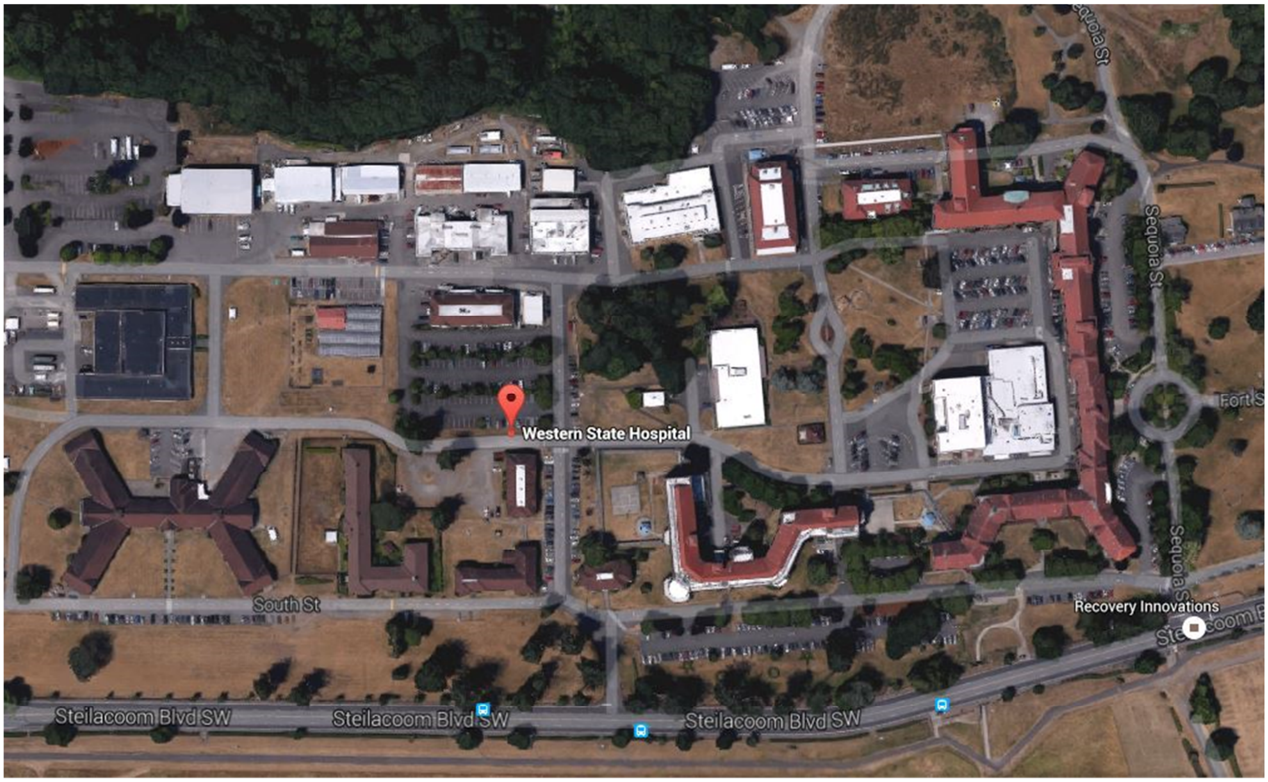

Western State Hospital
Lakewood, WA

Unified Communication Study

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Final Document

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1.0 Executive Summary

The existing Nortel telephone system providing voice service to the WSH and CSTC campus is obsolete and is no longer supported by the manufacturer and urgently needs to be replaced. DSHS and WSH are exploring options for replacing the existing telephone system with a network-based Universal Communication (UC), Voice over IP (VoIP), or cellular-based system. However, the existing telecommunications infrastructure on the WSH campus does not have sufficient capacity, bandwidth, or resilience to support these future voice and messaging technologies.

The existing telecommunications infrastructure has been implemented through multiple phases and projects over several decades and most of the existing older buildings and facilities were not originally built to accommodate current technologies. As a result, the existing telecommunications infrastructure including cabling, pathways, and spaces is severely limited and is inadequate to support the current and future telecommunications needs of WSH and needs to be improved, expanded, or replaced.

Hargis Engineers was engaged to review and evaluate the existing telecommunications infrastructure on the WSH and CSTC campus and provide options for infrastructure improvements, costs, and roadmap for implementing the infrastructure improvements. This document provides a summary of existing conditions as well as recommendations and options that can be used to plan budgets and create budget requests.

The existing campus telecommunications cabling infrastructure includes inter-building optical fiber cabling and unshielded twisted-pair copper backbone cabling installed from the campus main Equipment Room located in Building 18 to the other buildings on the campus. This backbone cabling has been installed and modified over a period of years. There is evidence of deteriorated and damaged backbone cabling in many areas of the campus. In most areas, the backbone cabling is antiquated and is unable to support the deployment of new technologies. New single mode and multimode optical fiber cabling will be required to provide the necessary bandwidth and capacity in the backbone.

The inter-building cabling is installed in a pathway system consisting of underground conduits, man holes, and steam tunnels. The pathway system is at capacity in many locations and routing through a steam tunnel leaves cabling vulnerable to physical damage by most notably the accidental release of steam. There are also inter-building pathways that pass from one building and through another building en route to other buildings. Therefore future work or physical damage to the cabling infrastructure in one building will also impact the cabling infrastructure to other buildings. New underground pathways are required to facilitate installation and maintenance of new high-bandwidth single mode optical fiber backbone infrastructure.

The horizontal cabling within the buildings on campus includes unshielded twisted-pair copper cable to provide network connectivity to computers, telephones, printers, and other network attached devices. As with the backbone cabling this cabling has been installed in a series of projects over time and the condition and capability of the cabling varies considerably. To support current and future technology, much of the existing horizontal cabling will require replacement. Additionally, the quantity of horizontal cabling ports will need to be augmented to support the transition of telephony into network connected devices. The cabling within the buildings terminates in telecommunications rooms or closets also known as Intermediate Distribution Frames (IDF). The older buildings on campus were not originally built for telecommunications infrastructure so these spaces were retrofitted into spaces that were not well planned for future enhancements and/or modifications. In the newer buildings these spaces were included in the original design. However, many of the newer IDF’s do not have adequate space and do not provide sufficient access and clearance to cabling and equipment. The IDF’s do not have the capacity to add more cabling and equipment to support the additional devices required for an enterprise UC system and need to be expanded or new IDF rooms will need to be built to provide adequate facilities for the new infrastructure.

Table 1

Option	Title	Scope	Rationale	Cost	Risks and Disadvantages
1	New IT building with new inter-building optical fiber cabling	• Construct new 3,000 square foot IT building to provide standards-compliant space to support campus telecommunication infrastructure. • Trenching, underground duct banks, and inner duct from existing Building MDF rooms to new IT facility. • Extend existing optical fiber to new IT facility where available. • New 12-strand multimode, 24-strand single mode inter-building optical fiber backbone cabling where required.	The existing campus Equipment Room (ER) serving the campus is in adequate. The room does not have available space to accommodate the additional cabling and equipment. The height of the space is restricted and cabling pathways to the space at capacity. There are severe constraints to adding additional pathways in the future.	$3,464,000	Creating a new IT building will impact the existing site and the additional trenching will require archaeological review and associated costs.
2a	New inter-building optical fiber backbone from existing ER in Building 18 to existing building MDF Rooms where required.	• New 12-strand multimode and 24-strand single mode optical fiber cabling from existing ER in Building 18 to existing Building MDF's currently without adequate singlemode or multimode cabling. • Reuse existing pathways where available. • Expand and renovate existing ER in Building 18 into adjacent space, including demolition, new construction, power, cooling, grounding and bonding, and cable management supporting systems. • New cabling pathways into Building 18 ER space.	Existing optical fiber backbone cabling infrastructure does not provide the bandwidth and capacity required to support enterprise UC and messaging applications.	$1,634,000	There are constraints to improving the ER space in an older facility such as Building 18. Implementing the specified changes may still not result in a facility that can adequately serve the campus in the future. New cabling will be installed in existing steam tunnels and exposing the cabling to potential damage from accidental steam leaks or pipe rupture. The scope of work will involve work that will impact existing space and systems and will likely require shutdowns and outages.
2b	New Inter-building Optical Fiber Backbone from Existing ER in Building 18 to existing building MDF Rooms with new inter-building pathways	• New 12-strand multimode and 24-strand single mode optical fiber cabling from existing ER in Building 18 to existing Building IDF rooms. • New inter-building pathways for majority of campus • Expand and renovate existing ER in Building 18 as described in Option 2a.	The majority of the existing pathways are at or near capacity and do not provide ability to easily add and expand campus cabling infrastructure to support current and future technologies. There are inter-building pathways that pass through one building on route to another building or buildings. Therefore future work impacting cabling infrastructure to one building may also impact the cabling infrastructure to other buildings.	$3,000,000	This option retains the existing ER in Building 18 along with its inherent limitations. The scope of work will involve work that will impact existing space and systems and will likely require shutdowns and outages.
3	New intra-building optical fiber backbone	• New 12-strand single mode and 12-strand multimode intra-building optical fiber cabling from existing MDF rooms to existing IDF rooms within each building. • New pathways for intra-building optical fiber from MDF's to IDF's	Existing cat 5e/6 backbone cabling has bandwidth limited to 1000Mb/sec	$400,000	This option retains the existing IDF rooms, and the majority of the IDF rooms are very limited with respect to available space and ability to provide adequate access and clearance to equipment and cabling.
4	New horizontal cabling throughout Campus	• New Category 6 horizontal cabling to existing network attached equipment. • New IDF Rooms with associated power, cooling, grounding and bonding, and cable management supporting systems. • New intra-building pathways to support installation of horizontal cabling.	Existing cabling, pathways and spaces have significant deficiencies and limit or prohibit the ability to deploy current technologies.	$7,500,000	Existing horizontal cabling extends to wards and offices and replacing existing horizontal cabling will impact existing operations and will require coordination to minimize disruptions and loss of critical services.
5	Cellular Option	• Cellular recommendations are currently being developed.			

2.0 Introduction

2.1 Background

Western State Hospital, established in 1871, is the largest inpatient psychiatric facility in the State of Washington. It occupies a 264-acre campus including 44 buildings totaling 1.1 million square feet and currently serving over 900 patients with approximately 1750 staff positions and 800 beds. Western State Hospital is operated by the Behavioral Health and Services Integration Administration (BHSIA) of the Washington Department of Social and Health Services (DSHS). The entire WSH site is located within the site of Fort Steilacoom which is listed on the national historical register and requires additional site preparation, planning and execution when the scope of work includes disturbing the grounds for digging and excavation.

The campus is comprised of Western State Hospital (WSH) and the Child Study and Treatment Center (CSTC) and includes specialized secure units including the Center for Forensic Services (CFS) for patients who have been committed to Western State Hospital by a court of Law or meet the criteria for involuntary treatment. Given the population served, WSH is committed to providing a safe environment for patients, staff, and the surrounding community.

A critical component of the WSH/CSTC communication, security, and safety policy and procedures is the telephone system which provides voice and messaging services to high priority locations throughout the entire campus. Interruptions and outages of telephone service can severely impact the operations of the WSH facility and impair the WSH staff's ability to communicate, evaluate and respond to emergencies and other events.

However, the existing telephone system serving the campus is obsolete and is no longer supported by the original manufacturer and spare parts must be obtained from third-party sources. The system is prone to failures and extended outages that can isolate parts of the campus and prohibit access to 911 emergency services and impact the staff's ability to ensure personal and patient safety.

Washington Technology Solutions (WA Tech) provides technical support to state agencies for voice and data systems. However, WA Tech has announced that by 2024 it will discontinue support for traditional PBX and analog voice systems.

Due to the existing conditions of the current telephone system and lack of continuing support, DSHS and WSH are exploring options for replacing the existing telephone system with a Universal Communication (UC) or Voice over IP (VoIP) network-based system. Since these potential replacement systems depend on the network to operate, it is imperative that the network and its supporting infrastructure be highly available and fault tolerate to ensure the communication system operates reliability and consistently. Alternatively, DSHS and WSH are also investigating an option to implement a cellular phone system in lieu of a wired communication system.

2.2 Objective

The Department of Enterprise Services and DSHS has contracted Hargis Engineers, Inc. to complete a comprehensive assessment of the existing campus telecommunications infrastructure on the Western State Hospital and the Child Study and Treatment Center (WSH/CSTC) campus to assist WSH and DSH planning and decisions making efforts to replace the existing telephone system.

Specifically, the project has the following objectives.

- Inventory and document the condition of the existing telecommunications infrastructure including telecommunications spaces, pathways, and cabling
- Identify current deficiencies
- Recommend infrastructure improvements to bring the campus infrastructure into compliance with current codes and standards
- Evaluate cellular phone coverage and propagation on the campus and identify which buildings are most susceptible to signal loss
- Provide ROM costs for improvements

2.3 Methodology

The team completed an on-site survey and assessment of the existing telephone system and associated infrastructure to document existing conditions and identify deficiencies.

Current codes, standards, State of Washington RCW's and WAC, and industry best practices were used to evaluate the infrastructure's ability to ensure reliable performance of telecommunications systems and provide the ability to access, maintain and accommodate future technologies, improvements and enhancements.

From this information a set of criteria were established to assist the survey team in evaluating the existing telecommunication rooms and spaces and determining deficiencies. A summary of the criteria is contained in the following table.

Table 2- Evaluation Criteria for Telecommunications Rooms and Spaces

Room/Space	• Available space to install and terminate new cabling and rack space to mount new equipment • Adequate working clearances to access and maintain additional equipment and cabling • Space is dedicated to telecommunications • Space is secured to prevent unauthorized access
Racks	• Equipment racks with available space for new rack mounted network equipment required to support programs housed in building or area
Grounding and Bonding	• Grounding bus bar bonded to NEC recognized grounding systems. • Equipment and cabling bonded to ground

UPS	• Uninterruptable Power Supply (UPS) in place and operational to provide backup power in case of power failure. • UPS sized to provide adequate run time to support new network equipment.
Cooling	• Dedicated cooling equipment for equipment housed in space. • Expected life span of existing equipment • Adequate capacity to support new equipment
Backbone Cabling	• Existing fiber backbone with bandwidth and capacity to support current and future application. • Minimum of 24 single mode and 12 multimode optical fiber cables.
Cable Management	• Cable trays and wall mounted support systems • Rack-mounted vertical and horizontal cable management systems
Pathway	• Dedicated telecommunications standard compliant pathways • Spare conduits available with capacity for new cabling

Members of the WSH Information Technology (IT) Staff were interviewed to learn about known issues and better understand the present challenges faced by the staff when implementing and supporting the current systems and applications on the campus. The IT staff also identified aspects of the infrastructure that were not fully documented.

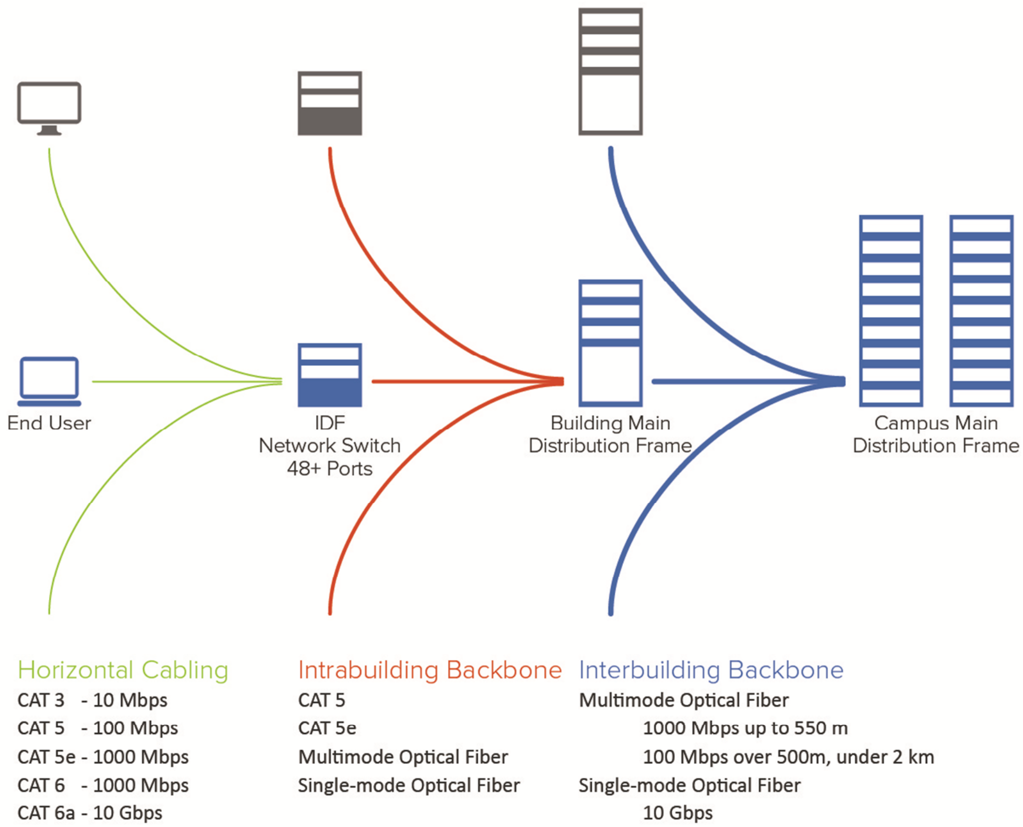
The project team completed a thorough review of available as-built drawings including plans of the buildings and site, previous reports and system documents to confirm locations and extent of telecommunications infrastructure and gather information regarding system capabilities and limitations.

Radio Frequency wireless propagation and coverage testing was also completed to determine feasibility, recommendations, costs, and consideration for implementing a cellular phone based communication system for the campus.

The data was compiled and organized to provide a comprehensive assessment of the current campus infrastructure and its ability to support the planned future communications technologies.

Results from the assessment were analyzed and evaluated and a set of recommendations were developed to aid WSH and DSHS stake holders in planning future projects, budget requests, and establishing priorities. The recommendations were organized into discrete projects to allow WSH and DSHS flexibility in scheduling and funding the recommended improvements. Rough Order of Magnitude (ROM) costs were developed for each recommendation based on cost estimating tools, previous professional experience and projects similar in size and scope.

The devices, software, and programs used by the end users was not evaluated as part of this study but the information below helps illustrate the cabling needs and considerations used when making the recommendations. The digital files sized being accessed/used by each end users have sizes ranging in Megabytes (MB) and the speed in which it is delivered is Megabits or Megabit per second (Mbps). A Megabyte is 8 times larger than a Megabit, so to download a 1 MB file in 1 second required a download speed of 8 Mbps. To understand the impacts of each user on the system one would need to know how much data is being accessed at any given time and then combine the end users into the network switches, which combine into the building Main Distribution Frames and all of the buildings are combined at the campus MDF. Graphic 1 below is a visual representation of how all of these are combined.



Graphic 1: Combining End User Needs on a Campus

Some examples of digital information and technology used on campus would be viewing medical images or using voice and video for communication. For viewing medical images the speeds required to download and display the images is dependent on the size of the images. Newer 3D images can be as large as 200 MB+ which would require a speed of 1.6 Gbps to the end user to refresh the image in 1 second. To be able to utilize communication technology for voice and video there are recommended and minimum download and upload speeds required which are shown in Table 3 below.

Table 3 - Digital Technology Download and Upload Speeds

	Recommended Speeds		Minimum Speeds	
	Download	Upload	Download	Upload
Calling	100 kbps	100 kbps	30 kbps	30 kbps
Video Calling/Screen Sharing	300 kbps	300 kbps	128 kbps	128 kbps
Video Calling (HD)	1.5 Mbps	1.5 Mbps	1.2 Mbps	1.2 Mbps
Group Video (3 People)	2 Mbps	512 kbps	512 kbps	128 kbps
Group Video (7+ People	8 Mbps	512 kbps	4 Mbps	128 kbps

Based on the growing demand for digital information at the end user stations, each end user speed should only be limited by the cabling from the Network switch to the end user and not by the intra-building and inter-building backbone cabling on campus.

3.0 Existing Conditions

3.1 Telephone System

Campus voice communication services are currently provided by a Nortel Meridian 1 Private Branch Exchange (PBX) telephone system located in the Equipment Room, 18G-03, in the basement level of Building 18. Voice communication is distributed from this location over twisted-pair copper backbone cables to over 2000 telephones and voice circuits distributed across the campus.

Photo 1: Existing Nortel PBX

The existing telephones are line powered from the PBX and the system includes battery-backed power supplies which can provide temporary power in the event of a power outage. The telephone system can also be powered from the standby generator to provide additional run time.

The Nortel product was acquired by Avaya in 2009. Avaya has announced they will completely stop supporting this product in June 2018. The system can no longer be enhanced or upgraded and it is becoming difficult to obtain spare parts. The lack of support and available spare parts increases the risk that events or system failures will impact operations of the campus and could potentially result in system-wide communications interruptions and extended outages.

Options for replacing the existing telephone system include a network-based unified communications platform or VoIP system both of which operate over the campus backbone cabling and network switches in the telecommunications spaces located across the campus. If primary power is lost and the network switches do not have backup UPS or generator power available, the switches will power down and network attached telephones will not operate until power has been restored and the switches have restarted and the network connections have been reestablished. If the existing telephone system is replaced with a network-based system, it is therefore essential that campus telecommunications infrastructure be capable of supporting the network traffic and be fault tolerant and resilient so that the communications system can remain in operation during power outages and other planned or unplanned events.

3.2 Telecommunications Infrastructure

The existing telecommunications infrastructure has been implemented over time in multiple stages, phases and projects. Currently it is a variety of vintages and existing conditions that have been installed and implemented as new buildings have been constructed and existing buildings have been upgraded, expanded and improved during building remodels and renovations and as programs and new technology has required.

However, even with the many improvements and new infrastructure added over several decades, the existing telecommunications infrastructure including cabling, pathways, and spaces does not have sufficient capacity, bandwidth, or resilience to adequately support the planned future voice and messaging technologies.

3.2.1 Rooms and Spaces

The project team surveyed and reviewed over 67 telecommunications spaces on the WSH and CSTC campus. These spaces house equipment and cabling for the operation and maintenance of critical voice and data systems and must contain the necessary infrastructure and backup systems to ensure critical systems operate reliably and without interruption.

The spaces in the older buildings were retrofitted into facilities not originally designed to house modern telecommunications infrastructure. As a result, many of these were built inside existing electrical rooms, offices, closets, and storage rooms. Often these spaces are too small with limited room for existing cabling and equipment and lack the ability to expand equipment and cabling or add new technologies. They may also not provide adequate access and working clearances to properly maintain and support the equipment. Due to the limited space, many rooms do not have room for a full size standard floor mounted equipment rack and instead have resorted to mounting equipment and cabling to wall mounted plywood backboards or wall mounted equipment cabinets. These arrangement leave little to no room for installing and mounting additional equipment and cabling.

Typically they are not dedicated telecommunications rooms and may also be used for storage or contain electrical panels, junction boxes, and other equipment. Therefore, these spaces may not be adequately secured, as is typically required in spaces housing critical infrastructure, to prevent unauthorized persons from intentionally or accidently modifying or damaging the equipment. Most existing spaces do not include acceptable cable management system limiting the ability to properly support and maintain cabling.

The survey team found inadequate or non-existent telecommunications grounding systems which can create a difference of ground potential between system components and could impact system performance or damage equipment.

The majority of the existing spaces do not have any equipment dedicated to maintaining temperatures. Typically conductive cooling is relied upon to dissipate the heat from the equipment into the space. However, heat loads in the telecommunications spaces will increase as more switches are deployed to power the VoIP telephones and other network attached devices.

These rooms have limited electrical power circuits and typically do not contain battery-backed Uninterruptible Power Supply (UPS) units to provide temporary power in the event of power outages. In the spaces that do contain UPS units, they units may not have the capacity to support the additional equipment that would be required for a network-based communications system.

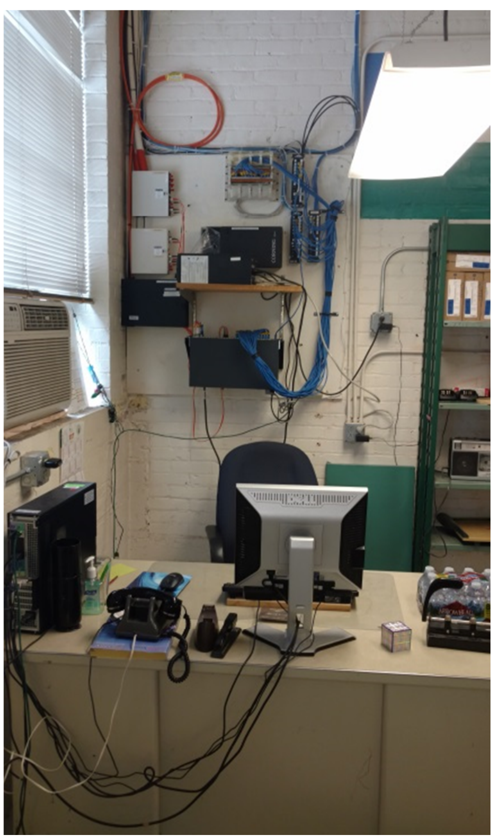


Photo 2: Example of shared Telecommunications Space - Machine Shop

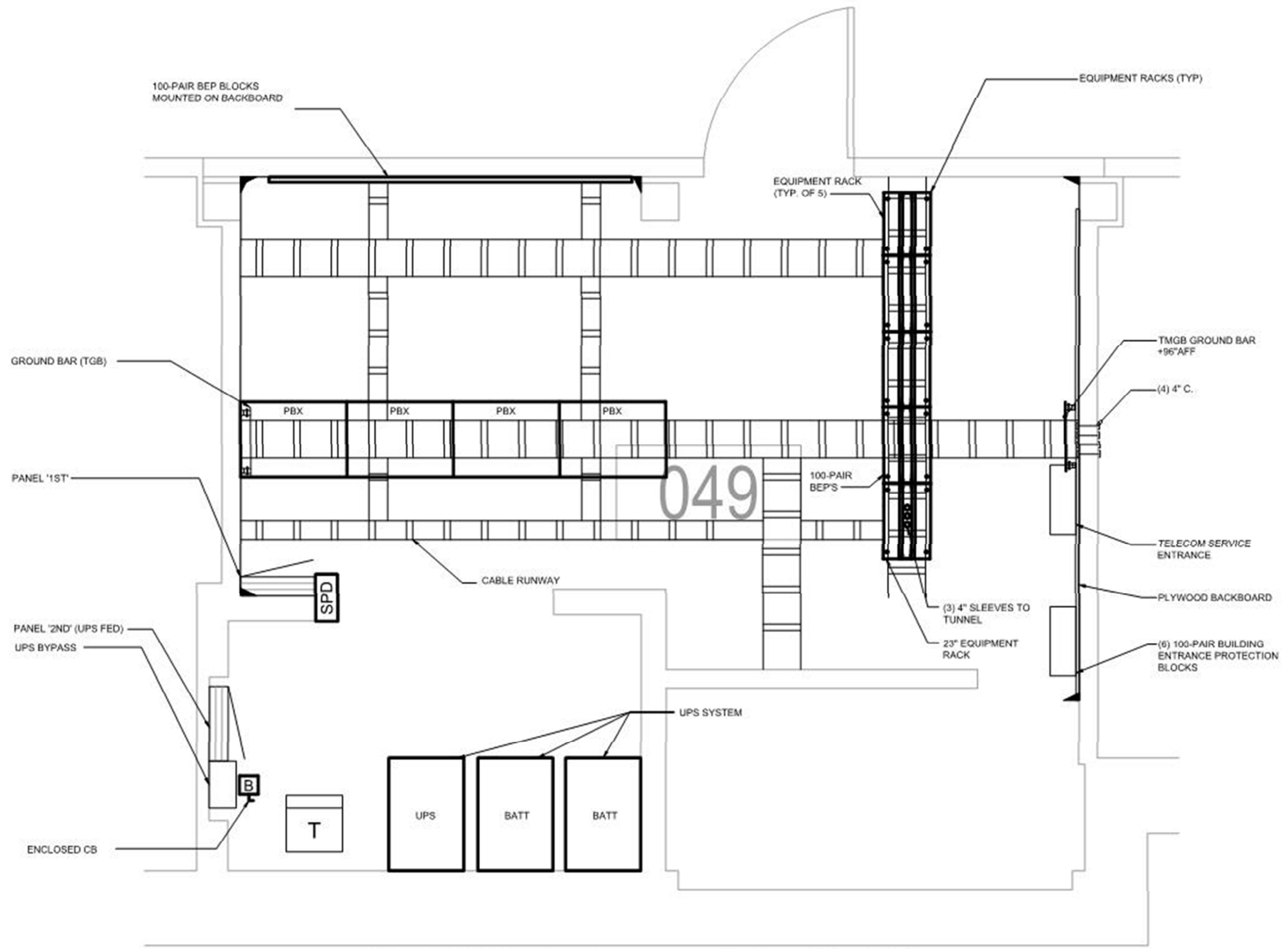
Telecommunications Rooms, F102 in Building 28 is an example of one of the few rooms that more closely complies with current design standards. It is dedicated spaces containing a wall mounted equipment rack for mounting network equipment. The grounding and bonding systems is sufficient to ensure acceptable performance and prevent damage to the equipment. The room is equipped with overhead cable tray and wall mounted and rack mounted cable management systems

Photo 3: Building 28 Telecommunications room F102

The Building 18 Equipment Room (ER) houses the existing telephone switch and is the main point of entry for services to the campus. It is also the distribution point for all of the optical fiber backbone cabling. In addition to the phone system and associated power supplies, the ER contains equipment racks for terminating copper and optical fiber backbone cabling, overhead ladder tray, and plywood backboards for wall mounted equipment and an industry-standard grounding system. Proper temperature and humidity are maintained in the room by a Mitsubishi ductless split system cooling unit and dedicated thermostat. However, the space is an example of a critical telecommunications spaces created within a historical structure. Located on the lower level of Building 18, the space suffers from a number of deficiencies including:

- A low ceiling limiting the ability to install ladder tray and overhead cable management systems to support and distribute cabling within the room.
- Restricted pathways for distributing cabling into and out of the space. The existing conduits to steam tunnel are at capacity.
- Inadequate space with limited ability to expand to accommodate new technology, equipment, and cabling. Currently some of the campus backbone optical fiber cabling terminates in a small rack suspended from the ceiling because there is no floor space available to install additional racks.
- Limited power capacity which will be expensive to upgrade and expand.
- Located in a historical building limits the options for expanding and improving the space and increases the cost.
- The ER is not located centrally in the campus, which increases the cost of installing new pathways and cabling to other building and locations.

At approximately 350 square feet, the existing ER room cannot support new communications equipment with its current size and the room will, at a minimum, need to be expanded and upgraded with additional electrical capacity and mechanical cooling to support the new equipment required for the telephone system replacement.



ENLARGED FLOOR PLAN - EQUIPMENT ROOM

A complete summary of the Telecommunication Room survey is included in table 4. Each of the spaces surveyed is listed along the left hand margin and the criteria used to evaluate the spaces is listed across the top. A check mark in a cell represents a telecommunications space that meets the minimum requirements of the evaluation criterion.

Table 4

Building	Room Number	Room Name/Location	Room/Space	Racks	Grounding	UPS	Cooling	Fiber Backbone	Cable Management	Pathway
Building 1		NE Office	☐	☐	☐	☐	☐	☐	☐	☐
Building 3		Machine Shop	☐	☐	☐	☐	☐	☐	☐	☐
Building 4		Basement Level Storage Room SW Corner	☐	☐	☐	☐	☐	☐	☐	☐
Building 5		2nd Floor Break Room	☐	☐	☐	☐	☐	☐	☐	☐
Building 6		Basement Level Janitor/Storage room	☐	☐	☐	☐	☐	☐	☐	☐
Building 8		Basement Level Storage Room	☐	☐	☑	☐	☐	☐	☐	☐
Building 8		2nd Floor Fiber Closet	☐	☐	☐	☐	☐	☐	☐	☐
Building 8		Library Office	☐	☐	☑	☐	☐	☐	☐	☐
Building 9	129	IDF Closet	☐	☐	☐	☐	☐	☐	☐	☑
Building 9	429	IDF Closet	☐	☐	☐	☐	☐	☐	☐	☑
Building 10		Janitor Closet	☐	☐	☐	☐	☐	☐	☐	☐
Building 10		IDF Room	☑	☐	☐	☐	☐	☐	☐	☐
Building 11		1st Floor Receiving Office	☐	☐	☐	☐	☐	☐	☐	☐
Building 13		Mechanical Room	☐	☐	☐	☐	☐	☐	☐	☐
Building 13		Storage room in Pharmacy Area	☐	☐	☐	☐	☐	☐	☐	☐
Building 15		Storage room	☐	☐	☑	☐	☐	☐	☐	☐
Building 16	116	IDF Room	☑	☐	☑	☐	☐	☐	☑	☐
Building 16	232	IDF Closet	☐	☐	☑	☐	☐	☐	☐	☐
Building 16	320	IDF Room	☐	☐	☑	☐	☐	☐	☐	☐
Building 17	C7-027	Basement IDF Closet	☐	☐	☐	☐	☐	☐	☐	☑
Building 17	C7-132	First Floor IDF Closet	☐	☐	☐	☐	☐	☐	☐	☑
Building 17	155	Court Break Area	☐	☐	☐	☐	☐	☐	☐	☐
Building 17	C7-232	Second Floor IDF Closet	☐	☐	☐	☐	☐	☐	☐	☑
Building 17	C7-332	Third Floor IDF Closet	☐	☐	☐	☐	☐	☐	☐	☑

Building	Room Number	Room Name/Location	Room/Space	Racks	Grounding	UPS	Cooling	Fiber Backbone	Cable Management	Pathway
Building 18	011	Ground Floor IDF Closet	☐	☐	☐	☐	☐	☐	☐	☐
Building 18	109	First Floor IDF Closet	☐	☐	☐	☐	☐	☐	☐	☑
Building 18	211	Second Floor IDF Closet	☐	☐	☐	☐	☐	☐	☐	☑
Building 18	311	Third Floor IDF Closet	☐	☐	☐	☐	☐	☐	☐	☑
Building 18	MDF	Ground Floor IDF Closet	☐	☐	☑	☑	☐	☑	☑	☑
Building 19	027	Ground Floor IDF Closet	☐	☐	☐	☐	☐	☐	☐	☑
Building 19	109	First Floor IDF Closet	☐	☐	☐	☐	☐	☐	☐	☑
Building 19	209	Second Floor IDF Closet	☐	☐	☐	☐	☐	☐	☐	☑
Building 19	311	Third Floor IDF Closet	☐	☐	☐	☐	☐	☐	☐	☑
Building 20	011	Ground Floor IDF Closet	☐	☐	☐	☐	☐	☐	☐	☐
Building 20	113	First Floor IDF Closet	☐	☐	☐	☐	☐	☐	☐	☐
Building 20	213	Second Floor IDF Closet	☐	☐	☐	☐	☐	☐	☐	☐
Building 20	313	Third Floor IDF Closet	☐	☐	☐	☐	☐	☐	☐	☐
Building 21	258	MDF Room/Elec Room	☐	☐	☐	☐	☐	☐	☐	☐
Building 21	358	Third Floor Storage Room	☐	☐	☐	☐	☐	☐	☐	☐
Building 21	458	Fourth Floor Storage Room	☐	☐	☐	☐	☐	☐	☐	☐
Building 21	558	Fifth Floor Storage Room	☐	☐	☐	☐	☐	☐	☐	☐
Building 23		Office Closet	☐	☐	☐	☐	☐	☐	☐	☐
Building 24		Office Closet	☐	☐	☐	☐	☐	☐	☐	☐
Building 25		Basement Storage	☐	☐	☐	☐	☐	☐	☐	☐
Building 27		Electrical/Storage Room	☐	☐	☐	☐	☐	☐	☐	☐
Building 28	E200	Electrical Room	☐	☐	☐	☐	☐	☐	☐	☑
Building 28	F102	MDF Room	☑	☑	☑	☐	☐	☑	☑	☑
Building 29	003	Electrical Room	☐	☐	☐	☐	☐	☐	☐	☐

Building	Room Number	Room Name/Location	Room/Space	Racks	Grounding	UPS	Cooling	Fiber Backbone	Cable Management	Pathway
Building 29	005	Server Room	❑	❑	❑	❑	❑	❑	❑	❑
Building 29	A112	Ward E1	❑	❑	❑	❑	❑	❑	❑	❑
Building 29		Ward E5	❑	❑	❑	❑	❑	❑	❑	❑
Building 29		Ward E6	❑	❑	❑	❑	❑	❑	❑	❑
Building 29	D162	Ward E7	❑	❑	❑	❑	❑	❑	❑	❑
Building 29		Ward E8	❑	❑	❑	❑	❑	❑	❑	❑
Building 32		On Landing above Entry Lobby	❑	❑	❑	❑	❑	❑	❑	❑
Building 33		Office/Storage Room	❑	❑	☑	❑	❑	❑	❑	❑
Building 34		Second Floor Office/Key Shop	❑	❑	❑	❑	❑	❑	❑	❑
Building 35		Storage Area	❑	❑	❑	❑	❑	❑	❑	❑
Building 50		Basement	❑	❑	❑	❑	❑	❑	❑	❑
Building 50		Attic	❑	❑	❑	❑	❑	❑	❑	❑
Building 51		Mechanical Attic	❑	❑	❑	❑	❑	❑	❑	❑
Building 52		Basement	❑	❑	❑	❑	❑	❑	❑	❑
Building 53		Basement	❑	❑	❑	❑	❑	❑	❑	❑
Building 54		Basement	❑	❑	❑	❑	❑	❑	❑	❑
Building 56		Storage Room	❑	❑	❑	❑	❑	❑	❑	❑

3.2.2 Cabling

Horizontal Cabling

The unshielded twisted-pair copper cable horizontal cabling within the buildings on campus provides network connectivity to computers, telephones, printers, and other network attached devices. Like much of the telecommunications infrastructure on campus, this cabling has been installed in a series of projects over time and the condition and capability of the cabling varies considerably. The type of cabling installed ranges from Category 3 to 5e with some instances of Category 6.

Table 5 – Horizontal Cable Types and Characteristics

	Category 3	Category 5e (Enhanced)	Category 6	Category 6A (Augmented)
Adopted	1991	2001	2002	2008
Bandwidth	100 MHz	100 MHz	250 MHz	500 MHz
Ethernet Applications megabits/second (Mbps)	10 Mbps	10 Mbps 100 Mbps 1000 Mbps	10 Mbps 100 Mbps 1000 Mbps	10 Mbps 100 Mbps 1000 Mbps 10,000 Mbps

Category 6 or 6A cabling is recommended for VoIP or Universal Communications applications because the cables are constructed with tighter twists to minimize interference and provide the greater performance required for voice and communications. Also the larger gauge conductors used in category 6/6A cabling reduces power loss and heat dissipation from the cable which is critical for VoIP and other applications that power the devices using the network cabling.

Therefore, much of the existing horizontal cabling will need to be replaced to support future technology bandwidth requirements. Further, the quantity of horizontal cabling will need to be increased to support the additional network connected communication devices.

Backbone Cabling

There are approximately 6,500 pairs of copper telephone cabling installed throughout the campus. The campus telephone cabling is installed from buildings on campus to Building 18 and terminated in the telecommunications Equipment Room. The existing cabling is of varying age and condition. A project was recently completed to improve the grounding system for this cabling in the ER to better protect the existing telephone system from transient voltage and errant voltage spikes until which time the system can be replaced. However, at the remote end many of the copper backbone cables lack adequate grounding. Also, much of the copper backbone cabling has deteriorated with age and damaged, is improperly installed, or not the correct type of cabling to be used in an outdoor environment. The copper backbone cabling has the capacity to support voice traffic but does not have the capability to support network-based UC applications or VoIP systems. The existing copper cabling plant can be maintained to support legacy voice-based systems and other low bandwidth applications but optical fiber backbone cabling is required for transporting Ethernet network communication.

Older multimode and newer single mode fiber optical fiber backbone cabling is installed in a hierarchical star topology from the Equipment Room in Building 18 out to the other buildings on campus. With the distances between buildings on campus the older multimode cabling is limited to a maximum of 1 Gigabit per second (Gbps) network applications whereas the single mode cabling can support applications running at 10 Gbps and beyond.

The majority of the buildings on the campus are connected to the ER with just multimode optical fiber therefore restricting the ability of the network to accommodate additional applications or applications requiring higher bandwidth.

A limited amount of single mode fiber has been installed between Building 18 and Buildings 4, 6, 8, 10, 15, 27, 29, but at a minimum 12-strand single mode cabling will be required to all the buildings on campus in order to provide the bandwidth and capacity for the future network-based communications applications

There is existing backbone cabling installed within buildings to connect together the various telecommunications rooms located in the building. At a minimum, this cabling needs to be a newer laser optimized 50 micron multimode cabling or single mode cable to support the higher bandwidth applications. However, the current in-building backbone cabling is the older low bandwidth multimode cabling or in some cases, category 5e copper cabling.

3.2.3 Pathways

Building Pathways

The existing building pathways are used to distribute horizontal cabling to network attached devices or backbone cabling to connect Telecommunication Rooms. Typically in-building pathways consist of a combination of:

1. Conduits installed within walls, above ceilings or surface mounted.
2. Cable tray or open cabling suspended from hangers above accessible ceilings
3. Raceways or channels surface mounted to walls or ceilings

The survey found many of these existing in-building pathways to be at or near capacity with limited or no spare pathways to allow for new cabling to be added without removing existing cabling or creating new cabling pathways.

Site Pathways

The campus backbone cabling is installed from the ER in Building 18 out to the campus using site pathways consisting of underground steam tunnels and a system of underground vaults with connecting conduits. The survey team reviewed the tunnel system and 20 maintenance holes to accurately document the extent and conditions of the existing telecommunications pathways and cabling.

The tunnel system links the core buildings on campus but does not extend west beyond buildings 21 and building 4 or to the north portions of the campus. The tunnels are large enough to walk upright and include lighting and racking on the walls to supporting steam pipes and other systems. Cabling is typically installed along the floor or surface mounted to the wall of the steam tunnel.

Photo 4: Tunnel from Building 9

In some cases the pathway from the tunnel enters directly into a building, but in other cases the pathway is extended into buildings with conduits. At the transitions from the tunnel to the buildings the cabling pathways are often constricted and congested with conduits typically at or near capacity.

Photo 5: Steam Tunnel entrance from Building 18

The steam tunnels are considered to be confined spaces and subject to WAC 296-809-100 and permits are required to work in the tunnels. The WSH IT staff are also not trained, and do not have the requisite protective equipment to enter confined spaces.

The cabling installed in steam tunnels is at risk of catastrophic failure from a break in a steam pipe or accidental release of steam exposing the cabling to extremely high temperatures and quickly damaging the cable to a point where it can no longer carry signals or be repaired.

At Building 4 the pathway leaves the steam tunnel and routes through Building 4 and transitions to underground conduits to connect additional buildings. Beyond Building 4, the cabling pathway passes through one building before transitioning back underground to the next building in a daisy-chain fashion. This daisy-chain arrangement of pathways increases the likelihood that impacts, scheduled or otherwise, to pathways or cabling in one building will also impact other buildings. Some of the underground conduits in this area of the campus have spare capacity for new cabling, but there are other pathways that are constricted, congested, or at capacity.

The pathway to the North portion of campus (buildings 28, 29 and CSTC campus) first passes through the ceiling spaces of buildings 18 and 17 and then transitions down into two 4" conduits in the IDF closet C7-027 in Building 17. The conduits extend through the IDF closet to the crawl space of building 17 and out to a telecommunications concrete vault in the street outside building 17. These two conduits are completely filled and not able to support additional cabling. The pathway extends from the vault outside building 17 connects to building 29 through four (4) 4" conduits and a series of concrete vaults. There are a minimum of two spare conduits minimum between each vault and is the only section of existing pathways on the campus that could be considered as meeting existing standards.

Diagram 1 summarizes the existing size pathways and available capacity.

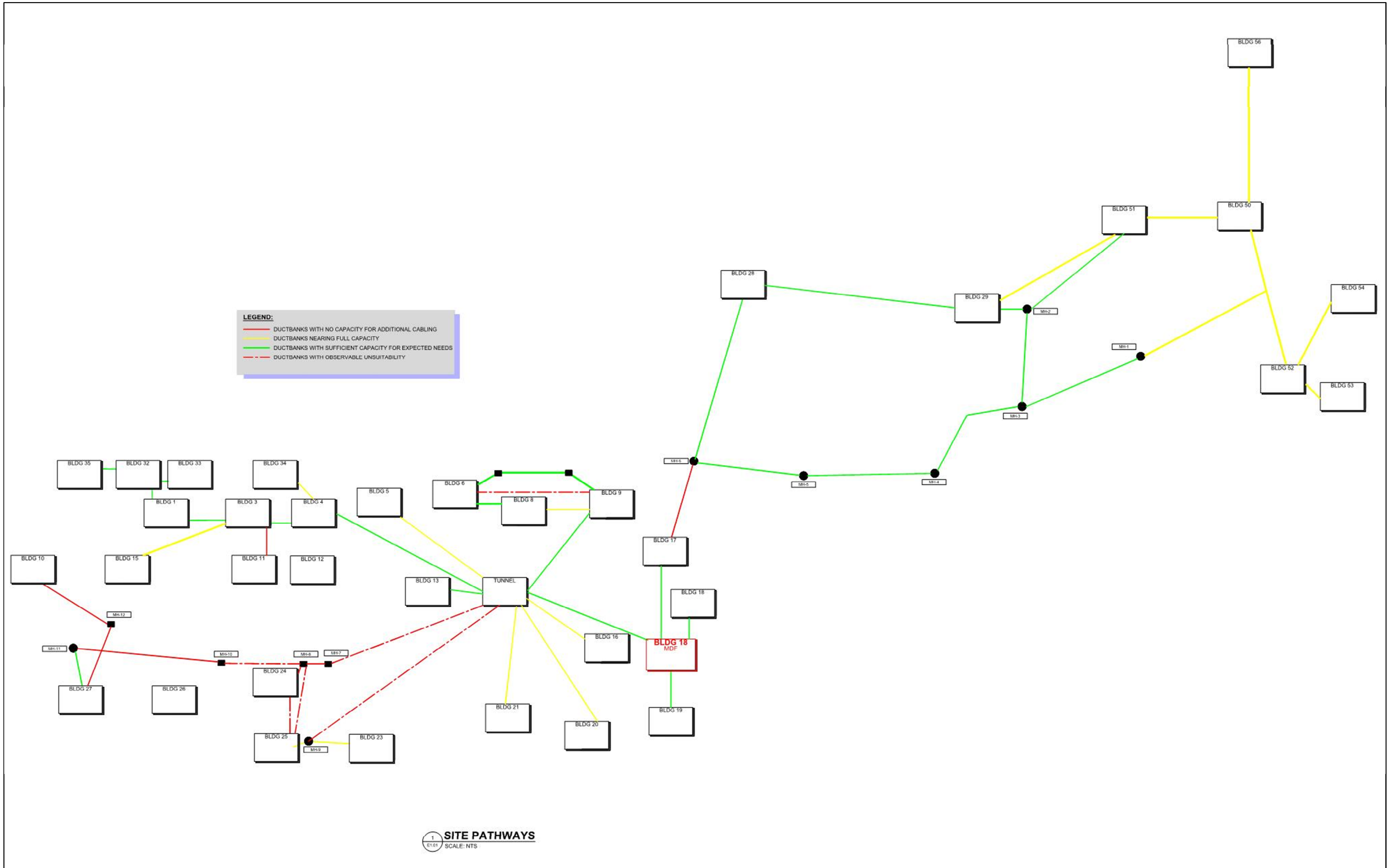


Diagram 1 – Existing Site Pathways

3.3 Wireless Signal

The radio frequency environment has been assessed by Gunnerson Consulting to include preliminary IBC Fire Code Section 510 evaluation, Combined Communication Network of Pierce County, all wireless carriers and the two-way networks of WSH. The scope also included the determination of existing buildings and what consideration should be given to radio frequency penetration factors. Gunnerson Consulting was not tasked with evaluating WiFi, "panic button" or location based networks.

The IBC Fire Code Section 510 evaluation would be classified as marginal for passing this code section. Although most of the buildings and floors are passable, certain sections of the lower floors have marginal signal quality. An internal "distributed antenna system" (DAS) would be required to bring these areas up to the requirements contained in Section 510. Any new buildings may need a DAS for complying with this code section as a requirement. Buildings that were built prior to the adoption of Section 510 have a grandfather clause. Structures built after the adoption of this code have a requirement to comply. The user group for this issue would be Fire, Rescue and Police.

The wireless networks for the area were evaluated (Sprint, T-Mobile, Verizon and AT&T). The three main areas that were evaluated were in-building, WSH campus, and 2-mile radius. Consideration for this evaluation was to determine if WSH could or should create an environment where all four wireless carriers have adequate signal inside and outside. Statistically, the user group population is greatest in this order; (1) Verizon, (2) AT&T, (3) T-Mobile and (4) Sprint. The quality of signal strength for the WSH campus varies with each wireless carrier with the best signal strength being; (1) T-Mobile, (2) AT&T, (3) Sprint, and (4) Verizon. Correction of these coverage deficits can be overcome in combinations of three ways: (1) build a DAS network that accommodates the wireless carriers, (2) locate Verizon, Sprint and AT&T on the or near the campus and have them install cell sites, and (3) work with the wireless carriers on unique micro-cell installations that are specific to WSH. There is very little data that would compel any wireless carrier to build a new cell site in the area because of their existing cellular spacing is within 1.5 miles of the campus. Any DAS solution would most likely be a WSH cost with minimal support from the wireless carriers. It should be noted that none of the wireless carriers have adequate coverage for all of the building spaces; no wireless carrier is dominant. The user group for this issue is every employee and contractor.

The final radio frequency environment evaluated was the two-way radio and paging systems that are owned and maintained by WSH on UHF frequencies. The current configuration of this system is basically two frequencies with two talk groups. As discussed below this does not imply that four simultaneous transmissions are capable and thus limiting the total users possible. Security is currently using the first talk group by itself and all others are on the second talk group. The radio frequency environment and placement of antennas and transmitters was measured and determined that the signal strength is more than adequate for all portable users and special placement or DAS networks would not make these radios perform better. A further evaluation was made of the specific software configurations of the radios. Most of these portable radios and associated transmitters are somewhat dated, and are currently configured in a way that limits the total amount of simultaneous transmissions that can be accommodated. There are some short term changes that can be accomplished to increase traffic use capability. Long term solutions should be considered that are outside of simply appending changes to existing devices and frequencies. Cross-over networks that might be found in updated telephone-to-radio or computer-to-radio networks should be considered. Basically, the current use of this radio network is from within the discipline that is assigned to the talk group. This renders the radios to being very functional but not necessarily versatile. Location based features for these two-way user groups would be difficult at best. However, location based services for any employee/contractor is possible with other systems. Any recommendation for system alterations should consider 'keeping it simple' enough that user errors aren't a factor in daily use. The user group(s) for this issue are security and maintenance personnel with just over 300 portable units.

4.0 Options and Recommendations

Based on the assessment and analysis of the results of the survey the following are recommendations and options for improvements to the existing telecommunications infrastructure in preparation for the replacement of the existing telephone system. More detail cost information is provided in Section 5.0

1.	• Create a new IT building to create the space required to house the new equipment required for a network-based communications system and have the capacity to expand and grow the infrastructure in the future. • Install new inter-building optical fiber cabling throughout the campus. Includes new multimode and single mode optical fiber cabling and industry-standard pathways to existing Telecommunications Rooms where required.	$3,463,676
2a.	• Expand and renovate existing ER in Building 18 into adjacent space. The scope of work includes: demolition, new construction, power, cooling, grounding and bonding, and cable management supporting systems. • New inter-building optical fiber backbone from existing ER in Building 18 to existing building MDF Rooms where required to meet the current standard. • Reuse existing pathways where possible and new pathways only where no other option exists.	$1,633,180
2b.	• Expand and renovate existing ER in Building 18 into adjacent space. The scope of work includes: demolition, new construction, power, cooling, grounding and bonding, and cable management supporting systems. • New inter-building optical fiber backbone from existing ER in Building 18 to existing building MDF Rooms where required to meet the current standard. • Replace existing non-standard pathways with new standard-compliant pathways.	$2,973,626
3.	• New intra-building optical fiber backbone consisting of 12-strand single mode and 12-strand multimode intra-building optical fiber cabling from existing MDF rooms to existing IDF rooms within each building. • New pathways for intra-building optical fiber from MDF's to IDF's	$399,361
4.	• New Category 6 horizontal cabling to existing network attached equipment. • New IDF Rooms with associated power, cooling, grounding and bonding, and cable management supporting systems. • New intra-building pathways to support installation of horizontal cabling Upgrade Horizontal cabling with buildings	$6,375,000
5.	• Cellular recommendations are in development and will be finalized in the next submittal.	

5.0 Cost Analysis

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BASIS OF OPINION Other **PREPARED BY** Doug Svee **DATE** May 31, 2018

JOB NUMBER 17-122 **CHECKED BY** Paul Robiadek **GC OVERHEAD & PROFIT** 10%

GC GENERAL CONDITIONS 10%

project summary	cost	general conditions	general contractor OH&P	total
Option 1				
Build New MDF Building	1,122,375	112,238	123,461	1,358,074
New Campus backbone with new ductbank	1,740,167	174,017	191,418	2,105,602
			Total	**$3,463,676**
Option 2a				
Expand Existing Building 18 MDF Room	717,375	71,738	78,911	868,024
New Campus Backbone with minimum new ductbank	632,361	63,236	69,560	765,156
			Total	**$1,633,180**
Option 2b				
Expand Existing Building 18 MDF Room	717,375	71,738	78,911	868,024
New Campus backbone with new ductbank	1,740,167	174,017	191,418	2,105,602
			Total	**$2,973,626**
Option 3				
Intrabuilding Backbone Cabling	330,050	33,005	36,306	399,361
			Total	**$399,361**
Option 4				
New IDF Rooms	1,331,700	133,170	146,487	1,611,357
New Cabling from new IDF room	4,805,088	480,509	528,560	5,814,157
			Total	**$7,425,514**

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GC GENERAL CONDITIONS 10%

project summary	cost	general conditions	general contractor OH&P	total
Options for New MDF				
Expand Existing Building 18 MDF Room	717,375	71,738	78,911	868,024
Build New MDF Building	1,122,375	112,238	123,461	1,358,074
Options for Campus Backbone				
New Campus Backbone with minimum new ductbank	632,361	63,236	69,560	765,156
New Campus backbone with new ductbank	1,740,167	174,017	191,418	2,105,602
Horizontal Backbone				
Intrabuilding Backbone Cabling	330,050	33,005	36,306	399,361
	-			
New cabling to workstation				
New IDF Rooms	1,331,700	133,170	146,487	1,611,357
New Cabling from new IDF room	4,805,088	480,509	528,560	5,814,157

EXCLUSIONS

1 - Phased construction
2 - Sales tax
3 - Escalation
4 - Archeological Services for Site Work

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JOB NUMBER 17-122 | **CHECKED BY** Paul Robiadek | **OVERHEAD & PROFIT** 15%

	quantity		material cost		labor cost		engineering opinion		
description	number	unit	unit cost	total	unit cost	total	subtotal	OH&P	total
Expand Existing Building 18 MDF Room									
Remodel*	1000	SF	250.00	250,000	200.00	200,000	450,000		450,000
Cuttover	1	LS	50,000.00	50,000	62,500.00	62,500	112,500	16,875.00	129,375
Backup Power	1	LS	60,000.00	60,000	25,000.00	25,000	85,000	12,750.00	97,750
Pathways	1		10,000.00	10,000	25,000.00	25,000	35,000	5,250.00	40,250
Subtotal Building 18 Expansion									**$717,375**
Build New MDF Building									
New Building*	2,500	SF	200.00	500,000	100.00	250,000	750,000		750,000
Backup Power	1	LS	120,000.00	120,000	62,500.00	62,500	182,500	27,375.00	209,875
Site Utilities*	1	LS	100,000.00	100,000	62,500.00	62,500	162,500		162,500
Subtotal New MDF Building							1,777,500	62,250	**$ 1,122,375**

* = subcontractor OH&P already included in SF number

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	quantity		material cost		labor cost		engineering opinion		
description	number	unit	unit cost	total	unit cost	total	subtotal	OH&P	total
New Campus Backbone with minimum new ductbank									
Large Ductbank (4) 4" conduits	18000	LF	8.00	144,000	8.69	156,375	300,375	45,056.25	345,431
Small Ductbank (2) 4" conduits		LF							
Trenching	3000	LF	2.57	7,710	2.89	8,663	16,373	2,455.88	18,828
Manholes	5	EA	2,100.00	10,500	1,056.25	5,281	15,781	2,367.19	18,148
Optical Fiber (24SM/12MM armored optical fiber)	69000	LF	1.65	113,850	1.50	103,500	217,350	32,602.50	249,953
Subtotal new campus backbone with minimum new ductbank									**632,361**
New Campus backbone with new ductbank									
Large Ductbank (4) 4" conduits	57996	LF	8.00	463,968	8.69	503,840	967,808	145,171.24	1,112,979
Small Ductbank (2) 4" conduits	7838	LF	8.00	62,704	8.69	68,093	130,797	19,619.49	150,416
Trenching	13585	LF	2.57	34,913	2.89	39,227	74,140	11,121.02	85,261
Manholes	39	EA	2,100.00	81,900	1,056.25	41,194	123,094	18,464.06	141,558
Optical Fiber (24SM/12MM armored optical fiber)	69000	LF	1.65	113,850	1.50	103,500	217,350	32,602.50	249,953
Subtotal new campus backbone with new ductbank									**1,740,167**

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JOB NUMBER	17-122	**CHECKED BY**	Paul Robiadek	**OVERHEAD & PROFIT**	15%

description	quantity		material cost		labor cost		engineering opinion		
	number	unit	unit cost	total	unit cost	total	subtotal	OH&P	total
Intrabuilding Backbone Cabling									
Building 8	2	SF	5,500.00	11,000	4,750.00	9,500	20,500	3,075.00	23,575
Building 9,17,18,19,20	11	SF	5,500.00	60,500	4,750.00	52,250	112,750	16,912.50	129,663
Building 16	2	SF	5,500.00	11,000	4,750.00	9,500	20,500	3,075.00	23,575
Building 21	5	SF	5,500.00	27,500	4,750.00	23,750	51,250	7,687.50	58,938
Building 28	4	SF	5,500.00	22,000	4,750.00	19,000	41,000	6,150.00	47,150
Building 29	4	SF	5,500.00	22,000	4,750.00	19,000	41,000	6,150.00	47,150
Subtotal for Intrabuilding backbone cabling									**330,050**

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JOB NUMBER	17-122	**CHECKED BY**	Paul Robiadek	**OVERHEAD & PROFIT**	15%

description	quantity		material cost		labor cost		engineering opinion		
	number	unit	unit cost	total	unit cost	total	subtotal	OH&P	total
New Cabling from new IDF room									
Building 1	8,500	SF	2.50	21,250	1.00	8,500	29,750	4,462.50	34,213
Building 3	10,200	SF	2.50	25,500	1.00	10,200	35,700	5,355.00	41,055
Building 4	10,250	SF	2.50	25,625	1.00	10,250	35,875	5,381.25	41,256
Building 5	16,000	SF	2.50	40,000	1.00	16,000	56,000	8,400.00	64,400
Building 6	12,100	SF	2.50	30,250	1.00	12,100	42,350	6,352.50	48,703
Building 8	22,800	SF	2.50	57,000	1.00	22,800	79,800	11,970.00	91,770
Building 9,17,18,19,20	281,200	SF	2.50	703,000	1.00	281,200	984,200	147,630.00	1,131,830
Building 10	38,500	SF	2.50	96,250	1.00	38,500	134,750	20,212.50	154,963
Building 11	9,000	SF	2.50	22,500	1.00	9,000	31,500	4,725.00	36,225
Building 13	15,000	SF	2.50	37,500	1.00	15,000	52,500	7,875.00	60,375
Building 15	1,750	SF	2.50	4,375	1.00	1,750	6,125	918.75	7,044
Building 16	64,600	SF	2.50	161,500	1.00	64,600	226,100	33,915.00	260,015
Building 21	147,000	SF	2.50	367,500	1.00	147,000	514,500	77,175.00	591,675
Building 23	8,400	SF	2.25	18,900	1.00	8,400	27,300	4,095.00	31,395
Building 24	11,500	SF	2.25	25,875	1.00	11,500	37,375	5,606.25	42,981
Building 25	16,000	SF	2.25	36,000	1.00	16,000	52,000	7,800.00	59,800

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description	quantity		material cost		labor cost		engineering opinion		
	number	unit	unit cost	total	unit cost	total	subtotal	OH&P	total
Building 27	44,750	SF	2.25	100,688	1.00	44,750	145,438	21,815.63	167,253
Building 28	188,000	SF	2.25	423,000	1.00	188,000	611,000	91,650.00	702,650
Building 29	206,000	SF	2.25	463,500	1.00	206,000	669,500	100,425.00	769,925
Building 32	6,100	SF	2.25	13,725	1.00	6,100	19,825	2,974	22,799
Building 33	4,800	SF	2.25	10,800	1.00	4,800	15,600	2,340	17,940
Building 34	3,900	SF	2.25	8,775	1.00	3,900	12,675	1,901	14,576
Building 35	11,000	SF	2.25	24,750	1.00	11,000	35,750	5,363	41,113
Building 50	35,000	SF	2.25	78,750	1.00	35,000	113,750	17,063	130,813
Building 51	22,000	SF	2.25	49,500	1.00	22,000	71,500	10,725	82,225
Building 52	11,200	SF	2.25	25,200	1.00	11,200	36,400	5,460	41,860
Building 53	10,500	SF	2.25	23,625	1.00	10,500	34,125	5,119	39,244
Building 54	10,600	SF	2.25	23,850	1.00	10,600	34,450	5,168	39,618
Building 56	10,000	SF	2.25	22,500	1.00	10,000	32,500	4,875	37,375
Subtotal for Cabling from new IDF Rooms									4,805,088

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JOB NUMBER 17-122 **CHECKED BY** Paul Robiadek **OVERHEAD & PROFIT** 15%

	quantity		material cost		labor cost		engineering opinion		
description	number	unit	unit cost	total	unit cost	total	subtotal	OH&P	total
New IDF Rooms									
Building 1	1	EA	10,800.00	10,800	8,500.00	8,500	19,300	2,895	22,195
Building 3	1	EA	10,800.00	10,800	8,500.00	8,500	19,300	2,895	22,195
Building 4	1	EA	10,800.00	10,800	8,500.00	8,500	19,300	2,895	22,195
Building 5	1	EA	10,800.00	10,800	8,500.00	8,500	19,300	2,895	22,195
Building 6	1	EA	10,800.00	10,800	8,500.00	8,500	19,300	2,895	22,195
Building 8	3	EA	10,800.00	32,400	8,500.00	25,500	57,900	8,685	66,585
Building 9,17,18,19,20	11	EA	10,800.00	118,800	8,500.00	93,500	212,300	31,845	244,145
Building 10	4	EA	10,800.00	43,200	8,500.00	34,000	77,200	11,580	88,780
Building 11	1	EA	10,800.00	10,800	8,500.00	8,500	19,300	2,895	22,195
Building 13	2	EA	10,800.00	21,600	8,500.00	17,000	38,600	5,790	44,390
Building 15	1	EA	10,800.00	10,800	8,500.00	8,500	19,300	2,895	22,195
Building 16	3	EA	10,800.00	32,400	8,500.00	25,500	57,900	8,685	66,585
Building 21	5	EA	10,800.00	54,000	8,500.00	42,500	96,500	14,475	110,975
Building 23	1	EA	10,800.00	10,800	8,500.00	8,500	19,300	2,895	22,195
Building 24	1	EA	10,800.00	10,800	8,500.00	8,500	19,300	2,895	22,195
Building 25	1	EA	10,800.00	10,800	8,500.00	8,500	19,300	2,895	22,195
Building 27	1	EA	10,800.00	10,800	8,500.00	8,500	19,300	2,895	22,195
Building 28	3	EA	10,800.00	32,400	8,500.00	25,500	57,900	8,685	66,585
Building 29	8	EA	10,800.00	86,400	8,500.00	68,000	154,400	23,160	177,560
Building 32	1	EA	10,800.00	10,800	8,500.00	8,500	19,300	2,895	22,195
Building 33	1	EA	10,800.00	10,800	8,500.00	8,500	19,300	2,895	22,195
Building 34	1	EA	10,800.00	10,800	8,500.00	8,500	19,300	2,895	22,195
Building 35	1	EA	10,800.00	10,800	8,500.00	8,500	19,300	2,895	22,195
Building 50	1	EA	10,800.00	10,800	8,500.00	8,500	19,300	2,895	22,195

electrical **cost opinion**

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Uniform Communications

Western State Hospital - DSHS

BASIS OF OPINION Other | **PREPARED BY** Doug Svee | **DATE** May 31, 2018

JOB NUMBER 17-122 | **CHECKED BY** Paul Robiadek | **OVERHEAD & PROFIT** 15%

description	quantity		material cost		labor cost		engineering opinion		
	number	unit	unit cost	total	unit cost	total	subtotal	OH&P	total
Building 51	1	EA	10,800.00	10,800	8,500.00	8,500	19,300	2,895	22,195
Building 52	1	EA	10,800.00	10,800	8,500.00	8,500	19,300	2,895	22,195
Building 53	1	EA	10,800.00	10,800	8,500.00	8,500	19,300	2,895	22,195
Building 54	1	EA	10,800.00	10,800	8,500.00	8,500	19,300	2,895	22,195
Building 56	1	EA	10,800.00	10,800	8,500.00	8,500	19,300	2,895	22,195
Subtotal for Cabling from new IDF Rooms									1,331,700

6.0 Appendices

A. Reference Standards

B. Existing Conditions Drawings

C. Riser Diagrams

D. Wireless Signal Mapping

Appendix A - Reference Standards

The following references were used to prepare this study:

- WAC 296-46B: Electrical Safety Standards, Administration and Installation
- National Electrical Code, 2014 Edition
- EIA/TIA 568-C Commercial Building Telecommunications Cabling Standard
- EIA/TIA 569-D Commercial Building Standard for Telecommunications Pathways and Spaces.
- EIA/TIA 606-B Administration Standard for the Telecommunications Infrastructure of Commercial Buildings
- EIA/TIA 607-B Telecommunications Bonding and Grounding For Customer Premises
- TIA-758-B, Customer Owned Outside Plant Telecommunications Cabling Standard.
- BICSI Telecommunications Distribution Methods Manual

Appendix B - Existing Condition Drawings

GENERAL

- EXISTING ELECTRICAL TO BE REMOVED
- EXISTING ELECTRICAL TO REMAIN
- NEW ELECTRICAL WORK
- MATCHLINE OR PROPERTY LINE
- ENLARGED PLAN BOUNDARY
- 1 / E1.1 — DETAIL/PLAN IDENTIFIER
- A / E1.1 — SECTION IDENTIFIER
- A / E1.1 — ELEVATION IDENTIFIER
- REVISION DEFINITION AREA, AREA ENCIRCLED CONTAINS CHANGES MADE SUBSEQUENT TO PREVIOUS ISSUE
- 1 — REVISION CALLOUT
- 1 — FLAG NOTE TAG
- 1 — DEMOLITION NOTE TAG
- 1 — EQUIPMENT TAG
- AHU-01 — MECHANICAL EQUIPMENT TAG
- 1 / AHU — MECHANICAL EQUIPMENT TAG
- N — NORTH ARROW
- 1 — LOCATION WHERE PICTURE WAS TAKEN AND DIRECTION

RACEWAYS AND BOXES

- J — JUNCTION BOX
- J F — FURNITURE WALL FEED OUTLET BOX
- PB XX — PULL BOX (WHERE INDICATED, SUBSCRIPT INDICATES PULL BOX NUMBER)
- XX — MANHOLE (WHERE INDICATED, SUBSCRIPT INDICATES MANHOLE NUMBER)
- HH — HANDHOLE
- A — FLOORBOX (SUBSCRIPT INDICATES TYPE, WHERE NO SUBSCRIPT, SEE SPECIFICATIONS)
- A — POKETHRU (SUBSCRIPT INDICATES TYPE, WHERE NO SUBSCRIPT, SEE SPECIFICATIONS)
- POWER POLE, FLOOR TO CEILING
- SURFACE METAL RACEWAY
- RACEWAY CONCEALED IN WALL OR IN CEILING (EXPOSED IN UNFINISHED AREAS)
- RACEWAY RUN BELOW FLOOR OR BELOW GRADE
- FLEXIBLE RACEWAY
- RACEWAY (CIRCLE DENOTES VERTICAL TRANSITION)
- RACEWAY CONTINUATION
- RACEWAY STUB WITH BUSHING
- RACEWAY SLEEVE WITH BUSHINGS
- EZ-PATH FIRE STOPPING SLEEVE
- LADDER TRAY
- HA-3 — HOMERUN TO PANEL (INDICATES PANEL DESIGNATION AND CIRCUIT NUMBER)
- #10 — (GAUGE OF WIRE OTHER THAN AWG#12) NUMBER OF CONDUCTORS (GROUND CONDUCTOR) (PHASE CONDUCTORS) (NEUTRAL CONDUCTOR)

POWER

- SWITCHBOARD/SWITCHGEAR
- PANELBOARD, FLUSH MOUNTED
- PANELBOARD, SURFACE MOUNTED
- T — (FRONT) TRANSFORMER
- MOTOR CONNECTION.
- DISCONNECT SWITCH, NON FUSED
- DISCONNECT SWITCH, FUSED
- B — ENCLOSED CIRCUIT BREAKER
- VARIABLE FREQUENCY DRIVE
- S M — MANUAL MOTOR STARTER WITH THERMAL OVERLOADS
- COMBINATION STARTER/DISCONNECT
- MAGNETIC STARTER
- EQUIPMENT CONNECTION. CONFIRM CONNECTION WITH EQUIPMENT MANUFACTURER
- J F/S — FIRE/SMOKE DAMPER
- PUSHBUTTON CONTROLLER (SINGLE OR MULTIPLE BUTTONS)
- EMERGENCY POWER OFF PUSHBUTTON

TELECOMMUNICATIONS SYSTEM

- TELECOMMUNICATIONS DEVICE
  - (X = REPRESENTS THE # OF TELECOMMUNICATIONS MODULES)
  - (W = TELECOMMUNICATIONS WALL PHONE MTD AT +48" AFF)
  - (B = BLANK COVER PLATE)
  - (F = MODULAR FURNITURE DEVICE)
  - (AC = ABOVE COUNTER DEVICE)
  - (S = SURFACE MOUNT)
  - (WAP = WALL MOUNTED WIRELESS ACCESS POINT DATA DEVICE)
- ABOVE CEILING TELECOMMUNICATIONS DEVICE (X = REPRESENTS THE # OF TELECOMMUNICATIONS MODULES)
  - WAP — (WAP = WIRELESS ACCESS DEVICE)
  - (SV = SECURITY VIDEO CAMERA)
- FIRE RESISTANT 3/4" PLYWOOD BACKBOARD
- TWO-POST EQUIPMENT RACK
- 3.65" DOUBLE-SIDED VERTICAL MANAGEMENT
- 6" DOUBLE-SIDED VERTICAL MANAGEMENT
- 12" DOUBLE-SIDED VERTICAL MANAGEMENT
- WALL MOUNTED ENCLOSURE
- FLOOR MOUNTED SERVER ENCLOSURE
- 110 BLOCK WITH LEGS
- 66 BLOCK

ABBREVIATIONS

A	AMPERE
AC	AIR CONDITIONING; ALTERNATING CURRENT
AF	AMP FRAME
AF	AMP FUSE; AMP FRAME
AFF	ABOVE FINISHED FLOOR
AG	ABOVE GRADE
AHJ	AUTHORITIES HAVING JURISDICTION
AHU	AIR HANDLING UNIT
AIC	AMPERE INTERRUPTING CURRENT
AL	ALUMINUM
ANSI	AMERICAN NATIONAL STANDARDS INSTITUTE
AS	AMP SWITCH
AT	AMP TRIP
ATS	AUTOMATIC TRANSFER SWITCH
ATM	ASYNCHRONOUS TRANSFER MODE
AV	AUDIO VISUAL
AWG	AMERICAN WIRE GAUGE
BAS	BUILDING AUTOMATION SYSTEM
BATT	BATTERIES
BKBD	BACKBOARD
BIL	BASIC IMPULSE INSULATION LEVEL
BKR	BREAKER
BLDG	BUILDING
C	CONDUIT; CONTROLLED; DEGREES CELSIUS
CAB	CABINET
CAT	CATEGORY
CATV	COMMUNITY ANTENNA TELEVISION
CB	CIRCUIT BREAKER
CCTV	CLOSED CIRCUIT TELEVISION
CLG	CEILING
CO	CONDUIT ONLY
COW	COMPUTER ON WHEELS
CT	CURRENT TRANSFORMER
CU	COPPER
DDC	DIRECT DIGITAL CONTROL
DEMARC	DEMARCATION POINT
DISC	DISCONNECT
DIST	DISTRIBUTION
DSL	DIGITAL SUBSCRIBER LINE
DTAP	DOOR TOP ALARM PANEL
DWG	DRAWING
(E)	EXISTING
EA	EACH
EF	EXHAUST FAN
EIA	ELECTRONIC INDUSTRIES ASSOCIATION
ELEV	ELEVATION
EM	EMERGENCY
EMT	ELECTRICAL METALLIC TUBING
ENCL	ENCLOSURE
EPM	ELECTRONIC POWER METER
EPO	EMERGENCY POWER OFF
EQUIP	EQUIPMENT
ETR	EXISTING TO REMAIN
EWC	ELECTRIC WATER COOLER
F	FUSE; DEGREES FAHRENHEIT
FA	FIRE ALARM
FAAP	FIRE ALARM ANNUNCIATOR PANEL
FACP	FIRE ALARM CONTROL PANEL
FBO	FURNISHED BY OWNER
FOIC	FURNISHED BY OWNER INSTALLED BY CONTRACTOR
FOIO	FURNISHED BY OWNER INSTALLED BY OWNER
FSD	FIRE SMOKE DAMPER
G	GROUND
GFI	GROUND FAULT INTERRUPTER
GFCI	GROUND FAULT CIRCUIT INTERRUPTER
GND	GROUND
GRS	GALVANIZED RIGID STEEL
HC	HORIZONTAL CROSS CONNECT
HID	HIGH INTENSITY DISCHARGE
HP	HORSEPOWER
HTR	HEATER
Hz	HERTZ
IC	INTERMEDIATE CROSS CONNECT
IBC	INTERNATIONAL BUILDING CODE
IDF	INTERMEDIATE DISTRIBUTION FRAME
IEEE	INSTITUTE OF ELECTRICAL AND ELECTRONIC ENGINEERS
IG	ISOLATED GROUND
IMC	INTERMEDIATE METALLIC CONDUIT
ISDN	INTEGRATED SERVICES DIGITAL NETWORK
J	JUNCTION
kVA	KILOVOLT AMPERE
kW	KILOWATT
KCMIL	THOUSAND CIRCULAR MILS
KVAR	KILOVOLT AMPERE REACTIVE
LAN	LOCAL AREA NETWORK
LCP	LIGHTING CONTROL PANEL
LEC	LOCAL EXCHANGE CARRIER
LT	LIGHT
LTG	LIGHTING
M	METER
MAN	METROPOLITAN AREA NETWORK
MAX	MAXIMUM
MC	MAIN CROSS CONNECT; METAL CLAD (CABLE)
MCC	MOTOR CONTROL CENTER
MCB	MAIN CIRCUIT BREAKER
MDF	MAIN DISTRIBUTION FRAME
MDP	MAIN DISTRIBUTION PANEL
MFR	MANUFACTURER
MH	MANHOLE
MIN	MINIMUM
MLO	MAIN LUGS ONLY
MM	MULTIMODE
MPOE	MAIN POINT OF ENTRY
MPOP	MAIN POINT OF PRESENCE
MTD	MOUNTED
MTS	MANUAL TRANSFER SWITCH
N	NEUTRAL
(N)	NEW
NAC	NOTIFICATION APPLIANCE CIRCUIT
NEC	NATIONAL ELECTRICAL CODE
NEMA	NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION
NF	NON FUSED
NIC	NOT IN CONTRACT
NL	NIGHT LIGHT
OS	OCCUPANCY SENSOR
OFC	OPTICAL FIBER CABLE
OHL	OVERHEAD LINE
OL	OVERLOAD
OSP	OUTSIDE PLANT
P	POLE
PBX	PRIVATE BRANCH EXCHANGE
PF	POWER FACTOR
PH	PHASE
PIR	PASSIVE INFRARED
PIV	POST INDICATING VALVE
PNL	PANEL
PP	PATCH PANEL
PT	POTENTIAL TRANSFORMER
PVC	POLYVINYL CHLORIDE
RCP	REFLECTED CEILING PLAN
REC	RECEPTACLE
REF	REFER TO
REV	REVISION
RM	ROOM
RMFC	RACK MOUNT FIBER CABINET
RU	RACK UNIT
SHT	SHEET
SLC	SIGNALING LINE CIRCUIT
SM	SINGLEMODE
SMFC	SURFACE MOUNT FIBER CABINET
SMR	SURFACE METAL RACEWAY
SONET	SYNCHRONOUS OPTICAL NETWORK
SP	SERVICE PROVIDER
SPD	SURGE PROTECTIVE DEVICE
SPEC	SPECIFICATIONS
SPST	SINGLE POLE SINGLE THROW
ST	SHUNT TRIP
STP	SHIELDED TWISTED PAIR
SVGA	SUPER VIDEO GRAPHICS ARRAY
SW	SWITCH
SWBD	SWITCHBOARD
T	TAMPER PROOF
TBB	TELECOMMUNICATIONS BONDING BACKBONE
TEL	TELEPHONE
TELCO	TELEPHONE COMPANY
TGB	TELECOMMUNICATIONS GROUNDING BUSBAR
TIA	TELECOMMUNICATIONS INDUSTRY ASSOCIATION
TMGB	TELECOMMUNICATIONS MAIN GROUNDING BUSBAR
TP	TAMPER PROOF
TR	TELECOMMUNICATIONS ROOM
TTB	TELEPHONE TERMINAL BOARD
TV	TELEVISION
TVSS	TRANSIENT VOLTAGE SURGE SUPPRESSION
TYP	TYPICAL
UG	UNDERGROUND
UL	UNDERWRITERS LABORATORIES
UON	UNLESS OTHERWISE NOTED
UPS	UNINTERRUPTIBLE POWER SUPPLY
UTP	UNSHIELDED TWISTED PAIR
UV	UNIT VENTILATOR
V	VOLTS
VA	VOLT AMPERES
VFD	VARIABLE FREQUENCY DRIVE
W	WATT; WIRE
W/	WITH
W/O	WITHOUT
WA	WORKSTATION AREA
WAN	WIDE AREA NETWORK
WG	WIRE GUARD
WH	WATT HOUR METER
WP	WEATHERPROOF
XMFR	TRANSFORMER
Y	WYE
Z	IMPEDANCE

GENERAL NOTES

1. PERFORM WORK IN ACCORDANCE WITH APPLICABLE NATIONAL AND STATE CODES AS AMENDED LOCALLY AND ENFORCED BY THE AHJ.
2. OBTAIN AND PAY FOR PERMITS REQUIRED FOR INSTALLATION OF WORK. ARRANGE AND SCHEDULE REQUIRED INSPECTIONS.
3. DRAWINGS ARE DIAGRAMMATIC IN NATURE. PROVIDE COMPONENTS AS REQUIRED FOR A COMPLETE OPERATIONAL SYSTEM WHETHER OR NOT SPECIFICALLY SHOWN ON THE DRAWINGS.
4. DEVICE LOCATIONS ARE APPROXIMATE. COORDINATE DEVICE LOCATIONS AND ELEVATIONS WITH APPROPRIATE DOCUMENTS INCLUDING SHOP DRAWINGS AND ARCHITECT'S INTERIOR ELEVATIONS PRIOR TO ROUGH-IN.
5. COMPLETION OF WORK SHALL BE EXECUTED IN ACCORDANCE WITH THE PROJECT SCHEDULE. SCHEDULE INSTALLATION WITH OTHER TRADES TO ENSURE PROJECT MILESTONES ARE MET.
6. BRANCH CIRCUIT HOMERUNS ARE SHOWN TO INDICATE CIRCUIT PROPERTIES AND CONFIGURATION. SINGLE-CIRCUIT HOMERUNS MAY BE COMBINED IN ACCORDANCE WITH THE SPECIFICATIONS. EXTEND AND CONNECT BRANCH CIRCUIT RACEWAY AND WIRING FROM HOMERUN TO DEVICES AND EQUIPMENT WITH CIRCUIT NUMBERS INDICATED. CONDUCTOR QUANTITIES AND SIZES ARE INDICATED AT HOMERUNS ONLY. SHOW ACTUAL RACEWAY ROUTING AND CIRCUITING ON RECORD DRAWINGS. MINIMUM CONDUCTOR SIZE #12 AWG.
7. LOCATIONS OF RACEWAYS, PATHWAYS, AND SIMILAR ITEMS ARE SHOWN SCHEMATICALLY. COORDINATE INSTALLATION, INCLUDING BUT NOT LIMITED TO CONDUIT WITH LOCATIONS OF FIXED CASEWORK AND BUILDING CONDITIONS AFFECTING THE WORK OF THIS CONTRACT.
8. NEW CABLING INSTALLATIONS SHALL BE CONCEALED IN WALLS AND CEILINGS, UNLESS OTHERWISE NOTED ON THE DRAWINGS. CABLING IN ACCESSIBLE CEILING SPACES SHALL BE INSTALLED IN CONDUIT NEAR STRUCTURES AND WALLS OR AS SPECIFICALLY NOTED ON DRAWINGS. SEE SPECIFICATIONS FOR SUPPORT REQUIREMENTS.
9. PROVIDE FIRE-STOPPING SYSTEMS FOR CONDUIT AND RACEWAY SYSTEMS AT PENETRATIONS, SLEEVES AND SLOTS OF FIRE-RATED CONSTRUCTION FOR INTRABUILDING PATHWAYS AND SPACES.

NON-STRUCTURAL ELECTRICAL COMPONENT NOTES

1. THE FOLLOWING ITEMS ARE TAKEN DIRECTLY FROM THE 2015 INTERNATIONAL BUILDING CODE AND FROM THE AMERICAN SOCIETY OF CIVIL ENGINEERS (ASCE) STANDARD 7. THE CONTRACTOR SHALL REFER TO THE ABOVE FOR ADDITIONAL INFORMATION, EXCEPTIONS, AND FURTHER DESCRIPTIONS. THE CONTRACTOR SHALL ADHERE TO REQUIREMENTS AND AS SUCH, SHALL BE INCLUDED WITHIN BID. ALSO REFER TO SPECIFICATIONS.
2. 2015 IBC, 1613.1, SCOPE: ARCHITECTURAL, MECHANICAL, ELECTRICAL, AND NON-STRUCTURAL COMPONENTS THAT ARE PERMANENTLY ATTACHED TO STRUCTURES AND THEIR SUPPORTS AND ATTACHMENTS SHALL BE DESIGNED AND CONSTRUCTED TO RESIST THE EFFECTS OF EARTHQUAKE MOTIONS IN ACCORDANCE WITH ASCE 7, EXCLUDING CHAPTER 14 AND APPENDIX 11A.
3. 2015 IBC, 1706.1, CONTRACTOR RESPONSIBILITY: THE CONTRACTOR SHALL BE RESPONSIBLE FOR THE CONSTRUCTION OF A SEISMIC-FORCE-RESISTING SYSTEM, DESIGNATED SEISMIC SYSTEM, OR SEISMIC-RESISTING COMPONENT LISTED IN THE STATEMENT OF SPECIAL INSPECTIONS AND SHALL SUBMIT A WRITTEN STATEMENT OF RESPONSIBILITY TO THE BUILDING OFFICIAL AND THE OWNER PRIOR TO THE COMMENCEMENT OF WORK ON THE SYSTEM OR COMPONENT. THE CONTRACTOR'S STATEMENT OF RESPONSIBILITY SHALL INCLUDE THE FOLLOWING:
   A. ACKNOWLEDGMENT OF AWARENESS OF THE SPECIAL REQUIREMENTS CONTAINED IN THE STATEMENT OF SPECIAL INSPECTIONS;
   B. ACKNOWLEDGMENT THAT CONTROL WILL BE EXERCISED TO OBTAIN CONFORMANCE WITH THE CONSTRUCTION DOCUMENTS APPROVED BY THE BUILDING OFFICIAL;
   C. PROCEDURES FOR EXERCISING CONTROL WITHIN THE CONTRACTOR'S ORGANIZATION, THE METHOD AND FREQUENCY OF REPORTING, AND THE DISTRIBUTION OF THE REPORTS;
   D. IDENTIFICATION AND QUALIFICATIONS OF THE PERSON(S) EXERCISING SUCH CONTROL AND THEIR POSITION(S) IN THE ORGANIZATION.
4. DIVISION 26 RESPONSIBILITIES:
   A. HANGERS AND SEISMIC BRACING FOR ELECTRICAL SYSTEMS SHALL BE DESIGNED AND SPECIFIED BY DIVISION 26. DIVISION 26 SHALL REFER TO THE ELECTRICAL DRAWINGS FOR LOCATIONS OF EQUIPMENT AND ELECTRICAL SYSTEMS AS STRUCTURAL DRAWINGS DO NOT SHOW THE LOCATIONS OF ELECTRICAL EQUIPMENT, RACEWAYS, AND OTHER COMPONENTS.
   B. DIVISION 26 SHALL COORDINATE THE SUPPORT SYSTEMS AND DESIGN LOADS FOR HUNG RACEWAYS AND OTHER ELECTRICAL SYSTEMS (INCLUDING COMBINED MULTIPLE RACEWAY RUNS) WITH THE GENERAL CONTRACTOR AND THE STEEL AND WOOD JOIST MANUFACTURERS IN ADDITION TO OTHER TRADES THAT MAY BE IMPACTED.

DRAWING INDEX

NOT ALL SYMBOLS MAY APPEAR ON THE DRAWINGS

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LAKEWOOD, WA 98498

REV.	RELEASE	DATE
	FINAL REPORT	5/31/18

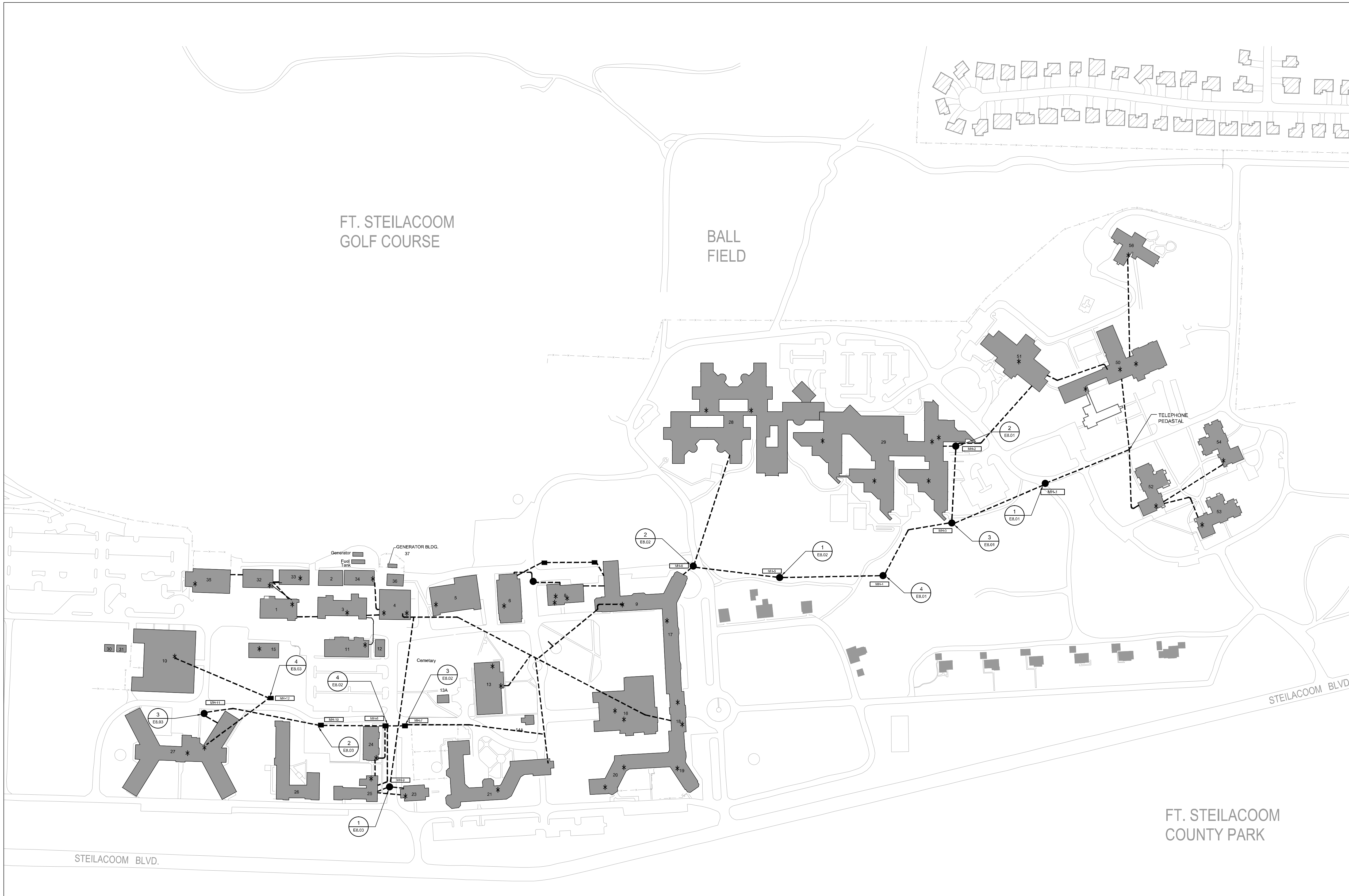
PROJECT NO.	2017-467
HARGIS PROJECT NO.	17122
DRAWN BY	AH
CHECKED BY	DS
APPROVED BY	ES

SHEET TITLE

ELECTRICAL LEGEND, DRAWING INDEX, NOTES AND ABBREVIATIONS

SHEET NUMBER

E0.01



ELECTRICAL SITE PLAN

1 E1.01 SCALE: 1" = 125'-0"

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ELECTRICAL SITE PLAN

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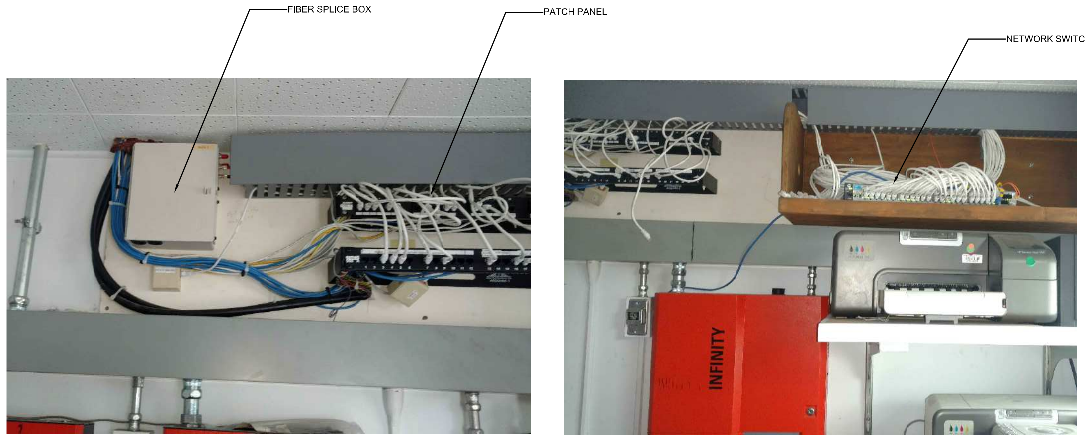
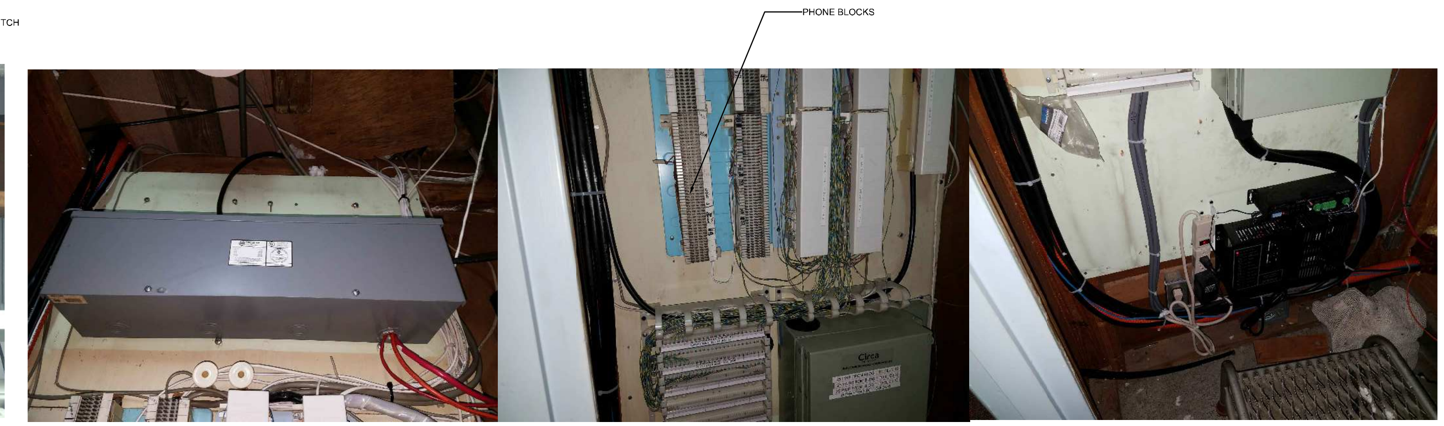
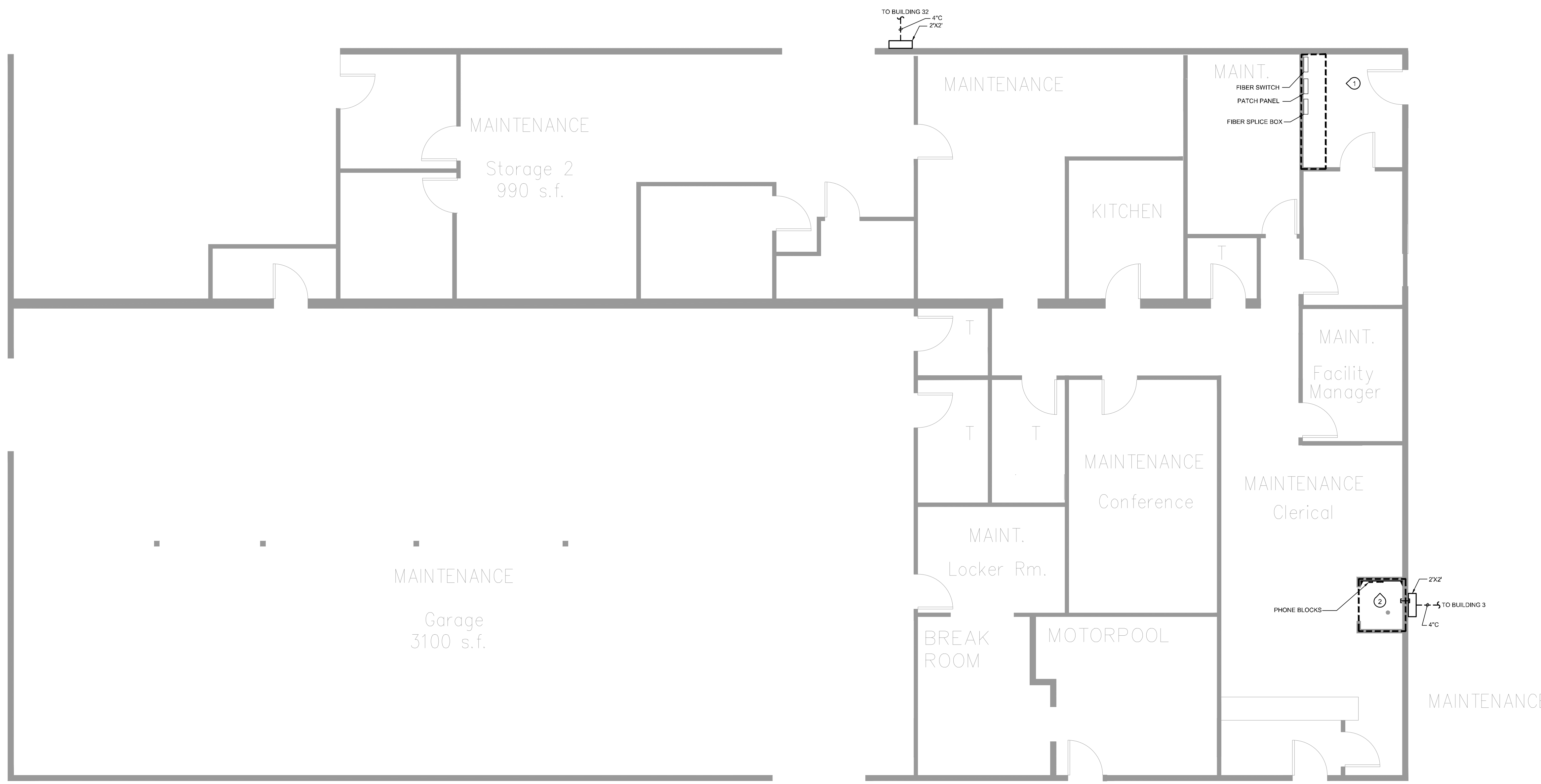


1 **BUILDING 1 IDF**



2 **BUILDING 1 TELEPHONE CLOSET**



1 E3.01A **BUILDING 1 TELECOMMUNICATIONS FLOOR PLAN**
SCALE: 1/4" = 1'-0"

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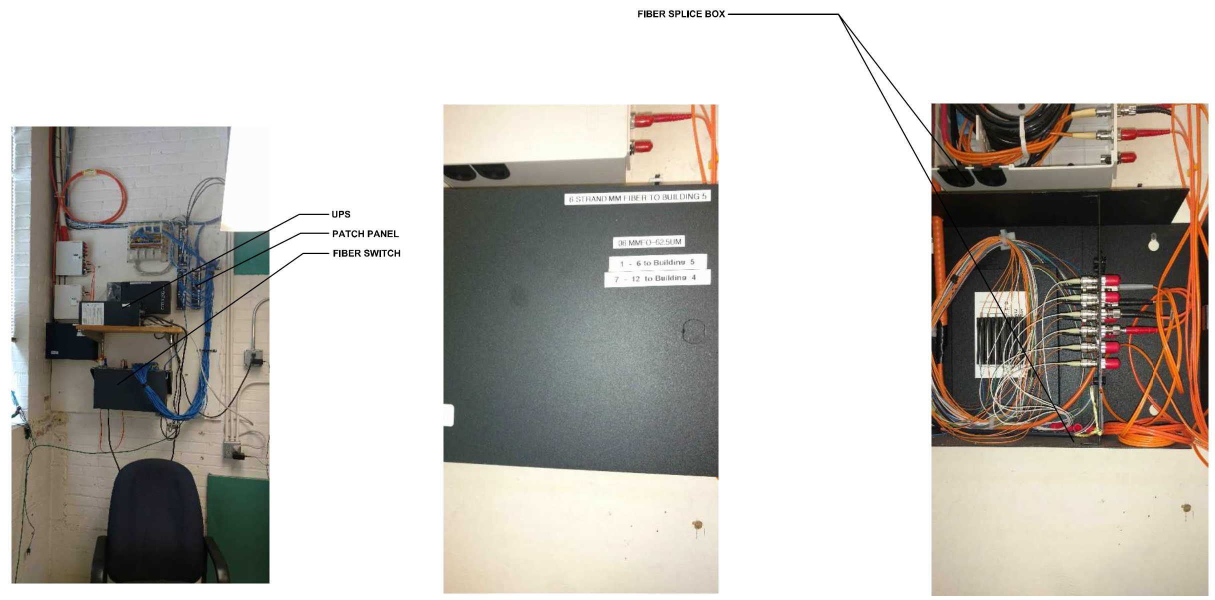
CHECKED BY	DS
APPROVED BY	ES

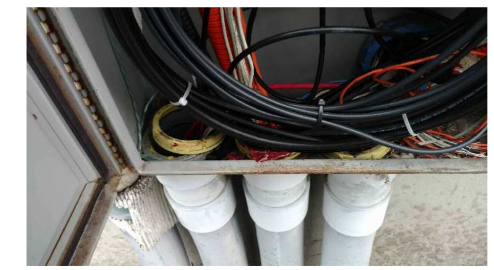
SHEET TITLE
BUILDING 1 TELECOMMUNICATIONS FLOOR PLAN

SHEET NUMBER
E3.01A

1 BUILDING 3 ELECTRICAL SHOP ELEVATIONS

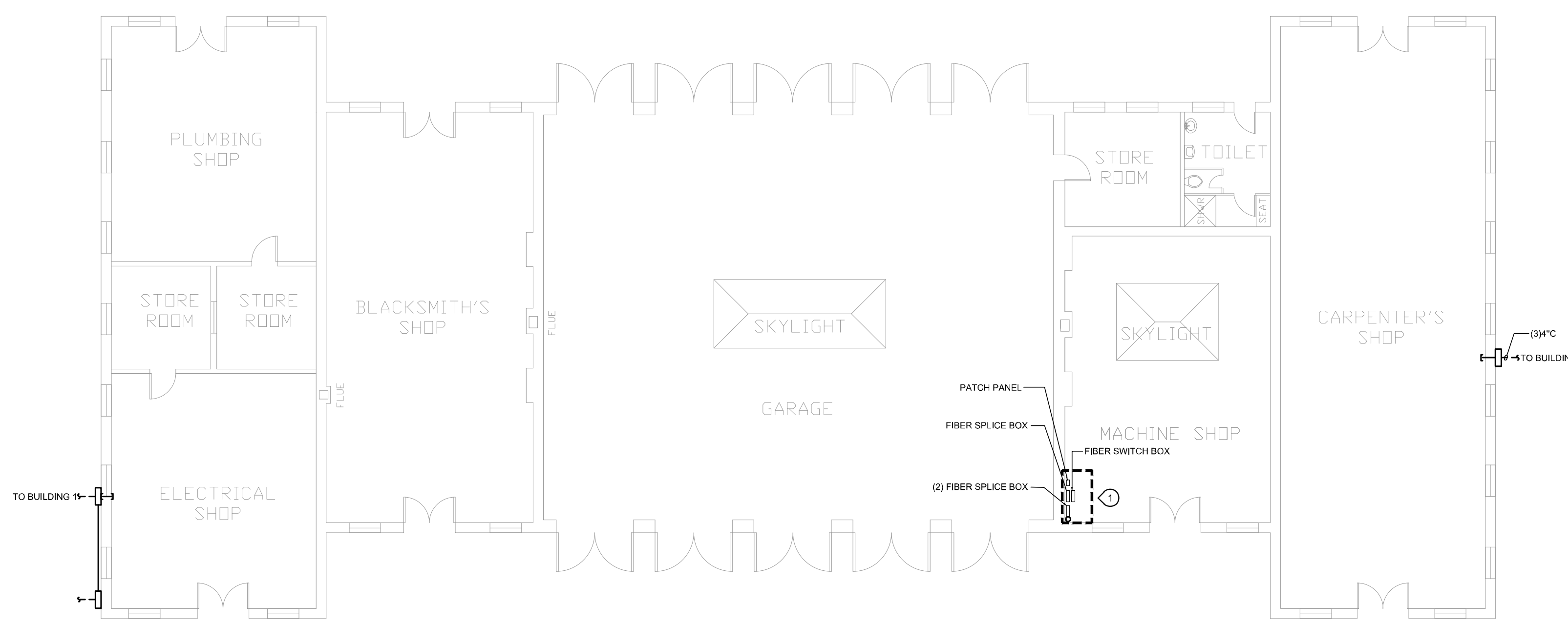


2 BUILDING 3 MACHINE SHOP ELEVATIONS



3 TO BUILDING 4

4 TO BUILDING 1



1 E3.03A ELECTRICAL BUILDING 3 FIRST FLOOR PLAN
SCALE: 1/8" = 1'-0"

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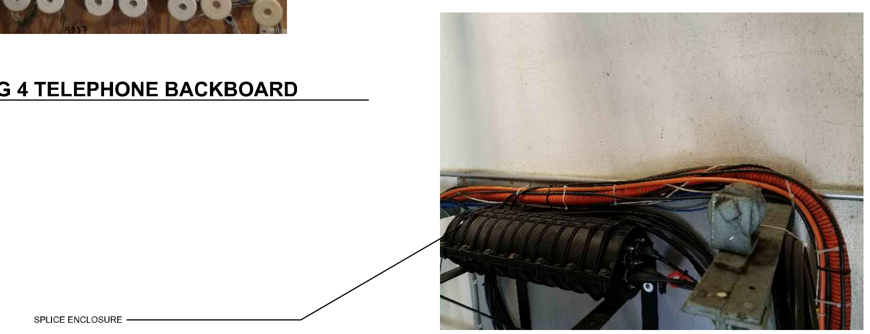
CHECKED BY	DS
APPROVED BY	ES

SHEET TITLE
BUILDING 3
TELECOMMUNICATIONS
FLOOR AND ROOF PLANS

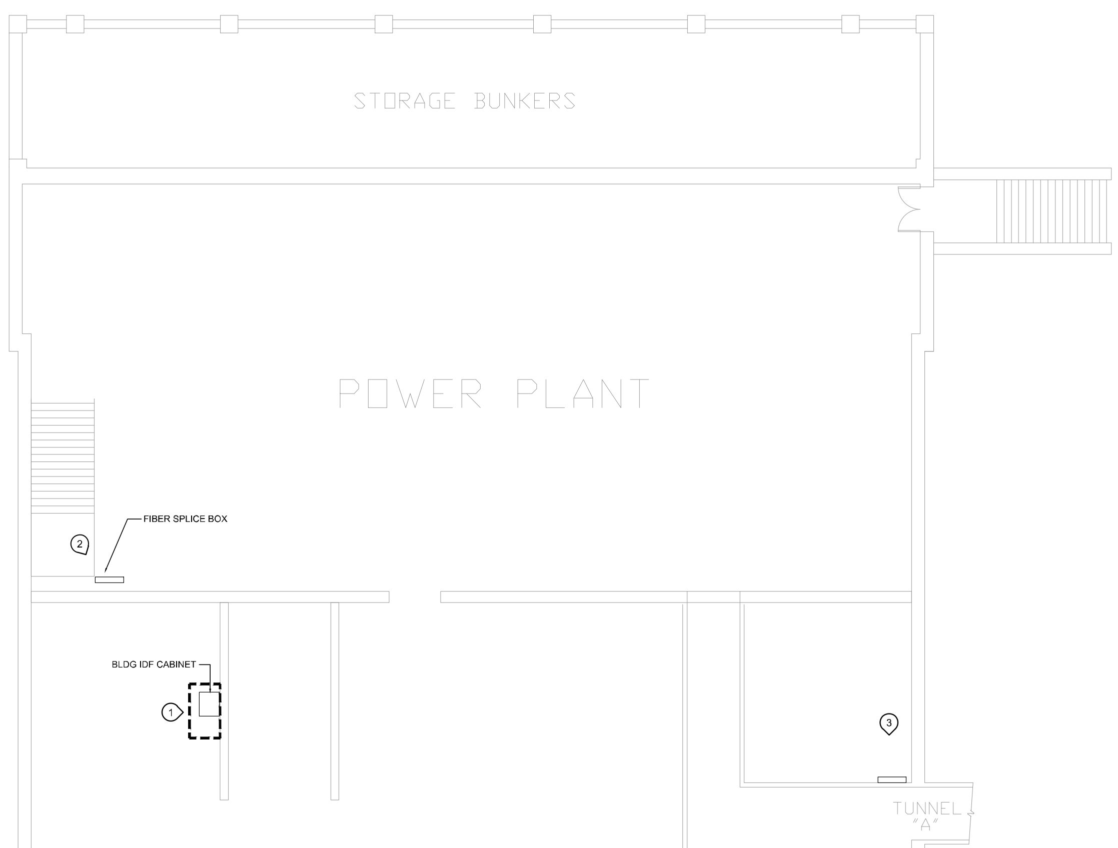
SHEET NUMBER
E3.03A

(1) **BUILDING 4 IDF CABINET**

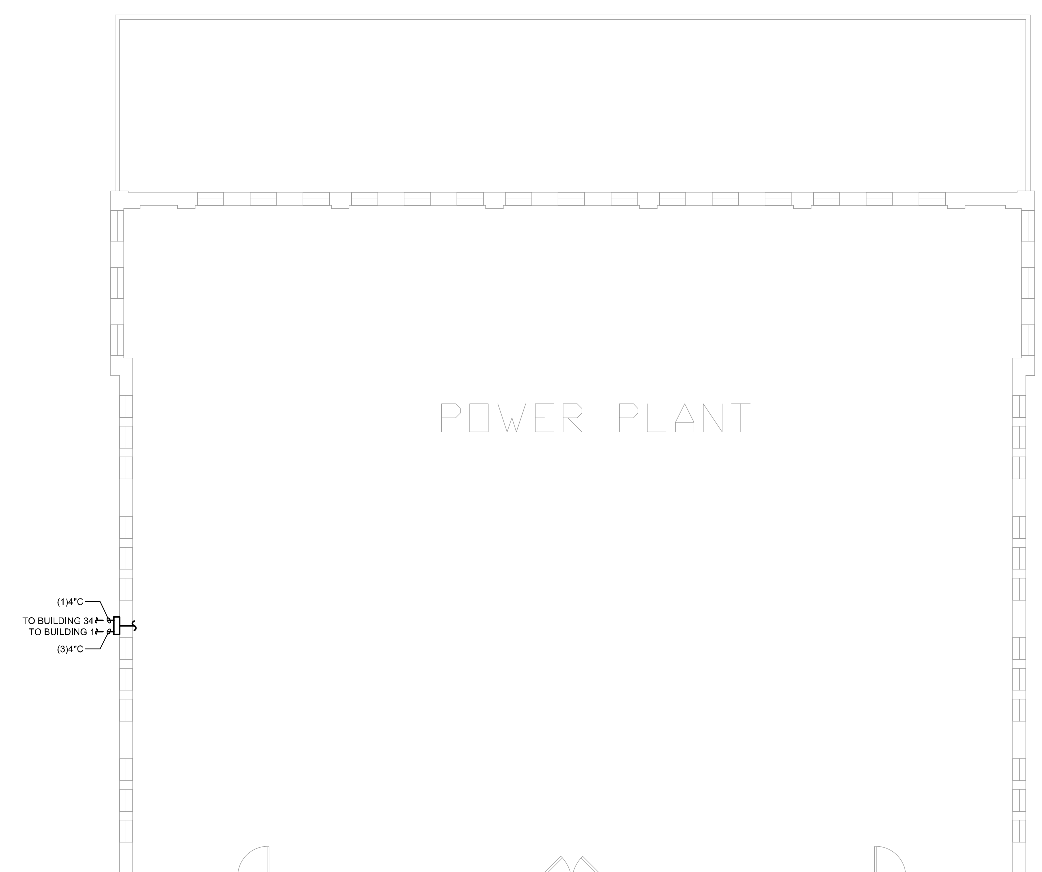
(3) **BUILDING 4 TELEPHONE BACKBOARD**



(2) **BUILDING 4**



LOWER FLOOR ELEVATIONS
1 E3.04A
SCALE: 1/8" = 1'-0"



UPPER FLOOR ELEVATIONS
2 E3.04A
SCALE: 1/8" = 1'-0"

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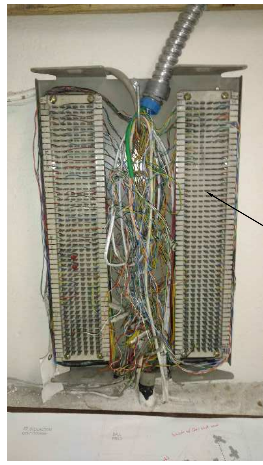
9601 STEILACOOM BLVD SW
LAKEWOOD, WA 98498

REV.	RELEASE	DATE
	FINAL REPORT	5/31/18

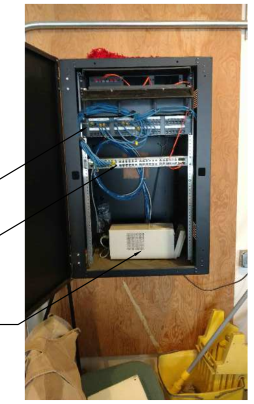
PROJECT NO.	2017-467
HARGIS PROJECT NO.	17122
DRAWN BY	AH
CHECKED BY	DS
APPROVED BY	ES

SHEET TITLE
BUILDING 4
TELECOMMUNICATIONS
BASEMENT & FLOOR PLANS

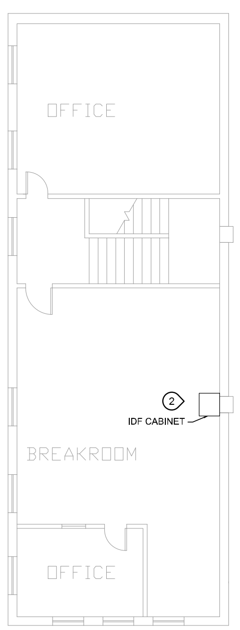
SHEET NUMBER
E3.04A



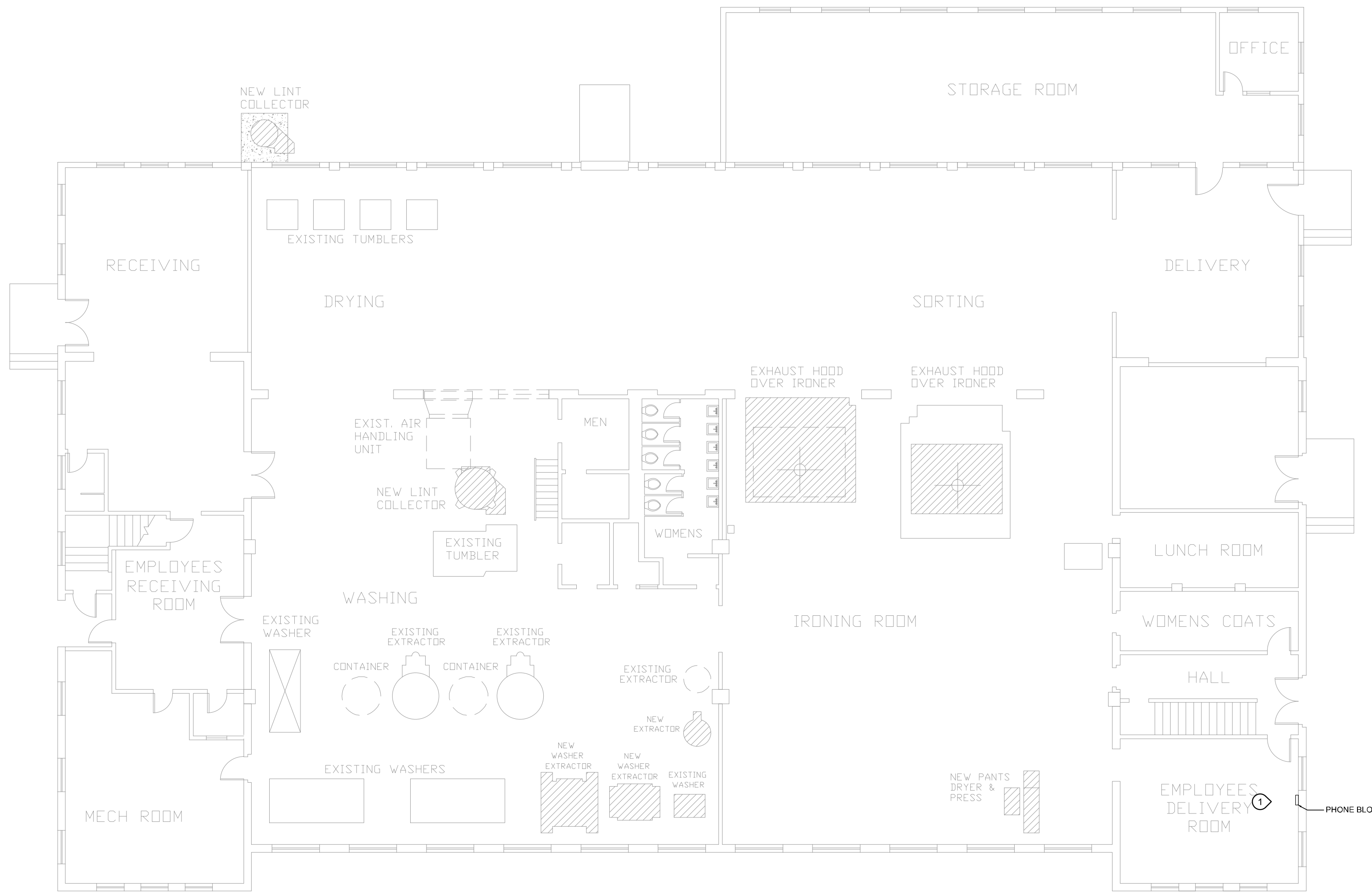
1 **BUILDING 5 EMPLOYEES DELIVERY ROOM ELEVATIONS**



2 **BUILDING 5 IDF CABINET**



2 E3.05A **BUILDING MEZZANINE**
SCALE: 1/8" = 1'0"



1 E3.05A **BUILDING 5 TELECOMMUNICATIONS FLOOR PLAN**
SCALE: 1/8" = 1'-0"

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DEPARTMENT OF SOCIAL AND HEALTH SERVICES
WESTERN STATE HOSPITAL

WSH & CSTC UC UPGRADES (2017-467)

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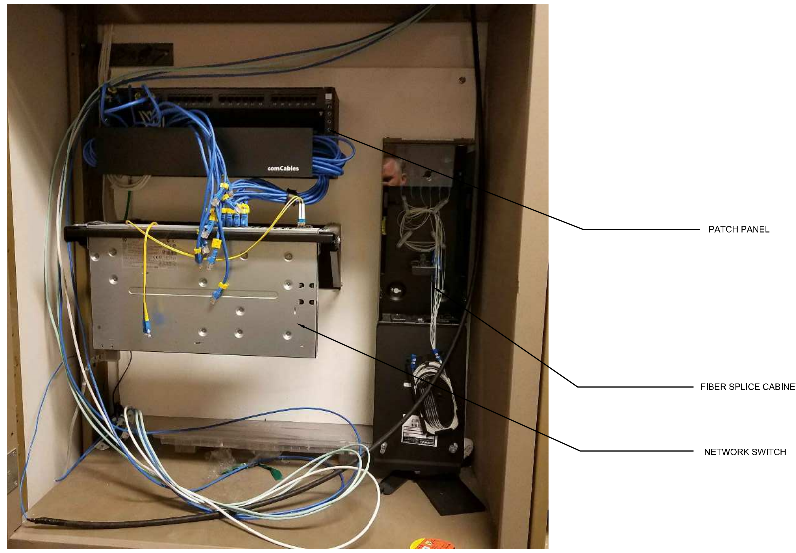
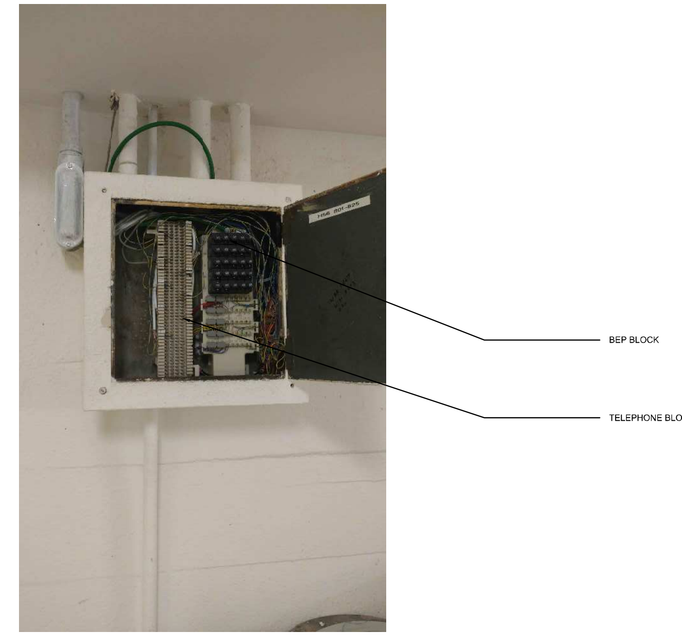
SHEET TITLE
BUILDING 5 TELECOMMUNICATIONS FLOOR PLAN

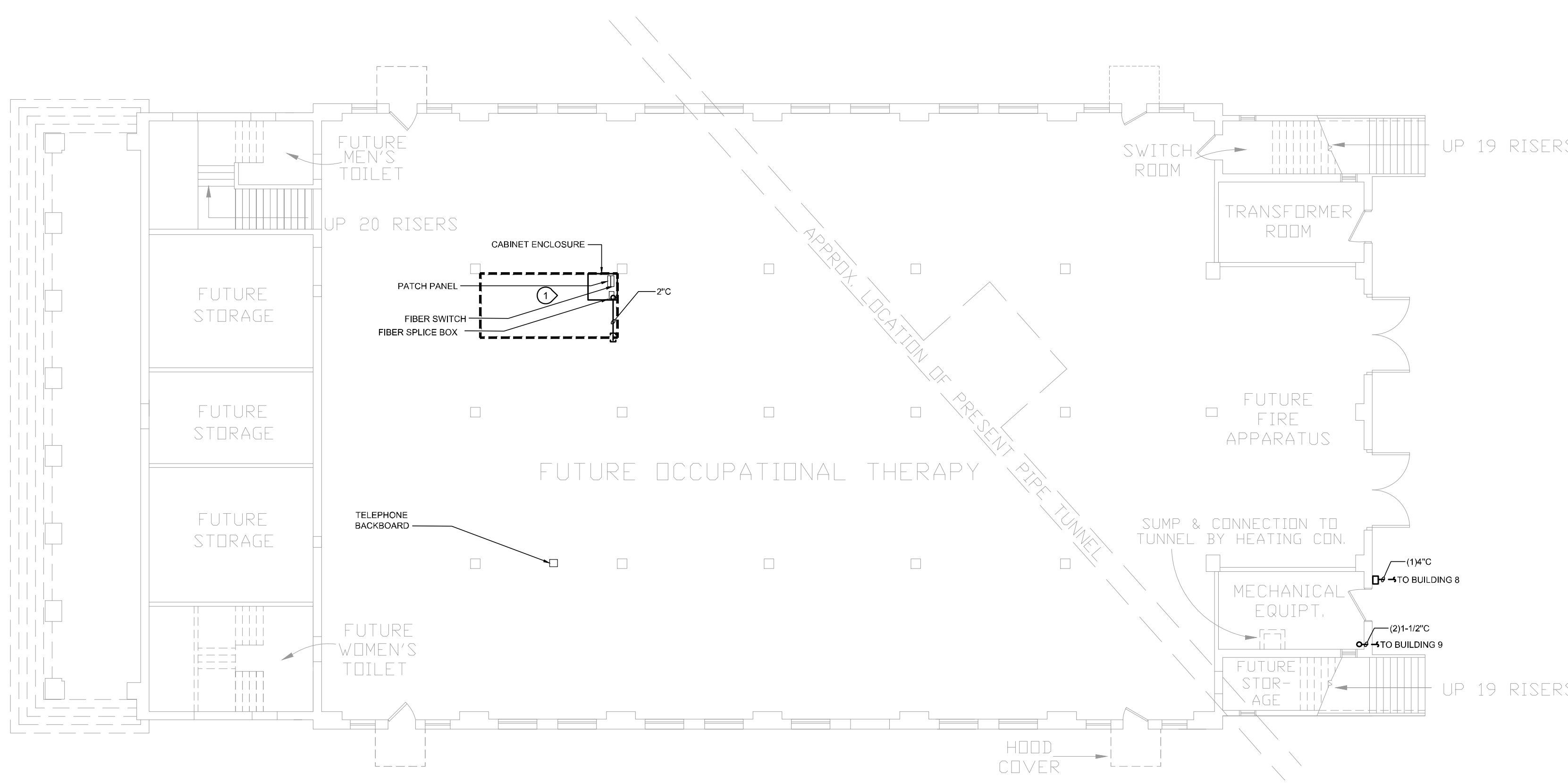
SHEET NUMBER
E3.05A



(1) **BUILDING 6 IDF CABINET**



(2) **BUILDING TELEPHONE BACKBOARD**



(1 / E3.06A) **ELECTRICAL BUILDING 6 BASEMENT PLAN**
SCALE: 1/8" = 1'-0"

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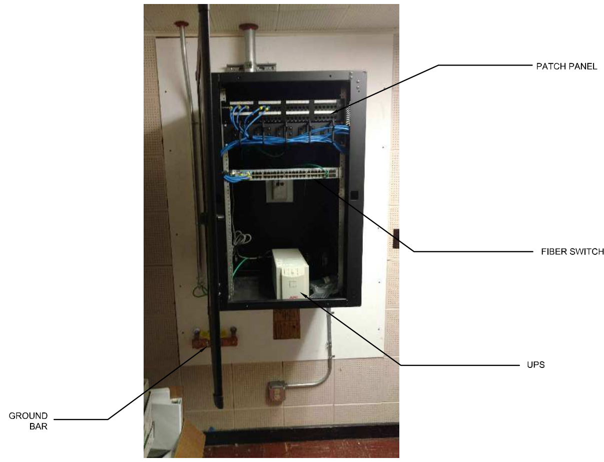
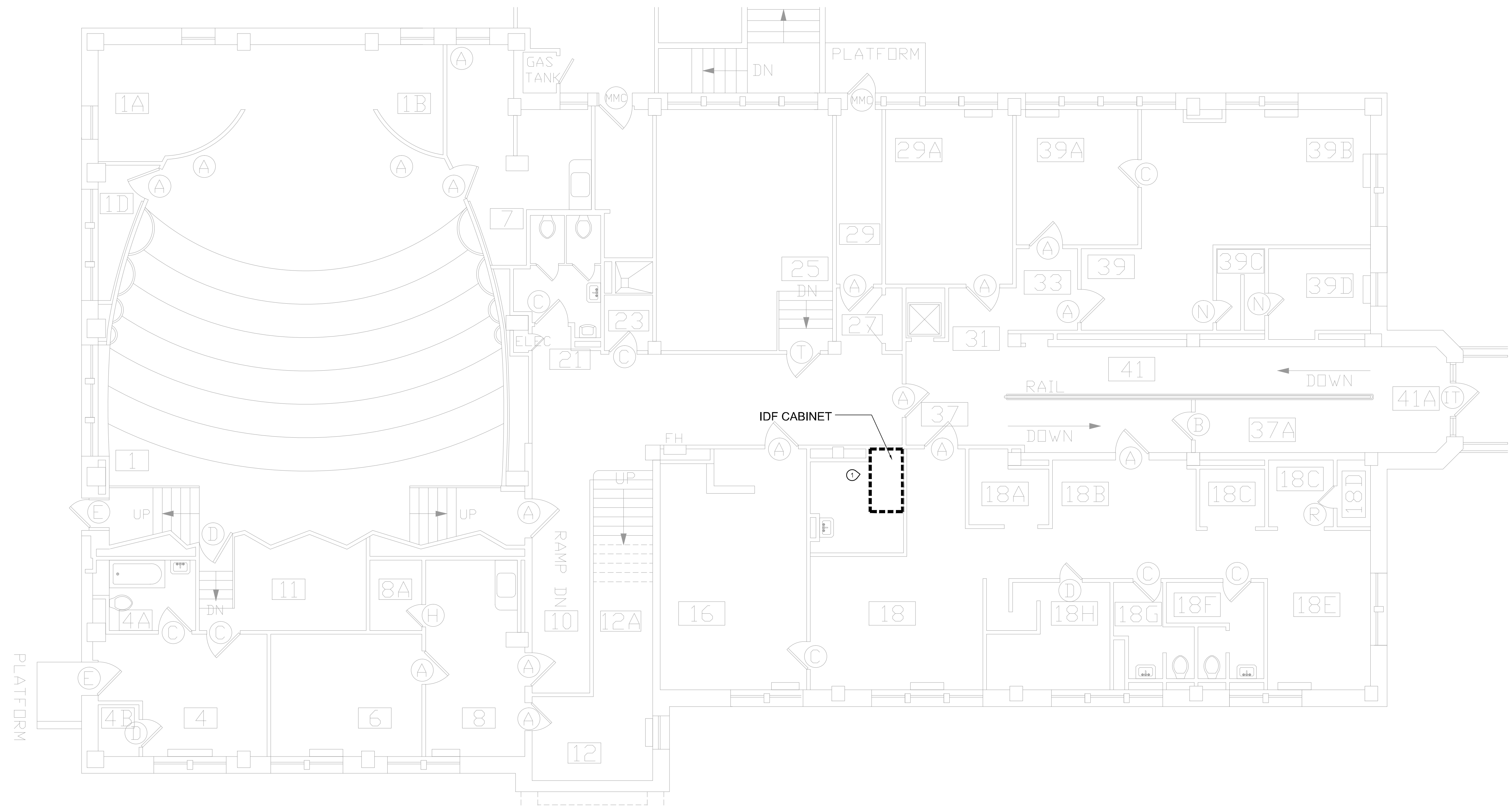
SHEET TITLE
BUILDING 6
TELECOMMUNICATIONS
BASEMENT FLOOR PLAN

SHEET NUMBER
E3.06A



1 BUILDING 8 BASEMENT ELEVATIONS



1 E3.08A ELECTRICAL BUILDING 8 GROUND FLOOR PLAN
SCALE: 1/4" = 1'-0"

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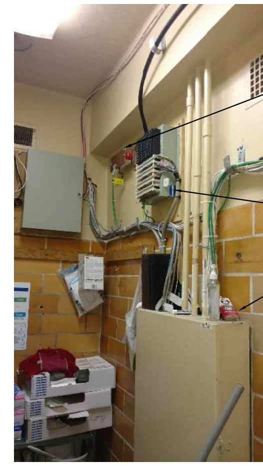
SHEET TITLE

BUILDING 8
TELECOMMUNICATIONS
GROUND FLOOR PLAN

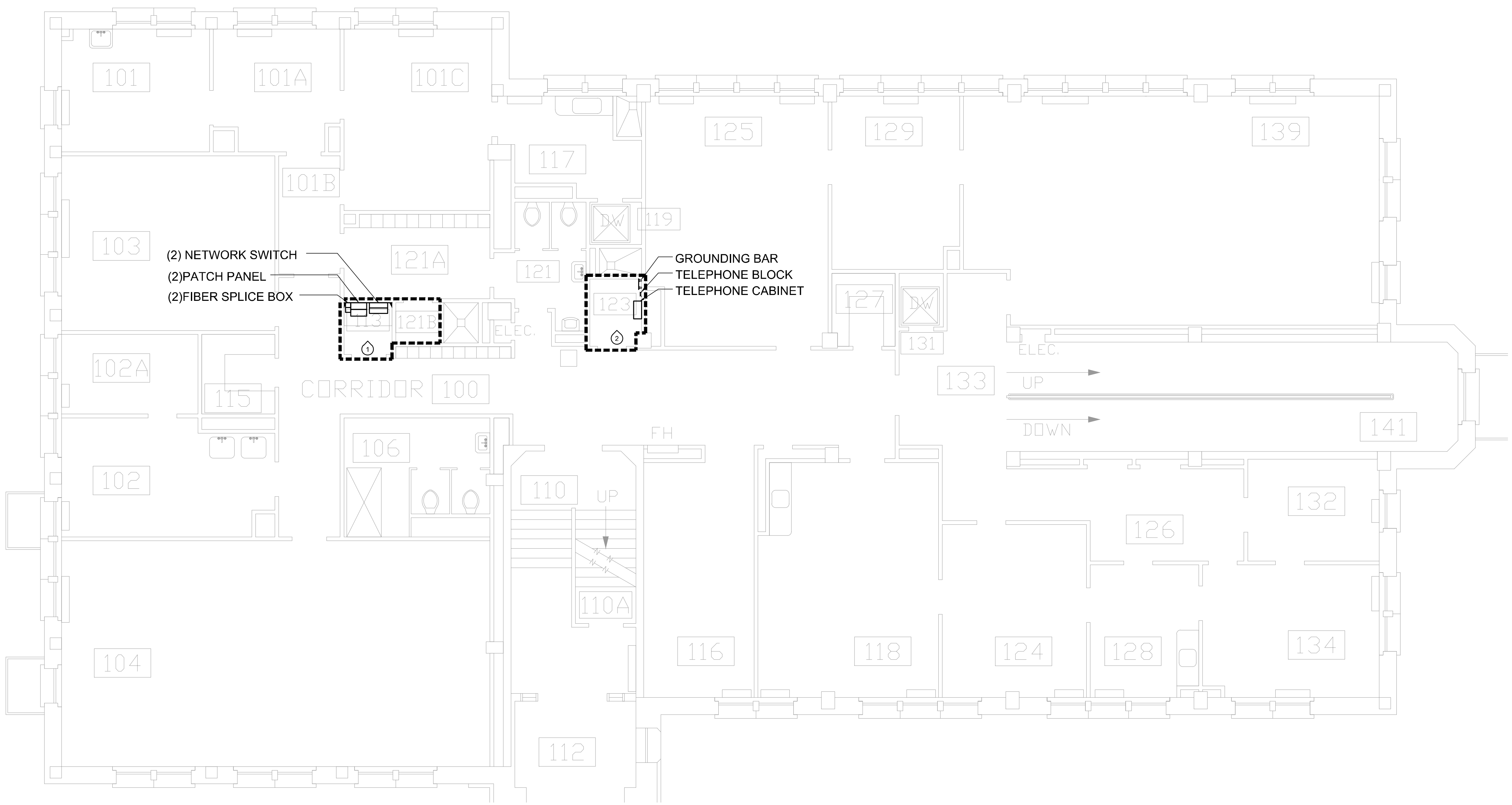
SHEET NUMBER

E3.08A

① BUILDING 8 FIBER CLOSET ELEVATIONS



② BUILDING 8 JANITOR CLOSET ELEVATIONS



ELECTRICAL BUILDING 8 FIRST FLOOR PLAN
SCALE: 1/4" = 1'-0"

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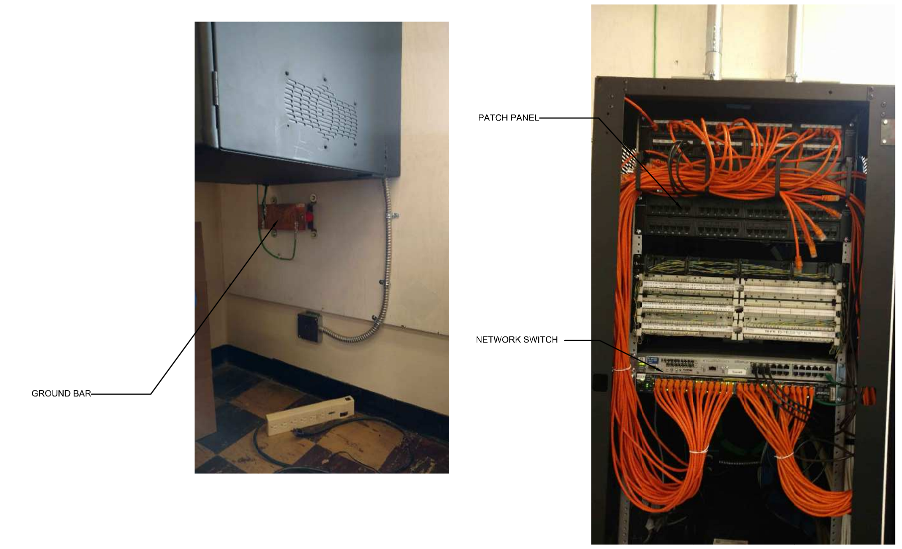
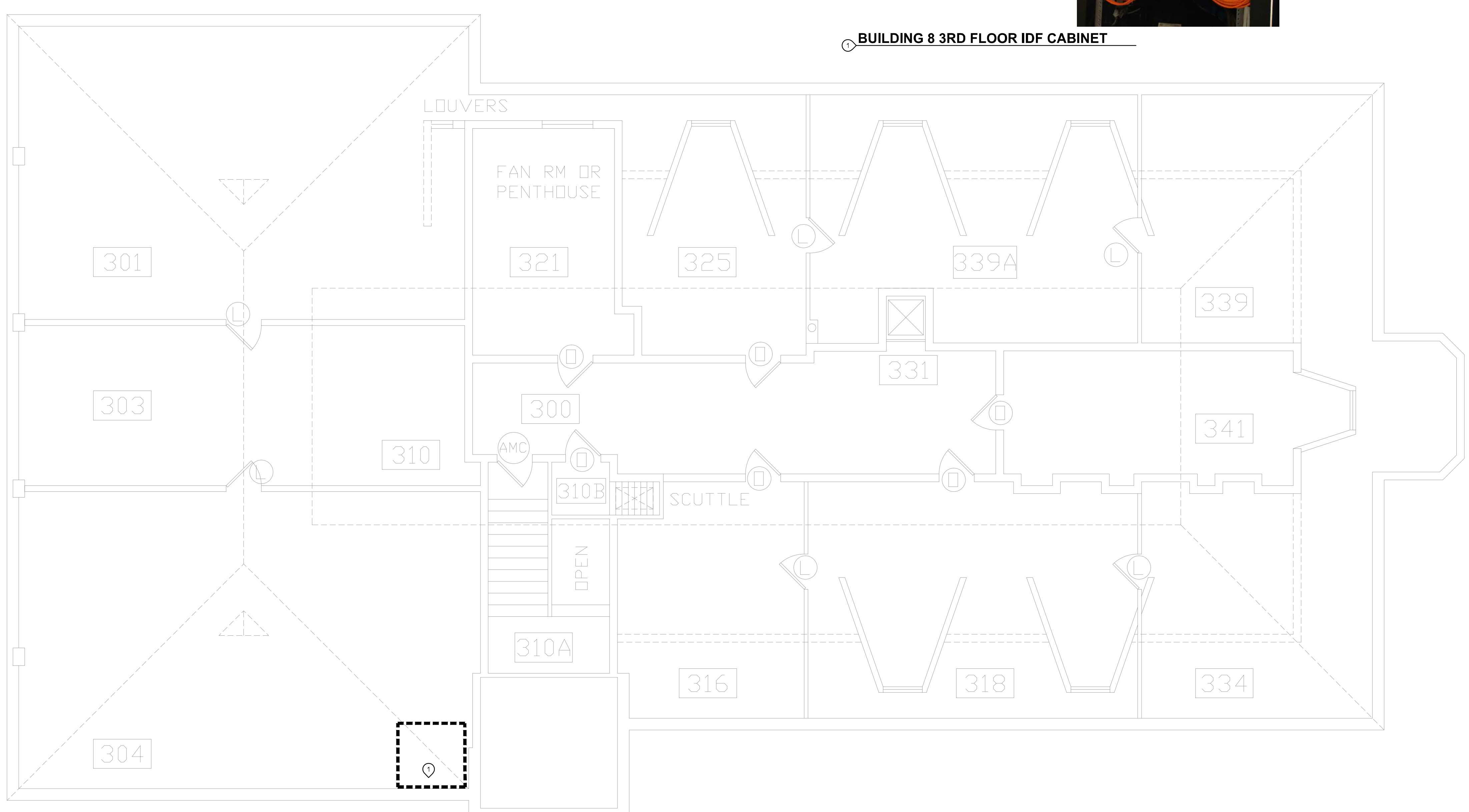
SHEET TITLE
BUILDING 8
TELECOMMUNICATIONS
FIRST FLOOR PLAN

SHEET NUMBER
E3.08B



1 **BUILDING 8 3RD FLOOR IDF CABINET**



1 E3.08C **ELECTRICAL BUILDING 8 3RD FLOOR PLAN**
SCALE: 1/8" = 1'-0"

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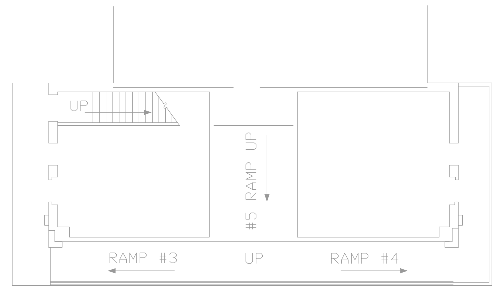
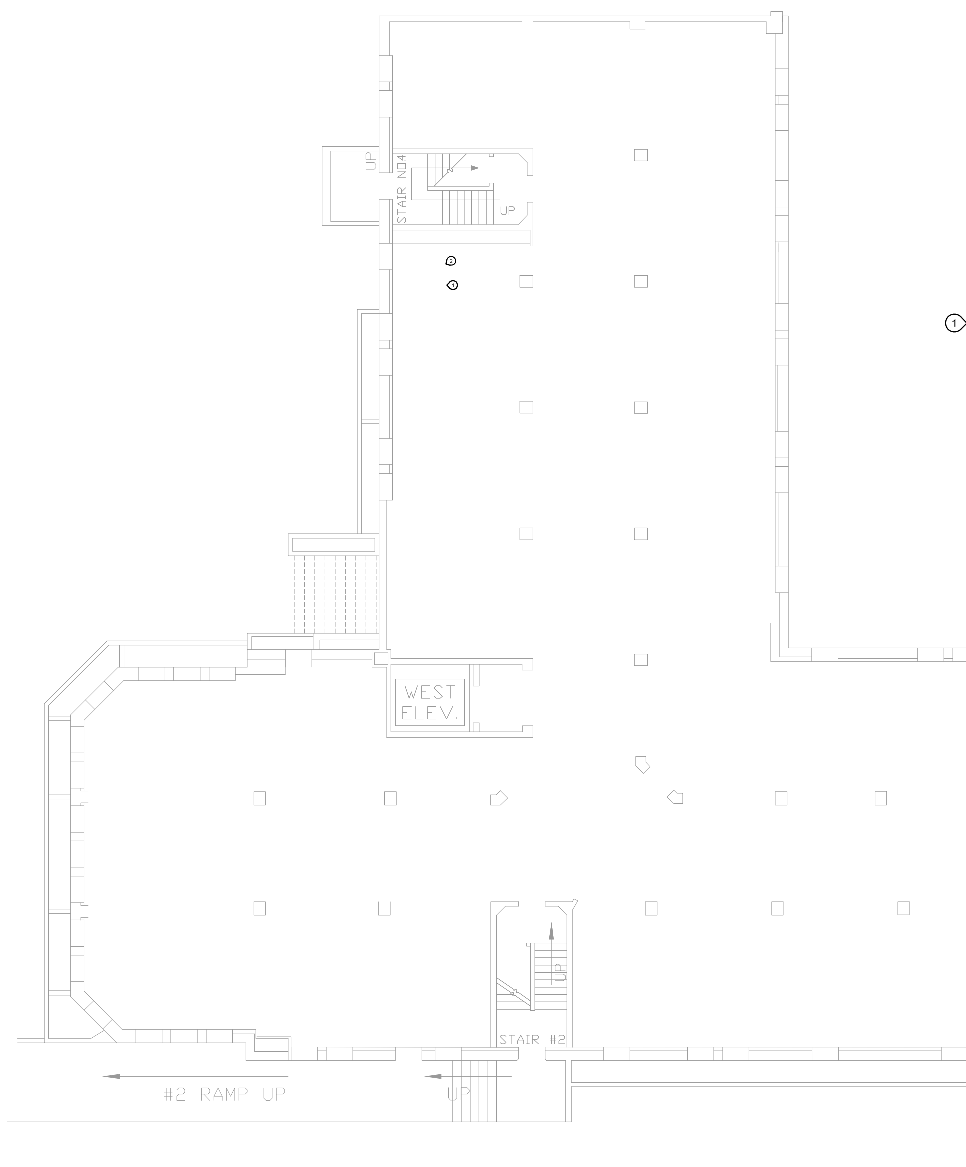
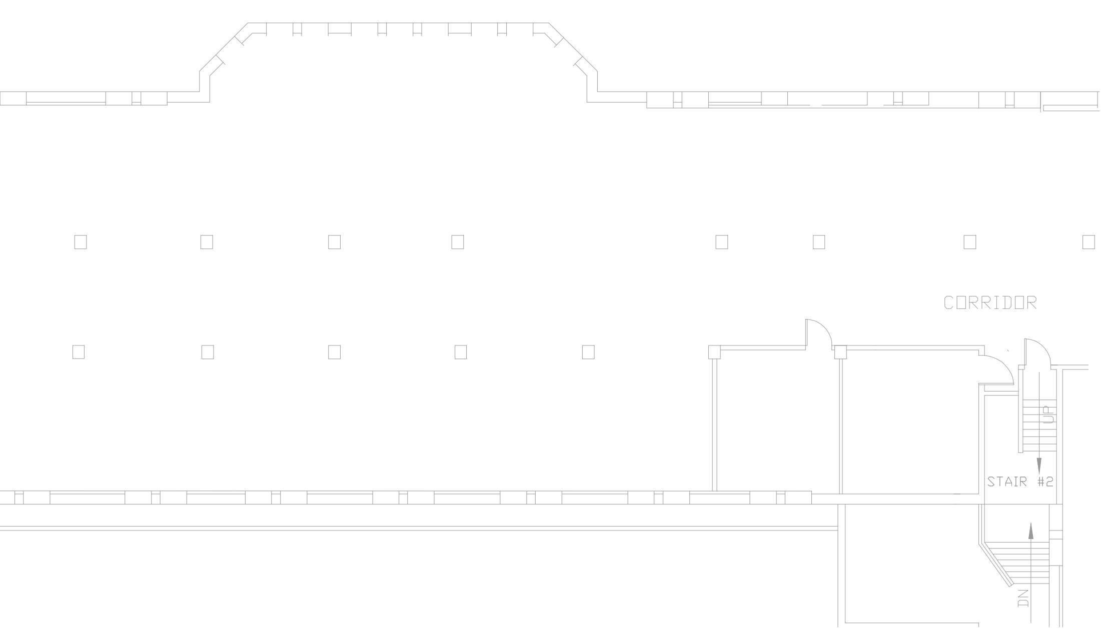
SHEET TITLE
BUILDING 8
TELECOMMUNICATIONS
SECOND FLOOR PLAN

SHEET NUMBER
E3.08C



1 PATHWAY TO BLDG 8

2 PATHWAY TO BLDG 8

1 BUILDING 9 TELECOMMUNICATIONS BASEMENT FLOOR PLAN

E3.09A

SCALE: 1/8" = 1'-0"

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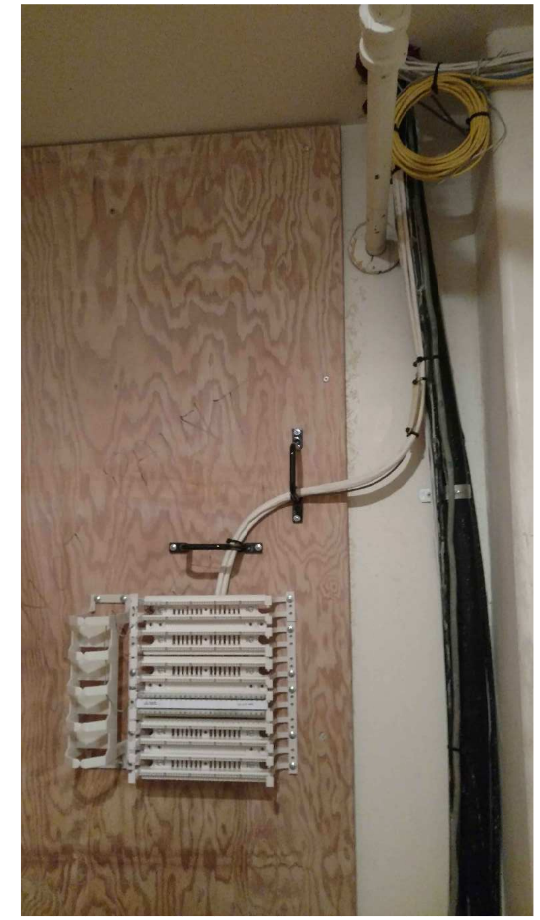
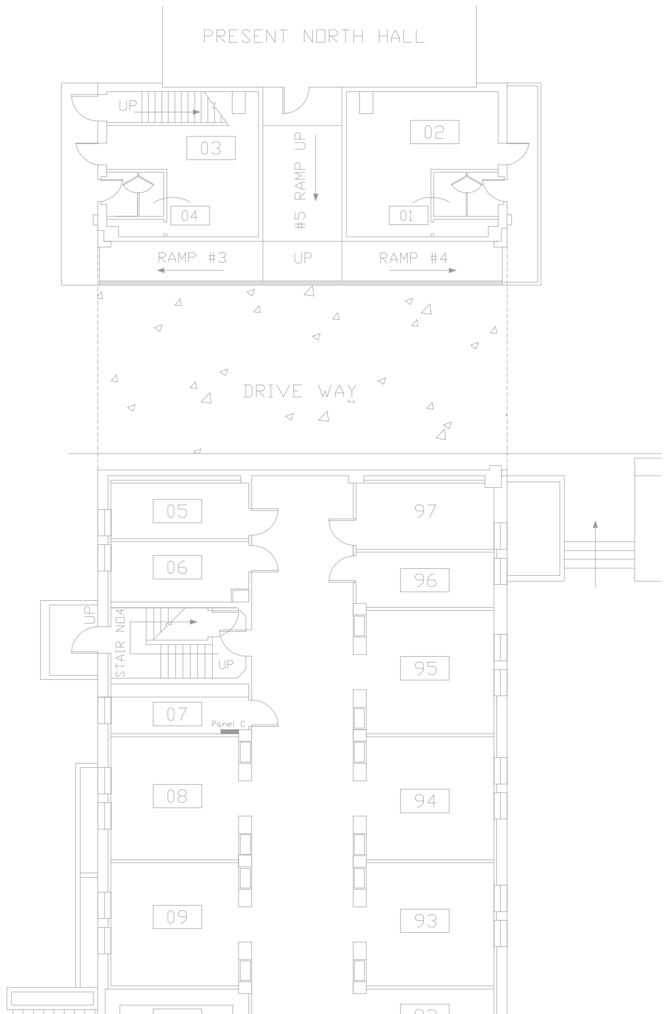
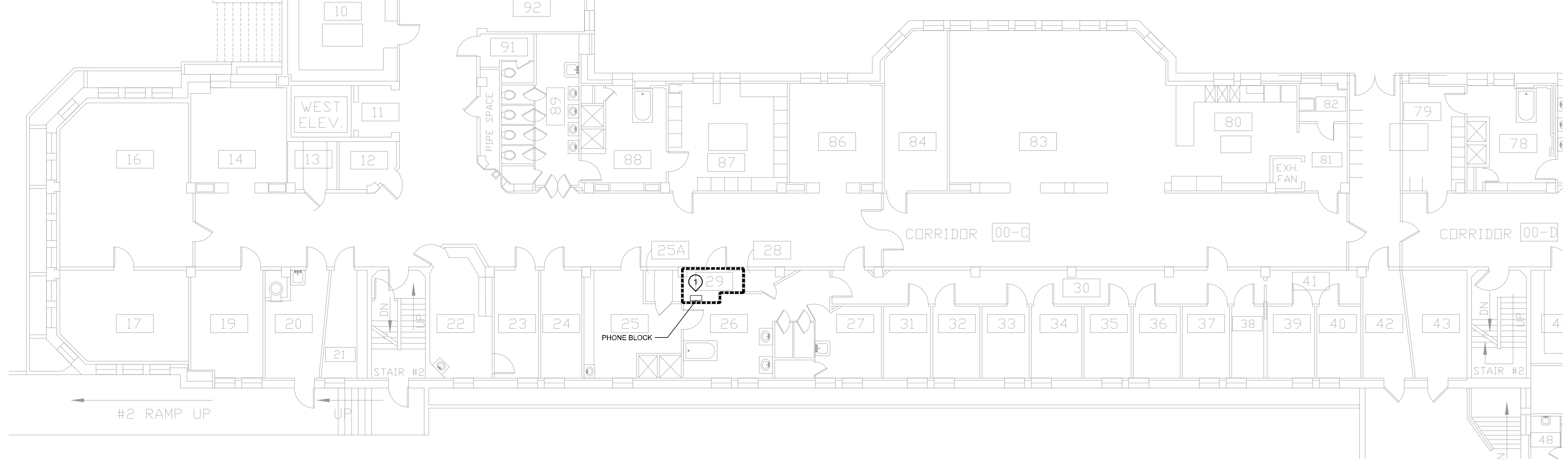
SHEET TITLE
BUILDING 9 TELECOMMUNICATIONS BASEMENT FLOOR PLAN

SHEET NUMBER
E3.09A



BUILDING 9 BASEMENT IDF ELEVATION

BUILDING 9 TELECOMMUNICATIONS GROUND FLOOR PLAN
SCALE: 1/8" = 1'-0"

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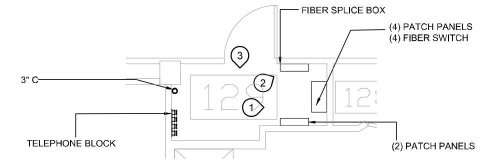
SHEET TITLE

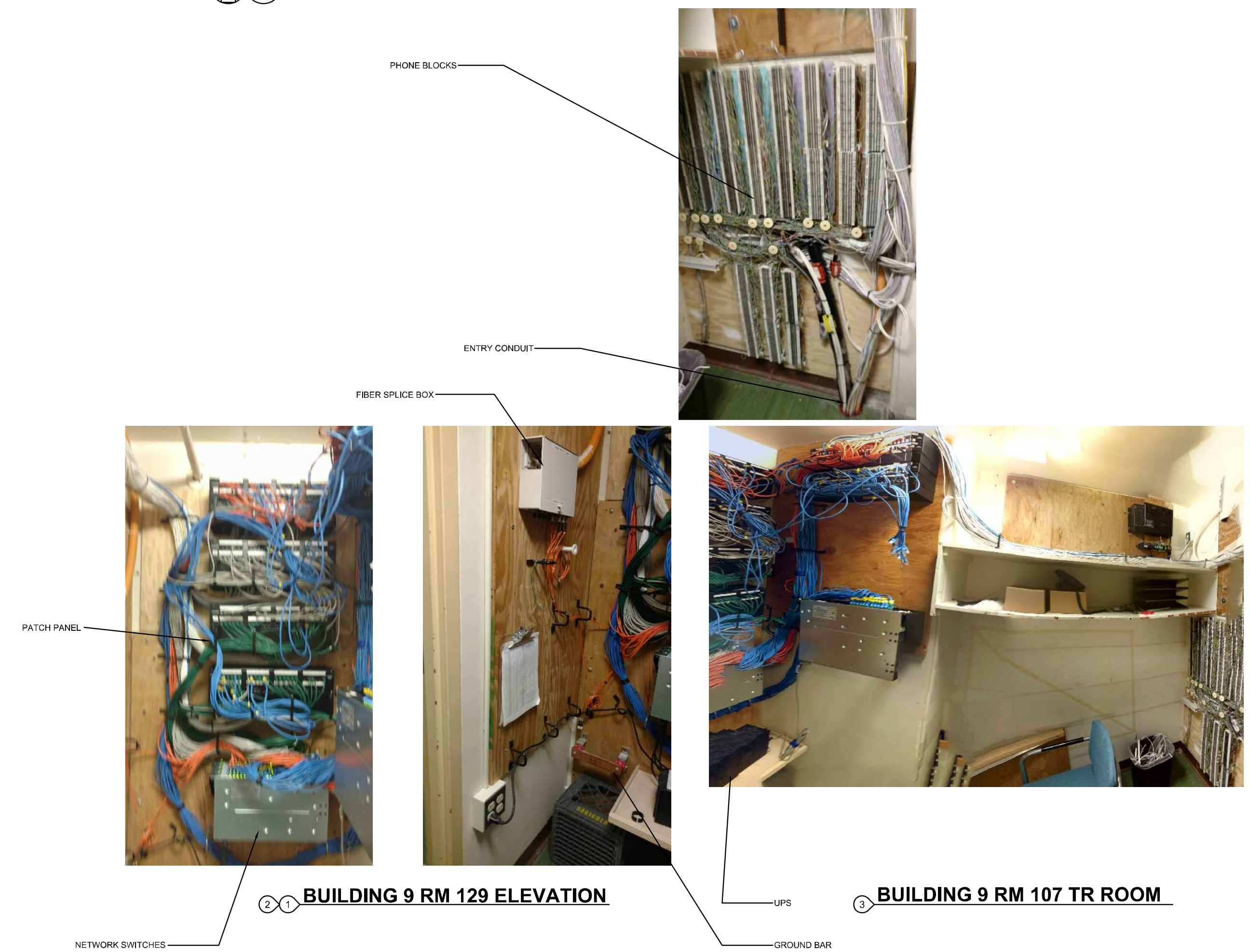
BUILDING 9
TELECOMMUNICATIONS
GROUND FLOOR PLAN

SHEET NUMBER

E3.09B

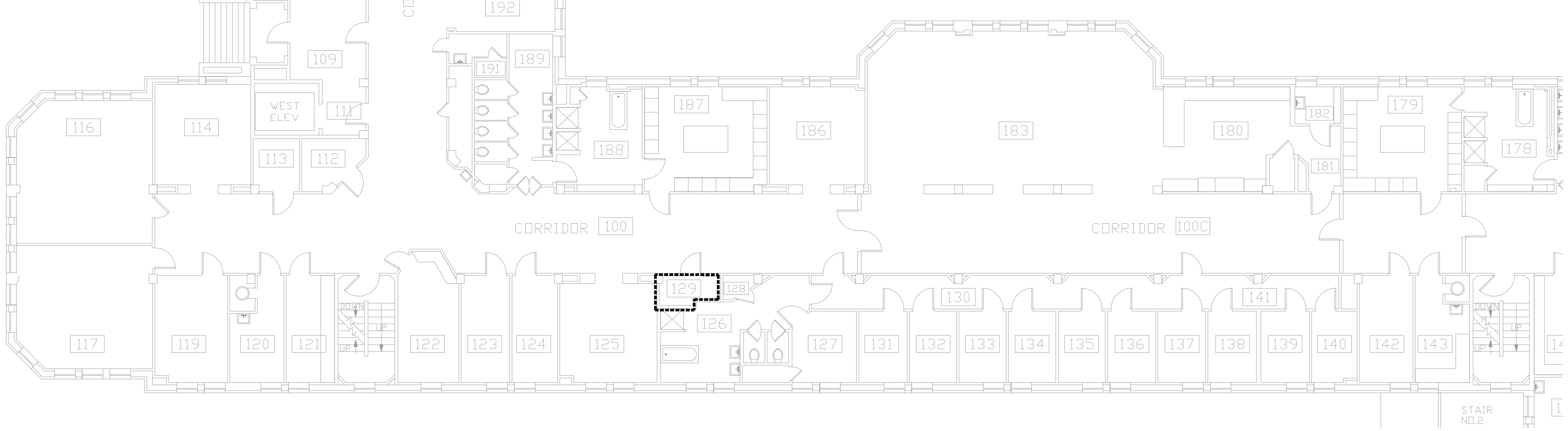


BUILDING 9 ROOM 107 ENLARGED PLAN
SCALE: 1/4" = 1'-0"



BUILDING 9 RM 129 ELEVATION

BUILDING 9 RM 107 TR ROOM



BUILDING 9 TELECOMMUNICATIONS FIRST FLOOR PLAN
SCALE: 1/8" = 1'-0"

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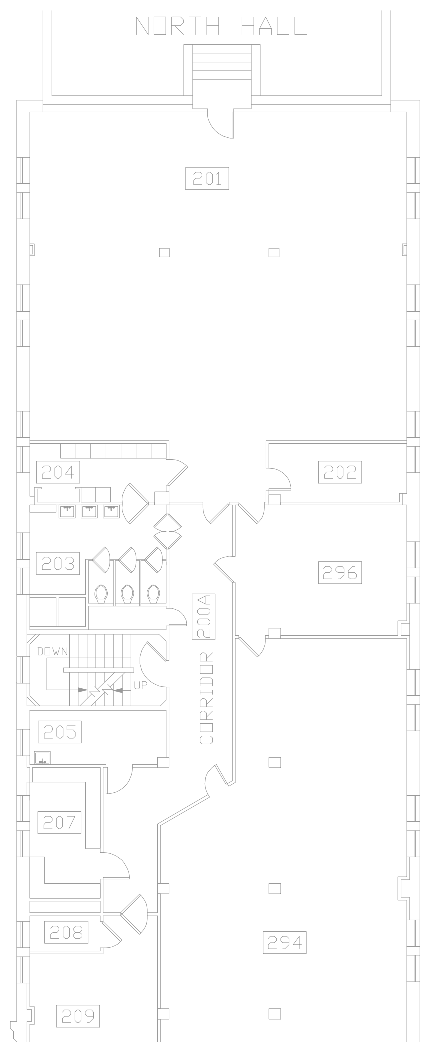
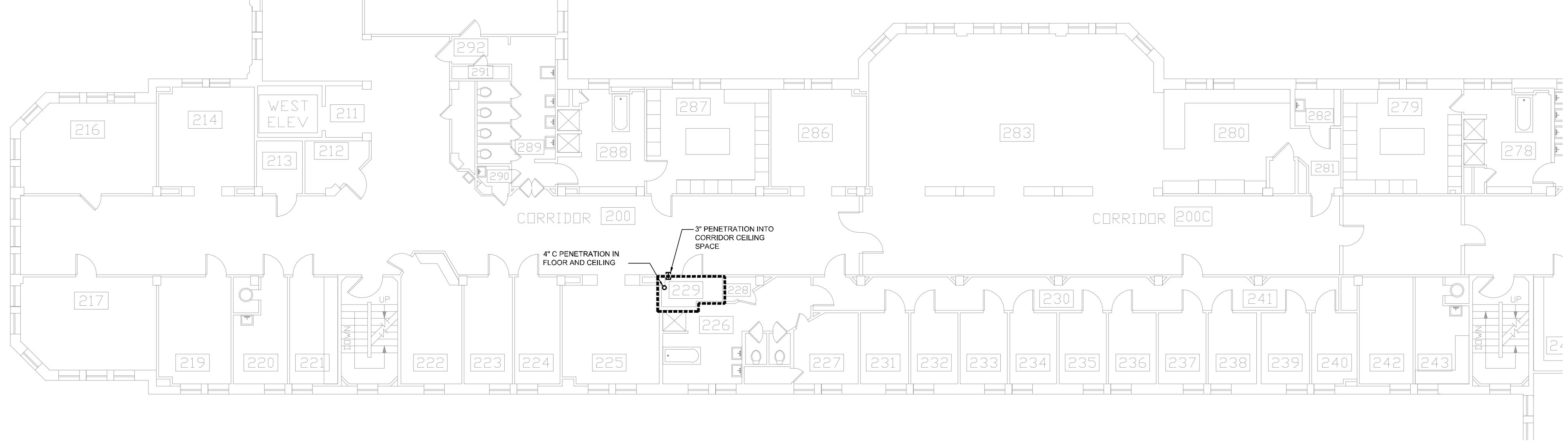
SHEET TITLE
BUILDING 9 TELECOMMUNICATIONS FIRST FLOOR PLAN

SHEET NUMBER
E3.09C

① BUILDING 9 RM 229 ELEVATION

① E3.09D BUILDING 9 TELECOMMUNICATIONS SECOND FLOOR PLAN
SCALE: 1/8" = 1'-0"

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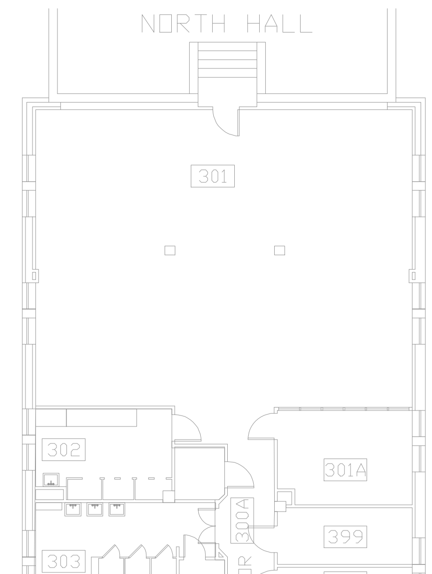
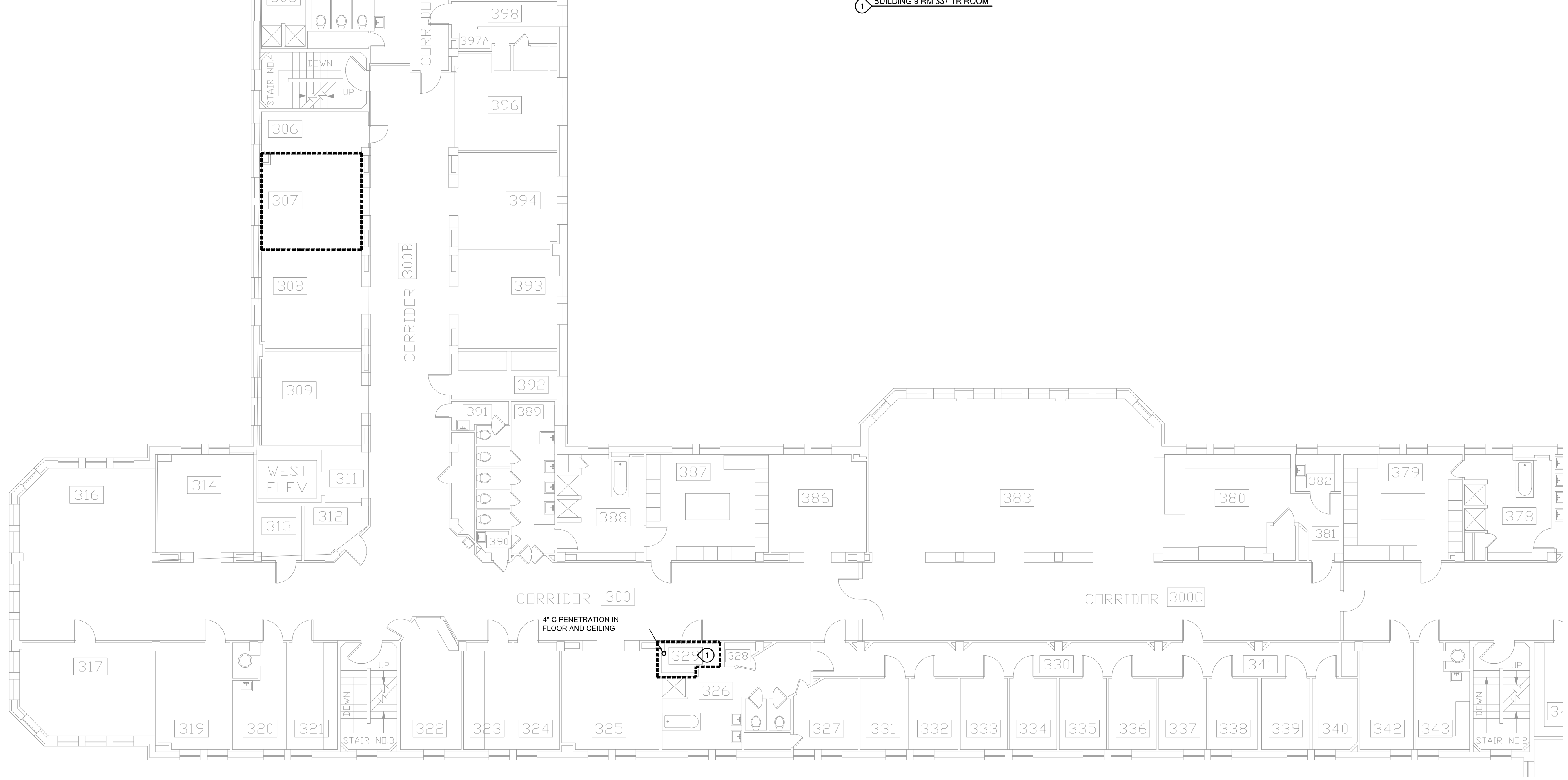
SHEET TITLE

BUILDING 9
TELECOMMUNICATIONS
SECOND FLOOR PLAN

SHEET NUMBER

E3.09D

1 BUILDING 9 RM 337 TR ROOM

1 E3.09E **BUILDING 9 TELECOMMUNICATIONS THIRD FLOOR PLAN**
SCALE: 1/8" = 1'-0"

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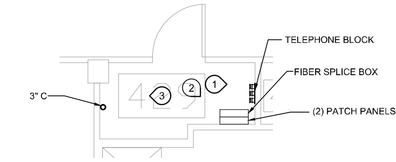
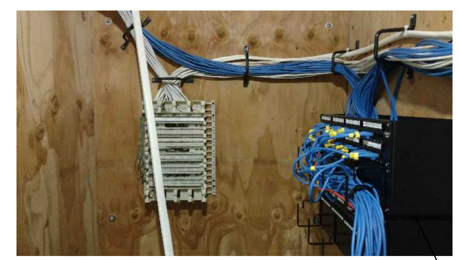
SHEET TITLE
BUILDING 9
TELECOMMUNICATIONS
THIRD FLOOR PLAN

SHEET NUMBER
E3.09E



BUILDING 9 ROOM 435 ENLARGED PLAN
SCALE: 1/8" = 1'-0"

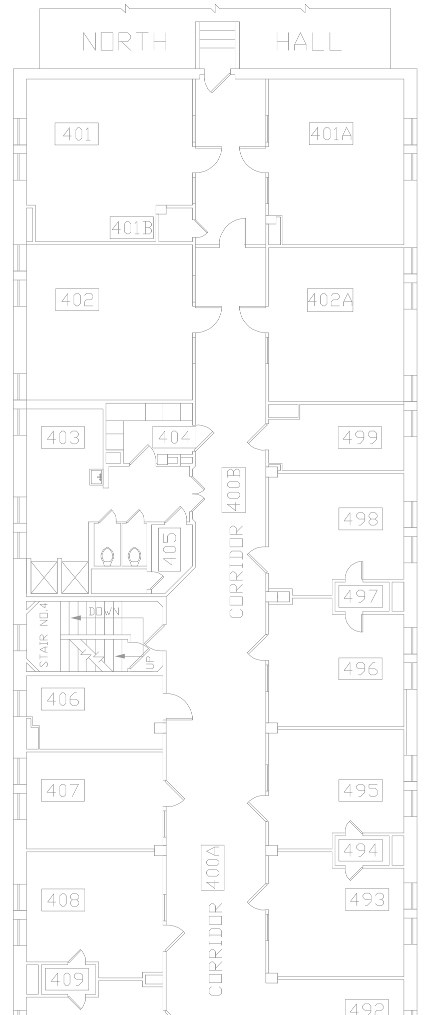
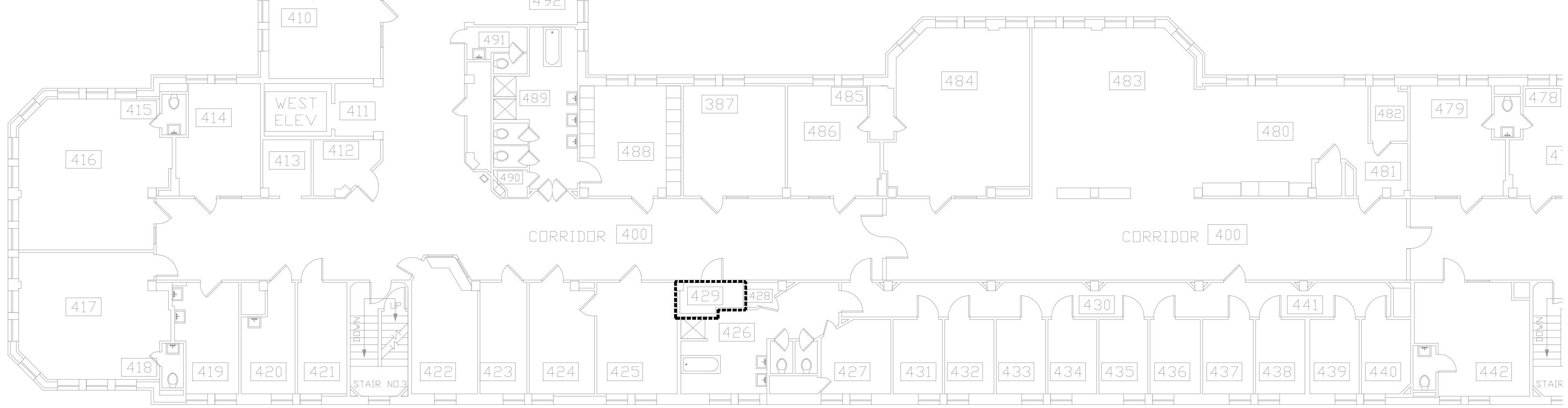

③ BULDING 9 RM 435 TR ROOM



① BUILDING 9 RM 435 TR ROOM

④ BUILDING 9 RM 435 TR ROOM

UPS
NETWORK SWITCH
GROUND BAR
PATCH PANEL

BUILDING 9 TELECOMMUNICATIONS FOURTH FLOOR PLAN
SCALE: 1/8" = 1'-0"

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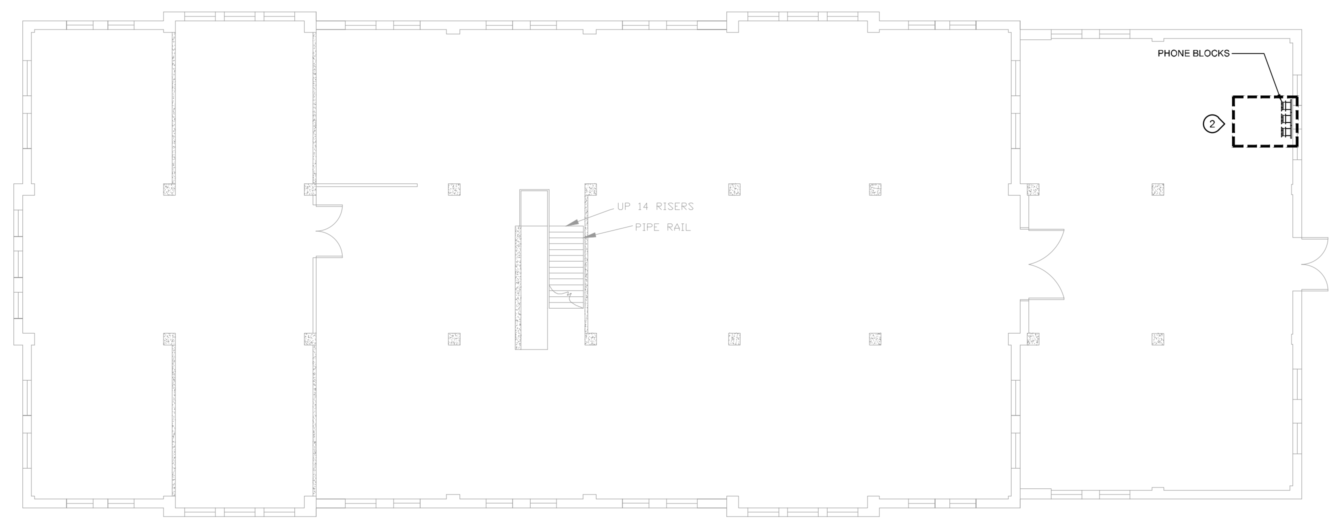
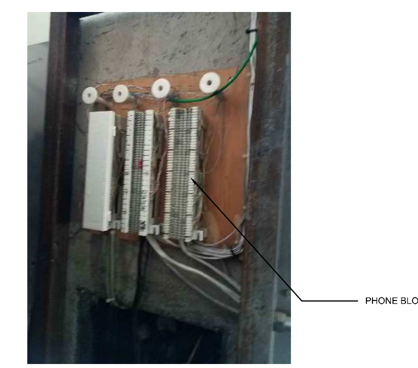
SHEET TITLE
BUILDING 9 TELECOMMUNICATIONS FOURTH FLOOR PLAN

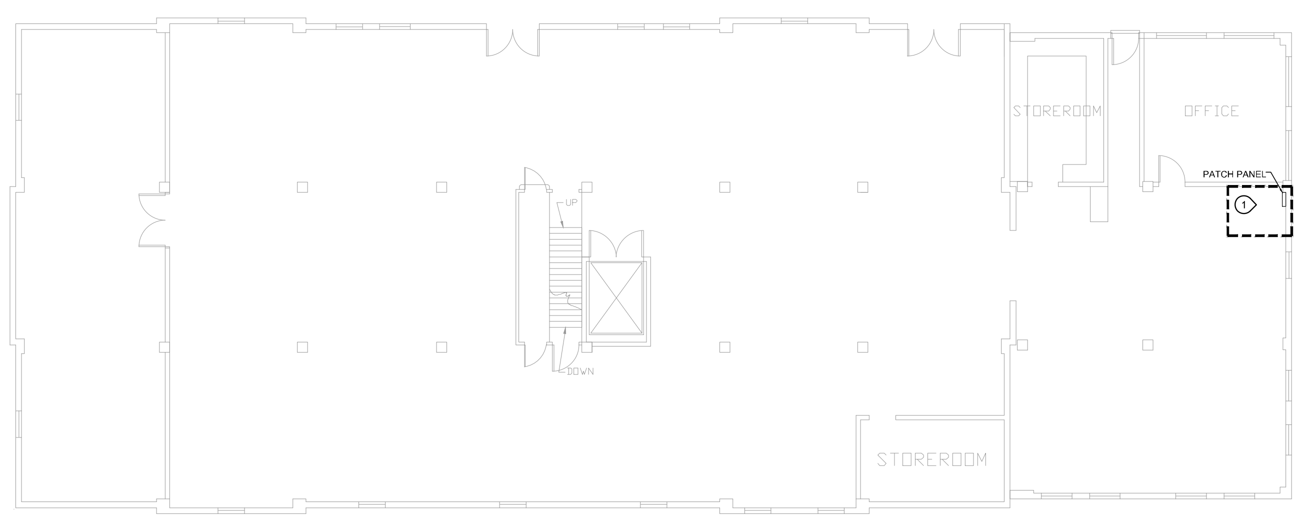
SHEET NUMBER
E3.09F



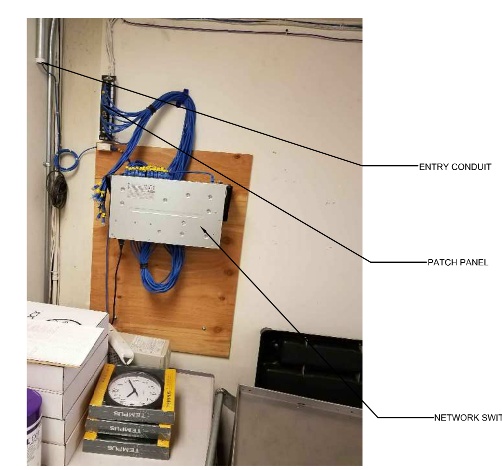
ELECTRICAL BUILDING 11 BASEMENT FLOOR PLAN
1 E3.11A
SCALE: 1/8" = 1'-0"



2 BUILDING 11 BASEMENT ELEVATIONS



ELECTRICAL BUILDING 11 FIRST FLOOR PLAN
2 E3.11A
SCALE: 1/8" = 1'-0"



1 BUILDING 11 FIRST FLOOR ELEVATIONS

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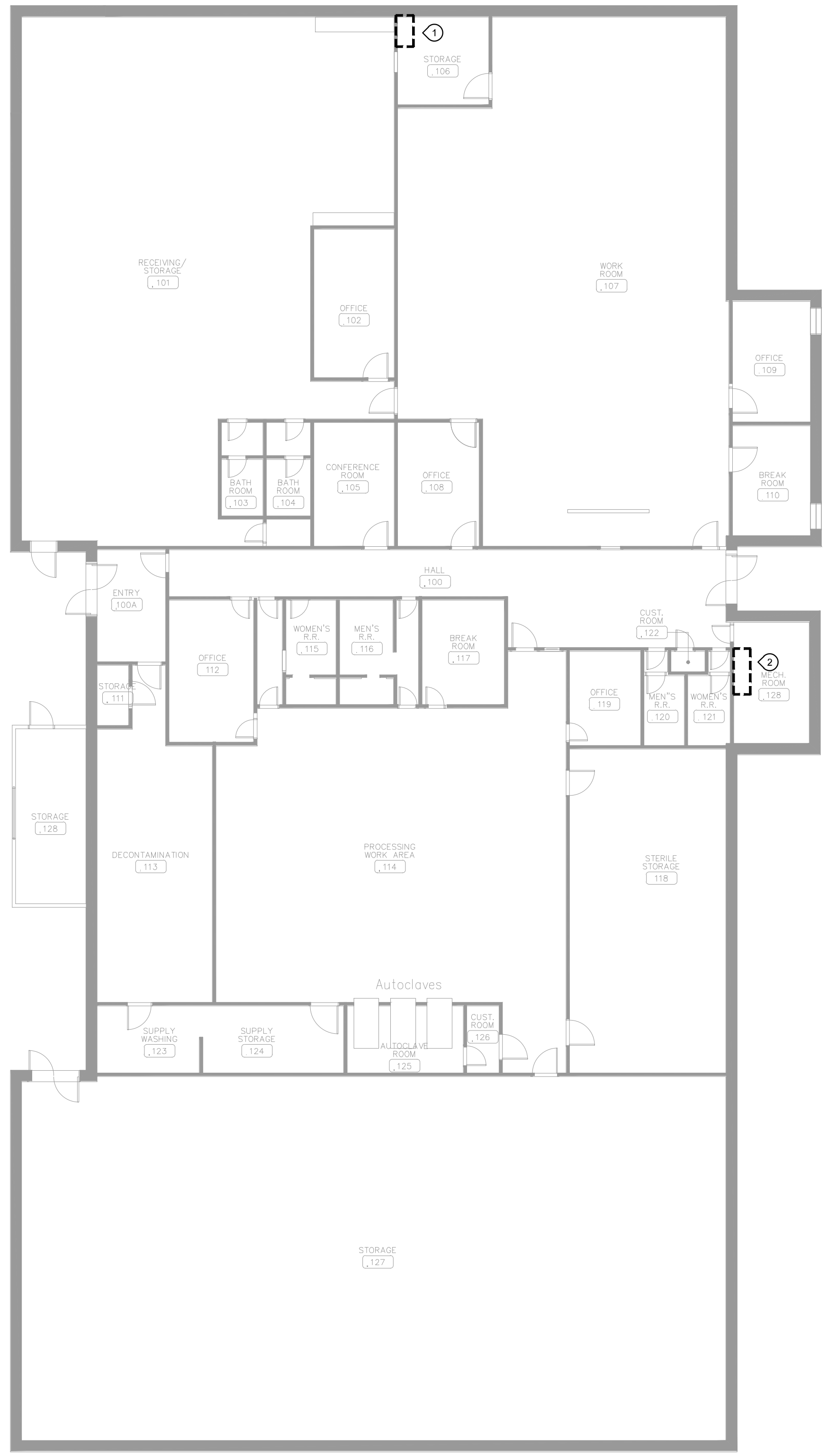
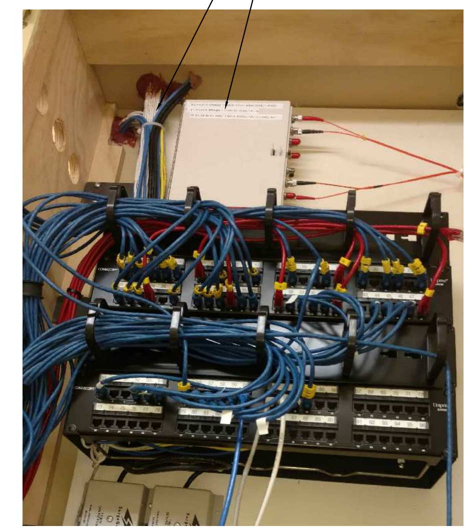
BUILDING 11 TELECOMMUNICATIONS FLOOR PLANS

SHEET NUMBER
E3.11A

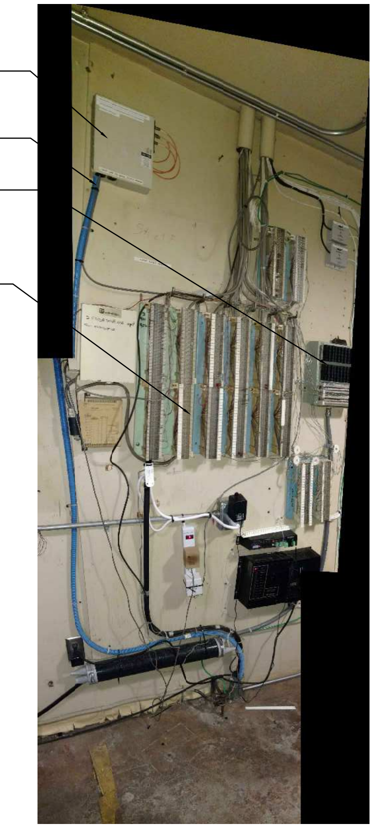


BUILDING 13 TELECOMMUNICATIONS FLOOR PLAN

SCALE: 3/32" = 1'-0"



1 BUILDING 13 STORAGE ROOM ELEVATIONS



2 BUILDING 13 MECHANICAL ROOM ELEVATIONS

1 BUILDING 13 STORAGE ROOM ELEVATIONS

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WESTERN STATE HOSPITAL

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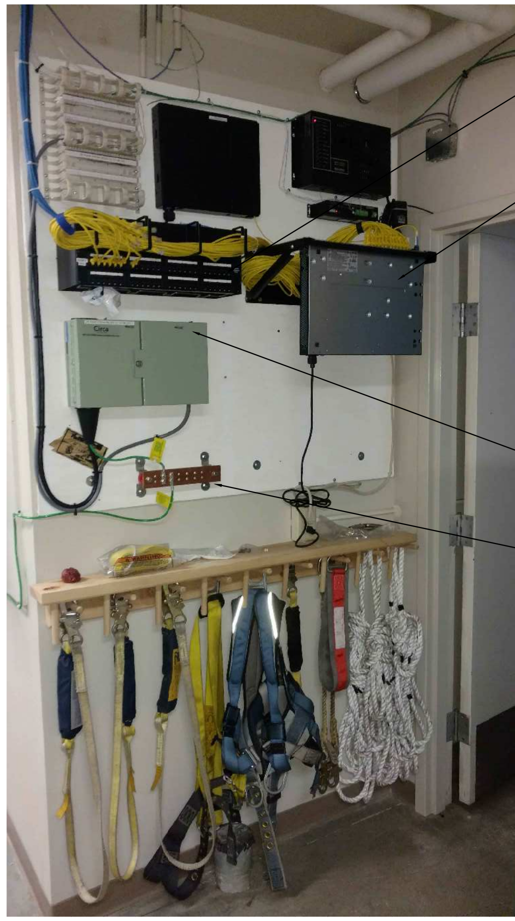
SHEET TITLE

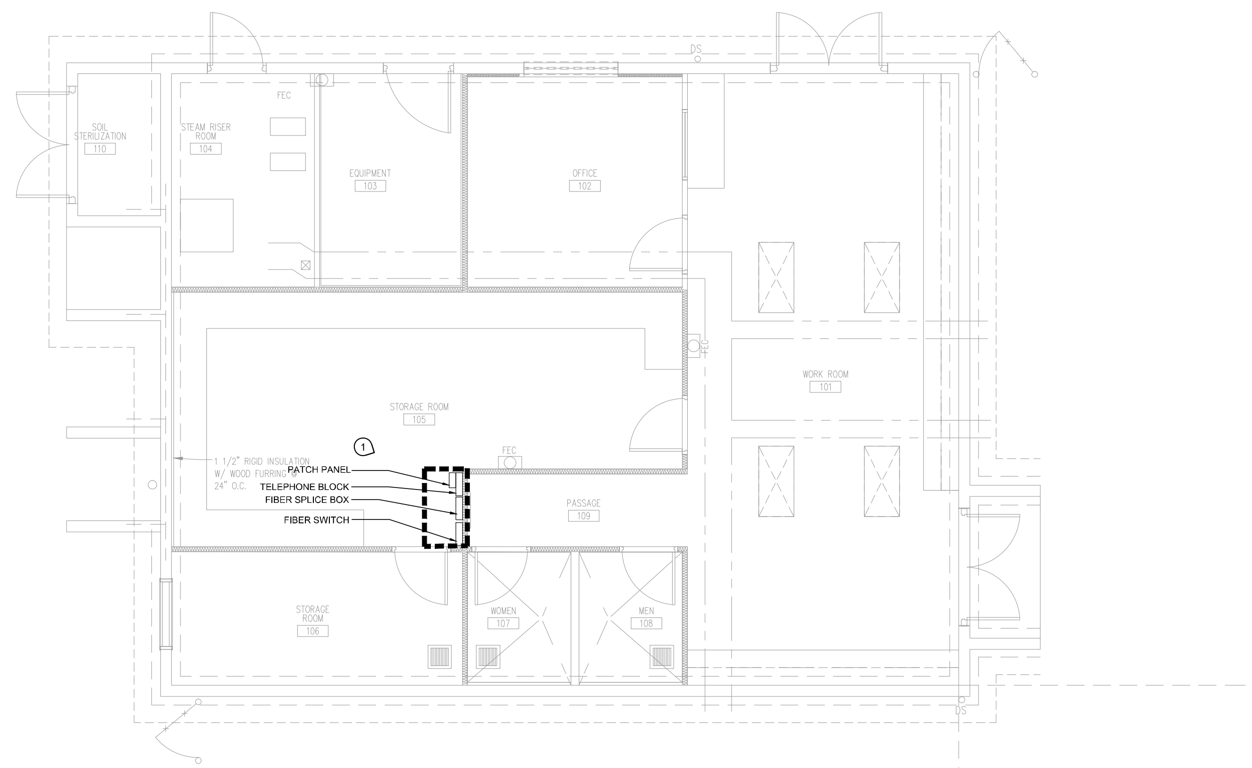
BUILDING 13 TELECOMMUNICATIONS FLOOR PLAN

SHEET NUMBER

E3.13A



1 **BUILDING 15 STORAGE ROOM ELEVATION**



N 1 E3.15A **BUILDING 15 TELECOMMUNICATIONS FLOOR PLAN**
SCALE: 1/4" = 1'-0"

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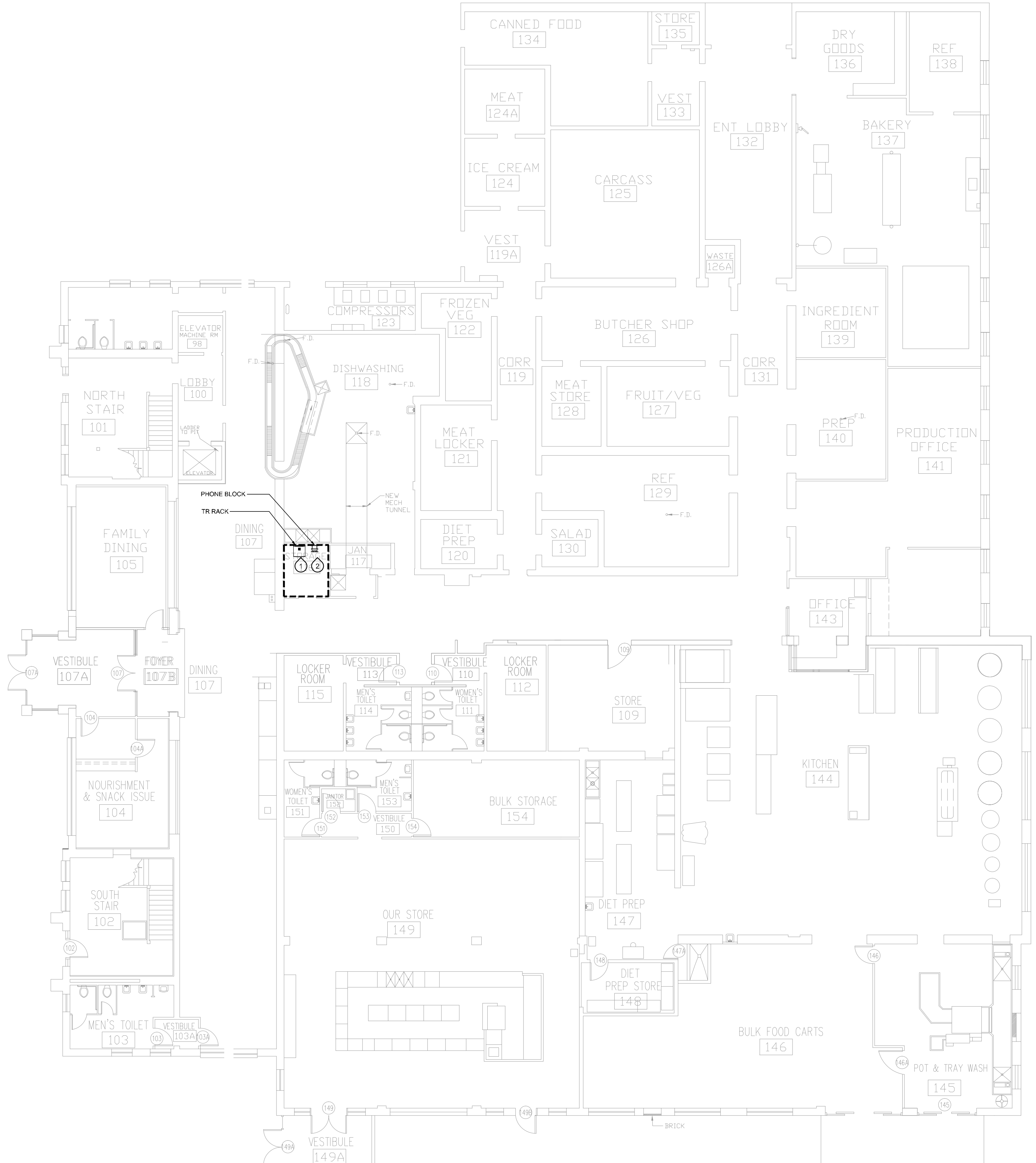
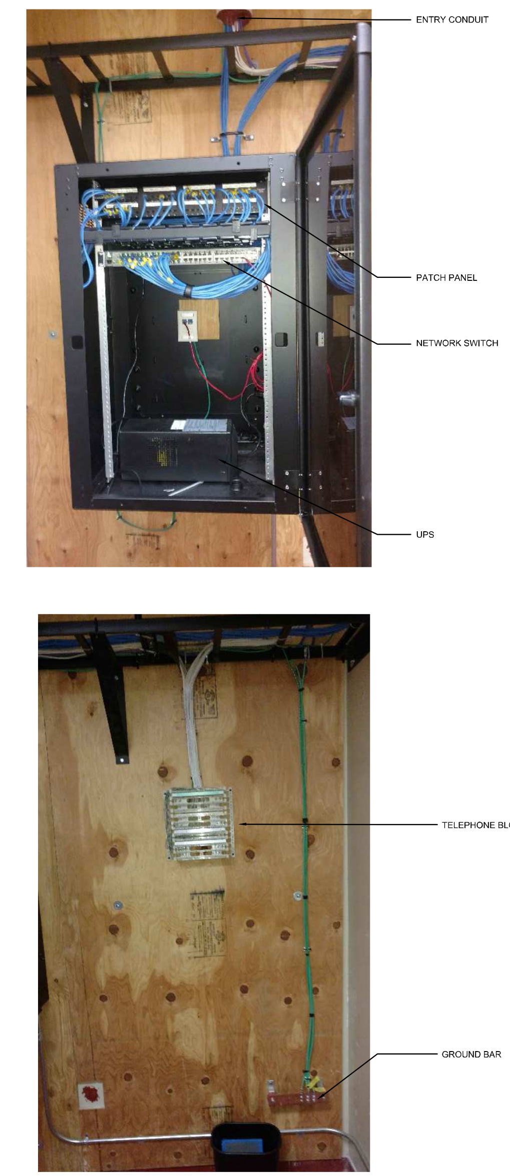
SHEET TITLE
BUILDING 15 TELECOMMUNICATIONS FLOOR PLAN

SHEET NUMBER
E3.15A



ELECTRICAL BUILDING 16 FIRST FLOOR PLAN

SCALE: 1/8" = 1'-0"



BUILDING 16 ROOM 116 ELEVATIONS

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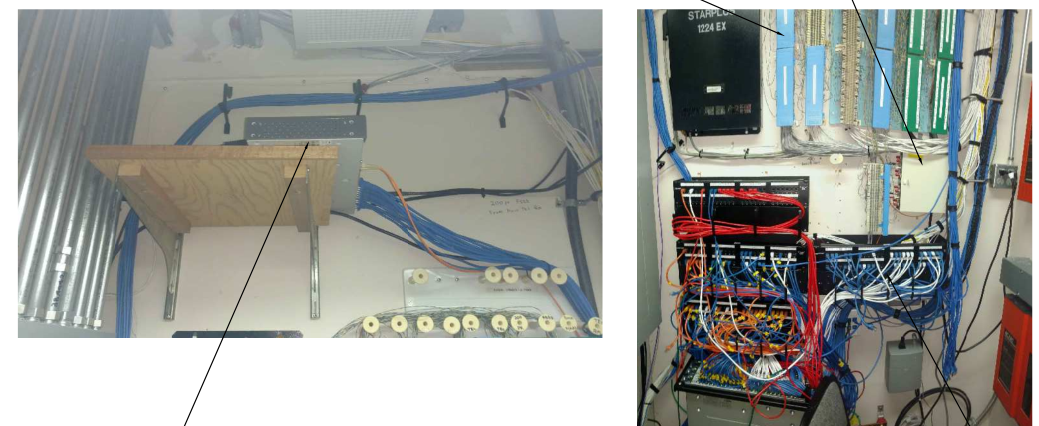
SHEET TITLE

BUILDING 16
TELECOMMUNICATIONS
FIRST FLOOR PLAN

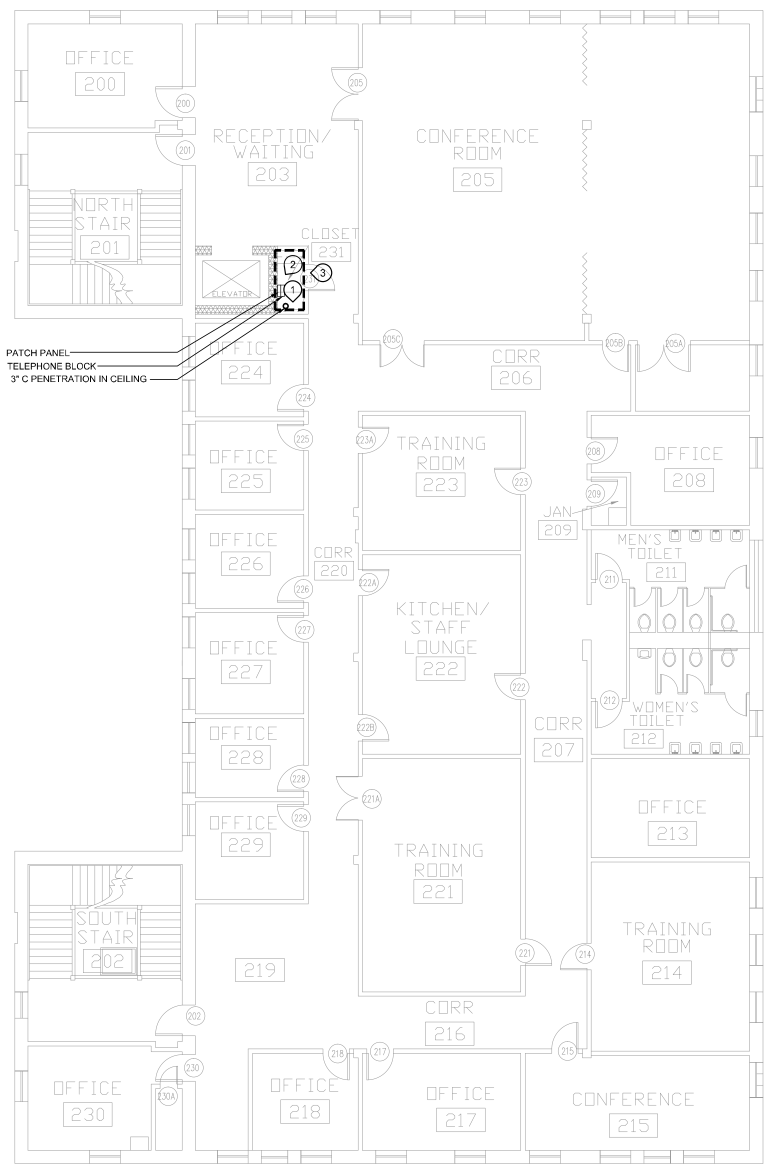
SHEET NUMBER

E3.16A

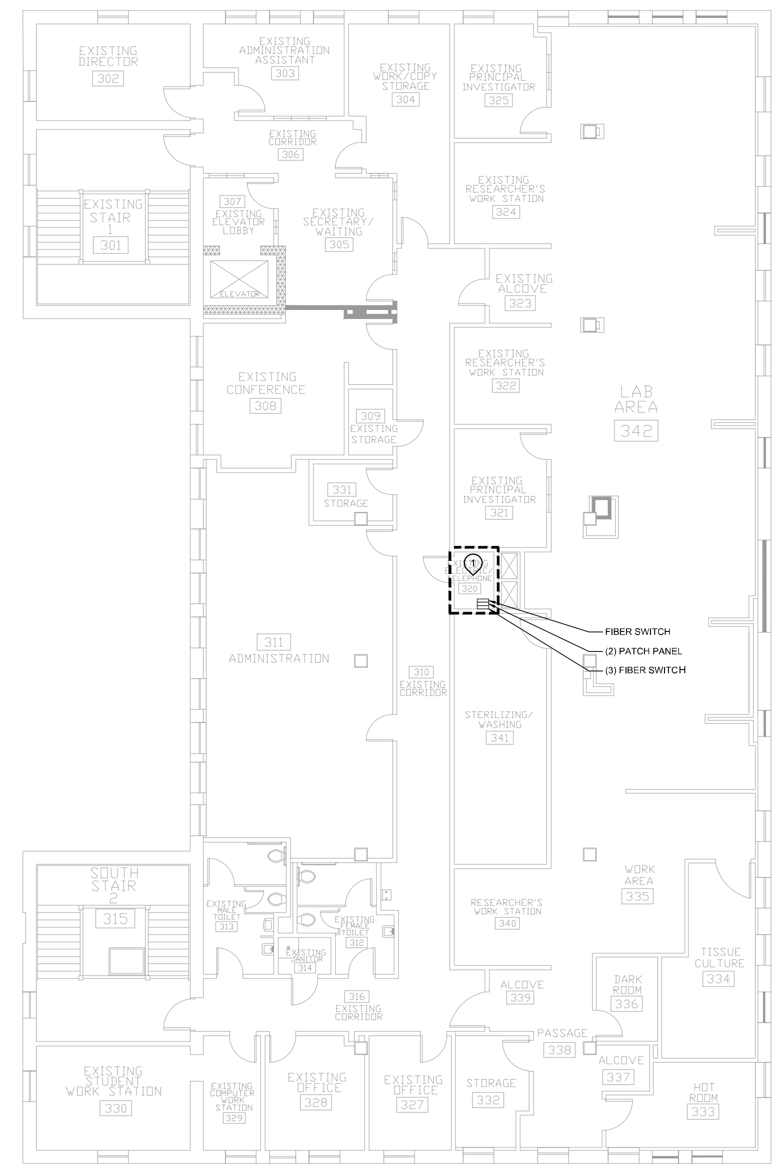
1 2 3 **BUILDING 16 ELECTRICAL CLOSET 232 ELEVATION**



4 **BUILDING 16 ELECTRICAL CLOSET 320 ELEVATION**



1 E3.16B **ELECTRICAL BUILDING 16 SECOND FLOOR PLAN**
SCALE: 1/8" = 1'-0"



1 E3.16B **ELECTRICAL BUILDING 16 THIRD FLOOR PLAN**
SCALE: 1/8" = 1'-0"

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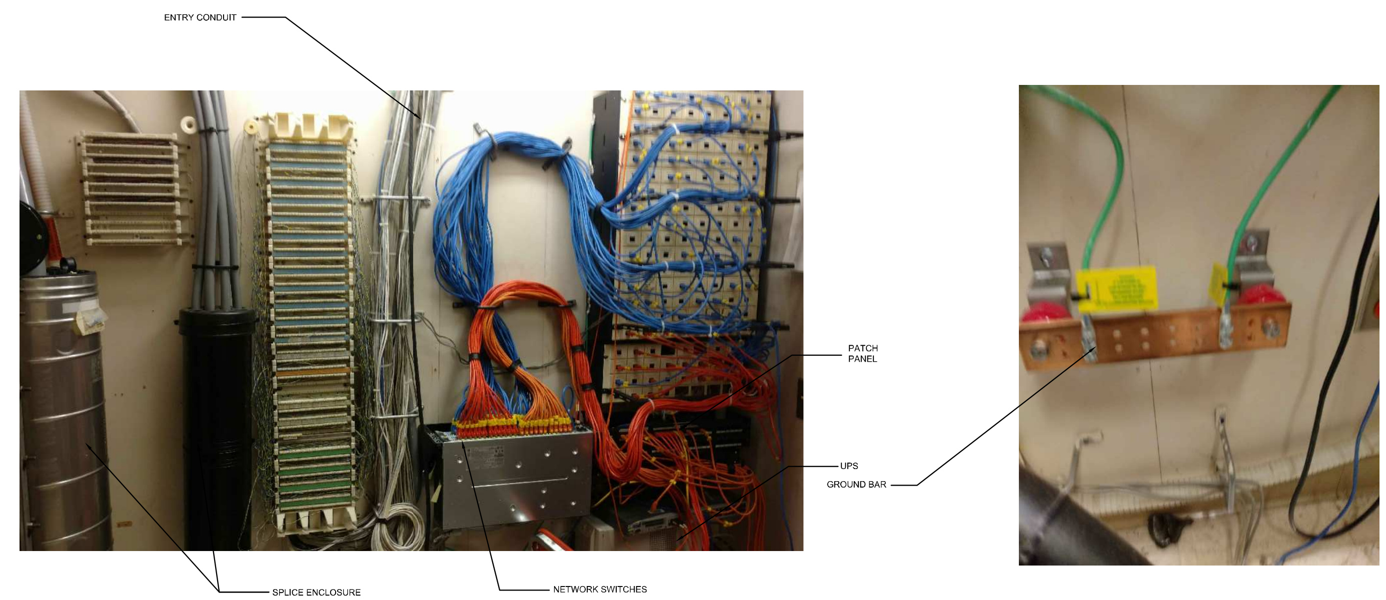
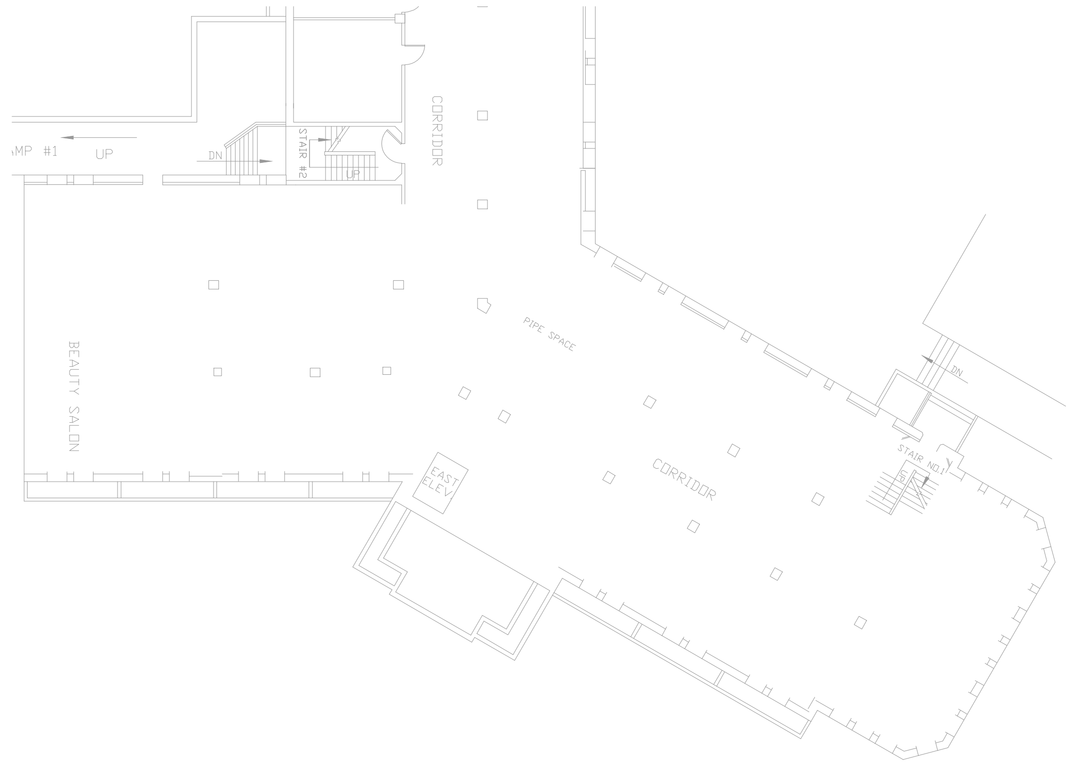
SHEET TITLE
BUILDING 16 TELECOMMUNICATIONS SECOND & THIRD FLOOR PLANS

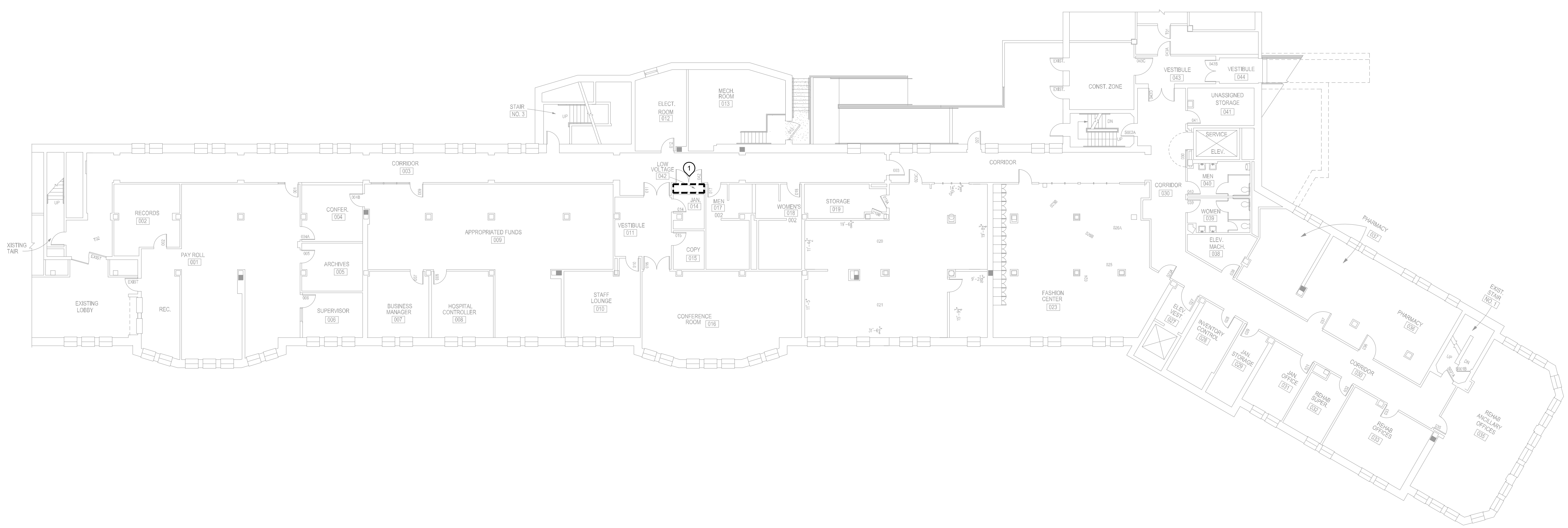
SHEET NUMBER
E3.16B



1 BUILDING 17 GROUND FLOOR IDF CLOSET



1 E3.17A ELECTRICAL BUILDING 17 BASEMENT PLAN
SCALE: 3/32" = 1'-0"



1 E3.17A ELECTRICAL BUILDING 17 GROUND FLOOR PLAN
SCALE: 3/32" = 1'-0"

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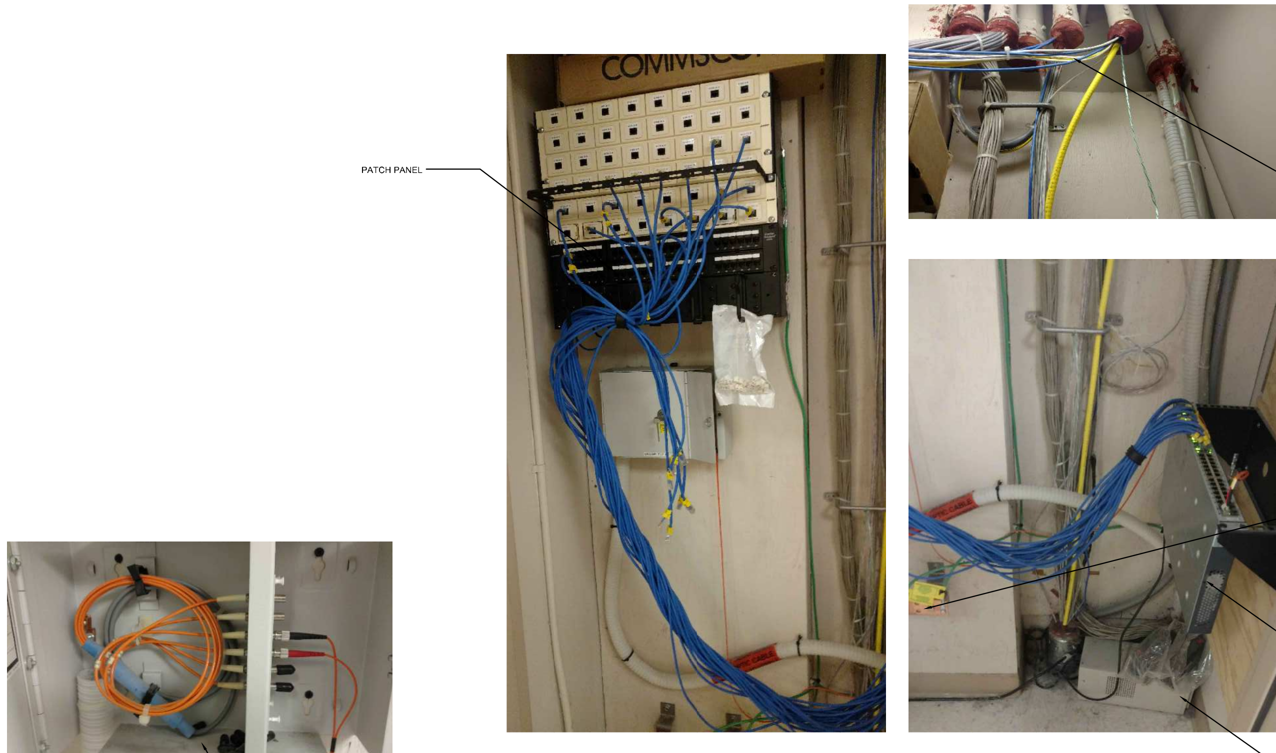
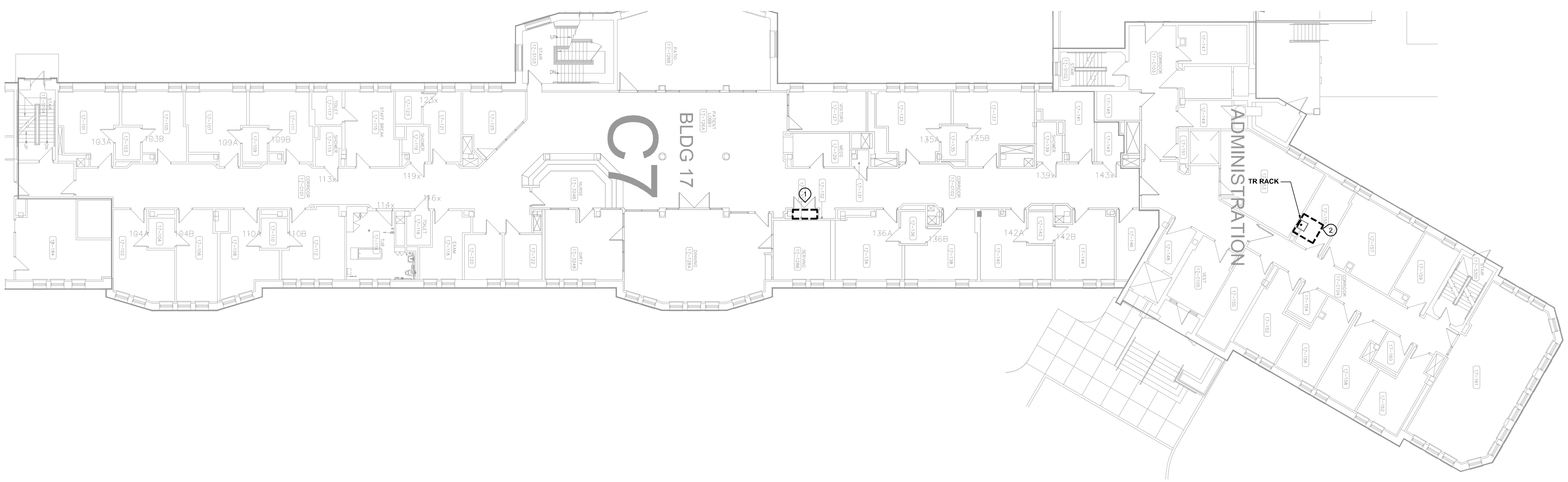
SHEET TITLE
BUILDING 17
TELECOMMUNICATIONS GROUND & BASEMENT FLOOR PLANS

SHEET NUMBER
E3.17A



1 BUILDING 17 FIRST FLOOR IDF CLOSET

2 BUILDING 17 FIRST FLOOR IDF RACK



1 E3.17B ELECTRICAL BUILDING 17 FIRST FLOOR PLAN
SCALE: 3/32" = 1'-0"

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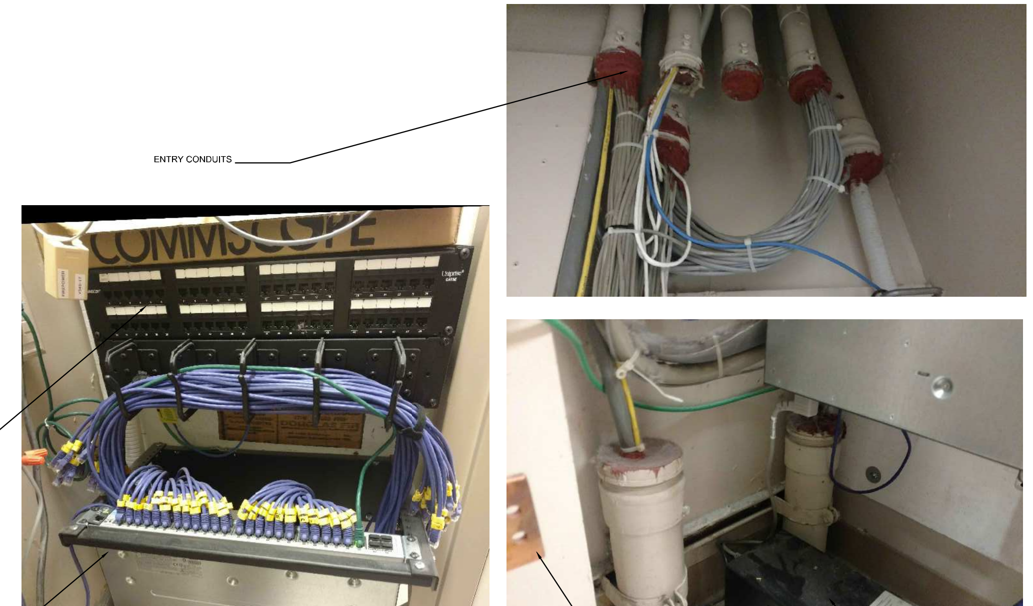
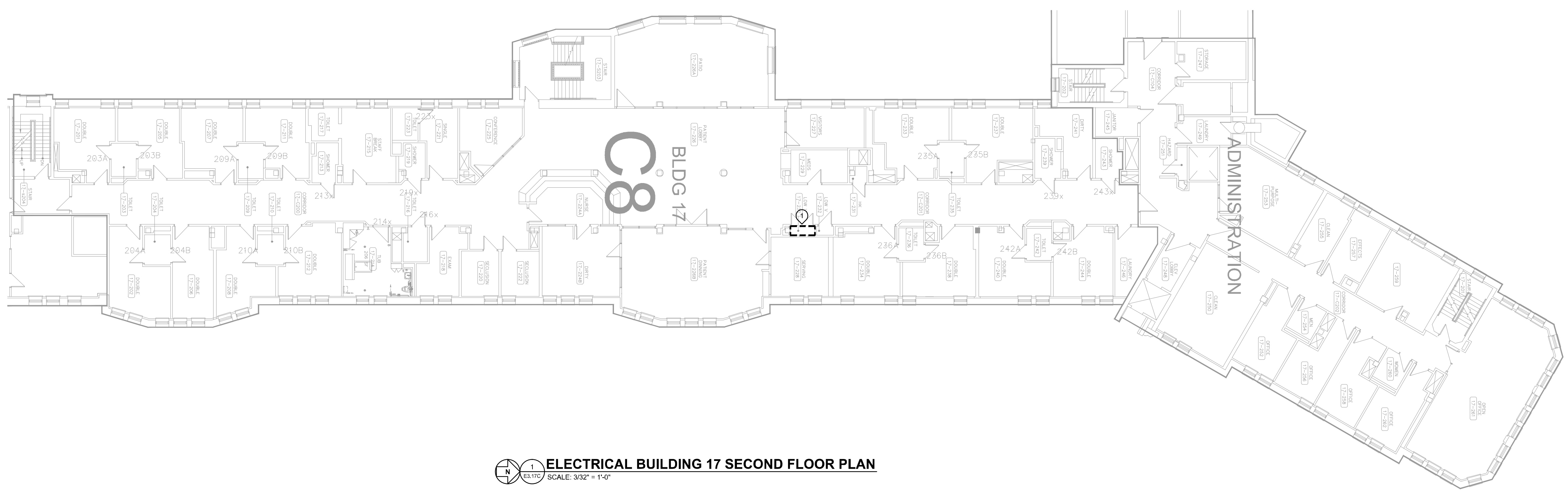
SHEET TITLE
BUILDING 17 TELECOMMUNICATIONS FIRST FLOOR PLAN

SHEET NUMBER
E3.17B



1 **BUILDING 17 SECOND FLOOR IDF CLOSET**



1 E3.17C **ELECTRICAL BUILDING 17 SECOND FLOOR PLAN**
SCALE: 3/32" = 1'-0"

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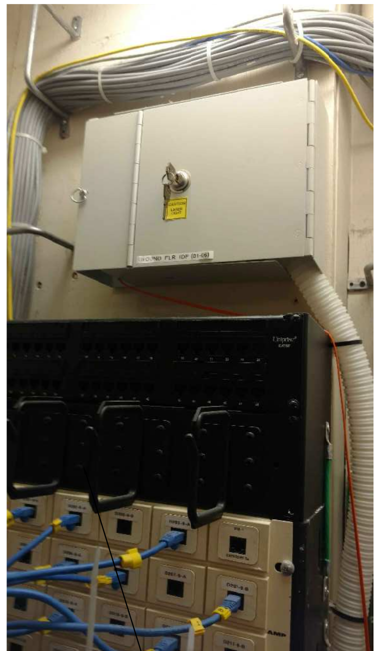
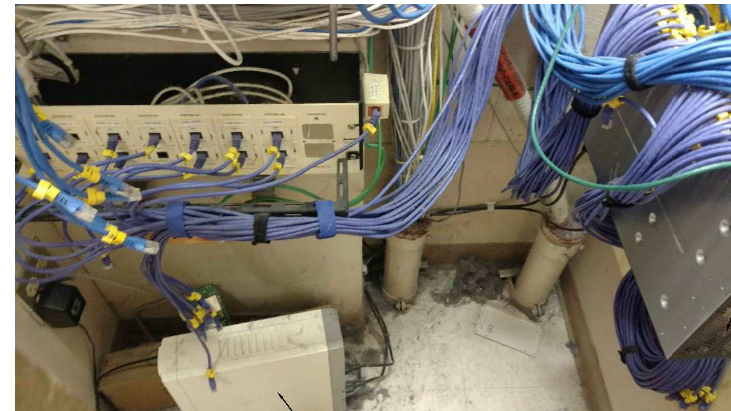
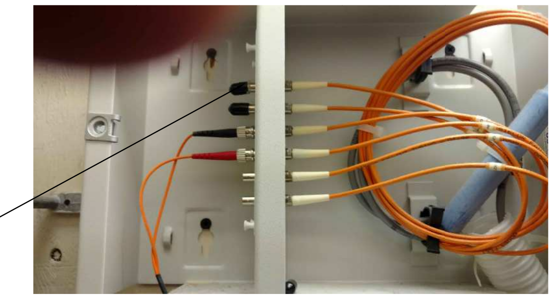
SHEET TITLE
BUILDING 17
TELECOMMUNICATIONS
SECOND FLOOR PLAN

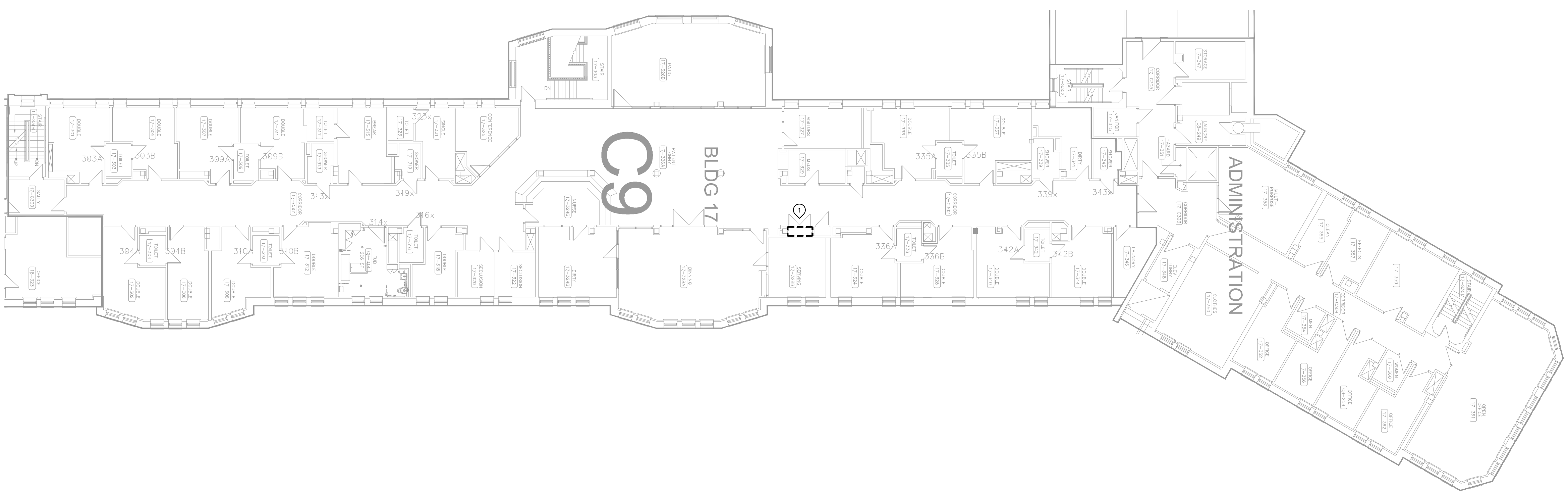
SHEET NUMBER
E3.17C







1 BUILDING 17 THIRD FLOOR IDF CLOSET



1 E3.17D **ELECTRICAL BUILDING 17 THIRD FLOOR PLAN**

SCALE: 3/32" = 1'-0"

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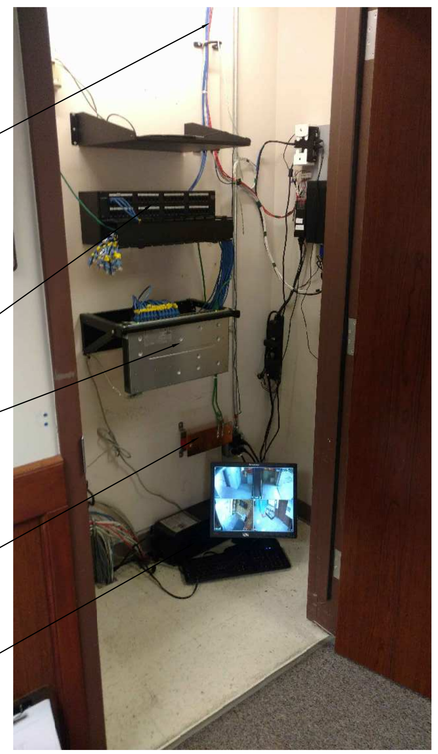
SHEET TITLE

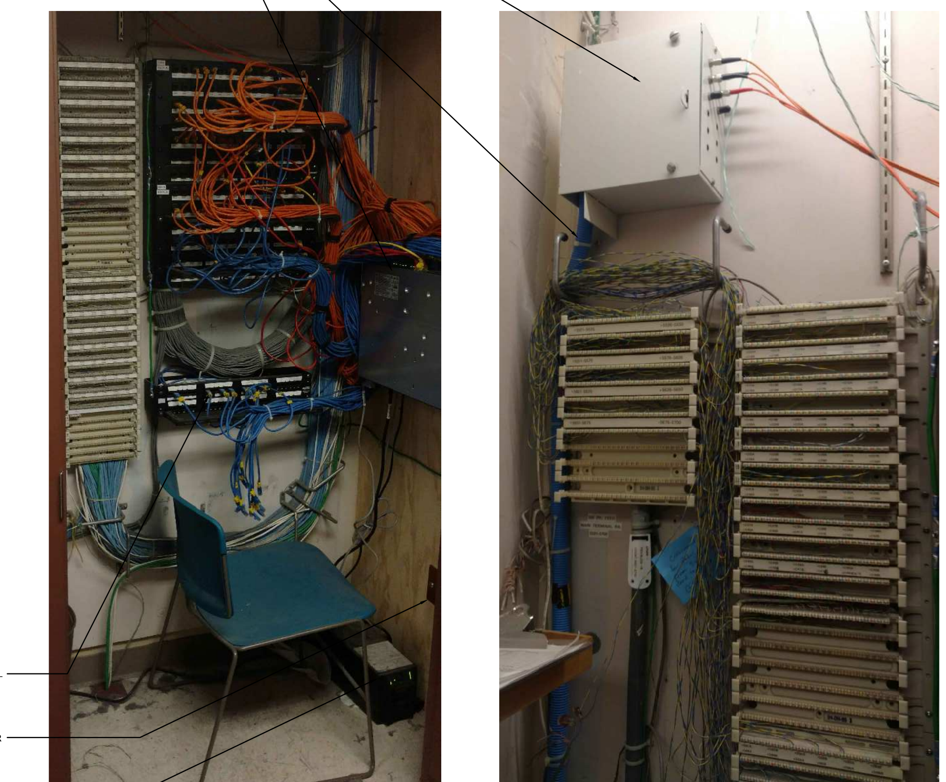
BUILDING 17 TELECOMMUNICATIONS THIRD FLOOR PLAN

SHEET NUMBER

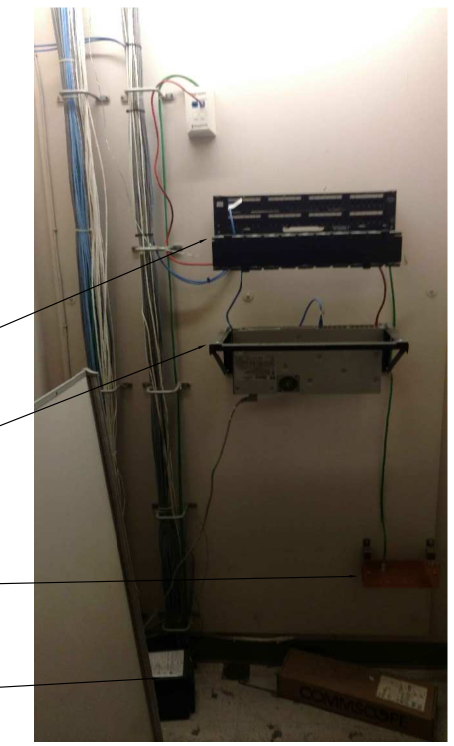
E3.17D



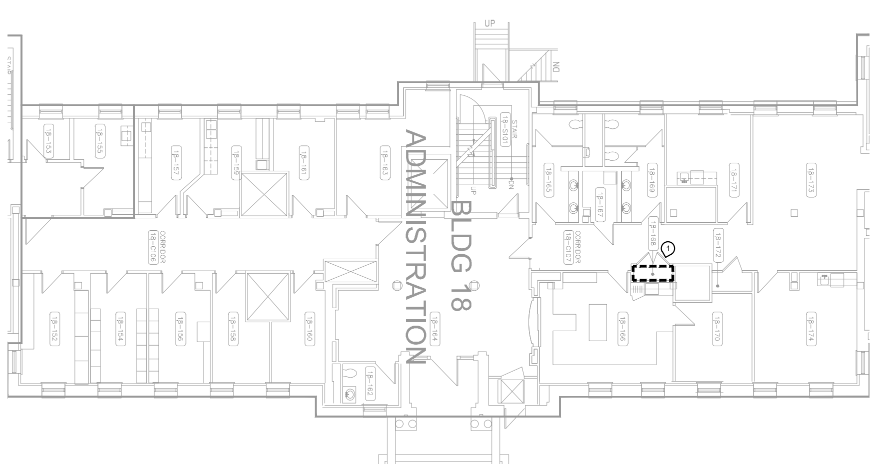
1 BUILDING 18 FIRST FLOOR IDF CLOSET



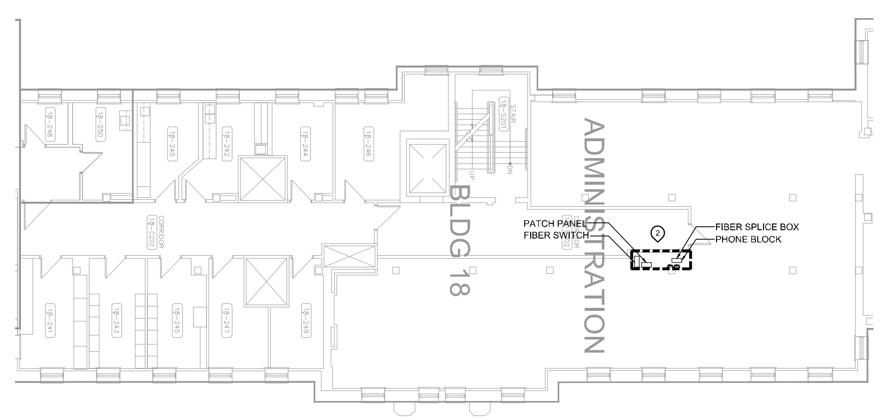
2 BUILDING 18 SECOND FLOOR IDF CLOSET



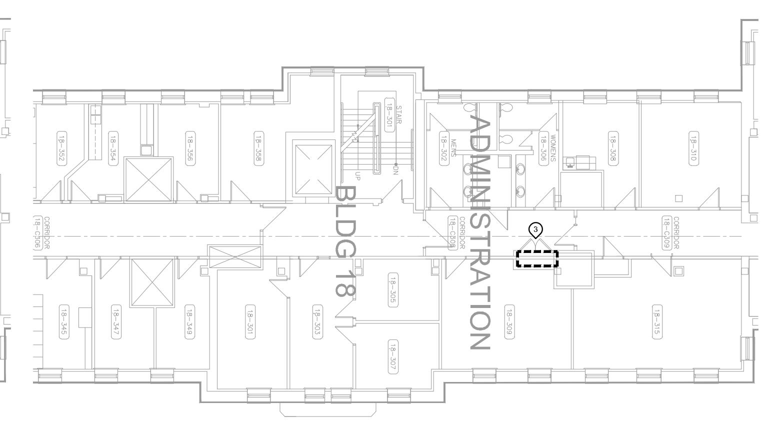
3 BUILDING 18 FIRST FLOOR IDF CLOSET



1 E3.18A ELECTRICAL BUILDING 18 FIRST FLOOR PLAN
SCALE: 3/32" = 1'-0"



2 E3.18A ELECTRICAL BUILDING 18 SECOND FLOOR PLAN
SCALE: 3/32" = 1'-0"



3 E3.18A ELECTRICAL BUILDING 18 THIRD FLOOR PLAN
SCALE: 3/32" = 1'-0"

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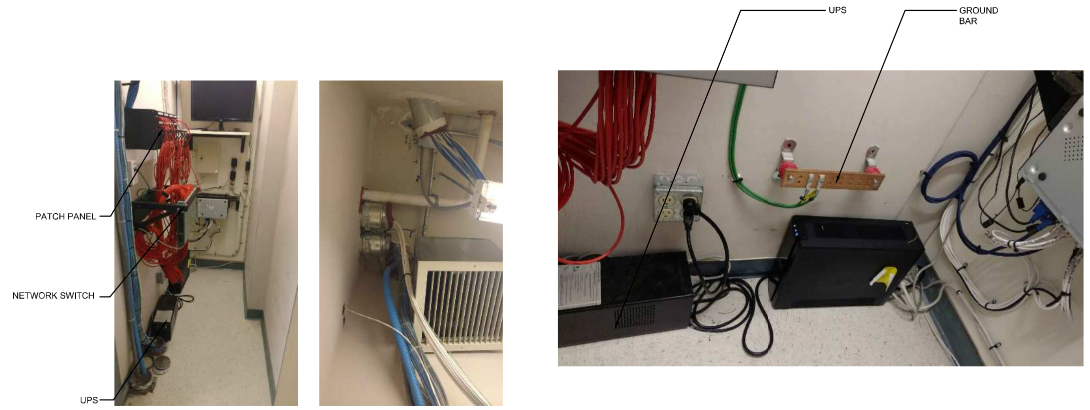
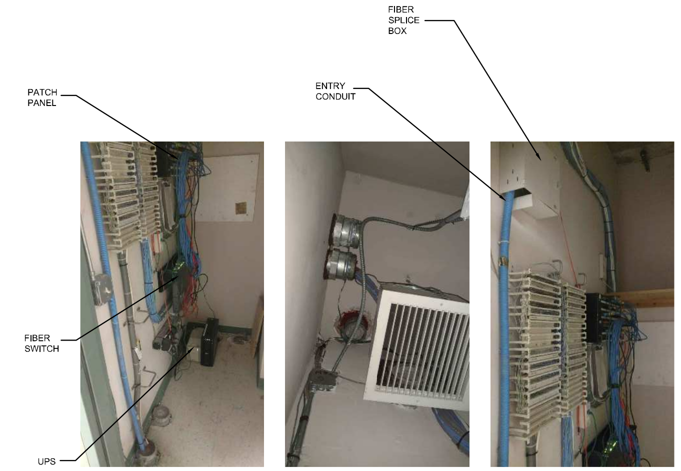
SHEET TITLE
BUILDING 18
TELECOMMUNICATIONS
FLOOR PLANS

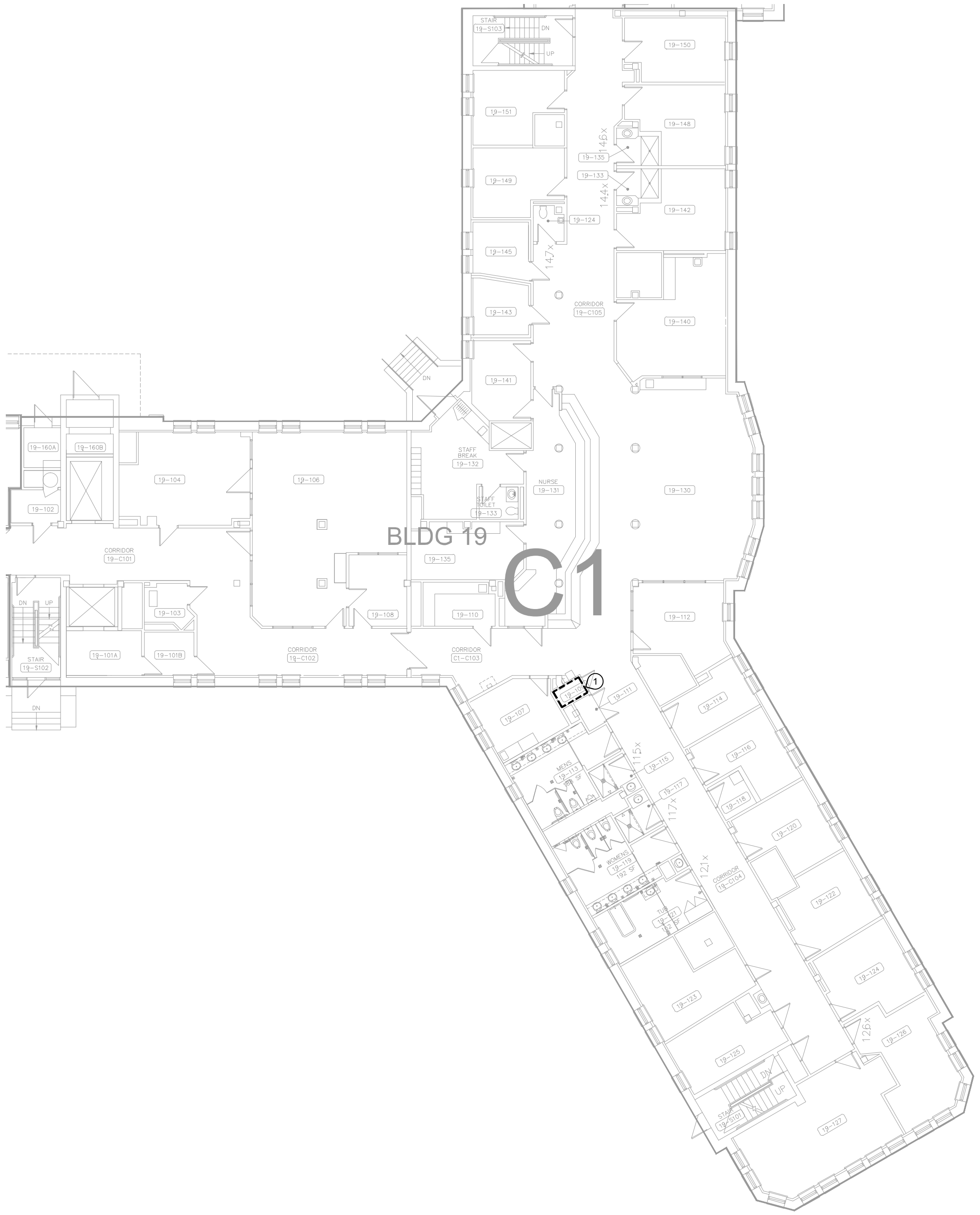
SHEET NUMBER
E3.18A



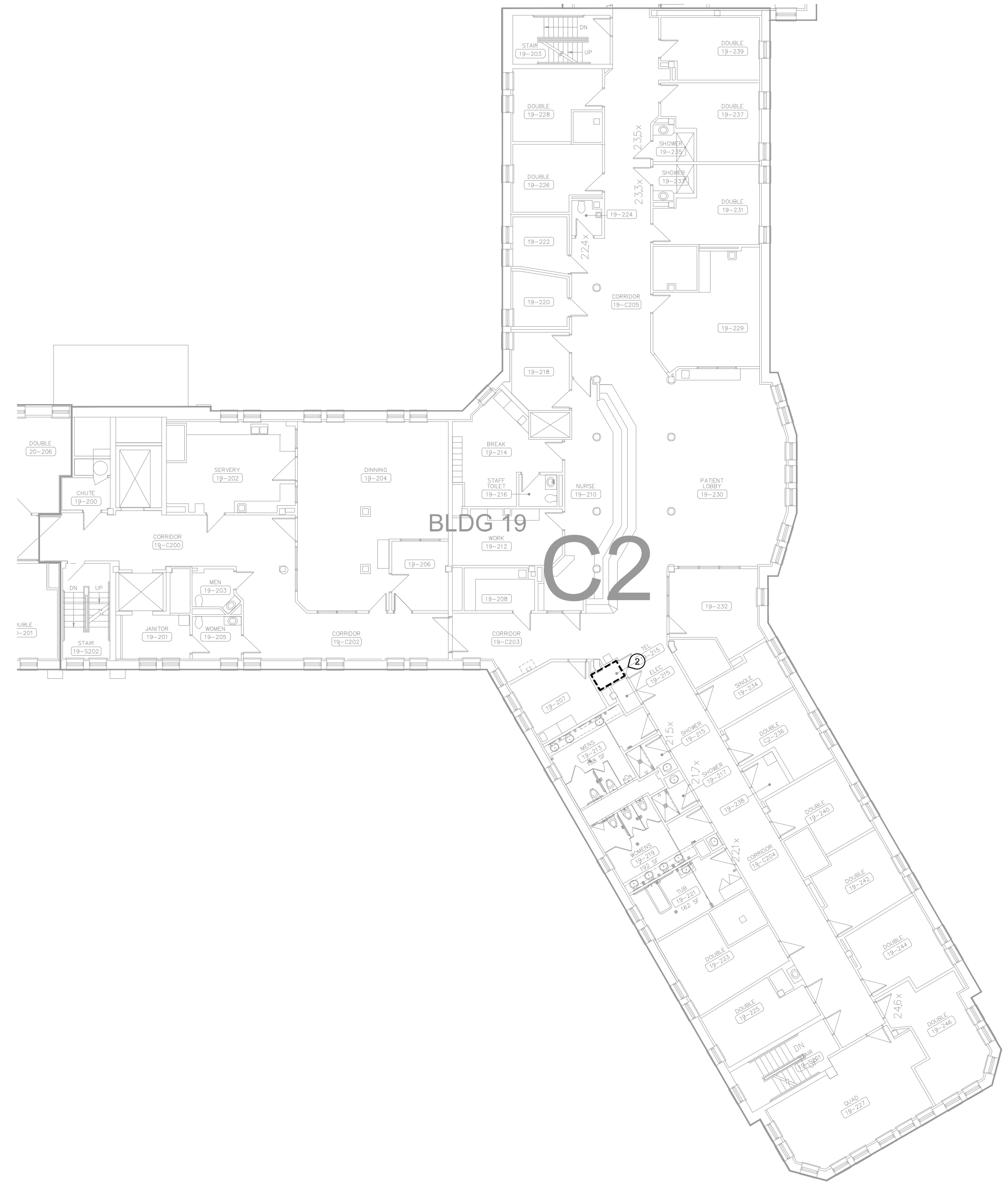
1 BUILDING 19 TELECOM IDF ROOM



4 BUILDING 19 TELECOM ROOM ELEVATIONS



1 E3.19A **ELECTRICAL BUILDING 19 FIRST FLOOR PLANS**
SCALE: 3/32" = 1'-0"



2 E3.19A **ELECTRICAL BUILDING 19 SECOND FLOOR PLANS**
SCALE: 3/32" = 1'-0"

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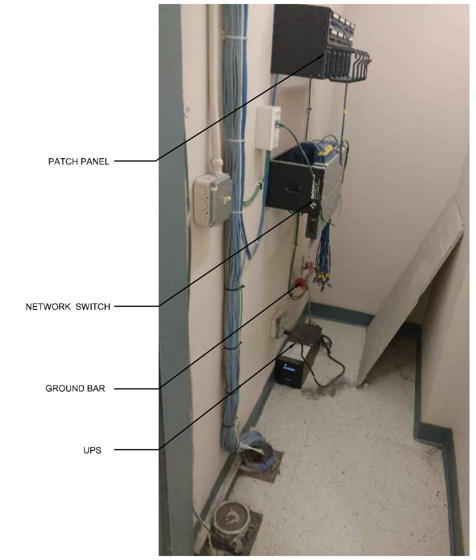
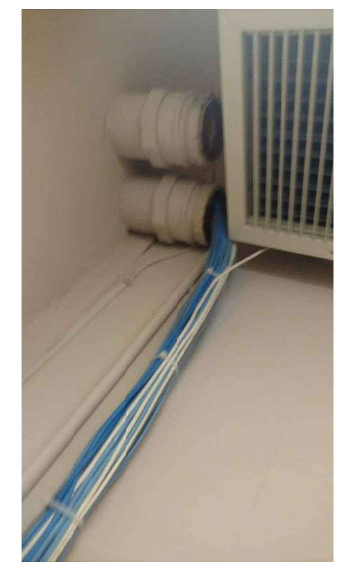
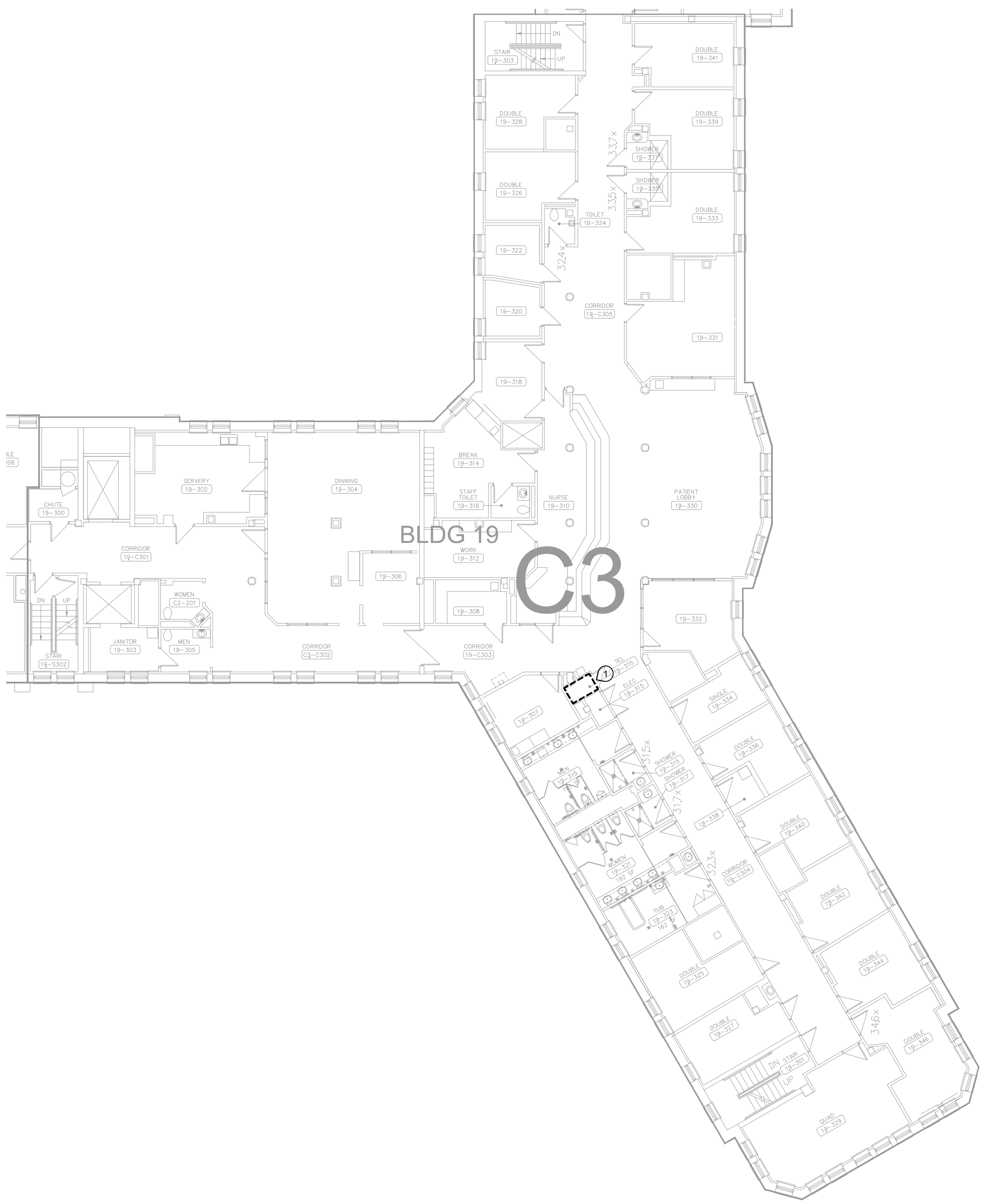
SHEET TITLE
BUILDING 19
TELECOMMUNICATIONS FIRST & SECOND FLOOR PLANS

SHEET NUMBER
E3.19A





1 BUILDING 19 TELECOM IDF ROOM



1 E3.19B ELECTRICAL BUILDING 19 THIRD FLOOR PLANS
SCALE: 3/32" = 1'-0"

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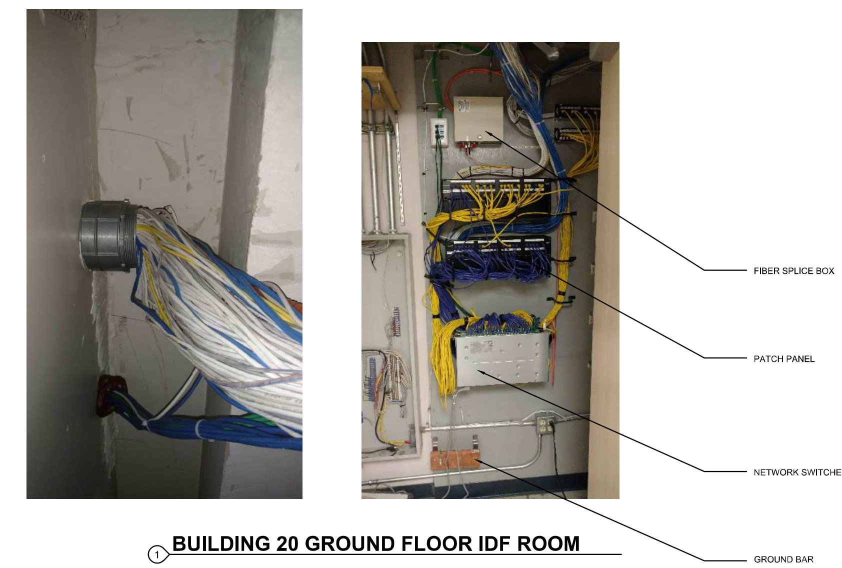
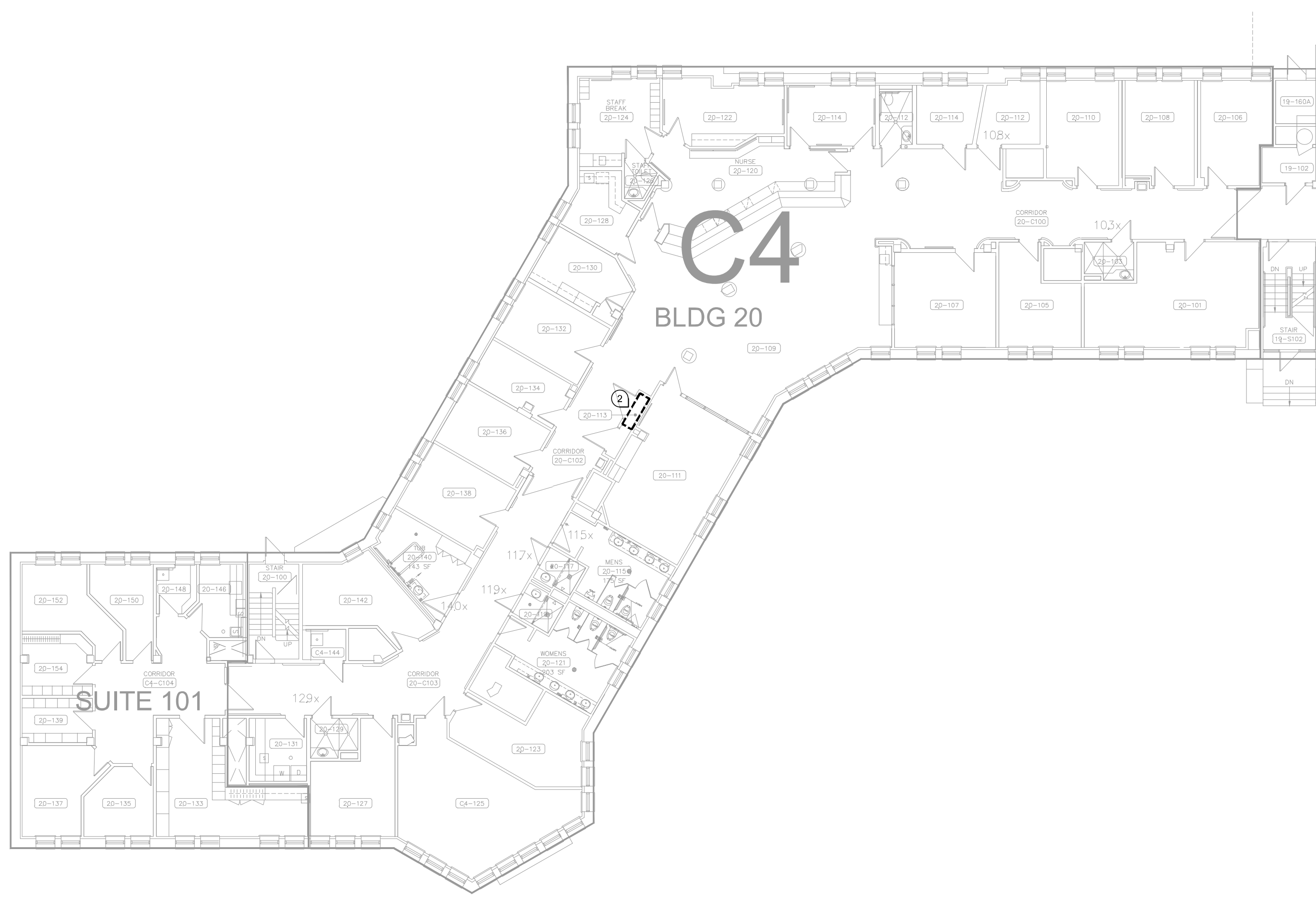
SHEET TITLE
BUILDING 19 TELECOMMUNICATIONS THIRD FLOOR PLAN

SHEET NUMBER
E3.19B

ELECTRICAL BUILDING 20 GROUND FLOOR PLANS
SCALE: 3/32" = 1'-0"



1 BUILDING 20 GROUND FLOOR IDF ROOM



ELECTRICAL BUILDING 20 FIRST FLOOR PLANS
SCALE: 3/32" = 1'-0"

2 BUILDING 20 FIRST FLOOR IDF ROOM

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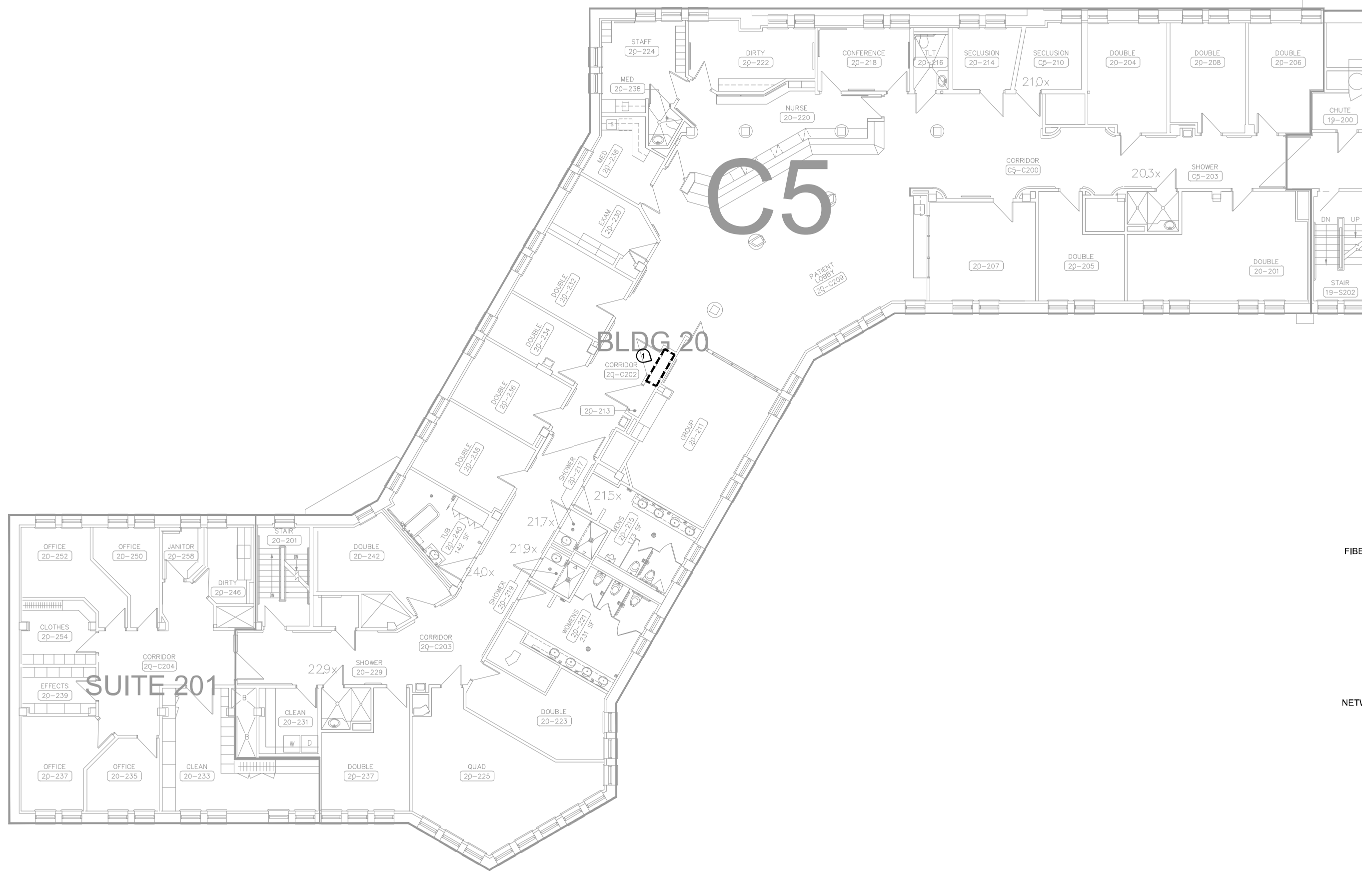
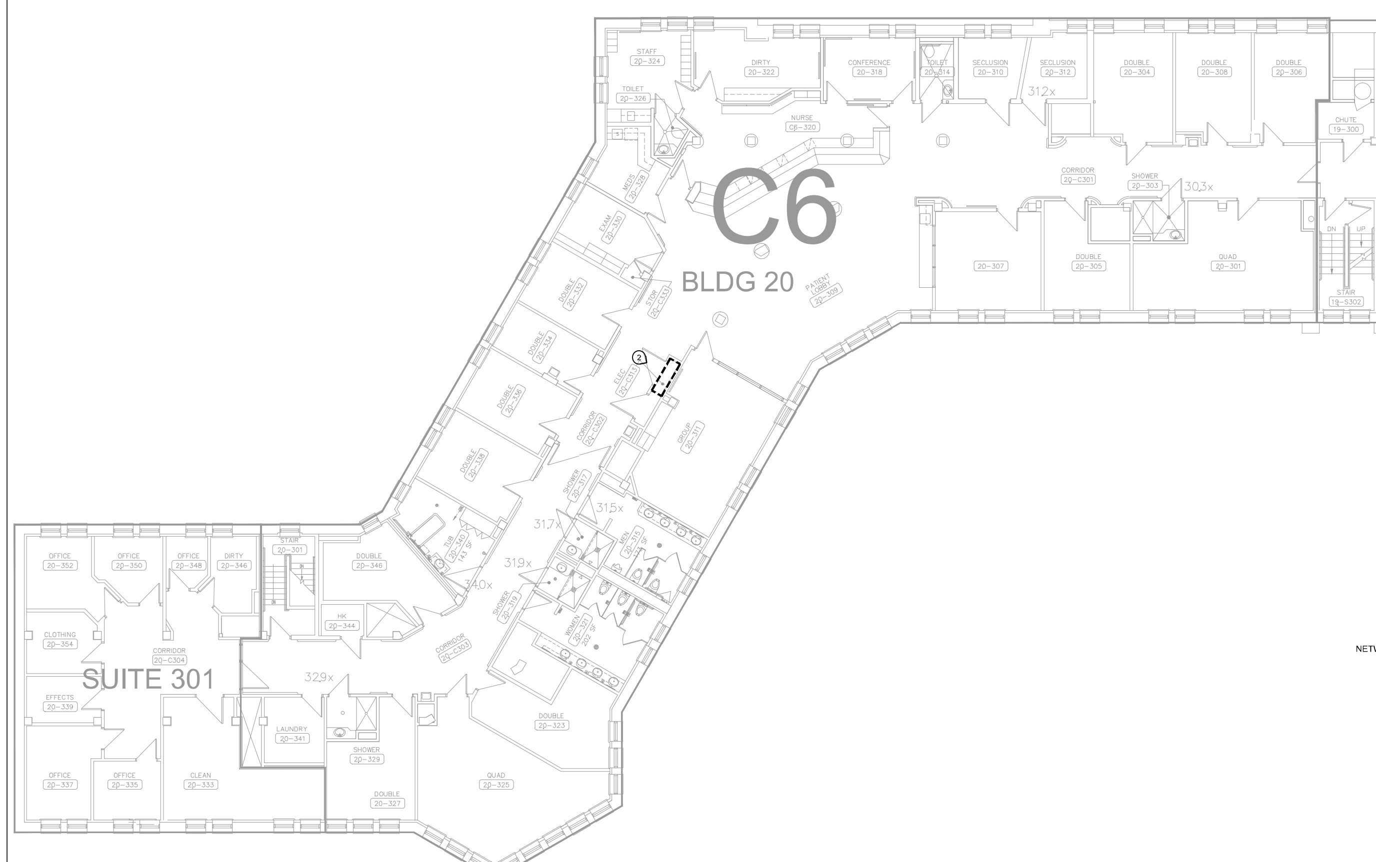
SHEET TITLE
BUILDING 20
TELECOMMUNICATIONS
GROUND & FIRST FLOOR PLANS

SHEET NUMBER
E3.20A



ELECTRICAL BUILDING 20 SECOND FLOOR PLANS
SCALE: 3/32" = 1'-0"

BUILDING 20 SECOND FLOOR IDF ROOM



ELECTRICAL BUILDING 20 THIRD FLOOR PLAN
SCALE: 1/8" = 1'-0"

BUILDING 20 THIRD FLOOR IDF ROOM

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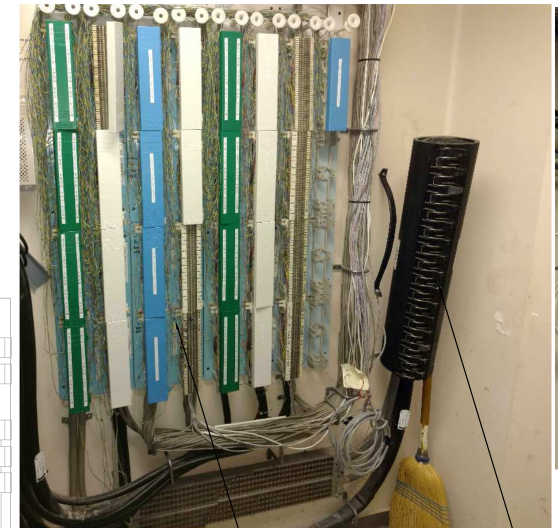
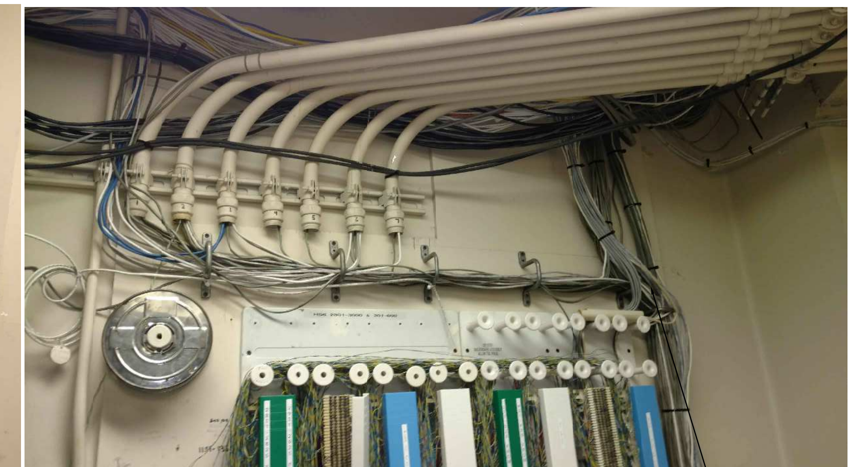
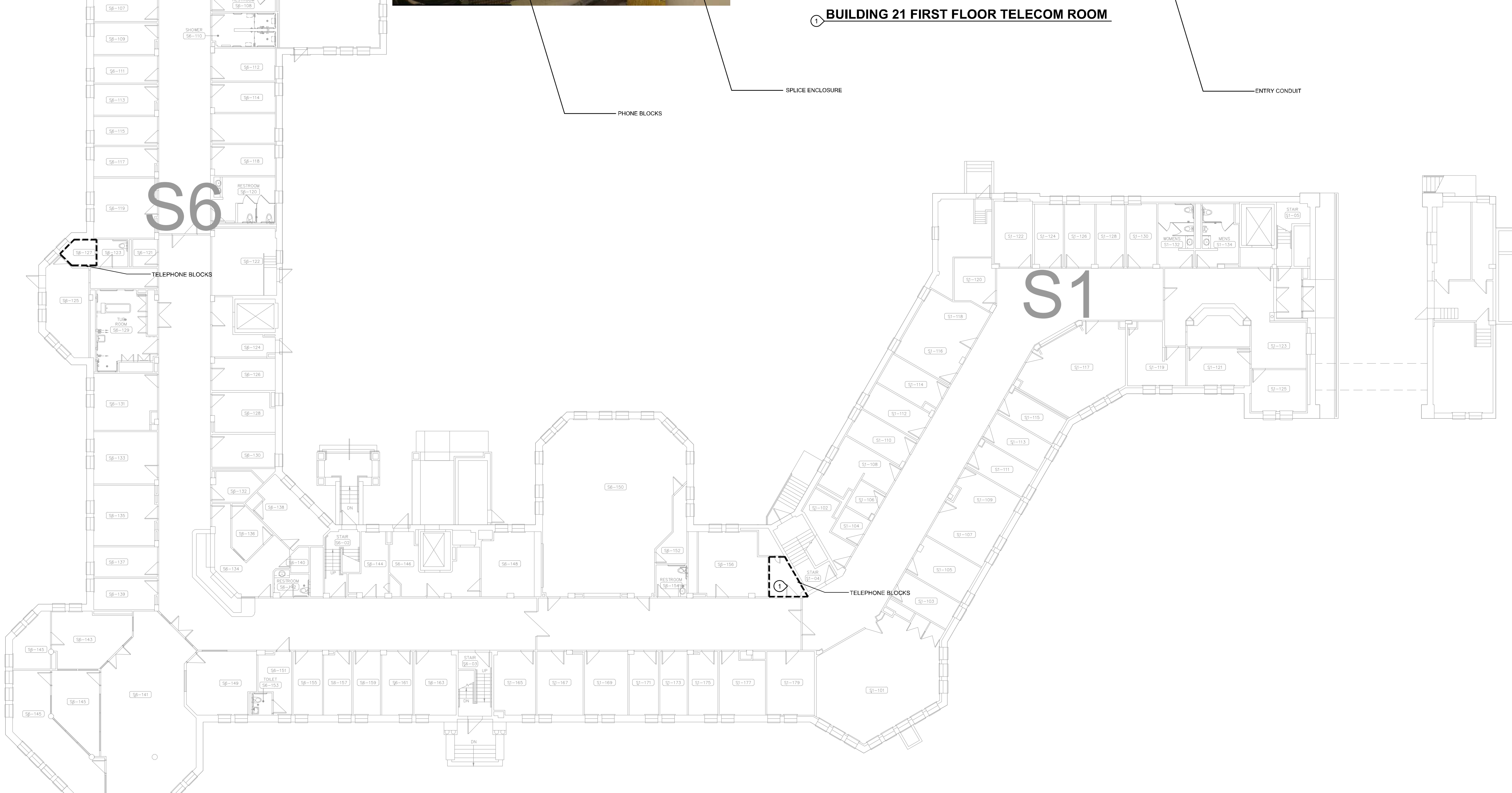
SHEET TITLE
BUILDING 20
TELECOMMUNICATIONS
SECOND & THIRD FLOOR PLANS

SHEET NUMBER
E3.20B





1 BUILDING 21 FIRST FLOOR TELECOM ROOM



1 E3.21A ELECTRICAL BUILDING 21 FIRST FLOOR PLAN

SCALE: 3/32" = 1'-0"

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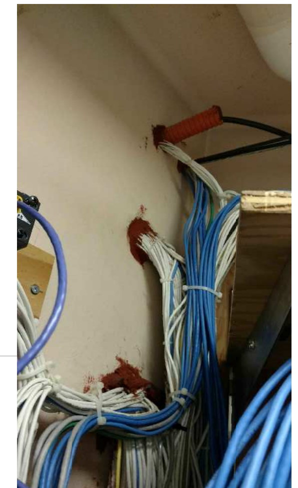
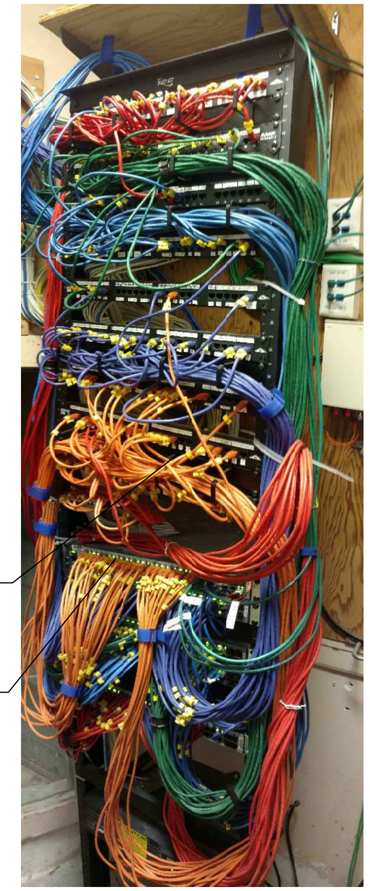
SHEET TITLE

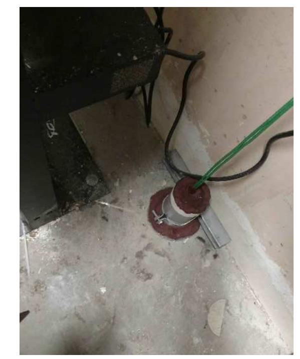
BUILDING 21
TELECOMMUNICATIONS
FIRST FLOOR PLAN

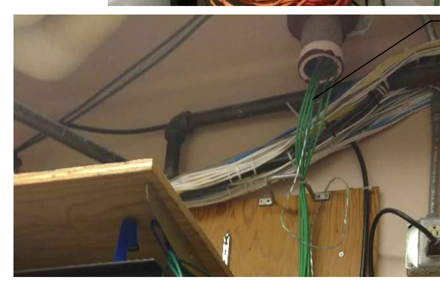
SHEET NUMBER

E3.21A

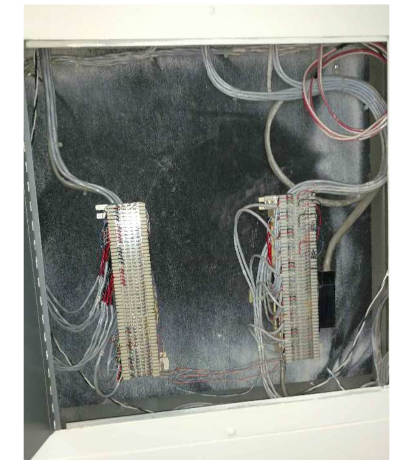




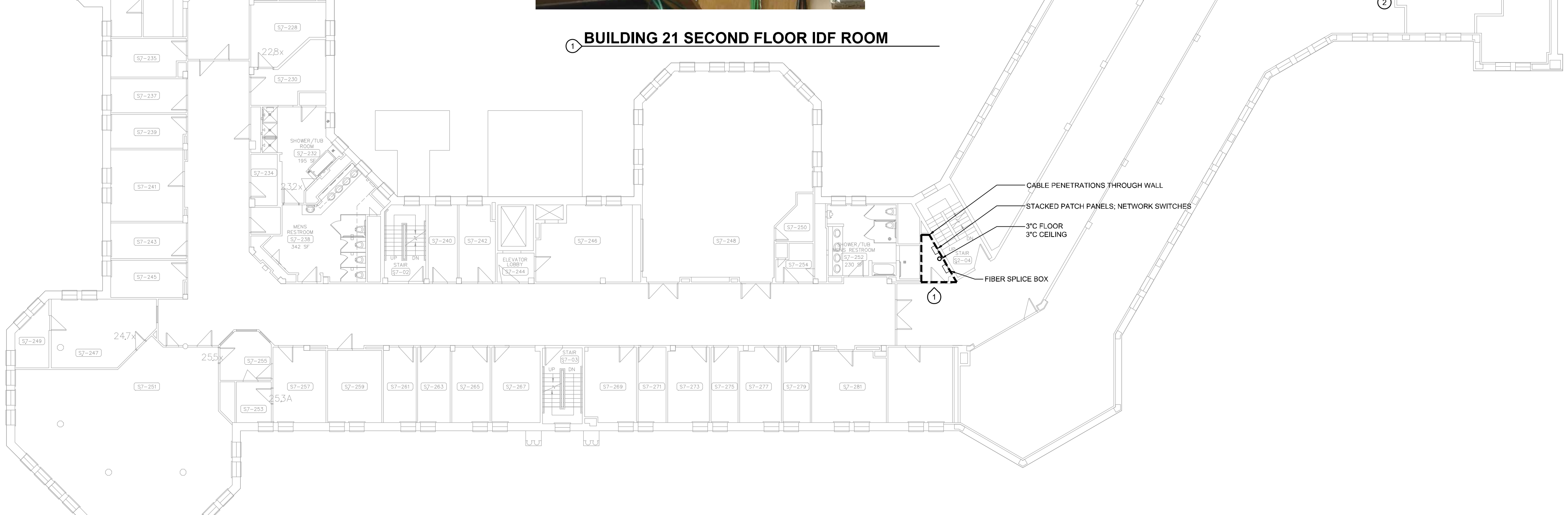




1 BUILDING 21 SECOND FLOOR IDF ROOM



2 BUILDING 21 SECOND FLOOR PHONE BOX



1 E3.21B BUILDING 21 TELECOMMUNICATIONS SECOND FLOOR PLAN
SCALE: 3/32" = 1'-0"

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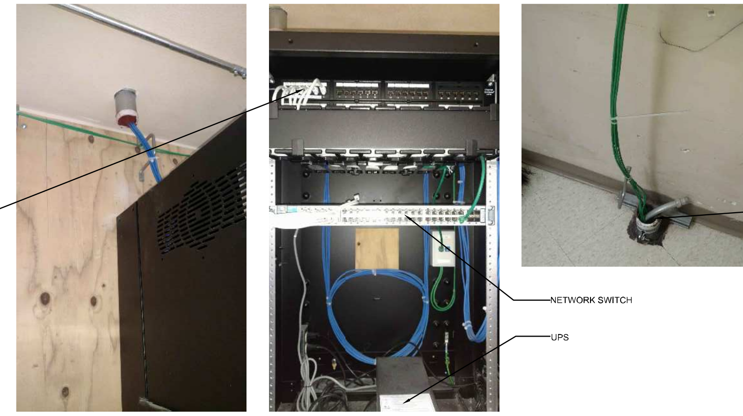
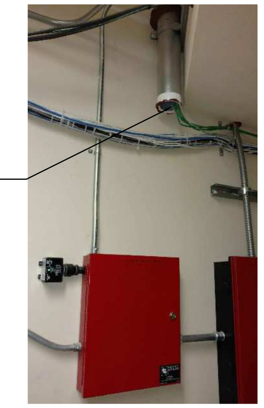
SHEET TITLE
BUILDING 21 TELECOMMUNICATIONS SECOND FLOOR PLAN

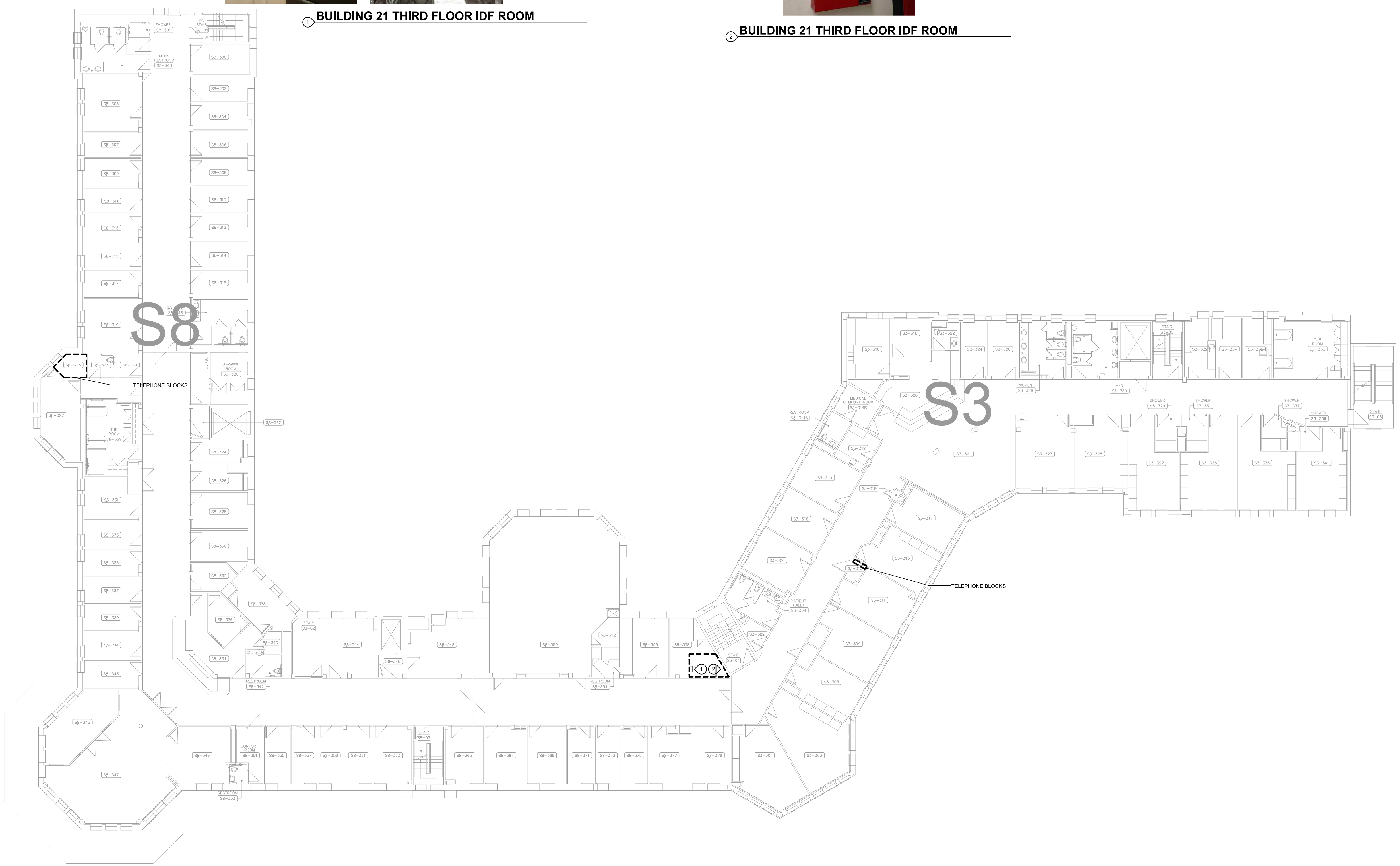
SHEET NUMBER
E3.21B



1 **BUILDING 21 THIRD FLOOR IDF ROOM**



2 **BUILDING 21 THIRD FLOOR IDF ROOM**



1 E3.21C **BUILDING 21 TELECOMMUNICATIONS THIRD FLOOR PLAN**
SCALE: 3/32" = 1'-0"

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REV.	RELEASE	DATE
	FINAL REPORT	5/31/18

PROJECT NO.	2017-467
HARGIS PROJECT NO.	17122
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CHECKED BY	DS
APPROVED BY	ES

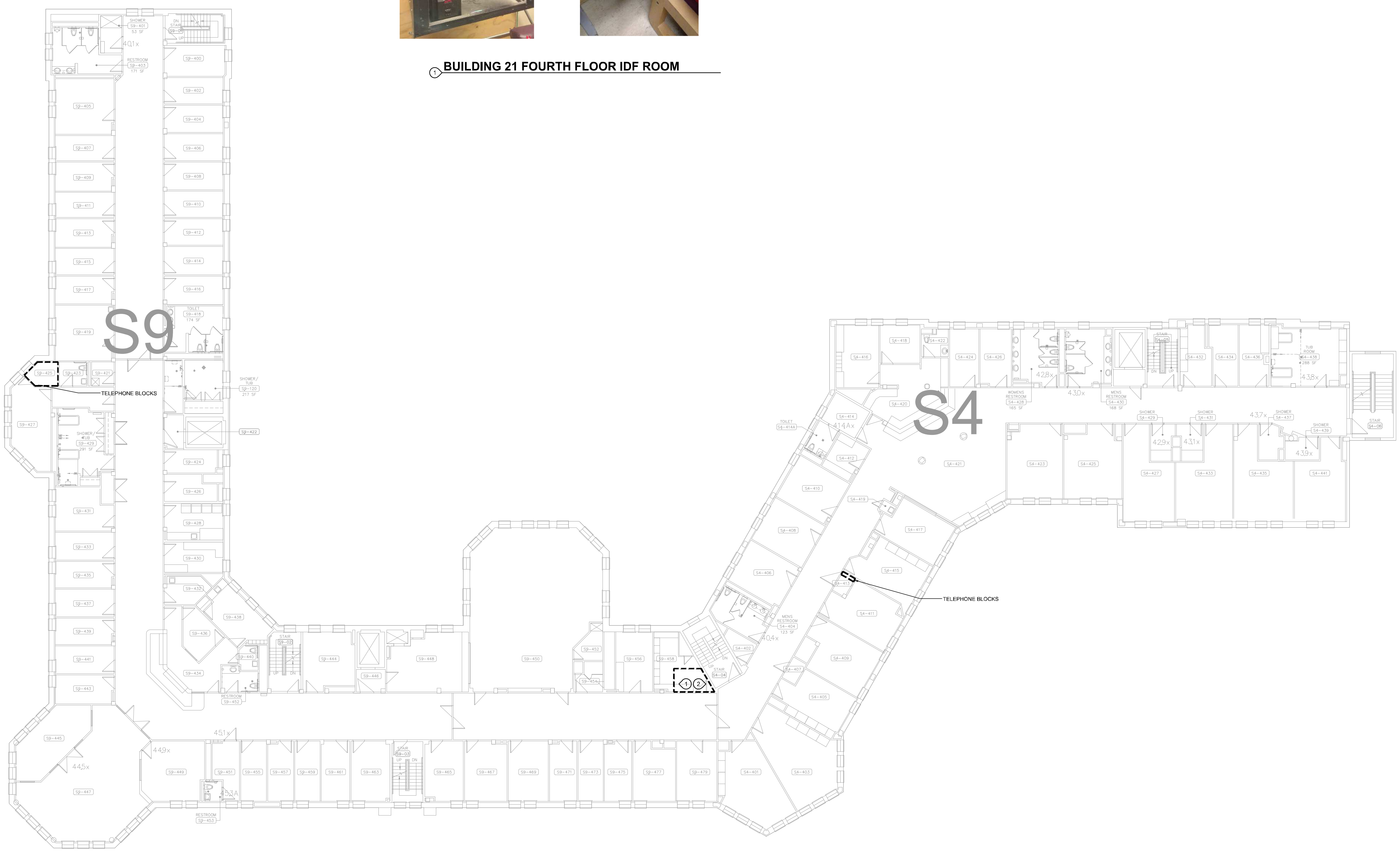
SHEET TITLE

BUILDING 21
TELECOMMUNICATIONS
THIRD FLOOR PLAN

SHEET NUMBER

E3.21C

1 BUILDING 21 FOURTH FLOOR IDF ROOM



1 E3.21D **BUILDING 21 TELECOMMUNICATIONS FOURTH FLOOR PLAN**
SCALE: 3/32" = 1'-0"

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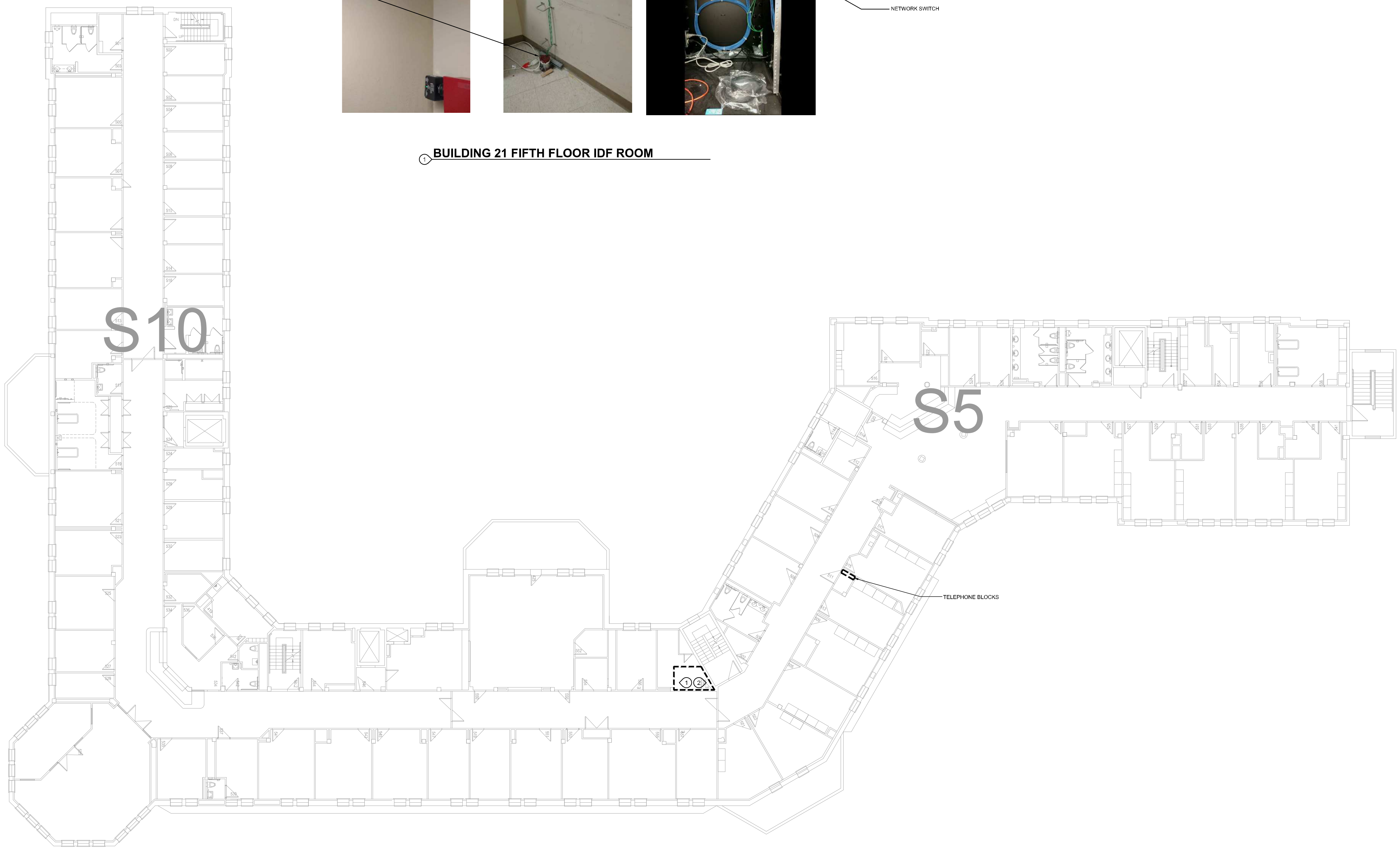
SHEET TITLE
BUILDING 21 TELECOMMUNICATIONS FOURTH FLOOR PLAN

SHEET NUMBER
E3.21D

1 BUILDING 21 FIFTH FLOOR IDF ROOM



1 E3.21E **BUILDING 21 TELECOMMUNICATIONS FIFTH FLOOR PLAN**
SCALE: 3/32" = 1'-0"

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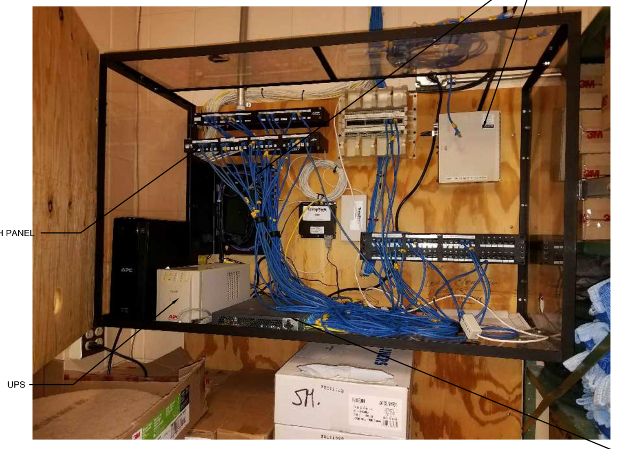
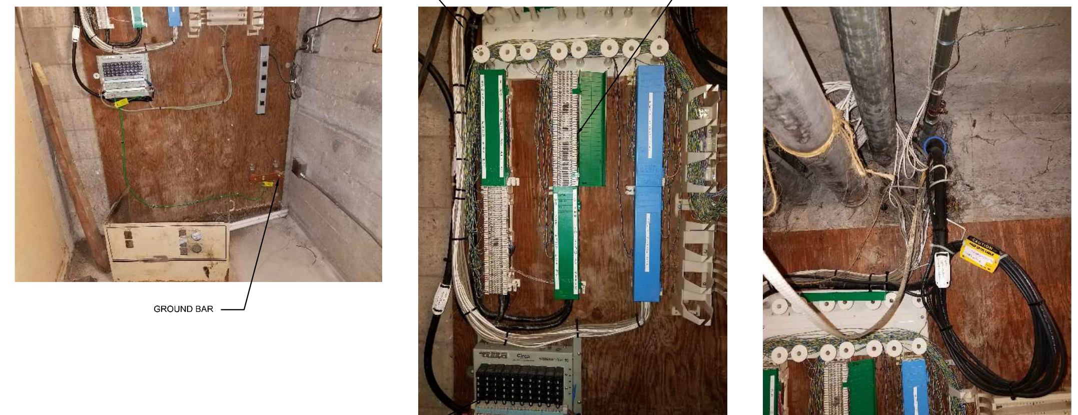
SHEET TITLE
BUILDING 21
TELECOMMUNICATIONS
FIFTH FLOOR PLAN

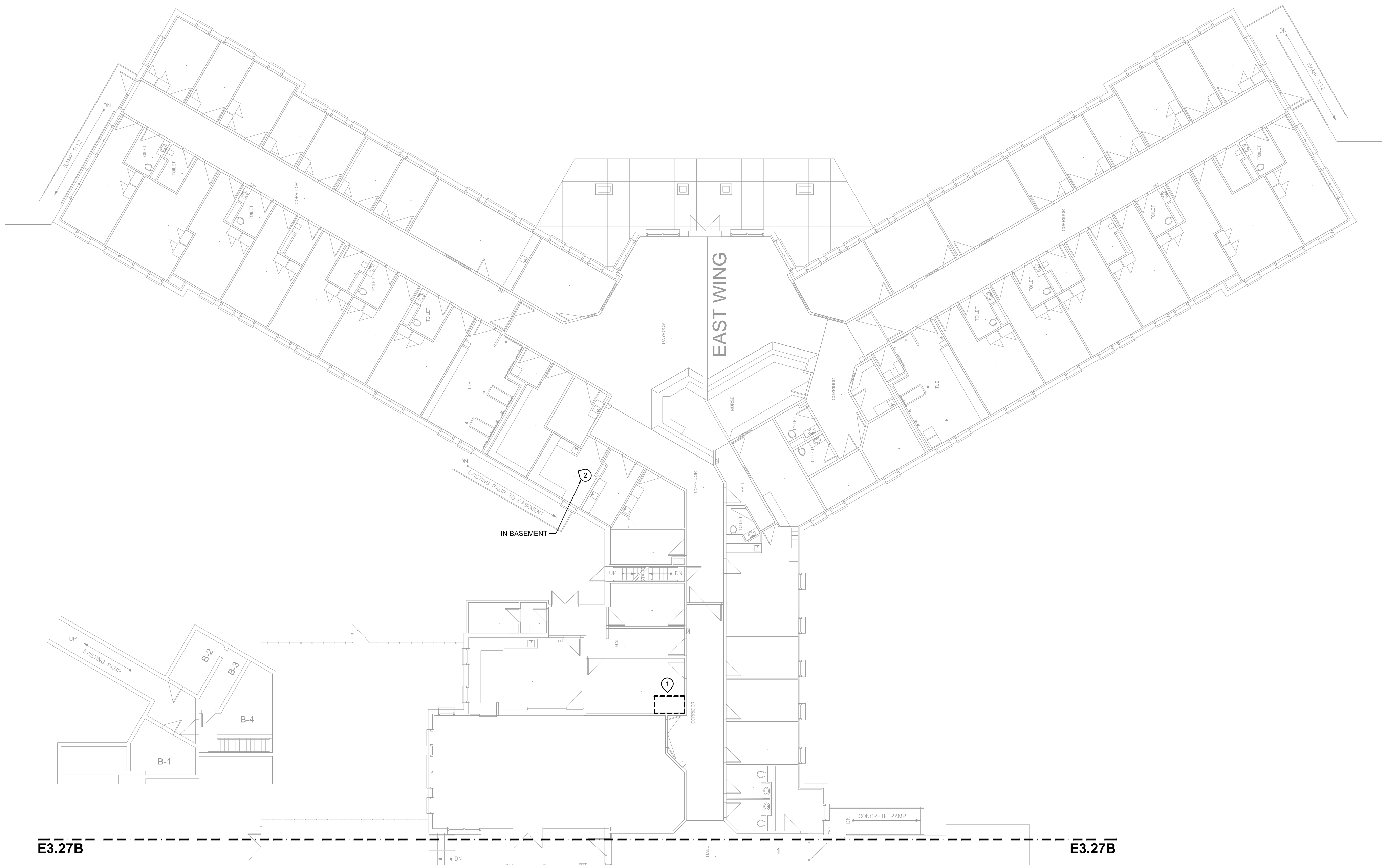
SHEET NUMBER
E3.21E



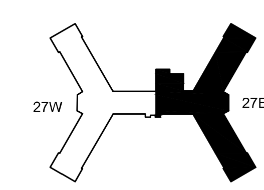
1 BUILDING 27 ELECTRICAL IDF CABINET



2 BUILDING 27 BASEMENT TELECOM ROOM



1 E3.27A **BUILDING 27 TELECOMMUNICATIONS FIRST FLOOR EAST**
SCALE: 1/8" = 1'-0"



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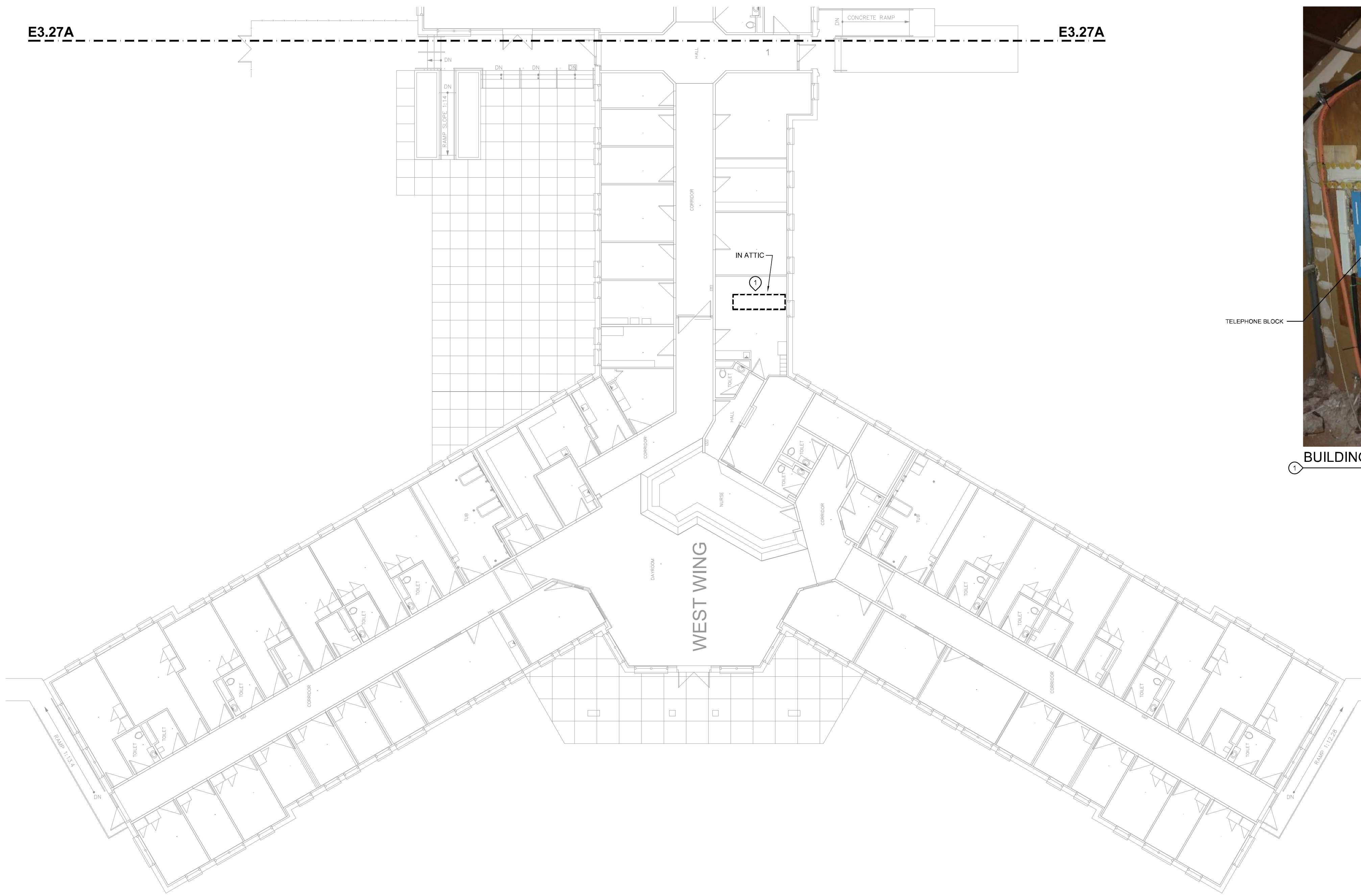
SHEET TITLE
BUILDING 27 TELECOMMUNICATIONS FIRST FLOOR EAST

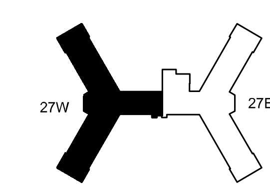
SHEET NUMBER
E3.27A



BUILDING 27 TELECOMMUNICATIONS FIRST FLOOR WEST

SCALE: 1/8" = 1'-0"

1 BUILDING 27 TELECOM BACKBOARD



BUILDING 27E, 27W

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REV.	RELEASE	DATE
	FINAL REPORT	5/31/18

PROJECT NO. 121-16033	2017-467
HARGIS PROJECT NO.	17122
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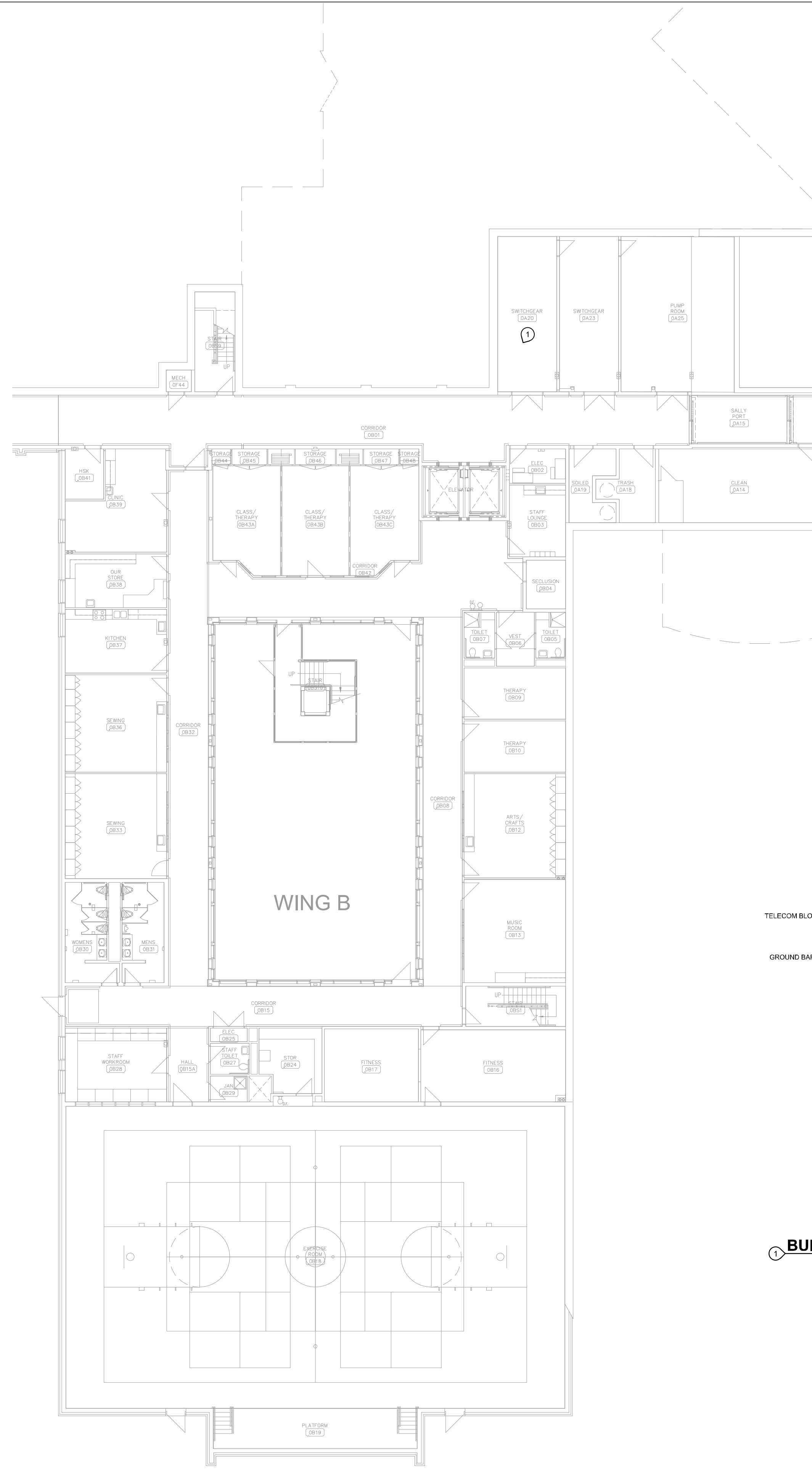
CHECKED BY	DS
APPROVED BY	ES

SHEET TITLE

BUILDING 27 TELECOMMUNICATIONS FIRST FLOOR WEST

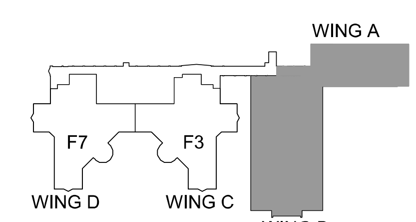
SHEET NUMBER

E3.27B



1 BUILDING 28 BASEMENT FLOOR TELECOM BACKBOARD

N 1 E2.28A **BUILDING 28 TELECOMMUNICATIONS GROUND FLOOR WING A & B**
SCALE: 3/32" = 1'-0"



N BLDG 28
GROUND FLOOR KEY PLAN

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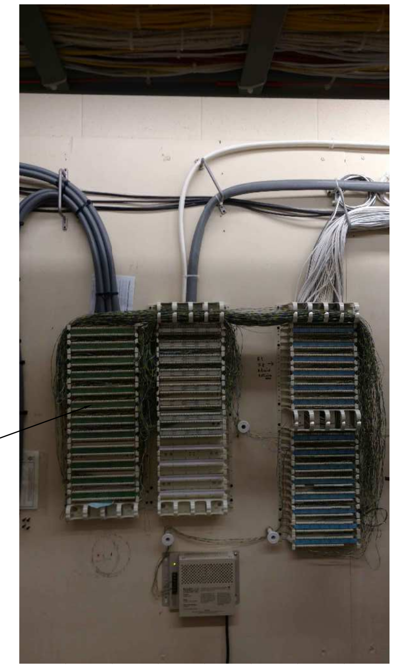
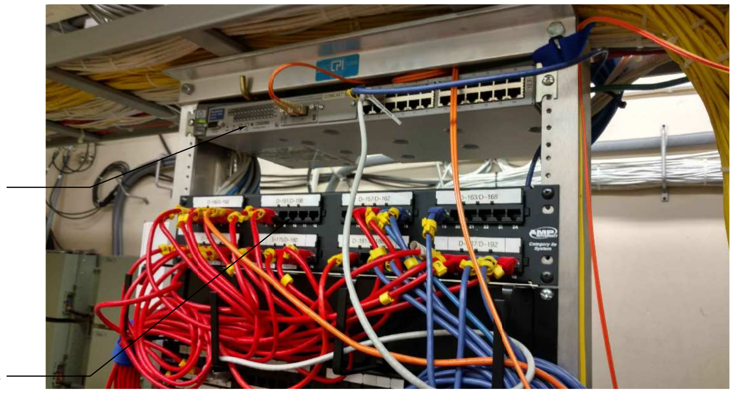
SHEET TITLE
BUILDING 28
TELECOMMUNICATIONS
GROUND FLOOR WING A & B

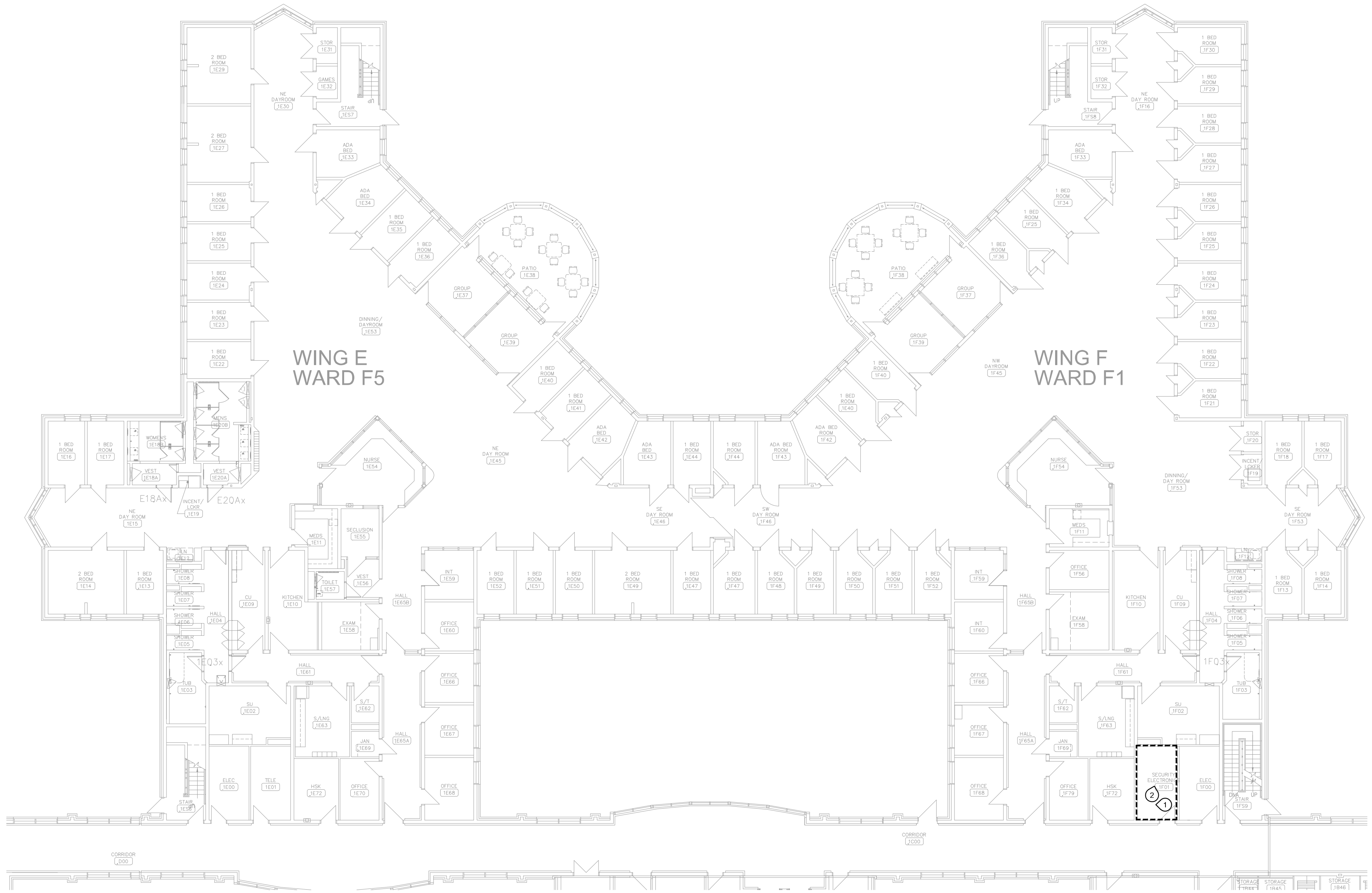
SHEET NUMBER
E2.28A



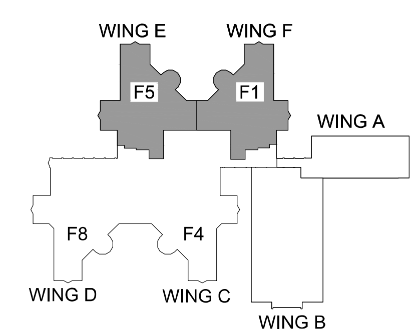
1 BUILDING 28 F102 MDF ROOM



2 BUILDING 28 F102 MDF ROOM



1 BUILDING 28 TELECOMMUNICATIONS FIRST FLOOR WING E & F
SCALE: 3/32" = 1'-0"



BLDG 28
FIRST FLOOR KEY PLAN

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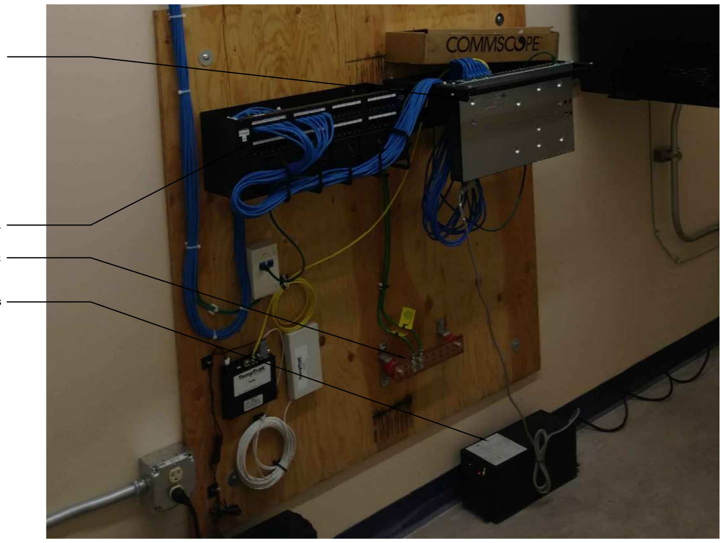
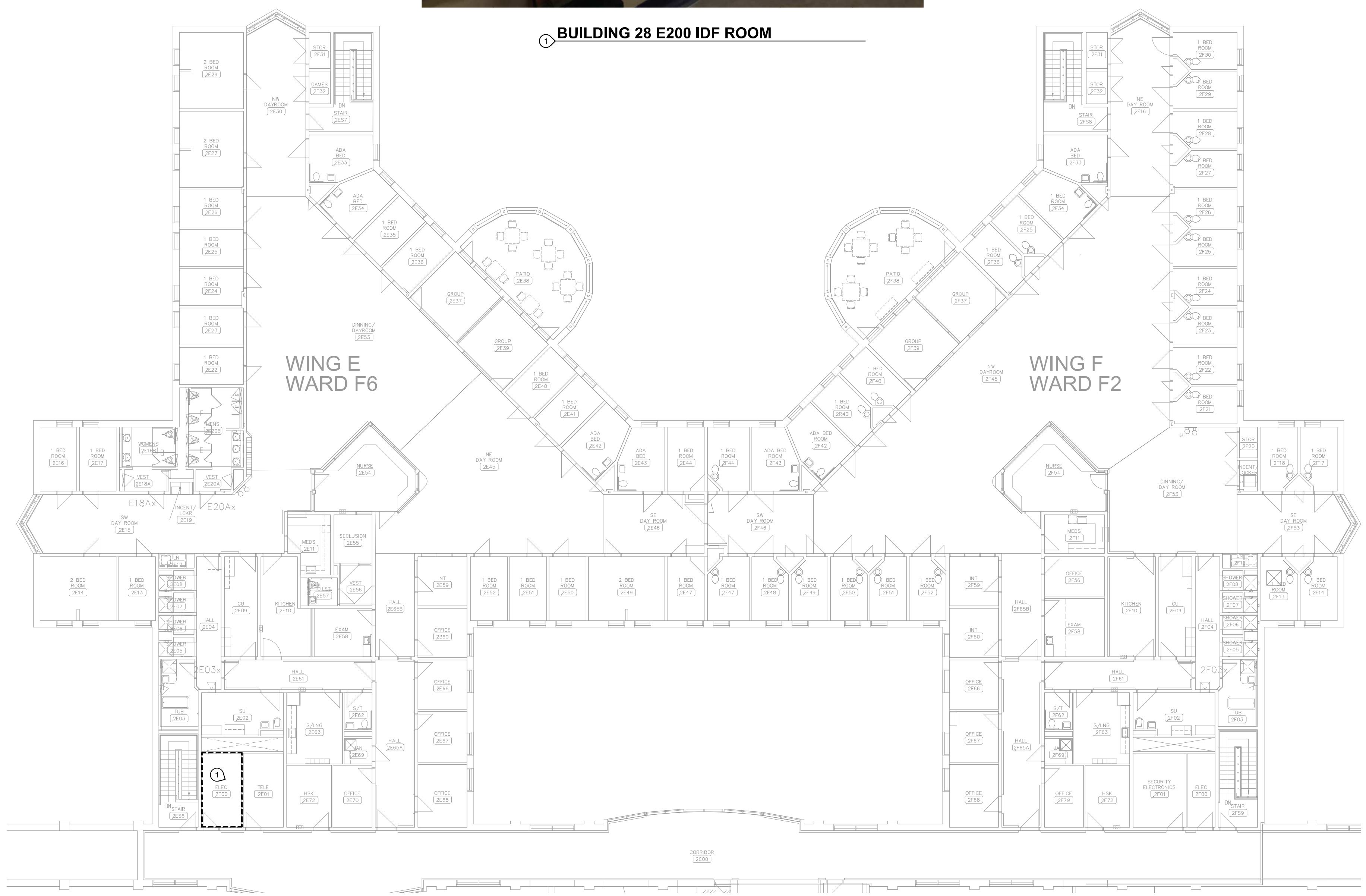
SHEET TITLE
BUILDING 28
TELECOMMUNICATIONS
FIRST FLOOR WING E & F

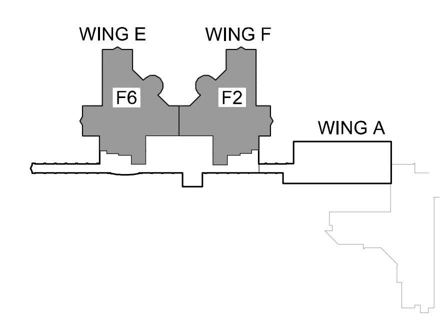
SHEET NUMBER
E2.28E



1 BUILDING 28 E200 IDF ROOM



1 E3.28G BUILDING 28 TELECOMMUNICATIONS SECOND FLOOR WING E & F
SCALE: 3/32" = 1'-0"



BLDG 28
SECOND FLOOR KEY PLAN

BUILDING 28 F102 MDF ROOM

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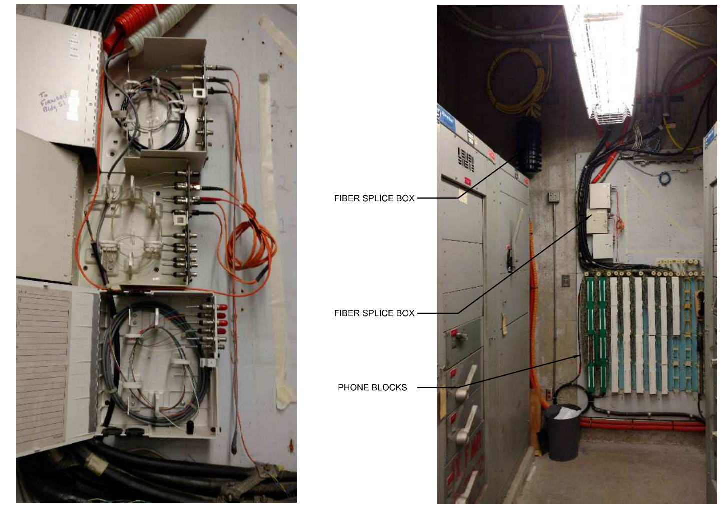
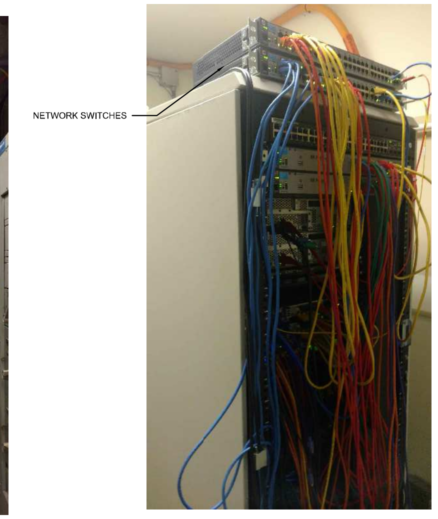
APPROVED BY	ES

SHEET TITLE
BUILDING 28
TELECOMMUNICATIONS
SECOND FLOOR WING E & F

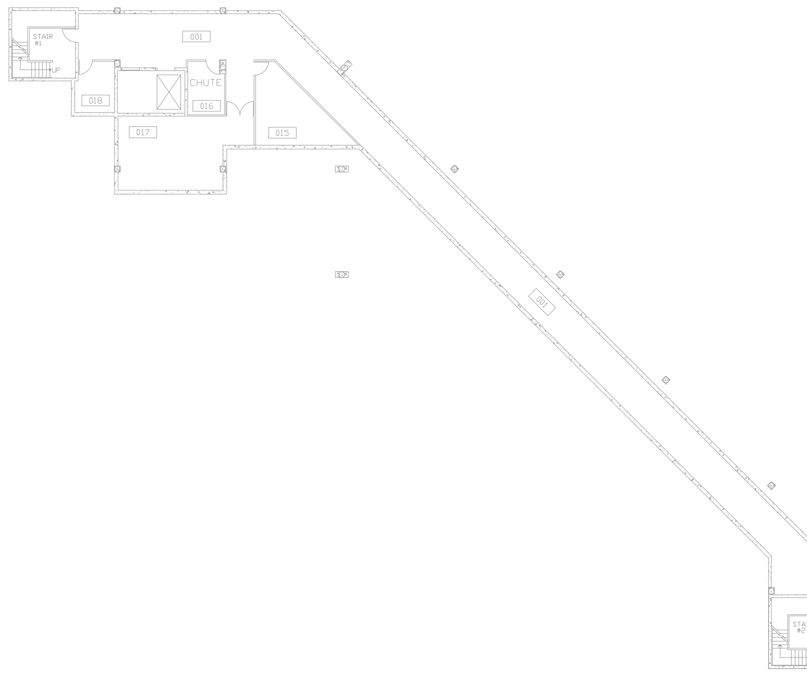
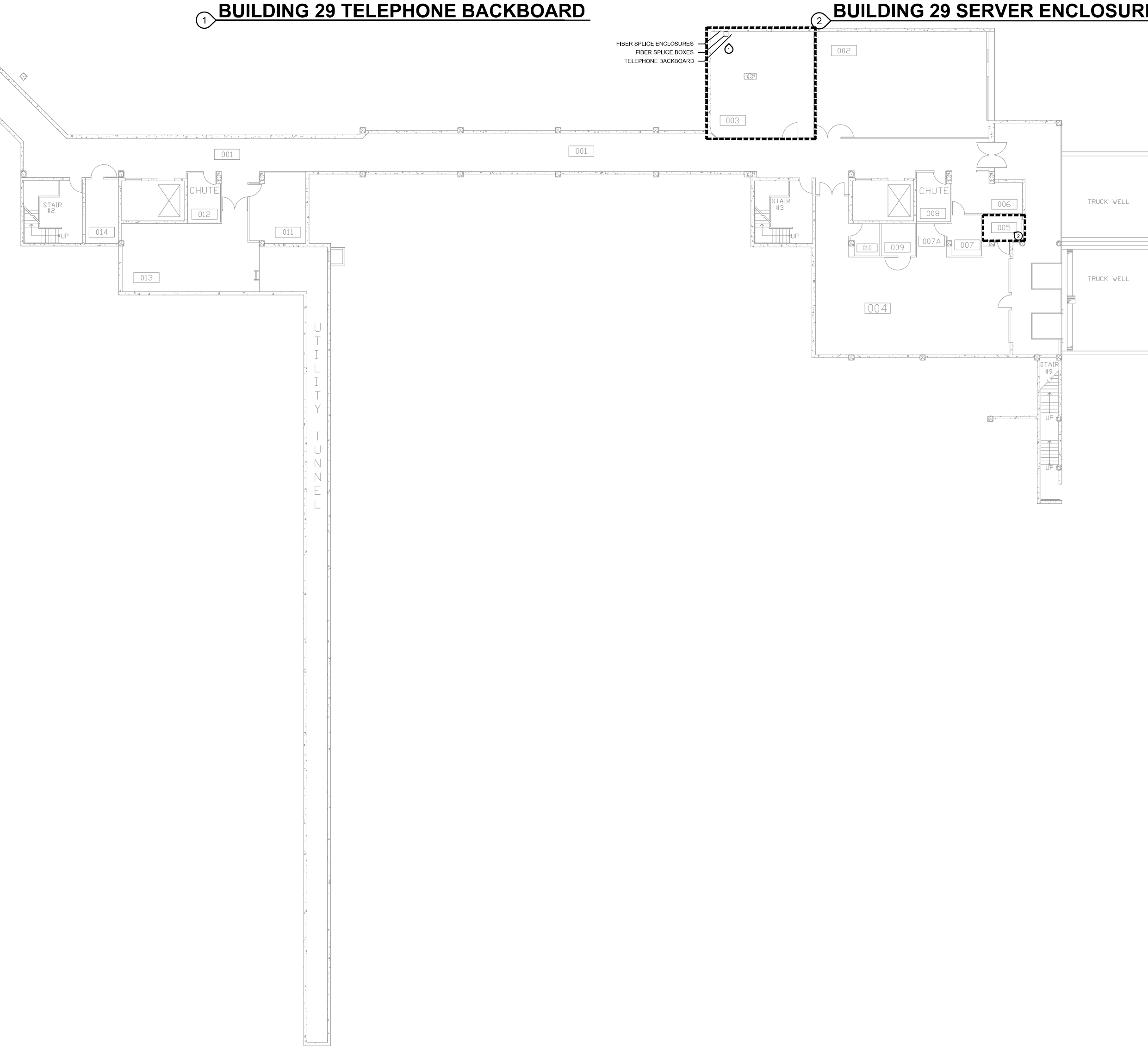
SHEET NUMBER
E3.28G



1 **BUILDING 29 TELEPHONE BACKBOARD**



2 **BUILDING 29 SERVER ENCLOSURE**

1 E3.29A **BUILDING 29 TELECOMMUNICATIONS BASEMENT PLAN**
SCALE: 1/16" = 1'-0"

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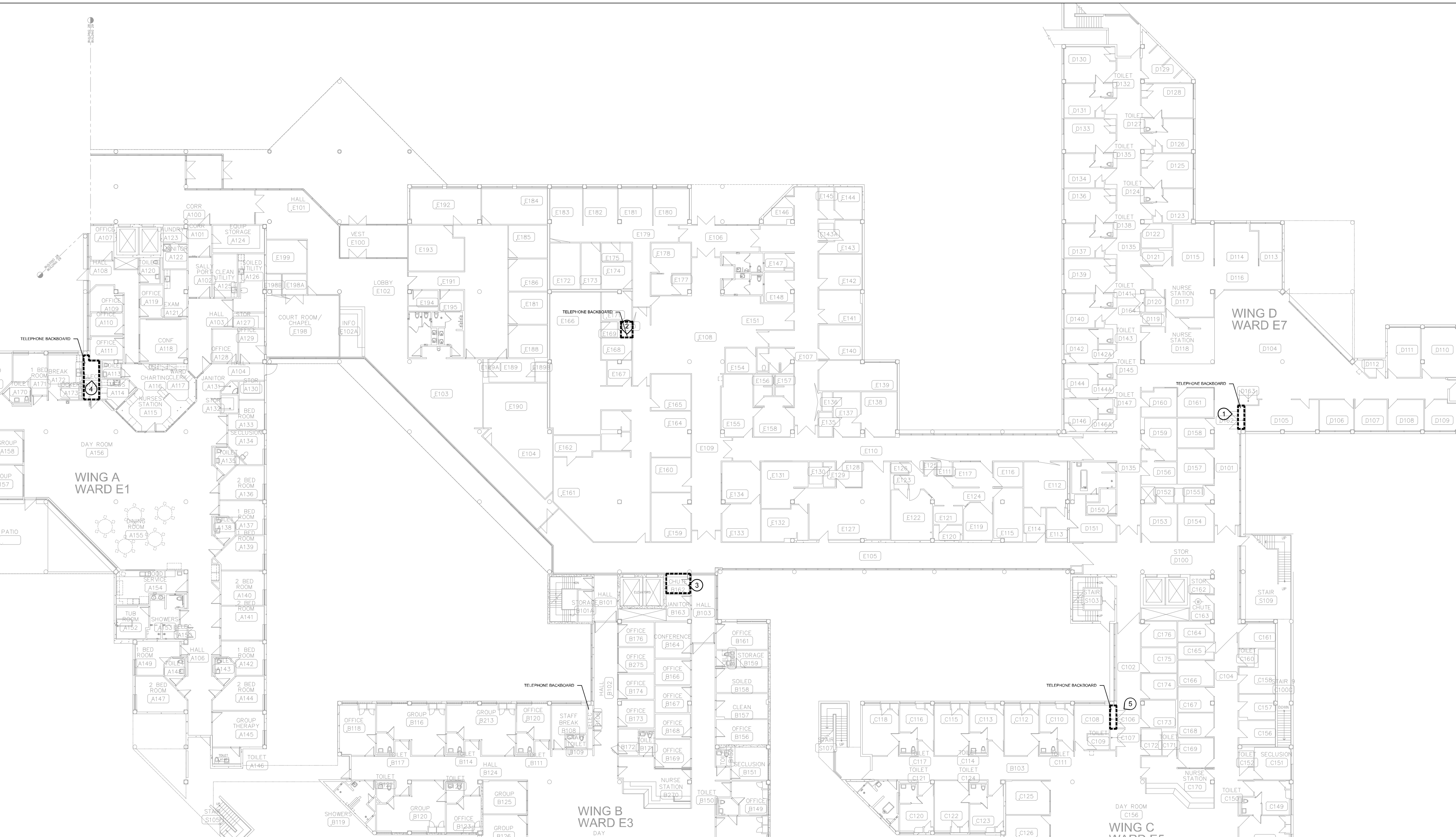
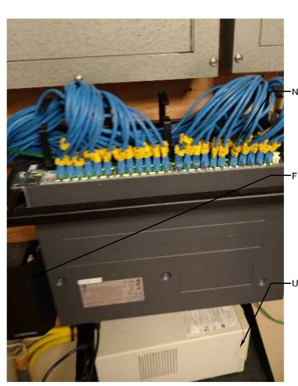
SHEET TITLE
BUILDING 29
TELECOMMUNICATIONS
BASEMENT PLAN

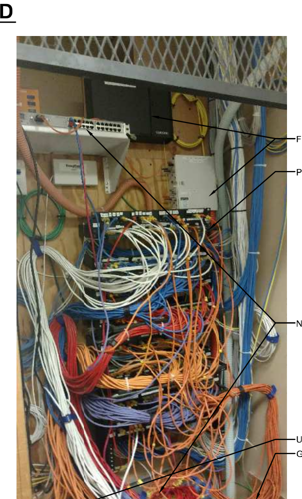
SHEET NUMBER
E3.29A



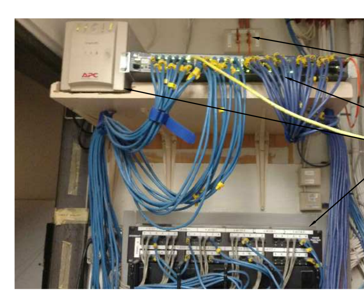
2 BUILDING 29 TELEPHONE BACKBOARD



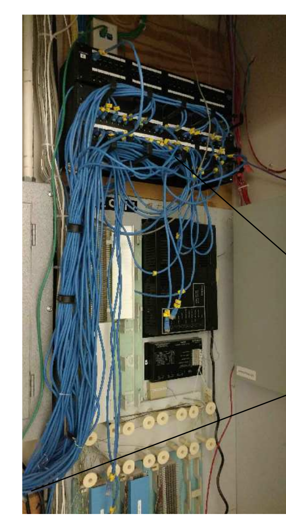
1 BUILDING 29 IDF CLOSET



3 BUILDING 29 IDF ROOM



4 BUILDING 29 IDF ROOM



5 BUILDING 29 IDF CLOSET

1 E3.29B **BUILDING 29 TELECOMMUNICATIONS FIRST FLOOR PLAN**
SCALE: 1/16" = 1'-0"

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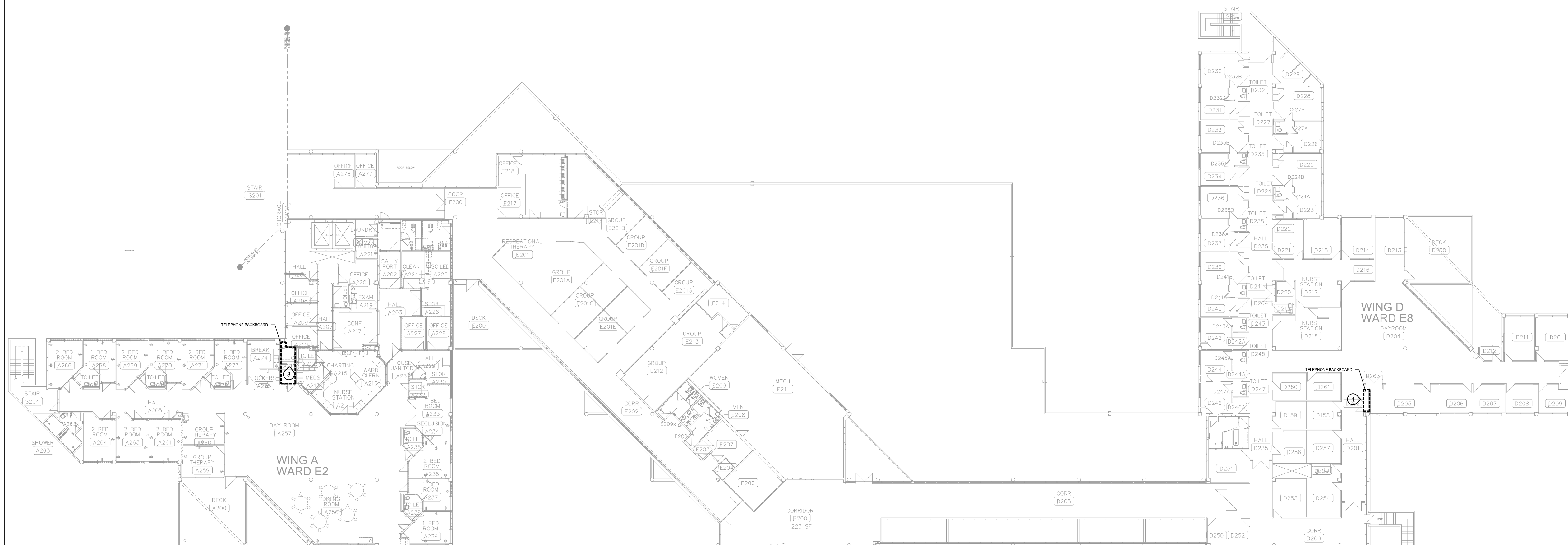
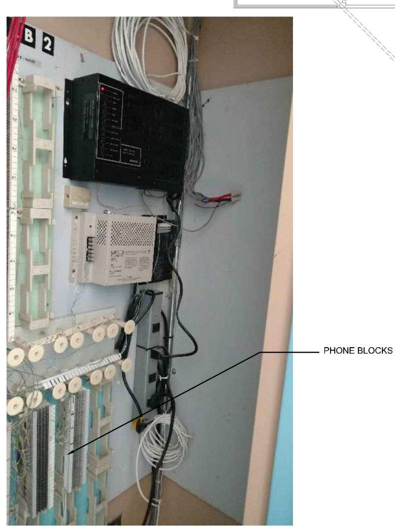
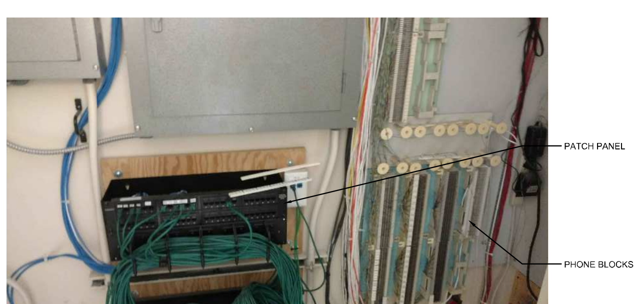
SHEET TITLE
BUILDING 29
TELECOMMUNICATIONS
FIRST FLOOR PLAN

SHEET NUMBER
E3.29B

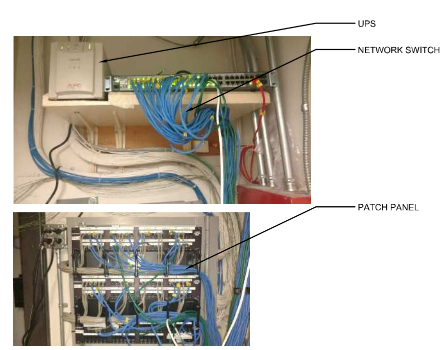




2 BUILDING 29 IDF CLOSET



1 BUILDING 29 IDF CLOSET



3 BUILDING 29 IDF CLOSET

3 BUILDING 29 IDF CLOSET

1 E3.29C **BUILDING 29 TELECOMMUNICATIONS SECOND FLOOR PLAN**
SCALE: 1/16" = 1'-0"

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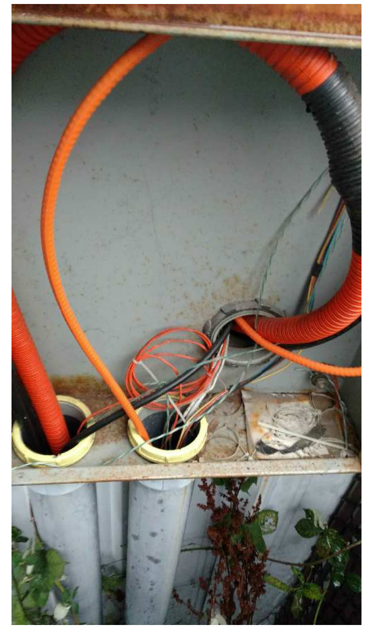
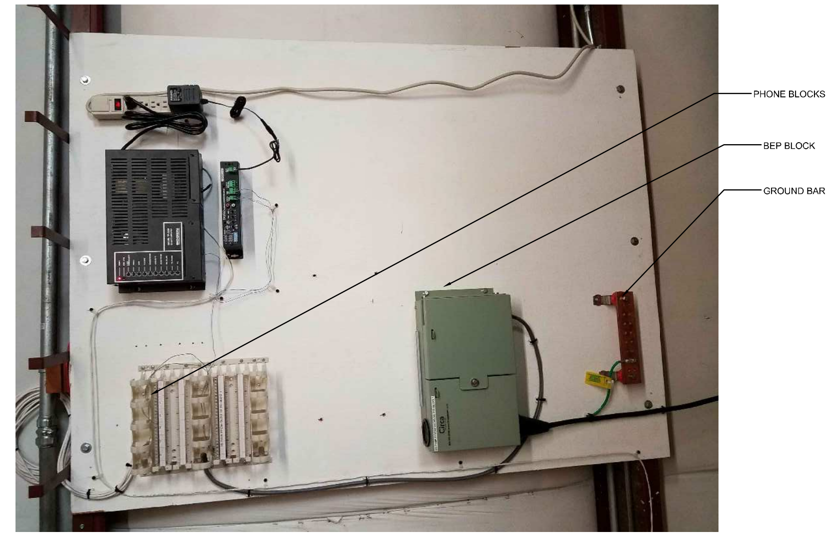
SHEET TITLE
BUILDING 29
TELECOMMUNICATIONS
SECOND FLOOR PLAN

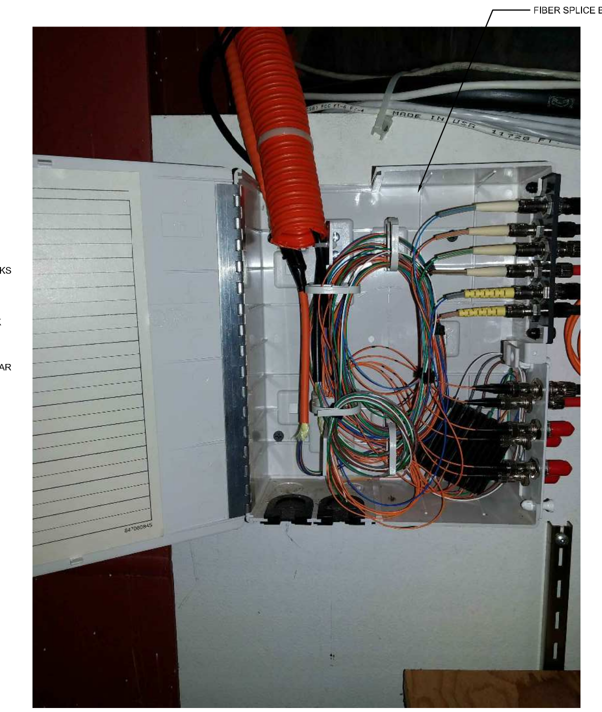
SHEET NUMBER
E3.29C



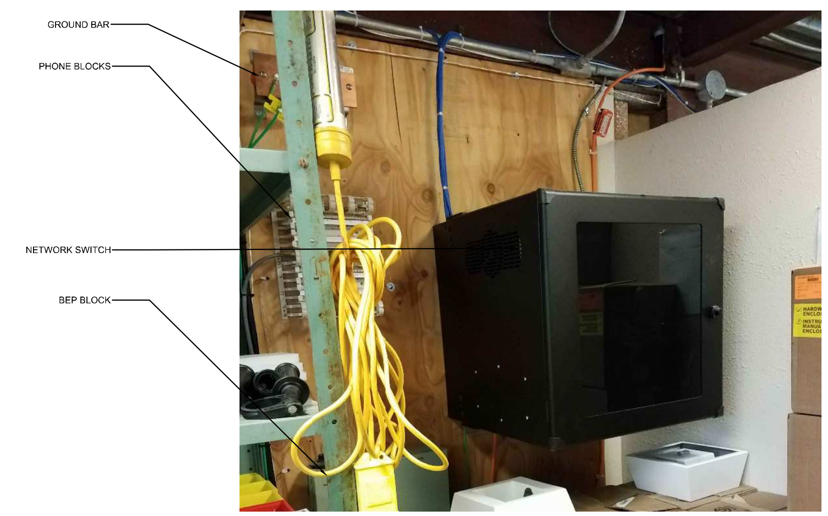
① ENCLOSURE TO BLDG 1 AND 33



② BUILDING 32 TELEPHONE BACKBOARD

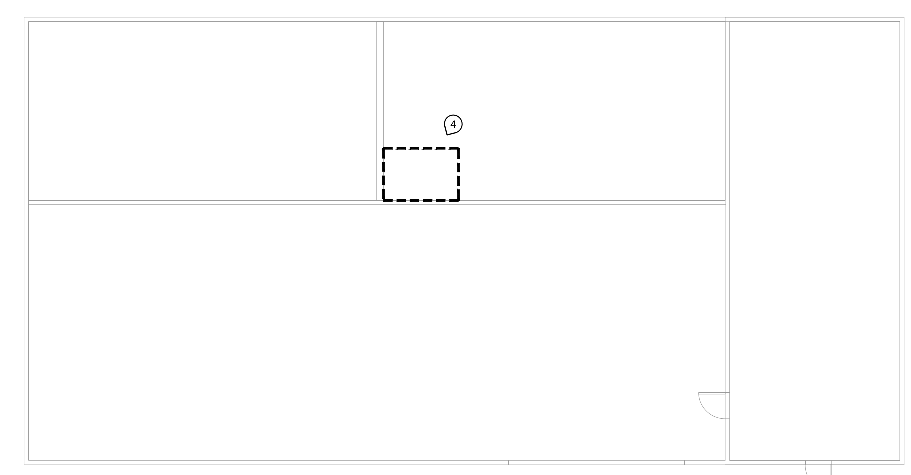


③ BUILDING 33 FIBER SPLICE BOX



④ BUILDING 32 IDF CABINET

N 1 / E3.32A **ELECTRICAL BUILDING 32 FIRST FLOOR**
SCALE: 1/8" = 1'-0"



N 2 / E3.32A **ELECTRICAL BUILDING 33 FIRST FLOOR**
SCALE: 1/8" = 1'-0"

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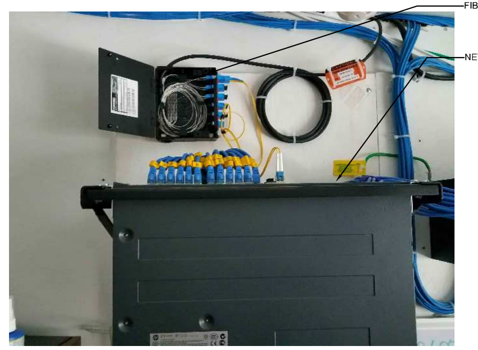
CHECKED BY	DS
APPROVED BY	ES

SHEET TITLE

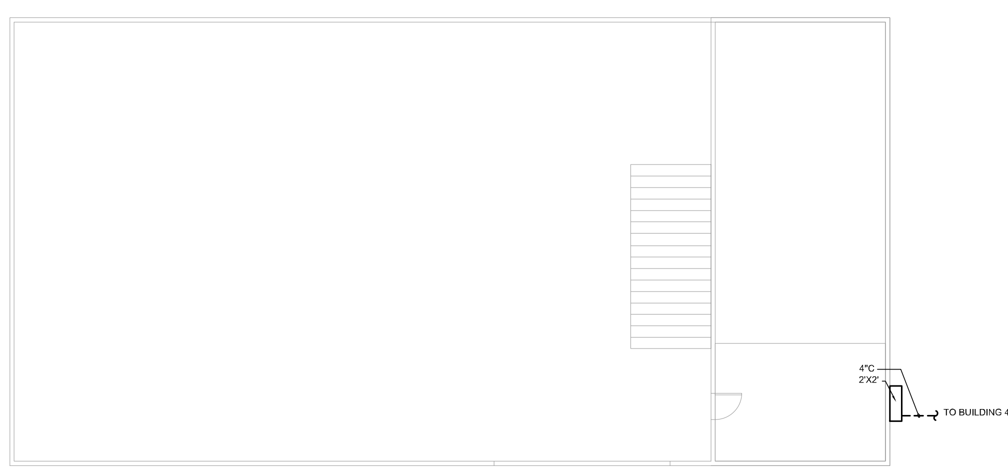
BUILDING 32&33
TELECOMMUNICATIONS
FLOOR PLANS

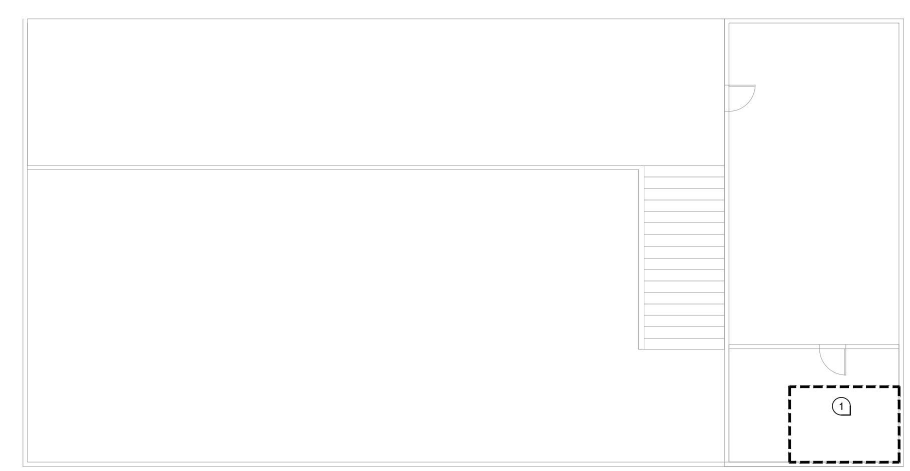
SHEET NUMBER

E3.32A



1 BUILDING 34 IDF EQUIPMENT





N 1 E3.34A **ELECTRICAL BUILDING 34 FIRST FLOOR**
SCALE: 1/8" = 1'-0"

N 2 E3.34A **ELECTRICAL BUILDING 34 MEZZANINE**
SCALE: 1/8" = 1'-0"

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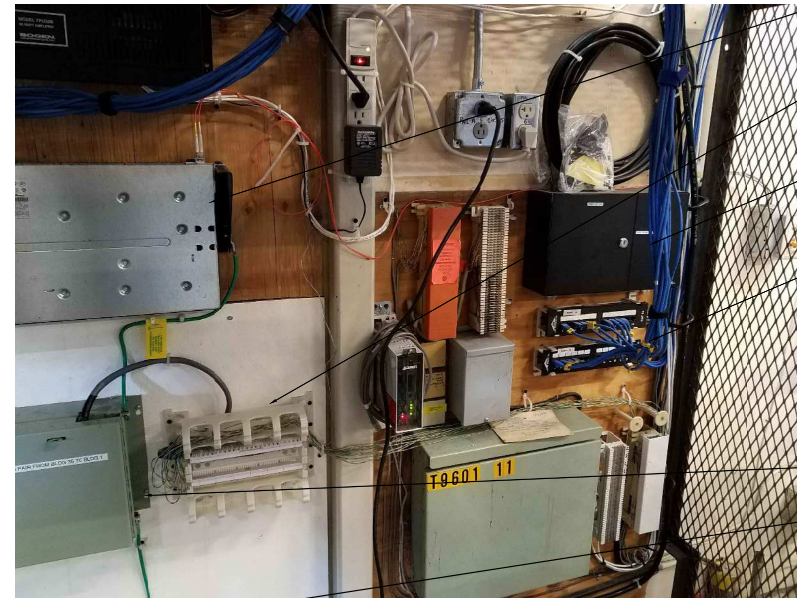
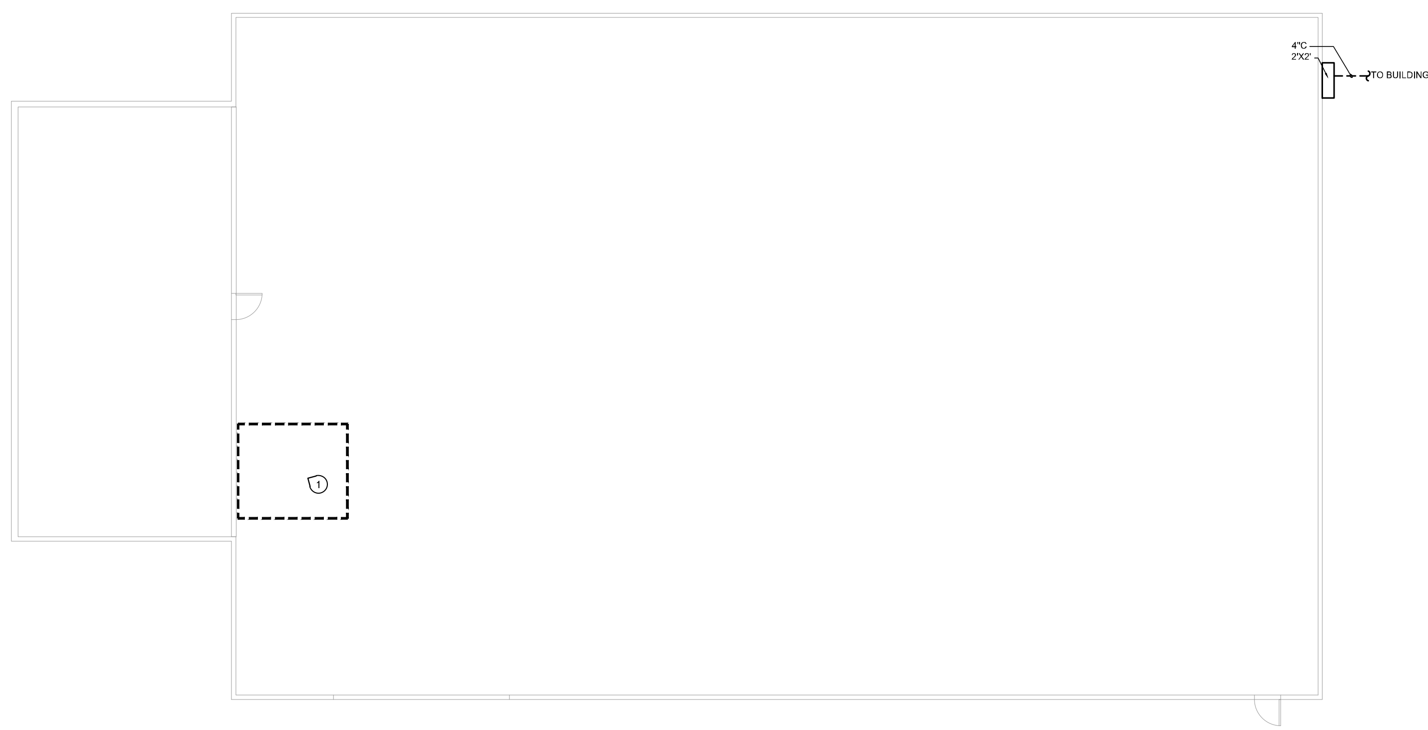
SHEET TITLE
BUILDING 34
TELECOMMUNICATIONS
FLOOR PLANS

SHEET NUMBER
E3.34A



1 BUILDING 35 IDF EQUIPMENT



1 E3.35A BUILDING 35 TELECOMMUNICATIONS FLOOR PLAN
SCALE: 1/8" = 1'-0"

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	FINAL REPORT	5/31/18

PROJECT NO.	2017-467
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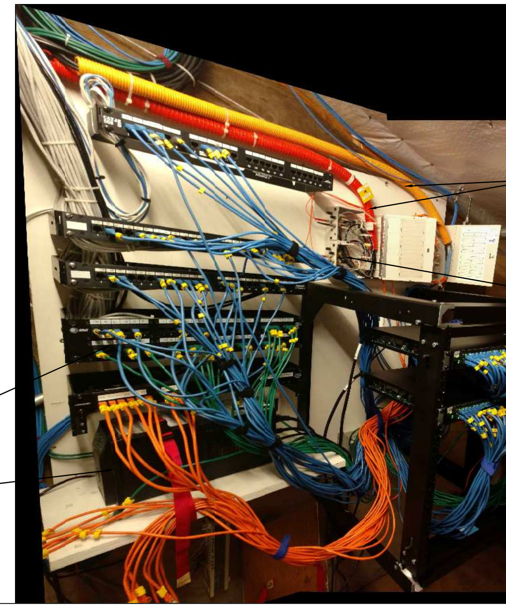
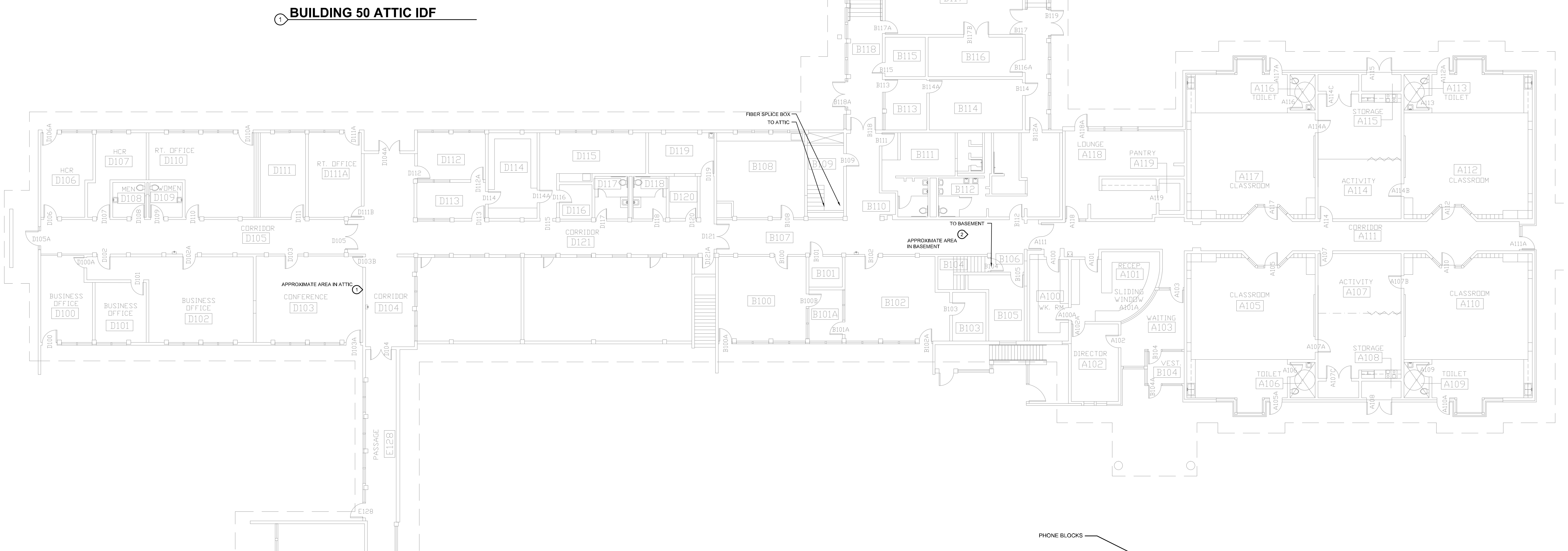
APPROVED BY	ES

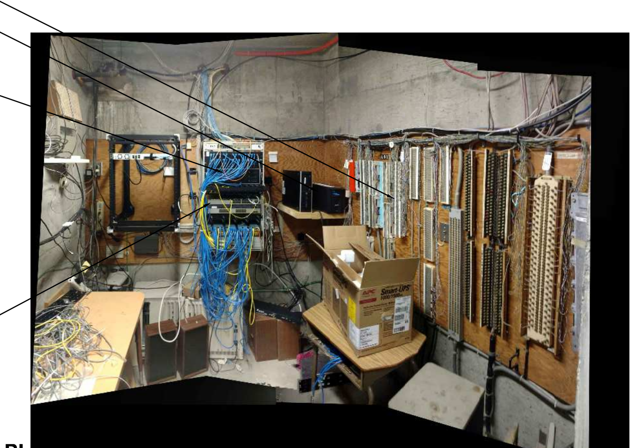
SHEET TITLE
BUILDING 35 TELECOMMUNICATIONS FLOOR PLAN

SHEET NUMBER
E3.35A



① BUILDING 50 ATTIC IDF





① BUILDING 50 TELECOMMUNICATIONS FLOOR PL
SCALE: 3/32" = 1'-0"

② BUILDING 50 BASEMENT IDF

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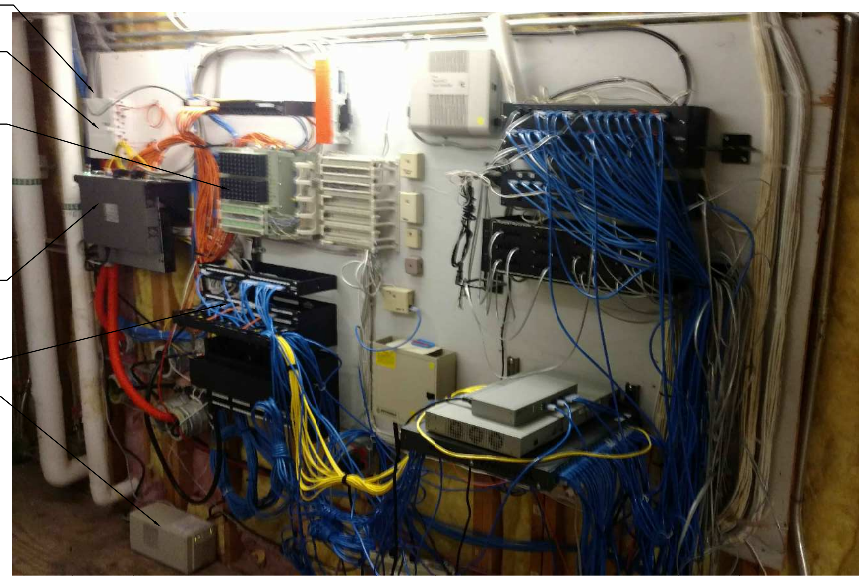
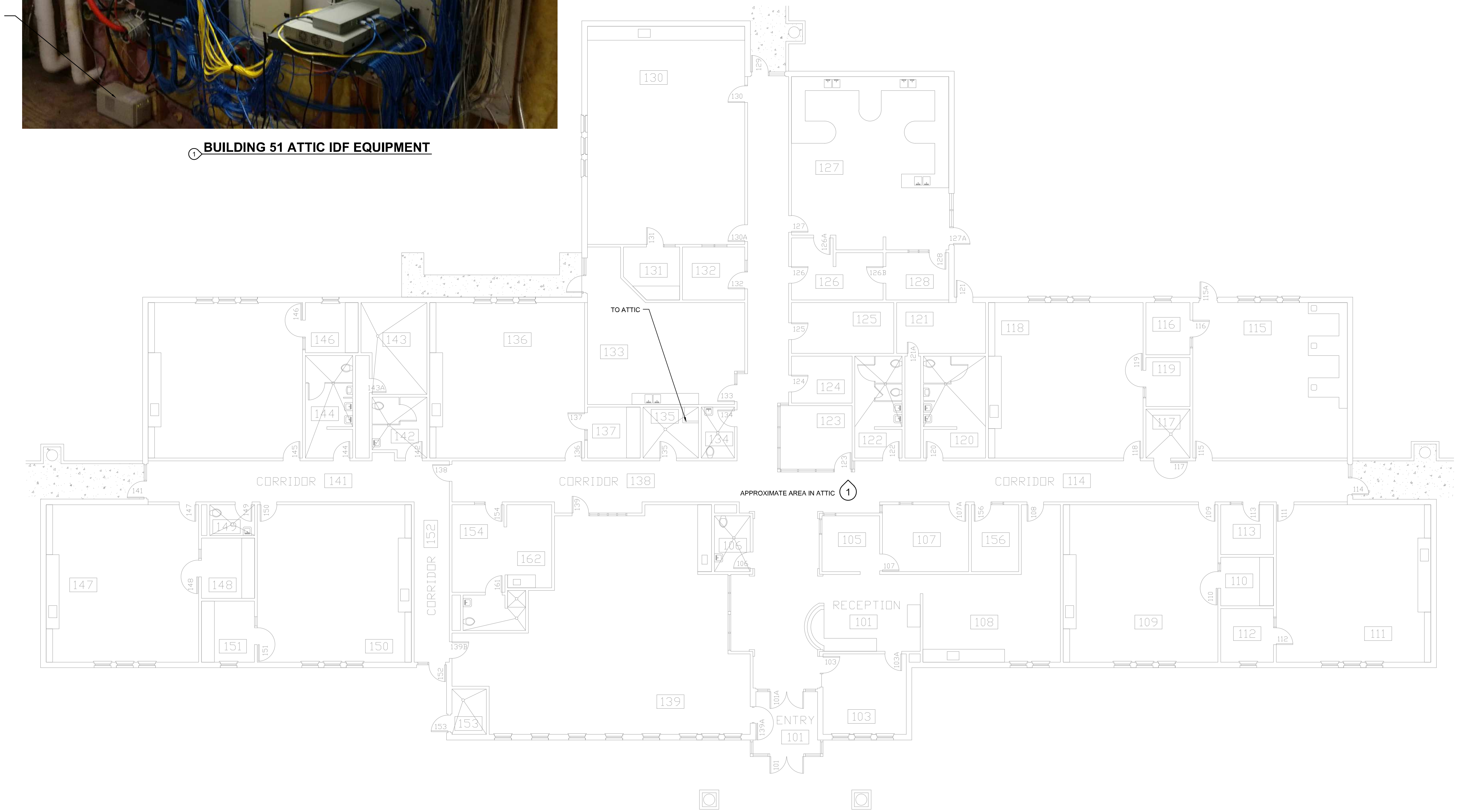
SHEET TITLE
BUILDING 50 TELECOMMUNICATIONS FLOOR PLAN

SHEET NUMBER
E3.50A



BUILDING 51 ATTIC IDF EQUIPMENT (1)



BUILDING 51 TELECOMMUNICATIONS FLOOR PLAN
SCALE: 1/8" = 1'-0"

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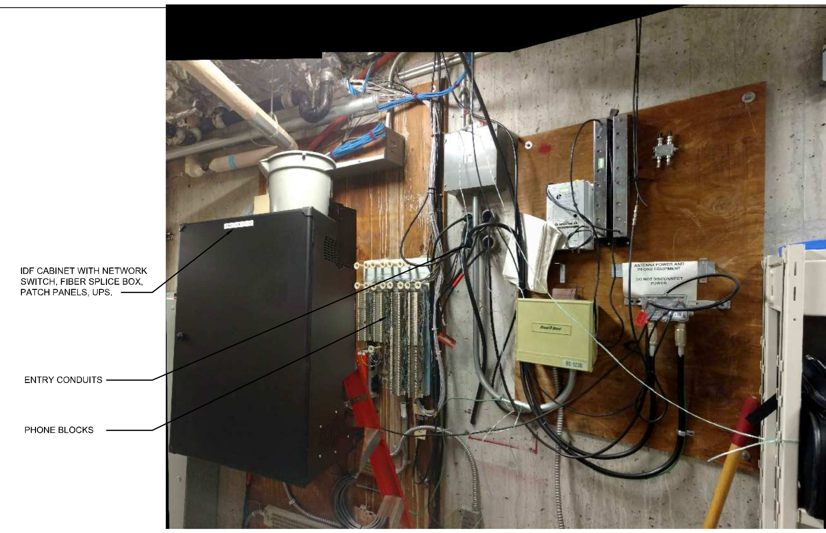
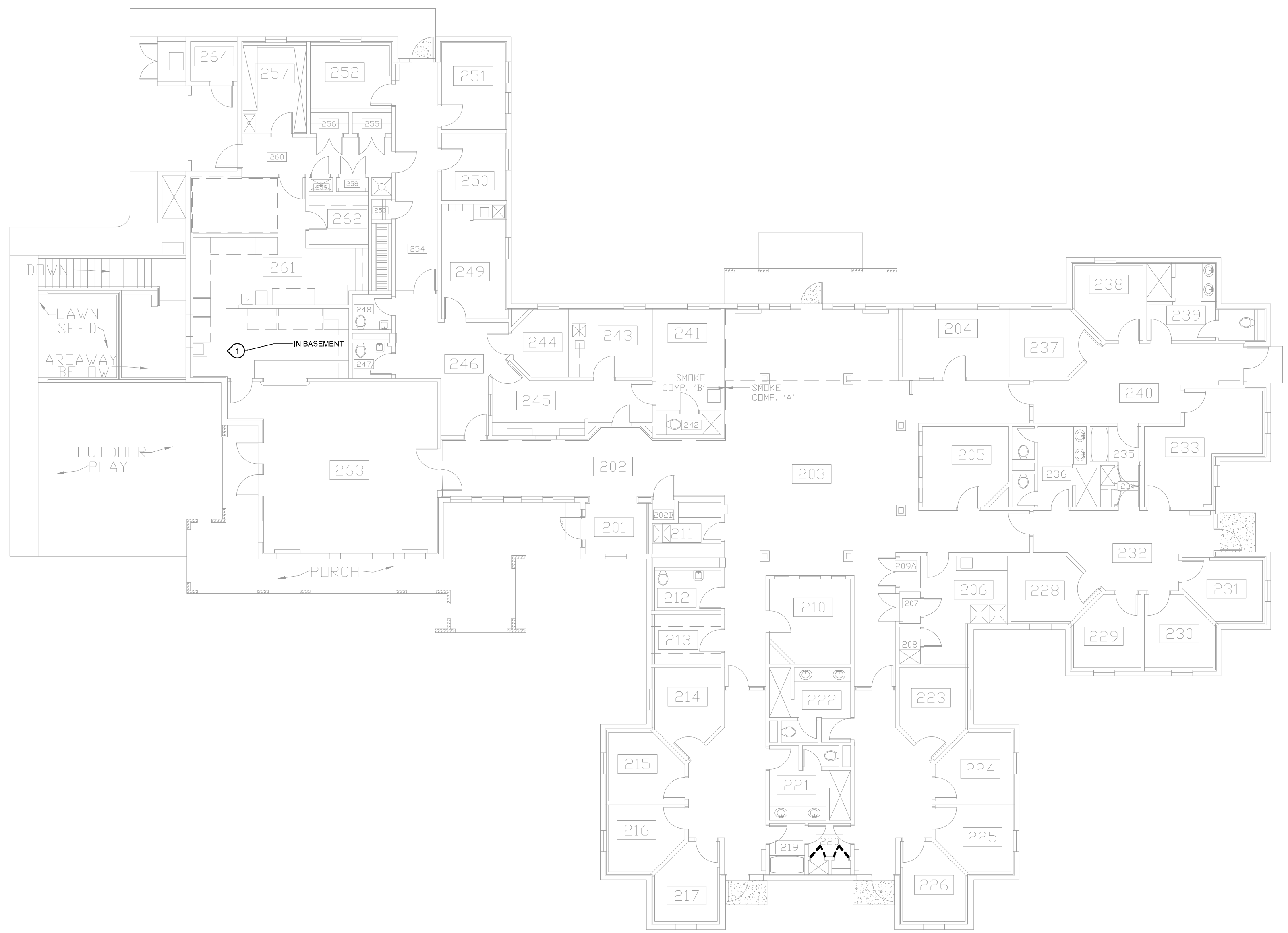
SHEET TITLE
BUILDING 51 TELECOMMUNICATIONS FLOOR PLAN

SHEET NUMBER
E3.51A



1 **BUILDING 52 IDF ROOM**



1 E3.52A **BUILDING 52 TELECOMMUNICATIONS FLOOR PLAN**
SCALE: 1/8" = 1'-0"

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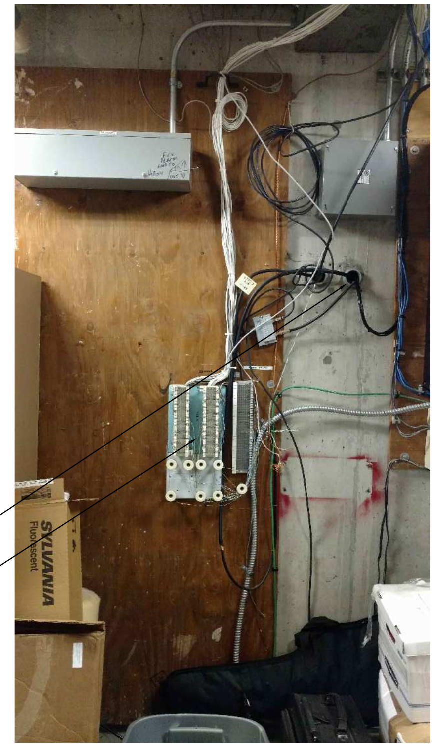
SHEET TITLE
BUILDING 52
TELECOMMUNICATIONS
FLOOR PLAN

SHEET NUMBER
E3.52A

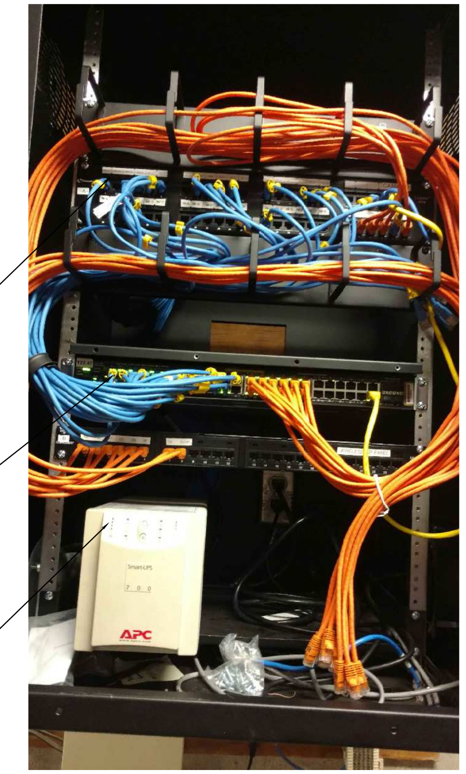
ENTRY CONDUITS
PHONE BLOCKS



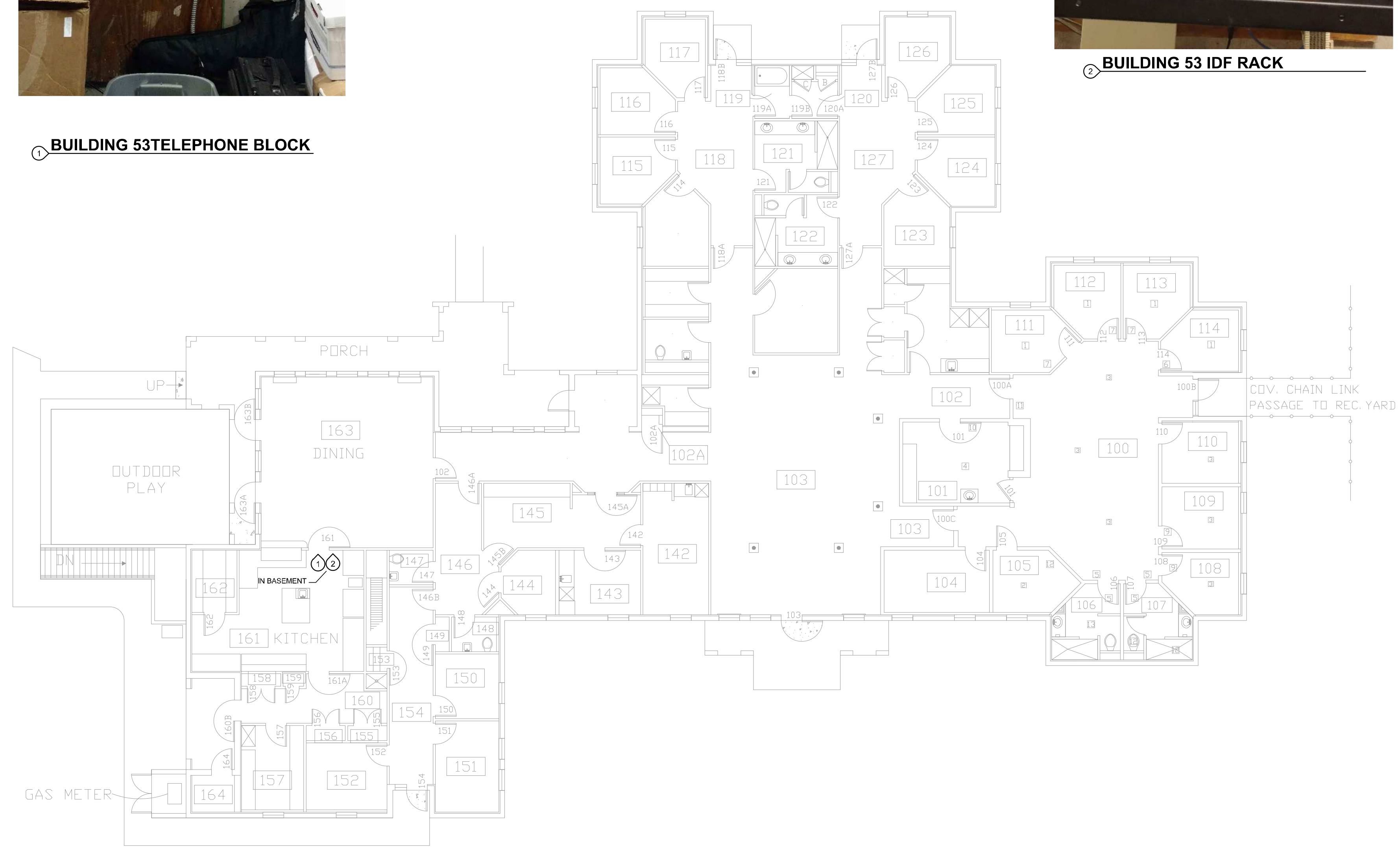
(1) BUILDING 53TELEPHONE BLOCK

GROUND BAR

PATCH PANEL
NETWORK SWITCH
UPS



(2) BUILDING 53 IDF RACK



(1 / E3.53A) BUILDING 53 TELECOMMUNICATIONS FLOOR PLAN
SCALE: 1/8" = 1'-0"

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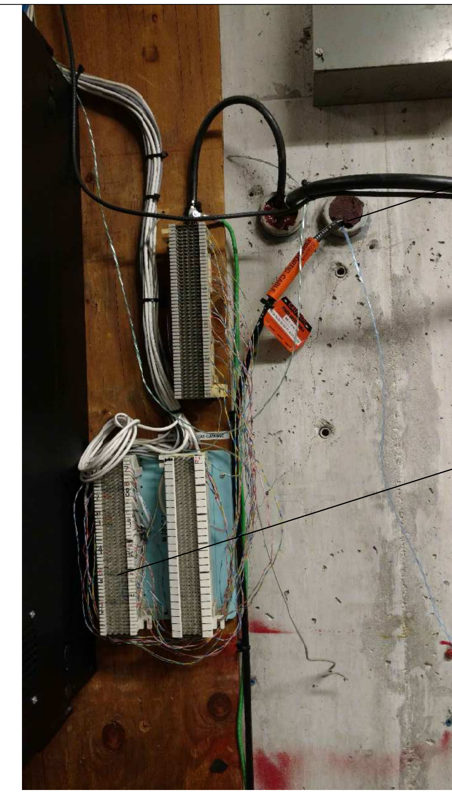
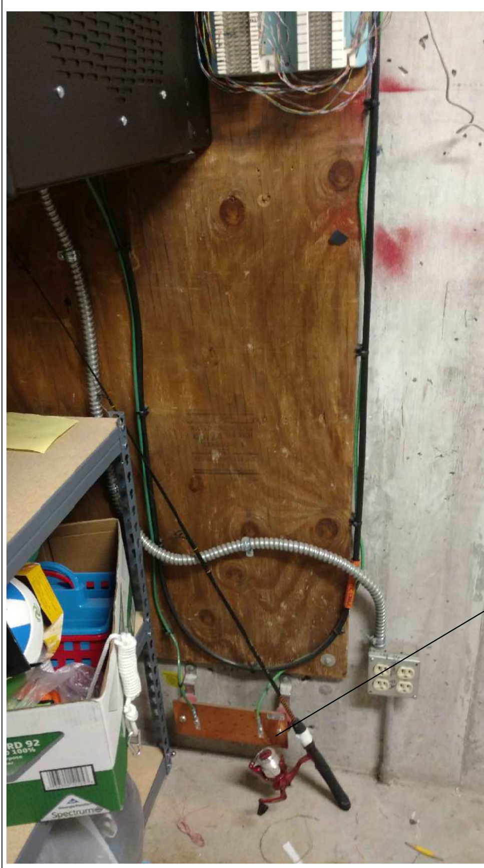
SHEET TITLE
BUILDING 53 TELECOMMUNICATIONS FLOOR PLAN

SHEET NUMBER
E3.53A



1 **BUILDING 54 IDF LOCATION**



1 **BUILDING 54 IDF LOCATION**

1 E3.54A **BUILDING 54 TELECOMMUNICATIONS FLOOR PLAN**
SCALE: 1/8" = 1'-0"

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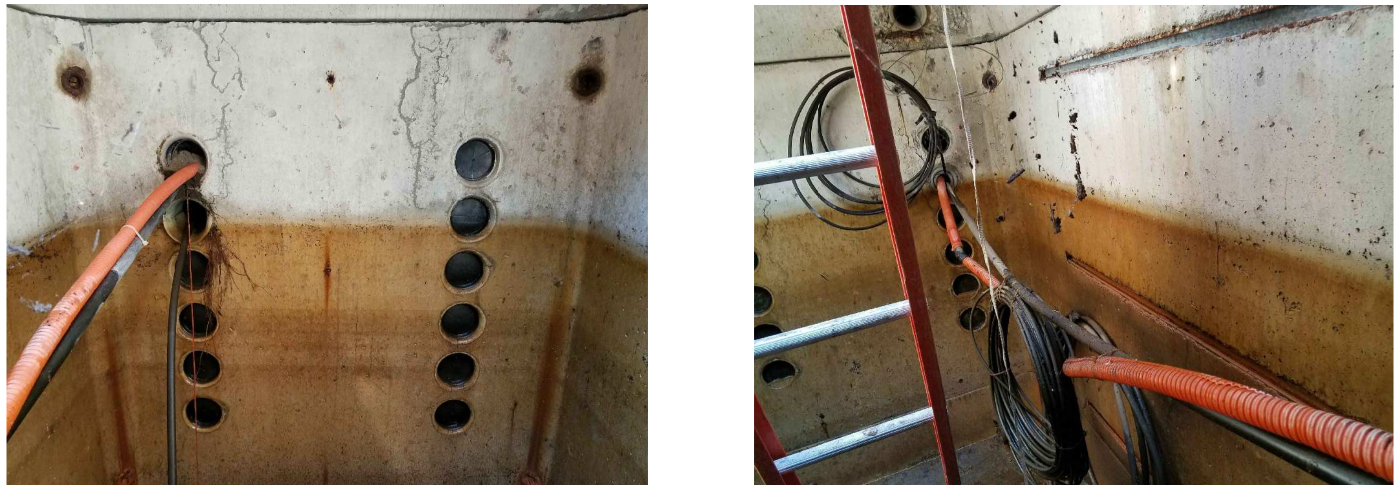
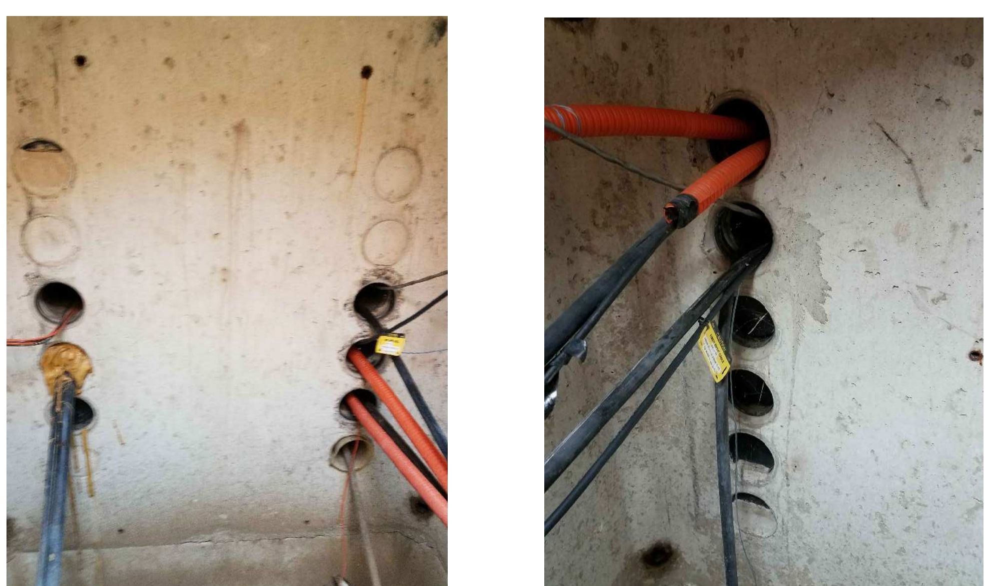
SHEET TITLE
BUILDING 54
TELECOMMUNICATIONS
FLOOR PLAN

SHEET NUMBER
E3.54A

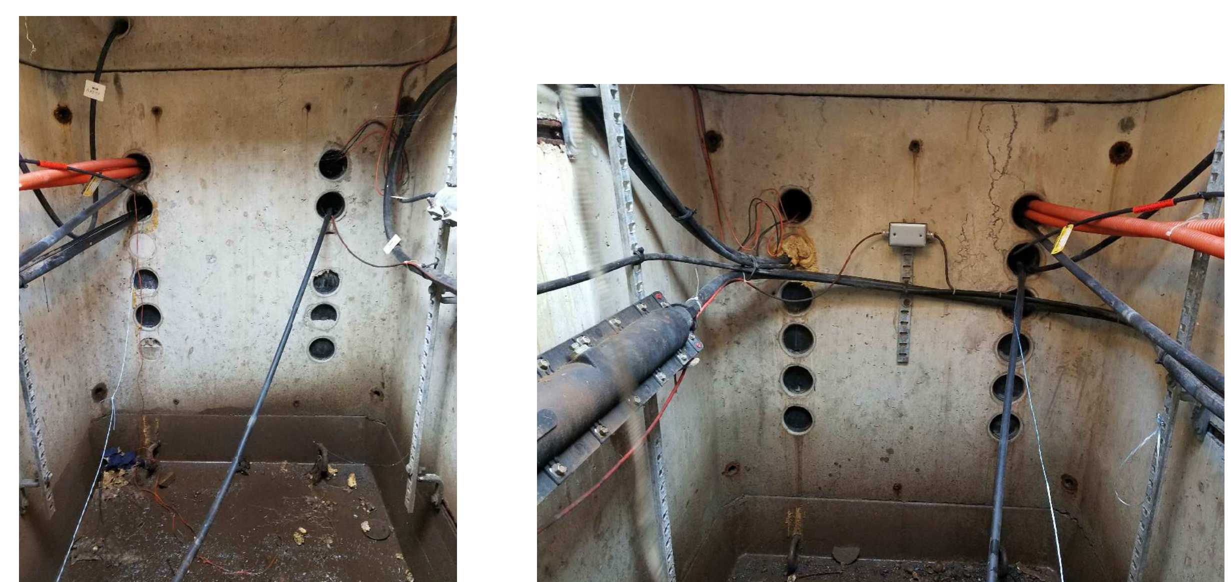


MANHOLE 1
1 / E8.01
NTS

MANHOLE 2
2 / E8.01
NTS



MANHOLE 3
3 / E8.01
NTS



MANHOLE 4
4 / E8.01
NTS

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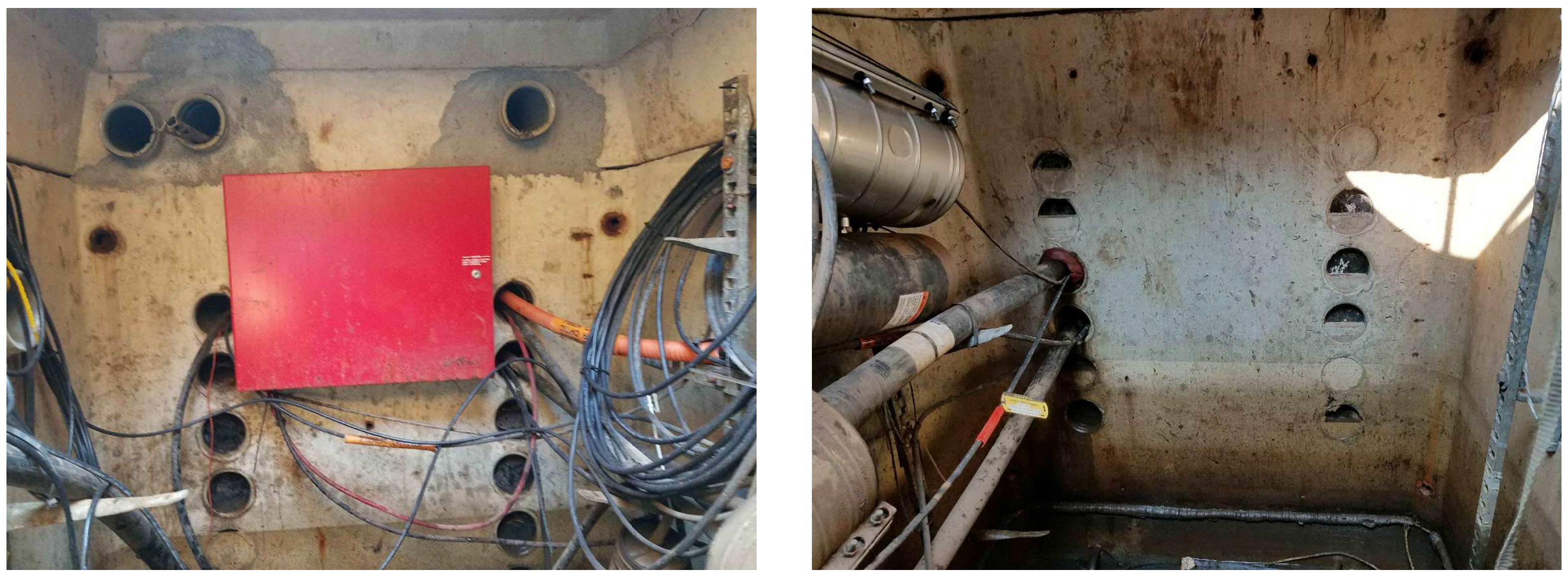
SHEET TITLE

VAULT PHOTOS

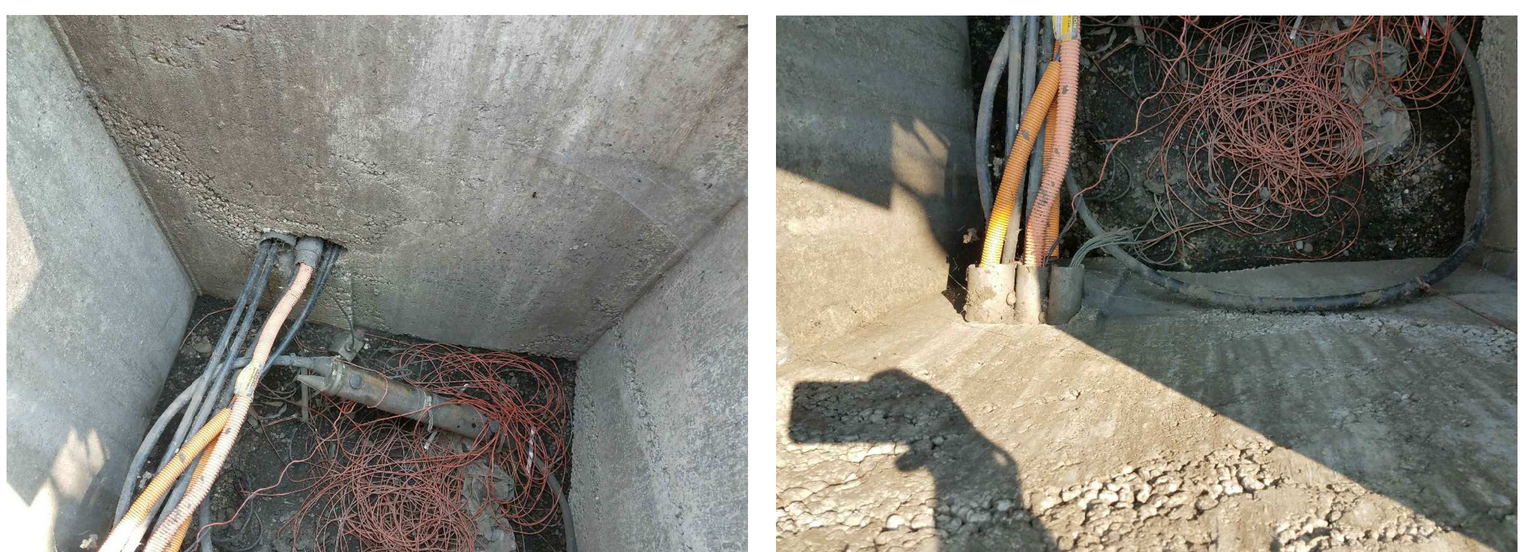
SHEET NUMBER

E8.01

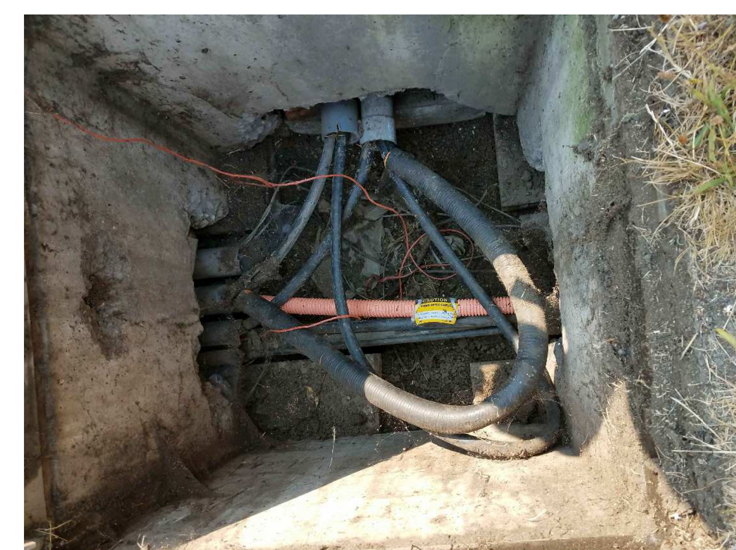
1 E8.02 **MANHOLE 5**
NTS



2 E8.02 **MANHOLE 6**
NTS



3 E8.02 **MANHOLE 7**
NTS



4 E8.02 **MANHOLE 8**
NTS

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SHEET TITLE
VAULT PHOTOS

SHEET NUMBER
E8.02

1 E8.03 **MANHOLE 9**
NTS

2 E8.03 **MANHOLE 10**
NTS

3 E8.03 **MANHOLE 11**
NTS

4 E8.03 **MANHOLE 12**
NTS

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APPROVED BY	ES

SHEET TITLE

VAULT PHOTOS

SHEET NUMBER

E8.03

WESTERN STATE UTILITY VAULT SURVEY
IN
SECTION 33, TOWNSHIP 20N, RANGE 2 EAST, W.M.

MAINTENANCE HOLE

NUMBER	NORTHING	EASTING	DESCRIPTION
MH-1	680291.25	1128167.57	CENTER 1.4'Ø RIM
MH-2	680418.64	1127853.30	CENTER 1.4'Ø RIM
MH-3	680169.51	1127836.28	CENTER 1.4'Ø RIM
MH-4	679996.71	1127571.71	CENTER 1.4'Ø RIM
MH-5	679983.42	1127236.53	CENTER 1.4'Ø RIM
MH-6	680019.20	1126976.69	CENTER 1.4'Ø RIM
MH-7	679500.52	1126034.44	NW CORNER LID
	679500.53	1126037.50	NE CORNER LID
	679497.49	1126034.45	SW CORNER LID
	679497.49	1126037.51	SE CORNER LID
MH-8	679499.03	1125938.28	NW CORNER LID
	679498.97	1125940.51	NE CORNER LID
	679496.76	1125938.22	SW CORNER LID
	679496.68	1125940.45	SE CORNER LID
MH-9	679296.86	1125961.83	CENTER 1.95'Ø RIM
MH-10	679478.86	1125720.56	CENTER 1.4'Ø RIM
MH-11	679521.45	1125379.57	NW CORNER LID
	679520.92	1125382.60	NE CORNER LID
	679518.52	1125379.21	SW CORNER LID
	679517.99	1125382.24	SE CORNER LID
MH-12	679592.64	1125444.68	NW CORNER LID
	679591.78	1125446.09	NE CORNER LID
	679590.50	1125443.42	SW CORNER LID
	679589.64	1125444.83	SE CORNER LID
MH-12A	679592.44	1125454.21	NW CORNER LID
	679592.50	1125456.19	NE CORNER LID
	679589.51	1125454.26	SW CORNER LID
	679589.57	1125456.24	SE CORNER LID
MH-13	680009.44	1126416.05	NW CORNER LID
	680009.61	1126419.04	NE CORNER LID
	680006.42	1126416.24	SW CORNER LID
	680006.60	1126419.23	SE CORNER LID
MH-14	680271.18	1127054.71	CENTER 1.9'Ø RIM
MH-15	680037.30	1126461.56	NW CORNER LID
	680037.54	1126463.81	NE CORNER LID
	680035.04	1126461.82	SW CORNER LID
	680035.30	1126464.10	SE CORNER LID
MH-16	680048.96	1126663.58	NW CORNER LID
	680049.15	1126665.85	NE CORNER LID
	680046.71	1126663.74	SW CORNER LID
	680046.85	1126666.03	SE CORNER LID
MH-17	679975.27	1126524.67	NW CORNER LID
	679975.44	1126526.95	NE CORNER LID
	679973.21	1126524.64	SW CORNER LID
	679973.38	1126526.91	SE CORNER LID
MH-18	679497.75	1125767.78	NW CORNER LID
	679497.96	1125770.07	NE CORNER LID
	679495.45	1125767.95	SW CORNER LID
	679495.66	1125770.24	SE CORNER LID

BASIS OF MERIDIAN:
WASHINGTON STATE PLANE COORDINATE, NAD 83/91 SOUTH ZONE 4602

VERTICAL DATUM:
NAVD 88 PER WSDOT MONUMENT CUSTER: ELEVATION = 263.635'

BOUNDARY NOTE:
NO CORNERS WERE SET BY THIS SURVEY, NO TITLE REPORT WAS OBTAINED AND NO EASEMENTS ON THE PROPERTY, IF ANY, ARE SHOWN. BOUNDARY AND RIGHT OF WAY LINES ARE SHOWED PER BEST AVAILABLE RECORD INFORMATION, AND TIES TO EXISTING LOCAL MONUMENTATION.

SURVEYORS NOTE:
BUILDINGS AND ROADWAYS ARE SHOWN PER RECORD. THEY ARE INTENDED TO BE USED AS A VISUAL AIDE ONLY.

UTILITY NOTE:
UTILITIES SHOWN HEREON ARE PER KPFF AS-BUILT OF SITE SURFACE FEATURES. NO UNDERGROUND UTILITY LOCATES WERE PERFORMED DURING THE COURSE OF THIS SURVEY.

METHOD OF SURVEY:
CONTROL SURVEY PERFORMED WITH THE USE OF TOPCON GR5 GPS RECEIVERS, TOPOGRAPHIC AND SUPPLEMENTAL CONTROL SURVEY PERFORMED USING CONVENTIONAL GROUND METHODS USING A TOPCON PS-103 ROBOTIC TOTAL STATION.

ALL WORK PERFORMED DURING THE COURSE OF THIS SURVEY MEETS OR EXCEEDS THE STANDARDS AS SET FORTH IN WAC 332-130-090.

SURVEY PERFORMED IN MAY OF 2018.

N

0 50 100 150
1" = 50'

LEGEND
COMMUNICATIONS MANHOLE
COMMUNICATIONS VAULT
COMMUNICATIONS HANDHOLE

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www.kpff.com

JEREME F. CHAPMAN
STATE OF WASHINGTON
45779
REGISTERED PROFESSIONAL LAND SURVEYOR
PROFESSIONAL STAMP

DEPARTMENT OF SOCIAL AND HEALTH SERVICES
WESTERN STATE HOSPITAL

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SHEET TITLE	

SHEET 1
SHEET NUMBER

WESTERN STATE UTILITY VAULT SURVEY
IN
SECTION 33, TOWNSHIP 20N, RANGE 2 EAST, W.M.

0 50 100 150

1" = 50'

LEGEND

COMMUNICATIONS MANHOLE
COMMUNICATIONS VAULT
COMMUNICATIONS HANDHOLE

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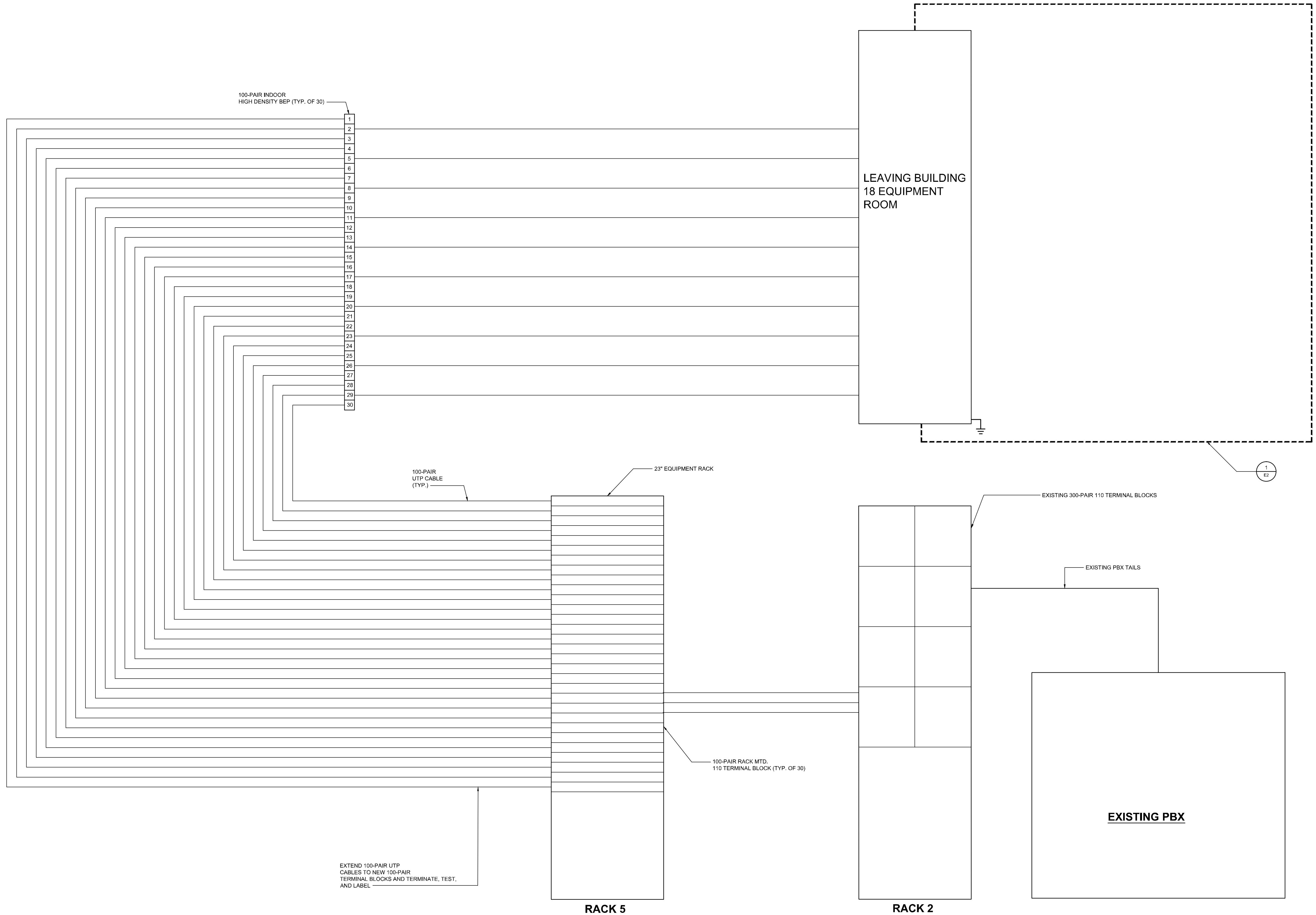
SHEET TITLE	

SHEET 2
SHEET NUMBER

Appendix C - Riser Diagrams



1
E1
DIAGRAM - COPPER TELECOMMUNICATIONS BACKBONE CABLING
SCALE: NONE

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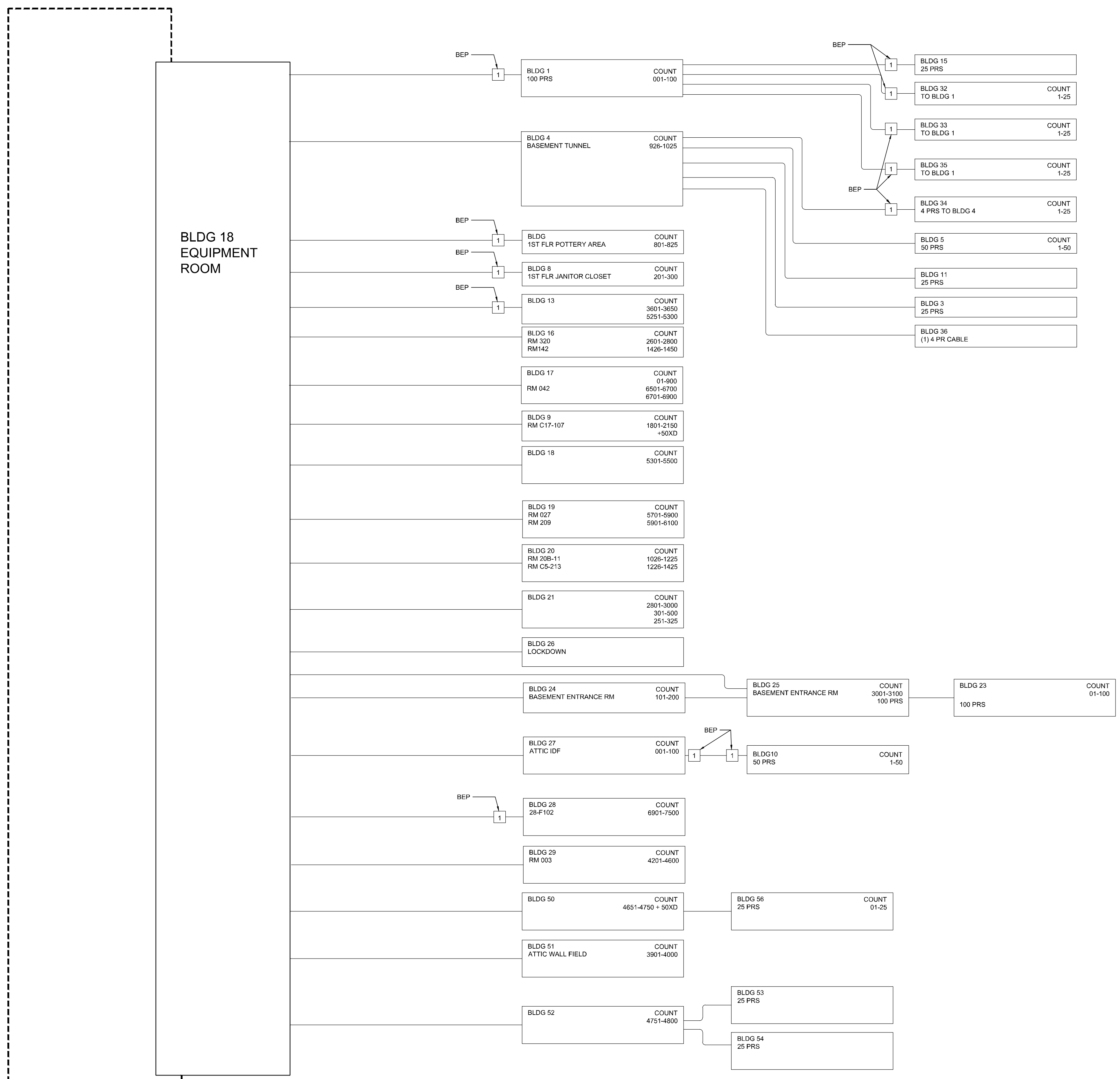
SHEET TITLE	

COPPER RISER
DIAGRAMS

SHEET NUMBER

E1



1 E2 **DIAGRAM - COPPER TELECOMMUNICATIONS BACKBONE CABLING**
SCALE: NONE

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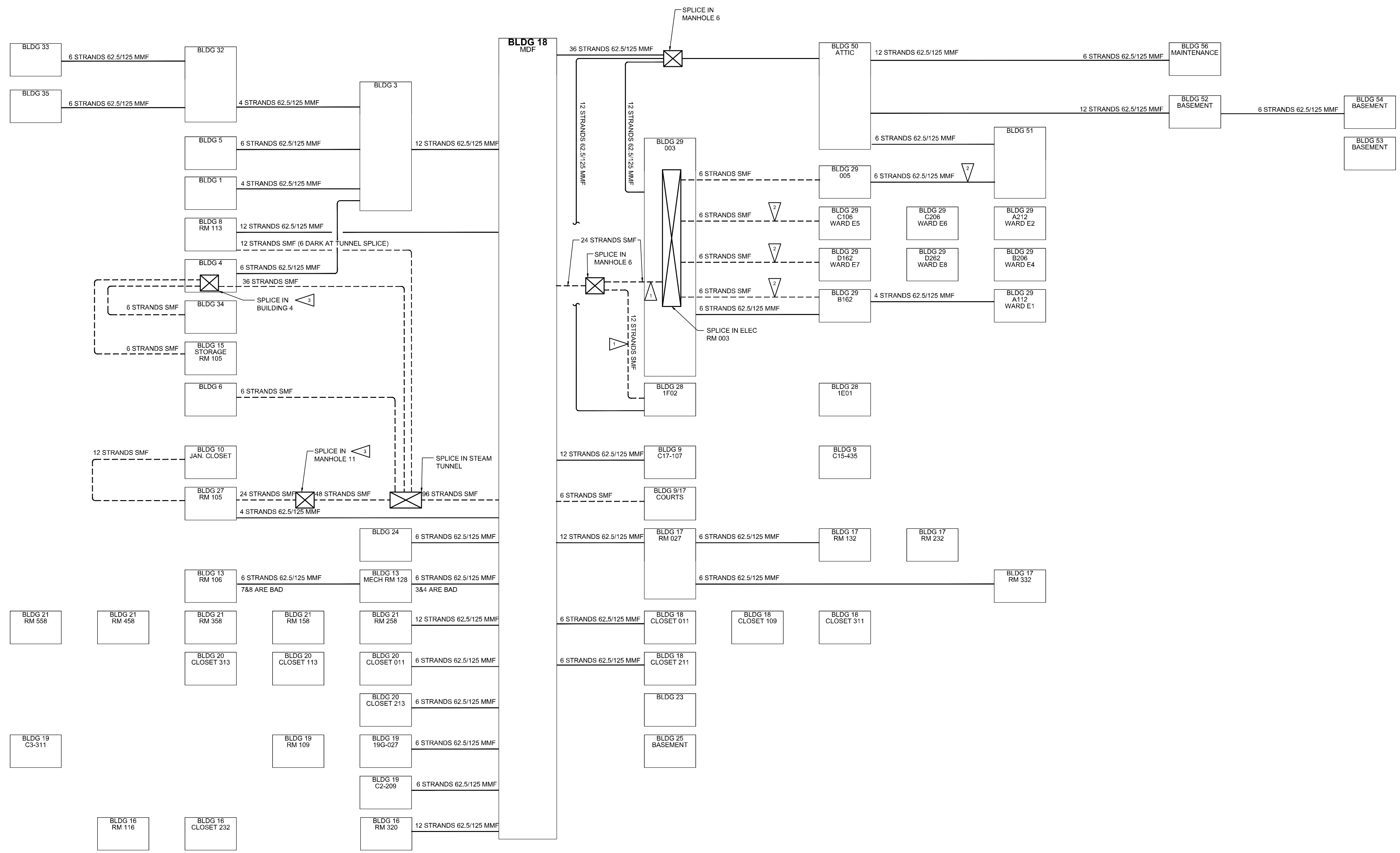
SHEET TITLE	

COPPER RISER
DIAGRAMS

SHEET NUMBER
E2

FLAG NOTES:

1. SIX (6) STRANDS DARK
2. TWO (2) STRANDS DARK
3. TWENTY FOUR (24) STRANDS DARK



1/E3 DIAGRAM - OPTICAL FIBER TELECOMMUNICATIONS BACKBONE CABLING

SCALE: NONE

NOTE: BUILDINGS/ROOMS SHOWN ALL HAVE HAVE HORIZONTAL CABLING

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OPTICAL FIBER RISER DIAGRAM

SHEET NUMBER

E3

Appendix D - Wireless Signal Mapping

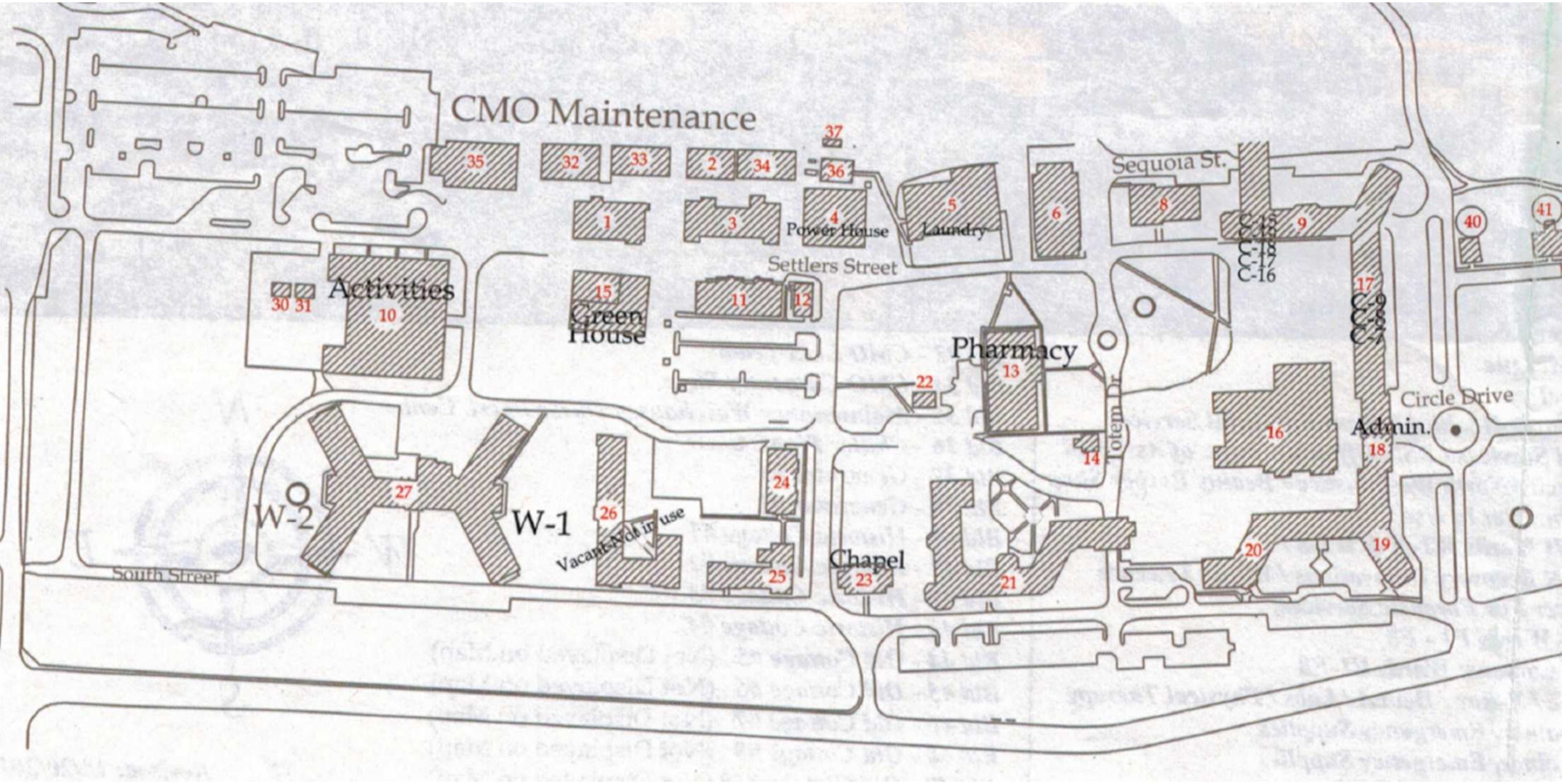
Western State Hospital

Communication Overview

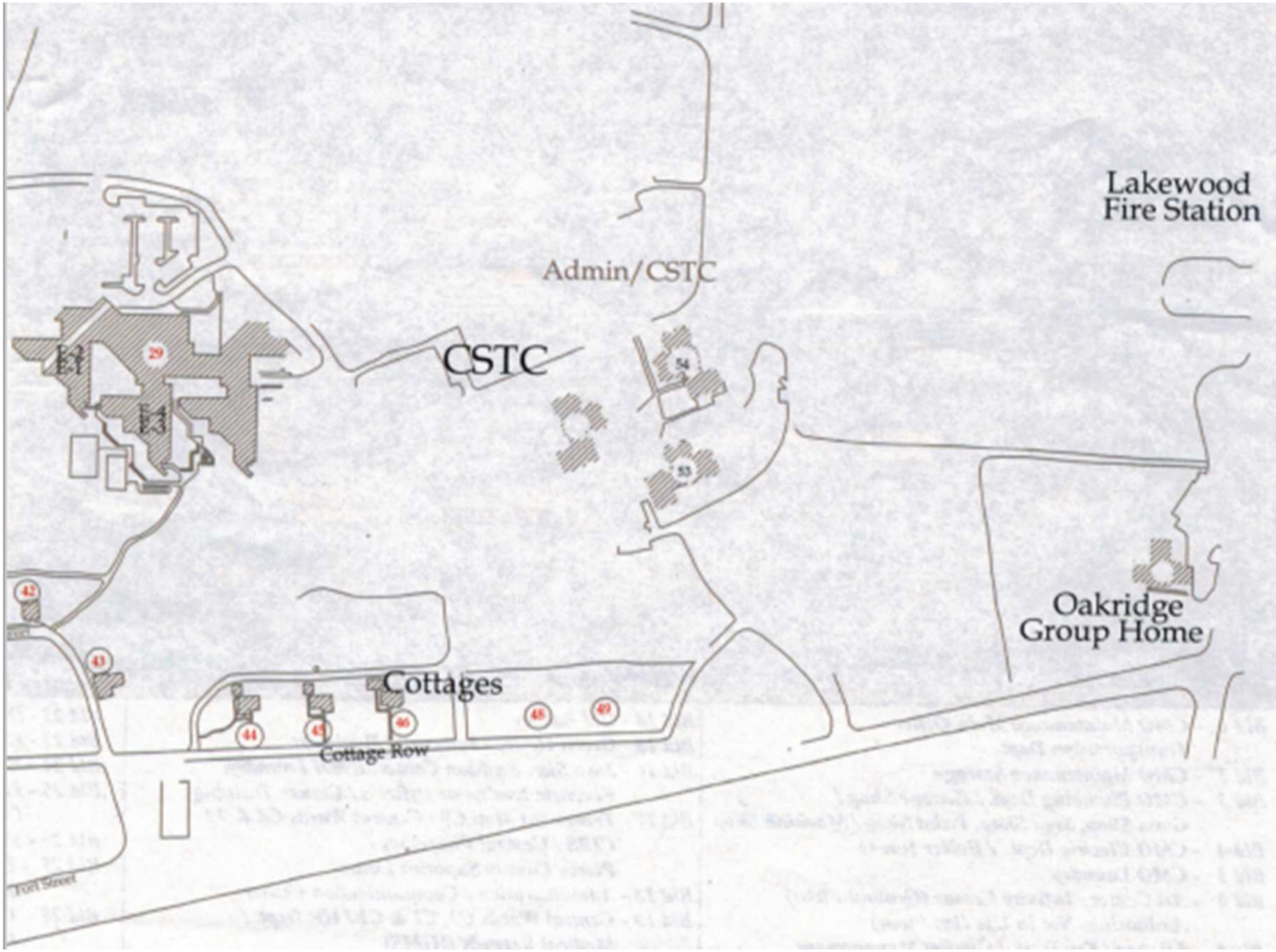
30,000 foot view of "what is the potential scope of any wireless issues"

- This picture is literally at 30K ft as seen from Google Earth and a 2 mile circle around WSH.
- There are systems outside of the WSH campus that effect workers as well as systems inside the campus.
- Our objective is to identify those factors that contribute to WSH and suggest ways to solve the observed problems.
- We will be discussing WSH repeaters and paging, cellular, and safety 911 systems.

Building(s) Layout



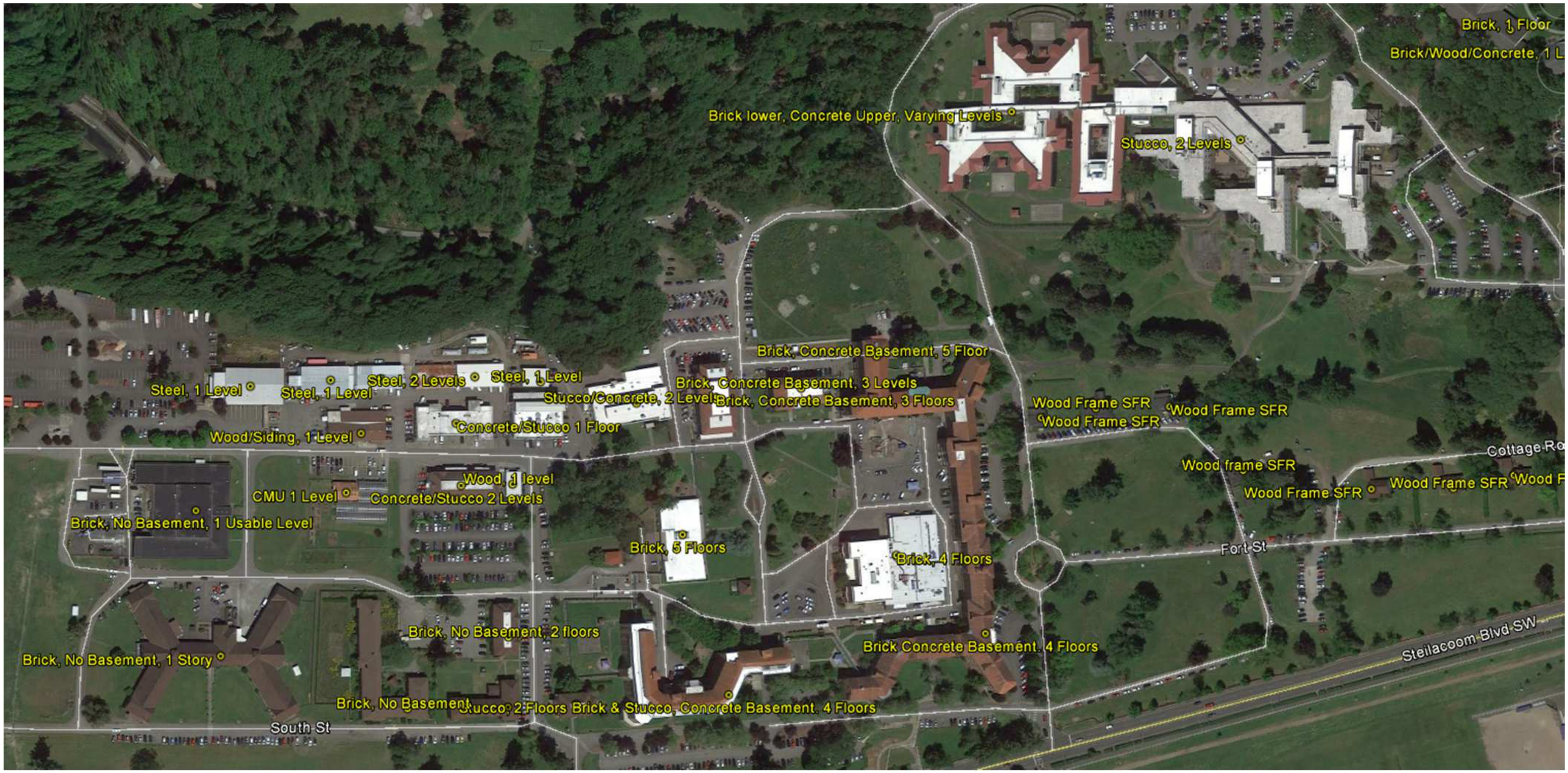
Building(s) Layout



Construction materials used for various buildings

Key factor when comparing predictive coverage analysis tools to determine what the internal building signal should be.

Also see tabular form of building materials and penetration loss figures

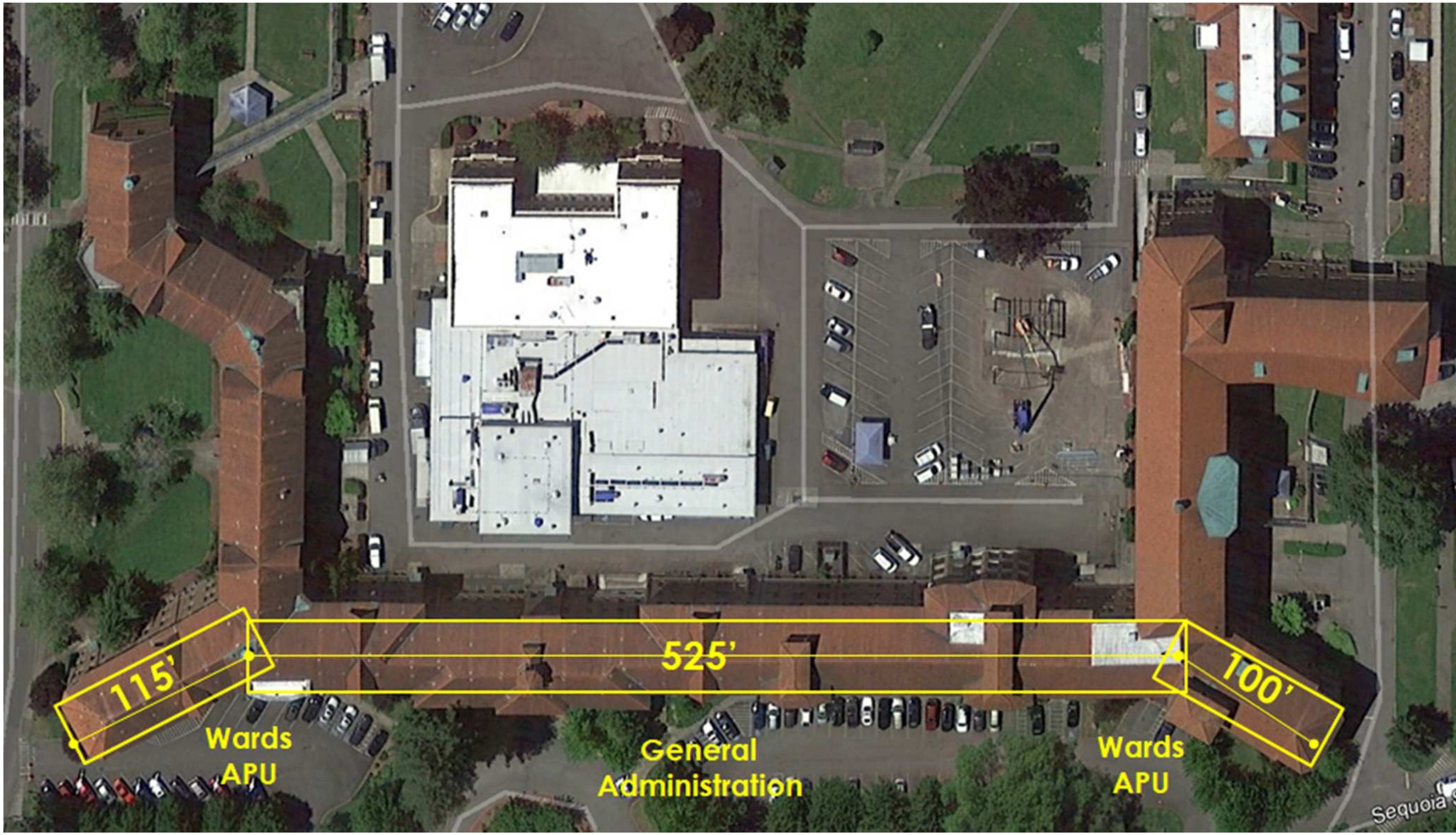


Signal Measurements for UHF Frequencies

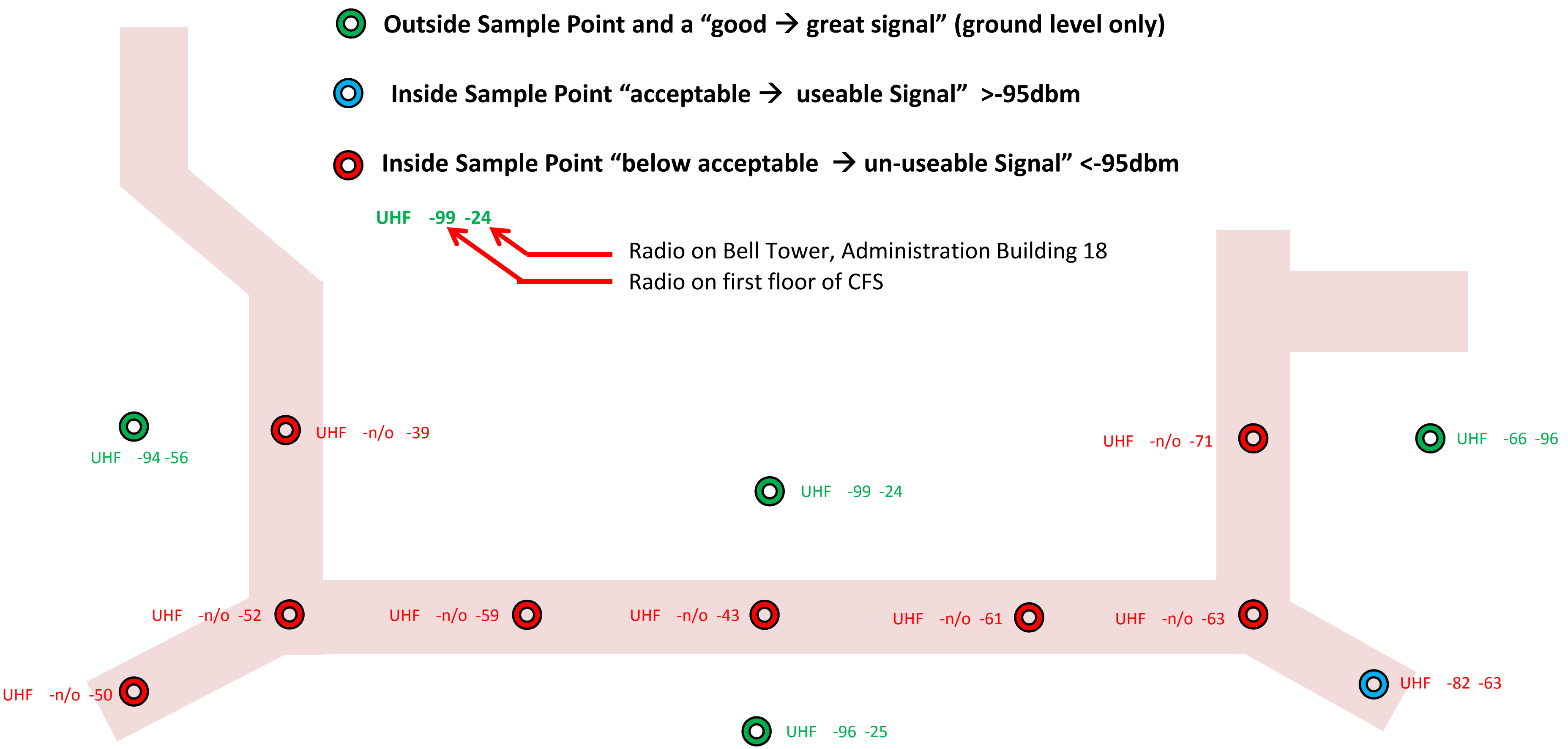
462.0125M_{hz} Repeater: located in a closet in the ground floor of the CFS Building
464.6750M_{hz} Repeater: located in the top floor of the ADMIN building in Bell Tower
462.9000M_{hz} Paging: located in the top floor of the ADMIN building in Bell Tower

(Note: measurements for 464.675M_{hz} and 462.9000M_{hz} from the Bell Tower are the same)

Survey Area of Administration Building

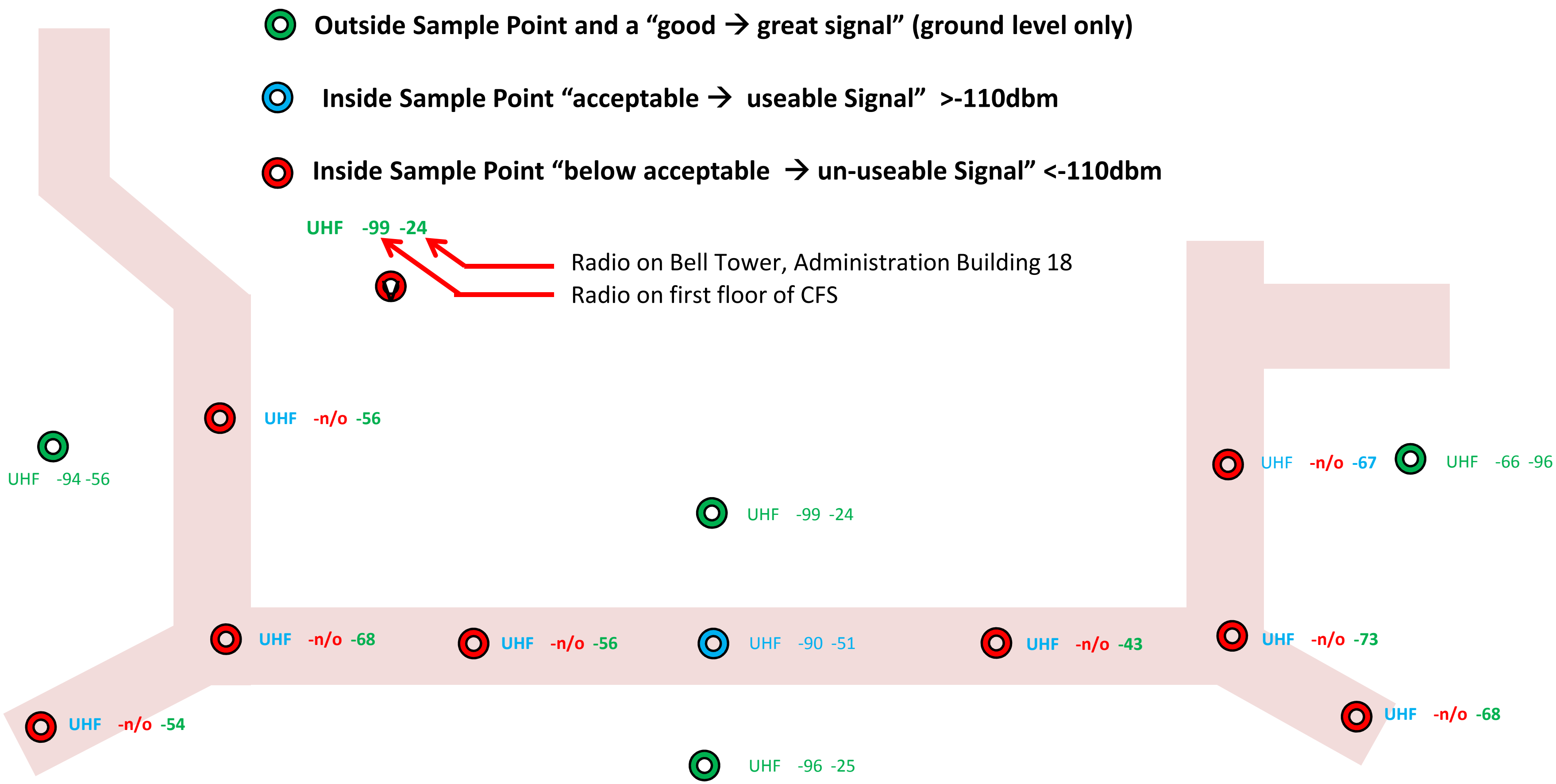


Administration Building 462/464M$_{hz}$ TX Measurements
GROUND LEVEL/LEVEL A



Note: a ⭘ Indicates that one of the two frequencies is unusable.

WSH 462/464M_{hz} TX Measurements
BASEMENT LEVEL/LEVEL B



Note: a ⭘ Indicates that one of the two frequencies is unusable.

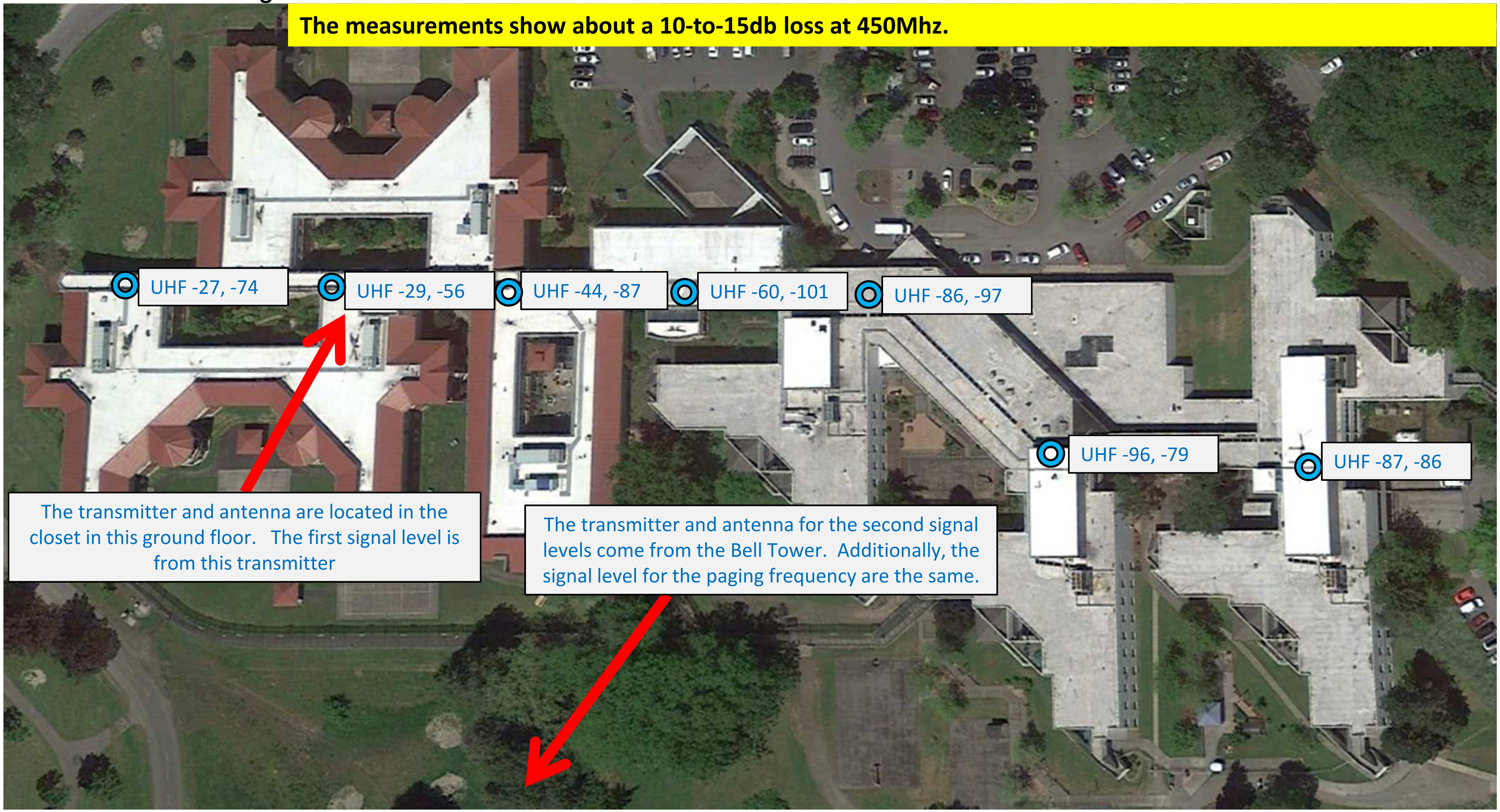
WSH 462/464M_{hz} TX Measurements

CFS Building (Lower Level)

Outside Sample Point and a "good → great signal" (ground level only)

Inside Sample Point "below acceptable → un-useable Signal" <-110dbm

Inside Sample Point "acceptable → useable Signal" >-95dbm



WSH 462/464M_{hz} TX Measurements

CFS Building (First Level)

Outside Sample Point and a "good → great signal" (ground level only)

Inside Sample Point "below acceptable → un-useable Signal" <-110dbm

Inside Sample Point "acceptable → useable Signal" >-95dbm

Objective: Which buildings are most susceptible to signal losses.

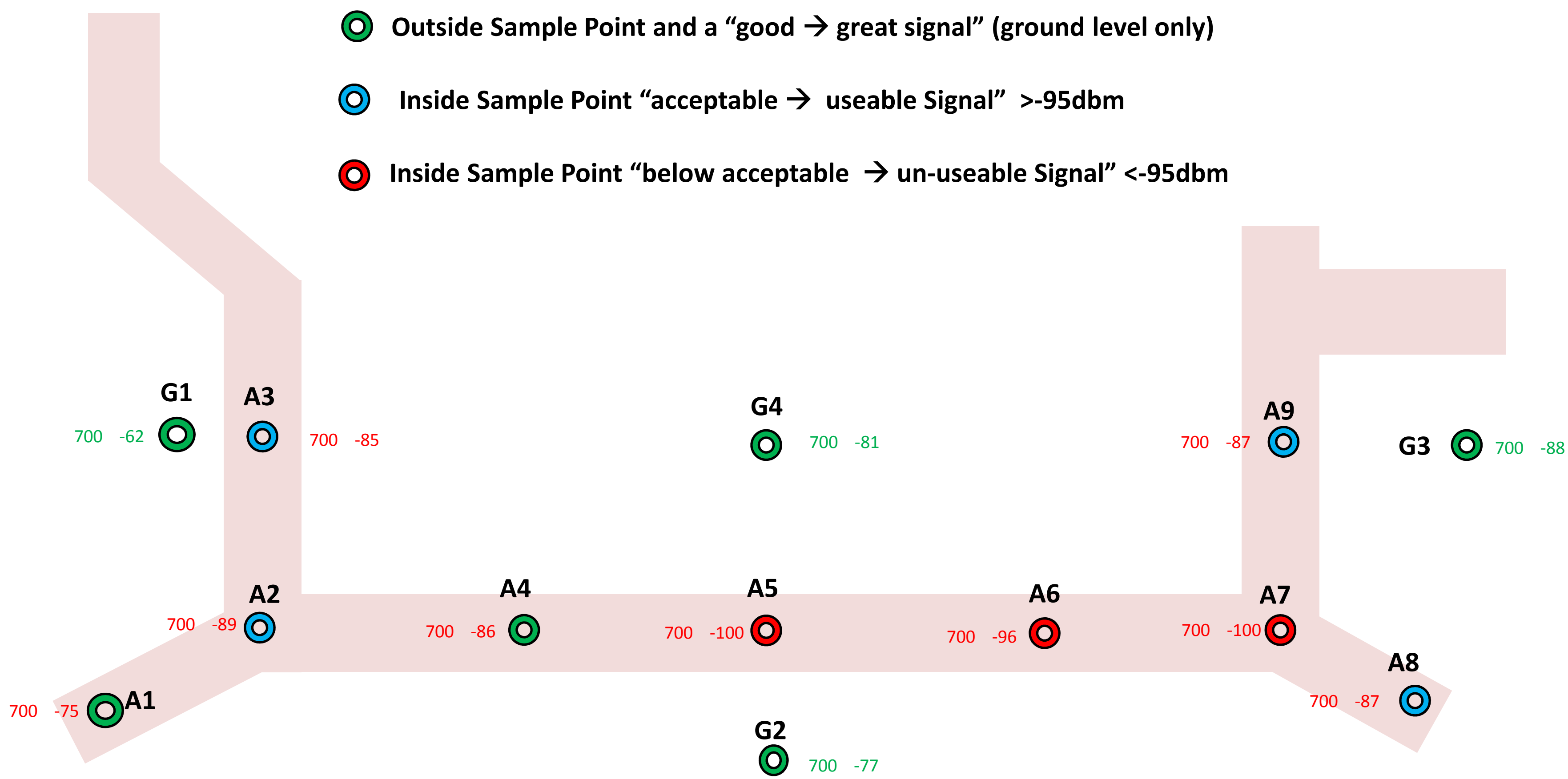
Assumptions: Not all buildings were measured. However, common building materials equals similar levels of signal loss at frequencies.

Building Factors				Attenuation Factor			
Building #	Function	Occupational Load (Aprox)	Building Composite Material	150 Mhz Two-Way	450 Mhz Two-Way + Paging	700Mhz to 900Mhz Wireless, Trunked	1700mhz to 2400Mhz Wireless
1	CMO Maintenance Main Office/Transportation Dept.	10	Wood Frame	-2	-3	-5	-8
2	CMO Maintenance Storage	10	Steel	-2	-3	-5	-8
3	CMO Plumbing Dept. Garage Shop/Glass Shop, Sign Shop, Paint Shop/Machine Shop	10	Concrete/Stucco	-6	-7	-9	-12
4	CMO Electric Dept./Boiler House	10	Concrete/Stucco	-6	-7	-9	-12
5	CMO Laundry	20	Concrete/Stucco	-6	-7	-9	-12
6	Art Center/ Infinity Center (Ground Floor) Auditorium Not in Use (1st Floor)	0	Brick/Conc Basement	-8	-9	-11	-14
7	NONE	0		0	0		0
8	Library/Key Department./Quality Management	15	Brick/Conc Basement	-8	-9	-11	-14
9	IT Department/ Staff Office's	15	Brick/Conc Basement	-8	-9	-11	-14
10	Hiring / Training Center, HMH Carpentry Shop	20	Brick	-6	-7	-9	-12
11	Commissary, CIBS	20	Concrete/Stucco	-6	-7	-9	-12
12	CMO Maintenance Machine Shop Storage	10	Wood Frame	-2	-3	-5	-8
13	Pharmacy / Central Services	15	Brick	-6	-7	-9	-12
14	Old Bakery	0		-4	-5	-7	-10
15	Green House / Insustrial Hygienist	15	Cinderblock	-6	-7	-9	-12
16	Java Site, Fashion Center, HMH Laundry, Forensic Elaluator Office's / Cerner Training	25	Brick	-6	-7	-9	-12
17	Treatment Mall C9 / Central Wards C8 & 7 / CIBS / Central Pharmacy / Pierce County Superior Court	25	Brick/Conc Basement	-8	-9	-11	-14
18	Administration / Communication Center	25	Brick/Conc Basement	-8	-9	-11	-14
19	Central Wards C3, C2 and C1 / HR Department / Medical Records (HIMS)	25	Brick/Conc Basement	-8	-9	-11	-14
20	Central Wards C6, C5 and C4 / Labor Relations / Public Relations / Publications / Mail Room	25	Brick/Conc Basement	-8	-9	-11	-14
21	South Hall Wards S10, S9, S8, S7, S5, S4, S3 / South Hall Treatment Mall S1 and S6 / Staff Office S2	50	Brick	-6	-7	-9	-12
22	Old Morgue	0	N/A	-2	-3	-5	-8
23	Chapel		Stucco	-6	-7	-9	-12
24	Employee Health / Patient Financial Services	3	Brick	-6	-7	-9	-12
25	Legal Services / RSN Office's / Dept. of Assigned Council / North West Justice / Beauty Barber Shop	25	Brick	-6	-7	-9	-12
26	NONE	0	Brick	-6	-7	-9	-12
27	HMH Wards W1-N and W1-S / W2- Recovery Innovations / W2-S: Telecare	25	Brick	-6	-7	-9	-12
28	Center for Forensic Services: CFS Wards F1- F8	25	Brick/Concrete	-6	-7	-9	-12
29	East Campus: Wards E1-E8 / Clinic / X-Ray /Dental / Labs / Physical Therapy	25	Stucco	-6	-7	-9	-12
30	Container, Emergency Supplies	5	Steel	-2	-3	-5	-8

Signal Measurements for 700M_{hz} Frequencies used by the Combined Communication Network for Pierce County

These are a part of the frequencies that make up criterial for complying with IBC Fire Cole 510.

Combined Communication Network for Pierce County 700M$_{hz}$
GROUND LEVEL/LEVEL A



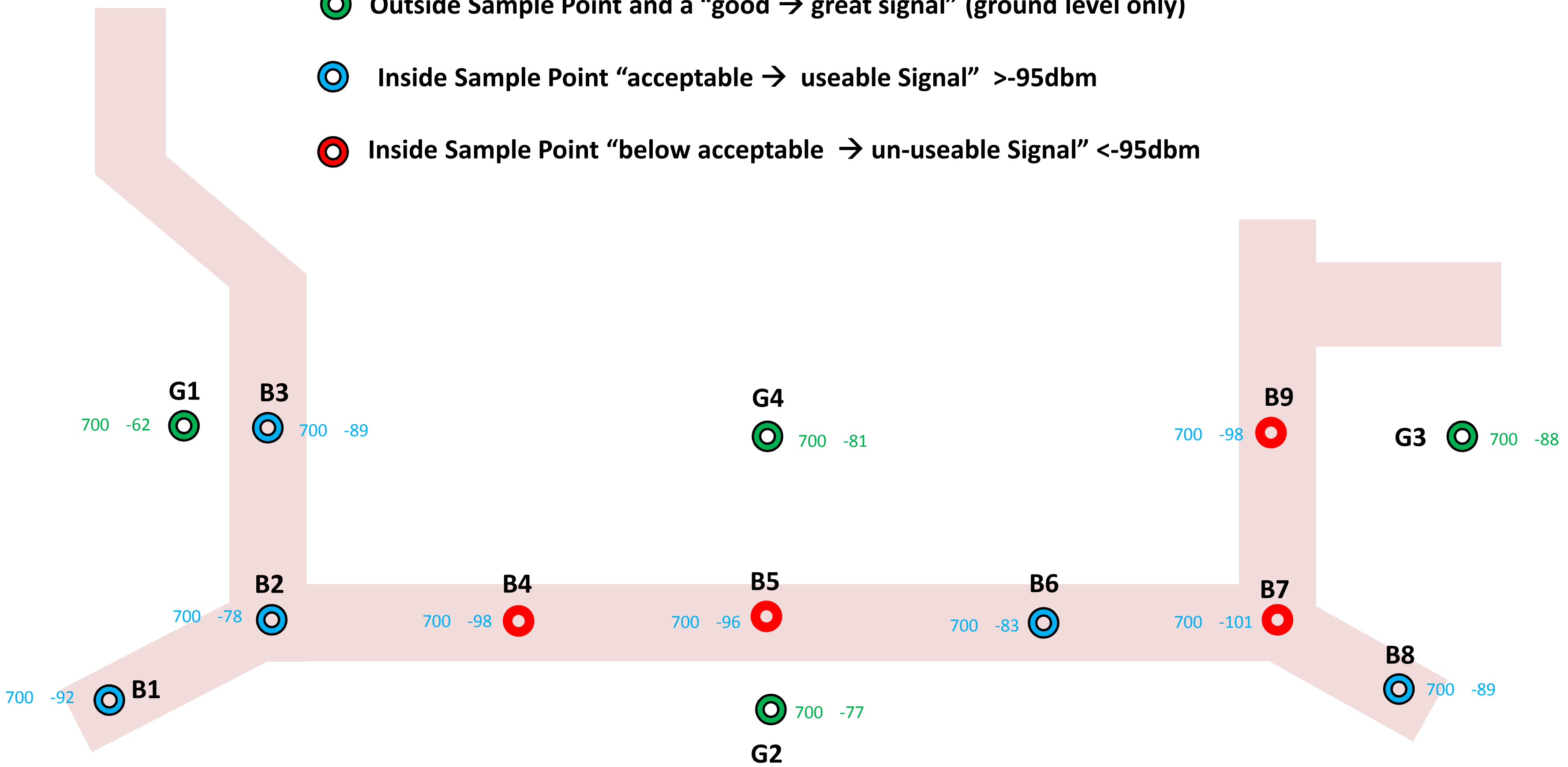
Combined Communication Network for Pierce County 700M_{hz}

BASEMENT LEVEL/LEVEL B

Outside Sample Point and a "good → great signal" (ground level only)

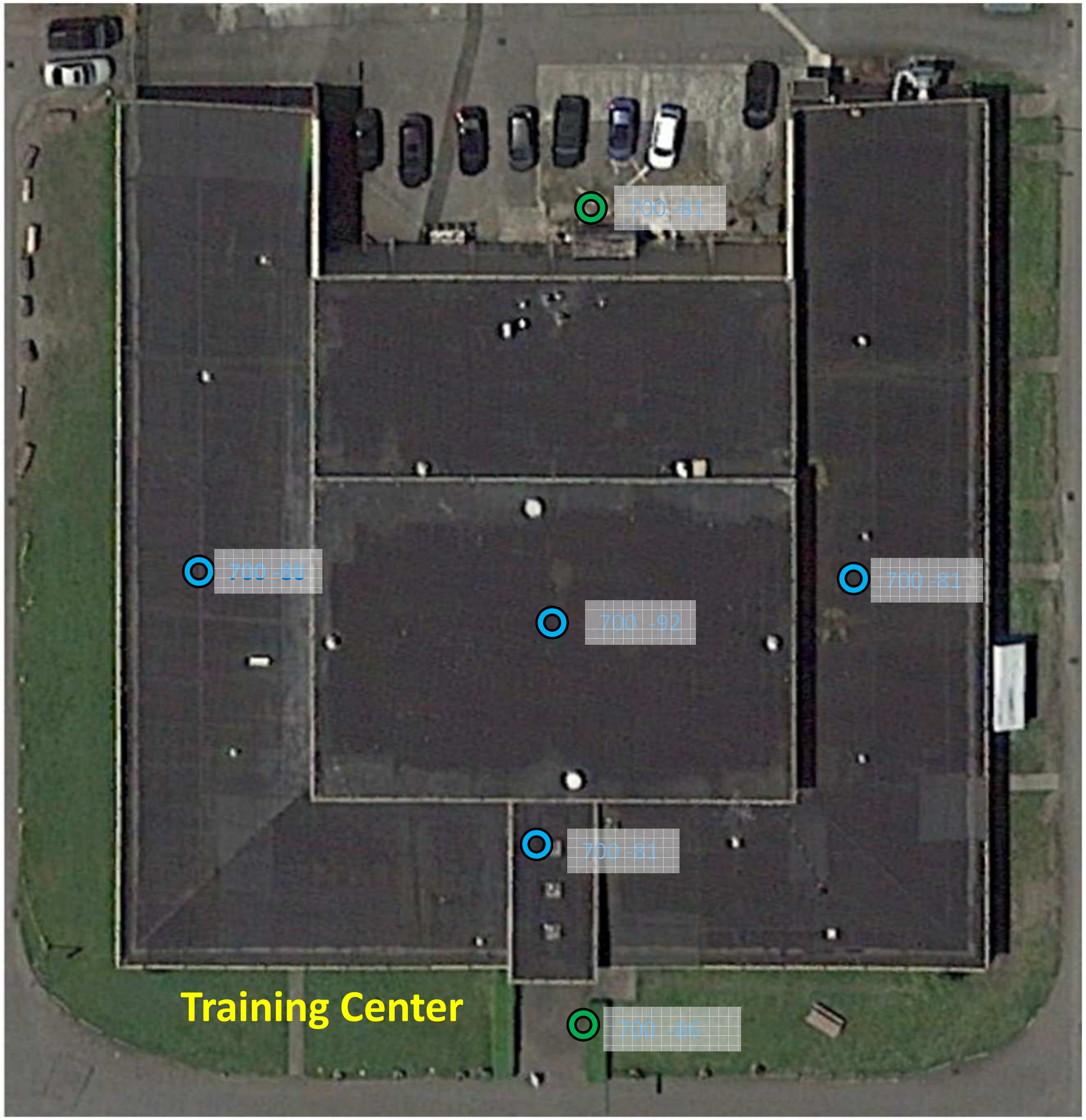
Inside Sample Point "acceptable → useable Signal" >-95dbm

Inside Sample Point "below acceptable → un-useable Signal" <-95dbm



Combined Communication Network for Pierce County 700M$_{hz}$

Training Building



Outside Sample Point and a "good → great signal" (ground level only)

Inside Sample Point "acceptable → useable Signal" >-95dbm

Inside Sample Point "below acceptable → un-useable Signal" <-95dbm

The measurements show about a 5-to-7db loss at 700Mhz.

Also shows that CCNPC works well in this building and would pass a Fire Code 510 measurement.

Combined Communication Network for Pierce County 700M_{hz}

CFS Building (Lower Level)

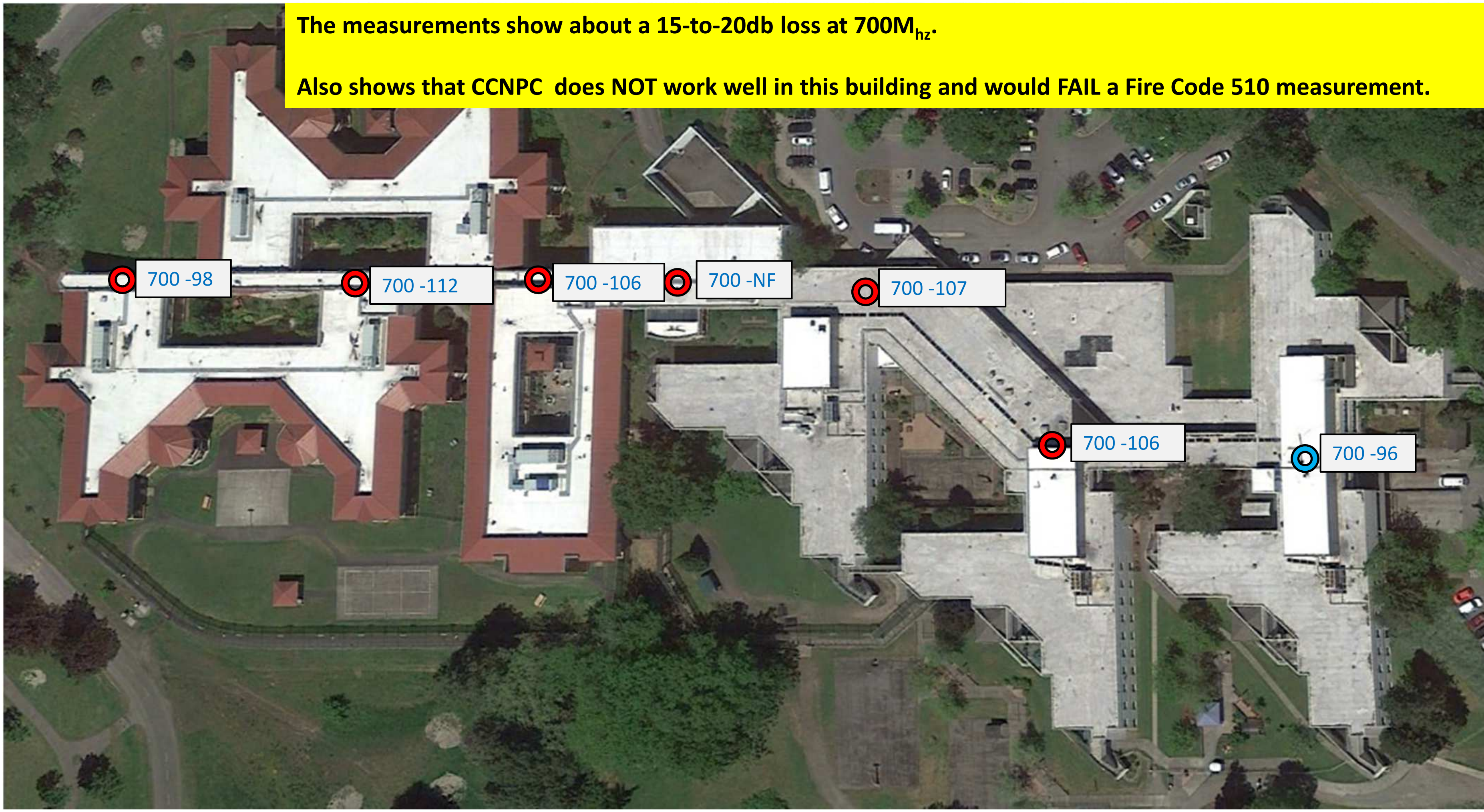
Outside Sample Point and a “good → great signal” (ground level only)

Inside Sample Point “below acceptable → un-useable Signal” <-95dbm

Inside Sample Point “acceptable → useable Signal” >-95dbm

The measurements show about a 15-to-20db loss at 700M_{hz}.

Also shows that CCNPC does NOT work well in this building and would FAIL a Fire Code 510 measurement.



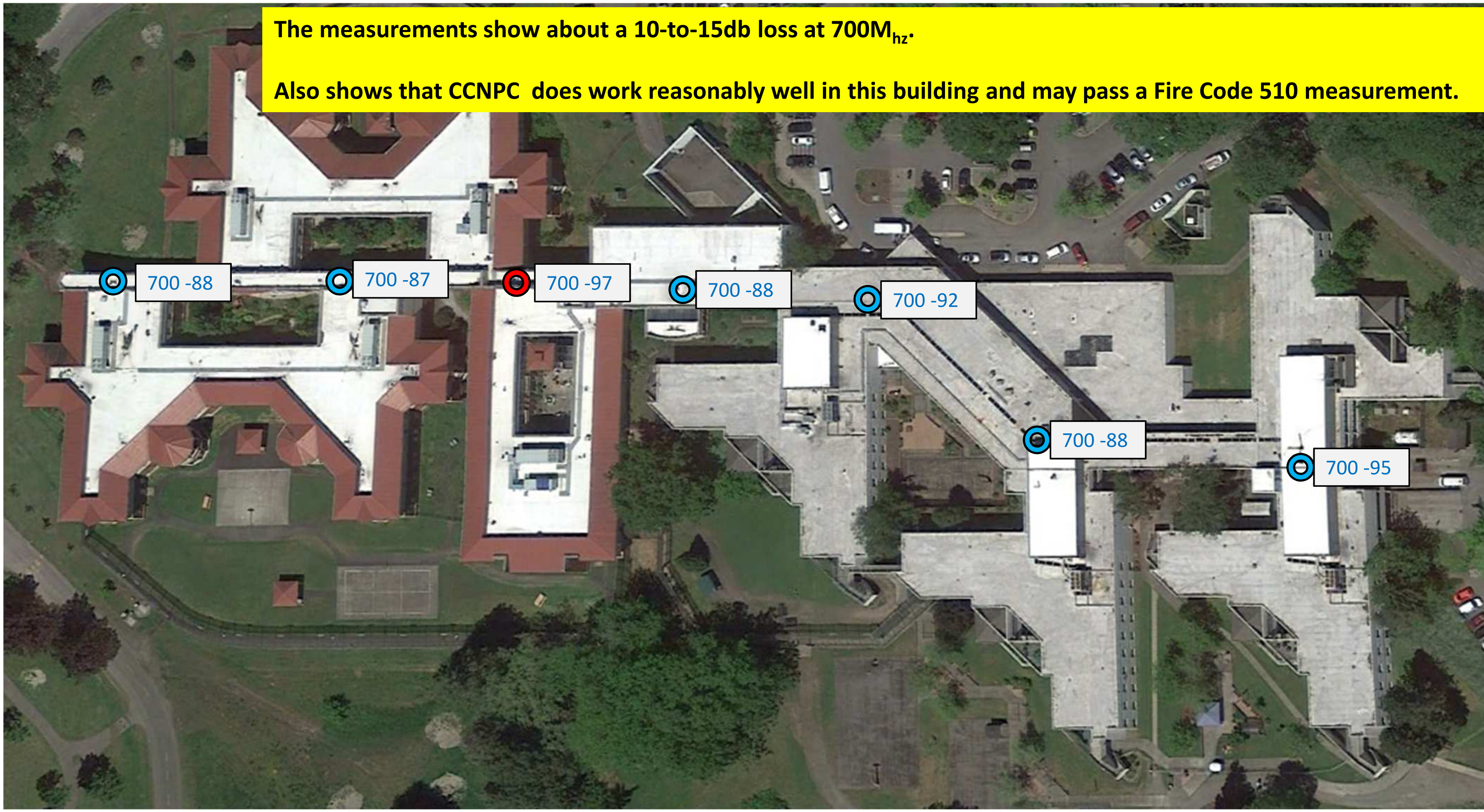
Combined Communication Network for Pierce County $700M_{hz}$

CFS Building (Lower Level)

Outside Sample Point and a "good → great signal" (ground level only)

Inside Sample Point "below acceptable → un-useable Signal" <-95dbm

Inside Sample Point "acceptable → useable Signal" >-95dbm



Repeater stations for Security, IT, etc. @ CFS

462.0125Mhz Repeater: located in a closet in the ground floor of the CFS Building
464.6750Mhz Repeater: located in the top floor of the ADMIN building in Bell Tower

Repeater Block Diagram
CFS 462.0125M_{hz}

Data closet on 3rd floor of CMU

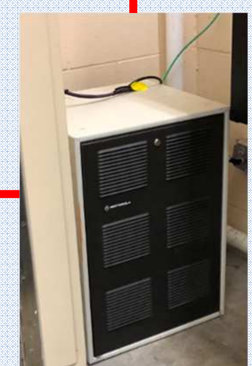
WiFi air interface to Bell Tower repeater junction

Photo not available of network junction terminal

Closet and ceiling on 1st floor of CMU

RFS BA6012-1
0.0 db Gain

30ft LMR400 Coax
0.81db Loss



40 Watts output

Paging System and Bell Tower Equipment

Paging Frequency and System

Direct inward dial numbers (DID) available.

The paging system is fairly simple in its architecture. The controller (paging generator) automatically answers it's own extension and the user presses a short code of numbers.

There is a provision in the phone system to dial from outside of the WSH extensions. GCCSS tested, with the IT staff, and it didn't function.

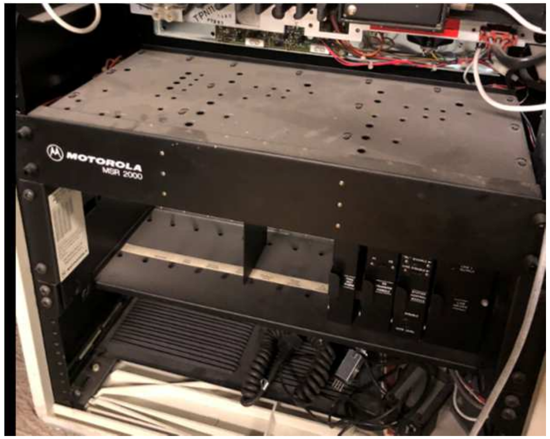
Paging Frequency and System

The Prism ipBSC paging controller is still currently in production and the manufacture supports this model used by WSC

GCCSS did observe that several voice pages were over-modulated and distorted.   This could be a cause of audio settings from the Prism controller to the base station transmitter.   GCCSS reported the findings to IT for a potential trouble ticket.

There was a set of spares found in the back of the cabinet that should be tested or rotated with the active units periodically.

Old Equipment



Several pieces of old equipment found in the Bell Tower should be removed. Especially, those old and unused modules that are nested within the working cabinets.

There is very little labeling or identification of how the equipment is configured and this correction will aid in future trouble-shooting.

Bell Tower Antenna Grounding

GCCSS general observation regarding the installation practices of the antennas and radios that were inspected would be considered "fair-to-good".

Grounding , weather-proofing and connections appeared good. The antennas tested showed that proper readings from our meters.

GCCSS found in all cases that LMR400 RF cables were used which re non-riser fire rated.

The cabling for the antennas that are in the Bell should be changed from LMR400 to ½" or $^{7}/_{8}$" riser rated cable.

Bell Tower Radio Equipment

The equipment is aging but still supported by the manufactures.

Remote Base in Bell Tower

This remote base radio is located in the Bell Tower and appears to have a remote connection through the IT department. It's connected to an antenna feed that we were unable to trace.

No corresponding antenna was located on the roof of the Bell Tower.

It's believed that it may be connected to the security desk at the main entrance……

Portable Radio Software (Code Plug)

Code Plug Analysis

Code Plugs create the software features programmed into each portable radio that make the unique personalities for the capabilities of that radio.

Capacity Plus

	Nursing - 16	Nursing - 17	Nursing - 18	Nursing - 19	Nursing - 20
Call Type	Private Call	Private Call	Private Call	Private Call	Private Call
Call ID	568	569	570	571	572
Connection Type	N/A	N/A	N/A	N/A	N/A
Route Type	Regular	Regular	Regular	Regular	Regular
Call Receive Tone	Enabled	Enabled	Enabled	Enabled	Enabled

Capacity Plus

	Nursing - 21	Nursing - 22	Patrol - 10	Nursing - 24	Nursing - 25
Call Type	Private Call	Private Call	Private Call	Private Call	Private Call
Call ID	573	574	596	576	577
Connection Type	N/A	N/A	N/A	N/A	N/A
Route Type	Regular	Regular	Regular	Regular	Regular
Call Receive Tone	Enabled	Enabled	Enabled	Enabled	Enabled

Small Sample of Features

Code Plug Analysis

Code Plugs work with the system capabilities and thus require "matching" the desired operation to the system capability.

TX

Frequency (MHz)	456.637500	N/A	N/A	N/A
Squelch Type	N/A	N/A	N/A	N/A
DPL Code (Octal)	N/A	N/A	N/A	N/A
DPL Invert	N/A	N/A	N/A	N/A
TPL Frequency (Hz)	N/A	N/A	N/A	N/A
TPL Code	N/A	N/A	N/A	N/A
Signaling System	N/A	N/A	N/A	N/A
Contact Name	IT/Telecom Dir	Sec/Ward	Emerg Mgmt	CMO/Maint
Emergency System	None	None	None	None
VOX	Disabled	Disabled	Disabled	Disabled
Power Level	High	High	High	High
PTT Keyup Mode	N/A	N/A	N/A	N/A
PTT Keyup Encode	N/A	N/A	N/A	N/A
PTT Dekey Encode	N/A	N/A	N/A	N/A
Private Call Confirmed	Disabled	Disabled	Disabled	Disabled

Small Sample of Features

Channel Pool

Code Plug Analysis

Currently the encryption feature for secure voice is not being used.

Firmware Version	R02.08.01.0000
Codeplug Version	12.00.16
Wi-Fi MAC Address	4C-CC-34-1F-F8-9C
Last Programmed Date and Time	12/05/2017 1:59 PM

Device Features

Feature	Status
Digital	Free
IP Site Connect	Free
Capacity Plus - Single Site	Free
Enhanced Privacy	Free
Transmit Interrupt	Free
Digital Phone Patch	Free
GNSS	Free
Capacity Plus - Multi-Site	Free
Capacity Plus - Multi-Site Extended	Available for Purchase
OTAR	Available for Purchase
Data Services via Bluetooth	Available for Purchase
Digital Emergency	Free
Radio Inhibit	Free
Bluetooth Permanent Discoverable	Available for Purchase
AES	Available for Purchase

Easy to buy a scanner

Picking a Digital Scanner

Trying to decide between the BC996XT or Radio Shack PRO-197? Or considering an older model from the used market? This page is intended to be your guide to picking the best digital trunking scanner.

Digital Signal Reception

Monitoring digital systems is the main reason why people purchase these scanners, given that they cost significantly more than comparable radios that only receive analog systems. All current digital trunked scanners can monitor unencrypted Motorola APCO Project 25 (P-25) digital systems. Unfortunately, no digital scanner radios can monitor encrypted channels or other digital systems, like EDACS "ProVoice" Digital systems. Luckily most digital systems nationwide are unencrypted, APCO P-25 systems and therefore can be heard with these scanners. An APCO 25 digital scanner tends to be more expensive than similar radios that lack digital coverage. You may want to check on systems in your area prior to making a purchase.

Code Plug Analysis

Features programed but probably not even known to users.

	E4 - 1	E4 - 2	E4 - 3	E5 - 1	E5 - 2
Call Type	Private Call	Private Call	Private Call	Private Call	Private Call
Call ID	289	290	488	460	497
Connection Type	N/A	N/A	N/A	N/A	N/A
Route Type	Regular	Regular	Regular	Regular	Regular
Call Receive Tone	Enabled	Enabled	Enabled	Enabled	Enabled

Text Messages

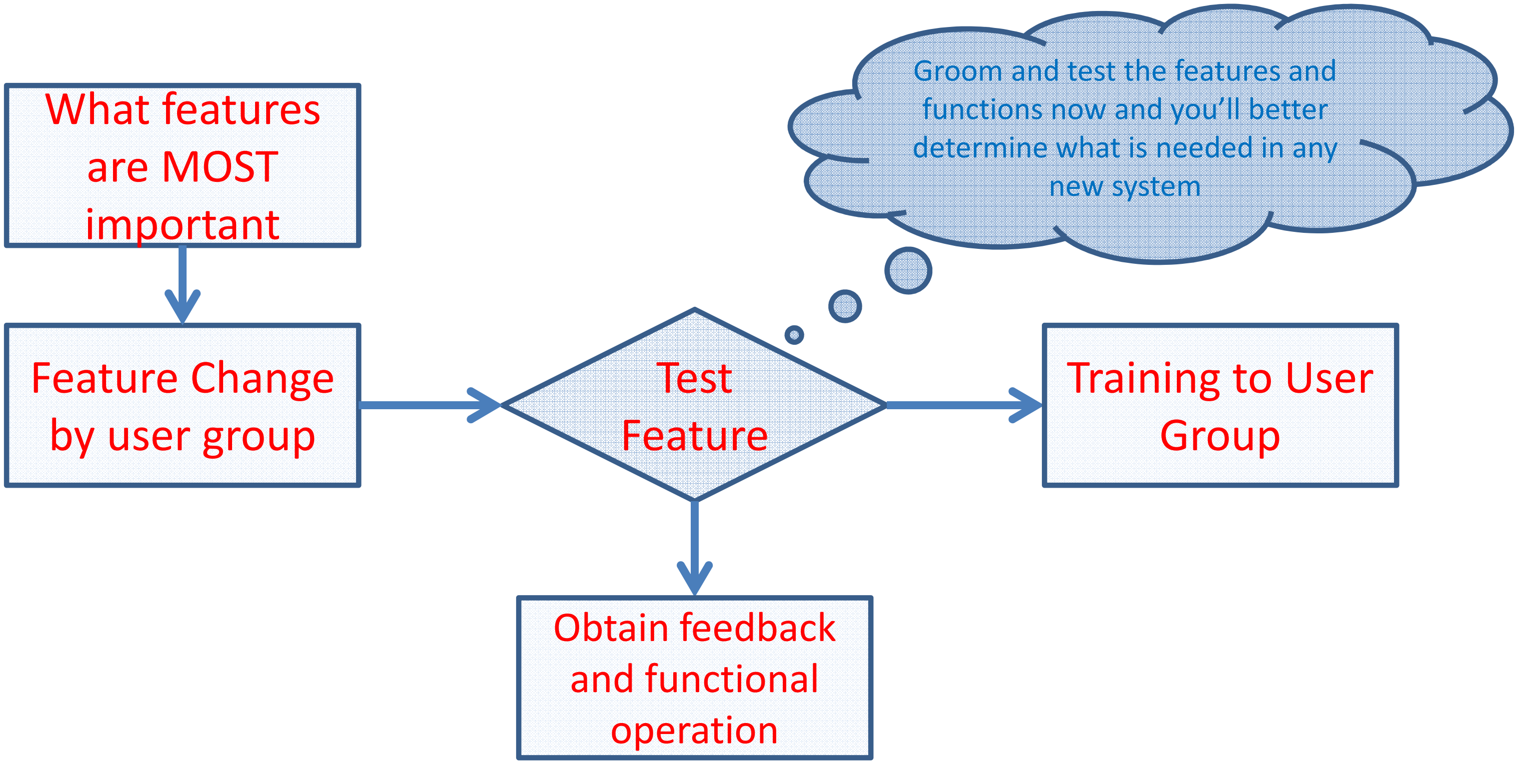
Message	1	Where are you?
Message	2	ETA back to office?
Message	3	On my way
Message	4	Will meet you there
Message	5	Are you on-site?
Message	6	In meeting - will get back
Message	7	URGENT - Return to office
Message	8	URGENT - Call me on phone
Message	9	URGENT - Radio Me
Message	10	Return
Message	11	All SECURITY to office

GCCSS believes that the code plugs denote approximately 94 separate radios for the private call settings.

Somewhere, we thought that the number of radios as being >250 units. The disparity could be duplicated settings.

Code Plug Analysis

Code Plug changes to the operation require thoughtful review, implementation and TRAINING. Basically, make small changes that are tested and good staff training.



FCC Licenses

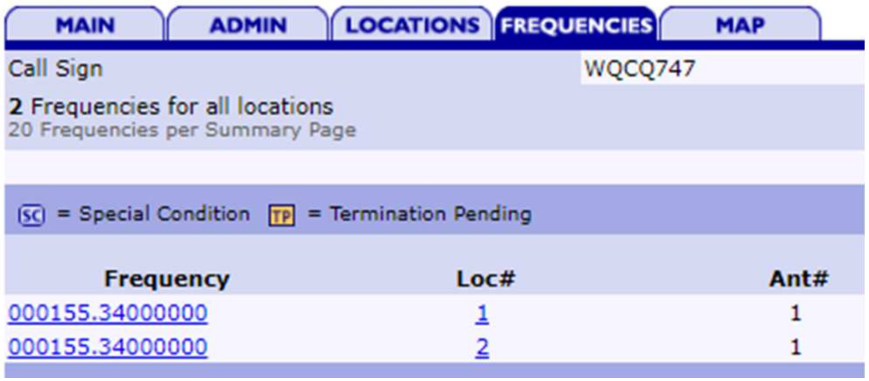
WSH Licensed Frequencies

469.67500	464.67500	5.00 MHz	Minus	☐	FM	AdminOUT
464.67500	469.67500	5.00 MHz	Plus	☐	FM	AdminIN
467.01250	462.01250	5.00 MHz	Minus	☐	FM	CFSOUT
462.01250	467.01250	5.00 MHz	Plus	☐	FM	CFSIN
456.63750	456.63750		Simplex	☐	FM	WSHSMPLX
457.76250	457.76250		Simplex	☐	FM	WSH N/U
462.90000	462.90000		Simplex	☐	FM	PAGING
155.34000	155.34000		Simplex	☐	FM	HEAR N/U

GCCSS didn't find any uses or transmitters for two frequencies

Licenses for 155.34M_{hz}

GCCSS did not find any associated radios on the WSH campus for the use of this frequency.



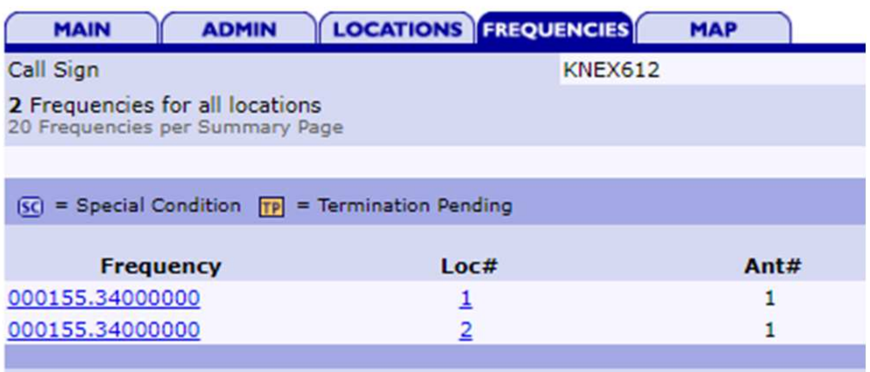
MAIN | ADMIN | LOCATIONS | FREQUENCIES | MAP

Call Sign	WQCQ747

2 Frequencies for all locations
20 Frequencies per Summary Page

SC = Special Condition TP = Termination Pending

Frequency	Loc#	Ant#
000155.34000000	1	1
000155.34000000	2	1



MAIN | ADMIN | LOCATIONS | FREQUENCIES | MAP

Call Sign	KNEX612

2 Frequencies for all locations
20 Frequencies per Summary Page

SC = Special Condition TP = Termination Pending

Frequency	Loc#	Ant#
000155.34000000	1	1
000155.34000000	2	1

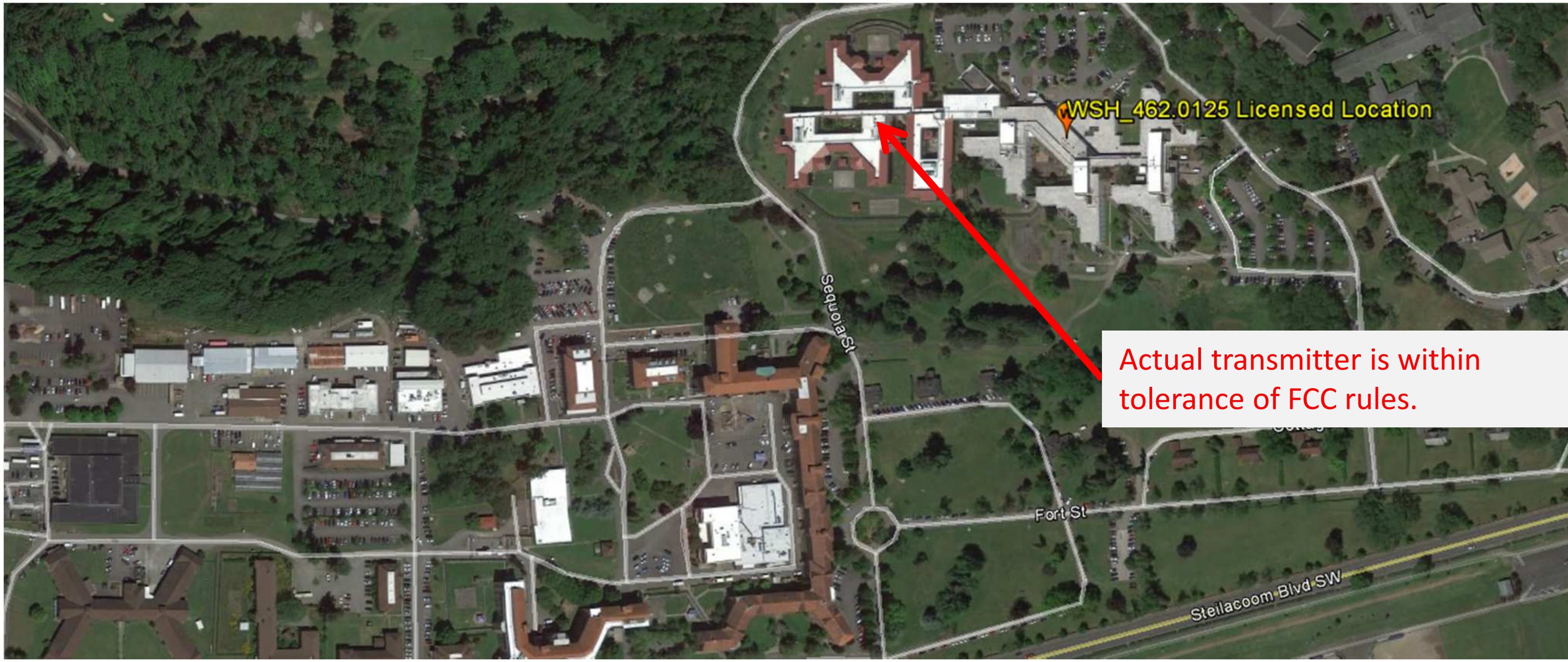
This frequency is used generally for hospital and emergency transport or a system known as H.E.A.R. (Hospital Emergency Ambulance Radio).

There are 183 WA hospitals and medical centers with licenses on this frequency.

There is a group of frequencies associated with H.E.A.R.:

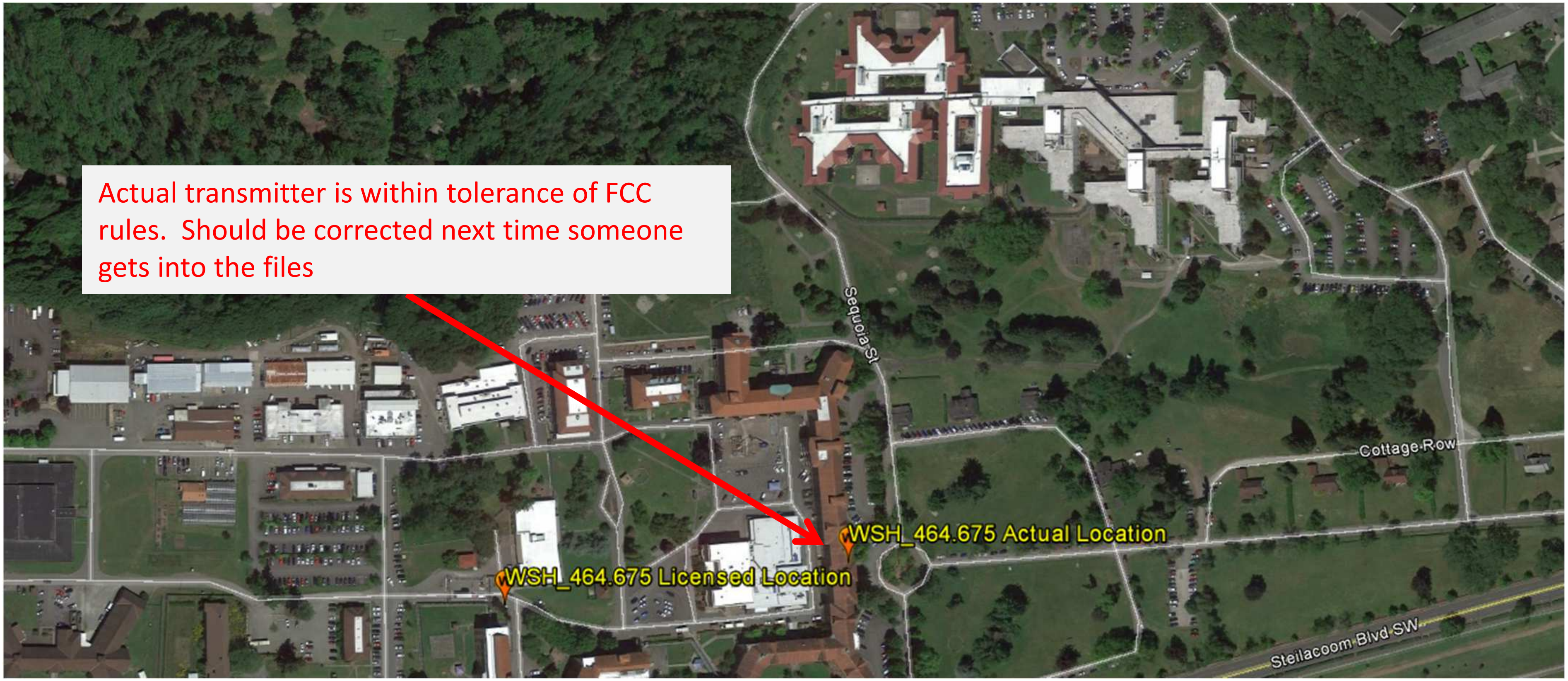
155.34Mhz for Hospital and Transport
121.50Mhz for Aircraft
40.500Mhz for Military Air/ground

462.0125 M_{hz} License KNAE967 (Repeater)



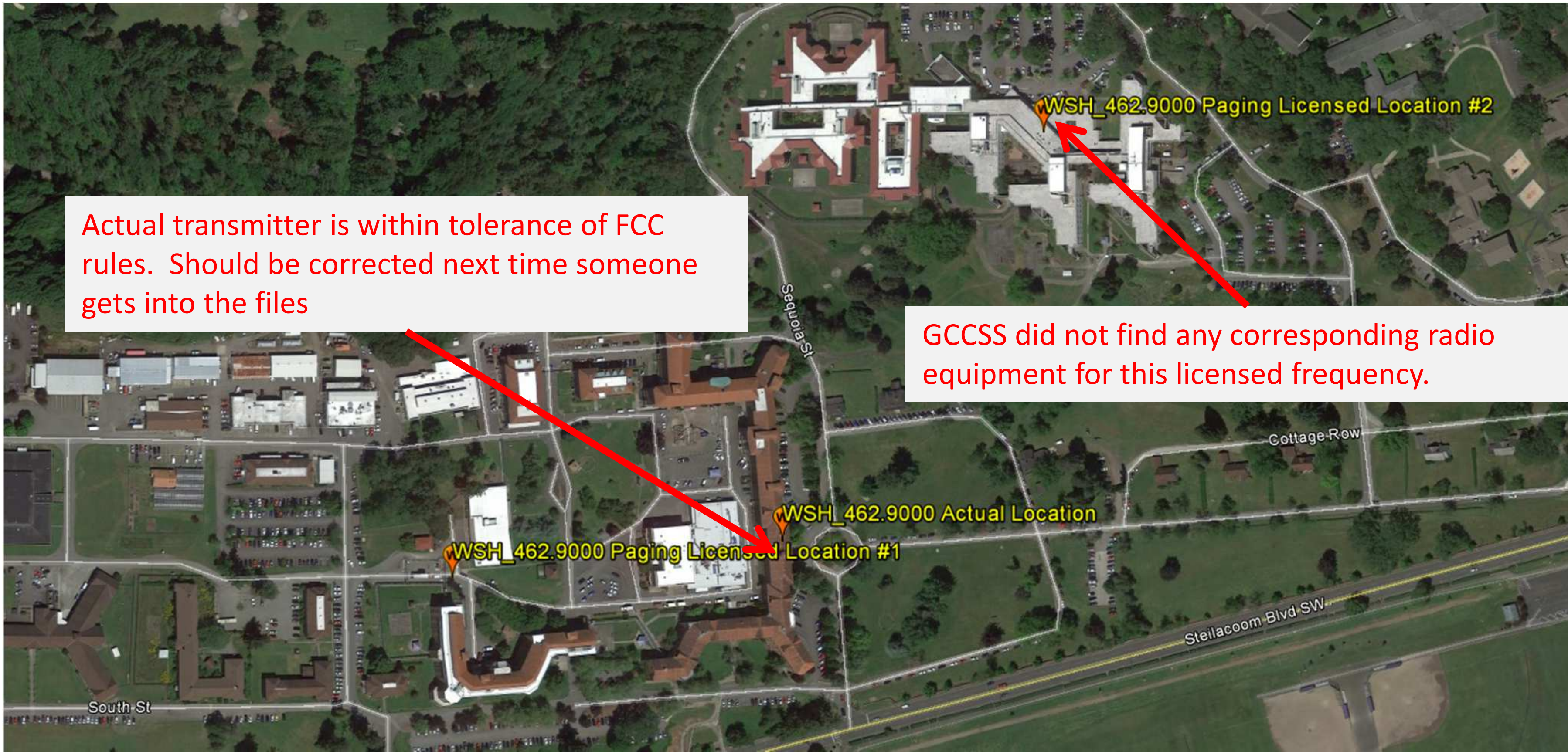
Under the FCC rules for IG-Industrial/Business Pool, Conventional there is "NO Interference Protection". This license will expire and need to be renewed in Nov. 2025

464.675 M_{hz} License KNAE967 (Repeater)



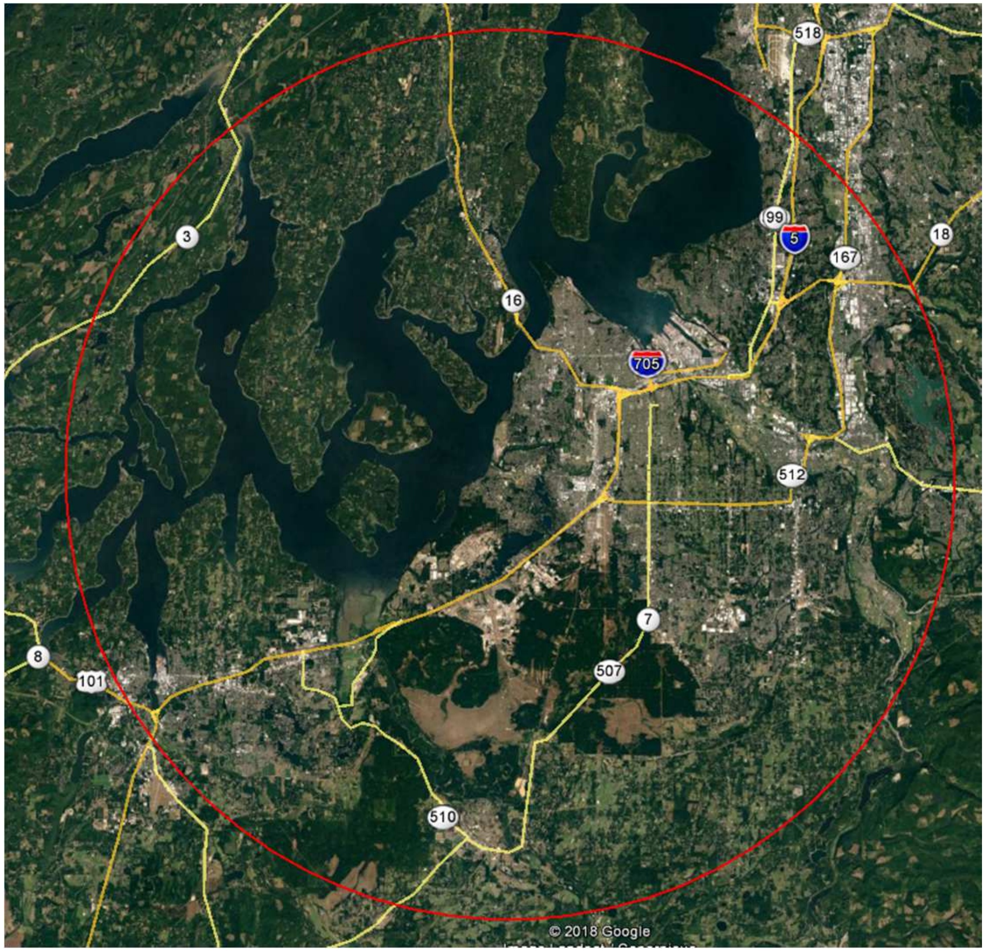
Under the FCC rules for IG-Industrial/Business Pool, Conventional there is "NO Interference Protection". This license will expire and need to be renewed in Nov. 2025

462.900 M_{hz} License KNAE967 (Paging)



Under the FCC rules for IG-Industrial/Business Pool, Conventional there is "NO Interference Protection". This license will expire and need to be renewed in Nov. 2025

456.6375 M_{hz} License KNAE967 (Simplex)

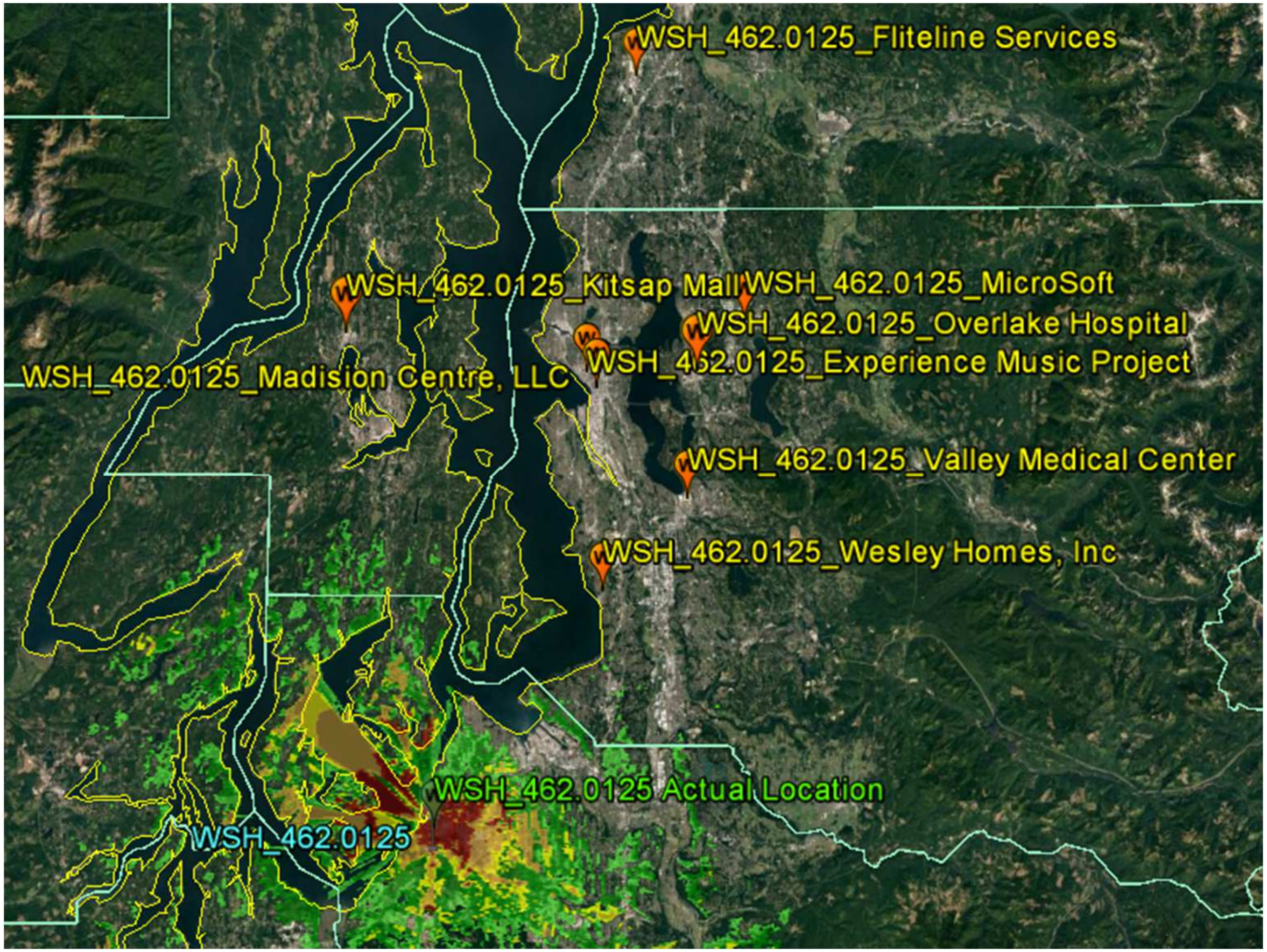


This location is not defined as a point rather an distance of 32KM for use between portable units.

This is a typical licensed configuration and there are no issues.

Under the FCC rules for IG-Industrial/Business Pool, Conventional there is "NO Interference Protection". This license will expire and need to be renewed in Nov. 2025

462.0125 Potential Interference



Data from FCC license data base.

Given that this frequency is used as a down-link to the WSH user devices and the signal from the WSH transmitter is substantially greater 18db over any interfering signals it is highly unlikely that any interference should exist or interrupt the user experience.

462.0125 Potential Interference

Specified Search

State = **Washington**
Status = **Active**
Frequency Assigned = **462.0125**

Matches 1- 23 (of 23)

PA = Pending Application(s)
TP = Termination Pending
L = Lease

Page 1

	Call Sign/Lease ID	Name	FRN	Radio Service	Status	Expiration Date
1	KB53169	MC LEOD, JACK A	0005866033	IG	Active	06/08/2024
2	KB62746	SKAGIT RIVER STEEL & SUPPLY INC	0001580422	IG	Active	09/18/2024
3	KNAE867	WESTERN STATE HOSPITAL	0001563865	IG	Active	11/14/2025
4	WNYB745	Business Radio, Inc.	0001587195	IK	Active	12/31/2026
5	WPMB868	OVERLAKE HOSPITAL MEDICAL CENTER	0004528105	IG	Active	05/21/2023
6	WPSM310	PPR KITSAP MALL LLC	0005746912	IG	Active	06/19/2021
7	WQAJ534	THE BOEING COMPANY	0001583483	IG	Active	06/15/2024
8	WQAL298	FLITELINE SERVICES, INC.	0009909490	IG	Active	06/25/2024
9	WQBT444	ZCELL NETWORK LLC	0007675390	IG	Active	12/09/2024
10	WQFJ598	Experience Music Project	0015013659	IG	Active	07/31/2026
11	WQGW547	Microsoft Corporation	0008512311	YG	Active	05/07/2027
12	WQJJ302	Microsoft Corporation (GFS)	0008512311	IG	Active	09/27/2018
13	WQJY816	BAREFOOT SERVICES INC	0018439661	IG	Active	02/19/2019
14	WQLD922	ALAN RITCHEY, INC.	0006230155	IG	Active	12/18/2019
15	WQPC838	Industrial Communications	0018883678	YK	Active	04/10/2022
16	WQUS889	TEMCO, LLC	0021834759	IG	Active	10/01/2024
17	WQUT535	AUTO WAREHOUSING	0022982235	IG	Active	10/07/2024
18	WQVH255	Wesley Homes Inc.	0006580211	YG	Active	02/11/2025
19	WQWQ525	THE BOEING COMPANY	0001583483	IG	Active	10/27/2025
20	WQXC888	Valley Medical Center	0021622493	YG	Active	02/02/2026
21	WRAH402	MADISON CENTRE, LLC	0026924175	IG	Active	11/16/2027
22	WRAL480	Mobile Talk Wireless Company	0022194880	YG	Active	12/22/2027
23	WYL941	PASCO SCHOOL DISTRICT 1	0001575620	IG	Active	02/28/2025
	Call Sign/Lease ID	Name	FRN	Radio Service	Status	Expiration Date

Page 1

Green = WSH Licensed Location
Yellow = Potential Interference
RED = No Potential Interference

911 Outside Operations on 700Mhz

CCN 700Mhz Measurements

Fire Code Section 510:	-95dbm is the least useable signal
User typical experience:	-105 for typical quality of use

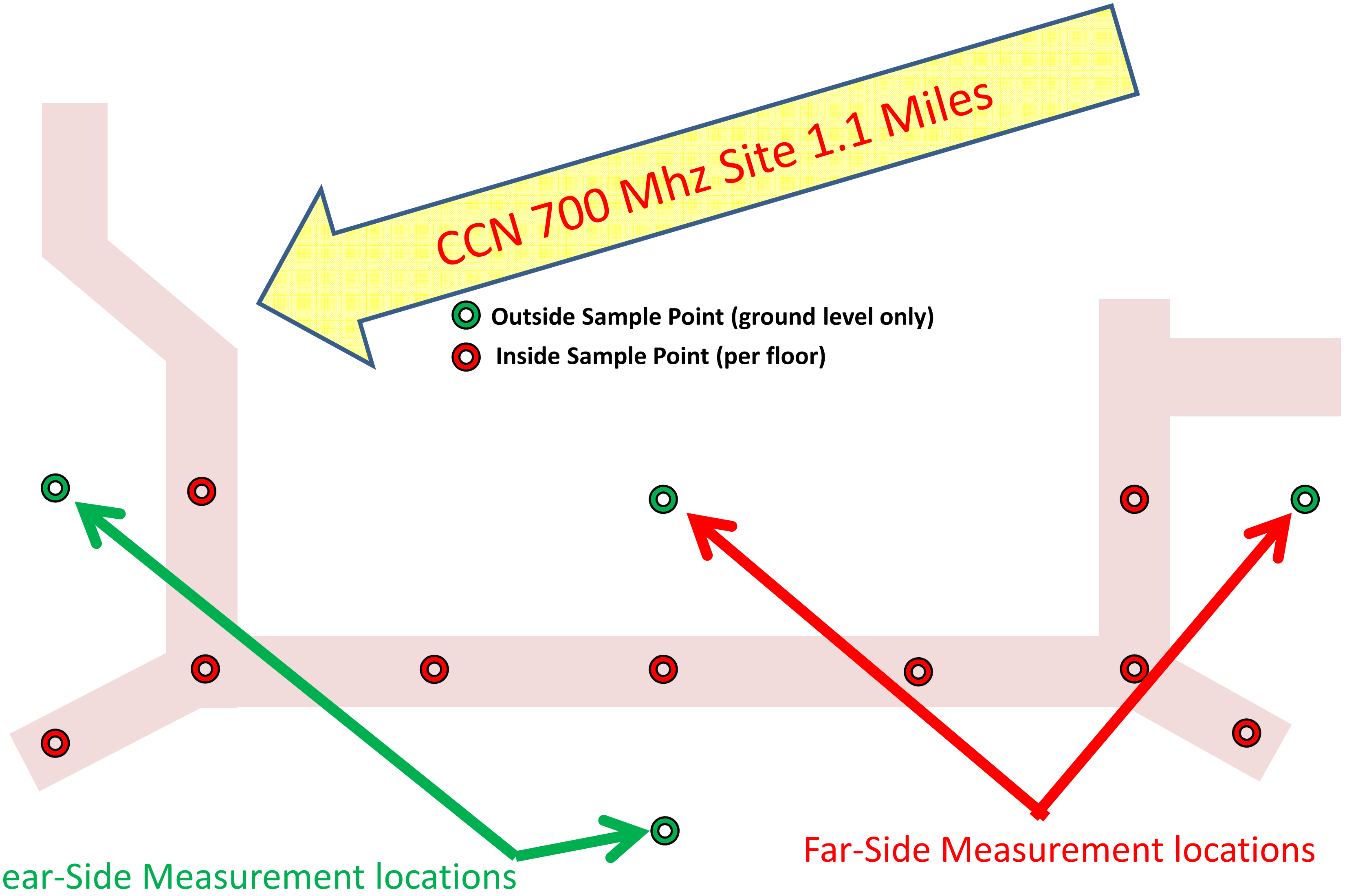
Combined **C**ommunication **Net**work for Pierce County 700Mhz

Building Composite	Measured Buildings	Near Side Signals	In-Building
Outside Signals on near-side of CCNet site.	9, 17, 18, 19, 20,	-62, -77	N/A
Outside Signals on far-side of CCNet site.	9, 17, 18, 19, 20	-81, -88	N/A
Main Floor Ground Level A.	9, 17, 18, 19, 20	N/A	(~ -12.5 db building loss with a maximum of -19db)
Concrete to thick concrete and brick ½ basement floor	9, 17, 18, 19, 20	N/A	(~ -14.6 db building loss with a maximum of -20db)

Combined Communication Network for Pierce County 700Mhz

Building Composite	Measured Buildings	Near Side Signals	In-Building
Outside Signals on near-side of CCNet site.	CFS and Training	-62, -77	N/A
Outside Signals on far-side of CCNet site.	CFS and Training	-81, -88	N/A
Main Floor Ground Level A.	CFS	N/A	(~ -15db building loss with a maximum of -19db)
Concrete to thick concrete and brick ½ basement floor	CFS	N/A	(~ -17 db building loss with a maximum of -20db)
Brick and metel	Training	-62, -77	(~ -10db building loss with a maximum of -15db)

Signal Survey Area of Administration Building
CCN 700 Mhz



Combined Communication Network for Pierce County 700Mhz

CCNET
Combined Communications Network Enterprise

About the CCN

Pierce Transit and the County formed this joint venture in the public interest to support the development, operation, and maintenance of a combined radio communications interoperability network for purposes of ensuring communications for Pierce Transit's system and for the County's public safety programs as well as for the benefit of such other public agencies as added in the future.

Predicted coverage analysis plot of the campus from the CCN tower located at 1.1mi SSE of campus.

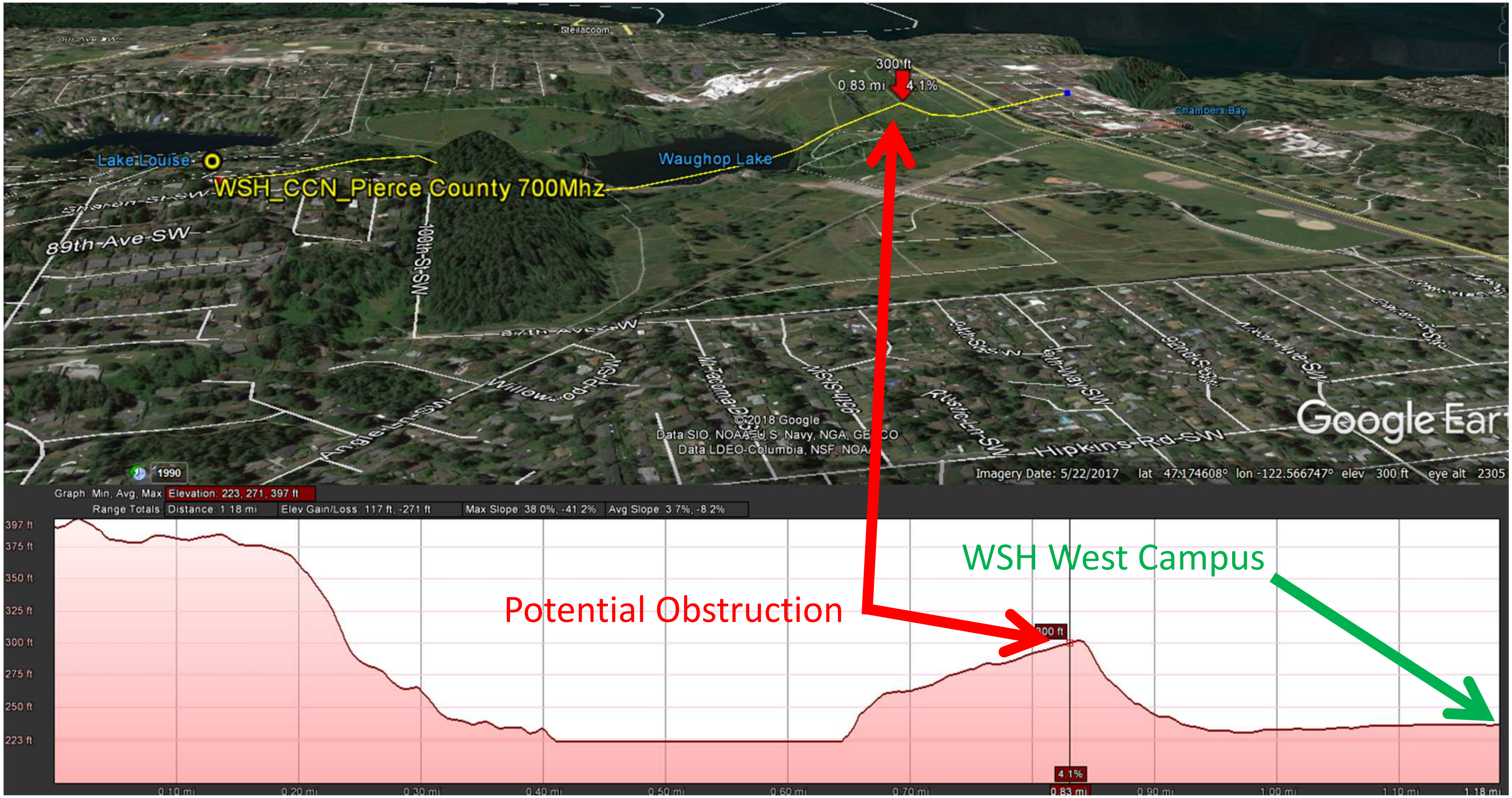
Measurements outside are +5db and -12db from the plot references.

This network should operate down to a level of -110db.

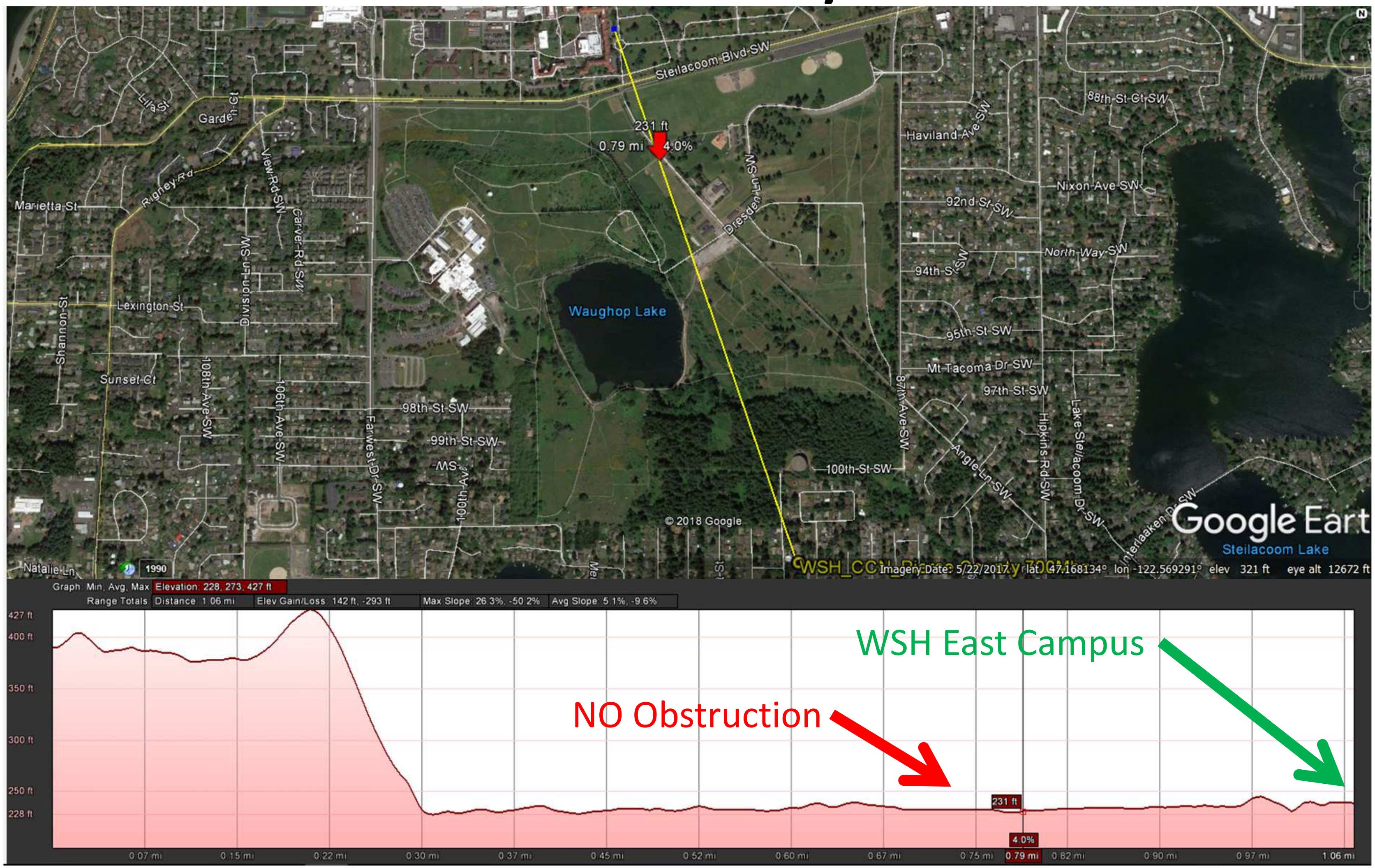
Combined Communication Network for Pierce County 700Mhz

Site at 391' MSL
Antenna @ 500' AGL
Distance to Hospital 1.1 Mi.
Hospital @ 240' MSL

Combined Communication Network for Pierce County 700Mhz



Combined Communication Network for Pierce County 700Mhz



800 Mhz Link

800 Mhz HSPCOM Link

Operator console located at the front lobby appears to be the only location where operation of the radio and dispatch.

Slide under construction

Bell Tower directional antenna to the east.

Bell Tower transmitter

Water Pumping and Storage

WATER PUMPING and STORAGE

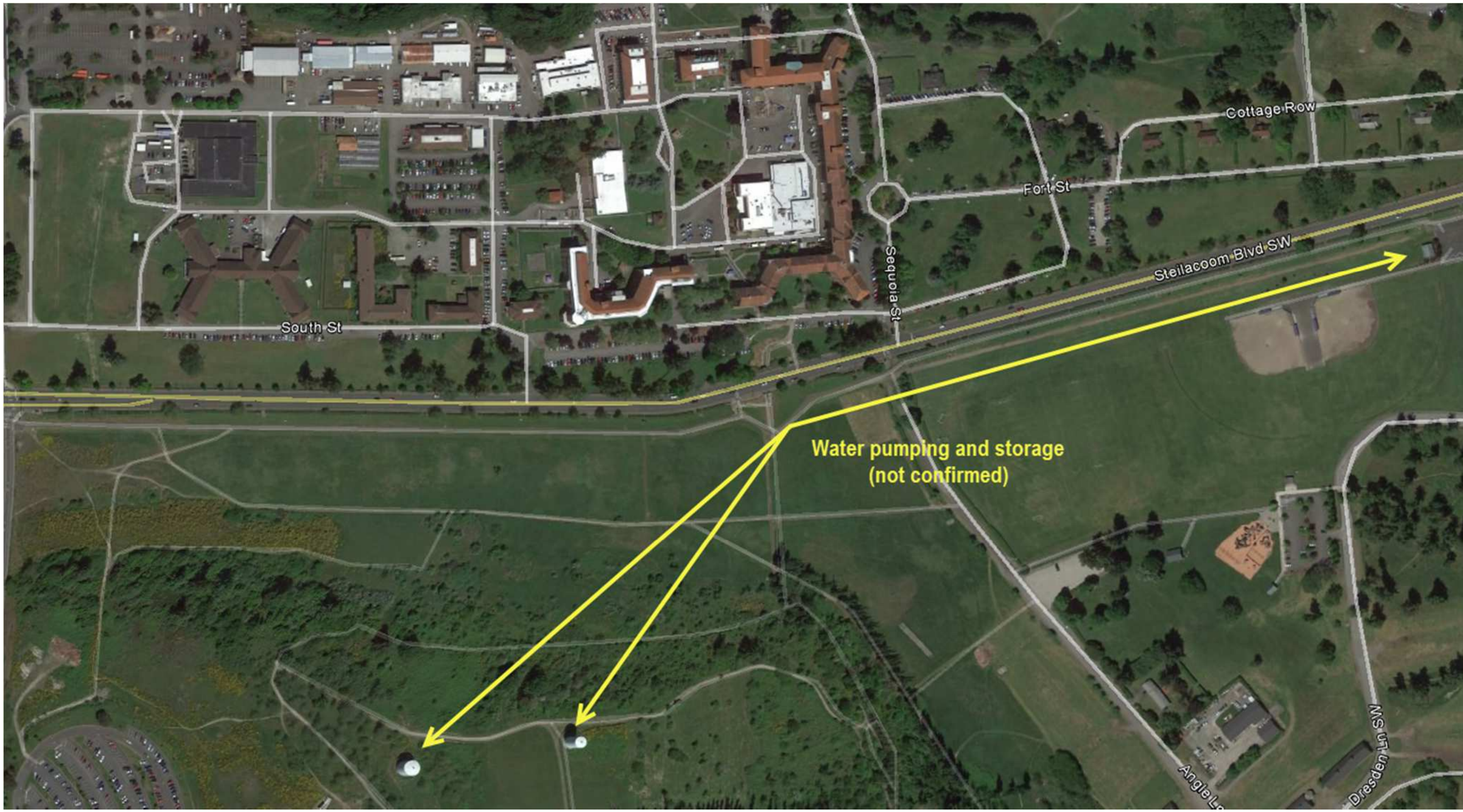
There are two distinct wireless systems connected to the “Plumbing” Bldg 3.

There is a UHF directional beam that is pointed to the pumping station and an omni directional 2.4Ghz antenna connected to an alarm system in the plant. It’s unknown where the 2.4Ghz antenna derives its end data but appears to have responsive water pressure readings back to a fault recorder.

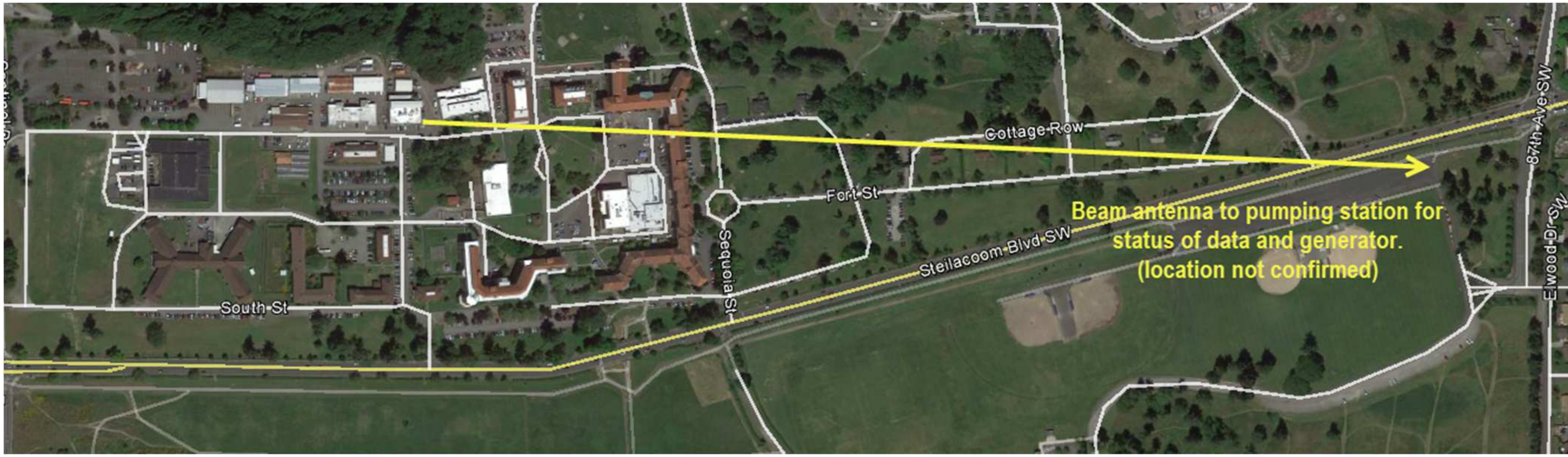
Most cities have taken all these type devices and converted to fiber that will support more specific measurement and control(s) along with security for doors and cameras.

Pumping and Water Storage

Most Cities are running fiber to their pumping and storage facilities



Pumping and Water Storage



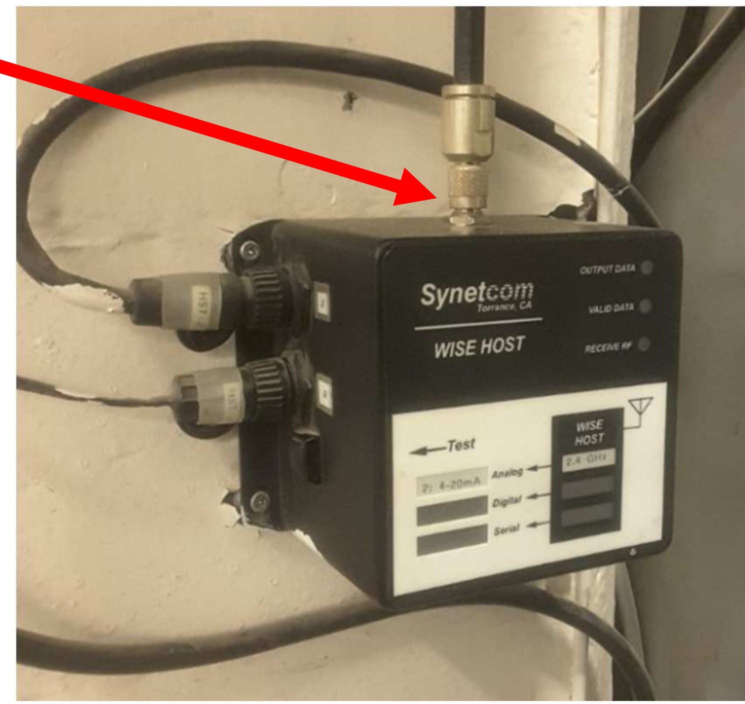
GCCSS doesn't have confirmation that this is the pumping station

Pumping and Water Storage

This particular antenna/coax is for water-works monitoring. The unit appears “dead” however it is connected and alarms when powered down. Normally these units are used when fiber isn’t available for the radio link.

The company is still in business.

This model is not sold or supported any longer at least according to the published web site.



Wireless Carrier Services

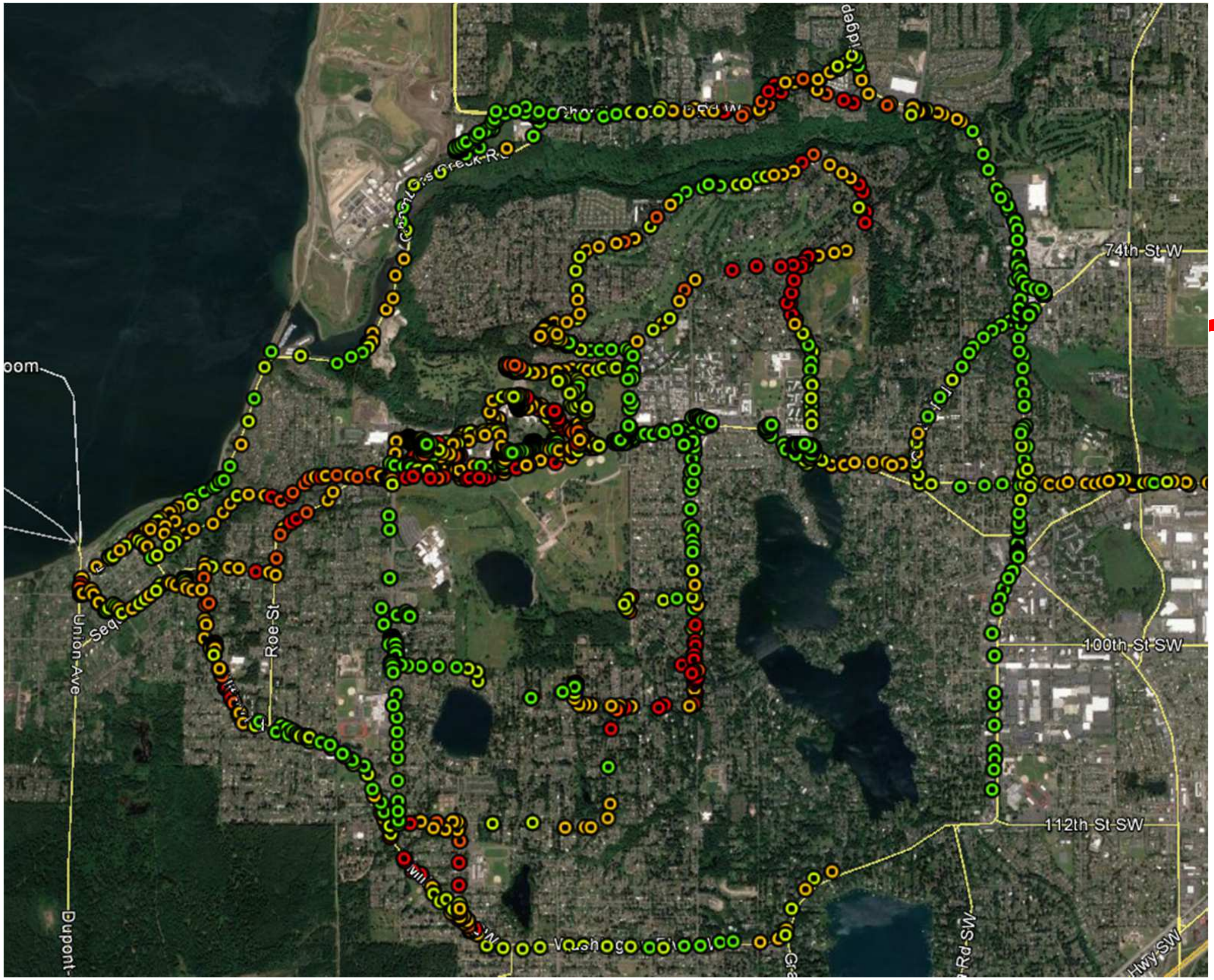
Wireless Carrier Services

General note @ coverage measurements for the slides below:

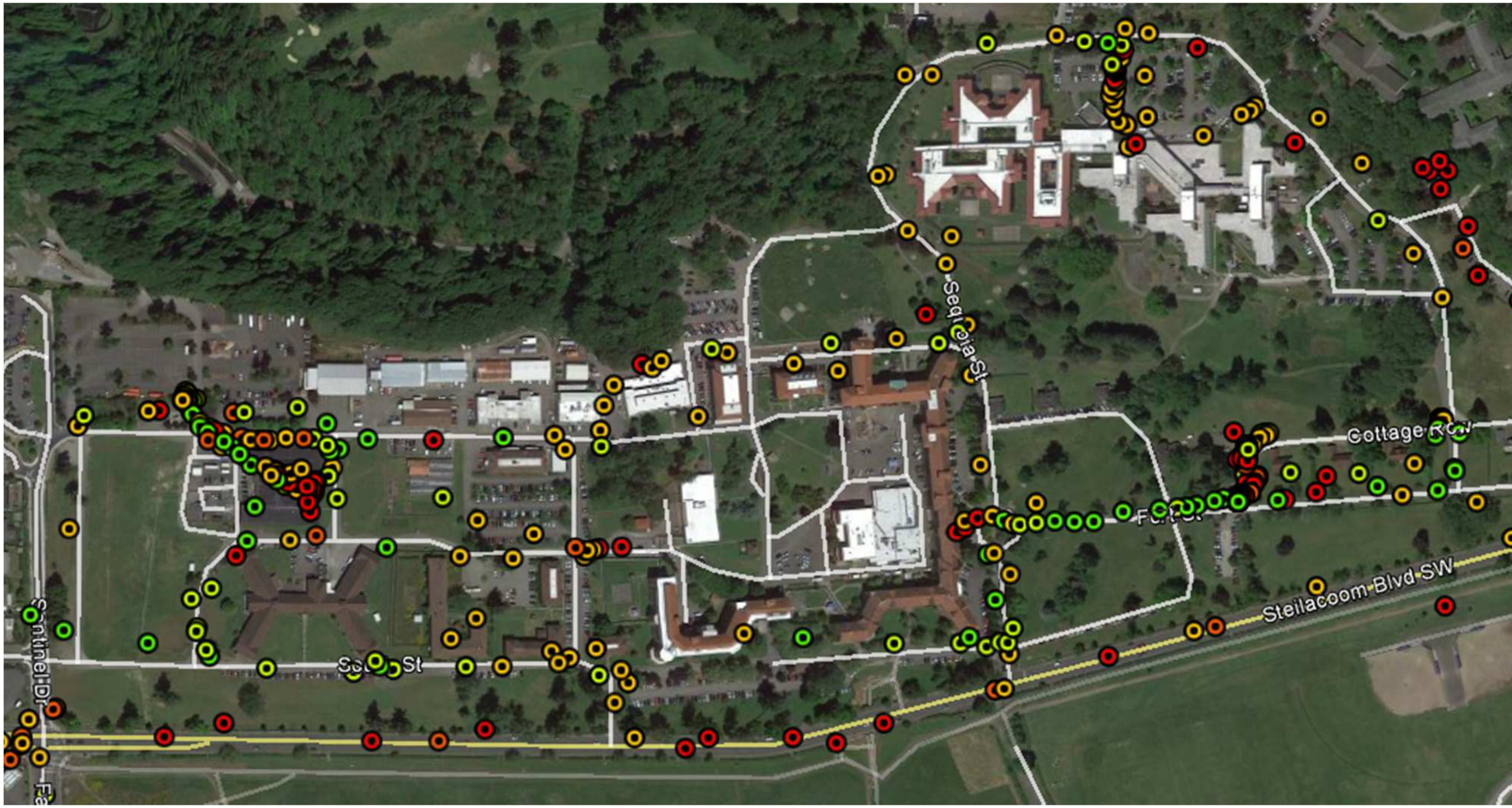
- GCCSS collected over 400,000 data points for the campus and surrounding area.
- Each wireless carrier uses it's own signal strength to represents how many "bars" show on the phone devices. GCCSS has normalized the "bars" to mean the same signal strength for each wireless carrier.

Wireless Carrier	General Area Coverage	Campus Coverage
T-Mobile	1	1
Sprint	4	2
AT&T	2	3
Verizon	3	4

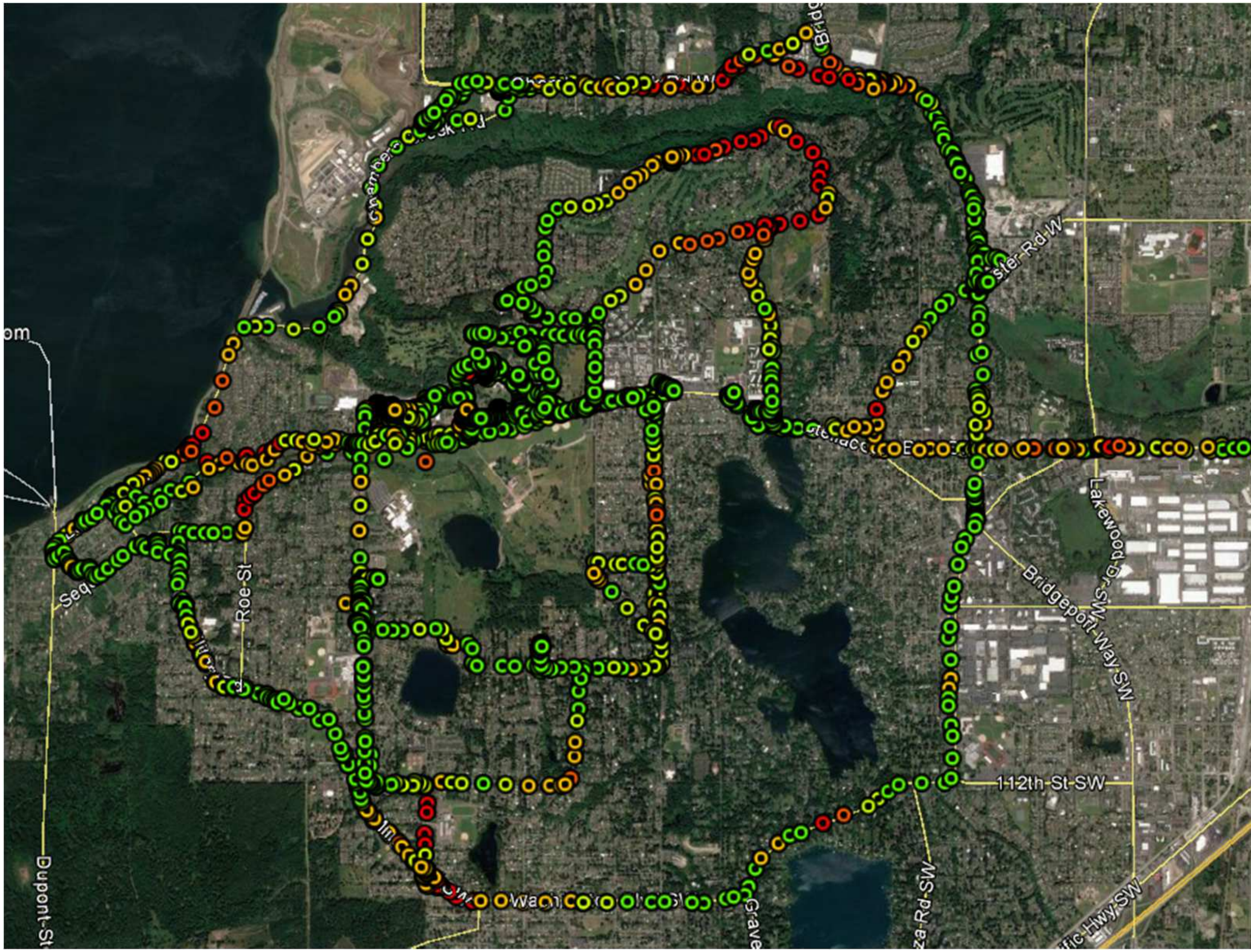
Verizon General Area Coverage



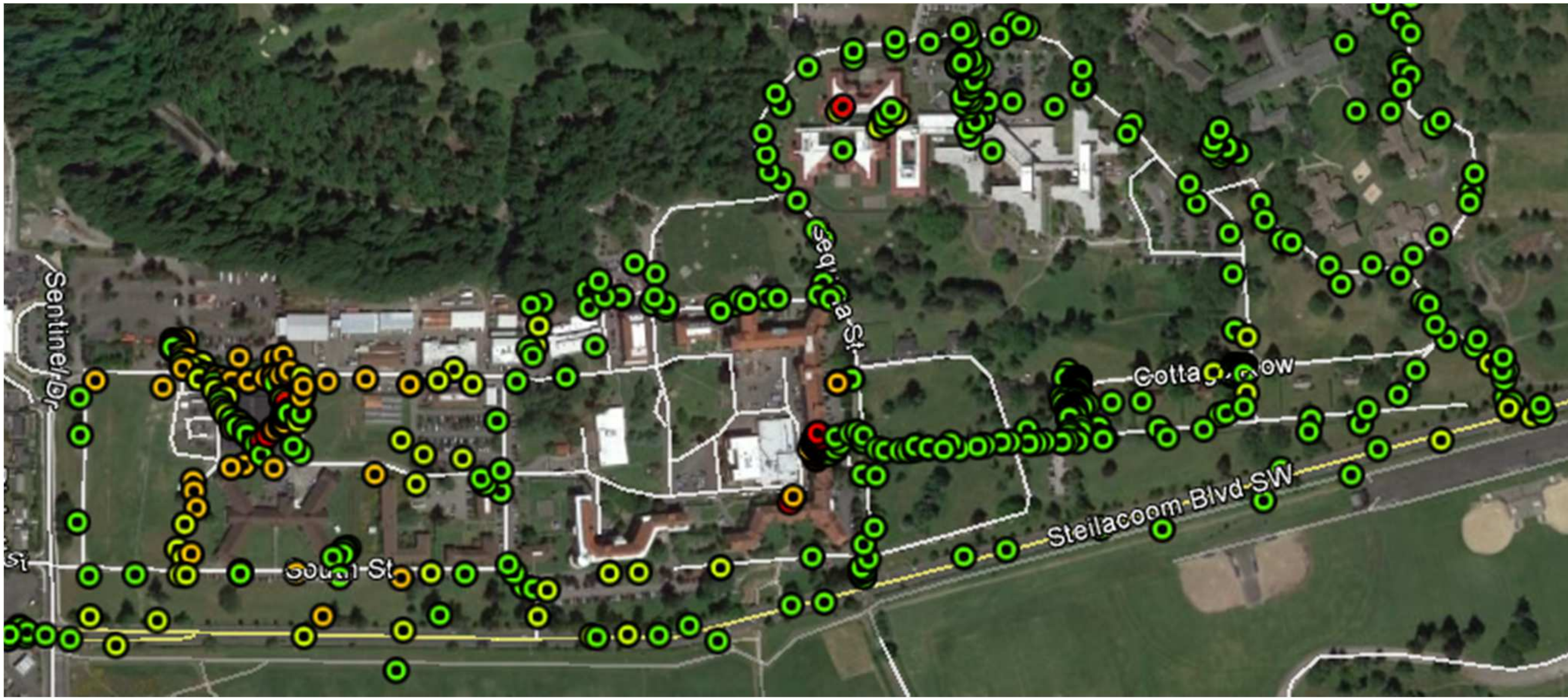
Verizon Coverage on WSH Campus



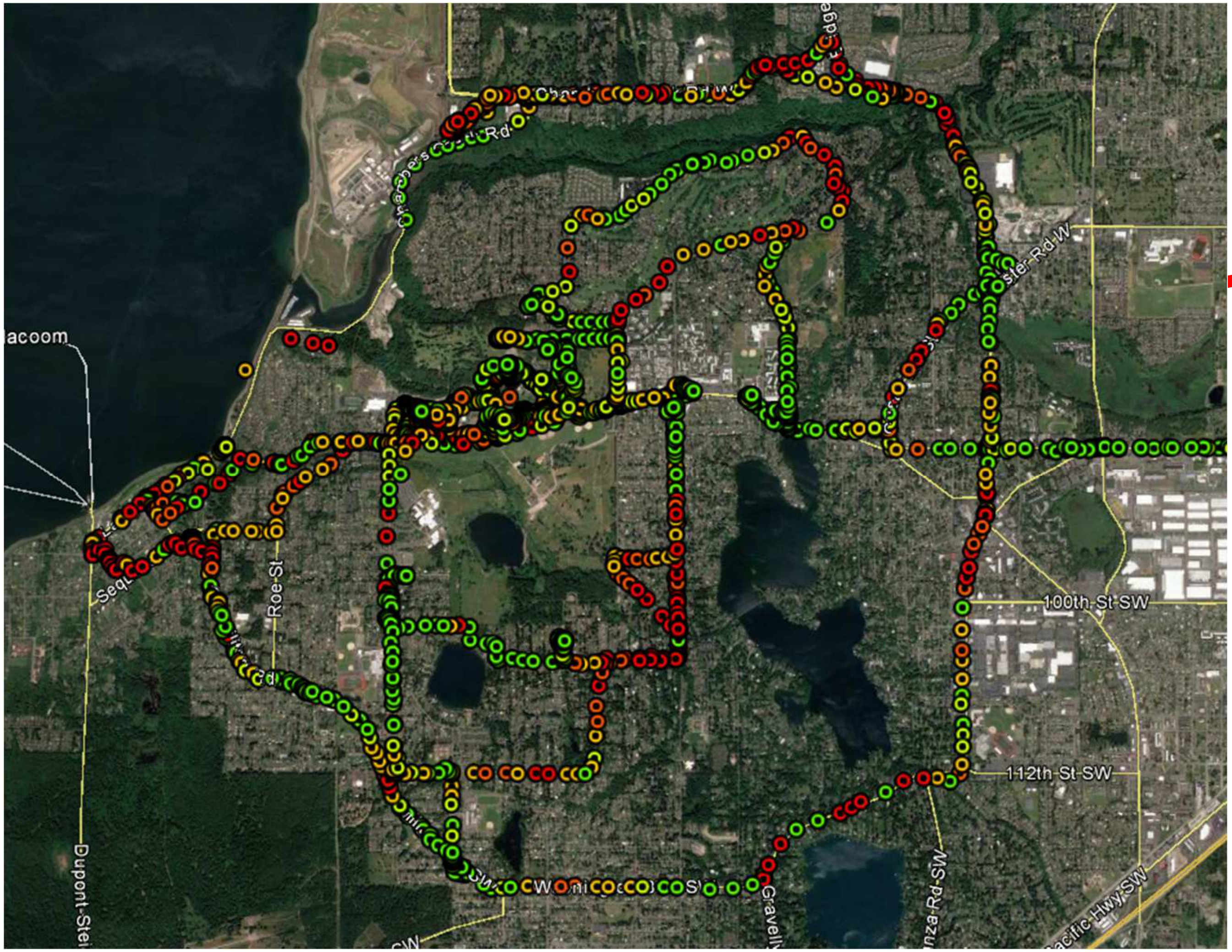
T-Mobile General Area Coverage



T-Mobile Coverage on WSH Campus

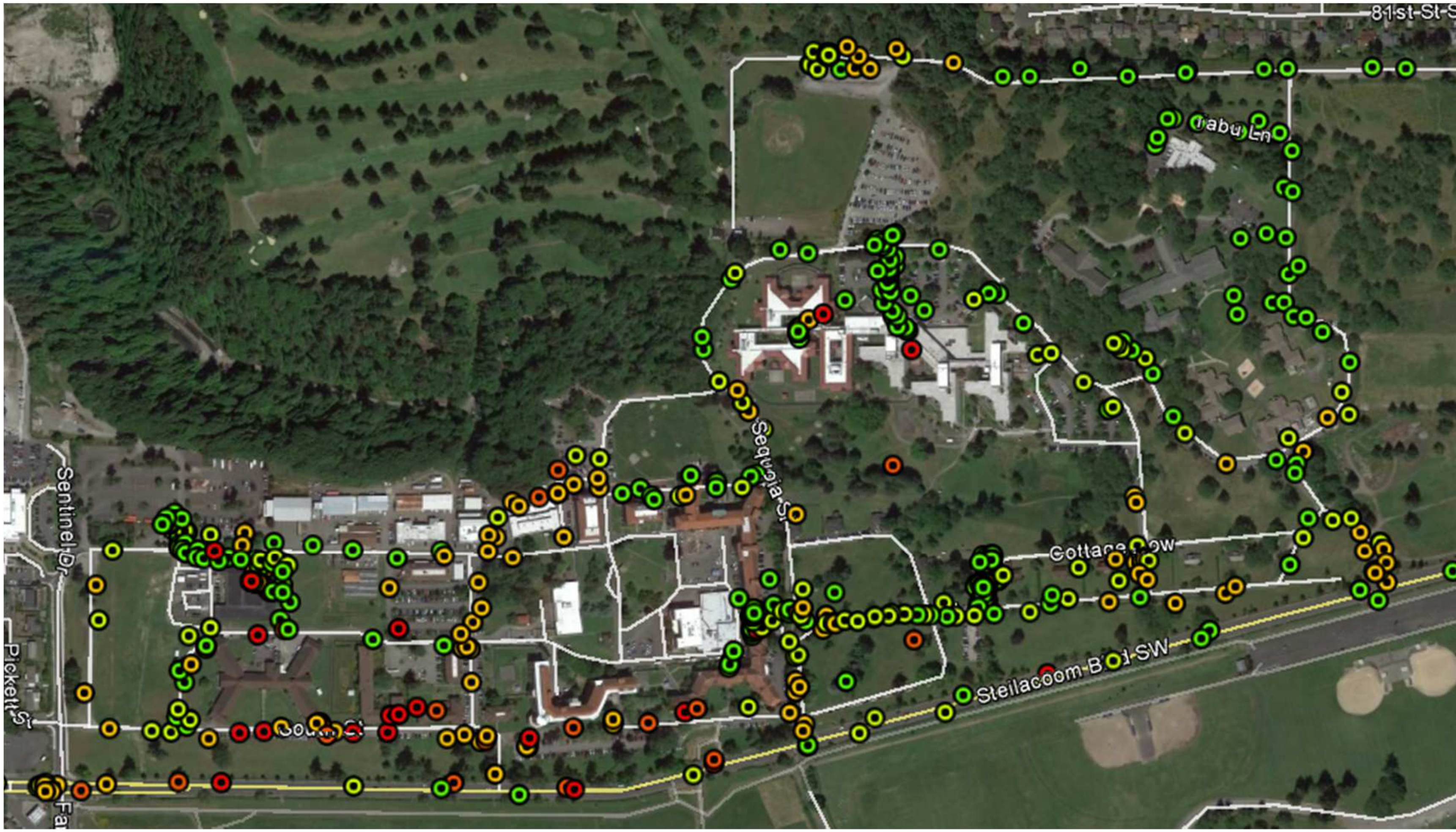


Sprint General Area Coverage

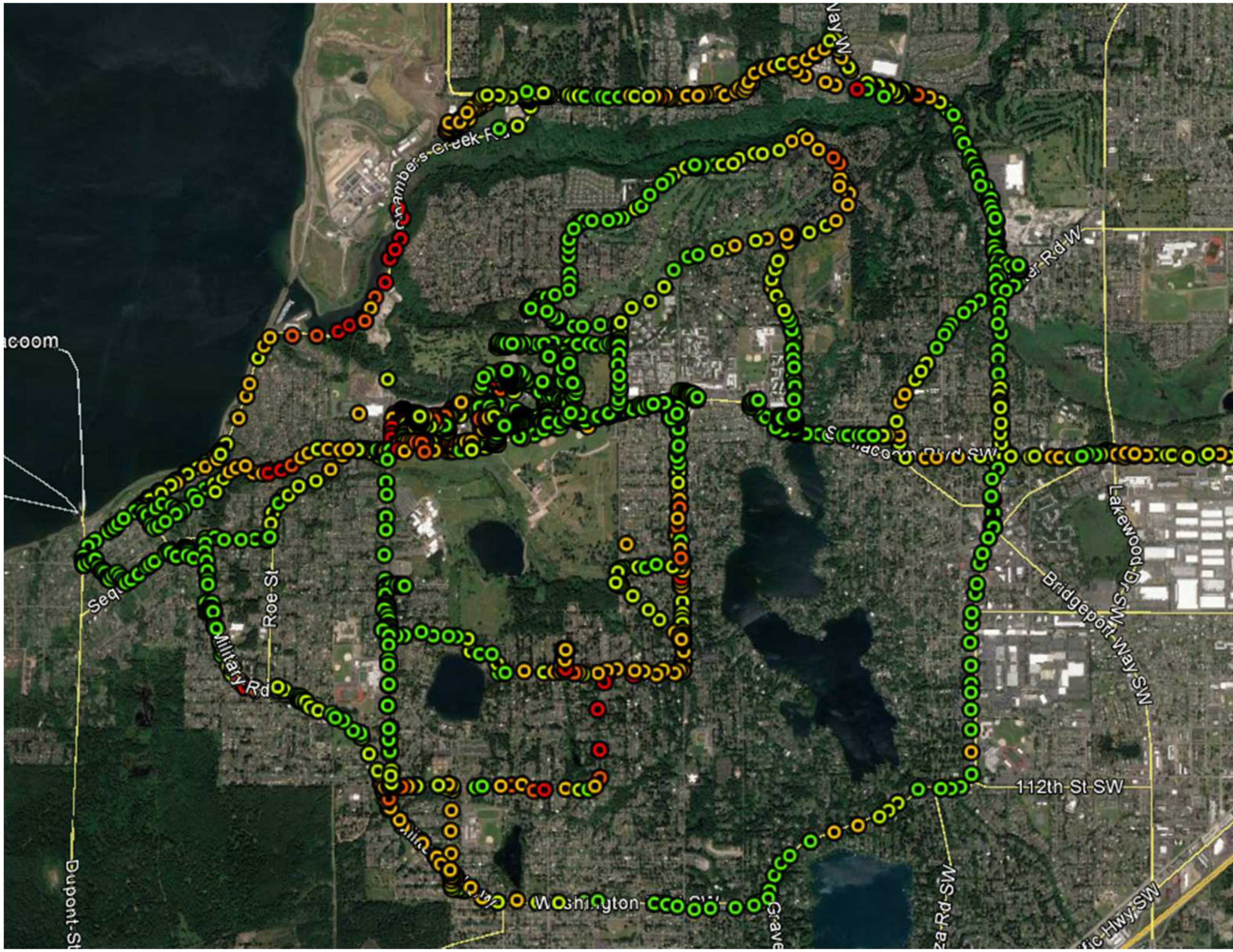


WSH Campus

Sprint Coverage on WSH Campus

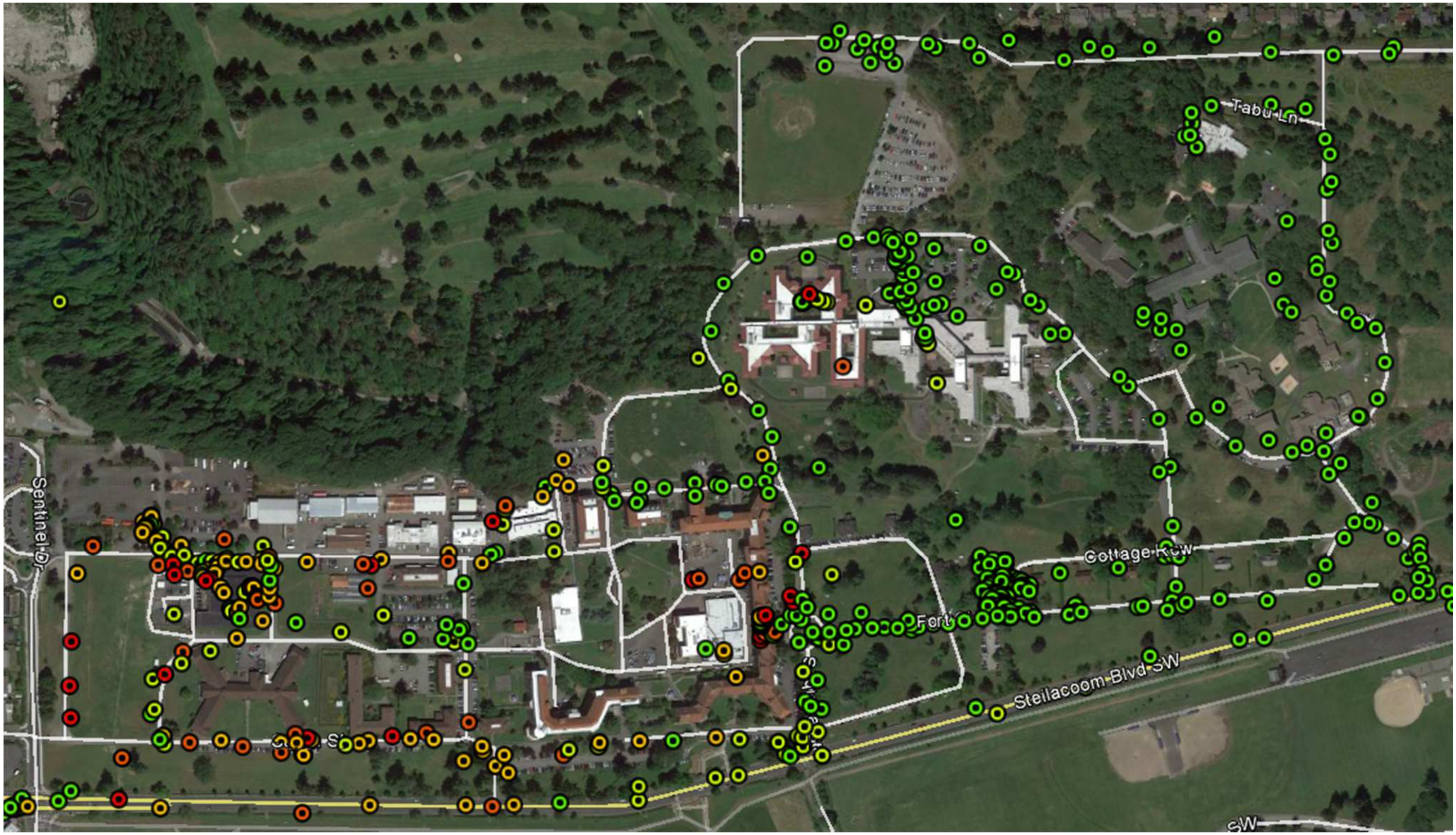


AT&T General Area Coverage

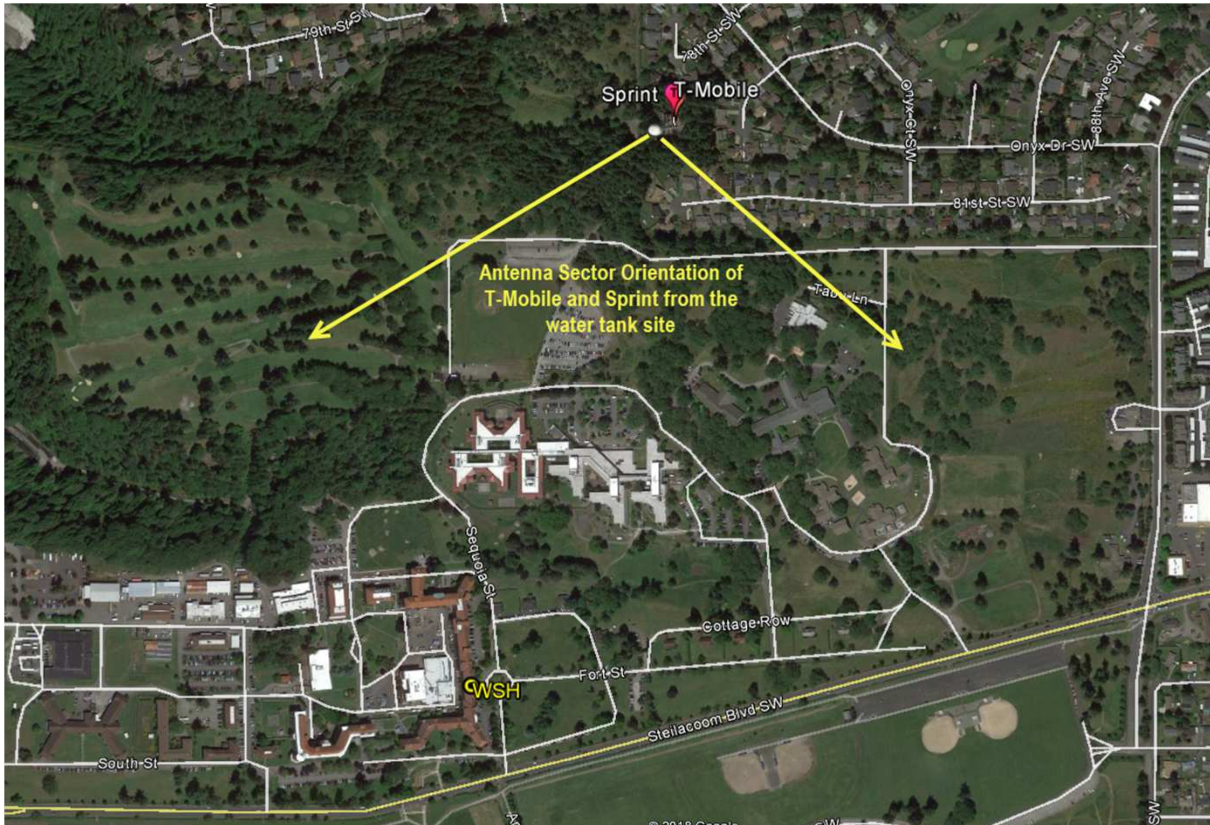


WSH Campus

AT&T Coverage on WSH Campus



Closest wireless site is the water tank to the north occupied by Sprint and T-Mobile



This water tank site is very close to WSH and the signals from T-Mobile and Sprint are better than AT&T and Verizon. However, neither have the building penetration that is needed.

Where to Place a Wireless Compound

Correction Activities Started by WSH

From our initial visit with Mike Hull on Thursday January 4, 2018:

- **Day Wireless:** GCCSS understands that a request has been made of Day Wireless (Motorola) for a "unified 2-way system" that costs under $250,000.

  - If vendors wish to compete in proposing systems, they should be charged with detailed features and functions of the existing and proposed systems in writing and reviewed with WSH in a structured meeting. Additionally, any representation, promises or features should be an exhibit to a purchase/maintenance agreement. Always avoid paying maximum price for a system and then even more for the features you thought you were to get or might want to incorporate.

- **Verizon:** GCCSS understands that a request has been made to Verizon about a plan to located a wireless site on the building or grounds of WSH. As of our visit, Verizon has not responded to any request.

Wireless Compound

The need for a separate wireless compound comes from these factors:

1. Locating a wireless carrier company like Verizon or AT&T onto the WSH campus without locating their equipment on any roof tops.

2. Finding a more suitable and central location for the WSH communication radios.

The location selection comes from these factors:

a) Centrally located on the campus between the two major building complexes.
b) Outside of any 20 year build plans.
c) Available to wireless carriers without having it's contractors/security for access.
d) "building" labeled location is off a logical end of the existing building.
e) "trees" is nestled in the grove of trees adding camouflage for ease of zoning.

Wireless Compound (Towers)

Typical 150ft Tall Structures to host wireless carriers and WSH communication Equipment

Mono-pine to match trees and nestled in the "tree" area.

Mono-pole does not match anything and at the end of the "building" area.

Wireless Compound (Shelter)

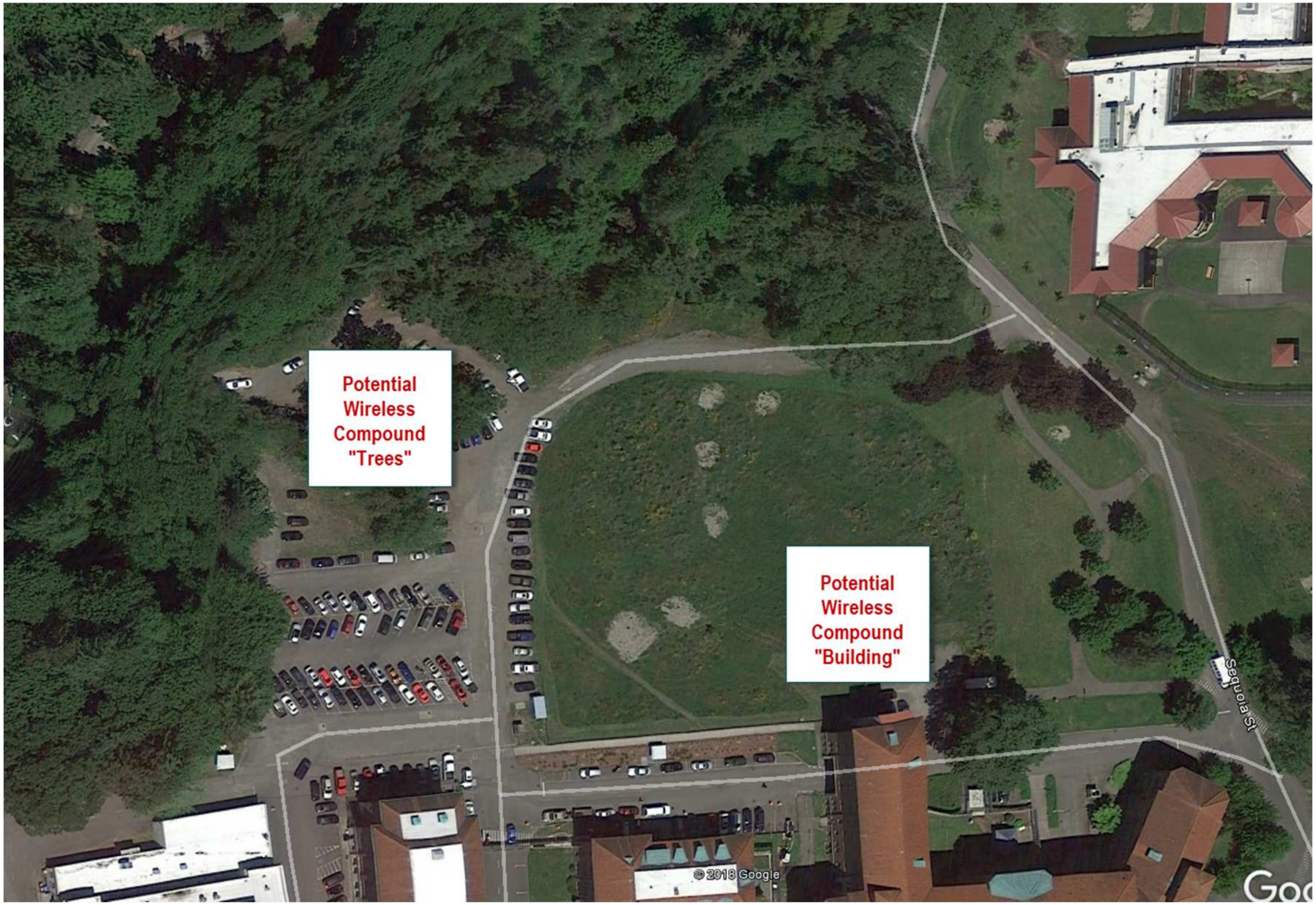
This is a typical "bullet proof" communication shelter for two-way (WSH) type equipment.

Air conditioning, batteries, generator, etc.

This is what a typical installation looks like for wireless carriers.

Outdoor cabinets, racks, batteries, etc.

Logical Location(s) for a Communication structure and equipment area



Fire and CCN$_{et\ (700Mhz)}$

How to comply with IBC Fire Code 510