Fermilab

Managed by Fermi Research Alliance, LLC for the U.S. Department of Energy Office of Science

Conceptual Design and Cost Estimates for SBN Near and Far Detector Facilities

S. Dixon

Short Baseline Neutrino Meeting

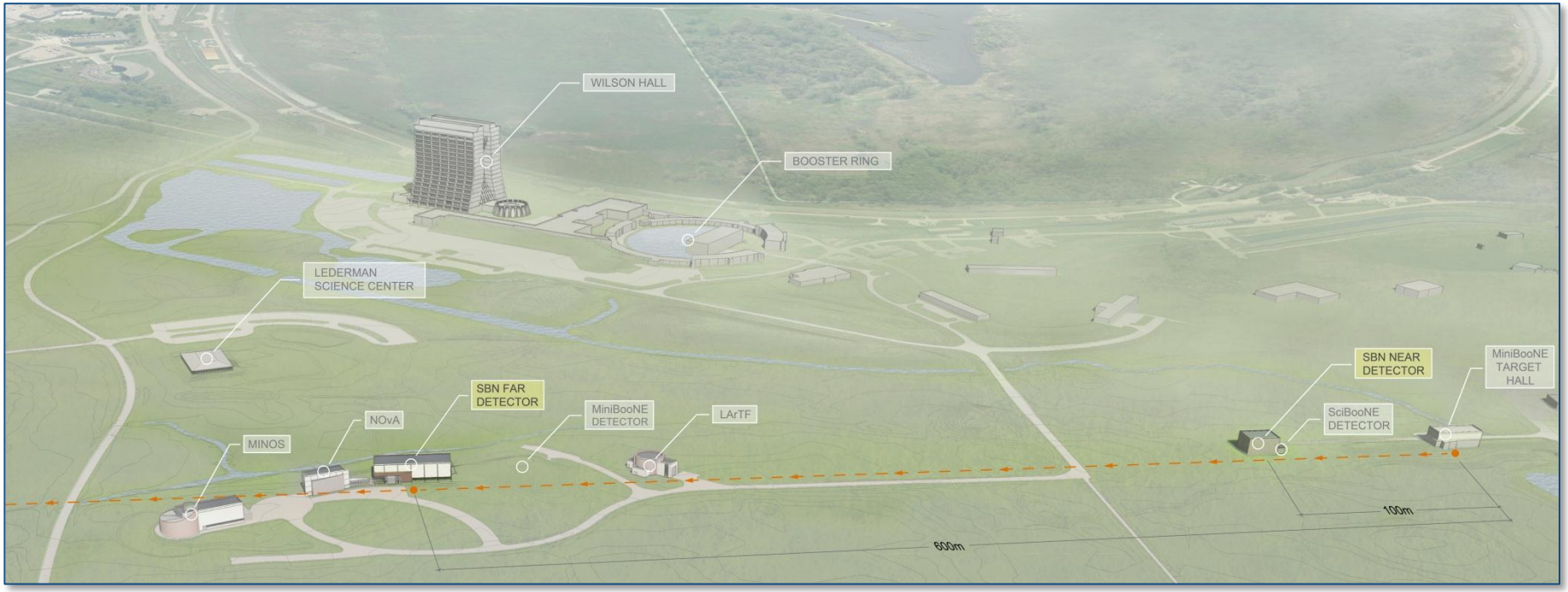
26 September 2014

Agenda

- Near Detector Building
- Far Detector Building
- What's Next

Location Plan

Aerial View from West



Near Detector Building

- Near Detector Building
  - Location
  - Background
  - Cost Estimate
  - Drawings
  - Changes/Modifications

Near Detector Site Location

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Near Detector Site Location

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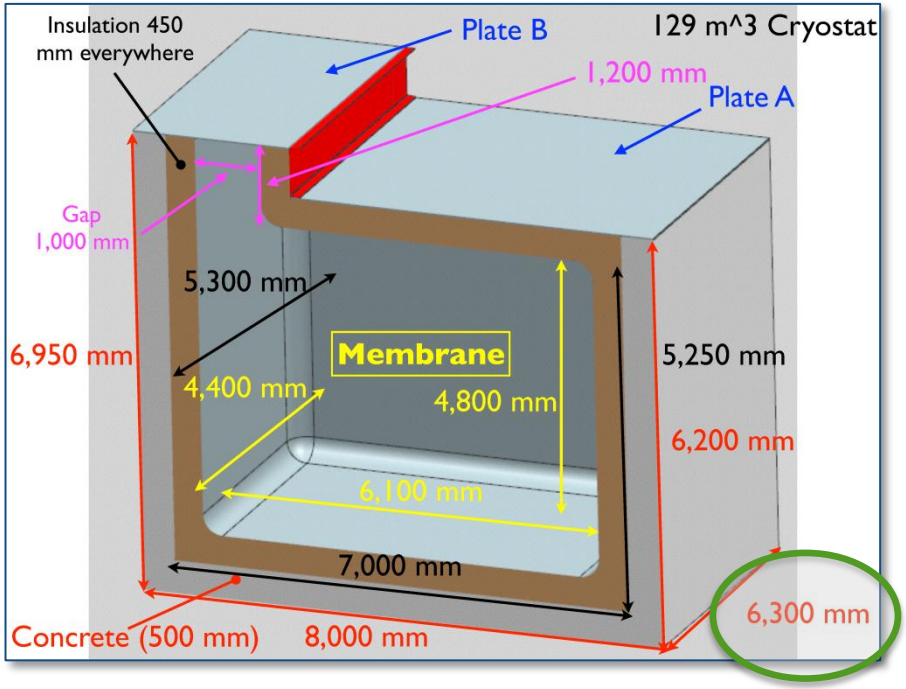
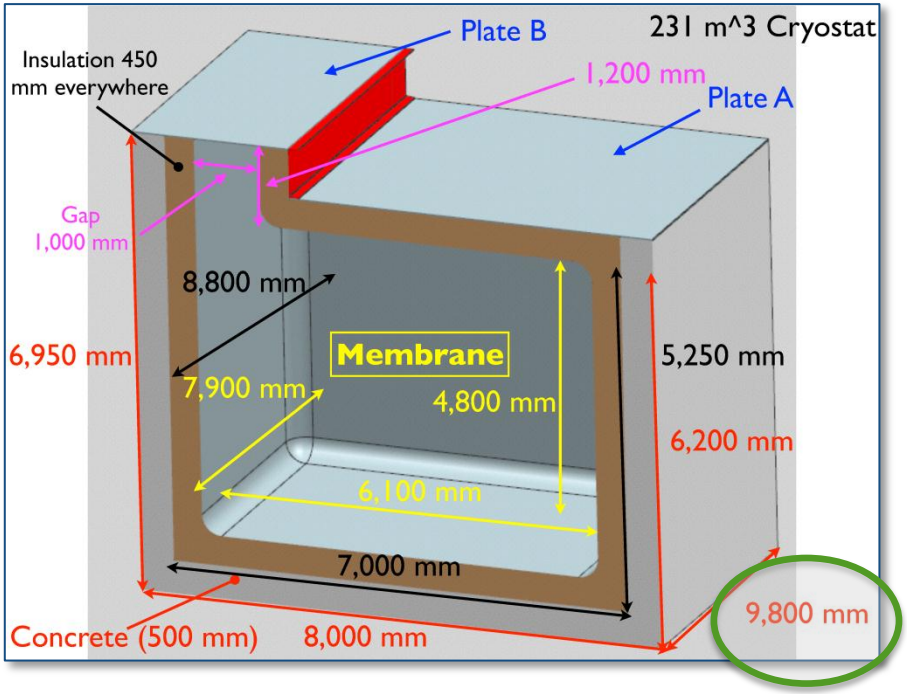
Near Detector Site- SciBooNE Construction Photos

Near Detector - Requirements



129m3 Version



231m3 Version

From D. Montanari

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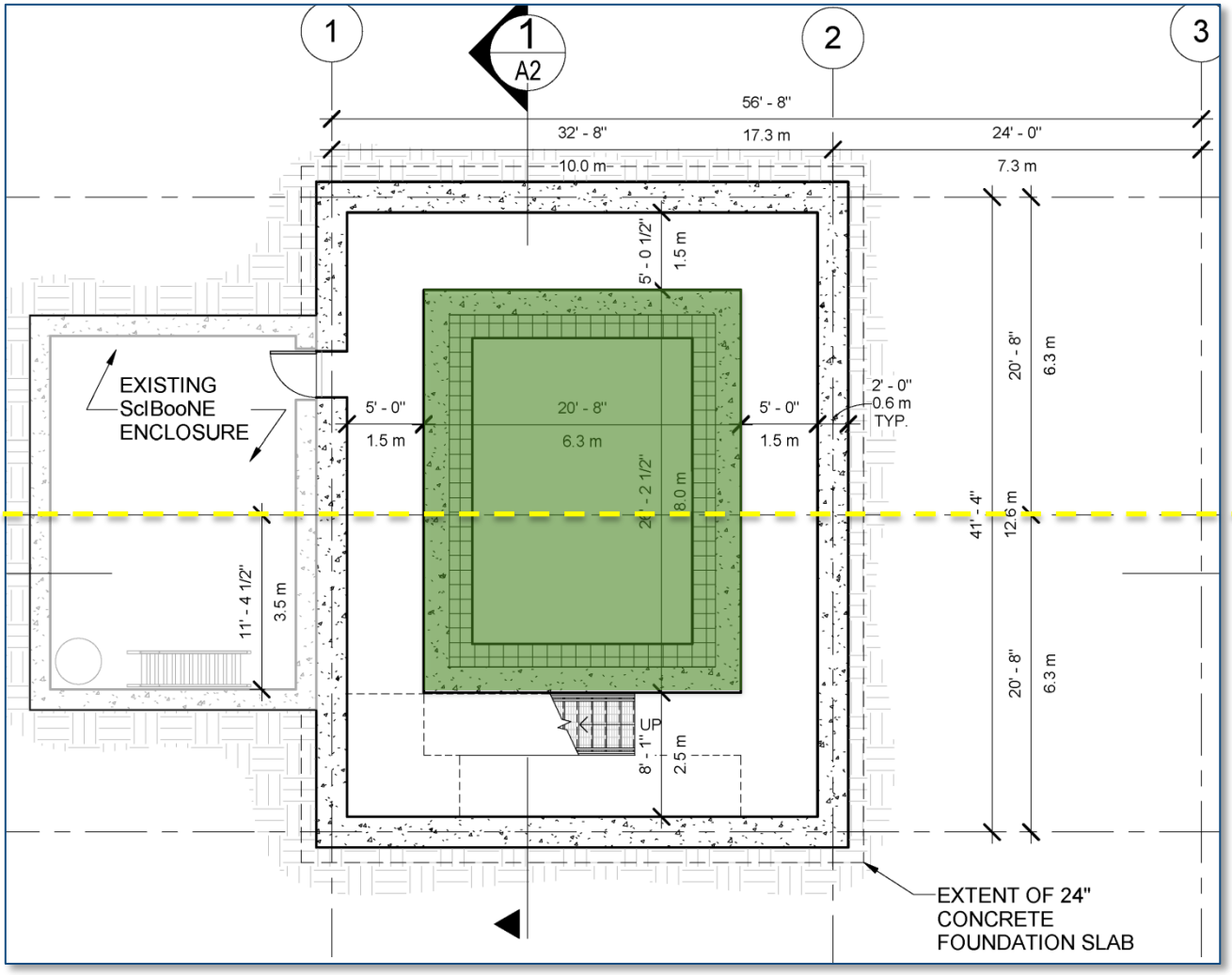
Design/Cost Estimate Process – Target: $3.5m

- July 2014 Design Refined – 2 designs at 2 locations
- *August 2014 - External Estimate*
  - *129m3 Version - $4.3m (total project cost)*
  - *231m3 Version - $5.1m (total project cost)*
- *Scope Reductions – focused on 129m3 version*
  - *Eliminated additional loading dock bay*
  - *Removed toilets/utilities*
  - *Removed cryostat concrete*
  - *Reduced siding cost*
  - *Onsite disposal of excess spoils*
  - *Moved overhead crane from Base Scope to Scope Contingency*
- *August 2014 - External Estimate - $3.5m (total project cost)*

Near Detector Building



Plan at Detector Level

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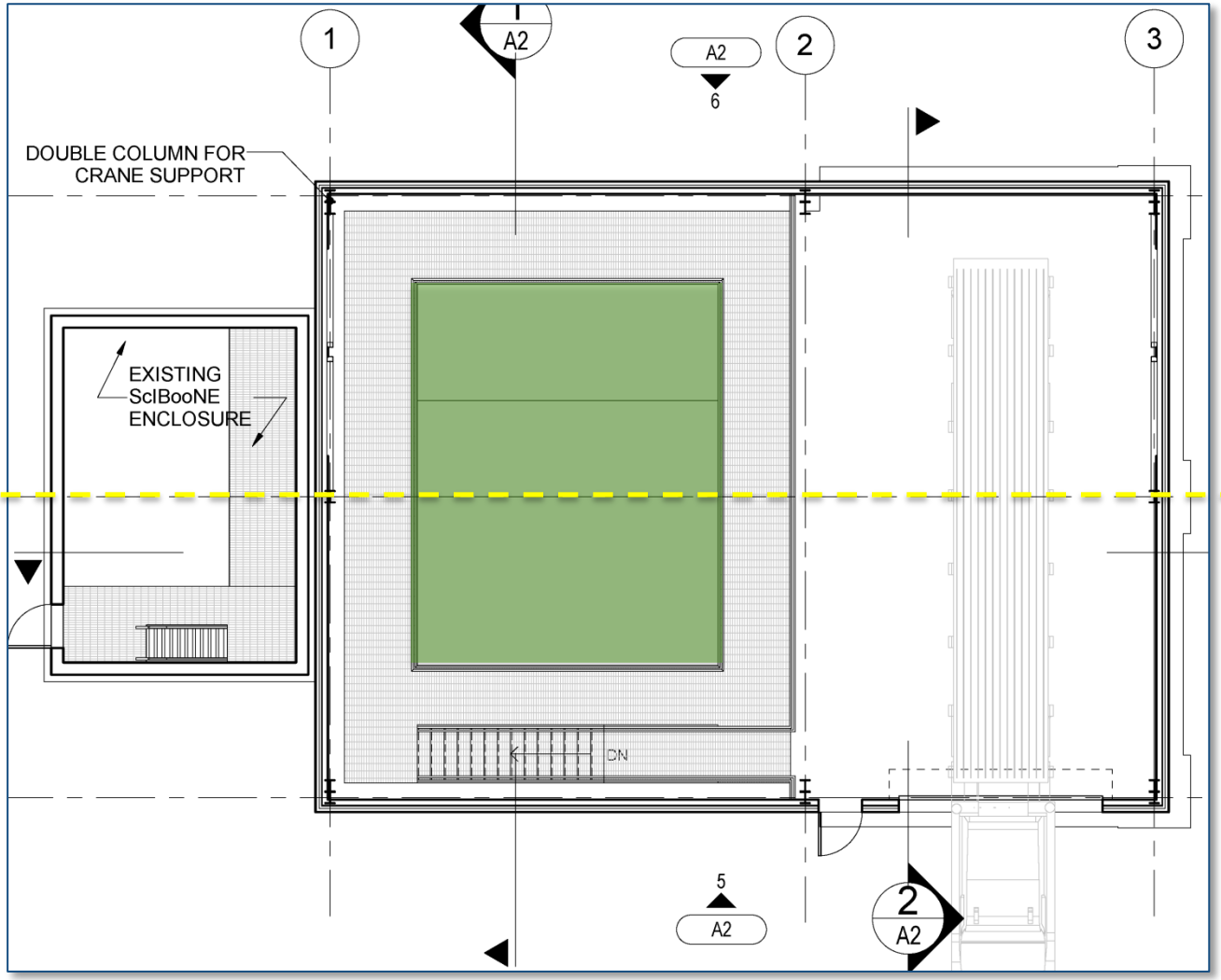
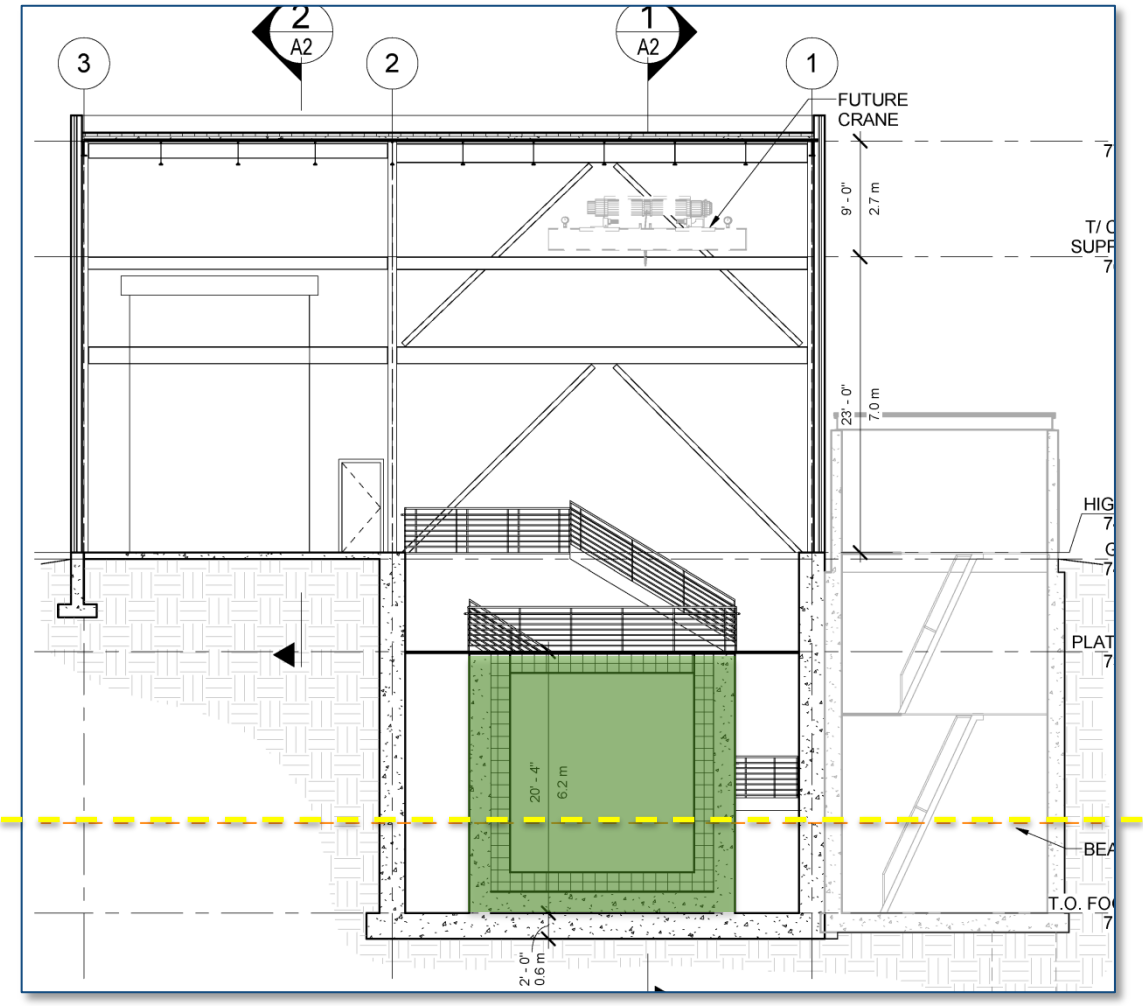
Near Detector Building



Plan at Grade Level

Fermilab

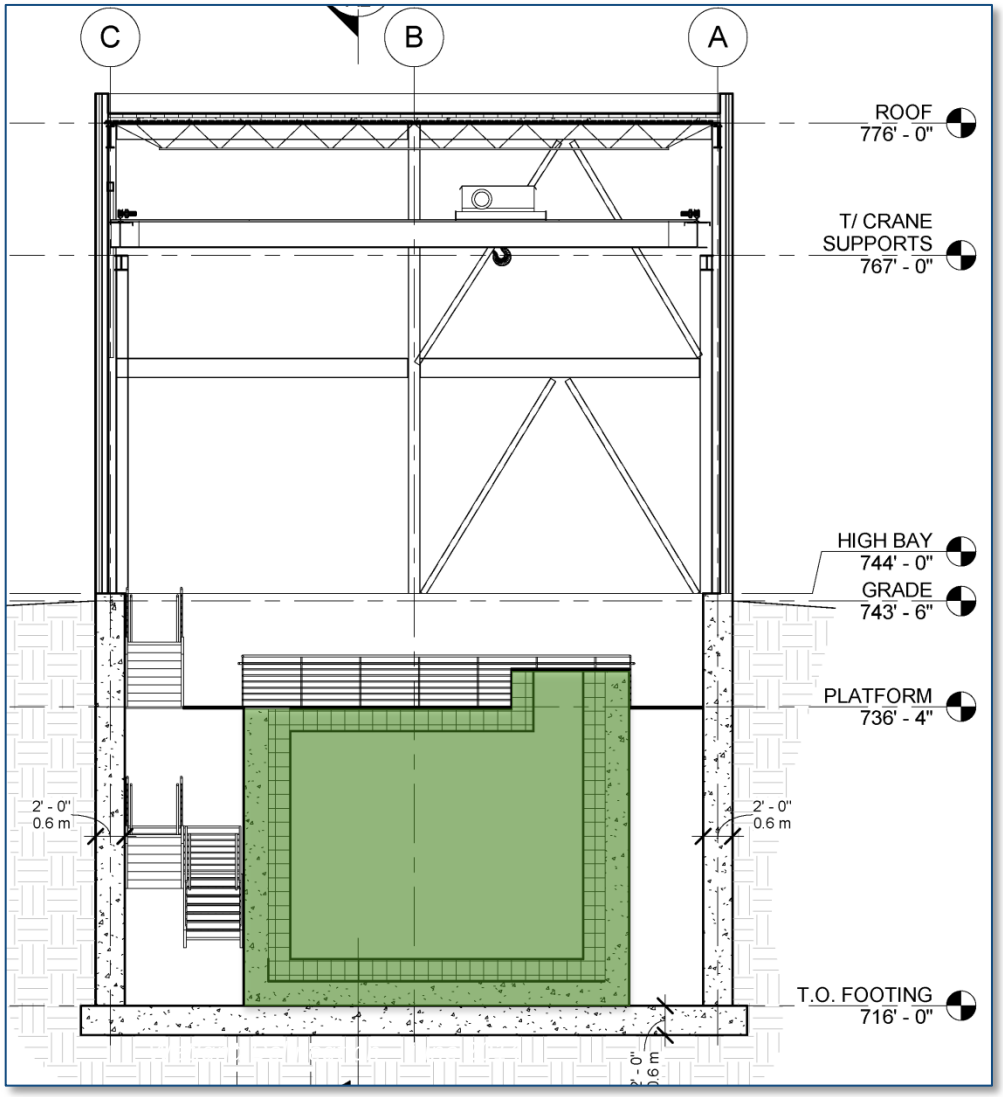
Near Detector Building



Section

Fermilab

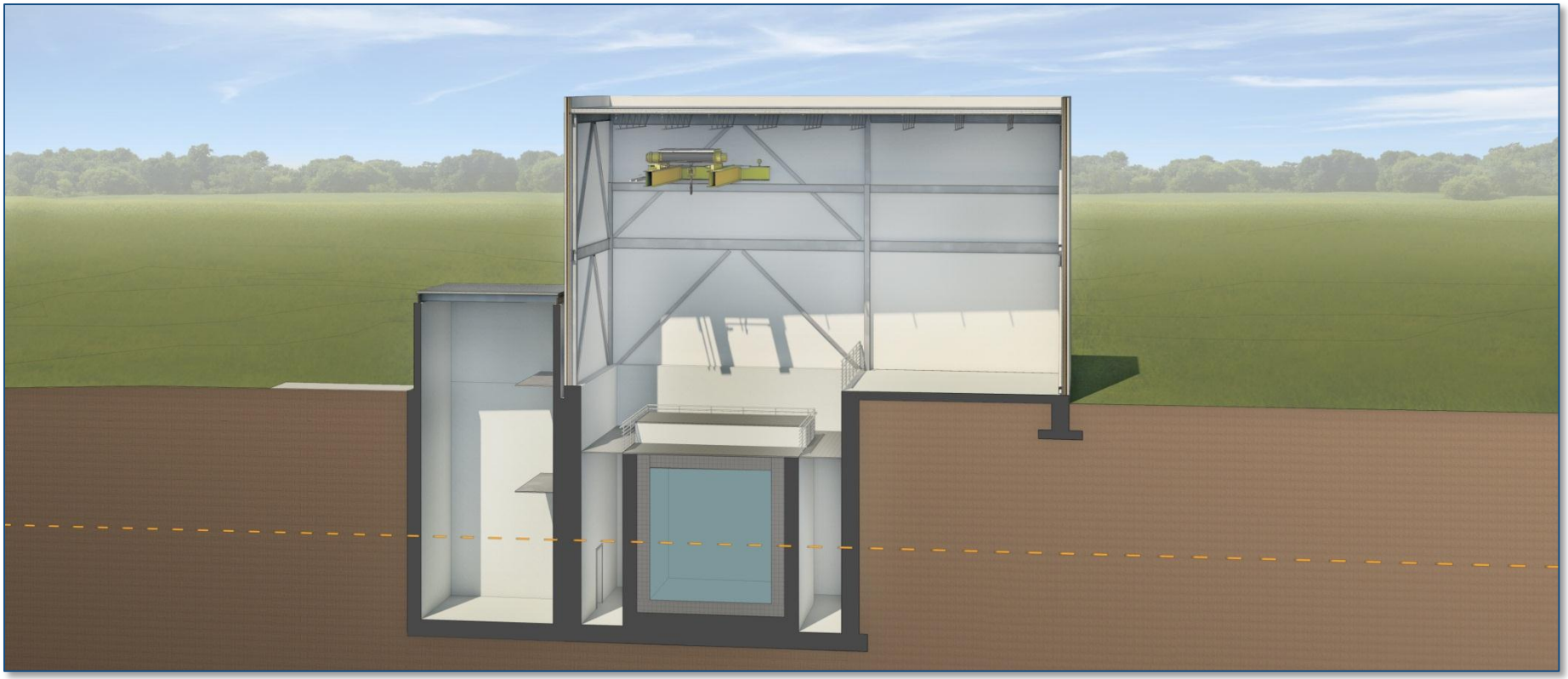
Near Detector Building



Section

Fermilab

Near Detector Building

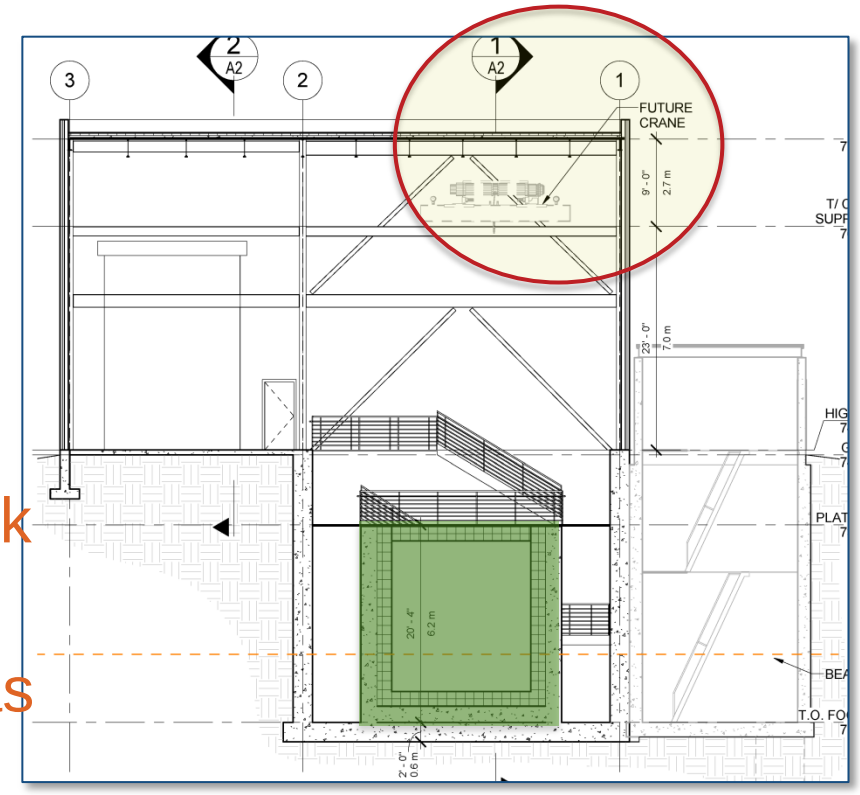


Section/Perspective Looking West

Near Detector Building – Potential Changes

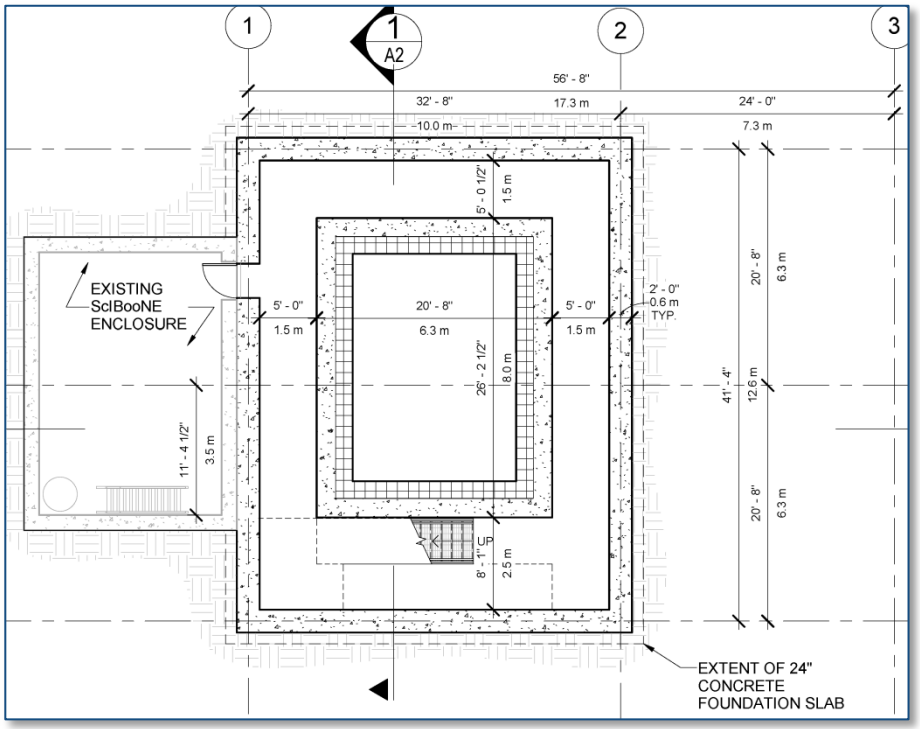
Overhead Crane

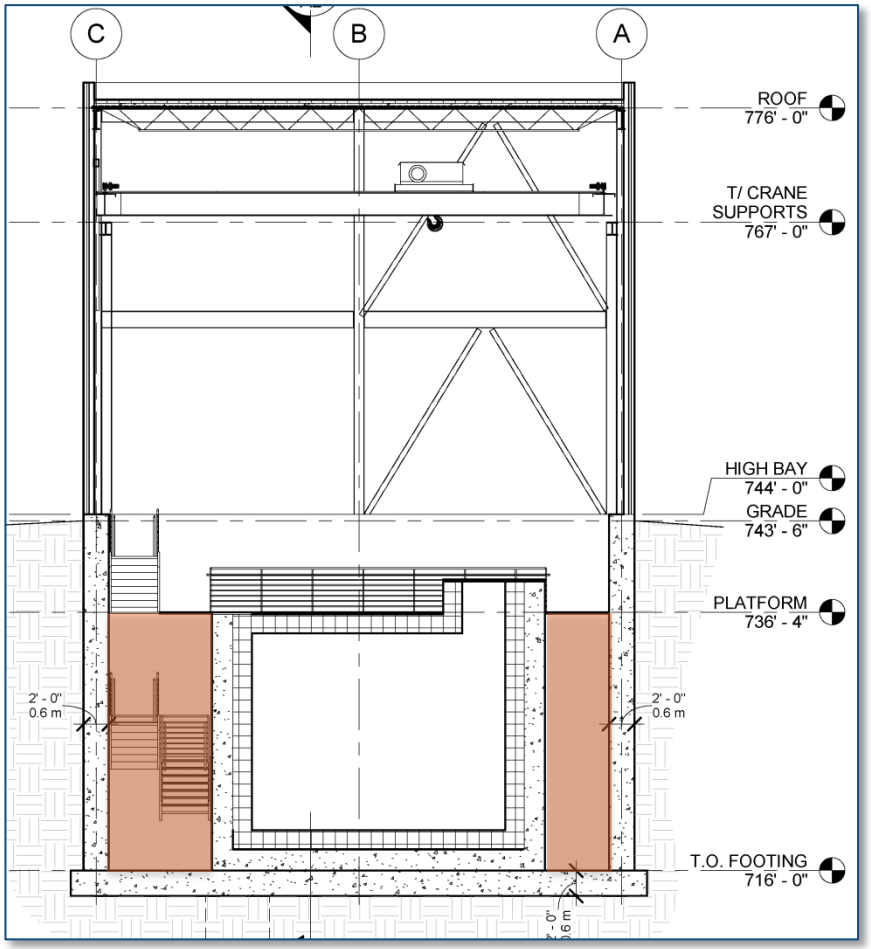
- Base scope does not include the crane, only the structure capable of supporting a crane;
- Recognize that a crane is needed for installation;
- Cost for 10 ton crane is ~$140k
- Project Plan (section 2.1 on page 12) identifies the crane as one of the highest priorities;



Near Detector Building – Potential Changes

Reduced Size of Lower Level





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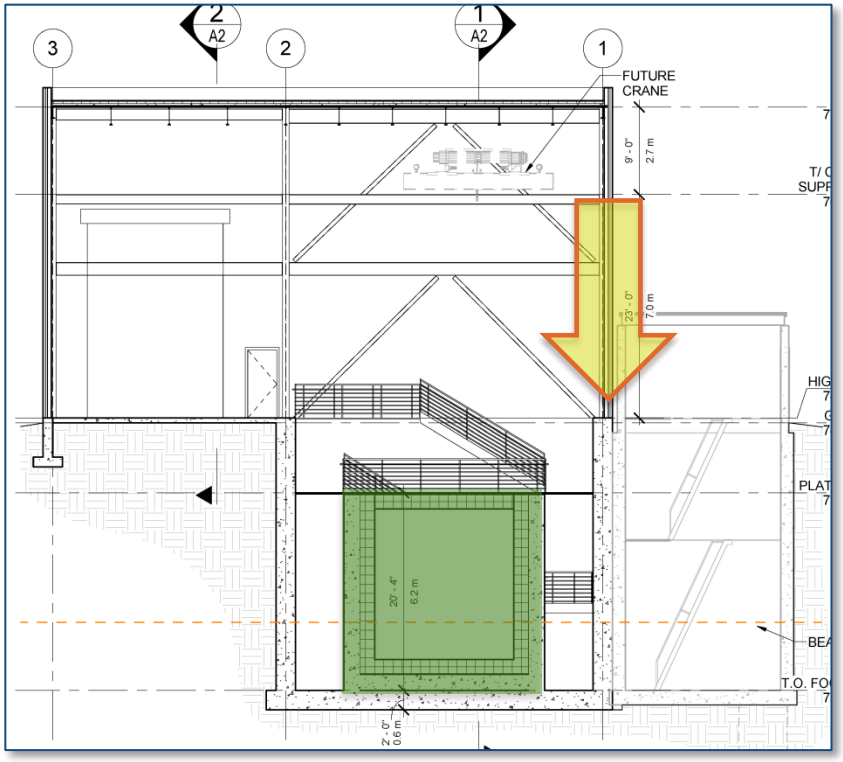
Near Detector Building – Potential Changes

Shielding - #1

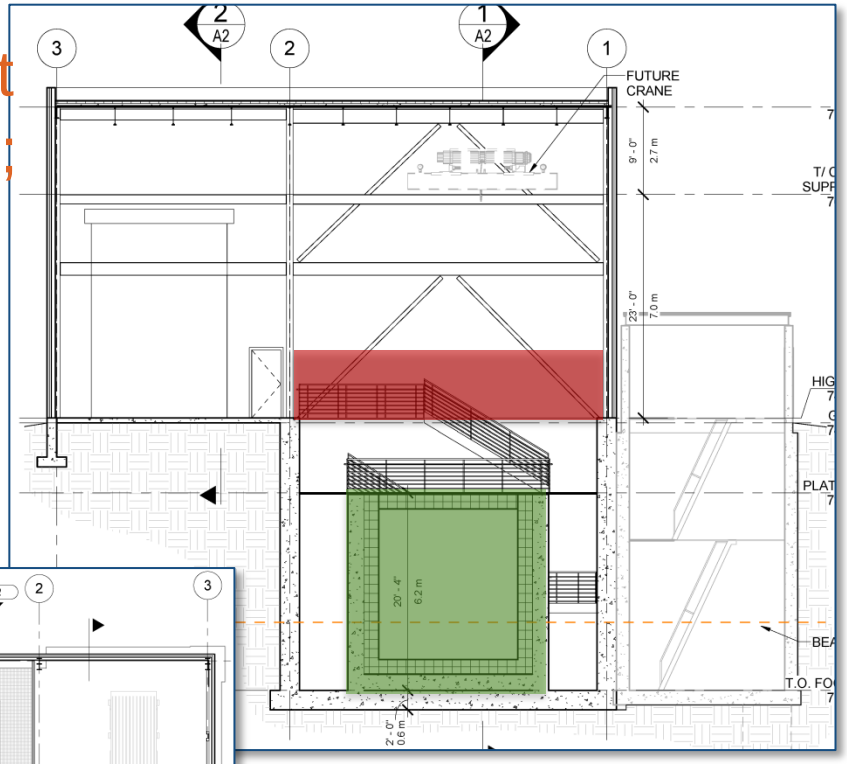
- Move enclosure north of SciBoone by ~10 feet;

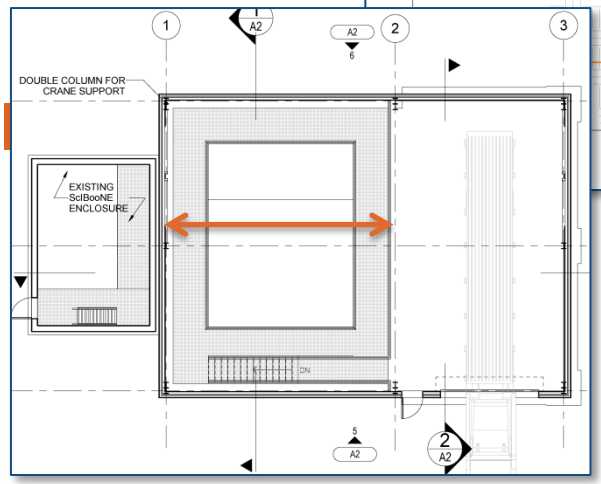


Near Detector Building – Potential Changes

Shielding - #2

- Be able to accommodate 9 feet of shielding above the detector;
- Current Span (30’-8”) is longer than standard shield blocks
- 24’ “G” Block = 22’ clear *
- 30’ “N” Block = 28’ clear **
- Revised Ledge
- Raise ground level
- Larger crane





* Standard Fermilab Block, but availability uncertain/unlikely (**7.7 tons**)

** Non-standard Fermilab Block (**9.7 tons**)

Near Detector Building – Potential Changes

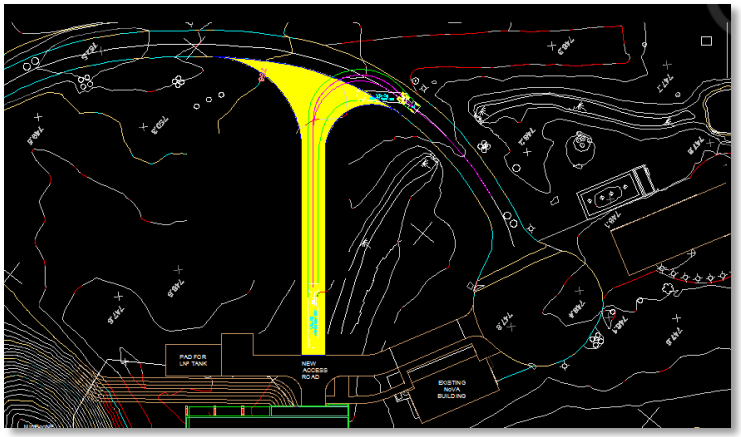
From September 2014 - LAr1-ND Collaboration Meeting

- Consider Rotating Detector 90 degrees
- Consider Eliminating the walkway at the base of the detector
- Consider Lowering the bottom of the detector
- Shielding: Investigate weak spot at precast/ground level
- Shielding: Rotated detector/eliminated walkway may allow standard shield block

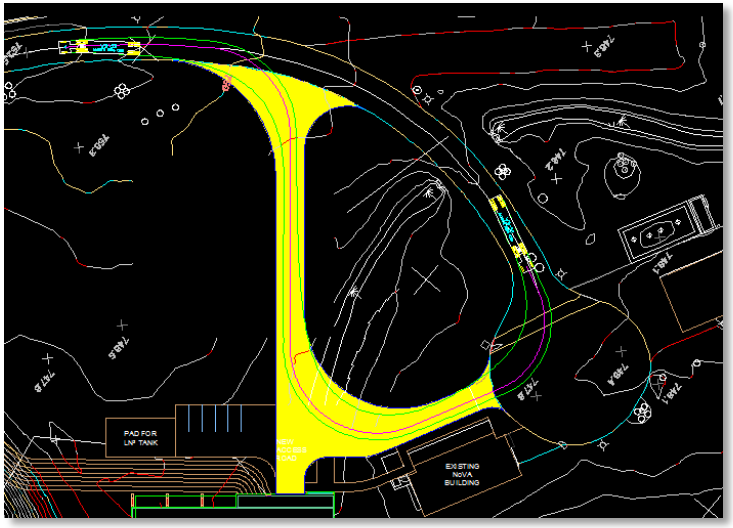
Far Detector Building

- Far Detector Building
  - Truck Access
  - Wetland
  - Cost Estimate Process
    - Shielded Enclosure
    - Removable Roof
  - Changes/Modifications
  - T1200 Options

Truck Access Options



Option 1



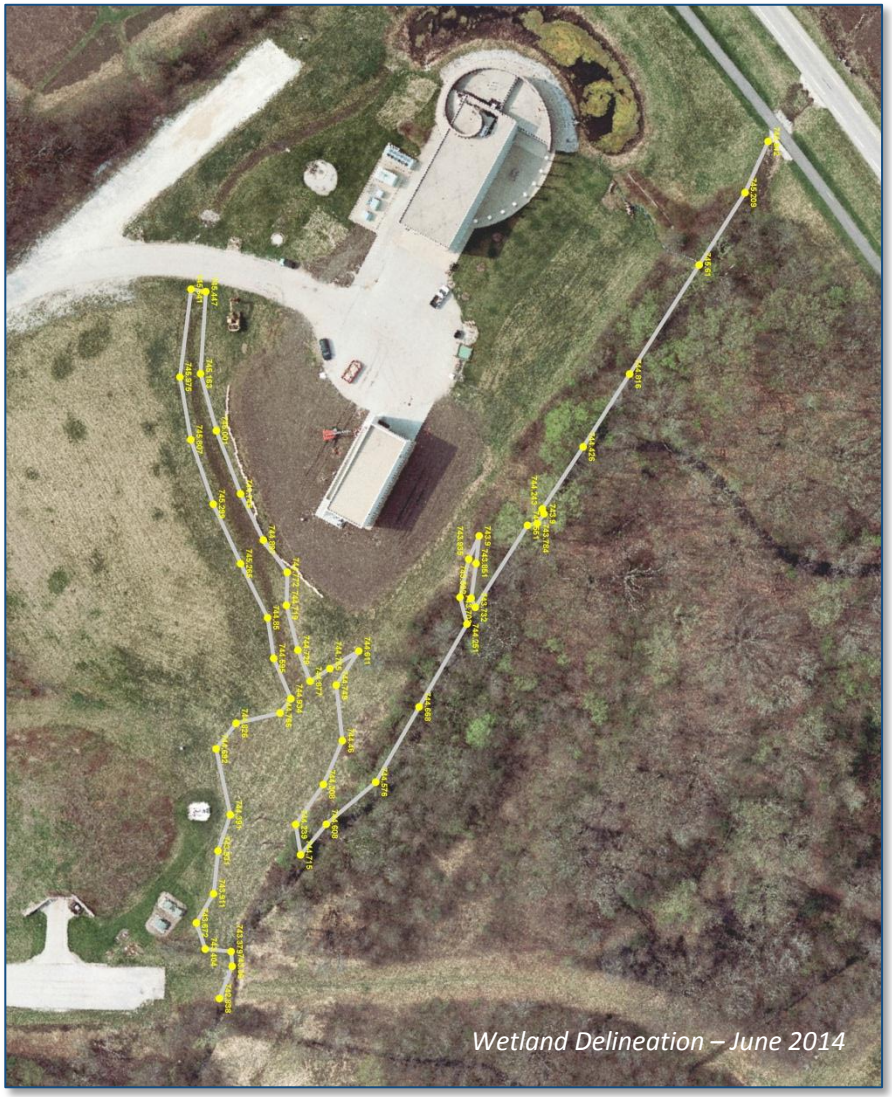
Option 2

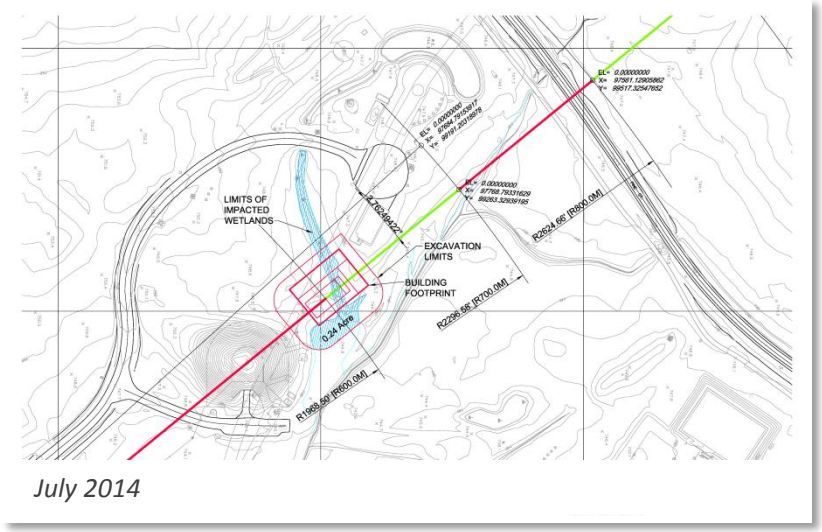
Wetlands

Process

- Delineation - complete
- Report - complete
- Discussion with USACOE – in progress
  - Visited the Site - complete
  - Submit Permit - complete
  - Additional Information Requested – in progress
- Mitigation Options
  - Create Wetland
  - Purchase Credit – Preferred Option

Wetlands





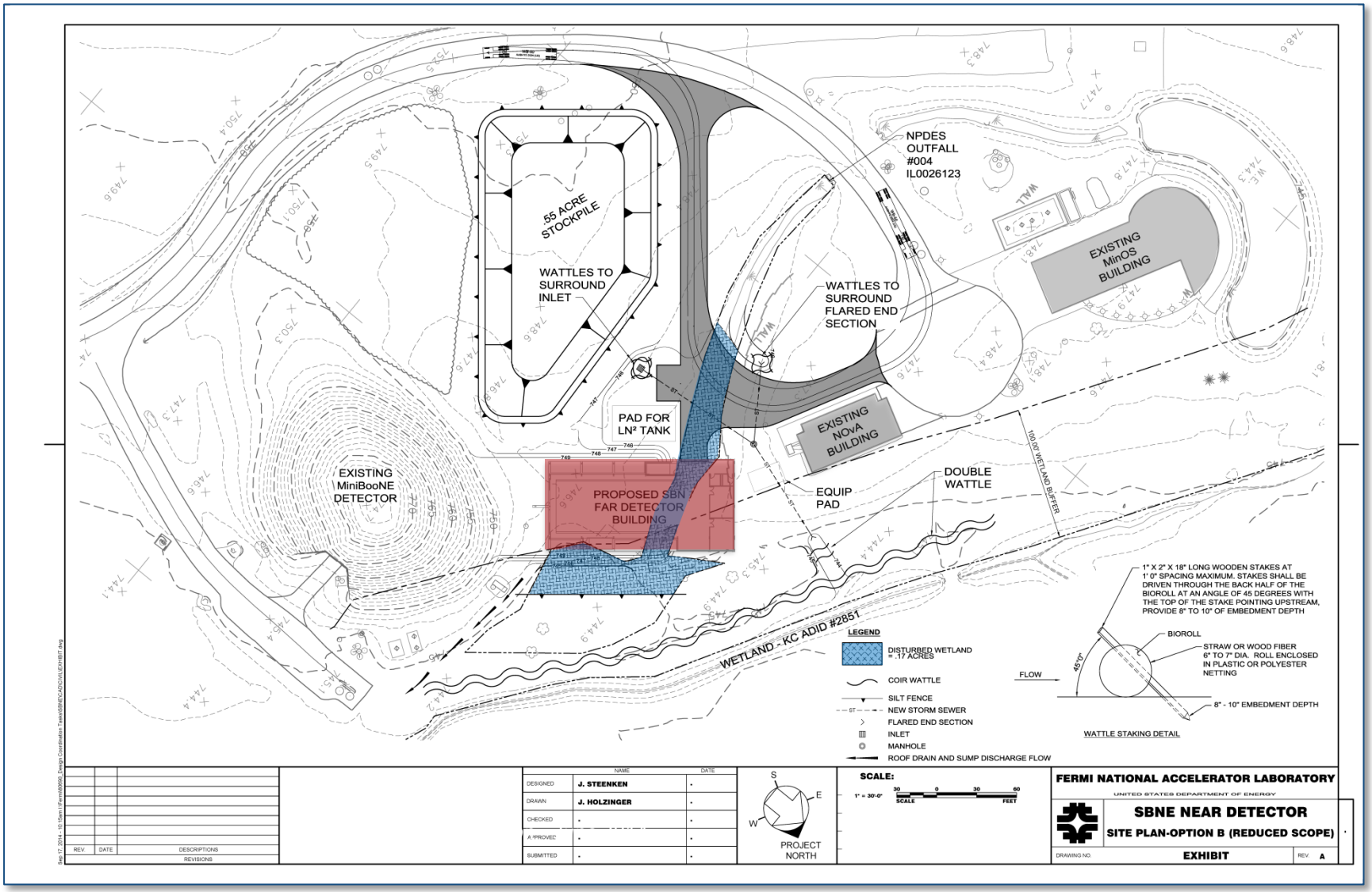
July 2014

Wetland Goals

- Less Impact is better
- <0.1 acre = Letter of No Objection
- <0.25 acre = Regional Permit
- >0.25 acre = Standard Permit

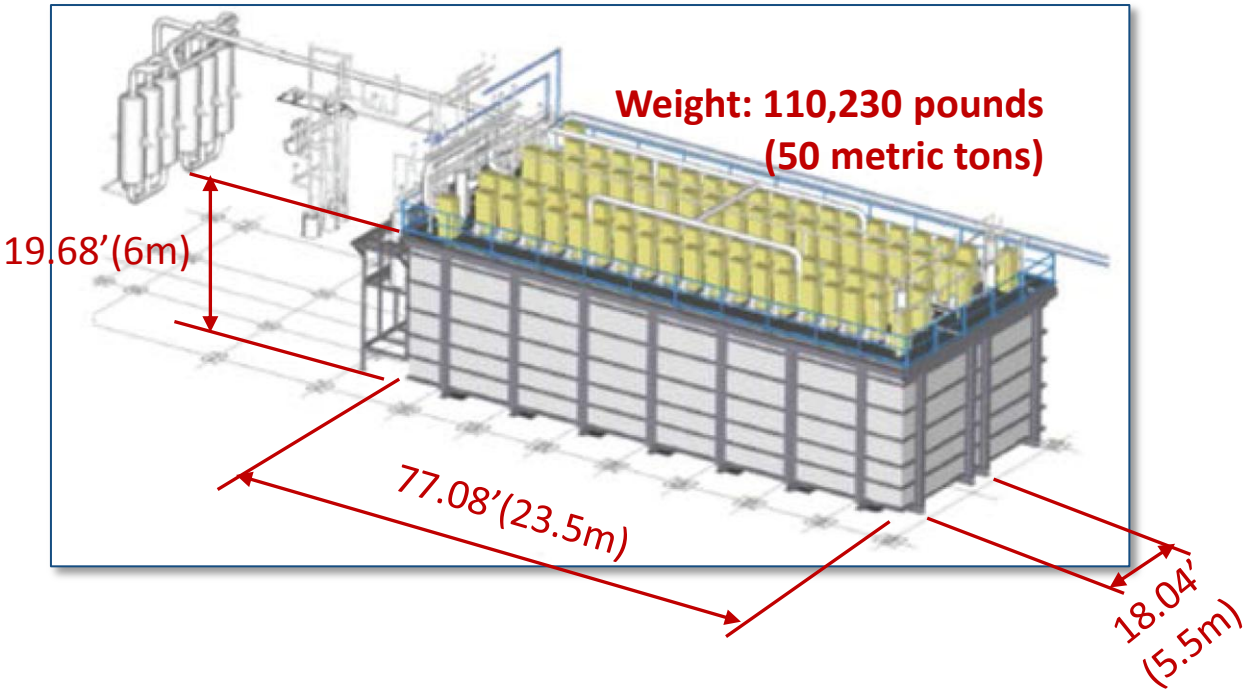
- July 2014: 0.24 acres
- September 2014: 0.17 acres

Wetlands – Reduced Building and Access Road



Far Detector Building Options

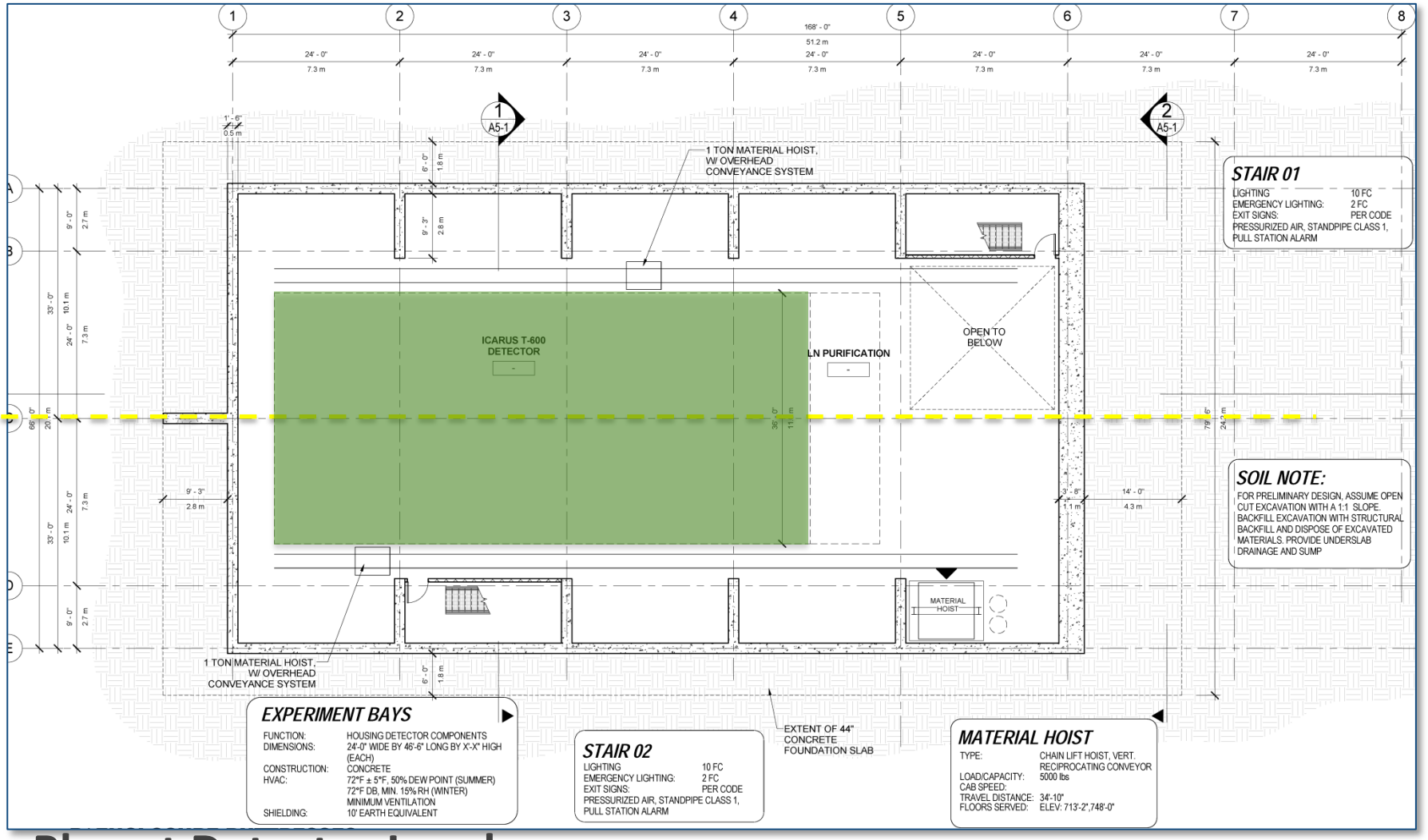
- **Shielded Enclosure**
- **Removable Roof + Shielding**



Design/Cost Estimate Process – Shielded Enclosure

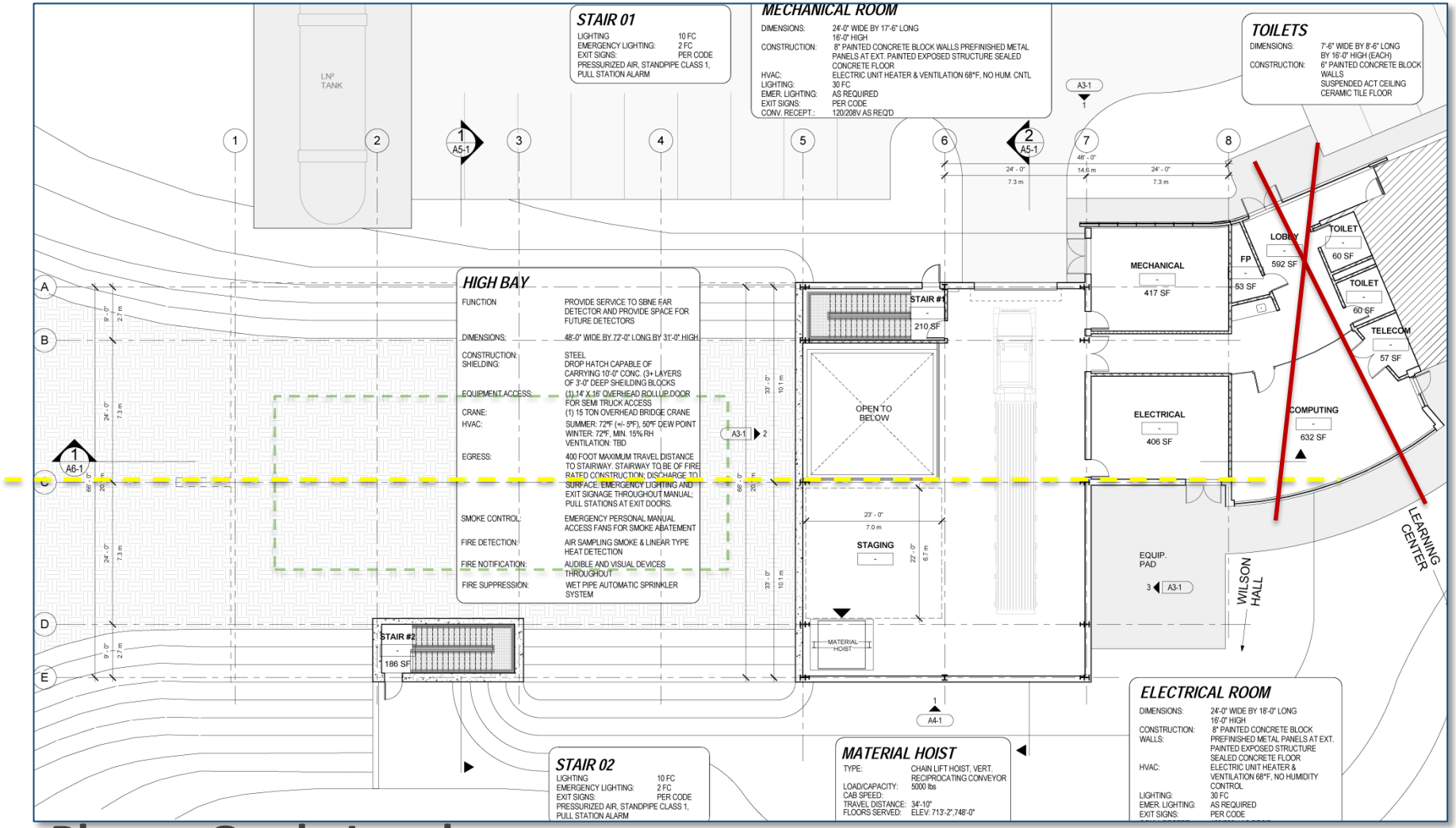
- Refined July 2014 Design
- *External Estimate - $13.5m (total project cost)*
- *Reduced Size of Surface Building*
- *External Estimate - $12.4m (total project cost)*
- *Separated "lid" from Enclosure/Building*
- *External Estimate*
  - *$8.9m (Enclosure/Building) – Fits within GPP envelope*
  - *$3.5m (Lid and Shielding) – Assumes funded separately*
  - *$12.4m total of all both projects*

Shielded Enclosure Option



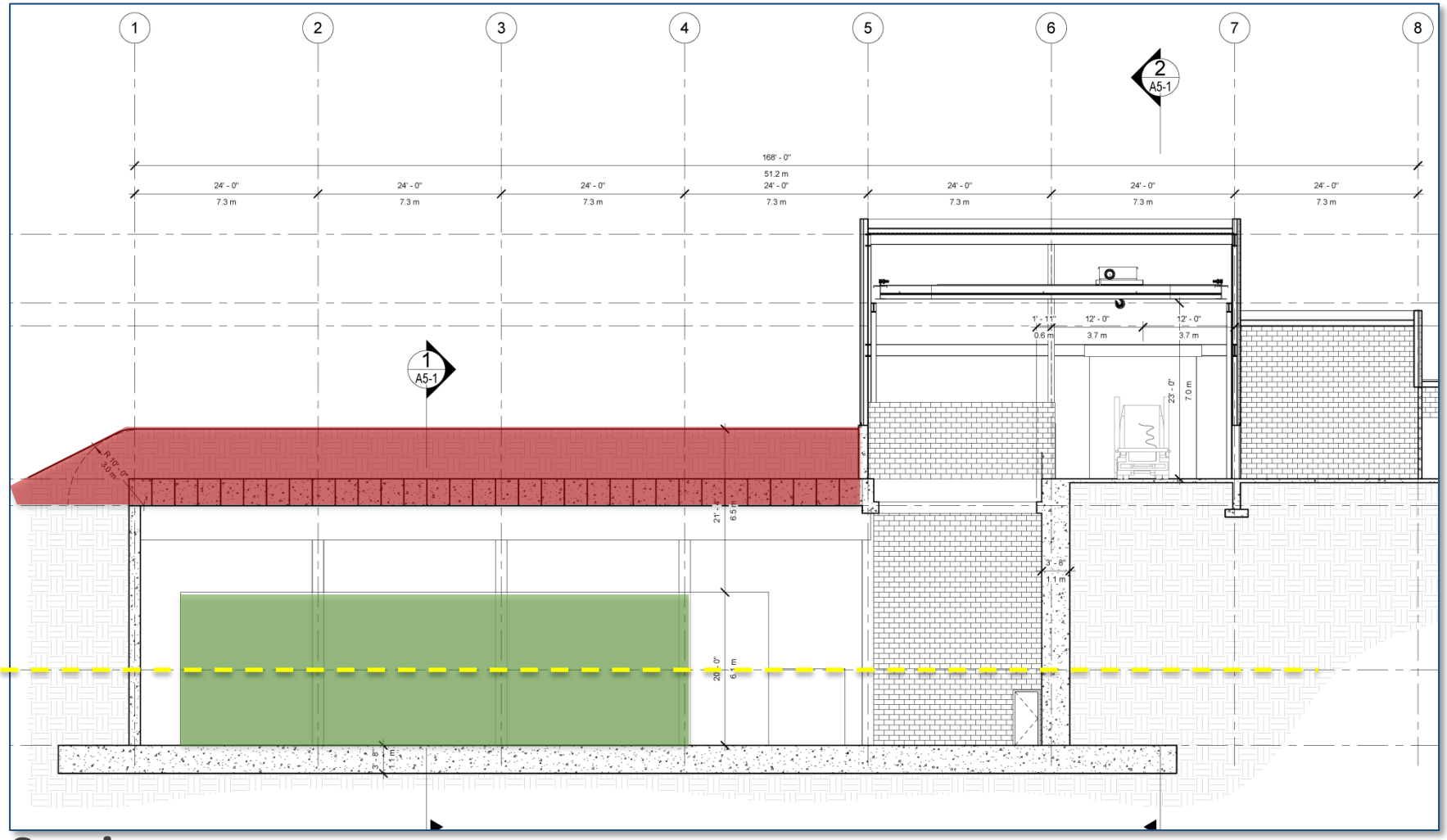
Plan at Detector Level

Shielded Enclosure Option



Plan at Grade Level

Shielded Enclosure Option



Section

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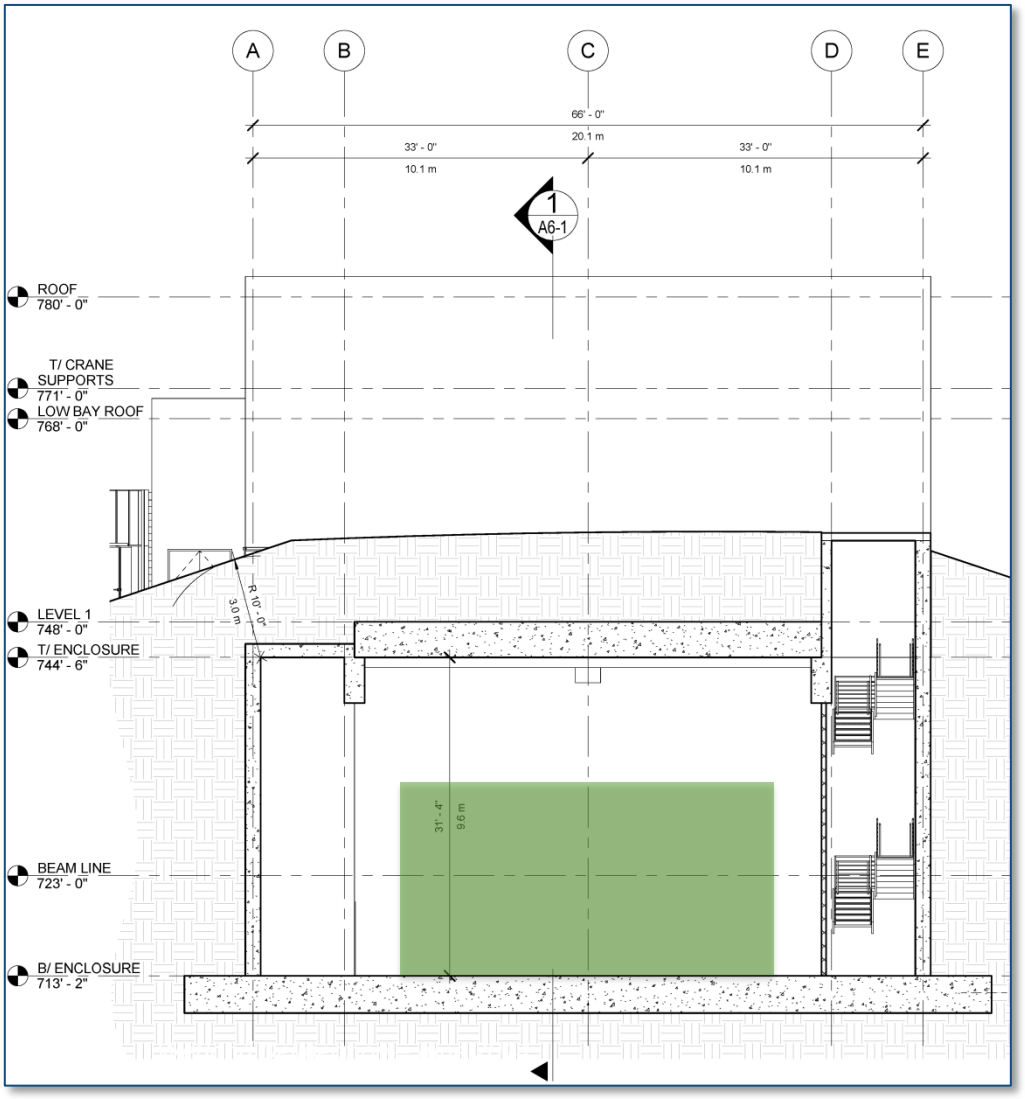
Shielded Enclosure Option



Section

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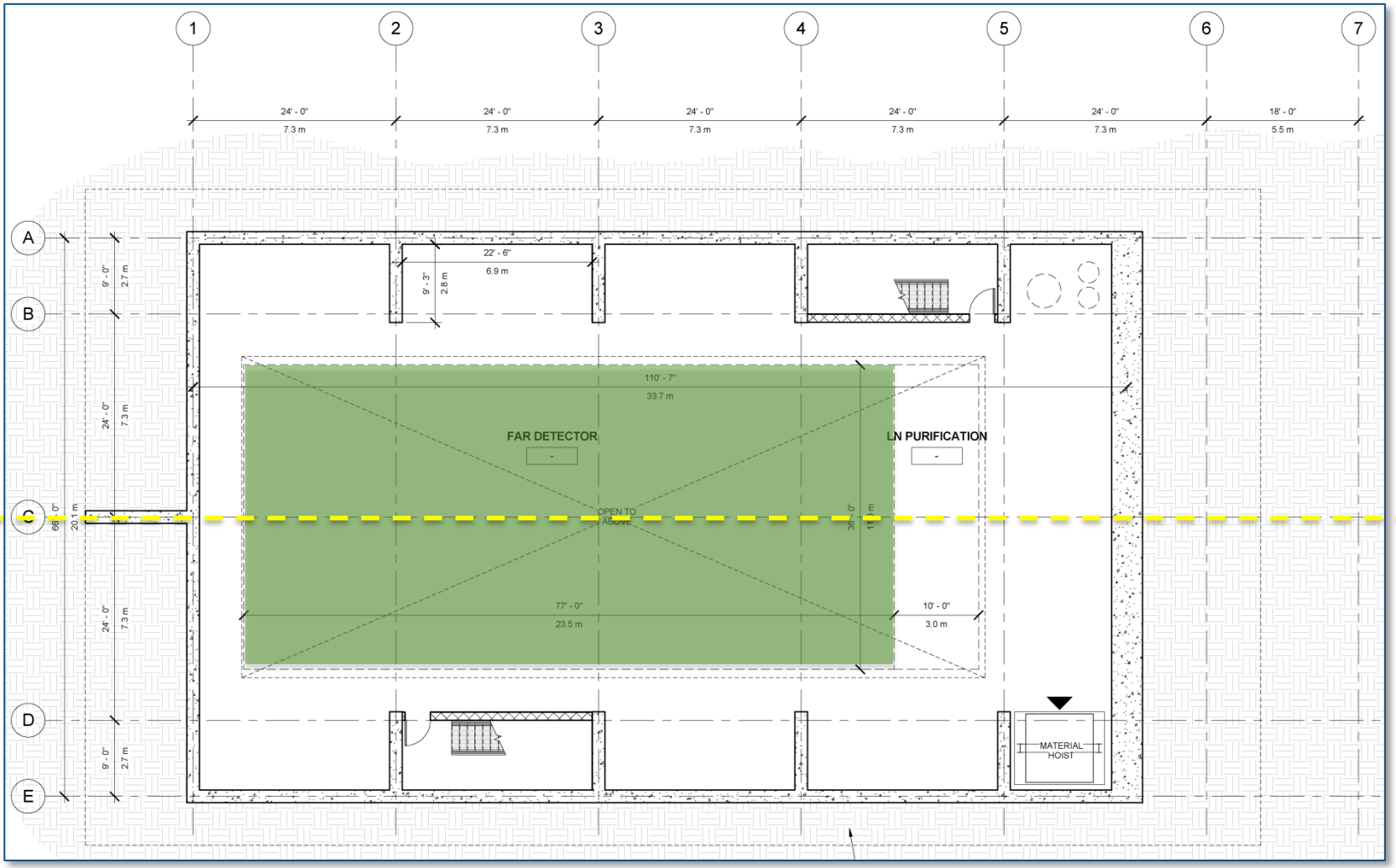
Design/Cost Estimate Process – Removable Roof+Shielding

- Refined July 2014 Design
- *External Estimate - $16.1m (total project cost)*
- *Reduced Size of Surface Building*
- *External Estimate - $15.6m (total project cost)*
- *Reduced Size of Surface Building Again*
- *External Estimate - $14.3m (total project cost)*
- *Separated Projects*
  - *$9.8m (Building with Removable Roof) – Fits with GPP Limit*
  - *$1.5m (Site Prep and Utilities) – Assumes funded separately*
  - *$3.6m (Shielding and Crane) – Assumes funded separately*
  - *$14.9m total of all three projects*

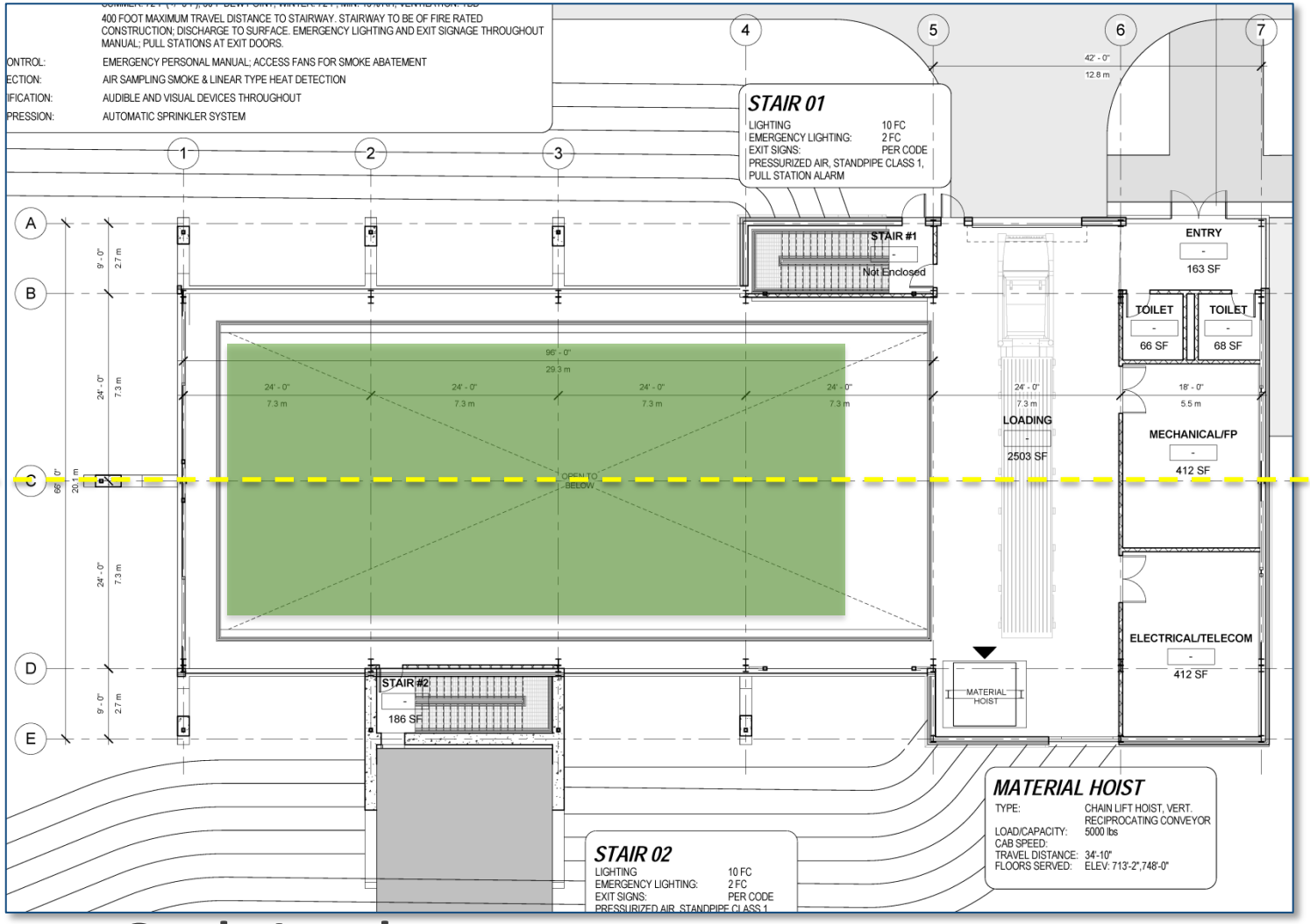
Removable Roof + Shielding



Plan at Detector Level

Fermilab

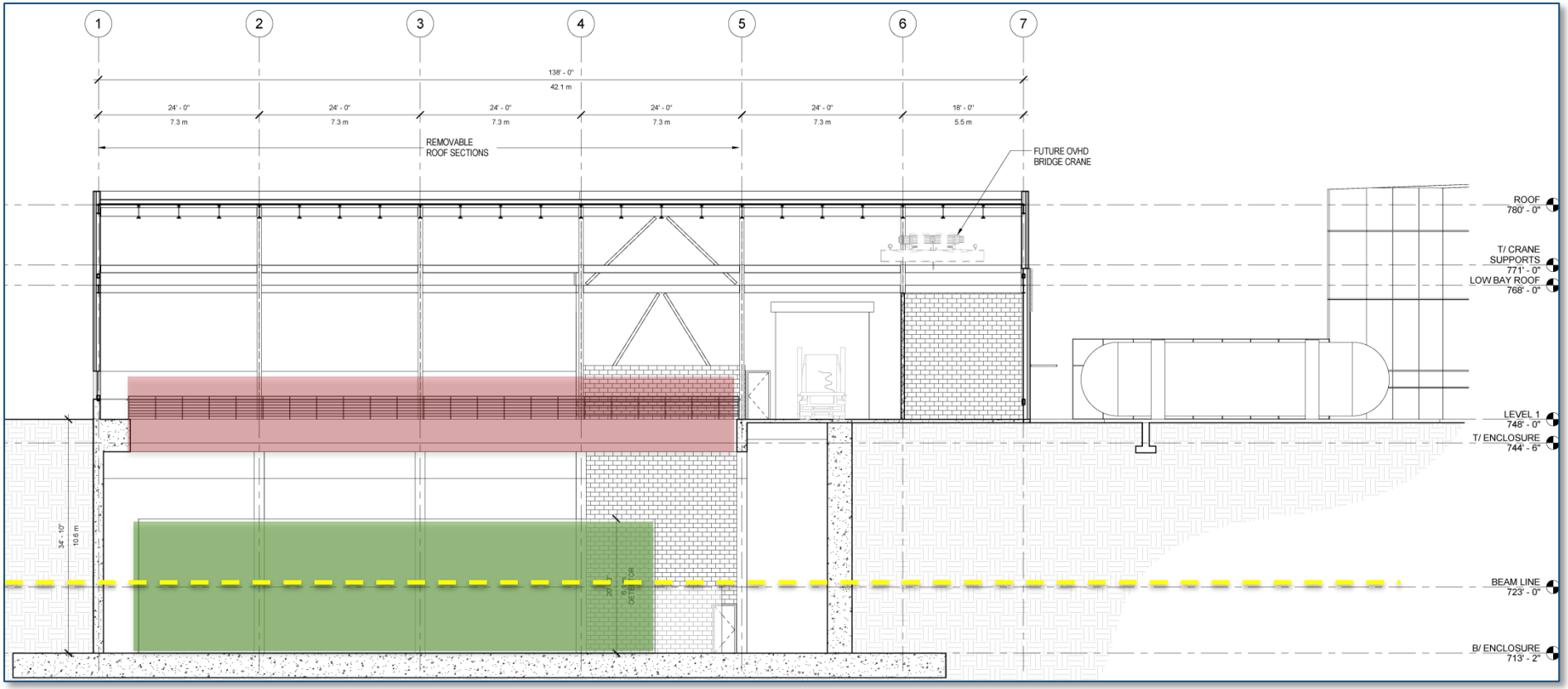
Removable Roof + Shielding



Plan at Grade Level

Fermilab

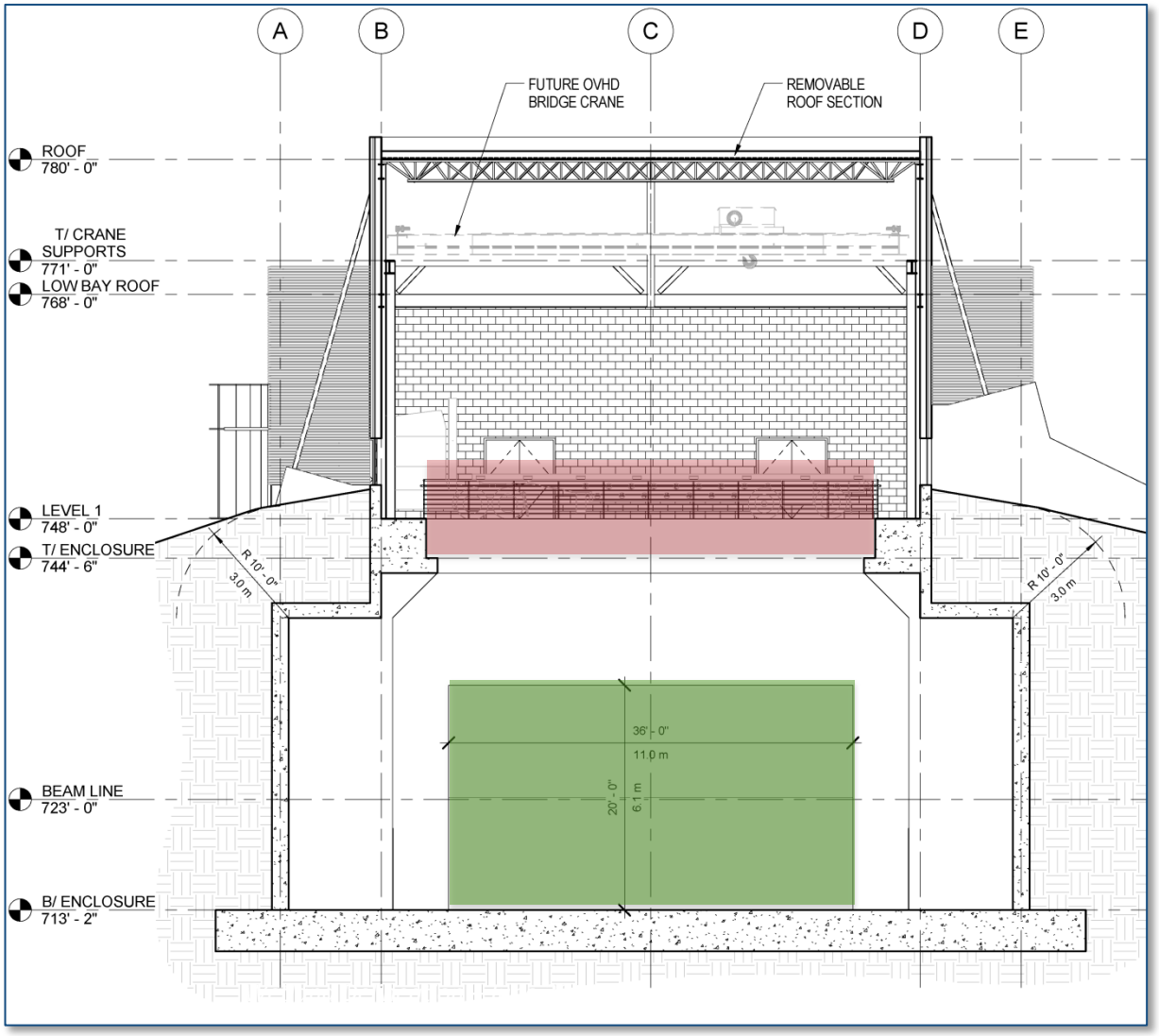
Removable Roof + Shielding



Section

Fermilab

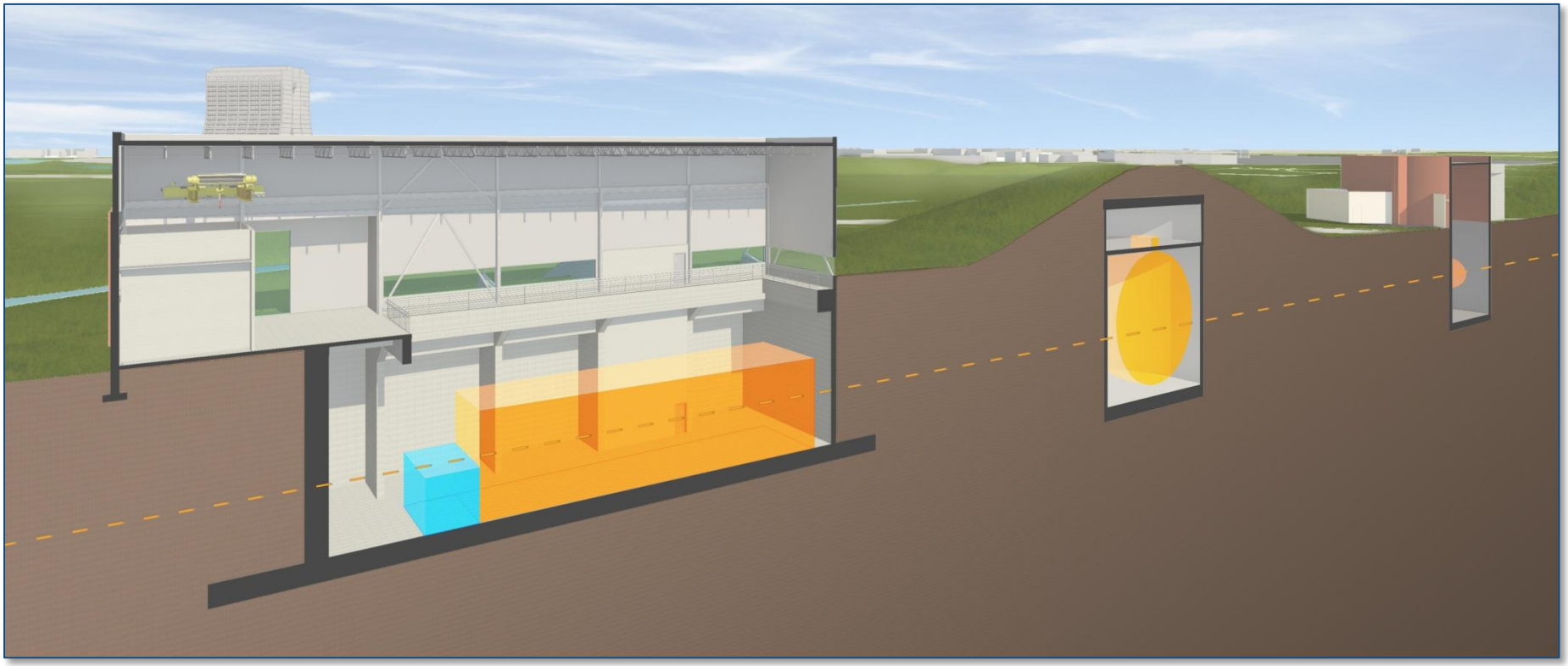
Removable Roof + Shielding



Section

Fermilab

Removable Roof + Shielding



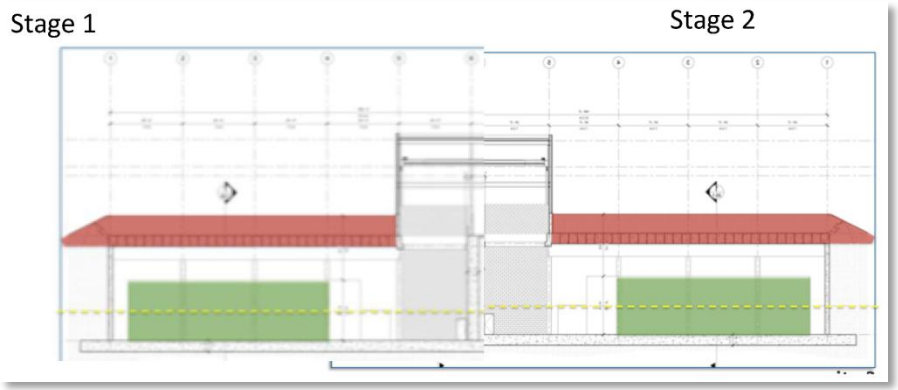
Section/Perspective Looking Southeast

Fermilab

Removable Roof + Shielding

T1200 Options - Assumptions

- The T1200 would be built of four (4) T300 cryostats;
- Similar size, infrastructure requirements;
- Phased installation: 2 cryostats installed initially;
- Cost/Schedule Impact on Conventional Construction
- Two Options:
  - Double the Length
  - Double the Height

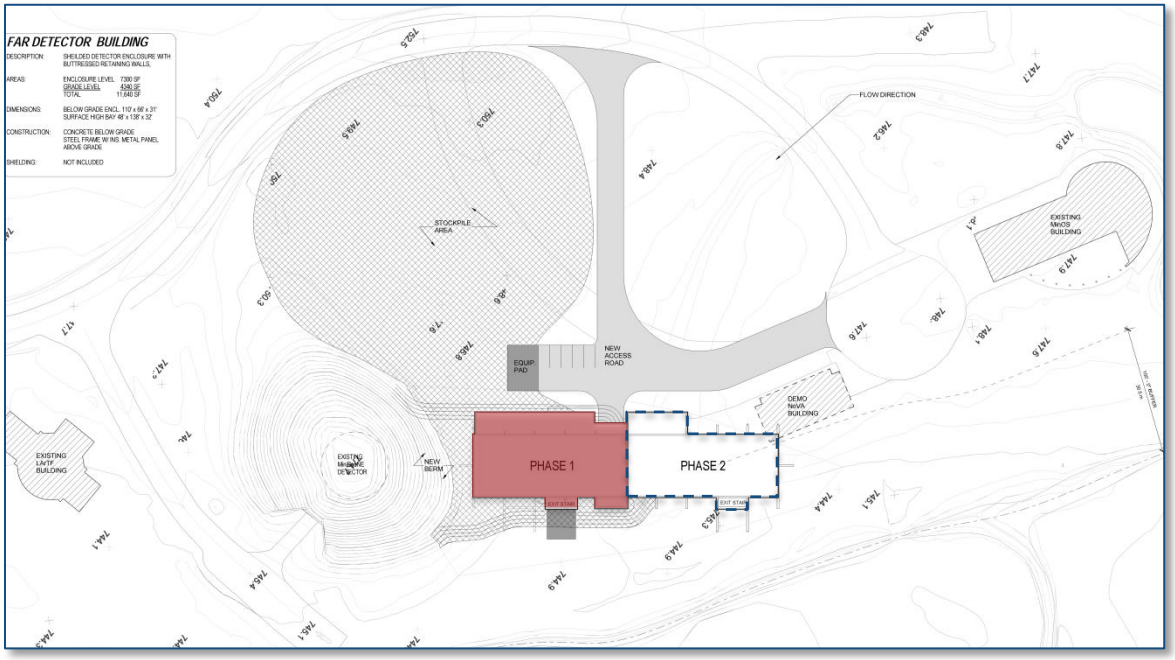


M. Nessi, 12SEP14

M. Nessi, 12SEP14

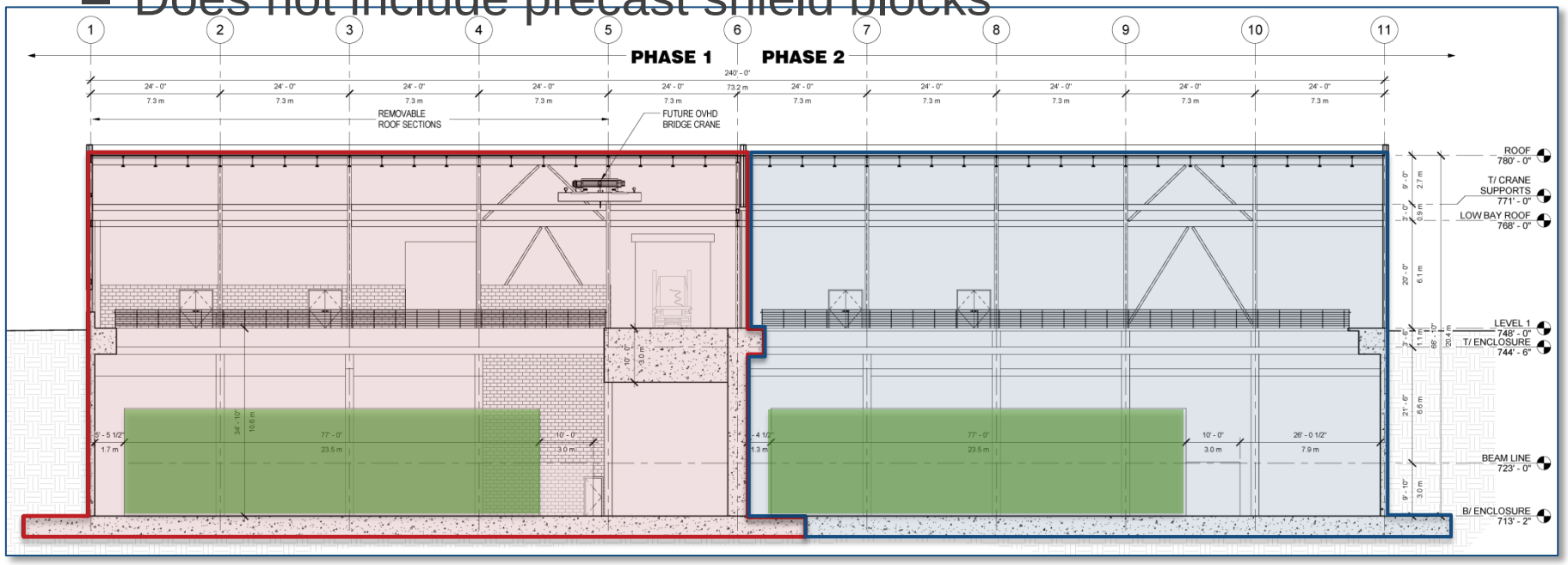
T1200 Option 1 – Double the Length

- Site Location
  - Relocate Phase 1 Building upstream (~33 feet, 10 meters);
  - Relocate LN2 and LAr tanks;
  - $0.2m, minimal schedule impact.



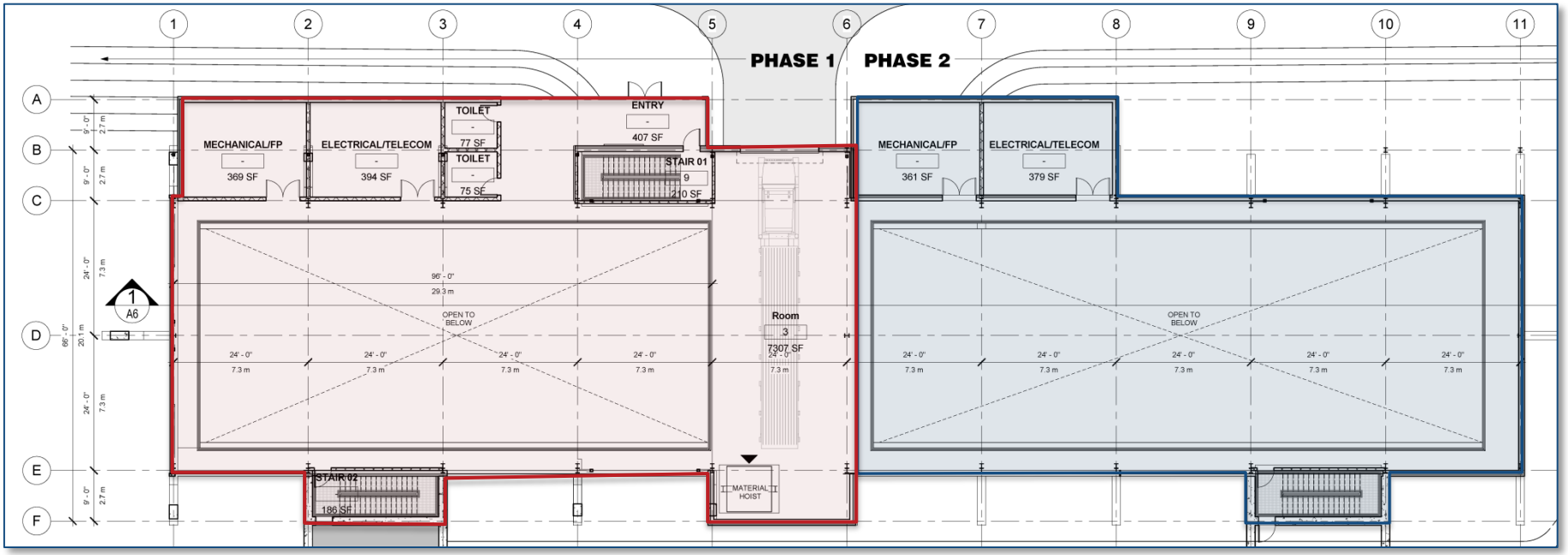
T1200 Option 1 – Double the Length

- Shielding
  - Redesign Loading Dock to provide shielding (10 feet, 3 meters);
  - Relocate the north wall;
  - $0.1m, minimal schedule impact
  - Does not include precast shield blocks



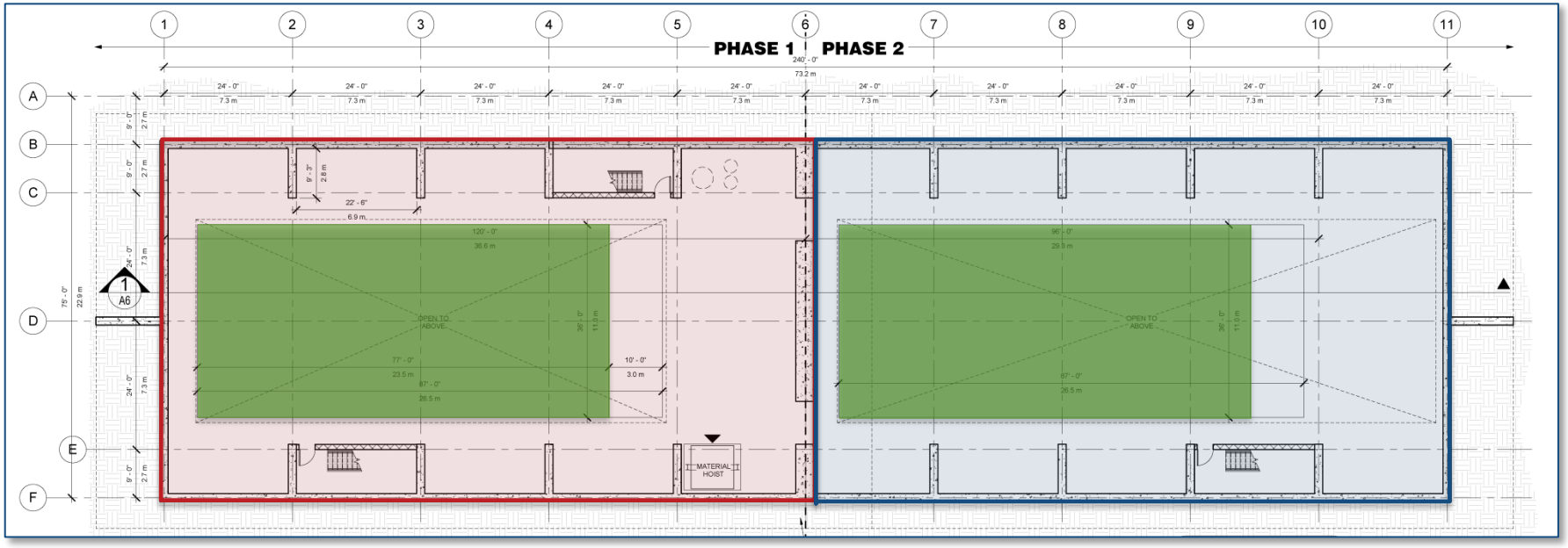
T1200 Option 1 – Double the Length

- Support Bay
  - Relocate Support Bay to west side of high bay;
  - Relocate the north wall
  - $0 cost, no schedule impact



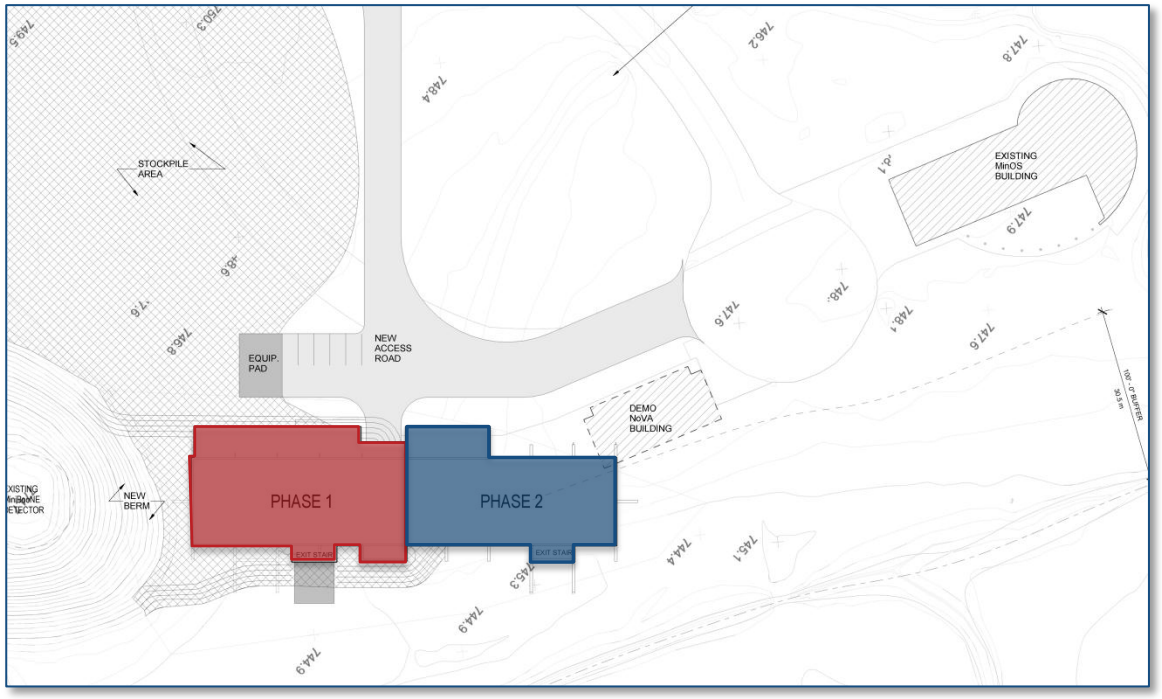
T1200 Option 1 – Double the Length

- Detector Enclosure
  - Design for phase 2 expansion;
  - Relocate the north wall;
  - $0.1m, no schedule impact



T1200 Option 1 – Double the Length

- Second Phase
  - Construct a similar sized project to SBN Far Detector Building;
  - Demolish existing NOvA Surface Building;
  - $10m-$13m, 2-3 years construction.



T1200 Option 1 – Double the Height

- Impact on First Phase
  - Construct a larger detector enclosure
    - Taller walls: $3.6m, 7-9 months
    - Additional Depth: $1.5m-$2.5m, 5-7 months
    - Additional Shielding: $? Cost, 1 month
  - Utilities: $0.8m-$1.3m, 2-3 months
  - Surface Building: $1.5m-$2.0m, 3-6 months
  - Additional Investigation Required
    - Earth retention system for deeper excavation;
    - Bearing capacity of existing soils;

T1200 Options - Summary

- Preliminary Estimates based on conceptual ideas;
- Requires a more in-depth study to understand the full implications;

What's Next – Near Detector Building

Project Plan (GPP Funding)

- SBN-doc-72
- Ready to submit for FY15 funding in October 2014
- Expect funding in 2Q FY15

Subsurface Investigation

- Soil boring to confirm the soil conditions

Final Design

- Develop an request for proposal for an AE firm
- Start Final Design in Spring 2015 (based on construction funding in FY2016 – October 2015)

What's Next – Far Detector Building

Wetland Mitigation

- Updated information to US Corps Of Engineers
- Regional Permit Process

Project Plan (GPP funding)

- Goal was to have completed by ~~01OCT14~~ 10OCT14
- Issued for Comment and Compliance Review
  - Based on $9.8 total project cost
  - Comments due on 03OCT14
  - SBN-doc-113
- Expect initial funding in October 2014
- Still need funding source for the $1.5m site prep work

What's Next

Final Design

- Have Soil Boring Proposal (~$20k)
- Develop Final Design Request for Proposal – October 2014
- Need Technical Requirements – November 2014
- Start Final Design – December 2014 (maybe earlier)

Goal: Groundbreaking in May 2015

Questions