FIRE STATION 35

SAN FRANCISCO, CA

RE: City of San Francisco

Date: February 3, 2021

To: Prospective Bidders

RE: *Floating Barge*

The City of San Francisco has expressed concern that a rigid foundation will not provide adequate service life for the intended Fire Station 35 due to the threat of global warming and rising sea levels. With the total building life cycle in mind, the City of San Francisco requests that prospective bidders provide design considerations for a tethered, floating steel barge to support the Fire Station.

Selection of systems and materials pertaining to the alteration of the design intent remain the responsibility of the Design-Builder. Design-Builders are required to prepare a narrative, schedule, and risk/benefit analysis based upon the following:

- *Scope:* Floating Steel Barge
    - Dimensions: 180' x 80' x 10'
    - Design Life: 75 years
    - Design Float Freeboard: 5 feet
- *Design Performance Criteria*:
    - Seismic Risk Category IV
    - Survive a 100-year storm event with minimal damage to facility.
    - Maintain adequate float keel clearance at extreme low tide.
    - Floating barge shall be moored using steel pipe guide piles founded in competent subsurface strata.
    - Design shall include wind, current and wave loading criteria.

<u>Deliverables:</u>

- *Design Narrative*: Based on the information provided, provide a clear design and construction approach to meet the above requirements. Include design considerations for super structure and interior finishes and clearly define how these are affected by utilizing a floating barge.
- *Schedule*: Prepare a separate schedule section for steel barge construction activity.
    - Minimum (10) activities required (including but not limited to):
        - Barge Tank Fabrication/Connection
        - Ballast Construction
        - Guide Pile Placement
        - Deck Form/Utility Rough-In
        - Deck Pour
        - Transfer Span (Access Ramp)
    - Barge Construction Schedule **MUST FINISH BY** Utility Tie-In Date
- *Risk/Benefit Analysis*: Provide a risk/benefit analysis comparing the floating barge to a traditional dry dock marine structure.

DESIGN CRITERIA

SPECIFICATIONS

Primary

ABS Rules	American Bureau of Shipping, *Rules for Building and Classing Steel Vessels 2011*. Houston, TX: American Bureau of Shipping, 2011.
ABS Shipbuilding	American Bureau of Shipping, *Shipbuilding and Repair Quality Standard for Hull Structures during Construction 2007*. Houston, TX: American Bureau of Shipping, 2007.
ASCE 61	American Society of Civil Engineers/Coasts, Oceans, Ports, and Rivers Institute 61-14: *Seismic Design of Piers and Wharves*. Reston, VA: ASCE, 2014
CBC	International Code Council and the California Building Standards Commission, *2016 California Building Code, California Code of Regulations.* Sacramento, CA: CBSC, 2016.
PoSF	2016 Port of San Francisco Port Building Standard Code

Secondary

AISC	American Institute of Steel Construction, *Steel Construction Manual, 14th Edition*. Chicago, IL: American Institute of Steel Construction, 2014.
ASCE 7	American Society of Civil Engineers, ASCE/SEI Standard 7-10, *Minimum Design Loads for Buildings and Other Structures*. Reston, VA: American Society of Civil Engineers, 2010.
AWS	American Welding Society, AWS D1.1/D1.1M:2015, *Structural Welding Code – Steel*, 23rd Edition. Miami, FL: American Welding Society, 2015.
ABS Welding	American Bureau of Shipping, *Rules for Materials and Welding (Part 2) 2003*. Houston, TX: American Bureau of Shipping, 2003.

DESIGN REFERENCES (INFORMATION ONLY – NOT CRITERIA)

AASHTO	American Association of State Highway and Transportation Officials, Inc., *AASHTO LRFD Bridge Design Specifications*, 8th Edition. Washington, DC: AASHTO, 2017.
ACOE	Army Corp of Engineers, Coastal Engineering Manual, Washington D.C.: US Army Corp of Engineers, 2008.
MIL	MIL-HDBK-1026/4A Mooring Design, Department of Defense Handbook, Washington, D.C.,1999.
MOTEMS	International Code Council and the California Building Standards Commission, Notice of Proposed Action, Marine Oil Terminals in 2001 California Building Code, California Code of Regulations, Title 24, Part 2, Vol. 2. CBSC, 2001.
PIANC	Working Group 33 of the Maritime Navigation Commission, Guidelines for the Design of Fender Systems: 2002. Brussels, Belgium: International Navigation Association, 2002.

GENERAL (REF. A)

Essential facility: The marine structures will be designed to be operational with no to minimal damage after the Operating Level Earthquake (OLE), minimal damage after the Contingency Level Earthquake (CLE), and operational with controlled and repairable damage after the Design Earthquake (DE, 2/3 of the Maximum Considered Earthquake design motions) and 100-year Design Storm. This meets or exceeds ASCE 61 requirements, and is consistent with the Marine Structural criteria provided in Reference A, Appendix J.1 page 88, "Seismic Performance Criteria". See ASCE 61 for damage definitions and strain limits.

Occupancy Category (CBC): IV

Risk Category: IV

Design life: 50 years typical, 25 years for fenders. Design to consider sea level rise in 50 years, i.e., the year 2070.

This is a dynamically loaded structure designed for a high fatigue reliability, however the inside of the float and float deck should be visually inspected every two years and any cracks repaired in accordance with AWS D1.1 requirements for dynamically loaded structures. The marine structural engineer shall be sent documentation of the discovered cracks and repairs.

DATUM

Elevations are North American Vertical Datum of 1988 (NAVD 88) unless otherwise noted.

WATER LEVELS (REF. A)

Level	Elev. (ft) NAVD 88
Design High Water - Tsunami	16.60
Design High Water - Operating	12.22
Design Base Flood Elevation (100 year Still Water Level)	9.80
Maximum (highest observed level)	9.42
Highest Astronomical Tide	7.75
Mean Higher High Water (MHHW)	6.37
Mean High Water (MHW)	5.76
Mean Sea Level (MSL)	3.22
Mean Low Water (MLW)	1.19
SFVD2013	0.02
NAVD88	0.00
Mean Lower Low Water (MLLW)	-0.23
Lowest Astronomical Tide	-2.17
Design Low Water	-2.42
Minimum (lowest observed tide)	-2.80

Notes:

1. Water Levels based on RFP Appendix J.1 – Technical Design Criteria, Table 13 on page 92, and NOAA site, Station 9414290, San Francisco, CA
2. "Design High Water – Tsunami" based on Tsunami of 8.04 ft + MHW + Sea Level Rise of 2.8 ft by 2070, where Tsunami height is based on the "Attachment B – City & County of San Francisco Coastal Tsunami Inundation Map" in the "City & County of San Francisco Emergency Response Plan, Tsunami Response Annex" dated September 2008 and SLR is based on RFP Appendix J.1 – Technical Design Criteria, Water Levels on page 76.
3. "Design High Water – Operating" based on Maximum (highest observed level) of 9.42' + Sea Level Rise of 2.8 ft by 2070. Wave action will be accounted for in the pile length design.
4. Design Low Water based on expected Sea Level Rise in 2020 from NOAA site, Extreme Water Levels for Station 9414290, San Francisco, CA
5. SFVD2013: From RFP Appendix J.1 – Technical Design Criteria, page 58:

   Datum

   The Record of Survey provided by Public Works indicated that the Geometric Datum is NAD83 (2011) and the reference network is CCSF – 2013 HPN. The City of San Francisco recently changed their vertical datum. The Designer should take note that record drawings or as-built drawings may be on the old City Datum. The conversion from current datum is as follows:

   SFVD2013 = Old City Datum + 11.35'

   From RFP Appendix J.1 – Technical Design Criteria, page 534:

   SF City Datum = NAVD88 - 11.326'
6. Sea Level Rise of 4.5' by 2100 (80 years) based on the maximum of the following:
   a. Rate of sea level risk for 50 year design life projected to 80 years
   b. Mid-level projection of sea level rise of 46" in Table 6-2 in POSF Seawall Vulnerability Study, Phase 2 report, in RFP Appendix J.4

100% MS CD SET

NOTE: If this drawing is not 34"x22" it has been revised from its original size and the scales noted on drawing/details are no longer applicable.

NO.	DATE	ISSUE DESCRIPTION
B	11/2/18	90% MARINE STRUCTURAL CD
C	12/14/18	MARINE STRUCTURAL SHOP DRAWINGS 1
D	01/25/19	MARINE STRUCTURAL FOR SHOP DRAWINGS 2
1	06/07/19	100% MARINE STRUCTURAL CD

SAN FRANCISCO FIRE DEPARTMENT

FIRE BOAT 35

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FOR LIFTECH CONSULTANTS INC
SIGNATURE DATE: 06/07/19

Drawing Title
DESIGN CRITERIA - 1

Drawing No.
MS-002

Sheet No. of

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VESSEL DATA (REF. A)

Vessel	Guardian	Phoenix	St. Francis	Moose Boat
Length Overall, LOA	88'	89'	88'	37'-10"
Beam	21.6'	19.5'	26.0'	13'-6"
Maximum Displacement	188 long tons	146 long tons	260 long tons	8 long tons (dry)
Loaded Draft	7.0'	7.0'	9.0'	1.83'
Freeboard at Midship	3.5'	5.67' (1)	7.25' (1)	
Trim	4.0'			

Based on RFP Appendix J.1 – Technical Design Criteria, Table 12 on page 91; RFP Addendum No. 3 Item 18; and March 6, 2018, site visit, measured at mid vessel (items marked with (1))

BASIC LOADS – UNFACTORED (ASD) UNLESS OTHERWISE NOTED

GENERAL LOAD DEFINITIONS

D Dead Load – Weight of Fixed Structure and Components

Live Loads
LU Uniform Loads from People and Equipment
LC Concentrated Loads
LB Vessel Berthing
LM Mooring Loads

Environment Loads Excluding Wind
EW Waves
EM Marine Growth = 5 psf on submerged surfaces
EC Current

W Wind Loads per ASCE 7-10 unless otherwise noted

q_zG = $0.00256\ K_z\ K_{zt}\ K_d\ V^2\ G$ (psf)
= 20 psf at 15' above water

Basic wind speed, V	115 mph, 3-s gust, at 33 ft
Risk Category	IV
Exposure category	D
Velocity pressure coef., K_z	$z < 15'$: $K_z = 1.05$
	$z \geq 15'$: $K_z = 2.01\ (z/700)^{0.17}$
Structure height, z	in feet
Topographic factor, K_{zt}	1.0
Directionality factor, K_d	0.85
Gust effect factor, G	0.85

S Earthquake Loads, Factored (LRFD)

Inertial loads based on site specific ground motions (see Float, Gangway, and Pier sections)

COMPONENT LOAD DEFINITIONS

Railings / Guardrails (CBC is primary design specification)

L LU_R Lateral Load of 50 PLF, "U" is for uniform, typical
LC_R 200 lbs on handrail in any direction, "C" is for concentrated, typical

Gangway (CBC is primary design specification)

L Live Loads - Individual Nonconcurrent Loads:
LU_G 100 psf
LC_G 400 pounds

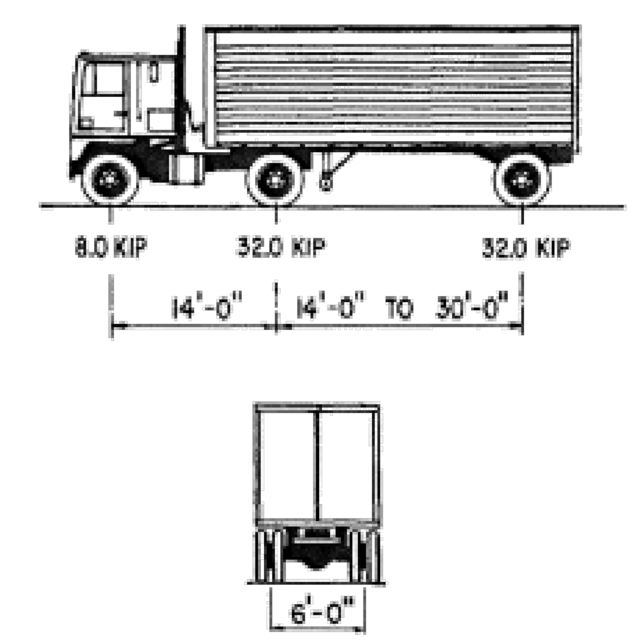
S Earthquake Loads, Factored (LRFD)

The Port of SF has agreed that we can design for a pier EQ acceleration of 1.5 g in any direction with 0.45 g concurrent in the orthogonal directions. Based on this and on much smaller float design storm and EQ accelerations, we recommend the following EQ loading combinations for the gangway supports (directions are relative to gangway):

a. EQ 100% in Transverse Direction, 30% in Longitudinal Direction
   i. Pier End: 0.5 g x W transverse, 0.45 g x W longitudinal, where W is the total mass (weight) of the gangway
   ii. Float End: 0.25 g x W transverse, wheel friction longitudinal
b. EQ 100% in Longitudinal Direction, 30% in Transverse Direction
   i. Pier End: 0.15 g x W transverse, 1.5 g x W longitudinal
   ii. Float End: 0.08 g x W transverse, wheel friction longitudinal

Access Ramp (CBC is primary design specification)

L Live Loads - Individual Nonconcurrent Loads:
LU_{AR} 250 psf (between girders)
LC_{AR} AASHTO HS20-44 (between girders)
LU_{HP} 100 psf at the AWSS Hose Platform



Note: LL deflection ≤ L/180 maximum (REF. A)

S Access ramp and gangway structure designs controlled by non-seismic loads

Access ramp connections designed to ASCE 61 to be operational with little or no damage based on design acceleration of pier and floats, mass of ramp, and 1% wheel friction.

Gangway connections designed to remain elastic under float design movements and a main pier/existing wharf design acceleration of 1.5 g in any lateral direction with a concurrent acceleration of 0.45 g in the orthogonal lateral direction. A large design acceleration is used because the dynamic response of this structure is unknown, and the mass of the gangway is small, i.e., it is practical to design for a conservative acceleration.

E,W,S Design displacements and rotations. See sheet MS-009.

100% MS CD SET

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Drawing Title
DESIGN CRITERIA - 2

Drawing No.
MS-003

Sheet No. of

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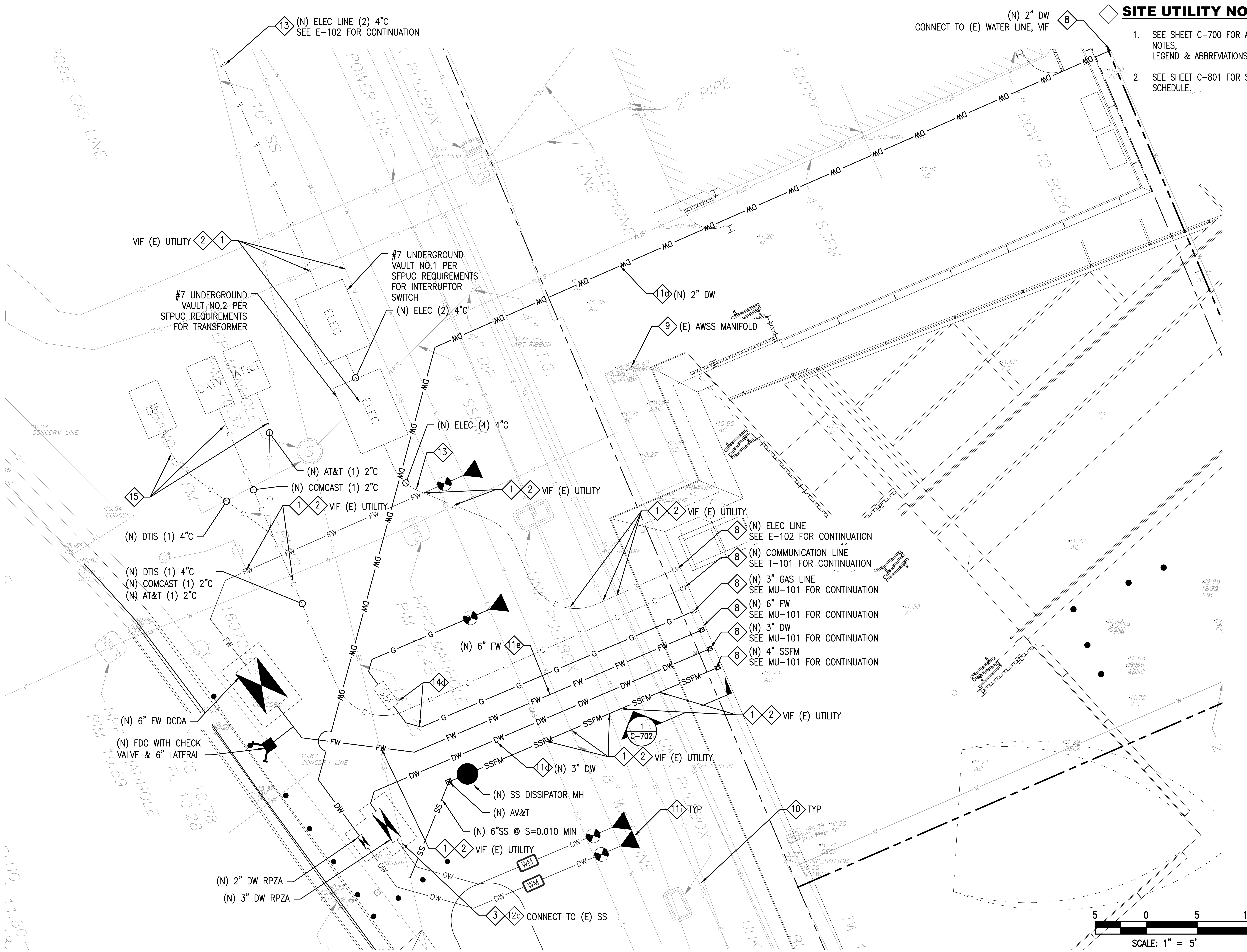

SITE UTILITY NOTES

1. SEE SHEET C-700 FOR ALL UTILITY NOTES, LEGEND & ABBREVIATIONS.
2. SEE SHEET C-801 FOR STRUCTURE SCHEDULE.

NOTE: If this drawing is not 34"x22" it has been revised from its original size and the scales noted on drawing/details are no longer applicable.

NO.	DATE	ISSUE DESCRIPTION
	6/25/18	100% SCHEMATIC DESIGN
	9/13/18	50% DESIGN DEVELOPMENT INTERNAL REVIEW
	10/29/18	100% DESIGN DEVELOPMENT
	2/19/19	50% CONSTRUCTION DOCUMENTS
	4/29/19	90% CD ISSUE FOR PERMIT
R2	11/12/19	100% CD ISSUED FOR CONSTRUCTION
R3	09/18/20	100% CD ISSUED FOR CONSTRUCTION - CIVIL (ADDENDUM 4)

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Drawing Title
SITE UTILITY PLAN

Drawing No.
C-701

SKA Project Number: 16713