

INSPECTION REPORT
Sedimentation Structure
N14-B
Kayenta Mine
Navajo County, Arizona
for
PEABODY COAL COMPANY



Dames & Moore
10139-011-22

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INTRODUCTION

Sedimentation Structure N14-B is an earthen embankment, designed and constructed in 1981 by Peabody Coal Company as a temporary sedimentation structure to control runoff and sediment from the disturbed mining areas of the Kayenta Mine. The location of Structure N14-B is shown on Plate 1, Site Plan.

This inspection report contains information specific to Structure N14-B. Regional site information is presented in the "General Report, Kayenta and Black Mesa Mines, Navajo County, Arizona for Peabody Coal Company," along with the methods and results of analyses used for slope stability, hydrology and hydraulics.

INSPECTION

Structure N14-B was inspected on September 9, 1985 by an interdisciplinary team of engineers from Dames & Moore. The purpose of the inspection was to assess the safety and general condition of the structure with respect to United States Department of Interior, Office of Surface Mining (OSM) regulations.

Dames & Moore's inspection was performed in accordance with applicable 30 CFR 780 and 816 regulations and included a review of the N14-B project files and a field inspection of the structure. The most current information contained in the Peabody Coal Company files includes the 1984 and current survey data and inspections performed in 1984 and 1985 by

Peabody Coal Company. The survey data developed in August 1984 was used in the analyses of the structure. Results of the field inspection are included in this report as Appendix A.

SITE DESCRIPTION

LAND USE

Structure N14-B has a 62.3-acre tributary drainage area and is located near Moenkopi Wash at the Kayenta Mine. The watershed is classified as 59% Pinion/Juniper, 33% disturbed, and 8% Sagebrush/grass.

EMBANKMENT

Structure N14-B is a homogeneous earthen embankment classified as a cross-valley embankment. Physical characteristics of the embankment are listed in the following table:

Structure N14-B

| | |
|----------------------------|----------------------|
| Embankment | Residual Shale Soils |
| Foundation | Sandstone |
| Right Abutment | Residual Shale Soils |
| Left Abutment | Residual Shale Soils |
| Height | 15.8 ft |
| Crest Width | 15 ft |
| Upstream Slope | 2.25 H : 1 V |
| Downstream Slope | 2.9 H : 1 V |

A cross-section of the embankment is shown on Plate 2, Existing Maximum Cross Section N14-B, A-A'.

ANALYSES

STABILITY

Structure N14-B is a category B-5 embankment. A standard category B-5 embankment has static and seismic factors of safety equal to or greater than 1.5 and 1.2, respectively, under the following conditions:

1. Maximum height = 20 ft
2. Maximum upstream slope = 2.0 H : 1 V
3. Maximum downstream slope = 2.5 H : 1 V
4. Normal pool with steady seepage saturation conditions

The N14-B embankment is lower in height and has flatter slopes than the category standard; therefore, the embankment has factors of safety greater than the design minimum.

HYDROLOGY

The hydrologic analysis was completed using the U.S. Army Corps of Engineers generalized computer program HEC-1, Flood Hydrograph Package. Structure N14-B is not in series with any other structure and therefore the spillway was analyzed using the 25-year, 6-hour storm. The storage capacity of Structure N14-B was analyzed using the 10-year, 24-hour storm.

The following parameters were used in the hydrologic analysis:

1. Water Course length, L 0.455 mi
2. Elevation Difference, H 155 ft
3. Time of Concentration, T_c 0.150 h
4. Lag time, 0.6T_c 0.090 h
5. SCS Curve Number 86
6. Rainfall Depth, 10-year, 24-hour storm . 2.1 in.
25-year, 6-hour storm. . 1.9 in.
7. Drainage Area 62.3 acres

HYDRAULICS

The HEC-1 program was used to evaluate inflow to the sedimentation structure, outflow from the structure and the resulting water surface elevations. The initial conditions and results of the analysis are summarized in the following table.

N14-B HYDRAULICS

| Units | 10-year 24-hour Storm | 25-year 6-hour Storm |
|---------------------------------|-----------------------------|--------------------------------------|
| Initial Reservoir Volume | | |
| Condition | Empty | Full to the spillway elevation |
| Inflow | | |
| Peak Flow cfs | 93 | 115 |
| Volume acre-ft | 4.82 | 4.15 |
| Storage | | |
| Peak Stage ft | 6838.36 | 6840.81 |
| Spillway Elevation . . ft | 6838.76 | -- |
| Peak Storage acre-ft | 4.82 | -- |
| Storage Capacity . . . acre-ft | 6.40 | -- |
| Outflow | | |
| Peak Flow cfs | -- | 67 |
| Embankment Crest | | |
| Elevation ft | -- | 6840.94 |
| Peak Stage ft | -- | 6840.81 |
| Freeboard ft | -- | 0.13 |

Spillway Channel

The existing spillway for N14-B has a trapezoidal channel with the following dimensions:

| | |
|---|-----------|
| Channel depth | 3.2 ft |
| Channel width | 13 ft |
| Channel length | 65 ft |
| Side slopes (horizontal to vertical). . . | 2:1 |
| Average exit slope | 0 percent |

There is presently no erosion protection within the channel.

Outflow Channel

The structure presently has no outflow channel.

STORAGE CAPACITY

The impoundment volume-elevation curve is based on site specific surveys conducted for Peabody Coal Company's August 1984 inspection, and 1985 resurveys, where available. Additionally, the most current topographic maps available were used in developing Plate 3, Volume-Elevation Curve, N14-B.

The calculations for the sediment load entering Structure N14-B were made utilizing the Universal Soil Loss Equation with the following parameters:

1. Rainfall Factor, R 40
2. Soil Erodibility Factor, K 0.22
3. Slope Factor, LS 4.27
4. Cover Factor, C 0.463
5. Erosion Control Factor, P 1.0

The hydrologic analysis gives the storage volume required to contain the 10-year, 24-hour storm, and the remaining storage volume available for storing sediment. The existing storage capacity of N14-B and the results of the sediment inflow analysis are summarized in the following table.

N14-B STORAGE

| | | |
|---|-------|------------|
| Total Storage Capacity | 6.40 | acre-ft |
| 10-year, 24-hour Storm Inflow | 4.82 | acre-ft |
| Available Sediment Storage Capacity | 1.58 | acre-ft |
| Sediment Inflow Rate | 0.463 | acre-ft/yr |
| Sediment Storage Life | 3 | yrs |

REMEDIAL COMPLIANCE PLAN

GEOTECHNICS

The inspection of Structure N14-B indicated that the geotechnical problems consist of rill and gully erosion on the upstream and downstream slopes, the side slopes of the spillway channel and the right abutment and evidence of seepage below the toe of the downstream slope of the embankment. Correction of erosion is considered a periodic maintenance task and does not

require remedial action. The evidence of seepage is not considered to be a problem at the present time. However, future inspections should note any changes in the condition of the seepage.

HYDRAULICS

The storage capacity and the spillway capacity of Structure N14-B are inadequate. The structure does not have an adequate outflow channel. The bottom elevation of the existing spillway channel should be raised to elevation 6840.50 feet while maintaining the bottom width of 15 feet as shown on Plate 5. The embankment crest should be raised to elevation 6843.50 feet. A trapezoidal outflow channel with the same bottom width as the spillway and a stilling basin should be constructed along the alignment shown in Plate 1. The channel and stilling basin profile is shown in Plate 4 and required dimensions are shown in Plate 5 and Plate 6. The spillway, outflow channel and stilling basin should be protected against erosion using geotextile and riprap as shown in Plate 5.

Raising the spillway elevation and the dam crest elevation increases the storage capacity. The analysis of these conditions is summarized in the following table.

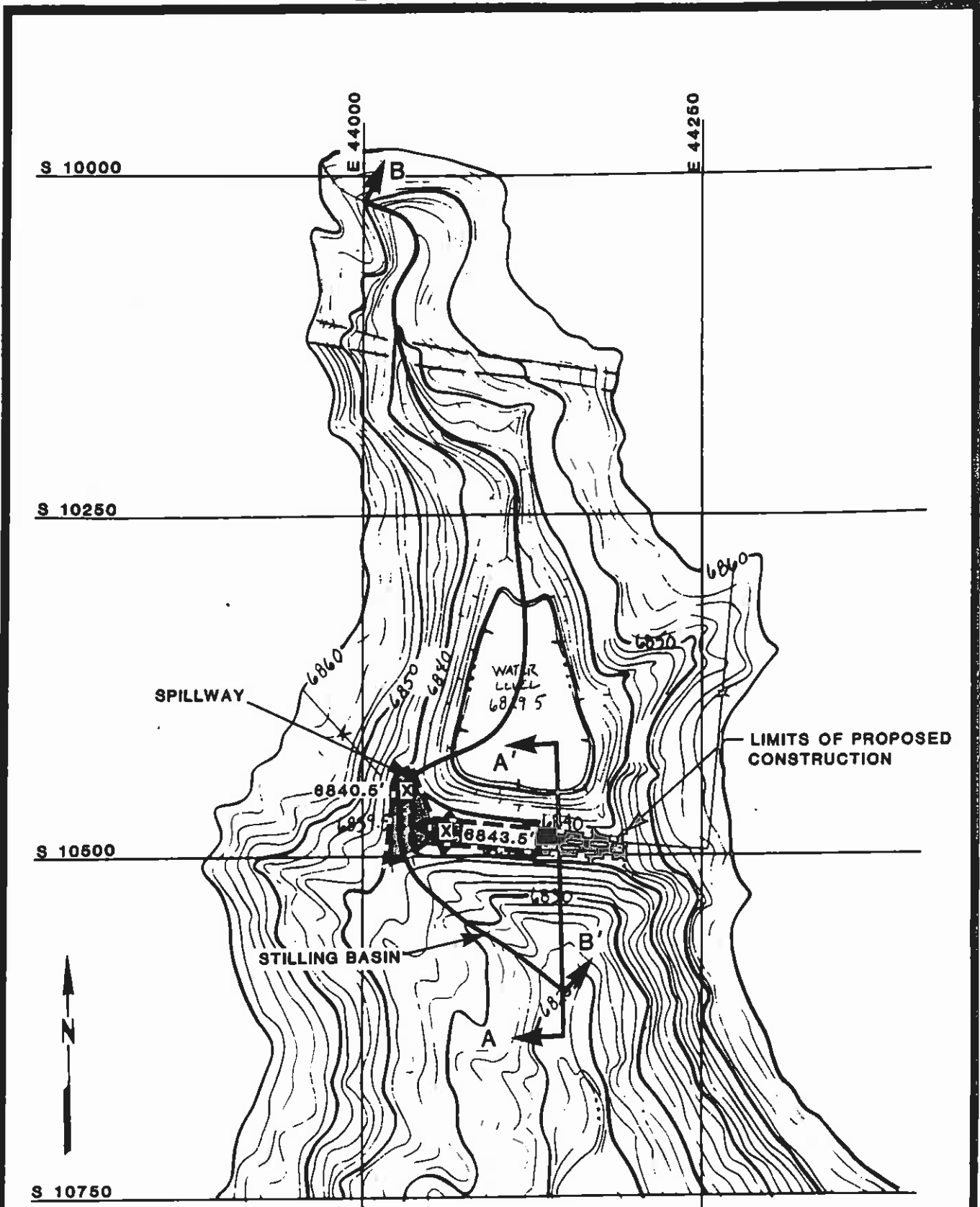
N14-B HYDRAULICS FOR REDESIGNED SPILLWAY

| | Units | 10-year 24-hour Storm | 25-year 6-hour Storm |
|---------------------------------|------------|-----------------------------|--------------------------------------|
| Initial Reservoir Volume | | | |
| Condition | | Empty | Full to the spillway elevation |
| Inflow | | | |
| Peak Flow | cfs | 93 | 115 |
| Volume | acre-ft | 4.82 | 4.15 |
| Storage | | | |
| Peak Stage | ft | 6838.50 | 6842.46 |
| Spillway Elevation . . | ft | 6840.50 | -- |
| Peak Storage | acre-ft | 4.82 | -- |
| Storage Capacity . . . | acre-ft | 6.70 | -- |
| Available Sediment | | | |
| Storage Capacity . . | acre-ft | 1.88 | -- |
| Sediment Inflow Rate . | acre-ft/yr | 0.459 | -- |
| Sediment Storage Life. | yrs | 4 | -- |
| Outflow | | | |
| Peak Flow | cfs | 0 | 58 |
| Embankment Crest | | | |
| Elevation | ft | -- | 6843.50 |
| Peak Stage | ft | -- | 6842.46 |
| Freeboard | ft | -- | 1.04 |
| Spillway Channel | | | |
| Flow Depth | ft | -- | 1.96 |
| Critical Velocity . . . | fps | -- | 4.6 |
| Manning's "n" | | -- | 0.040 |
| Outflow Channel | | | |
| Slope | % | -- | 15 |
| Normal Velocity | fps | -- | 8.0 |
| Normal Depth | ft | -- | 0.45 |
| Manning's "n" | | -- | 0.040 |

* * *

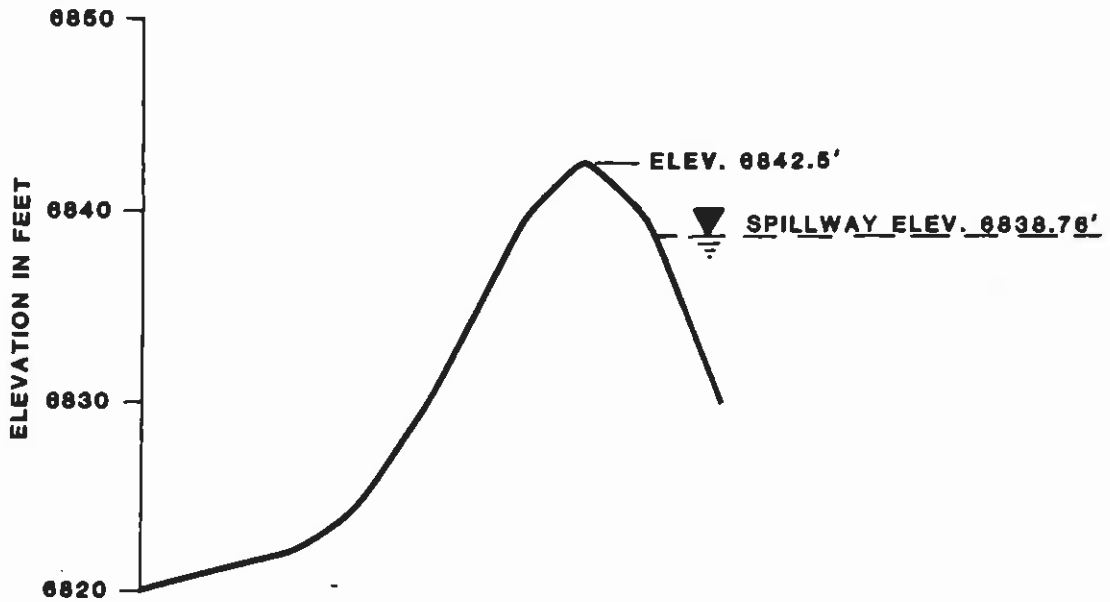
The following plates and appendix are attached and complete this inspection report.

- Plate 1 - Site Plan N14-B
- Plate 2 - Existing Maximum Cross Section N14-B, A-A'
- Plate 3 - Volume-Elevation Curve N14-B
- Plate 4 - Channel Profile N14-B, B-B'
- Plate 5 - Spillway and Outflow Channel Cross Section N14-B
- Plate 6 - Spillway Stilling Basin Plan N14-B
- Appendix A - Inspection Check List
- Appendix B - Hydrology and Hydraulic Calculations



**SITE PLAN
N14-B.**

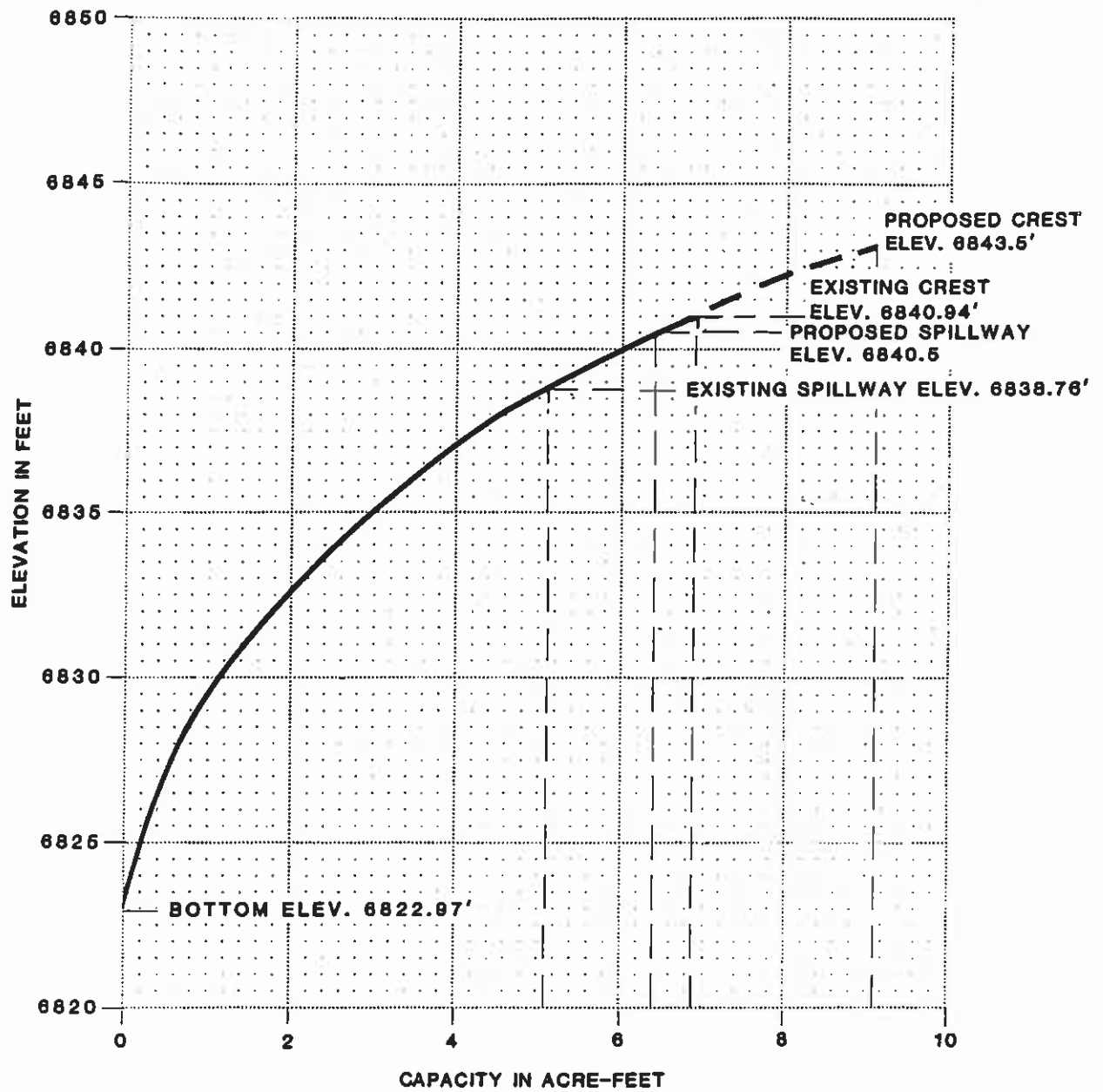




EXISTING
MAXIMUM CROSS-SECTION
A-A'
N14-B

FOR LOCATION SEE PLATE 1

BY **Dames & Moore** Plate 2



VOLUME-ELEVATION
CURVE
N14-B