Heartland Corridor, Walton Virginia to Columbus Ohio

Preliminary Engineering Phase Report

Big Four No. 2 Tunnel – MP N395.07 Huger, WV

October 14, 2005, Rev. 2

Hatch Mott MacDonald

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Norfolk Southern Railway
Heartland Corridor, Walton VA to Columbus OH

Big Four No. 2 Tunnel – MP N395.07

Statistics: Pocahontas Division
Double-width Tunnel for Main #1 & Main #2
Length = 174'
Concrete lined
Tangent Track (per Track Chart)
Superelevation = 0.0”

1. EXISTING CONDITIONS

1.1 Background

Valuation Map V-13WV/22 (16278) for the Big Four No. 2 Tunnel is dated June 30, 1916. Parcels for the tunnel were acquired in 1908. It is therefore suspected that the tunnel was constructed in 1908 or shortly afterwards. Additional information on this tunnel was obtained from various sources such as topographic maps, aerial photos, inspection reports, track charts, and field investigations that were performed on March 15 and June 9, 2005.

1.2 General Area

The tunnel is located in a sparsely populated area with good access to the east portal. The railroad's access road connects to US Rt. 52, provides access to the west portal of Big Four No. 1 and continues on to the east portal of Big Four No. 2. No practical access to the west portal of Big Four No. 2 was observed. There are no siding tracks in the vicinity of this tunnel. There are very few nearby buildings and most of the area around the tunnel is rocky, hilly, and wooded. There is an old, unlined railroad tunnel approximately 100' to the north of Big Four No. 2. The USGS Topographic Map shows a mine dump to the west of the tunnel.

1.3 Structural Conditions

The tunnel is 174' long with a concrete lining and a nominal width of 28'. It is a double-width tunnel for two tracks. A signals and communications cable is mounted on the north wall. The liner is typically dry, even at construction joints, except for near each portal where there is some very minor leaking. There are typical minor spalls and small cracks in each segment of the liner. The concrete liner is in generally very good condition.

Ballast covers the top of the liner footing on the both sides for the entire length of the tunnel. A small portion of the tunnel invert material was excavated to fully expose the base of the tunnel liner footing. The footing thickness was found to be 24". The vertical distance from the top of rail to the base of the footing was measured at 32".

1.4 Track

The track is continuously welded rail of conventional design with wooden crossties at approximately 19" and a stone ballast section. The ballast is generally clean and even with the ties. The rail is typically 132RE or 141RE. The track is tangent throughout the entire length of the tunnel. The water in the tunnel was tested and its pH reading was 6.68. This is a fairly neutral reading and indicates that the water is not unusually corrosive.

1.5 Geotechnical

The tunnels in the eastern part of the Pocahontas Division (including Big Four No. 2) are located in the Appalachian Plateaus Physiographic Province, a region characterized by deeply incised

plateaus underlain by flat-lying sedimentary rock. The tunnels themselves are lined and no rock was exposed. The description of the site geology at each tunnel is based on our observations of the rockmass at the portals and adjacent cuts and the 1968 *West Virginia Geologic Map* prepared by the West Virginia Geologic and Economic Survey.

The Big Four No. 2 Tunnel was excavated through medium- to thick-bedded sandstone of the Pocahontas Formation. Minor interbeds of shale, siltstone, and coal may also be present in this formation, but were not observed in the exposures. Bedding is sub-horizontal. An older, now abandoned, tunnel was excavated adjacent to the Big Four No. 2 Tunnel – this tunnel was not inspected during our work at this site.

The rock quality designation, Q, at the portals was determined to be 23. A Q rating between 10 and 40 is considered "Good" with 10 bordering on "Fair" and 40 bordering on "Very Good." A sample of rock was taken from the portal and tested.

The geoprobes taken in the tunnel indicate that the top of rock is located between 1.5' to 3.6' (averaging about 2.2') below the top of ballast throughout the tunnel for Main #1 and between 2.0' to 4.0' (averaging about 2.6') below the top of ballast throughout the tunnel for Main #2. Top of ballast is typically about 0.8' below top of low rail. Geoprobes were also taken at 100' increments for 1000' outside of each portal. At 100' and 200' west of the tunnel, rock was found at 2.5' to 3.5' below the top of ballast on both tracks. From 200' to 1000' west of the tunnel, each probe reached a depth of 5.0' below the top of ballast without reaching refusal. East of the tunnel, each probe reached a depth of 5.0' below top of ballast without reaching refusal.

1.6 Clearances

The laser car measurements indicate that the existing tunnel has adequate horizontal clearances, however the portion of the composite template that represents the "High-Wide Load" is shown completely against the left wall at each section. This tunnel is somewhat narrower than other two-track tunnels. For vertical clearance, the Double Stack portion of the composite design template encroaches on the tunnel by about 13" throughout the tunnel on the right wall and about 21" throughout the tunnel on the left wall. The High-Wide Load portion of the composite template encroaches into the crown about 12" on the left side at a lower point than the Double Stack portion. The left track appears to be about 10" closer to the left wall than the right track is to the right wall. The template encroaches the tunnel lining at the 10-11 o'clock and 1-2 o'clock positions. Cross sections of the tunnel clearance encroachments are shown in the drawings at the end of this report. The maximum vertical encroachments are summarized in the table below:

	Crown Encroachment (radial inches)	
Distance (ft) from East Portal	**Left Side**	**Right Side**
0	20	13
50	21	13

	Crown Encroachment (radial inches)	
Distance (ft) from East Portal	Left Side	Right Side
102	22	13
150	19	13

2. CLEARANCE IMPROVEMENT ALTERNATIVES

Given the magnitude of the vertical clearance deficiency, there are several general alternatives that can be used to obtain the clearance; realigning the tracks, replacing the lining, or notching the lining. Combinations of the general methods may be required to obtain a design that is cost effective and that can be constructed within reasonable track outages. Track lowering or undercutting does not appear feasible due to the proximity of the top of rock to the surface. The topography of this site also makes daylighting a potentially viable option.

2.1 Track Realignment

Centering the tracks within the tunnel would even out the vertical conflicts, decreasing the amount on the left side and increasing the amount on the right side, minimizing the maximum depth of any notches.

2.2 Liner Replacement

To obtain the desired clearance, the concrete liner must be demolished, the native rock excavated to the clearance limits plus the new liner thickness, and a new concrete liner installed. Based on the 21" average encroachment on the left side of the tunnel, this method would be required for the length of the tunnel. Due to the high cost of this alternative, realignment and notching would be preferable to liner replacement if at all possible. Detailed investigation into the liner thickness would be required before selecting this alternative.

2.3 Notching the Crown

Notching in the upper quadrants of the tunnel may not cut entirely through the liner and could be an alternative to complete liner replacement. If used in conjunction with track realignment, this alternative may be feasible for the entire length of the tunnel. Detailed investigation into the liner thickness would be required to determine the maximum allowable notch depth.

2.4 Daylighting

The topography of this site and the length of the tunnel make daylighting a possible alternative. It is estimated, based on USGS topography, that the depth of rock over the tunnel at the east portal is about 40' and at the west portal is only 15'. A cut would be made that is several feet wider than the existing tunnel to allow for snow removal. The amount of rock excavation for

this 174' tunnel would be on the order of 30,000 CY. This alternative offers the long term benefit of eliminating tunnel maintenance. Further topographic survey is required in order to evaluate this alternative. In the final design phase a variation of this alternative will be researched where the tunnel will be daylighted and the walls left in place. This scheme will reduce the amount of rock excavation.

3. PREFERRED ALTERNATIVE

Daylighting was selected as the preferred method for achieving the clearances at this location. This alternative offers the long term benefit of eliminating tunnel maintenance.

3.1 Preliminary Design

The preliminary design uses NS's current mainline typical section for the width of the cut. The side slopes were set at 1H on 6V to match the stable slopes at the tunnel portals. The cuts at each portal would be line drilled and blasted to widen the cuts to meet the new NS standards. Two feet (2') wide benches were provided at 25' vertical increments in the preliminary design. The final design will confirm the rock slopes and locate the benches at elevations reflecting softer layers of rock.

3.2 Schedule

The estimated schedule for completing improvements on this tunnel is eleven (11) weeks from mobilization to demobilization. The schedule assumes that flagging is used to protect trains during the blasting and rock excavation. Both tracks would be closed during blasting on the approach cuts for short periods during the actual blast and removal of incidental fly rock. The track adjacent to the rock face would be closed for ten hours, five days a week during the cut widening. Since the overburden rock would be removed, temporary support of the liner is not possible, therefore both tracks would need to be closed for ten hours, five days a week, for the two weeks required for liner removal.

The schedule assumes that the rock overburden would be removed down to the liner from the top, and that the rock removal in the cuts would be performed prior to removing the liner. Progressing the work in this manner uses the existing liner as a shield to protect the track and trains while the rock removal is performed.

3.3 Estimate

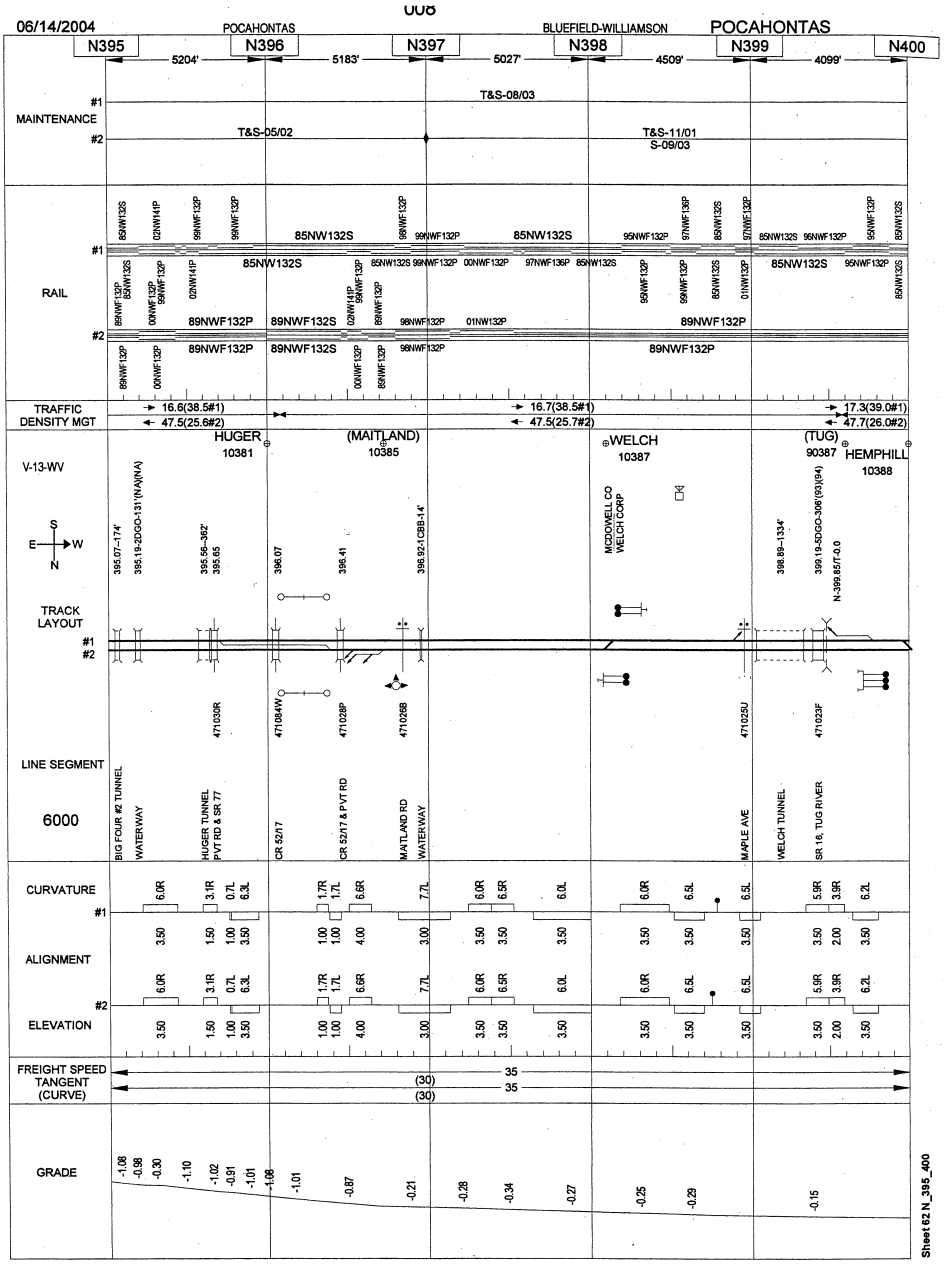
The total estimated cost for achieving clearance at this location is $1.7 million (2005 rates) or $9,624 per foot of tunnel. The work items include mobilization, surveying, rock excavation, crown removal, wall removal, and demobilization. The total cost is made up of tunnel, track, signal, and site work items at $1.1 million plus a 25% construction contingency, a 10% engineering allowance, and a 14% construction management allowance.

4. USGS TOPOGRAPHIC MAP

Big Four No. 2 Tunnel is located above the word "*Creek*"

5. AERIAL PHOTO

6. TRACK CHART



7. PHOTOS

Photo 1. East portal

Photo 2. Looking to the east from east of the tunnel

Photo 3. West portal

Photo 4. Looking to the west from west of the tunnel

Photo 5. Typical minor spalls and wetness at construction joint

Photo 6. Wet walls at end of tunnel

8. ESTIMATE

Big Four No. 2

Tunnel Length	174	ft
Tunnel Width	30	ft
# of Tracks	2	

	Contractor		Railroad	
Work Window	10	hrs	10	hrs
Setup & Demobilization Allowance	2	hrs	2	hrs
Production Time	8	hrs	8	hrs

Tunnel Work Items	UOM	Quantity	Unit Rate	Total
Mobilization	%	5%		$2,802.38
Crown Removal	SF	7700	$1.77	$13,639.20
Wall Removal	SF	7000	$2.60	$18,185.60
Rock Cut Drainage Trench	LF	200	$84.14	$16,828.80
Tunnel Drainage	LF	200	$20.55	$4,110.84
Demobilization	DY	1	$3,283.20	$3,283.20
Total Tunnel Work Items	**LF**	**174**	**$338.22**	**$58,850.03**

Trackwork Items	UOM	Quantity	Unit Rate	Total
Mobilization	DY			
Surfacing & Lining	PF	500	$10.30	$5,152.03
Demobilization	DY			
Total Trackwork Items				**$5,152.03**

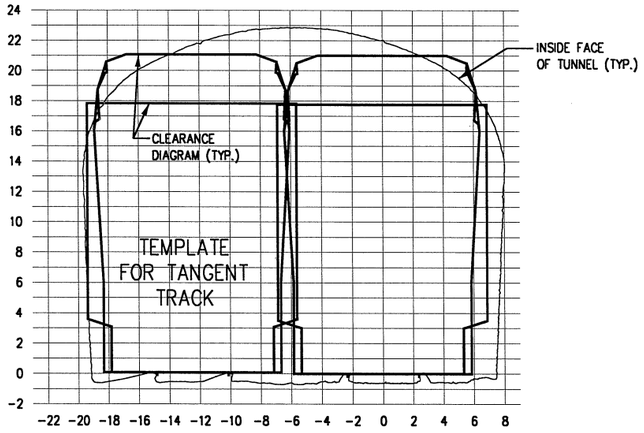
Signal Items	UOM	Quantity	Unit Rate	Total
Mobilization	DY			
Relocate Cables / Track Leads	LF	200	$19.11	$3,822.59
Demobilization	DY			
Total Signal Items				**$3,822.59**

Site Items	UOM	Quantity	Unit Rate	Total
Mobilization	DY	1	$2,483.60	$2,483.60
Erosion & Sedimentation Control	EA	1	$11,958.80	$11,958.80
Site Grading	CY	2000	$24.62	$49,243.34
Rock Excavation	CY	30000	$27.56	$826,826.10
Demobilization	DY			
Total Site Items				**$890,511.84**

Special Items	UOM	Quantity	Unit Rate	Total
Mobilization	DY			
Flagging	DY	52	$821.50	$42,718.00
Flood Track with Ballast for Protection	TN	1600	$39.35	$62,963.03
Remove Flooded Ballast	TN	1600	$10.20	$16,316.30
Demobilization	DY			
Total Specialty Items				**$121,997.33**

Subtotal All Items		**$1,080,333.82**
Construction Contingency	**25%**	**$270,083.46**
Engineering Allowance	**10%**	**$135,041.73**
Construction Management Allowance	**14%**	**$189,058.42**
Total		**$1,674,517.43**

9. DRAWINGS



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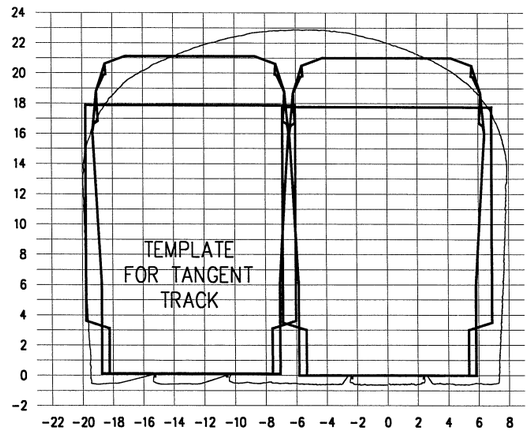

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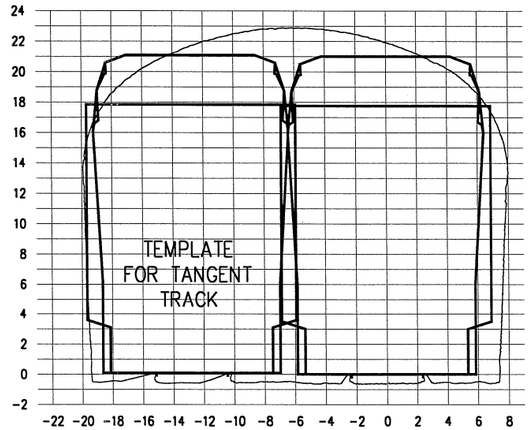

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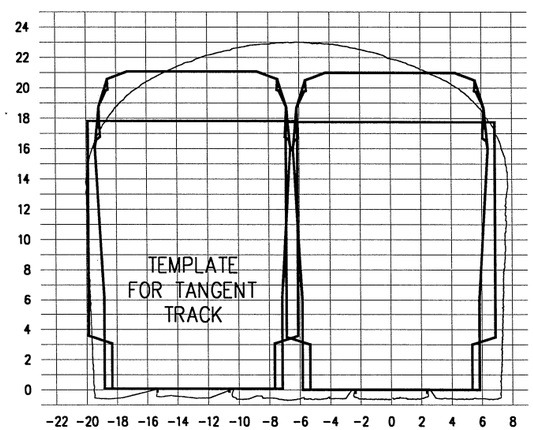


1+50

NOTES:

1. HORIZONTAL DATUM IS PARALLEL TO TRACK. WHERE TRACK IS SUPERELEVATED, DATUM IS NOT PARALLEL WITH GROUND.
2. CROSS SECTION GIVEN FOR STA. 0+00 IS A COMPOSITE FOR THE TUNNEL FROM STA. 0+00 THROUGH 0+50. ALL OF THE SECTIONS FOLLOW THIS CONVENTION.

NOT FOR CONSTRUCTION

SCALE: 1" = 100'

50 0 100 200 300

Hatch Mott MacDonald

NORFOLK SOUTHERN

OWNING COMPANY
POCAHONTAS
OPERATING DIVISION
OFFICE OF THE CHIEF ENGINEER - DESIGN AND CONSTRUCTION - ATLANTA, GA

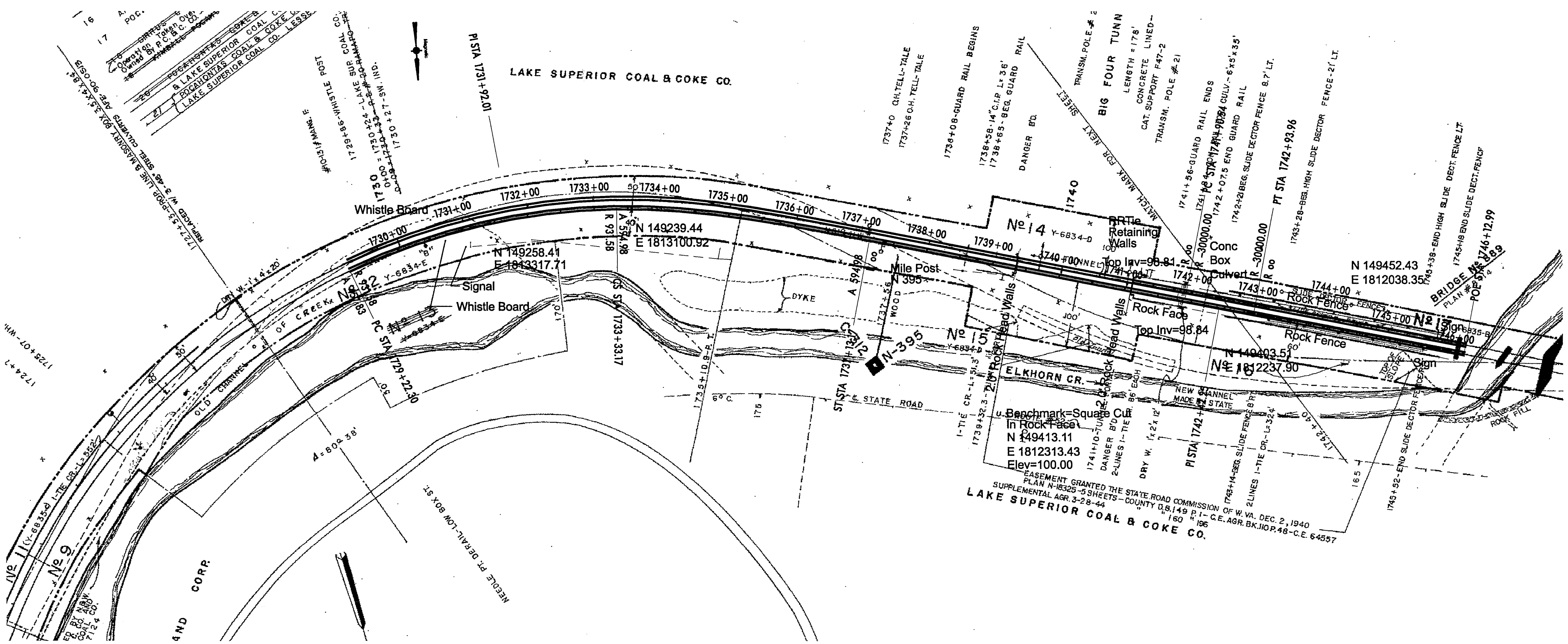
REV	BY	DATE	DESCRIPTION
P1	DJL	8505	PRELIMINARY ENGINEERING PHASE REPORT

LOCATION: BIG FOUR NO. 2 TUNNEL, HUGER, WV

TITLE: TUNNEL CLEARANCE CROSS SECTIONS – 1 OF 1

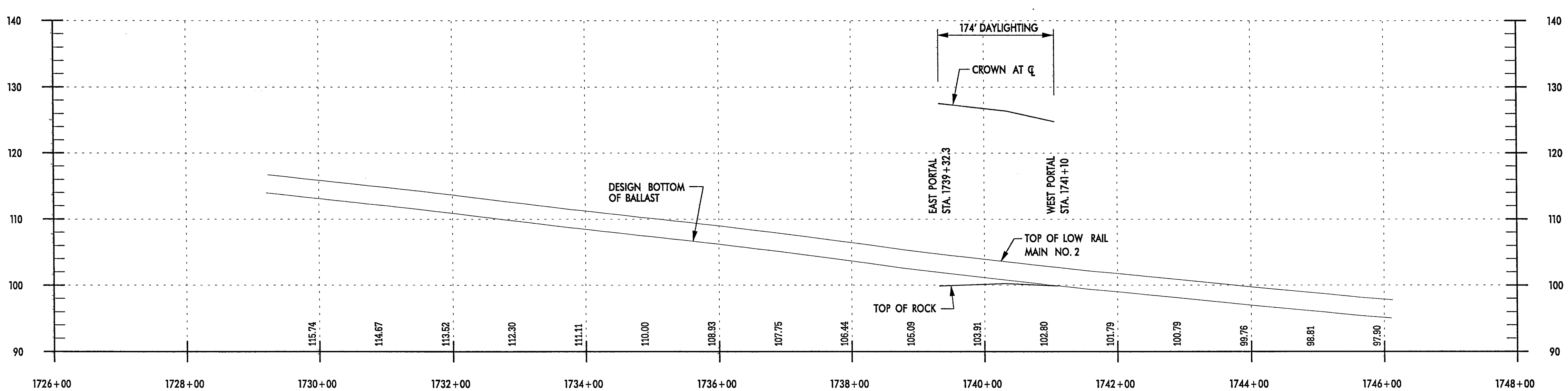
DSN	P.I.D. No.	VAN 16278	MILE POST N-395.07
DWN	FILE No.		DRAWING NUMBER
CHK	DATE APRIL 8, 2005		

FILE NAME = $FILE$ $TIME$
DATE/TIME = $DATE$



BIG FOUR NO. 2 PLAN

SCALE: 1"=100'



BIG FOUR NO. 2 PROFILE

SCALE: 1"=100' HORIZ.
1"=10' VERT.

BIG FOUR NO. 2 CURVE DATA

Project Name: bigfour2
Description:
Horizontal Alignment Name: 2
Description:
Style:
Input Factor: 1.0000

	STATION	NORTHING	EASTING
PC (6)	1729+22.30	149296.80	1813529.52
PI ( )	1731+31.23	149215.01	1813337.26
CC (7)		150154.03	1813164.84
CS (8)	1733+33.16	149223.16	1813128.49
Radius:	931.58		
Delta:	25°16′55″ Right		
Degree of Curvature(Chord):	6°09′12″		
Length:	411.06		
Length(Chorded):	410.86		
Tangent:	208.93		
Chord:	407.73		
Middle Ordinate:	22.58		
External:	23.14		
Tangent Direction:	246°57′17″		
Radial Direction:	336°57′17″		
Chord Direction:	259°35′44″		
Radial Direction:	2°14′11″		
Tangent Direction:	272°14′11″		
Element: Clothoid			
CS (8)	1733+33.16	149223.16	1813128.49
SPI (9)	1734+60.33	149228.12	1813001.42
ST (10)	1737+13.16	149289.21	1812754.99
Entrance Radius:	931.58		
Exit Radius:	0.00		
Length:	380.00		
Angle:	11°41′09″ Right		
Constant:	594.98		
Long Tangent:	253.89		
Short Tangent:	127.17		
Long Chord:	379.30		
Xs:	378.42		
Ys:	25.76		
P:	6.45		
K:	189.74		
Tangent Direction:	272°14′11″		
Radial Direction:	2°14′11″		
Chord Direction:	280°01′42″		
Radial Direction:	13°55′20″		
Tangent Direction:	283°55′20″		
Element: Linear			
ST (10)	1737+13.16	149289.21	1812754.99
PC ( )	1741+90.54	149404.07	1812291.64
Tangent Direction:	283°55′20″		
Tangent Length:	477.37		
Element: Circular			
PC ( )	1741+90.54	149404.07	1812291.64
PI ( )	1742+42.25	149416.51	1812241.45
CC (11)		120285.38	1805073.49
PT (12)	1742+93.96	149428.78	1812191.21
Radius:	30000.00		
Delta:	0°11′51″ Left		
Degree of Curvature(Chord):	0°11′28″		
Length:	103.42		
Length(Chorded):	103.42		
Tangent:	51.71		
Chord:	103.42		
Middle Ordinate:	0.04		
External:	0.04		
Tangent Direction:	283°55′20″		
Radial Direction:	13°55′20″		
Chord Direction:	283°49′25″		
Radial Direction:	13°43′29″		
Tangent Direction:	283°43′29″		
Element: Linear			
PT (12)	1742+93.96	149428.78	1812191.21
POE (4)	1746+12.98	149504.47	1811881.30
Tangent Direction:	283°43′29″		
Tangent Length:	319.02		

NOT FOR CONSTRUCTION

SCALE: 1"=100'   50 0 100 200 300

REV	BY	DATE	DESCRIPTION
P2	DJL	10/14/05	PRELIMINARY ENGINEERING PHASE REPORT
P1	MJL	8/5/05	PRELIMINARY ENGINEERING PHASE REPORT

Hatch Mott MacDonald

NORFOLK SOUTHERN

OWNING COMPANY

POCAHONTAS

OPERATING DIVISION

OFFICE OF THE CHIEF ENGINEER - DESIGN AND CONSTRUCTION - ATLANTA, GA.

LOCATION: BIG FOUR NO. 2 TUNNEL, HUGER, WV

TITLE: PLAN AND PROFILE

DGN	PID No.	VRN 16278	MILE POST N-395.07
DWN	FILE No.		DRAWING NUMBER
CHK	DATE APRIL 8, 2005		

FILE NAME = P:\NSR\29339\CAD\survey info\395.07 Big Four 2\395.07 big four 2.dgn
DATE/TIME = 10/12/2005 02:32:56 PM

SCHEDULE OF PROPERTY

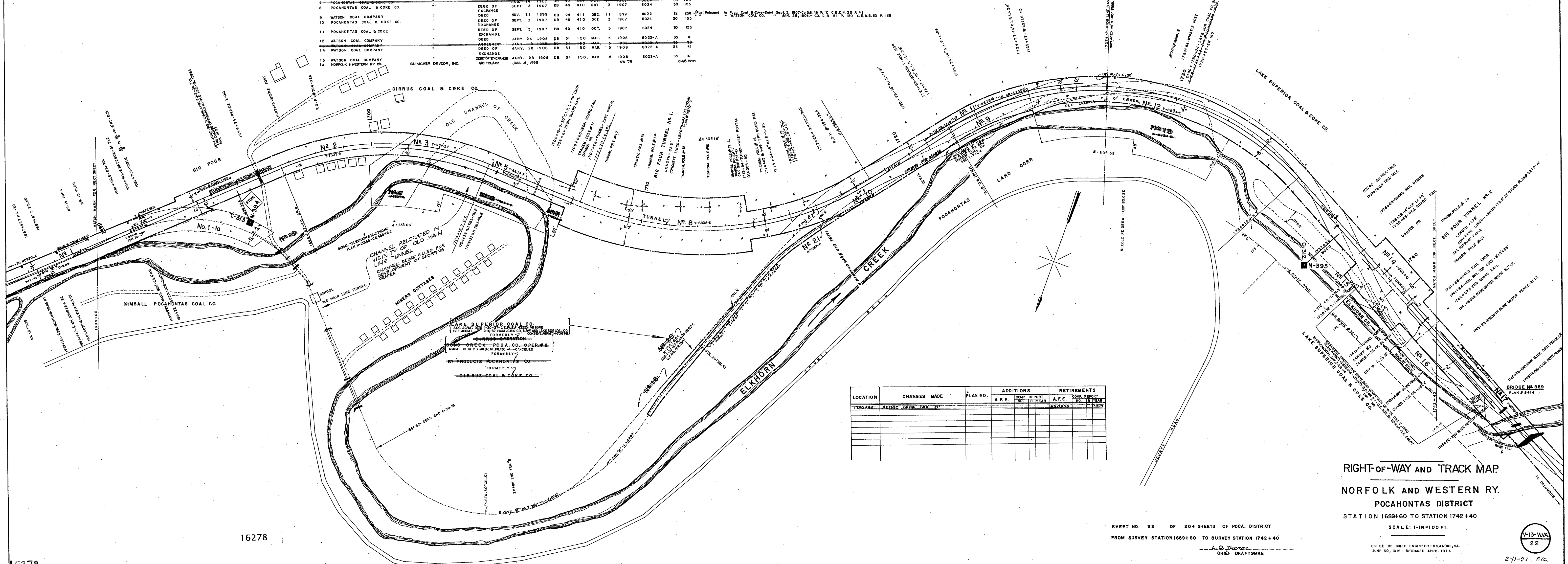
NO.	GRANTOR	GRANTEE	INSTRUMENT	DATE	RECORD	CUST. NO.	REMARKS
1	ANDREW BELCHER, ET UX.	W. V. & I RR. CO.	DEED	MAY 9 1890	DB 14 116 SEPT. 26 1890	8019	C.E.DB.6 P. 354
2	ANDREW BELCHER, ET UX.	N&W. RY. CO.	"	APR. 28 1908	DB 51 369 APR. 29 1908	8019-A	33 97
2	CIRRUS COAL & COKE CO. LESSEE	"	"	FEBY. 25 1910	DB 56 394 MAR. 7 1910	8019-A	37 161
3	E. W. CLARK, L. N. COLTON JR. AND H. M. BELL, TRUSTEES	W. V. & I. R.R. CO.	"	DEC. 20 1889	DB 14 113 SEPT. 25 1890	8021	6 357
3	POCAHONTAS COAL & COKE CO.	N&W. RY. CO.	DEED OF EXCHANGE	SEPT. 3 1907	DB 49 410 OCT. 3 1909	8024	30 155
~~4~~	~~POCAHONTAS COAL & COKE CO.~~	~~"~~	~~AGREEMENT~~	~~AUG. 14 1907~~	~~DB 49 354 OCT. 11 1907~~	~~8024~~	~~30 180~~
5	WATSON COAL COMPANY	"	DEED OF EXCHANGE	JANY. 28 1908	DB 51 150 MAR. 5 1908	8022-A	35 41
~~6~~	~~WATSON COAL COMPANY~~	~~"~~	~~AGREEMENT~~	~~JANY. 8 1908~~	~~DB 51 163 MAR. 5 1908~~	~~8022-A~~	~~35 90~~
~~7~~	~~POCAHONTAS COAL & COKE CO.~~	~~"~~	~~"~~	~~AUG. 14 1907~~	~~DB 49 354 OCT. 11 1907~~	~~8024~~	~~30 180~~
8	POCAHONTAS COAL & COKE CO.	"	DEED OF EXCHANGE	SEPT. 3 1907	DB 49 410 OCT. 3 1907	8024	30 155
9	WATSON COAL COMPANY	"	DEED	NOV. 21 1899	DB 24 411 DEC. 11 1899	8022	12 256 {Part Released to Poca Coal & Coke-Deed Sept. 3, 1907-Co.D.B.49 P.10 C.E.D.B.35 P.41 / " " " WATSON COAL CO. " JAN. 28, 1908- CO. D.B. 51 P. 150 C.E.D.B.30 P.155
10	POCAHONTAS COAL & COKE CO.	"	DEED OF EXCHANGE	SEPT. 3 1907	DB 49 410 OCT. 3 1907	8024	30 155
11	POCAHONTAS COAL & COKE	"	DEED OF EXCHANGE	SEPT. 3 1907	DB 49 410 OCT. 3 1907	8024	30 155
12	WATSON COAL COMPANY	"	DEED	JANY. 28 1908	DB 51 150 MAR. 5 1908	8022-A	35 41
~~13~~	~~WATSON COAL COMPANY~~	~~"~~	~~AGREEMENT~~	~~JANY. 8 1908~~	~~DB 51 163 MAR. 5 1908~~	~~8022-A~~	~~35 90~~
14	WATSON COAL COMPANY	"	DEED OF EXCHANGE	JANY. 28 1908	DB 51 150 MAR. 5 1908	8022-A	35 41
15	WATSON COAL COMPANY	"	DEED OF EXCHANGE	JANY. 28 1908	DB 51 150, MAR. 5 1908	8022-A	35 41
1a	NORFOLK & WESTERN RY. CO.	GLIMCHER DEVCOR, INC.	QUITCLAIM	JAN. 4, 1993		NW-79	0.48 Acre

SCHEDULE OF PROPERTY

NO.	GRANTOR	GRANTEE	INSTRUMENT	DATE	RECORD	CUST. NO.	REMARKS
16	E. W. CLARK, L. N. COLTON, JR. AND H. M. BELL, TRUSTEES	W. V. & I R.R. CO.	DEED	DEC. 20 1889	DB 14 128 OCT. 1 1890	8023	C.E.D.B. 6. P. 357
17	POCAHONTAS COAL & COKE CO.	N&W. RY. CO.	DEED OF EXCHANGE	SEPT. 3 1907	DB 49 410 OCT. 3 1907	8024	30 155
~~18~~	~~CIRRUS COAL & COKE CO.~~	~~"~~	~~AGREEMENT~~	~~OCT. 31 1908~~	~~DB~~		~~SEE AGREEMENT BOOK #31 PAGE 312~~
~~19~~	~~KIMBALL POCAHONTAS COAL CO.~~	~~"~~	~~"~~	~~OCT. 14 1914~~			~~SEE AGREEMENT BOOK #43 PAGE 204~~ Tracks Retired From Parc.# 19-V.P. 4306 (1928)
~~20~~	~~POCAHONTAS COAL & COKE CO.~~ & LAKE SUPERIOR COAL COMPANY	~~N.&W. RY. CO.~~	~~AGREEMENT~~	~~JAN. 30 1937~~	— SEE OLD PARC. #18 ABOVE —	PLAN N-7067	C.E.D.B. 81 P. 339 R/W Rewrite See Agr. 1-30-37
21	POCAHONTAS COAL & COKE CO. LAKE SUPERIOR COAL CO. LESSEE	N&W. RY. CO.	SDG. AGR.	JAN. 30, 1937		PLAN N-7067-B	AGR. BK. 92, P. 54

Operation Taken Over By Lake Superior Coal Co. 1-30-37 - Track (B) Shifted To New Location - Lands Now Owned By P.C. & C. CO. - See New R/W Agreement Under Parc. # 20 Below

Agrmt. of 10-31-08 Superseded By Agrmt. 10-14-21 With By Products Poca. Coal Co. — This Agrmt, In Turn, Superseded By Agrmt. 10-19-23 With Pond Creek Poca. Coal Co. — Operation Taken Over By Lake Superior Coal Co. Agrmt. 1-30-1937 - See Ag. Bks. 31, 59 & 61 Pages 312, 46 & 130 Resp. — See Plans N-7067, N-7067-A, N-7067-B & # 10987 - C.E. File # 45581 & 43555 -



LOCATION	CHANGES MADE	PLAN NO.	ADDITIONS				RETIREMENTS			
			A.F.E.	COMP. REPORT NO.	P.	YEAR	A.F.E.	COMP. REPORT NO.	P.	YEAR
1730+33	RETIRE 1404' TRK. "B"						950958			1995

SHEET NO. 22 OF 204 SHEETS OF POCA. DISTRICT

FROM SURVEY STATION 1689+60 TO SURVEY STATION 1742+40

L.O. Turner
CHIEF DRAFTSMAN

RIGHT-OF-WAY AND TRACK MAP

NORFOLK AND WESTERN RY.

POCAHONTAS DISTRICT

STATION 1689+60 TO STATION 1742+40

SCALE: 1-IN=100 FT.

OFFICE OF CHIEF ENGINEER—ROANOKE, VA.
JUNE 30, 1916 - RETRACED APRIL 1974

V-13-W.VA. 22

2-11-97 ETC.

16278