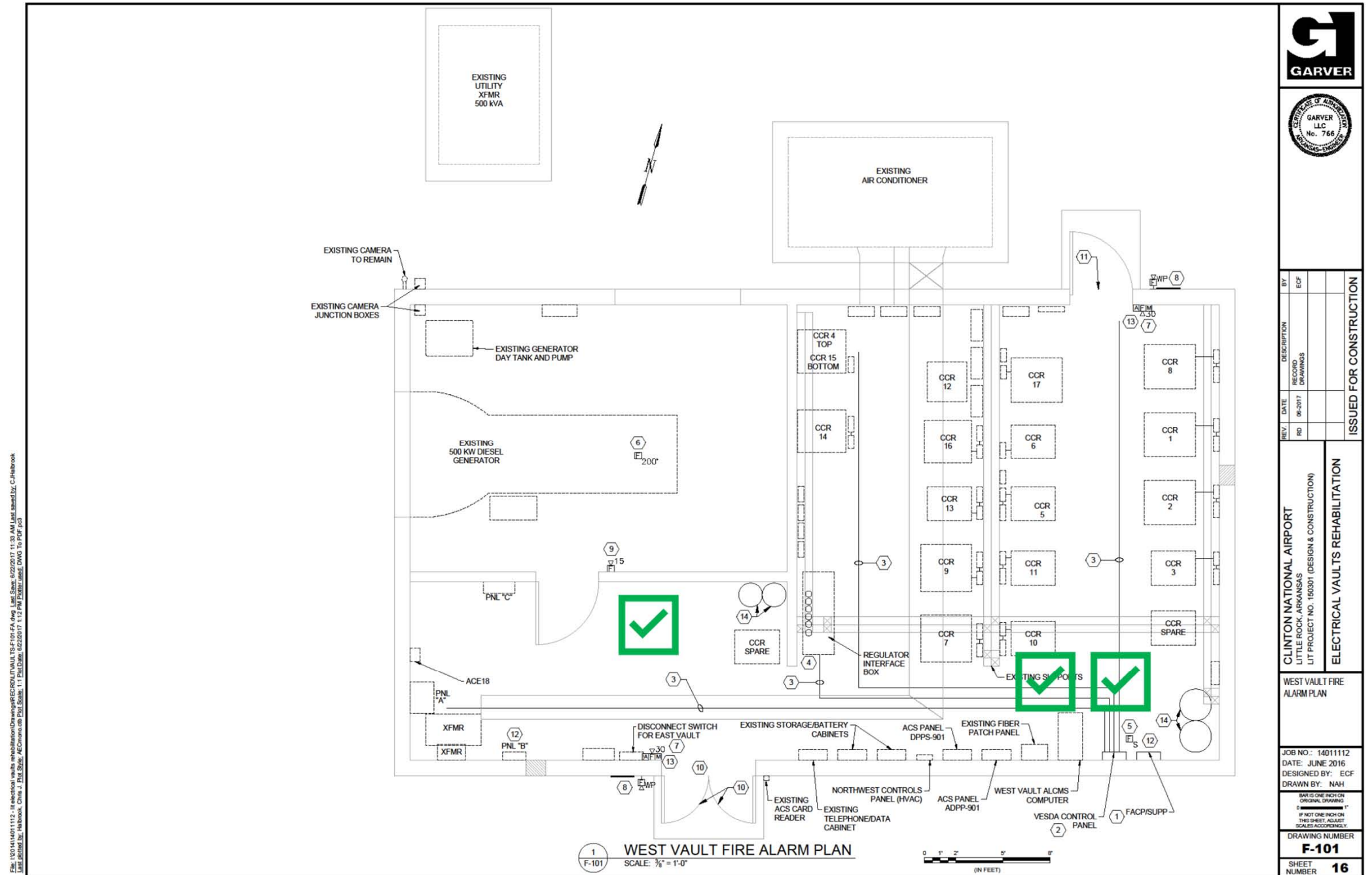
Rehab Phase 1

Power

- Exterior Utility Disconnect
- Generator Shutoff Station
- ATS Replacement
- Docking Station



- Networked Fire Alarm Panel
- Sampling Tube, Aspirating Type, Early Warning Fire Detection System
- Horns/Strobes Inside/Outside
- Manual Pull Stations / Abort Stations



West Electrical Vault

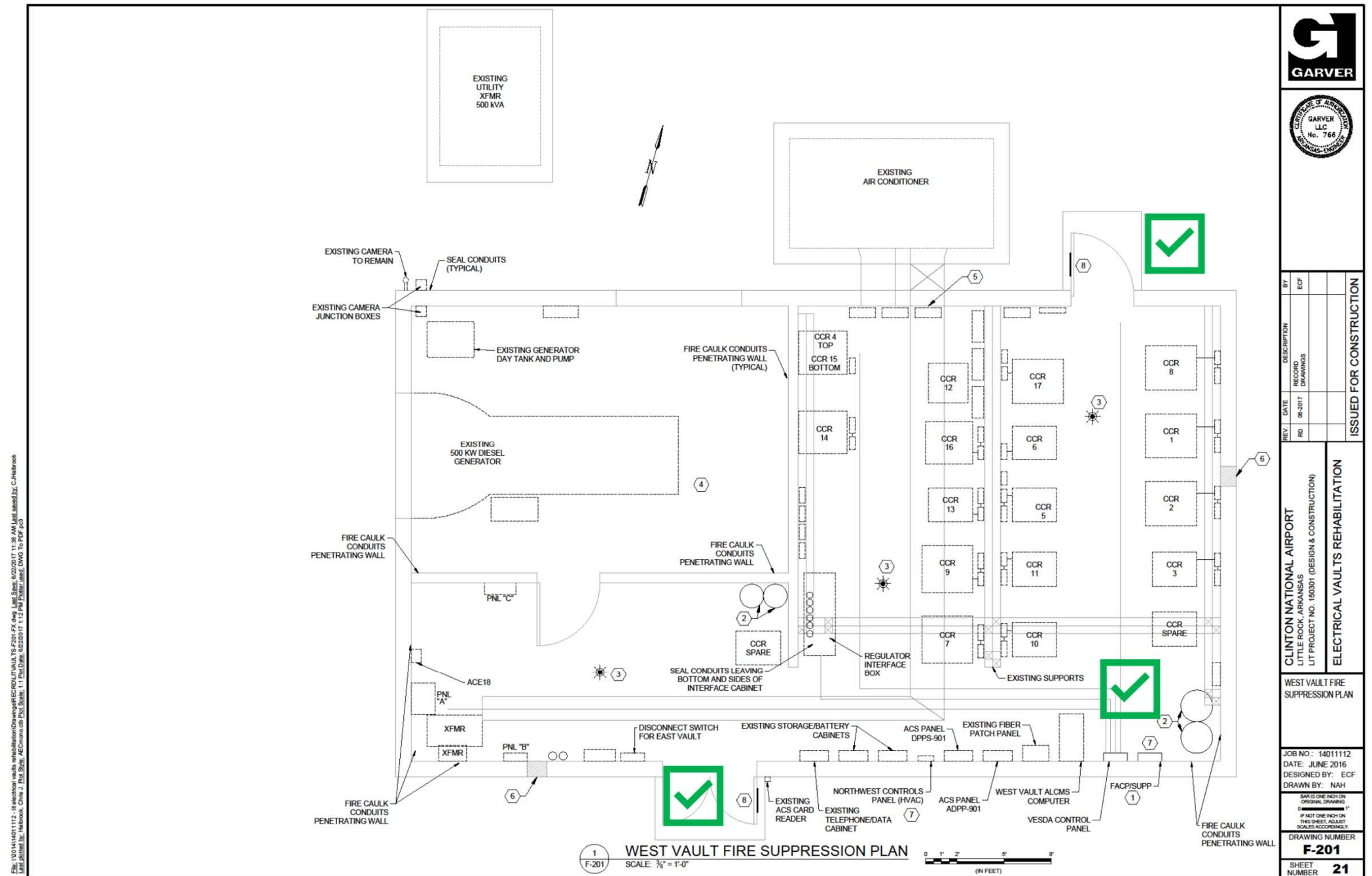
Rehab Phase 1

Fire Detection

- Networked Fire Alarm Panel
- Sampling Tube, Aspirating Type, Early Warning Fire Detection System – Including to Interface Box
- Horns/Strobes Inside/Outside
- Manual Pull Stations / Abort Stations



- Environmentally Safe Agent Fire Suppression System
- Building Work to Seal Area
- Signage with Procedures / Abort Stations



West Electrical Vault

Rehab Phase 1

Fire Suppression

- Environmentally Safe Agent Fire Suppression System
- Building Work to Seal Area
- Signage with Procedures / Abort Stations

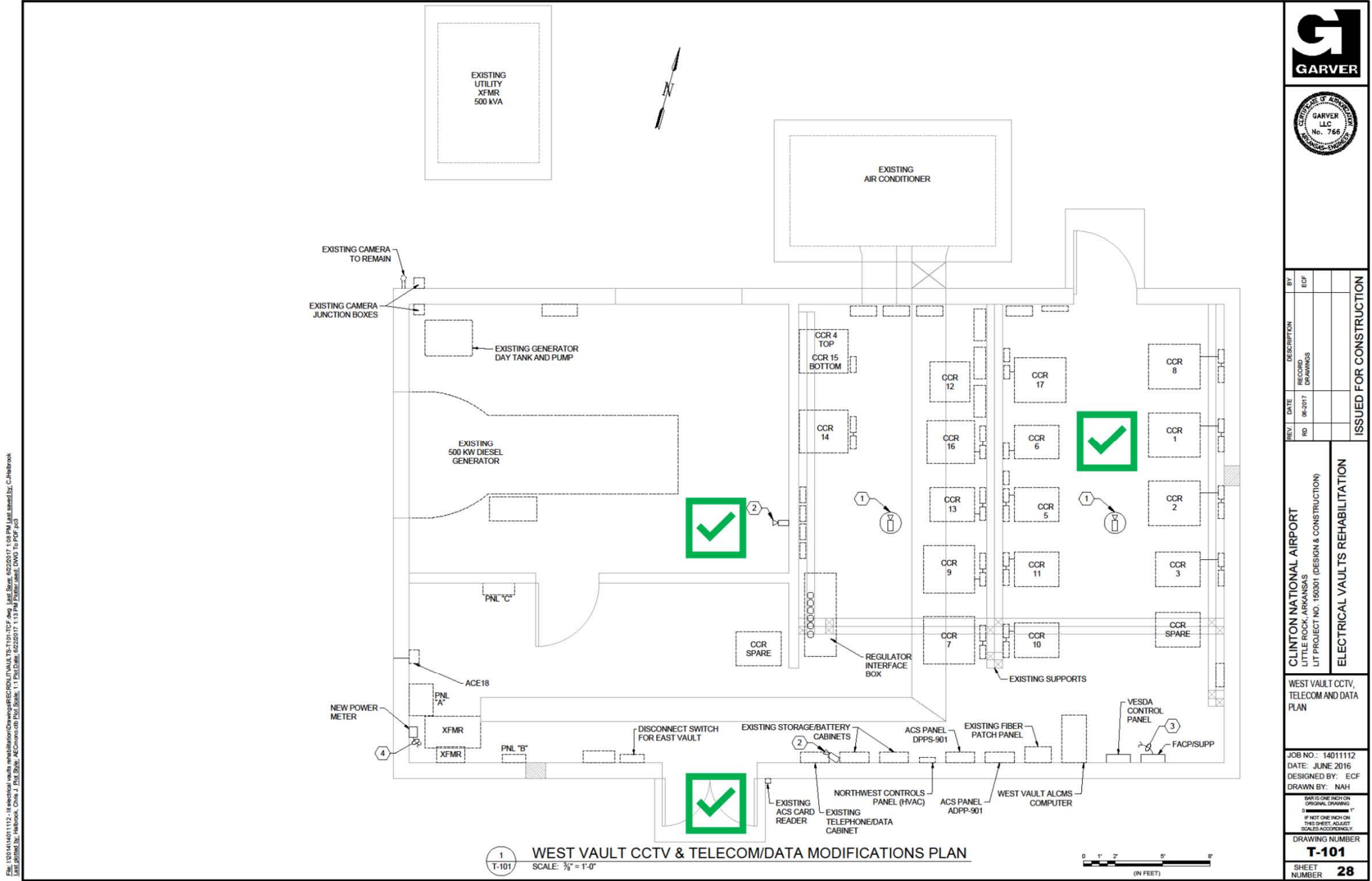


West Electrical Vault

Rehab Phase 1

CCTV Cameras

- 360 Degree, Hemispherical Cameras for No Blind Spots
- Fixed Cameras to Supplement
- Door Panic Bar Upgrades for Access Control Improvements

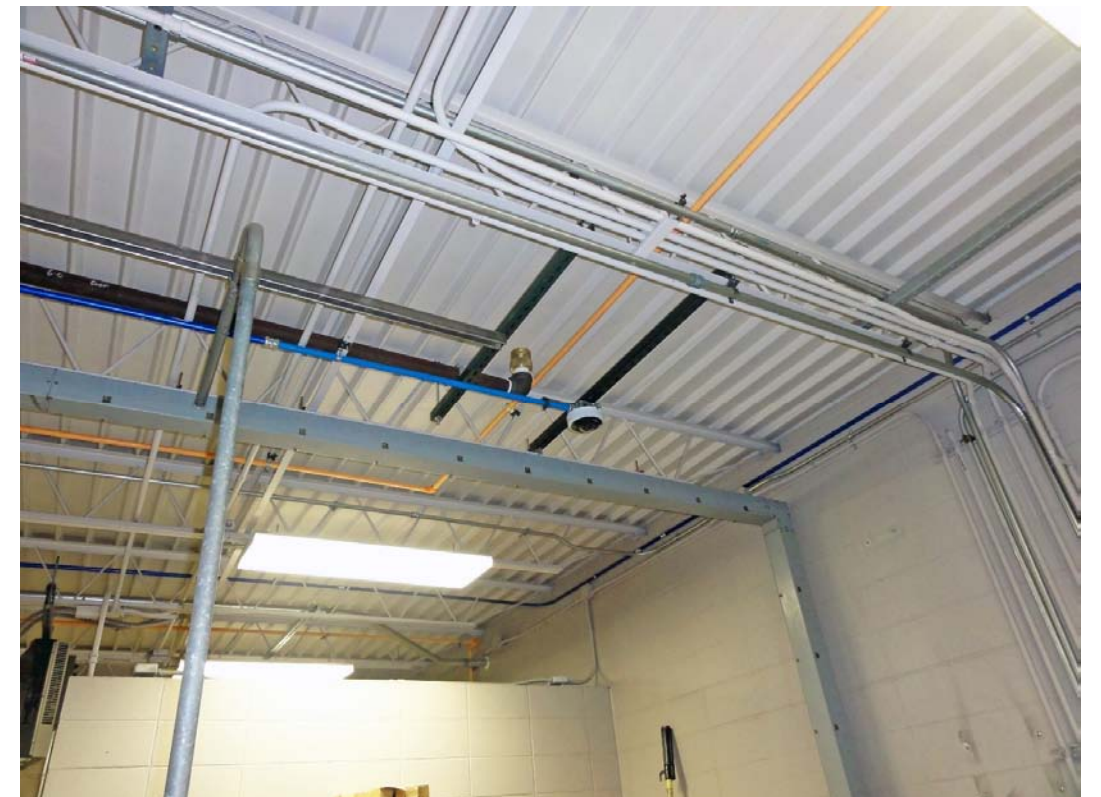


West Electrical Vault

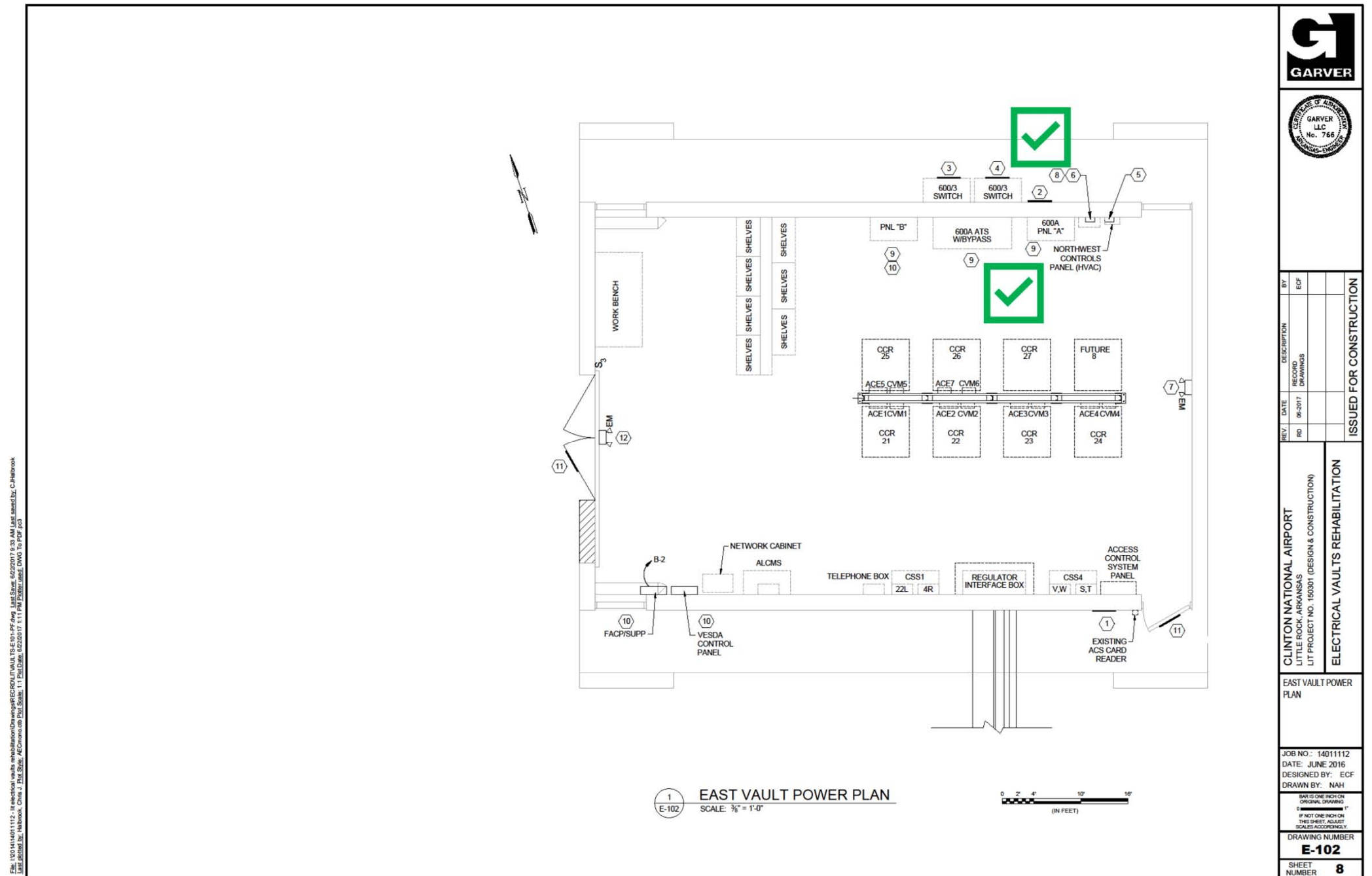
Rehab Phase 1

CCTV Cameras

- 360 Degree, Hemispherical Cameras for No Blind Spots
- Fixed Cameras to Supplement
- Door Panic Bar Upgrades for Access Control Improvements



- Disconnects Signage
- Building Load Meter
- ALCMS Updates
- Signage with Procedures



East Electrical Vault

Rehab Phase 1

Power

- Disconnects Signage
- Building Load Meter
- ALCMS Updates
- Signage with Procedures

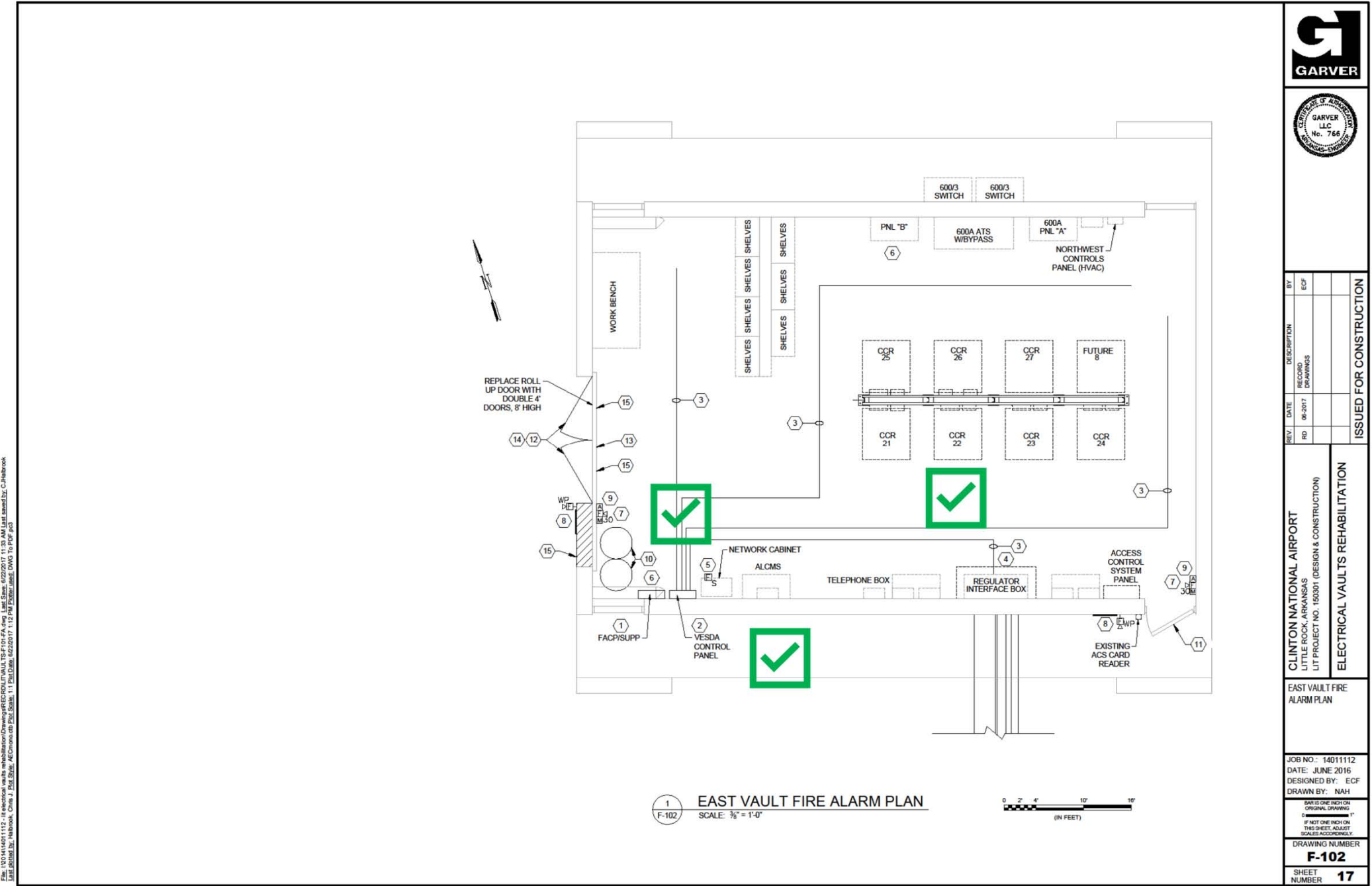


East Electrical Vault

Rehab Phase 1

Fire Detection

- Networked Fire Alarm Panel
- Sampling Tube, Aspirating Type, Early Warning Fire Detection System
- Horns/Strobes Inside/Outside
- Manual Pull Stations / Abort Stations



East Electrical Vault

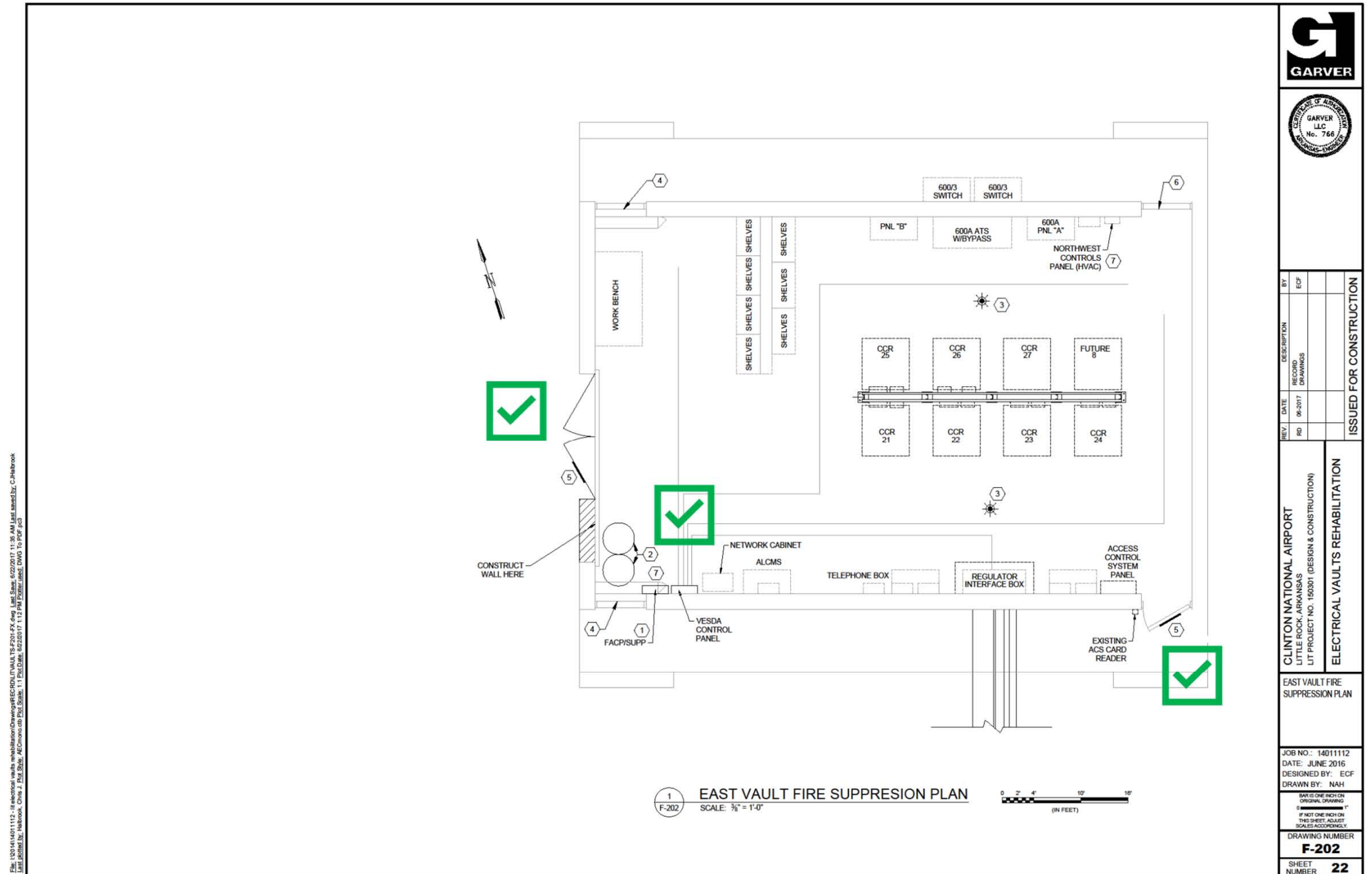
Rehab Phase 1

Fire Detection

- Networked Fire Alarm Panel
- Sampling Tube, Aspirating Type, Early Warning Fire Detection System
- Horns/Strobes Inside/Outside
- Manual Pull Stations / Abort Stations



- Environmentally Safe Agent Fire Suppression System
- Building Work to Seal Area
- Signage with Procedures



East Electrical Vault

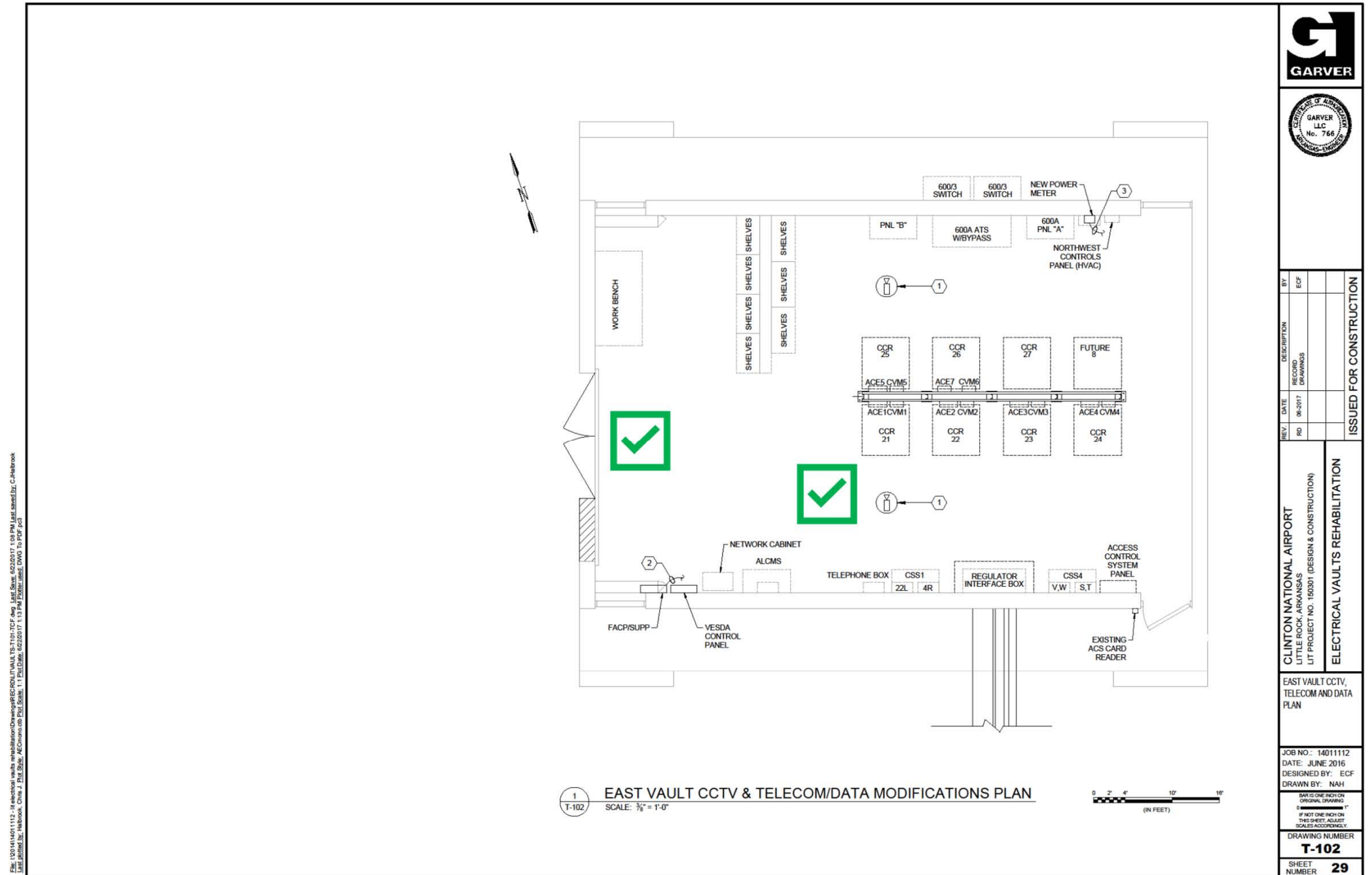
Rehab Phase 1

Fire Suppression

- Environmentally Safe Agent Fire Suppression System
- Building Work to Seal Area
- Signage with Procedures



- 360 Degree, Hemispherical Cameras for No Blind Spots
- Door Panic Bar Upgrades for Access Control Improvements



East Electrical Vault

Rehab Phase 1

CCTV Cameras

- 360 Degree, Hemispherical Cameras for No Blind Spots
- Door Panic Bar Upgrades for Access Control Improvements





Lesson Learned



#2

Power Improvements

Learn Things

- Docking Station – Tremendous Asset
- Fast Acting ATS are Not All Equal



Lesson Learned



#3

Fire Alarm Improvements

Learn Things

- Suppression Tank Calculations – Future Room to Add
- Door, Wall, and Conduit Sealing – Prior to Testing



Electrical Vault Rehab – Phase 2



Improvements at Each Vault - Resilience

- Replace West Vault Diesel Generator with Natural Gas Genset
- Install New ATS and UPS in West Vault
- Install New East Vault Natural Gas Generator
- Install New ATS, Docking Station, and UPS at East Vault
- Install New ARFF Natural Gas Generator
- **Warning Procedure Signage, Testing, Training – LIT and ARFF**

Phase 1

Genset/UPS

Power/Fire

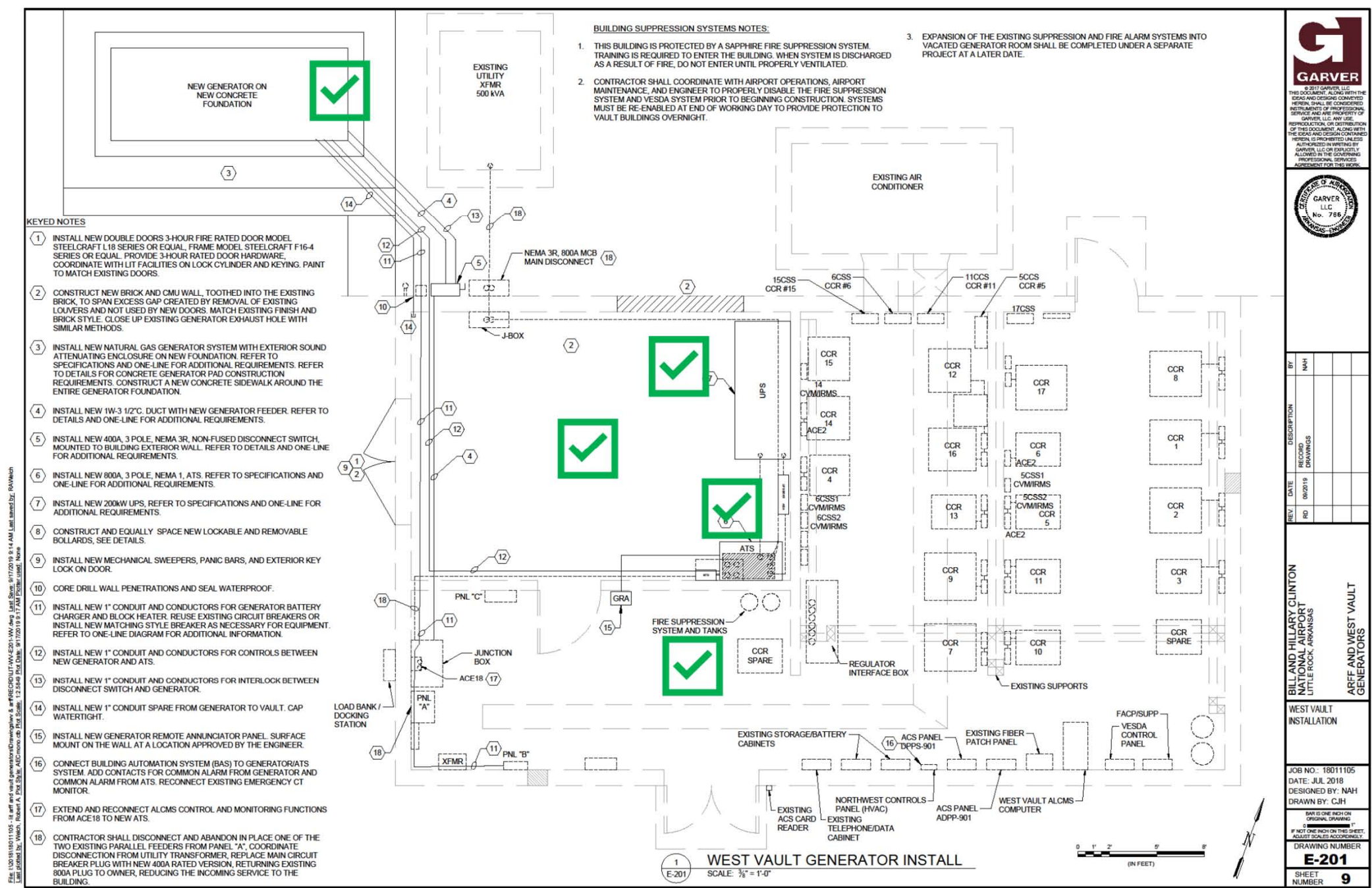
Phase 2

West Electrical Vault

Rehab Phase 2

Generator and UPS

- Remove Diesel Generator
- New 250 kW Natural Gas Generator
- Replace ATS – Specific Unit
- New 200 kW UPS with Bypass
- Extend Fire Detection & Suppression Systems



West Electrical Vault

Rehab Phase 2

Generator and UPS

- Remove Diesel Generator
- New 250 kW Natural Gas Generator
- Replace ATS – Specific Unit
- New 200 kW UPS with Bypass
- Expand Fire Suppression System

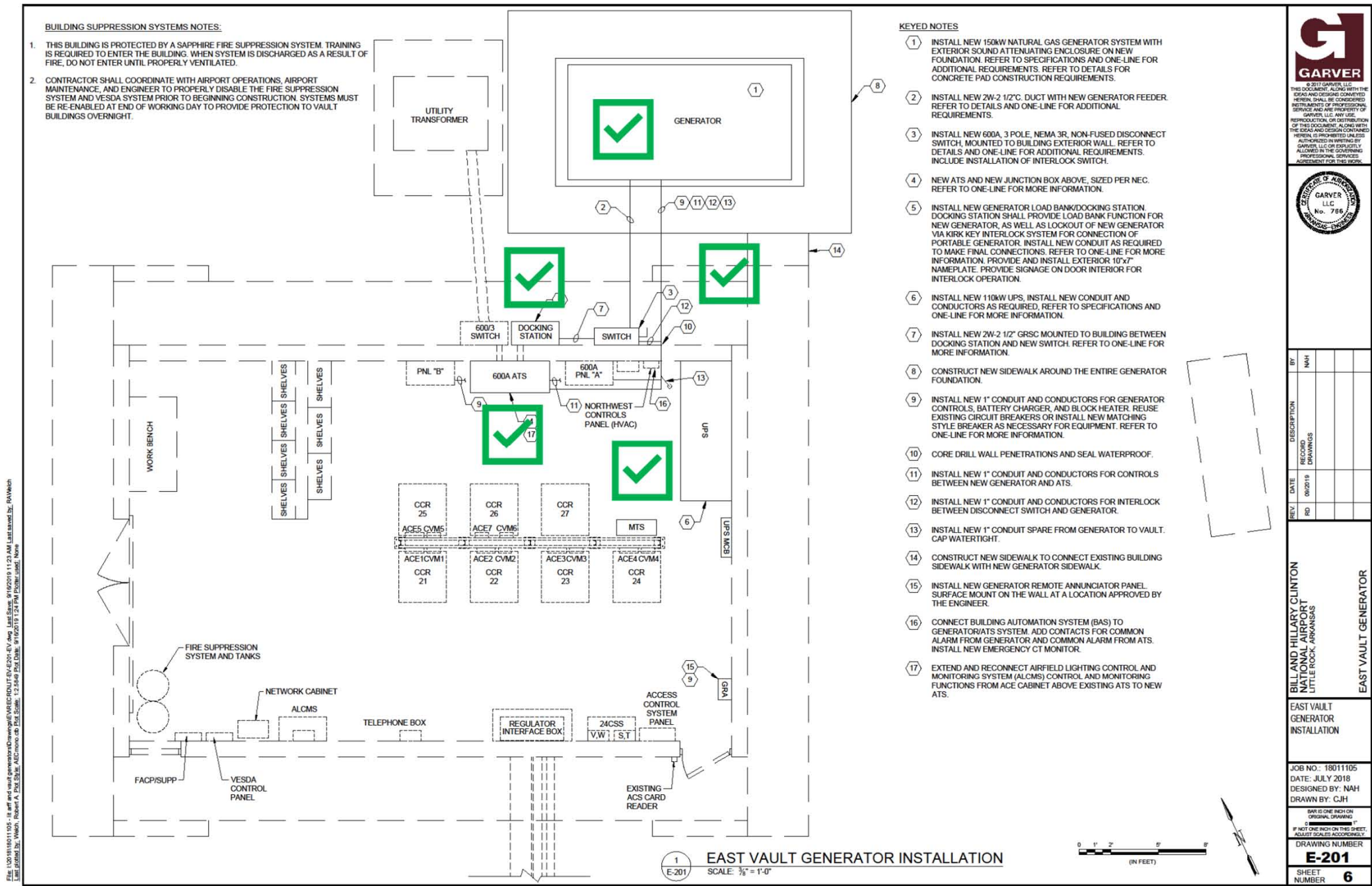


East Electrical Vault

Rehab Phase 2

Generator and UPS

- New 150 kW Natural Gas Generator
- Replace ATS – Specific Unit
- New Docking Station
- New 200 kW UPS with Bypass
- Signage and Procedures



East Electrical Vault

Rehab Phase 2

Generator and UPS

- 150 kW Natural Gas Generator
- Replace ATS – Specific Unit
- New Docking Station
- New 200 kWUPS with Bypass
- Signage and Procedures





Lesson Learned



#4



Natural Gas Generators

Learn Things

- Startup and Voltage Regulation / Qualified Technicians
- Natural Gas Piping / Supplier Calcs / Arrangement and Protection





Lesson Learned



#5

Uninterruptible Power Systems

Learn Things

- Programming and Startup
- Power Transfers in Short Time Periods – Inherent Protective Functions

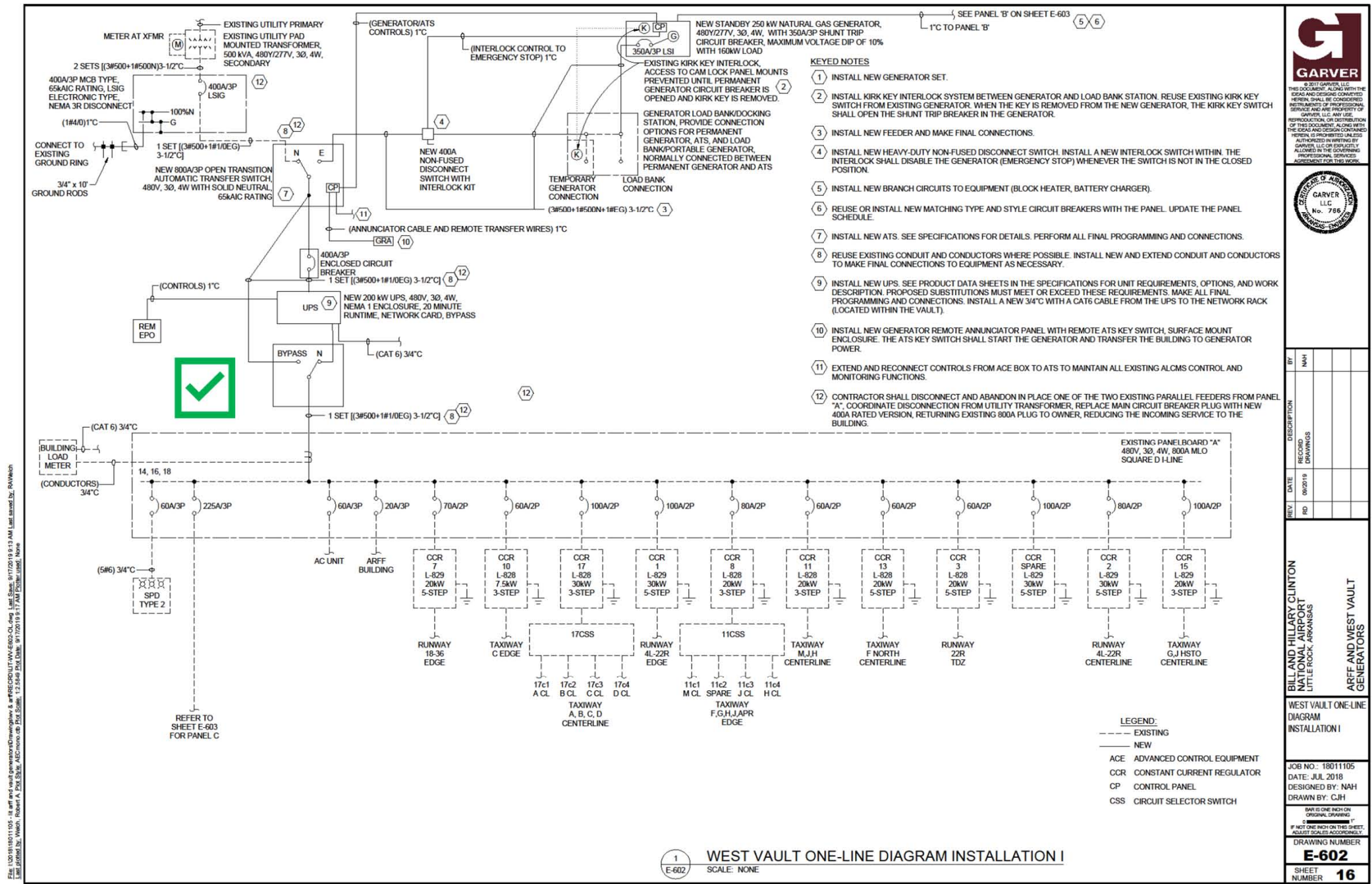


West Electrical Vault

Rehab Phase 2

Generator and UPS

- Add Manual Type Switch Bypass for UPS Installed



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Electrical Vault Rehabilitation Lessons Learned

Questions?

