VE 199708

VALUE ENGINEERING SUMMARY
OF
US 68
PARIS TO CARLISLE
ITEM NO. 07-00310.00
BOURBON-NICHOLAS COUNTIES, KENTUCKY

AUGUST 18-22, 1997

Prepared by:
William F. Ventry, P.E., C.V.S.

In Association With:

Kentucky Transportation Cabinet
Wilbur Smith Associates

TABLE OF CONTENTS

I. EXECUTIVE SUMMARY

INTRODUCTION

This Value Engineering report summarizes the results of the Value Engineering study performed by Ventry Engineering for the Kentucky Transportation Cabinet. The study was performed during the week of August 18-22, 1997.

The subject of the study was US 68, Bourbon & Nicholas Counties from Paris to Carlisle.

PROJECT DESCRIPTION

The project as currently proposed is to construct two new lanes and acquire right of way for two future lanes, which would produce an ultimate four lane typical section with a 40' median. The limits of the project are from Paris to east of the KY 68 and KY 36 split, approximately 13.5 miles. It is also proposed to bypass Millersburg and construct a new bridge over Hinkston Creek.

METHODOLOGY

The Value Engineering Team followed the basic Value Engineering procedure for conducting this type of analysis.

This process included the following phases:

1. Investigation
2. Speculation
3. Evaluation
4. Development
5. Presentation
6. Report Preparation

Evaluation criteria identified as a basis for the comparison of alternatives included the following:

- Right of way impacts/cost
- Historical Impacts
- Level of service
- Roadway construction cost
- Bridge construction cost
- Maintenance of traffic
- Impacts to Millersburg
- Local impacts from construction
- Arterial Continuity
- Safety

RESULTS

The following five areas of focus were analyzed by the Value Engineering team.

1. Typical Section

2. Profile Grades

3. Horizontal Alignment

4. Right of Way

5. Historical Impacts/Mitigation

From these areas the following Value Engineering alternatives were developed and are recommended for Implementation:

Recommendation Number 1

The Value Engineering Team recommends that Value Engineering Alternative No. 1 be implemented. This alternative utilizes four lanes with a 40' median, reconstructs two lanes as close to the existing alignment as possible and constructs two new lanes, corrects the existing profile for stopping sight distance where needed, realigns the proposed bypass alignment from west of Millersburg to Hinkston Creek, avoids any historical impacts by shifting the alignment where needed or narrowing the median to four lanes with a 15' median with median barrier, and uses the existing right of way as much as possible from Paris to KY 36.

If this recommendation can be implemented, there is a possible savings of **$10,572,999** over the "As Proposed" at the time of ultimate buildout and **$3,175,500** over the Modified "As Proposed"(VE 8).

Recommendation Number 2-If Recommendation No. 1 cannot be implemented

The Value Engineering Team recommends that Value Engineering Alternative No. 3 be implemented. This alternative uses four lanes with 40' median, reconstructs two lanes as close to the existing alignment as possible and two separate new lanes, corrects the existing profile for stopping sight distance where needed, uses a four lane urban typical section through Millersburg, avoids any historical impacts by shifting the alignment where needed or narrowing the median to four lanes with a 15' median with median barrier, and uses the existing right of way as much as possible from Paris to KY 36.

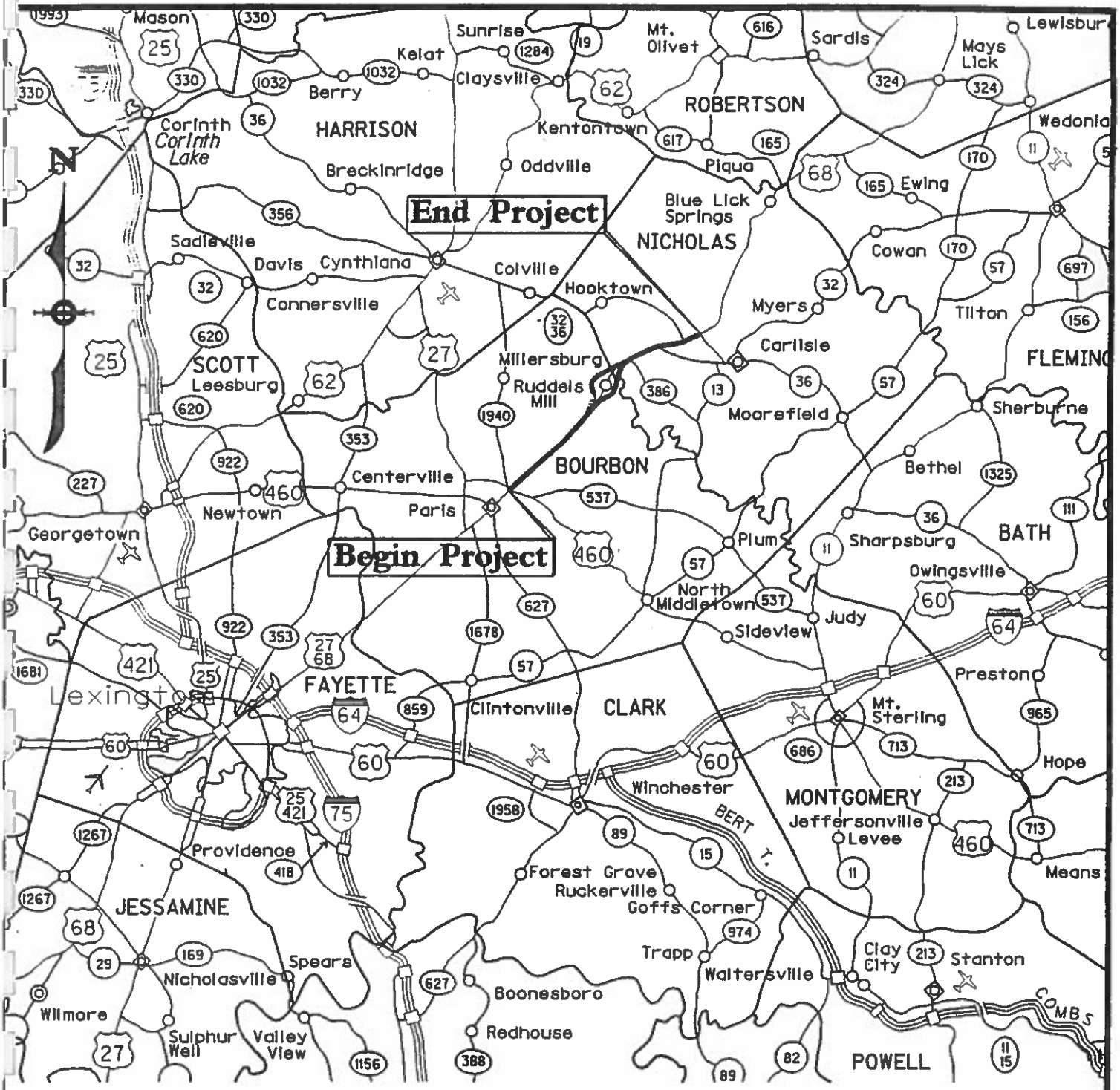
If this recommendation can be implemented, there is a possible savings of **$17,495,899** over the "As Proposed" at the time of ultimate buildout and **$10,098,400** over the Modified "As Proposed" (VE 8).

Recommendation Number 3-If Recommendations Nos. 1 or 2 cannot be implemented

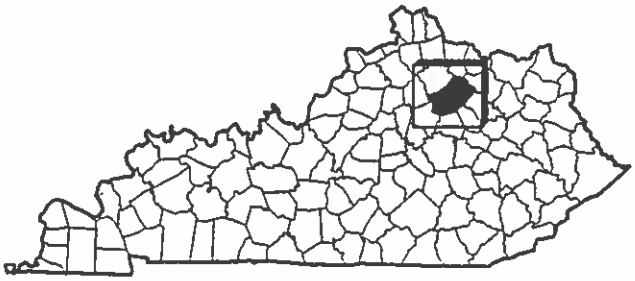
The Value Engineering Team recommends that Value Engineering Alternative No. 2 be implemented. This alternative uses four lanes with a 40' median, reconstructs two lanes as close to the existing alignment as possible and two separate new lanes, corrects the existing profile for stopping sight distance where needed, realigns the proposed bypass alignment from west of Millersburg to Hinkston Creek,avoids any historical impacts by shifting the alignment where needed or narrowing the median to four lanes with a 15' median with median barrier from Paris to west of Millersburg, from Millersburg to the end of the project uses a two lane section with a bypass around Millersburg, and uses the existing right of way as much as possible from Paris to west of Millersburg

If this recommendation can be implemented, there is a possible savings of $14,726,749 over the "As Proposed" at the time of buildout and $7,329,250 over the Modified "As Proposed"(VE 8).

II. LOCATION OF PROJECT



VICINITY MAP



LOCATION MAP

EXHIBIT 1

US 68 Project Area
Location In
Bourbon & Nicholas Counties, Ky.

III. TEAM MEMBERS AND PROJECT DESCRIPTION

TEAM MEMBERS

NAME	AFFILIATION	EXPERTISE	PHONE
William F. Ventry, P.E., C.V.S.	Ventry Engineering	Team Leader	850/627-3900
Don Keenan	Ventry Engineering	Structural Team Member	850/627-3900
Jerry Love	Ventry Engineering	Roadway Team Member	850/627-3900
Dallas Gray	Ventry Engineering	Right of Way Team Member	850/627-3900
Karen Hudson	Wilbur Smith Associates	Environmental Team Member	606/254-5759
Stuart Goodpaster	Kentucky TC	Structural	502/564-4560
Larry Trenkamp	Kentucky TC	Construction	606/341-2700
Jack Conway	Kentucky TC	Materials	502/564-2374
Joette Fields	Kentucky TC	Design	502/564-3280
Robert Semones	Kentucky TC	Design	502/564-3280

PROJECT DESCRIPTION

The project as currently proposed is to construct two new lanes and acquire right of way for two future lanes, which would produce an ultimate four lane typical section with a 40' median. The limits of the project are from Paris to east of the KY 68 and KY 36 split, approximately 13.5 miles. It is also proposed to bypass Millersburg and construct a new bridge over Hinkston Creek.

PERSONS CONTACTED

NAME	AFFILIATION	PHONE
Paul Doss	Federal Highway Administration	502/223-6740
Janet Coffey	Kentucky TC, Operations	502/564-4556
Dave Heil	EA Partners	606/277-8320
Jerry Cottingham	EA Partners	606/277-8320
Steve Farmer	Kentucky TC, Maintenance	606/246-2355
Daryl Greer	Kentucky TC, Design	502/564-3280
Wayne Mosley	Kentucky TC, Construction	606/246-2355
Keith Caudill	Kentucky TC, Design	606/246-7355
I.J. Blankenship	Kentucky TC, Design	606/246-7355
Robert Polsgrove	Kentucky TC, Environmental	502/564-7250
A.L. Perkins	Kentucky TC, Preconstruction	606/246-2355
John Mettille	Kentucky TC, Environmental	502/564-7250
Jim Simpson	Kentucky TC, Design	502/564-3280
John Sacksteder	Kentucky TC, Design	502/564-3280
Louis Morris	Midwest Construction Products	800/382-5922
Carl Hazenburg	Tensar	800/292-4459

IV. INVESTIGATION PHASE

FUNCTIONAL ANALYSIS WORKSHEET, INVESTIGATION PHASE
PROJECT: US 68, BOURBON & NICHOLAS COUNTIES, PARIS TO CARLISLE
DATE: AUGUST 18-22, 1997

ITEM	FUNCT. VERB	FUNCT. NOUN	TYPE	COST *	WORTH *	VALUE INDEX
Roadway Pavement & Base	Support	Vehicles	B	$ 5,500	$ 2,700	2.04
Earthwork	Provide	Profile	B	$ 5,300	$ 500	10.60
Hinkson Creek Bridge	Span	Creek	B	$ 635	$ 635	1.00
Box Culverts	Convey	Water	B	$ 1,500	$ 400	3.75
Guardrail	Redirect	Vehicles	B	$ 440	$ 200	2.20
Cross Drains	Convey	Water	B	$ 500	$ 200	2.50
Maintenance of Traffic	Maintain	Traffic	B	$ 660	$ 660	1.00
Right of Way	Provide	Area	B	$ 7,550	$ 705	10.70
Erosion Control	Protect	Area	S	$ 480	$ 480	1.00
Historical Mitigation	Preserve	Area	S	$ 1,000	$ 500	2.00
R/W Fence	Control	Access	S	$ 453	$ 302	1.50
Clear & Grub	Prepare	Site	B	$ 580	$ 290	2.00
Shoulder Pavement & Base	Support	Roadway	B	$ 4,500	$ 2,700	1.70

B = Basic Function
S = Secondary Function
* = All amounts x 1000

INVESTIGATION

After completion of the functional worksheet, the following have been identified by the Value Engineering Team as areas of focus and investigation for the Value Engineering process:

1. **Typical Section**

2. **Profile Grades**

3. **Horizontal Alignment**

4. **Right of Way**

5. **Historical Impacts/Mitigation**

V. SPECULATION PHASE

SPECULATION

Ideas generated, utilizing the brainstorming method, for performing the functions of previously identified areas of focus.

1. TYPICAL SECTION

- **Environmental Shoulders rather than paved shoulders**
- **Four lanes with a 15' median with median barrier**
- **Reconstruct the existing two lanes only**
- **Construct two new lanes as close to the existing alignment as possible**
- **Four lanes with 40' median, reconstruct two lanes as close to the existing alignment as possible and two new lanes**
- **Use a bifurcated median where needed**
- **Decrease shoulder where possible**
- **Use a four lane urban typical through Millersburg**
- **Use a two lane urban typical through Millersburg**
- **Five lanes throughout the project**
- **One way pairs through Millersburg**
- **Three lane rural throughout the project**

2. PROFILE GRADES

- **Use a bifurcated profile grade**
- **Correct the existing profile for stopping sight distance where needed**
- **Reconstruct the two existing lanes for all vertical requirements**

3. HORIZONTAL ALIGNMENT

- **Realign the proposed bypass alignment from west of Millersburg to Hinkston Creek**
- **Correct the existing horizontal alignment to meet requirements**
- **Utilize the existing alignment from a point west of Millersburg, through Millersburg**

- Correct the existing horizontal alignment to meet requirements with a new bypass around Millersburg
- Use a new alignment independent of the current alignment but as close to the existing alignment as possible
- Reconsider the cross country alignment
- Use a bifurcated alignment where needed

4. RIGHT OF WAY

- Utilize the existing right of way as much as possible
- Utilize retaining walls or steepened slopes where possible to reduce right of way takes

5. HISTORICAL IMPACTS/MITIGATION

- Avoid any impacts by shifting the alignment where needed
- Avoid any impacts by narrowing the typical section where needed
- Avoid any impacts by providing less lanes where needed
- Avoid any impacts by using an independent alignment where possible
- Reduce impacts by using landscaping
- Reduce impacts by moving structure or entire site if possible
- Reduce impacts by using HABS

VI. EVALUATION PHASE

VI.(a) ALTERNATIVES

ALTERNATIVES

From the ideas generated in the speculation phase, the following alternatives were formulated during the "eliminate and combine" portion of the Evaluation Phase, which would incorporate all the areas of focus.

Value Engineering Alternative No. 1-Four lanes with 40' median, reconstruct two lanes as close to the existing alignment as possible and two new lanes, correct the existing profile for stopping sight distance where needed, realign the proposed bypass alignment from west of Millersburg to Hinkston Creek, avoid any historical impacts by shifting the alignment where needed or narrowing the median to four lanes with a 15' median with median barrier, and use the existing right of way as much as possible from Paris to KY 36.

Value Engineering Alternative No. 2-Four lanes with 40' median, reconstruct two lanes as close to the existing alignment as possible and two new lanes, correct the existing profile for stopping sight distance where needed, realign the proposed bypass alignment from west of Millersburg to Hinkston Creek, avoid any historical impacts by shifting the alignment where needed or narrowing the median to four lanes with a 15' median with median barrier from Paris to west of Millersburg, from Millersburg to the end of the project use a two lane section with a bypass around Millersburg, and use the existing right of way as much as possible from Paris to west of Millersburg.

Value Engineering Alternative No. 3-Four lanes with 40' median, reconstruct two lanes as close to the existing alignment as possible and two new lanes, correct the existing profile for stopping sight distance where needed, use a four lane urban typical section through Millersburg, avoid any historical impacts by shifting the alignment where needed or narrowing the median to four lanes with a 15' median with median barrier, and use the existing right of way as much as possible from Paris to KY 36.

Value Engineering Alternative No. 4-Construct two new lanes as close to the existing alignment as possible and acquire right of way for a future four lane typical with 40' median, do not provide a bypass around Millersburg, and use the existing right of way as much as possible from Paris to west of Millersburg.

Value Engineering Alternative No. 5-Construct two new lanes as close to the existing alignment as possible and acquire right of way for a future four lane typical with 40' median, realign the proposed bypass around Millersburg, and use the existing right of way as much as possible from Paris to west of Millersburg.

Value Engineering Alternative No. 6-Construct two new lanes as close to the existing alignment as possible, do not provide a bypass around Millersburg, and use the existing right of way as much as possible from Paris to west of Millersburg.

Value Engineering Alternative No. 7-Construct two new lanes as close to the existing alignment as possible, realign the proposed bypass around Millersburg, and use the existing right of way as much as possible from Paris to west of Millersburg .

Value Engineering Alternative No. 8 (Modified "As Proposed") - "As Proposed" except construct four lanes as required by the design year traffic rather than construct two lanes with future four lanes.

VI.(b) ADVANTAGES AND DISADVANTAGES

EVALUATION

The following Advantages and Disadvantages were developed for the Value Engineering Alternatives previously generated during the speculation phase. It also includes the Advantages and Disadvantages for the "As Proposed" and Modified "As Proposed".

"As Proposed" - Construct two lanes and acquire right of way for a future four lane typical section.

Advantages

- **Low maintenance of traffic cost/impacts**
- **Medium roadway construction cost**
- **Medium bridge cost**
- **Medium arterial continuity**

Disadvantages

- **High right of way cost**
- **High direct impacts on the historical properties outside of Millersburg**
- **Low level of service**
- **Does not utilize the entire right of way throughout the project**
- **May be high indirect impacts to historic district in Millersburg**

Conclusion:
Recommend to be carried forward for further Evaluation

Value Engineering Alternative No. 1-Four lanes with 40' median, reconstruct two lanes as close to the existing alignment as possible and two new lanes, correct the existing profile for stopping sight distance where needed, realign the proposed bypass alignment from west of Millersburg to Hinkston Creek, avoid any historical impacts by shifting the alignment where needed or narrowing the median to four lanes with a 15' median with median barrier, and use the existing right of way as much as possible from Paris to KY 36.

Advantages

- **Medium right of way takes**
- **Medium direct impacts to the historic properties outside Millersburg**
- **Low direct impact to the historic district in Millersburg**
- **May reduce potential accidents in Millersburg**
- **Low to medium maintenance of traffic**
- **Single impact of construction on local area**
- **High level of service**
- **High arterial continuity**

Disadvantages

- **High roadway construction cost**
- **High indirect impact to Millersburg historic district**
- **High bridge cost**

Conclusion:
Recommend to be carried forward for further Evaluation

Value Engineering Alternative No. 2-Four lanes with 40' median, reconstruct two lanes as close to the existing alignment as possible and two new lanes, correct the existing profile for stopping sight distance where needed, realign the proposed bypass alignment from west of Millersburg to Hinkston Creek, avoid any historical impacts by shifting the alignment where needed or narrowing the median to four lanes with a 15' median with median barrier from Paris to west of Millersburg, from Millersburg to the end of the project use a two lane section with a bypass around Millersburg, and use the existing right of way as much as possible from Paris to west of Millersburg.

Advantages

- **Low to medium right of way takes**
- **No indirect impact to the historic district in Millersburg**
- **No direct impact to the historic district in Millersburg**
- **Low to medium impact to the historic properties outside Millersburg**
- **Medium maintenance of traffic cost/impacts**
- **Low to medium roadway construction cost**
- **No bridge cost**

Disadvantages

- **Low to medium level of service**
- **Possibly no reduction in accidents in Millersburg**
- **Low arterial continuity since no bypass of Millersburg**

Conclusion:
Recommend to be carried forward for further Evaluation

Value Engineering Alternative No. 3-Four lanes with 40' median, reconstruct two lanes as close to the existing alignment as possible and two new lanes, correct the existing profile for stopping sight distance where needed, use a four lane urban typical section through Millersburg, avoid any historical impacts by shifting the alignment where needed or narrowing the median to four lanes with a 15' median with median barrier, and use the existing right of way as much as possible from Paris to KY 36.

Advantages

- Medium right of way takes
- Medium impact on the historic properties outside Millersburg
- Low direct impact to the historic district in Millersburg
- Low bridge cost
- Medium level of service
- Low to medium maintenance of traffic
- Single impact of construction to local area

Disadvantages

- High roadway construction cost
- Low arterial continuity without the bypass around Millersburg
- Possibly no reduction of accidents in Millersburg

Conclusion:
Recommend to be carried forward for further Evaluation

Value Engineering Alternative No. 4-Construct two new lanes as close to the existing alignment as possible and acquire right of way for a future four lane typical with 40' median, do not provide a bypass around Millersburg, and use the existing right of way as much as possible from Paris to west of Millersburg.

Advantages

- Low roadway construction cost
- No bridge cost
- Medium right of way takes
- Medium impact on the historic properties outside Millersburg
- Low direct impact to the historic district in Millersburg

Disadvantages

- Medium to high maintenance of traffic
- Low level of service
- Low arterial continuity since no bypass
- Possibly no reduction of accidents overall

Conclusion:
Recommend to be carried forward for further Evaluation

Value Engineering Alternative No. 5-Construct two new lanes as close to the existing alignment as possible and acquire right of way for a future four lane typical with 40' median, realign the proposed bypass around Millersburg, and use the existing right of way as much as possible from Paris to west of Millersburg.

Advantages

- Low roadway construction cost
- Medium bridge cost
- Medium right of way takes
- Medium impact on the historic properties outside Millersburg
- Low direct impact to the historic district in Millersburg

Disadvantages

- High indirect impact to the historic district in Millersburg
- Medium to high maintenance of traffic
- Low level of service
- Low arterial continuity since no bypass
- Possibly no reduction of accidents overall

Conclusion:
Recommend to be carried forward for further Evaluation

Value Engineering Alternative No. 6-Construct two new lanes as close to the existing alignment as possible, do not provide a bypass around Millersburg, and use the existing right of way as much as possible from Paris to west of Millersburg.

Advantages

- Low right of way takes
- Low roadway construction cost
- Low direct impacts to historic properties outside Millersburg
- Low indirect impacts to historic district in Millersburg since no bypass
- No bridge cost

Disadvantages

- Low level of service
- High maintenance of traffic
- Low to medium arterial continuity

Conclusion:
Recommend to be carried forward for further Evaluation

Value Engineering Alternative No. 7-Construct two new lanes as close to the existing alignment as possible, realign the proposed bypass around Millersburg, and use the existing right of way as much as possible from Paris to west of Millersburg.

Advantages

- Low right of way takes
- Low roadway construction cost
- Low direct impacts to historic properties outside Millersburg
- Medium bridge cost

Disadvantages

- Low level of service
- High maintenance of traffic
- Low to medium arterial continuity
- High indirect impacts to historic district in Millersburg

Conclusion:
Recommend to be carried forward for further Evaluation

Value Engineering Alternative No. 8 (Modified "As Proposed") - "As Proposed" except construct four lanes as required by the design year traffic rather than constructing two lanes with future four lanes.

Advantages

- Low maintenance of traffic cost/impacts
- High level of service
- High arterial continuity
- May reduce potential accidents in Millersburg
- Single impact of construction on local area
- Low direct impact on the historic district of Millersburg

Disadvantages

- High right of way takes
- High roadway construction cost
- High bridge cost
- High direct impact on historic sites outside Millersburg
- Does not utilize existing right of way
- High indirect impact on historic district of Millersburg

Conclusion:
Recommend to be carried forward for further Evaluation

VI.(c) EVALUATION MATRIX

***NOTE:** **Matrices are used to determine a preferred alternative when more than one competing Alternative to the "As Proposed" Alternative survives the advantages and disadvantages process.**

EVALUATION MATRIX

U.S. 68, BOURBON & NICHOLS COUNTIES

4- VERY GOOD 3 - GOOD 2 - FAIR 1 - POOR	R/W IMPACTS & COST	OVERALL HISTORICAL IMPACTS	LEVEL OF SERVICE	ROADWAY CONSTRUCTION COST	BRIDGE CONSTRUCTION COST	MAINTENANCE OF TRAFFIC	MILLERSBURG IMPACTS	CONSTRUCTION IMPACTS TO LOCALS	ARTERIAL CONTINUITY	SAFETY	TOTAL SCORE	RANKING
Weight / Alternative	6	7	9	7	2	4	4	2	5	7		
As Proposed	2 / 12	1 / 7	1 / 9	3 / 21	2.5 / 5	4 / 16	2.5 / 10	1 / 2	3 / 15	1 / 7	104	
VE ALT. NO 1	3 / 18	3 / 37	4 / 36	2 / 14	1 / 2	4 / 16	2.5 / 10	4 / 8	4 / 20	4 / 28	152	1
VE ALT. NO 2	3 / 18	3.5 / 24.5	2 / 18	3 / 21	4 / 8	3 / 12	4 / 16	3 / 6	2 / 10	2 / 14	147.5	3
VE ALT. NO 3	3 / 18	3 / 21	3 / 27	2.5 / 17.5	2.5 / 5	3 / 12	1 / 4	4 / 8	3 / 15	3 / 21	148.5	2
VE ALT. NO 4	2.5 / 15	3 / 21	1 / 9	4 / 28	4 / 8	2 / 8	4 / 16	1 / 2	1 / 5	1 / 7	119	
VE ALT. NO 5	2 / 12	3 / 21	1 / 9	3.5 / 24.5	2.5 / 5	2 / 8	2.5 / 10	4 / 8	4 / 20	4 / 28	145.5	
VE ALT. NO 6	4 / 24	4 / 28	1 / 9	4 / 28	4 / 8	1 / 4	4 / 16	1 / 2	1 / 5	1 / 7	131	
VE ALT. NO 7	3.5 / 21	3.5 / 24.5	1 / 9	3.5 / 24.5	2.5 / 5	1 / 4	2.5 / 10	1 / 2	2 / 10	1 / 7	117	
VE ALT. NO 8 As Prop.Mod.	2 / 12	1 / 7	4 / 36	1 / 7	1 / 2	4 / 16	2.5 / 10	4 / 8	4 / 20	4 / 28	146	

VII. DEVELOPMENT PHASE

VII.(a) AS PROPOSED

"As Proposed"

The "As Proposed" alternative consists of constructing two new lanes on a new alignment to the west of the existing alignment. This alignment extends from the Paris bypass to west of Hinkston Creek (west of Millersburg) and then bypasses Millersburg to the north and continues east to the end of the project at the intersection with KY 32. The "As Proposed" alternative will be constructed as a two lane initial and a future four lane facility. The "As Proposed" utilizes the existing right of way from the beginning of the project to west of Millersburg then the alignment is to the left of the existing KY 68 and the existing right of way is abandoned. The typical section is two 3.6 meter lanes, with two 3.0 meter shoulders. A new bridge over Hinkston Creek will be required on the Millersburg bypass.

The "As Proposed" alternative is classified as a primary arterial on the National Highway System. As shown in the attached table 11-6, Guide for Selection of Design Levels of Service, AASHTO Geometric Design Manual, the appropriate level of service for a rural arterial in rolling terrain is LOS B. Therefore, this level of service should be provided for this project.

The "As Proposed" alternative provides the LOS and capacities as follows:

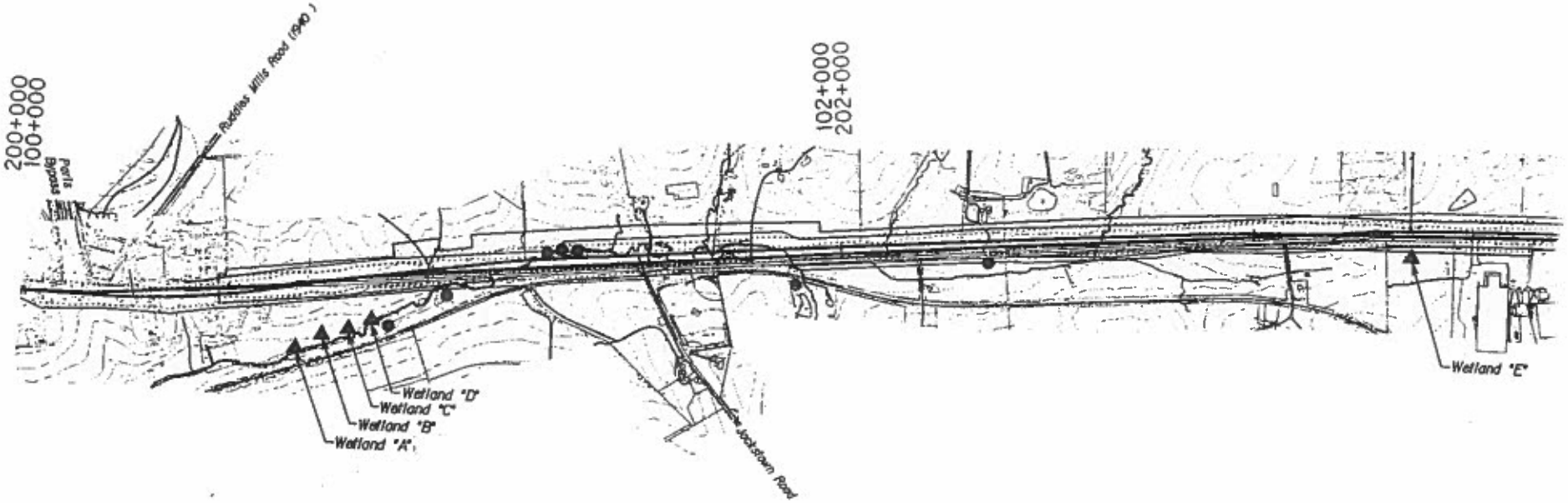
Segment	Actual 2021 DHV	LOS (Two Lane Hwy.)
3	1,579	E
5(Millersburg ByPass)	1,075	D
7	761	C
6	1,277	D

The cost for the different "As Proposed" Alternatives have been adjusted for use in the Value Engineering Analysis as follows:

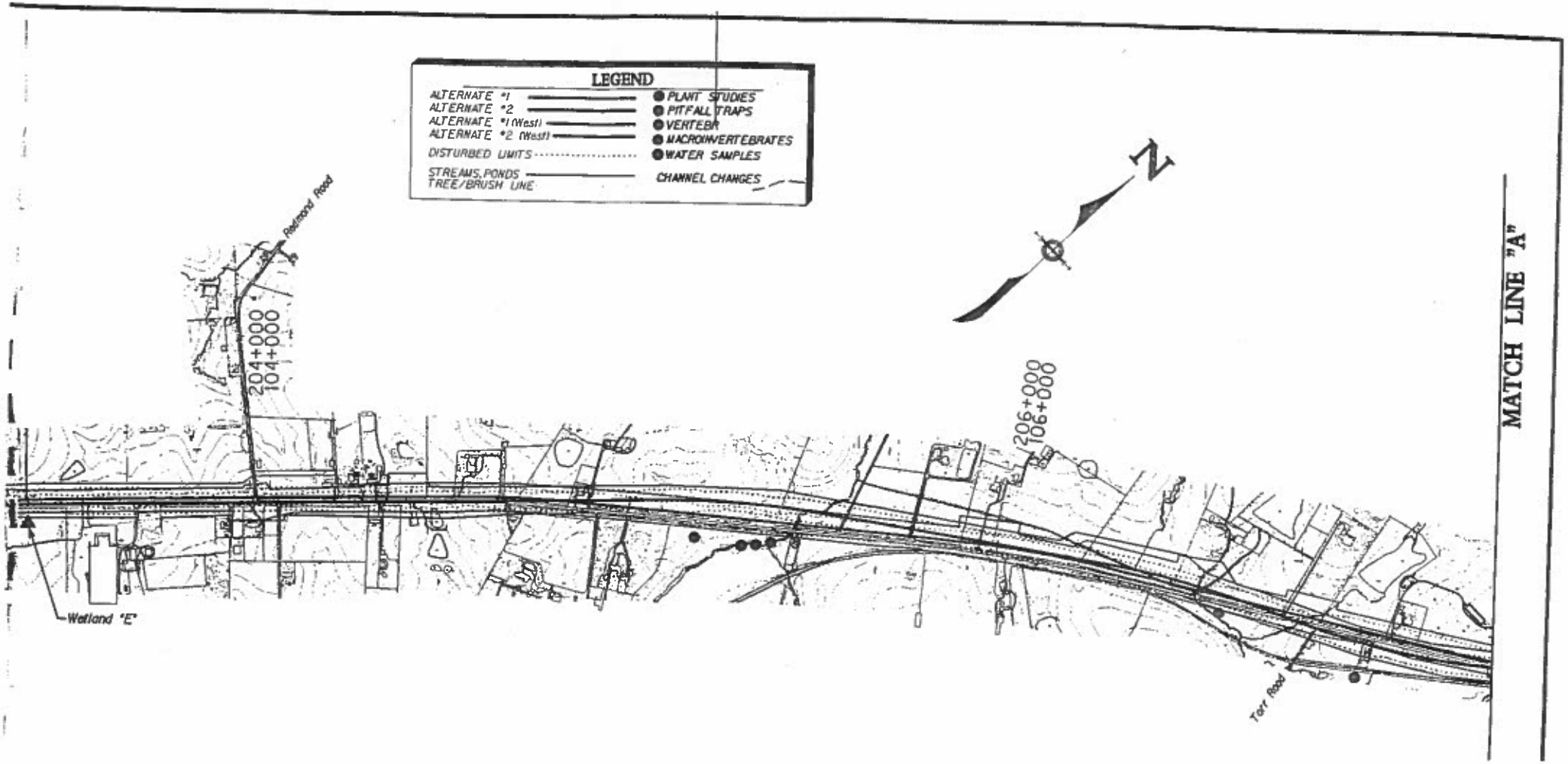
"As Proposed" (2 land/4 lane Future) = $35,889,876
"As Proposed" (2 lane const. w/ultimate 4 lane buildout = $48,079,299
"As Proposed" (VE-8)(4 lane const.) = $40,681,800

"AS PROPOSED", AT THE TIME OF ULTIMATE BUILDOUT
COST ESTIMATE

DESCRIPTION	UNIT COST	PROP'D QTY.	2 LANE, 4 LANE ULTIMATE PROP'D COST	PROP'D QTY.	ULTIMATE BUILDOUT PROP'D COST
COST OF ORIGINAL 2 LANES	LS	1	$26,284,299		$26,284,299
R/W COST			$ 8,031,000		$ 8,031,000
HISTORICAL IMPACT	LS	1	$1,036,500	1	$ 1,036,500
COST OF ADDITIONAL 2 LANES					$11,928,300
Use 6.7% increase in cost of project for future cost of future two lanes 11,928,300 x .067 (10 year future)					$ 799,200
TOTAL			$35,889,876		$48,079,299


200+000
100+000
Ruddles Mills Road (940)
Perth Bypass
102+000
202+000
Wetland "D"
Wetland "C"
Wetland "B"
Wetland "A"
Jocksdown Road
Wetland "E"

AS PROPOSED

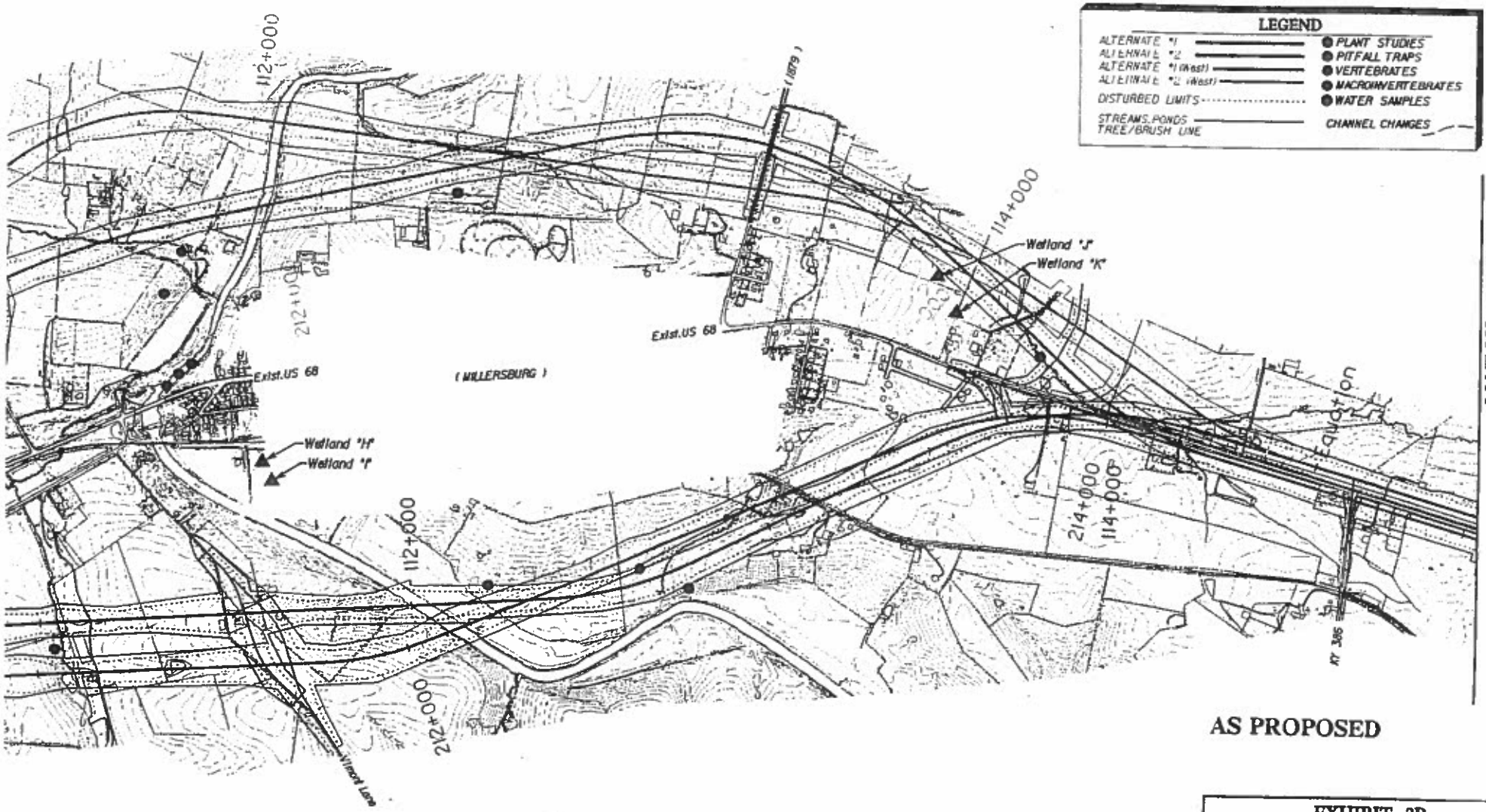


AS PROPOSED

METRIC
Scale= 1:10,000
Contour Interval = 2.5m

EXHIBIT 2A
BOURBON / NICHOLAS COUNTY
US 68 (Paris – Maysville Road)
Item No. 7 – 310.00
PROJECT ALTERNATES & ECOLOGICAL RESOURCES

AS PROPOSED
N
MATCH LINE "A"
208+000
209+000
109+000
210+000
110+000

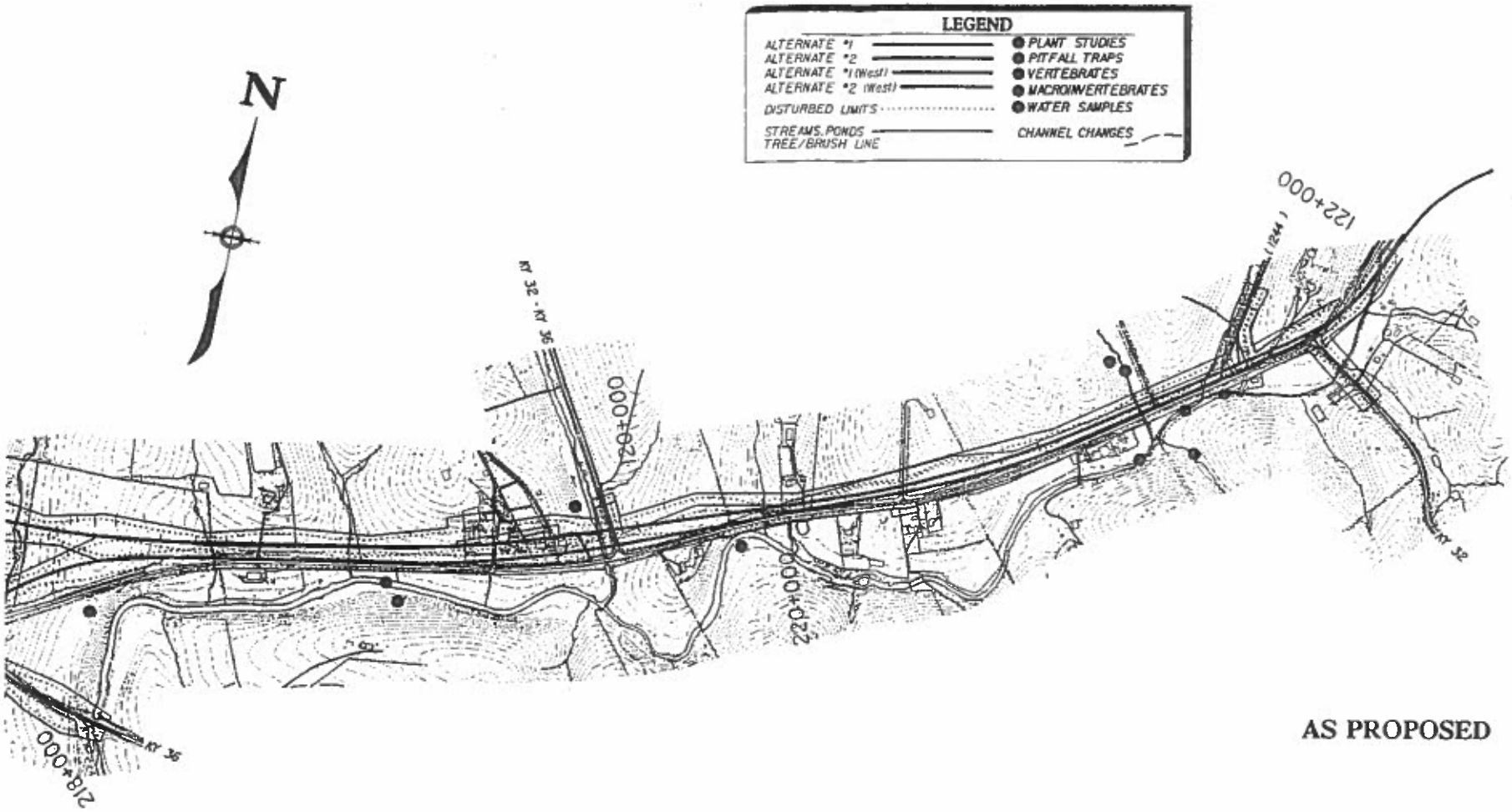


AS PROPOSED

METRIC
Scale- 1:10,000
Contour Interval - 2.5m

EXHIBIT 2B
BOURBON / NICHOLAS COUNTY
US 68 (Paris – Maysville Road)
Item No. 7 – 310.00
PROJECT ALTERNATES & ECOLOGICAL RESOURCES

AS PROPOSED
MATCH LINE "B"
Walnut Grove Road
218+000
216+000
214+000
212+000



AS PROPOSED

METRIC
Scale= 1:10,000
Contour Interval = 2.5m

EXHIBIT 2C
BOURBON / NICHOLAS COUNTY
US 68 (Paris – Maysville Road)
Item No. 7 – 310.00
PROJECT ALTERNATES & ECOLOGICAL RESOURCES

VII.(b) V.E. ALTERNATIVE NO. 1

Value Engineering Alternative No. 1

Description

This alternative follows the profile and horizontal alignment of the existing highway except where profile modifications are required to provide a minimum safe stopping sight distance of 205m for a design speed of 100 km/h and where minor alignment shifts may be warranted to reduce possible adverse impacts at historical site locations.

Typical section

The typical section as shown in the drawings provides a four lane divided highway with an 9.8m depressed median, 1.2m left shoulders, and 3.0m right shoulders, and 3.6m lane widths. At certain locations the median may be narrowed to reduce historical property impacts. From the US 68/KY 36 intersection to the end of the project, a two lane roadway is proposed.

Horizontal Alignment

From the Paris bypass to the westerly approach to Millersburg, the existing horizontal alignment is satisfactory for a design speed of 60 mph. The proposed four lane northerly bypass of Millersburg is on the revised alignment of the present "As Proposed" alignment.

From Millersburg to the end of the project at the intersection with KY 32, the horizontal alignment is also acceptable for a design speed of 60 mph with the exception of the 10° horizontal curve at the intersection with KY 36 which would be eliminated with the proposed revised design for this intersection.

As shown on the drawings, a revised alignment for the westerly end of the bypass has been developed which reduces the undesirable bisecting of farm land that would occur with the proposed alignment. Although the revised alignment will slightly increase the length of the twin bypass structures over Hinkston Creek, there will be a reduction in required ROW.

Profile

The profile of the existing roadway has been plotted on the profile sheets in this section. With certain exceptions, the existing roadway profile would be maintained where feasible to do so. For the section of the project from the Paris bypass to Millersburg, the maximum existing grade is approximately 3.6%. A profile revision is proposed in the vicinity of the historically designated Davenport house, (Sta. 209 + 000), to reduce the amount of additional ROW and to avoid an exceptionally steep driveway grade. As shown in the cross section, the profile of the existing highway would be raised by constructing a retaining wall approximately 3m high between the highway and railroad thereby decreasing the width of the required cut section with a lower profile.

From Millersburg easterly to the end of the project, the profile of the existing highway would be maintained to the extent feasible. However, there are locations where existing grades in the range of 4% to 5% will require additional excavation to obtain a stopping sight distance of 205m for a design speed of 100km/h. The most critical grade occurs at the US 68/KY 36 (4.92%) which will be improved with the revised horizontal alignment through the intersection.

Level of Traffic Service

The four lane typical section will operate at LOS A and will also provide additional capacity for future traffic growth. For the two lane section from the US 68/KY 36 intersection to the end of the project, traffic will operate between an LOS B and LOS C.

Construction Considerations

Consideration should be given to milling the asphalt concrete of the existing roadway and stockpiling the material for recycling and use as an asphalt base for the new roadway. This should result in a cost savings and also provide a means of smoothing the existing roadway profile.

Maintenance of Traffic

Traffic would be maintained on the existing highway while the new westbound roadway of the four lane facility is being constructed. Two way traffic would then be diverted to the completed westbound roadway while the eastbound roadway is being constructed. For the two lane section from the US 68/KY 36 intersection to the end of the project, traffic could be detoured over local roads while construction is underway.

Cost Estimate

The following is the estimated cost of V.E. Alternative No. 1 as compared to the "As Proposed" design modified for a four lane divided roadway.

VALUE ENGINEERING ALTERNATIVE NO. 1
COST COMPARISON

DESCRIPTION	UNIT COST	PROP'D QTY.	4 LANE PROP'D COST	V.E. QTY.	V.E. COST
CLEAR & GRUBBING	LS	1	$ 780,400	1	$ 680,000
R/W COST	LS	1	$8,031,000	2	$6,860,000
BRIDGE	$635,000/Br	2	$1,270,000	2	$1,270,000
HISTORICAL IMPACT	LS	1	$1,036,500	1	$ 488,100
CULVERT	LS	1	$2,275,300	1	$2,275,000
CROSS DRAINS	LS	1	$ 695,000	1	$ 695,000
ASPHALT (SURF)	$33/m-ton	48,900	$1,612,400	29,942	$ 988,100
ASPHALT (BASE)	$30/m-ton	284,200	$8,525,800	265,200	$7,954,800
DGA	$15/m-ton	520,700	$7,811,000	485,800	$7,287,200
EXCAVATION	$3.75/$m^3$	1,942,100	$7,282,800	1,900,000	$7,125,000
STRIPING	$1.50/M	138,400	$ 207,600	138,400	$ 207,600
GUARD RAIL	$30/M	13,200	$ 396,000	14,400	$ 432,000
STAKING	LS	1	$ 98,000	1	$ 98,000
MOT	LS	1	$ 660,000	1	$ 700,000
TOTAL			$40,681,800		$37,506,300

Possible Savings $ 3,175,500

Reduce VE-1 Cost to Reflect not Surfacing Existing Rdwy

24 x 73,477.7 = 1,763,464.8 Ft^2 ÷ 9 = 195,940.54 yd^2

195,940.54 y^2 x 110 #/yd^2/inch x 1.6 = 34,485,535 #

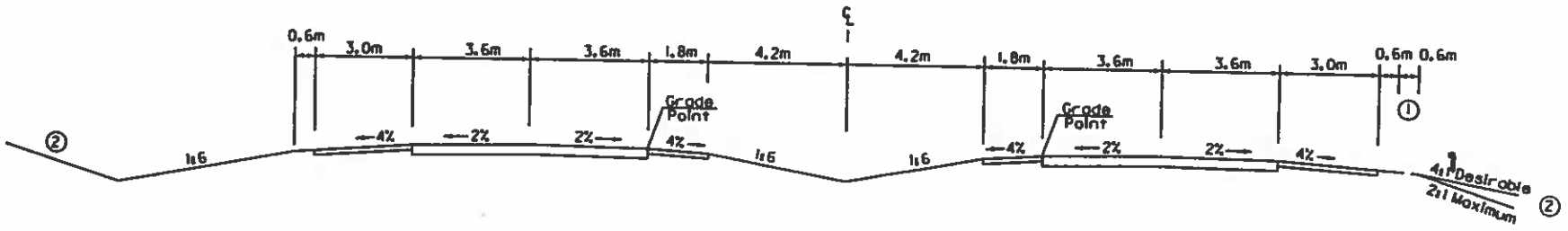
34,485,535 # / 2202.48 = 15,657.59 m-ton

15,657.59 m-ton x $33/m-ton = $516,700

45,600
- 15,658
29,942 x $33 = 988,086

TYPICAL SECTION

U.S. 68 (PARIS BYPASS-KY. 36)
WITH 12.0 m DEPRESSED MEDIAN



NORMAL SECTION

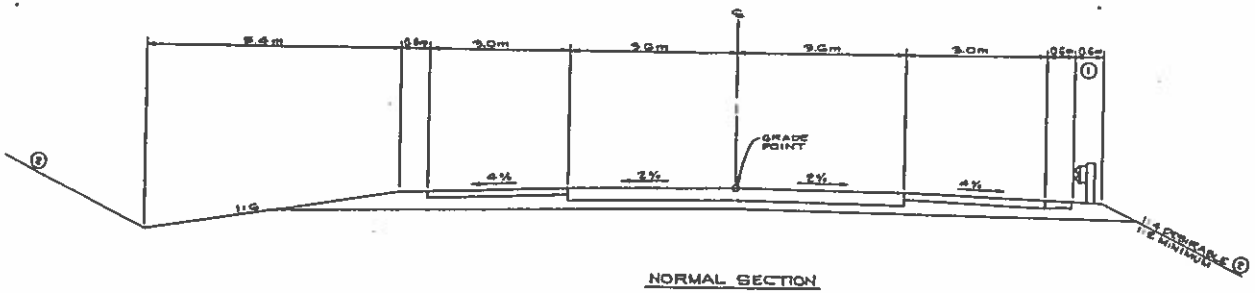
① SHOULDER SHALL BE WIDENED 0.6 METER WHERE GUARDRAIL IS TO BE INSTALLED

② SEE CROSS-SECTIONS FOR SLOPES OUTSIDE LIMITS OF THE SHOULDER

VALUE ENGINEERING
ALTERNATIVE NO. 1

TYPICAL SECTIONS

U.S. 68 (KY. 36 - KY. 32)
KY. 36



NORMAL SECTION

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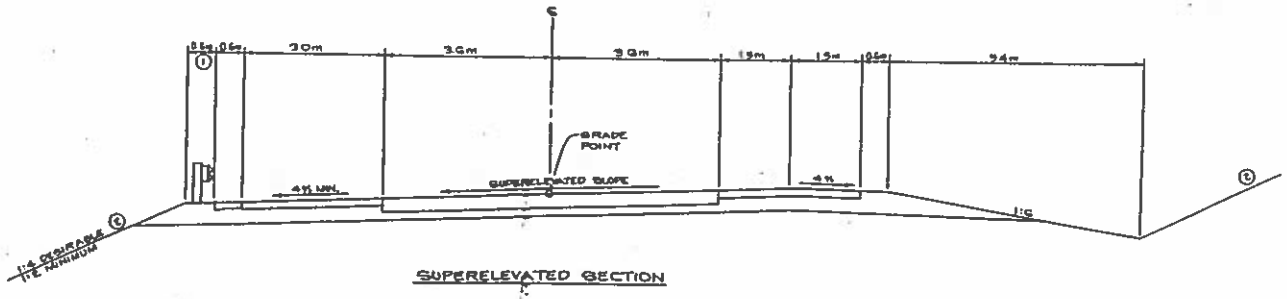
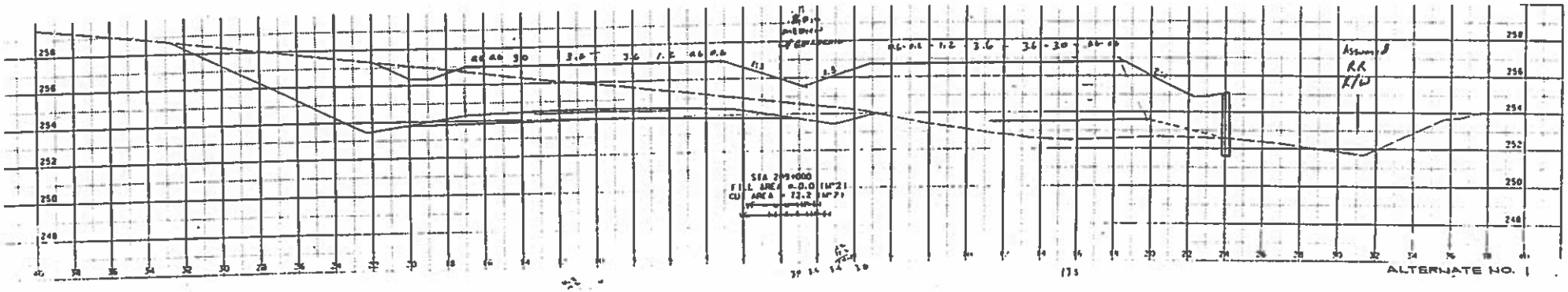
② SEE CROSS-SECTIONS FOR SLOPES OUTSIDE THE LIMITS OF THE SHOULDER.



SUPERELEVATED SECTION

VALUE ENGINEERING
ALTERNATIVE NO. 1

TYPICAL SECTIONS

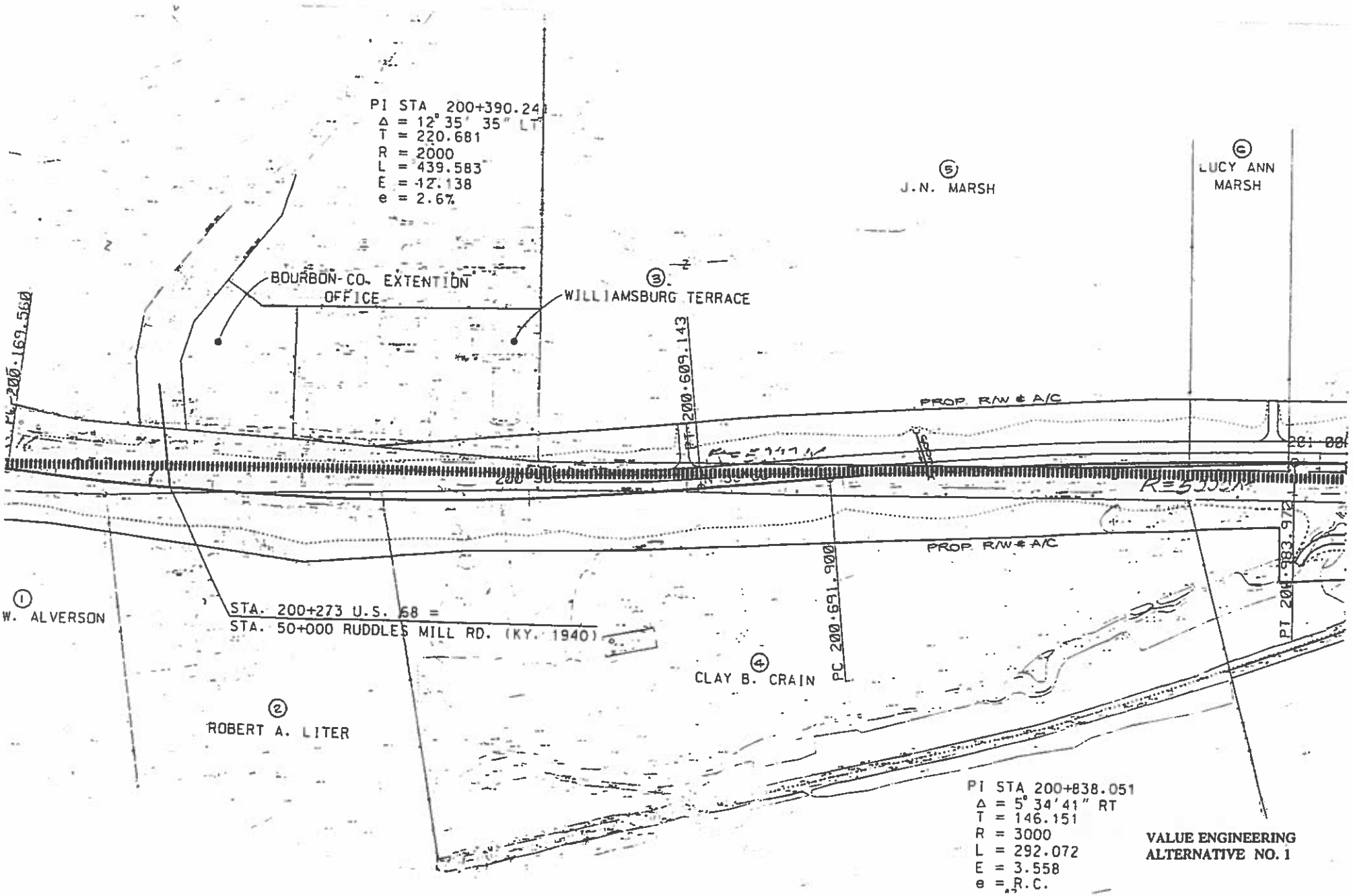


Revised Cross Section

Sta 209 + 000

Davenport Historical House Site

VALUE ENGINEERING
ALTERNATIVE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R = 2000
L = 439.583
E = 12.138
e = 2.6%
BOURBON-CO. EXTENTION OFFICE
WILLIAMSBURG TERRACE
J.N. MARSH
LUCY ANN MARSH
PT 200+609.143
PROP R/W & A/C
PROP R/W & A/C
W. ALVERSON
STA. 200+273 U.S. 68 =
STA. 50+000 RUDDLES MILL RD. (KY. 1940)
CLAY B. CRAIN
PC 200+691.900
ROBERT A. LITER
PI STA 200+838.051
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T = 146.151
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e = R.C.
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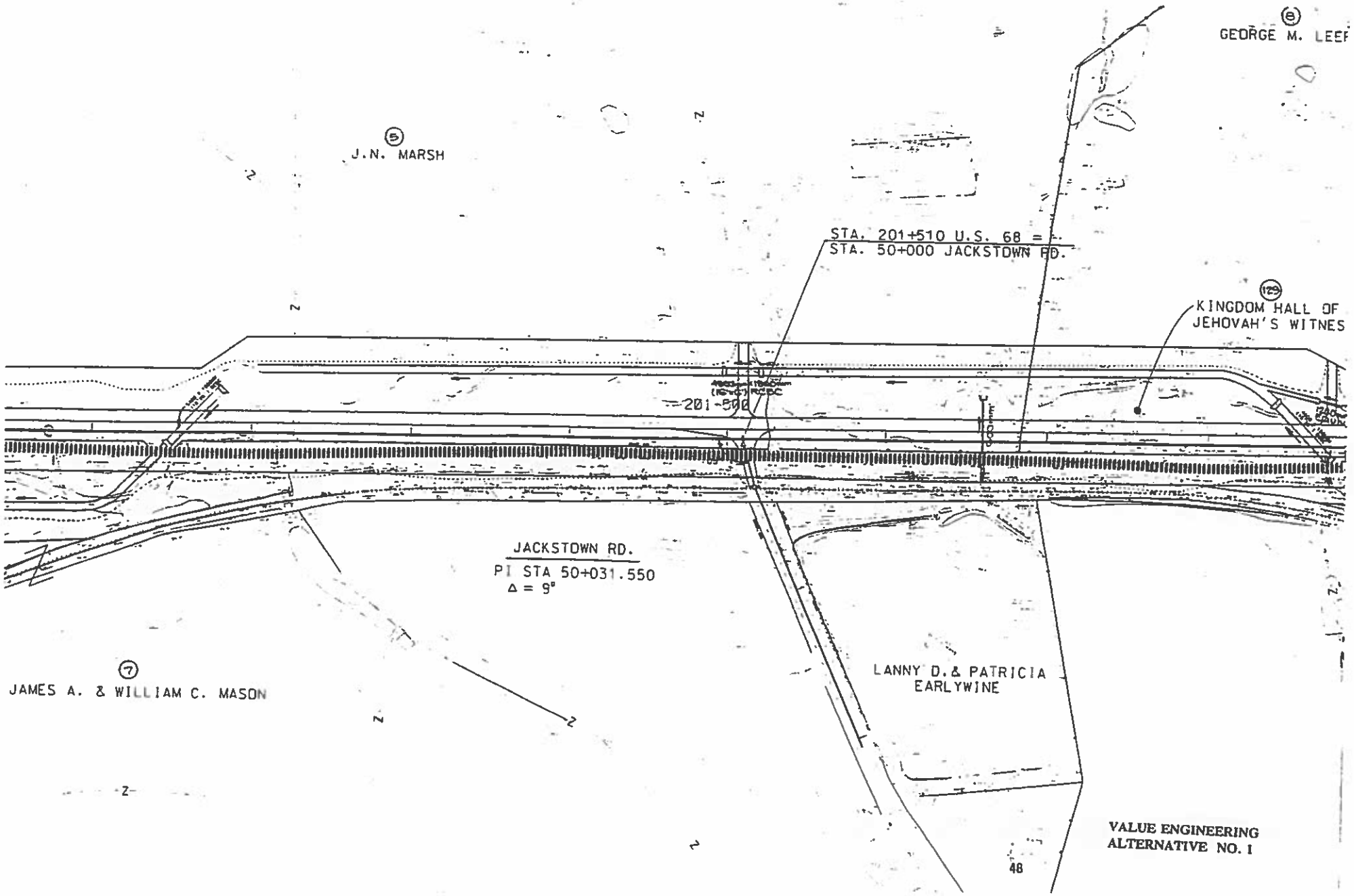
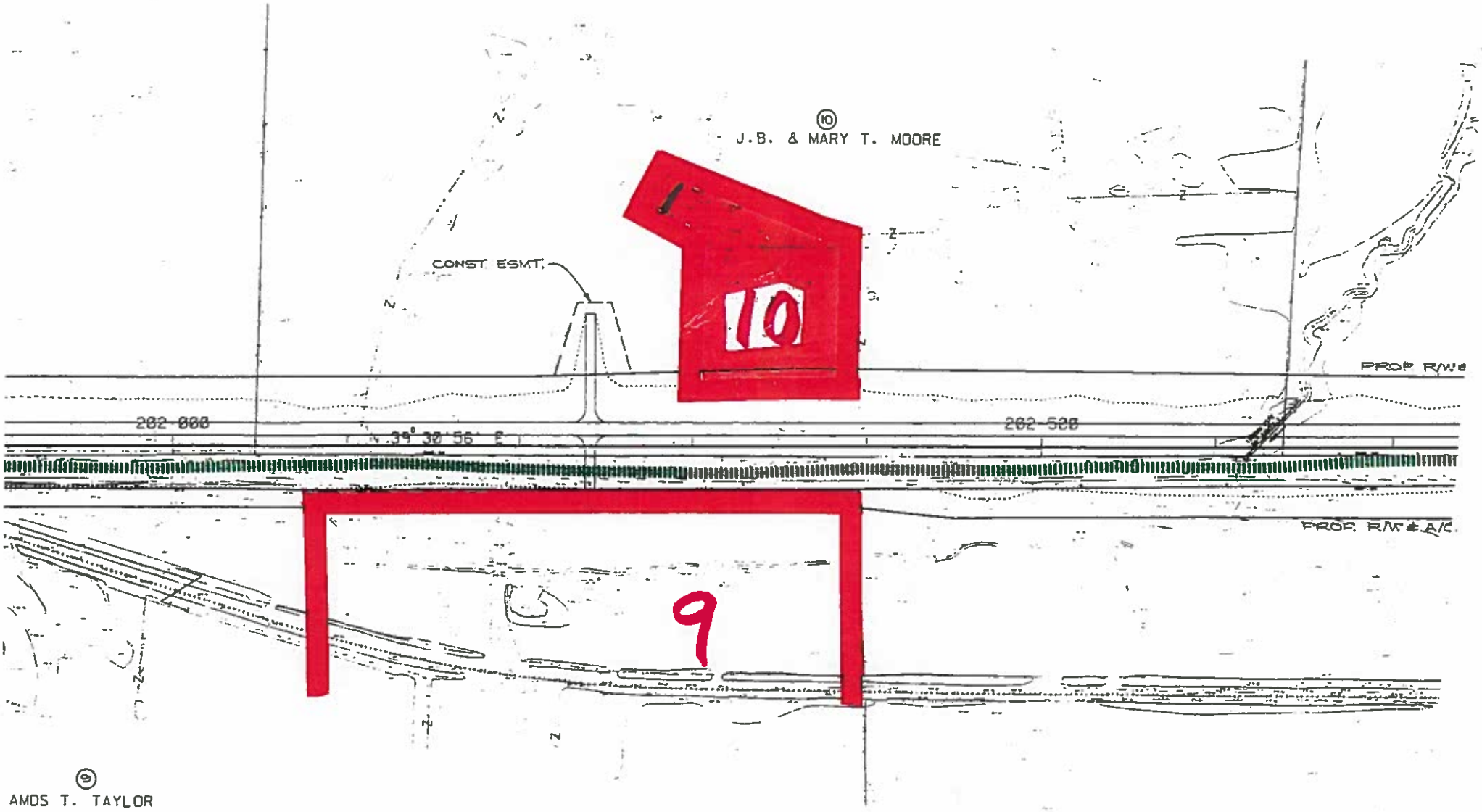
ALTERNATIVE NO. 1


⑥
GEORGE M. LEEF
⑤
J.N. MARSH
STA. 201+510 U.S. 68 =
STA. 50+000 JACKSTOWN RD.
(129)
KINGDOM HALL OF
JEHOVAH'S WITNES
201-500
JACKSTOWN RD.
PI STA 50+031.550
Δ = 9°
⑦
JAMES A. & WILLIAM C. MASON
LANNY D.& PATRICIA
EARLYWINE
VALUE ENGINEERING
ALTERNATIVE NO. 1
48



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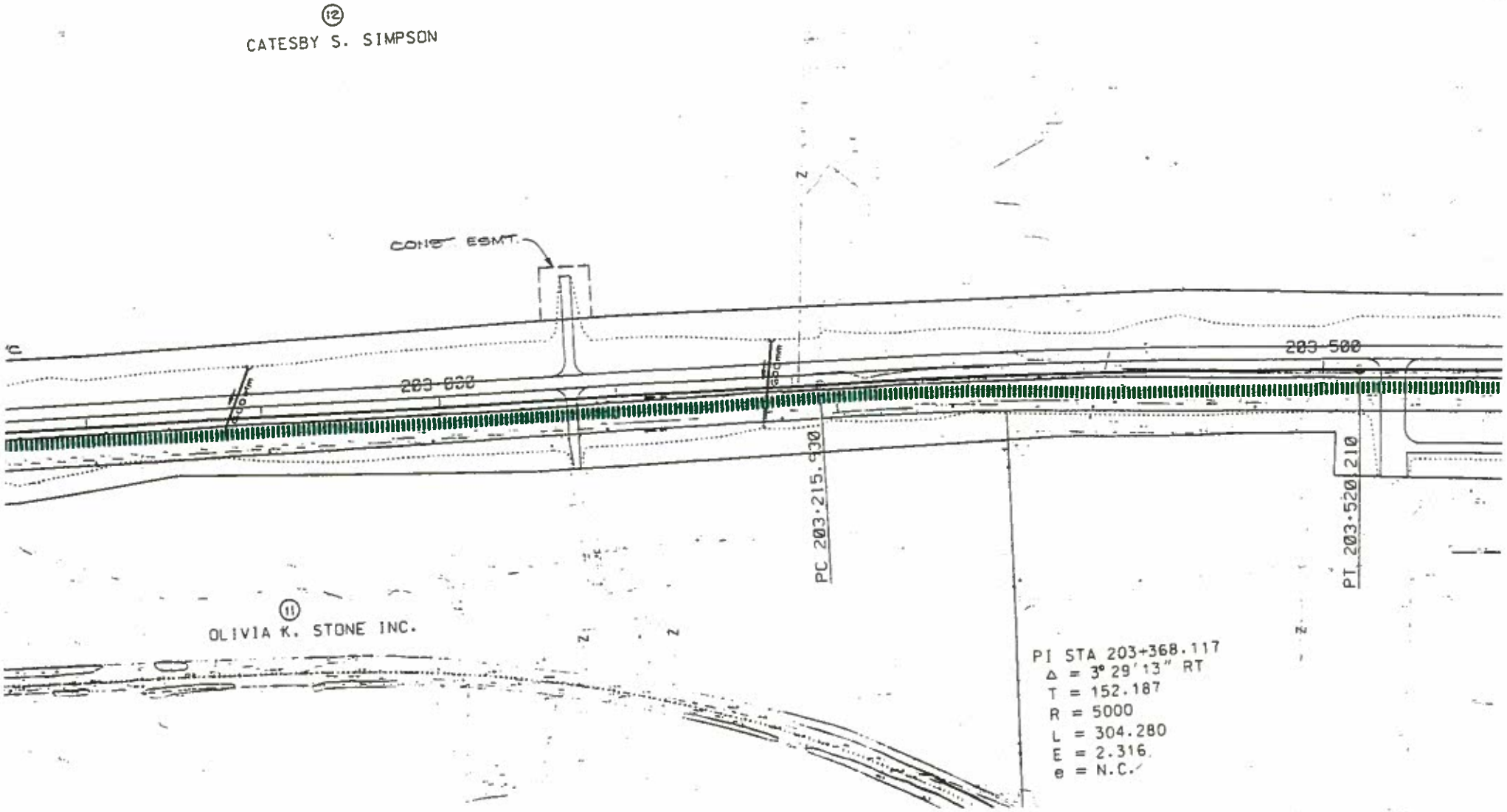

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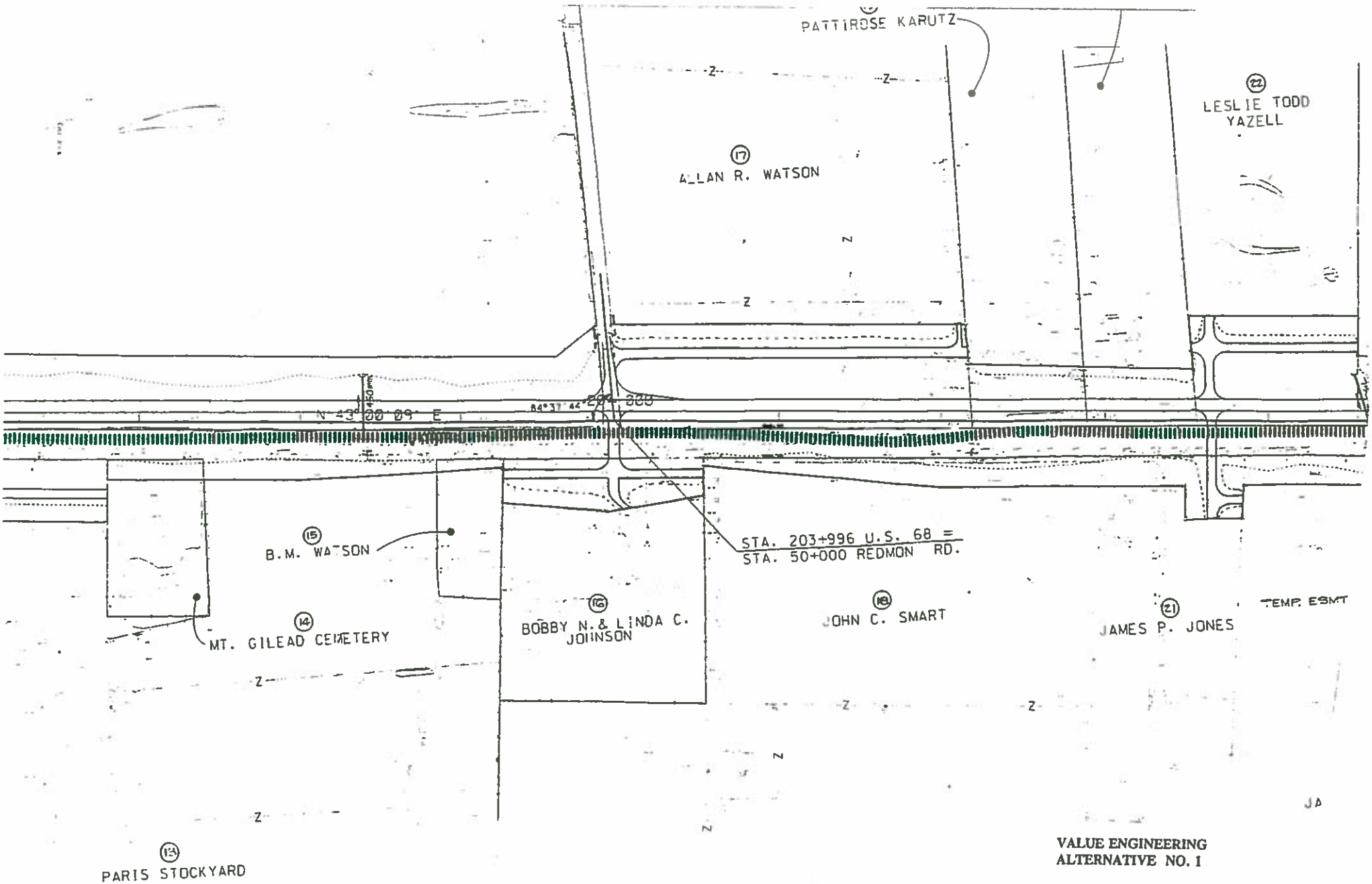

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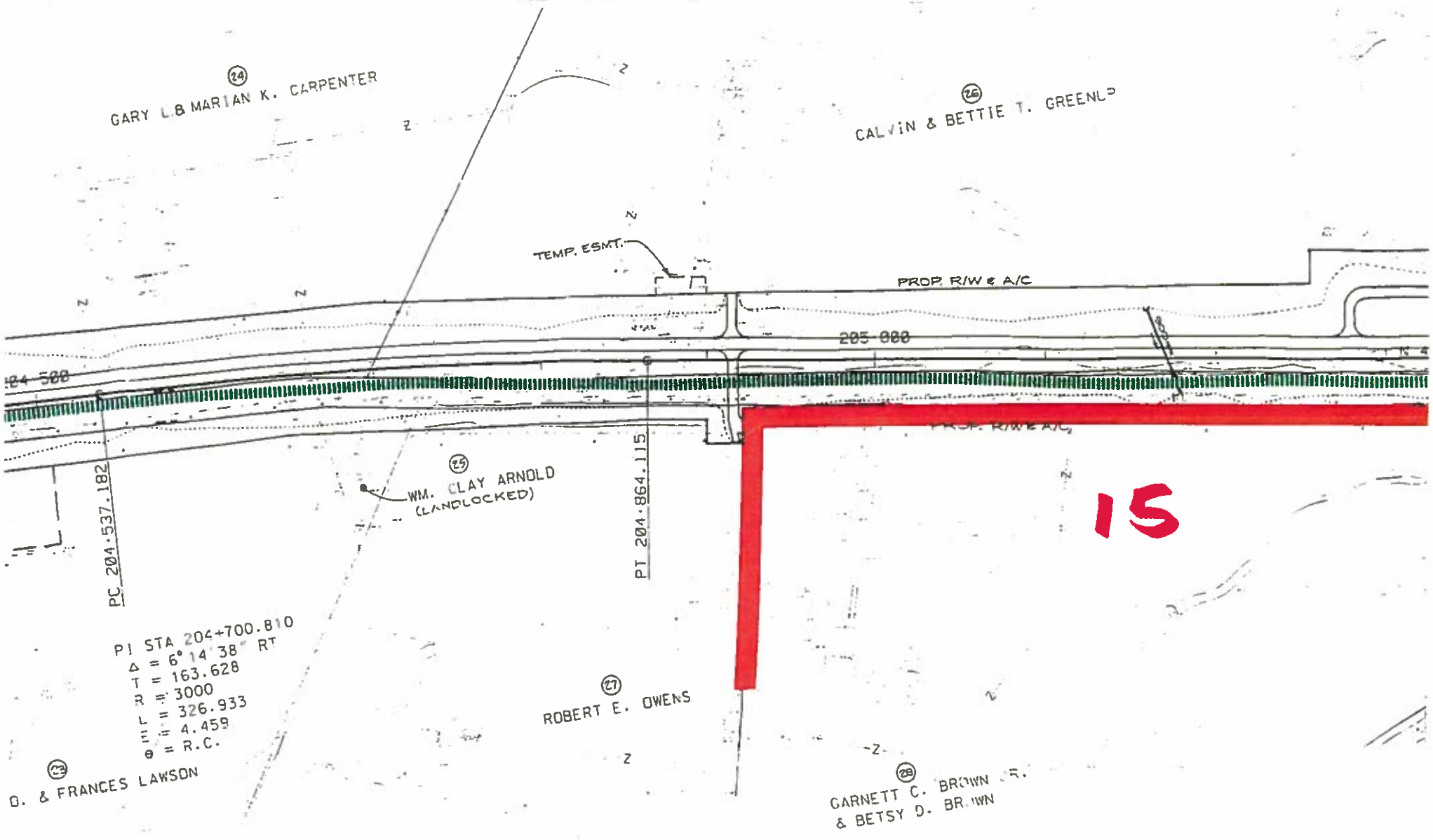

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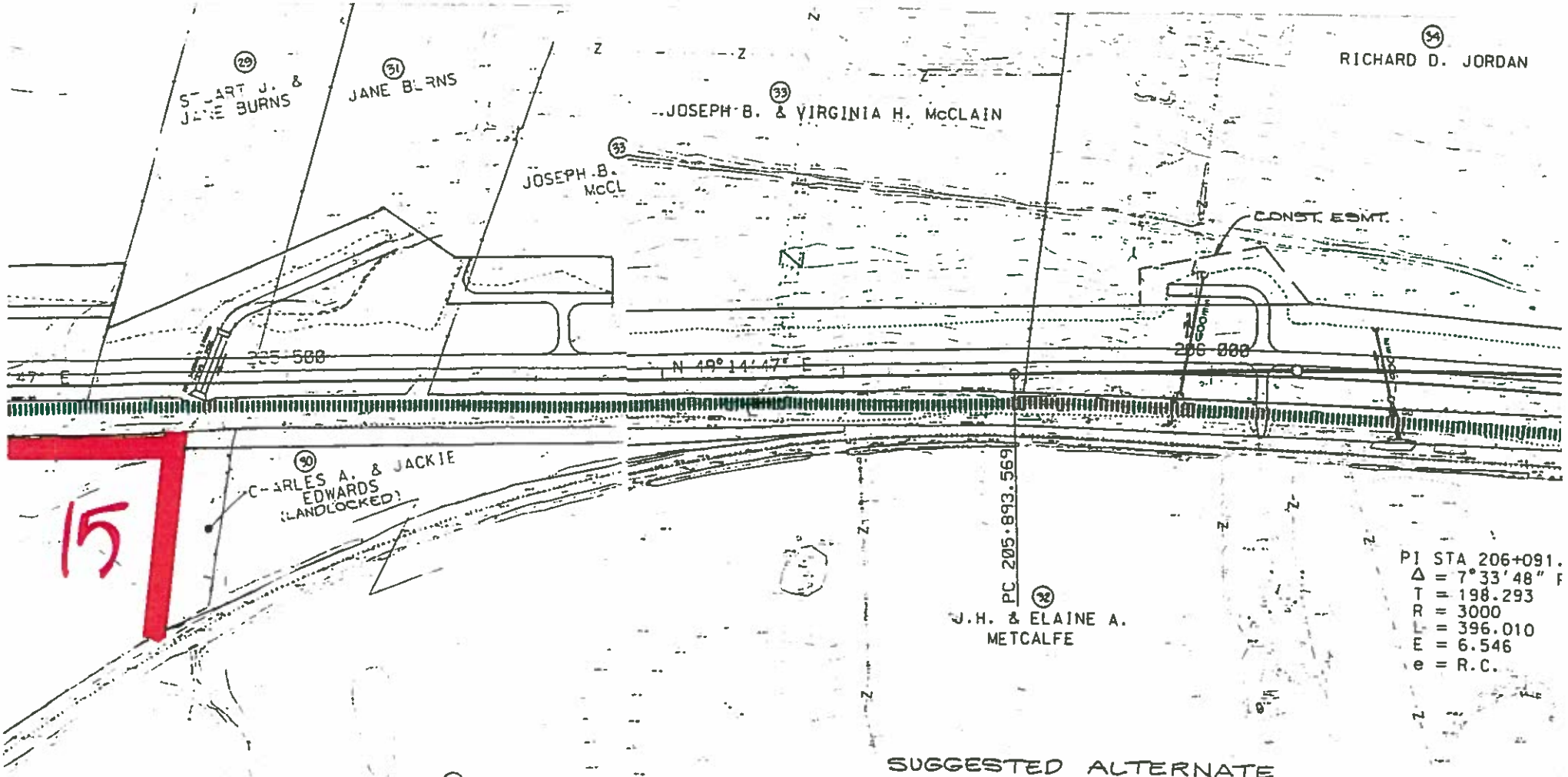

(32)
J.H. & ELAINE A. METCALFE
SUGGESTED ALTERNATE
U.S. 68
BOURBON CO.
ALTERNATE 1
SHEET 1

SCALE 1:2000

SUGGESTED ALTERNATE
U.S. 68
BOURBON CO.
ALTERNATE 1
SHEET 2

SCALE 1:2000

VALUE ENGINEERING
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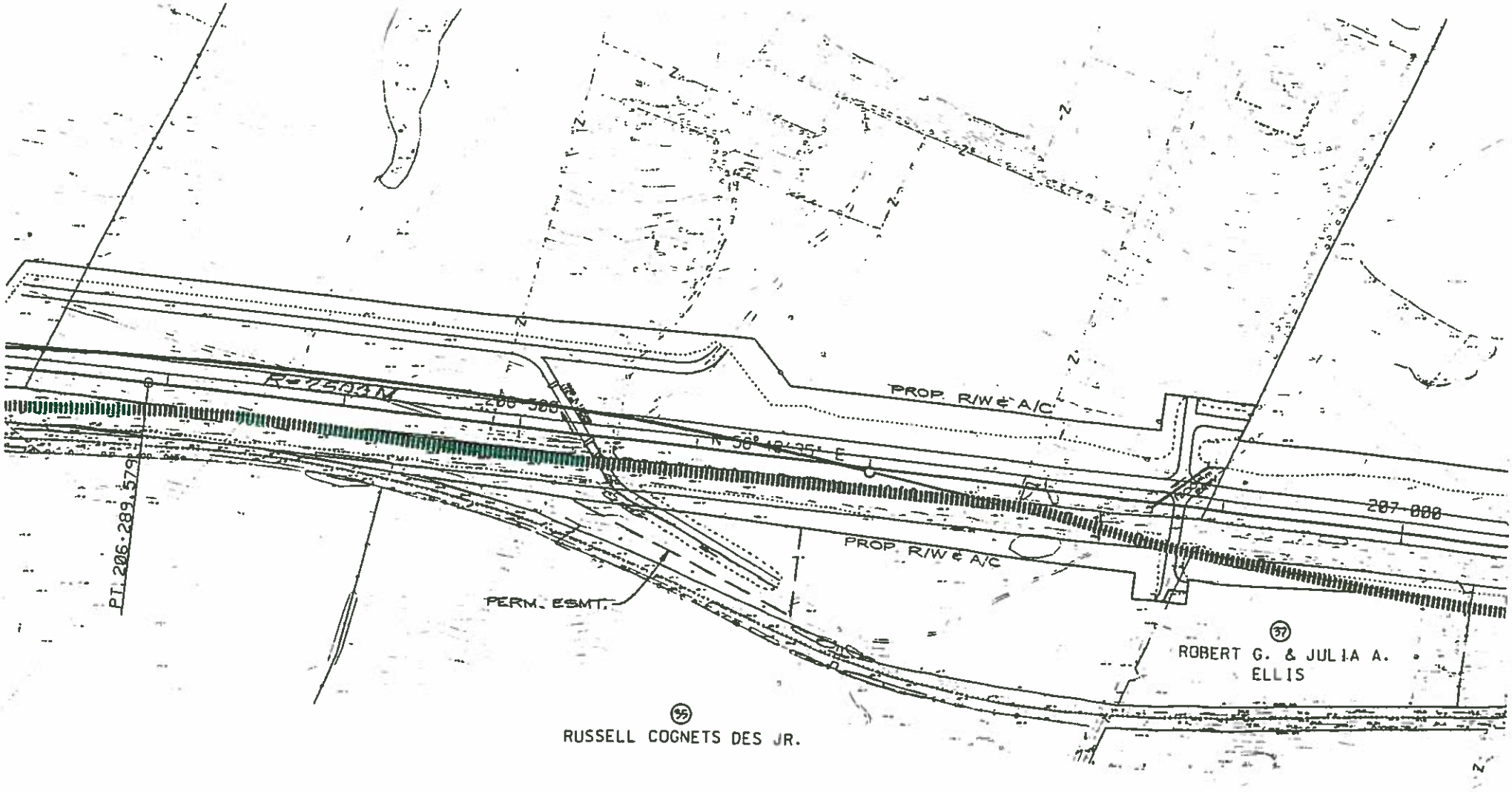

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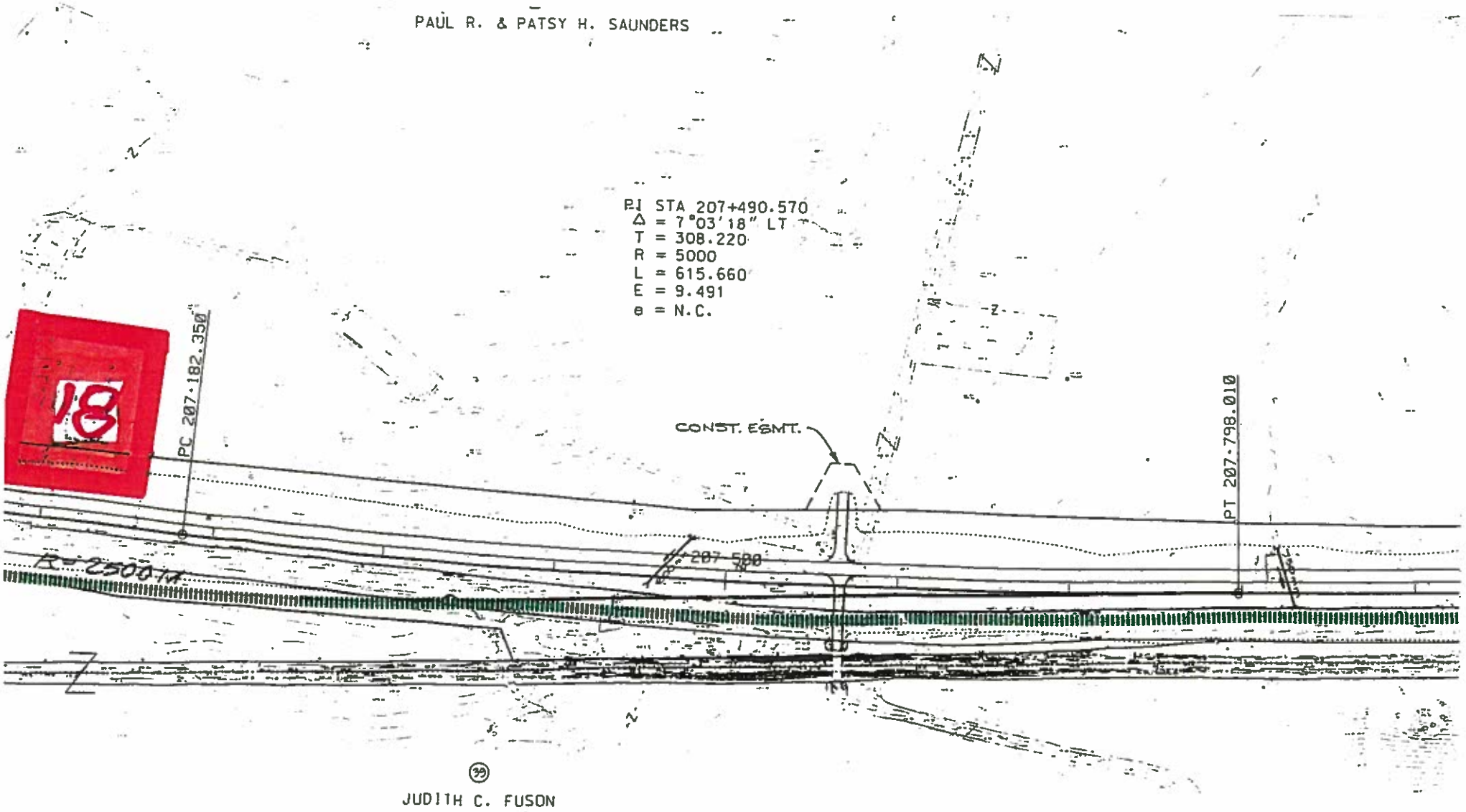

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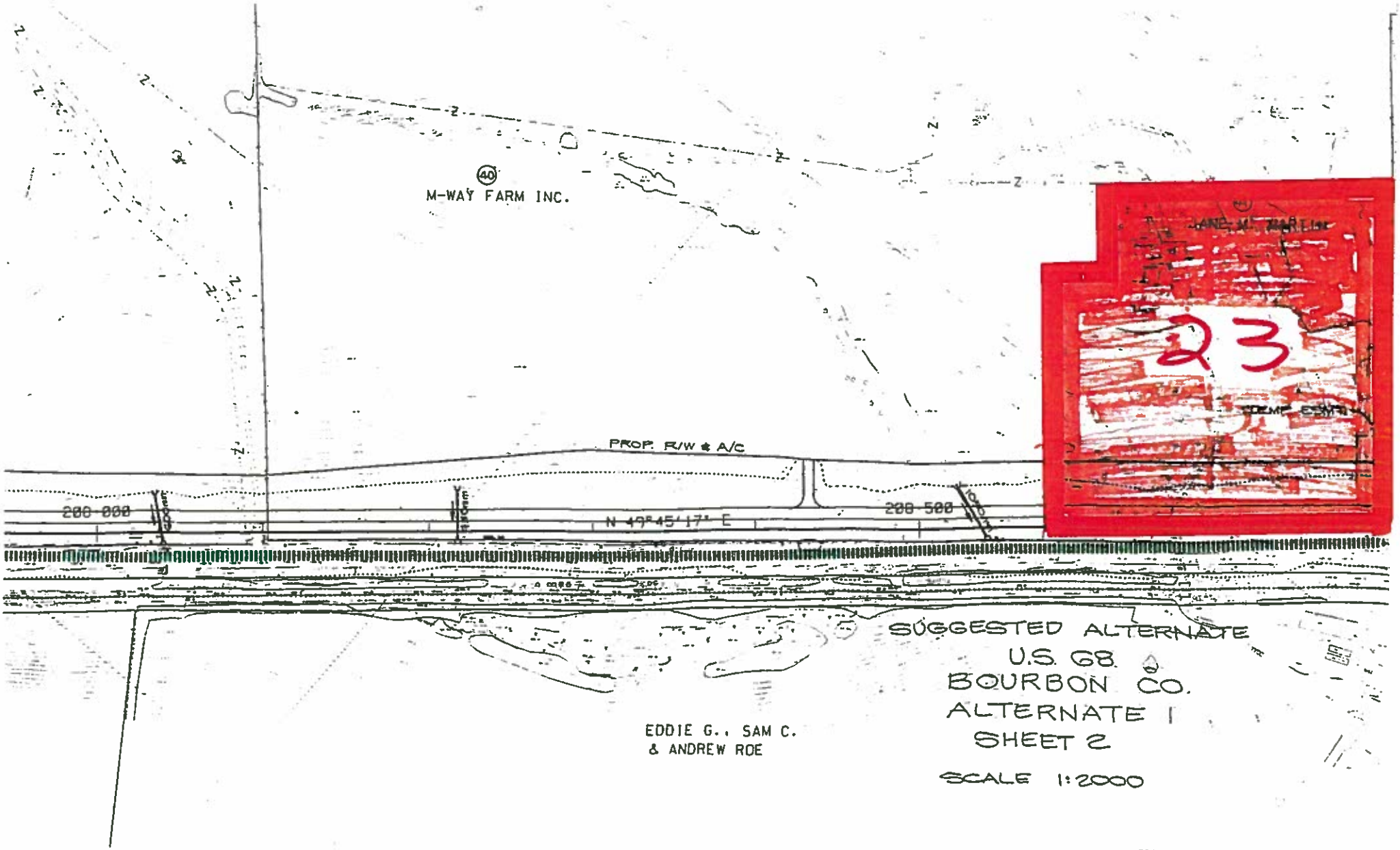

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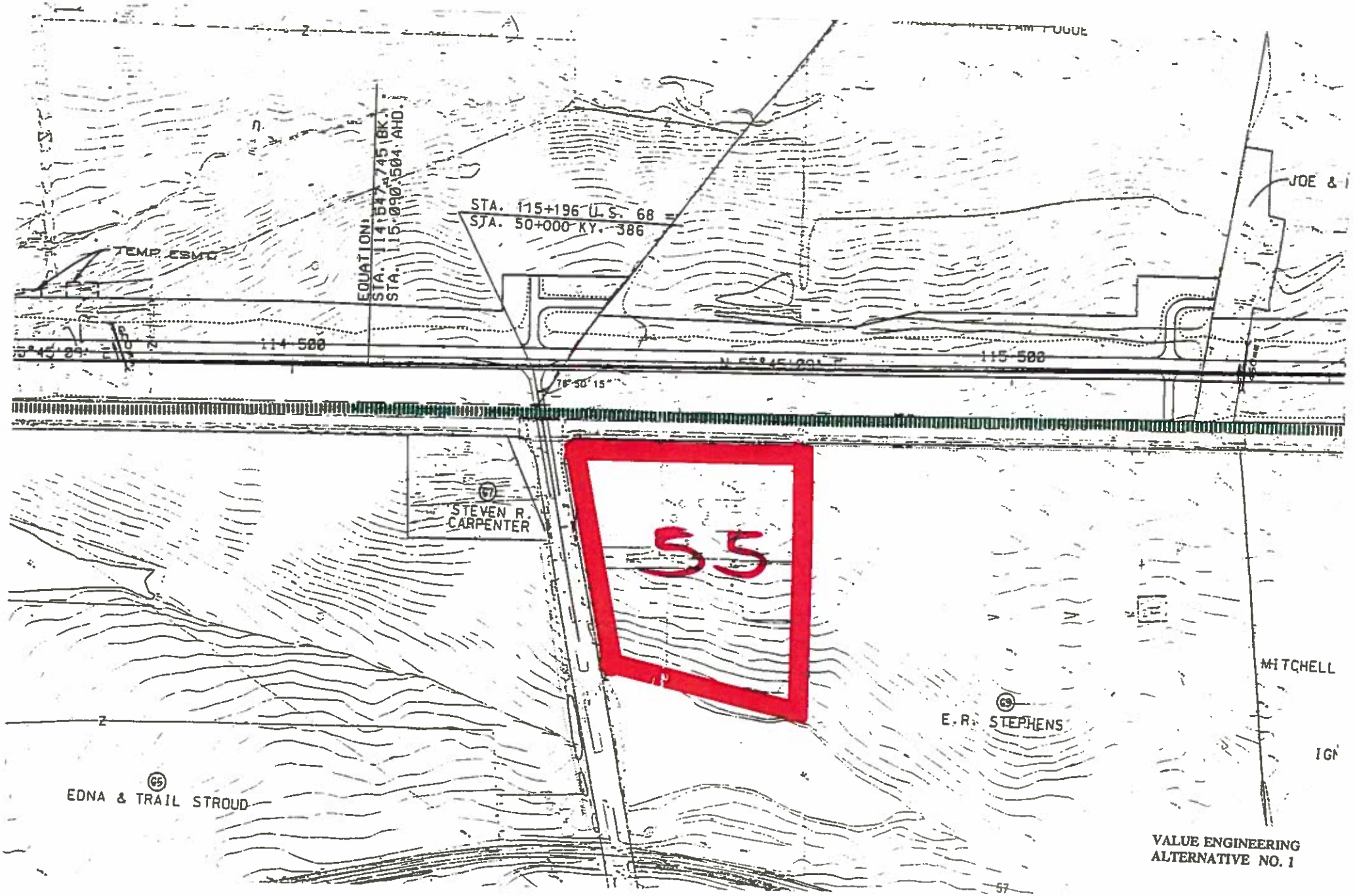
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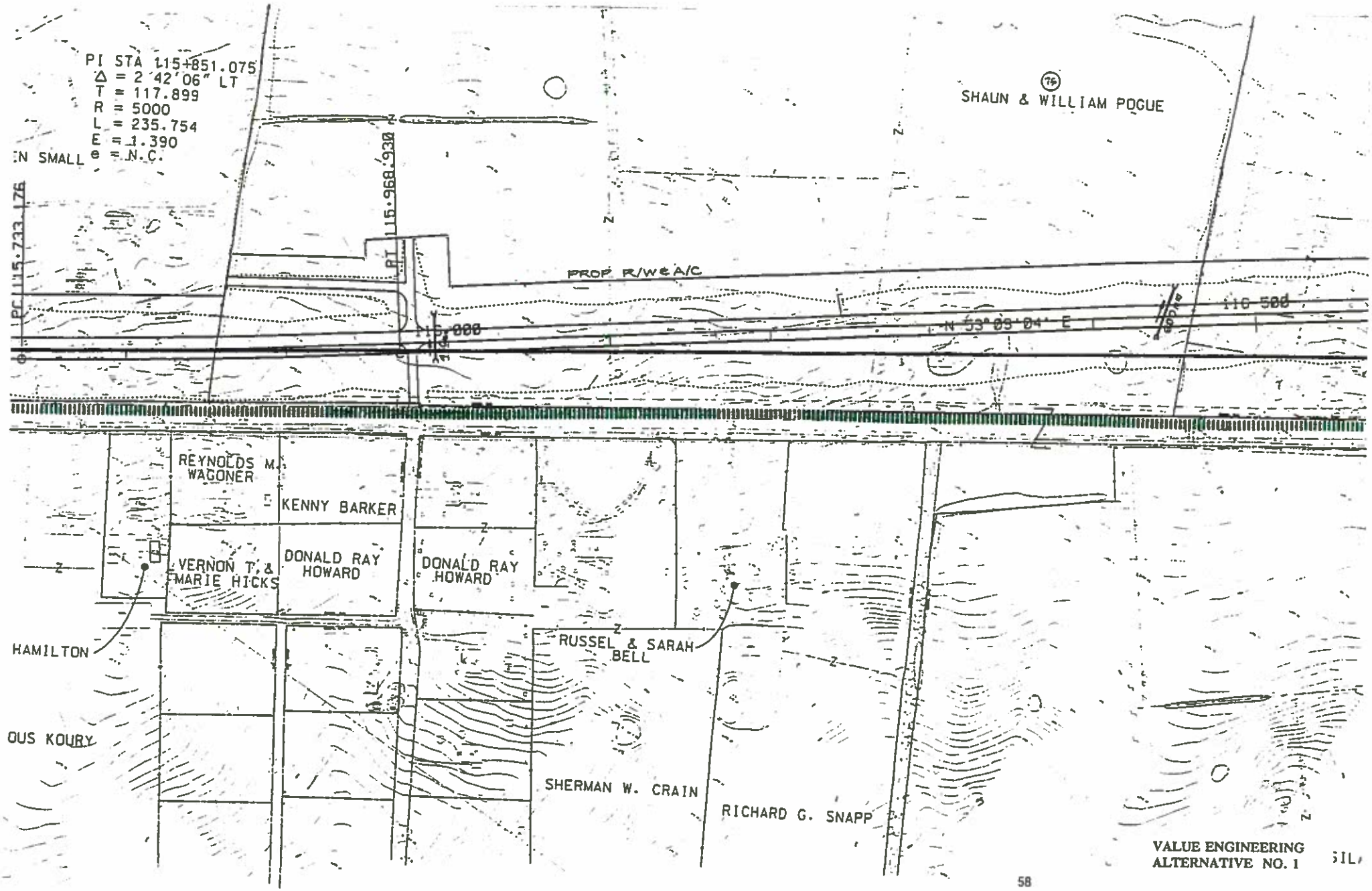
STA. 115+090.504 AHD.
STA. 115+196 U.S. 68 =
STA. 50+000 KY. 386
TEMP. ESMT.
114.500
115.500
78°50'15"
S5
STEVEN R. CARPENTER
E. R. STEPHENS
EDNA & TRAIL STROUD
MITCHELL
JOE &
VALUE ENGINEERING
ALTERNATIVE NO. 1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Δ = 2°42'06" LT
T = 117.899
R = 5000
L = 235.754
E = 1.390
e = N.C.
N SMALL
PC 115+733.176
PT 116+968.930
SHAUN & WILLIAM POGUE
PROP R/W & A/C
116+500
116+000
N 53°09'04" E
REYNOLDS M. WAGONER
KENNY BARKER
VERNON T. & MARIE HICKS
DONALD RAY HOWARD
DONALD RAY HOWARD
HAMILTON
RUSSEL & SARAH BELL
OUS KOURY
SHERMAN W. CRAIN
RICHARD G. SNAPP
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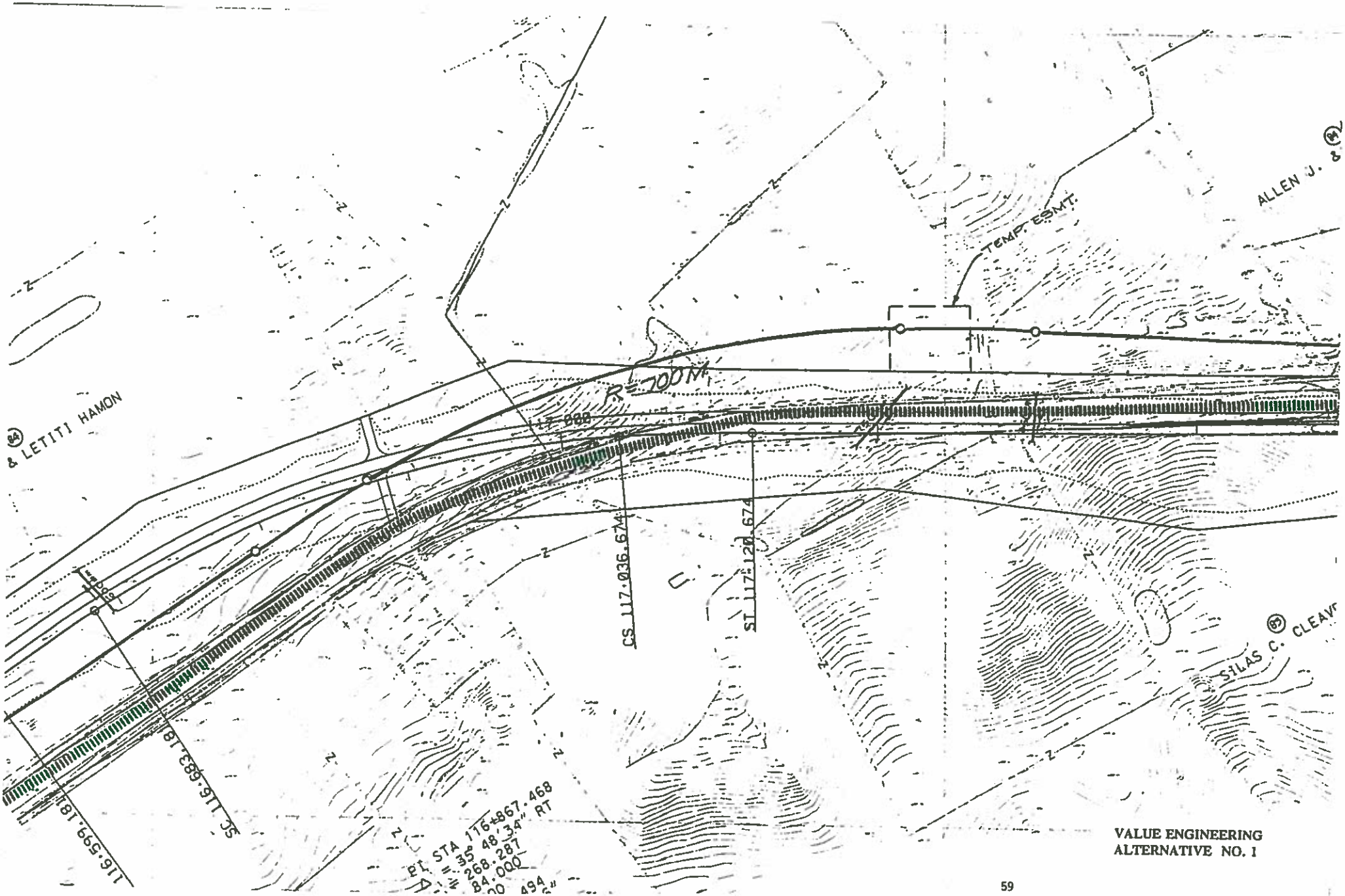

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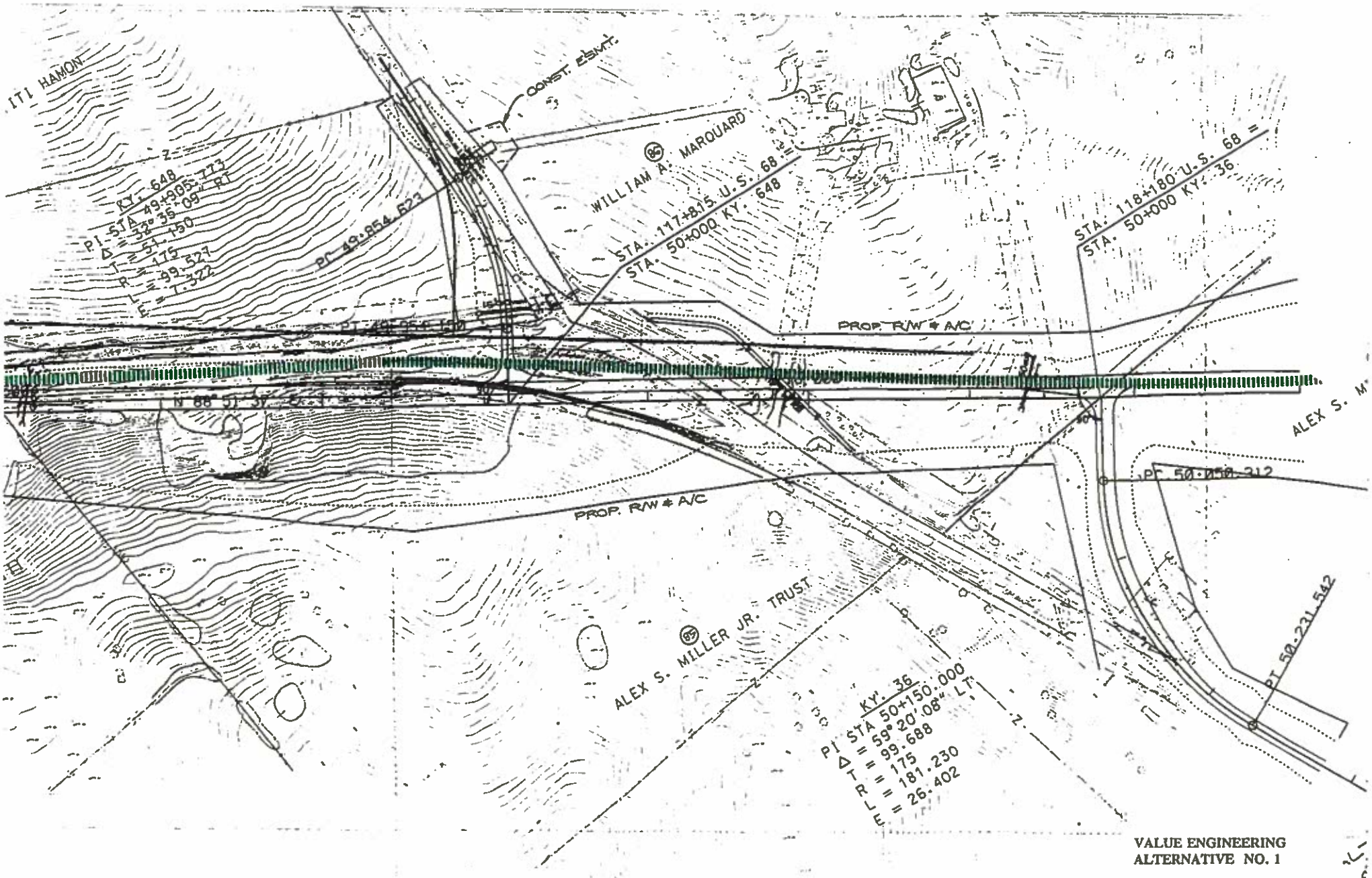

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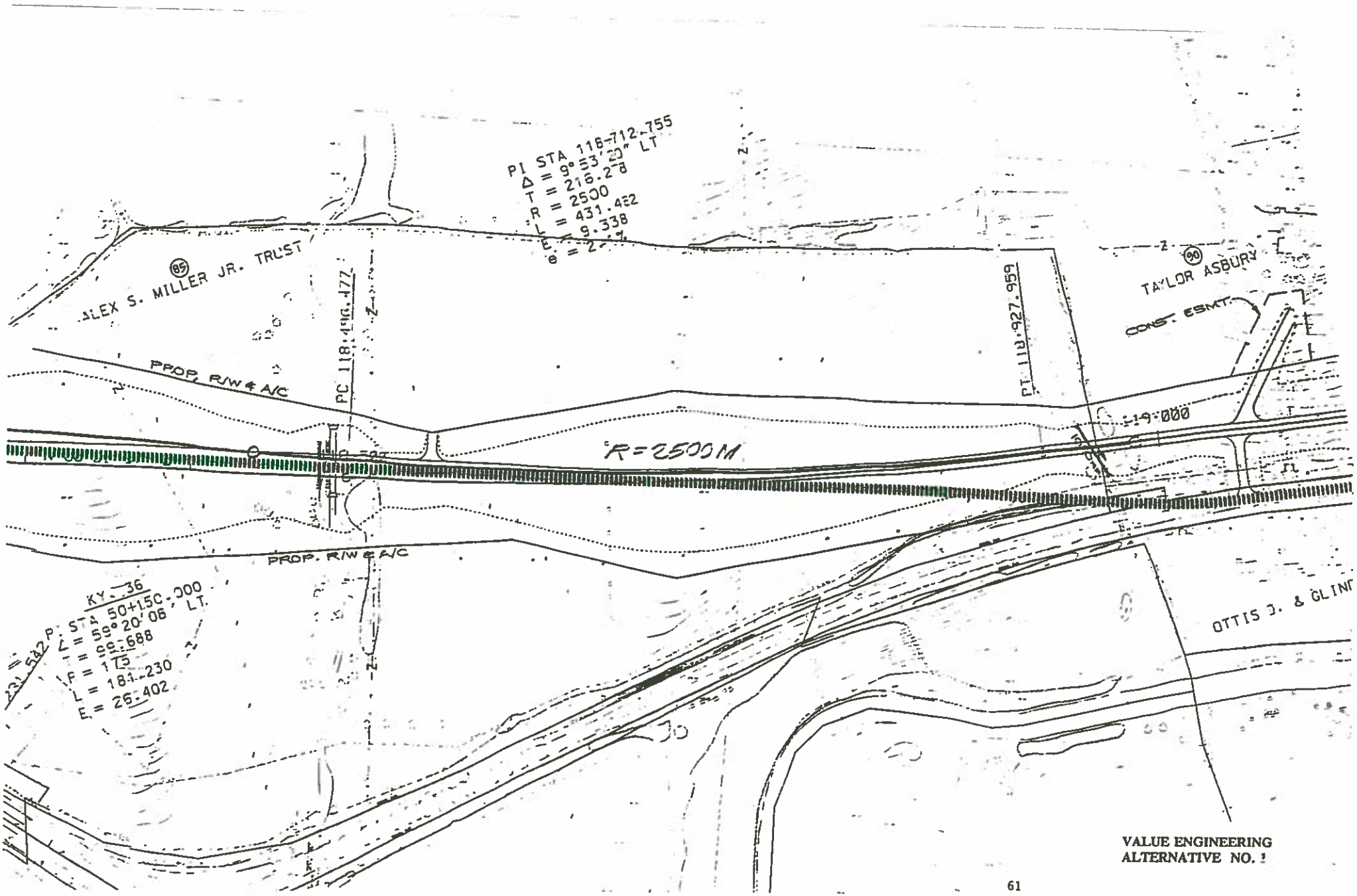

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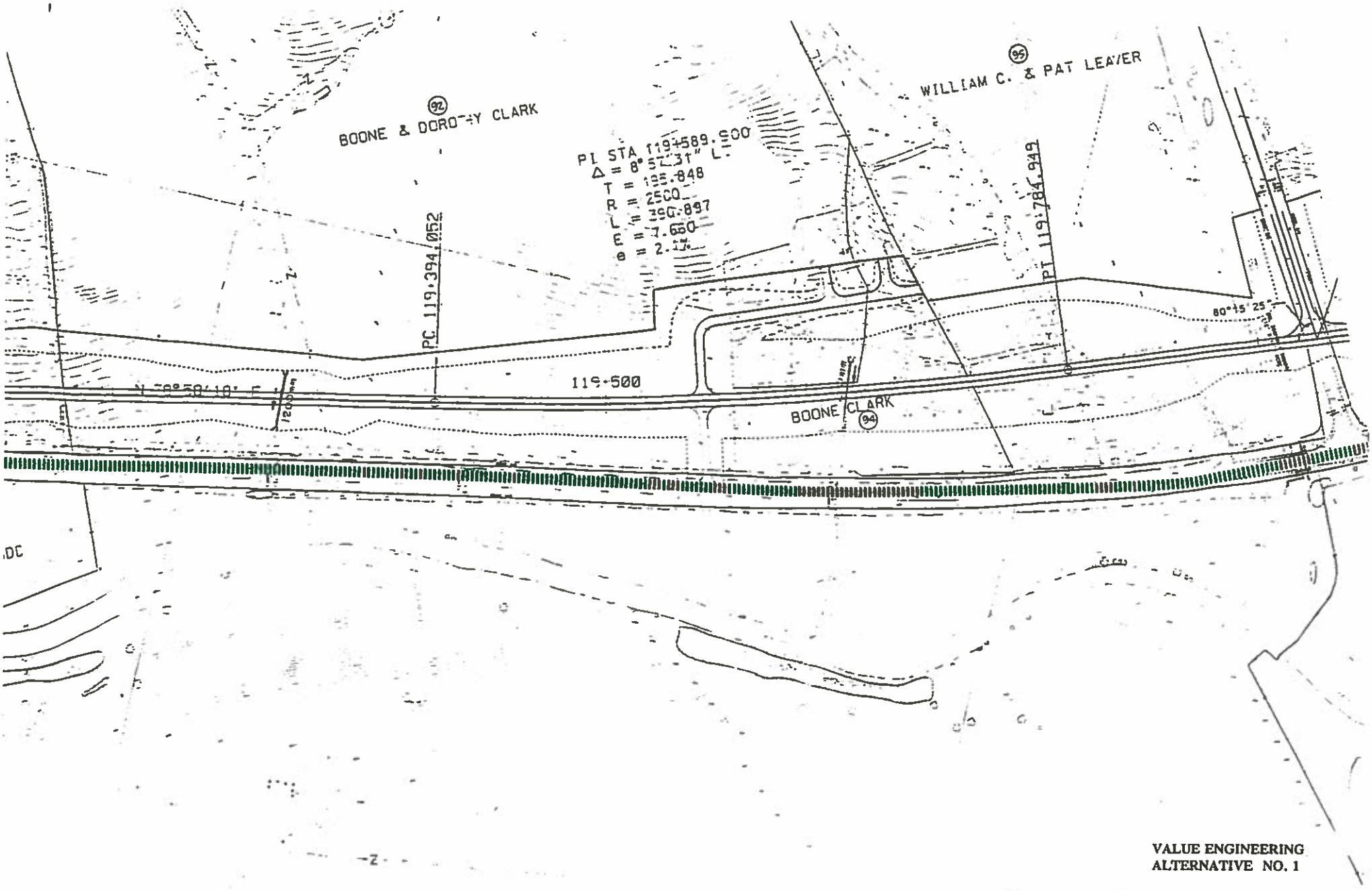

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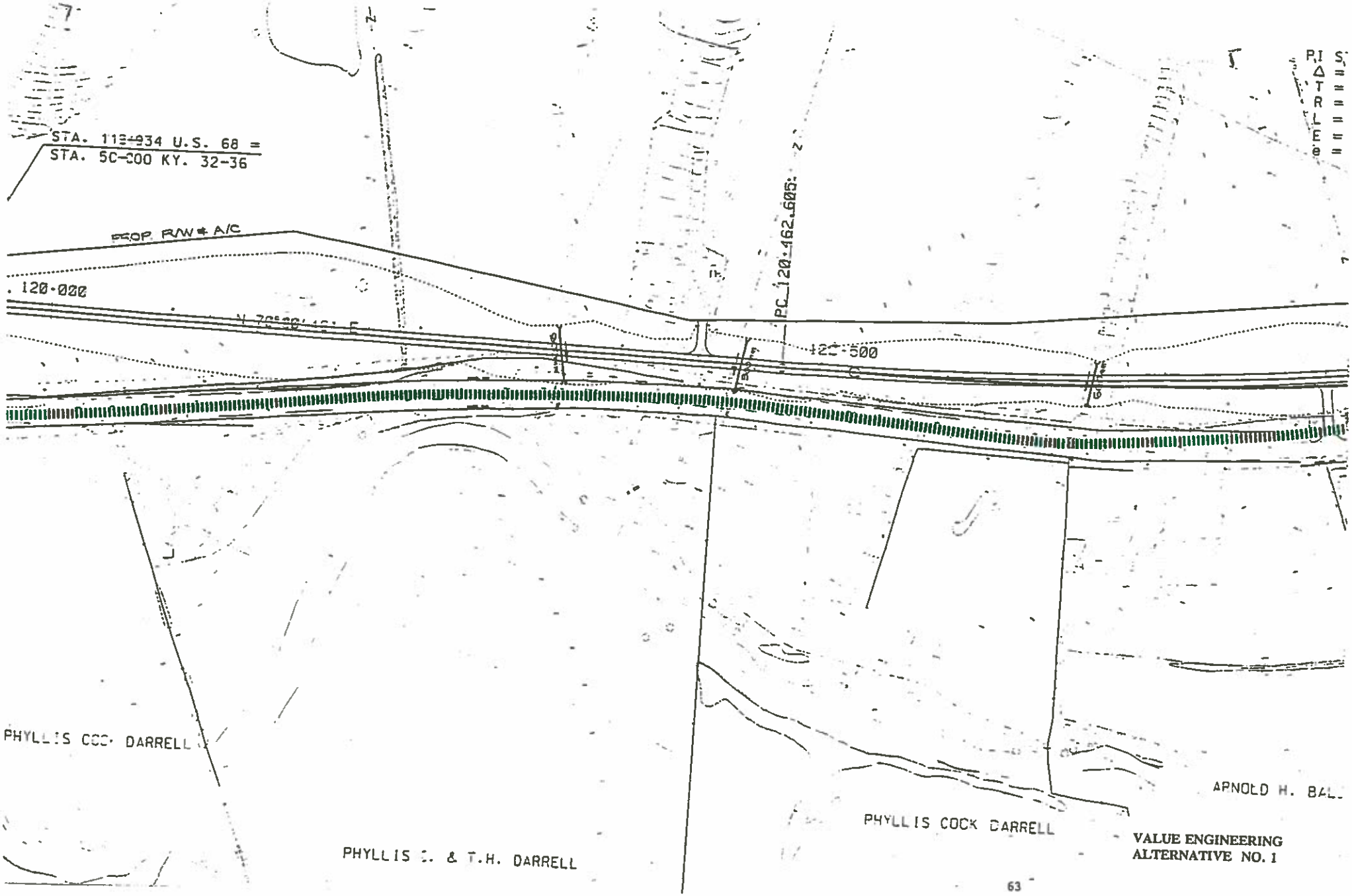

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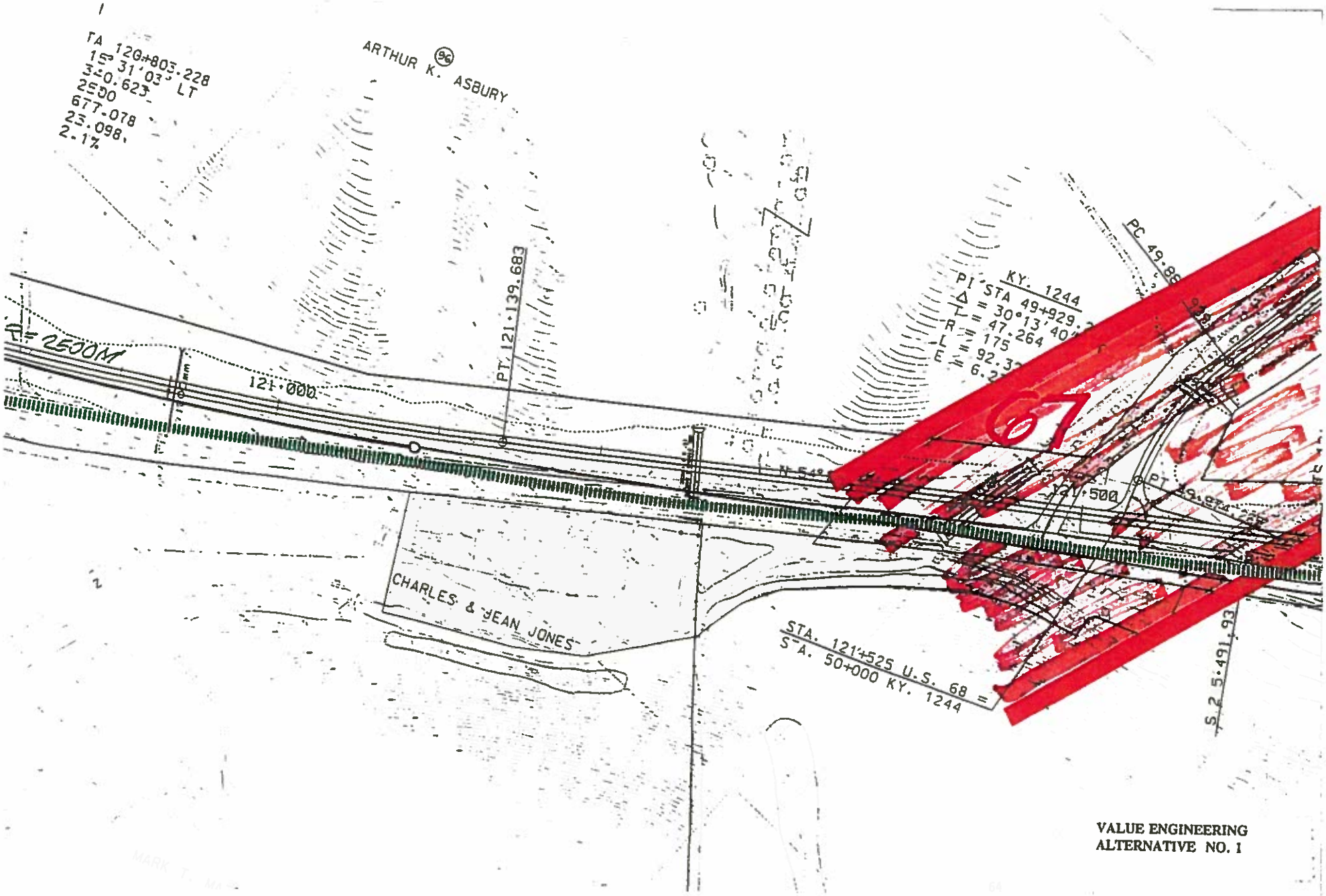

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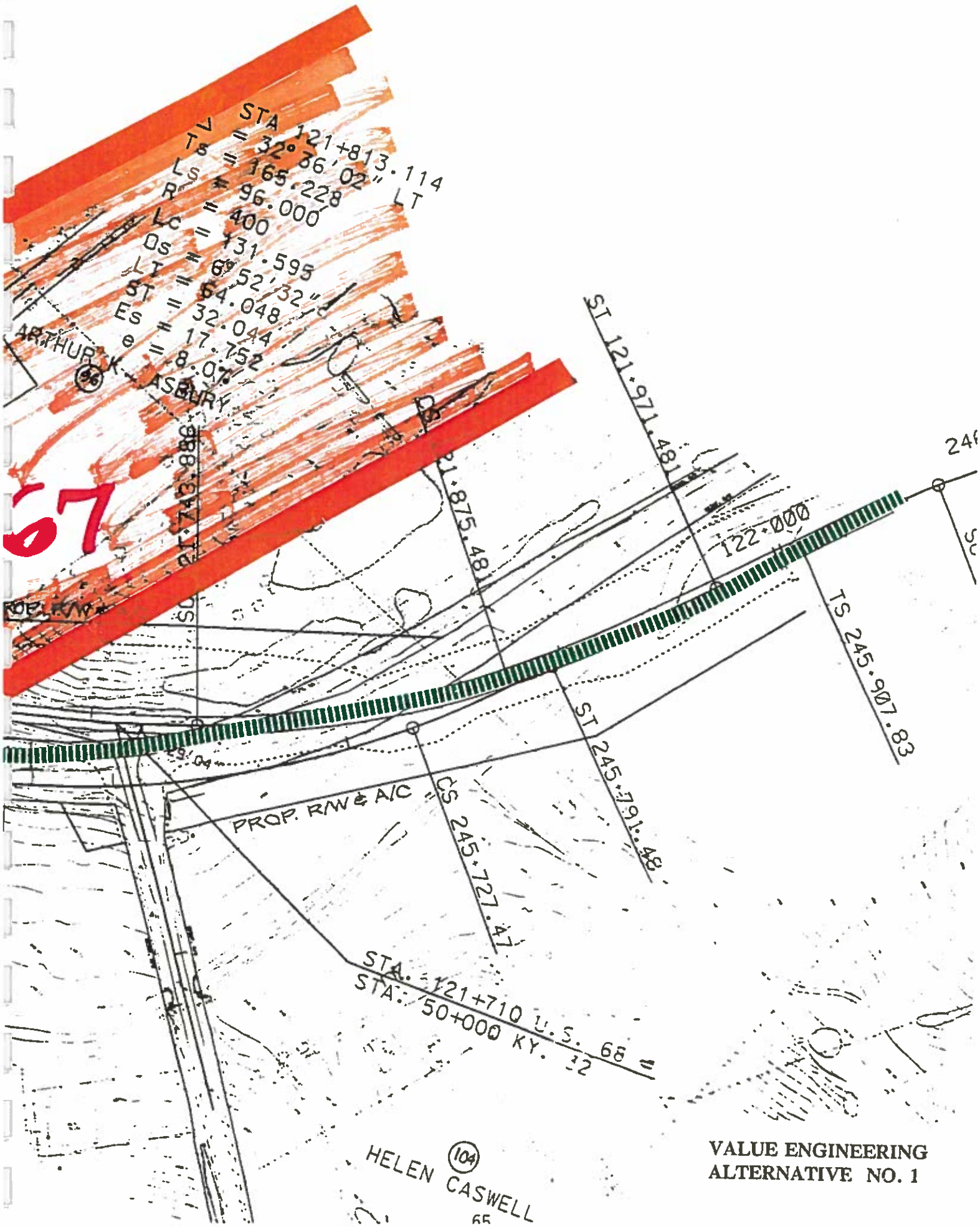
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Ls = 165.228
R = 96.000
Lc = 400
Os = 131.595
LT = 69° 52' 32"
ST = 64.048
Es = 32.044
e = 17.752
8.07
ARTHUR K. ASBURY
96
ST 121+971.481
121+875.481
122+000
TS 245+907.83
ST 245+791.48
CS 245+727.47
PROP. R/W & A/C
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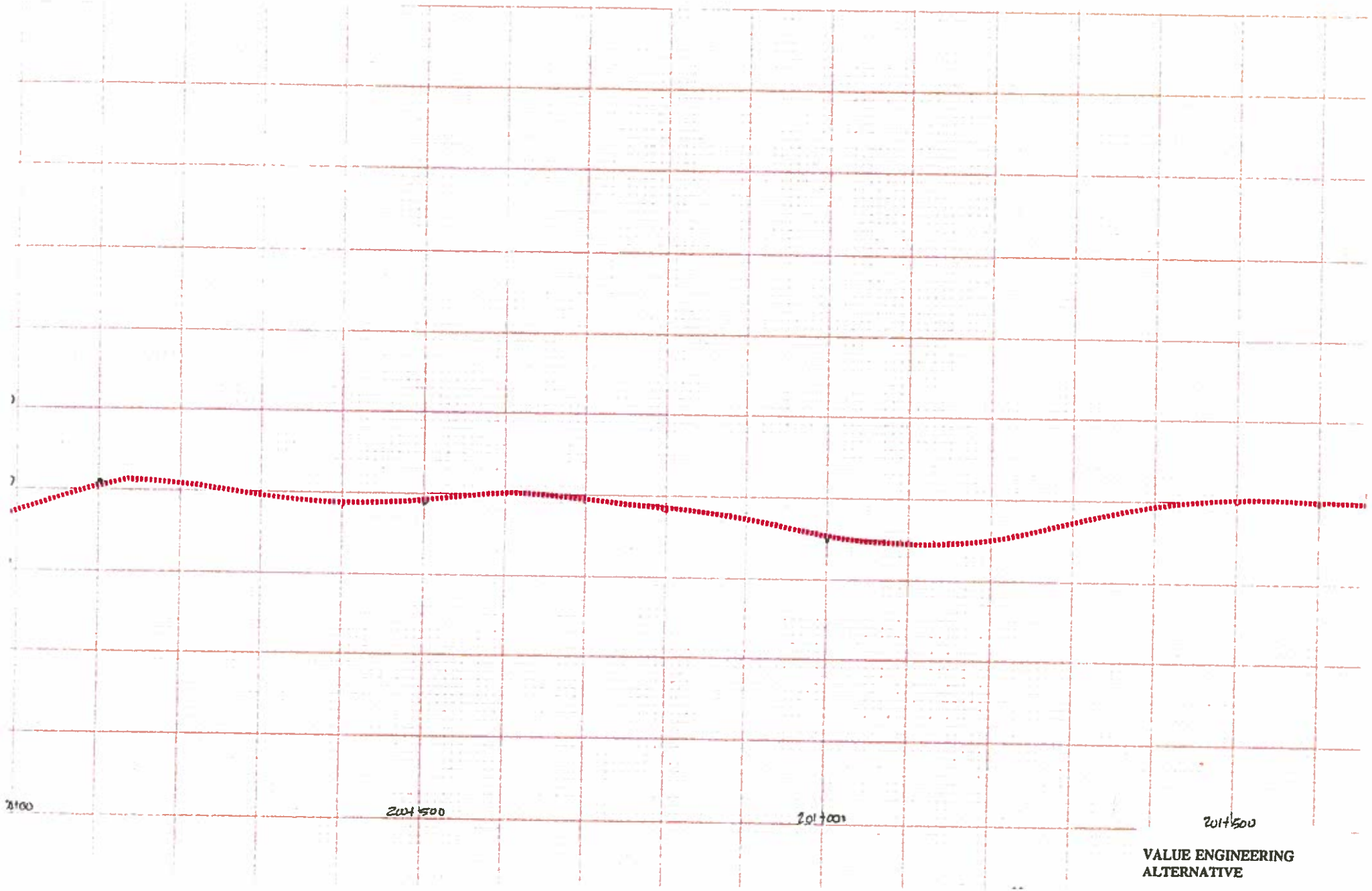
STA. 50+000 KY. 12
HELEN CASWELL
104
65
VALUE ENGINEERING
ALTERNATIVE NO. 1



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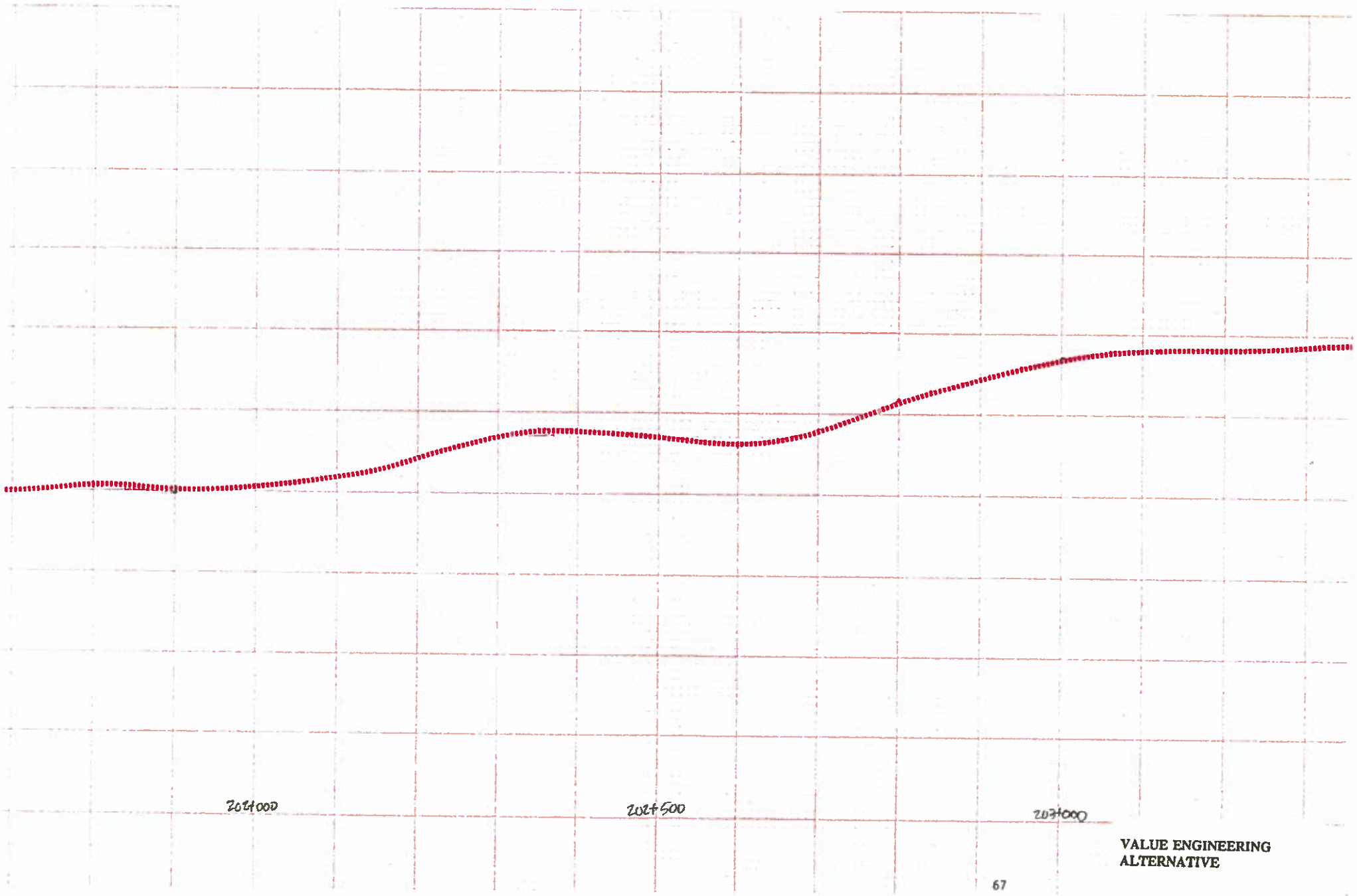

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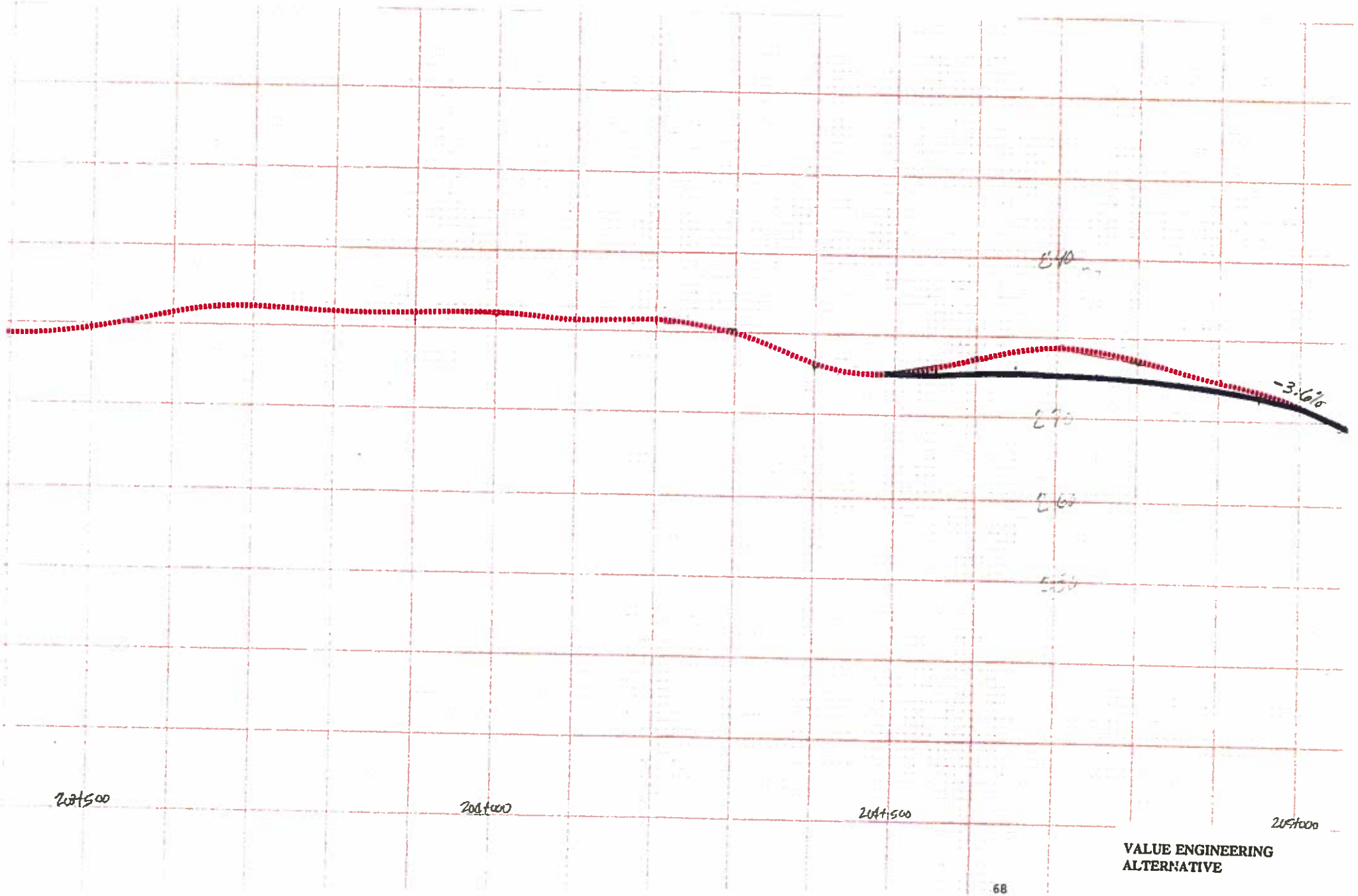

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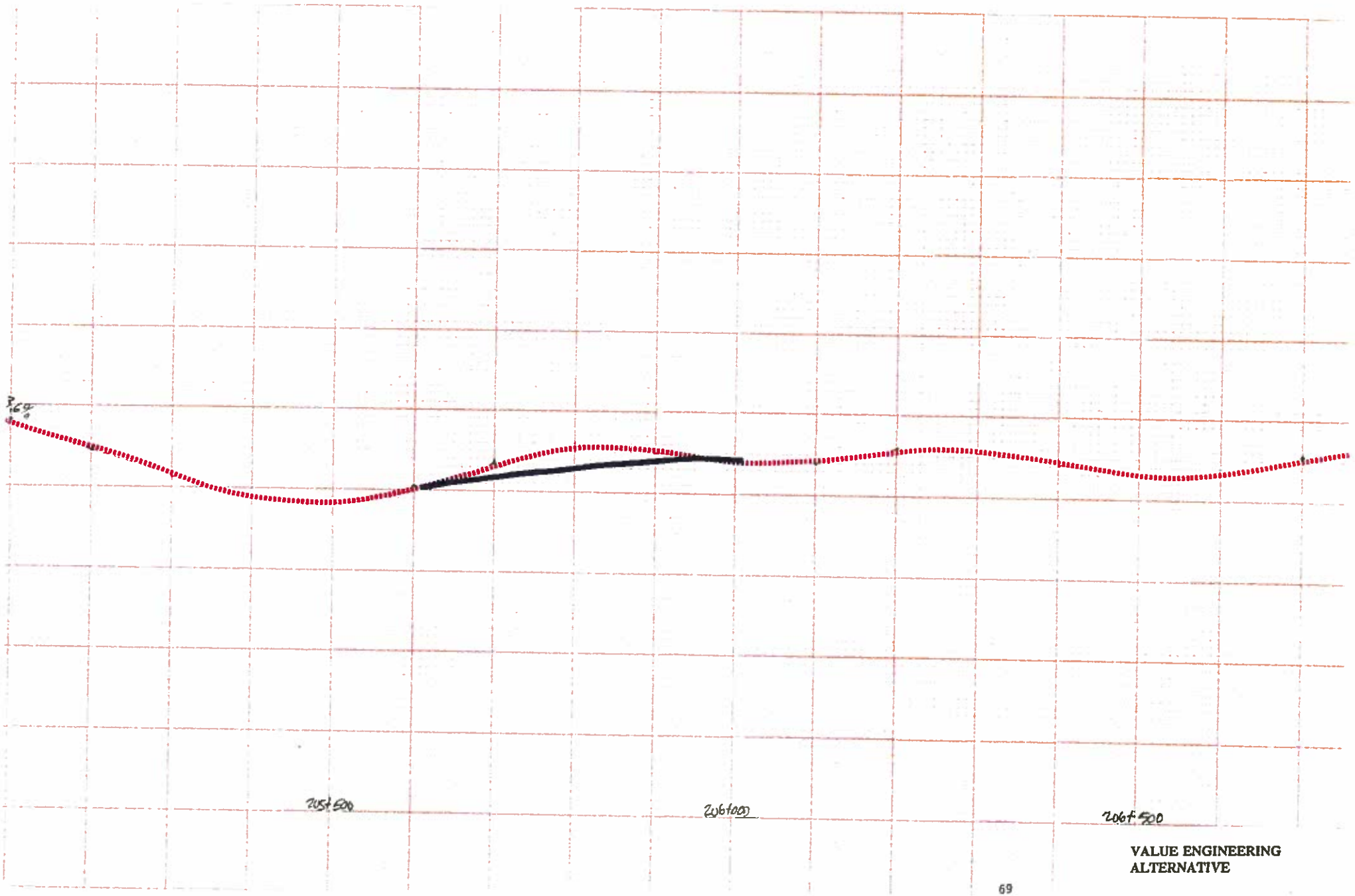

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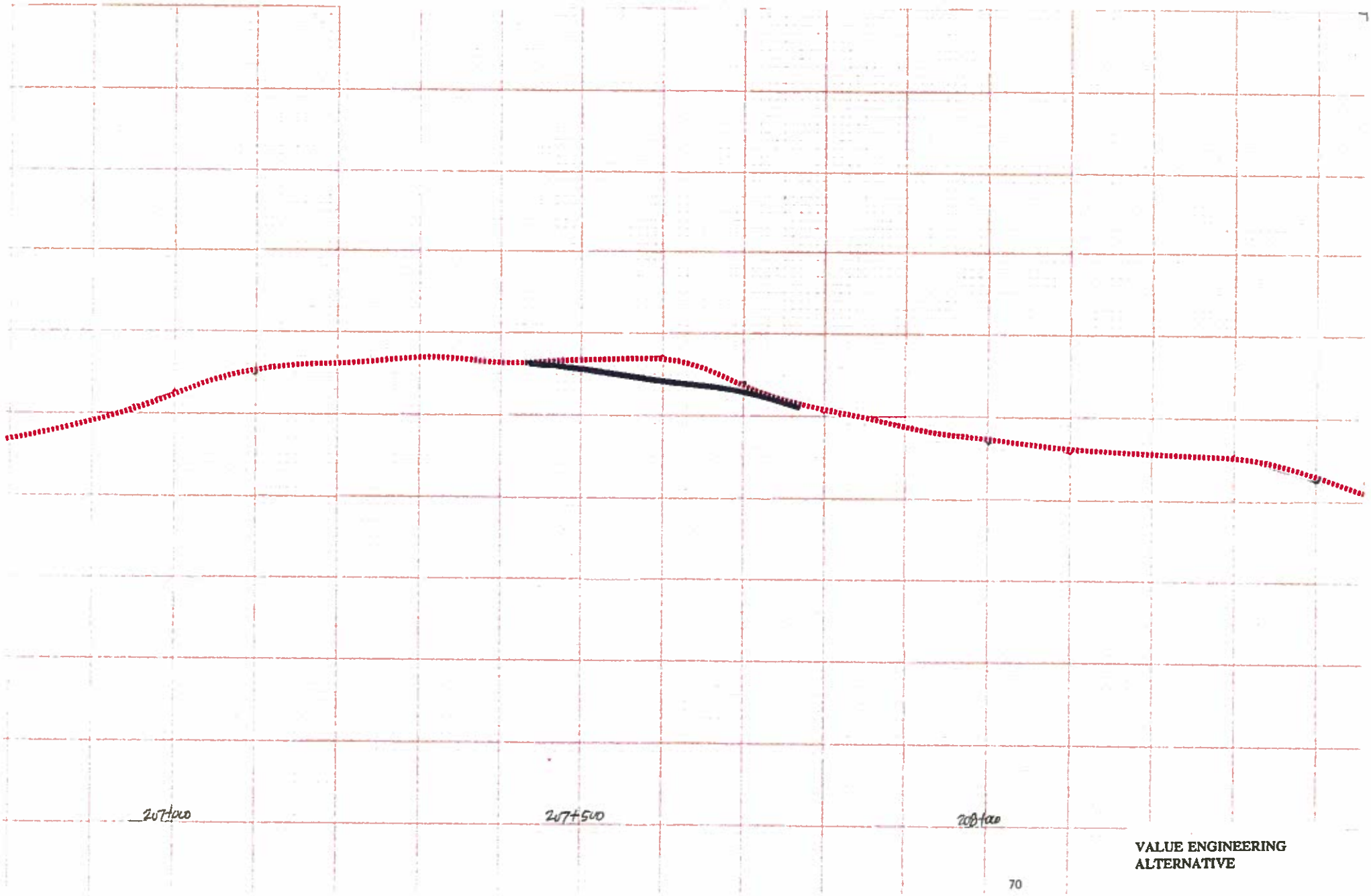

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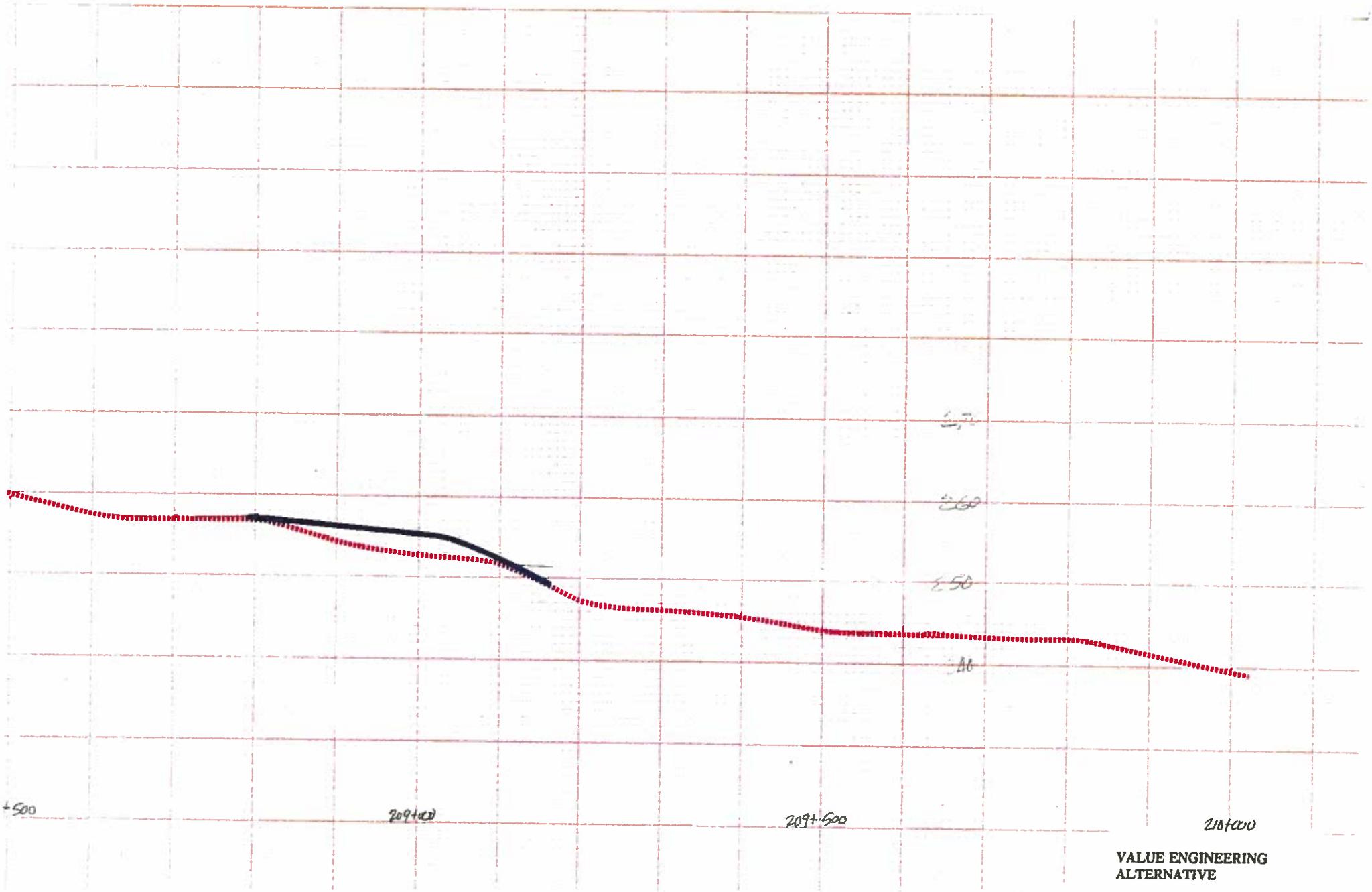
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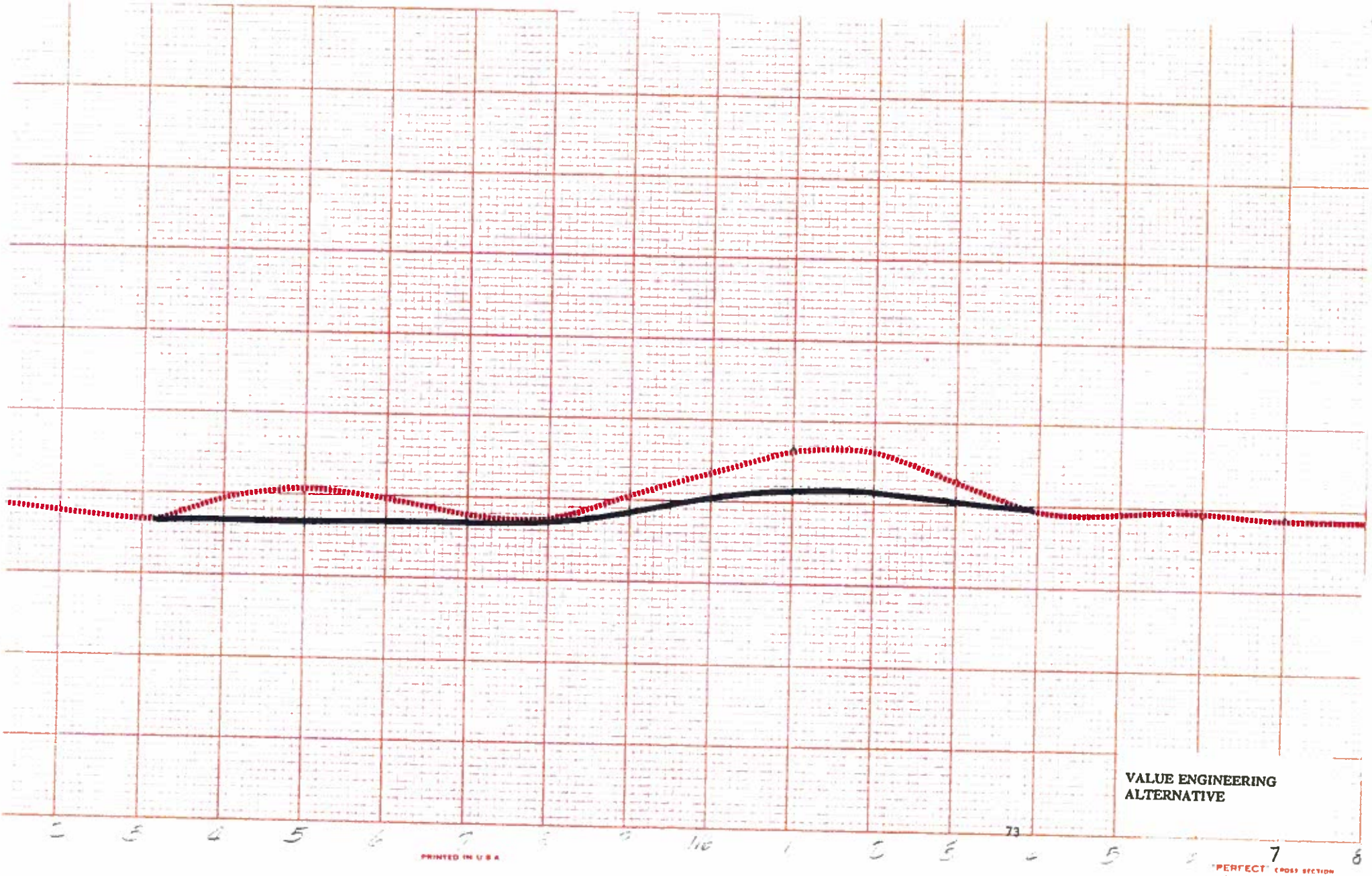
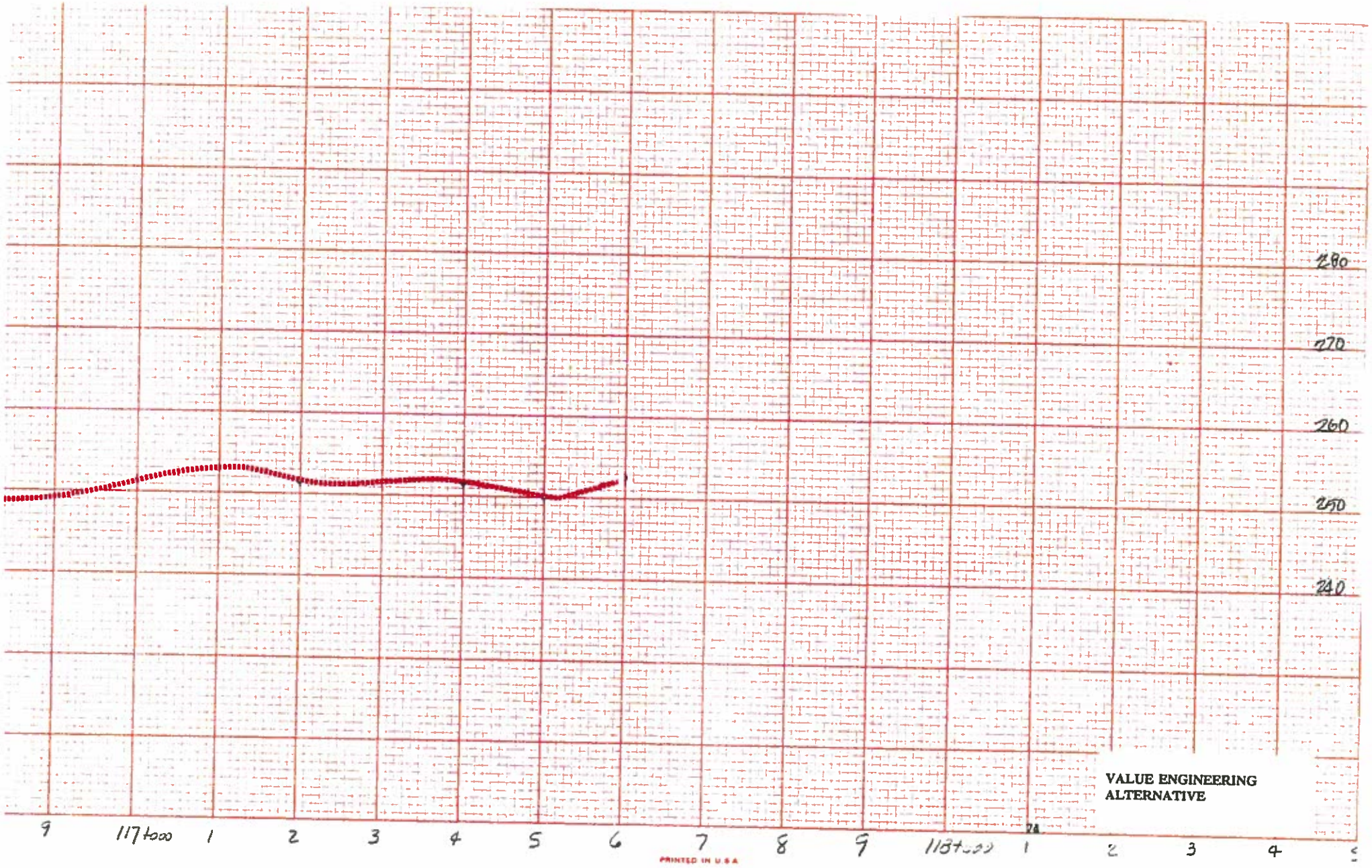
209+000
209+500
210+000
VALUE ENGINEERING
ALTERNATIVE




280
270
260
250
240
9
117+00
1
2
3
4
5
6
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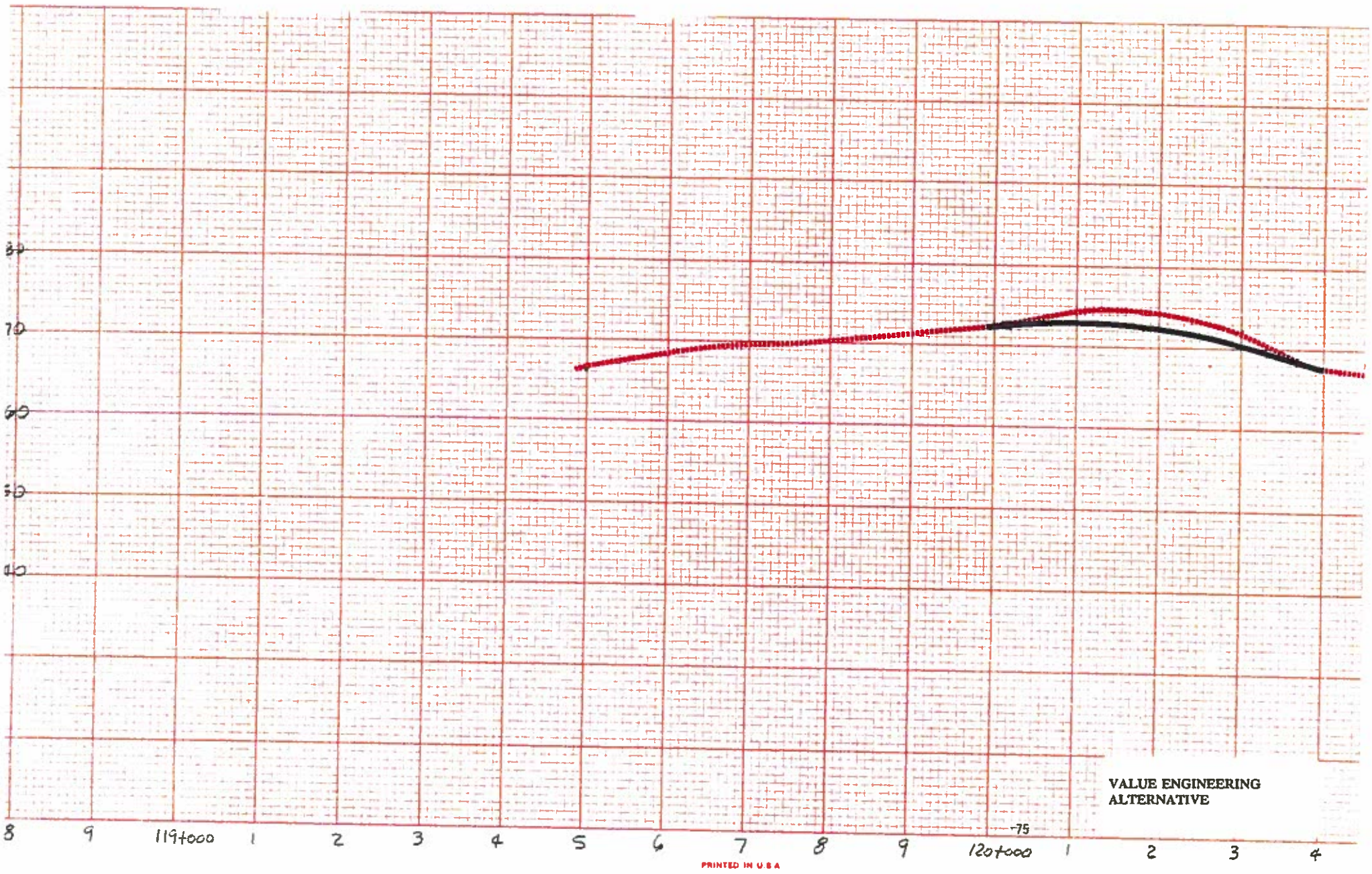
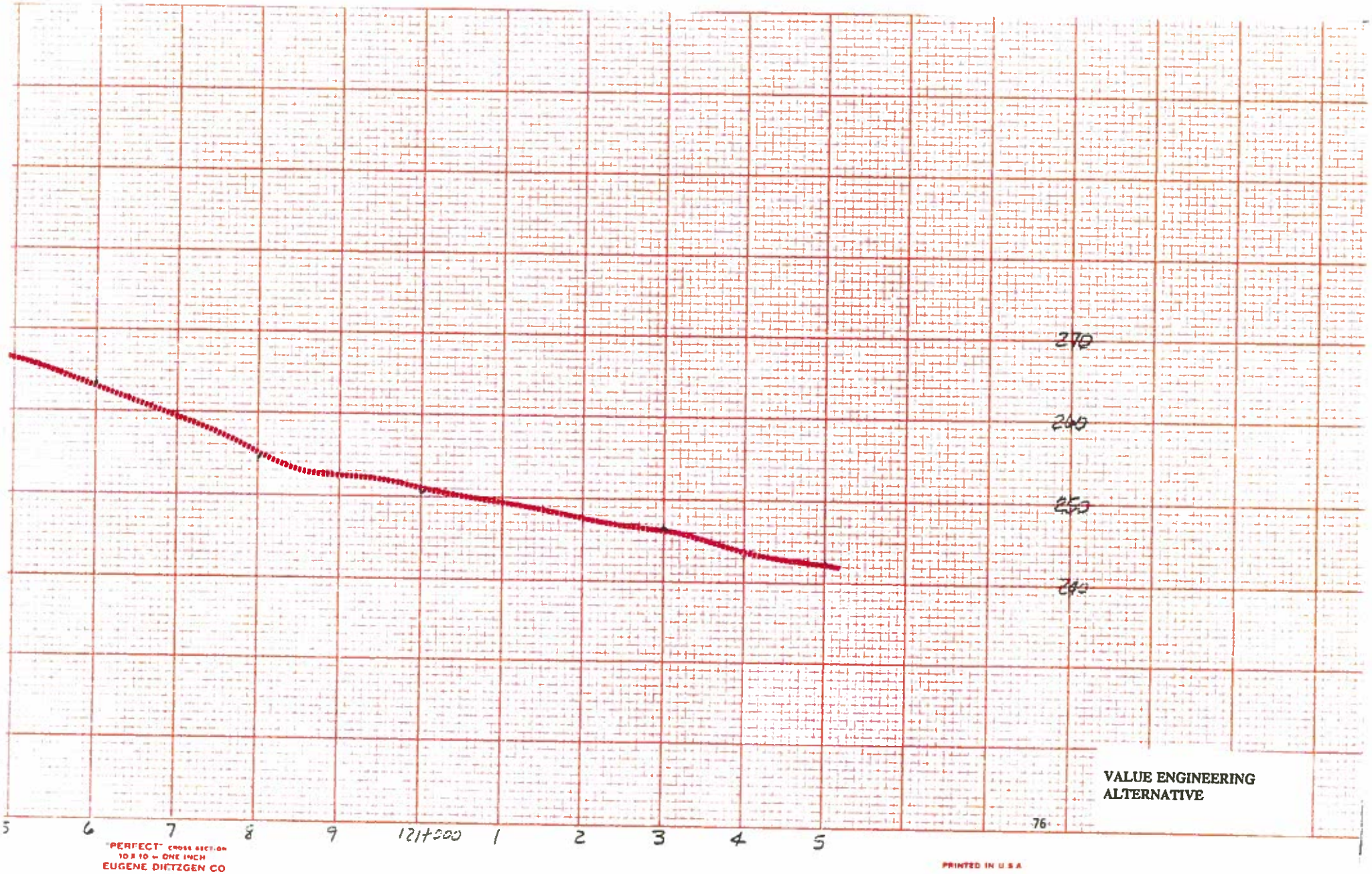
8
9
118+00
1
2
3
4
VALUE ENGINEERING
ALTERNATIVE
PRINTED IN U.S.A.




270
260
250
240
5
6
7
8
9
1214500
1
2
3
4
5
VALUE ENGINEERING
ALTERNATIVE
"PERFECT" CROSS SECTION
10 X 10 = ONE INCH
EUGENE DIETZGEN CO
PRINTED IN U.S.A.

VII.(c) V.E. ALTERNATIVE NO. 2

Value Engineering Alternative No. 2

Value Engineering Alternative No. 2 follows the same plan and profile as Value Engineering Alternative No. 1 until it is west of Hinkston Creek. A two lane bypass extends to the north of Millersburg and connects with the proposed alignment east of Millersburg. This alternative then connects to the existing alignment and continues as a two lane facility to the end of the project.

This alternative provides a four lane facility from the beginning of the project to west of Hinkston Creek and the Millersburg bypass; the bypass is a two lane facility and KY 68 east of Millersburg is a two lane facility. This alternative would utilize as much of the existing right of way as possible.

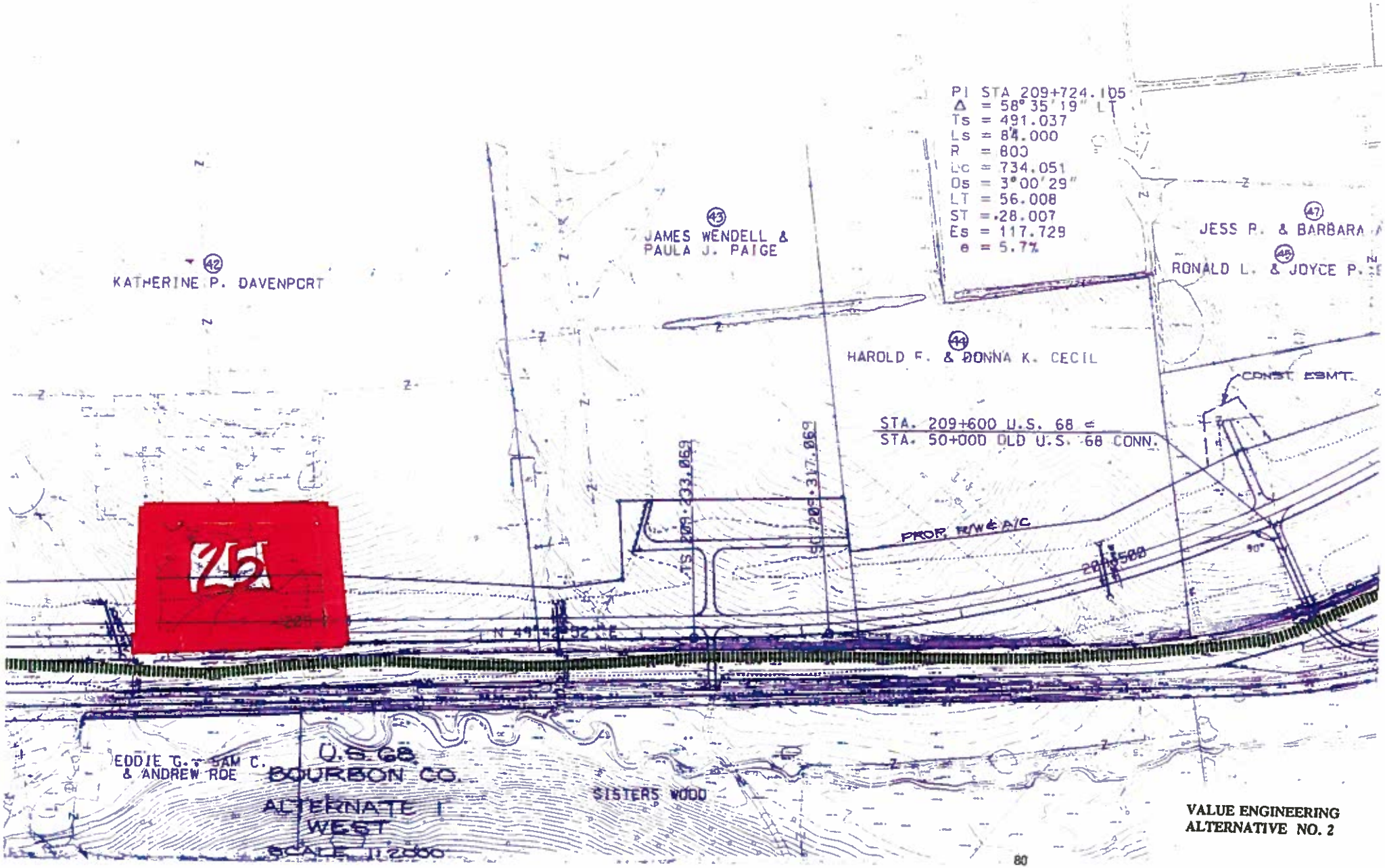
This alternative's four lane section provides two 3.6m lanes,a 3.0m exterior shoulder and a 1.2 meter shoulder in each direction. A 12.2m median is utilized as much as possible.

This alternative provides a LOS A for the section from the Paris bypass to the western end of the Millersburg bypass. The two lane Millersburg by- pass has a LOS D. The section east of Millersburg to KY 36 has a LOS D. The LOS C is provided from KY 36 to the end of the project.

VALUE ENGINEERING ALTERNATIVE NO. 2
COST COMPARISON

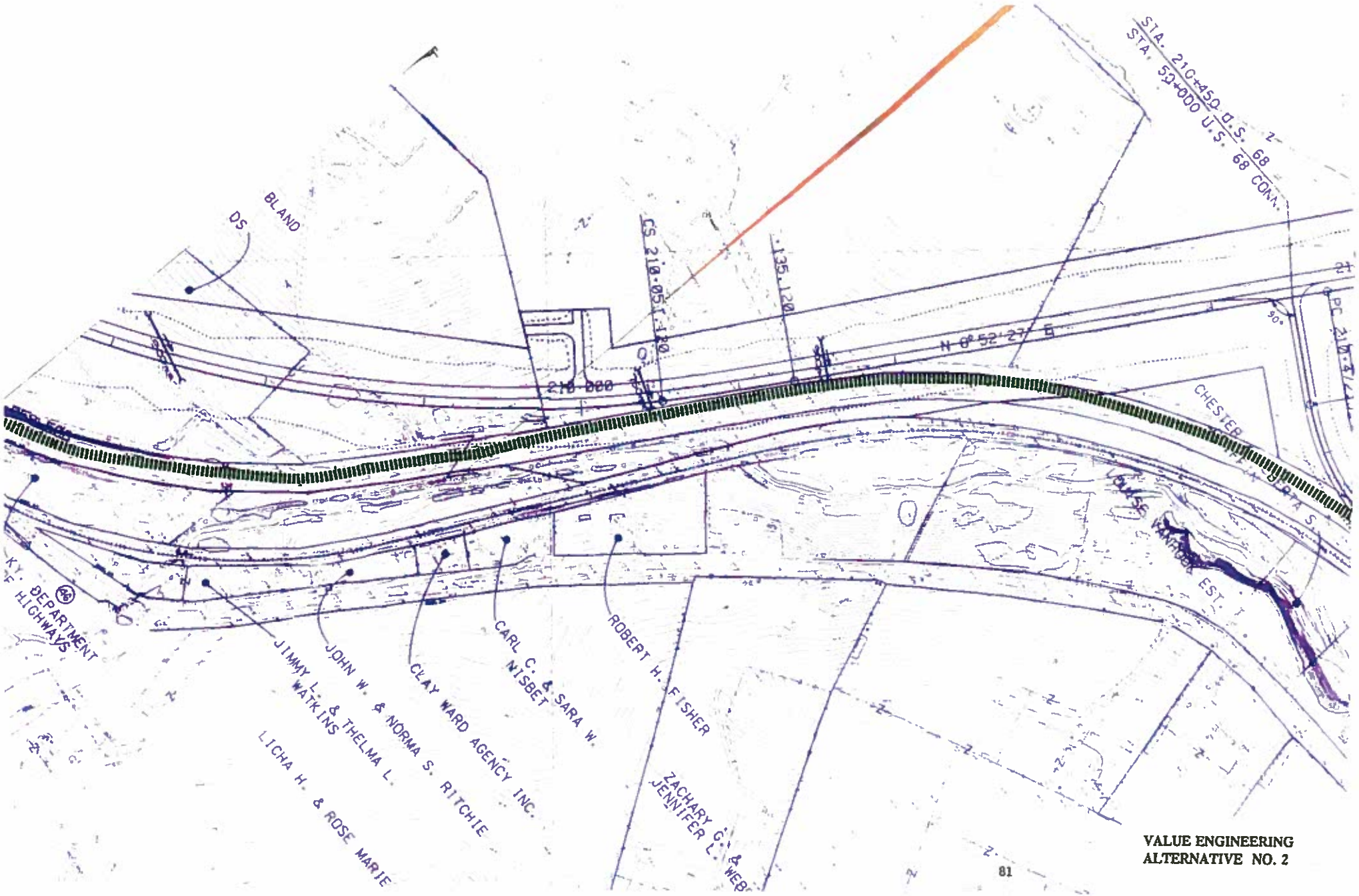
DESCRIPTION	UNIT COST	PROP'D QTY.	4 LANE PROP'D COST	V.E. QTY.	V.E. COST
CLEARING 7 GRUBBING	LS	1	$ 780,400	1	$ 346,900
R/W COST	LS	1	$8,031,000	1	$6,860,000
BRIDGE	$635,000/EA	2	$1,270,000	1	$ 635,000
HISTORICAL IMPACT	LS	1	$1,036,500	1	$ 488,100
CULVERT	LS	1	$2,275,300	1	$1,605,900
CROSS DRAINS	LS	1	$ 695,000		$ 370,600
ASPHALT (SURF)	$33/M-TON	48,900	$1,612,400	46,100	$1,599,900
ASPHALT (BASE)	$30/M-TON	284,200	$8,525,800	277,500	$8,323,800
DGA	$15/M-TON	520,700	$7,811,000	510,607	$7,659,100
EXCAVATION	$3.75/M^3	1,942,100	$7,282,800	1,205,000	$4,520,800
STRIPING	$1.50/M	138,400	$ 207,600	44,300	$ 66,450
GUARDRAIL	$30/M	13,200	$ 396,000	13,200	$ 396,000
STAKING	LS	1	$ 98,000	1	$ 84,000
MOT	LS	1	$ 660,000	1	$ 396,000
TOTAL			$40,681,800		$33,352,550

Possible Savings $ 7,329,250



VALUE ENGINEERING ALTERNATIVE NO. 2


PROP R/W & A/C
211+888
PROP R/W & A/C
50+068.129
U.S. 68 CONN.
PI STA 50+123.000
Δ = 40° 11' 09" LT
T = 54.871
R = 150
L = 105.206
E = 9.721
PI 50+123.335
PI STA 211+138.754
Δ = 36° 51' 22" RT
R = 666.400
D = 2000
T = 1286.523
E = 108.101
e = 2.62
PI STA 50+094.250
Δ = 33° 07' 29" RT
R = 44.609
T = 150
L = 86.720
E = 6.493
PT 50+049.641
PI 50+136.361
KY. 1893
LITTON WILLIAMS
FREDDIE G. & LINDA H. GILLISPIE
JAMES E. JOHNSON
NORMAN JUDY
ST
ST
VALUE ENGINEERING
ALTERNATIVE NO. 2



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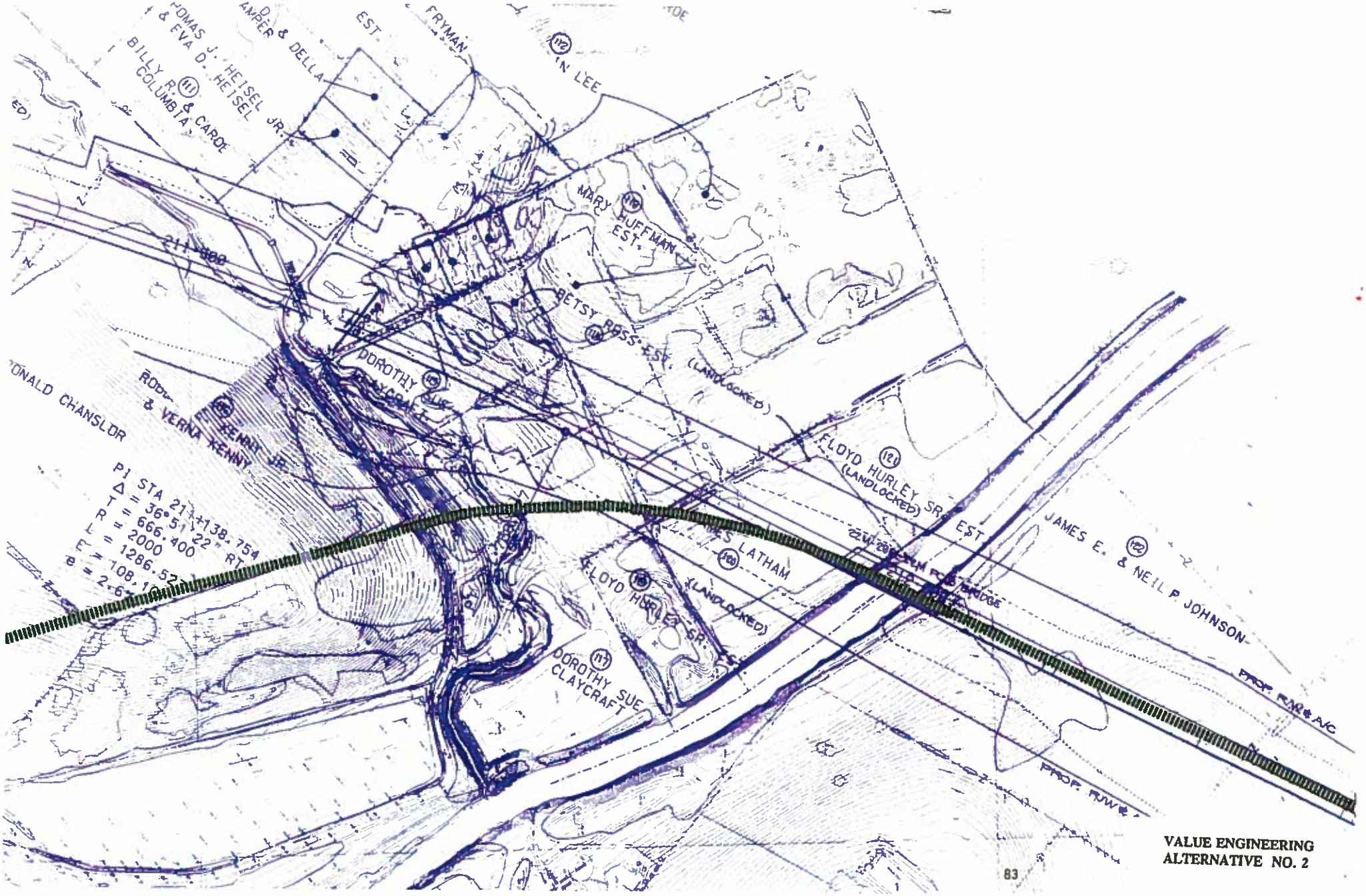

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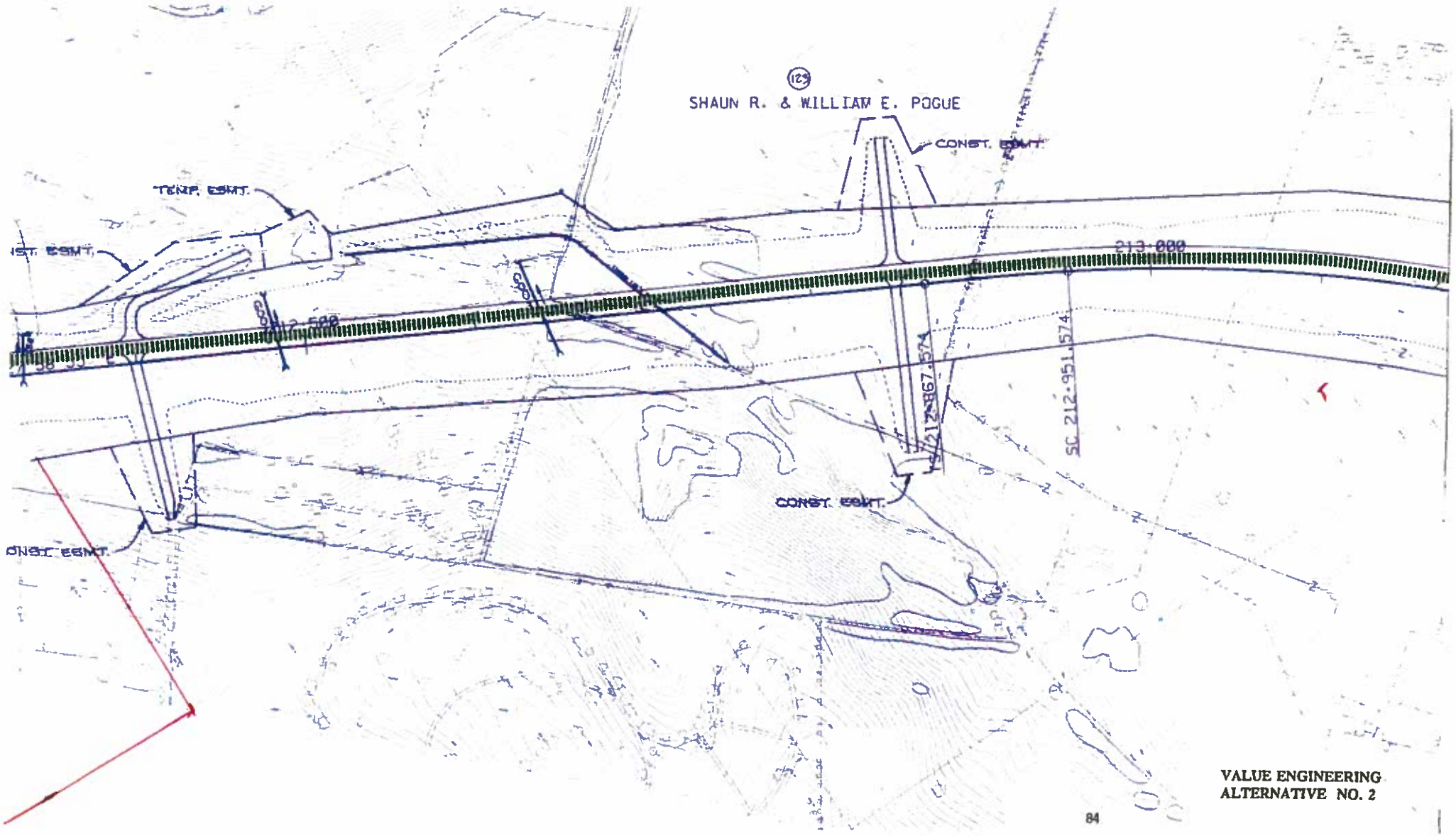

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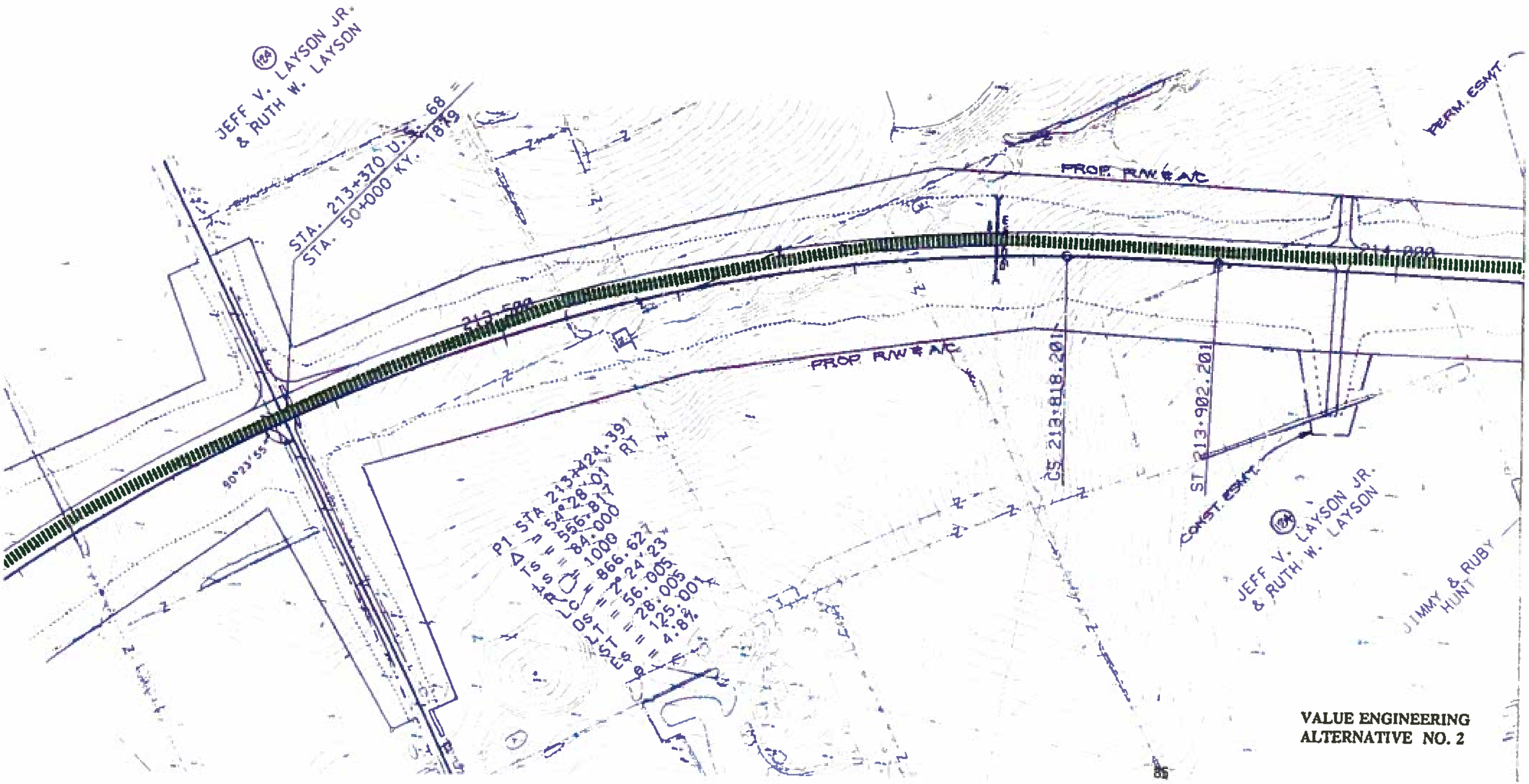

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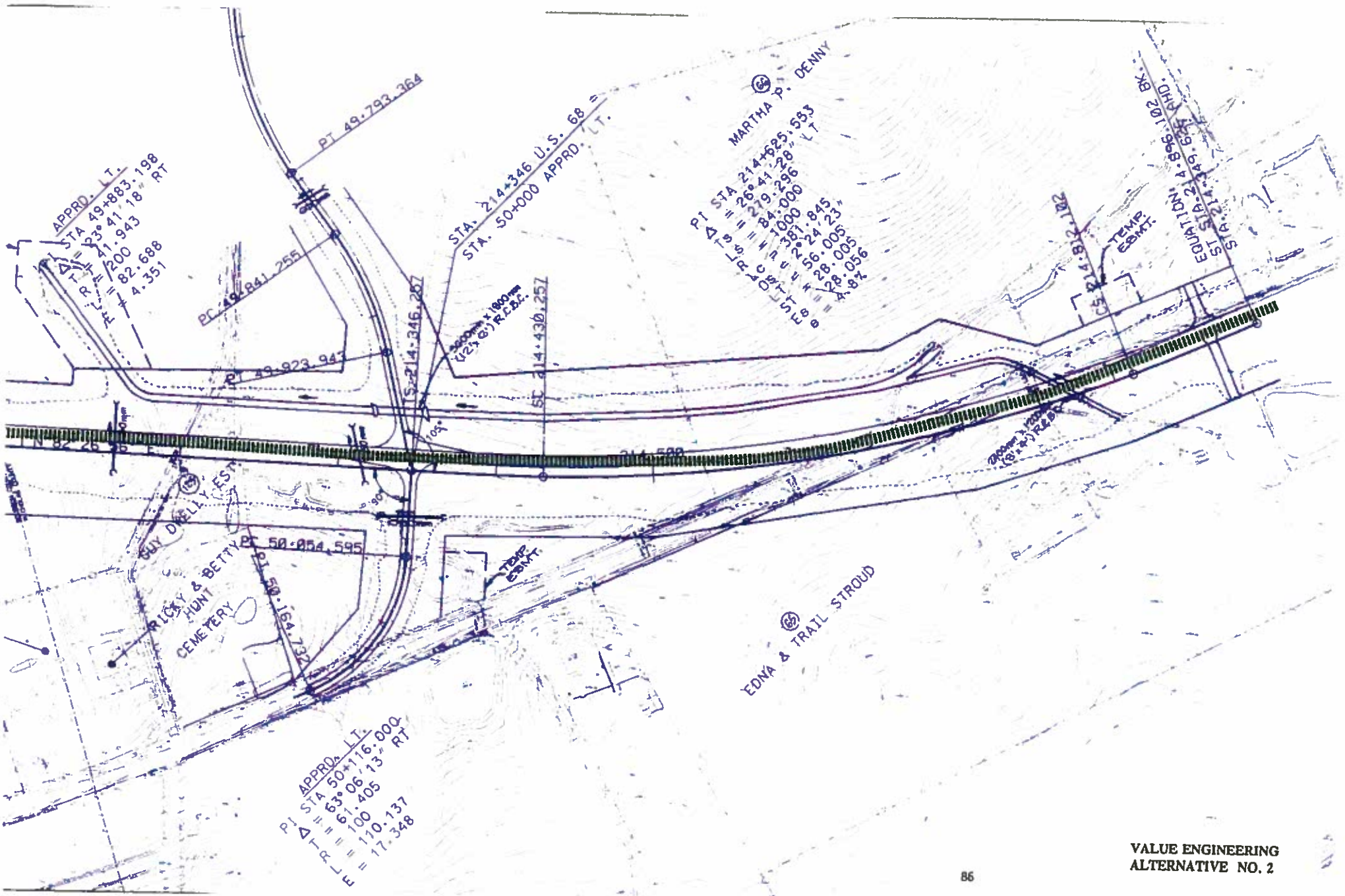


VALUE ENGINEERING
ALTERNATIVE NO. 2

VII.(d) V.E. ALTERNATIVE NO. 3

Value Engineering Alternative No. 3

Value Engineering Alternative No. 3 follows the same plan and profile as Value Engineering Alternative No. 1 on each side of Millersburg but follows the existing KY 68 profile and alignment through Millersburg. The profile is adjusted when necessary and a split profile is utilized. This alternate utilizes a four lane facility through Millersburg until it reaches KY 36, then a two lane facility is utilized to the end of the project. The existing right of way is utilized. The Value Engineering Alternative No. 3 is a four lane facility, utilizes two 3.6m lanes, a 3.0m exterior shoulder and a 1.2m interior shoulder in each direction. A 12.2m median is provided whenever possible. An Urban four lane is used through Millersburg.

This alternative provides a 2025 LOS A to the intersection with KY 36. The two lane section from KY 36 to the end of the project provides a LOS C.

VALUE ENGINEERING ALTERNATIVE NO. 3
COST COMPARISON

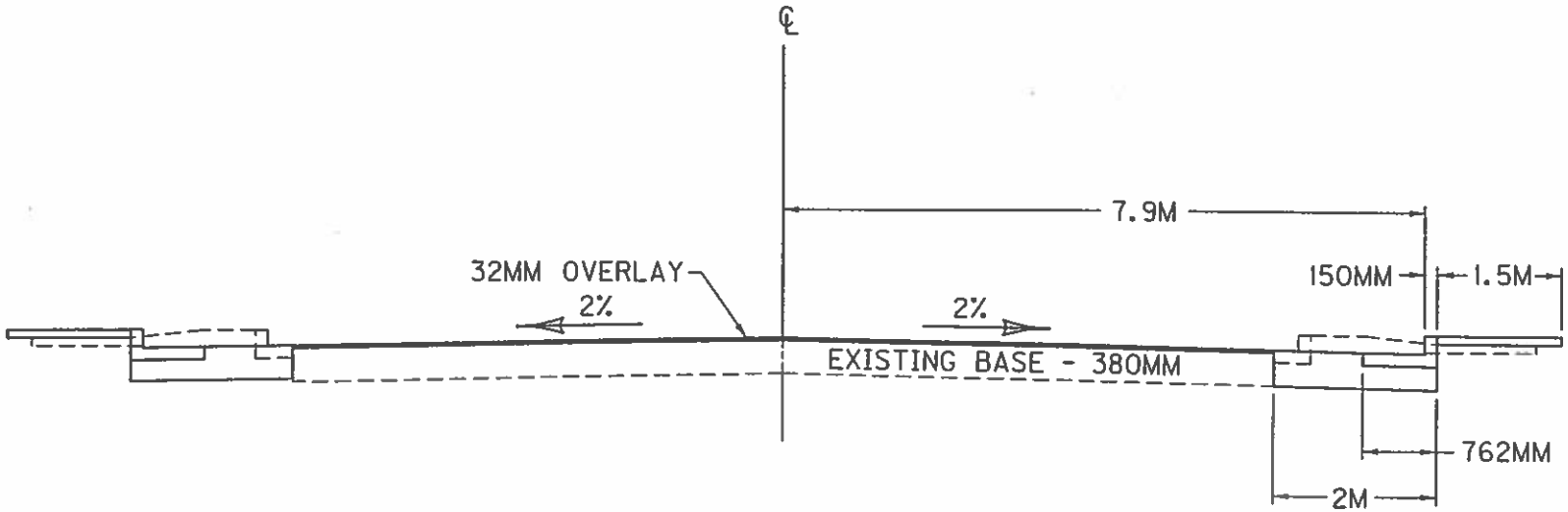
DESCRIPTION	UNIT COST	PROP'D QTY.	4 LANE PROP'D COST	V.E. QTY.	V.E. COST
CLEARING & GRUBBING	LS	1	$ 780,400	1	$ 514,500
R/W COST	LS	1	$8,031,000	1	$5,425,600
BRIDGE	$635,000	1	$1,270,000	1	$ 635,000
HISTORICAL IMPACT	LS	1	$1,036,500	1	$ 488,100
CULVERT	LS	1	$2,275,300	1	$1,777,600
CROSS DRAINS	LS	1	$ 695,000	1	$ 461,500
ASPHALT (SURF)	$33/M-TON	48,900	$1,612,400	38,100	$1,258,500
ASPHALT (BASE)	$30/M-TON	158,700	$8,525,800	218,200	$6,547,300
DGA	$15/M-TON	288,700	$7,811,000	394,000	$5,909,500
EXCAVATION	$3.75/$M^3$	1,942,100	$$7,282,800	1,543,700	$5,788,800
SPECIAL EXCAVATION	LS			1	$ 50,000
SIDEWALK	$40.53/^{2}			4096	$ 166,000
CURB & GUTTER	$44.74/M			2682	$ 120,000
CURB BOX REMOVE	$400 EA.			40	$ 16,000

VALUE ENGINEERING ALTERNATIVE NO. 3
COST COMPARISON
(CONTINUED)

DESCRIPTION	UNIT COST	PROP'D QTY.	4 LANE PROP'D COST	V.E. QTY.	V.E. COST
NEW CURB BOX	$2500/EA			42	$ 105,000
RECONNECT CULVERT	$230/M			128	$ 29,500
GUARDRAIL	$30/M	13,200	$ 396,000	10,270	$ 308,100
STRIPPING	$1.50/M	138,400	$ 207,600	136,667	$ 205,000
STAKING	LS	1	$ 98,000	1	$ 100,000
MOT	LS	1	$ 660,000	1	$ 677,400
TOTAL			$40,681,800		$30,583,400

Possible Savings $ 10,098,400

TYPICAL SECTION THROUGH MILLERSBURG

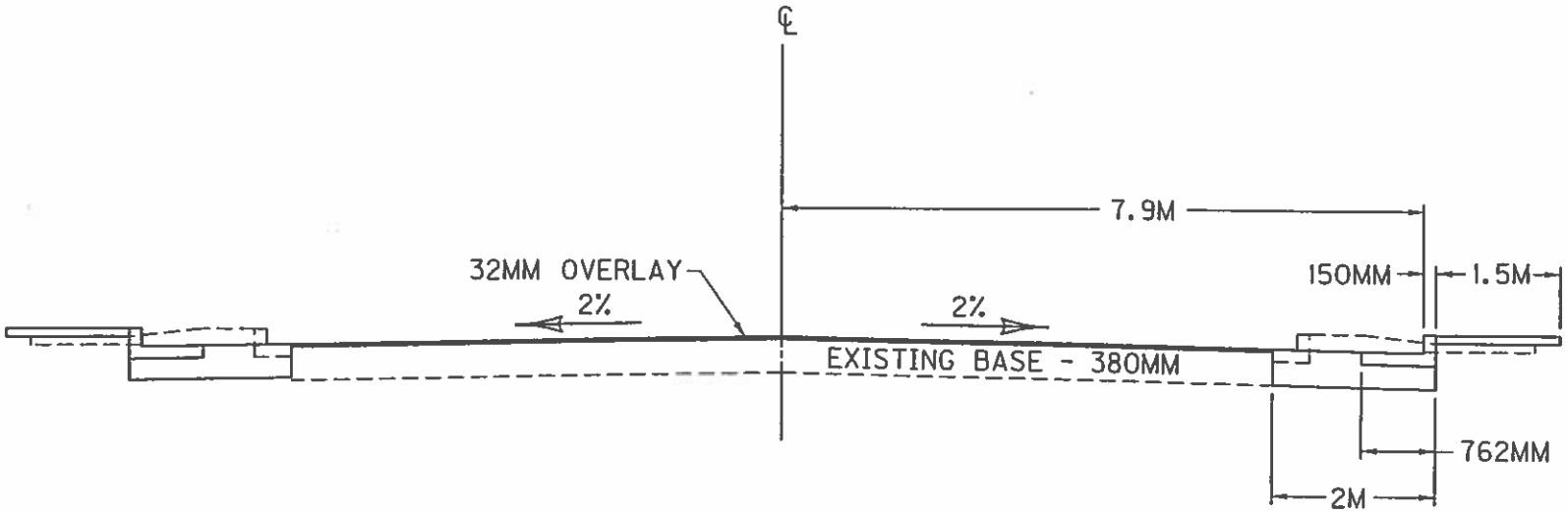


NEW CONSTRUCTION: WIDENING & RESURFACING

32MM SURFACE
75MM BASE
100MM BASE
100MM BASE
100MM DGA

VALUE ENGINEERING ALTERNATIVE NO. 3

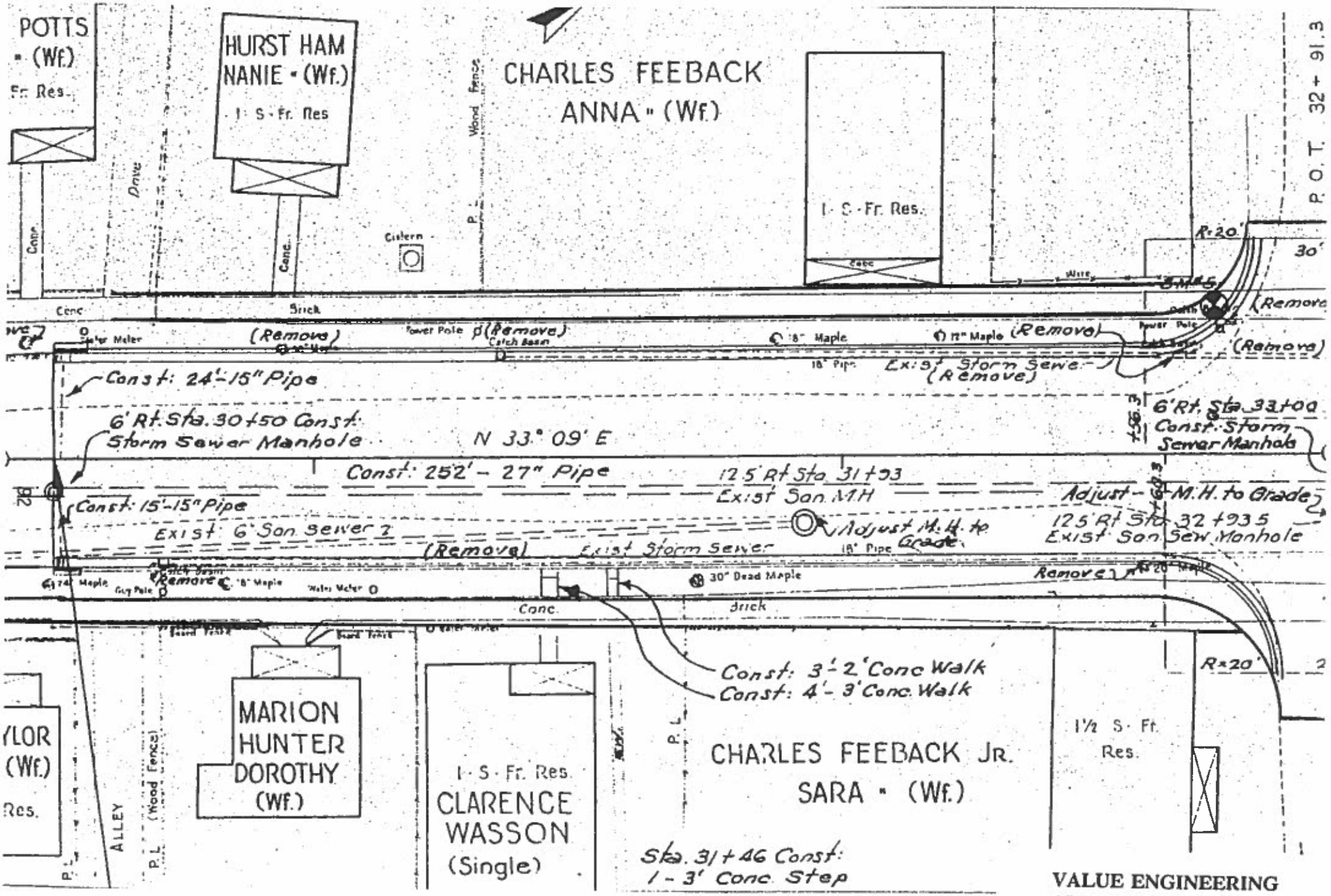
TYPICAL SECTION THROUGH MILLERSBURG



NEW CONSTRUCTION: WIDENING & RESURFACING

32MM SURFACE
75MM BASE
100MM BASE
100MM BASE
100MM DGA

VALUE ENGINEERING ALTERNATIVE NO. 3



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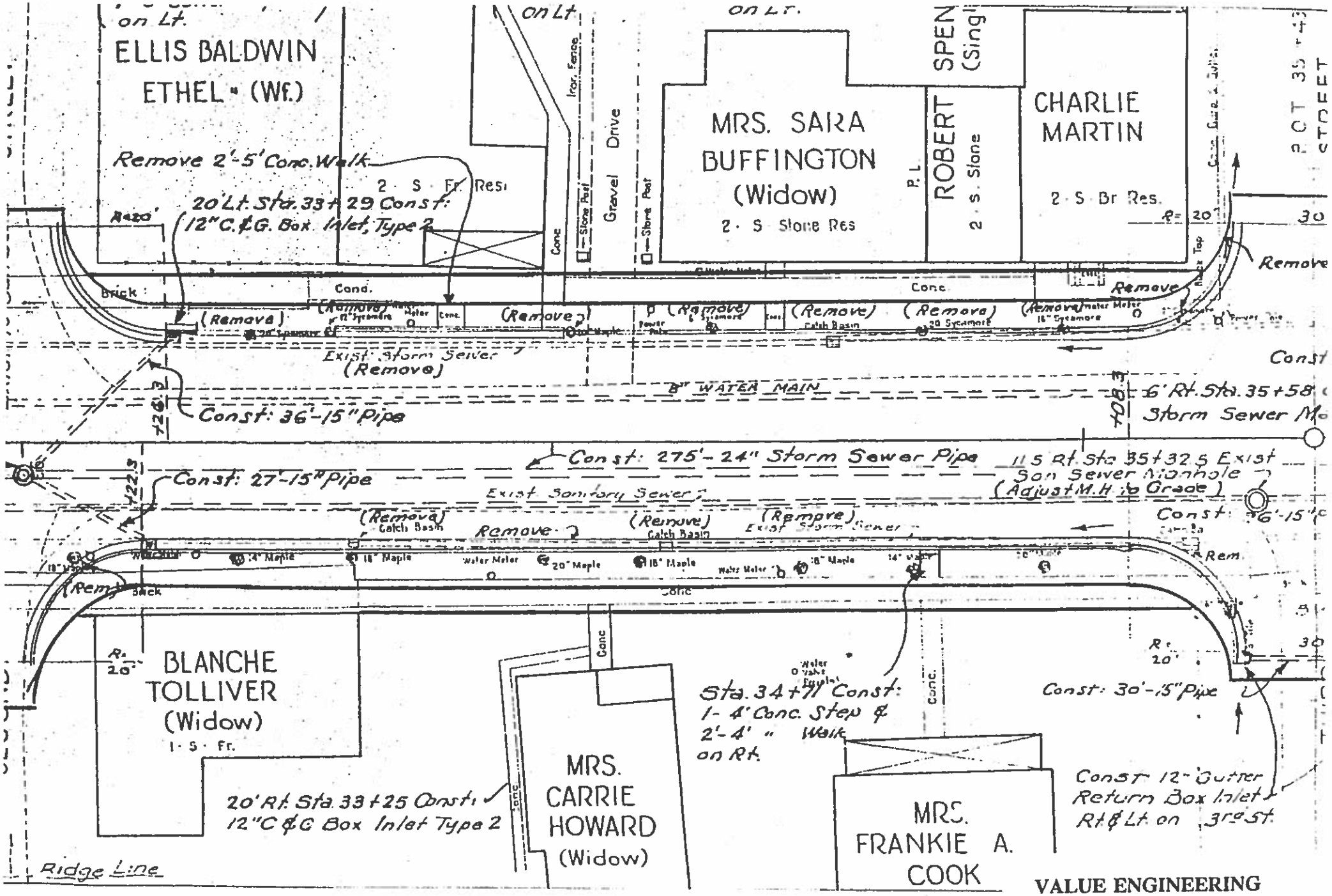

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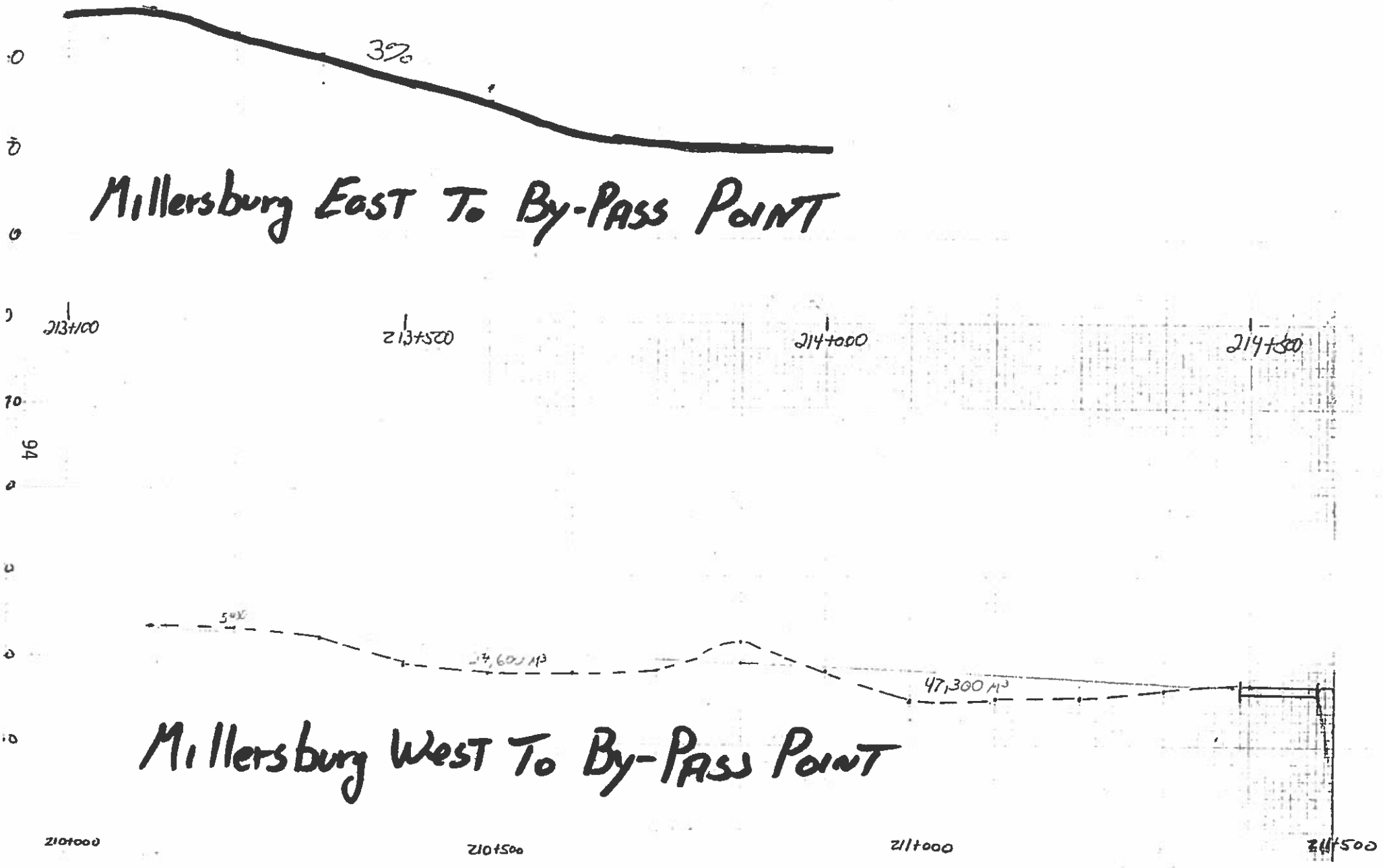
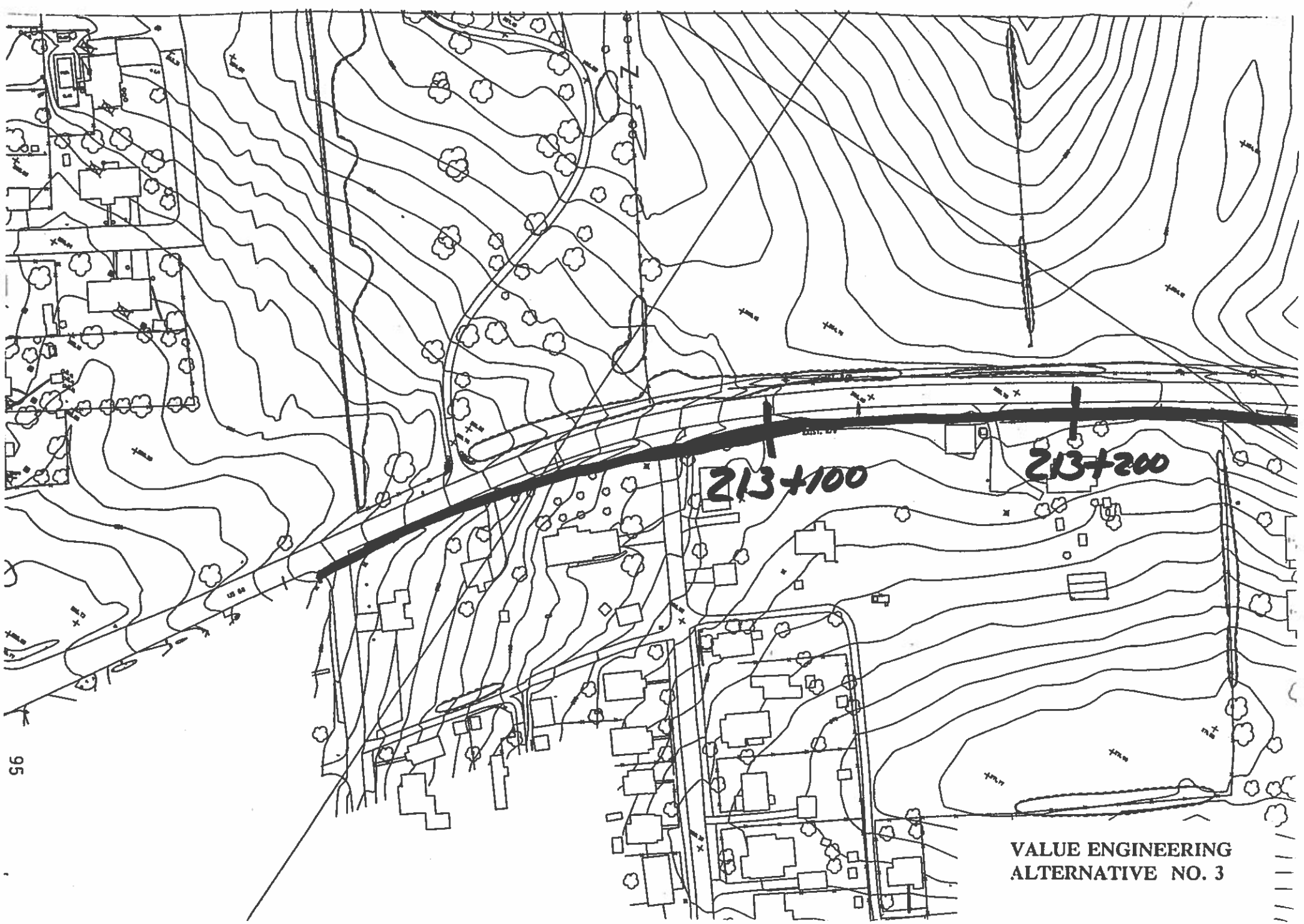


VALUE ENGINEERING
ALTERNATIVE NO. 3



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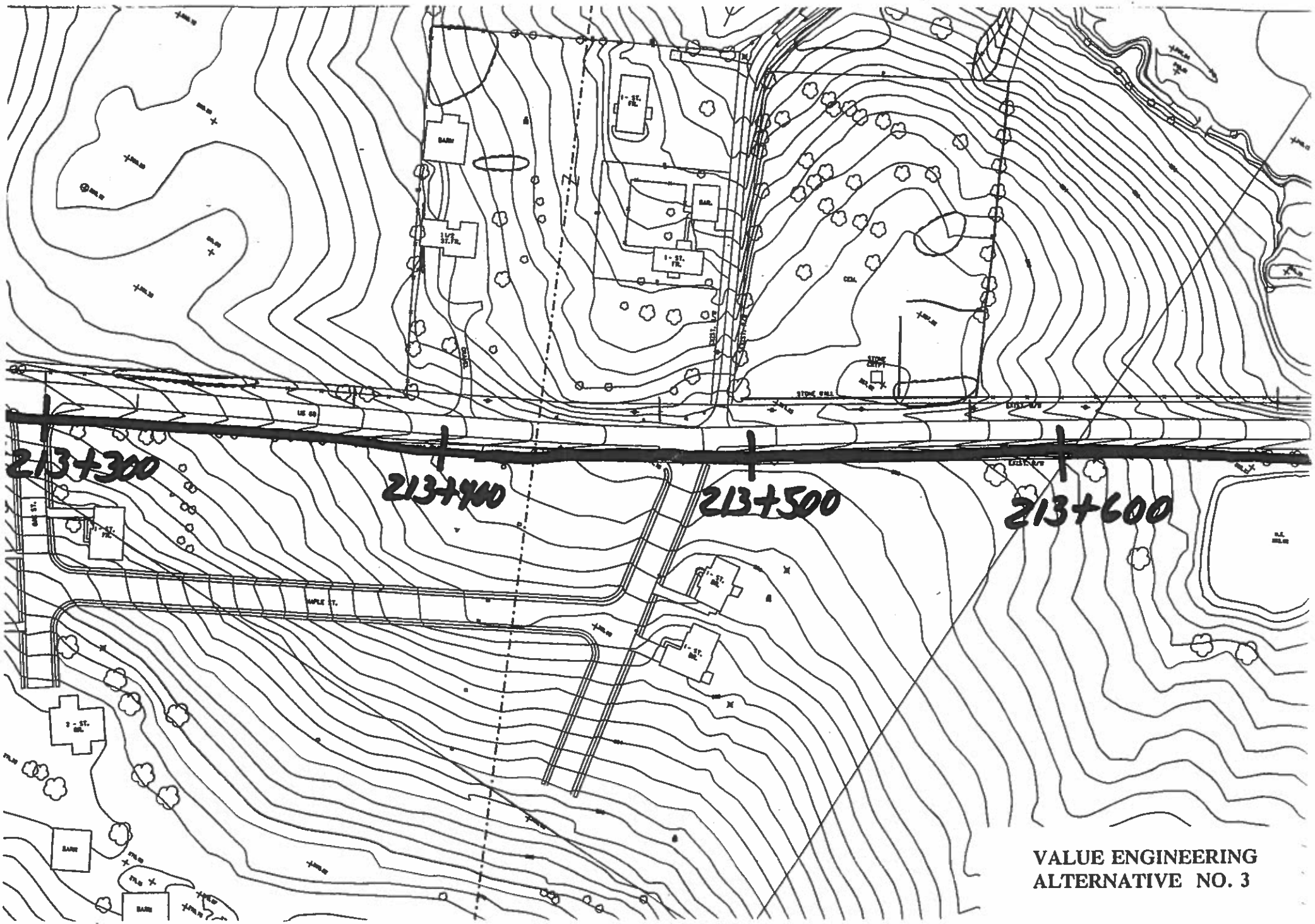

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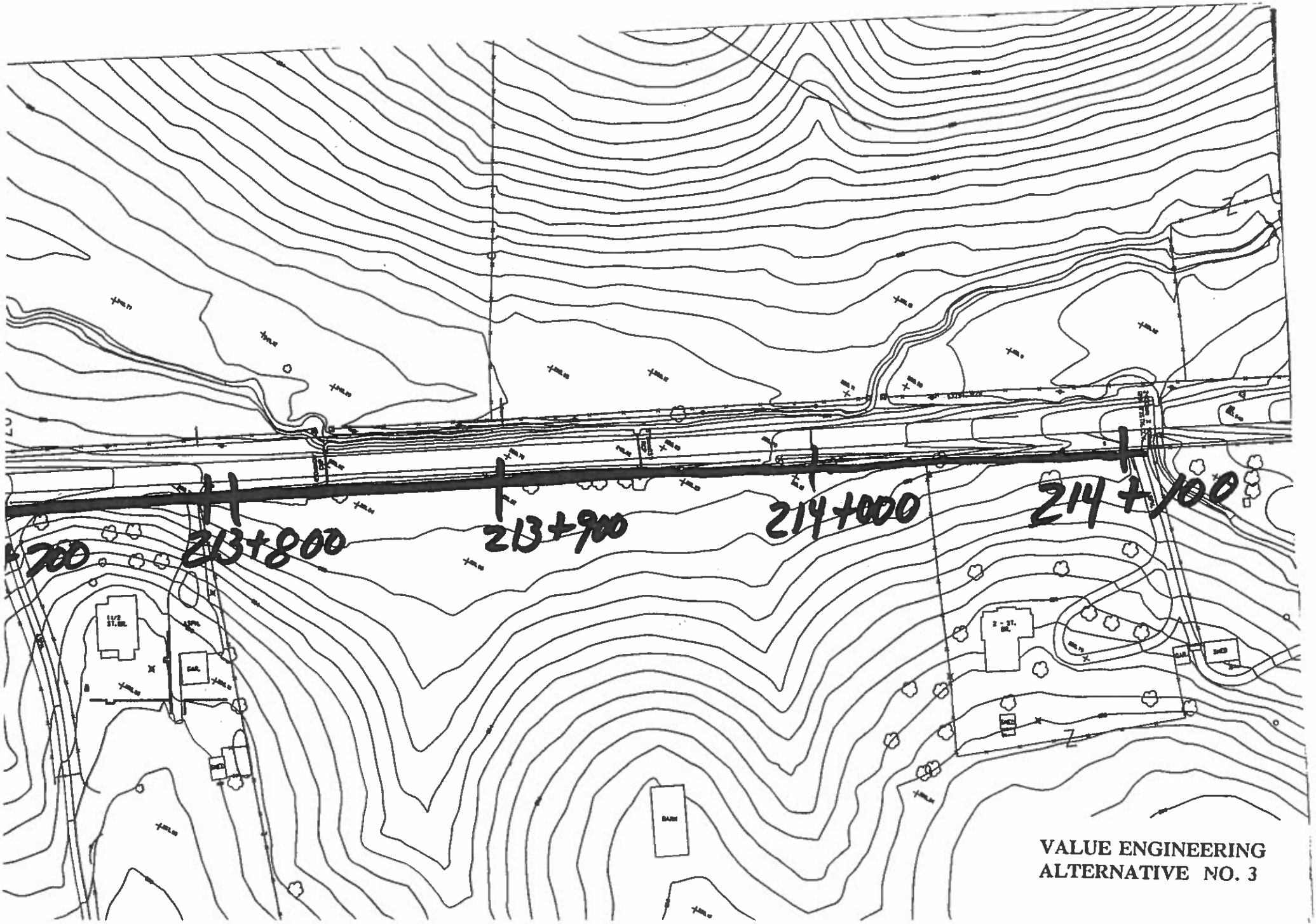

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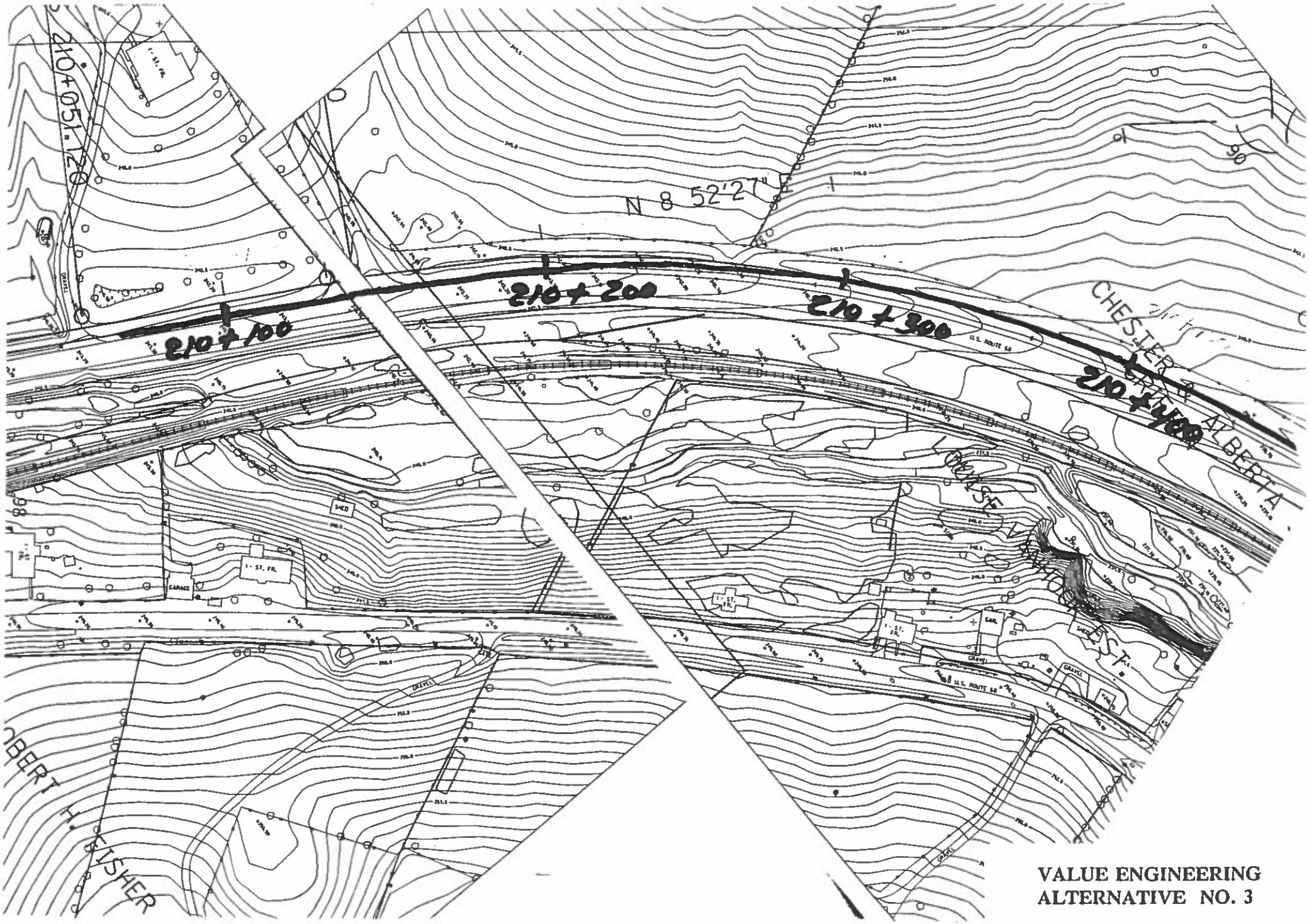

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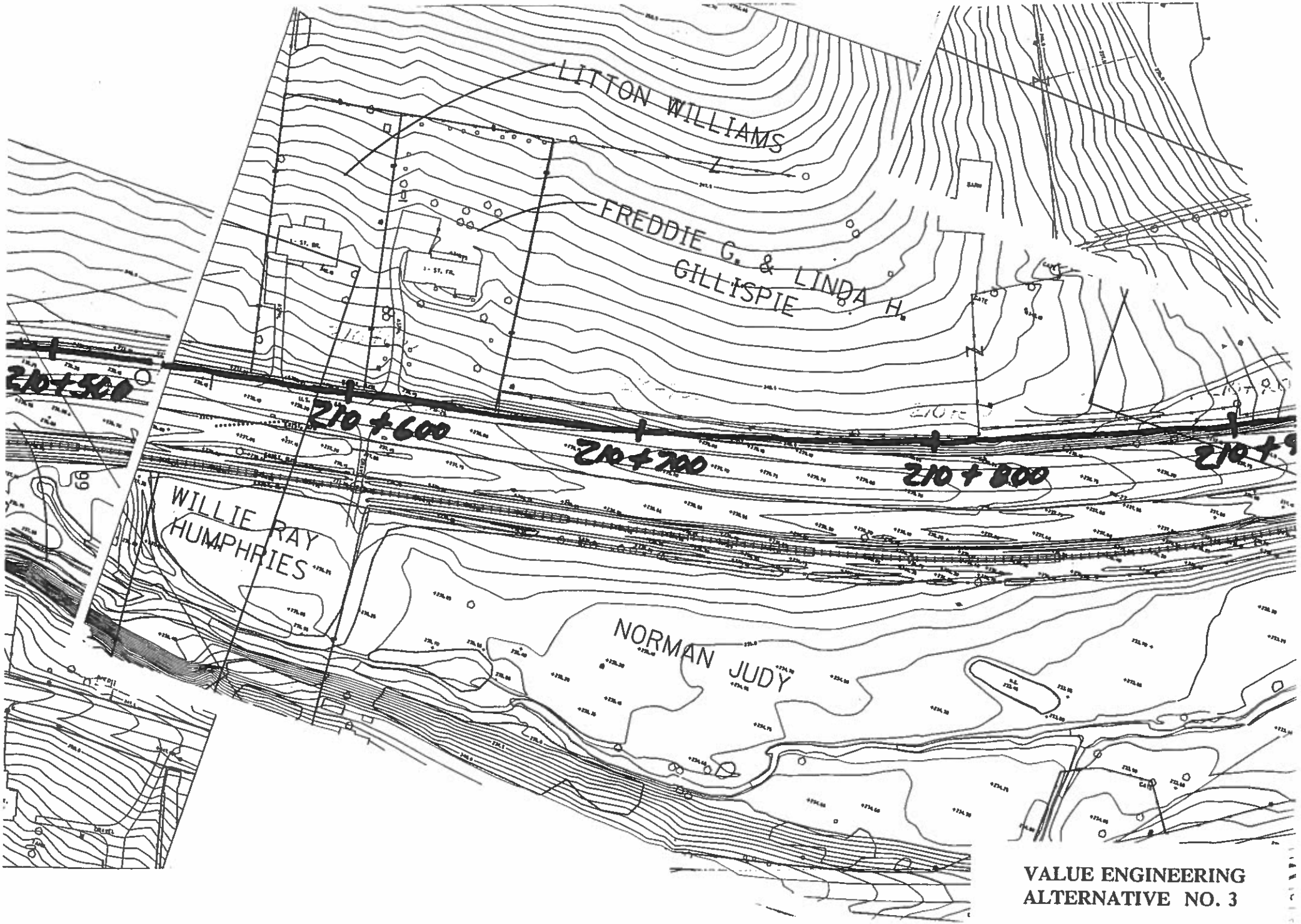

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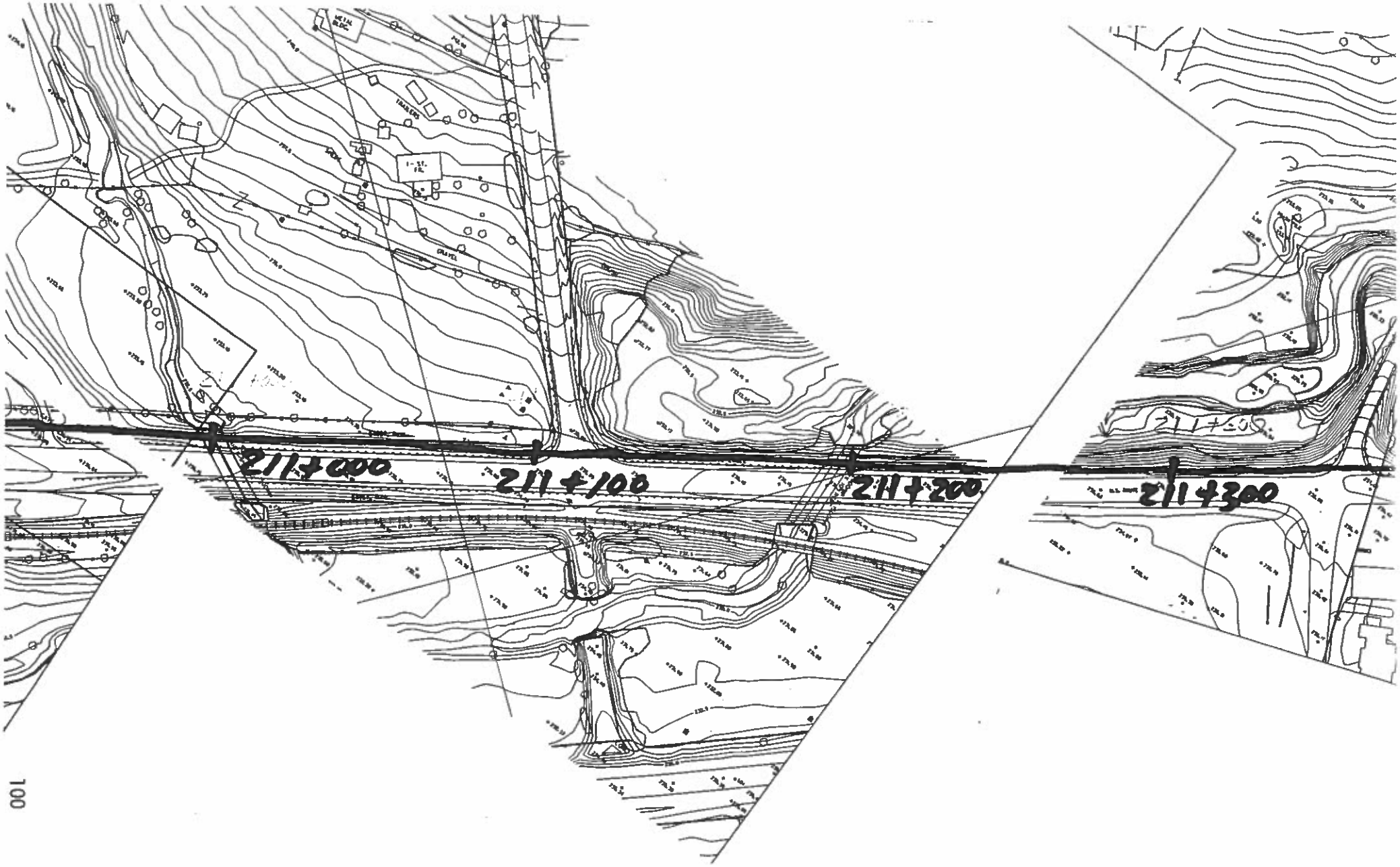

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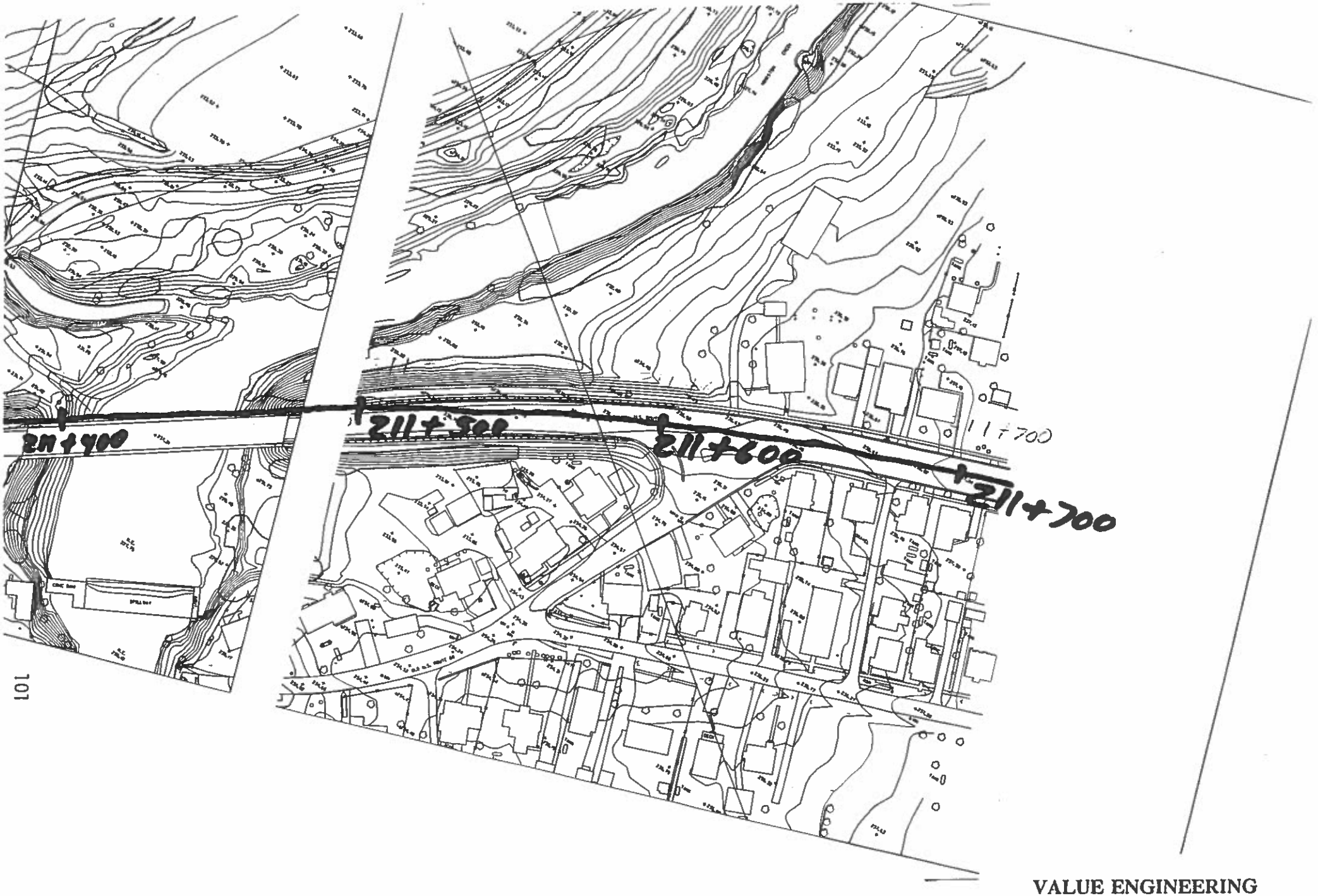
VALUE ENGINEERING
ALTERNATIVE NO. 3



VALUE ENGINEERING ALTERNATIVE NO. 3

VII.(e) V.E. ALTERNATIVE NO. 8

Value Engineering Alternative No. 8
("As Proposed" Modified)

This alternative is similar to the designers "As Proposed" alternative except it utilizes a four lane facility from the Paris bypass to KY 36, a two lane facility is utilized for the remainder of the project. A four lane Millersburg bypass is utilized. The "As Proposed" alignment utilizes the existing right of way from the Paris bypass to west of Millersburg. The existing right of way east of Millersburg is not fully utilized. The typical section utilizes two 3.6m lanes, a 3.0m exterior shoulder and a 1.2m interior shoulder in each direction with a 12.2m median.

This alternative provides a 2025 LOS A from the Paris bypass to west of the Millersburg bypass. The Millersburg bypass has a 2025 LOS B. the section east to KY 36 has a LOS A. The remaining section, a two lane section, is a 2025 LOS D.

VALUE ENGINEERING ALTERNATIVE NO. 8
("AS PROPOSED" MODIFIED FOR FOUR LANES)
COST COMPARISON

DESCRIPTION	UNIT COST	PROP'D QTY.	2 LANE/4 LANE FUTURE PROP'D COST	V.E. QTY.	V.E. COST
CLEAR & GRUBBING	LS	1	$ 578.100	1	$780,400
R/W COST	LS	1	$8,031,000	1	$8,031,000
BRIDGE	$635,000/EA	1	$ 635,000	2	$1,270,000
HISTORICAL IMPACT	LS	1	$1,036,500	1	$1,036,500
CULVERT	LS	1	$1,459,900	1	$2,275,300
CROSS DRAINS	LS	1	$ 495,500	1	$ 695,000
ASPHALT (SURF)	$33/M-TON	27,300	$ 899,900	48,900	$1,612,400
ASPHALT (BASE)	$30/M-TON	158,700	$4,760,900	284,200	$8,525,800
DGA	$15/M-TON	288,700	$4,331,200	520,700	$7,811,000
EXCAVATION	$3.75/$m^3$	1,416,300	$5,311,000	1,942,100	$7,282,800
STRIPING	$1.50/M	69,200	$ 103,800	138,400	$ 207,600
GUARDRAIL	$30/M	12,690	$ 380,700	13,200	$ 396,000
STAKING	LS	1	$ 70,000	1	$ 98,000
MOT	LS	1	$ 660,000	1	$ 660,000
TOTAL			$28,753,500		$40,681,800

Possible Additional Cost **$ 11,928,300**
Over 2 lane const. with a 4 lane future

VII.(f) TRAFFIC

TRAFFIC ANALYSIS

U.S. 68 has been designated as a primary arterial on the National Highway System. As shown in Table 11-6, Guide for selection of design levels of service LOS, AASHTO Geometric Design Manual, the appropriate level of service for a rural arterial in rolling terrain is LOS B. This LOS should, therefore, be provided for this project, based on acceptable AASHTO criteria. This LOS will provide reasonably free flow with flow rates not exceeding 55% of capacity, which equates to 1,200 passenger vehicles per lane, per hour, at an average travel speed of 96Km/h (60 mph) under ideal conditions for a multilane rural highway. For a two lane two directional highway, with LOSB, the average travel speed would be 88 Km/h (55 mph) with a flow rate of 750 passenger cars per hour, (total two way) under ideal conditions.

Capacity analyses were made for various segments of the project utilizing the Highway Capacity Manual procedure for two lane, two directional highways and 20 year design hour volumes provided by the Department. Copies of the traffic data sheets are included, as well as the results of the capacity analyses which are summarized as follows:

Segment	2021 DHV Actual Flow Rate (WPH) 2021 DHV	Level of Service (Two Lane Hwy.)
3	1579	E
5 (Millersburg ByPass)	1075	D
7	761	C
6	1277	D

In addition to the preceding analyses, the VE team also obtained the results of mainline capacity analysis prepared by the Department for the segment of US 68 from Paris to Millersburg. As shown in the table (7B), the projected LOS for this project (Sections H through M) would be E, with 2025 year traffic volumes. For Section N (KY 36 to KY 32/KY 36, the projected LOS is D.

Based on the preceding traffic capacity analyses, for the project section from the beginning of the project to the Westerly connection to Millersburg, a four lane divided highway should be constructed to obtain an acceptable LOS for a rural arterial.

For the proposed Millersburg bypass, (Segment 5), a two lane, two directional roadway will provide LOS D for 2021 design hour volumes. Although this may be acceptable, the consensus of the Value Engineering team was that a four lane divided section should be provided.

Immediately west of Millersburg (Segment 6) to the intersection with KY 36, a two lane two directional highway will also provide LOSD for the projected 2021 design hour volumes. The Value Engineering team agreed that a four lane divided facility should be constructed and provide an operating speed and free flow condition that is consistent with the contiguous segment.

At the intersection of US 68 and KY 36, there is a significant reduction in the traffic volumes on US 68 east of the intersection. For this section, a two lane roadway will provide adequate capacity for LOS C. The Value Engineering team concurred that a two lane section is acceptable, particularly since two lanes are to be provided for the continuation of US 68 in Nicholas County.

In summary, although a two lane two directional roadway will provide an acceptable LOS for current traffic, the operating speed and free flow conditions would be significantly compromised prior to the end of the 20 year design period. A very supportable case can, therefore, be made for the construction of a four lane facility initially which will not only provide a LOS A for projected design year volumes, but will also provide sufficient capacity for additional traffic growth that may occur in this traffic corridor.

Once a level of service has been selected, it is desirable that all elements of the roadway are consistently designed to this level. This consistency of design service flow rate results in near-constant freedom of traffic movement and operating speed, and flow interruptions from bottlenecks can be avoided.

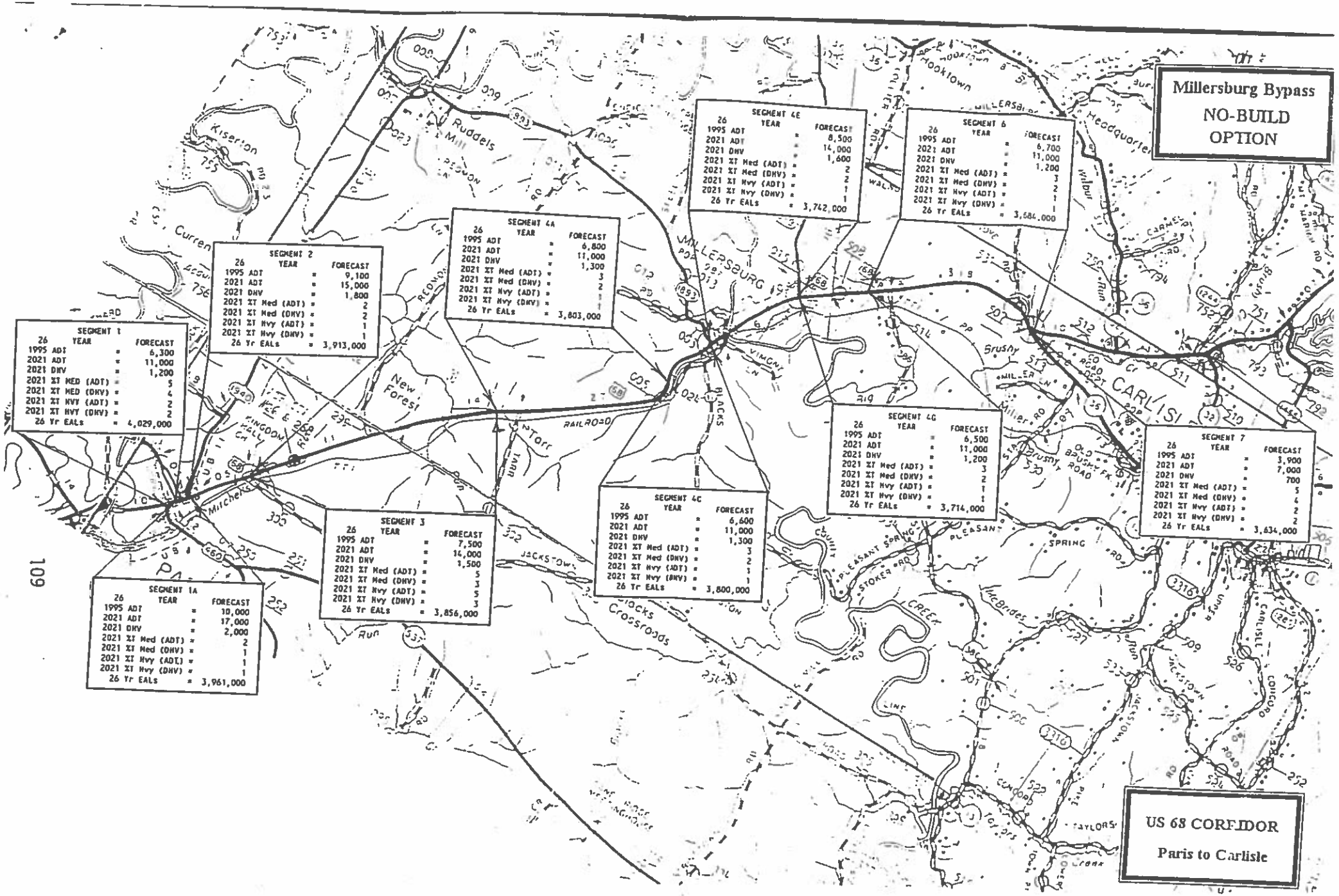
The HCM (11) supplies the analytical base for design calculations and decisions, but the designer must use his or her judgment to select the proper level of service. The designer may possibly select a design service flow rate less than the anticipated demand for certain recreational routes or for environmental or land use planning reasons. Or, the guidance given in Table II-6 may be chosen for the appropriate values in particular locations.

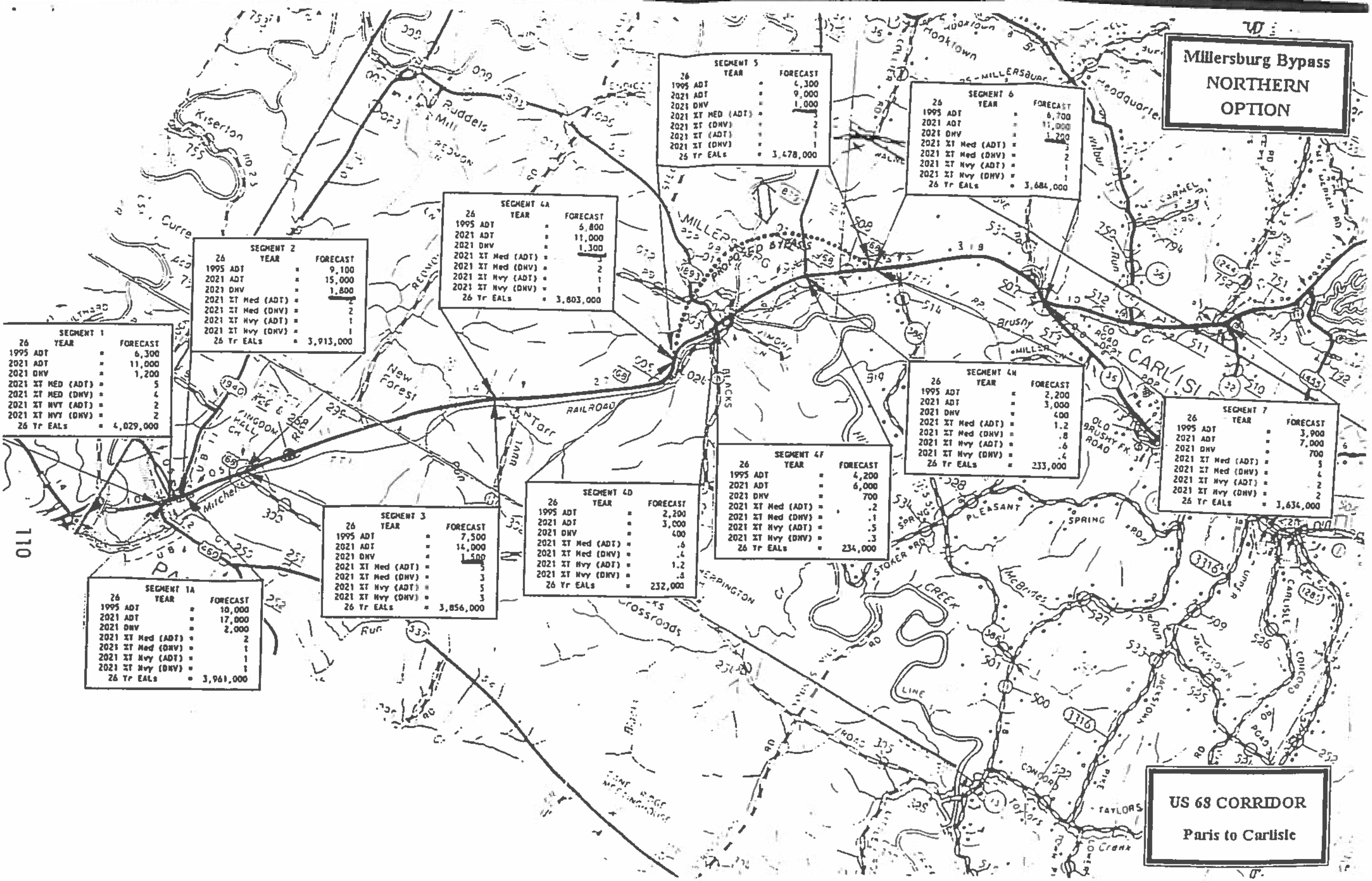
Whether designing an intersection, an interchange, an arterial, or a freeway, the selection of the desired level of service must be carefully weighed because the adequacy of the roadway is dependent on this choice.

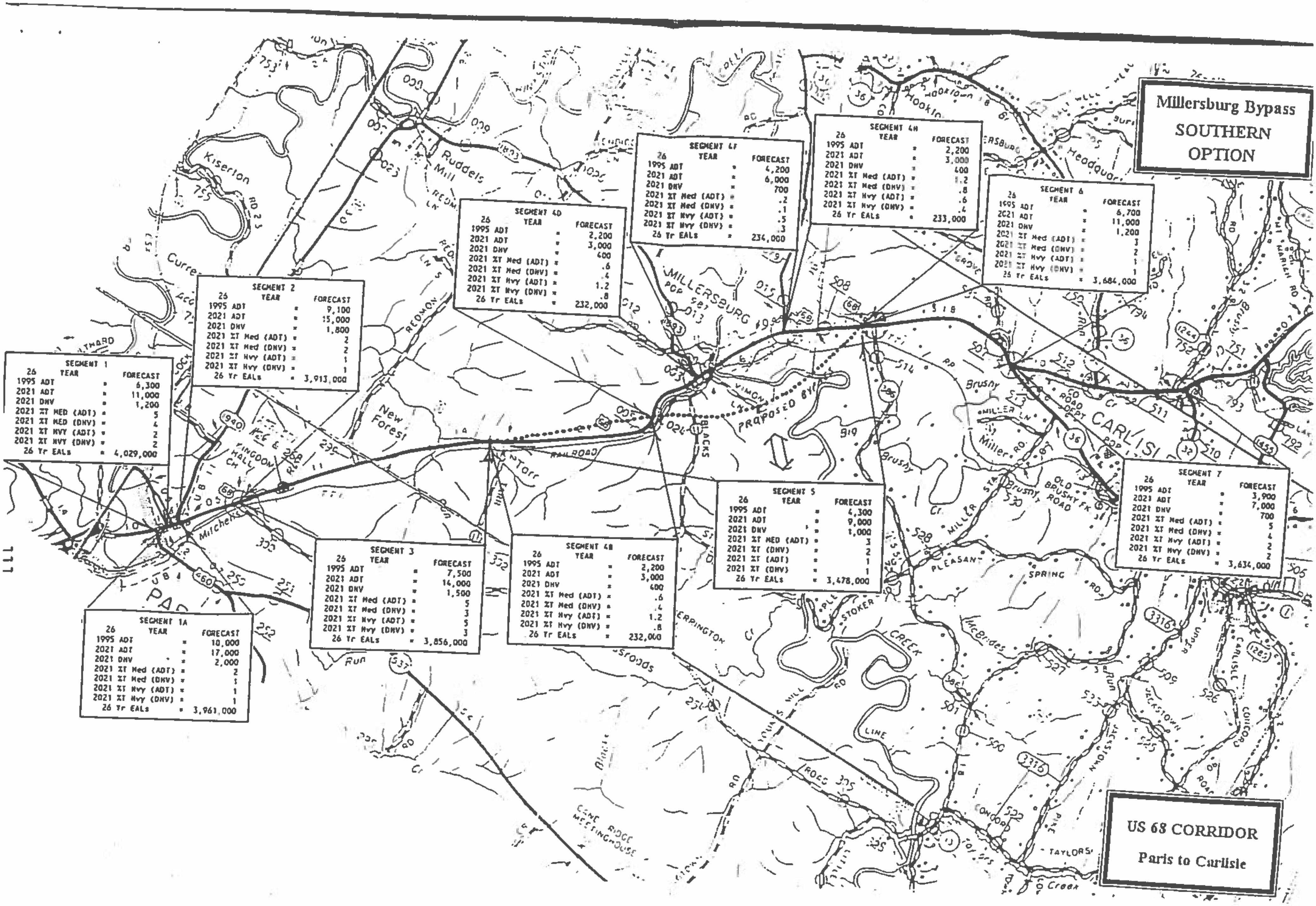
Highway Type	Type of Area and Appropriate Level of Service			
	Rural Level	Rural Rolling	Rural Mountainous	Urban and Suburban
Freeway	B	B	C	C
Arterial	B	B	C	C
Collector	C	C	D	D
Local	D	D	D	D

NOTE: General operating conditions for levels of service (Source: Ref. 11):
A - free flow, with low volumes and high speeds.
B - reasonably free flow, but speeds beginning to be restricted by traffic conditions.
C - in stable flow zone, but most drivers restricted in freedom to select their own speed.
D - approaching unstable flow, drivers have little freedom to maneuver.
E - unstable flow, may be short stoppages.

Table II-6. Guide for selection of design levels of service.


Millersburg Bypass
NO-BUILD
OPTION
SEGMENT 1
26 YEAR FORECAST
1995 ADT = 6,300
2021 ADT = 11,000
2021 DHV = 1,200
2021 %T Med (ADT) = 5
2021 %T Med (DHV) = 4
2021 %T Hvy (ADT) = 2
2021 %T Hvy (DHV) = 2
26 Yr EALs = 4,029,000
SEGMENT 1A
26 YEAR FORECAST
1995 ADT = 10,000
2021 ADT = 17,000
2021 DHV = 2,000
2021 %T Med (ADT) = 2
2021 %T Med (DHV) = 1
2021 %T Hvy (ADT) = 1
2021 %T Hvy (DHV) = 1
26 Yr EALs = 3,961,000
SEGMENT 2
26 YEAR FORECAST
1995 ADT = 9,100
2021 ADT = 15,000
2021 DHV = 1,800
2021 %T Med (ADT) = 2
2021 %T Med (DHV) = 2
2021 %T Hvy (ADT) = 1
2021 %T Hvy (DHV) = 1
26 Yr EALs = 3,913,000
SEGMENT 3
26 YEAR FORECAST
1995 ADT = 7,500
2021 ADT = 14,000
2021 DHV = 1,500
2021 %T Med (ADT) = 5
2021 %T Med (DHV) = 3
2021 %T Hvy (ADT) = 5
2021 %T Hvy (DHV) = 3
26 Yr EALs = 3,856,000
SEGMENT 4A
26 YEAR FORECAST
1995 ADT = 6,800
2021 ADT = 11,000
2021 DHV = 1,300
2021 %T Med (ADT) = 3
2021 %T Med (DHV) = 2
2021 %T Hvy (ADT) = 1
2021 %T Hvy (DHV) = 1
26 Yr EALs = 3,803,000
SEGMENT 4C
26 YEAR FORECAST
1995 ADT = 6,600
2021 ADT = 11,000
2021 DHV = 1,300
2021 %T Med (ADT) = 3
2021 %T Med (DHV) = 2
2021 %T Hvy (ADT) = 1
2021 %T Hvy (DHV) = 1
26 Yr EALs = 3,800,000
SEGMENT 4E
26 YEAR FORECAST
1995 ADT = 8,500
2021 ADT = 14,000
2021 DHV = 1,600
2021 %T Med (ADT) = 2
2021 %T Med (DHV) = 2
2021 %T Hvy (ADT) = 1
2021 %T Hvy (DHV) = 1
26 Yr EALs = 3,742,000
SEGMENT 4G
26 YEAR FORECAST
1995 ADT = 6,500
2021 ADT = 11,000
2021 DHV = 1,200
2021 %T Med (ADT) = 3
2021 %T Med (DHV) = 2
2021 %T Hvy (ADT) = 1
2021 %T Hvy (DHV) = 1
26 Yr EALs = 3,714,000
SEGMENT 6
26 YEAR FORECAST
1995 ADT = 6,700
2021 ADT = 11,000
2021 DHV = 1,200
2021 %T Med (ADT) = 3
2021 %T Med (DHV) = 2
2021 %T Hvy (ADT) = 1
2021 %T Hvy (DHV) = 1
26 Yr EALs = 3,684,000
SEGMENT 7
26 YEAR FORECAST
1995 ADT = 3,900
2021 ADT = 7,000
2021 DHV = 700
2021 %T Med (ADT) = 5
2021 %T Med (DHV) = 4
2021 %T Hvy (ADT) = 2
2021 %T Hvy (DHV) = 2
26 Yr EALs = 3,634,000
US 68 CORRIDOR
Paris to Carlisle
MILLERSBURG
CARLISLE
Paris
Kiserton
Ruddels Mill
New Forest
Mitchells
Jacks Crossroads
Brushy
Pleasant Spring
Stoker Rd
Miller Rd
Old Brushy Fk Road
Headquarters
Hookstown
Curren
Run
Creek
Railroad
109


Millersburg Bypass
NORTHERN
OPTION
US 68 CORRIDOR
Paris to Carlisle
SEGMENT 1
26 YEAR FORECAST
1995 ADT = 6,300
2021 ADT = 11,000
2021 DHV = 1,200
2021 %T MED (ADT) = 5
2021 %T MED (DHV) = 4
2021 %T HVY (ADT) = 2
2021 %T HVY (DHV) = 2
26 Yr EALs = 4,029,000
SEGMENT 1A
26 YEAR FORECAST
1995 ADT = 10,000
2021 ADT = 17,000
2021 DHV = 2,000
2021 %T Med (ADT) = 2
2021 %T Med (DHV) = 1
2021 %T Hvy (ADT) = 1
2021 %T Hvy (DHV) = 1
26 Yr EALs = 3,961,000
SEGMENT 2
26 YEAR FORECAST
1995 ADT = 9,100
2021 ADT = 15,000
2021 DHV = 1,800
2021 %T Med (ADT) = 2
2021 %T Med (DHV) = 2
2021 %T Hvy (ADT) = 1
2021 %T Hvy (DHV) = 1
26 Yr EALs = 3,913,000
SEGMENT 3
26 YEAR FORECAST
1995 ADT = 7,500
2021 ADT = 14,000
2021 DHV = 1,500
2021 %T Med (ADT) = 3
2021 %T Med (DHV) = 3
2021 %T Hvy (ADT) = 3
2021 %T Hvy (DHV) = 3
26 Yr EALs = 3,856,000
SEGMENT 4A
26 YEAR FORECAST
1995 ADT = 6,800
2021 ADT = 11,000
2021 DHV = 1,300
2021 %T Med (ADT) = 3
2021 %T Med (DHV) = 2
2021 %T Hvy (ADT) = 1
2021 %T Hvy (DHV) = 1
26 Yr EALs = 3,803,000
SEGMENT 4D
26 YEAR FORECAST
1995 ADT = 2,200
2021 ADT = 3,000
2021 DHV = 400
2021 %T Med (ADT) = .6
2021 %T Med (DHV) = .4
2021 %T Hvy (ADT) = 1.2
2021 %T Hvy (DHV) = .8
26 Yr EALs = 232,000
SEGMENT 4F
26 YEAR FORECAST
1995 ADT = 4,200
2021 ADT = 6,000
2021 DHV = 700
2021 %T Med (ADT) = .2
2021 %T Med (DHV) = .1
2021 %T Hvy (ADT) = .5
2021 %T Hvy (DHV) = .3
26 Yr EALs = 234,000
SEGMENT 4H
26 YEAR FORECAST
1995 ADT = 2,200
2021 ADT = 3,000
2021 DHV = 400
2021 %T Med (ADT) = 1.2
2021 %T Med (DHV) = .8
2021 %T Hvy (ADT) = .6
2021 %T Hvy (DHV) = .4
26 Yr EALs = 233,000
SEGMENT 5
26 YEAR FORECAST
1995 ADT = 4,300
2021 ADT = 9,000
2021 DHV = 1,000
2021 %T MED (ADT) = 3
2021 %T (DHV) = 2
2021 %T (ADT) = 1
2021 %T (DHV) = 1
26 Yr EALs = 3,478,000
SEGMENT 6
26 YEAR FORECAST
1995 ADT = 6,700
2021 ADT = 11,000
2021 DHV = 1,200
2021 %T Med (ADT) = 3
2021 %T Med (DHV) = 2
2021 %T Hvy (ADT) = 1
2021 %T Hvy (DHV) = 1
26 Yr EALs = 3,684,000
SEGMENT 7
26 YEAR FORECAST
1995 ADT = 3,900
2021 ADT = 7,000
2021 DHV = 700
2021 %T Med (ADT) = 5
2021 %T Med (DHV) = 4
2021 %T Hvy (ADT) = 2
2021 %T Hvy (DHV) = 2
26 Yr EALs = 3,634,000
PROPOSED BYPASS
CARLISLE
MILLERSBURG
RAILROAD
New Forest
BLACKS
CREEK


Millersburg Bypass
SOUTHERN
OPTION
US 68 CORRIDOR
Paris to Carlisle
SEGMENT 1 / 26 YEAR / FORECAST / 1995 ADT = 6,300 / 2021 ADT = 11,000 / 2021 DHV = 1,200 / 2021 %T MED (ADT) = 5 / 2021 %T MED (DHV) = 4 / 2021 %T HVY (ADT) = 2 / 2021 %T HVY (DHV) = 2 / 26 Yr EALs = 4,029,000
SEGMENT 1A / 26 YEAR / FORECAST / 1995 ADT = 10,000 / 2021 ADT = 17,000 / 2021 DHV = 2,000 / 2021 %T Med (ADT) = 2 / 2021 %T Med (DHV) = 1 / 2021 %T Hvy (ADT) = 1 / 2021 %T Hvy (DHV) = 1 / 26 Yr EALs = 3,961,000
SEGMENT 2 / 26 YEAR / FORECAST / 1995 ADT = 9,100 / 2021 ADT = 15,000 / 2021 DHV = 1,800 / 2021 %T Med (ADT) = 2 / 2021 %T Med (DHV) = 2 / 2021 %T Hvy (ADT) = 1 / 2021 %T Hvy (DHV) = 1 / 26 Yr EALs = 3,913,000
SEGMENT 3 / 26 YEAR / FORECAST / 1995 ADT = 7,500 / 2021 ADT = 14,000 / 2021 DHV = 1,500 / 2021 %T Med (ADT) = 5 / 2021 %T Med (DHV) = 3 / 2021 %T Hvy (ADT) = 5 / 2021 %T Hvy (DHV) = 3 / 26 Yr EALs = 3,856,000
SEGMENT 4D / 26 YEAR / FORECAST / 1995 ADT = 2,200 / 2021 ADT = 3,000 / 2021 DHV = 400 / 2021 %T Med (ADT) = .6 / 2021 %T Med (DHV) = .4 / 2021 %T Hvy (ADT) = 1.2 / 2021 %T Hvy (DHV) = .8 / 26 Yr EALs = 232,000
SEGMENT 4B / 26 YEAR / FORECAST / 1995 ADT = 2,200 / 2021 ADT = 3,000 / 2021 DHV = 400 / 2021 %T Med (ADT) = .6 / 2021 %T Med (DHV) = .4 / 2021 %T Hvy (ADT) = 1.2 / 2021 %T Hvy (DHV) = .8 / 26 Yr EALs = 232,000
SEGMENT 4F / 26 YEAR / FORECAST / 1995 ADT = 4,200 / 2021 ADT = 6,000 / 2021 DHV = 700 / 2021 %T Med (ADT) = .2 / 2021 %T Med (DHV) = .1 / 2021 %T Hvy (ADT) = .5 / 2021 %T Hvy (DHV) = .3 / 26 Yr EALs = 234,000
SEGMENT 4H / 26 YEAR / FORECAST / 1995 ADT = 2,200 / 2021 ADT = 3,000 / 2021 DHV = 400 / 2021 %T Med (ADT) = 1.2 / 2021 %T Med (DHV) = .8 / 2021 %T Hvy (ADT) = .6 / 2021 %T Hvy (DHV) = .4 / 26 Yr EALs = 233,000
SEGMENT 5 / 26 YEAR / FORECAST / 1995 ADT = 4,300 / 2021 ADT = 9,000 / 2021 DHV = 1,000 / 2021 %T MED (ADT) = 3 / 2021 %T (DHV) = 2 / 2021 %T (ADT) = 1 / 2021 %T (DHV) = 1 / 26 Yr EALs = 3,478,000
SEGMENT 6 / 26 YEAR / FORECAST / 1995 ADT = 6,700 / 2021 ADT = 11,000 / 2021 DHV = 1,200 / 2021 %T Med (ADT) = 3 / 2021 %T Med (DHV) = 2 / 2021 %T Hvy (ADT) = 1 / 2021 %T Hvy (DHV) = 1 / 26 Yr EALs = 3,684,000
SEGMENT 7 / 26 YEAR / FORECAST / 1995 ADT = 3,900 / 2021 ADT = 7,000 / 2021 DHV = 700 / 2021 %T Med (ADT) = 5 / 2021 %T Med (DHV) = 4 / 2021 %T Hvy (ADT) = 2 / 2021 %T Hvy (DHV) = 2 / 26 Yr EALs = 3,634,000
MILLERSBURG
PROPOSED BYP
CARLISLE
Ruddels Mill
New Forest
Kiserton
Hooktown
BLACKS
STOKER
CREEK
PLEASANT
SPRING
RAILROAD

1985 HCM:TWO-LANE HIGHWAYS
****

FACILITY LOCATION.... segment 3
ANALYST.....
TIME OF ANALYSIS.....
DATE OF ANALYSIS..... 08-20-1997
OTHER INFORMATION....

A) ADJUSTMENT FACTORS

PERCENTAGE OF TRUCKS.....	6
PERCENTAGE OF BUSES.....	0
PERCENTAGE OF RECREATIONAL VEHICLES.....	0
DESIGN SPEED (MPH).....	60
PEAK HOUR FACTOR.....	.95
DIRECTIONAL DISTRIBUTION (UP/DOWN).....	50 / 50
LANE WIDTH (FT).....	12
USABLE SHOULDER WIDTH (AVG. WIDTH IN FT.)...	10
PERCENT NO PASSING ZONES.....	15

B) CORRECTION FACTORS

ROLLING TERRAIN

LOS	E T	E B	E R	f w	f d	f HV
A	4	3	3.2	1	1	.85
B	5	3.4	3.9	1	1	.81
C	5	3.4	3.9	1	1	.81
D	5	2.9	3.3	1	1	.81
E	5	2.9	3.3	1	1	.81

C) LEVEL OF SERVICE RESULTS

INPUT VOLUME(vph): 1500
ACTUAL FLOW RATE: 1579

LOS	SERVICE FLOW RATE	V/C
A	237	.1
B	519	.23
C	881	.39
D	1287	.57
E	2123	.94

LOS FOR GIVEN CONDITIONS: E

1985 HCM:TWO-LANE HIGHWAYS

****

FACILITY LOCATION.... segment 5
ANALYST.....
TIME OF ANALYSIS.....
DATE OF ANALYSIS..... 08-20-1997
OTHER INFORMATION....

A) ADJUSTMENT FACTORS

PERCENTAGE OF TRUCKS.....	3
PERCENTAGE OF BUSES.....	0
PERCENTAGE OF RECREATIONAL VEHICLES.....	0
DESIGN SPEED (MPH).....	60
PEAK HOUR FACTOR.....	.93
DIRECTIONAL DISTRIBUTION (UP/DOWN).....	50 / 50
LANE WIDTH (FT).....	12
USABLE SHOULDER WIDTH (AVG. WIDTH IN FT.)...	10
PERCENT NO PASSING ZONES.....	12

B) CORRECTION FACTORS

ROLLING TERRAIN

LOS	E T	E B	E R	f w	f d	f HV
A	4	3	3.2	1	1	.92
B	5	3.4	3.9	1	1	.89
C	5	3.4	3.9	1	1	.89
D	5	2.9	3.3	1	1	.89
E	5	2.9	3.3	1	1	.89

C) LEVEL OF SERVICE RESULTS

INPUT VOLUME(vph): 1000
ACTUAL FLOW RATE: 1075

LOS	SERVICE FLOW RATE	V/C
A	257	.1
B	575	.23
C	975	.39
D	1425	.57
E	2350	.94

LOS FOR GIVEN CONDITIONS: D

1985 HCM:TWO-LANE HIGHWAYS

****

FACILITY LOCATION.... segment 7
ANALYST.....
TIME OF ANALYSIS.....
DATE OF ANALYSIS..... 08-20-1997
OTHER INFORMATION....

A) ADJUSTMENT FACTORS

PERCENTAGE OF TRUCKS	6
PERCENTAGE OF BUSES	0
PERCENTAGE OF RECREATIONAL VEHICLES	0
DESIGN SPEED (MPH)	60
PEAK HOUR FACTOR	.92
DIRECTIONAL DISTRIBUTION (UP/DOWN)	50 / 50
LANE WIDTH (FT)	12
USABLE SHOULDER WIDTH (AVG. WIDTH IN FT.)	10
PERCENT NO PASSING ZONES	15

B) CORRECTION FACTORS

ROLLING TERRAIN

LOS	E T	E B	E R	f w	f d	f HV
A	4	3	3.2	1	1	.85
B	5	3.4	3.9	1	1	.81
C	5	3.4	3.9	1	1	.81
D	5	2.9	3.3	1	1	.81
E	5	2.9	3.3	1	1	.81

C) LEVEL OF SERVICE RESULTS

INPUT VOLUME(vph): 700
ACTUAL FLOW RATE: 761

LOS	SERVICE FLOW RATE	V/C
A	237	.1
B	519	.23
C	881	.39
D	1287	.57
E	2123	.94

LOS FOR GIVEN CONDITIONS: C

1985 HCM:TWO-LANE HIGHWAYS

****

FACILITY LOCATION.... Segment 6
ANALYST.....
TIME OF ANALYSIS.....
DATE OF ANALYSIS..... 08-21-1997
OTHER INFORMATION....

A) ADJUSTMENT FACTORS

PERCENTAGE OF TRUCKS.....	3
PERCENTAGE OF BUSES.....	0
PERCENTAGE OF RECREATIONAL VEHICLES.....	0
DESIGN SPEED (MPH).....	60
PEAK HOUR FACTOR.....	.94
DIRECTIONAL DISTRIBUTION (UP/DOWN).....	50 / 50
LANE WIDTH (FT).....	12
USABLE SHOULDER WIDTH (AVG. WIDTH IN FT.)...	10
PERCENT NO PASSING ZONES.....	15

B) CORRECTION FACTORS

ROLLING TERRAIN

LOS	E T	E B	E R	f w	f d	f HV
A	4	3	3.2	1	1	.92
B	5	3.4	3.9	1	1	.89
C	5	3.4	3.9	1	1	.89
D	5	2.9	3.3	1	1	.89
E	5	2.9	3.3	1	1	.89

C) LEVEL OF SERVICE RESULTS

INPUT VOLUME(vph): 1200
ACTUAL FLOW RATE: 1277

LOS	SERVICE FLOW RATE	V/C
A	257	.1
B	575	.23
C	975	.39
D	1425	.57
E	2350	.94

LOS FOR GIVEN CONDITIONS: D

TABLE 7b
MAINLINE CAPACITY ANALYSIS
US 68 Paris to Maysville

SECT	TERMINI	MILE-POINTS	1995 DDHV	1995 %T (DHV)	1995 2 LANES LOS	1995 2 LANES V/C	2025 DDHV	2025 % T (DHV)	2025 2 LANES LOS	2025 2 LANES V/C	*IMPROVED 2 LANES 1995 LOS	*IMPROVED 2 LANES 1995 V/C	*IMPROVED 2 LANES 2025 LOS	*IMPROVED 2 LANES 2025 V/C	**4 LANE DIVIDED 1995 LOS	**4 LANE DIVIDED 2025 LOS
G	US 68 Bypass	2.360														
	KY 1940	2.447	1,100	2	E	0.53	1990	2	E	0.91	N/A	N/A	N/A	N/A	A	B
H	KY 1940	2.447														
	Redmon Road	4.766	1,000	2	E	0.64	1820	2	E	0.99	D	0.45	E	0.81	A	A
I	Redmon Road	4.766														
	KY 1893	9.228	730	3	D	0.40	1320	3	E	0.73	C	0.33	E	0.59	A	A
J	KY 1893	9.228														
	KY 1879	10.414	940	3	E	0.49	1690	3	E	0.95	D	0.40	E	0.84	A	A
K	KY 1879	10.414														
	Nicholas Co. Line	10.814	720	4	E	0.43	1300	4	E	0.75	C	0.34	E	0.62	A	A
L	Nicholas Co. Line	0.000														
	KY 386	0.694	720	4	E	0.46	1300	4	E	0.81	C	0.34	E	0.62	A	A
M	KY 386	0.694														
	KY 36	2.714	760	4	D	0.45	1380	4	E	0.82	D	0.36	E	0.66	A	A
N	KY 36	2.714														
	KY 32/KY 36	3.717	400	6	C	0.26	720	6	D	0.47	C	0.20	D	0.37	A	A
O	KY 32/KY 36	3.717														
	KY 1244 (south)	4.675	430	5	C	0.27	780	5	D	0.48	C	0.21	D	0.39	A	A
P	KY 1244 (south)	4.675														
	KY 1455 (south)	5.953	410	6	D	0.32	740	6	E	0.58	C	0.21	D	0.38	A	A
Q	KY 1455 (south)	5.953														
	KY 1455 (north)	10.652	320	7	C	0.26	580	7	E	0.47	B	0.17	C	0.31	A	A
R	KY 1445 (north)	10.652														
	Robertson Co. Line	12.211	300	7	C	0.20	540	7	D	0.36	B	0.16	C	0.29	A	A
S	Robertson Co. Line	0.000														
	Fleming Co. Line	1.357	260	8	B	0.19	470	8	C	0.34	B	0.14	C	0.26	A	A

LEVEL OF SERVICE LOWER THAN D

* Assumed improvements include: 12 ft lane widths, 8 ft shoulders, and 60 percent passing sight distance.

** Assumed improvements include: 4-lane divided highway, 12 ft lanes, 10 ft right and 2 ft left shoulders, and (4-lane) DHV = 0.6 * (2-lane) DHV.

VII.(g) HISTORICAL

ARCHITECTURAL/HISTORIC ASSESSMENT

Architectural/Historic Resource Impact analyses are governed by the following rules and regulations: (1) National Environmental Policy Act, PL. 91-190, including Sections 102(2)A, 102(2)B, and 102(2)C; (2) Department of Transportation Act, PL. 89-670, Section 4(f); (3) National Historic Preservation Act, PL. 89-665, Section 106; (4) Federal Regulations 36 CFR Part 800, 36 CFR 60 and 48 FR 44716; and (5) Kentucky Heritage Council Statute, KRS 171.381.

The consultant (Powell, Helen 1997) began the architectural/historic resource assessment with the identification of properties on or considered eligible for listing on the National Register of Historic Places (NR property). All historic sites were plotted on a map of the proposed project. An historic boundary was delineated for all NR properties. The consultant identified the alternatives which have an effect on the NR properties and discussed the nature of the effect (No Effect, No Adverse Effect, Adverse Effect). For each proposed alternate, a summary of historic properties affected and the nature of the effect on each was provided. Finally, mitigation recommendations were suggested.

The Value Engineering team did not evaluate the consultants conclusions concerning the National Register eligibility of properties, the delineation of historic boundaries, or the justification of the boundaries. We did, however, consider the consultants conclusions concerning the effect of the proposed alternate on the NR properties as well as the recommended mitigation.

Both the direct and indirect effects on each NR property must be considered. Direct effects involve fee simple acquisition or acquisition of permanent easements from within the NR boundaries of the site. Indirect effects involve temporary easements, "constructive use" effects, or other non-acquisition effects such as visual, audible or atmospheric impacts on the site. A project will be considered to constitute a "constructive use" of a site if it will substantially impair the use of the site or the features which make it eligible.

The mitigation recommendations must describe how the direct and indirect effects of each alternate on NR properties can be eliminated or mitigated pursuant to 36 CFR 800. If the assessment indicates that adverse effects will result, an investigation of the elimination of impacts by project modification should be conducted. In the event that it is not prudent and feasible to avoid the use of a NR property, a Section 4(f) evaluation must be prepared. Members of KYTC's Division of Environmental Analysis suggest that a years delay could be expected if a project is required to enter the Section 4(f) process.

As Proposed/Modified As Proposed[1]

The consultant concluded that the proposed alignment would effect nine historic properties listed on, or eligible for listing on, the National Register of Historic Places (9, 10, 15, 18, 23, 25, 54, 55, 67). Three strategies for lessening the impact on the properties were proposed-- reconstructing rock fences, constructing retaining walls, and landscaping. The consultant concluded that as a result of the mitigation strategies suggested, there would be no adverse impact on NR properties located in the project corridor.

Site #	Alternate	Mitigation Suggested	Cost for Suggested Mitigation
9	1	reconstruct rock fence (304 meters)	$51,950
10	1	retaining wall	$135,890 + 38,000
15	1	landscaping	$50,000
18	1	retaining wall	$97,840 + 211,000
23	1	reconstruct rock fence and landscaping (203 meters)	$85,300
25	1W	retaining wall	$81,534 + 41,000
54	1W	retaining wall	$58,678
55	2	landscaping	$50,000
67	2	reconstruct rock fences (813 meters)	$135,350
4(f)		.06	$62,193
TOTAL			$1,098,735

No costs for architectural/historic site mitigation were included in the Proposed Alignment cost. Given the limited information available, the VE team arrived at the mitigation costs presented in the above table. Over 1,320 meters of rock fencing will be destroyed by the proposed alignment. The proposed mitigation plan suggests that the fences should be reconstructed outside the project right-of-way. Precedence suggests that the State Historic Preservation Office (SHPO) will require that Historic American Building Survey (HABS) documentation be conducted before the fences are removed. HABS large format photography and site plans will cost approximately $2,000 per fence. Precedence also suggests that the Division of Environmental Analysis will require the consultant to employ a qualified dry stone mason to reconstruct the fences. The Dry Stone Conservancy (606-272-

[1]The As Proposed and Modified as Proposed will have the same effect on NR properties and thus are considered together.

4807) maintains a registry of masons qualified to reconstruct historic stone fences. The Conservancy estimates that the labor cost of reconstructing dry laid rock fences at $150.00 per yard. Using this figure, the labor cost to reconstruct the three fences impacted by the proposed alignment would be $222,600.

Landscaping was suggested as a mitigation strategy for three sites. The consultant did not offer any landscaping plans nor a description of the current landscaping. Based on a windshield survey and past experience, the VE team estimated that it would cost approximately $50,000 per site to replace trees and vegetation removed by the project with like species and frequency consistent with the present condition.

Finally, the consultant suggested that three properties should be mitigated by the construction of retaining walls in front of the homes. The actual cost of building the walls ($20.00 a square foot) would be $373,942. It is our opinion, however, that the SHPO will not approve the proposed retaining walls as a mitigation strategy and thus, will find that the proposed alignment will result in an adverse effect on all three of the properties. This could result in the properties having to be moved and placed in a similar setting. The properties would have to be purchased and HABS documentation would have to be completed before the homes could be moved. This would result in approximately $290,000 additional costs.

Finally, as a result of the adverse effect on NR properties, the project would have to go through the Section 4(f) process. Members of the Division of Environmental Analysis suggest that this will result in a minimum of a one year delay. This will cost, at a minimum, six percent for inflation, and could ultimately result in the loss of the Federal funds.

VE-1, VE-2, VE-3

US 68 has been designated a Scenic Byway. Congress created the National Scenic Byways Program for two primary reasons:

1) to designate an elite set of national scenic byways that celebrate the cultural diversity of the nation and its various regions; and

2) to provide a dedicated source of funding for development of state and national scenic byways--the National Scenic By-ways Discretionary Grant Program.

Because of the scenic and historic significance of US 68, as acknowledged by its designation as a Scenic Byway, special efforts should be taken to help preserve the characteristics which enable it to convey its significance. As in the case of Paris Pike, this designation allows designers to use some unique tools to help avoid adversely impacting significant sites, for example, environmentally friendly shoulders, split grades, interpretive signs, and the acquisition of scenic easements and historic sites. All of these strategies were considered in the VE alternatives.

All VE alternatives will follow the current alignment as closely as possible, utilize environmentally friendly shoulders, and will employ split grades to minimize differences in elevation. In most cases, the VE alternatives will remain inside the current southern right-of-way. As a result, four properties (9, 15, 54, 55) which were being impacted by the proposed alternate will not be adversely effected by the VE alternates, for example, the rock fences at Site 9 will not be taken. The total savings of not impacting the four properties will be approximately $210,628.

One instance where the VE alignments will not remain inside the current southern right-of-way is at Site 25. In this case, the alignment will be moved to the south in order to lessen the impact on the historic home. In addition, a split grade will be used to minimize the difference in the elevation, and the retaining wall will be built between the southern right-of-way and the railroad, instead of in front of the home, as has been proposed. The same mitigation strategy will be used at site 10 and 18. We believe the SHPO will find that there is no adverse effect in these cases, eliminating the need to move the homes and enter the 4(f) process. This will result in a savings of $163,950.

SITE NUMBER	AS PROPOSED MITIGATION COST	VE 1-2-3 MITIGATION COST
9	$51,950	NC
10	$173,890	$135,890
15	$50,000	NC
18	$308,840	$50,000
23	$85,300	$85,300
25	$122,534	$81,534
54	$58,678	NC
55	$50,000	NC
67	$135,350	$135,350
4(f)	$62,193	NC
TOTAL	$1,098,735	$488,074

The consultant's architectural/historic report did not consider the indirect effect of the bypass on Millersburg. The VE team considered both the impact of the bypass and the impact of a four lane alternate through the historic district which would take all on-street parking.

Highway bypasses have long provided a practical approach to improving transportation levels of service through small cities in primarily rural settings by rerouting through traffic. Bypasses normally produce benefits for road users in the form of reduced travel time, vehicle operating costs, and improvement in safety. It also reduces environmental nuisance from traffic to residents and pedestrians along the bypassed roads. In addition, bypass construction normally produce local economic impacts of the following nature: (a) the creation of new jobs and subsidy revenue from facility planning, construction, and operations; (b) the indirect impact of increased production because of reduced transportation costs and delays; and © the indirect impact of all of the above on nonusers because of the multiplier effect.

The construction of bypasses, however, have not always been meet with unanimous approval. Communities have feared that their economies would be adversely affected by the bypass construction. Business interests in the bypassed cities have often felt that large numbers of customers would be diverted from the business district. Studies have shown, however, that the economic impact of highway bypasses on small cities in rural settings is not uniform and in most cases appears to be rather minor. Only in the case of highway-oriented business (i.e., those providing fuel, food, and accommodations for travelers) does there appear to be a serious affect. Highway-oriented business does not appear to be a significant contributor to the Millersburg historic district.

The four lane through Millersburg alternate would take all of the on-street parking. Since World War II, downtown parking has evolved from a "convenience" to a "necessity." Based upon attitude surveys, most customers now expect convenient, safe, easily accessible parking; and virtually all business owners see it as a necessity. The attitude surveys clearly indicate that people believe adequate parking is necessary and that without it, downtown revitalization will fail.

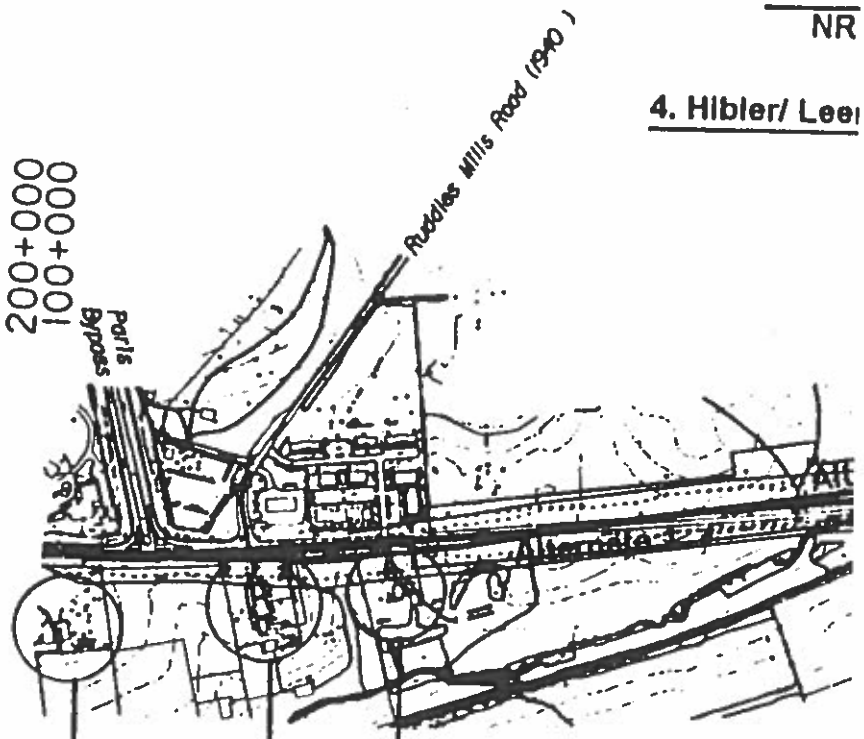
Considering the effects of both a bypass and a four lane alternate through the Millersburg Historic District, the VE team concluded that the bypass would have less impact on the district. The negative impact can be lessened by constructing environmentally friendly signs directing the public to the historic district and by strengthening zoning laws which would control commercial growth along the bypass. Funding for the signs could be obtained from the National Scenic By-Ways Discretionary Grant Program.

CULTURAL HISTORICAL SITE SURVEY

Page 1 of 3 September 1996

Revised 7/97

Note: "NR" indicates that a site is in one of the following
Listed on the National Register
Determined eligible for the National Register
Meets National Register criteria



7. Lee
NR

4. Hibler/ Lee

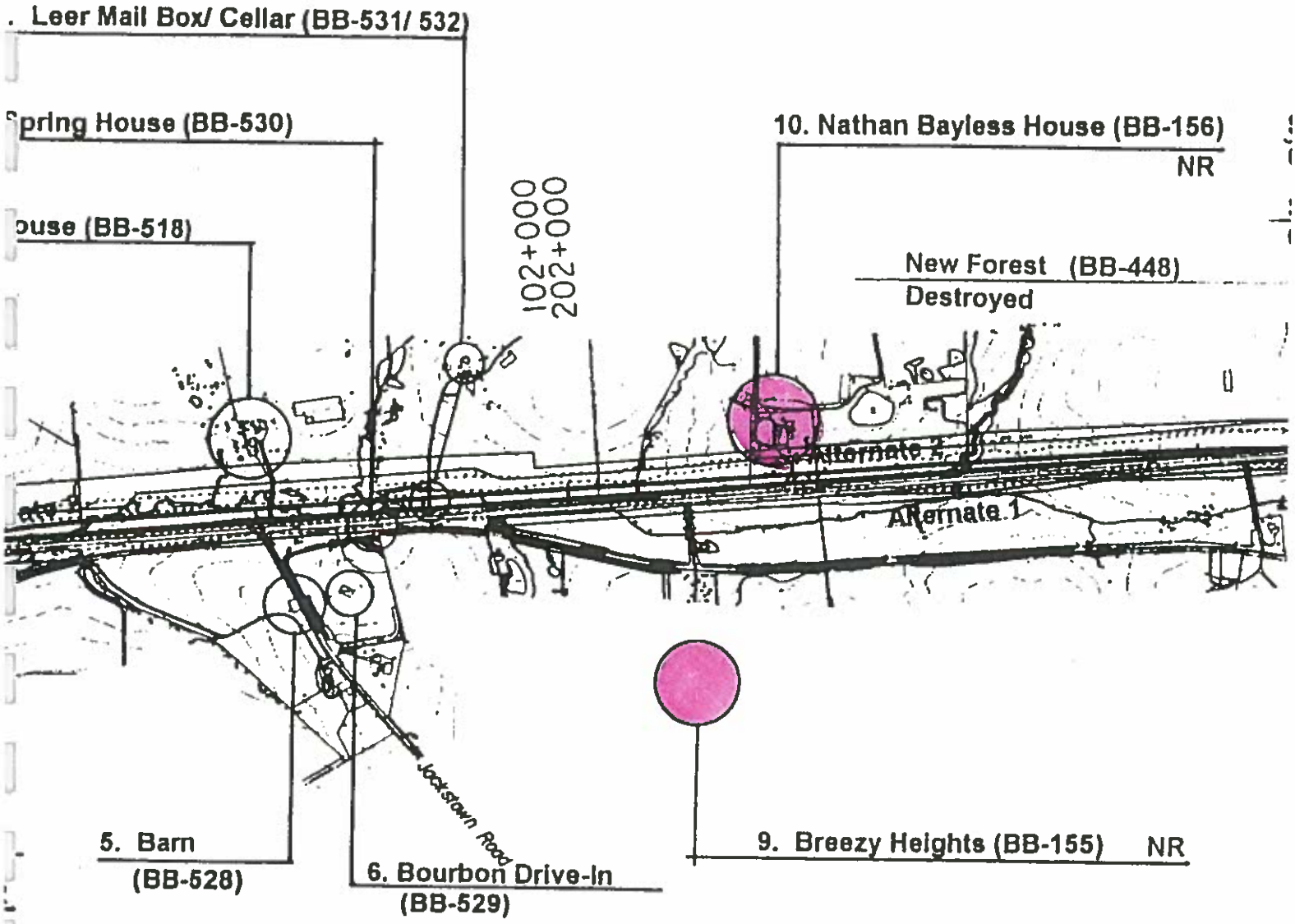
3. Dwelling (BB-526/ 527)

2. Brick Foursquare (BB-525)

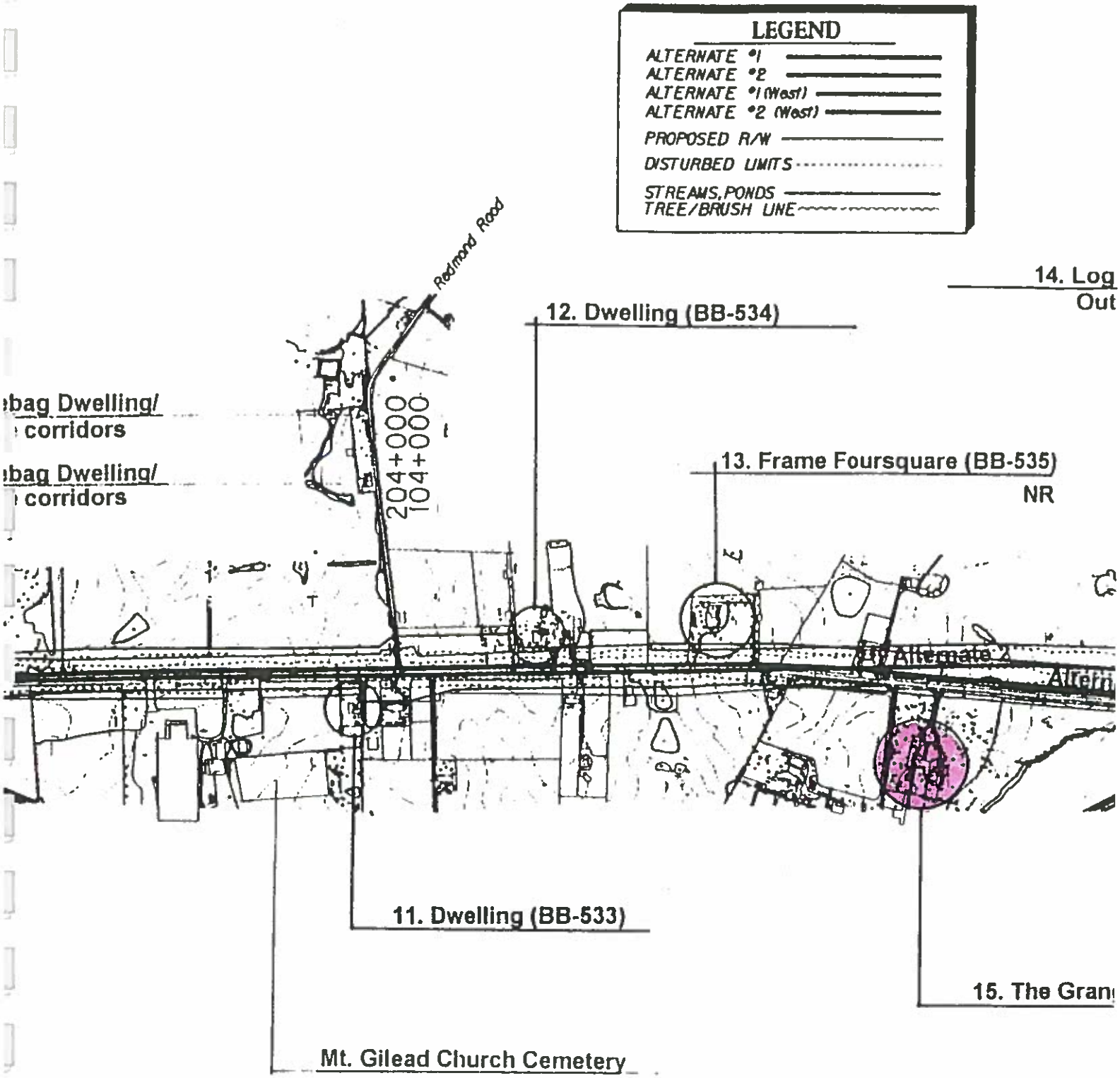
1. Albemarle (BB-154) NR

AS PROPOSED

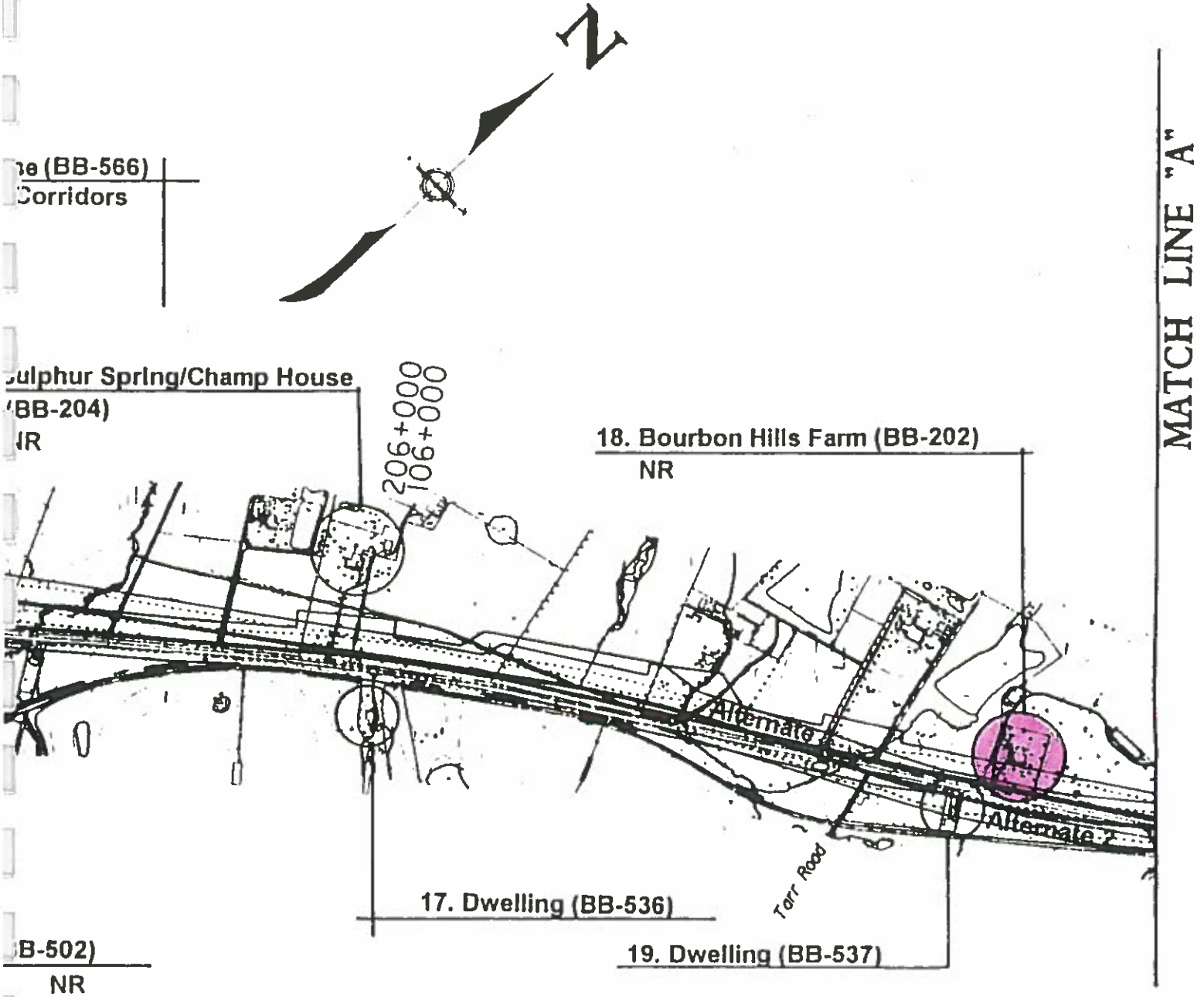
ıtegories:



AS PROPOSED


LEGEND
ALTERNATE #1
ALTERNATE #2
ALTERNATE #1 (West)
ALTERNATE #2 (West)
PROPOSED R/W
DISTURBED LIMITS
STREAMS, PONDS
TREE/BRUSH LINE
Redmond Road
204+000
104+000
14. Log
Out
12. Dwelling (BB-534)
bag Dwelling/
corridors
bag Dwelling/
corridors
13. Frame Foursquare (BB-535)
NR
Alternate 2
Alterr
11. Dwelling (BB-533)
15. The Gran
Mt. Gilead Church Cemetery

AS PROPOSED



AS PROPOSED

METRIC 126
Scale- 1:10,000
Contour Interval - 2.5m

EXHIBIT 2A

BOURBON / NICHOLAS COUNTY
US 68 (Paris – Maysville Road)
Item No. 7 – 310.00

PROJECT CORRIDOR

CULTURAL HISTORICAL SITE SURVEY
Page 2 of 3 September 1996

Note: "NR" indicates that a site is in one of the following categories:
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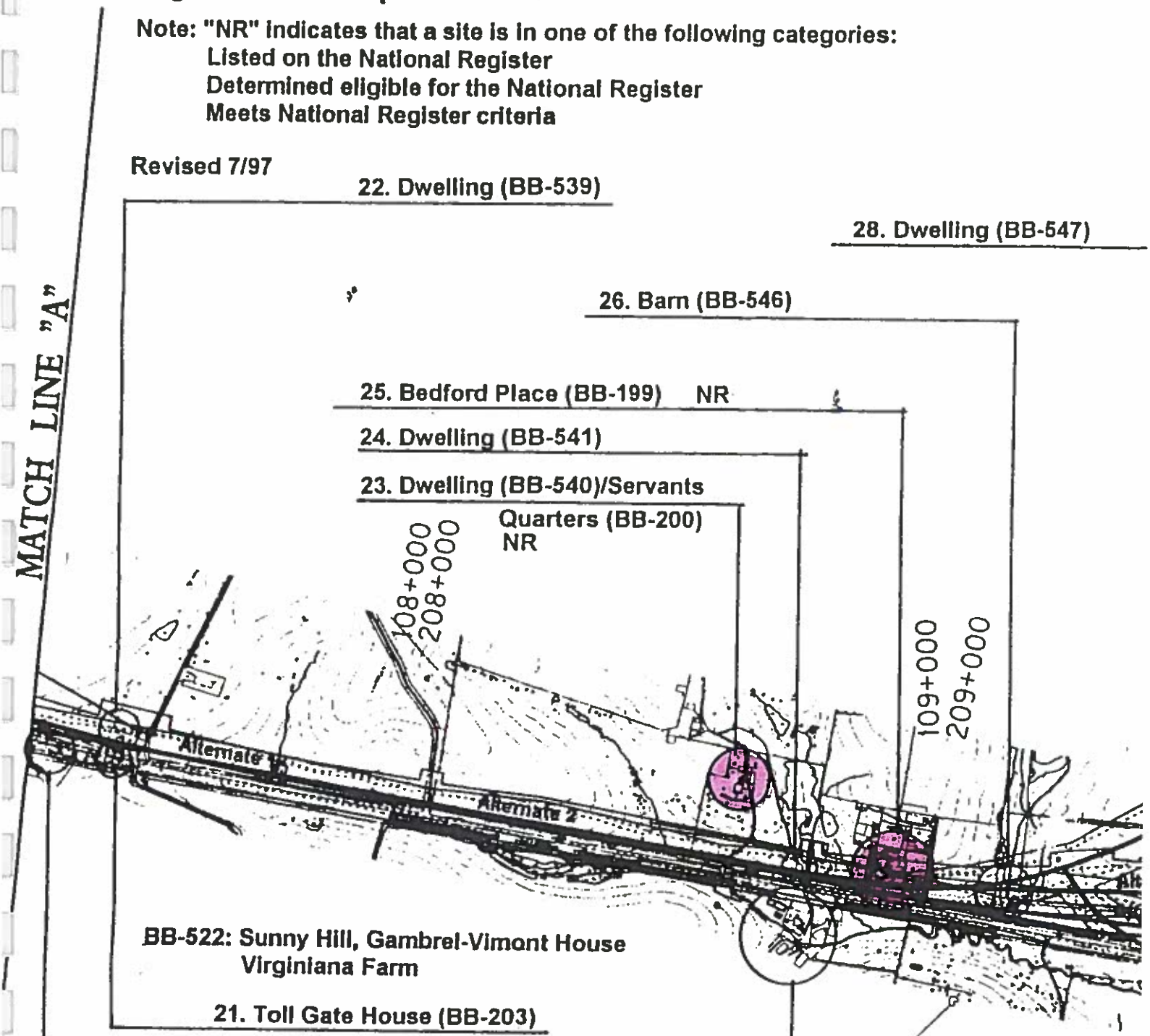
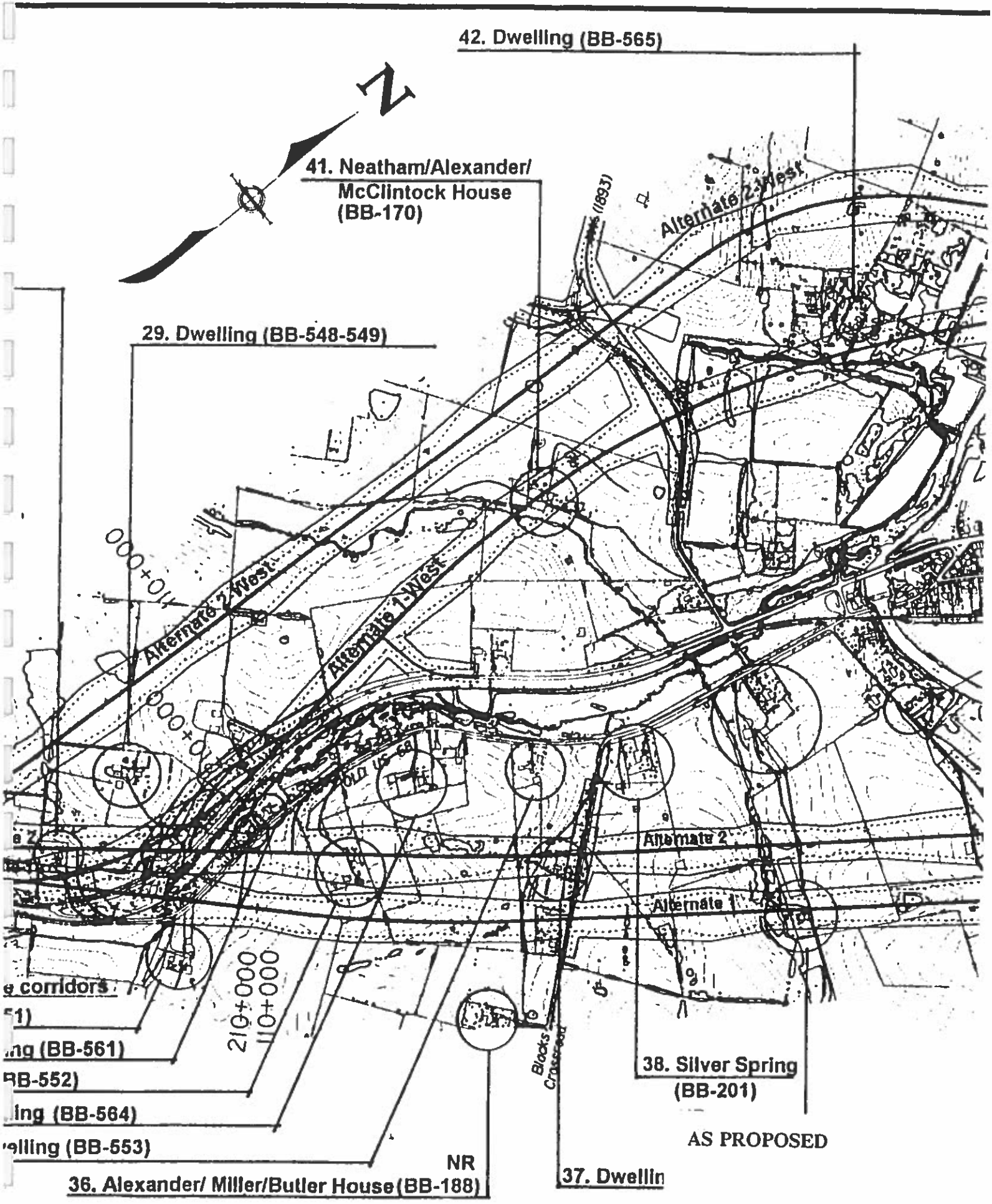
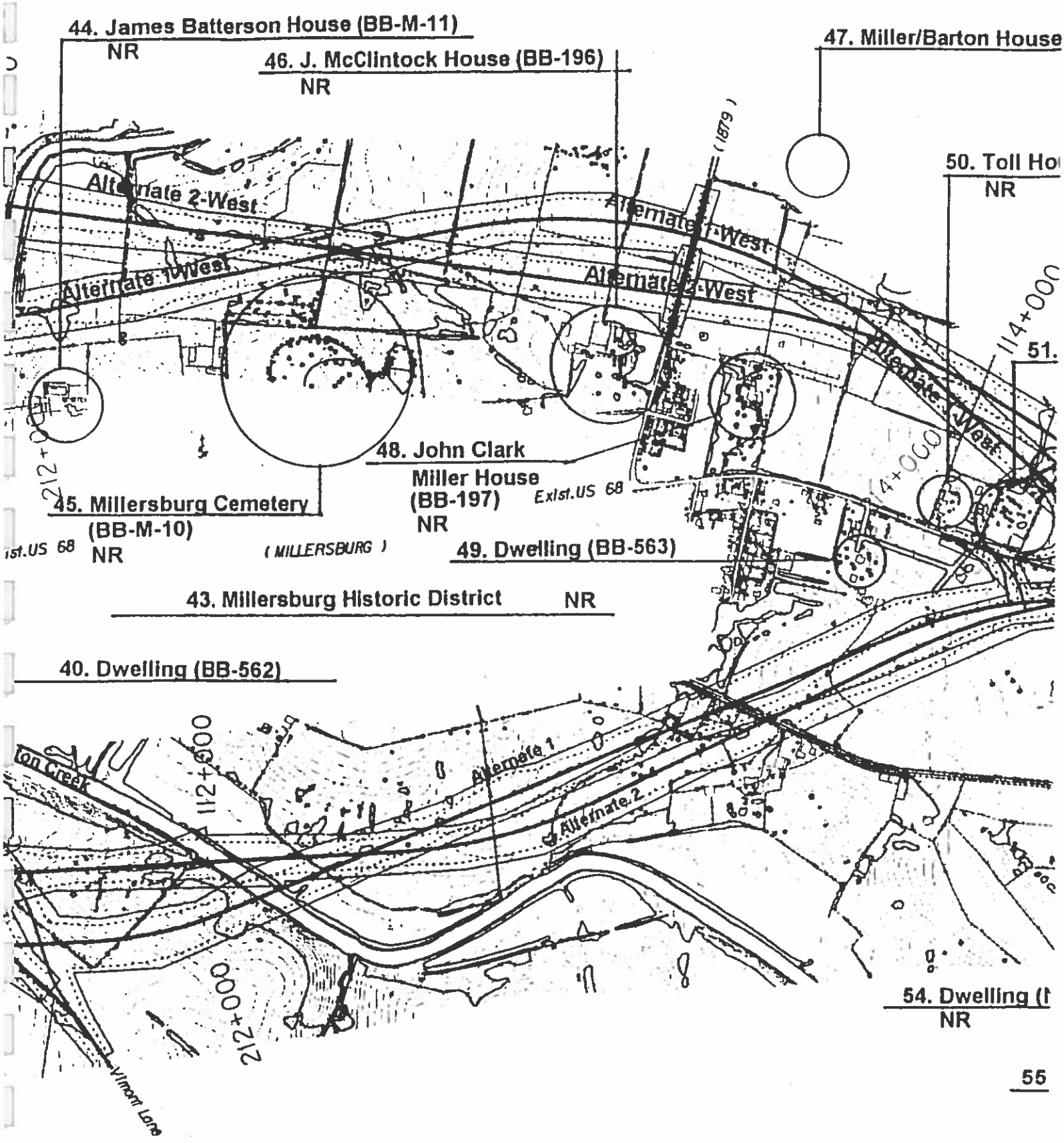
Revised 7/97



AS PROPOSED


42. Dwelling (BB-565)
41. Neatham/Alexander/
McClintock House
(BB-170)
29. Dwelling (BB-548-549)
Alternate 2-West
Alternate 1-West
Alternate 2
Alternate 1
38. Silver Spring
(BB-201)
AS PROPOSED
37. Dwellin
36. Alexander/ Miller/Butler House (BB-188)
NR
e corridors
ng (BB-561)
BB-552)
ing (BB-564)
elling (BB-553)



louse (BB-198)/ Barns (BB-555-559)

AS PROPOSED

BB-195)

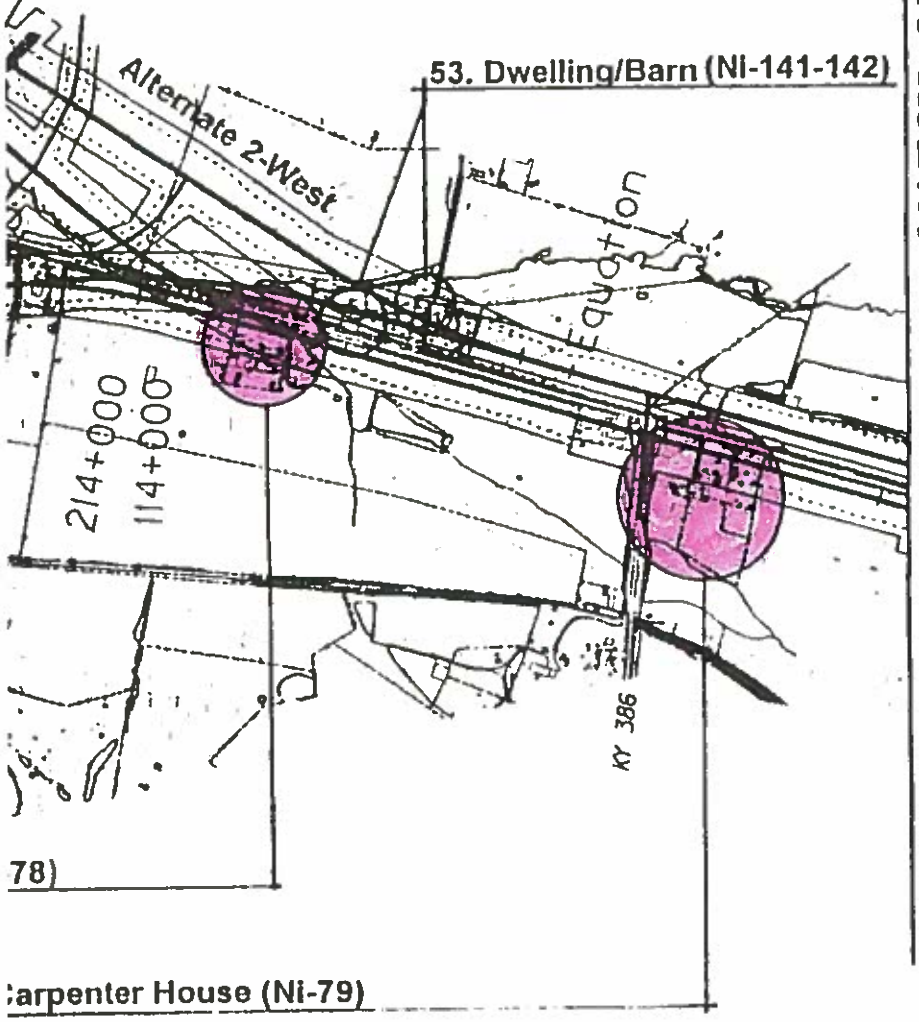
e (Ni-139)

LEGEND

- ALTERNATE #1
- ALTERNATE #2
- ALTERNATE #1 (West)
- ALTERNATE #2 (West)
- PROPOSED R/W
- DISTURBED LIMITS
- STREAMS, PONDS
- TREE/BRUSH LINE

ld Millersburg Cemetery (Ni-77) NR

52. Dwelling (Ni-140)



MATCH LINE "B"

78)

arpenter House (Ni-79)

NR

EXHIBIT 2B

BOURBON / NICHOLAS COUNTY

US 68 (Paris – Maysville Road)

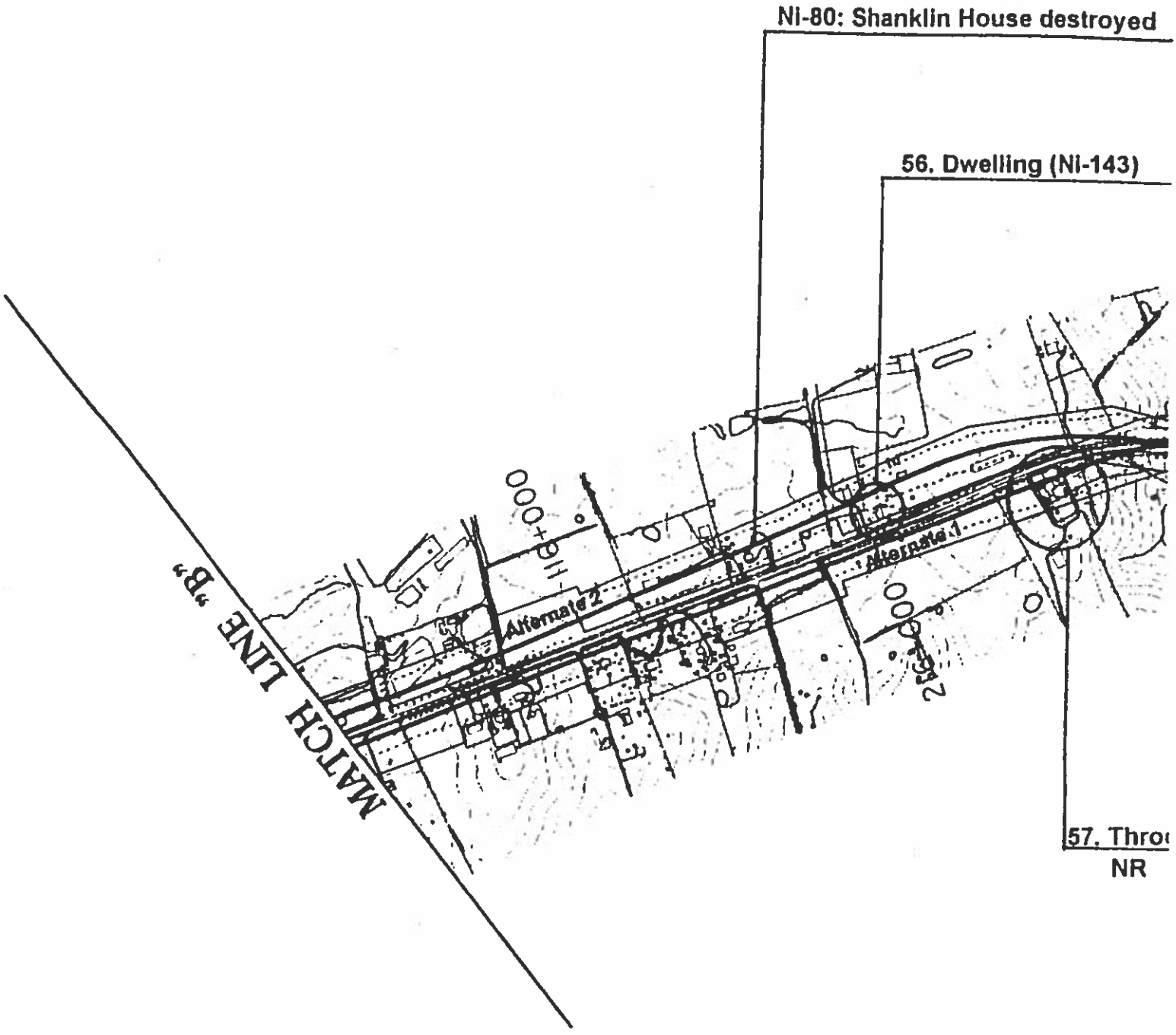
Item No. 7 - 310.00

PROJECT CORRIDOR **AS PROPOSED**

METRIC
Scale- 1:10,000
Contour Interval - 2.5m

CULTURAL HISTORICAL SITE SURVEY

Page 3 of 3 September 1996
Revised 1/97



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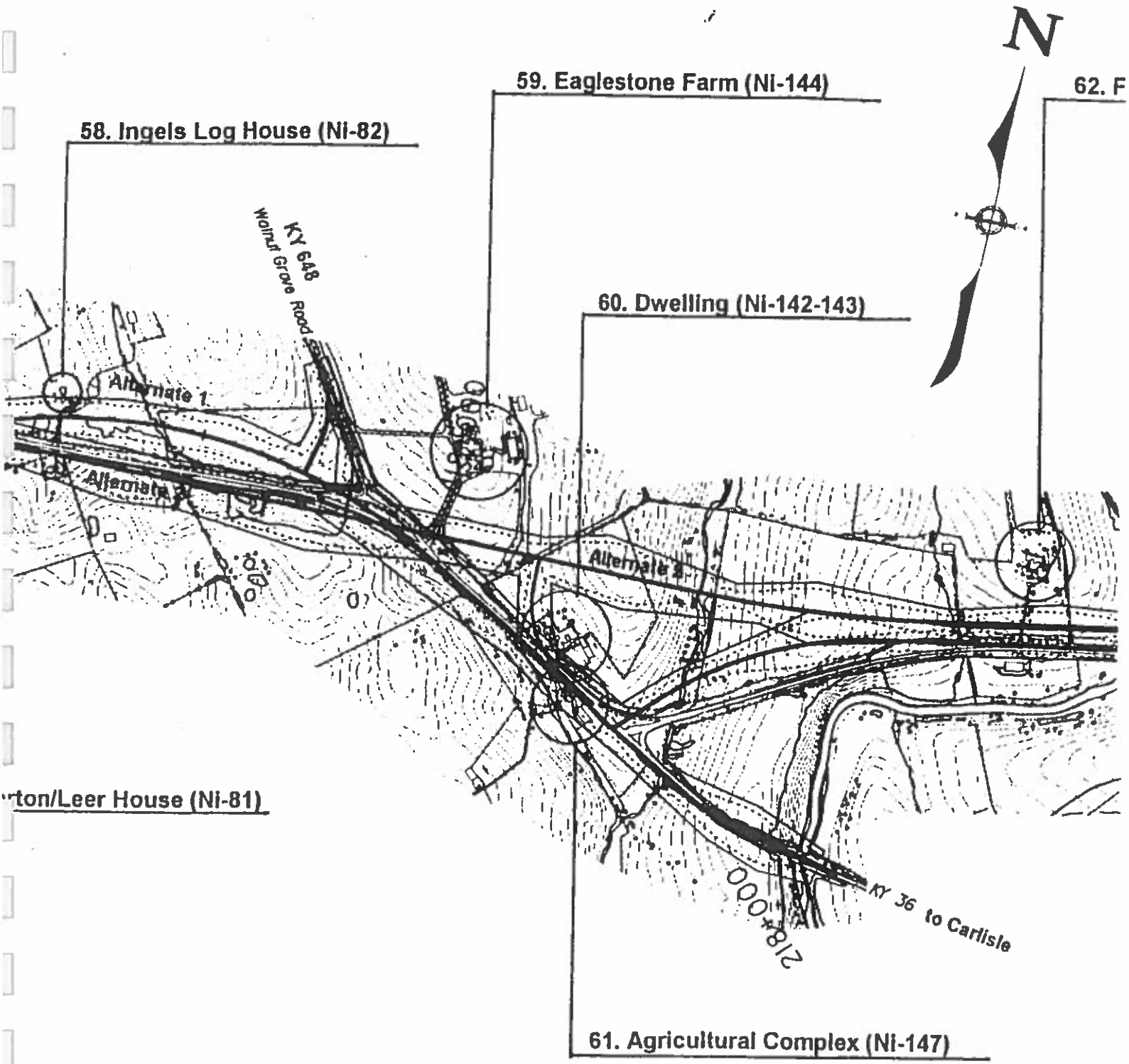
AS PROPOSED


N
59. Eaglestone Farm (NI-144)
62. F
58. Ingels Log House (NI-82)
KY 648
Walnut Grove Road
60. Dwelling (NI-142-143)
Alternate 1
Alternate 2
Alternate 3
rton/Leer House (NI-81)
KY 36 to Carlisle
61. Agricultural Complex (NI-147)

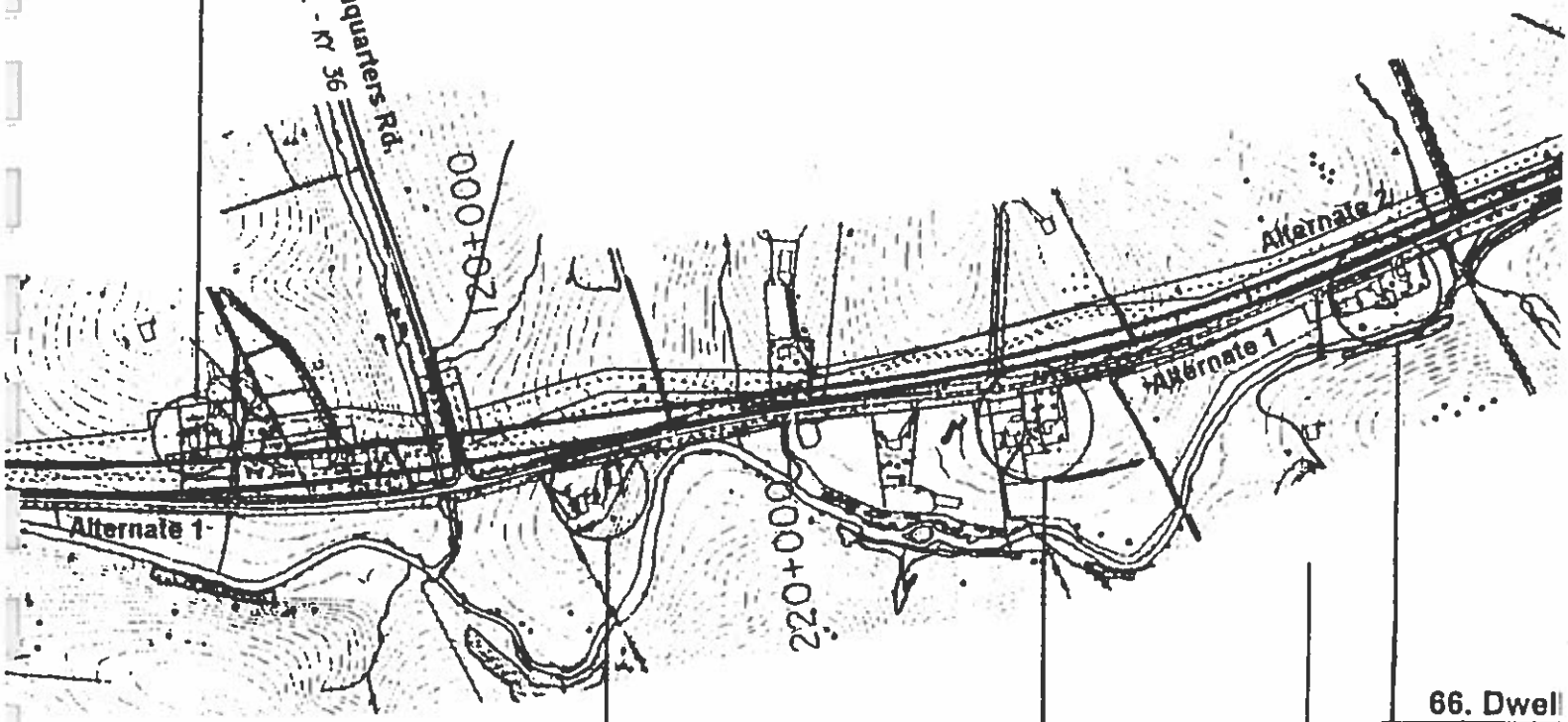
AS PROPOSED

67. Forest Retreat: Metcalfe Hc
NR

ıer Ridge Farm (Ni-91)

Forest Retreat: Stone Barn (Ni-9
NR

63. Longview Farm (Ni-148)



66. Dwell
NR

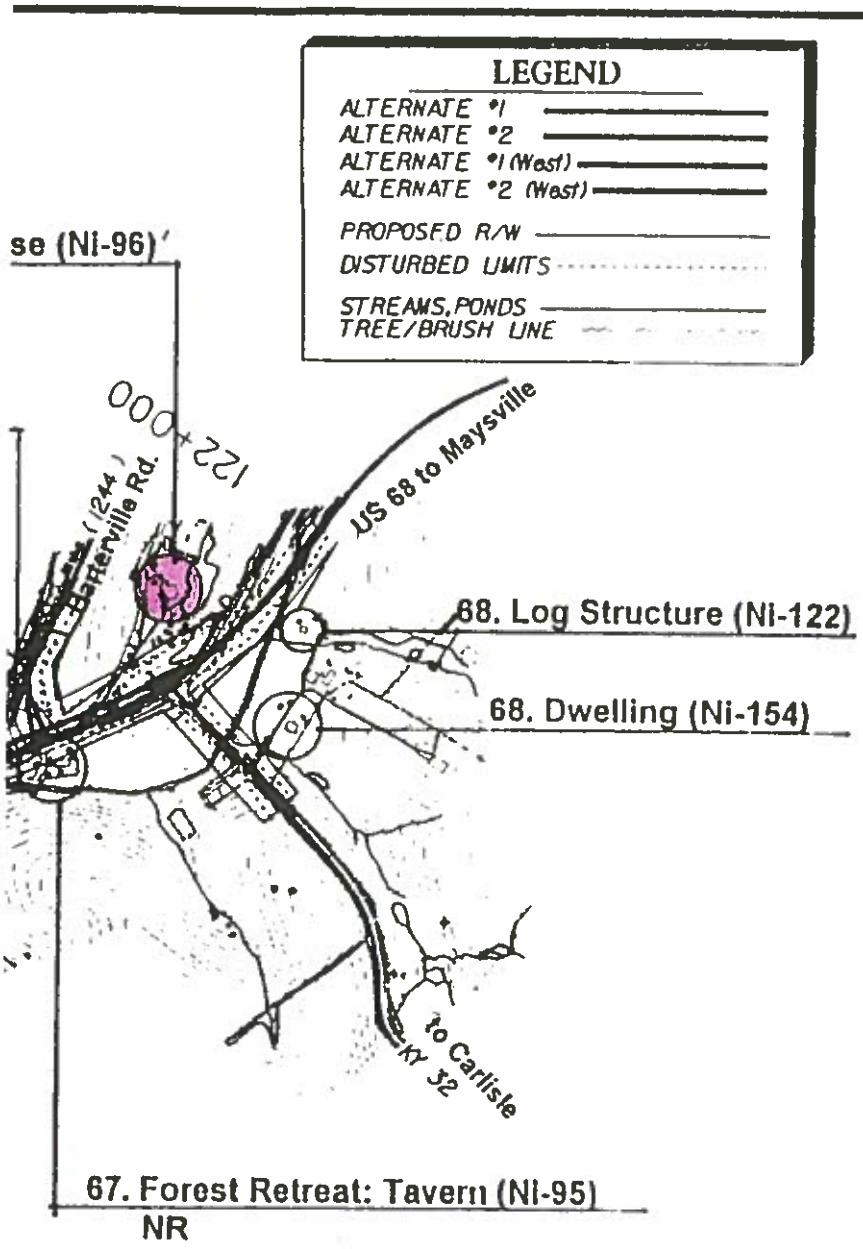
Daniel Boone Ca
Outside corrido

4. Sunset Hills Farm (Ni-149-151)

65. Dwelling (NI-92)/Stone Barn

AS PROPOSED

ET
cal
ont



C
1:10,000
Interval = 2.5m

EXHIBIT 2C

BOURBON / NICHOLAS COUNTY
US 68 (Paris – Maysville Road)
Item No. 7 – 310.00

PROJECT CORRIDOR

AS PROPOSED

CULTURAL HISTORICAL SITE SURVEY

Page 1 of 3 September 1996
Revised 7/97

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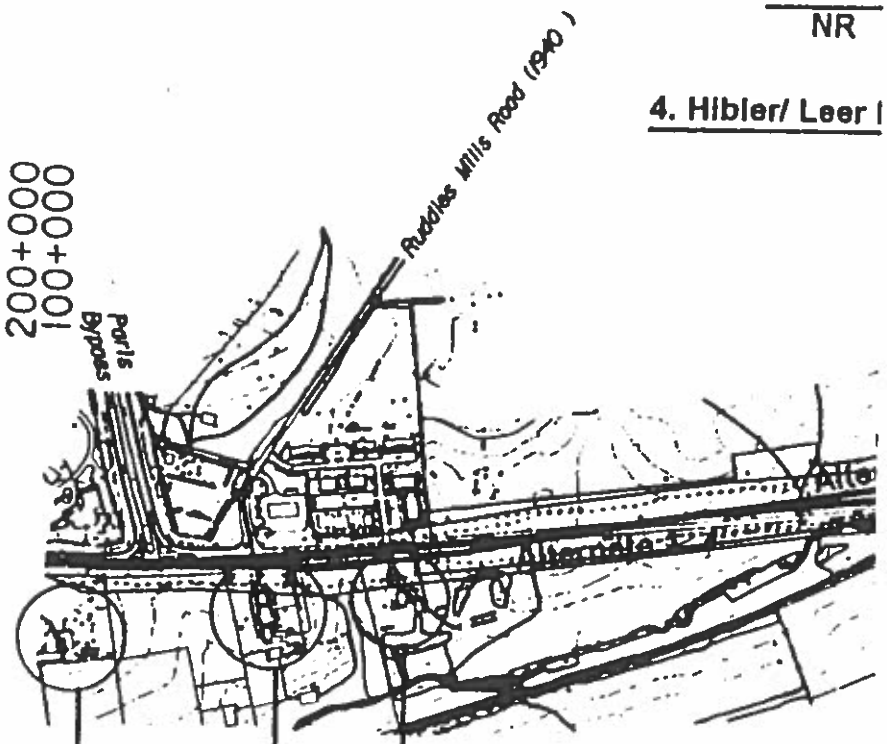
7. Leer
NR

4. Hibler/ Leer



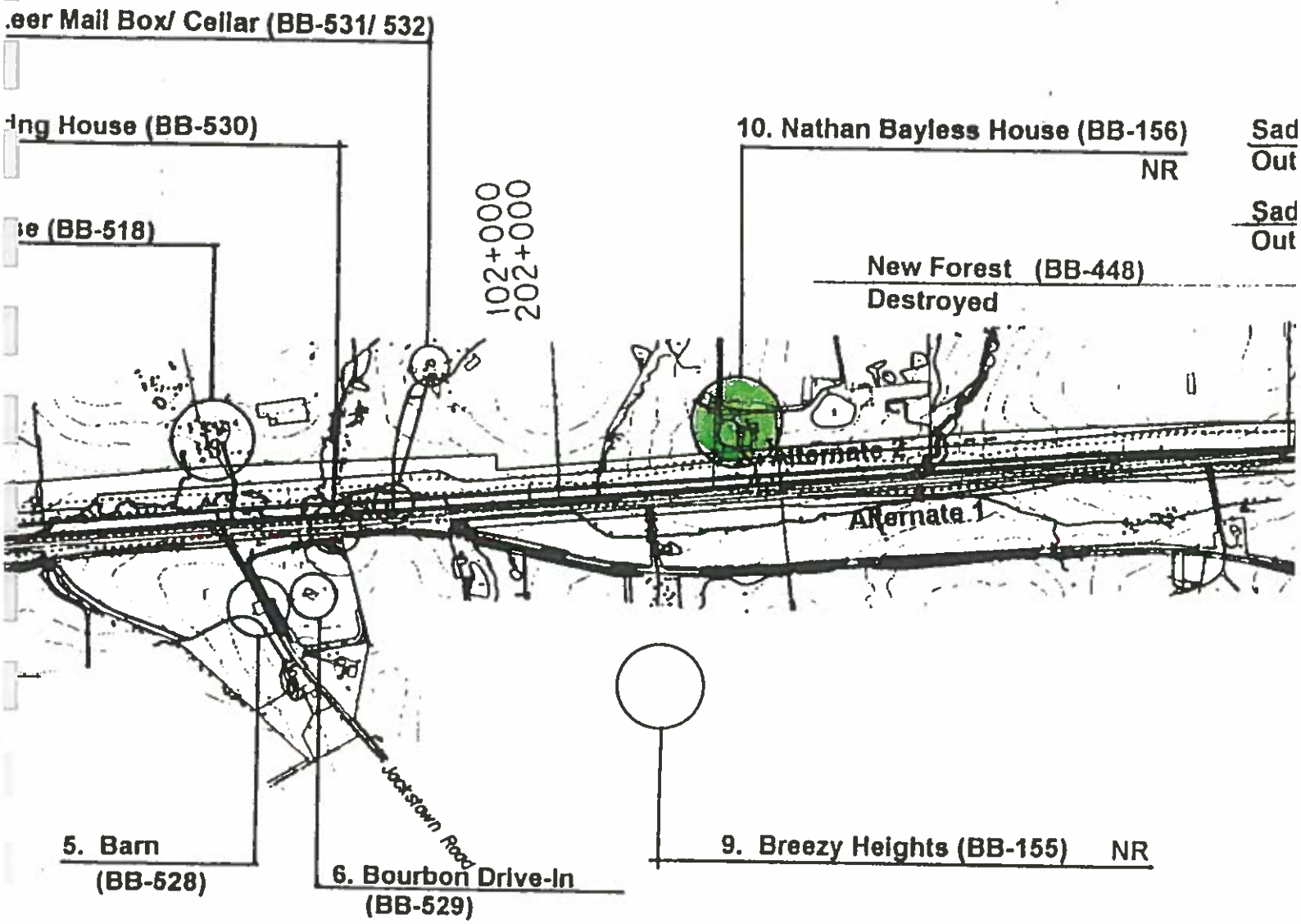
3. Dwelling (BB-526/ 527)

2. Brick Foursquare (BB-525) N

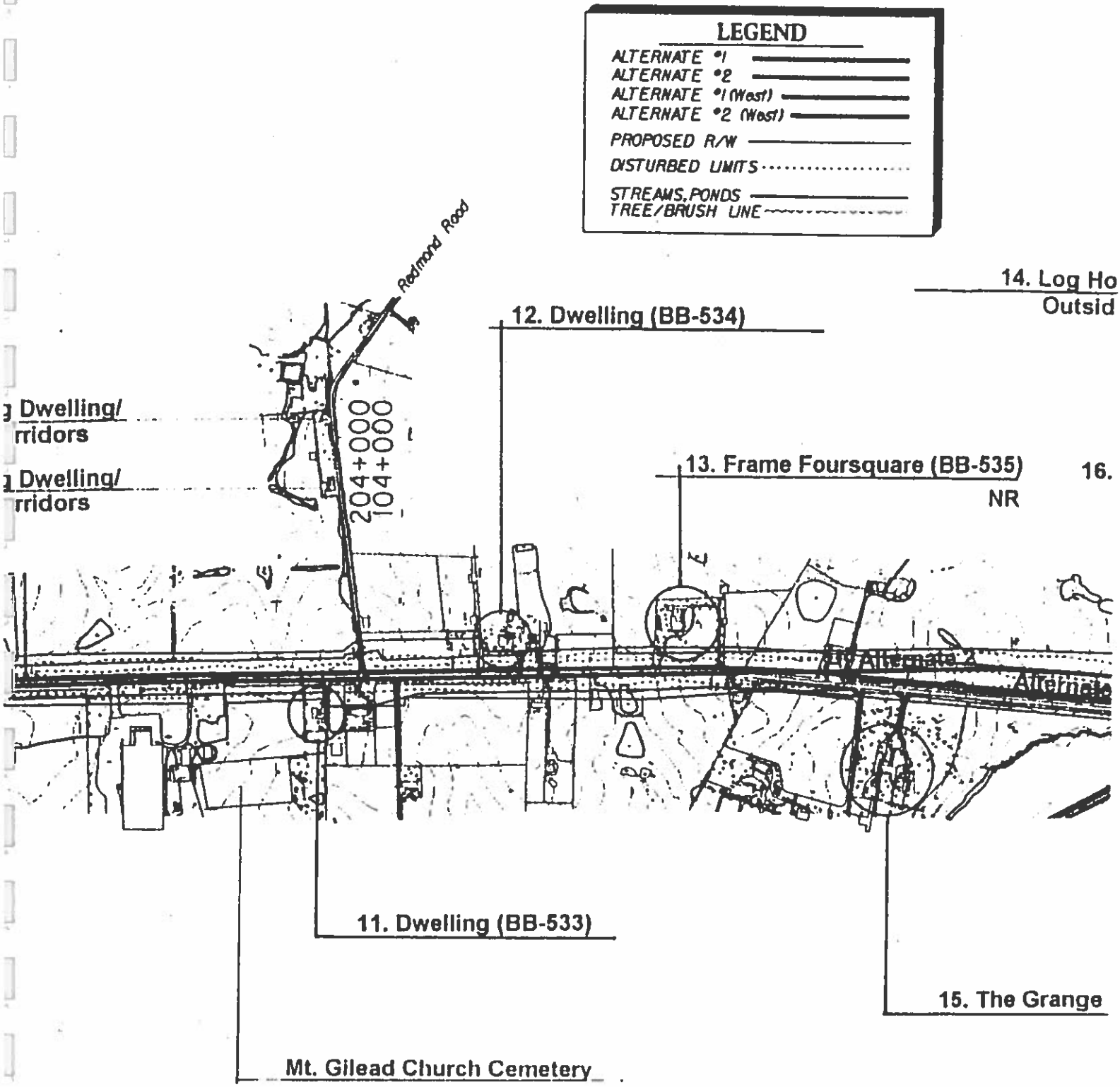
1. Albemarle (BB-154) NR

VALUE ENGINEERING
ALTERNATIVE

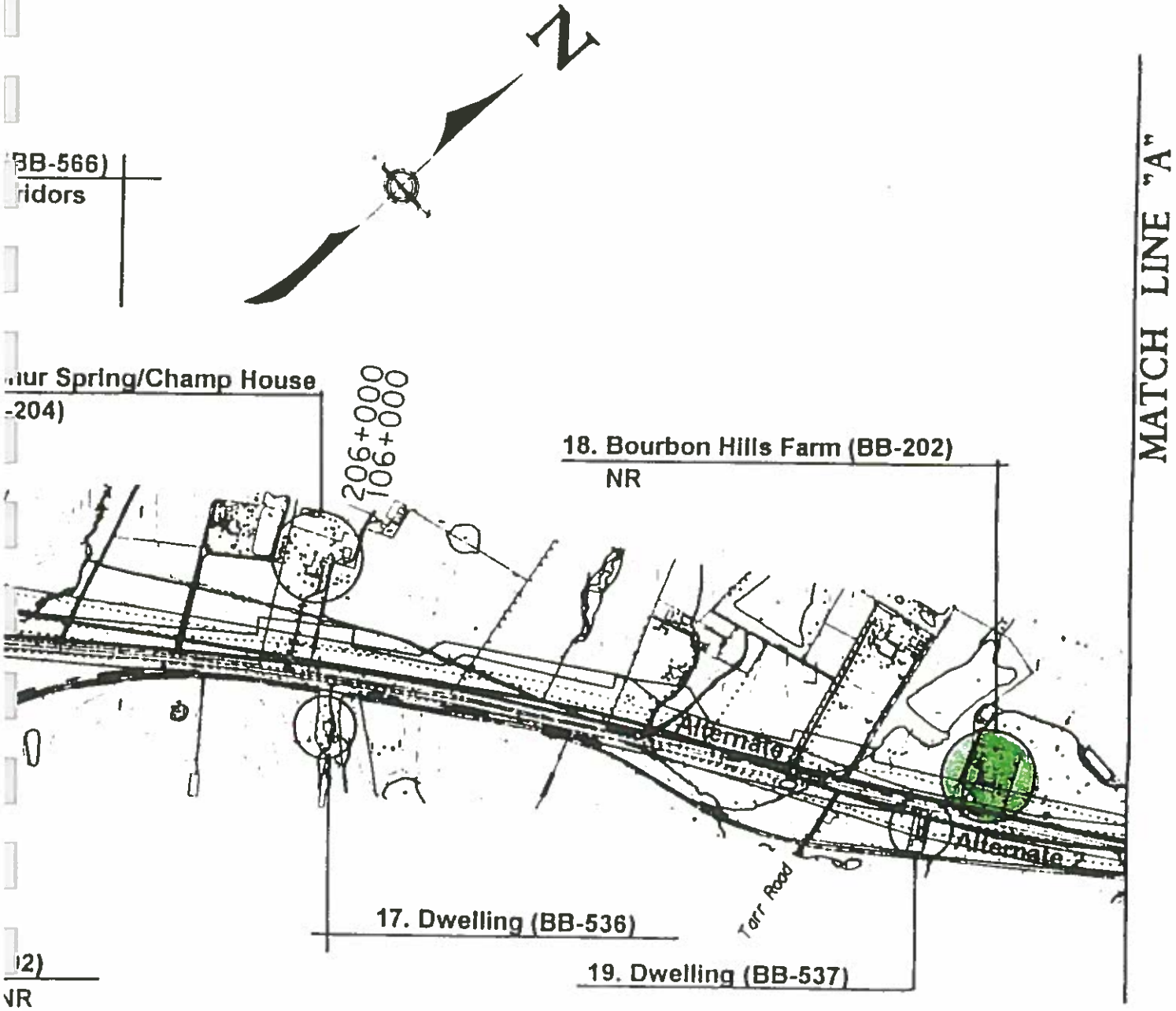
gories:



VALUE ENGINEERING
ALTERNATIVE



VALUE ENGINEERING
ALTERNATIVE



VALUE ENGINEERING
ALTERNATIVE

METRIC
Scale- 1:10,000
Contour Interval - 2.5m

EXHIBIT 2A

BOURBON / NICHOLAS COUNTY
US 68 (Paris – Maysville Road)
Item No. 7 – 310.00

PROJECT CORRIDOR

CULTURAL HISTORICAL SITE SURVEY
Page 2 of 3 September 1996

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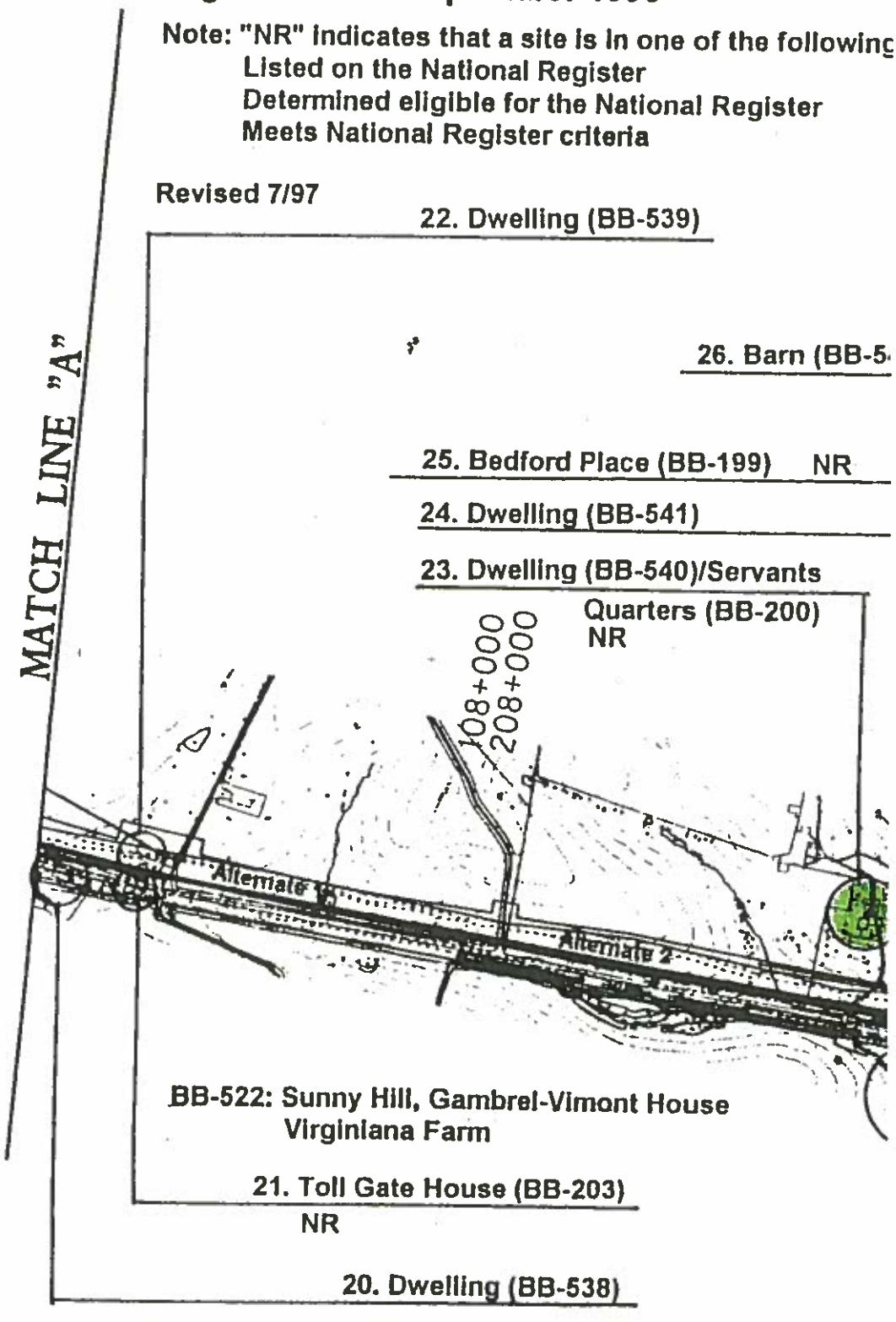
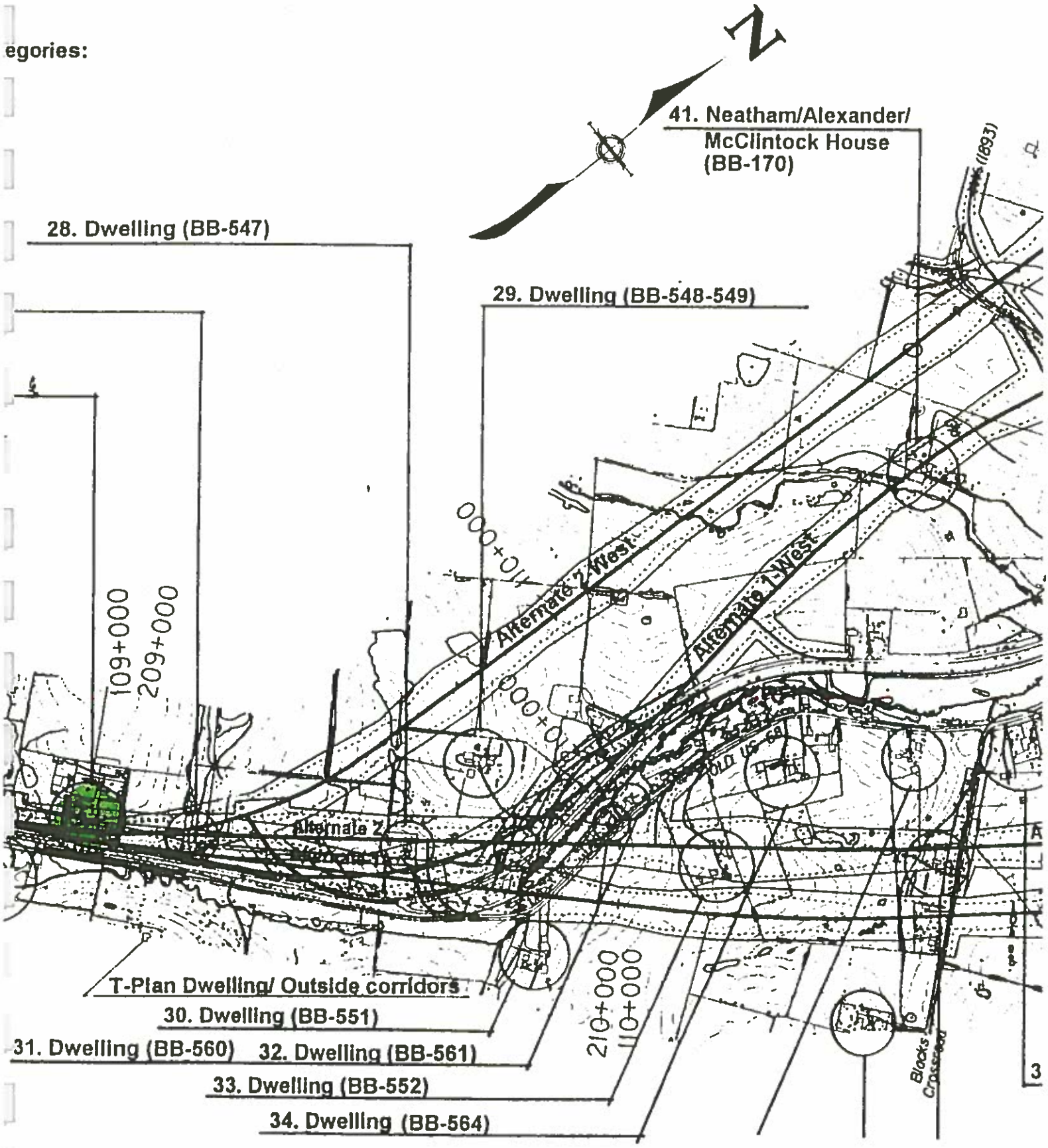
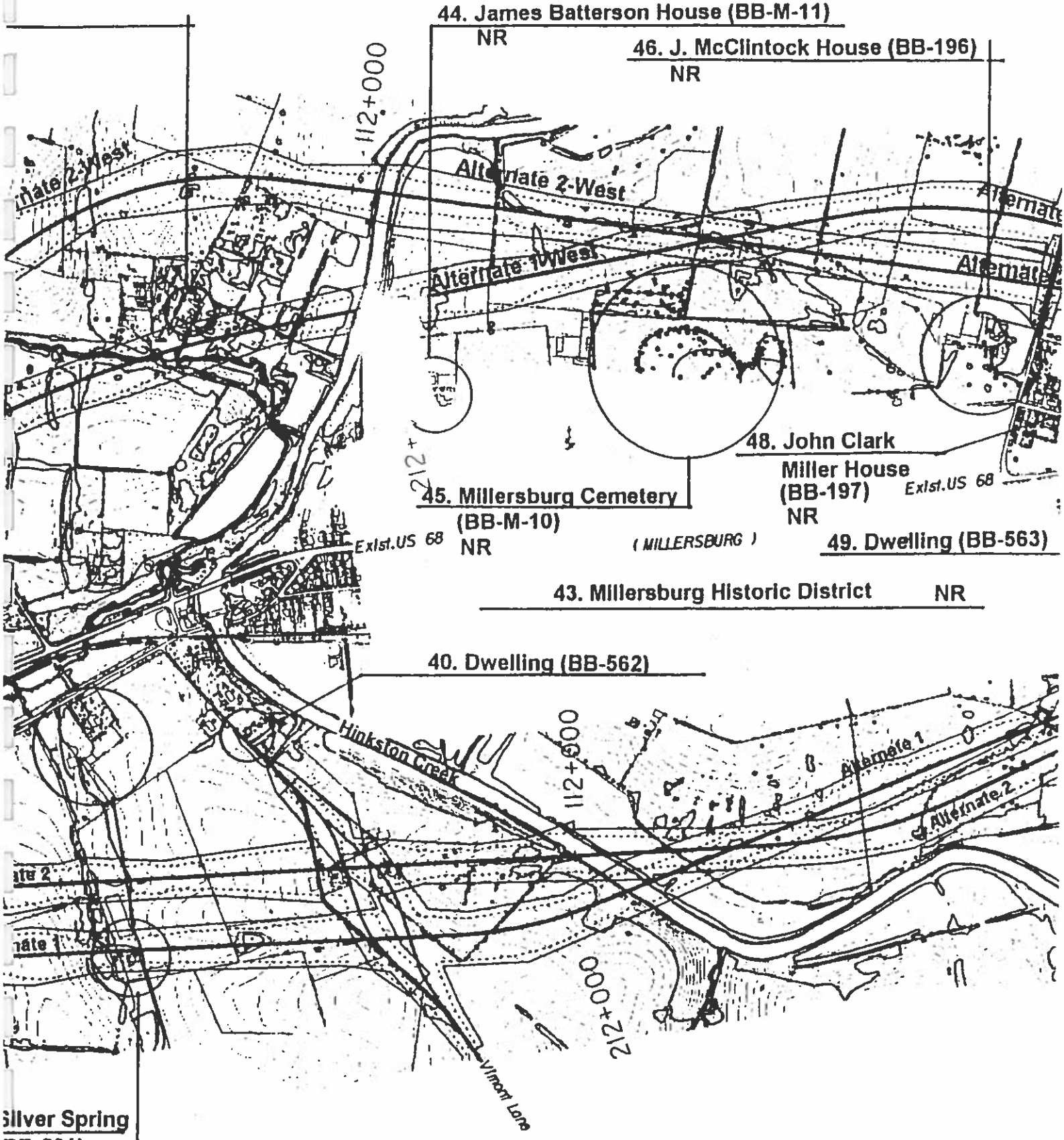


VALUE ENGINEERING
ALTERNATIVE

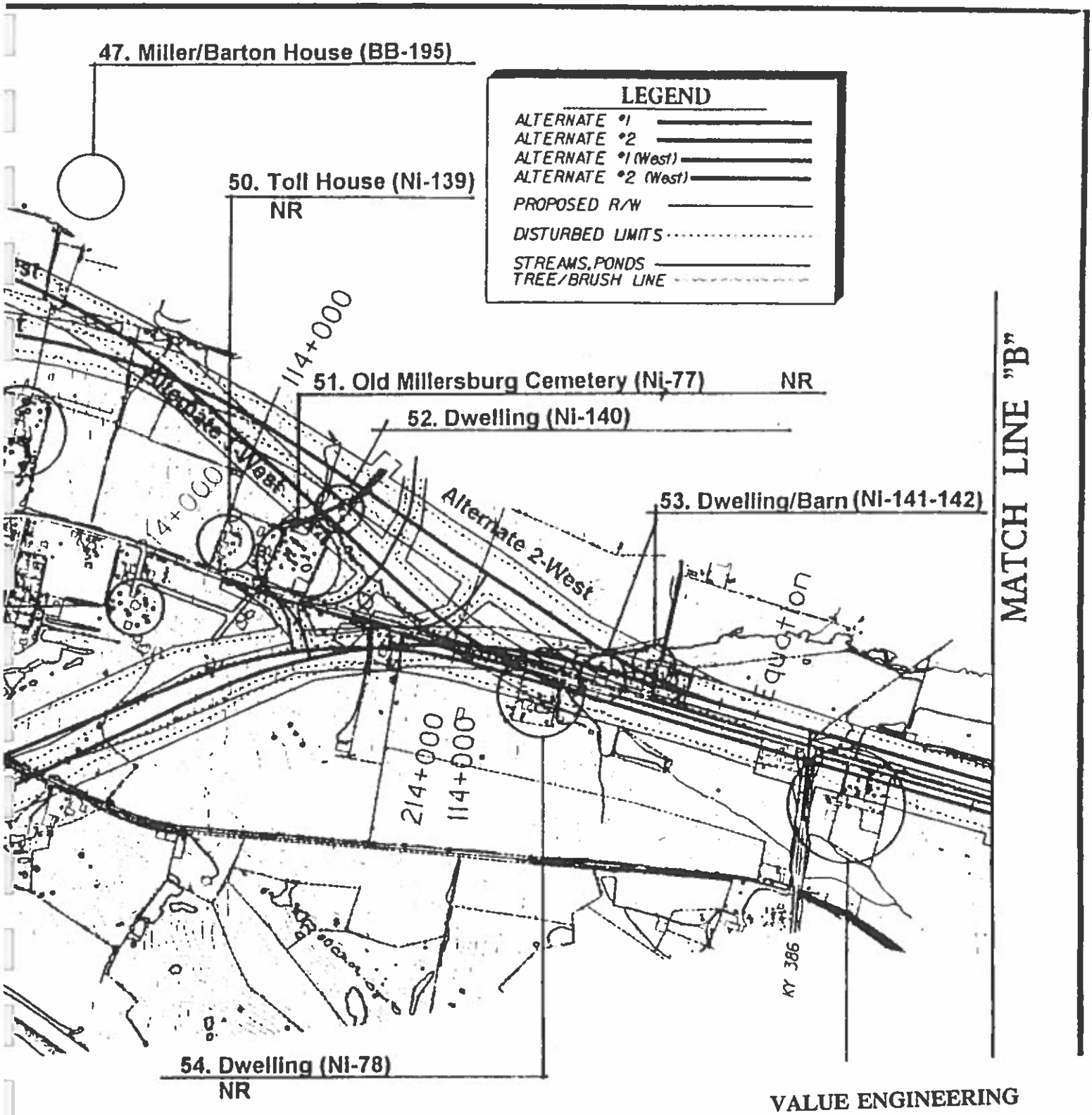
egories:



VALUE ENGINEERING
ALTERNATIVE



VALUE ENGINEERING
ALTERNATIVE



VALUE ENGINEERING ALTERNATIVE

METRIC
Scale- 1:10,000
Contour Interval - 2.5m

EXHIBIT 2B

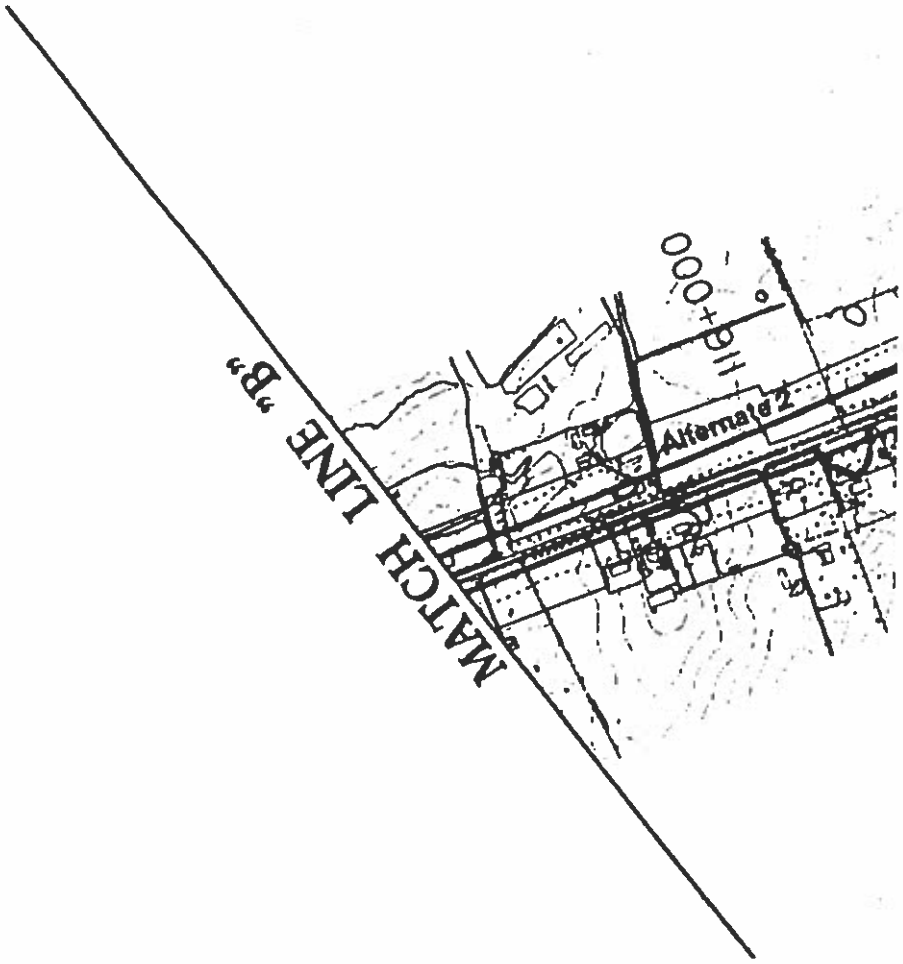
BOURBON / NICHOLAS COUNTY
US 68 (Paris – Maysville Road)
Item No. 7 – 310.00

PROJECT CORRIDOR

CULTURAL HISTORICAL SITE SURVEY

Page 3 of 3 September 1996

Revised 1/97



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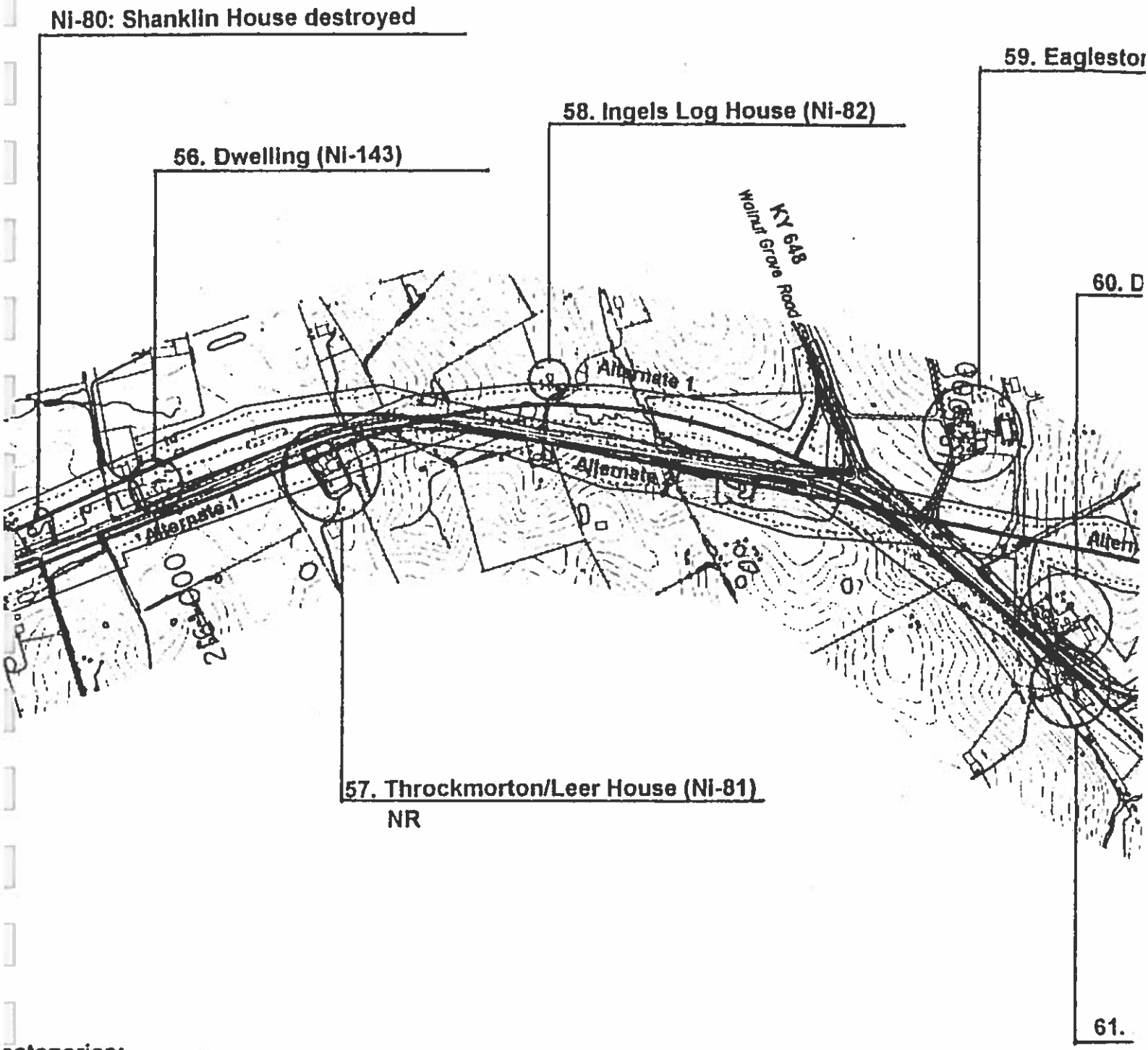
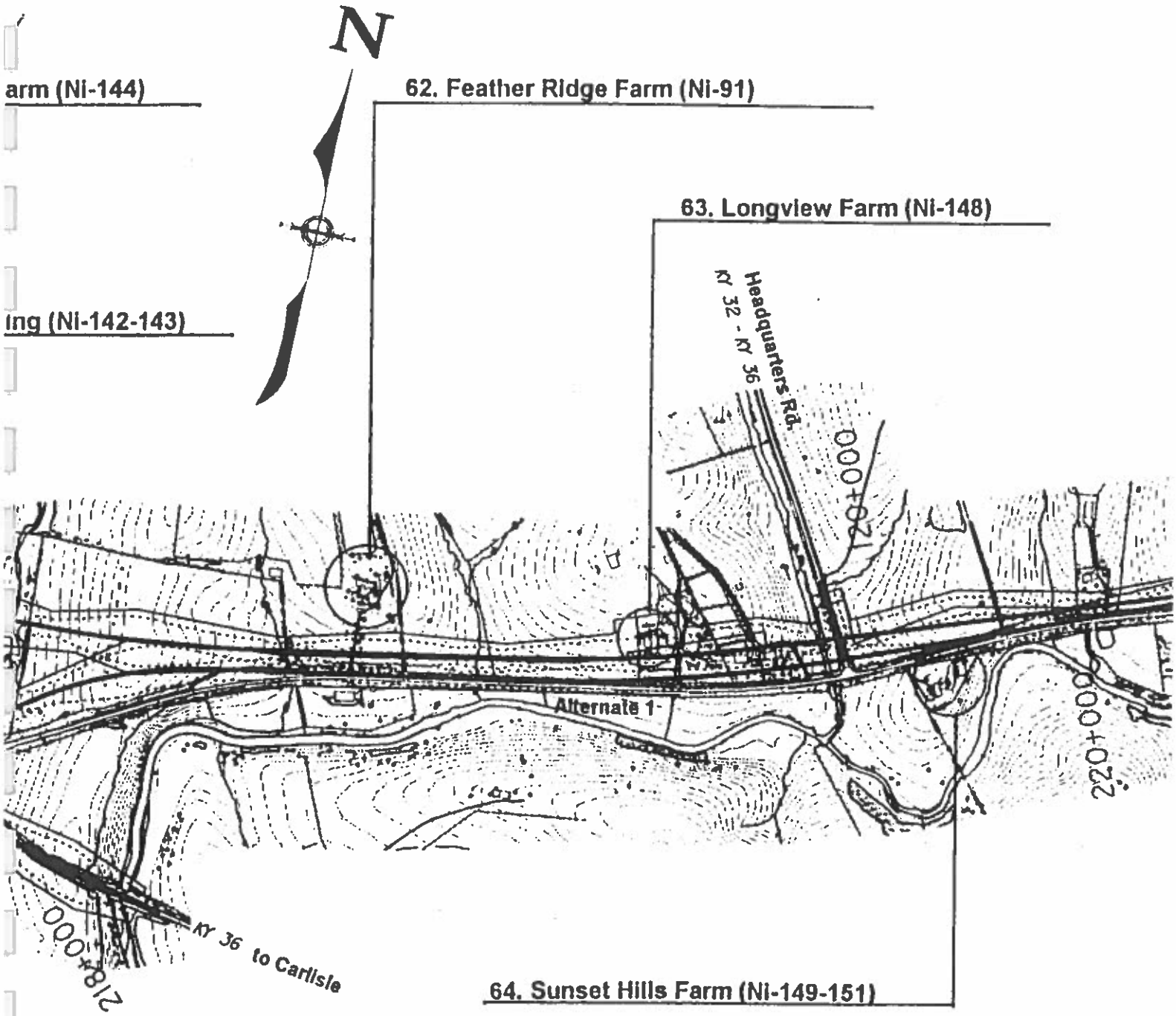
VALUE ENGINEERING
ALTERNATIVE

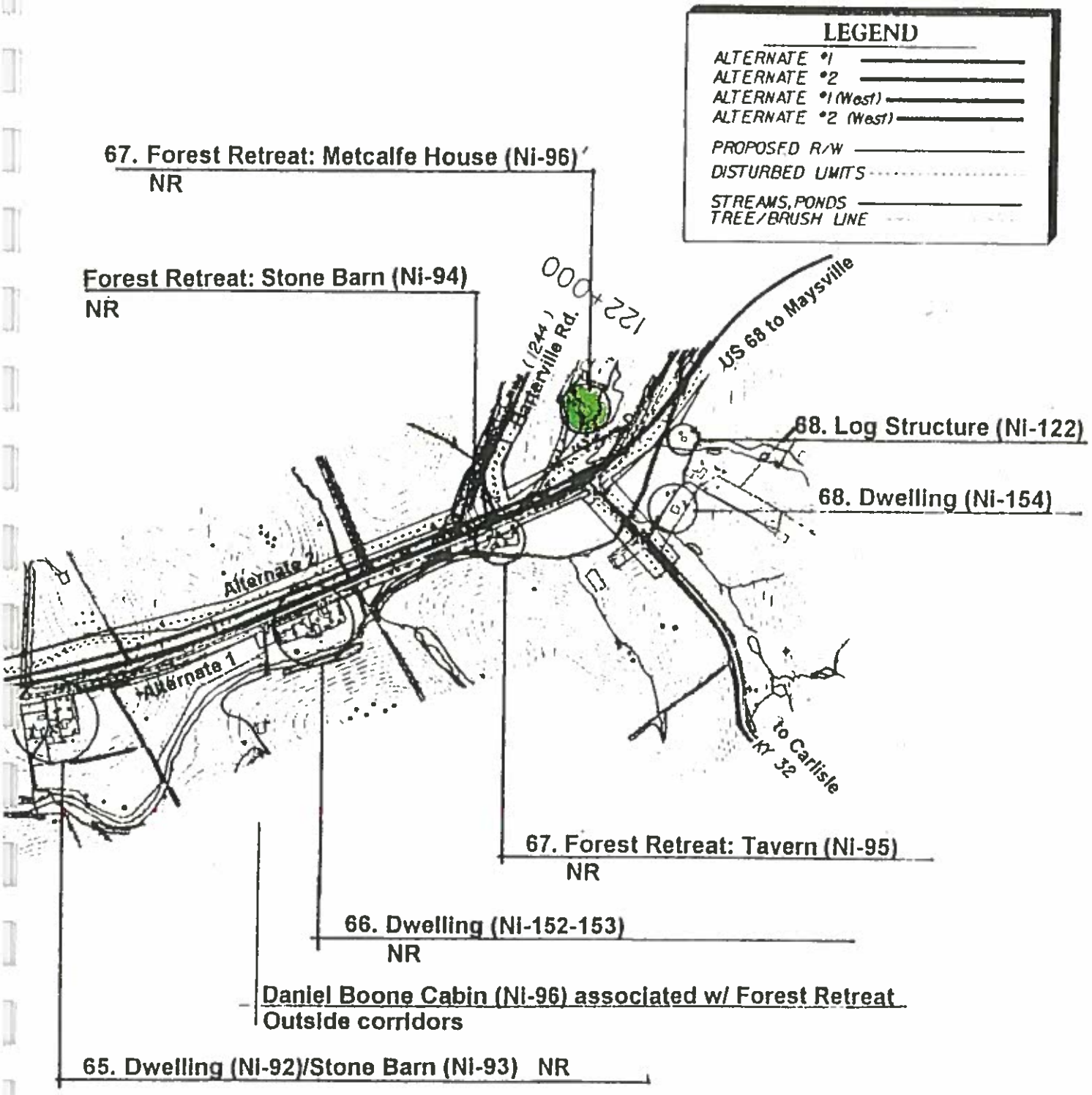


categories:

VALUE ENGINEERING
ALTERNATIVE



VALUE ENGINEERING
ALTERNATIVE



VALUE ENGINEERING ALTERNATIVE

EXHIBIT 2C

BOURBON / NICHOLAS COUNTY
US 68 (Paris – Maysville Road)
Item No. 7 – 310.00

PROJECT CORRIDOR

METRIC
Scale- 1:10,000
Contour Interval - 2.5m

VII.(b) RIGHT OF WAY

Right of Way cost

The data was not specific to the "As Proposed" Alternative that was the subject of the Value Engineering study. Therefore, the R/W cost of the "As Proposed" Alternative was extracted from the various alignments. Eighty seven (87) parcels, based on maps provided for the study, are the basis of the R/W cost estimate.

Sheet "AA" attached sets forth the assumptions on which all R/W cost estimates, all alternatives were made.

"As Proposed" $8,031,000, 407.55ac (165 hectar)

Value Engineering Alternative No. 1

$6,860,000, 348.2ac (140.94 hectar)

This alternative utilizes no R/W south of the existing roadway from beginning of project to Millersburg. This is estimated to be 22.59 ac with a value of $445,200. Existing R/W is utilized where possible from east of Millersburg to end project. This is estimated to be 36.15 ac with a value of $712,000. The R/W was reduced by .68 ac valued at $13,400 in front of a historical property. Total value reduction from the "As Proposed" alternative: $1,171,000.

Value Engineering Alternative No. 2

Same R/W cost as VE 1

Value Engineering Alternative No. 3

$5,425,400, 275.3ac (111.46) hectar

This estimate was based on same premise as VE 1 with the following addition and deletion. The four lanes through Millersburg requires additional R/W on the east and west end (2700m at 80 ft. wide) 16.26ac valued at $320,400(+). The bypass is deleted from this alternative. The acreage estimate is 89.05ac (hectar) valued at $1,754,800(-).

SHEET "AA"

R/W Cost estimate information for the "As Proposed" alignment:

Using a 66%+ factor:	
87 parcels	$4,836,400
20% Court	967,280
Bldg. removal (Est.)	500,000
7% Adm. Cost	338,548
Relocation (Est.)	700,000
Family Units	550,000
Non Profit Move	22,500
Misc. Move	116,500
	$8,031,000

*Note: Derived from R/W cost info provided

Calculations Est. Only:
Assumption: 165 Hector = 407.55ac = $19,706 per ac**, 29.28ac per mile. Ave. R/W width 241.5, length of Proj. 13.92mi. 22.396m - 73,476.8 ft.

**Per acre cost includes:land & improvements, court, bldg. removal, adm. cost, relocation, family units, non profit and misc. move.

VIII. SUMMARY OF RECOMMENDATIONS

SUMMARY OF RECOMMENDATIONS

It is the recommendation of the Value Engineering team that the following Value Engineering Alternatives be carried into the Project Development process for further development.

Recommendation Number 1

The Value Engineering Team recommends that Value Engineering Alternative No. 1 be implemented. This alternative utilizes four lanes with a 40' median, reconstructs two lanes as close to the existing alignment as possible and constructs two new lanes, corrects the existing profile for stopping sight distance where needed, realigns the proposed bypass alignment from west of Millersburg to Hinkston Creek, avoids any historical impacts by shifting the alignment where needed or narrowing the median to four lanes with a 15' median with median barrier, and uses the existing right of way as much as possible from Paris to KY 36.

If this recommendation can be implemented, there is a possible savings of $10,572,999 over the "As Proposed" at the time of ultimate buildout and $3,175,500 over the Modified "As Proposed"(VE 8).

Recommendation Number 2-If Recommendation No. 1 cannot be implemented

The Value Engineering Team recommends that Value Engineering Alternative No. 3 be implemented. This alternative uses four lanes with 40' median, reconstructs two lanes as close to the existing alignment as possible and two separate new lanes, corrects the existing profile for stopping sight distance where needed, uses a four lane urban typical section through Millersburg, avoids any historical impacts by shifting the alignment where needed or narrowing the median to four lanes with a 15' median with median barrier, and uses the existing right of way as much as possible from Paris to KY 36.

If this recommendation can be implemented, there is a possible savings of $17,495,899 over the "As Proposed" at the time of ultimate buildout and $10,098,400 over the Modified "As Proposed" (VE 8).

Recommendation Number 3-If Recommendations Nos. 1 or 2 cannot be implemented

The Value Engineering Team recommends that Value Engineering Alternative No. 2 be implemented. This alternative uses four lanes with a 40' median, reconstructs two lanes as close to the existing alignment as possible and two separate new lanes, corrects the existing profile for stopping sight distance where needed, realigns the proposed bypass alignment from west of Millersburg to Hinkston Creek,avoids any historical impacts by shifting the alignment where needed or narrowing the median to four lanes with a 15' median with median barrier from Paris to west of Millersburg, from Millersburg to the end of the project uses a two lane section with a bypass around Millersburg, and uses the existing right of way as much as possible from Paris to west of Millersburg

If this recommendation can be implemented, there is a possible savings of $14,726,749 over the "As Proposed" at the time of buildout and $7,329,250 over the Modified "As Proposed"(VE 8).

US 68, BOURBON & NICHOLAS COUNTIES
PARIS TO CARLISLE
V.E. STUDY PRESENTATION
AUGUST 22, 1997

NAME	AFFILIATION	PHONE
Bill Ventry	Ventry Engineering	(850) 627-3900
Benn S. Powell	C.O. Design	(502) 564-3280
Jerry Cottingham	E A Partners	(606) 277-8320
A.L. Perkins	D7 Preconstruction	(606) 246-2355
D. Wayne Mosley	D7 Construction	(606)246-2355
Dave Heil	E A Partners	(606) 277-8320
Paul Doss	FHWA	(502) 223-6740
Karen Hudson	Wilbur Smith Assoc.	(606) 254-5759
Joette Fields	KYTC Highway Design	(502) 564-3280
Keith Caudill	D7 Design	(606) 246-2355
Robert Semones	KYTC Highway Design	(502) 564-3280
Jack Conway	KTC Materials	(502) 564-2374
Robert Polsgrove	KTC Environ. Analysis	(502) 564-7250
Jerry Love	Ventry Engineering	(850) 627-3900
Daryl Greer	KTC Highway Design	(502) 564-3280

IX. APPENDICES

Environmental Shoulders

The Value Engineering team investigated the use of environmental shoulders (grassed shoulders capable of supporting the travel pavement and vehicles that need to seek refuge on the shoulders).

Two alternatives were investigated. One, reinforced soil, was approximately one half the cost of paved shoulders. The other using a geoweb was approximately twice the cost of paved shoulders.

The use of geoweb or similar product would not experience the magnitude of rutting that a reinforced shoulder may experience.

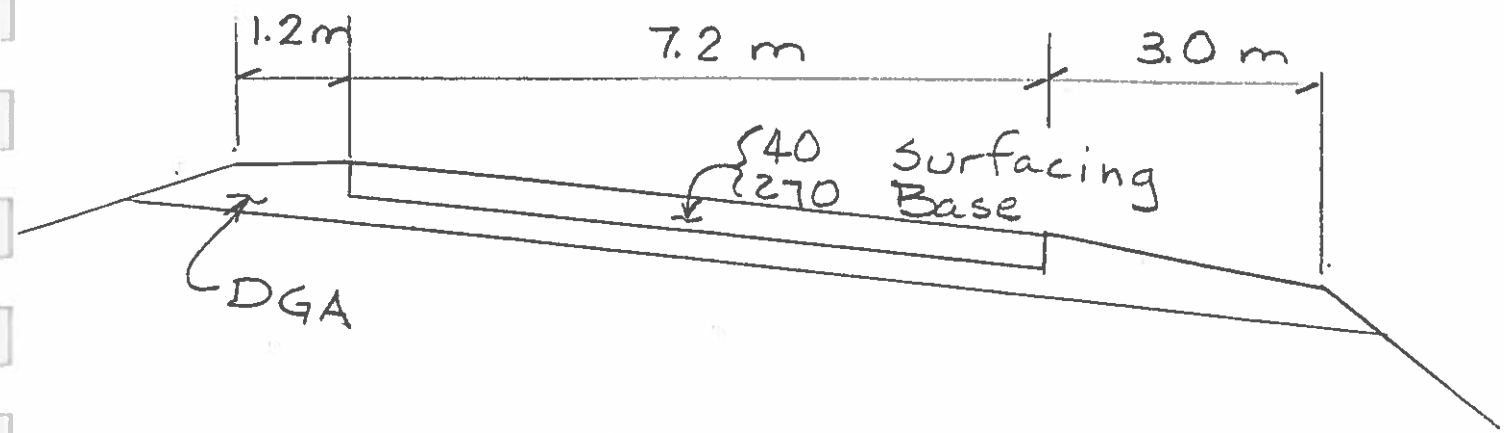
The Kentucky Transportation Cabinet may wish to spend the extra funds on some projects where public criticism is an issue.

The reinforced soil shoulder consists of a geosynthetic approximately eight inches below the ground. this geosynthetic would extend approximately two feet under the travel lane to the outside of the shoulder. This system would not prevent some rutting of the shoulder but control the amount of rutting.

The geoweb shoulder consists of a geoweb with the webs filled with soil. This allows the grass to grow through the web cells.

Both systems require designs. The designs can be obtained from the proprietary suppliers.

Environmental Shoulder



'AS Proposed'

Environmental Shoulder

1.2 + 3.0 = 4.2 m width of shoulder

2 Lanes

Length of 'As Proposed' Alternate = 22,396.048 m

Area (4.2 + 1.2) × 22,396.048 = 120,938.66 m^2
(shoulder + tie to pavement)

Cost 120,938.66 m^2 × $3.50/$m^2$ = $423,285.31

Tensar

Geo web

Area 4.2 × 22,396.048 = 94,063.402 m^2

Cost 94,063.402 m^2 × $14.00 = $1,316,888

'As Proposed'

Asphalt shoulder

$(3.0 + 3.0) \times 22,396.048 = 134,376 \ m^2$

$134,376 \ m^2 \times 136.85 \#/m^2 \times 4 = 73,557,580 \#$

$73,557,580 \# \div 2202.64 = 33,395 \ m\text{-ton}$

$33,395 \ m\text{-ton} \times 33/m\text{-ton} = 1,102,041$

VE-1

Environmental Shoulder

4 Lanes

Tensar

1.2 + 3.0 = 4.2 m width of shoulder / 2 lanes

Length of VE-1 Alignment
use same length as 'As Proposed'
22,396.048 m

Cost same as VE-5 $846,570.61

Geoweb

Cost same as VE-5 $2,633,775

VE-1

Asphalt Shoulder

Same as VE-5

$(1.2 + 3.0) \times 2 \times 22{,}396.048 = 188{,}126.8\ m^2$

$188{,}126.8\ m^2 \times 136.85\ \#/m^2 \times 4 = 102{,}980{,}610\ \#$

$102{,}980{,}610\ \# \div 2202.64\ \#/m\text{-}ton = 46753.26\ m\text{-}ton$

$46{,}753.26\ m\text{-}ton \times \$33/m\text{-}ton = \$1{,}542{,}858$

VE-2

Environmental Shoulder

4 lanes to Millersburg
2 lanes thru Millersburg to end of Project

Length of alignment

Beg. Proj: Sta 200+00
Eq. 214+896.102 BK = 214+349.626 Ahe 114+00
West of Millersburg 211+500
End of Proj. 121+500

211+500
- 200+000
11+500 = 11500 m Beg Proj to Millersburg

214+896.102
- 211+500
3+396.102 = 3396.102 m Millersburg By-Pass

121+500
- 114+000
7+500 = 7500 m East of Millersburg to End of Proj.

22,396.102

214+ 4470 m thru Millersburg

VE-2

Tensar

Area $(1.2 + 3.0 + 1.2) \times 2 \times 11,500 = 124,200\ m^2$

$(1.2 + 3.0 + 1.2) \times (7500 + 4470) = 64,638\ m^2$

$188,838\ m^2$

Cost $188,938\ m^2 \times \$3.5/m^2 = \$660,933$

Geoweb

Area $(1.2 + 3.0) \times 2 \times 11,500 = 96,606\ m^2$

$(1.2 + 3.0) \times (7500 + 4470) = 50,274\ m^2$

$146,874\ m^2$

Cost $146,874\ m^2 \times \$14.00/m^2 = \$2,056,236$

VE-2

Asphalt Shoulder

$(1.2 + 3.0) \times 2 \times 11{,}500\ m = 96{,}600\ m^2$

$(1.2 + 3.0) \times (7500 + 4470) = \underline{50{,}274\ m^2}$

$146{,}874\ m^2$

$146{,}874\ m^2 \times 136.85\ \#/m^2 \times 4 = 80{,}398{,}827.6\ \#$

$80{,}398{,}827.6\ \# \div 2202.64\ \#/m\text{-ton} = 36501\ m\text{-tons}$

$36{,}501\ m\text{-tons} \times \$33/m\text{-ton} = \$1{,}204{,}537$

VE - 3

Environmental Shoulder

4 Lanes thru Millersburg to KY 36
2 Lanes from KY 36 to End of Project

Length of 4 lanes = 11,500
4470
7500
- 3403
20,067 m 4 lanes

3403 m 2 lanes

Tensar

Area (1.2+3.0+1.2) x 2 x 20,067 = 216,723.6 m^2
(1.2+3.0+1.2) x 3403 m = 18,376.2 m^2
235,099.8 m^2

Cost 235,100 m^2 x $3.5 / m^2 = $822,850

Geoweb Area

(1.2+3.0) x 2 x 20,067 = 168,562.8 m^2
(1.2+3.0) x 3403 = 14,292.6
182,855.4 m^2

Cost 182,855.4 m^2 x $14.00 / m^2 = $2,559,976

VE-3

Asphalt shoulder

$(1.2 + 3.0) \times 2 \times 20,067 = 168,562.8\ m^2$

$(1.2 + 3.0) \times 3403 = 14,292.6\ m^2$

$182,855.4\ m^2$

$182,855.4\ m^2 \times 136.85\ \#/m^2 \times 4 = 100,095,046\ \#$

$100,095,046\ \# \div 2202.64\ \#/m\text{-}ton = 45,443.22\ m\text{-}ton$

$45,443.22\ m\text{-}ton \times \$33/m\text{-}ton = \$1,499,626$

VE-5 (As Proposed Modified)

Environmental Shoulder

Tensar — 4 lanes

1.2 + 3.0 = 4.2 width of shoulder/2 Lanes

Length of 'As Proposed' = 22,396.048 m

Area (4.2 + 1.2) × 2 × 22,396.048 = 241,877.32 m^2

Cost 241 877.32 m^2 × $3.50/$m^2$ = $846,570.61

Geoweb

Area 4.2 × 2 × 22,396.048 = 188,126.80 m^2

Cost 188,126.80 m^2 × $14.00/$m^2$ = $2,633,775

VE-5 (As Proposed Modified)

Asphalt Shoulder

Same as VE-1

$1,542,858