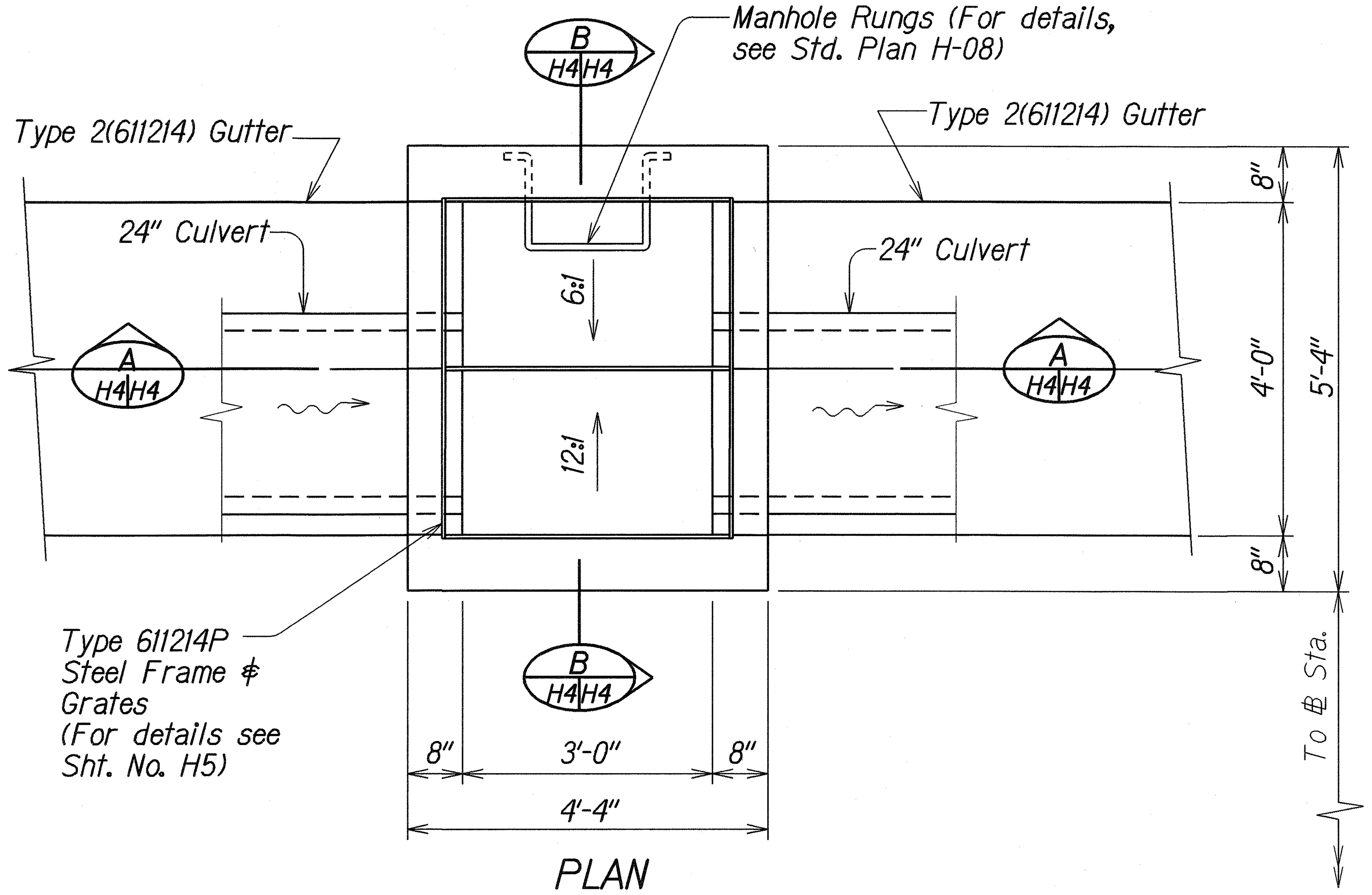
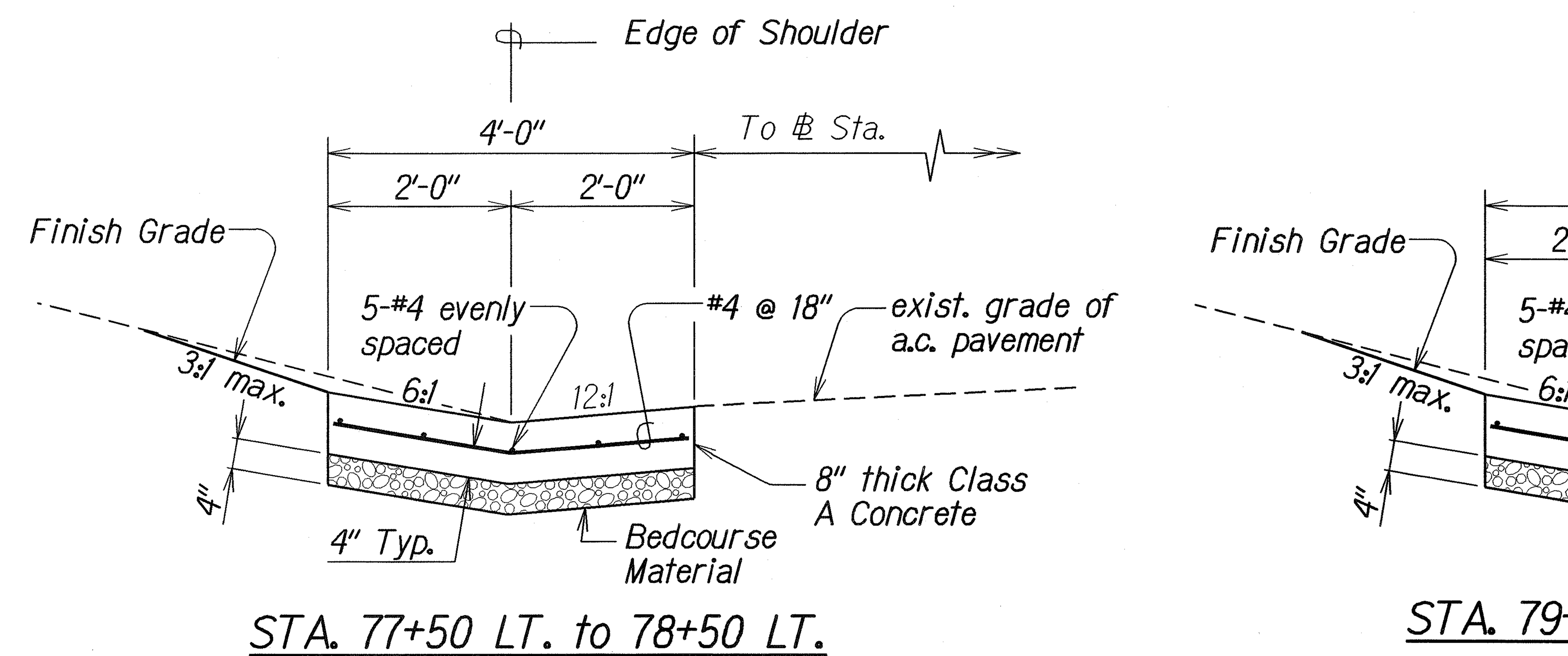
FED. ROAD DIST. NO.	STATE	FED. AID PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
HAWAII	HAW.	DE-072-1(48)R	2006	9	20



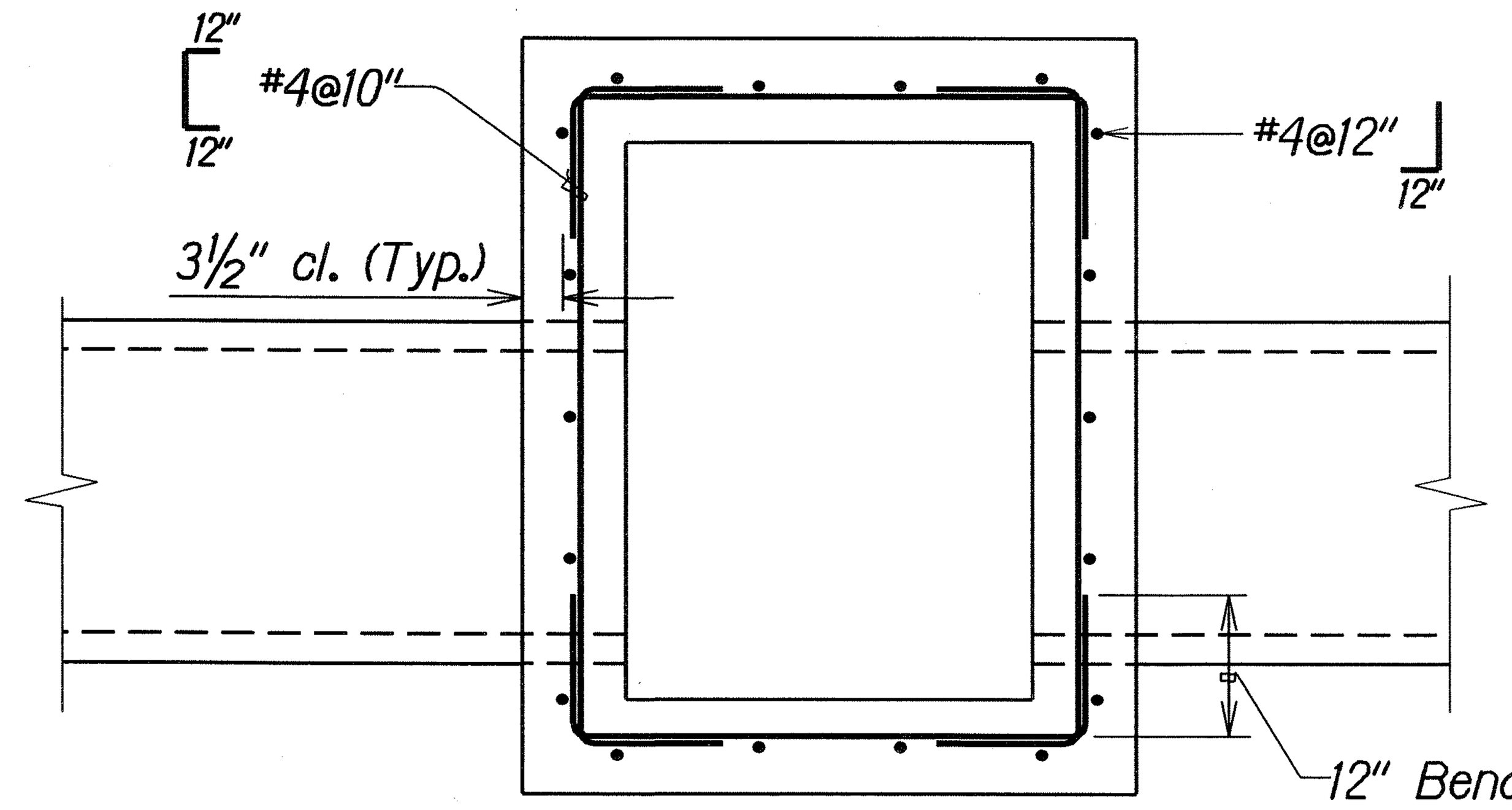
PLAN



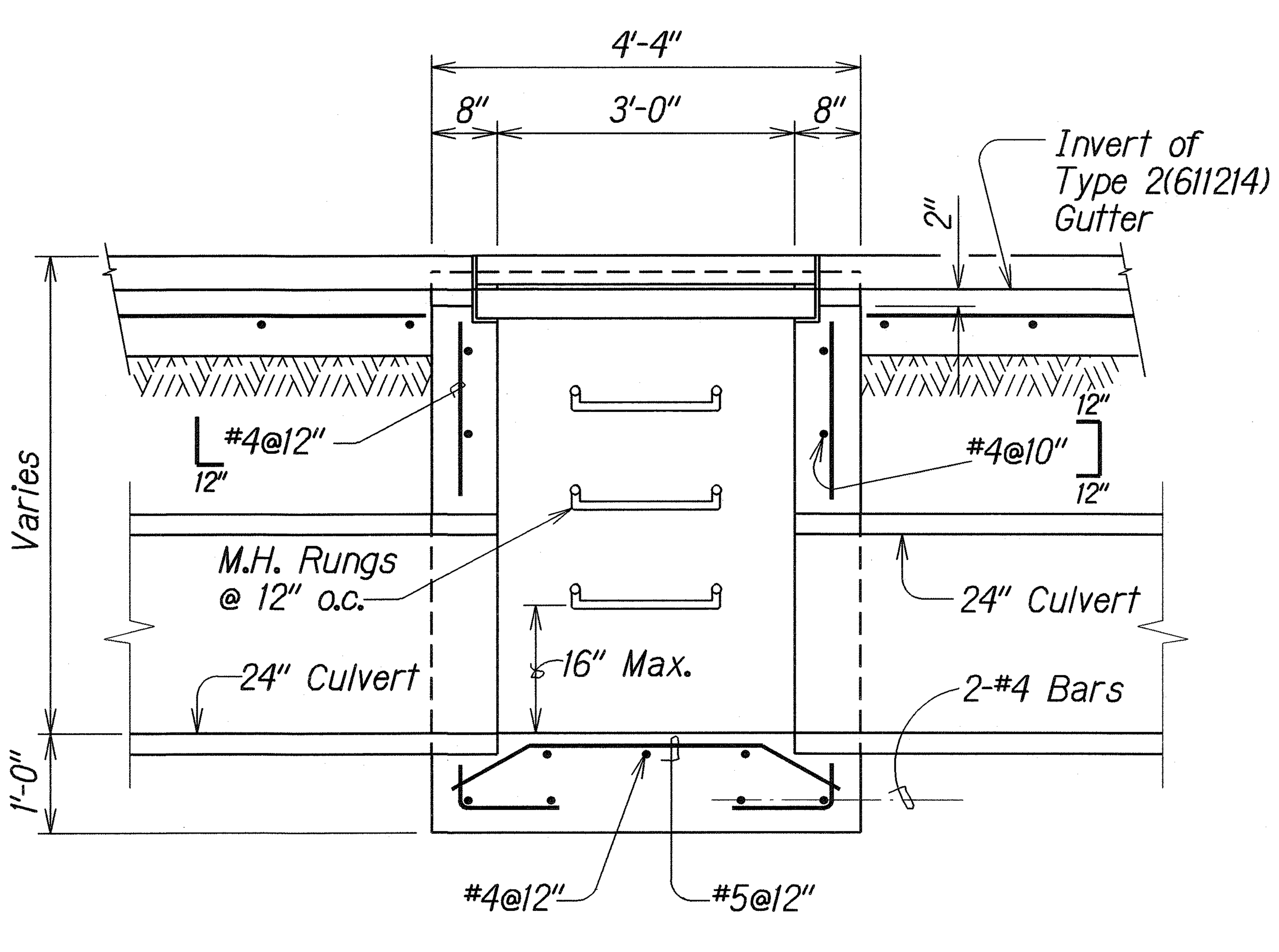
STA. 77+50 LT. to 78+50 LT.

STA. 79+00 LT. to 79+50 LT.

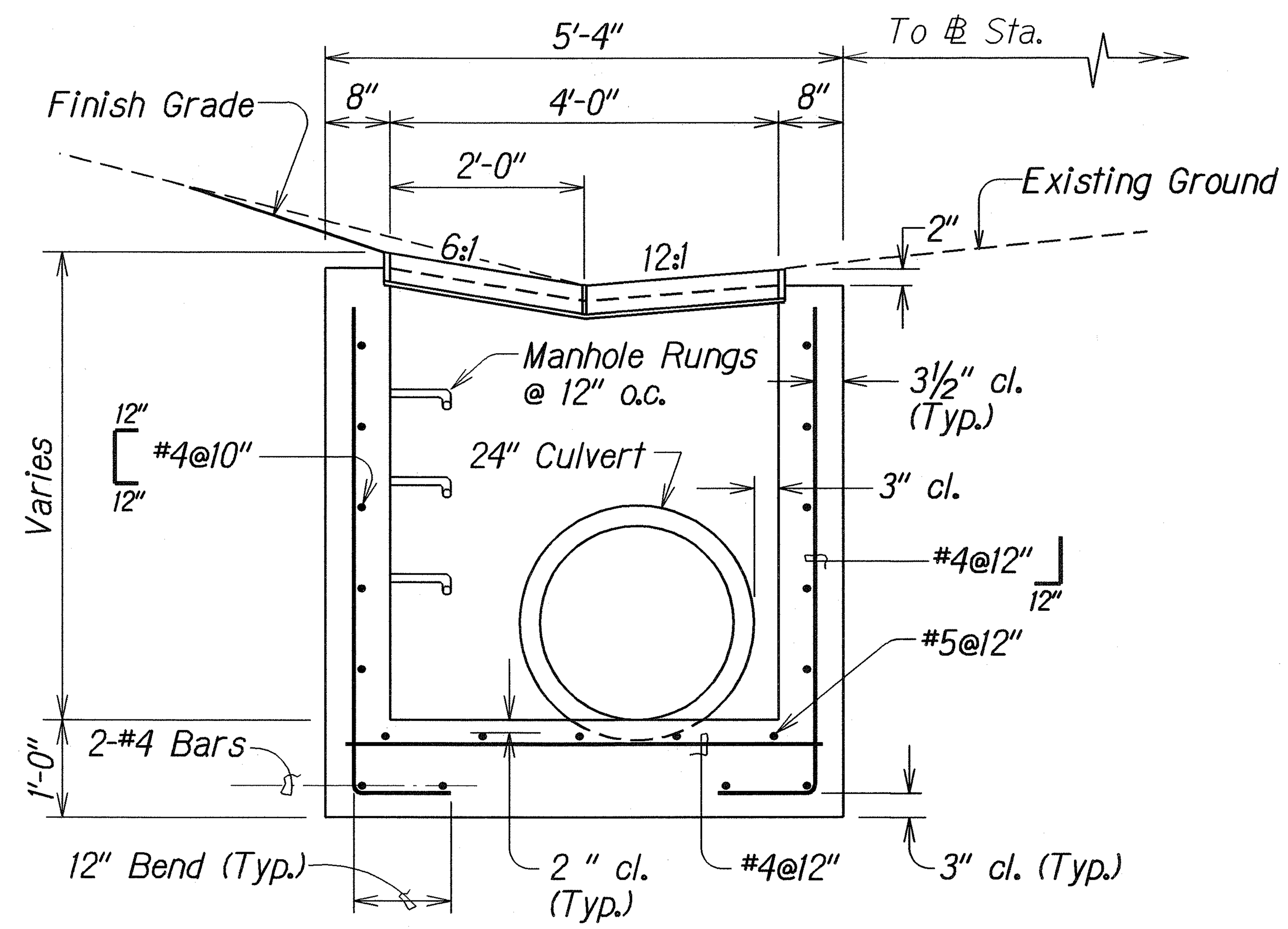
DETAILS OF TYPE 2(611214) GUTTER



PLAN VIEW OF WALL REINFORCING

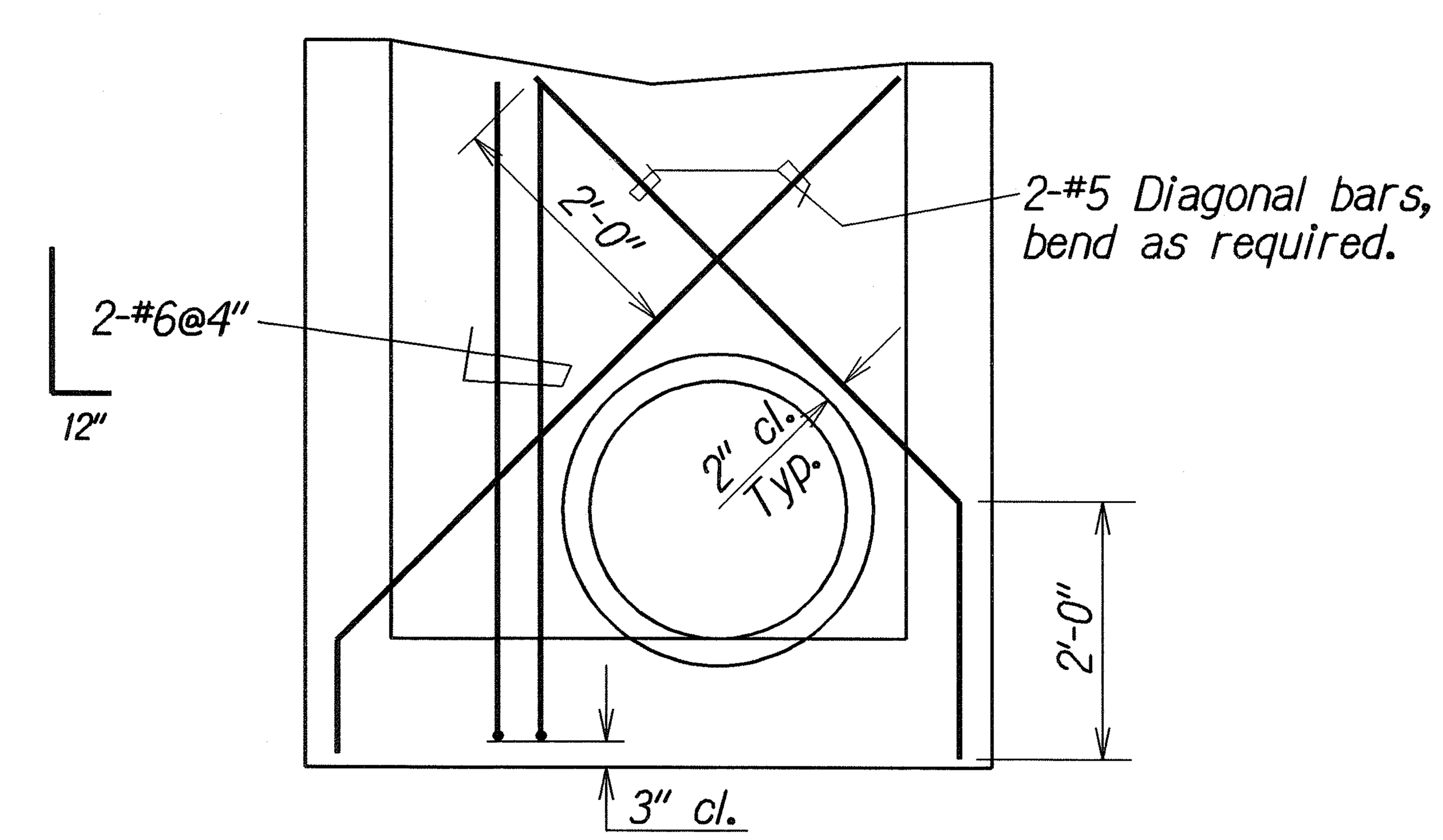


SECTION A H4 H4



SECTION B H4 H4

DETAILS OF TYPE 611214P GRATED DROP INLET



ADDED REINFORCING FOR CULVERT OPENING

STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION

DRAINAGE DETAIL

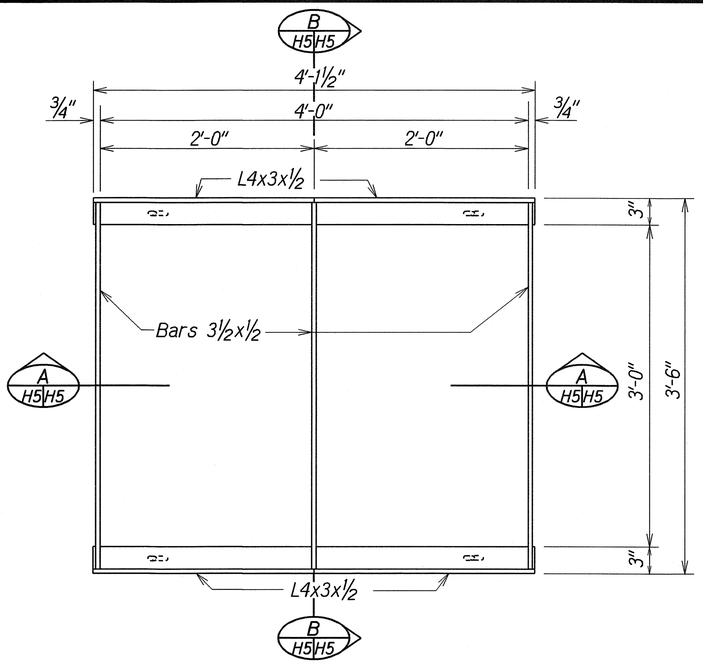
KALANIANAOLE HIGHWAY
DRAINAGE IMPROVEMENTS
Vicinity of Keolu Hills
Fed. Aid Project No. DE-072-1(48)R

Scale: ¾"=1'-0" Date: May, 2005

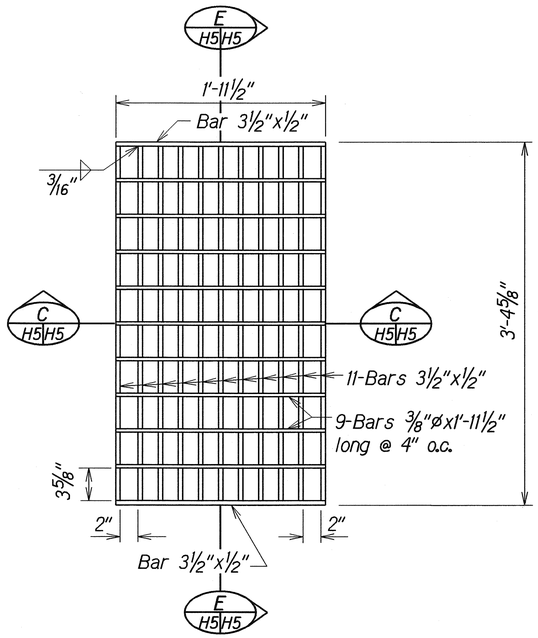
SHEET No. H4 OF 9 SHEETS

ORIGINAL PLAN	SURVEY PLOTTED BY	DATE
NOTE BOOK	DRAWN BY	
	TRACED BY C.M.	
	DESIGNED BY	
	QUANTITIES BY	
	CHECKED BY	

FED. ROAD DIST. NO.	STATE	FED. AID PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
HAWAII	HAW.	DE-072-1(48)R	2006	10	20



PLAN



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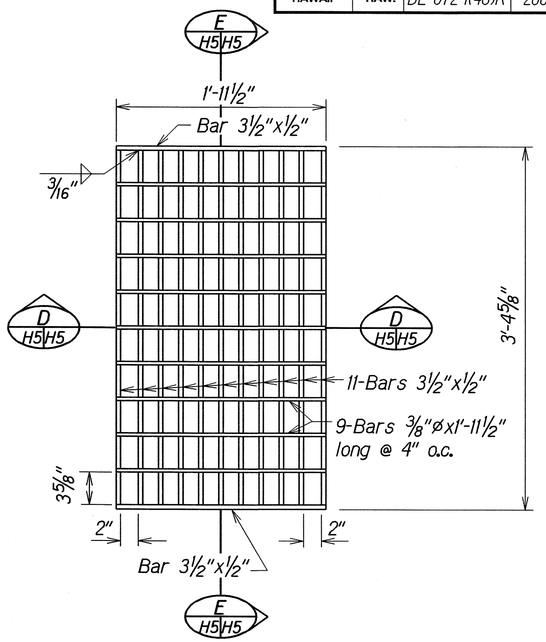

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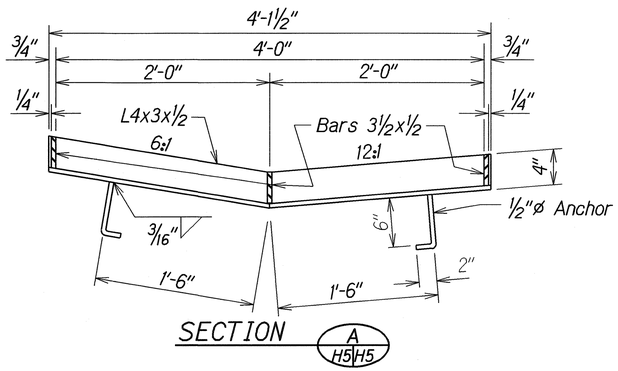
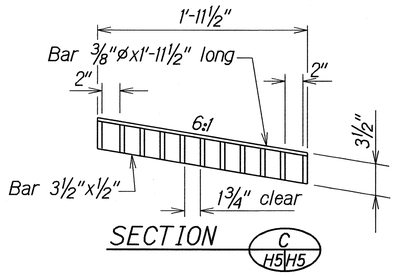
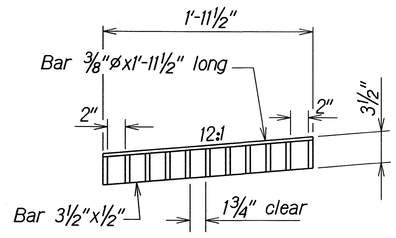


SECTION A H5 H5



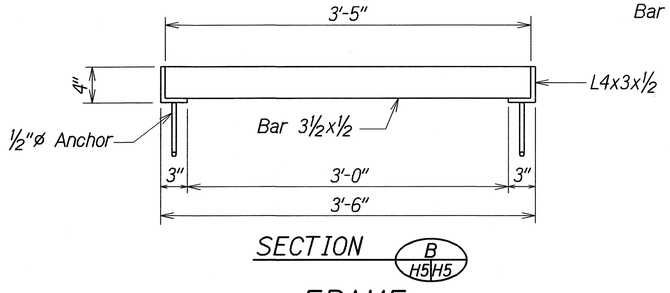
SECTION C H5 H5

DETAIL OF 6:1 STEEL GRATE



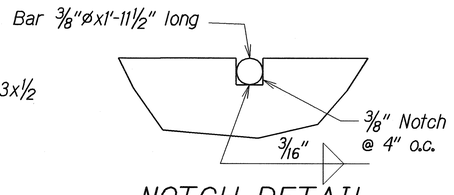
SECTION D H5 H5

DETAIL OF 12:1 STEEL GRATE



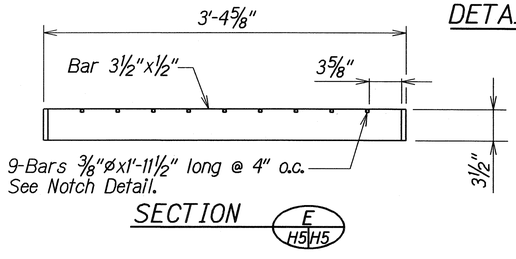
SECTION B H5 H5

FRAME



NOTCH DETAIL

Full Size



SECTION E H5 H5

GRATE

NOTE:
All welds ⅜" unless otherwise noted.

DETAILS OF TYPE "611214P" STEEL FRAME AND GRATES

ORIGINAL PLAN	SURVEY PLOTTED BY	DATE 7/28/05
	DRAWN BY J.E.C.	
	TRACED BY	
NOTE BOOK	DESIGNED BY J.M.	
	QUANTITIES BY	
	CHECKED BY	

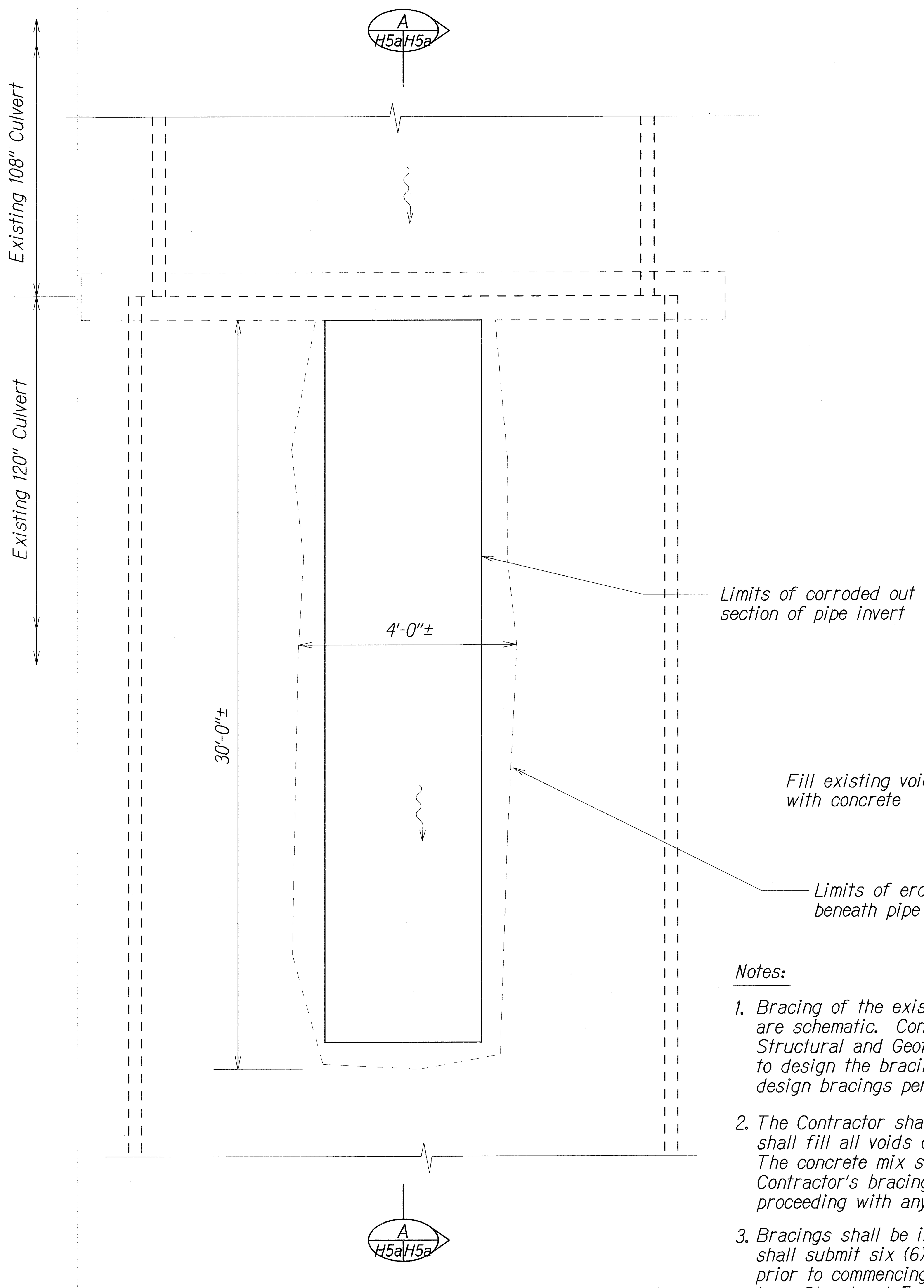
STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION

DRAINAGE DETAIL
KALANIANAOLE HIGHWAY
DRAINAGE IMPROVEMENTS
Vicinity of Keolu Hills
Fed. Aid Project No. DE-072-1(48)R

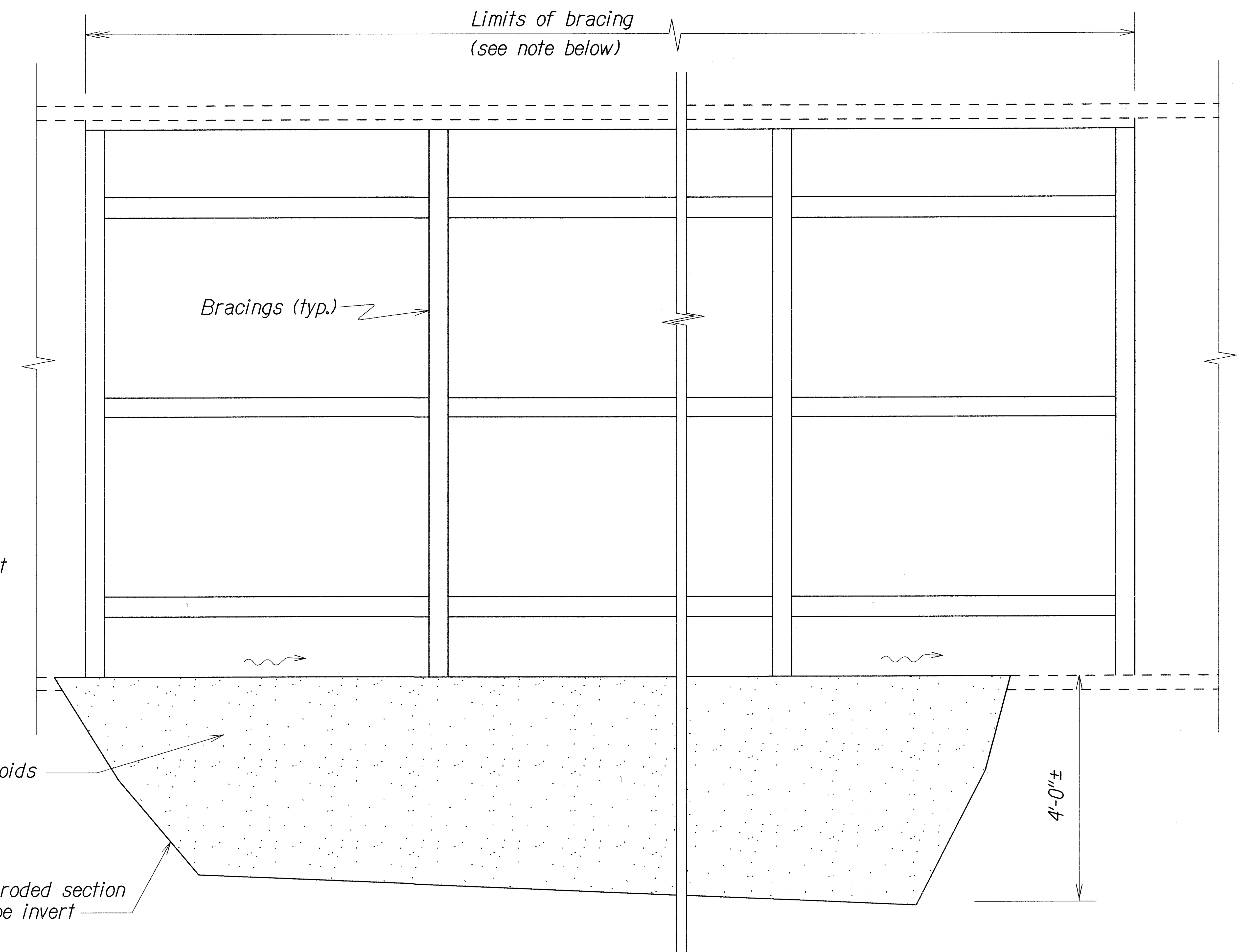
Scale: 1½"=1'-0" Date: May, 2005

SHEET No. H5 OF 9 SHEETS

FED. ROAD DIST. NO.	STATE	FED. AID PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
HAWAII	HAW.	DE-072-1(48)R	2006	C.O.10S-1	20



PLAN



SECTION A H5a H5a

Not to Scale

Notes:

1. Bracing of the existing culvert walls and concrete fill shown above are schematic. Contractor shall be responsible for consulting a Structural and Geotechnical Engineer licensed in the State of Hawaii to design the bracings as appropriate. The Structural Engineer shall design bracings per the Geotechnical Engineer's recommendations.

2. The Contractor shall provide a concrete mix which is flowable and shall fill all voids completely (minimum f'c = 1500 psi after 3 days). The concrete mix submitted by the Contractor shall be part of the Contractor's bracing design and be approved by the Engineer before proceeding with any work.

3. Bracings shall be installed prior to placing concrete. The Contractor shall submit six (6) sets of shop drawings to the Engineer for approval prior to commencing with construction. Shop drawings shall be stamped by a Structural Engineer licensed in the State of Hawaii.

4. Voids between the existing culvert and existing backfill shall be filled with pressure grout in lifts. The first lift shall not be more than one foot. Successive lifts shall not be more than 2.5 feet.

DATE	REVISION
6/14/06	Added Plan Sht. C.O. 10 S-1.

STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION

DRAINAGE DETAIL

KALANIANAOLE HIGHWAY
DRAINAGE IMPROVEMENTS
Vicinity of Keolu Hills
Fed. Aid Project No. DE-072-1(48)R

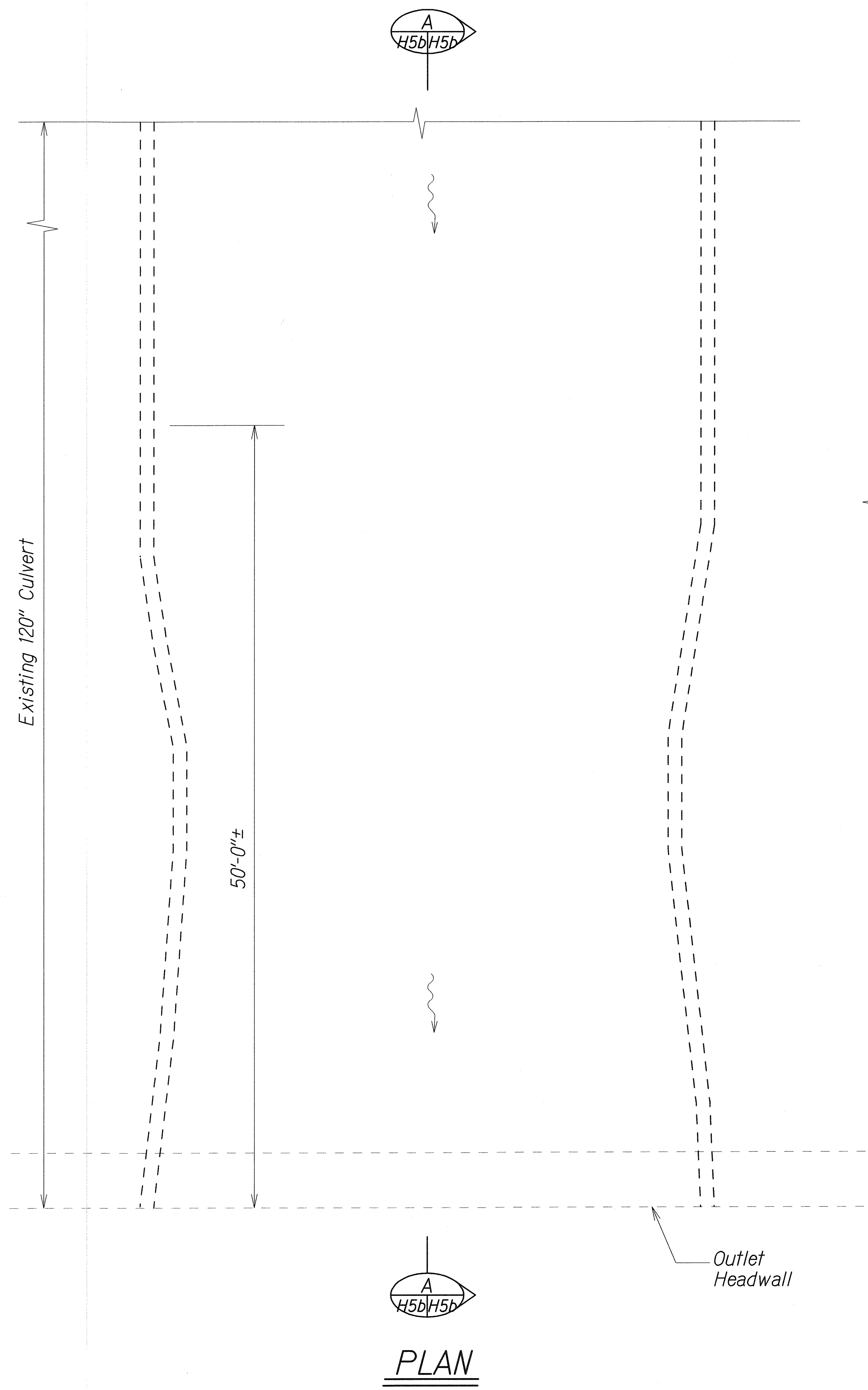
Scale: Not to scale   Date: June 2006

SHEET No. H5a OF 9 SHEETS

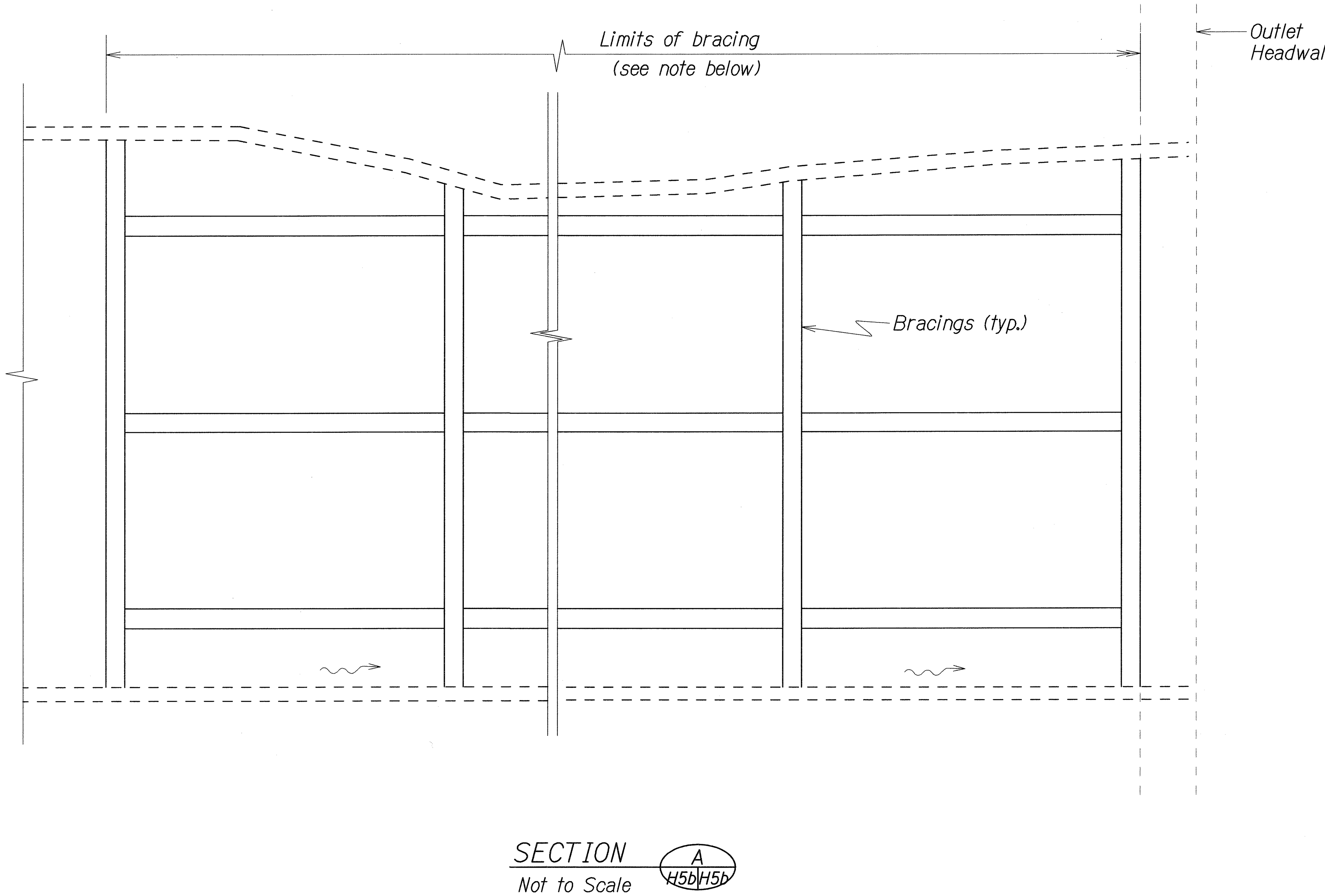
C.O. 10 S–1

ORIGINAL PLAN	SURVEY PLOTTED BY	DATE
NOTE BOOK	DRAWN BY	
	TRACED BY	
	DESIGNED BY	
	QUANTITIES BY	
	CHECKED BY	

FED. ROAD DIST. NO.	STATE	FED. AID PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
HAWAII	HAW.	DE-072-1(48)R	2006	C.O.10S-2	20



PLAN



SECTION (A, H5b H5b)
Not to Scale

Notes:

1. Bracing of the existing culvert walls shown above are schematic. Contractor shall be responsible for consulting a Structural and Geotechnical Engineer licensed in the State of Hawaii to design the bracings as appropriate. The Structural Engineer shall design bracings per the Geotechnical Engineer's recommendations.

2. The Contractor shall submit six (6) sets of shop drawings to the Engineer for approval prior to commencing with construction. Shop drawings shall be stamped by a Structural Engineer licensed in the State of Hawaii.

DATE	REVISION
6/14/06	Added Plan Sht. C.O. 10 S-2.

STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION

DRAINAGE DETAIL

KALANIANAOLE HIGHWAY
DRAINAGE IMPROVEMENTS
Vicinity of Keolu Hills
Fed. Aid Project No. DE-072-1(48)R

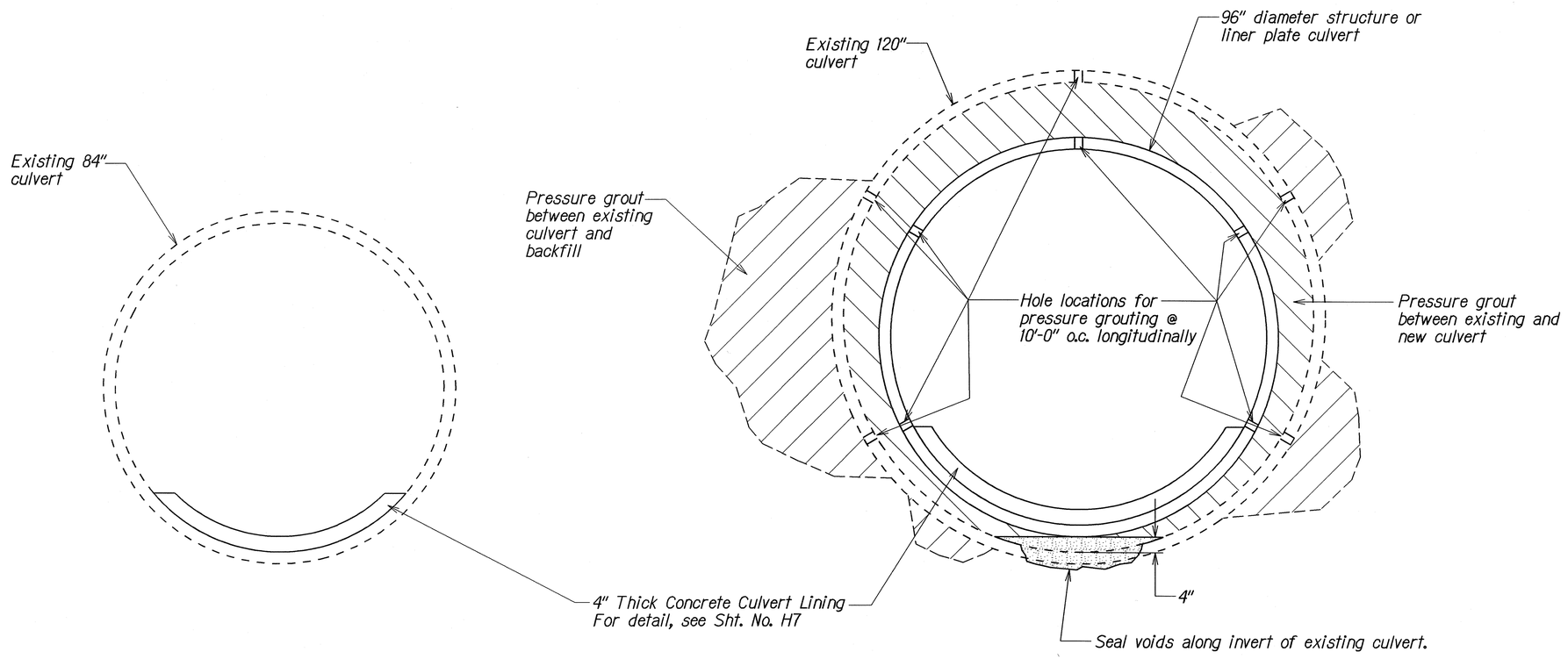
Scale: Not to scale — Date: June 2006

SHEET No. H5b OF 9 SHEETS

C.O. 10 S-2

ORIGINAL PLAN | SURVEY PLOTTED BY | DRAWN BY | TRACED BY | DESIGNED BY | QUANTITIES BY | CHECKED BY | NOTE BOOK | DATE

FED. ROAD DIST. NO.	STATE	FED. AID PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
HAWAII	HAW.	DE-072-1(48)R	2006	11	20



Note: Contractor shall seal voids along the existing invert prior to pressure grouting between the existing culvert and backfill.

TYPICAL CULVERT SECTION LOOKING DOWNSTREAM

ORIGINAL PLAN		DATE
	SURVEY PLOTTED BY	
	DRAWN BY K.K.	12/9/05
	TRACED BY	
NOTE BOOK	CHECKED BY K.K.	
DATED	QUANTITIES BY	
No.	CHECKED BY	

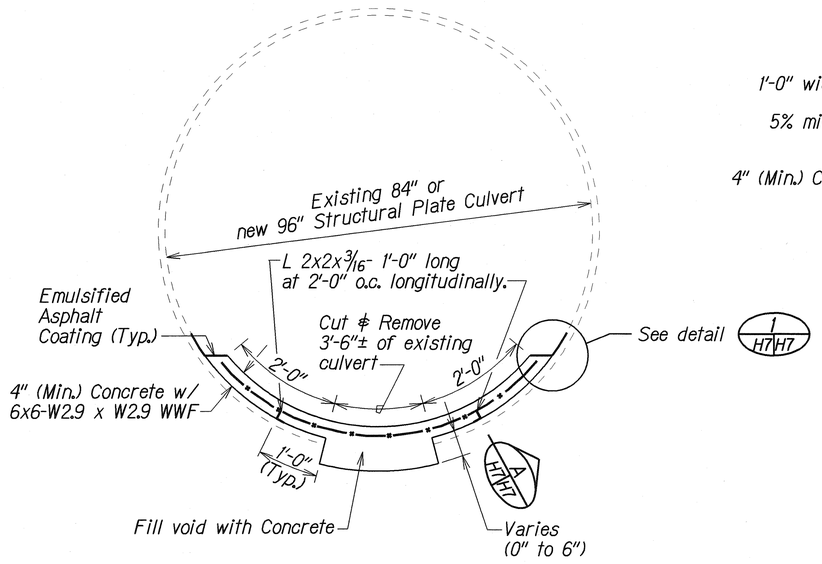
STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION

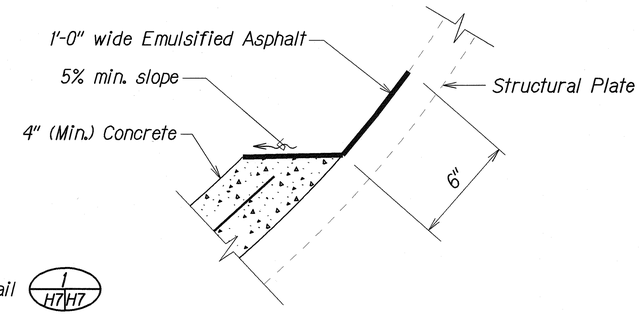
DRAINAGE DETAIL
KALANIANAOLE HIGHWAY
DRAINAGE IMPROVEMENTS
Vicinity of Keolu Hills
Fed. Aid Project No. DE-072-1(48)R

Scale: 3/4"=1'-0" Date: May, 2005

SHEET No. H6 OF 9 SHEETS

FED. ROAD DIST. NO.	STATE	FED. AID PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
HAWAII	HAW.	DE-072-1(48)R	2006	ADD 12	20

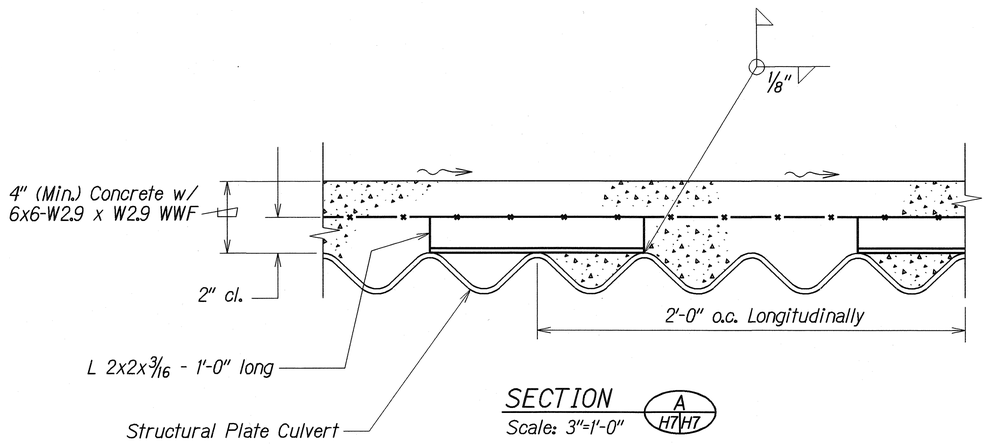




DETAIL
Scale: 3"=1'-0"
1
H7 H7

TYPICAL SECTION OF CULVERT

Scale: 3/4"=1'-0"



SECTION
Scale: 3"=1'-0"
A
H7 H7

NOTES:

1. The culvert surface shall be cleaned of all dirt, rust, scale, and other foreign materials. Cut, remove and dispose of corroded sections as ordered by the Engineer in increments not exceeding 50-feet in length.
2. The Contractor shall provide adequate bracing for the culvert. The Contractor shall, at his own expense, consult with a Geotechnical Engineer to determine the required amount of bracing based on his construction methodology.
3. Angle irons shall be welded to the structural plate culvert at two-feet on-center longitudinally. Welded wire fabric steel reinforcement shall be placed two inches above the crest of the corrugations. The welded wire fabric shall be lapped a minimum of six inches.
4. The culvert surface to be in contact with the epoxy shall be clean and dry. The epoxy bonding agent shall be applied just before the placement of the concrete. Any excess bonding agent that collects in pockets shall be removed.
5. The concrete for the culvert lining shall have a minimum 28-day strength of 4,000 psi. Coarse aggregate no. 67 (3/4 inch to No. 4) shall be used. The total free water shall not exceed 285 pounds per cubic yard of concrete and the water cement ratio shall not exceed 0.45. The slump of concrete shall be 3 to 5 inches. The Contractor shall proportion the concrete lining mix to provide a workable mix of uniform composition and consistency. Water-reducing, water-reducing and retarding, or high range water reducing admixtures may be used as needed to achieve the desired slump and workability. No water shall be added at the jobsite.
6. Voids under the structural plate shall be filled with concrete. The concrete shall be troweled to form a smooth, dense surface finish.
7. The concrete culvert lining shall be scored 3/4-inch deep laterally along the crest of the corrugations, 10-feet (max) on-center.
8. Apply one-foot wide coating of Emulsified Asphalt to the score lines on the existing concrete lining, to both edges of the new concrete lining, and to the 3/4-inch scores after the new concrete lining has cured. The finished coating shall be a continuous film free of voids, gaps or pin holes.
9. All construction joints shall be perpendicular to the surface and to the full depth of the concrete lining.

ORIGINAL PLAN	SURVEY PLOTTED BY	DATE 7/09/05
	DRAWN BY J.C.	
	TRACED BY	
NOTE BOOK	DESIGNED BY S.M.	
REVISED PLAN	QUANTITIES BY	
No. dtail07.dgn	CHECKED BY	

DATE	REVISION
8/15/05	Removed Longitudinal Rebars

STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION

DRAINAGE DETAIL

KALANIANAOLE HIGHWAY
DRAINAGE IMPROVEMENTS
Vicinity of Keolu Hills
Fed. Aid Project No. DE-072-1(48)R

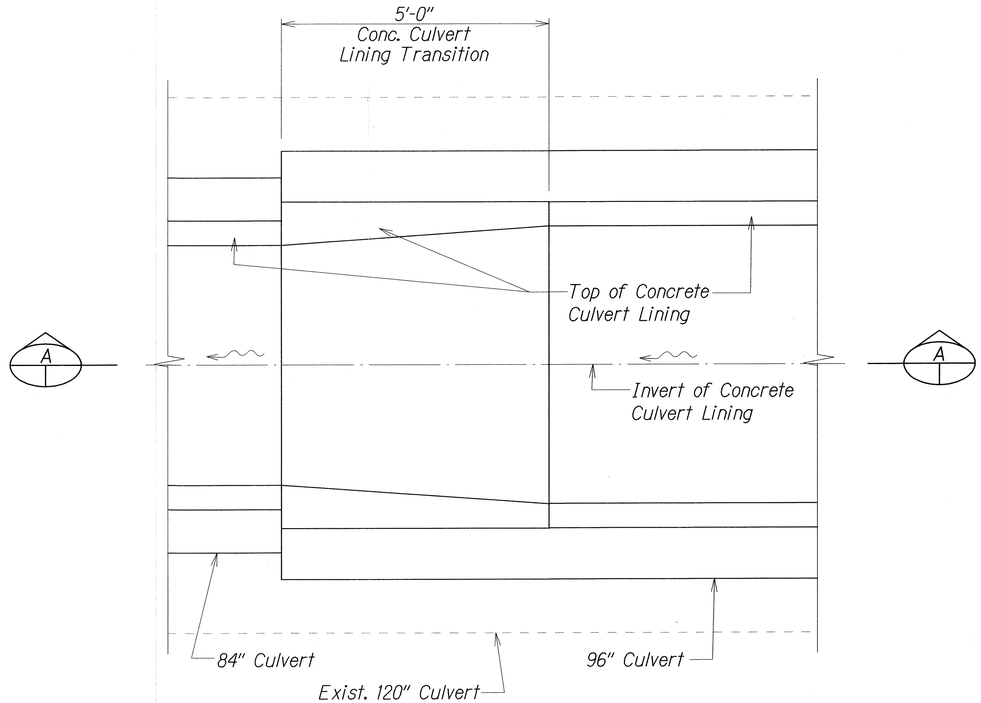
Scale: 3/4"=1'-0" Date: May, 2005

SHEET No. H7 OF 9 SHEETS

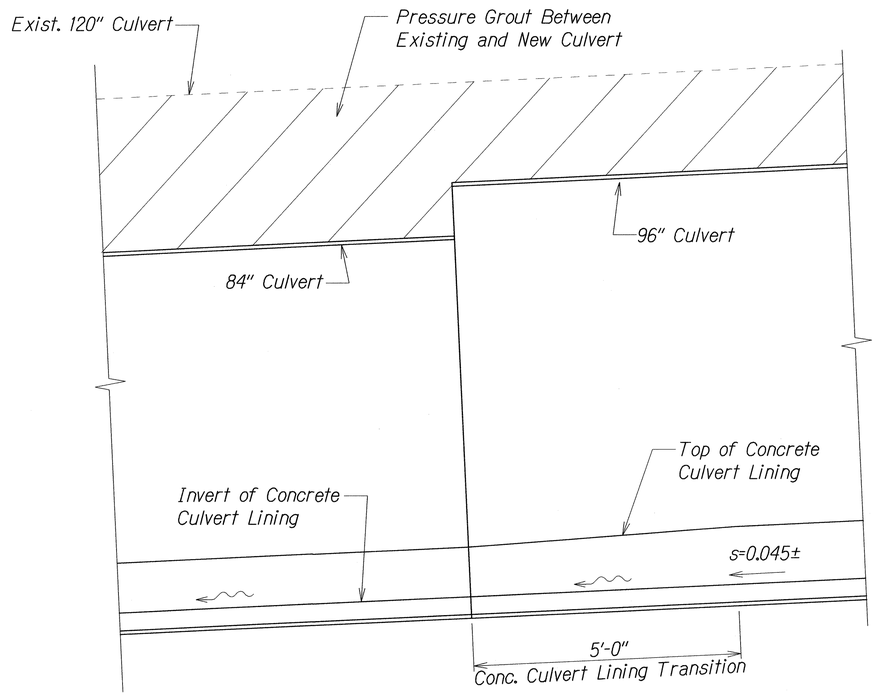
DETAILS OF CONCRETE CULVERT LINING

ADD 12

FED. ROAD DIST. NO.	STATE	FED. AID PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
HAWAII	HAW.	DE-072-1(48)R	2006	C.00	20



PLAN



SECTION A

ORIGINAL PLAN	SURVEY PLOTTED BY	DATE 1/09/03
	DRAWN BY LBK	
NOTE BOOK	TRACED BY	
	DESIGNED BY CM	
	QUANTITIES BY	
	CHECKED BY	

DETAILS OF CONCRETE CULVERT TRANSITION

DATE	REVISION
12/21/06	Added Plan Sht. C.O. ADD. 12 S-1

STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION

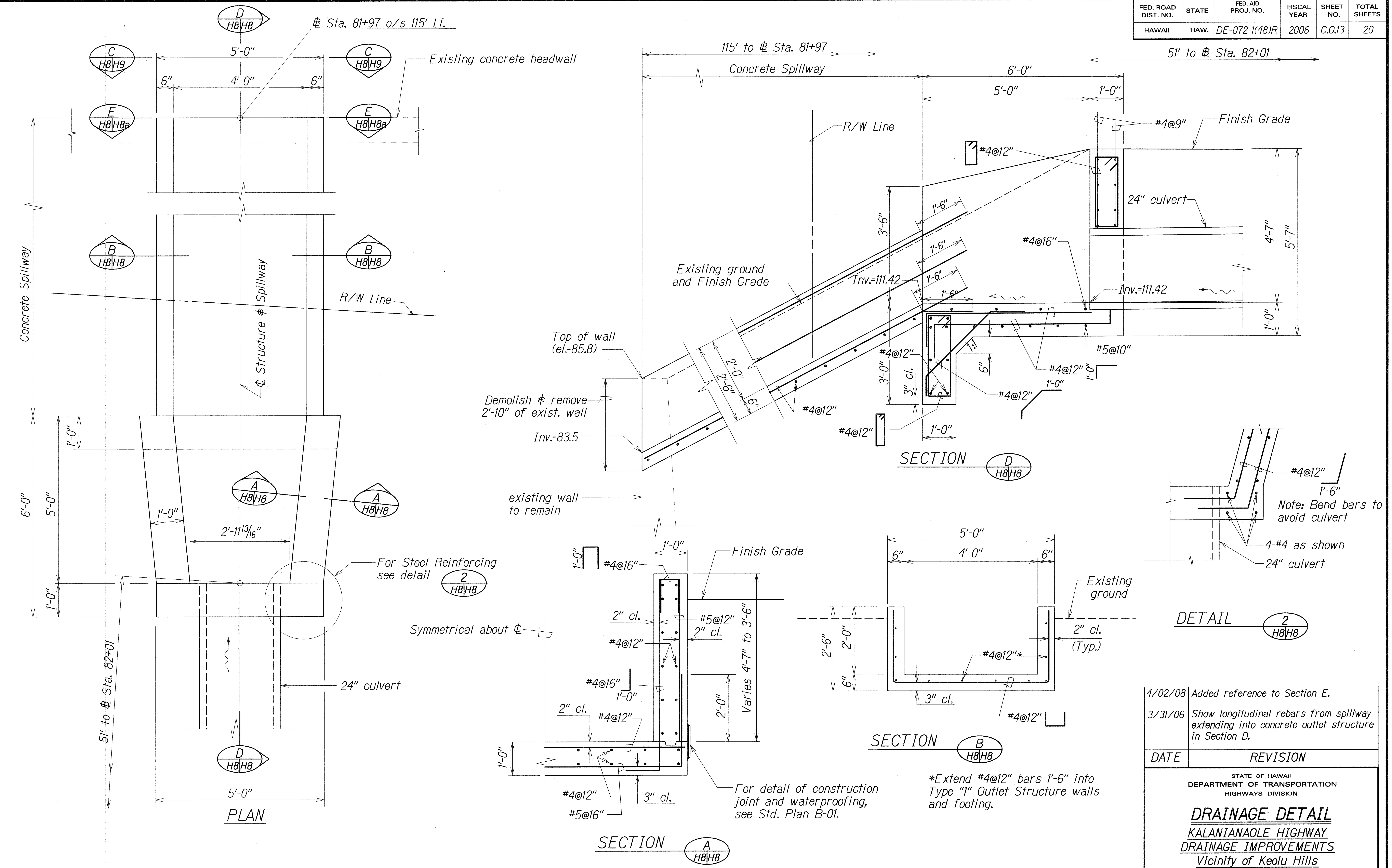
DRAINAGE DETAIL
KALANIANAOLE HIGHWAY
DRAINAGE IMPROVEMENTS
Vicinity of Keolu Hills
Fed. Aid Project No. DE-072-1(48)R

Scale: 3/4"=1'-0" Date: May, 2005

SHEET No. H7a OF 9 SHEETS

C.O. ADD. 12 S-1

FED. ROAD DIST. NO.	STATE	FED. AID PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
HAWAII	HAW.	DE-072-1(48)R	2006	C.O.13	20



DATE	REVISION
4/02/08	Added reference to Section E.
3/31/06	Show longitudinal rebars from spillway extending into concrete outlet structure in Section D.

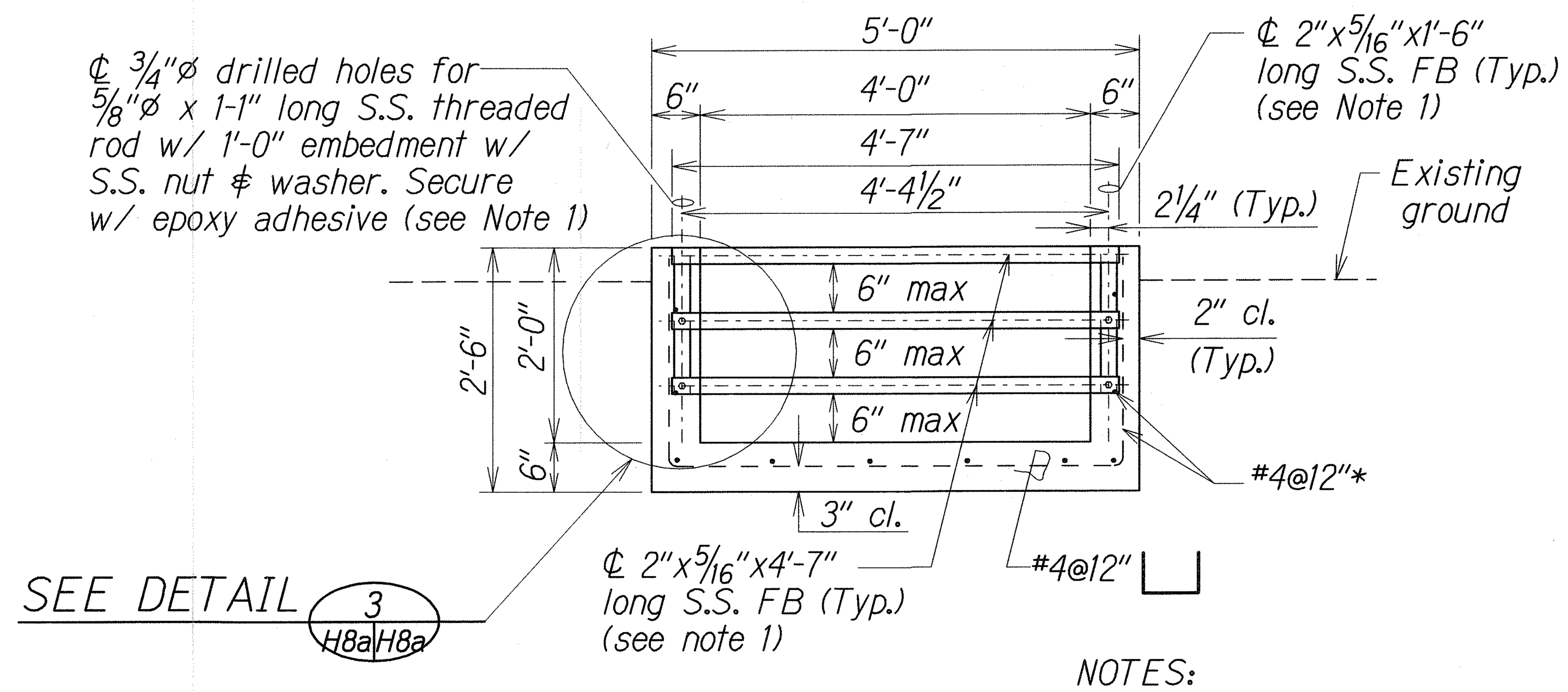
STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION

DRAINAGE DETAIL

KALANIANAOLE HIGHWAY
DRAINAGE IMPROVEMENTS
Vicinity of Keolu Hills
Fed. Aid Project No. DE-072-1(48)R
Scale: 3/4"=1'-0" Date: May, 2005
SHEET No. H8 OF 9 SHEETS

DETAILS OF TYPE "1" OUTLET STRUCTURE AND CONCRETE SPILLWAY AT ℄ STA. 82+01 O/S 51' LT.

FED. ROAD DIST. NO.	STATE	FED. AID PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
HAWAII	HAW.	DE-072-1(48)R	2006	C.O.13 S-1	20

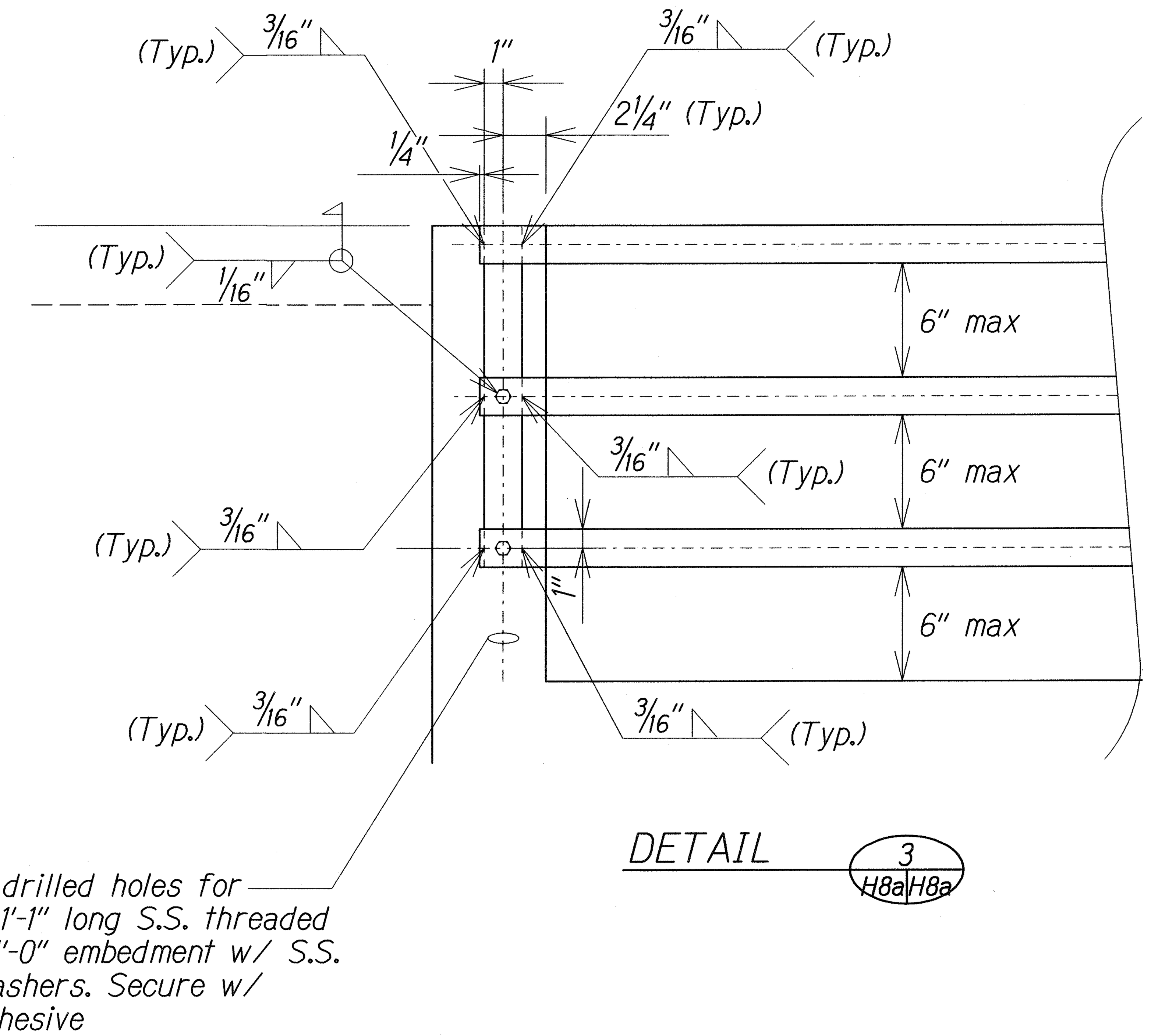


SECTION E H8 H8a

*Extend #4@12" bars 1'-6" into Type "1" Outlet Structure walls and footing.

NOTES:

1. All 2"x5/16" flat bars shall be Type 316 Stainless Steel meeting ASTM A 276. All 1/2" diameter threaded rods shall be Type 316 Stainless Steel meeting ASTM F 593. Washers and nuts for the threaded rods shall be Stainless Steel meeting ASTM F 594.



DETAIL 3 H8a H8a

DETAILS OF TYPE "1" OUTLET STRUCTURE AND CONCRETE SPILLWAY AT ℄ STA. 82+01 O/S 51' LT.

DATE	REVISION
3/31/08	Added Plan Sheet C.O. 13 S-1.

STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION

DRAINAGE DETAIL

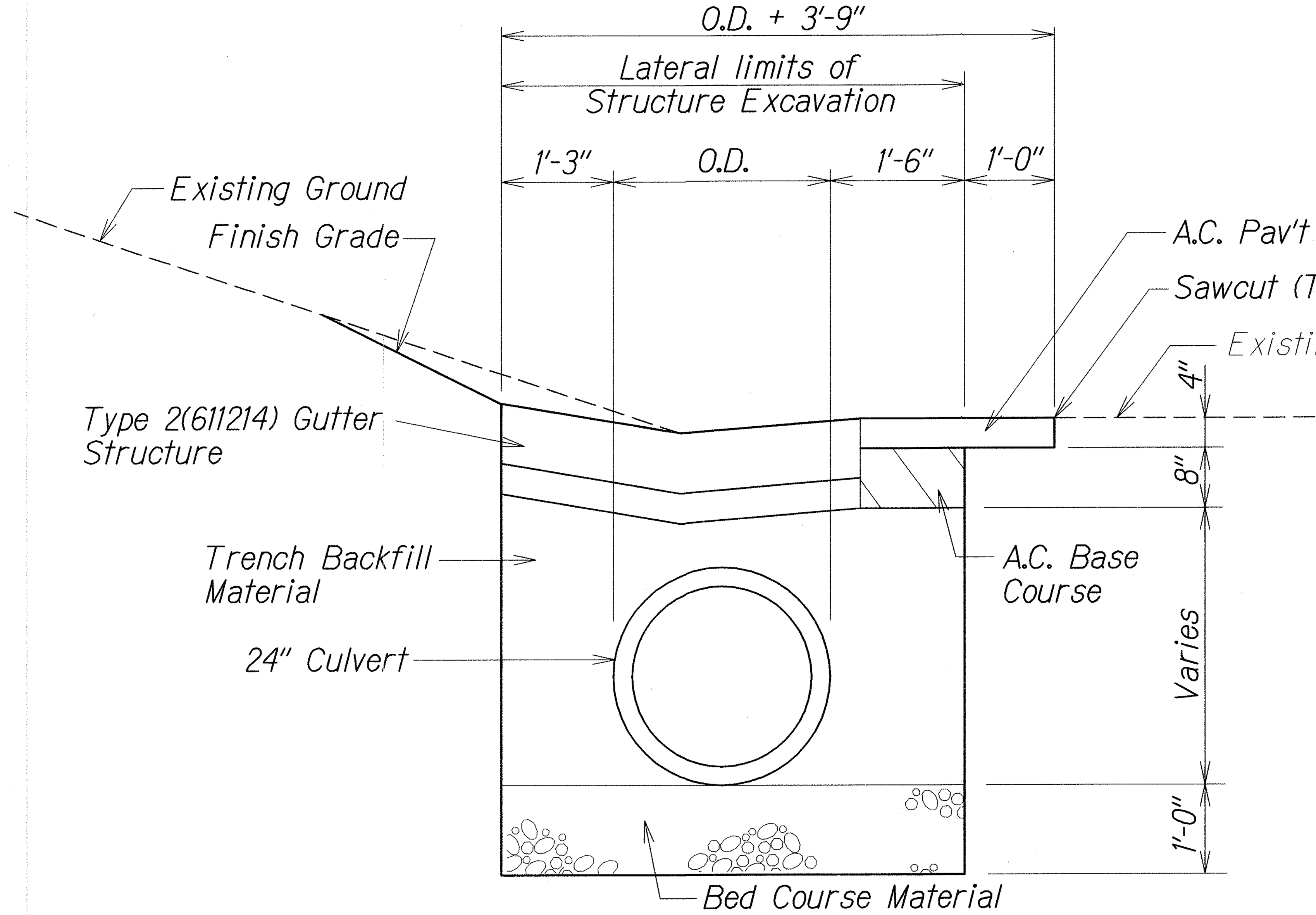
KALANIANAOLE HIGHWAY
DRAINAGE IMPROVEMENTS
Vicinity of Keolu Hills
Fed. Aid Project No. DE-072-1(48)R

Scale: 3/4"=1'-0" Date: May, 2005

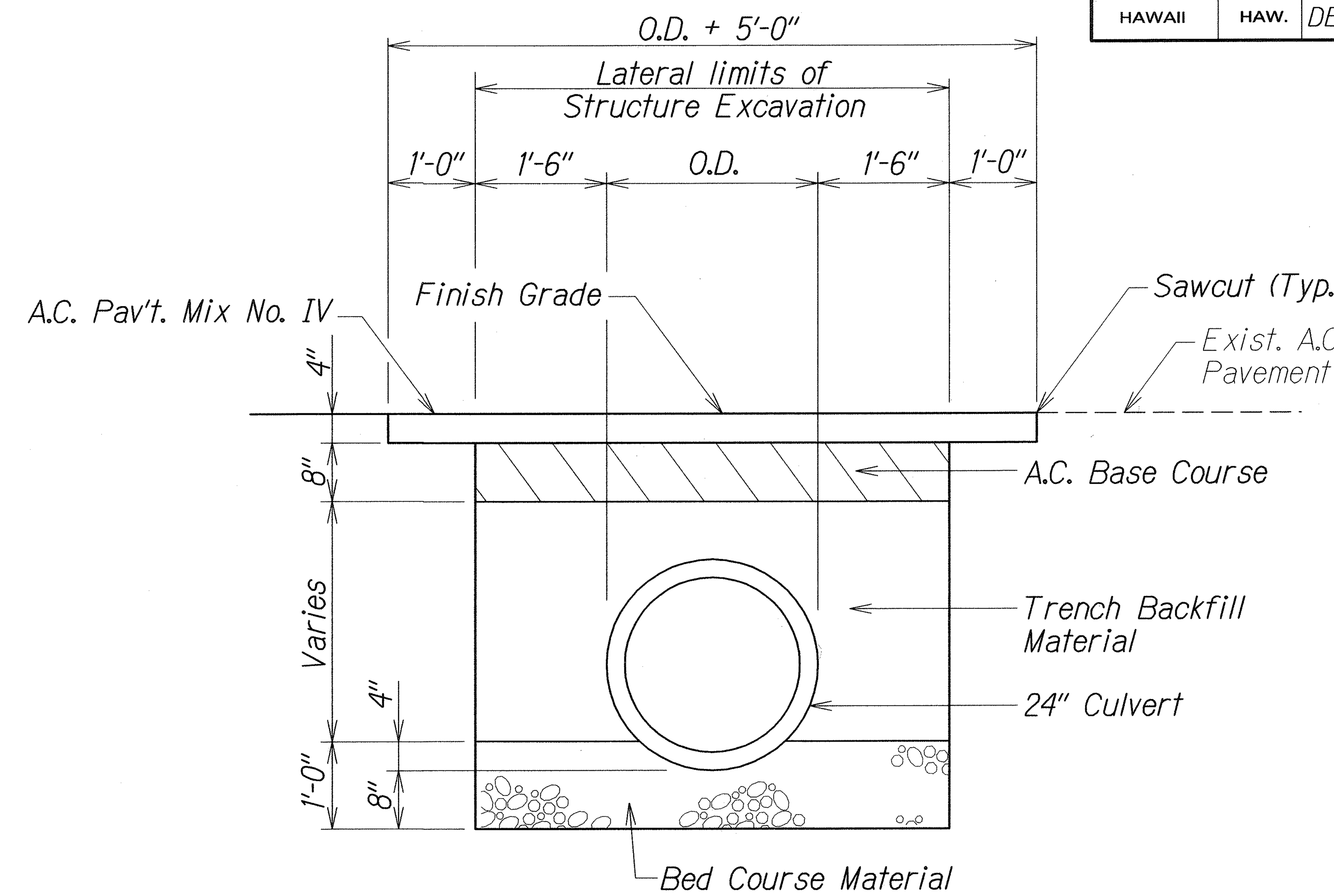
SHEET No. H8a OF 9 SHEETS

C.O. 13 S-1

FED. ROAD DIST. NO.	STATE	FED. AID PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
HAWAII	HAW.	DE-072-1(48)R	2006	C.O.14	20



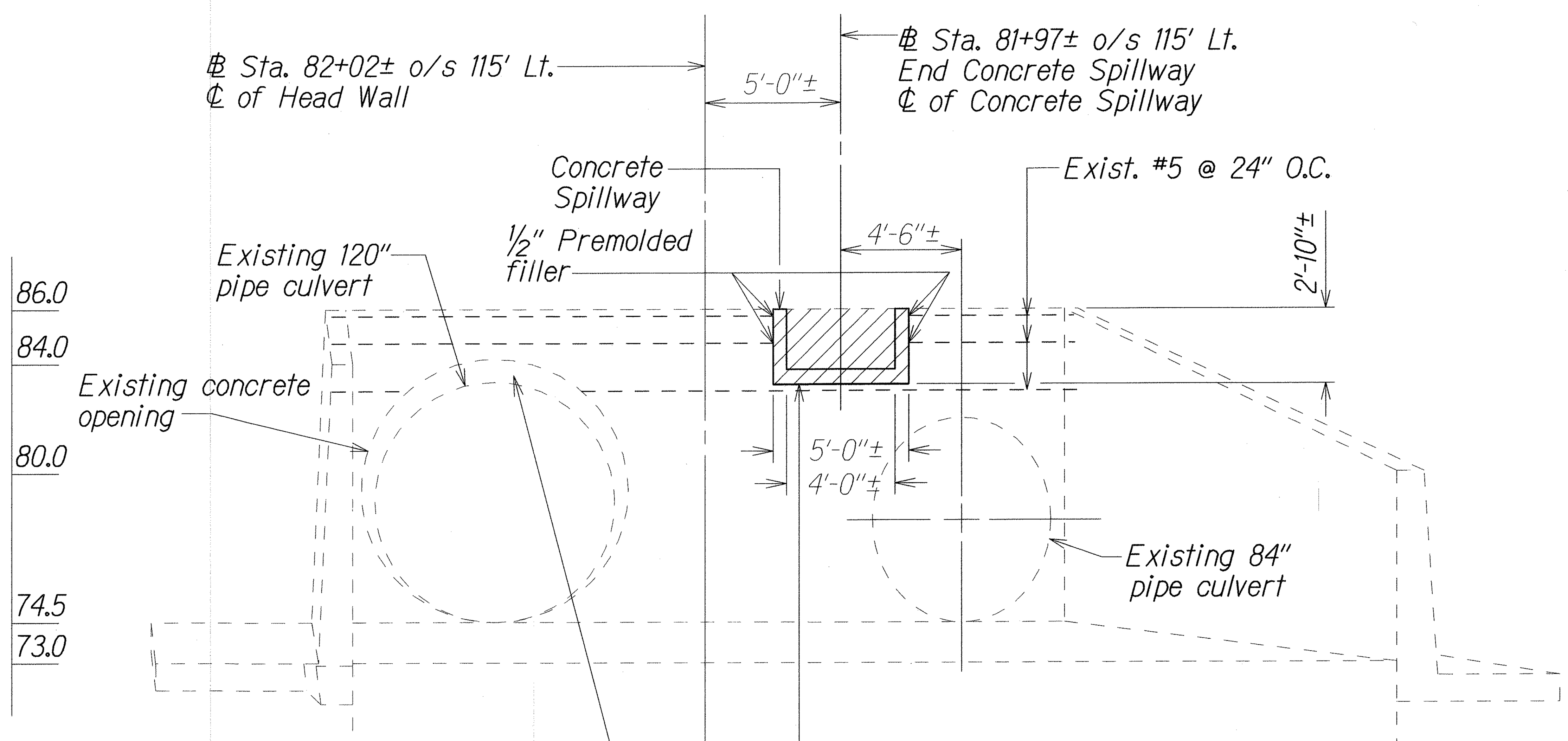
℄ STA. 78+00 LT. TO STA. 79+50 LT.



℄ STA. 79+50 LT. TO STA. 82+01 LT.

DETAILS OF CULVERT TRENCH RESTORATION

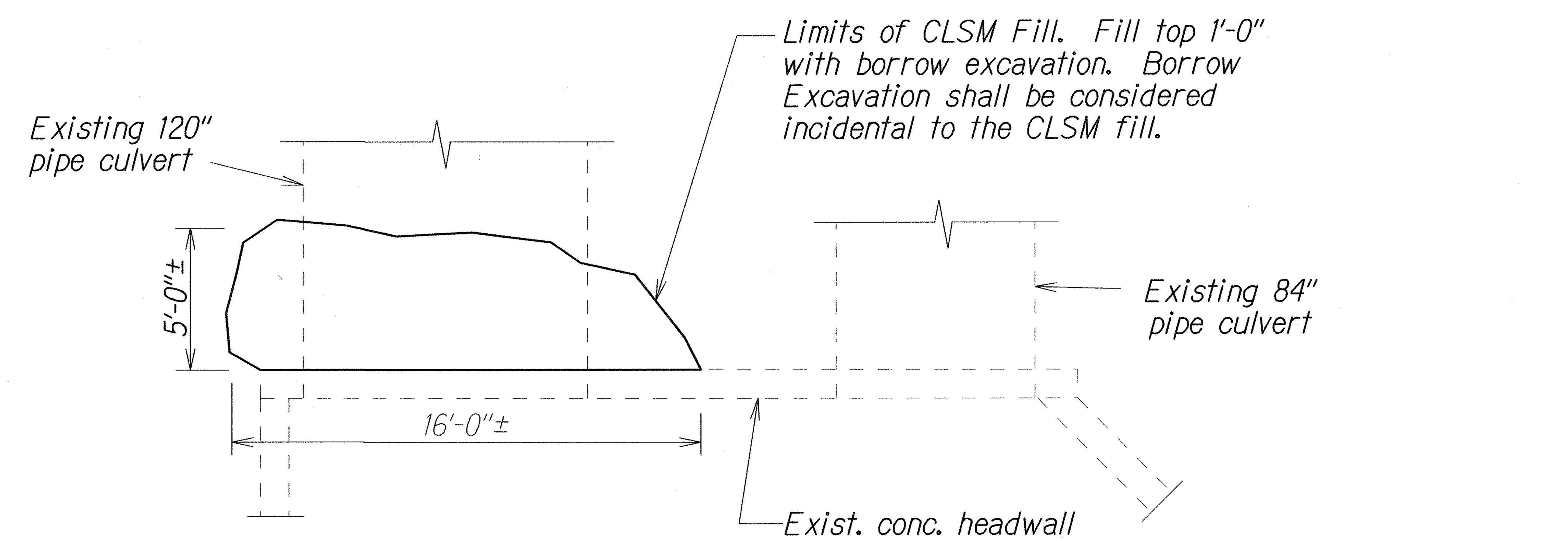
Scale: 3/4"=1'-0"



Fill space between existing metal culvert and existing concrete headwall with 1'-0"± thick non-shrink grout. Existing concrete surface shall be roughened to a minimum 1/4" amplitude and cleaned prior to placement of grout.

2-layer asphalt roll roofing ASTM D224 Type II.

SECTION (C / H8 H9)
Scale: 1/4"=1'-0"



PLAN
Scale: 1/4"=1'-0"

DETAILS OF TYPE "1" OUTLET STRUCTURE AND CONCRETE SPILLWAY AT ℄ STA. 82+01 O/S 51' LT.

DATE	REVISION
5/11/06	Add detail of CLSM fill, Plan view Add note to fill space with grout

STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION

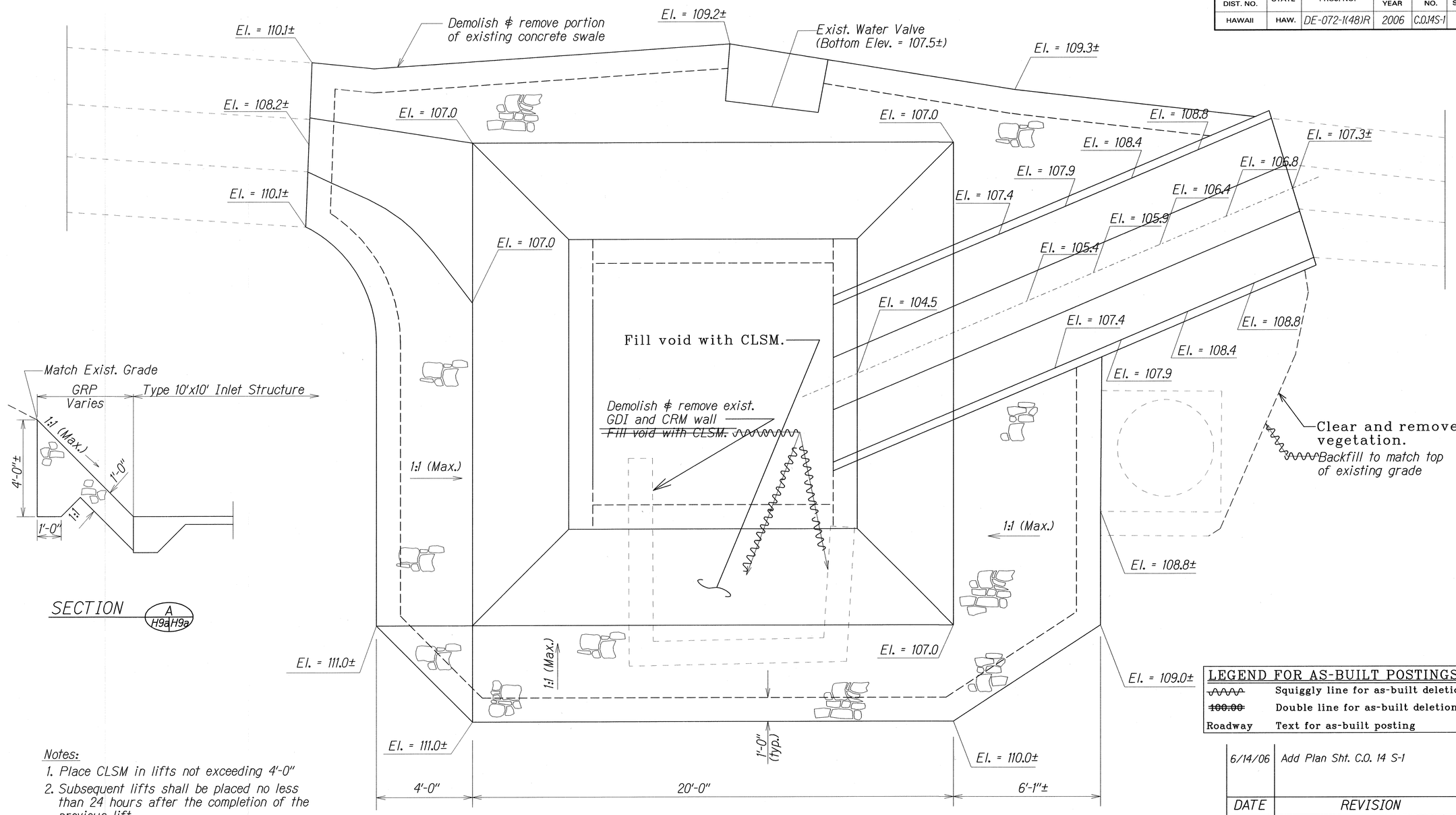
DRAINAGE DETAIL
KALANIANAOLE HIGHWAY
DRAINAGE IMPROVEMENTS
Vicinity of Keolu Hills
Fed. Aid Project No. DE-072-1(48)R

Scale: As Shown — Date: May, 2005

SHEET No. H9 OF 9 SHEETS

ORIGINAL PLAN		DATE
SURVEY PLOTTED BY		7/10/03
DRAWN BY	LBC	
TRACED BY		
DESIGNED BY	C.M.	
QUANTITIES BY		
CHECKED BY		
NOTE BOOK		

FED. ROAD DIST. NO.	STATE	FED. AID PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
HAWAII	HAW.	DE-072-1(48)R	2006	C.O.14S-1	20



PLAN

SECTION A H9a H9a

Notes:

1. Place CLSM in lifts not exceeding 4'-0"
2. Subsequent lifts shall be placed no less than 24 hours after the completion of the previous lift.
3. Roughen CLSM surfaces to ¼" minimum roughness.

LEGEND FOR AS-BUILT POSTINGS	
∿∿∿∿	Squiggly line for as-built deletion
~~100.00~~	Double line for as-built deletion
Roadway	Text for as-built posting

DATE	REVISION
6/14/06	Add Plan Sht. C.O. 14 S-1

ORIGINAL PLAN
SURVEY PLOTTED BY
DRAWN BY
TRACED BY
DESIGNED BY
QUANTITIES BY
CHECKED BY
DATE
NOTE BOOK

STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION

DRAINAGE DETAIL

KALANIANAOLE HIGHWAY
DRAINAGE IMPROVEMENTS
Vicinity of Keolu Hills
Federal Aid Proj. No. DE-072-1(48)R

Scale: ½"=1'-0" Date: Apr, 2006

SHEET No. H9a OF 9 SHEETS

DETAILS OF GRP SLOPE PROTECTION AT ℄ STA. 82+19 RT.

"AS-BUILT"

C.O. 14 S-1