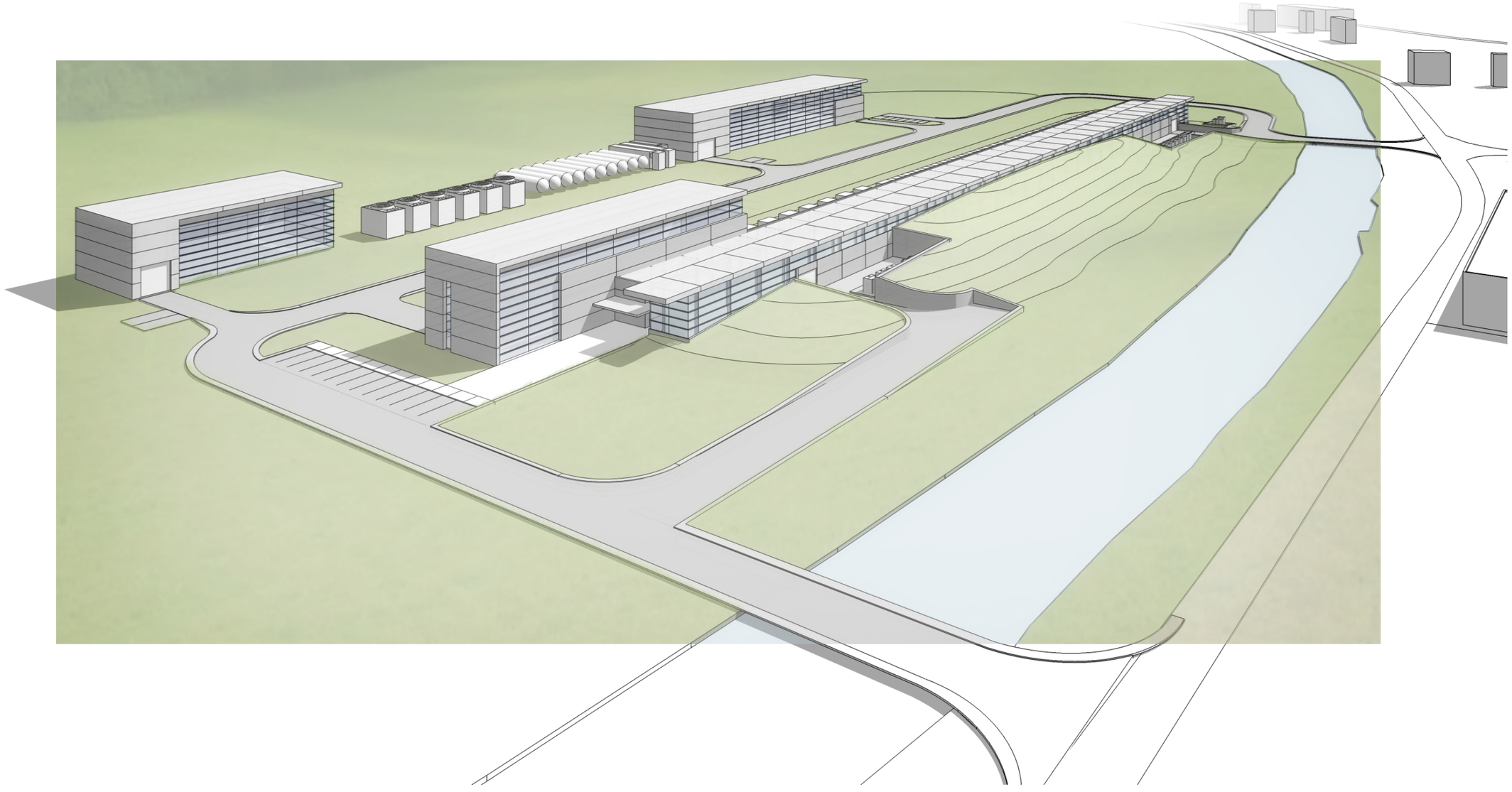
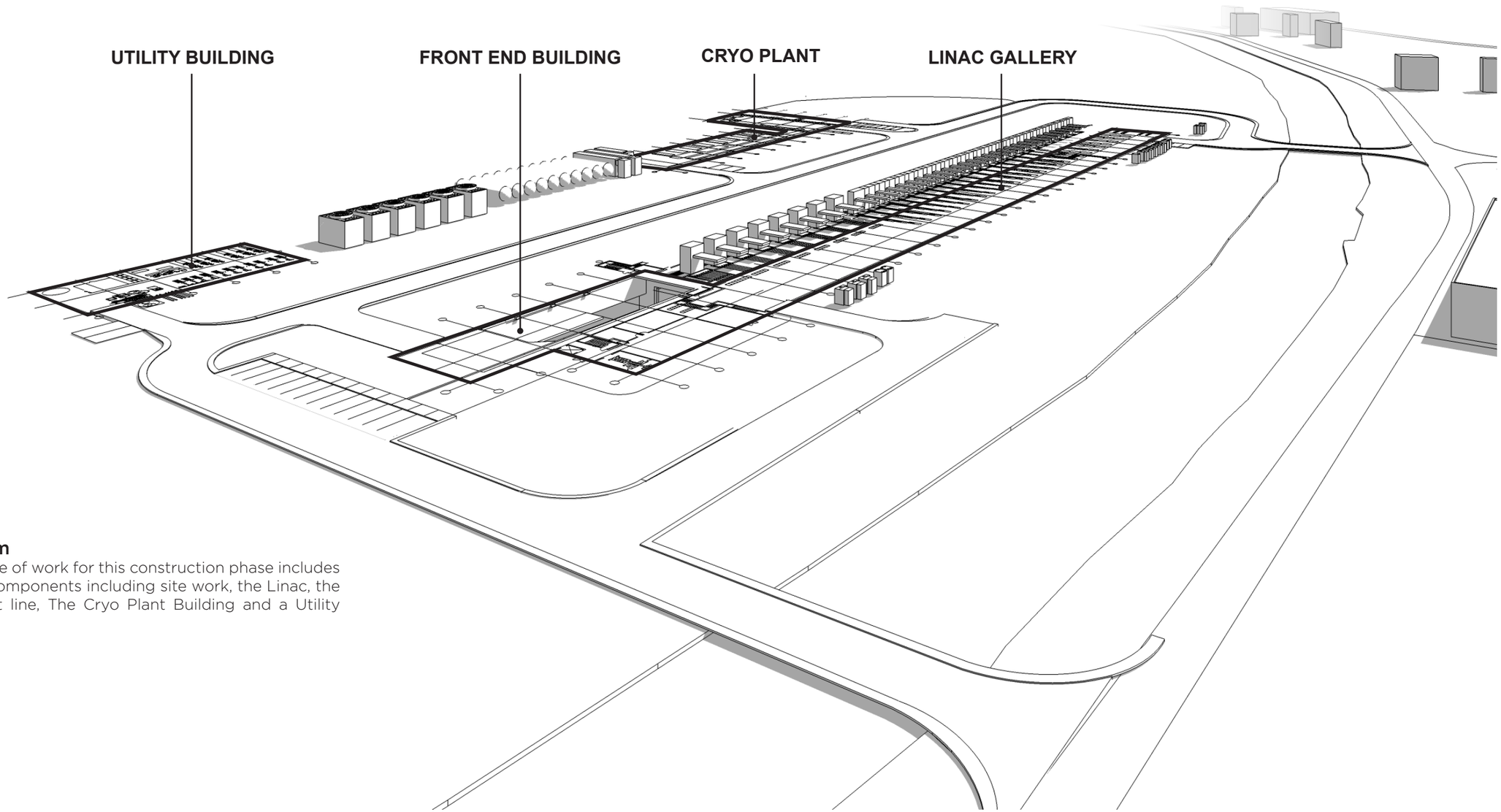
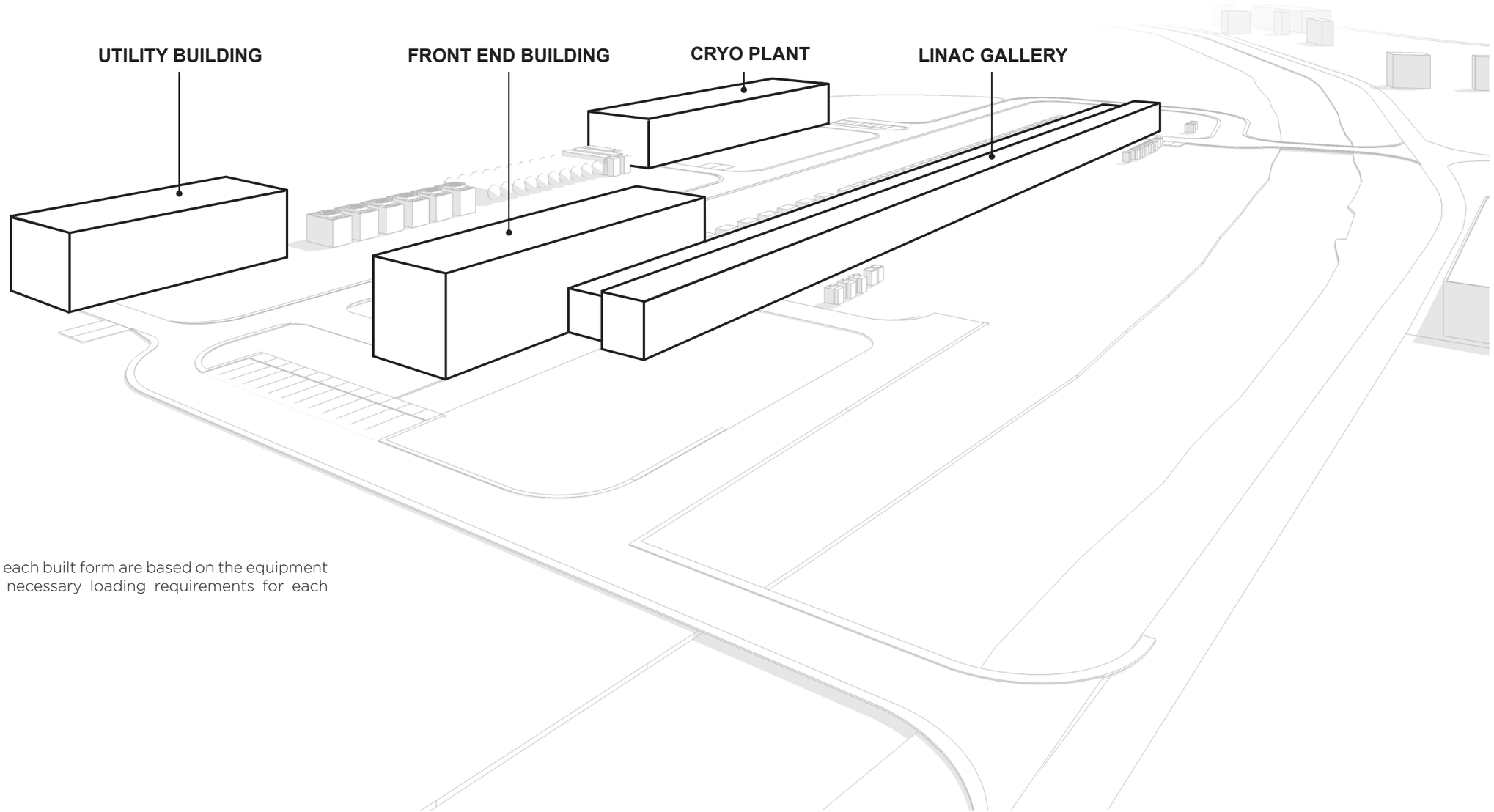


01FEB17

Project Site
Site location provides proximity to existing utilities and services while also accommodating future expansion.

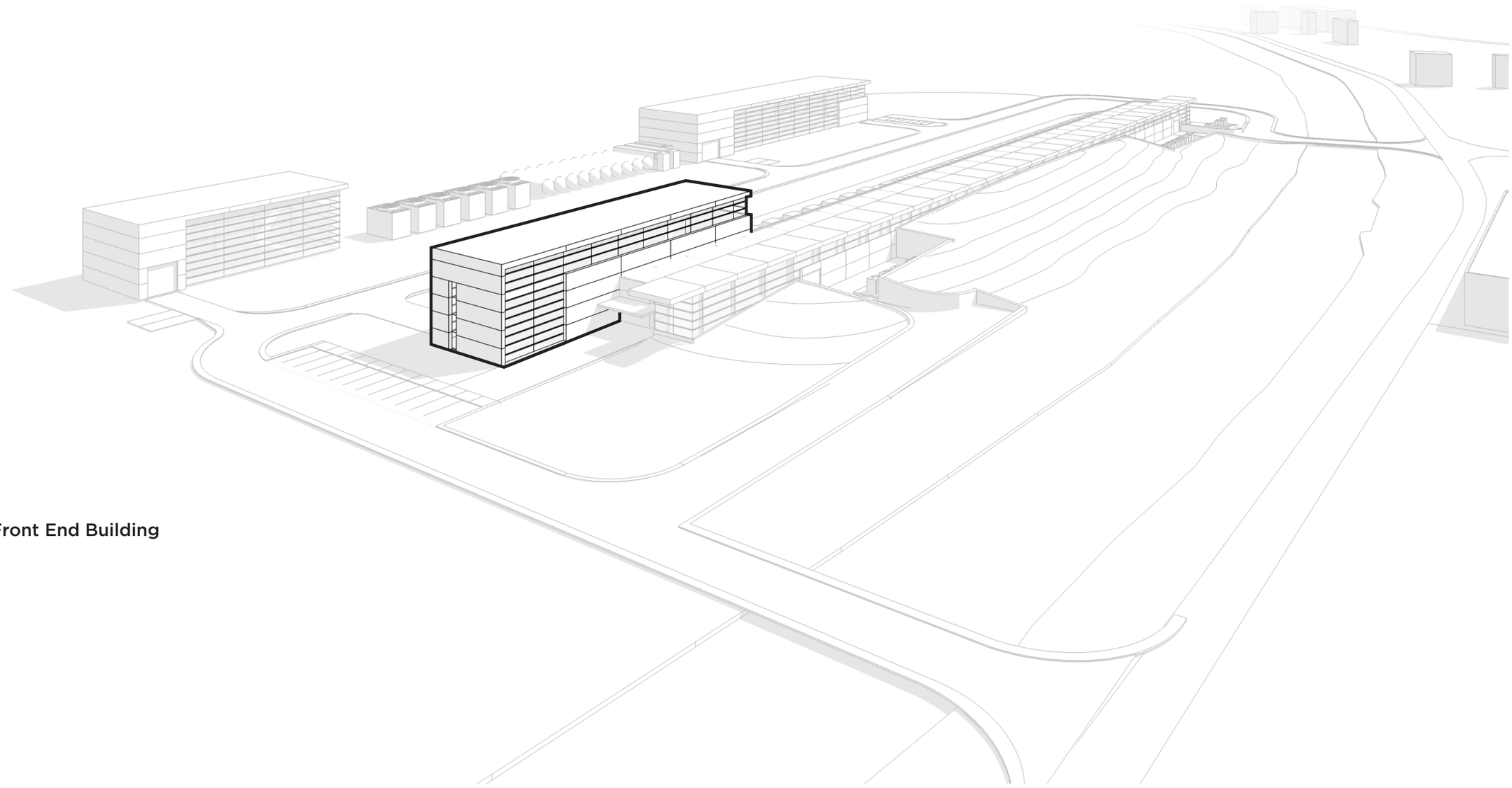


Program
The scope of work for this construction phase includes several components including site work, the Linac, the Transport line, The Cryo Plant Building and a Utility Building.

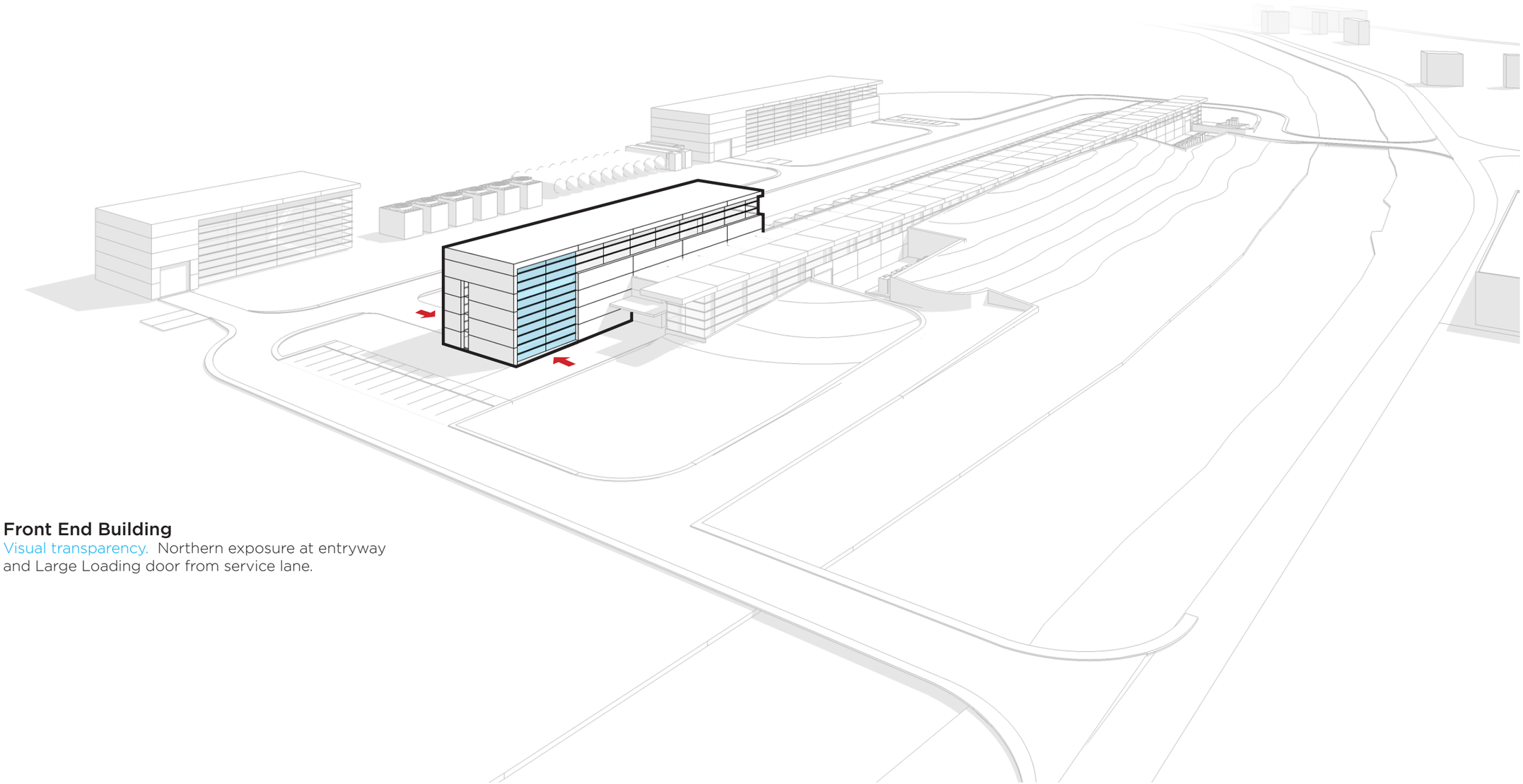


Massing

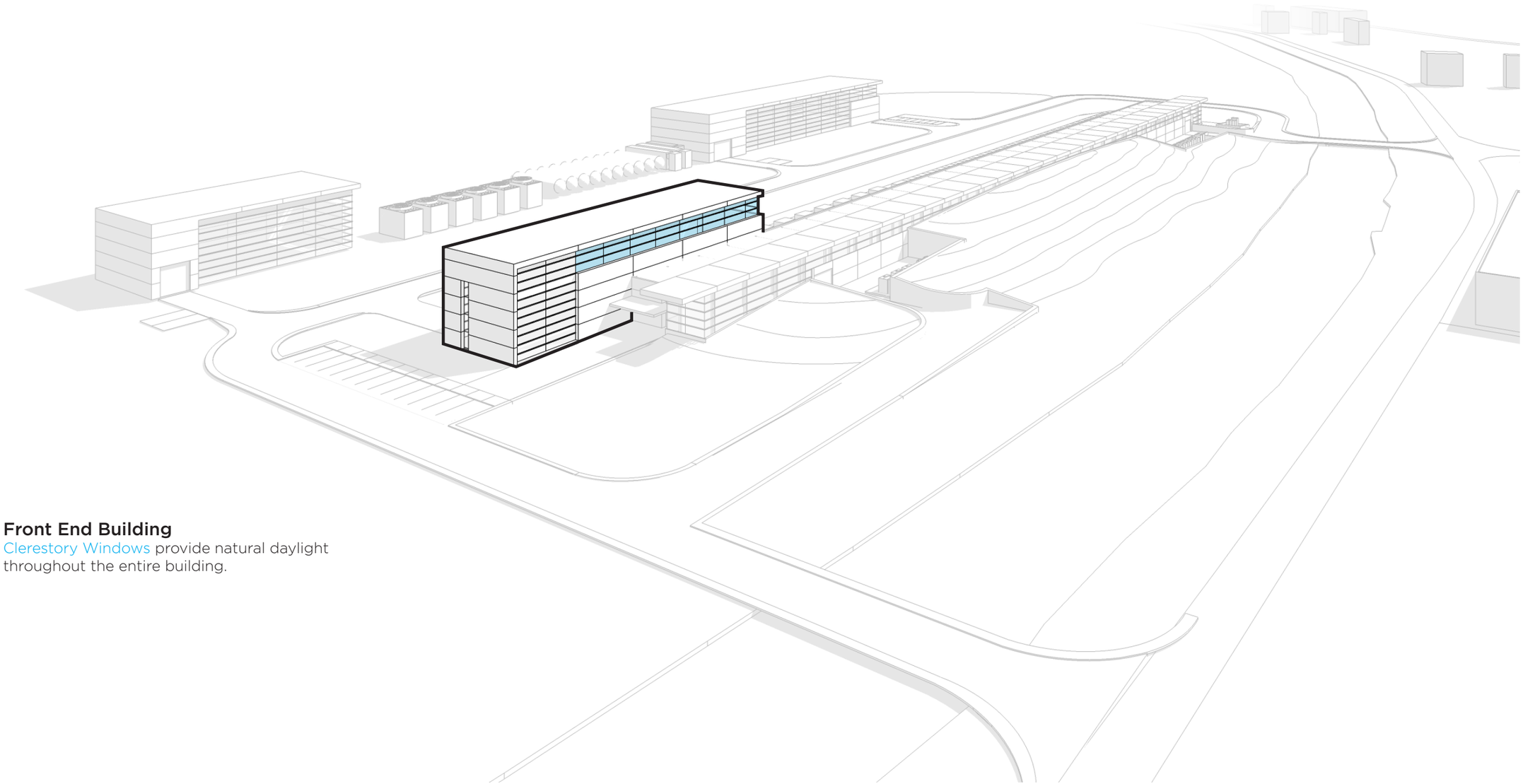
Heights for each built form are based on the equipment needs and necessary loading requirements for each space.



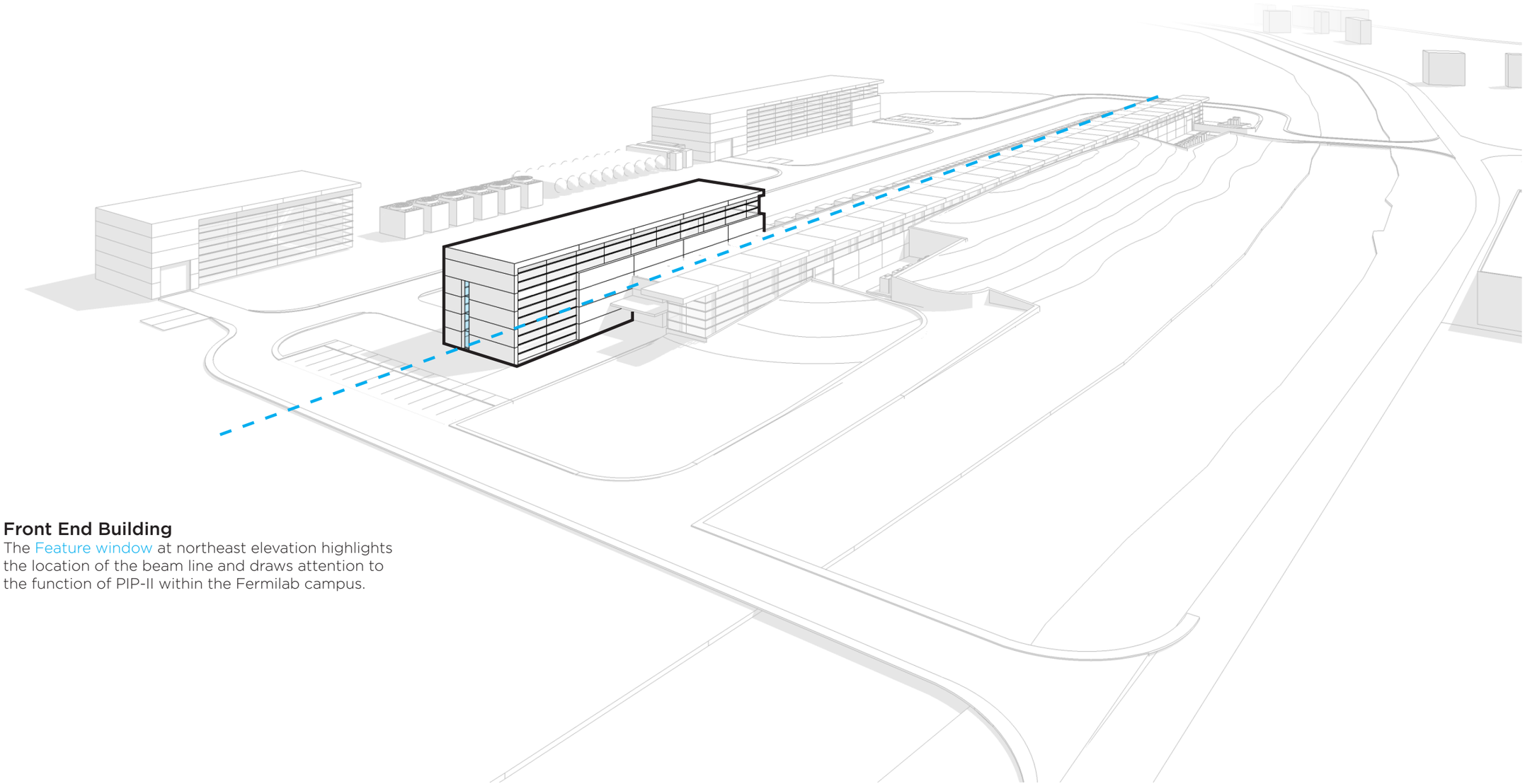
Front End Building



Front End Building
Visual transparency. Northern exposure at entryway and Large Loading door from service lane.

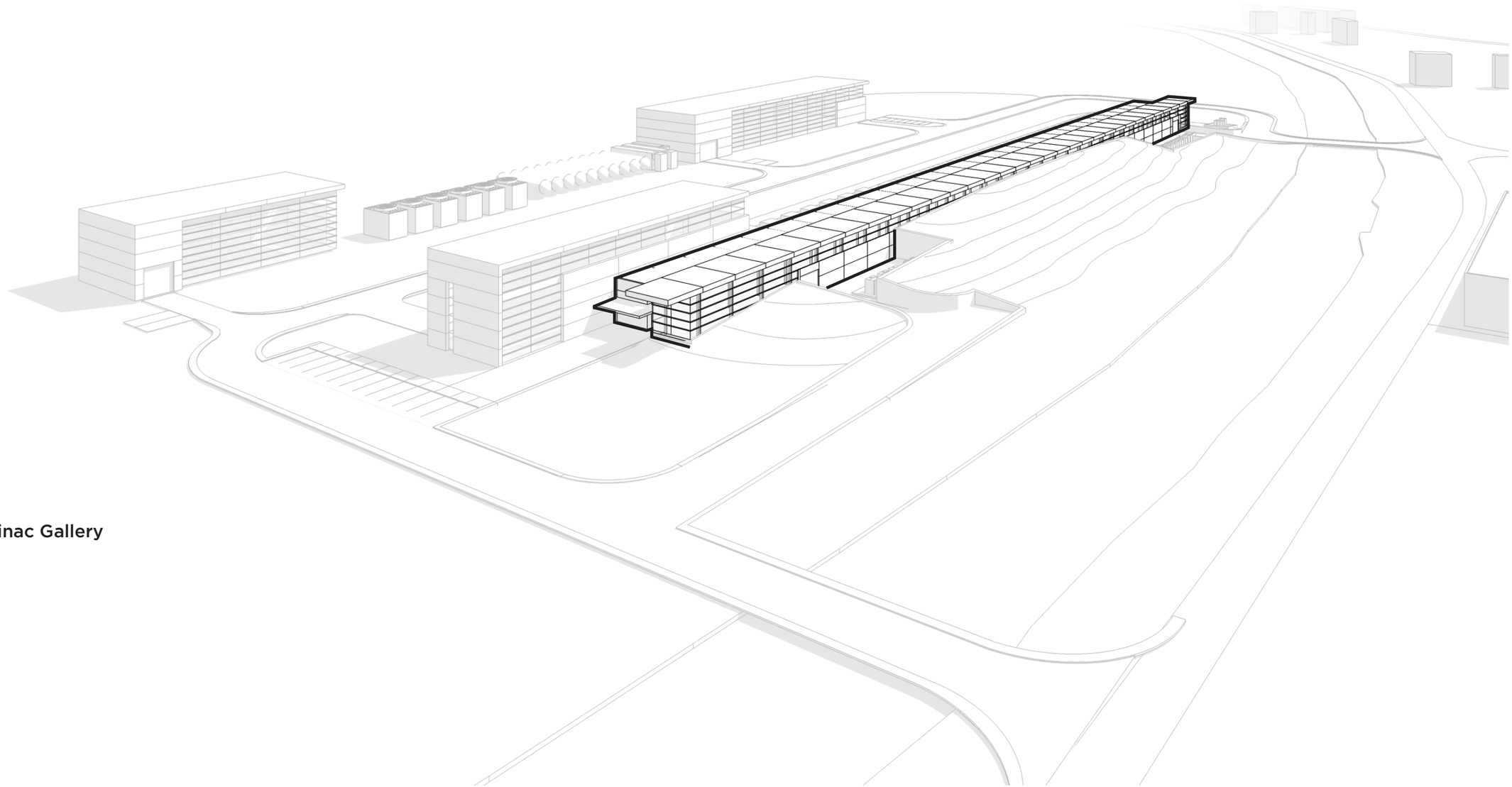


Front End Building
Clerestory Windows provide natural daylight throughout the entire building.

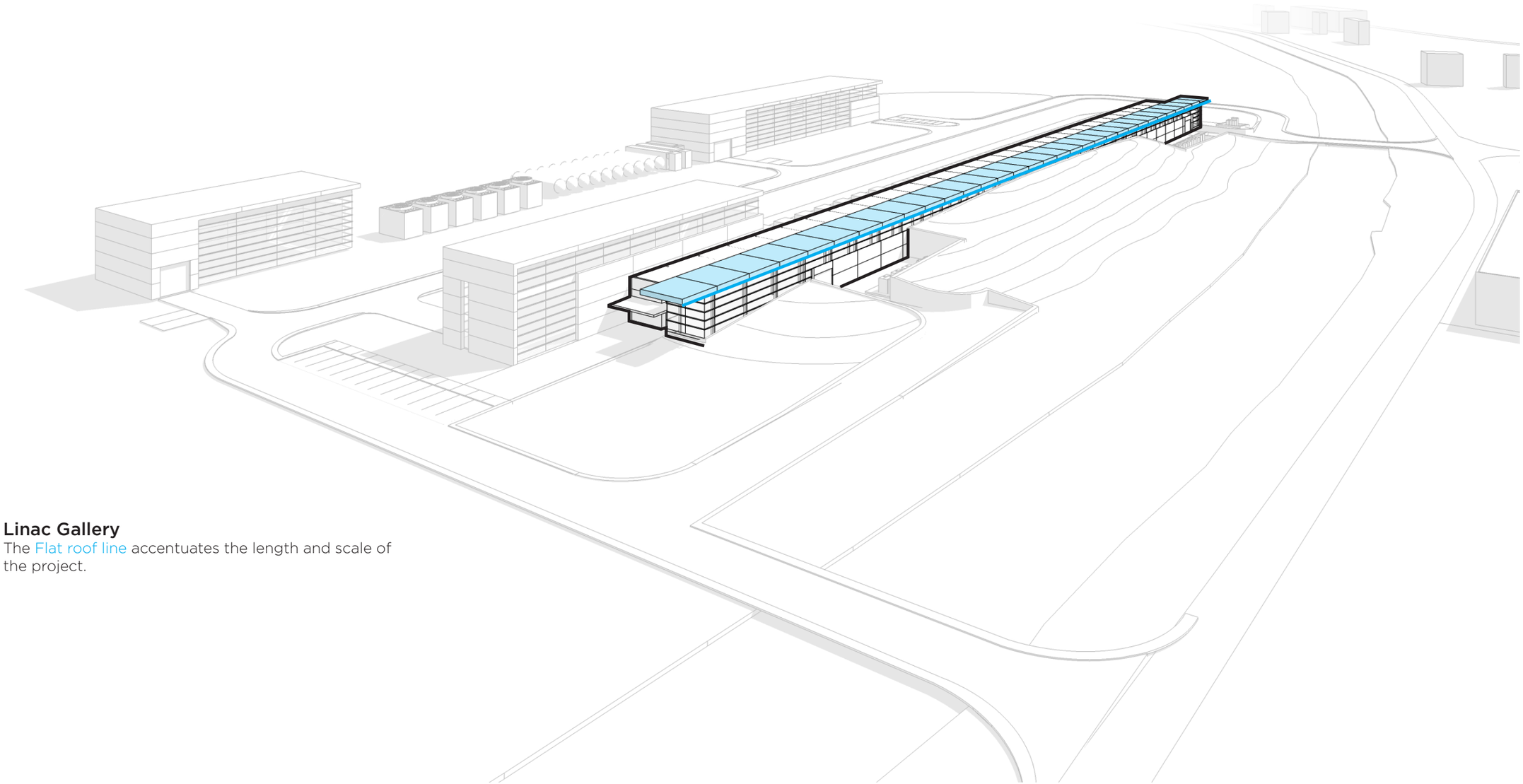


Front End Building

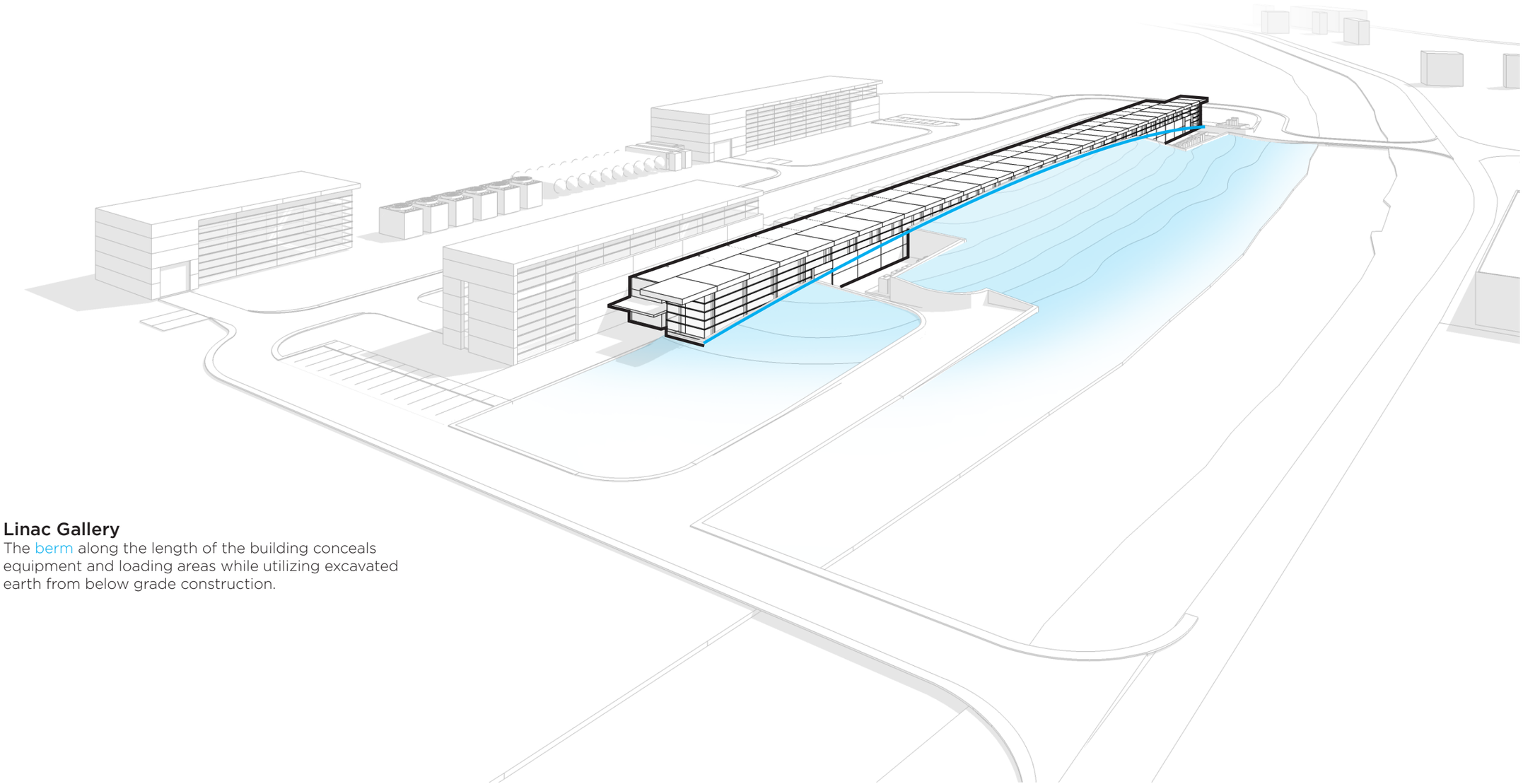
The Feature window at northeast elevation highlights the location of the beam line and draws attention to the function of PIP-II within the Fermilab campus.



Linac Gallery

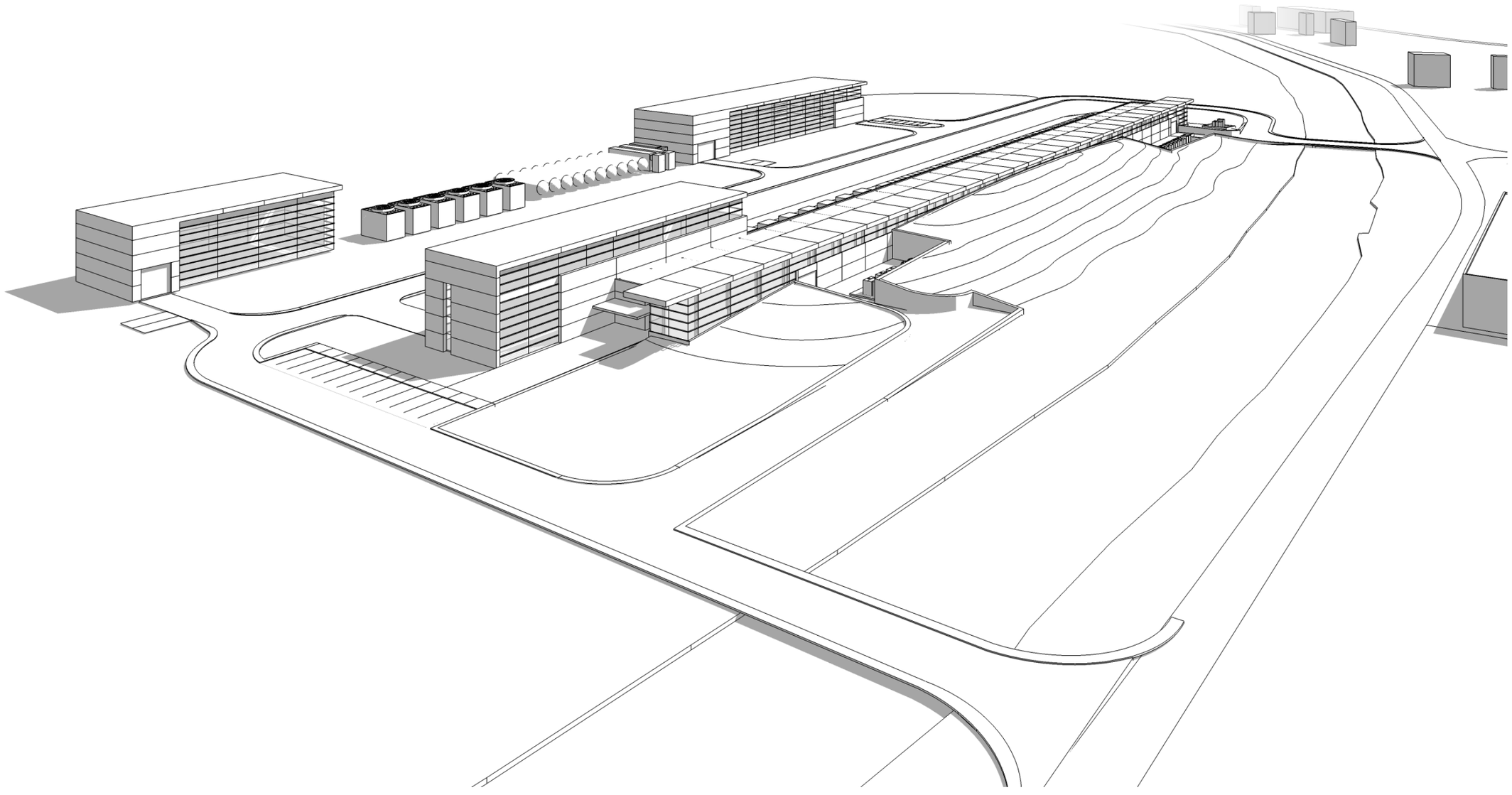


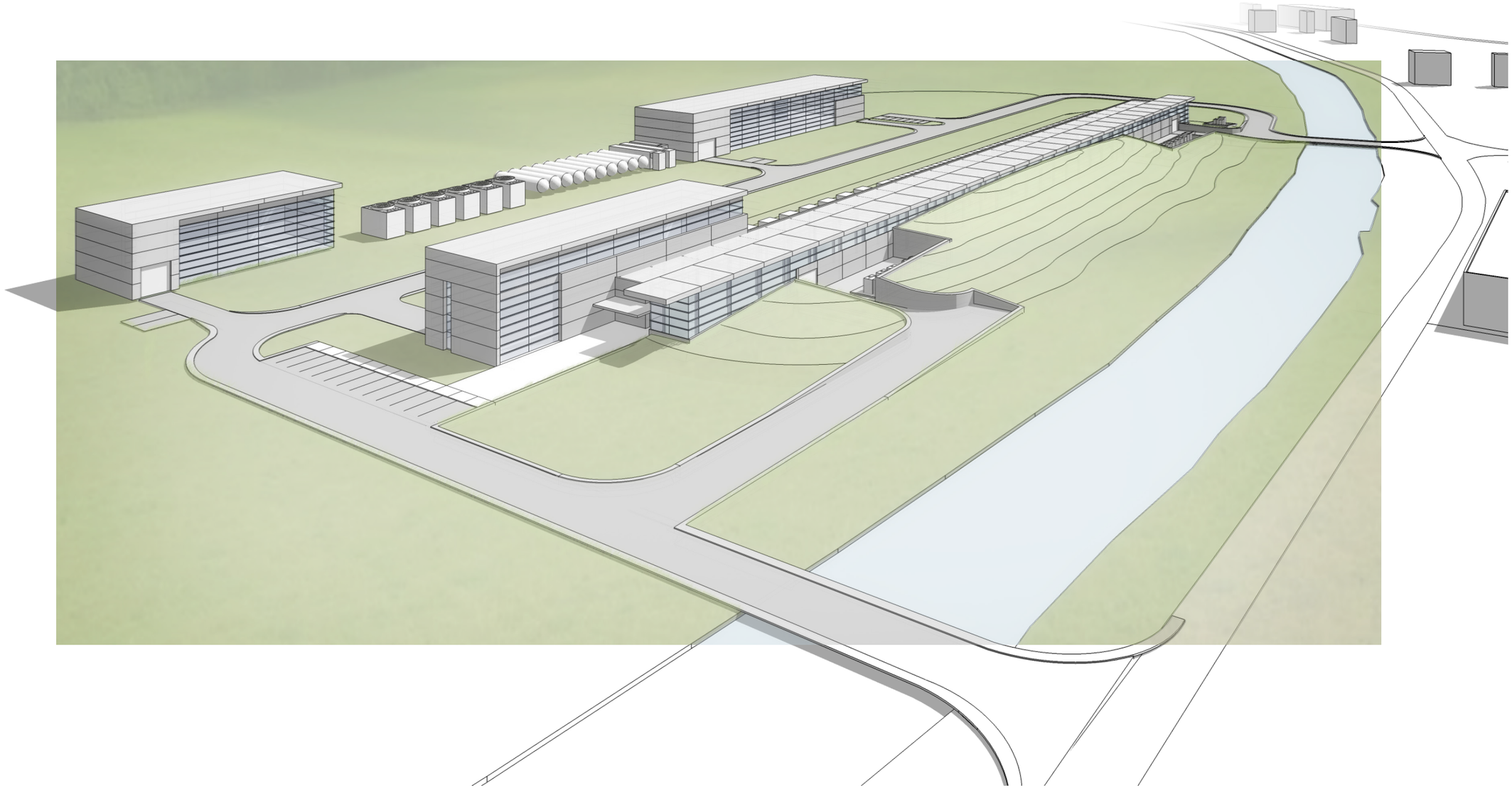
Linac Gallery
The Flat roof line accentuates the length and scale of the project.

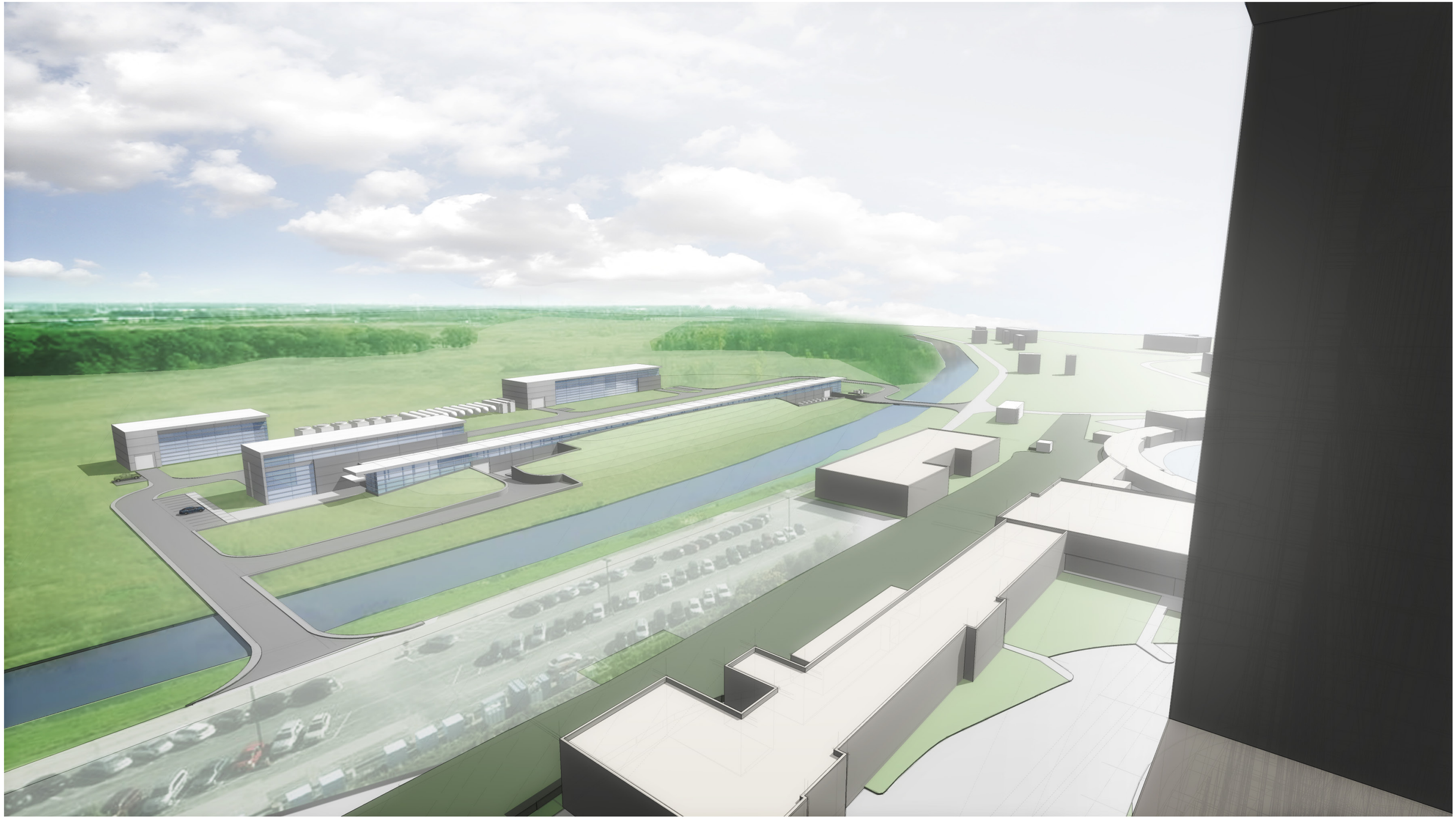


Linac Gallery

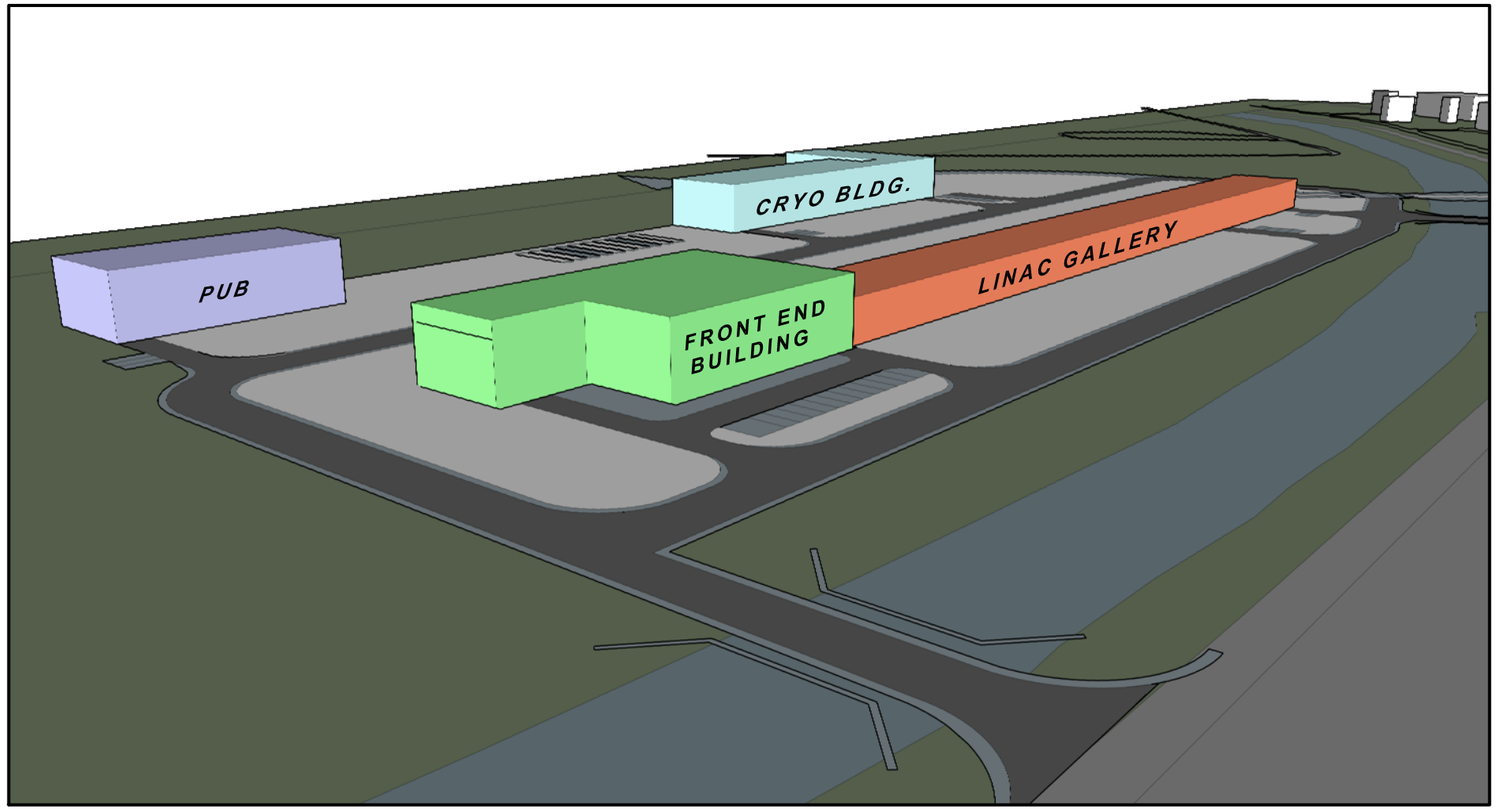
The berm along the length of the building conceals equipment and loading areas while utilizing excavated earth from below grade construction.







PROTON IMPROVEMENT PLAN - II



LIST OF DRAWINGS

G-1	TITLE SHEET, LIST OF DRAWINGS
C-1	SITE IMAGE
C-2	FUTURE BEAMLINES SITE PLAN
C-3	WETLANDS SITE PLAN
C-4	SITE PLAN
C-5	ENLARGED PLAN AT ABSORBER
C-6	UTILITIES SITE PLAN
C-7	SOIL BORINGS
A-1	DESIGN BASIS - SHEET 1
A-2	DESIGN BASIS - SHEET 2
A-3	DESIGN BASIS - SHEET 3
A-4	LIFE SAFETY
A-5	ENCLOSURE KEY PLAN
A-6	LINAC ENCLOSURE PLAN - SHEET 1
A-7	LINAC ENCLOSURE PLAN - SHEET 2
A-8	LINAC ENCLOSURE PLAN - SHEET 3
A-9	LINAC ENCLOSURE PLAN - SHEET 4
A-10	TRANSPORT ENCLOSURE PLAN - SHEET 1
A-11	TRANSPORT ENCLOSURE PLAN - SHEET 2
A-12	TRANSPORT ENCLOSURE PLAN - SHEET 3
A-13	TRANSPORT ENCLOSURE PLAN - SHEET 4
A-14	TRANSPORT ENCLOSURE PLAN - SHEET 5
A-15	TYP. LINAC ENCLOSURE SECTION
A-16	TYP. TRANSPORT ENCLOSURE SECTION
A-17	ELEVATION AT MAIN RING CROSSING
A-18	PIP II CAMPUS PLAN
A-19	LINAC SUPPORT BUILDING KEY PLAN
A-20	LINAC SUPPORT BUILDING PLAN - SHEET 1
A-21	LINAC SUPPORT BUILDING PLAN - SHEET 2
A-22	LINAC SUPPORT BUILDING PLAN - SHEET 3
A-23	LINAC SUPPORT BUILDING PLAN - SHEET 4
A-24	LINAC SUPPORT BUILDING PLAN - SHEET 5
A-25	SOUTHEAST BOOSTER BUILDING - DEMO PLAN
A-26	SOUTHEAST BOOSTER BLDG. - EXCAVATION PLAN
A-27	SOUTHEAST BOOSTER BUILDING - PLAN
A-28	SECTION THRU HIGH BAY RECEIVING
A-29	CROSS SECTION THRU HIGH BAY
A-30	CROSS SECTION @ HWR
A-31	SECTION THRU HIGH BAY
A-32	SECTION @ COAX FOR SSR1, SSR2
A-33	SECTION @ WAVEGUIDE FOR LB 650, HB 650
A-34	SECTION AT LINAC ALCOVES
A-35	SECTION SHEET - 1
A-36	SECTION SHEET - 2
A-37	SECTION SHEET - 3
A-38	SECTION SHEET - 4
A-39	SECTION SHEET - 5
A-40	CRYOGENIC PLANT
A-41	COLD BOX STATION PLAN
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A-43	PIP II UTILITY PLANT PLAN
M-1	HVAC - CONCEPTUAL DESIGN BASIS
M-2	CF MECHANICAL - CONCEPTUAL DESIGN BASIS
M-3	COOLING HEAT REJECTION CONCEPT
E-1	POWER SINGLE LINE DIAGRAM

SCALE:

PROTON IMPROVEMENT PLAN - II

TITLE SHEET, LIST OF DRAWINGS

Fermilab

PIP-II

DATE

28 OCT. 2016

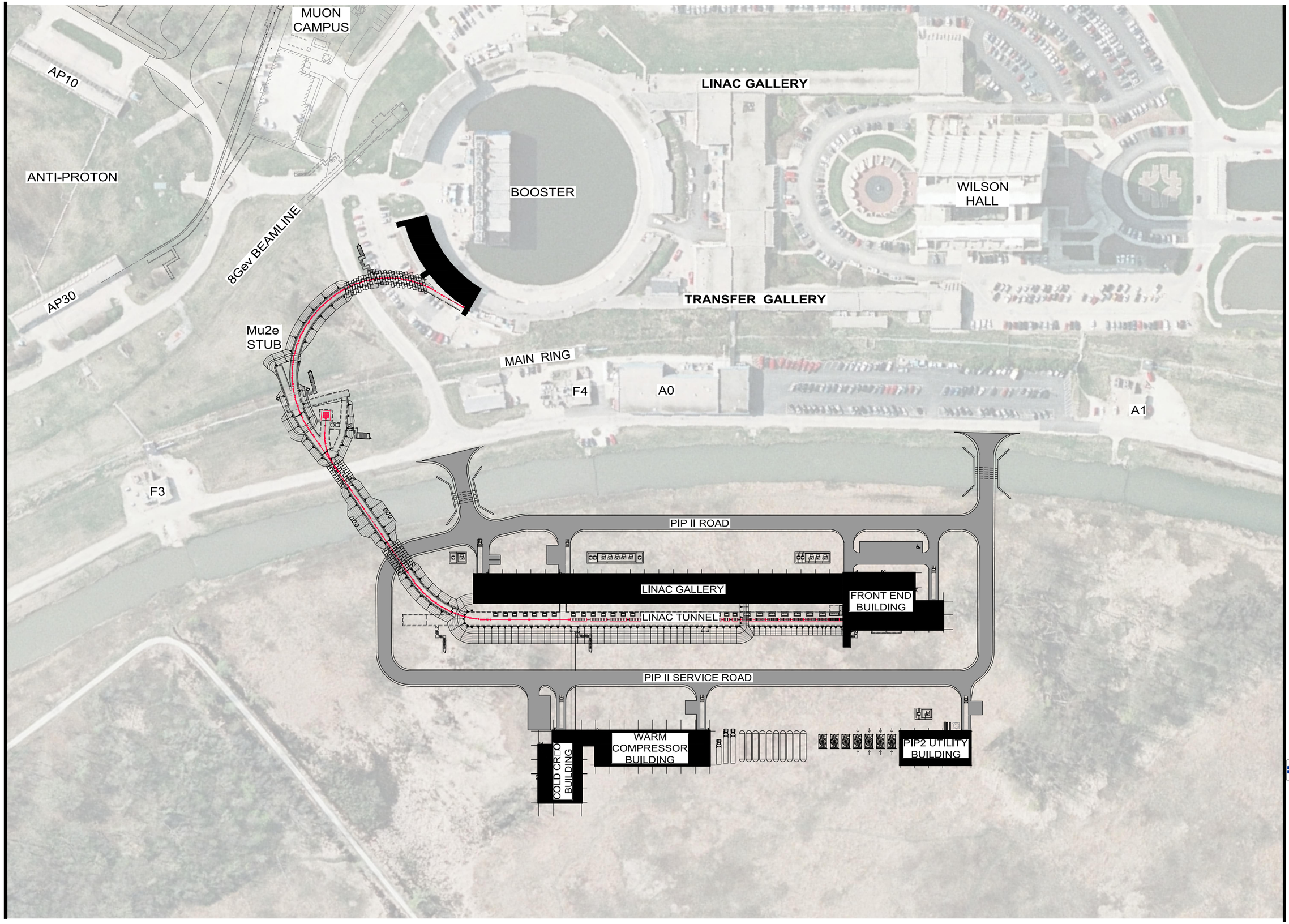
PROJECT NO.

4-2-3

DRAWING NO.

G-1

Mar 03, 2017 - 9:02am G:\4-2-3_CURRECT DGWS POST OCT24\G-1_4-2-3.dwg



SCALE: 1"=150

150 0 150

S W E PROJECT NORTH

PROTON IMPROVEMENT PLAN - II

SITE IMAGE

Fermilab

PIP-II

DATE

28 OCT. 2016

PROJECT NO.

4-2-3

DRAWING NO.

C-1

Mar 03, 2017 - 8:01am M:\Active Projects\412\312 - Conceptual Design\Drawings\C-1_4-2-3.dwg

Mu2e
AP10
MC-1
AP50
SW BOOSTER GALLERY
LINAC GALLERY
WILSON HALL
SOUTH BOOSTER ROAD
C.U.B.
SE BOOSTER GALLERY
PARKING
BEAM TO Mu2e
AP30
TRANS. LINE SERVICE BUILDING
TRANSFER GALLERY
BOOSTER RING
INDIAN ROAD
MAIN RING
F4
A0
MI-8 SERVICE BLDG.
8 Gev BEAM ENCLOSURE
ABORT
WET DITCH TO END OF POND
F3
TRANSFER TUNNEL
PIP II ROAD
MAIN RING ROAD
CONCRETE LINED DITCH AT TUNNEL CROSSING
LINAC GALLERY
LINAC TUNNEL
FRONT END BUILDING
AP0 TARGET HALL
F2
PIP II SERVICE ROAD
COLD CRYO BUILDING
WARM COMPRESSOR BUILDING
YARD
PIP2 UTILITY BUILDING

LEGEND
- INDICATES PIP 2 CONSTRUCTION
- INDICATES FUTURE BEAMLINE TO MUON CAMPUS
- INDICATES FUTURE RCS EXTENSION
- INDICATES FUTURE NEW LINAC

SCALE: 1" = 60'-0"
60 0 60 120 180 220 280 FEET SCALE

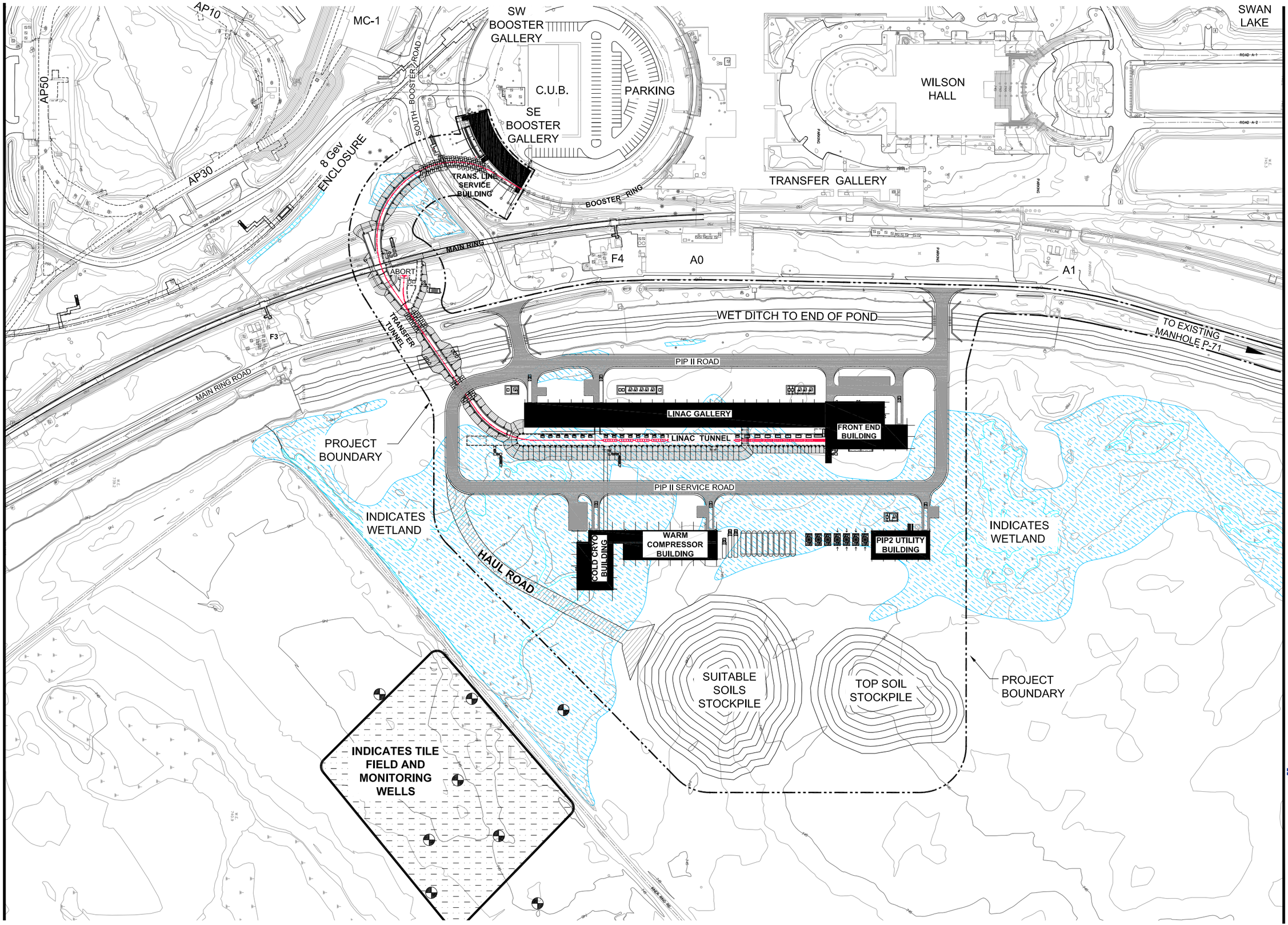
S W E PROJECT NORTH

PROTON IMPROVEMENT PLAN - II
FUTURE BEAMLINES SITE PLAN

Fermilab
PIP-II

DATE
28 OCT., 2016
PROJECT NO.
4-2-3
DRAWING NO.
C-2

Oct 21, 2016 - 9:29am G:\4-2-3\pip2~NEW BEAM 20may2016_FUTURE BEAMS.dwg



PROTON IMPROVEMENT PLAN - II

WETLANDS SITE PLAN

Fermilab

PIP-II

DATE

28 OCT. 2016

PROJECT NO.

4-2-3

DRAWING NO.

C-3

Oct 21, 2016 - 9:30am G:\4-2-3\pip2--NEW BEAM 20may2016_WETLAND_recover.dwg

SHIELDING STEEL UNDER ROAD, PARKING AND BUILDING

T/BERM EL. 749.0'

SE BOOSTER GALLERY

PARKING

POWER SUPPLY BUILDINGS

SOUTH BOOSTER ROAD

BOOSTER RING

TRANSFER GALLERY

Mu2e STUB

MAIN RING

T/BERM EL. 753.0'

F4

A0

PARKING

ABORT

SEE ENLARGED PLAN DWG. C-5

MAIN RING ROAD

T/BERM EL. 749.0'

WET DITCH TO END OF POND

CONCRETE CULVERTS AT ROAD CROSSING

CONCRETE CULVERTS AT ROAD CROSSING

SHIELDING STEEL UNDER ROAD

TRANSFER TUNNEL

T/BERM EL. 750.5'

PIP II ROAD

CONCRETE LINED DITCH AT TUNNEL CROSSING WITH CULVERTS

SHIELDING STEEL

T/BERM EL. 748.5'

SITE EL. 744.5' SLOPE TO DRAIN

LINAC GALLERY

FRONT END BUILDING

LINAC TUNNEL

T/BERM EL. 754.0'

T/BERM EL. 754.0'

T/BERM EL. 749.0'

PIP II SERVICE ROAD

TEMP HAUL RD.

WARM COMPRESSOR BUILDING

COLD CRYO BUILDING

PIP2 UTILITY BUILDING

SCALE: 1" = 30'-0"

30 0 30 60 90 120 150 FEET

SCALE

W S E PROJECT NORTH

PROTON IMPROVEMENT PLAN - II

SITE PLAN

Fermilab

PIP-II

DATE

28 OCT., 2016

PROJECT NO.

4-2-3

DRAWING NO.

C-4

Oct 21, 2016 - 9:39am G:\4-2-3\pip2--NEW BEAM 20may2016_WETLAND_recover.dwg

TRANSFER TUNNEL
T/BERM EL. 749'-0"
SOUTH BOOSTER ROAD
SE BOOSTER BUILDING PARKING
Mu2e STUB
STAIR #8
T/BERM EL. 753'-0"
NEW CAST-IN-PLACE CONCRETE SECTION IN MAIN RING
CONCRETE CULVERTS AT DITCH CROSSING
MAIN RING
T/BERM EL. 749'-0"
ABORT
T/BERM EL. 753'-0"
TOE/BERM EL. 745'-0"±
STAIR #7
T/BERM EL. 749.0'
MAIN RING ROAD
CONCRETE CULVERTS AT ROAD CROSSING
SHIELDING STEEL UNDER ROAD
MAIN RING ROAD
T/BERM EL. 748.5'

SCALE: 1" = 10'-0"
SCALE 10 0 10 20 30 40 50 FEET
W S E PROJECT NORTH

PROTON IMPROVEMENT PLAN - II
ENLARGED PLAN AT ABSORBER

Fermilab
PIP-II

DATE
28 OCT., 2016
PROJECT NO.
4-2-3
DRAWING NO.
C-5

Oct 21, 2016 - 9:34am G:\4-2-3\pip2--NEW BEAM 20may2016_WETLAND_recover.dwg

SE BOOSTER GALLERY
PARKING
POWER SUPPLY BUILDINGS
SOUTH BOOSTER ROAD
BOOSTER RING
TRANSFER GALLERY
Mu2e STUB
MAIN RING
F4
A0
ABORT
MAIN RING ROAD
TRANSFER TUNNEL
CONNECT TO UTILITIES IN MAIN RING UTILITY CORRIDOR
WET DITCH TO END OF POND
CONCRETE CULVERTS AT ROAD CROSSING
CONCRETE CULVERTS AT ROAD CROSSING
PIP II ROAD
SITE EL. 744.5' SLOPE TO DRAIN
LINAC GALLERY
FRONT END BUILDING
LINAC TUNNEL
PIP II SERVICE ROAD
WARM COMPRESSOR BUILDING
COLD CRYO BUILDING
PIP2 UTILITY BUILDING
TEMP HAUL RD.
PARKING

SCALE: 1" = 30'-0"
30 0 30 60 90 120 150 FEET SCALE

PROJECT NORTH

LEGEND
- INDICATES NATURAL GAS PIPING
- INDICATES DOMESTIC WATER PIPING
- INDICATES ICW PIPING
- INDICATES SANITARY SEWER PIPING
- INDICATES POWER DUCT BANK
- INDICATES COMMUNICATION DUCT BANK

PROTON IMPROVEMENT PLAN - II

SITE UTILITIES PLAN

Fermilab

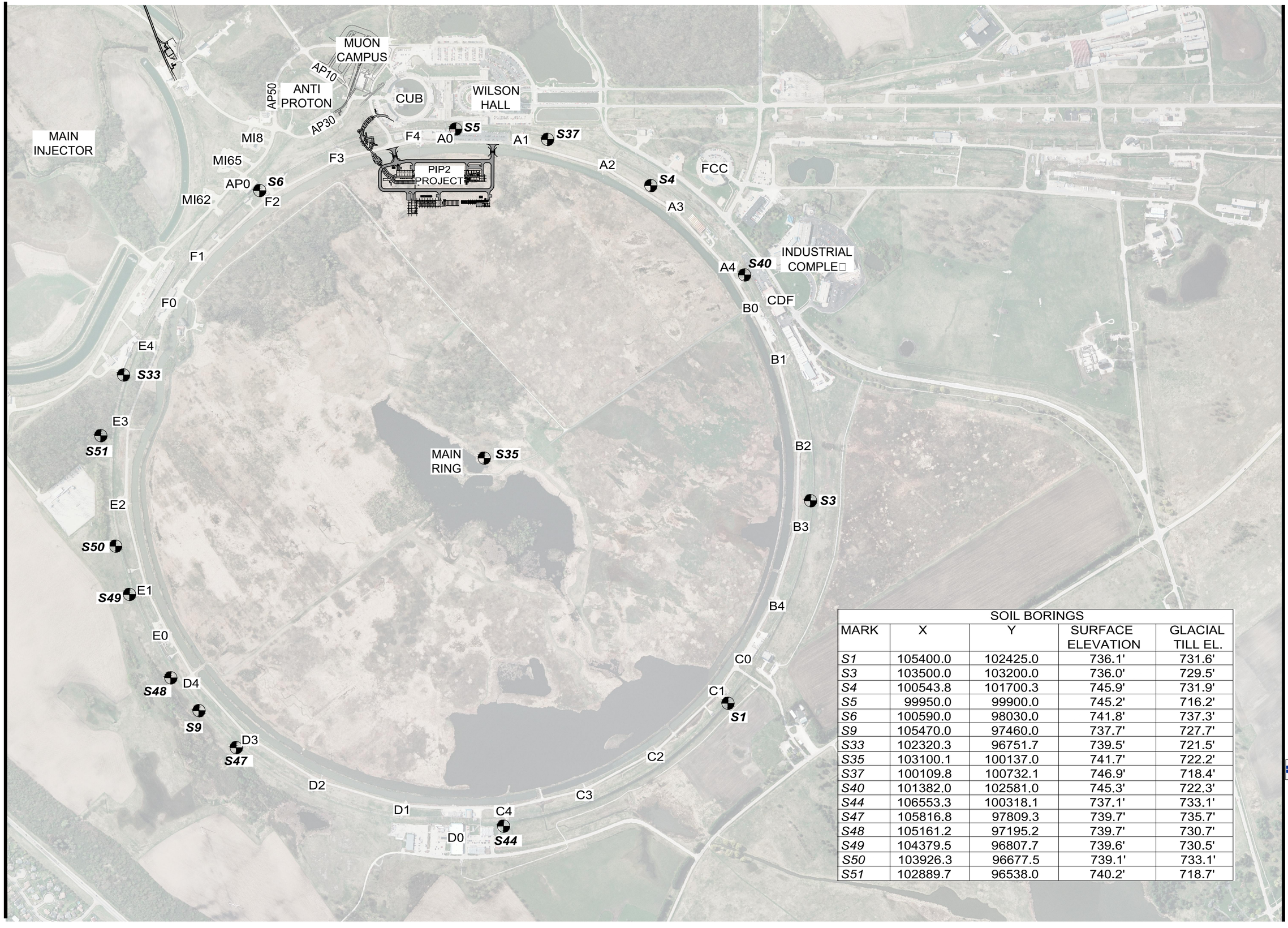
PIP-II

DATE
28 OCT., 2016

PROJECT NO.
4-2-3

DRAWING NO.
C-6

Oct 21, 2016 - 9:37am G:\4-2-3\pip2-A\NEW BEAM 20may2016_WETLAND_recover.dwg



SCALE: 800 0 400 800
1"=800

PROJECT NORTH

SOIL BORINGS				
MARK	X	Y	SURFACE ELEVATION	GLACIAL TILL EL.
S1	105400.0	102425.0	736.1'	731.6'
S3	103500.0	103200.0	736.0'	729.5'
S4	100543.8	101700.3	745.9'	731.9'
S5	99950.0	99900.0	745.2'	716.2'
S6	100590.0	98030.0	741.8'	737.3'
S9	105470.0	97460.0	737.7'	727.7'
S33	102320.3	96751.7	739.5'	721.5'
S35	103100.1	100137.0	741.7'	722.2'
S37	100109.8	100732.1	746.9'	718.4'
S40	101382.0	102581.0	745.3'	722.3'
S44	106553.3	100318.1	737.1'	733.1'
S47	105816.8	97809.3	739.7'	735.7'
S48	105161.2	97195.2	739.7'	730.7'
S49	104379.5	96807.7	739.6'	730.5'
S50	103926.3	96677.5	739.1'	733.1'
S51	102889.7	96538.0	740.2'	718.7'

PROTON IMPROVEMENT PLAN - II

SOIL BORINGS

Fermilab

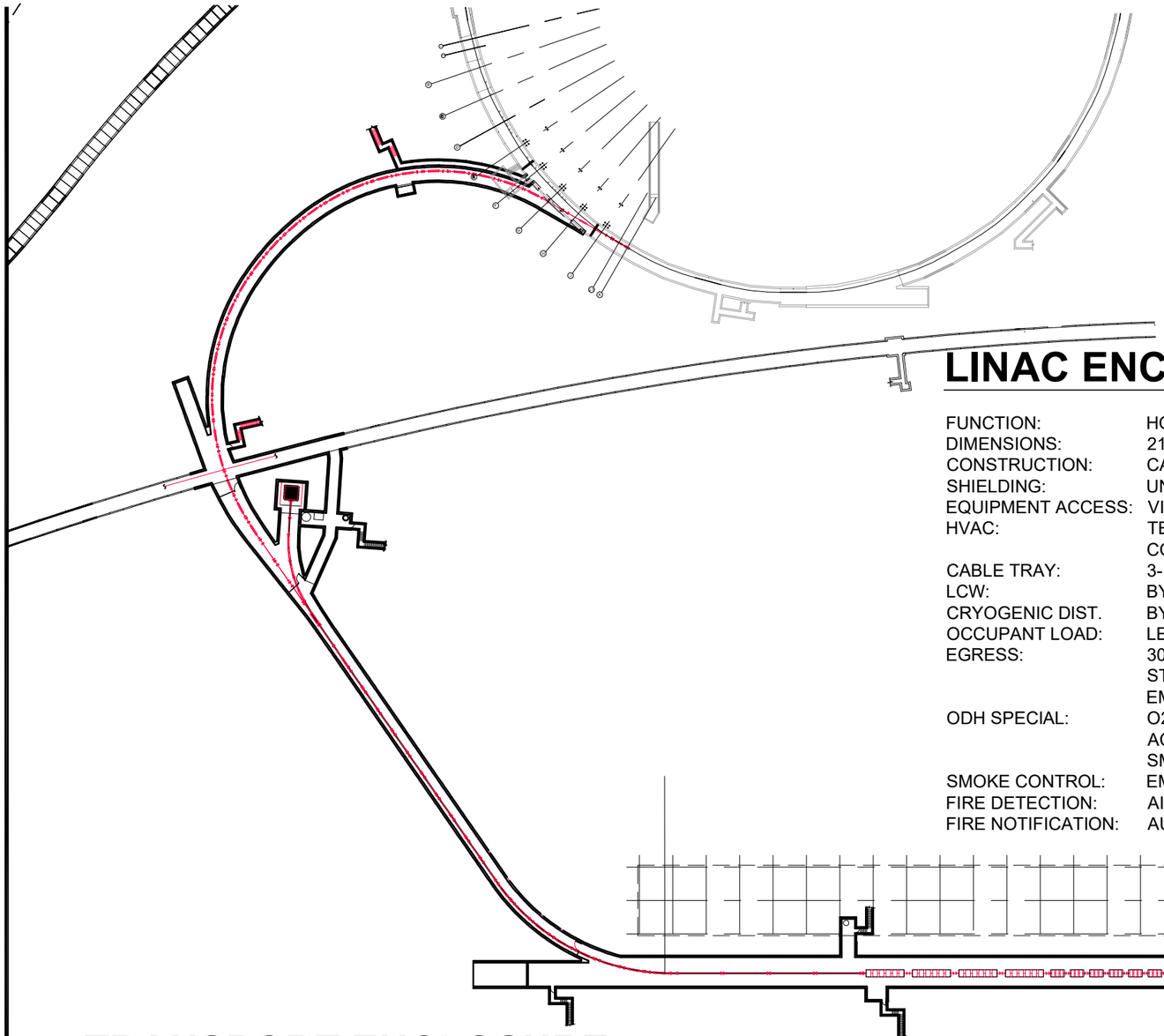
PIP-II

DATE
23 JAN. 2017

PROJECT NO.
4-2-3

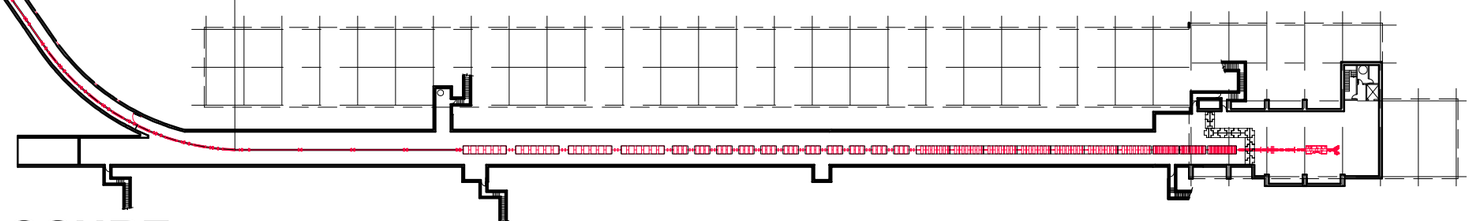
DRAWING NO.
C-7

Mar 03, 2017 - 8:07am M:\Active Projects\42\3\2 - Conceptual Design\Drawings\C-7_4-2-3.dwg



LINAC ENCLOSURE

FUNCTION:	HOUSE LINAC CRYOMODULES
DIMENSIONS:	21'-10"' WIDE BY 13'-6 HIGH
CONSTRUCTION:	CAST-IN-PLACE CONCRETE
SHIELDING:	UNLIMITED OCCUPANCY - 13.5 FEET @ SSR1 & SSR2; 18.5 FEET AT LB 650 & HB 650
EQUIPMENT ACCESS:	VIA GALLERY HIGH BAY
HVAC:	TEMPERATURE 60 DEGREE F MIN. NO MAXIMUM HUMIDITY MAX. 60% RH CONTINUOUS AIRFLOW DURING BEAM ON (ASSUME 100 CFM)
CABLE TRAY:	3- 4" X 18" FOR FULL LENGHT PLUS LATERAL TRAYS AT EACH CRYOMODULE
LCW:	BY ACCELERATOR WBS
CRYOGENIC DIST.	BY CROGENIC WBS
OCCUPANT LOAD:	LESS THAN 50
EGRESS:	300 FOOT MAXIMUM TRAVEL DISTANCE TO STAIRWAY. MAX. 50 FOOT SINGLE PATH OF TRAVEL. STAIRWAY FIRE RATED CONSTRUCTION, DISCHARGE TO GRADE; EMERGENCY LIGHTING AND EXIT SIGNAGE THROUGHOUT SMOKE PROOF STAIRWAY; 2 AC/HR.
ODH SPECIAL:	O2 MONITORING SENSORS THROUGHOUT, EXHAUST PURGE FANS & ADMINISTRATION CONTROL ACCESS PROVIDED SMOKE CONTROL:EMERGENCY PERSONEL MANUAL ACCESS FANS FOR SMOKE ABATEMENT
SMOKE CONTROL:	EMERGENCY PERSONNEL MANUAL ACCESS FANS FOR SMOKE ABATEMENT
FIRE DETECTION:	AIR SAMPLING SMOKE & LINEAR TYPE HEAT DETECTION
FIRE NOTIFICATION:	AUDIBLE AND VISUAL DEVICES THROUGHOUT



TRANSPORT ENCLOSURE

DIMENSIONS:	10' WIDE BY MIN. 8' HIGH
CONSTRUCTION:	CAST IN PLACE CONCRETE
FUNCTION:	HOUSE TRANSPORT BEAM FROM LINAC TO EXISTING BOOSTER ENCLOSURE
SHIELDING:	UNLIMITED OCCUPANCY - 18.5 FEET
EQUIPMENT ACCESS:	VIA GALLERY HIGH BAY AND HATCH NEAR BOOSTER
HVAC:	TEMPERATURE 60 DEGREE F MIN. / NO MAXIMUM HUMIDITY MAX. 60% RH CONTINUOUS AIRFLOW DURING BEAM ON (ASSUME 100 CFM); AIR BARRIER SEPERATING TRANSPORT ENCLOSURE FROM LINAC TO CONTAIN ODH
CABLE TRAY:	2- 4" X 18"
LCW:	BY ACCELERATOR WBS
OCCUPANT LOAD:	LESS THAN 50, SHARED WITH LINAC ENCLOSURE
EGRESS:	300 FOOT MAXIMUM TRAVEL DISTANCE TO STAIRWAY. STAIRWAY FIRE RATED CONSTRUCTION, DISCHARGE TO SURFACE EMERGENCY LIGHTING AND EXIT SIGNAGE THROUGHOUT SMOKE PROOF STAIRWAY
SMOKE CONTROL:	EMERGENCY PERSONNEL MANUAL ACCESS FANS FOR SMOKE ABATEMENT
FIRE DETECTION:	AIR SAMPLING SMOKE & LINEAR TYPE HEAT DETECTION
FIRE NOTIFICATION:	AUDIBLE AND VISUAL DEVICES THROUGHOUT

DESIGN BASIS PLAN SHT. 1

1"=100'-0"

SCALE:
1" = 100'-0"

100 0 100 150 FEET

S W E PROJECT NORTH

PROTON IMPROVEMENT PLAN - II

DESIGN BASIS - SHEET 1

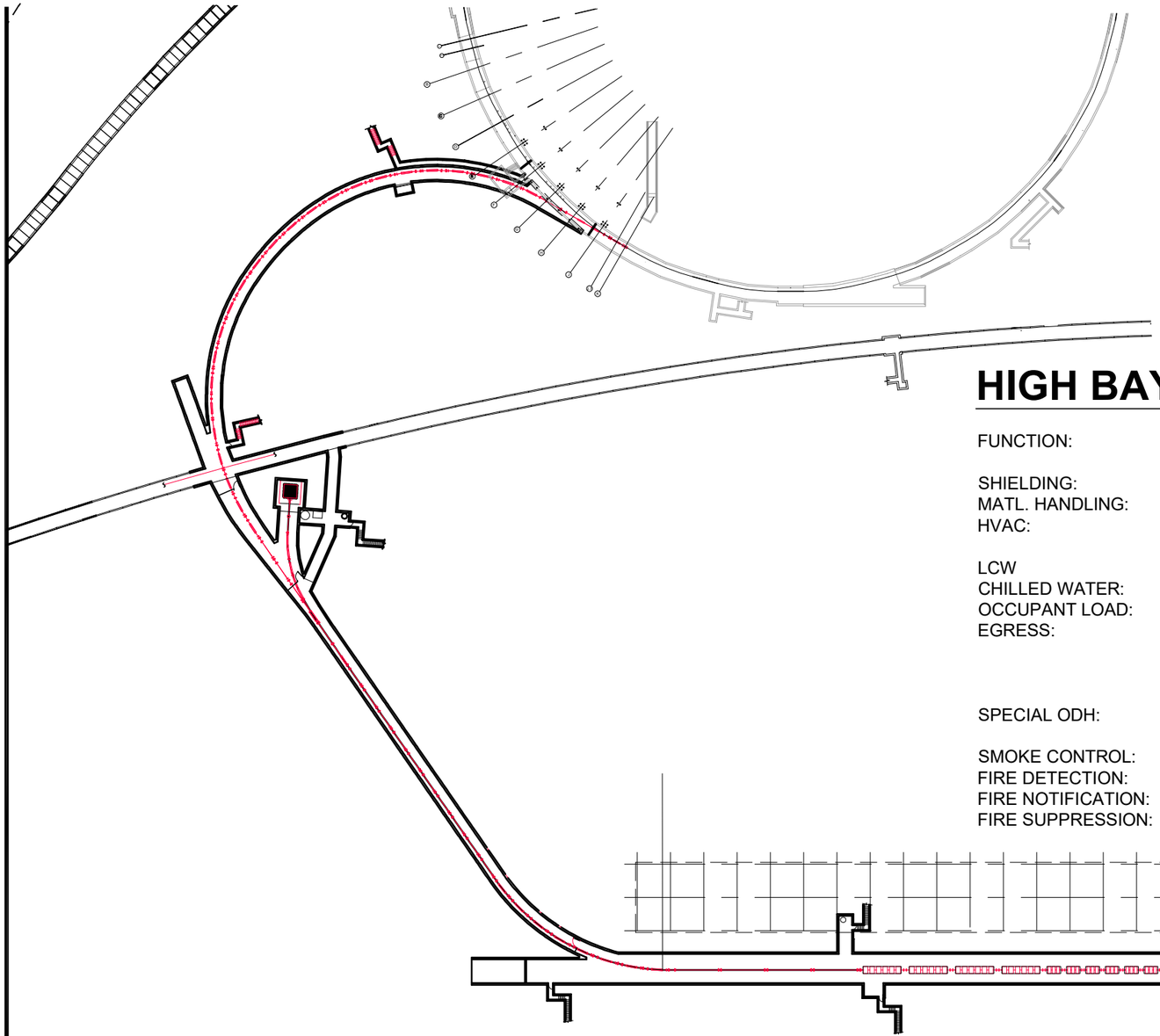
Fermilab

PIP-II

DATE
28 OCT. 2016

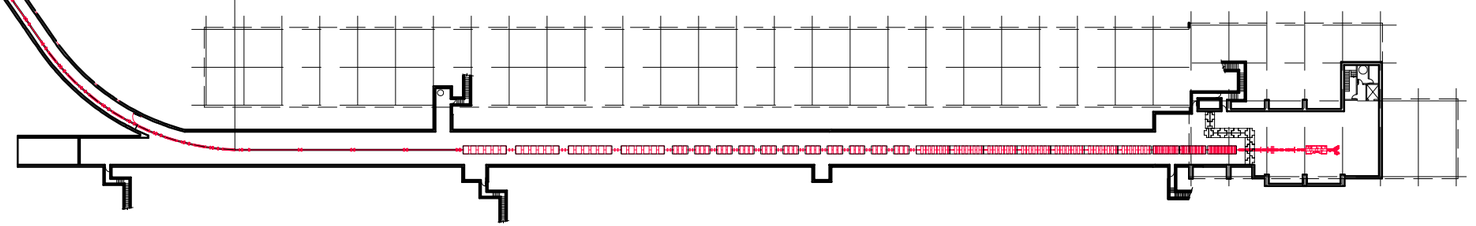
PROJECT NO.
4-3-2

DRAWING NO.
A-1



HIGH BAY ENCLOSURE

FUNCTION:	HOUSE LINAC, ION SOURCE TO HWR; EQUIPMENT ACCESS TO LINAC AND TRANSORT ENCLOSURES; LCW SKIDS; POWER AMP.
SHIELDING:	0 FEET FROM ION SOURCE TO HWR, HWR 6 FEET EARTH EQ.
MATL. HANDLING:	20 TON OVERHEAD CRANES IN BUILDING ABOVE
HVAC:	NO MAXIMUM OR MINIMUM RH REQUIREMENT 78f MAX. +/- ; 68F DRY BULB MIN.
LCW CHILLED WATER:	BY ACCELLERATOR WBS FROM CUB FOR FRONT END LCW
OCCUPANT LOAD:	LESS THAN 50
EGRESS:	300 FOOT MAXIMUM TRAVEL DISTANCE TO STAIRWAY; STAIRWAY FIRE RATED CONSTRUCTION; 50% DISCHARGE DIRECTLY TO SURFACE; EMERGENCY LIGHTING AND EXIT SIGNAGE THROUGHOUT; MANUAL PULL STATIONS AT EXIT DOORS
SPECIAL ODH:	O2 MONITORING SENSORS THROUGHOUT; EXHAUST PURGE FANS & ADMINISTRATION CONTROL ACCESS PROVIDED;
SMOKE CONTROL:	EMERGENCY PERSONEL MANUAL ACCESS FANS FOR SMOKE ABATEMENT; 2 AC/HR
FIRE DETECTION:	AIR SAMPLING SMOKE & LINEAR TYPE HEAT DETECTION
FIRE NOTIFICATION:	AUDIBLE AND VISUAL DEVIC THROUGHOUT
FIRE SUPPRESSION:	WET SPRINKLERS, NORMAL HAZARD GROUP I



STAIRWAYS

LIGHTING:	10 FC
EMERGENCY LIGHTING:	2 FC
EXIT SIGNS:	PER CODE
PULL STATION ALARM	

DESIGN BASIS PLAN SHT. 2

1"=100'-0"

SCALE:
1" = 100'-0"
100 0 100 150 FEET

S W E PROJECT NORTH

PROTON IMPROVEMET PLAN II

DESIGN BASIS - SHEET 2

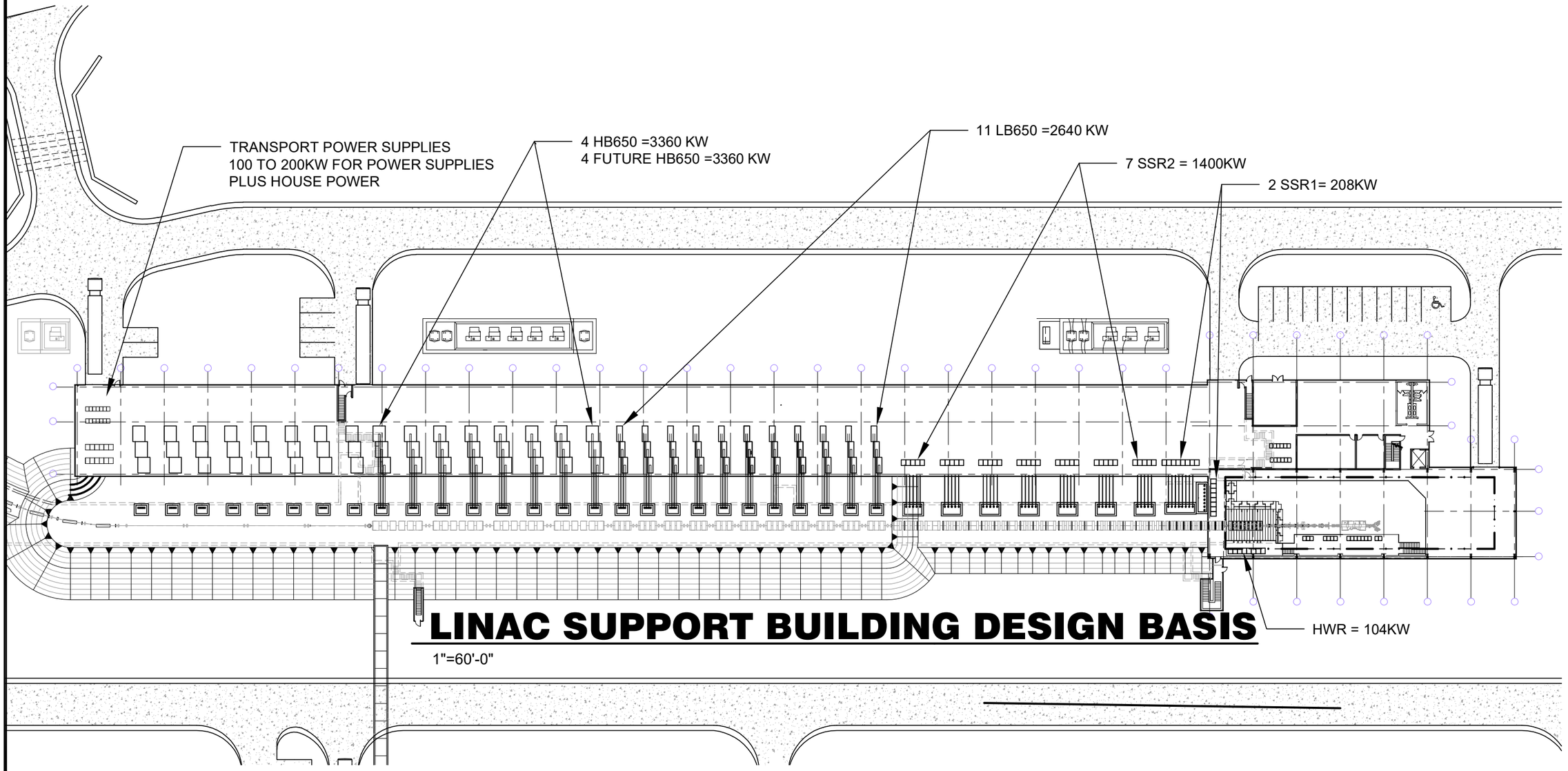
Fermilab

PIP-II

DATE
28 OCT. 2016

PROJECT NO.
4-3-2

DRAWING NO.
A-2



LINAC SUPPORT BUILDING DESIGN BASIS

1"=60'-0"

LINAC SUPPORT BUILDING

FUNCTIONAL AREAS:	HIGH BAY / RECIEVING: MATERIAL ENTRY, MATERIAL HANDLING, MATERIAL STAGING AND STORAGE (NORMALLY OCCUPIED) SIDE BAY: ESCORTED PUBLIC ENTRY, OPERATIONS SUPPORT INCLUDING TECH. SPACE, CONTROL ROOM, MEETING ROOM, TOILETS AND BUILDING UTILITIES (NORMALLY OCCUPIED) GALLERY: HOUSES AMPS, RACKS FOR CRYOMODULE CONTROL AND SUPPORT, MAGNET POWER SUPPLIES
CONSTRUCTION:	NON PROTECTED EXPOSED STEEL TYPE II B PER IBC.
U-VALUES:	PER ASHRAE 90.1 & HPSB GUIDING PRINCIPLES
EQUIPMENT ACCESS:	OVERHEAD ROLL UP DOORS
EQUIPMENT HANDLING:	20 TON OVERHEAD CRANE IN HIGH BAY, 1 TON MONORAIL HOISTS IN GALLERY
OCCUPANT LOAD:	30-50 PERSONS DURING INSTALLATION, 10-20 PERSONS DURING MAINTENANCE, 6-8 PERSONS DURING NORMAL OPERATIONS
HVAC:	HIGH BAY AND SIDE BAY: 78 MAX SUMMER, 68MIN. WINTER, NO HUMIDITY CONTROL; GALLERY 80 MAX, 65M MIN., NO HUMIDITY CONTROL. CONTROL ROOM POS. PRESSURE TO SURROUNDING AREAS.
PURGE VENTILATION:	2 ACH (HIGH BAY ONLY)
OCCUPANT VENTILATION:	PER ASHRAE 62.1
LCW:	ALL BURIED PIPE BY CONVENTIONAL COST. DISTRIBUTION BY OTHER WBS
CHILLED WATER:	FOR HVAC, ION SOURCE AND RFQ VANE
ICW:	FIRE PROTECTION
TECH POWER:	480V DISTRIBUTION TO 800 OR 1200 AMP POWER PANELS, 120/208V DISTRIBUTION TO 400 AMP POWER PANELS; MAJOR LOADS SHOWN ON PLAN ABOVE
LIGHTING:	65FC cONTROLLED VIA LIGHTING PANEL
EMERGENCY LIGHTING:	PER NFPA 101 LIFE SAFETY CODE
EXIST SIGNS:	PER NFPA 101 LIFE SAFETY CODE
CONV RECEPT:	120 / 208 V AC
WELDING RECEP:	(QTY 2 INGALLERY) 480V
EGRESS:	MAXIMUM TRAVEL DISTANCE 250-FT TO EXIT
SPECIAL:	ADMINISTRATION CONTROL ACCESS PROVIDED
FIRE DETECTION:	MANUAL PULL STATIONS AT EXITS
FIRE NOTIFICATION:	AUDIBLE AND VISUAL DEVICES THROUGHOUT
FIRE SUPPRESSION:	AUTOMATIC SPRINKLER SYSTEM DESIGNED TO ORDINARY HAZARD GROUP II - HIGH TEMPERATURE SPRINKLERS

SCALE:
1" = 60'-0"
60 0 60 90 FEET

S W E PROJECT NORTH

PROTON IMPROVEMENT PLAN - II
DESIGN BASIS - SHEET 3

Fermilab
PIP-II

DATE
28 OCT. 2016
PROJECT NO.
4-2-3
DRAWING NO.
A-3

LIFE SAFETY / EGRESS SUMMARY

EXCERPTS, MODIFIED TO FERMILAB'S STANDARDS, FROM THE "FIRE PROTECTION/LIFE SAFETY ANALYSIS FOR THE PROTON IMPROVEMENT PLAN - II PROJECT (PIP II)" REPARED BY JENSON HUGHES, OCTOBER 6, 2016

CODES, STANDARDS, AND GUIDELINES:

- DOE ORDER 420.1B, FACILITY SAFETY
- DOE STANDARD 1066, FIRE PROTECTION - 2017 (DRAFT)
- INTERNATIONAL BUILDING CODE, 2015 EDITION (IBC)
- INTERNATIONAL FIRE CODE, 2015 EDITION (IFC)
- NFPA 101, LIFE SAFETY CODE, 2015 EDITION
- NFPA 70, NATIONAL ELECTRICAL CODE, 2014 EDITION
- NFPA 90A, STANDARD FOR INSTALLATION OF AIR-CONDITIONING AND VENTILATING SYSTEMS, 2015 EDITION
- NFPA 850 RECOMMENDED PRACTICE FOR FIRE PROTECTION FOR ELECTRIC GENERATING PLANTS AND HIGH VOLTAGE DIRECT CURRENT CONVERTER STATIONS

OCCUPANCY CLASSIFICATION

THE FACILITIES CLOSELY RESEMBLE USE GROUP F-2, LOW-HAZARD FACTORY INDUSTRIAL OCCUPANCIES. THESE FACILITIES WOULD BE CLASSIFIED AS SPECIAL PURPOSE INDUSTRIAL OCCUPANCIES BY SECTION 40.1.2.1.2 OF THE LIFE SAFETY CODE, NFPA 101 - 2015 EDITION.

THE LINAC ENCLOSURE AND THE TRANSPORT LINE ENCLOSURE WOULD ALSO BE CLASSIFIED AS UNDERGROUND STRUCTURES AS DEFINED BY SECTION 3.3.272.11 OF THE LIFE SAFETY CODE.

CONSTRUCTION TYPE

- ABOVEGROUND STRUCTURES IS TYPE IIB
- BELOW GRADE ENCLOSURES IS TYPE IB.

EMERGENCY POWER

EMERGENCY POWER SHOULD BE PROVIDED FOR THE FOLLOWING SYSTEMS SUCH THAT THE TRANSITION TIME FROM THE INSTANT OF FAILURE OF NORMAL POWER TO AN ALTERNATE POWER SOURCE DOES NOT EXCEED 10 SECONDS (IBC SECTION 2702):

- FIRE DETECTION AND ALARM SYSTEMS, (24 HOURS)
- EXIT SIGN ILLUMINATION, (90 MINUTES)
- EMERGENCY LIGHTING, (90 MINUTES)

STANDBY POWER

STANDBY POWER SHOULD BE PROVIDED FOR THE FOLLOWING SYSTEMS SUCH THAT THE TRANSITION TIME FROM THE INSTANT OF FAILURE OF NORMAL POWER TO AN ALTERNATE POWER SOURCE DOES NOT EXCEED 60 SECONDS (IBC SECTION 2702): ALL LIGHTING FOR ROOMS CONTAINING HVAC EQUIPMENT FOR BELOW GRADE AREAS, ALL VENTILATION SYSTEMS SERVING BELOW GRADE AREAS, SUMP PUMPS AND ODH FAN UNITS.

MEANS OF EGRESS

LINAC ENCLOSURE AND TRANSPORT ENCLOSURE TRAVEL DISTANCES

- MAXIMUM TRAVEL DISTANCE: 400 FEET (DOE STD 1066)
- MAXIMUM COMMON PATH OF TRAVEL: 50 FEET (LSC 40.2.5.1)
- MAXIMUM DEAD END: 50 FEET (LSC 40.2.5.1)
- MINIMUM AISLE WIDTH: 44 INCHES (DOE-STD-1066)
- MINIMUM STAIRWAY WIDTH: 36 INCHES (LSC 7.2.2.2.1.2)
- STAIRWAY ENCLOSURES: 2 HR.
- MINIMUM DOOR WIDTH: 32 INCHES CLEAR (LSC 7.2.1.2.3.2)

ABOVE GROUND STRUCTURES

- MAXIMUM TRAVEL DISTANCE: 250 FEET (LSC 40.2.6.1)
- MAXIMUM COMMON PATH OF TRAVEL: 100 FEET (LSC 40.2.5.1)
- MAXIMUM DEAD END: 50 FEET (LSC 40.2.5.1)
- MINIMUM AISLE WIDTH: 36 INCHES (LSC 7.3.4.1)
- MINIMUM DOOR WIDTH: 32 INCHES CLEAR (LSC 7.2.1.2.3.2)

THE EXIT ACCESS OVER THE EQUIPMENT IN THE TUNNEL SHOULD MEET THE FOLLOWING DIMENSIONAL CRITERIA (LSC 40.2.5.3.1):

FEATURE	DIMENSIONAL CRITERIA
MINIMUM HORIZONTAL DIMENSION OF ANY WALKWAY, LEADING, OR PLATFORM	22 IN. CLEAR
MINIMUM STAIR WIDTH BETWEEN RAILS	22 IN. CLEAR
MINIMUM TREAD WIDTH	22 IN. CLEAR
MINIMUM TREAD DEPTH	10 IN.
MAXIMUM RISER HEIGHT	9 IN.
MINIMUM HEADROOM	6 FT. 8 IN

FIRE PROTECTION / FIRE DETECTION SUMMARY

FIRE SUPPRESSION

ABOVEGROUND STRUCTURES

FIRE SPRINKLER SYSTEMS WILL BE PROVIDED FOR THE LINAC SUPPORT BUILDING, COLD BOX STATION, WARM COMPRESSOR STATION, AND UTILITY BUILDING. ALL FIRE SPRINKLER SYSTEMS DESIGNED TO:

DISCHARGE DENSITY 0.15 GPM/FT^2
HYDRAULICALLY MORE REMOTE AREA 1,500 FT^2
COMBINED HOSE STREAM ALLOWANCE OF 250 GPM

EXCEPT FOR HIGH BAY AREA, DESIGNED TO:
DISCHARGE DENSITY OF 0.20
HYDRAULICALLY MORE REMOTE AREA 1,500 FT^2
COMBINED HOSE STREAM ALLOWANCE OF 250 GPM

QUICK RESPONSE, STANDARD SPRAY SPRINKLERS SHOULD BE USED THROUGHOUT

2-1.2 INCH FIRE DEPARTMENT HOSE VALVES WILL BE PROVIDED AT THE LOWEST STAIR LANDING IN THE LINAC AREA

BELOWGROUND STRUCTURES

AUTOMATIC FIRE SPRINKLER SYSTEMS ARE NOT REQUIRED FOR THE LINAC ENCLOSURE AND TRANSPORT LINE ENCLOSURE DUE TO THE FOLLOWING:

- THE ENCLOSURES ARE CLASSIFIED AS GROUP F-2 LOW HAZARD, FACTORY INDUSTRIAL OCCUPANCIES.
- THE FLOORS OF THE ENCLOSURES ARE LESS THAN 30 FEET BELOW THE LEVEL OF EXIT DISCHARGE.
- THE MAXIMUM OCCUPANT LOAD WITHIN THE UNDERGROUND ENCLOSURES WILL BE RESTRICTED TO 50 PERSONS.

FIRE DETECTION AND ALARM SYSTEMS

FIRE DETECTION AND ALARM/VOICE SYSTEM ARE REQUIRED FOR ALL ABOVE GROUND AND UNDERGROUND FACILITIES BY NFPA 101, SECTION 40.3.4.1. THE VOICE ALARM SYSTEM WILL BE INTERFACED WITH FERMILAB'S EXISTING SITE-WIDE EMERGENCY WARNING SYSTEM. THE FIRE ALARM SYSTEM WILL BE MONITORED BY FERMILAB EXISTING FACILITY INCIDENT REPORTING UTILITY SYSTEM (FIRUS)

FIRE DETECTION AND ALARM/VOICE SYSTEM(S) WILL BE PROVIDED AND INCLUDE THE FOLLOWING:

- MANUAL FIRE ALARM STATIONS AT ALL EXITS AND AT OTHER LOCATIONS SUCH THAT TRAVEL DISTANCE TO A STATION DOES NOT EXCEED 200 FEET,
- AIR SAMPLING SMOKE DETECTION SYSTEMS THROUGHOUT ALL THE ABOVEGROUND FACILITIES AND AT THE LINAC ENCLOSURE,
- LINEAR HEAT DETECTION SYSTEMS THROUGHOUT THE LINAC ENCLOSURE AND TRANSPORT LINE ENCLOSURE LOCATED AT THE CENTER OF THE ENCLOSURE CEILING,
- DUCT TYPE SMOKE DETECTORS ON THE SUPPLY SIDE OF ALL AIR HANDLING UNITS HAVING A CAPACITY GREATER THAN 2,000 CFM AND ON BOTH SUPPLY AND RETURN ON UNITS GREATER THAN 15,000 CFM (NFPA 90A),
- FIRE SPRINKLER SYSTEM WATERFLOW DETECTORS,
- VALVE SUPERVISORY SWITCHES,
- COMBINATION SPEAKER/STROBE DEVICES LOCATED THROUGHOUT THE FACILITIES,
- ADDRESSABLE FIRE ALARM/VOICE CONTROL PANEL WITH STANDBY POWER SUPPLIES.

FIRE HYDRANTS

FIRE HYDRANTS SHOULD BE PROVIDED AROUND THE PERIMETER OF THE FACILITY IN ACCORDANCE WITH APPENDIX C OF THE INTERNATIONAL FIRE CODE. BASED ON THE PRELIMINARY DRAWINGS, AT LEAST FOUR FIRE HYDRANTS ARE REQUIRED, WITH A MAXIMUM SPACING OF 250 FT. BETWEEN HYDRANTS AND MINIMUM OF 40 FEET FROM BUILDING.

FIRE APPARATUS

DRIVE ACCESS SHOULD BE 24-FT IN WIDTH FOR TWO-WAY TRAFFIC WITH A CLEARANCE OF 13 FT 6 INCHES (IFC 507)

FIRE EXTINGUISHERS

PORTABLE FIRE EXTINGUISHERS ARE REQUIRED THROUGHOUT ALL AREAS OF THE FACILITIES (IBC, SECTION 906.1). THE PORTABLE FIRE EXTINGUISHERS SHOULD BE PROVIDED IN ACCORDANCE WITH NFPA 10, STANDARD FOR PORTABLE FIRE EXTINGUISHERS, AND AS DIRECTED BY THE FERMILAB FIRE DEPARTMENT.

FIRE EXTINGUISHERS WILL NOT BE INSTALLED BELOWGROUND IN ENCLOSURES (FESHM 6020.1)

OUTDOOR TRANSFORMERS

OUTDOOR LIQUID FILLED TRANSFORMERS SHOULD BE SEPARATED FROM BUILDINGS BY DISTANCES IN ACCORDANCE WITH FM GLOBAL DATA SHEET 5-4, TRANSFORMERS. MINIMUM SEPARATIONS DISTANCES FROM CONTAINMENT TO BUILDING WALLS ARE DEPENDENT UPON THE VOLUME OF FLUID IN THE TRANSFORMERS, AND ARE AS FOLLOWS BASED ON NFPA 850:

500 GALLONS.....15 FEET (OR 2 HR. FIRE WALL)
500 TO < 5000 GALLONS.....25 FEET (OR 2 HR. FIRE WALL)
> 5000 GALLONS.....50 FEET (OR 3 HR. FIRE WALL)

SCALE: 1" = 80'-0"

120 80 40 0 80 FEET SCALE

W S E PROJECT NORTH

PROTON IMPROVEMENT PLAN - II

LIFE SAFETY

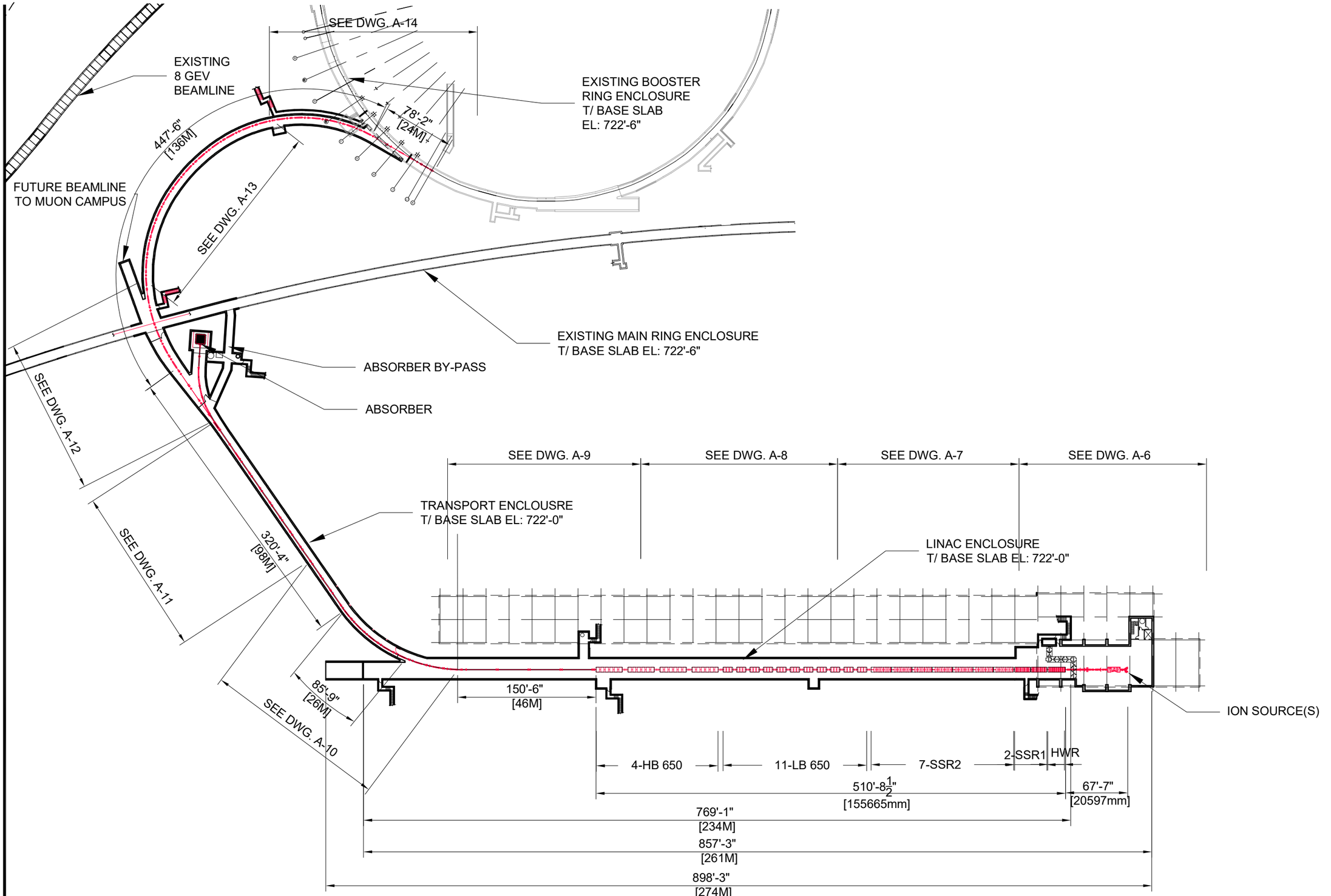
Fermilab

PIP-II

DATE
28 OCT. 2016

PROJECT NO.
4-3-2

DRAWING NO.
A-4



ENCLOSURE KEY PLAN

1"=100'-0"

SCALE:
1" = 100'-0"
100 0 100 150
FEET

PROJECT NORTH

PROTON IMPROVEMENT PLAN II

ENCLOSURE KEY PLAN

Fermilab

PIP-II

DATE
28 OCT. 2016

PROJECT NO.
4-2-3

DRAWING NO.
A-5

FOR CONTINUATION SEE DWG. A-7

STAIR #2

SUMP

ELEV. MACH. RM.

STAIR #1

ELEV.

25'-0" [8M]

REMOVE SHIELD BLOCKS FOR EQUIPMENT ACCESS INTO LINAC

13'-6" H "T" BLOCKS

T/SLAB EL: 722'-0"

STAGING AND STORAGE

41'-10" [13M]

50'-0" [15M]

6'-0"

82'-1" [25M]

LCW SKIDS THIS AREA

G A-31

STAIR #5

125'-0" [38M]

F A-30

E A-29

FOR CONTINUATION SEE DWG. A-7

PLAN

1"=15'-0"

SCALE: 1" = 15'-0"

15 0 5 10 15 20 25 FEET

S W E PROJECT NORTH

PROTON IMPROVEMENT PLAN II

LINAC ENCLOSURE PLAN - SHEET 1

Fermilab

PIP-II

DATE

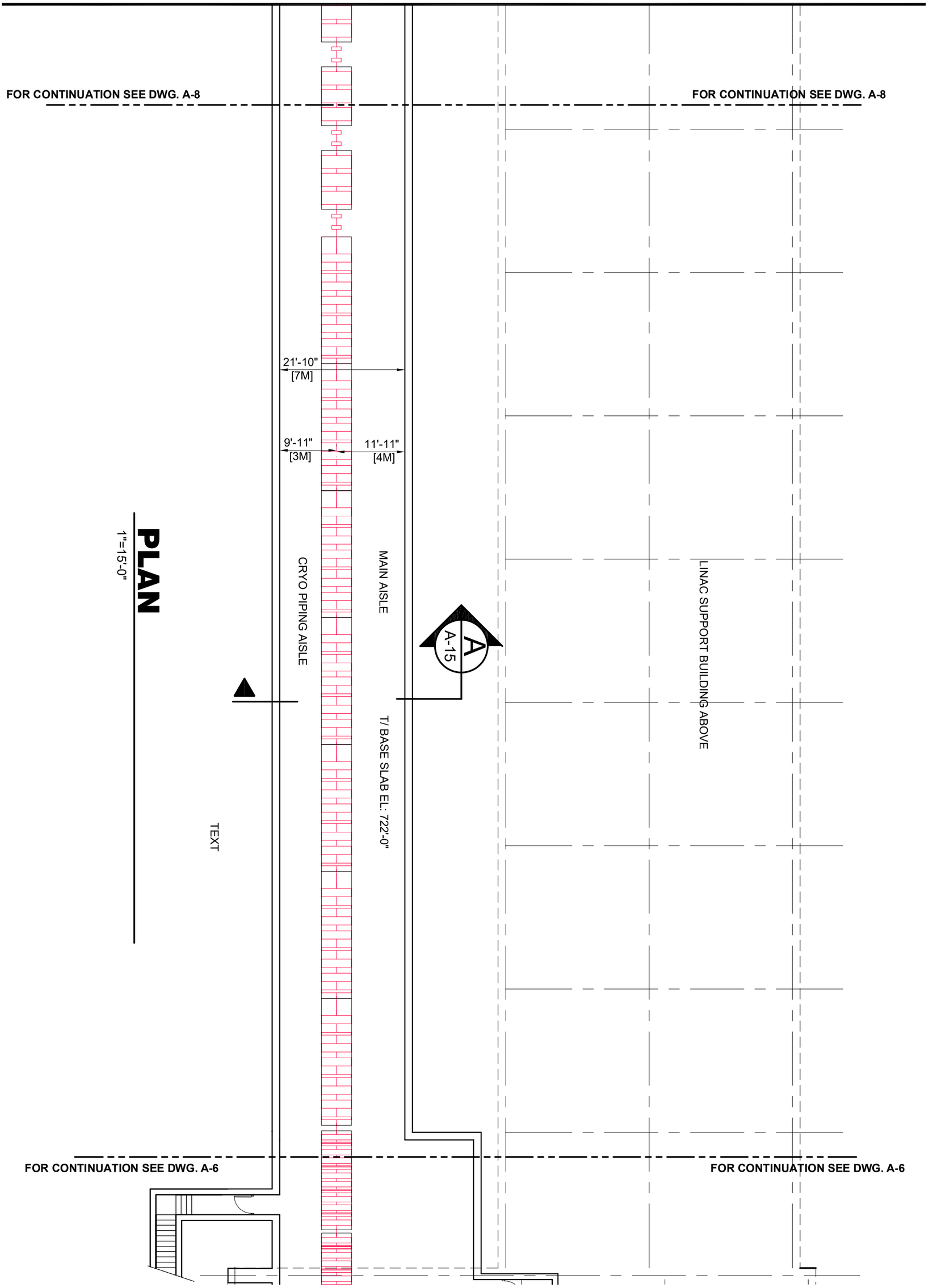
28 OCT. 2016

PROJECT NO.

4-2-3

DRAWING NO.

A-6



PLAN

1"=15'-0"

PROTON IMPROVEMENT PLAN II

LINAC ENCLOSURE PLAN - SHEET 2

Fermilab

PIP-II LINAC

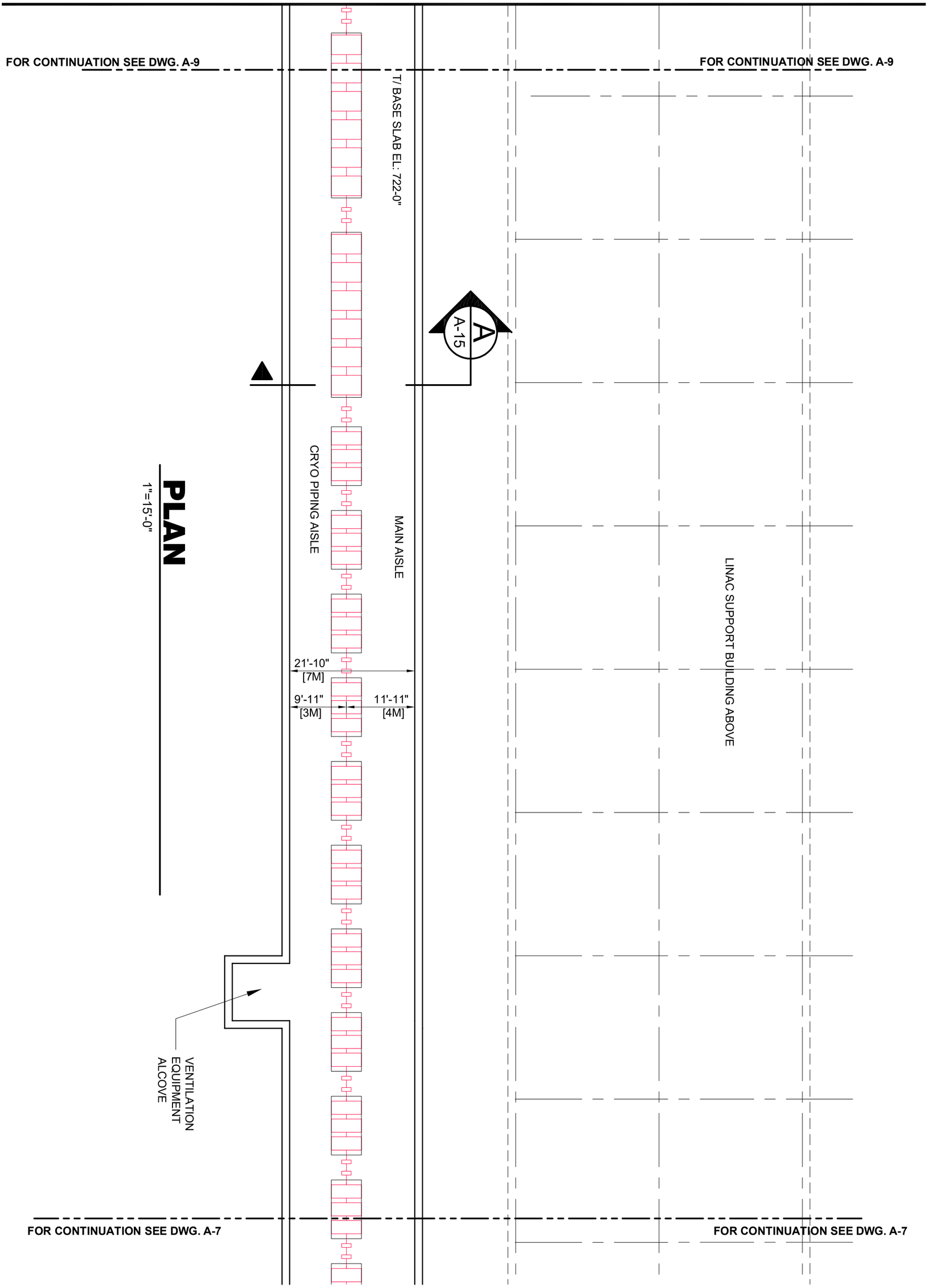
DATE: 28 OCT. 2016

PROJECT NO.: 4-2-3

DRAWING NO.: A-7

S
E
W
PROJECT NORTH

SCALE:
1" = 15'-0"
15 0 5 10 15 20 25
FEET



PROTON IMPROVEMENT PLAN II

LINAC ENCLOSURE PLAN - SHEET 3

S
E
W
PROJECT NORTH

SCALE:
1" = 15'-0"
15 0 5 10 15 20 25
FEET

Fermilab
PIP-II LINAC

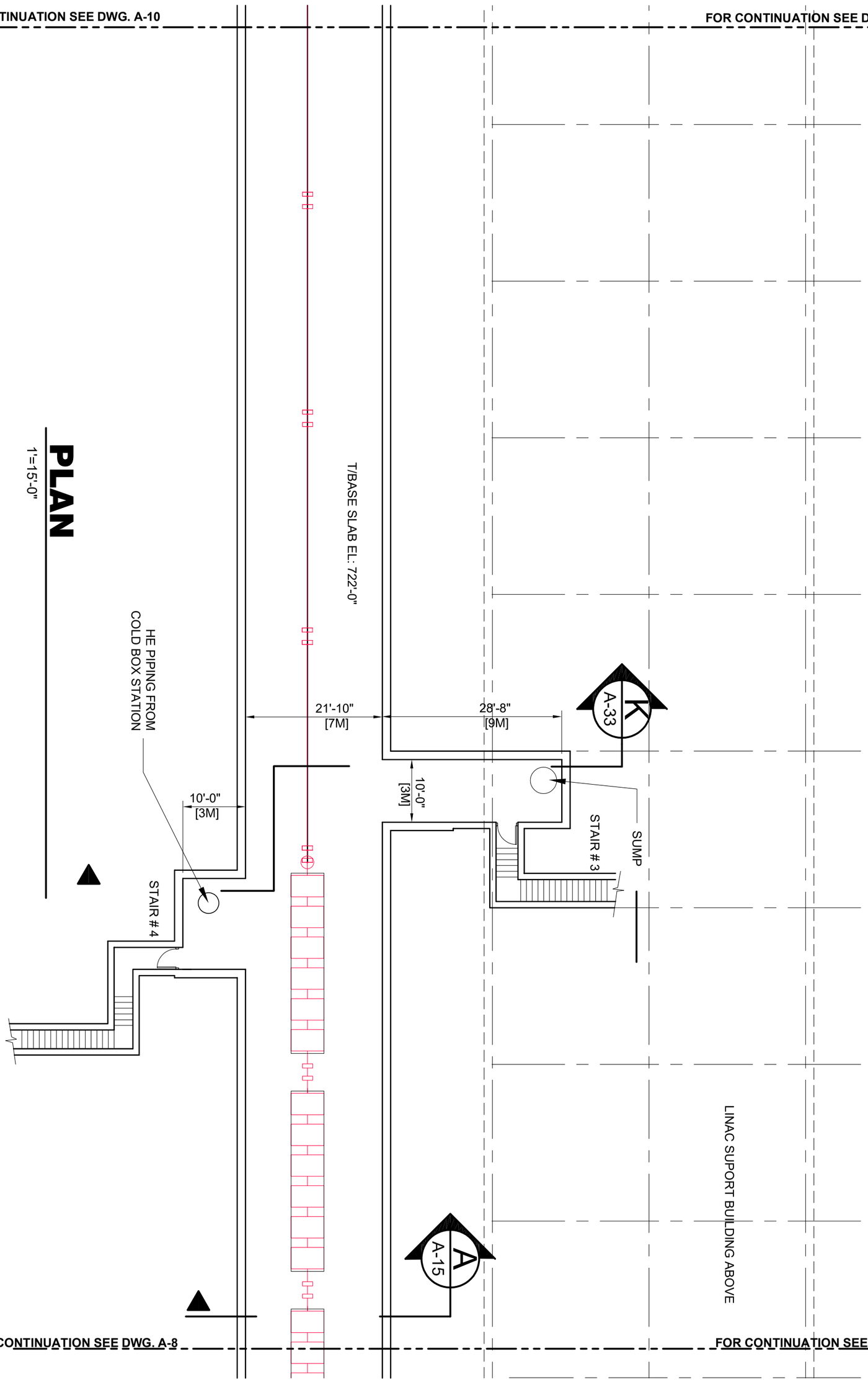
DATE
28 OCT. 2016

PROJECT NO.
4-2-3

DRAWING NO.
A-8

FOR CONTINUATION SEE DWG. A-10

FOR CONTINUATION SEE DWG. A-10



FOR CONTINUATION SEE DWG. A-8

FOR CONTINUATION SEE DWG. A-8

Fermilab

PIP-II LINAC

PROTON IMPROVEMENT PLAN II

LINAC ENCLOSURE PLAN SHEET 5

DRAWING NO. A-9

PROJECT NO. 4-2-3

DATE 28 OCT. 2016

S E W PROJECT NORTH

SCALE:
1" = 15'-0"
15 0 5 10 15 20 25
FEET

FOR CONTINUATION SEE DWG. A-11

24'-7"
[8M]

T/ SLAB
EL: 722'-0"

10'-0"
[3M]

TRANSPORT ENCLOSURE

B
A-16

AIR BARRIER TO
LIMIT ODH IN TRANSPORT
ENCLOSURE

START OF TRANSPORT
ENCLOSURE

SAND FILLED ENCLOSURE EXTENSION
TO ALLOW FUTURE EXCAVATION TO
EXTEND ENCLOSURE WITHOUT EFFECTING
OPERATION OF PROPOSED PIP II

STAIR #6

40'-0"
[12M]

46'-2"
[14M]

FOR CONTINUATION SEE DWG. A-9

FOR CONTINUATION SEE DWG. A-9

PLAN

1"=15'-0"

SCALE:
1" = 15'-0"

15 0 5 10 15 20 25 FEET

W S E PROJECT NORTH

PROTON IMPROVEMENT PLAN II

TRANSPORT ENCLOSURE PLAN - SHEET 1

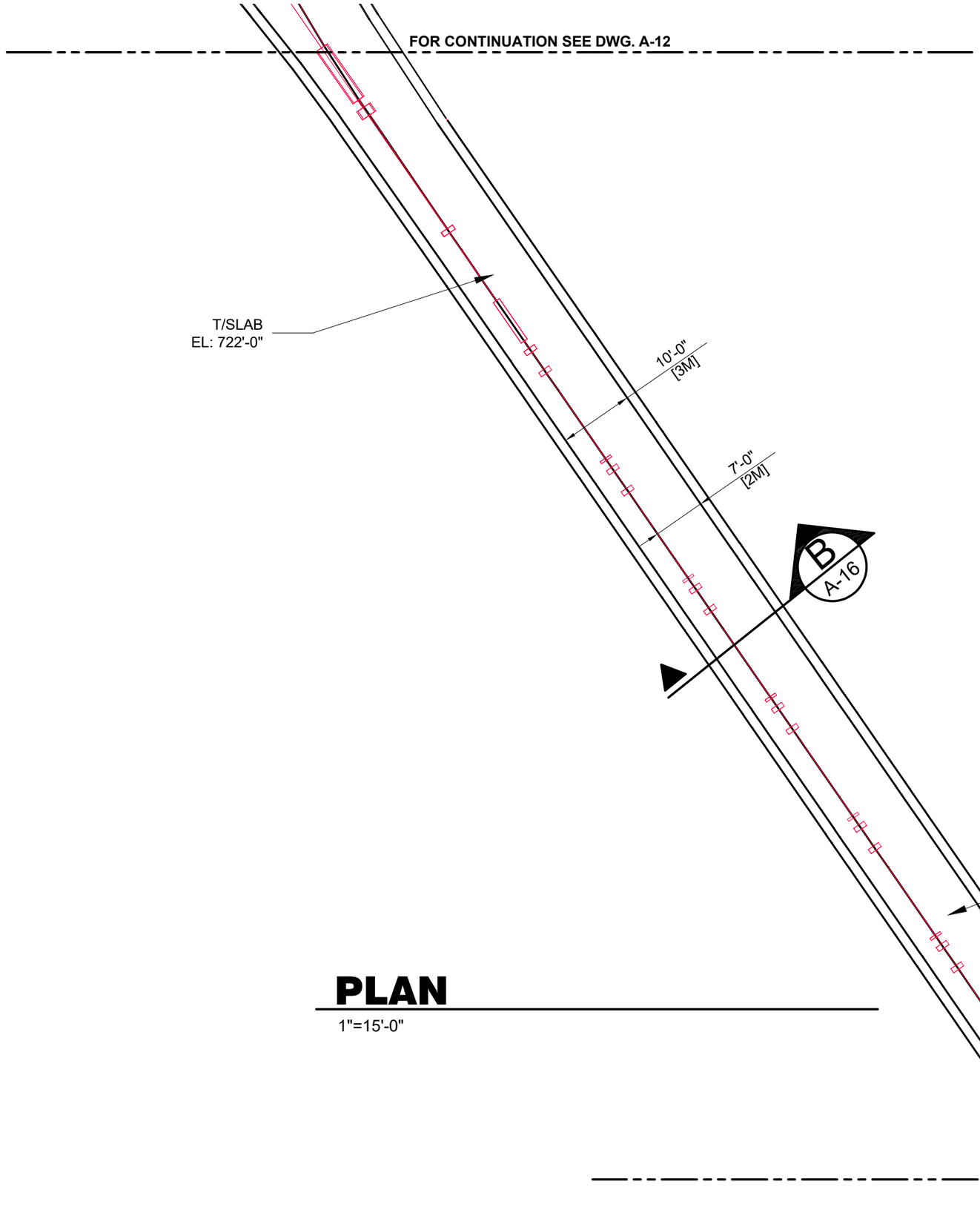
Fermilab

PIP-II

DATE
28 OCT. 2016

PROJECT NO.
4-2-3

DRAWING NO.
A-10



PLAN

1"=15'-0"

SCALE:
1" = 15'-0"
15 0 5 10 15 20 25
FEET

W
S
E
PROJECT NORTH

PROTON IMPROVEMENT PLAN II

TRANSPORT ENCLOSURE PLAN - SHEET 2

Fermilab

PIP-II

DATE
28 OCT. 2016

PROJECT NO.
4-2-3

DRAWING NO.
A-11

FOR CONTINUATION SEE DWG. A-13

C
A-17

STAIR # 8

REBUILT MAIN RING ENCLOSURE
W/ RECTANGULAR CROSS SECTION

APPROX. POSITION OF MAIN RING BEAMLINE

118'-7"
[36M]

10'-0"
[3M]

T BASE SLAB
EL: 722'-6"

6" STEP

21'-0"
[6M]

16'-0"
[5M]

10'-0"
[3M]

8'-0"
[2M]

CONCRETE SURROUNDING
STEEL SHIELD SURROUNDING
WATER COOLED CORE

SLOPE BY-PASS SLAB FROM 722'-0" TO
722'-6" UP TO MAIN RING

DOUBLE WALLED SUMP FOR
RAW WATER FROM UNDER ABORT
AND FOR RAW SKID.

RAW SKID

T/ BASE SLAB
EL: 722'-0"

GATED ACCESS CONTROL

EXISTING MAIN RING ENCLOSURE
T/BASE SLAB EL: 722'-6"

10'-0"
[3M]

14'-0"
[4M]

18'-8"
[6M]

STAIR # 7

ABORT
BY-PASS

GATED ACCESS CONTROL

PLAN

1"=15'-0"

FOR CONTINUATION SEE DWG. A-11

SCALE:
1" = 15'-0"
15 10 5 0 5 10 15 20 25 FEET

S W E PROJECT NORTH

PROTON IMPROVEMENT PLAN II

TRANSPORT ENCLOSURE PLAN - SHEET 3

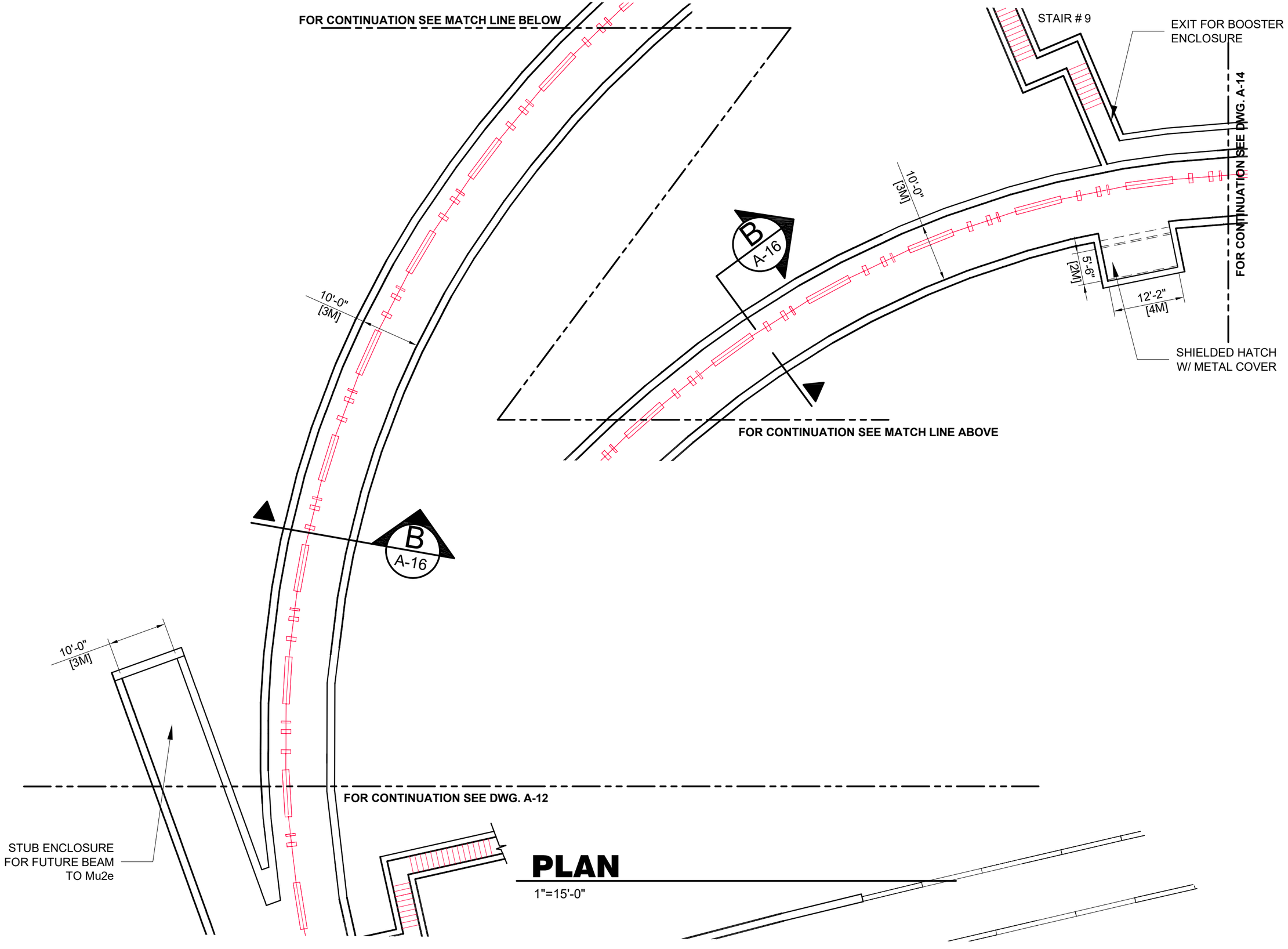
Fermilab

PIP-II

DATE
28 OCT. 2016

PROJECT NO.
4-2-3

DRAWING NO.
A-12



PLAN

1"=15'-0"

SCALE: 1" = 15'-0"

25 20 15 10 5 0 15 FEET

W S E PROJECT NORTH

PROTON IMPROVEMENT PLAN II

TRANSPORT ENCLOSURE PLAN - SHEET 4

Fermilab

PIP-II

DATE

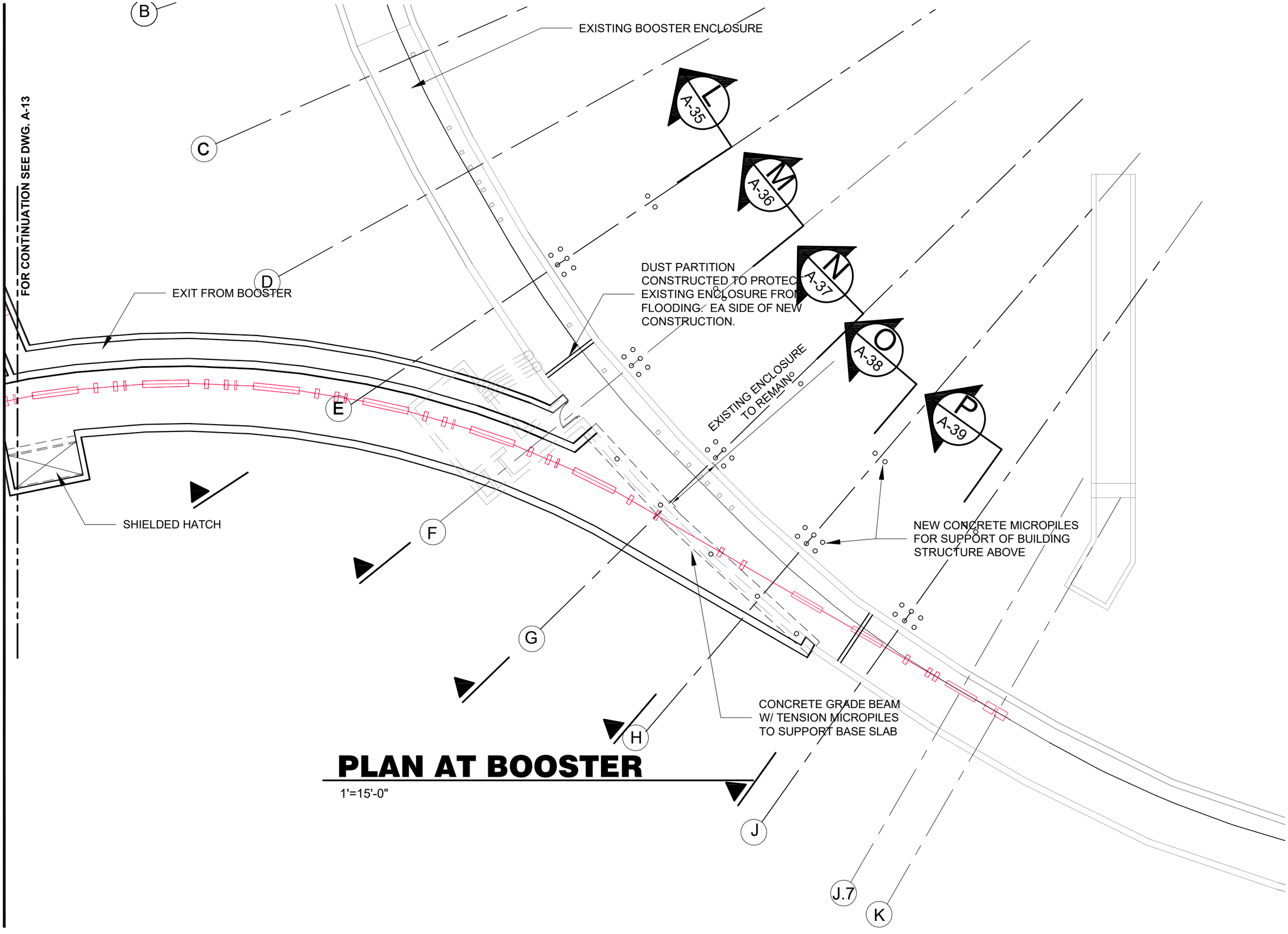
28 OCT. 2016

PROJECT NO.

4-2-3

DRAWING NO.

A-13



PLAN AT BOOSTER

1'=15'-0"

SCALE:
1" = 15'-0"
15 0 5 10 15 20 25 FEET

W
S
E
PROJECT NORTH

PROTON IMPROVEMENT PLAN II

TRANSFER ENCLOSURE PLAN - SHEET 5

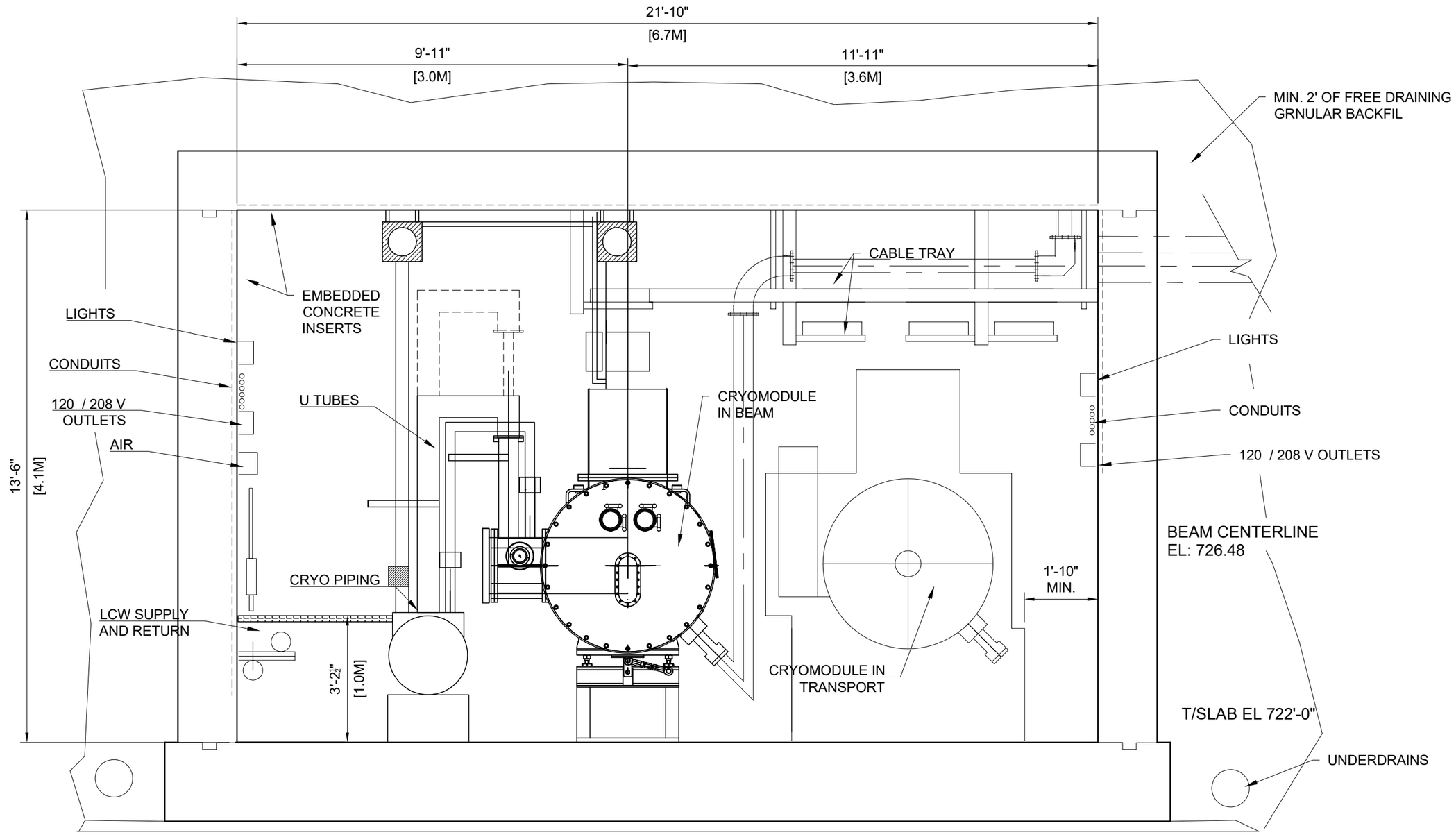
Fermilab

PIP-II

DATE
28 OCT. 2016

PROJECT NO.
4-2-3

DRAWING NO.
A-14



TYP. LINAC ENCLOSURE SECTION

3/8" = 1'-0"

A
A-7, A-8, A-9

SCALE:
3/8" = 1'-0"
0 1 2 3 4 5 FEET
SCALE

PROTON IMPROVEMENT PLAN II

TYP. LINAC ENCLOURE SECTION

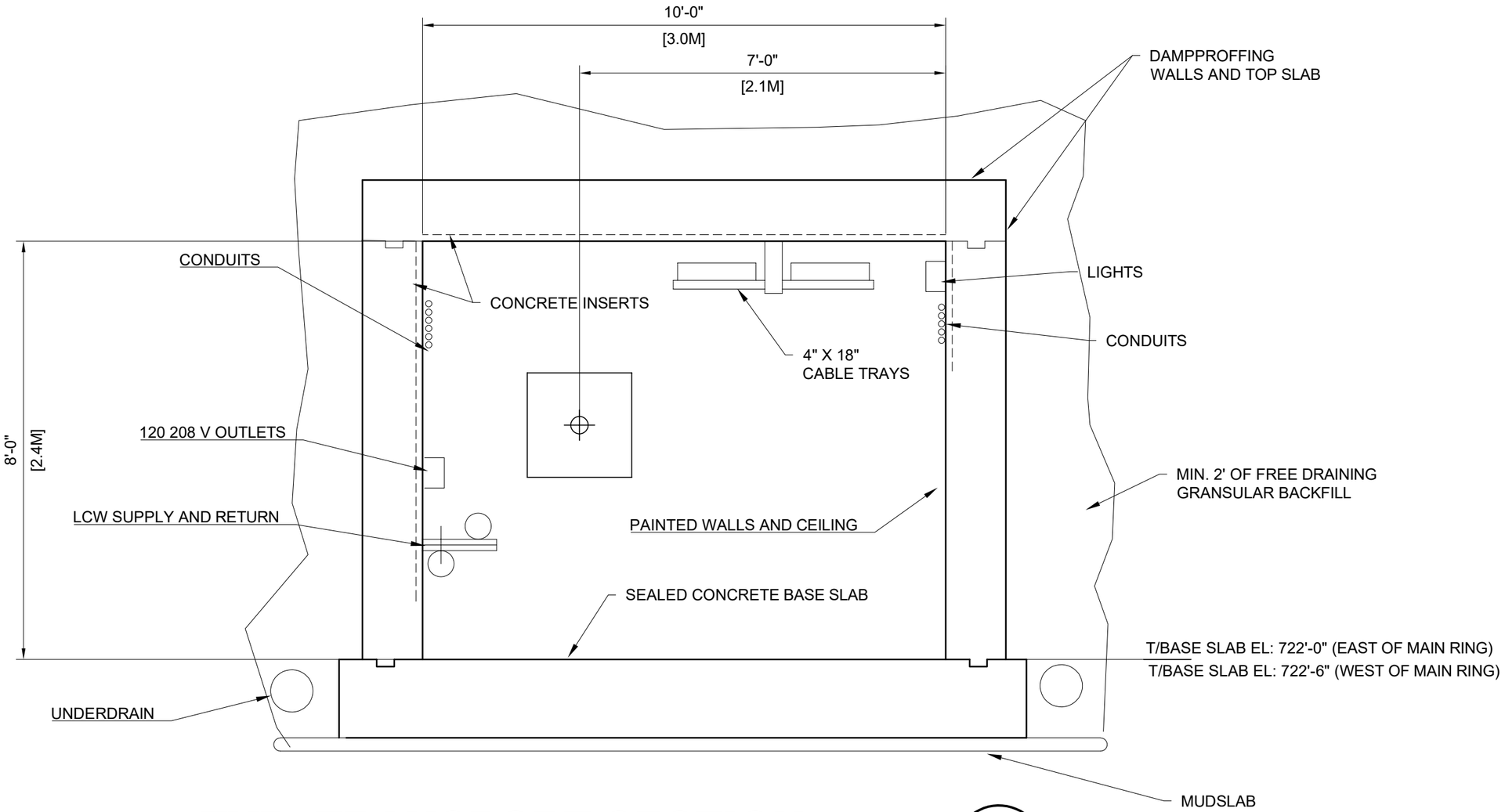
Fermilab

PIP-II

DATE
28 OCT. 2016

PROJECT NO.
4-2-3

DRAWING NO.
A-15



TYP. TRANSPORT SECTION

3/8" = 1'-0"

B

A-10, A-11, A-13

SCALE:

3/8"=1'-0"

0 1 2 3 4 5 FEET

SCALE

PROTON IMPROVEMENT PLAN II

TYP. TRANSPORT ENCLOSURE SECTION

.

Fermilab

PIP-II

DATE

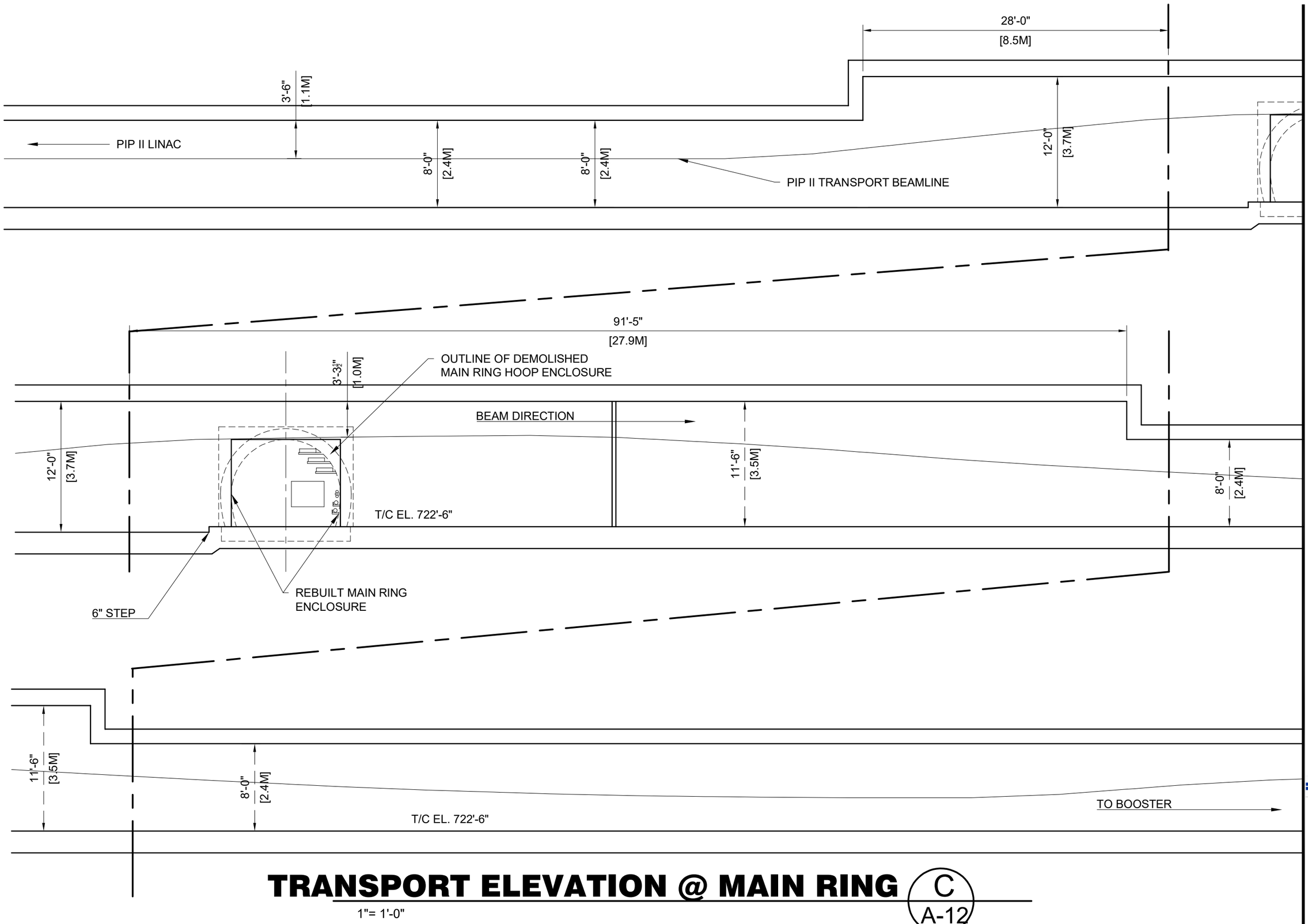
28 OCT. 2016

PROJECT NO.

4-2-3

DRAWING NO.

A-16



TRANSPORT ELEVATION @ MAIN RING

1"= 1'-0"

C
A-12

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

12 8 0 8 FEET SCALE

PROTON IMPROVEMENT PLAN II

ELEVATION AT MAIN RING CROSSING

Fermilab

PIP-II

DATE

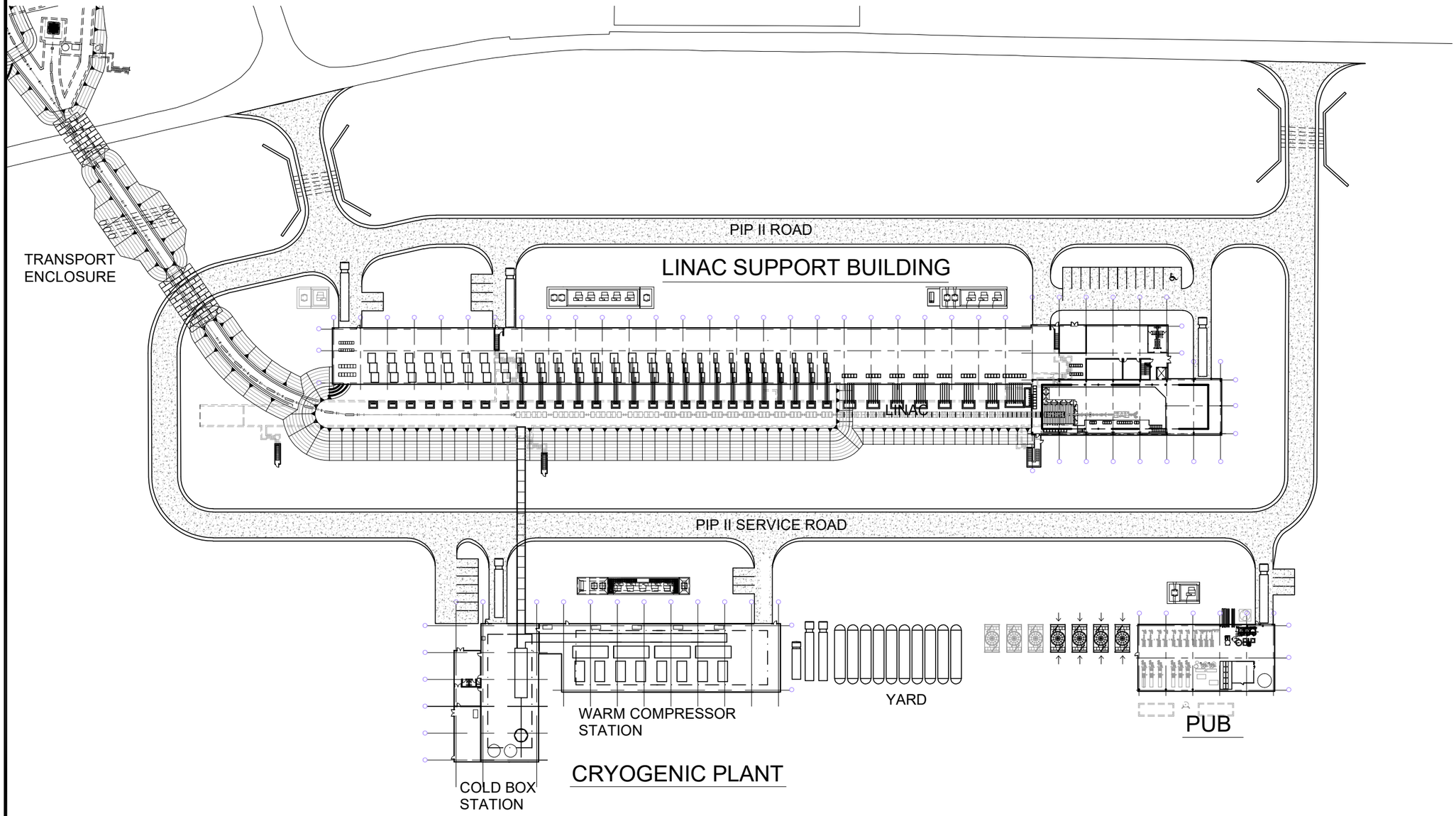
28 OCT. 2016

PROJECT NO.

4-2-3

DRAWING NO.

A-17



PIP II CAMPUS PLAN

1"=100'-0"

SCALE:
1" = 100'-0"
100 0 100 150
FEET

S W E
PROJECT NORTH

PROTON IMPROVEMENT PLAN - II

PIP II CAMPUS PLAN

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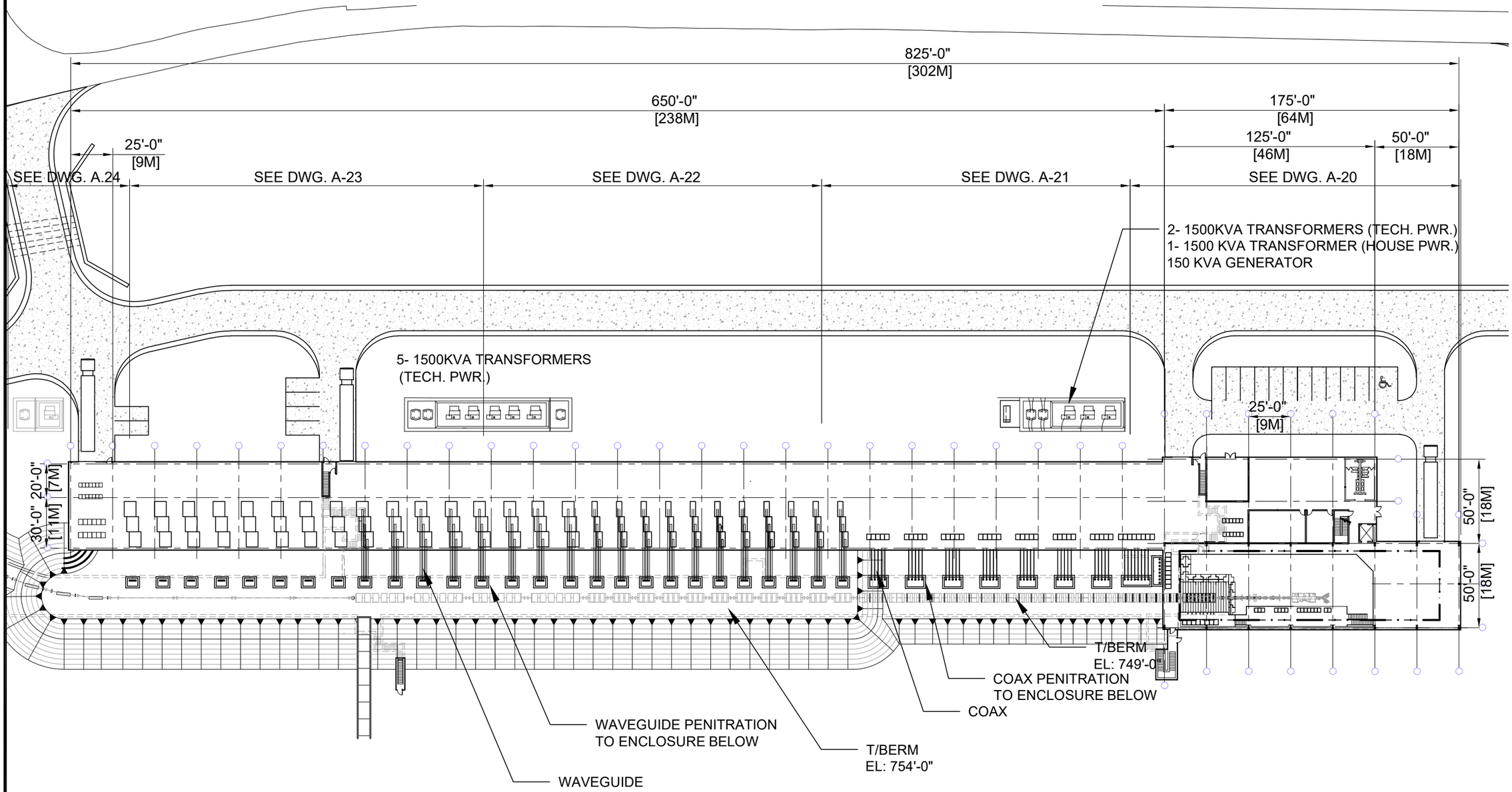
Fermilab

PIP-II

DATE
28 OCT. 2016

PROJECT NO.
4-2-3

DRAWING NO.
A-18



LINAC SUPPORT BUILDING PLAN

1"=60'-0"

SCALE: 1" = 60'-0"

90 60 0 60 FEET

PROJECT NORTH

PROTON IMPROVEMENT PLAN - II

LINAC SUPPORT BUILDING KEY PLAN

Fermilab

PIP-II

DATE

28 OCT. 2016

PROJECT NO.

4-2-3

DRAWING NO.

A-19

175'-0"
[64M]

50'-0"
[18M]

2'-9"
[1M]

2'-9"
[1M]

FOR CONTINUATION SEE DWG. A-21

STAIR # 2

GALLERY
RECIEVING
W/ 1 TON
MONORAIL

MECHANICAL /
ELECTRICAL

TECH SPACE

TOILETS

CONTROL
ROOM

CONF.

STAIR #1

ELEV

16' X 16' OHD

RECIEVING
T/SLAB EL:745'-0"

20 TON CRANE
W/ 22' HOOK HEIGHT

CRANE LIMITS

50'-0"
[18M]

MEZZ.

STAIR #5

26 27 28 29 30 31 32 33 34

A B C D E

F A-30

E A-29

D A-28

G A-31

PLAN

1"=15'-0"

SCALE:
1" = 15'-0"
FEET
25 20 15 10 5 0 15

W S E PROJECT NORTH

PROTON IMPROVEMENT PLAN - II

LINAC SUPPORT BUILDING PLAN - SHEET 1

CDR

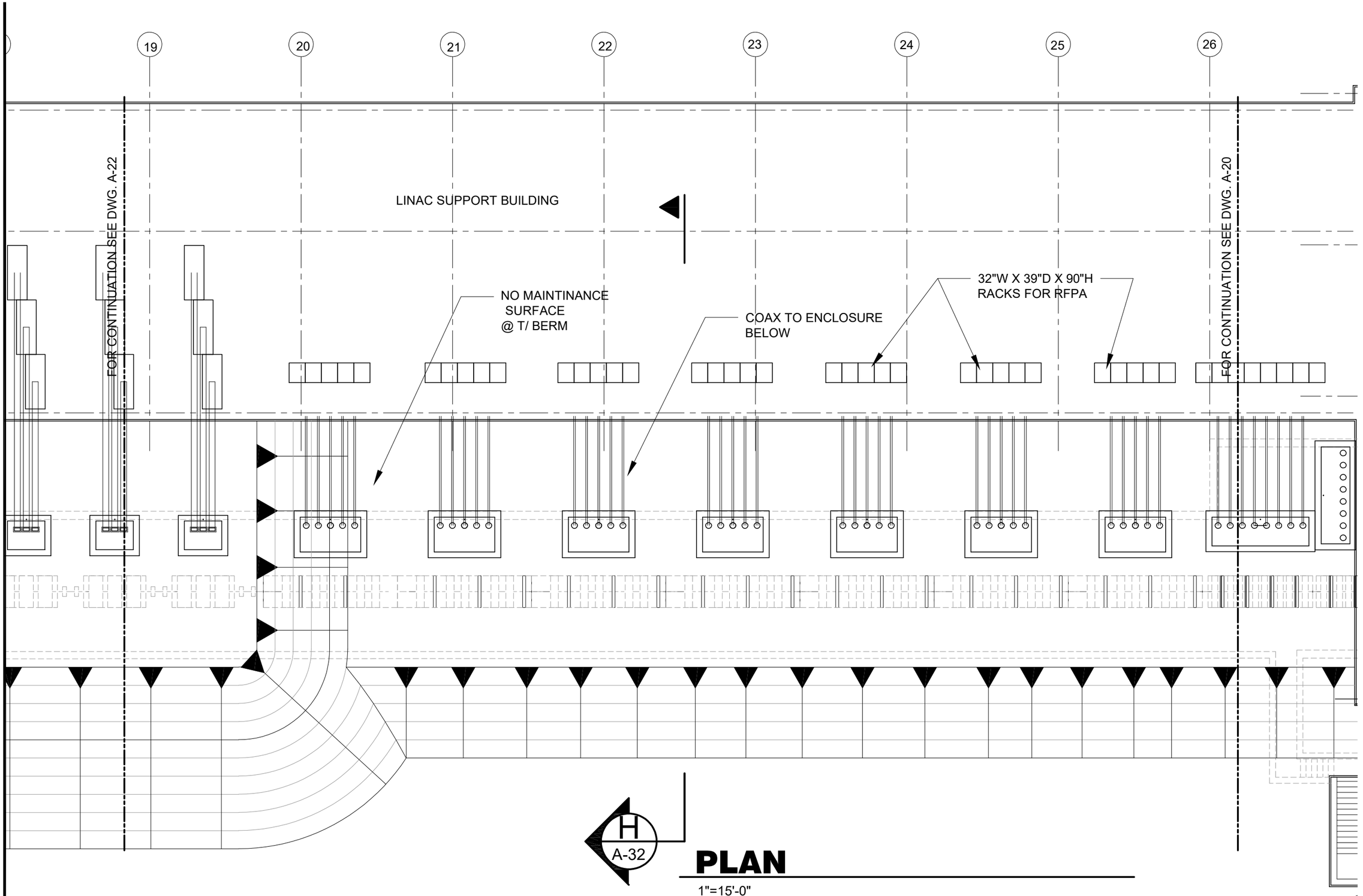
Fermilab

PIP-II

DATE
28 OCT. 2016

PROJECT NO.
4-2-3

DRAWING NO.
A-20



H
A-32

PLAN

1"=15'-0"

SCALE:

1" = 15'-0"

15 0 5 10 15 20 25 FEET

S W E PROJECT NORTH

PROTON IMPROVEMENT PLAN - II

LINAC SUPPORT BUILDING PLAN - SHEET 2

Fermilab

PIP-II

DATE

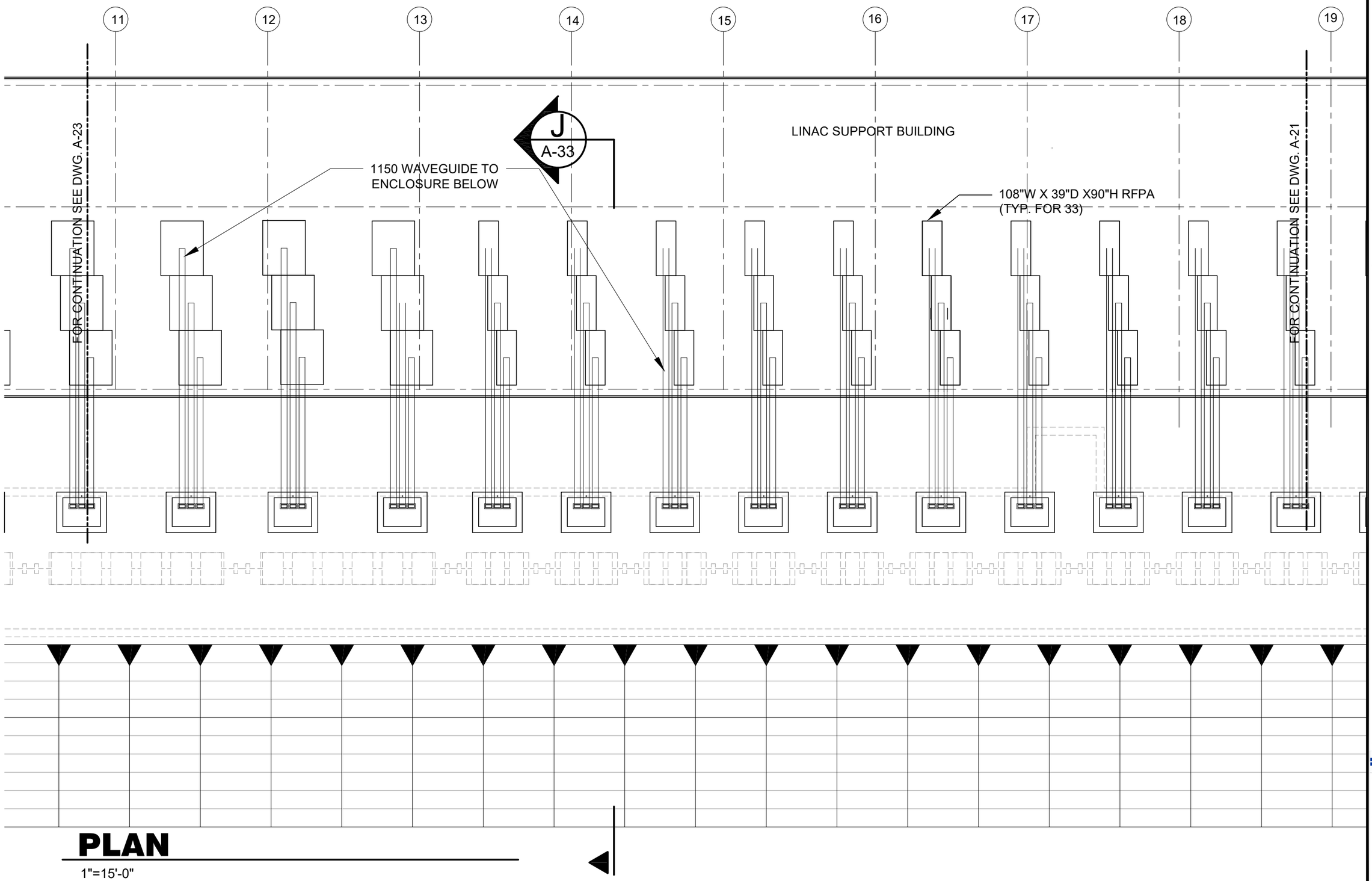
28 OCT. 2016

PROJECT NO.

4-2-3

DRAWING NO.

A-21



PLAN

1"=15'-0"

SCALE:
1" = 15'-0"
-15 0 5 10 15 20 25 FEET

S W E PROJECT NORTH

PROTON IMPROVEMENT PLAN - II

LINAC SUPPORT BUILDING PLAN - SHEET 3

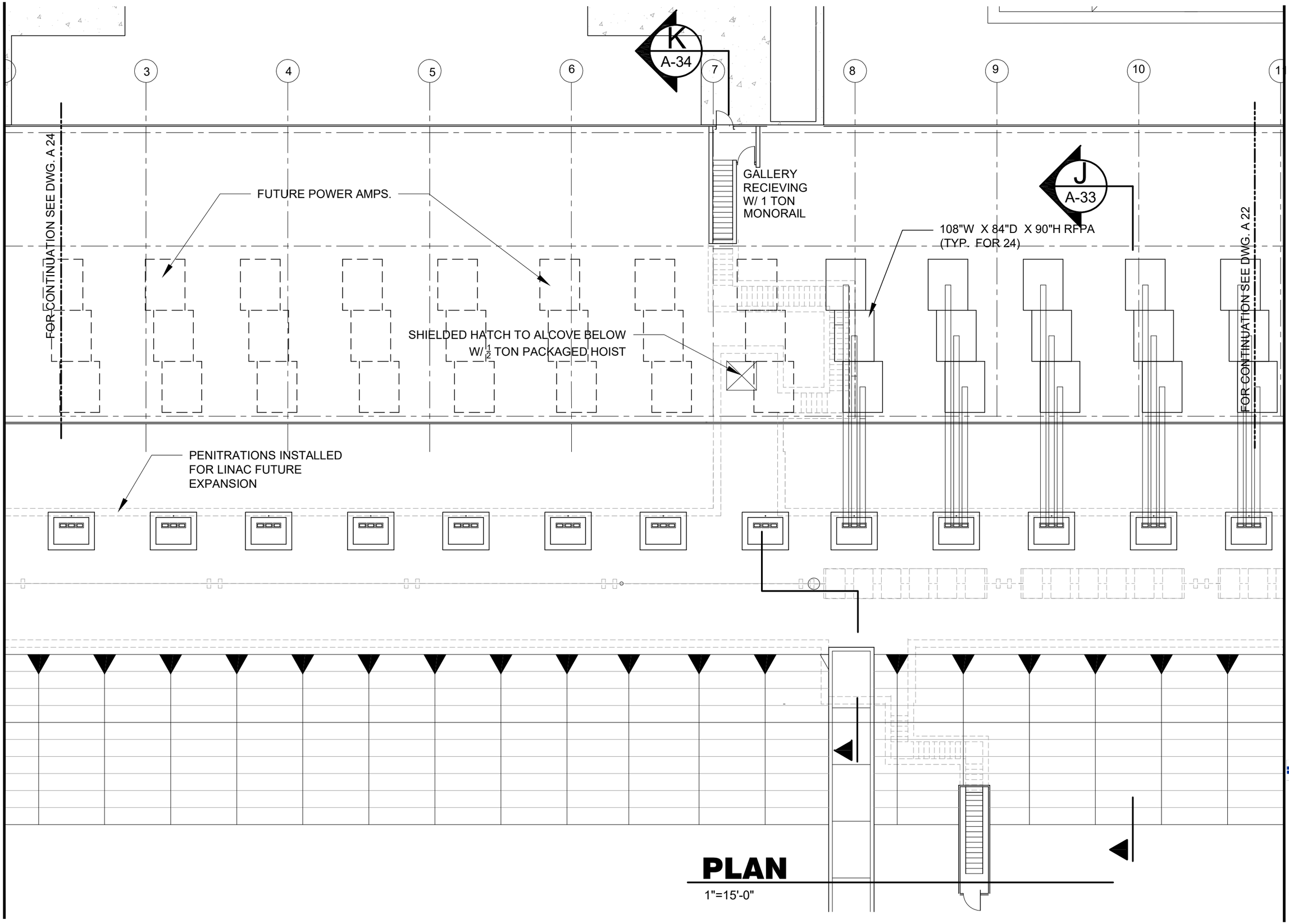
Fermilab

PIP-II

DATE
28 OCT. 2016

PROJECT NO.
4-2-3

DRAWING NO.
A-22



PLAN

1"=15'-0"

SCALE:
1" = 15'-0"
25 20 15 10 5 0 15
FEET

W
S
E
PROJECT NORTH

PROTON IMPROVEMENT PLAN - II

LINAC SUPPORT BUILDING PLAN - SHEET 4

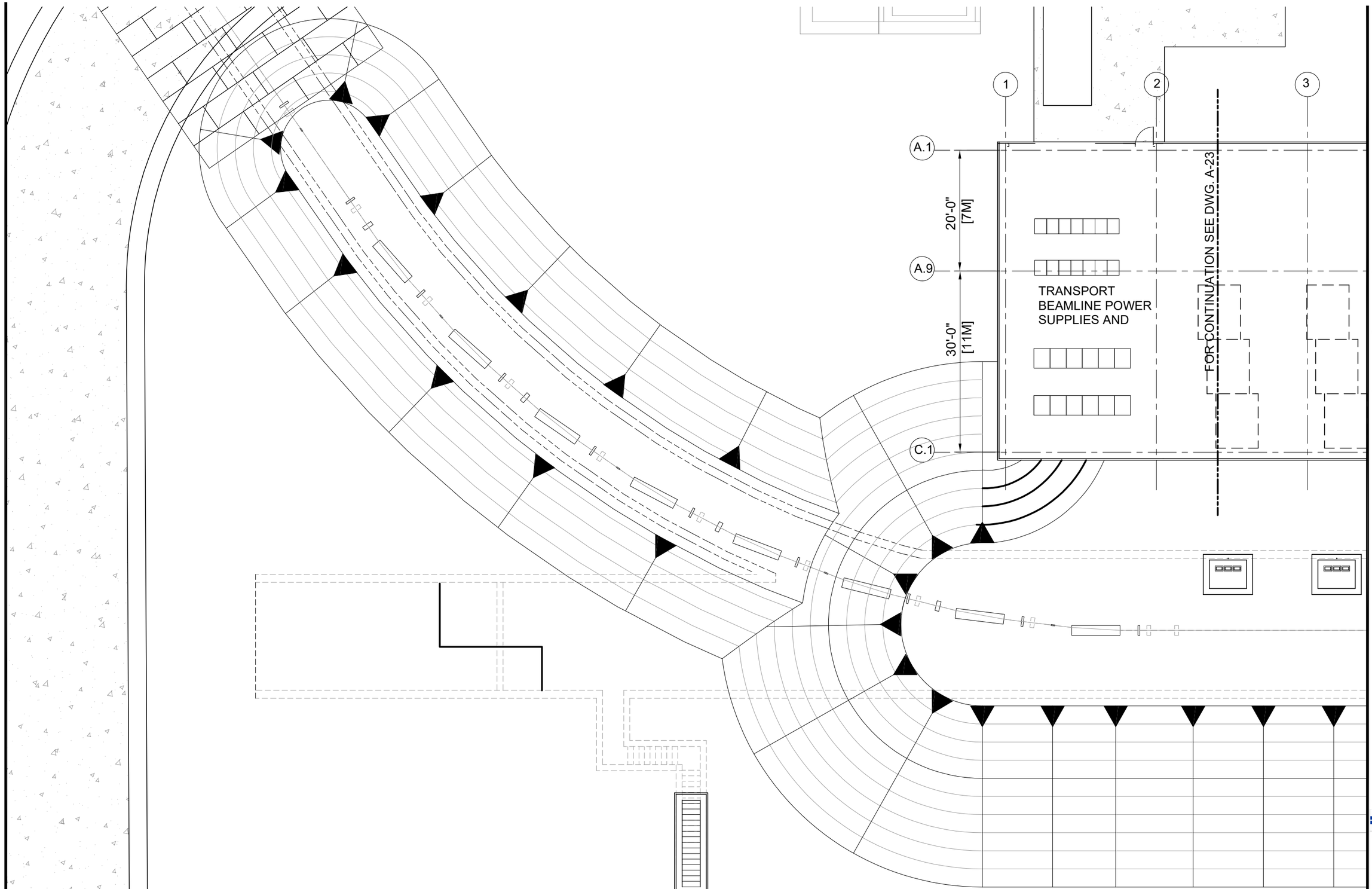
Fermilab

PIP-II

DATE
28 OCT. 2016

PROJECT NO.
4-2-3

DRAWING NO.
A-23



PLAN

1"=15'-0"

SCALE:

1" = 15'-0"

15 0 5 10 15 20 25 FEET

S W E PROJECT NORTH

PROTON IMPROVEMENT PLAN - II

LINAC SUPPORT BUILDING PLAN - SHEET 5

Fermilab

PIP-II

DATE

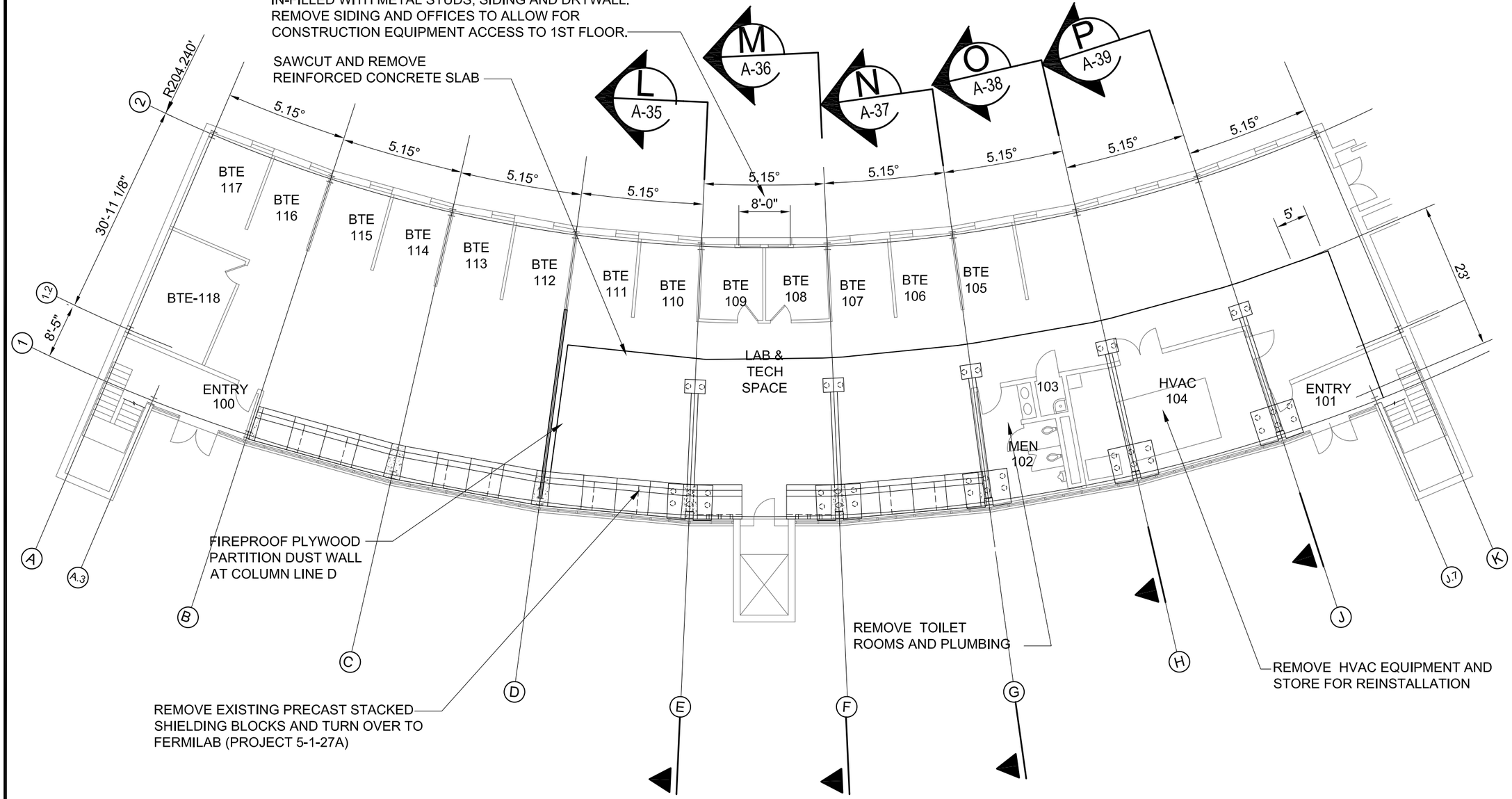
28 OCT. 2016

PROJECT NO.

4-2-3

DRAWING NO.

A-24



ASSUME THIS BUILDING IS UNOCCUPIED DURING CONSTRUCTION

DEMO PLAN - EAST BOOSTER TOWER

1" =15'

SCALE: 1" = 15'-0"

15 0 5 10 15 20 25 FEET

PROJECT NORTH

PROTON IMPROVEMENT PLAN - II

SOUTHEAST BOOSTER BUILDING - DEMO PLAN

Fermilab

PIP-II

DATE

28 OCT. 2016

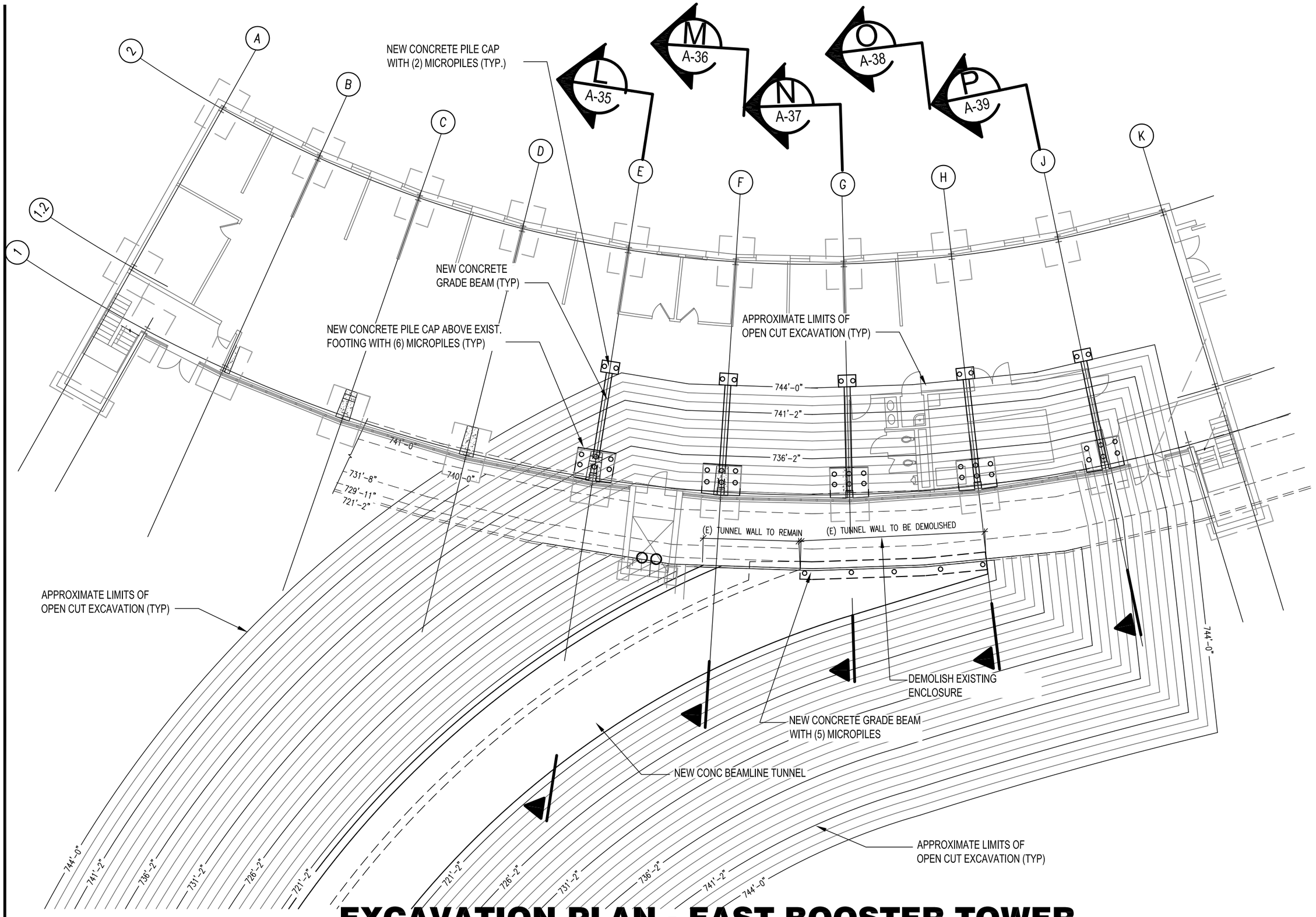
PROJECT NO.

4-2-3

DRAWING NO.

A-25

Oct 21, 2016 - 9:44am G:\4-2-3\A-25_4-2-3.dwg



EXCAVATION PLAN - EAST BOOSTER TOWER

1" = 15'

SCALE:
1" = 15'-0"
15 0 5 10 15 20 25 FEET

PROJECT NORTH

PROTON IMPROVEMENT PLAN - II

SOUTHEAST BOOSTER BUILDING - EXCAVATION PLAN

Fermilab

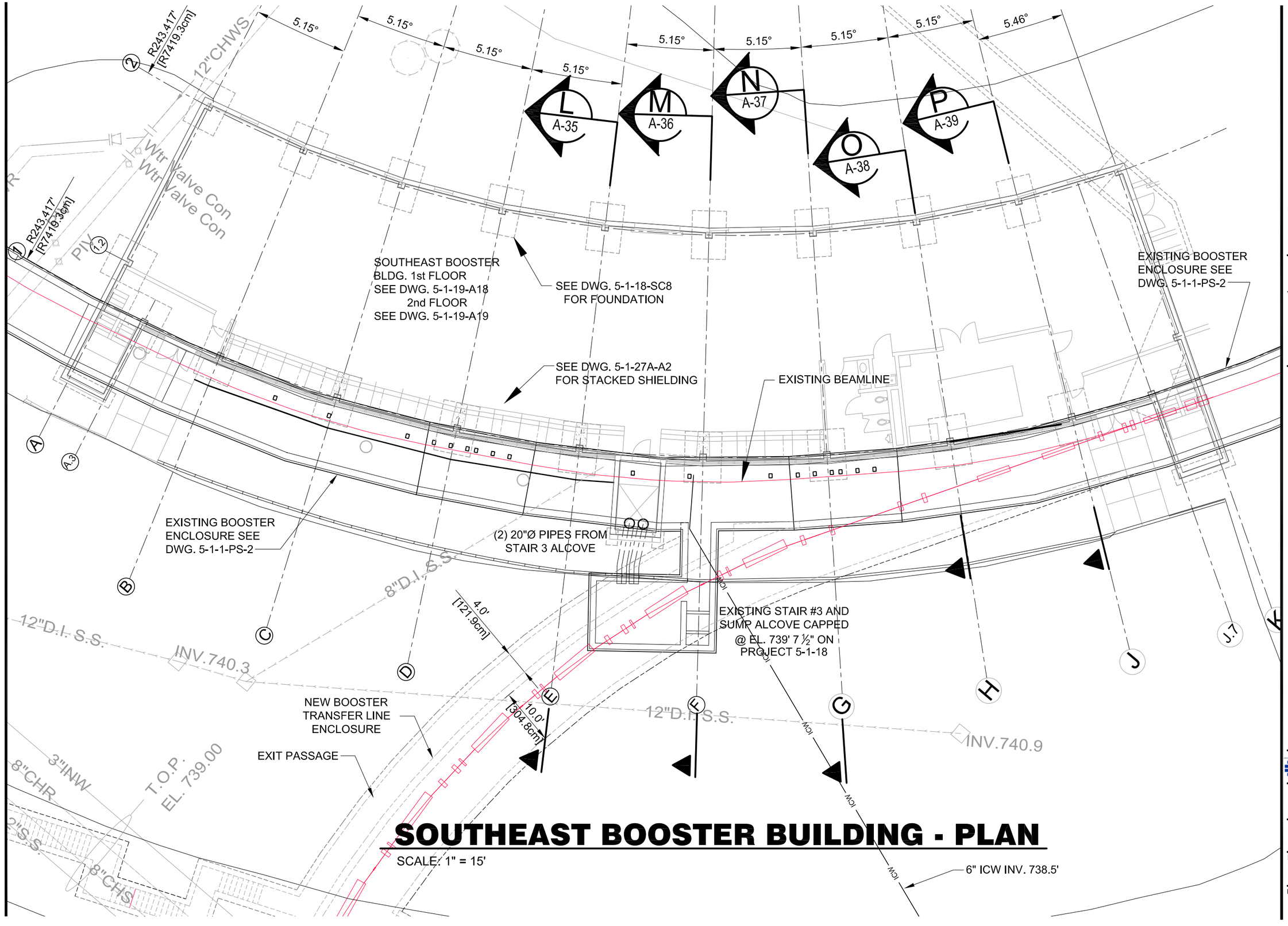
PIP-II

DATE
28 OCT. 2016

PROJECT NO.
4-2-3

DRAWING NO.
A-26

Oct 21, 2016 - 9:45am G:\4-2-3\A-26_4-2-3.dwg



SOUTHEAST BOOSTER BUILDING - PLAN

SCALE: 1" = 15'

PROTON IMPROVEMENT PLAN - II

SOUTHEAST BOOSTER BUILDING - PLAN

Fermilab

PIP-II

DATE

28 OCT. 2016

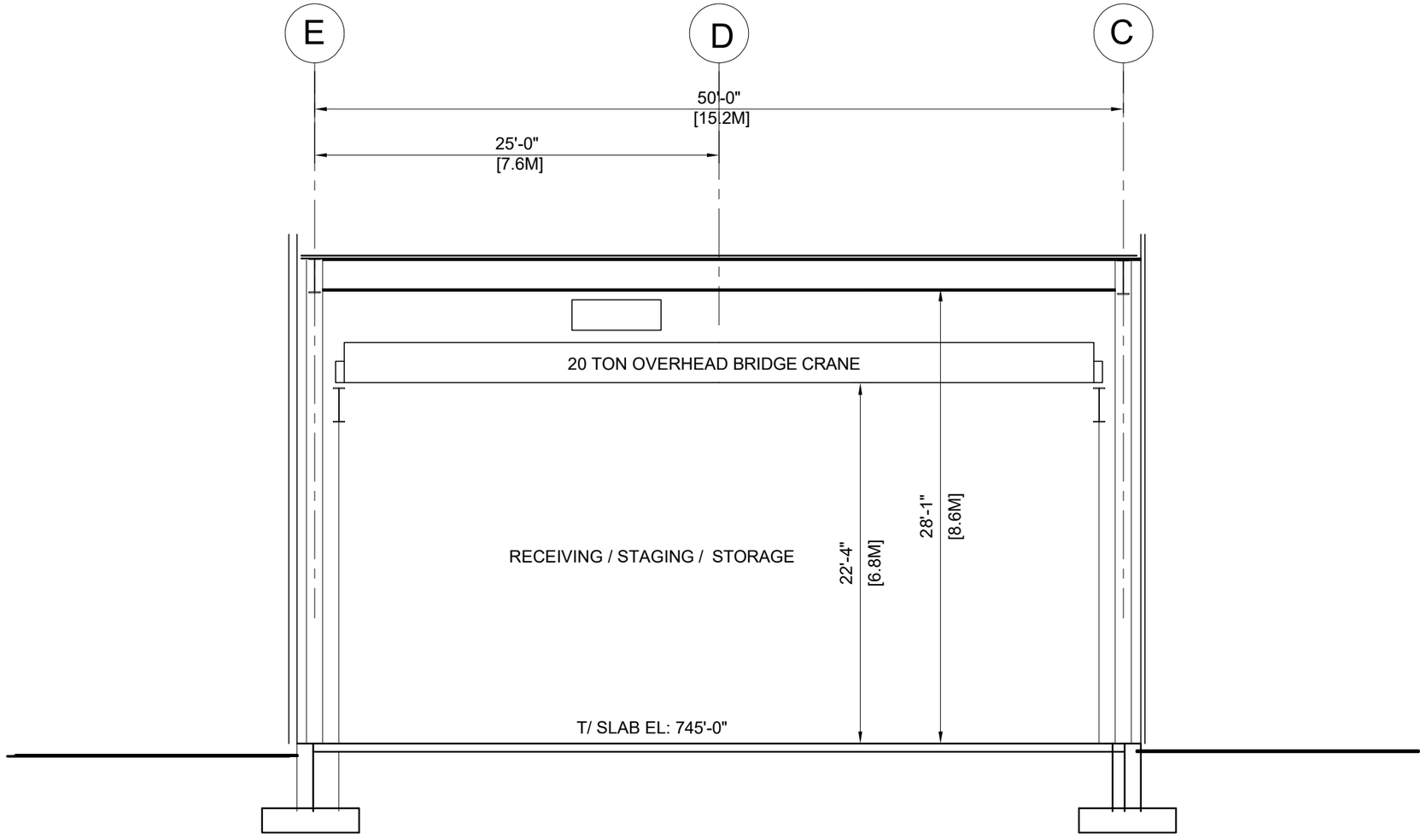
PROJECT NO.

4-2-3

DRAWING NO.

A-27

Oct 21, 2016 - 9:45am G:\4-2-3\A-27_4-2-3.dwg



SECTION THRU RECEIVING

1/8' = 1'-0"

D
A-20

SCALE:
1/8"=1'-0"
8 0 8 12
FEET
SCALE

PROTON IMPROVEMENT PLAN II

SECTION THRU HGH BAY RECEIVING

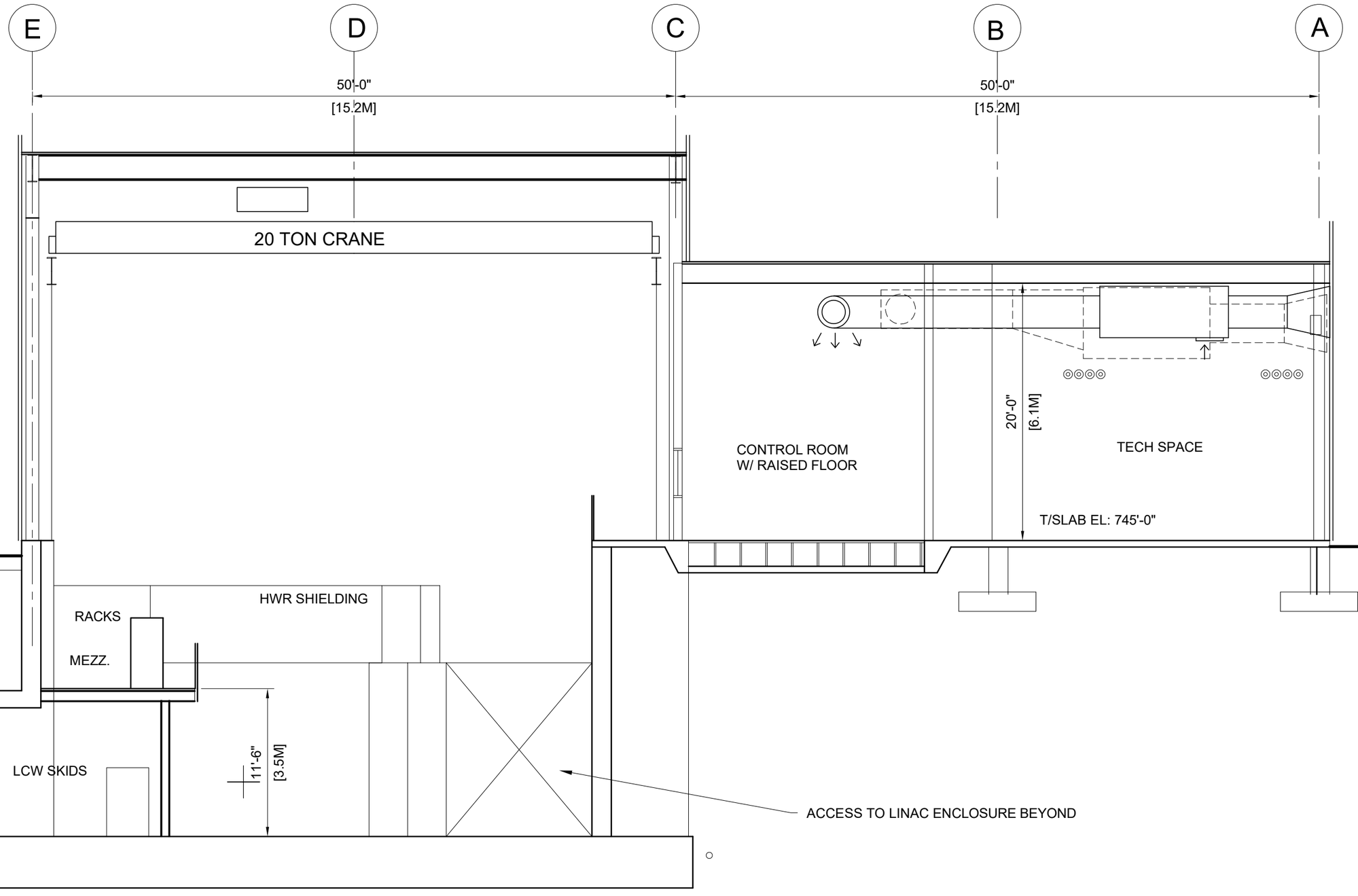
Fermilab

PIP-II

DATE
28 OCT. 2016

PROJECT NO.
4-2-3

DRAWING NO.
A-28



SECTION

1/8" = 1'-0"

E
A-6, A-20

SCALE:
1/8"=1'-0"
12 8 0 8
FEET
SCALE

PROTON IMPROVEMENT PLAN II

CROSS SECTION THRU HIGH BAY

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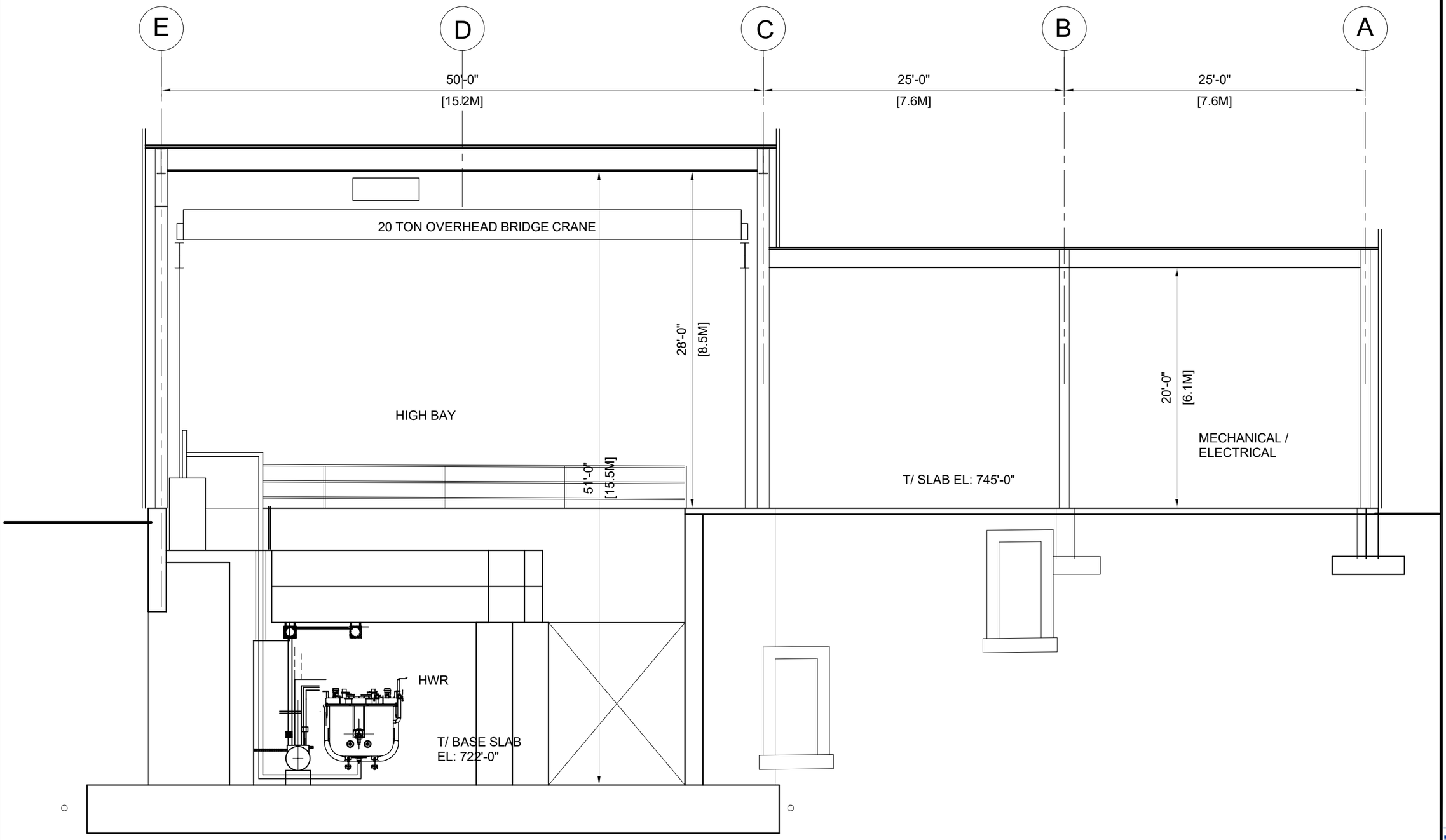
Fermilab

PIP-II

DATE
28 OCT. 2016

PROJECT NO.
4-2-3

DRAWING NO.
A-29



SECTION

1/8" = 1'-0"

F
A-6, A-20

SCALE:
1/8"=1'-0"
12 8 0 8
FEET
SCALE

PROTON IMPROVEMENT PLAN II

CROSS SECTION @ HWR

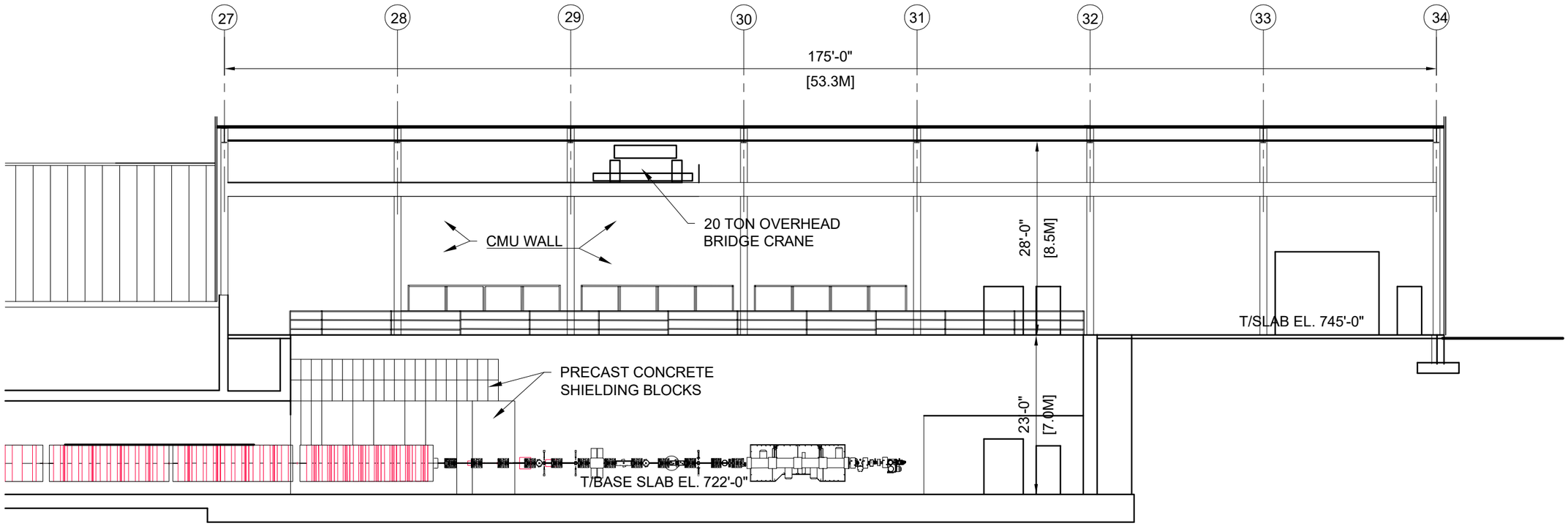
Fermilab

PIP-II

DATE
28 OCT. 2016

PROJECT NO.
4-2-3

DRAWING NO.
A-30



SECTION

1/16" = 1'-0"

G
A-20

SCALE:
1/16" = 1'-0"
8 0 8 16 24
SCALE FEET

PROTON IMPROVEMENT PLAN II

SECTION THRU HIGH BAY

Fermilab

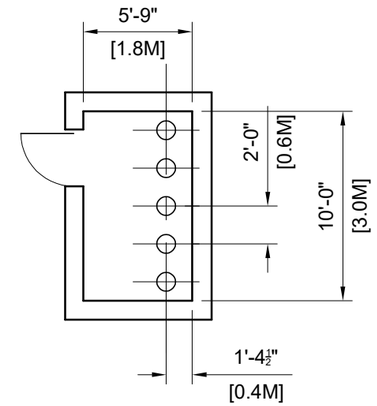
PIP-II

DATE
28 OCT. 2016

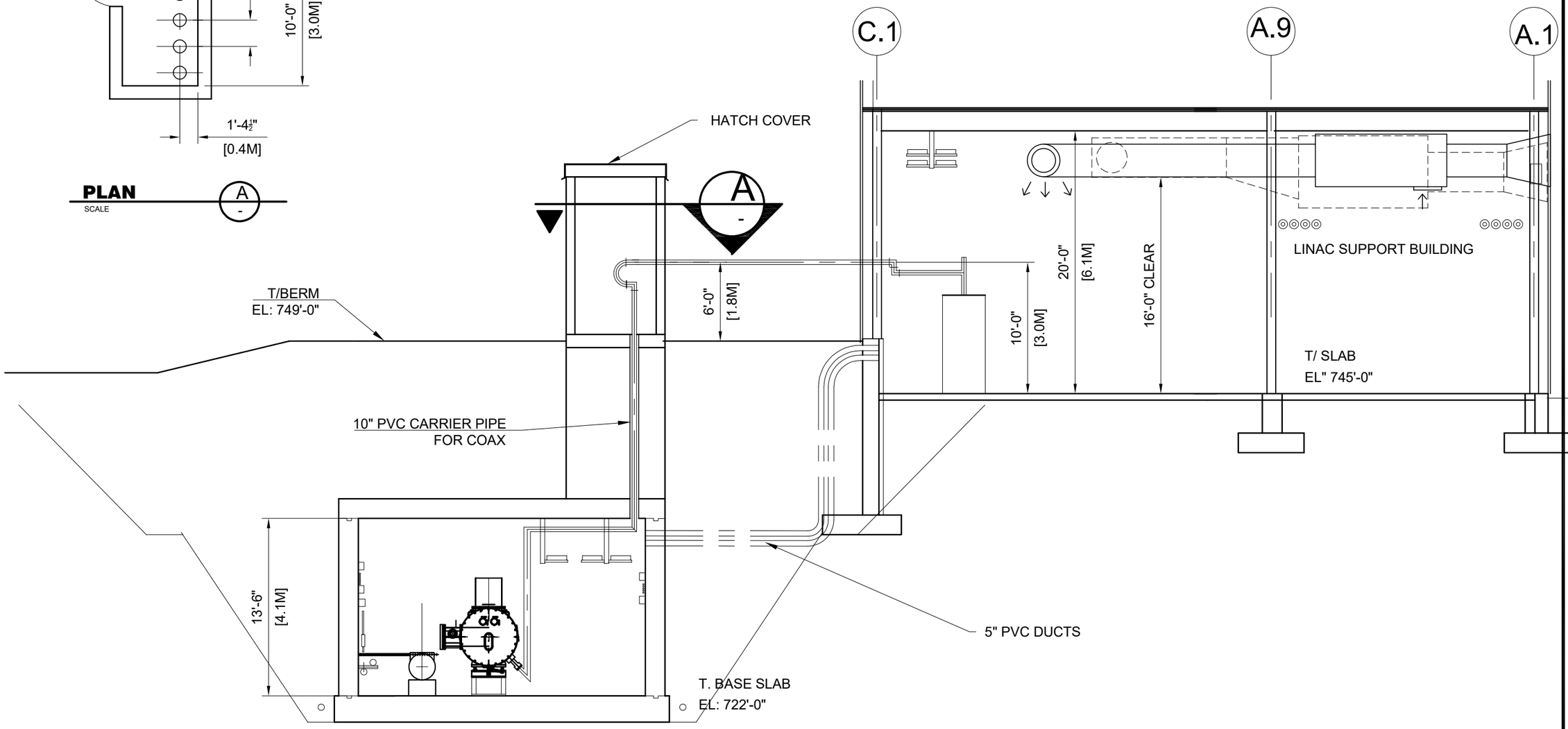
PROJECT NO.
4-2-3

DRAWING NO.
A-31

SSR2 5 - 4.125 COAX IN 10" PVC CARRIER PIPES
AS SHOWN
SSR1 8 - 3.125" COAX IN 10" PVC CARRIER PIPES
SIMILAR



PLAN
SCALE
A
-



SECTION @ COAX

1/8" = 1'-0"

H
A-21

SCALE:

PROTON IMPROVEMENT PLAN II

SECTION @ COAX FOR SSR1, SSR2

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Fermilab

PIP-II

DATE

28 OCT. 2016

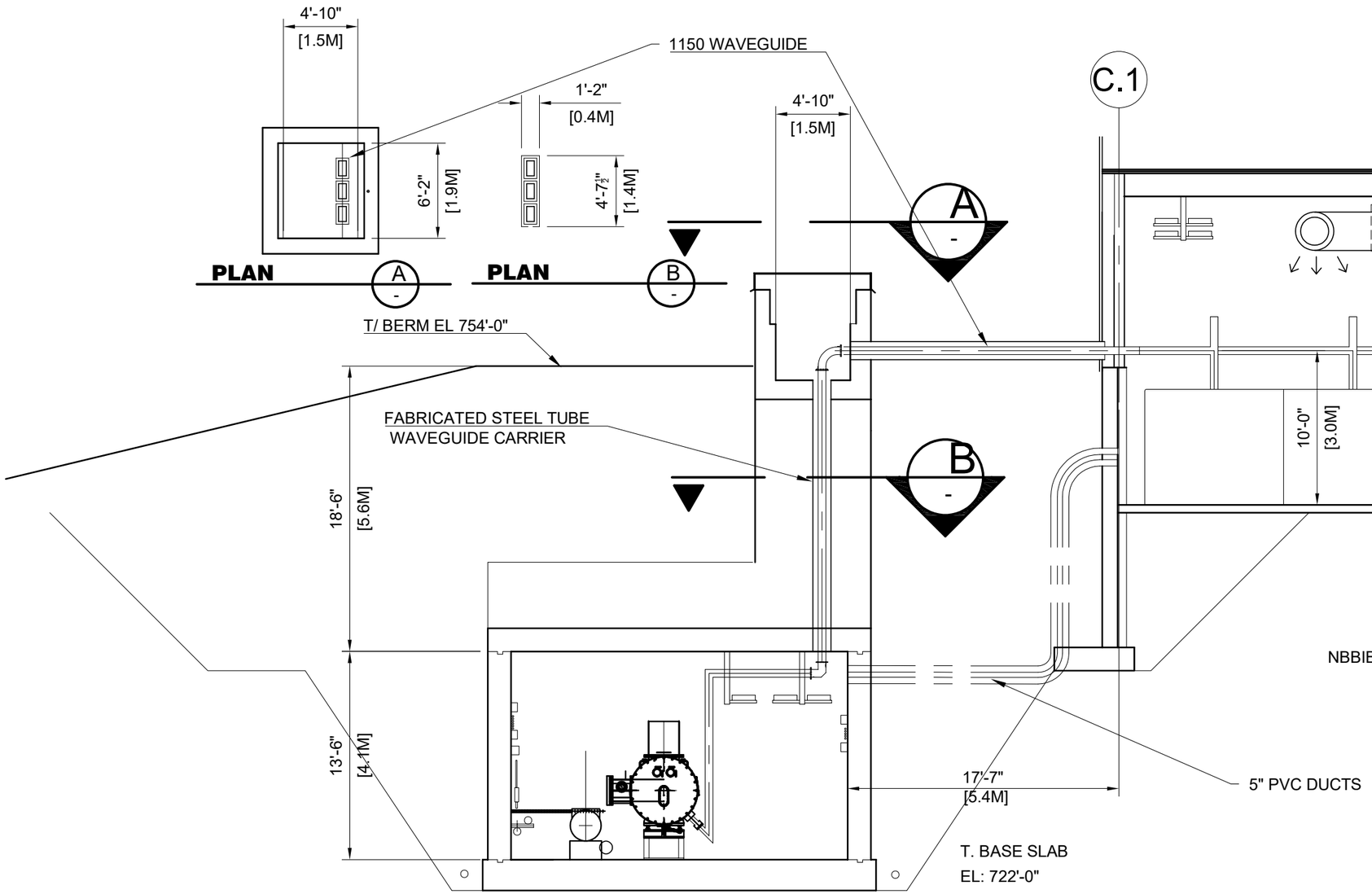
PROJECT NO.

4-2-3

DRAWING NO.

A-32

1 SET OF 3 WAVEGUIDE @ LB650
2 SETS OF 3 WAVEGUIDE @ HB650



SECTION @ WAVEGUIDE

1/8" = 1'-0"

J
A-22, A-23

SCALE:
1/8"=1'-0"
SCALE
12 8 0 8 FEET

PROTON IMPROVEMENT PLAN II

SECTION @ WAVEGUIDE FOR LB 650, HB 650

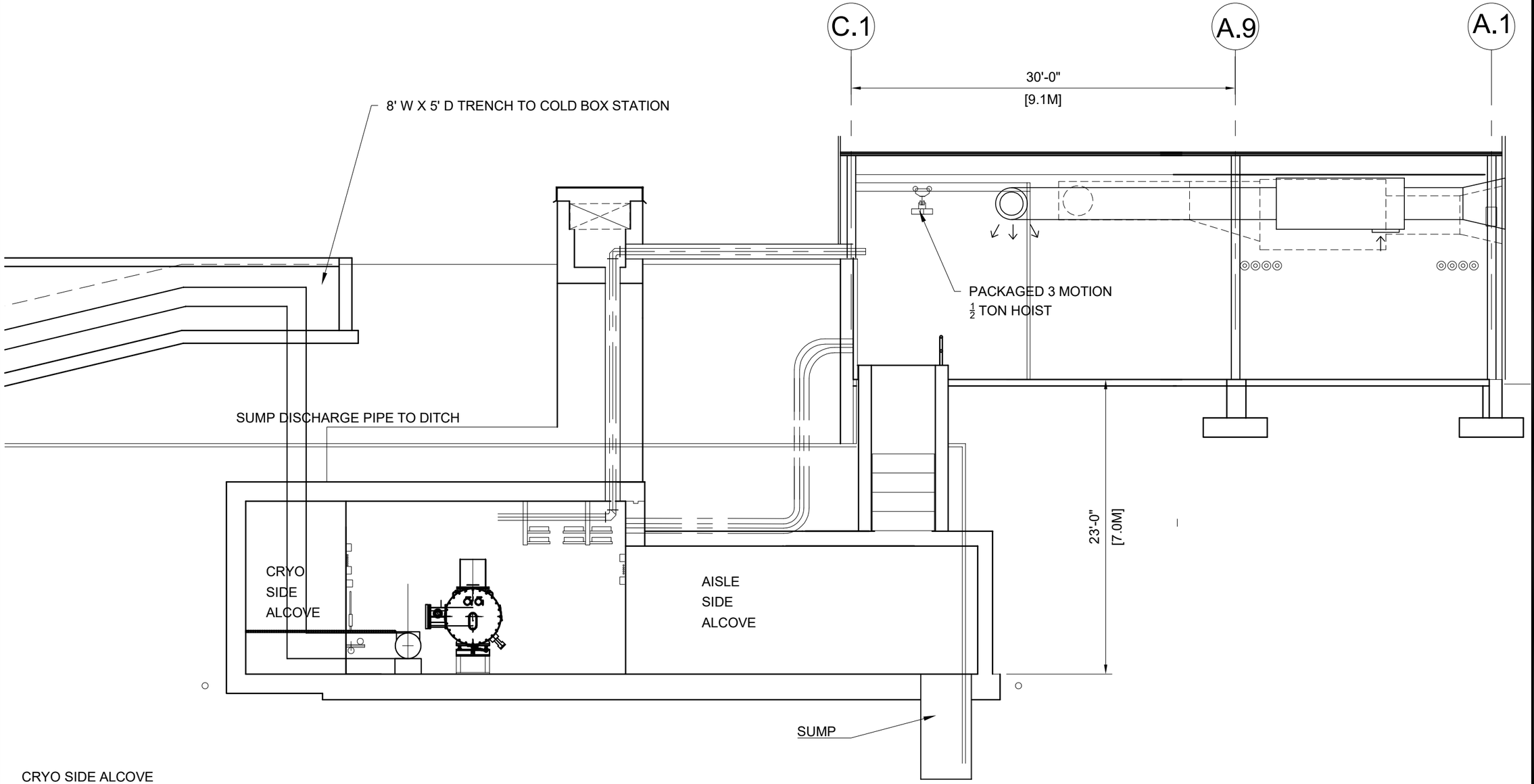
Fermilab

PIP-II

DATE
28 OCT. 2016

PROJECT NO.
4-2-3

DRAWING NO.
A-33



CRYO SIDE ALCOVE
POWER - 480 PANEL, TRANSFORMER, 120/208V PANEL, LIGHTING PANEL
CONTROLING OUTLETS AND LIGHTS ON THIS SIDE OF ENCLOSURE

AISLE SIDE ALCOVE
POWER - 480 PANEL, TRANSFORMER, 120/208V PANEL, LIGHTING PANEL
CONTROLING OUTLETS AND LIGHTS ON THIS SIDE OF ENCLOSURE

SUMP

SECTION AT ALCOVES

1/8" = 1'-0"

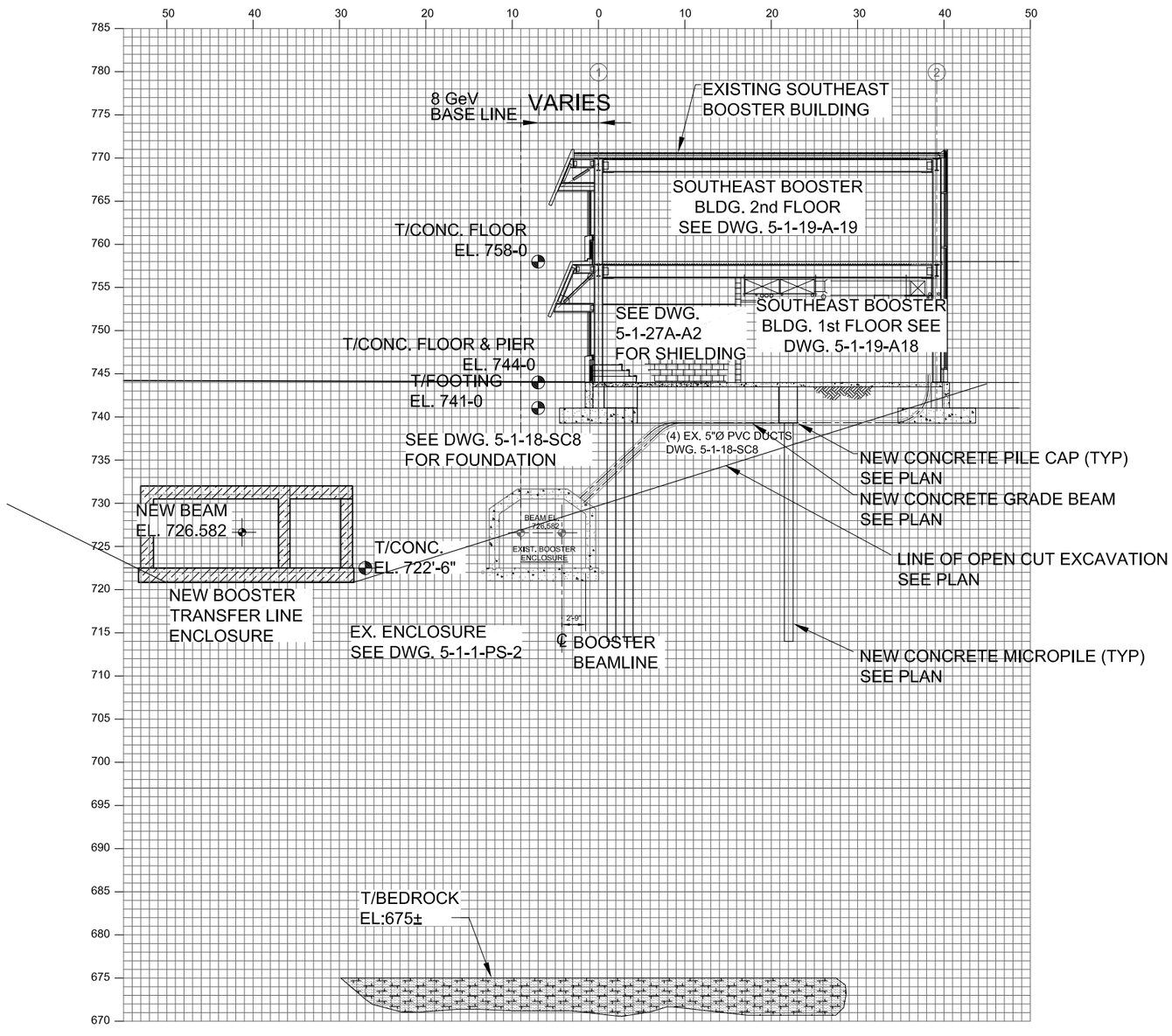
K
A-9, A-23

SCALE:
1/8"=1'-0"
8 0 8 12
FEET
SCALE

PROTON IIMPROVEMENT PLAN II
SECTION AT LINAC ALCOVES

Fermilab
PIP-II

DATE
28 OCT. 2016
PROJECT NO.
4-2-3
DRAWING NO.
A-34



SECTION

SCALE: 1" = 15'

L
A-25, A-26 & A-27

ASSUME THIS BUILDING IS UNOCCUPIED DURING CONSTRUCTION

SCALE:
1" = 15'-0"

15 0 5 10 15 20 25 FEET

PROTON IMPROVEMENT PLAN - II

SECTION SHEET - 1

Fermilab

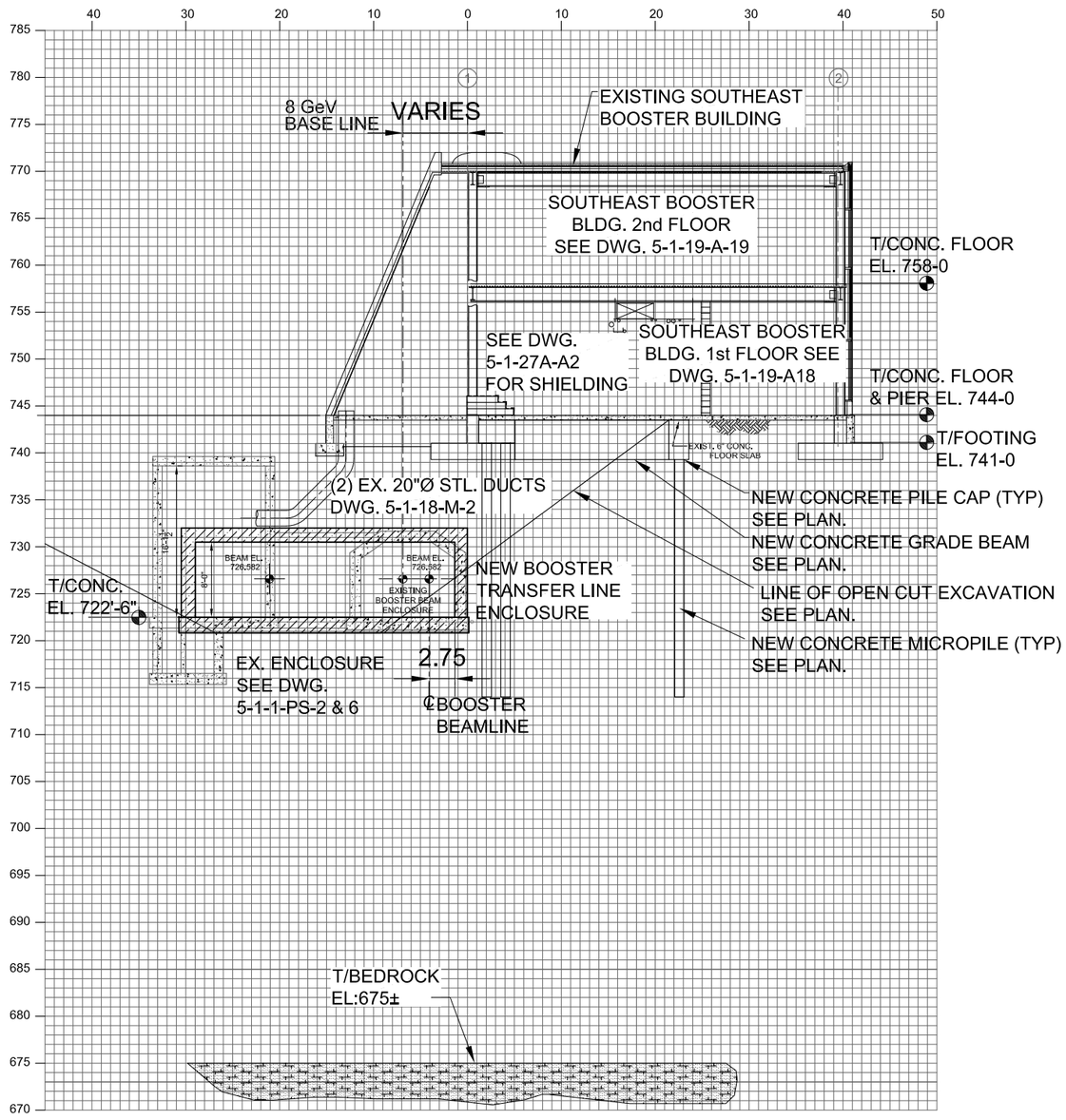
PIP-II

DATE
28 OCT. 2016

PROJECT NO.
4-2-3

DRAWING NO.
A-35

Oct 21, 2016 - 10:14am G:\4-2-3\booster-sections-DETAILS.dwg



SECTION

SCALE: 1" = 15'

M
A-25, A-26 & A-27

ASSUME THIS BUILDING IS UNOCCUPIED DURING CONSTRUCTION

SCALE:
1" = 15'-0"
15 0 5 10 15 20 25 FEET

PROTON IMPROVEMENT PLAN - II

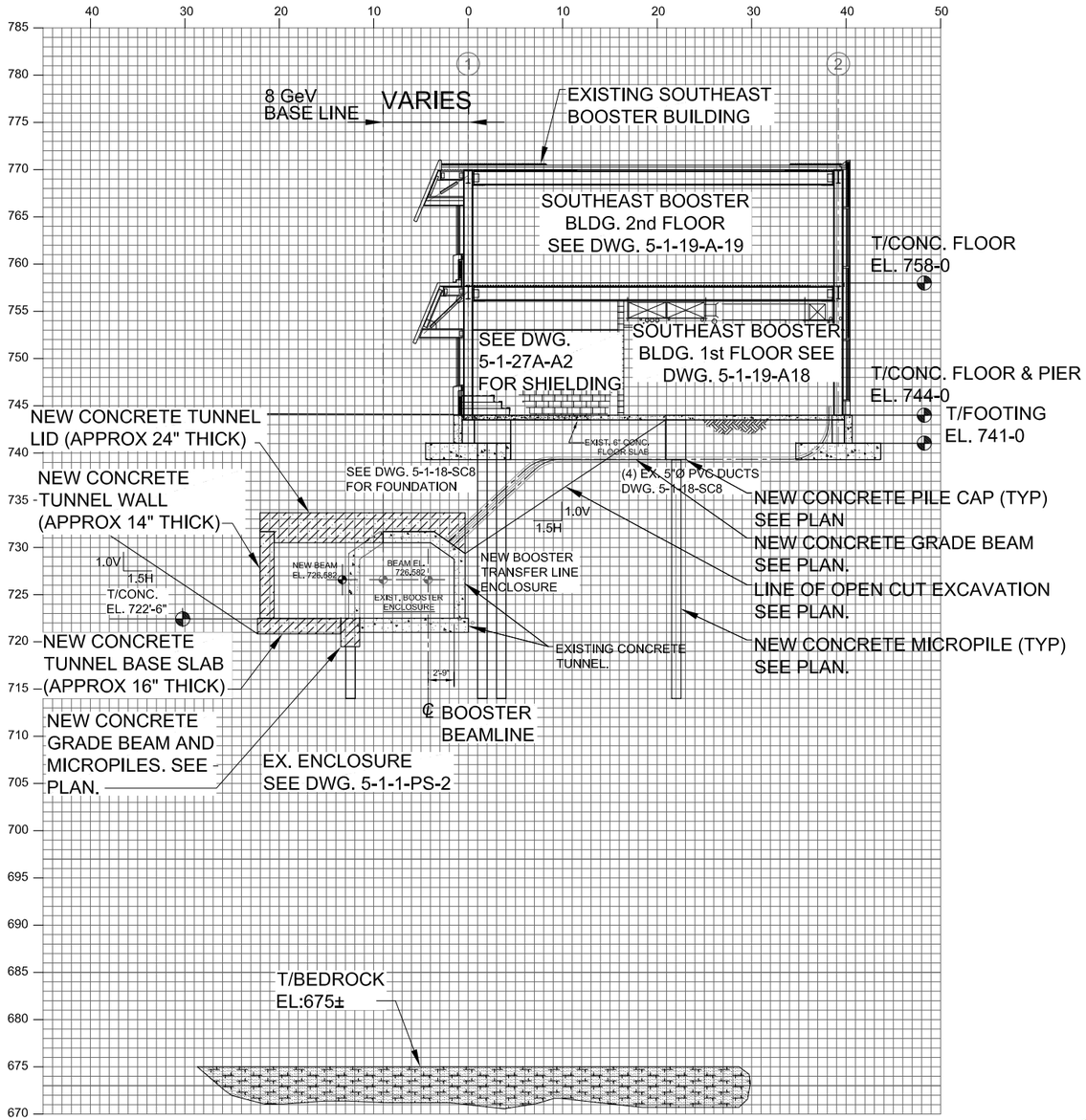
SECTION SHEET - 2

Fermilab

PIP-II

DATE
28 OCT. 2016
PROJECT NO.
4-2-3
DRAWING NO.
A-36

Oct 21, 2016 - 10:11am G:\4-2-3\booster-sections-DETAILS.dwg



SECTION

SCALE: 1" = 15'

N

A-25, A-26 & A-27

ASSUME THIS BUILDING IS UNOCCUPIED DURING CONSTRUCTION

SCALE:
1" = 15'-0"

15 10 5 0 5 10 15 20 25 FEET

PROTON IMPROVEMENT PLAN - II

SECTION SHEET - 3

Fermilab

PIP-II

DATE

28 OCT. 2016

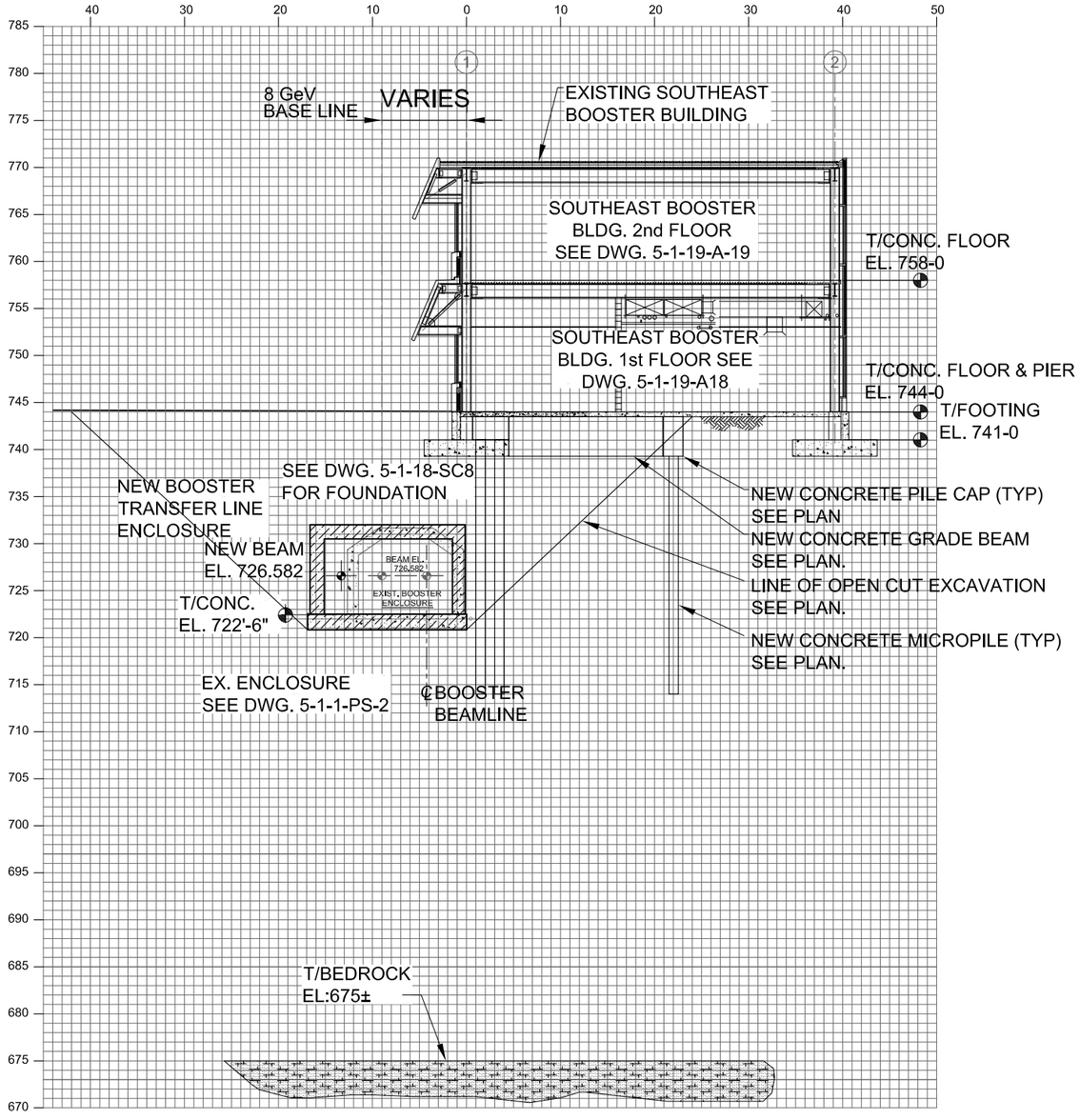
PROJECT NO.

4-2-3

DRAWING NO.

A-37

Oct 21, 2016 - 10:11am G:\4-2-3\booster-sections-DETAILS.dwg



SECTION

SCALE: 1" = 15'

O
A-25, A-26 & A-27

ASSUME THIS BUILDING IS UNOCCUPIED DURING CONSTRUCTION

SCALE:
1" = 15'-0"
15 0 5 10 15 20 25
FEET

PROTON IMPROVEMENT PLAN - II

SECTION SHEET - 4

Fermilab

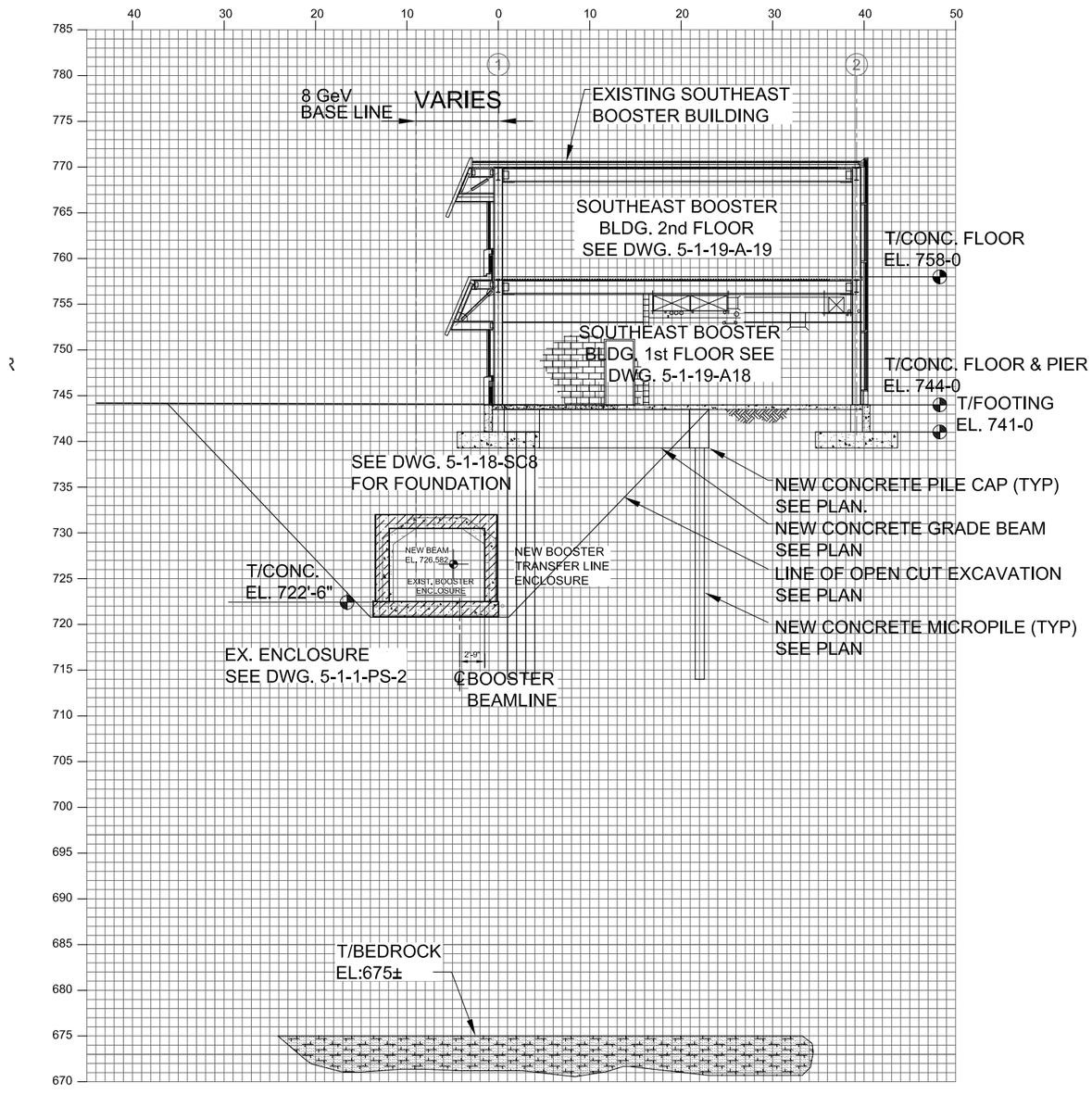
PIP-II

DATE
28 OCT. 2016

PROJECT NO.
4-2-3

DRAWING NO.
A-38

Oct 21, 2016 - 10:11am G:\4-2-3\booster-sections-DETAILS.dwg



SECTION

SCALE: 1" = 15'

P
A-25, A-26 & A-27

ASSUME THIS BUILDING IS UNOCCUPIED DURING CONSTRUCTION

SCALE:
1" = 15'-0"

0 5 10 15 20 25 FEET

PROTON IMPROVEMENT PLAN - II

SECTION SHEET - 5

Fermilab

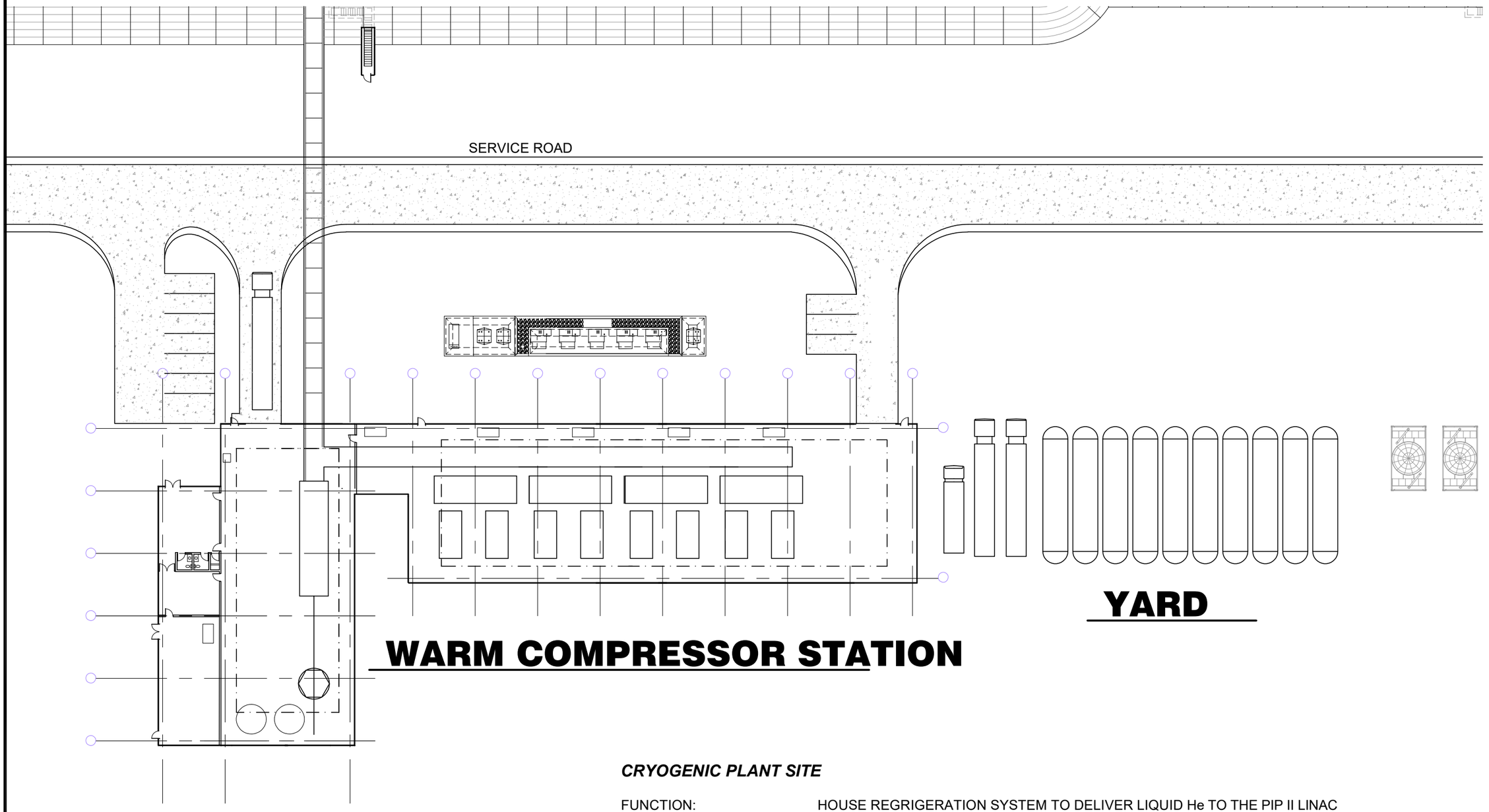
PIP-II

DATE
28 OCT. 2016

PROJECT NO.
4-2-3

DRAWING NO.
A-39

Oct 21, 2016 - 10:12am G:\4-2-3\booster-sections-DETAILS.dwg



CRYOGENIC PLANT SITE

FUNCTION:	HOUSE REGRIGERATION SYSTEM TO DELIVER LIQUID He TO THE PIP II LINAC
CRYO PIPING TRENCH:	8' W X 5' D PIPING TRENCH W/ REMOVABLE COVERS BETWEEN COLD BOX STATION AND LINAC ENCLOSURE
TANK STORAGE YARD:	65' X 180' X 1.5' STONE HARDSTAND FOR TRUCK AND TANK STORAGE
PARKING:	10 CARS - 1 ACCESSABLE
FIRE PROECTION:	FIRE HYDRANTS AT 250' MAX.

CRYOGENIC PLANT PLAN

1"=40'-0"

SCALE:
1" = 40'-0"
40 0 40 60
FEET

PROJECT NORTH

PROTON IMPROVEMENT PLAN - II

CRYOGENIC PLANT

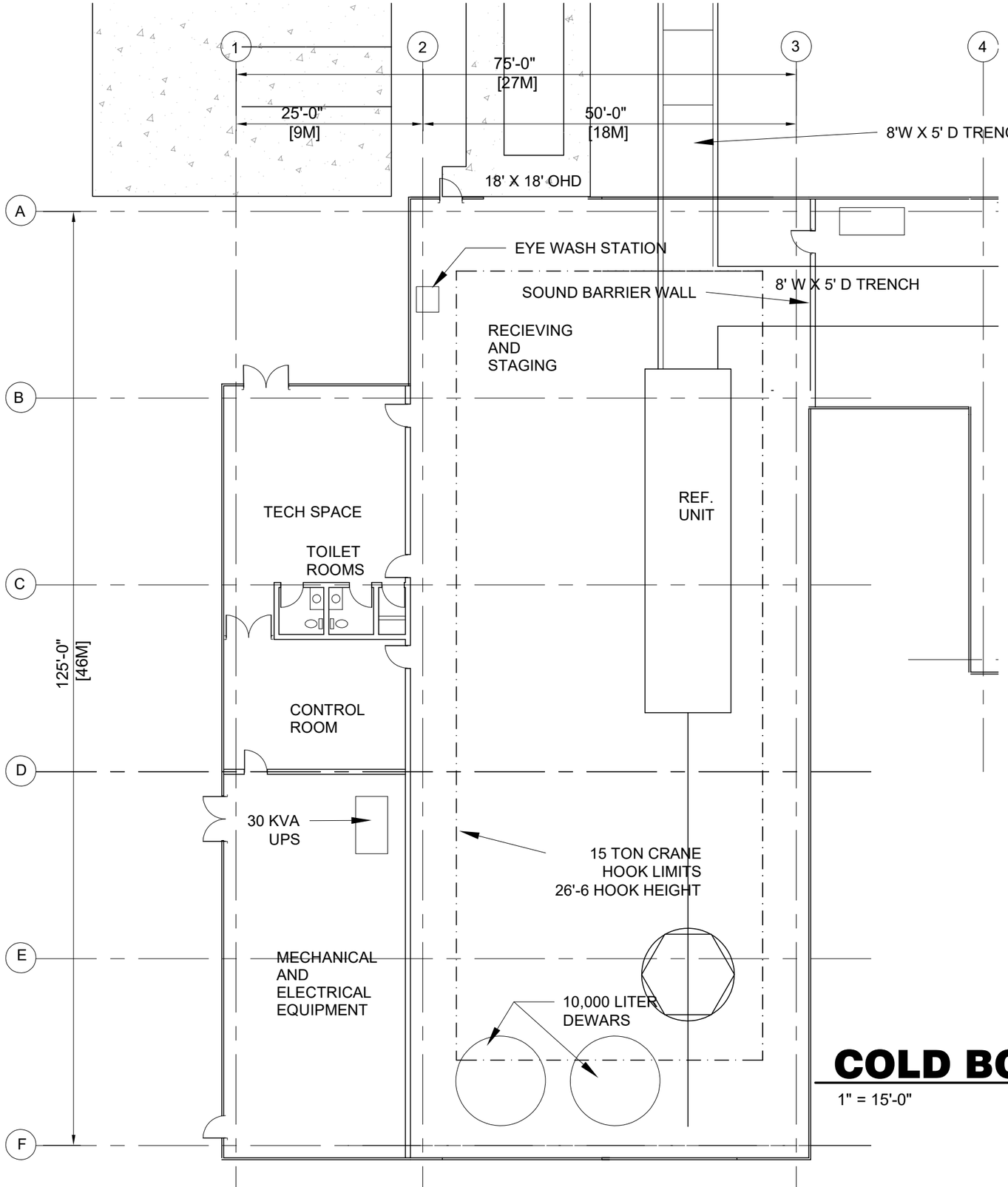
Fermilab

PIP-II

DATE
28 OCT. 2016

PROJECT NO.
4-2-3

DRAWING NO.
A-40



COLD BOX STATION PLAN

1" = 15'-0"

COLD BOX STATION

FUNCTION:	HOUSE REFRIGERATOR, CONTROL ROOM, TECH. SPACE
CONSTRUCTION:	NON PROTECTED EXPOSED STEEL TYPE II B PER IBC.
U-VALUES:	ASHRAE 90.1
EQUIPMENT ACCESS:	18' W X 18' H ROLL UP DOORS
EQUIPMENT HANDLING:	15 TON OVERHEAD BRIDGE CRANE
HVAC:	68 MIN. 78 MAX., 55% MAXIMUM HUMIDITY
MECHANICAL ROOM:	68 MIN. NO MAX.
ODH VENTILATION:	45,000 CFM LOCATED HIGH AND 10,000 LOCATED LOW
OCCUPANT VENTILATION:	N/A
CHILLED WATER:	150 GPM ALLOWANCE
ICW :	FIRE PROTECTION APPROX. 600 GPM
OCCUPANT LOAD:	10-15 DURING INSTALLATION / 4-5 NORMALLY
LIGHTING:	65FC
EMERGENCY LIGHTING:	PER NFPA 101 LIFE SAFETY CODE
EXIST SIGNS:	PER NFPA 101 LIFE SAFETY CODE
CONV RECEPT:	120 / 208 V AC
WELDING RECEP:	480V 60 AMP (QTY2)
EGRESS:	MAXIMUM TRAVEL DISTANCE 250-FT TO EXIT
SPECIAL:	ADMINISTRATION CONTROL ACCESS
EYE WASH STATIONS;	1
EXHAUST CONTROL:	ODH ABATEMENT TO BE PROVIDED
FIRE DETECTION:	MANUAL PULL STATIONS AT EXITS
FIRE NOTIFICATION:	AUDIBLE AND VISUAL DEVICES THROUGHOUT
FIRE SUPPRESSION:	AUTOMATIC SPRINKLER SYSTEM DESIGNED TO ORDINARY HAZARD GROUP II - HIGH TEMPERATURE SPRINKLERS

SCALE:
1" = 15'-0"
15 0 5 10 15 20 25 FEET

W S E PROJECT NORTH

PROTON IMPROVEMENT PLAN - II

COLD BOX STATION PLAN

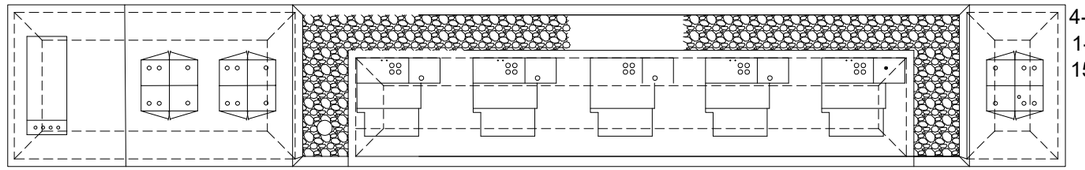
Fermilab

PIP-II

DATE
28 OCT. 2016

PROJECT NO.
4-2-3

DRAWING NO.
A-41



4- 1500 KVA 13.8KV TO 4160 V
1- 1500 KVA 13.8 TO 480V HOUSE POWER
150 KVA GENERATOR

4 5 6 7 8 9 10 11 12

200'-0"
[73M]

SWITCHBOARD

18' X 18' OHD

A

8' W X 5 ' DEEP COVERED PIPE TRENCH

COMPRESSOR STATION #1

COMPRESSOR STATION #2

COMPRESSOR STATION #3

COMPRESSOR STATION #4

RECIEVING AND STAGING

60'-0"
[22M]

25 TON CRANE HOOK LIMITS, 25'-6" HOOK HEIGHT

C.5

WARM COMPRESSOR STATION PLAN

1" = 15'-0"

WARM COMPRESSOR STATION

FUNCTION:	HOUSE FOUR CRYO COMPRESSORS
CONSTRUCTION:	NON PROTECTED EXPOSED STEEL TYPE II B PER IBC.
U-VALUES:	ASHRAE 90.1
EQUIPMENT ACCESS:	18' W X 18'H OVERHEAD ROLL UP DOOR
EQUIPMENT HANDLING:	25 TON OVERHEAH BRIDGE CRANE
HVAC:	SUMMER AMBIENT VENTILATION ONLY, NO MAXIMUM HUMIDITY WINTER 65F, NO MINIMUM HUMIDITY
PURGE VENTILATION:	50,000 CFM FOR ODH CONDITION
OCCUPANT VENTILATION:	N/A
LCW:	NONE
PROCESS COOLING:	1400 GPM PROCESS COOLING WATER 95° (PWC) FOR COMPRESSORS COOLING
ICW:	FOR FIRE PROTECTION

OCCUPANT LOAD:	10 - 15 DURING INSTALLATION / 4-5 FOR START UP AND OPERATIONS (20% OF TIME)
LIGHTING:	65FC
EMERGENCY LIGHTING:	PER NFPA 101 LIFE SAFETY CODE
EXIST SIGNS:	PER NFPA 101 LIFE SAFETY CODE
CONV RECEPT:	120 / 208 V AC
WELDING RECEP:	480V 60 AMP (QTY 4)
EGRESS:	MAXIMUM TRAVEL DISTANCE 250-FT TO EXIT
SPECIAL:	ADMINISTRATION CONTROL ACCESS PROVIDED; EYEWASH STATIONS
FIRE DETECTION:	MANUAL PULL STATIONS AT EXITS
FIRE NOTIFICATION:	AUDIBLE AND VISUAL DEVICES THROUGHOUT
FIRE SUPPRESSION:	AUTOMATIC SPRINKLER SYSTEM DESIGNED TO ORDINARY HAZARD GROUP II - HIGH TEMPERATURE SPRINKLERS

SCALE:
1" = 15'-0"
15 0 5 10 15 20 25 FEET

S W E PROJECT NORTH

PROTON IMPROVEMENT PLAN - II

WARM COMPRESSOR STATION PLAN

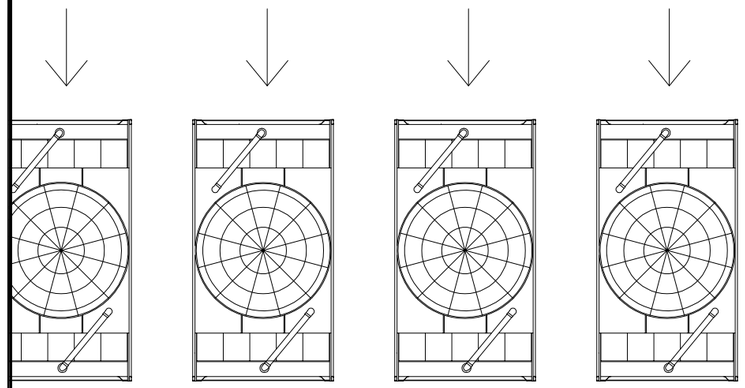
Fermilab

PIP-II

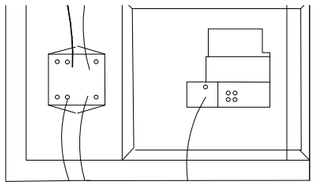
DATE
28 OCT. 2016

PROJECT NO.
4-2-3

DRAWING NO.
A-42

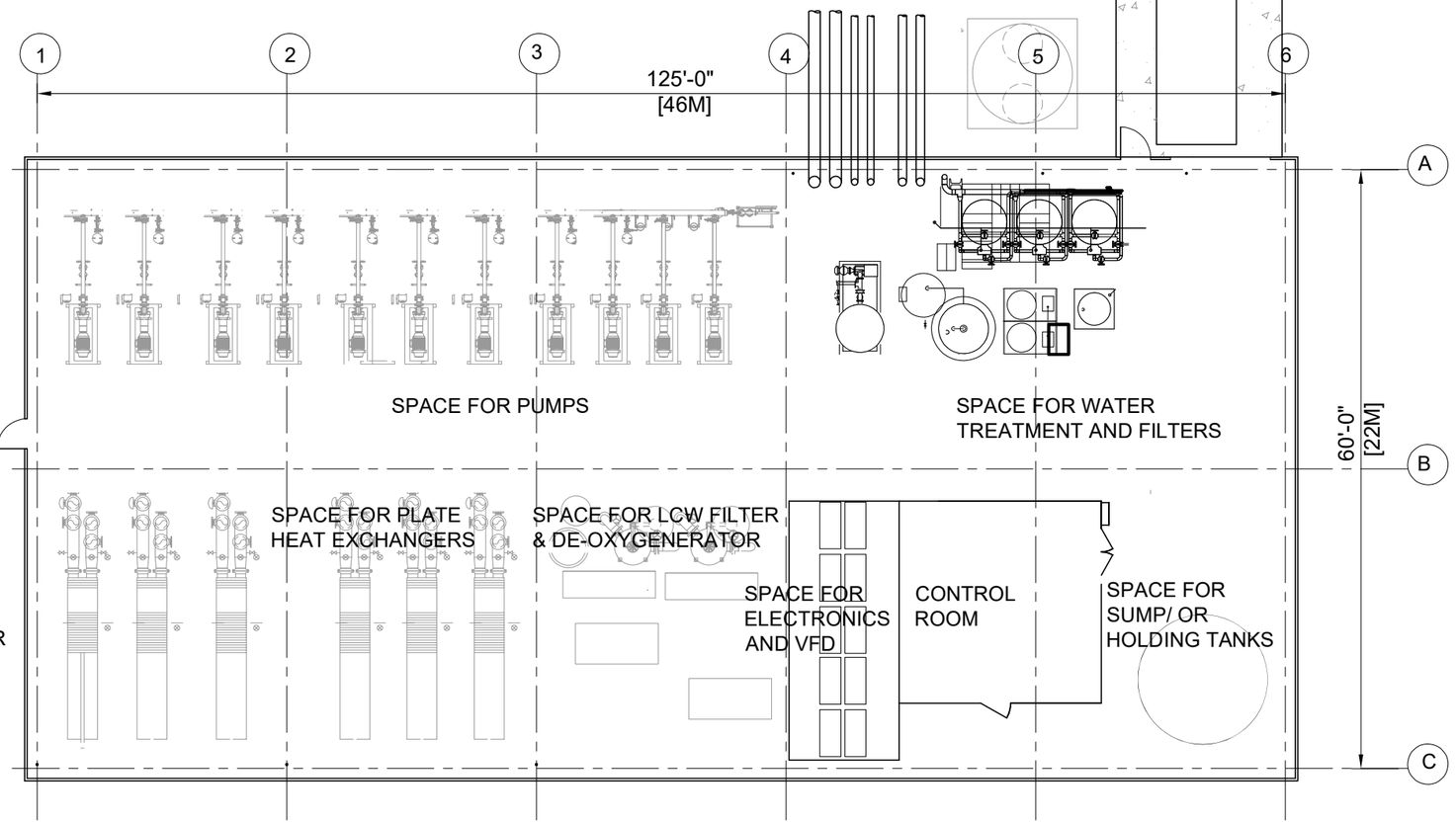


COOLING TOWERS
(EVAPORATIVE FLUID
COOLERS)



1500 KVA TRANSFORMER
W/ OIL CONTAINMENT

PIPING TO GALLERY &
CRYO BLDG
PIPING FROM CUB



AIRCOOLED
CHILLERS & BUFFER
TANK (GLYCOL CHW)
WITH ECONOMIZER
FOR CW MODE's
HEAT-LOAD-TO-AIR

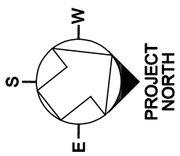
PIP2 UTILITY BUILDING (PUB)

FUNCTION:	HOUSE HEAT EXCHANGERS, PUMPS AND ASSOC EQUIP
COSMIC SHIELDING:	NONE
CONSTRUCTION:	NON PROTECTED EXPOSED STEEL TYPE II B PER IBC. STRUCTURE TO BE DESIGNED FOR FUTURE MEZZANINE TO HOUSE ADDITIONAL MECHANICAL EQUIPMENT.
U-VALUES:	ASHRAE 90.1
EQUIPMENT ACCESS:	OVERHEAD ROLL UP DOORS
EQUIPMENT HANDLING:	FORK LIFT. STRUCTURE TO BE DESIGNED FOR 1 TON HOIST FROM ANY ROOF BEAM.
HVAC:	SUMMER AMBIENT VENTILATION ONLY, NO MAXIMUM HUMIDITY; WINTER 65F, NO MINIMUM HUMIDITY
OCCUPANT VENTILATION:	N/A
LCW:	NONE
CHILLED WATER:	NONE
PROCESS COOLING:	NONE
ICW:	FIRE PROTECTION APPROX. 600 GPM
OCCUPANT LOAD:	4 TO 5 DURING MAINTENANCE
LIGHTING:	65FC
EMERGENCY LIGHTING:	PER NFPA 101 LIFE SAFETY CODE
EXIST SIGNS:	PER NFPA 101 LIFE SAFETY CODE
CONV RECEPT:	120 / 208 V AC
WELDING RECEP:	480V 60 AMP. (QTY. 2)
EGRESS:	MAXIMUM TRAVEL DISTANCE 250-FT TO EXIT
SPECIAL:	ADMINISTRATION CONTROL ACCESS
FIRE DETECTION:	MANUAL PULL STATIONS AT EXITS
FIRE NOTIFICATION:	AUDIBLE AND VISUAL DEVICES THROUGHOUT
FIRE SUPPRESSION:	AUTOMATIC SPRINKLER SYSTEM DESIGNED TO ORDINARY HAZARD GROUP II - HIGH TEMPERATURE SPRINKLERS

PIP II UTILITY BUILDING (PUB) PLAN

1"=15'-0"

SCALE:
1" = 15'-0"
15 0 5 10 15 20 25 FEET



PROTON IMPROVEMENT PLAN - II

PIP II UTILITY BUILDING

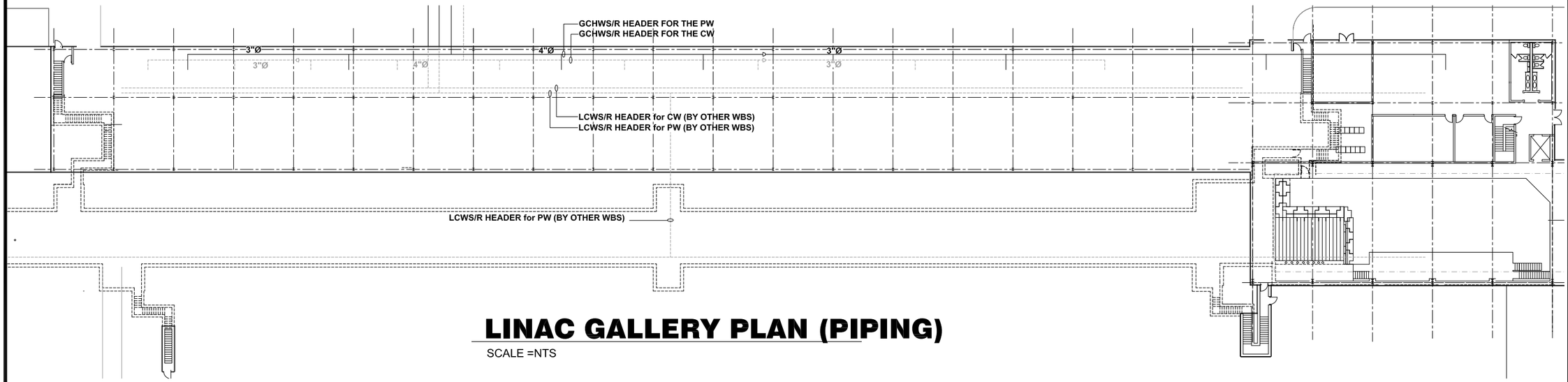
Fermilab

PIP-II

DATE
28 OCT. 2016

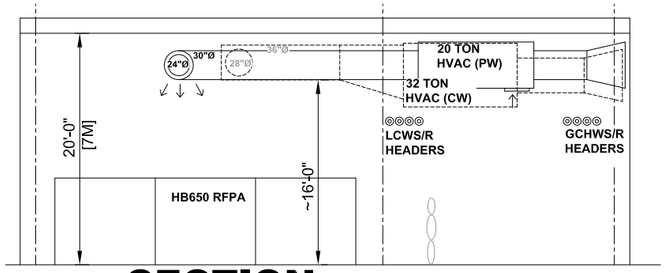
PROJECT NO.
4-2-3

DRAWING NO.
A-43



LINAC GALLERY PLAN (PIPING)

SCALE =NTS



SECTION

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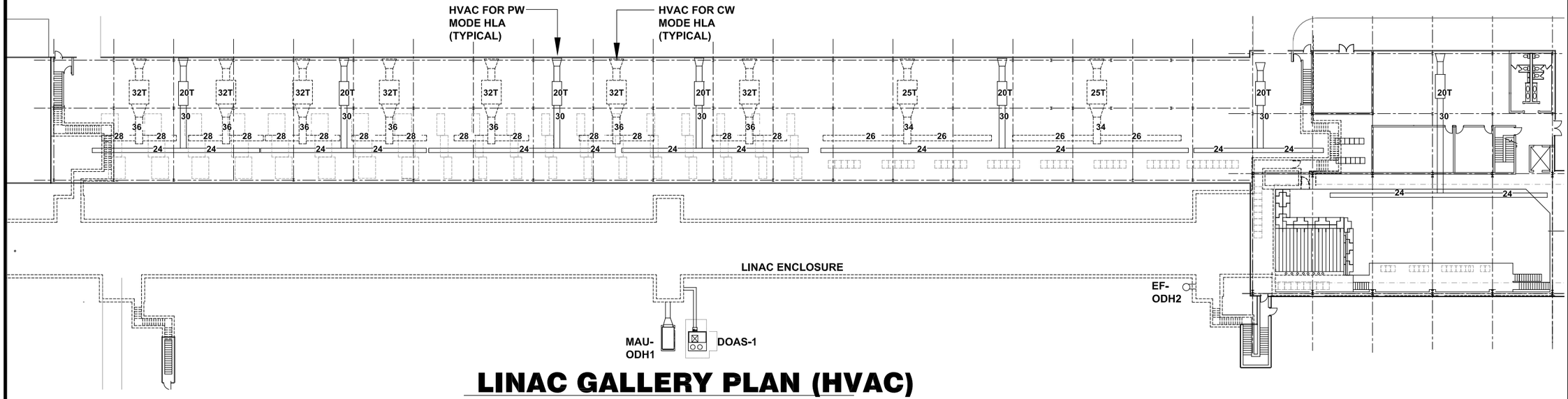


LINAC GALLERY PLAN (HVAC)

SCALE = NTS

SCALE:

PROJECT NORTH

PROTON IMPROVEMENT PLAN

HVAC - CONCEPTUAL DESIGN BASIS

Fermilab

PIP-II

DATE

01 SEPT. 2016

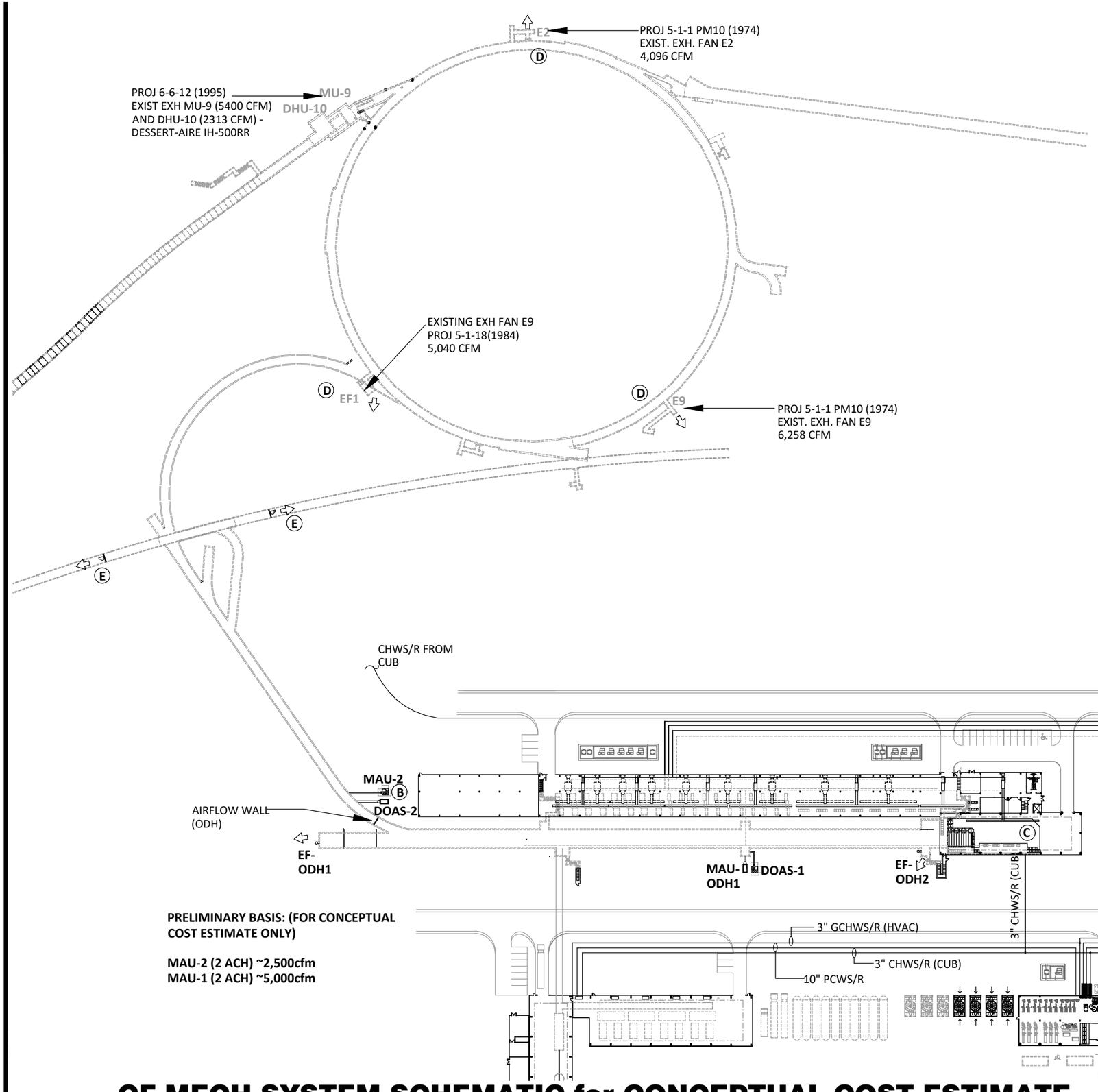
PROJECT NO.

4-2-3

DRAWING NO.

M-1

Mar 03, 2017 - 11:56am M:\Active Projects\#2\312 - Conceptual Design\Drawings\Emils drawings\M1 M2.dwg



PRELIMINARY BASIS: (FOR CONCEPTUAL COST ESTIMATE ONLY)

MAU-2 (2 ACH) ~2,500cfm
MAU-1 (2 ACH) ~5,000cfm

CF MECH SYSTEM SCHEMATIC for CONCEPTUAL COST ESTIMATE

SCALE ?

(A) LAYOUT SHOWN IS FOR CONCEPTUAL ESTIMATE ONLY (NOT TO BE USE FOR INSTALLATION OR DESIGN)

(B) LOCATIONS OF VENTILATION SYSTEM FOR TRANSFER TUNNEL ARE PRELIMINARY (FOR CONCEPTUAL COST ESTIMATE ONLY). ACTUAL LOCATION SHALL BE FINALIZED DURING DESIGN STAGE

(C) FRONT END HIGH BAY ODH VENTILATION IS ROOF EXHAUST FANS AND WALL LOUVERS

(D) EXISTING VENTILATION ASSESSMENT AND REBALANCING ON BOOSTER TUNNEL

(E) EXHAUST FAN FOR TUNNEL

(F) OTHER UTILITIES (GAS, SAN, DWS, ICW) ARE NOT SHOWN. REFER TO SITE UTILITY DRAWING)

CHW=	**CHILLED WATER FROM CUB ~43°F**
GCHW=	**GLYCOL CHILLED WATER, 46°F**
TW=	**COOLING TOWER WATER/ WITH GLYCOL 83°F**
PCW=	**PROCESS COOLING WATER TO CRYO 95°F**
LCW=	**LOW CONDUCTIVITY WATER 86°F**
PW=	**PULSE WAVE MODE OPERATION OF THE LINAC**
CW=	**CONTINUOUS WAVE MODE OPERATION OF THE LINAC**
HLA=	**HEAT LOAD TO AIR**
DX=	**DIRECT EXPANSION/ REFRIGERANT BASED SYSTEM**
DOAS=	**DEDICATED OUTDOOR AIR SYSTEM (DX)**
MAU=	**MAKE-UP AIR UNIT (GAS HEAT)**
ACH=	**AIR CHANGES PER HOUR**

SCALE:

W S E PROJECT NORTH

PROTON IMPROVEMENT PLAN - II

CF MECHANICAL - CONCEPTUAL DESIGN BASIS

Fermilab

PIP-II

DATE

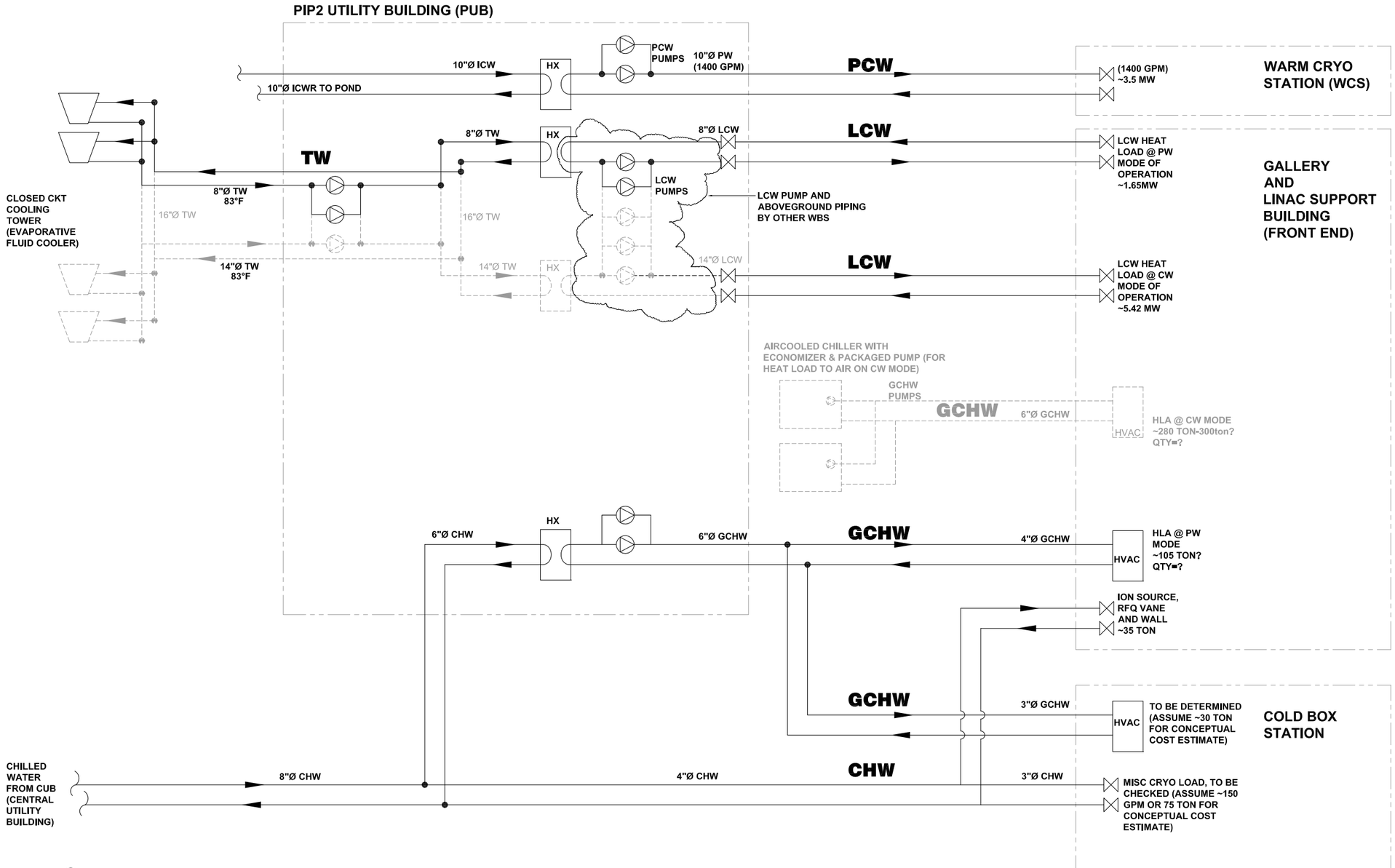
28 OCT. 2016

PROJECT NO.

4-2-3

DRAWING NO.

M-2



Ⓐ PIPE SIZES ARE BASED ON 10°F DELTA T AND MAY CHANGE BASED ON THE FINAL SYSTEM DELTA T
Ⓑ QUANTITIES OF EQUIPMENT SHOWN ARE SCHEMATIC AND DOES NOT REFLECT THE FINAL EQUIPMENT COUNT
Ⓒ BLDG HVAC ARE PRELIMINARY ESTIMATES
Ⓓ NOT ALL ACCESSORIES ARE SHOWN (TOWER WATER SPRAY , MAKE UP, BLOWDOWN, WATER TREATMENT, SOFTENERS, SANDFILTERS, HOLDING TANKS, BRINE TANK, LCW DEOXYGENERATOR, LCW FULL FLOW FILTERS, ETC)
Ⓔ THIS DOES NOT INCLUDE THE SYSTEM FOR COOLING THE FUTURE (4) HB650 CRYOMODULE

CHW=	CHILLED WATER FROM CUB ~43°F
GCHW=	GLYCOL CHILLED WATER, 46°F
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HLA=	HEAT LAOD TO AIR
DX=	DIRECT EXPANSION/ REFRIGERANT BASED SYSTEM
ICW=	INDUSTRIAL COOLING WATER (CASEYS POND WATER)
- - - -	EQUIPMENT ASSOCIATED WITH CW MODE OPERATION

CF COOLING HEAT REJECTION CONCEPT

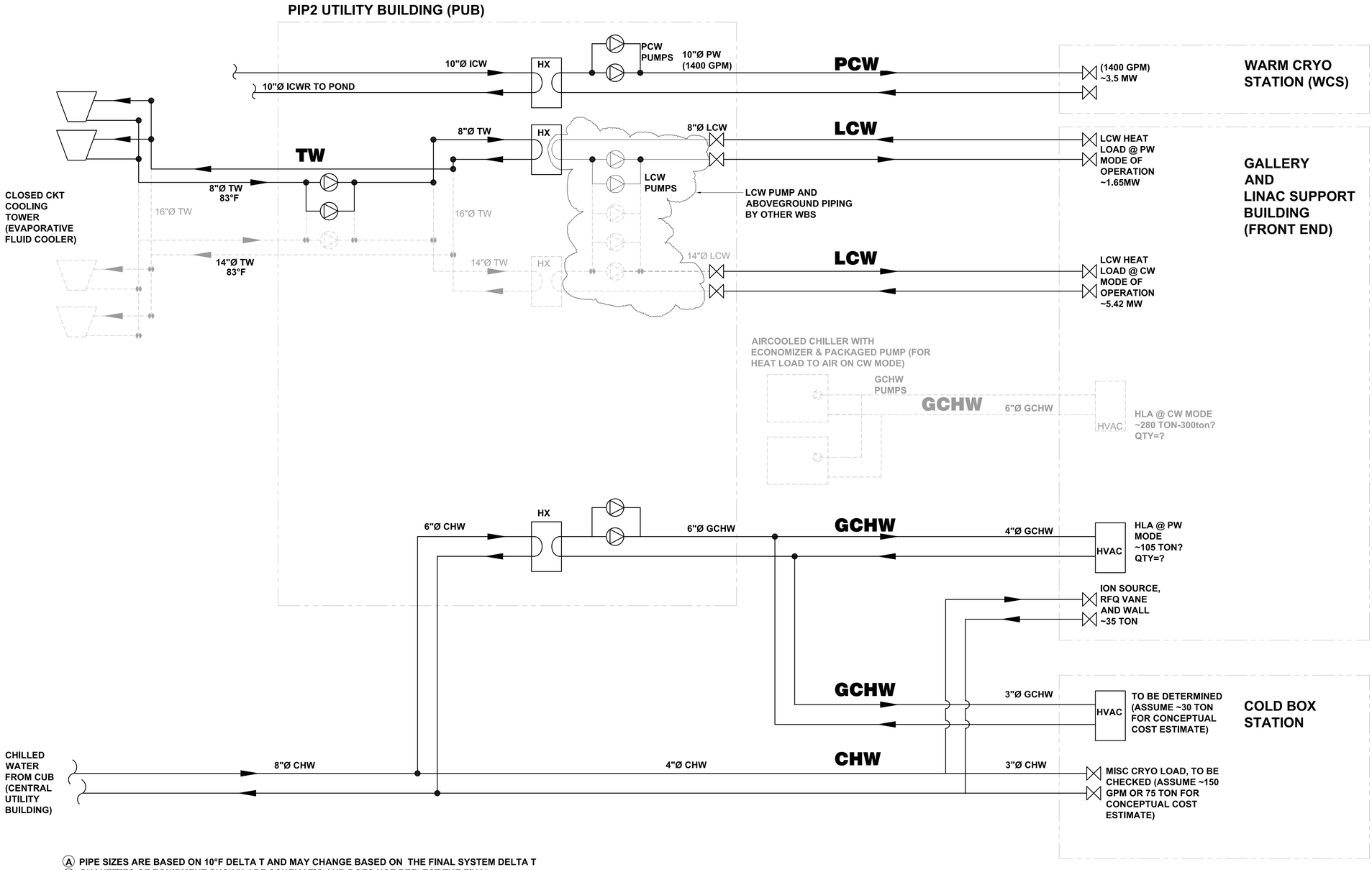
(FOR CONCEPTUAL COST ESTIMATE ONLY)

SCALE: 1" = 60'-0"
SCALE 60 0 60 120 180 220 280 FEET
S W E PROJECT NORTH

PROTON IMPROVEMENT PLAN - II
COOLING HEAT REJECTION CONCEPT

CDR
Fermilab
PIP-II
DATE
27 JAN 2017
PROJECT NO.
4-2-3
DRAWING NO.
M-3

Mar 03, 2017 - 8:19am M:\Active Projects\4\2\302 - Conceptual Design\Drawings\Emils drawings\M3 Cooling Concept Schematic JAN272017.dwg



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(B) QUANTITIES OF EQUIPMENT SHOWN ARE SCHEMATIC AND DOES NOT REFLECT THE FINAL EQUIPMENT COUNT
(C) BLDG HVAC ARE PRELIMINARY ESTIMATES
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CF COOLING HEAT REJECTION CONCEPT

(FOR CONCEPTUAL COST ESTIMATE ONLY)

SCALE: 1" = 60'-0"
60 0 60 120 180 220 280 FEET SCALE

PROJECT NORTH

PROTON IMPROVEMENT PLAN - II

COOLING HEAT REJECTION CONCEPT

CDR

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DATE

27 JAN 2017

PROJECT NO.

4-2-3

DRAWING NO.

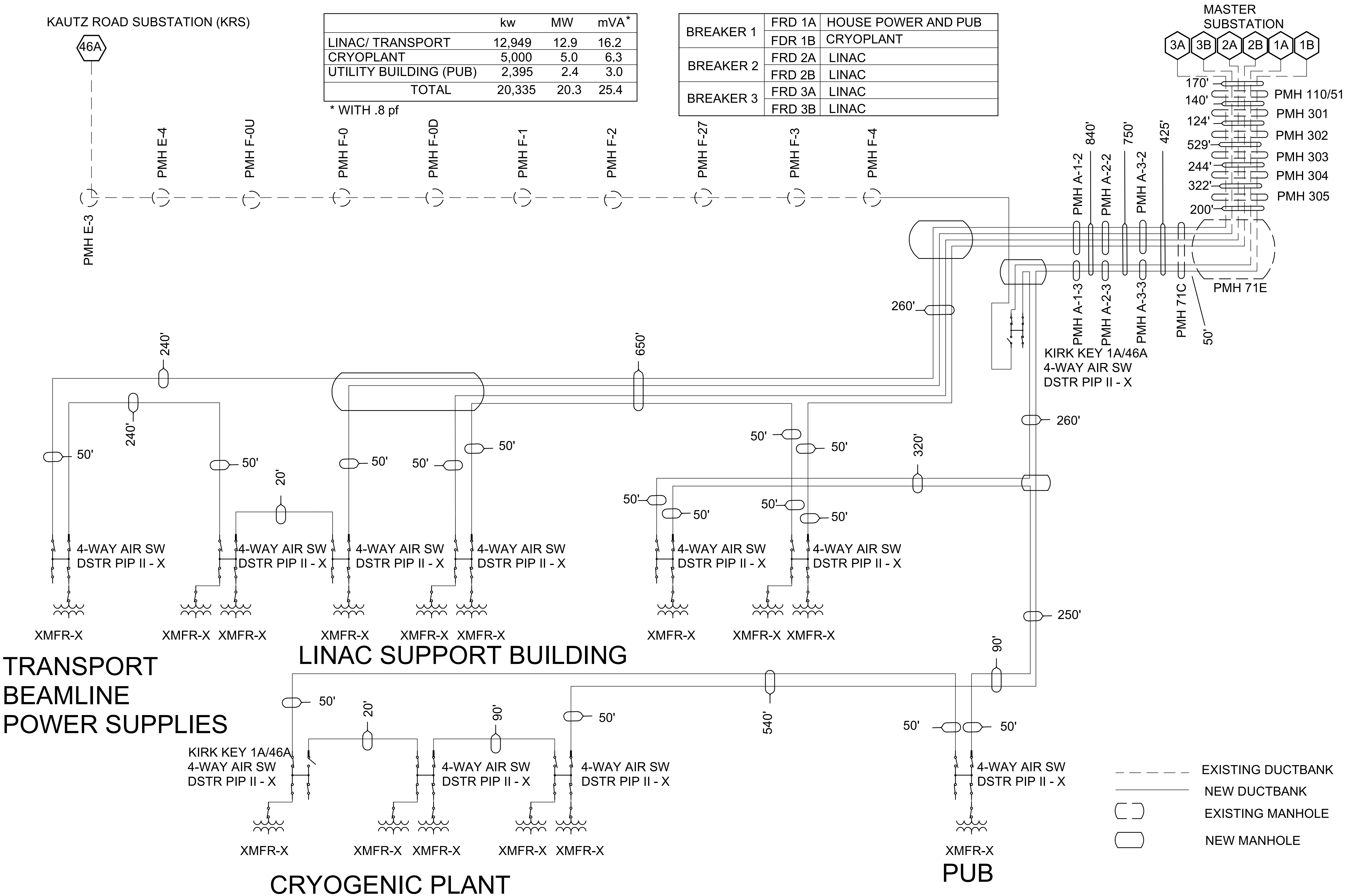
M-3

Jan 27, 2017 - 10:48am Y:\FESS_ENG\Active Projects\4\2\3\2 - Conceptual Design\Drawings\Emils drawings\M3 Cooling Concept Schematic JAN272017.dwg

	kw	MW	mVA*
LINAC/ TRANSPORT	12,949	12.9	16.2
CRYOPLANT	5,000	5.0	6.3
UTILITY BUILDING (PUB)	2,395	2.4	3.0
TOTAL	20,335	20.3	25.4

* WITH .8 pf

BREAKER 1	FRD 1A	HOUSE POWER AND PUB
	FDR 1B	CRYOPLANT
BREAKER 2	FRD 2A	LINAC
	FRD 2B	LINAC
BREAKER 3	FRD 3A	LINAC
	FRD 3B	LINAC



KAUTZ ROAD SUBSTATION (KRS)
46A
MASTER SUBSTATION
3A 3B 2A 2B 1A 1B
PMH E-3
PMH E-4
PMH F-0U
PMH F-0
PMH F-0D
PMH F-1
PMH F-2
PMH F-27
PMH F-3
PMH F-4
PMH 110/51
PMH 301
PMH 302
PMH 303
PMH 304
PMH 305
170'
140'
124'
529'
244'
322'
200'
PMH A-1-2
PMH A-2-2
PMH A-3-2
840'
750'
425'
PMH A-1-3
PMH A-2-3
PMH A-3-3
PMH 71C
PMH 71E
50'
260'
KIRK KEY 1A/46A
4-WAY AIR SW
DSTR PIP II - X
240'
650'
50'
20'
320'
4-WAY AIR SW
DSTR PIP II - X
XMFR-X
TRANSPORT
BEAMLINE
POWER SUPPLIES
LINAC SUPPORT BUILDING
250'
90'
540'
CRYOGENIC PLANT
PUB
EXISTING DUCTBANK
NEW DUCTBANK
EXISTING MANHOLE
NEW MANHOLE

POWER SINGLE LINE DIAGRAM

NOT TO SCALE

SCALE:

PROTON IMPROVEMENT PLAN - II

POWER SINGLE LINE DIAGRAM

Fermilab

PIP-II

DATE

28 OCT. 2016

PROJECT NO.

4-2-3

DRAWING NO.

E-1