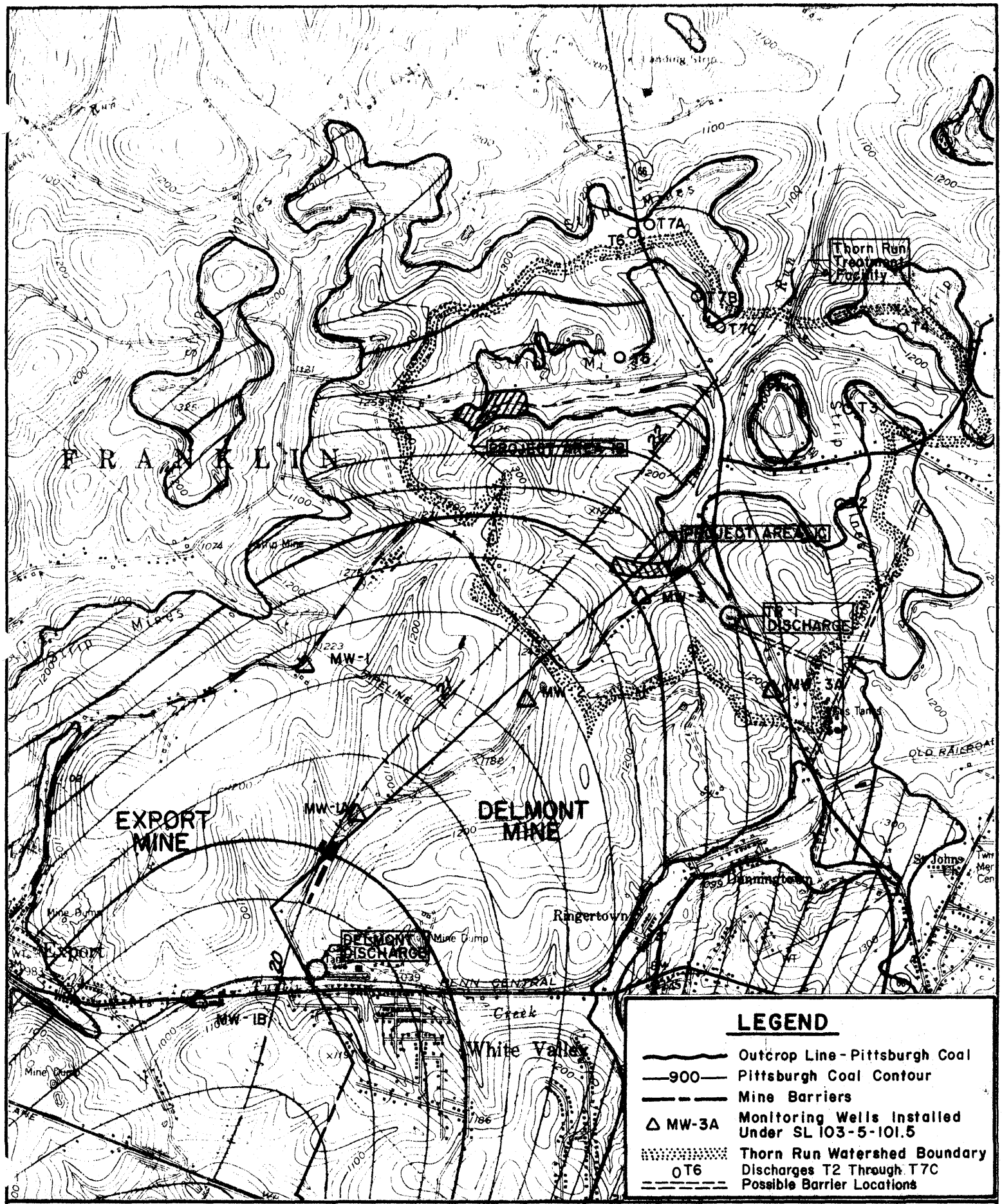
SECTION VII

CONCLUSIONS



THORN RUN WATERSHED

DRAWN W.J.M. DATE SCALE 1" = 2000'

COMMONWEALTH OF PENNSYLVANIA
DEPT. OF ENVIRONMENTAL RESOURCES

PLATE 37

ATLAS LITHO CO., PGH., PA. 1020 CLEARPRINT

7.0 CONCLUSIONS

1. During the SL 103-5 study period, total monthly precipitation was respectively about fifteen percent (15%) and twenty-four percent (24%) greater than normal at the downtown Pittsburgh and Greater Pittsburgh International Airport National Weather Service stations. Assuming that the precipitation over the SL 103-5 study area correspondingly exceeded its normal by one-fifth, then the average daily flow rates of the seven acid mine water discharges can be assumed to also have been approximately one-fifth greater than normal. This deviation does not warrant consideration in the design flow rate sizing of the treatment systems discussed herein.

2. Based on prior stream water quality data, collected by the Bureau of Water Quality Management, the headwaters of Turtle Creek in the Export-Delmont vicinity are generally of poor quality. This is due to the introduction of numerous small AMD point sources as well as the Export and Delmont discharges into its upper reaches. With increasing drainage area, however, a gradual improvement occurs, even with the introduction of Brush Creek, which carries the Irwin and Coal Run discharges. The quality of Brush Creek also improves with enlarged runoff area. The Youghiogheny River is bombarded with many AMD point discharges and AMD pollution-laden tributaries which somewhat offset its improvement with increasing drainage area.

3. The dominant source of water recharge in the Irwin syncline basin occurs via the overburden. Research, by others, of bituminous mining areas having comparable geologic and climatic settings, indicates that approximately 30% of the rainfall that occurs is "...available to enter a mine..." assuming the necessary compatible subsurface characteristics are present. Within the Irwin basin these characteristics, specifically the permeability, are such that they presumably permit the entry of a greater percentage of rainfall. This is based on the extensiveness of mining, the use of explosives throughout the basin and the fact that the permeability associated with fractures and bedding planes (secondary permeability) is more dominant in southwestern Pennsylvania than the intergranular type. In addition, permeability tends to decrease with increasing depth but the overburden region having the lower permeabilities is flooded, leaving the more porous upper zones to enhance the capture of precipitation. The inundated state meanwhile reduces the distance overwhich the captured rainfall must travel to recharge the pool.

4. Strip mine areas along the outcrop can sometimes be responsible for a sizeable portion of AMD recharge water, but in the Irwin syncline basin, outcrop area recharge is considered a secondary recharge source. Other minor sources include core borings from

early coal exploration, boreholes used for water discharge from old mine workings, subsidence area recharge, surface water loss via streambed capture and wastewater disposal. The combined effect of these sources is considered negligible in comparison to overburden recharge and thus the total abatement scheme makes no recommendations for remedial work in any of these areas with the exception of some minor projects in the Thorn Run area (See Section 6.0).

5. Throughout the Irwin syncline basin, the effectiveness of barrier pillars to restrict seepage varies over a wide range which can be attested to by persons familiar with early mining practices. In one instance a 5' x 5-1/2' tunnel was constructed through a barrier pillar to equalize the water level in the adjacent mines. In many cases the barriers are partially mined, or severed entirely, and offer little resistance to flow. The one hundred foot thick barrier between the Marchand and ocean mines was completely circumvented by constructing the Dillon-Gibbon rock tunnel which allows water to flow from the Ocean into the Marchand mine.

6. Next to the influence of the mine barrier pillars, the Dillon-Gibbon rock tunnel is probably the most unique single structure affecting the subsurface hydrology. Built over thirty years ago to alleviate a dangerous buildup of water against the northernmost barrier of the then-active Hutchison mine, it has served to maintain equilibrium in the basin and has conceivably prevented the occurrence of other acid mine water discharges. It is presently operating as intended, conveying water from the Ocean to Marchand mines, however, the mine pool monitoring data indicates that the borehole on the Marchand side is plugged above the tunnel.

7. Other subsurface features that exhibit more localized effects on the mine hydrology include dams and coal reserves. Dams were commonly built to prevent water from flowing into the mine workings such as those constructed in the lower third dip mains of the South Side mine. Coal reserves were primarily left as support for population centers, public institutions and often railroad corridors especially in areas of shallow overburden. The Export and Delmont discharges are good examples of the influence of reserves.

8. Mine pool elevation monitoring was fundamental to a comprehensive subsurface analysis. The initial data set, obtained at a dozen abandoned air shafts, pumpholes and boreholes, was not sufficient to generate the flow network for the entire study area. However, it was helpful in determining what additional information would be useful and in providing some insight as to the influence of specific dams, barriers, etc. It also permitted the effects of the abandonment of the Hutchison mine to be observed, it aided the analysis of the current operation of the Dillon-Gibbon rock tunnel and finally, provided a chance for familiarization of the response of the basin to seasonal variations in precipitation.

9. Abandonment of the Hutchison mine in June, 1973, just prior to the initiation of Project SL 103-5, was approached as an interruption

of the basin's normal hydrogeologic behavior. Without data prior to its abandonment, the basin had to be allowed to regain equilibrium in order to distinguish normal operating conditions from those during the inundation process. The water level rose quickly in Hutchison, forcing more water into Banning No. 4. It was predicted previously by others that when Hutchison was abandoned the water quality from the Marchand, Upper Guffey and Lower Guffey Station discharges would improve. Their combined average daily acid load fell from 10,000 to 2,000 pounds per day, though further monitoring is necessary to confirm this prediction.

10. Inundation of Hutchison led to the occurrence of several isolated acid mine water discharges from along the cropline of the Redstone Coal seam along Little Sewickley Creek at approximate elevation 785±. This illustrates the fractured conditions of the strata between the Pittsburgh and Redstone coal seams.

11. Mine pool measurements in the Marchand side of the Dillon-Gibbon rock tunnel were incongruous with surrounding elevations. With the installation of additional monitoring wells it was shown that the tunnel itself is operative but the borehole on the Marchand side was plugged above the elevation of the tunnel.

12. The coal reserve beneath the east-west railroad corridor, from the Export-Delmont mine barrier to the cropline at Export, retains a small pool of water in the Export mine. The fringe of this pool coincides with the haulway leading to the discharge thus fixing the limit of the pool at elevation 981'±. Most of the water in the Export mine is generated via the overburden outletting, of course, at the Export discharge.

13. Based on mine pool elevation measurements at McCullough Shaft and Monitoring Well Number 5, the north edge of the Irwin basin pool at maximum flow conditions lies at elevation 954±, some 25 feet below the Export discharge (elevation 980.3). It is concluded that neither the Export or Delmont discharge is affected by the basin pool.

14. Neither sealing the Export discharge or providing a drain for the water pooled in the Export mine by severing the railroad reserve constitutes an effective means of abatement. In the first case, sealing would force the water to accumulate in the mine. Eventually a pressure head would develop sufficient to erupt along the coal cropline. The latter case may be exorbitantly costly. However, treatment is not necessary either; the raw AMD can be conveyed to the No. 2 Export mine where it will be absorbed into the basin pool.

15. The Delmont discharge is an artesian source originating from a pool of water contained by the Export-Delmont barrier pillar and the railroad coal reserve. Haulways through the reserve have been sealed with dams. The pool in the mine extends approximately to elevation 1020±. Recharge is mainly via the overburden.

16. The Delmont discharge can be effectively abated without treatment also. The pressure exerted by the pool in the Delmont mine will force the raw acid mine drainage through a conduit from the discharge into the mined out, but unflooded, part of the basin, where it will be absorbed by the Irwin pool.

17. According to a previous report the acid mine drainage from the TR-1 discharge in the Thorn Run watershed should be ..."diverted into, abandoned mine headings and hence, away from Thorn Run..." The method suggested to accomplish this diversion was the construction of dams. It is the opinion of the consultant, however, that only exploratory excavation will reveal the conditions responsible for this discharge and the measures required to insure its effective abatement. It is quite feasible that the AMD can be directed into the Delmont mine.

18. The Irwin discharge, actually the old South Side drainageway, combines with the Coal Run discharge to induce a drawdown on the surrounding pool. This behavior might be considered analogous to water table drawdown as water is pumped from an aquifer. At pool monitoring locations such as the Edna No. 2 pumphole, far from these discharges, the pool fluctuates cyclically. Moving radially closer towards the Irwin and Coal Run discharges the fluctuation in the mine pool is dissipated as the water "rushes" toward these outlets. Thus in the immediate vicinity of these relief points the pool surface is essentially constant year round as exhibited by the South Side, Jimtown, Adams and Biddle shafts pool monitoring data in Appendix B.

19. Erratic flow from the Coal Run discharge is due to the interference of the Paintertown mine barrier with the relatively stable, drawn down pool surface just described. This barrier parallels the local coal contours and creates a "step" effect in the pool. The pool just exceeds the outlet elevation and the barrier tends to dampen what little fluctuation occurs in the pool causing the water in the Paintertown mine to become almost static. This provides an ideal situation for the formation of the "yellowboy" that clogs the 12" outlet pipes. As the pool increases sufficient pressure builds to force the pipes open.

20. Due to a lack of pool monitoring data from existing sites along the west flank of the basin the data generated by the pool monitoring wells installed in this area under Operation Scarlift Project SL 103-5-101.5 assumed even greater significance in the effort to establish the subsurface conditions governing the Upper Guffey Station discharge. The nearest existing, but inaccessible site was the Riley shaft for which its current average pool elevation was estimated based on a thorough evaluation of the basin mining and hydrogeologic history. It was concluded that the Irwin Syncline pool intersects the drainageway leading to the Upper Guffey Station discharge, accounting for the gravity flow.

21. The actual subsurface conditions creating the Lower Guffey Station discharge are nebulous and can only be firmly established through exploratory excavation. It is apparently unrelated to the Upper Guffey Station source.

22. Marchand is simply an artesian discharge flowing from the main slope entry of the Marchand mine. This AMD source began just after the Dillon-Gibbon rock tunnel was completed in 1942. This discharge exhibits a drawdown effect on the surrounding basin pool, i.e. a piezometric map of mine pool elevations would show concentric contours around the Marchand discharge.

23. Given the relative geographical and subsurface hydrologic settings, three treatment facilities are necessary for abatement. Using a neutralization-oxidation process it is estimated that separate facilities might be constructed to treat Coal Run and Irwin combinded, Marchand individually, and the Guffey Station discharges together.

24. The Irwin, Coal Run and Marchand discharges can be eliminated in another fashion; by lowering the mine pool by pumping from the Biddle airshaft and the Marchand mine air shaft second north (ASSN). Pump tests at these sites would be necessary to determine how the discharges in particular and the basin in general would respond. If the pump test data reveals that the pool can be lowered sufficiently to eliminate these AMD sources, permanent pumping and treatment facilities would be constructed at the pump sites. The pool would be lowered enough to provide some in-mine wet weather flow storage capacity. The AMD would be delivered to the surface at a constant rate and treated. On the whole, acid and iron abatement costs for this scheme are comparable to those for the recommended scheme which provides treatment at each source. The advantages of this scheme are (1) an additional factor of safety against the northernmost edge of the Irwin pool rising toward the Export-Delmont area, (2) a possible recession in flow at Upper Guffey Station which would imply that Lower Guffey Station could be added to the Irwin pool and (3) the almost certain elimination of the Redstone coal seam AMD discharges along Little Sewickley Creek.

25. The Banning No. 4 mine must contend with water inflow exerted by the Irwin basin pool via the Yough Slope, Hutchison and Osborne mines. To the south and west inundated conditions also exist, thus when Banning No. 4 is abandoned it will flood to an elevation coincident with the surrounding piezometric surface. No additional acid mine water discharges are expected to occur when this flooding occurs nor is the chemical composition of any existing discharges expected to change. The flow of the Marchand discharge might increase slightly but equalization lagoons at the Marchand treatment facility (recommended scheme) would be able to accomodate a minimal increase. If the flow increased drastically, additional storage lagoons could be added.