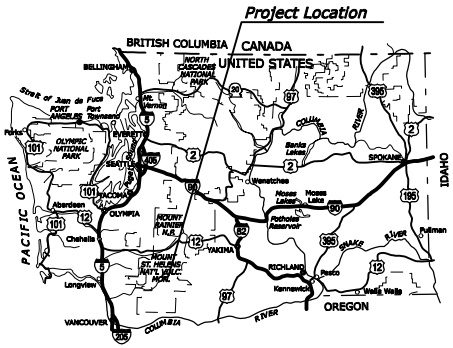
STATE	PROJECT	SHEET NUMBER
WA	FS ERFO 2007(1)-22(1)	A.1

U. S. DEPARTMENT OF TRANSPORTATION
FEDERAL HIGHWAY ADMINISTRATION



WASHINGTON KEY MAP

PLANS FOR PROPOSED PROJECT

WA FS ERFO 2007(1)-22(1)

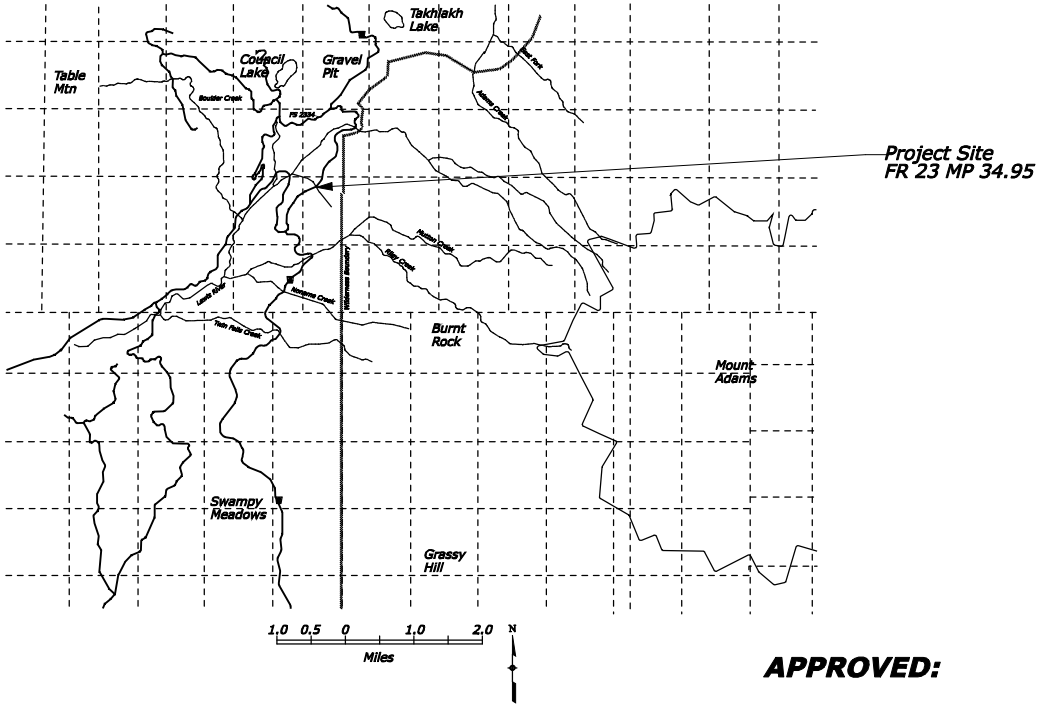
MT ST HELENS DISTRICT REPAIRS
FR 23 MP 34.95

GIFFORD-PINCHOT NATIONAL FOREST
SKAMANIA COUNTY
WASHINGTON

LENGTH 0.054 MILES

INDEX TO SHEETS

A. GENERAL INFORMATION
A.1 TITLE SHEET
A.2 PLAN SYMBOLS AND ABBREVIATIONS
A.3 VICINITY MAP
B. SUMMARIES
B.1 SUMMARY OF QUANTITIES
C. TYPICAL SECTION(S)
C.1 TYPICAL SECTION
D. PLAN-PROFILE
D.1 PLAN AND PROFILE
E. CULVERTS
E.1 CULVERT PLAN AND PROFILE
E.2-4 CULVERT DETAILS
E.5 HEADWALL AND PIPE END DETAILS
F. EROSION CONTROL
F.1 EROSION CONTROL DETAILS
F.2 TEMPORARY DIVERSION CHANNELS



TYPE OF CONSTRUCTION:

Grading, culvert, aggregate surfacing

DESIGN DESIGNATION:

ADT (2008)	75
ADT (2028)	75
V	25 MPH
e (max)	0.040

SPECIFICATION:

Standard Specifications for Construction of Roads and Bridges on Federal Highway Projects, FP-03 US Customary Units

FEDERAL LANDS HIGHWAY
COMMITMENT TO EXCELLENCE

PLANS PREPARED BY

U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL HIGHWAY ADMINISTRATION
WESTERN FEDERAL LANDS HIGHWAY DIVISION
VANCOUVER, WASHINGTON

APPROVED:

/s/ Robert B Lale, III DATE 6/4/08

Director, Project Delivery,
Western Federal Lands Highway Division

PROJECT MANAGER
N. PHAN

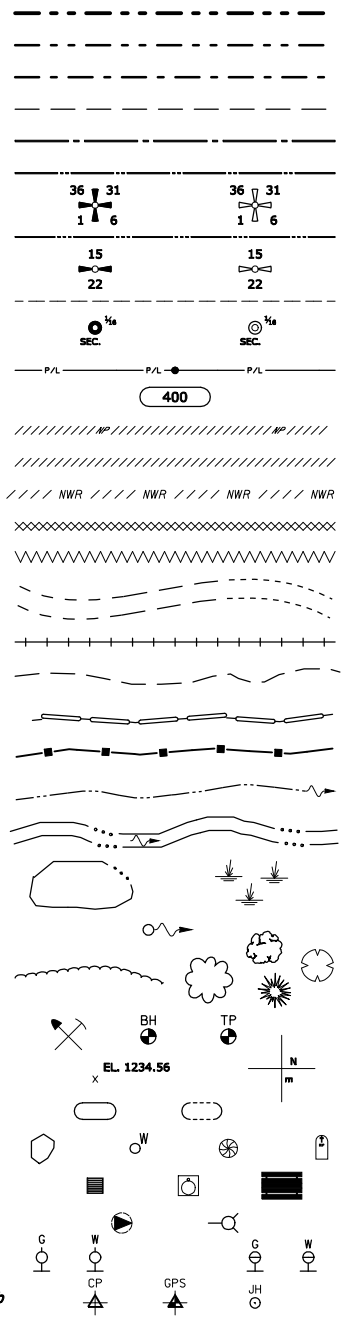
STATE	PROJECT	SHEET NUMBER
WA	FS ERFO 2007(1)-22(1)	A.2

Δ	total central angle
Δc	curve central angle
Ø	diameter
θs	spiral central angle
abut.	abutment
ADT	average daily traffic
AH	ahead
appr.	approach
BK	back
BM	bench mark
BP	balance point
br.	bridge
brg.	bearing
cc or c. to c.	center to center
℄	centerline
clr.	clear
CMP	corrugated metal pipe
col.	column
conc.	concrete
conn.	connection
constr. jt.	construction joint
cont.	continuous
CS	point of curve to spiral
ctrs.	centers
CUFT	cubic foot (feet)
culv.	culvert
CUYD	cubic yard(s)
D	diameter
DHV	design hourly volume
dia.	diameter
diag.	diagonal
diaph.	diaphragm
dist.	distance
drwg(s).	drawing(s)
E	east
e	superelevation rate
El. 94.16 ft	elevation with number
elev.	elevation
emb.	embankment
EP	edge of pavement
EQ or eq.	equation
ER	edge of road
EW	edge of water
exc.	excavation
exp. jt.	expansion joint
fin.	finish
flg.	flange
ft2	square foot
ft3	cubic foot (feet)
ftg.	footing
ga.	gage (gauge)
galv.	galvanized
hdwl.	headwall
hex.	hexagon
HW	high water
ID	inside diameter
jt.	joint
L	length of curve
lam.	lamination
lat.	latitude
LNFT	linear foot (feet)
long.	longitudinal
LPSM	lump sum
Ls	length of spiral
lt. or LT	left
LW	low water
M.L.	main line
M.P.	mile post
matl.	material
max.	maximum
MGAL	thousand gallon
min.	minimum
mon.	monument
N	north
NC	normal crown
o. c.	on center
o. to o.	out to out
OD	outside diameter
OG	original ground
PC	point of curve
PCC	point of compound curve
PCS	point of curve to spiral
PI	point of intersection
pl.	plate
POC	point on curve
POS	point on spiral
POT	point on tangent
PS	point of tangent to spiral
PSC	point of spiral to curve
PST	point of spiral to tangent
PT	point of tangent
pvmt.	pavement
R	radius
R.	range
R/W	right-of-way
rdwy.	roadway
reinf.	reinforcement
reqd.	required
rt. or RT	right
rte.	route
S	south
SADT	seasonal average daily traffic
SC	point of spiral to curve
sec.	section
shldr.	shoulder
SLRY	slurry unit
spa.	spacing, spaces or spaced
SQFT	square foot
SQYD	square yard
SRS	point of spiral to reverse spiral
SS	point of spiral to spiral (no curve)
ST	point of spiral to tangent
STA, Sta.	station
std.	standard
stgr.	stringer
stiff.	stiffener
struc.	structural
STS	point of spiral to tangent spiral
sym.	symmetrical
T	tangent distance
T.	township
TBM	temporary bench mark
thd.	thread
TS	point of tangent to spiral
Ts	tangent distance (spiraled curve)
typ.	typical
V	design speed
vph	vehicles per hour
VPI	vertical point of intersection
W	west
yd2	square yard
yd3	cubic yard(s)

NOTE:

1. Other symbols used in the plans will be shown in a legend on the appropriate plan sheet.

National Boundary
State Boundary
County Boundary
City Boundary
Township or Range Line
Section Line
Section Corner (Found, Projected)
¼ Section Line
¼ Section Corner (Found, Projected)
1/16 Section Line
1/16 Section Corner (Found, Projected)
Property Line w/Found Property Corner
Parcel Number
National Park Boundary
National Forest Boundary
National Wildlife Refuge Boundary
BLM Lands Boundary
Indian Reservation Boundary
Existing Roadway (Road, Paved, Gravel)
Railroad
Trail
Wattle
Silt Fence
Intermittent Drainage or Small Creek
Large Creek or River
Lake, Pond or Reservoir; Marshland
Spring or Seep
Treeline; Individual Trees
Material Source; Bore Hole; Test Pit
Spot Elevation; Coordinate Grid Tick
Above Ground Tank; Underground Tank
Boulder; Well; Satellite Dish; Grave
Cooking Grate; Garbage Can; Picnic Table
Flagpole; Fire Hydrant
Gas & Water Meter; Gas & Water Valve
Control Point (Terestrial and GPS); Jump Hub



North Arrow

	EXISTING	PROPOSED
Slope Stake Limits: Top of Cut		
Toe of Fill		
Transition		
Fence		
Gate with Fence		
Cattleguard		
Guardrail		
Concrete Barrier		
Retaining Wall	wall face	
Signs (Single, double post; portable)		
Delineators		
Pipe Culvert (arrow shows flow)		
Pipe Culvert with End Section		
Pipe Culvert with Headwall		
Pipe Culvert with Drop Inlet	DI	DI
Box Culvert		
Underdrain	UD	UD
Overhead/Above Ground Utilities	P	P
Underground Utilities	W	W

FM = force main, FO = fiber optic, G = gas, IRR = irrigation, O = oil, P = power, SA= sanitary sewer, SD = storm drain, SS = storm sewer, STEAM = steam, T = telephone, TV = CATV, W = water

Poles (Power, Telephone, Joint Use, Light, Support w/Anchor)

Miscellaneous Utility Features: T

EM = electric meter, T = telephone pedestal, TV = CATV pedestal, UP = transformer or junction box, WF = water fountain

Building

Right-of-Way Line with Monument: R/W

Permanent Easement: P/E

Construction Easement: - no symbol -

Riprap

NO SCALE

U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL HIGHWAY ADMINISTRATION
WESTERN FEDERAL LANDS HIGHWAY DIVISION

U.S. CUSTOMARY DETAIL

PLAN SYMBOLS AND ABBREVIATIONS

DETAIL APPROVED FOR USE 11/2001
REVISED: 9/2005 1/2007

DETAIL W101-1

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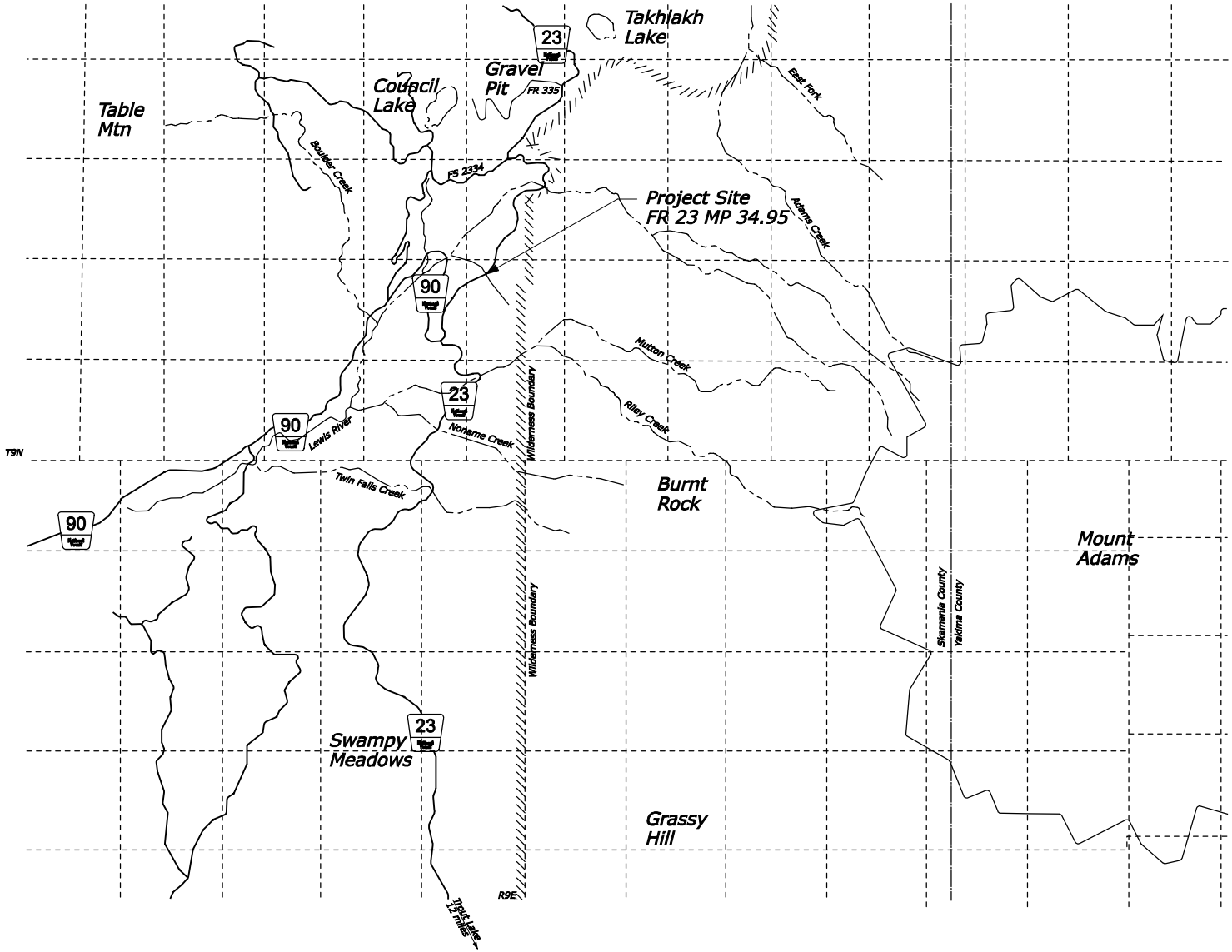
STATE	PROJECT	SHEET NUMBER
WA	FS ERFO 2007(1)-22(1)	A.3



N

1.0 0.5 0 1.0 2.0

Miles

VICINITY MAP

STATE	PROJECT	SHEET NUMBER
WA	FS ERFO 2007(1)-22(1)	B.1

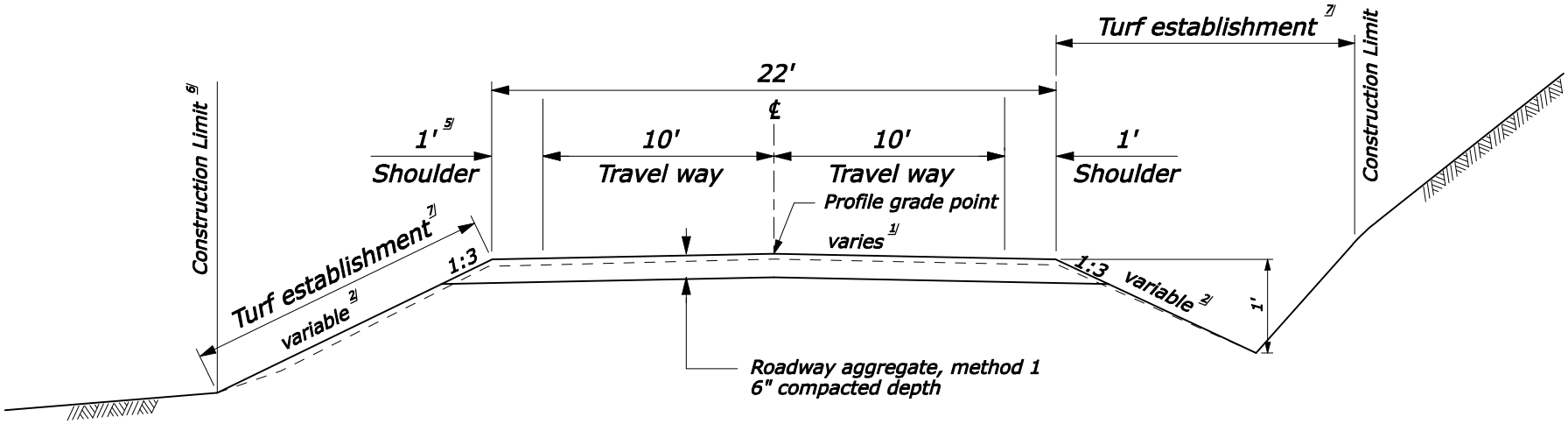
SUMMARY OF QUANTITIES

ITEM	DESCRIPTION	UNIT	C. TYPICAL	D. PLAN-PROFILE	E. CULVERTS	F. EROSION CONTROL										ESTIMATED QUANTITIES PLAN	ESTIMATED QUANTITIES BID SCHEDULE	
	PLAN SHEET SECTION -------->>																	
15101-0000	MOBILIZATION	LPSM														ALL	ALL	
15201-0000	CONSTRUCTION SURVEY AND STAKING	LPSM														ALL	ALL	
15401-0000	CONTRACTOR TESTING	LPSM														ALL	ALL	
15501-0000	CONSTRUCTION SCHEDULE	LPSM														ALL	ALL	
15702-1000	SOIL EROSION CONTROL, TEMPORARY DIVERSION CHANNEL	LPSM														ALL	ALL	
15705-1500	SOIL EROSION CONTROL, SEDIMENT WATTLE	LNFT	340													340	340	
20102-0000	CLEARING AND GRUBBING	LPSM														ALL	ALL	
20301-1900	REMOVAL OF PIPE CULVERT	EACH	1													1	1	
20401-0000	ROADWAY EXCAVATION	CUYD	117													117	117	(CQ)
20403-0000	UNCLASSIFIED BORROW	CUYD	2639													2639	2,639	(CQ)
20701-1500	EARTHWORK GEOTEXTILE, TYPE IV-D	SQYD			95											95	100	
25101-4000	PLACED RIPRAP, CLASS 4	CUYD			136											136	136	(CQ)
25101-5000	PLACED RIPRAP, CLASS 5	CUYD			25											25	25	(CQ)
30802-1000	ROADWAY AGGREGATE, METHOD 1	TON	232													232	260	
60201-1600	72-INCH PIPE CULVERT	LNFT			144											144	144	
62201-0250	DUMP TRUCK, 10 CUBIC YARD MINIMUM CAPACITY	HOUR	10													10	10	
62201-0700	BACKHOE LOADER, 1 CUBIC YARD MINIMUM CAPACITY FRONTEND BUCKET, 10 CUBIC FOOT MINIMUM CAPACITY BACKHOE BUCKET, 90 HP	HOUR	10													10	10	
62301-0000	GENERAL LABOR	HOUR	10													10	10	
62511-2000	SEEDING, HYDRAULIC METHOD	SQYD	1114													1114	1,114	(CQ)
62516-2000	MULCHING, HYDRAULIC METHOD	SQYD	1114													1114	1,114	(CQ)

(CQ) means Contract Quantity

4-Jun-2008 3:01 PM | Designed by: D. Bowman | 3/2008 | Checked by: D. Christianson | 4/2008
[Summary.xls]Sheet

STATE	PROJECT	SHEET NUMBER
WA	FS ERFO 2007(1)-22(1)	C.1



10+27.50 to 13+15.00

SUMMARY OF QUANTITIES			
ITEM	DESCRIPTION	UNIT	QTY
15701-1500	Soil erosion control , sediment wattles	lnft	340
20301-1900	Removal of pipe culvert	ea	1
20401-0000	Roadway excavation	cuyd	117
20403-0000	Unclassified borrow 8/	cuyd	2639
30802-1000	Roadway aggregate, method 1 4/	tons	232
62511-2000	Seeding, hydraulic method	sqyd	1114
62516-2000	Mulching, hydraulic method	sqyd	1114

CURVE WIDENING 5/		
STATION	OFFSET	SIDE
10+73.09	11.0	LT
11+23.09	13.0	LT
12+17.35	13.0	LT
12+53.47	11.0	LT

FOOTNOTES:

1/ For superelevation, see staking report.

2/ See staking report data listing (FAR 52.236-4).

3/ Quantities for culvert pipe installation.

4/ 1.97 tons per cuyd assumed

5/ For curve widening, see staking report data listing.

6/ Place sediment control wattles at lower limit of excavation and along embankment slope as needed to prevent sediment transport beyond limits. See Section F.

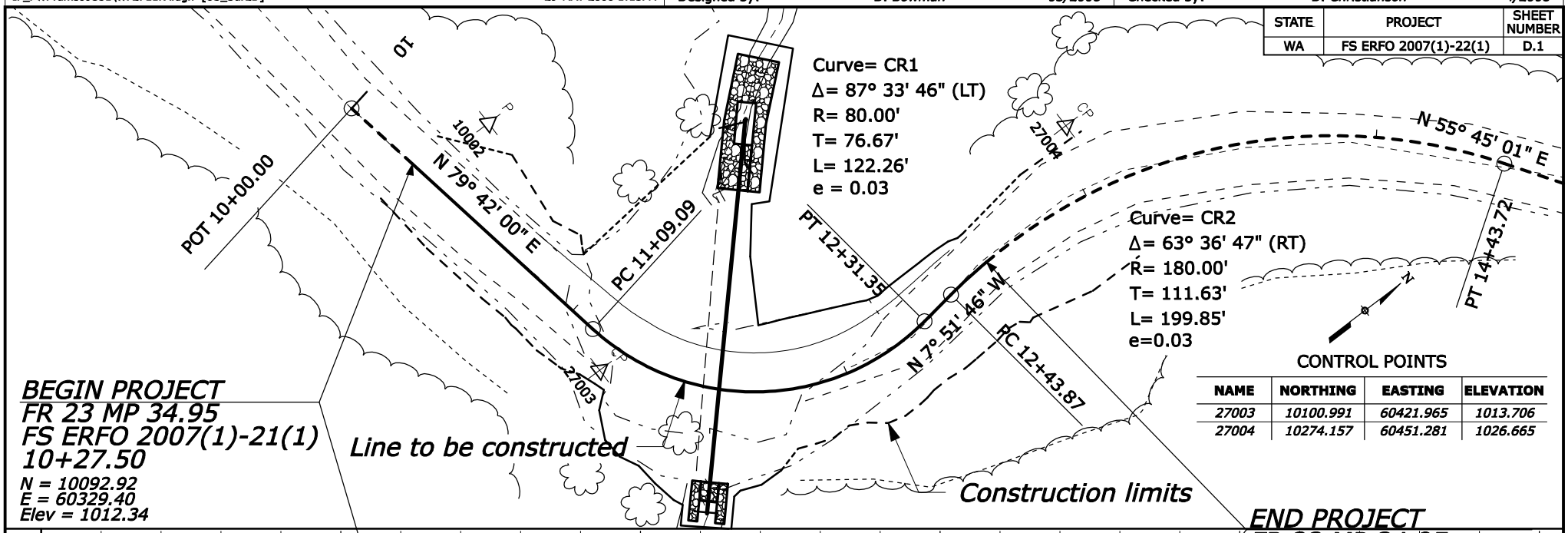
7/ Place conserved topsoil on finished slopes before seeding and mulching.

8/ Does not include pipe backfill quantities resulting from structural excavation.

INFORMATIONAL QUANTITIES		
ITEM	UNIT	QTY
Embankment	cuyd	2756
Structural excavation 3/	cuyd	556

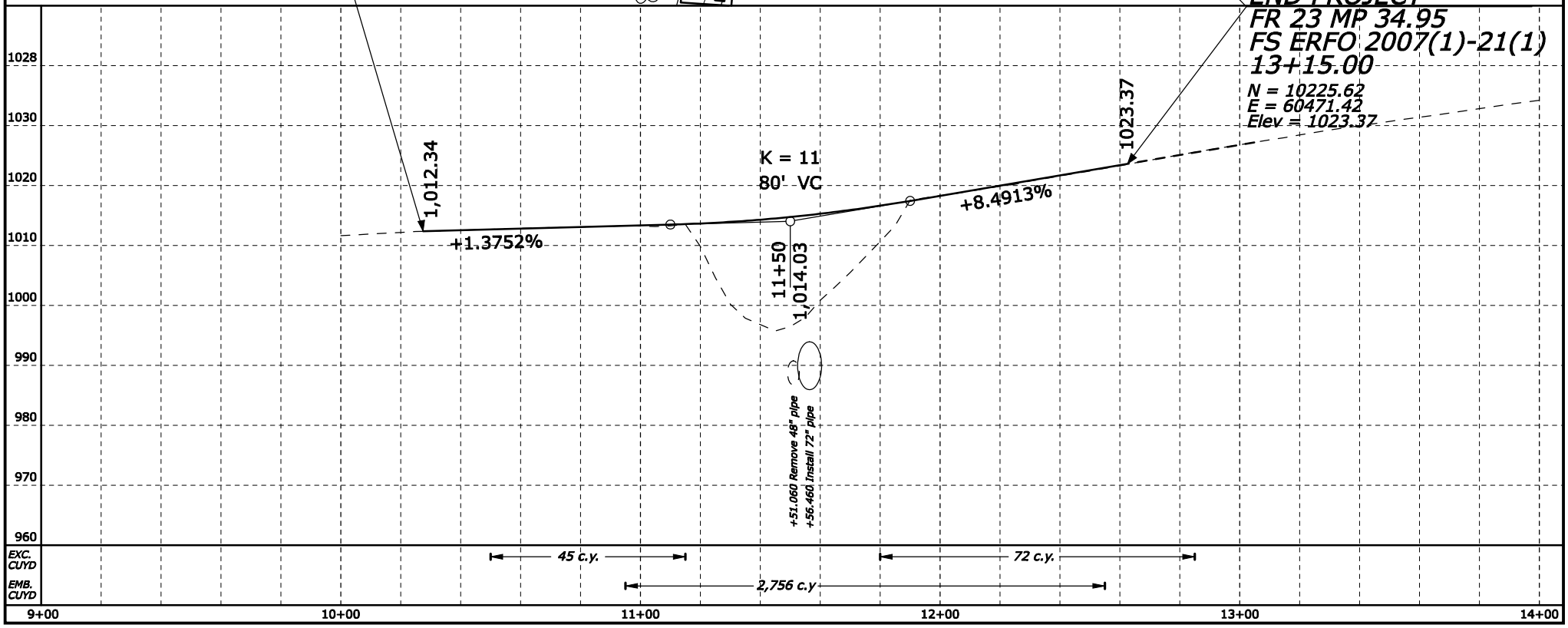
TYPICAL SECTION

STATE	PROJECT	SHEET NUMBER
WA	FS ERFO 2007(1)-22(1)	D.1



CONTROL POINTS

NAME	NORTHING	EASTING	ELEVATION
27003	10100.991	60421.965	1013.706
27004	10274.157	60451.281	1026.665



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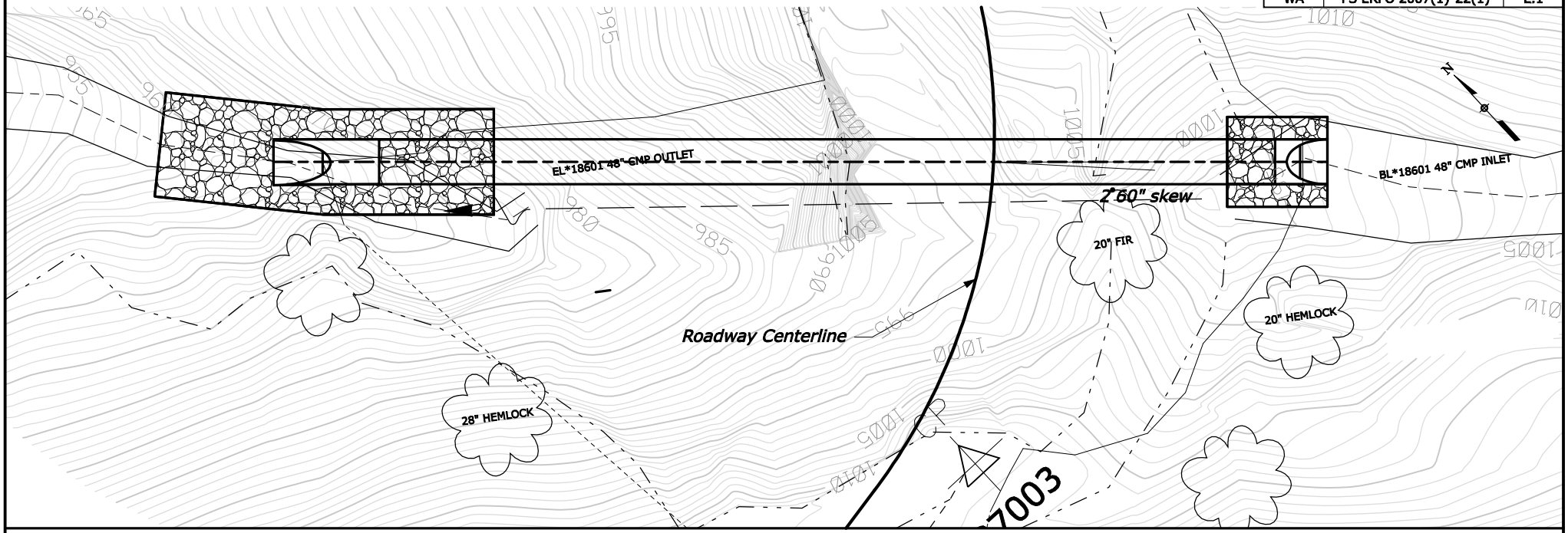
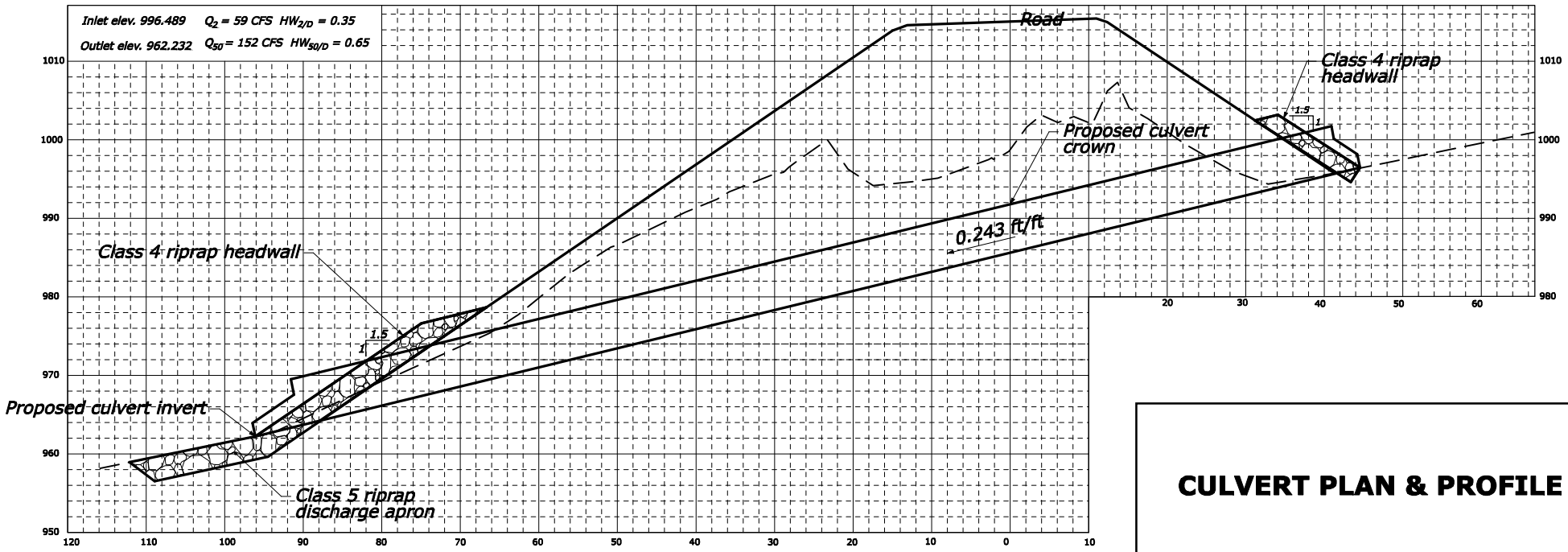
STATE	PROJECT	SHEET NUMBER
WA	FS ERFO 2007(1)-22(1)	E.1





CULVERT PLAN & PROFILE

STATE	PROJECT	SHEET NUMBER
WA	FS ERFO 2007(1)-22(1)	E.2

METAL ROUND PIPE CULVERT

FILL HEIGHT AND METAL THICKNESS TABLE FOR HELICAL LOCKSEAM AND WELDED SEAM PIPE CULVERT

STEEL

PIPE SIZE DIAMETER INCHES	MINIMUM COVER INCHES	2⅔" x ½" CORRUGATIONS					3" x 1" CORRUGATIONS					5" x 1" CORRUGATIONS				
		METAL THICKNESS (INCH/GAGE)														
		0.064/16	0.079/14	0.109/12	0.138/10	0.168/8	0.064/16	0.079/14	0.109/12	0.138/10	0.168/8	0.064/16	0.079/14	0.109/12	0.138/10	0.168/8
		MAXIMUM FILL HEIGHT ABOVE TOP OF PIPE (FEET)														
12	12	100	100	100	100	100										
15	12	100	100	100	100	100										
18	12	100	100	100	100	100										
21	12	100	100	100	100	100										
24	12	100	100	100	100	100										
30	12	85	100	100	100	100										
36	12	71	89	100	100	100	81	100	100	100	100					
42	12	61	76	100	100	100	70	87	100	100	100					
48	12	53	66	93	100	100	61	76	100	100	100	54	68	95	100	100
54	12		59	83	100	100	54	68	95	100	100	48	60	85	100	100
60	12			74	97	100	49	61	86	100	100	43	54	76	98	100
66	12				87	100	44	55	78	100	100	39	49	69	89	100
72	12				80	97	40	51	71	92	100	36	45	63	82	100
78	12					87	37	47	66	85	100	33	42	58	75	92
84	12					75	35	43	61	78	96	31	39	54	70	86
90	12						32	40	57	73	90	29	36	51	65	80
96	12							38	53	69	84		34	48	61	75
102	18							36	50	65	79		32	45	57	71
108	18								47	61	75			42	54	67
114	18								45	58	71			40	52	63
120	18								43	55	67			38	49	60
126	18									52	64				47	57
132	18									50	61				44	54
138	18									48	58				42	52
144	18										56					50

ALUMINUM

PIPE SIZE DIAMETER INCHES	MINIMUM COVER INCHES	2⅔" x ½" CORRUGATIONS					3" x 1" CORRUGATIONS				
		METAL THICKNESS (INCH/GAGE)									
		0.060/16	0.075/14	0.105/12	0.135/10	0.164/8	0.060/16	0.075/14	0.105/12	0.135/10	0.164/8
		MAXIMUM FILL HEIGHT ABOVE TOP OF PIPE (FEET)									
12	12	100	100	100	100	100					
15	12	100	100	100	100	100					
18	12	100	100	100	100	100					
21	12	88	100	100	100	100					
24	12	77	97	100	100	100					
30	12	62	77	100	100	100	71	89	100	100	100
36	12	52	64	90	100	100	59	74	100	100	100
42	12	44	55	77	99	100	51	64	89	100	100
48	12			67	87	100	44	56	78	100	100
54	18			54	71	88	39	50	69	93	100
60	18				57	72	35	45	62	83	98
66	18					58	32	40	56	76	89
72	18					45	30	37	55	70	82
78	24							34	48	64	75
84	24								44	59	70
90	24								41	62	65
96	24								38	51	61
102	24									46	55
108	24									42	50
114	24										45
120	24										40

NOTE:

1. When directed, camber pipe culverts upward from a chord through the inlet and outlet inverts an ordinate amount equal to 1% of the pipe length. Develop camber on a parabolic curve. If the midpoint elevation on the parabolic curve as designed exceeds the elevation of the inlet invert, reduce the amount of camber or increase the pipe culvert gradient.
2. Fill heights exceeding 100 feet require special analysis by the CO.
3. The fill heights in the table are for helical lockseam and welded seam pipe only. Fill heights for culvert pipe with annular corrugations are more restrictive than those of helical lockseam and welded seam pipe. Obtain approval before furnishing annular corrugation pipe.
4. Measure minimum cover from the top of the pipe culvert to the subgrade for flexible pavements, and to the top of the pavement for rigid pavements. Measure maximum fill height from the top of the pipe to the top of the pavement for both flexible and rigid pavement.

METAL PIPE ARCH CULVERT

FILL HEIGHT AND METAL THICKNESS TABLE FOR HELICAL LOCKSEAM AND WELDED SEAM PIPE CULVERT

STEEL

PIPE ARCH SIZE SPAN x RISE INCHES	EQUI-VALENT DIAMETER INCHES	MINIMUM CORNER RADIUS INCHES	MINIMUM COVER INCHES	2⅔" x ½" CORRUGATIONS					3" x 1" CORRUGATIONS					5" x 1" CORRUGATIONS				
				METAL THICKNESS (INCH/GAGE)														
				0.064/16	0.079/14	0.109/12	0.138/10	0.168/8	0.079/14	0.109/12	0.138/10	0.168/8	0.079/14	0.109/12	0.138/10	0.168/8
				MAXIMUM FILL HEIGHT ABOVE TOP OF PIPE (FEET)														
17 x 13	15	3	12	13														
21 x 15	18	3	12	12														
24 x 18	21	3	12	13														
28 x 20	24	3	12	13														
35 x 24	30	3	12	12														
42 x 29	36	3.5	12	12														
49 x 33	42	4	12		12													
57 x 38	48	5	12			12												
60 x 46	54	8	15							21				21				
64 x 43	54	6	12			12												
66 x 51	60	9	15							21				21				
71 x 47	60	7	12				12											
73 x 55	66	12	18							20				20				
77 x 52	66	8	12					12										
81 x 59	72	14	18						17				17					
83 x 57	72	9	12					12										
87 x 63	78	14	18						17				17					
95 x 67	84	16	18						17				17					
103 x 71	90	16	18							17			17					
112 x 75	96	18	21							16				16				
117 x 79	102	18	21							16				16				
128 x 83	108	18	24								16					16		
137 x 87	114	18	24								16					16		
142 x 91	120	18	24									16						16

ALUMINUM

PIPE ARCH SIZE SPAN x RISE INCHES	EQUI-VALENT DIAMETER INCHES	MINIMUM CORNER RADIUS INCHES	MINIMUM COVER INCHES	2⅔" x ½" CORRUGATIONS				3" x 1" CORRUGATIONS			
				METAL THICKNESS (INCH/GAGE)							
				0.060/16	0.075/14	0.105/12	0.135/10	0.060/16	0.075/14	0.105/12	0.135/10
				MAXIMUM FILL HEIGHT ABOVE TOP OF PIPE (FEET)							
17 x 13	15	3	12	13							
21 x 15	18	3	12	12							
24 x 18	21	3	12	13							
28 x 20	24	3	12		13						
35 x 24	30	3	12		12						
42 x 29	36	3.5	15			12					
49 x 33	42	4	15			12					
57 x 38	48	5	15				12				
60 x 46	54	8	15					21			
64 x 43	54	6	18				12				
66 x 51	60	9	18					21			
73 x 55	66	12	18						20		
81 x 59	72	14	21							17	
87 x 63	78	14	21							17	
95 x 67	84	16	24							17	
103 x 71	90	16	24								17

NO SCALE

U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL HIGHWAY ADMINISTRATION
FEDERAL LANDS HIGHWAY

U.S. CUSTOMARY STANDARD

METAL PIPE CULVERT

STANDARD APPROVED FOR USE 12/1993
REVISED: 4/1994 6/2005

STANDARD 602-1

STATE	PROJECT	SHEET NUMBER
WA	FS ERFO 2007(1)-22(1)	E.3

COUPLING BANDS FOR METAL PIPE CULVERT 1/

CORRUGATION SIZE 2/ INCHES	ROUND PIPE DIAMETER INCHES	PIPE ARCH SPAN x RISE INCHES	MINIMUM BAND WIDTH (INCHES) ANNULAR CORRUGATED BANDS 3/	HELICALLY CORRUGATED BANDS 4/	SEMI-CORRUGATED BANDS 5/
1½ x ¼	underdrain 6/	-	10.5	7	10.5
2⅔ x ½	12 to 36	17 x 13 to 42 x 29	7	12	
	42 to 72	49 x 33 to 83 x 57	10.5	12	
	78 to 84	-	10.5	12	10.5
3 x 1	36 to 72	60 x 46 to 81 x 59	12	14	10.5
	78 to 144	87 x 64 to 142 x 91	12	14	10.5
5 x 1	36 to 72	60 x 46 to 81 x 59	20	22	
	78 to 144	87 x 64 to 142 x 91	20	22	

1/ Fabricate annular, helical and semi-corrugated type coupling bands from the same metal as the connecting pipe. Provide coupling bands not more than 3 nominal sheet thicknesses thinner than the thickness of the pipe to be connected, and no thinner than 0.052 inch for steel or 0.048 inch for aluminum. Fasten coupling bands with the following diameter of bolt:
⅜" for 18" round culvert (21" x 15" pipe arch) or less
½" for 21" round culvert (24" x 18" pipe arch) or more

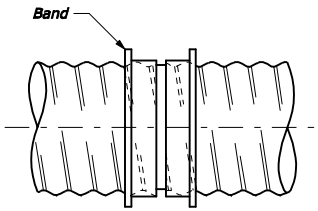
2/ For helically corrugated pipe with rerolled ends, the nominal corrugations size refers to the dimension of the end corrugation in the pipe.

3/ Use annular corrugated bands with pipes having annular corrugations or with helical pipe having rerolled end to form annular corrugations. A 10.5 inch band is acceptable on pipe ends rerolled with 2⅔" x ½" corrugations. A 12 inch band is acceptable on pipe ends rerolled with 3" x 1" pipe corrugations.

4/ Use helical corrugated bands with pipes having helically corrugated ends.

5/ The minimum band widths shown for 3" x 1" and 5" x 1" corrugated sizes apply to 2⅔" x ½" corrugations on rerolled pipe ends.

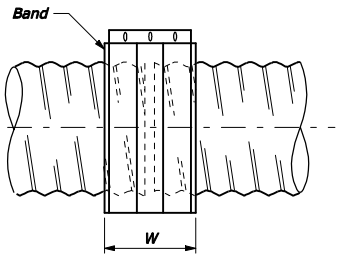
6/ Smooth sleeve-type couplers and flat bands may be used for pipe diameters of 12" or less. Use a matching metal having a nominal thickness of not less than 0.040 inch for steel, or 0.036 inch for aluminum, or a plastic with an equivalent strength to metal.



SLEEVE JOINT

Smoother sleeve with center stop.
Stab type joint

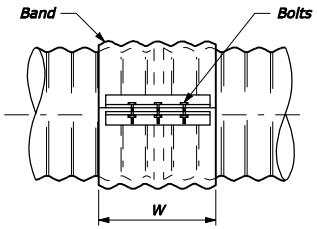
SMOOTH SLEEVE BAND



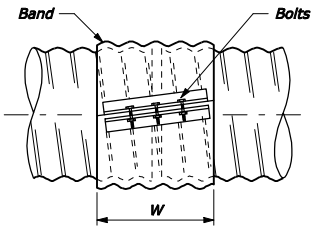
FLAT BAND

NOTE:

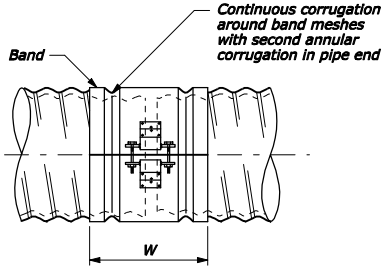
1. Watertight pipe joints are not required unless specified in the Special Contract Requirements.
2. Other types of coupling bands or fastening devices that comply with the joint performance criteria of AASHTO Standard specifications for Highway Bridges, Division II Section 26 may be used.



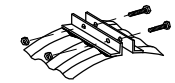
SIDE VIEW



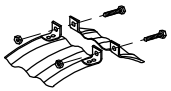
SIDE VIEW



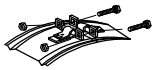
SIDE VIEW



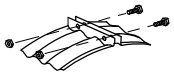
Band Angle



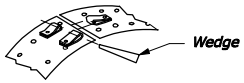
Oval Lug



Bar & Strap

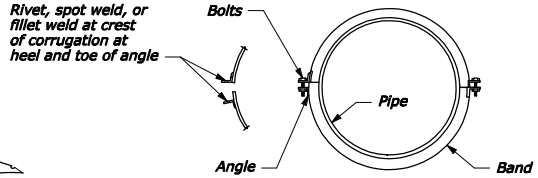


Integral Flange



Wedge and Strap

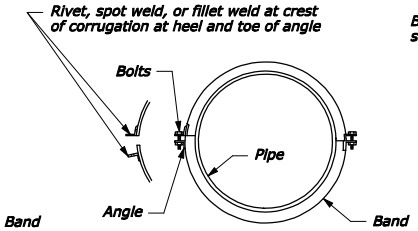
STANDARD BAND CONNECTIONS



END VIEW

Second angle connection optional to 42" diameter, required above 42" diameter

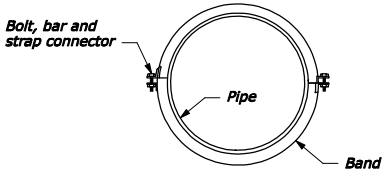
ANNULAR BAND



END VIEW

Second angle connection optional to 42" diameter, required above 42" diameter

HELICAL BAND



END VIEW

SEMI-CORRUGATED BAND

NO SCALE

U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL HIGHWAY ADMINISTRATION
FEDERAL LANDS HIGHWAY

U.S. CUSTOMARY STANDARD

METAL PIPE CULVERT COUPLING BAND

STANDARD APPROVED FOR USE 12/1993
REVISED: 4/1994 8/2005

STANDARD 602-2

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STATE	PROJECT	SHEET NUMBER
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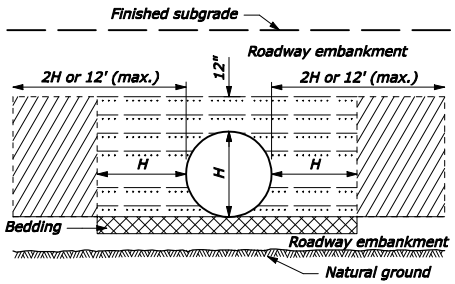
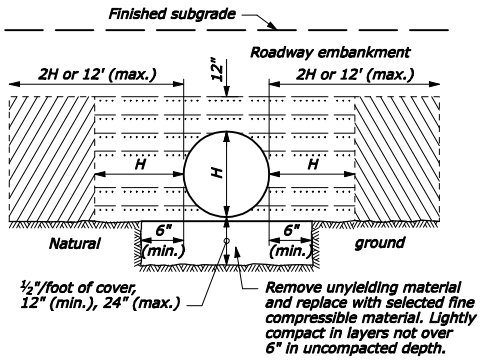
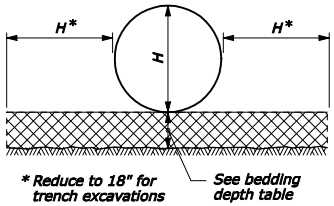


ABOVE NATURAL GROUND



ON UNYIELDING MATERIAL

BEDDING DEPTH	
PIPE SIZE (H)	DEPTH
12" to 54"	4"
> 54"	6"

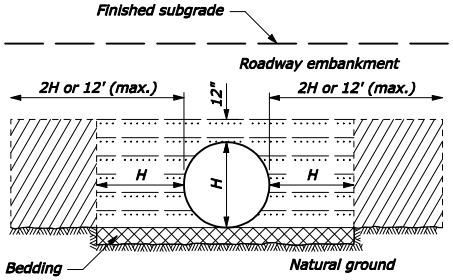


PIPE BEDDING

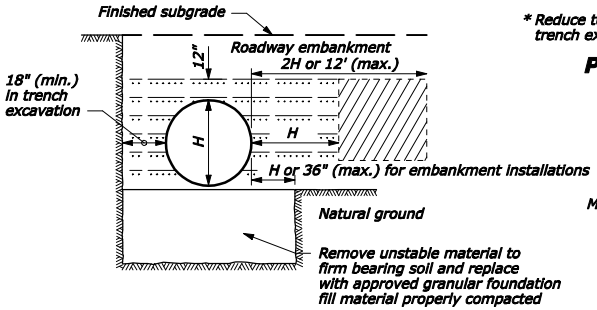
NOTE:

1. When directed, camber pipe culverts upward from a chord through the inlet and outlet inverts an ordinate amount equal to 1% of the pipe length. Develop camber on a parabolic curve. If the midpoint elevation on the parabolic curve as designed exceeds the elevation of the inlet invert, reduce the amount of camber or increase the pipe culvert gradient.
2. H equals the diameter of all round pipe culverts or the rise dimension of all pipe arch culverts.

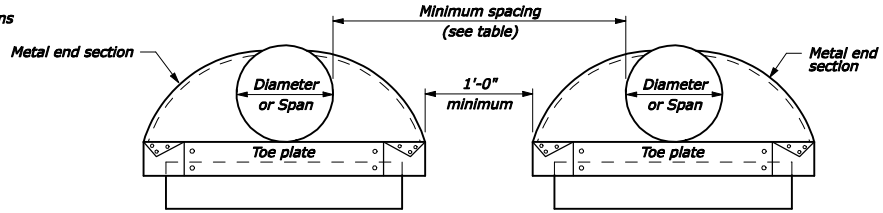
MINIMUM SPACING	
DIAMETER or SPAN	SPACING
UP to 48"	24"
48" and UP	Half diameter or span OR 36" whichever is less



ON NATURAL GROUND

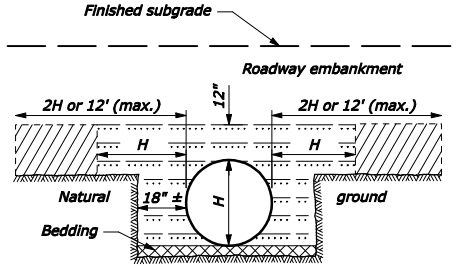


ON UNSTABLE MATERIAL

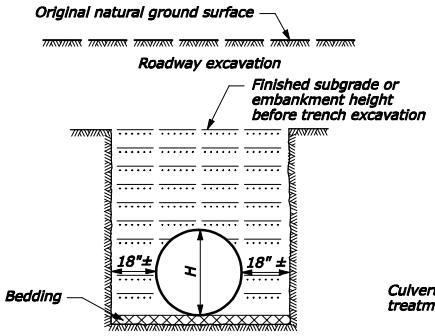


ELEVATION

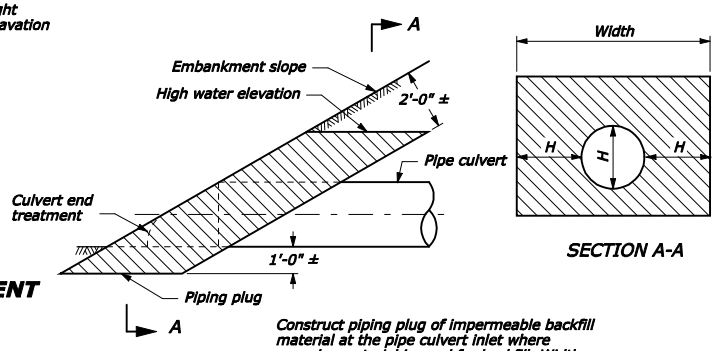
MULTIPLE PIPE INSTALLATION



ABOVE AND BELOW NATURAL GROUND



BELOW NATURAL GROUND OR TRENCH EXCAVATION IN EMBANKMENT



SECTION A-A

Construct piping plug of impermeable backfill material at the pipe culvert inlet where granular material is used for backfill. Width may be adjusted to tie into impervious material.

PIPING PLUG

NO SCALE

Bedding material (uncompacted)

Embankment material placed in layers not exceeding 6" compacted depth.

Compacted backfill material placed in layers not exceeding 6" compacted depth meeting the following:
Metal Pipe: Maximum particle size = 3"
Soil classification: A-1, A-2, or A-3
Plastic Pipe: Maximum particle size: 1½"
Soil classification: A-1, A-2-4, A-2-5, or A-3
Or lean concrete backfill in accordance with Section 614.

U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL HIGHWAY ADMINISTRATION
FEDERAL LANDS HIGHWAY

U.S. CUSTOMARY STANDARD

METAL AND PLASTIC PIPE CULVERT BEDDING

STANDARD APPROVED FOR USE 12/1993
REVISED: 4/1994 6/2005

STANDARD 602-3

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STATE	PROJECT	SHEET NUMBER
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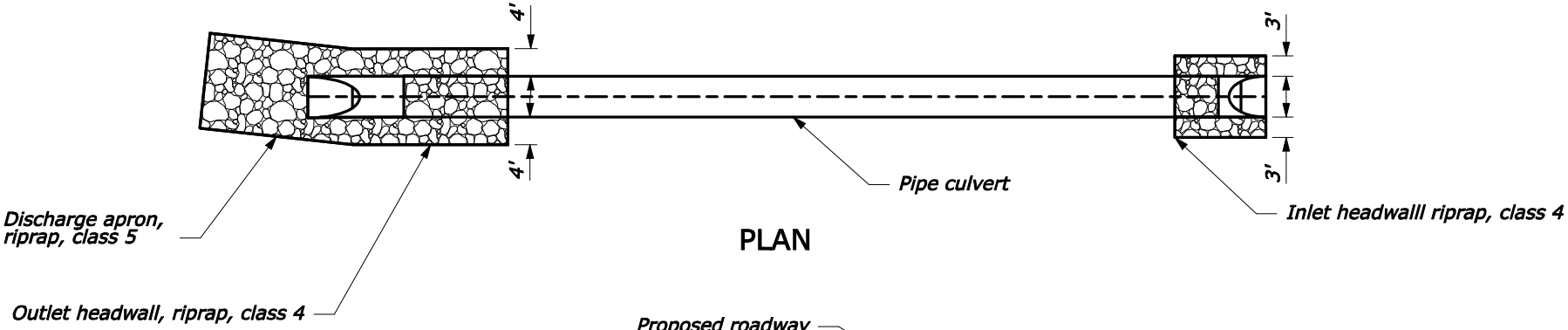
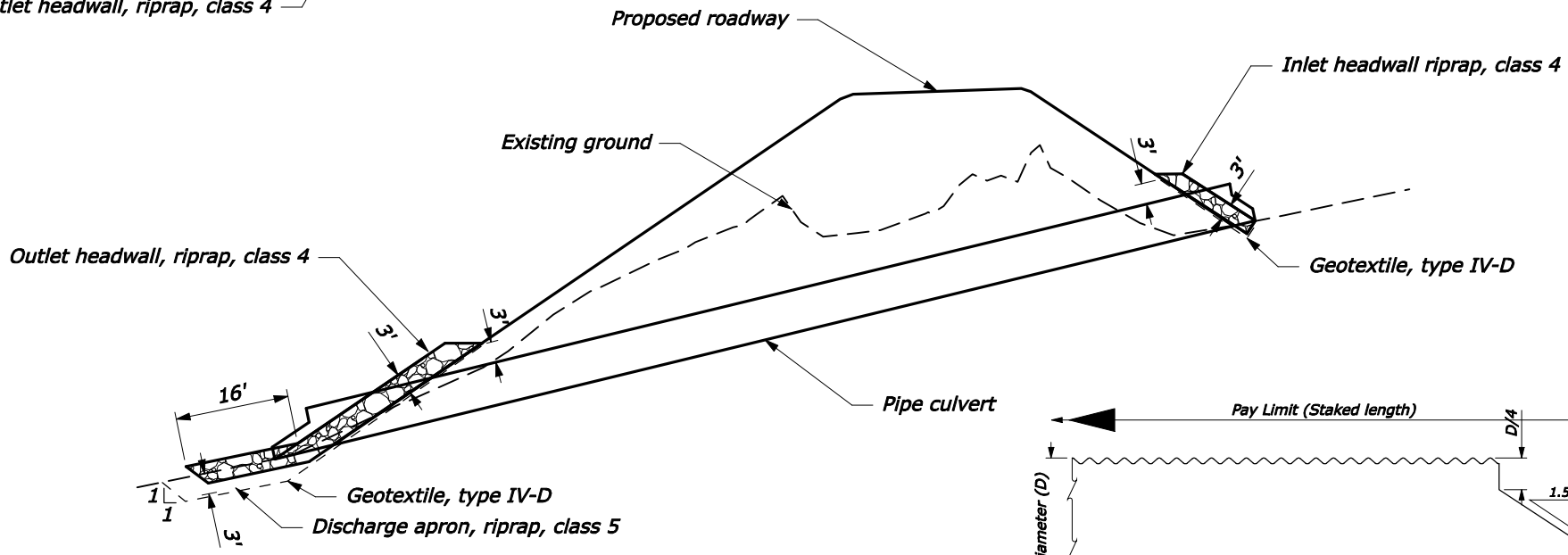
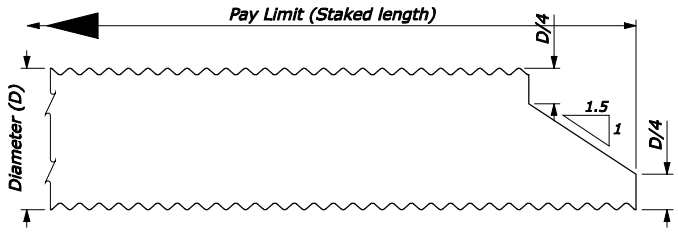


PLAN



ELEVATION



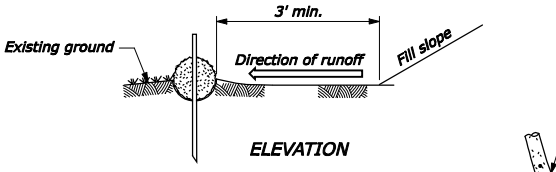
PIPE END TREATMENT DIAGRAM

QUANTITY SUMMARY

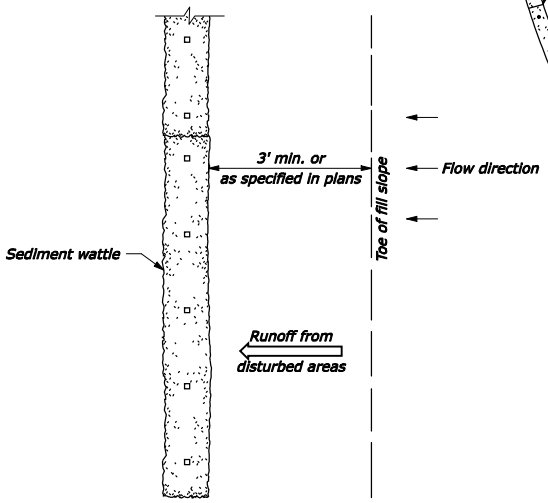
ITEM	DESCRIPTION	QUANTITY	UNITS
20701-1500	Geotextile, type IV-D	95	sqyd
25101-4000	Riprap, class 4	136	cuyd
25101-5000	Riprap, class 5	25	cuyd
60201-1600	72-inch pipe culvert	144	lnft

HEADWALL AND PIPE END DETAILS

STATE	PROJECT	SHEET NUMBER
WA	FS ERFO 2007(1)-22(1)	F.1

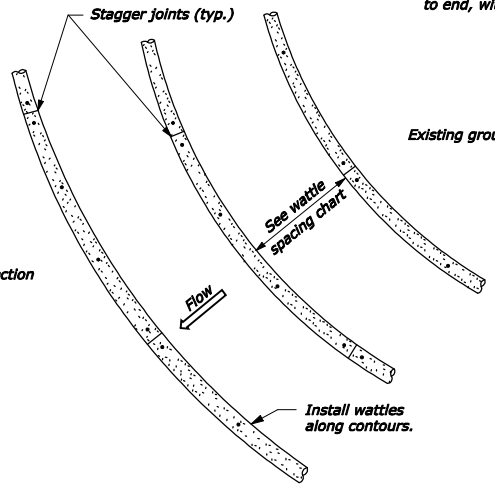


ELEVATION

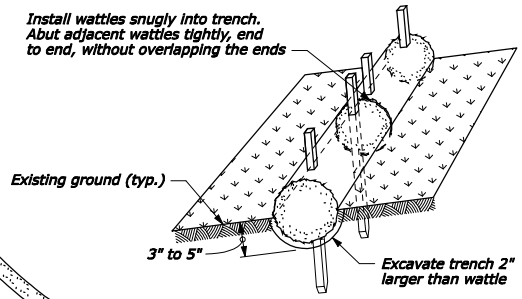


PLAN

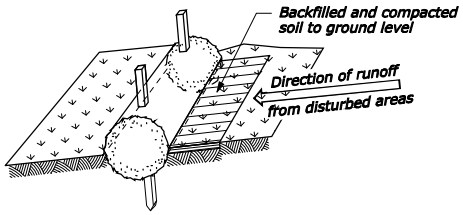
INSTALLATION BEYOND TOE OF SLOPE



INSTALLATION ALONG SLOPES



Step 1: Excavate trench and install wattles



Step 2: Backfill soil against wattles

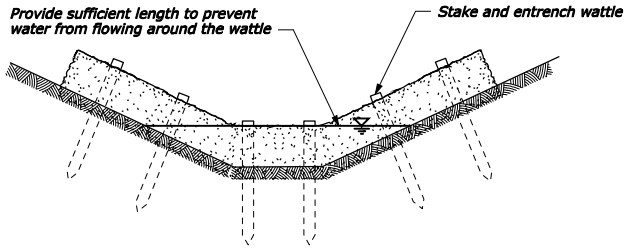
PROPERLY STAKED AND ENTRENCHED WATTLE

NOTE:

1. Drive stakes at each end and at 4' spacing until wattle is secure to slope. Do not crush wattle while staking. Live stakes may be used for permanent installations.
2. Use drainage ditch installation only in low flow conditions.

STAKES REQUIRED	
Wattle length (ft)	Stakes required for each wattle
25	8
20	6
12	4

WATTLE SPACING	
Slope	Spacing (ft)
1:4 or flatter	40
1:3	30
1:2	20
1:1	10



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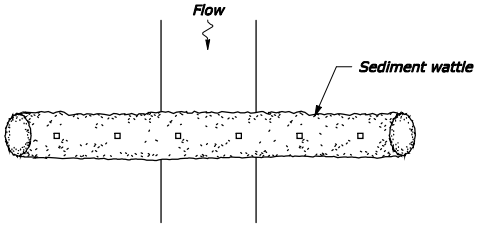
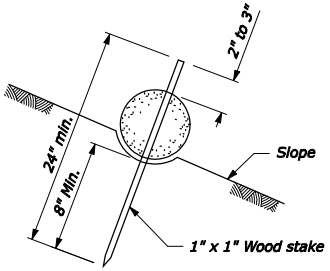


PLAN

DRAINAGE DITCH INSTALLATION



WATTLE STAKING DETAIL

NO SCALE

U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL HIGHWAY ADMINISTRATION
WESTERN FEDERAL LANDS HIGHWAY DIVISION

U.S. CUSTOMARY DETAIL

SEDIMENT WATTLE

DETAIL APPROVED FOR USE 9/2007

REVISED:

DETAIL W157-20

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STATE	PROJECT	SHEET NUMBER
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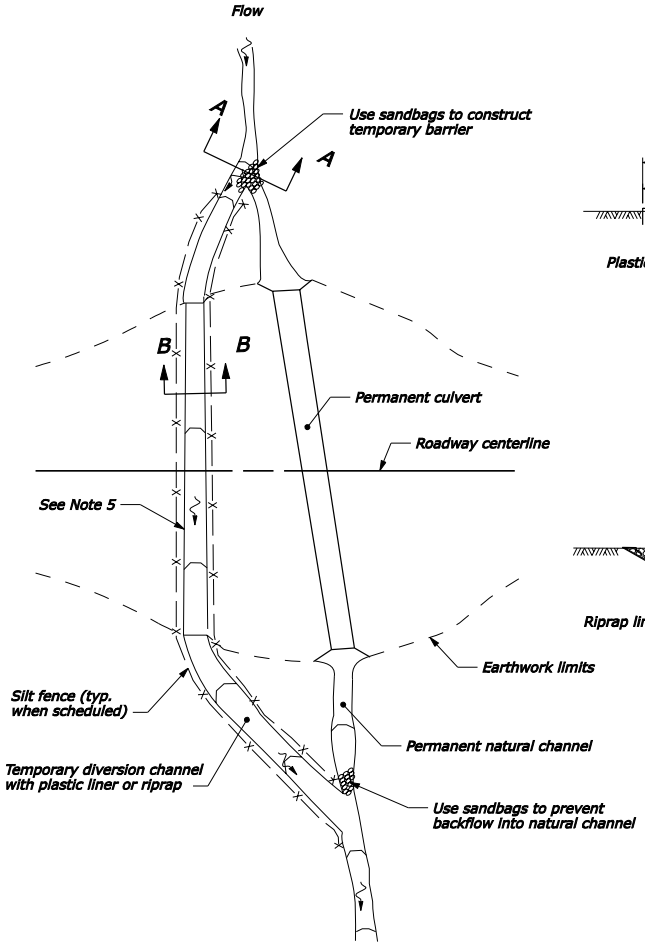
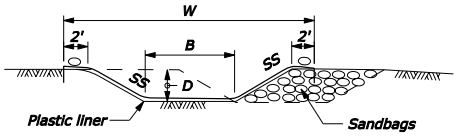
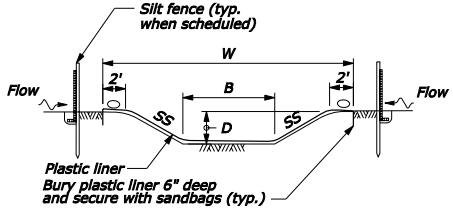


PLAN

DIVERSION CHANNEL

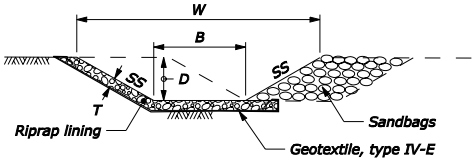


SECTION A-A

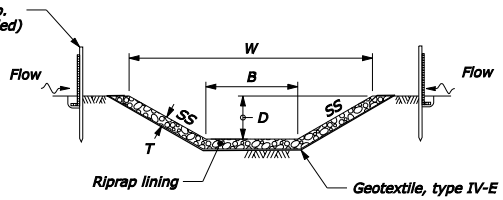


SECTION B-B

PLASTIC LINED DIVERSION CHANNEL

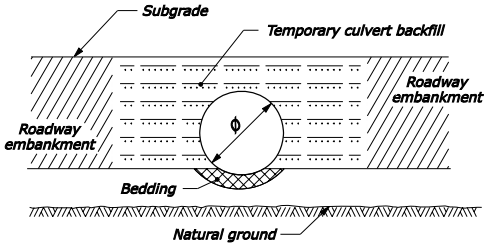


SECTION A-A



SECTION B-B

RIPRAP LINED DIVERSION CHANNEL



SECTION B-B

TEMPORARY CULVERT

NOTE:

1. See Erosion Control Section for temporary culvert diameter, riprap class, channel dimensions and quantities.
2. Use plastic liner or riprap along the entire length and width of the temporary diversion channel.
3. Construct channel at a minimum grade of 0.5 percent.
4. Do not construct with longitudinal joints if using a plastic liner. Bury the upstream edge of the liner a minimum of 6" deep and secure with riprap or sandbags.
5. When specified replace the portion of the diversion channel through the roadway embankment with temporary culvert. Compact temporary culvert backfill using one of the methods listed in Subsection 204.11(a).

NO SCALE

U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL HIGHWAY ADMINISTRATION
FEDERAL LANDS HIGHWAY

U.S. CUSTOMARY STANDARD

TEMPORARY DIVERSION CHANNELS

STANDARD APPROVED FOR USE 6/2005
REVISED: 6/2007

STANDARD 157-5

27-Jun-2007 03:54 PM
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