

STATE OF VERMONT
AGENCY OF TRANSPORTATION

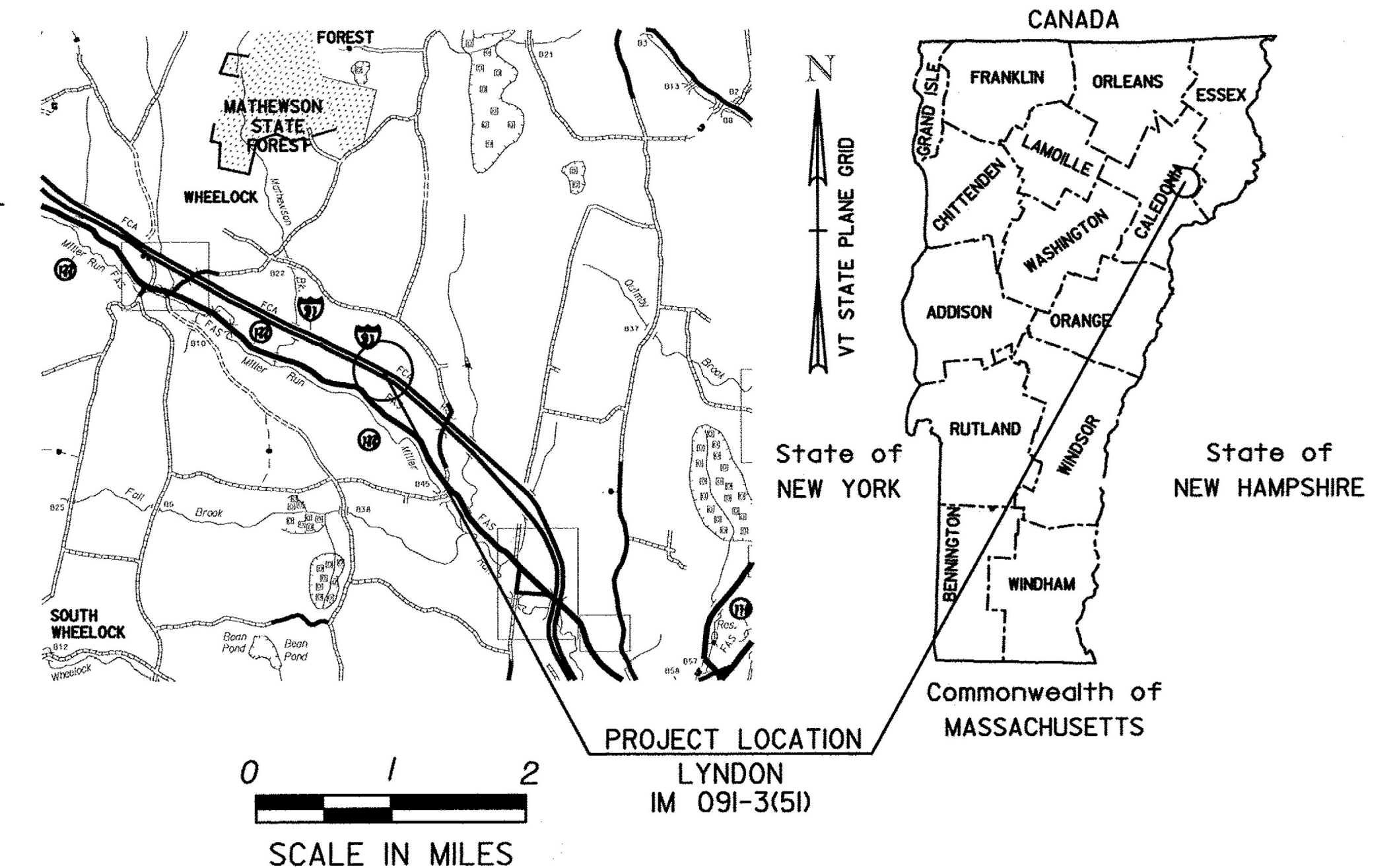


PROPOSED IMPROVEMENT
TOWN OF LYNDON
COUNTY OF CALEDONIA
I-91 (PRINCIPAL ARTERIAL - INTERSTATE) (NHS)

ADJACENT TO AND RIGHT OF INTERSTATE 91 NORTHBOUND BEGINNING AT
STA 7527+25.00 (MM 142.562) AND EXTENDING NORTHERLY 767.50 FEET
(0.145 MILE) TO AN ENDING POINT AT STA 7534+92.50 (MM 142.707).

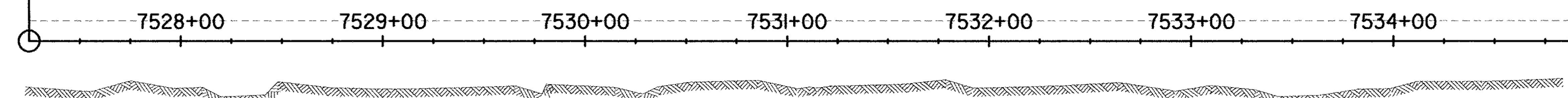
LENGTH OF PROJECT = 767.50 FT (0.145 MILE)

WORK TO BE PERFORMED UNDER THIS PROJECT INCLUDES HAND SCALING,
TRIM BLASTING, ROCK ANCHORING, CATCHMENT DITCH EXCAVATION, TRAFFIC
CONTROL, GUARDRAIL INSTALLATION AND OTHER HIGHWAY RELATED ITEMS.



STA 7527+25.00 (MM 142.562)
BEGIN IM 091-3(51)

I-91 NB
FROM EXIT #24



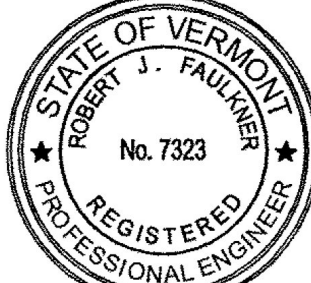
STA 7534+92.50 (MM 142.707)
END IM 091-3(51)

I-91 NB
TO EXIT #25

CONSTRUCTION IS TO BE CARRIED ON IN ACCORDANCE
WITH THESE PLANS AND THE STANDARD SPECIFICATIONS
FOR CONSTRUCTION DATED 2011, AS APPROVED BY THE
FEDERAL HIGHWAY ADMINISTRATION ON JULY 20, 2011
FOR USE ON THIS PROJECT, INCLUDING ALL SUBSEQUENT
REVISIONS AND SUCH REVISED SPECIFICATIONS AND
SPECIAL PROVISIONS AS ARE INCORPORATED IN THESE
PLANS.

QUALITY ASSURANCE PROGRAM : LEVEL I	
SURVEYED BY :	R. GILMAN, VAOT
SURVEYED DATE :	05/2014
DATUM	
VERTICAL	NAVD 88
HORIZONTAL	NAD 83 (2011)

0 50 100
SCALE IN FEET

PLANS PREPARED BY		DIRECTOR OF PROJECT DELIVERY	
		APPROVED 	DATE 12/21/2016
		PROJECT MANAGER : BRUCE MARTIN, P.E.	
		PROJECT NAME : LYNDON	
		PROJECT NUMBER : IM 091-3(51)	
		SHEET 1 OF 35 SHEETS	

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IM 09I-3(5I) SHEETS

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HIGHWAY SAFETY & DESIGN DETAIL

GUARDRAIL TERMINAL LABEL DETAIL (HSD - 621.06)

VAOT STANDARDS

G-1	STEEL BEAM GUARDRAIL WITH STEEL POSTS/WOOD POSTS	11-10-15
G-1D	STEEL BEAM GUARDRAIL DETAILS (END TERMINAL, ANCHOR, MEDIAN)	02-10-14
G-19	GENERIC GRADING PLANS FOR GUARDRAIL END TERMINALS	11-15-02
T-1	TRAFFIC CONTROL GENERAL NOTES	04-25-16
T-11	CONSTRUCTION APPROACH SIGNING DIVIDED HIGHWAY ONE LANE CLOSED	08-06-12
T-12	CONSTRUCTION APPROACH SIGNING DIVIDED HIGHWAY ONE LANE CLOSED	08-06-12
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T-16	TRAFFIC CONTROL FOR U-TURN USE ON DIVIDED HIGHWAY	08-06-12
T-28	CONSTRUCTION SIGN DETAILS	08-06-12
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T-45	SQUARE TUBE SIGN POST AND ANCHOR	01-02-13



PROJECT NAME: LYNDON	
PROJECT NUMBER: IM 09I-3(5I)	
FILE NAME: z13a370Ind.dgn	PLOT DATE: 2/1/2017
PROJECT LEADER: D. GOZALKOWSKI	DRAWN BY: J. HEALD
DESIGNED BY: J. OLSEN	CHECKED BY: J. SHIELDS
INDEX OF SHEETS	SHEET 2 OF 35

FILE NAME = W:\P\c\jesta\ANY-KA\29752\CAADD_MSTN13a\378\Consult\anta\Highway\z13a378csi.dgn
DATE/TIME = 12/13/2016
USER = 5323

GENERAL INFORMATION

SYMBOLGY LEGEND NOTE

THE SYMBOLGY ON THIS SHEET IS INTENDED TO COVER STANDARD CONVENTIONAL SYMBOLGY. THE SYMBOLGY IS USED FOR EXISTING & PROPOSED FEATURES WITH HEAVIER LINEWEIGHT, IN COMBINATION WITH PROJECT ANNOTATION, AS NOTED ON PROJECT PLAN SHEETS. THIS LEGEND SHEET COVERS THE BASICS. SYMBOLGY ON PLANS MAY VARY, PLAN ANNOTATIONS AND NOTES SHOULD BE USED TO CLARIFY AS NEEDED.

R. O. W. ABBREVIATIONS (CODES) & SYMBOLS

POINT	CODE	DESCRIPTION
	CH	CHANNEL EASEMENT
	CONST	CONSTRUCTION EASEMENT
	CUL	CULVERT EASEMENT
	D&C	DISCONNECT & CONNECT
	DIT	DITCH EASEMENT
	DR	DRAINAGE EASEMENT
	DRIVE	DRIVEWAY EASEMENT
	EC	EROSION CONTROL
	HWY	HIGHWAY EASEMENT
	I&M	INSTALL & MAINTAIN EASEMENT
	LAND	LANDSCAPE EASEMENT
	R&RES	REMOVE & RESET
	R&REP	REMOVE & REPLACE
	SR	SLOPE RIGHT
	UE	UTILITY EASEMENT
	(P)	PERMANENT EASEMENT
	(T)	TEMPORARY EASEMENT
■	BNDNS	BOUND SET
▣	BNDNS	BOUND TO BE SET
●	IPNS	IRON PIN SET
◎	IPNS	IRON PIN TO BE SET
⊠	CALC	EXISTING ROW POINT
○	PROW	PROPOSED ROW POINT
[LENGTH]		LENGTH CARRIED ON NEXT SHEET

COMMON TOPOGRAPHIC POINT SYMBOLS

POINT	CODE	DESCRIPTION
⌘	APL	BOUND APPARENT LOCATION
□	BM	BENCHMARK
▣	BND	BOUND
▣	CB	CATCH BASIN
⊕	COMB	COMBINATION POLE
▣	DITHR	DROP INLET THROATED DNC
⊕	EL	ELECTRIC POWER POLE
○	FPOLE	FLAGPOLE
○	GASFIL	GAS FILLER
○	GP	GUIDE POST
×	GSO	GAS SHUT OFF
○	GUY	GUY POLE
○	GUYW	GUY WIRE
×	GV	GATE VALUE
⊗	H	TREE HARDWOOD
△	HCTRL	CONTROL HORIZONTAL
△	HVCTRL	CONTROL HORIZ. & VERTICAL
◇	HYD	HYDRANT
⊙	IP	IRON PIN
⊙	IPIPE	IRON PIPE
⊕	LI	LIGHT - STREET OR YARD
⊕	MB	MAILBOX
○	MH	MANHOLE (MH)
▣	MM	MILE MARKER
⊙	PM	PARKING METER
▣	PMK	PROJECT MARKER
⊙	POST	POST STONE/WOOD
⊕	RRSIG	RAILROAD SIGNAL
⊕	RRSL	RAILROAD SWITCH LEVER
⊕	S	TREE SOFTWOOD
⊕	SAT	SATELLITE DISH
⊕	SHRUB	SHRUB
⊕	SIGN	SIGN
⊕	STUMP	STUMP
⊕	TEL	TELEPHONE POLE
⊕	TIE	TIE
⊕	TSIGN	SIGN W/DOUBLE POST
⊕	VCTRL	CONTROL VERTICAL
○	WELL	WELL
×	WSO	WATER SHUT OFF

THESE ARE COMMON VAOT SURVEY POINT SYMBOLS FOR EXISTING FEATURES, ALSO USED FOR PROPOSED FEATURES WITH HEAVIER LINEWEIGHT, IN COMBINATION WITH PROPOSED ANNOTATION.

PROPOSED GEOMETRY CODES

CODE	DESCRIPTION
PC	POINT OF CURVATURE
PI	POINT OF INTERSECTION
CC	CENTER OF CURVE
PT	POINT OF TANGENCY
PCC	POINT OF COMPOUND CURVE
PRC	POINT OF REVERSE CURVE
POB	POINT OF BEGINNING
POE	POINT OF ENDING
STA	STATION PREFIX
AH	AHEAD STATION SUFFIX
BK	BACK STATION SUFFIX
D	CURVE DEGREE OF (100FT)
R	CURVE RADUIS OF
T	CURVE TANGENT LENGTH
L	CURVE LENGTH OF
E	CURVE EXTERNAL DISTANCE

UTILITY SYMBOLGY

UNDERGROUND UTILITIES

— UGU —	— · — · — · —	UTILITY (GENERIC-UNKNOWN)
— UT —	— · — · — · —	TELEPHONE
— UE —	— · — · — · —	ELECTRIC
— UC —	— · — · — · —	CABLE (TV)
— UEC —	— · — · — · —	ELECTRIC+CABLE
— UET —	— · — · — · —	ELECTRIC+TELEPHONE
— UCT —	— · — · — · —	CABLE+TELEPHONE
— UECT —	— · — · — · —	ELECTRIC+CABLE+TELEP.
— G —	— · — · — · —	GAS LINE
— W —	— · — · — · —	WATER LINE
— S —	— · — · — · —	SANITARY SEWER (SEPTIC)

ABOVE GROUND UTILITIES (AERIAL)

— AGU —	— · — · — · —	UTILITY (GENERIC-UNKNOWN)
— T —	— · — · — · —	TELEPHONE
— E —	— · — · — · —	ELECTRIC
— C —	— · — · — · —	CABLE (TV)
— EC —	— · — · — · —	ELECTRIC+CABLE
— ET —	— · — · — · —	ELECTRIC+TELEPHONE
— AER E&T —	— · — · — · —	ELECTRIC+TELEPHONE
— CT —	— · — · — · —	CABLE+TELEPHONE
— ECT —	— · — · — · —	ELECTRIC+CABLE+TELEP.
— · —	— · — · — · —	UTILITY POLE GUY WIRE

PROJECT CONSTRUCTION SYMBOLGY

PROJECT DESIGN & LAYOUT SYMBOLGY

— · — — CZ — · —	CLEAR ZONE
—————	PLAN LAYOUT MATCHLINE

PROJECT CONSTRUCTION FEATURES

△ — △ — △ — △	TOP OF CUT SLOPE
○ — ○ — ○ — ○	TOE OF FILL SLOPE
⊗ ⊗ ⊗ ⊗ ⊗ ⊗	STONE FILL
-----	BOTTOM OF DITCH
=====	CULVERT PROPOSED
-----	STRUCTURE SUBSURFACE
PDF — PDF —	PROJECT DEMARCATION FENCE
BF — BF —	BARRIER FENCE
XXXXXXXXXXXXXXXXXXXX	TREE PROTECTION ZONE (TPZ)
//////////	STRIPING LINE REMOVAL
~~~~~	SHEET PILES

CONVENTIONAL BOUNDARY SYMBOLGY

BOUNDARY LINES

—————	TOWN LINE	TOWN BOUNDARY LINE
—————	COUNTY LINE	COUNTY BOUNDARY LINE
—————	STATE LINE	STATE BOUNDARY LINE
———		PROPOSED STATE R.O.W. (LIMITED ACCESS)
———		PROPOSED STATE R.O.W.
———		STATE ROW (LIMITED ACCESS)
———		STATE ROW
———		TOWN ROW
— · — · — · — · —		PERMANENT EASEMENT LINE (P)
— · — · — · — · —		TEMPORARY EASEMENT LINE (T)
+		SURVEY LINE
— P — — P —		PROPERTY LINE (P/L)
△ SR — SR — SR —		SLOPE RIGHTS
6f — — 6f —		6F PROPERTY BOUNDARY
4f — — 4f —		4F PROPERTY BOUNDARY
HAZ — — HAZ —		HAZARDOUS WASTE

EPSC LAYOUT PLAN SYMBOLGY

EPSC MEASURES

ONNOONNOONNO	FILTER CURTAIN
— X — X — X — X —	SILT FENCE
— X — X — X — X —	SILT FENCE WOVEN WIRE
→ — → — → — → —	CHECK DAM
▣	DISTURBED AREAS REQUIRING RE-VEGETATION
▣	EROSION MATTING

ENVIRONMENTAL RESOURCES

———	WETLAND BOUNDARY
-----	RIPARIAN BUFFER ZONE
-----	WETLAND BUFFER ZONE
-----	SOIL TYPE BOUNDARY
—— T&E ———	THREATENED & ENDANGERED SPECIES
—— HAZ ———	HAZARDOUS WASTE AREA
—— AG ———	AGRICULTURAL LAND
—— HABITAT ———	FISH & WILDLIFE HABITAT
—— FLOOD PLAIN ———	FLOOD PLAIN
—— OHW ———	ORDINARY HIGH WATER (OHW)
———	STORM WATER
———	USDA FOREST SERVICE LANDS
———	WILDLIFE HABITAT SUIT/CONN

ARCHEOLOGICAL & HISTORIC

—— ARCH ———	ARCHEOLOGICAL BOUNDARY
—— HISTORIC DIST ———	HISTORIC DISTRICT BOUNDARY
—— HISTORIC ———	HISTORIC AREA
(H)	HISTORIC STRUCTURE

CONVENTIONAL TOPOGRAPHIC SYMBOLGY

EXISTING FEATURES

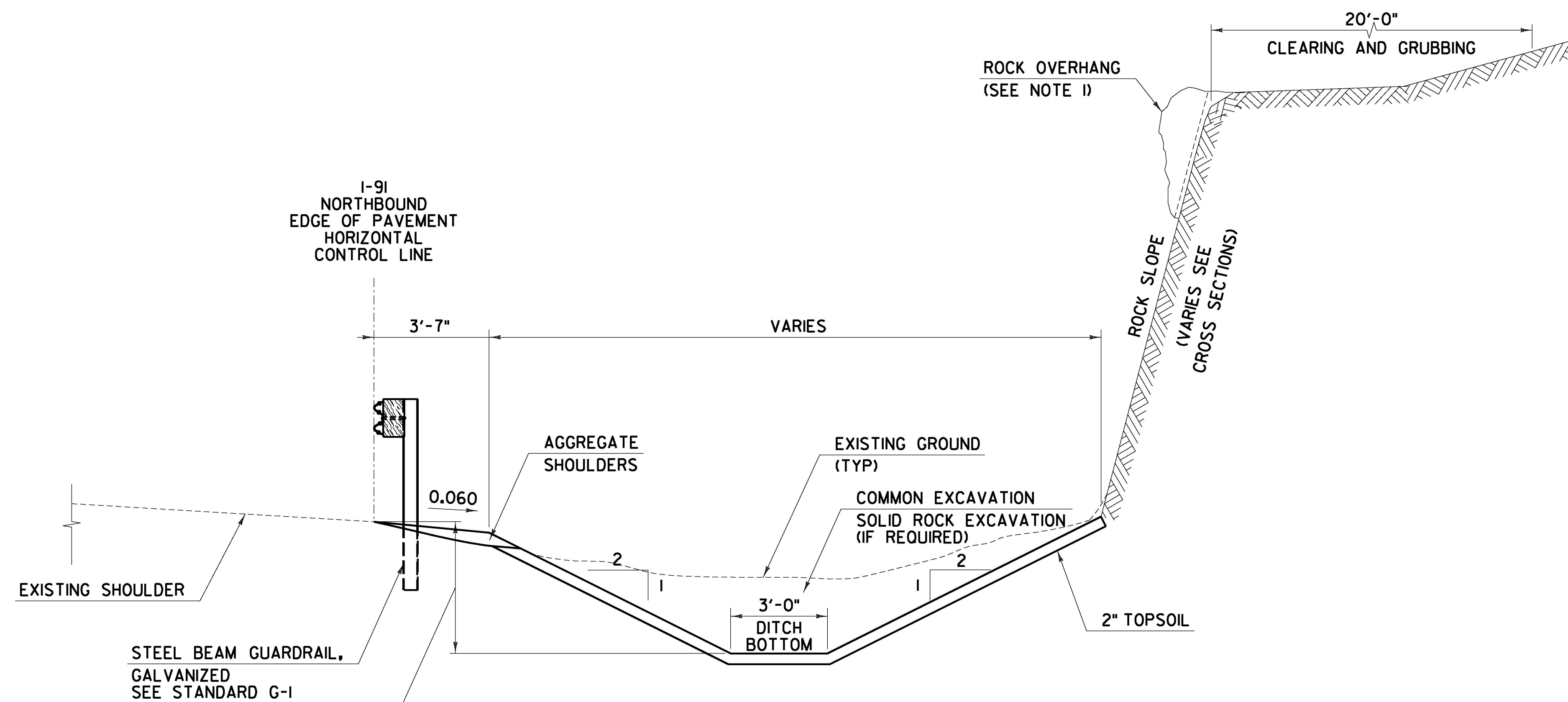
-----	ROAD EDGE PAVEMENT
-----	ROAD EDGE GRAVEL
-----	DRIVEWAY EDGE
-----	DITCH
-----	FOUNDATION
× — × — × — × —	FENCE (EXISTING)
□ — □ — □ — □ —	FENCE WOOD POST
○ — ○ — ○ — ○ —	FENCE STEEL POST
~~~~~	GARDEN
○ — ○ — ○ — ○ —	ROAD GUARDRAIL
	RAILROAD TRACKS
-----	CULVERT (EXISTING)
○○○○○○○○○○○○○○○○○○	STONE WALL
-----	WALL
~~~~~	WOOD LINE
~~~~~	BRUSH LINE
~~~~~	HEDGE
~~~~~	BODY OF WATER EDGE
~~~~~	LEDGE EXPOSED

PROJECT NAME:	LYNDON
PROJECT NUMBER:	IM 091-3(51)
FILE NAME:	z13a370csi.dgn
PROJECT LEADER:	D. GOZALKOWSKI
DESIGNED BY:	J. OLSEN
CONVENTIONAL SYMBOLGY LEGEND SHEET	CHECKED BY: J. SHIELDS
	PLOT DATE: 12/13/2016
	DRAWN BY: J. HEALD
	SHEET 3 OF 35



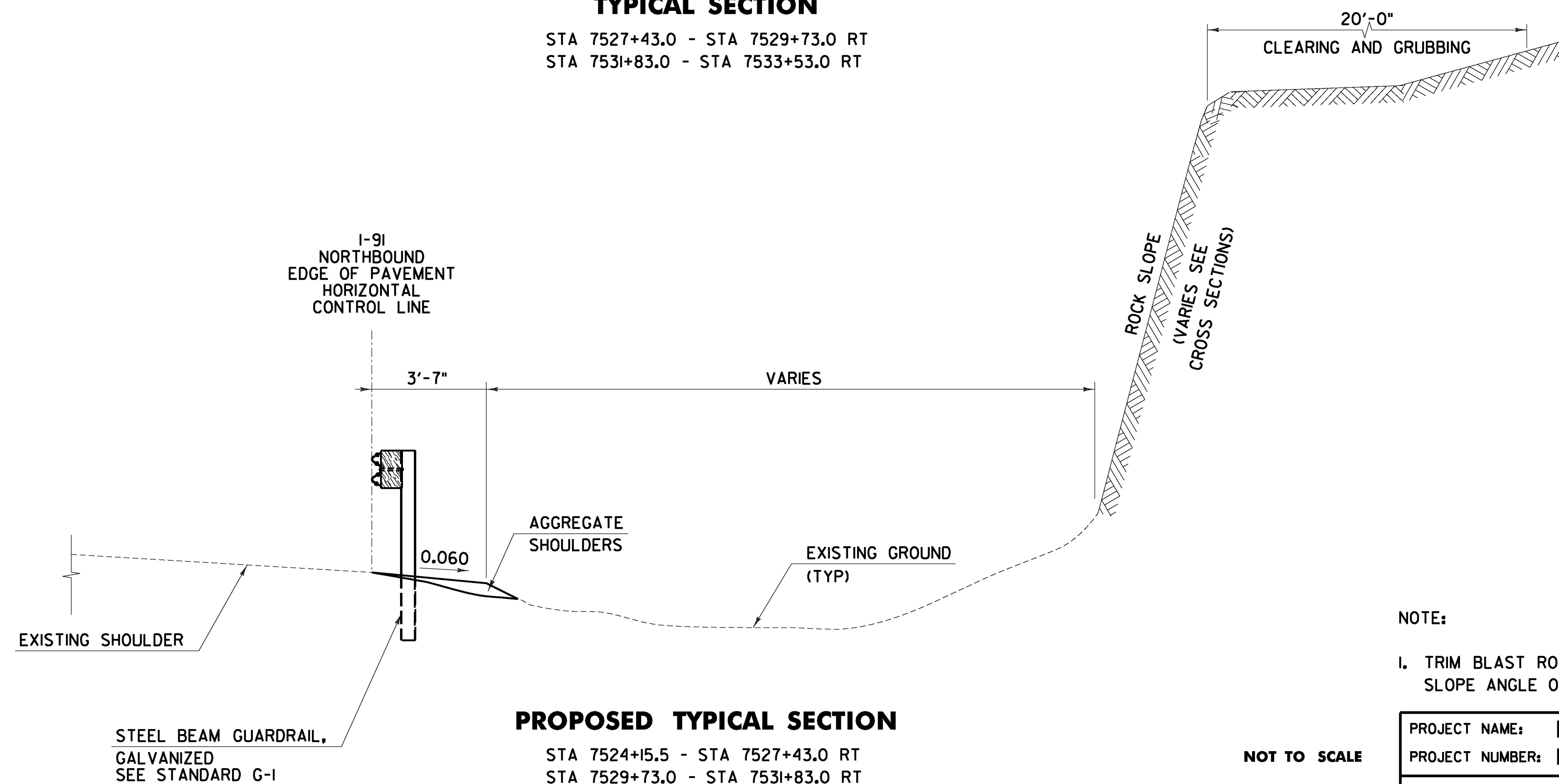


FILE NAME: W:\P\c\jesta\ANY\KA\29752\CAADD_MSTN13a378\Consultanta\Highway\z13a378typ.dgn  
DATE/TIME: 12/13/2016  
USER: 5323



**PROPOSED CATCHMENT DITCH  
TYPICAL SECTION**

STA 7527+43.0 - STA 7529+73.0 RT  
STA 7531+83.0 - STA 7533+53.0 RT



**PROPOSED TYPICAL SECTION**

STA 7524+15.5 - STA 7527+43.0 RT  
STA 7529+73.0 - STA 7531+83.0 RT  
STA 7533+53.0 - STA 7534+92.5 RT

**NOTE:**

1. TRIM BLAST ROCK OVERHANGS TO MATCH EXISTING ROCK CUT SLOPE ANGLE OF APPROXIMATELY 76°.

NOT TO SCALE

**CHA**

PROJECT NAME: LYNDON	
PROJECT NUMBER: IM 091-3(51)	
FILE NAME: z13a370typ.dgn	PLOT DATE: 12/13/2016
PROJECT LEADER: D. GOZALKOWSKI	DRAWN BY: J. HEALD
DESIGNED BY: J. OLSEN	CHECKED BY: J. SHIELDS
TYPICAL SECTION SHEET	SHEET 4 OF 35



**STATE OF VERMONT  
AGENCY OF TRANSPORTATION**

PROJECT NAME: LYNDON	
PROJECT NUMBER: IM 09I-3(5I)	
FILE NAME: z13a370qty.dgn	PLOT DATE: 1/30/2017
PROJECT LEADER: D. GOZALKOWSKI	DRAWN BY: J. HEALD
DESIGNED BY: J. OLSEN	CHECKED BY: J. SHIELDS
QUANTITY SHEET 1	SHEET 5 OF 35



# QUANTITY SHEET 2

**STATE OF VERMONT  
AGENCY OF TRANSPORTATION**

[illegible]

REVISION	DATE	DESCRIPTION	BY
	03-06-2017	CHANGED THE QUANTITY OF SPECIAL PROVISION (HAND SCALING) FROM 160 HOURS TO 40 HOURS.	JJO

# CHIA

PROJECT NAME: LYNDON  
PROJECT NUMBER: IM 091-3(51)

FILE NAME: z13a370q+y.dgn  
PROJECT LEADER: D. GOZALKOWSKI  
DESIGNED BY: J. OLSEN  
QUANTITY SHEET 2

PLOT DATE: 3/3/2017  
DRAWN BY: J. HEALD  
CHECKED BY: J. SHIELDS  
SHEET 6 OF 35



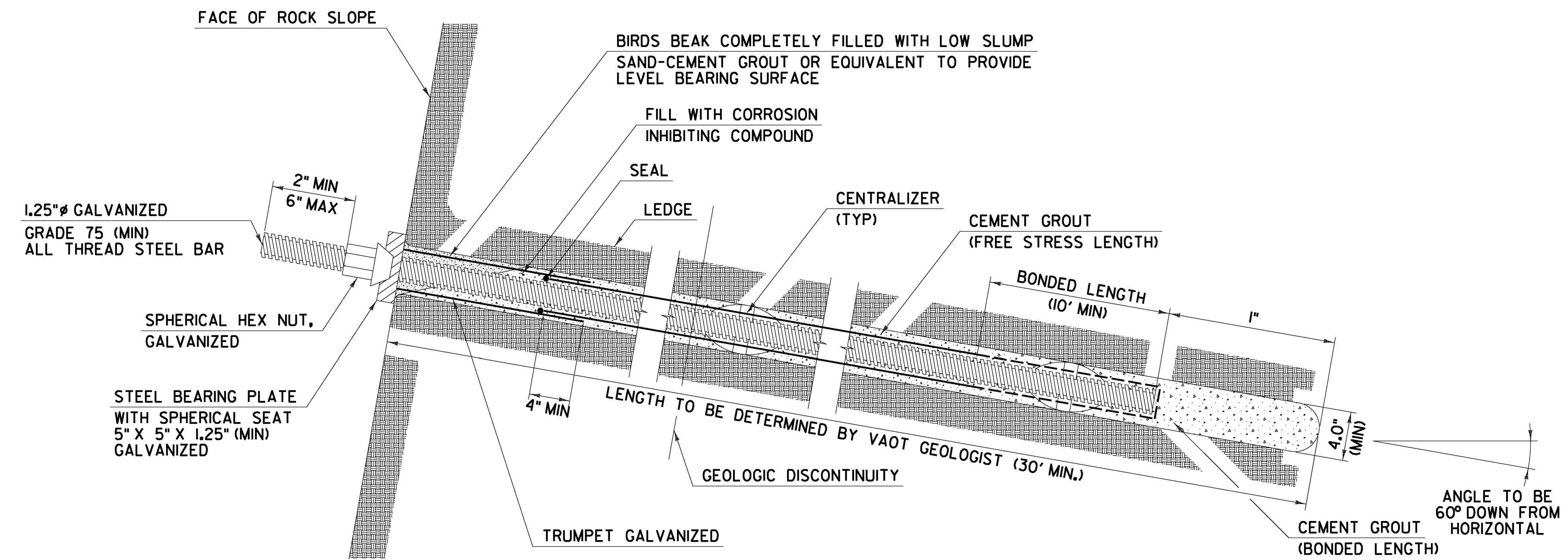
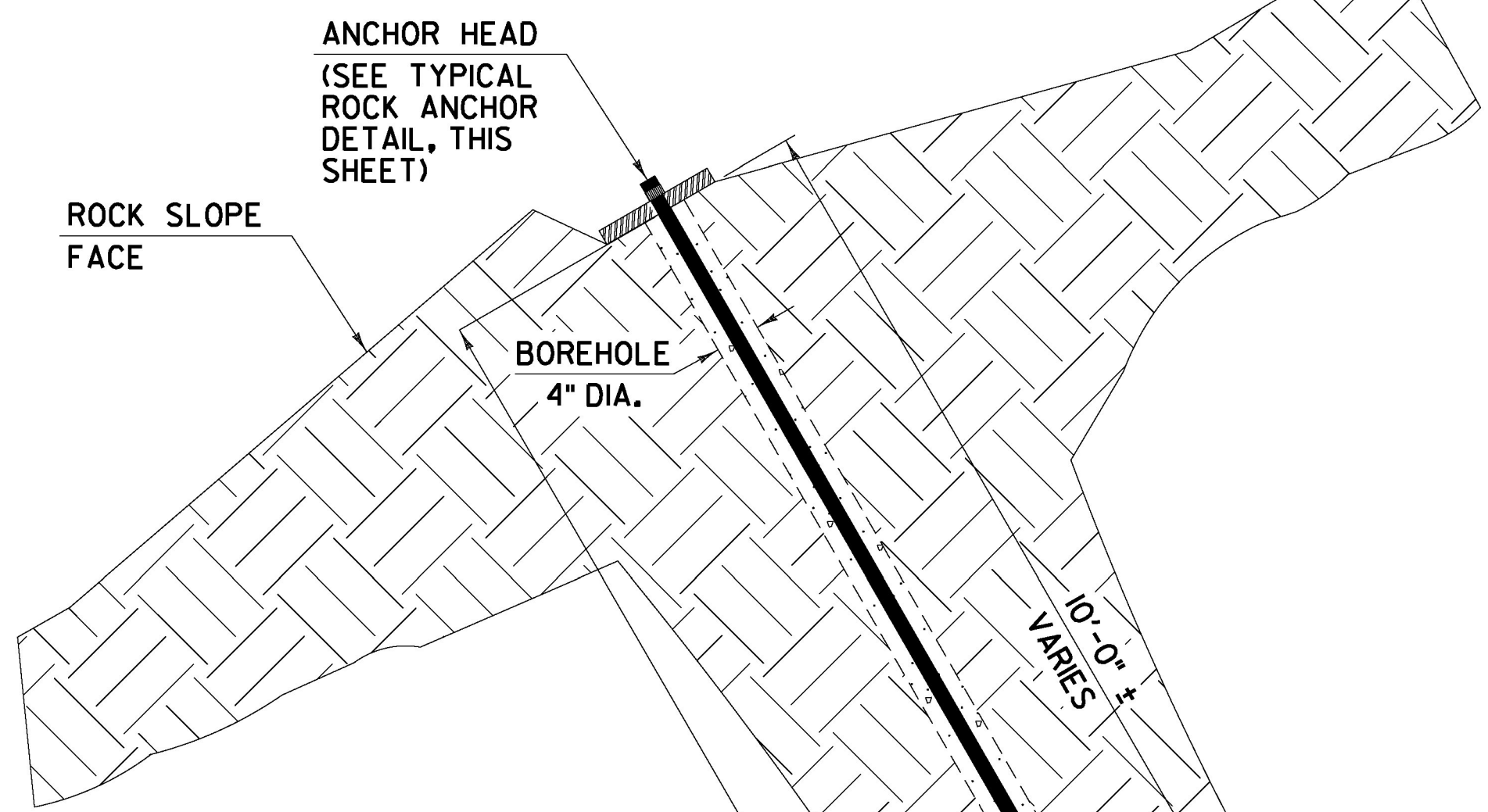
**STATE OF VERMONT  
AGENCY OF TRANSPORTATION**

PROJECT NAME: LYNDON	
PROJECT NUMBER: IM 09I-3(5I)	
FILE NAME: z13a370ess.dgn	PLOT DATE: 12/13/2016
PROJECT LEADER: D. GOZALKOWSKI	DRAWN BY: J. HEALD
DESIGNED BY: J. OLSEN	CHECKED BY: J. SHIELDS
EARTHWORK SUMMARY SHEET	SHEET 7 OF 35

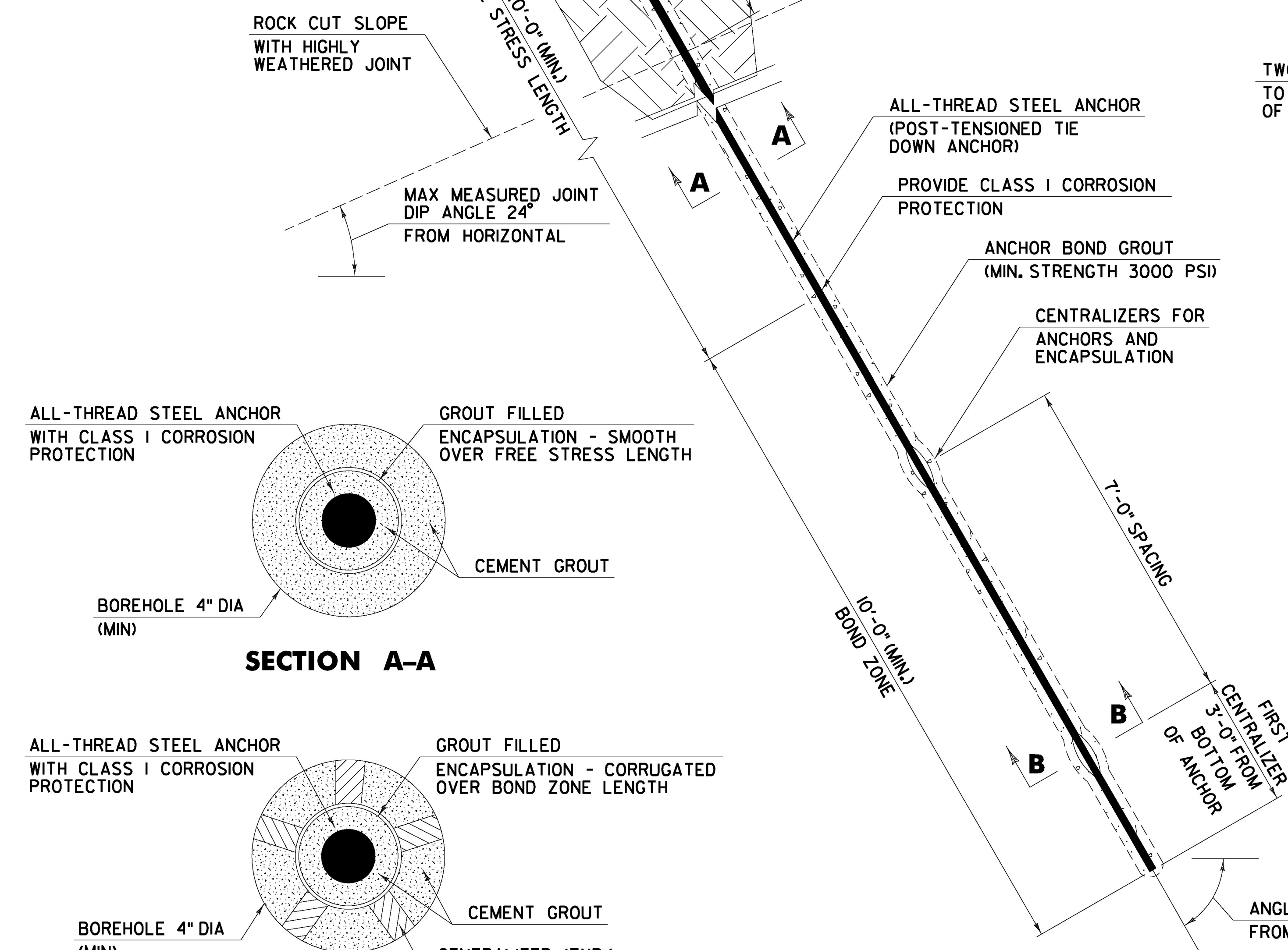
**CHA**



* DESIGN LOAD = 40 KIPS  
LOCK OFF LOAD = 44 KIPS  
ANCHOR SPACING 10' ON CENTER



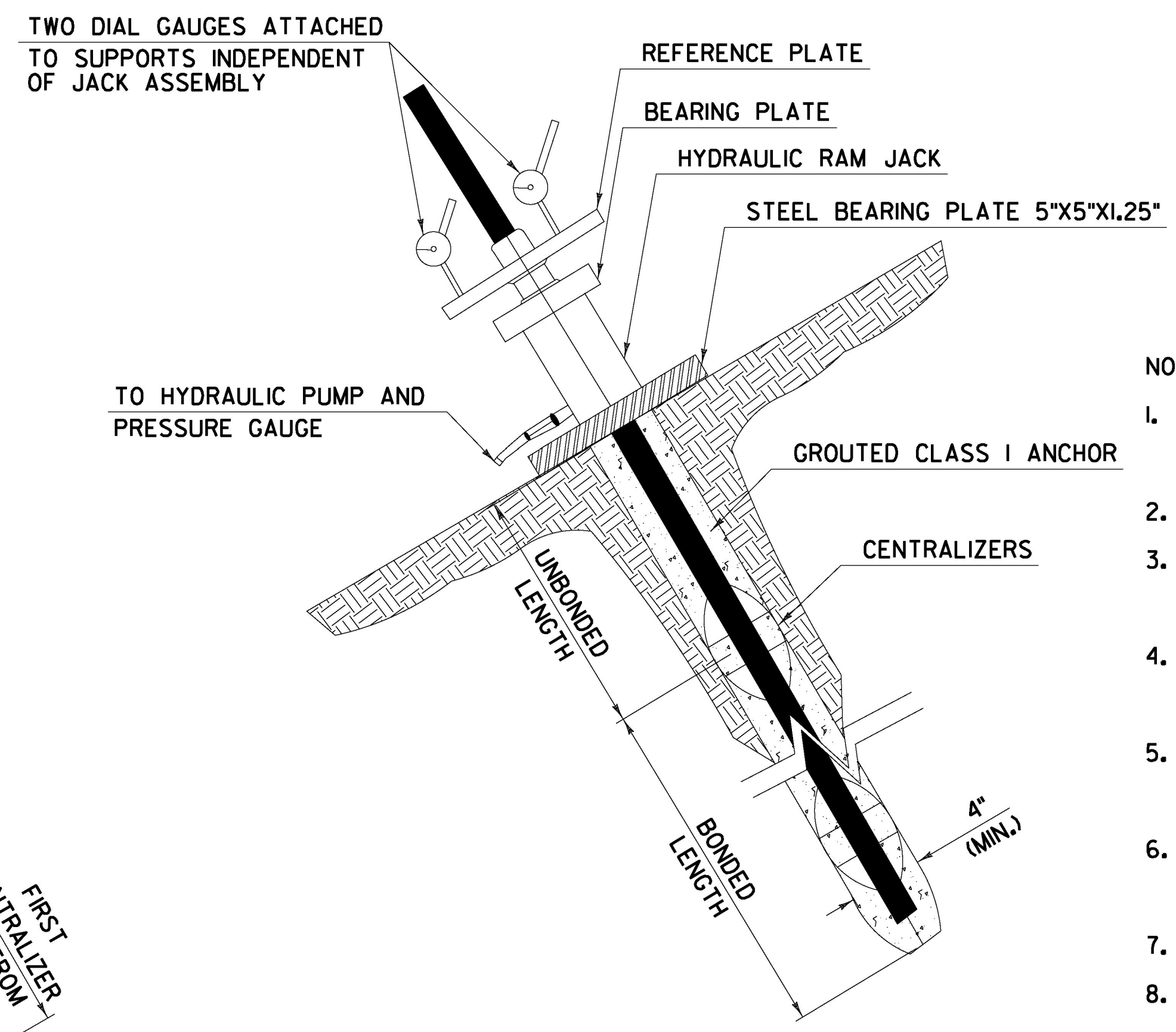
**TYPICAL ROCK ANCHOR DETAIL  
(TENSIONED ROCK BOLT)**



**SECTION A-A**

**SECTION B-B**

**ROCK ANCHOR DETAIL**  
STA 7528+73.0 - STA 7529+13.0 RT



**TYPICAL PULL-OUT TEST  
ROCK ANCHOR DETAIL**

SPECIAL PROVISION (ROCK ANCHOR TESTING)

NOT TO SCALE  
**CHA**

- NOTES:
1. CENTRALIZERS TO BE PLACED AT A MAXIMUM OF SEVEN FEET ON CENTER AND WITHIN THREE FEET FROM THE TOP AND BOTTOM OF DRILL HOLE ON CENTER.
  2. CENTRALIZERS SHALL BE MADE OF PVC.
  3. STEEL BEARING PLATE SHALL COVER THE DRILL HOLE COMPLETELY AND BEAR ON CEMENT/GROUT LEVELING SURFACE.
  4. WHEN ROCK AROUND THE DRILL HOLE OPENING HAS BROKEN, A CEMENT PAD FOR THE STEEL BEARING PLATE SHALL BE MADE AS NEEDED.
  5. THE TOTAL LENGTH OF THE STEEL BAR TO BE PAID FOR SHALL BE EQUAL TO THE LENGTH OF THE DRILL HOLE, THE BAR CAN BE TRIMMED AFTER INSTALLATION.
  6. ALL DRILL HOLES SHALL BE OVERDRILLED BY ONE FOOT. (ONE FOOT BETWEEN END BAR AND BOTTOM OF DRILL HOLE).
  7. PAY ITEM 900.640 SPECIAL PROVISION (ROCK ANCHOR).
  8. ROCK ANCHOR DETAIL SHOWS THE RELATIONSHIP OF THE ANCHOR TO THE SLOPE, TYPICAL ROCK ANCHOR DETAIL (TENSIONED ROCK BOLT) SHALL BE REFERRED TO FOR DETAILED COMPONENTS.

PROJECT NAME:	LYNDON
PROJECT NUMBER:	IM 091-3(51)
FILE NAME:	z13a370detail.dgn
PROJECT LEADER:	D. GOZALKOWSKI
DESIGNED BY:	J. EVERLETH
DETAIL SHEET	
PLOT DATE:	12/13/2016
DRAWN BY:	J. HEALD
CHECKED BY:	M. QUINN
SHEET	8 OF 35

FILE NAME = W:\P\Projects\ANY-KA\29152\CAADD\15STN13a370\Consult\anta\highway\z13a370detail.dgn  
DATE/TIME = 12/13/2016  
USER = 5323



FILE NAME = W:\Projects\ANY\KA\29752\CADD\MSTN13a\7B\Consult\anta\Highway\213a\7Bbl.dgn  
DATE/TIME = 12/13/2016  
USER = 5323

DATUM	
VERTICAL	NAVD88
HORIZONTAL	NAD83(2011)
ADJUSTMENT	

ALIGNMENT TIES

NORTH =
EAST =
ELEV. =

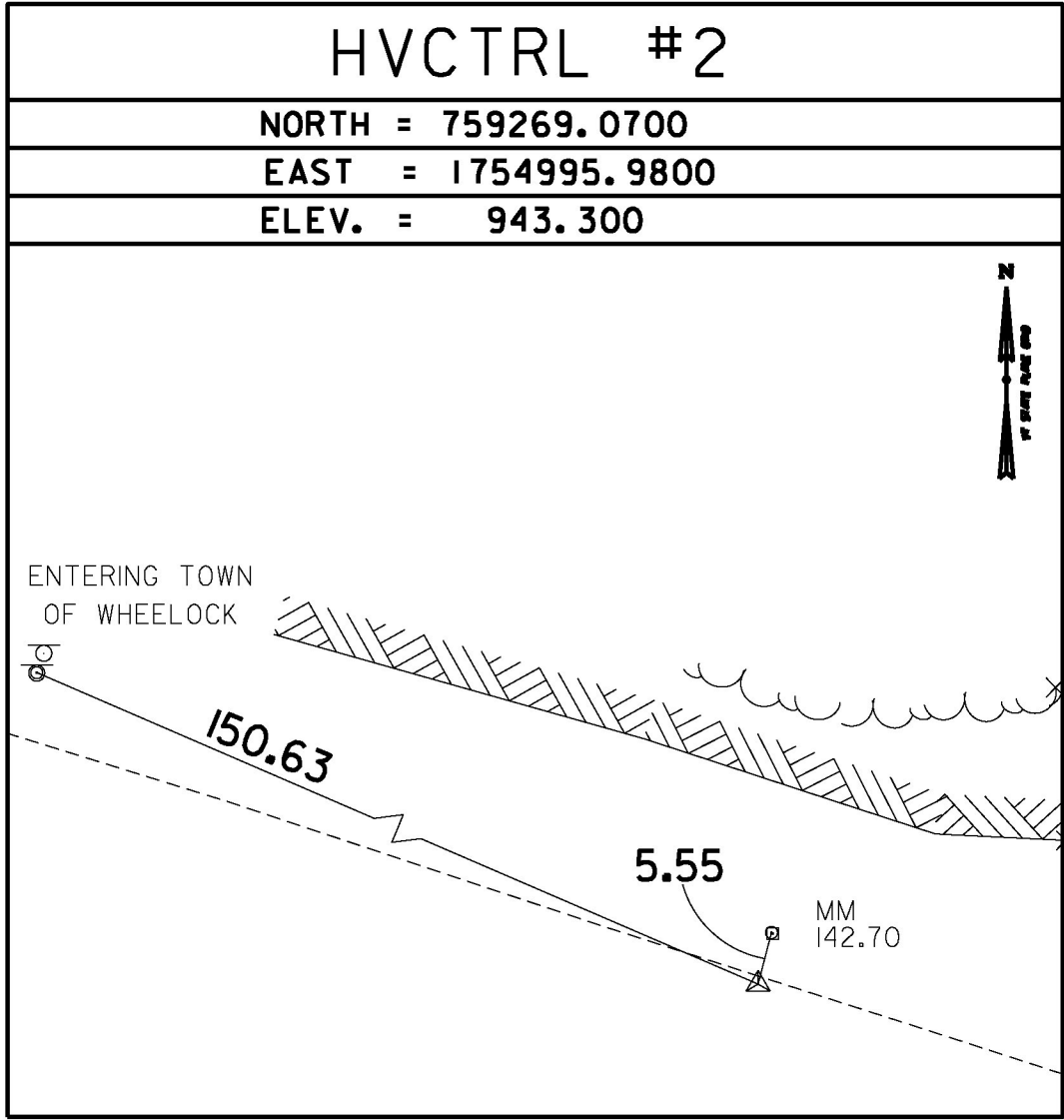
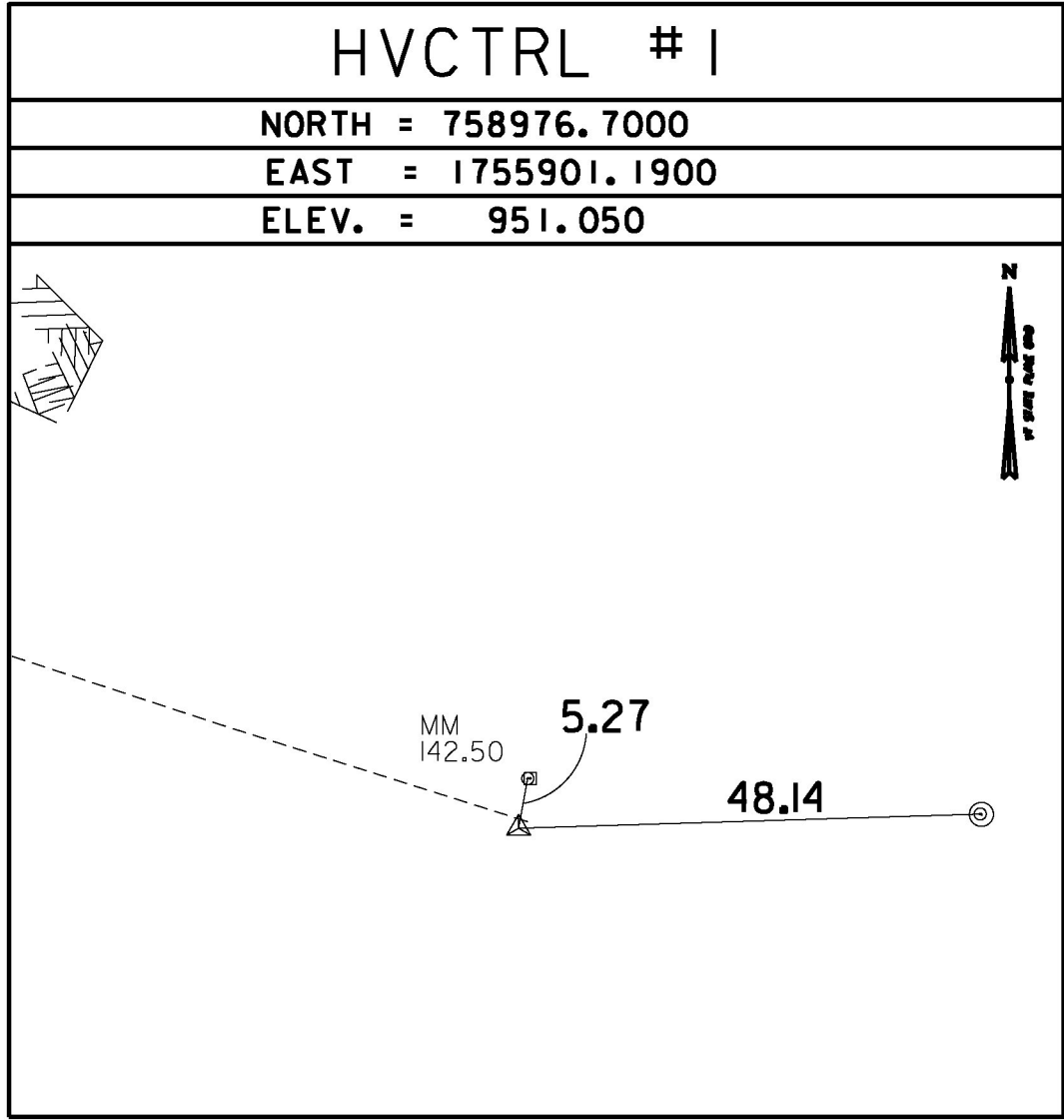
NORTH =
EAST =
ELEV. =

NORTH =
EAST =
ELEV. =

NORTH =
EAST =
ELEV. =

NORTH =
EAST =
ELEV. =

TRAVERSE TIES



NORTH =
EAST =
ELEV. =

NORTH =
EAST =
ELEV. =

NORTH =
EAST =
ELEV. =

GPS CONTROL POINTS

ST J CORS ARP VTD7  
NORTH = 692116.20  
EAST = 1764393.26  
ELEV. =

THE STATION IS A GPS CONTINUOUSLY OPERATING REFERENCE STATION. STATION IS THE ANTENNA REFERENCE POINT OF THE GPS ANTENNA. THE MONUMENT IS ATTACHED TO A TWO STORY CONCRETE BLOCK BUILDING WITH A 6 FT CONCRETE FOUNDATION BUILT IN 1972. MAST IS A 1.75 INCH DIA GALV PIPE THAT IS 108 INCHES LONG. THE MAST ATTACHED TO A STEEL MOUNTING FRAME WITH THREE ATTACHMENTS CONSISTING OF 3/8 INCH SS THROUGH BOLTS. THE MOUNTING FRAME IS ATTACHED TO THE BUILDING USING 8 THROUGH BOLTED ATTACHMENT POINTS THAT CONSIST OF 1/2 INCH SS THREADED RODS AND NUTS.



PROJECT NAME: LYNDON	
PROJECT NUMBER: IM 091-3(51)	
FILE NAME: z13a370blt.dgn	PLOT DATE: 12/13/2016
PROJECT LEADER: D. GOZALKOWSKI	DRAWN BY: C. CYR
DESIGNED BY: VTRANS	CHECKED BY: P. BEYOR
TIE SHEET	SHEET 9 OF 35



GENERAL NOTES

1. THE CONTRACTOR SHALL BE RESPONSIBLE FOR FIELD VERIFYING ALL DIMENSIONS APPLICABLE TO THIS WORK.
2. IN ACCORDANCE WITH SUBSECTION 107.12 THE CONTRACTOR SHALL TAKE CARE NOT TO DAMAGE THE EXISTING PAVEMENT, SUBBASE, SHOULDER MATERIAL, PIPES, DROP INLETS, SIGNS, SIGN POSTS, CONCRETE SIGN FOUNDATIONS AND HEADWALLS. IF DAMAGED, THE CONTRACTOR, AT NO ADDITIONAL COMPENSATION BY THE STATE OF VERMONT, SHALL REPAIR THE DAMAGED ITEMS TO THE SATISFACTION OF THE ENGINEER.
3. THE CONTRACTOR SHALL REMOVE AND STORE SIGNS, MILE MARKER POSTS, AND DELINEATORS AND REINSTALL THEM IN THEIR PROPER LOCATION AT THE EARLIEST PRACTICABLE OPPORTUNITY WHEN REQUIRED WORK MAY CAUSE DAMAGE TO THEM.
4. ALL EQUIPMENT SHALL BE MOVED OUTSIDE OF THE CLEAR ZONE (30 FEET OUTSIDE TRAVELLED WAY) OR PROTECTED BY APPROVED BARRIERS AT ALL TIMES.
5. THE CONTRACTOR SHALL ADEQUATELY MAINTAIN A FLOW LINE TO ENSURE PROPER DRAINAGE DURING CONSTRUCTION ACTIVITIES. UPON COMPLETION OF THE WORK, THE CONTRACTOR SHALL RE-ESTABLISH (OR IMPROVE) THE EXISTING DITCH LINE.
6. IT SHALL BE THE CONTRACTOR'S RESPONSIBILITY TO VERIFY LOCATIONS OF EXISTING UTILITIES THROUGH DIG SAFE AND ITEM 204.22 TRENCH EXCAVATION OF EARTH, EXPLORATORY (N.A.B.I.) PRIOR TO THE START OF CONSTRUCTION.
7. AN ESTIMATED QUANTITY OF TWENTY-FIVE CY OF FILL MATERIAL AND THREE (3) INCHES OF AGGREGATE SHOULDERS (ON TOP) HAS BEEN INCLUDED FOR THE NEW GUARDRAIL END TERMINAL.

LEDGE REMOVAL NOTES

1. LEDGE REMOVAL SHALL CONSIST OF THE REMOVAL OF LEDGE FROM THE LEDGE CUT USING THE FOLLOWING CONTRACT ITEMS:  
  
900.608 SPECIAL PROVISION (REMOVAL OF LEDGE WASTE MATERIAL)  
900.608 SPECIAL PROVISION (TRIM BLASTING)  
900.630 SPECIAL PROVISION (HAND SCALING)  
  
APPROXIMATE LIMITS OF LEDGE REMOVAL METHODS ARE PROVIDED ON THE PLANS.
2. ADDITIONAL LEDGE REMOVAL WORK (HAND SCALING OR TRIM BLASTING) MAY BE REQUIRED OUTSIDE THE WORK SHOWN IN THE PLANS. DETERMINATION OF THIS WILL BE BY THE ENGINEER OR VAOT GEOLOGIST. THE CONTRACTOR SHALL PERFORM ANY ADDITIONAL WORK WITHIN THE PROJECT LIMITS AT THE UNIT PRICES PROVIDED IN THE CONTRACT UNDER THE FOLLOWING ITEMS:  
  
900.608 SPECIAL PROVISION (REMOVAL OF LEDGE WASTE MATERIAL)  
900.608 SPECIAL PROVISION (TRIM BLASTING)  
900.630 SPECIAL PROVISION (HAND SCALING)
3. ROCK ANCHOR LOCATIONS WILL BE AS SHOWN ON THE PLANS UNLESS DIRECTED OTHERWISE BY THE ENGINEER OR VAOT GEOLOGIST. ROCK ANCHORS SHALL BE INSTALLED EVERY 10' ON CENTER. WORK SHALL BE PAID FOR UNDER ITEM 900.640 SPECIAL PROVISION (ROCK ANCHOR) AND ITEM 900.620 SPECIAL PROVISION (ROCK ANCHOR TESTING).

CLEARING AND GRUBBING NOTES

1. CLEARING SHALL CONSIST OF REMOVAL OF ALL TREES, SHRUBS, AND ROOT BALL WHILE MINIMIZING IMPACTS TO TOPSOIL AND GROUND COVER AS DEPICTED ON THE PLANS (APPROXIMATELY 20 FEET BEYOND THE CREST OF THE LEDGE). THE FINAL CLEARING LIMITS SHALL BE DETERMINED BY THE ENGINEER AND THE VAOT GEOLOGIST. THIS WORK SHALL BE INCIDENTAL TO ITEM 201.11 CLEARING AND GRUBBING, INCLUDING INDIVIDUAL TREES AND STUMPS.
2. ALL VEGETATION SHALL BE REMOVED FROM THE FACE OF THE LEDGE. THIS WORK SHALL BE PAID FOR UNDER ITEM 201.10 CLEARING AND GRUBBING, INCLUDING INDIVIDUAL TREES, STUMPS AND ROOTS. ALL TOOLS, MACHINES AND LABOR REQUIRED TO REMOVE VEGETATION AND SOILS SHALL BE INCIDENTAL TO ITEM 201.10.
3. ALL VEGETATION, INCLUDING REMOVED LIMBS, FOR ITEMS 201.11 AND 201.10, SHALL BE CLEARED AND DISPOSED OF IN ACCORDANCE WITH SECTION 201 AND THE CONTRACT DOCUMENTS.
4. INDIVIDUAL TREES THAT ARE DEEMED, BY THE ENGINEER, TO BE AT RISK OF FALLING OUTSIDE OF THE CLEARING AND GRUBBING AREA IDENTIFIED ON THE PLANS SHALL BE REMOVED. THIS WORK SHALL BE INCIDENTAL TO ITEM 201.11 CLEARING AND GRUBBING, INCLUDING INDIVIDUAL TREES AND STUMPS.
5. IT SHALL BE THE CONTRACTOR'S RESPONSIBILITY TO MAINTAIN, TO THE SATISFACTION OF THE ENGINEER, A NEAT TREE LINE ALONG THE AREA TO BE CLEARED. THIS WORK SHALL BE INCIDENTAL TO ITEM 201.11 CLEARING AND GRUBBING, INCLUDING INDIVIDUAL TREES AND STUMPS.
6. AN ESTIMATED QUANTITY OF ITEM 651.35 TOPSOIL HAS BEEN ADDED IF THE ENGINEER DEEMS NECESSARY THAT THE RESHAPING OF THE DITCH REQUIRES MORE MATERIAL ONCE THE LEDGE HAS BEEN REMOVED.
7. AN ESTIMATED QUANTITY OF ITEM 651.25 HAY MULCH HAS BEEN ADDED IF THE ENGINEER DEEMS ITS USE IS NECESSARY.
8. THE CONTRACTOR MAY GRIND OR TREAT WITH HERBICIDES THE EXISTING STUMPS DESIGNATED FOR REMOVAL WITHIN CLEARING AND GRUBBING AREAS (APPROXIMATELY 20 FEET BEYOND THE CREST OF THE LEDGE). THE CONTRACTOR SHALL ENSURE THAT THE STUMPS WILL NOT GROW BACK. PAYMENT WILL BE INCLUDED IN THE UNIT PRICE BID FOR CONTRACT ITEM 201.11.

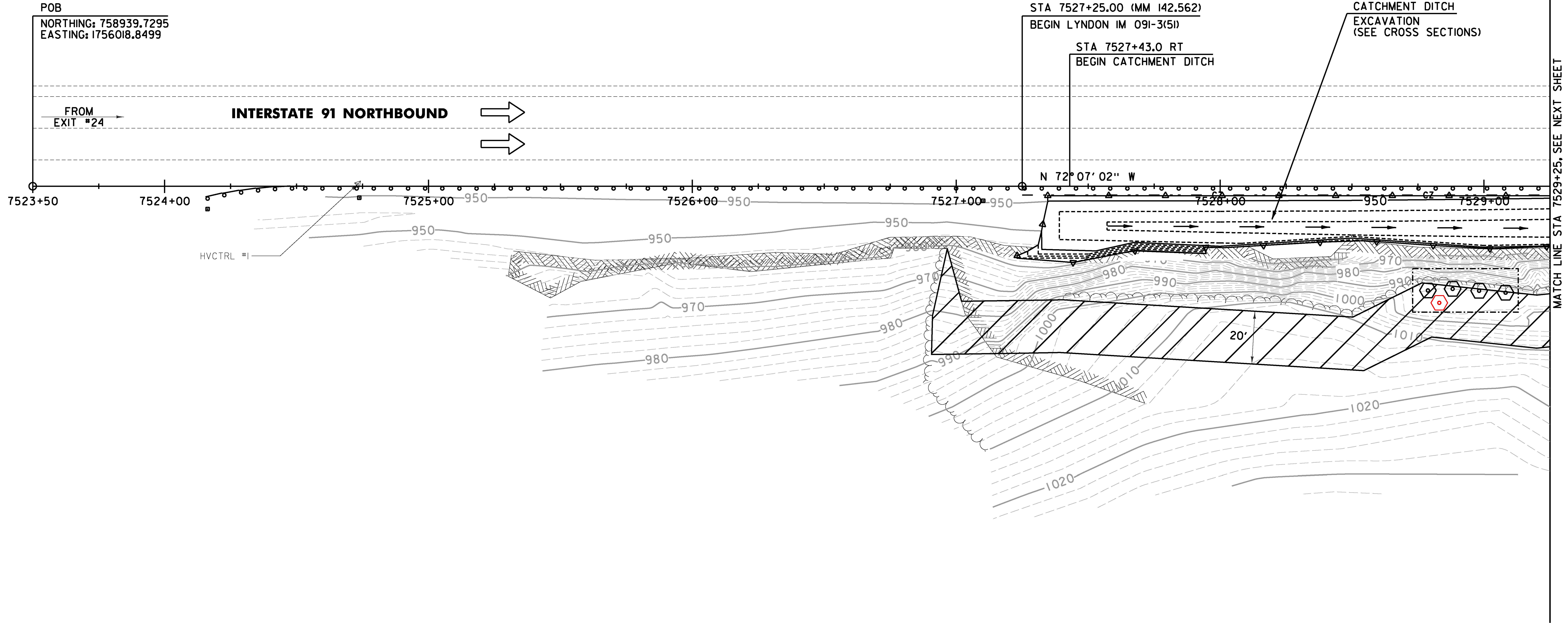


PROJECT NAME: LYNDON	
PROJECT NUMBER: IM 091-3(51)	
FILE NAME: z13a370notes.dgn	PLOT DATE: 1/30/2017
PROJECT LEADER: D. GOZALKOWSKI	DRAWN BY: J. HEALD
DESIGNED BY: J. OLSEN	CHECKED BY: J. SHIELDS
GENERAL NOTES SHEET	SHEET 10 OF 35



ROCK CUT TREATMENT LOCATION	PHOTO REFERENCE NUMBER															
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
ROCK ANCHORS												X	X			

NOTE: REFER TO CONTRACT DOCUMENTS FOR PHOTOGRAPHS



MANUFACTURED TERMINAL SECTION, FLARED  
STA 7524+15.5 - STA 7524+53.0 RT

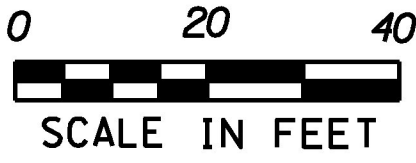
STEEL BEAM GUARDRAIL, GALVANIZED  
STA 7524+53.0 - STA 7529+25.0 RT

SPECIAL PROVISION (HAND SCALING)  
STA 7527+43.0 - STA 7529+25.0 RT

SPECIAL PROVISION (ROCK ANCHOR)  
STA 7528+73.0 - STA 7529+13.0 RT

REMOVAL OF EXISTING DELINEATOR  
STA 7524+74.0 RT  
STA 7527+10.0 RT

DELINEATOR WITH STEEL POST  
STA 7524+15.5 RT (BLUE)  
STA 7524+74.0 RT (WHITE)  
STA 7527+10.0 RT (WHITE)



CHA

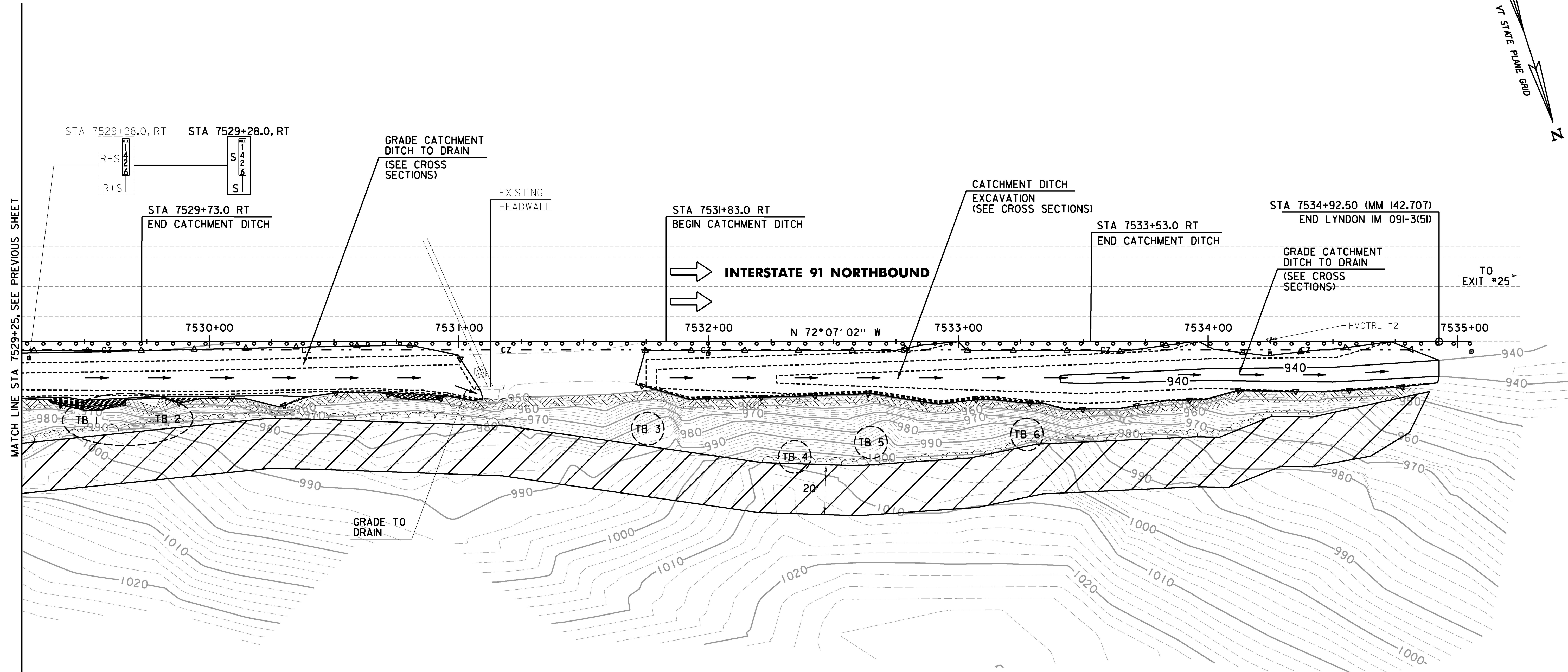
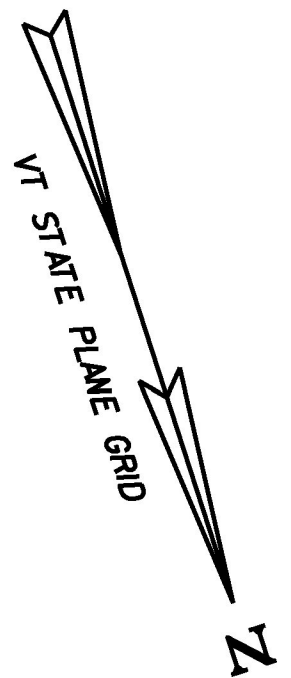
LEGEND	
	TRIM BLASTING LOCATION
	DIRECTION OF TRAFFIC
	ROCK ANCHOR LOCATION
	CLEARING AND GRUBBING (BY THE ACRE) (SEE NOTES ON SHEET 10)

PROJECT NAME: LYNDON  
PROJECT NUMBER: IM 091-3(5)

FILE NAME: z13a370bdr.dgn  
PROJECT LEADER: D. GOZALKOWSKI  
DESIGNED BY: J. OLSEN  
PLAN SHEET I

PLOT DATE: 1/30/2017  
DRAWN BY: J. HEALD  
CHECKED BY: J. SHIELDS  
SHEET II OF 35





ROCK CUT TREATMENT LOCATION	PHOTO REFERENCE NUMBER															
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
TB1	X	X														
TB2	X		X	X												
TB3					X											
TB4						X	X	X								
TB5						X	X	X	X							
TB6								X		X	X					
EXISTING HEADWALL														X	X	X

NOTE: REFER TO CONTRACT DOCUMENTS FOR PHOTOGRAPHS

**SPECIAL PROVISION (HAND SCALING)**  
STA 7529+25.0 - STA 7529+73.0 RT  
STA 7531+83.0 - STA 7533+53.0 RT

**STEEL BEAM GUARDRAIL, GALVANIZED**  
STA 7529+25.0 - STA 7535+05.0 RT

**ANCHOR FOR STEEL BEAM RAIL**  
STA 7534+98.5 RT

**REMOVING SIGNS**  
STA 7529+28.0 RT

**ERECTING SALVAGED SIGNS**  
STA 7529+28.0 RT

**SETTING SALVAGED POST**  
STA 7529+28.0 RT

**REMOVAL OF EXISTING DELINEATOR**  
STA 7531+99.8 RT  
STA 7534+24.8 RT

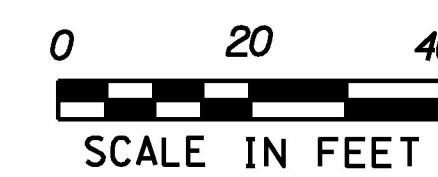
**DELINEATOR WITH STEEL POST**  
STA 7531+99.8 RT (WHITE)  
STA 7534+24.8 RT (WHITE)  
STA 7535+05.0 RT (GREEN)

**SPECIAL PROVISION (TRIM BLASTING)**  
TB1 - STA 7529+48.0 RT  
TB2 - STA 7529+88.0 RT  
TB3 - STA 7531+75.0 RT  
TB4 - STA 7532+36.0 RT  
TB5 - STA 7532+65.0 RT  
TB6 - STA 7533+29.0 RT

EXISTING ROW

**LEGEND**  
 TRIM BLASTING LOCATION  
 ROCK ANCHOR LOCATION  
 DIRECTION OF TRAFFIC  
 CLEARING AND GRUBBING (BY THE ACRE) (SEE NOTES ON SHEET 10)

**SIGN LEGEND**  
R = REMOVE  
S = SALVAGE  
N = NEW  
RET = RETAIN  
B-B = BACK TO BACK  
EXISTING =   
NEW =



PROJECT NAME: LYNDON  
PROJECT NUMBER: IM 091-3(51)

FILE NAME: z13a370bdr.dgn  
PROJECT LEADER: D. GOZALKOWSKI  
DESIGNED BY: J. OLSEN  
PLAN SHEET 2

PLOT DATE: 12/13/2016  
DRAWN BY: J. HEALD  
CHECKED BY: J. SHIELDS  
SHEET 12 OF 35



# TRAFFIC SIGN SUMMARY SHEET

FILE NAME = V:\Projects\ANY\K4\29752\CADD\MSTN\13a370\Consultants\Highway\z13a370tss.dgn  
DATE/TIME = 12/13/2016  
USER = 5323



EPSC PLAN NARRATIVE

1.1 PROJECT DESCRIPTION

THIS PROJECT INVOLVES THE REHABILITATION OF AN EXISTING ROCK SLOPE ADJACENT TO INTERSTATE 91 NORTHBOUND. THE PROJECT BEGINS AND ENDS BETWEEN MILE MARKERS 142.562 AND 142.707, RESPECTIVELY. THE SUBJECT ROCK SLOPE IS LOCATED IN THE TOWN OF LYNDON, ADJACENT TO AND RIGHT OF INTERSTATE 91 NORTHBOUND.

NOTE: AREA OF DISTURBANCE INCLUDES LIMITS OF EARTH DISTURBANCE WITHIN THE PROJECT AREA, AS WELL AS WASTE, BORROW AND STAGING AREAS, AND OTHER EARTH DISTURBING ACTIVITIES WITHIN OR DIRECTLY ADJACENT TO THE PROJECT LIMITS AS SHOWN ON THE ATTACHED EPSC PLAN.

TOTAL AREA OF DISTURBANCE AS SHOWN ON THE ATTACHED EPSC PLAN IS APPROXIMATELY 0.69 ACRE.

IT IS ANTICIPATED THAT THIS PROJECT WILL LAST ONE CONSTRUCTION SEASON.

1.2 SITE INVENTORY

1.2.1 TOPOGRAPHY

THE TOPOGRAPHY OF THE AREA IS FAIRLY FLAT WITH STEEP SLOPES ADJACENT TO THE NORTHBOUND BARREL OF INTERSTATE 91. WITHIN THE PROJECT LIMITS THERE IS A HEADWALL AND DROP INLET THAT RECEIVE WATER DRAINING OFF OF THE ROCK SLOPE AND INTERSTATE 91.

1.2.2 DRAINAGE, WATERWAYS, BODIES OF WATER, AND PROXIMITY TO NATURAL OR MAN-MADE WATER FEATURES

DRAINAGE THROUGH THE PROJECT AREA CONSISTS PRIMARILY OF OVERLAND FLOW WHICH COLLECTS IN GRASSED SWALES THAT RUN PARALLEL WITH INTERSTATE 91 AND EVENTUALLY DISCHARGE INTO A DROP INLET THAT RUNS ACROSS THE NORTHBOUND BARREL TO THE MEDIAN. THERE ARE NO WETLANDS WITHIN THE PROJECT CORRIDOR.

1.2.3 VEGETATION

THE VEGETATION IN THE PROJECT AREA CONSISTS OF GRASSY SWALES AND EVERGREEN TREES ON THE ROCK SLOPE. THE IMPACT TO VEGETATION WILL CONSIST OF CLEARING AND GRUBBING ON TOP OF THE ROCK SLOPE AND DITCH WORK ADJACENT TO THE INTERSTATE HIGHWAY. THE DISTURBED AREA WILL BE COVERED WITH TEMPORARY EROSION MATTING UNTIL THE VEGETATION CAN BE ESTABLISHED AND STABILIZE THE AREA.

1.2.4 SOILS

ALL SOIL DATA CAME FROM THE U.S. DEPARTMENT OF AGRICULTURE SOIL CONSERVATION SERVICE FOR THE COUNTY OF CALEDONIA, VERMONT. SEE TABLE BELOW FOR SOIL TYPES LOCATED WITHIN THE PROJECT AREA.

MAP UNIT	DESCRIPTION	SLOPES	K-VALUE
214D	VERSHIRE-LOMBARD COMPLEX, VERY FINE SANDY LOAM	15-35%	0.32

NOTE: K-VALUES GENERALLY INDICATE THE FOLLOWING:  
0.0-0.23 = LOW EROSION POTENTIAL  
0.24-0.36 = MODERATE EROSION POTENTIAL  
0.37 AND HIGHER = HIGH EROSION POTENTIAL

1.2.5 SENSITIVE RESOURCE AREAS  
CRITICAL HABITATS: NO  
HISTORICAL OR ARCHEOLOGICAL AREAS: NO  
PRIME AGRICULTURAL LAND: NO  
THREATENED AND ENDANGERED SPECIES: YES, NORTHERN LONG EARED BAT, FEDERAL LISTED THREATENED SPECIES.  
WATER RESOURCE: NONE  
WETLANDS: NO

1.3 RISK EVALUATION

THIS PROJECT DOES NOT FALL UNDER THE JURISDICTION OF CONSTRUCTION GENERAL PERMIT 3-9020 FOR STORM WATER RUNOFF FROM CONSTRUCTION SITES. SHOULD CHANGES PRIOR TO OR DURING CONSTRUCTION RESULT IN ONE OR MORE ACRES OF EARTH DISTURBANCE OR SHOULD THE PROJECT BECOME PART OF A LARGER PLAN OF DEVELOPMENT, THE CONTRACTOR WILL BE RESPONSIBLE FOR ANY ADDITIONAL PERMITTING.

1.4 EROSION PREVENTION AND SEDIMENT CONTROL

THE EROSION PREVENTION AND SEDIMENT CONTROL PLANS ARE MEANT AS A GUIDELINE FOR PREVENTING EROSION AND CONTROLLING SEDIMENT TRANSPORT. THE PRINCIPLES OUTLINED IN THIS NARRATIVE CONSIST OF APPLYING MEASURES THROUGHOUT CONSTRUCTION OF THE PROJECT IN ORDER TO MINIMIZE SEDIMENT TRANSPORT TO THE RECEIVING WATERS. THE MEASURES INCLUDE STABILIZATION AND STRUCTURAL PRACTICES STORM WATER CONTROLS AND OTHER POLLUTION PREVENTION PRACTICES. THEY HAVE BEEN PROPOSED BY THE DESIGNER AS A BASIS FOR PROTECTING RESOURCES AND WILL NEED TO BE BUILT UPON BASED ON THE SPECIFIC MEANS AND METHODS OF THE CONTRACTOR. REFER TO THE VERMONT STANDARDS AND SPECIFICATIONS FOR EROSION PREVENTION AND SEDIMENT CONTROL AND APPROPRIATE DETAIL SHEETS FOR SPECIFIC GUIDANCE AND CONSTRUCTION DETAILING.

ALL MEASURES SHALL BE REGULARLY MAINTAINED AND SHALL BE CHECKED FOR SEDIMENT BUILD-UP. SEDIMENT SHALL BE DISPOSED OF AT AN APPROVED SITE WHERE IT WILL NOT BE SUBJECT TO EROSION.

1.4.1 MARK SITE BOUNDARIES  
SITE BOUNDARIES AND AREAS CONSTRUCTION EQUIPMENT CAN ACCESS SHALL BE DELINEATED.

PROJECT DEMARCATION FENCING (PDF) SHALL BE USED TO PHYSICALLY MARK SITE BOUNDARIES.

1.4.2 LIMIT DISTURBANCE AREA  
PREVENTING INITIAL SOIL EROSION BY MINIMIZING THE EXPOSED AREA IS MUCH MORE EFFECTIVE THAN TREATING ERODED SEDIMENT. EARTH DISTURBANCE CAN BE MINIMIZED THROUGH CONSTRUCTION PHASING BY ONLY OPENING UP EARTH AS NECESSARY. THIS CAN LIMIT THE AREA THAT WILL BE DISTURBED AND EXPOSED TO EROSION. EMPLOY TEMPORARY CONSTRUCTION STABILIZATION PRACTICES IN INCREMENTAL STAGES AS PHASES CHANGE. FOR PROJECTS WHICH FALL UNDER THE CONSTRUCTION GENERAL PERMIT, ONLY THE ACREAGE LISTED ON THE PERMIT AUTHORIZATION MAY BE EXPOSED AT ANY GIVEN TIME.

MAINTAINING VEGETATED BUFFERS ALONG STREAM BANKS, WETLANDS OR OTHER SENSITIVE AREAS IS A CRUCIAL EROSION AND SEDIMENT CONTROL MEASURE THAT SHOULD BE ESTABLISHED WHEREVER POSSIBLE.

1.4.3 SITE ENTRANCE/EXIT STABILIZATION  
TRACKING OF SEDIMENT ONTO PUBLIC HIGHWAYS SHALL BE MINIMIZED TO REDUCE THE POTENTIAL FOR RUNOFF ENTERING RECEIVING WATERS. INSTALLATION SHALL COINCIDE WITH THE CONTRACTOR'S PROGRESS SCHEDULE.

STABILIZED CONSTRUCTION ENTRANCES SHALL BE INSTALLED AS PROPOSED ON THE EPSC PLAN AND ANYWHERE EQUIPMENT WILL BE GOING FROM AREAS OF EXPOSED SOILS TO PAVED SURFACES.

1.4.4 INSTALL SEDIMENT BARRIERS  
SEDIMENT BARRIERS SHALL BE UTILIZED TO INTERCEPT RUNOFF AND ALLOW SUSPENDED SEDIMENT TO SETTLE OUT. THEY SHALL BE INSTALLED PRIOR TO ANY UP SLOPE WORK.

FILTER FABRIC DROP INLET PROTECTION AND PIPE INLET PROTECTION WILL BE INSTALLED TO FILTER SEDIMENT FROM INCOMING STORM WATER FOR EXISTING DROP INLETS AND CULVERTS ALONG THE INTERSTATE.

1.4.5 DIVERT UPLAND RUNOFF  
DIVERSIONARY MEASURES SHALL BE USED TO INTERCEPT RUNOFF FROM ABOVE THE CONSTRUCTION AND DIRECT IT AROUND THE DISTURBED AREA SO THAT CLEAN WATER DOES NOT BECOME MUDDIED WHILE TRAVELING OVER EXPOSED SOILS ON THE CONSTRUCTION SITE.

THE PROJECT AREA IS RELATIVELY FLAT. THEREFORE IT IS NOT ANTICIPATED THAT DIVERSION MEASURES WILL BE NECESSARY.

1.4.6 SLOW DOWN CHANNELIZED RUNOFF  
CHECK STRUCTURES SHALL BE UTILIZED TO REDUCE THE VELOCITY, AND THUS THE EROSION POTENTIAL, OF CONCENTRATED FLOW IN CHANNELS.

STONE CHECK DAMS WILL BE INSTALLED AS PROPOSED ON THE EPSC PLAN, AT A MINIMUM.

1.4.7 CONSTRUCT PERMANENT CONTROLS  
PERMANENT STORMWATER TREATMENT DEVICES SHALL BE INSTALLED AS SHOWN ON THE PLANS AND IN ACCORDANCE WITH PERMIT CONDITIONS.

1.4.8 STABILIZE EXPOSED SOILS DURING CONSTRUCTION  
ALL AREAS OF DISTURBANCE MUST HAVE TEMPORARY STABILIZATION IN PLACE WITHIN 48 HOURS OF DISTURBANCE.

SURFACE ROUGHENING OF ALL EXPOSED SLOPES, COMBINED WITH TEMPORARY MULCHING, SHALL BE UTILIZED ON A REGULAR BASIS. BIODEGRADABLE EROSION CONTROL MATTING OR AN EQUIVALENT SHALL BE USED TO STABILIZE ALL SLOPES STEEPER THAN 1:3.

THE FORECAST OF RAINFALL EVENTS SHALL TRIGGER IMMEDIATE PROTECTION OF EXPOSED SOILS.

1.4.9 WINTER STABILIZATION  
IF CONSTRUCTION ACTIVITIES INVOLVING EARTH DISTURBANCE CONTINUE PAST OCTOBER 15 OR BEGIN BEFORE APRIL 15, THE FOLLOWING MUST BE INCORPORATED INTO THE EPSC PLAN:

- ENLARGED ACCESS POINTS, STABILIZED TO PROVIDE FOR SNOW STOCKPILING.
- LIMITS OF DISTURBANCE MOVED OR REPLACED TO REFLECT BOUNDARY OF WINTER WORK.
- A SNOW MANAGEMENT PLAN INCLUDING ADEQUATE STORAGE AND CONTROL OF SNOWMELT, REQUIRING CLEARED SNOW TO BE STORED DOWN GRADIENT OF ALL AREAS OF DISTURBANCE AND PROHIBITING STORAGE OF SNOW IN STORMWATER TREATMENT STRUCTURES.
- A MINIMUM 25 FOOT BUFFER SHALL BE MAINTAINED FROM PERIMETER CONTROLS SUCH AS SILT FENCE TO ALLOW FOR SNOW CLEARING AND MAINTENANCE.
- IN AREAS OF DISTURBANCE WITHIN 100 FEET OF A RECEIVING WATER, SILT FENCE SHALL BE REINFORCED OR ELSE REPLACED WITH PERIMETER DIKES, SWALES, OR OTHER PRACTICES RESISTANT TO THE FORCES OF SNOW LOADS.
- DRAINAGE STRUCTURES SHALL BE KEPT OPEN AND FREE OF SNOW AND ICE DAMS.
- THE CONTRACTOR SHALL INSTALL SILT FENCE AND OTHER PRACTICES REQUIRING EARTH DISTURBANCE AHEAD OF GROUND FREEZING.
- WHERE MULCH IS THE SELECTED STABILIZATION MEASURE, USE DOUBLE THE STANDARD RATE OF MULCH.
- THE REQUIREMENT FOR NETTING OR OTHER APPROACH TO ANCHOR MULCH TO PREVENT REMOVAL BY WIND.
- TO ENSURE COVER OF DISTURBED SOIL IN ADVACE OF A MELT EVENT, AREAS OF DISTURBED SOIL MUST BE STABILIZED AT THE END OF EACH WORK DAY, WITH THE FOLLOWING EXCEPTIONS:
  - IF NO PRECIPITATION WITHIN 24 HOURS IS FORECAST AND WORK WILL RESUME IN THE SAME DISTURBED AREA WITHIN 24 HOURS, DAILY STABILIZATION IS NOT NECESSARY.
  - DISTURBED AREAS THAT COLLECT AND RETAIN RUNOFF, SUCH AS HOUSE FOUNDATIONS OR OPEN UTILITY TRENCHES.
- REMOVE SNOW OR ICE TO LESS THAN 1 INCH THICKNESS PRIOR TO STABILIZATION.

1.4.10 STABILIZE SOIL AT FINAL GRADE  
EXPOSED SOIL MUST BE STABILIZED WITHIN 48 HOURS OF REACHING FINAL GRADE.

SEED, MULCH, FERTILIZER AND LIME SHALL BE USED TO ESTABLISH PERMANENT VEGETATION. FOR SLOPES STEEPER THAN 1:3, BIODEGRADABLE EROSION CONTROL MATTING OR AN EQUIVALENT SHALL BE USED INSTEAD OF MULCH.

1.4.11 DE-WATERING ACTIVITIES  
NO DE-WATERING ACTIVITIES ANTICIPATED AT THIS TIME.

1.4.12 INSPECT YOUR SITE  
INSPECT THE PROJECT SITE BASED ON SPECIAL PROVISION REQUIREMENTS OR CONSTRUCTION GENERAL PERMIT AUTHORIZATION STIPULATIONS.

1.5 SEQUENCE AND STAGING

THIS SECTION WILL BE DEVELOPED BY THE CONTRACTOR USING THE GUIDANCE OUTLINED IN THE VTRANS EPSC PLAN CONTRACTOR CHECKLIST.

1.5.1 CONSTRUCTION SEQUENCE

1.5.2 OFF-SITE ACTIVITIES  
IN ADDITION TO THE CONTRACTOR CHECKLIST ANY ACTIVITIES OUTSIDE THE CONSTRUCTION LIMITS SHALL FOLLOW SPECIFICATION 105.25- 105.29 OF THE STANDARD SPECIFICATIONS FOR CONSTRUCTION.

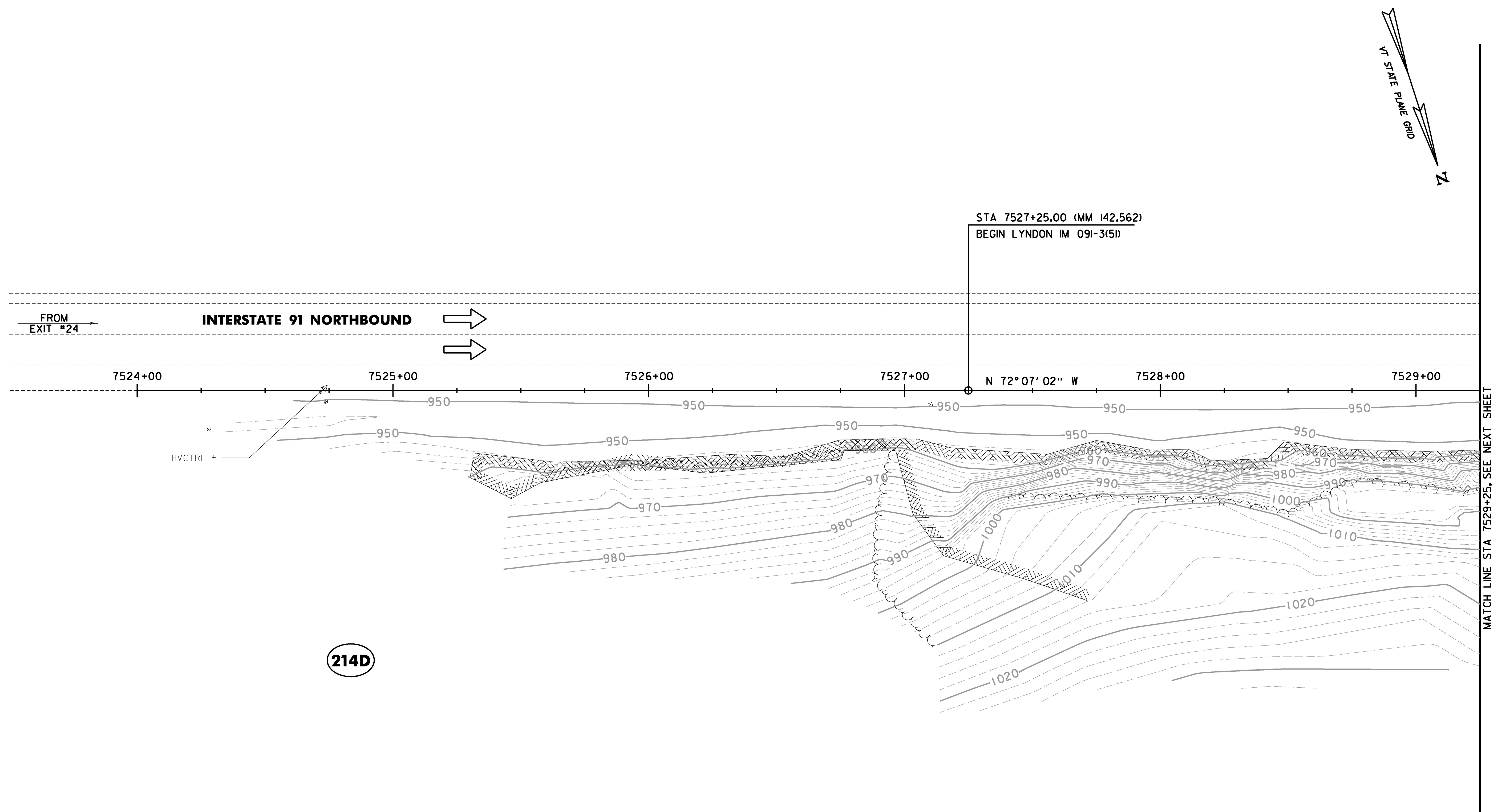
1.5.3 UPDATES

PROJECT NAME: LYNDON	
PROJECT NUMBER: IM 091-3(51)	
FILE NAME: z13a370epscgn01.dgn	PLOT DATE: 12/13/2016
PROJECT LEADER: D. GOZALKOWSKI	DRAWN BY: J. HEALD
DESIGNED BY: J. OLSEN	CHECKED BY: J. SHIELDS
EPSC NARRATIVE SHEET	SHEET 14 OF 35





FILE NAME = W:\Projects\VT\KAY\201752\CAADD_MSTN13a370\Consultants\Highway\213a370bdr_ero.ex.dgn  
DATE/TIME = 12/13/2016  
USER = 5323



**LEGEND**

→ DIRECTION OF TRAFFIC

XX SOIL MAP UNIT SYMBOL (SEE SHEET 14 FOR DETAILS)

0 20 40  
SCALE IN FEET

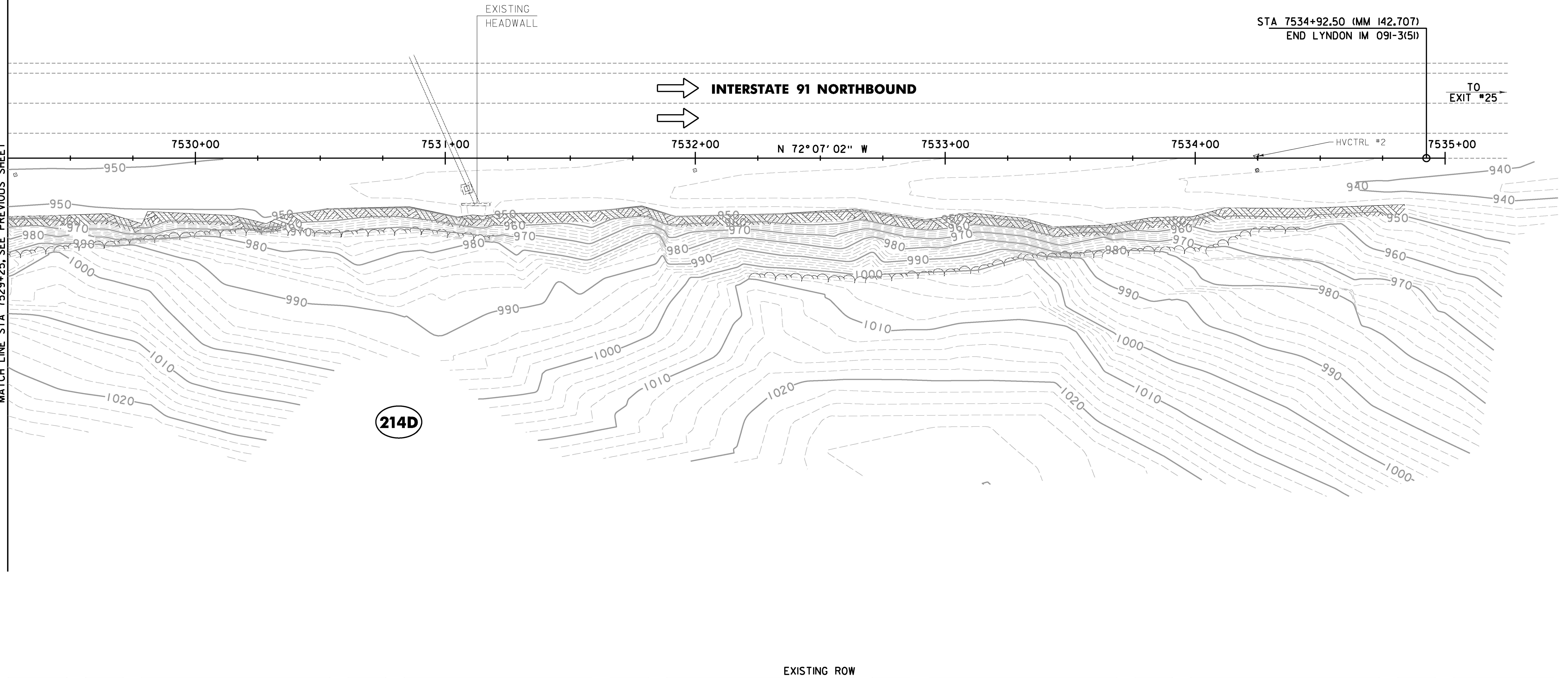
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PROJECT NAME: LYNDON	
PROJECT NUMBER: IM 09I-3(5I)	
FILE NAME: z13a370bdr_ero.ex.dgn	PLOT DATE: 12/13/2016
PROJECT LEADER: D. GOZALKOWSKI	DRAWN BY: J. HEALD
DESIGNED BY: J. OLSEN	CHECKED BY: J. SHIELDS
EPSC EXISTING CONDITIONS PLAN SHEET 1	SHEET 15 OF 35

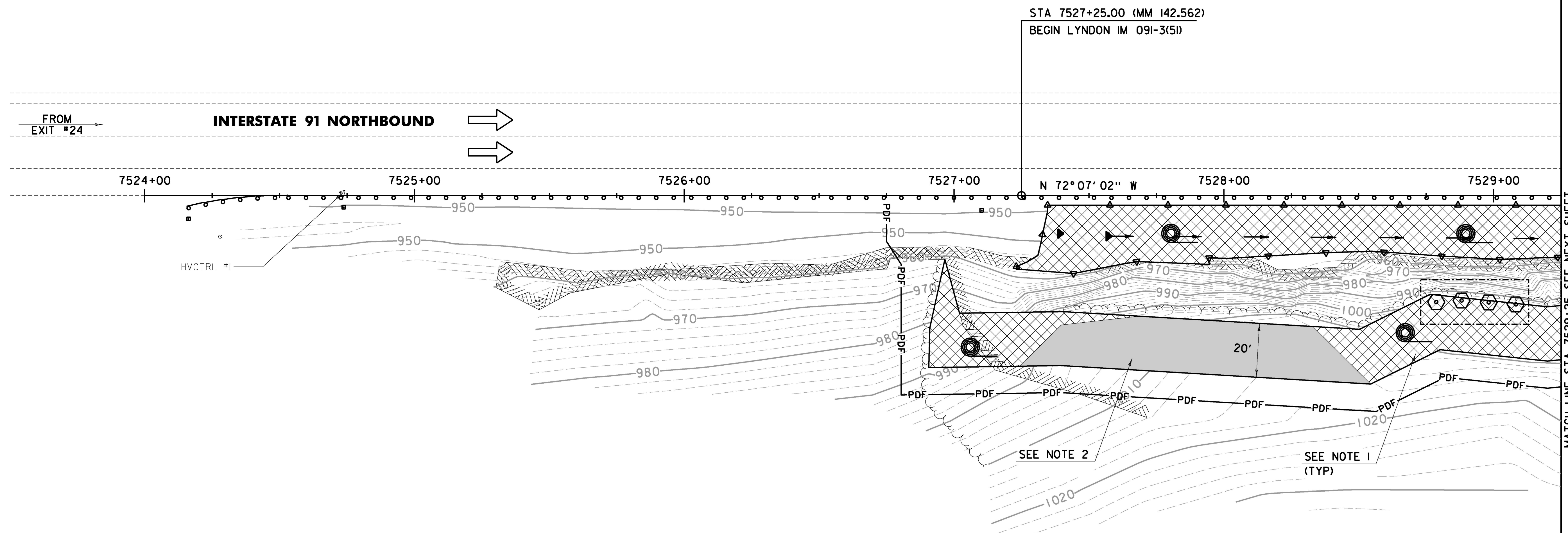
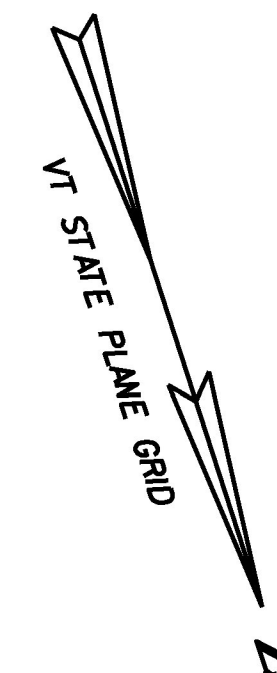


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DATE/TIME = 12/13/2016  
USER = 5323

MATCH LINE STA 7529+25, SEE PREVIOUS SHEET







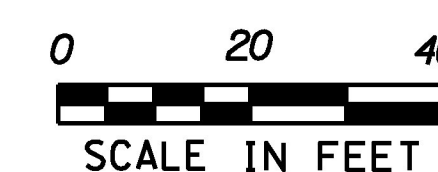
### LEGEND

- |  |                                  |  |                                     |
|--|----------------------------------|--|-------------------------------------|
|  | DIRECTION OF TRAFFIC             |  | FILTER FABRIC DROP INLET PROTECTION |
|  | STABILIZED CONSTRUCTION ENTRANCE |  | FILTER FABRIC PIPE INLET PROTECTION |
|  | STONE - CHECK DAM                |  | ROCK ANCHOR LOCATION                |
|  | TRIM BLASTING LOCATION           |  |                                     |

EXISTING ROW

### NOTES:

1. FOR ESTIMATING PURPOSES ASSUME 25% OF THE AREAS SHOWN WILL NEED TO BE REVEGETATED AND NEED PROTECTION WITH EROSION CONTROL MATTING DUE TO TREE REMOVAL OPERATIONS.
2. FOR ESTIMATING PURPOSES ASSUME 25% OF THE AREA SHOWN WILL NEED TO BE REVEGETATED DUE TO TREE REMOVAL OPERATIONS.



**CHA**

PROJECT NAME: LYNDON  
PROJECT NUMBER: IM 091-3(51)

FILE NAME: z13a370bdr_ero.dgn  
PROJECT LEADER: D. GOZALKOWSKI  
DESIGNED BY: J. OLSEN  
EPSC CONSTRUCTION PLAN SHEET 1

PLOT DATE: 12/13/2016  
DRAWN BY: J. HEALD  
CHECKED BY: J. SHIELDS  
SHEET 17 OF 35

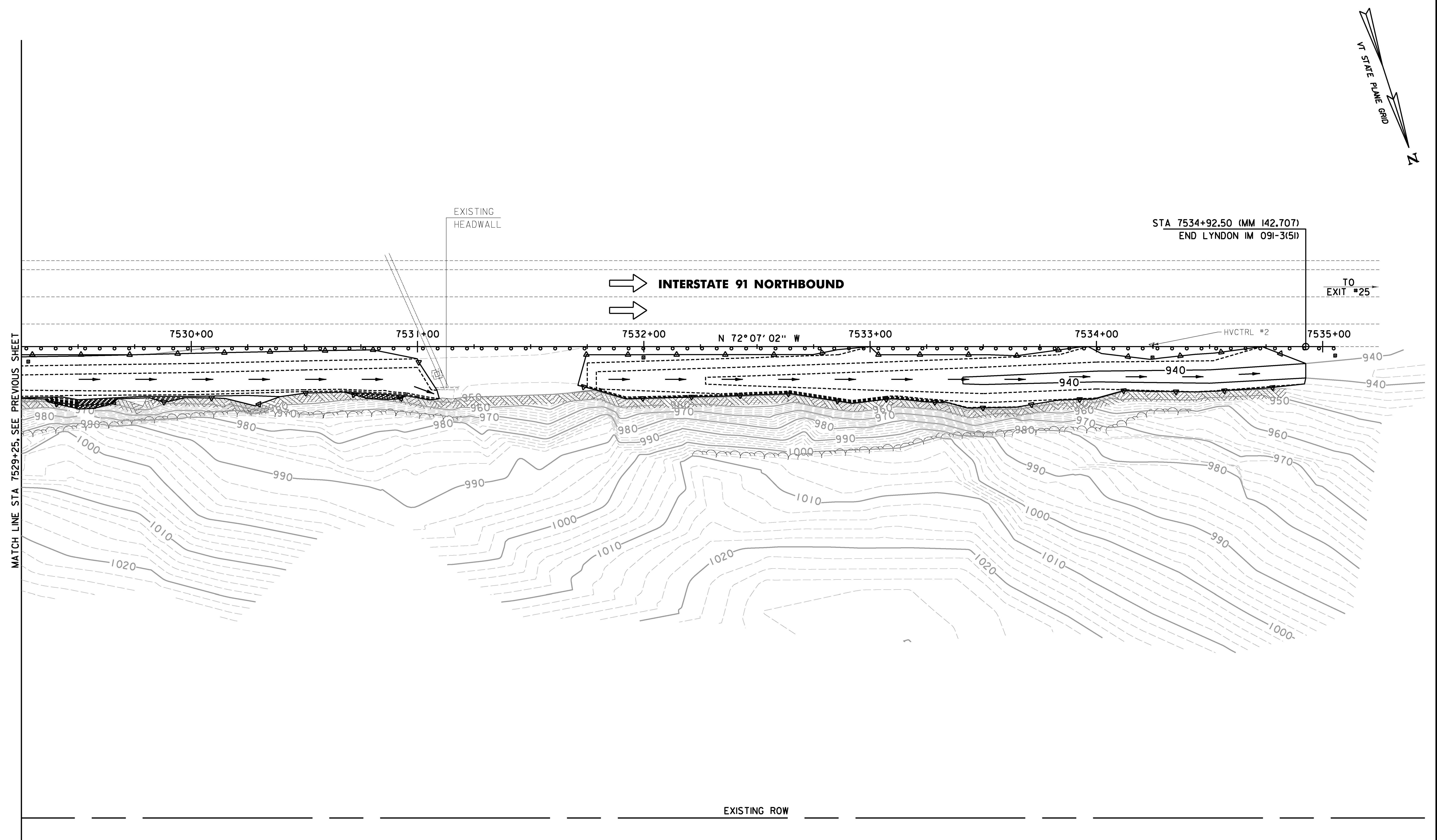




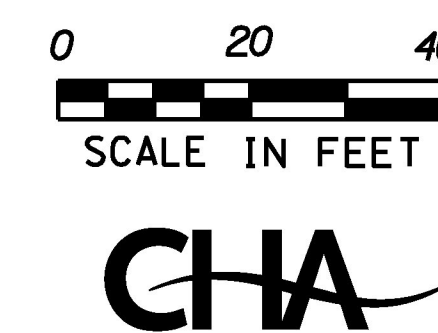








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DATE/TIME = 12/13/2016
USER = 5323
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FILE NAME = W:\P\c\projects\VT\13a370\Consolidated\Highway\213a370.ecd.dgn  
DATE/TIME = 12/13/2016  
USER = 5323

VAOT LOW GROW / FINE FESCUE MIX						
	LBS/AC					
WEIGHT	BROADCAST	HYDROSEED	NAME	LATIN NAME	GERM	PURITY
38%	57	95	CREeping RED FESCUE	FESTUCA RUBRA VAR. RUBRA	90%	98%
29%	43.5	72.5	HARD FESCUE	FESTUCA LONGIFOLIA	85%	95%
15%	22.5	37.5	CHEWINGS FESCUE	FESTUCA RUBRA VAR. COMMUTATA	87%	95%
15%	22.5	37.5	ANNUAL RYEGRASS	LOLIUM MULTIFLORUM	90%	95%
3%	4.5	7.5	INERTS			
100%	150	250				

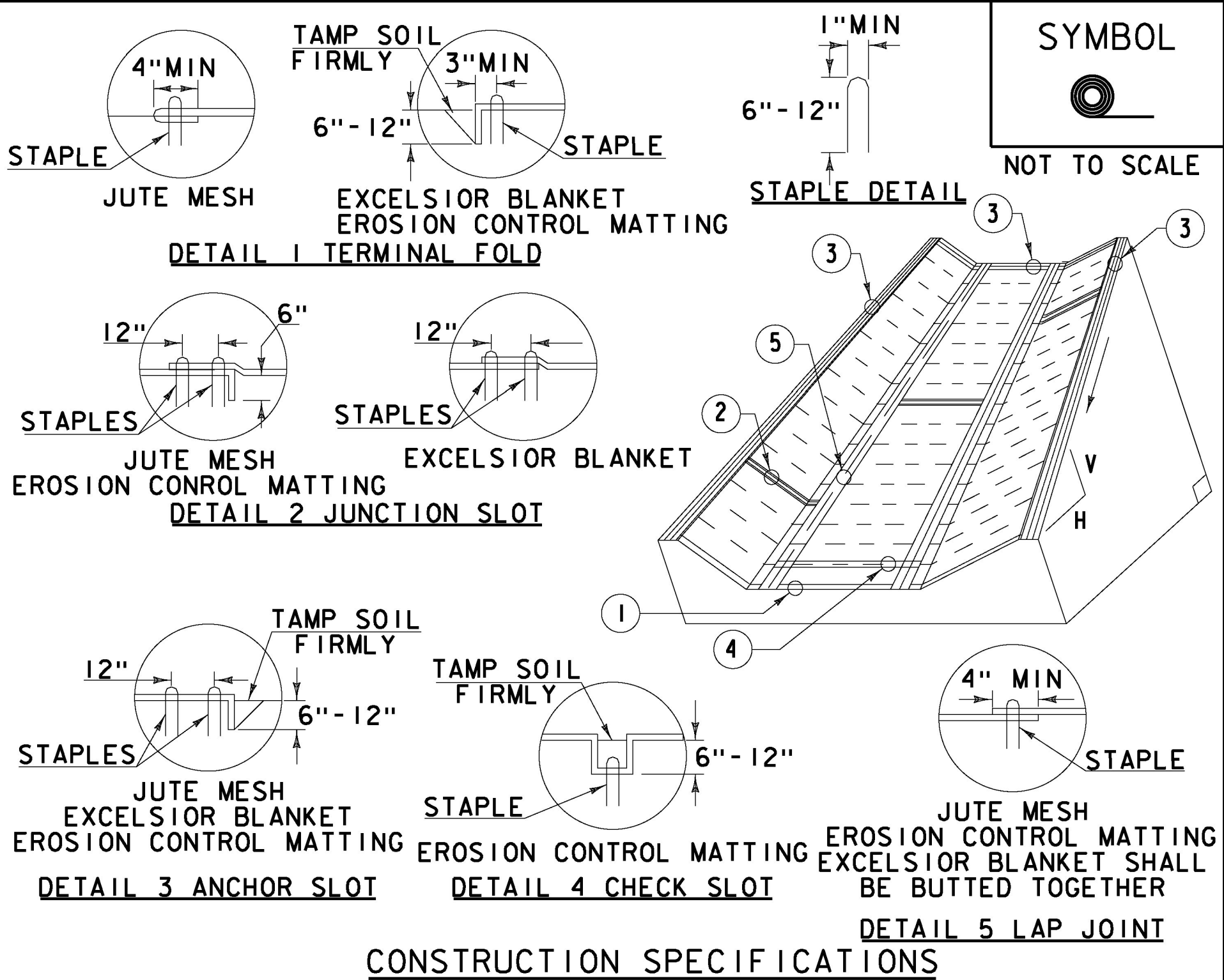
VAOT RURAL AREA MIX						
	LBS/AC					
WEIGHT	BROADCAST	HYDROSEED	NAME	LATIN NAME	GERM	PURITY
37.5%	22.5	45	CREeping RED FESCUE	FESTUCA RUBRA VAR. RUBRA	85%	98%
37.5%	22.5	45	TALL FESCUE	FESTUCA ARUNDINACEA	90%	95%
5.0%	3	6	RED TOP	AGROSTIS GIGANTEA	90%	95%
15.0%	9	18	WHITE FIELD CLOVER	TRIFOLIUM REPENS	85%	98%
5.0%	3	6	ANNUAL RYE GRASS	LOLIUM MULTIFLORUM	85%	95%
100%	60	120				

GENERAL AMENDMENT GUIDANCE		
FERTILIZER	LIME	
10/20/10	AG LIME	PELLITIZED
500 LBS /AC	2 TONS /AC	1 TONS /AC

#### CONSTRUCTION GUIDANCE

1. SEED MIX: THE CONTRACTOR SHALL COORDINATE WITH THE RESIDENT ENGINEER ON WHICH SEED MIX TO USE.
2. SEED MIX: USE AS INDICATED IN THE PLANS AND/OR FOR ALL ESTABLISHED UPLAND (NON WETLAND) AREAS DISTURBED BY THE CONTRACTOR.
3. ALL SEED MIXTURES: SHALL NOT HAVE A WEED CONTENT EXCEEDING 0.40% BY WEIGHT AND SHALL BE FREE OF ALL NOXIOUS SEED.
4. FERTILIZER AND LIMESTONE: SHALL FOLLOW RATES SHOWN ON PLAN OR AS DIRECTED BY THE ENGINEER.
5. HAY MULCH: TO BE PLACED ON EARTH SLOPES AT THE RATE OF 2 TONS/ACRE, ACHIEVE 90% GROUND COVER OR AS DIRECTED BY THE ENGINEER.
6. HYDROSEEDING: ALTHOUGH GUIDANCE IS GIVEN ABOVE THE SITE CONDITIONS AND THE TYPE OF HYDROSEED PROPOSED FOR USE WILL ULTIMATELY DICTATE THE AMOUNTS AND TYPES OF SOIL AMENDMENTS TO BE APPLIED.
7. TURF ESTABLISHMENT: PLACING SEED, FERTILIZER, LIME AND MULCH PRIOR TO SEPTEMBER 15 AND AFTER APRIL 15 CAN BETTER ENSURE A VIGOROUS GROWTH OF GRASS.

ADAPTED FROM VTRANS TECHNICAL LANDSCAPE MANUAL FOR ROADWAYS AND TRANSPORTATION FACILITIES		TURF ESTABLISHMENT	
THIS WORK SHALL BE PERFORMED IN ACCORDANCE WITH SECTION 651 FOR SEED (PAY ITEM 651J15)		REVISIONS	
		JANUARY 12, 2015	WHF



1. EROSION MATTING, CHECK SLOTS, SHALL BE SPACED IN DITCH CHANNEL SO THAT ONE OCCURS WITHIN EACH 50' ON SLOPES OF MORE THAN 4% AND LESS THAN 6%. ON SLOPES OF 6% OR MORE, THEY SHALL BE SPACED SO THAT ONE OCCURS WITHIN EACH 25'.
2. APPLY FERTILIZER, LIME SEED PRIOR TO PLACING MATTING.
3. STAPLES ARE TO BE PLACED ALTERNATELY, IN COLUMNS APPROXIMATELY 2' APART AND IN ROWS APPROXIMATELY 3' APART. APPROXIMATELY 175 STAPLES ARE REQUIRED PER 4' X 225' ROLL OF MATERIAL AND 125 STAPLES ARE REQUIRED PER 4' X 150' ROLL OF MATERIAL.
4. DISTURBED AREAS SHALL BE SMOOTHLY GRADED. EROSION CONTROL MATERIAL SHALL BE PLACED LOOSELY OVER GROUND SURFACE. DO NOT STRETCH.
5. ALL TERMINAL ENDS AND TRANSVERSE LAPS SHALL BE STAPLED AT APPROXIMATELY 12" INTERVALS.

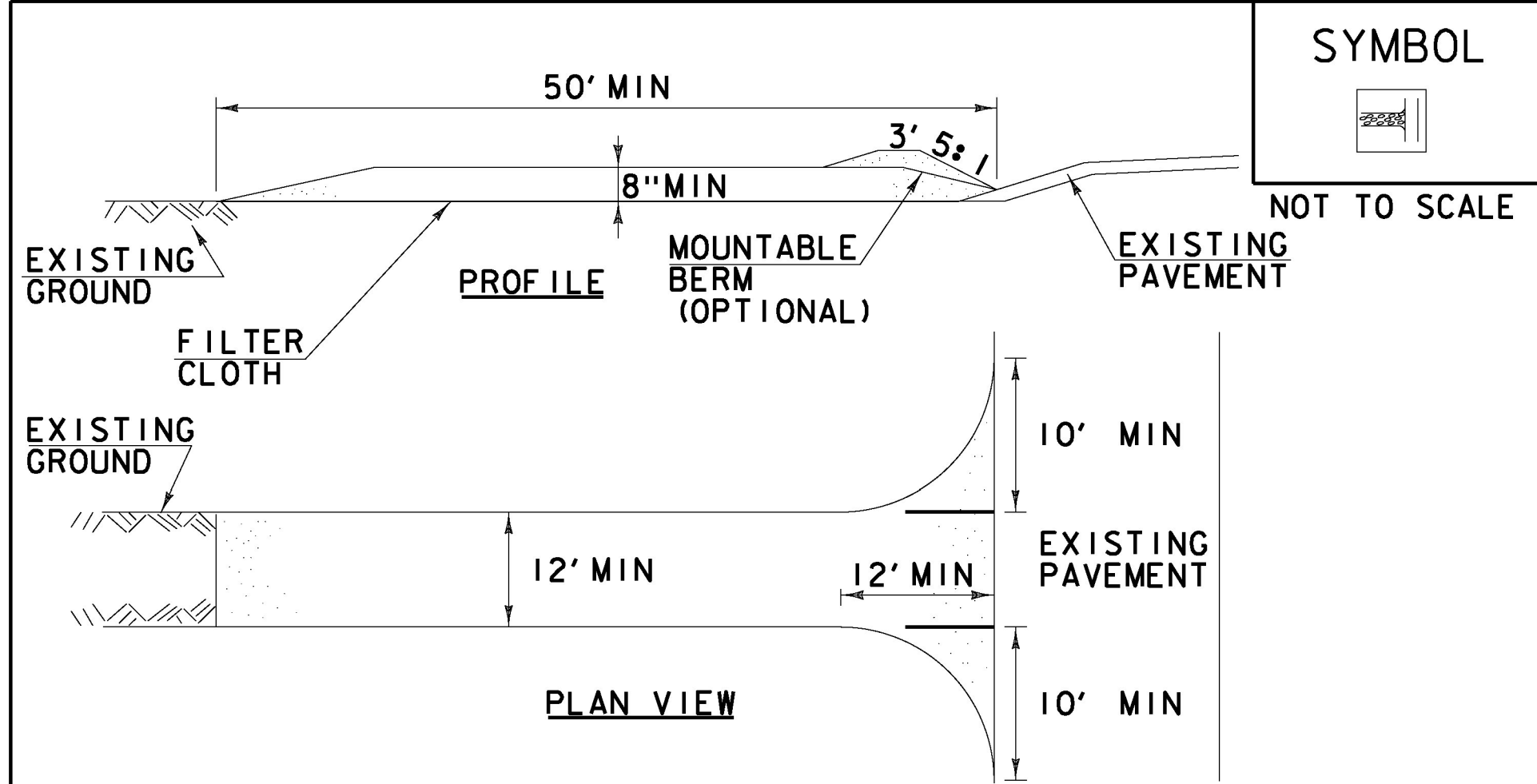
ADAPTED FROM DETAILS PROVIDED BY: NEW YORK STATE DEC  
ORIGINALLY DEVELOPED BY USDA-NRCS  
VERMONT DEPARTMENT OF ENVIRONMENTAL CONSERVATION

ROLLED EROSION  
CONTROL PRODUCT  
(RECP) DITCH

NOTES:  
REFER TO "THE VERMONT STANDARDS & SPECIFICATIONS FOR EROSION PREVENTION & SEDIMENT CONTROL -2006- "FROM THE VT AGENCY OF NATURAL RESOURCES FOR ADDITIONAL GUIDANCE.

THIS WORK SHALL BE PERFORMED IN ACCORDANCE WITH SECTION 653 AND AS SHOWN IN THE PLANS FOR TEMPORARY EROSION MATTING (PAY ITEM 653.20) OR PERMANENT EROSION MATTING (PAY ITEM 653.21).

REVISIONS		
MARCH 8, 2007	JMF	
APRIL 16, 2007	WHF	
JANUARY 13, 2009	WHF	



1. STONE SIZE- USE 1-4" STONE, RECLAIMED OR RECYCLED CONCRETE EQUIVALENT.
2. LENGTH- NOT LESS THAN 50' (EXCEPT ON A SINGLE RESIDENCE LOT WHERE A 30' MINIMUM LENGTH APPLIES).
3. THICKNESS- NOT LESS THAN 8".
4. WIDTH- 12' MINIMUM, BUT NOT LESS THAN THE FULL WIDTH AT POINTS WHERE INGRESS OR EGRESS OCCURS. 24' IF SINGLE ENTRANCE TO SITE.
5. GEOTEXTILE MUST BE PLACED OVER THE ENTIRE AREA PRIOR TO PLACING STONE.
6. SURFACE WATER- ALL SURFACE WATER FLOWING OR DIVERTED TOWARD CONSTRUCTION ENTRANCES SHALL BE PIPED BENEATH THE ENTRANCE. IF PIPING IS IMPRACTICAL, A MOUNTABLE BERM WITH 5:1 SLOPES WILL BE PERMITTED.
7. MAINTENANCE- THE ENTRANCE SHALL BE MAINTAINED IN A CONDITION WHICH WILL PREVENT TRACKING OR FLOWING OF SEDIMENT ONTO PUBLIC RIGHTS-OF-WAY, ALL SEDIMENT SPILLED, DROPPED, WASHED OR TRACKED ONTO PUBLIC RIGHTS-OF-WAY MUST BE REMOVED IMMEDIATELY.
8. WHEN WASHING IS REQUIRED, IT SHALL BE DONE ON AN AREA STABILIZED WITH STONE AND WHICH DRAINS INTO AN APPROVED SEDIMENT TRAPPING DEVICE.
9. PERIODIC INSPECTION AND NEEDED MAINTENANCE SHALL BE PROVIDED ACCORDING TO PERMIT REQUIREMENTS.

ADAPTED FROM DETAILS PROVIDED BY: NEW YORK STATE DEC  
ORIGINALLY DEVELOPED BY USDA-NRCS  
VERMONT DEPARTMENT OF ENVIRONMENTAL CONSERVATION

STABILIZED  
CONSTRUCTION  
ENTRANCE

NOTES:  
REFER TO "THE VERMONT STANDARDS & SPECIFICATIONS FOR EROSION PREVENTION & SEDIMENT CONTROL -2006- "FROM THE VT AGENCY OF NATURAL RESOURCES FOR ADDITIONAL GUIDANCE.

THIS WORK SHALL BE PERFORMED IN ACCORDANCE WITH SECTION 653 FOR VEHICLE TRACKING PAD (PAY ITEM 653.35) OR AS SPECIFIED IN THE CONTRACT.

REVISIONS		
MARCH 24, 2008	WHF	
JANUARY 13, 2009	WHF	

PROJECT NAME: LYNDON  
PROJECT NUMBER: IM 091-3(51)

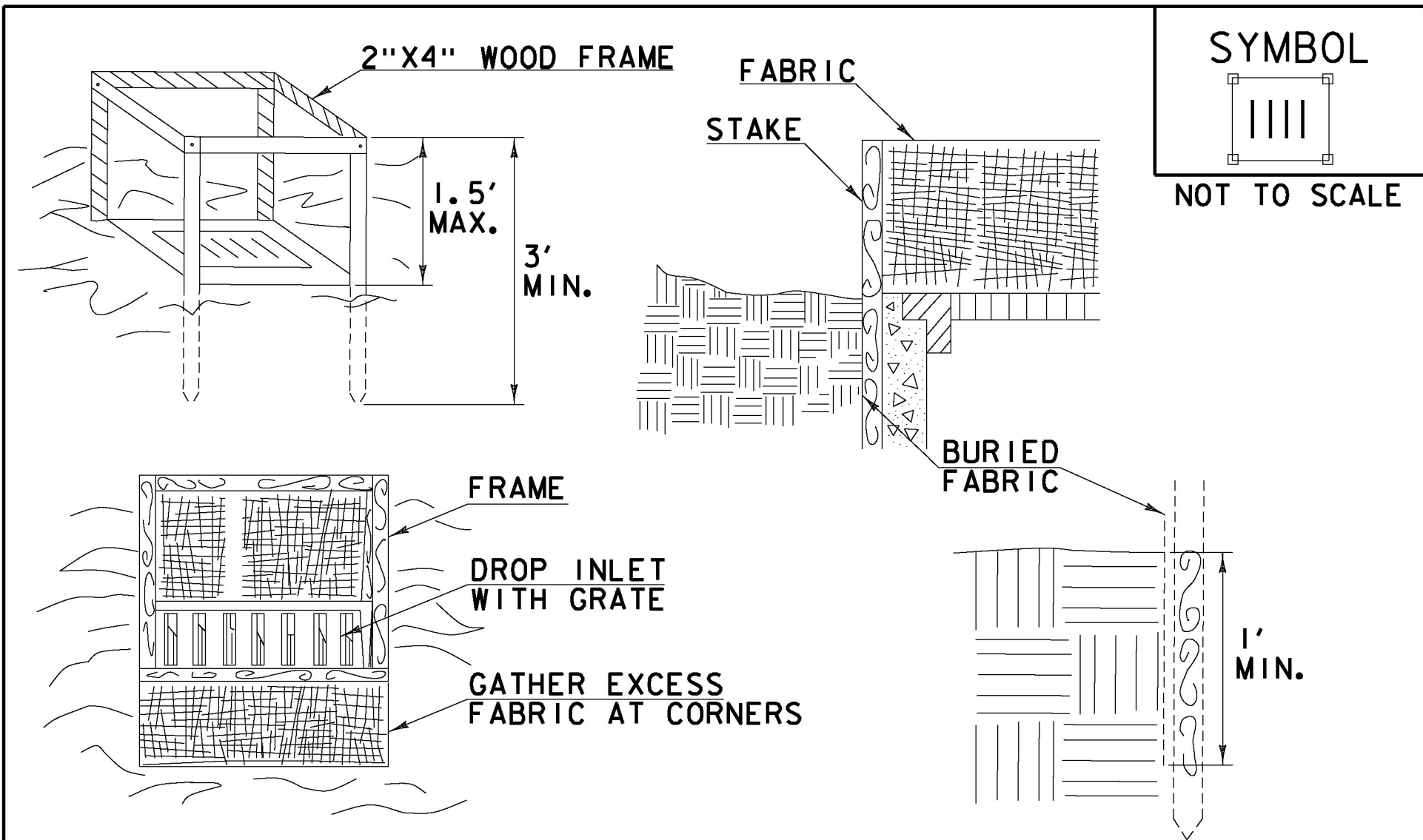
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PROJECT LEADER: D. GOZALKOWSKI  
DESIGNED BY: J. OLSEN  
EPSC DETAIL SHEET 1

PLOT DATE: 12/13/2016  
DRAWN BY: J. HEALD  
CHECKED BY: J. SHIELDS  
SHEET 21 OF 35

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DATE/TIME = 12/13/2016  
USER = 5323



#### CONSTRUCTION SPECIFICATIONS

1. FILTER FABRIC SHALL HAVE AN APPARENT OPENING SIZE OF 40-85. BURLAP MAY BE USED FOR SHORT TERM APPLICATIONS.
2. CUT FABRIC FROM A CONTINUOUS ROLL TO ELIMINATE JOINTS. IF JOINTS ARE NEEDED THEY WILL BE OVERLAPPED TO THE NEXT STAKE.
3. STAKE MATERIALS WILL BE STANDARD 2" x 4" WOOD OR EQUIVALENT METAL WITH A MINIMUM LENGTH OF 3'.
4. SPACE STAKES EVENLY AROUND INLET 3' APART AND DRIVE A MINIMUM 18" DEEP. SPANS GREATER THAN 3' MAY BE BRIDGED WITH THE USE OF WIRE MESH BEHIND THE FILTER FABRIC FOR SUPPORT.
5. FABRIC SHALL BE EMBEDDED 1' MINIMUM BELOW GROUND AND BACKFILLED. IT SHALL BE SECURELY FASTENED TO THE STAKES AND FRAME.
6. A 2" x 4" WOOD FRAME SHALL BE COMPLETED AROUND THE CREST OF THE FABRIC FOR OVER FLOW STABILITY.
7. MAXIMUM DRAINAGE AREA 1 ACRE

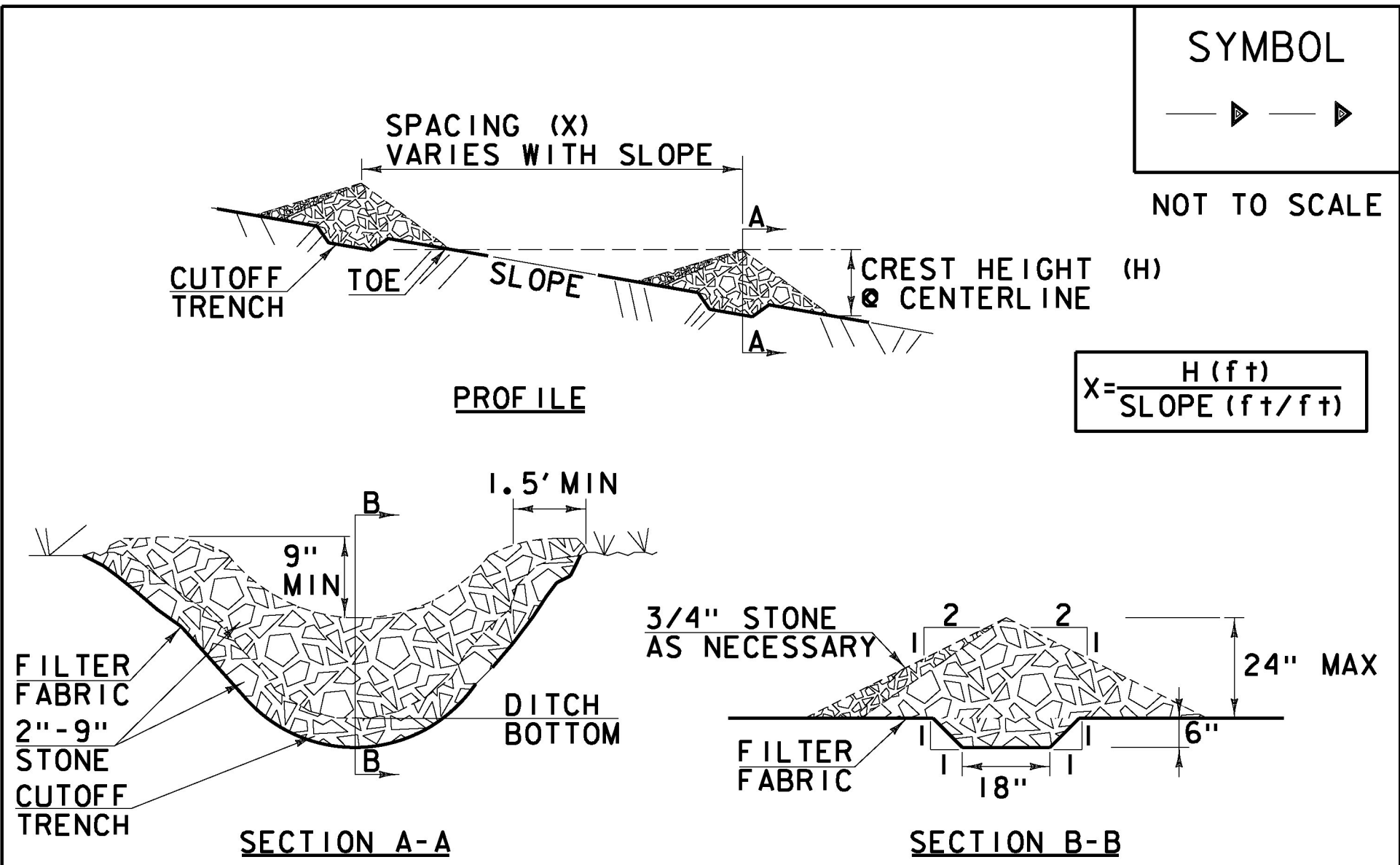
ADAPTED FROM DETAILS PROVIDED BY: NEW YORK STATE DEC  
ORIGINALLY DEVELOPED BY USDA-NRCS  
VERMONT DEPARTMENT OF ENVIRONMENTAL CONSERVATION

#### FILTER FABRIC DROP INLET PROTECTION

NOTES:  
REFER TO "THE VERMONT STANDARDS & SPECIFICATIONS FOR  
EROSION PREVENTION & SEDIMENT CONTROL -2006- "FROM  
THE VT AGENCY OF NATURAL RESOURCES FOR ADDITIONAL  
GUIDANCE.

THIS WORK SHALL BE PERFORMED IN ACCORDANCE WITH  
SECTION 653 FOR INLET PROTECTION DEVICE, TYPE 1(PAY  
ITEM 653.40).

REVISIONS		
MARCH 7, 2008	WHF	
JANUARY 13, 2009	WHF	



#### CONSTRUCTION SPECIFICATIONS

1. STONE WILL BE PLACED ON A FILTER FABRIC FOUNDATION.
2. CHECK DAMS SHALL BE SPACED SO THAT THE ELEVATION OF THE CREST OF THE DOWNSTREAM DAM IS AT THE SAME ELEVATION AS THE TOE OF THE UPSTREAM DAM.
3. 3/4" FILTERING STONE MAY BE ADDED TO THE FACE OF THE CHECK DAM AS NECESSARY.
4. EXTEND THE STONE A MINIMUM OF 1.5' BEYOND THE DITCH BANKS TO PREVENT CUTTING AROUND THE DAM.
5. PROTECT CHANNEL DOWNSTREAM OF THE LOWEST CHECK DAM FROM SCOUR AND EROSION WITH STONE OR LINER AS APPROPRIATE.
6. ENSURE THAT CHANNEL APPURTENANCES SUCH AS CULVERT ENTRANCES BELOW CHECK DAMS ARE NOT SUBJECT TO DAMAGE OR BLOCKAGE FROM DISPLACED STONE.
7. MAXIMUM DRAINAGE AREA 2 ACRES.

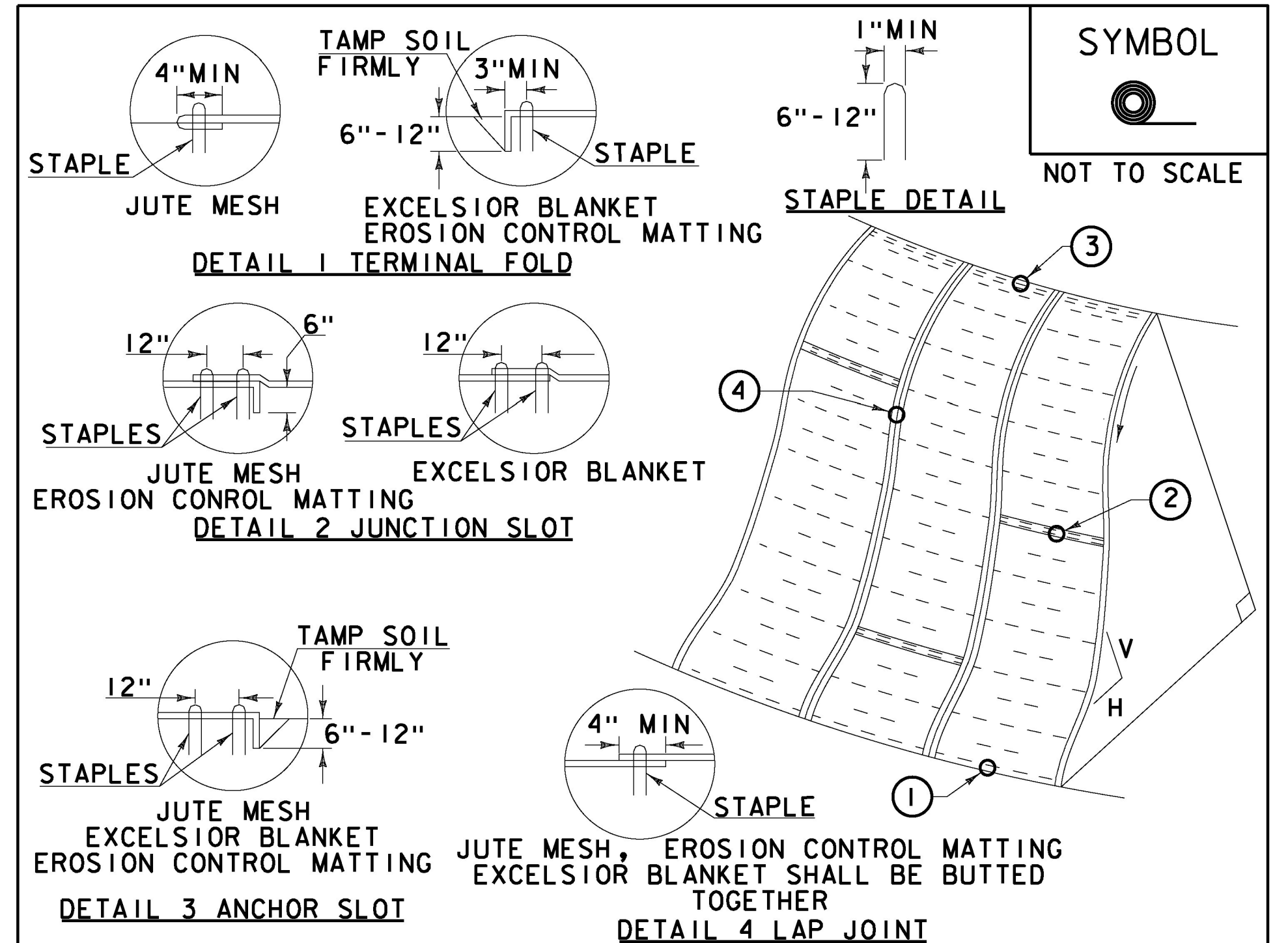
ADAPTED FROM DETAILS PROVIDED BY: NEW YORK STATE DEC  
ORIGINALLY DEVELOPED BY USDA-NRCS  
VERMONT DEPARTMENT OF ENVIRONMENTAL CONSERVATION

#### CHECK DAM

NOTES:  
REFER TO "THE VERMONT STANDARDS & SPECIFICATIONS FOR  
EROSION PREVENTION & SEDIMENT CONTROL -2006- "FROM  
THE VT AGENCY OF NATURAL RESOURCES FOR ADDITIONAL  
GUIDANCE.

THIS WORK SHALL BE PERFORMED IN ACCORDANCE WITH  
SECTION 653 FOR TEMPORARY STONE CHECK DAM, TYPE 1(PAY  
ITEM 653.25)

REVISIONS		
MARCH 21, 2008	WHF	
JANUARY 8, 2009	WHF	



#### CONSTRUCTION SPECIFICATIONS

1. APPLY TO SLOPES GREATER THAN 3H:1V OR WHERE NECESSARY TO AID IN ESTABLISHING VEGETATION.
2. APPLY FERTILIZER, LIME SEED PRIOR TO PLACING MATTING.
3. STAPLES ARE TO BE PLACED ALTERNATELY, IN COLUMNS APPROXIMATELY 2' APART AND IN ROWS APPROXIMATELY 3' APART. APPROXIMATELY 175 STAPLES ARE REQUIRED PER 4' X 225' ROLL OF MATERIAL AND 125 STAPLES ARE REQUIRED PER 4' X 150' ROLL OF MATERIAL.
4. DISTURBED AREAS SHALL BE SMOOTHLY GRADED. EROSION CONTROL MATERIAL SHALL BE PLACED LOOSELY OVER GROUND SURFACE. DO NOT STRETCH.
5. ALL TERMINAL ENDS AND TRANSVERSE LAPS SHALL BE STAPLED AT APPROXIMATELY 12" INTERVALS.

ADAPTED FROM DETAILS PROVIDED BY: NEW YORK STATE DEC  
ORIGINALLY DEVELOPED BY USDA-NRCS  
VERMONT DEPARTMENT OF ENVIRONMENTAL CONSERVATION

#### ROLLED EROSION CONTROL PRODUCT (RECP) SIDE SLOPE

NOTES:  
REFER TO "THE VERMONT STANDARDS & SPECIFICATIONS FOR  
EROSION PREVENTION & SEDIMENT CONTROL -2006- "FROM  
THE VT AGENCY OF NATURAL RESOURCES FOR ADDITIONAL  
GUIDANCE.  
THIS WORK SHALL BE PERFORMED IN ACCORDANCE WITH SECTION  
653 AND AS SHOWN IN THE PLANS FOR TEMPORARY EROSION  
MATTING (PAY ITEM 653.20) OR PERMANENT EROSION MATTING  
(PAY ITEM 653.25).

REVISIONS		
APRIL 16, 2007	JMF	
JANUARY 13, 2009	WHF	

PROJECT NAME: LYNDON  
PROJECT NUMBER: IM 091-3(51)

FILE NAME: z13a370ecd.dgn  
PROJECT LEADER: D. GOZALKOWSKI  
DESIGNED BY: J. OLSEN  
EPSC DETAIL SHEET 2

PLOT DATE: 12/13/2016  
DRAWN BY: J. HEALD  
CHECKED BY: J. SHIELDS  
SHEET 22 OF 35

CHA



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DATE/TIME = 12/13/2016  
USER = 5323

SYMBOL

NOT TO SCALE

PIPE DIA.	R
18"	7'
24"	7'
30"	8'

SECTION A-A

CONSTRUCTION SPECIFICATIONS

1. USE 2" TO 3" STONE. FILTERING STONE SHALL BE 3/4".
2. PLACE STONE OVER GEOTEXTILE.
3. ONCE THE AREAS UPSTREAM FROM THE CHECK DAM ARE STABILIZED WITH VEGETATION, THE SEDIMENT TRAPPED BEHIND THE DAM SHALL BE DISPOSED OF IN AN APPROVED WASTE AREA.
4. THE CHECK DAM(S) SHALL BE FLATTENED AND GRADED IN A MANNER WHICH PROTECTS THE AREA FROM EROSION AND CHANNEL BLOCKAGE . (GEOTEXTILE MUST BE REMOVED).
5. THE GEOTEXTILE MUST BE DISPOSED OF APPROPRIATELY.
6. THE AREA CONTRIBUTING TO THE CHECK DAM SHALL NOT EXCEED 4 ACRES.

ADAPTED FROM DETAILS PROVIDED BY: ILLINOIS USDA-NRCS ORIGINALLY DEVELOPED BY USDA-NRCS	PIPE INLET PROTECTION
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THIS WORK SHALL BE PERFORMED IN ACCORDANCE WITH SECTION 653 FOR INLET PROTECTION DEVICE, TYPE I(PAY ITEM 653.40).

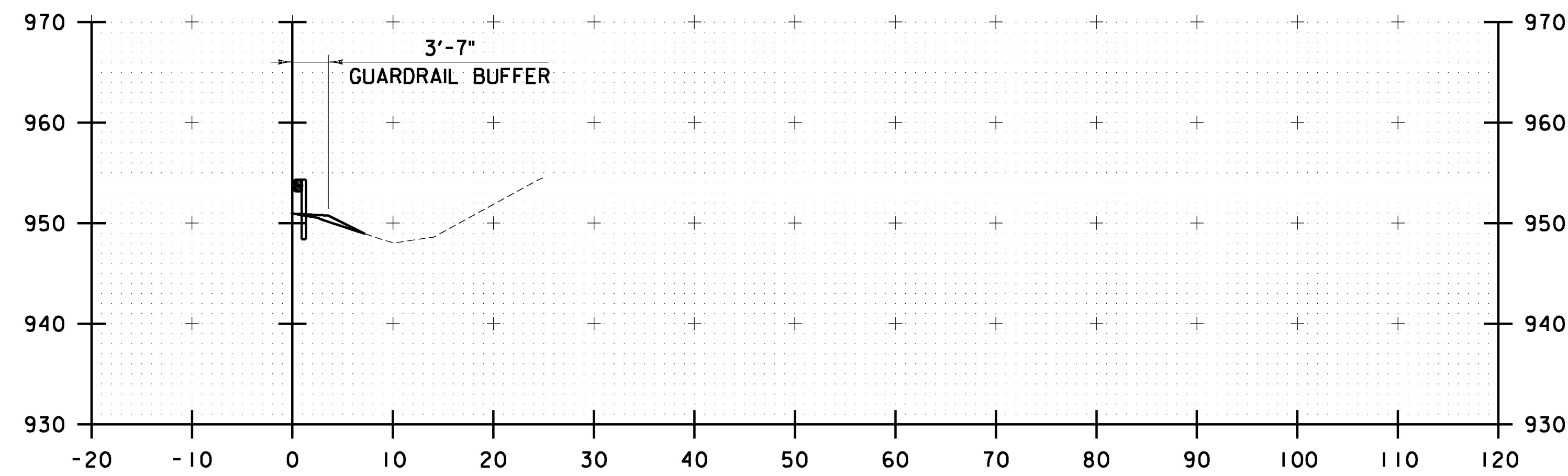
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MARCH 6, 2008	WHF
JANUARY 13, 2009	WHF



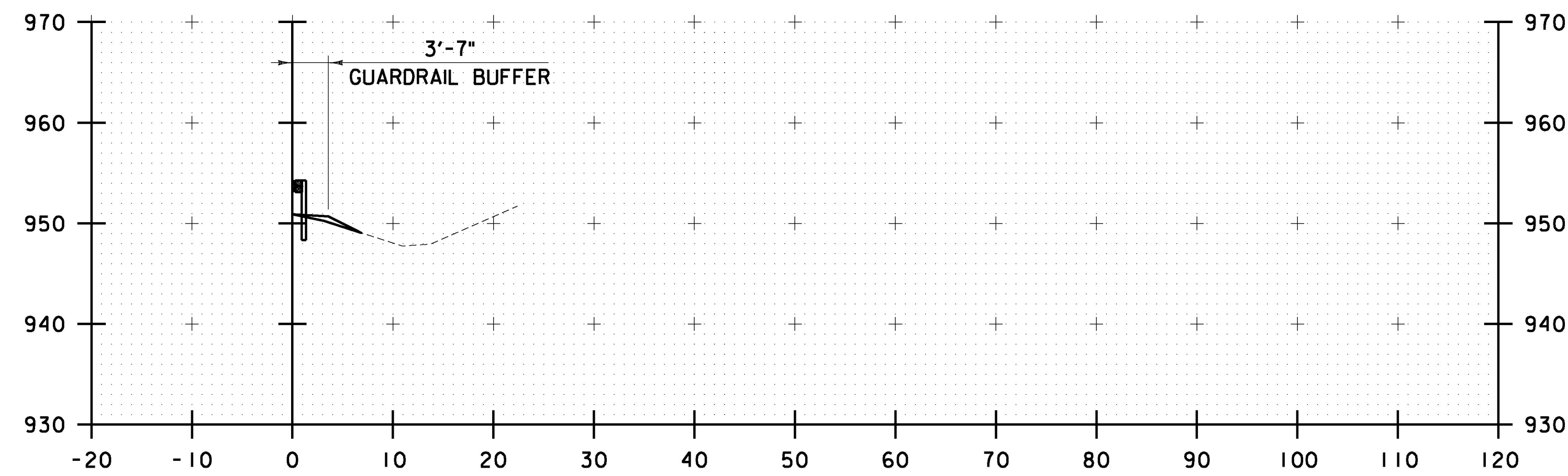
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PROJECT NUMBER: IM 091-3(51)	
FILE NAME: z13a370ecd.dgn	PLOT DATE: 12/13/2016
PROJECT LEADER: D. GOZALKOWSKI	DRAWN BY: J. HEALD
DESIGNED BY: J. OLSEN	CHECKED BY: J. SHIELDS
EPSC DETAIL SHEET 3	SHEET 23 OF 35



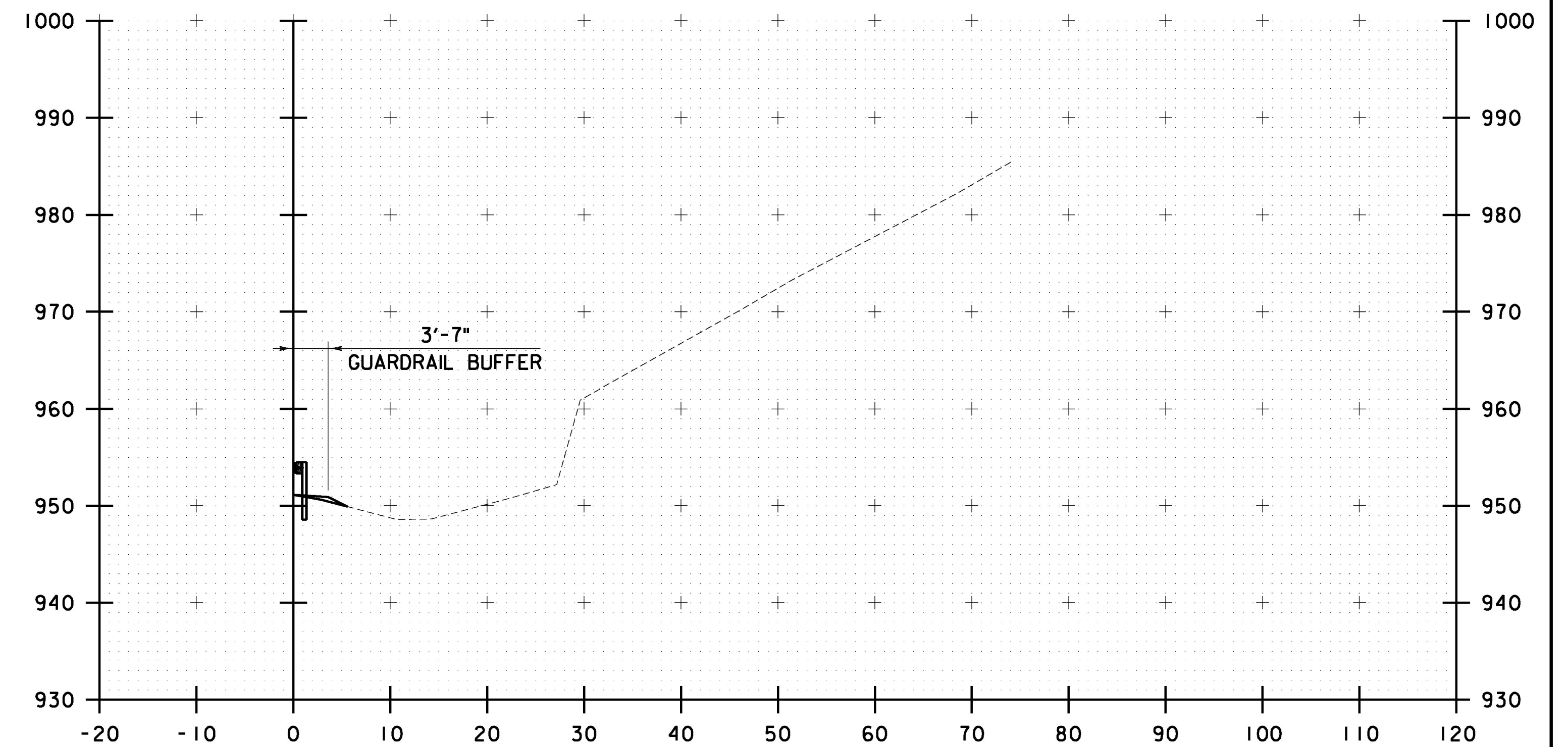
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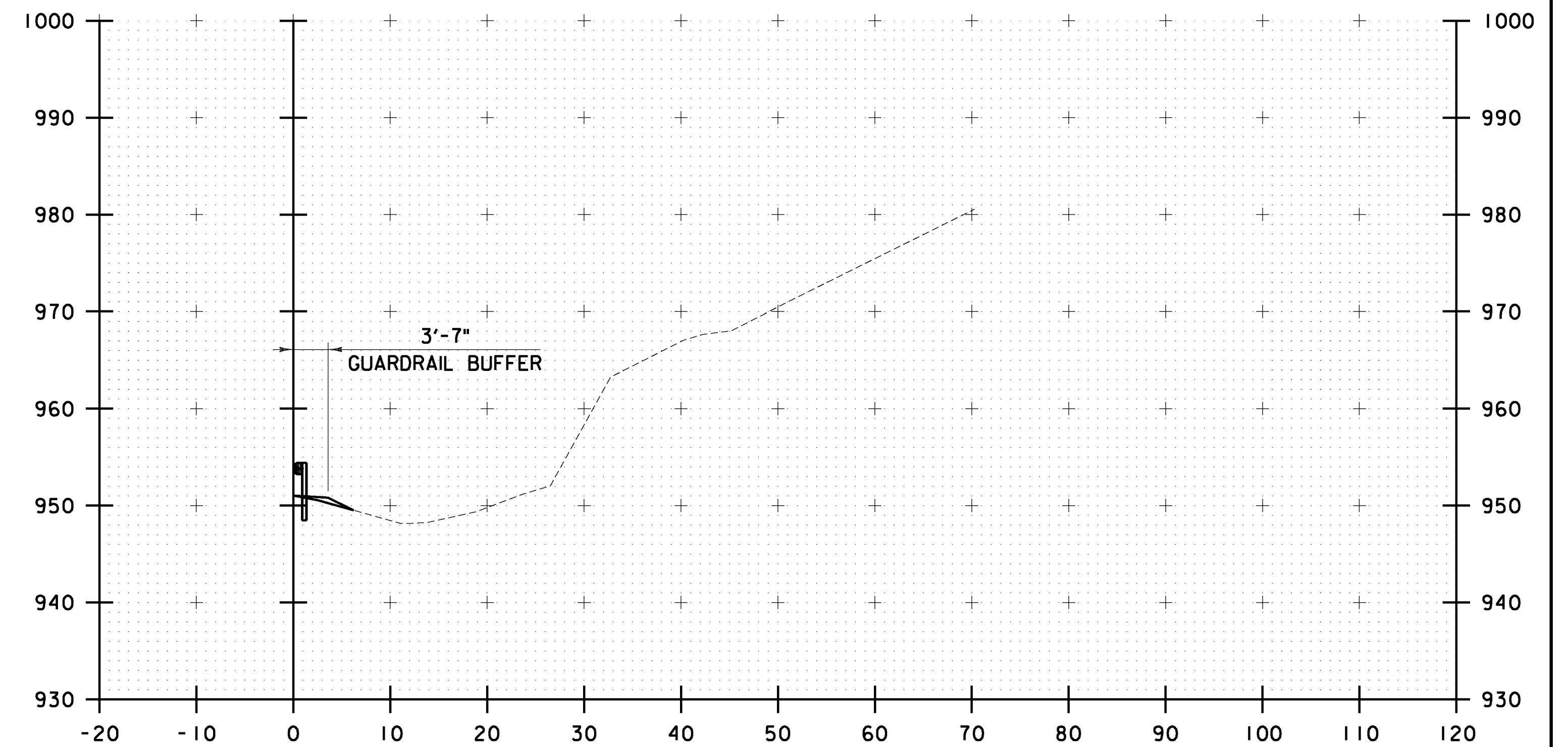
7525+00



7524+53



7526+00



7525+50

STA. 7524+53 TO STA. 7526+00

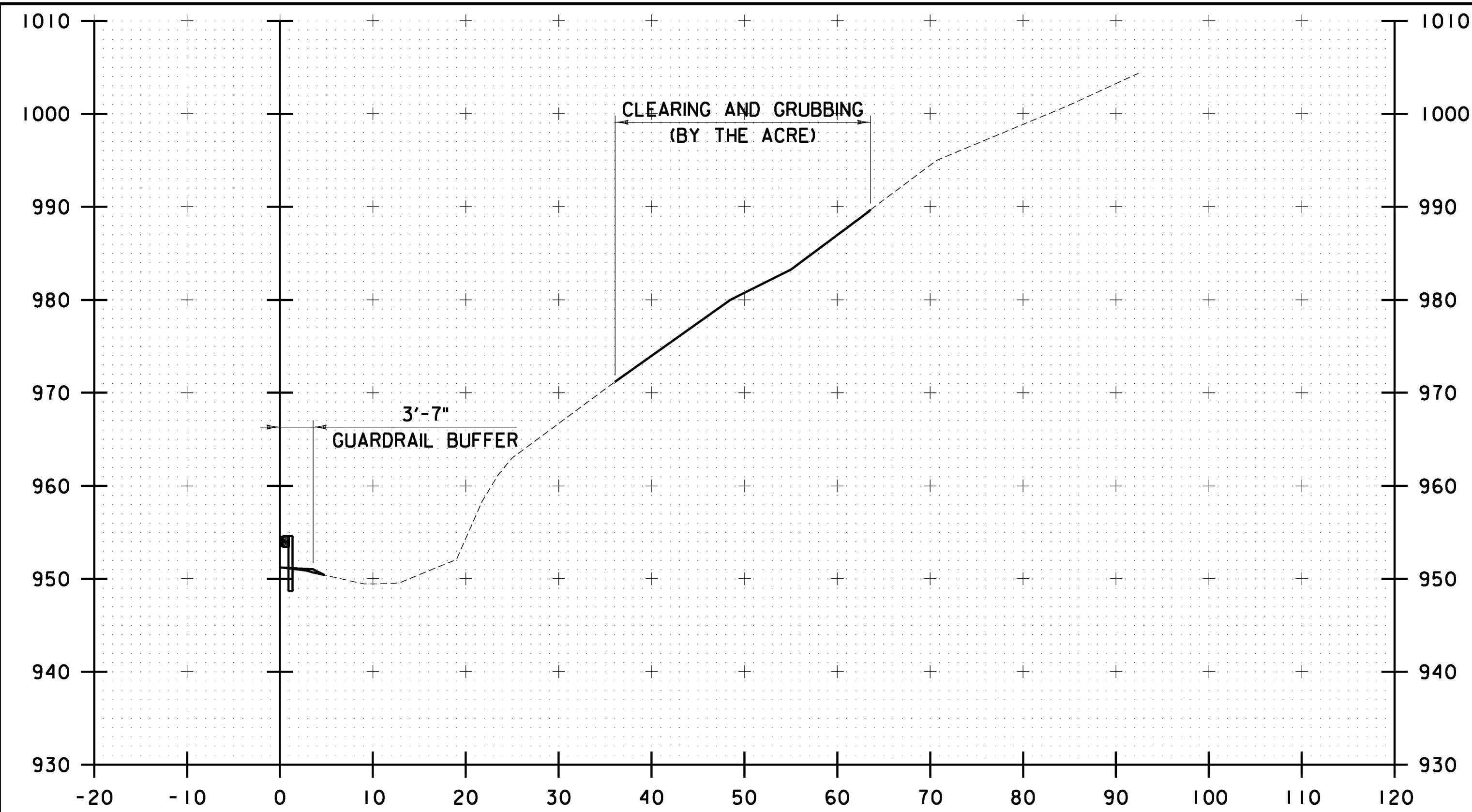
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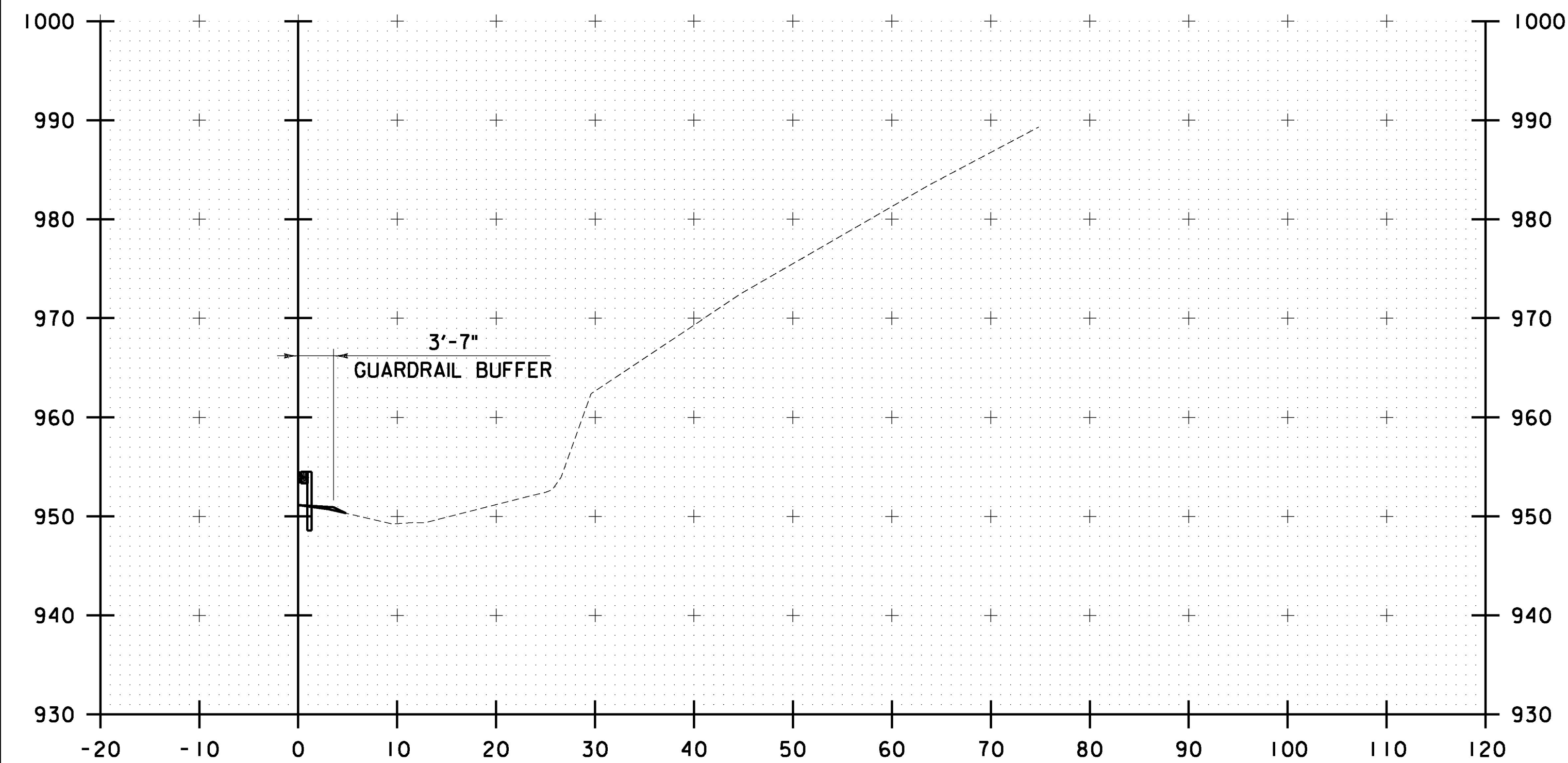
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PROJECT NUMBER: IM 091-3(51)	
FILE NAME: z13a370xsc.dgn	PLOT DATE: 12/13/2016
PROJECT LEADER: D. GOZALKOWSKI	DRAWN BY: J. HEALD
DESIGNED BY: J. OLSEN	CHECKED BY: J. SHIELDS
CROSS SECTIONS SHEET 1	SHEET 24 OF 35



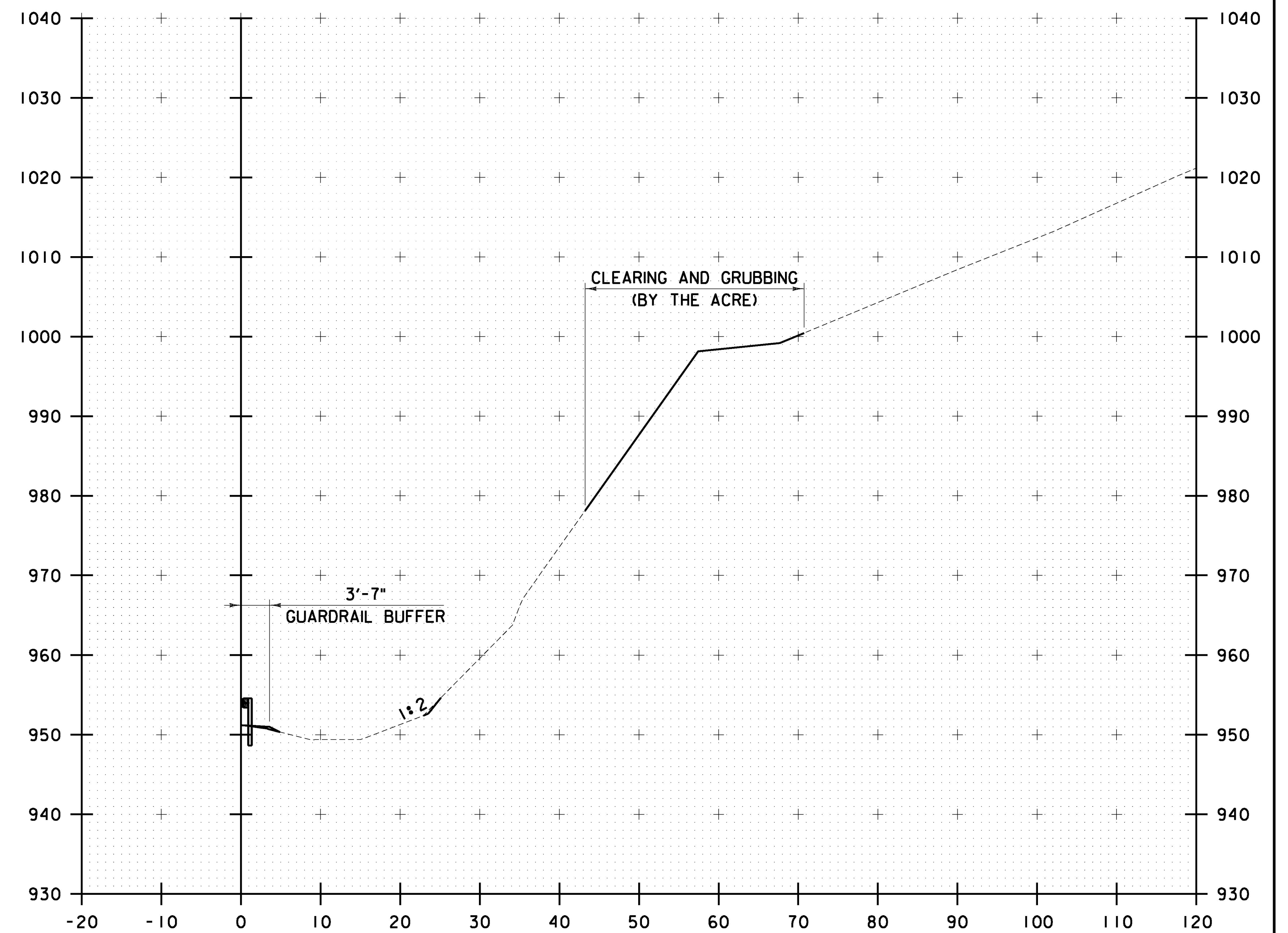
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USER = 5323



7527+00



7526+50



7527+25  
BEGIN PROJECT

STA. 7526+50 TO STA. 7527+25

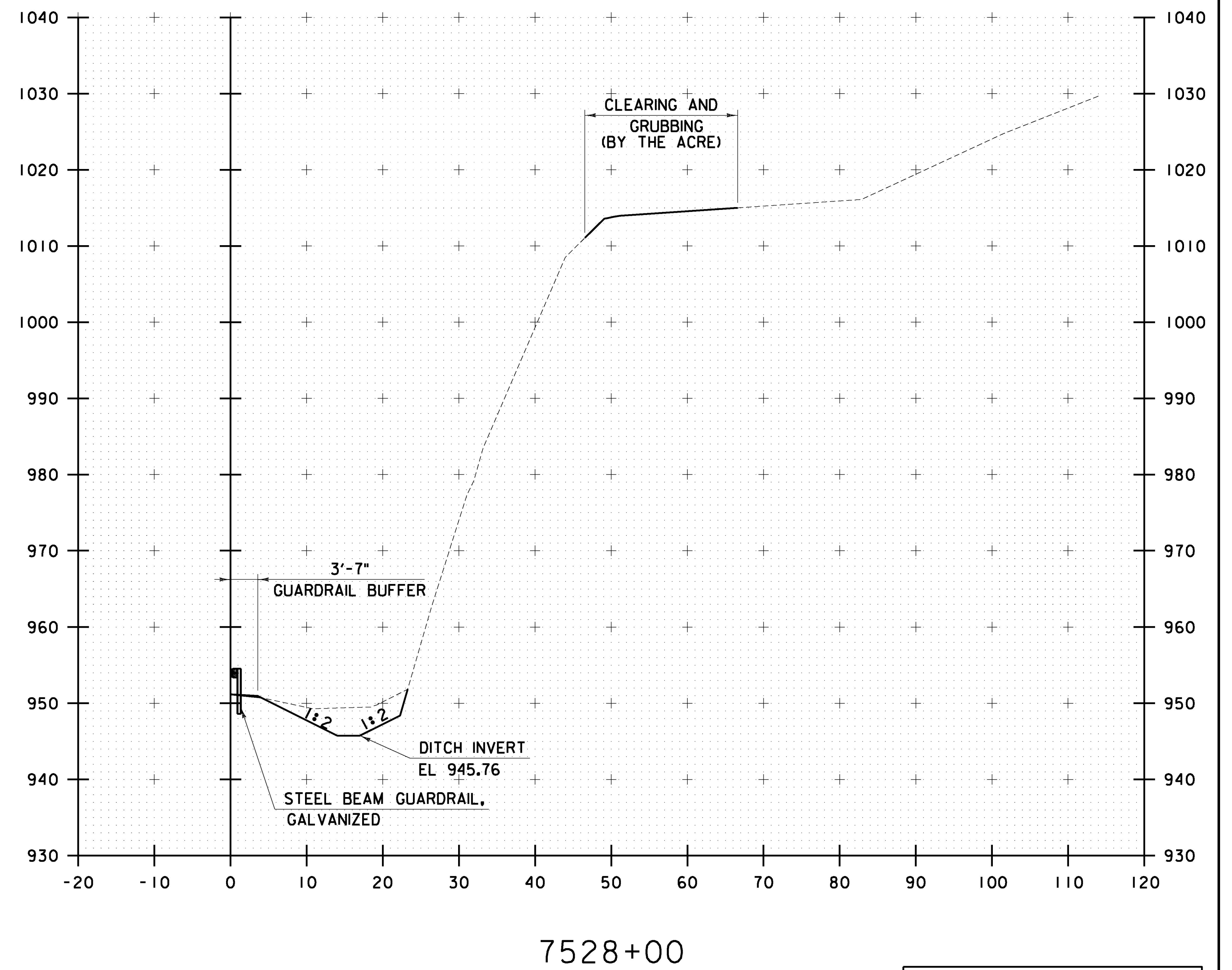
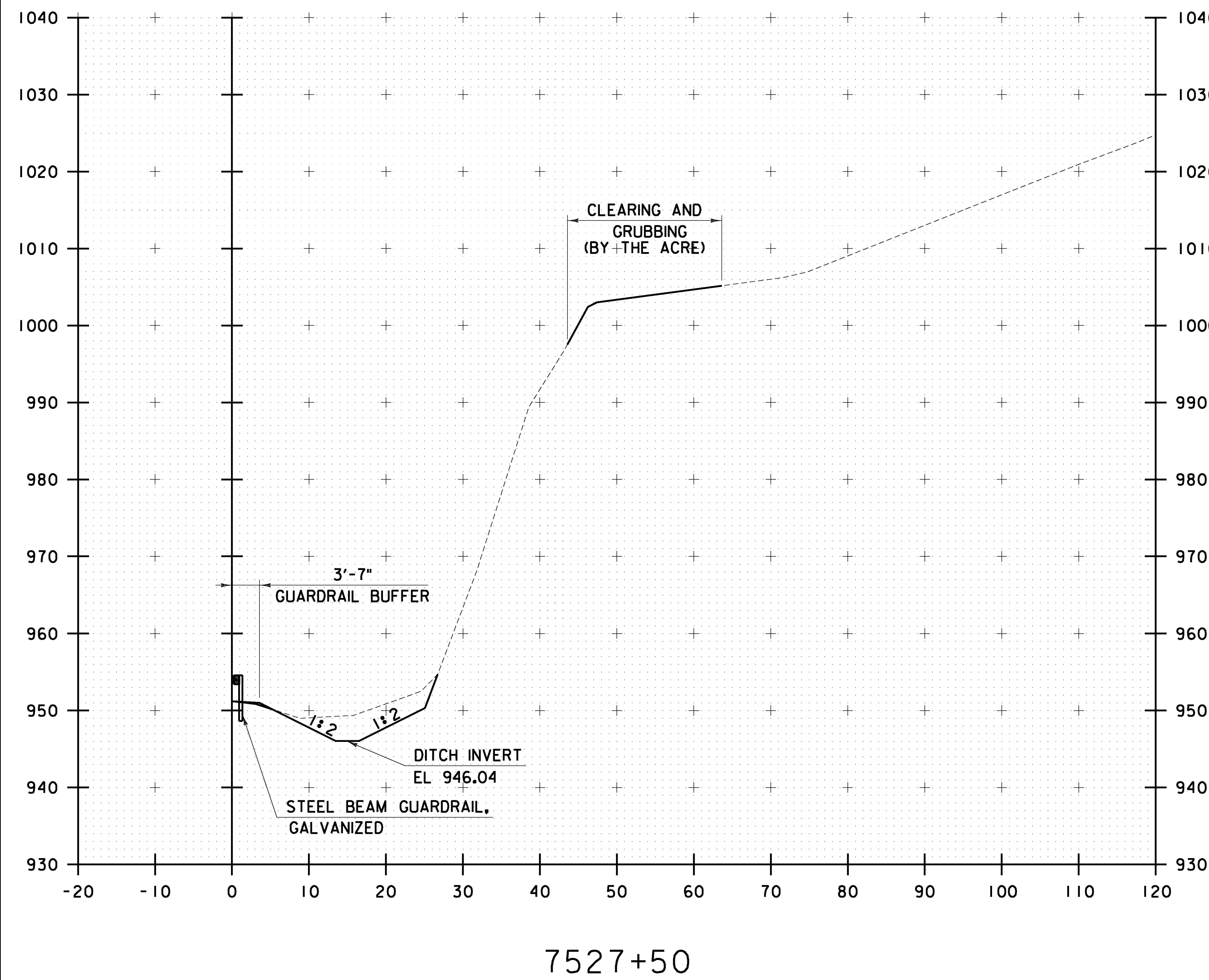
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PROJECT NUMBER: IM 091-3(51)	
FILE NAME: z13a370xsc.dgn	PLOT DATE: 12/13/2016
PROJECT LEADER: D. GOZALKOWSKI	DRAWN BY: J. HEALD
DESIGNED BY: J. OLSEN	CHECKED BY: J. SHIELDS
CROSS SECTIONS SHEET 2	SHEET 25 OF 35



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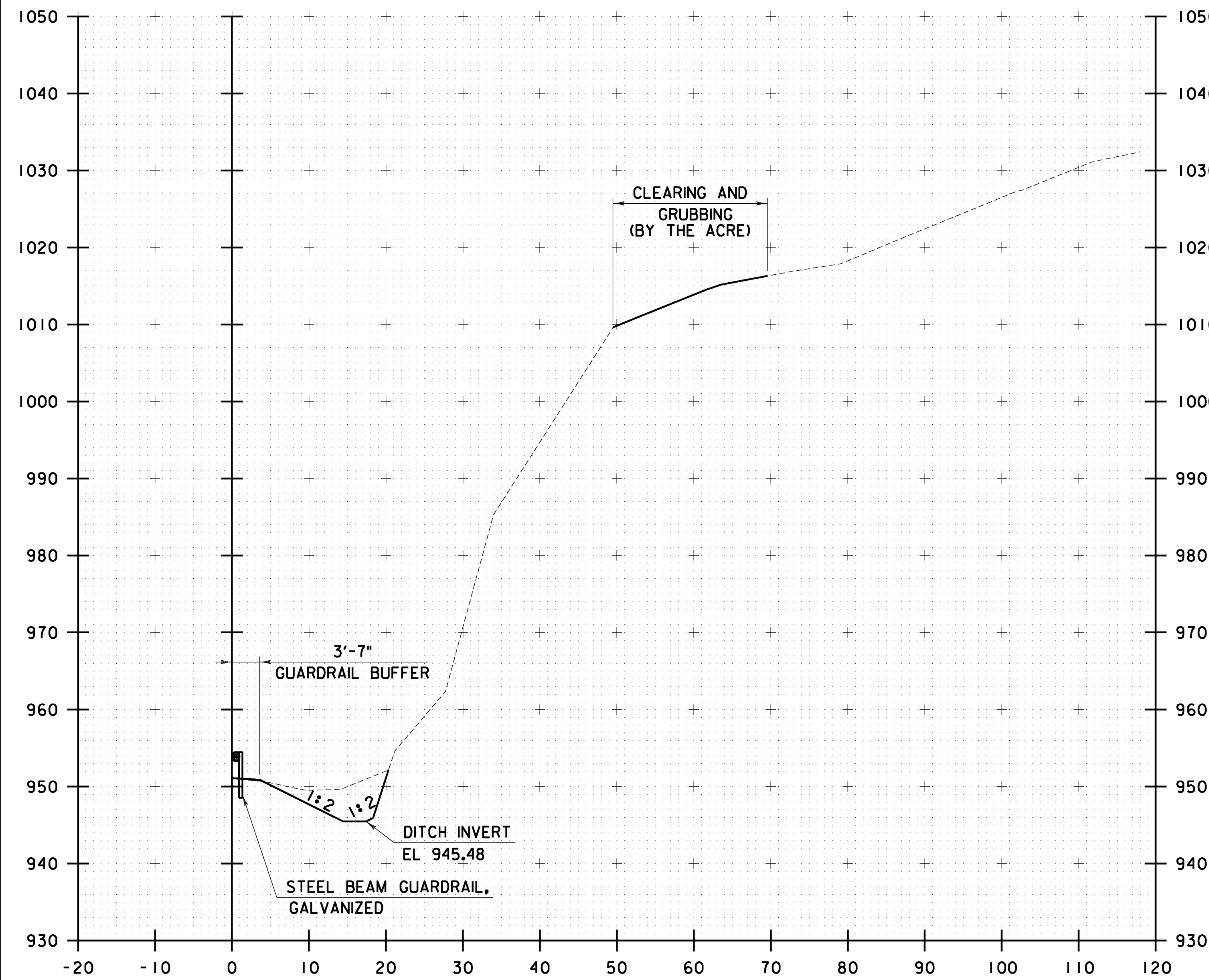
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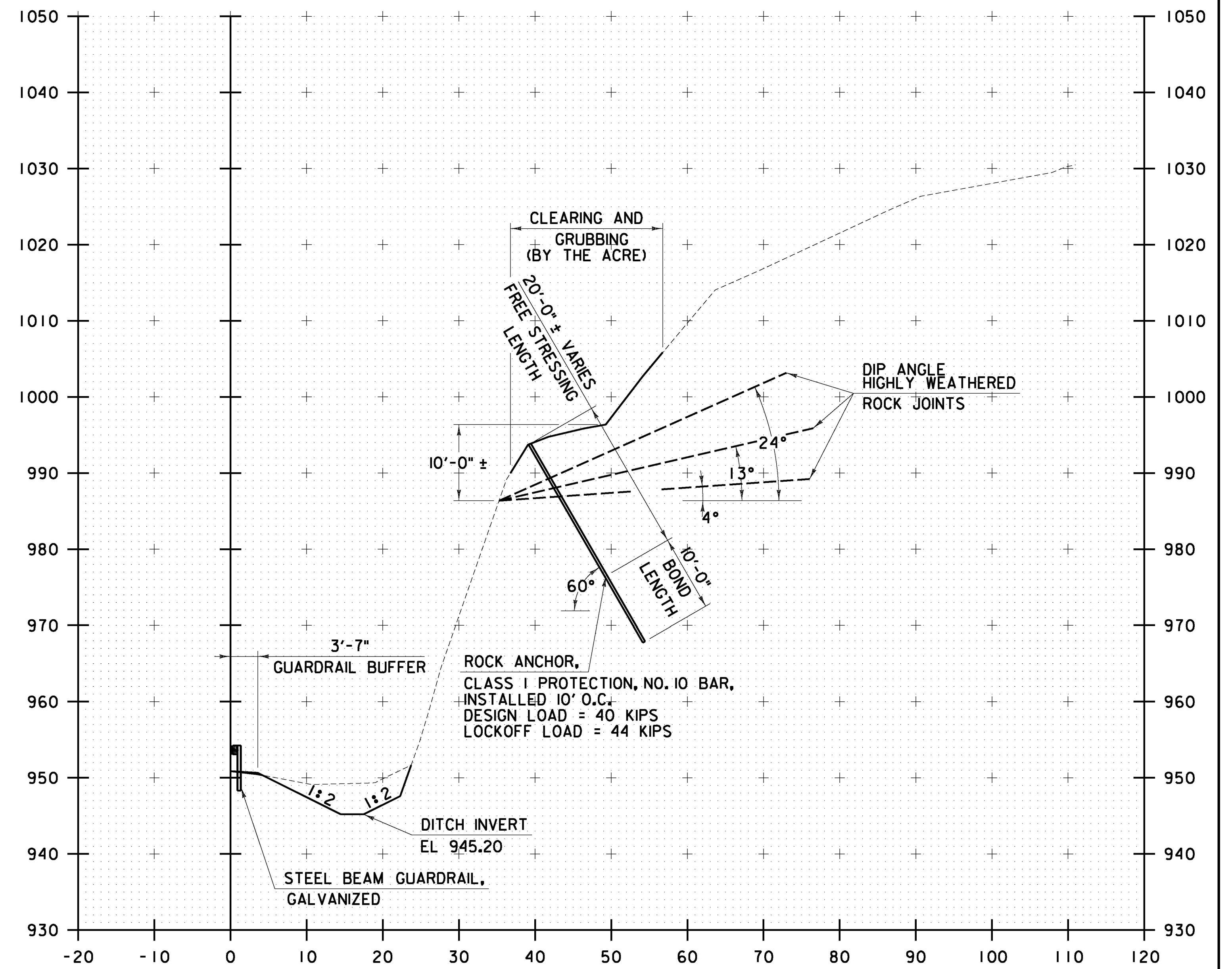
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PROJECT NUMBER: IM 091-3(51)	
FILE NAME: z13a370xsc.dgn	PLOT DATE: 12/13/2016
PROJECT LEADER: D. GOZALKOWSKI	DRAWN BY: J. HEALD
DESIGNED BY: J. OLSEN	CHECKED BY: J. SHIELDS
CROSS SECTIONS SHEET 3	SHEET 26 OF 35



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USER = 5323



7528+50



7529+00

STA. 7528+50 TO STA. 7529+00

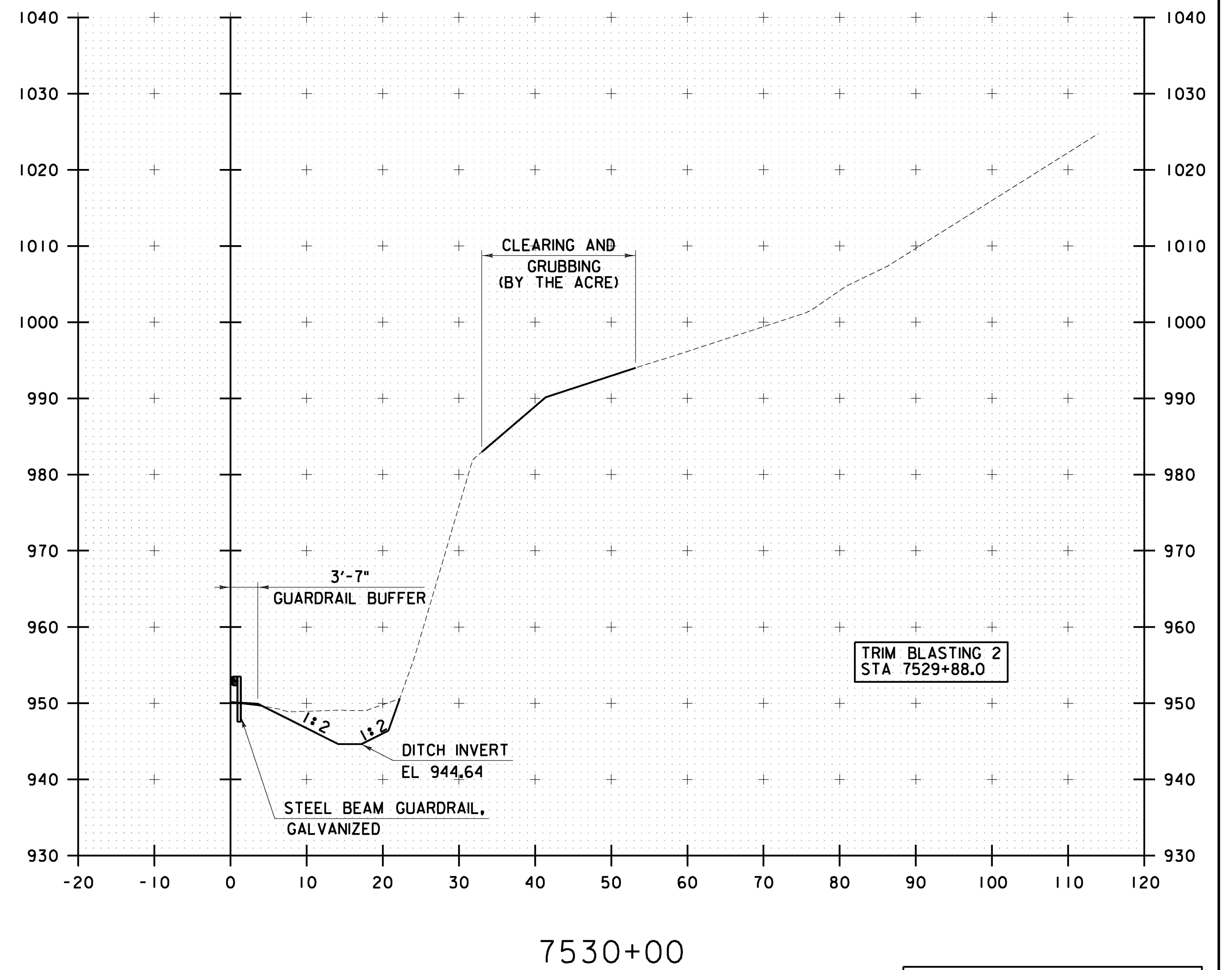
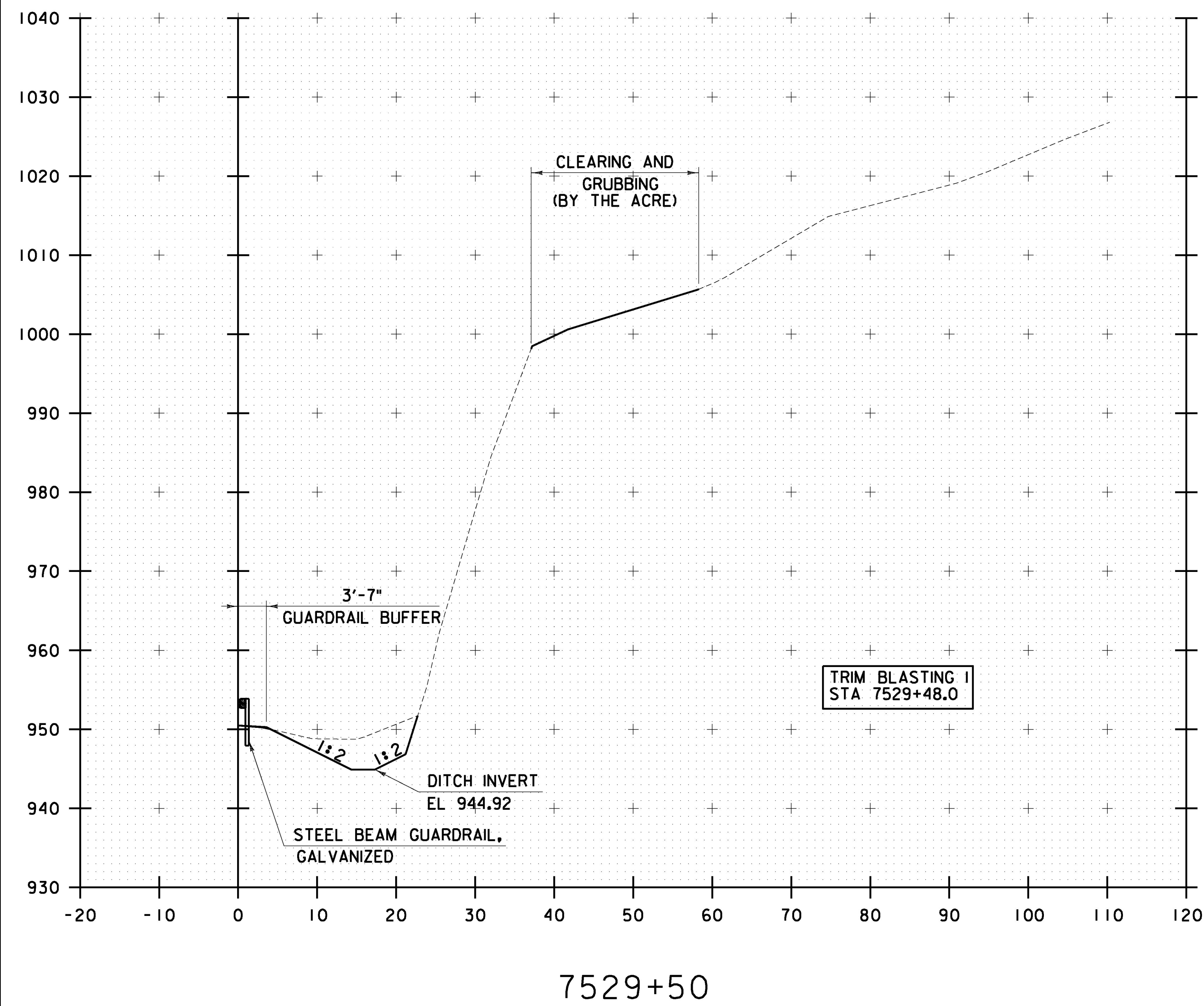
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PROJECT NUMBER: IM 091-3(51)	
FILE NAME: z13a370xsc.dgn	PLOT DATE: 12/13/2016
PROJECT LEADER: D. GOZALKOWSKI	DRAWN BY: J. HEALD
DESIGNED BY: J. OLSEN	CHECKED BY: J. SHIELDS
CROSS SECTIONS SHEET 4	SHEET 27 OF 35



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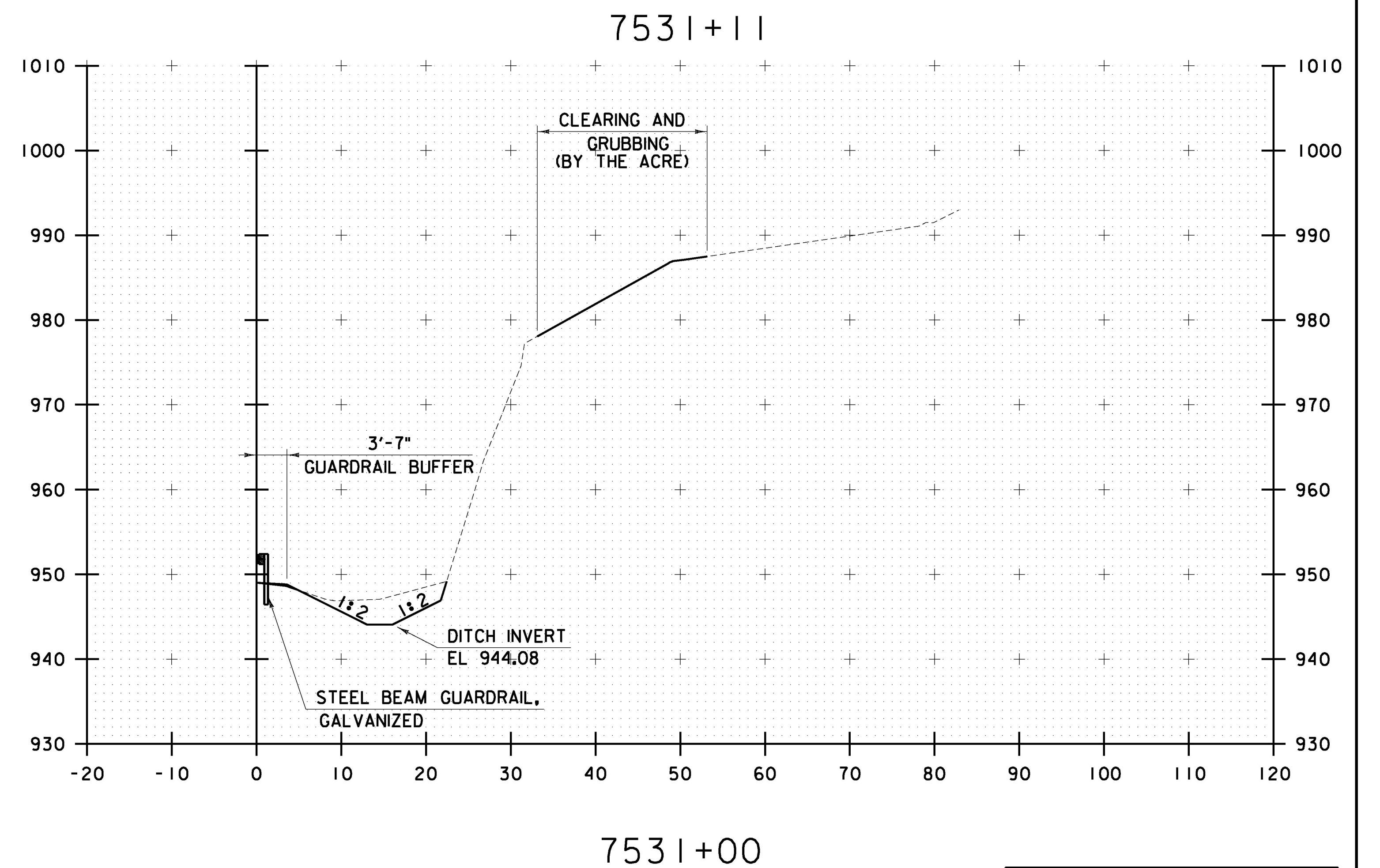
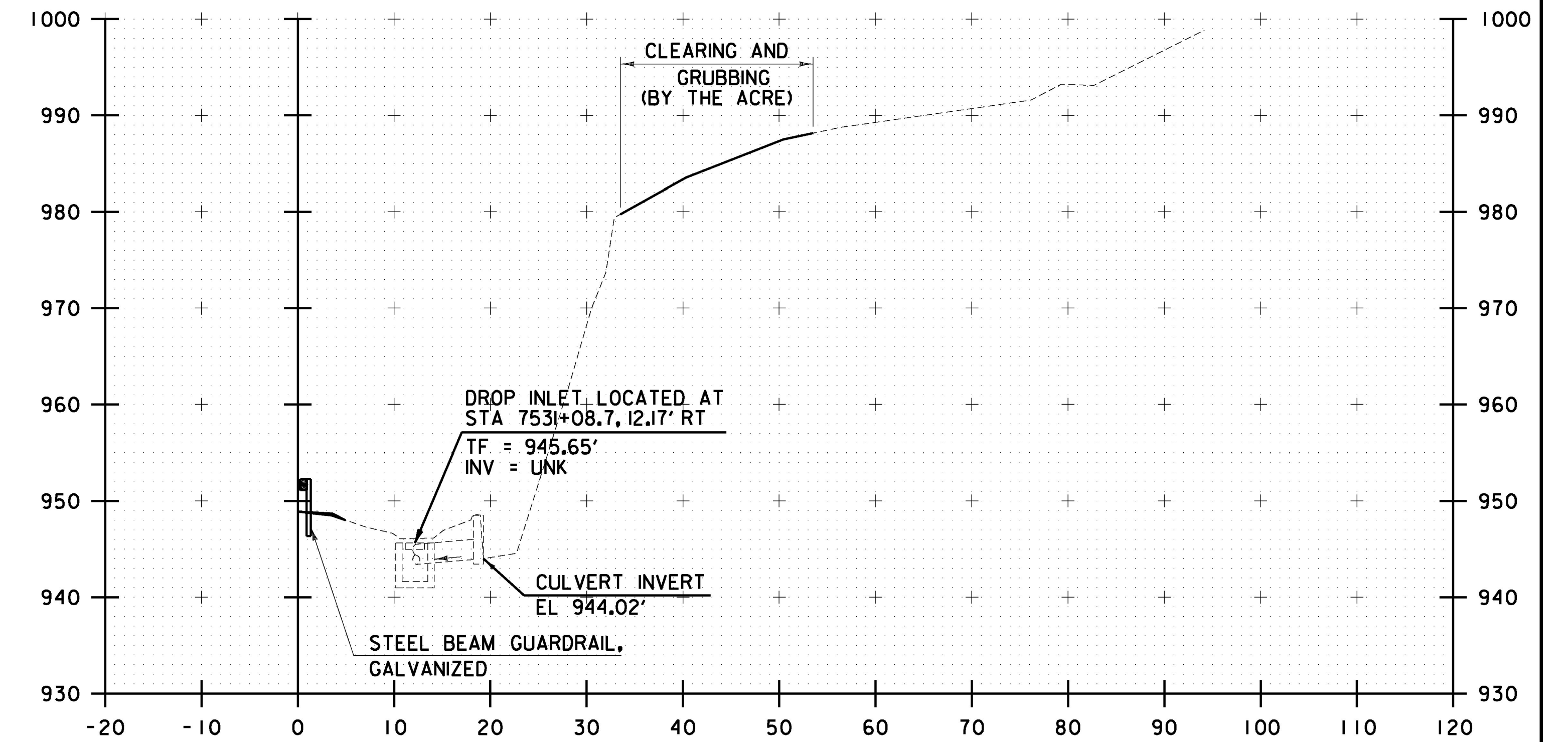
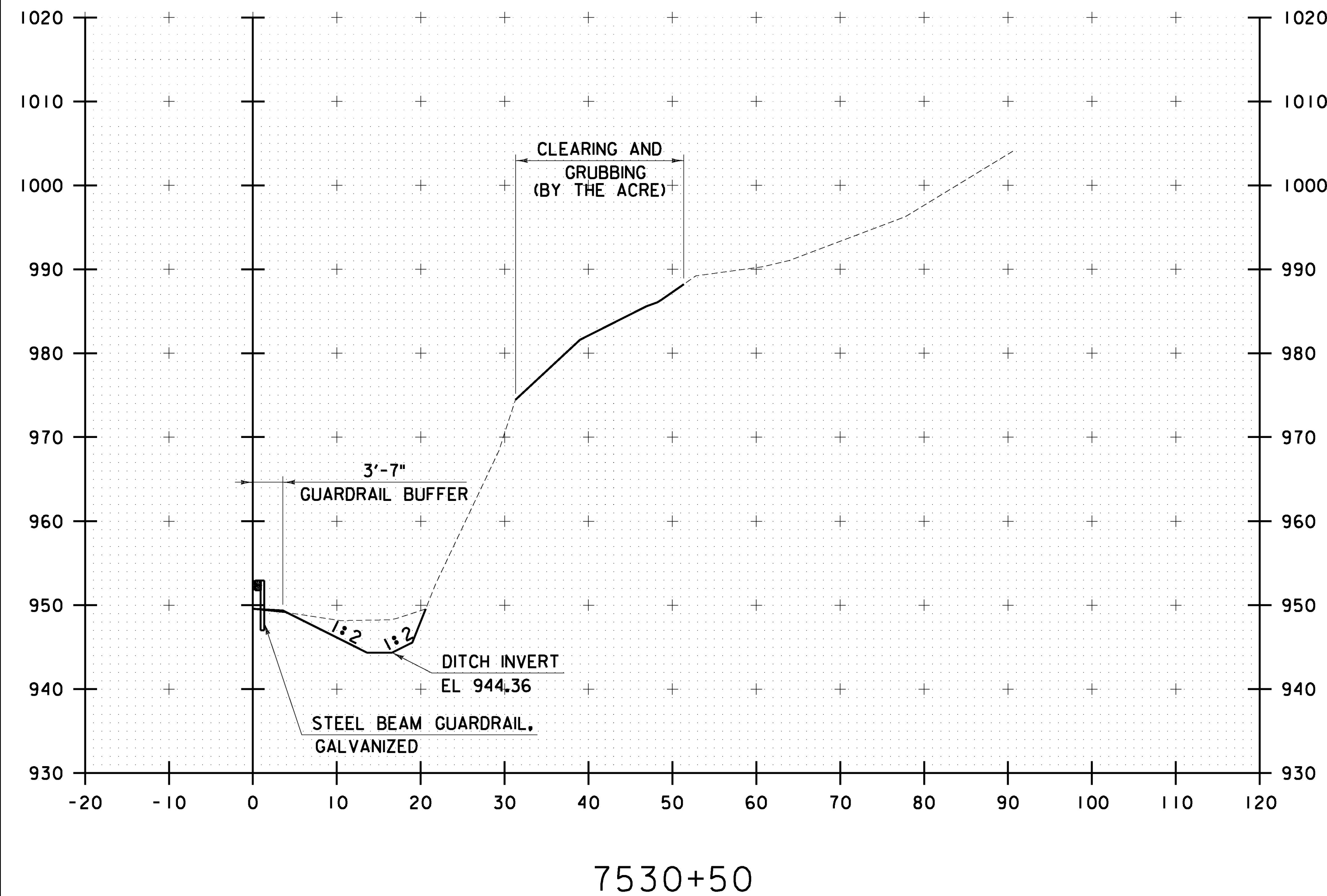
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PROJECT NUMBER: IM 091-3(51)	
FILE NAME: z13a370xsc.dgn	PLOT DATE: 12/13/2016
PROJECT LEADER: D. GOZALKOWSKI	DRAWN BY: J. HEALD
DESIGNED BY: J. OLSEN	CHECKED BY: J. SHIELDS
CROSS SECTIONS SHEET 5	SHEET 28 OF 35



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STA. 7530+50 TO STA. 7531+11

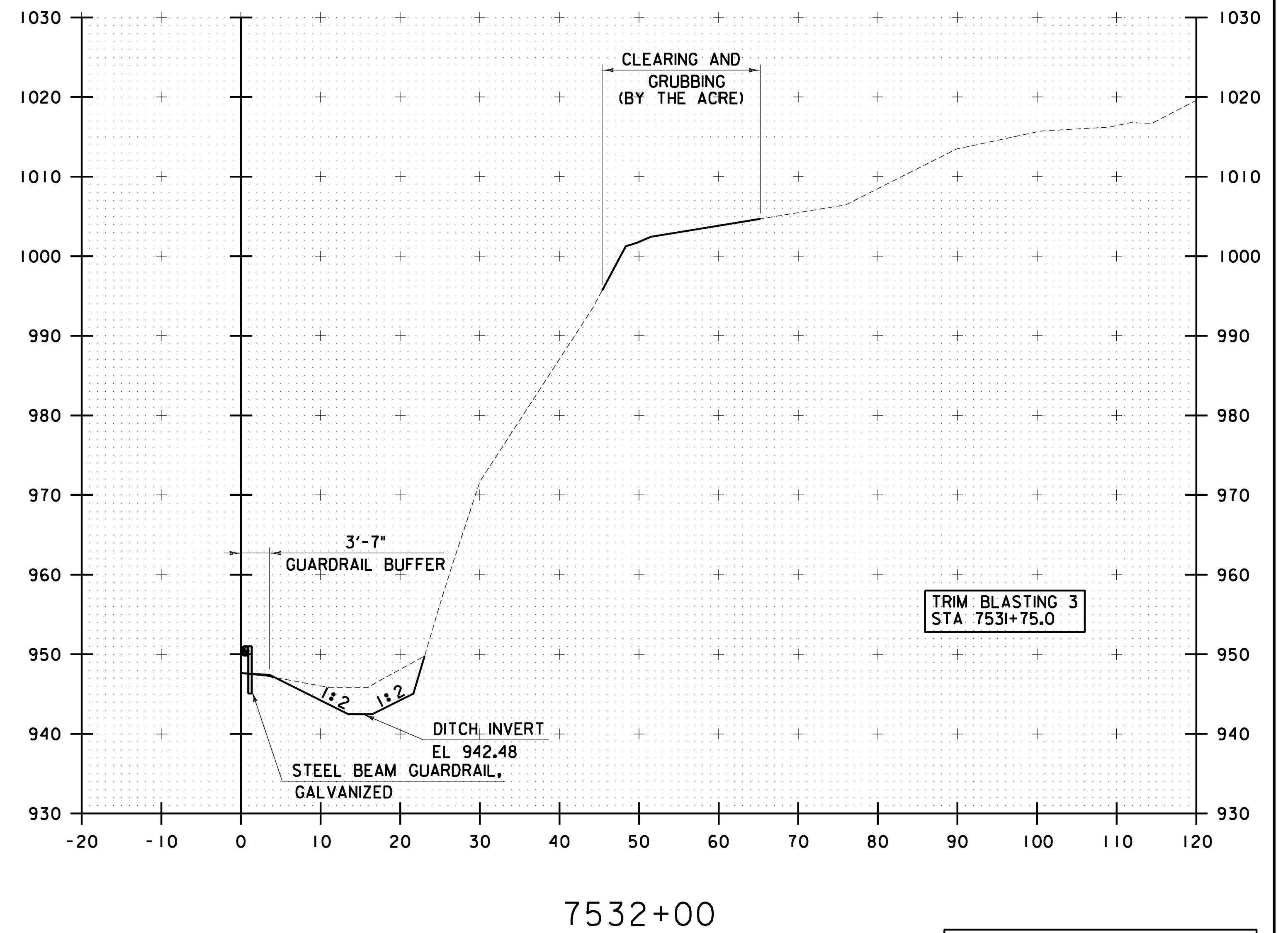
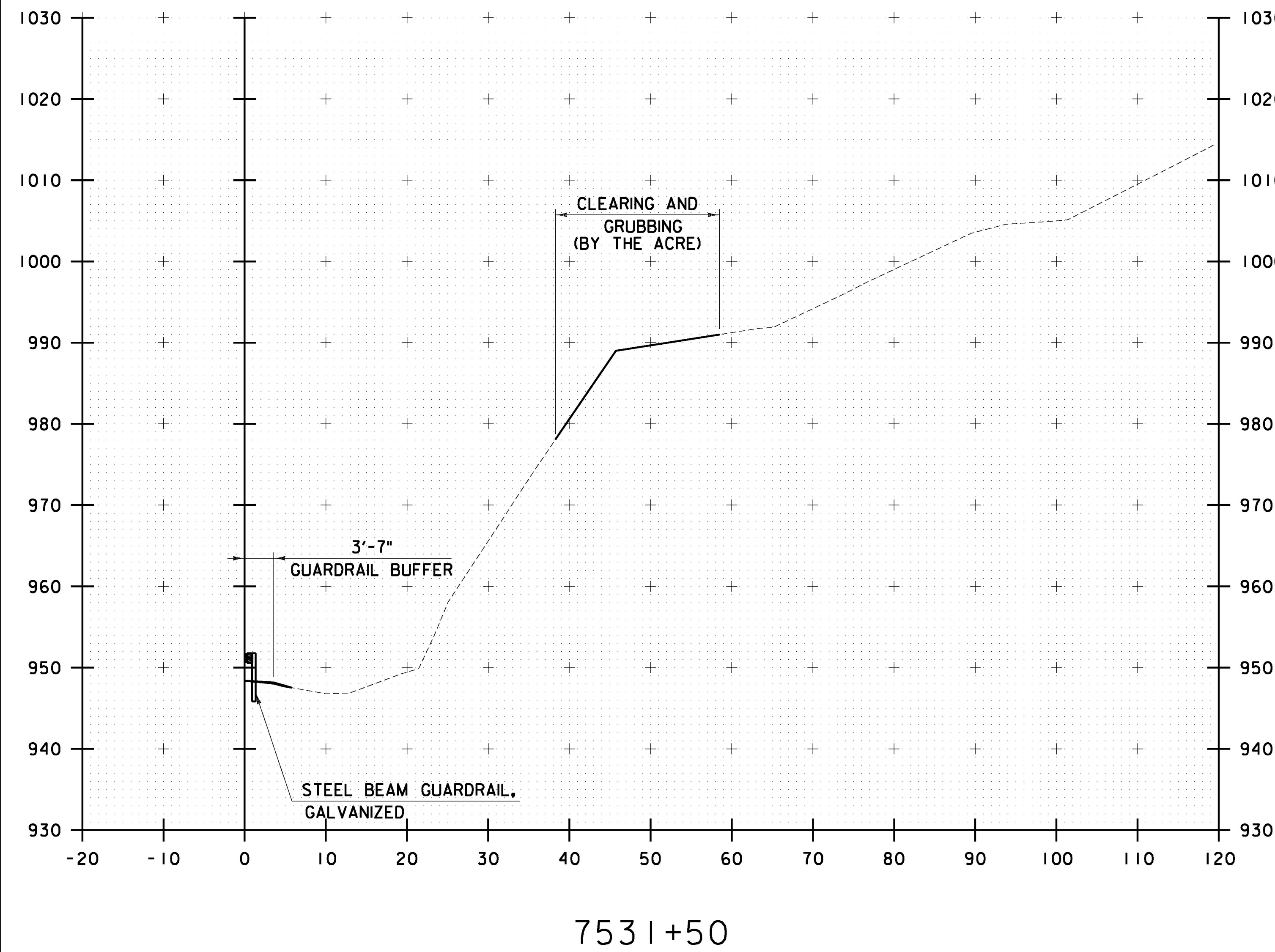
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PROJECT NUMBER: IM 091-3(51)	DRAWN BY: J. HEALD
FILE NAME: 213a370xsc.dgn	CHECKED BY: J. SHIELDS
PROJECT LEADER: D. GOZALKOWSKI	SHEET 29 OF 35
DESIGNED BY: J. OLSEN	
CROSS SECTIONS SHEET 6	



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STA. 7531+50 TO STA. 7532+00

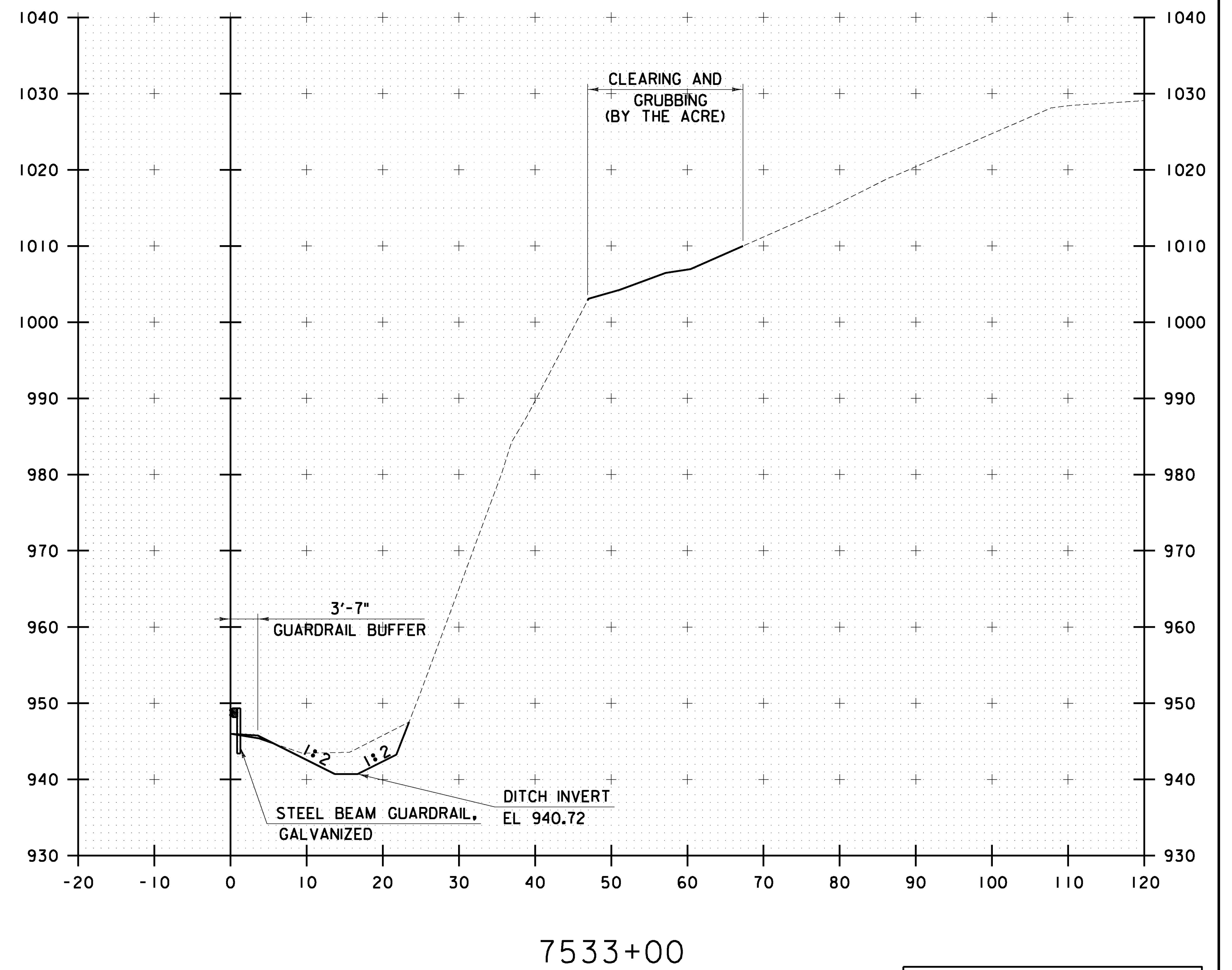
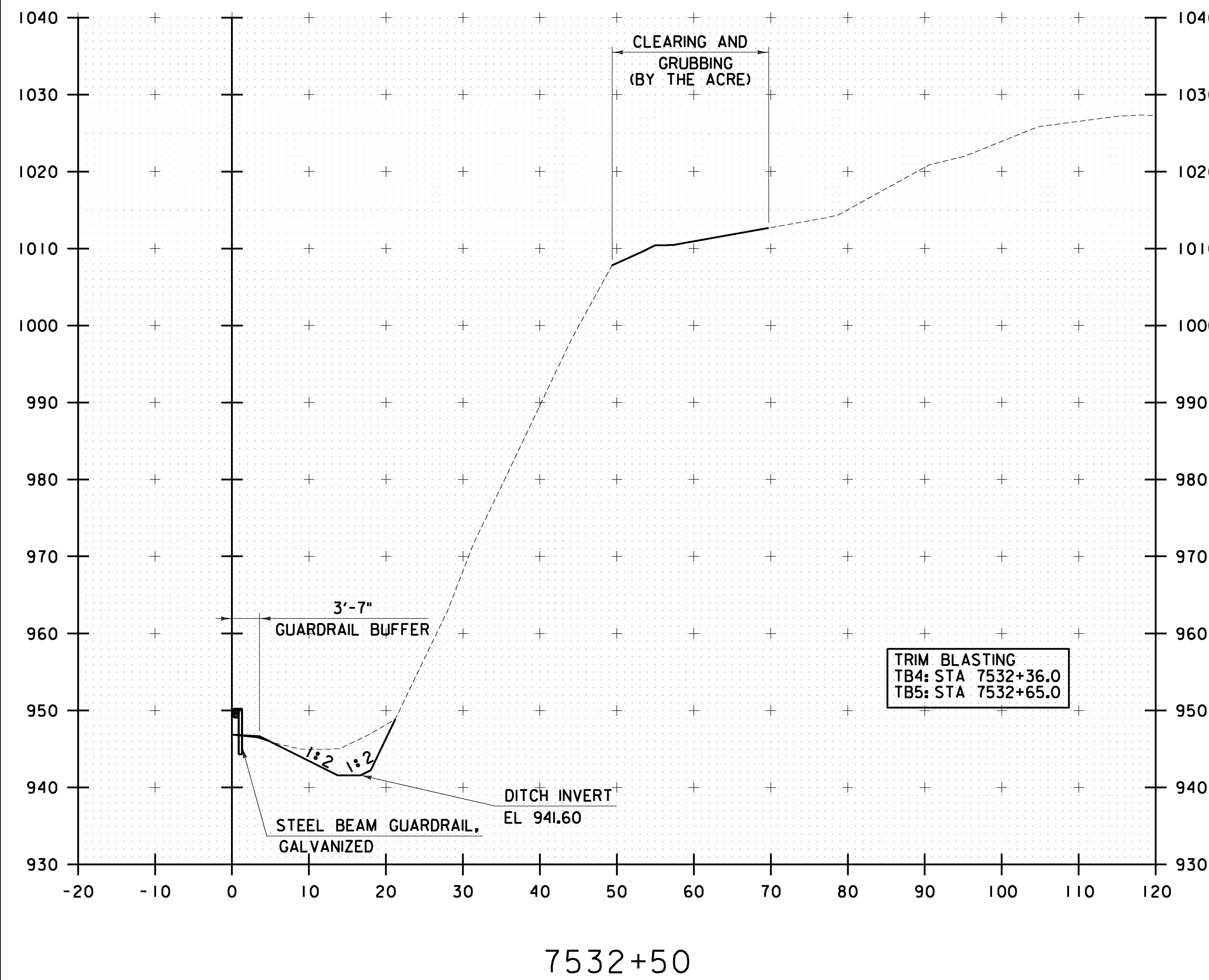
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PROJECT NUMBER: IM 091-3(51)	
FILE NAME: z13a370xsc.dgn	PLOT DATE: 12/13/2016
PROJECT LEADER: D. GOZALKOWSKI	DRAWN BY: J. HEALD
DESIGNED BY: J. OLSEN	CHECKED BY: J. SHIELDS
CROSS SECTIONS SHEET 7	SHEET 30 OF 35



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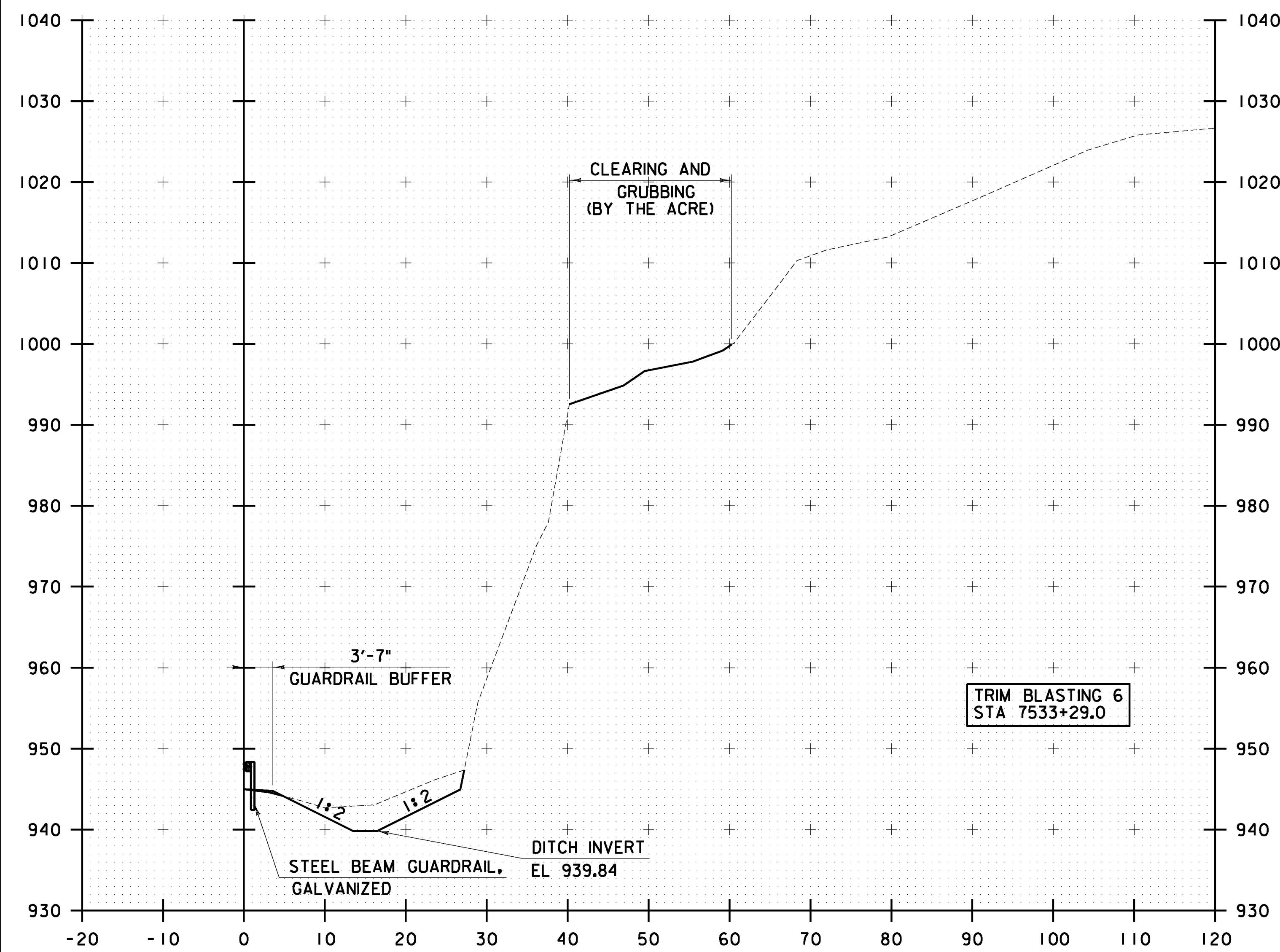
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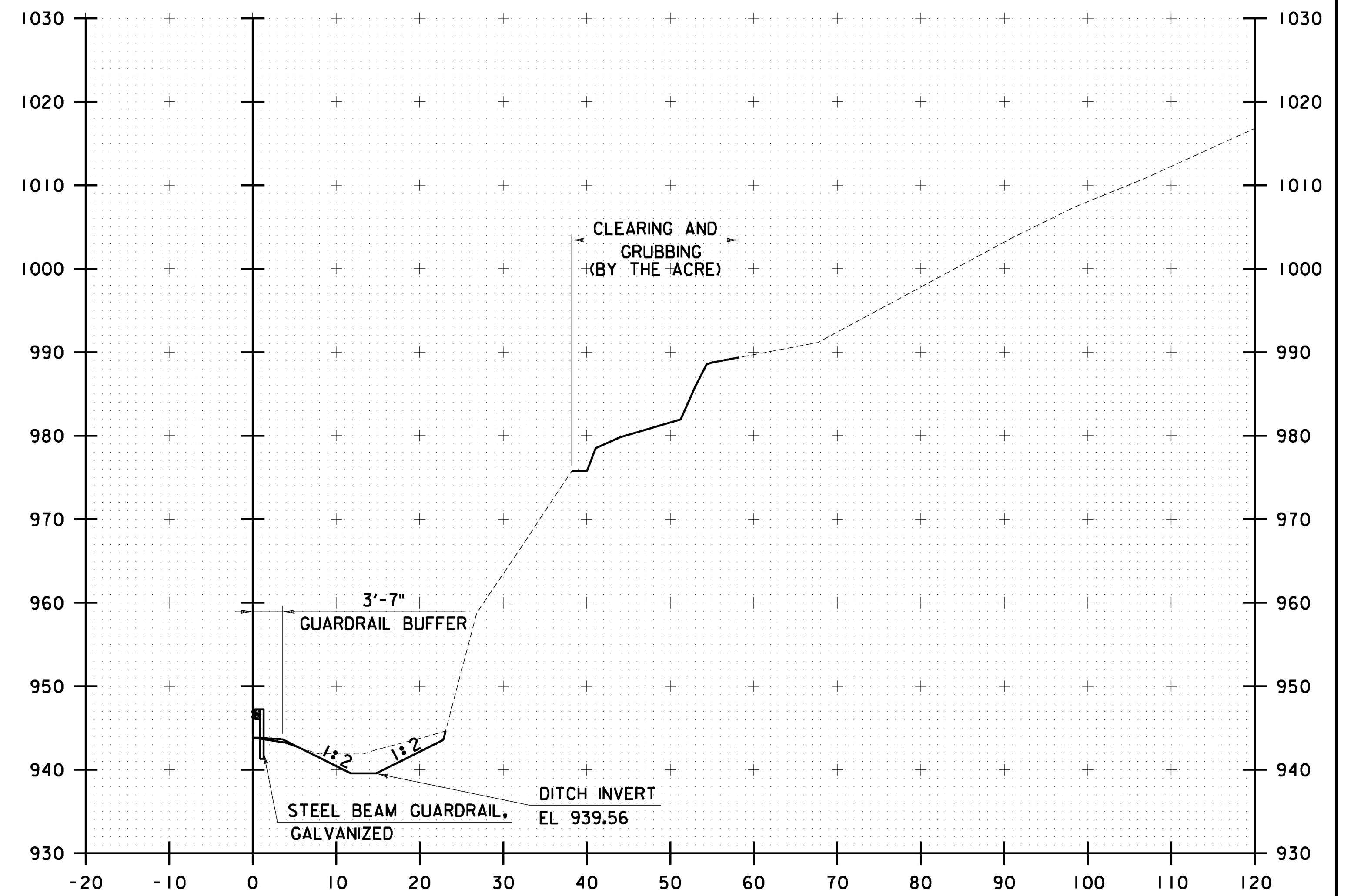
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PROJECT LEADER: D. GOZALKOWSKI	DRAWN BY: J. HEALD
DESIGNED BY: J. OLSEN	CHECKED BY: J. SHIELDS
CROSS SECTIONS SHEET 8	SHEET 31 OF 35



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DATE/TIME = 12/13/2016  
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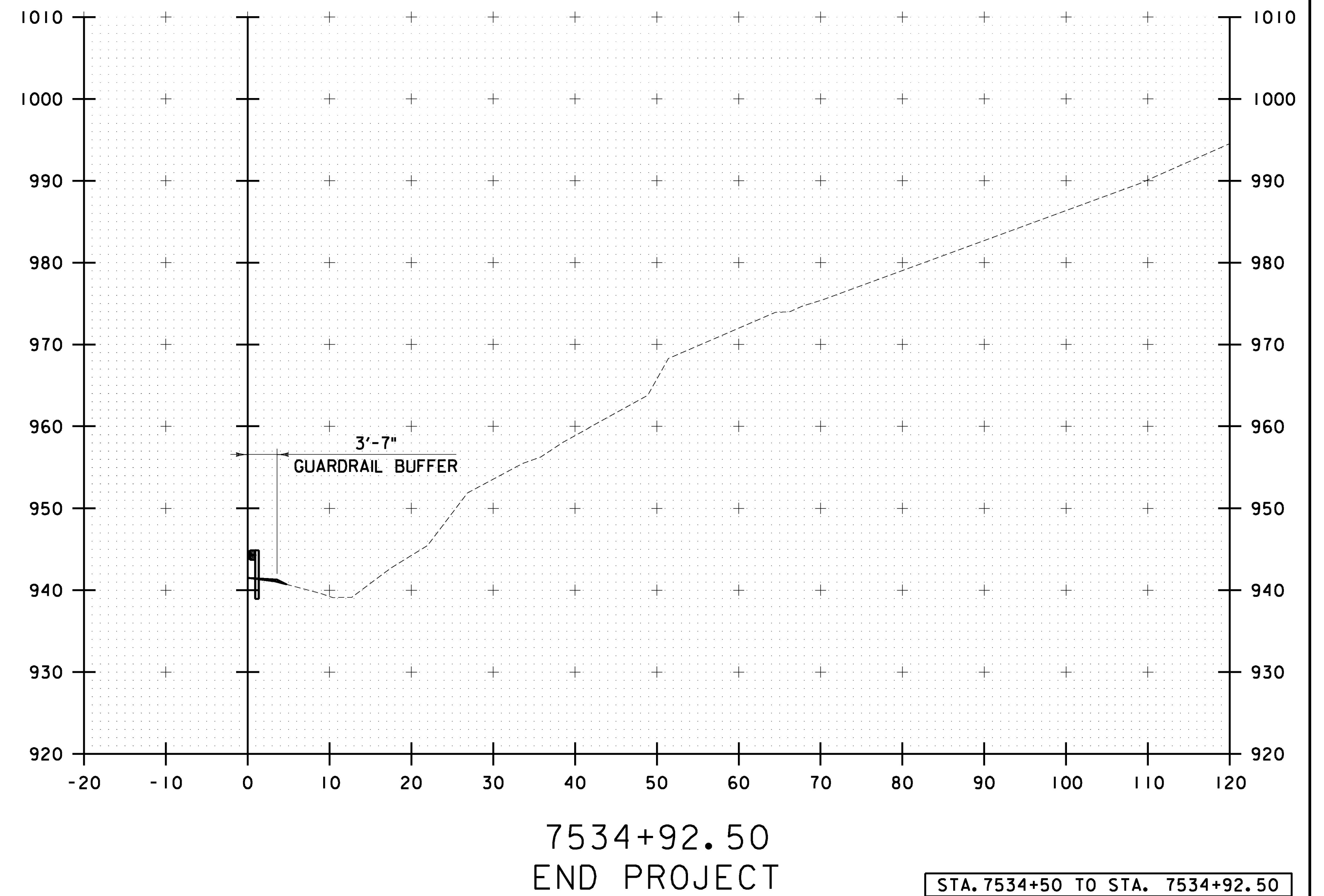
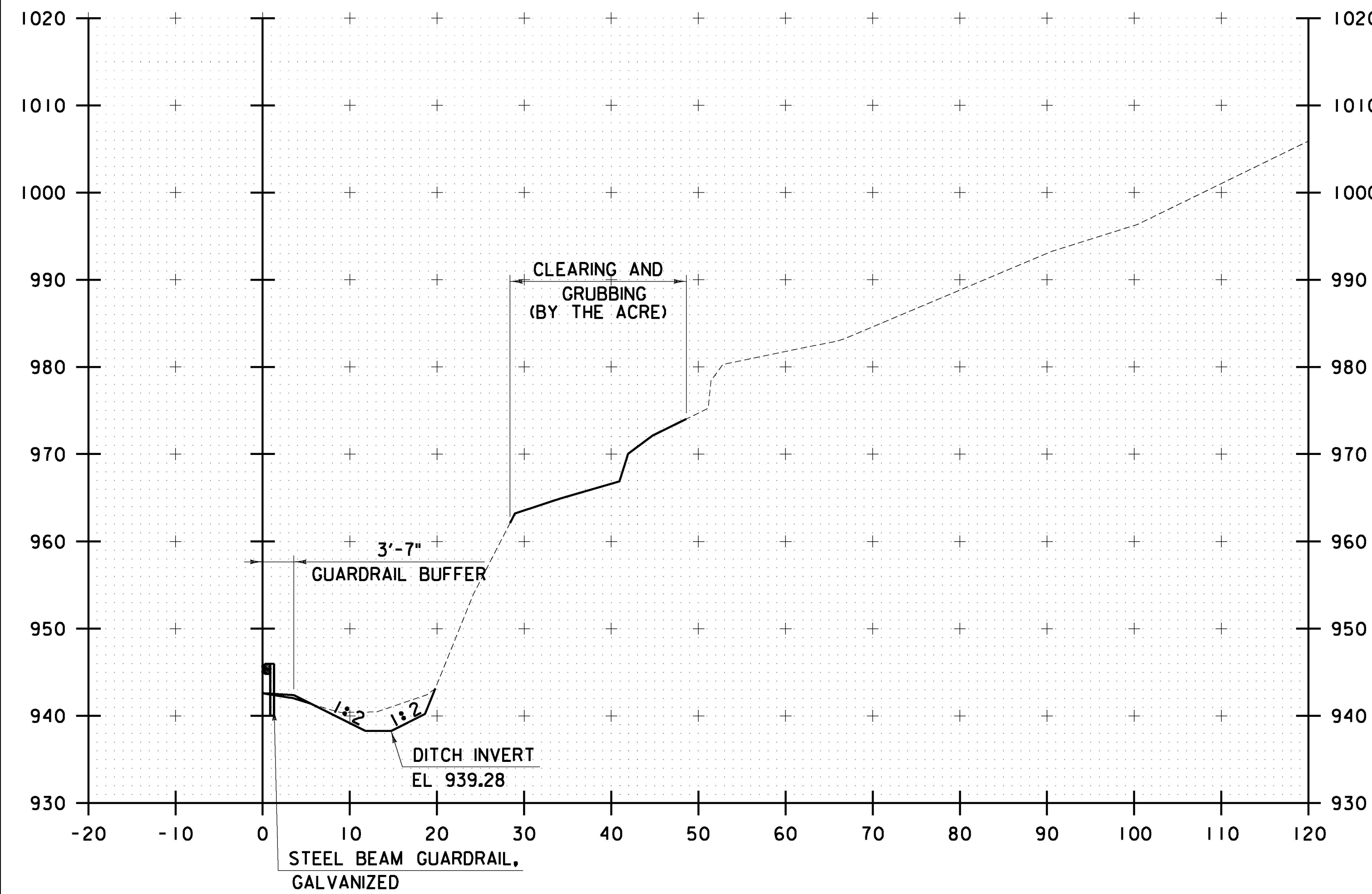
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PROJECT NAME: LYNDON	
PROJECT NUMBER: IM 091-3(51)	
FILE NAME: z13a370xsc.dgn	PLOT DATE: 12/13/2016
PROJECT LEADER: D. GOZALKOWSKI	DRAWN BY: J. HEALD
DESIGNED BY: J. OLSEN	CHECKED BY: J. SHIELDS
CROSS SECTIONS SHEET 9	SHEET 32 OF 35



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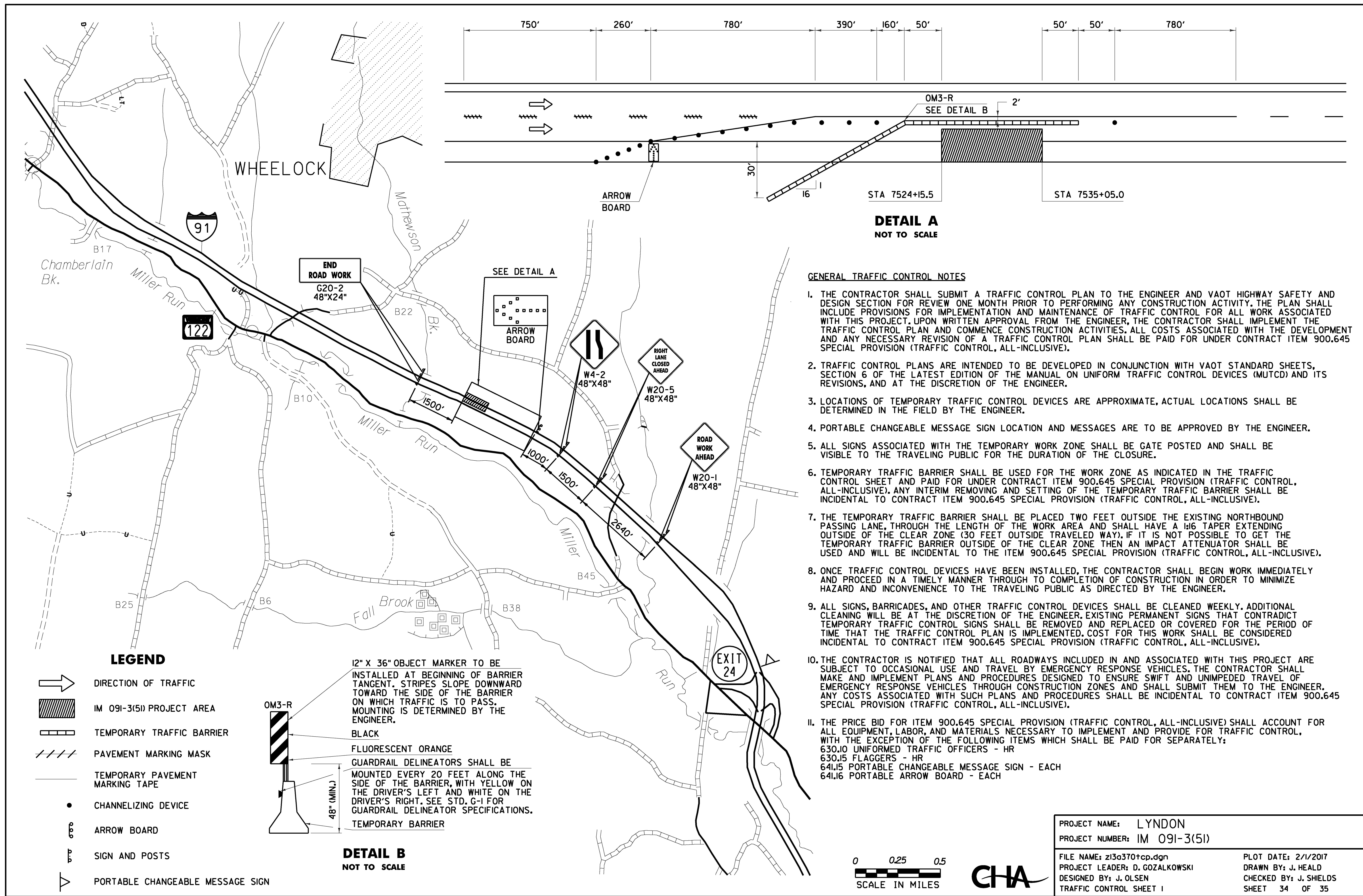


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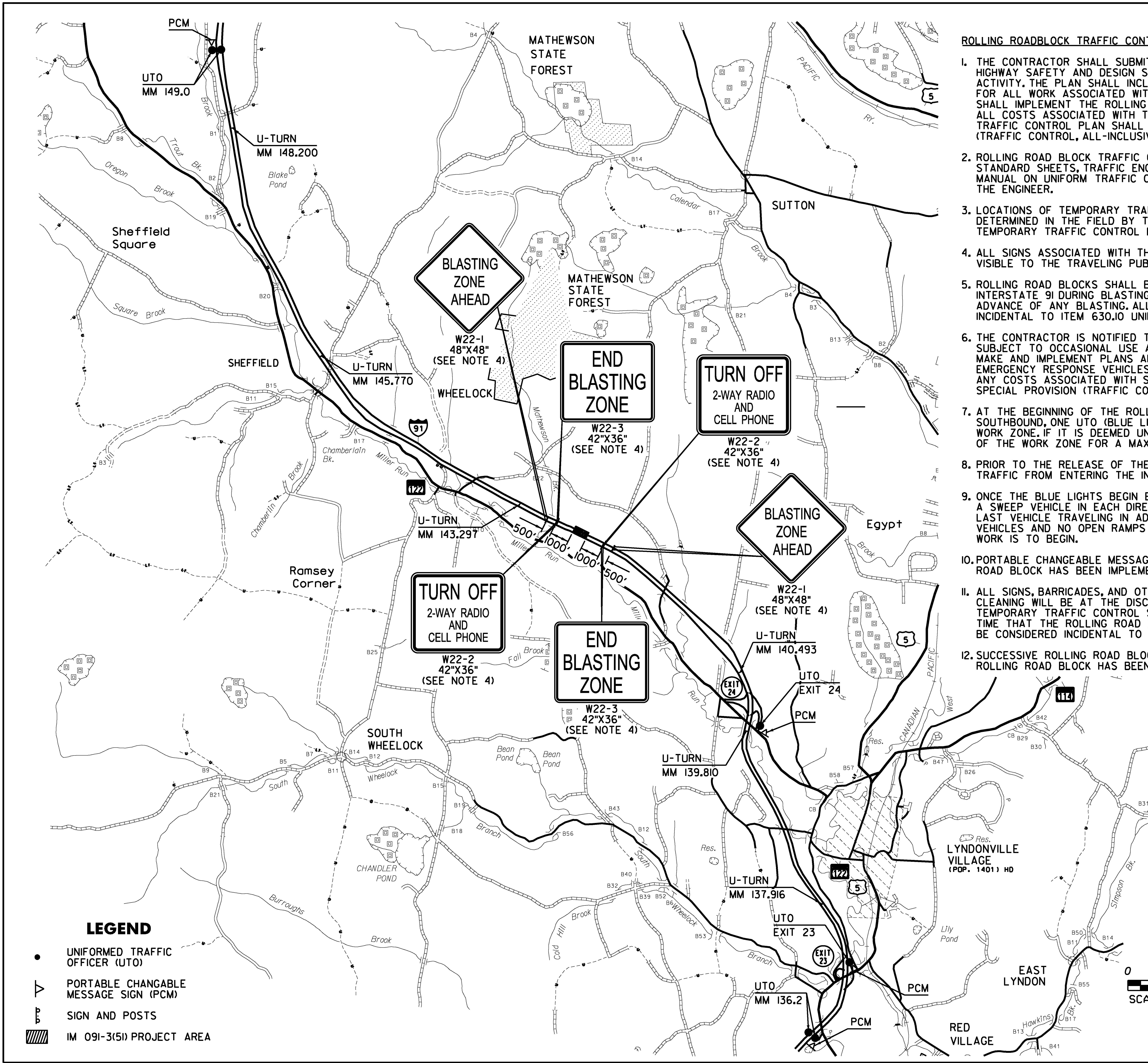
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PROJECT NAME: LYNDON	
PROJECT NUMBER: IM 091-3(51)	
FILE NAME: z13a370xsc.dgn	PLOT DATE: 12/13/2016
PROJECT LEADER: D. GOZALKOWSKI	DRAWN BY: J. HEALD
DESIGNED BY: J. OLSEN	CHECKED BY: J. SHIELDS
CROSS SECTIONS SHEET 10	SHEET 33 OF 35









**ROLLING ROADBLOCK TRAFFIC CONTROL NOTES**

1. THE CONTRACTOR SHALL SUBMIT A ROLLING ROAD BLOCK TRAFFIC CONTROL PLAN TO THE ENGINEER AND VAOT HIGHWAY SAFETY AND DESIGN SECTION FOR REVIEW ONE MONTH PRIOR TO PERFORMING ANY CONSTRUCTION ACTIVITY. THE PLAN SHALL INCLUDE PROVISIONS FOR IMPLEMENTATION AND MAINTENANCE OF TRAFFIC CONTROL FOR ALL WORK ASSOCIATED WITH THIS PROJECT. UPON WRITTEN APPROVAL FROM THE ENGINEER, THE CONTRACTOR SHALL IMPLEMENT THE ROLLING ROAD BLOCK TRAFFIC CONTROL PLAN AND COMMENCE CONSTRUCTION ACTIVITIES. ALL COSTS ASSOCIATED WITH THE DEVELOPMENT AND ANY NECESSARY REVISION OF A ROLLING ROAD BLOCK TRAFFIC CONTROL PLAN SHALL BE PAID FOR UNDER CONTRACT ITEM 900.645 SPECIAL PROVISION (TRAFFIC CONTROL, ALL-INCLUSIVE).
2. ROLLING ROAD BLOCK TRAFFIC CONTROL PLANS ARE INTENDED TO BE DEVELOPED IN CONJUNCTION WITH VAOT STANDARD SHEETS, TRAFFIC ENGINEERS INSTRUCTIONS (TEI) 16-601, SECTION 6 OF THE LATEST EDITION OF THE MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES (MUTCD) AND ITS REVISIONS, AND AT THE DISCRETION OF THE ENGINEER.
3. LOCATIONS OF TEMPORARY TRAFFIC CONTROL DEVICES ARE APPROXIMATE, ACTUAL LOCATIONS SHALL BE DETERMINED IN THE FIELD BY THE ENGINEER. ADJUSTMENTS MAY BE NEEDED TO ACCOUNT FOR OTHER TEMPORARY TRAFFIC CONTROL DEVICES ALREADY SET IN PLACE.
4. ALL SIGNS ASSOCIATED WITH THE ROLLING ROAD BLOCK SHALL BE GATE POSTED AND SHALL BE VISIBLE TO THE TRAVELING PUBLIC FOR THE DURATION OF THE ESCORT.
5. ROLLING ROAD BLOCKS SHALL BE UTILIZED ON BOTH THE NORTHBOUND AND SOUTHBOUND BARRELS OF INTERSTATE 91 DURING BLASTING OPERATIONS AND UNIFORMED TRAFFIC OFFICERS (UTO'S) SHALL BE NOTIFIED IN ADVANCE OF ANY BLASTING. ALL COSTS ASSOCIATED WITH THE ROLLING ROAD BLOCKS WILL BE CONSIDERED INCIDENTAL TO ITEM 630.10 UNIFORMED TRAFFIC OFFICERS.
6. THE CONTRACTOR IS NOTIFIED THAT ALL ROADWAYS INCLUDED IN AND ASSOCIATED WITH THIS PROJECT ARE SUBJECT TO OCCASIONAL USE AND TRAVEL BY EMERGENCY RESPONSE VEHICLES. THE CONTRACTOR SHALL MAKE AND IMPLEMENT PLANS AND PROCEDURES DESIGNED TO ENSURE SWIFT AND UNIMPEDED TRAVEL OF EMERGENCY RESPONSE VEHICLES THROUGH CONSTRUCTION ZONES AND SHALL SUBMIT THEM TO THE ENGINEER. ANY COSTS ASSOCIATED WITH SUCH PLANS AND PROCEDURES SHALL BE INCIDENTAL TO CONTRACT ITEM 900.645 SPECIAL PROVISION (TRAFFIC CONTROL, ALL-INCLUSIVE).
7. AT THE BEGINNING OF THE ROLLING ROAD BLOCK, MILE MARKER 136.2 NORTHBOUND AND MILE MARKER 149.0 SOUTHBOUND, ONE UTO (BLUE LIGHTS FLASHING) PER LANE SHALL BEGIN ESCORTING TRAFFIC TOWARD THE WORK ZONE. IF IT IS DEEMED UNSAFE FOR TRAFFIC TO PASS, THE ESCORT SHALL STOP 1500 FEET IN ADVANCE OF THE WORK ZONE FOR A MAXIMUM OF TEN MINUTES.
8. PRIOR TO THE RELEASE OF THE BLUE LIGHT ESCORT, UTO'S STATIONED AT RAMP LOCATIONS WILL STOP ALL TRAFFIC FROM ENTERING THE INTERSTATE.
9. ONCE THE BLUE LIGHTS BEGIN ESCORTING THE TRAFFIC TO THE WORK AREA, THE CONTRACTOR SHALL PROVIDE A SWEEP VEHICLE IN EACH DIRECTION OF TRAVEL WITH AMBER STROBE LIGHTS ACTIVATED TO FOLLOW THE LAST VEHICLE TRAVELING IN ADVANCE OF THE ROLLING ROAD BLOCK TO ENSURE THERE ARE NO PARKED VEHICLES AND NO OPEN RAMPS OR OTHER ACCESS POINTS AND THAT THE ROADWAY IS CLEAR BEFORE THE WORK IS TO BEGIN.
10. PORTABLE CHANGEABLE MESSAGE SIGN LOCATION AND MESSAGES, PRIOR TO, DURING, AND AFTER THE ROLLING ROAD BLOCK HAS BEEN IMPLEMENTED ARE TO BE APPROVED BY THE ENGINEER.
11. ALL SIGNS, BARRICADES, AND OTHER TRAFFIC CONTROL DEVICES SHALL BE CLEANED WEEKLY. ADDITIONAL CLEANING WILL BE AT THE DISCRETION OF THE ENGINEER. EXISTING PERMANENT SIGNS THAT CONTRADICT TEMPORARY TRAFFIC CONTROL SIGNS SHALL BE REMOVED AND REPLACED OR COVERED FOR THE PERIOD OF TIME THAT THE ROLLING ROAD BLOCK TRAFFIC CONTROL PLAN IS IMPLEMENTED. COST FOR THIS WORK SHALL BE CONSIDERED INCIDENTAL TO CONTRACT ITEM 900.645 SPECIAL PROVISION (TRAFFIC CONTROL, ALL-INCLUSIVE).
12. SUCCESSIVE ROLLING ROAD BLOCKS SHOULD NOT BE STARTED UNTIL THE TRAFFIC FROM THE PRECEDING ROLLING ROAD BLOCK HAS BEEN SUFFICIENTLY CLEARED FROM THE WORK LOCATION.

ROLLING ROADBLOCK ADVANCE SIGNING	
ROAD WORK AHEAD	
TRAFFIC STOPPED 2 MILES	
REDUCE SPEED AHEAD	
TRAFFIC STOPPED 1 MILE	
BE PREPARED TO STOP	
STOP AHEAD (SYMBOL)	

**LEGEND**

- UNIFORMED TRAFFIC OFFICER (UTO)
- △ PORTABLE CHANGABLE MESSAGE SIGN (PCM)
- ▲ SIGN AND POSTS
- IM 091-3(51) PROJECT AREA

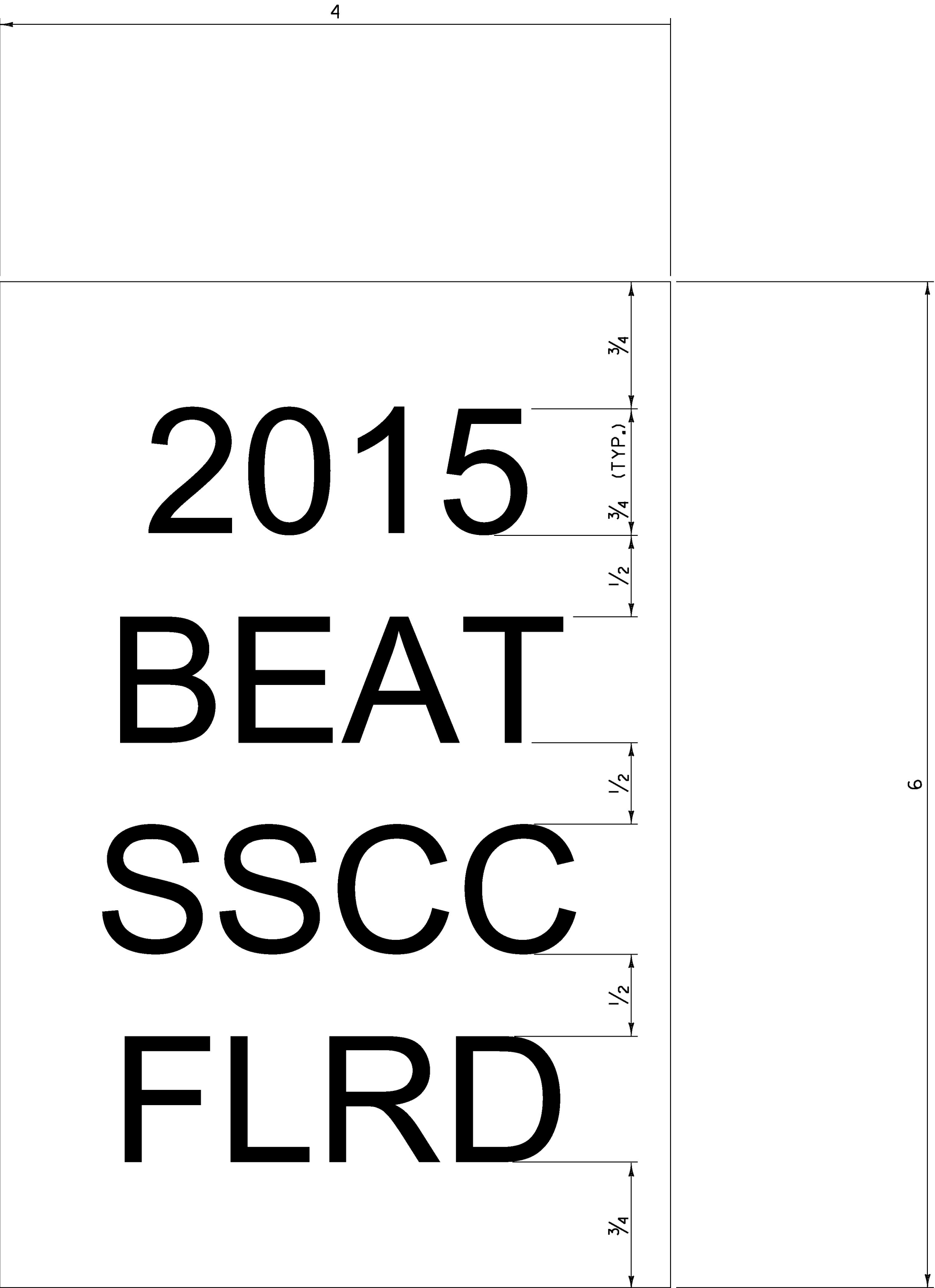
PROJECT NAME: LYNDON  
PROJECT NUMBER: IM 091-3(51)

FILE NAME: z13a370tcp.dgn  
PROJECT LEADER: D. GOZALKOWSKI  
DESIGNED BY: J. OLSEN  
TRAFFIC CONTROL SHEET 2

PLOT DATE: 1/30/2017  
DRAWN BY: J. HEALD  
CHECKED BY: J. SHIELDS  
SHEET 35 OF 35

CHA





**GENERAL NOTES:**

1. LINE ONE SHALL INDICATE THE INSTALLATION YEAR (YYYY).
2. LINE TWO SHALL INDICATE THE MODEL AS IDENTIFIED ON THE APPROVED PRODUCTS LIST. FOR GENERIC INSTALLATIONS THE STANDARD DRAWING DESIGNATION OR NAME AS IDENTIFIED IN THE FHWA ELIGIBILITY LETTER SHALL BE USED.
3. LINE THREE SHALL SHALL INDICATE ADDITIONAL MODEL INFORMATION IF NECESSARY.
4. LINE FOUR SHALL INDICATE FLARED (FLRD) OR TANGENT (TANG).
5. LEGEND SHALL BE ONE ARIEL FONT.
6. LEGEND SHALL BE BLACK ON A WHITE BACKGROUND, LENGEND AND BACKGROUND SHALL NOT BE REFLECTIVE.
7. SUITABLE MATERIAL SHALL BE USED SO AS TO NOT DETERIORATE DURING EXPOSURE TO WEATHER.
8. LABELS SHALL BE APPLIED IN SUCH A WAY THAT THEY REMAIN INTACT DURING THE LIFE OF THE TERMINAL.
9. FOR W-BEAM GUARDRAIL, LABEL SHALL BE PLACED ON THE TOP OF POST ONE FACING AWAY FROM TRAFFIC.
10. FOR BOX BEAM GUARDRAIL, LABEL SHALL BE PLACED ON THE BOX BEAM ADJACENT TO POST ONE FACING AWAY FROM TRAFFIC.
11. PAYMENT SHALL BE INCIDENTAL TO OTHER TRAFFIC BARRIER ITEMS.
12. ALL DIMENSIONS IN INCHES.

REV.	DATE	DESCRIPTION
0	NOV. 3, 2015	ORIGINAL APPROVAL
OTHER DETAILS REQUIRED: NONE		
DETAILS APPROVED FOR USE BY HIGHWAY SAFETY & DESIGN		

GUARDRAIL TERMINAL LABEL DETAIL



HIGHWAY SAFETY  
& DESIGN DETAIL  
HSD - 621.06



# 400 – 1500 cfm

Portable High-Pressure Air Compressors



Doosan Infracore  
Portable Power





**Doosan Infracore**  
Portable Power

## Compressor technology that sets the standard

Doosan Portable Power offers the right level of technology, from years of proven direct engine control to our innovative microcontroller and more. We listen to our customers and design our product to meet those demands. We utilize mechanical control of the inlet and oil temperature valve for maximum durability that performs in the harshest conditions. The backlit gauges on the panel are intuitively placed, the layout of the cool-box design allows quick service and the paint quality, weld strength and reliability are just some of the things that enhance your product experience. The running gear system is designed with life extending features that provide security mile after mile. No wonder Doosan Portable Power sets the standard by which others are measured.



### Performance features (WCAT)

- 110% fluid containment base (except XHP750)
- 1-year/2,000-hour warranty package
- 2-year/4,000-hour airend warranty is standard, extended to 5-year/10,000-hour warranty when genuine filters, fluids and parts from an authorized Doosan Portable Power dealer are used at the prescribed maintenance intervals
- 500-hour engine oil service/1,000-hour airend oil service warranty
- Automatic safety shutdowns for high discharge air temp, low engine oil pressure, high engine coolant temp and low fuel level
- Central drains included (drains for XHP750 are optional)
- Construction-grade pedestal jack stand
- Easy access for service maintenance of coolers and filters
- Fuel/water separator as primary filtration
- Galvanneal sheet metal enclosure
- Heavy-duty A-frame detachable drawbar with adjustable pintle eye
- Microprocessor-controlled engine with optimal compressor performance and diagnostics

## The highest density commercialized portable compressors available

### XHP open frame models

- XHP1170FCAT
- XXHP1270/XHP1500FCAT

### Available options (factory-installed WCAT)

- Aftercoolers plus water separator with 20 degree F approach temperature (25 degree F on XHP750)
- Automatic engine oil replenishment system
- Automatic start/stop controller with remote start
- Battery trickle charger sealed for drill environment durability
- Cold-start kit includes heaters for engine block, engine oil pan and batteries
- Emergency stop
- IQ System® consists of aftercooler plus particulate and coalescing filters with a patented condensate disposal system for cleaner, Instrument Quality air (low ambient system included with aftercooler blowdown, airflow control and orifice heaters for operation at any temperature)
- Less running gear includes isolation mounts for truck or trailer or permanent pad installation





	MODEL	VHP400WJD	VHP750WCAT	XHP750WCAT
Compressor	Free-Air Delivery – cfm (m³/min)	400 (11.3)	750 (21.2)	750 (21.2)
	Rated Operating Pressure – psi (bar)	200 (13.8)	200 (13.8)	300 (21)
	Pressure Range – psi (bar)	80 – 225 (5.5 – 15.5)	80 – 225 (5.5 – 15.5)	140 – 325 (9.65 – 22.4)
	Air Discharge Outlet NPT Size – in (mm)	2.0 (50.8)	2.0 (50.8)	2.0 (50.8)
	Air Discharge Outlet Quantity	1	1	1
	Compressor Oil Capacity – gal (L)	12 (45.4)	18.5 (70)	19.8 (75)
Engine	Make/Model	John Deere/6068H	Caterpillar/C9	Caterpillar/C9
	Emissions Tier Level	Tier 3	Tier 3	Tier 3
	# of Cylinders	6	6	6
	Displacement – cu in (L)	414 (6.8)	535 (8.8)	535 (8.8)
	Rated Speed – rpm	2200	1800	1800
	Idle Speed – rpm	1500	1350	1350
	Bhp (kW)@ Rated Speed	173 (129)	300 (223.7)	350 (261)
	Electrical – volts/battery qty	24/(2) 1000 CCA	24/(2) 1000 CCA	24/(2) 1000 CCA
	Engine Oil Capacity – qt (L)	8.6 (32.5)	34 (32.1)	34 (32.1)
	Radiator Coolant Capacity – gal (L)	7.0 (26.5)	12.7 (48)	12.7 (48)
	Fuel Tank Capacity – gal (L)	73 (276)	110 (416) Tandem 140 (530) Wagon	110 (416) Tandem 140 (530) Wagon
Dimensions With Running Gear	Overall Length – in (mm)	170 (4318)	163 (4140) Wagon 215 (5461) Tandem	163 (4140) Wagon 215 (5461) Tandem
	Overall Width – in (mm)	78.1 (1984)	79 (2007)	79 (2007)
	Overall Height – in (mm); excluding exh. pipe	76 (1930)	91.2 (2316) Wagon 87.9 (2233) Tandem	91.2 (2316) Wagon 87.9 (2233) Tandem
	Track Width – in (mm)	66.2 (1681)	66.3 (1684) Wagon 68.5 (1740) Tandem	66.3 (1684) Wagon 68.5 (1740) Tandem
	Tire Size	ST235/80R16	7.5-16LT Wagon 8-14.5LT Tandem	7.5-16LT Wagon 8-14.5LT Tandem
	Shipping Weight – lb (kg) no fuel	5133 (2328)	9370 (4250) Wagon 9480 (4300) Tandem	9370 (4250) Wagon 9480 (4300) Tandem
	Working Weight – lb (kg) with fuel	5644 (2560)	10560 (4790) Wagon* 10460 (4745) Tandem*	10560 (4790) Wagon* 10460 (4745) Tandem*
Dimensions Without Running Gear	Overall Length – in (mm)	117 (2972)	153 (3886)	153 (3886)
	Overall Width – in (mm)	61 (1549)	79 (2007)	79 (2007)
	Overall Height – in (mm)	56.9 (1443)	80.4 (2042)	80.4 (2042)
	Shipping Weight – lb (kg) no fuel	4565 (2070)	9120 (4137)	9120 (4137)
	Working Weight – lb (kg) with fuel	5000 (2268)	10110 (4586)	10110 (4586)
	MODEL	XHP1170WCAT	XHP1170FCAT	XXHP1270-XHP1500FCAT
Compressor	Free-Air Delivery – cfm (m³/min)	1170 (33.1)	1170 (33.1)	1270 (36) – 1500 (42.5)
	Rated Operating Pressure – psi (bar)	350 (24.1)	350 (24.1)	500 (34.5) – 350 (24.1)
	Pressure Range – psi (bar)	150 – 375 (10.3 – 25.9)	150 – 375 (10.3 – 25.9)	175 – 375 (12.1 – 25.9) 400 – 525 (27.8 – 36.2)
	Air Discharge Outlet NPT Size – in (mm)	3 (76.2)	2 (50.8)	3 (76.2)
	Air Discharge Outlet Quantity	1	1	1
	Compressor Oil Capacity – gal (L)	55 (208)	55 (208)	85 (322)
Engine	Make/Model	Caterpillar/C15	Caterpillar/C15	Caterpillar/C18
	Emissions Tier Level	Tier 3	Tier 3	Tier 3
	# of Cylinders	6	6	6
	Displacement – cu in (L)	923 (15.1)	923 (15.1)	1105 (18.1)
	Rated Speed – rpm	1800	1800	1625/1850
	Idle Speed – rpm	1350	1350	1350
	Bhp (kW)@ Rated Speed	540 (402.7)	540 (402.7)	700 (522)
	Electrical – volts/battery qty	24/(2) 1400 CCA	24/(2) 1400 CCA – Optional	24/(2) 1400 CCA – Optional
	Engine Oil Capacity – qt (L)	42 (40)	42 (40)	50 (47.3)
	Radiator Coolant Capacity – gal (L)	15.2 (57.5)	15.2 (57.5)	13.5 (51.1)
	Fuel Tank Capacity – gal (L)	Tank 1 – 98 (369) Tank 2 – 98 (369) <b>Total – 196 (738)</b>	14 (52) day tank option	20 (75.7) day tank option
Dimensions With Running Gear	Overall Length – in (mm)	222.4 (5649) Wagon 290.5 (7379) Tandem	N/A	N/A
	Overall Width – in (mm)	90 (2286)	N/A	N/A
	Overall Height – in (mm); excluding exh. pipe	101.8 (2586) Wagon 100 (2540) Tandem	N/A	N/A
	Track Width – in (mm)	71.6 (1818.5) Wagon 71 (1803) Tandem	N/A	N/A
	Tire Size	215/75R17.5	N/A	N/A
	Shipping Weight – lb (kg) no fuel	16100 (7303) Wagon 16420 (7464) Tandem	N/A	N/A
	Working Weight – lb (kg) with fuel	17790 (8069) Wagon** 17850 (8114) Tandem**	N/A	N/A
Dimensions Without Running Gear	Overall Length – in (mm)	222.4 (5649)***	156 (3962)	184.1 (4676)
	Overall Width – in (mm)	90 (2286)	89.5 (2273)	89.2 (2266)
	Overall Height – in (mm)	86.4 (2196)	92 (2337)	89.5 (2273)
	Shipping Weight – lb (kg) no fuel	15350 (6963)	11200 (5080)	16120 (7327)
	Working Weight – lb (kg) with fuel	17040 (7729)**	N/A	16910 (7686)

Portable High-Pressure  
Air Compressors

*Rear steps deduct 4.5"

**Add 600 lb (272 kg) for IQ System

***Deduct 12.5" for Service Valve



Model  
**534D10-45**  
TELEHANDLER



**Performance**

**Rated Capacity**

At 24 in. (610 mm) load center,  
10,000 lb (4,536 kg)

**Maximum Lift Height**

45 ft (13.7 m)

**Frame Leveling**

8 degrees

**Lift Speed (boom retracted)**

Up: 10.8 sec

Down: 8.1 sec

**Boom Speed**

Extend: 14.5 sec

Retract: 13.4 sec

**Travel Speeds Forward**

2WD 0-19 mph (30.6 kmph)

4WD 0-6.5 mph (10.5 kmph)

**Drawbar Pull (Loaded)**

21,000 lb (9,526 kg)

**Operating Weight**

With 48 in. (1.2 m) carriage and forks,  
25,300 lb (11,476 kg)

**Standard Specifications**

**Engine**

Make and Model	John Deere 4045TF275
	Turbocharged
Fuel	No. 2 Diesel
Cycles	4
No. of Cylinders	4
Displacement	276 cu in (4.5 L)
Rated Speed	2,500 rpm
Max. Gross BHP	115 hp (85 kW)
Fuel Tank	38 gal (144 L)

**Engine Filters**

Two-stage dry air cleaner — centrifugal  
pre-cleaner with continuous dust ejector plus  
replaceable dry filter element.

Visual service indicator.

Replaceable spin-on fuel filter. Full-flow  
replaceable spin-on engine oil filter.

**Electrical System**

Voltage: 12V

Alternator: 65 amp

Battery: 1050 cold cranking amps at 0°F

**Hydrostatic Drive**

6,300 PSI (43,437 kPa) closed loop with  
piston pump and motors.

All hydraulic connections ORS and  
Code 62 O-ring flanges.

Integral reservoir with implement hydraulics.

8 micron suction filter for charge pump.

Self-contained, swashplate design, variable  
displacement, over center, piston pump.

Neutral start switch. (Park brake must also be  
engaged to start.)

2WD — 4WD inching.

Audible back-up travel alarm mounted in  
counterweight area signals reverse movement.

**Axles**

Planetary hubs with piston motors on rear axle.

Piston motor-driven planetary front axle  
with high-bias differential.

**Service Brakes**

Hydraulic wet disc brake on each front wheel.

Hydraulic dynamic braking on front axle  
and both rear wheels.

**Parking Brakes**

Wet disc spring-applied electro/hydraulic  
release, fail-safe on both front wheels.

Light on dash indicates when brakes are on.

Frame mounted right side rear view mirror.

**Tires**

Standard: 14:00 x 24 — 12PR, G2 type.

Optional: Radial 14:00 x 24 — 12PR  
L2 rock tires.

**Cab**

Certified ROPS/FOPS structure with horn,  
back-up alarm and standard right side rear  
view mirror.

Forward, neutral, reverse lever on left  
of steering column.

Single foot pedal control provides  
both braking and inching for lifting while  
maneuvering vehicle.

Electro/hydraulic traction lock valve for  
superior tractive effort.

**Steering**

Hydraulic power steering with manual backup.

Rear wheel steering, 90° pivot around either  
front tire.

Outside turning radius is less than  
chassis length.

**Instruments**

Volt meter, hourmeter, engine oil pressure,  
temperature, fuel gauge.

All gauges protected by clear acrylic cover.

**Controls**

Grouped for operator comfort and convenience.

2WD and 4WD switch on dash.

Boom lift and crowd on single joystick.

Right-hand tilt and sway lever.

Foot throttle.

Floor mounted traction lock switch.

**Hydraulic System-Implement**

Single-section gear pump.

40 gal (151.6 L) system capacity.

8 micron filter with visual service indicator  
and suction strainer.

Lift, crowd, tilt and sway cylinders have safety  
checks to prevent dropping of load in the event  
of hose or other hydraulic failure.

**Auxiliary Hydraulics**

Used for all attachments equipped with  
cylinders or other hydraulic components.  
Consists of valves, controls and hydraulic lines.

**Accessories & Options**

**Cab Enclosure**

Lockable, split door. Windshield wiper.

Heater & defroster fan.

**Light Group**

Consists of 2 cab-mounted headlights,  
1 backup/tail/stoplight and rotating beacon.

**Radial and Rock Tires**

**Winch**

**Left Hand Tilt/Sway Control**

**Tilt on Joystick**

**Attachments**

**Standard Carriage**

48 in. (1.2 m), 66 in. (1.7 m) or 72 in. (1.8 m)

**Side Tilt Carriage**

48 in. (1.2 m) or 66 in. (1.7 m)

**100° Swing Carriage**

72 in. (1.8 m) Carriage

**180° Swing Carriage**

72 in. (1.8 m)

**100° Drywall Swing Carriage**

72 in. (1.8 m)

**Pallet Forks**

2 x 6 x 48 in.

(51 mm x 152 mm x 1.2 m)

**Cubing Forks**

2 x 2 x 48 in.

(51 mm x 51 mm x 1.2 m)

**Vertical Mast**

6 ft (1.8 m)

**100° Swing Mast**

6 ft (1.8 m)

**Truss Boom With or Without Winch**

10 ft (3.0 m)

**Bucket**

0.75 cu yd (0.57 m³) or

1.25 cu yd (0.95 m³)

**Work Platform**

**Slip On Crane Hook**

**Instant Hook**

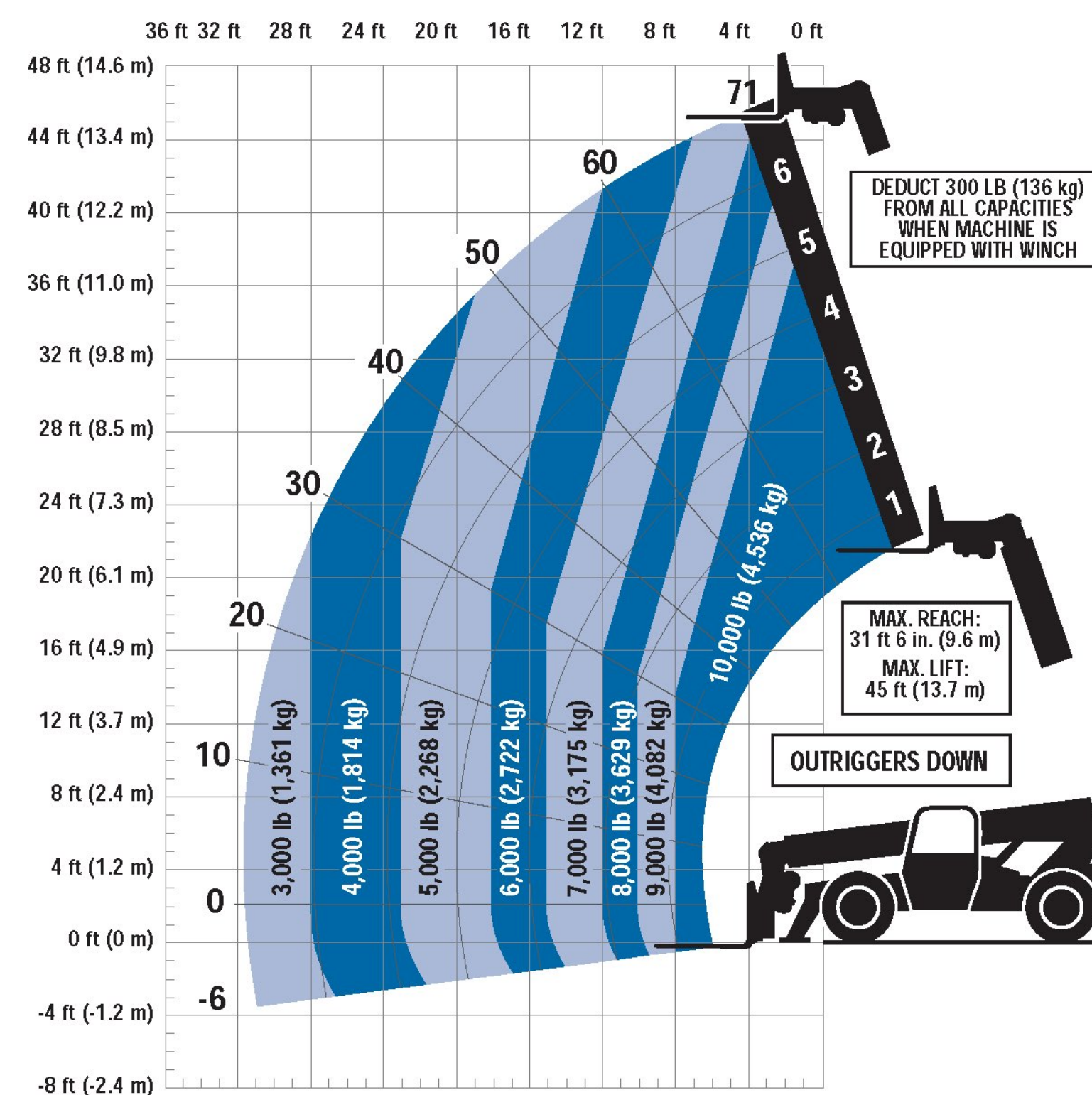
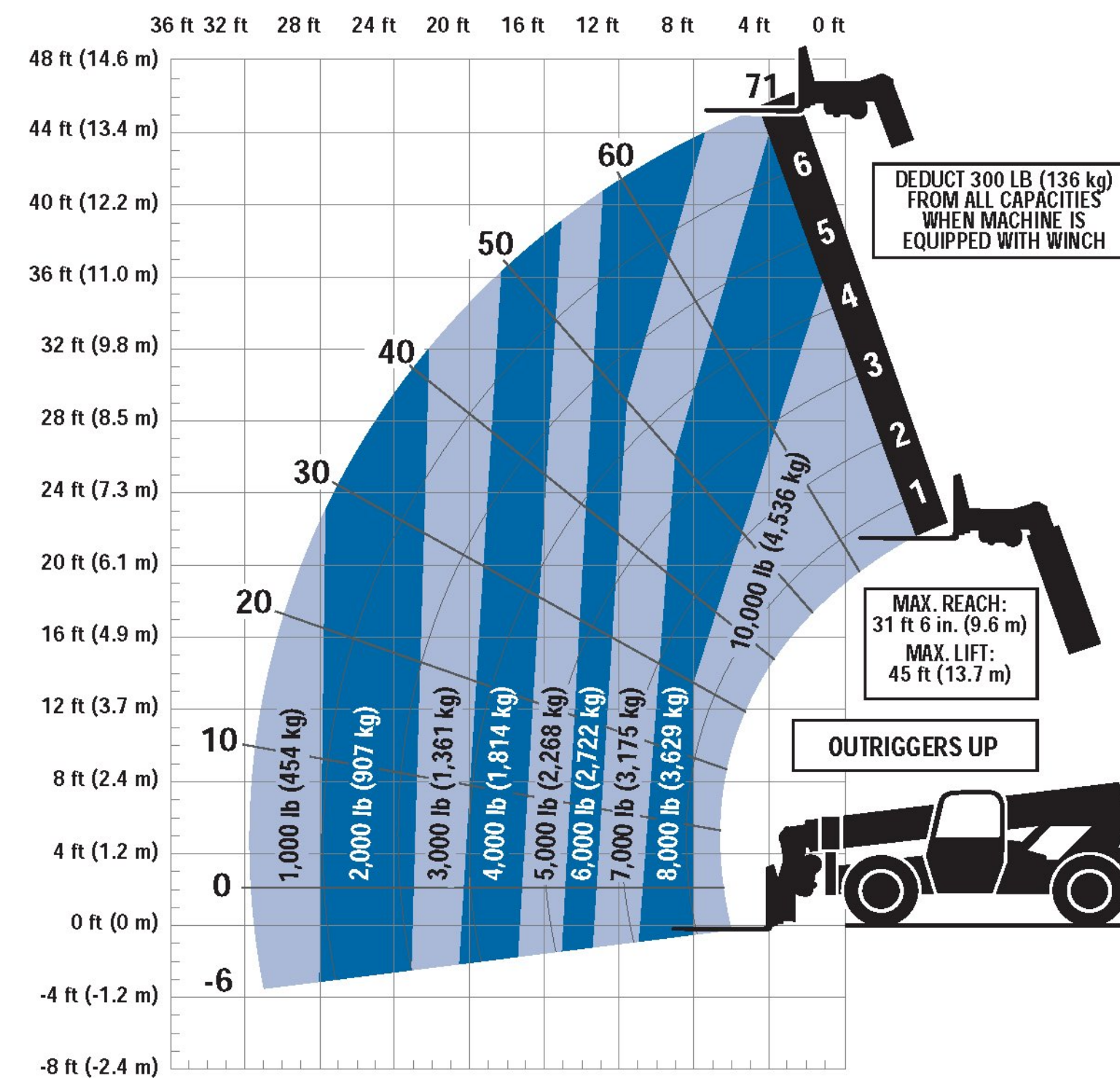
GRADALL®

SPECIFICATIONS



# GRADALL®

## Model 534D10-45 TELEHANDLER



Due to continuous product improvements, JLG Industries reserves the right to make specification and/or equipment changes without prior notification. This machine meets or exceeds ASME B56.6-2002 as originally manufactured for intended applications.

Form No.: SS-G534D1045-0104-15M  
Part No.: 3132206  
R060501  
Printed in USA

### Dimensions

Length (less forks) . . . . . 237 in. (6.01 m)  
Width . . . . . 98.8 in. (2.50 m)  
Height . . . . . 93 in. (2.36 m)  
Wheelbase . . . . . 135 in. (3.42 m)  
Ground Clearance . . . . 19.3 in. (490 mm)  
Outside Turning Radius . . 175 in. (4.44 m)  
Max. Reach from Front Tires to  
24 in. (610 mm) Load Center . . . . 31.5 ft  
(9.60 m)

### IMPORTANT

Rated lift capacities shown are with machine equipped with carriage and pallet forks. The machine must be level on a firm surface with undamaged, properly inflated tires. Machine specifications and stability are based on rated lift capacities at specific boom angles and boom lengths. (If specifications are critical, the proposed application should be discussed with your dealer.)

DO NOT exceed rated lift capacity loads, as unstable and dangerous machine conditions will result.

DO NOT tip the machine forward to determine the allowable load.

Use only JLG approved attachments with proper material handler model/attachment load capacity charts displayed in the operator's cab. OSHA requires all rough terrain forklift operators be trained according to OSHA 29 CFR 1910.178 (1).



### JLG Industries, Inc.

1 JLG Drive  
McConnellsburg, PA 17233-9533  
Telephone 717-485-5161  
Toll-free in US 877-JLG-LIFT  
Fax 717-485-6417  
www.jlg.com



# ChemGrout® Geotech Series

The versatile Geotech Series pumps a wide variety of materials including bentonites, neat cement and non-shrink grouts.

***CG-500/031/DH/GT  
Diesel/Hyd. Powered**



**CG-555/031/GH/GT  
Gas/Hyd. Powered**



**CG-550/031/GH/GT  
Gas/Hyd. Powered**



Large capacity mix tanks and holding hopper provide continuous pumping, increasing productivity and reducing line blockage.

Series features ChemGrout's powerful 3" piston pump for fast, trouble-free operation.

Conveniently located variable speed controls allow a single operator to quickly mix and pump batches, ensuring a simple, efficient operation.

Match grout plant with job size with your choice of single or double 70-gallon mix tanks.

Geotech Series features specially designed blades and baffles that develop a high shearing action, providing rapid and thorough mixing.

Optional trailer package available for single mix tank design, for convenient job-site mobility.

**ChemGrout®**  
Widest Selection of Grouting Equipment in the World



CG Geotech Series

The ChemGrout Geotech Series offers exceptional productivity, minimal maintenance and a quick payback for a wide variety of grouting applications.

These simple, easy-to-use grout plants offer a balanced design and are ready for jobsite operation. Both mixer and pump feature centrally located, variable speed controls for quick adjustment. The mixer utilizes specially designed blades and baffles that develop a high shearing action, insuring a rapid and thorough mixing process.

The mixer, hopper and grout pump are a balanced system allowing the mixer to stay ahead of the pump to provide a continuous output of material. After mixing, the material is transferred to the lower hopper through a large slide gate designed to handle high ratio sand/cement, neat cement and non-shrink grout. This efficient use of a holding hopper enables a new batch to be mixed while the first is being pumped.

The Geotech Series features ChemGrout's patented CG-031 single acting variable speed piston pump that easily handles materials ranging from fluid slurries to heavily sanded grouts.

The versatile CG-031 piston pump is engineered for ease of operation and low cost of maintenance. The unique staple lock construction holds all working components together allowing parts to be easily accessed for cleaning and maintenance. The pump can be completely disassembled and reassembled in minutes by using only a hammer.

The compact skid mounted versions are available in air, hydraulic, gas/hydraulic electric/hydraulic and diesel/hydraulic. The trailer mounted CG555/GT is available in a single tank design and is a fully integrated system, combining mixer, pump and power system, all in a single road worthy package.

Specifcations

Model	CG500/031/GT	CG550/031/GT
Mix Tank	2 - 70 Gallon (530 liters)	1 - 70 Gallon (265 liters)
Pump	CG-031 Single Acting Piston	
Max. Output Pressure	16 gpm (60 ipm) 550 psi (38 bar)	
Holding Hopper	45 Gallon (170 liters)	

CG550/031 Skid	Required	Weight	Size
Air	185 cfm	690 lbs	66"L x 34"W x 58"H
Hydraulic	2 supplies 9/6 gpm, 2300 psi	650 lbs	88"L x 34"W x 58"H
Electric/Hyd.	*Three Phase Electricity	1300 lbs	88"L x 34"W x 58"H
Gas/Hydraulic	Self-Contained	1300 lbs	90"L x 34"W x 58"H
Diesel/Hydraulic	Self-Contained	1300 lbs	90"L x 34"W x 58"H

CG500/031 Skid	Required	Weight	Size
Air	185 cfm	1100 lbs	88"L x 34"W x 58"H
Hydraulic	2 supplies 9/6 gpm, 2300 psi	1050 lbs	88"L x 34"W x 58"H
Electric/Hyd.	*Three Phase Electricity	1500 lbs	88"L x 34"W x 58"H
Gas/Hydraulic	Self-Contained	1500 lbs	88"L x 34"W x 58"H
Diesel/Hydraulic	Self-Contained	1500 lbs	88"L x 34"W x 58"H

CG555/031 Trailer	Required	Weight	Size
Electric/Hyd.	*Three Phase Electricity	1700 lbs	110"L x 68"W x 76"H
Gas	Self-Contained	1700 lbs	110"L x 68"W x 76"H
Diesel	Self-Contained	1700 lbs	110"L x 68"W x 76"H

*Several Voltages Available

Applications Include:

Soil compaction, soil & rock grouting, void filling, soil anchors, contact grouting, marine/underwater, precast, machine base installation, rock bolts, self-leveling, slab undersealing, well casings,encasements and post tensioning, abandoned shafts and geothermal.

**ChemGrout®**

Widest Selection of Grouting Equipment in the World



# ORBIT

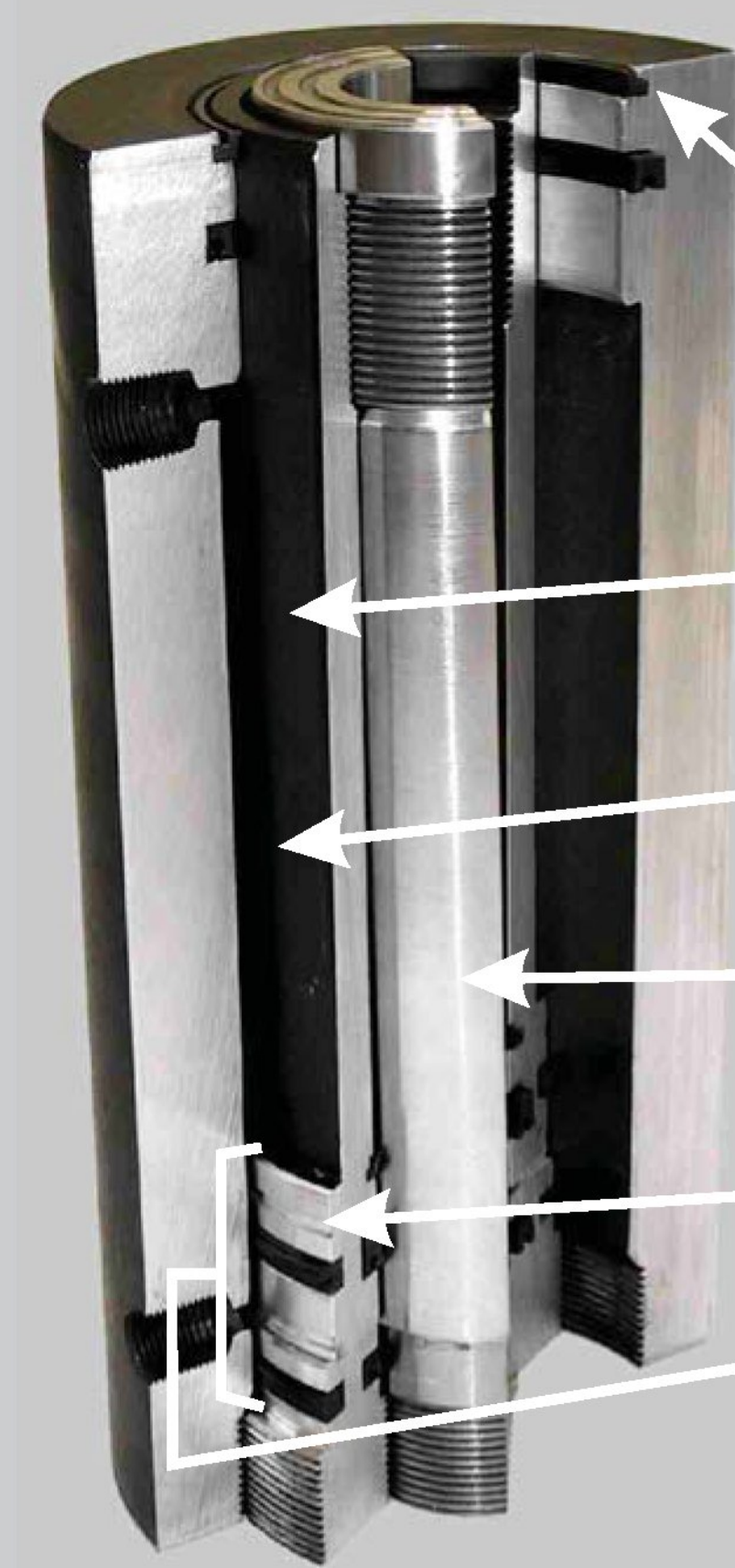
## ALUMINUM



## CYLINDERS

### Double Acting Hollow Center

- Lightweight aluminum alloy construction. Up to 60% lighter than comparable tonnage steel jacks!
- Virtually impervious to lateral load
- 3/8" high-flow quick disconnect couplers
- Constructed and tested in compliance with ANSI B30.1



Wiper seals out dirt and contamination

Hard anodizing for extra protection against corrosion and wear

One piece rod and piston for extra stability and less maintenance

Chrome plated inner tube for extra protection against corrosion and wear

Balancing / Lubricating Grooves

Large bearing surface for protection against side loading

Made in Canada 

**"ORBIT"** - The Lightweight with a **Solid** Punch



Ordering Information

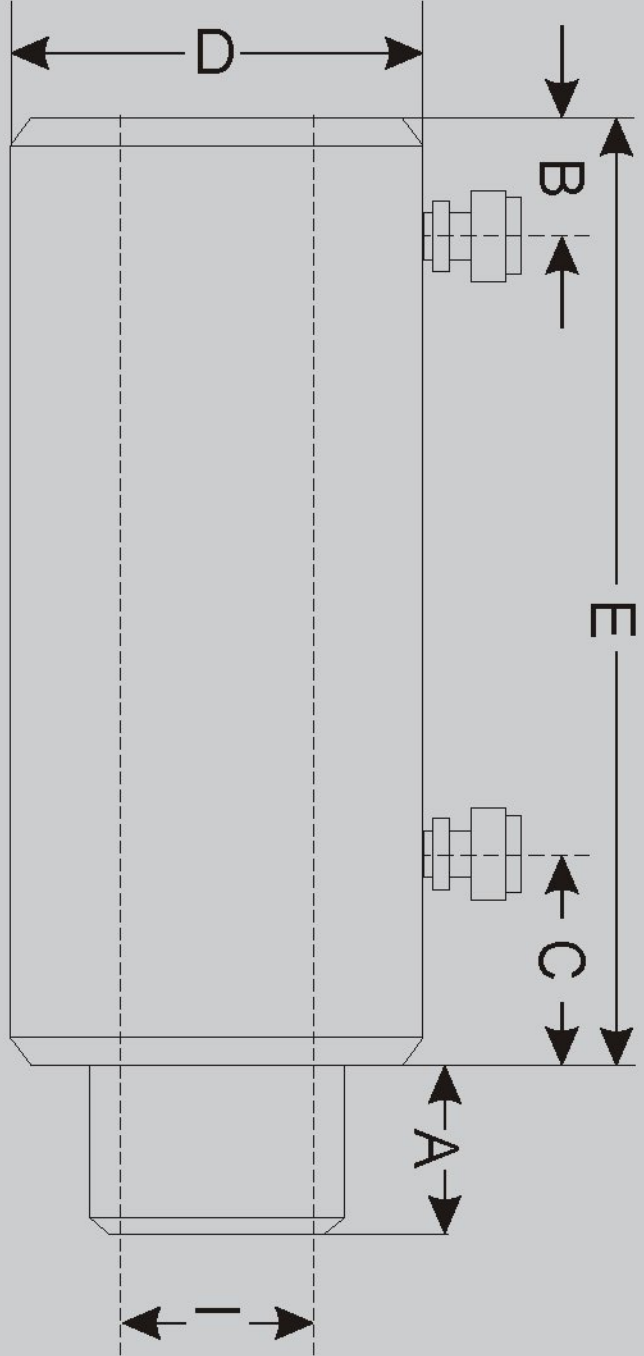
Operating pressure for all “ORBIT” cylinders up to 700 BAR / 10,000 PSI Double-Acting, hollow plunger design - 30 through 150 ton capacities

ORDER MODEL NUMBER	CYLINDER CAPACITY	A STROKE	E RE-TRACTED HEIGHT	I CENTER HOLE	EFFECTIVE AREA		OIL CAPACITY		B BASE TO INLET PORT	C COLLAR TO INLET PORT	D CYLINDER BODY	WEIGHT
	TON	mm / in	mm / in	mm / in	push cm2 / sqin	pull cm2 / sqin	push cm3 / cu.in	pull cm3 / cu.in	mm / in	mm / in		KG / LB
ORDH 30/2	30	50 / 2	177.8/7.0	38/1.5	40.97/6.35	20.96/3.25	235/14.34	106/6.50	44.44/1.750	44.44/1.750	139.7/5.5	6.35/14
ORDH 30/4	30	100 / 4	228.6/9.0	38/1.5	40.97/6.35	20.96/3.25	470/28.68	213/13.00	44.44/1.750	44.44/1.750	139.7/5.5	9.07/20
ORDH 30/6	30	152 / 6	279.40/11.0	38/1.5	40.97/6.35	20.96/3.25	705/43.02	319/19.50	44.44/1.750	44.44/1.750	139.7/5.5	10.88/24
ORDH 30/10	30	254 / 10	381.00/15.0	38/1.5	40.97/6.35	20.96/3.25	1175/71.70	532/32.50	44.44/1.750	44.44/1.750	139.7/5.5	15.87/35
ORDH 50/2	50	50 / 2	177.80/7.0	53.97/2.125	66.45/10.30	22.12/3.43	356/21.71	112/6.86	44.44/1.750	44.44/1.750	190.5/7.5	11.33/25
ORDH 50/4	50	100 / 4	228.60/9.0	53.97/2.125	66.45/10.30	22.12/3.43	712/43.44	224/13.72	44.44/1.750	44.44/1.750	190.5/7.5	15.87/35
ORDH 50/6	50	152 / 6	279.40/11.0	53.97/2.125	66.45/10.30	22.12/3.43	1068/65.16	337/20.58	44.44/1.750	44.44/1.750	190.5/7.5	19.95/44
ORDH 50/10	50	254 / 10	381.00/15.0	53.97/2.125	66.45/10.30	22.12/3.43	1780/108.60	562/34.30	44.44/1.750	44.44/1.750	190.5/7.5	27.21/60
ORDH 75/2	75	50 / 2	229/9.0	69.85/2.750	98.25/15.23	43.64/6.77	500/30.50	221/13.54	50.80/2.0	50.80/2.0	228.6/9.0	23.58/52
ORDH 75/4	75	100 / 4	280/11.0	69.85/2.750	98.25/15.23	43.64/6.77	1000/61.08	443/27.08	50.80/2.0	50.80/2.0	228.6/9.0	30.00/65
ORDH 75/6	75	152 / 6	330/13.0	69.85/2.750	98.25/15.23	43.64/6.77	1501/91.62	665/40.62	50.80/2.0	50.80/2.0	228.6/9.0	34.50/76
ORDH 75/10	75	254 / 10	432/17.0	69.85/2.750	98.25/15.23	43.64/6.77	2503/152.70	1109/67.70	50.80/2.0	50.80/2.0	228.6/9.0	45.35/100
ORDH 100/2	100	50 / 2	253.99/10.0	88.90/3.500	130.83/20.28	50.32/7.80	680/41.52	255/15.60	63.50/2.5	63.50/2.5	279.4/11.0	38.55/85
ORDH 100/4	100	100 / 4	304.79/12.0	88.90/3.500	130.83/20.28	50.32/7.80	1361/83.04	511/31.20	63.50/2.5	63.50/2.5	279.4/11.0	47.62/105
ORDH 100/6	100	152 / 6	355.59/14.0	88.90/3.500	130.83/20.28	50.32/7.80	2041/124.56	767/46.80	63.50/2.5	63.50/2.5	279.4/11.0	54.43/120
ORDH 100/10	100	254 / 10	457.19/18.0	88.90/3.500	130.83/20.28	50.32/7.80	3403/206.60	1278/78.00	63.50/2.5	63.50/2.5	279.4/11.0	70.30/155
ORDH 150/2	150	50 / 2	253.99/10.0	88.90/3.500	203.03/31.47	58.00/9.00	1004/61.26	295/17.96	63.50/2.5	63.50/2.5	304/12.0	45.81/101
ORDH 150/4	150	100 / 4	304.79/12.0	88.90/3.500	203.03/31.47	58.00/9.00	2008/122.52	590/35.93	63.50/2.5	63.50/2.5	304/12.0	54.88/121
ORDH 150/6	150	152 / 6	355.59/14.0	88.90/3.500	203.03/31.47	58.00/9.00	3012/183.73	885/53.89	63.50/2.5	63.50/2.5	304/12.0	63.95/141
ORDH 150/10	150	254 / 10	457.19/18.0	88.90/3.500	203.03/31.47	58.00/9.00	5021/306.30	1475/89.82	63.50/2.5	63.50/2.5	304/12.0	81.64/180

ORBIT Manufacturing Inc. is committed to continuous product enhancement and development and reserves the right to make product design changes without prior notice.

Warranty  
All ORBIT cylinders are guaranteed against defects in materials and workmanship. Warranty does not cover normal wear and tear, overloading or improper use. For warranty claims, please contact your nearest ORBIT dealer.

ORBIT Manufacturing Inc.  
Distributed by: OTTO SERVICE      Phone: (818) 845-3928      Fax: (818) 842-0761  
Email: ceo@hyjacks.com  
Web: www.hyjacks.com



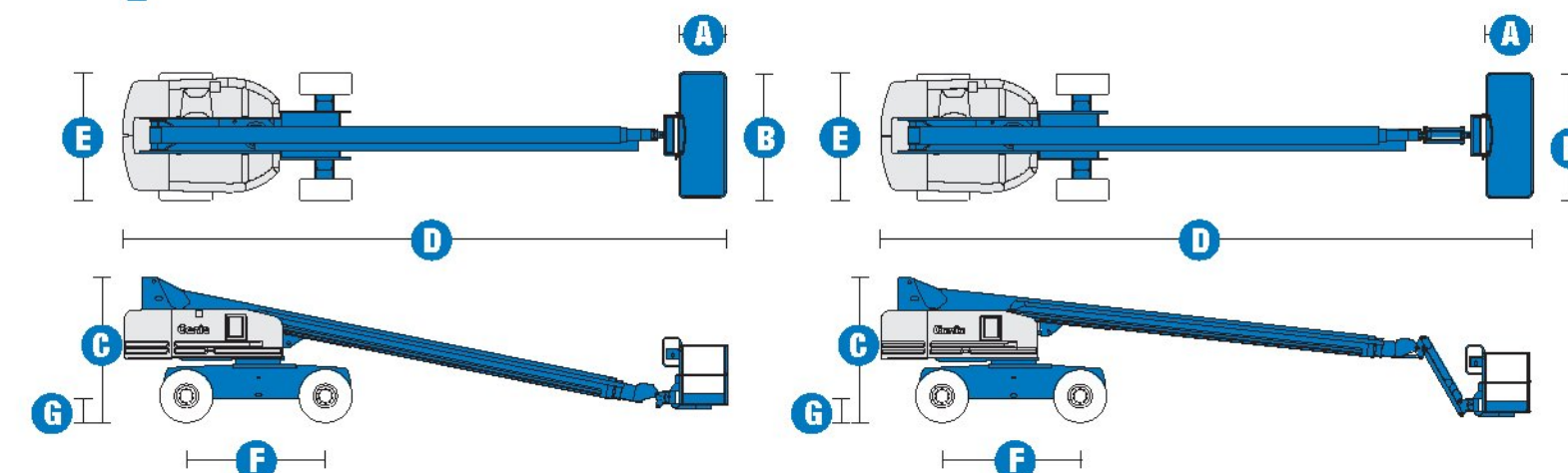


## SELF-PROPELLED TELESCOPIC BOOMS

### S™-80 & S™-85



## Specifications



MODELS	S™-80		S™-85	
MEASUREMENTS	US	Metric	US	Metric
Working height maximum*	86 ft	26.38 m	91 ft	27.90 m
Platform height maximum	80 ft	24.38 m	85 ft	25.90 m
Horizontal reach maximum	72 ft 5 in	22.07 m	77 ft 5 in	23.60 m
Below ground reach	10 ft 3 in	3.12 m	13 ft 9 in	4.19 m
A Platform length - 8 ft model	3 ft	.91 m	3 ft	.91 m
Platform length - 6 ft model	2 ft 6 in	.76 m	2 ft 6 in	.76 m
B Platform width - 8 ft model	8 ft	2.44 m	8 ft	2.44 m
Platform width - 6 ft model	6 ft	1.83 m	6 ft	1.83 m
C Height - stowed	9 ft 2 in	2.80 m	9 ft 2 in	2.80 m
D Length - stowed	37 ft 3 in	11.35 m	40 ft 7 in	12.37 m
Length - transport (jib tucked under)			35 ft	10.67 m
E Width - axles retracted	8 ft	2.44 m	8 ft	2.44 m
Width - axles extended	10 ft 1 in	3.07 m	10 ft 1 in	3.07 m
F Wheelbase	9 ft	2.74 m	9 ft	2.74 m
G Ground clearance - center	1 ft 5 in	.43 m	1 ft 5 in	.43 m

### PRODUCTIVITY

Lift capacity - 8 ft platform	500 lbs	227 kg	500 lbs	227 kg
Lift capacity - 6 ft platform	600 lbs	272 kg	500 lbs	227 kg
Platform rotation	160°		160°	
Vertical jib rotation	—		135°	
Turntable rotation	360° continuous		360° continuous	
Turntable tailswing - axle retracted	4 ft 8 in	1.42 m	4 ft 8 in	1.42 m
Turntable tailswing - axle extended	3 ft 8 in	1.12 m	3 ft 8 in	1.12 m
Drive speed - stowed - 2WD/4WD	3.5 mph	5.6 km/h	3.5 mph	5.6 km/h
Drive speed - raised/extended	0.68 mph	1.1 km/h	0.68 mph	1.1 km/h
Gradeability - 2WD - stowed**	30%		30%	
Gradeability - 4WD - stowed**	45%		45%	
Turning radius - axle extended: inside	10 ft 8 in	3.25 m	10 ft 8 in	3.25 m
outside	23 ft	7.01 m	23 ft	7.01 m
Controls	12V DC proportional		12V DC proportional	
Tires - RT lug	385/65 D22.5		385/65 D22.5	

### POWER

Power source	Deutz BF4L 2011 4 cylinder turbo diesel 78 hp (58.1 kW) Perkins 804C-33 4 cylinder diesel 63 hp (47 kW) Continental TME27 4 cylinder Gas/LPG 74 hp (56 kW)			
Auxiliary power unit	12V DC		12V DC	
Hydraulic tank capacity	45 gal	170 L	45 gal	170 L
Fuel tank capacity	33 gal	125 L	33 gal	125 L

### WEIGHT***

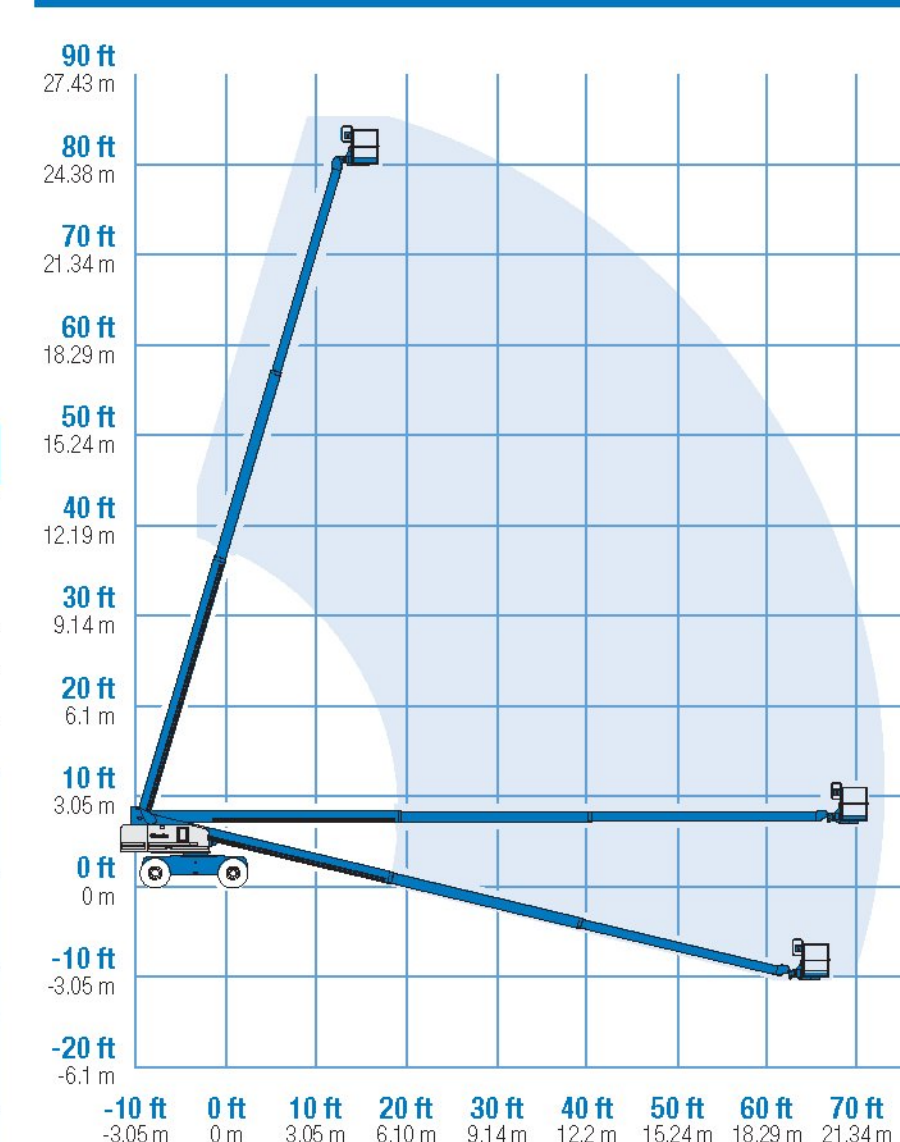
2WD	33,230 lbs	15,073 kg	35,710 lbs	16,198 kg
4WD	33,380 lbs	15,141 kg	35,860 lbs	16,266 kg

### STANDARDS COMPLIANCE

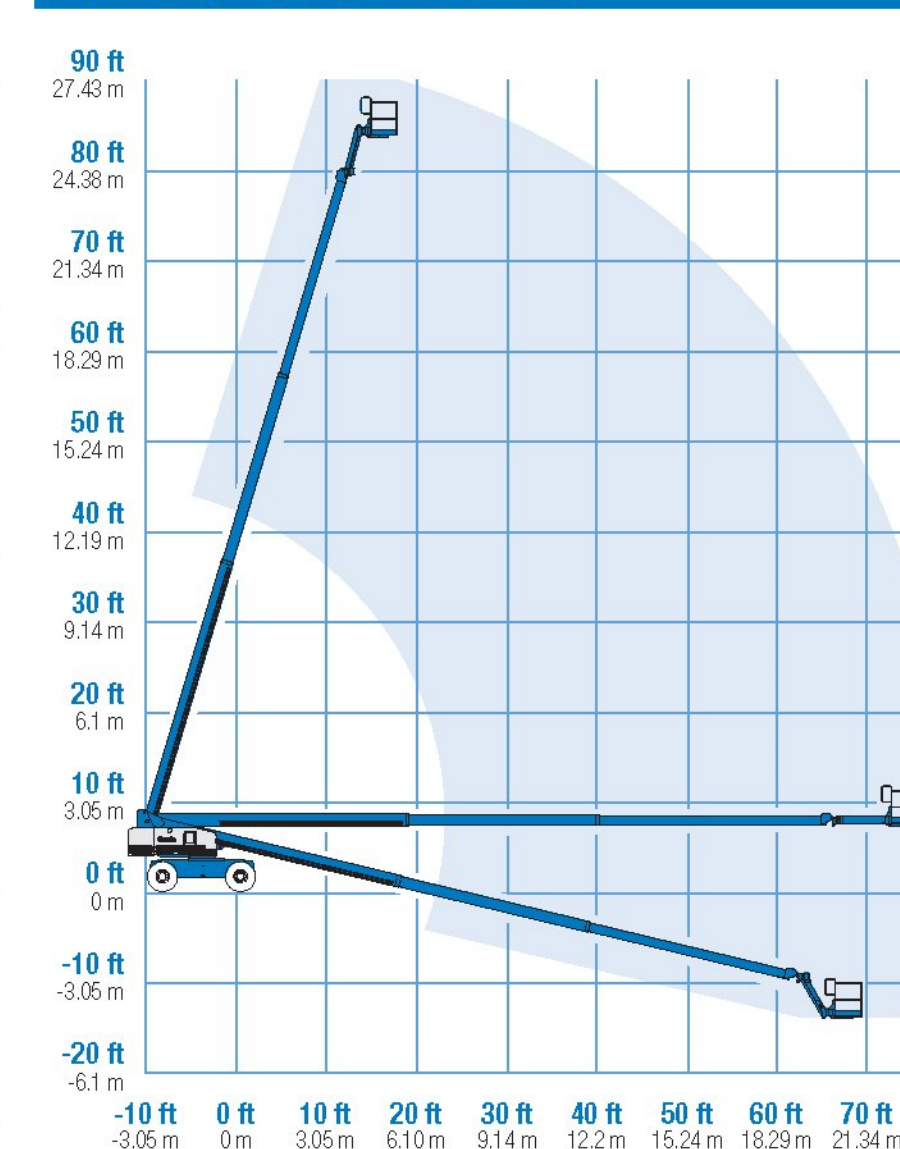
ANSI A92.5, CSA B354.4, CE Compliance, AS 1418.10

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### RANGE OF MOTION S™-80



### RANGE OF MOTION S™-85



* The metric equivalent of working height adds 2 m to platform height. U.S. adds 6 ft to platform height.  
** Gradeability applies to driving on slopes. See operator's manual for details regarding slope ratings.  
*** Weight will vary depending on options and/or country standards.







SELF-PROPELLED TELESCOPIC BOOMS  
**S™-80 & S™-85**

# Features

## EASILY CONFIGURED TO MEET YOUR NEEDS

### PLATFORM OPTIONS

- Steel 8 ft (2.44 m) (standard)
- Steel 6 ft (1.83 m)
- Steel 6 or 8 ft (1.83 or 2.44 m) tri-entry
- Steel 4 ft (1.22 m)
- Steel 5 ft (1.52 m)

### JIB OPTIONS

- Non-jib
- 5 ft (1.52 m) jib boom

### POWER OPTIONS

- Deutz turbo diesel 78 hp (58.1 kW)
- Perkins diesel 63 hp (50 kW)
- Continental Gas/LPG 74 hp (56 kW)

### DRIVE OPTIONS

- 2WD
- 4WD

### AXLE

- Active oscillation

### TIRE OPTIONS

- Rough terrain air-filled (standard)
- Rough terrain foam-filled
- Rough terrain non-marking air or foam-filled
- High flotation air-filled
- Sealant treated air-filled

## STANDARD FEATURES

### MEASUREMENTS

#### S™-80

- 86 ft (26.38 m) working height
- 72 ft 5 in (22.07 m) horizontal reach
- 600 lb (272 kg) lift capacity with 6 ft (1.83 m) platform
- 500 lb (227 kg) lift capacity with 8 ft (2.44 m) platform

#### S™-85

- 91 ft (27.90 m) working height
- 77 ft 5 in (23.60 m) horizontal reach
- 500 lb (227 kg) lift capacity with 6 ft (1.83 m) platform
- 500 lb (227 kg) lift capacity with 8 ft (2.44 m) platform

### PRODUCTIVITY

- Self-leveling platform
- Hydraulic platform rotation
- Fully proportional Hall effect joystick controls
- Drive enable
- AC power cord to platform
- Horn
- Hour meter
- Tilt alarm
- 360° continuous turntable rotation
- Locking low profile turntable covers
- Positive traction drive
- Two speed wheel motors

### POWER

- All engines are emissions compliant
- 12V DC auxiliary power
- Anti-restart engine protection
- Auto engine fault shutdown
- Catalytic converter muffler (Continental)
- Engine block heater (Continental)



## OPTIONS & ACCESSORIES

### PRODUCTIVITY

- 750 lb capacity, S-80 only
- Platform swing gate
- Half mesh platform inserts with swing gate
- Platform top auxiliary rail
- Arc Pro 275™ Heavy-Duty Welder package
- Welder Ready package
- Weld leads to platform
- Air line to platform
- Hydraulic oil cooler
- Arctic hydraulic oil
- Arctic hose package
- Basic hostile environment kit
- Deluxe hostile environment kit
- Standard aircraft protection package
- Deluxe aircraft protection package (6 ft platform only)
- Thumb rocker steer
- Tool tray
- Fluorescent tube caddy
- Pipe cradle (pair)
- Alarm package
- Panel cradle package*
- Platform work lights
- Front driving lights
- Lockable platform control box covers
- Second battery
- Tow package

### POWER

- Engine gauge package
- AC Generator Packages (3000 or 3500 watts)
- Cold Start Packages
- Diesel scrubber/spark arrestor muffler
- Diesel spark arrestor muffler
- Retained key selector switch
- LPG tank only, steel, 33.5 lb (15.19 kg) capacity
- Additional LPG tank with carrier

* Available on select models

### Genie United States

18340 NE 76th Street  
P.O. Box 97030  
Redmond, Washington 98073-9730  
Telephone **(425) 881-1800**  
Toll Free in USA/Canada **800-536-1800**  
Fax (425) 883-3475

### Genie Europe

The Maltings  
Wharf Road  
Grantham NG31 6BH  
U.K.  
Telephone **+44 (0)1476 584333**  
Fax +44 (0)1476 584334  
Email: [infoeurope@genieind.com](mailto:infoeurope@genieind.com)

### Distributed By:

#### Bigge Equipment Co.

10700 Bigge Avenue  
San Leandro, CA 94577  
Phone: (877) 244-4380 or (510) 639-4041  
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**MME**

## HYDRAULIC DRILLING ATTACHMENT FOR MINI AND SMALL EXCAVATORS

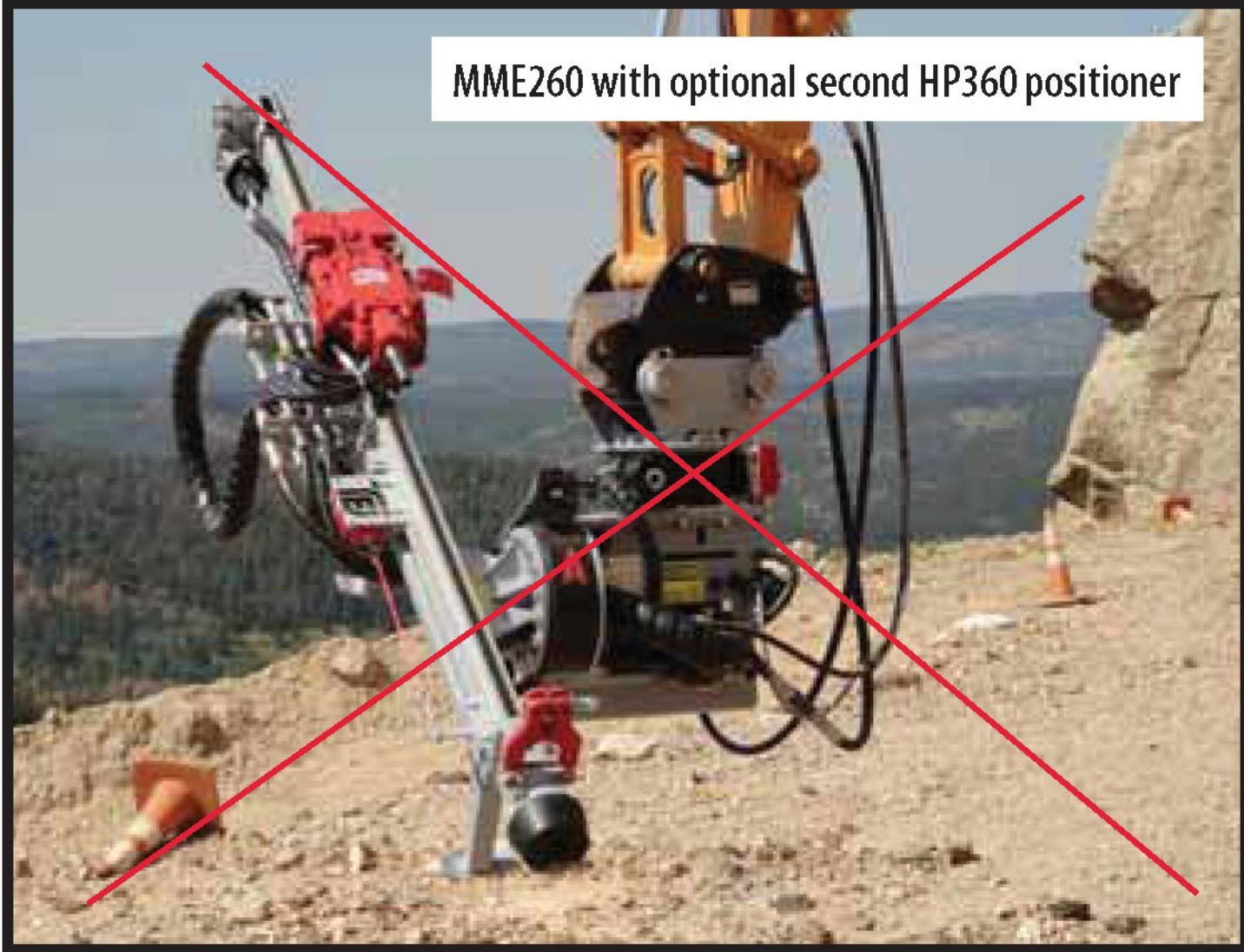
Ground Consolidation, Earth Retention, Rock Drilling

PO BOX 1309, MONTROSE, CO 81402 USA • (800) 777-3745 • (970) 249-1515 • [www.teirockdrills.com](http://www.teirockdrills.com)





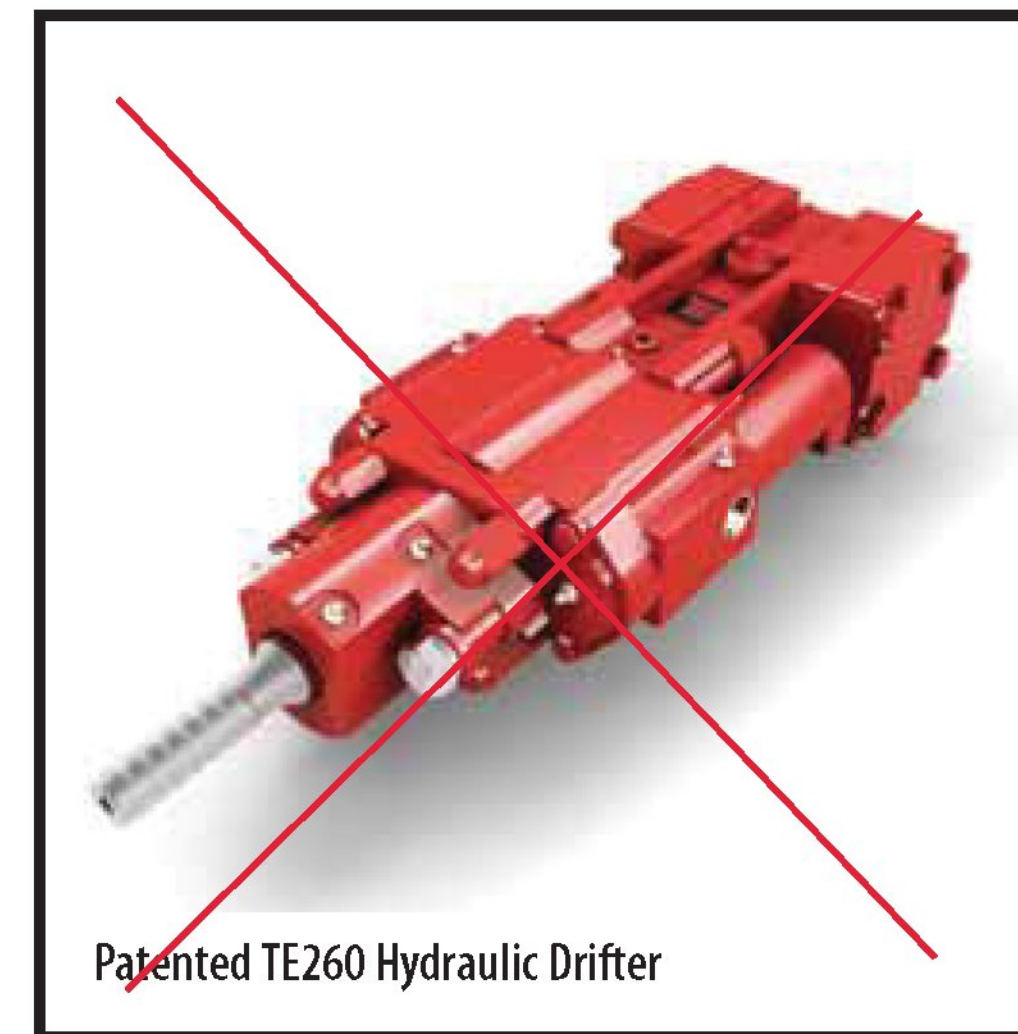
**MME** | HYDRAULIC DRILLING ATTACHMENT FOR MINI AND SMALL EXCAVATORS



The MME is a lightweight drill for excavators 5-10 tons, incorporating many of the same features as the much larger HEM. The MME uses the same aluminum feed system as the man-portable drills. In this way many contractors consider the MME to be their "outside" drill while the man-portable drill is the "inside" drill. Using TEI's patented drifter technology the MME is an excellent tool for installing micropiles, soil nails, teibacks, rock drilling and the installation of the popular hollow bars.



## MME | HYDRAULIC DRILLING ATTACHMENT FOR MINI AND SMALL EXCAVATORS



Similar application. Drill will held with a high reach forklift.



### Standard Features of the MME:

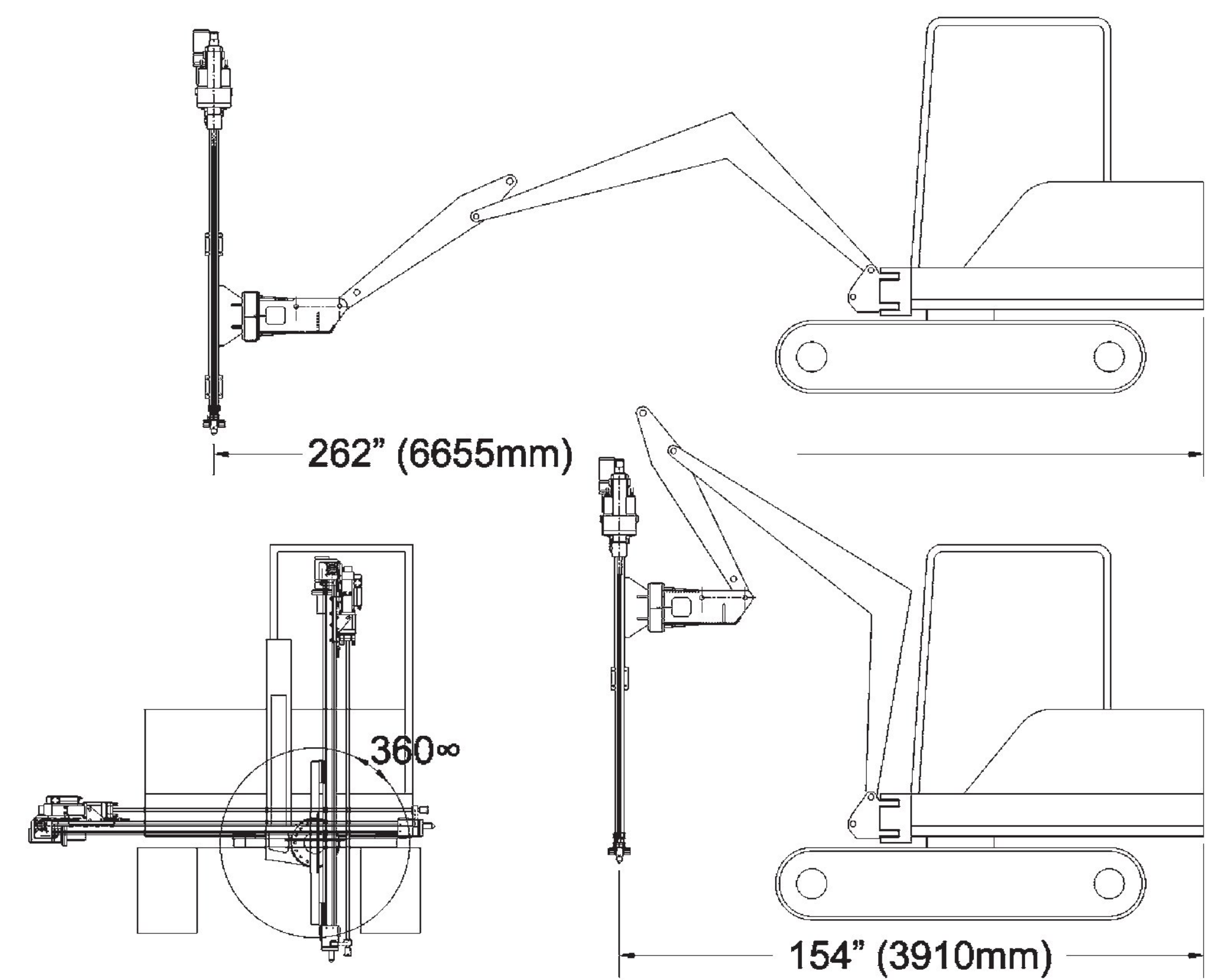
- TEI Patented Drifter or TEI Rotary Head
- ACF Aluminum Chain Feed for 3-meter Rods
- Radio Remote Controls with Manual Override
- MME Mount with 360-Degree Positioning
- HCA4 Single Hydraulic Foot Clamp

### Optional Features of the MME:

- Second 360-Degree Positioner
- Misting for Dust Suppression
- European Union Approved Safety Cage
- DM300 Hydraulic Power Pack



**MME** | **HYDRAULIC DRILLING ATTACHMENT FOR MINI AND SMALL EXCAVATORS**



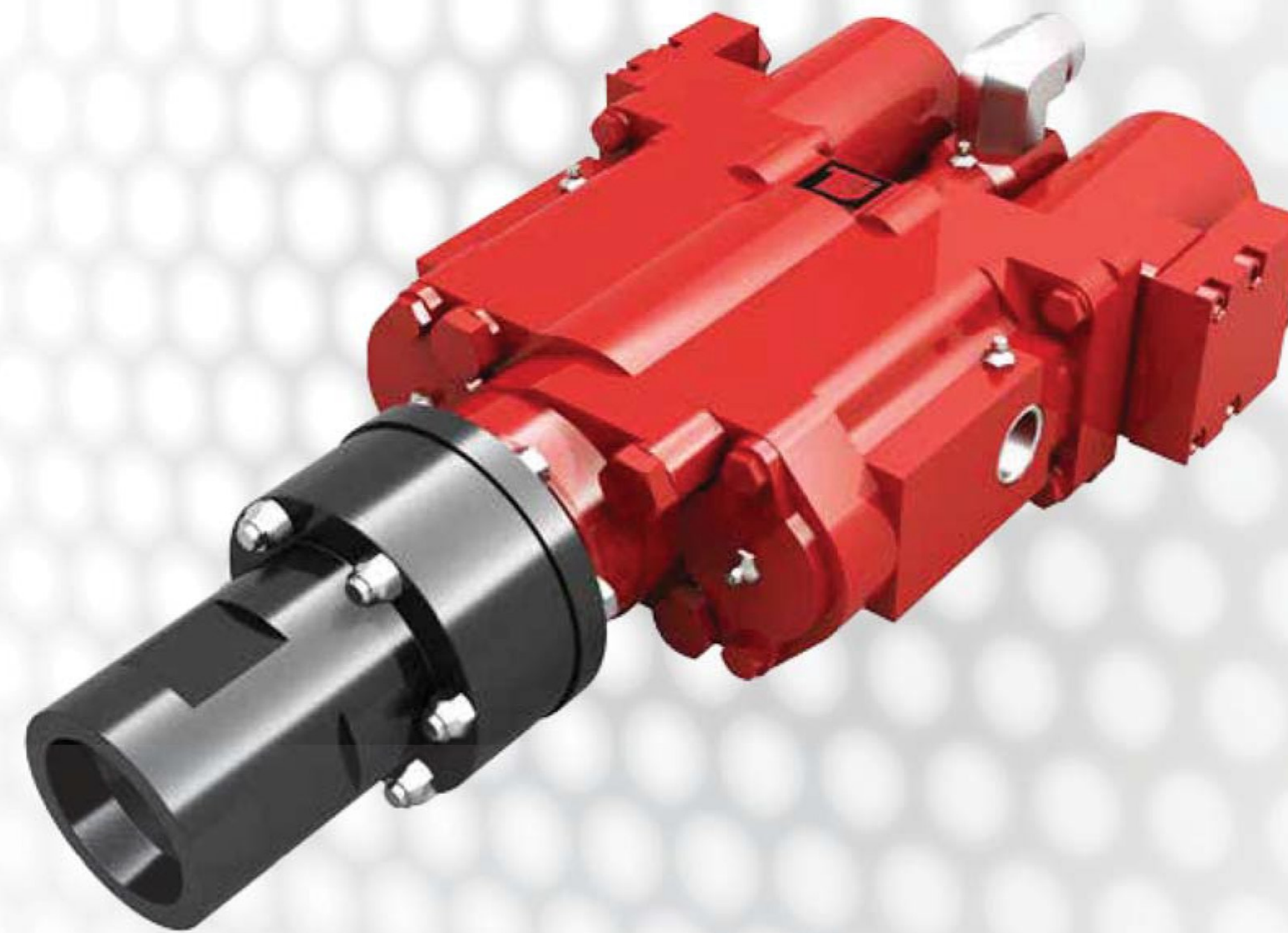
**MME DRILL TOOL WITH ACF10 FEED**

	US	METRIC
MME260 System Flow and Pressure	25 GPM @ 2250 PSI	95 LPM @ 155 BAR
MME250R System Flow and Pressure	18 GPM @ 2500 PSI	69 LPM @ 172 BAR
MME260 Hole Size	1.375" to 2.0"	35mm to 52mm
MME250R Hole Size	2.75" to 4.0"	70mm to 102mm
ACF10 Drill Length	13.5 feet	4.1 meters
ACF10 Travel	10.5 feet	3.2 meters
ACF10 Pullback	1500 lbs.	680 kgs.
Approximate Drill Tool Weight	1080 lbs.	488 kgs.

Minimum Excavator Size: 5 TONS

ALL ATTACHMENT CARRIERS MUST BE PLUMBED WITH LOW PRESSURE RETURN AUXILIARY HYDRAULICS.  
AN ADDITIONAL HYDRAULIC OIL COOLER IS RECOMMENDED FOR PRODUCTION DRILLING.





# RDS250

## ROTARY HEAD

A lightweight-compact hydraulic rotary head for man-portable drills and limited access drills. The RDS250 is designed for smooth operation and simple maintenance to be used for general rotary drilling applications.

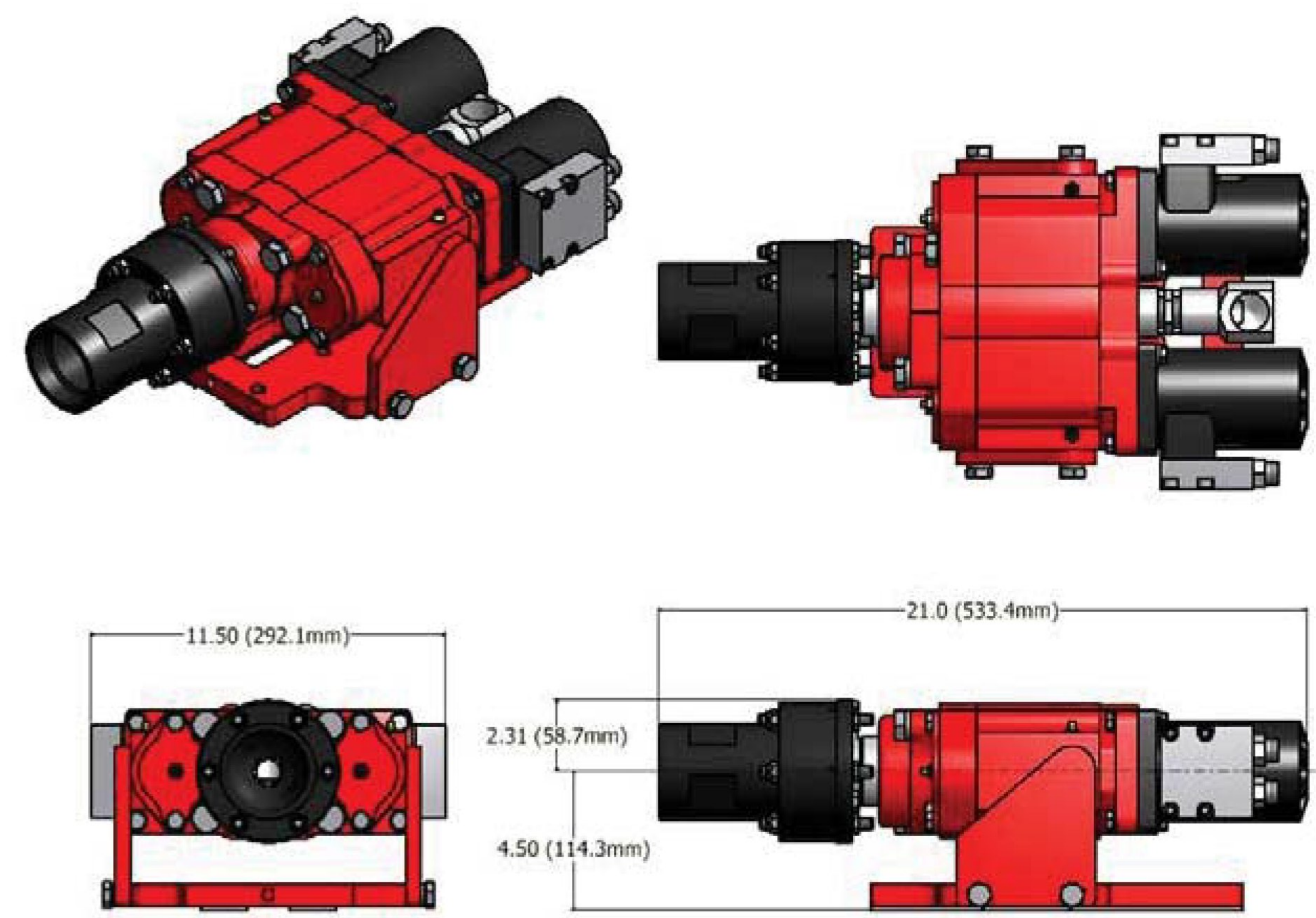
- Flange Connection
- 2-Speed Rotary
- Optional Shock Sub

PO BOX 1309, MONTROSE, CO 81402 USA • (800) 777-3745 • (970) 249-1515 • [www.teirockdrills.com](http://www.teirockdrills.com)





**RDS250 | ROTARY HEAD**



	US	METRIC
Rotation Torque	1,000 ft/lbs	135 daNm
Rotation Speed	Up to 400 RPM	Up to 400 RPM
Supply Pressure	2500 PSI	172 bar
Supply Flow	15 GPM	57 LPM
Flushing Shaft ID	7/8"	22 mm
Weight	106 Lbs	52 Kg
Output Threads	CA21 Male, 2-3/8" API Regular Male & Female, 1-5/8" Auger Hex, 1-3/8" Auger Hex, Other Threads Available	

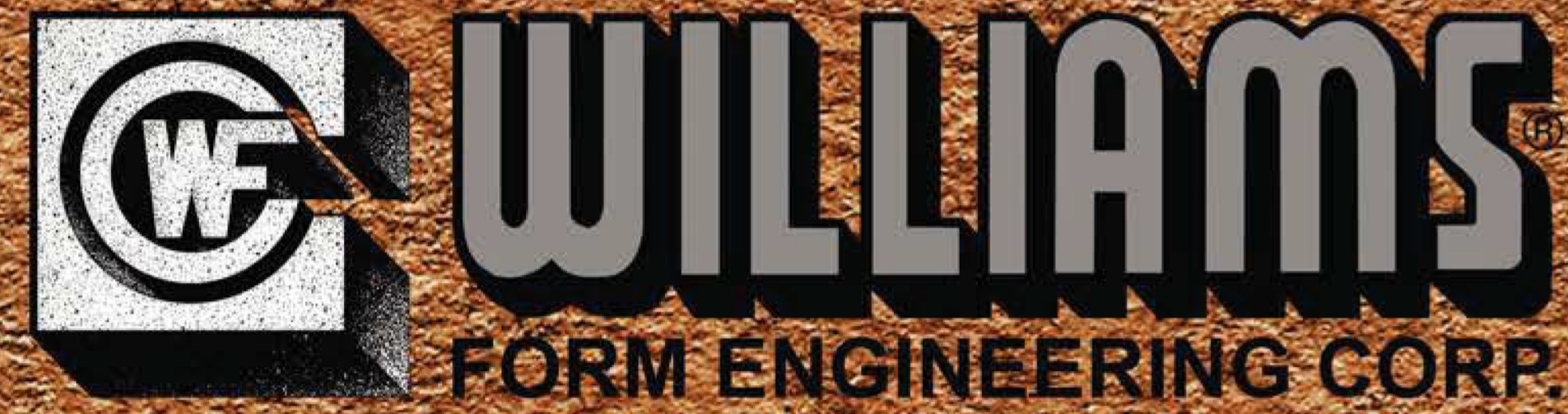
***Used on the ACF feed system.***  
***TEI technical specifications consider a 40% hydraulic power loss.***



## APPENDIX D

### Catalog Cuts and SDS Sheets





# ***Ground Engineering Systems***

***For Over 90 Years***

***No. 114u***





# Introduction

## Using Williams Products

Readers of this catalog should independently verify the efficiency of any Williams products for the purpose intended by the user. The suitability of Williams products will depend upon field conditions, fabrications and user specifications which must be investigated and controlled by the user or its representatives. What follows are some suggestions for proper use of Williams products.

### ***Proper Use is the Key***

Williams Form Engineering Corporation provides a limited warranty on all of its products, as set forth in its quotations, acknowledgements and invoices furnished to each customer in connection with the sale of those products. Notwithstanding this limited warranty, you should be aware that Williams products are intended for use by qualified and experienced workers. Serious accidents may result from misuse or improper supervision or inspection. Carefully field test any use not strictly conforming to normal practice before general adoption of the application. Carefully evaluate the product application, determine safe working loads and control all field conditions to prevent unsafe load applications. All safety factors shown are approximate, and in no case should they be exceeded.

**IMPROPER USE OR INSTALLATION MAY RESULT IN SERIOUS INJURY OR DEATH. IF YOU HAVE THE SLIGHTEST DOUBT CONCERNING PROPER USE OR INSTALLATION, PLEASE CONSULT WITH OUR ENGINEERING DEPARTMENT.**

### ***You are Responsible for Any Modifications or Substitutions***

Do not weld any casting, unless in the opinion of a qualified engineer such weld is in a no load, non-critical area. Welding creates carbides and causes extreme brittleness near the weld point, and destroys nearly all load value. Any welding or modifications to Williams products are the responsibility of the user, and as set forth in its limited warranty, Williams Form Engineering Corporation makes no representations or warranties concerning products altered, welded, bent or modified by others.

Many Williams products are manufactured, supplied and or designed as a system. Hence, we cannot guarantee that components from systems supplied by other manufacturers are interchangeable with our products. For best results, all parts of a system should consist of Williams products. From time to time, Williams Form Engineering Corporation may change product designs, safe working load ratings and product dimensions without prior notice to users. For the most current information concerning Williams products, please contact our engineering department, one of our technical representative or see our web site.

### ***Ongoing Inspection and Replacement are Essential***

Each user should periodically inspect bolts and working hardware for wear and discard worn parts. Bent bolts and bolts used at loads exceeding advertised yield strength should be discarded and replaced. A comprehensive inspection and replacement program should be instituted and followed, so that all bolts will be replaced after a predetermined number of uses, regardless of the apparent condition of the bolt.

All lifting hardware units displayed in this catalog are subject to wear, misuse, overloading, corrosion, deformation and other factors which may affect their safe working load. They should be regularly inspected to see if they may be used at the rated safe working load or removed from service. Frequency of inspection is dependent upon frequency and period of use, environment and other factors, and is best determined by an experienced user taking into account the actual conditions under which the hardware is used.

### ***Ordering Procedure and Warranties***

This catalog is intended to provide potential purchasers and users with general information about products offered by Williams Form Engineering Corporation. Prices, specifications, product descriptions and catalog items are subject to modification without prior notice. Any person desiring further information about products offered by Williams Form Engineering Corporation may contact the company or its authorized representatives. In appropriate cases, Williams will provide quotations for possible orders.

Because the contents of this catalog are intended for general information purposes, they are subject to change without notice. Any warranties for Williams products shall be governed by Williams quotations, acknowledgements and invoices furnished to customers in connection with the sale of Williams products, as these documents contain more detail than this catalog. Williams Form Engineering Corporation disclaims all other warranties for its products, expressed or implied, including IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE, which might otherwise arise from the contents of this catalog.





## Design Considerations

### Different Types of Earth Anchors

Williams Form Engineering is known throughout the world as one of the leaders in the manufacturing of ground anchor systems. With over 80 years of experience we are able to provide product and/or information for virtually any ground anchor application, and if necessary supply on-site technical assistance. Williams manufactures or distributes anchors in all four primary groups of ground anchor systems available on the market today. The four primary groups of ground anchors are as shown:



#### → **Cement Grout Bonded Anchors**

Cement grout is used to develop a bond between the anchor and the soil or rock. Williams anchors can be made with several different types of steel grades.



#### **Polyester Resin Anchors**

Resin cartridges are used to develop anchorage between the anchor bar and the rock. Williams supplies All-Thread-Bars and threaded rebar for resin anchoring. Resin anchors often are a fast and economical solution for temporary rock support.



#### **Mechanical Rock Anchors**

A mechanical head assembly with an expansion shell and cone is used to develop a friction lock between the rock and head assembly.



#### **Mechanical Soil Anchors**

A pivoting plate such as the one used with the Manta Ray soil anchor shown above, is driven to a specified depth and rotated 90° to develop anchorage in the soil.





## Differences Between Anchor Types

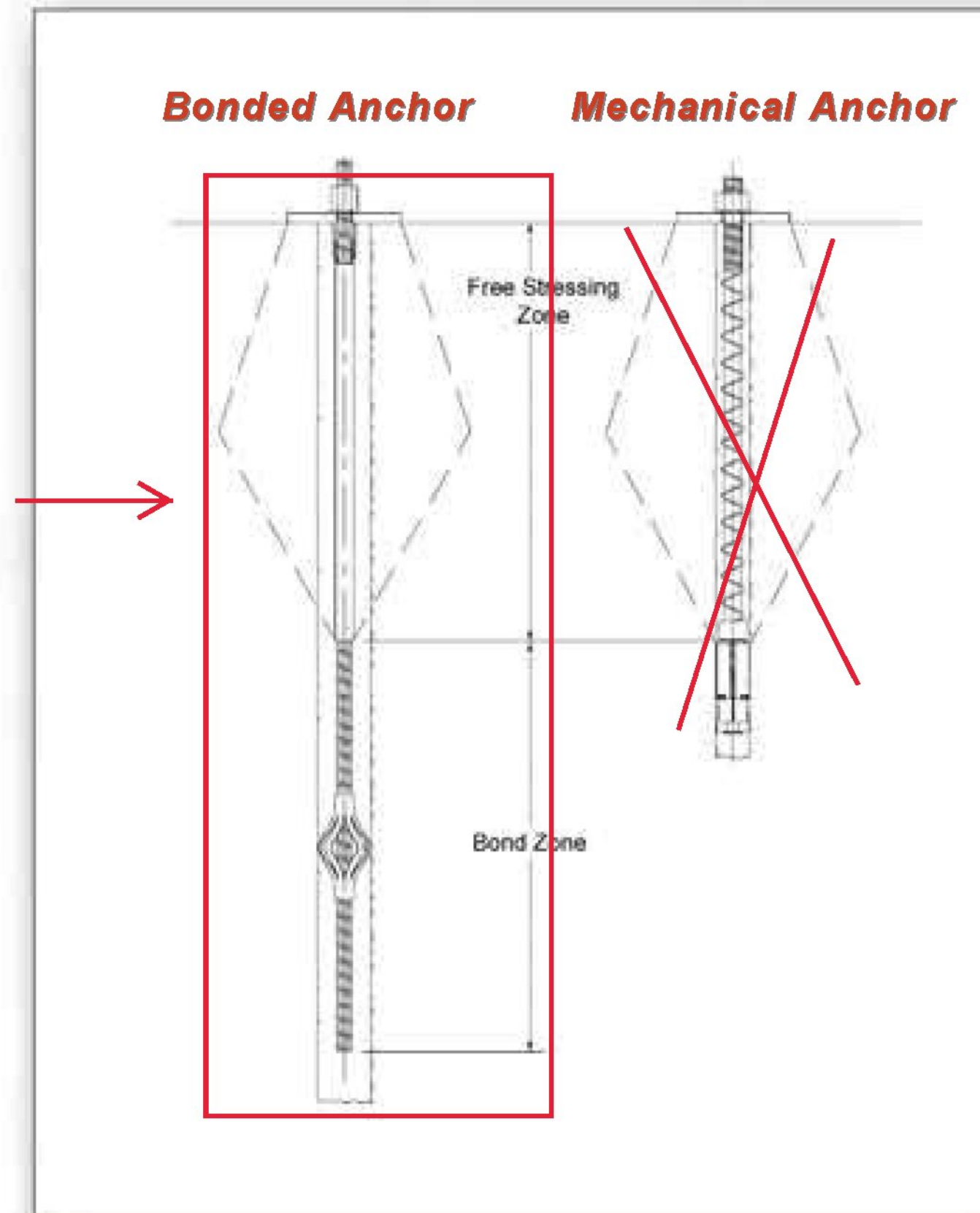
### ~~Mechanical Rock Anchors~~

#### **Advantages**

1. No bond zone, so less drilling is necessary to develop the same shear cone as the bonded anchor system. Also, less grout is needed since there is less hole volume.
2. The installer can prestress and grout the anchor in the same day.
3. There is no cracking of the grout column, since the installer is prestressing the anchor before grouting.
4. The oversized drill hole provides for excellent grout coverage.

#### **Disadvantages**

1. The mechanical rock anchor should only be used in competent rock.
2. The maximum working load for Williams largest mechanical anchor, utilizing a 2:1 safety factor from the ultimate tensile steel capacity, is 180 kips.



### **Grout Bonded Rock & Soil Anchors**

#### **Advantages**

1. Grout bonded anchors can be used in virtually all rock conditions and also in most soils.
2. The maximum working load with a single Williams bar anchor or multi-strand tendon can exceed 1,000 kips.

#### **Disadvantages**

1. The installer must wait for adequate compressive strength of the grout to be reached before prestressing the anchor.
2. A bond zone must be established, so deeper drilling is required to develop the design load in comparison to a mechanical anchor.
3. In weak rock or soils, a test program or sample borings should be used to determine drill hole diameter and anchor lengths.

### ~~Polyester Resin Rock Anchors~~

#### **Advantages**

1. Prestressing can be accomplished within minutes of the installation.
2. Resin bonded anchor bolts are one of the most economical temporary rock anchor systems available.
3. Resin anchoring is successful in most rock types.

#### **Disadvantages**

1. Resin anchors are difficult to protect against corrosion. They require tight drill holes for proper mixing of cartridges, resulting in only a thin resin cover. In addition, resin anchors cannot be centered in the drill hole, which allows the bolt to rest on the bottom or side of the hole. Resin is placed into the drill hole in a premeasured amount which does not account for resin loss into rock seams and cracks. Loss of resin creates unprotected gaps along the anchor, essentially reducing the safety factor of the system.
2. Resin anchors with lengths over 25 feet are difficult to install because resin gel time often requires speedy installations. Couplings cannot be used with full column resin anchors because their outer diameter is too large relative to the drill hole diameter.
3. Water presence can greatly reduce the holding capacity of the anchor or cause the anchors to be susceptible to creep.
4. Temperature affects set and cure times of the resin.

### ~~Mechanical Soil Anchors~~

#### **Advantages**

1. Problems associated with drilling anchor holes are eliminated because the anchor is driven into the soil.
2. All anchors are tested during installation and provide immediate anchorage. Actual holding capacity is determined during pull testing.
3. Time and expense associated with mixing and dispensing grout is eliminated.

#### **Disadvantages**

1. The anchors are designed to hold no more than a 50 kip maximum working load. Holding capacity can be limited by the bearing strength of the soil.
2. Corrosion protection is limited.
3. Rocks or other obstructions in the installation path can prevent adequate embedment.





# Design Considerations

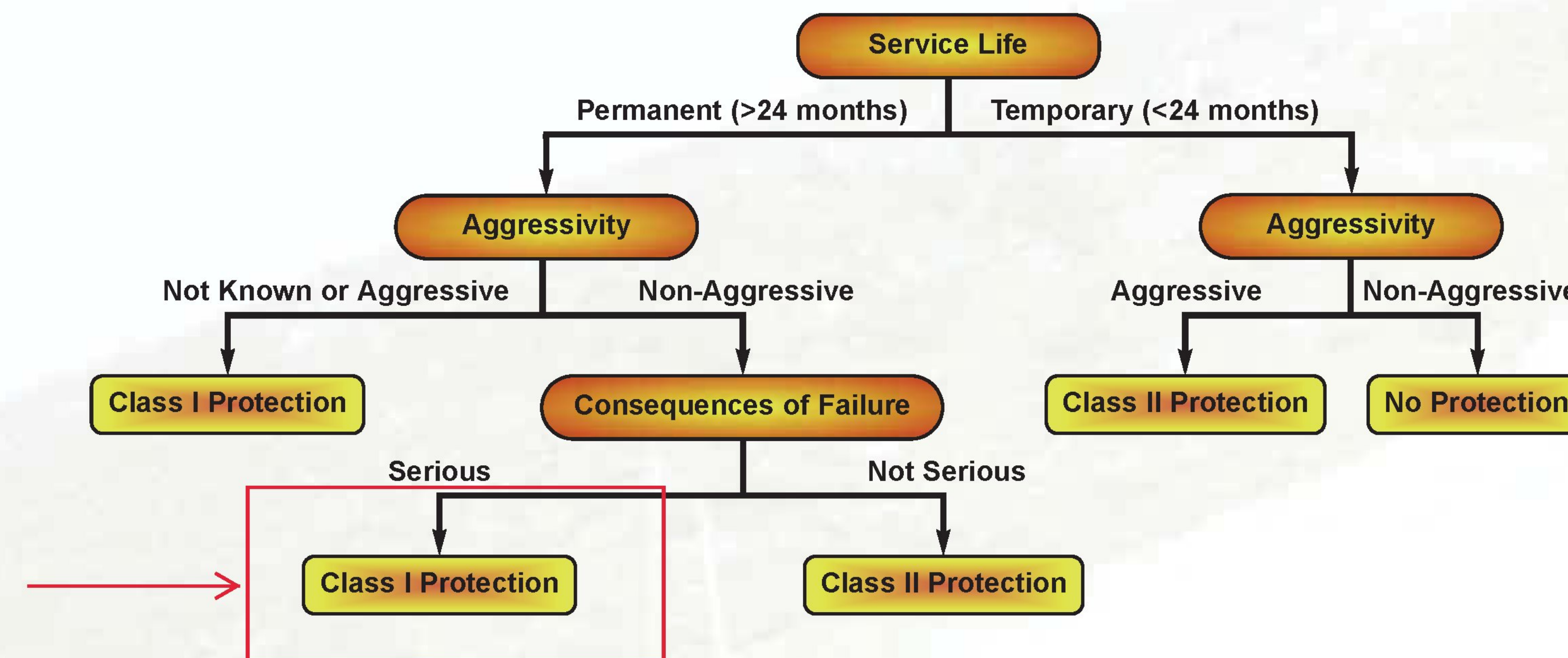
## Corrosion Protection

The level of corrosion protection for an earth anchor is primarily dependent on the service life of the anchor, the aggressivity of the environment, installation methods and consequences of failure. An anchor with a service life greater than 24 months is generally considered permanent. Permanent anchors should always have some type of corrosion protection incorporated into their design.

Ground aggressivity is generally influenced by the following:

1. Electrical resistivity of the soil (Soil is aggressive if resistance is less than 2000 ohm-cm.)
2. pH value of the soil (Soil is aggressive if less than 5.5)
3. Chemical characteristics of the ground water, rock, or soil (salt water, slag fill, industrial waste, organic fill etc.)
4. Moisture
5. Presence of oxygen
6. Stray electrical currents

Governing Specifications for each anchor application may specify different protection schemes and these specifications should always be followed in designing the appropriate corrosion protection level. The following "Decision Tree" published in the PTI Recommendations for Prestressed Rock and Soil Anchors, assists designers in following a logical approach to corrosion protection selection:



### Grout Bonded Rock or Soil Anchors

The standard permanent grout bonded rock or soil anchor consists of an epoxy coated or galvanized anchor rod, grouted in an oversized drill hole. Centralizers should be used to assure good grout cover (approximately 25 mm) around the bar. Additional corrosion protection may be desired if the rock or soil is considered to be aggressive, consequences of failure are high or anchoring into material where good grout cover is difficult to achieve. Williams Multiple Corrosion Protection (MCP) systems offer increasing barriers against corrosion attack. Williams MCP systems allow the anchor bar to be engulfed in a pre-grouted poly-corrugated tube. Protective end caps may also be used to seal the nut and washer from the environment when the outer end of the anchorage will not be encased in concrete.

### Grout Bonded Multi-Strand Anchors

Williams also offers permanent and temporary multi-strand ground anchors. Williams strand anchors are offered with a corrosion inhibiting compound under an extruded high density polyethylene/polypropylene in the anchor unbonded length. The permanent anchors are protected with corrugated high density polyethylene/polypropylene (HDPE/PP) over the entire length of the anchor excluding the stressing tail. The corrugated (HDPE/PP) offers one level of corrosion protection while the field grouting operation inside the corrugated (HDPE/PP) offers an additional level of protection. Temporary anchors are not manufactured with the corrugated (HDPE/PP) over the anchor bond and unbonded lengths. Upon request, the 0.6" diameter, 270 KSI, 7 wire strand is offered epoxy coated or galvanized.





## Corrosion Protection

### Mechanical Rock Anchors

Williams Spin-Lock mechanical rock anchors are used when anchoring into competent rock. The standard Williams Spin-Lock anchor relies on cement grout for corrosion protection. Williams Spin-Locks can be specified with a hollow anchor bar, allowing the system to be grouted from the lowest gravitational point in both up and down bolting applications. This provides a solid grout cover surrounding the anchor rod. Unlike the bonded rock anchor, the Spin-lock is grouted after the anchor is stressed so cracking of the grout column due to prestressing is eliminated. Spin-Lock anchors have been in service since 1959 and in most cases have relied strictly on cement grout for corrosion protection. If so desired, additional corrosion protection can be provided by step drilling a larger diameter drill hole, which provides additional grout cover, or by galvanizing the steel anchor rod. Protective end caps may also be used to seal the nut and washer from the environment when the outer end of the anchorage will not be encased in concrete.

### Anchor Head Protection

The most important section of a ground anchor that needs adequate corrosion protection is the portion of the anchor exposed to air/oxygen. This is typically defined as the "anchor head", which generally consists of a steel bearing plate, a hex nut and washer for a bar system, or a wedge plate and wedges for a strand system. For permanent ground anchors it is best to galvanize the hex nut and plates even if the bar is epoxy coated. Galvanized components, if scratched during shipping, are less likely to cause corrosion concerns than scratched epoxy coated components. The end of the steel bar protruding out from the hex nut is often protected by the use of a plastic or steel end cap packed with grease or cement grout. Williams offers several different types of PVC and metal end caps to provide corrosion protection at otherwise exposed anchor ends.



Fiber Reinforced Nylon Cap



Strand End Cap



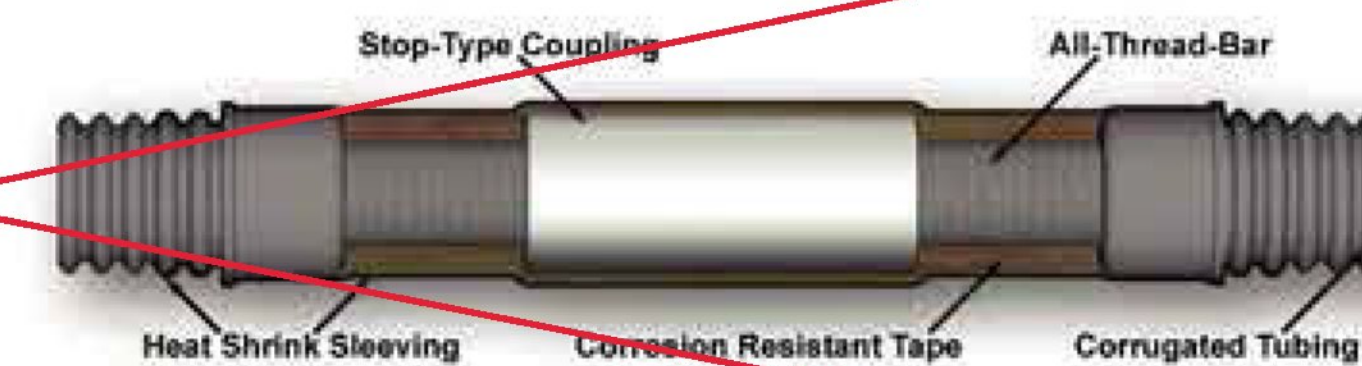
Steel Tube welded on Flange with Threaded Screw Connections



Screw-On PVC Cap

### Field Splice for Bars

Continuous corrosion protection can even be accomplished for the MCP Pregouted anchors manufactured from Williams Form Engineering. To achieve the equivalent levels of corrosion protection the coupled sections of bar anchors can be wrapped in a grease impregnated tape that is further protected with heat shrink sleeving. This scheme is acceptable by most governing agencies and is specified in the PTI Recommendations for Prestressed Rock and Soil Anchors.



### Methods of Corrosion Protection

Corrosion Protection Method	Abrasion Resistance (4 = best)	Typical Thickness	Relative Cost (4 = highest)	Production Lead Time	Can be Applied to Accessories?	Can be Applied in the Field?
Hot Dip Galvanizing	4	3-4 mils	2	2-4 weeks	yes	no
Epoxy Coating	1	7-12 mils	1	2-3 weeks	yes	no
Pre-Grouted Bars	3	2", 3" or 4" tubing	3	2 weeks	no	yes
Extruded Polyethylene/Polypropylene Coating	2	23-25 mils	1	2-4 weeks	no	no
Corrosion Inhibiting Compound	2	N.A.	2	2-4 weeks	yes	yes

- Other thicknesses can be applied, contact a Williams representative for issues regarding threadability of fasteners
- Combination of protection methods are available (i.e. epoxy bar with a pregrout section, galvanizing with epoxy)
- Field patch kits are available for galvanized and epoxy coated products
- Field procedures are available for coupling (2) pregrouted anchors
- Contact Williams for more information regarding the appropriate corrosion protection level and corresponding governing reference specifications/documents.





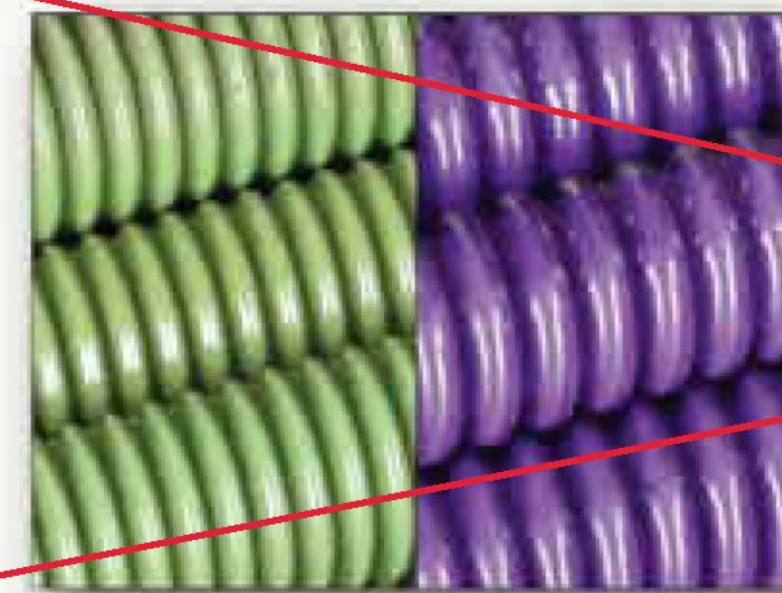
## Design Considerations

### Corrosion Protection



#### **Pre-Grouted Bars** ←

Cement Grout filled corrugated polyethylene tubing is often used to provide an additional barrier against corrosion attack in highly aggressive soils. These anchors are often referred to as MCP or Multiple Corrosion Protection anchors. The steel bars are wrapped with an internal centralizer then placed inside of the polyethylene tube where they are then factory pre-grouted. When specifying couplings with MCP ground anchors, verify coupling locations with a Williams representative.



#### **Epoxy Coating**

Fusion bonded epoxy coating of steel bars to help prevent corrosion has been successfully employed in many applications because of the chemical stability of epoxy resins. Epoxy coated bars and fasteners should be done in accordance with ASTM A775 or ASTM A934. Coating thickness is generally specified between 7 to 12 mils. Epoxy coated bars and components are subject to damage if dragged on the ground or mis-handled. Heavy plates and nuts are often galvanized even though the bar may be epoxy coated since they are difficult to protect against abrasion in the field. Epoxy coating patch kits are often used in the field for repairing nicked or scratched epoxy surfaces.



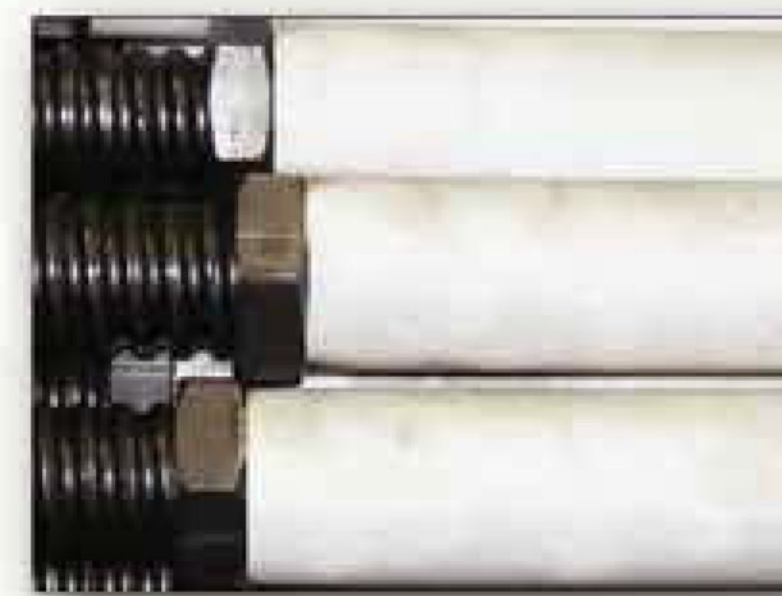
#### **Hot Dip Galvanizing** ←

Zinc serves as a sacrificial metal corroding preferentially to the steel. Galvanized bars have excellent bond characteristics to grout or concrete and do not require as much care in handling as epoxy coated bars. However, galvanization of anchor rods is more expensive than epoxy coating and often has greater lead time. Hot dip galvanizing bars and fasteners should be done in accordance with ASTM A153. Typical galvanized coating thickness for steel bars and components is between 3 and 4 mils. 150 KSI high strength steel bars shall require special cleaning procedures to avoid problems associated with hydrogen embrittlement in compliance with ASTM A143.



#### **Extruded Polyethylene/Polypropylene**

Williams strand tendons contain an extruded high density polyethylene/polypropylene sheathing around each individual strand in the free-stressing portion of the anchorage. The sheathing is minimum 60 mils thick and applied once the 7-wire strand has been coated with a corrosion inhibiting compound. Extruded polyethylene/polypropylene sheathing provides a moisture tight barrier for corrosion protection and allows the strand to elongate freely throughout the free-stressing length during the prestressing operation.



#### **Corrosion Inhibiting Grease or Wax Gel with Sheath** ←

Williams corrosion inhibiting compounds can be placed in the free stressing sleeves, in the end caps, or in the trumpet areas. Often bars are greased/wax gelled and PVC is slipped over the greased/wax gelled bar prior to shipping. Each are of an organic compound with either a grease or wax gel base. They provide the appropriate polar moisture displacement and have corrosion inhibiting additives with self-healing properties. They can be pumped or applied manually. Corrosion inhibiting compounds stay permanently viscous, chemically stable and non-reactive with the prestressing steel, duct materials or grout. Both compounds meet PTI standards for Corrosion Inhibiting Coating.





## Grout Bonded MCP Anchors

### Multiple Corrosion Protection Anchors

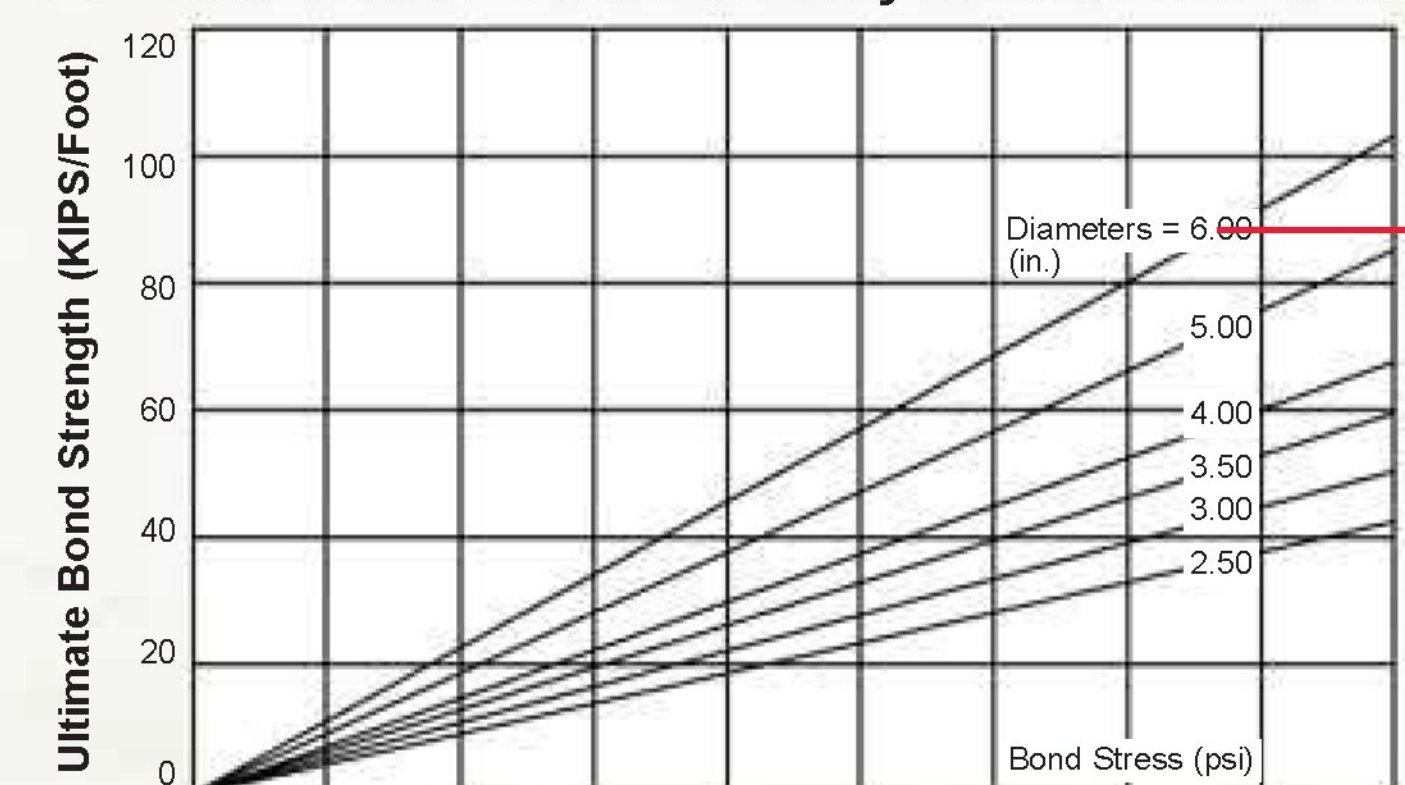
Williams standard grout bonded rock & soil anchors consist of a plain or epoxy coated bar, grouted in an oversized drill hole. Centralizers should be used to assure good grout cover (approximately 25 mm) around the bar. Where anchors will penetrate aggressive soils that are low in pH value (<5.5) and high in sulfate, additional corrosion protection may be desirable. The degree of protection should be matched against the aggressivity of the environment and the expected life of the anchorage system. Williams Multiple Corrosion Protection (MCP) systems offer increasing barriers against corrosion attack for confidence in permanent anchorage in all ground environments. Williams protective outer end caps may also be used to seal the nut and washer from the environment when the outer end of the anchorage will not be encased in concrete.

Typically, Williams MCP anchors are supplied in 150 KSI All-Thread Grade (as shown below) and used in various applications such as externally supported earth structures and tension tie-down systems.



### Ultimate Bond Strength

Per Linear Foot of Cement Grout by Diameter of Drill Hole



Rock  
Type

- A. Coral
- B. Soft Limestone
- C. Dolomitic Limestone
- D. Soft Shale
- E. Sandstone
- F. Granite & Basalt
- G. Hard Shale & Slate
- H. Concrete

### 150 KSI All-Thread Bar

Bar Diameter	Minimum Net Area Thru Threads	Minimum Ultimate Strength	Minimum Yield Strength
1"	0.85 in ² (549 mm ² )	128 kips (567 kN)	102 kips (454 kN)
1-1/4"	1.25 in ² (807 mm ² )	188 kips (834 kN)	150 kips (667 kN)
1-3/8"	1.58 in ² (1019 mm ² )	237 kips (1054 kN)	190 kips (843 kN)
1-3/4"	2.60 in ² (1664 mm ² )	390 kips (1734 kN)	312 kips (1388 kN)
2-1/4"	4.08 in ² (2632 mm ² )	613 kips (2727 kN)	490 kips (2181 kN)
2-1/2"	5.18 in ² (3350 mm ² )	778 kips (3457 kN)	622 kips (2766 kN)
3"	6.46 in ² (4169 mm ² )	969 kips (4311 kN)	775 kips (3448 kN)

For complete 150 KSI All-Thread-Bar chart see page 62.

For Grade 75 All-Thread Rebar strengths, see page 64

### Structural Properties

Bar Type	Yield Stress	Ultimate Stress	Minimum Elongation	Reduction of Area
150 KSI	128 KSI (881 MPa)	150 KSI (1034 MPa)	4% in 20 bar diameters	20%
Grade 75	75 KSI (517 MPa)	100 KSI (689 MPa)	6-7% in 8" gauge length	-

**Notes:** If overall length is over 50' (or 45' for 3" diameter), anchor coupling should be located in bond zone with field-applied barrier, such as heat shrink tube installed across splice joint. At minimum drill hole size, centralizers will only fit around anchor in the bond zone. Drill hole diameters and bond lengths are based on geologic conditions. Consult your geotechnical engineer for recommendations.



# Grout Bonded MCP Anchors



## Multiple Corrosion Protection Anchors

Shown with 150 KSI All-Thread Bar. Drill hole diameters and bond lengths are based on geological conditions. Consult your geotechnical engineer for recommendations. Per PTI, the minimum grout cover over the tendon bond length shall be 1/2" (13 mm).

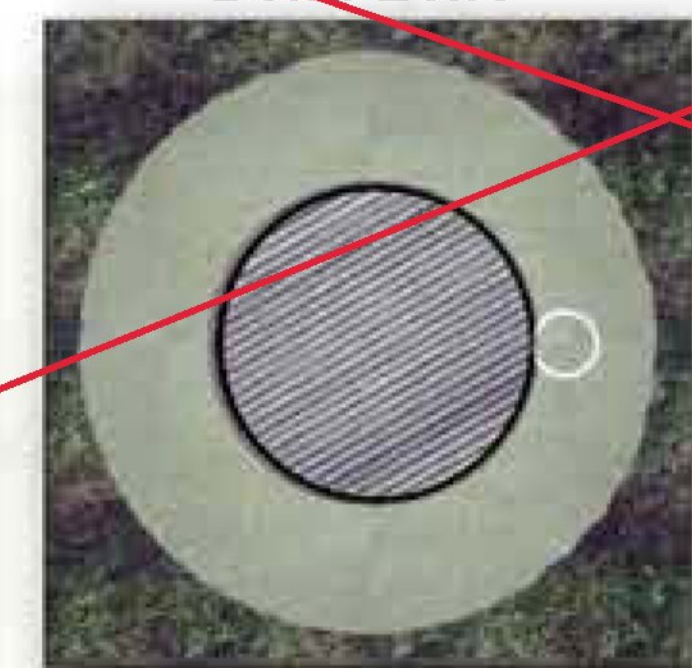
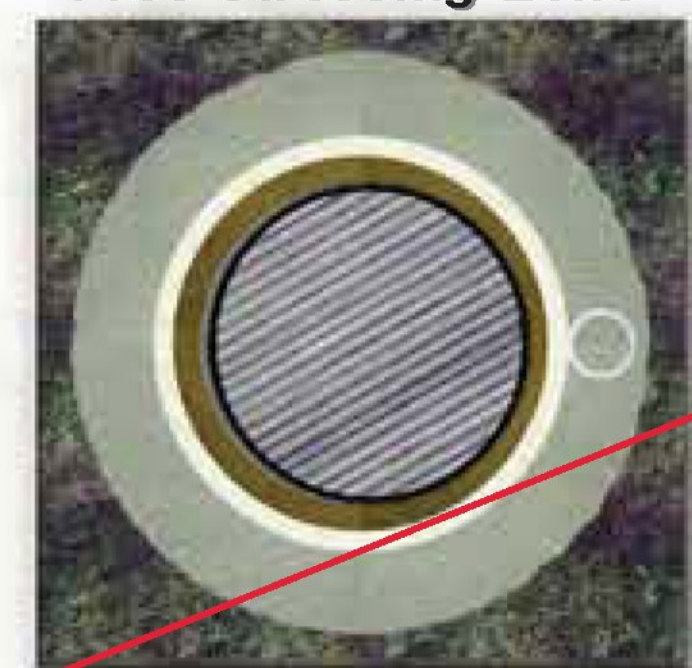
### ~~Williams MCP I - PTI Class II Anchor~~

~~Two barriers around plain bar in free-stress zone plus drill hole grout.~~

- ~~• Plain or epoxy coated bar~~
- ~~• Smooth PVC sleeve over bar in free-stressing zone~~
- ~~• Grease/wax gel or grout filled smooth PVC sleeve over bar in the free-stress zone~~
- ~~• Unit is centered in drill hole grout with centralizers~~

~~Free-Stressing Zone~~

~~Bond Zone~~



Bar Diameter	Minimum Drill Hole Diameter	Common Drill Hole Diameter Range
1" (26 mm)	3-1/2" (89 mm)	3-1/2" to 5" (89 to 127 mm)
1-1/4" (32 mm)	3-1/2" (89 mm)	3-1/2" to 5" (89 to 127 mm)
1-3/8" (36 mm)	4" (102 mm)	4" to 6" (102 to 152 mm)
1-3/4" (45 mm)	4-1/2" (114 mm)	4-1/2" to 7" (114 to 178 mm)
2-1/4" (57 mm)	5" (127 mm)	5" to 8" (127 to 203 mm)
2-1/2" (65 mm)	5" (127 mm)	5" to 8" (127 to 203 mm)
3" (75 mm)	5" (127 mm)	5" to 8" (127 to 203 mm)

### ~~Williams MCP II - PTI Class I Anchor~~

~~Two barriers around plain bar full length plus drill hole grout.~~

- ~~• Bar engulfed in pre-grouted poly corrugated tube in the bond anchorage zone~~
- ~~• Smooth PVC sleeve over bar in free-stressing zone~~
- ~~• Grease/wax gel or grout filled smooth PVC sleeve over bar in the free stress zone~~
- ~~• Unit is centered in drill hole by centralizers and surrounded by grout~~

~~Free-Stressing Zone~~

~~Bond Zone~~



Bar Diameter	Minimum Drill Hole Diameter	Common Drill Hole Diameter Range
1" (26 mm)	3-1/2" (89 mm)	3-1/2" to 5" (89 to 127 mm)
1-1/4" (32 mm)	3-1/2" (89 mm)	3-1/2" to 5" (89 to 127 mm)
1-3/8" (36 mm)	4" (102 mm)	4" to 6" (102 to 152 mm)
1-3/4" (45 mm)	4-1/2" (114 mm)	4-1/2" to 7" (114 to 178 mm)
2-1/4" (57 mm)	5" (127 mm)	5" to 8" (127 to 203 mm)
2-1/2" (65 mm)	5" (127 mm)	5" to 8" (127 to 203 mm)
3" (75 mm)	5" (127 mm)	5" to 8" (127 to 203 mm)

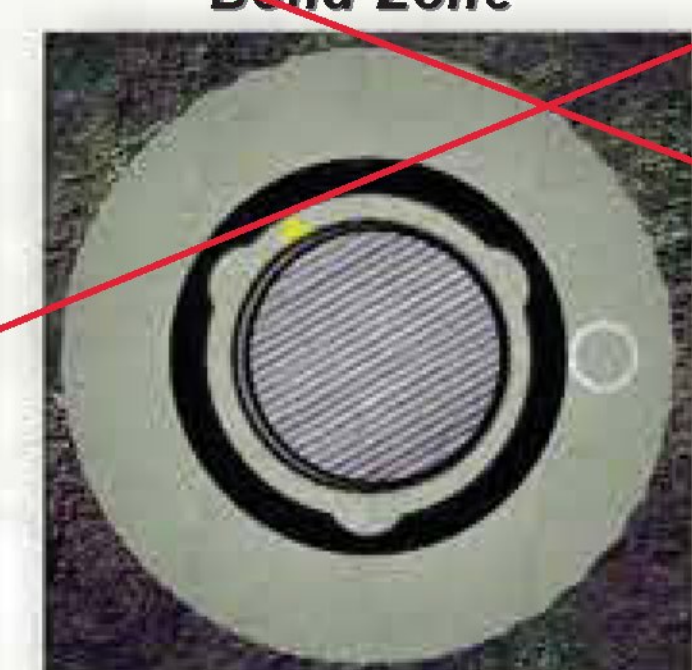
### ~~Williams MCP III - PTI Class I Anchor~~

~~Three barriers around plain bar in free-stress zone, two barriers in bond zone, plus drill hole grout.~~

- ~~• Bar engulfed in pre-grouted poly corrugated tube in the bond anchorage zone and the free-stressing zone.~~
- ~~• Smooth PVC sleeve over the corrugated tube in the free-stressing zone~~
- ~~• Unit is centered in drill hole by centralizer and surrounded by grout~~
- ~~• Plain or galvanized plate with a welded trumpet~~
- ~~• Protective end cap over nut and washer~~

~~Free-Stressing Zone~~

~~Bond Zone~~



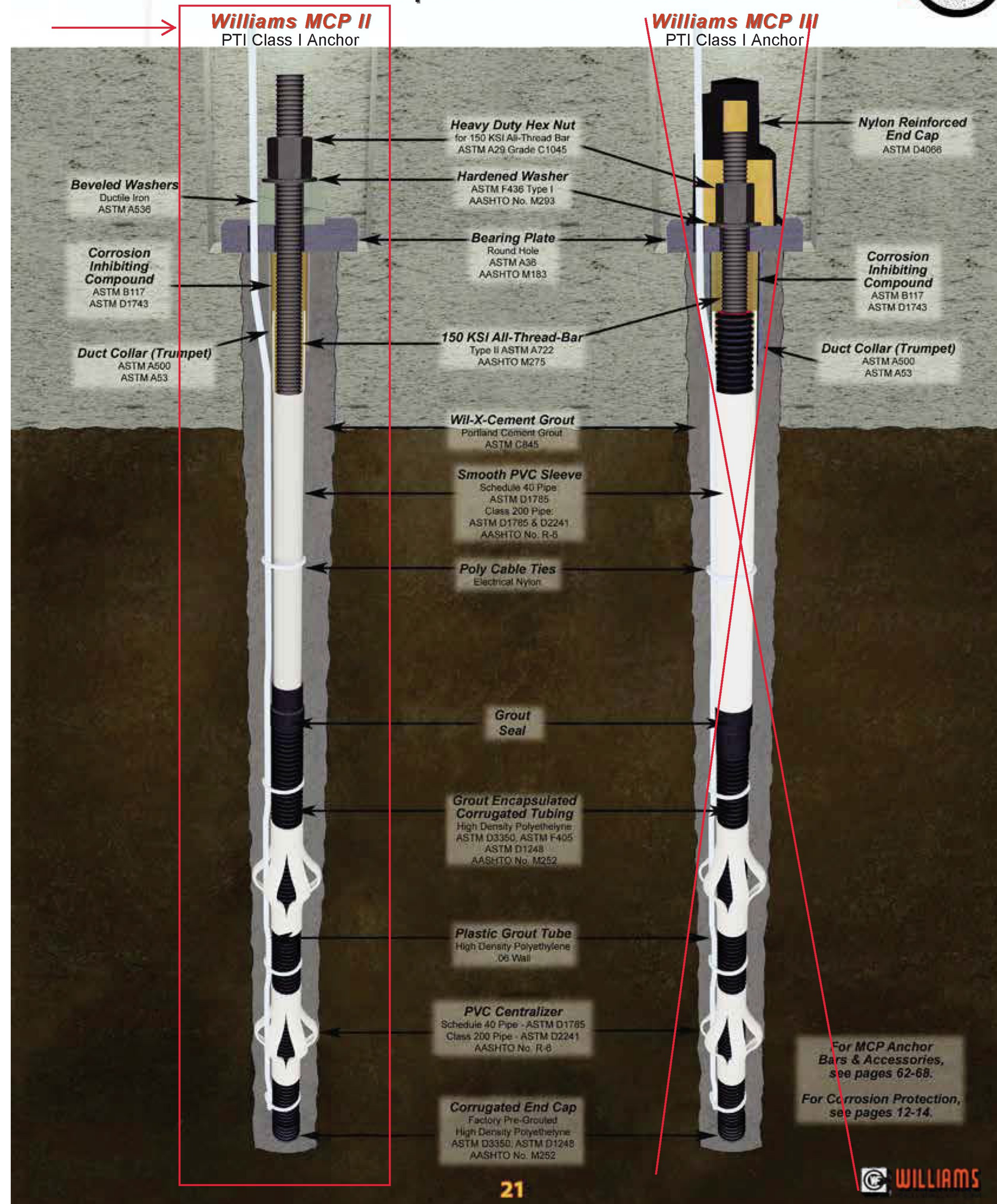
Bar Diameter	Minimum Drill Hole Diameter	Common Drill Hole Diameter Range
1" (26 mm)	4-1/2" (114 mm)	4-1/2" to 6" (114 to 152 mm)
1-1/4" (32 mm)	4-1/2" (114 mm)	4-1/2" to 6" (114 to 152 mm)
1-3/8" (36 mm)	4-1/2" (114 mm)	4-1/2" to 6" (114 to 152 mm)
1-3/4" (45 mm)	7" (178 mm)	7" to 8" (178 to 203 mm)
2-1/4" (57 mm)	8" (204 mm)	8" to 10" (203 to 254 mm)
2-1/2" (65 mm)	8" (204 mm)	8" to 10" (203 to 254 mm)
3" (75 mm)	8" (204 mm)	8" to 10" (203 to 254 mm)



# Grout Bonded MCP Anchors



## Grout Bonded Multiple Corrosion Protection Anchors







# Threaded Bars & Fasteners

## 150 KSI All-Thread-Bar



### R71 150 KSI All-Thread-Bar - ASTM A722*

Nominal Bar Diameter & Pitch	Minimum Net Area Thru Threads	Minimum Ultimate Strength	Prestressing Force			Nominal Weight	Approx. Thread Major Dia.	Part Number
			0.80f pu A	0.70f pu A	0.60f pu A			
1" - 4 (26 mm)	0.85 in ² (549 mm ² )	128 kips (567 kN)	102 kips (454 kN)	89.3 kips (397 kN)	76.5 kips (340 kN)	3.09 lbs./ft. (4.6 Kg/M)	1-1/8" (28.6 mm)	R71-08
1-1/4" - 4 (32 mm)	1.25 in ² (807 mm ² )	188 kips (834 kN)	150 kips (667 kN)	131 kips (584 kN)	113 kips (500 kN)	4.51 lbs./ft. (6.71 Kg/M)	1-7/16" (36.5 mm)	R71-10
1-3/8" - 4 (36 mm)	1.58 in ² (1019 mm ² )	237 kips (1054 kN)	190 kips (843 kN)	166 kips (738 kN)	142 kips (633 kN)	5.71 lbs./ft. (8.50 Kg/M)	1-9/16" (39.7 mm)	R71-11
1-3/4" - 3-1/2 (46 mm)	2.60 in ² (1664 mm ² )	390 kips (1734 kN)	312 kips (1388 kN)	273 kips (1214 kN)	234 kips (1041 kN)	9.06 lbs./ft. (13.5 Kg/M)	2" (50.8 mm)	R71-14
2-1/4" - 3-1/2 (57 mm) *	4.08 in ² (2632 mm ² )	613 kips (2727 kN)	490 kips (2181 kN)	429 kips (1909 kN)	368 kips (1636 kN)	14.1 lbs./ft. (20.8 Kg/M)	2-1/2" (63.5 mm)	R71-18
2-1/2" - 3 (65 mm)	5.19 in ² (3350 mm ² )	778 kips (3457 kN)	622 kips (2766 kN)	545 kips (2422 kN)	467 kips (2074 kN)	18.2 lbs./ft. (27.1 Kg/M)	2-3/4" (69.9 mm)	R71-20
3" - 3 (75 mm) *	6.46 in ² (4169 mm ² )	969 kips (4311 kN)	775 kips (3448 kN)	678 kips (3018 kN)	581 kips (2587 kN)	22.3 lbs./ft. (32.7 Kg/M)	3-3/64" (77.4 mm)	R71-24

* The 2-1/4" diameter is not covered under ASTM A722.

• ACI 355.1R section 3.2.5.1 indicates an ultimate strength in shear has a range of .6 to .7 of the ultimate tensile strength. Designers should provide adequate safety factors for safe shear strengths based on the condition of use.

- Per PTI recommendations for anchoring, anchors should be designed so that:
  - The design load is not more than 60% of the specified minimum tensile strength of the prestressing steel.
  - The lock-off load should not exceed 70% of the specified minimum tensile strength of the prestressing steel.
  - The maximum test load should not exceed 80% of the specified minimum tensile strength of the prestressing steel.

### Sizes

Williams 150 KSI bars are manufactured in 7 diameters from 1" (26 mm) through 3" (75 mm). Most diameters are available in continuous lengths up to 50' (15.2 m).

### Threads

All-Thread-Bars are cold rolled threaded to close tolerances under continuous monitoring procedures for quality control. Threads for Williams 150 KSI bar are specially designed with a rugged thread pitch wide enough to be fast under job site conditions and easy to assemble. They also have a smooth, wide, concentric, surface suitable for torque tensioning. This combination offers tremendous installation savings over inefficient, hot rolled, non-concentric thread forms. Threads are available in both right and left hand.

Williams All-Thread-Bars are threaded around the full circumference enabling the load transfer from the bar to the fasteners to occur efficiently without eccentric point loading. Williams fasteners easily meet the allowable load transfer limitations set forth by the Post Tensioning Institute. Williams 150 KSI All-Thread-Bars and fasteners are machined to tight tolerances for superior performance and mechanical lock. Precision machining greatly reduces concern of fastener loosening or detensioning. Williams 150 KSI bars exceed the deformation requirements of ASTM A722-07. Williams special thread deformation pattern projects ultra high relative rib area, much greater than conventional rebar. This provides for superior bond performance in concrete.

### Cutting (No Welding)

Williams 150 KSI All-Thread-Bar should not be subjected to the heat of a torch, welding or used as a ground. Field cutting should be done with an abrasive wheel or band saw.

### Steel Quality

Williams 1", 1-1/4", & 1-3/8" 150 KSI bars are smooth, hot rolled, high strength prestressing steel. The bars are cold-stressed and stress relieved to produce the above properties. The 1-3/4" through 3" 150 KSI bars are from an alloy based steel that is hot rolled, quenched and tempered to produce to the prescribed mechanical properties of ASTM A722-07.

Thorough inspection and traceability are carried out during all phases of manufacturing to assure the highest standards of quality.

### Properties

Williams 150 KSI bars are manufactured in strict compliance with ASTM A722-07 and AASHTO M275 Highway Specifications. The prestressing steel is high in strength yet ductile enough to exceed the specified elongation and reduction of area requirements. Selected heats can also pass the 135° supplemental bend test when required. Testing has shown Williams 150 KSI All-Thread-Bars to meet or exceed post tensioning bar and rock anchoring criteria as set by the Post Tensioning Institute including dynamic test requirements beyond 500,000 cycles of loading.

Williams 360° continuous thread deformation pattern has the ideal relative rib area configuration to provide excellent bond strength capability to grout or concrete, far better than traditional reinforcing deformation patterns.

### Tensile Strength & Working Loads

Williams 150 KSI bars are available with ultimate tensile strengths and working loads as displayed above. Safety factors and functional working loads are at the discretion of the project design engineer, however test loads should never exceed 80% of the published ultimate bar strength.



# Threaded Bars & Fasteners



## 150 KSI All-Thread-Bar Accessories



Hex Nut

Rounded Collar Nut

### R73 Hex Nuts - ASTM A29 or A576

Bar Diameter	Across Flats	Across Corners	Thickness	Part Number
1" (26 mm)	1-3/4" (44.5 mm)	2.02" (51.3 mm)	2" (50.8 mm)	R73-08
1-1/4" (32 mm)	2-1/4" (57.2 mm)	2.60" (66.0 mm)	2-1/2" (63.5 mm)	R73-10
1-3/8" (36 mm)	2-1/2" (63.5 mm)	2.89" (73.4 mm)	2-3/4" (69.9 mm)	R73-11
1-3/4" (46 mm)	3" (76.2 mm)	3.46" (87.9 mm)	3-1/2" (88.9 mm)	R73-14
2-1/4" (57 mm)	3-1/2" (88.9 mm)	4" (102 mm)	4-1/4" (108 mm)	R73-18
2-1/2" (65 mm)	4-1/4" (108 mm)	4.90" (124 mm)	4-3/4" (121 mm)	R73-20
3" (75 mm)	4-1/4" (108 mm)	5" (127 mm)	6-1/8" (156 mm)	R74-24

* Rounded collar nut with OD of 5" (127 mm).



ASTM A29, Grade C1045 or ASTM A576

### R72 Stop-Type Coupling

Bar Diameter	Outside Diameter	Overall Length	Part Number
1" (26 mm)	1-3/4" (44.5 mm)	4-1/4" (108 mm)	R72-08
1-1/4" (32 mm)	2-1/8" (54.0 mm)	5-1/4" (133 mm)	R72-10
1-3/8" (36 mm)	2-3/8" (60.3 mm)	5-3/4" (146 mm)	R72-11
1-3/4" (46 mm)	3" (76.2 mm)	8-1/2" (216 mm)	R72-14
2-1/4" (57 mm)	3-1/2" (88.9 mm)	9" (229 mm)	R72-18
2-1/2" (65 mm)	4-1/4" (108 mm)	9-3/8" (238 mm)	R72-20
3" (75 mm)	5" (127 mm)	11-7/8" (302 mm)	R72-24



Domed Washer

Provides up to 5° angle when used with a dished plate.

### R9F Hardened Washers - ASTM F436

Bar Diameter	Outside Diameter	Inside Diameter	Thickness	Part Number
1" (26 mm)	2-1/4" (57.2 mm)	1-1/4" (31.8 mm)	5/32" (3.97 mm)	R9F-09-436
1-1/4" (32 mm)	2-3/4" (69.9 mm)	1-1/2" (38.1 mm)	5/32" (3.97 mm)	R9F-11-436
1-3/8" (36 mm)	3" (76.2 mm)	1-5/8" (41.3 mm)	5/32" (3.97 mm)	R9F-12-436
1-3/4" (46 mm)	3-3/4" (95.3 mm)	2-1/8" (54.0 mm)	7/32" (5.56 mm)	R9F-16-436
2-1/4" (57 mm)	4-1/2" (114 mm)	2-5/8" (66.7 mm)	9/32" (7.14 mm)	R9F-20-436
2-1/2" (65 mm)	5" (127 mm)	2-7/8" (73.0 mm)	9/32" (7.14 mm)	R9F-22-436
3" (75 mm)	6" (152 mm)	3-3/8" (85.7 mm)	9/32" (7.14 mm)	R9F-26-436

### R88 Spherical Hex Nuts - ASTM A536

Bar Diameter	Across Flats	Thickness	Outside Dome	Part Number
1" (26 mm)	1-3/4" (44.5 mm)	2-1/4" (57.2 mm)	2-1/2" (63.5 mm)	R88-08
1-1/4" (32 mm)	2-1/4" (57.2 mm)	2-3/4" (69.9 mm)	3-1/8" (79.5 mm)	R88-10
1-3/8" (36 mm)	2-1/2" (63.5 mm)	3-1/4" (82.6 mm)	3-5/8" (90.2 mm)	R88-11
1-3/4" (46 mm)	3" (76.2 mm)	3-1/2" (88.9 mm)	4" (102 mm)	R88-14
2-1/4" (57 mm)	3-1/2" (88.9 mm)	5-3/4" (146 mm)	5-1/2" (140 mm)	R73-18 R81-18
2-1/2" (65 mm)	4-1/4" (108 mm)	6-1/2" (165 mm)	6" (152 mm)	R73-20 R81-20
3" (75 mm)	4-1/4" (108 mm)	8-1/8" (206 mm)	7" (178 mm)	R74-24 R81-24

* Requires a standard nut with spherical washer assembly.

** Requires rounded collar nut with spherical washer assembly.



These Jam Nuts can't be substitute for full strength nuts and can't be used on bars other than Williams 150 KSI All-Thread-Bars of the same diameter.

### R73-JN Jam Nuts - ASTM A29, C1045

Bar Diameter	Across Flats	Thickness	Part Number
1" (26 mm)	1-3/4" (44.5 mm)	1/2" (12.7 mm)	R73-08JN
1-1/4" (32 mm)	2-1/4" (57.2 mm)	5/8" (15.9 mm)	R73-10JN
1-3/8" (36 mm)	2-1/2" (63.5 mm)	11/16" (17.5 mm)	R73-11JN
1-3/4" (46 mm)	3" (76.2 mm)	7/8" (22.2 mm)	R73-14JN
2-1/4" (57 mm)	3-1/4" (82.6 mm)	1" (25.4 mm)	R73-18JN
2-1/2" (65 mm)	4" (102 mm)	1-3/16" (30.2 mm)	R73-20JN
3" (75 mm)	4-1/2" (114 mm)	2" (50.8 mm)	R74-24JN

* Rounded collar nut

### R8M Beveled Washers - ASTM A47 or ASTM A536

Bar Diameter	Degree of Bevel	Outside Diameter	Inside Diameter	Maximum Thickness	Minimum Thickness	Part Number
1" (26 mm)	10°	2-27/32" (72.2 mm)	1-7/16" (36.5 mm)	7/8" (22.2 mm)	3/8" (9.52 mm)	R8M-08-150
1-1/4" (32 mm)	15°	5-1/4" (133 mm)	1-21/32" (42.1 mm)	1-41/64" (41.7 mm)	19/64" (7.54 mm)	R8M-10-150
1-3/8" (36 mm)	15°	5-1/4" (133 mm)	1-25/32" (45.2 mm)	1-41/64" (41.7 mm)	19/64" (7.54 mm)	R8M-11-150
1-3/4" (46 mm)	10°	5-1/2" (140 mm)	2-1/2" (63.5 mm)	1-23/32" (43.7 mm)	3/4" (19.0 mm)	R8M-14-150
2-1/4" (57 mm)	10°	6-1/2" (165 mm)	3" (76.2 mm)	1-7/8" (47.6 mm)	3/4" (19.0 mm)	R8M-18-150
2-1/2" (65 mm)	10°	7-1/2" (190 mm)	3-1/2" (88.9 mm)	2-31" (58.7 mm)	1" (25.4 mm)	R8M-20-150
3" (75 mm)	10°	8" (203 mm)	3-5/8" (92.1 mm)	2-43" (61.7 mm)	1" (25.4 mm)	R8M-24-150

* Additional USS Hardened Washer Required





## Other Accessories

### Other Anchor Accessories

**Bearing Plates** - Williams steel bearing plates are standard with a round hole for non-grouted ground anchors. Also available are dished plates for use with spherical hex nuts and keyhole plates which provide free access for grout tube entry. Bearing plates are customized for each application. Plate dimensions should be specified around the parameters of the project. In addition, corrosion protection should be considered along with specifying hole diameter and bar angle.

~~S1K - Round~~



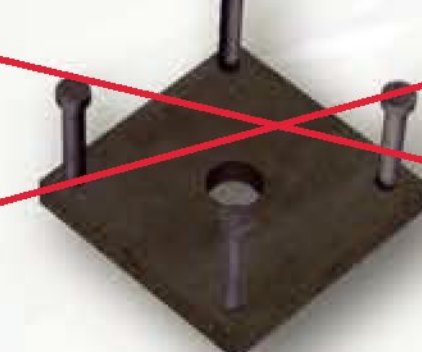
R80 - Dished



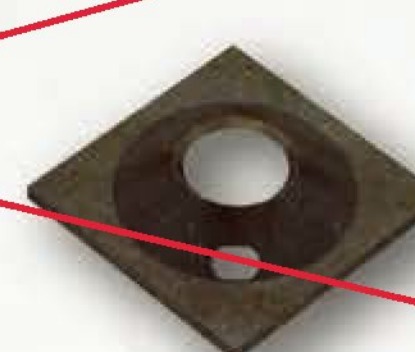
~~S1K - Keyhole~~



~~S0K - Studed~~

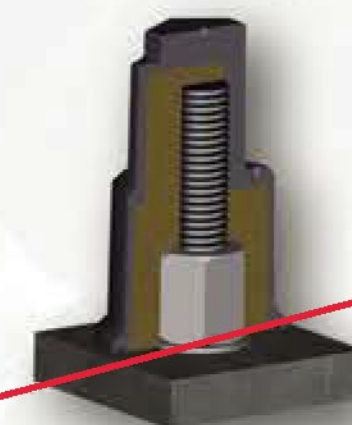


~~S2K - Domed~~

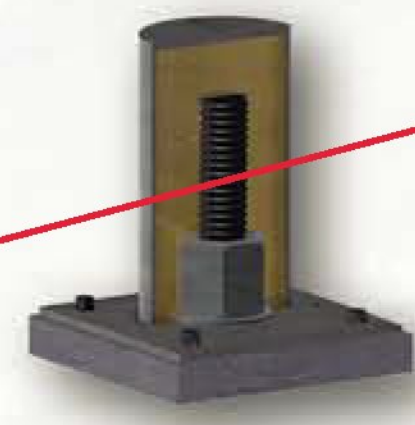


**End Caps** - Williams offers several different types of PVC and metal end caps to provide corrosion protection at otherwise exposed anchor ends. Most often the caps are packed with corrosion inhibiting grease. Caps made from steel are used in exposed impact areas.

~~Fiber Reinforced  
Nylon Cap~~



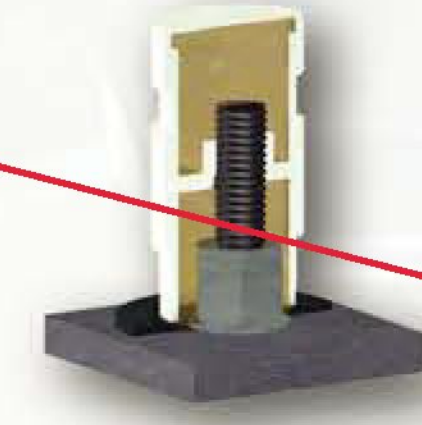
~~Steel Tube welded on  
Flange with Threaded  
Screw Connections~~



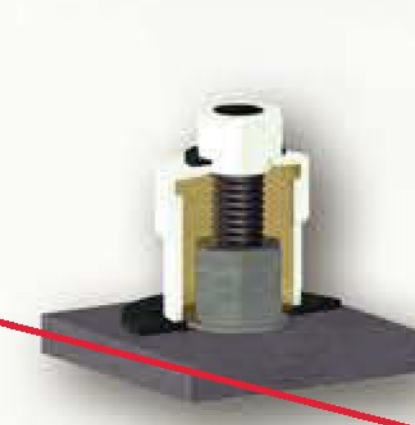
~~Steel Tube  
with Jam Nut~~



~~Screw-on PVC  
Cap w/ Plastic Nut~~



~~Slip-on PVC  
Cap~~



#### CEN PVC Centralizer

The Williams PVC Centralizer is used to center the anchor assembly in the drill hole. They are usually spaced 10 to 15 feet along the bar. To order, specify drill hole diameter, bar size or the outer diameter of sleeve when used over bar.

#### Eye Nuts

Williams Eye Nuts may be used as lifting eyes for forms, concrete blocks, concrete cylinders, machinery or equipment. The large base on three of the models makes them excellent for anchoring guy wires. Safety factors and working loads based on the ultimate strength of the Eye Nuts should be determined for the specific application by the project design engineer.

E1N



E1N3



E1N4



Eye Nut Designation	Inside Width	Inside Height	Ring Diameter	Overall Height	Taps Available				Max Pick S.W.L.	Max Ground Anchor S.W.L.	Max Test Load	Blank Part Number
					UNC C1045 Coil C1045	Grade 60 Grade 75	150 KSI All-Thread	B7X Hollow				
E1N * Forged Steel	2" (51 mm)	2-1/2" (64 mm)	7/8" (22 mm)	5-1/8" (130 mm)	1/2"; 5/8" 3/4"; 7/8"; 1"	#4; #5; #6 #7; #8	-	-	17.5 kips (77.8 kN)	N/A	N/A	E1M-00-E1N
E1N3 Forged Steel	2" (51 mm)	3" (76 mm)	1-3/4" (45 mm)	8" (203 mm)	1-1/8"; 1-1/4" 1-3/8"; 1-1/2"	#9; #10 #11	1"; 1-1/4" 1-3/8"	32 mm 38 mm	59.7 kips (266 kN)	74.7 kips (332 kN)	99.4 kips (442 kN)	E1M-00-E1N3
E1N4 Forged Steel	2-1/2" (64 mm)	3-3/4" (95 mm)	2-3/16" (56 mm)	10" (254 mm)	1-3/4"; 2"	#14	1-1/4"; 1-3/8" 1-3/4"	51 mm	90.7 kips (402 kN)	113 kips (503 kN)	151 kips (672 kN)	E1M-00-E1N4
E1N4C Forged Steel	3" (76 mm)	5" (127 mm)	2" (51 mm)	10-1/4" (260 mm)	1-1/4"; 1-3/8" 1-1/2"; 1-3/4"; 2"	#10; #11 #14	1-1/4"; 1-3/8" 1-3/4"	51 mm	86.7 kips (386 kN)	108 kips (480 kN)	144 kips (641 kN)	E1M-00-E1N4C

* Non-Domestic





## Other Accessories

### Grout & Grout Tubes

#### S52 WIL-X CEMENT GROUT

Conforms to ASTM C845-76 T

Wil-X is chemically compensated for shrinkage. It has a high bond value and is crack resistant for permanent installations. Because it is a cement-grout, it is non-explosive and has a long shelf life when kept dry.



94 lbs. bag

Compressive Strength  
Wil-X Cement Grout & Water  
(73° F Dry Environment)  
0.44 w/c ratio

Time	PSI	MPa
1 Day	2,800	19.3
3 Days	6,400	44.1
7 Days	7,700	53.1
28 Days	9,500	65.5

Wil-X may be used to build up leveling pads by simply mixing with sand or pea gravel. This mixture should not be run through the grout pump.

**Setting Time:** Gilmore Needles (ASTM C266). Initial set 45 minutes; final set 10 hours.

**Comparative compressive strength test in PSI** (modified ASTM C109) Actual strengths as mixed according to Williams Instructions range from 6,000 to 9,500 PSI depending on water content. Copy of ASTM Modification available upon request.



5 gallon, resealable,  
moisture proof,  
polypropylene pails

Note: Results based on a controlled laboratory environment. Jobsite results may vary based on temperature and w/c ratio.

#### US Spec RA Grout

##### Product Description

US Spec RA Grout consists of specialty blended cements and admixtures to provide maximum flow, shrinkage compensation and extended working times in an aggregate free formulation where clearances are minimal. RA Grout is non-metallic and non-corrosive. RA Grout has been specifically formulated to meet and exceed the testing requirements of **ASTM C-1107** and US Army Corps of Engineers CRD C-621. When tested in accordance with ASTM C-827 RA Grout yields a controlled positive expansion.



##### Advantages

- Pumpable fluid grout for very tight clearances
- Non-bleeding
- Attains high compressive strengths at specified w/c ratios
- Extended working time for maximum pumping range
- Non-shrink from time of placement
- Thixotropic: High flow restored by agitation
- Encapsulates tendons, bolts or bars to protect from corrosion
- Consistent: Strict Quality Control testing and standards

Time	PSI	MPa
1 Day	4,500	31.02
7 Days	11,000	75.84
28 Days	15,000	103.42

##### Packaging and Yield

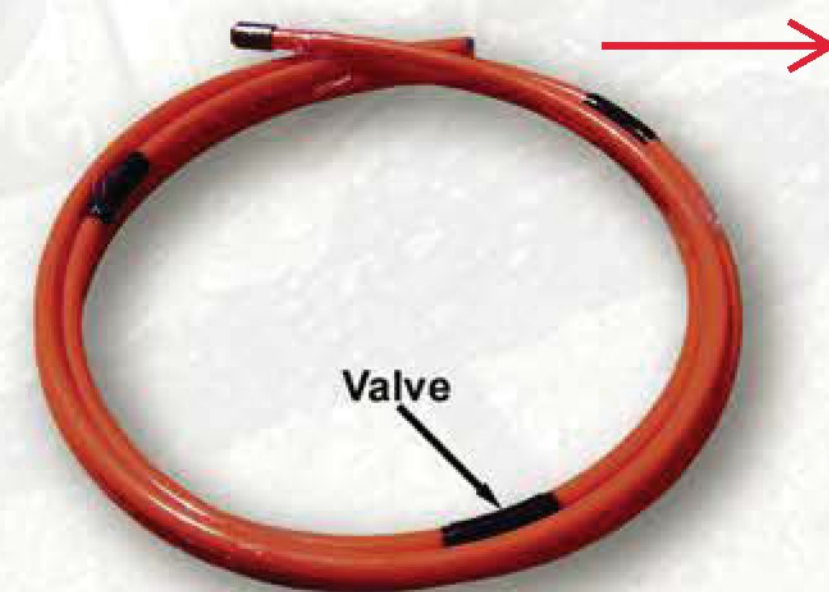
US Spec RA Grout is packaged in heavy duty, polyethylene line backs containing 50 lb (22.7 kg), yielding 0.53 cubic feet when 7.75 quarts of mixing water is used. Each pallet contains 48 bags of RA Grout.

##### Mixing

Mix US Spec RA Grout to a uniform consistency in accordance with the manufacturer's instructions. Potable water containing no chlorides or other foreign substance shall be used. The water shall be accurately measured and placed in the mixer first. Start with 1.94 gallons of water per 50lb bag of US Spec RA Grout and mix continuously for 3-5 minutes before placing. If possible, the grout should be mixed continuously until placing is completed, but if this is not practical, a brief remixing prior to pumping or placement is adequate to overcome the effect of "thixotropic set". Do not use any other admixtures or additives. a brief remixing prior to pumping or placement is adequate to overcome the effect of "thixotropic set".

#### Post-Grout Tube

Williams will provide post-grout tubes for anchors bonded in weak rock or soil upon request. The Williams supplied flexible or rigid post-grout tube has a bursting strength of 1000 psi. The post-grout tube length and valve placement are adjustable and can be specified at the time of order. There is no field assembly of the post grout tube, other than attaching it to the anchor as it is being installed down the drill hole. Drill hole diameter should be a 1" minimum clearance to accommodate Post-Grout Tube.



#### T3P Heavy Duty Plastic Grout Tube

Furnished in product lengths for the rockbolts or in rolls.



O.D.	I.D.	Part No.
3/8" (9.5 mm)	1/4" (6.4 mm)	T3P03002
1/2" (12.7 mm)	3/8" (9.5 mm)	T3P04003
5/8" (15.9 mm)	1/2" (12.7 mm)	T3P05004
3/4" (19.1 mm)	5/8" (15.9 mm)	T3P06005
1" Nom. (25.4 mm)	3/4" Nom. (19.1 mm)	T3P06

#### T4Z Grout Tube Adapter



For down pressure grouting only when grout is forced through normal grout hole in the hollow bar.





## Grouting Accessories & Pumps

### Grout Socks

What was once considered to be an impossible anchorage is made easy with a practical solution from Williams. For difficult bonding applications such as anchors in weak coral, sandstone, highly fractured rock, underwater holes and in artesian water conditions, we place Grout Socks on our grout bonded anchors to prevent grout loss due to permeation or washing away by flowing water. The socks are individually manufactured to be a minimum of 1" larger than the drill hole diameter, allowing the sock to expand into the deformations in the drill hole wall, and in many cases providing the only means to achieve a mechanical bond. In some geotechnical conditions, designers should be aware that Grout Sock may adversely affect the bond strength between the grout and ground. Williams recommends that a testing program be implemented to determine actual bond stress values for elements installed with grout socks.



### Super Plasticizer

Plasticizer is available and is used as a water reducer for ease of pumping grout through tubes at lower water to cement ratios.



### T6Z-04 Hand Pump

2 stroke position, piston driven pump. Pump cement grout only, no sand. Use of plasticizer is recommend with hand pumps.

Approximate size: 30-3/4" high  
24-1/4" wide  
35" high with handle  
Weight: 60 lbs. (Dry weight)  
Outlet capacity: 40 psi average,  
80 psi maximum



### T6Z-08 Air Pump

Or similar

Pumps cement grout only, no sand. 32 Gallon Mixing Tank. Mixes up to 2 sacks of material at once and allows for grout to be pumped during mixing or mixed without pumping.

Weight: 560 lbs.  
Dimension Size: 50" long  
30.5" wide  
52" high  
Production Rate: 8 gallons per minute at 150 psi

### Colloidal Grout Plant

The heavy duty, high volume Colloidal Grout Plant is favored for precision grouting. The unit features a high speed shear mixer that thoroughly wets each particle and discharges the mixed material into a 13 cubic foot capacity agitating holding tank. A direct coupled progressing cavity pump delivers slurries at a rate of up to 20 gpm and pressures of up to 261 psi. The unit easily mixes and pumps slurries of Portland cement, fly ash, bentonite, and lime flour. All controls are conveniently located on the operator platform for easy one-man control.



#### Pump

Pump Type: 31.6 progressing cavity  
Output/Pressure: variable up to 20 gpm, 261 psi

#### Colloidal Mixer

Mix Tank: 13.0 CF with bottom clean out  
Mixing Pump: 2 x 3 x 6 diffuser-type centrifugal  
Holding Tank: 13.0 CF paddle agitating

#### Drive Power

Air: 300 CFM, 100 psi

#### Physical Specifications

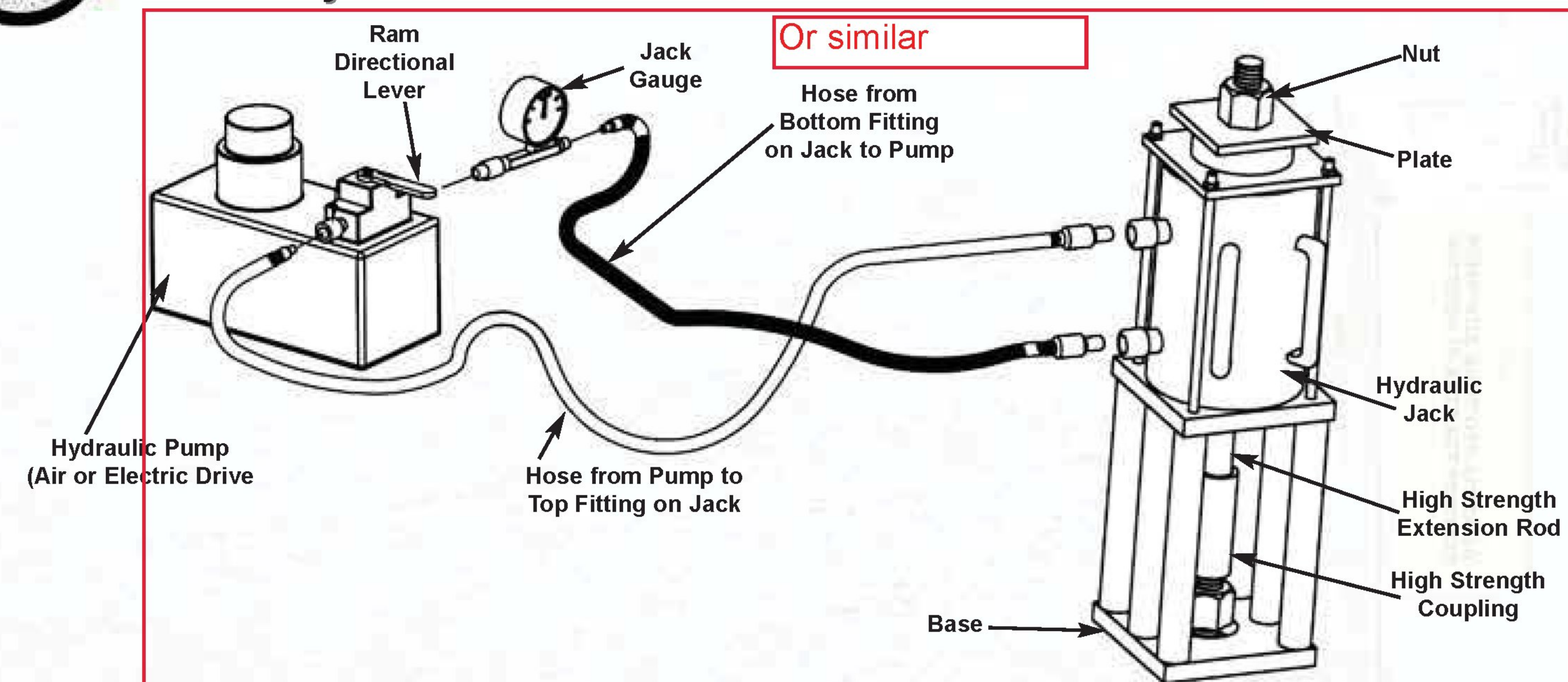
Dimensions: 96"L x 60"W x 63"H  
Weight: 1800-2800 lbs.





# Installation Equipment

## Hydraulic Jacks for Threaded Bar Anchors



### T72 Open Frame Hydraulic Jacks

Used for testing and pre-stressing All-Thread-Bars. Available with up to 5-1/8" center hole. Unit comes with ram, pump, gauge, hoses, jack stand, high strength coupling, high strength test rod, plate, hex nut and knocker wrench.



Jack Capacity	Pump Method	Ram Height	Base Size	Ram Travel	Minimum Total Ram & Frame Height	Maximum Test Rod Diameter	Ram Area	Approx. Total Ram & Frame Weight
10 tons (89 kN)	Hand Single Acting	5-5/16" (135 mm)	3" Diameter (76 mm)	2-1/2" (64 mm)	8-3/8" (213 mm)	3/4" (19 mm)	2.12 in ² (1,368 mm ² )	12 lbs. (5.4 kg)
30 tons (267 kN)	Hand Single Acting	6-1/16" (154 mm)	8" x 8" (203 x 203 mm)	3" (76 mm)	19" (483 mm)	1-1/4" (32 mm)	5.89 in ² (3,800 mm ² )	80 lbs. (36 kg)
60 tons (534 kN)	Hand, Air, or Electric Double Acting	9-1/2" (241 mm)	8" x 8" (203 x 203 mm)	5" (127 mm)	29" (737 mm)	2" (51 mm)	12.31 in ² (7,942 mm ² )	153 lbs. (69 kg)
60 tons (534 kN)	Hand, Air, or Electric Double Acting	12-3/4" (324 mm)	9" x 9" (228 x 228 mm)	6-1/2" (165 mm)	29" (737 mm)	2" (51 mm)	12.73 in ² (8,213 mm ² )	225 lbs. (102 kg)
100 tons (890 kN)	Air or Electric Double Acting	13-1/2" (343 mm)	9" x 9" (228 x 228 mm)	6" (152 mm)	35" (889 mm)	3-1/8" (79 mm)	20.63 in ² (13,310 mm ² )	270 lbs. (123 kg)
100 tons (890 kN)	Air or Electric Double Acting	12-3/8" (314 mm)	9" x 9" (228 x 228 mm)	6" (152 mm)	28" (711 mm)	2" (51 mm)	20.03 in ² (12,923 mm ² )	192 lbs. (87 kg)
150 tons (1334 kN)	Air or Electric Double Acting	12-1/4" (311 mm)	12" x 12" (305 x 305 mm)	5" (127 mm)	32-1/4" (819 mm)	2-1/2" (64 mm)	30.1 in ² (19,419 mm ² )	350 lbs. (159 kg)
200 tons (1779 kN)	Air or Electric Double Acting	16" (406 mm)	12" x 12" (305 x 305 mm)	8" (203 mm)	34" (864 mm)	4" (102 mm)	40.45 in ² (26,097 mm ² )	518 lbs. (235 kg)
300 tons (2670 kN)	Electric Double Acting	27-1/2" (699 mm)	15" Dia. (381 mm)	15" (381 mm)	50-1/2" (1283 mm)	5-3/8" (137 mm)	78.5 in ² (50,645 mm ² )	1,400 lbs. (635 kg)
400 tons (3558 kN)	Electric Double Acting	18-3/4" (476 mm)	15" Dia. (381 mm)	6" (152 mm)	45-3/4" (1162 mm)	4-1/4" (108 mm)	91.5 in ² (59,032 mm ² )	1,300 lbs. (590 kg)
400 tons (3558 kN)	Electric Double Acting	20-3/8" (518 mm)	17" Dia. (432 mm)	8" (203 mm)	49" (1245 mm)	5" (127 mm)	118.2 in ² (76,258 mm ² )	1,500 lbs. (680 kg)

### T80 Post-Tension Hydraulic Jacks

With the T80 series the enclosed bearing housing contains a geared socket drive to tighten the bolt hex nut during tensioning. Test jack housing will accommodate up to a 16" deep pocket (The 200 ton accommodates a 14-1/2" pocket).



Jack Capacity	Pump Method	Ram Height	Base Size	Ram Travel	Minimum Total Ram & Frame Height	Maximum Test Rod Diameter	Ram Area	Approx. Total Ram & Frame Weight
60 tons (534 kN)	Hand, Air, or Electric Double Acting	9-1/2" (241 mm)	GearBox: 8.5" x 20.5" (215 x 520 mm)	5" (127 mm)	33" (838 mm)	2" (51 mm)	12.31 in ² (7,942 mm ² )	122 lbs. (55 kg)
60 tons (534 kN)	Hand, Air, or Electric Double Acting	12-3/4" (324 mm)	Cylinder: 3.63" Dia. (92 mm Dia.)	6-1/2" (165 mm)	36" (914 mm)	2" (51 mm)	12.73 in ² (8,213 mm ² )	225 lbs. (102 kg)
100 tons (890 kN)	Air or Electric Double Acting	13-1/2" (343 mm)	GearBox: 8.5" x 20.5" (216 x 520 mm)	6" (152 mm)	39" (990 mm)	3-1/8" (79 mm)	20.63 in ² (13,310 mm ² )	270 lbs. (123 kg)
150 tons (1334 kN)	Air or Electric Double Acting	12-1/4" (311 mm)	Cylinder: 4.63" Dia. (118 mm Dia.)	5" (127 mm)	28" (965 mm)	2-1/2" (64 mm)	30.1 in ² (19,419 mm ² )	243 lbs. (110 kg)
200 tons (1779 kN)	Air or Electric Double Acting	16" (406 mm)	Frame: 11"x11"x19.75" Nose: 7" Dia.	8" (203 mm)	43" (1097 mm)	4" (102 mm)	40.45 in ² (26,097 mm ² )	455 lbs. (203 kg)

Certification of gauge accuracy available on request prior to shipment only.