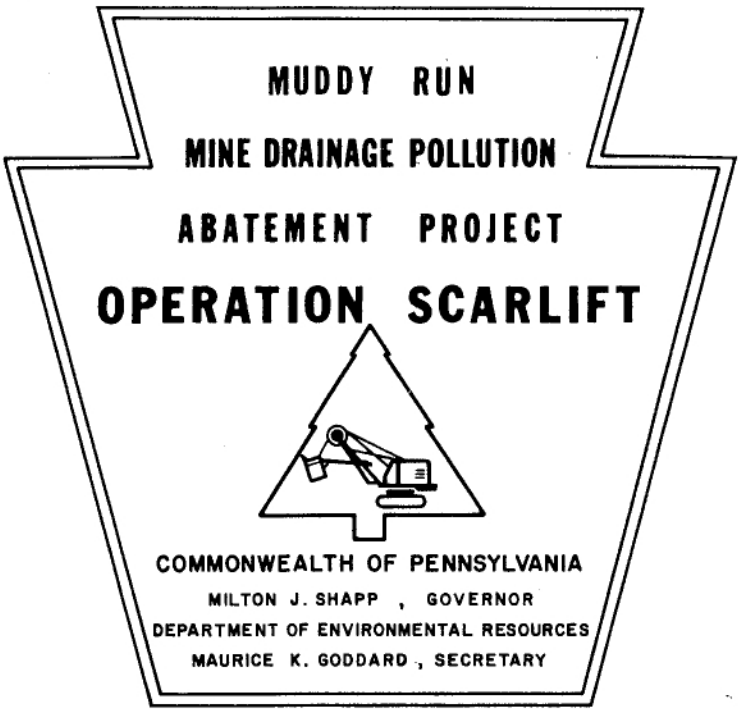


THE ABATEMENT PLAN

THE ABATEMENT PLAN

A review of the study's findings as set forth in "Study Results" clearly indicates that the principal source of pollution on the watershed is` abandoned deep mines. These mines contribute an average of 27,000 pounds of acid per day or 78% of the total acid load from all sources. This fact became evident early in the study and resulted in the submission and approval of a proposal to immediately commence detailed investigation and design of abatement measures for five major pollution sources.

This initial action to plan for specific pollution abatement was designated as Quick Starts Two through Six. Design of Quick Start One has already been completed as a part of this original study contract.

COMPOSITION OF THE PLAN

The abatement plan, therefore, is comprised of six (6) principal parts:

1) Immediate design and construction of abatement measures for the six Quick Start areas.
2) Priority ranking of remaining pollution sources according to the highest abatement-cost ratio.

3) Determine from this ranking, the recommended extent of implementation of abatement measures to accomplish reasonable and feasible goals of stream quality.

4) Preparation of plans, specifications and bidding documents for construction of abatement measures at the recommended sites (in addition to previous work carried out for the Quick Start areas).

5) Construction of abatement measures and coordination with active mining

6) Monitoring of abatement areas and streams to determine the effect of the program on the watershed, and to recommend additional projects to reach higher levels of stream quality, if necessary.

RATIONALE FOR PRIORITIES

In view of the limited public monies presently available for abandoned mine pollution abatement, expenditures must be directed toward correcting those pollution problems which will restore the maximum uses to the streams and will reclaim the most miles of stream. In the case of Muddy Run, over half the pollution load from the watershed emanates from

one source. Its abatement will serve to improve water quality in half the length of Clearfield Creek and many miles of the West Branch Susquehanna River, but will aid less than three miles of Muddy Run's main stem. Significant improvement to Muddy Run, therefore, is contingent upon correcting adverse conditions at certain key areas throughout the watershed. The priority lists that have been established are designed to provide incremental improvements in water quality and/or to increase the length of main stem of Muddy Run which is restored.

The acid quantity from each source was the primary parameter used in comparing pollution loads. It is believed that low pH is the principal impediment to normal propagation of desirable aquatic life. Stream siltation, including precipitation of iron from mine drainage is next in importance. Accordingly, abatement measures are directed toward reduction of acid (with the usual concomitant reduction of iron) and siltation from unrestored strip mines and refuse piles.

Two priority lists are provided. One is divided into two parts to include the Quick Start areas, the major acid and silt pollution sources, and dangerous mine openings. The dangerous mine openings are listed at the request of the Department so that prompt measures can be taken to eliminate hazardous conditions. The second list includes minor pollution sources for which no abatement is required.

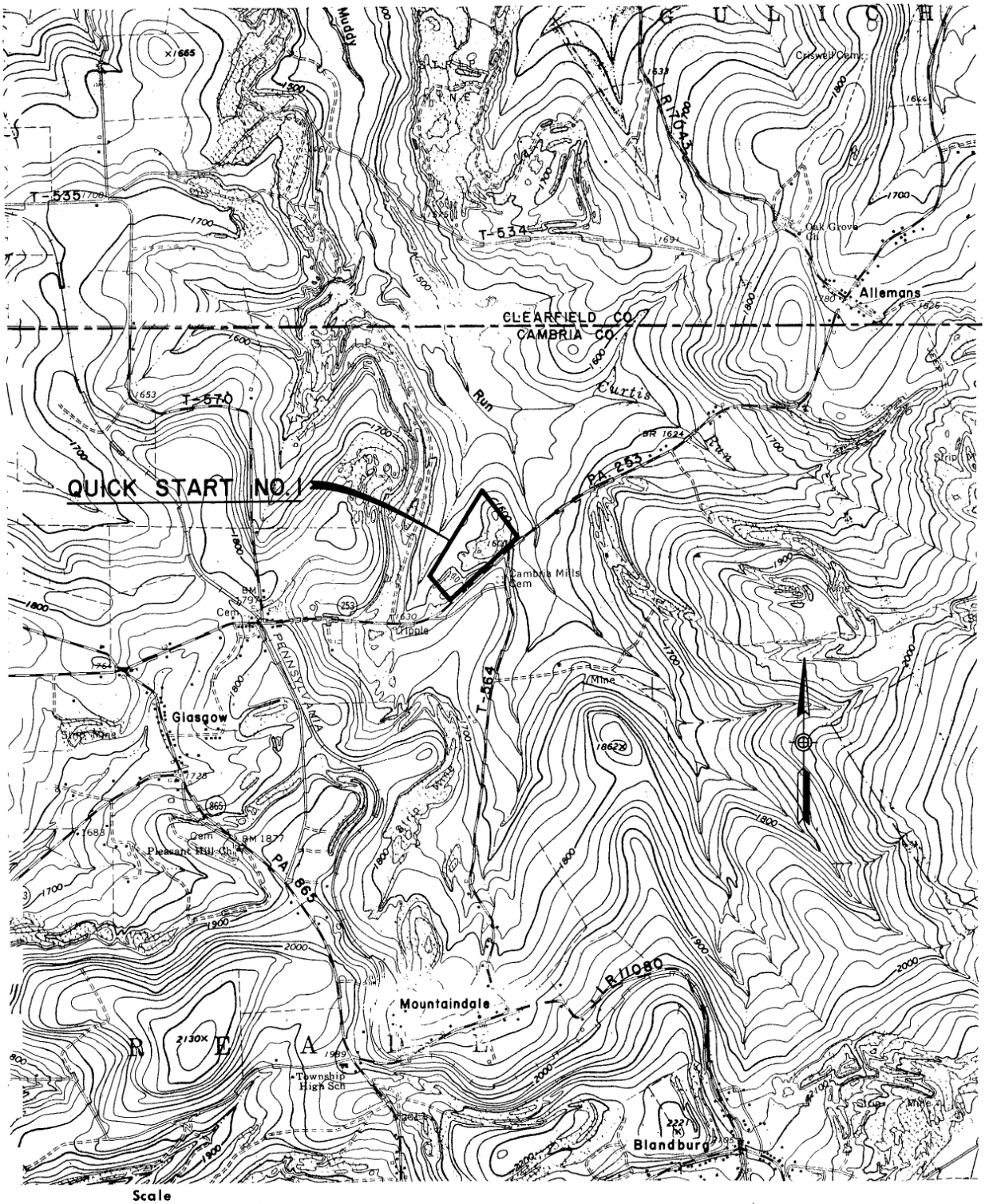
POLLUTION SOURCE DESCRIPTIONS
AND RECOMMENDED ABATEMENT
MEASURES

Immediate Pollution Abatement (Quick

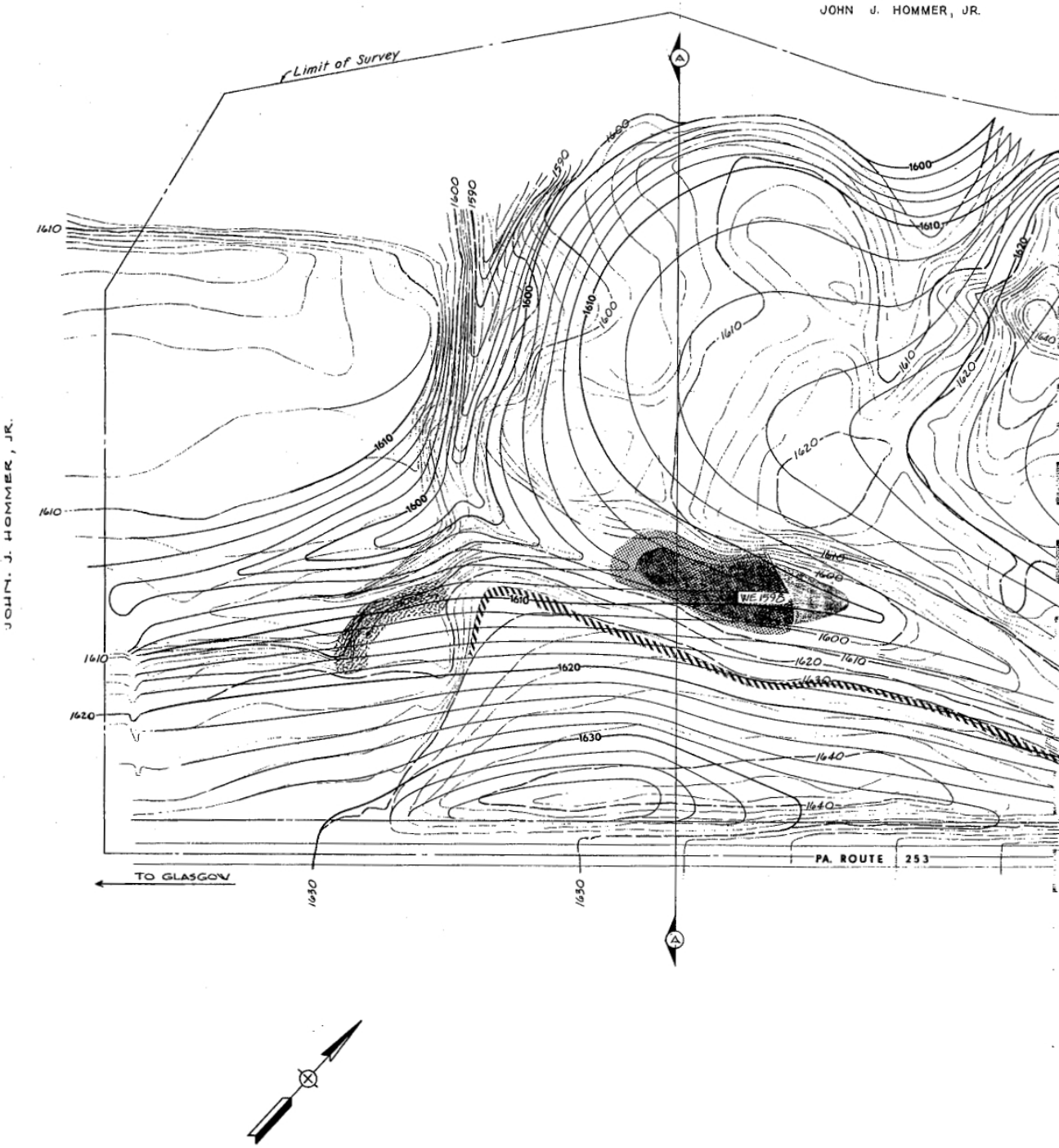
Starts) Pollution Source 121 - Description - Quick Start One

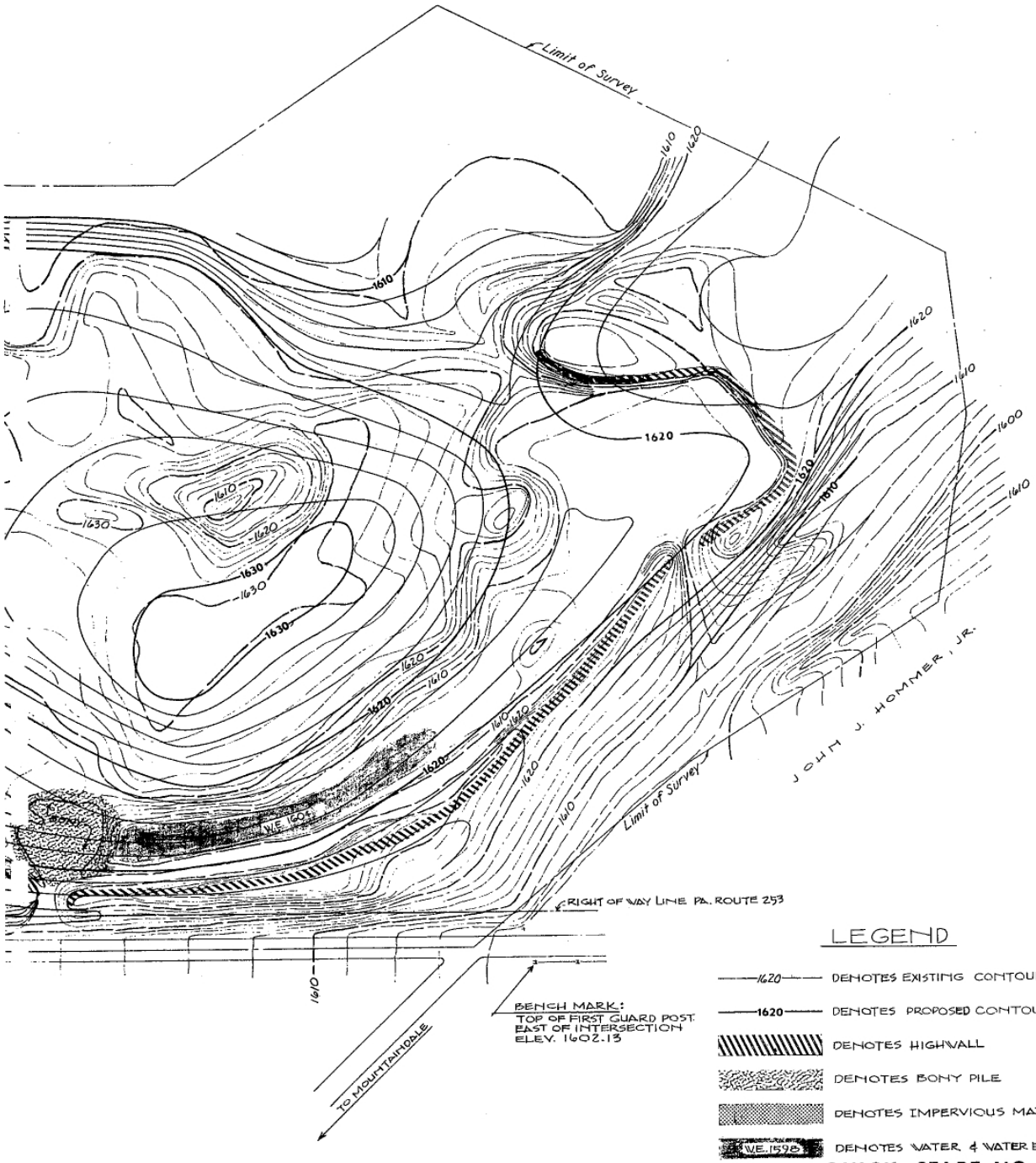
This pollution source is a small, intermittent, gravity discharge from an abandoned, open strip mine on the Lower Kittanning (B) seam near the intersection of Township Road 564 and Pennsylvania Route 253. Although small in volume, this discharge contributes very heavy concentrations of acid, iron and sulfate. Measured contribution averages 15 pounds of acid per day.

Presently, Scott Brothers Coal Company is using this open pit as a bony dump. This particular dumping operation has impounded a large body of water which can only be released after filtering through the bony, which contains large amounts of sulfuritic minerals. The water is derived from both groundwater and surface drainage and the bottom of the pit is also lined with coal and bony. The fact that this poor quality water can easily filter through a constantly replenished supply of oxidizing sulfuritic minerals makes it a very formidable, potential slugger. For this reason,, this area was chosen for Quick Start One.



LOCATION MAP


JOHN J. HOMMER, JR.
Limit of Survey
JOHN J. HOMMER, JR.
WE 1595
TO GLASGOW
PA. ROUTE 253



LEGEND

- 1620 — DENOTES EXISTING CONTOURS
- 1620 — DENOTES PROPOSED CONTOURS
- DENOTES HIGHWALL
- DENOTES BONY PILE
- DENOTES IMPERVIOUS MATERIAL
- VE. 1598 — DENOTES WATER & WATER ELEVATION

QUICK START NO. 1

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF ENVIRONMENTAL RESOURCES
MUDDY RUN WATERSHED
PROJECT NO. SL-155-1

GRADING PLAN

SCALE
1" = 50'

DATE
SEPT. 1970

Skelly and Loy
ENGINEERS CONSULTANTS
TWENTY TWENTY-THREE NORTH SECOND STREET
HARRISBURG, PENNSYLVANIA

SHEET NO.
2 OF 3

Pollution Source 121 - Abatement - Quick Start One

Abatement will be accomplished by restoring the stripped area. compacting coal refuse on the bottom of the strip cut; grading the entire area; treating the soil with limestone and fertilizer; and applying seed.

Estimated cost is $30,200.

Pollution Source 125 - Description - Quick Start Two

This pollution source is a large, artesian discharge from the Brookwood ShaftMine on the Lower Kittanning (B) seam (located one mile southwest of Ramey). The discharge, which contributes extremely high concentrations and loads of acid, iron and sulfate, is the most serious pollution source in the Muddy Run, as well as the Clearfield Creek watersheds. In addition, it has rendered the lower i mile of Little Muddy Run, a large stream capable of supporting trout, uninhabitable.

This discharge comes from a large bore hole sunk to intersect a down dip heading of the Brookwood Shaft Mine on the Lower Kittanning coal, a distance of 88 feet. A trench was excavated west from this point to enable the water to drain to Little Muddy Run. The discharge water presently collects in a large impoundment created by a beaverdam before being released to Little Muddy Run. This contaminates all surface and ground water drainage, which naturally collects in this topographic basin. This condition also makes accurate flow measurement extremely difficult, if not impossible.

The Brookwood Shaft Mine, which was originally mined by Hale Coal Company and later by William Gulbranson, comprises a total area of $1_2$931 acres. It is bounded to the southwest by the Tipton Fault and to the

southeast by its outcrop. Development to the east reaches as far as Morann and to the north as far as the drainage bore hole. Most of the development of the mine was done by the Hale Coal Company with William Gulbranson re-entering in the 1940's to extract some of the remaining reserves. The long heading was driven to the dip (northwest) and the bore hole was sunk to it to alleviate the drainage problem within the mine. Water was pumped from this bore hole at the lowest point in the mine. Upon completion of mining, the pumps were removed and the bore hole was left unsealed. The mine flooded until a sufficient head was created to re-establish drainage from the bore hole.

The southeastern boundary, where extensive unbackfilled stripping has removed the outcrop barrier and exposed drift headings on old, connecting mines (such as Elizabeth Mine No. 1, Elizabeth Mine No. 2 and Eureka Mine No. 24), is a large source of water entering the Brookwood Shaft Mine. The southwestern boundary created by the Tipton Fault may also be an important source of water, since fractures in that area would intersect any overlying aquifers, connecting them to the mine. There is also evidence that joint partings are well developed in the strata overlying the entire mine, because communities in the area lost their well water soon after the commencement of mining. Infiltrating rainfall entering these overlying aquifers enters the mine via fractures caused by roof collapse

and is probably the major source of mine water.

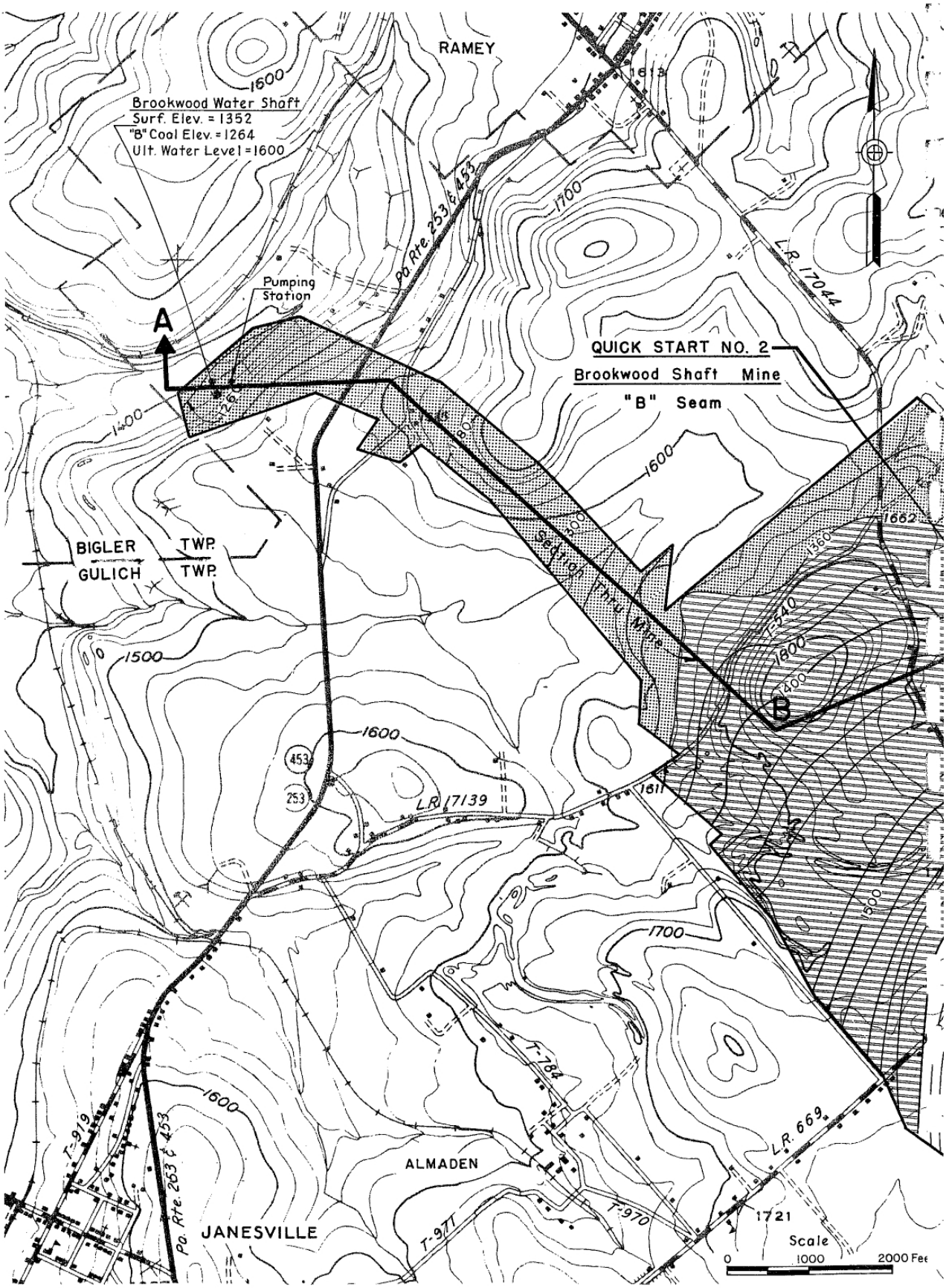
Presently, the level of the mine pool has stabilized at elevation 1426. The relief within the mine is 536 feet, with the low point at the drainage bore hole being at elevation 1264. The high point at outcrop is at elevation 1800. This allows a potential hydraulic head at the drainage bore hole of 440 feet. Test borings have revealed that a 65 foot driving head of water exists within the mine. This driving head produces the artesian discharge from the bore hole.

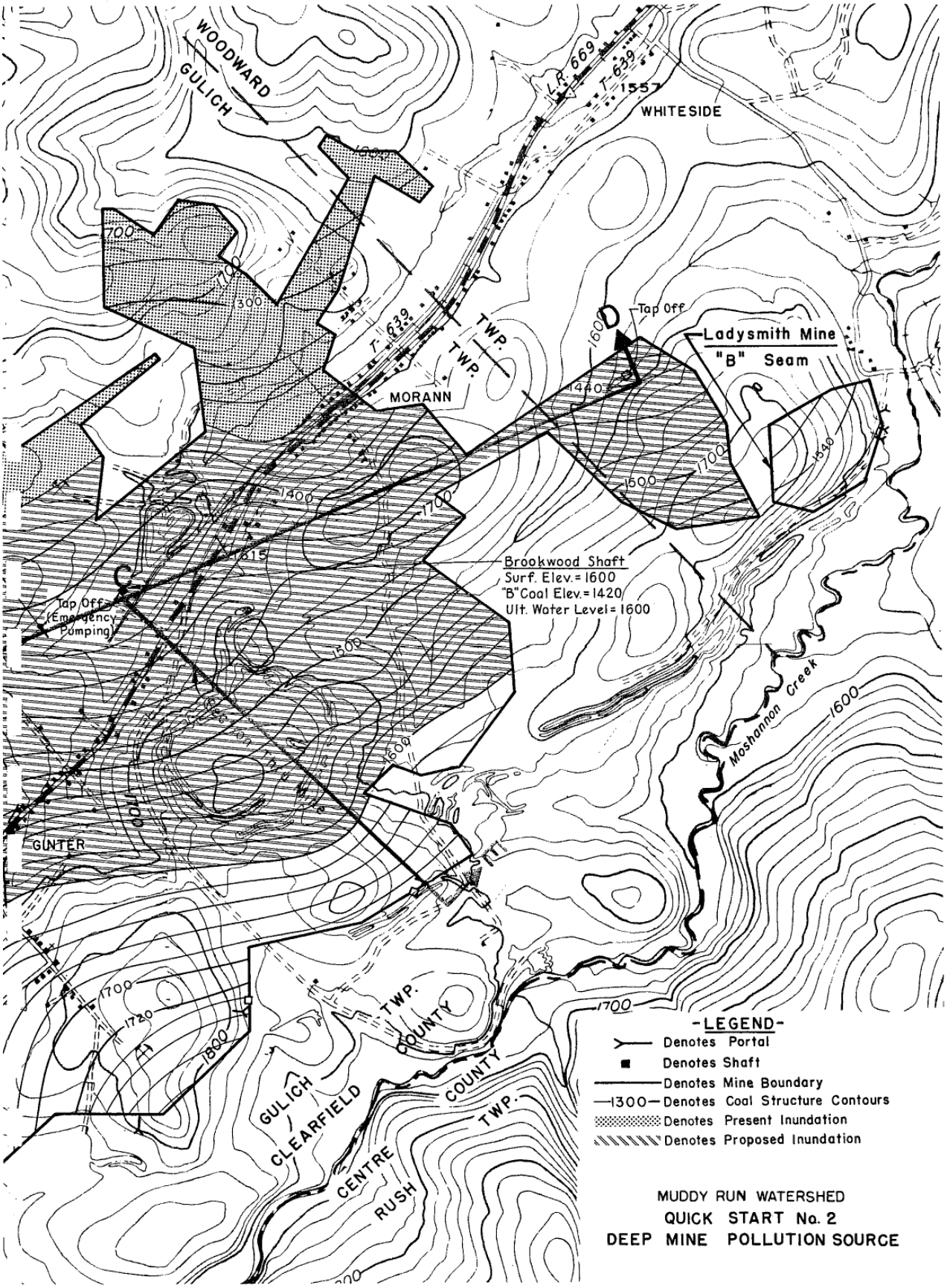
The water level shown on the 1000 scale map does not agree with the profile since the map was made prior to the test boring program. The correct present water level is 1426 as shown on the profile.

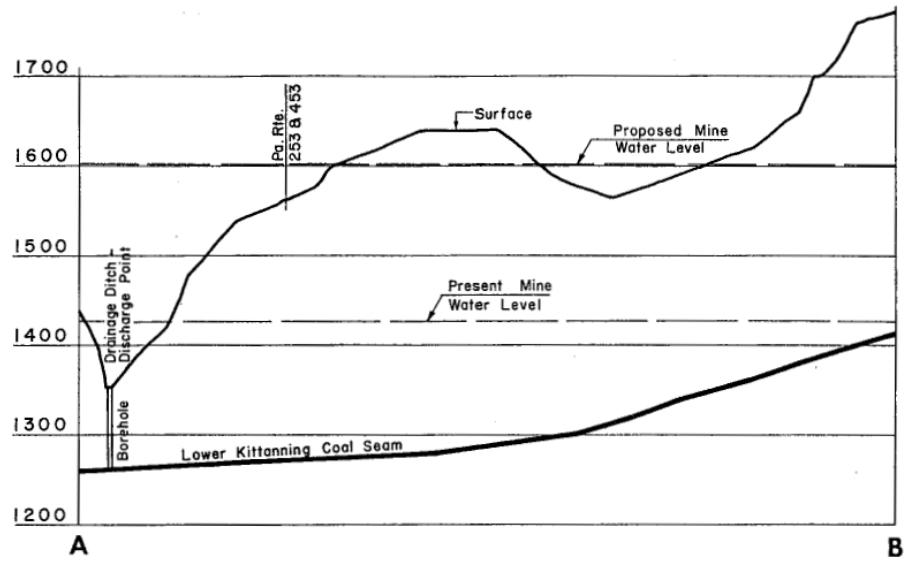
A sampling of the discharge from the Brookwood Water Shaft for one year revealed an average daily loading of 17,263 pounds acid and 1 ,730 pounds iron. Again, this is based on estimated flows, and their accuracy is questionable.

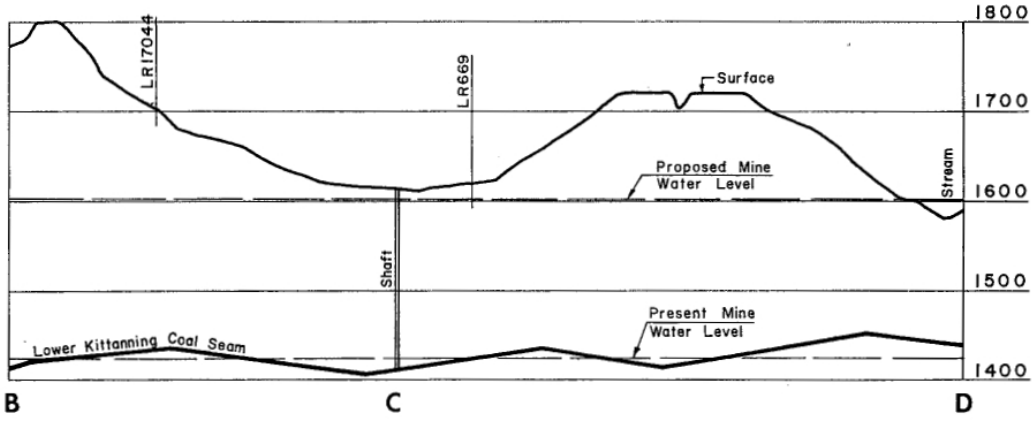
Pollution Source 125 - Abatement - Quick Start Two

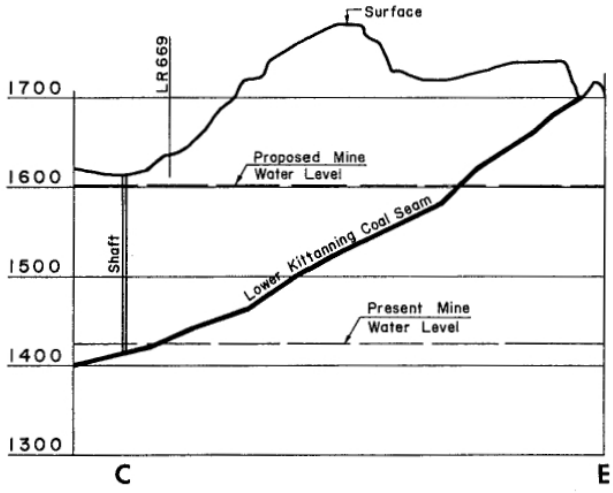
The abatement plan is to seal the Brookwood Water Shaft to prevent the flow of poor quality water from the deepest level of the mine and inundate more of the mine workings. Inundation of the mine workings


RAMEY
Brookwood Water Shaft
Surf. Elev. = 1352
"B" Coal Elev. = 1264
Ult. Water Level = 1600
Pumping Station
Pa. Rte. 253 & 453
L.R. 17044
QUICK START NO. 2
Brookwood Shaft Mine
"B" Seam
A
B
Section Thru Mine
BIGLER TWP.
GULICH TWP.
L.R. 17139
T-340
T-784
T-919
T-971
T-970
L.R. 669
ALMADEN
JANESVILLE
Pa. Rte. 253 & 453
1600
1700
1500
1400
1662
1611
1721
Scale
0
1000
2000 Fee


WOODWARD GULICH
L.R. 669
T-639
1557
WHITESIDE
T-639
TWP.
TWP.
MORANN
Tap Off
Ladysmith Mine
"B" Seam
Brookwood Shaft
Surf. Elev.= 1600
"B" Coal Elev.= 1420
Ult. Water Level= 1600
Tap Off
(Emergency Pumping)
Moshannon Creek
GUNTER
TWP.
COUNTY
GULICH
CLEARFIELD
CENTRE
COUNTY
TWP.
RUSH
-LEGEND-
Denotes Portal
Denotes Shaft
Denotes Mine Boundary
1300 Denotes Coal Structure Contours
Denotes Present Inundation
Denotes Proposed Inundation
MUDDY RUN WATERSHED
QUICK START No. 2
DEEP MINE POLLUTION SOURCE





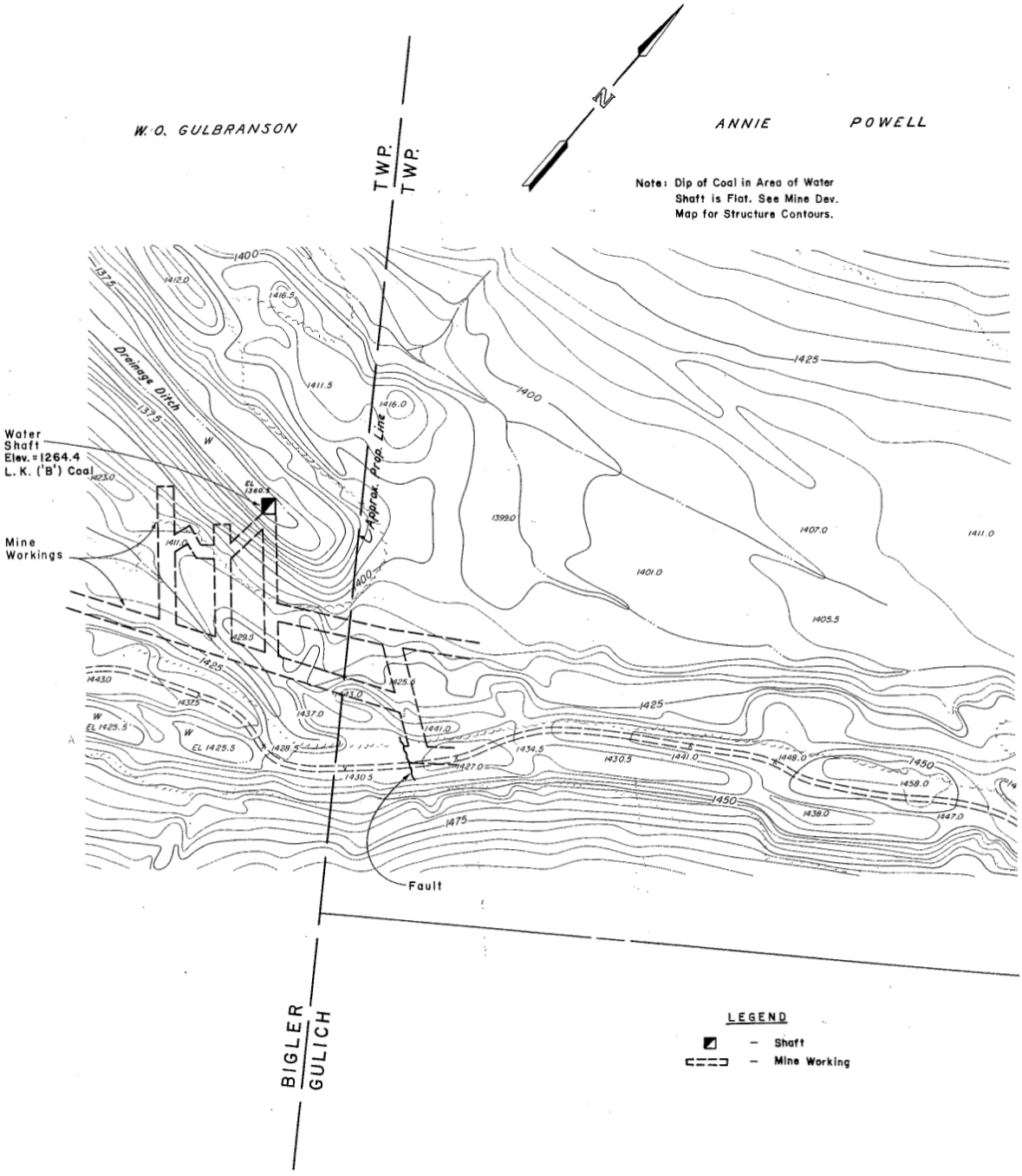


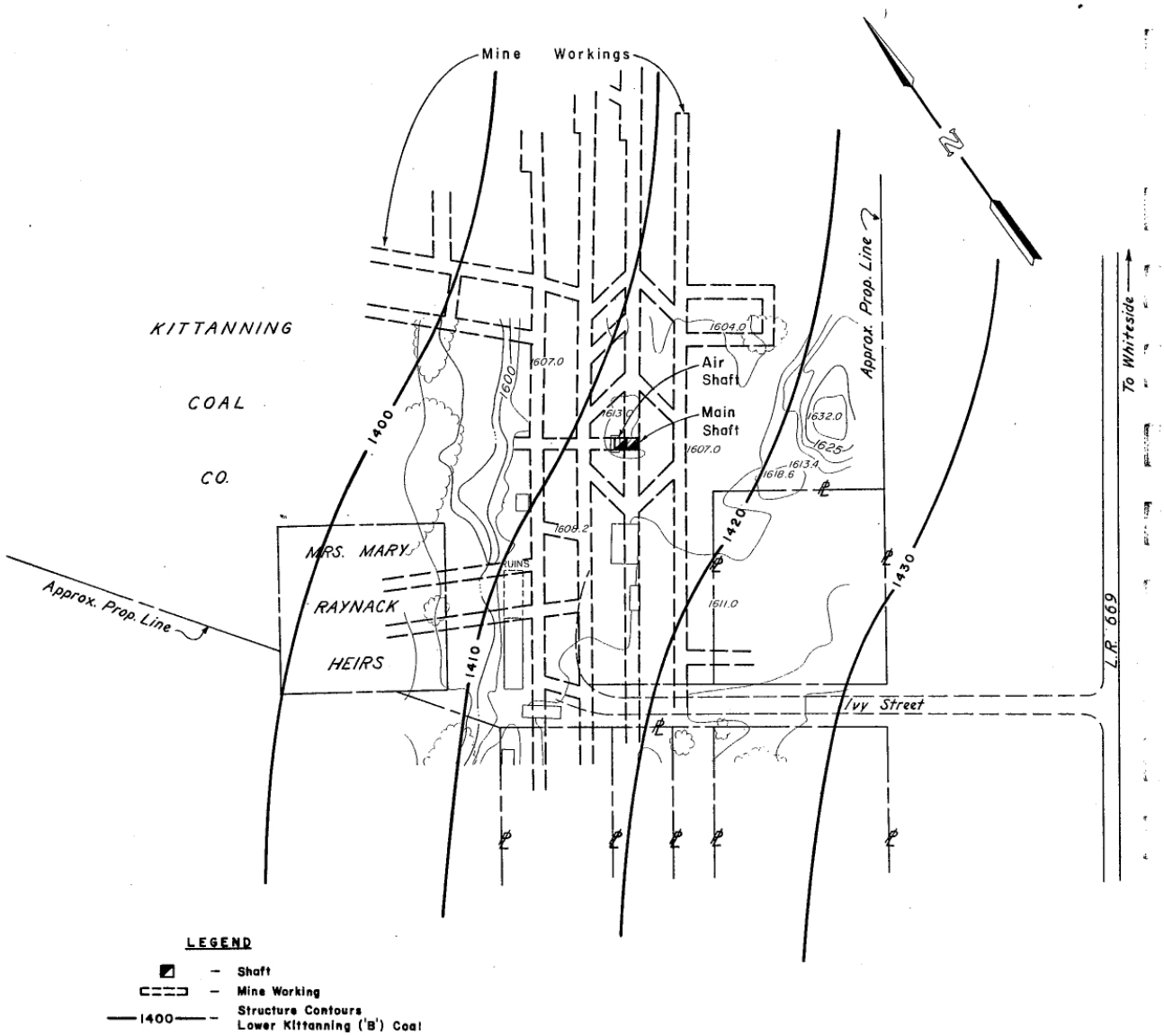
SCALE

Hor. - 1000 0 2000 Feet

Vert. - 100 0 200 Feet

SECTIONS THRU BROOKWOOD SHAFT MINE


W. O. GULBRANSON
ANNIE POWELL
TWP.
TWP.
Note: Dip of Coal in Area of Water Shaft is Flat. See Mine Dev. Map for Structure Contours.
Drainage Ditch
Water Shaft Elev. = 1264.4 L. K. ('B') Coal
Mine Workings
Approx. Prop. Line
Fault
BIGLER GULICH
LEGEND
Shaft
Mine Working
QUICK START NO. 2
BROOKWOOD SHAFT
SCALE
100 0 200 Feet



QUICK START NO. 2
BROOKWOOD SHAFT

SCALE
100 0 200 Feet

will improve water quality in the mine so that the quality of high-level discharges or tap-offs will be considerably improved.

The discharge leading from the Brookwood Water Shaft toward Little Muddy Run presently is impounded by a large beaver dam. This dam has caused water to back up so that the top of the shaft is submerged. This beaver dam will have to be removed to dewater the construction site and to permit access to the site.

To place the seal in the Brookwood Water Shaft it will be necessary to stop the flowing water through the shaft. A drill hole will be placed nearby and pumps installed to reverse the hydraulic gradient at the point of discharge. Due to the large size of the mine complex pool it would be impractical and time consuming to draw down the pool to construct the seal. The intent of the pumping will not be to lower the pool but to discharge at a rate comparable to the current discharge rate and hence maintain a static column of water in the shaft.

The shaft seal will be constructed to withstand the maximum anticipated hydraulic head. After completion of the seal, the pumps will be removed and the drill holes capped and used as emergency release valves. Other tap-offs will be established at various elevations so the water level can be maintained at any desired elevation.

A series of water level monitoring holes will be developed,

utilizing existing shafts and bore holes wherever possible, for observing rise in water elevation and for obtaining water samples to monitor changes in water quality..

To obtain maximum inundation and control of tap-offs the Brookwood Shaft, located near the center of the complex, will be sealed and established as an emergency pumping tap-off.

Two drifts and a furnace shaft at the Ladysmith Mine, located on the eastern limit of the mine complex, will be sealed to prevent discharge beforee the desired water level is reached.

The initial target elevation for the top water is 1600 feet. This will create a hydraulic head of 240 feet near the low levels of the mines. Regular patrols will be maintained to survey the area and record any subsidence or breakout..

Estimated cost is $212,400.

Pollution Source 108 - Description - Quick Start Three

This pollution source is a continuous, artesian discharge from the hoisting shaft of the Eureka Mine No. 29 on the Lower Kittanning (B) seam. The shaft has a concrete coping and is capped by a 6 inch concrete slab. The discharge comes from a 30 inch pipe installed 10 feet below the top of the coping to relieve pressure. The shaft area is 15 feet x 10 feet and is sunk 190 feet to the bottom of the coal seam.

The Eureka Mine No. 29 connects with the Eureka Mine No. 28 in the vicinity of the Janesville Dam. This system is joined, in turn, with (1) the Viola Mine No. 1 (3,000 feet southeast of the Janesville Dam), and (2) the Fernwood Mine No. 1 at Fernwood. A smaller venture was initiated at Allemans to connect with Viola Mine No. 1 . Other small mines have intersected the workings of Eureka Mine No. 28 and its crop on the eastern boundary of the watershed. The total worked out area of this system is approximately 2,500 acres.

The hoisting shaft (Eureka Mine No. 29 shaft) has been sunk very close to the axis of the Houtzdale Synclinorium where the bottom of the Lower Kittanning coal has an elevation of 1210 feet. From this point the mine system advances up dip on the southeast limb of this basin until it approaches crop or the coal is offset by the Tipton Fault. The coal was

not mined extensively on the northwest limb, due to depositional interruptions.

Drainage into the mines is derived from both surface and ground water sources. A large non-backfilled strip mine area on the southeast border, which affects the Clarion, Middle Kittanning and Lower Kittanning seams serves as a large catchment area for any surface drainage in that vicinity. The Middle Kittanning pits also contribute water through the joint partings developed both by the underlying mining and the Tipton Fault system to the east. The Clarion pits, while lying below the Lower Kittanning at this point may also be contributing collected surface drainage by lateral migration through the overlying disturbed rock. The dip to the northwest is great enough in this area to make this conceivable.

The wide lateral extent of this mine and the bedding relief makes possible the interception of many aquifers and increases the potential for ground water to be drained to this mine. The development of vertical joint partings in the roof rock due to imposed strain also attracts groundwater, as can be attested by the loss of water in wells in the overlying communities. Presently the level of the mine pool has stabilized at elevation 1456 and has inundated all workings west of the intersection of the Pennsylvania Route 453 and Township Road 971.

Sampling data taken for one year revealed an average discharge

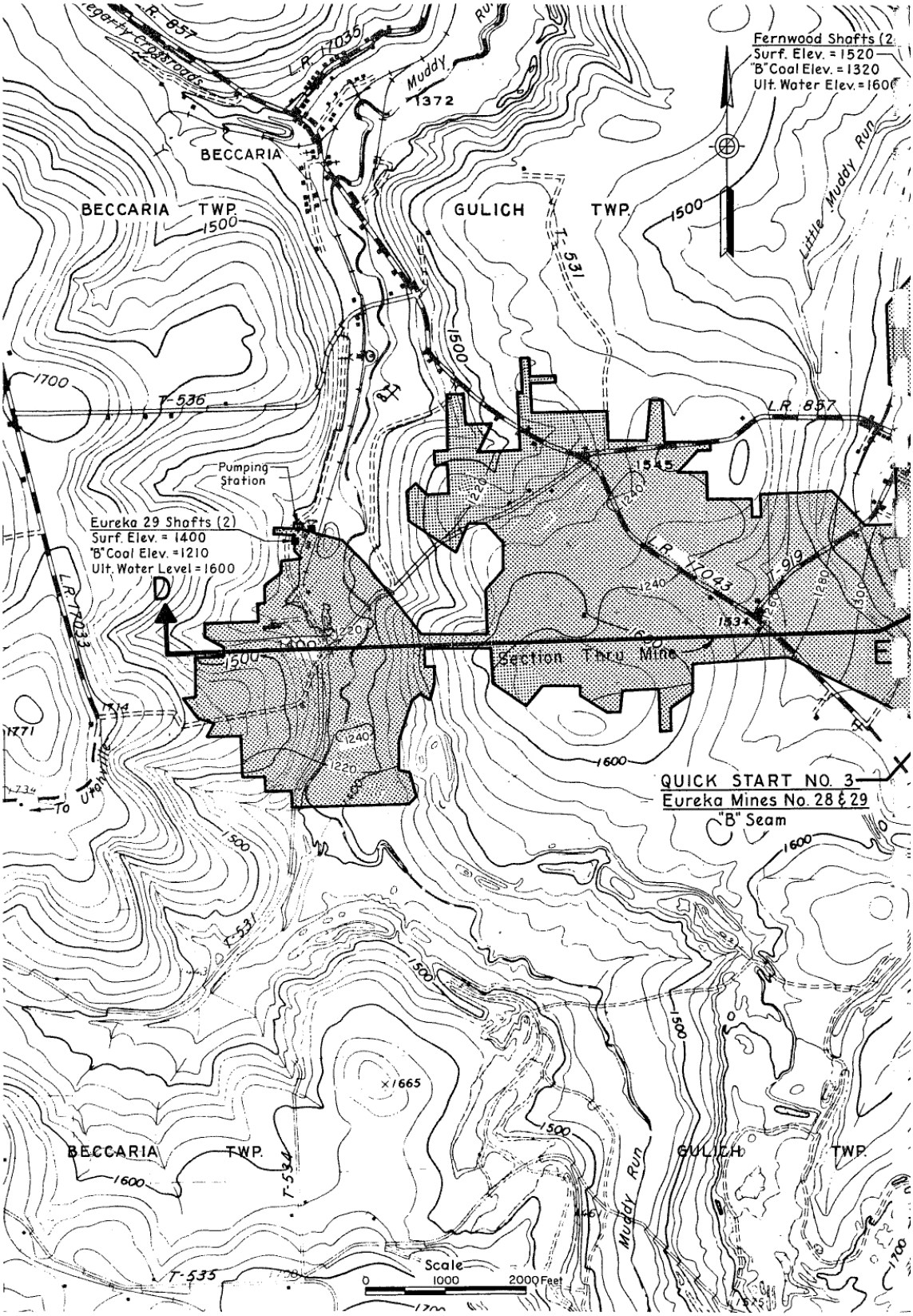
from the Eureka Mine No. 29 shaft of 4 cfs, with an average daily loading of 3,669 pounds acid and 373 pounds iron.

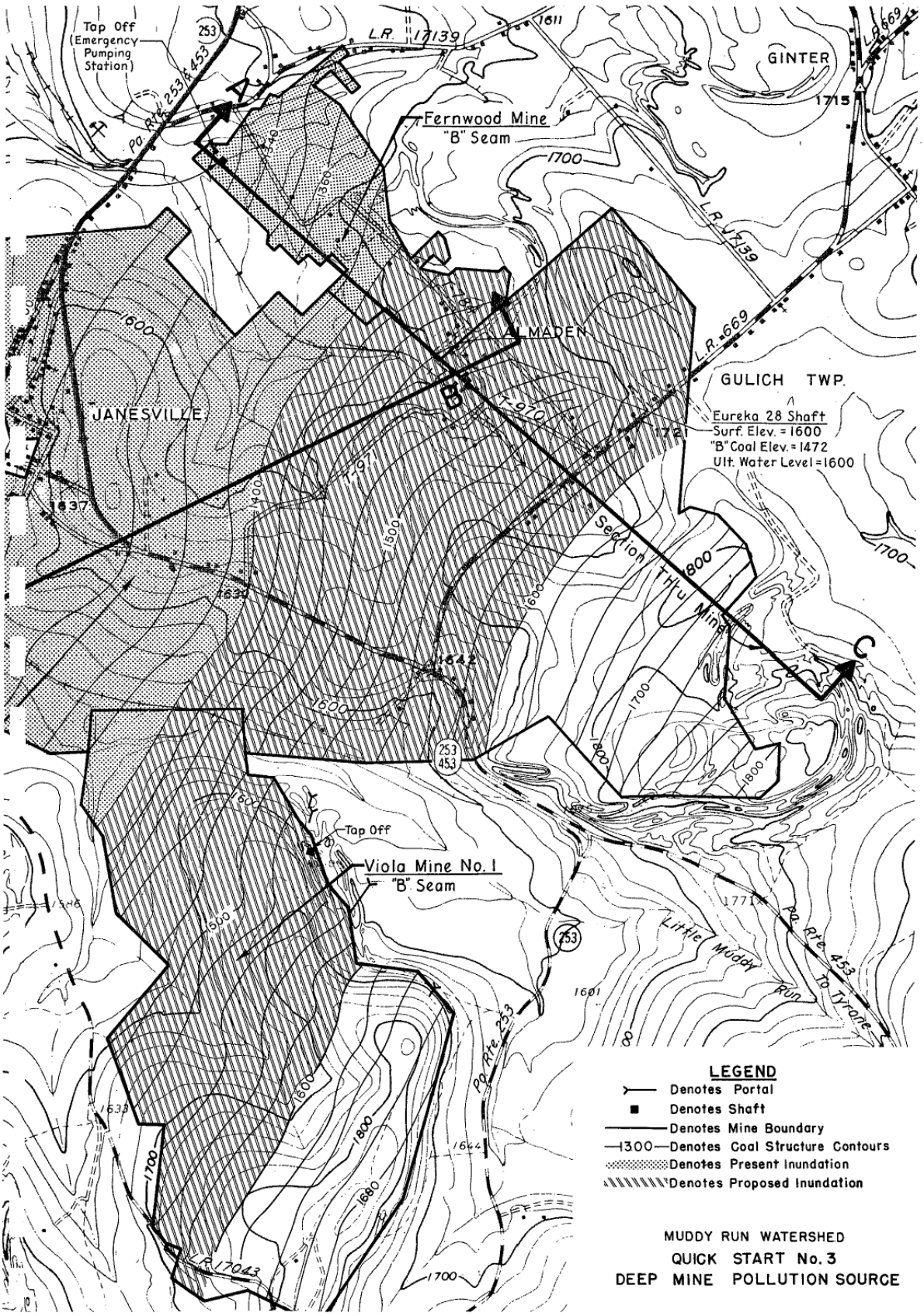
Pollution Source 108 - Abatement - Quick Start Three

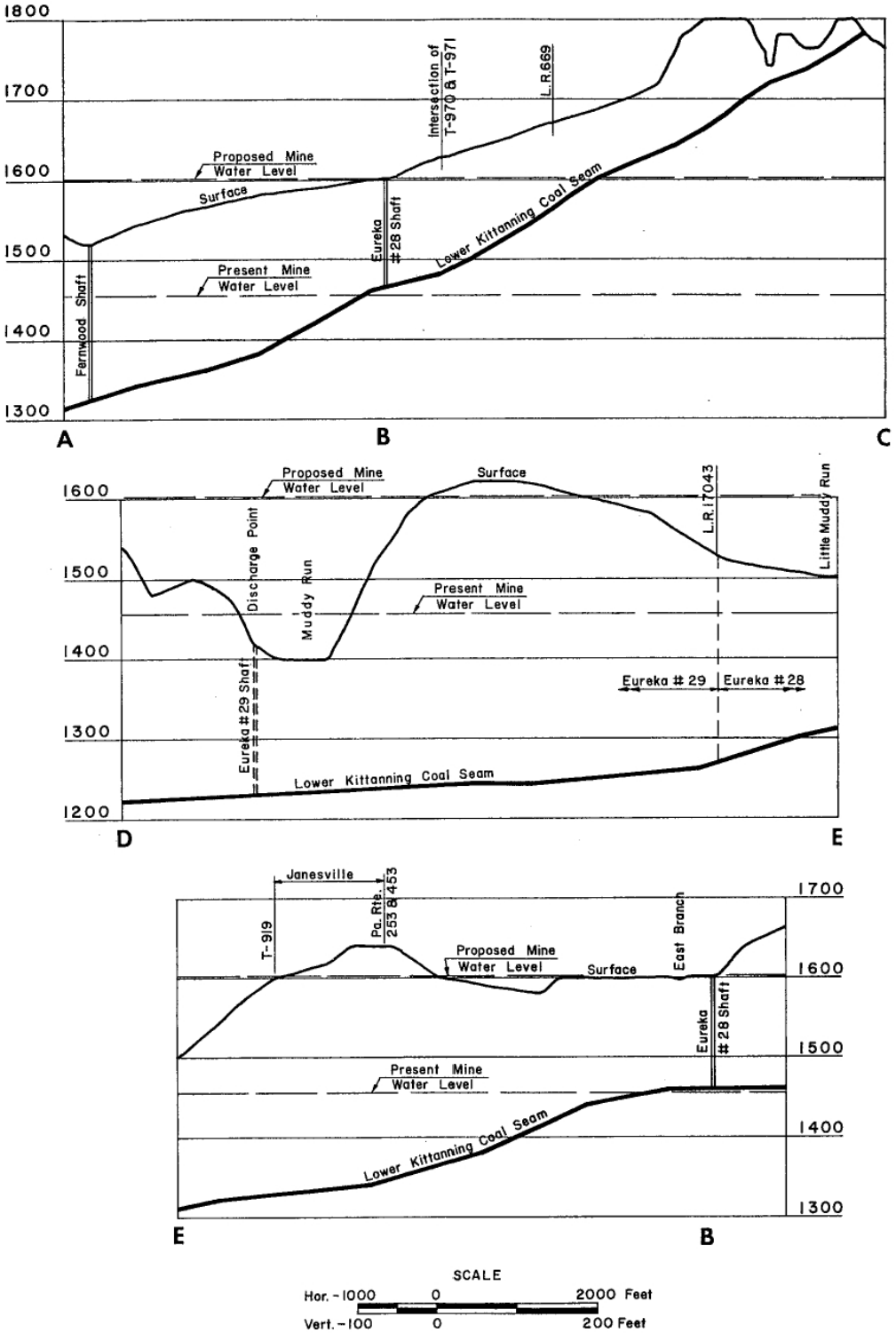
The ultimate goal for abatement in the Eureka complex is to inundate as much of the workings as possible, thereby minimizing the formation of acid water. During this design investigation and upon completion of sampling the discharge point has changed. Additional investigation is underway to determine the new flow path of the discharge.

Inundation will be accomplished by first sealing the major discharge point, the Eureka Mine No. 29 shaft, with a seal capable of withstanding the maximum anticipated hydraulic head (207 feet). The ultimate water elevation in the mine will be determined during the monitoring of the project. The initial target elevation is 1600 feet. Tap-offs will be established at Eureka Mine No. 29, Eureka Mine No. 28, Fernwood Mine, and other strategic shafts and/or drill holes to provide flexibility in water level control.

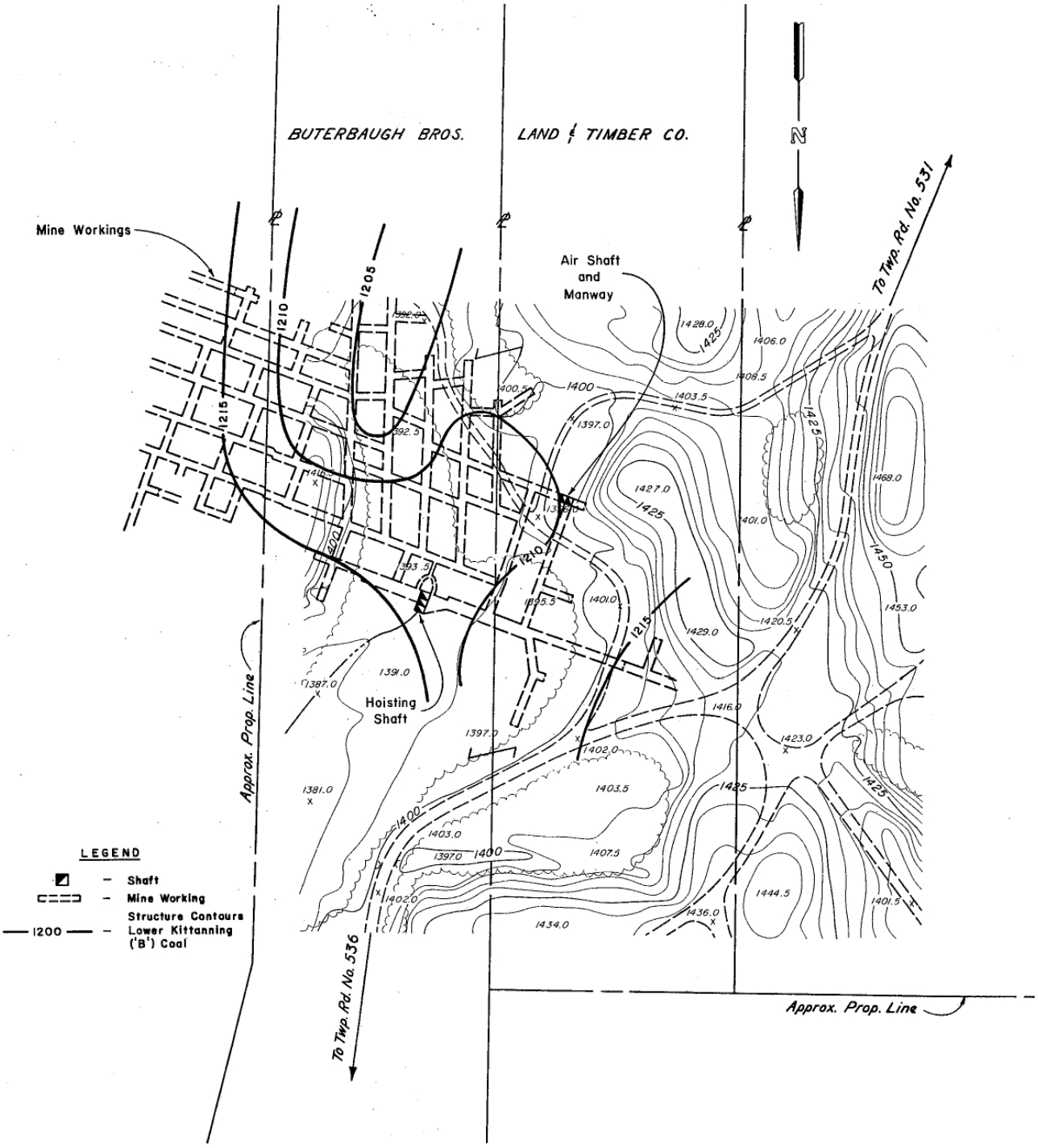
The large strip mine area on the eastern border of Viola Mine No. 1 , where the outcrop barrier has been stripped, will be restored by constructing a clay barrier against the highwall and grading in a manner


Fernwood Shafts (2
Surf. Elev. = 1520
"B" Coal Elev. = 1320
Ult. Water Elev. = 1600
Eureka 29 Shafts (2)
Surf. Elev. = 1400
"B" Coal Elev. = 1210
Ult. Water Level = 1600
Pumping Station
Section Thru Mine
QUICK START NO. 3
Eureka Mines No. 28 & 29
"B" Seam
BECCARIA TWP.
GULICH TWP.
BECCARIA
Muddy Run
Little Muddy Run
L.R. 17035
L.R. 17043
L.R. 17033
L.R. 857
T-536
T-531
T-534
T-535
T-919
To Utahville
Scale
0 1000 2000 Feet


Tap Off
(Emergency
Pumping
Station)
Pa. Rte. 253 & 453
L.R. 17139
1611
GINTER
L.R. 669
1715
Fernwood Mine
"B" Seam
1700
L.R. 17139
1600
JALMADEN
L.R. 669
GULICH TWP.
JANESVILLE
Eureka 28 Shaft
Surf. Elev. = 1600
"B" Coal Elev. = 1472
Ult. Water Level = 1600
1637
1400
1500
Section THRU Mine
1800
1700
1630
1642
1600
253
453
Tap Off
Viola Mine No. 1
"B" Seam
1548
1500
1771
Little Muddy Run
Pa. Rte. 453 to Tyrone
1601
Pa. Rte. 253
1633
1600
1800
1644
1700
1680
L.R. 17043
1700
LEGEND
Denotes Portal
Denotes Shaft
Denotes Mine Boundary
1300 Denotes Coal Structure Contours
Denotes Present Inundation
Denotes Proposed Inundation
MUDDY RUN WATERSHED
QUICK START No. 3
DEEP MINE POLLUTION SOURCE



SECTIONS THRU
EUREKA AND FERNWOOD SHAFT MINES

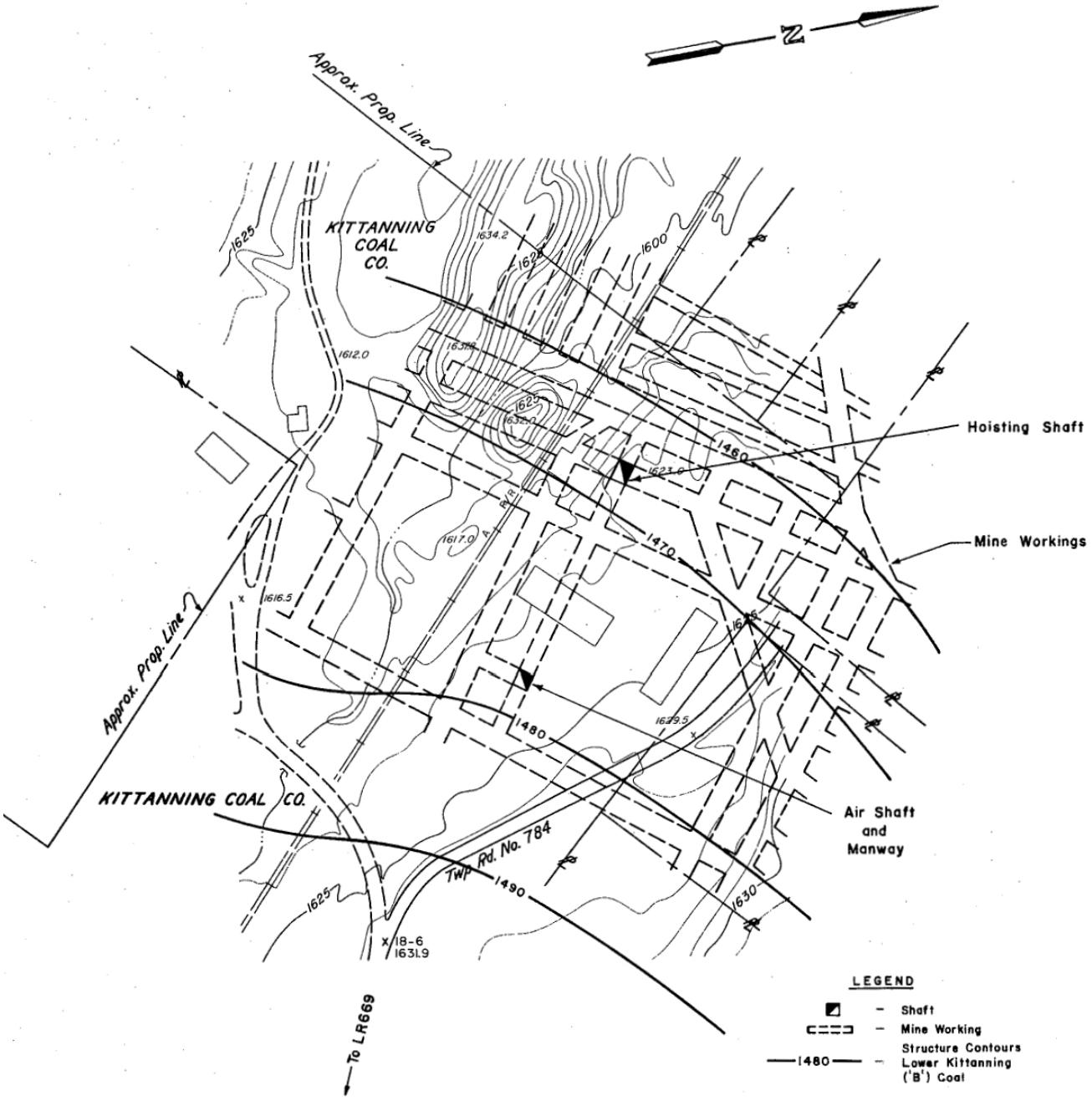


QUICK START NO. 3

EUREKA NO. 29 SHAFT

SCALE

100 0 200 Feet



QUICK START NO. 3

EUREKA NO. 28 SHAFT

SCALE

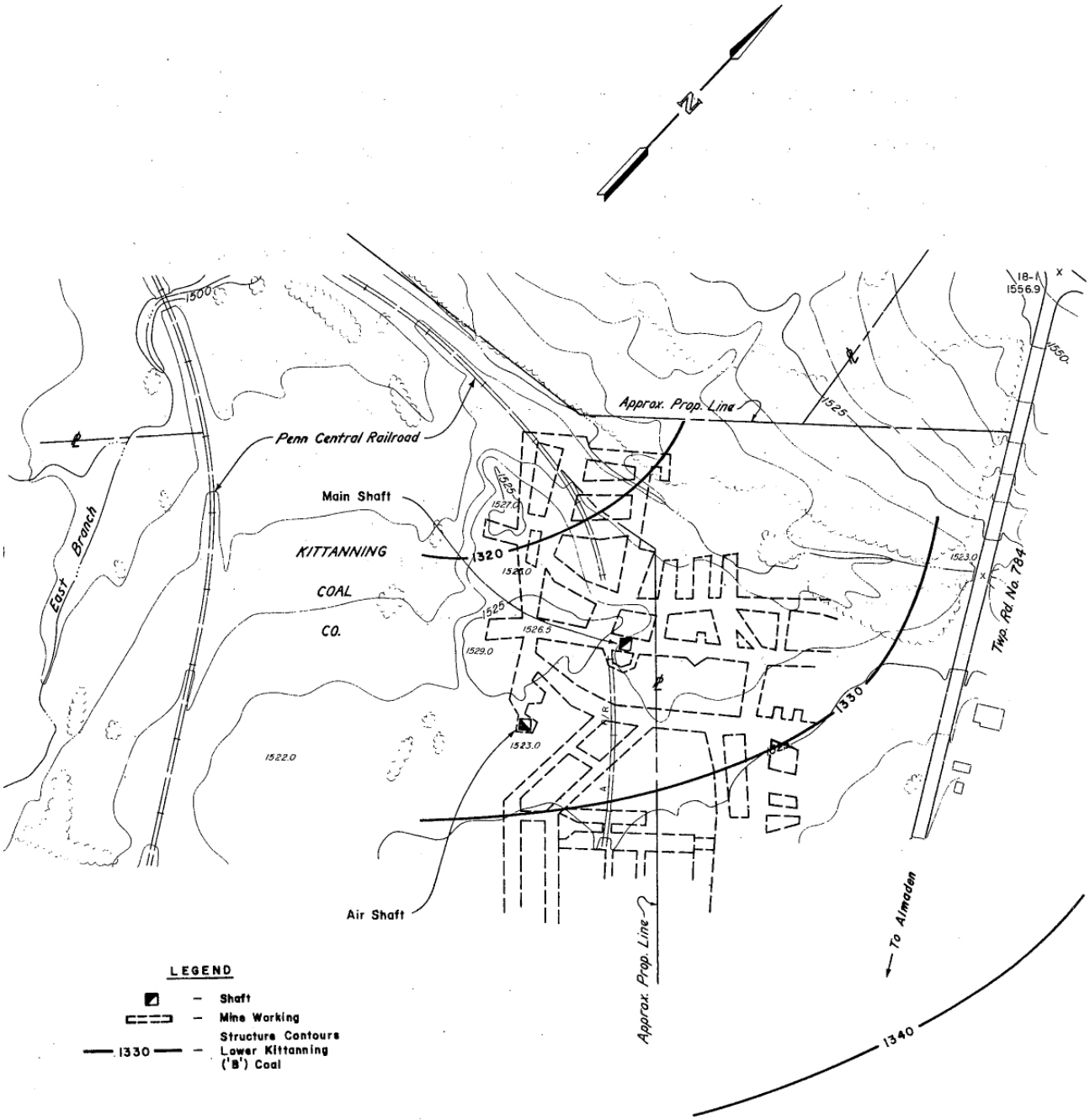
100 0 200 Feet

to discourage surface water from ponding in the stripped area. This will eliminate the easy access of surface drainage to the mine complex and will also provide for maximum inundation of the workings.

The Eureka No. 28 Shaft and the two Fernwood Mine Shafts will be sealed with seals capable of withstanding the anticipated head at each shaft and to prevent discharge before the target elevation is reached.

Due to the extent of the mine workings and the possibility of water escaping through some uncharted working, a close surveillance of the Eureka complex perimeter will be kept during the rise in water level. At the same time, water quality changes will be identified by sampling and analyses from tap-offs and monitoring bore holes.

Estimated cost is $452,000.

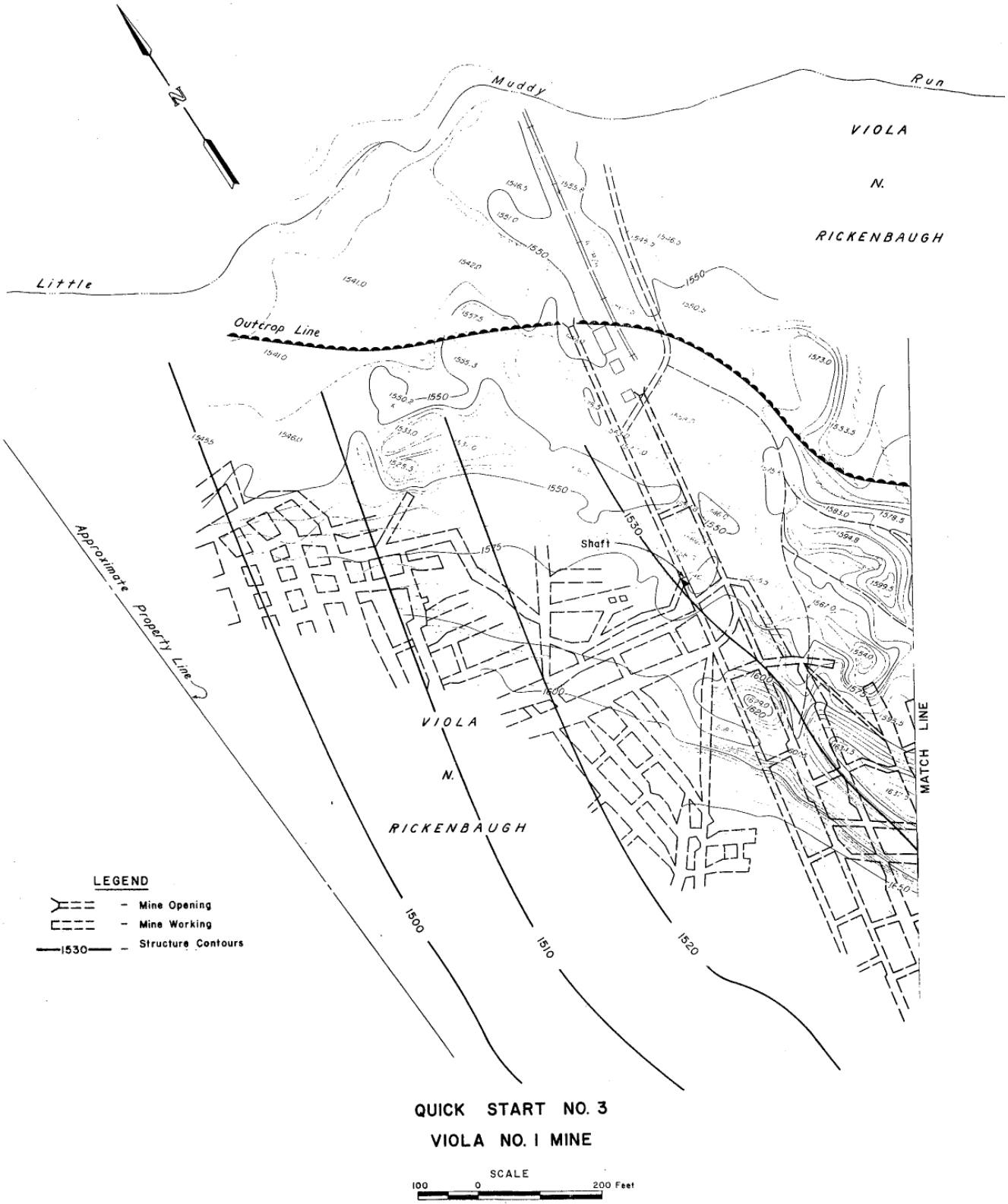


QUICK START NO. 3

FERNWOOD SHAFT

SCALE

100 0 200 Feet

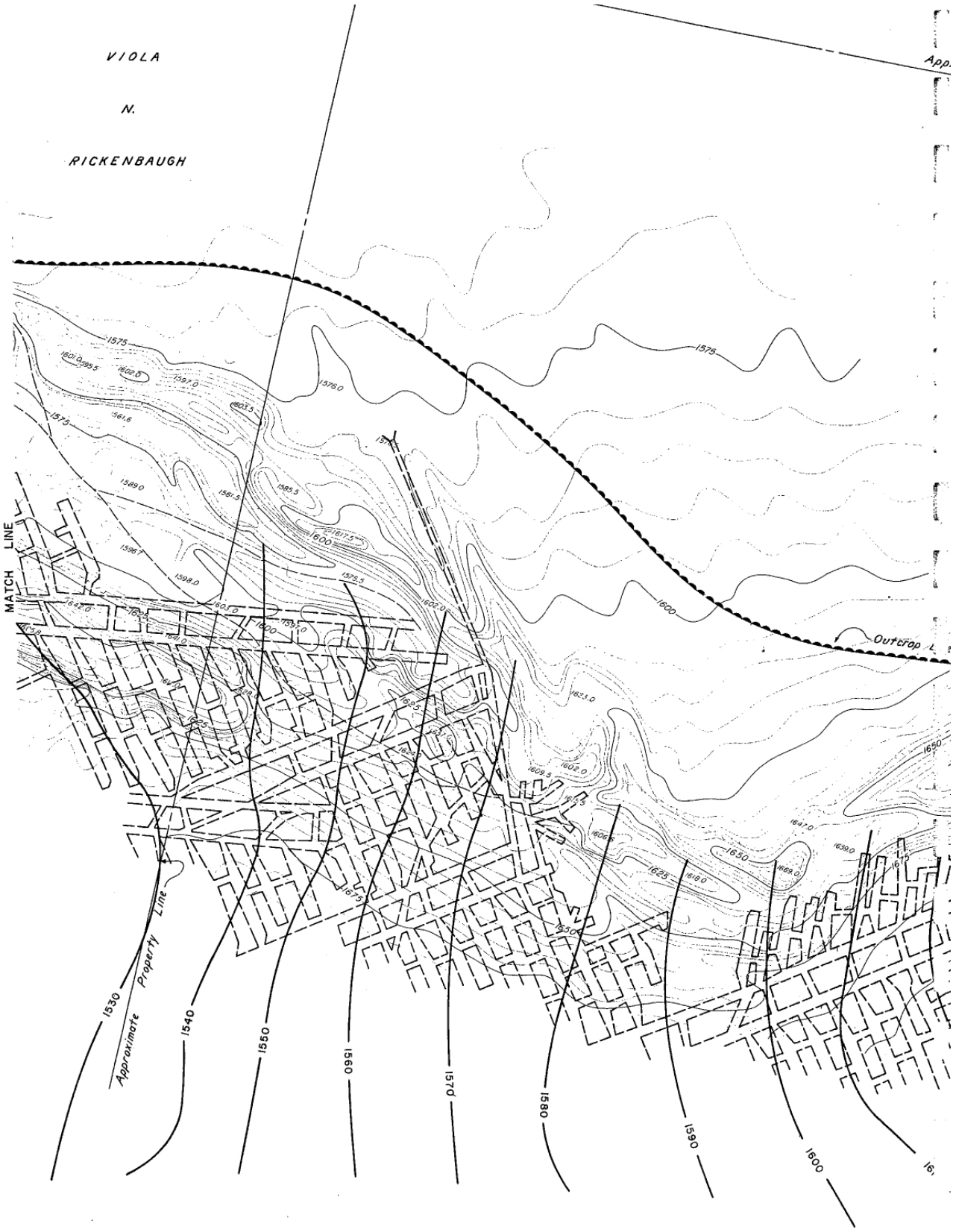


QUICK START NO. 3

VIOLA NO. 1 MINE

SCALE

100 0 200 Feet


VIOLA
N.
RICKENBAUGH
MATCH LINE
Approximate Property Line
Outcrop
1530
1540
1550
1560
1570
1580
1590
1600
1575
1600
1625
1650

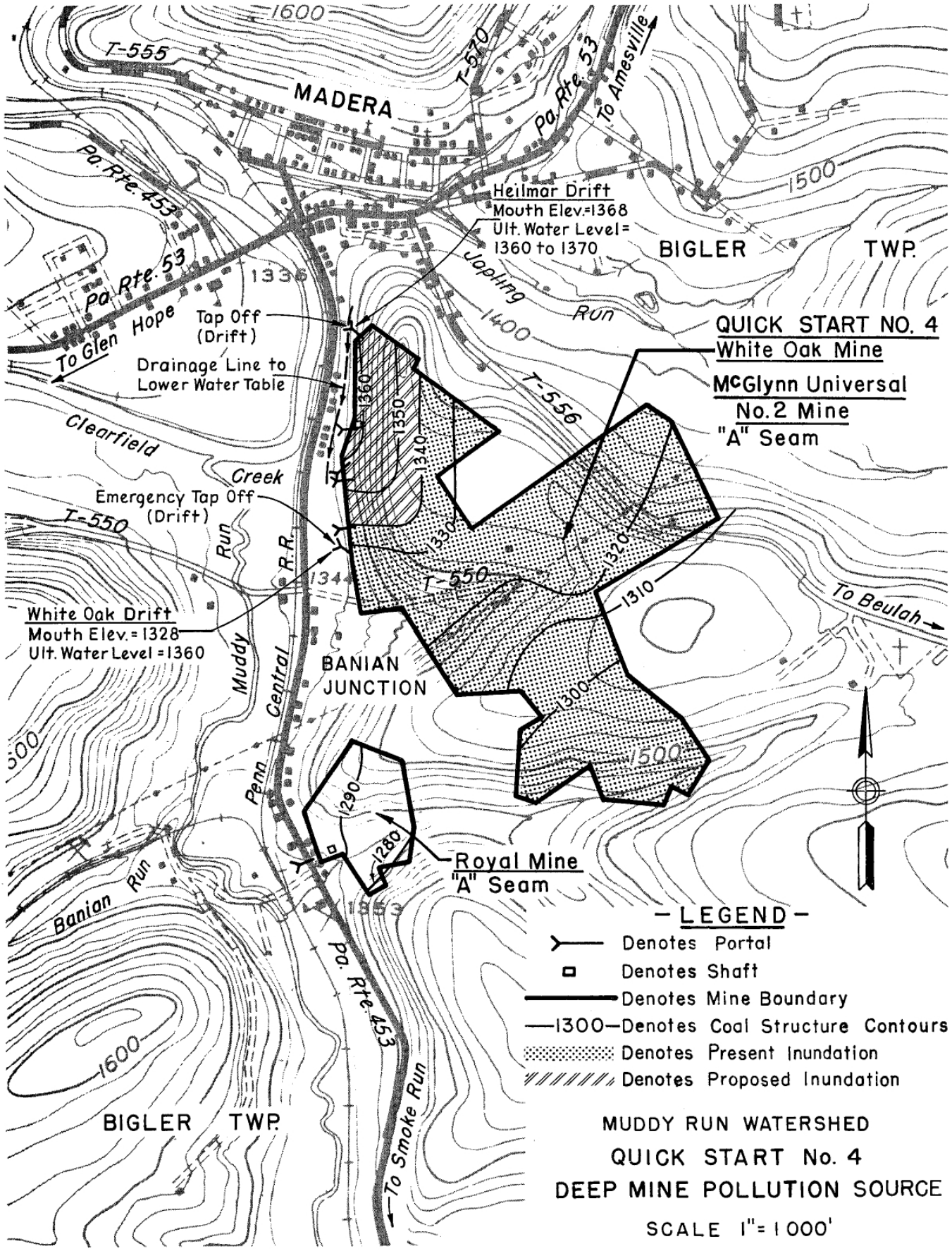

Property Line
To Jamesville
Pa. Rte. 253
To Glasgow
N
1620
1630
1640
1650
1660
QUICK START NO. 3
VIOLA NO. 1 MINE
SCALE
100 0 200 Feet

Pollution Source 100 - Description - Quick Start Four

The White Oak Mine (Universal Mine No. 2 and Heilmar Mine No. 1), a 138 acre deep mine situated on the Clarion (A) seam had been developed by drifts and slopes to the dip. A daily average of 2,446 pounds of acid, measured at station 100, is emanating from a caved drift in the western extremity of the mine and a smaller amount through the outcrop barrier 100 feet north of this drift. This pollution source is also contributing an average daily load of 991 pounds of iron. The mine is located in the northern portion of the watershed near Madera. The mine was entered by drifts and slopes at the western extremity where the coal crops. It was mined to the dip (southeast) and sealed upon completion of extraction by caving methods. Discharges developed along the entire western outcrop barrier after flooding of the mine and persisted until the seal in the drift entrance failed, providing a common exit for the water. Because mining was accomplished to the dip, approximately 80% of the mine is presently flooded. This project is scheduled for abatement under Quick Start Four.

Pollution Source 100 - Abatement - Quick Start Four

The abatement method recommended is to inundate the remain-


MADERA
T-555
T-570
Pa. Rte. 53
To Amesville
Pa. Rte. 453
Heilmar Drift
Mouth Elev.=1368
Ult. Water Level=
1360 to 1370
BIGLER TWP.
Pa. Rte. 53
To Glen Hope
Tap Off
(Drift)
Drainage Line to
Lower Water Table
Japing Run
QUICK START NO. 4
White Oak Mine
McGlynn Universal
No. 2 Mine
"A" Seam
T-556
Clearfield Creek
Emergency Tap Off
(Drift)
T-550
Muddy Run
R.R.
White Oak Drift
Mouth Elev.= 1328
Ult. Water Level = 1360
BANIAN
JUNCTION
Penn Central
To Beulah
Royal Mine
"A" Seam
Banian Run
Pa. Rte. 453
To Smoke Run
BIGLER TWP.
1600
1500
1400
1360
1350
1340
1330
1320
1310
1300
1290
1280
LEGEND
Denotes Portal
Denotes Shaft
Denotes Mine Boundary
1300 Denotes Coal Structure Contours
Denotes Present Inundation
Denotes Proposed Inundation
MUDDY RUN WATERSHED
QUICK START No. 4
DEEP MINE POLLUTION SOURCE
SCALE 1"= 1000'


Outcrop Line-Clarion ("A") Coal
To Smoke Run
TWP. RD. No. 550
SUB - STATION
1
2
3
4
5
6
7
8
1386.6
1385.2
1386.5
1386.1
1386.0
1350
1370
1400
1450
1500
Test Boring No. 1
Test Boring No. 2
Approx. Prop. Line
1330
1340
1350

QUICK START NO. 4

HEILMAR, WHITE OAK & UNIVERSAL MINES

SCALE

100 0 200 Feet

-ing 20% of the mine. The exploratory drilling phase has provided information to determine the appropriate double bulkhead seal to be used. The seal will be placed through the portal opening when possible, but if there is broken or fragmented rock near the portal opening or-if the opening has subsided greatly, a deep mine seal will be placed through drill holes. This . sealing should raise the water level sufficiently to completely inundate the mine workings. Seals in portals presently discharging water will require a pumping system to eliminate the flow while the seal is setting.

Grout curtains will be constructed adjacent to the seals to discourage seepage around the seal.

A system of valved pipes will be installed to provide water level control.

In the past, some of the portals were plugged with an earth backfill, and as the water level rose a discharge occurred along the outcrop of the "A" seam, which is in the proximity of the homes on Pennsylvania Route 453. To prevent a recurrence of this, a trench will be excavated inn the area back of the homes to intercept any discharge . An underdrain pipe will be placed in the trench and backfilled with aggregate to assure interception of ground as well as surface water. The top portion of the trench will be topsoiled and seeded to maintain the same appearance as at present.

The expected discharge point is at the high point of the mine - a portal located in the extreme northwestern corner. Estimated cost is $16'6,500.

Pollution Source 117 and 1 18 - Description - Quick Start Five

Source 117: This pollution source is a constant discharge emanating from a breached outcrop barrier in the vicinity of the Mountaindale drifts at the Great Bend Mine. It is a heavy acid, iron, and sulfate contributor. The Great Bend Mine is part of an interconnecting deep mine system of approximately 275 acres on the Lower Kittanning (B) seam. It includes the Merrit Mine No. 3, the Fallen Timber Mine No. 1 , Cambria Mills Smokeless Mine No. 2, and the Gwin Slope or Bucket Mine. The Great Bend Mine and the MerritMine No. 3 are contained within the limits of a knoll which separates Blandburg from Mountaindale. The coal dips to the northwest in this area and has been mined to the dip through drifts on the southern cropline at Blandburg and on the eastern cropline along L.R. 11080. Along the northern cropline at Mountaindale mining has been performed to the rise. Apparently, the northern outcrop barrier was breached by deep mining either by the original company, the Great Bend Coal Company, by individuals re-entering to extract coal for domestic purposes, or by an exploratory strip cut.

Presently all of the drifts are in a collapsed condition, the mine being quite old. Excavations were originally made in the area of these dishcarges for the purpose of installing the drifts. Waste from this

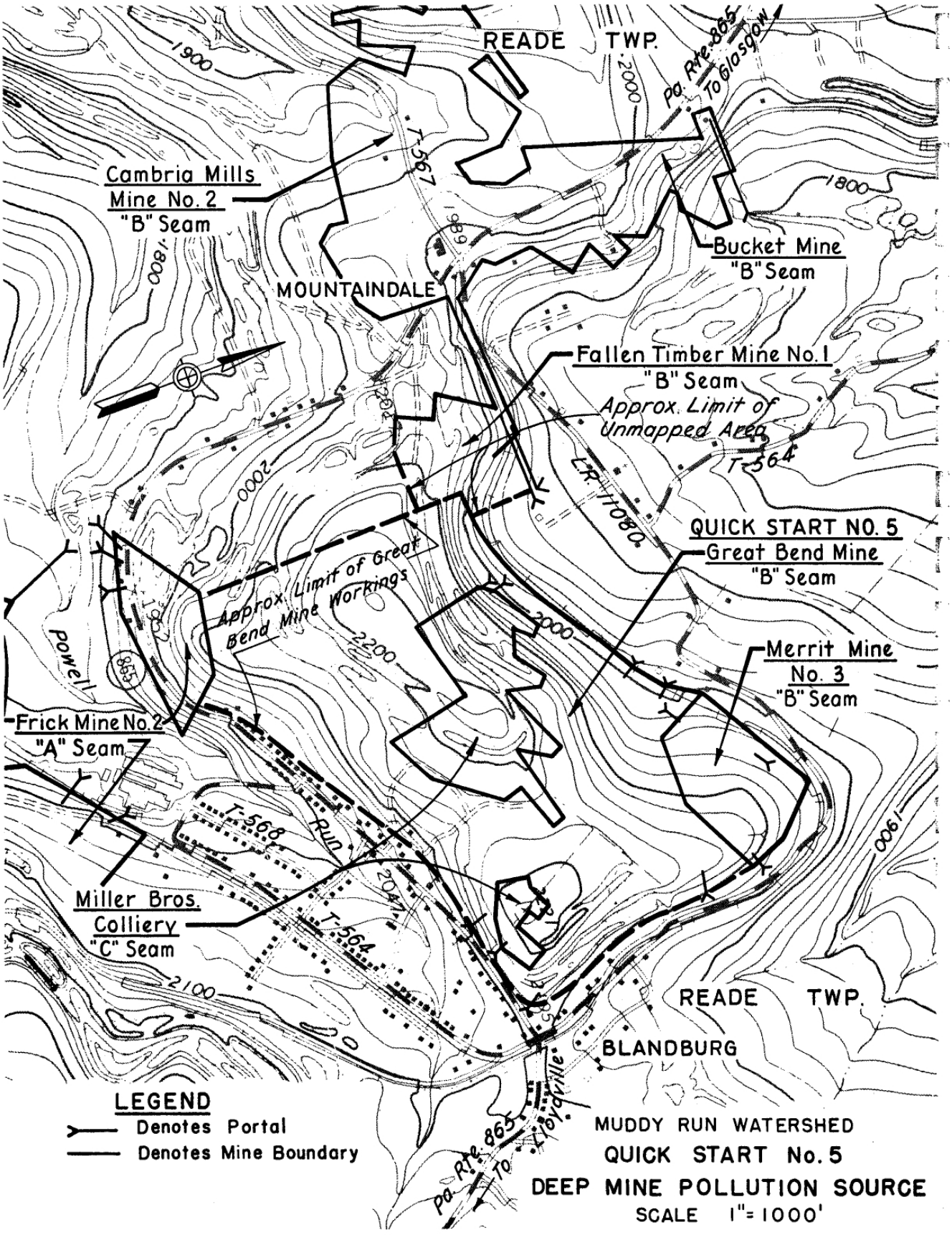
mine and from the Fallen Timber Mine No. 1 or Cambria Mills. Smokeless Mine No. 2 forms the bed of the stream carrying the discharge from the area.

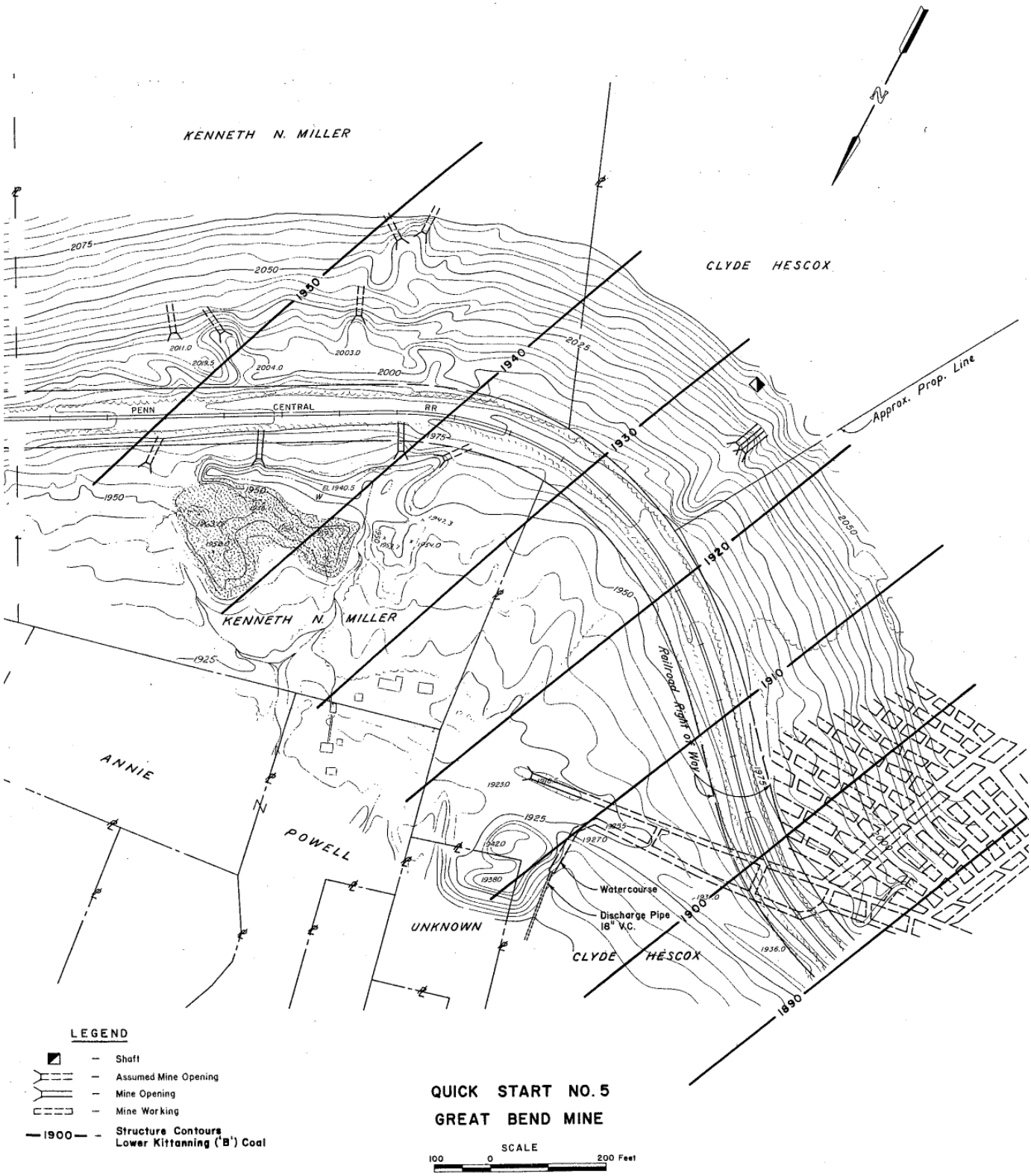
The Great Bend Mine is not delineated on the Mine Development Drawing because mine maps could not be located. The mine is old and ownership has changed and apparently the mine maps were lost somewhere. Many unsuccessful attempts were made to secure this mine map.

Pollution Source 117 and 118 - Abatement - Quick Start Five

Source 117: At first, the abatement method that appeared most applicable to the broad bank of seeps was to strip away the overburden and place a clay barrier against the outcrop. However, further investigation of the area revealed a weakened and fragmented condition of the rock directly behind the outcrop. This meant that a clay barrier would prove ineffectual because water would find its way through the fragmented rock and over the top of the barrier. Although some inundation would occur, a greater amount is desired.

To achieve this desired inundation, the slurry trench method will be utilized by placing the trench up dip from the fragmented rock. The slurry trench will be supplemented by curtain grouting. Together


READE TWP.
Pa. Rte. 865
To Glasgow
Cambria Mills
Mine No. 2
"B" Seam
T-567
1900
2000
1800
1989
Bucket Mine
"B" Seam
MOUNTAINDALE
Fallen Timber Mine No. 1
"B" Seam
Approx. Limit of
Unmapped Area
T-564
L.R. 11080
QUICK START NO. 5
Great Bend Mine
"B" Seam
Approx. Limit of Great
Bend Mine Workings
2200
Merrit Mine
No. 3
"B" Seam
Powell
865
Frick Mine No. 2
"A" Seam
T-568
Run
Miller Bros.
Colliery
"C" Seam
2100
READE TWP.
BLANDBURG
Pa. Rte. 865
To Reynoldsville
LEGEND
Denotes Portal
Denotes Mine Boundary
MUDDY RUN WATERSHED
QUICK START No. 5
DEEP MINE POLLUTION SOURCE
SCALE 1"= 1000'


KENNETH N. MILLER
CLYDE HESCOX
PENN CENTRAL RR
Approx. Prop. Line
KENNETH N. MILLER
ANNIE
POWELL
UNKNOWN
CLYDE HESCOX
Railroad Right of Way
Watercourse
Discharge Pipe 18" V.C.
2075
2050
2025
2000
1975
1950
1940
1930
1920
1910
1900
1990
2011.0
2004.0
2003.0
EL 1940.5
1942.3
1924.0
1923.0
1927.0
1938.0
1936.0
LEGEND
Shaft
Assumed Mine Opening
Mine Opening
Mine Working
1900 Structure Contours Lower Kittanning ('B') Coal
QUICK START NO. 5
GREAT BEND MINE
SCALE
100 0 200 Feet

they should accomplish partial inundation of the "B" seam and divert water to other down dip workings, which is the practical limit of abatement in the Great Bend area. The large number of openings on the "C" seam make it impractical to seal all openings and attempt further inundation from a cost versus pollution abated standpoint.

During the field investigations many openings were located and others were indicated by local residents. Since mine maps are so scarce in this area, and so much independent mining was performed, the possibility exists that there are portals hidden by time and nature. A close patrol of the area will be necessary as the water rises. Breakout from some "B" seam portal would be reason for considering additional abatement construction. Discharge from "C" seam portals should be of a quality which, although not the most ideal, will be considerably improved and probably satisfactory. This pollution source is to be abated at the same time as Source 118 under Quick Start Five. Costs and pollution loadings are given below.

Pollution Source 117 and 118 .- Description - Quick Start Five

Source 118: This constant discharge also emanates from the Great Bend Mine and is related to the development of the Cambria Mills

Smokeless Mine No. 2. This is a heavy acid, iron and sulfate contributor located approximately 1,000 feet northwest of discharge 117.

The Fallen Timber Coal Company originally operated in this area near Mountaindale, driving a slope westward into the Lower Kittanning seam, approximately .500 feet north of the northwest corner of the Great Bend Mine. Headings were driven south and southeast off this slope until the Great Bend Mine was reached. The mine flooded, since it was down dip from the Great Bend Mine. In the late 1940's, Cambria Mills Coal Company mined this coal to the west by driving a slope at the same location. This slope was driven at a shallower angle than the Fallen Timber effort and rooms were not opened until the slope reached the vicinity of the Mountaindale High School. To combat the water problem which befell the Fallen Timber Company, a pipeline was constructed. This carried the water under the slope until reaching the surface, approximately 100 feet from L. R. 11080.

It is not known whether this drainage system is still operating as efficiently as it was during active operation of the mine. It is known that the Bucket Mine, located down dip from the Cambria Mills Smokeless Mine No. 2, is partially flooded. This is due to aquifers intercepted by that mining, aquifers intercepted by the Cambria Mills Smokeless Mine No. 2, and possibly breakdown of the pipe system allowing drainage from

the Great Bend Mine to enter. Pollution sources 117 and 118 contribute a combined daily loading of 972 pounds acid and 1 18 pounds iron to the watershed, and have been scheduled for abatement under Quick Start Five.

Pollution Source 117 and 118 - Abatement - Quick Start Five

Source 118: Abatement will be accomplished by inserting double bulkhead deep mine seals into both the watercourse and the slope. To accomplish a substantial deep mine seal, the flowing water will be detoured from the area of the seal by pumping through strategically placed drill holes. After the seals are in effect and the water level begins to rise the area will be patrolled for any indication of breakout.

A portal at the northern end of the Bucket Mine, on the down dip side of the entire complex, will be observed closely. This portal showed some evidence of discharge, but only of a superficial nature. Continuing field investigations revealed that discharge was in evidence only after heavy rains. This is due to the overflow of the pond formed in the trench that was excavated for access to the slope. The plug in this portal which was apparently placed by the operators of the mine, is holding little head. The mine is not fully flooded indicating that seepage is occurring through the coal barrier to the Scott Brothers Mine No. 2. As the hydraulic head

increases due to sealing: other discharge points,. the effectiveness of this plug must be re-evaluated and may require reinforcement or replacement with a double bulkhead seal.

As was noted in the abatement section of pollution source 117, the Great Bend area was mined by many independent firms and individuals. A great number of these operations were probably never recorded and so hidden portals are a real possibility. These factors point to the need for regular reconnaissance after completion of the abatement construction.

Drill holes will be utilized to establish points for water level monitoring and quality sampling.

Estimated cost for both 117 and 118 is $100,000.