LOUISIANA BUILDING DESIGN

TECHNICAL REVIEW

JULY 22, 1996

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Presentation Overview

- Summary of LA design process
- Design differences relative to WA
  - » site layout
  - » mid station (Valve Station)
  - » climate
- LA cost estimate

Design Process Summary

- The initial LA design started as copy of the WA FDR design, modified for:
  - » differences in site requirements
  - » available property
  - » HVAC load
  - » Drainage
- Facilities Group conducted a table top review on June 11, 1996, at Parsons

Design Process (ctd)

- Contacted LSU and Woodward Clyde for a recommendation of an A/E firm familiar with standard building practices in the Gulf coast region.
- Selected and retained John Desmond Associates to review the Parsons design and make recommendations.

Design Process (ctd)

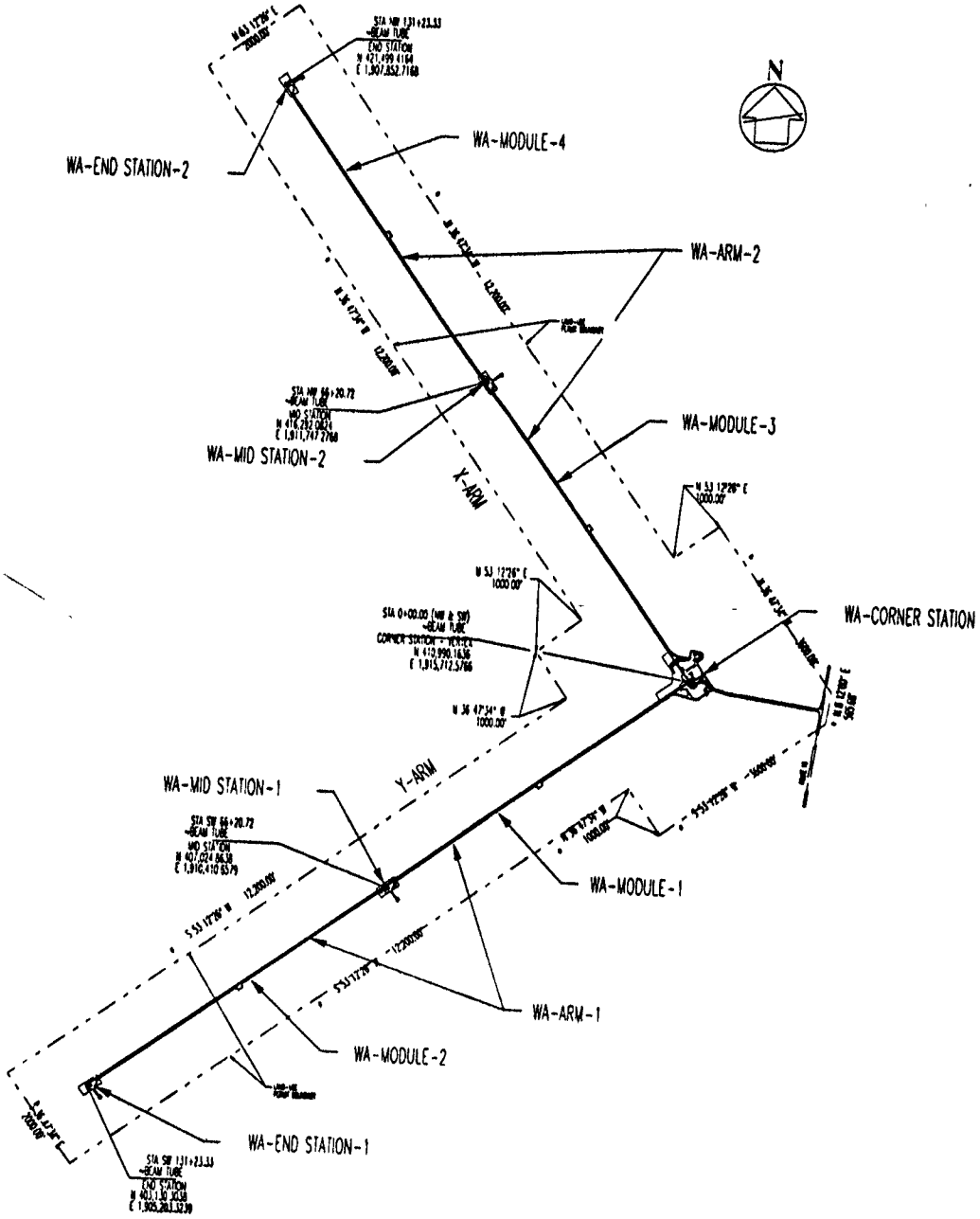
- Reviewed John Desmond Comments with Parsons for resolution
- Technical review board approval desired to ratify that proper design considerations have been implemented.

LA Requirement Differences

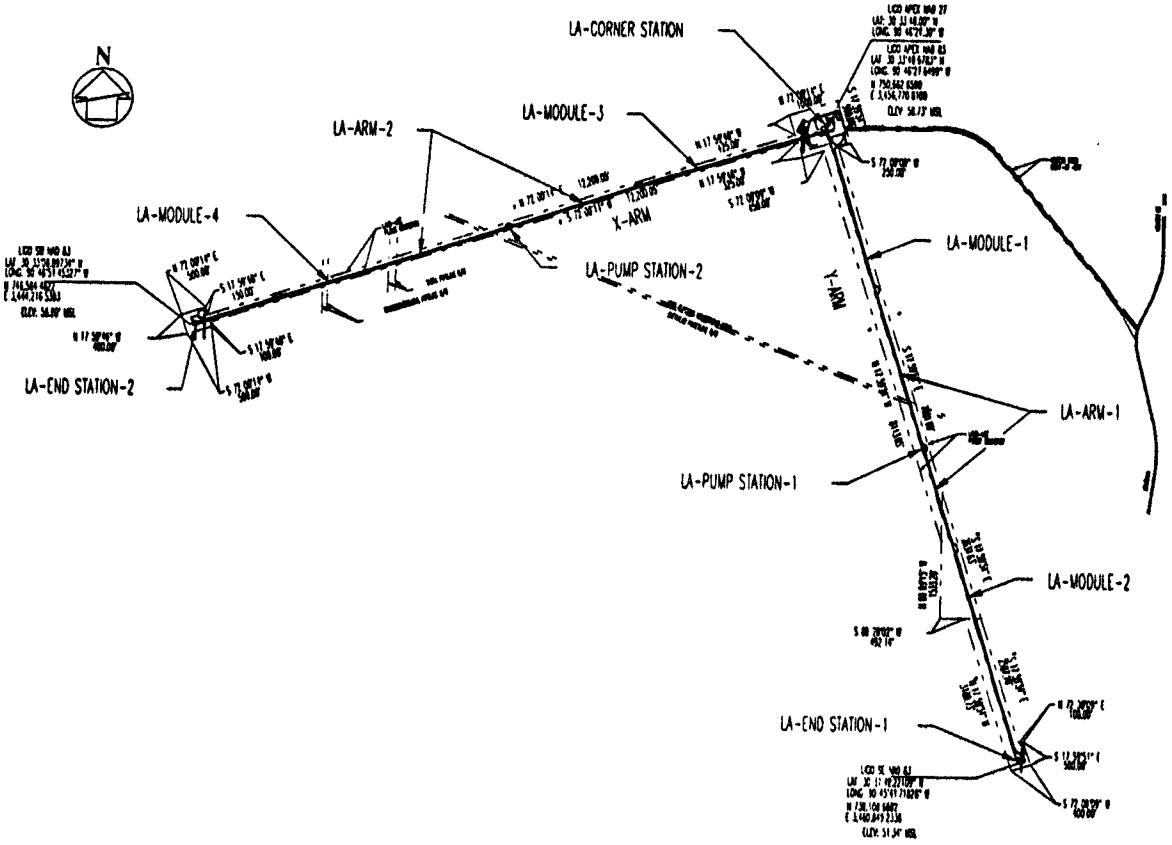
- Two interferometers
  - » Buildings sized to to accommodate two full length interferometers
- Mid station
  - » No half size interferometer at Mid Station
  - » Gate valve protection only

LA Design Differences

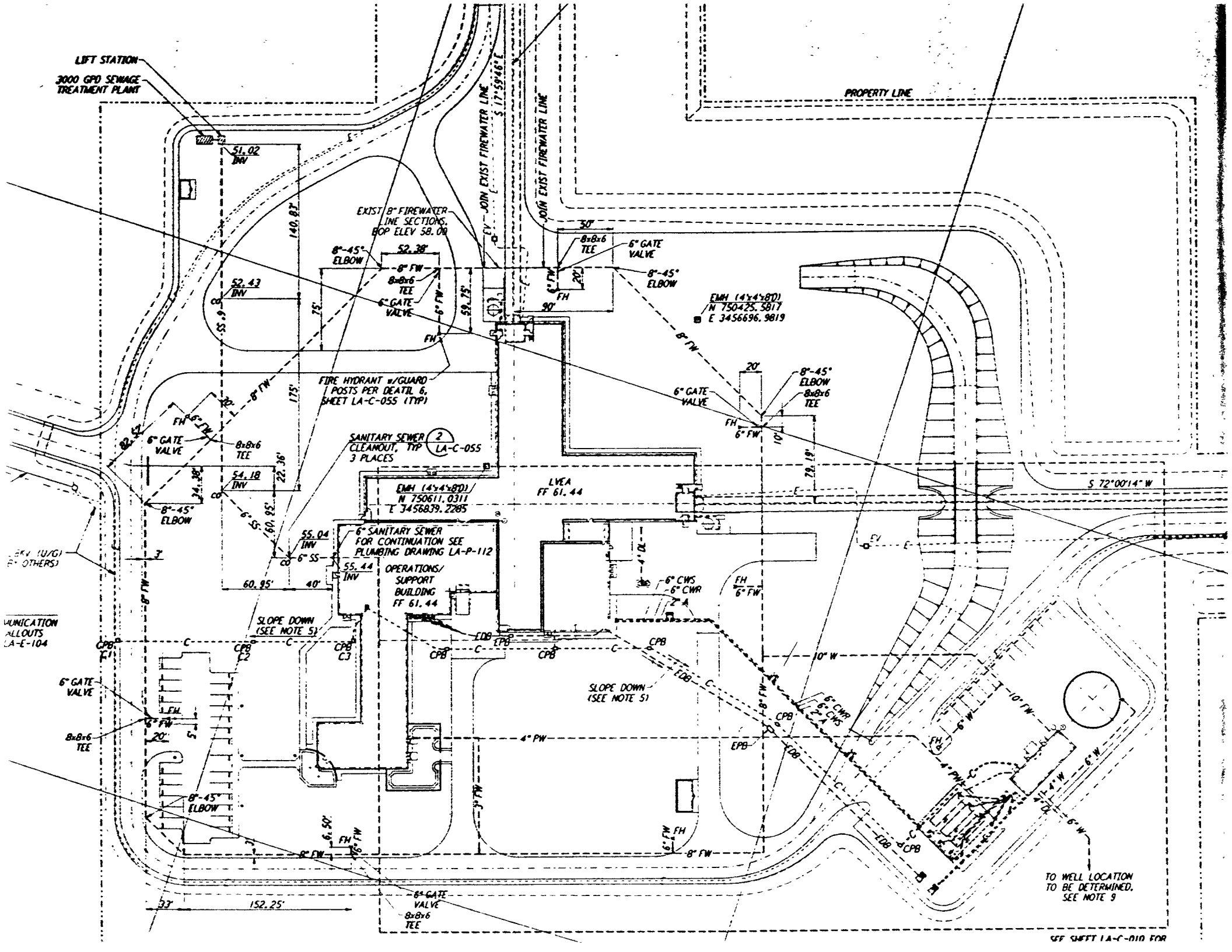
- Site Property
  - » Purchased/leased minimum land required for construction and operation
  - » Property boundary constraints required different layout
- Environmental
  - » Flat plaine (flood conditions)
  - » High water table (settlement)
  - » High humidity/precipitation
  - » Difficult drainage

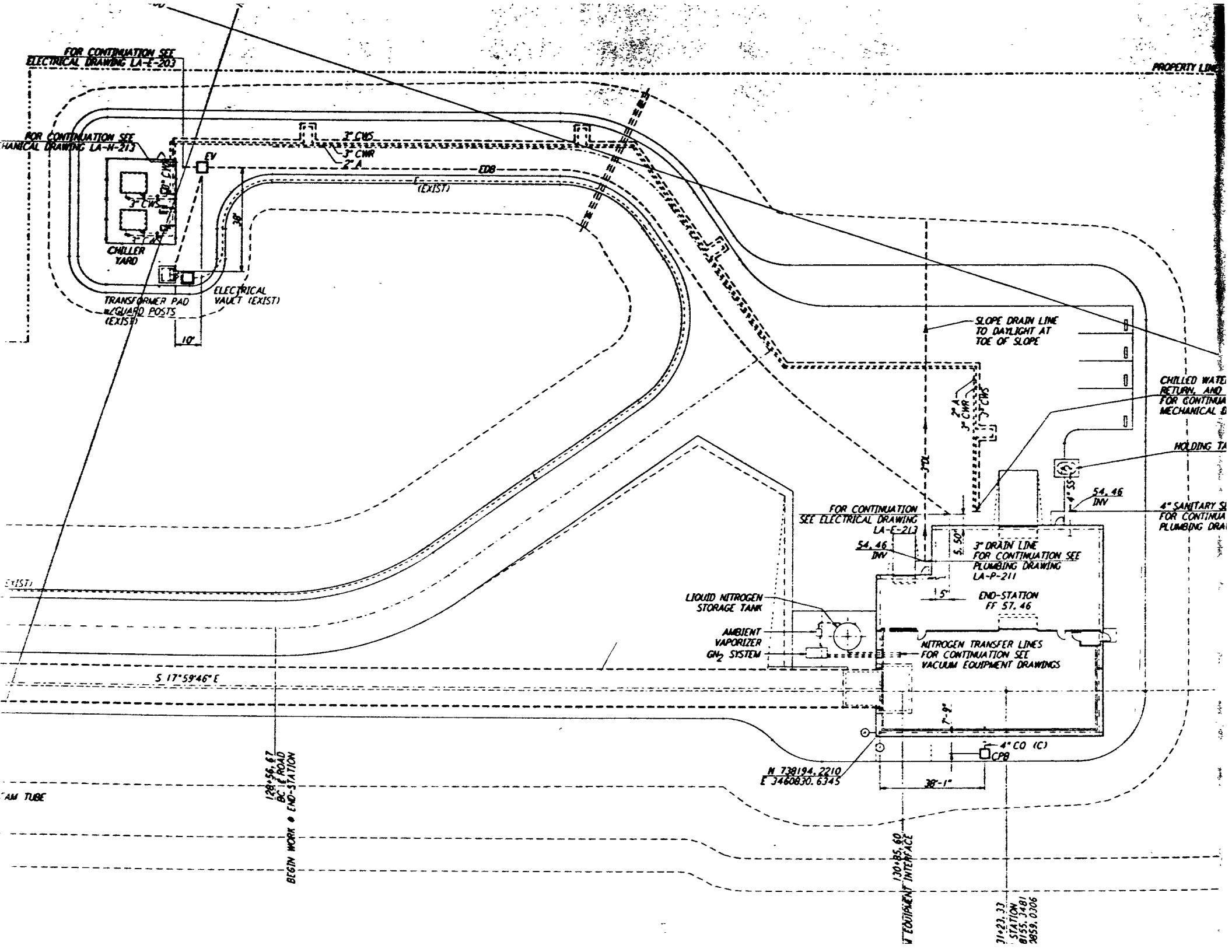


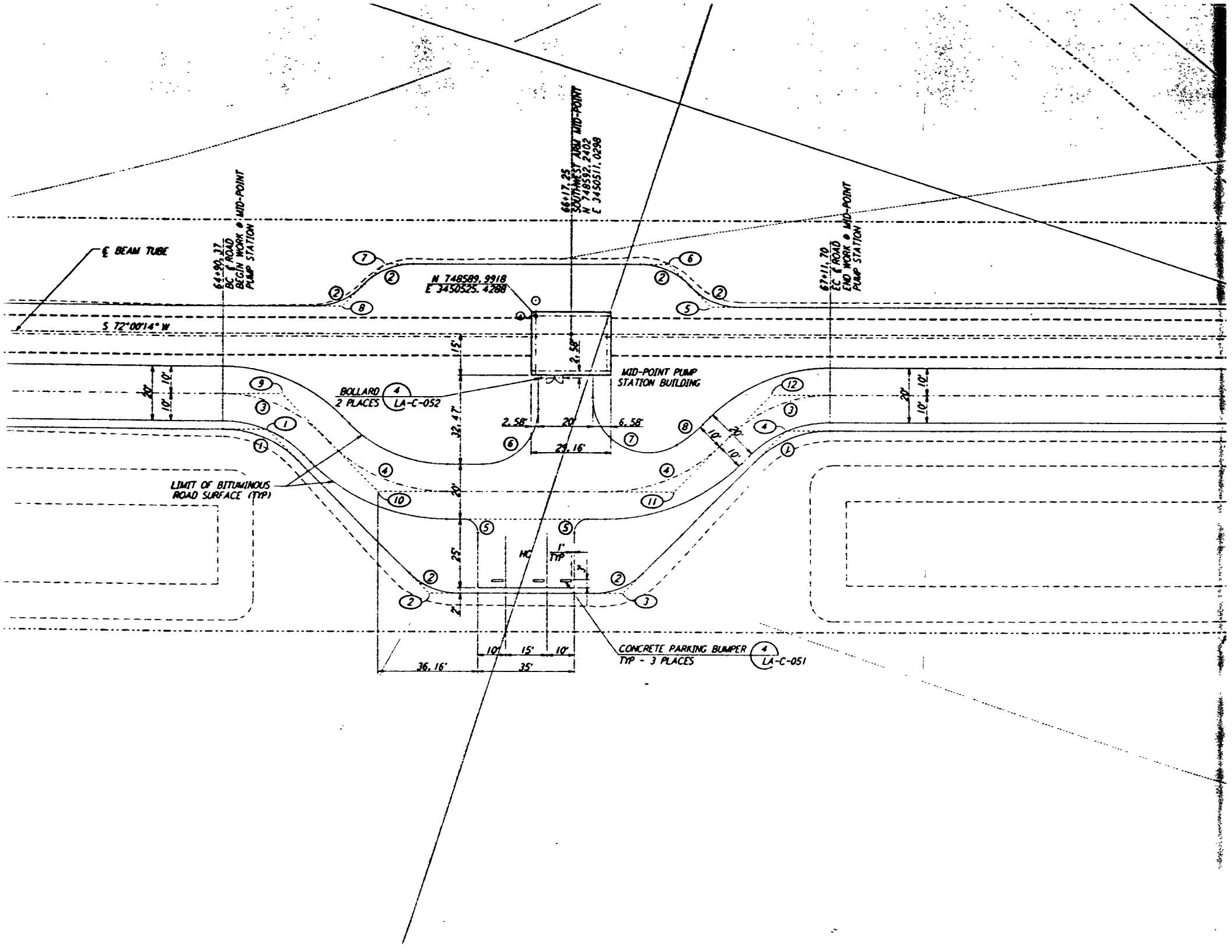
Hanford Property Boundaries



Livingston Property Boundaries

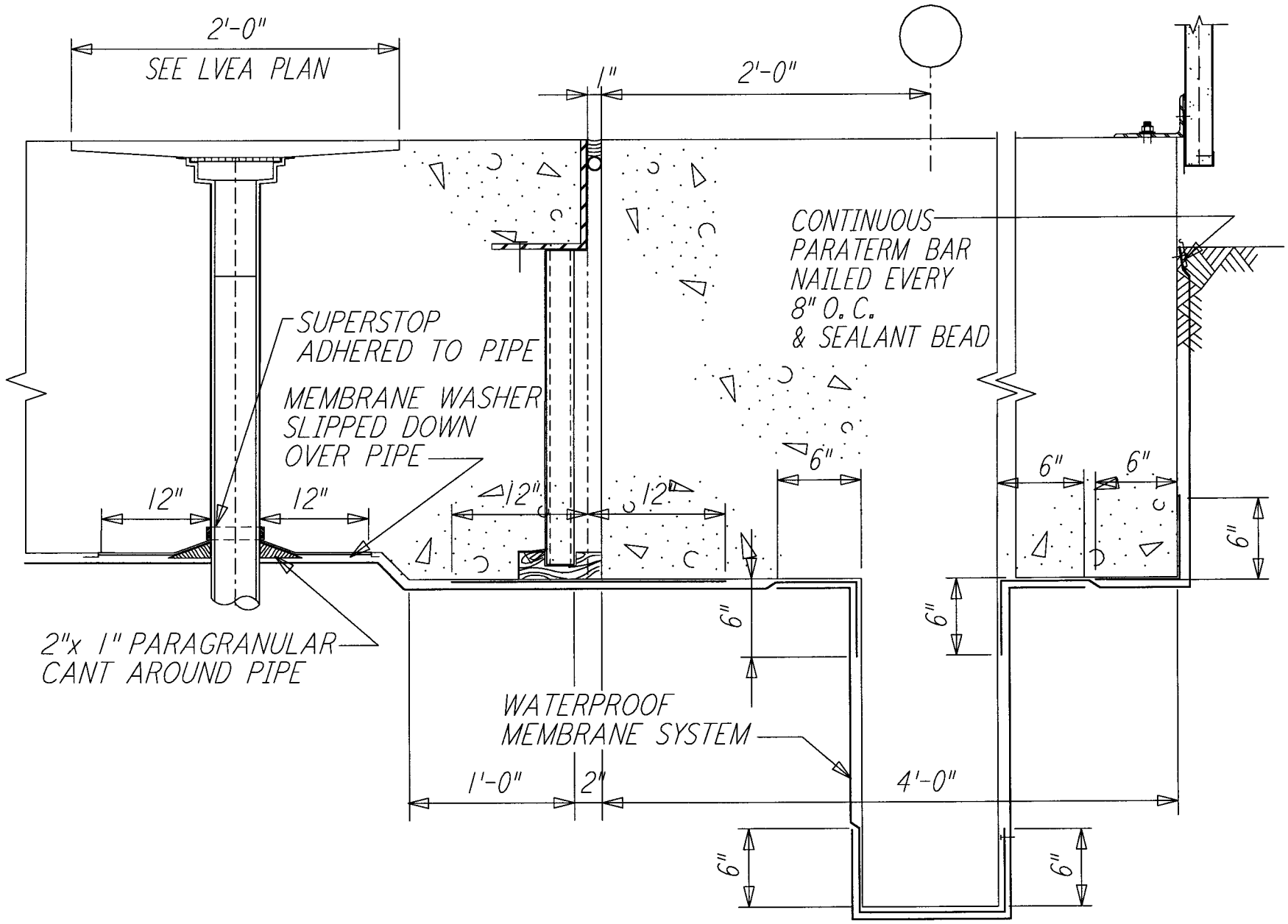

LIFT STATION
3000 GPD SEWAGE TREATMENT PLANT
PROPERTY LINE
JOIN EXIST FIREWATER LINE
S 17°59'46" E
EXIST 8" FIREWATER LINE SECTIONS, TOP ELEV 58.09
EV - JOIN EXIST FIREWATER LINE
51.02 INV
140.83'
52.38'
8"-45° ELBOW
8"FW
8x8x6 TEE
6" GATE VALVE
20'
90°
FH
EMH (4'x4'x8D)
N 750425.5817
E 3456696.9819
52.43 INV
55.9'
75'
59.75'
6"FW
FIRE HYDRANT w/GUARD POSTS PER DEATIL 6, SHEET LA-C-055 (TYP)
175'
SANITARY SEWER CLEANOUT, TYP 3 PLACES
2 LA-C-055
54.18 INV
22.36'
34.38'
60.95'
55.5'
40'
EMH (4'x4'x8D)
N 750611.0311
E 3456839.2285
LVEA
FF 61.44
S 72°00'14" W
78.19'
10'
55.04 INV
6" SS
6" SANITARY SEWER FOR CONTINUATION SEE PLUMBING DRAWING LA-P-112
55.44 INV
OPERATIONS/ SUPPORT BUILDING FF 61.44
4" OL
6" CWS
6" CWR
2" A
SLOPE DOWN (SEE NOTE 5)
CPB
EOB
10" W
4" PW
3" FW
6.50'
TO WELL LOCATION TO BE DETERMINED, SEE NOTE 9
33'
152.25'
SEE SHEET LA-C-010 FOR


FOR CONTINUATION SEE ELECTRICAL DRAWING LA-E-203
PROPERTY LINE
FOR CONTINUATION SEE MECHANICAL DRAWING LA-M-213
3" CWS
3" CWR
2" A
EDB
(EXIST)
CHILLER YARD
TRANSFORMER PAD w/GUARD POSTS (EXIST)
ELECTRICAL VAULT (EXIST)
10'
SLOPE DRAIN LINE TO DAYLIGHT AT TOE OF SLOPE
CHILLED WATER RETURN, AND FOR CONTINUATION MECHANICAL
HOLDING TA
4" SS
54.46 INV
4" SANITARY SE FOR CONTINUA PLUMBING DRA
FOR CONTINUATION SEE ELECTRICAL DRAWING LA-E-213
54.46 INV
5.50'
3" DRAIN LINE FOR CONTINUATION SEE PLUMBING DRAWING LA-P-211
5"
END-STATION FF 57.46
LIQUID NITROGEN STORAGE TANK
AMBIENT VAPORIZER GN_2 SYSTEM
NITROGEN TRANSFER LINES FOR CONTINUATION SEE VACUUM EQUIPMENT DRAWINGS
S 17°59'46" E
7'-9"
4" CO (C)
CPB
N 738194.2210
E 3460830.6345
38'-1"
AM TUBE
128+56.67
BC ℄ ROAD
BEGIN WORK ● END-STATION
130+85.60
T EQUIPMENT INTERFACE
71+23.33
STATION
8155.3481
2859.0306


℄ BEAM TUBE
64+90.37
BC ℄ ROAD
BEGIN WORK ● MID-POINT
PUMP STATION
66+17.25
SOUTHWEST CORNER MID-POINT
N 748592.2102
E 3450511.0298
67+11.70
EC ℄ ROAD
END WORK ● MID-POINT
PUMP STATION
N 748589.9918
E 3450525.4288
S 72°00'14" W
MID-POINT PUMP
STATION BUILDING
BOLLARD 4
2 PLACES LA-C-052
LIMIT OF BITUMINOUS
ROAD SURFACE (TYP)
HC
1' TYP
CONCRETE PARKING BUMPER 4
TYP - 3 PLACES LA-C-051
2.58'
20'
6.58'
29.16'
32.17'
15'
25'
2'
10'
15'
10'
36.16'
35'

Foundation Work

- Slab versus piles
  - » Woodward Clyde recommended slab foundation
  - » Parsons designers concurred
  - » Instrumented RG to validate settlement
- Bentonite sealant on rubber mat around foundation
  - » Installation sequence for slab and foundation to be determined by building contractor



THRU FLOOR PENETRATION

1"=1'-0"

6 REF
LA-A-429

K/LA-S-101
LA-A-101

Ceiling Panels

- Charles Martin, LSU VP, recommended the use of 2x2 ceiling panels in place of the originally planned 4x4 panels:
  - » Current design uses 2x2 panels
  - » J. Desmond concurred that either size was acceptable (except for prolonged shut downs)

Valve station requirements

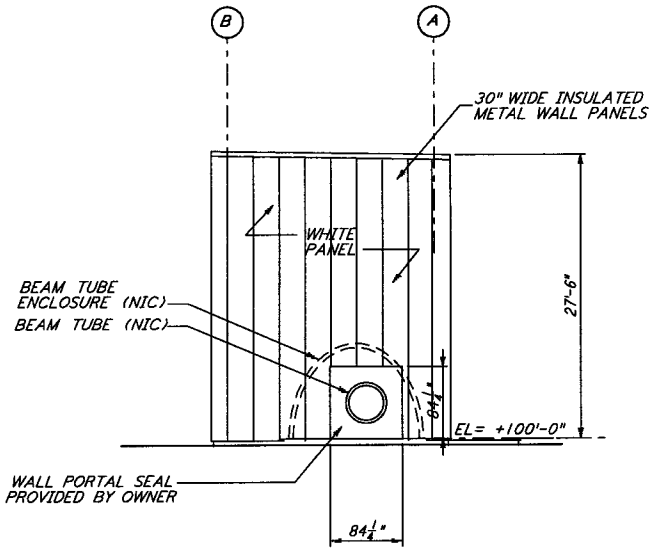
- Initial requirements were not specific
- Developed a set of requirements
  - Joint effort with Systems Engineering
  - Resulted in a "wish list"
- Parsons cost estimate for the ensuing design was deemed too expensive
  - $175K per station
- Reduced requirements to minimal needs
  - Weather protection for valve only

Valve station design alternatives

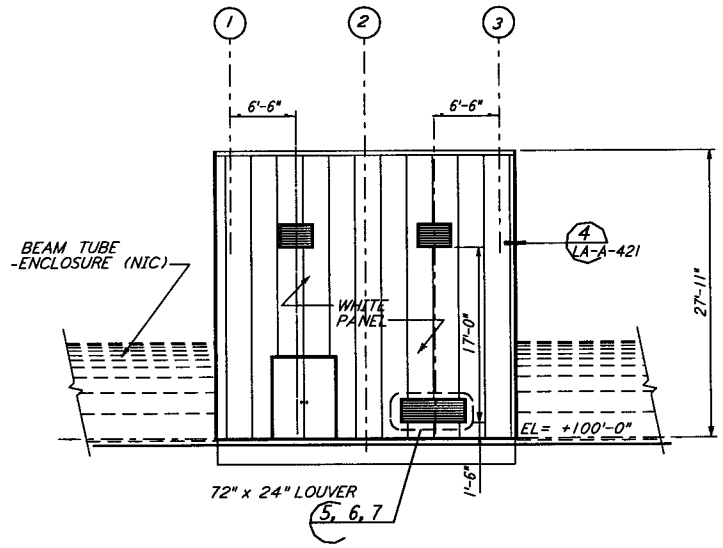
- With environmental control (HVAC system) and electrical power
  - Fully engineered and Pre-engineered full size building
  - Pre-engineered with removable roof for valve removal
- Weather protection only
  - Engineered and pre-engineered metal frame building
  - Concrete Masonry Unit (CMU) with steel framed roof system
- Design selection
  - Buildings with HVAC and permanent Power far exceeded budget cost
  - Tough CMU was lowest cost, selected the Engineered building to match the other site buildings

Valve station design

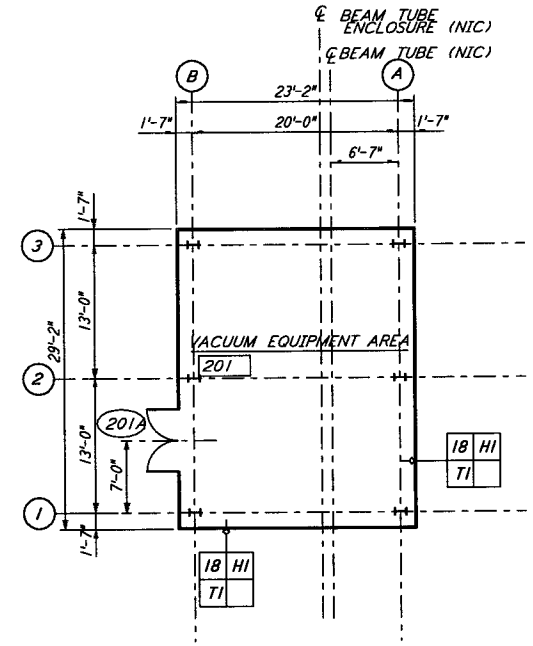
- Weather protection for valve only
  - no power, no water, no HVAC
  - Conduit stub-ups, same as 250 m points
  - internal roof height of 23 feet to accommodate gate valve disassembly
  - floor space of 20 x26 feet for clear area around valve
  - 6 x 8 foot roll up door for gate valve installation
  - Louvers provide ventilation
  - Entire foundation acts as the termination slab
- Operational considerations
  - Power is only required during acceptance testing and bake; this can be installed on a temporary basis
  - Valve operation during operation is minimal and can be accomplished either manually or with portable generator



ELEVATION
1/8"=1'-0"
C
LA-A-201



ELEVATION
1/8"=1'-0"
D
LA-A-201

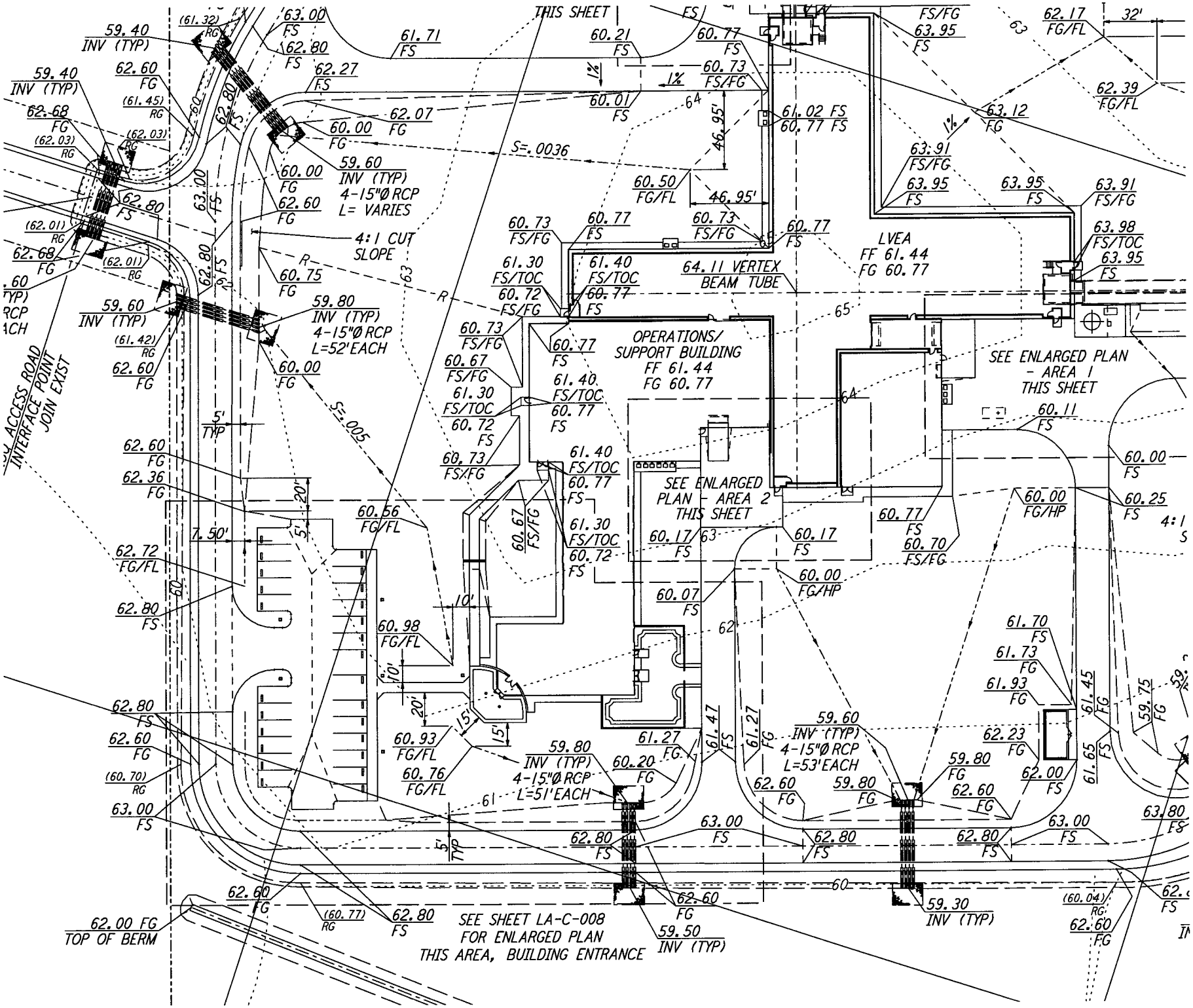


MID STATION "B" FLOOR PLAN
1/8"=1'-0"
3
LA-A-201

0 8 16 24 32FT
1/8" = 1'-0"

Rain-Roof-Wall-Drainage

- Concern over water influx at eves, through wall and on top of foundation
  - Specifications for wall panels, caulking provisions, mud sill and eve details were reviewed by Desmond his recommendations incorporated by Parsons
- Drainage provisions
  - 30 " retaining wall at "back" side of LVEA
  - Corner station area drains away from buildings using culverts under service roads
  - All building floors are above 500 year flood level


THIS SHEET
59.40 INV (TYP)
62.60 FG
62.68 FG
(62.03) RG
(62.01) RG
(61.42) RG
(61.45) RG
(61.32) RG
63.00 FS
62.80 FS
62.27 FS
61.71 FS
60.21 FS
60.77 FS
60.73 FS/FG
60.01 FS
62.07 FG
60.00 FG
59.60 INV (TYP) 4-15"Ø RCP L= VARIES
59.80 INV (TYP) 4-15"Ø RCP L=52'EACH
4:1 CUT SLOPE
60.75 FG
S=.0036
S=.005
46.95'
1%
61.02 FS
60.77 FS
63.12 FG
63.91 FS/FG
63.95 FS
62.17 FG/FL
62.39 FG/FL
32'
60.50 FG/FL
60.73 FS/FG
60.77 FS
63.98 FS/TOC
LVEA FF 61.44 FG 60.77
64.11 VERTEX BEAM TUBE
61.30 FS/TOC
60.72 FS/FG
61.40 FS/TOC
60.77 FS
OPERATIONS/ SUPPORT BUILDING FF 61.44 FG 60.77
SEE ENLARGED PLAN - AREA 1 THIS SHEET
SEE ENLARGED PLAN - AREA 2 THIS SHEET
60.67 FS/FG
60.11 FS
60.00 FS
60.25 FS
60.00 FG/HP
60.17 FS
60.70 FS/FG
60.56 FG/FL
62.36 FG
62.72 FG/FL
7.50'
5' TYP
20'
10'
60.98 FG/FL
60.93 FG/FL
60.76 FG/FL
15'
61.27 FG
61.47 FS
60.20 FG
59.60 INV (TYP) 4-15"Ø RCP L=53'EACH
59.80 INV (TYP) 4-15"Ø RCP L=51'EACH
61.70 FS
61.73 FG
61.93 FG
61.45 FG
59.75 FG
62.23 FG
62.00 FS
61.65 FS
59.80 FG
62.60 FG
63.00 FS
62.80 FS
63.80 FS
(60.70) RG
(60.77) RG
62.00 FG TOP OF BERM
SEE SHEET LA-C-008 FOR ENLARGED PLAN THIS AREA, BUILDING ENTRANCE
59.50 INV (TYP)
59.30 INV (TYP)
(60.04) RG
ACCESS ROAD INTERFACE POINT JOIN EXIST

Critical Elevations

- At Corner Station:
  - » Top of Beam Tube Enclosure Slab 64.05 ft
  - » LVEA Finish Floor (same as OSB) 61.44 ft
  - » Top of Final Grade (outside OSB) 60.77 ft
  - » LVEA Bottom of technical foundation 60.0 ft
  - » Existing Grade (Average at Corner) 59.0 ft
  - » 500 year flood level 59.6 ft

HVAC

- Higher environmental loads in LA
  - » lower temperatures but higher humidity
- Design is the same as WA
  - » less building sq. ft
- Design includes humidifiers in LA to meet minimum 30% RH specification
  - » recommend that this apparatus be removed

Livingston Relative Humidity (RH)

- LIGO RH criteria 20% to 70%
- Parsons RH design >30% to <70%
- Lowest RH (without humidifiers) 18%
- Number of hours per year at <30% 340hrs

- Cost Estimate for humidification system $55K

John Desmond Recommendation

- Six comments received July 3, 1996:
  - Below Slab Membrane
  - Mud-Sill Detail
  - Eave Detail
  - Roof Edge
  - Curved Wall Base
  - Metal Doors and Frames
- All comments have been resolved
  - Parsons has modified some of the sealing details
  - Type of below slab Bentonite membrane was new to Desmond

Cost summary

- Parsons estimate $ 15.15 M
- Cost book $ 16.50 M
- Uncertainties (Compared to Hanford)
  - » different business environment
  - » lower labor costs
  - » higher aggregate material costs
  - » longer construction period due to weather