DEPARTMENT OF ENVIRONMENTAL RESOURCES

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COMMONWEALTH OF PENNSYLVANIA DEPARTMENT OF ENVIRONMENTAL RESOURCES

MINE DRAINAGE ABATEMENT MEASURES FOR THE JEANSVILLE BASIN

Carbon, Luzerne, and Schuylkill Counties, Pennsylvania

PRELIMINARY ENGINEERING REPORT
PROJECT NO. SL-135

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November 26, 1974

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Attention: Dr. Maurice K. Goddard, Secretary

Gentlemen:

Project No. SL-135
Jeansville Basin

In accordance with the provisions of our Service Contract dated July 8, 1969, and Change Order dated December 18, 1972, we are pleased to submit the enclosed report covering the findings, conclusions, and recommendations resulting from investigations of mine drainage abatement measures related to the Jeansville Basin.

Very truly yours,

GANNETT FLEMING CORDDRY AND CARPENTER, INC.

R. S. KLINGENSMITH
Manager, Mine Drainage
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FOREWORD

"The Land and Water Conservation and Reclamation Act" was enacted on January 19, 1968. The act authorizes the Commonwealth of Pennsylvania to issue bonds in the amount of $500,000,000 for the purpose of conservation and reclamation of air, water, and land resources. Of this amount, the act stipulates that $200,000,000 is to be used for (1) eliminating air pollution from burning coal refuse banks, and surface and underground mine fires; (2) reducing or eliminating surface subsidence above abandoned deep mine workings; (3) restoring abandoned strip mines; and (4) abating stream pollution from coal mine drainage. Responsibility for the allocation and administration of this bond issue money lies with the Department of Environmental Resources.

One of the streams of the Commonwealth polluted by coal mine drainage is Catawissa Creek, which lies within the Susquehanna River watershed. The known major mine drainage pollution sources on the Catawissa Creek watershed originate from mine workings in three separate coal basins; namely, South Green Mountain Basin, North Green Mountain Basin, and Jeansville Basin. Both the North and South Green

Mountain Basins lie within the Catawissa Creek watershed. Mine workings within these two basins drain to the Catawissa Creek watershed. Jeansville Basin, however, lies on the Susquehanna River-Delaware River watershed divide with drainage from mine workings within this basin conveyed through a drainage tunnel known as the Audenried Tunnel to Catawissa Creek, then to the Susquehanna River, as well as through a drainage tunnel known as Quakake Tunnel to Wetzel Creek and then to the Delaware River.

In an effort to improve stream quality in Catawissa Creek, the Pennsylvania Department of Environmental Resources has instituted a continuing program to eliminate or reduce mine drainage pollution in the watershed. At present, the Department is using bond issue funds and funds made available from the United States Environmental Protection Agency to construct, and evaluate the effectiveness of, various preventive measures in the South Green Mountain Basin. Concurrently, the Department has authorized a study funded by the bond issue to determine the applicability and effectiveness of placing watertight seals in the two drainage tunnels, as well as determine the applicability and effectiveness of other preventive measures in the Jeansville Basin.

This report sets forth the findings, conclusions, and recommendations resulting from the preliminary engineering investigation and study authorized by the Department to determine the most feasible and economic method for abating or reducing mine drainage pollution from the Jeansville Basin by preventive measures.

SUMMARY OF FINDINGS, CONCLUSIONS, AND RECOMMENDATIONS

The findings, conclusions, and recommendations resulting from investigations of the project area are summarized as follows:

1. The Jeansville Basin covers approximately 20 square miles in Luzerne, Schuylkill, and Carbon Counties in the southern part of the Eastern Middle Anthracite Field.

2. The Basin lies on both the Susquehanna and Delaware River watersheds.

3. Extensive mining of the Basin coal measures has occurred since the mid-1800's. However, anthracite mining, once the mainstay of the Basin economy, has significantly declined in recent years, as well as in the entire field. Approximately 199,000 tons of coal were mined from the Basin in 1972 through strip mining and bank recovery. No coal was recovered by deep mining.

4. As a result of past extensive deep and strip mining, all natural drainage patterns of surface streams within the Basin have been destroyed.

5. All surface water draining into or overlying the Basin coal measures infiltrates through broken strata or strip pits to enter the underlying deep mines.

6. Drainage from the Basin deep mines is discharged via two drainage tunnels: the Audenried and Quakake Tunnels.

7. The Audenried Tunnel discharges acid mine drainage into, and adds to the pollutional load of, Catawissa Creek, a tributary of the Susquehanna River.

8. The Quakake Tunnel discharges acid mine drainage into, and pollutes, Wetzel Creek, a headwaters tributary of Black Creek with eventual discharge to the Delaware River.

9. Past deep mining of the Basin coal measures occurred through the development of large mine complexes.

10. In order to maximize development of the coal measures and reduce operating costs, elaborate drainage systems interconnect the mine complexes enabling all mine drainage to be carried by the Audenried and Quakake Tunnels.

11. A study of available mine maps indicates that the Audenried Tunnel presently drains the following deep mine complexes:

Audenried
Tresckow
North of Fault
Beaver Brook Spring
Brook
Portions of Spring Mountain

12. The following deep mine complexes are currently drained by the Quakake Tunnel:

Beaver Meadow
Coleraine
Remainder of Spring Mountain

13. Interconnections exist between those mines currently drained by the Audenried Tunnel and those presently drained by the Quakake Tunnel.

14. The degree of interconnection increases as the deep mine workings approach higher elevations.

15. Additional interconnections occur at higher elevations as the result of past strip mining.

16. In addition to natural surface waters draining into the Basin coal measures, two sources contribute to tunnel discharges:

    a. Water pumped from outside sources used in coal preparation facilities in the Basin.

    b. Wastewaters from municipalities overlying the Basin coal measures.

17. During this investigation, the Audenried and Quakake Tunnel discharges were gaged, sampled, and analyzed. As a result of this program, the following design parameters were established:

18. Various abatement measures considered applicable to problems and conditions in the Basin were reviewed during the development of alternative abatement plans.

	Design Average		Design Wet-Weather		Design Maximum	
	Audenried Tunnel	Quakake Tunnel	Audenried Tunnel	Quakake Tunnel	Audenried Tunnel	Quakake Tunnel
Volume (mgd)	18.4	16.6	24.5	19.6	317	285
pH Range	3.2-3.5	3.2-3.6	3.2-3.5	3.4-3.6	3.2-3.5	3.4-3.6
Total Iron						
mg/l	4.6	3.6	3.1	1.6	3.1	1.6
tons/day	0.35	0.25	0.32	0.13	4.1	1.9
Acid (as $CaCO_3$)						
mg/l	345	235	329	208	329	208
tons/day	26.5	16.3	33.6	17.0	435	247

19. On the basis of the scope of work authorized, the various abatement plans considered were confined to those incorporating only preventive measures.

20. Preliminary consideration was given to developing abatement plans in two categories:

a. Abatement plans consisting of various preventive measures excluding mine sealing.

b. An abatement plan consisting of mine sealing only.

21. The Basin is contained within a tightly folded syncline. Resistant, competent sandstones and conglomerates of the Pottsville Formation comprise the enclosing rims of the Basin and underlie the coal measures.

22. Because of the intense deformation to which this syncline was subjected, the rock strata have been faulted and fractured.

23. If this faulting and fracturing were extensive, and if the resultant cracks were open through the enclosing formations, considerable leakage would occur if seals were placed in the drainage tunnels.

24. If leakage should occur, it would create new and possibly widespread outlets for the acid mine drainage. Hence, it is of primary importance to locate and evaluate all potential leakage points.

25. Surface maps and aerial photographs were studied to help define and describe fractures and faults in the Basin and through the enclosing mountains.

26. The permeability of the enclosing rock units was evaluated by close examination of rock outcroppings and hand specimens.

27. Low angle thrust faults and bedding plane slippages were observed on the surface and in the tunnels.

28. None of the faults observed appear to possess serious leakage potential because they nearly parallel the strike of the bedding and do not traverse the rock underlying the workings.

29. The nature and condition of the rock observed in the Quakake Tunnel are believed satisfactory for the successful installation of a seal that will contain the anticipated impoundment.

30. Observations in the Audenried Tunnel are inconclusive because of the significant length of tunnel not open for study. It is believed that an effective seal can be constructed in the Audenried Tunnel, but neither this question nor the selection of a seal location can be definitively answered without additional studies.

31. It is not considered possible to determine the exact amount and location of possible leakage without actual inundation of the workings. However, no major leakage is expected.

32. Ultimate water levels cannot be predicted with precision. However, it is believed that the underground pool will ultimately overflow into the Beaver Creek headwaters near Beaver Meadows Borough at approximately +1550 feet.

33. It is estimated that 70 percent of the Basin deep mine workings will be inundated by the establishment of a pool to +1550 feet.

34. It is expected that the quality of the pool overflow will vary considerably but will ultimately be markedly improved when compared to the present-day quality of the Audenried and Quakake Tunnel discharges. The estimated pool overflow quality is summarized in the following:

35. Inundation of coal measures below +1550 will preclude further mining of remaining coal below this elevation but should not seriously hamper recovery of any coal above pool elevation.

	Design Average Conditions				
	Volume	Acid (as $CaCO_3$)		Iron	
	(mgd)	mg/l	tons/day	mg/l	tons/day
First Year Average	35	550	80.3	25	3.6
Third Year Average	35	100	14.6	15	2.2
Thirtieth Year and After Average	35	40	5.8	5	0.7

36. Minor surface subsidence could occur in the vicinity of Beaver Meadows Borough, if mining has been accomplished in this area, as the pool level initially rises or fluctuates seasonally. This potential for subsidence resulting from seasonal fluctuation of the pool level could be reduced by drilling boreholes or excavating open channels into the deep mine workings.

37. As a result of mine sealing, a major pollution source to Catawissa Creek would be eliminated. Coupled with other mine drainage abatement projects on this watershed, the Catawissa Creek stream quality would be substantially improved, and its acid load to the Susquehanna River significantly reduced.

38. Elimination of the Quakake Tunnel discharge would remove the entire acid load to Wetzel Creek, resulting in improved stream quality and enhancing its potential for public use.

39. Establishment of a pool overflow to Beaver Creek should have no adverse effect upon current stream uses.

40. Transfer of the present Audenried Tunnel discharge to the Delaware River watershed would augment Delaware River flow.

41. Sealing of the Audenried and Quakake Tunnels should have no adverse effect on quality or yield of water supplies near the Basin coal measures.

42. Establishment of a large underground pool in the Basin could provide an important source of water for both public and private use.

43. On the basis of investigations and previous experience, it would be totally impractical and prohibitively expensive to develop an abatement plan comprised solely of preventive measures that would completely abate the Basin mine drainage pollutional load.

44. On the basis of investigations and previous experience, abatement plans involving preventive measures other than mine sealing were limited to diverting surface water flows presently draining into the Basin coal measures to streams outside the Basin, because of the large area and physical condition of the surface overlying the Basin coal measures.

45. Three abatement plans were studied in detail: Abatement Plans I and II consist of preventive measures excluding mine sealing; Abatement Plan III is limited to mine sealing.

46. Despite the many benefits that would result from Abatement Plan III, consisting of sealing the Audenried and Quakake Tunnels, a recommendation to implement this plan cannot be made at this time because of the uncertainty regarding the location of, and effectiveness of placing, a seal in the Audenried Tunnel for its intended purpose.

47. Conversely, the overriding benefits associated with placing seals in the Audenried and Quakake Tunnels when compared to the other abatement plans should not be discounted until it can be conclusively determined that an effective seal cannot be placed in the Audenried Tunnel.

48. A course of action is recommended that includes a core drilling program capable of providing sufficient geologic information to establish the feasibility of placing an effective seal in the Audenried Tunnel.

49. If feasibility of placing an effective seal in the Audenried Tunnel is established, it is recommended that seals be constructed in both the Audenried and Quakake Tunnels.

50. If feasibility of placing an effective seal in the Audenried Tunnel is not established, it is recommended that Abatement Plan I, involving diversion and conveyance of surface water around and through the west end of the Basin, be implemented.

51. Comparative estimated design average reductions associated with the recommended alternative plans are summarized in the following:

	Recommended Alternative	Estimated Design Average Reductions		
		Volume (mgd)	Acid (tons/day)	Iron (tons/day)
Abatement Plan I	Reduction of surface water infiltration	2.09	3.05	0.04
Abatement Plan III	Construction of tunnel seals	0.00	37.00	0.1 (increase)

52. Costs associated with the recommended alternatives are summarized as follows:

Recommended Alternative	Project Cost	Initial 30 Years		Next 270 Years		300 Years	
		Average Annual Cost	Per Ton Acid Removed	Average Annual Cost	Per Ton Acid Removed	Average Annual Cost	Per Ton Acid Removed
Abatement Plan I - Reduction of surface water infiltration	$244,600	$20,400	$18.30	$5,000	$4.50	$6,570	$5.90
Abatement Plan III - Construction of tunnel seals	$937,000	$68,100	$ 5.13	$1,200	$0.09	$8,010	$0.59