Long-Term Stability of Valley Fills

Peter Michael, Geologist

U.S. Department of Interior

Office of Surface Mining

Appalachian Region

Introduction

Citation: In Appendices A-C to U.S. EPA 2003 Draft Programmatic Environmental Impact Statement: "Mountaintop Mining/Valley Fills in Appalachia," EPA 9-03-R-00013, EPA Region 3, Philadelphia, PA.

Purpose of investigation: Assess the effectiveness of current regulatory and policy-driven safeguards against future fill instability that may negatively affect public safety.

“Long Term”

- Not until final bond release.
- Not 25 years.
- Not over geologic time.
- **“As long as we’re here.”**
- **Intent of SMCRA is to ensure appropriate engineering measures are taken to enhance stability beyond final bond release (time period of the Act’s jurisdiction).**

“Stability”

- Absence of instability (mass movement).

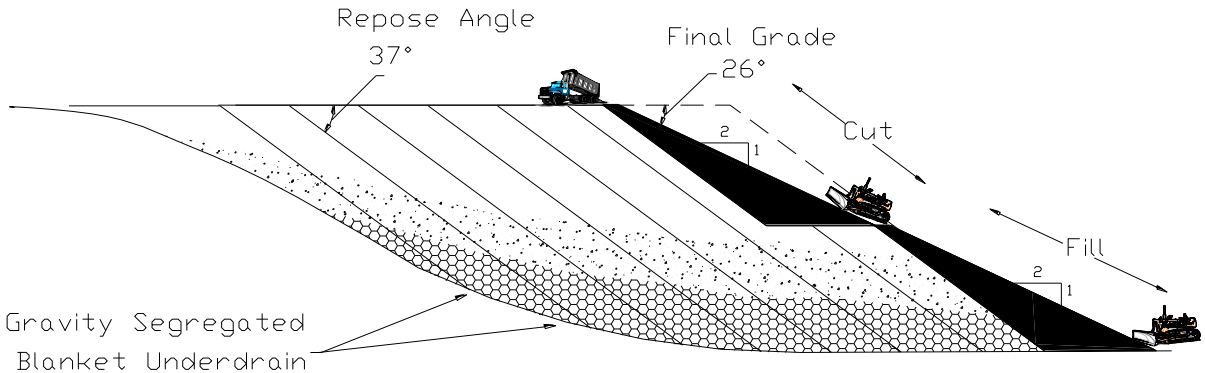
Instability defined in this study as evidence that:

- Part of the fill’s mass has separated from the rest of the fill.
- The separation occurs along a continuous slip surface, or continuous sequence of slip surfaces, intersecting the fill’s surface.
- Some vertical movement has occurred.

Major vs. Minor Instability

- ***Minor***: mass movement occurs over *a* **small area on the fill** (e.g. not more than one bench on the fill face) and only **necessitating minor reworking of the fill material** (without significantly changing the fill configuration).
- ***Major***: mass movement occurs **over a large fraction of the fill face** (e.g. over at least a few outslope benches) and/or **require a major remediation effort** (redistribution of the spoil from one part of the fill to another, construction of rock toe buttresses, extensive reworking or augmenting of drainage systems etc.).

“Durable-Rock” Fill



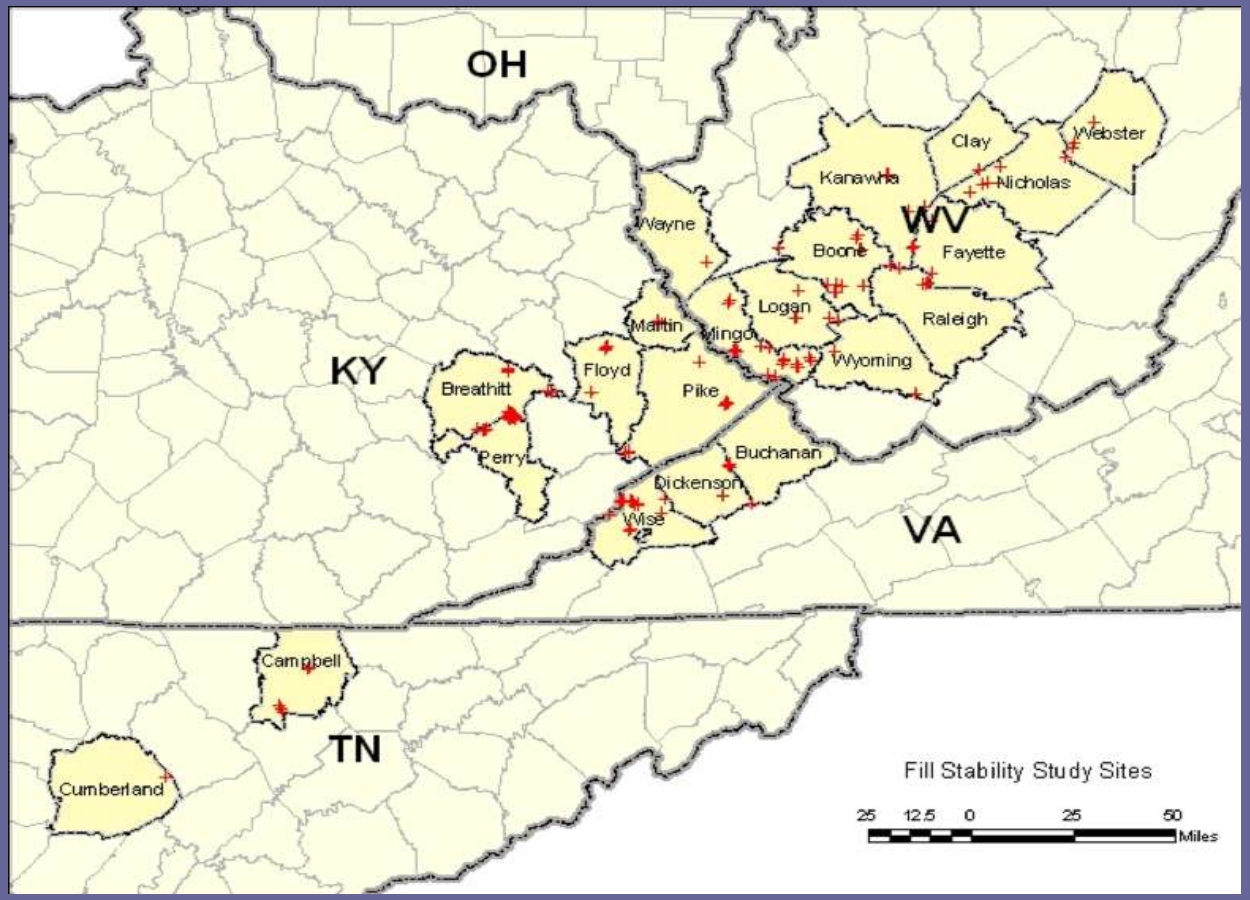
- Fill contains 80 % durable rock by volume
- Durable rock does not slake in water or disintegrate into soil.
- End dumping results in a gravity-segregated “core” or “blanket” underdrain.

Valley Fill Sample Selections

State	Total # of fills	Durable rock fills	Reclaimed fills	Aerial inspection	Ground inspection	Spoil Volume (mcy)	Construct-ion dates (yr)
WV	49	34	35	49	19	0.2-201.1	78-98
KY	48	46	6	0	48	0.2-90.9	87-00
VA	25	24	10	25	13	0.3-16.8	90-99
TN	6	4	0	0	1	0.2-7.5	86-98
Total	128	108	51	74	81	0.2-201.1	78-00

Includes all known cases of valley fill instability.

Locations of Valley Fill Samples

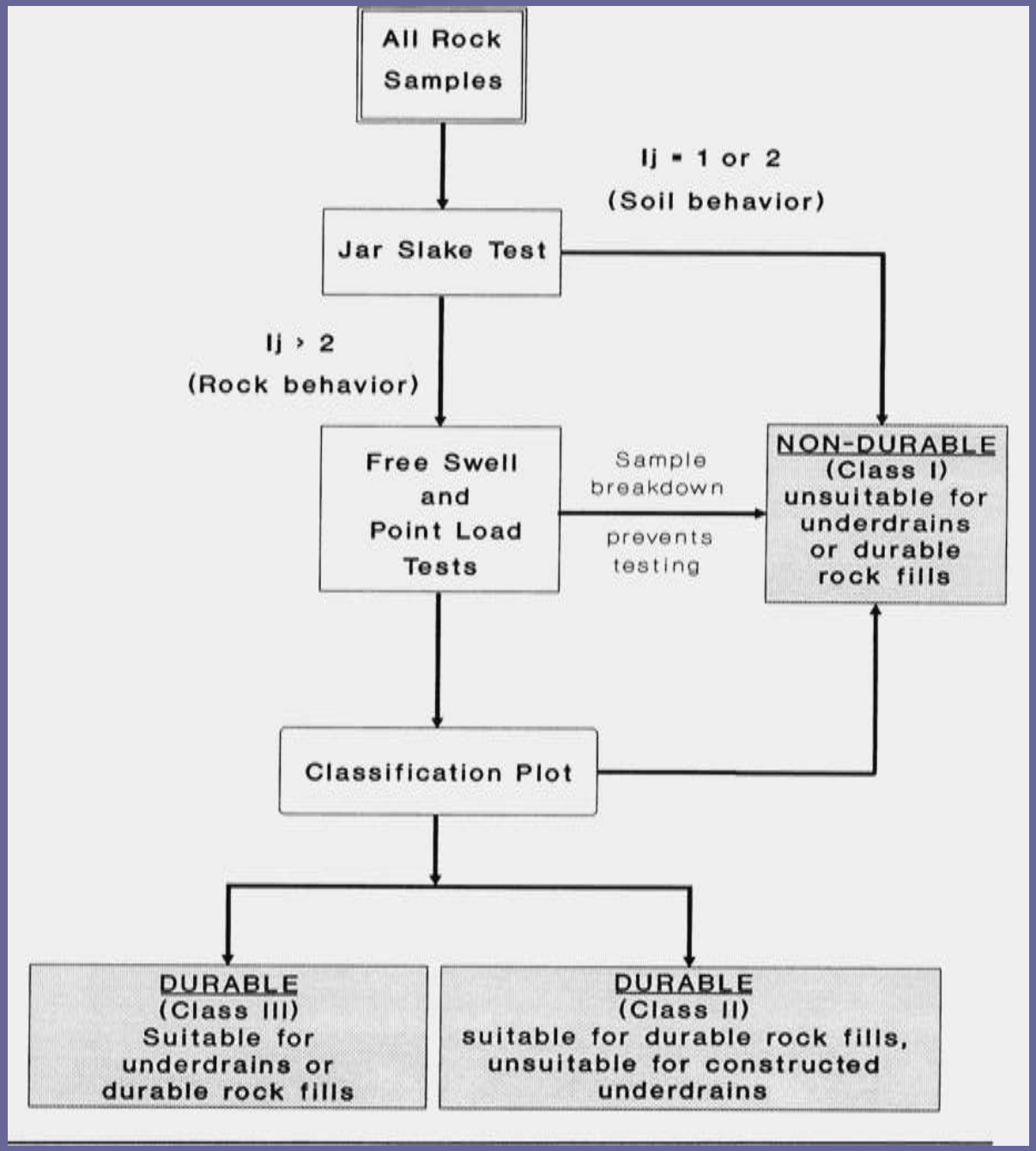


Rock-Durability Testing

Slake Durability Index (standard used in all four states)

- Oven-dry and weigh rock sample
- Rotate sample in 2 mm wire mesh drums at 2 rpm for 2, 10-minute cycles (1/3 of drums immersed in water.
- Oven-dry remaining sample
- Calculate SDI $[(W_2 \div W_1) \times 100]$
- If SDI $\geq$ 90 %, sample is durable.

Proposed Strength-Durability Classification System.



Interviews re: Durability Tests

(Example Comments from State Regulators and Federal Agencies).

- SDI not a good test for mine spoil.
- No opinion on SDI, but it is a recognized standard in the professional engineering community.
- Greater density of samples (in the rock column) than one sample per formation should be required.
- ASTM protocol for SDI should be modified to include a measure of specimen breakdown inside the drum.
- Confidence in 80% durable rock in VA and southern WV where massive sandstones occur.
- Confidence in the stability of DR fills based on their good record to-date.
- Incorporate particle size distribution in inspection procedure during DR fill construction.

Rock Durability
Data Collection and Analysis

- Visual estimation of % durable rock in fills under construction and judgment whether effective underdrain is forming via gravity segregation (using on-site observations and photographs).
- 44 fills evaluated.
- 28 fills appeared to have less than 80% DR (estimates for these range from 20-70%).
- 5 fills lacked discernable underdrains (note: "discernable" ≠ "effective").

Formation of a Gravity-Segregated Underdrain

Lack of durable rock and gravity segregation in a “durable rock fill” under construction.

Underdrain Formation in a Durable Rock Fill—Aerial View

Underdrain Formation—Ground-Level View of Center and Left Flank.

“Underdrain Formation”—Ground-Level View, Right Flank

Valley Fill Design

Foundation investigations: *review of permits for 129 fills.*

- 25 permits without a foundation investigation.
- 55 permits with a narrative, generally stating (1) that a foundation investigation was performed; (2) the type of underlying rock; (3) that the soil depth was shallow; and (4) that springs, seeps, or other potential sources of instability were not found.
- 48 permits with test pits or test holes in the foundation area. Soil depths were generally reported as shallow.

Valley Fill Design

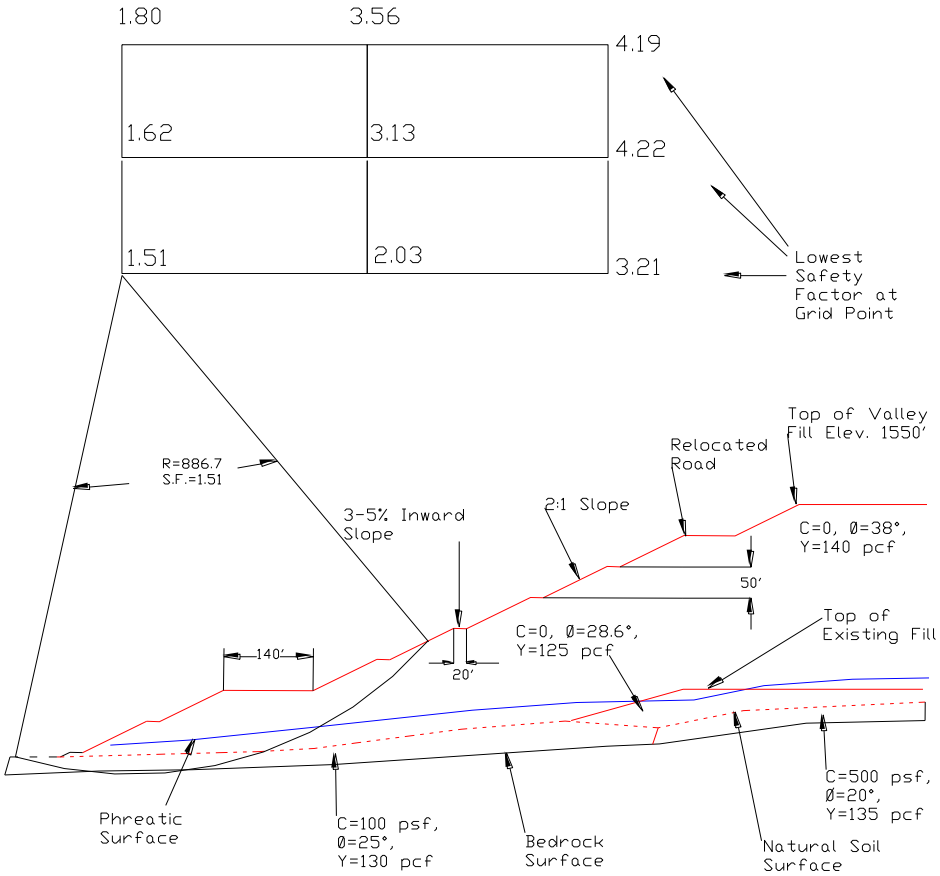
Foundation Investigations: *in-field and photograph assessment of foundation conditions.*

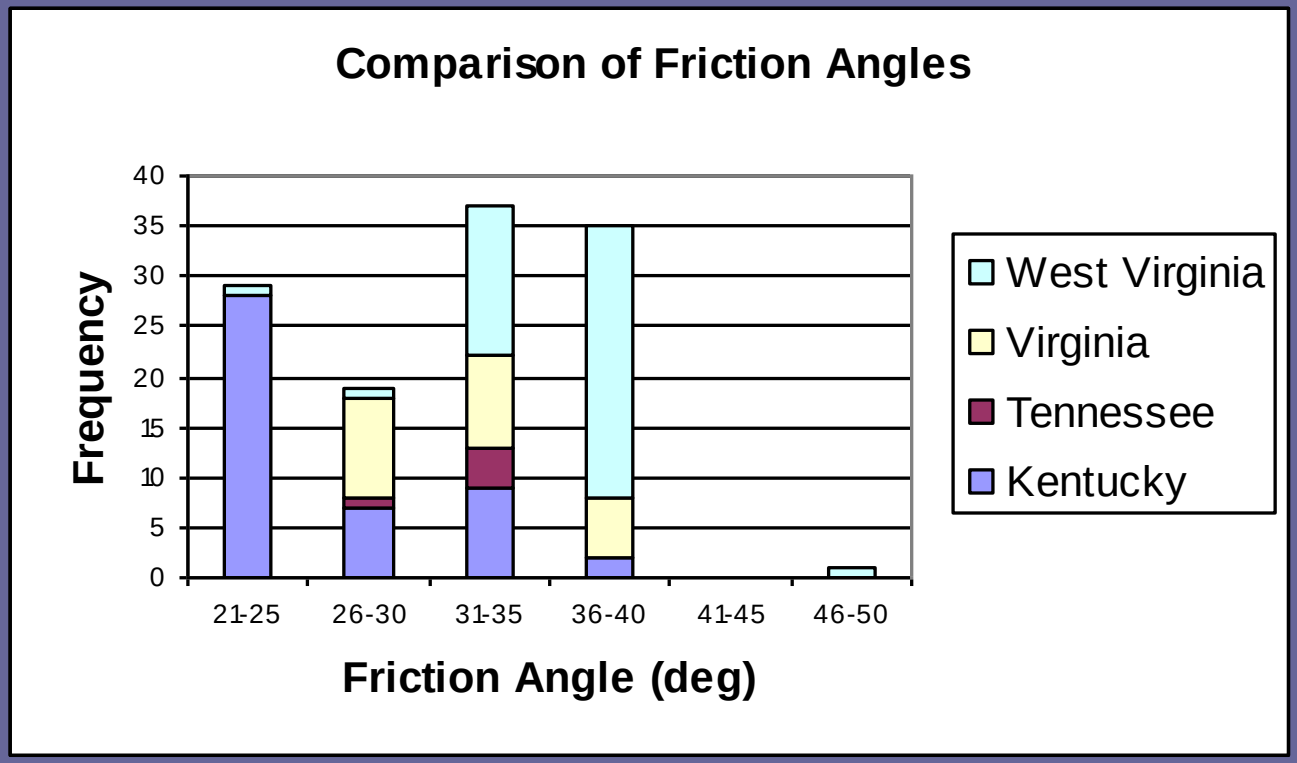
- 11 fills with clear cases of seeps or springs.
- 9 fills in landslide topography (instability in surrounding natural slopes).
- 17 of 20 cases of major fill instability attributed, in part, to inadequate underdrains or thick foundation soils.

Seepage at Toe of Valley Fill

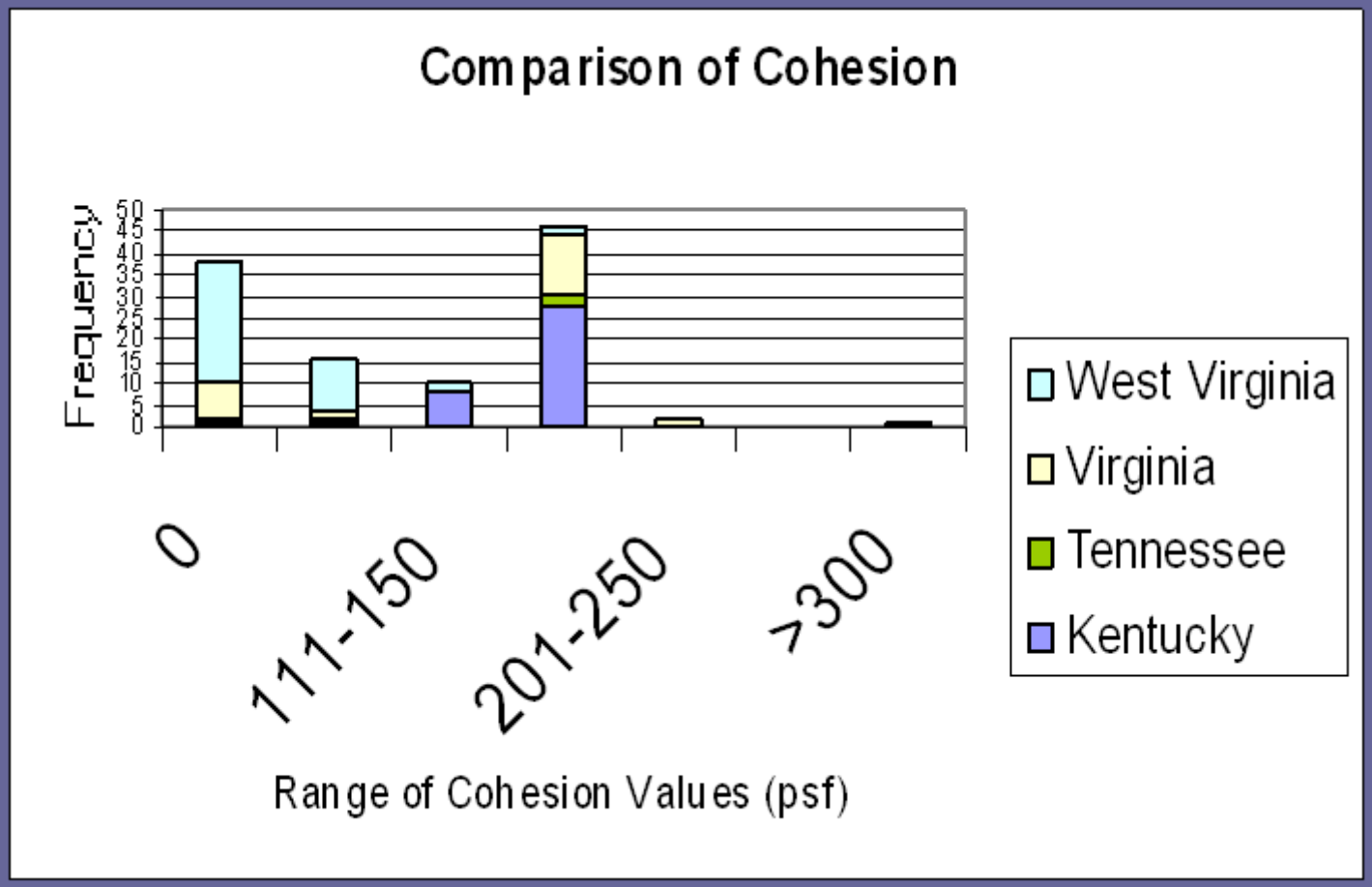
Aerial View of Earth Slide or Flow on Right Flank (looking upslope) of Valley Fill

Valley Fill Design Parameters





(Published values:
- Spoil: 25-40 degrees
- Durable rock spoil: 30-40 degrees)



(Published values:
- Spoil: 0-400 psf
- Durable rock spoil: 0 psf)

Engineering Values of the Fill Foundation

73 stability analyses included foundation engineering values. Their ranges were:

- Unit weight: 90-130 pcf
- Friction angle: 22-45 deg.
  (most values ≥ 30 deg.)
- Cohesion: mostly 0-200 psf

Most of the numbers seem to reflect rock-like values. This underlies the importance of:

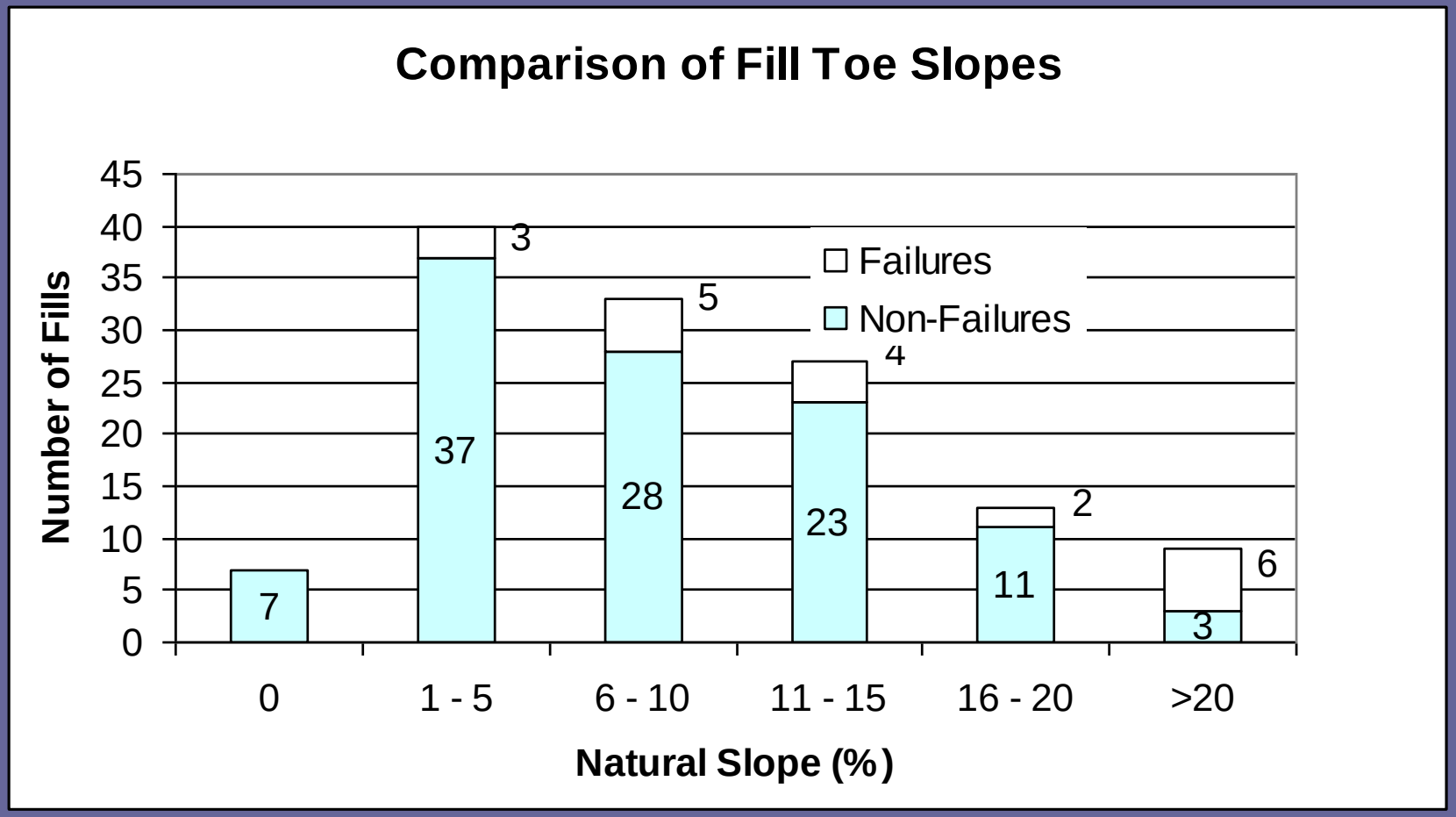
- Careful foundation investigations.
- Adequate clearing and grubbing operations.

Sensitivity Analysis

Influence of toe-foundation slope on Safety Factor:

- Applied SB-Slope stability analysis to a specific WV fill (original toe foundation slope was 7 %).
- Incrementally shifted toe upslope (increasing the foundation slope) and determined SF for each toe position (until SF falls below 1.5).
- Used the same engineering values for each increment.
- Maintained 2:1 slope and 50 ft. vertical distance between terraces.
- Did not conserve original fill volume (e.g. by backstacking spoil above the crown of the fill).

Result: SF < 1.5 at 25-27% slope.



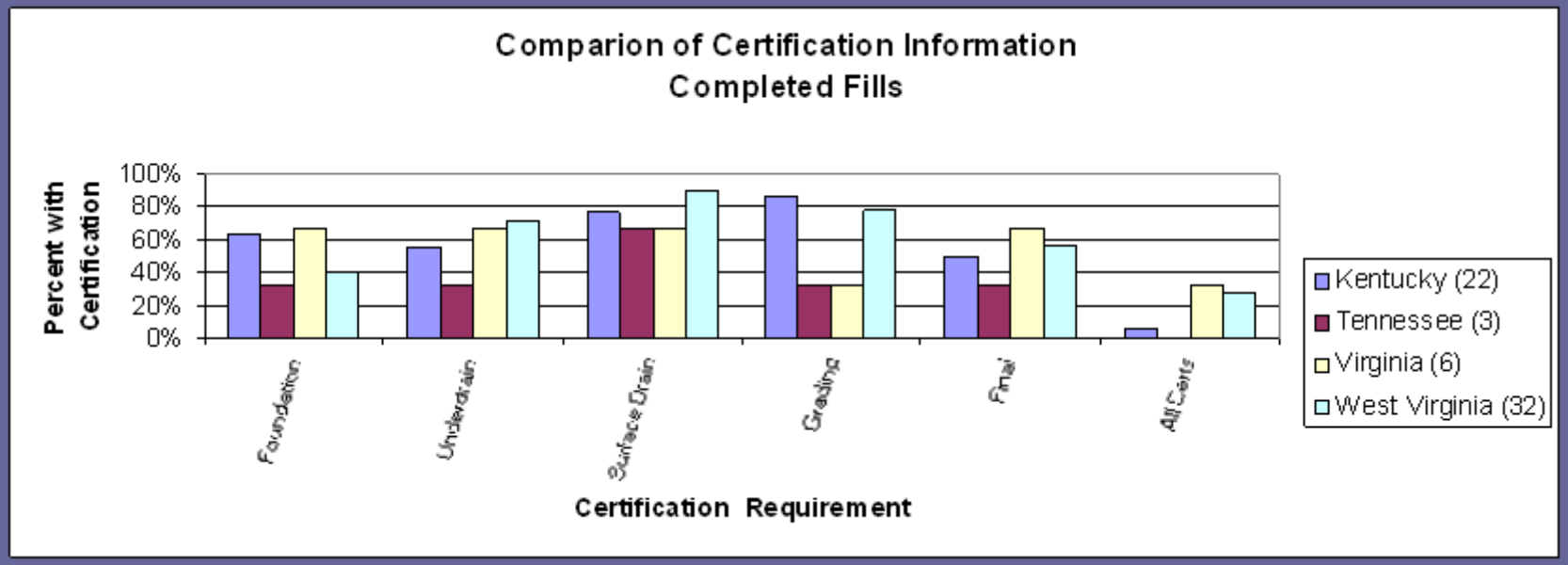
Average toe foundation slope from total fill sample is 10 %; for unstable fills, the average is 16 %. Four out of 5 fills with foundation slopes > 25 % are unstable.

Coal Refuse Impoundments Subjacent to Valley Fills

The Federal regulations prohibit the placement of permanent impoundment structures on all excess spoil fills. The concerns behind this prohibition apply to *Old* valley fill sites (or new valley fills on old impoundments). Potential scenarios are:

- Impounding structure on fill crest: increased load on fill mass and increased stress on the fill internal drainage system.
- Impounding structure immediately down-stream of fill: free-flow of internal drainage impeded.
- New valley fill above old impoundment: unstable foundation.

Valley Fill Construction



Frequency percent of completed valley fill samples with critical phase certifications.

Valley Fill Construction—Additional Concerns

- ***As-built vs. as-designed*** volume, configuration, and/or position of fill.
  - Change in conditions affecting SF.
  - Change in toe foundation slope.
  - Change in foundation materials.
- ***Wing dumping***.
  - Weathered material at base of underdrain.
  - Change in toe foundation slope/materials.
  - More surface disturbance than necessary.
- ***Concave face***.
  - Over-steepened side slopes
  - Less effective surface drainage.

Valley Fill Construction—Additional Concerns

- ***Gravity Segregation***. Its effectiveness determined by:
  - % durable rock
  - slope inclination
  - slope length
  - particle shape
- ***Timely reclamation*** (8 cases of fills idle for a year or more).
  - Weathering of surface spoil—decreased engineering strength and permeability.
  - Flooding/erosion.
- ***Plugging of DR fill underdrains*** during final regrading of fill face.

Limited gravity segregation on a long outslope of a developing durable rock fill.

Spoil Degradation, Erosion, and Mass Movement on an Unreclaimed Durable Rock Fill

Valley Fill Performance

Processes that could eventually cause or indicate major instability events:

- Ground-crack formation
- Ground Subsidence
- Erosion
- Seeps/springs
- Changes in vegetation/soil color
- Minor instability events

One or more of these events observed at 42 out of 123 sample fills. All correctible.

Major instability events.

20 out more than 4.000 fills constructed or under construction.

Seepage and erosion at right side of fill toe.

Seepage from arcuate crack pattern near toe, left of center drain.

Landslip on valley fill

Conclusions:

- Fill Instability is neither commonplace nor widespread.
- No cases of fill instability post-bond release.
- Most reclaimed valley fills are evolving into stable landforms.
- No systemic failings in the regulations.

(Post-study landslide during early stages of fill end-dumping. Most of the transported material was coluvium and old spoil.)

Conclusions, cont:

• While the study found only a very small percentage of excess spoil fills that experienced instability over the past “23” (now 25) years, there are areas of fill design and construction that could be improved to ensure “long-term” stability.

Potential Improvements for Consideration

- Establish a ***different fill construction method*** that would replace the durable rock and lift-type fill techniques. Combine construction of underdrains and end-dumping.
- Establish a ***more discriminating rock durability test*** or testing protocol. Consider incorporating sandstone percent. Develop guidelines for sample-collection frequency for testing and for insurance of 80% DR during construction. Identify spoil slaking/weathering properties for a range of subsurface conditions.
- Develop protocol for ensuring formation of ***adequate underdrain formation*** during the construction of a durable rock fill.

Potential Improvements for Consideration (cont.)

- ***Specify the detail necessary to satisfy existing foundation investigation requirements*** for the proposed valley fill footprint. Include identification of old underground mines. Include maximum anticipated subsurface flows for underdrain sizing.
- ***Increase inspection frequencies during critical construction phases***, particularly during foundation preparation and underdrain installation. Require that each certification clearly indicate which critical phase is being documented. Make up-to-date certifications available to the public.

Potential Improvements for Consideration (cont.)

- ***Expand temporary cessation (TC) requirements to valley fill construction.*** Require timely regrading to a 2:1 slope for sites anticipating TC. Require immediate regrading following end dumping for sites not in TC.
- ***Avoid contact between valley fills and coal-refuse impoundments.***
- ***Specify fill stability analysis parameters*** (e.g. grid, range of circle radii, engineering values).
- Periodically perform ***long-term stability studies*** of bond-released fills, including the used of remote sensing techniques and selective ground-level inspections.

Case Study - Lyburn Durable Rock Fill

Can such consequences be prevented in the future?

Jim Pierce, P.E. – Division of Mining and Reclamation

March 30, 2004

7 20 '02

7 20 '02

Lyburn Event

- ~2.5+ inches of rain occurred on July 19, 2002
  (Source – West Virginia Automated Flood Warning System, http://www.afws.net/search2002.htm)
- Bandmill Coal Company - Permit S-5023-93
- Valley Fill No. 6
- Located in Winding Shoals Hollow at Lyburn, West Virginia

Valley Fill 6 - Winding Shoals

- An initial wash-out occurred in May 2002, with only minor damage, i.e., plugged culverts and mud deposits on road and yards. An IHCO was issued.
- Pond completely cleaned as result of this IHCO/NOV
- A second, more damaging wash-out occurred on July 19, 2002
- Complete reclamation of fill has spanned well over one year

Identified Problems

- Reduction in fill volume, as designed
- Fill shape
- Gradation of durable rock fill material
- Intensity and duration of precipitation
- Particular period of fill construction

Downstream Effects of Event

- Fortunately, no injuries
- Destroyed/damaged homes and vehicles
- WVDEP issued imminent harm cessation order (IHCO)
- The permittee provided temporary housing, began downstream clean-up and stepped up reclamation efforts of fill

Primary Causes of Fill Problems

- Over 2.5 inches of rain in short time (high intensity/short duration)
- Saturation of the unreclaimed face of Valley Fill No. 6, resulted in massive erosion of fill face
- Proximity of downstream sediment pond (Pond No. 6) to the community
- Resulting fill configuration conflicted with design plan

DEERE

7 20 '02

Is Lyburn the only example of mass erosion in West Virginia?

- To fully answer this question, WVDEP researched instances off-site damage related to valley fills

<u>49 fill wash-outs</u> had occurred in just a five year period preceding the Lyburn event. Since the inception of end-dumped fills in West Virginia in ~1982, even more instances of off-site damage were noted, but not categorized.

WVDEP's Conclusion & Response

- Obviously, the design provisions and performance standards in our promulgated rules were incapable of preventing such occurrences. *(The Lyburn permit had three (3) oversight inspections by OSM prior to the July 19th event with everything being found to be in compliance.)*
- Policy alone, would have limited effectiveness to limit off-site damage from valley fills.
- Such erosion vulnerability cannot be eliminated by increasing on-ground performance standards.
- Regulatory changes were deemed the best method to reduce this erosion vulnerability.

Issues Addressed by WVDEP

1. Establish regulatory limits to prevent fills from being inactive for extended periods of time
2. Revise fill construction techniques to limit sediment transport vulnerability
3. Discourage U-shaped configuration of fills by
   a) Prohibiting underfilling
   b) Prohibiting wing dumping
4. Limit/Control drainage from fill face at all times

Issues Addressed by WVDEP

5. Mandate the design of surface runoff control for all current and proposed fills
   - Pond storage should not be relied upon as a justification for delayed reclamation
6. Scrutinize engineering certifications for major departures from the approved fill design

Lyburn, Then and Now

Lyburn, Then and Now

Office of Surface Mining
Knoxville Field Office

LYNCO MINING CO.
FILL FAILURE
CASE STUDY

By

Dennis Clark - KFO

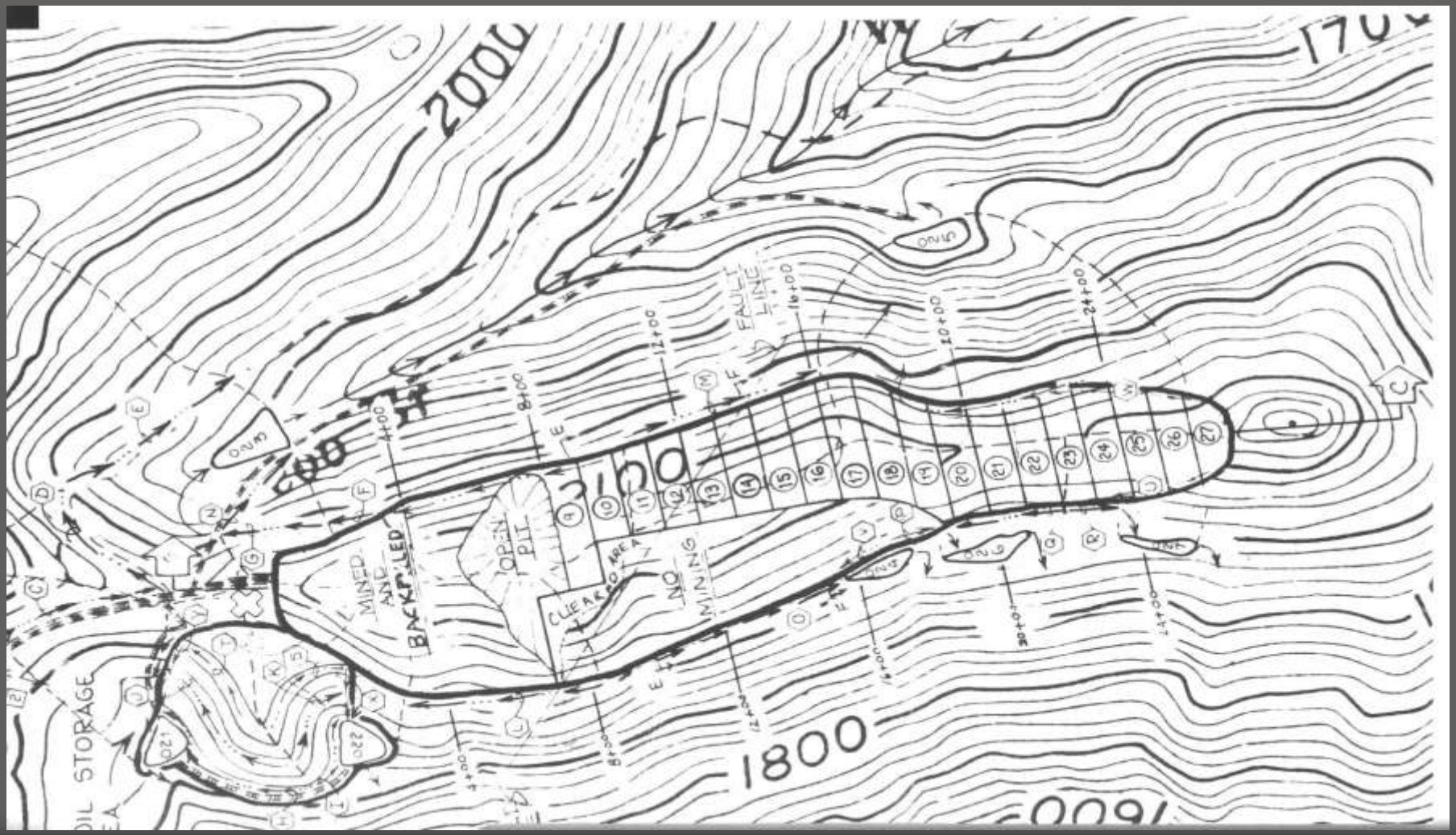
LYNCO MINING CO.
AREA No. 2
Scott County, Tennessee

- PERMITTED 1987
- Haulback/Crossridge Mining with Small Excess Spoil Storage Site
- Projected Overburden Removal: 2,600,000 C.Y.
- Projected Excess Material to Fill: 107,000 C.Y.
- Actual Excess Material Placed in Fill: 72,000 C.Y.
- Projected Coal Recovery: 221,000C.Y.
- Failure of Fill Initially Viewed July 6,1989

Approved Disposal Plan

- Area Selected due to Proximity to the Mine Site
- Area Underlain by Sandstone & Shale
- No Springs, Seeps or Ground Water Found
- No Rock Chimney Core or Underdrain to be Constructed
- No Foundation Investigation to Insure the Probability of no Significant Problem for Overall Stability
- Effects of Blasting Stated to be of no Concern
- All Factors of Safety Meet Requirements of Regulations

PERMITTED MINE SITE PRIOR TO FILL FAILURE



Mine Inspector Concerns Regarding Fill & Adjacent Stuctures

- Movement & Settlement of Sediment Pond Embankment Located Below Fill

Ariel Photo Downslope of Disturbance

July 1989 Site Investigation

- “Hollowfill” Complete, but not Constructed as Approved
- Non-approved Drainage Design resulted in Poor Drainage Control
- A Number of Tension Cracks Observed
- Scrap in the Upper Terrace of Fill
- Failure Appears to be Foundation Failure
- Thick Deposit of Colluvial Soil at Toe of Fill has been Displaced

Ariel photo of Failed Fill Area
Scarp at Upper Right

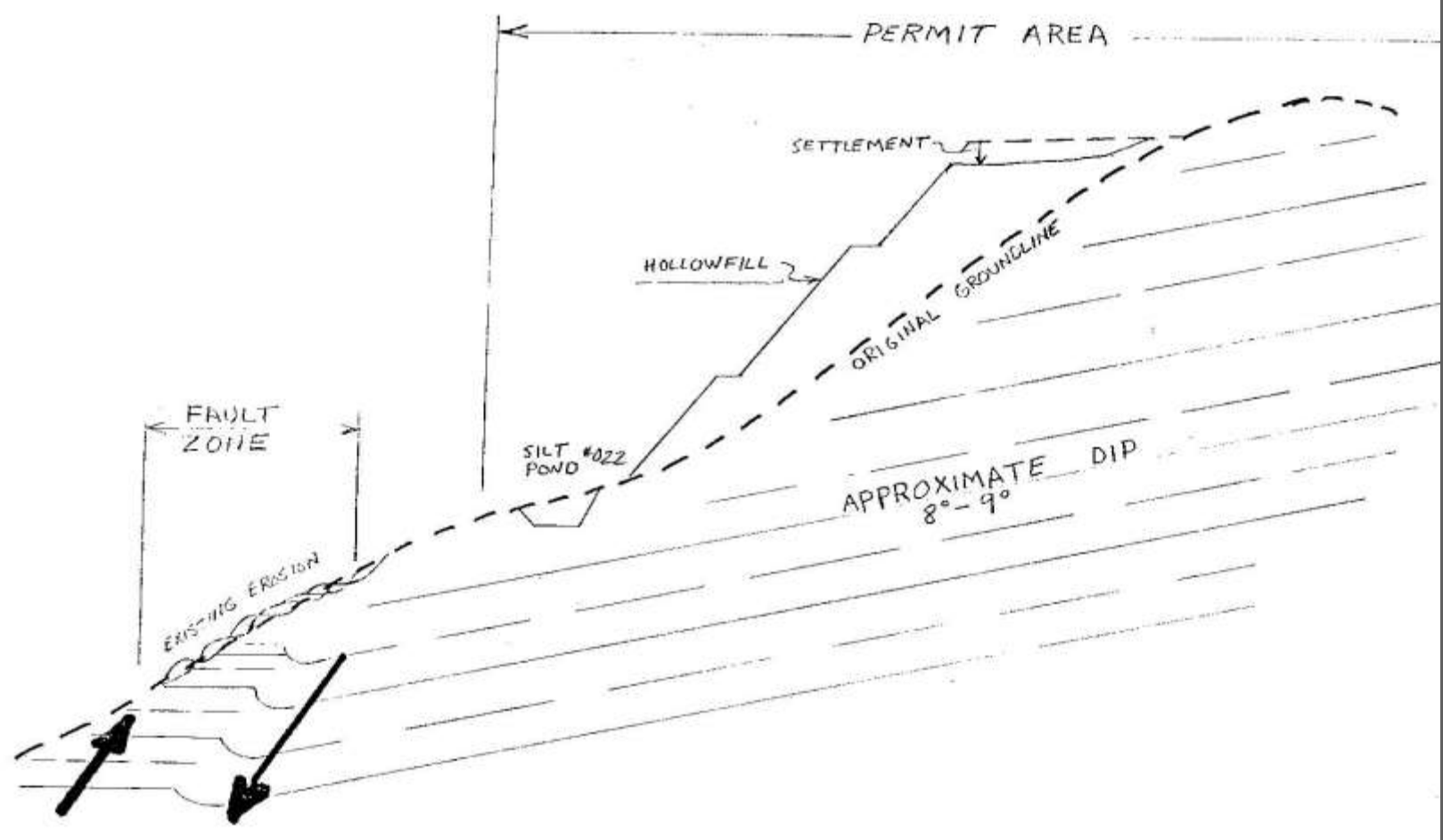
Downslope Disturbance
Below Windrowed Timber

Main Scrap of Failed Fill

GEOTECHNICAL FINDINGS

- Determined that the Terry Creek Fault which runs NW-SE below the fill & subsequent structural stability of the subsurface, adversely affected the site conditions
- Intrusions of surface water migrating down dip toward the fault zone compounded the problem
- Even with reducing surface water intrusion, the long term conditions could not be predicted

Cross-Section Fill
Note Settlement & Dip of Bedrock



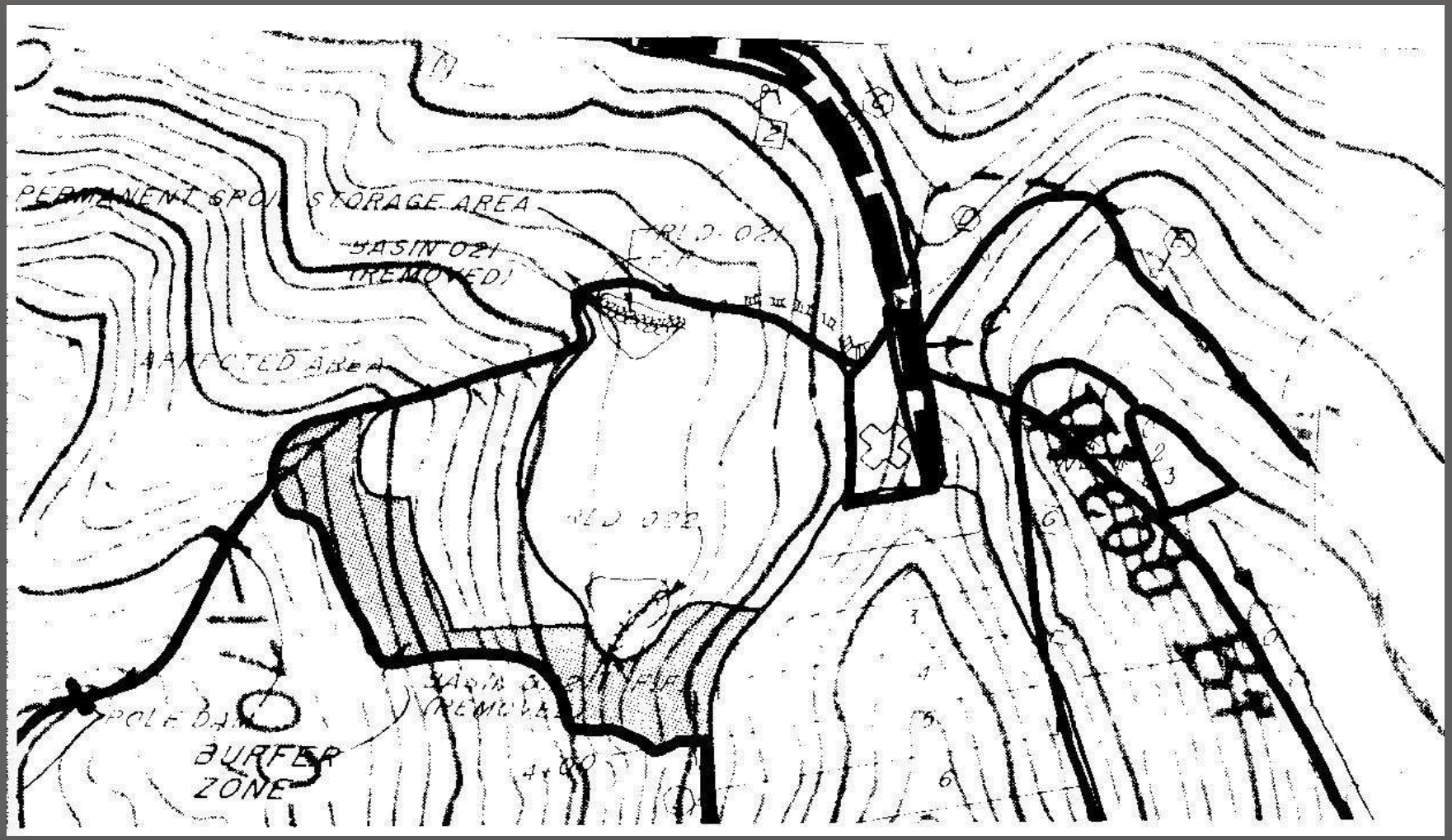
LYNCO MINING CO.
PROPOSED ACTION PLAN

- Removal of 2 silt ponds at toe of fill
- Diversion of all drainage away from the fill area
- Minimize disturbance on the fill except to repair large cracks & revegetate fill slopes
- No effort to reshape the face of fill to presettlement slopes & grades
- Use alternative sediment control (filter fabric fence)
- Continue monitoring the local fault zone

PERMIT REVISION

- ADDITIONAL ACREAGE
  #1: Addition of a buffer zone below & adjacent to the slide & fill area
- #2: Construction of a sediment basin & drainage
- INCREMENTAL BONDING RESULTING FROM the FILL FAILURE
  #1: Include both the slide & a buffer area
  #2: New sediment basin & associated drainway

Plan View of Fill Area
Note Affected & Buffer Area



Remedial Measures

- Approximately 22,000 C.Y. Moved from Fill to on Bench Site
- Area Below Toe Graded & New Drainage Constructed
- French Drains: rip-rap & perforated pipes considered
- All Basins on West Side of Permit Removed
- Silt Fences & Pole Dams Constructed
- Some 60% (5.9 ac) of Fill Area to be Disturbed
- New Basin Constructed Below Toe of Fill

SLIDE MONITORING PLAN

- August 1990:
  #1: Place 7 Hubs along Major Settlement Crack
  #2: 4 Hubs Placed Below Failure
  #3: 3 Hubs Located Above Failure
  #4: Hubs Monitored by Surveying for Horizontal & Vertical Displacement on Routine Basis
  #5: After Phase I Bond Release – Visual Inspection Only

Regraded Fill and Downslope Area

CONCLUSION

EVEN SMALL FILLS CAN LEAD TO

BIG TROUBLE

Break

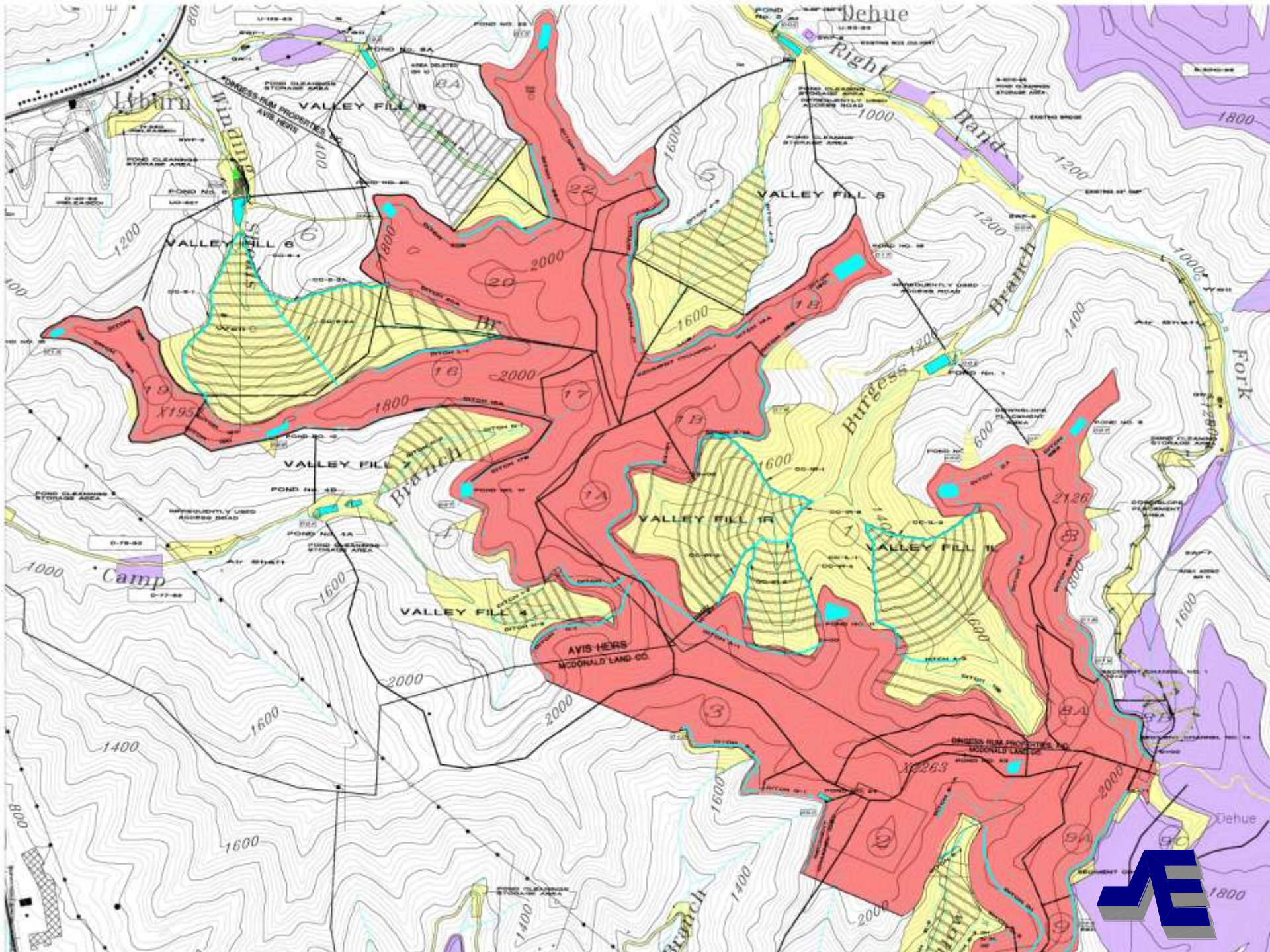
Bandmill Coal Corporation

S – 5023-93

Lyburn Fill (HF-No. 6)

David F. Rasnick, PE, LS

Summit Engineering, Inc.


Dehue
Right
Hand
Branch
Burgess
Fork
Lybrin
Windmill
Branch
Camp
VALLEY FILL 8
VALLEY FILL 6
VALLEY FILL 5
VALLEY FILL 7
VALLEY FILL 1R
VALLEY FILL 1L
VALLEY FILL 4
AVIS HEIRS
MCDONALD LAND CO.
ONGESS-RUM PROPERTIES INC.
AVIS HEIRS
POND CLEANING STORAGE AREA
Air Shaft
Dehue

Bandmill Coal Corporation

S – 5023-93

Lyburn Fill (HF-No. 6)

Did Failure Occur at the Lyburn Fill ?

History

• Pittston Permit Issued (S-5023-93)	November 1993
• Built pond / began fill	August 1996
• Massey Energy Purchase	Summer 1998
• Mined Until	Fall 2000

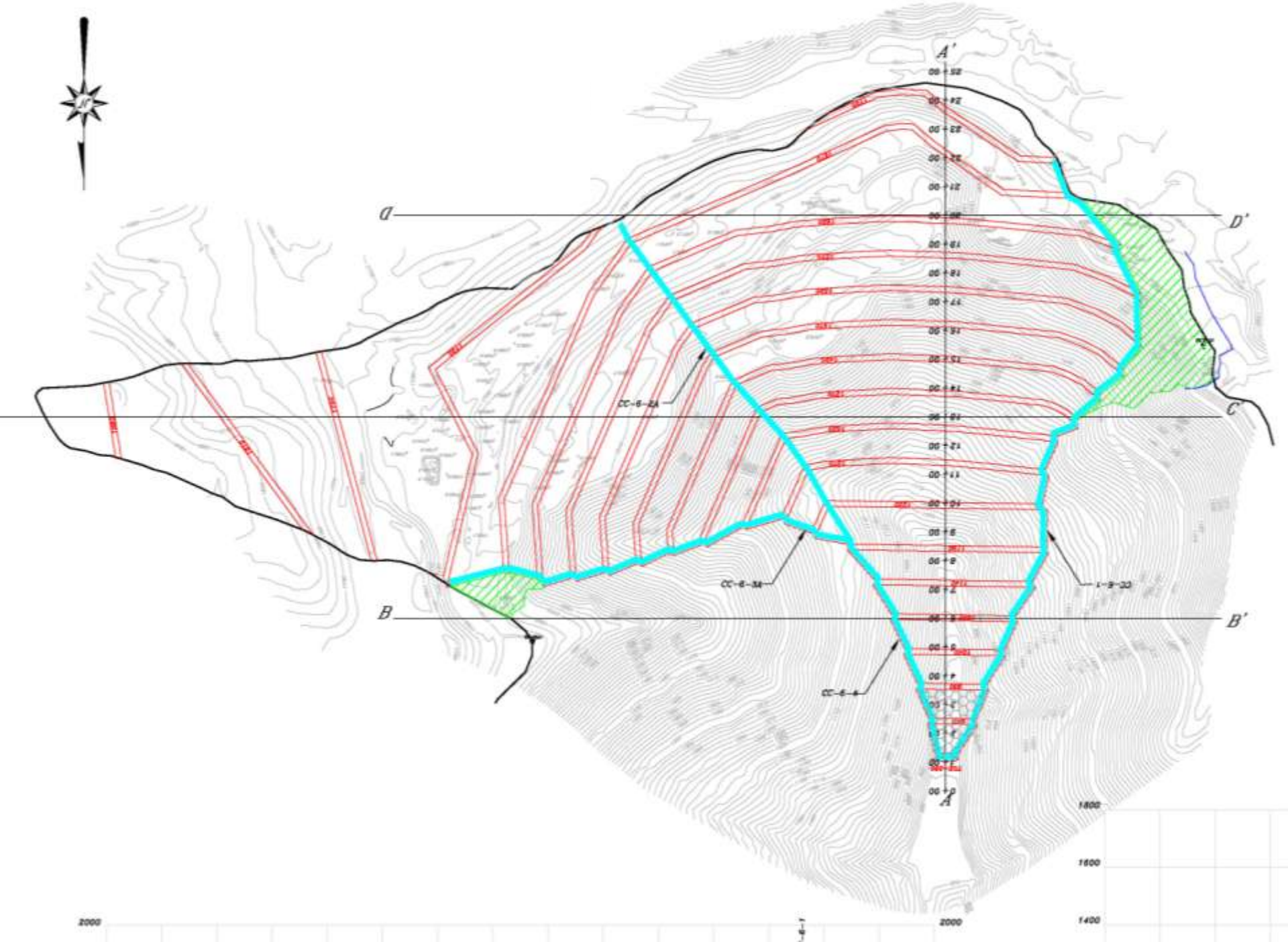
August 1998

History

• Pittston Permit Issued (S-5023-93)	November 1993
• Built pond / began fill	August 1996
• Massey Energy Purchase	Summer 1998
• Mined until	Fall 2000
• Began Breaking down fill	Spring 2002
• Rain Event	May 13, 2002
• Major Rain Event	July 19, 2002
• Completed Majority Reclamation	3rd quarter '03

Massey's Reclamation Effort

- Left side of hollow - Long slope


A'
D
D'
C
C'
B
B'
A
CC-6-24
CC-6-34
CC-6-1
CC-6-4
1800
1600
1400
2000
2000

December 21, 2001

First Quarter 2002

Massey's Reclamation Effort

- Left side of hollow - Long slope
- Rain Fall event - May 13, 2002

June 17, 2002

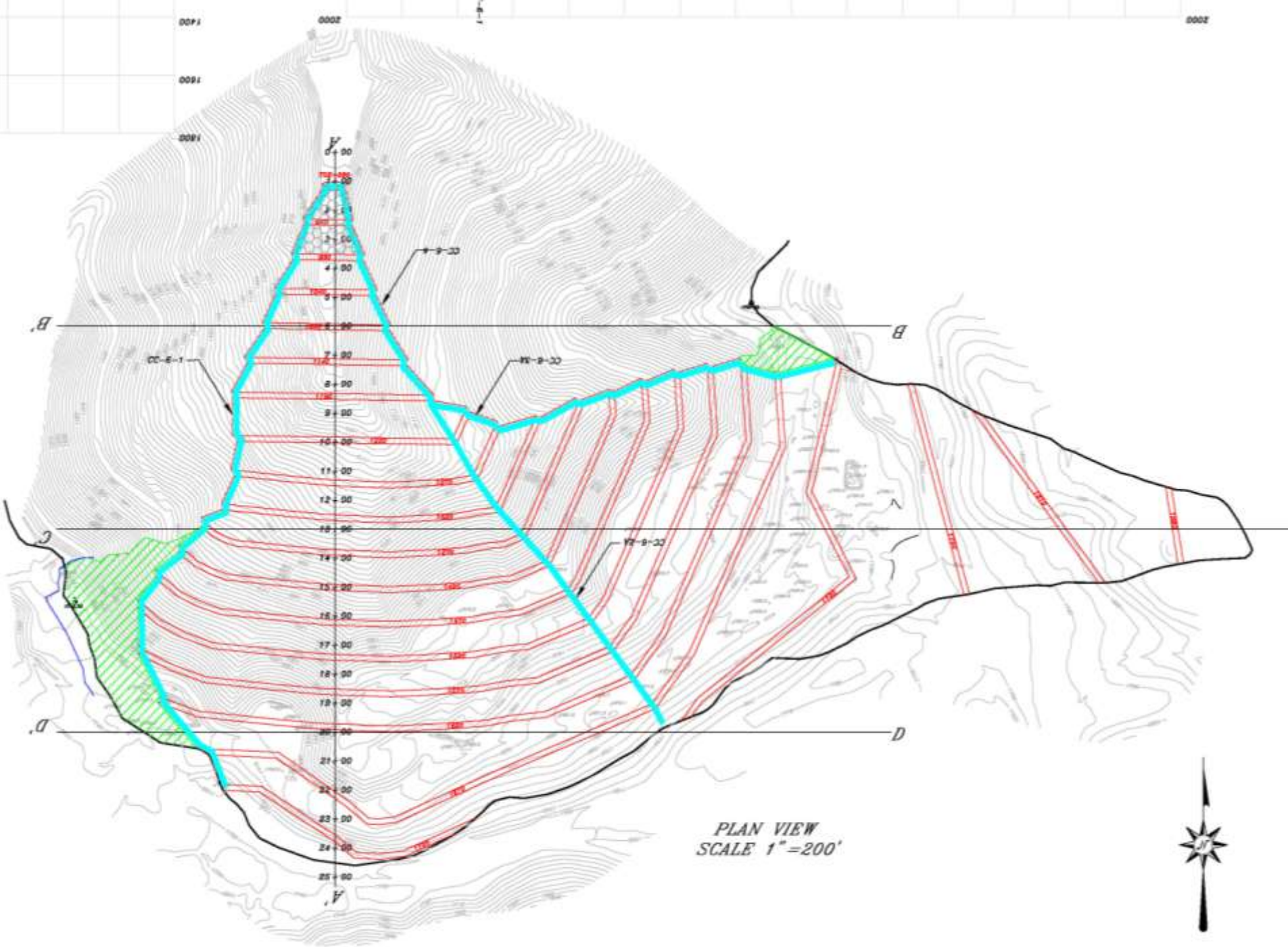
Massey's Reclamation Effort

- Left side of hollow - Long slope
- Rain Fall event - May 13, 2002
- Clean-up Pond / fill

June 3, 2002

Massey's Reclamation Effort

- Left side of hollow - Long slope
- Rain Fall event - May 13, 2002
- Clean-up Pond / fill
- Push in middle of fill - Long slope


A
A'
B
B'
C
C'
D
D'
CC-6-1
CC-6-2
CC-6-3
CC-6-4
PLAN VIEW
SCALE 1"=200'

June 20, 2002

July 12, 2002

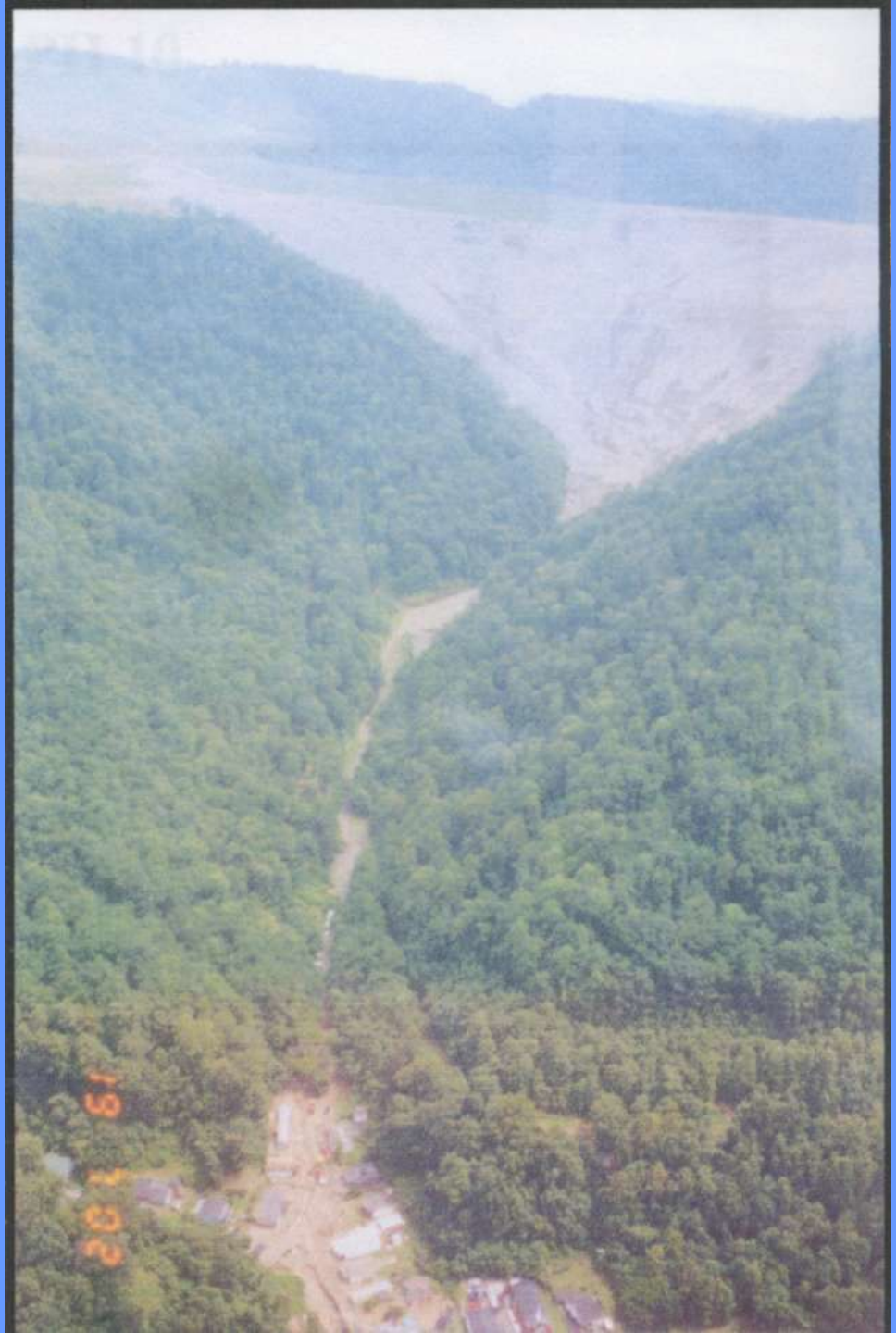
Massey's Reclamation Effort

- Left side of hollow - Long slope
- Rain Fall event - May 13, 2002
- Clean-up Pond / fill
- Push in middle of fill - Long slope
- Major Rain fall event - July 19, 2002

July 19, 2002

July 19, 2002

July 19, 2002



July 19, 2002

July 19, 2002

July 19, 2002

July 19, 2002

July 19, 2002

Massey's Reclamation Effort

- Left side of hollow - Long slope
- Rain Fall event - May 13, 2002
- Clean-up Pond / fill
- Push in middle of fill - Long slope
- Major Rain fall event - July 19, 2002
- Reclaimed from top – down
  Benches / drains

November 15, 2002

Fall 2002

Fall 2002

March 21, 2003

March 14, 2003

May 8, 2003

May 19, 2003

Lyburn Community Effect

- July 19, 2002 Rainfall Event

July 19, 2002

July 19, 2002

July 19, 2002

July 19, 2002

July 19, 2002

July 19, 2002

July 19, 2002

July 19, 2002

Lyburn Community Effect

- July 19, 2002 Rainfall Event

- Response
  - ✓ Governor Bob Wise
  - ✓ Secretary DEP Dave Callahan
  - ✓ Deputy Director DEP, Matt Crum
  - ✓ Various Inspectors / Engineers
  - ✓ Massey Energy Personnel
  - ✓ MSHA Representatives
  - ✓ Consultants
  - ✓ Media

Facts on Cause

- 4.35” / < 4 hr. on July 19, 2002 (>100 yr storm)
- Long Slope
- Broke crust
- Massive erosion occurred

July 19, 2002

July 19, 2002

July 19, 2002

July 19, 2002

July 19, 2002

June 3, 2002

July 19, 2002

Facts on Cause

- 4.35” / < 4 hr. on July 19, 2002 (>100 yr storm)
- Long Slope
- Broke crust
- Massive erosion occurred
- No plane or rotational failure seen

July 19, 2002

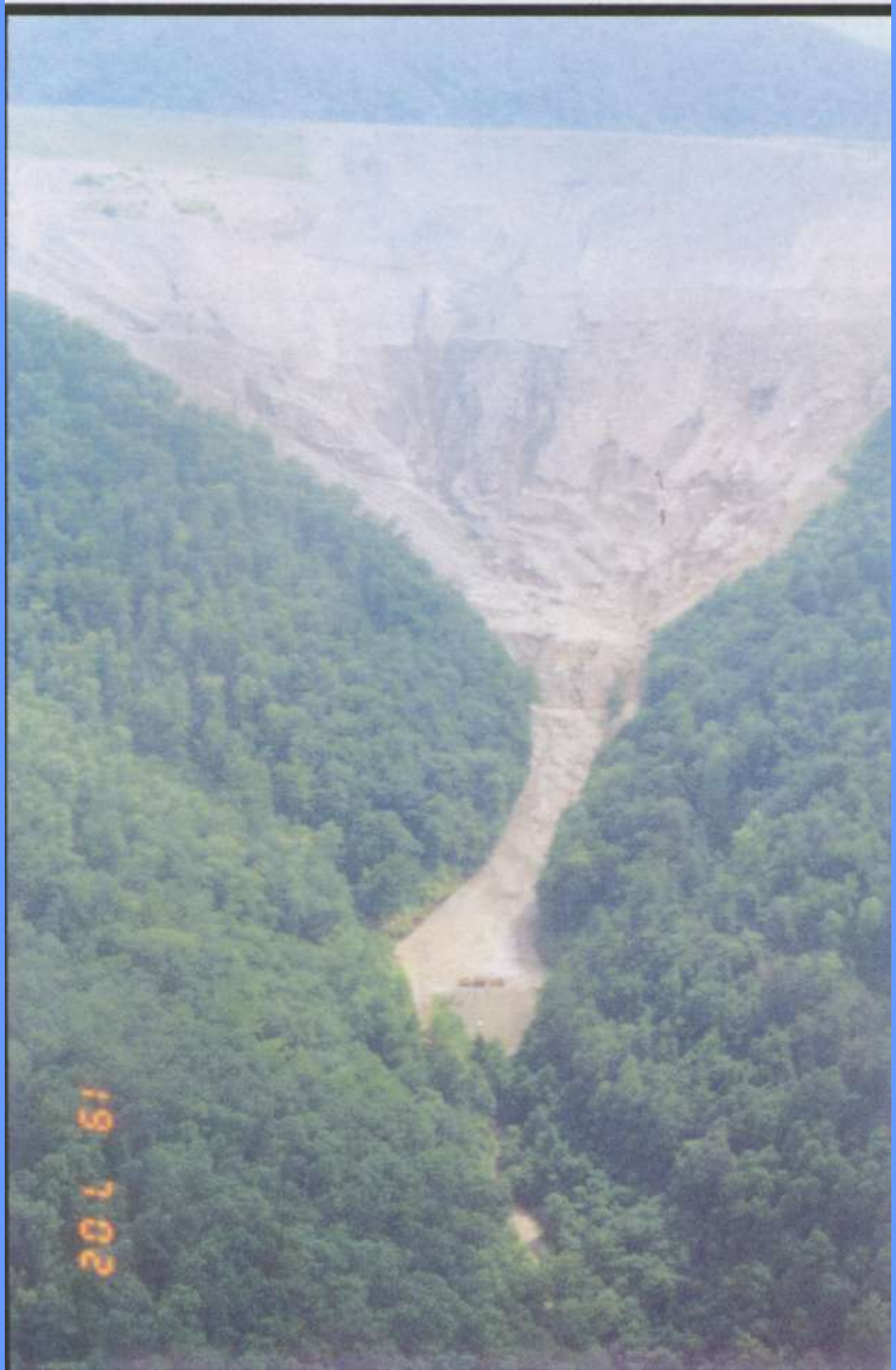
July 19, 2002

July 19, 2002

July 19, 2002

Facts on Cause

- 4.35” / < 4 hr. on July 19, 2002 (>100 yr storm)
- Long Slope
- Broke crust
- Massive erosion occurred
- No plane or rotational failure seen
- Dam did not fail



July 19, 2002

July 19, 2002

July 19, 2002

July 19, 2002

VOLVO
July 19, 2002

July 19, 2002

VOLVO
A35D
July 19, 2002

July 19, 2002

Facts on Cause

- 4.35” / < 4 hr. on July 19, 2002 (>100 yr storm)
- Long Slope
- Broke crust
- Massive erosion occurred
- No plane or rotational failure seen
- Dam did not fail
- 48” pipe under Lyburn Community

July 19, 2002

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- No plane or rotational failure seen
- Dam did not fail
- 48” pipe under Lyburn Community
- Massey Energy did stay with clean-up to completion

September 2003

September 2003

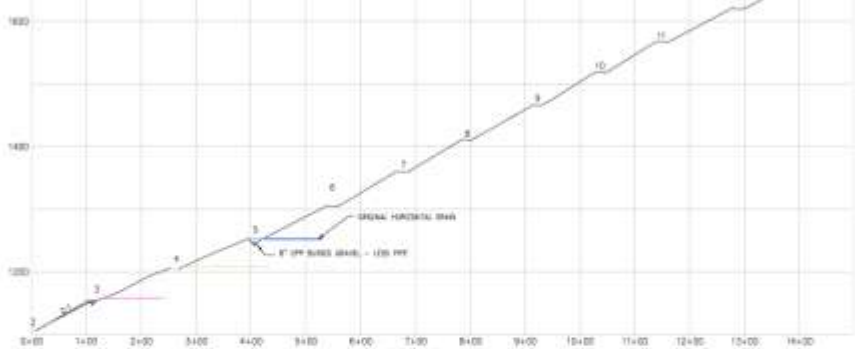
March 22, 2004

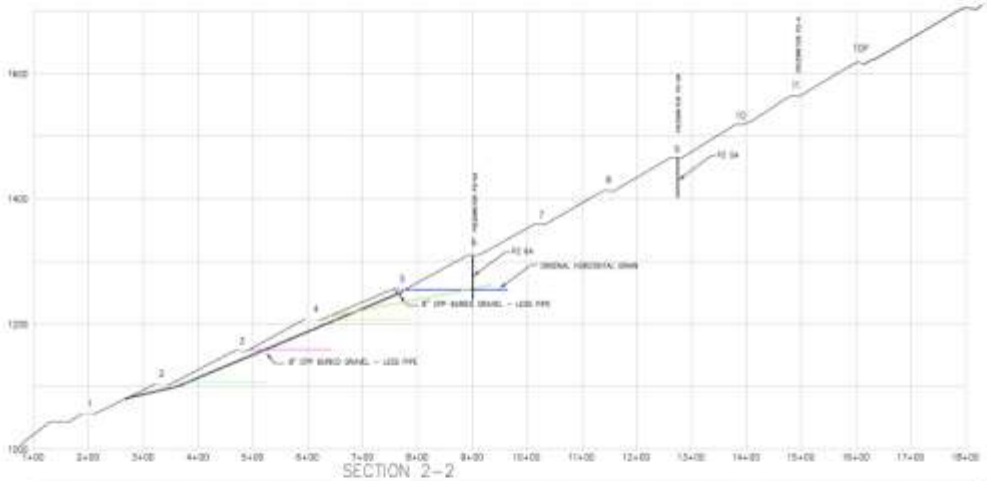
March 22, 2004

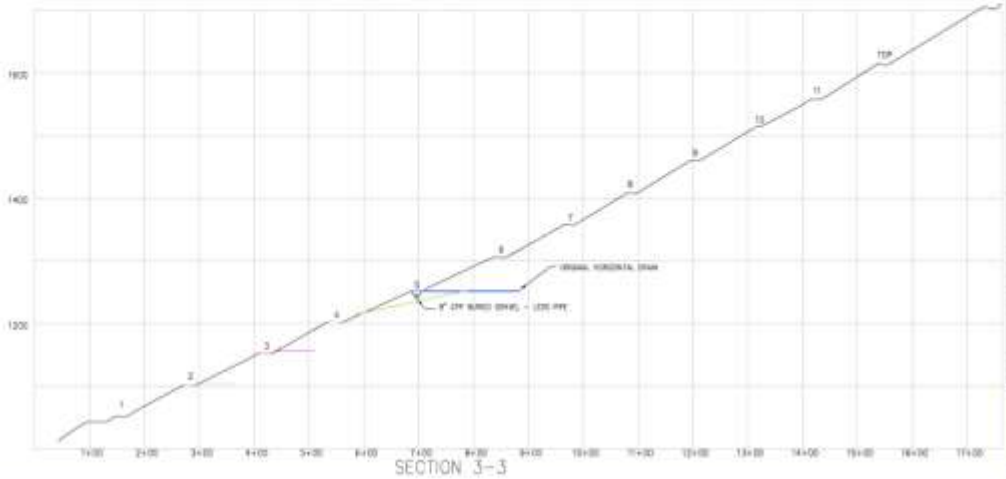
March 22, 2004

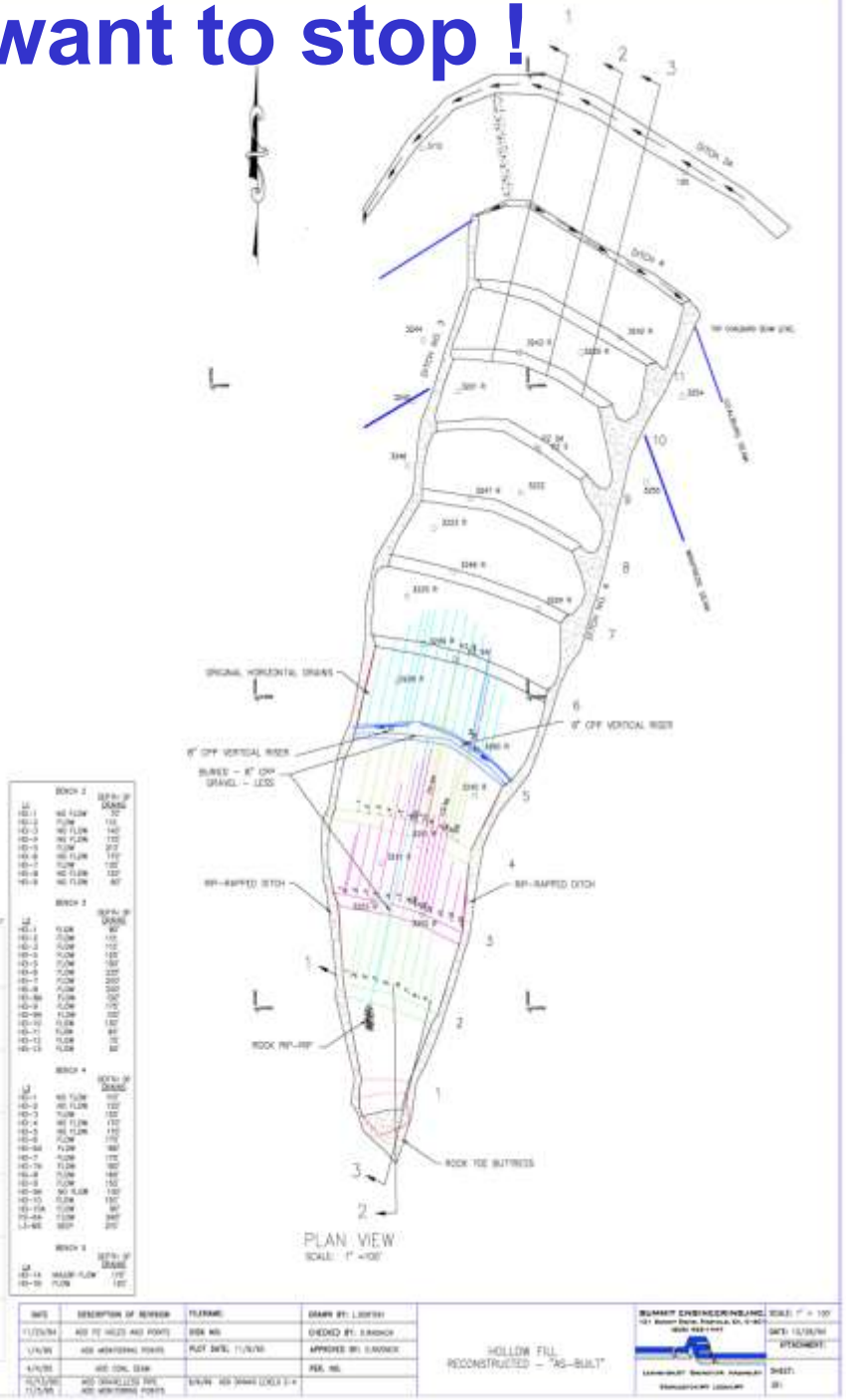
March 22, 2004

Another fill that didn't want to stop !



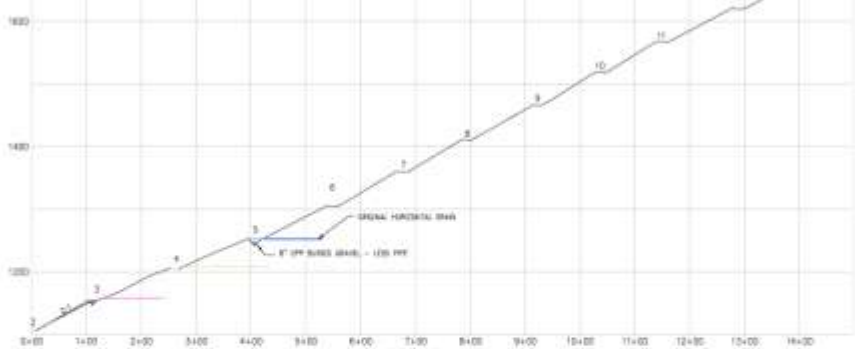


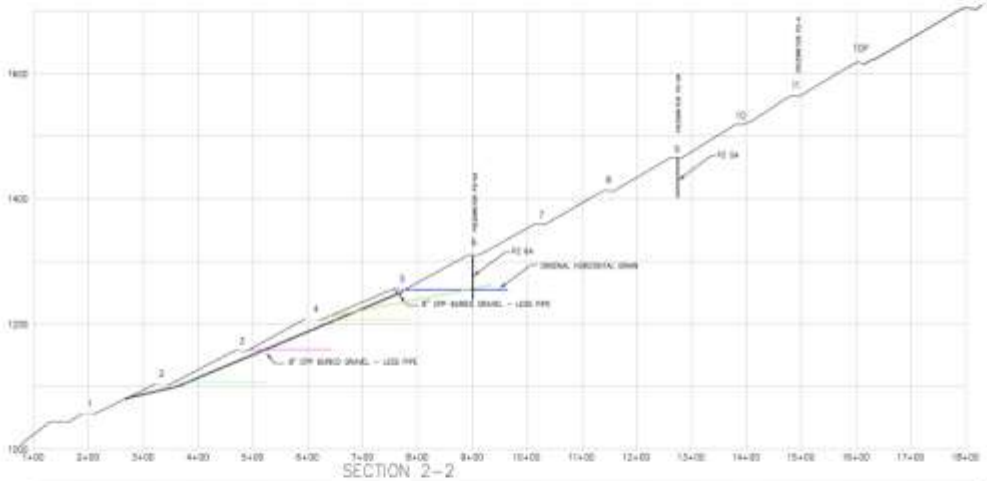


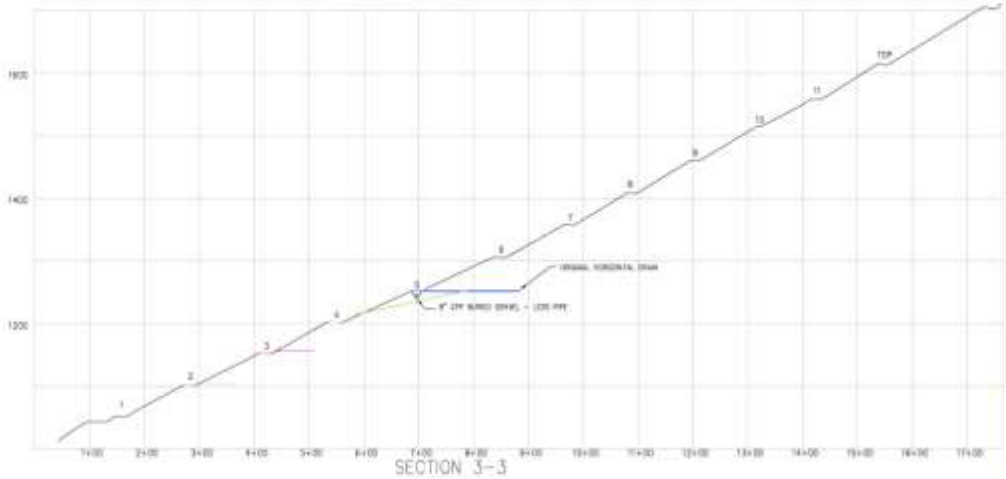


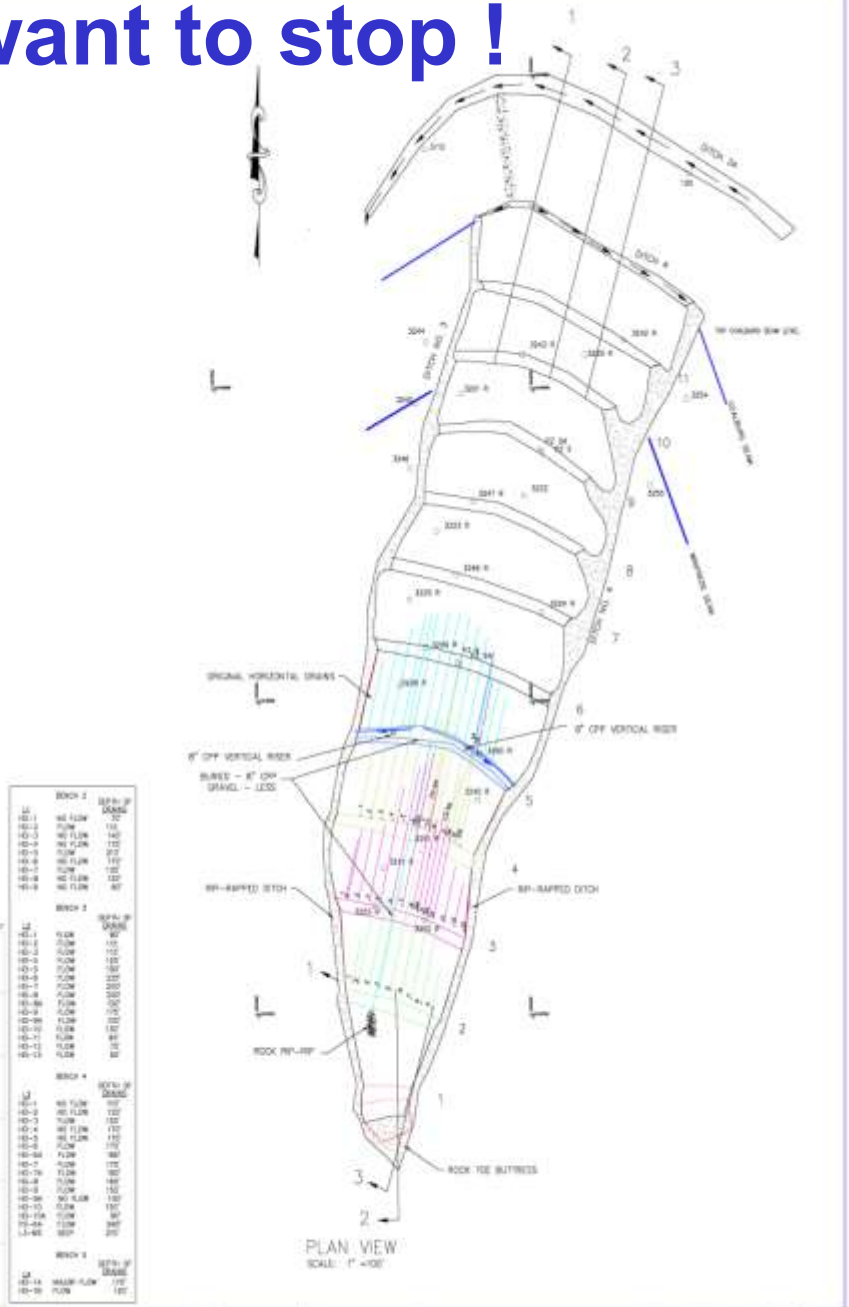
- June 1990 — Added fill to permit
- Winter 1991 — Pushed fill down during wet season
- Aug 1992 — Final configuration achieved
- Jan 1993 — Crack above Bench no. 10, bulge on Bench No. 3
- Feb 1993 — Drilled 15 horizontal drains on Bench No. 5
- July 1993 — Re-opened Stockton bench to check for water
  Groin ditch deepened to natural rock
- Sept 1993 — Drilled numerous horizontal drains near Winifred
- June 1994 — Groin ditches deepened to 20’ +/-
- Mar 1995 — Stiff diagram on water
- Aug 1995 — Install 8” gravelless pipe from Bench No. 5 to below
  Bench no. 2
- May 1996 — Drilled more horizontal drains in Benches 2, 3 & 4
- Sept 1997 — Redesigned fill with DEP approval to move top 4
  lifts to toe area
- July 1998 — Waited on dry weather to re-configure
  Installed French drains where water was encountered
- Sept 1999 — Fill stopped moving

Another fill that didn't want to stop !









HOLLOW FILL
RECONSTRUCTED - "AS-BUILT"

Conclusion

- Regulations – needed as guide
- Does contemporaneous reclamation of high walls (time & distance) effect reclamation of fills?
- Time of year of break down operation is critical
- Reclaim from top down causes problems
- Long slope causes problems
- More regulations are not the answer
- Regulations do not (and cannot) fit <u>all</u> situations

Question:

Did failure occur at the Lyburn Fill ?

Answer:

The fill did not fail …

Perhaps all of us failed the fill.

Office of Surface Mining
Knoxville Field Office

Tennessee Permitting Requirements
DISPOSAL of EXCESS SPOIL

By

Dennis Clark, PE

Mining Engineer

30 CFR Part 715
General Performance Standards

715.15 Disposal of Excess Spoil

- General Requirements
- Valley Fills
- Head-of-Hollow Fills
- Durable Rock Fills
- Preexisting Benches

GENERAL REQUIREMNTS #I

- Spoil not required to achieve approximate original contour
- Designed using professional standards
- All organic & topsoil material removed from disposal area
- Minimize surface erosion at the site
- Disposal site on a stable area
- Spoil placed in a controlled manner

GENERAL REQUIREMENTS #II

- Final Configuration Suitable for Postmining Landuse
- Use Terraces to Control Erosion & Enhance Stability
- Depending on Slope (>36%), Keyways Cuts &/or Rock Toe Buttresses should be Considered
- Inspected & Certified by a P.E.
- No Coal Processing Waste Placed in Fill

GENERAL REQUIREMENTS #III

- Use Underdrain, Durable Rock & Filters if Water Flow is a Concern
- Foundation Investigation & Testing of Materials of the Fill Area is a Must
- Excess Material Maybe Returned to Underground Workings with RA & MSHA Approvable
- Disposal on Lower Bench-Special Case

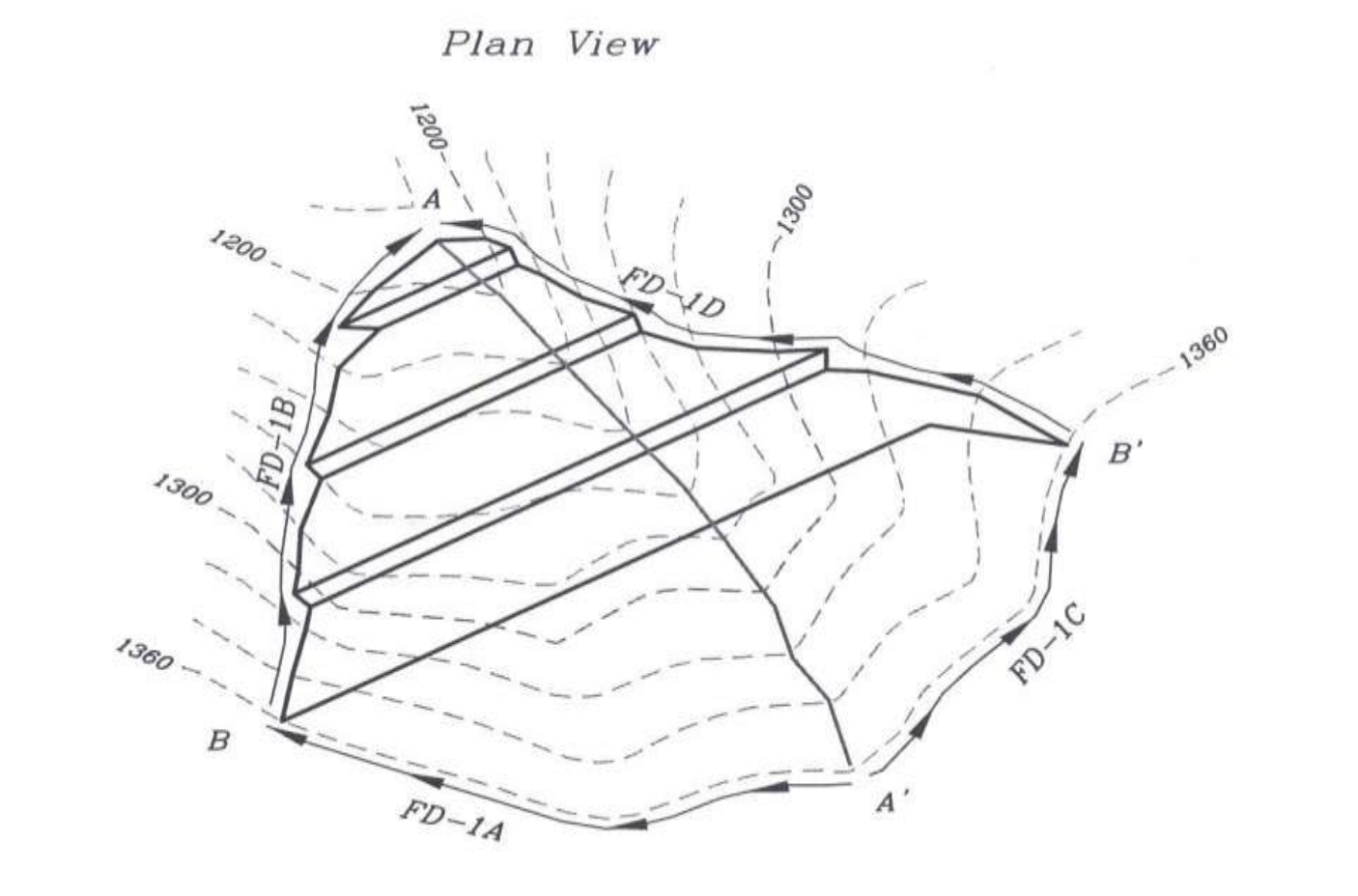
DEFINITIONS

- Valley Fills: A fill structure of non-organic material, that is placed in a valley where the side slopes measured at the steepest point > (greater than) than 20 degrees, or the average slope of the profile of the toe of fill to the top of the fill is > than 10 degrees.

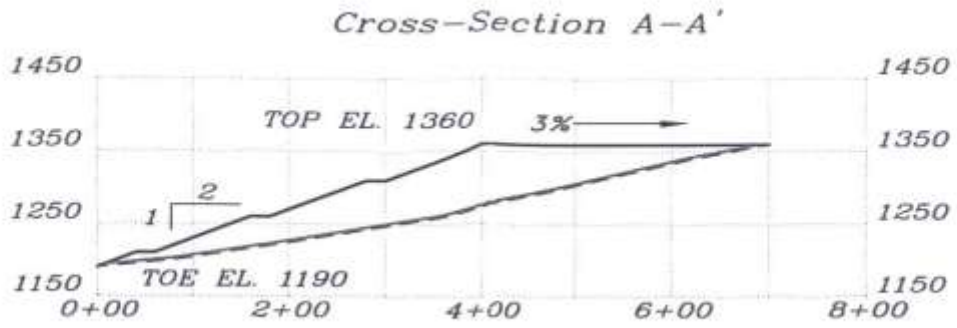
VALLEY FILLS

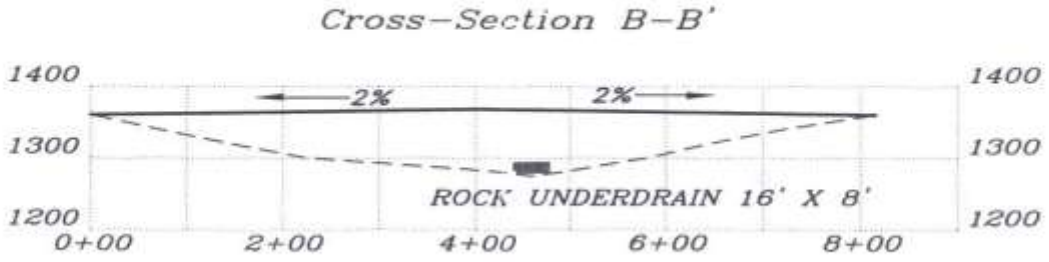
- Fill designed to long term static S.F. of 1.5 or greater
- Durable rock under drain
- Material lifts no greater than 4 feet (always the intinal lift)
- All diversions designed for a 100-year, 6-hour event
- Terraces < (less than) 50 ft. in height & 5 % grade drain
- No drainage directed over out-slope of fill
- Overall slope not to exceed 50 %

PLAN VIEW of a VALLEY FILL

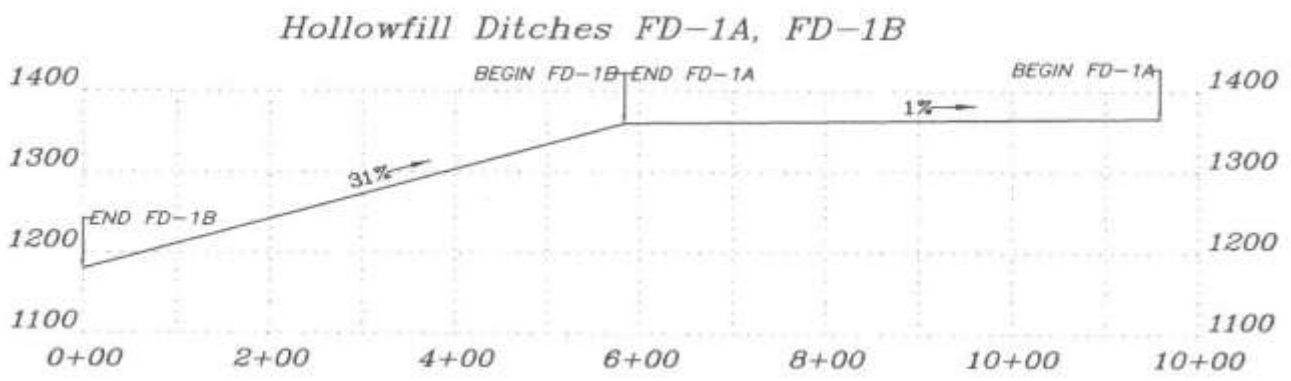


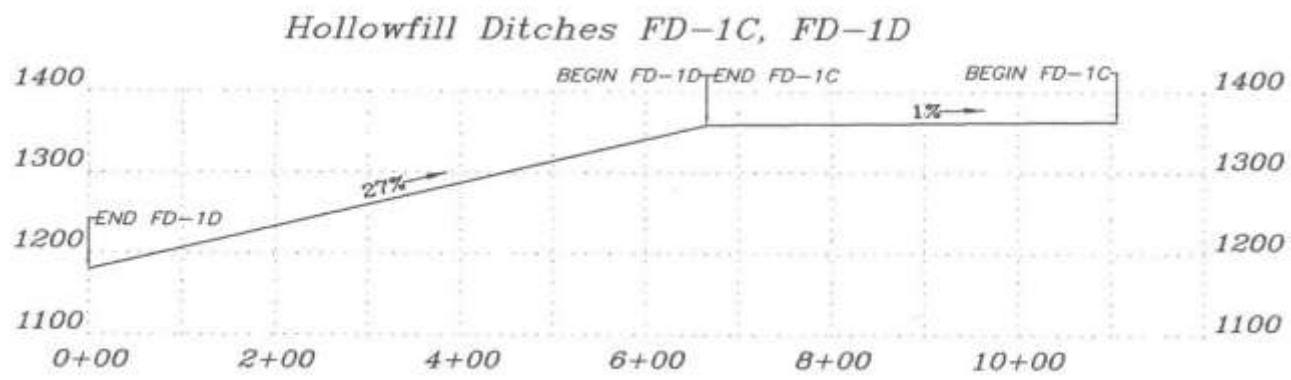
VALLEY FILL CROSS-SECTIONS





DIVERSION DITCHES for FILL





Valley Fill: Sub-Drainage System

- Shall consist of non-degradable, non-acid or toxic forming rock, such as sandstone, limestone, or rock that will not slake in water and will be free of *coal, clay or shale*
- Located along natural drainage system
- Extends from toe to head of fill
- Place lateral drains to each area of potential drainage or seepage

Example of Non-Durable Rock

Example of Non-Degradable Rock

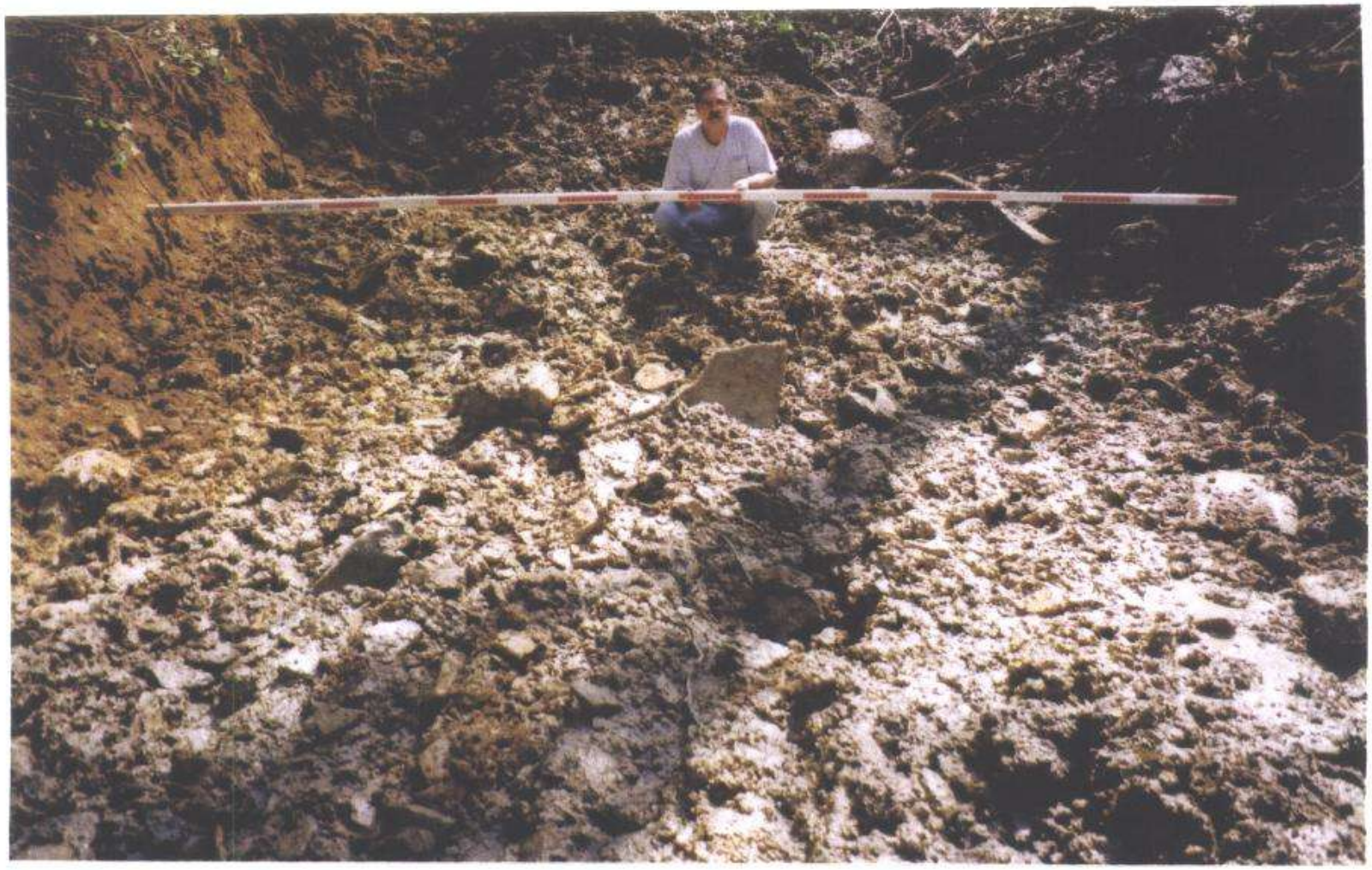
Valley Fill Under-drains

- In addition a durable rock, a corrosion resistant, long-term life, perforated pipe under-drain is acceptable
- The system shall be designed to carry anticipated seepage due to rainfall and water from seeps and springs in the foundation of the disposal area
- System protected from piping & contamination by an adequate filter

Rock-Core Chimney Drains

- *NOTE:* A rock-core may be used in a valley fill if the fill does not exceed 250,000 cubic yards of material and upstream drainage is diverted around the fill
- Common Fill Construction in TENNESSEE Uses a Rock-Drainage Blanket Under-drain, Regardless of Size

Total amount of Fill Material	Predominant type of fill material	Maximum size of drain width in feet	Maximum size of drain height in feet
Less than 1,000,000 cubic yards	Sandstone	10 feet	4 feet
Do……	Shale	16 feet	8 feet
More than 1,000,000 cubic yards	Sandstone	16 feet	8 feet
Do……	Shale	16 feet	16 feet



EXCAVATED CHANNEL WIDTH

EXCAVATED CHANNEL DEPTH

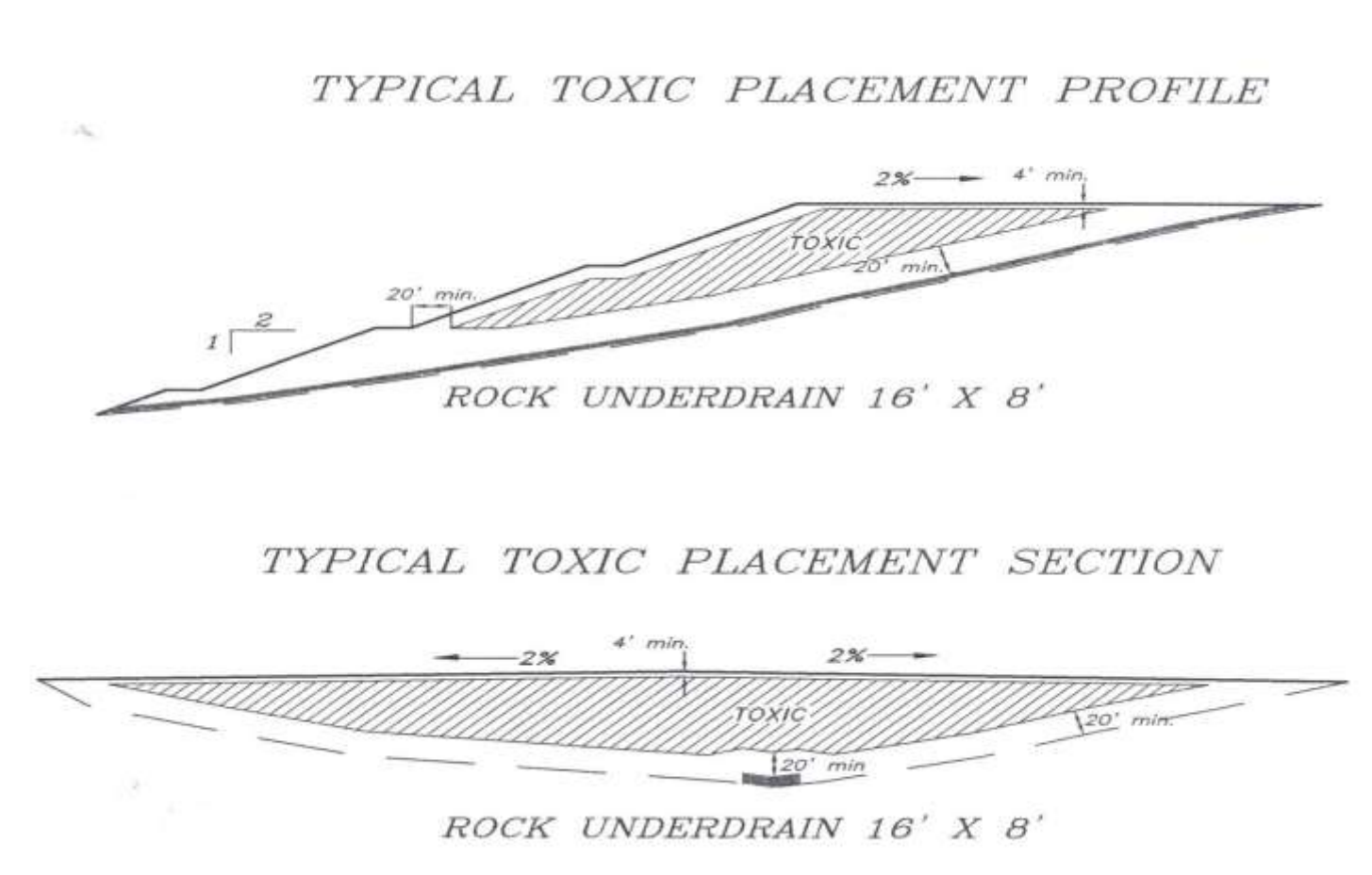
Valley Fill: Spoil Placement

- Controlled and Compacted Placement of Excess Spoil
- Ensure mass stability
- Prevent mass movement
- Avoid contamination of the rock under-drain
- Prevent formation of voids

Excess Material is Acid-or-Toxic Forming

- Such material shall be adequately covered with nonacid, nontoxic and noncombustible material, or treated, to control the impact on surface and ground water, per 30 CFR 816.41

TOXIC MATERIALS Within a FILL



HEAD-of-HOLLOW FILLS

- Material placed in the uppermost reaches of a hallow
- Side slopes of fill at steepest point < 20
- Profile from top to toe of fill < 10
- > 250,000 cy, top of fill @ coal elevation
- All others, top of fill @ elevation of adjacent ridge line
- No significant natural drainage occurs above the fill, so as to drain into it

DURABLE ROCK FILLS

- Fill Construction by Gravity Placement if Spoil is 80%, by Volume, Durable, Non-Acid/Toxic Rock
- Long Term Safety Factor of 1.5 & Seismic of 1.1
- Underdrain Constructed by Natural Segregation
- Diversion Channels Designed to meet a 100-year, 6-hour Precipitation Event

Pre-EXISTING BENCH FILLS

- Vegetation & Organic Materials, plus Topsoils Removed from Site
- Long Term Safety Factor of 1.3 for all portions
- Achieve Most Moderate Slope, Maximum Highwall Elimination & Minimize Off-Site Effects
- Prevent Water Infiltration & Ensure Stability
- See §816.74 Disposal of Excess Spoil

30 CFR Part 780
Min. Requirements for R & O Plan
780.35 Disposal of Excess Spoil

- Maps & cross-sections of the proposed site, plus description of the process, including maintenance & removal if appropriate
- Geotechnical investigation
- Access the need for a rock-toe buttress or key-way cut

GEOTECHNICAL INVESTIGATION INCLUDES

- Bedrock character & any adverse conditions
- Survey of all springs, seepage & ground water flows seen or anticipated
- Potential effects of subsidence
- Overall stability analysis

Check-list for Item 57A of the Tennessee Program Permit Application

- Ensure that plans follow sound engineering principles and meet the requirements of the performance standards
- Consider the following:
- 1: logs of borings
- 2: depth of bedrock and hardness
- 3: location of slippage planes
- 4: slope of finished face
- 5: internal drainage – piping possibility, & seepage planes

Cont. Check-list

- ---- the following:
- 6: stability of abutment
- 7: foundation uplift pressures
- 8: Additional considerations:
  - bedding planes
  - solution cavities
  - fissures and clay seams
  - joints
  - faults

TN PERMIT ITEM 57

Disposal of Excess Spoil, Coal Processing Waste & Underground Development Waste

- Permanent or Temporary
- Permanent requires cy generated & swell factor + cy to be placed in fill
- Describe construction, placement, operation, maintenance, & methods for transport & stabilization
- Minimize potential adverse impacts to all waters, include acid-forming/toxic materials

TN PERMIT ITEM 57 Continued

- Geo-Tech Investigation: bedrock, soils & adverse site conditions, springs, seepage, & groundwater flow during wet periods
- Potential effects of subsidence
- Description of rock chimney cores or rock drainage blanket
- Stability analysis
- Needs of rock-toe-buttresses or key-way cuts
- Type of FILL

TN PERMIT ITEM 58
Combustible & Toxic-Forming Materials Control

- Describe Acid/Toxic Material Handling
- Materials stored on Permit: how are these materials stored &/or disposed regarding surface & ground waters, prevent combustion, & minimize adverse effects on plant growth

CONTEMPORANEOUS RECLAMATION

- Reclamation efforts, including but not limited to disposal, grading, topsoil replacement, and revegetation, on all areas that has been disturbed from and for excess spoil placement shall occur as contemporaneously as practicable

RECLAMATION: Continued
per 30 CFR 816.22

- Organic material may be used as mulch, or included in the salvaged topsoil
- Once a lift is graded, the surface is covered with topsoil or substitute material
- The final configuration shall be suitable for the approved land use
- Small depressions may be allowed by the RA, if required, and not incompatible with the stability of the fill

THANK YOU

Virginia Department of Mines Minerals and Energy

VALLEY FILL PERMITTING REQUIREMENTS IN VIRGINIA

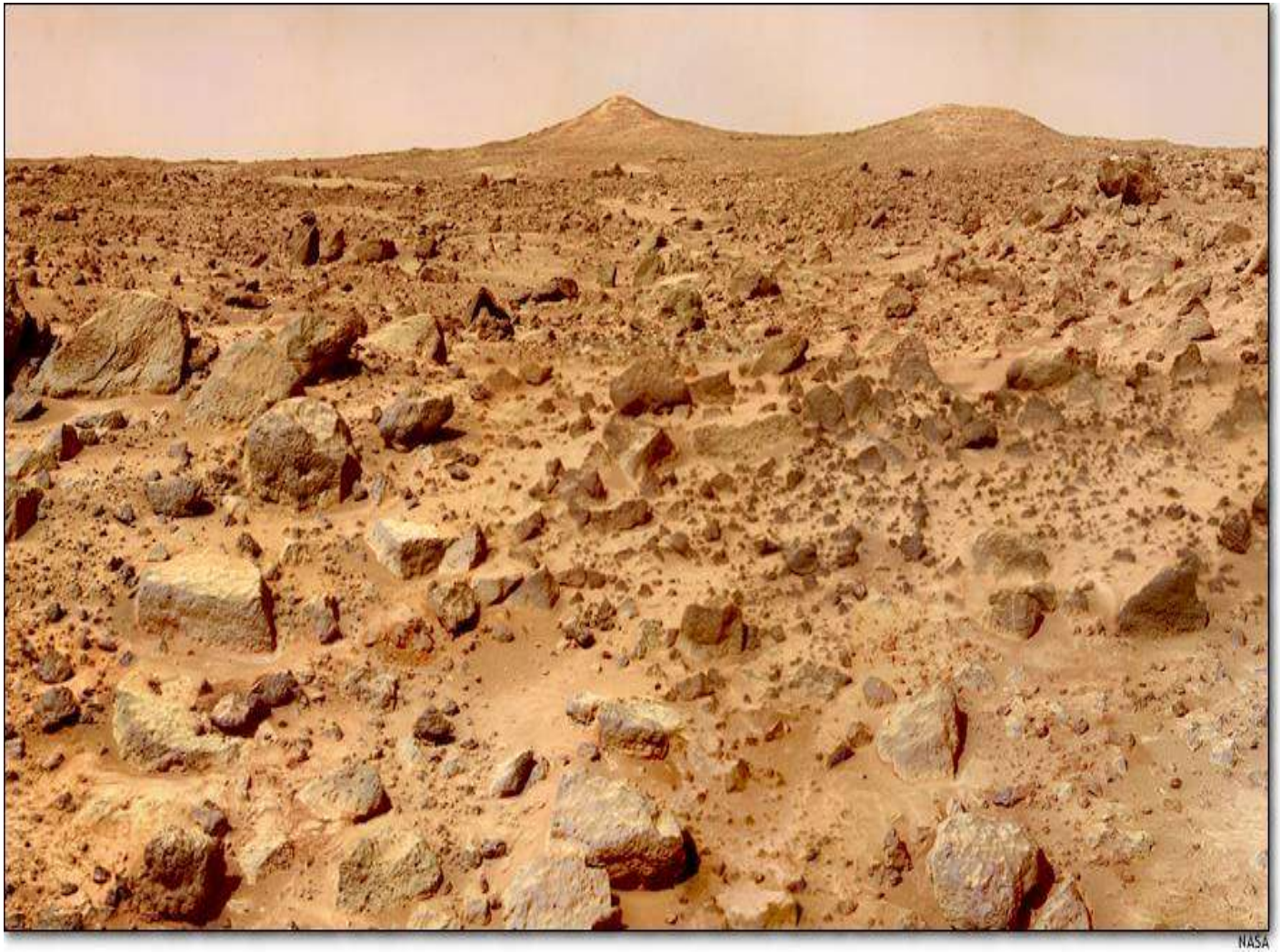
GERALD D. COLLINS, P.E.

TECHNICAL SERVICES MANAGER

DMLR TECHNICAL SECTION

- **Permit Review**
  During the permit application review process, the Technical Services Unit works with applicants and their consultants to ensure proposed coal mining activity can be conducted in an environmentally sound manner in compliance with Virginia's coal mining reclamation laws and regulations. Technical Services staff, with assistance from the Reclamation Services Unit, **conduct field reviews, evaluate permit application plans**, check **applicant violation history** data to determine permit eligibility, conduct public meetings and respond to comments, and finally, make a determination to either issue a permit or deny the application. DMME's Division of Mined Land Reclamation (DMLR) issues a joint CSMO and National Pollutant Discharge Elimination System (NPDES) permit. A **standard application form** is utilized to allow electronic permitting to be conducted.

VALLEY FILL – BEFORE MINING



VALLEY FILL – AFTER MINING

7/30/2001

General Excess Spoil Fill Requirements

General. Excess spoil shall be placed in **designated disposal areas within the permit area, in a controlled manner to-**

- Minimize the adverse effects of leachate and surface water runoff from the fill on surface and ground waters;
- Ensure mass stability and prevent mass movement during and after construction; and
- Ensure that the final fill is suitable for reclamation and revegetation compatible with the natural surroundings and the approved postmining land use.

Certifications

Design certification.

- The fill and appurtenant structures shall be designed using current, prudent engineering practices and any criteria established by the division as necessary to achieve the standards of this Part. A qualified registered professional engineer experienced in the design of earth and rock fills shall certify the design of the fill and appurtenant structures.
- The fill shall be designed to attain a minimum long-term static safety factor of 1.5. The foundation and abutments of the fill must be stable under all conditions of construction.

FOUNDATION INVESTIGATIONS

- Sufficient foundation investigations, as well as any necessary laboratory testing of foundation material, shall be performed in order to determine the design requirements for foundation stability. The analyses of foundation conditions shall take into consideration the effect of underground mine workings, if any, upon the stability of the fill and appurtenant structures.

PLACEMENT OF SPOIL

- All vegetative and organic materials shall be removed from the disposal area prior to placement of the excess spoil. Topsoil shall be removed, segregated and stored or redistributed in accordance with 4VAC25-130-816.22. If approved by the division, organic material may be used as mulch or may be included in the topsoil to control erosion, promote growth of vegetation or increase the moisture retention of the soil.

3/11/2003

LIFT THICKNESS

- Excess spoil shall be transported and placed in a controlled manner in horizontal lifts not exceeding **four feet in thickness**; concurrently compacted as necessary to ensure mass stability and to prevent mass movement during and after construction; graded so that surface and subsurface drainage is compatible with the natural surroundings; and covered with topsoil or substitute material in accordance with 4VAC25-130-816.22. **The division may approve a design which incorporates placement of excess spoil in horizontal lifts greater than four feet in thickness when it is demonstrated by the permittee and certified by a qualified registered professional engineer that the design will ensure the stability of the fill and will meet all other applicable requirements**.

SLOPES/TERRACES

- The final configuration of the fill shall be suitable for the approved postmining land use. **Terraces may be constructed** on the outslope of the fill if required for stability, control of erosion, to conserve soil moisture, or to facilitate the approved postmining land use. The **grade of the outslope between terrace benches shall not be steeper than 2h:1v (50 percent**). **Terraces, if constructed, shall be no less than 20 feet in width and the vertical distance between terraces shall not exceed 50 feet**. Terraces on the fill shall be **graded with a minimum 3.0% grade toward the fill and a minimum 1.0% slope toward the drainage control system.**

ACID/TOXIC MATERIALS

- Excess spoil that is acid- or toxic-forming or combustible shall be adequately covered with nonacid, nontoxic and noncombustible material, or treated, to control the impact on surface and ground water in accordance with 4VAC25-130-816.41, to prevent sustained combustion, and to minimize adverse effects on plant growth and the approved postmining land use.

UNDERDRAINS

- Underdrains shall consist of **durable rock** or pipe, be designed and constructed using current, prudent engineering practices and any criteria established by the division as necessary to achieve the standards of this Part. The underdrain system shall be **designed to carry the anticipated seepage of water due to rainfall away from the excess spoil fill and from seeps and springs in the foundation of the disposal area and shall be protected from piping and contamination by an adequate filter.** Rock underdrains shall be constructed of **durable, nonacid-, nontoxic-forming rock** (e.g., natural sand and gravel, sandstone, limestone, or other durable rock) that does not slake in water or degrade to soil material, and which is free of coal, clay or other nondurable material. Perforated pipe underdrains shall be corrosion resistant and shall have characteristics consistent with the long-term life of the fill.

INSPECTIONS/CERTIFICATIONS

- Inspections. **A qualified registered professional engineer, or other qualified professional specialist under the direction of the professional engineer**, shall periodically inspect the fill during construction. The professional engineer and specialist shall be experienced in the construction of earth and rock fills.
- Such inspections shall be made **at least quarterly throughout construction and during critical construction periods**. Critical construction periods shall include at a minimum: (i) **Foundation preparation**, including the removal of all organic material and topsoil; (ii) **placement of under drains** and protective filter systems; (iii) installation of final surface drainage systems; and (iv) the final graded and revegetated fill. Regular inspections by the engineer or specialist shall also be conducted during placement and compaction of fill materials.

VALLEY FILLS

- Valley fills and head-of-hollow fills shall meet the requirements of 4VAC25-130-816.71 and the additional requirements of this section.
- Drainage control:

The top surface of the completed fill shall be graded such that the **final slope after settlement will be toward properly designed drainage channels**. Uncontrolled surface drainage may not be directed over the outslope of the fill. **The maximum slope of the top of the fill shall be 20h:1v (5.0%).**

DIVERSION DITCHES

Runoff from areas above the fill and runoff from the surface of the fill shall be diverted into stabilized diversion channels designed to meet the requirements of 4VAC25-130-816.43 and, in addition, to safely pass the runoff from a **100-year, 6-hour precipitation event**. The appropriate surface drainage system shall be installed prior to placement of excess spoil in the fill area. Temporary diversions may be approved by the division for use during fill construction provided that erosion is minimized and no threat to the public or the environment results.

7/30/2001

UNDERDRAIN SIZING

- Total Amt. Of Fill | Predominant Rock | Size of Drain

Total Amt. Of Fill	Predominant Rock	Size of Drain
Less than 1 M CY	Sandstone	10′ x 4′
	Shale	16′ x 8′
More than 1 M CY	Sandstone	16′ x 8′
	Shale	16′ x 16′

- No more than 10 percent of the rock used in the underdrains may be less than 12 inches in size and no single rock may be larger than 25 percent of the width of the drain

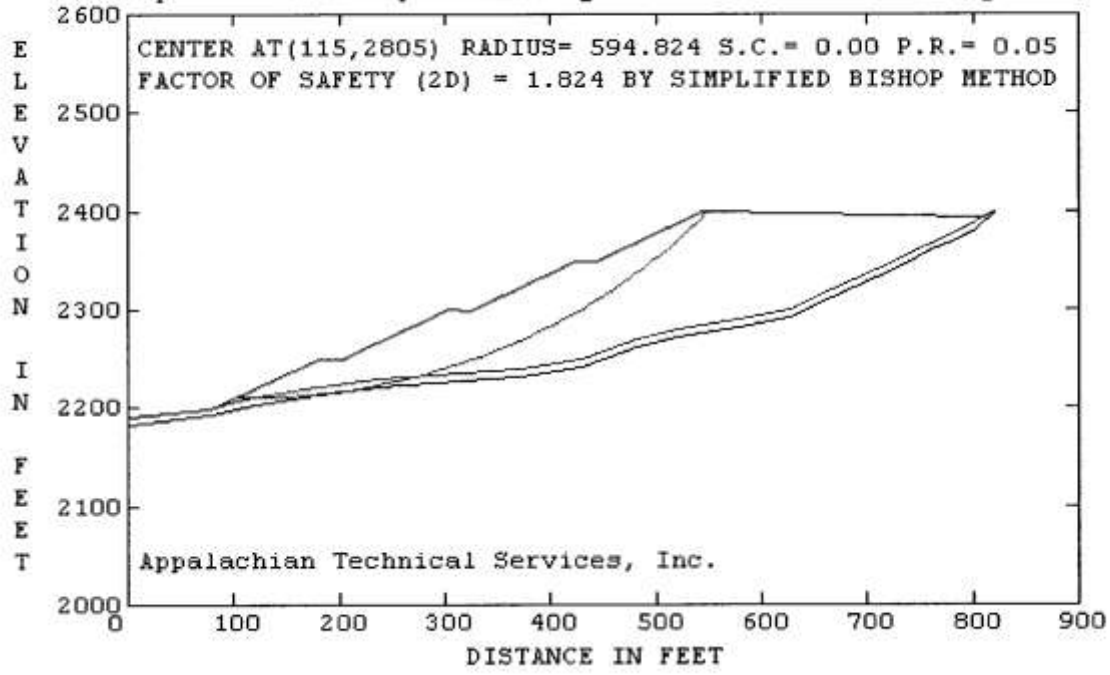
DURABLE ROCK FILLS

Disposal of excess spoil; durable rock fills:

The division may approve the **alternative method** of disposal of excess durable rock spoil by gravity placement in **single or multiple lifts**, provided the following conditions are met:

- The excess spoil **consists of at least 80 percent, by volume, durable nonacid-and nontoxic-forming rock** (e.g., sandstone or limestone) that does not slake in water and will not degrade to soil material. Where used, noncemented clay shale, clay spoil, soil or other nondurable excess spoil materials shall be mixed with excess durable rock spoil in a controlled manner such that no more than 20 percent of the fill volume, as determined by tests performed by a registered engineer and approved by the division, is not durable rock.
- **The fill is designed to attain a minimum long-term static safety factor of 1.5, and an earthquake safety factor of 1.1.**

Nine Mile Spur LLC Strip #2 Project #0316.01 Valley Fill 2



DURABLE ROCK FILL UNDERDRAINS

The underdrain system may be constructed simultaneously with excess spoil placement by the **natural segregation of dumped materials**, provided the resulting underdrain system is capable of carrying anticipated seepage of water due to rainfall away from the excess spoil fill and from seeps and springs in the foundation of the disposal area and the other requirements for drainage control are met.

DIVERSION DITCHES

- Surface water runoff from areas adjacent to and above the fill is not allowed to flow onto the fill and is diverted into stabilized diversion channels designed to meet the requirements of 4VAC25-130-816.43 and to safely pass the runoff from a **100-year, 6-hour precipitation event.** The appropriate surface drainage system shall be installed prior to placement of excess spoil in the fill area. Temporary diversions may be approved by the division for use during fill construction, provided that erosion is minimized and no threat to the public or the environment results.

Revised Durable Rock Fill Construction Methods

Jim Pierce, P.E. – Mining and Reclamation
March 30, 2004

Regulatory Basis

The justification for strengthening the regulations is based upon more than just the Lyburn event. Case studies of 49 other traditional “end-dumped” fills provide anecdotal and scientific evidence demonstrating significant erosion problems. These fill “washouts” highlight the inadequacies of the prior regulations.

Fill Design Issues

- Unpredictable Gradation of Durable Rock Fill Material
- Wide Variability of Durable Rock Material Physical Characteristics
- Topographical and Mining Method Influences upon Fill Configurations

Durable Rock Fill Construction Methods

- Constructed from the toe upward (Bottom-Up Method)
- Constructed by end dumping with an **E**rosion **P**rotection **Z**one (EPZ Method)

Does Bottom-up Construction Work to Reduce Erosion?

Prior to this regulatory change, various companies have already been employing bottom-up construction techniques. Over 100 valley fills have been designed and constructed based upon this method. No documented washouts have resulted from these bottom-up constructed fills. Rarely, does a sediment pond need cleaned.

Bottom-Up Construction Method

Approved Rules Addressing Durable Rock Fill Construction Methods (Bottom-Up)

14.14.g.3. Design Specifications and Requirements for Durable Rock Fills designed to be reclaimed from the toe upward. Durable rock fills that are designed to be reclaimed from the toe upward shall comply with all requirements of this subdivision including the following:

14.14.g.3.A. Transportation of Material to toe of fill. The method of transporting material to the toe of the fill shall be specified in the application and shall include a plan for inclement weather dumping. The means of transporting material to the toe may be by any method authorized by the Act and this rule and is not limited to the use of roads.

14.14.g.3.A.1. Constructed roads shall be graded and sloped in such a manner that water does not discharge over the face. Sumps shall be constructed along the road in switchback areas and shall be located at least 15 feet from the outslope.

Approved Rules Addressing Durable Rock Fill Construction Methods (Bottom-Up)

14.14.g.3.A.2. The constructed road shall be in compliance with all applicable State and Federal safety requirements. The design criteria to comply with all applicable State and Federal safety requirements shall be included the permit.

14.14.g.3.B. Once the necessary volume of material has been transported to the toe of the fill, face construction and installation of terraces and permanent drainage shall commence. The face construction and reclamation of the fill shall be from the bottom up with progressive construction of terraces and permanent drainage in dumping increments not to exceed 100 feet.

EPZ Construction Method

Comprised of two parts:

1. ***E***rosion ***P***rotection ***Z***one
2. Single Lift Placement Zone

Approved Rules Addressing Durable Rock Fill Construction Methods (EPZ Method)

14.14.g.2.B. Single Lift Construction Requirements.

14.14.g.2.B.1 Excess spoil disposal shall commence at the head of the hollow and proceed downstream to the final toe. Unless required for construction of the underdrain, there shall be no material placed in the fill from the sides of the valley more than 300 feet ahead of the advancing toe. Exceptions from side placement of material limits may be approved by the Secretary if requested and the applicant can demonstrate through sound engineering that it is necessary to facilitate access to the head of the hollow or otherwise facilitates fill stability or erosion control.

14.14.g.2.B.2. During construction, the fill shall be designed and maintained in such a manner as to prevent water from discharging over the face of the fill.

Wing Dumping Example

Approved Rules Addressing Durable Rock Fill Construction Methods (EPZ Method)

14.14.g.2.B.2.(a) The top of the fill shall be configured to prevent water from discharging over the face of the fill and to direct water to the sides of the fill.

14.14.g.2.B.2.(b) Water discharging along the edges of the fill shall be conveyed in such a manner to minimize erosion along the edges of the fill.

14.14.g.2.B.3. Reclamation of the fill shall be initiated from the top of the fill and progress to the toe with concurrent construction of terraces and permanent drainage.

Approved Rules Addressing Durable Rock Fill Construction Methods (EPZ Method)

14.14.g.2. Design Specifications and Requirements of Single Lift Fills with an Erosion Protection Zone. In addition to the requirements of this subdivision, the design, specifications and requirements of single lift fills with an erosion protection zone shall be in accordance with the following:

14.14.g.2.A. Erosion Protection Zone.
The erosion protection zone is a designed structure constructed to provide energy dissipation to minimize erosion vulnerability and may extend beyond the designed toe of the fill.

14.14.g.2.A.1. The effective length of the erosion protection zone shall be at least one half the height of the fill measured to the target fill elevation or fill design elevation as defined in approximate original contour procedures and shall be designed to provide a continuous underdrain extension from the fill through and beneath the erosion protection zone.

Approved Rules Addressing Durable Rock Fill Construction Methods (EPZ Method)

14.14.g.2.A.2. The height of the erosion protection zone shall be sufficient to accommodate designed flow from the underdrain of the fill and shall comply with 14.14.e.1. of this rule.

14.14.g.2.A.3. The erosion protection zone shall be constructed of durable rock as defined in 14.14.g.1. originating from the permit area and shall be of sufficient gradation to satisfy the underdrain function of the fill.

14.14.g.2.A.4. The outer slope or face of the erosion protection zone shall be no steeper than two (2) horizontal or one (1) vertical (2:1). The top of the erosion protection zone shall slope toward the fill at a three (3) to five (5) percent grade and slope laterally from the center toward the sides at one (1) percent grade to discharge channels capable of passing the peak runoff of a one-hundred (100) year, twenty-four (24) hour precipitation event.

Approved Rules Addressing Durable Rock Fill Construction Methods (EPZ Method)

14.14.g.2.A.5. Prior to commencement of single lift construction of the durable rock fill, the erosion protection zone must be seeded and certified by a registered professional engineer as a critical phase of fill construction. The erosion protection zone shall be maintained until completion of reclamation of the fill.

14.14.g.2.A.6. Unless otherwise approved in the reclamation plan, the erosion protection zone shall be removed and the area upon which it was located shall be regraded and revegetated in accordance with the reclamation plan.

EPZ Design

1. The erosion protection zone development area must be constructed and vegetated to create the erosion protection zone prior to end-dump fill placement from the head of the hollow.

2. This area must be constructed of durable rock and be of sufficient height and gradation to ensure adequate underdrain function for the valley fill. The toe of this area can extend beyond the toe of the valley fill.

3. The EPZ must provide a continuous underdrain from the valley fill. An underdrain must be established and certified as a critical phase of construction prior to end-dump placement of spoil.

EPZ Design

4. The erosion protection zone must provide adequate energy dissipation during the end-dump operation by providing adequate length. This length is to be based upon one-half of the height of the fill measured from fill toe to the fill's final design elevation or target fill elevation.

5. The deck of the erosion protection zone must be sloped toward the fill at a three (3) to five (5) percent grade. Reclamation of the end-dump zone must proceed from the top down with terraces being constructed in the process.

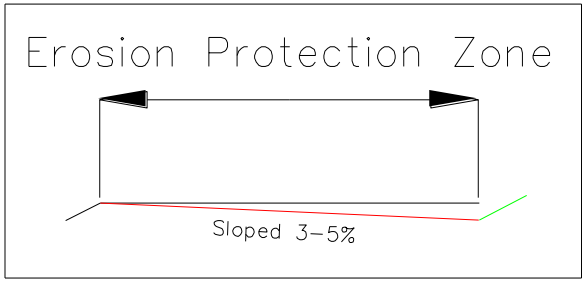
6. Durable rock fills constructed by the EPZ method must have diversion channels around their periphery instead of center channels.

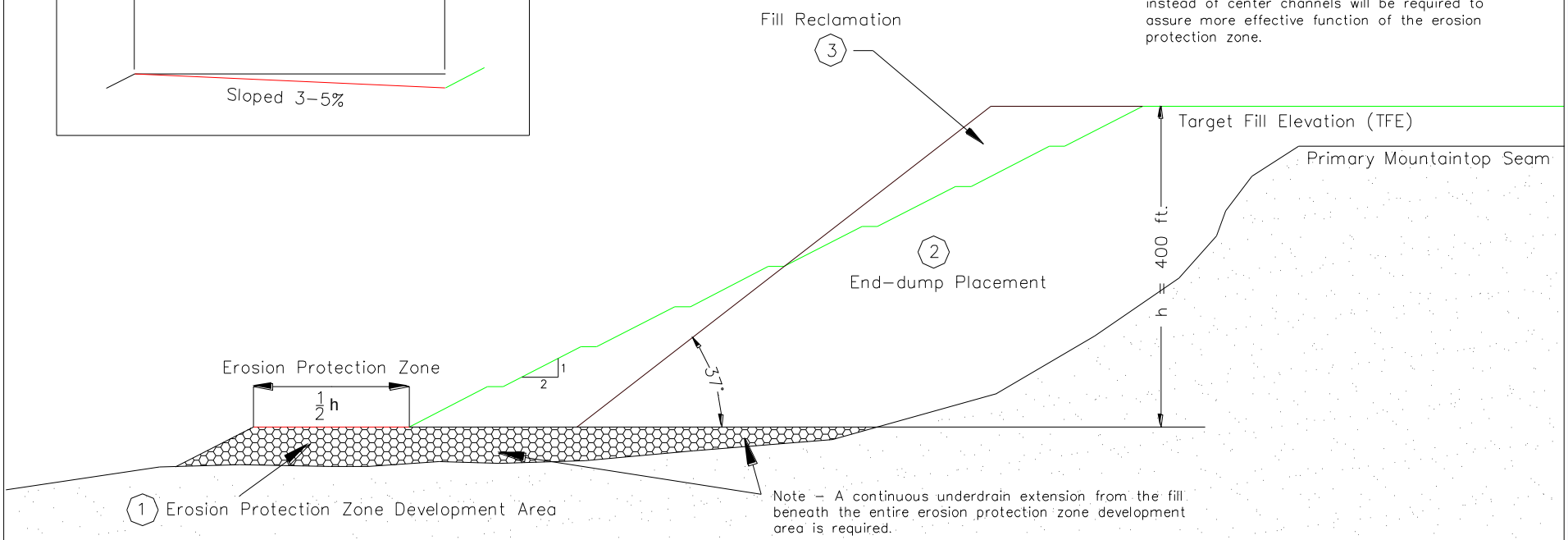
Construction Notes

Terraces will be constructed in accordance with the rules requiring a minimum width of twenty (20) feet, a three (3) to five (5) percent slope toward the fill, and a one (1) percent lateral slope to drainage channels around the fill.

The reclaimed top portion of the fill will be sloped up to five (5) percent toward the back of the fill as required by the rules.

Constructed diversion channels around the fill instead of center channels will be required to assure more effective function of the erosion protection zone.





Construction Sequence

1. Perform foundation preparation, then construct the erosion protection zone (EPZ) development area comprised of suitable durable rock and of sufficient height to form a functional underdrain system and create the EPZ. The length of the created EPZ is to be equal one–half the height of the fill as measured from its toe to the target fill elevation. These areas are to be seeded prior to end–dump placement.

2. Begin end–dump placement from the head of the hollow.

3. Once the projected fill volume is achieved, begin reclamation of the fill by pushing down and constructing terraces progressively. Any remaining portion of EPZ downstream of the reclaimed valley fill must either be removed or meet appropriate criteria to be left as permanent.

West Virginia Department of Environmental Protection
10 McJunkin Road
Nitro, WV 25143

Erosion Protection Zone (EPZ) Construction Method for Durable Rockfills

Drawn By: jbp
File: d:\Autodesk Map 5 \bottom-up \alt_epz.dwg
Date: January 21, 2003
Scale: 1" = 200'

Cut/Fill Rehandle (Unit Width Analysis)

$\sin 37° = \frac{1/2 h}{x}$

$x = .83082$

$\cos 37° = \frac{a}{x}$

$a = .66352$

$\sin 22.6197° = \frac{1/2 h}{y}$

$y = 1.3h$

$\cos 22.6197° = \frac{a+b}{y}$

$b = 1.2h - a = .53648h$

$$\text{Volume} = \tfrac{1}{2}(a+b)(\tfrac{1}{2}h) - \tfrac{1}{2}(a)(\tfrac{1}{2}h)$$
$$= \cancel{\tfrac{1}{4}ah} + \tfrac{1}{4}bh - \cancel{\tfrac{1}{4}ah}$$
$$= \tfrac{1}{4}bh$$

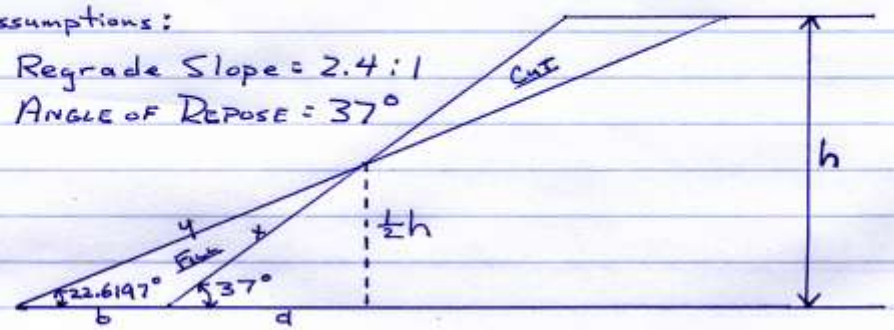
Since $b = .53648h$

$$\boxed{\text{Volume} = .13412\,h^2}$$

Assumptions:

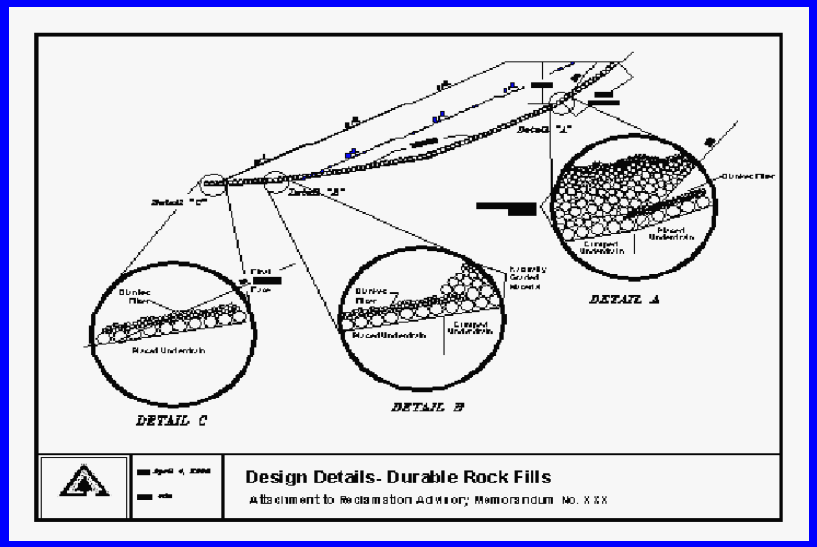
Regrade Slope = 2.4 : 1

Angle of Repose = 37°



ARCC-OSMRE Valley Fill Workshop

Kentucky Valley Fill Permitting Requirements



Presented by:

Gary M. Gilliam, P.E.

Environmental Engineering Consultant

Division of Permits

Topics to Be Addressed:

- Types of Excess Disposal Fills
- General Information regarding our permitting process
- Siting Considerations, such as Water Resources, Cultural/Historic Resources, Threatened/Endangered Species, etc.
- Technical Considerations during the permitting process
- Recent Initiatives addressing design, construction, sediment control/flooding, and enforcement

Regulatory Citations

TITLE 30--MINERAL RESOURCES THE INTERIOR PART 701--PERMANENT REGULATORY PROGRAM--Table of Contents Sec. 701.5 Definitions.

Valley fill means a fill structure consisting of any material, other than organic material, that is placed in a valley where side slopes of the existing valley, measured at the steepest point, are greater than 20 degrees, or where the average slope of the profile of the valley from the toe of the fill to the top of the fill is greater than 10 degrees.

Head-of-hollow fill means a fill structure consisting of any material, other than organic material, placed in the uppermost reaches of a hollow where side slopes of the existing hollow, measured at the steepest point, are greater than 20 degrees or the average slope of the profile of the hollow from the toe of the fill to the top of the fill is greater than 10 degrees. In head-of-hollow fills the top surface of the fill, when completed, is at approximately the same elevation as the adjacent ridge line, and no significant area of natural drainage occurs above the fill draining into the fill area.

From 405 KAR 16:001, Section 1. Definitions.

(124) "Valley fill" means a fill structure consisting of any material other than coal waste and organic material that is placed in a valley where side slopes of the existing valley measured at the steepest point are greater than twenty (20) degrees or the average slope of the profile of the valley from the toe of the fill to the top of the fill is greater than ten (10) degrees.

(43) "Head-of-hollow fill" means a fill structure consisting of any material, other than coal processing waste and organic material, placed in the uppermost reaches of a hollow near the approximate elevation of the ridgeline, where there is no significant natural drainage area above the fill, and where the side slopes of the existing hollow measured at the steepest point are greater than twenty (20) degrees or the average slope of the profile of the hollow from the toe of the fill to the top of the fill is greater than ten (10) degrees.

Regulatory Provisions (405 KAR 16:130):

Our regulations, like the Federal regulations, make provisions for several broad categories of excess spoil storage

-Spoil Banks-General

-All spoil disposal facilities not meeting other criteria listed below

-Head of hollow fills

- steeply sloping sides, located at the top of the drainage basin

-Valley Fills

- steeply sloping sides, located lower in the drainage basin

-Disposal on Existing Benches

-regulations patterned to mirror backfill regulations

-Underground disposal

- Excess spoil may be disposed of in underground mine workings but only in accordance with a plan approved by the cabinet and MSHA, and in accordance with the requirements for underground disposal of coal processing waste under 405 KAR 8:040, Section 27.

Variations provided by regulation:

- End-Dump method of construction
  - Placement of durable material by gravity placement in a single lift
  - Underdrain formation by natural segregation
  - By far the most common fill construction technique proposed
- Development of rock core chimney drains
  - Can be used in lieu of a more traditional sub-drain or underdrain system)
  - Allows for alternative drainage patterns atop the fill
  - This alternative is very seldom seen in applications submitted to Division of Permits
- Underground Development Waste
  - may be disposed of in excess spoil fills, if certain criteria are met
- Coal Processing Waste
  - The regulations are specific that such waste “shall not be disposed of in fills designed and approved for excess spoil”.

A Total of 8,678 * Excess Spoil Disposal Facilities in Kentucky's Jurisdiction

- **During the life of the Kentucky surface mine regulatory program, a total of 7,910 Valley Fills or Hollow Fills have been reviewed**
  - **Standard compaction or end-dump facilities**
- **Our records show an additional 551 spoil banks or bench type fill areas**
- **Total Number of Permits- 2,379 * ***
  - **This total includes both Surface Mining Operations and Surface Effects of Underground Mining**
  - **Overall, these reflect an average of about four excess disposal areas per permit.**

* This is the total number of fills reviewed and approved, but does not necessarily reflect the total number of structures constructed in the field.

* * About 2000 of these permits are "inspect-able". The others have obtained complete release, undergone forfeiture, or in some way have been removed from our jurisdiction.

From statistics compiled by OSMRE-LFO, during calendar 2002;

- The average fill associated with surface mining operations occupies 12.69 acres, housing slightly more that 1.5 MCY of spoil, and lays in a watershed totaling 51.3 acres of drainage area.
- The average fill associated with underground mining operations occupies 5.89 acres, housing slightly more that 400,000 CY of spoil, and lays in a watershed totaling 38.1 acres of drainage area.
- Sixty-eight (68) percent of all fills permitted in Kentucky during 2002 lay in a watershed of less than 50 acres.
- Only one percent of all fills (3 sites) were located in a watershed of greater than 250 acres. (This is down from a historic average of around five percent.)
- The trend, on average, in recent years has been towards smaller fills in smaller watersheds.

Permitting Process- Relevant to Valley Fills

- Preliminary Application/Pre-Mine Walk
  - Sites are reviewed by on-staff biologists and archaeologists
  - Check databases and consult with relevant state and Federal agencies dealing with T/E, cultural/historic resources, high value habitat, etc.
  - Site investigation, including assessment of stream quality (including biological as well as chemical)
  - Call for additional studies or surveys on an as-needed basis, including review, comment, and final approval of those studies/surverys.
- Completeness Process
  - General review of application, including ownership/control and ensuring that appropriate laboratory testing and baseline data are included
- Technical Review
  - Full assessment of overall operation, including a comprehensive review of environmental and technical issues associated with proposed valley fills

Technical Review Process- Relevant to Valley Fills

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

- Review of Geologic Data
  - Review of overburden material
  - Presence of durable material for underdrain and/or end-dump construction
  - Presence of potentially acidic material

- Detailed review of Spoil Calculations to determine accuracy of "Excess Spoil" estimate
  - Includes assessment of proposed backfill configuration and volumes, particularly for sites proposing a variance from AOC requirements
  - Assessment of projected swell factor (based on geology)
  - Delineation appropriate fill material handling, primarily involving delineation of durable/non-durable material

Technical Review Process- Relevant to Valley Fills (cont.)

- Review of Overall Configuration
  - Compliance with relevant slope and configuration drainage restrictions
  - Compliance with drainage requirements
    - Diversion ditch construction diverts water from fill area during material placement
    - Timing sequence of diversion ditch construction
    - 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.

- Assessment of structural stability
  - Material placement and grading requirements
    - Determining if keyway cuts are needed
    - Determine the predominant type of fill material and corresponding minimum underdrain size
    - Stability analysis showing the fill meets the required factor of safety, including appropriate moisture conditions (dependent on results of pre-development reconnaissance) ;

- Assessment of Construction and Reclamation Specifications
  - Construction Sequence and specifications (segregation, compaction, lines and grades)
  - Underdrain Placement
  - Final grading and terrace construction
  - Removal plans if proposed as a temporary structure
  - Applying topsoil or alternate material.

The Federal Draft Programmatic Environmental Impact Statement (EIS) delineated several "Issues of Concern" based on comments received during the "scoping" process. These were:

- Direct Stream Loss
- Stream Impairment
- Fill Minimization
- Assessing and Mitigating Stream and Aquatic Functions
- Cumulative Impacts
- Deforestation
- Blasting
- Air Quality
- Flooding
- Land Use
- Threatened and Endangered Species
- Scenery and Culturally Significant Landscapes
- Exotic and Invasive Species
- Valley Fill Stability
- Economics
- Environment Efficiency
- Government Efficiency

While this study dealt primarily with mountain top removal mining, a number the concerns noted had direct impact on valley fill permitting and construction.

Of the concerns listed, relating solely to valley fills, significant efforts are already made in our permitting process, or recent programmatic enhancements have been implemented, in the nine highlighted areas:

- ***Direct Stream Loss***
- ***Stream Impairment***
- ***Fill Minimization***
- Assessing and Mitigating Stream and Aquatic Functions
- ***Cumulative Impacts***
- ***Deforestation***
- Blasting
- Air Quality
- ***Flooding***
- ***Land Use***
- ***Threatened and Endangered Species***
- Scenery and Culturally Significant Landscapes
- ***Exotic and Invasive Species***
- ***Valley Fill Stability***
- Economics
- Environment Efficiency
- Government Efficiency

Issued on September 10, 2002, Reclamation Advisory Memorandum (RAM) #135 contained specific construction and design criteria to be included in all applications proposing durable rock fills.

This document provide guidance on requirements for underdrain construction, clearing/grubbing, rock check structures, stability, and a summary of the general information that will is required for permitting of an end-dump (durable rock) fill.

Kentucky
Department for Surface Mining
Reclamation and Enforcement

Reclamation Advisory Memorandum

RAM # 135

From: Carl E. Campbell, Commissioner C.E.C.
Date: September 10, 2002
Subject: Review of Durable Rock Fill Designs

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.

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.

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

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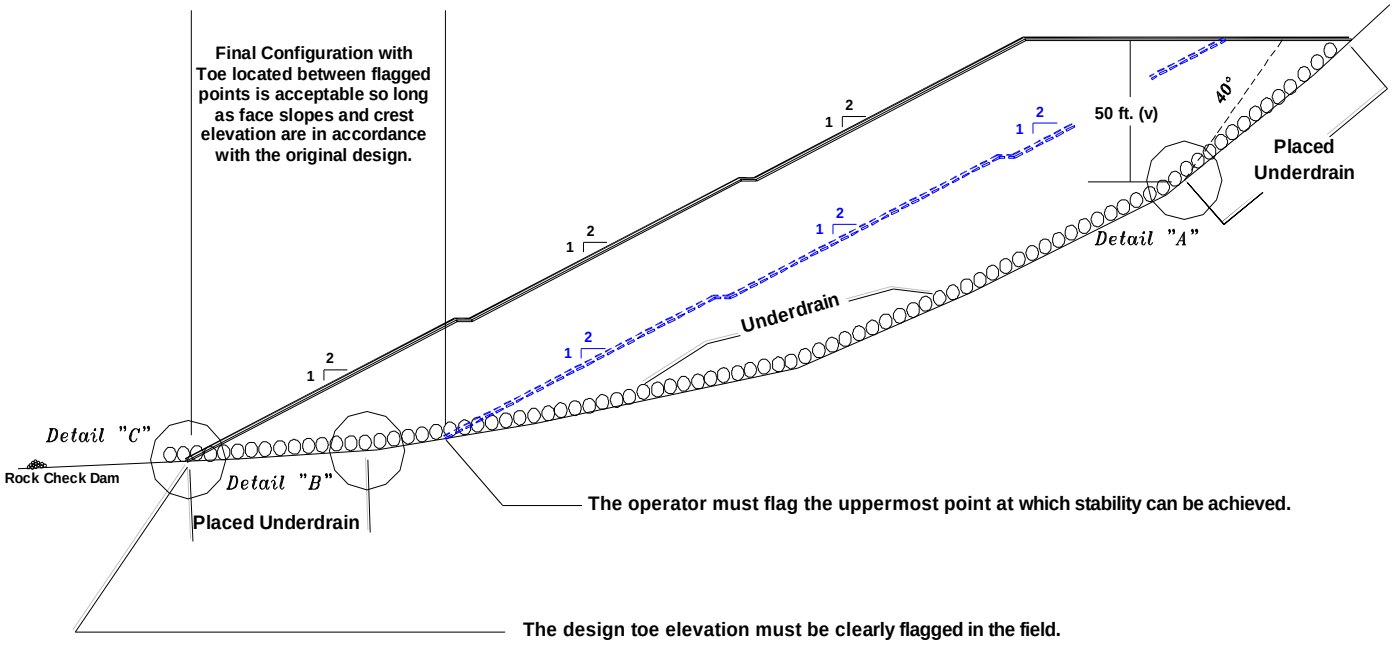
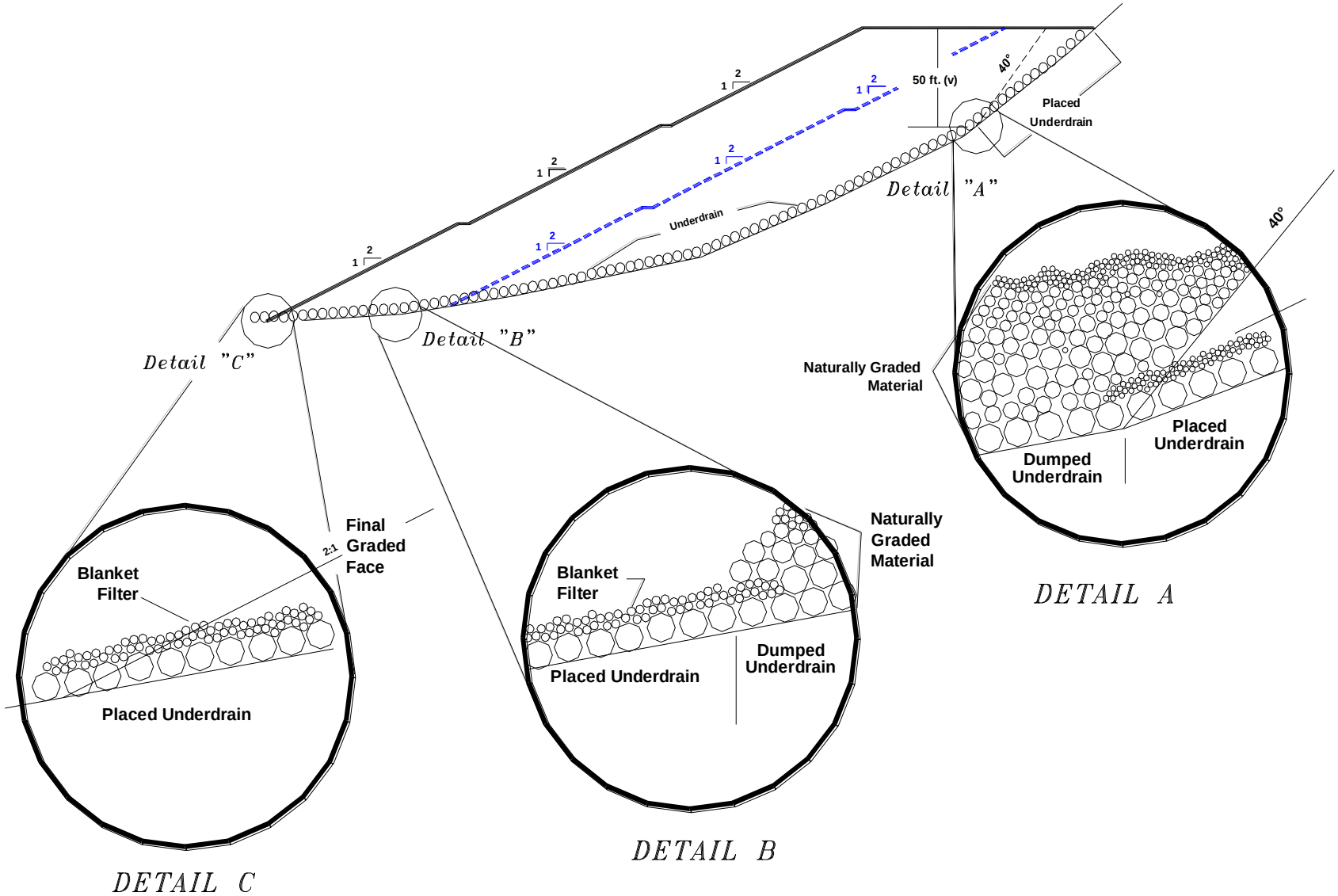
Detailed Profile from RAM #135

-A key requirement is the placement of the upper and lower segments of underdrain in end-dump fills

-An allowance is also provided for designation of an “uppermost” fill limit



Details of the Underdrain Placement Requirement (from RAM #135)



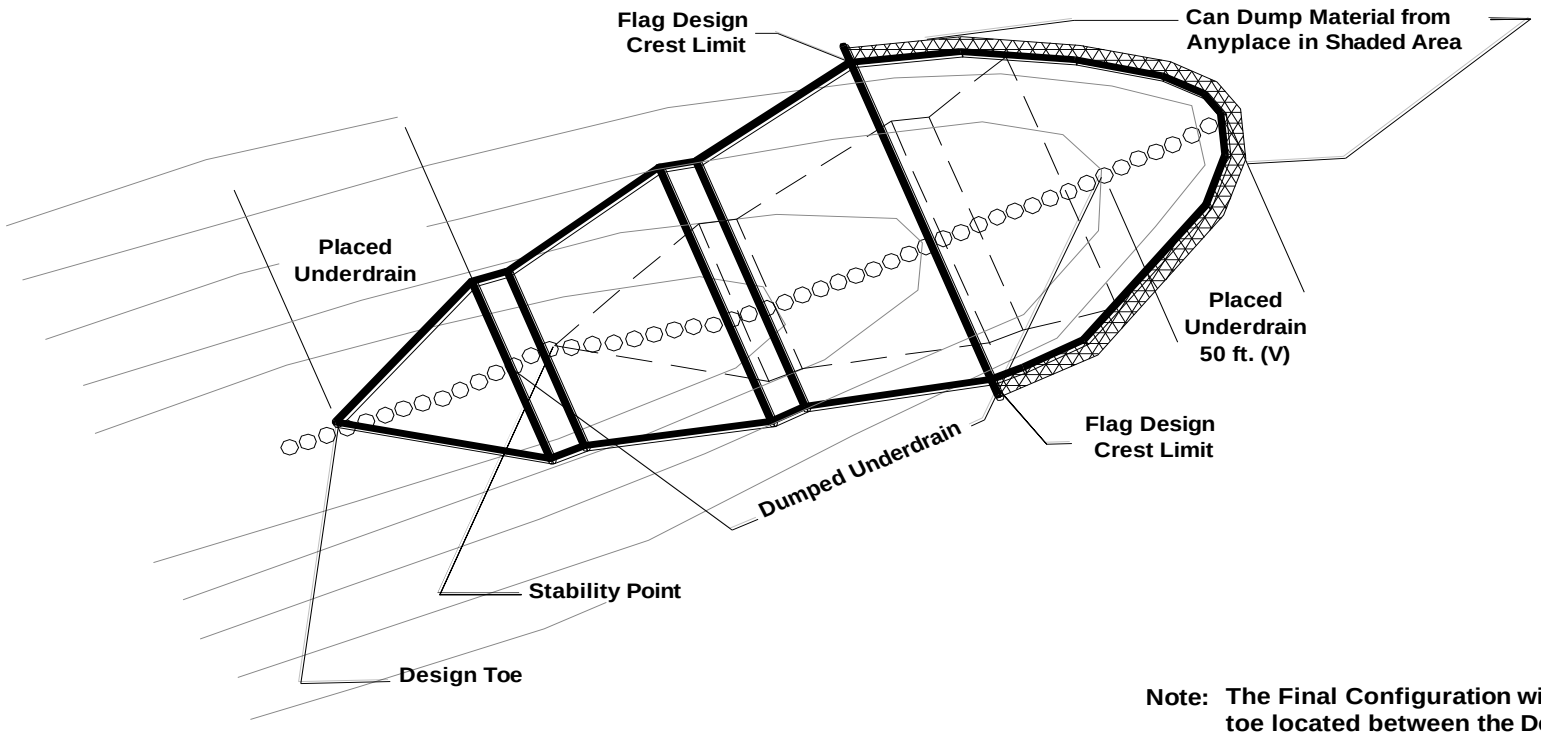
Other Technical Issues addressed in RAM #135

- **Clearing and Grubbing-** Progressive clearing and grubbing is strongly encouraged, so as to minimize the levels of active disturbance and early-term sedimentation

- **Rock Check Structures-** These are required below the toe of each fill by 405 KAR 16:070, Section 1(2). RAM #135 advises that additional structures may be required for larger fills and larger disturbed areas.

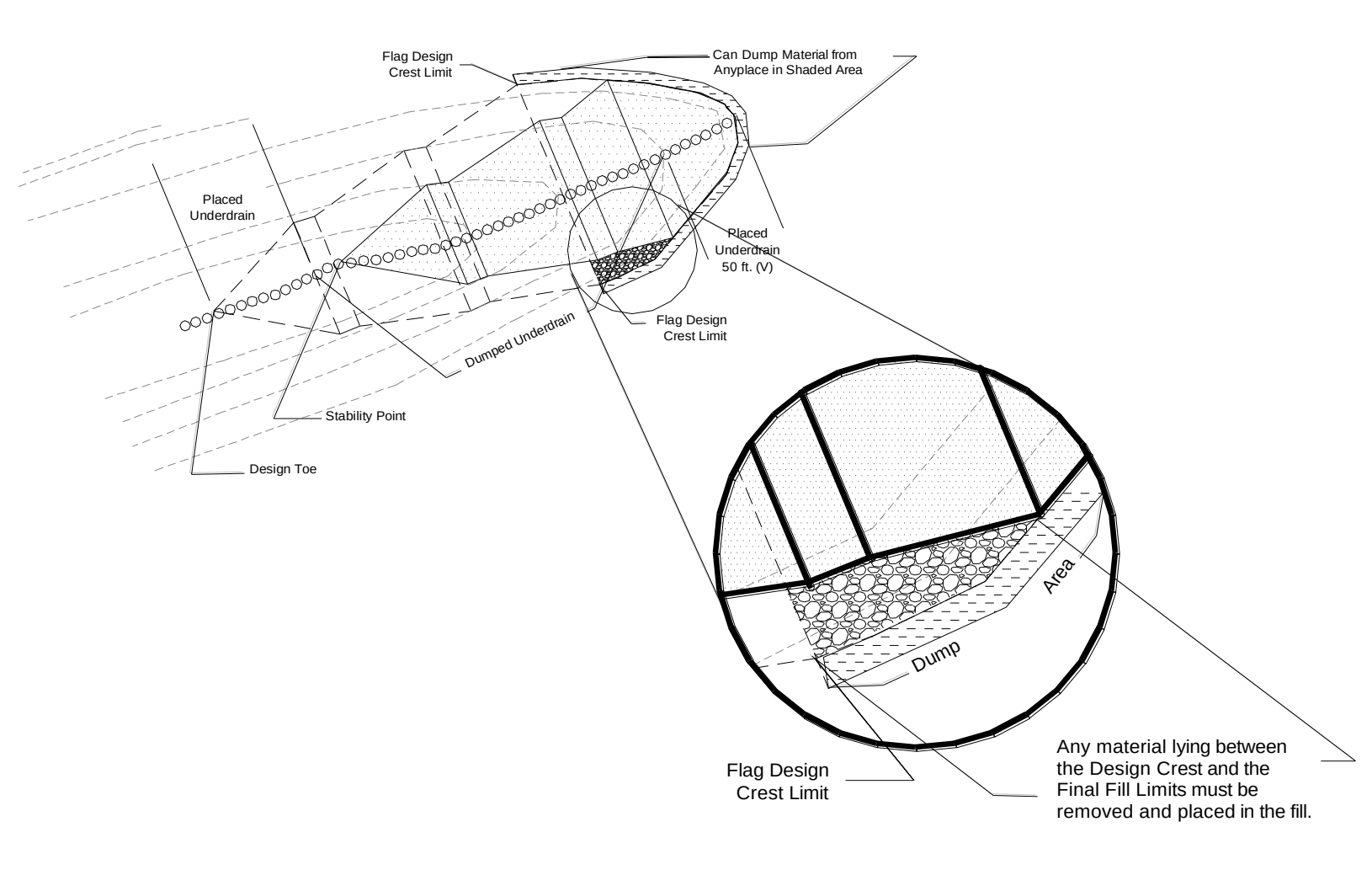
- **Stability-** This RAM makes provision for designation of an upper toe, defining an acceptable range in which the final toe of the fill must be established.

- **Other-** The RAM further delineates other considerations that will be made in assessing the proposed fill, including adjacent coal seams, past and active mining, geology, etc.



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.

The “typical” plan view included with RAM #135 reflects a number of the issues addressed.



Any material lying between the Design Crest and the Final Fill Limits must be removed and placed in the fill.

Another area of recent emphasis has involved the impact of valley fill structures, and in particular end dump fills, on sediment control.

JAMES E. BICKFORD
SECRETARY

PAUL E. PATTON
GOVERNOR

COMMONWEALTH OF KENTUCKY
NATURAL RESOURCES AND ENVIRONMENTAL PROTECTION CABINET
DEPARTMENT FOR SURFACE MINING RECLAMATION & ENFORCEMENT
FRANKFORT, KENTUCKY 40601
CARL E. CAMPBELL
COMMISSIONER

MEMORANDUM

TO: Technical Review Staff

FROM: Larry D. Adams, Director
Division of Permits

DATE: August 7, 2002

SUBJECT: Sediment / Flood Control Design Considerations

Mining disturbances have the potential to alter watershed characteristics and increase peak flows due to changes in topography and vegetation. Whether or not flooding occurs is a site specific circumstance based on the degree of flow alteration caused by the mining activities and the downstream channel capacity and geometry, as well as the influence of other manmade alterations to channels and flood plains (e.g., roads, culverts, stream crossings, bridges, residential or business fills encroaching on stream beds, and other obstructions).

A Joint Special Study was conducted by OSM and DSMRE on drainage control at ten mine sites in Kentucky. Site selection was based on citizen complaints alleging life threatening "wash-outs" were caused by mining or mining otherwise significantly contributed to downstream flooding. Of the ten sites investigated, three were determined to have increased flood potential based on the operators failure to follow the approved drainage plan. The report concluded that compliance with the approved regulatory program effectively minimized flooding potential.

Recommendations of the Joint OSM – DSMRE Special Study Report on Drainage Control are summarized as follows:

- Permitted worst case models must reflect on anticipated ground site conditions to insure the adequacy of sediment / flood control measures. To assist in site inspections, the method of operation should be expanded to include drainage information.

EDUCATION PAYS

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On August 7, 2002, the Division of Permits issued guidance related to various sediment and flood control considerations.

This guidance dealt extensively with the development of valley fills, with a particular emphasis on end-dump structures.

This guidance address the need for permitted worst case models to reflect anticipated on ground site conditions to insure the adequacy of sediment / flood control measures. It further requires that the method of operation narrative should be expanded to include specific drainage information (such as the construction rate, sequence, and any limitations on disturbance) to assist in site inspections,

Hollow Fill Design and Modeling
Default Modeling Configuration for End-Dump Fills

- Fill modeled at full capacity/size,
- Default surface condition of entire fill is bare spoil, no seeding/mulching, no final grading, no terraces,
- Slope and, more importantly, slope lengths used in Tc, Muskingum k, and sedimentology inputs should reflect absence of terraces, considering the full length of the downstream face.
- The remainder of the mining activity within the watershed should be modeled for an acceptable worst-case estimation, and the pond performance assessed accordingly.

Hollow Fill Design and Modeling
Design Modeling Configuration – Bottom up Fill Construction

Must be supported by specific construction practices and sequence delineated within the plans, specifications, and drawings. Including:

- An estimation of the time to required for completion of the fill, from initial clearing through final grading and revegetation,
- Maximum height of fill/volume of fill to be exposed at any time before initiation of grading/vegetation,
- Hollow fill aging (worst case model) should reflect the reclamation pattern described in the specifications, including variable cover conditions and including the maximum allowable height of the exposed fill face.
- If there is more than one hollow fill within a drainage area, the operation narrative should specifically address the relative reclamation status of all fills.

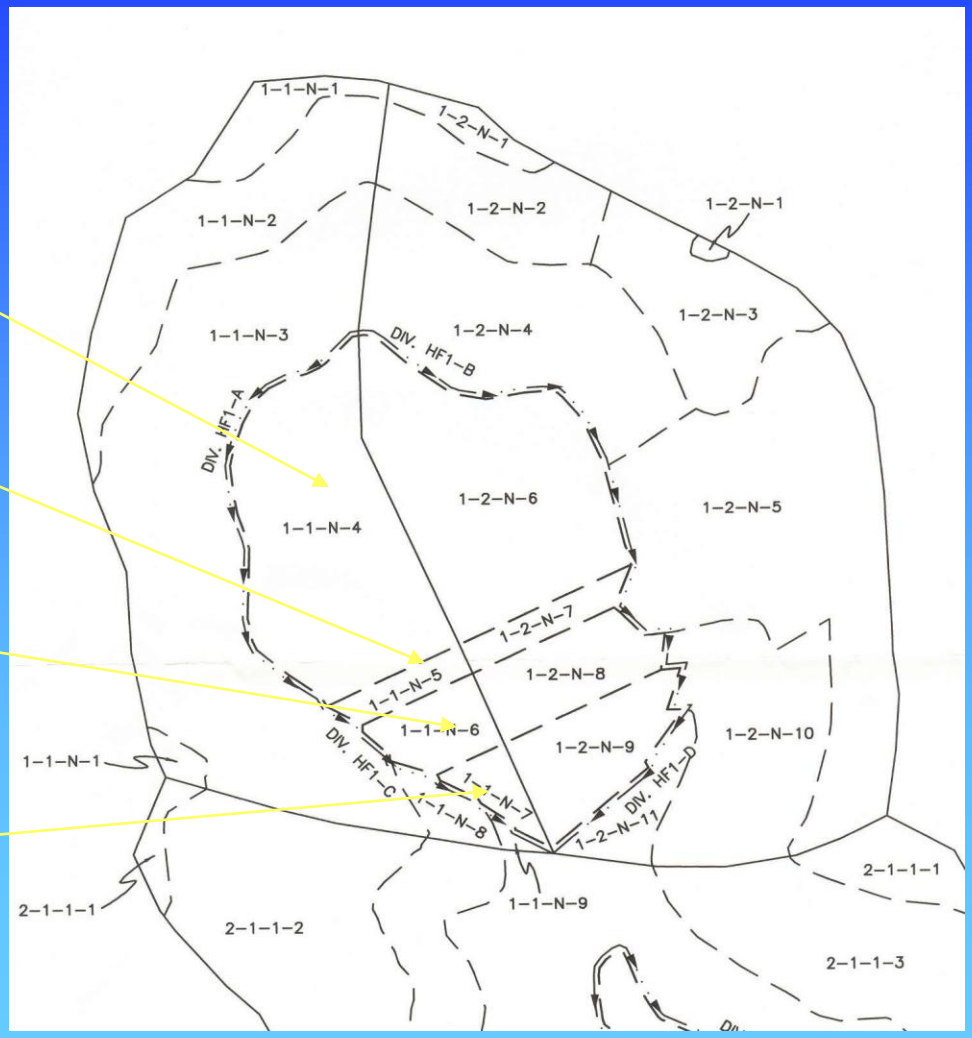
Inappropriate Modeling for End – Dump Fills (without complementary specifications) Shows progressive reclamation during fill development, with initial reclamation preceding fill completion by more than a year.

CN 75
(Durable Rock)

CN 79
(Seeded 0 – 2 Mo.)

CN 74
(Reveg. 2 – 12 Mo.)

CN 69
(Reveg. + 12 mo.)



The Guidance Memorandum also addressed other areas of importance to the Sediment / Flood Control Plan effectiveness.

Worst Case Modeling Variables

- Reclamation Timing
- Contemporaneous Reclamation Variances
- Ponds in Series

Each of these areas have an effect on the size and construction timing of the valley structures. As such, this emphasis results in a greater reconciliation of various keys elements of the Proposed Operational Plans

Ponds in Series -Worst Case Design Considerations

- For watersheds proposing structures in series, it is most common to find the sediment control network consists of a final embankment structure fed by a series of smaller, in-ground dugout ponds. These ponds generally flank the valley fill within that hollow, providing sediment control for the various states of development.

- Where ponds are proposed in series, extra diligence should be employed in assessing the worst case sediment and storm load. Particularly where multiple on-bench dugout structures are proposed in support of a downstream impoundment. The rate of fill construction, as well as the corresponding reclamation schedule, are critical in assessing the true "worst case" condition. Additional modeling scenarios may be necessary for fully assess the projected load on the lowest downstream discharge point.

- In no case should the watershed plan be approved based solely on a demonstration showing all active disturbances above an upper level structure. Consideration must be given to the predicted storm performance, sediment accumulation, and effluent for the lowest structure in the watershed under the maximum predicted load for that structure. As such more than one model may be required to demonstrate compliance in some situations

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PROCEDURE NO. 36 **Page 1 of 8**

INTERNAL DOCUMENT

KENTUCKY DEPARTMENT FOR
SURFACE MINING RECLAMATION AND ENFORCEMENT

DIVISION OF FIELD SERVICES

DIRECTIVE

(For Utilization Only in Clarifying Enforcement Policies and Procedures)

Subject: Excess Spoil Fill, Contemporaneous Reclamation, & Backfilling/Grading Inspection/Enforcement Procedures

FREQUENCY

The required inspection frequency on active permits is once per month. But a **complete** inspection is required by regulation only quarterly. This makes it possible for the excess spoil, backfilling and grading and contemporaneous reclamation performance standards to only get inspected quarterly. Because of the importance of these activities the Division hereby institutes a policy **requiring monthly inspection frequency** of the Excess Spoil Disposal standard during fill construction, and Backfilling and Grading and Contemporaneous Reclamation standards when these standards are applicable to hollowfills. (A similar policy regarding prime farmland removal and reconstruction has been successful.)

Also, in conjunction with this procedure, the process will involve inspector documentation at the time of critical phases in fill construction. A recent joint study between the Department and OSM showed that stability problems with fills usually result from improper foundation preparation, improper underdrain formation/construction and improper final grading of the toe of the fill. The inspector must inspect the construction procedure from the perspective that anything that constricts the underdrain will affect the long- term stability of the fill. Key operations to observe would include, but not be limited to (refer to Figure 1):

SEE ATTACHEMENT

Approved: Mark W. Thompson by KBS
Director, Division of Field Services

Date: 12/11/02

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Subsequent to this initiative, further guidance was issued to field personnel addressing excess spoil disposal.

This guidance increased the frequency of inspection during fill construction, and provides for additional documentation of critical phases of construction for valley fills.

Questions?

14

INDUSTRY PERSPECTIVE ON PERMITTING REQUIREMENTS

DAN GEIGER. P.E.
JAMES RIVER COAL COMPANY
LONDON, KENTUCKY

INDUSTRY ENGINEERS ARE GENERALLY CONTENT WITH CURRENT KENTUCKY FILL PERMITTING RULES

THE U.S. C.O.E. 404 FILL PERMITTING PROGRAM CAUSES CONCERN DUE TO TIMELINESS AND MITIGATION COST ISSUES

KENTUCKY TECHNICAL REQUIREMENTS ARE WELL DEFINED AND ACHEIVABLE

STABILITY ANALYSIS

UNDER DRAIN DESIGN

TYPES OF ALLOWABLE FILLS

- HAUL DOWN
- END DUMP
- SIDE DUMP

Kentucky
Department for Surface Mining
Reclamation and Enforcement

Reclamation Advisory Memorandum

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

Date: September 10, 2002

Subject: Review of Durable Rock Fill Designs

RAM # 135

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.

RAM 135, “REVIEW OF DURABLE ROCK FILL DESIGNS” September 10, 2002

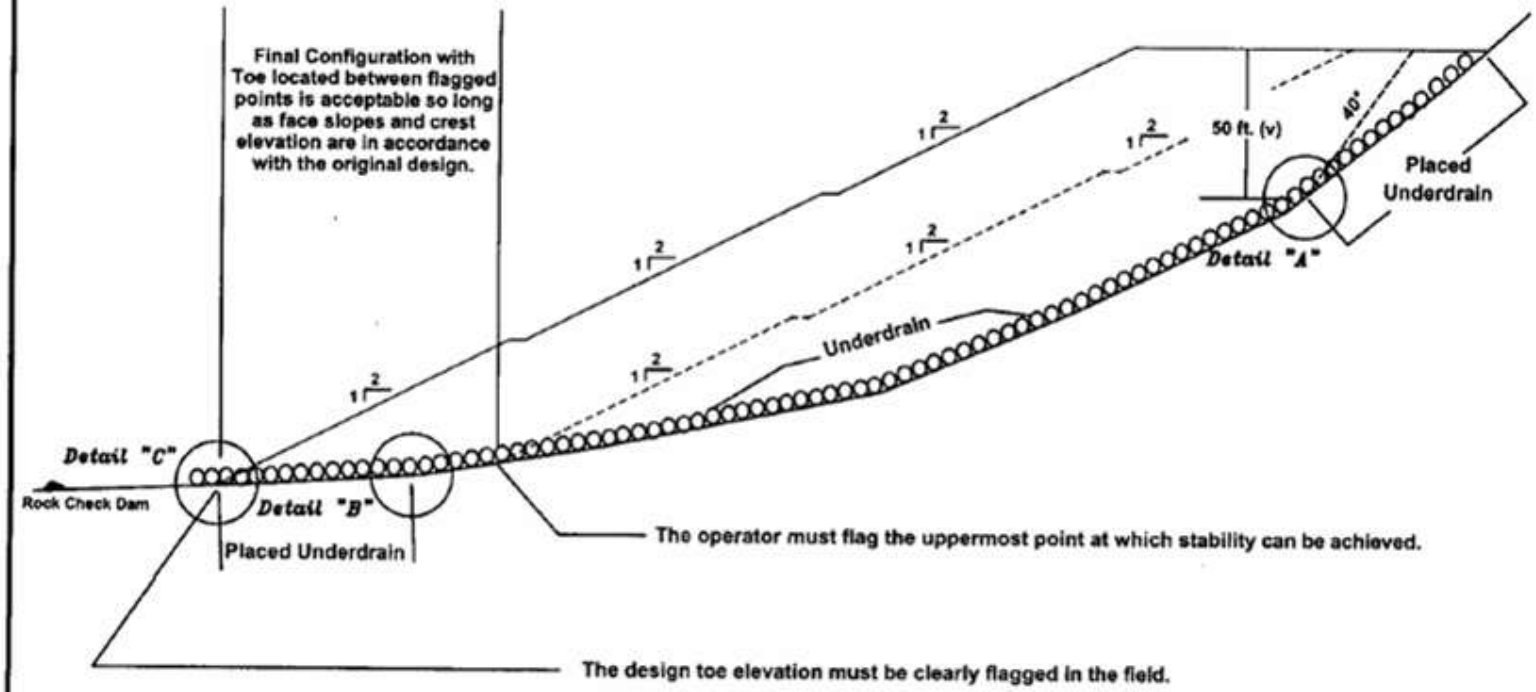
1.Resolved concern about formation of under drain by natural segregation

Requires machine placement of upper and lower segments of under drain (until 50 feet vertical dump height can be achieved)

2. Allows for flexible fill size so long as stability can be demonstrated.

3. Allows side dumping within the proposed crest area.

4. Includes checklist of design elements.



Date: April 4, 2002

Scale: n/a

General Durable Rock Fill Profile

Attachment to Reclamation Advisory Memorandum No. 135

INDUSTRY IS CONCERNED ABOUT:

1. OSM proposed rule concerning excess spoil fills and stream buffer zones.

2. Discussion amongst regulators and environmental groups proposing the elimination of durable rock end-dumped fills.

OSM PROPOSED RULE CONCERNIG CFR PARTS 780,816,AND 817, Surface coal mining and reclamation operations, excess spoil, stream buffer zones, and diversions

Published January 7, 2004

The proposed rules, which were initially published on January 7, 2004, in the Federal Register, would require coal operators to demonstrate:

(1) Excess spoil is avoided or minimized;

(2) Fills will be designed and constructed no larger than needed to accommodate the anticipated volume of excess spoil from that mine; and

(3) Alternative fill locations and configurations are considered, and the preferred excess spoil disposal plan minimizes, to the extent possible, adverse impacts to the prevailing hydrologic balance, fish, wildlife, and related environmental values.

The proposed rules would also revise and clarify the stream buffer zone regulation to align it more closely to statutory requirements of the Surface Mining Control and Reclamation Act (SMCRA) and OSM's long experience of implementing the rule.

Industry is concerned about the excess spoil, fill minimization, and minimum impact language.

Placing excess spoil in valley fills is generally the least costly method in that it makes use of gravity which is free.

Up hill or long hauls are costly, requiring more trucks, slowing productivity, and burning more diesel fuel.

Industry favors the stream buffer zone regulation change as it clears up any conflict between the CWA and SMRCA and allows in-stream fills after the RA makes certain findings.

Concern about the possibility of no longer approving durable rock end dump fills.

Opponents of durable rock fills point to the Lyburn fill episode as an example of why these fills should not be constructed.

End dumped fills have an excellent history. OSM's "Long-Term Stability of Valley Fills, Final Report" dated March 2002 notes that out of 4000+ fills constructed over 23 years:

- 20 cases of VF instability
- No cases of instability after bond release
- No loss of life
- No significant property damage

Kentucky regulations provide for conservative durable rock fill design and inspection procedures

1. 80% of fill material must be +90 SDI
2. Non-durable material must be evenly distributed
3. Inspector can request SDI testing during mining
4. Under drain on the upper and lower ends must be machine placed.
5. Minimum 20 degree slope and 50 foot vertical to assure natural segregation.
6. Rock checks required.
7. Fill inspections required monthly plus critical stages with digital photos.

In a 8/7/02 letter to staff, KY DNR reported the results of a DNR/OSM study of 10 wash out sites.

- 3 failed to follow the approved plans
- Concluded that compliance with approved plan minimized flooding.

The loss of end dump fills and the reduction in the amount of material that can be placed in valley fills will result in:

1. Large increase in the cost of mining which is passed on to the retail electric utility consumer.

2. Large increase in the burning of diesel fuel as heavy trucks haul up hill loaded to place rock higher in the backfill.

3. These costs will prevent the commissioning of some mines.

EXAMPLE:

Medium size MTR mine

- 100,000 tons per month
- 18:1 strip ratio
- 5 year life
- 108 million bank cubic yards

ESTIMATED COST OF MOVING SURFACE MINE OVERBURDEN	
Type	**Cost per CY**
Drill and shoot for moving by dozer or truck, sand stone	$0.40
Drill and shoot for moving by dozer or truck, shale	$0.30
Drill and shoot for blast casting, 50% SS, 50% SH	$0.50
Move material down hill (5% grade) with large dozer, 300 feet	$0.40
Move material down hill (10% grade) with large truck, includes loader, 2000 feet	$0.85
Move material up hill (10% grade) with large truck, includes loader, 2000 feet	$1.10

COMPARE TWO REGRADING PLANS

SCENARIO 1:	70 % AOC
	30 % FILLS
SCENARIO 2:	80 % AOC
	20 % FILLS

AVERAGE COST:

Move material down hill, 30% dozer, 70% truck = $0.61/CY

Move material up hill, trucks = $1.10/CY

COST DIFFERENCE, SCENARIO 1 COMPARED TO SCENARIO 2 = $5,290,000

RESULTS

SAVINGS = $0.88/ton of coal

HISTORIC EARNINGS = $2.00/ton

LOSS OF EARNINGS = 44%

FUEL CONSUMPTION SAVINGS

TRUCKS, HAULING UP HILL

400 cy/hr., 28 gal./hr

TRUCKS, HAULING DOWN HILL

800cy/hr., 20 gal/hr.

FUEL SAVINGS, SCENARIO 1 COMPARED TO SCENARIO 2:

500,000 GALLONS

QUESTIONS

Office of Surface Mining
Knoxville Field Office

Valley Fill Construction and Inspection

By Inspector George Olvey

Requirements from 30 CFR

§816.71 Disposal of excess spoil:

General requirements.

- (a) General
- (b) Design certification
- (c) Location
- (d) Foundation
- (e) Placement of excess spoil
- (f) Drainage control
- (g) Surface area stabilization
- (h) Inspections

Permit Application

- Technical and inspector review of permit application
- Deficiencies identified and letter sent to permitee
- Pre-mine inspection scheduled and conducted
- Deficiencies addressed from field inspection
- Deficiencies addressed and permit approved

Permit Approval

- Inspector assigned and inspection contact begun
- Inspections begin with at least minimum required under 30 CFR

Inspection

- Basin construction before disturbance
- Clearing and grubbing
- Rock toe buttress construction
- Under drain construction
- Approved materials used in construction

Certifications

- Basin certification
- Location approval
- Material certification
- Design certification

OFFICE OF SURFACE MINING (OSM)

CONSTRUCTION INSPECTION CERTIFICATE

This certification and any revision applications stemming from this certification shall be submitted to the OSM, Inspection Group, promptly after inspection.

1. The construction inspection herein certified was made (check one)

   _____ during construction.

   _____ upon completion of construction.

2. I, hereby certify, in accordance with 30 CFR 942.816.49(a)(10)(ii) and others as applicable, that with respect to the following facility:

   Name of Permittee _____ Permit No. _____
   Mine Name _____ Facility No._____
   Which is a (check one)

   _____ primary road
   _____ sedimentation pond
   _____ permanent water impoundment
   _____ temporary water impoundment
   _____ *refuse pile
   _____ *excess spoil disposal fill
   _____ *coal processing waste dam
   _____ *processing waste impoundment

   a. I, or persons under my supervision, have conducted adequate inspection of the construction of the structure; and

   b. This certification is in accordance with the rules of professional conduct promulgated by the Tennessee Board of Examiners for Architects and Engineers; and

   c. The construction has been performed in accordance with accepted construction practices; and (check one)

   _____ The facility HAS BEEN constructed in accordance with the design approved in this permit; and actual location and dimensions ARE within accepted engineering tolerances for such facilities.

   _____ The facility HAS NOT BEEN constructed in accordance with the design approved in this permit; or actual location or dimensions ARE NOT within accepted engineering tolerances for such facilities. (In this instance, submit 5 copies of a revision application with this certification).

Affix seal of engineer making this certification. All data on the seal must be legible:

_____
Seal

*During construction reports are required@

Certific.con

Scalping and Grubbing

Removing material from sidewalls to
key-in rock toe buttress

Material being placed in buttress

Upper section of underdrain construction

Limestone placement in upper section of underdrain

Limestone placement in lower section

Checking design of underdrain

Covering drain with fabric material

Underdrain
final stages

Underdrain tie-in with rock toe buttress

Rock toe buttress completed

Side drains excavated and
ready for rock lining

Beginning first lift

Virginia Department of Mines Minerals and Energy

Valley Fill/Head of Hollow Fill/Durable Rock Fill

Inspection Requirements

Butch Lambert – Reclamation Specialist

Pre-inspection

- Inspector receives notice from company/consultant of proposed permit application
- Inspector schedules field visit
- Initial review of application
- Conditions documented (fill area –springs, seeps, streams if any, foundation pit if applicable)

Application Submitted for Technical Review

- Routing sheet attached to application
- Comments (if any) included, noting field observations and conditions

Virginia Department of Mines Minerals and Energy

COMMONWEALTH OF VIRGINIA
DEPARTMENT OF MINES, MINERALS AND ENERGY
DIVISION OF MINED LAND RECLAMATION
P.O. DRAWER 900; BIG STONE GAP, VA 24219
TELEPHONE:(540) 523-8202

APPLICATION CHECKLIST & ROUTING SLIP

		Publication No.	
COMPANY NAME	CLINTWOOD ELKHORN MINING COMPANY	**CSMO/NPDES No.**	
For the following, check or insert appropriate response:		Application No.	1001045

Y	Pre-Inspection of proposed permit area completed by Field Inspector.
	Number of copies of application initially received: 3
Y	Sample public notice reviewed and deemed acceptable by Field Inspector.
Y	**Instructed Applicant to send copies of application package to DMLR office.** (Once the DMLR office receives the copies, the review process will commence.)
Y	Department of Environmental Quality - Water Division
	Department of Environmental Quality - Air Division
Y	Department of Game and Inland Fisheries
Y	Department of Historic Resources
Y	U. S. Fish and Wildlife Service
Y	Army Corps of Engineers
	Other -

Please Route to the Following for Technical Review

Y	Enforcement	Y	Blasting
Y	Permitting	Y	Drafting
Y	Geology/Groundwater	Y	Agronomy/Ecology
Y	Water Quality		AVS
Y	Drainage/Engineering		Other

Check all that apply for this application package:

Application Type: NEW CSMO/NPDES

Electronic Data? Y Significant Revision? Y Incidental boundary change? N

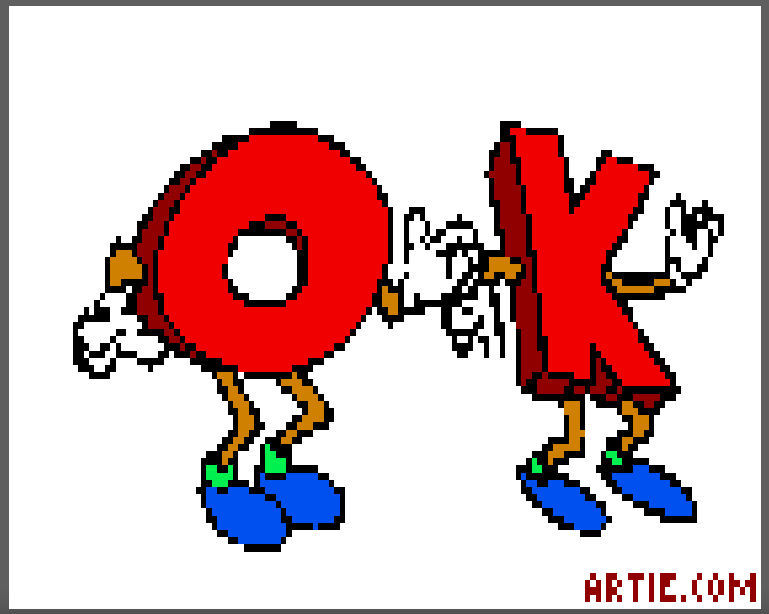
Remining? Y Experimental Practice? N

Comments:

DMLR-PT-008
Rev. 9/00

Permit Approval

Returned with comments



Inspection Frequency

- Three inspections per quarter
- At least one complete per quarter
- Critical construction stage any time (if necessary)
- Completion report filed
- One complete per quarter
- until bond release

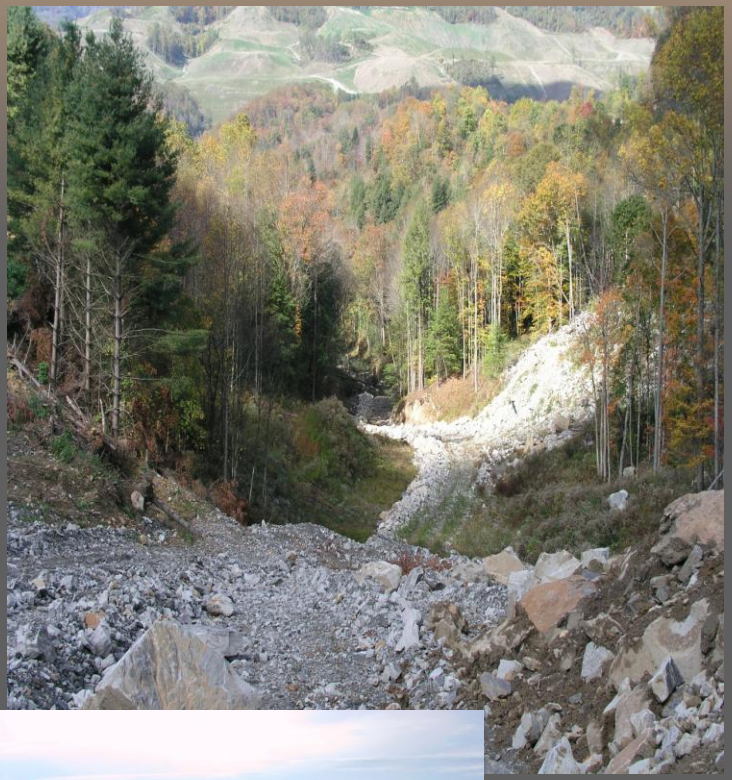
INSPECTION

- Drainage control (ponds in place and water diverted around fill area)
- Clearing and grubbing
- Underdrain construction (depending on type of fill)
- Material being used (durability and size)

Valley Fills/Head of Hollow Fills

(Inspection)

- No more than 10% of the rock used may be less than 12” in size
- No single rock may be larger than 25% of the width of the drain
- Runoff shall be diverted around fill area
- Surface drainage not allowed over the face of fill when completed
- Material to be placed in 4’ lifts



Durable Rock Fills (Inspection)

- Underdrain construction (constructed simultaneously with excess spoil placement)
- Excess Spoil (durability and size – 80% by volume of durable rock)

Seeding after completion of lifts

Surface water including intermittent and perennial streams not allowed to flow into the fill

MEMORANDUM TO FIELD PERSONNEL JANUARY 3, 1996 Inspection Narrative

Disposal of spoil (excess)

- Are critical and quarterly certifications current?
- If required, is acid base analysis current?
- What is the current construction status of each spoil disposal fill on this site?
- Are any signs of instability noted?

Inspection Performance Code For Spoil Disposal - DS

	Disposal of Spoil & Waste Material		
DS	816/817.71(a)	Failure to dispose of spoil within permit or area approved for disposal	offsite sedimentation; water pollution; hazard to public
DS	816/817.71(b)	Failure to have fill design approved/certified	obstruction to enforcement; fill instability
DS	816/817.71(c)	Failure to place spoil on most moderately sloping & natural stable areas	Fill instability; erosion; hazard to public
DS	816/817.71(d)	Failure to conduct sufficient foundation investigation/test of foundation materials	“ obstruction to enforcement
DS	816/817.71(e)	Failure to remove vegetation/topsoil properly Failure to construct fill per plans	Fill instability; hazard to public; erosion
DS	816/817.71(f)	Failure to prevent water infiltration into fill	“
DS	816/817.71(g)	Failure to stabilize fill slopes	Fill instability; erosion
DS	816/817.71(h)	Failure to inspect during construction	obstruction to enforcement
SS	816/817.72(a)	Failure to divert drainage from above fill to stabilized diversion channels	Fill instability; erosion
DS	816/817.72(b) 816/817.73(e)	Failure to install underdrains properly	Fill instability; degradation of surface and/or ground water; hazard to public
DS	816/817.74	Failure to properly place spoil on the pre-existing bench	“
DS	816/817.75(d & e)	Failure to properly construct structural zone & its underdrain	“

The above list attempts to place a performance standard code with the statute or regulation that could be violated. Please note that the regulation numbers would be prefixed by “**4 VAC 25-130-**”. The list of events or obstructions is not all inclusive, but is provided as potential concerns. Each violation must be evaluated by its unique circumstances.

PROCEDURE NO. 3.3.07 (issued 2/6/03)

Excess Spoil Fill

Excess spoil fills must meet the requirements of Section 4VAC 25-130-816.71(h) or 817.71 (h).

If the fill construction does not correspond with the approved design and specifications, the Inspector shall instruct the permittee to note the changes in the "quarterly fill certification" or "critical construction certification". Also, complete design information that meets the minimum design requirements of the regulations must be submitted with the fill certification form (DMLR-PT-105). Generally, such construction changes as, but not limited to, the following list will require that design information accompany the fill certification:

1. Change in the number of terraces, vertical spacing of terraces;
2. Change in fill volume;
3. Change in the size, length, type of rock of the underdrain;
4. Change from a standard fill to a durable rock fill or vice versa;
5. Increasing the steepness of the fill outslope;
6. Fill construction is completed in a manner resulting in the toe of the fill resting on a steeper slope than was approved;
7. Increase of aerial extent of fill;
8. Change in stream channel length (may require additional mitigation measures);
9. Change in size, location, grade or lining of diversion ditches;
10. Increase in lift thickness; and/or
11. Adding additional underdrains.

PROCEDURE NO. 3.3.07 (cont.)

Upon submittal of the certification the Inspector shall:

- **Review and initial DMLR-PT-105.**
- **Ensure that a qualified, registered professional engineer makes the certification.**
- **Ensure that color photographs are included with the certification.**
- **Include a map with the "final fill certification" that shows the final fill footprint configuration containing four digitizing tics with the coordinate values in the Virginia South NAD27 State plane.**
- **Instruct the permittee to submit the complete original certification package to the Division's office for DMLR Engineers to review if the fill construction does not correspond with the approved design and specifications (If a problem is found with the design information, the Review Inspector will return the certification package with comments for correction).**
- **Route the final fill footprint map the Drafting Section.**
- **Enter the certification information into the ENF Laptop Program.**

Quarterly Acid-Base Monitoring Report

- Submitted if required

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QUARTERLY ACID-BASE MONITORING REPORT

COMPANY		**PERMIT NO.**			
ADDRESS		**Reporting Quarter**		**Year**	

Name of Laboratory (performing analyses)		**Address**	

REPORTING INSTRUCTIONS:

1. Submit at the end of each calendar quarter to the attention of the DMLR "Geology Section" at the above address.
2. All samples analyzed must be reported.

ANALYSIS RESULTS			
SAMPLE NO.			
Sample Description			
Date Collected			
pH			
Sulfur Content (%)			
Form Analyzed (total or pyritic)			
Maximum Potential Acidity*			
Neutralization Potential*			
Net Neutralization Potential* (expressed as + or -)			

***** Determined in tons/1,000 tons calcium carbonate equivalent.

CERTIFICATION: I certify that I am familiar with the information submitted herein, and to the best of my knowledge, such information is true, complete, and accurate.		Date	
Name of Principal Executive Officer or Authorized Agent		Signature	

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MIDTERM REVIEW CHECKLIST

COMPANY		**CSMO/NPDES No.**	

This checklist shall be completed when reviewing the success of the approved plans, relative to the permit's compliance with the regulations and performance standards. For each item on the checklist, place an "X" in the appropriate column. Under "**Comments**", each remark should be correlated to the appropriate item number.

Please refer to the "Application for Coal Surface Mining and Reclamation Operations" (**DMLR-PT-034e**) when reviewing the following sections. Check "**Yes**" if the plans are in compliance; "**No**" if the plans are deficient (then explain in the applicable portion of the comment section); or "**N/A**" if not applicable.		**Field Review**		
		Yes	**No**	**N/A**
I.	**General Information**	☐	☐	☐
II.	**Administrative Information**	☐	☐	☐
III.	**Site Information**	☐	☐	☐
IV.	**Geology**	☐	☐	☐
V.	**Hydrology**	☐	☐	☐
VI.	**Probable Hydrologic Consequences (PHC)/Hydrologic Reclamation Plan (HRP)**	☐	☐	☐
VII.	**Land Use**	☐	☐	☐
VIII.	**Fish and Wildlife**	☐	☐	☐
IX.	**Soils and Revegetation**	☐	☐	☐
X.	**Operations Plan**	☐	☐	☐
XI.	**Drainage Control**	☐	☐	☐
XII.	**Sediment Control**	☐	☐	☐
XIII.	**Backfilling / Grading**	☐	☐	☐
XIV.	**Excess Materials Disposal**	☐	☐	☐
XV.	**Toxic Materials Handling Plan**	☐	☐	☐
XVI.	**Blasting**	☐	☐	☐
XVII.	**Transportation Plan**	☐	☐	☐
XVIII.	**Underground Control Plan**	☐	☐	☐
XIX.	**Bonding**	☐	☐	☐
XX.	**Special Categories**	☐	☐	☐
XXI.	**Verifications / Certifications**	☐	☐	☐

Mid-Term Review Checklist

- Mid-term review conducted every 2 ½ years
- All sections of the permit are reviewed for compliance including disposal of excess material

Construction Certification

- Submitted quarterly
- Critical construction
  - Foundation preparation
  - Vegetation removal
  - Placement of underdrain
  - Filter systems placement
  - Installation of final drainage
  - Final grading and seeding

Virginia Department of Mines Minerals and Energy

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EXCESS SPOIL FILLS AND REFUSE EMBANKMENTS CONSTRUCTION CERTIFICATION

COMPANY NAME		**PERMIT NO.**	

Fill Number		Type of Fill	
Enter ?**A**? if this Certification concerns a critical stage of construction; ?**B**? a quarterly inspection; ?**F**? a final inspection; or ?**C**? combination.			

Removal of Organic Materials and Topsoil	
Distance in feet that clearing and grubbing operations precede spoil placement.	
Distance in feet that topsoil removal operations precede spoil placement.	
Yes or **N**o	Where applicable, enter the appropriate response to the following. If not applicable, enter ?NA?.
	Topsoil is removed to competent subsoil or rock.
	All topsoil is being stockpiled or placed on completed portions.

Placement of Underdrain System (attach color photographs)	
Height by width **dimensions** (in feet) of the underdrain per the approved detailed plans.	
Actual constructed height by width **dimensions** (in feet) of the underdrain.	
Yes or **N**o	Where applicable, enter the appropriate response to the following. If not applicable, enter ?NA?.
	Durable rock is free of shale, fines, and other contaminants.
	The rock grading is in accordance with the approved design.
	Rock is being placed by selective handling from the toe of the fill.
	The keyway cut was constructed in accordance with the approved design.
	The rock toe buttress was constructed in accordance with the approved design.
	The filter systems for the underdrain(s) were constructed in accordance with the approved design.
	Lateral drains were placed to all springs and potential seeps.

Installation of the Surface Drainage System		
	Sediment ponds were installed prior to any fill construction disturbance.	
	Temporary diversion ditches, if applicable, were installed in accordance with the approved design.	
	Permanent diversion ditches, side drains and terraces are installed in accordance with the approved designs, and	
	- are placed on the proper grade(s).	
	- are constructed in accordance with the approved design dimensions.	
	Indicate the type of erosion protection techniques used in the side drains, diversion ditches, and terraces by entering ?**R**? for rock rip rap; ?**B**? for bed rock; ?**V**? for vegetation; and ?**O**? for other (specify ✍).	
	The rip rap meets the design specifications for depth and grading.	

Certification Form

Virginia Department of Mines Minerals and Energy

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EXCESS SPOIL FILLS AND REFUSE EMBANKMENTS CONSTRUCTION CERTIFICATION

COMPANY NAME		PERMIT NO.	

Fill Number		Type of Fill	
Enter A if this Certification concerns a critical stage of construction; B a quarterly inspection; F a final inspection; or C combination.			

Removal of Organic Materials and Topsoil	
Distance in feet that clearing and grubbing operations precede spoil placement.	
Distance in feet that topsoil removal operations precede spoil placement.	
Yes or No	Where applicable, enter the appropriate response to the following. If not applicable, enter NA.
	Topsoil is removed to competent subsoil or rock.
	All topsoil is being stockpiled or placed on completed portions.
Placement of Underdrain System (attach color photographs)	
Height by width **dimensions** (in feet) of the underdrain per the approved detailed plans.	
Actual constructed height by width **dimensions** (in feet) of the underdrain.	
Yes or No	Where applicable, enter the appropriate response to the following. If not applicable, enter NA.
	Durable rock is free of shale, fines, and other contaminants.
	The rock grading is in accordance with the approved design.
	Rock is being placed by selective handling from the toe of the fill.
	The keyway cut was constructed in accordance with the approved design.
	The rock toe buttress was constructed in accordance with the approved design.
	The filter systems for the underdrain(s) were constructed in accordance with the approved design.
	Lateral drains were placed to all springs and potential seeps.
Installation of the Surface Drainage System	
	Sediment ponds were installed prior to any fill construction disturbance.
	Temporary diversion ditches, if applicable, were installed in accordance with the approved design.
	Permanent diversion ditches, side drains and terraces are installed in accordance with the approved designs, and
	- are placed on the proper grade(s).
	- are constructed in accordance with the approved design dimensions.
	Indicate the type of erosion protection techniques used in the side drains, diversion ditches, and terraces by entering R for rock rip rap; B for bed rock; V for vegetation; and O for other (specify →).
	The rip rap meets the design specifications for depth and grading.

	The rip rap meets the design specifications for depth and grading.	
Placement and Compaction of Materials		
Yes or No	Where applicable, enter the appropriate response to the following. If not applicable, enter NA.	
	The material is placed in 4 feet lifts or less as specified in the approved design.	
	The haulage vehicles are routed to achieve compaction.	
	List other methods of compaction utilized in the fill construction.	
	What is the percent of compaction?	
	What is the moisture content of the material at the time of placement?	
	Potentially toxic or acid forming material is being handledaccording to the approved plans.	
	This is a durable rock fill composed of 80% durable rock, and	
	- with the clay or shale dispersed properly.	
	- the spoil is dumped at the approved locations.	
	- the bench height above the completed portions are no greater than 50 feet.	
Vegetation		
	Topsoiling and seeding are conducted concurrently with terrace completion.	
	Seeding is in accordance with the approved mixtures and rates.	
	Indicate the approximate percentage of ground cover.	

Sketch of Fill(s) and Support Structure(s)

Submit a sketch (on a separate sheet) of each fill and supporting structures which are subject to this certification. Include the following information:

1. approximate North.
2. outline of the fill area.
3. location of sediment control structure(s).
4. number and location of completed terraces.
5. the limits of organic material removal.
6. the limits of topsoil removal.
7. the location of any surface or ground water discharges.
8. the location of all underdrains and diversion ditches.
9. discuss any changes to be made, variations from the approved design, and any improper practices encountered.

Comments

Certification by Registered Professional Engineer

I certify that the aforemention fill is constructed and installed in accordance with the requirements of the **Virginia Coal Surface Mining Reclamation Regulations** and as per the approved design(s).

CERTIFIED BY:		Certification/Registration No.	
SIGNATURE:		Date:	
PLACE SEAL HERE			

Water Quality Monitoring

- Active mining sampled 2 X month
- Reclamation areas 1 X month

  (Completion material submitted)

- Submitted quarterly until

  approved to delete

INSPECTION

- Five years after completion
- Bond release

West Virginia Inspection Requirements

- Legal Authority – 38CSR-2-14-14

West Virginia Inspection Requirements

- Over 1000 Valley Fills currently permitted
- Over 200 Valley Fills currently active and unreclaimed

West Virginia Inspection Requirements

- New regulations effective 01-01-04 for proposed durable rock fills.

West Virginia Inspection Requirements

- Single lift fills with an erosion protection zone
- Durable rock fills designed to be reclaimed from the toe upward

West Virginia Inspection Requirements

- As a result of the Lyburn flood in July of 2002, OSM and WVDEP agreed to evaluate all of the states excess disposal fills to determine if conditions existing on other fills posed a hazard to downstream residents

West Virginia Inspection Requirements

- This created an inventory of all permitted valley fills in the state.
- Inventory is updated annually and maintained on a TAGIS system to allow easy access.

West Virginia Inspection Requirements

- Certifications are submitted by a Registered Professional Engineer at the end of each quarter and during critical construction periods.

EXCESS SPOIL FILLS AND REFUSE EMBANKMENTS CONSTRUCTION CERTIFICATION

COMPANY NAME		**PERMIT NO.**	

Fill Number		Corp Authorization No.		Expiration Date

Enter "**A**" if this Certification concerns a critical stage of construction; "**B**" a quarterly inspection; "**F**" a final inspection; or "**C**" combination.	

1. Removal of Organic Materials and Topsoil	
A. Describe area cleared and grubbed.	
B. Is Topsoil removed to competent subsoil or rock?	
C. Describe disposal of cleared and grubbed material.	
D. Attach documentation that foundation is prepared according to the plans.	

2. Placement of Underdrain System (attach color photographs)	
Designed Underdrains:	
A. Designed height by width **dimensions** (in feet) of the underdrain per the approved plans.	
B. Actual constructed height by width **dimensions** (in feet) of the underdrain.	
C. Attached photographs for each phase of underdrain construction if applicable.	
D. Lateral drains were installed to all springs and potential seeps.	
E. Protective filter systems were installed.	
Natural Segregation: Attach photographic documentation that natural segregation is occurring and proper underdrain material is forming in advance of fill placement.	

3. Construction Aspects of Rock Toe Buttress/Keyway Cut	
Attach documentation that buttress/keyway cut is constructed according to plan.	

4. Fill Construction Status	
A. Type of fill (durable, conventional).	
B. Method of construction (end dump, bottom up, modified bottom up).	
C. Designed volume of fill.	
D. Volume of material disposed of in fill during reporting period.	
E. Current total volume of fill.	
F. Current status of fill (active, being reclaimed, inactive):	
(1) If Inactive, date of last activity:	
(2) Percent slope of ground at toe at current location (only for end dump fills):	
(3) If Being Reclaimed, projected date of completion:	
(4) Method of reclamation, i.e. top down in lifts, long sloping (only for end dump fills:	

5. Installation of the Surface Drainage System		
Yes or No	Where applicable, enter the appropriate response to the following. If not applicable, enter "NA".	
	A. Sediment ponds were installed and certified prior to any fill construction and being maintained in accordance with the approved design.	
	B. Temporary drainage control, if needed, was installed in accordance with the approved design.	
	C. Describe methods used to control surface water runoff from areas above and adjacent to durable rock fills during construction.	
	D. Indicate the type of erosion protection techniques used in the fill area (i.e., "**R**" for rock rip rap; "**B**" for bed rock; "**V**" for vegetation; and "**O**" for other (specify).	
	E. Permanent diversion ditches and terraces are installed in accordance with the approved designs.	

6. Placement of Materials	
Yes or No	Where applicable, enter the appropriate response to the following. If not applicable, enter "NA".
	A. Material is placed in lifts as specified in the approved design.
	B. Potentially toxic or acid forming material is being handled according to the approved plans.
	C. The fill contains no more than 20% non-durable material.
	D. Prohibited materials are not being placed, deposited, or disposed of into the fill area.

7. Sketch of Fill(s) and Support Structure(s)

Submit a drawing of each fill and supporting structures, which are subject to this certification. Include the following information:

A. Current delineation of fill.
B. location of sediment control and drainage structure(s).
C. number and location of completed lifts.
D. limits of clearing and grubbing.
E. location of any surface or ground water discharges.
F. current extent and location of underdrains.
G. current location of toe (latitude, longitude, and elevation).

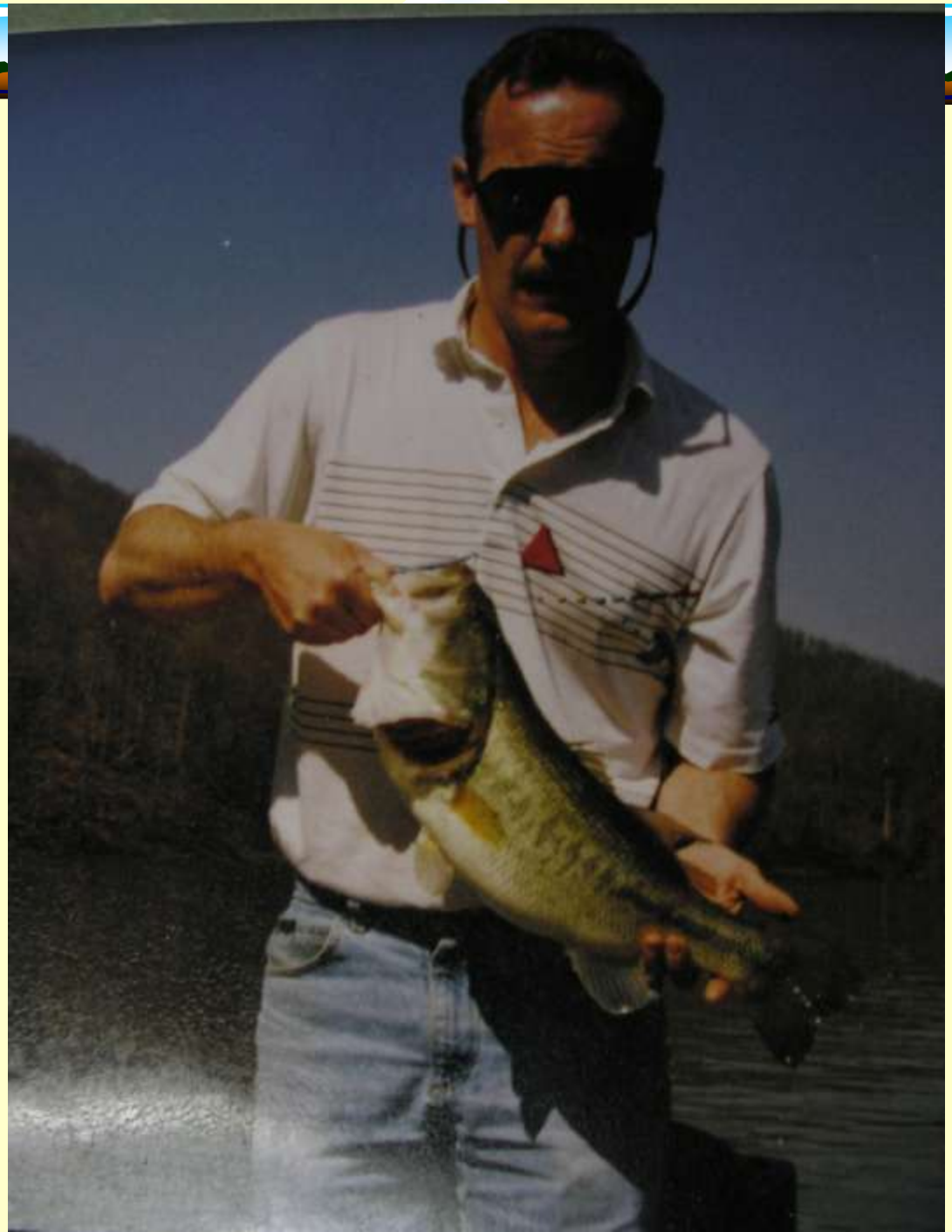
8. Comments

Discuss any appearance of any instability, structural weakness, or other hazardous condition including, but not limited to underdrain function or erosion vulnerability. (Documentation of implemented or proposed solutions for specific construction or quality control problems must be included.)

Certification by Registered Professional Engineer

I certify that the aforementioned fill is constructed and installed in accordance with the Regulations and as per the approved design(s).

CERTIFIED BY:		Certification/Registration No.	
SIGNATURE:		Inspection Date:	
PLACE SEAL HERE			



FILL CHECKLIST

Type: ED for End Dump, BU = Bottom Up, M = Modified Bottom Up **Photos yes no (circle)**
Status: A = Active dumping, AR = Being Reclaimed, IA = Inactive, R = Reclaimed, NS = Not Started

Note: If fill is NS or R, complete top line only

Company	Permit #	Fill Name	Type	Status	
			YES	NO	NOV
1. Is the mining and reclamation plan being followed, i.e. is mining sequence, method of mining, and spoil material removal and placement in the fill in accordance with the approved permit?					
2.a. Does it appear that the fill is going to reach design capacity? If not provide reason:					
b. If not, will the fill toe out on slopes < 20%?					
3. Is upland drainage directed away from the fill face?					
4. a. Is underdrain visible?					
b. If end dump, is natural segregation of dumped material occurring?					
c. Does underdrain extend through all of fill under construction?					
d. If end dump and in reclamation, is underdrain progressing ahead of material being pushed down?					
e. Is there any signs the underdrain is not functioning properly, i.e., wet spots above underdrain?					
4. a. Is fill deck sloped to the back to prevent runoff over the face of fill?					
b. Is fill deck sloped to prevent water from impounding on deck of fill?					
5. Has erosion been an ongoing issue, i.e., silt snakes, repeated pond cleaning, etc.?					
6. a. Is fill inactive? If yes, note date of last activity Month Year					
b. If fill is inactive can it be demonstrated that reactivation is feasible?					
c. If fill is inactive, is fill toe located on slopes greater than 20%?					
d. If fill is inactive, what is its estimated volume?					
7. a. Has critical foundation area been grubbed or prepared?					
b. Has all clearing and grubbing debris been completely disposed of to prevent clogging downstream drainage structures?					

	YES	NO	NOV
8. Is fill being reclaimed by the "long slope" method?			
9. Is gradation of the material on face of fill susceptible to erosion?			
10. Do certifications match field conditions/permit?			

	Concave	Straight	Convex
11. Shape of fill face			

	<0.5	**0.5-1.0**	**>1.0**
12. Distance from proposed toe location to nearest downstream dwelling (miles).			

13. Do you have any concerns related to this fill? Yes ☐ No ☐ If yes, explain

14. Action taken (Enforcement, Abatement etc,)

Inspector	DATE

DIRECTIVE #36 AND RAM #135

Introduction

- DIRECTIVE #36 AND RAM #135 REQUIRE SPECIFIC INSPECTION PROCEDURES WHEN INSPECTING DISPOSAL OF EXCESS SPOIL SITES. I WILL DISCUSS HOW THE RAM AND THE DIRECTIVE AFFECT OUR INSPECTION PROCEDURES.

Topics of Discussion

- FEQUENCY
- REPORTS
- CERTIFICATION VERIFICATION
- WING DUMPING
- CRITICAL PHASES
- DOCUMENTATION
- CONTEMPORANEOUS RECLAMATION OF FILLS
- CERTIFICATION

FREQUENCY

- MONTHLY
- DURING CONSTRUCTION OF CRITICAL PHASES
- QUARTERLY AND AS NEEDED AFTER FINAL CERTIFICATION

WHAT DO WE CHECK?

- CRITICAL PHASES OF CONSTRUCTION
- ANYTHING CONSTRICTING THE UNDERDRAIN
- THE SPOIL HAS GOOD INTERFACE AND CONTACT WITH THE FOUNDATION
- DURABLE, NON-TOXIC MATERIAL IN THE UNDERDRAIN
- PREVENTING THE UNDERDRAIN FORM BEING SEALED OFF AT THE TOE

CRITICAL PHASES

- FOUNDATION PREPRATION
- PLACEMENT OF UNDERDRAINS AND PROTECTIVE FILTER SYSTEMS
- INSTALATION OF FINAL SURFACE DRAINAGE SYSTEMS
- COMPLETION OF FINAL GRADING
- COMPLETION OF THE INITIAL REVEGETATION

FOUNDATION PREPARATION

- CLEARING

FOUNDATION PREPARATION

- FOUNDATION AND SPOIL INTERFACE

UNDERDRAIN DURABLITY

- UNDERDRAIN MATERIAL

SURFACE DRAINAGE

- INSTALATION OF SURFACE DRAINAGE SYSTEMS

REPORTS

- MUST DOCUMENT CRITICAL PHASES WITH COMMENTS AND DIGITAL IMAGES
- MUST DOCUMENT PROGRESS OF FILL WITH COMMENTS
- DIGITAL IMAGES MUST BE STORED ON THE PHOTO IMAGE FORM OR IN THE DOCUMENT MANAGEMENT SYSTEM WHEN AVAILABLE

											05/10/03

(SM)	FC	Signs and Markers KAR 16:030 or 18:030	(SC)	FP	Sedimentation Ponds KAR 16:090 or 18:090	(SS)	FC	Steep Slopes KAR 20:060
(AC)		Roads KAR 16:220 or 18:230	(DV)	FC	Diversions KAR 16:080 or 18:080	(MR)		Mountaintop Removal KAR 20:050
(TH)	FC	Topsoil KAR 16:050 or 18:050	(WQ)	FC	Water Quality KAR 16:070 or 18:070	(AM)	FC	Auger Mining KAR 20:030
(UE)		Use of Explosives KAR 16:120 or 18:120	(HR)		General Hydrologic Requirements KAR 16:060 or 18.060 & KRS 350.421	(PF)	NA	Prime Farmland KAR 20:040
(DS)	FP	Disposal of Excess Spoil KAR 16:130 or 18:130	(WM)		Water Monitoring KAR 16:110 or 18:110	(PP)	NA	Processing Plants KAR 20:070 or 20:080
(BG)	FC	Backfilling and Grading KAR 16:190 or 18:190	(IM)		Impoundments KAR 16:100 or 18:100	(PL)		Post-Mining Land Use KAR 16:210 or 18:220
(CR)	FC	Contemporaneous Reclamation KAR 16:020 or 18:020	(WD)	NA	Coal Waste Dams KAR 16:160 or 18:160	(DH)		Drilled Holes KAR 16:040 or 18:040
(OF)	NA	Other Facilities KAR 16:250 or 18:260	(DC)	NA	Disposal of Coal Processing Waste KAR 16:140 or 18:140	(UO)		Approved Operator KAR 8:010
(DW)		Disposal of Non-Coal Waste KAR 16:150 or 18:150	(AP)		Air Resources Protection KAR 16:170 or 18:170	(OC)		Ownership and Control KAR 8:010
(RV)	FC	Revegetation KAR 16:200 or 18:200	(FW)		Fish and Wildlife Protection KAR 16:180 or 18:180	(SB)	NA	Subsidence KAR 18:210
(OD)	NA	Off Permit Disturbance KAR 7:040	(OO)	NA	Mining Off Permit U/G KAR 7:040 or 8:010	(OT)		Other Permit Conditions
(OM)	FC	Method of Operation KAR 08:010	(LI)	FC	Liability Insurance KAR 10:030	(SF)		Surety Failure KAR 10:030
(EL)		Effluent Limitations KAR 5:065						

REPORT

Describe all changes since last inspection, including change in operator or contractor and name(s) of any person(s) who accompanied you during this inspection (citizen, chief, other federal or state inspectors); etc.

Complete inspection - All structures with KPDES sampled and in compliance. Yes☐ No☐ If Yes not selected, list points in violation.

1.) INSPECTION OF HOLLOWFILLS #1, #3, #4, #5. FILL #2 IS INACTIVE, COMPLETE AND FINAL CERTIFIED. FILL #1 IS ACTIVE. ADDITIONAL MATERIAL HAS BEEN ADDED SINCE LAST INSPECTION (3-10-03). FILL #3 IS ACTIVE CRITICAL PHASE INSPECTED-- THE UNDERDRAIN IS FORMING ACCORDING TO DESIGN. THE OPERATOR IS AUTHORIZED TO CONTINUE ADDITIONAL MATERIAL PLACEMENT IN THE SAME MANNER. PHOTOS TAKEN. SUBMIT STAGE CERTIFICATION FOR UNDERDRAIN CONSTRUCTION WITH APPROPRIATE COLOR PHOTOGRAPHS WITHIN 2 WEEKS OF THIS DATE. FILL #4 IS ACTIVE. ADDITIONAL MATERIAL HAS BEEN ADDED SINCE LAST INSPECTION. THE FILL IS NEARING DESIGN CAPACITY ACCORDING TO THE LATEST CERTIFCATION 2-28-03. PREPARE TO BEGIN FINAL GRADE WORK, INSTALL SIDE DIVERSION DITCHES ACCORDING TO APPROVE DESIGN, INSTALL TERRACES, REVEGETATE AND FINAL CERIFY WITHIN TWO WEEKS OF COMPLETION. FILL #5 IS ACTIVE. THE OPERATOR HAS JUST BEGUN CLEARING AND GRUBBING OPERATIONS. REMOVE TOPSOIL ACCORDING TO THE APPROVED PLANS AND STOCKPILE IN DESIGNATED AREAS. INSTALL THE FIRST SEGEMENT OF UNDERDRAIN FOR THE FIRST LIFT OF THE FILL. THE UNDERDRAIN MUST EXTEND DOWNSTREAM FAR ENOUGH TO ALLOW PROPER SEGRATION OF THE DUMPED

CERTIFICATION VERIFICATION

- STABILITY POINTS
- CREST ELEVATION
- SLOPE REQUIREMENT
- DRAINAGE CONTROL

WING DUMPING

- DEFINITION
- LIMITS
- CRITICAL LOCATION IDENTIFICATION AREAS
- ENFORCEMENT PROCEDURES

WING DUMPING

- DEFINITION: ANY MATERIAL DUMPED TO THE RIGHT OR LEFT OF THE CENTER LINE OF THE HOLLOWFILL TEMPLET.

WING DUMPING

- LIMITS: NO DUMPING BEYOND THE PERMITTED HOLLOWFILL CREST PERMIT BOUNDARY

CONTEMPORANEOUS RECLAMATION OF FILLS

- DOCUMENTATION
- CERTIFICATION
- POND CLEAN OUT
- SUSPENDED AND SETTLEABLE SOLIDS EFFLUENT PROBLEMS
- WORST CASE WATERSHED MODELING

What This Means

- THIS PROCEDURE IS TIME CONSUMING AND TEDIOUS. IT WILL REQUIRE THE INSPECTORS TO BUDGET THEIR TIME MORE EFFICIENTLY AND IN SOME CASES ALTER THEIR INSPECTION SCHEDULES TO MEET REQUIREMENTS TO DOCUMENT CRITICAL PHASES.

DIRECTIVE #36 REQUIREMENTS

- DS, BG, AND CR MUST BE INSPECTED ON EACH PARTIAL INSPECTION
- CRITICAL PHASES AND CONTINUING CONSTRUCTION PROGRESS ON THE FILL MUST BE DOCUMENTED ON THE MIR. PHOTOGRAPHIC DOCUMENTATION OF THE UNDERDRAIN BY THE INSPECTOR IS ALSO REQUIRED.
- WING DUMPING IS ALLOWABLE, BUT NOT PAST THE FLAGGED CREST DESIGN LIMIT.
- CERTIFICATIONS MUST PROVIDE THE CURRENT CAPACITYOF THE FILL AND IDENTIFY THE LOCATON OF THE REMAINING YARDAGE TO BE PLACED. ALSO, THE CERTIFICATION MUST IDENTIFY WHICH CRITICAL PHASE OF CONSTRUCTION IS BEING CERTIFIED.

RECLAMATION ADVISORY MEMORANDUM 135

RAM 135 INSPECTION

- UNDERDRAIN CONSTRUCTION
- CREST LIMITS
- CLEARING AND GRUBBING
- ROCK CHECK STRUCTURES
- STABILTY

INDUSTRY PERSPECTIVE ON INSPECTION AND ENFORCEMENT

DAN GEIGER, P.E.
VICE PRESIDENT, ENGINEERING
JAMES RIVER COAL COMPANY, LONDON, KY

The Kentucky Industry generally finds the inspection and enforcement program to be reasonable.

Most Notices of Noncompliance (NNC) are reasoned and considered deserved.

NNC’s include remedial measures which spell out what is expected to abate the NNC.

Inspection reports include Preventive Enforcement (Code FP) comments which warn of potential violations.

THE MINE SUPERINTENDENT AND THE INSPECTOR

The Superintendent understands the requirement for inspections and seeks the Inspector’s approval.

Concerns about unequal and inconsistent treatment.

MINE SUPERINTENDENT STRESS

-Meet the cost budget

-Meet the production budget

-Operate safely

-Manage 25 to 75 employees and deal with employee/union issues

-Satisfy inspectors from multiple agencies

-Maintain contemporaneous reclamation

-Comply with permit conditions

The Superintendent will comply with Inspector requests cheerfully when the request does not negatively impact cost, production, or safety.

At 5,000 tons per day, one day's production revenue is $150,000.

The decision to litigate NNC's is driven by cost and perceived guilt.

Overly lenient inspectors are not helpful in the long run.

Not correcting problems early can lead to larger problems later.

THE CERTIFYING ENGINEER AS POLICE MAN

The struggle between helping the employer/client and professional ethics.

Ethics win.

Illegible multipart carbon copy inspection reports and NNC’s have been replaced by lap top computers and portable printers.

QUESTIONS

ROCK FILL CONSTRUCTION AT WEST VIRGINIA DOH

Valley Fill Workshop
Ft. Mitchell, Kentucky
March 31, 2004

Joe Deneault, P.E.
Director of Construction Services

HNTB

ROCK FILL CONSTRUCTION

- SELDOM DO ROAD EMBANKMENTS LOOK LIKE VALLEY FILLS
  - **Crosses the valley or hollow**
  - **Runs along the slope of mountain**
  - **Deep pipes handle surface drainage from valley head**

ROCK FILL CONSTRUCTION

- TYPICAL PRACTICES
  - Clearing and grubbing
  - Rock fill construction
  - Other concerns

ROCK FILL CONSTRUCTION

- CLEARING AND GRUBBING
  - Fill height under 5 feet--clear and grub
  - Fill height over 5 feet--clear only
- START AT
  - Lowest point below grade
  - Bottom of ravines
  - Foot of slopes on side hill fills

ROCK FILL CONSTRUCTION

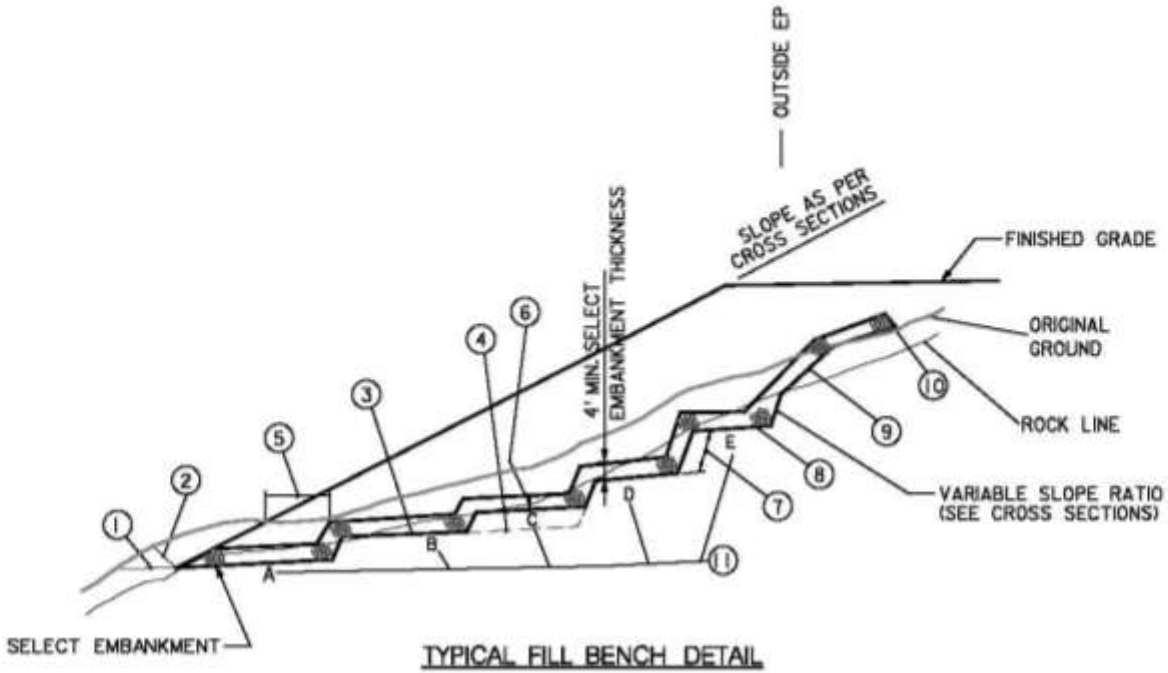
- LIFTS CONSTRUCTED
  - Approximately parallel to finish grade
  - Leveled and smoothed
  - Extends across entire fill area unless otherwise authorized

ROCK FILL CONSTRUCTION

- MATERIALS DEFINITIONS
  - Shale-clay, silt or combination, may have fine sand
  - Soft shale-breaks down under roller
  - Hard shale-does not break down under roller
  - Rock-sandstone, limestone or concrete, can’t go in 6 inch lift

ROCK FILL CONSTRUCTION

- ROCK MAY BE USED TO
  - Provide base for embankments
    - May be on fabric
    - Lift governed by equipment stability
  - Form select embankment areas
  - Form drainage systems
    - Hill side slope blanket
    - Rock core, may be in drainage fabric
    - Drainage blanket under entire fill area
    - Widen previously constructed embankments



TYPICAL FILL BENCH DETAIL

FILL BENCH DESIGN LEGEND:

1. WHERE POSSIBLE, DAYLIGHT THE EXCAVATION ON A 20:1 SLOPE AWAY FROM THE EMBANKMENT.

2. WHEN RIGHT OF WAY OR OTHER CONSIDERATIONS DICTATE, EXCAVATION FOR THE TOE MAY BE AS SHOWN. IN SOME SITUATIONS THIS EXCAVATION WOULD BE BACKFILLED, AND IN OTHERS LEFT OPEN. DRAINAGE OF THE SELECT EMBANKMENT SHOULD ALWAYS BE OBTAINED EITHER LONGITUDINALLY OR BY OCCASIONAL LATERAL TRENCHES IF THE TOE IS BACKFILLED.

3. MINIMUM WIDTH OF THE EXCAVATED BENCH IS 12 FT, SLOPED AWAY FROM THE EMBANKMENT AT 20:1.

4. ACTUAL WIDTH DESIGNED SHOULD BE A COMPROMISE BETWEEN EXCAVATION COSTS OF A FEW LARGE BENCHES AND ENGINEERING (SURVEY) COSTS OF MANY SMALLER ONES.

5. THE MINIMUM WIDTH OF BACKFILL ANYWHERE IN THE EMBANKMENT IS 12 FT. IF ALL ROCK, AND 12 FT. PLUS THE WIDTH OF THE SELECT EMBANKMENT LAYER WHERE BOTH SELECT EMBANKMENT BLANKET AND RANDOM MATERIAL ARE USED. DURING CONSTRUCTION, THE WIDTH OF THE SELECT EMBANKMENT BLANKET MAY BE INCREASED PROVIDED THAT EITHER THE FULL WIDTH OF THE EMBANKMENT IS CONSTRUCTED OF ROCK OR THAT THE MINIMUM 12 FT. WIDTH OF EARTH BACKFILL SHALL BE RETAINED TO ALLOW PROPER COMPACTION.

6. SELECT EMBANKMENT BLANKETS WILL BE CONTINUOUS WITH A MINIMUM THICKNESS OF 4 FT. PERPENDICULAR TO THE NEAT LINE OF THE EXCAVATION.

7. HEIGHT OF BACKSLOPE IS VARIABLE DEPENDING ON SLOPE OF ROCK AND SOIL CONTACT. SLOPE RATIO IS ALSO VARIABLE BUT SINCE BENCHES ARE BACKFILLED QUICKLY, THE SLOPE IS USUALLY CUT STEEPER THAN IN ROADWAY CUTS OF COMPARABLE ROCK.

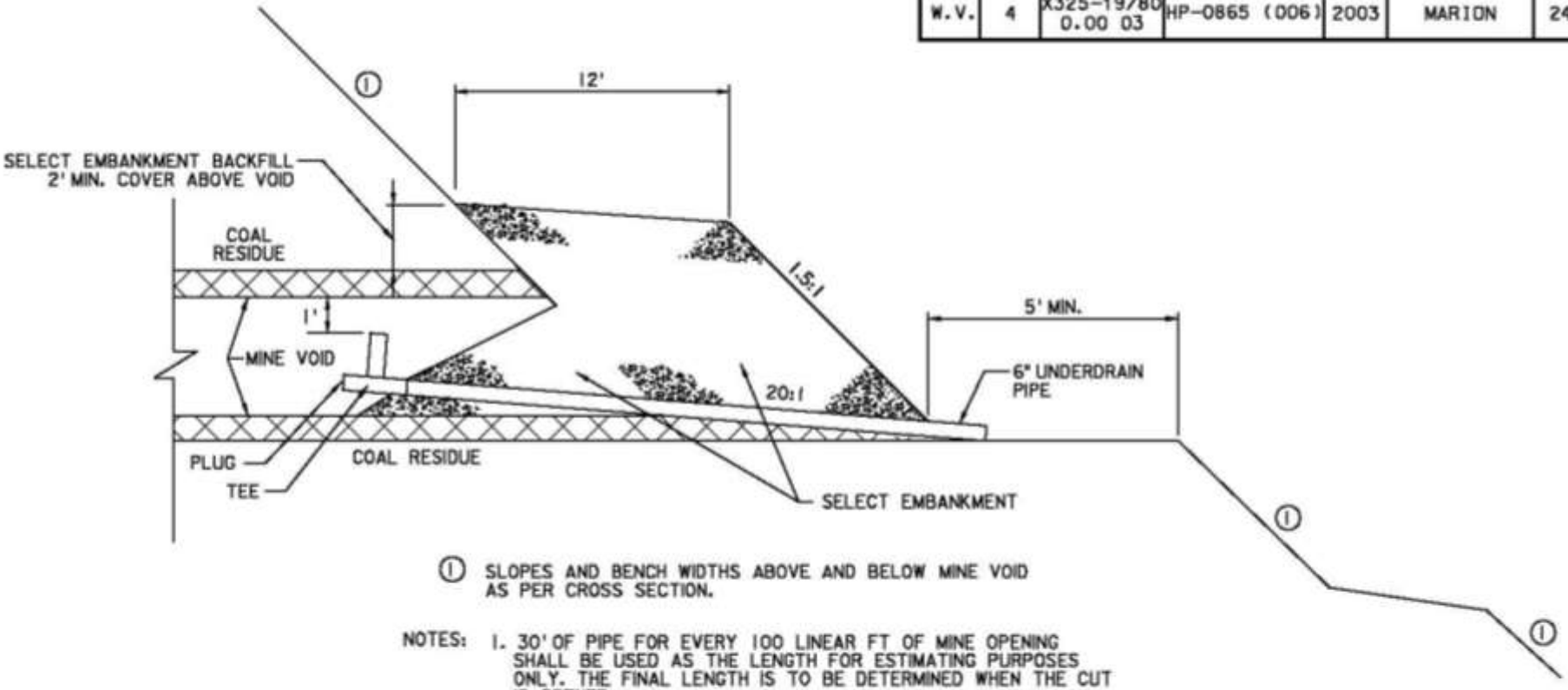
8. THE LAST BENCH SHOULD TERMINATE IN THE VICINITY OF THE OUTSIDE EDGE OF PAVEMENT.

9. SLOPE IN SOIL IS VARIABLE, BUT SHOULD BE FLAT ENOUGH TO PREVENT FAILURE DURING CONSTRUCTION.

10. SELECT EMBANKMENT SHOULD BE CONTINUED ON THE EXISTING GROUND AS FAR AS CONSIDERED NECESSARY TO PROVIDE ADEQUATE DRAINAGE AND STABILITY AT THE BASE OF THE FILL.

11. THE BENCHES ARE INTENDED TO BE GENERALLY HORIZONTAL LONGITUDINALLY.

PUBLIC ROADS DIV.	STATE DIST. NO.	STATE PROJECT NO.	FEDERAL PROJECT NO.	FISCAL YEAR	COUNTY	SHEET NO.	TO SHE
W.V.	4	X325-19/80 0.00 03	HP-0865 (006)	2003	MARION	24	1-



① SLOPES AND BENCH WIDTHS ABOVE AND BELOW MINE VOID AS PER CROSS SECTION.

NOTES:
1. 30' OF PIPE FOR EVERY 100 LINEAR FT OF MINE OPENING SHALL BE USED AS THE LENGTH FOR ESTIMATING PURPOSES ONLY. THE FINAL LENGTH IS TO BE DETERMINED WHEN THE CUT IS OPENED.
2. ALL COSTS SHALL BE INCIDENTAL TO ITEM 207001-001, UNCLASSIFIED EXCAVATION.

CUT SLOPE TREATMENT IN MINE VOID AREAS

NOT TO SCALE

ROCK FILL CONSTRUCTION

- LIFT THICKNESSES
  - Rock less than 35% -- 6 inch lift
  - Rock 35% to 65%--12 inch lift
  - Rock greater than 65%--based on size of material, 36 inch maximum
  - Select material—85% rock
  - Hard shale—same as rock except 24 inch maximum lift

ROCK FILL CONSTRUCTION

- OTHER ISSUES
  - Large rocks to be moved to outer face
  - Material is to be bladed into final position in lifts across fill width
  - Distribute material to minimize voids, pockets, bridging and deformation

ROCK FILL CONSTRUCTION

- OTHER ISSUES (con't)
  - Non-rock embankment to slope 4% to outside before beginning rock fill
  - Compaction with pneumatic roller with effective weight of 50 tons
  - Sub-surface drainage designed to fit site

ROCK FILL CONSTRUCTION

- OTHER ISSUES (con't)
  - Surface drainage during construction by sloping
  - Surface drainage after constriction designed to fit site
  - Stability analysis done for each fill. Toe benches, hill side benches, and cut fill transition benches designed as needed

ROCK FILL CONSTRUCTION

- WHAT'S NEW
  - Proposal to partner with industry and other agencies to use valley fills and other mined areas
  - Must be concerned with excessive differential settlement
  - Many issues to work out
    - Permits
    - Financial

ROCK FILL CONSTRUCTION

- WHAT WILL BE DIFFERENT
  - 85% rock or hard shale
  - Lift thickness 50 feet or less
  - 5 foot maximum size of material
  - End dumping at face of fill

ROCK FILL CONSTRUCTION

- WHAT WILL BE DIFFERENT (con't)
  - **Dozer to work face continuously**
  - **Material within 5 feet to be random material**
  - **WVDOH shall inspect by visual observation**

ROCK FILL CONSTRUCTION

- CONCLUSION
  - Experience with valley fills will result in changing WVDOH practices
  - Highways are beneficial post-mining use of valley fills

Ohio's Integrated Permit Process

Buffer Zone Variance Request

- Defines proposed activities
- Provides linear stream measurements locating specific activities
- Describes why the disturbance is necessary and other options considered
- Describes the water quality, quantity, and environmental resources of the stream

Buffer Zone Variance Request

- Describes the existing riparian vegetation
- Defines areas to be avoided
- Describes measure to be taken to minimize impacts to the stream & buffer zone
- Describes the plan for stream reconstruction using natural stream channel designs

Regulatory Requirements

U.S. 30 CFR 816.57

Ohio 1501:13-9-04 (E) OAC

Regulatory Requirements

Section 401 Federal Water Pollution Control Act (OhioEPA)

Section 404 of the Clean Water Act (USACE)

Ohio's Permit Conditions

CONDITIONS

CONDITION TYPE	DESCRIPTION
Archeology	Avoidance with flagging of the following archaeological sites: (STA-3427-20; 33ST904), (33ST903) and (33ST905) until the Phase I report has been reviewed and cleared by the Division and the Ohio Historic Preservation Office.
Streams	No disturbance of the streams identified in this permit that are currently under 401/404 consideration with OEPA and the Corps of Engineers. This condition shall be lifted or revised upon notification of receipt of the 401/404 permits and submittal and approval of an ARP revising the permit accordingly.
Wetlands	No disturbance of wetland areas identified in the wetland delineation. This condition may be lifted or revised upon notification of approved 404/401 permits, and submittal and approval of an ARP revising the permit accordingly. If 404/401 permits are not required, mitigation of identified wetlands may still be required.

We Began to Read The 404 and 401 Documents

There were differences in all three agencies determinations of

- Stream Designations
- Stream Lengths
- Wetland Acreages

SO

Ohio Began Requiring a Permit Revision to be Submitted to Lift the Permit Condition, Including Buffer Zone Variances in Order for the Permits to be Consistent

Problem ID

Industry Problem:

ACOE Wouldn’t Process the 404 Permit Application until the Operator Had Obtained an Ohio Mining Permit

Ohio’s Problem:

We were Reviewing Buffer Zone Plans and Drainage Control and Wetland Plans Many Times

Early 2003
Joint Agency Workgroup was Established

DMRM / Ohio EPA / Huntington COE / Pittsburgh COE

PURPOSE:

- Open Communications
- Provide for Education
- Examine Potential for a Single Permit or Review

Considerations

- Looked at conducting joint field reviews for stream and wetland limits
- Examined DMRM Buffer Zone Variance Requirements
- Examined DMRM Environmental Resource Information
- Examined DMRM Surface and Groundwater Information

PROGRESS THUS FAR

- The three agencies conduct joint field reviews of proposed mining sites
- The three agencies have agreed to process applications concurrently
- DMRM would serve as the clearing house for all three agencies required information.

Our Goals

- Implement a Concurrent Application Review Process
- Create Consistent Mining and Reclamation Permit Requirements between agencies
- Reduce Permit Revision Requirements
- Reduce the need for Conditional Coal Permit Issuance

Process Dynamics

- Continuing Educational Efforts
- Testing of the Process
- Process Refinement

Questions or Inquiries

Russ Gibson
DMRM Permitting Manager
(614) 265-6663

Valley Fill Regulatory Requirements

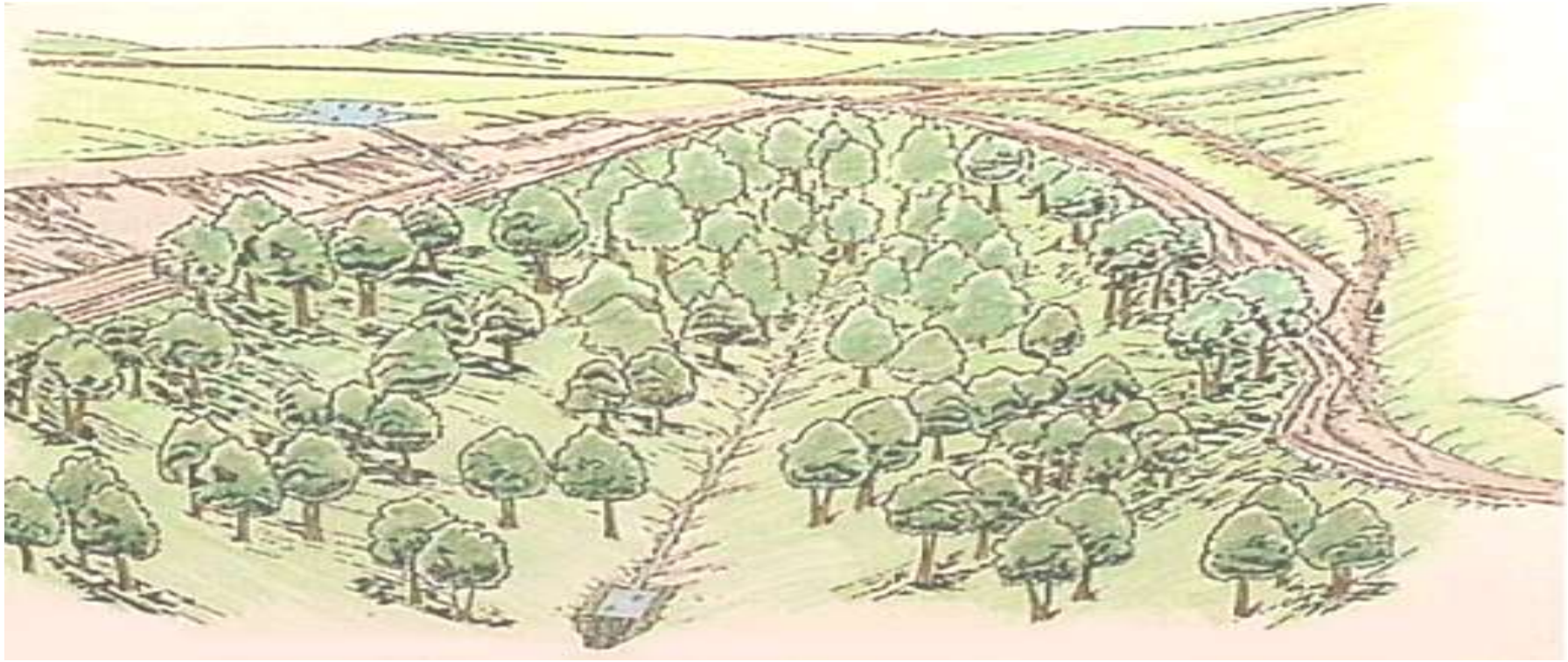
Implemented Before, During, and After Construction

Michael C. Castle M.B.A., J.D.

Designated Disposal Area

-Minimized

-Balanced



Phase 1

Sediment Pond Installed

Suitable

-Reclamation

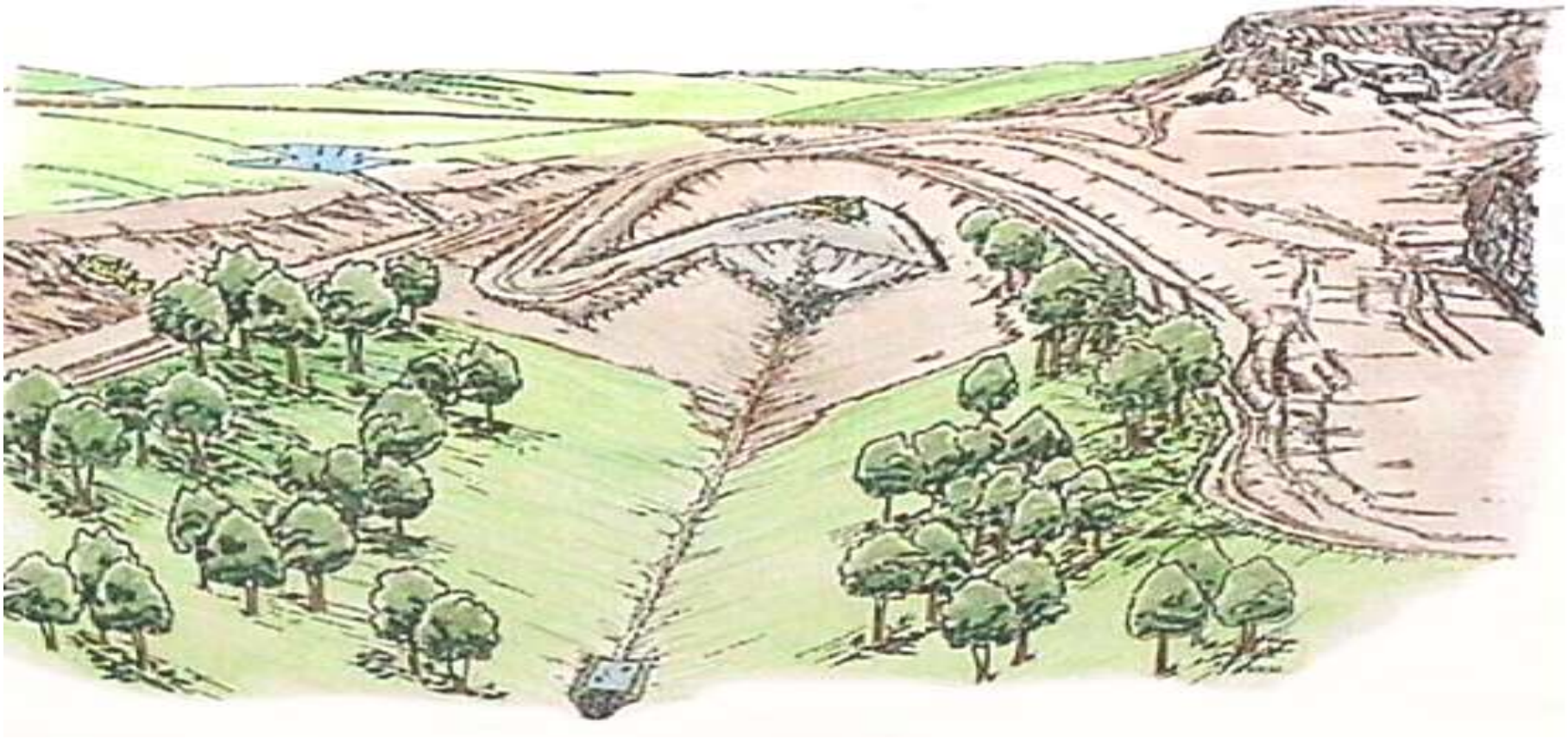
-Revegetation

Compatible

-PMLU

-Compliment Surronding Landscape

Spoil Placement
-Prepared Footprint



Phase 2

Initial Overdurden Placement in Fill Area

Toe Location: ***Stability***

-Moderate or Terrace:

Durable Rock Underdrain

Gravity Segregation- End Dump

Durable Rock Underdrain

Modified End Dump

Fill Material

-Durable

-Gradation

End Dump Method

Fill Material

-Durable

-Gradation

Modified End Dump

Fill Development

-Progress

Modified End Dump

Fill Development

-Progress

Modified End Dump

Fill Development

-Progress

End Dump

Fill Development

-Progress

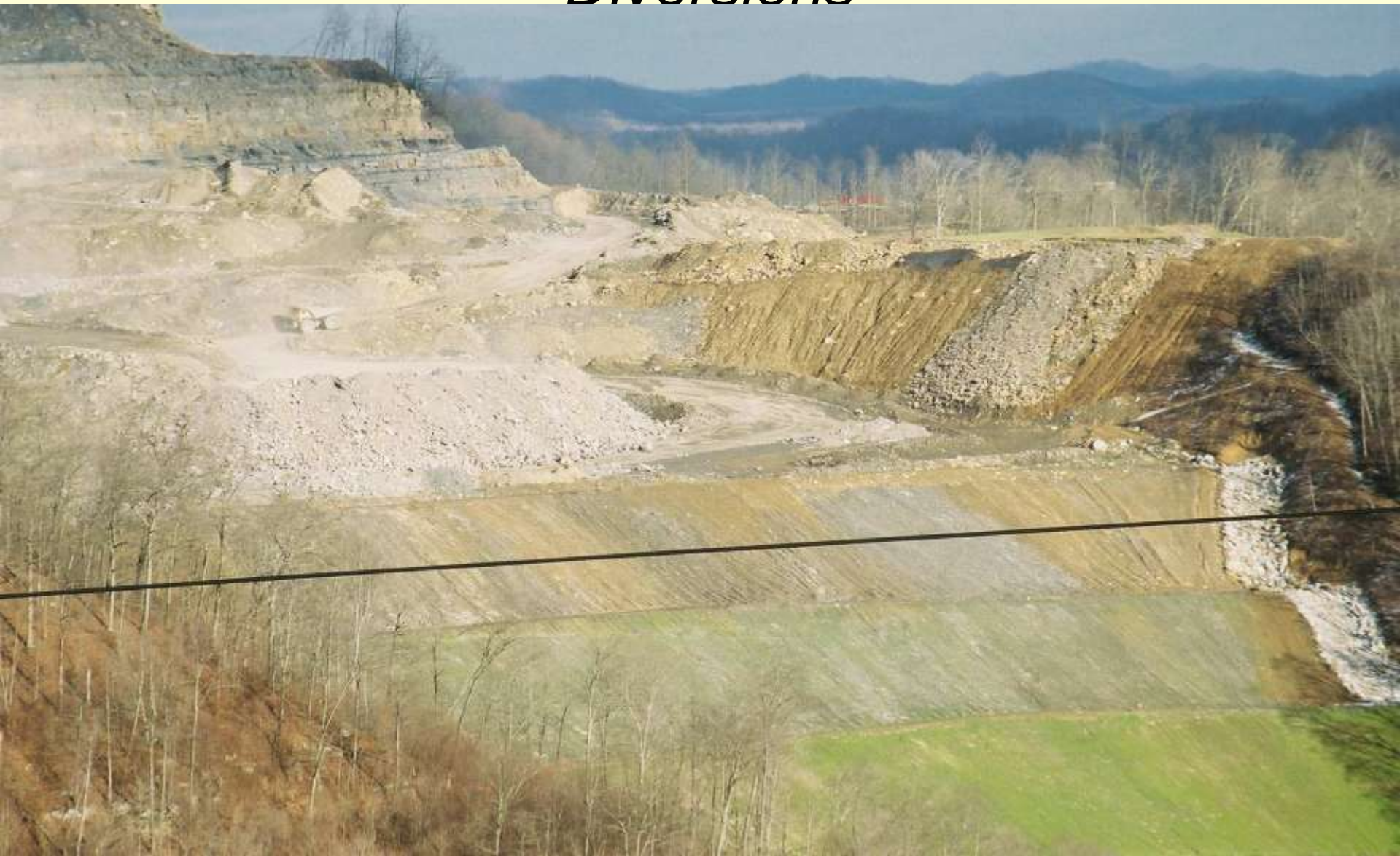
End Dump

Drainage Control

-Diversions

Drainage Control

-Diversions



Finished Fill

Modified End Dump

Finished Fill

End Dumped

Mass Stability
-Finished Fills