

Diagram illustrating the cross-section of a trench repair, showing the following components and dimensions:

- WHEN TRENCH IS PLACED IN A GRAVELED SURFACE, RESTORE TO ORIGINAL MATERIAL TYPE & DEPTH (12" MIN.)**
- EARTH MOUND FOR TRENCH UNDER EARTH SURFACE ONLY**
- EARTH SURFACE, GRAVEL ROAD OR GRAVEL ROAD SHOULDER**
- 42" MIN.** (Total depth from ground surface to the bottom of the trench)
- 18"** (Depth from ground surface to the top of the backfill material)
- 12"** (Depth from the top of the backfill material to the bottom of the trench)
- MARKING RIBBON**
- EXISTING UTILITY**
- BACKFILL MATERIAL AND COMPACTION AS REQUIRED BY STATE D.O.T. (SEE SPECIFICATIONS FOR MINIMUMS)**
- CONCRETE ENCASED**
- 4- 1 1/2" HDPE INNER DUCTS IN 6" HDPE CASING**
- 3" MIN.** (Depth from the bottom of the trench to the top of the concrete encasement)
- 12" MIN.** (Depth from the top of the concrete encasement to the bottom of the trench)
- 3" MIN.** (Depth from the bottom of the trench to the top of the concrete encasement)
- 12" MIN.** (Depth from the top of the concrete encasement to the bottom of the trench)
- 3" MIN.** (Depth from the bottom of the trench to the top of the concrete encasement)

Diagram illustrating the cross-section of a road construction project, showing the layers and materials involved:

- REPLACED ROAD SURFACE WITH MIN. 4" ASPHALT PAVEMENT MIX IV OR MATCH EXISTING THICKNESS, WHICHEVER IS GREATER.
- SAW CUT EXIST. PAVEMENT PRIOR TO REPAVING
- 8" MIN. AGGREGATE BASE COURSE OR MATCH EXISTING THICKNESS, WHICHEVER IS GREATER.
- PAVED ROAD SURFACE
- TACK COAT
- PRIME COAT
- MARKING RIBBON
- 12" MIN. AGGREGATE SUBBASE COURSE, OR MATCH EXISTING THICKNESS, WHICHEVER IS GREATER
- EXISTING UTILITY
- BACKFILL MATERIAL AND COMPACTION AS REQUIRED BY STATE D.O.T. (SEE SPECIFICATIONS FOR MINIMUMS)
- 4-1 1/2" HDPE CONDUITS
- 12" MIN.
- 12" MIN.
- 12" MIN.
- 42" MIN.

ROADWAY SHOULDER

REPLACED ROAD SURFACE WITH ASPHALT PAVEMENT MIX IV TO MATCH EXISTING THICKNESS.

SAW CUT EXISTING PAVEMENT PRIOR TO PAVING

SAW CUT EXISTING PAVEMENT PRIOR TO TRENCHING

VARIABLES

18"

MARKING RIBBON

24" MIN. AGGREGATE SUBBASE COURSE, OR MATCH EXISTING THICKNESS, WHICHEVER IS GREATER

EXISTING UTILITY

42" MIN.

12" MIN.

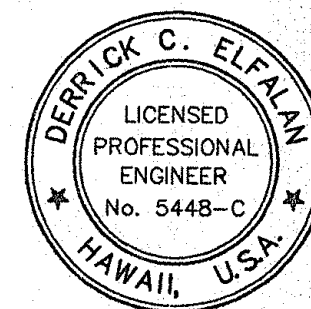
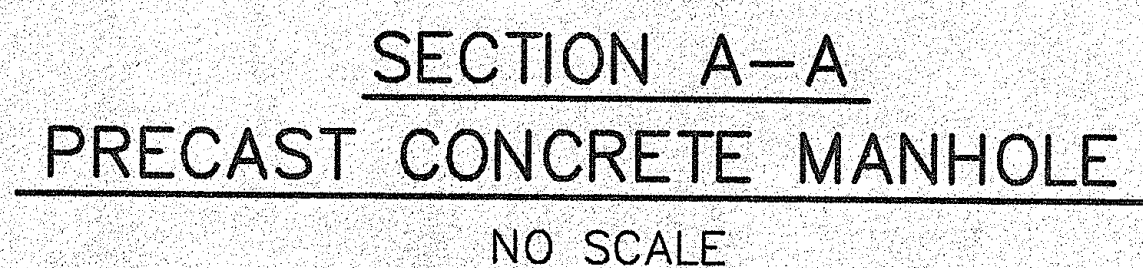
4-1 1/2" HDPE CONDUITS

12" MIN.

Diagram illustrating the trench layout for waterline installation:

- EXISTING SURFACE: DIRT, ASPHALT, OR CONCRETE
- 60" MIN. OR AS SHOWN ON PLAN
- EXISTING WATERLINE
- 3'-0" MIN. VERTICAL CLEAR TO WATERLINE
- 4-1 1/2" HDPE INNER DUCTS IN 6" HDPE CASING

WT 956D1000



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OUTSIDE PLANT _____ ENGINEER _____ DATE _____

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SIGNED _____
DATE 01/15/84 REG. No. 5448-C

ParEn, Inc.
dba **Park Engineering**
SUITE 300, KAWAHAAO PLAZA
567 SOUTH KING STREET
HONOLULU, HAWAII 96813
TELEPHONE: (AOR) 531-1678

PROPRIETARY	
USE PURSUANT TO COMPANY INSTRUCTIONS	
SPECIFICATION	WT 35956
ESTIMATE	73

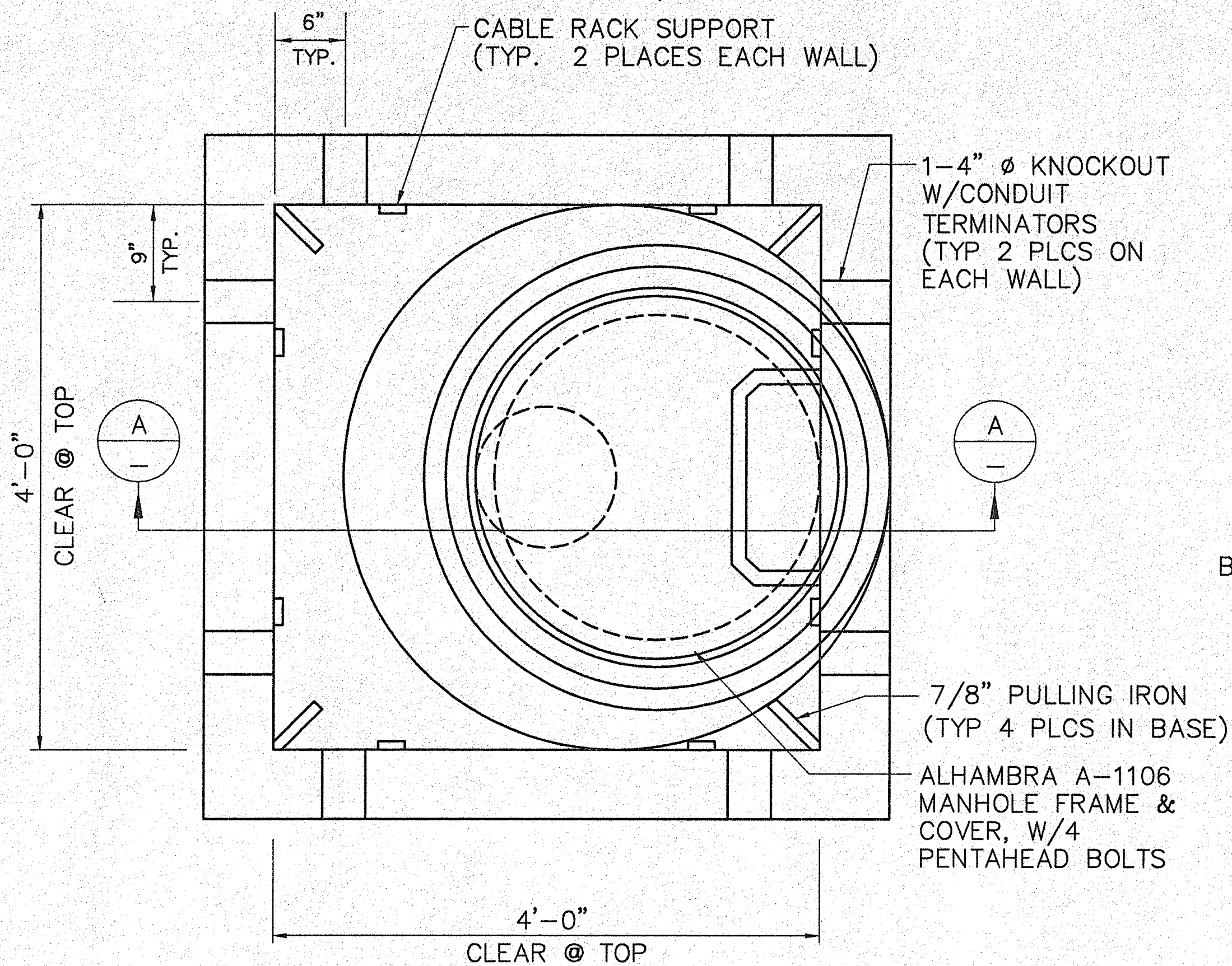
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CABLE GEO:
CABLE CLI: WNAEHU0004

SCALE: NONE

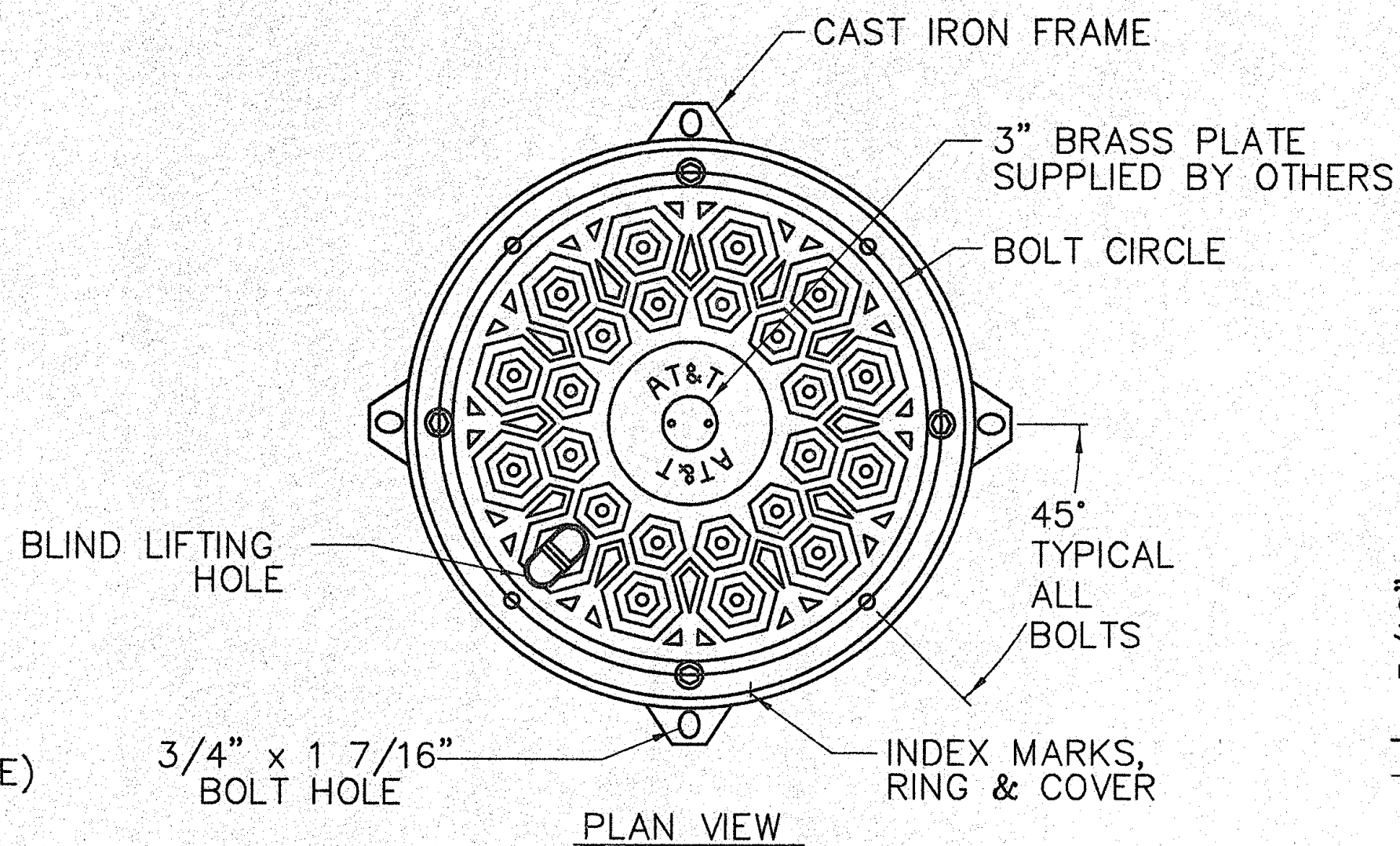
MAKAHA CABLE STATION
TO KEAWAULA CABLE STATION
LIGHTGUIDE SYSTEM

MAKAHA TO KEAWAULA FTA
TYPICAL DETAIL DRAWINGS

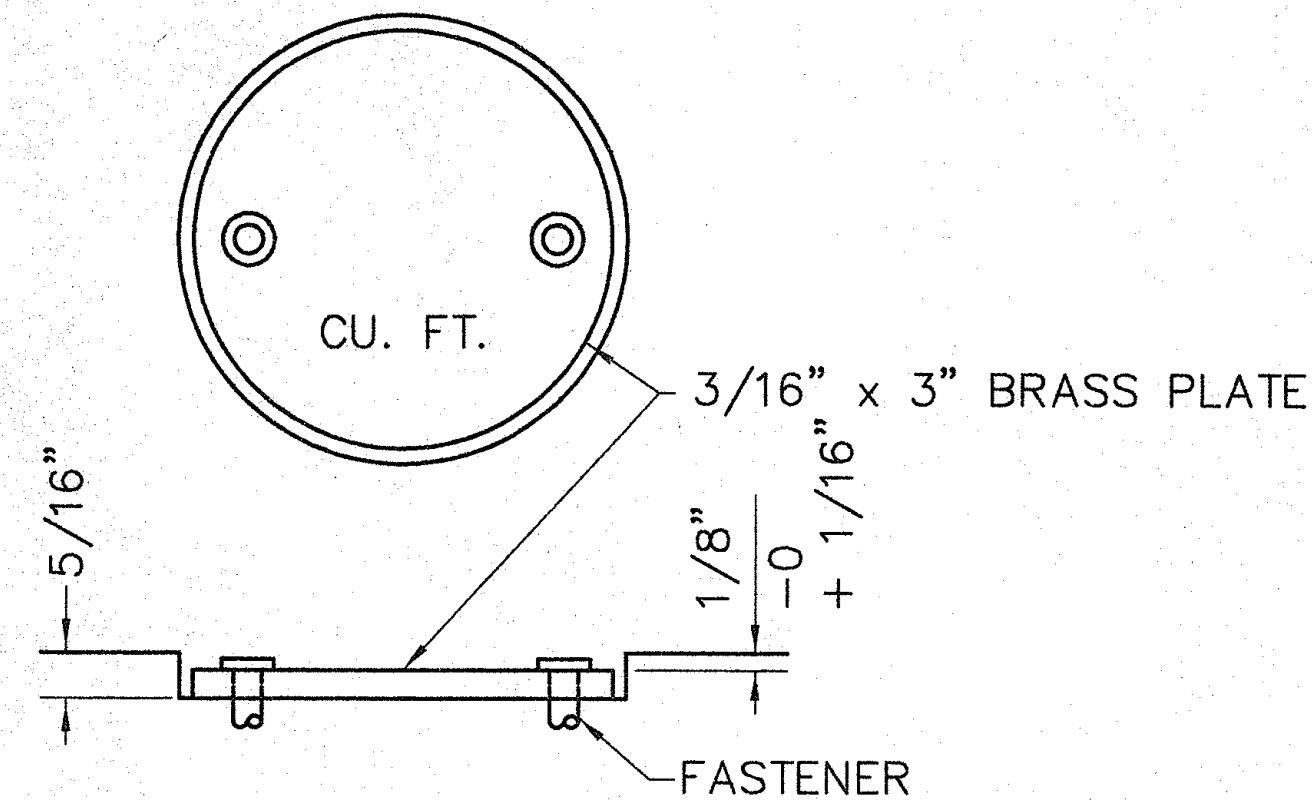
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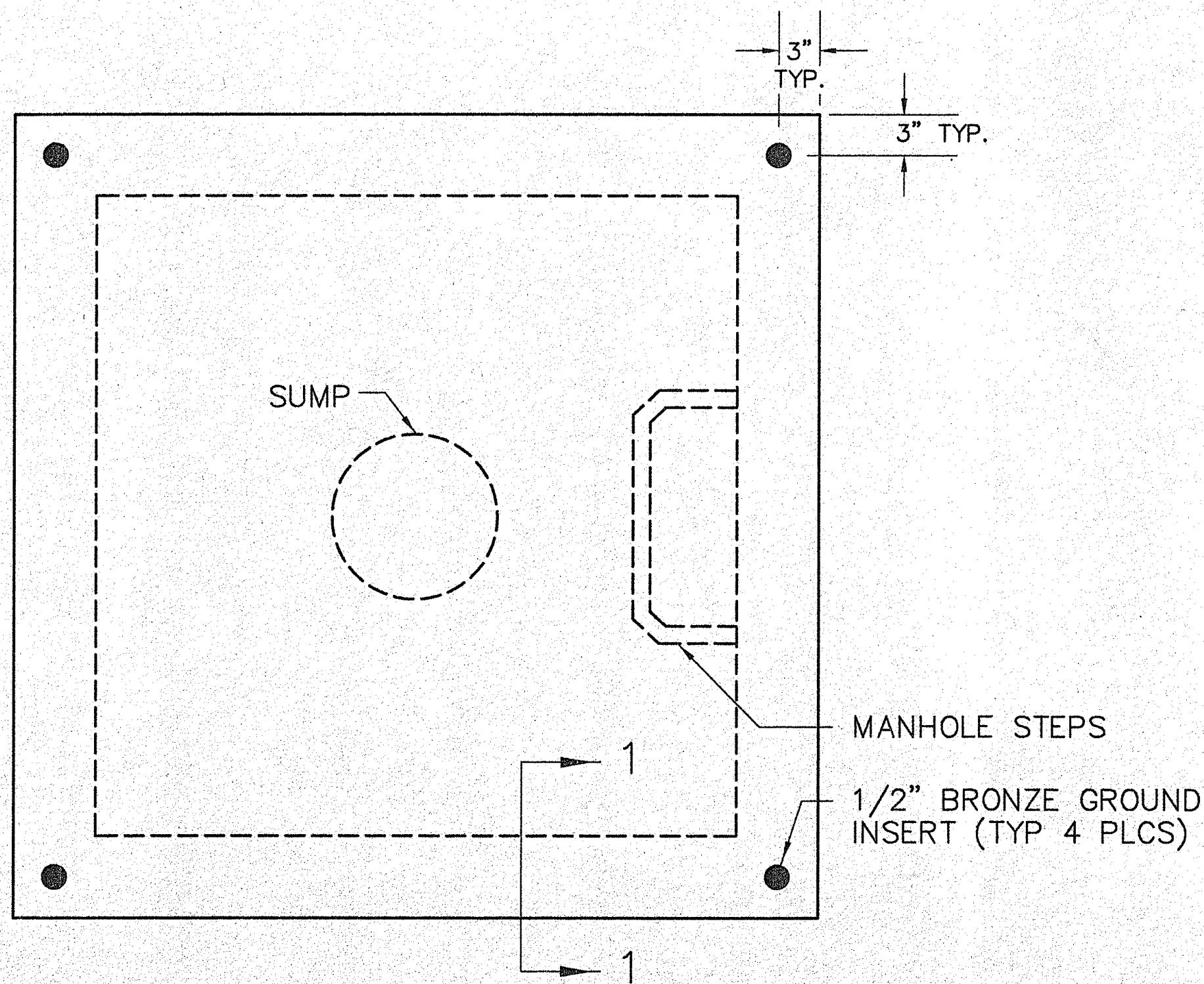
PLAN VIEW
PRECAST CONCRETE MANHOLE
NO SCALE



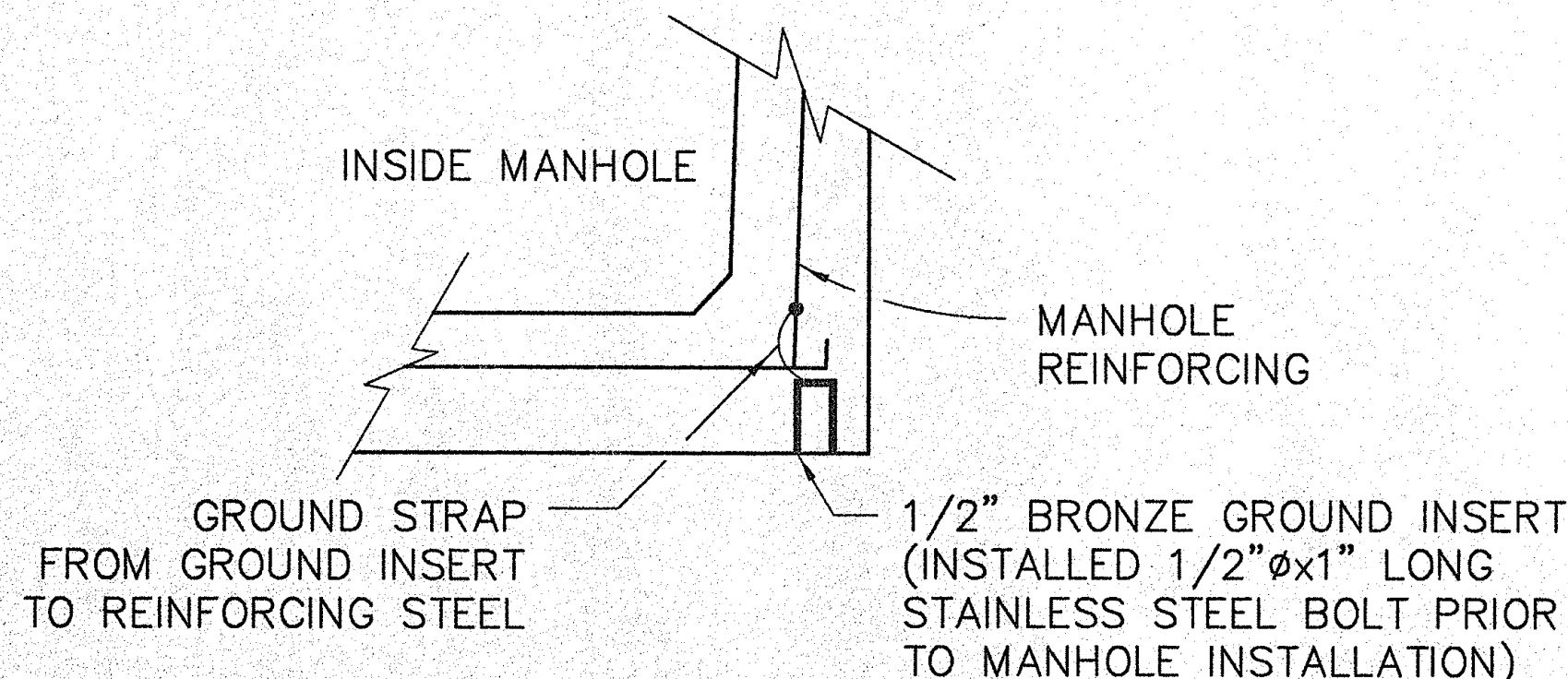
ALHAMBRA A-1106 MANHOLE
FRAME & COVER
NO SCALE



BRASS PLATE DETAIL
NO SCALE



REFLECTED PLAN VIEW - BOTTOM SLAB
(LOOKING FROM OUTSIDE)
NO SCALE



SECTION 1-1
NO SCALE

MANHOLE VOLUMES	
STANDARD VOLUME = 110 FT ³	
GRADE RING SIZE	ADDITIONAL VOLUME TO ADD TO STANDARD VOLUME
4"	2.3 FT ³
6"	3.5 FT ³
12"	7.1 FT ³

ROUND VOLUME UP TO NEAREST 5 FT³. STAMP THAT VOLUME ON APPROPRIATE MARKER.

REVISIONS:

NOTES:



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SIGNED: *Derrick C. Elfrain* DATE: 9/27/99 REG. NO. 5448-C

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TELEPHONE: (808) 531-1678

PROPRIETARY

USE PURSUANT TO COMPANY INSTRUCTIONS

SPECIFICATION WT 35956

ESTIMATE 73

OWNERSHIP: -

CABLE GEO:

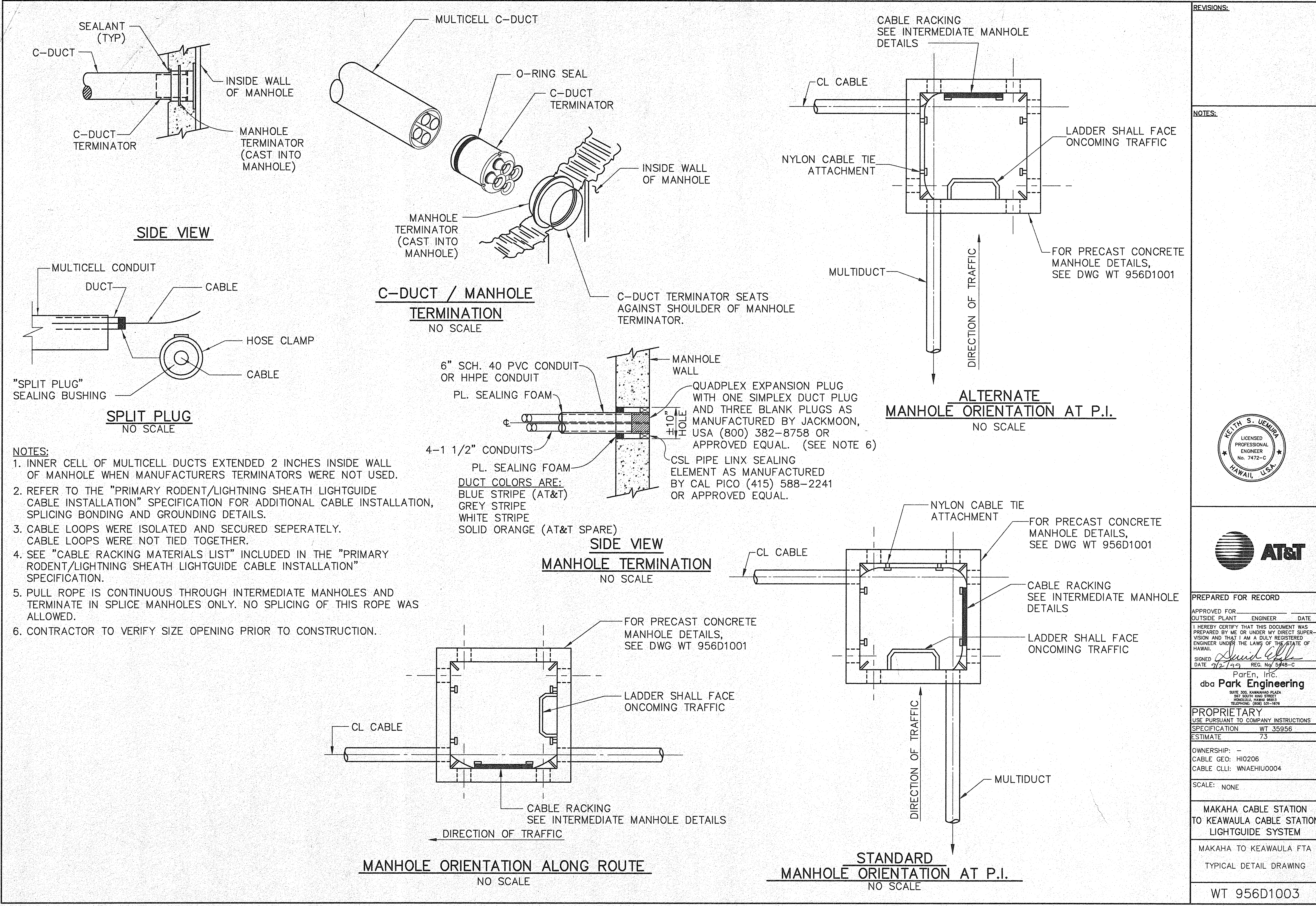
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SCALE: NONE

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TO KEAWAULA CABLE STATION
LIGHTGUIDE SYSTEM

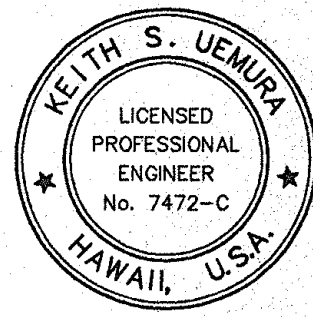
MAKAHA TO KEAWAULA FTA
TYPICAL DETAIL DRAWING

WT 956D1002

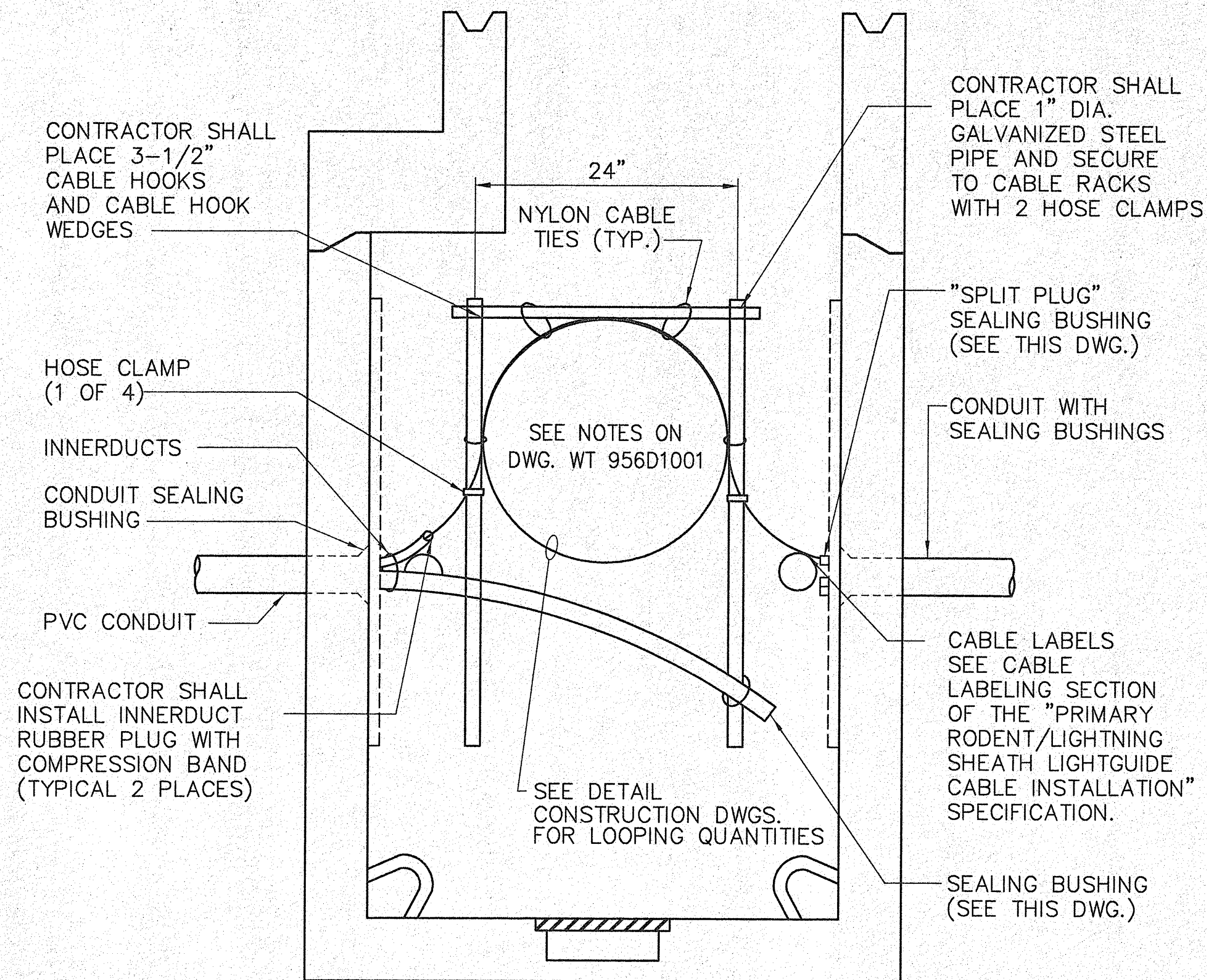


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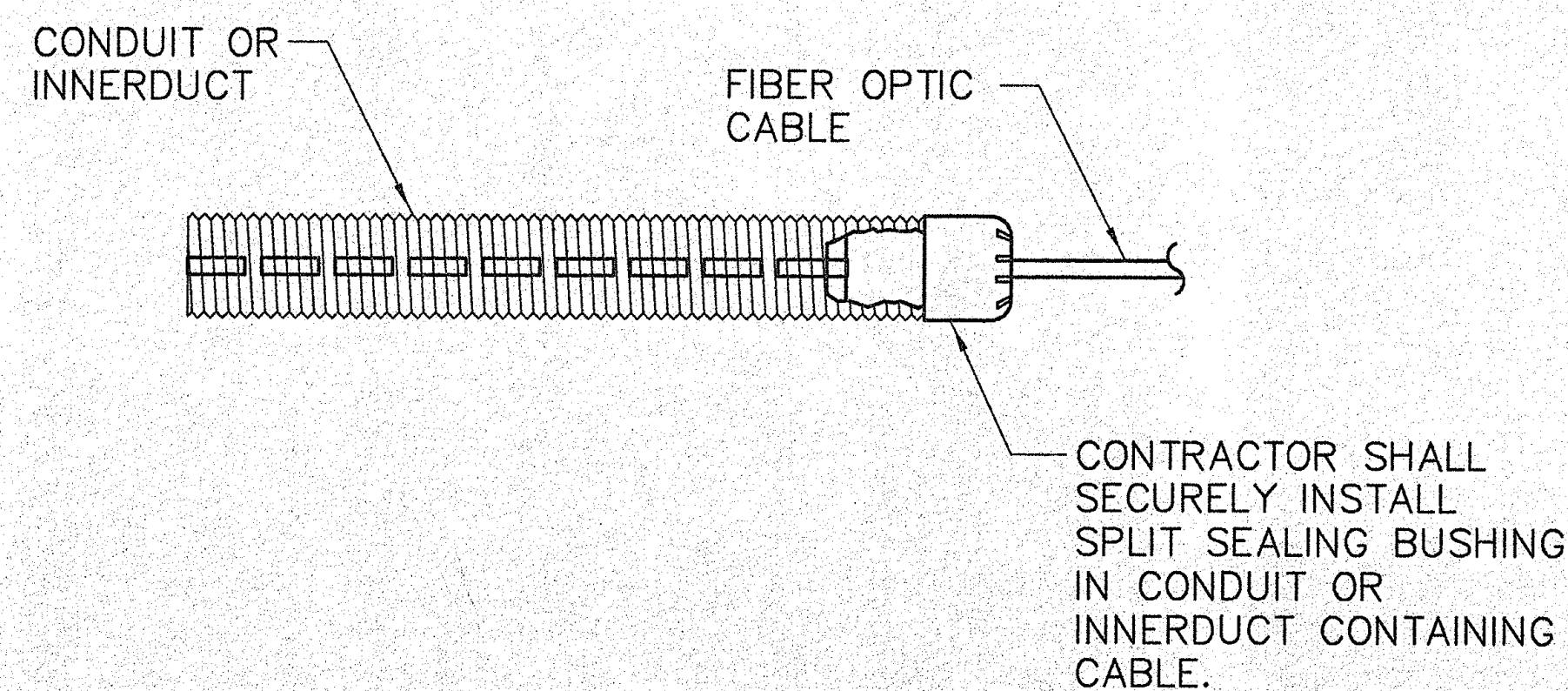
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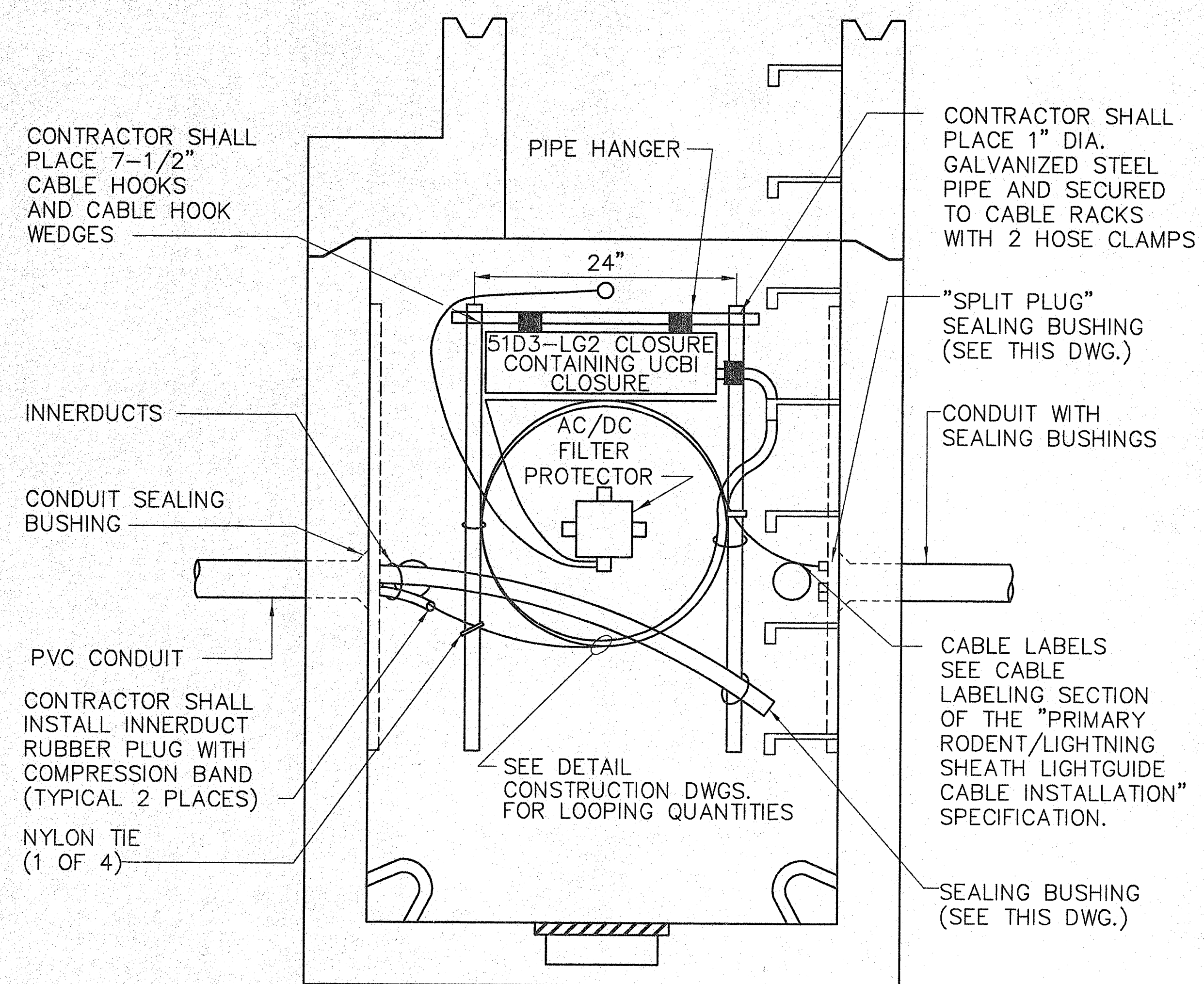
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APPROVED FOR	ENGINEER	DATE
OUTSIDE PLANT		
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SIGNED	REG. NO.	DATE
<i>Keith S. Uemura</i>	5448-C	7/2/99
ParEn, Inc. dba Park Engineering SUITE 300 KAWAHAHA PLAZA 367 SOUTH KING STREET HONOLULU, HAWAII 96813 TELEPHONE: (808) 431-1676		
PROPRIETARY USE PURSUANT TO COMPANY INSTRUCTIONS		
SPECIFICATION	WT 35956	
ESTIMATE	73	
OWNERSHIP: - CABLE GEO: H10206 CABLE CLL: WNAEHU0004		
SCALE: NONE		
MAKAHA CABLE STATION TO KEAWAULA CABLE STATION LIGHTGUIDE SYSTEM		
MAKAHA TO KEAWAULA FTA TYPICAL DETAIL DRAWING		
WT 956D1003		



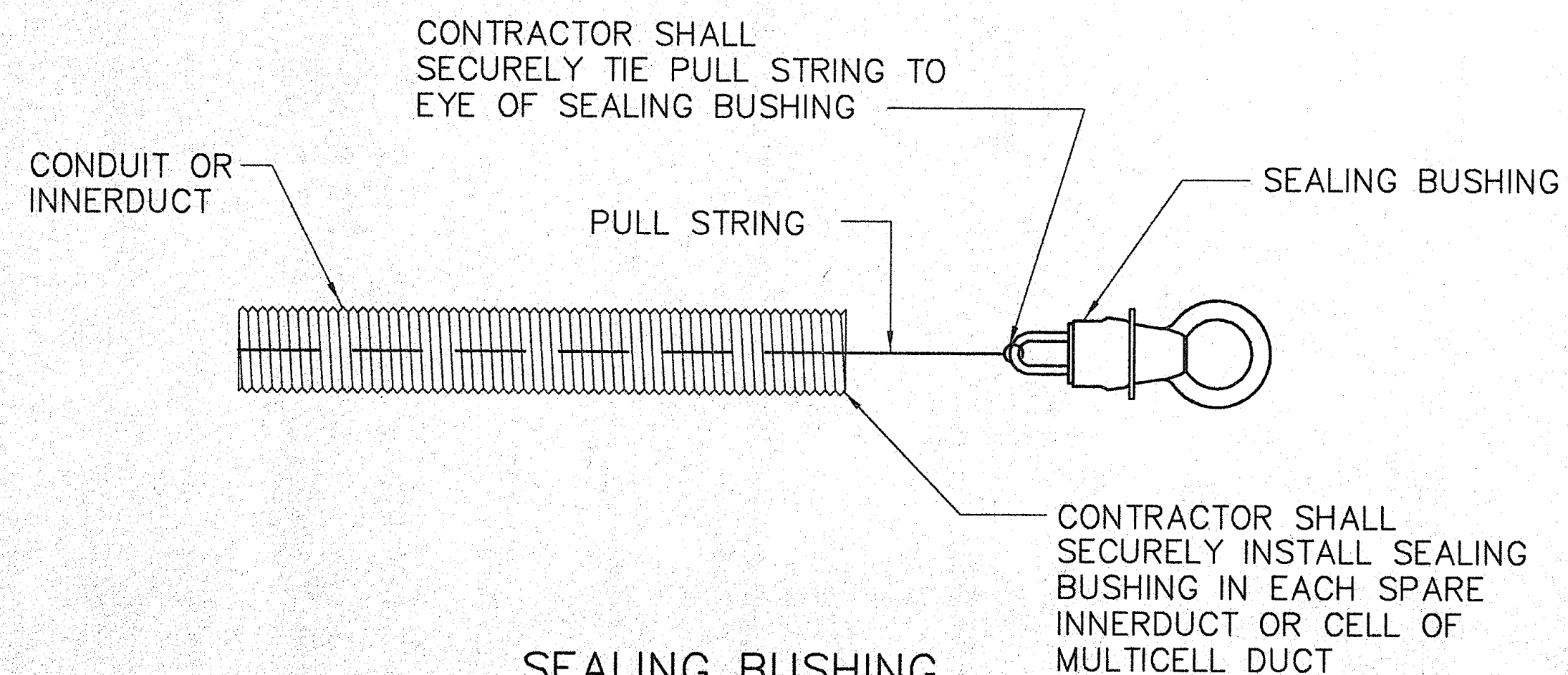
CABLE RACKING
INTERMEDIATE MANHOLE
NO SCALE



SEALING BUSHING
DUCT WITH CABLE
NO SCALE



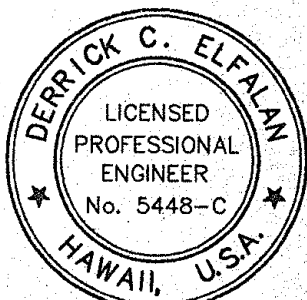
CABLE RACKING
SPLICE MANHOLE
NO SCALE



SEALING BUSHING
SPARE DUCTS
NO SCALE

REVISIONS:

NOTES:



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SIGNED
DATE 7/2/99 REG. No. 5448-C

ParEn, Inc.
dba Park Engineering
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607 SOUTH KING STREET
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TELEPHONE (808) 531-1676

PROPRIETARY
USE PURSUANT TO COMPANY INSTRUCTIONS
SPECIFICATION WT 35956
ESTIMATE 73

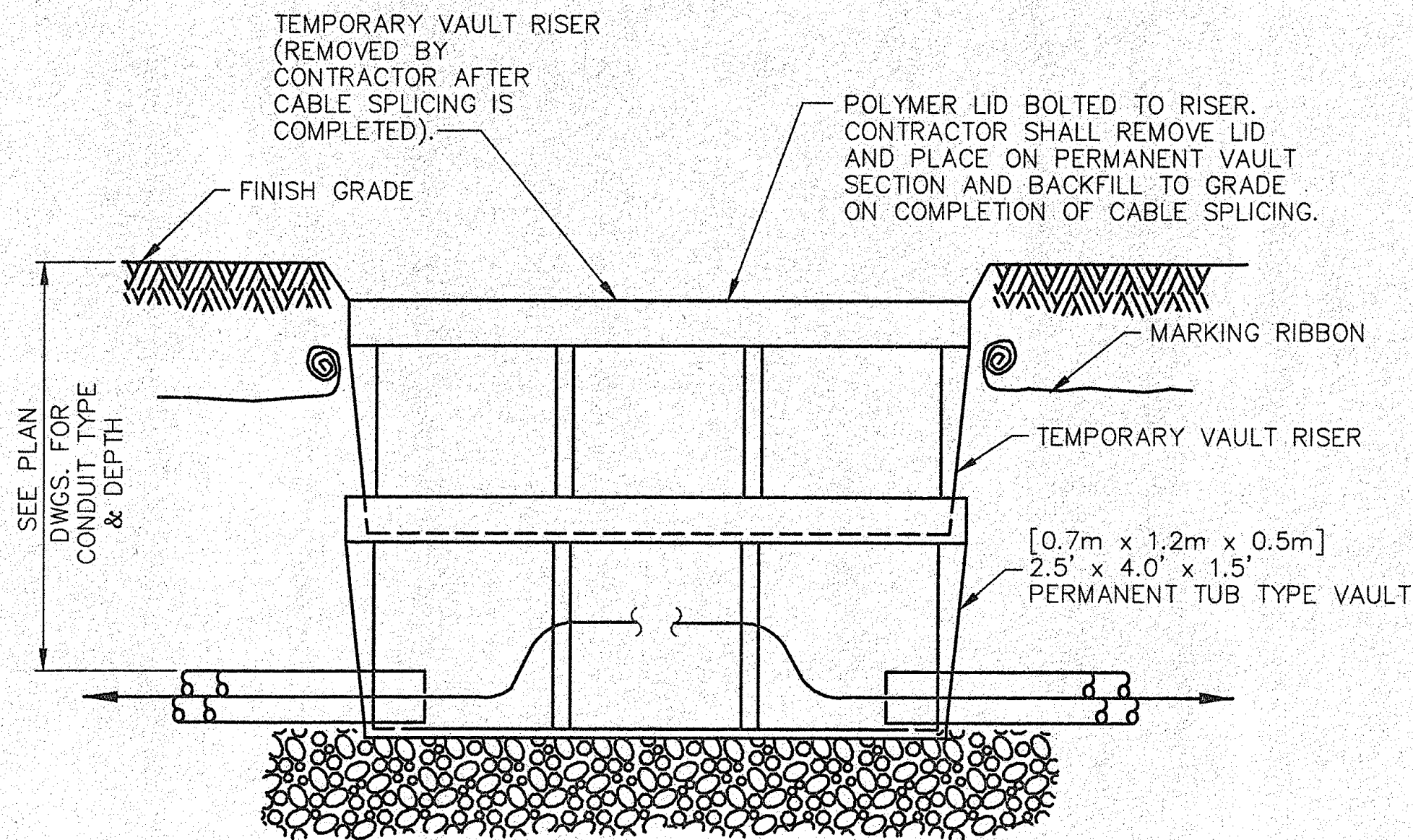
OWNERSHIP: -
CABLE GEO: HIO206
CABLE CLI: WNAEHU0004

SCALE: AS SHOWN

MAKAHA CABLE STATION
TO KEAWAULA CABLE STATION
LIGHTGUIDE SYSTEM

MAKAHA TO KEAWAULA FTA
TYPICAL DETAIL DRAWING

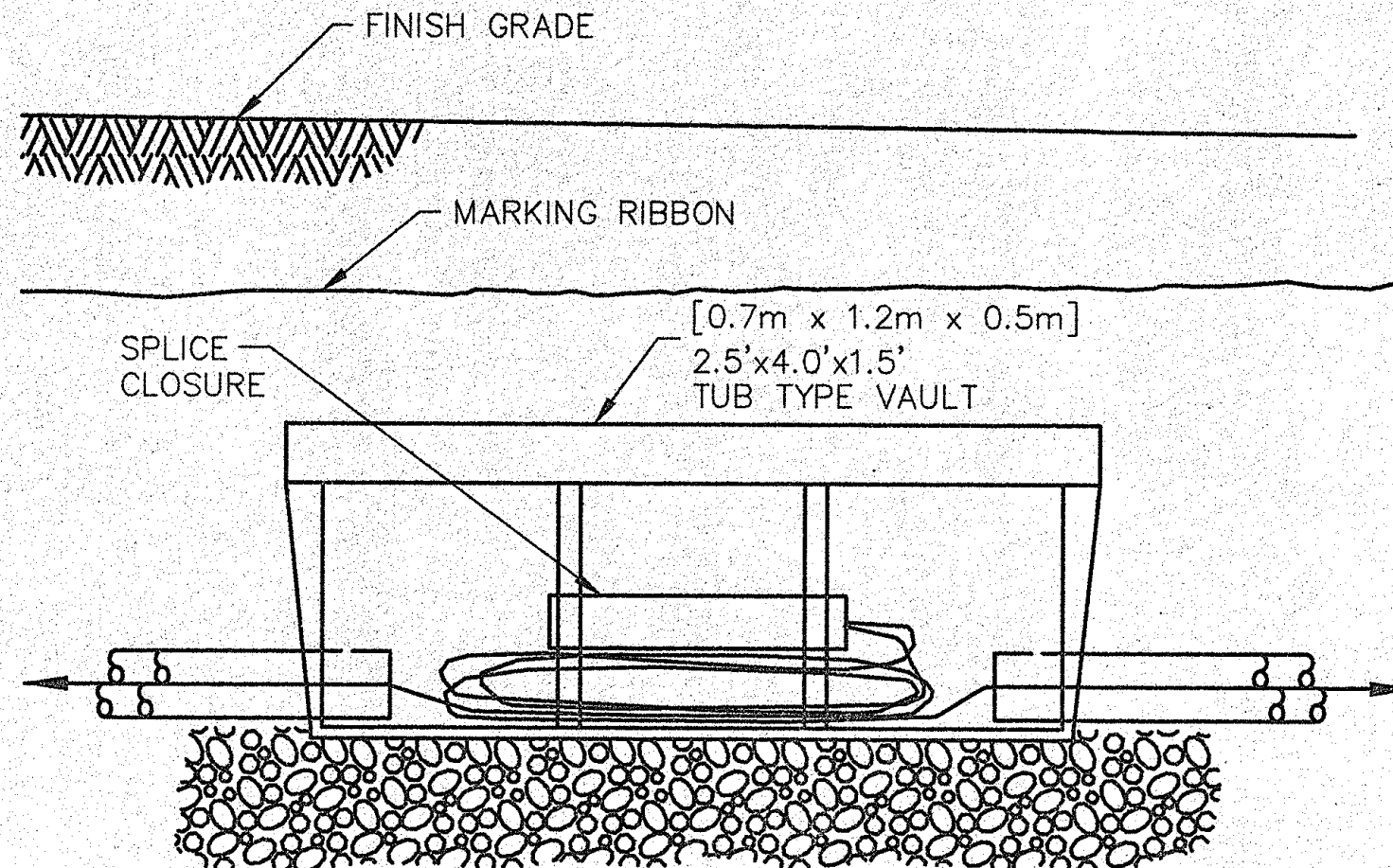
WT 956D1004



NOTE:1. CONTRACTOR SHALL COIL 100' OF EACH CABLE IN VAULT.
2. SPLICE VAULT GROUNDING NOT SHOWN FOR CLARITY. SEE GROUNDING DETAIL THIS DRAWING.

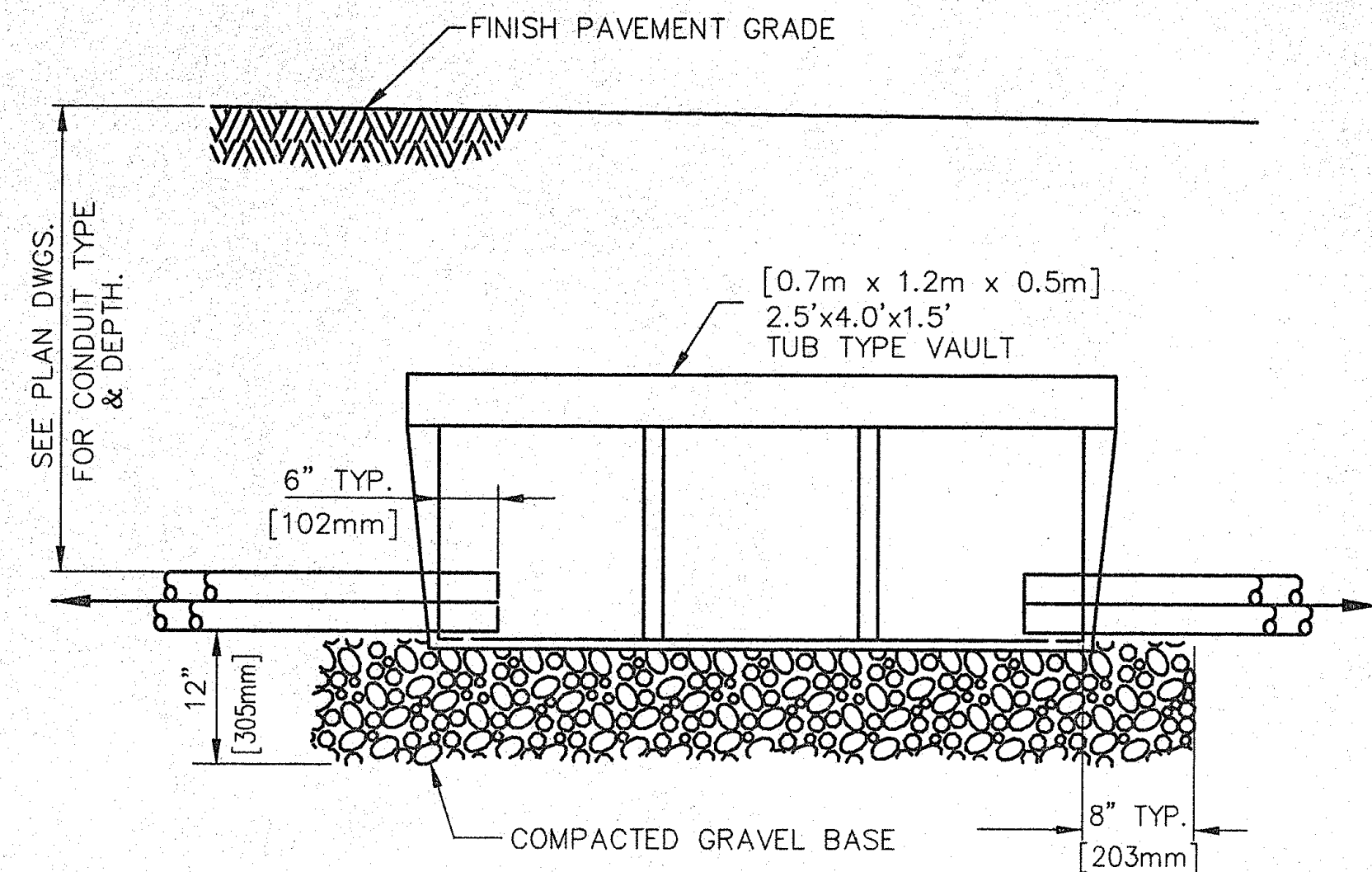
TYPICAL DIRECT BURIED
CABLE SPLICE VAULT
INITIAL INSTALLATION

NO SCALE



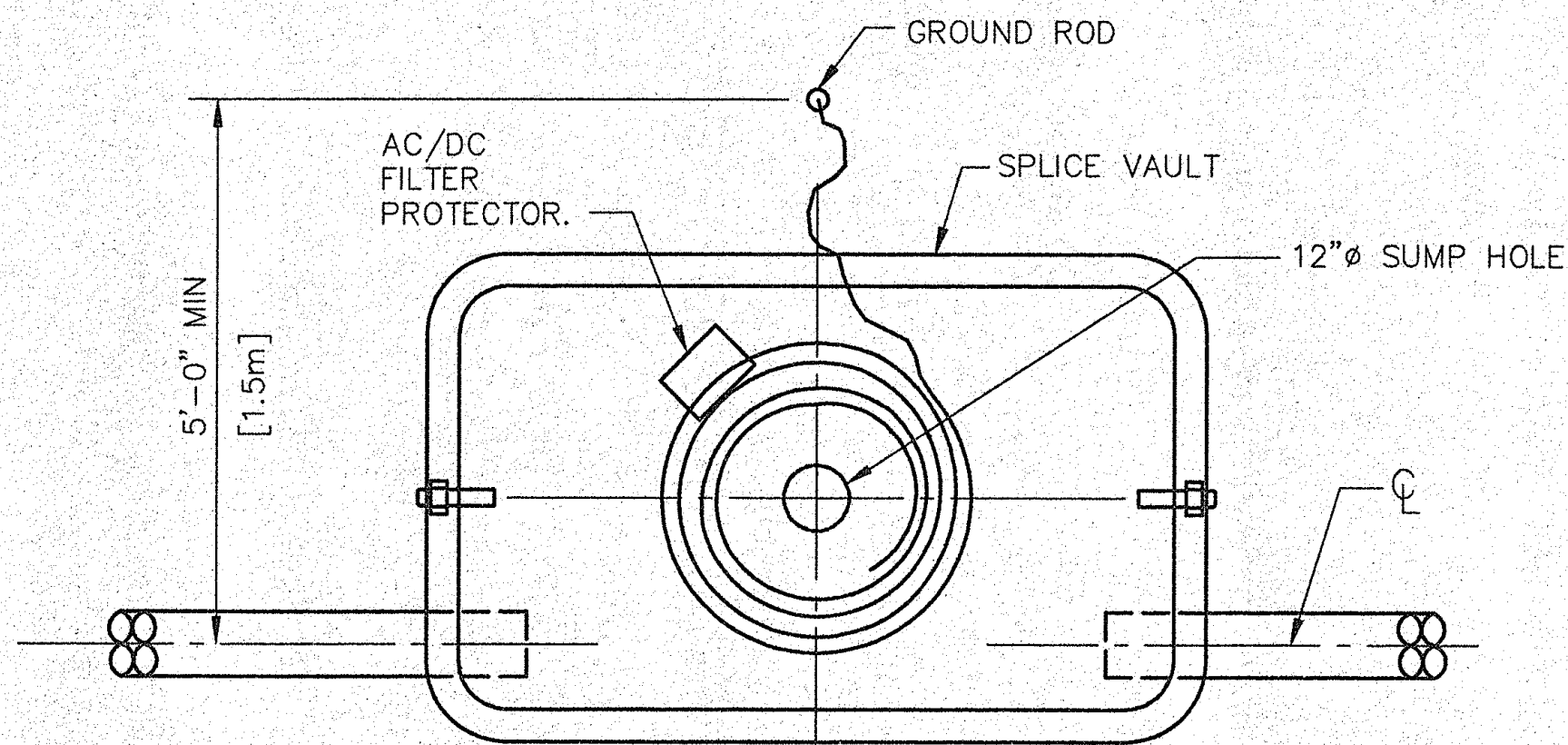
TYPICAL DIRECT BURIED
CABLE SPLICE VAULT
FINAL INSTALLATION

NO SCALE



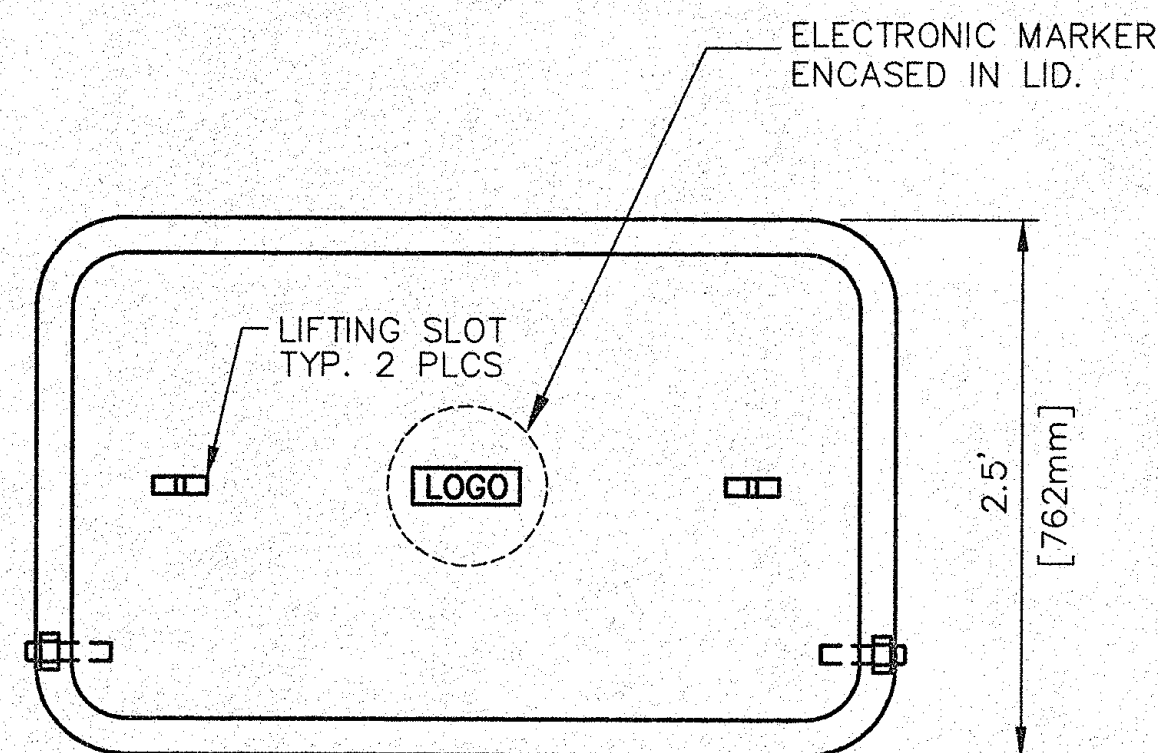
TYPICAL BURIED VAULT
INSTALLATION

NO SCALE



PLAN

NO SCALE

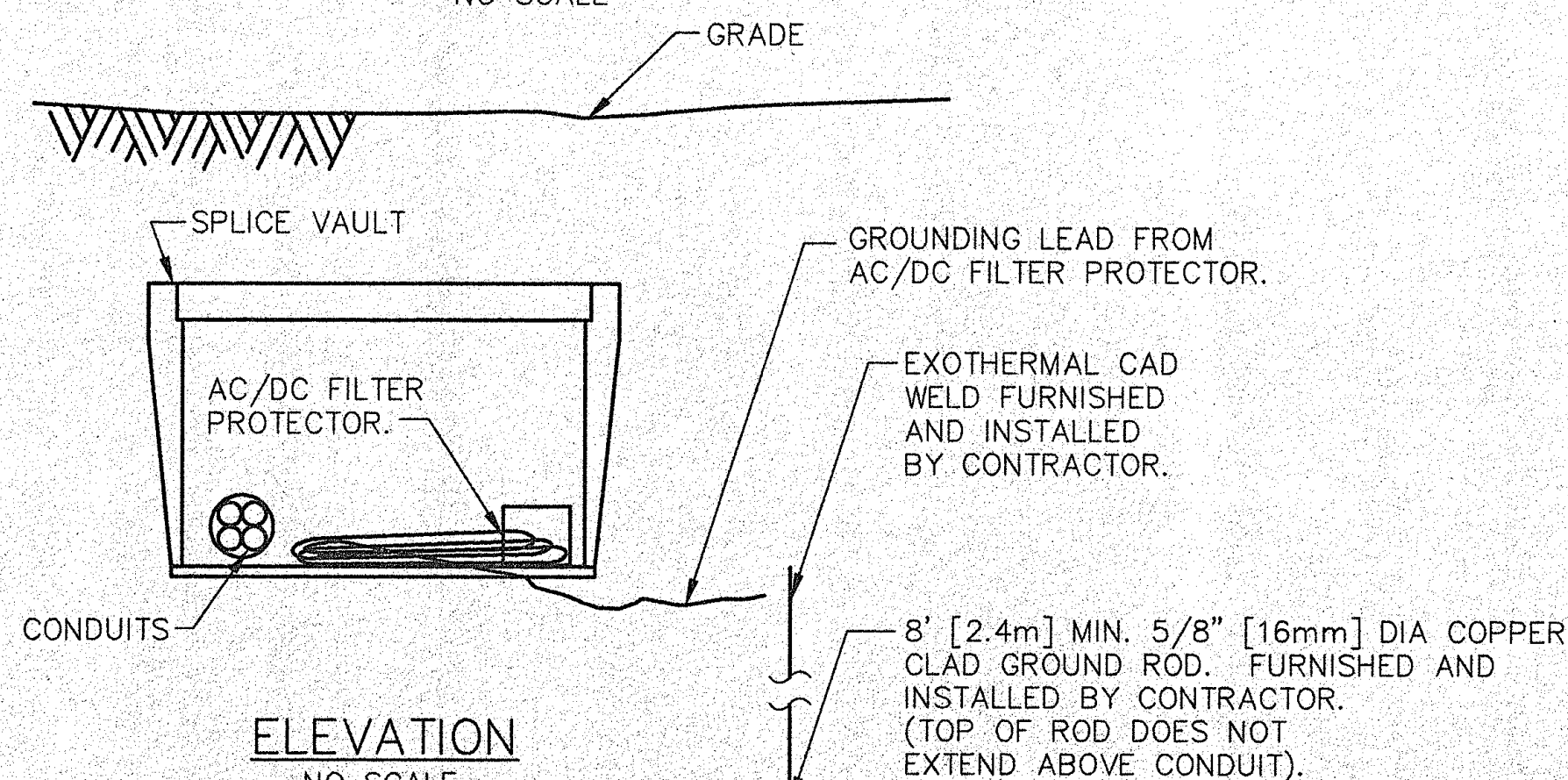


PLAN

NO SCALE

NOTES:

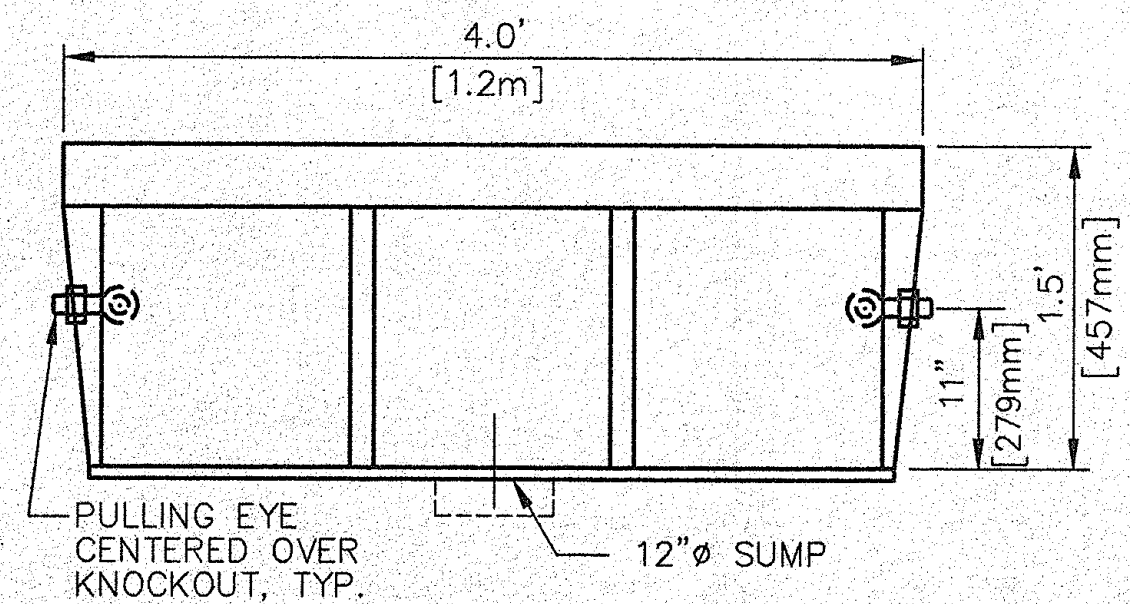
1. VAULTS SHALL BE TUB TYPE WITH MONOLITHIC FLOORS AND WALLS.
2. REFER TO THE "PRIMARY RODENT/LIGHTNING SHEATH LIGHTGUIDE CABLE INSTALLATION" SPECIFICATION FOR ADDITIONAL CABLE INSTALLATION, SPLICING, BONDING AND GROUNDING DETAILS.
3. CABLE LOOPS SHALL BE ISOLATED AND SECURED SEPARATELY. CONTRACTOR SHALL NOT TIE CABLE LOOPS TOGETHER.
4. SEE "CABLE RACKING MATERIALS LIST" INCLUDED IN THE "PRIMARY RODENT/LIGHTNING SHEATH LIGHTGUIDE CABLE INSTALLATION" SPECIFICATION.
5. PULL ROPE SHALL BE CONTINUOUS THROUGH INTERMEDIATE VAULTS, AND SHALL TERMINATE IN SPLICE VAULTS ONLY. NO SPLICING OF THIS ROPE WILL BE ALLOWED.



ELEVATION

NO SCALE

SPLICE VAULT GROUNDING

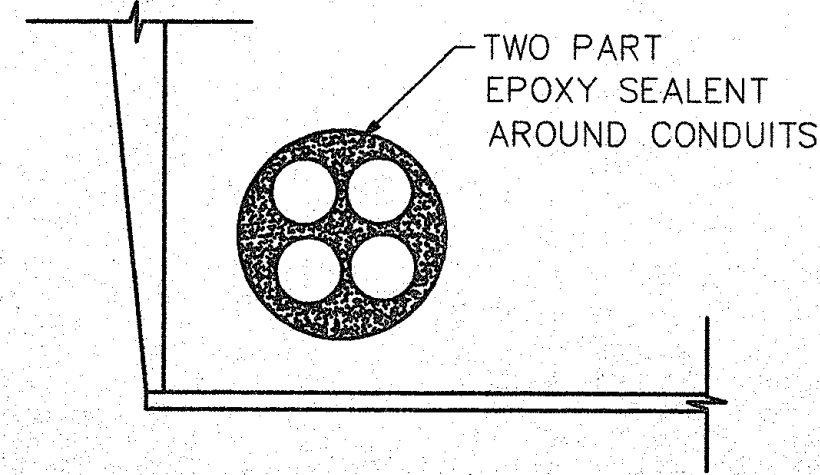
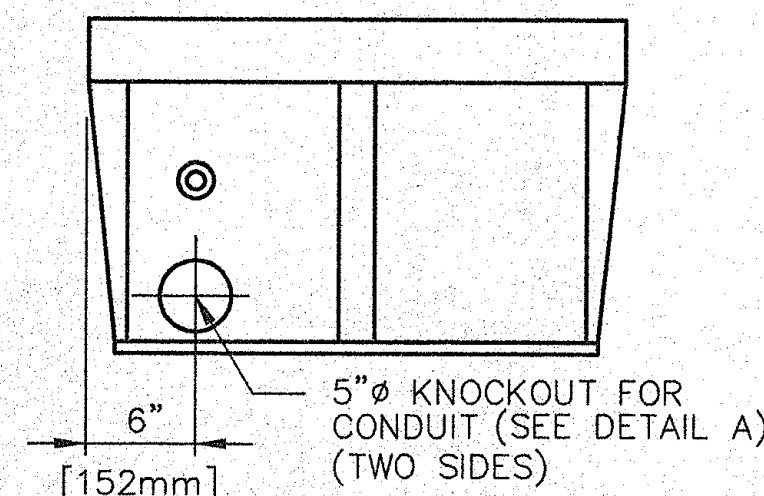


ELEVATION

NO SCALE

BURIED VAULT DETAILS

NO SCALE



DETAIL A

NO SCALE

REVISIONS:

NOTES:



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OUTSIDE PLANT _____ ENGINEER _____ DATE _____
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SIGNED _____
DATE 7/27/99 REG. NO. 5448-C

ParEn, Inc.
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HONOLULU, HAWAII 96813
TELEPHONE: (808) 531-1676

PROPRIETARY

USE PURSUANT TO COMPANY INSTRUCTIONS

SPECIFICATION WT 35956

ESTIMATE 73

OWNERSHIP: -

CABLE GEO: H10206

CABLE CLLI: WNAEHU0004

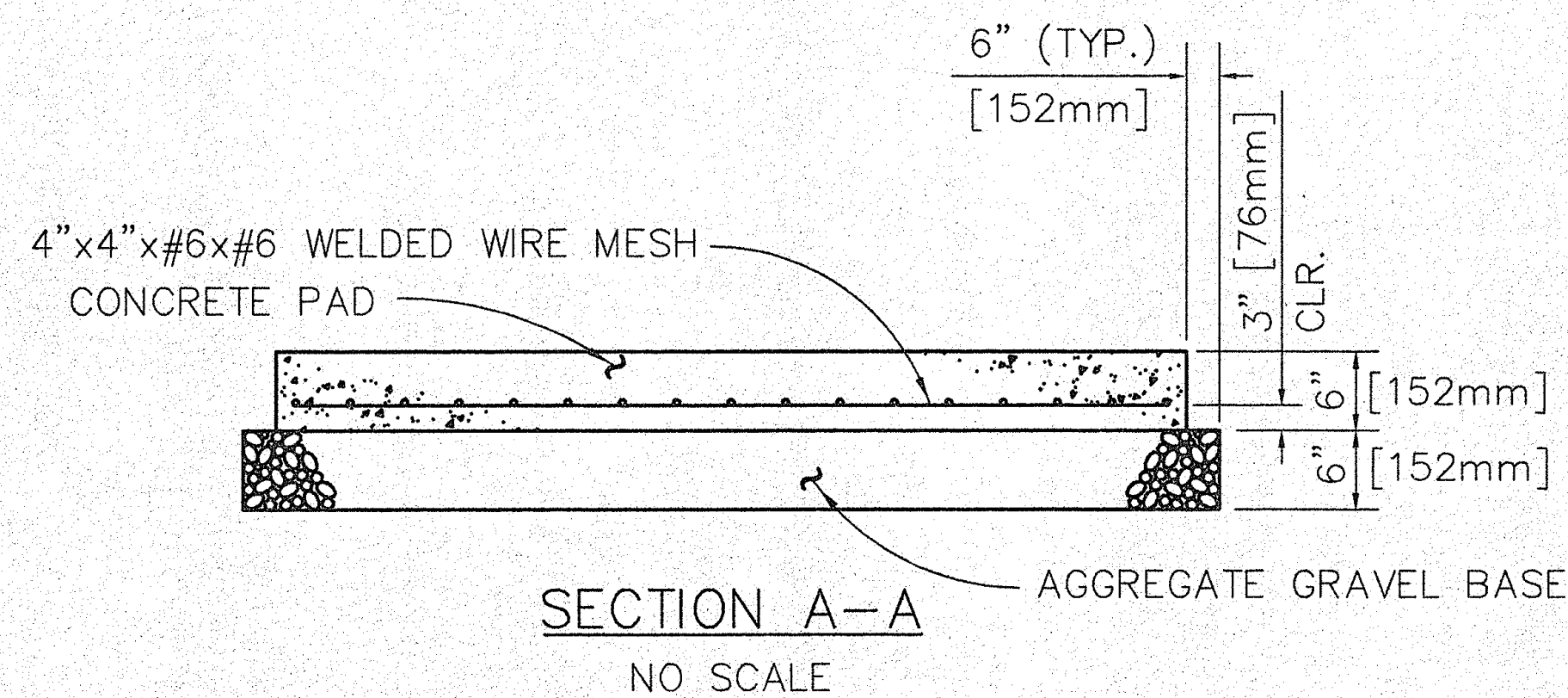
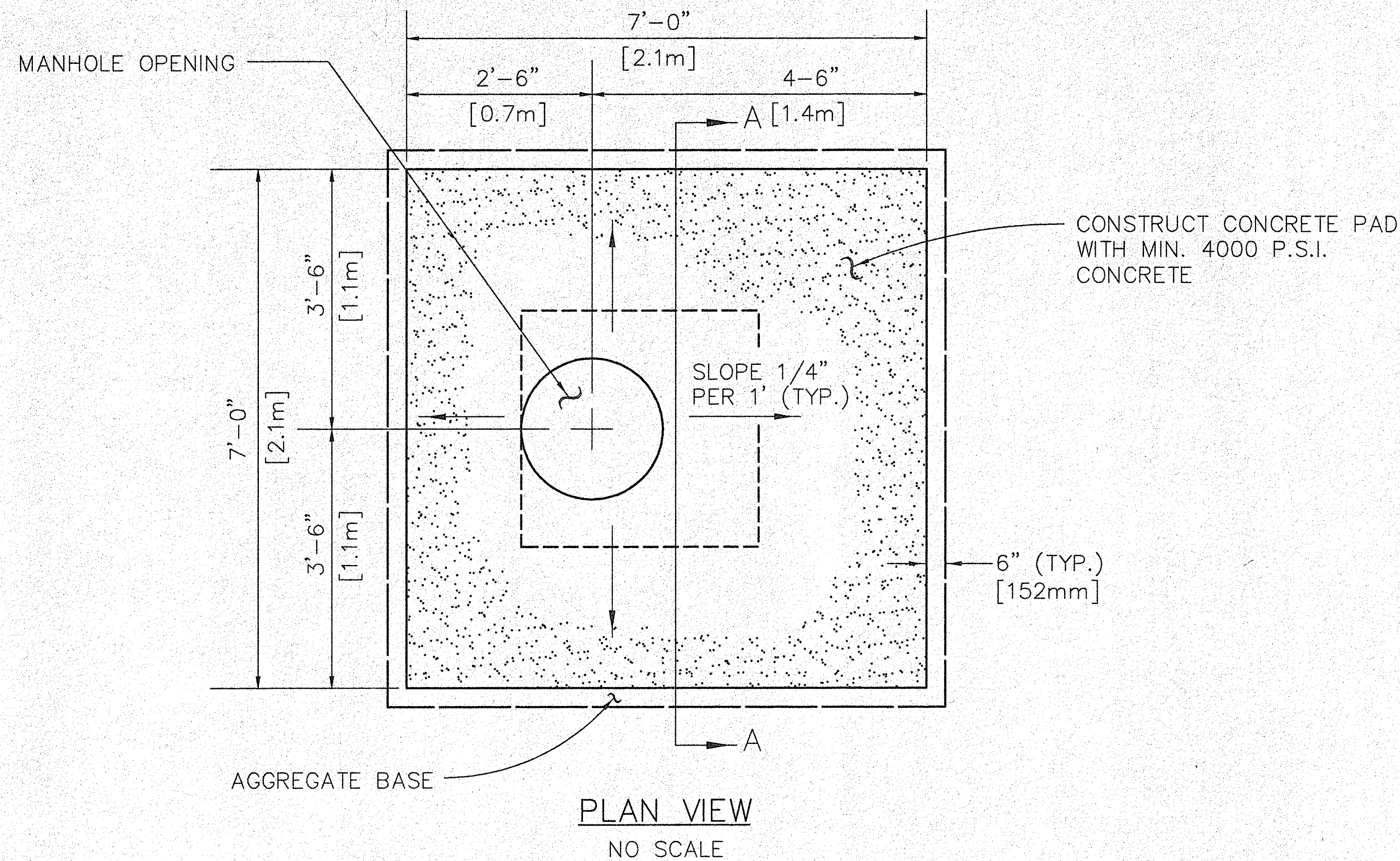
SCALE: AS SHOWN

**MAKAHA CABLE STATION TO
KEAWAULA CABLE STATION
LIGHTGUIDE SYSTEM**

MAKAHA TO KEAWAULA FTA

CONSTRUCTION NOTES

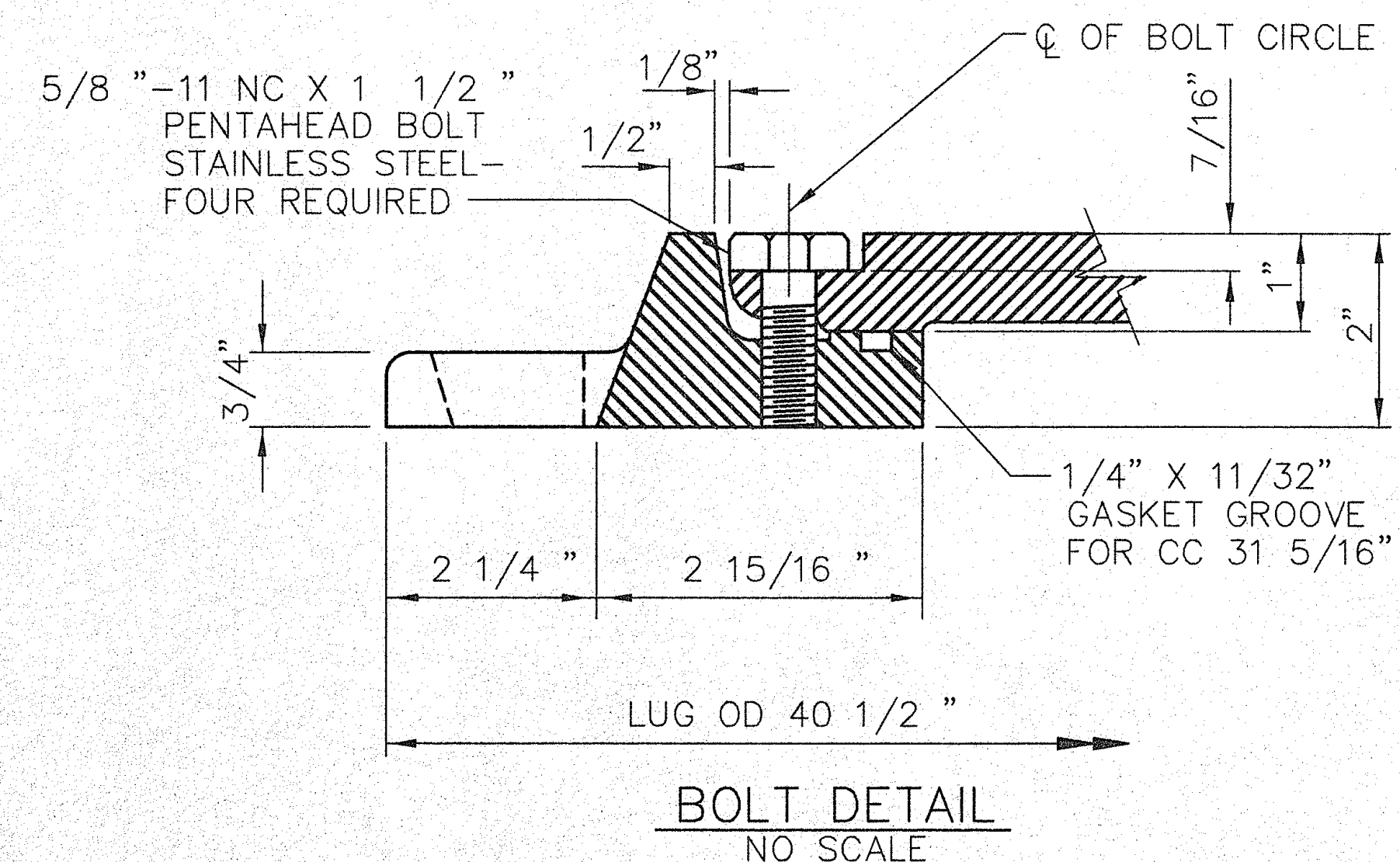
WT 956D1005



CAST IN PLACE WORKING CONCRETE PAD
NO SCALE

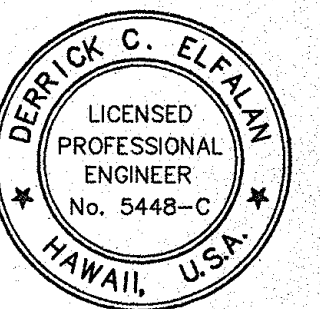
NOTES:

1. MANHOLES SHALL BE 4'x4'x6' MONOLITHIC STRUCTURE DESIGNED FOR AASHTO HL-20 TRAFFIC LOADING (16,000 lb. WHEEL LOAD).
2. THE COMPRESSIVE STRENGTH OF THE CONCRETE SHALL BE 4000 P.S.I. MIN. AT 28 DAYS.
3. REINFORCED STEEL SHALL BE ASTM A615 GRADE 60; 60,000 P.S.I. (MIN. #4 REBAR);
4. INNER CELL OF MULTICELL DUCTS OR DIRECT BURIED CONDUIT SHALL EXTEND 2 INCHES INSIDE THE WALL OF MANHOLE WHEN MANUFACTURERS TERMINATORS ARE NOT USED.
5. CONTRACTOR SHALL INSTALL FIBER OPTIC CABLE IN A 10 FOOT SECTION OF MULTIDUCT OR PVC CONDUIT WITH INNERDUCTS WHERE DIRECT BURIED CABLE ENTERS OR EXITS A MANHOLE.
6. REFER TO THE "PRIMARY RODENT / LIGHTNING SHEATH LIGHTGUIDE CABLE INSTALLATION" SPECIFICATION FOR ADDITIONAL CABLE INSTALLATION, SPLICING BONDING, AND GROUNDING DETAILS.
7. CABLE LOOPS SHALL BE ISOLATED AND SECURED SEPARATELY. CABLE LOOPS SHALL NOT BE TIED TOGETHER.
8. SEE "CABLE RACKING MATERIALS LIST" INCLUDED IN THE "PRIMARY RODENT / LIGHTNING SHEATH LIGHTGUIDE CABLE INSTALLATION" SPECIFICATION.
9. PULL ROPE SHALL BE CONTINUOUS THROUGH INTERMEDIATE MANHOLES AND TERMINATE IN SPLICE MANHOLES ONLY. NO SPLICING OF THIS ROPE SHALL BE ALLOWED.
10. ALL INTERIOR SURFACES SHALL BE PAINTED WITH TWO COATS OF WHITE LATEX PAINT (EXCEPT FLOOR SURFACE).
11. CONTRACTOR SHALL PROVIDE 4 EACH 1/2" DIAMETER BRONZE GROUNDING INSERTS WELDED TO REINFORCING CAGE.



REVISIONS:

NOTES:



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DATE 9/2/99 REG. NO. 5448-C

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PROPRIETARY

USE PURSUANT TO COMPANY INSTRUCTIONS

SPECIFICATION WT 35956

ESTIMATE 73

OWNERSHIP: -

CABLE GEO: H10206

CABLE CLLI: WNAEHU0004

SCALE: AS SHOWN

MAKAHA CABLE STATION TO

KEAWAULA CABLE STATION

LIGHTGUIDE SYSTEM

MAKAHA TO KEAWAULA FTA

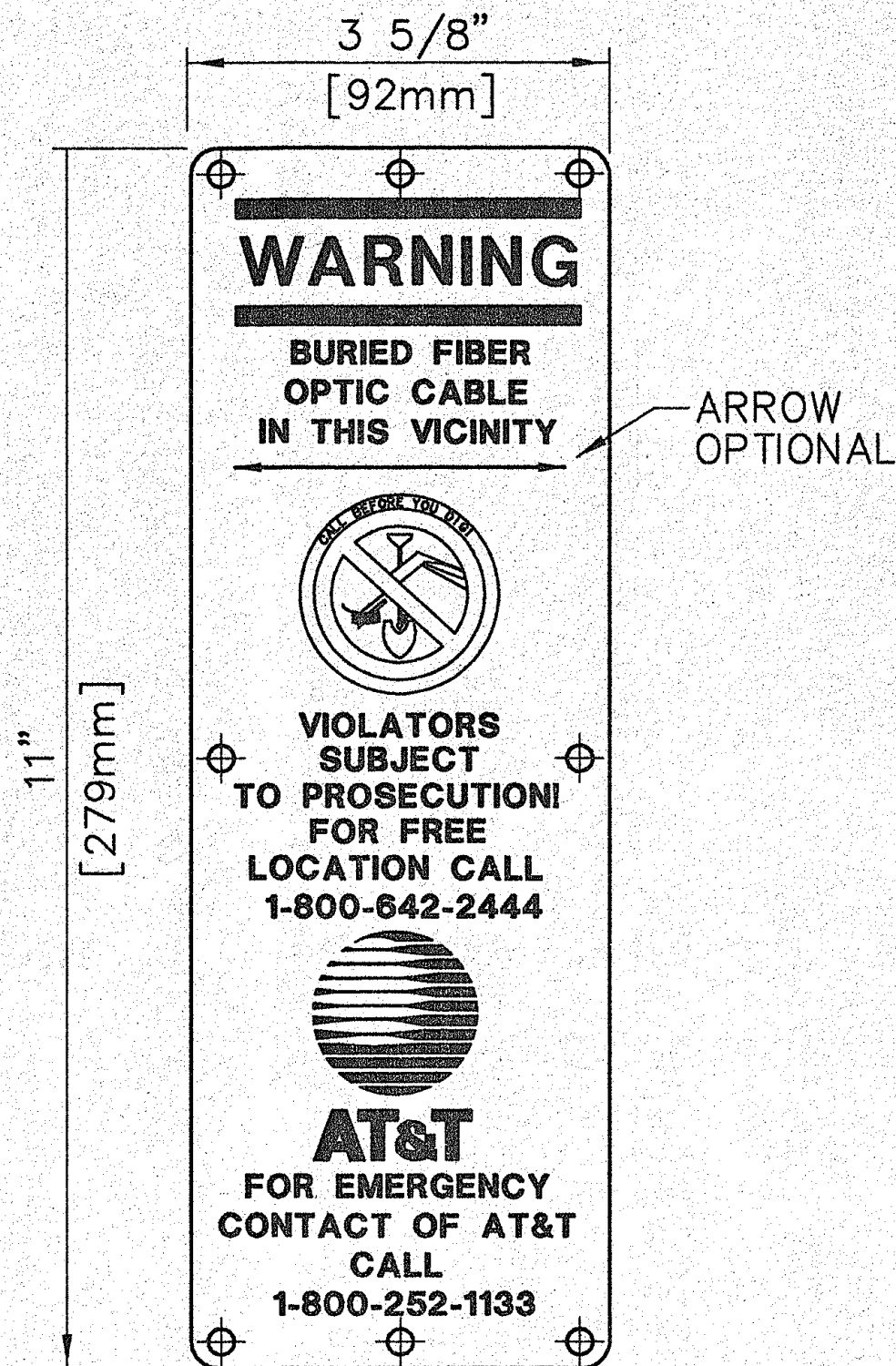
CONSTRUCTION NOTES

WT 956D1006



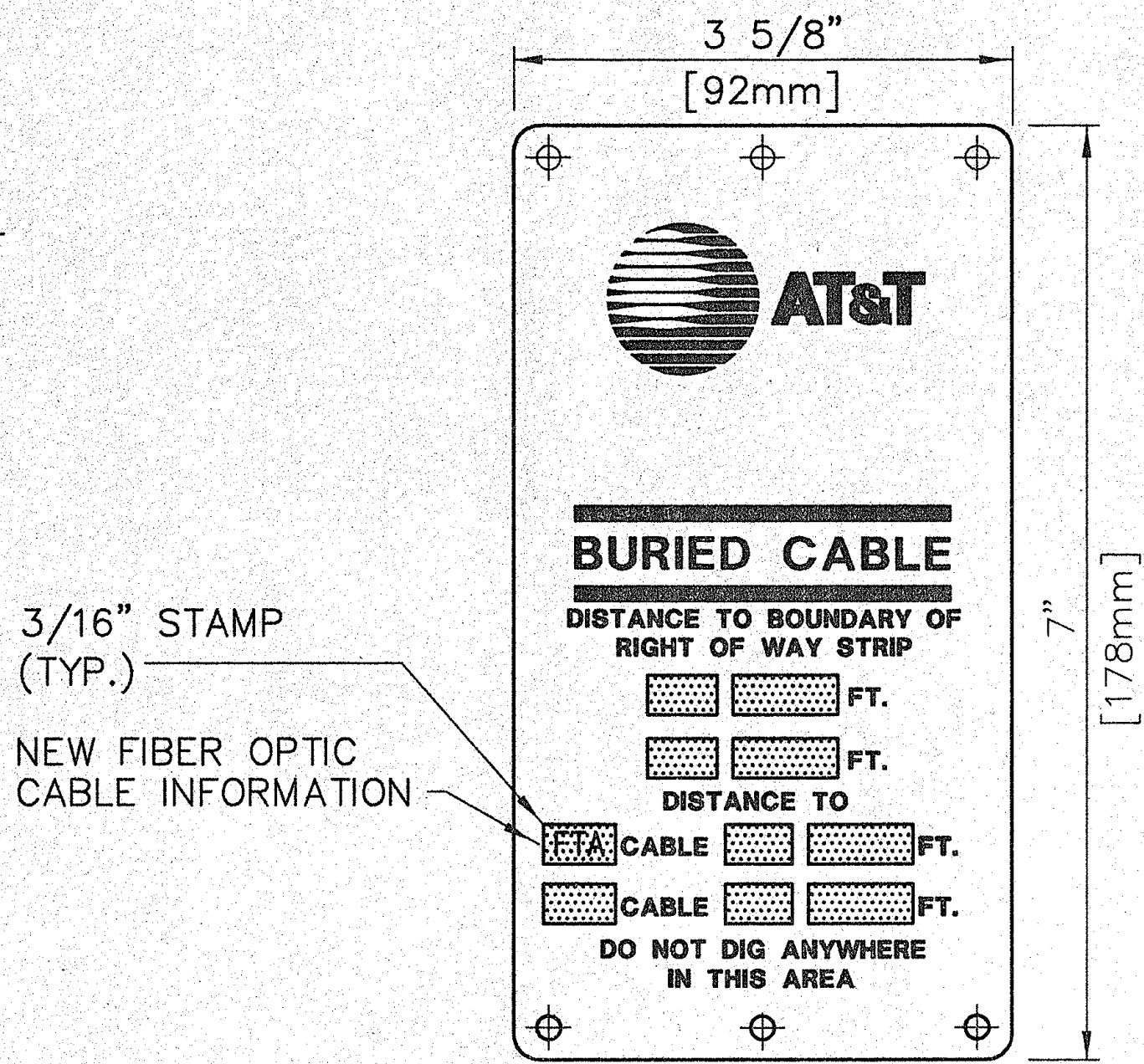
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ALL TEXT FILLED IN SO
AS TO APPEAR SOLID.

RM-1 FLAT
NO SCALE



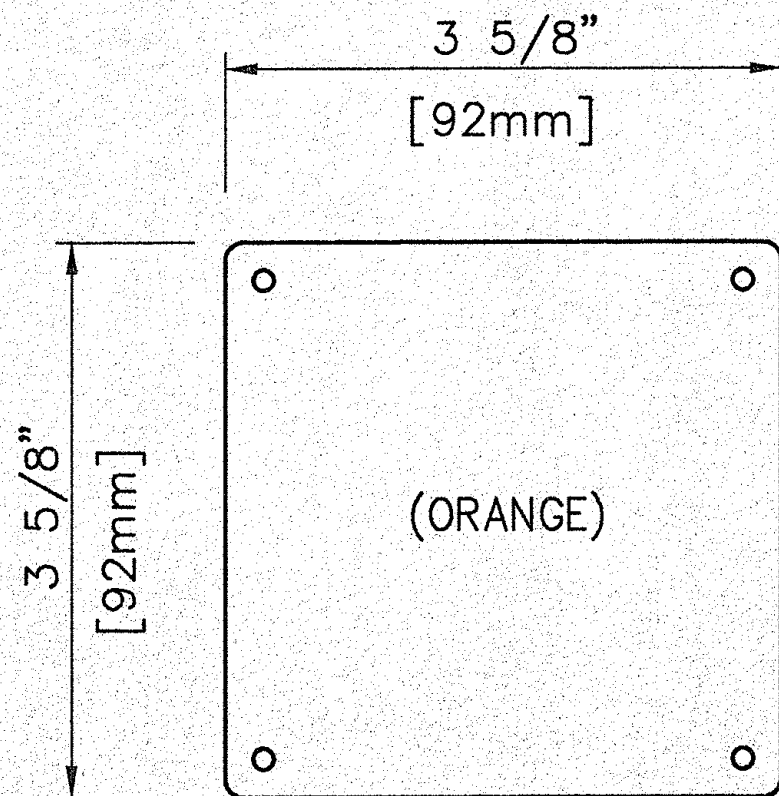
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RM-3 FLAT
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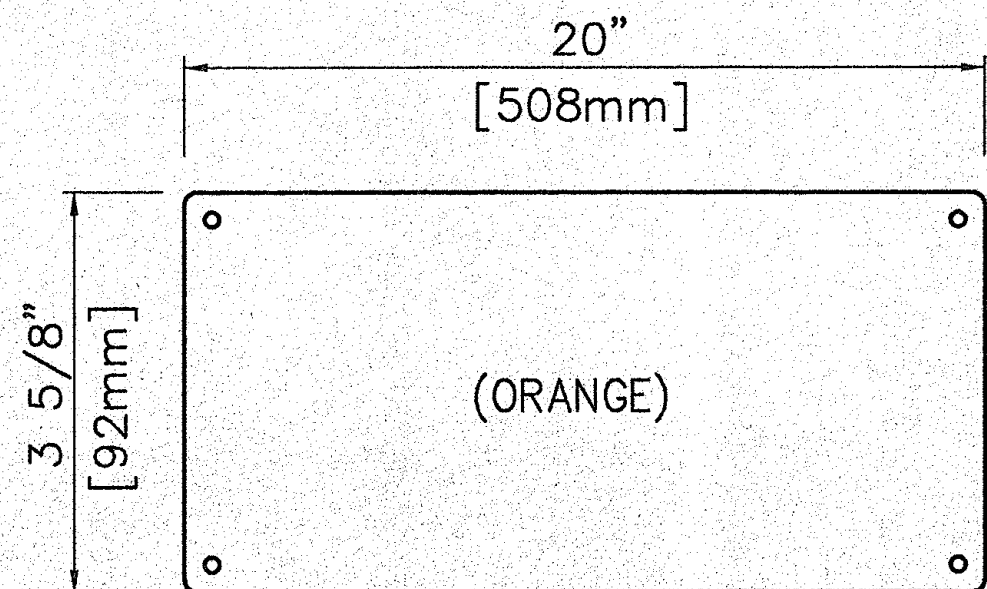


NOTE:
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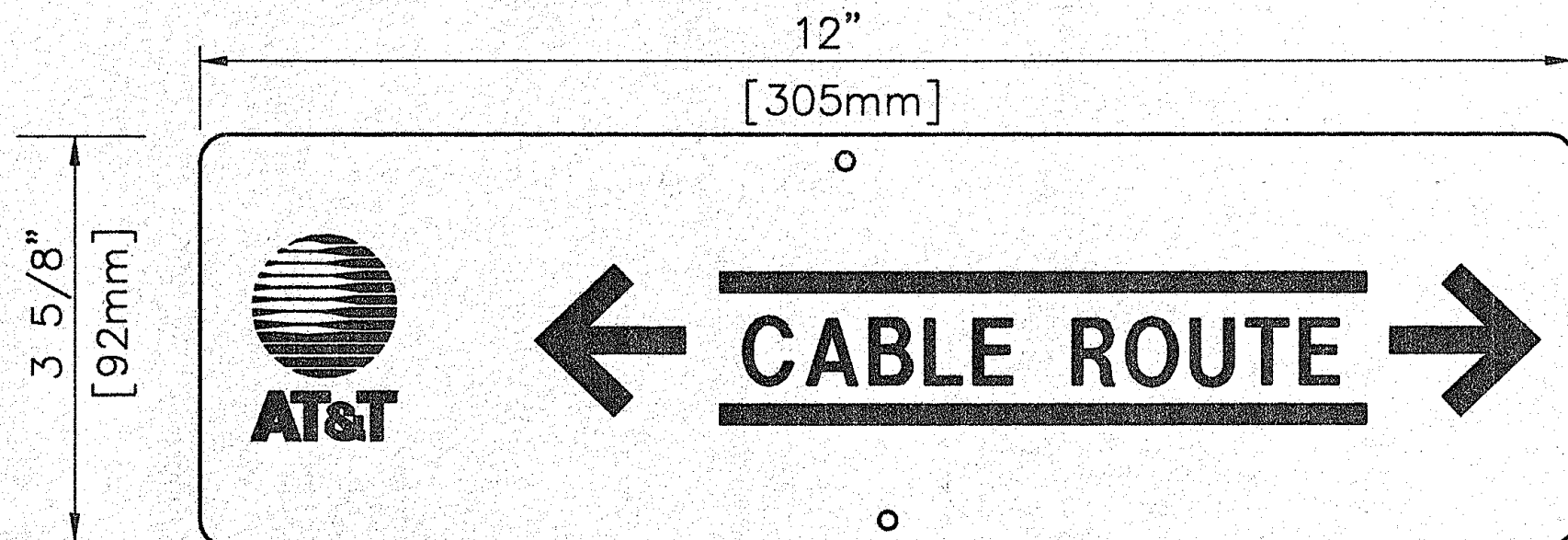
RM-9
NO SCALE



AT&T-S3
NO SCALE

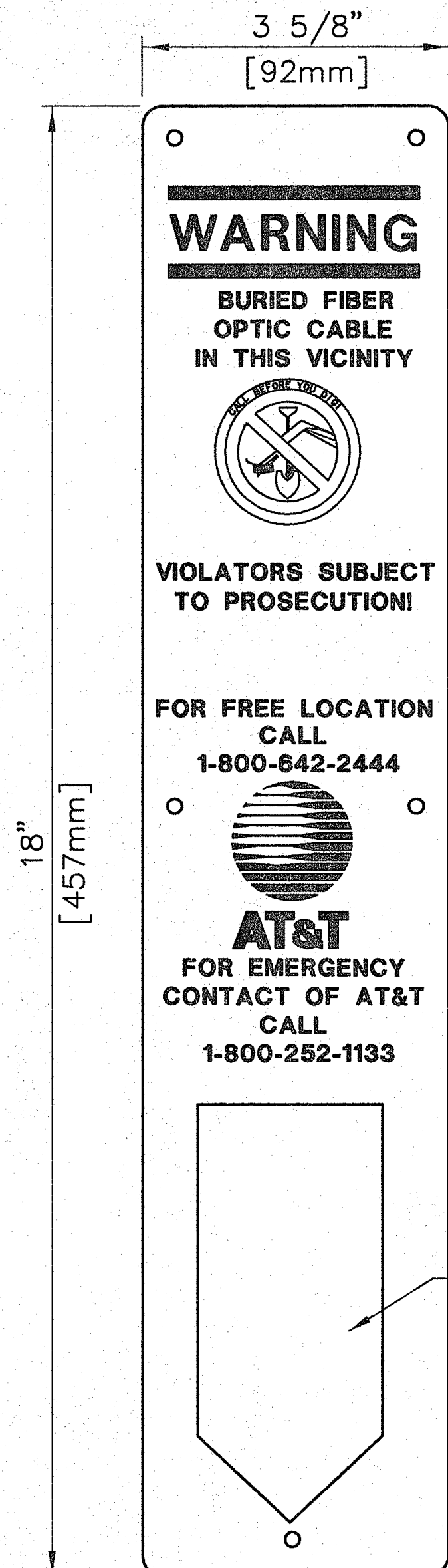


RM-11
NO SCALE



NOTE:
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AS TO APPEAR SOLID.

RM-10
NO SCALE

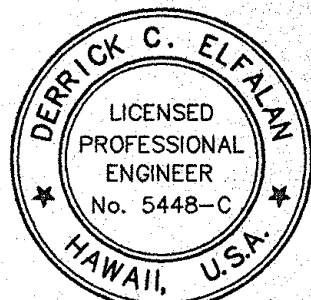


NOTE:
1. ALL TEXT FILLED IN SO
AS TO APPEAR SOLID.

RM-6 FLAT
NO SCALE

REVISIONS:

NOTES:



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HAWAII.
SIGNED *David Elftan*
DATE 9/2/99 REG. NO. 5448-C

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dba **Park Engineering**
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HONOLULU, HAWAII 96813
TELEPHONE: (808) 531-1676

PROPRIETARY
USE PURSUANT TO COMPANY INSTRUCTIONS
SPECIFICATION WT 35956
ESTIMATE 73

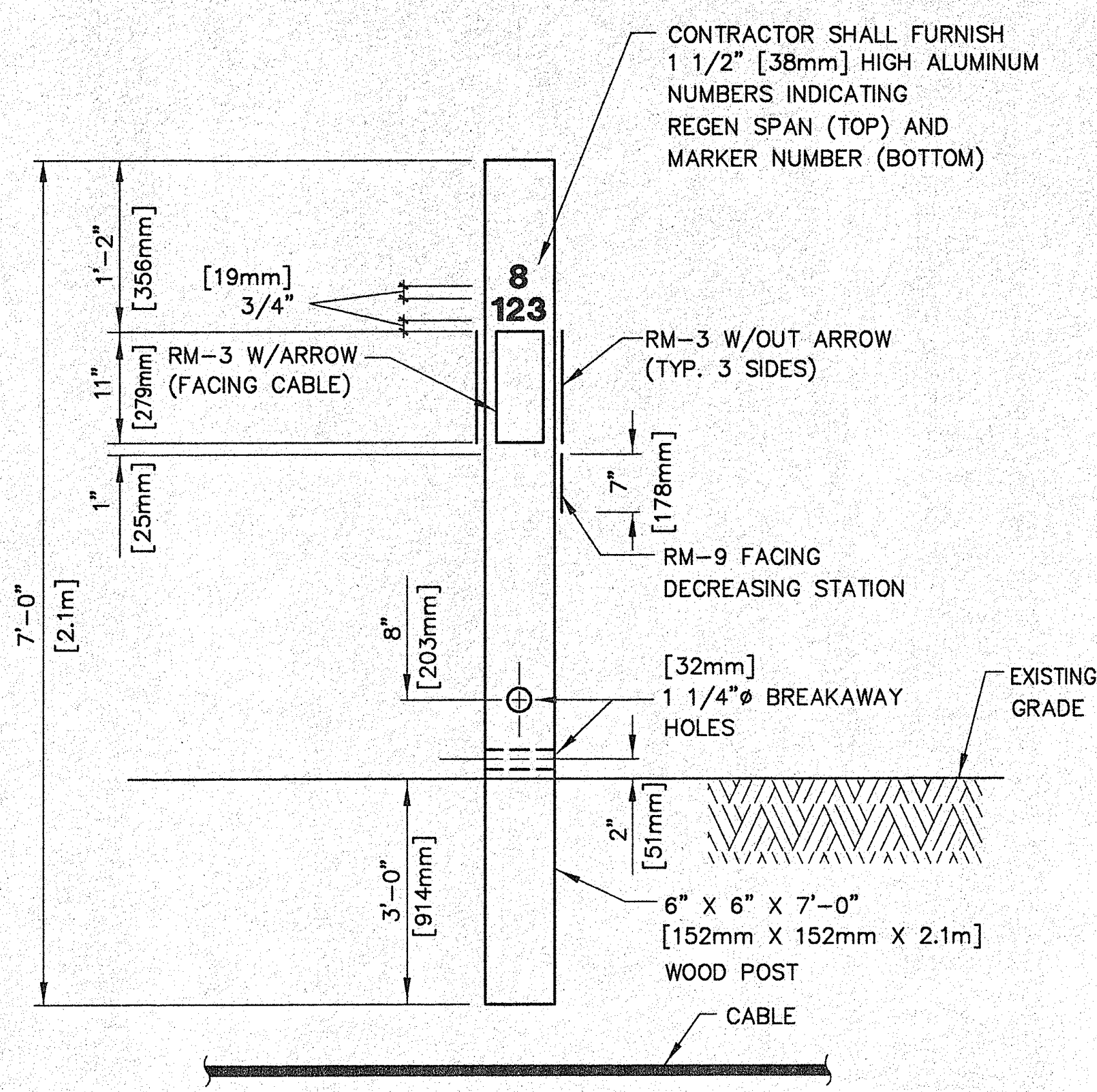
OWNERSHIP: -
CABLE GEO: HIO206
CABLE CLLI: WNAEHU0004

SCALE: AS SHOWN

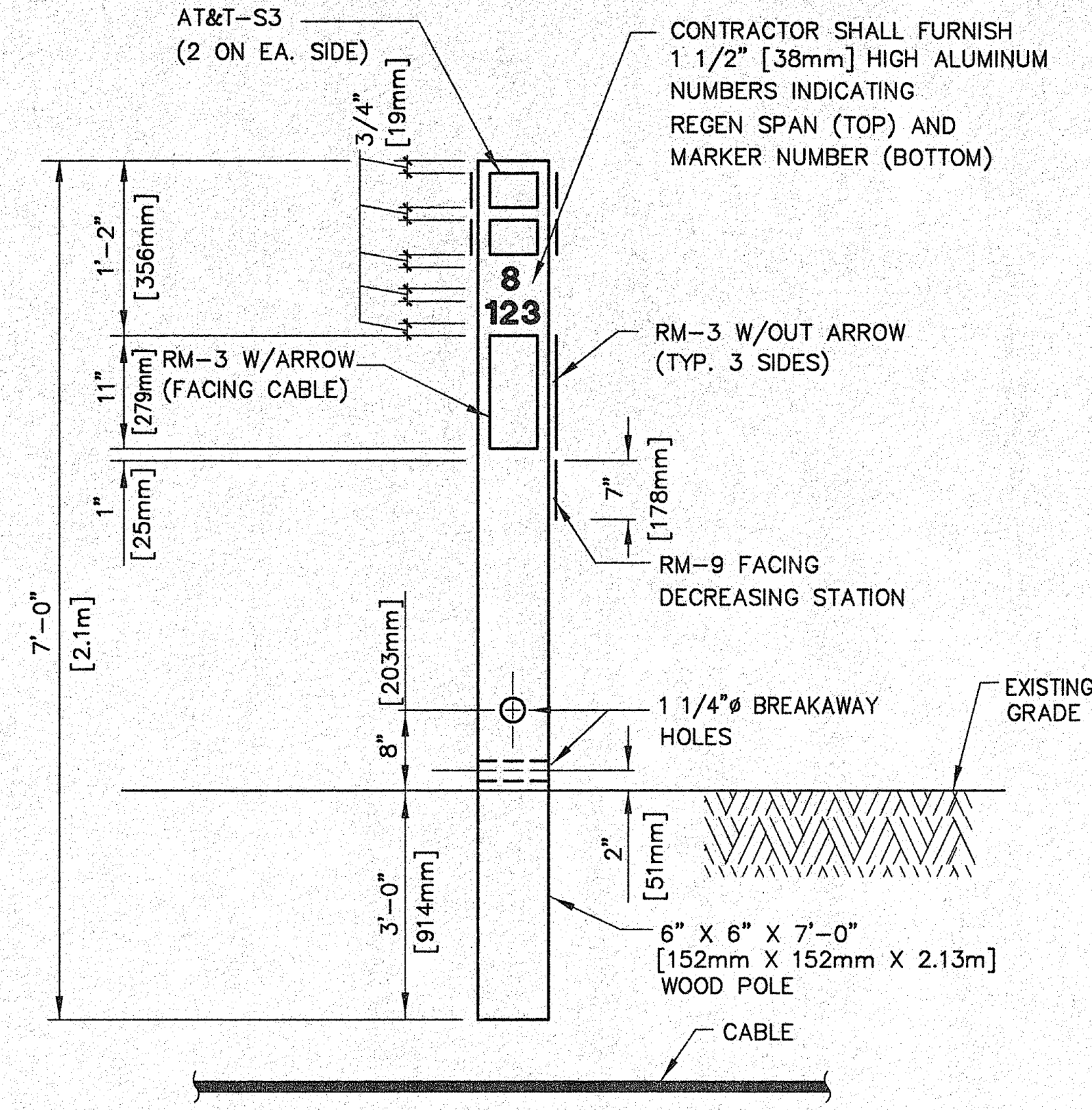
MAKAHA CABLE STATION
TO KEAWAULA CABLE STATION
LIGHTGUIDE SYSTEM

MAKAHA TO KEAWAULA FTA
TYPICAL DETAIL DRAWING

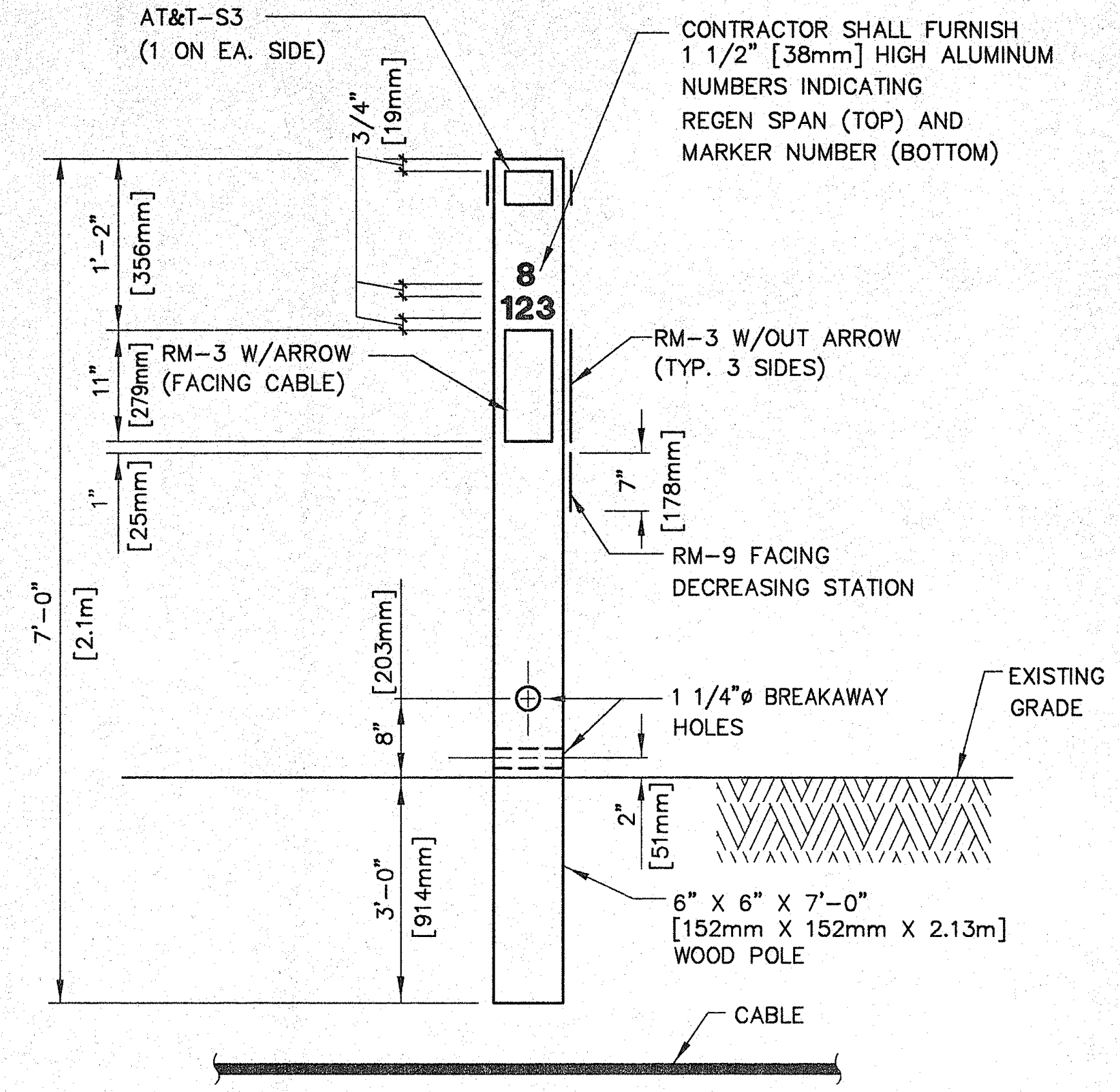
WT 956D1007



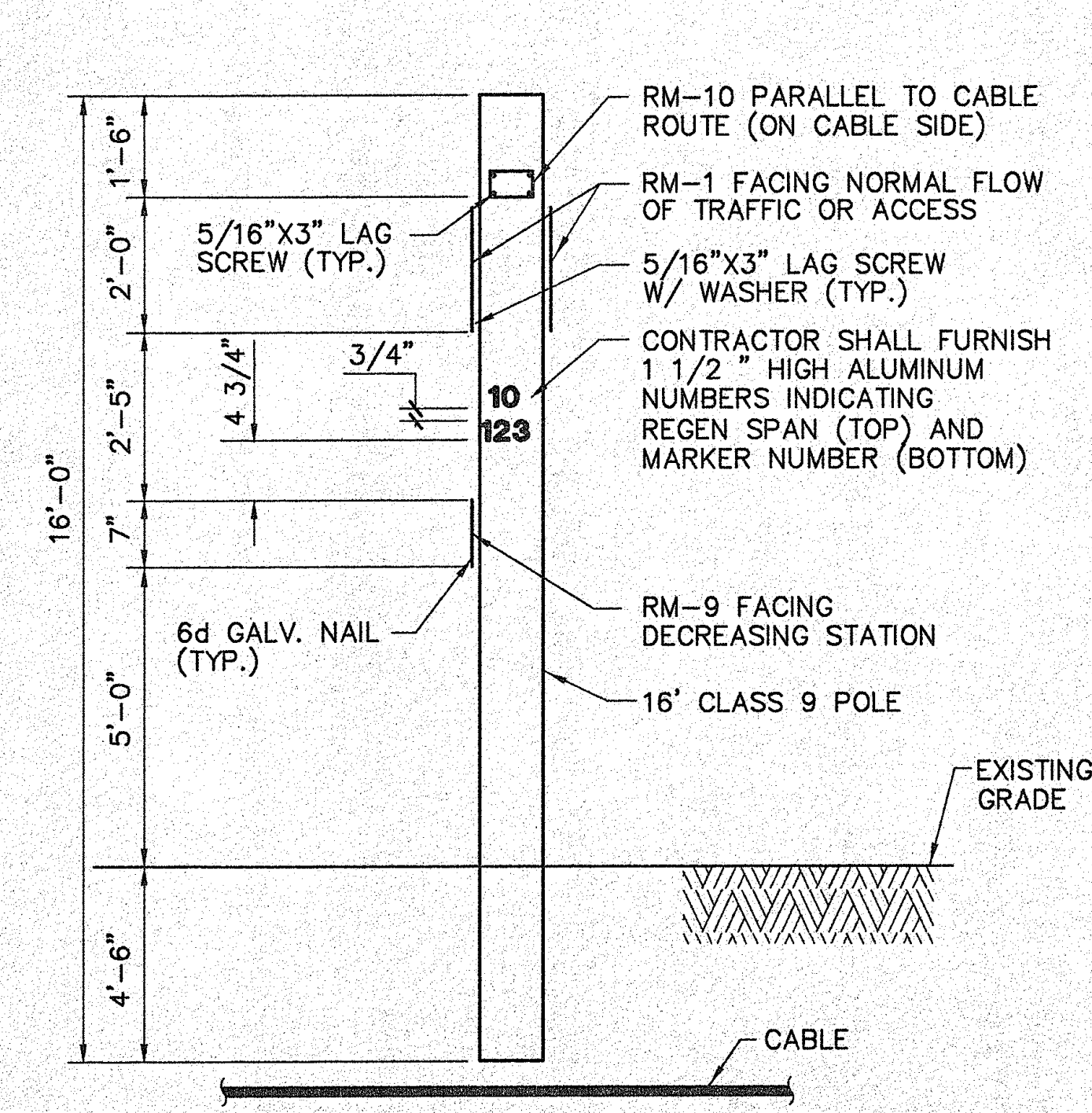
TYPE A1
GENERAL MARKER
NO SCALE



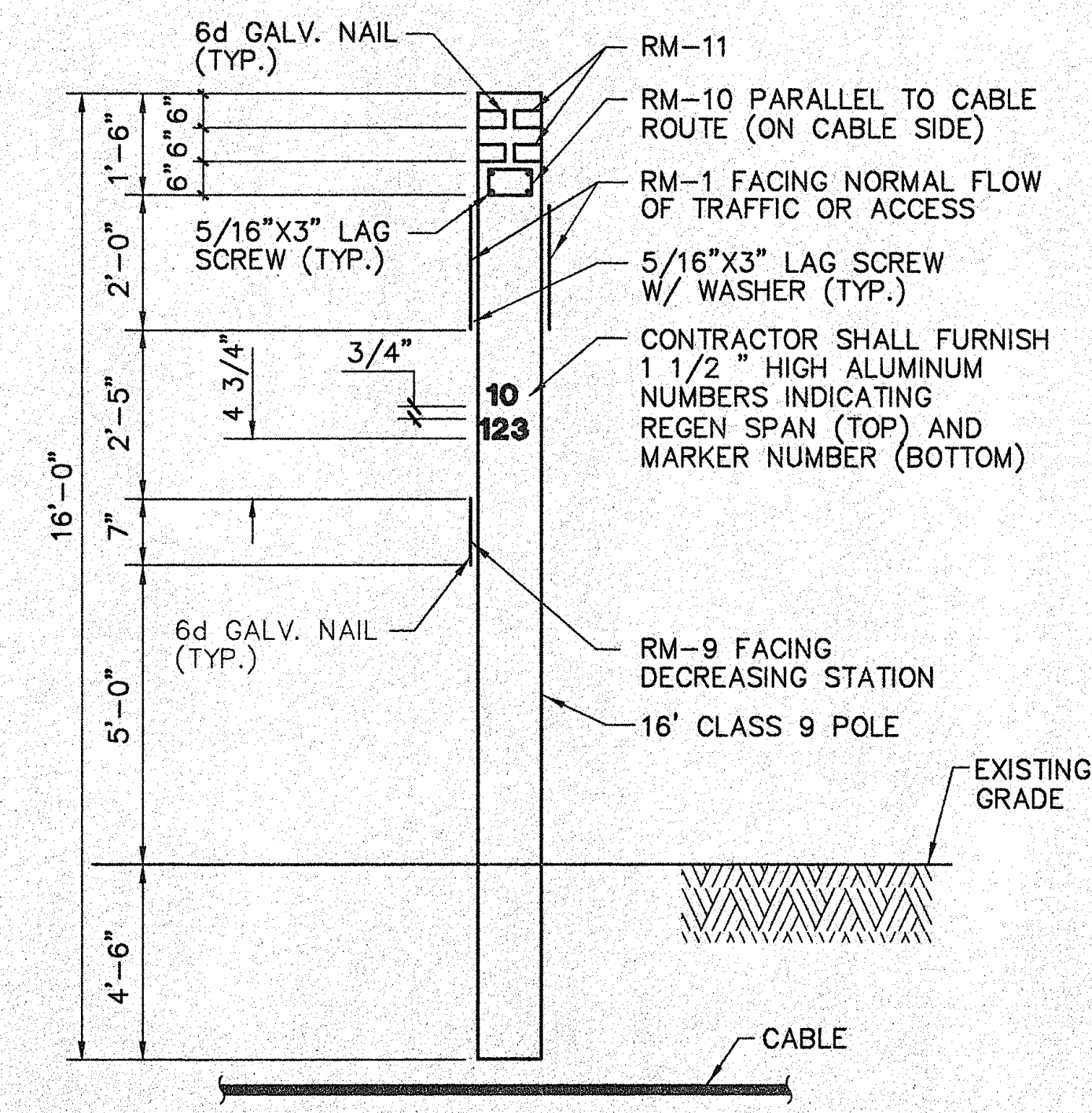
TYPE B1
MARKER AT SPLICE
NO SCALE



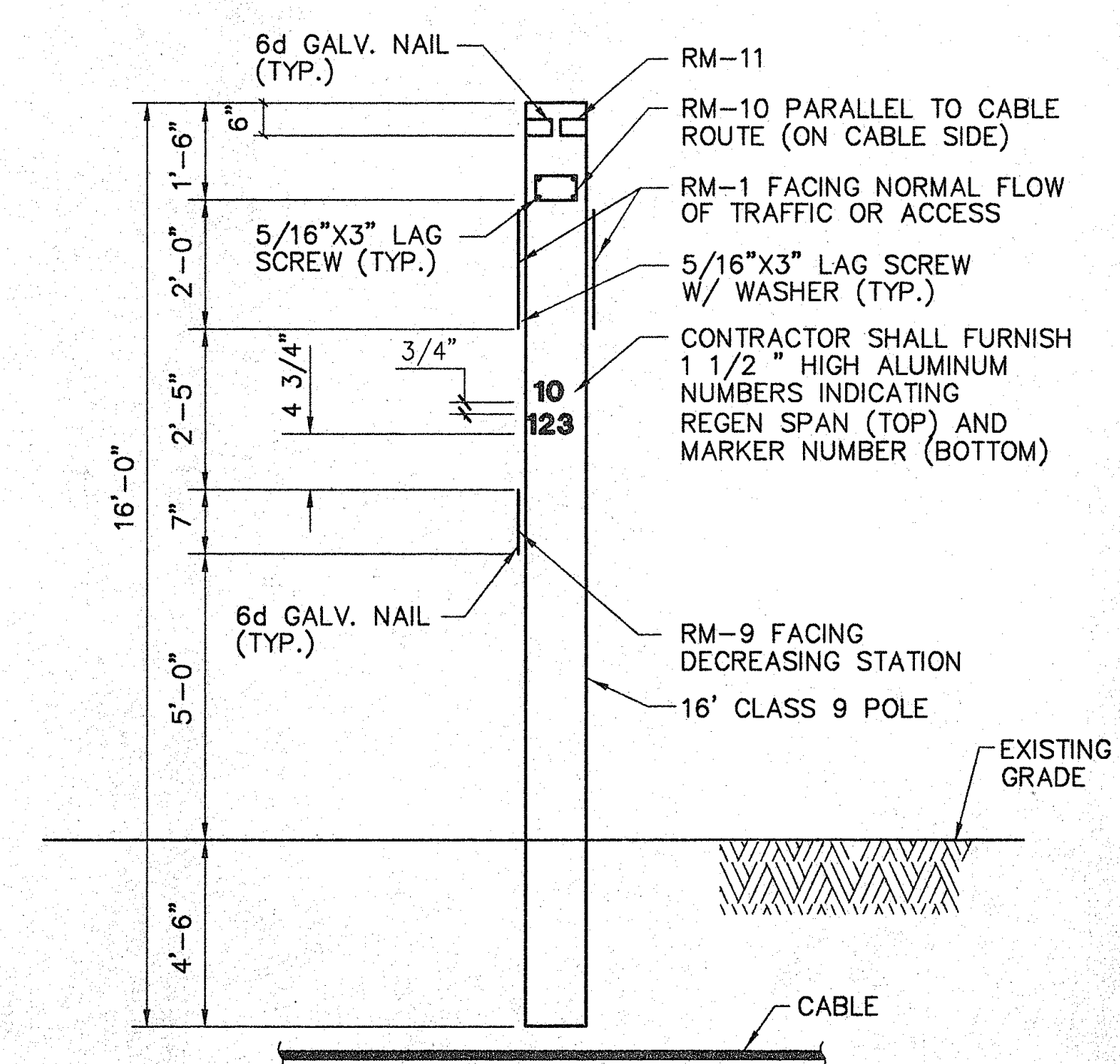
TYPE C1
MARKER AT INTERMEDIATE
VAULTS AND MANHOLES
NO SCALE



TYPE D1
GENERAL MARKER
NO SCALE



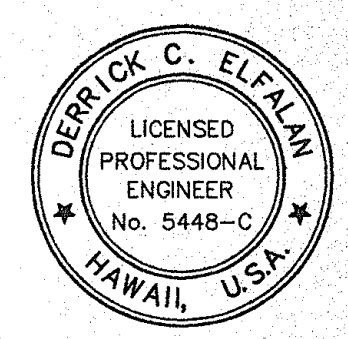
TYPE E1
MARKER AT SPLICE
NO SCALE



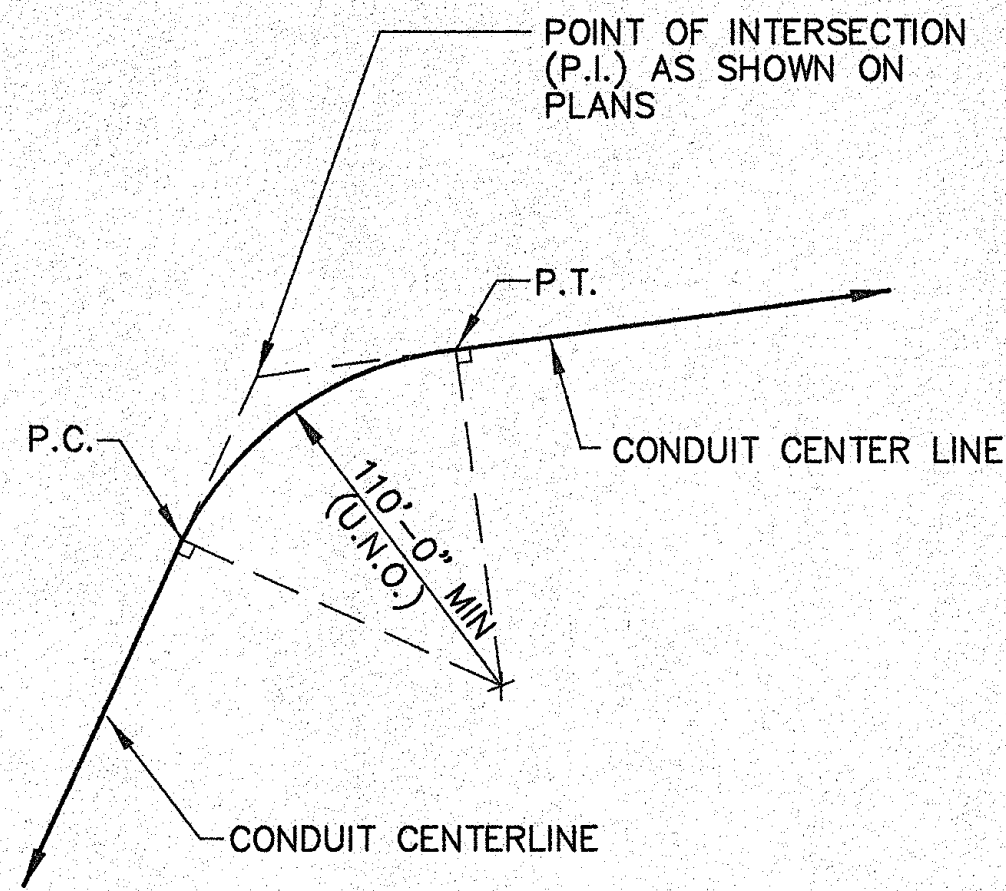
TYPE F1
MARKER AT INTERMEDIATE
VAULTS AND MANHOLES
NO SCALE

REVISIONS:

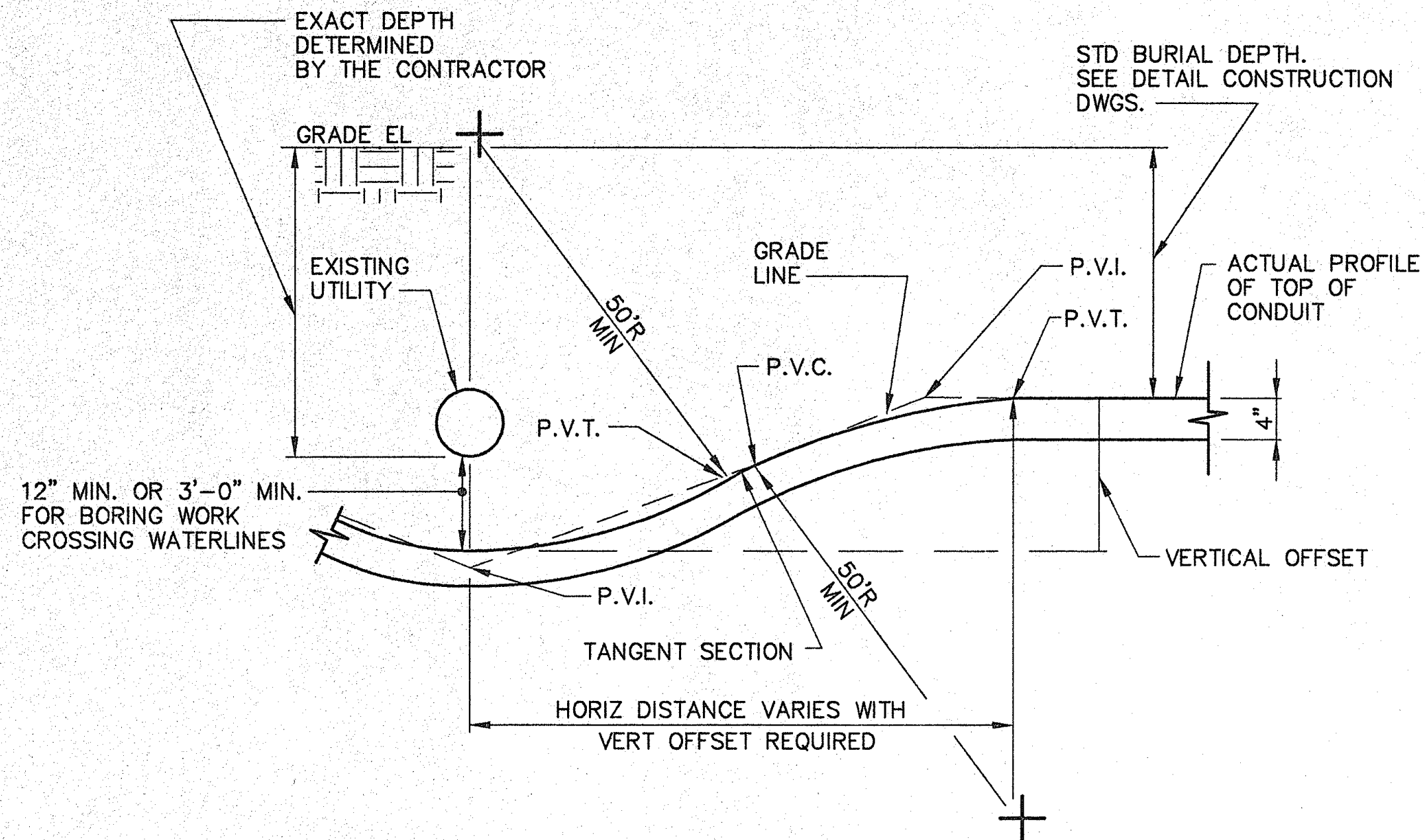
NOTES:



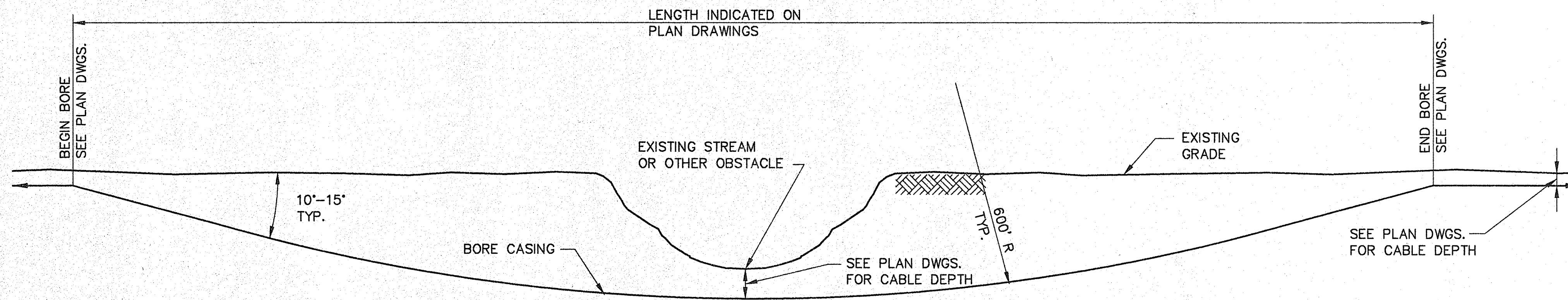
PREPARED FOR RECORD		
APPROVED FOR	ENGINEER	DATE
OUTSIDE PLANT		
I HEREBY CERTIFY THAT THIS DOCUMENT WAS PREPARED BY ME OR UNDER MY DIRECT SUPERVISION AND THAT I AM A DULY REGISTERED ENGINEER UNDER THE LAWS OF THE STATE OF HAWAII.		
SIGNED	<i>Derrick C. ElFaln</i>	
DATE	9/5/99	REG. NO. 5448-C
ParEn, Inc. dba Park Engineering SUITE 300, KAWAHAUA PLAZA 2075 KAWAHAUA STREET HONOLULU, HAWAII 96813 TELEPHONE: (808) 531-1676		
PROPRIETARY USE PURSUANT TO COMPANY INSTRUCTIONS		
SPECIFICATION	WT. 35856	
ESTIMATE	73	
OWNERSHIP: -		
CABLE GEO: H10206		
CABLE CLI: WNAEHU0004		
SCALE: AS SHOWN		
MAKAHA CABLE STATION TO KEAWAULA CABLE STATION LIGHTGUIDE SYSTEM		
MAKAHA TO KEAWAULA FTA TYPICAL DETAIL DRAWING		
WT 956D1008		



**TYPICAL CONDUIT INSTALLATION
AT OR NEAR A P.I.**
NO SCALE



**TYPICAL VERTICAL OFFSET IN CONDUIT
SYSTEM AT INTERFACE WITH
EXISTING UTILITIES**
NO SCALE



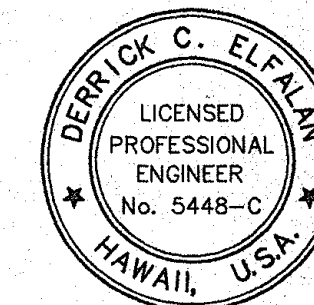
TYPICAL GUIDED BORE PROFILE
NO SCALE

APPROVED:

Michael Fala
for CHIEF, PLANNING & ENGINEERING, BWS *9/28/99* DATE

REVISIONS:

NOTES:



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APPROVED FOR
OUTSIDE PLANT ENGINEER DATE
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ENGINEER UNDER THE LAWS OF THE STATE OF
HAWAII.
SIGNED *Derrick C. Elfa*
DATE *9/28/99* REG. NO. *5448-C*

ParEn, Inc.
dba Park Engineering
SUITE 300, KAWAHAU PLAZA
657 SOUTH KING STREET
HONOLULU, HAWAII 96813
TELEPHONE: (808) 531-1676

PROPRIETARY
USE PURSUANT TO COMPANY INSTRUCTIONS
SPECIFICATION WT 35956
ESTIMATE 73

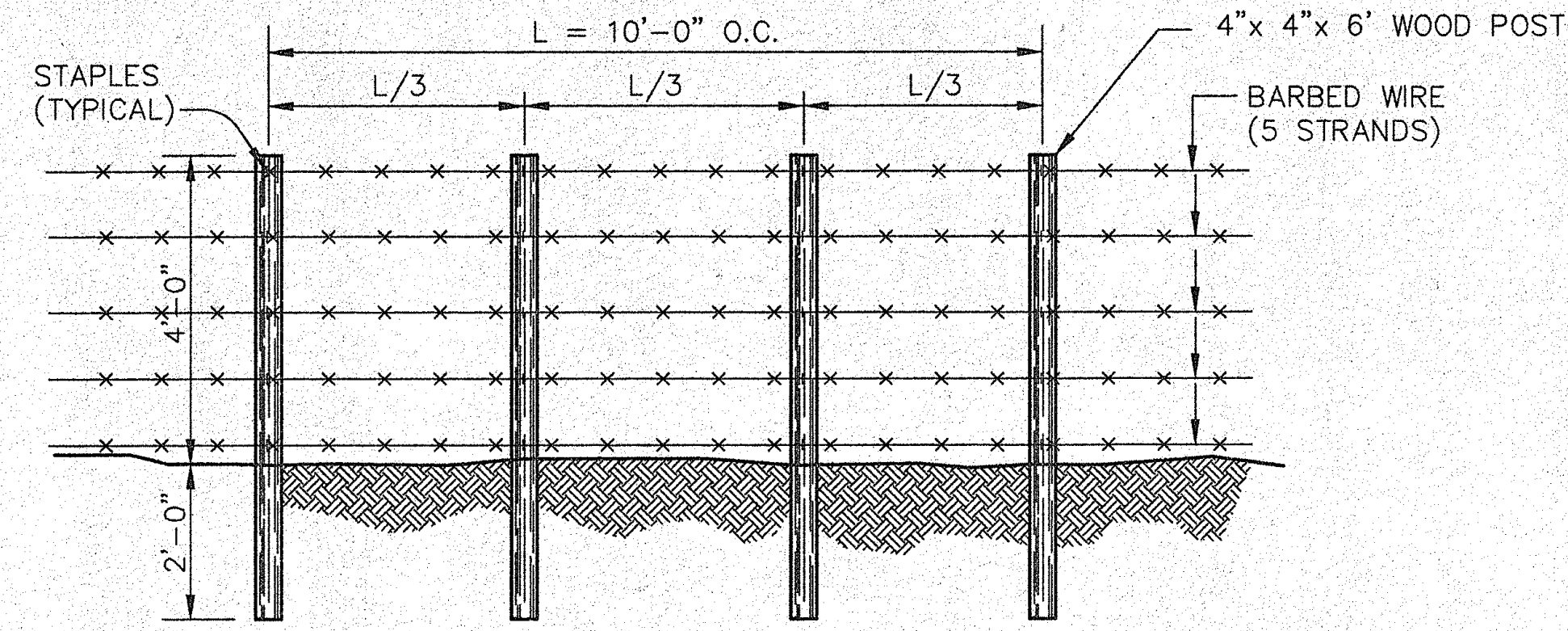
OWNERSHIP: -
CABLE GEO: H10206
CABLE CLLI: WNAEHU0004

SCALE: NONE

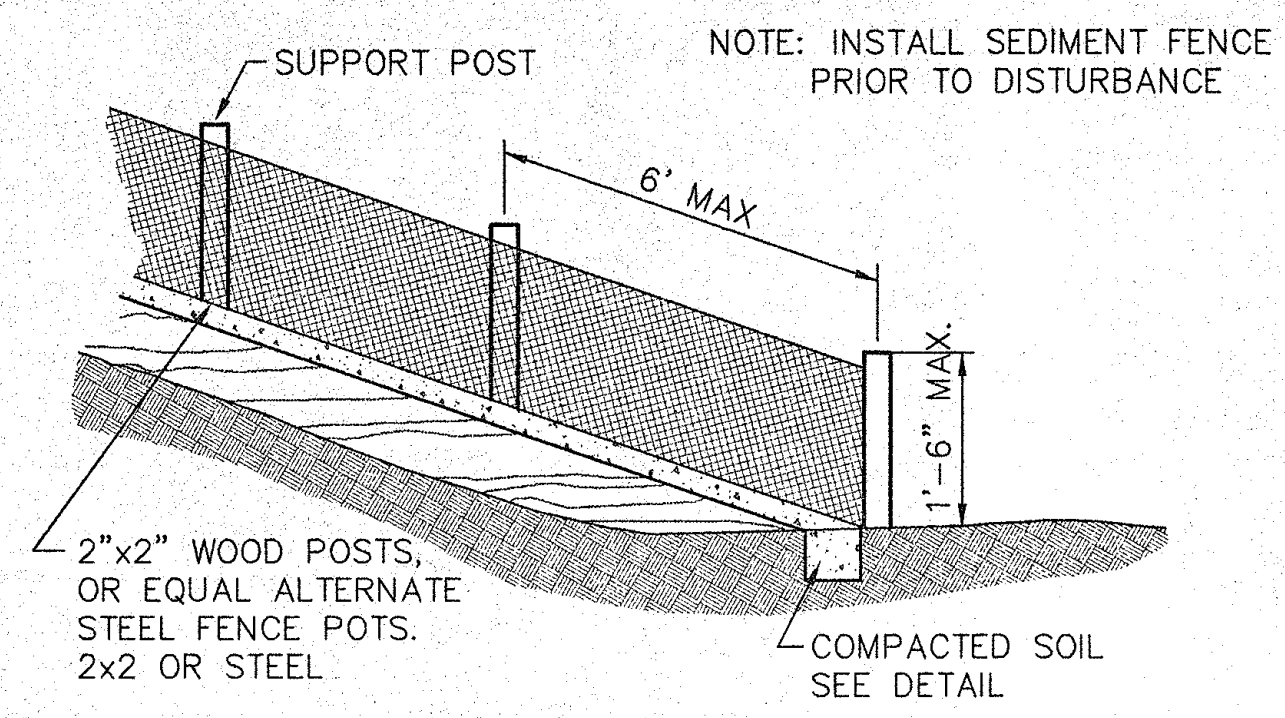
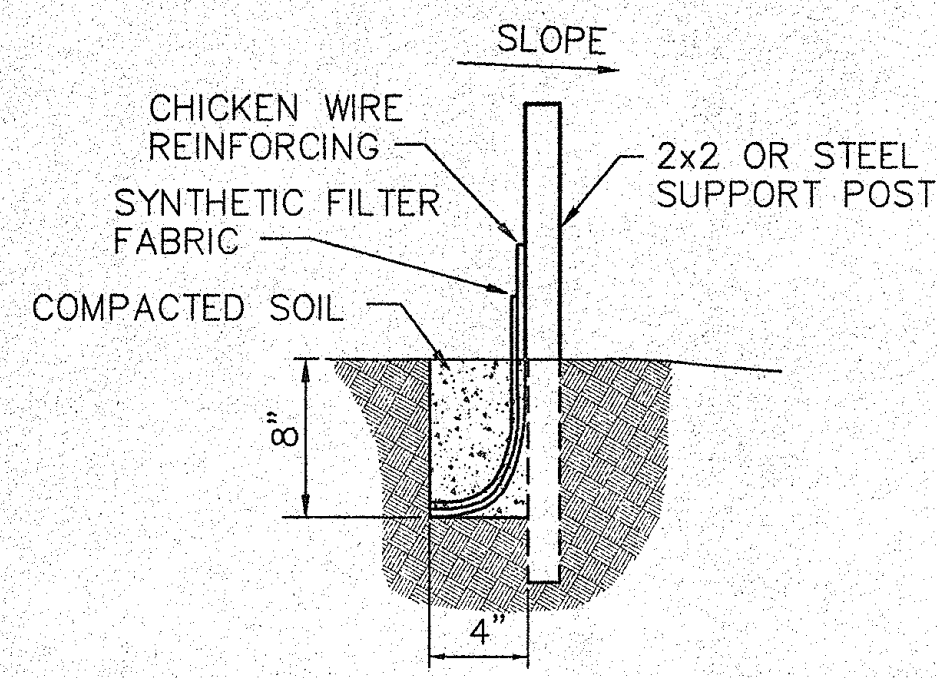
MAKAHA CABLE STATION
TO KEAWAULA CABLE STATION
LIGHTGUIDE SYSTEM

MAKAHA TO KEAWAULA FTA
TYPICAL DETAIL DRAWING

WT 956D1009



BARBED WIRE FENCING
NO SCALE



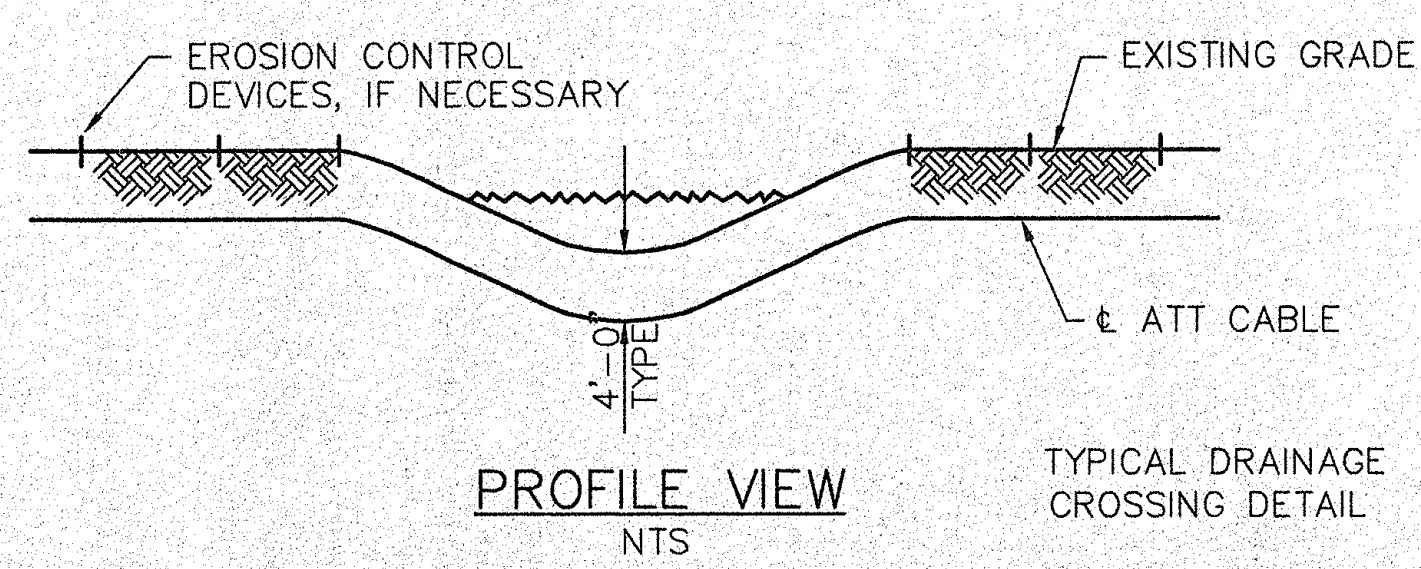
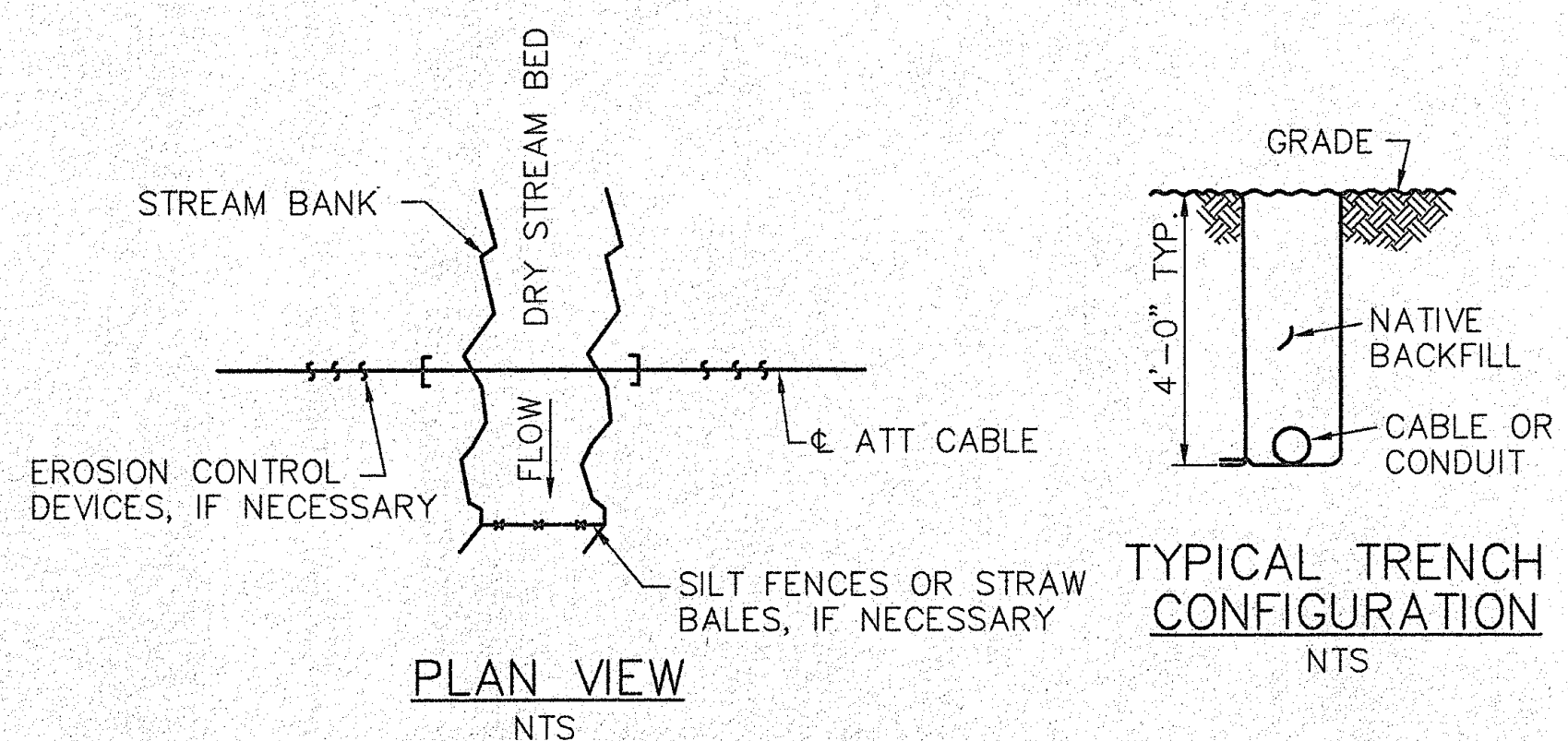
SEDIMENTATION FENCE INSTALLATION
NO SCALE

NOTES:

1. PLACE THE FILTER FABRIC FROM A CONTINUOUS ROLL CUT TO THE LENGTH OF THE BARRIER FENCE TO AVOID JOINTS. WHEN THE JOINTS ARE NECESSARY, SECURELY FASTEN THE FILTER FABRIC ONLY AT A SUPPORT POST WITH OVERLAP TO THE NEXT POST.
2. SUPPORT STANDARD STRENGTH FILTER FABRIC BY CHICKEN WIRE FASTENED SECURELY TO THE UPSLOPE SIDE OF THE POST. EXTEND THE CHICKEN WIRE SUPPORT TO THE BOTTOM OF THE TRENCH. WIRE FENCE SHALL BE A MINIMUM 14 GAUGE WITH A MAXIMUM WIRE SPACING OF SIX (6) INCHES.
3. WHEN A CHICKEN WIRE SUPPORT FENCE IS USED, SPACE POST A MAXIMUM OF 6 FEET AWAY.
4. EXTRA STRENGTH FILTER FABRIC WITH 6 FOOT POST SPACING DOES NOT REQUIRE CHICKEN WIRE SUPPORT FENCE.
5. DO NOT ATTACH FILTER FABRIC TO EXISTING TREES.
6. REFER TO TABLE FOR SPECIFICATIONS FOR SEDIMENT FENCE FABRIC
7. SEDIMENTATION FENCE SHALL BE MONITORED FOR EXCESS SEDIMENT BUILD-UP.

SPECIFICATIONS FOR FILTER FABRIC

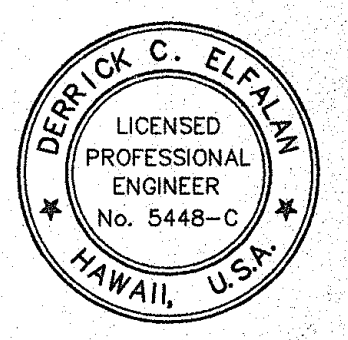
PHYSICAL PROPERTY	REQUIREMENTS
FILTERING EFFICIENCY	85% (MIN.)
TENSILE STRENGTH AT 20% (MAX.) ELONGATION	STANDARD STRENGTH 30 LB/LIN IN. (MIN.)
SLURRY FLOW RATE	0.3 GAL./SQ. FT./MIN. (MIN.)



TYPE I - DRAINAGE CROSSING
NO SCALE

REVISIONS:

NOTES:



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APPROVED FOR
OUTSIDE PLANT ENGINEER DATE
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SIGNED *Derrick C. Elean*
DATE 9/2/99 REG. NO. 5448-C

ParEn, Inc.
dba Park Engineering
SUITE 300, KAWAHAHA PLAZA
567 SOUTH KING STREET
HONOLULU, HAWAII 96813
TELEPHONE: (808) 531-1676

PROPRIETARY
USE PURSUANT TO COMPANY INSTRUCTIONS
SPECIFICATION WT 35956
ESTIMATE 73

OWNERSHIP: -
CABLE GEO: H10206
CABLE CLLI: WNAEH1U0004

SCALE: NONE

MAKAHA CABLE STATION
TO KEAWAULA CABLE STATION
LIGHTGUIDE SYSTEM

MAKAHA TO KEAWAULA FTA
TYPICAL DETAIL DRAWING

WT 956D1011