

**FEASIBILITY STUDY
OF WATER SERVICE**

TO

BLUE MOUNDS STATE PARK

FROM

**ROCK COUNTY RURAL
WATER DISTRICT**

JULY 2016

DGR Project No. 801402

FEASIBILITY STUDY
OF
WATER SERVICE TO BLUE MOUNDS STATE PARK
FROM
ROCK COUNTY RURAL WATER DISTRICT

July 2016

	<p>I hereby certify that this plan, specification, or report was prepared by me or under my direct supervision and that I am a duly Licensed Professional Engineer under the laws of the State of Minnesota.</p> <p>By <u><i>Darin Schriever</i></u> <u>July 20, 2016</u> Darin L. Schriever, P.E. (date)</p> <p>License Number <u>42149</u></p> <p>My License renewal date is June 30, 2018.</p> <p>Pages or sheets covered by this seal: <u>All bound pages except Appendix.</u></p> <hr/>
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DGR Project No. 801402

DGR Engineering

Rock Rapids, IA • Sioux Falls, SD • Sioux City, IA • Ankeny, IA
(712) 472-2531 (605) 339-4157 (712) 266-1554 (515) 963-3488

FEASIBILITY STUDY
OF
WATER SERVICE TO BLUE MOUNDS STATE PARK
FROM ROCK COUNTY RURAL WATER DISTRICT

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FEASIBILITY STUDY

OF

**WATER SERVICE TO BLUE MOUNDS STATE PARK
FROM ROCK COUNTY RURAL WATER DISTRICT**

The State of Minnesota (via the Department of Natural Resources, or DNR) in conjunction with Rock County Minnesota has requested a determination on the feasibility of providing water service from the Rock County Rural Water District (RCRWD) to the Blue Mounds State Park (Park) water system. The DNR has requested a water service capable of 25 gpm, delivered generally to the maintenance shop (Shop) area.

Shallow bedrock (Sioux quartzite) is known to be a hindrance to pipeline construction in the project area. In an attempt to quantify the amount of rock interference, manual probing was performed with a pressure washer machine and a 6- to 7-ft wand. The wand was inserted into the ground until reaching a depth of 6- to 7-ft or until it was unable to advance due to rock. The location of each probing effort was documented with GPS and a record of the insertion depth. Probing was performed at an interval of about 200- to 400-ft apart where rock was generally not encountered or not expected to be a problem. Where rock was encountered or was expected to be an issue, the probing interval was reduced to approximately 50 ft.

The 25 gpm water service requested generally requires a 3-inch pipeline extension from RCRWD. A hydraulics memo dated April 4, 2016 (included in Appendix A) provides a summary of water service alternatives for the Park. It is recommended that the Park be served from the west.

Three potential pipeline routes were considered: Route 1, Route 1A, and Route 2. The general routes are shown on Drawing 1. More detailed route information and probing information is included in Appendix B.

The recommended bury depth for small diameter pipeline in the project area is 5.5- to 6-ft. Where probing indicated a clear depth of 6 ft, no insulation or rock excavation was assumed to be needed. Where rock interferes at 5.5 ft or less, it is recommended that 4-inch thickness of rigid insulation be installed above the pipe to a width of 4 ft. When the excavation results in the trench bottom being rock, it is recommended to install 6-inches of granular bedding below the pipe and the bedding should extend to 6-inches above the pipe. The rigid insulation should be installed on top of the pipe bedding (6-inches above the pipe). A 6-inch layer of granular material should then be placed on top of the insulation.

The minimum recommended trench depth is 4-ft. Where rock interferes at less than 4-ft depth, rock excavation is recommended to a depth of 4-ft. Rock excavation could consist of pneumatic hammers, rock buckets on excavators, blasting, etc. Table 1 provides an estimate of required pipe insulation and rock excavation.

Route 1 connects to existing 6" pipe one mile west of Highway 75 and would construct about 3 miles of new 3" pipeline to reach the Shop. From station 120+00 to station 140+00 (about 2000 ft), probing was not performed. Easement on that segment of land was obtained (land owner J.D. Bowron), but during the field work the pasture was full of bison cows and calves. Field personnel did not wish to upset them and did not want to have the landowner corral them for a day or two. For feasibility study purposes, assumptions were made concerning rock in this area. If construction were to proceed, it is assumed that an easement could be obtained. For Route 1, as shown in Table 1, it is estimated that about 3600 ft will need to be insulated and about 1750 ft will need rock excavation. Route 1 is considered the most feasible pipeline route.

Route 1A utilizes the same route as in Route 1 for the first mile west of Highway 75, but then follows Highway 75 and Highway 20 on the way to the Shop. For Route 1A, as shown in Table 1, it is estimated that about 6200 ft will need to be insulated and about 4000 ft will need rock excavation.

Route 2 (from the east) was briefly considered. Approximately 3.5 miles of 6" pipe would be needed within the existing system (parallel pipe). Approximately 4.5 miles of 3" pipe would also be needed. A brief review indicates rock interference at least as much as Route 1. A very rough cost estimate would be \$1,050,000 assuming rock interference about equal to Route 1. Delivery pressure is estimated at only 30 psi due to system hydraulics, specifically the relative elevations of the Magnolia Tower and the elevation at the Shop. Adding a booster station to improve pressure would increase the project cost to about \$1,300,000. Because the cost is much higher than Route 1, Route 2 was not considered further. Drawings are including in this report to document the rock probing efforts done in the field.

Budget cost estimates for Route 1 and Route 1A are provided in Table 2. Standard pipeline items are included along with special construction items for pipe insulation, bedding and rock excavation. Considering the variable nature of the rock interference, it is recommended to use a construction contingency budget of at least 15% in addition and an overall project contingency of 10%. This provides \$120,000 to \$150,000 to project contingency funds to use if needed. The total estimated project cost for Route 1 is \$643,000 and for Route 1A is \$827,000.

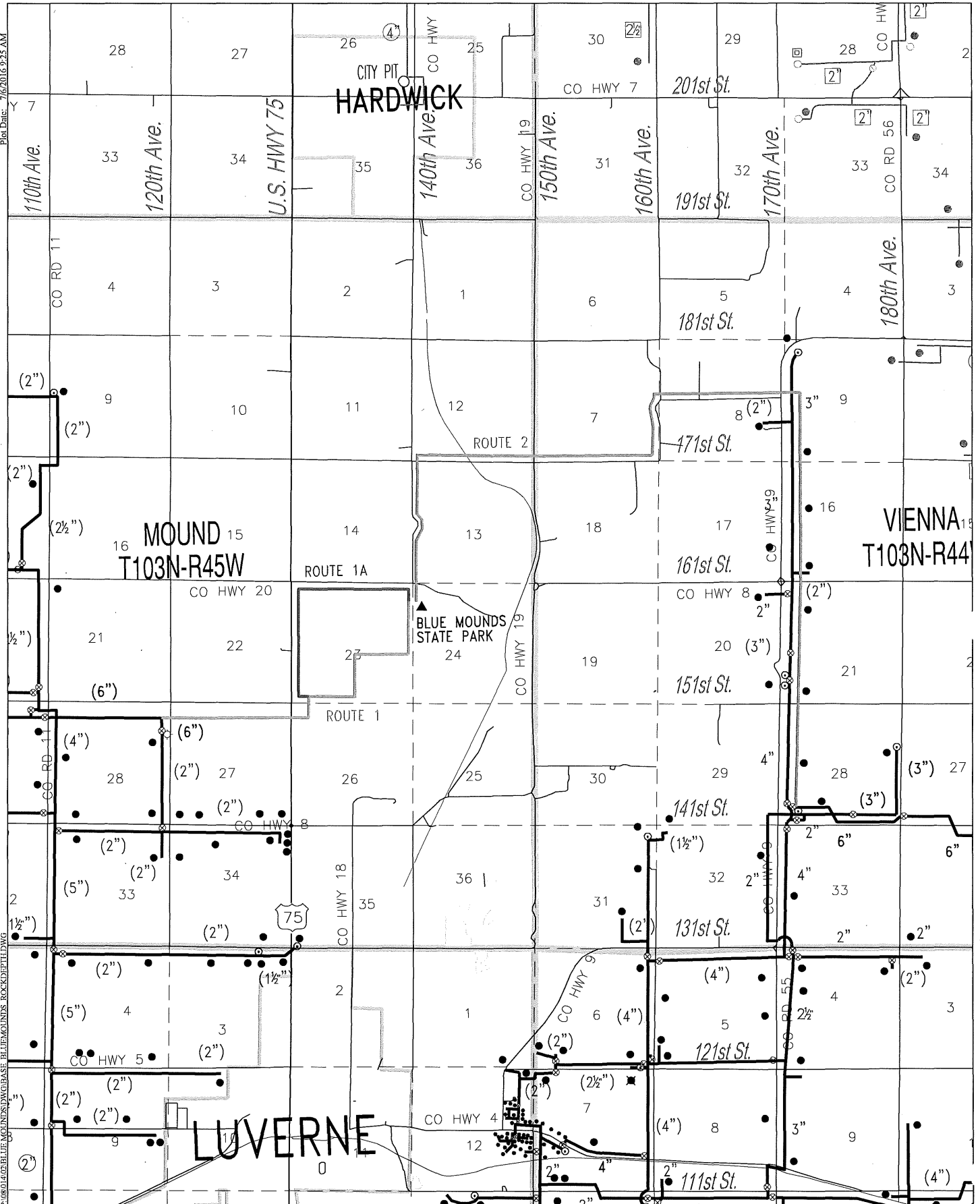
The overall project schedule depends on several items with variable time requirements. Included in these are prelim project review and approval, securing project funds, engineering design, permitting, bidding, and construction. The estimated timetable for construction is as follows:

- Route 1 – 50-60 construction days, or 10-12 weeks.
- Route 1A – 65-75 construction days, or 13-15 weeks.

* * * End of Report * * *

DRAWINGS

Plot Date: 7/6/2016 9:25 AM
P:\091402\BLUE MOUNDS\DWG\BASE\BLUE MOUNDS ROCK DETAIL.DWG



REV	DATE	DESCRIPTION



Project Manager: DLS
 Designer: JMG
 Project Number: 801402
 Phone: (712) 472-2531

ROCK COUNTY
 RURAL WATER DISTRICT
 LUVERNE, MINNESOTA

PIPELINE ROUTES
 SERVICE TO BLUE MOUNDS
 STATE PARK

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TABLES

TABLE 1
Rock & Insulation Calculations
Potential Water Service from RCRWD
Blue Mound State Park

Route 1

Sheet	Station	Depth to Rock, ft Length, ft		Action				
				Insulate length, ft	Excavate Rock			
					length, ft	width, ft	thickness, ft	volume, CY
1		Clear						
2	35+50	5.5	50	50				
	37+75	5	50	50				
	39+00 to 40+50	4-5	200	200				
	41+50	5	50	50				
	44+00	5	75	75				
	47+00	5	50	50				
	48+00	4.5	50	50				
3	59+50	4	75	75				
	74+00	5	50	50				
4	77+50	5	50	50				
	81+50	5	50	50				
	82+00 to 85+00	0-3	350	350	350	4	3	156
	95+00	5	50	50				
	99+00	4	100	100				
5	120+00 to 130+00	Assumed clear						
6	130+00 to 135+00 (a)	5	500	500				
	135+00 to 137+00 (a)	4	200	200				
	137+00 to 139+00 (a)	2	200	200	200	4	2	60
	139+00 to 140+00 (a)	1	100	100	100	4	3	45
	140+00 to 147+00	0	700	700	700	4	4	415
	147+00 to 148+00 (a)	3	100	100	100	4	1	15
	150+50	5	50	50				
7	155+50 to 158+50	2-4	300	300	300	4	1.5	67
	159+00 to 161+00	5	200	200				
		Route 1 - TOTAL:		3600	1750			758
	(a) = assumed							

TABLE 1 (cont.)
Rock & Insulation Calculations
Potential Water Service from RCRWD
Blue Mound State Park

Route 1A

Sheet	Station	Depth to Rock, ft	Length, ft	Action				
				Insulate length, ft	Excavate Rock			
					length, ft	width, ft	thickness, ft	volume, CY
1		Clear						
2	35+50	5.5	50	50				
	37+75	5	50	50				
	39+00 to 40+50	4-5	200	200				
	41+50	5	50	50				
	44+00	5	75	75				
	47+00	5	50	50				
	48+00	4.5	50	50				
3	59+50	4	75	75				
4	80+00	2	100	100	100	4	2	30
	94+50	5	100	100				
	100+00	5	100	100				
5	107+00	5.5	100	100				
	110+00	2.5	300	300	300	4	1.5	67
	114+00	4	100	100				
	118+50	4	100	100				
	123+00	3	100	100	100	4	1	15
	127+50	3	150	150	150	4	1	23
	129+50	4	200	200				
	131+50	0	100	100	100	4	4	60
	134+50	5	200	100				
6	137+50	4.5	300	300				
	141+50	3	350	350	350	4	1	52
	144+50	2.5	250	250	250	4	1.5	56
	146+50	3	250	250	250	4	1	38
	155+25	0.5	150	150	150	4	3.5	78
	155+50	0	100	100	100	4	4	60
	157+50	2	200	200	200	4	2	60
	159+75	3	300	300	300	4	1	45
7	162+50	2.5	300	300	300	4	1.5	67
	166+25	5	500	500				
	172+25	2	500	500	500	4	2	149
	176+25	2	500	500	500	4	2	149
	181+00 (a)	3	350	350	350	4	1	52
Route 1A - TOTAL:				6200	4000			1001
	(a) = assumed							

TABLE 2
Budget Cost Estimate
Potential Water Service from RCRWD
Blue Mound State Park

Item No.	Description	Estimated Unit Price	Route 1		Route 1A		
			Total Quantities	Total Amount	Total Quantities	Total Amount	
<u>Pipeline Construction Cost</u>							
1	3" Class 200 SDR 21 PVC pipe, per lf	\$ 5.35	15,500	\$ 82,925	18,300	\$ 97,905	
2	3" Class 200 SDR 21 restrained joint, per lf	\$ 16.00	600	\$ 9,600	-	\$ -	
3	2" Service Line, per lf	\$ 6.60	100	\$ 660	100	\$ 660	
4	Service, per ea.	\$ 2,750.00	1	\$ 2,750	1	\$ 2,750	
5	Valves, per ea.	\$ 1,200.00	3	\$ 3,600	3	\$ 3,600	
6	T/1 Road Crossings, per ea.	\$ 9,000.00	1	\$ 9,000	1	\$ 9,000	
7	T/2 Road Crossings, per ea.	\$ 2,400.00	2	\$ 4,800	2	\$ 4,800	
8	Stream Crossings, per ea.	\$ 8,750.00	-	\$ -	-	\$ -	
9	Ties, per ea.	\$ 750.00	1	\$ 750	1	\$ 750	
10	Cleanouts, per ea.	\$ 1,550.00	1	\$ 1,550	1	\$ 1,550	
11	Ditch Work, per lf	\$ 2.00	1,600	\$ 3,200	1,800	\$ 3,600	
12	Tracer Wire, per lf	\$ 0.25	16,100	\$ 4,025	18,300	\$ 4,575	
13	Rock Excavation, per CY	\$ 250.00	758	\$ 189,500	1,001	\$ 250,250	
14	Pipe Bedding, per lf	\$ 9.00	3,600	\$ 32,400	6,200	\$ 55,800	
15	Pipe Insulation - 4", per lf	\$ 10.00	3,600	\$ 36,000	6,200	\$ 62,000	
16	Drain Tile Repair, per ea.	\$ 300.00	8	\$ 2,400	6	\$ 1,800	
17	Seeding, per SY	\$ 0.40	20,000	\$ 8,000	13,333	\$ 5,333	
18	Erosion Control, per lf	\$ 3.50	600	\$ 2,100	600	\$ 2,100	
19	Construction Contingency, % of construction		15%	\$ 58,989	15%	\$ 75,971	
20	Mobilization, % of construction		5%	\$ 22,612	5%	\$ 29,122	
Total Estimated Pipeline Construction Cost				\$ 475,000		\$ 612,000	
<u>Other Project Costs</u>							
Engineering, Project Observation, Legal, Fiscal, etc., % of construction			20%	\$ 95,000	20%	\$ 122,400	
Crop Damages, per acre			\$ 900.00	16.0	\$ 14,400	18.9	\$ 17,010
Overall Project Contingencies			10%	\$ 58,440	10%	\$ 75,141	
Total Other Project Costs				\$ 168,000		\$ 215,000	
Total Estimated Project Cost				\$ 643,000		\$ 827,000	

Appendix A – Hydraulics Memo

Memo



TO: Travis Meyers
FROM: Paul Messner
DATE: 4/4/2016
RE: 103-45-24 Blue Mounds

Model used: 15bm01.p2k

I reviewed the two different routes to serve Blue Mounds State Park.

Sheet 1 shows the pressures and flows of Option #1.

Sheet 2 shows the pressures and flows of Option #2.

Sheet 3 shows the pressures and flows of Option#2 with an additional 3.5 miles of parallel 6" to eliminate head loss.

Sheet 4 shows the HGL and flows of the previous sheet.

Hydraulically, the Magnolia Tower has limited ability to provide service to Blue Mounds State Park due to the elevation of the park. We recommend serving Blue Mounds from the west (Option #1).

See the following sheets for details.

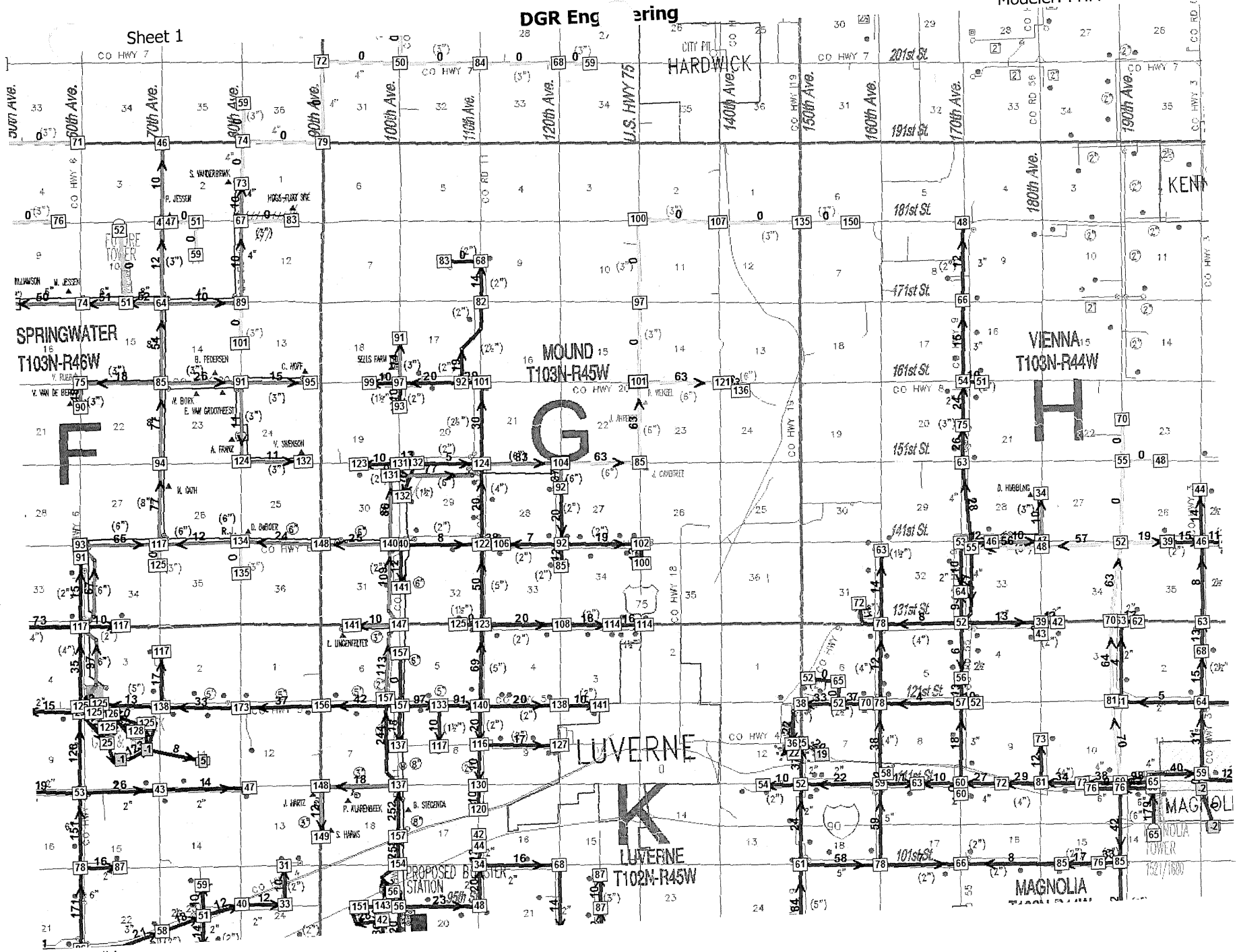
Please contact us with any questions.

Sincerely,

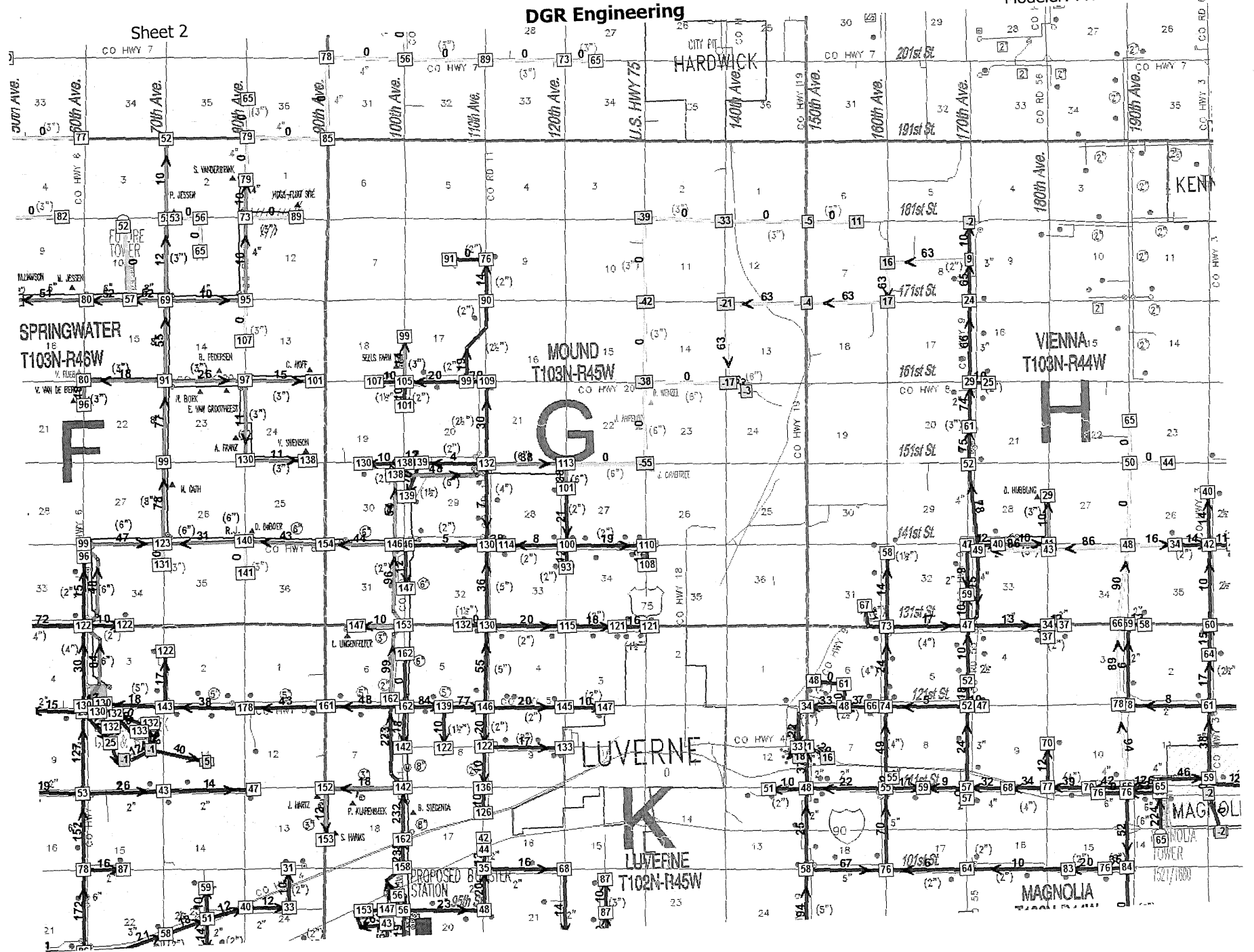
DGR ENGINEERING

Paul Messner

Paul Messner
Enclosure

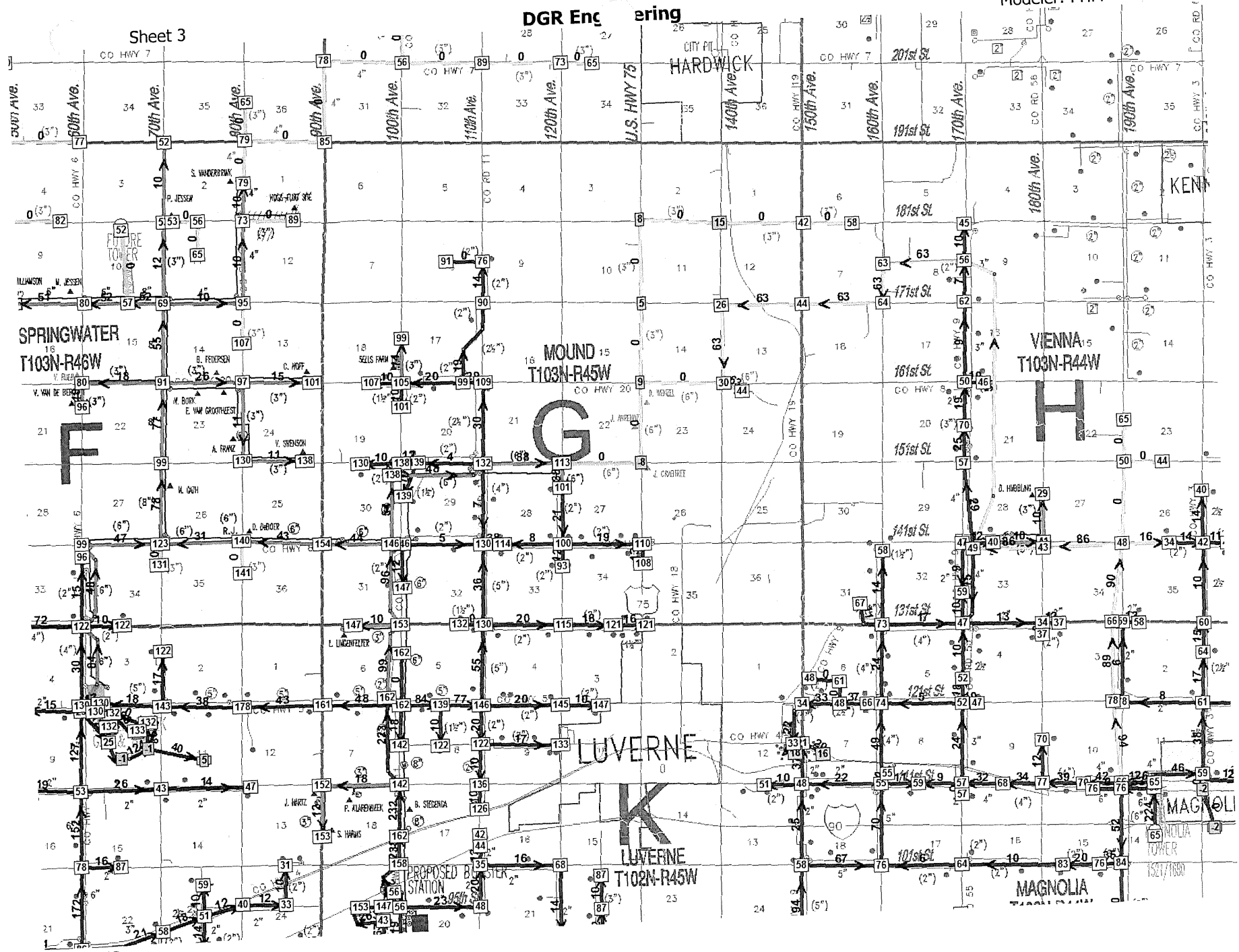


Option #1
 Blue Mounds (70 connections) served from the west

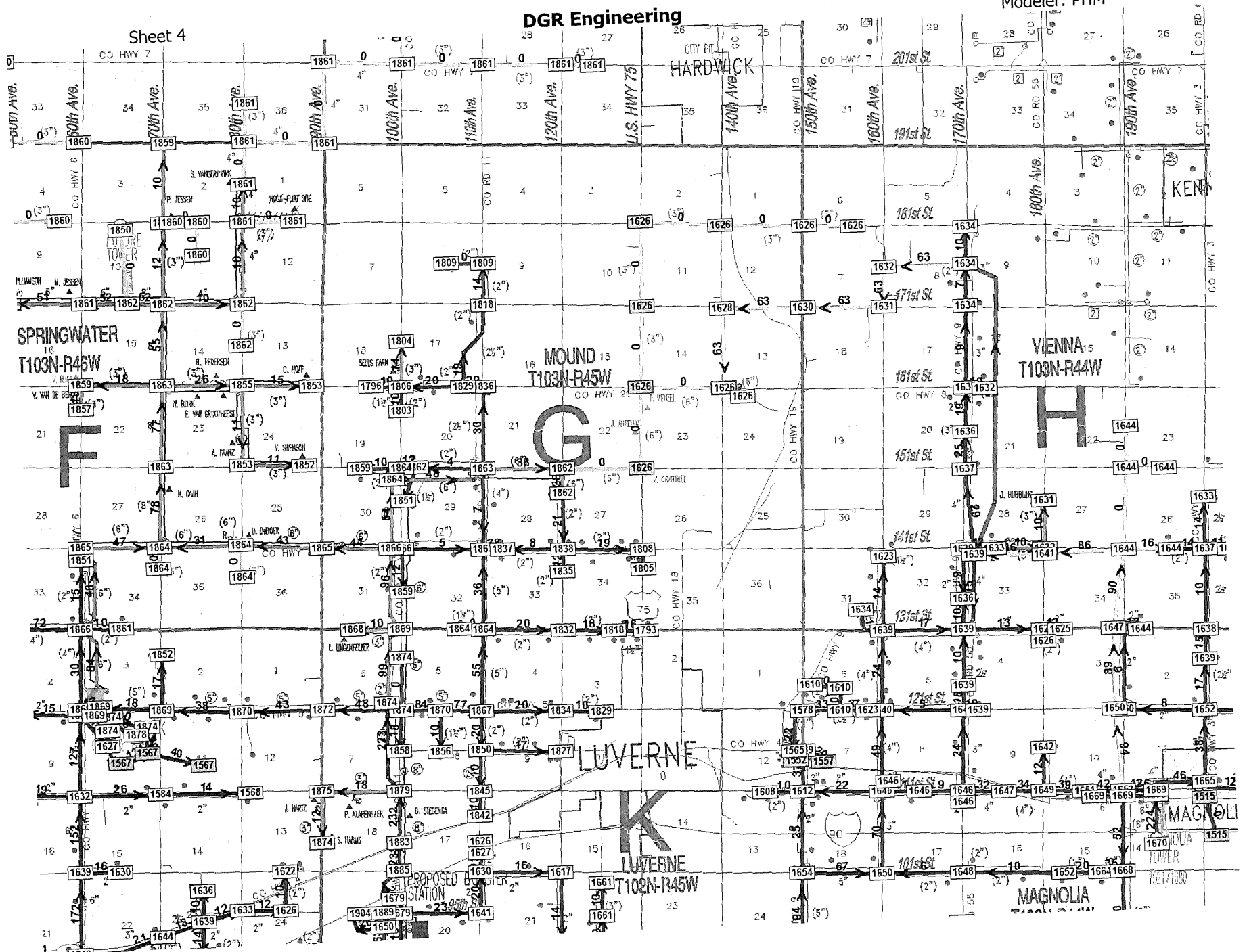


Option #2
 Blue Mounds (70 connections) served from the east

DGR Encircling



Option #2
 Blue Mounds (70 connections) served from the **east**
 3.5 miles of parallel added



Option #2 - HGL
 Blue Mounds (70 connections) served from the east
 3.5 miles of parallel added

Appendix B – Route Information

Route 1

Sheet R1-LP (Location Plan)

Sheets R1-1 through R1-7

Route 1A

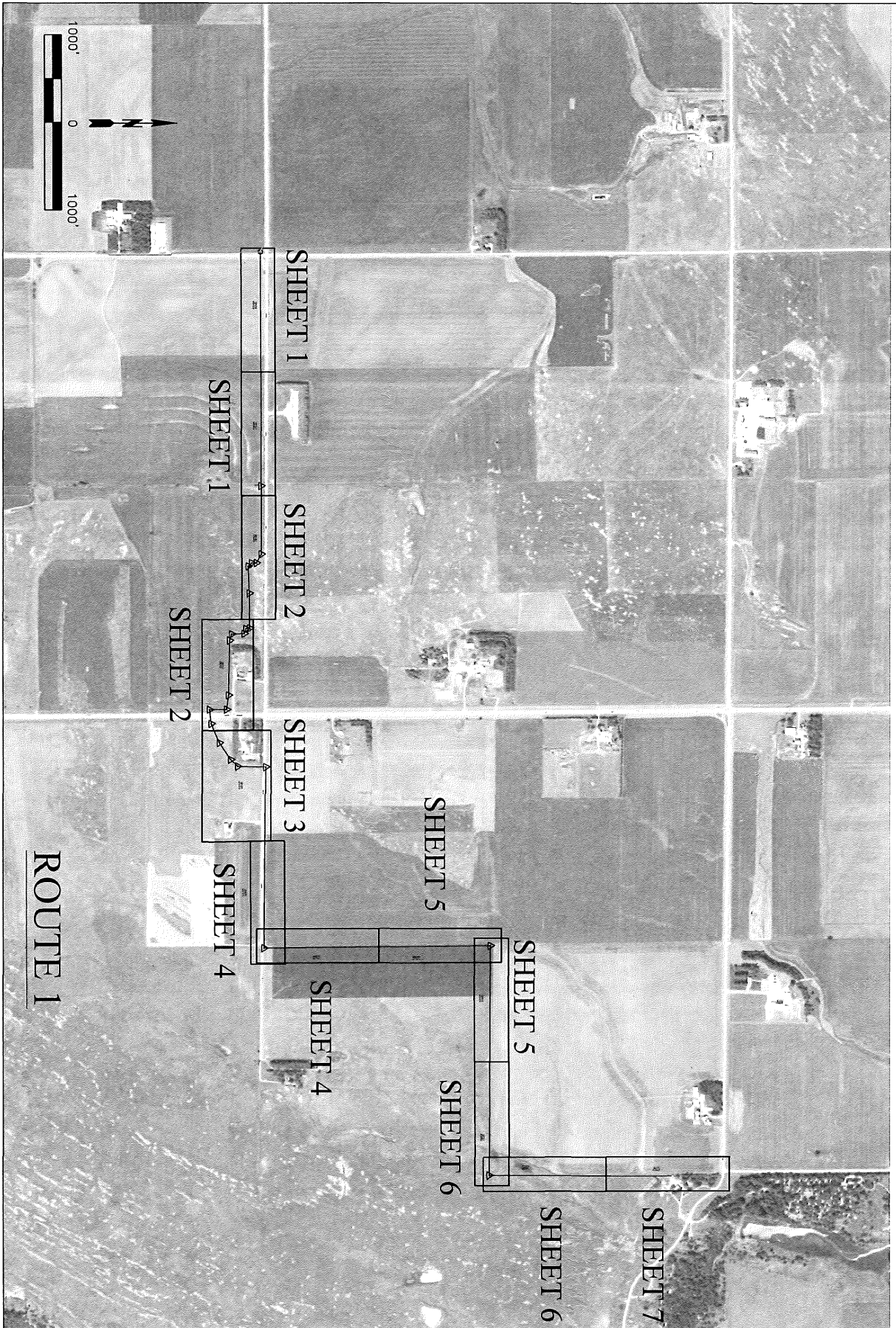
Sheet R1A-LP (Location Plan)

Sheets R1A-1 through R1A-7

Route 2

Sheet R2-LP (Location Plan)

Sheets R2-1 through R2-10

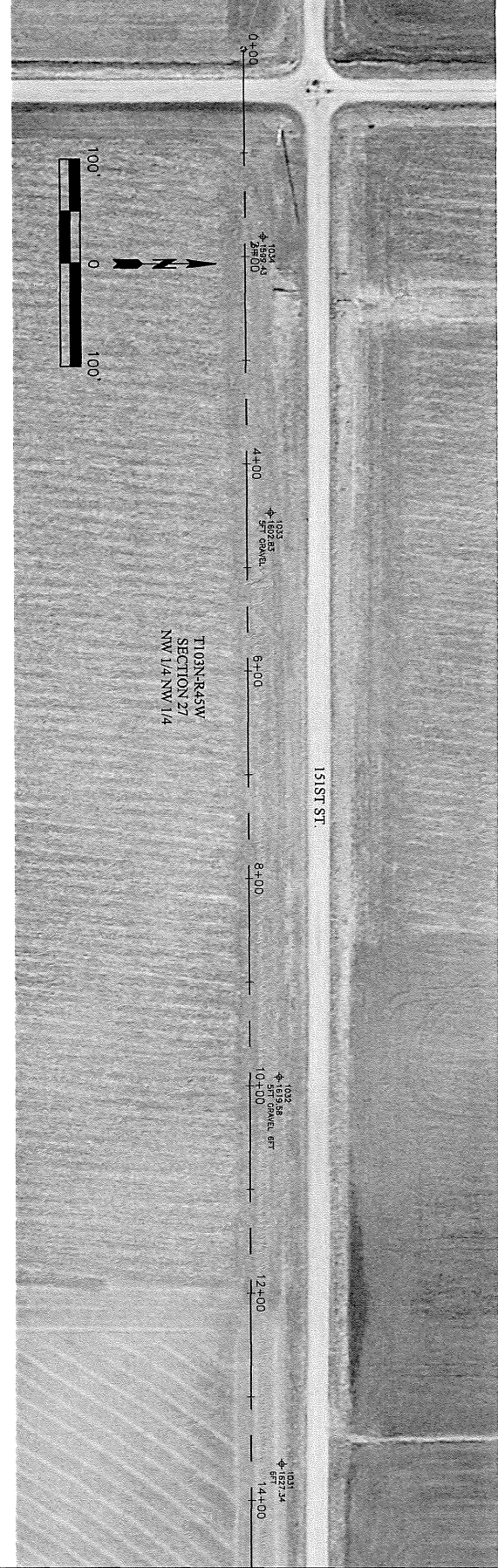
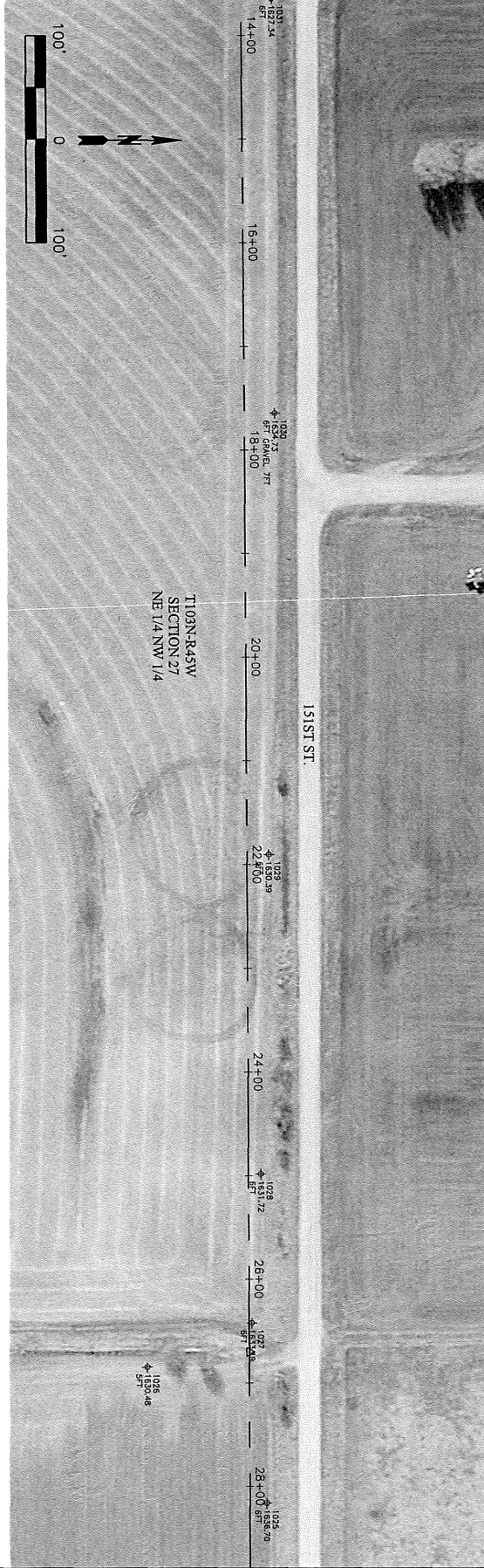


Project Manager: DLS
 Designer: TCM
 Project Number: 801400
 Phone: (712) 472-2531

PROPOSED MAINLINE ROUTE - ROCK DEPTHS	
STATIONING	DEPTH

SERVICE TO BLUE MOUNDS STATE PARK
 ROCK COUNTY RURAL WATER DISTRICT
 LUVERNE, MINNESOTA

Sheet
 R1-L1P



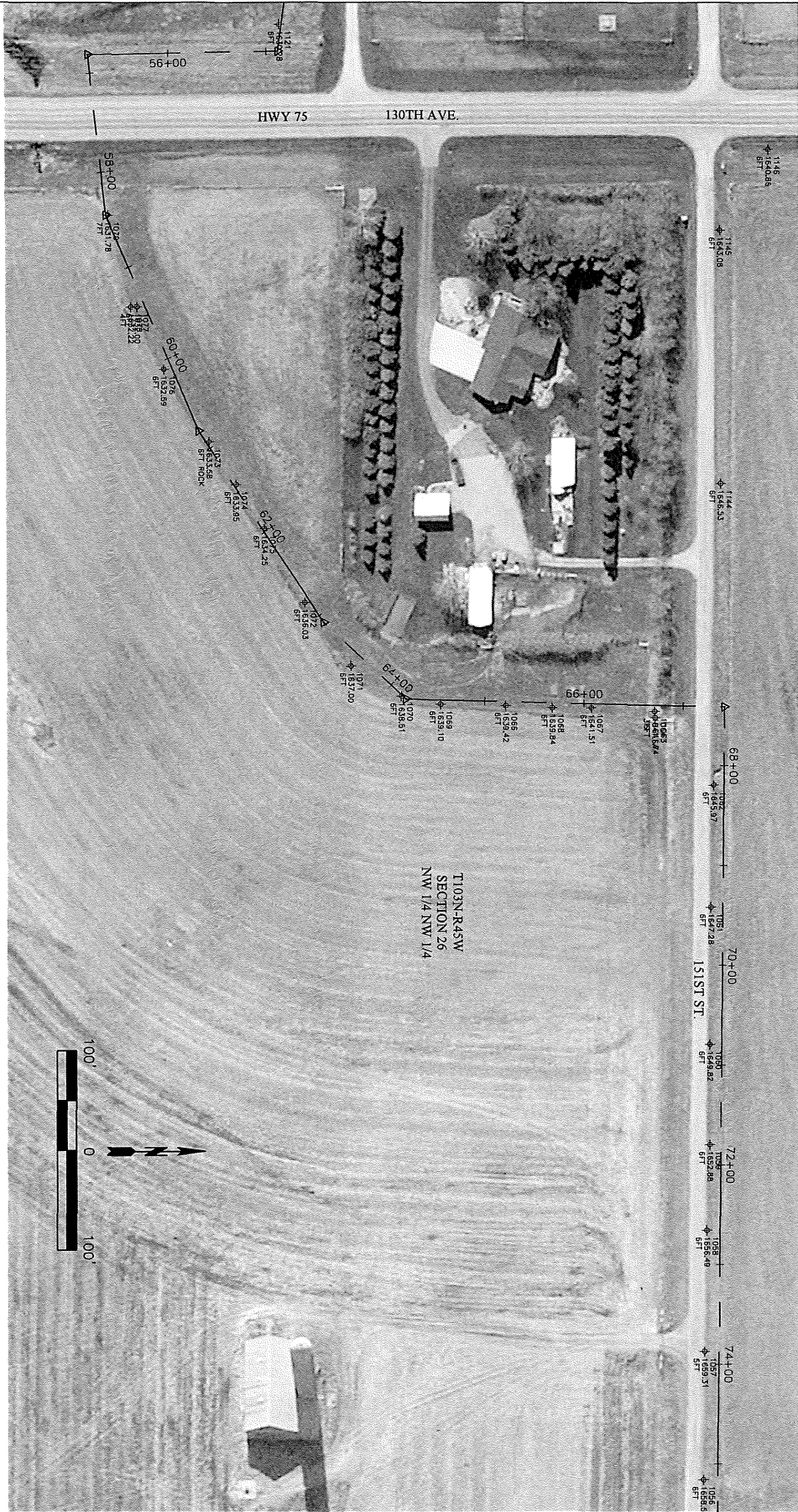
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R1-1

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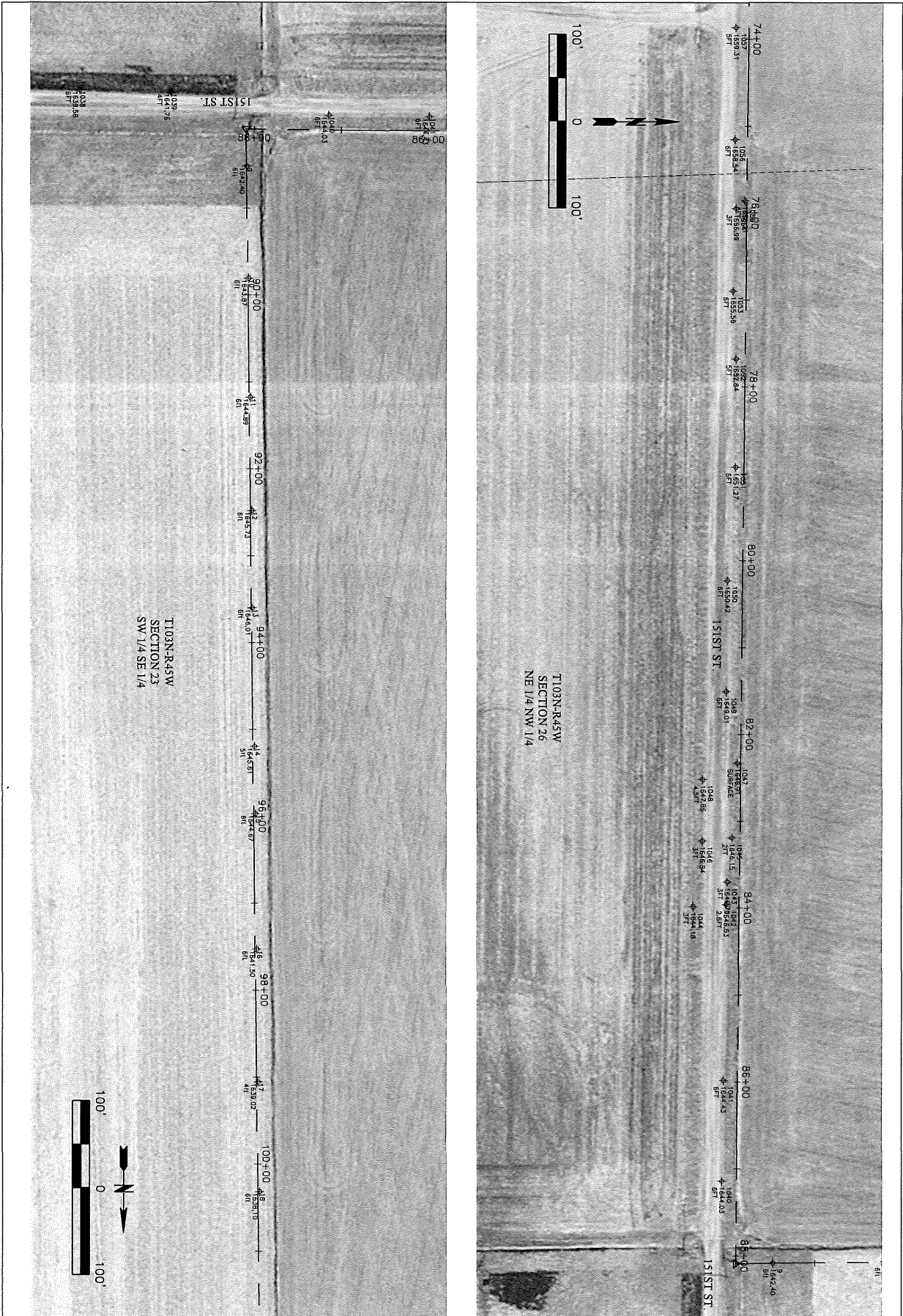
PROPOSED MAINLINE ROUTE - ROCK DEPTHS

STATIONING	ROCK DEPTH
14+00	
18+00	
22+00	
26+00	
28+00	

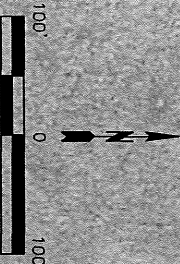
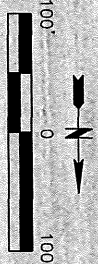
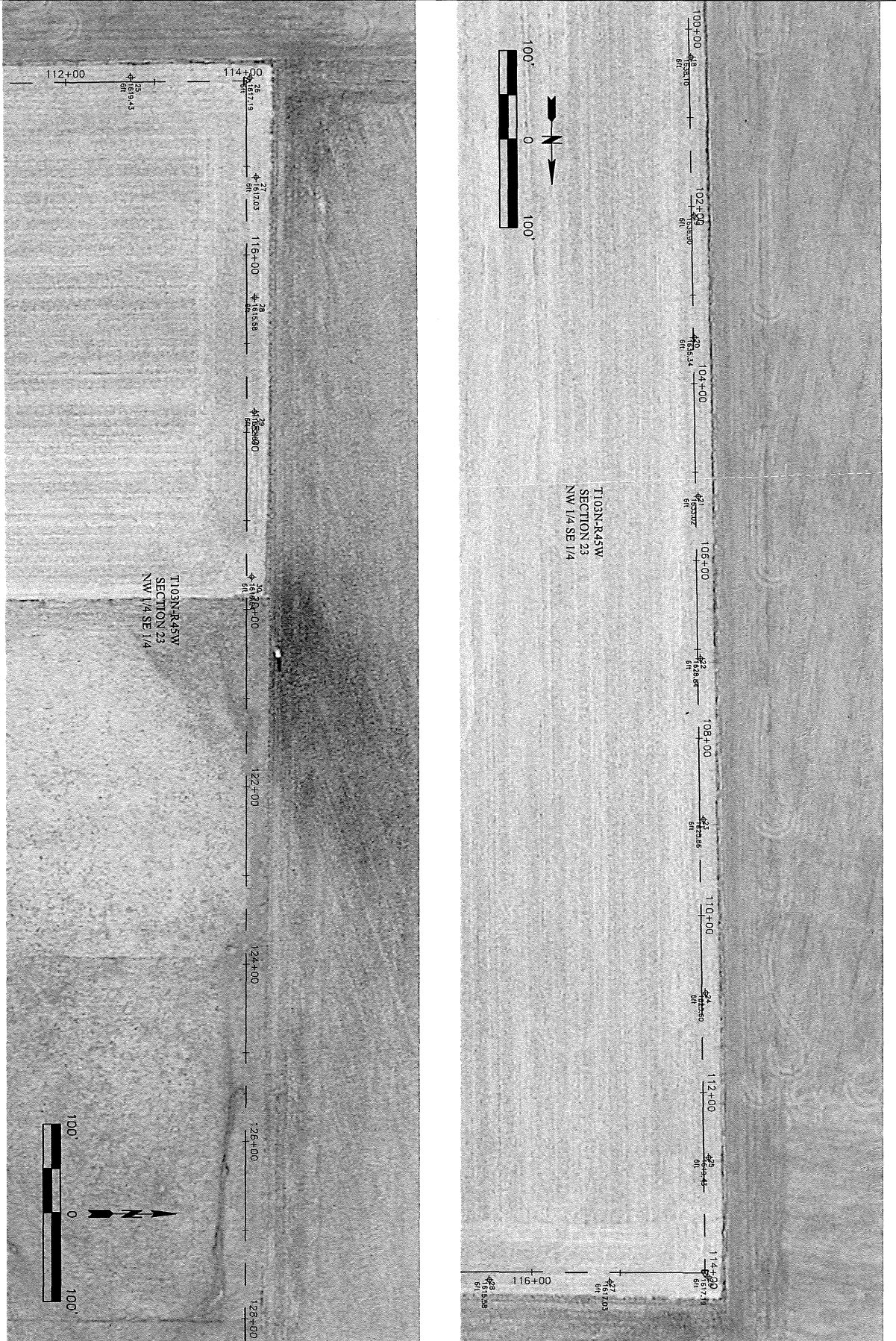
SERVICE TO BLUE MOUNDS STATE PARK
 ROCK COUNTY RURAL WATER DISTRICT
 LUVERNE, MINNESOTA



	Project Manager: DLS Designer: TCM Project Number: 801400 Phone: (712) 472-2531	PROPOSED MAINLINE ROUTE - ROCK DEPTHS	SERVICE TO BLUE MOUNDS STATE PARK ROCK COUNTY RURAL WATER DISTRICT LUVERNE, MINNESOTA
	SHEET R1-3	REVISIONS	



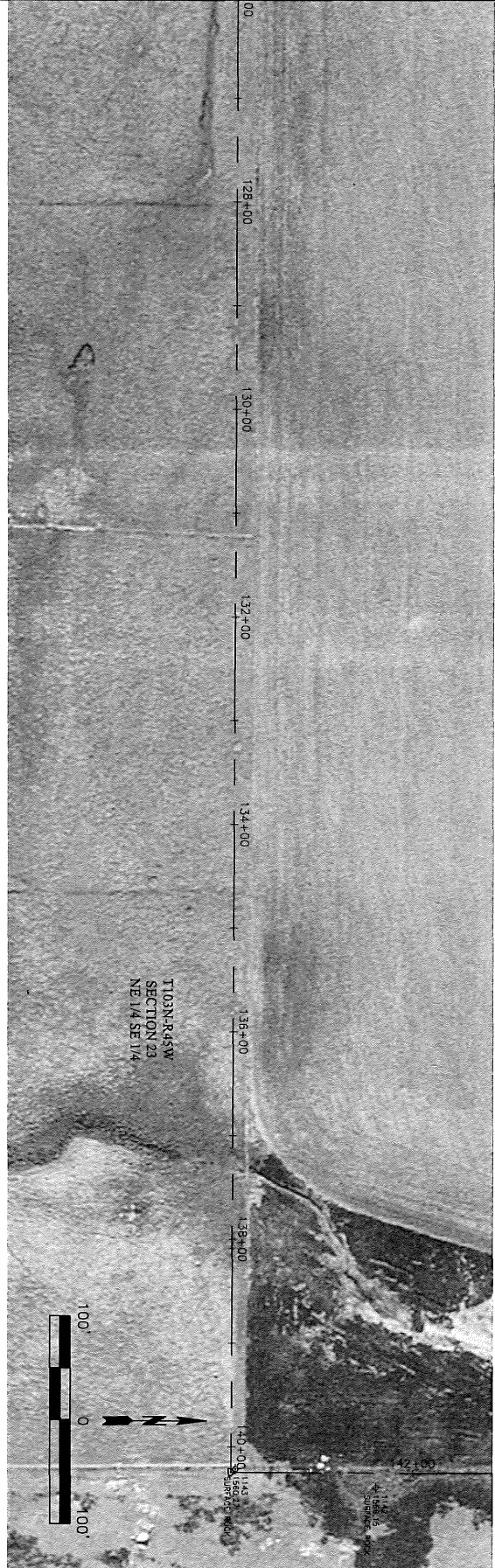
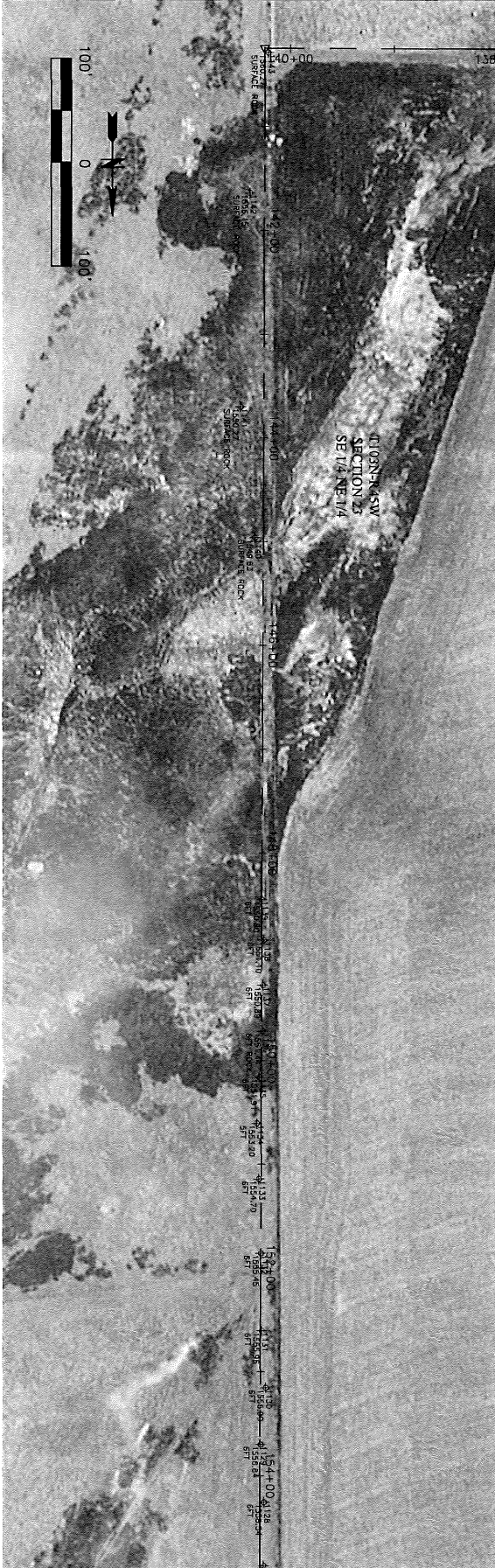
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		REVISIONS	REVISIONS	REVISIONS



T103N-R45W
SECTION 23
NW 1/4 SE 1/4

T103N-R45W
SECTION 23
NW 1/4 SE 1/4

	Project Manager: DLS Designer: TCM Project Number: 801400 Phone: (712) 472-2531	PROPOSED MAINLINE ROUTE - ROCK DEPTHS REVISIONS:	SERVICE TO BLUE MOUNDS STATE PARK ROCK COUNTY RURAL WATER DISTRICT LUVERNE, MINNESOTA
	Sheet R1-5	(Empty table for revisions)	



Sheet
R1-6

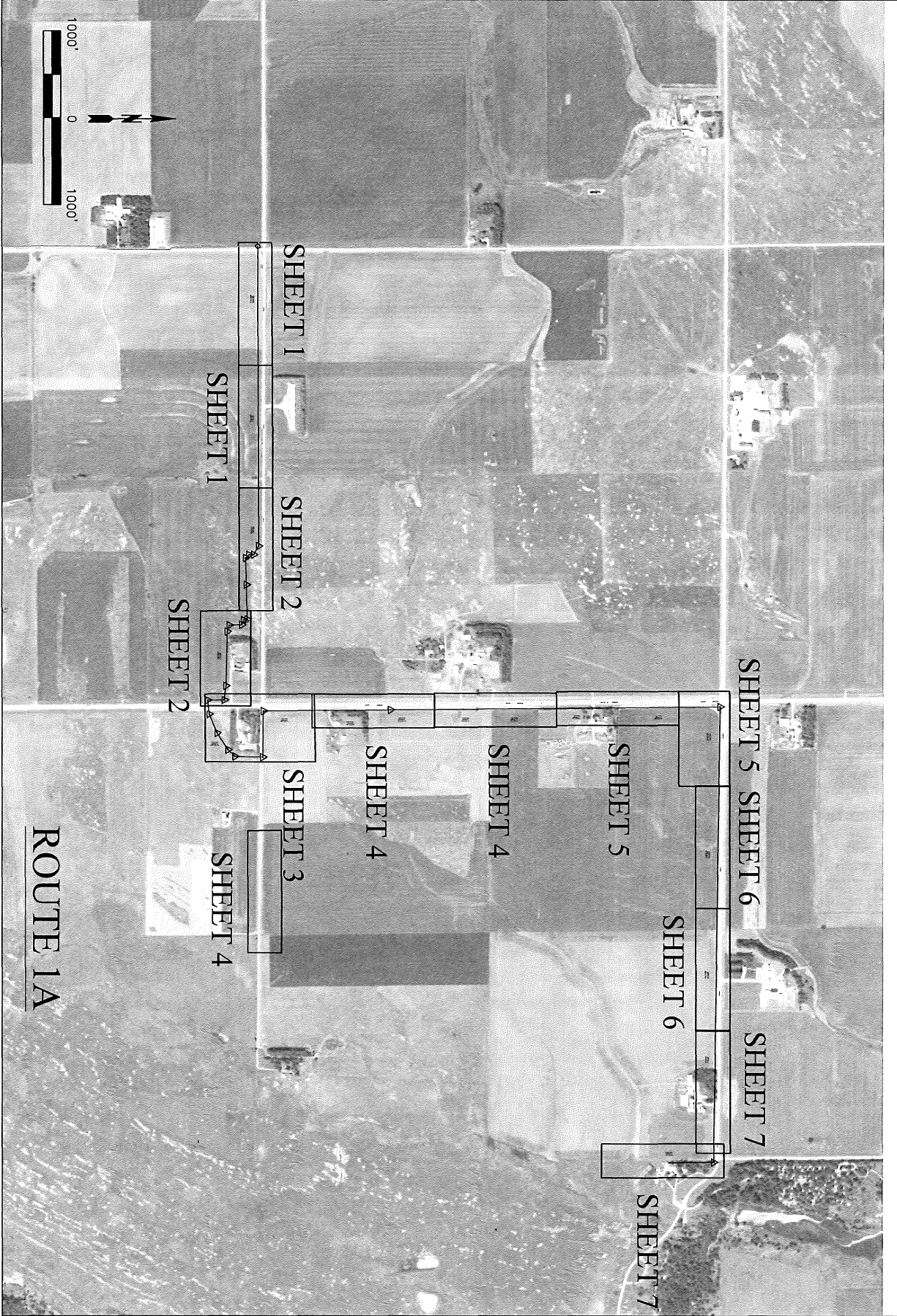


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 Project Number: 801400
 Phone: (712) 472-2531

REFERENCES	

PROPOSED MAINLINE ROUTE - ROCK DEPTHS

SERVICE TO BLUE MOUNDS STATE PARK
 ROCK COUNTY RURAL WATER DISTRICT
 LUVERNE, MINNESOTA



Sheet
R1A-LP

Project Manager: DLS
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PROPOSED MAINLINE ROUTE - ROCK DEPTHS

SECTION	DEPTH

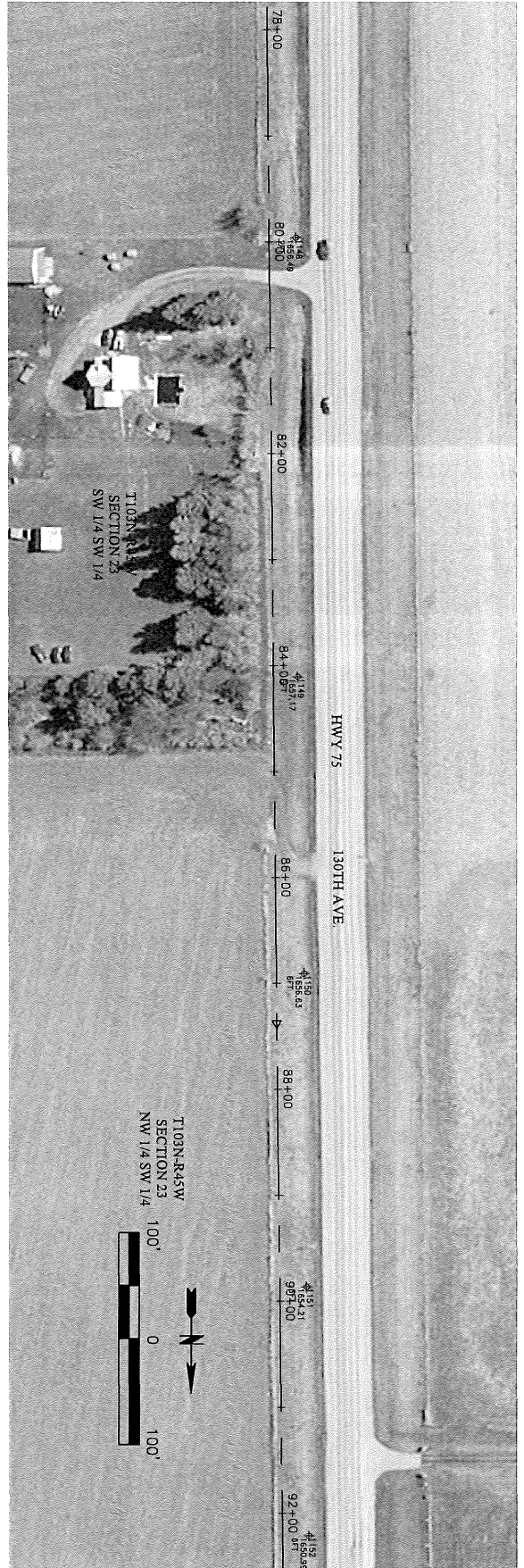
SERVICE TO BLUE MOUNDS STATE PARK
 ROCK COUNTY RURAL WATER DISTRICT
 LUVERNE, MINNESOTA



Sheet R1A-1		Project Manager: DLS Designer: TCM Project Number: 801400 Phone: (712) 472-2531	PROPOSED MAINLINE ROUTE - ROCK DEPTHS	REVISIONS <table border="1" style="width: 100%; border-collapse: collapse;"> <tr><td style="width: 50px; height: 15px;"> </td><td style="width: 50px; height: 15px;"> </td></tr> <tr><td style="width: 50px; height: 15px;"> </td><td style="width: 50px; height: 15px;"> </td></tr> </table>					SERVICE TO BLUE MOUNDS STATE PARK ROCK COUNTY RURAL WATER DISTRICT LUVERNE, MINNESOTA



Sheet RIA-3		Project Manager: DLS Designer: TCM Project Number: 801460 Phone: (712) 472-2531	PROPOSED MAINLINE ROUTE - ROCK DEPTHS	SERVICE TO BLUE MOUNDS STATE PARK ROCK COUNTY RURAL WATER DISTRICT LUVERNE, MINNESOTA
		REVISIONS:		



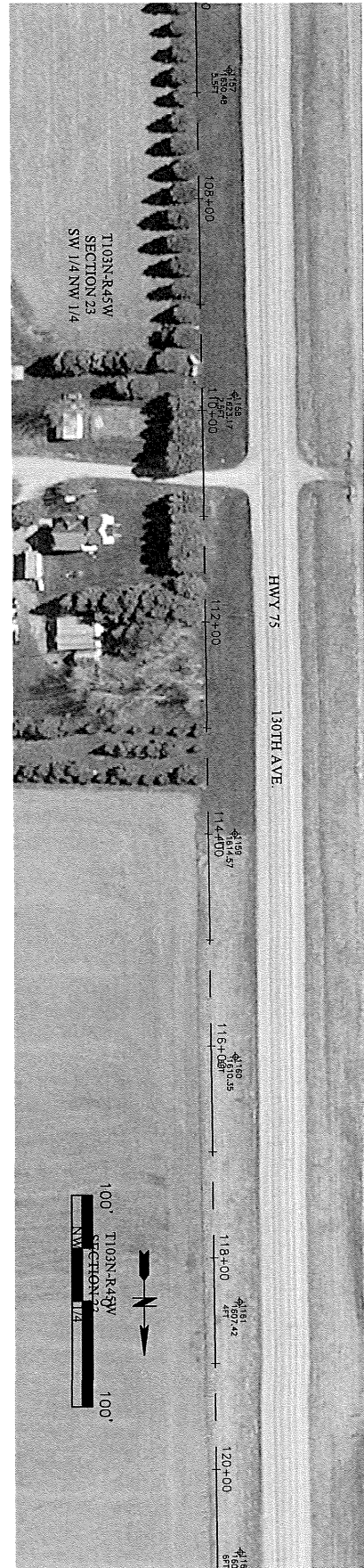
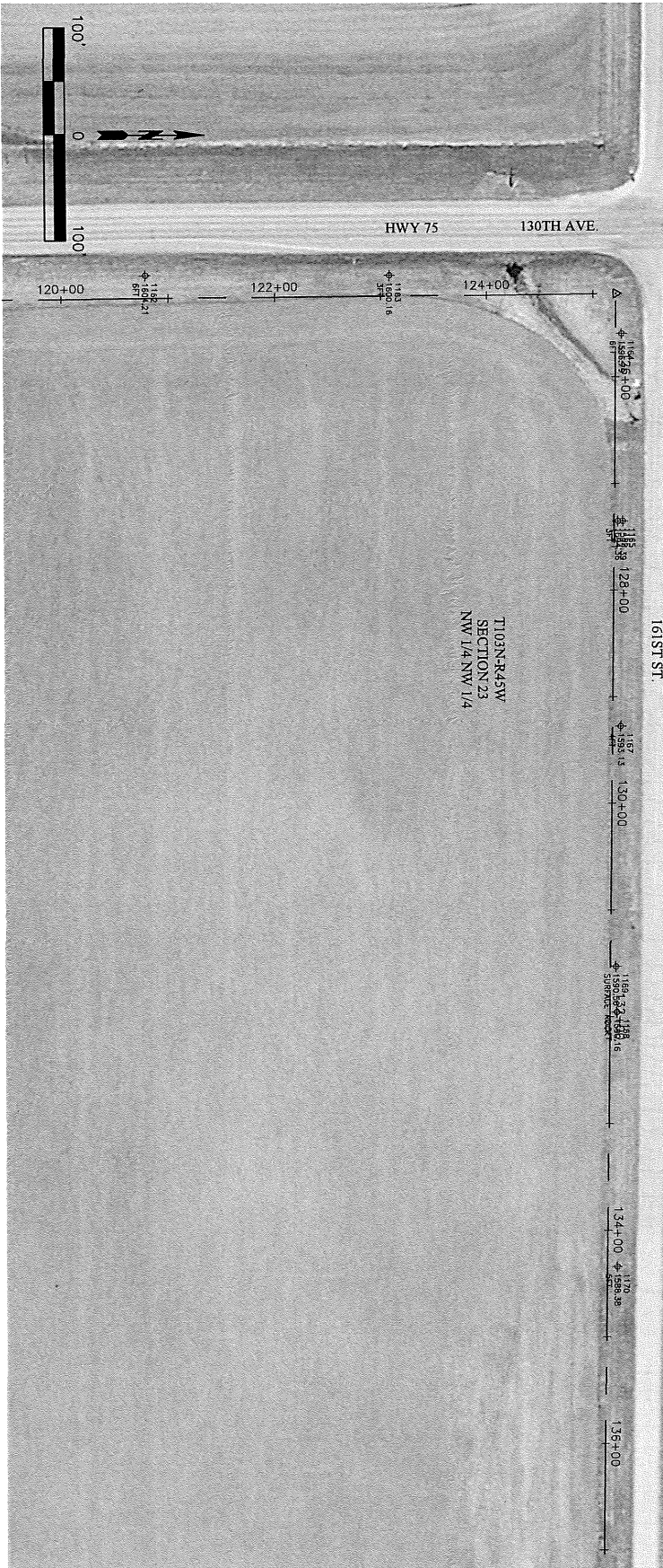
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R1A-4



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 Designer: TCM
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PROPOSED MAINLINE ROUTE - ROCK DEPTHS	
STATION	DEPTH

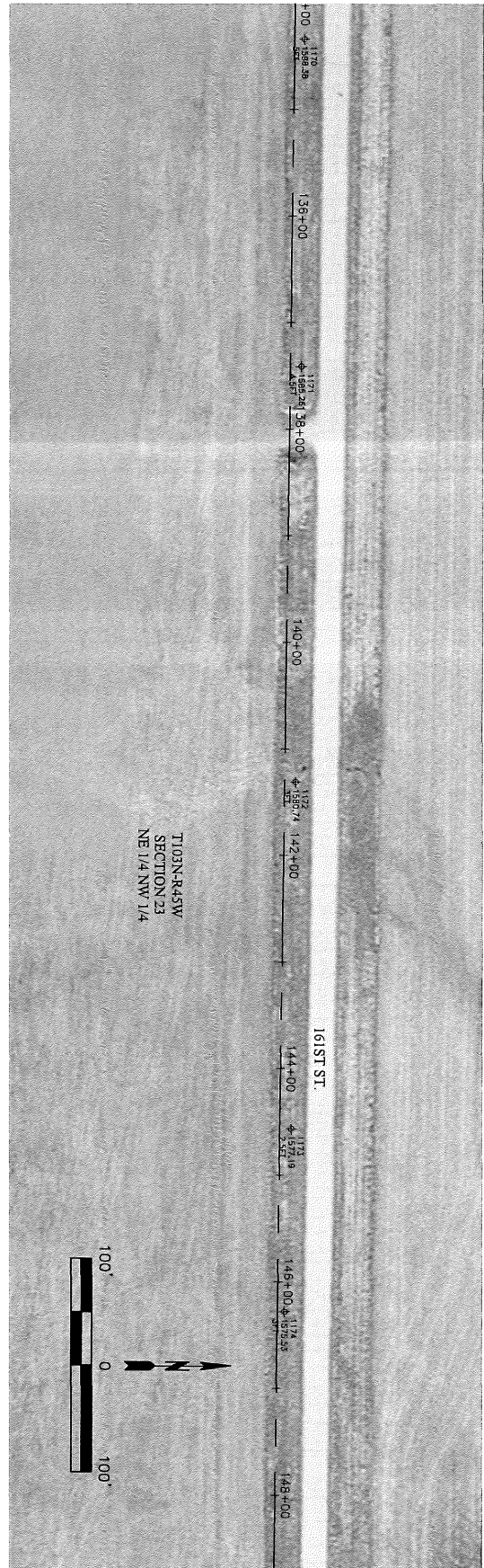
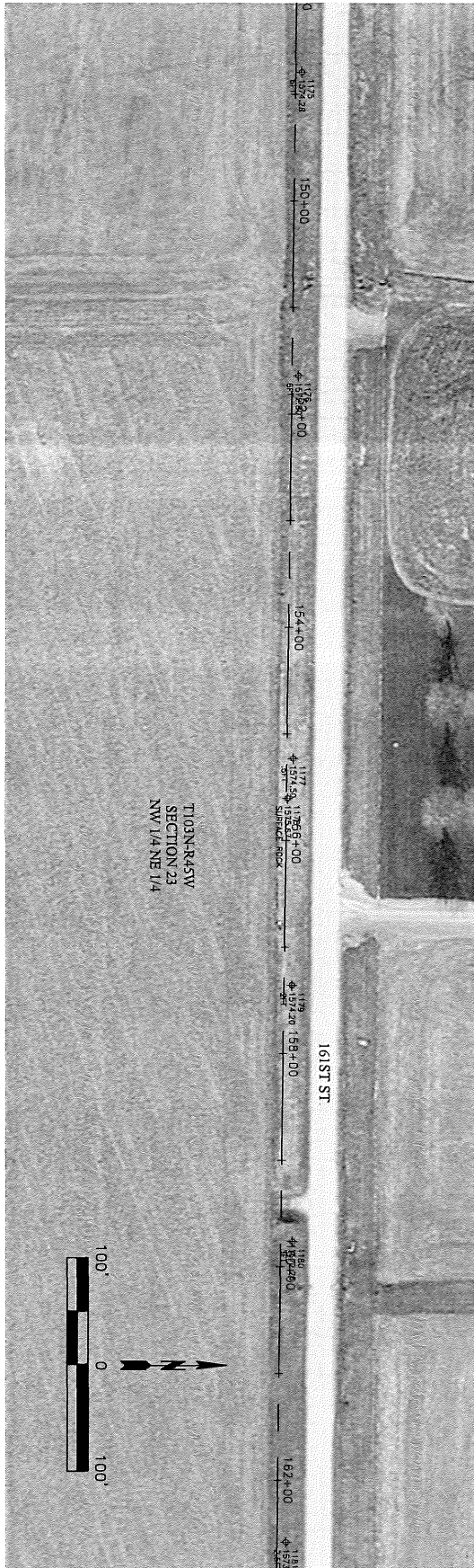
SERVICE TO BLUE MOUNDS STATE PARK
 ROCK COUNTY RURAL WATER DISTRICT
 LUVERNE, MINNESOTA



Project Manager: DLS
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PROPOSED MAINLINE ROUTE - ROCK DEPTHS	
STATION	DEPTH

SERVICE TO BLUE MOUNDS STATE PARK
 ROCK COUNTY RURAL WATER DISTRICT
 LUVERNE, MINNESOTA



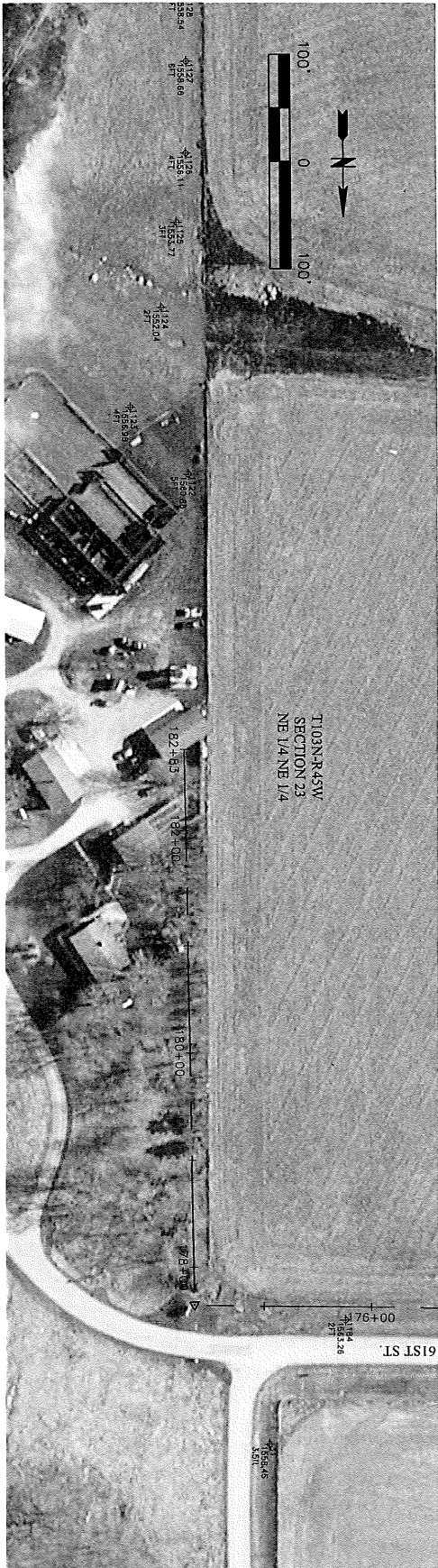
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RIA-6



Project Manager: DLS
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PROPOSED MAINLINE ROUTE - ROCK DEPTHS	
STATION	DEPTH

SERVICE TO BLUE MOUNDS STATE PARK
 ROCK COUNTY RURAL WATER DISTRICT
 LUYERNE, MINNESOTA



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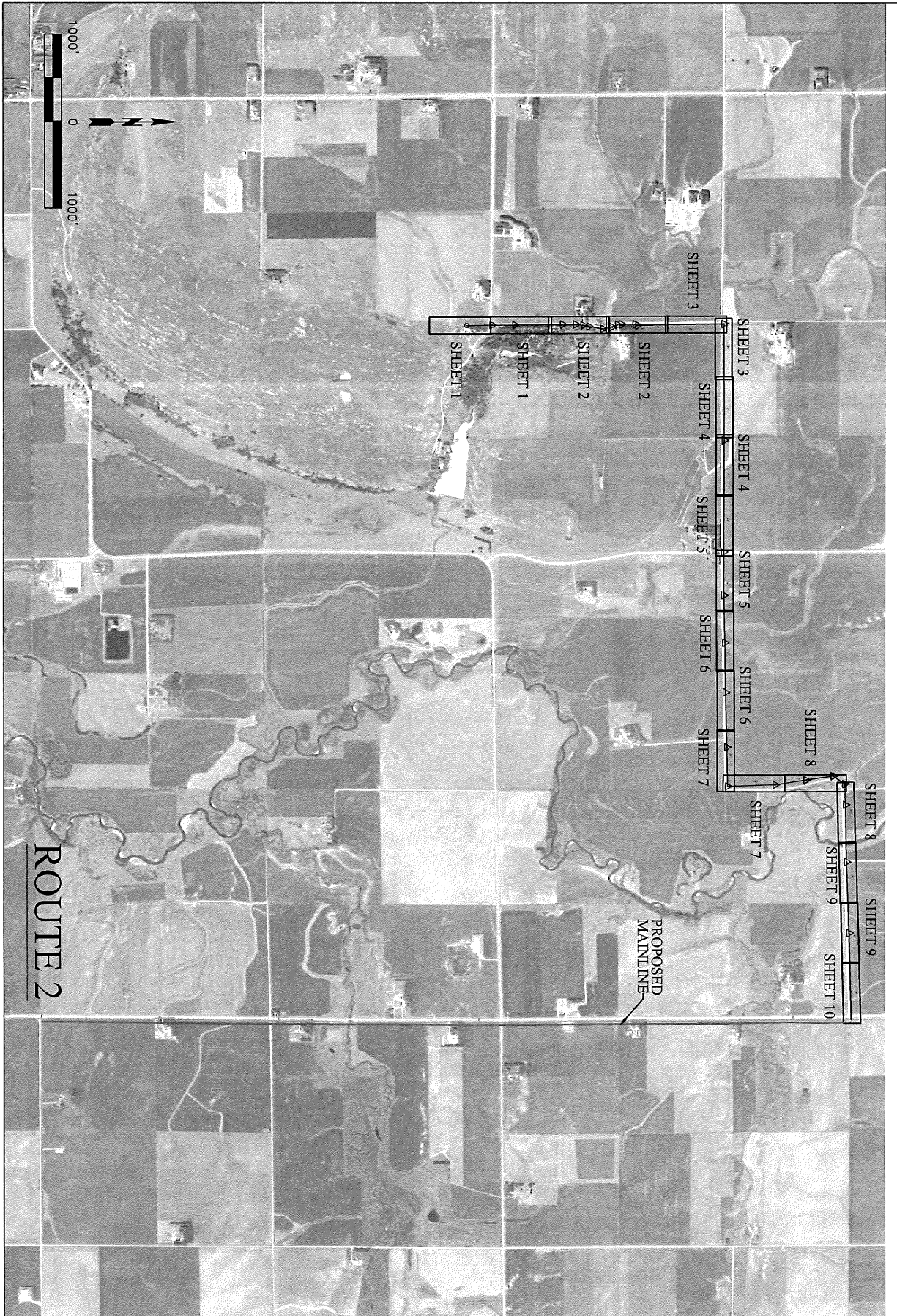
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PROPOSED MAINLINE ROUTE - ROCK DEPTHS

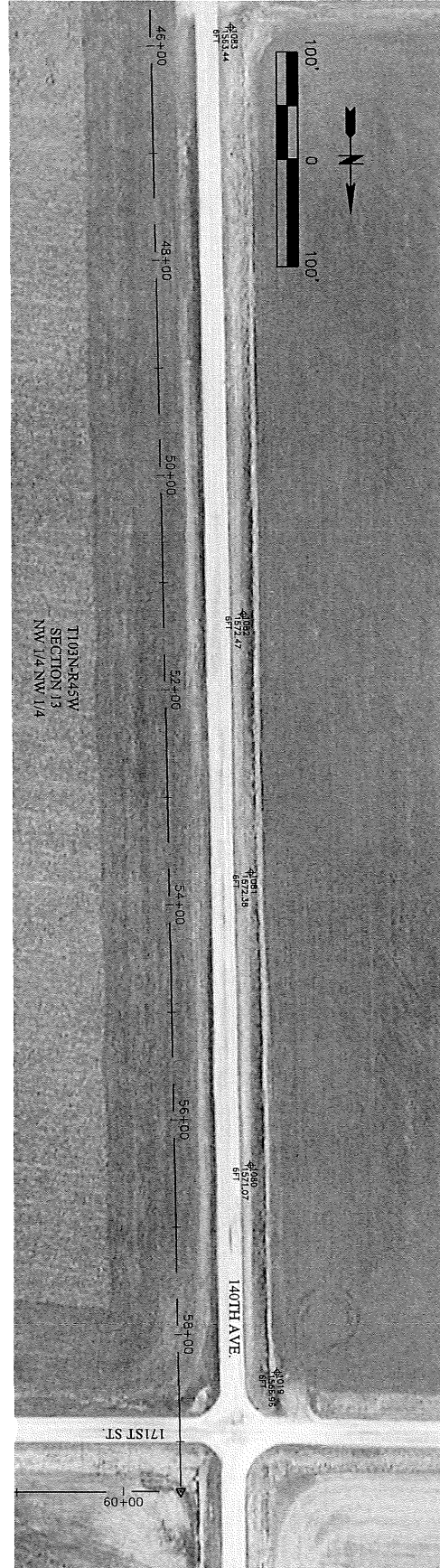
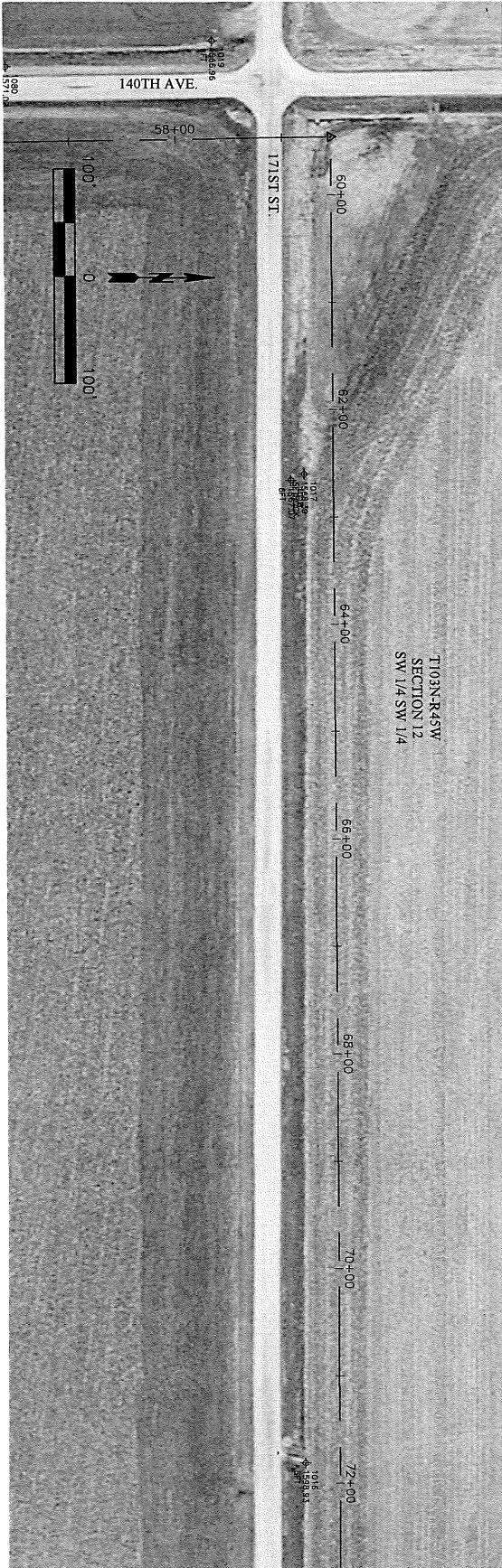
REVISIONS	DATE	BY	DESCRIPTION

SERVICE TO BLUE MOUNDS STATE PARK
 ROCK COUNTY RURAL WATER DISTRICT
 LUVERNE, MINNESOTA

Sheet
 R1A-7



Sheet R2-LP		Project Manager: DLS Designer: TCAI Project Number: 801400 Phone: (712) 472-2531	PROPOSED MAINLINE ROUTE - ROCK DEPTHS	SERVICE TO BLUE MOUNDS STATE PARK ROCK COUNTY RURAL WATER DISTRICT LUVERNE, MINNESOTA
		REVISIONS		

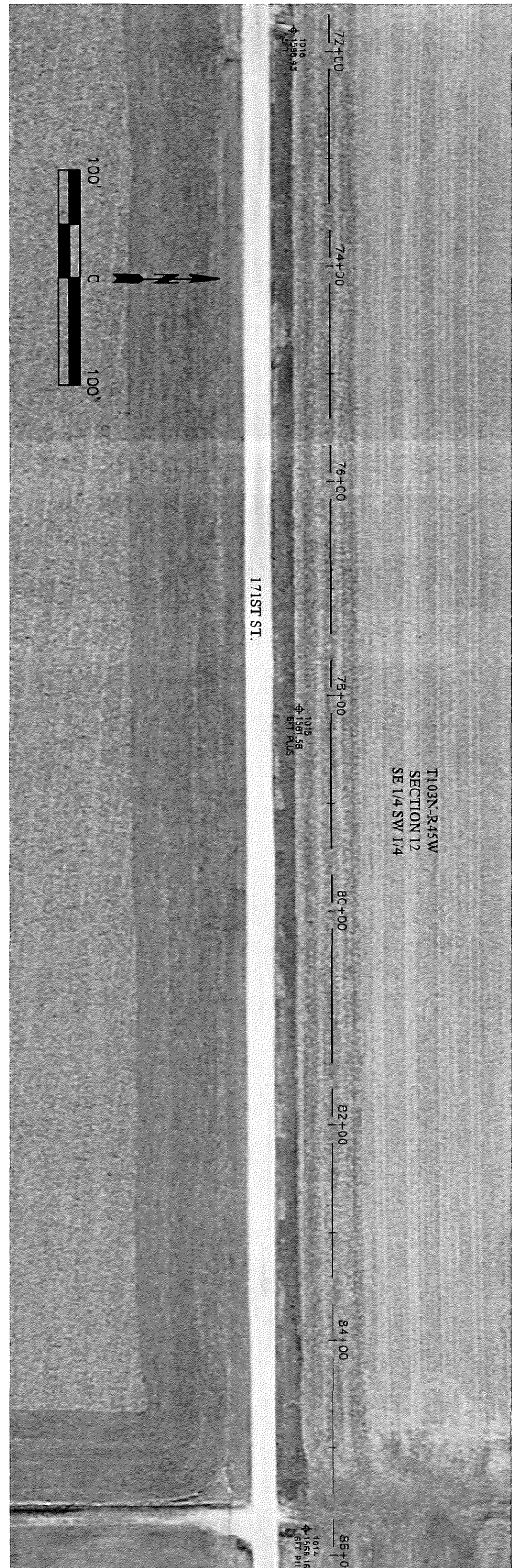
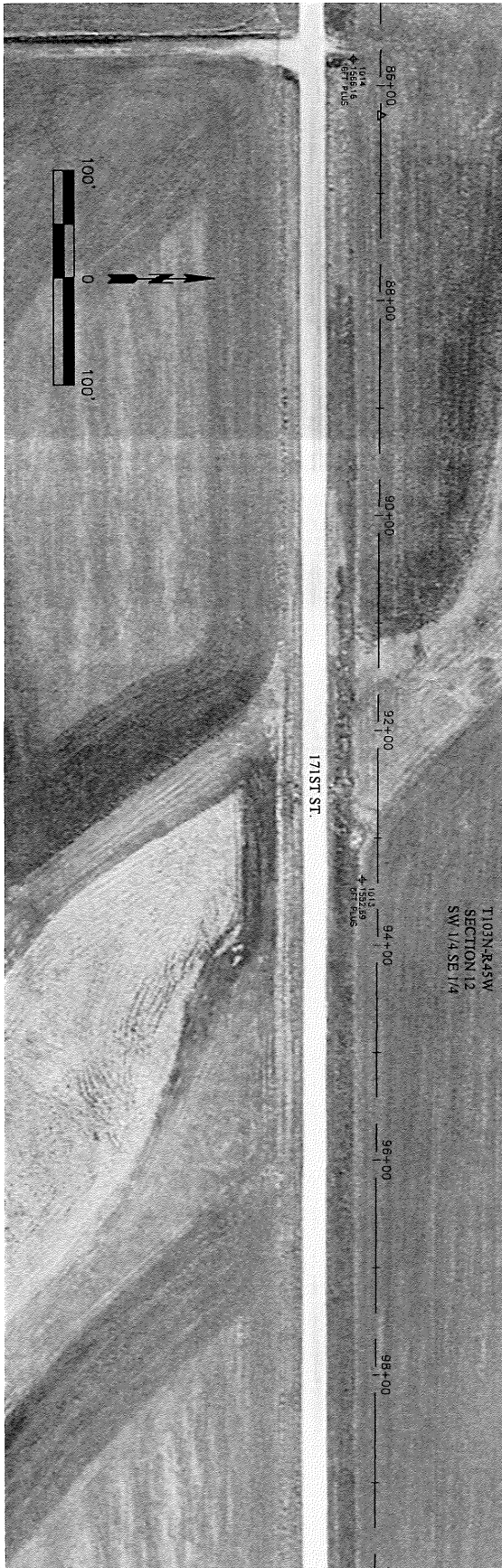


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PROPOSED MAINLINE ROUTE - ROCK DEPTHS	
STATION	DEPTH

SERVICE TO BLUE MOUNDS STATE PARK
 ROCK COUNTY RURAL WATER DISTRICT
 LUVERNE, MINNESOTA

Sheet
 R2-3



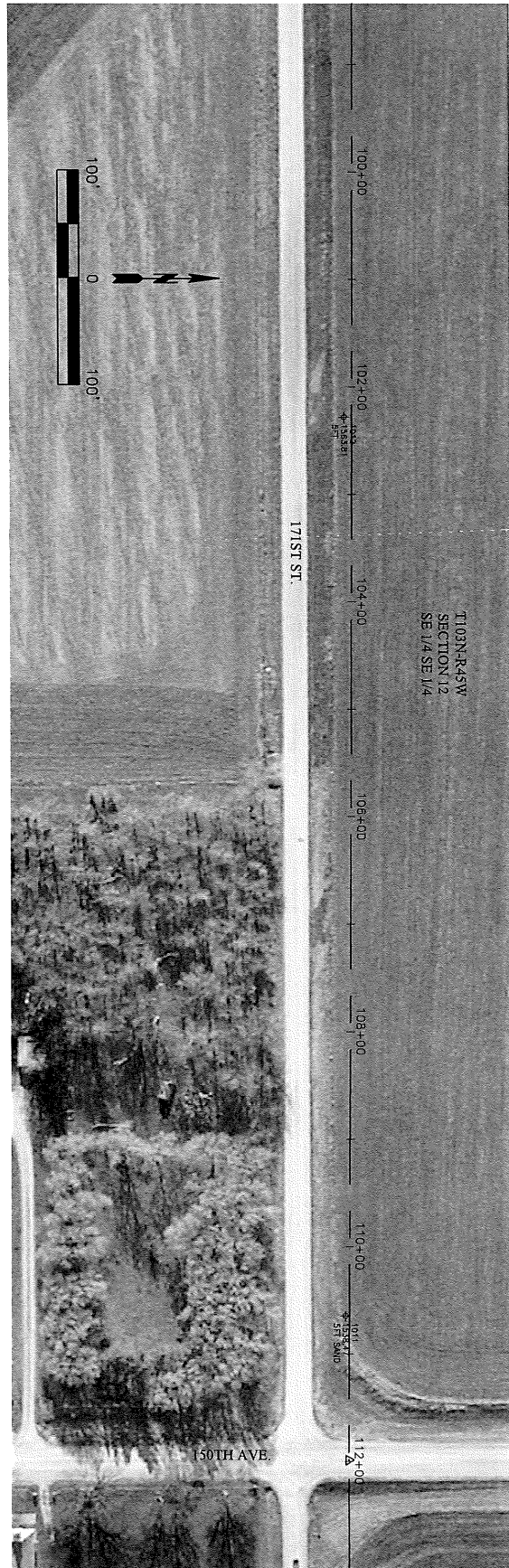
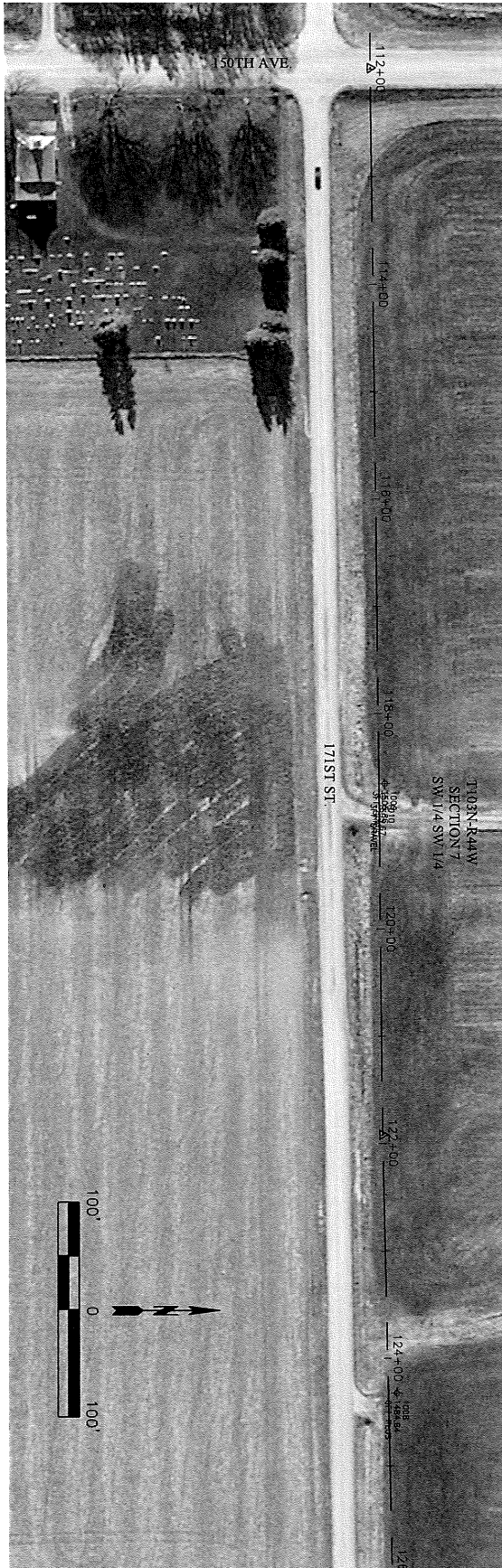
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PROPOSED MAINLINE ROUTE - ROCK DEPTHS	
STATION	DEPTH

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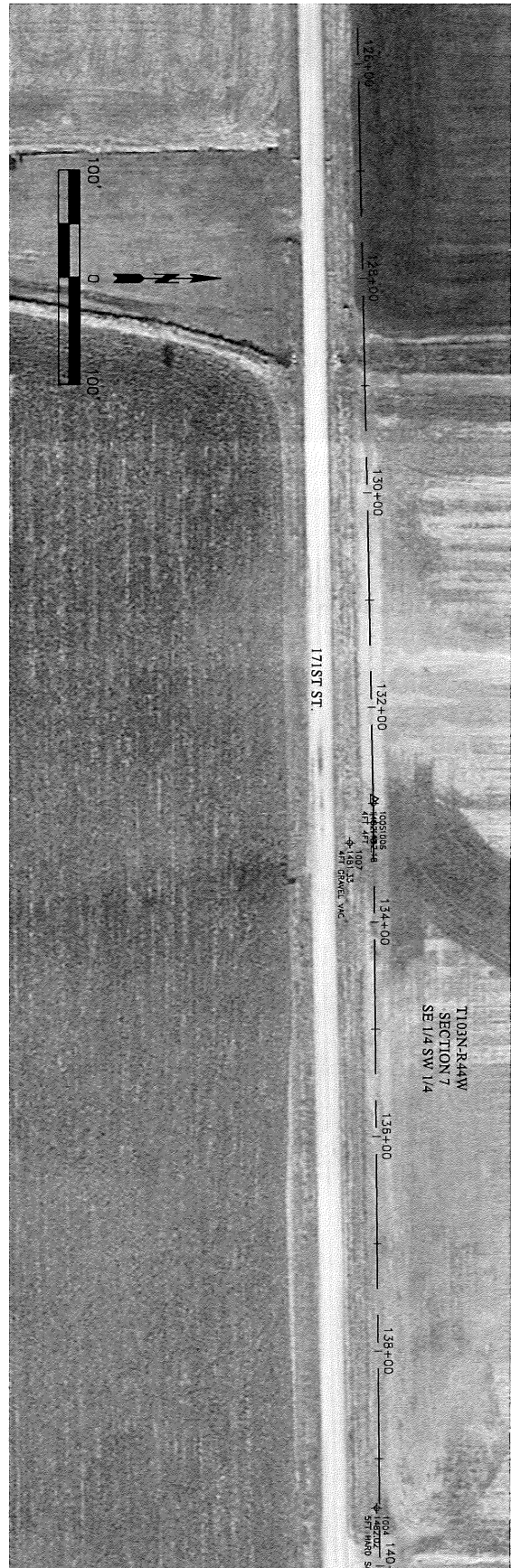
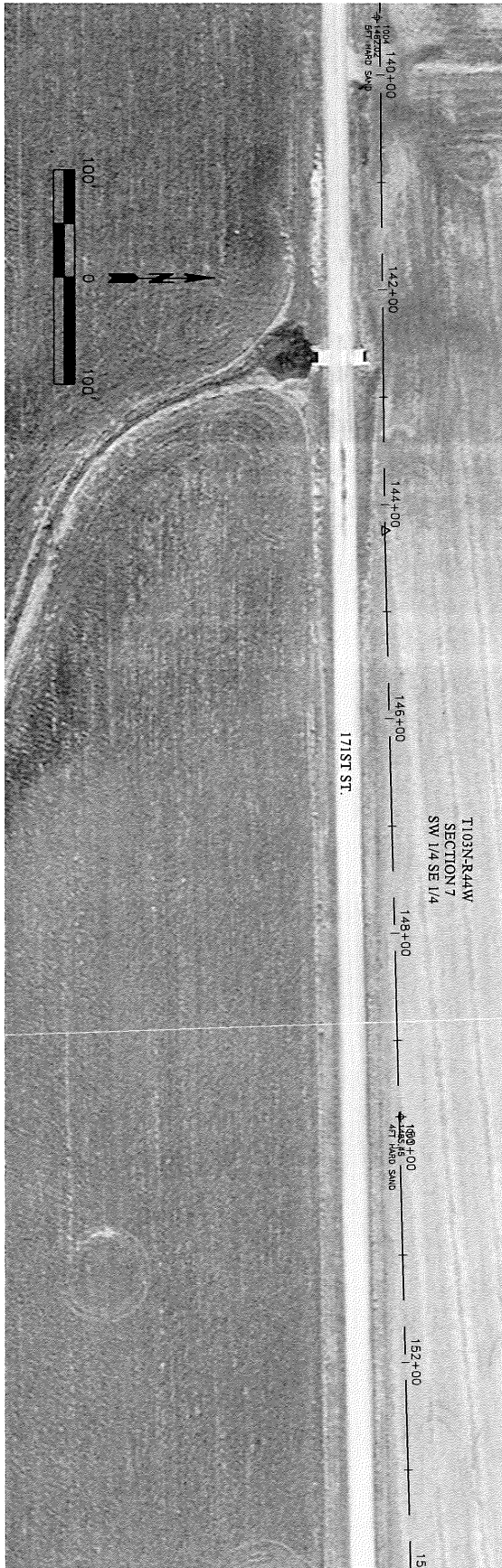


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R2-5

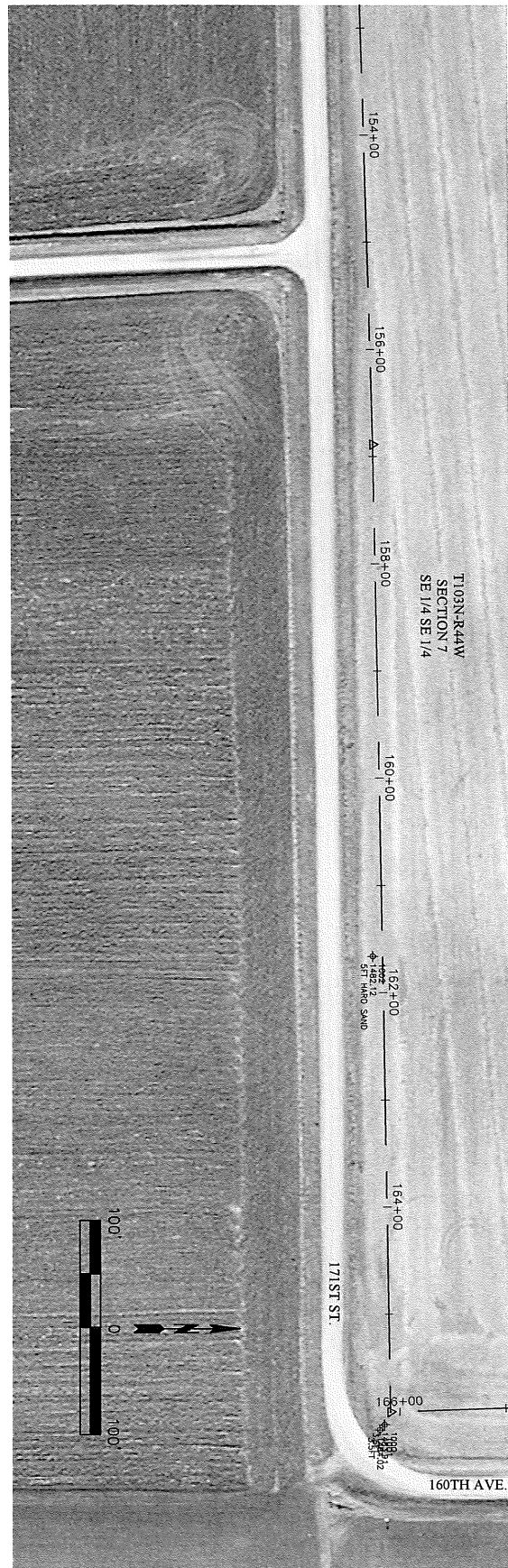
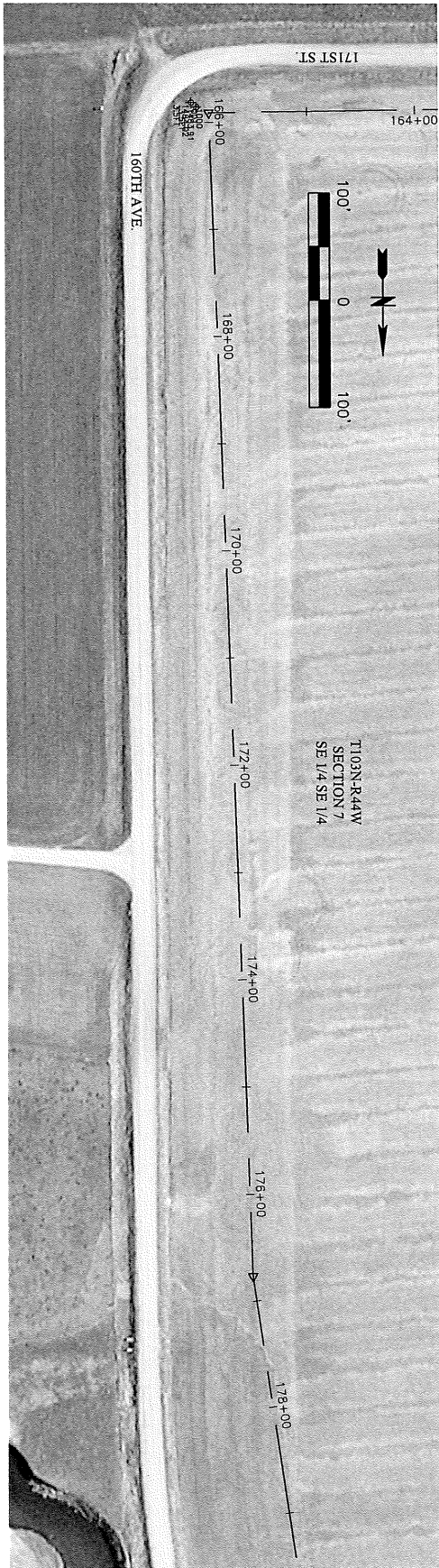
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PROPOSED MAINLINE ROUTE - ROCK DEPTHS	
STATION	DEPTH

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PROPOSED MAINLINE ROUTE - ROCK DEPTHS	
STATION	DEPTH



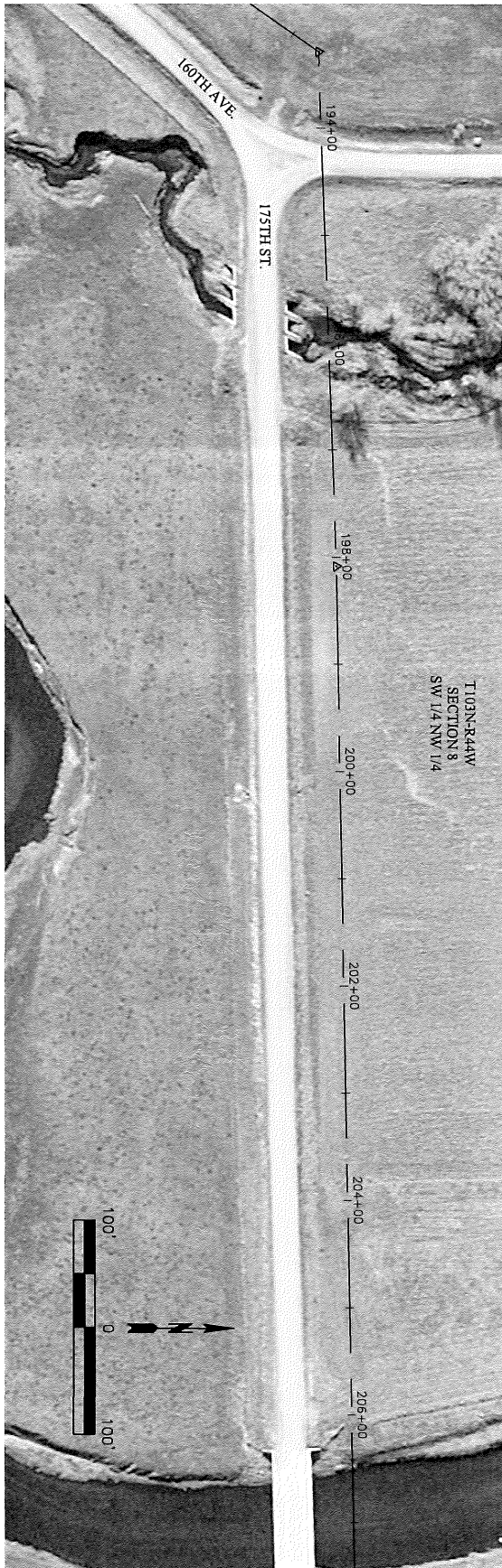
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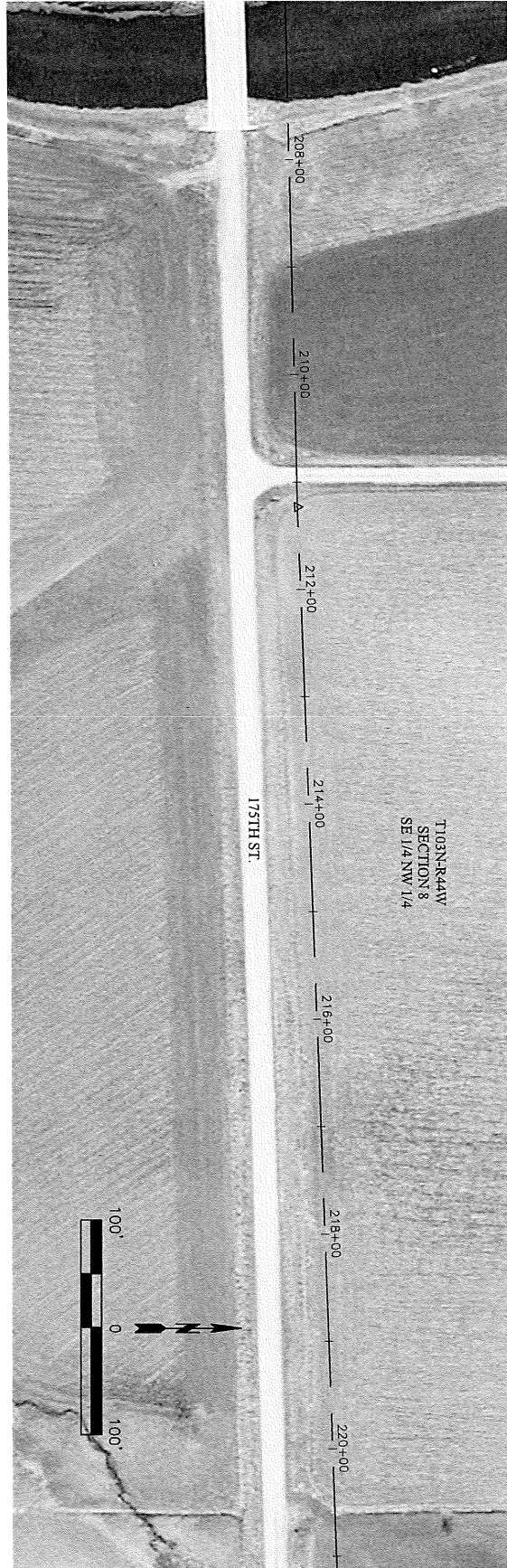
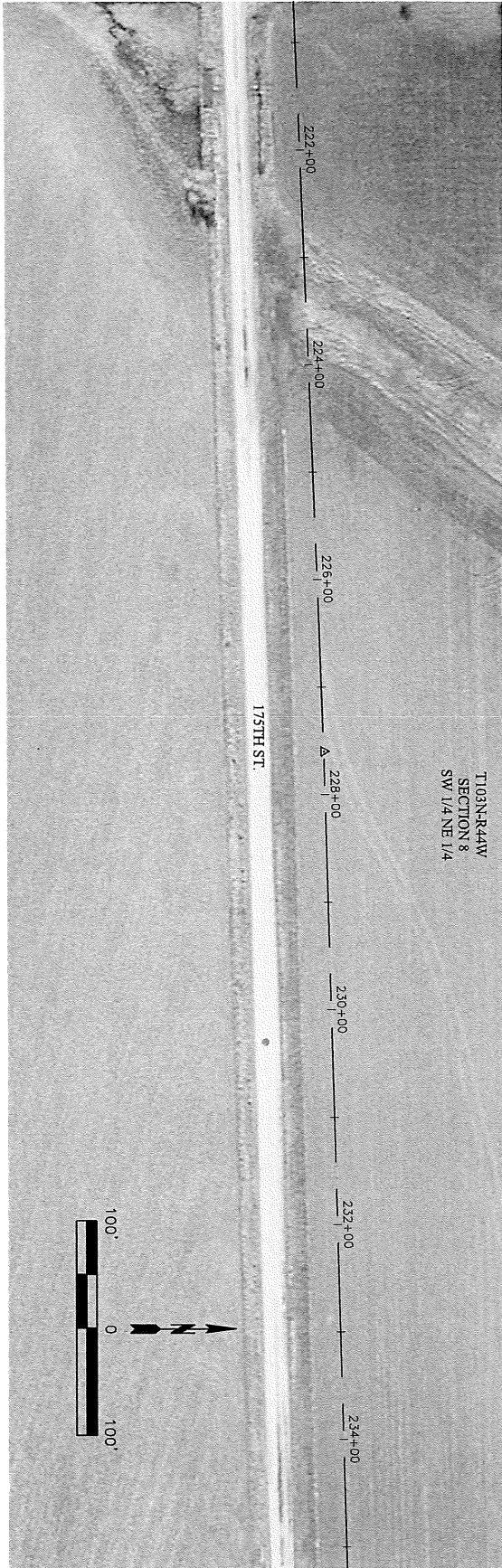


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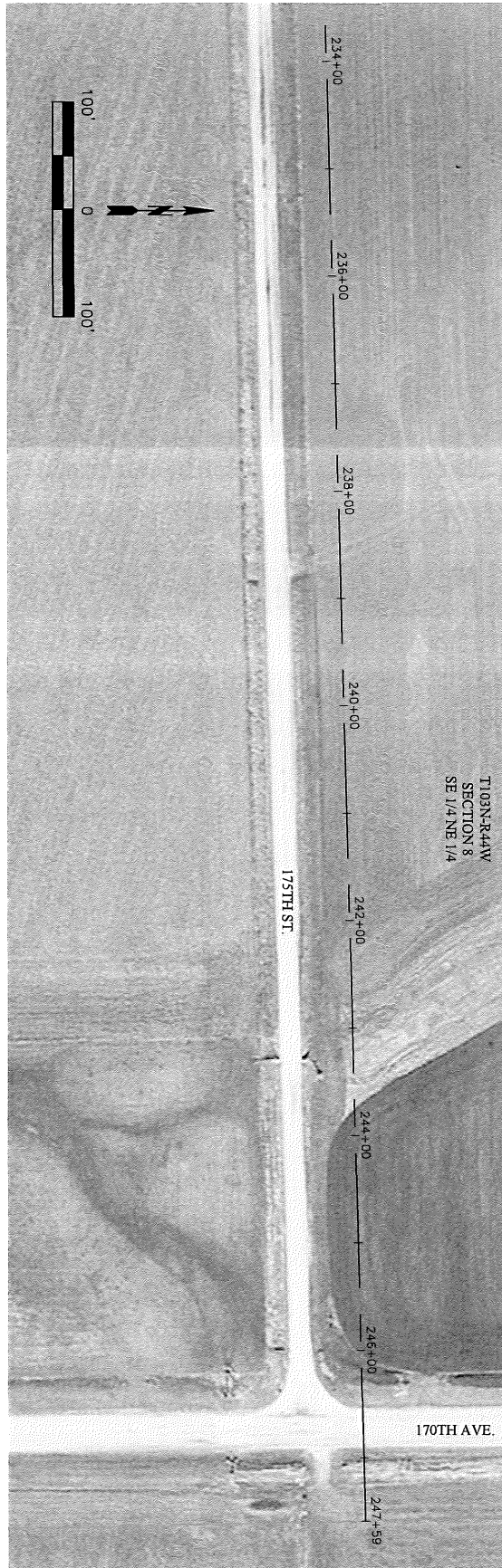
PROPOSED MAINLINE ROUTE - ROCK DEPTHS	
STATIONING	DEPTH

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PROPOSED MAINLINE ROUTE - ROCK DEPTHS	
Station	Rock Depth

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