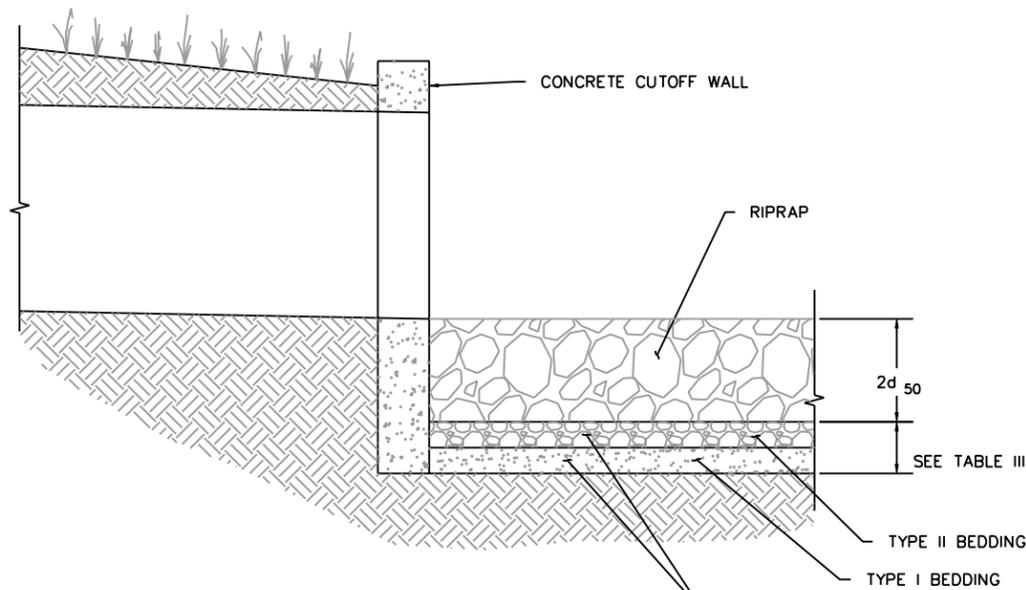
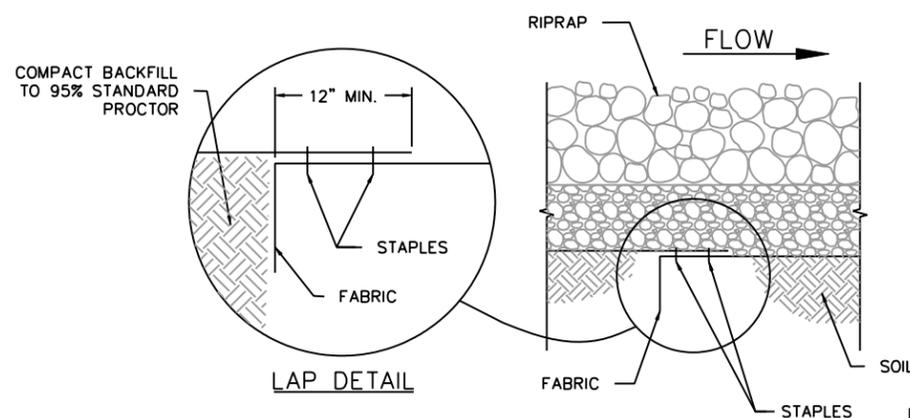


RIPRAP AT PIPE OUTLET WITHOUT CUTOFF WALL



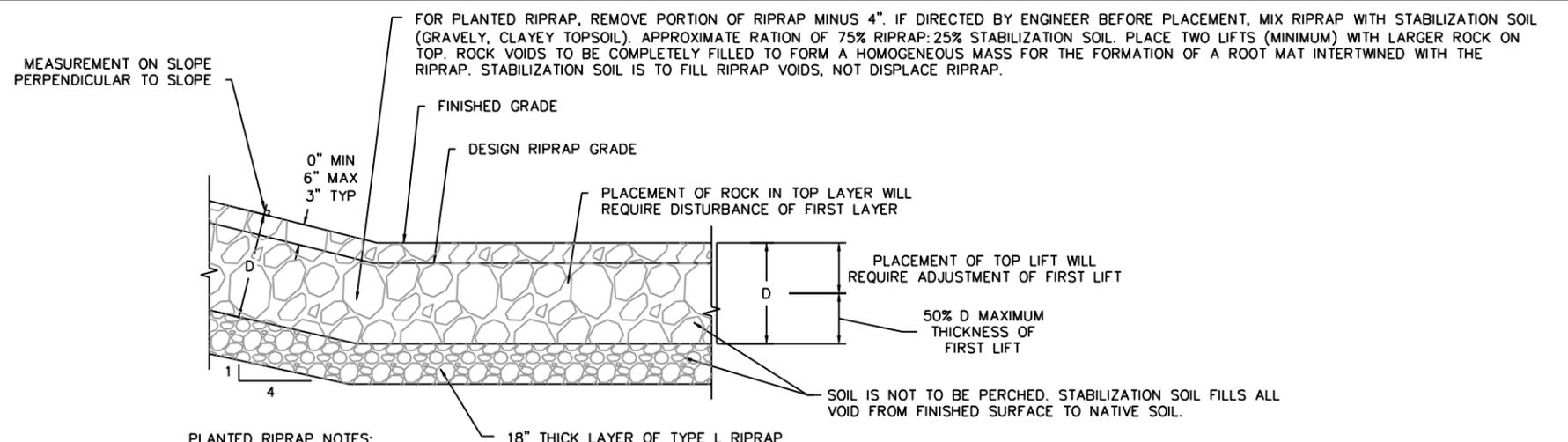
RIPRAP AT PIPE OUTLET WITH CUTOFF WALL



FILTER FABRIC PLACEMENT AND LAP DETAIL

FILTER FABRIC NOTES:

1. FILTER FABRIC MAY BE USED IN COMBINATION WITH TYPE II BEDDING AT DROP STRUCTURES AS AN ALTERNATIVE TO A TWO LAYER FILTER.
2. FILTER FABRIC SHALL CONFORM TO CDOT SPECIFICATIONS FOR CLASS A DRAINAGE GEOTEXTILES - SECTION 712.



PLANTED RIPRAP NOTES:

1. GENERAL PLACEMENT TECHNIQUES SHOULD RESULT IN LARGER ROCK AT THE SURFACE WITH ROCK SECURELY INTERLOCKED AT THE DESIGN THICKNESS AND GRADE. COMPACTION AND LEVELING SHOULD RESULT IN MINIMAL VOIDS AND PROJECTIONS ABOVE GRADE. TYPICAL FOR BOTH BURIED AND EXPOSED RIPRAP.
2. FOR PLANTED RIPRAP: FINAL RIPRAP TO BE COMPACTED BY FULL LOADING OF BACKHOE BUCKET, AS APPROVED. ANY SOFT, YIELDING OR PACKETS OF SMALL ROCK WILL BE REWORKED. PLACE STABILIZATION SOIL SO NO MORE THAN 3 INCHES THICK OVER ROCK AND 25 TO 50 PERCENT OF ROCK EXPOSED AS DIRECTED. COORDINATE ROCK PLACEMENT TO PROVIDE TREE OR SHRUB PLANTING PITS AS INDICATED ON PLANNING PLANS.

TYPICAL PLANTED RIPRAP PLACEMENT

**TABLE I
CLASSIFICATION AND GRADATION OF ORDINARY RIPRAP**

RIPRAP DESIGNATION	% SMALLER THAN GIVEN SIZE BY WEIGHT	INTERMEDIATE ROCK DIMENSIONS (INCHES)	d ₅₀ (INCHES)*
TYPE VL	70-100	12	6**
	50-70	9	
	35-50	6	
	2-10	2	
TYPE L	70-100	15	9**
	50-70	12	
	35-50	9	
	2-10	3	
TYPE M	70-100	21	12
	50-70	18	
	35-50	12	
	2-10	4	
TYPE H	70-100	30	18
	50-70	24	
	35-50	18	
	2-10	6	
TYPE VH	70-100	42	24
	50-70	33	
	35-50	24	
	2-10	9	

* d₅₀ = MEAN PARTICAL SIZE (INTERMEDIATE DIMENSION) BY WEIGHT.
 ** MIX VL AND L RIPRAP WITH 30% (BY VOLUME) TOPSOIL AND BURY IT WITH 6+ INCHES OF TOP SOIL, ALL VIBRATION COMPACTED, AND REVEGETATED.

GENERAL NOTES:

1. FOR CHANNEL APPLICATIONS REFER TO THE MAJOR DRAINAGE CHAPTER OF THE URBAN STORM DRAINAGE CRITERIA MANUAL, VOLUME 1, FOR RIPRAP SIZING.
2. FOR CULVERT/STORM SEWER OUTLET APPLICATIONS REFER TO THE HYDRAULIC STRUCTURES CHAPTER OF THE URBAN STORM DRAINAGE CRITERIA MANUAL, VOLUME 2, FOR RIPRAP SIZE, RIPRAP DEPTH, BASIN LENGTH, AND BASIN WIDTH.

**TABLE II
GRADATION FOR GRANULAR BEDDING**

U.S. STANDARD SIEVE SIZE	PERCENT WEIGHT BY PASSING SQUARE-MESH SIEVES	
	TYPE I CDOT SECT. 703.01	TYPE II CDOT SECT. 703.09 CLASS A
3 INCHES	----	90-100
1 1/2 INCHES	----	----
3/4 INCHES	----	20-90
3/8 INCHES	100	----
#4	95-100	0-20
#16	45-80	----
#50	10-30	----
#100	2-10	----
#200	0-2	0-3

**TABLE III
THICKNESS REQUIREMENTS FOR GRANULAR BEDDING**

U.S. STANDARD SIEVE SIZE	PERCENT WEIGHT BY PASSING SQUARE-MESH SIEVES		
	FINE-GRAINED SOILS*		COURSE-GRAINED SOILS**
	TYPE I	TYPE II	TYPE II
VL(d ₅₀ = 6 IN.), L(d ₅₀ = 9 IN.)	4	4	6
M(d ₅₀ = 12 IN.)	4	4	6
H(d ₅₀ = 18 IN.)	4	6	8
VH(d ₅₀ = 24 IN.)	4	6	8

* MAY SUBSTITUTE ONE 12-INCH LAYER OF TYPE II BEDDING. THE SUBSTITUTE OF ONE LAYER OF TYPE II BEDDING SHALL NOT BE PERMITTED AT DROP STRUCTURES. THE USE OF A COMBINATION OF FILTER FABRIC AND TYPE II BEDDING AT DROP STRUCTURES IS ACCEPTABLE.

** FIFTY PERCENT OR MORE BY WEIGHT RETAINED ON THE #40 SIEVE.

RIPRAP INSTALLATION



CITY OF LOVELAND
PUBLIC WORKS DEPT.
STORMWATER

STORMWATER
CONSTRUCTION
DRAWINGS

APPROVED: KWG
DATE: 8/17/07
DRAWN BY: DLE

DRAWING
SW-9