Kentucky
Energy and Environment Cabinet
Department for Natural Resources

Reclamation Advisory Memorandum

From: Carl E. Campbell, Commissioner C.E.C.

Date: September 18, 2009

Subject: Review of Durable Rock Fill Designs

RAM # 141

This RAM supersedes RAM # 135 of September 10, 2002.

A proposed durable rock (end-dumped) fill design must properly address the construction of the underdrain system, discuss material placement, and minimize impacts to streams. The Division of Permits will require the following construction and design criteria be included in all applications proposing durable rock fills.

Underdrain Construction

The initial portion of the underdrain located at the head of hollow (back of the hollow fill) will be built by conventional methods typically used for hollow fills that are constructed in four (4) foot lifts. The placed segment of the underdrain will need to be constructed to a point where fifty (50) vertical feet of fill height is obtained, thus allowing proper segregation of the dumped material to form the underdrain in the remaining portion of the durable rock fill. The design drawings will be required to show the segment of underdrain to be constructed prior to material placement within the initial 50-foot vertical zone. For durable fills that are proposed in multiple natural drainways, conventional underdrain placement will be required in each drainway.

Color photographs shall be taken of the underdrain as the underdrain is being formed. The photographs accompanying each certified report shall be of adequate size and number with enough terrain or other physical features of the site to provide a relative scale to specifically and clearly identify the site. The underdrain must be visible and functional at the time of final certification and shall not extend beyond the intersection of the side drains.

The construction narrative (Attachment 26.3) will identify the source of the durable material for the initial underdrain. The geologic column in Item 15.2 currently identifies all durable strata within the coal removal area. It will now also identify the durable strata that will be used to construct the initial underdrain. The narrative must also address methods to be used in blasting, handling, and transporting the durable rock to ensure the most competent material is used in the construction.

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The construction narrative must also address the degraded material along the outcrop [see 405 KAR 16:130 Section 4(2)(b)] and how it will be handled to avoid plugging the underdrain. The application will describe how the underdrain will be protected to assure long-term function. The underdrain must be covered by a minimum of four (4) feet of material to prevent equipment from crushing the underdrain and to prevent degraded material from being placed around the underdrain. Once the underdrain is covered, end dumping of the remainder of the fill height is acceptable since segregation is no longer an issue. The applicant will be required to show this portion of the durable rock fill on the design drawings.

The design crest limit must be flagged along the outcrop of the lowest seam to be mined on both sides of the hollow. These points will define the downstream limits of end dumping.

Once the above methods are implemented, dumping may proceed in the normal fashion. Dumping along the sides of the fill footprint is acceptable. A study conducted by Skelly & Loy for the EPA in 1979 recommended a good mix of end dumping and side dumping to promote fill stability by interlocking the dumped material. However, the drainway must still be at least 50 vertical feet below the top of the fill, and the side slopes must be sufficiently steep to allow for proper segregation. In keeping with the regulatory definition of steep slopes, that angle must be at least 20° from the horizontal. No material may be side dumped through any area outside the design limits of the fill.

The applicant will be required to state in the construction narrative that once the durable rock fill has reached its design capacity, and prior to grading the material to the final slope, the underdrain will be extended downstream from the toe by conventional methods as described previously. This segment of the underdrain is designed to avoid blockage during final grading. The applicant will need to describe how both segments of the constructed underdrain will be connected to the end-dumped portion of the underdrain. The connections are required to be shown on the design drawings.

Transport areas outside the footprints of hollow fills are not to be approved except as provided in 405 KAR 16:130, Section 5(2).

Clearing and Grubbing

Clearing and grubbing the entire footprint of the fill at one time is to be discouraged. Progressive clearing and grubbing is encouraged to minimize the disturbed area and associated runoff and siltation in accordance with 405 KAR 16:130 Section 1(1)(a) and Section 1(7), and 405 KAR 16:060 Section 1 and Section 2.

One possible exception would be when working in Indiana bat habitat. Tree cutting is then often limited to a period from mid-October through the end of March. Exact tree clearing dates are specified by permit condition. Obviously, clearing and grubbing would have to provide sufficient area to construct fills during the no-cutting period, so a detailed analysis of the mine plan would have to be presented to determine the amount of clearing and grubbing needed to allow operations to continue uninterrupted. The plan should consider the type of equipment, expected spoil generation during the period, and planned allocation of excess spoil to individual hollow fills. The upper and lower limits of the fill must be flagged or permanently marked in the field.

Other possible exceptions could include size of the proposed fill(s) or issues of safety. Procedures not involving progressive clearing and grubbing must be discussed in detail and justified by the applicant on a case-by-case basis. All other provisions of this policy would still apply.

Rock Check Structures

In accordance with 405 KAR 16:070 Section 1(2), rock check structures will be required below the toes of the fills. Larger fills and larger disturbed areas may need multiple structures in series. The rock checks will minimize siltation below the fills and assist in the entrapment of debris that might affect sediment pond function. Rock checks must be constructed below dumped fills, and the application will describe their construction and maintenance.

The rock checks are not to be considered for sediment control purposes in the analysis of ponds. The application must provide for periodic removal of sediment from rock checks below the final toe. Sediment behind rock checks will not be allowed to remain in the channel during placement of the next segment of under drain. Rock checks should not be constructed in the footprint of the fill. Avoid material being trapped by the structure to the extent the material backs up onto the toe of the fill and the outlet under drain. If progressive material placement is proposed, then the rock check will be located so that placement of under drain construction will not be impeded.

Stability

Two points will define the acceptable range in which the final toe of the fill is to be located. The most downstream point will be established based on the maximum volume expected to be placed in the fill. The most upstream point will be the point

above which fill stability cannot be achieved. These points, and the channel between them, will be verified by Department personnel during the field walk.

The upper stability point must be permanently located in the field. The application will need to describe how the upstream point will be established in the field and justify the methods used to locate the point on the ground. If the permittee demonstrates that the hollow fill is stable along the length of the design profile, placing the fill toe at any point upstream of the design toe location is acceptable. The volumes in Table 26.1 should be reported as a range from the minimum at the upper point of stability to the maximum at the lower design point.

In evaluating the stability of the design, the fill top elevation and face slopes must be the same at each point. Slopes should be evaluated at 2:1. The weight on the toe will thus be maximized and the safety factor minimized. Any decrease in slope will only increase the safety factor since 2:1 is the worst case.

Certifications

A certification of construction shall be performed for each critical phase of fill construction. The regional engineer must compare the current stage of construction to the design and documenting compliance. Only minor deviations from the design can be certified by the regional engineer.

Overstacking the "Deck" of the Fill

The inspector shall monitor the placement of spoil to ensure the material is placed back into the pit area during backfilling and grading operations and the fill does not "toe out" onto the deck of the fill, unless approved in the permit application. Once the final fill configuration has been attained, no material shall be allowed on the top deck and no surface drainage shall flow over the face of the hollow fill.

Other Considerations

The Department will also analyze other circumstances that might affect hollow fill design and/or stability. These include, but are not limited to:

1) Existing coal seams;
2) Abandoned surface and underground mining;
3) Active or proposed surface and underground mining;
4) Coal pavement elevations; and
5) Local and regional dip.

Permitting Actions

As long as the slopes and top elevations do not adversely affect stability, the toe of the fill may fall anywhere between the established lower and upper limits without requiring a permitting action.

Permitting actions will be required for significant deviations from the approved fill design during construction. Fill modifications such as changes in face slopes, changes in top elevation and the inability to attain the upper stability point as a result of a reduction in fill volume are examples of significant deviations. Proposals to change methods of operation may also result in revised hollow fill designs. Revised fill designs should be accompanied by new spoil balance calculations and stability analyses for all of the previous examples.

Existing Design and Construction Criteria

Below is a summary of the existing design and construction criteria which will still be required for all applications that propose durable rock fills:

1) Geotechnical investigation including:
   - a) Location of fill;
   - b) Location of seeps and springs;
   - c) Removal of organic material;
   - d) Removal of topsoil;
   - e) Discussion of subsidence effects if underground mining has occurred beneath the fill; and
   - f) Discussion of method of handling unconsolidated material (depth to bedrock and if material to be removed or modeled in stability analysis).

2) Diversion ditch construction:
   - a) Diverting water from fill area during material placement;
   - b) Timing sequence of diversion ditch construction; and
   - c) If fill placement is proposed in an intermittent or perennial stream, then a stream diversion designed for the proper storm event and the requirements of 405 KAR 16:080 Section 2 are met.

3) Material placement and grading requirements:

   a) Determining if keyway cuts are needed;

   b) SDI analysis of material to be placed in the fill;

   c) A calculation showing the material is at least 80% by volume durable material;

   d) Determine the predominant type of fill material and corresponding minimum underdrain size;

   e) Stability analysis showing the fill meets the required factor of safety;

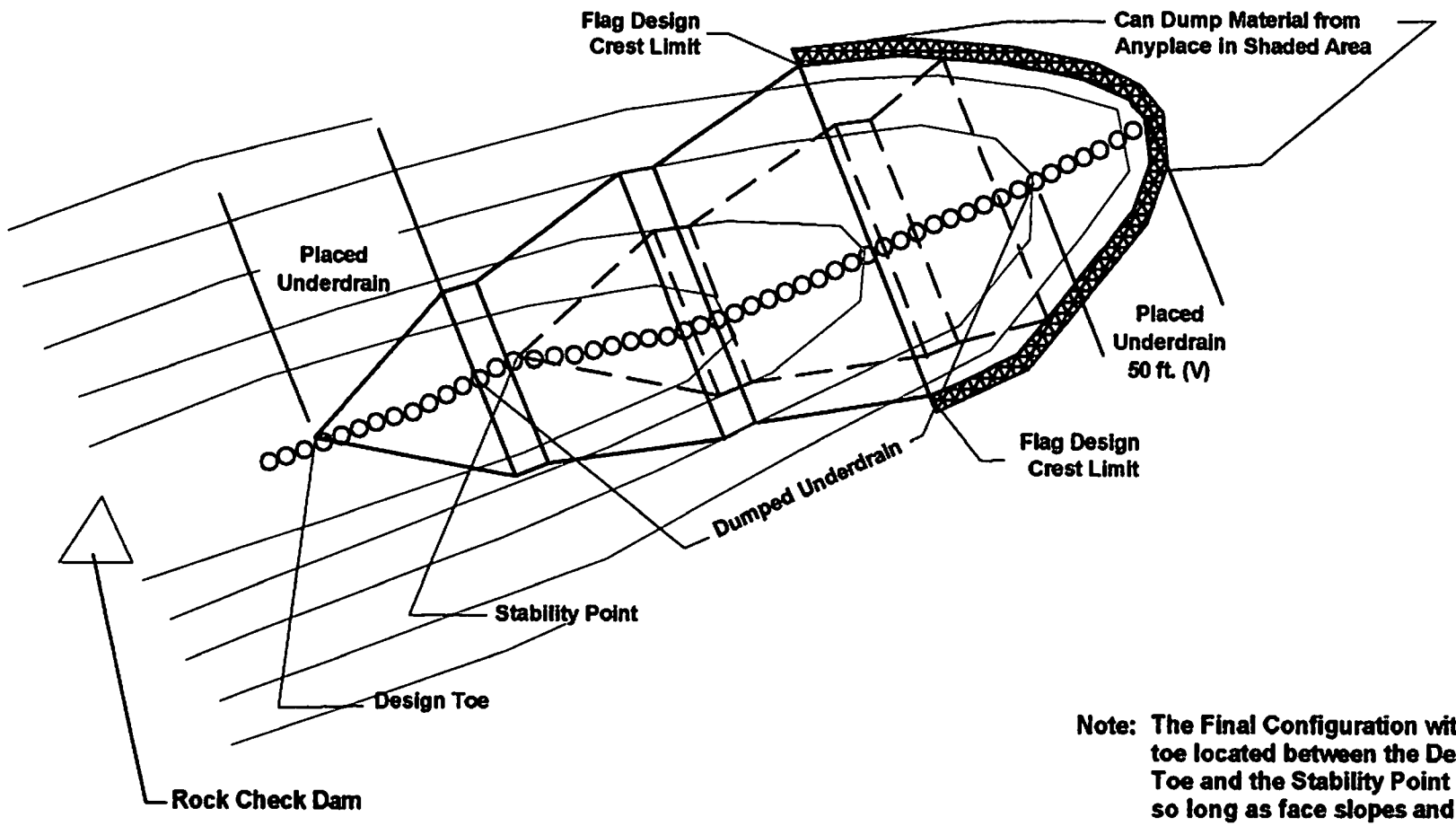
   f) Final grading and terrace construction;

   g) Removal plans if proposed as a temporary structure; and

   h) Applying topsoil or alternate material.

If you have questions about the issues discussed in this RAM, please contact Ron Mills, Director, Division of Permits at 502-564-2320 or e-mail: Ron.Mills@ky.gov

Attached drawings:
1. General Durable Rock Fill Plan View
2. General Durable Rock Fill Profile
3. Design Details – Durable Rock Fills
4. Crest Details-Plan View
5. Rock Check Dam-Profile View
6. Rock Check Dam-Detail Sheet



Note: The Final Configuration with the toe located between the Design Toe and the Stability Point is acceptable so long as face slopes and crest elevation are in accordance with the original design. These points shall be flagged in the field prior to construction.

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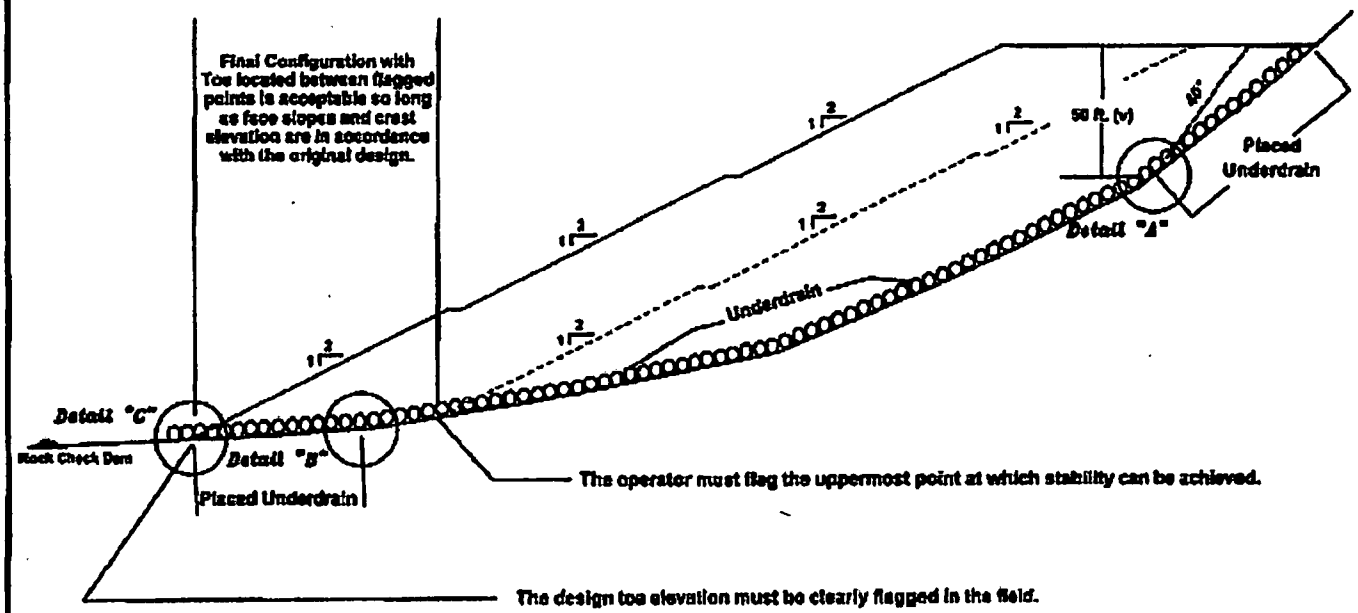
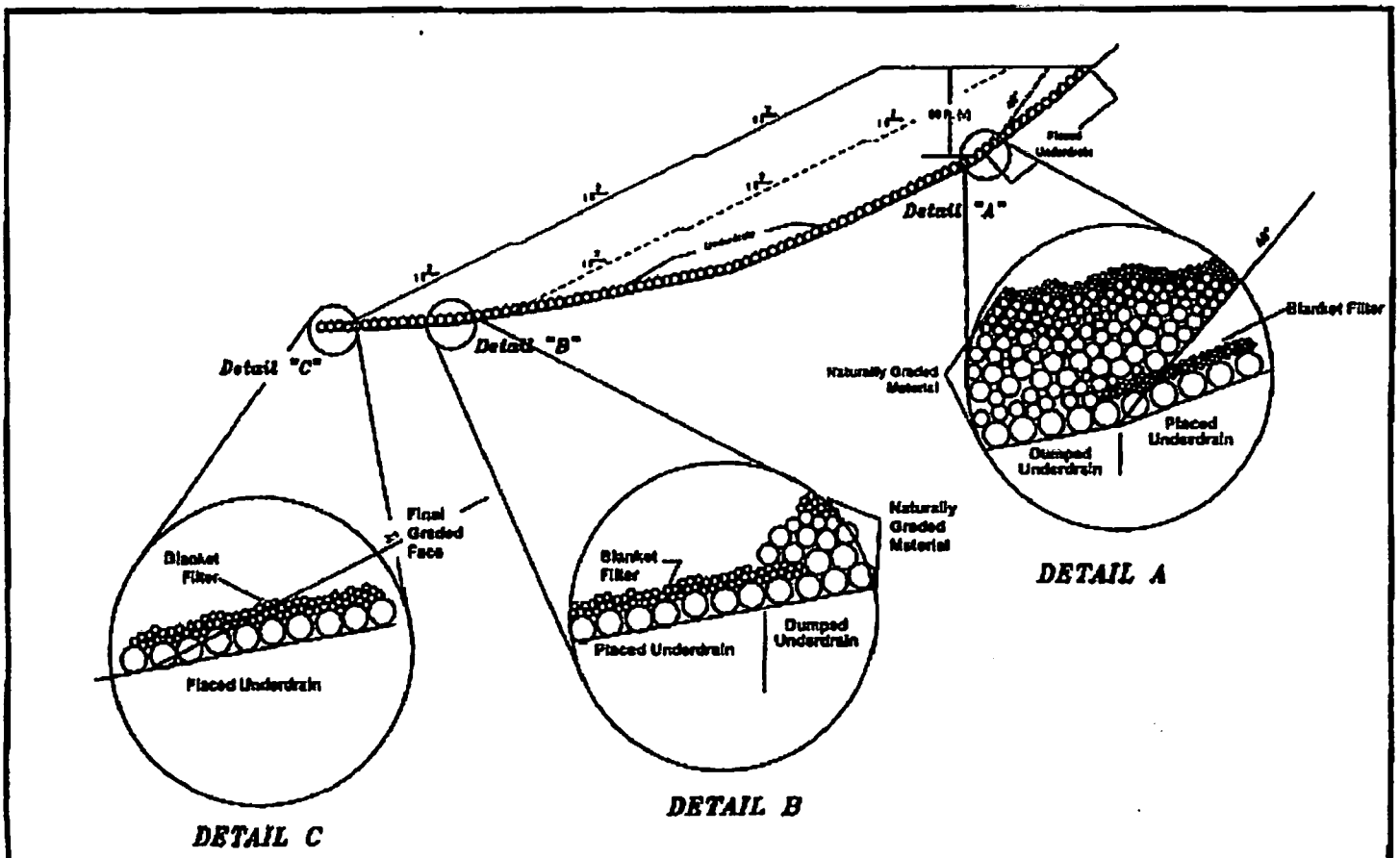


Date April 4, 2002

General Durable Rock Fill Profile

Attachment to Reclamation Advisory Memorandum No. 141

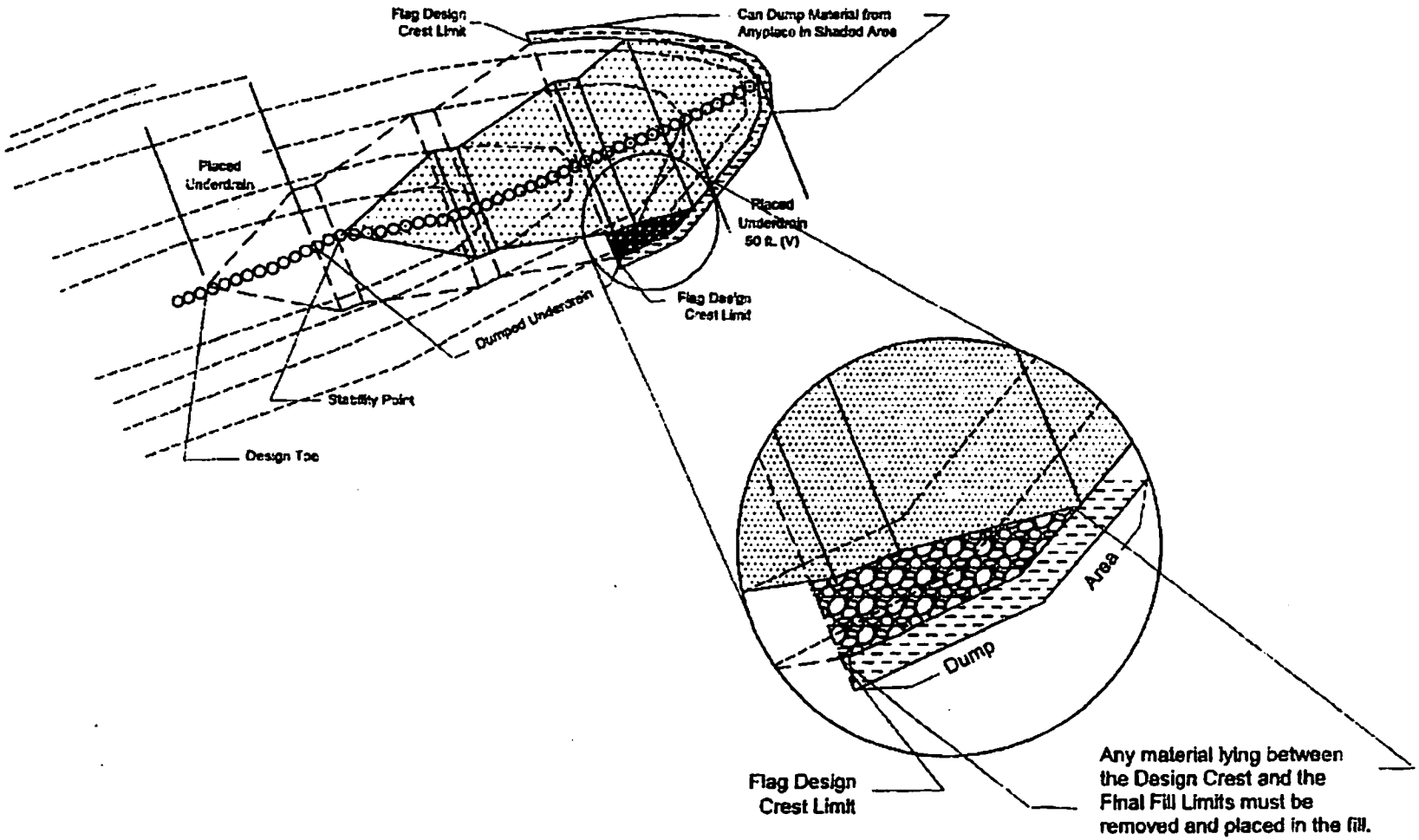


Date: April 4, 2002

Note: n/a

Design Details- Durable Rock Fills

Attachment to Reclamation Advisory Memorandum No. 141



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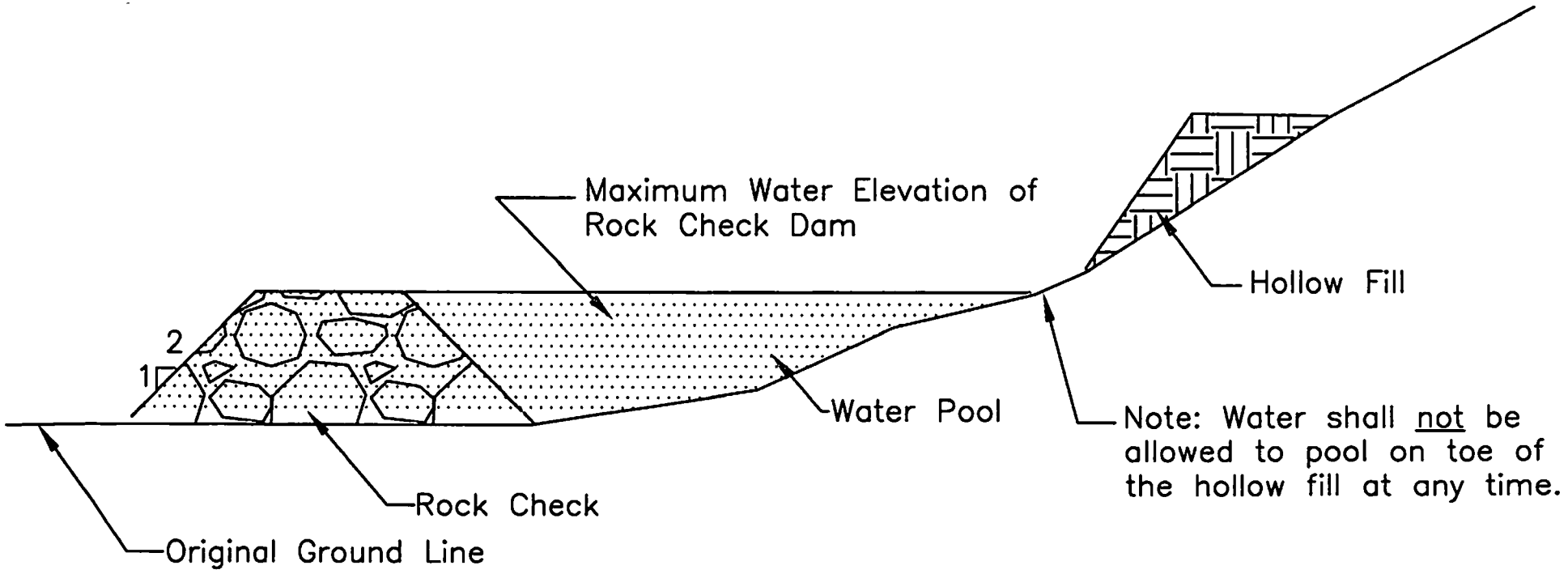
Durable Rock Fill Plan View - Crest Detail
Figure 4

Figure 5

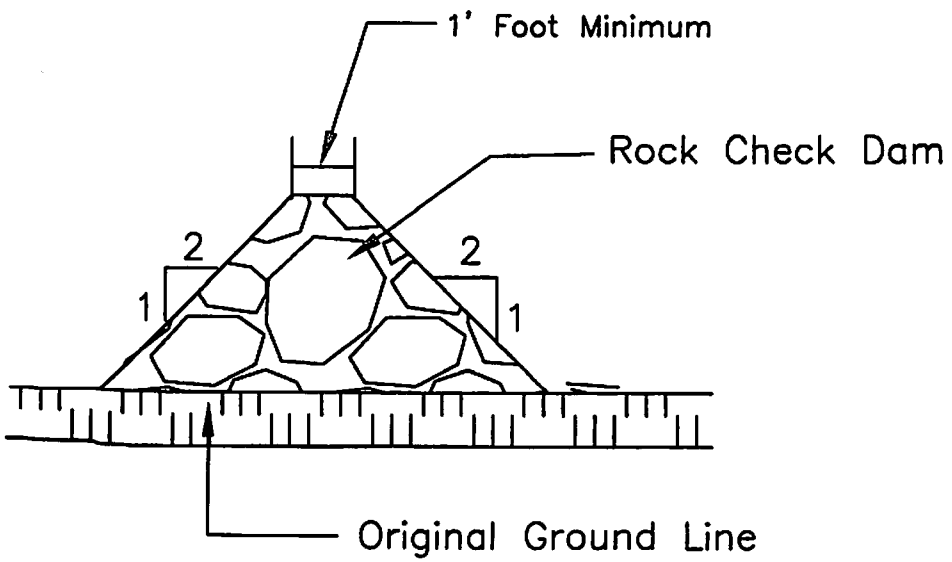
Rock Check Dam
Profile View

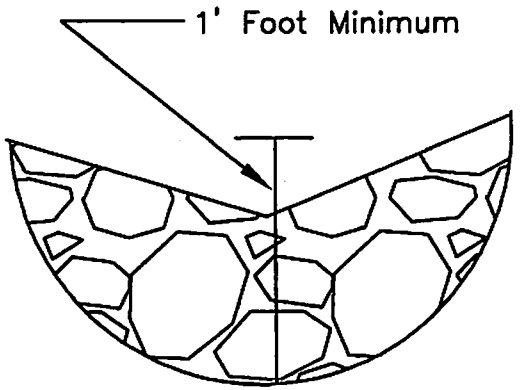


NOTE: The size, shape, and location of rock checks may be adjusted, as directed by an Engineer. Middle of the rock check shall be a minimum of 1' foot lower than sides so flow will not bypass check or erode natural stream banks.

Figure 6

Detail Sheet–Rock Check





NOTE: The size, shape, and location of rock checks may be adjusted by an Engineer. Middle of the rock check shall be a minimum of 1' foot lower than sides, so flow will not bypass the rock check or erode natureal stream banks.