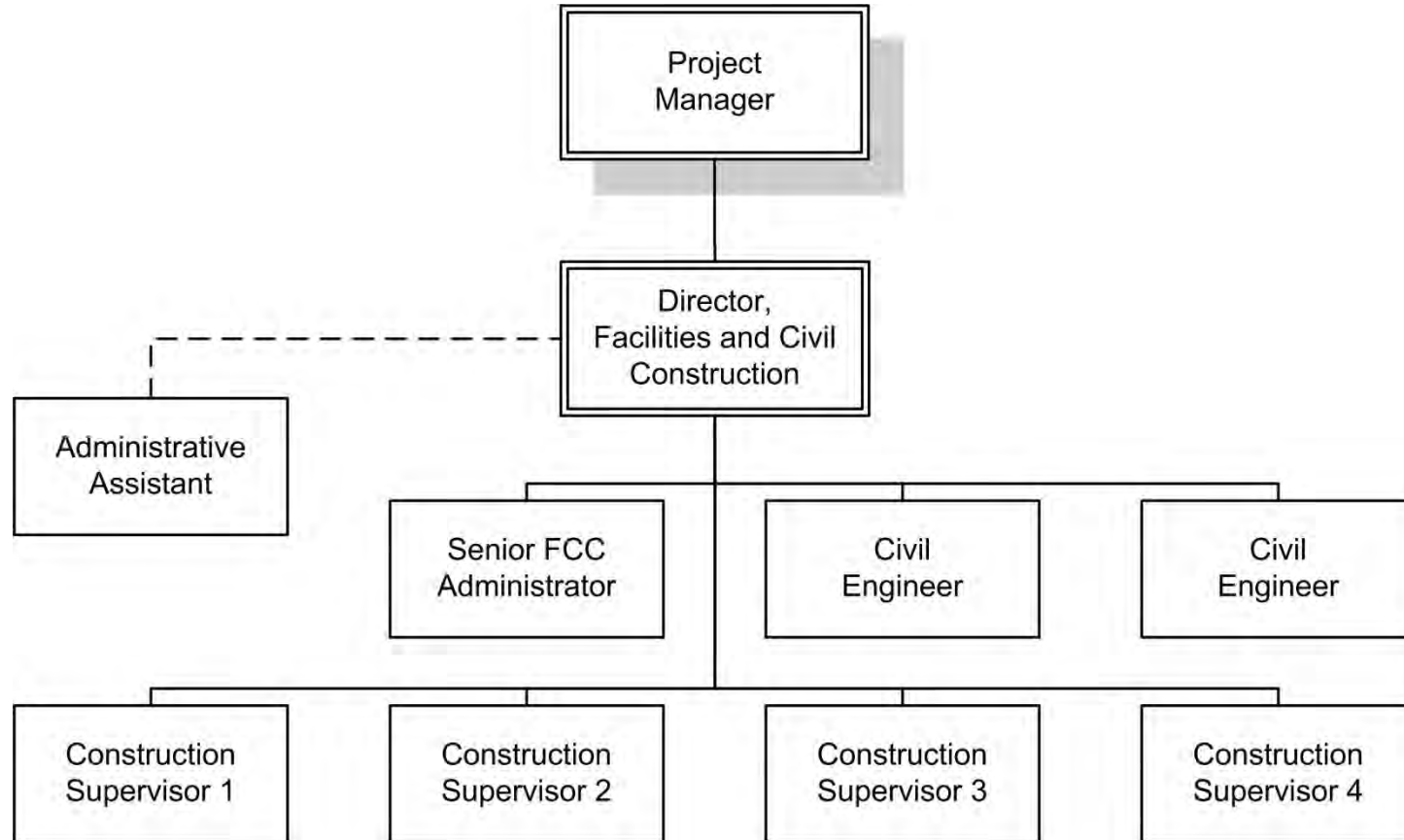


National Ecological Observatory Network

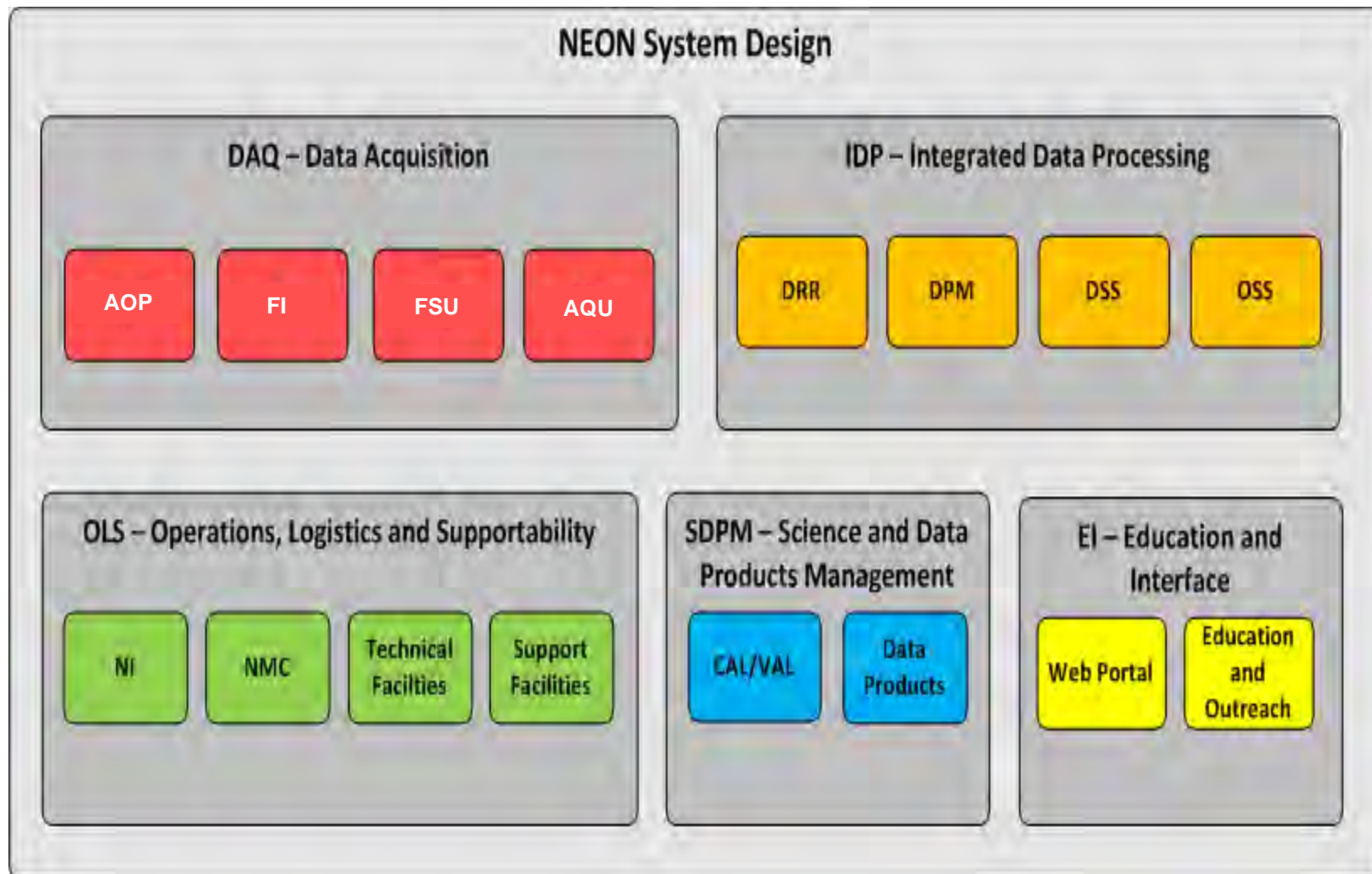
Facilities & Civil Construction

B. Porter/NEON Project Team

FCC Org Chart



System Design



Subsystem Documents

- NEON.DSDV.FCC.001000.PLA _ FCC Acquisition Plan
- NEON.DSDV.FCC.001002.PLA.C _ FCC Management Plan
- NEON.DSDV.FCC.001005.PLA.B _ FCC Construction Requirements
- NEON.DSDV.FCC.001006.PLA.B _ FCC Construction Plan and Procedures

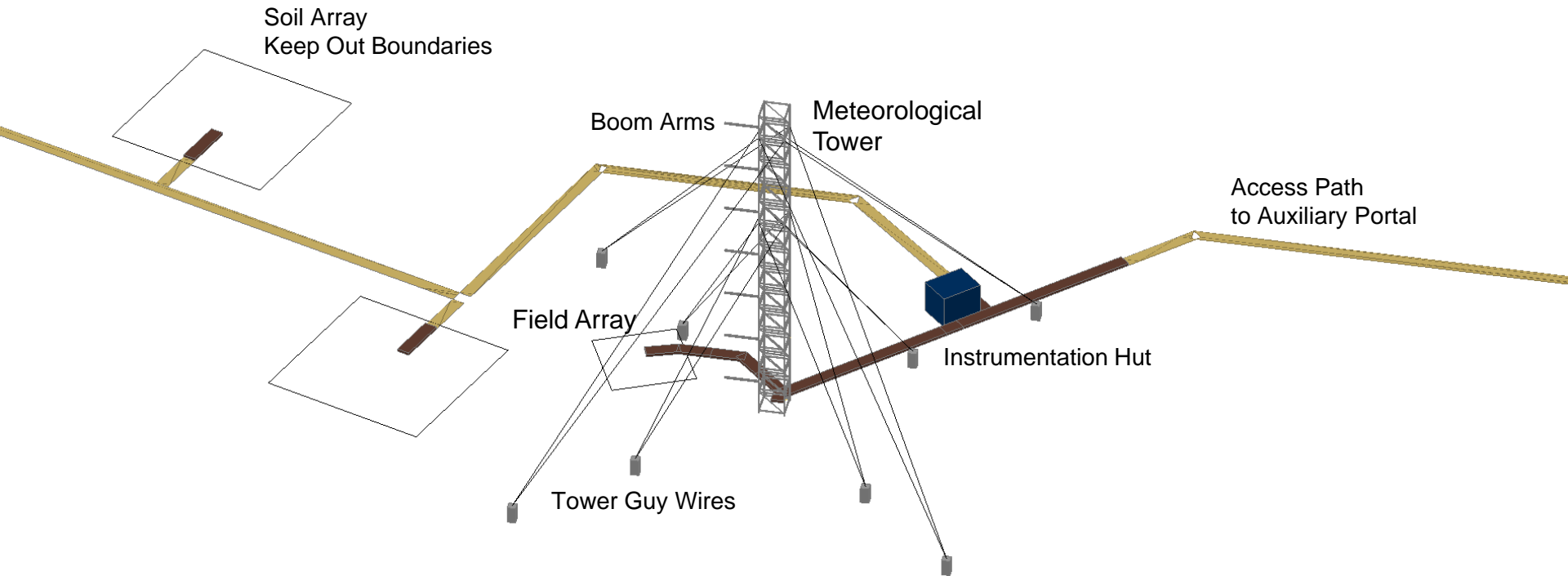
- NEON.DSDV.FCC.001026.DSN.A _ D01 FINAL REV 20090407
- NEON.DSDV.FCC.001027.DSN.A _ D02 FINAL REV 20090409
- NEON.DSDV.FCC.001028.DSN.B _ D03 FINAL _ 20090414

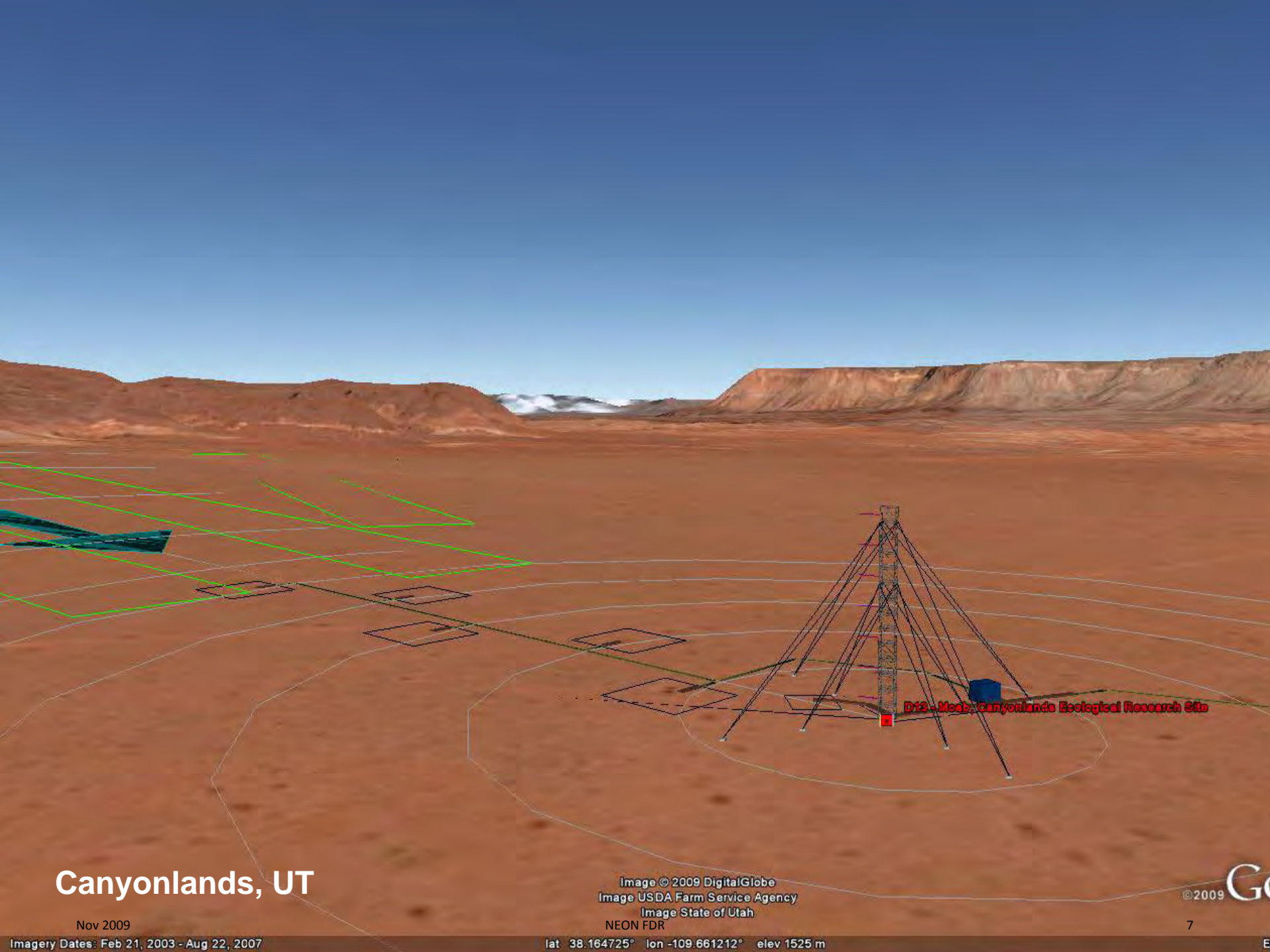
- NEON.DSDV.FCC.001042.DSN.A _ D18 FINAL 20090413
- NEON.DSDV.FCC.001043.DSN.A _ D19 FINAL 20090409
- NEON.DSDV.FCC.001044.DSN.A _ D20 FINAL 20090324

Domain Facilities [x 20]

- Access
- Boardwalks and Paths
- Auxiliary Portal
- Power Supply/Power Generation
- Towers: 1 Core, 2 Relocatables (typ.)
- Instrument Hut: 1 per Tower (typ.)
- Soil Arrays: 5 per Tower (typ.)
- Power & Signal Distribution
- Fencing and Security
- Aquatic Array/STREON
- Domain Lab, Office, Classroom (LOC)
- Portal Container Sets (PCS)

Tower Site Schematic Layout





Canyonlands, UT

Nov 2009

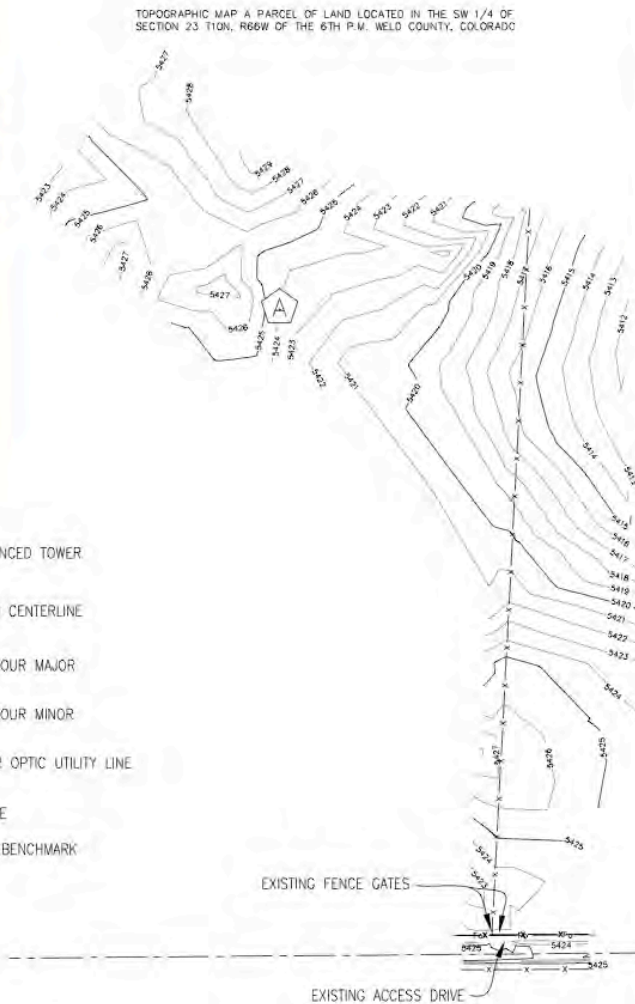
Imagery Dates: Feb 21, 2003 - Aug 22, 2007

Image © 2009 DigitalGlobe
Image USDA Farm Service Agency
Image State of Utah
NEON FDR

lat 38.164725° lon -109.661212° elev 1525 m

©2009 Go

D10 Core Site Map and Survey



SURVEY NOTES

- ORIGIN BENCH MARK: NGS MONUMENT DESIGNATION C 391 PID LL1110. FOUND A STEEL ROD IN A PVC PIPE WITH A LOGO CAP SET IN CONCRETE LOCATED 196.5 FEET SOUTH OF THE CENTERLINE OF U.S. HIGHWAY 85, 24.6 FEET SOUTH OF A CATTLE GUARD AND THE CENTER OF COUNTY ROAD 114, ELEVATION = 5476.4 (NAVD 88 DATUM)
- SITE BENCHMARK: TOP OF SET #5 REBAR WITH ORANGE PLASTIC CAP AS SHOWN.
- THIS TOPOGRAPHIC SURVEY IS NOT AN "IMPROVEMENT SURVEY PLAN OR "LAND SURVEY PLAN". NO BOUNDARY DETERMINATIONS HAVE BEEN MADE, OR TITLE SEARCHES PREPARED.
- THE LOCATION OF THE ABOVE GROUND UTILITIES SHOWN HEREON ARE BASED ON THE FIELD SURVEY BY SCOTT, COX & ASSOCIATES, INC. THE LOCATIONS OF THE UNDERGROUND UTILITIES SHOWN HEREON ARE BASED ON SAID SURVEY AND INFORMATION PROVIDED BY OTHERS (WHICH MAY INCLUDE THE UTILITY OWNER OR UTILITY LOCATING SERVICES). SCOTT, COX & ASSOCIATES, INC. IS NOT RESPONSIBLE FOR UTILITY INFORMATION PROVIDED BY OTHERS. SCOTT, COX & ASSOCIATES, INC. RECOMMENDS THAT THE LOCATION OF THE UTILITIES BE FIELD VERIFIED PRIOR TO ANY DIGGING ON, OR ADJACENT TO THE SUBJECT PROPERTY.
- THIS DRAWING IS BASED ON A FIELD SURVEY COMPLETED ON 08/06/09.
- NOTICE: ACCORDING TO COLORADO LAW, YOU MUST COMMENCE ANY LEGAL ACTION BASED ON ANY DEFECT IN THIS SURVEY WITHIN THREE YEARS AFTER YOU FIRST DISCOVER SUCH DEFECT, IN NO EVENT, MAY ANY ACTION BASED UPON ANY DEFECT IN THIS SURVEY BE COMMENCED MORE THAN TEN YEARS FROM THE DATE SHOWN HEREON. CRS-13-80-105(3)g.
- BASIS OF COORDINATES: BASED ON NGS POINT C-391 PID LL1110. PUBLISHED STATE COORDINATES COLORADO NORTH ZONE (SPC CO N) NAD 83(2007) WITH A PUBLISHED COMBINED FACTOR OF 0.99974568. DRAWING COORDINATES ARE MODIFIED (SCALED TO GROUND) SPC CO N USING THE COMBINED FACTOR. HORIZONTAL AND VERTICAL POSITIONS WERE ESTABLISHED ON THE SITE FROM THE NGS POINT USING GPS METHODS.
- USGS QUAD MAP REFERENCE: CHALK BLUFFS SW AND DOVER.
- STEWART TITLE- COMMITMENT FOR TITLE INSURANCE- ORDER NUMBER 915529, EFFECTIVE DATE: JULY 29, 2009, AT 7:30 A.M. WAS REVIEWED IN THE PREPARATION OF THIS MAP. SCHEDULE B-2 EXCEPTIONS AFFECT THE PROPERTY BUT ARE UNLOCATABLE AND OR BLANKET IN NATURE.

LEGEND

- ADVANCED TOWER
- ROAD CENTERLINE
- CONTOUR MAJOR
- CONTOUR MINOR
- FIBER OPTIC UTILITY LINE
- FENCE
- SITE BENCHMARK

ADVANCED TOWER SURVEY
10C1.01

National Ecological
Observatory Network
5540 Airport Blvd
Boulder, CO 80501

LEO A DAILY

6600 Irving 1000 Drive
Englewood, CO 80110-1000 USA
Tel: 402-911-8111 Fax: 402-911-8044

neon

KEY PLANS

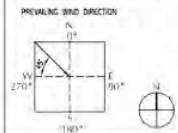
REVISIONS

NO.	DESCRIPTION	DATE

FILE LOG:

DATE	BY	DESCRIPTION

NOT FOR CONSTRUCTION

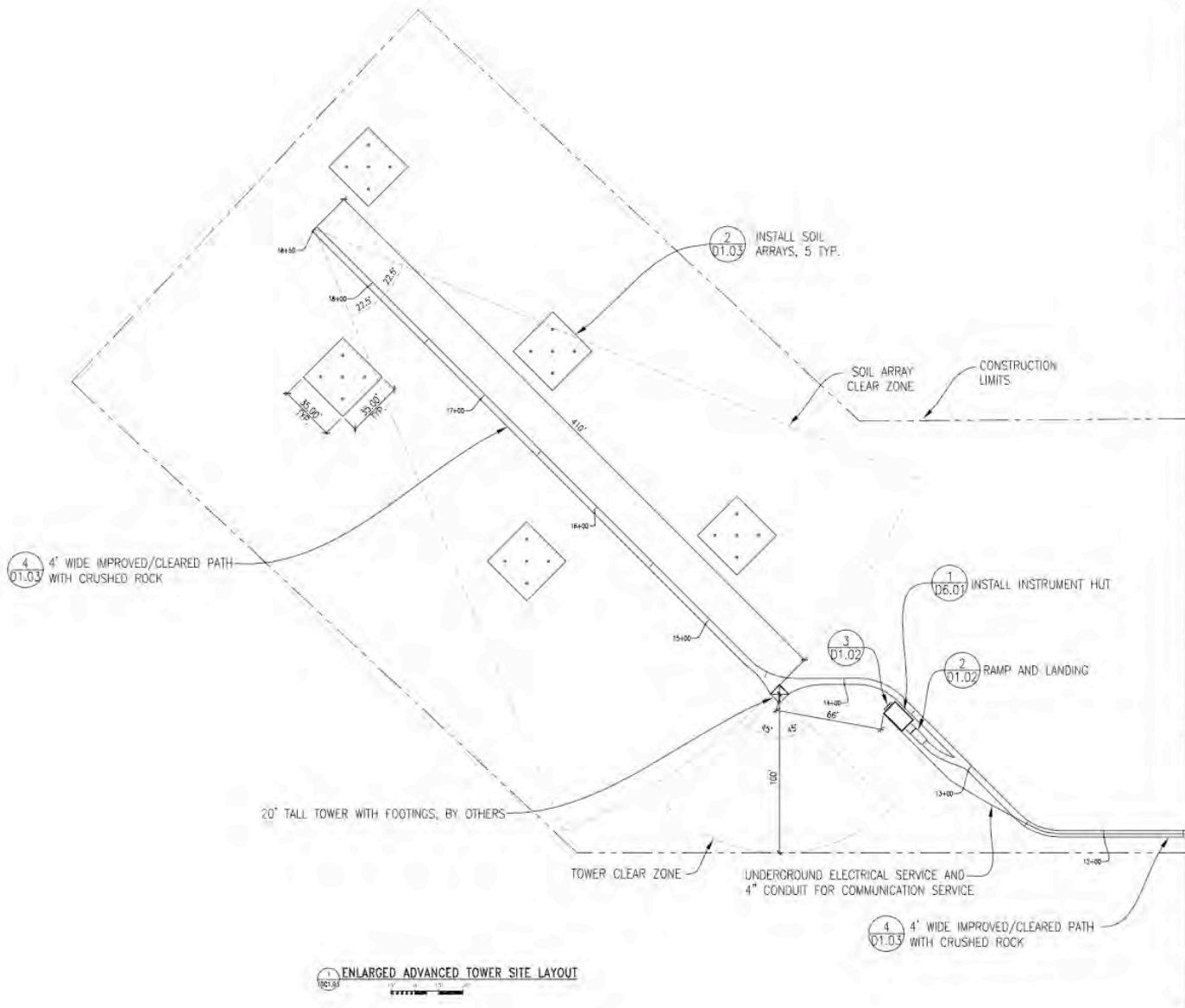


Date Project No: 003-00074-000
NEON Project No: 04.08.C.0000
OCTOBER 26, 2009

DOMAIN: CENTRAL PLAINS-
ADVANCED TOWER LOCATION-
MAP AND SURVEY

10C1.01

D10 Core Site Layout



ENLARGED ADVANCED TOWER SITE LAYOUT

National Ecological
Observatory Network
5340 Airport Blvd.
Boulder, CO 80501

LEO A DALY

1800 Madison Mill Drive
Crestline, HI 91134-4019 USA
Tel: 402-593-6111 Fax: 402-330-2544

neon

KEY PLAN

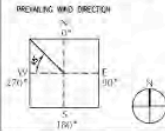
REVISIONS

NO.	DATE	DESCRIPTION

FILE LOG

DATE	BY	DESCRIPTION

NOT FOR CONSTRUCTION



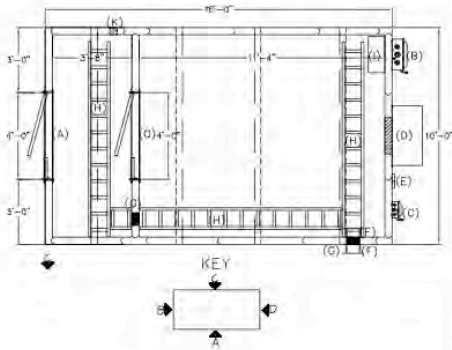
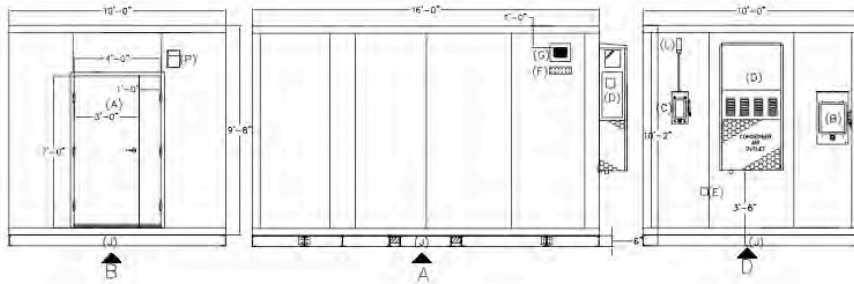
Daly Project No: 003400733.000
NEON Project No: 04.08.C.0008
OCTOBER 26, 2009

DOWN TO CENTRAL PLANS
ENLARGED ADVANCED TOWER
SITE LAYOUT

10C1.03

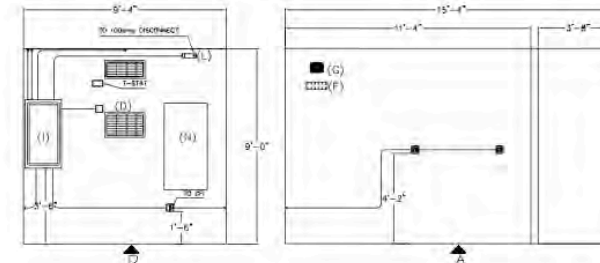
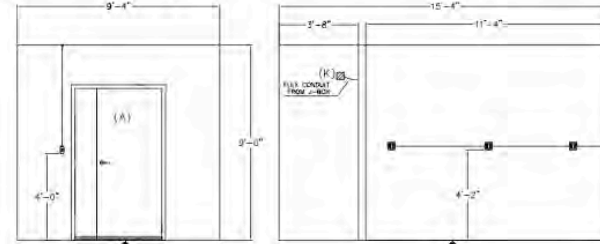
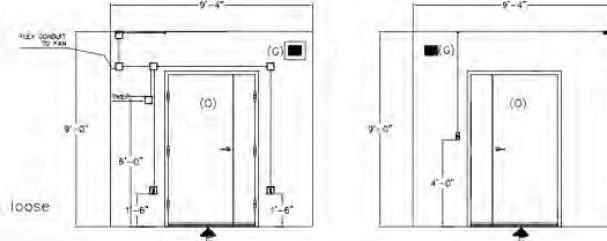
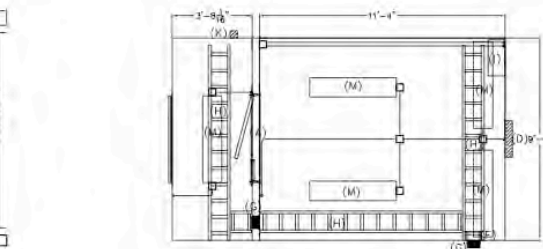
21081-10013-2009 Design 50-00-0101 (Electrical) Dwg 02-Summary/10C1-03.dwg October 21, 2009 - 12:26pm Anykay

D10 Instrument Hut Detail

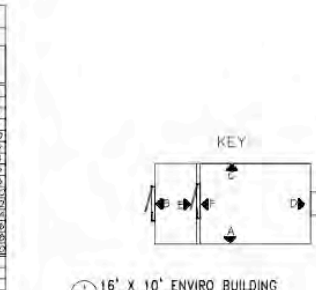
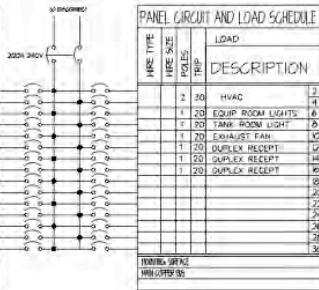


LEGEND

- CEILING -----
FLOOR -----
- (A) Double Door, 4'0" x 7'0", insulated
 - (B) Disconnect - 200 amp
 - (C) Disconnect - 100 amp
 - (D) HVAC - 2 ton cooling
 - (E) GFI receptacle
 - (F) Ground bar 12"x4"x1/4" - exterior to ship loose
 - (G) Rextec entry part
 - (H) 12" cable runway 8'-0" AFF
 - (I) Load Center - 200 amp service
 - (J) Steel building skid
 - (K) Exhaust fan
 - (L) 1.5" LB
 - (M) Florescent Light
 - (N) Telco board - 2'-0" x 4'-0"
 - (O) DOUBLE DOOR, 4'-0" x 7'-0", INSULATED
 - (P) EXTERIOR LIGHT - PHOTOCELL
- QUADPLEX WALL RECEPTACLES
 - DUPLEX WALL RECEPTACLES
 - LIGHT SWITCH
 - 4 X 4 BOX



PANEL CIRCUIT AND LOAD SCHEDULE			
LOAD	TRIP	POLES	WIRE SIZE
DESCRIPTION	TYPE	NO.	AMP
1	TOWER PANEL FEEDER	60/2	
2	QUADPLEX RECEPT	20/1	
3	QUADPLEX RECEPT	20/1	
4	QUADPLEX RECEPT	20/1	
5	QUADPLEX RECEPT	20/1	
6	QUADPLEX RECEPT	20/1	
7	QUADPLEX RECEPT	20/1	
8	QUADPLEX RECEPT	20/1	
9	QUADPLEX RECEPT	20/1	
10	QUADPLEX RECEPT	20/1	
11	QUADPLEX RECEPT	20/1	
12	QUADPLEX RECEPT	20/1	
13	QUADPLEX RECEPT	20/1	
14	QUADPLEX RECEPT	20/1	
15	QUADPLEX RECEPT	20/1	
16	QUADPLEX RECEPT	20/1	
17	QUADPLEX RECEPT	20/1	
18	QUADPLEX RECEPT	20/1	
19	QUADPLEX RECEPT	20/1	
20	QUADPLEX RECEPT	20/1	
21	QUADPLEX RECEPT	20/1	
22	QUADPLEX RECEPT	20/1	
23	QUADPLEX RECEPT	20/1	
24	QUADPLEX RECEPT	20/1	
25	QUADPLEX RECEPT	20/1	
26	QUADPLEX RECEPT	20/1	
27	QUADPLEX RECEPT	20/1	
28	QUADPLEX RECEPT	20/1	
29	QUADPLEX RECEPT	20/1	
30	QUADPLEX RECEPT	20/1	



16' X 10' ENVIRO BUILDING
SCALE AS SHOWN

National Ecological Observatory Network
5141 Airport Blvd.
Boulder, CO 80501

LEO A DAILY

1000 Indigo Hill Drive
Fountain, CO 80015-4019 USA
Tel: 402-701-0133 Fax: 402-701-0994

KEY PLAN

REVISIONS

NO.	DESCRIPTION	DATE

FILE LOC:

DATE: 11/01/09
DRAWN: JAC
CHECKED: JAC
APPROVED: JAC

NOT FOR CONSTRUCTION

Daily Project No. 001-0007-0000
NEON Project No. 04-06-00000
ENC TOBER 26, 2009

ENVIRO BUILDING
16' X 10'
REFERENCE DRAWINGS

D6.01

Instrument Hut Example



TMTB Tower





AeroSolutions LLC

5500 Flatiron Parkway, Suite 100
 Boulder, CO 80301
 (720)-304-6882 Fax: (720)-304-6883

Optimizing your Tower Infrastructure
www.AeroSolutionsLLC.com

Structural Analysis Report

PIF Project No.: **41709-0050**
 Structure: 181.5 ft Guyed Tower

Prepared For:



5340 Airport Boulevard
 Boulder, CO 80301

October 9, 2009

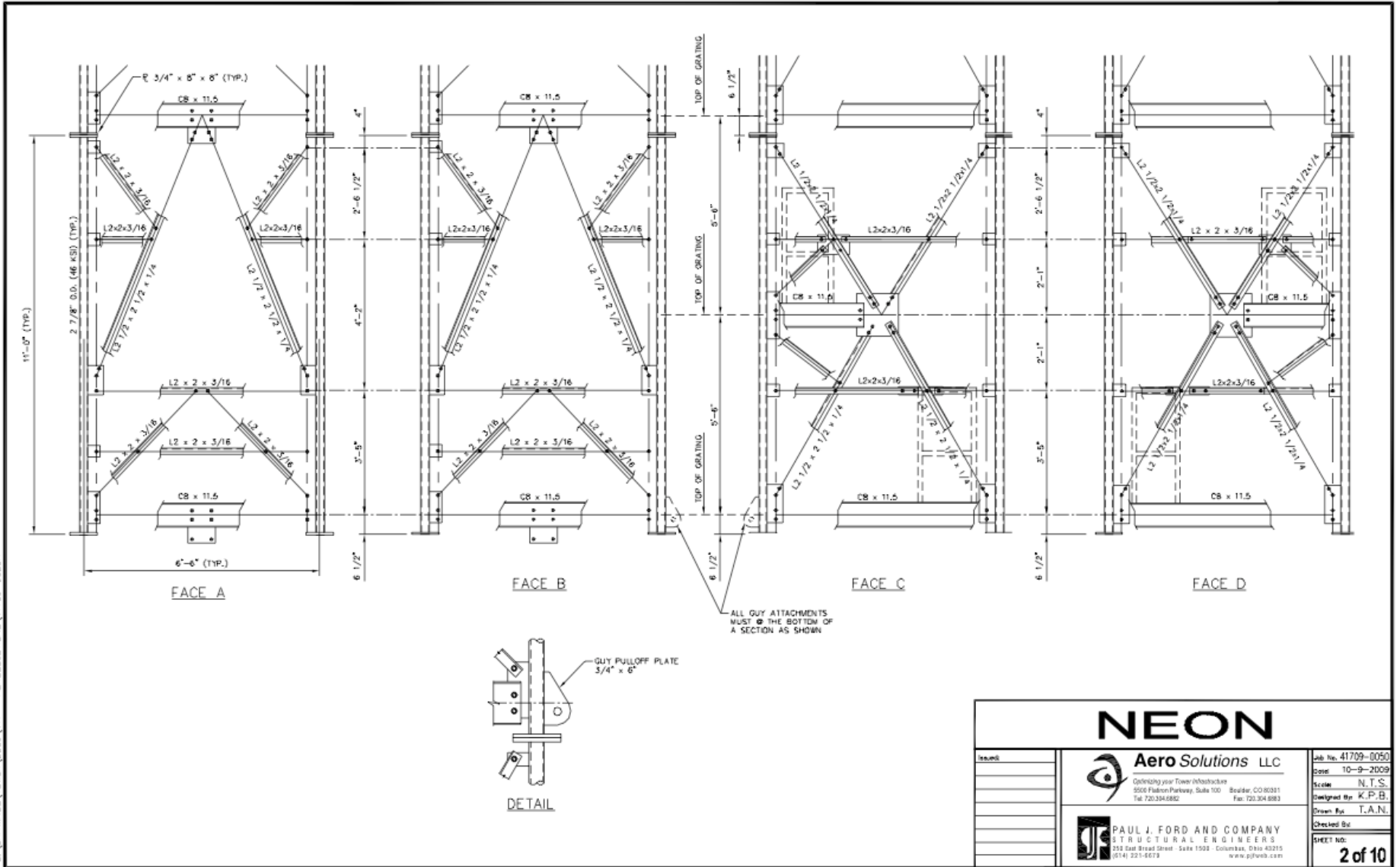
Analysis by:
 Kevin P. Bauman, P.E.
 Tower Department Manager
kbauman@pjfweb.com



PAUL J. FORD AND COMPANY
 STRUCTURAL ENGINEERS
 259 East Broad Street • Suite 1500 • Columbus, Ohio 43215

Tower Structural Analysis Report

Tower Face Details



G:\DRAWINGS\TOWER\2009\417 - AEROSOLUTIONS\41709-00504

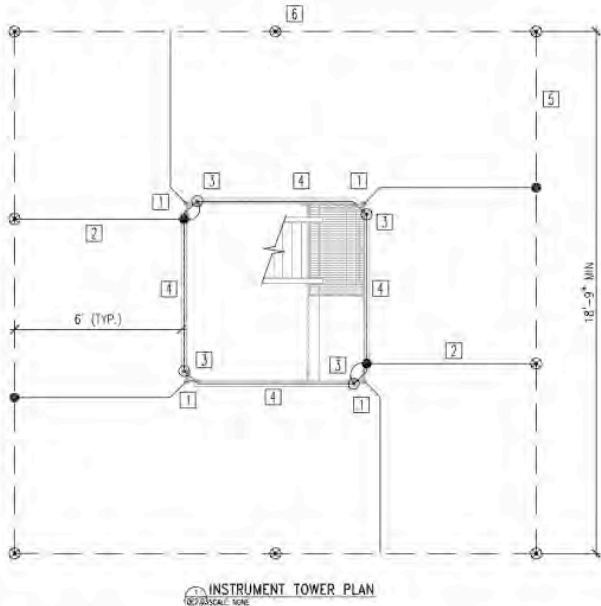
NEON		Job No. 41709-0050
Aero Solutions LLC		Date 10-9-2009
<small>Get into your Tower Infrastructure 5505 Fiddlers Parkway, Suite 100 Boulder, CO 80331 Tel. 720.334.8882 Fax. 720.334.8883</small>		Scale N.T.S.
PAUL J. FORD AND COMPANY <small>STRUCTURAL ENGINEERS 255 East Broad Street Suite 1500 Columbus, Ohio 43215 (614) 221-8678 www.pjfweb.com</small>		Designed By K.P.B.
		Drawn By T.A.N.
		Checked By
		SHEET NO. 2 of 10

Steps to install a 26' tower and foundation:

Tower Installation Procedure Graphic

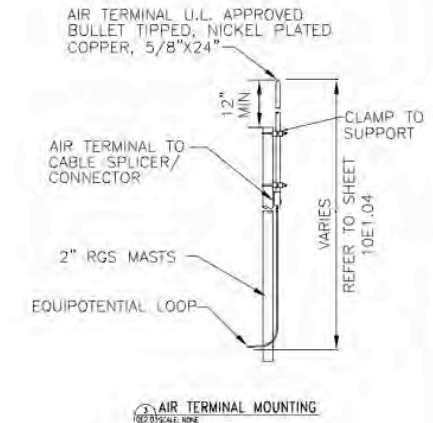
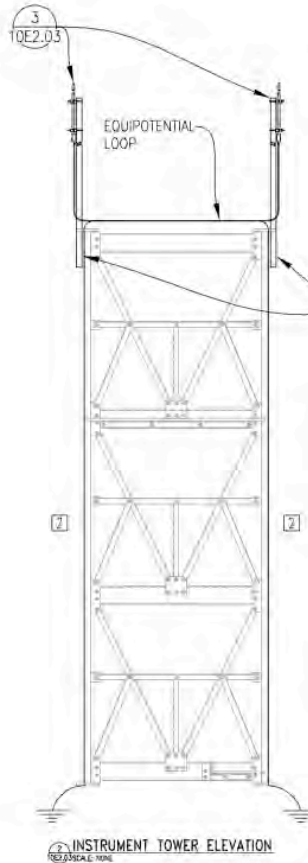
Prepare a walkway path		Foundation is excavated		Foundation reinforcing	
1	<p>Prepare a walkway path to the tower location from the nearest road. The walkway will not exceed 5' in width and will be built to minimize disruption to vegetation and soil.</p>	2	<p>Foundation is excavated using a mini excavator. All soils are emptied into a large canvas haul bag that is kept in the walkway easement and hauled in and out by another mini excavator. Excavated soils cannot be allowed to stay on site and cannot be placed over existing vegetation. All excavation that cannot be reached or handled by the mini ex must be performed by people hand digging with shovels.</p>	3	<p>All rebar for the foundation is carried to the foundation by the mini ex. Rebar is placed and tied in the hole by men.</p>
Concrete is hand mixed on site		Tower steel delivery		Tower steel components	
4	<p>Concrete is hand mixed on site and poured into hole with careful consideration to not spill outside of walkway easement or excavation area.</p>	5	<p>Tower steel arrives out at the road near the site and is offloaded from the flat bed truck.</p>	6	<p>Tower steel components are brought into the compound piece by piece and erected via a stick building methodology using a gin pole.</p>
Stick building methodology		Lightning system and fence		Walkway installation	
7	<p>Steel components are installed using a gin pole - winch or helicopter depending on site environment restrictions.</p>	8	<p>A 6' security fence is attached directly to the tower face as soon as the erection is complete. The fence will include a gate to allow climbers to access the internal stair system. Lightning system is installed on the tower. This can be installed by two men and does not require equipment.</p>	9	<p>Walkway grating is installed 2' off of ground level and anchored via small foundation footings with concrete mixed on site. The walkway is installed with minimal interruption to surrounding environment.</p>

D10 Tower Lightning Protection



KEYED NOTES:

- 1 BOND TO TOWER LEG AND CONNECT TO COUNTERPOISE WITH BARE #4/0 COPPER CONDUCTORS AS SHOWN.
- 2 ROUTE DOWN CONDUCTOR FROM TOP EQUIPOTENTIAL LOOP DOWN TOWER LEG AND CONNECT TO COUNTERPOISE AS SHOWN.
- 3 PROVIDE AIR TERMINAL AT EACH CORNER OF TOWER AS SHOWN.
- 4 PROVIDE EQUIPOTENTIAL LOOP AT TOP OF TOWER TO INTERCONNECT ALL FOUR AIR TERMINALS.
- 5 PROVIDE #4/0 BARE CONDUCTOR AROUND TOWER AS SHOWN TO FORM COUNTERPOISE. MAKE ALL CONNECTIONS WITH EXOTHERMIC WELDS.
- 6 PROVIDE 5/8" BY 10' COPPER GROUND RODS WHERE SHOWN. CONNECT TO COUNTERPOISE.



National Ecological Observatory Network
5340 Arroyo Blvd.
Boulder, CO 80508

LEO A DALY
A DIVISION OF
THE UNIVERSITY OF COLORADO
SYSTEMS

5940 Arroyo Blvd. Drive
Crested Butte, CO 81224
Tel: 402.591.6311 Fax: 402.591.6344

neon

KEY PLAN

REVISIONS

NO.	DESCRIPTION	DATE

FILE LOG

NO.	DATE	DESCRIPTION

NOT FOR CONSTRUCTION

Daly Project No. 003-10073-dali
NEON Project No. 01306.C1000
OCTOBER 26, 2009

EXAMINE ALL CENTRAL FRAMES
RELOCATABLE TOWER
LIGHTNING PROTECTION

10E2.03



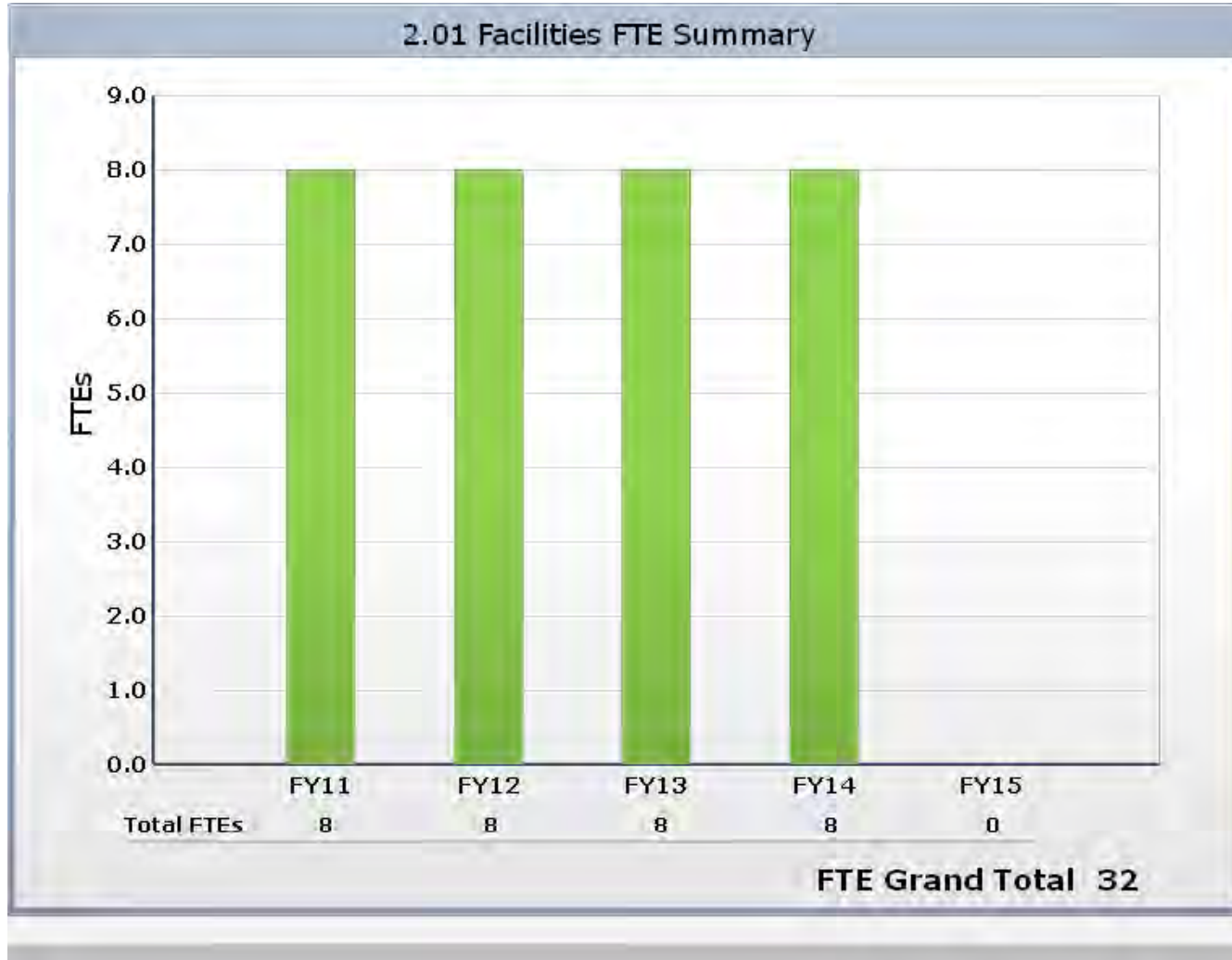
PDR Comments & Responses

- Prior to FDR, NEON, Inc. critical personnel should visit, identify and catalogue site challenges for all 20 Domains and incorporate into final design. **Done/Ongoing.**
- Prior to FDR, NEON, Inc. should refine their Risk Register to include probability of occurrence as a factor in contingency calculations. The project should also take into account the findings of the ground construction assessments recommended above. **Done.**
- Remain vigilant for construction difficulties that could occur at more difficult and complex sites. **Continual.**
- The panel recommends that site-by-site antenna grounding plans are reviewed by an independent consulting company and that the recommendations and final design are available at FDR. **Done.**
- Prior to FDR, establish a process to include local expertise and domain managers at an appropriately early time. **Done.**

2.01 Facilities - WBS

WBS	Title
2	NEON Ecological Observatory Network
2.01	Facilities
2.01.10	Facilities Management
2.01.30	Domain Facility Infrastructure
2.01.30.01	Northeast Domain Infrastructure
2.01.30.02	Mid Atlantic Domain Infrastructure
2.01.30.03	Southeast Domain Infrastructure
2.01.30.04	Atlantic Neotropical Domain Infrastructure
2.01.30.05	Great Lakes Domain
2.01.30.06	Prairie Peninsula Domain Infrastructure
2.01.30.07	Appalachians/Cumberland Plateau Domain
2.01.30.08	Ozarks Complex Domain Infrastructure
2.01.30.09	Northern Plains Domain Infrastructure
2.01.30.10	Central Plains Domain Infrastructure
2.01.30.11	Southern Plains Domain Infrastructure
2.01.30.12	Northern Rockies Domain Infrastructure
2.01.30.13	Southern Rockies/Colorado Plateau Domain Infrastructure
2.01.30.14	Desert Southwest Domain Infrastructure
2.01.30.15	Great Basin Domain Infrastructure
2.01.30.16	Pacific Northwest Domain Infrastructure
2.01.30.17	Pacific Southwest Domain Infrastructure
2.01.30.18	Tundra Domain Infrastructure
2.01.30.19	Taiga Domain Infrastructure
2.01.30.20	Pacific Tropical Domain Infrastructure

2.01 Facilities - FTE Spread by FY



FCC PT Risk Summary

Total Number of Risks					
0.9					
0.7					
0.5	1	2	1	1	
0.3		1	4		
0.1					1
	1	2	3	4	5

Impact

Total Number of Risks	11
Total Occurrence Cost of Risks	\$ 6,960,000

Near-Term Risks					
0.9					
0.7					
0.5					
0.3			1		
0.1					
	1	2	3	4	5

Impact

Mid-Term Risks					
0.9					
0.7					
0.5	1	2	1		
0.3		1	3		
0.1					1
	1	2	3	4	5

Impact

Far-Term Risks					
0.9					
0.7					
0.5					
0.3					
0.1					
	1	2	3	4	5

Impact

FCC PT Risk Register

Risk ID	Risk Title	Description	RRS	Risk Exposure	Occurrence Cost	Program Area	Status
100	Host Agreement Delays (MOU, MOA, etc.)	Every NEON site requires an agreement with the host agency, institution, or landowner in order for the construction to proceed. If the agreements are not in place, construction cannot begin. Cost: \$100k Reason: Cost is impacted by construction cost inflation, schedule delays, etc. Add 3% to average domain cost. Apply to 5 domains (25%).	2	Medium	\$ 500,000	FCC	Monitor
95	Contract Price Increase Requests by Contractors	Most construction materials and commodities will be purchased by contractors under their construction contracts w/ NEON. If these materials become scarce or rise inordinately in price, contractors may request price increases. Cost Estimate: \$72k Reason: Increased cost would be a small percentage addition to material costs. Assume 6% of 40% (material) of average domain cost. Applies to 25% of domains.	1.5	Medium	\$ 360,000	FCC	Monitor
103	Logistics Issues	Some NEON sites are remote and inaccessible by normal material delivery means. Cost: \$150k Reason: Remoteness factor is considered in the engineering cost estimates; however, if they prove insufficient, an additional 5% is considered as sufficient mitigation cost per domain. Apply to half of Medium and Hard sites = $9D \times 3 S/D \times 0.5 = 13$.	1	Medium	\$ 1,950,000	FCC	Monitor
104	Procurement Delays	Procurement process not accomplished timely Cost: \$100k Reason: Procurement delay costs are driven by price increase over time, inflation, and project schedule loss. Assume 3% to 5% of average domain cost. Apply to 3 contracts.	1	Medium	\$ 300,000	FCC	Monitor
96	Construction Flaws	The contractor does not successfully or faithfully execute the approved design during construction. Cost: \$150k Reason: R/R of flawed construction generally will be the responsibility of the contractor under the warranty. Associated costs will be more in terms of schedule loss. Assume 5% of average domain cost. Applies to 25% domains.	0.9	Medium	\$ 750,000	FCC	Monitor
97	Contractor Bid Pricing	Construction of the NEON Domain sites will be by contractors procured under a competitive bid process. Bid pricing will be a function of quality of the bid documents, contractor schedule availability, hunger, perception of the NEON project, and perception of NEON as a client, etc. Applies to 1 contract. Cost: \$200k to \$300k Reason: Average domain cost is ~\$3M. If bids come in 7% - 10% high, cost effect is ~\$250,000.	0.9	Medium	\$ 250,000	FCC	Monitor

FCC PT Risk Register

Risk ID	Risk Title	Description	RRS	Risk Exposure	Occurrence Cost	Program Area	Status
101	Site Use Costs	As a result of MOU/MOA negotiations, NEON may have to share site construction improvement and/or maintenance costs with host organizations (cf.: NEON-100). Maintenance is an Operations budget cost; however, site improvements may be an unbudgeted construction cost. Cost: \$100k Reason: Difficult to estimate, since tied to specific sites and host requirements. Assume 5% of domain construction cost. Apply to 20% of sites (12 sites).	0.9	Medium	\$ 1,200,000	FCC	Monitor
102	High Inflation	Economic factors influence construction costs, both material and labor. Normal inflation levels are generally anticipated in construction bids; however, inordinately high inflation may lead to higher prices. Cost: \$60k Reason: Assume inflation at 5% will add 2% to 2.5% to total domain construction cost. Applies to 50% of domains.	0.9	Medium	\$ 600,000	FCC	Monitor
98	Contractor Default	Contractor fails and is unable to complete the construction. Cost: \$100k to \$150k Reason: Cost of non-performance will be covered by performance bond. Cost to project will be in lost time and some peripheral expenses (travel, meetings, etc.). Assume 3% additional cost. Applies to 20% of total no of contracts (D10, D01, D15, Regional contracts = total of 10) or 2 contracts.	0.6	Low	\$ 250,000	FCC	Monitor
94	Weather Delays	Weather delays at various sites cause construction delays. Cost Estimate: \$50k Reason: Weather delays generally are priced into a contractor's bid. Hence, if a weather delay is incurred, there should be low cost impact. Assume 1 week delay (1/20th schedule delay equiv to ~5% of site cost). Domains judged most likely to experience weather delays: 1,5,9,12,13,15,16,17,18,19.	0.5	Low	\$ 500,000	FCC	Monitor
99	Contractor Protests	Contractor believes he has been treated unfairly, unethically, or illegally. Cost: \$300k Reason: Nuisance settlement costs, arbitration costs, legal costs, cost of judgment, lost time, etc., Assume 10% of average domain cost. Apply to 1 contract.	0.5	Low	\$ 300,000	FCC	Monitor

FCC Operations

Responsibility for:

- Relocating the Relocatables
- Special Maintenance/Repair Callouts
- Headquarter Facilities Maintenance Support (if needed)

Operations Staffing

- FCC Operations
 - Civil Engineer
 - Field Construction Supervisors (x2)
- Contract Administration → P&C (Overhead)

Future Work

(Present to Construction Start)

- Continue Domain / Site Designs
 - Confer on Site Characterizations and Final Site Configuration
 - Visit Sites w/ Design Firm
 - Ground Survey
 - Geotechnical Borings
 - Electrical Utility Provider
 - Jurisdictional Construction Permitting
 - Manage Final Design Development
- Manage Tower Contractor
- Participate in GC Bid Document Preparation
- Participate in GC Selection
- Coordinate Contractor Pre-Construction Activities



NATIONAL ECOLOGICAL OBSERVATORY NETWORK

The National Ecological Observatory Network is a project sponsored by the National Science Foundation and managed under cooperative agreement by NEON Inc.