

Appendix E: Blue Book Standard Drawings

MATERIALS

ROCK: 150 TO 300mm NOMINAL DIAMETER, HARD, EROSION RESISTANT ROCK. SMALLER ROCK MAY BE USED IF SUITABLE LARGE ROCK IS NOT AVAILABLE.

SANDBAGS: GEOTEXTILE BAGS (WOVEN SYNTHETIC, OR NON-WOVEN BIODEGRADABLE) FILLED WITH CLEAN COARSE SAND, CLEAN AGGREGATE, STRAW OR COMPOST.

INSTALLATION

1. REFER TO APPROVED PLANS FOR LOCATION AND INSTALLATION DETAILS. IF THERE ARE QUESTIONS OR PROBLEMS WITH THE LOCATION OR METHOD OF INSTALLATION, CONTACT THE ENGINEER OR RESPONSIBLE ON-SITE OFFICER FOR ASSISTANCE.

2. PRIOR TO PLACEMENT OF THE CHECK DAMS, ENSURE THE TYPE AND SIZE OF EACH CHECK DAMS WILL NOT CAUSE A SAFETY HAZARD OR CAUSE WATER TO SPILL OUT OF THE DRAIN.

3. LOCATE THE FIRST CHECK DAM AT THE DOWNSTREAM END OF THE SECTION OF CHANNEL BEING PROTECTED. LOCATE EACH SUCCESSIVE CHECK DAM SUCH THAT THE CREST OF THE IMMEDIATE DOWNSTREAM DAM IS LEVEL WITH THE TOE OF THE CHECK DAM BEING INSTALLED.

4. ENSURE THE CHANNEL SLOPE IS NO STEEPER THAN 10:1 (H:V). OTHERWISE CONSIDER THE USE OF A SUITABLE CHANNEL LINER INSTEAD OF THE CHECK DAMS.

5. CONSTRUCT THE CHECK DAM TO THE DIMENSIONS AND PROFILE SHOWN WITHIN THE APPROVED PLAN.

6. WHERE SPECIFIED, THE CHECK DAMS SHALL BE CONSTRUCTED ON A SHEET OF GEOTEXTILE FABRIC USED AS A DOWNSTREAM SPLASH PAD.

7. EACH CHECK DAM SHALL BE EXTENDED UP THE CHANNEL BANK (WHERE PRACTICABLE) TO AN ELEVATION AT LEAST 150mm ABOVE THE CREST LEVEL OF THE DAM.

MAINTENANCE

1. INSPECT EACH CHECK DAM AND THE DRAINAGE CHANNEL AT LEAST WEEKLY AND AFTER RUNOFF-PRODUCING RAINFALL.

2. CORRECT ALL DAMAGE IMMEDIATELY. IF SIGNIFICANT EROSION OCCURS BETWEEN ANY OF THE CHECK DAMS, THEN CHECK THE SPACING OF DAMS AND WHERE NECESSARY INSTALL INTERMEDIATE CHECK DAMS OR A SUITABLE CHANNEL LINER.

3. CHECK FOR DISPLACEMENT OF THE CHECK DAMS

4. CHECK FOR SOIL SCOUR AROUND THE ENDS OF EACH CHECK DAM. IF SUCH EROSION IS OCCURRING, CONSIDER EXTENDING THE WIDTH OF THE CHECK DAM TO AVOID SUCH PROBLEMS.

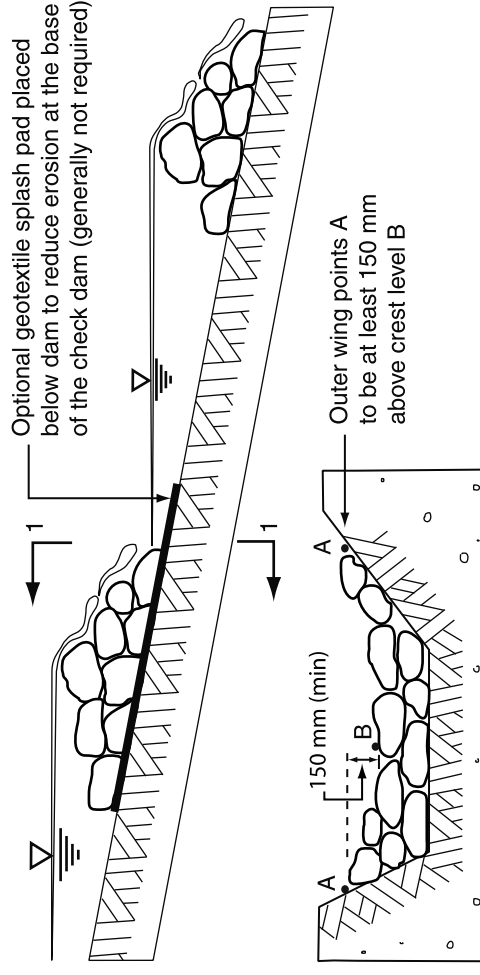
5. IF SEVERE SOIL EROSION OCCURS EITHER UNDER OR AROUND THE CHECK DAMS, THEN SEEK EXPERT ADVICE ON AN ALTERNATIVE TREATMENT MEASURE.

REMOVAL

6. REMOVE ANY SEDIMENT ACCUMULATED BY THE CHECK DAMS, UNLESS IT IS INTENDED THAT THIS SEDIMENT WILL REMAIN WITHIN THE CHANNEL.

7. DISPOSE OF COLLECTED SEDIMENT IN A SUITABLE MANNER THAT WILL NOT CAUSE AN EROSION OR POLLUTION HAZARD.

8. REMOVE THE CHECK DAMS AND ASSOCIATED SEDIMENT AND DISPOSE OF IN A SUITABLE MANNER THAT WILL NOT CAUSE AN EROSION OR POLLUTION HAZARD.



Section 1-1

Figure 1 - Layout and profile of check dams (rock check dams shown)

Drawn: GMW	Date: Dec-09	Check Dams	RCD-01
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MATERIALS

FABRIC: POLYPROPYLENE, POLYAMIDE, NYLON, POLYESTER, OR POLYETHYLENE WOVEN OR NON-WOVEN FABRIC, AT LEAST 700mm IN WIDTH AND A MINIMUM UNIT WEIGHT OF 140g/m². ALL FABRICS TO CONTAIN ULTRAVIOLET INHIBITORS AND STABILISERS TO PROVIDE A MINIMUM OF 6 MONTHS OF USEABLE CONSTRUCTION LIFE (ULTRAVIOLET STABILITY EXCEEDING 70%).

FABRIC REINFORCEMENT: WIRE OR STEEL MESH MINIMUM 14-GAUGE WITH A MAXIMUM MESH SPACING OF 200mm.

SUPPORT POSTS/STAKES: 1500mm² (MIN) HARDWOOD, 2500mm² (MIN) SOFTWOOD, OR 1.5kg/m (MIN) STEEL STAR PICKETS SUITABLE FOR ATTACHING FABRIC.

INSTALLATION

1. REFER TO APPROVED PLANS FOR LOCATION, EXTENT, AND REQUIRED TYPE OF FABRIC (IF EXTENDED), IF THERE ARE QUESTIONS OR PROBLEMS WITH THE LOCATION, EXTENT, FABRIC TYPE, OR METHOD OF INSTALLATION CONTACT THE ENGINEER OR RESPONSIBLE ON-SITE OFFICER FOR ASSISTANCE.

2. TO THE MAXIMUM DEGREE PRACTICAL, AND WHERE THE PLANS ALLOW, ENSURE THE FENCE IS LOCATED:

- (i) TOTALLY WITHIN THE PROPERTY BOUNDARIES;
- (ii) ALONG A LINE OF CONSTANT ELEVATION WHEREVER PRACTICAL;
- (iii) AT LEAST 2m FROM THE TOE OF ANY FILLING OPERATIONS THAT MAY RESULT IN SHIFTING SOIL/FILL DAMAGING THE FENCE.

3. INSTALL RETURNS WITHIN THE FENCE AT MAXIMUM 20m INTERVALS IF THE FENCE IS INSTALLED ALONG THE CONTOUR, OR 5 TO 10m MAXIMUM SPACING (DEPENDING ON SLOPE) IF THE FENCE IS INSTALLED AT AN ANGLE TO THE CONTOUR. THE 'RETURNS' SHALL CONSIST OF EITHER:

- (i) V-SHAPED SECTION EXTENDING AT LEAST 1.5m UP THE SLOPE; OR
- (ii) SANDBAG OR ROCK/AGGREGATE CHECK

DAM A MINIMUM 1/3 AND MAXIMUM 1/2 FENCE HEIGHT, AND EXTENDING AT LEAST 1.5m UP THE SLOPE.

4. ENSURE THE EXTREME ENDS OF THE FENCE ARE TURNED UP THE SLOPE AT LEAST 1.5m, OR AS NECESSARY, TO MINIMISE WATER BYPASSING AROUND THE FENCE.

5. ENSURE THE SEDIMENT FENCE IS INSTALLED IN A MANNER THAT AVOIDS THE CONCENTRATION OF FLOW ALONG THE FENCE, AND THE UNDESIRABLE DISCHARGE OF WATER AROUND THE ENDS OF THE FENCE

6. IF THE SEDIMENT FENCE IS TO BE INSTALLED ALONG THE EDGE OF EXISTING TREES, ENSURE CARE IS TAKEN TO PROTECT THE TREES AND THEIR ROOT SYSTEMS DURING INSTALLATION OF THE FENCE. DO NOT ATTACH THE FABRIC TO THE TREES.

7. UNLESS DIRECTED BY THE SITE SUPERVISOR OR THE APPROVED PLANS, EXCAVATE A 200mm WIDE BY 200mm DEEP TRENCH ALONG THE PROPOSED FENCE LINE, PLACING THE EXCAVATED MATERIAL ON THE UP-SLOPE SIDE OF THE TRENCH.

8. ALONG THE LOWER SIDE OF THE TRENCH, APPROPRIATELY SECURE THE STAKES INTO THE GROUND SPACED NO GREATER THAN 3m IF SUPPORTED BY A TOP SUPPORT WIRE OR WEIR MESH BACKING, OTHERWISE NO GREATER THAN 2m.

9. IF SPECIFIED, SECURELY ATTACH THE SUPPORT WIRE OR MESH TO THE UP-SLOPE SIDE OF THE STAKES WITH THE MESH EXTENDING AT LEAST 200mm INTO THE EXCAVATED TRENCH. ENSURE THE MESH AND FABRIC IS ATTACHED TO THE UP-SLOPE SIDE OF THE STAKES EVEN WHEN DIRECTING A FENCE AROUND A CORNER OR SHARP CHANGE OF DIRECTION.

10. WHEREVER POSSIBLE, CONSTRUCT THE SEDIMENT FENCE FROM A CONTINUOUS ROLL OF FABRIC. TO JOIN FABRIC EITHER:

- (i) ATTACH EACH END TO TWO OVERLAPPING STAKES WITH THE FABRIC FOLDING AROUND THE ASSOCIATED STAKE ONE TURN, AND WITH

THE TWO STAKES TIED TOGETHER WITH WIRE;
OR
(ii) OVERLAP THE FABRIC TO THE NEXT
ADJACENT SUPPORT POST.

11. SECURELY ATTACH THE FABRIC TO THE SUPPORT POSTS USING 25 X 12.5mm STAPLES, OR TIE WIRE AT MAXIMUM 150mm SPACING.

12. SECURELY ATTACH THE FABRIC TO THE SUPPORT WIRE/MESH (IF ANY) AT A MAXIMUM SPACING OF 1m.

13. ENSURE THE COMPLETED SEDIMENT FENCE IS AT LEAST 450mm, BUT NOT MORE THAN 700mm HIGH. IF A SPILL-THOUGH WEIR IS INSTALLED, ENSURE THE CREST OF THE WEIR IS AT LEAST 300mm ABOVE GROUND LEVEL.

14. BACKFILL THE TRENCH AND TAMP THE FILL TO FIRMLY ANCHOR THE BOTTOM OF THE FABRIC AND MESH TO PREVENT WATER FROM FLOWING UNDER THE FENCE.

ADDITIONAL REQUIREMENTS FOR THE INSTALLATION OF A SPILL-THROUGH WEIR

1. LOCATE THE SPILL-THROUGH WEIR SUCH THAT THE WEIR CREST WILL BE LOWER THAN THE GROUND LEVEL AT EACH END OF THE FENCE:

2. ENSURE THE CREST OF THE SPILL-THROUGH WEIR IS AT LEAST 300mm THE GROUND ELEVATION.

3. SECURELY TIE A HORIZONTAL CROSS MEMBER (WEIR) TO THE SUPPORT POSTS/ STAKES EACH SIDE OF THE WEIR. CUT THE FABRIC DOWN THE SIDE OF EACH POST AND FOLD THE FABRIC OVER THE CROSS MEMBER AND APPROPRIATELY SECURE THE FABRIC.

4. INSTALL A SUITABLE SPLASH PAD AND/OR CHUTE IMMEDIATELY DOWN-SLOPE OF THE SPILL-THROUGH WEIR TO CONTROL SOIL EROSION AND APPROPRIATELY DISCHARGE THE CONCENTRATED FLOW PASSING OVER THE WEIR.

MAINTENANCE

1. INSPECT THE SEDIMENT FENCE AT LEAST WEEKLY AND AFTER ANY SIGNIFICANT RAIN. MAKE NECESSARY REPAIRS IMMEDIATELY.

2. REPAIR ANY TORN SECTIONS WITH A CONTINUOUS PIECE OF FABRIC FROM POST TO POST.

3. WHEN MAKING REPAIRS, ALWAYS RESTORE THE SYSTEM TO ITS ORIGINAL CONFIGURATION UNLESS AN AMENDED LAYOUT IS REQUIRED OR SPECIFIED.

4. IF THE FENCE IS SAGGING BETWEEN STAKES, INSTALL ADDITIONAL SUPPORT POSTS.

5. REMOVE ACCUMULATED SEDIMENT IF THE SEDIMENT DEPOSIT EXCEEDS A DEPTH OF 1/3 THE HEIGHT OF THE FENCE.

6. DISPOSE OF SEDIMENT IN A SUITABLE MANNER THAT WILL NOT CAUSE AN EROSION OR POLLUTION HAZARD.

7. REPLACE THE FABRIC IF THE SERVICE LIFE OF THE EXISTING FABRIC EXCEEDS 6-MONTHS.

REMOVAL

1. WHEN DISTURBED AREAS UP-SLOPE OF THE SEDIMENT FENCE ARE SUFFICIENTLY STABILISED TO RESTRAIN EROSION, THE FENCE MUST BE REMOVED.

2. REMOVE MATERIALS AND COLLECTED SEDIMENT AND DISPOSE OF IN A SUITABLE MANNER THAT WILL NOT CAUSE AN EROSION OR POLLUTION HAZARD.

3. REHABILITATE/REVEGETATE THE DISTURBED GROUND AS NECESSARY TO MINIMISE THE EROSION HAZARD

CONSTRUCTION		5. TAKE CARE NOT TO DAMAGE THE FABRIC DURING OR AFTER PLACEMENT. IF DAMAGE OCCURS, REMOVE THE ROCK AND REPAIR THE SHEET BY ADDING ANOTHER LAYER OF FABRIC WITH A MINIMUM OVERLAP OF 300mm AROUND THE DAMAGED AREA. IF EXTENSIVE DAMAGE IS SUSPECTED, REMOVE AND REPLACE THE ENTIRE SHEET. 6. WHERE LARGE ROCK IS USED, OR MACHINE PLACEMENT IS DIFFICULT, A MINIMUM 100mm LAYER OF FINE GRAVEL, AGGREGATE, OR SAND MAY BE NEEDED TO PROTECT THE FABRIC. 7. PLACEMENT OF ROCK SHOULD FOLLOW IMMEDIATELY AFTER PLACEMENT OF THE FILTER FABRIC. PLACE ROCK SO THAT IT FORMS A DENSE, WELL-GRADED MASS OF ROCK WITH A MINIMUM OF VOIDS. THE DESIRED DISTRIBUTION OF ROCK THROUGHOUT THE MASS MAY BE OBTAINED BY SELECTIVE LOADING AT THE QUARRY AND CONTROLLED DUMPING DURING FINAL PLACEMENT. 8. THE FINISHED SLOPE SHOULD BE FREE OF POCKETS OF SMALL ROCK OR CLUSTERS OF LARGE ROCKS. HAND PLACING MAY BE NECESSARY TO ACHIEVE THE PROPER DISTRIBUTION OF ROCK SIZES TO PRODUCE A RELATIVELY SMOOTH, UNIFORM SURFACE. THE FINISHED GRADE OF THE ROCK SHOULD BLEND WITH THE SURROUNDING AREA. NO OVERFALL OR PROTRUSION OF ROCK SHOULD BE APPARENT. 9. ENSURE THAT THE FINAL ARRANGEMENT OF THE SPILLWAY CREST WILL NOT PROMOTE EXCESSIVE FLOW THROUGH THE ROCK SUCH THAT THE WATER CAN BE RETAINED WITHIN THE SETTLING BASIN AN ELEVATION NO LESS	THAN 50mm ABOVE OR BELOW THE NOMINATED SPILLWAY CREST ELEVATION.	4. WHEN MAKING REPAIRS, ALWAYS RESTORE THE SPILLWAY TO ITS ORIGINAL CONFIGURATION UNLESS AN AMENDED LAYOUT IS REQUIRED.
1. THE SPILLWAY MUST BE EXCAVATED AS SHOWN ON THE PLANS, AND THE EXCAVATED MATERIAL IF CLASSIFIED AS SUITABLE, MUST BE USED IN THE EMBANKMENT, AND IF NOT SUITABLE IT MUST BE DISPOSED OF INTO SPOIL HEAPS. 2. ENSURE EXCAVATED DIMENSIONS ALLOW ADEQUATE BOXING-OUT SUCH THAT THE SPECIFIED ELEVATIONS, GRADES, CHUTE WIDTH, AND ENTRANCE AND EXIT SLOPES FOR THE EMERGENCY SPILLWAY WILL BE ACHIEVED AFTER PLACEMENT OF THE ROCK OR OTHER SCOUR PROTECTION MEASURES AS SPECIFIED IN THE PLANS. 3. PLACE SPECIFIED SCOUR PROTECTION MEASURES ON THE EMERGENCY SPILLWAY. ENSURE THE FINISHED GRADE BLENDS WITH THE SURROUNDING AREA TO ALLOW A SMOOTH FLOW TRANSITION FROM SPILLWAY TO DOWNSTREAM CHANNEL. 4. IF A SYNTHETIC FILTER FABRIC UNDERLAY IS SPECIFIED, PLACE THE FILTER FABRIC DIRECTLY ON THE PREPARED FOUNDATION. IF MORE THAN 1 SHEET OF FILTER FABRIC IS REQUIRED, OVERLAP THE EDGES BY AT LEAST 300mm AND PLACE ANCHOR PINS AT MINIMUM 1m SPACING ALONG THE OVERLAP. BURY THE UPSTREAM END OF THE FABRIC A MINIMUM 300mm BELOW GROUND AND WHERE NECESSARY, BURY THE LOWER END OF THE FABRIC OR OVERLAP A MINIMUM 300mm OVER THE NEXT DOWNSTREAM SECTION AS REQUIRED. ENSURE THE FILTER FABRIC EXTENDS AT LEAST 1000mm UPSTREAM OF THE SPILLWAY CREST.		5. TAKE CARE NOT TO DAMAGE THE FABRIC DURING OR AFTER PLACEMENT. IF DAMAGE OCCURS, REMOVE THE ROCK AND REPAIR THE SHEET BY ADDING ANOTHER LAYER OF FABRIC WITH A MINIMUM OVERLAP OF 300mm AROUND THE DAMAGED AREA. IF EXTENSIVE DAMAGE IS SUSPECTED, REMOVE AND REPLACE THE ENTIRE SHEET. 6. WHERE LARGE ROCK IS USED, OR MACHINE PLACEMENT IS DIFFICULT, A MINIMUM 100mm LAYER OF FINE GRAVEL, AGGREGATE, OR SAND MAY BE NEEDED TO PROTECT THE FABRIC. 7. PLACEMENT OF ROCK SHOULD FOLLOW IMMEDIATELY AFTER PLACEMENT OF THE FILTER FABRIC. PLACE ROCK SO THAT IT FORMS A DENSE, WELL-GRADED MASS OF ROCK WITH A MINIMUM OF VOIDS. THE DESIRED DISTRIBUTION OF ROCK THROUGHOUT THE MASS MAY BE OBTAINED BY SELECTIVE LOADING AT THE QUARRY AND CONTROLLED DUMPING DURING FINAL PLACEMENT. 8. THE FINISHED SLOPE SHOULD BE FREE OF POCKETS OF SMALL ROCK OR CLUSTERS OF LARGE ROCKS. HAND PLACING MAY BE NECESSARY TO ACHIEVE THE PROPER DISTRIBUTION OF ROCK SIZES TO PRODUCE A RELATIVELY SMOOTH, UNIFORM SURFACE. THE FINISHED GRADE OF THE ROCK SHOULD BLEND WITH THE SURROUNDING AREA. NO OVERFALL OR PROTRUSION OF ROCK SHOULD BE APPARENT. 9. ENSURE THAT THE FINAL ARRANGEMENT OF THE SPILLWAY CREST WILL NOT PROMOTE EXCESSIVE FLOW THROUGH THE ROCK SUCH THAT THE WATER CAN BE RETAINED WITHIN THE SETTLING BASIN AN ELEVATION NO LESS	THAN 50mm ABOVE OR BELOW THE NOMINATED SPILLWAY CREST ELEVATION.	4. WHEN MAKING REPAIRS, ALWAYS RESTORE THE SPILLWAY TO ITS ORIGINAL CONFIGURATION UNLESS AN AMENDED LAYOUT IS REQUIRED.
MAINTENANCE		1. DURING THE CONSTRUCTION PERIOD, INSPECT THE SPILLWAY PRIOR TO FORECAST RAINFALL, DAILY DURING EXTENDED PERIODS OF RAINFALL, AFTER SIGNIFICANT RUNOFF PRODUCING STORM EVENTS, OR OTHERWISE ON A WEEKLY BASIS. MAKE REPAIRS AS NECESSARY. 2. CHECK FOR MOVEMENT OF, OR DAMAGE TO, THE SPILLWAY'S LINING, INCLUDING SURFACE CRACKING. 3. CHECK FOR SOIL SCOUR ADJACENT TO THE SPILLWAY. INVESTIGATE THE CAUSE OF ANY SCOUR, AND REPAIR AS NECESSARY.	1. TEMPORARY SPILLWAYS SHOULD BE REMOVED WHEN AN ALTERNATIVE, STABLE, DRAINAGE SYSTEM IS AVAILABLE. 2. REMOVE ALL MATERIALS AND DEPOSITED SEDIMENT, AND DISPOSE OF IN A SUITABLE MANNER THAT WILL NOT CAUSE AN EROSION OR POLLUTION HAZARD. 3. GRADE THE AREA IN PREPARATION FOR STABILISATION, THEN STABILISE THE AREA AS SPECIFIED IN THE APPROVED PLAN.	4. WHEN MAKING REPAIRS, ALWAYS RESTORE THE SPILLWAY TO ITS ORIGINAL CONFIGURATION UNLESS AN AMENDED LAYOUT IS REQUIRED.
REMOVAL				

The diagram illustrates the cross-section of a spillway. On the left, a 'Settling pond' is shown with a water level indicated by a triangle and horizontal lines. An arrow points to the water surface with the label 'Maximum pond water prior to spillway discharge'. To the right of the pond is the 'Spillway crest', which is a sloped structure. A label points to the crest with the text 'Concrete sealing of the spillway crest to prevent water seepage through the rocks'. Further down the slope is the 'Spillway chute', which is a steeper section covered with rocks. The entire structure is shown on a foundation of rocks.

Figure 1 - Example of seepage control on the spillway crest

Drawn: GMW	Date: Dec-09	Emergency Spillways	ES-1
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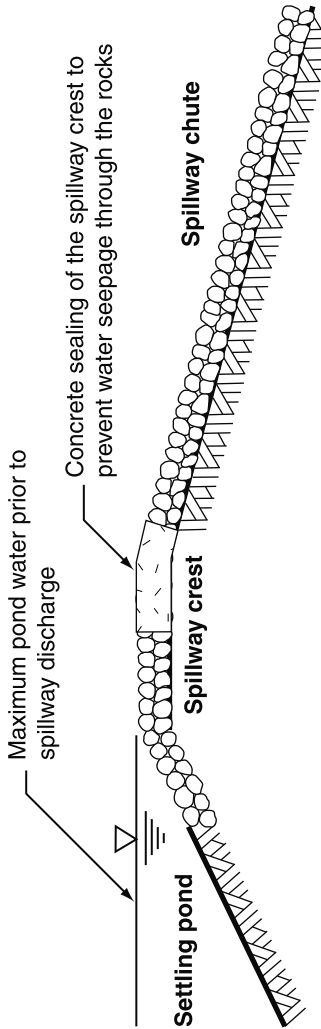


Figure 1 - Example of seepage control on the spillway crest

INSTALLATION		ADDITIONAL REQUIREMENTS FOR TURF PLACEMENT:		THE TURF AND THE SOIL SUCH THAT SEEPAGE FLOW BENEATH THE TURF IS AVOIDED.		DISPOSE OF ANY COLLECTED SEDIMENT OR FILL IN A MANNER THAT WILL NOT CREATE AN EROSION OR POLLUTION HAZARD.	
1. REFER TO APPROVED PLANS FOR LOCATION, EXTENT, AND CONSTRUCTION DETAILS. IF THERE ARE QUESTIONS OR PROBLEMS WITH THE LOCATION, EXTENT, OR METHOD OF INSTALLATION, CONTACT THE ENGINEER OR RESPONSIBLE ON-SITE OFFICER FOR ASSISTANCE. 2. ENSURE ALL NECESSARY SOIL TESTING (e.g. SOIL pH, NUTRIENT LEVELS) AND ANALYSIS HAS BEEN COMPLETED, AND REQUIRED SOIL ADJUSTMENTS PERFORMED PRIOR TO PLANTING. 3. CLEAR THE LOCATION FOR THE CHANNEL, CLEARING ONLY WHAT IS NEEDED TO PROVIDE ACCESS FOR PERSONNEL AND CONSTRUCTION EQUIPMENT. 4. REMOVE ROOTS, STUMPS, AND OTHER DEBRIS AND DISPOSE OF THEM PROPERLY. DO NOT USE DEBRIS TO BUILD ANY ASSOCIATED EMBANKMENTS. 5. EXCAVATE THE DIVERSION CHANNEL TO THE SPECIFIED SHAPE, ELEVATION AND GRADIENT. THE SIDES OF THE CHANNEL SHOULD BE NO STEEPER THAN A 2:1 (H:V) IF CONSTRUCTED IN EARTH, UNLESS SPECIFICALLY DIRECTED WITHIN THE APPROVED PLANS. 6. STABILISE THE CHANNEL AND BANKS IMMEDIATELY UNLESS IT WILL OPERATE FOR LESS THAN 30 DAYS. IN EITHER CASE, TEMPORARY EROSION PROTECTION (MATTING, ROCK, ETC.) WILL BE REQUIRED AS SPECIFIED WITHIN THE APPROVED PLANS OR AS DIRECTED. 7. ENSURE THE CHANNEL DISCHARGES TO A STABLE AREA.		1. TURF SHOULD BE USED WITHIN 12 HOURS OF DELIVERY, OTHERWISE ENSURE THE TURF IS STORED IN CONDITIONS APPROPRIATE FOR THE WEATHER CONDITIONS (e.g. A SHADED AREA). 2. MOISTENING THE TURF AFTER IT IS UNROLLED WILL HELP MAINTAIN ITS VIABILITY. 3. TURF SHOULD BE LAID ON A MINIMUM 75mm BED OF ADEQUATELY FERTILISED TOPSOIL. RAKE THE SOIL SURFACE TO BREAK THE CRUST JUST BEFORE LAYING THE TURF. 4. DURING THE WARMER MONTHS, LIGHTLY IRRIGATE THE SOIL IMMEDIATELY BEFORE LAYING THE TURF. 5. ENSURE THE TURF IS NOT LAID ON GRAVEL, HEAVILY COMPACTED SOILS, OR SOILS THAT HAVE BEEN RECENTLY TREATED WITH HERBICIDES. 6. ENSURE THE TURF EXTENDS UP THE SIDES OF THE DRAIN AT LEAST 100mm ABOVE THE ELEVATION OF THE CHANNEL INVERT, OR AT LEAST TO A SUFFICIENT ELEVATION TO FULLY CONTAIN EXPECTED CHANNEL FLOW. 7. ON CHANNEL GRADIENTS OF 3:1 (H:V) OR STEEPER, OR IN SITUATIONS WHERE HIGH FLOW VELOCITIES (i.e. VELOCITY >1.5m/s) ARE LIKELY WITHIN THE FIRST TWO WEEKS FOLLOWING PLACEMENT, SECURE THE INDIVIDUAL TURF STRIPS WITH WOODEN OR PLASTIC PEGS. 8. ENSURE THAT INTIMATE CONTACT IS ACHIEVED AND MAINTAINED BETWEEN		9. WATER UNTIL THE SOIL IS WET 100mm BELOW THE TURF. THEREAFTER, WATERING SHOULD BE SUFFICIENT TO MAINTAIN AND PROMOTE HEALTHY GROWTH 1. DURING THE SITE'S CONSTRUCTION PERIOD, INSPECT THE DIVERSION CHANNEL WEEKLY AND AFTER ANY INCREASE IN FLOWS WITHIN THE CHANNEL. REPAIR ANY SLUMPS, WHEEL TRACK DAMAGE OR LOSS OF FREEBOARD. 2. ENSURE FILL MATERIAL OR SEDIMENT IS NOT PARTIALLY BLOCKING THE CHANNEL. WHERE NECESSARY, REMOVE ANY DEPOSITED MATERIAL TO ALLOW FREE DRAINAGE. 3. GRADE THE AREA AND SMOOTH IT OUT IN PREPARATION FOR STABILISATION. 4. STABILISE THE AREA AS SPECIFIED IN THE APPROVED PLAN.		3. DISPOSE OF ANY COLLECTED SEDIMENT OR FILL IN A MANNER THAT WILL NOT CREATE AN EROSION OR POLLUTION HAZARD. 1. WHEN THE CONSTRUCTION WORK ABOVE A TEMPORARY DIVERSION CHANNEL IS FINISHED AND THE AREA IS STABILISED, THE AREA SHOULD BE APPROPRIATELY REHABILITATED. 2. DISPOSE OF ANY COLLECTED SEDIMENT OR FILL IN A MANNER THAT WILL NOT CREATE AN EROSION OR POLLUTION HAZARD. 3. GRADE THE AREA AND SMOOTH IT OUT IN PREPARATION FOR STABILISATION. 4. STABILISE THE AREA AS SPECIFIED IN THE APPROVED PLAN.	
MAINTENANCE		OPTIONAL EARTH EMBANKMENT TO INCREASE FLOW CAPACITY AND/OR ACT AS FREEBOARD		REMOVAL		Figure 1 - Typical profile of diversion channel with bank	
1. DURING THE SITE'S CONSTRUCTION PERIOD, INSPECT THE DIVERSION CHANNEL WEEKLY AND AFTER ANY INCREASE IN FLOWS WITHIN THE CHANNEL. REPAIR ANY SLUMPS, WHEEL TRACK DAMAGE OR LOSS OF FREEBOARD. 2. ENSURE FILL MATERIAL OR SEDIMENT IS NOT PARTIALLY BLOCKING THE CHANNEL. WHERE NECESSARY, REMOVE ANY DEPOSITED MATERIAL TO ALLOW FREE DRAINAGE.				Drawn: GMW Date: Dec-09		Diversion Channels DC-01	

INSTALLATION

- 1. REFER TO APPROVED PLANS FOR LOCATION, EXTENT, AND CONSTRUCTION DETAILS. IF THERE ARE QUESTIONS OR PROBLEMS WITH THE LOCATION, EXTENT, OR METHOD OF INSTALLATION, CONTACT THE ENGINEER OR RESPONSIBLE ON-SITE OFFICER FOR ASSISTANCE.
- 2. CLEAR THE LOCATION FOR THE BANK, CLEARING ONLY THE AREA THAT IS NEEDED TO PROVIDE ACCESS FOR PERSONNEL AND EQUIPMENT.
- 3. REMOVE ROOTS, STUMPS, AND OTHER DEBRIS AND DISPOSE OF THEM PROPERLY. DO NOT USE DEBRIS TO BUILD THE BANK.
- 4. FORM THE BANK FROM THE MATERIAL, AND TO THE DIMENSION SPECIFIED IN THE APPROVED PLANS.
- 5. IF EARTH IS USED, THEN ENSURE THE SIDES OF THE BANK ARE NO STEEPER THAN A 2:1 (H:V) SLOPE, AND THE COMPLETED BANK MUST BE AT LEAST 500mm HIGH.
- 6. IF FORMED FROM SANDBAGS, THEN ENSURE THE BAGS ARE TIGHTLY PACKED SUCH THAT WATER LEAKAGE THROUGH THE BAGS IS MINIMISED.
- 7. CHECK THE BANK ALIGNMENT TO ENSURE POSITIVE DRAINAGE IN THE DESIRED DIRECTION.

- 8. THE BANK SHOULD BE VEGETATED (TURFED, SEEDED AND MULCHED), OR OTHERWISE STABILISED IMMEDIATELY, UNLESS IT WILL OPERATE FOR LESS THAN 30 DAYS OR IF SIGNIFICANT RAINFALL IS NOT EXPECTED DURING THE LIFE OF THE BANK.
- 9. ENSURE THE EMBANKMENT DRAINS TO A STABLE OUTLET, AND DOES NOT DISCHARGE TO AN UNSTABLE FILL SLOPE.

MAINTENANCE

- 1. INSPECT FLOW DIVERSION BANKS AT LEAST WEEKLY AND AFTER RUNOFF-PRODUCING RAINFALL.
- 2. INSPECT THE BANK FOR ANY SLUMPS, WHEEL TRACK DAMAGE OR LOSS OF FREEBOARD. MAKE REPAIRS AS NECESSARY.

- 3. CHECK THAT FILL MATERIAL OR SEDIMENT HAS NOT PARTIALLY BLOCKED THE DRAINAGE PATH UP-SLOPE OF THE EMBANKMENT. WHERE NECESSARY, REMOVE ANY DEPOSITED MATERIAL TO ALLOW FREE DRAINAGE.
- 4. DISPOSE OF ANY COLLECTED SEDIMENT OR FILL IN A MANNER THAT WILL NOT CREATE AN EROSION OR POLLUTION HAZARD.
- 5. REPAIR ANY PLACES IN THE BANK THAT ARE WEAKENED OR IN RISK OF FAILURE.

REMOVAL

- 1. WHEN THE SOIL DISTURBANCE ABOVE THE BANK IS FINISHED AND THE AREA IS STABILISED, THE FLOW DIVERSION BANK SHOULD BE REMOVED, UNLESS IT IS TO REMAIN AS A PERMANENT DRAINAGE FEATURE.
- 2. DISPOSE OF ANY SEDIMENT OR EARTH IN A MANNER THAT WILL NOT CREATE AN EROSION OR POLLUTION HAZARD.

- 3. GRADE THE AREA AND SMOOTH IT OUT IN PREPARATION FOR STABILISATION.
- 4. STABILISE THE AREA BY GRASSING OR AS SPECIFIED IN THE APPROVED PLAN.

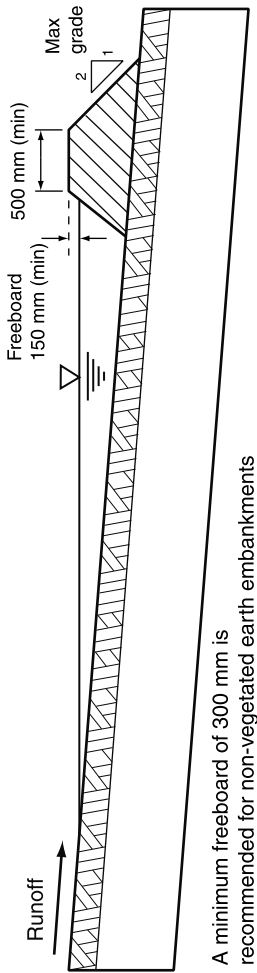


Figure 1 - Typical profile of flow diversion bank formed from earth

Table 1 - Recommended dimensions of flow diversion banks

Parameter	Earth banks	Vegetated banks	Compost berms	Sandbag berms
Height (min)	500 mm	500 mm	300 mm	N/A
Top width (min)	500 mm	500 mm	100 mm	N/A
Base width (min)	2500 mm	2500 mm	600 mm	N/A
Side slope (max)	2:1 (H:V)	2:1 (H:V)	1:1 (H:V)	N/A
Freeboard	300 mm	150 mm	100 mm	50 mm

Drawn: **GMW**

Date:

Dec-09

Flow Diversion Banks

DB-01

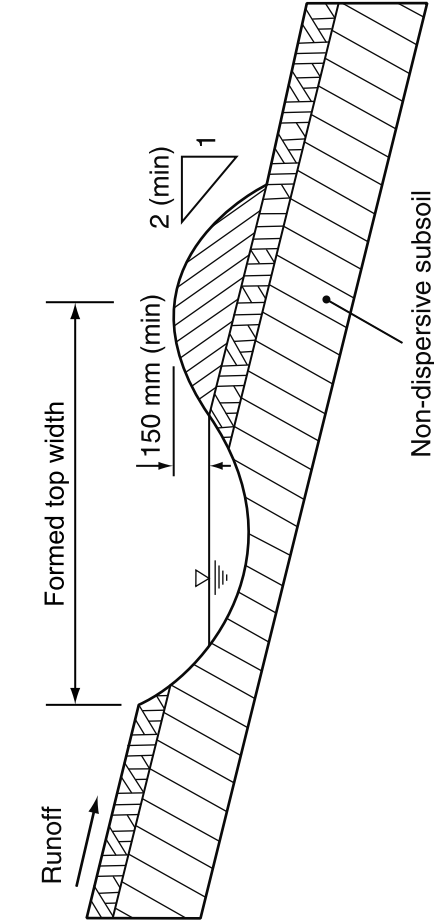
INSTALLATION 1. REFER TO APPROVED PLANS FOR LOCATION, EXTENT, AND CONSTRUCTION DETAILS. IF THERE ARE QUESTIONS OR PROBLEMS WITH THE LOCATION, EXTENT, OR METHOD OF INSTALLATION, CONTACT THE ENGINEER OR RESPONSIBLE ON-SITE OFFICER FOR ASSISTANCE. 2. ENSURE ALL NECESSARY SOIL TESTING (e.g. SOIL pH, NUTRIENT LEVELS) AND ANALYSIS HAS BEEN COMPLETED, AND REQUIRED SOIL ADJUSTMENTS PERFORMED PRIOR TO PLANTING. 3. CLEAR THE LOCATION FOR THE CATCH DRAIN, CLEARING ONLY WHAT IS NEEDED TO PROVIDE ACCESS FOR PERSONNEL AND EQUIPMENT FOR INSTALLATION. 4. REMOVE ROOTS, STUMPS, AND OTHER DEBRIS AND DISPOSE OF THEM PROPERLY. DO NOT USE DEBRIS TO BUILD THE BANK. 5. GRADE THE DRAIN TO THE SPECIFIED SLOPE AND FORM THE ASSOCIATED EMBANKMENT WITH COMPACTED FILL. NOTE THAT THE DRAIN INVERT MUST FALL 10cm EVERY 10m FOR EACH 1% OF CHANNEL GRADIENT. 6. ENSURE THE SIDES OF THE CUT DRAIN ARE NO STEEPER THAN A 1.5:1 (H:V) SLOPE AND THE EMBANKMENT FILL SLOPES NO STEEPER THAN 2:1. 7. ENSURE THE COMPLETED DRAIN HAS SUFFICIENT DEEP (AS SPECIFIED FOR THE TYPE OF DRAIN) MEASURED FROM THE DRAIN INVERT TO THE TOP OF THE EMBANKMENT. WHERE NECESSARY, CUT THE DRAIN SLIGHTLY DEEPER THAN THAT SPECIFIED ON THE PLANS SUCH THAT THE CORRECT CHANNEL DIMENSIONS ARE ACHIEVED FOLLOWING PLACEMENT OF THE TURF. 8. ENSURE THE DRAIN HAS A CONSTANT FALL IN THE DESIRED DIRECTION FREE OF OBSTRUCTIONS. 9. TURF SHOULD BE USED WITHIN 12-HOURS OF DELIVERY, OTHERWISE ENSURE THE TURF IS STORED IN CONDITIONS APPROPRIATE FOR THE WEATHER CONDITIONS (e.g. A SHADED AREA). 10. MOISTENING THE TURF AFTER IT IS UNROLLED WILL HELP MAINTAIN ITS VIABILITY. 11. TURF SHOULD BE LAID ON A MINIMUM 75mm BED OF ADEQUATELY FERTILISED TOPSOIL. RAKE THE SOIL SURFACE TO BREAK THE CRUST JUST BEFORE LAYING THE TURF. 12. DURING THE WARMER MONTHS, LIGHTLY IRRIGATE THE SOIL IMMEDIATELY BEFORE LAYING THE TURF. 13. ENSURE THE TURF IS NOT LAID ON GRAVEL, HEAVILY COMPACTED SOILS, OR SOILS THAT HAVE BEEN RECENTLY TREATED WITH HERBICIDES. 14. FOR WIDE DRAINS AND HIGH VELOCITY CHUTES, LAY THE FIRST ROW OF TURF IN A STRAIGHT LINE DIAGONAL TO THE DIRECTION OF FLOW. STAGGER SUBSEQUENT ROWS IN A BRICK-LIKE (STRETCHER BOND) PATTERN. THE TURF SHOULD NOT BE STRETCHED OR OVERLAPPED. USE A KNIFE OR SHARP SPADE TO TRIM AND FIT IRREGULARLY SHAPED AREAS.		MAINTENANCE 1. INSPECT ALL CATCH DRAINS AT LEAST WEEKLY AND AFTER RUNOFF-PRODUCING STORM EVENTS AND REPAIR ANY SLUMPS, BANK DAMAGE, OR LOSS OF FREEBOARD. 2. ENSURE FILL MATERIAL OR SEDIMENT IS NOT PARTIALLY BLOCKING THE DRAIN. WHERE NECESSARY, REMOVE ANY DEPOSITED MATERIAL TO ALLOW FREE DRAINAGE. 3. DISPOSE OF ANY SEDIMENT OR FILL IN A MANNER THAT WILL NOT CREATE AN EROSION OR POLLUTION HAZARD. REMOVAL 1. WHEN THE SOIL DISTURBANCE ABOVE THE CATCH DRAIN IS FINISHED AND THE AREA IS STABILISED, THE DRAIN AND ANY ASSOCIATED BANKS SHOULD BE REMOVED, UNLESS IT IS TO REMAIN AS A PERMANENT DRAINAGE FEATURE. 2. DISPOSE OF ANY SEDIMENT OR EARTH IN A MANNER THAT WILL NOT CREATE AN EROSION OR POLLUTION HAZARD. 3. GRADE THE AREA AND SMOOTH IT OUT IN PREPARATION FOR STABILISATION. 4. STABILISE THE AREA BY GRASSING OR AS SPECIFIED WITHIN THE APPROVED PLAN.		
Drawn: GMW		Date: Dec-09	Catch Drains - Grass Lined	CD-03

REMOVAL

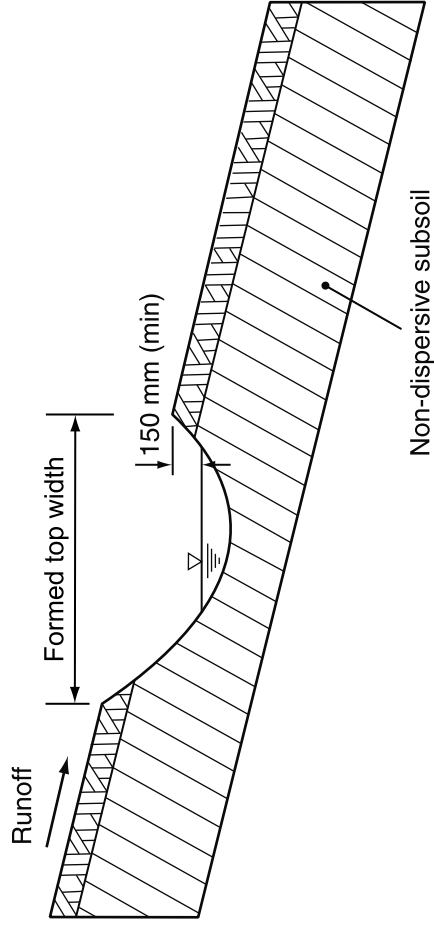
1. WHEN THE SOIL DISTURBANCE ABOVE THE CATCH DRAIN IS FINISHED AND THE AREA IS STABILISED, THE TEMPORARY DRAIN AND ANY ASSOCIATED BANKS SHOULD BE REMOVED, UNLESS IT IS TO REMAIN AS A PERMANENT DRAINAGE FEATURE.
2. DISPOSE OF ANY SEDIMENT OR EARTH IN A MANNER THAT WILL NOT CREATE AN EROSION OR POLLUTION HAZARD.
3. GRADE THE AREA AND SMOOTH IT OUT IN PREPARATION FOR STABILISATION.
4. STABILISE THE AREA BY GRASSING OR AS SPECIFIED WITHIN THE APPROVED SITE REHABILITATION PLAN.

CREATE AN EROSION OR POLLUTION HAZARD.

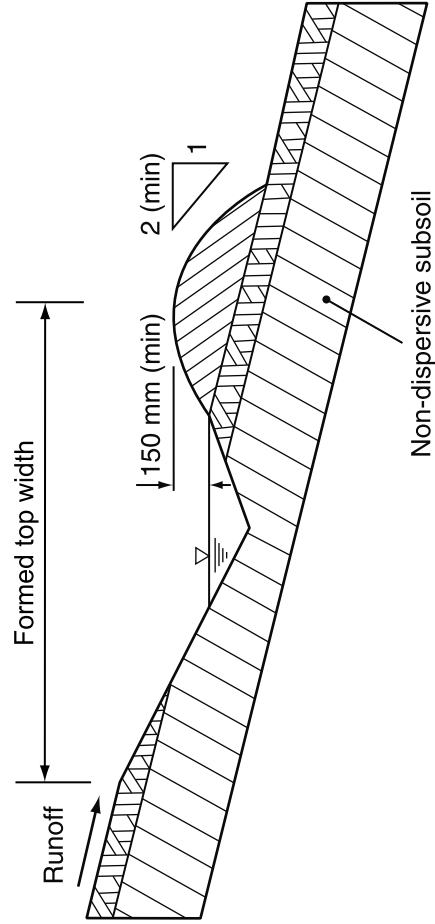
3. GRADE THE AREA AND SMOOTH IT OUT IN PREPARATION FOR STABILISATION.
4. STABILISE THE AREA BY GRASSING OR AS SPECIFIED WITHIN THE APPROVED SITE REHABILITATION PLAN.



(a) Parabolic catch drain with down-slope bank



(c) Parabolic catch drain without bank



(b) Triangular V-drain with down-slope bank

Constructed dimensions of parabolic catch drains		
Drain type	Formed top width with or without bank	Formed depth with or without bank
Type-A	1.6 m	0.30 m
Type-B	2.4 m	0.45 m
Type-C	3.6 m	0.65 m

Constructed dimensions of triangular V-drains		
Drain type	Formed top width with or without bank	Formed depth with or without bank
Type-AV	2.0 m	0.30 m
Type-BV	2.7 m	0.45 m
Type-CV	3.9 m	0.65 m

NOT TO SCALE

Drawn: **GMW**

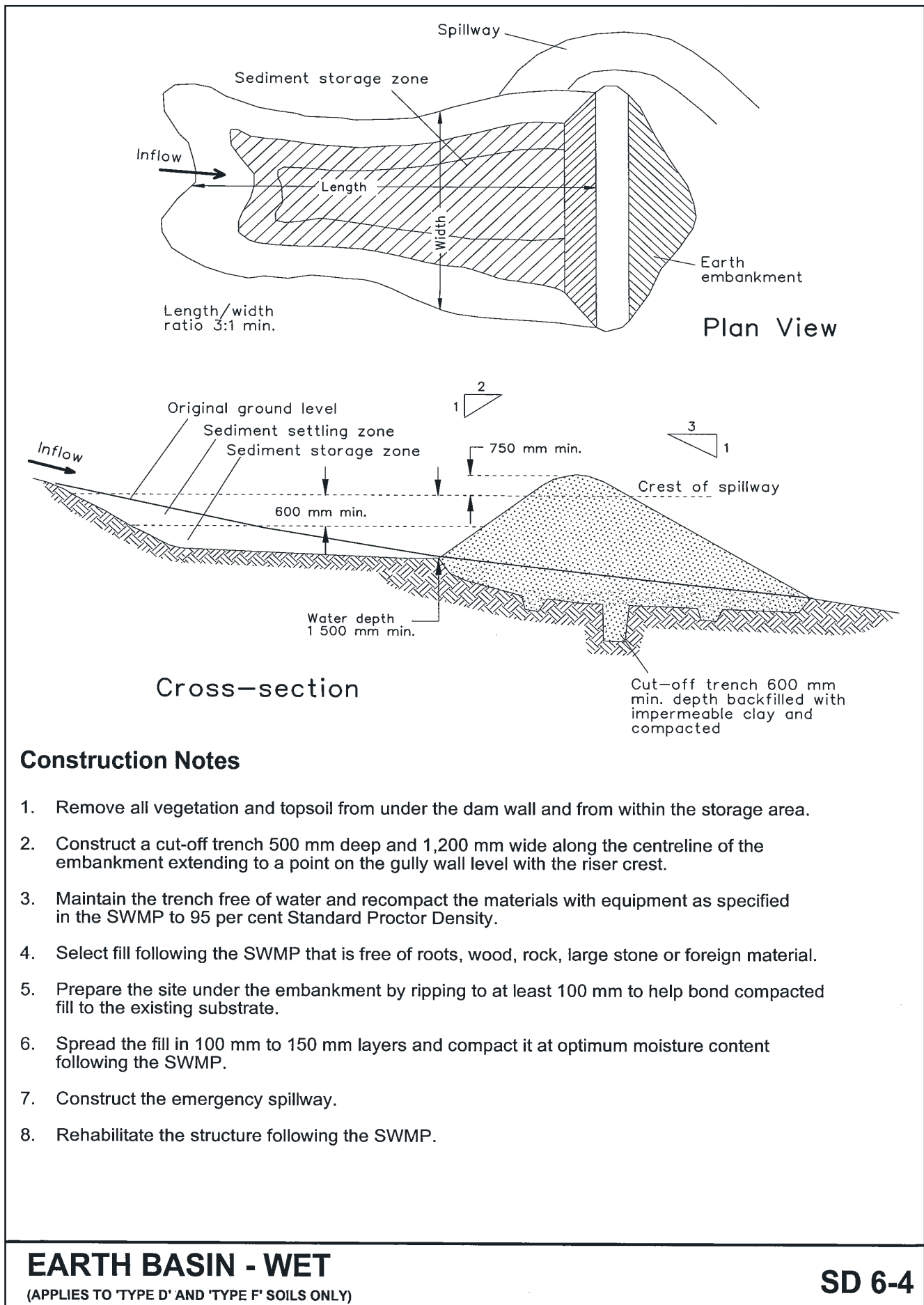
Date:

Dec-09

Catch Drains

CD-01

INSTALLATION	MAINTENANCE	REMOVAL																														
1. REFER TO APPROVED PLANS FOR LOCATION, EXTENT, AND CONSTRUCTION DETAILS. IF THERE ARE QUESTIONS OR PROBLEMS WITH THE LOCATION, EXTENT, OR METHOD OF INSTALLATION, CONTACT THE ENGINEER OR RESPONSIBLE ON-SITE OFFICER FOR ASSISTANCE. 2. CLEAR THE LOCATION FOR THE BERM, CLEARING ONLY THE AREA THAT IS NEEDED TO PROVIDE ACCESS FOR PERSONNEL AND EQUIPMENT. 3. REMOVE ROOTS, STUMPS, AND OTHER DEBRIS AND DISPOSE OF THEM PROPERLY. 4. FORM THE BERM FROM THE MATERIAL, AND TO THE DIMENSION SPECIFIED IN THE APPROVED PLANS. 5. IF FORMED FROM SANDBAGS, THEN ENSURE THE BAGS ARE TIGHTLY PACKED SUCH THAT WATER LEAKAGE THROUGH THE BAGS IS MINIMISED. 6. CHECK THE ALIGNMENT OF THE BERM TO ENSURE POSITIVE DRAINAGE IN THE DESIRED DIRECTION. 7. ENSURE THE BERM DISCHARGES TO A STABLE OUTLET. 8. ENSURE THE BERM DOES NOT DISCHARGE TO AN UNSTABLE FILL SLOPE.	1. INSPECT FLOW CONTROL BERMS AT LEAST WEEKLY AND AFTER RUNOFF-PRODUCING RAINFALL. 2. INSPECT THE BERM FOR ANY SLUMPS, WHEEL TRACK DAMAGE OR LOSS OF FREEBOARD. MAKE REPAIRS AS NECESSARY. 3. CHECK THAT FILL MATERIAL OR SEDIMENT HAS NOT PARTIALLY BLOCKED THE DRAINAGE PATH UP-SLOPE OF THE EMBANKMENT. WHERE NECESSARY, REMOVE ANY DEPOSITED MATERIAL TO ALLOW FREE DRAINAGE. 4. DISPOSE OF ANY COLLECTED SEDIMENT OR FILL IN A MANNER THAT WILL NOT CREATE AN EROSION OR POLLUTION HAZARD. 5. REPAIR ANY PLACES IN THE BERM THAT ARE WEAKENED OR IN RISK OF FAILURE.	1. WHEN THE SOIL DISTURBANCE ABOVE THE BANK IS FINISHED AND THE AREA IS STABILISED, THE FLOW CONTROL BERM SHOULD BE REMOVED, UNLESS IT IS TO REMAIN AS A PERMANENT DRAINAGE FEATURE. 2. DISPOSE OF ANY SEDIMENT OR EARTH IN A MANNER THAT WILL NOT CREATE AN EROSION OR POLLUTION HAZARD. 3. GRADE THE AREA AND SMOOTH IT OUT IN PREPARATION FOR STABILISATION. 4. STABILISE THE AREA BY GRASSING OR AS SPECIFIED IN THE APPROVED PLAN.																														
Table 1 - Recommended dimensions of flow control berms <table><tr><th>Parameter</th><th>Earth banks</th><th>Vegetated banks</th><th>Compost berms</th><th>Sandbag berms</th></tr><tr><td>Height (min)</td><td>500 mm</td><td>500 mm</td><td>300 mm</td><td>N/A</td></tr><tr><td>Top width (min)</td><td>500 mm</td><td>500 mm</td><td>100 mm</td><td>N/A</td></tr><tr><td>Base width (min)</td><td>2500 mm</td><td>2500 mm</td><td>600 mm</td><td>N/A</td></tr><tr><td>Side slope (max)</td><td>2:1 (H:V)</td><td>2:1 (H:V)</td><td>1:1 (H:V)</td><td>N/A</td></tr><tr><td>Freeboard</td><td>300 mm</td><td>150 mm</td><td>100 mm</td><td>50 mm</td></tr></table>			Parameter	Earth banks	Vegetated banks	Compost berms	Sandbag berms	Height (min)	500 mm	500 mm	300 mm	N/A	Top width (min)	500 mm	500 mm	100 mm	N/A	Base width (min)	2500 mm	2500 mm	600 mm	N/A	Side slope (max)	2:1 (H:V)	2:1 (H:V)	1:1 (H:V)	N/A	Freeboard	300 mm	150 mm	100 mm	50 mm
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Drawn: GMW	Date: Dec-09	Flow Control Berms		CB-01																												



EARTH BASIN - WET

(APPLIES TO 'TYPE D' AND 'TYPE F' SOILS ONLY)

SD 6-4