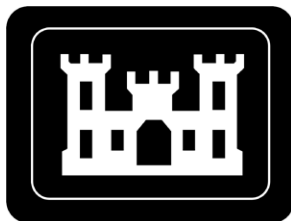

FINAL

**NORTH ST. LOUIS COUNTY HAUL
ROAD ANALYSIS AND JUSTIFICATION
FOR ADDITIONAL INVESTIGATION-
EVALUATION OF INACCESSIBLE
MATERIALS BENEATH PAVEMENTS
ST. LOUIS, MISSOURI**

JANUARY 7, 2005



**U.S. Army Corps of Engineers
St. Louis District Office
Formerly Utilized Sites Remedial Action Program**

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ST. LOUIS, MISSOURI

JANUARY 7, 2005

Prepared by

**U. S. Army Corp of Engineers, St. Louis District Office,
Formerly Utilized Sites Remedial Action Program**

With assistance from

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LIST OF ACRONYMS AND ABBREVIATIONS

AC	asphaltic concrete
AEC	Atomic Energy Commission
aka	also known as
B&K	B & K Construction Inc.
BNI	Bechtel National, Inc.
CADD	computer-aided design and drafting
CDC	Commercial Discount of Chicago
DOE	United States Department of Energy
EPA	United States Environmental Protection Agency
HISS	Hazelwood Interim Storage Site
MoDOT	Missouri Department of Transportation
NRC	Nuclear Regulatory Commission
ORNL	Oak Ridge National Laboratories
OU	Operable Units
PCC	portland cement concrete
ROW	right-of-way
SAIC	Science Applications International Corporation
SLAPS	St. Louis Airport Site
SLDS	St. Louis Downtown Site
SOR	sum of ratios
USGS	United States Geological Survey

DEFINITIONS:

Impact – Subject to the potential presence of **residue**.

Impervious – Will not allow the passage of fluid or dust.

Material – Any natural soil or manmade substance beneath a **road pavement**.

Obliterated – Completely demolished and removed leaving no clear traces.

Residue – Waste byproducts from processing activities carried out at Mallinckrodt Chemical Works in downtown St. Louis.

Right-of-way – Land subject to an easement for the passage of the public and other public uses.

Road pavements – The hard, durable, **impervious**, manmade surface covering of a street designed for the passage of vehicles.

1.0 INTRODUCTION AND PURPOSE

This report determines the potential location of possibly impacted materials beneath road pavements around the St. Louis Airport Site (SLAPS) and the Hazelwood Interim Storage Site (HISS). This report is limited to evaluating materials near or underlying the roadways located within an area referred to as the SLAPS Road Study Area. The area to be studied is bounded by the following roadways (See Exhibit A):

On the West by Lindbergh Boulevard,
On the North by Interstate 270,
On the East by Graham Road and North Hanley Road,
On the South by Airport Road to its intersection with McDonnell Boulevard and with McDonnell Boulevard to its intersection with Banshee Road and then with Banshee Road

This determination was accomplished by reviewing available records of pavement histories, road construction documents, historical aerial photographs, available pavement borings, historical maps and documents, site investigations, and other miscellaneous documents to determine when and how these pavements were constructed and when and how the materials beneath these pavements may have been potentially impacted by residue hauling or other possible means of residue transportation.

Impervious pavements that existed during the period of possible impacts protected the underlying material from direct exposure to residue; therefore, there is no need to subject those materials to further investigation. Conversely, further investigation is needed in the areas where pavements were constructed over materials possibly impacted by prior exposure to residues.

This report examines the history of road pavements relative to the effects from residues in the SLAPS Road Study Area.

This report

- Identifies the changes in road surface location, type of construction, right-of-way, and pavement widths for the SLAPS Road Study Area roads from 1946 to the present (2004).
- Determines whether the road surfaces prevented residue from migrating from the surface to directly affect the material beneath that pavement.
- Identifies where pavements have been constructed over areas possibly previously impacted by residue. This residue originates from residue hauling activities or water and wind erosion from the storage of wastes in the SLAPS Road Study Area.
- Evaluates the historical evidence, in conjunction with evidence from field-testing, to determine where further investigation is warranted.

Those properties along each roadway which have been identified as vicinity properties are listed in the following table.

Table 1-1 Vicinity Properties adjoining roadways

Road Segment	Vicinity Proprieties
Eva Avenue	16, 17, 18, 19
Hazelwood Avenue	24, 31A, 32, 33, 34, 35, 35A, 37, 38, 39, 39A, 40, 41, 42, 43, 44, 45, 46, 47, 48, 48A, 53
Latty Avenue	35, 37, 38, 39, 39A
Frost Avenue	19, 20, 20A, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31
I-170	31, 31A, 33, 34, 35, 39, 39A, 50
I-270	48A, 53, 54, 55, 56, 57, 58, 63A
Lindbergh Boulevard	3, 63
North Hanley Road	52
Graham Road	15
Airport Road	15
Banshee Road	14A
Pershall and Dunn roads	48, 48A, 49, 53, 54, 55, 56, 57, 58, 59, 60, 61, 62,
Polson Road	55, 56
Seeger Industrial Drive	21, 22, 23, 24, 32
Nyflot Road	39, 41
McDonnell Boulevard	2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 14A, 15, 16

2.0 SITE BACKGROUND AND HISTORY

Starting in the early 1940s, uranium metal and other radioactive substances were produced at the Mallinckrodt Chemical Works in St. Louis, Missouri. These facilities, as well as other properties in their vicinity, are now collectively known as the St. Louis Downtown Site (SLDS). Beginning in 1946 the residue from this processing operation was transported to and stored on a 21.7-acre property that is located north of St. Louis Municipal Airport (now Lambert-St. Louis International Airport). This parcel and surrounding areas are collectively now known as the SLAPS. The site was used for the storage of residues from 1946 to 1967. The residues were transported from the SLDS to the SLAPS by truck over public roadways. In 1966 the residues were sold to a private company, the Continental Mining and Milling Company (Continental), which transported the residues from the SLAPS over the public roadways to a second site for eventual reprocessing and shipment by rail to Cotter Corporation facilities in Canon City, Colorado. This second site, 9200 Latty Avenue, is located south of Latty Avenue and east of Coldwater Creek. This property and the surrounding properties are collectively known as the Latty Avenue Site. The area was used to store residues from 1966 to 1973. The SLAPS and the Latty Avenue Site are collectively known as the North St. Louis County Sites.

After the removal of the residues from the SLAPS by Continental, the SLAPS site was transferred to the control of the St. Louis Airport Authority. The structures at the site were

demolished and buried on-site. In 1970, approximately 1 to 3 feet of fill from airport construction projects was brought to the SLAPS and spread over the site. This fill and the returning trucks traveled over public roadways.

After the removal of much of the residue from the HISS by rail transport to Colorado, a portion of the remaining residues were removed and transported over the public roads to the West Lake Landfill facility for disposal. This activity occurred in 1973.

During all of these activities, the residues were stored on the open ground with few engineering controls to prevent erosion by water or wind action. The HISS and the SLAPS are also partially within the floodplain of Coldwater Creek.

2.1 TIMELINE OF EVENTS

The residue from the Mallinckrodt refining operation is the potential source of impacts along the roads. The events listed chronologically below are relevant to determining the possible impacts to roads.

- On April 24, 1941, Mallinckrodt began processing uranium ore in downtown St. Louis. Mallinckrodt continued uranium refining in downtown St. Louis until 1959. These activities were performed under contracts with the Manhattan Engineer District and the United States Atomic Energy Commission (AEC).
- In 1945 the Manhattan Engineering District began the process of looking for a 5-acre site to store residues from the SLDS. The need for the land was urgent because there was no room to store these residues at the downtown plant. The preferred land was to be:
 - Fairly isolated or easily capable of isolation by the erection of fences
 - Not subject to floods or excessive ground drainage
 - Readily available, and preferably located to the north or northwest of the city.
- On March 2, 1946, permission was obtained to use the SLAPS for the storage of residues. Actual title was not acquired until January 3, 1947. This land was acquired by condemnation. Due to the “unfavorable publicity” generated by the condemnation proceedings, a decision was made to erect a fence around the site. Most of the wastes and residues were stored on open ground.
- From 1946 through 1958, residues were transported to the SLAPS for storage, mostly from Mallinckrodt in downtown St. Louis. Private contractors using government-supplied equipment transported the residues over the public roadways.
- In 1948 and 1949, highly radioactive radium-bearing residues were transferred from the SLAPS to Fernald, Ohio.
- In 1952, “several hundred tons of contaminated metal and debris” were buried at the SLAPS under 6 to 8 feet of fill obtained from McDonnell Aircraft.

North St. Louis County Haul Road Analysis and Justification for Additional Investigation-Evaluation of
Inaccessible Materials Beneath Pavements

- In 1954, sixty tons of captured Japanese uranium residues and approximately 500 tons of other “low grade uranium bearing residues” were brought to the SLAPS from Middlesex, New Jersey.
- In an inventory of the site dated April 11, 1959, it is stated that the following residues had been delivered to the SLAPS:

Pitchblende Raffinate, AM-7	74,000 tons
Raffinate, AM-10	32,500 tons
Slag, C-liner	7,800 tons
Interim Residue Plant Tailings, C-701	5,400 tons
Barium Cake, AJ-4	10,200 tons
Vitro residues	290 tons
Captured Japanese Uranium precipitates	60 tons
55,000 30- and 50-gal drums as scrap	<u>3,500 tons</u>

Total tons hauled to the SLAPS prior to 1960 133,750 tons

These values were based on weight of residues delivered to the site with no adjustment for moisture pickup.

Source: March 22, 1960 drawing titled MCW DWG #6-1403-19-C.

See Reference Document No. 1 for a copy of a document titled *History of Material Storage at the St. Louis Airport Storage Site*, which contains a description of the residue designations listed above and additional information concerning the origins and disposition of the residues.

- In 1959, a railroad siding and loading facilities were constructed at the SLAPS.
- In 1960, Federal Division of Raw Materials explored disposal of the residues. Per their June 1960 memo, the refined value of the cobalt, nickel, copper and selenium in the residues was believed to be \$15,000,000 to \$20,000,000. In addition the residues contained 250,000 pounds of uranium, the value of which was not included in the \$15,000,000 to \$20,000,000.
- In 1962, bids were invited on the residues, and an award was made to Contemporary Metals Corporation, Los Angeles (Contemporary); however, Contemporary failed to furnish the \$50,000 performance bond and pay the \$126,500 bid and defaulted on the contract. Contemporary did no work on the site.
- Two additional invitations to bid were issued in 1964, neither of which produced a responsive bid.
- In 1964, 4,000 tons of C-Oxide residues were shipped either to Fernald, Ohio for processing or to Weldon Spring for storage.
- A September 23, 1965, Memo titled St. Louis Airport Resides listed the inventory for another invitation to bid to be following five categories of residues. Separate bids were invited for each category.

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Pitchblende Raffinate	74,000 tons
Colorado Raffinate	32,500 tons
Barium Cake, unbleached	1,500 tons
Barium Cake, leached	8,700 tons
Miscellaneous Material in Drums	350 tons

The memo also discussed the proposed remediation of the site as follows:

“The major problem would appear to be in 5 acres in the west end of the area. This was originally low swampy ground, drained by a couple of ditches. It was filled and graded and then the Colorado Raffinate, some drummed material and contaminated waste of all kinds were buried on this fill. However, there is buried somewhere in the fill about six carloads of metal scrap, an unknown quantity of drums, and a jeep.”

- In February 1966, Continental Mining and Milling (Continental) purchased the five residue items listed above for \$126,500. Continental then borrowed \$2,500,000 from Commercial Discount of Chicago (CDC) for the processing operation. The residues are believed to have totaled 117,000 tons. Continental later purchased 7,800 tons of C-Liner Slag for an additional \$14,000.
- On December 21, 1965, the Village of Hazelwood approved the use of the 9200 Latty Avenue property by Continental for refining operations.
- On February 14, 1966, AEC gave Continental a Source Material License for “Removal of stockpile residues from 50 Brown Road, Robertson, Missouri, and storage only at the licensee’s facilities located at 9200 Latty Avenue, Hazelwood, Missouri, in accordance with the procedures described in the licensee’s application dated February 4, 1966, and supplements dated February 7 and February 8, 1966.”
- On February 28, 1966, AEC gave Continental Notice to Proceed to remove the residues from the SLAPS. Continental was given 400 days, until April 4, 1967, to complete the task.
- In a five-month period, some time between March 1966 and April 1967, the residues were moved from the SLAPS to the HISS by a hauling contractor hired by Continental. This move required ten dump trucks for a period of five months and cost Continental \$100,000.
- On February 3, 1967, CDC foreclosed on Continental’s loan. CDC became the owner of the residues and the HISS property at a public sale.
- February 14, 1967, the AEC provided a “punch list” of items in need of completion at the SLAPS before April 4, 1967 in order for AEC to declare the work complete. One of the punch list items was to remove an “apparently abandoned” haulage truck from the SLAPS.
- On April 14, 1967, the AEC wrote Hartford Accident & Indemnity Company stating that Continental had not responded to earlier letters so “we (AEC) would assume from our knowledge, that we can expect no further action by them, so that we must, apparently, look to you (Hartford) for finishing the work.” Hartford apparently paid to complete the clean-up and AEC released their performance bond.

- In 1967, CDC attempted to sell the residues; there were no bidders. The residues at the HISS were estimated at 100,000 tons.
- From 1967 to 1968, CDC began drying the residues under an NRC license. The dried residues were shipped to Cotter Corporation facilities in Canon City, Colorado. By the end of 1968, 47,000 tons of residues had been shipped.
- In 1969, no activity took place at the HISS. The remaining residues were sold to Cotter Corporation.
- In 1969, the SLAPS was transferred to the St. Louis Airport Authority. The St. Louis Airport Authority demolished the existing buildings and buried the demolition debris on-site. The SLAPS was then covered with approximately 3 feet of clean fill. In 1970, this fill was trucked in from the construction of Lambert-St. Louis International Airport.
- In 1970, Cotter Corporation resumed drying operations and shipped all but 18,700 tons of residues to Canon City, Colorado.
- In 1973, the Cotter Corporation hired B & K Construction Inc. (B&K), a St. Ann, Missouri road construction company, to load the remaining residues onto rail cars for shipment to Cotter Corporation facilities in Canon City, Colorado. Approximately 10,000 tons of residues were shipped to Cotter Corporation in Canon City, Colorado without drying.
- In 1973, B&K disposed of the remaining residues (8,700 tons of leached barium sulfate cake) at the West Lake Landfill. It is uncertain what occurred. B&K billed Cotter for shipment of 50,000 tons, but B&K and others state that only 9,000 tons were actually sent to the landfill. The AEC was told that the remaining 8,700 tons of residue were mixed with 40,000 tons of soil prior to being sent to the landfill, but it does not appear that this actually occurred.
- In 1976 and 1977, the HISS (it was then know as the Latty Avenue site) was evaluated by the Nuclear Regulatory Commission for release for unrestricted use. Additional efforts were found to be needed.
- In 1984, the U.S. Department of Energy (DOE) issued a report titled *Post-Remedial Action Report* for the Hazelwood Site describing the testing performed to allow the cities of Berkeley and Hazelwood to design a new Latty Avenue road pavement and storm sewer system.
- In 1985, the DOE conducted mobile gamma scanning to detect any anomalies associated with the transportation routes between the Latty Avenue Properties and the West Lake Landfill. Impacts were found on McDonnell Boulevard, Pershall Road, and Hazelwood Avenue.
- In 1986, DOE directed Bechtel National, Inc. to provide radiological support to the cities of Berkeley and Hazelwood during the Latty Avenue road and storm sewer improvement project. During this time concentrations of radium-226 and thorium-230 contamination in excess of DOE remedial action guidelines were found along and under Latty Avenue. The asphalt pavement itself was also found to be impacted. The existing asphaltic concrete (AC) pavement was removed, as well as some of the material formerly under the pavement. A

new Portland Cement Concrete (PCC) pavement was constructed. The impacted material was removed and stockpiled on the HISS.

- In 1986, Oak Ridge National Laboratory (ORNL) issued a report entitled *Results of the Radiation Measurements Taken of Transportation Routes (LM004) in Hazelwood, Missouri*. This report indicated that anomalies were found along Pershall Road between Lindbergh Boulevard and Polson Lane, along Hazelwood Avenue between Pershall Road and Latty Avenue, and along McDonnell Boulevard between Byassee and Coldwater Creek. This study was a follow-up to the 1985 DOE mobile gamma scanning listed previously.
- In 1990, in a report entitled *Radiological Characterization Report for FUSRAP Properties in the St. Louis, Missouri Area*, Bechtel National, Inc. (BNI) stated that, based on subsurface drilling and testing, “In general, radioactive contamination is present in some areas underneath Latty Avenue, McDonnell Boulevard, and Pershall Road, and contamination exists along both sides of Hazelwood Avenue and Pershall Road.”
- In 1991, the DOE conducted mobile gamma scanning to detect anomalies. Anomalies were detected on McDonnell Boulevard, Pershall Road, and Hazelwood Avenue.

2.2 METHODS OF POSSIBLE IMPACT

The possible sources of residues which may have impacted materials, which are now under pavement, are listed below.

- Residue from SLDS was placed at SLAPS from 1946 through 1959.
- Residue was hauled by truck between the SLAPS and the HISS in 1966 and 1967.
- Fill material was brought by truck from airport construction projects to the SLAPS site and the empty trucks returned to the airport in 1969 and 1970.
- Residue was hauled by truck from the HISS to the West Lake Landfill in 1973.
- Storm water erosion from the SLAPS and the HISS site does not appear to have been rigorously controlled. Aerial photographs from the early 1950s show the SLAPS drainage ditches along interior roadways and around the stockpile areas, which discharge into Coldwater Creek. Storm water would have carried residue into these ditches and then into the Coldwater Creek floodplain.
- Wind erosion from the SLAPS and the HISS site does not appear to have been rigorously controlled. The residues stored at the SLAPS were reported to be in piles 20 to 25 feet in height, which would be higher than the surrounding terrain. The 20-foot height is given in a June 13, 1991 document by U.S. Department of Health and Human Services. This document states that “At the SLAPS site the uranium processing wastes were stored on open ground and once covered two-thirds of the area to an estimated height of 20 feet.” A 25-foot height is given in a 1959 memo as the height of a “Pitchblende Raffinate stockpile”.

2.2.1 How Impacts May Have Been Caused By Truck Transportation

Some possible mechanisms for the loss of residue during transportation by truck include, but are not limited to, spillage from trucks, dusting from driving at high speeds while hauling uncovered residue, and falling of residue and residue contaminated earth from vehicle undercarriages, beds, and wheels. Any areas adjoining traveled pavements not covered by other hard-surface pavements might have been impacted.

A conceivable, but unlikely, mechanism for contamination, would involve mechanical breakdowns or accidents involving the loaded trucks. In the event of an accident or breakdown of loaded vehicles, it is some times necessary for safety reasons that the load be dumped prior to repairing or towing of the vehicle. Should one of these uncommon occurrences have occurred involving a vehicle hauling residue it could have resulted in impact to areas on or near the roadways used to transport residues.

2.2.2 Protection of the Materials Under Pavements From Direct Impacts

Hard-surface pavements should have shielded the materials directly beneath them from direct impacts, while any areas adjoining hard-surface pavements (i.e., unpaved road shoulder and nearby unpaved areas) could have been impacted. Hard-surface pavements are considered to be portland cement concrete (PCC) or batch-mixed and -placed asphaltic concrete (AC) pavement of sufficient thickness to shield the material beneath. Oil-and-chip pavements, penetration AC pavements, or seal-coat-over-aggregate pavements are not considered sufficiently durable or nonporous to eliminate the potential for direct impacts to the material beneath them. Used in this report, unless otherwise noted, AC refers to batch-mixed and -placed AC of sufficient thickness and strength to prevent direct impacts to material beneath that pavement. Areas not covered with hard surface pavements could have been impacted. Those areas could have subsequently been paved as the result of new road construction, rendering the impacted material under the later constructed pavement inaccessible.

2.2.3 Low Probability of Occurrence Mechanisms that Could Result in Impacts Under Road Pavements

There are several mechanisms that would result in impacts under otherwise impervious pavements. Such mechanisms would include those described below.

Placement of new utilities. It is a common practice to place utility services within public right-of-ways (ROWs) and sometimes under the road pavement. Such utility placement can result in the removal of the existing pavement, trenching, backfilling, and replacement of the paved surface. It is possible that the backfill material could be impacted material “borrowed” from nearby road ROW or that the excavated material would be stored on impacted ground and become impacted. Utilities could include, but would not be limited to, storm and sanitary sewers, water, gas, electric, and communications lines. Boring, jacking, or other underground tunneling methods could also be used to place such utilities. Therefore, any utility placement

could have resulted in the movement of impacted material to locations that were previously protected by pavement.

Repair of existing utilities. All utilities are subject to failure, and the repair and replacement of failed utilities could have resulted in the placement of impacted materials to locations that were previously protected by pavement. Water and sewer failures could also have resulted in the movement of impacted material within the soil.

Structural failure of pavement, AC, or PCC. Such a failure could have allowed a route for impacting agents to enter locations that are under the pavement. Also, the repair of structural failures generally requires the removal and replacement of the existing surface and any failed subgrade material. Pavement repairs could have resulted in the movement of possibly impacted material to locations that were previously protected by pavement.

Pavement reconstruction. Impacts could have also resulted when an existing impervious pavement was obliterated and a new pavement constructed to replace it. The construction activities of demolishing and removing the old pavement, the regrading of the new subgrade, and the construction of the new pavement could have moved impacted material from the former shoulder area to beneath the new pavement.

While the mechanisms listed above could result in impacts to material located under otherwise protective pavements, the conclusions of this report are based on the judgment that the chances of such impacts are too low to justify additional testing of inaccessible material under substantial pavements. The material under such hard-surfaced and impermeable pavements is considered to have been protected from direct impacts.

2.3 CONSIDERATIONS AND PROCEDURES

The purpose of this report is to identify those materials under currently existing pavements that may have been impacted by residue lost during residue hauling activities, residues transported by stormwater or wind erosion, and residues transported by stormwater flooding. This report includes determinations for where the testing of materials under the pavement could find such impacted material.

The conclusions of this report are based on the following considerations:

- Residues would not have directly impacted those areas protected by hard-surface pavements prior to 1946.
- Pavements constructed prior to 1966 would have protected the materials beneath them from direct impacts from the 1966 and 1967 hauling activities between the SLAPS and the HISS.
- Pavements constructed after 1966, adjacent to the 1966 and 1967 the SLAPS-to-the-HISS hauling routes could possibly have been placed over directly impacted materials.

- Pavements constructed after 1946 within the floodplain of Coldwater Creek downstream of the SLAPS could possibly have been placed over materials impacted by residue transported by water erosion and flooding.
- Pavements constructed after 1946 adjacent to the SLAPS could possibly have been placed over materials impacted by residue transported by wind erosion.

2.4 HISTORICAL FIELD-TESTING

- In 1985, ORNL issued a report entitled *Results of Mobile Gamma Scanning Activities in Berkeley, Bridgeton, and Hazelwood, Missouri*, which stated in part:

“No anomalies were detected from the intersection of Pershall Road and Lindbergh Boulevard, Lindbergh Boulevard to Natural Bridge Road (Highway 115), and Natural Bridge Road to St. Charles Rock Road to the West Lake Landfill entrance. Also no anomalies were detected on North Hanley from I-270 to Airport Road, Airport Road, Frost Avenue, and Eva Avenue. Anomalies were detected on McDonnell Boulevard, south side, from Coldwater Creek to the intersection of Norfolk Southern Railroad crossing and on the north side of McDonnell Boulevard from the Berkeley city limits to Trumbell Asphalt sign near Byassee Road. Anomalies were detected along Pershall Road, south side, from the Ford Motor Company, new car parking area, to just past Polson Lane and on the north side of Pershall Road. Anomalies were also detected on Hazelwood Avenue, mainly on the west side of the street, in front of Wetterau Perishable Center approximately 115 feet south from the railroad crossing of Latty Avenue and one spot on the west side of Hazelwood Avenue”.

- In 1986, ORNL issued another report, entitled *Results of the Radiation Measurement Taken of Transportation Routes (LM004) in Hazelwood, Missouri*. This report identified concentrations of higher-than-background radiation readings on McDonnell Boulevard between Coldwater Creek and Byassee Road, on Hazelwood Avenue north of Latty Avenue, and on Pershall Road between Polson Road and Lindbergh Boulevard. These were the only routes surveyed for this report.
- In 1990, in a report entitled *Radiological Characterization Report for FUSRAP Properties in the St. Louis, Missouri Area*, Bechtel National, Inc. stated that, based on subsurface drilling and testing, “In general, radioactive contamination is present in some areas underneath Latty Avenue, McDonnell Boulevard, and Pershall Road, and contamination exists along both sides of Hazelwood Avenue and Pershall Road.”
- In 1991 DOE conducted mobile gamma scanning surveys to detect any anomalies associated with the transportation routes around the SLAPS. The following roads near the SLAPS were scanned:

St. Charles Rock Road from Fee Fee Road to Taussig Road
 Fee Fee Road from St. Charles Rock Road to McDonnell Boulevard
 Taussig Road from St. Charles Rock Road to Gist Road
 Gist Road from Taussig Road to Garret Road
 Garret Road from Gist Road to Missouri Bottom Road
 Natural Bridge Road from St. Charles Rock Road to Lindbergh Boulevard

Lindbergh Boulevard from Natural Bridge Road to McDonnell Boulevard
 Banshee Road from Lindbergh Boulevard to McDonnell Boulevard
 McDonnell Boulevard from Lindbergh Boulevard to Airport Road
 McDonnell Boulevard from Fee Fee Road to Dunn Road
 Dunn Road from McDonnell Boulevard to Lindbergh Boulevard
 Pershall Road from Lindbergh Boulevard to North Hanley Road
 North Hanley Road from Dunn Road to Airport Road
 Airport Road from North Hanley Road to McDonnell Boulevard
 Eva Avenue from McDonnell Boulevard to Frost Avenue
 Hazelwood Avenue from Frost Avenue to Pershall Road
 Frost Avenue from Eva Avenue to North Hanley Road
 Latty Avenue from the HISS to North Hanley Road

The results were issued in a report titled *Results of Mobile Gamma Scanning Activities in St. Louis, Missouri. ORNL*. This report also collected results from and discussed all of the prior mobile gamma scanning testing activities. Figures illustrating the roads, which were scanned, are reproduced as Figures 2-1, 2-2, and 2-3. Figure 2-1 shows the general location of the Mallinckrodt Chemical Plant and the SLAPS, the HISS, and West Lake Landfill storage sites, St. Louis, Missouri. Figure 2-2 is a diagram of routes scanned in the vicinity of the Mallinckrodt Chemical Plant site, St. Louis, Missouri. Figure 2-3 is a diagram of routes scanned by ORNL and routes characterized by BNI. in the vicinity of the Lambert-St. Louis International Airport, St. Louis, Missouri.

- This survey found no anomalies on the suspected haul routes in the vicinity of the Mallinckrodt plant that could not be explained by factors other than haulage activities. The survey found impacts along Latty Avenue from the HISS to Graham Road and confirmed the impacts found along other haul routes in past surveys.

2.4.1 Results Of Initial Testing Under Roads

At least 1,632 samples have been collected in areas that are in or near existing road pavements. Of these, 127 have individual test results exceeding remediation goals proposed in the Record of Decision for unrestricted release. These points are shown on the drawings contained in the appendices. These data were obtained from the FUSRAP primary sample database and represent the test results from many sources compiled into a common electronic format.

Figure 2-4 shows the roadways in or around which residue has been detected that may exceed remediation goals in the proposed Record of Decision.

Figure 2-1 General Location of the Mallinckrodt Chemical Plant and the SLAPS, HISS, and West Lake Landfill Storage Sites in St. Louis, Missouri

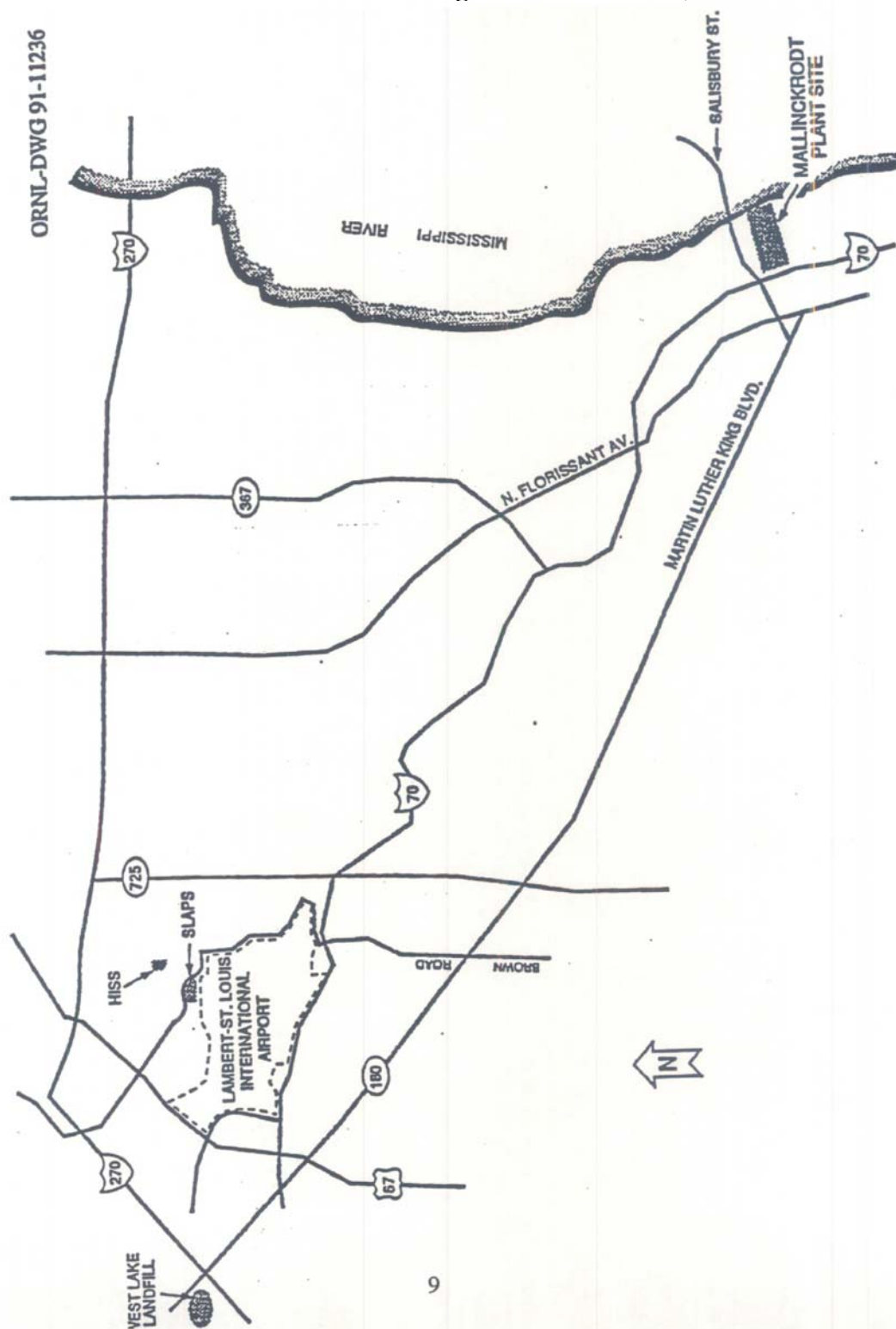


Figure 2-2 Diagram of Route Scanned in the Vicinity of the Mallinckrodt Chemical Plant Site, St. Louis, Missouri

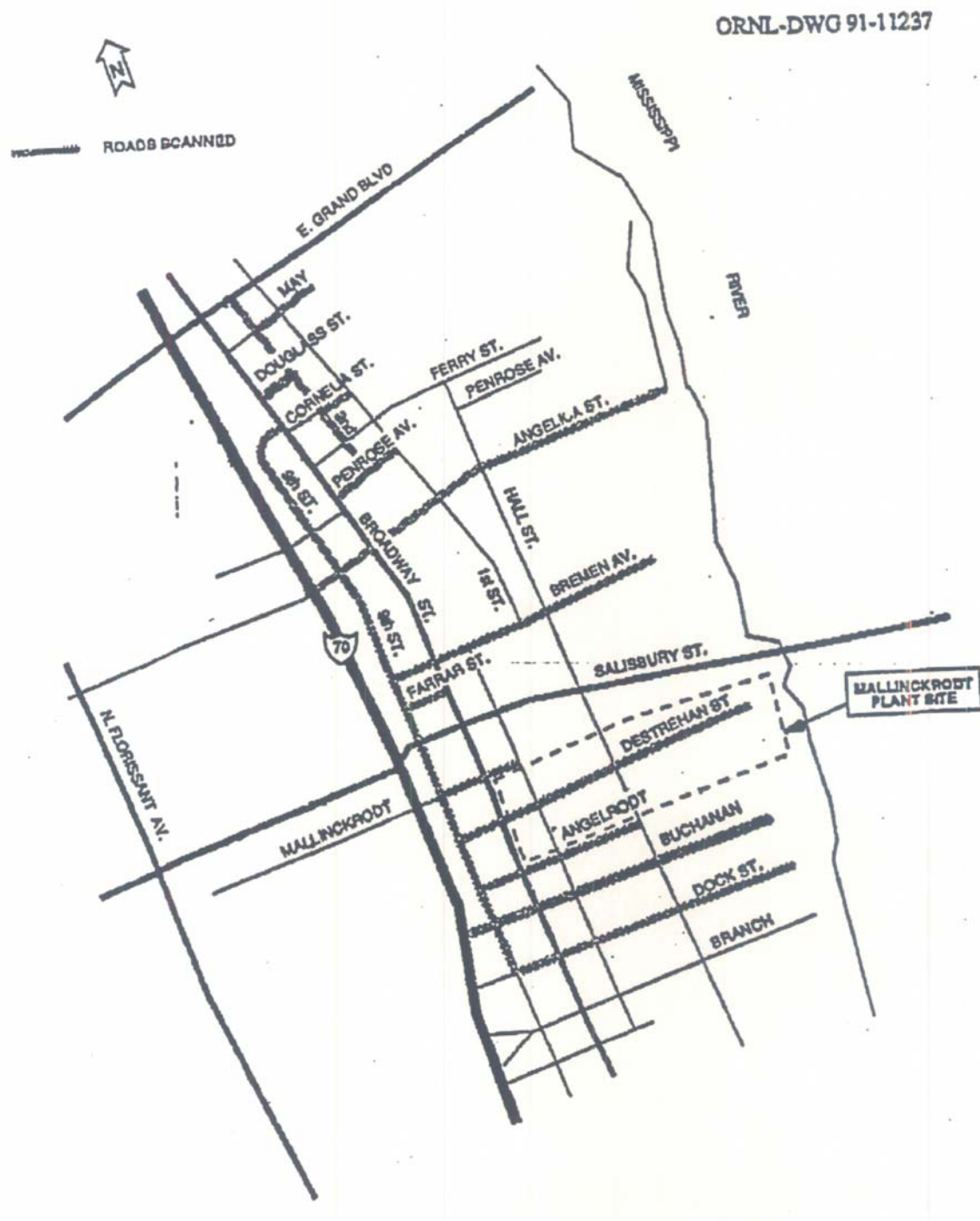
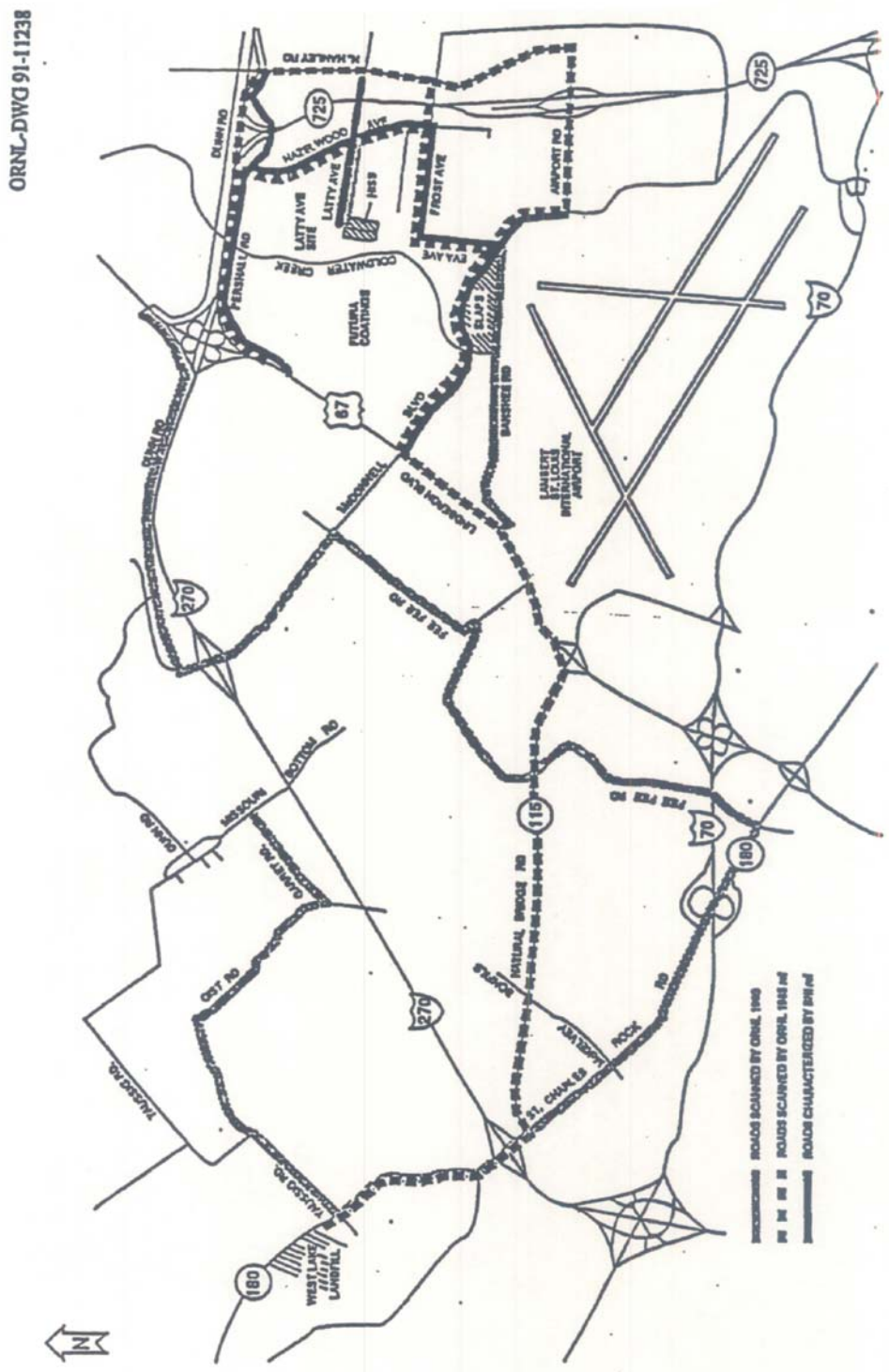
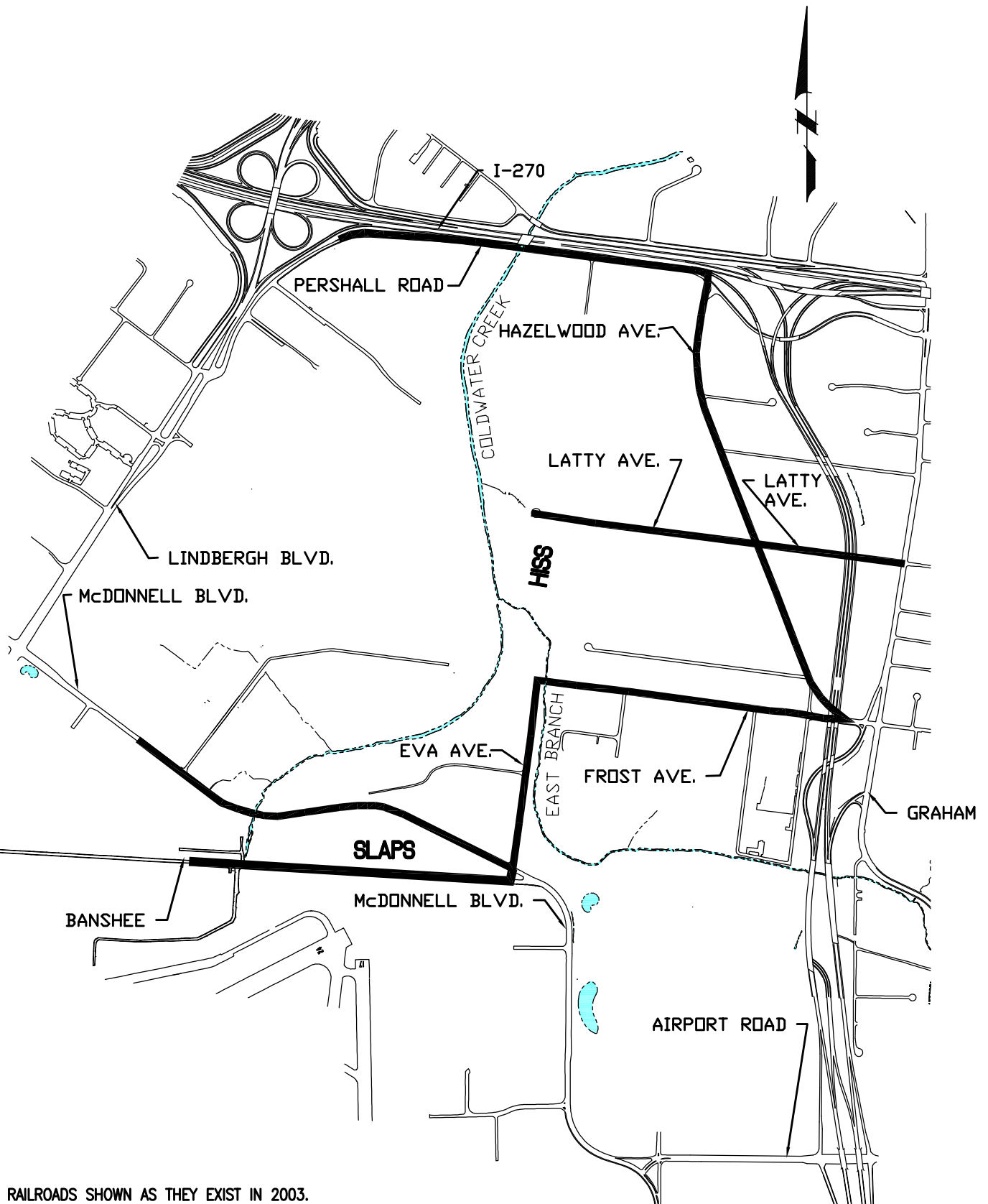


Figure 2-3 Diagram of Routes Scanned by Oak Ridge National Laboratory and Routes Characterized by Bechtel National, Inc. in the Vicinity of the Lambert-St. Louis International Airport, St. Louis, Missouri



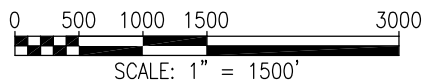
U:\CAD\NorthCo\Draws\HaulRouteP\InvestigativePlan\ROAD STUDY\Road Study cm\2003-06-03 2:4F.dwg, FIGURE 2-4, 1/5/2005 9:42:26 AM



ROADS AND RAILROADS SHOWN AS THEY EXIST IN 2003.

LEGEND:

IMPACTED



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LOCATIONS OF IMPACTS FOUND
BY TESTING

FIGURE 2-4

J.D.L.

REV. NO./DATE:
FINAL/01-07-05

CAD FILE:

2.5 HAUL ROUTES BETWEEN THE SLAPS AND THE HISS/FUTURA SITE

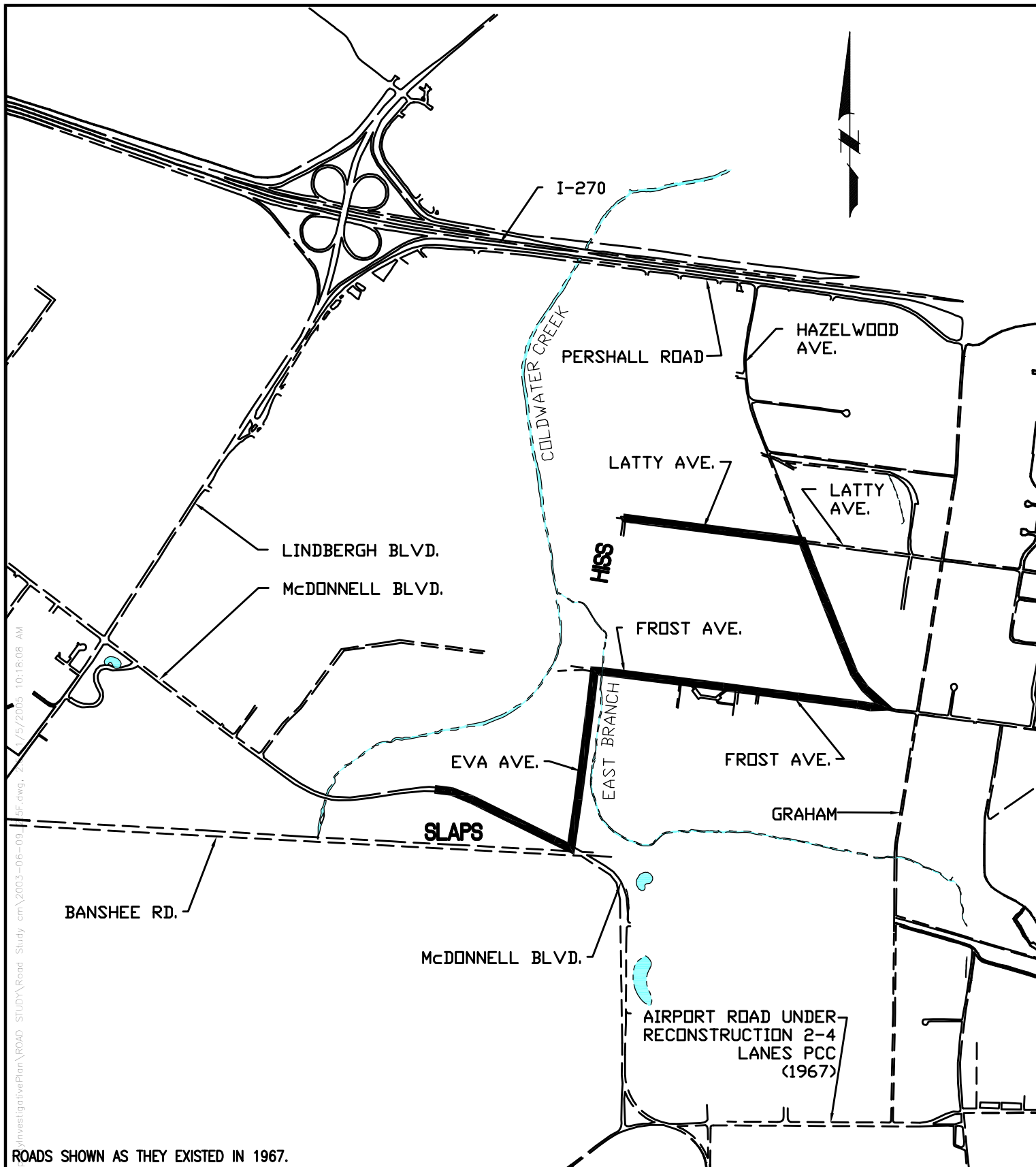
In transporting residue between the SLAPS and the HISS, the probable roads traveled include Eva Avenue, Hazelwood Avenue, Latty Avenue, Frost Avenue, I-270, Lindbergh Boulevard (also known as (aka) Highway 66/67), McDonnell Boulevard (aka Brown Road, State Route TT or STT), Pershall Road (aka I-270 South Outer Road), Dunn Road (aka I-270 North Outer Road), Graham Road (aka North Hanley Road), and Airport Road.

While there are many potential routes to get from one site to the other, the most direct route involves a portion of McDonnell Boulevard from the SLAPS to Eva Avenue, Eva Avenue to Frost Avenue, Frost Avenue to Hazelwood Avenue, Hazelwood Avenue to Latty Avenue, and Latty Avenue to the HISS (Route A). Route A is illustrated in Figure 2-5.

The photographic information examined shows evidence of wear consistent with heavy truck hauling on Eva, Frost and Latty avenues during the period consistent with the 1966 and 1967 hauling activities between the SLAPS and the HISS. It seems likely that the greatest potential for impacts would have occurred along the route described above. Reports from eyewitnesses to the hauling activities indicate that the trucks did use this route, except during periods of wet weather.

When the hauling activities did not use Route A, because of weather-related effects on the hauling roads, train traffic blocking the Frost Avenue crossing, or some other reason, other possible routes might have included those listed below. Since Eva Avenue and part of Frost Avenue were unimproved dirt roads at that time, they may not have been passable in times of prolonged wet weather.

- Route B - McDonnell Boulevard to Lindbergh Boulevard, Lindbergh Boulevard to Pershall Road, Pershall Road to Hazelwood Avenue, Hazelwood Avenue to Latty Avenue. This route is illustrated in Figure 2-6.
- Route C - McDonnell Boulevard to Lindbergh Boulevard, Lindbergh Boulevard to Pershall Road, Pershall Road to Graham Road, Graham Road to Latty Avenue. This route is illustrated in Figure 2-7.
- Route D - McDonnell Boulevard to Lindbergh Boulevard, Lindbergh Boulevard to I-270, I-270 to Graham Road, Graham Road to Latty Avenue. This route is illustrated in Figure 2-8.
- Route E - McDonnell Boulevard to Airport Road, Airport Road to Graham Road, Graham Road to Frost Avenue, Hazelwood Avenue to Latty Avenue. This route is illustrated in Figure 2-9.
- Route F - McDonnell Boulevard to Airport Road, Airport Road to Graham Road, Graham Road to Latty Avenue. This route is illustrated in Figure 2-10.

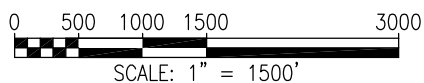


ROADS SHOWN AS THEY EXISTED IN 1967.

ROUTE LENGTH = 2.15 Mi.

LEGEND:

IMPACTED



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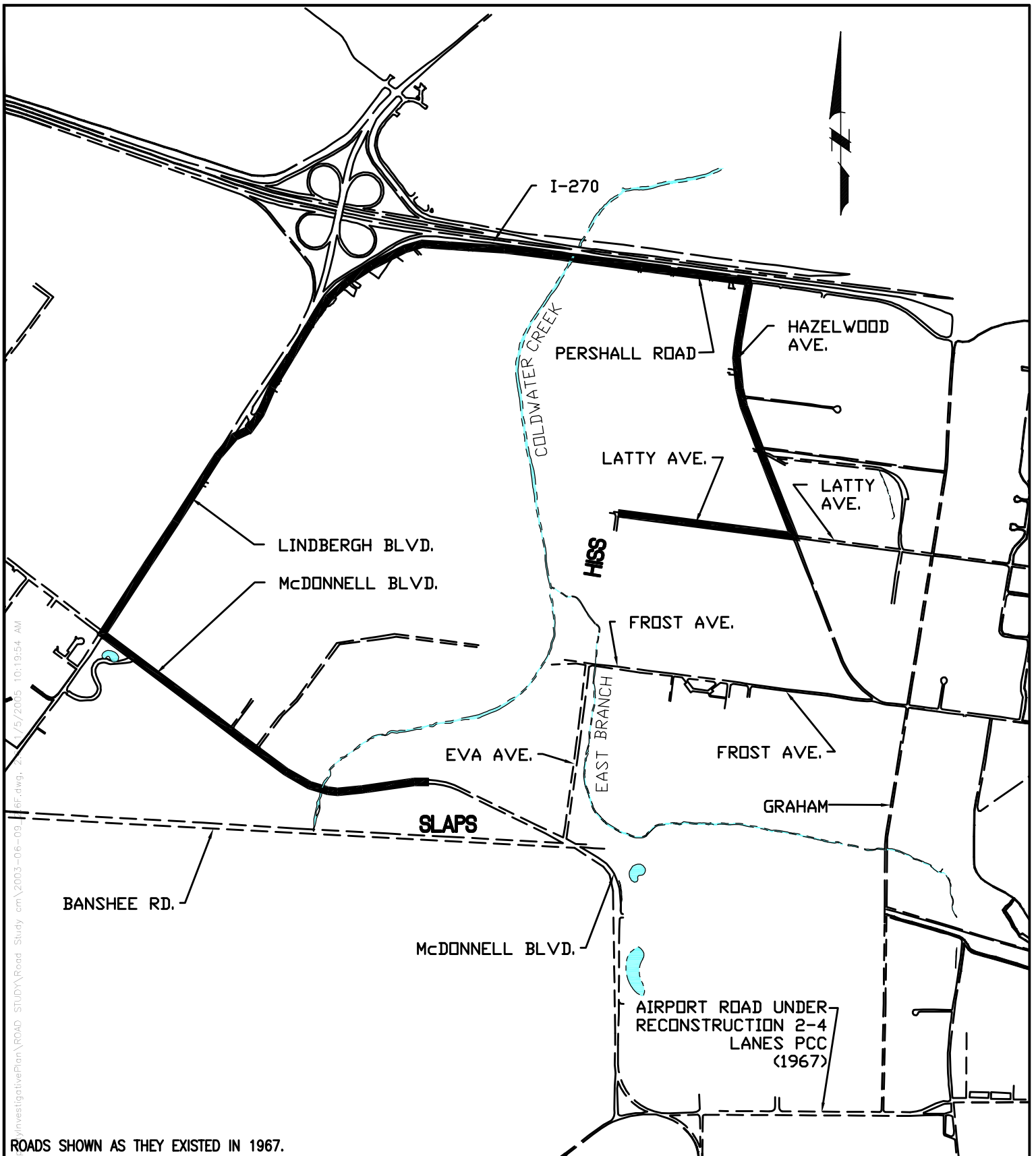
ROUTES BETWEEN SLAPS AND HISS
ROUTE A
MOST DIRECT ROUTE

FIGURE 2-5

J.D.L.

REV. NO./DATE:
FINAL/01-07-05

CAD FILE:

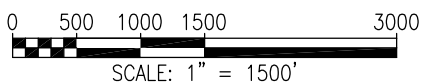


ROADS SHOWN AS THEY EXISTED IN 1967.

LENGTH= 3.6 Mi.

LEGEND:

IMPACTED



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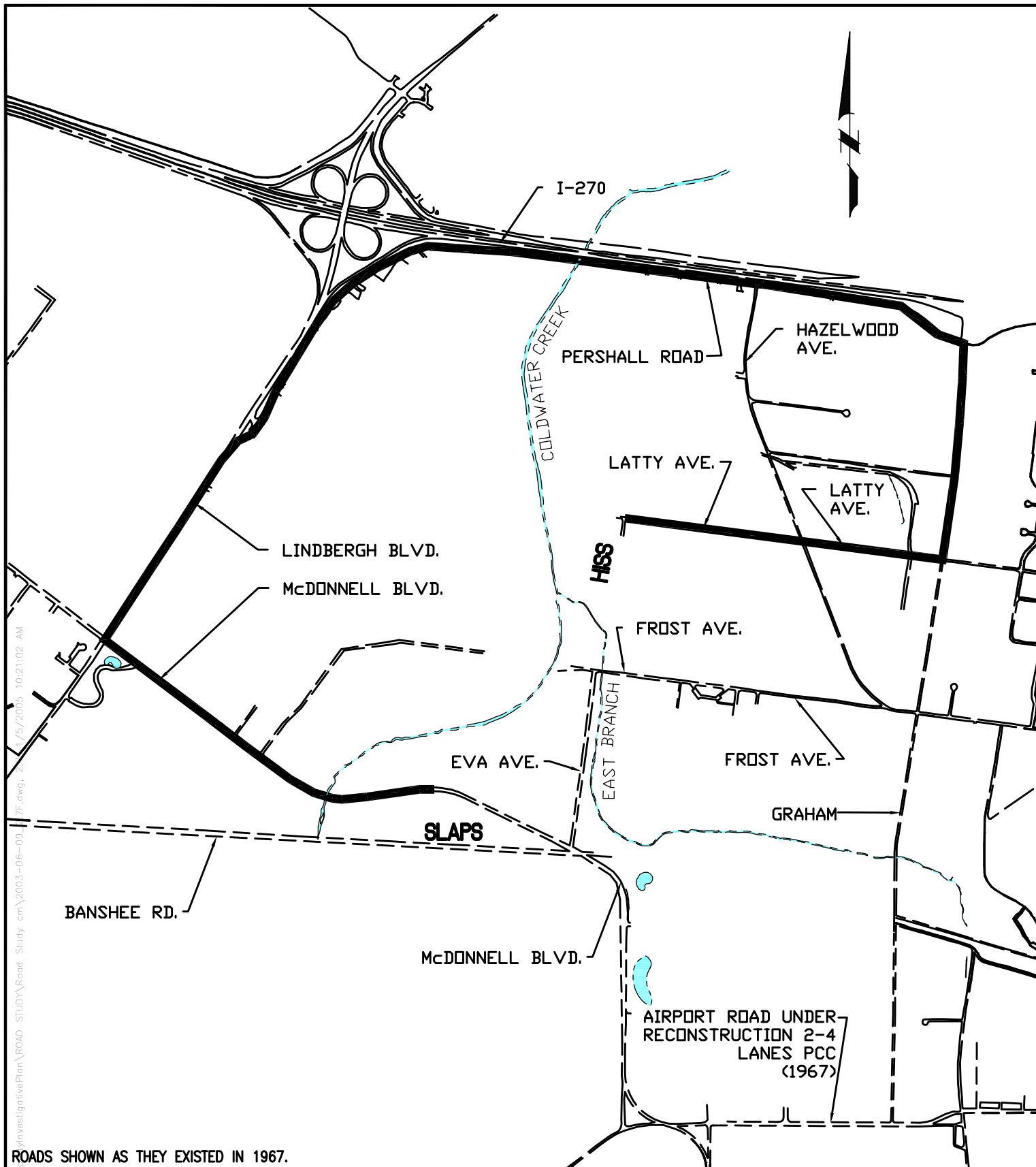
ROUTES BETWEEN SLAPS AND HISS
ROUTE B

FIGURE 2-6

J.D.L.

REV. NO./DATE:
FINAL/01-07-05

CAD FILE:



ROADS SHOWN AS THEY EXISTED IN 1967.

LENGTH=4.33 MILES

LEGEND:

IMPACTED

0 500 1000 1500 3000
SCALE: 1" = 1500'

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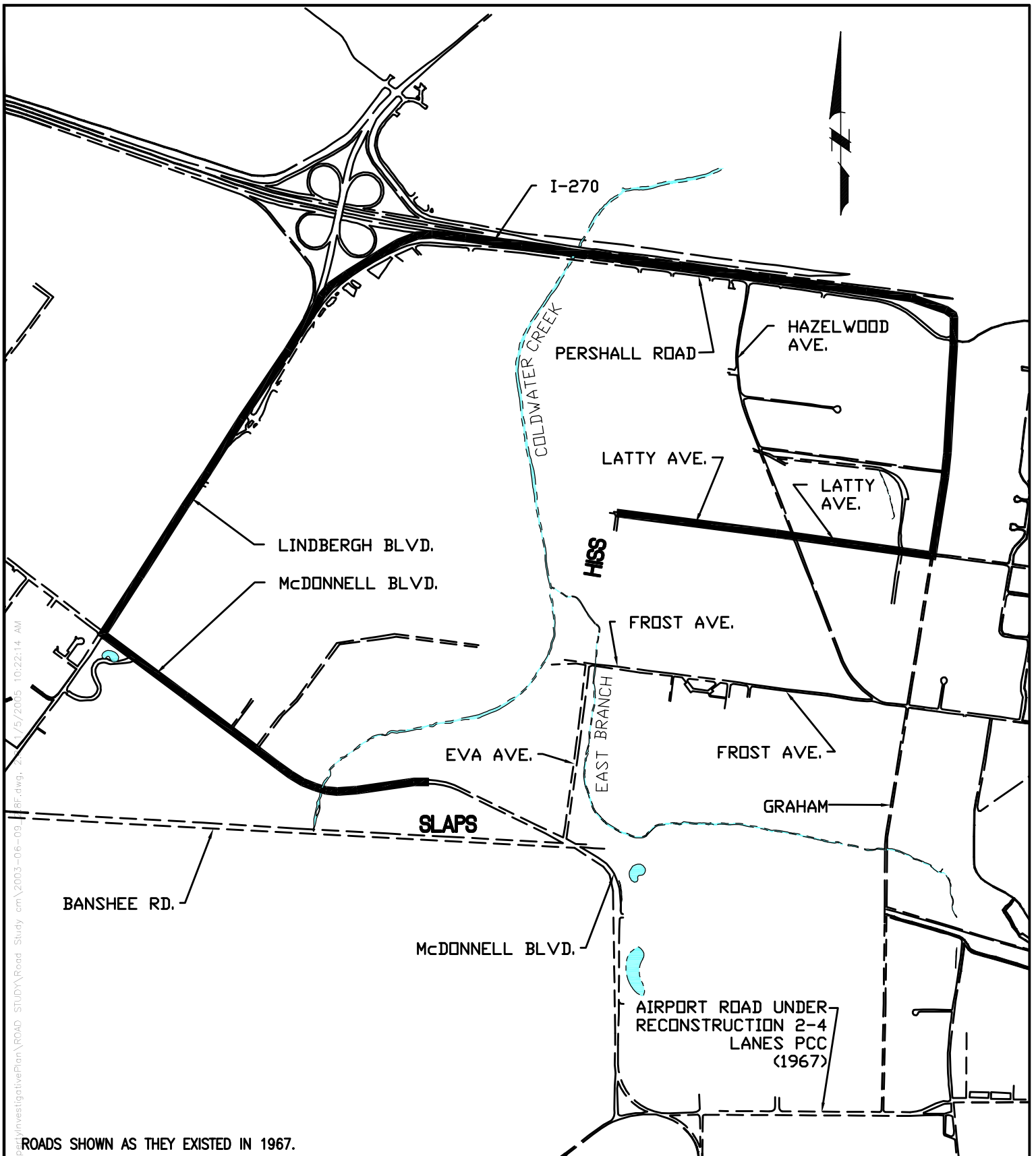
ROUTES BETWEEN SLAPS AND HISS
ROUTE C

FIGURE 2-7

J.D.L.

REV. NO./DATE:
FINAL/01-07-05

CAD FILE:

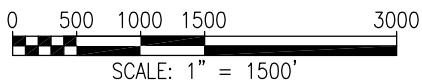


ROADS SHOWN AS THEY EXISTED IN 1967.

LENGTH= 4.38 MI.

LEGEND:

IMPACTED



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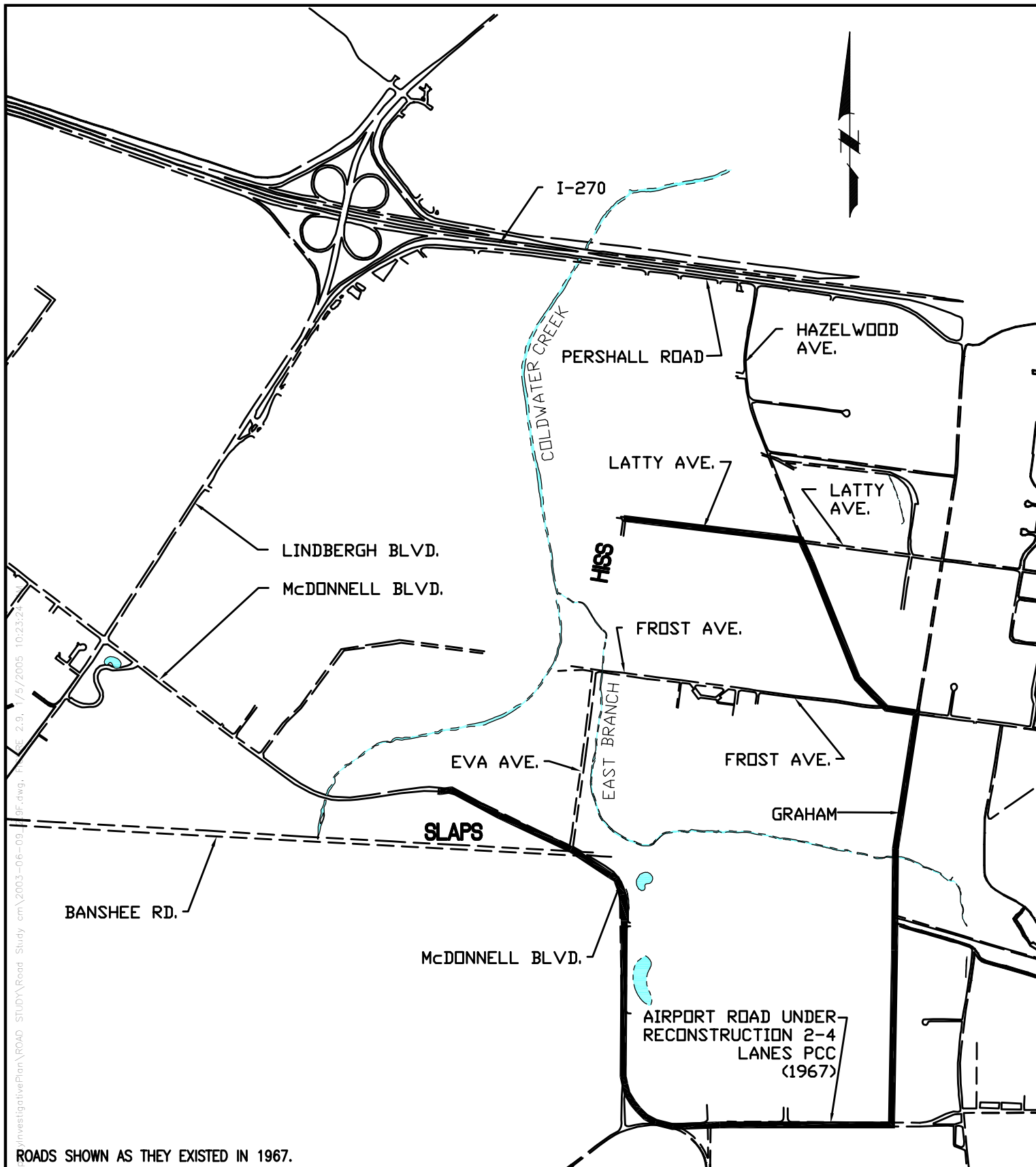
ROUTE BETWEEN SLAPS AND HISS
ROUTE D

FIGURE 2-8

J.D.L.

REV. NO./DATE:
FINAL/01-07-05

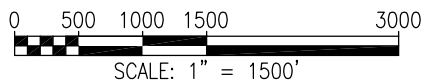
CAD FILE:



LENGTH=3.28 MILE

LEGEND:

IMPACTED



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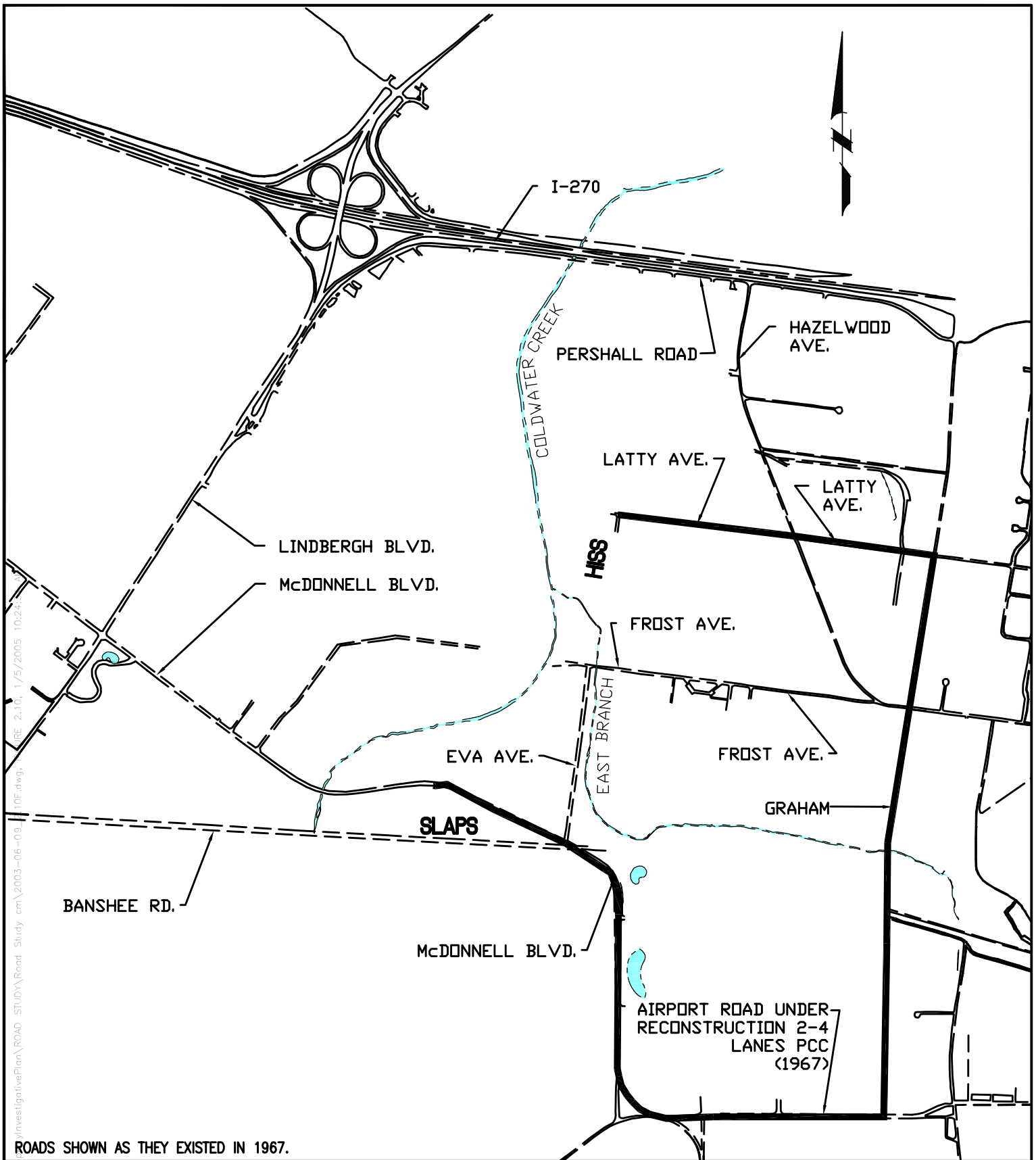
ROUTE BETWEEN SLAPS AND HISS
ROUTE E

FIGURE 2-9

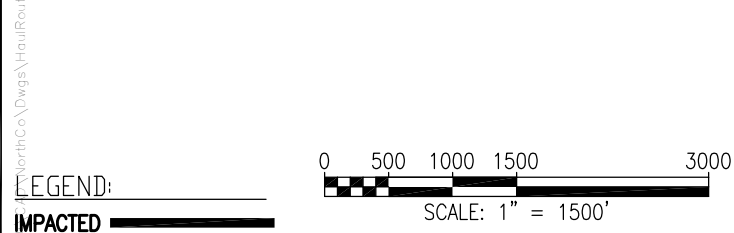
J.D.L.

REV. NO./DATE:
FINAL/01-07-05

CAD FILE:



LENGTH=3.4 MILES



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Science Applications
International Corporation

ROUTE BETWEEN SLAPS AND HISS
ROUTE F

FIGURE 2-10

J.D.L.

REV. NO./DATE:
FINAL/01-07-05

CAD FILE:

2.5.1 Evaluation of Haul Routes Between the SLAPS and the HISS

It is the conclusion of this report that Route A would have been the most heavily used route. If Route A were not available, then Route B would be the next most reasonable route. Routes E and F were also reasonable routes; however, there are construction plans, completed in July 1966, for a major reconstruction of Airport Road. It is our judgment that this work would have been placed out for bid in 1966 or 1967, making it likely that Airport Road was under construction when the SLAPS to the HISS haulage activities occurred. Residue hauling could have used Airport Road before construction started, during the Airport Road reconstruction, or after construction was finished. However, this use would be considered less likely than the use of Route B. Routes C and D cannot be ruled out but appear to offer no advantage over shorter routes. Impacts have been found on Latty Avenue east of Hazelwood Avenue. For such impacts to have occurred some haulage would have had to use Routes C or F. Table 2-1 compares routes A through F.

Table 2-1 Comparison of Haul Routes Between the SLAPS and the HISS

ROUTE	LENGTH	COMMENTS
Route A	2.15 miles	Most direct route
Route B	3.60 miles	A reasonable route
Route C	4.33 miles	No known advantage over shorter routes.
Route D	4.38 miles	No known advantage over shorter routes.
Route E	3.28 miles	A reasonable route. However, Airport Road believed to be under construction 1966 to 1967.
Route F	3.44 miles	A reasonable route. However, Airport Road believed to be under construction 1966 to 1967

2.5.2 Methods for Transporting Residues Between the SLAPS and the HISS

According to an August 15, 1967 memo titled *Historical Review of the Mallinckrodt Airport Cake*, believed to be from the Congress of the United States, House of Representatives, Committee for Public Works and Transportation, Science and Technology, the residues were moved from the SLAPS to the HISS by Continental Mining and Milling of Chicago, Illinois. This move required ten dump trucks for five months and cost Continental \$100,000.

In a bid dated December 27, 1965, from Braun Excavating Company (Braun) to Contemporary and Continental, Braun made the following statement:

The unit price quoted includes loading of material into trucks at the existing stockpile area, transporting same to the new stockpile area, unloading and stockpiling. We anticipate washing down the truck wheels before entering the public road, utilizing the existing wash facilities at the Brown Road location. We further anticipate the necessity of keeping a bulldozer and operator at the General Electric plant site to stockpile the material as it is dumped, and the second washing down of the truck wheels before again entering the road.

Items which we have not included in our Per Ton price quotation, and which are to be borne by other, are as follows:

North St. Louis County Haul Road Analysis and Justification for Additional Investigation-Evaluation of Inaccessible Materials Beneath Pavements

- a. Truck washing facilities at both present and future stockpile areas.
- b. Water used for washing trucks.
- c. Additional hazard insurance coverage over and above our present standard workman's compensation, and comprehensive liability coverage.
- d. Required periodic medical examinations, special wearing apparel, etc., for employees.
- e. Weighting facilities for trucks at either location, and wages for scale man.
- f. Any special material, such as wax paper, oil, sand, etc., required to facilitate dumping of material from trucks.
- g. Facilities to be used by employees for washing, showering, and changing of apparel.

It is likely that the actual hauling activities in 1966 and 1967 were conducted using methods similar to the above. The residue would have been carried in over-the-road dump trucks. Loading of the trucks would have been by portable conveyor system or front-end loader. Either method would have produced dust.

Braun's bid price for this work was \$1.25 per ton. The contractor who actually performed this work in 1967 for Continental was paid \$100,000, which would be approximately \$0.85 per ton.

It is believed that the trucks used would have been 20-ton dump trucks, similar to the one shown in Illustration 2.1; however, no documented evidence concerning the actual type of equipment used, other than that the equipment used for transport was "dump trucks", has been located to date.

An indication of the level of dust control expected in this work in the mid-1960s comes from a United States Memorandum dated July 25, 1967, entitled *Requirements for Surface Cleanup of the Airport Site*, which states

...the following should be considered the general plan for decontamination, which the Airport Commission will be required to follow. It is noted that none of the clean-up operations are of such nature to require film badging or protective precautions other than ordinary personal hygiene practices. All trucking operations shall be conducted in a manner to assure minimum dusting. This can be easily accomplished by wetting down truckloads prior to departure.

Illustration 2.1



Typical 1960 20-Ton Over-the-Road Dump Truck

The information available indicates that the hauling of materials from the SLAPS to the HISS required 10 dump trucks for a period of five months. A typical 1960 era 20-ton dump truck is shown in Illustration 2.1 above. This type of truck has a bed capacity of 12 cubic yards. Dry loose earth has a typical weight of 2,000 pounds per cubic yard. Heavy wet mud has a typical weight of 3,000 pounds per cubic yard. Assuming a weight for the residue of 2,500 pounds and that each truck was loaded with 12 yards of material would mean that each truck load would carry about 15 tons of material. The trucks would need to be heaped to carry the 20 tons capacity. It is common practice for each truck to carry the maximum possible load. If the material were heaped it would increase the chance of dusting and spillage from the truck bed. To move the 120,000 tons of residue would have required between 6,000 and 8,000 trips.

2.5.3 Conclusions

The primary means of transport of residue between the SLAPS and the HISS was by means of dump trucks. The most probable route for transport of residues between the SLAPS and the HISS was Route A, from the SLAPS to McDonnell Boulevard to Eva Avenue, Eva Avenue to Frost Avenue to Hazelwood Avenue, Hazelwood Avenue to Latty Avenue as shown in Figure 2-5. However, Routes B, E, and F, as shown in Figures 2-6, 2-9 and 2-10, were also used. These routes appear to have offered the quickest and most economical routes between the SLAPS and the HISS in 1966 and 1967.

McDonnell Boulevard must have been used as a haul route. McDonnell Boulevard is the only road access to the SLAPS.

Lindbergh Boulevard must have been used as a haul route, since impacts have been found on McDonnell Boulevard west of Coldwater Creek. The impacted areas on McDonnell Boulevard cannot be explained by wind or stormwater action. The impacts must be the result of haulage activities. Lindbergh Boulevard has undergone extensive widening and reconstructions since that time and any impacts to the shoulders in 1967 or earlier would now be under pavement.

Graham Road must also have been used as a haul road, since impacts have been found along portions of Latty Avenue east of Hazelwood Avenue. The impacted areas on Latty Avenue east of Hazelwood Avenue cannot be explained by wind or stormwater action and must be the result of haulage activities. This haulage activity must have occurred as part of the 1966 and 1967 haulage of residues from the SLAPS to the HISS. There are two possible routes from the SLAPS to the HISS involving Graham Road. One route would have entered Graham Road from I-270 or Pershall Road and proceeded south on Graham Road. This portion on Graham Road has been obliterated and been totally reconstructed as the much wider North Hanley Road. Any impacts to the shoulders of Graham Road in 1967, where it has been replaced with North Hanley Road, would now be under the North Hanley Road pavement.

The second route would use Graham Road by way of Airport Road and proceed north on Graham Road. Airport Road was undergoing reconstruction in 1966 and 1967 and would have likely been an undesirable haul route because of the construction-related delays likely to be encountered in the use of this route. A portion of the pre-North Hanley/Graham Road pavement is still in existence. The portion in existence also contains the location of a former railroad crossing of the Norfolk Southern mainline.

2.6 RESEARCH SUMMARY

Documents were obtained and reviewed from a number of sources. Among the records reviewed were aerial photographs, construction plans, road maintenance records, county tax records, highway maps, United States Geological Survey (USGS) quad maps, and historical documents.

One key document was a 1992 United States Environmental Protection Agency (EPA) Region VII study entitled *Aerial Photographic Analysis of the St. Louis Airport Study Area, Hazelwood, Missouri*. This document contains a collection of aerial photographs from the years 1941, 1953, 1965, 1971, 1974, 1980, 1984, 1985, and 1990 showing the HISS and the SLAPS and some of the surrounding roads. Each photograph is accompanied by an analysis of the work being done on or around the sites at each particular time. These photographs of the sites were indispensable in determining what had occurred on the roads over time. While these photographs provide excellent coverage of the roads immediately adjacent to the SLAPS and the HISS, they do not always extend far enough to cover Route 67 (aka Lindbergh Boulevard), Airport Road, North Hanley Road, or I-270. In addition, the scale of the photographs is very large, with 1 inch equal to 1,000 feet and 1 inch equal to 2,000 feet being the most common.

This large scale made it difficult to determine with certainty the condition and type of the road surface.

Additional aerial photographs were obtained from St. Louis County. These aerial photographs were 1 inch equal to 200 feet or 1 inch equal to 400 feet in scale. St. Louis County has aerial photographs available from 1966, 1981, 1985, 1990, 1993, 1995, and 1997. The 1966 (1 inch equal to 200 feet) and 1997 (1 inch equal to 400 feet) photographs were copied and reviewed for the purposes of this report. The other photographs were from periods in which other coverage was available or covered times of lesser interest and, therefore, were not purchased for review.

Aerial photographs were also obtained in electronic form from Surdex Corporation, a St. Louis-based aerial photogrammetry firm. These photographs were from 1965, 1971, 1973, 1975, and 1997. The figures included in the appendices use the 1997 aerial photographs as background and also show the outline of the pavement from the 1965 photographs.

All of these aerial photographs were used to determine what generally occurred on the roadways over time. The interpretation of this type of information is, by necessity, subjective. The photographic data available for review is listed in Table 2-2.

Construction plans and maintenance records provide more objective and detailed information to supplement the interpretation of the aerial photographs. The dates available are from the fiscal year in which the projects were funded for construction, and those are the dates used in this report. The actual date of construction might be as many as several years later. The information from the construction and maintenance records was used in preference to the aerial photographs wherever possible; however, for some of the roads, the aerial photographs were the only records available. Those aerial photographs available are listed in Table 2-2.

Table 2-2 Aerial Photographs Available

YEAR	SCALE	USED	SOURCE	COMMENTS
1941	1:11000	Yes	1992 EPA Study	
1953	1:20,350	Yes	1992 EPA Study	
1958	1:10,895	Yes	1992 EPA Study	
1965	CADD	Yes	Surdex Corporation	
1965	1:11,110	Yes	1992 EPA Study	
1966	1:2400	Yes	St. Louis County	
1971	1:10,825	Yes	1992 EPA Study	
1971	CADD	No	Surdex Corporation	
1973	CADD	No	Surdex Corporation	
1974	1:12,115	Yes	1992 EPA Study	
1975	CADD	No	Surdex Corporation	
1980	1:7,777	Yes	1992 EPA Study	

Table 2-2 Aerial Photographs Available (Cont'd)

YEAR	SCALE	USED	SOURCE	COMMENTS
1981	1:4800	No	St. Louis County	
1984	1:6,060	Yes	1992 EPA Study	Color Photograph
1985	1:8,290	Yes	1992 EPA Study	
1985	1:4800	No	St. Louis County	
1990	1:4800	No	St. Louis County	
1993	1:4800	No	St. Louis County	
1995	1:4800	No	St. Louis County	
1997	1:4800	Yes	St. Louis County	Believed same as Surdex CADD below
1997	CADD	Yes	Surdex Corporation	

For those roadways that are part of the state of Missouri highway system (e.g., I-170, I-270, (I-270 includes Dunn Road as the north outer road and Pershall Road as the south outer road), Lindbergh Boulevard (State Route 67), and McDonnell Boulevard (State Route TT), a key resource was the Missouri Department of Transportation (MoDOT) pavement history drawings. These drawings show the project year and type of road surface constructed. Equally important, they provide the construction project number, which is the key to MoDOT's microfilm system of the old construction plans for those highways. Only selected construction plans were obtained for this report, but should a greater level of detail be desired in the future, additional plans are available.

The pavement history drawings obtained from MoDOT were as follows:

096 St. Louis Sheet 8 of 31 covering I-170

096 St. Louis Sheet 11 of 31 covering Lindbergh Boulevard (State Route 67)

096 St. Louis Sheet 20 of 31 covering I-270

096 St. Louis Sheet 25 of 31 covering McDonnell Boulevard (State Route TT)

Selected highway construction plans were obtained for portions of I-170, Lindbergh Boulevard, I-270, Pershall Road, and McDonnell Boulevard. Additional details of the plans reviewed are provided in the appendices with the associated roads. These plans were also used to help determine the ROW widths and whether fill was placed on impacted material.

Selected St. Louis County Land Information Services maps were also obtained. These computer-aided design and drafting (CADD) drawings are at a 1-inch equal to 400 feet scale and show street and road ROWs and property boundaries of all parcels. They also list the St. Louis County Locator Number for each parcel. With the locator number, the owner of record, last recorded deed, zoning, and other information can be obtained from the St. Louis County Web site. The reliability of the information from the county tax assessor's office, however, must be considered low. The assessor's office makes no warranty as to its accuracy, and the quality

assurance of the input of this information is poor. For certainty in property boundary-line location, a registered land surveyor, using the latest property boundary description of record, surveyed property monument locations, and the historical chain of title for that parcel, should locate boundary and ROW lines in the field. The maps obtained were Map Panels 9-K, 9-L, 10-K, 10-L, 11-K, and 11-L.

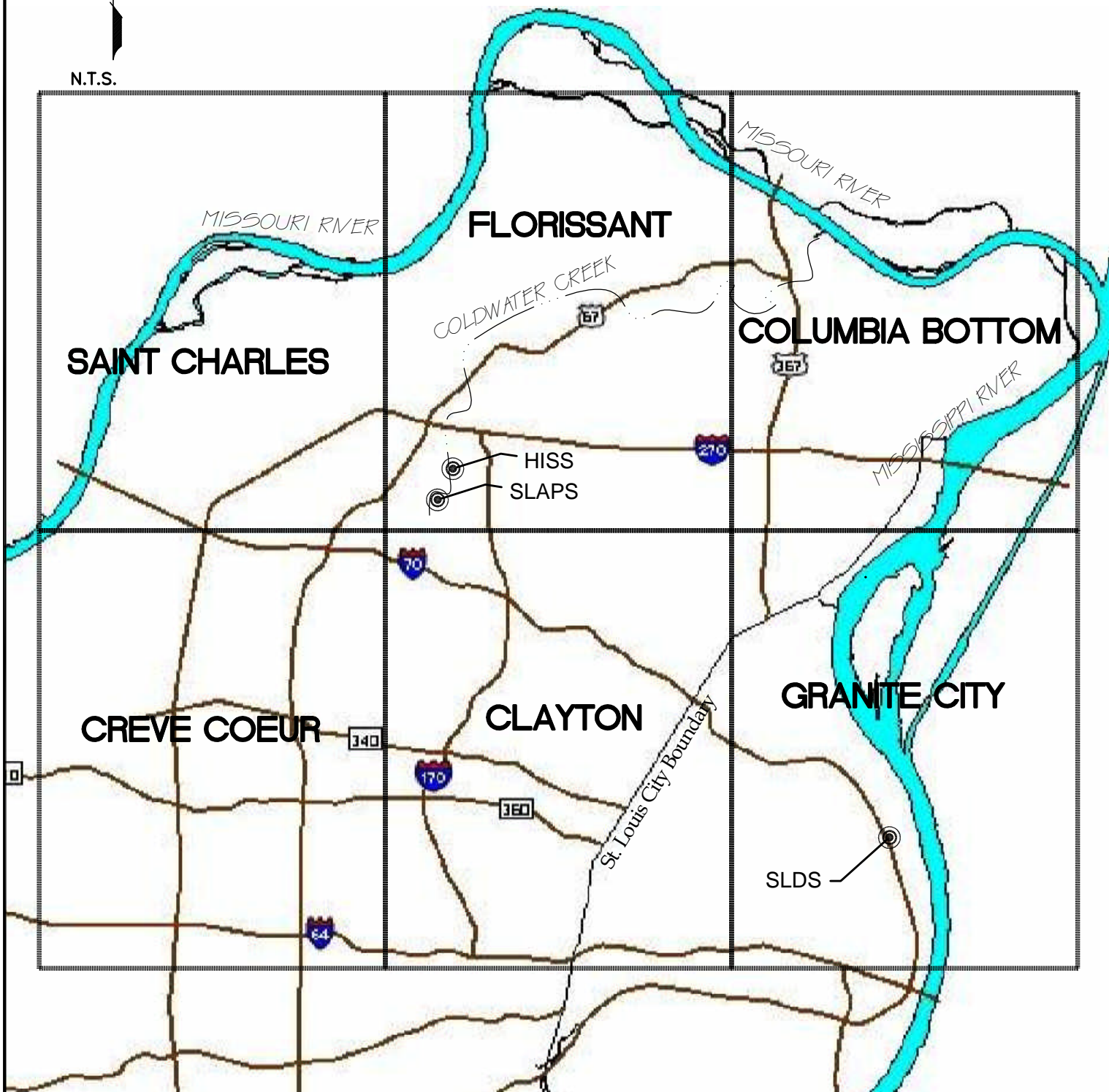
In addition, selected tax assessor's maps were obtained. These hand-drawn and hand-updated drawings are at various scales, with 1 inch equal to 150 feet being the most common. These drawings have the dimensions of the property boundary lines, acreages, county location number, record owner, existing buildings and pavements, and recording information of deeds or plats. The quality assurance of these records is also poor, but they do provide some additional information. These maps are quite old, and some times provide a historical record of what might have occurred on a parcel over time. These drawings certainly predate any work at the SLAPS or the HISS. The panels obtained were Map Numbers Ferguson-Florissant R-2 6, 7 and Hazelwood 237, 238, 245, 247b, 249, 250.

Historical highway maps were obtained from the COE. The maps obtained were dated 1952, 1965, and 1976.

Historical mapping from the USGS reviewed included the maps listed below. Figure 2-11 shows the six USGS quadrants of primary interest.



N.T.S.



LEGEND:

RELATIONSHIP BETWEEN USGS
1"=2000' QUAD MAPS.

— · · · — CREEK

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USGS QUAD MAP
LOCATIONS

FIGURE 2-11

J.D.L.

REV. NO./DATE:
FINAL/01-07-05

CAD FILE:

North St. Louis County Haul Road Analysis and Justification for Additional Investigation-Evaluation of
Inaccessible Materials Beneath Pavements

Clayton Quad Map

1941 (photographed 1933)	roll 079, frame 321
1941	roll 079, frame 322
1954	roll 229, frame 075
1954 (photograph revised 1968)	roll 079, frame 319
1954 (photograph revised 1968 and 1974)	roll 079, frame 318

Columbia Bottoms Quad Map

1935 (photographed 1924)	roll 079, frame 364
1941 (published 1952)	roll 079, frame 363
1941 (published 1959)	roll 079, frame 361

Granite City Quad Map

1940 (photographed 1933)	roll 059, frame 216
1950 (photographed 1949)	roll 059, frame 214
1956	roll 059, frame 213
1954 (photographed 1952; published 1958)	roll 059, frame 212
1954 (photographed 1952; published 1966)	roll 059, frame 211

St. Charles Quad Map

1933 (photographed 1927)	roll 082, frame 178
1947 (photographed 1927; revised 1946)	roll 082, frame 177
1955 (revised 1946)	roll 082, frame 176
1960 (photographed 1952)	roll 082, frame 175
1969 (photographed 1952; revised 1968)	roll 082, frame 169
1975 (photographed 1968)	roll 229, frame 378
1986 (photographed 1974)	roll 229, frame 377

Creve Coeur Quad Map

1940 (photographed 1933)	roll 079, frame 385
1956 (photographed 1933; revised 1954)	roll 079, frame 386
1959 (photographed 1952)	roll 079, frame 383
1966 (photographed 1952; revised 1965)	roll 082, frame 175
1969 (photographed 1968)	roll 082, frame 169
1976 (photographed 1974)	roll 229, frame 378

Florissant Quad Map

1954 (photographed 1952)	roll 080, frame 053
1966 (photographed 1952; revised 1954)	roll 080, frame 052
1968 (photographed 1968)	roll 080, frame 051
1975 (photographed 1974)	roll 229, frame 134
1982 (photographed 1979)	roll 385, frame 041

Many documents were reviewed during the preparation of this report. Those documents found to be most pertinent are listed in Appendix A.15.

3.0 SUMMARY OF POTENTIAL IMPACTS BY ROADS

3.1 SUMMARY OF RESULTS OF HISTORICAL TESTING

Testing has identified impacted material adjoining several suspected haul roads. This testing has also found evidence of impacts believed to be associated with erosion of the SLAPS and flooding of Coldwater Creek and also with wind and storm water erosion. Based on the results of all scanning information reports and analytical testing reviewed, impacted materials have been found under or adjoining the pavements of:

- McDonnell Boulevard. The possible cause of these impacts could be wind erosion from the adjoining SLAPS property or flooding of Coldwater Creek.
- Eva Avenue. The possible cause of these impacts could be haulage from the SLAPS to the HISS in 1966 and 1967. Eva Avenue is on the most direct route between the SLAPS and the HISS. A railroad lead track also crosses Eva Avenue. A lead track is an industrial spur that services multiple properties. This lead track would have been used for rail transport of residue from the HISS. Eva Avenue is also within the floodplain of Coldwater Creek; however this area would be a backwater, and flood related impacts to this area would be unlikely.
- Frost Avenue. The possible cause of these impacts could be haulage from the SLAPS to the HISS in 1966 and 1967. Use of Frost Avenue would have been a necessary if Eva Avenue were used.
- Hazelwood Avenue. The possible cause of these impacts could be haulage from the SLAPS to the HISS in 1966 and 1967. Hazelwood Avenue would likely have been used for haulage activities since it is the road allowing easiest access to the HISS. Other routes which avoid using Hazelwood Avenue are possible, but these routes are longer and offer no apparent advantage.
- Pershall Road. The possible cause of these impacts could be from flooding of Coldwater Creek, or haulage from the SLAPS to the HISS in 1966 and 1967.
- Latty Avenue. The possible cause of these impacts could be flooding of Coldwater Creek or haulage from the SLAPS to the HISS in 1966 and 1967. Latty Avenue must have been used for all haulage activity to and from the HISS, since it is the only road allowing access to the HISS.
- Banshee Road. The possible cause of these impacts could be wind erosion from the adjoining the SLAPS property or haulage of fill material to the SLAPS from the airport in the 1950s and 1973.

The results of this study are summarized in the following tables (Tables 3-1 through 3-5). The findings are categorized by the potential for direct impacts beneath the various pavement surfaces. These findings and the appendices to this report that detail the information used to reach these conclusions and results are summarized in Table 3-5. The sources of possible direct impacts by road are summarized in Table 3-6.

Table 3-1 identifies the roads potentially impacted by residue hauling activities between the SLAPS and the HISS. The type of pavement existing on each road used for hauling residues is evaluated to determine the probability that material under the existing pavement could have been impacted.

North St. Louis County Haul Road Analysis and Justification for Additional Investigation-Evaluation of Inaccessible Materials Beneath Pavements

Table 3-1 Possible Impacts from Haulage SLAPS and the HISS 1966/67

COLUMN 1	COLUMN 2	COLUMN 3	COLUMN 4	COLUMN 5
			WIDENED OR PAVED	POSSIBLE IMPACT
STREET NAME	PAVED	USED	1966 TO 1973	
Airport Road	Yes PCC	Possible	40 feet PCC 1966	Possible
Banshee Road	Yes PCC/AC	No	8 feet PS	No
Dunn Road	Yes PCC	No	PS	No
Eva Avenue	1974 AC	Yes	No	Yes
Frost Avenue	1972 AC	Yes	8 feet AC	Yes
Hazelwood Avenue	Yes AC	Yes	No	No
I-170	1980 PCC	No	24 feet PS 1972	No
I-270	1962 PCC	No	No	No
Latty Avenue	>1965 AC	Yes	No	Yes
Lindbergh Boulevard	Yes PCC	Yes	40 feet AC	Yes
McDonnell Boulevard	Yes AC	Yes	8 feet AC 1974	Yes
North Hanley Road/Graham Road	Yes AC/PCC	Possible	48 feet PCC, PS 1972	Possible
Nyflot Avenue	Yes AC	No	28 feet AC 1974	No
Pershall Road	1962 PCC	Yes	PS	Yes
Polson Road	>1954 AC	No	No	No
Seeger Industrial Road	1971 PCC	No	No	No

Shadowing added for emphasis PS = Paved shoulders added.
Shadowing added for emphasis

- Column 1 lists roads within SLAPS Road Study Area.
- Column 2 lists the type of pavement in existence from 1966 to 1967, and if known the date pavement was constructed.
- Column 3 lists whether the road was likely to have been used for hauling residues from 1966 to 1967.
 - “Yes” means that residue hauling must have occurred on that road. It had to have been used.
 - “Probable” means that the judgment of this report is that residue hauling occurred on that road.
 - “Possible” means that the judgment of this report is that residue hauling on that road cannot be ruled out.
 - “No” means that the judgment of this report is that residue hauling on that road was either impossible or so improbable that it can be ruled out.
- Column 4 lists whether the pavement was widened during or after the transport of residues from the SLAPS to the HISS, and the date that pavement was constructed. PS stands for “Paved Shoulders” and means that aggregate shoulders were replaced with pavement.
- Column 5 lists whether there was an impact to the material under the pavement constructed since 1966. Shadowing added for emphasis
 - “Yes” means that residue hauling is believed to have occurred on that road and that testing indicated that impacts did occur along that route.
 - “Likely” means that residue hauling is believed to have occurred on that road but that no testing has confirmed that belief.
 - “Possible” means that while it is not believed that hauling of residues occurred on that road, such hauling cannot be ruled out.
 - “No” means that no residue hauling is believed to have occurred on that road or that that road did not exist in this time period.

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Table 3-2 identifies the roads potentially impacted by residue hauling activities between the HISS and the West Lake Landfill. The type of pavement existing on each road used for hauling residues is evaluated to determine the probability that material under the existing pavement could have been impacted.

Table 3-2 Possible Impacts from Haulage HISS and West Lake Landfill 1973

COLUMN 1	COLUMN 2	COLUMN 3	COLUMN 4	COLUMN 5
STREET NAME	HISS TO LANDFILL 1974			
	PAVED	USED	1973 TO PRESENT	POSSIBLE IMPACT
			WIDENED	
Airport Road	Yes PCC	No	8 feet PCC 1983	No
Banshee Road	Yes AC/PCC	No	PS	No
Dunn Road	Yes PCC	No	PS	No
Eva Avenue	Yes AC	Possible	2-4 feet AC	Possible
Frost Avenue	Yes AC	Possible	4-8 feet AC	Possible
Hazelwood Avenue	Yes AC	Probable	1-2 feet AC	Possible
I-170	Yes PCC	No	24 feet PCC 1983	No
I-270	Yes PCC	No	PS	No
Latty Avenue	Yes AC	Yes	8 feet PCC	Possible
Lindbergh Boulevard	Yes PCC	Possible	24 feet PCC 1978	Possible
McDonnell Boulevard	Yes AC	Possible	24 feet AC 1978	Possible
North Hanley Road/Graham Road	Yes AC/PCC	No	No	No
Nyflot Avenue	Yes AC	Possible	No	No
Pershall Road	Yes PCC	Possible	PS	Possible
Polson Road	Yes AC	No	No	No
Seeger Industrial Road	Yes AC	No	No	No

- Column 1 lists roads within the SLAPS road study area.
- Column 2 lists the existence of pavement in 1973.
- Column 3 lists whether the road was likely to have been used for hauling residues in 1973.
 - “Yes” means that residue hauling must have occurred on that road. It had to have been used.
 - “Probable” means that the judgment of this report is that residue hauling occurred on that road.
 - “Possible” means that judgment of this report is that residue hauling on that road cannot be ruled out.
 - “No” means that the judgment of this report is that residue hauling on that road was either impossible or so improbable that it can be ruled out.
- Column 4 lists whether the pavement was widened during or after the transport of residues from the HISS to the West Lake Landfill.
- Column 5 lists whether there was an impact to the material under the pavement constructed since 1973. “Possible” means that impacts could have occurred along that route; however, all routes have been gamma tested, and no evidence of impacts has been found except along routes also used in earlier hauling activities.
 - “Possible” means that residue hauling is believed to have occurred on that road.
 - “No” means that no residue hauling is believed to have occurred on that road or that that road did not exist in this time period.

North St. Louis County Haul Road Analysis and Justification for Additional Investigation-Evaluation of Inaccessible Materials Beneath Pavements

Table 3-3 lists those roadways that are in locations where they might possibly be impacted by the movement of residues by wind, stormwater runoff or floodwaters.

Table 3-3 Potential Wind, Stormwater or Floodwater Impacts

COLUMN 1	COLUMN 2	COLUMN 3
STREET NAME	COLDWATER CREEK FLOODPLAIN	ADJOIN SLAPS/HISS WIND/STORM
Airport Road	No	No
Banshee Road	Yes	Yes
Dunn Road	Yes	No
Eva Avenue	Yes	No
Frost Avenue	Yes	No
Hazelwood Avenue	No	No
I-170	No	No
I-270	Yes	No
Latty Avenue	Yes	Yes
Lindbergh Boulevard	No	No
McDonnell Boulevard	Yes	Yes
North Hanley Road/Graham Road	No	No
Pershall Road	Yes	No
Polson Road	No	No
Seeger Industrial Road	Yes, minor	No

- Column 1 lists roads within the SLAPS Road Study Area.
- Column 2 lists whether part of the road pavement is within the floodplain of Coldwater Creek. "Yes" means that portions of the pavement are within the floodplain.
- Column 3 lists whether that road lies adjacent to the SLAPS or the HISS and is potentially impacted by windborne or stormwater runoff borne residue. "Yes" means that portions of the pavement could be over impacted material.

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Table 3-4 summarizes the results of known historical testing and indicates when and what type of testing was done, the results of that testing and any activities reportedly undertaken to respond to the test results.

Table 3-4 Results of Testing

COLUMN 1	COLUMN 2	COLUMN 3	COLUMN 4	COLUMN 5	COLUMN 6
STREET NAME	TESTED GAMMA	IMPACT FOUND GAMMA	TESTED LAB	IMPACT FOUND LAB	CLEANED UP
Airport Road	1985/1991	No/No	No	N/A	No
Banshee Road	1991	No	1984-1989	Yes	No
Dunn Road	No	N/A	No	N/A	No
Eva Avenue	1985/1991	No/No	1984-1989	Yes	Partial
Frost Avenue	1985/1991	No/No	1984-1989	Yes	Partial
Hazelwood Avenue	1985/1991	Yes/No	1984-1989	Yes	Partial
I-170	No	N/A	No	N/A	No
I-270	No	N/A	1984-1989	Yes	No
Latty Avenue	1991	No	1984-1989	Yes	Yes
Lindbergh Boulevard	1985	No	No	N/A	No
McDonnell Boulevard	1985/1991	Yes/No	1984-1989	Yes	Partial
North Hanley Road/Graham Road	1985/1991	No/No	No	N/A	No
Nyflot Avenue	No	N/A	No	N/A	No
Pershall Road	1985/1991	Yes/No	1984-1989	Yes	No
Polson Road	No	N/A	No	N/A	No
Seeger Industrial Road	No	N/A	No	N/A	No

- Column 1 lists roads within SLAPS Road Study Area.
- Column 2 lists whether the pavement was tested by gamma radiation methods and the year that those test results were reported.
- Column 3 lists whether impacts were detected by the gamma testing methods.
- Column 4 lists whether the roadway was tested by field sample collection and laboratory testing methods near, under, or in the pavement, by listing the year that those test results were reported.
- Column 5 lists whether the laboratory testing methods detected impacts.
- Column 6 lists whether the test results lead to actions near the roadways. "Yes" means that both materials under the pavement and on the shoulders have had past action taken. "Possible" means that the shoulders have had past action taken.

Shadowing added for emphasis.

North St. Louis County Haul Road Analysis and Justification for Additional Investigation-Evaluation of Inaccessible Materials Beneath Pavements

Table 3-5 expands on the description of the road segments and summarizes the results of this report.

Table 3-5 Summary of Findings

ROAD DESCRIPTION	CONDITION OF MATERIAL UNDER PAVEMENT
I-170 from Airport Road to I-270	Not impacted, except in some limited areas
I-270 from Lindbergh Boulevard (67) to Graham Road	A mix of impacted and non-impacted areas
Lindbergh Boulevard (67) from McDonnell Boulevard to I-270	A mix of impacted and non-impacted areas
McDonnell Boulevard from Airport Road to 67	A mix of impacted and non-impacted areas
Eva Avenue	All impacted
Frost Avenue	All impacted
Latty Avenue	All impacted, but action taken after testing
Hazelwood Avenue	Not impacted except in some limited areas
Pershall Road from 67 to Graham Road	A mix of impacted and non-impacted areas
Dunn Road from 67 to Graham Road	A mix of impacted and non-impacted areas
Airport Road from McDonnell Boulevard to I-170	A mix of impacted and non-impacted areas.
North Hanley Road from I-270 to Airport Road	A mix of impacted and non-impacted areas.
Banshee Road from McDonnell Boulevard to Coldwater Creek	All impacted
Nyflot Avenue from Graham Road to Hazelwood Avenue	Not impacted
Seeger Industrial Drive	Not impacted except in some limited areas
Polson Road	Not impacted
Graham Road	A mix of impacted and non-impacted areas

North St. Louis County Haul Road Analysis and Justification for Additional Investigation-Evaluation of Inaccessible Materials Beneath Pavements

Table 3-6 summarizes the possible cause of impacts under or near roads pavements in the SLAPS Roads Study Area.

Table 3-6 Cause of Impacts

COLUMN 1	COLUMN 2
STREET NAME	COMMENTS
	(IMPACTS CAUSED BY)
Airport Road	Possible hauling road
Banshee Road	Probably used to bring fill to the SLAPS and adjoins the SLAPS; possibly impacted by wind erosion from the SLAPS
Dunn Road	Coldwater Creek floodplain and probable hauling road
Eva Avenue	Coldwater Creek and certain hauling road
Frost Avenue	Coldwater Creek and certain hauling road
Hazelwood Avenue	Certain haul road but center 18 feet of pavement would have protected material underneath from direct impacts.
I-170	Constructed crossing former hauling roads but most not impacted.
I-270	Coldwater Creek and possible hauling road
Latty Avenue	Action taken
Lindbergh Boulevard	Certain hauling road and greatly widened, with much new pavement.
McDonnell Boulevard	Coldwater Creek, floodplain, adjoins the SLAPS, and certain hauling road
Nyflot Avenue	Not impacted
North Hanley Road/Graham Road	Graham Road possible hauling road; North Hanley not impacted
Pershall Road	Coldwater Creek floodplain and certain hauling road
Polson Road	Not impacted
Seeger Industrial Road	Partially in Coldwater Creek flood plain.

- Column 1 lists roads within SLAPS Road Study Area.
- Column 2 lists the possible source of Impacts and selected general information

Shadowing added for emphasis.

These findings and conclusions are perhaps best viewed by review of Exhibit A, which shows the entire project area at a 1-inch-equal-to-600-feet scale and shows the status of each roadway.

3.2 TYPICAL RIGHT-OF-WAY WIDTHS

Table 3-7 lists the typical current ROW widths for each road investigated in this study. Current ROW widths are also shown on the attached figures.

Table 3-7 Typical Right-of-way Widths

STREET OR ROAD	TYPICAL WIDTH OF ROW
Eva Avenue	40 feet
Hazelwood Avenue	80 feet south of Latty Avenue 85 feet north of Latty Avenue
Latty Avenue	45 or 50 feet
Frost Avenue	40, 45, or 50 feet
I-170	As marked in the field; typically 250 to 500 feet
I-270	As marked in the field; typically 350 to 600 feet
Lindbergh Boulevard	Varies from 120 to 300 feet
North Hanley Road	80 feet
Graham Road	40 feet
Airport Road	82 feet
Banshee Road	60 feet
Pershall and Dunn roads	Now part of I-270
Polson Road	20 and 18 feet
Seeger Industrial Drive	50 feet
Nyflot Road	40 feet
McDonnell Boulevard	Varies; typically 150 feet

3.3 AREAS OF FILL

There is evidence of fill being placed in areas that may have been impacted in the following areas:

- Much of McDonnell Boulevard was raised by placing 3 to 4 foot of earth fill above the former Brown Road, probably to elevate the roadway above the floodplain of Coldwater Creek. Fill near Coldwater Creek is up to approximately 10 feet in thickness. At the intersection of Eva Avenue with McDonnell Boulevard, Eva Avenue was raised approximately 3 to 4 feet, this fill transitions back to match the existing ground over a distance of approximately 200 feet.
- I-170 was elevated to pass over many of the cross streets with as much as 25 feet of fill being placed.
- Portions of the intersection ramps of I-170 and I-270 and of Lindbergh Boulevard and I-270 were also elevated with fill ranging in thickness from 0 to 25 feet.

3.4 BRIDGES

This section discusses whether bridge abutments and approaches could be constructed over impacted material, rendering that material inaccessible. The locations of these bridges are shown on Exhibit A.

- McDonnell Boulevard over Coldwater Creek

A bridge existed in this location prior to 1946 (MoDOT construction plans available). A replacement bridge was constructed in 1952 (MoDOT construction plans available). McDonnell Boulevard was widened in 1974. (No construction plans were available for this work.)

This area was subjected to possible impacts from: wind erosion from the SLAPS residue storage, water erosion from the SLAPS in conjunction with Coldwater Creek flooding, the SLAPS to the HISS haulage activities in 1966 and 1967, rail lines likely used for the 1966 to 1973 transport of residue from the HISS to Colorado, and HISS to West Lake Landfill haulage activities in 1973.

At least some of these events occurred prior to the construction of the current bridge; therefore, it is possible that the material under this bridge's abutments could have been impacted. However, typical bridge abutment construction methods would result in the removal of material and its subsequent replacement with concrete or other structural materials a short time later, so while it is possible that materials under this bridge abutment have been impacted, the probability of such impact is low. Impacts from Coldwater Creek flooding while possible, would also have a low probability of impact.

- Pershall Road over Coldwater Creek

This bridge was constructed in 1962.

This area was subjected to possible impacts from water erosion from the SLAPS in conjunction with Coldwater Creek flooding, probably to the SLAPS to the HISS haulage activities 1966 and 1967, and possibly to the HISS to West Lake Landfill haulage activities in 1973.

At least some of these events occurred prior to the construction of the current bridge, therefore it is possible that the material under this bridge's abutments could have been impacted. However, typical bridge abutment construction methods would result in the removal of material and its subsequent replacement with concrete or other structural materials a short time later, so while it is possible that materials under this bridge abutment have been impacted, the probability of such impact is low. Impacts from Coldwater Creek flooding while possible, would also have a low probability of impact.

- I-270 over Coldwater Creek

This bridge was constructed in 1962.

This area was subjected to possible impacts from water erosion from the SLAPS (Coldwater Creek flooding) and possibly to the SLAPS to the HISS haulage activities in 1966.

At least some of these events occurred prior to the construction of the current bridge, therefore it is possible that the material under this bridge's abutments could have been impacted. However, typical bridge abutment construction methods would result in the removal of material and its subsequent replacement with concrete or other structural materials a short time later, so while it is possible that materials under this bridge abutment have been impacted, the probability of such

impact is low. Impacts from Coldwater Creek flooding while possible, would also have a low probability of impact.

- Dunn Road over Coldwater Creek

A bridge was constructed in the 1930s (1930 bridge). This bridge was demolished and the road realigned shortly before 1990. A new bridge was constructed (1990 bridge). Fresh earthwork is visible in the 1990 photograph contained in the EPA Region VII study *Aerial Photographic Analysis of the St. Louis Airport Study Area* dated August 1992.

This area was subjected to possible impacts from water erosion from the SLAPS (Coldwater Creek flooding).

At least some of these events occurred prior to the construction of the current bridge, therefore it is possible that the material under this bridge's abutments could have been impacted. However, typical bridge abutment construction methods would result in the removal of material and it's subsequent replacement with concrete or other structural materials a short time later, so while it is possible that materials under this bridge abutment have been impacted, the probability of such impact is low. Impacts from Coldwater Creek flooding while possible, would also have a low probability of impact.

If abutments or approaches to the 1930 bridge remain, they would have protected the material under them from direct impact.

- Banshee Road over Coldwater Creek

A bridge existed in this location prior to 1941. By 1953, Coldwater Creek south of this bridge had been enclosed.

This area was subjected to possible impacts from wind erosion from the SLAPS residue storage.

These impacts occurred after the construction of the current bridge; therefore the material under this bridge should not be impacted.

- Frost Avenue over East Branch of Coldwater Creek

A bridge existed in this location prior to 1946 and is believed to be the same bridge now in existence.

This area was subjected to possible impact from water erosion from the SLAPS (Coldwater Creek flooding), the SLAPS to the HISS haulage activities 1966 and 1967, and rail lines likely used for the 1966 to 1973 transport of residue from the HISS to Colorado, and the HISS to West Lake Landfill haulage activities 1973.

These impacts occurred after the construction of the current bridge; therefore, the material under this bridge should not be impacted.

- Graham Road over East Branch of Coldwater Creek

A bridge existed in this location prior to 1946 and is believed to be the same bridge now in existence.

This area was subjected to possible impacts from water erosion from the SLAPS (Coldwater Creek flooding) and the SLAPS to the HISS haulage activities in 1966 and 1967.

The Coldwater Creek flooding in this area would be an area of ineffective flow. Ineffective flow means that while water would flood this area, it would not convey any significant portion of the flood; it would be a backwater. It is unlikely that this flooding would have resulted in impact to materials. These impacts occurred after the construction of the current bridge; therefore, the material under this bridge should not be impacted.

- I-170 Overpass over Airport Road

This overpass was constructed in 1980.

This area was subjected to possible impact from the SLAPS to the HISS haulage activities in 1966 and 1967 on Airport Road. The overpass is also over obliterated Graham Road. The SLAPS to the HISS haulage activities on Airport Road and this section of Graham Road cannot be ruled out.

The impact from possible haulage activities occurred prior to the construction of this dual bridge overpass; therefore the material under these overpasses could be impacted.

- I-170 Overpass over Norfolk Southern Rail lines and East Branch of Coldwater Creek

This overpass was constructed in 1980.

This area was subjected to no known mechanisms for impact other than the possible flooding from Coldwater Creek. This flooding is in an area of ineffective flow and would not have impacted materials in this area. Therefore, the material under these overpasses should not be impacted.

- I-170 Overpass over Frost Avenue

This overpass was constructed in 1980.

This area was subjected to possible impact from the SLAPS to the HISS haulage activities in 1966 and 1967 on Frost Avenue. The SLAPS to the HISS haulage activities on Frost Avenue and this section of Frost Avenue have been confirmed by testing.

The impact from possible haulage activities occurred prior to the construction of this dual bridge overpass; therefore, the material under these overpasses could be impacted.

- I-170 Overpass over Nyflot Avenue

This dual bridge overpass was constructed in 1980.

This area was subjected to no known mechanisms for impacts; therefore, the material under these overpasses should not be impacted.

3.5 ADDITIONAL INFORMATION

A more detailed description of the source documents reviewed and the conclusions drawn from that review is included in the appendices. This information is organized into segments based on individual roads. Each appendix contains figures at a 1-inch-equal-to-80 foot-scale, showing which pavements could require further investigation and which would not require further investigation. Exhibit B provides a key to the location of each figure.

4.0 REFERENCES

1. *Results of Mobile Gamma Scanning Activities in St. Louis, Missouri*, by Oak Ridge National Laboratory and Martin Marietta Energy Systems, Inc. for the U. S. Department of Energy, June 1991. ORNL/RASA-90/7.
2. *St. Louis Airport/Hazelwood Interim Storage/Futura Coating Company St. Louis, St. Louis County, Missouri*, CERCLA No. MOD980633176, U. S. Department of Health and Human Services Public Health Service Agency for Toxic Substances and Disease Registry, May 10, 1991.
3. *Results of the Mobile Gamma Scanning Activities in Berkeley, Bridgeton, and Hazelwood, Missouri*, by Oak Ridge National Laboratory, operated by Martin Marietta Energy Systems, Inc. for the U. S. Department of Energy, June 1985, ORNL/RASA-85/7.
4. *Radiological Characterization Report for FUSRAP Properties in the St. Louis, Missouri, Area*, by Bechtel National, Inc., August 1990, DOE/OR/20722-203.
5. *Results of Mobile Gamma Scanning Activities in St. Louis, Missouri*, by Oak Ridge National Laboratory and Martin Marietta Energy Systems, Inc. for the U. S. Department of Energy, June 1991. ORNL/RASA-90/7.
6. *History of Material Storage at the St. Louis Airport Storage Site*.
7. In 1984 the U.S. Department of Energy (DOE) issued a report titled *Post-remedial Action Report for the Hazelwood Site*.
8. According to an August 15, 1967 memo titled *Historical Review of the Mallinckrodt Airport Cake*.
9. U.S. Atomic Energy Commission, entitled *Hamm Drayage Co. 1957 Hauling Contract, Subcontract No. 25033M* and dated November 28, 1956.
10. *St. Louis Airport Residue*, unpublished government document. Miller, 1965.
11. *Committee Report on Disposition of St. Louis Airport Storage Site*, United States of America atomic Energy Commission. November 5, 1965.
12. *Results of the Radiation Measurement Taken of Transportation Routes (LM004) in Hazelwood, Missouri*. Oak Ridge National Laboratory. December 1986.
13. *Aerial Photographic Analysis of the St. Louis Airport Study Area, Hazelwood, Missouri*. U.S. Environmental Protection Agency, 1992.

APPENDICES

A.1 through A.15

A.1 Pavement Evaluation of McDonnell Boulevard

Background Information

Some reference stations along McDonnell Boulevard are as follows:

- The intersection of McDonnell Boulevard and Lindbergh Boulevard is McDonnell Boulevard Station 0+00 and Lindbergh Boulevard Station 163+73.
- The intersection of McDonnell Boulevard and Coldwater Creek is McDonnell Boulevard Station 30+05.
- Approximate station of Airport Road and McDonnell Boulevard is McDonnell Boulevard Station 99+00.

Evaluation of Aerial Photographs and Construction History Information

In the July 29, 1941, aerial photograph contained in the August 1992 EPA Region VII study, there is a small road in the approximate alignment of McDonnell Boulevard north of the Norfolk Southern railroad tracks to Coldwater Creek. The portion of the road shown does not appear to have a hard-surface pavement. There is a small bridge west of Coldwater Creek. The road has been surfaced to two lanes with an oil-and-chip surface.

Construction plans from 1943 show Brown Road from Highway 66 (Lindbergh Boulevard) Station 0+00 to Station 30+05 east (approximately Coldwater Creek) to be constructed of 7 inches of aggregate with 2 inches of penetration macadam and a seal coat. This is a high-quality oil-and-chip road surface. It is not believed that this surface would be considered durable or water-resistant enough to protect material underneath from direct impacts. This information is also shown on MoDOT pavement history drawing "St. Louis 096 Sheet 25 of 31."

Construction plans from MoDOT (Federal Project MO S-1207 [1]) from 1952 show that a new four-lane highway was constructed. From Station 0+00 to Station 26+00, the 1943 surface was 40 feet and was resurfaced with an AC overlay. From Station 26+00 to Station 72+00, new 40-foot-wide AC pavement was constructed. From Station 72+00 to Station 87+21.5, the surface was 40 foot and was resurfaced with an AC overlay. From Station 87+21.5 to Station 109+12.25, the typical section of new construction was 44 feet of 8-inch PCC pavement with 10-foot earth shoulders. The reconstructed sections of the road did not always follow the exact alignment of former Brown Road. This information was taken from MoDOT pavement history drawing "St. Louis 096 Sheet 25 of 31."

In the September 11, 1953, aerial photograph contained in the August 1992 EPA Region VII study, a new hard-surface, four-lane, paved road had been constructed. This road is known as State Route STT or McDonnell Boulevard.

The 1954 USGS quad map based on a 1952 aerial photograph shows McDonnell Boulevard as a heavy-duty paved road from Lindbergh Boulevard to the old Eva Avenue/Brown Road railroad crossing where the old crossing remains in place. The heavy-duty pavement continues on the south side of the railroad.

In the September 11, 1958, aerial photograph contained in the August 1992 EPA Region VII study, the McDonnell Boulevard pavement does not appear to have changed in alignment, width, or pavement type since the 1953 photograph.

In the October 10, 1965, aerial photograph contained in the August 1992 EPA Region VII study, the McDonnell Boulevard pavement does not appear to have changed in alignment, width, or pavement type since the 1958 photograph.

The 1968 USGS quad map shows McDonnell Boulevard as a heavy-duty paved road from Lindbergh Boulevard to Airport Road. The railroad crossing has been reconstructed since the 1954 mapping.

In the May 4, 1971, aerial photograph contained in the August 1992 EPA Region VII study, the McDonnell Boulevard pavement does not appear to have changed in alignment, width, or pavement type since the 1965 photograph.

In the May 6, 1974, aerial photograph contained in the August 1992 EPA Region VII study, the McDonnell Boulevard pavement does not appear to have changed in alignment, width, or pavement type since the 1971 photograph.

The 1974 USGS quad map shows McDonnell Boulevard as a heavy-duty paved road from Lindbergh Boulevard to Airport Road.

In 1974 the road from Station 6+00 to Station 65+00 was widened to 48 feet and received a new AC overlay. From Station 65+00 to Station 87+25, the road was widened to 44 feet with a 10-foot left turn lane. This information was taken from MoDOT pavement history drawing "St. Louis 096 Sheet 25 of 31."

In 1978 PCC widening occurred on the left and right and two 24-foot AC lanes were resurfaced from Station 0+00 to Station 8+65. This information was taken from MoDOT pavement history drawing "St. Louis 096 Sheet 25 of 31."

In the December 22, 1980, aerial photograph contained in the August 1992 EPA Region VII study, the McDonnell Boulevard pavement does not appear to have changed in alignment, width, or pavement type since the 1974 photograph.

In the May 1, 1984, aerial photograph contained in the August 1992 EPA Region VII study, the McDonnell Boulevard pavement does not appear to have changed in alignment, width, or pavement type since the 1980 photograph.

Anomalies were detected in the December 14, 1984, scan by EPA. In the May 1, 1985, aerial photograph contained in the August 1992 EPA Region VII study, the McDonnell Boulevard pavement does not appear to have changed in alignment, width, or pavement type since the 1984 photograph.

In the April 8, 1990, aerial photograph contained in the August 1992 EPA Region VII study, the McDonnell Boulevard pavement does not appear to have changed in alignment, width, or pavement type since the 1985 photograph.

In 1988 a 48-foot-wide pavement was resurfaced with AC from Station 0+00 to Station 65+00. From Station 65+00 to Station 109+06, a 44-foot-wide pavement overlay and a new turn lane were constructed. This information was taken from MoDOT pavement history drawing "St. Louis 096 Sheet 25 of 31."

On an April 4, 2002, site visit, it was apparent that the pavement had recently (within 1 year) been overlaid with a new AC surface.

Summary of Critical Facts

A 70-foot ROW for McDonnell Boulevard west of Coldwater Creek was created some time before 1950. An 80-foot ROW for McDonnell Boulevard east of Coldwater Creek was created some time before 1950.

In 1943 a four-lane, 40-foot-wide, oil-and-chip road existed to the west of Coldwater Creek. East of Coldwater Creek the road was a two-lane dirt or oil and clip aggregate road.

In 1952 part of the road was paved with 40-foot AC in a manner that would protect the materials beneath the road from Station 0+00 to Station 87+22. From Station 87+22 to the intersection with Airport Road, a 44-foot PCC pavement was constructed. The portion of McDonnell Boulevard adjoining Coldwater Creek and the SLAPS itself could have been impacted by storm water, floodwater, or windborne residue prior to the placement of this pavement.

In 1974 the road was rehabilitated and widened and the new pavement placed over impacted material.

Three additional AC resurfacings have taken place since 1952: one in 1974, one in 1988, and one in 2002. Paved shoulders have also been constructed.

Final Conclusions

McDonnell Boulevard from Airport Road to Lindbergh Boulevard

That portion of McDonnell Boulevard adjoining the SLAPS was not impermeably paved prior to the start of activities at the site in 1946. All material under the existing pavement could have been impacted.

That portion of McDonnell Boulevard within the floodplain of Coldwater Creek was not impermeably paved prior to the start of activities at the SLAPS in 1946. All material under the existing pavement could have been impacted.

The SLAPS to the HISS hauling activities. From 1966 to 1967 McDonnell Boulevard was hard-surfaced and impermeably paved, and this pavement would have protected the material under it; however, McDonnell Boulevard has been widened, and paved shoulders have been constructed since that time. It is certain that hauling occurred from the SLAPS to the HISS using Eva Avenue. It is very likely that hauling occurred from the SLAPS to Lindbergh Boulevard. It is possible, but not likely, that hauling occurred on McDonnell Boulevard from Eva Avenue to Airport Road. Any pavement widening that has since occurred or any construction of paved shoulders could be over impacted material.

The HISS to West Lake Landfill site. In 1973 McDonnell Boulevard was hard-surfaced and impermeably paved, and this pavement would have protected the material under it; however, McDonnell Boulevard has been widened, and new paved shoulders have been constructed since that time. It is possible that hauling occurred on McDonnell Boulevard from Eva Avenue to Lindbergh Boulevard. The pavement at the intersection with Lindbergh Boulevard was widened in 1978. Any pavement widening that has since occurred or any construction of paved shoulders could be over impacted material.

U:\CAD\NorthCo\Drawgs\HaulRoutePropertyInvestigativePlan\ROAD STUDY\Read Study cm\WCDONNELLC1R00.dwg, M1, 1/5/2005 11:53:33 AM

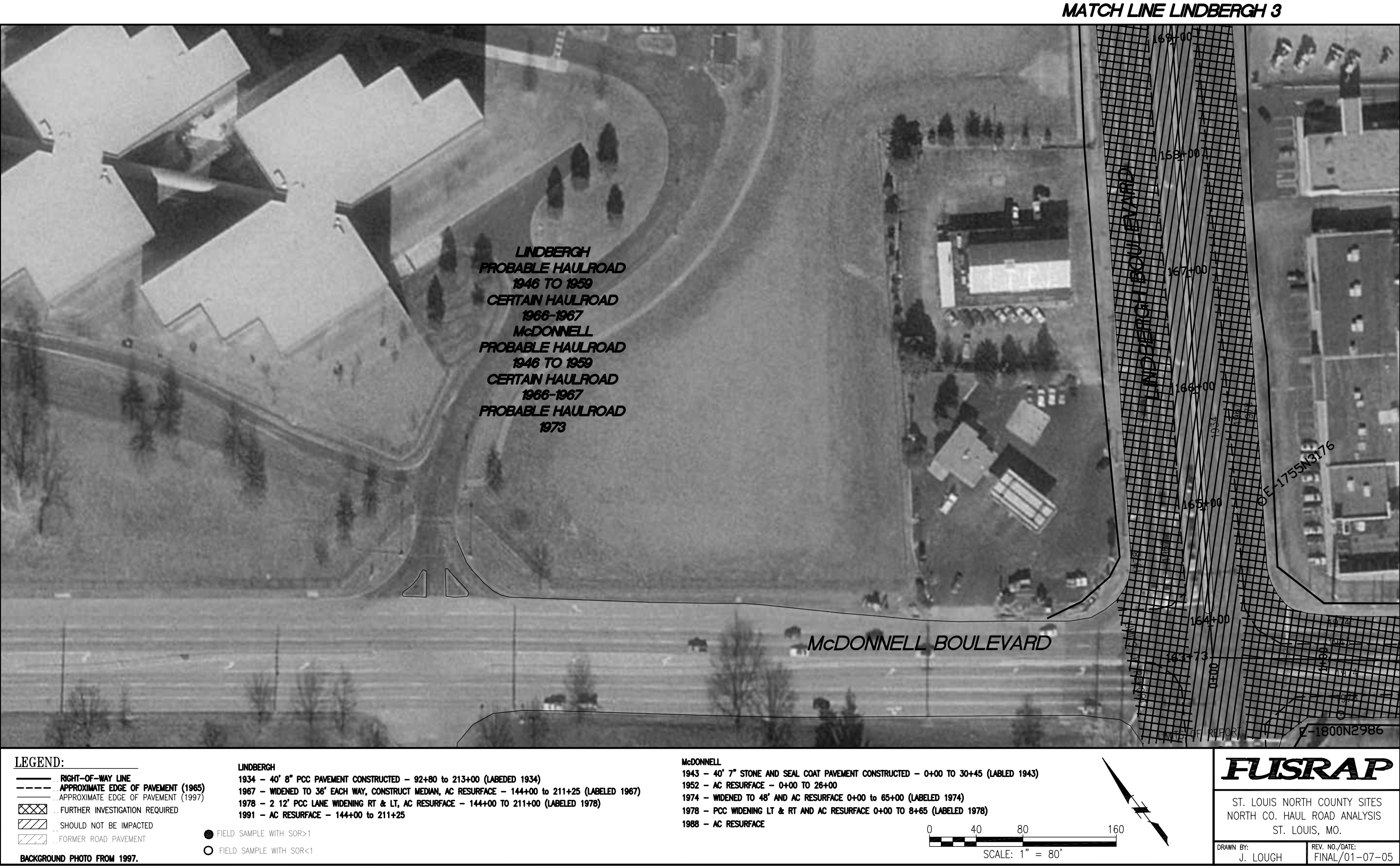
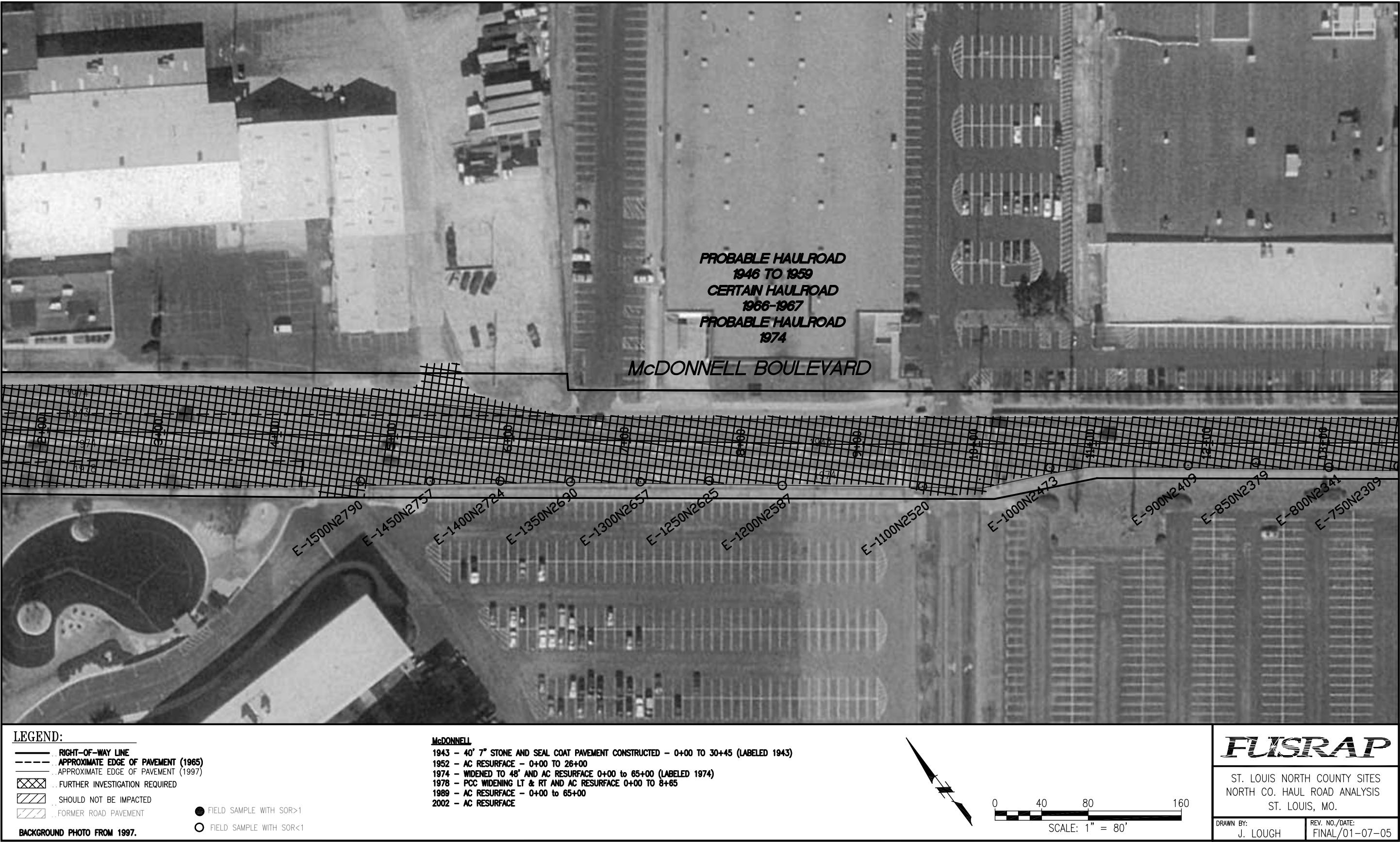


FIGURE McDONNELL 1.

U:\CAD\NorthCo\Drawgs\HaulRoutePropertyInvestigativePlan\ROAD STUDY\Road Study cm\MCDONNELL1R00.dwg, M2, 1/5/2005 2:35:02 PM

MATCH LINE MCDONNELL 1



MATCH LINE MCDONNELL 3

FIGURE MCDONNELL 2.

U:\CAD\NorthCo\Drawings\HaulRoutePropertyInvestigativePlan\ROAD STUDY\Road cm\MCDONNELL 1R00.dwg, M3, 1/7/2005 11:27:30 AM

MATCH LINE McDONNELL 2

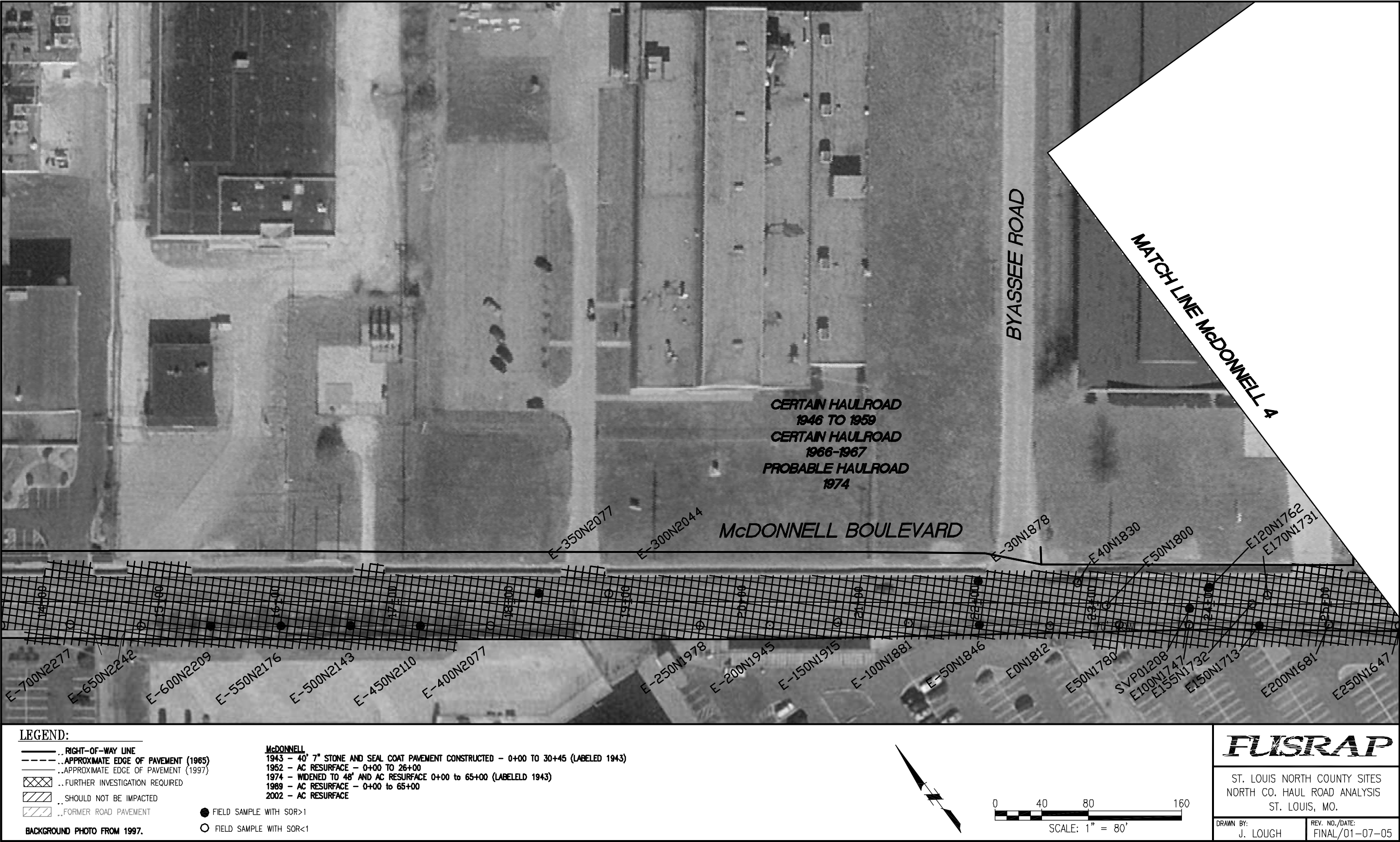
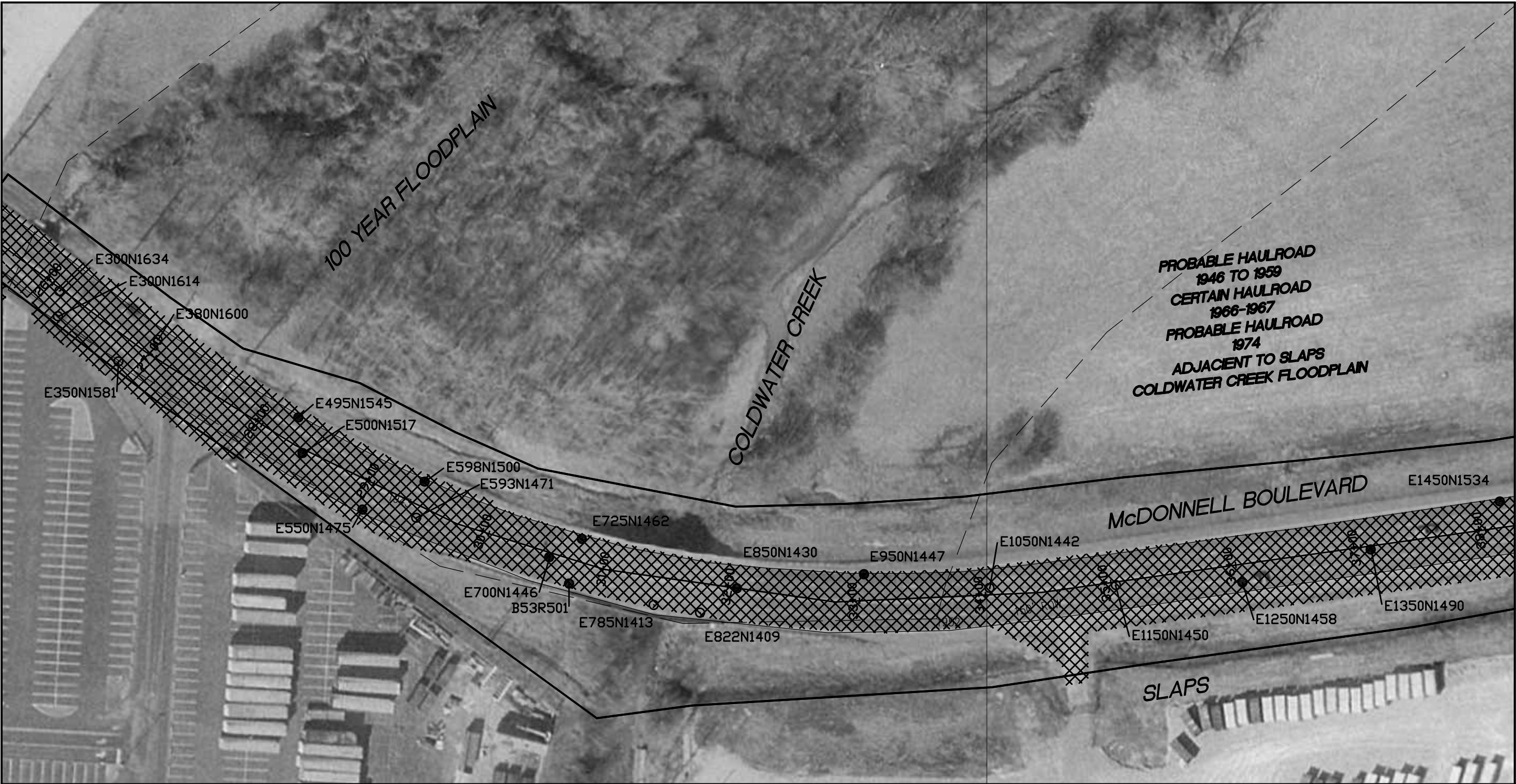


FIGURE McDONNELL 3.

U:\CAD\NorthCo\Drawings\HaulRoutePropertyInvestigativePlan\ROAD STUDY\Read Study cm\WCDONNELLC1R00.dwg, M4, 1/5/2005 11:49:52 AM

MATCH LINE McDONNELL 3



MATCH LINE McDONNELL 5

LEGEND:

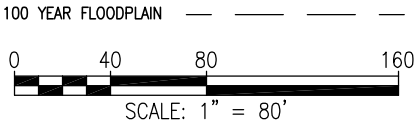
- RIGHT-OF-WAY LINE
- APPROXIMATE EDGE OF PAVEMENT (1965)
- APPROXIMATE EDGE OF PAVEMENT (1997)
- FURTHER INVESTIGATION REQUIRED
- SHOULD NOT BE IMPACTED
- FORMER ROAD PAVEMENT,

BACKGROUND PHOTO FROM 1997.

McDONNELL

- 1943 - 40' 7" STONE AND SEAL COAT PAVEMENT CONSTRUCTED - 0+00 TO 30+45 (LABELED 1943)
- 1952 - 40' AC (9" STONE & 3" AC) RECONSTRUCTION OF BROWN ROAD TO McDONNELL - 27+50 TO 72+00 (LABELED 1952)
- 1974 - WIDENED TO 48' AND AC RESURFACE 0+00 TO 65+00
- 1989 - AC RESURFACE - 0+00 TO 65+00
- 2002 - AC RESURFACE

- FIELD SAMPLE WITH SOR>1
- FIELD SAMPLE WITH SOR<1



FUSRAP

ST. LOUIS NORTH COUNTY SITES
NORTH CO. HAUL ROAD ANALYSIS
ST. LOUIS, MO.

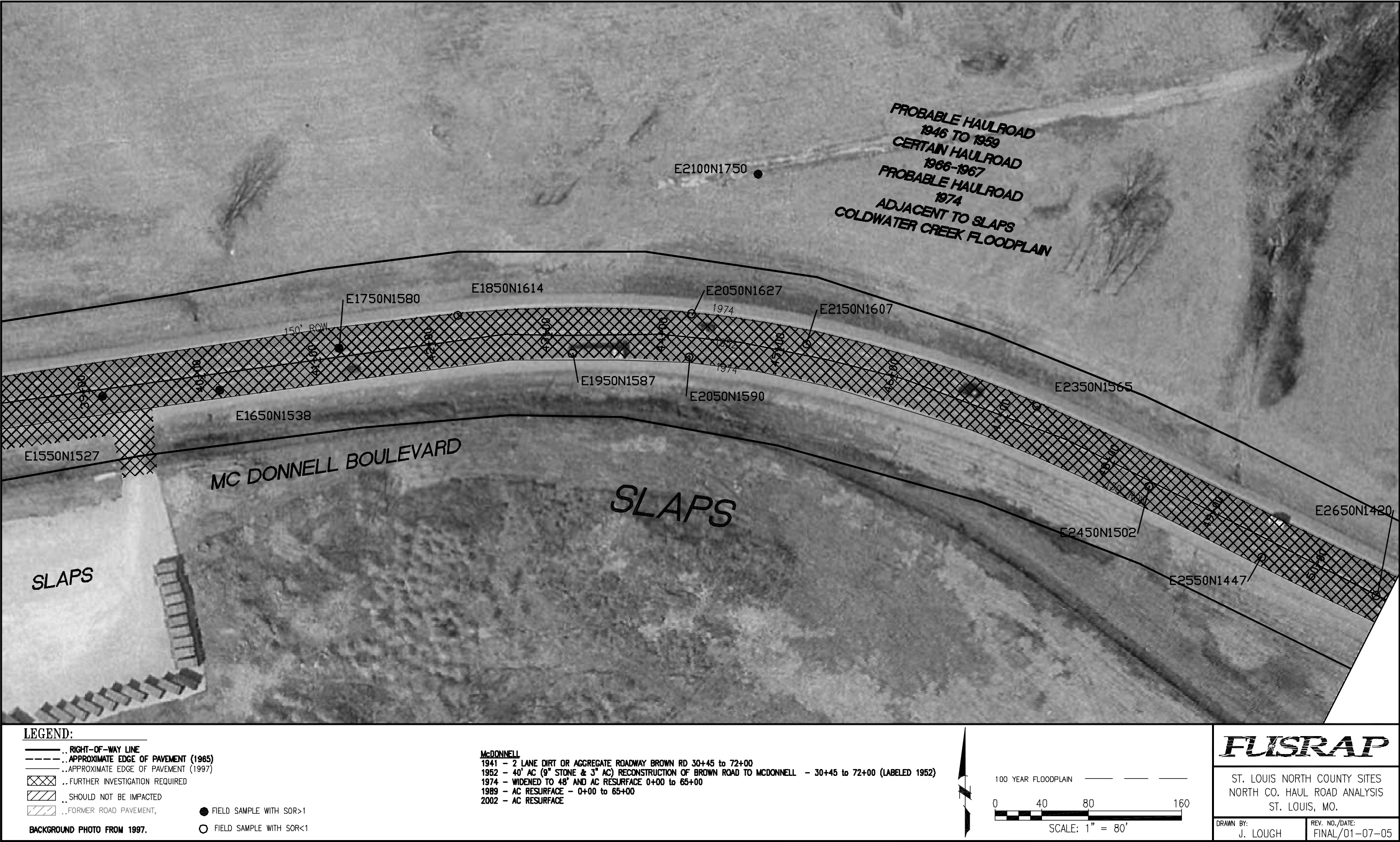
DRAWN BY:
J. LOUGH

REV. NO./DATE:
FINAL/01-07-05

FIGURE McDONNELL 4.

U:\CAD\NorthCo\Draws\HaulRoutePropertyInvestigativePlan\ROAD STUDY\cm\MCDONNELL 1R00.dwg, M5, 1/7/2005 11:28:19 AM

MATCH LINE McDONNELL 4



MATCH LINE McDONNELL 6

FIGURE McDONNELL 5.

U:\CAD\NorthCo\Drawings\HaulRoutePropertyInvestigativePlan\ROAD STUDY\Road cm\MCDONNELL 1R00.dwg, M6, 1/7/2005 11:30:31 AM

MATCH LINE McDONNELL 5



MATCH LINE McDONNELL 7

FIGURE McDONNELL 6.

U:\CAD\NorthCo\Draws\HaulRoutePropertyInvestigativePlan\ROAD STUDY\Road Study cm\MCDONNELL 1R00.dwg, M7, 1/7/2005 11:29:49 AM

MATCH LINE McDONNELL 6

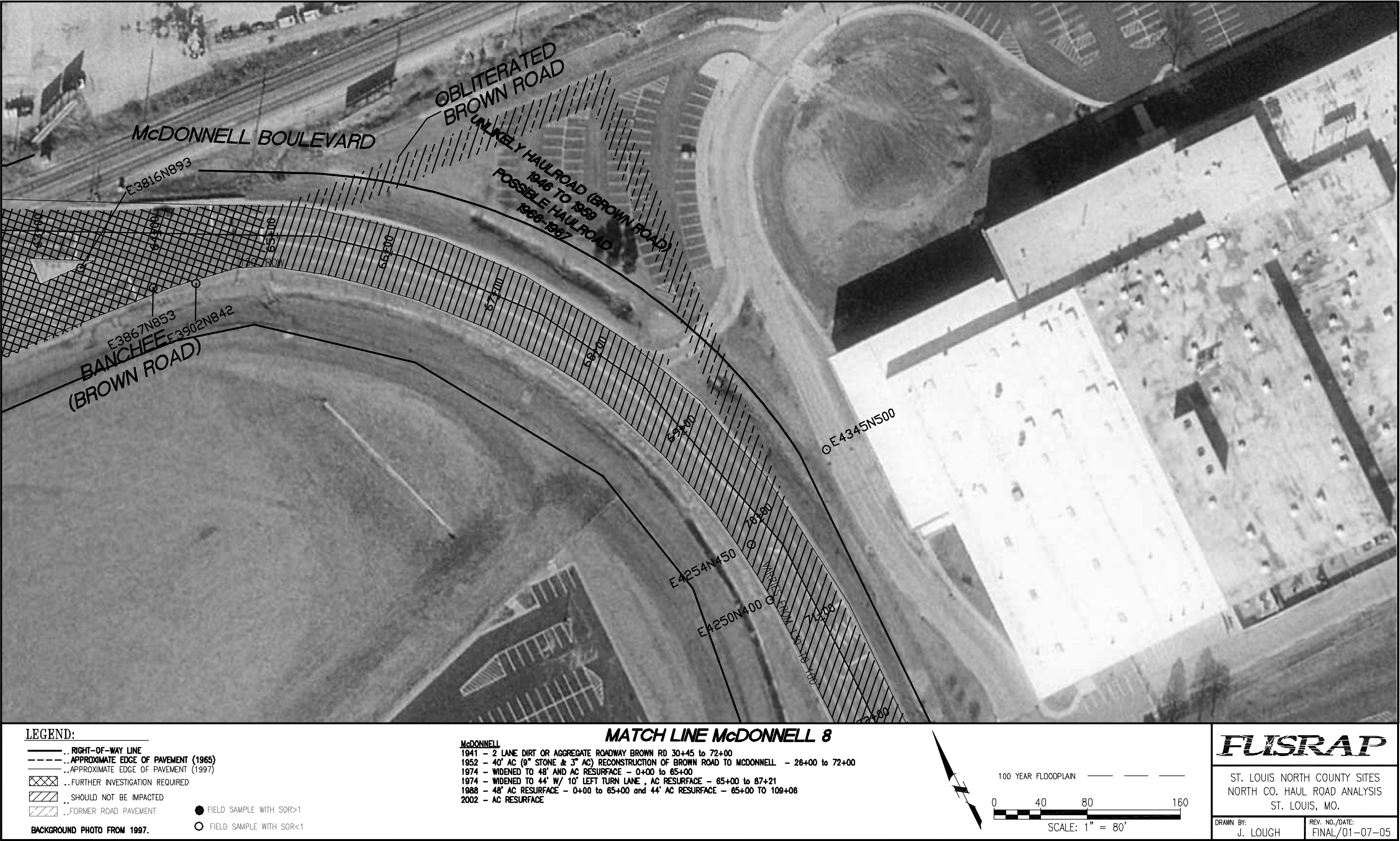


FIGURE McDONNELL 7.

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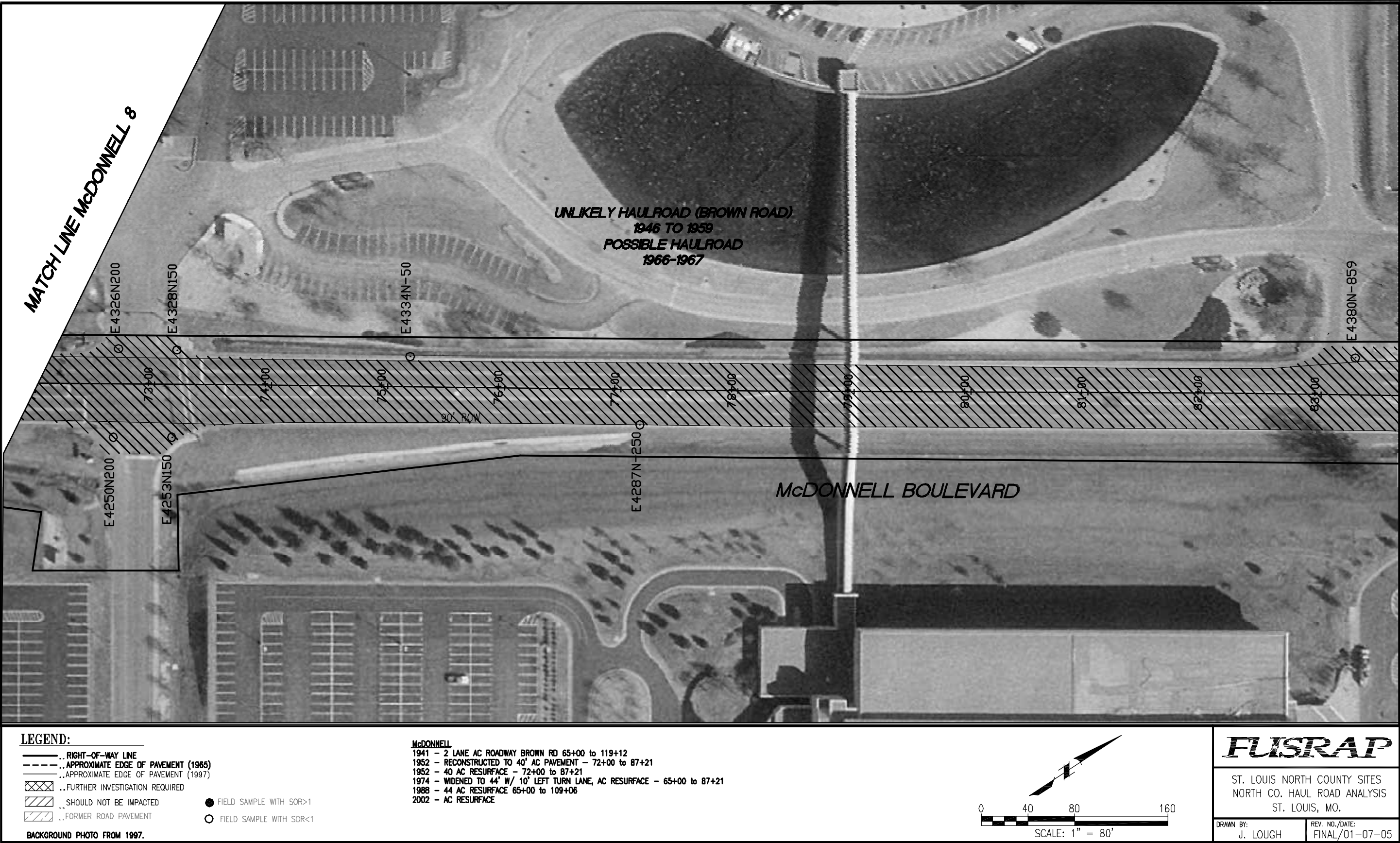


FIGURE McDONNELL 8.



A.2 Pavement Evaluation of I-270 Including Pershall and Dunn Roads Between Lindbergh Boulevard and Graham Road

Background Information

Some reference stations along I-270 are as follows:

- The intersection of I-270 and Lindbergh Boulevard is I-270 Station 263+08 and Lindbergh Boulevard Station 219+83.
- The intersection of I-270 and Graham Road is I-270 Station 334+97.

Pershall Road is the south outer road for I-270. The north outer road is Dunn Road. Dunn Road was an existing roadway prior to the work at the SLAPS and the HISS and is the only northern east/west roadway possibly used prior to the construction of I-270 and Pershall Road. All three of these roads are covered by a single set of figures included after this section.

Evaluation of Aerial Photographs and Construction History Information

In the September 11, 1953, aerial photograph contained in EPA Region VII study *Aerial Photographic Analysis of the St. Louis Airport Study Area* dated August 1992, Dunn Road is shown as a two-lane, paved road. Later plans from 1962 for I-270 show Dunn Road to be 20-foot-wide PCC. Pershall Road and I-270 did not exist at the time of the photograph.

The 1954 USGS quad map based on a 1952 aerial photograph shows Dunn Road (labeled Lindbergh Boulevard) as a heavy-duty paved road. I-270 and Graham Road did not exist.

In 1962 I-270 was typically constructed as two 24-foot PCC lanes from Station 263+08 to Station 334+97. This information was taken from MoDOT pavement history drawing "St. Louis 096 Sheet 20 of 31."

In 1962 I-270 was constructed, and the new south outer road for I-270 was named Pershall Road. This South Outer Road/Pershall Road was constructed as a 24-foot PCC pavement. Dunn Road, an existing 20-foot PCC pavement, became the north outer road for I-270.

The 1967 photograph from St. Louis County shows I-270 fully constructed, with Pershall Road as the south outer road and Dunn Road as the north outer road. Some preliminary work is shown for what would eventually become the I-270 and I-170 intersection. Most of I-270 is shown as two lanes of PCC in each direction.

The 1968 USGS quad map shows I-270 as a dual-divided freeway, heavy-duty paved road with full outer roads from Lindbergh Boulevard to Graham Road.

In 1972 two additional 12-foot PCC lanes were constructed on I-270, one for each direction of traffic, from Station 263+08 to Station 334+97. This information was taken from MoDOT pavement history drawing "St. Louis 096 Sheet 20 of 31."

In 1981, two 36-foot lanes were resurfaced with AC from Station 288+06 to Station 304+38. This information was taken from MoDOT pavement history drawing "St. Louis 096 Sheet 20 of 31."

The 1974 USGS quad map shows I-270 as a dual-divided freeway, heavy-duty paved road with full outer roads from Lindbergh Boulevard to Graham Road.

In the May 1, 1984, aerial photograph contained in the August 1992 EPA Region VII study, portions of Pershall Road near the intersection of I-170 have been obliterated and the road relocated to the south.

In 1981 a 12-foot PCC right lane was added and the existing 48-foot-wide pavement was resurfaced from Station 334+30 to Station 334+96. This information was taken from MoDOT pavement history drawing "St. Louis 096 Sheet 20 of 31."

A 1984 photograph contained in *Aerial Photographic Analysis of the St. Louis Airport Study Area* dated August 1992 shows I-270 with 48-foot pavement westbound and a combination of 36-foot and 48-foot pavement eastbound.

Anomalies were detected on Pershall Road during the December 14, 1984 scan by EPA. No scan was conducted on Dunn Road or I-270 at this time.

In the April 8, 1990 aerial photograph contained in the August 1992 EPA Region VII study, the Pershall Road pavement does not appear to have changed in alignment, width, or pavement type since the 1985 photo except for the following items. An AC overlay has been placed on the PCC pavement for much of the area of interest and the bridge over Coldwater Creek has been demolished and the road realigned in the vicinity of Coldwater Creek.

Two 36-foot PCC lanes were resurfaced in 1991 from Station 263+08 to Station 288+60. This information was taken from MoDOT pavement history drawing "St. Louis 096 Sheet 20 of 31."

All lanes were resurfaced 1998 from Station 291+84 to Station 334+97. This information was taken from MoDOT pavement history drawing "St. Louis 096 Sheet 20 of 31."

During a February 23, 2002 site visit, Pershall Road was found to have 4 to 6 inches of AC over PCC pavement. The original PCC has been overlaid with AC at least three times. However, the original PCC pavement still exists. The AC exhibits a definite expansion-joint pattern at 20-foot intervals. Several potholes were examined and revealed the 4 to 6 inches of asphalt over PCC. The approaches from Lindbergh Boulevard are PCC, which has not been overlaid with AC.

The approaches to I-170 are in the process of reconstruction for a new I-170 and I-270 interchange. The pavement on Pershall Road past Hazelwood Avenue has been removed.

Summary of Critical Facts

I-270, Pershall Road, and Dunn Road from Graham Road to Lindbergh Boulevard

I-270, from North Hanley Road to Lindbergh Boulevard, was typically constructed as two 24-foot PCC pavements in 1962. This pavement width was widened by the construction of additional lanes in 1972 and 1981. These newer lanes could have been constructed over impacted material.

Dunn Road was in existence as a two-lane, 20-foot-wide PCC pavement prior to 1941. Where this original pavement is still in existence, from Lindbergh Boulevard to Graham Road, it should have protected the material underneath from direct impacts. After I-270 and Pershall Road were constructed, it is unlikely that any hauling activity would have occurred on Dunn Road.

Sections of what was Pershall Road were obliterated in 1979 as part of the construction of I-270 interchanges with I-170. Impacts could still exist along the former alignment.

That portion of I-270, Pershall Road, and Dunn Road within the floodplain of Coldwater Creek was not paved prior to the start of activities at the SLAPS in 1946. All material under this pavement could have been impacted. A small amount of Dunn Road pavement constructed before 1946 and in the floodplain might still be in existence. Material under this pavement would have been protected from direct impact.

The SLAPS to the HISS hauling activities. From 1966 and 1967, I-270, Pershall Road, and Dunn Road had hard-surfaced and impermeable pavements, and this pavement would have protected the material under it; however, I-270 has been widened, and new paved shoulders have been constructed since that time. It is very likely that hauling occurred from the SLAPS to Lindbergh Boulevard to Pershall Road to Hazelwood Avenue. It is possible, but not as likely, that hauling occurred from the SLAPS to Lindbergh Boulevard to Pershall Road to Graham Road. It is also possible that this movement occurred from the SLAPS to Lindbergh Boulevard to I-270 to Graham Road. No activity on Dunn Road would be expected at this time.

The HISS to West Lake Landfill site. In 1973, I-270, Pershall Road, and Dunn Road had hard-surfaced and impermeable pavements, and this pavement would have protected the material under it. It is possible that hauling occurred on Pershall Road from Hazelwood Avenue to Lindbergh Boulevard.

U:\CAD\NorthCo\Drawings\HaulRoadPropertyInvestigativePlan\ROAD STUDY\cm\PERSHALLC1R00.dwg, P1, 1/7/2005 11:34:17 AM

MATCH LINE LINDBERGH 1

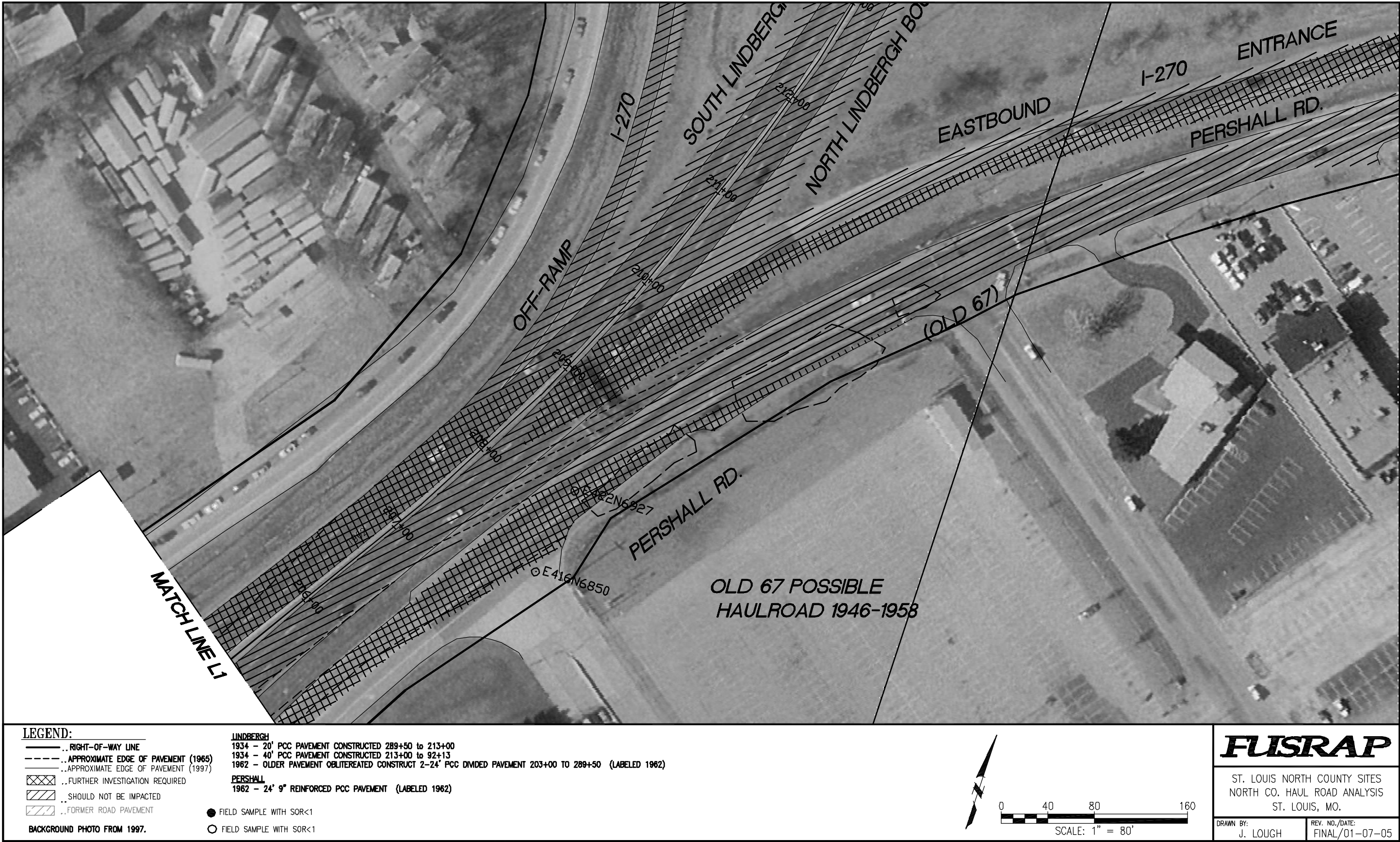
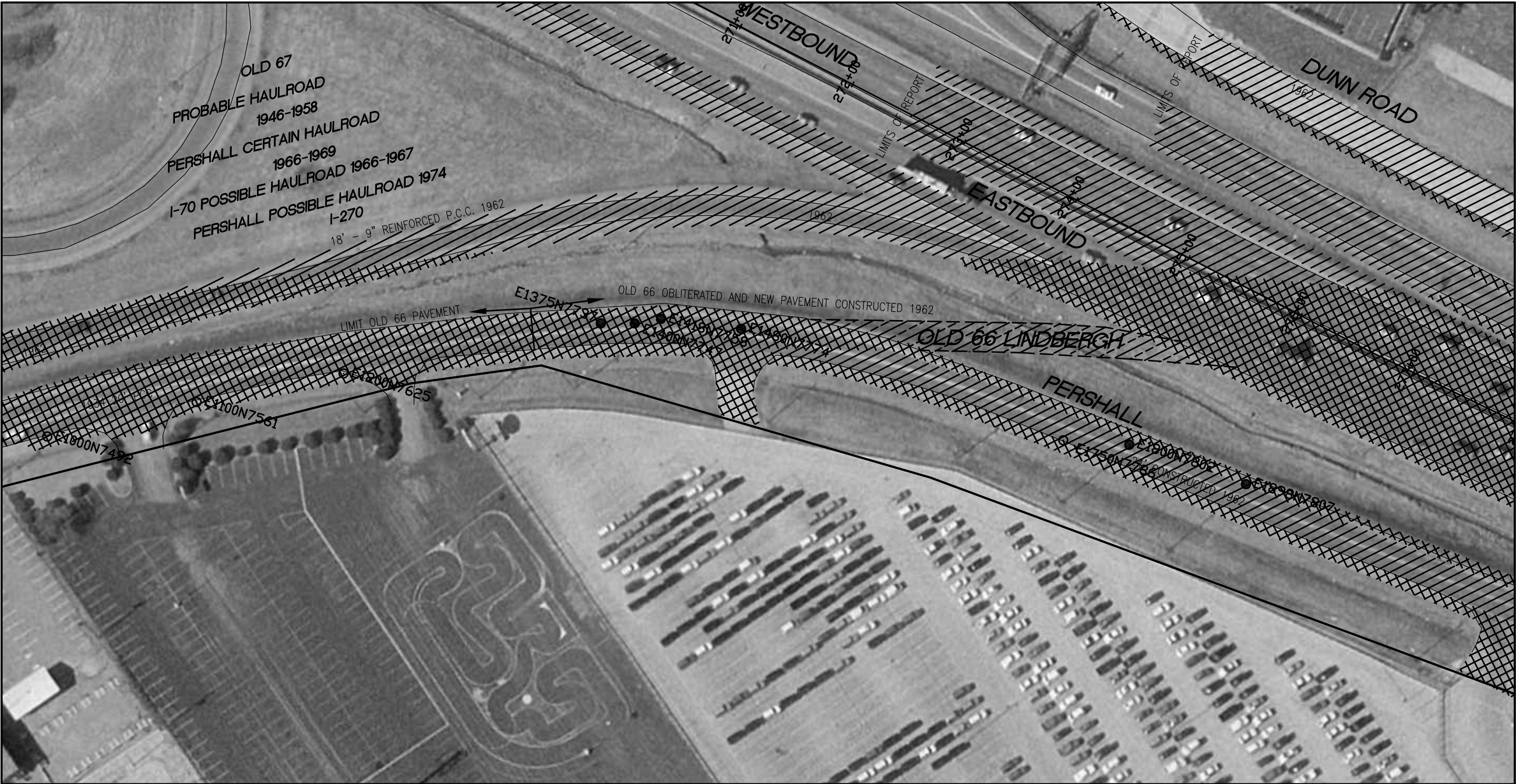


FIGURE PERSHALL 1.

U:\CAD\NorthCo\Drawings\HaulRouteInvestigativePlan\ROAD STUDY\Road Study cm\PERSHALLC1R00.dwg, P2, 1/5/2005 12:06:08 PM

MATCH LINE PERSHALL 1



MATCH LINE PERSHALL 2

MATCH LINE PERSHALL 4

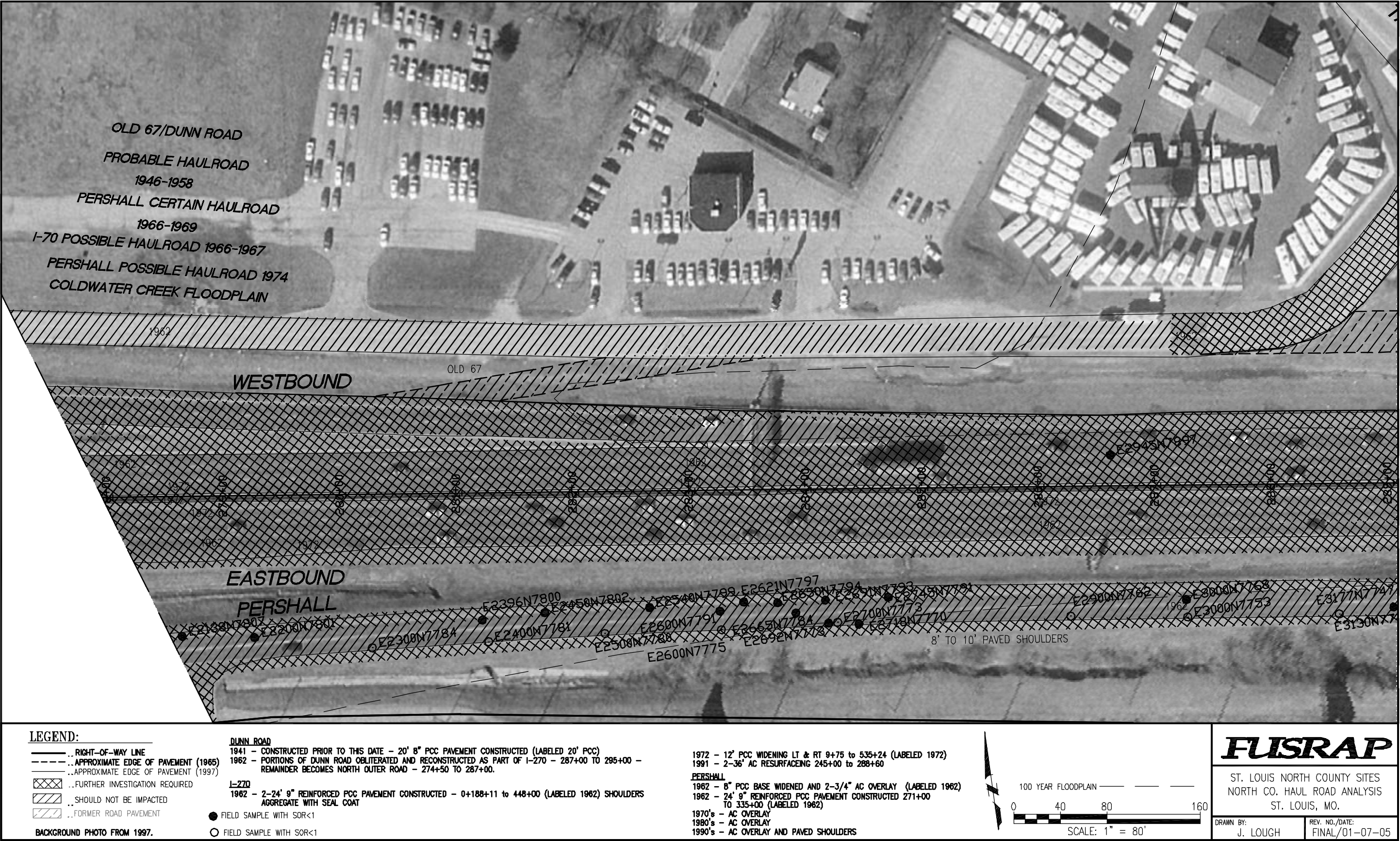
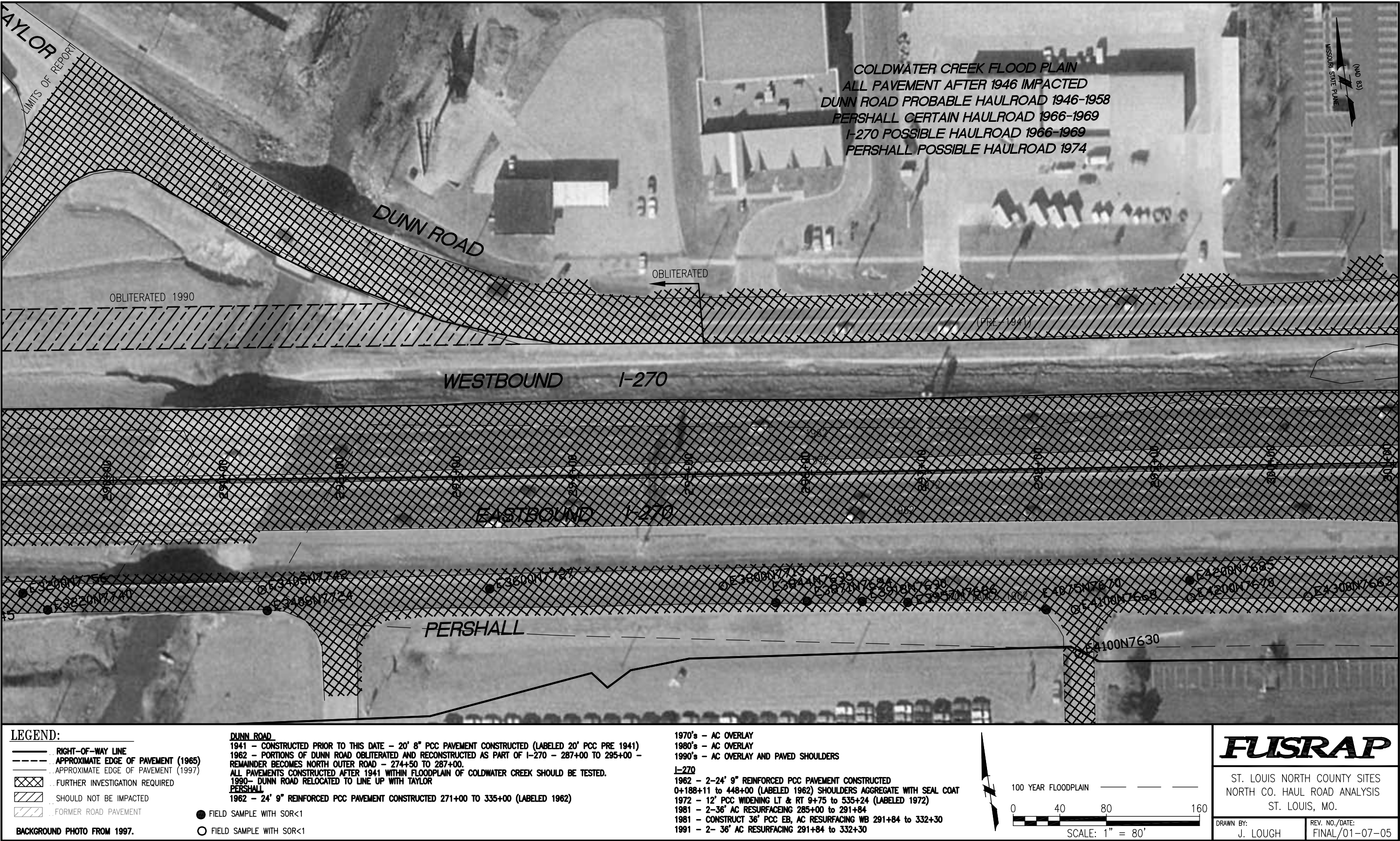


FIGURE PERSHALL 3.

U:\CAD\NorthCo\Drawings\HaulRoad\InvestigativePlan\ROAD STUDY\cm\PERSHALLC1R00.dwg, P4, 1/5/2005 12:08:44 PM

MATCH LINE PERSHALL 3



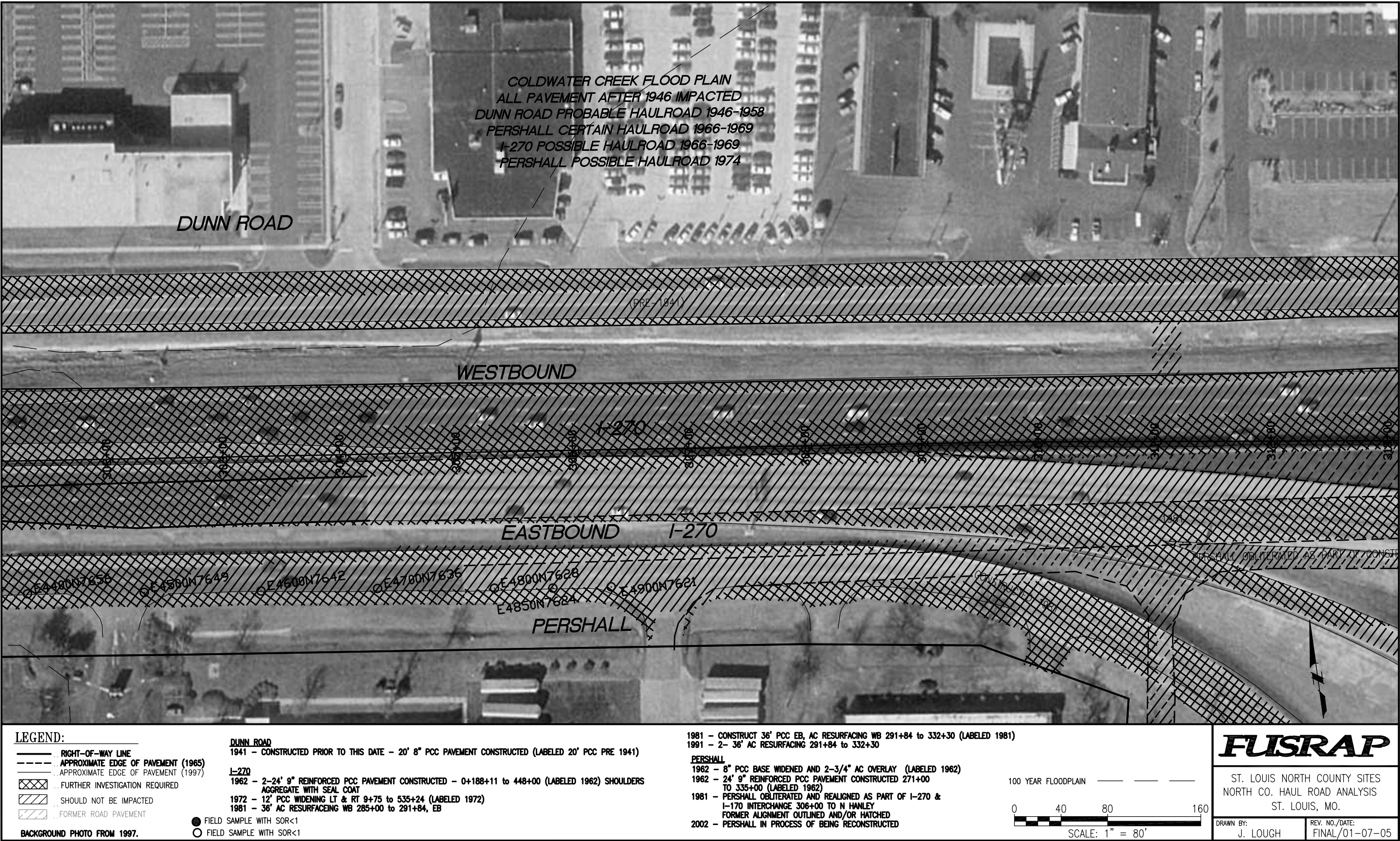
MATCH LINE PERSHALL 5

MATCH LINE POLSON 1

FIGURE PERSHALL 4.

U:\CAD\NorthCo\Drawings\HaulRoutePropertyInvestigativePlan\ROAD STUDY\Road Study cm\PERSHALLC1R00.dwg, P5, 1/5/2005 12:10:16 PM

MATCH LINE PERSHALL 4



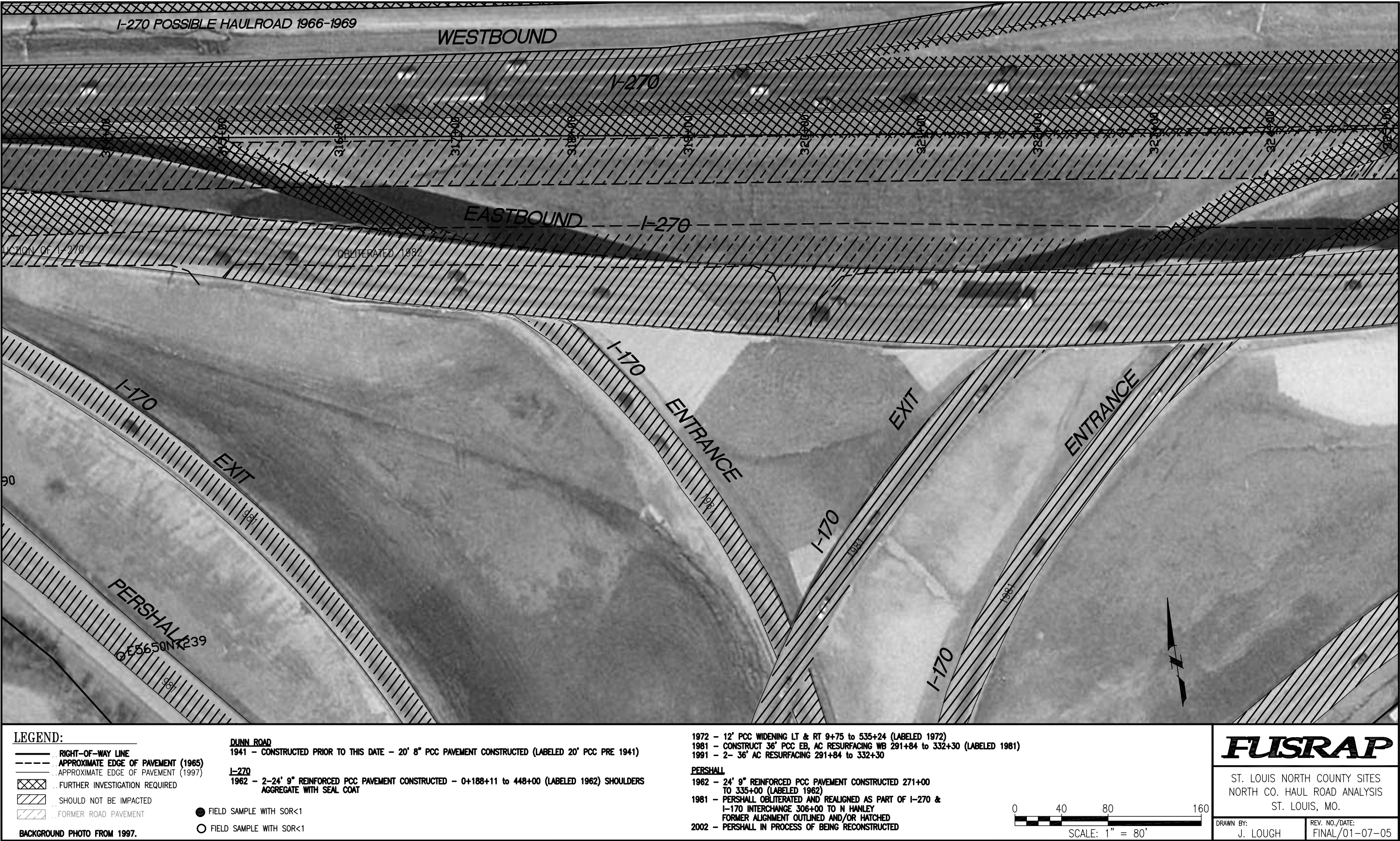
MATCH LINE PERSHALL 6

MATCH LINE HAZELWOOD 1

FIGURE PERSHALL 5.

U:\CAD\NorthCo\Drawgs\HaulRoutePropertyInvestigativePlan\ROAD STUDY\Road Study cm\PERSHALLC1R00.dwg, P6, 1/5/2005 12:11:15 PM

MATCH LINE PERSHALL 5

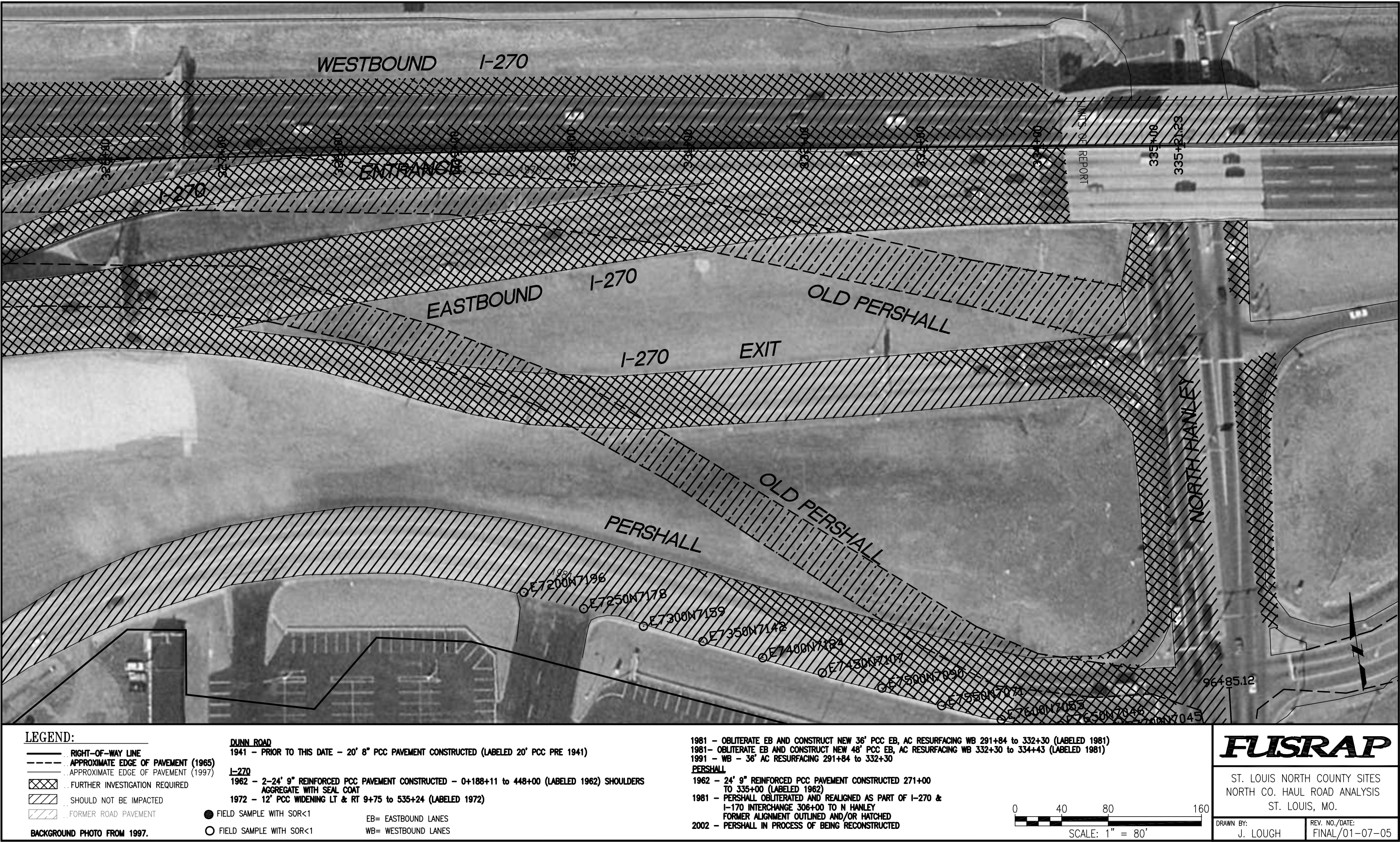


MATCH LINE PERSHALL 8

FIGURE PERSHALL 6.

U:\CAD\NorthCo\Drawings\HaulRouteInvestigativePlan\ROAD STUDY\Road Study cm\PERSHALLC1R00.dwg, P7, 1/5/2005 12:12:32 PM

MATCH LINE PERSHALL 6



MATCH LINE HANLEY 1

FIGURE PERSHALL 7.

U:\CAD\NorthCo\Drawings\HaulRouteInvestigativePlan\ROAD STUDY\Road Study cm\PERSHALLC1R00.dwg, P8, 1/5/2005 12:13:33 PM

MATCH LINE PERSHALL 6



MATCH LINE I-1

FIGURE PERSHALL 8.

A-3 Pavement Evaluation of Eva Avenue

Evaluation of Aerial Photographs and Construction History Information

In the July 29, 1941, aerial photograph contained in the August 1992 EPA Region VII study, Eva Avenue is not shown. There is a farm access road leading to a single farmstead, off Banshee Road, in approximately the same location. This road does not have a hard surface.

In a property boundary plat dated January 3, 1946, Eva Avenue is shown within a 40-foot ROW located 60 feet from the centerline of the easternmost rail tracks of the Burlington Northern Railroad spur then in existence. This railroad spur was constructed after 1941.

In construction plans dated April 1, 1952 showing construction of McDonnell Boulevard, new pavement is shown to be constructed for the southernmost 120 feet of Eva Avenue adjoining McDonnell Boulevard. This was done so that Eva Avenue could match the new vertical alignment of McDonnell Boulevard, which was approximately 3.5 feet above the existing elevation of Eva Avenue. All other intersecting roads shown on this sheet are outlined with a type of surface indicated; for example, "Brown Road (bituminous surface)." This is evidence that Eva Avenue was not hard-surfaced at this time.

In a property boundary plat dated January 21, 1953 by the Sewer and Paving Section of the City of St. Louis Board of Public Service, Eva Avenue is shown with a 40-foot ROW.

In the September 11, 1953, aerial photograph contained in the August 1992 EPA Region VII study, Eva Avenue does not appear to have been paved. McDonnell Boulevard has been constructed intersecting Eva Avenue just north of Banshee Road. A lead track railroad serving properties to the north includes the future HISS property. This railroad is constructed paralleling Eva Avenue for much of its length. An additional road has been constructed from the former terminus of Eva Avenue, providing access to Graham Road to the east.

The 1954 USGS quad map based on a 1952 aerial photograph shows Eva Avenue as an unimproved dirt road.

In the September 11, 1958, aerial photograph contained in the August 1992 EPA Region VII study, Eva Avenue does not appear to have been paved. The photograph indicates evidence consistent with an aggregate or dirt road. The traveled roadway is not straight, but winds within the ROW. The width of the roadway is not constant; some areas show considerable widening. There is evidence of rutting and of various colors of surface material. At intersections it is obvious that vehicles swing wide to make the curves at higher speeds. The photograph also shows that several additional parallel tracks have been added to the Burlington Northern Railroad spur.

In the October 10, 1965, aerial photograph contained in the August 1992 EPA Region VII study, Eva Avenue appears to have been oiled and chipped, but in a non-engineered manner. The edges

of the roadway are uneven, and the width of the roadway itself varies. The road shows evidence of ruts and puddles. There is evidence that traffic might be running off the pavement on both shoulders. Again, this is evidence consistent with heavy industrial hauling.

The 1968 USGS quad map shows Eva Avenue as an unimproved dirt road from a point approximately 400 foot north of the intersection with McDonnell Boulevard. The section between McDonnell Boulevard and the unimproved section is shown as a light-duty paved road.

In the May 4, 1971, aerial photograph contained in the August 1992 EPA Region VII study, the Eva Avenue pavement appears to be in very poor condition. Additional road entrances have been constructed off Eva Avenue to the west.

In the May 6, 1974, aerial photograph contained in the August 1992 EPA Region VII study, the AC Eva Avenue pavement appears to have been widened and paved with an engineered surface. The edges of the roadway are clean and straight. At intersections curves have been constructed. Many vehicles are visible on the road, and additional industrial development has occurred.

In the December 22, 1980, aerial photograph contained in the August 1992 EPA Region VII study, the Eva Avenue pavement does not appear to have changed in alignment, width, or pavement type since the 1974 photograph.

In the May 1, 1984, aerial photograph contained in the August 1992 EPA Region VII study, the Eva Avenue pavement does not appear to have changed in alignment, width, or pavement type since the 1980 photograph.

No anomalies were detected during the December 14, 1984, scan by EPA.

In the May 1, 1985, aerial photograph contained in the August 1992 EPA Region VII study, the Eva Avenue pavement does not appear to have changed since the 1984 photograph.

In the April 8, 1990, aerial photograph contained in the August 1992 EPA Region VII study, the Eva Avenue pavement does not appear to have changed in alignment, width, or pavement type since the 1985 photograph.

On April 24, 2002, site visit, Eva Avenue was observed to have been recently resurfaced with a 2-inch AC overlay.

Summary of Critical Facts

A 40-foot ROW for Eva Avenue was created some time before 1946.

In 1952 the south 120 feet of Eva Avenue were elevated to 3.5 foot and paved as part of the construction of McDonnell Boulevard. This pavement extended approximately 350 foot north of

McDonnell Boulevard. The remainder of the road was not hard-surfaced and appears to have been an aggregate/dirt hauling road up to some time between 1971 and 1974.

Some time between 1971 and 1974, the road was rehabilitated and paved. Little or no work appears to have been done from the mid-1970s until the recent resurfacing.

Final Conclusions

Based on the information available, all of the material beneath Eva Avenue was impacted prior to being paved; therefore, all paved areas will be subjected to further investigation. The largest elevation change in Eva Avenue is located in the 120 foot adjoining McDonnell Boulevard, and any potential impacts there could be up to an additional 3.5 foot beneath the surface.

The SLAPS to the HISS hauling activities: From 1966 to 1967 Eva Avenue was an unimproved dirt road. It is certain that hauling occurred from the SLAPS to McDonnell Boulevard to Eva Avenue to Frost.

Haulage from the HISS by railroad car would have used the lead track. It is certain that hauling residue occurred on this lead track. This haulage activity may have impacted the adjoining road right of way and this impacted material may have been since paved.

The HISS to West Lake Landfill site activity: In 1973 Eva Avenue had an AC surface that would have protected the material under it. Although Eva Avenue would not have been expected to be impacted by the movement of waste from HISS to Westlake Landfill, it will be subjected to further investigation as a result of possible impacts from earlier activities as described above.

MATCH LINE McDONNELL 9

EVA PROBABLE HAULROAD 1966-1969
EVA POSSIBLE HAULROAD 1974

EVA

40' ROW

AC PAVEMENT

NORFLOK SOUTHERN RAILROAD

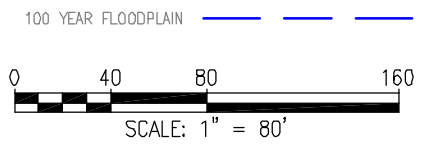
MATCH LINE EVA 2

LEGEND:

- RIGHT-OF-WAY LINE
- - - APPROXIMATE EDGE OF PAVEMENT (1965)
- - - APPROXIMATE EDGE OF PAVEMENT (1997)
- ▤ FURTHER INVESTIGATION REQUIRED
- ▨ SHOULD NOT BE IMPACTED
- ▧ FORMER ROAD PAVEMENT
- FIELD SAMPLE WITH SOR>1
- FIELD SAMPLE WITH SOR<1

BACKGROUND PHOTO FROM 1997.

EVA AVENUE
1941 - EVA AVENUE UNIMPROVED DIRT
1971 - 1974 - EVA AVENUE AC PAVEMENT



FUSRAP

ST. LOUIS NORTH COUNTY SITES
NORTH CO. HAUL ROAD ANALYSIS
ST. LOUIS, MO.

DRAWN BY: J. LOUGH	REV. NO./DATE: FINAL/01-07-05
-----------------------	----------------------------------

FIGURE EVA 1.



A.4 Pavement Evaluation of Frost Avenue

Evaluation of Aerial Photographs and Construction History Information

In the July 29, 1941, aerial photograph contained in the August 1992 EPA Region VII study, some small portions of what is now Frost Avenue are shown as a defined roadway. There is a farm access road leading to a single farmstead off Eva Avenue, in approximately the same alignment as Frost Avenue and approximately 500 foot in length. From the end of this road eastward, there is no road, only a field line leading to the intersection of Frost and Hazelwood avenues. From this intersection eastward approximately 350 feet to the intersection of Frost Avenue and Graham Road, there is a well-defined public road. These 350 foot appear to be paved, probably with an AC surface.

In a February 24, 1947 property boundary plat, the Frost Avenue ROW is shown to have a width of 40 foot west of Eva Avenue. Frost Avenue is also shown continuing east of Eva Avenue. West of Coldwater Creek, Frost Avenue is a “paper” street. There is no evidence that any roadway was ever constructed in this area.

In the September 11, 1953, aerial photograph contained in the August 1992 EPA Region VII study, a roadway has been constructed along the alignment of Frost Avenue from Eva Avenue to Hazelwood Avenue. This road goes from a wye intersection with Hazelwood Avenue to the intersection of Eva Avenue and continues westward across the lead track railroad spur serving properties to the north to a small facility on the bank of Coldwater Creek. The lead track crosses Frost Avenue just east of Eva Avenue. This road appears to have been designed, but with an aggregate surface which would not have protected the material underneath from potential impacts.

The 1954 USGS quad map based on a 1952 aerial photograph shows Frost Avenue as an unimproved dirt road west of Hazelwood Avenue. East of Hazelwood Avenue, Frost Avenue is shown as a light-duty paved road.

In the September 11, 1958, aerial photograph contained in the August 1992 EPA Region VII study, Frost Avenue appears to have an oil-and-chip surface. The width of the traveled surface is not constant, and it varies in width without any change in color, indicating that it was dirt or aggregate, possibly with oil stabilization. It is possible that this road was constructed to provide access to part of the airport lighting/guidance system, which was constructed after 1953 and is now serviced from this road.

Haulage from the HISS by railroad car would have used the lead track (a lead track is an industrial spur that services multiple properties) that crosses Frost Avenue near its intersection with Eva Avenue. It is certain that hauling occurred on this lead track. This haulage activity may have impacted the roadway near this crossing.

In the October 10, 1965, aerial photograph contained in the August 1992 EPA Region VII study, Frost Avenue has been upgraded to some extent. The road appears to be wider and with sharper edges. The surface has evidence of rutting or puddles indicating an oil-and-chip or a thin AC surface. This damage was likely the result of the road's providing access to several industrial facilities located south of Frost Avenue.

In April 8, 1966 construction plans for the Graham Road–Frost Avenue intersection traffic signal, Frost Avenue is shown to be 50 foot wide and the existing pavement to be approximately 32 foot wide. The ROW width between Graham Road and the wye at Hazelwood Avenue is 80 foot wide, with an existing 32-foot-wide AC pavement. The plans show widening this pavement to 44 foot, for an approximate length of 150 foot from Graham Road, and then tapering back to 32 foot over another 150 foot.

In a September 18, 1967 property boundary plat, Frost Avenue is shown with a 40-foot ROW width. This plat establishes Romiss Court with 75-foot-wide and Jonas Place with 50-foot-wide street and utility easements.

The 1968 USGS quad map shows Frost Avenue as a light-duty paved road from Hazelwood Avenue to a point approximately 1,000 foot east of Coldwater Creek. East of this point Frost Avenue is shown as an unimproved dirt road to the intersection with Eva Avenue.

In the May 4, 1971, aerial photograph contained in the August 1992 EPA Region VII study, new streets have been constructed south of Frost Avenue. These streets are Romiss Court and Jonas Place. By this time Frost Avenue has been widened and rehabilitated to the intersection of Jonas Place. Additional road entrances have been constructed off Frost Avenue to the south, at least some of which appear to be paved. Additional industrial facilities have been constructed north of Frost Avenue.

In an October 31, 1972 property boundary plat, the ROW for Frost Avenue is increased to 50 foot by the dedication of a 10-foot strip off the south side from the wye at Hazelwood Avenue to 100 foot west of Romiss Court Road. This dedication is to the city of Berkeley, Missouri. Both Romiss Court and Jonas Place roads are extended to a new road, Fleischer Place, just north of the railroad tracks.

In the September 1, 1972, plans for Graham Road, Frost Avenue are shown as having asphaltic pavement. The ROW is shown as being 50 foot wide. At the intersection with Graham Road, the pavement on Frost Avenue is adjacent to the north ROW line and has an 8-foot-wide concrete strip on the south side.

In the May 6, 1974, aerial photograph contained in the August 1992 EPA Region VII study, Frost Avenue pavement appears to have been rehabilitated and widened. Many vehicles are visible on the road, and additional industrial development has occurred.

The 1974 USGS quad map shows Frost Avenue as a light-duty paved road from Hazelwood Avenue to a point approximately 1,000 foot east of Coldwater Creek. East of this point Frost Avenue is shown as an unimproved dirt road to the intersection with Eva Avenue.

The 1978 USGS quad map shows Frost Avenue as a light-duty paved road from Hazelwood Avenue to a point approximately 1,000 foot east of Coldwater Creek. East of this point Frost Avenue is shown as an unimproved dirt road to the intersection with Eva Avenue.

In the December 22, 1980, aerial photograph contained in the August 1992 EPA Region VII study, the section of Frost Avenue between Graham Road and Hazelwood Avenue is being impacted by the construction of I-170, which is elevated over Frost Avenue. This elevation would have required fill for the overpass being placed on the material next to Frost Avenue. The pavement between Graham Road and Hazelwood Avenue has been widened. The remaining pavement appears unchanged.

In the May 1, 1984, aerial photograph contained in the August 1992 EPA Region VII study, Frost Avenue pavement does not appear to have changed in alignment, width, or pavement type since the 1980 photograph.

In the May 1, 1985, aerial photograph contained in the August 1992 EPA Region VII study, Frost Avenue pavement does not appear to have changed in alignment, width, or pavement type since the 1984 photograph.

In a February 7, 1989 property boundary plat, Frost Avenue, for 800 foot near its intersection with Frost Industrial Court, is shown to have a 40-foot-wide ROW.

In a February 28, 1989 property boundary plat, Frost Avenue between Romiss Court and Jonas Place is shown to be 50 foot wide. Frost Avenue is shown to have ROW monuments.

In a February 23, 1989 property boundary plat, transition from a 50-foot-wide ROW to 40-foot-wide ROW is shown to be 138 foot west of the right-lane line of Romiss Court.

In an April 27, 1989 property boundary plat, Frost Avenue is shown as a 40-foot-wide ROW from the intersection of Eva Avenue to a point 1,958 foot east.

In the April 8, 1990, aerial photograph contained in the August 1992 EPA Region VII study, Frost Avenue pavement does not appear to have changed in alignment, width, or pavement type since the 1985 photograph.

In a January 6, 1995 property boundary plat, Frost Avenue is shown with a 40-foot-wide ROW immediately west of the 50-foot-wide ROW shown on the October 31, 1972 plat.

In a September 23, 1998 boundary survey plat, Frost Avenue is shown to have a 50-foot-wide ROW from Hazelwood Avenue to 1,100 foot west.

In an April 24, 2002, site visit, Frost Avenue was observed to have been recently resurfaced with a 2-inch AC overlay. In this site visit, it was noted that Frost Avenue had curb inlets installed, but no sign of curbs was found. There was some evidence that AC curbs might have existed in the past. If so, this would be evidence that this street is AC pavement. The age of the curb inlets appeared to be consistent with the upgrade of the streets noted in the 1974 aerial photograph.

Summary of Critical Facts

The easternmost 350 foot of Frost Avenue was a paved road connecting Hazelwood Avenue and Graham Road in 1941. At that time Frost Avenue did not extend westward of this intersection. The ROW at that time was 40 foot wide.

A 40-foot ROW for Frost Avenue between Hazelwood Avenue and Eva Avenue was created some time before 1946. The road existed in an unpaved state until at least 1952, when a chip-and-seal pavement was added to a point approximately 1,000 foot east of the east branch of Coldwater Creek.

This pavement would not have prevented direct impact to the material under that pavement. The aerial photographs indicate that these road surfaces failed under the loads imposed on them.

In 1966 the intersection of Frost Avenue and Graham Road was reconstructed, and an additional turn lane was constructed on each side of the existing pavement. The ROW width was increased from 40 to 50 foot by the addition of 10 foot off the south edge of the street. The existing pavement at this time was 30-foot-wide AC pavement.

The road was rehabilitated between 1972 and 1974. Adding a lane to the south widened the section of roadway between Hazelwood Avenue and Romiss Court. New side streets were constructed off Frost Avenue. This is the period during which the curb inlets adjoining this road were installed.

Between 1974 and 1980 the section of road between Graham Road and Jonas Court was reconstructed and widened as part of the construction of I-170.

No anomalies were detected during the December 14, 1984 scan by EPA.

Little or no work appears to have been done on the road from 1980 until the 2002 resurfacing.

Final Conclusions

Based on the information available, all of Frost Avenue was impacted prior to the construction of substantial pavement; therefore, all paved areas should be investigated further.

The original pavement was widened and upgraded several times. Lanes were added near the intersection of Frost Avenue and Graham Road. A lane was added between Graham Road and

Romiss Court. Several side roads and driveways were constructed onto Frost Avenue. Any of these additional driveways might have impacted material beneath them.

The SLAPS to the HISS hauling activities: From 1966 to 1967 Frost Avenue was either an unimproved dirt road or an oil-and-chip surface. It is certain that hauling occurred from the SLAPS to McDonnell Boulevard to Eva Avenue to Frost Avenue to Hazelwood Avenue.

The HISS to West Lake Landfill site: In 1973 Frost Avenue had an AC surface, and this pavement would have protected the material under it.



FIGURE FROST 1.



FLISRAP

ST. LOUIS NORTH COUNTY SITES
NORTH CO. HAUL ROAD ANALYSIS
ST. LOUIS, MO.

DRAWN BY:
J. LOUGH

REV. NO./DATE:
FINAL/01-07-05

A.5 Pavement Evaluation of Hazelwood Avenue

Evaluation of Aerial Photographs and Construction History Information

In the July 29, 1941, aerial photograph contained in the August 1992 EPA Region VII study, Hazelwood Avenue is shown as a hard-surfaced road.

In a December 13, 1950, property boundary survey, Hazelwood Avenue is shown with a ROW of 80 foot.

In a May 20, 1951 property boundary survey, Hazelwood Avenue is shown with a ROW of 80 foot.

In the September 11, 1953, aerial photograph contained in the August 1992 EPA Region VII study, the Hazelwood Avenue pavement does not appear to have changed in alignment, width, or pavement type since the 1941 photograph.

The 1954 USGS quad map based on a 1952 aerial photograph shows Hazelwood Avenue as a light-duty paved road.

In an October 17, 1955 property boundary survey, Hazelwood Avenue is shown with a ROW of 80 foot.

In the September 11, 1958, aerial photograph contained in the August 1992 EPA Region VII study, the Hazelwood Avenue pavement does not appear to have changed in alignment, width, or pavement type since the 1953 photograph.

In a September 30, 1960, property boundary survey, Hazelwood Avenue is shown with a ROW of 80 foot.

In the October 10, 1965, aerial photograph contained in the August 1992 EPA Region VII study, the Hazelwood Avenue pavement does not appear to have changed in alignment, width, or pavement type since the 1958 photograph.

The 1968 USGS quad map shows Hazelwood Avenue as a light-duty paved road from Graham Road to Pershall Road.

In the May 4, 1971, aerial photograph contained in the August 1992 EPA Region VII study, the Hazelwood Avenue pavement does not appear to have changed in alignment, width, or pavement type since the 1965 photograph.

In a July 19, 1971 property boundary survey, Hazelwood Avenue is shown with a ROW of 80 foot.

In an August 13, 1971, property boundary survey, Hazelwood Avenue is shown with a ROW of 80 foot.

In an October 1, 1973, property boundary survey, Hazelwood Avenue is shown with a ROW of 80 foot.

In the May 6, 1974, aerial photograph contained in the August 1992 EPA Region VII study, the Hazelwood Avenue pavement does not appear to have changed in alignment, width, or pavement type since the 1971 photograph.

The 1974 USGS quad map shows Hazelwood Avenue from Pershall Road to Graham Road as a light-duty paved road.

In 1978, the southernmost 550 foot of pavement were demolished and realigned as part of construction activities for I-170. Some of this realigned pavement is over impacted material.

In 1978 the northernmost 250 foot of pavement were demolished and realigned as part of construction activities for I-170. Some of this realigned pavement is over impacted material.

In the December 22, 1980, aerial photograph contained in the August 1992 EPA Region VII study, the southernmost 450 foot (approximately) of Hazelwood Avenue have been removed for the construction of I-170. New pavement has been constructed from Frost Avenue to Seeger Court Road. The remaining portion of the pavement does not appear to have changed in alignment, width, or pavement type since the 1974 photograph.

In the May 1, 1984, aerial photograph contained in the August 1992 EPA Region VII study showing Hazelwood Avenue, the pavement does not appear to have changed in alignment, width, or pavement type since the 1980 photograph.

Anomalies were detected during the December 14, 1984, scan by EPA.

In an April 27, 1989 property boundary survey, Hazelwood Avenue is shown with a ROW of 80 foot.

In the May 1, 1985, aerial photograph contained in the August 1992 EPA Region VII study, the Hazelwood Avenue pavement does not appear to have changed in alignment, width, or pavement type since the 1984 photograph.

In the April 8, 1990, aerial photograph contained in the August 1992 EPA Region VII study, the Hazelwood Avenue pavement does not appear to have changed in alignment, width, or pavement type since the 1985 photograph.

In May 12, 1993, property boundary survey, Hazelwood Avenue is shown with a ROW of 80 foot.

Many additional property boundary drawings also show the Hazelwood Avenue ROW to be 80 foot wide.

On a February 23, 2002, site visit, the pavement on Hazelwood Avenue was noted to be very thick AC pavement. One pothole was noted to be approximately 8 to 10 inches deep through at least three layers of AC to an AC layer on the bottom. No signs of any expansion-joint pattern were noted; however, irregular shrinkage cracks were common, as well as areas in which the pavement is alligatored, indicating structural failure of the pavement. The conclusion drawn from this evidence is that Hazelwood Avenue does not contain a PCC concrete base, but is a full-depth AC pavement. The AC base that existed prior to operations at the SLAPS and the HISS would have been substantial enough to protect the materials underneath from direct impacts.

Summary of Critical Facts

An 80-foot ROW for Hazelwood Avenue was created some time before 1940.

A two-lane, bituminous concrete surface existed within this ROW prior to any activities at the SLAPS or the HISS. This AC surface was substantial enough to protect the underlying material from direct impacts.

There is a railroad spur crossing of Hazelwood Avenue between the intersection of Hazelwood and Latty avenues and the intersection of Hazelwood and Nyflot avenues. There is no reason to expect that railcars loaded with residue from the HISS would have used this crossing. However it is certain that haulage from the SLAPS to the HISS would have gone over this crossing. It is likely that additional material may have fallen off of the trucks on and near the railroad tracks.

Except for the southern 450 foot and the northern 250 foot of the alignment that were removed and replaced as part of the construction of I-170, most of this pavement remains in much the same configuration as in the 1940s. Impacts could have occurred along the removed section and under the realigned sections.

Final Conclusions

Based on the information available, approximately 9 foot on each side of the existing centerline has been covered with a hard-surface pavement since before activities began at the SLAPS and the HISS. All other material beneath entrances off Hazelwood Avenue was impacted prior to being paved; therefore, material beneath all entrances onto Hazelwood Avenue should be subjected to further investigation.

Hazelwood Avenue, from Dunn Road to Frost Avenue, was paved with a narrow AC surface prior to 1966. This surface protected the underlying material from direct impact, so it does not need to be subjected to further investigation. The southern 450 foot and the northern 250 foot of the alignment were obliterated and realigned as part of the construction of I-170 in the late 1970s. Some of the material beneath the southernmost 450 foot and the northernmost 250 foot of Hazelwood Avenue might be impacted and should be subjected to further investigation.

North St. Louis County Haul Road Analysis and Justification for Additional Investigation-Evaluation of
Inaccessible Materials Beneath Pavements

The SLAPS to the HISS hauling activities: From 1966 to 1967 Hazelwood Avenue was a two-lane, medium-duty paved roadway. It is certain that hauling from the SLAPS to the HISS used Hazelwood Avenue as a hauling road.

The HISS to West Lake Landfill site: In 1973 Hazelwood Avenue had an AC surface, and this pavement would have protected the material under it. It is certain that this activity used Hazelwood Avenue as a hauling road.

MATCH LINE PERSHALL 6

MATCH LINE PERSHALL 9

MATCH LINE PERSHALL 5

MATCH LINE HAZELWOOD 1

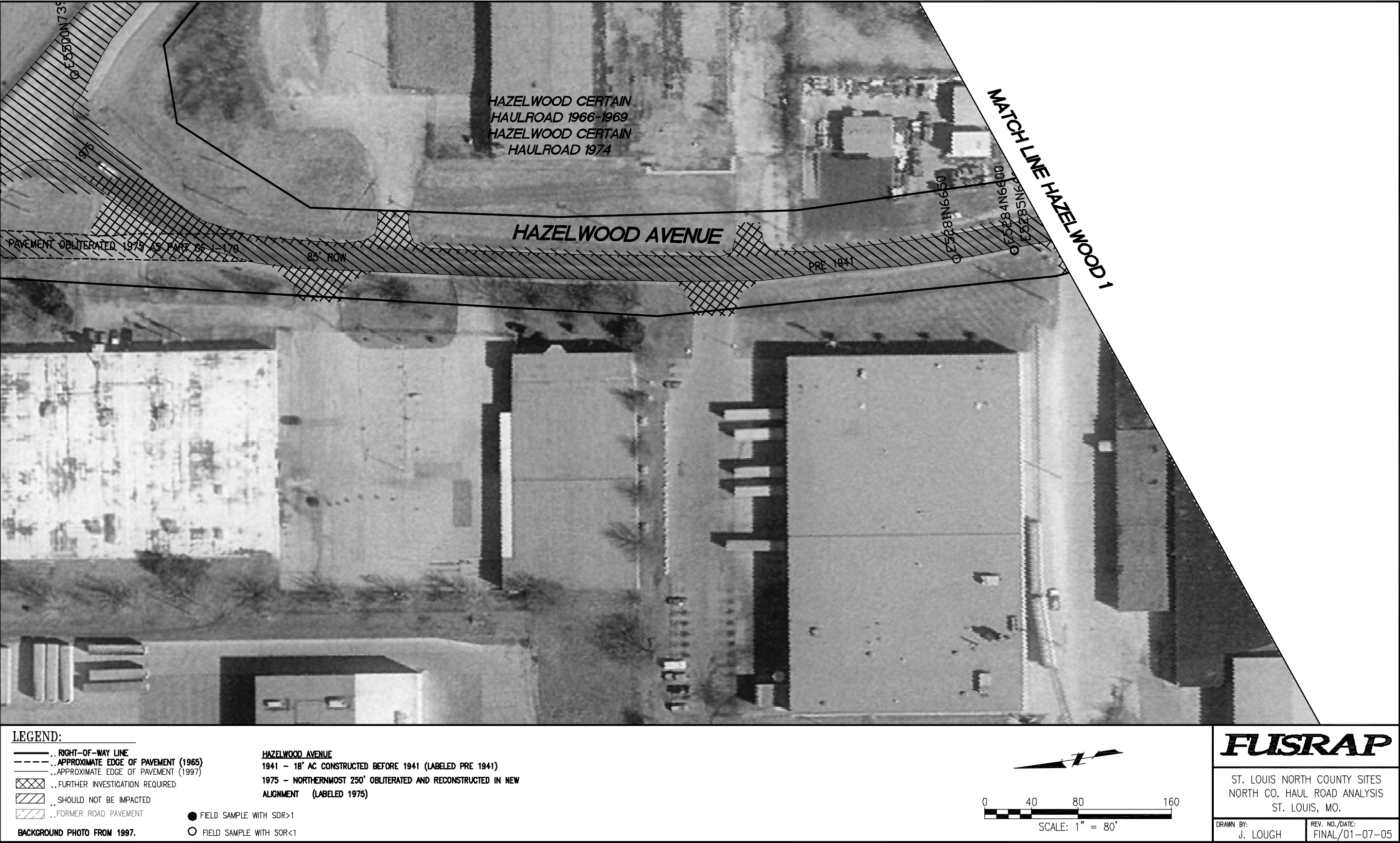
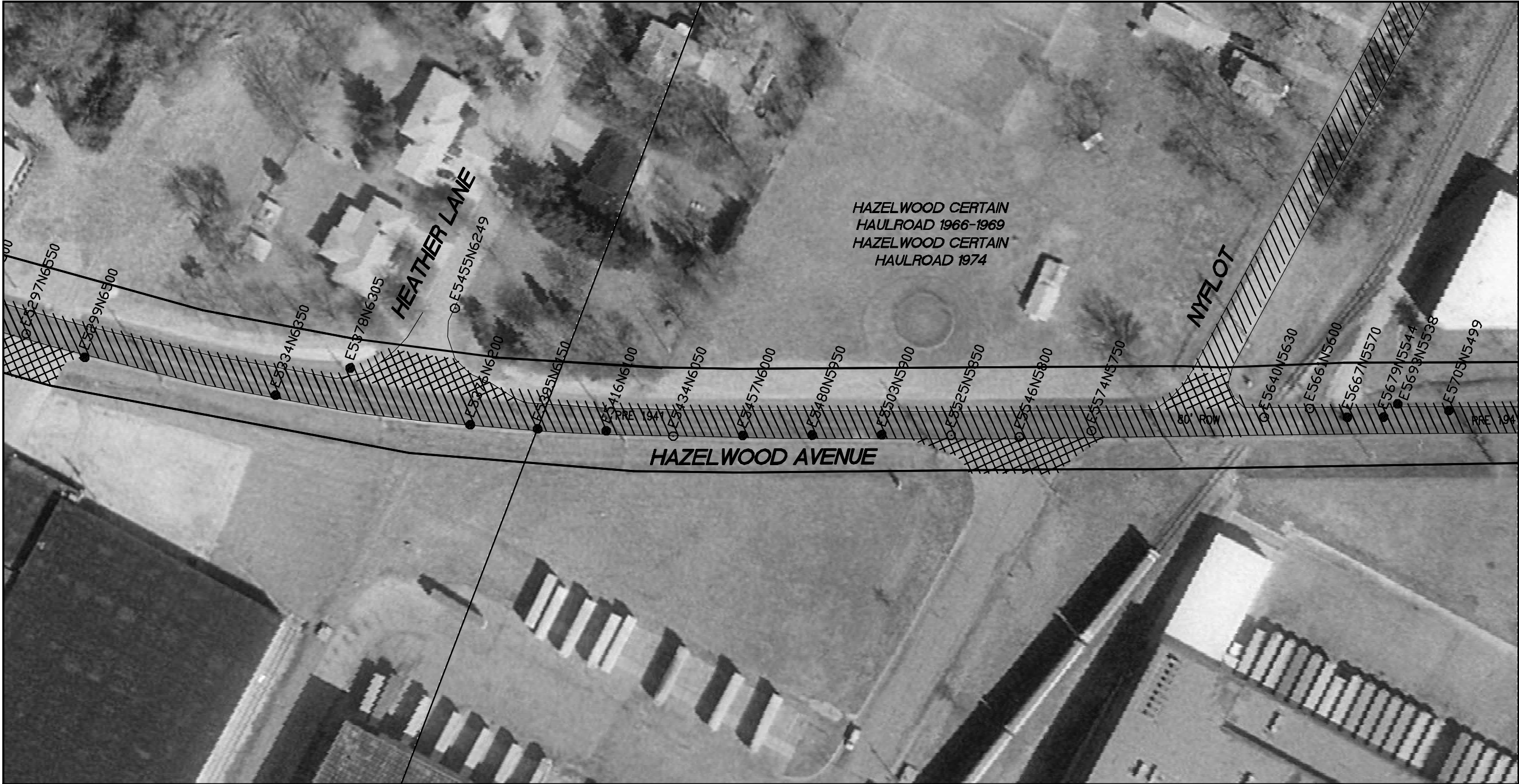


FIGURE HAZELWOOD 1.

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MATCH LINE HAZELWOOD 1



MATCH LINE HAZELWOOD 2

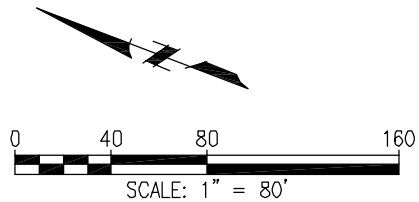
LEGEND:

- RIGHT-OF-WAY LINE
- - - APPROXIMATE EDGE OF PAVEMENT (1965)
- - - APPROXIMATE EDGE OF PAVEMENT (1997)
- XXXX FURTHER INVESTIGATION REQUIRED
- XXXX SHOULD NOT BE IMPACTED
- XXXX FORMER ROAD PAVEMENT

HAZELWOOD AVENUE
1941 - 18' AC CONSTRUCTED BEFORE 1941 (LABELED PRE 1941)

- FIELD SAMPLE WITH SOR>1
- FIELD SAMPLE WITH SOR<1

BACKGROUND PHOTO FROM 1997.



FUSRAP

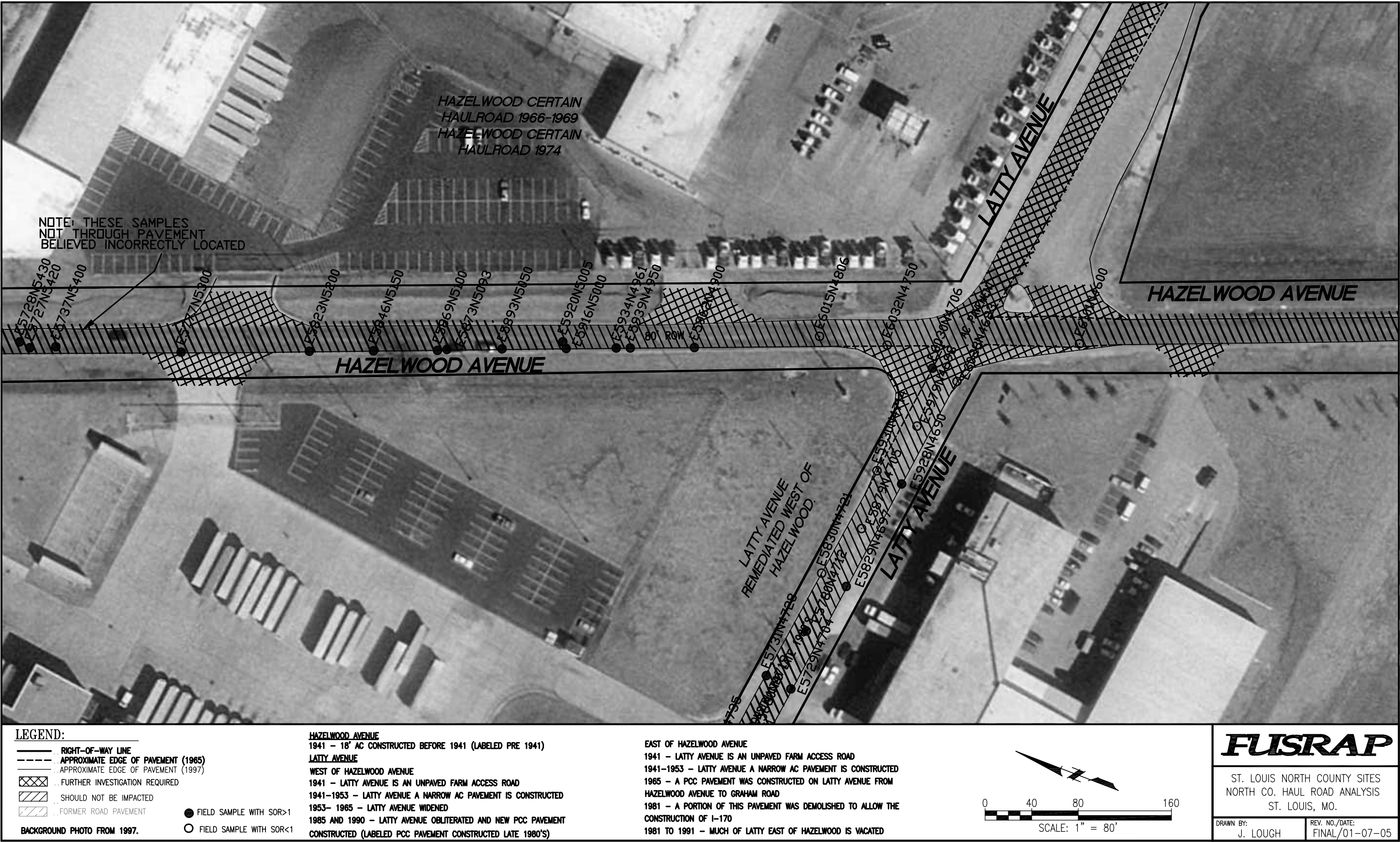
ST. LOUIS NORTH COUNTY SITES
NORTH CO. HAUL ROAD ANALYSIS
ST. LOUIS, MO.

DRAWN BY:
J. LOUGH

REV. NO./DATE:
FINAL/01-07-05

FIGURE HAZELWOOD 2.

MATCH LINE HAZELWOOD 2



MATCH LINE HAZELWOOD 4

FIGURE HAZELWOOD 3.

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MATCH LINE HAZELWOOD 3

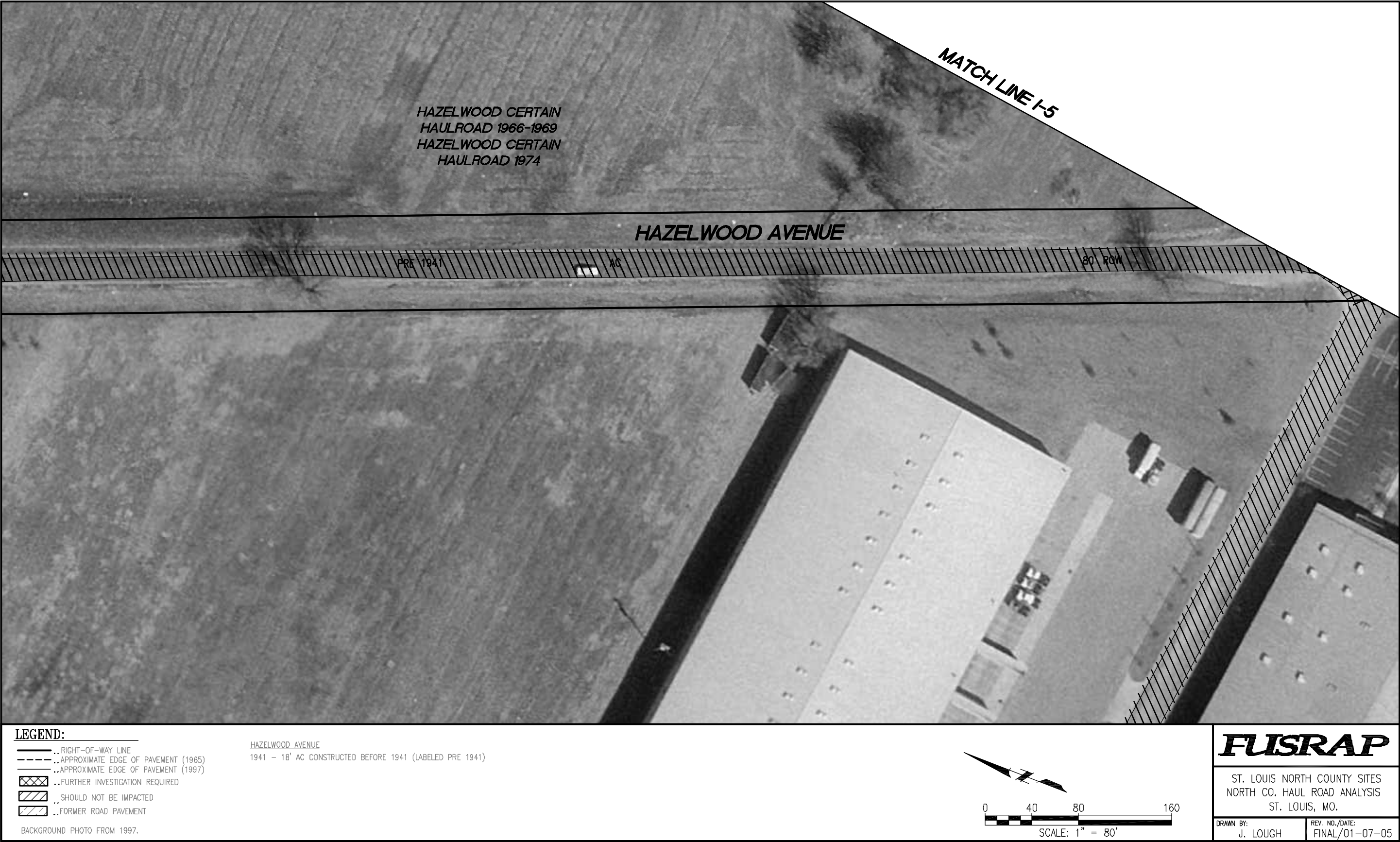


FIGURE HAZELWOOD 4.

A.6 Pavement Evaluation of Latty Avenue

Evaluation of Aerial Photographs and Construction History Information – West of Hazelwood Avenue

In the July 29, 1941, aerial photograph contained in the August 1992 EPA Region VII study, Latty Avenue is not shown. There is a farm access road leading to a single farmstead off Hazelwood Avenue in approximately the same location. The road shown does not have a hard-surface pavement.

In a December 13, 1950, property boundary plat, the Latty Avenue ROW is shown as being 40 foot wide.

In the September 11, 1953, aerial photograph contained in the August 1992 EPA Region VII study, some industrial facilities have been constructed on the future HISS property, and an access road exists within the Latty Avenue alignment. This road was constructed some time between 1941 and 1953. It appears to be very narrow and with a bituminous surface of either oil and chip or AC.

The 1954 USGS quad map based on a 1952 aerial photograph shows Latty Avenue west of Hazelwood Avenue as a light-duty road. Latty Avenue east of Hazelwood Avenue is shown as an unimproved dirt road.

In the September 11, 1958, aerial photograph contained in the August 1992 EPA Region VII study, Latty Avenue appears much the same as in the 1953 photograph. Wider aggregate shoulders have been added to the bituminous pavement.

In a September 30, 1960, property boundary plat, the Latty Avenue ROW is shown as being 40 foot wide.

In a May 20, 1964, property boundary plat, the Latty Avenue ROW is shown as being 40 foot wide. Latty Avenue is also shown extending past Coldwater Creek.

In the October 10, 1965, aerial photograph contained in the August 1992 EPA Region VII study, Latty Avenue appears much the same as in the 1958 photograph.

The 1968 USGS quad map shows Latty Avenue as a light-duty paved road from Hazelwood Avenue west to the HISS site. Some structures are shown on both the SLAPS and the HISS.

In the May 4, 1971, aerial photograph contained in the August 1992 EPA Region VII study, Latty Avenue appears much the same as in the 1965 photograph. Additional road entrances have been constructed off Latty Avenue to the north and south. Additional industrial facilities have been constructed that are served by Latty Avenue.

In August 13, 1971, property boundary plat, the Latty Avenue ROW is shown as being 40 foot wide.

In September 1, 1972, Graham Road construction plans, Latty Avenue is shown as having a 50-foot ROW. Existing pavement is shown as being 32-foot-wide AC pavement at the intersection with Graham Road.

In an October 1, 1973, property boundary survey, the Latty Avenue ROW is shown as being 40 foot wide and having a 5-foot-wide strip dedicated for highway purposes added to the north side, for a total width of 45 foot.

In the May 6, 1974, aerial photograph contained in the August 1992 EPA Region VII study, Latty Avenue appears much the same as in the 1971 photograph.

In the December 22, 1980, aerial photograph contained in the August 1992 EPA Region VII study, Latty Avenue pavement does not appear to have changed in alignment, width, or pavement type since the 1974 photograph.

In the May 1, 1984, aerial photograph contained in the August 1992 EPA Region VII study, Latty Avenue pavement does not appear to have changed in alignment, width, or pavement type since the 1980 photograph.

In 1984 the DOE authorized the removal of residues from the HISS and along the roadway. Road shoulders were released for unrestricted use so that the cities of Berkeley and Hazelwood could proceed with plans for road and drainage improvements. The AC pavement was removed and the material underneath subjected to remedial action. A new PCC pavement was then constructed in its place.

In the May 1, 1985, aerial photograph contained in the August 1992 EPA Region VII study, Latty Avenue pavement does not appear to have changed in alignment, width, or pavement type since the 1984 photograph.

In the April 8, 1990, aerial photographs contained in the August 1992 EPA Region VII study, Latty Avenue pavement does not appear to have changed in alignment, width, or pavement type since the 1985 photographs.

In a July 9, 1992, property boundary plat, the Latty Avenue ROW is shown as vacated by Ordinance No. 2121-88, Bill No. 2180, between I-170 and Hazelwood Avenue.

In April 24, 2002, site visit, it was noted that Latty Avenue currently has a good PCC pavement less than 20 years old.

Evaluation of Aerial Photographs and Construction History Information – East of Hazelwood Avenue

In the July 29, 1941, aerial photograph contained in the August 1992 EPA Region VII study, Latty Avenue is not shown. There is a field line in approximately the same location.

In a December 13, 1950, property boundary plat, the Latty Avenue ROW is shown as being 40 foot wide.

In the September 11, 1953, aerial photograph contained in the August 1992 EPA Region VII study, a farm access road has been constructed from Hazelwood Avenue to Graham Road. This road does not have a hard surface.

In the September 11, 1958, aerial photograph contained in the August 1992 EPA Region VII study, Latty Avenue appears much the same as in the 1953 photograph.

In a September 30, 1960, property boundary plat, the Latty Avenue ROW is shown as being 40 foot wide.

In a May 20, 1964, property boundary plat, Latty Avenue is shown as being 40 foot wide. Latty Avenue is also shown extending past Coldwater Creek.

In the October 10, 1965, aerial photograph contained in the August 1992 EPA Region VII study, Latty Avenue is in the process of being reconstructed. A hard-surface pavement is being constructed or rehabilitated. The surface appears to be concrete.

The 1968 USGS quad map shows Latty Avenue from Hazelwood Avenue to Graham Road as an unimproved dirt road. (This is incorrect; the 1966 construction must have been missed in the map update.)

In the May 4, 1971, aerial photograph contained in the August 1992 EPA Region VII study, the PCC pavement appears to have been completed from Hazelwood Avenue to Graham Road.

In an August 13, 1971, property boundary plat, Latty Avenue is shown as being 40 foot wide.

In September 1, 1972, Graham Road construction plans, Latty Avenue is shown as having a 50-foot-wide ROW. Existing pavement is shown as being 32 foot PCC wide with rolled curbs at the junction with Graham Road.

In an October 1, 1973, property boundary survey, Latty Avenue is shown as being 40 foot wide and having a 5-foot-wide strip dedicated for highway purposes added to the north side, for a total width of 45 foot.

In the May 6, 1974, aerial photograph contained in the August 1992 EPA Region VII study, Latty Avenue appears much the same as in the 1971 photograph.

The 1974 USGS quad map shows Latty Avenue from Hazelwood Avenue to Graham Road as an unimproved dirt road. (This is not correct.)

In the December 22, 1980, aerial photograph contained in the August 1992 EPA Region VII study, 1-170 construction has removed approximately 300 foot of Latty Avenue. The remaining pavement does not appear to have changed in alignment, width, or pavement type since the 1974 photograph.

In the May 1, 1984, aerial photograph contained in the August 1992 EPA Region VII study, Latty Avenue pavement does not appear to have changed in alignment, width, or pavement type since the 1980 photograph.

In the May 1, 1985, aerial photograph contained in the August 1992 EPA Region VII study, Latty Avenue pavement does not appear to have changed since the 1984 photograph.

In the April 8, 1990, aerial photograph contained in the August 1992 EPA Region VII study, Latty Avenue pavement does not appear to have changed in alignment, width, or pavement type since the 1985 photograph.

Summary of Critical Facts – West of Hazelwood Avenue

A 40-foot ROW for Latty Avenue was created some time before 1950.

An access road was created some time prior to 1953, to access industrial facilities near the future HISS property. This road appears to have been very narrow but paved.

Some time between 1953 and 1958, the road was widened, probably with aggregate shoulders.

Some time between 1985 and 1990, the road was rehabilitated and reconstructed as a concrete pavement. An additional 5 foot of ROW was dedicated on the north side. This section of road was subjected to remedial action at this time.

Little or no work appears to have been done after the 1990s.

Summary of Critical Facts – East of Hazelwood Avenue

A 40-foot ROW for Latty Avenue was created some time before 1950.

A farm access road was constructed on this alignment some time between 1941 and 1950 connecting Hazelwood Avenue and Graham Road.

In 1965 a PCC concrete surface was placed on this portion of the roadway.

Some time between 1971 and 1973, a section of this street was demolished to allow construction of I-170.

Some time prior to 1992 the section between Hazelwood Avenue and Graham Road was vacated, although this section of concrete pavement remains in place.

The HISS to Colorado residue hauling by railroad: It is certain that railroad tracks crossing and near the HISS were used to haul residue. Haulage from the HISS by railroad car would have used the lead track (a lead track is an industrial spur that services multiple properties). Loaded and unloaded cars may have been staged on these tracks. This haulage activity may have impacted the adjoining road ROW and that this impacted material may have been since paved.

Final Conclusions – East of Hazelwood Avenue

Latty Avenue west of North Hanley Road and east of Hazelwood Avenue: A narrow AC pavement was constructed on Latty Avenue prior to 1966. This pavement was used for hauling residue, directly affecting the adjoining area and pavement. This impact was confirmed by field test results. This pavement should be further investigated. A portion of the Latty Avenue ROW, that portion between I-170 and Hazelwood Avenue, has been vacated and some of the pavement under what is now I-170 has been obliterated.

Final Conclusion – West of Hazelwood Avenue

West of Hazelwood and Latty avenues was reconstructed and subjected to remedial action in 1984 and 1985. Because this section of road has since been tested and found to be acceptable, there is no need to further investigate materials under this pavement.

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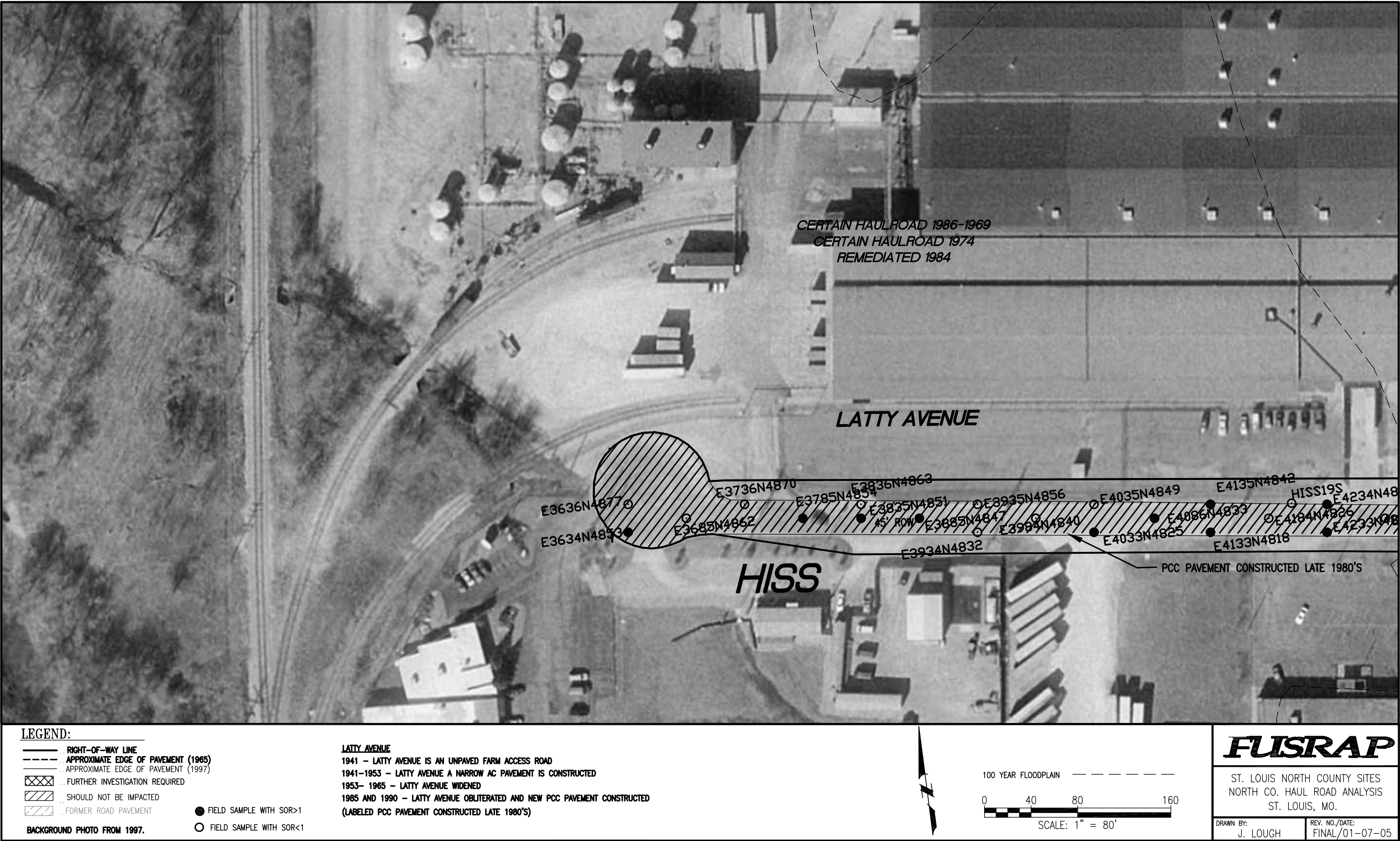


FIGURE LATTY 1.

MATCH LINE LATTY 2

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MATCH LINE LATTY 1

MATCH LINE HAZEL WOOD 3

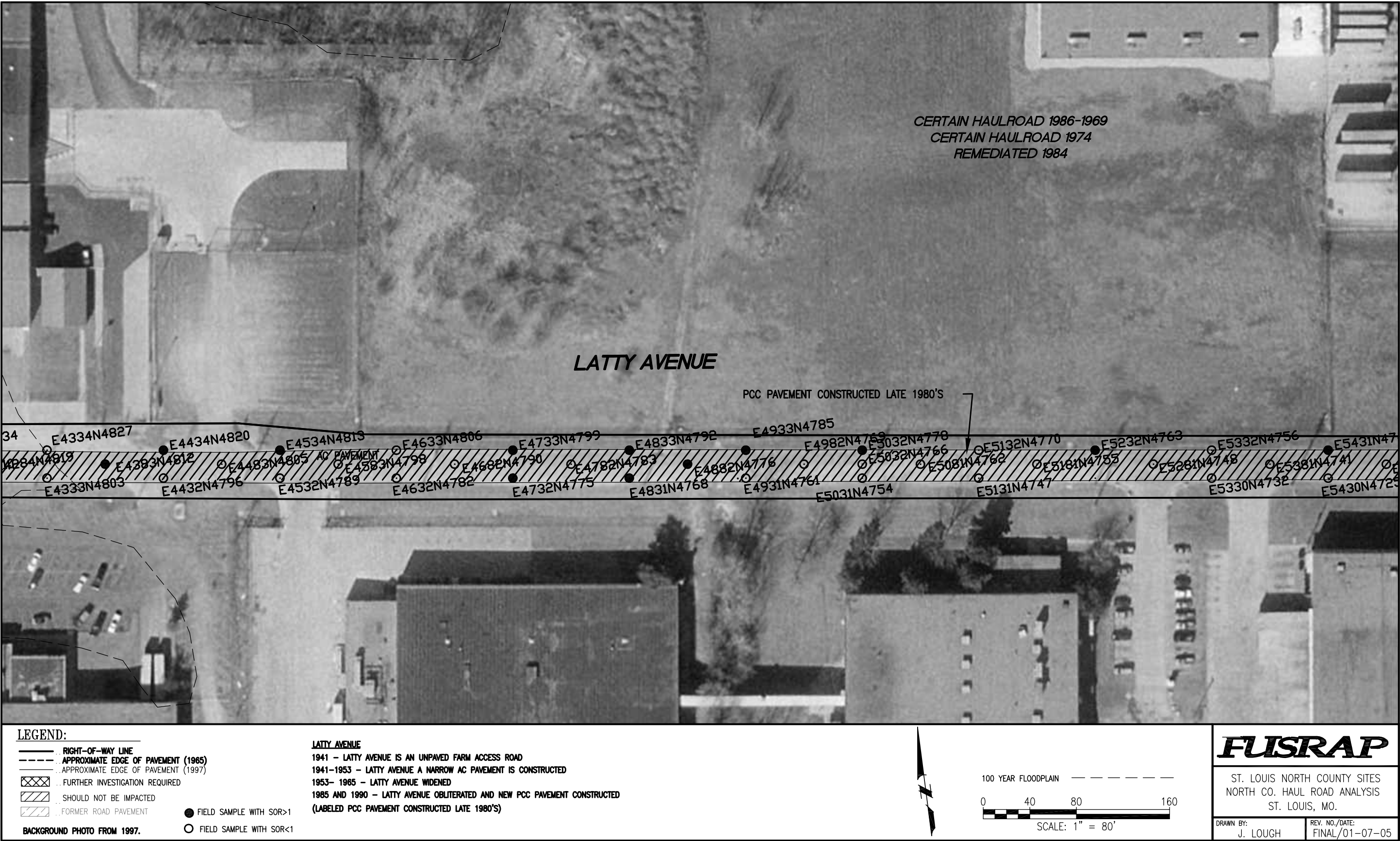


FIGURE LATTY 2.

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MATCH LINE HAZELWOOD 3

MATCH LINE HANLEY 3

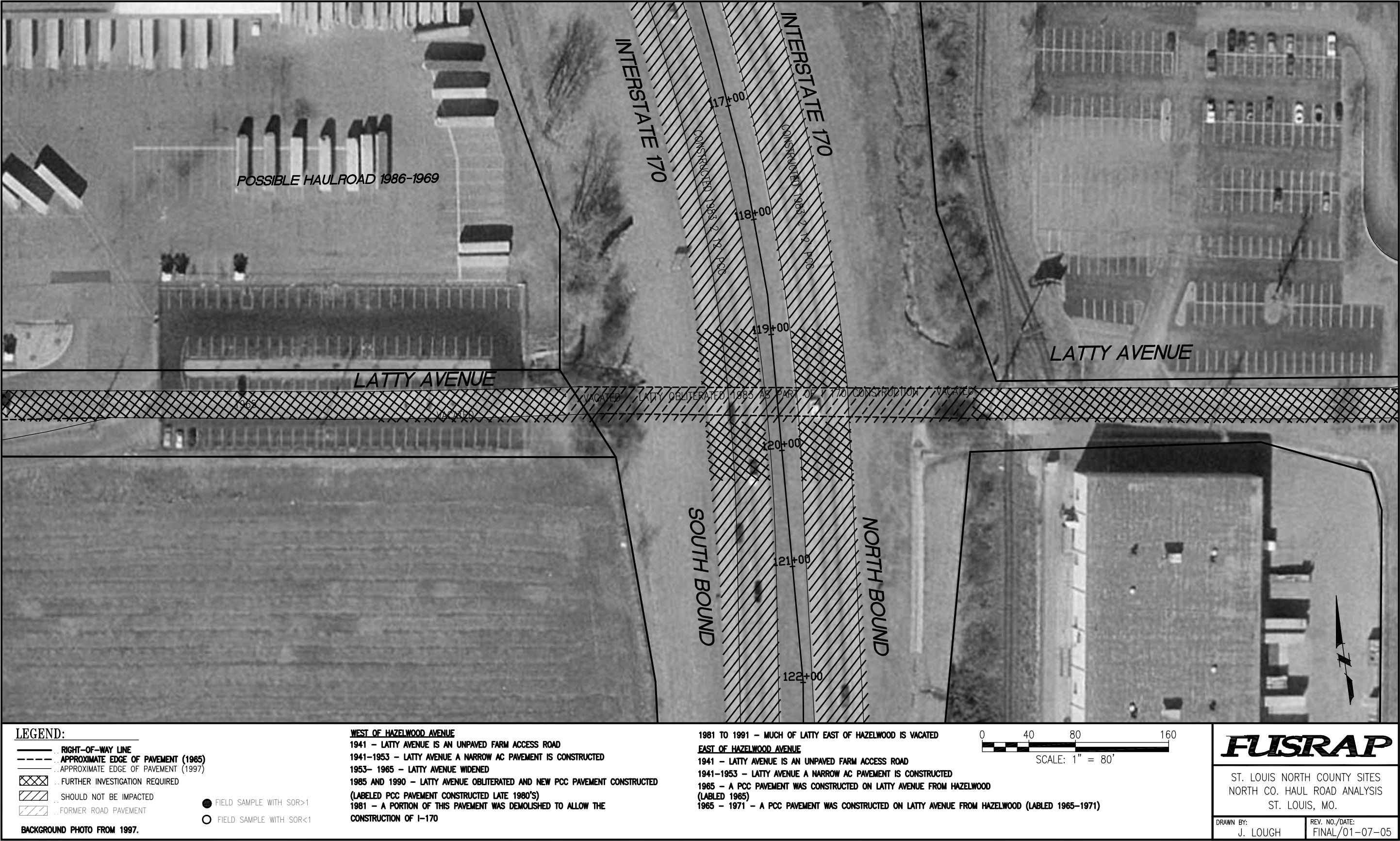


FIGURE LATTY 3.

A.7 Pavement Evaluation of I-170

Background Information

Some reference stations along I-170 are as follows:

- The intersection of I-170 and Pershall Road is Station 94+25.
- The intersection of I-170 and Frost Avenue is Station 134+61.
- The intersection of I-170 and Airport Road is Station 182+93.52, which is Station 25+05 Airport Road.

City of Berkeley and Hazelwood municipal boundary is Station 126+25.

I-170 was constructed as follows:

- 1979: grading for Stations 94+25 to 227+00.
- 1981: construction from Station 94+25 to 102+77.74 of two lanes of 24 foot of PCC with no median present in this section.
- 1981: construction of intersection with I-270.
- 1983: construction of Station 102+77.74 to 148+09 using 24 foot of PCC and divided by a median.
- 1983: construction from Station 148+09 to 150+28 using 24 foot of PCC southbound and 36 foot of PCC northbound and divided by a median.
- 1983: construction from Station 150+28 to 159+04 of two lanes using 36 foot of PCC with no median present in this section.
- 1983: construction from Station 159+04 to 182+94 of two lanes using 36 foot of PCC and divided by a median.

This information was taken from MoDOT pavement history drawing “St. Louis 096 Sheet 8 of 31.”

In 1991 I-170 was reconstructed as follows:

- added 12 foot of PCC southbound from Station 146+00 to 150+28.
- added 24 foot of PCC southbound from Station 150+28 to 167+06.
- added 12 foot of PCC southbound from Station 167+06 to 178+48.

- added 12 foot of PCC southbound from Station 178+48 to 182+94.

This information was taken from MoDOT pavement history drawing “St. Louis 096 Sheet 8 of 31.”

Evaluation of Construction History Information

In 2002 the intersection of I-170 and I-270 was being reconstructed. This area had been extensively disturbed in the construction of both I-270 and I-170. Pershall Road was originally constructed in 1962 and was relocated between 1979 and 1983 as part of the construction of I-170. In general I-170 was constructed as an elevated highway. The former alignments of Hazelwood Avenue and Latty Avenue are beneath approximately 25 foot of fill.

The ROW for I-170 varies in width; however, because it is a highway constructed to federal interstate standards, the ROW should be fenced or otherwise marked in the field.

Much of the other information about the construction of I-170 has been discussed in other appendices in reference to other roadways.

Summary of Critical Facts

Most of I-170 and its upgrades were constructed between 1979 and 1983, after hauling operations between the SLAPS and the HISS are believed to have ceased. The I-170 alignment does not follow any pre-existing roadway alignment that would have provided a source of possible impacts. There is little risk of direct impacts beneath the existing pavements except in those locations in which I-170 (a north-south alignment) obliterated an older east-west road alignment of a road potentially formerly used for hauling operations.

Portions of the former alignments of Latty Avenue, Graham Road, and Hazelwood Avenue have been covered by I-170. Impacted materials from these former alignments could be beneath approximately 25 foot of fill.

Final Conclusions

Based on the information available, there is little risk that materials beneath I-170 pavement were impacted except in those areas in which I-170 obliterated older pavements; therefore, only those paved areas near the previously existing alignments should be subjected to further investigation. Those areas are as follows:

- former Hazelwood Avenue crossing: further investigation needed of I-170 Station 136+00 to 137+00.
- former Latty Avenue crossing: further investigation needed of I-170 Station 119+00 to 121+00.

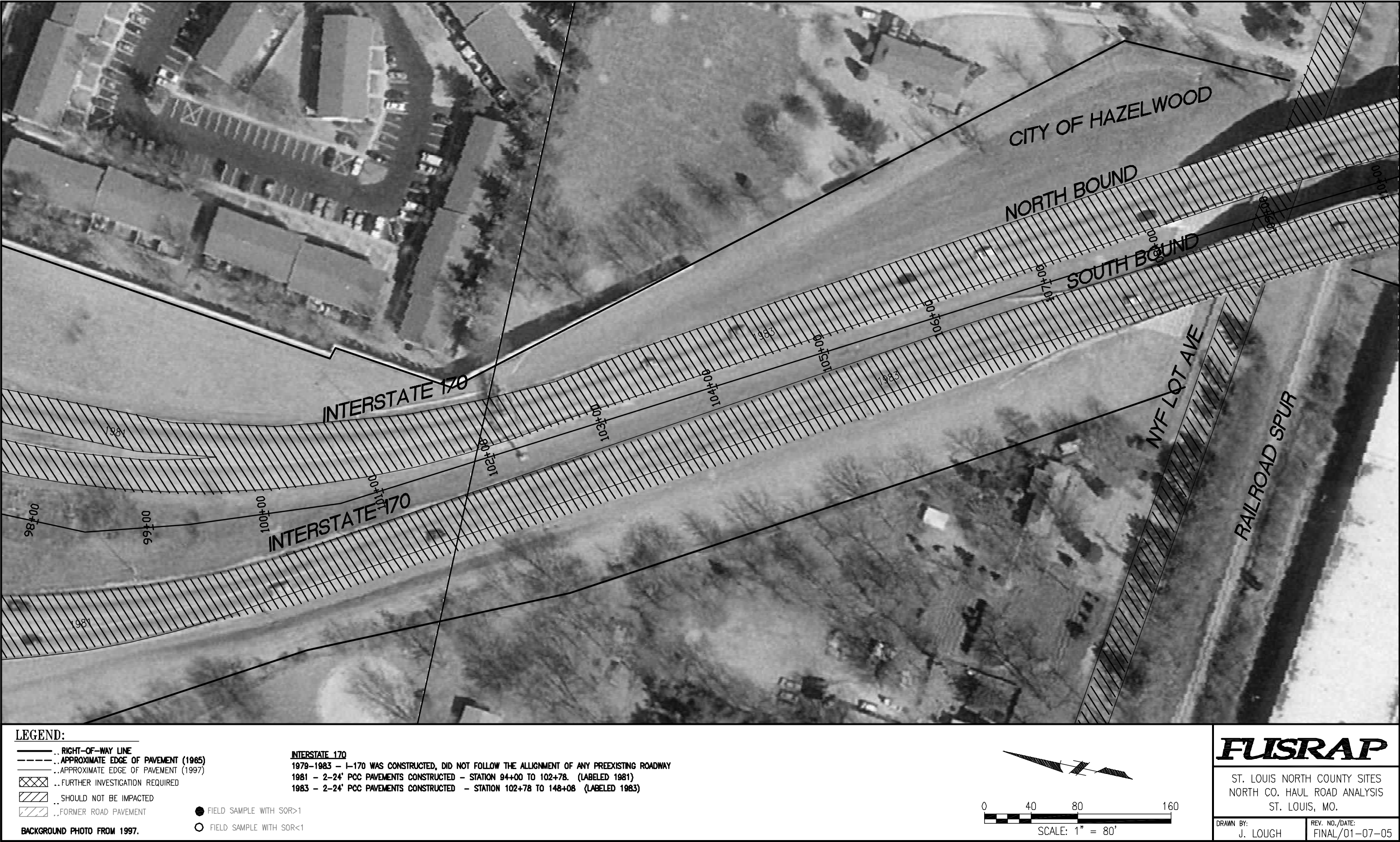
- former Hanley Road area: further investigation needed of I-170 Station 173+00 to 183+00.

Interstate 170 was constructed over the former location of portions of Latty Avenue, Hazelwood Avenue, Graham Road, and the I-270 south outer road (Pershall Road). These roads were obliterated and the new I-170 pavement constructed above their original locations. The material beneath the I-170 pavements near the older alignments is over impacted material. The remaining portion of I-170 is not over impacted material and does not need to be subjected to further investigation. There is no evidence that any hauling of residue has occurred on I-170.

I-170 also crosses over several rail lines. A plan for investigating rail lines within the North St. Louis County sites will be developed and subsequently be coordinated with regulators (e.g., Missouri Department of Natural Resources).

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MATCH LINE PERSHALL 8



MATCH LINE I-2

FIGURE I-1.

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MATCH LINE I-2

MATCH LINE I-4

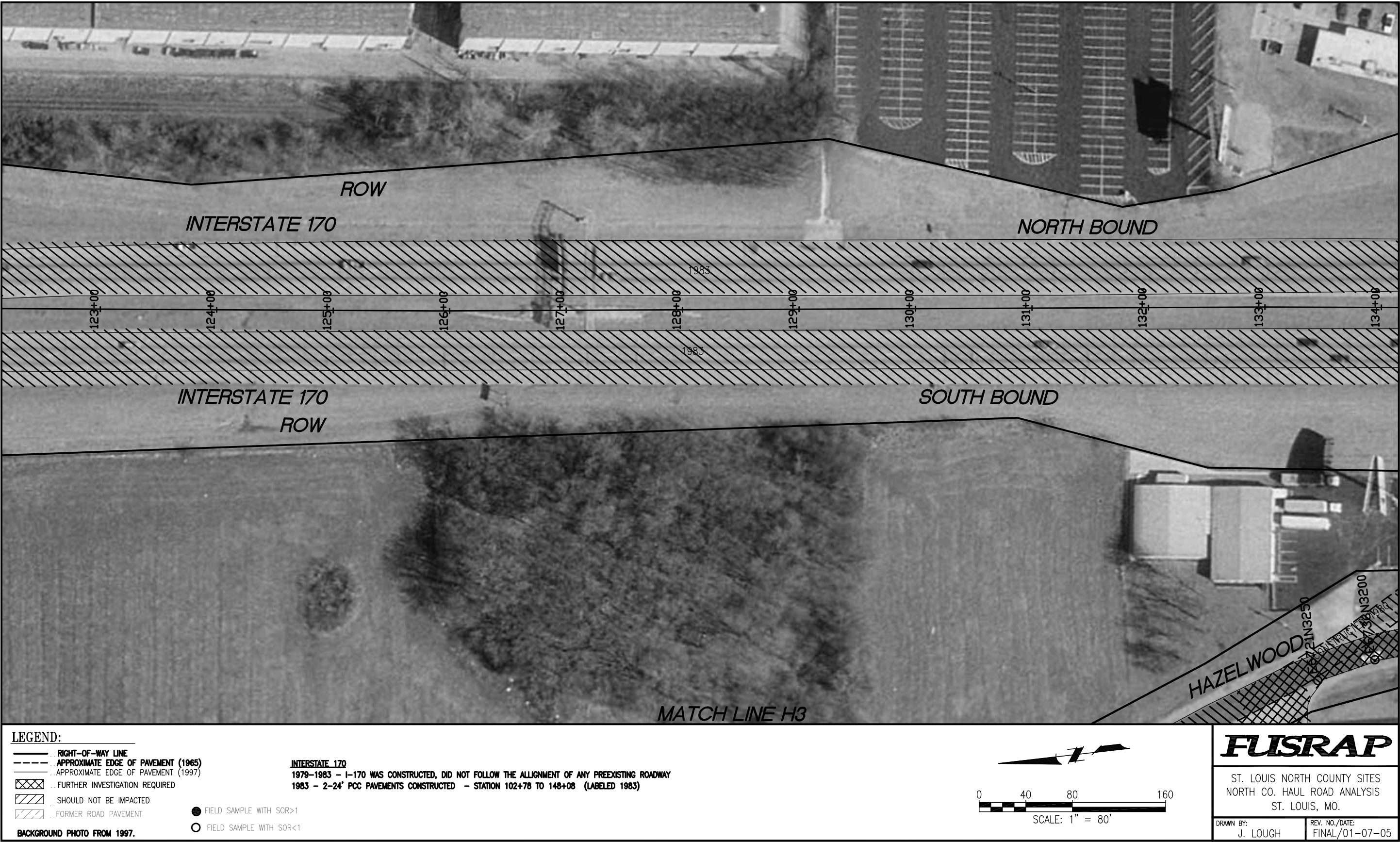


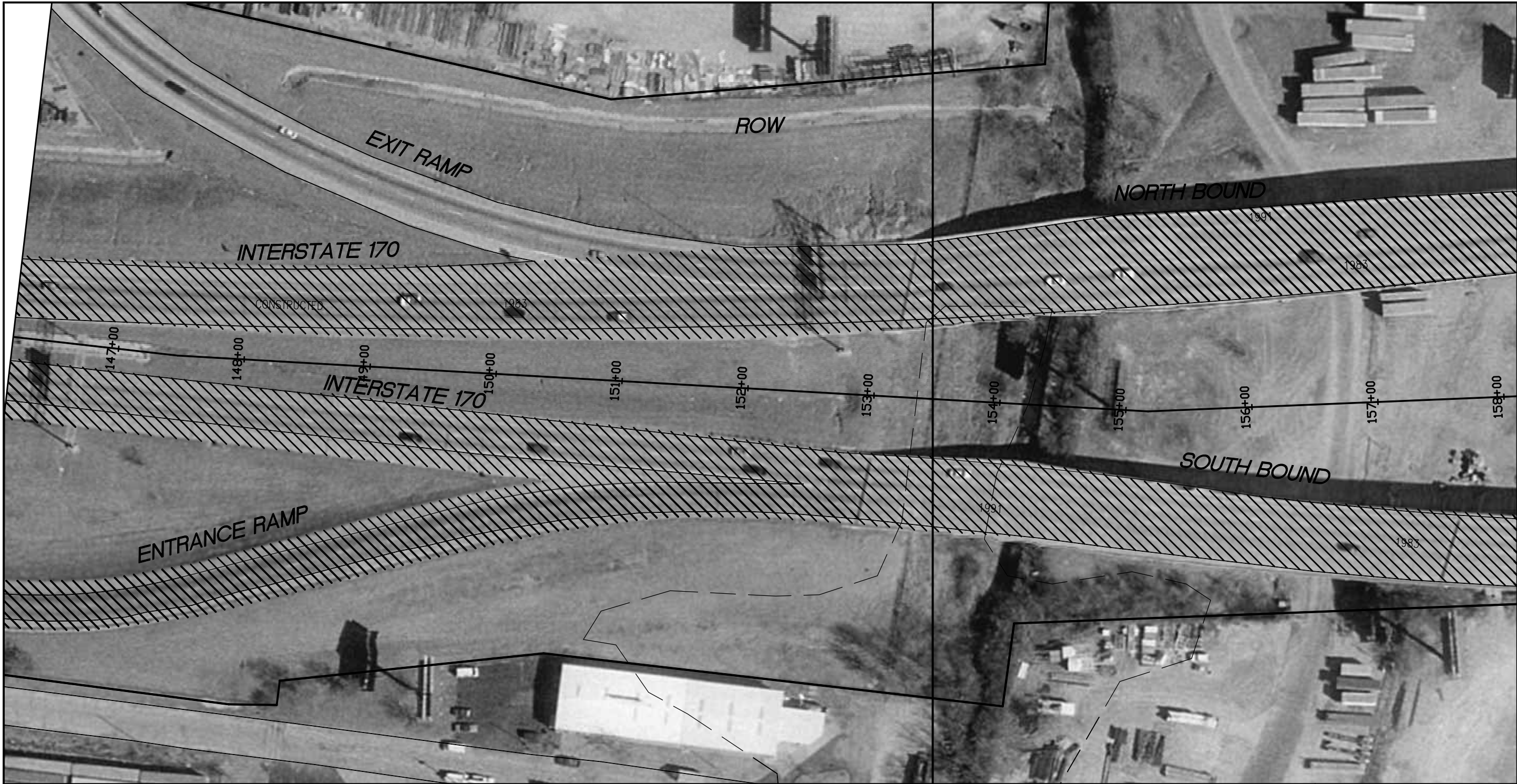
FIGURE I-3.



FIGURE 1-4.

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MATCH LINE I-4

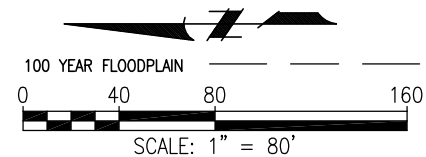


MATCH LINE I-6

LEGEND:

- RIGHT-OF-WAY LINE
 - - - APPROXIMATE EDGE OF PAVEMENT (1965)
 - - - APPROXIMATE EDGE OF PAVEMENT (1997)
 - XXXX FURTHER INVESTIGATION REQUIRED
 - SHOULD NOT BE IMPACTED
 - FORMER ROAD PAVEMENT
 - FIELD SAMPLE WITH SOR>1
 - FIELD SAMPLE WITH SOR<1
- BACKGROUND PHOTO FROM 1997.

INTERSTATE 170
1979-1983 - I-170 WAS CONSTRUCTED, DID NOT FOLLOW THE ALIGNMENT OF ANY PREEXISTING ROADWAY
1983 - 2-24' PCC PAVEMENTS CONSTRUCTED - STATION 102+78 TO 148+08 (LABELED 1983)
1983 - 24' PCC SB, 36' NB - STATION 148+09 TO 150+28
1983 - 2-36' PCC PAVEMENTS CONSTRUCTED - STATION 150+28 TO 182+94 (LABELED 1983)
1991 - 12' PCC LANES ADDED - STATION 150+28 TO 167+05 (LABELED 1991)



FUSRAP

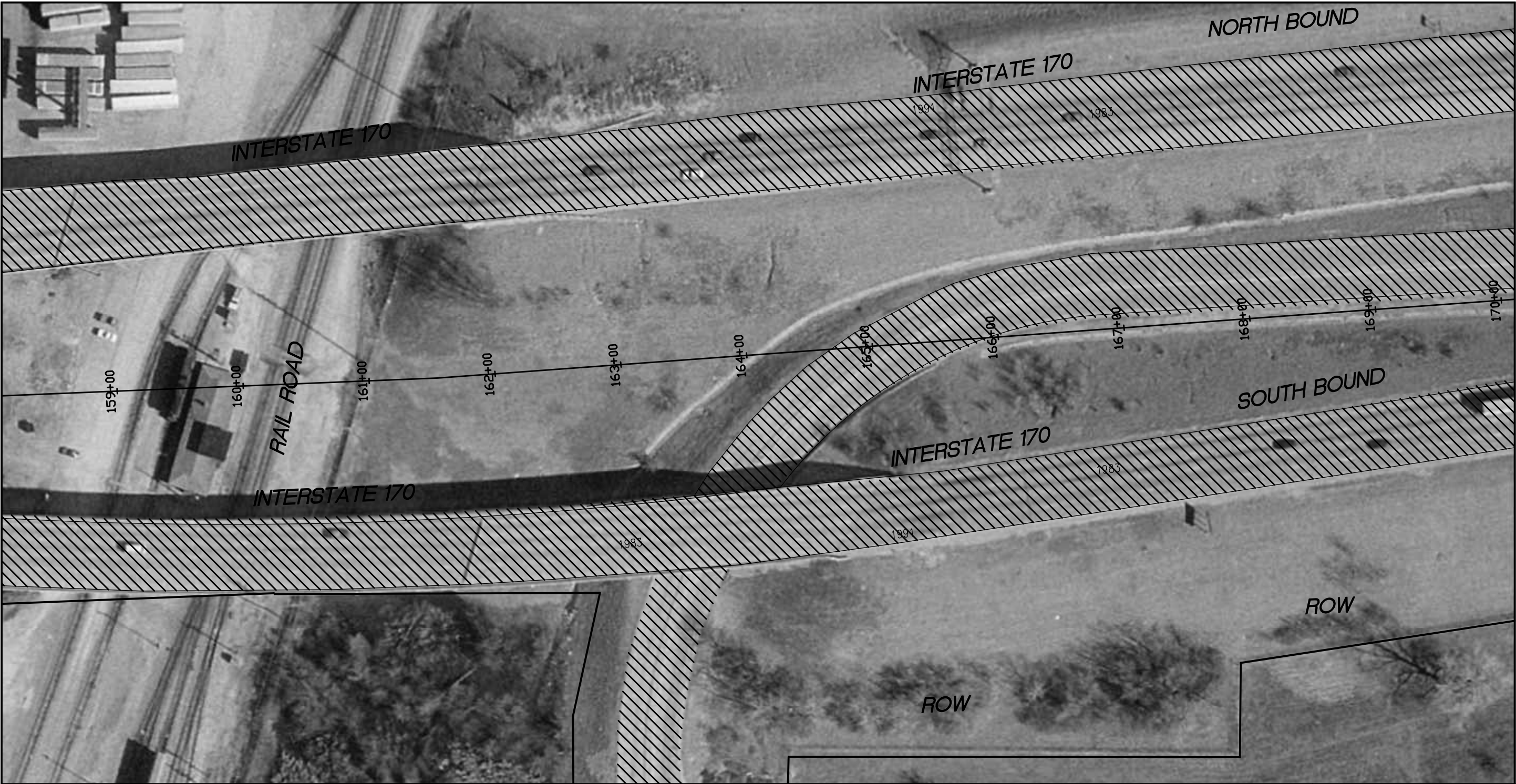
ST. LOUIS NORTH COUNTY SITES
NORTH CO. HAUL ROAD ANALYSIS
ST. LOUIS, MO.

DRAWN BY: J. LOUGH	REV. NO./DATE: FINAL/01-07-05
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FIGURE I-5.

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MATCH LINE I-5



MATCH LINE I-7

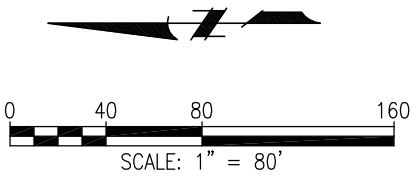
LEGEND:

- RIGHT-OF-WAY LINE
- - - APPROXIMATE EDGE OF PAVEMENT (1985)
- - - APPROXIMATE EDGE OF PAVEMENT (1997)
- XXXX FURTHER INVESTIGATION REQUIRED
- SHOULD NOT BE IMPACTED
- FORMER ROAD PAVEMENT

INTERSTATE 170

1979-1983 - I-170 WAS CONSTRUCTED, DID NOT FOLLOW THE ALIGNMENT OF ANY PREEXISTING ROADWAY
1983 - 2-36" PCC PAVEMENTS CONSTRUCTED - STATION 150+28 TO 182+94 (LABELED 1983)
1991 - 12' PCC LANES ADDED - STATION 150+28 TO 167+05 (LABELED 1991)
1991 - 12' PCC LANE ADDED NB - STATION 167+05 TO 178+48 (LABELED 1991)

BACKGROUND PHOTO FROM 1997.



FUSRAP

ST. LOUIS NORTH COUNTY SITES
NORTH CO. HAUL ROAD ANALYSIS
ST. LOUIS, MO.

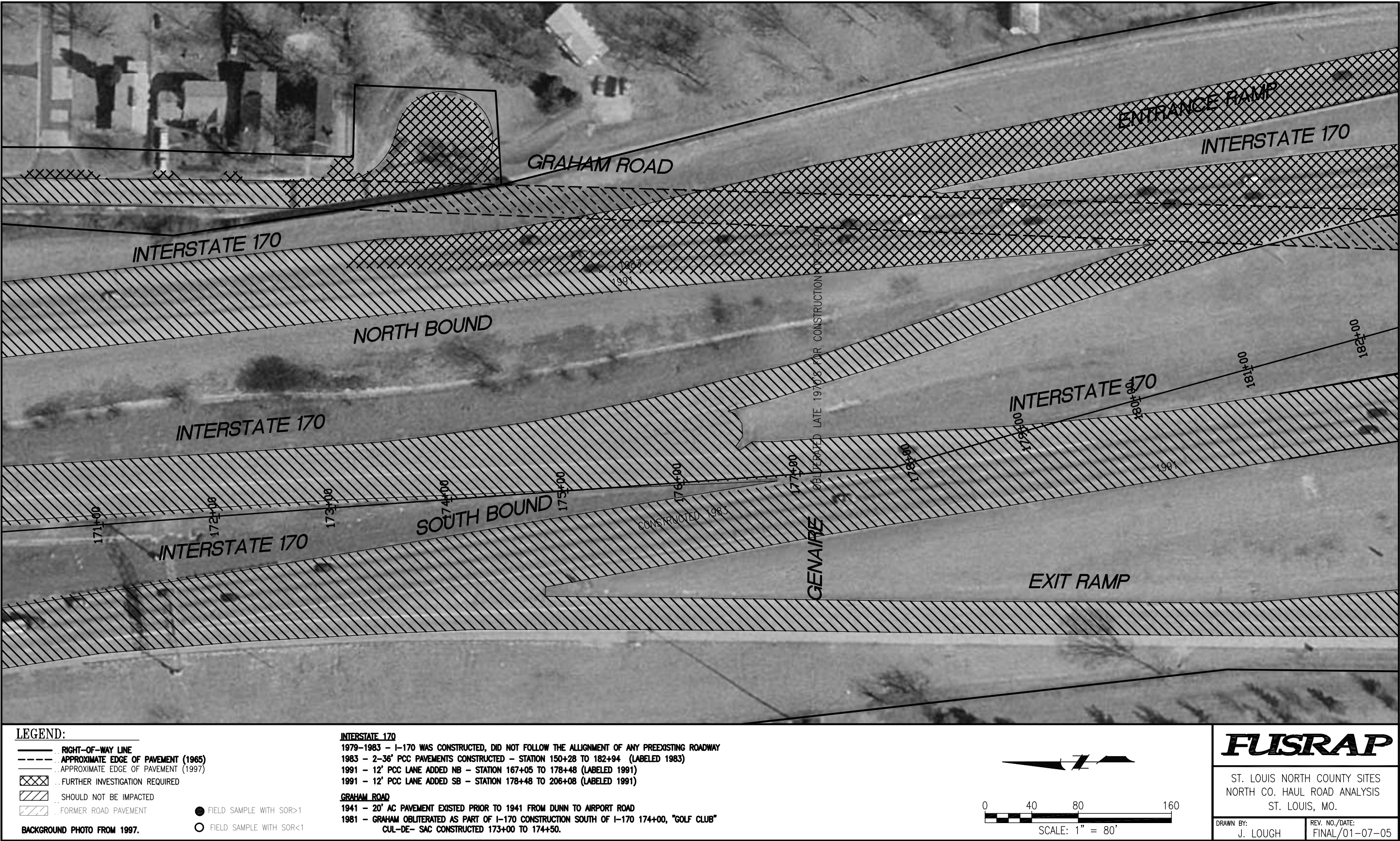
DRAWN BY:
J. LOUGH

REV. NO./DATE:
FINAL/01-07-05

FIGURE I-6.

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MATCH LINE I-6



MATCH LINE AIRPORT 3

FIGURE I-7.

A.8 Pavement Evaluation of Lindbergh Boulevard

Background Information

Some reference stations along Lindbergh Boulevard are as follows:

- The intersection of I-270 and Lindbergh Boulevard is Lindbergh Boulevard Station 219+83.
- The intersection of Lindbergh Boulevard and Pershall Road is Lindbergh Boulevard Station 213+00.
- The intersection of Lindbergh Boulevard and McDonnell Boulevard is Lindbergh Boulevard Station 163+73.

Evaluation of Aerial Photographs and Construction History Information

In 1934, Lindbergh Boulevard was constructed as a 20-foot-wide PCC pavement from Station 289+50 to Station 213+00. From Station 213+00 to Station 163+73, this road was constructed as a 40-foot-wide PCC pavement during the same year. This information was taken from MoDOT pavement history drawing “St. Louis 096 Sheet 11 of 31.”

In the September 11, 1953, aerial photograph contained in the August 1992 EPA Region VII study, Lindbergh Boulevard is shown as a paved road that is four lanes wide south of the intersection of Pershall Road and two lanes wide north of that location.

The 1954 USGS quad map based on a 1952 aerial photograph shows Lindbergh Boulevard as a heavy-duty, four-lane paved road.

In 1962, the 1934 pavement was obliterated from Station 219+83 to Station 203+00 and replaced by two 24-foot-wide, PCC divided lanes. This information was taken from MoDOT pavement history drawing “St. Louis 096 Sheet 11 of 31.”

In 1962, the PCC pavement was widened and raised medians were installed from Station 203+00 to Station 184+65. An AC pavement was overlaid on the concrete, resulting in two 24-foot divided lanes with a raised median. This information was taken from MoDOT pavement history drawing “St. Louis 096 Sheet 11 of 31.”

In 1962, the 40-foot-wide PCC pavement was overlain with AC from Station 184+65 to Station 189+95. This information was taken from MoDOT pavement history drawing “St. Louis 096 Sheet 11 of 31.”

In the 1966 aerial photograph from St. Louis County, Lindbergh Boulevard is shown as a four-lane divided highway from McDonnell Boulevard north to I-270.

The 1968 USGS quad map shows Lindbergh Boulevard as a four-lane, heavy-duty paved road from the Norfolk Southern Railroad crossing to I-270.

The 1974 USGS quad map shows Lindbergh Boulevard as a four-lane, heavy-duty paved road from the Norfolk Southern Railroad crossing to I-270.

In 1978 two additional 12-foot PCC lanes were constructed, one on each side of the pavement, and the two 36-foot divided lanes were resurfaced from Station 211+00 to Station 163+73. This information was taken from MoDOT pavement history drawing "St. Louis 096 Sheet 11 of 31."

No anomalies were detected during the December 14, 1984, scan by EPA.

The August 1990 *Radiological Characterization Report for FUSRAP Properties in the St. Louis, Missouri, Area* stated that the properties adjoining Lindbergh Boulevard did not show any impacts. This report further concluded "There is no evidence to suggest that Lindbergh Boulevard was used as a haul route during the waste transport activities between the St. Louis sites."

In 1991, two 24-foot pavements received an AC overlay from Station 219+83 to Station 211+00. From Station 211+00 to Station 163+73, the two 36-foot pavements received an AC overlay. This information was taken from MoDOT pavement history drawing "St. Louis 096 Sheet 11 of 31."

MoDOT maintains Lindbergh Boulevard.

Summary of Critical Facts

Lindbergh Boulevard had a PCC pavement prior to the start of operations at the HISS and the SLAPS. Prior to 1962 the pavement consisted of a 20-foot PCC pavement north of Station 213+00 and a 40-foot PCC pavement south of that station.

In 1962, the old pavement north of Station 203+00 was demolished and a new road constructed in its place. The pavement constructed in 1962 was a divided highway consisting of two 24-foot wide PCC lanes.

In 1978, two new lanes were added to the outside of the street. This last 12-foot width of new pavement could certainly have been constructed over impacted material.

In 1991, a new AC overlay was placed over all lanes.

Final Conclusions

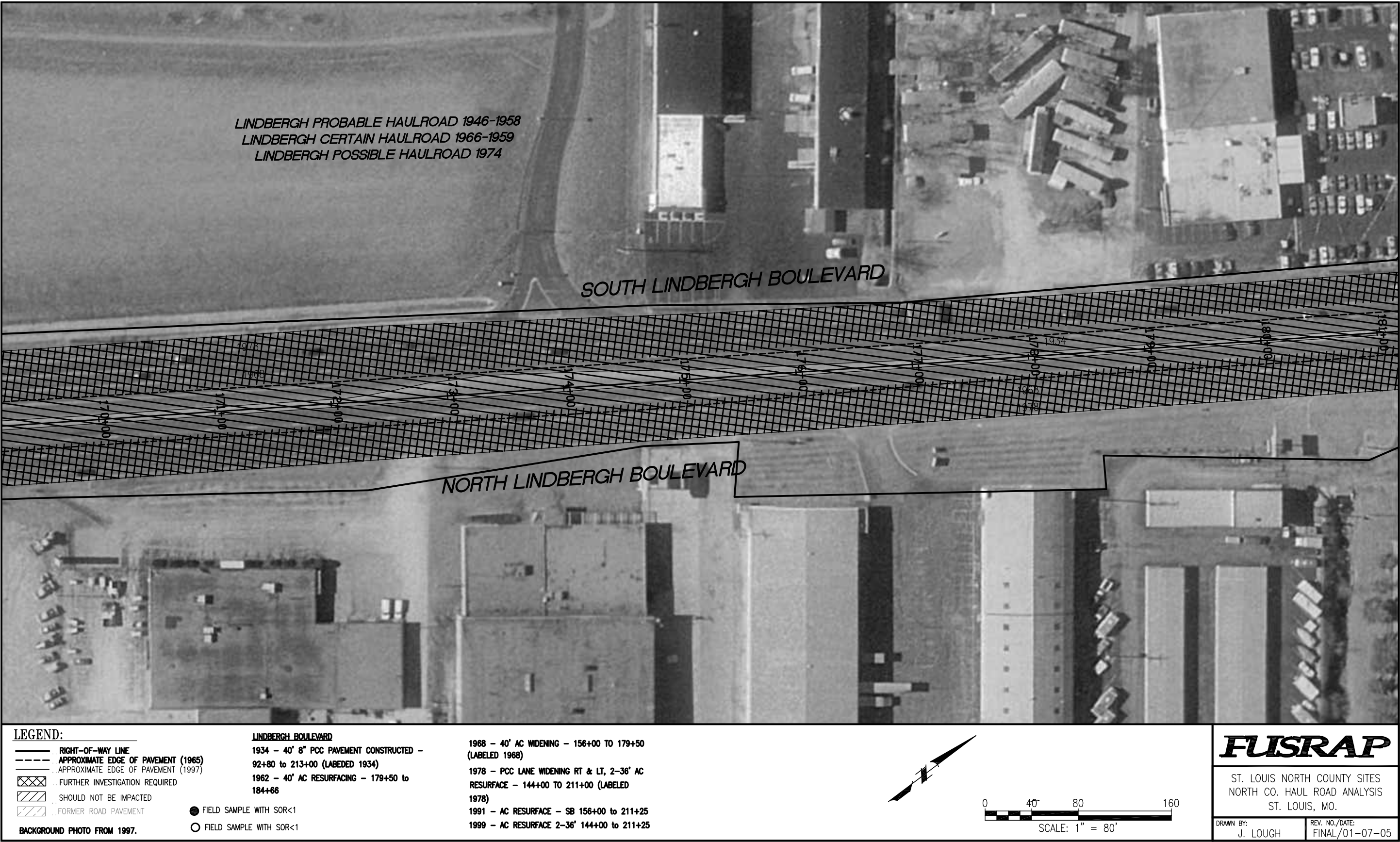
Any material beneath the pavements constructed in 1934 does not need to be subjected to further investigation. However, any pavement constructed after this period should be subjected to further investigation.

The SLAPS to the HISS hauling activities: From 1966 to 1967 Lindbergh Boulevard had a hard-surfaced and impermeable pavement, and this pavement would have protected the material under it; however, Lindbergh Boulevard has been widened and paved shoulders have been constructed since that time. It is certain that hauling occurred from the SLAPS to the HISS using this route. Any pavement widening constructed after 1969 could be over impacted material and should be evaluated further.

The HISS to West Lake Landfill site: In 1973 Lindbergh Boulevard had hard-surfaced and impermeable pavements, and this pavement would have protected the material under it; however, Lindbergh Boulevard has been widened, and new paved shoulders have been constructed since that time. Any pavement widening constructed after 1973 could be over impacted material and should be evaluated further.

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MATCH LINE McDONNELL 1



MATCH LINE LINDBERGH 2

FIGURE LINDBERGH 1.



FIGURE LINDBERGH 2.



FIGURE LINDBERGH 3.

A.9 Pavement Evaluation of North Hanley/Graham Road

Background Information

Some reference stations along North Hanley/Graham Road are as follows:

- The intersection of North Hanley and Airport Road is Station 0+00.
- The intersection of North Hanley and Pershall Road is Station 93+40.
- The intersection of North Hanley and old Graham Road is Station 36+00.
- The intersection of North Hanley and Frost Avenue is Station 50+59.
- The intersection of North Hanley and Latty Avenue is Station 68+51.

Graham Road was in existence prior to 1941. In 1972, the northernmost half of the roadway was obliterated and a new 60-foot-wide PCC pavement constructed in the same alignment. This new pavement is currently named North Hanley Road. North Hanley curves to the east approximately 3,000 feet to the north of Airport Road. Approximately 2,000 feet of the original Graham Road pavement remained in place and retained the name of Graham Road.

Evaluation of Aerial Photographs and Construction History Information

In the July 29, 1941, aerial photograph contained in the August 1992 EPA Region VII study, Graham Road is shown as a two-lane, AC-paved road from Airport Road to Dunn Road.

In the September 11, 1953, aerial photograph contained in the August 1992 EPA Region VII study, Graham Road does not appear to have changed in alignment, width, or pavement type since the 1941 photograph.

The 1954 USGS quad map based on a 1952 aerial photograph shows Graham Road as a medium-duty paved road. North Hanley does not exist.

In a March 5, 1956, property boundary plat, Graham Road is shown to have a 60-foot ROW near Gwen Court.

In the May 13, 1958, aerial photograph contained in the August 1992 EPA Region VII study, Graham Road does not appear to have changed in alignment, width, or pavement type since the 1953 photograph.

In a October 10, 1958, property boundary plat, Graham Road is shown to have a 60-foot ROW near Carmel Court.

In the October 10, 1965, aerial photograph contained in the August 1992 EPA Region VII study, Graham Road does not appear to have changed in alignment, width, or pavement type since the 1958 photograph. The surrounding area has developed a great deal; many new driveways now exit onto Graham Road in this area.

The 1968 USGS quad map shows Graham Road as a two-lane, medium-duty paved road from Airport Road to I-270. North Hanley is not shown.

In April 20, 1972, construction plans from the St. Louis County Department of Highways and Traffic for Graham Road, Airport Road to Frost Avenue, Station 0+00 to 50+19, construction of 8-inch, non-reinforced PCC pavement consisting of the following is shown:

- Station 0+00 to 13+48: construction of four 11-foot traffic lanes and two 10-foot emergency lanes of 8-inch, non-reinforced PCC with a vertical curb and sidewalk.
- Station 13+48 to 28+00: construction of four 11-foot traffic lanes and two 10-foot emergency lanes of 12-inch AC with no vertical curb and some sidewalks.
- Station 30+08 to 50+19: construction of four 11-foot traffic lanes and two 10-foot emergency lanes of 8-inch, non-reinforced PCC with a vertical curb and sidewalk.
- Construction of additional left and right turn lanes near the intersection with Airport Road.

All ROW is 80 foot wide.

In September 1, 1972, construction plans from the St. Louis County Department of Highways and Traffic for Graham Road, Frost Avenue to Dunn Road, Station 50+19 to 91+00, construction of 8-inch, non-reinforced PCC pavement consisting of four 11-foot traffic lanes and two 8-foot emergency lanes with a vertical curb and sidewalk is shown.

All ROW is 80 foot wide.

In the May 6, 1974, aerial photograph contained in the August 1992 EPA Region VII study, Graham Road north of the crossing of the East Branch of Coldwater Creek has been obliterated and replaced with four-lane PCC pavement (see above). All of this new pavement was constructed over impacted material. South of the crossing of the east branch of Coldwater Creek the older pavement remains in use and retains the name of Graham Road. The Graham Road crossing of the Norfolk Southern Railroad has been removed and replaced by the new North Hanley Road crossing some distance to the east.

The 1974 USGS quad map shows that the northern end of Graham Road has been reconstructed as North Hanley, a four-lane, medium-duty pavement, from a point approximately 1,000 foot north of the intersection with the Norfolk and Western Railroad. South of this point the existing two-lane, medium-duty pavement remains in place.

In the December 22, 1980, aerial photograph contained in the August 1992 EPA Region VII study, North Hanley Road and Graham Road do not appear to have changed since the 1974 photograph. I-170 is under construction, and many of the side roads connecting to the west side of North Hanley Road and Graham Road have been obliterated or cut. South of a point midway

between Graham Lane and Genaire to Airport Road, Graham Road has been obliterated as part of the I-170 project.

No anomalies were detected during the December 14, 1984, scan by EPA.

In the April 16, 1985, aerial photograph contained in the August 1992 EPA Region VII study, Graham Road does not appear to have changed in alignment, width, or pavement type since the 1980 photograph. The construction of I-170 has been completed; a portion of North Hanley has received an AC overlay.

In a March 18, 1998, property boundary plat, North Hanley (formerly Graham Road) is shown to have an 80-foot ROW near Carmel Court.

St. Louis County maintains Hanley Road/Graham Road.

Summary of Critical Facts

Graham Road had an AC pavement prior to the start of operations at the HISS and the SLAPS.

In 1972 the old pavement north of the intersection with Fleischer Place was demolished and a new road constructed in its place. South of Fleischer Place this new pavement continues over a new alignment as Middleway Drive and North Hanley. The pavement constructed in 1972 generally consisted of four 11-foot- and two 8-foot-wide PCC lanes. Where the 1972 pavement was constructed over materials not previously protected by pavement, the 1972 pavement was placed over impacted material.

From 1979 to 1981 I-170 was under construction, and Graham Road was obliterated south of a point midway between Graham Lane and Genaire to Airport Road. I-170 was then constructed over portions of the former alignment of Graham Road.

Final Conclusions

Based on the information available, the material beneath North Hanley pavement north of Fleischer Place (the PCC pavement constructed in 1972 by St. Louis County) should be subjected to further investigation except for those areas protected by the earlier pavement.

That portion not obliterated by the 1972 St. Louis County reconstruction or by the construction of I-170 does not need to be subjected to further investigation. This section of AC pavement was in existence prior to hauling activities and would have protected the material beneath.

Material along the obliterated alignment of Graham Road, under I-170, and at the former railroad crossing was impacted and should be subjected to further investigation.

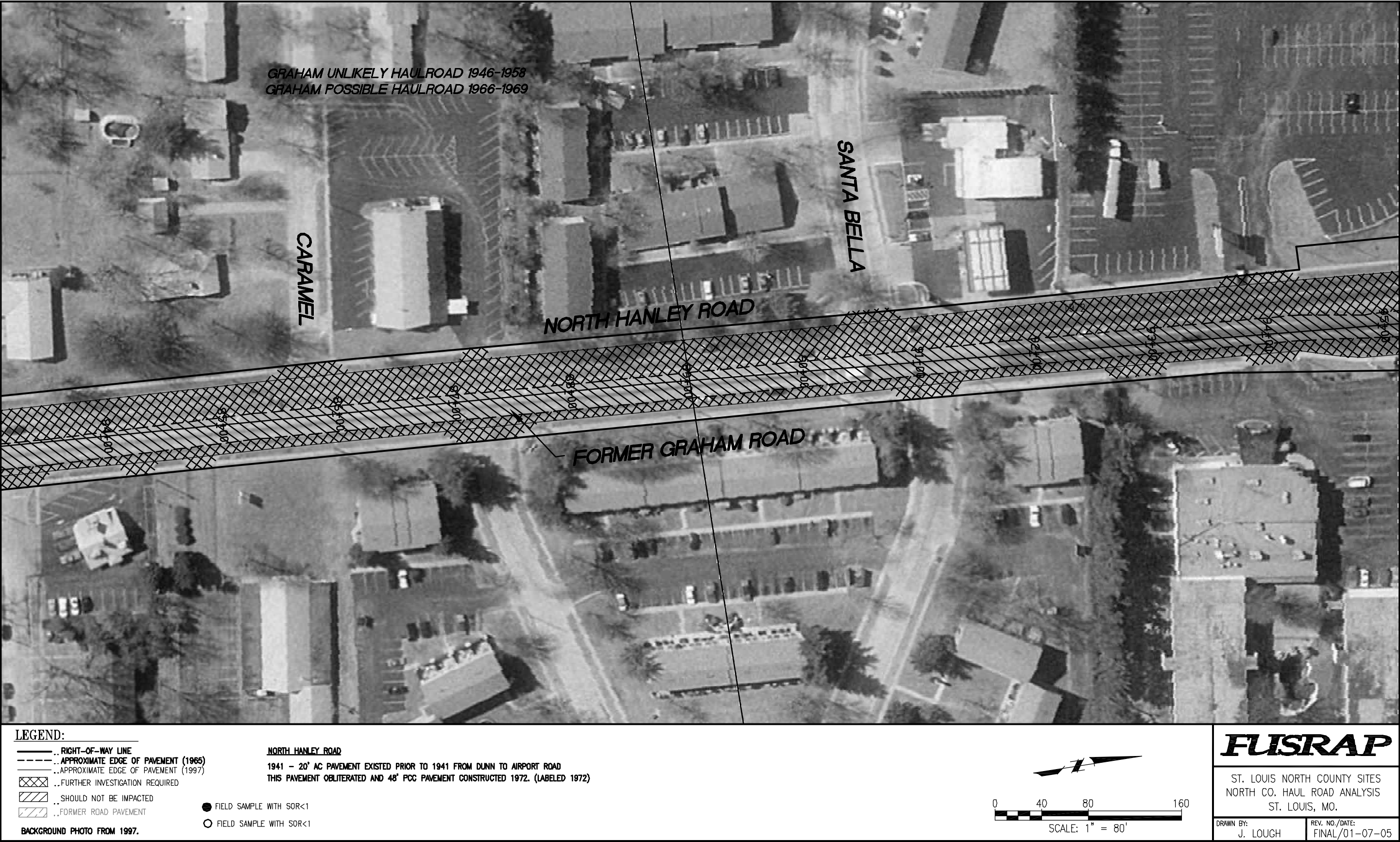
Portions of Graham Road were obliterated as part of the construction of I-170. Additional portions were obliterated as part of the construction of North Hanley. The former railroad

crossing of the Burlington Northern Railroad was abandoned as part of the construction of North Hanley.

The SLAPS to the HISS hauling activities: From 1966 and 1967 Graham Road was a two-lane, medium-duty AC street, and this pavement would have protected the material under it; however, work on North Hanley reconstructed much of Graham Road, widening it and adding pavement. It is certain that hauling occurred from the SLAPS to the HISS using this route. Any pavements constructed after 1966 could be over impacted material.

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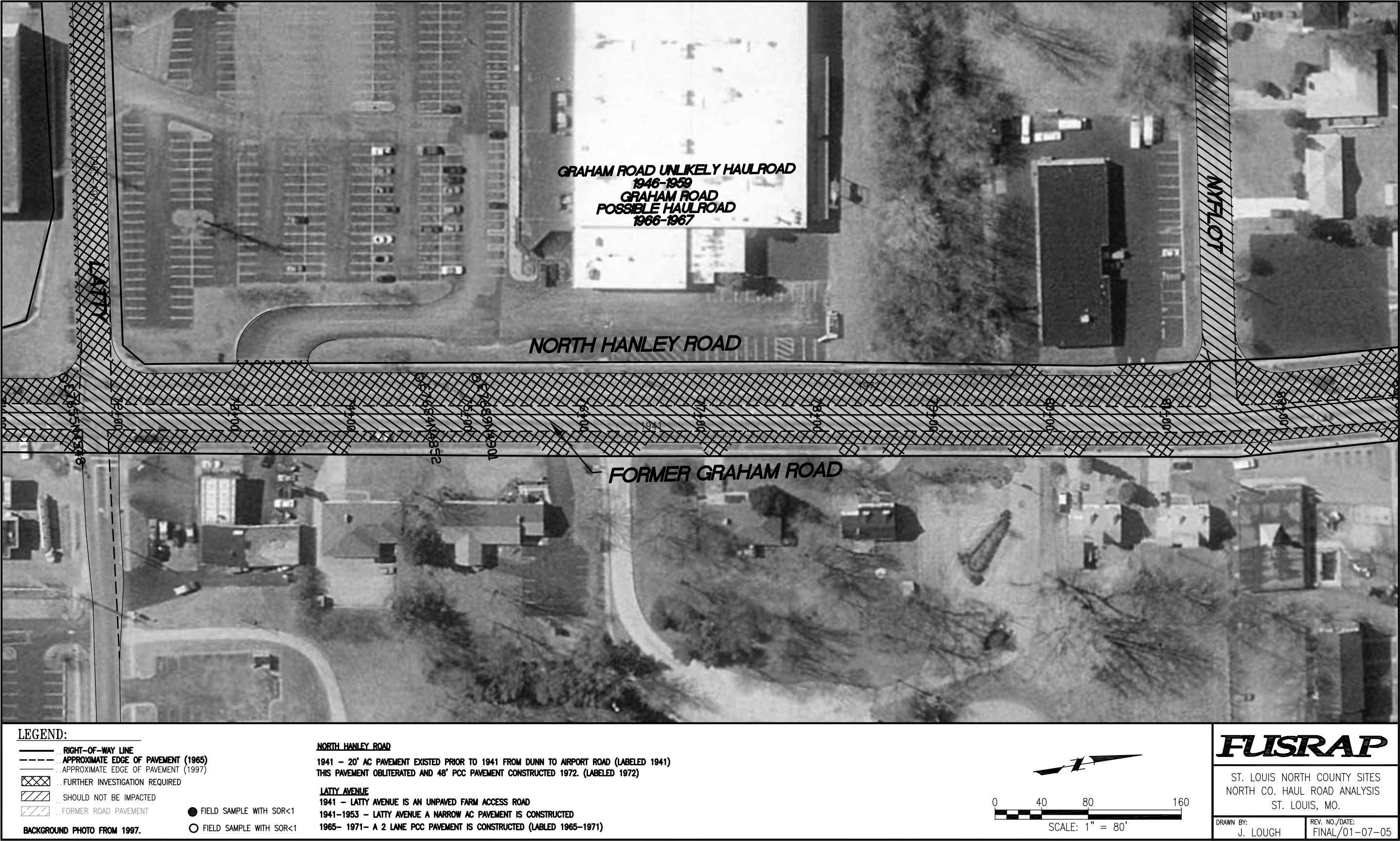
MATCH LINE HANLEY 2



MATCH LINE PERSHALL 7

FIGURE HANLEY 1.

MATCH LINE HANLEY 3

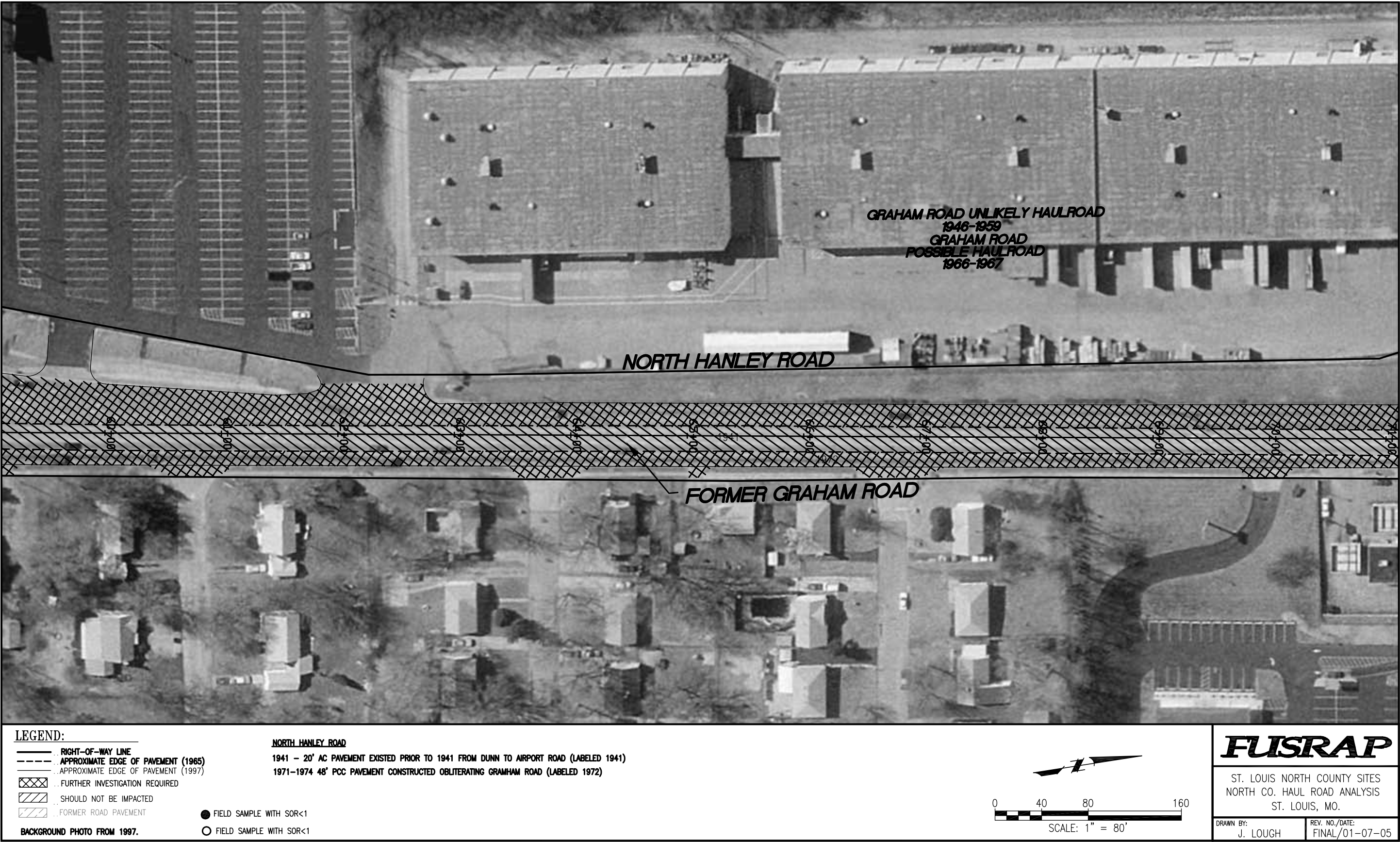


MATCH LINE HANLEY 1

FIGURE HANLEY 2.

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MATCH LINE HANLEY 4

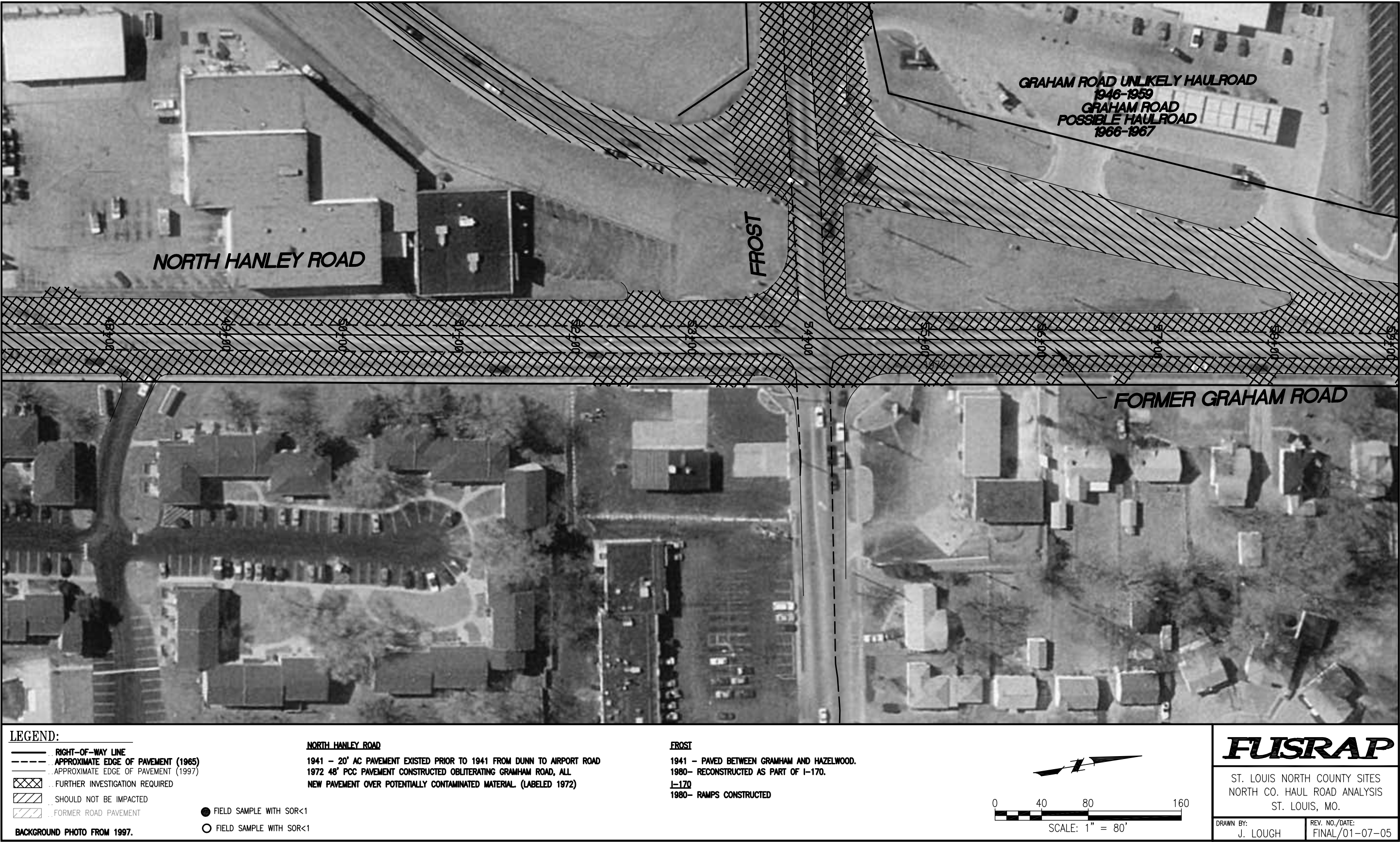


MATCH LINE HANLEY 2

FIGURE HANLEY 3.

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MATCH LINE HANLEY 5

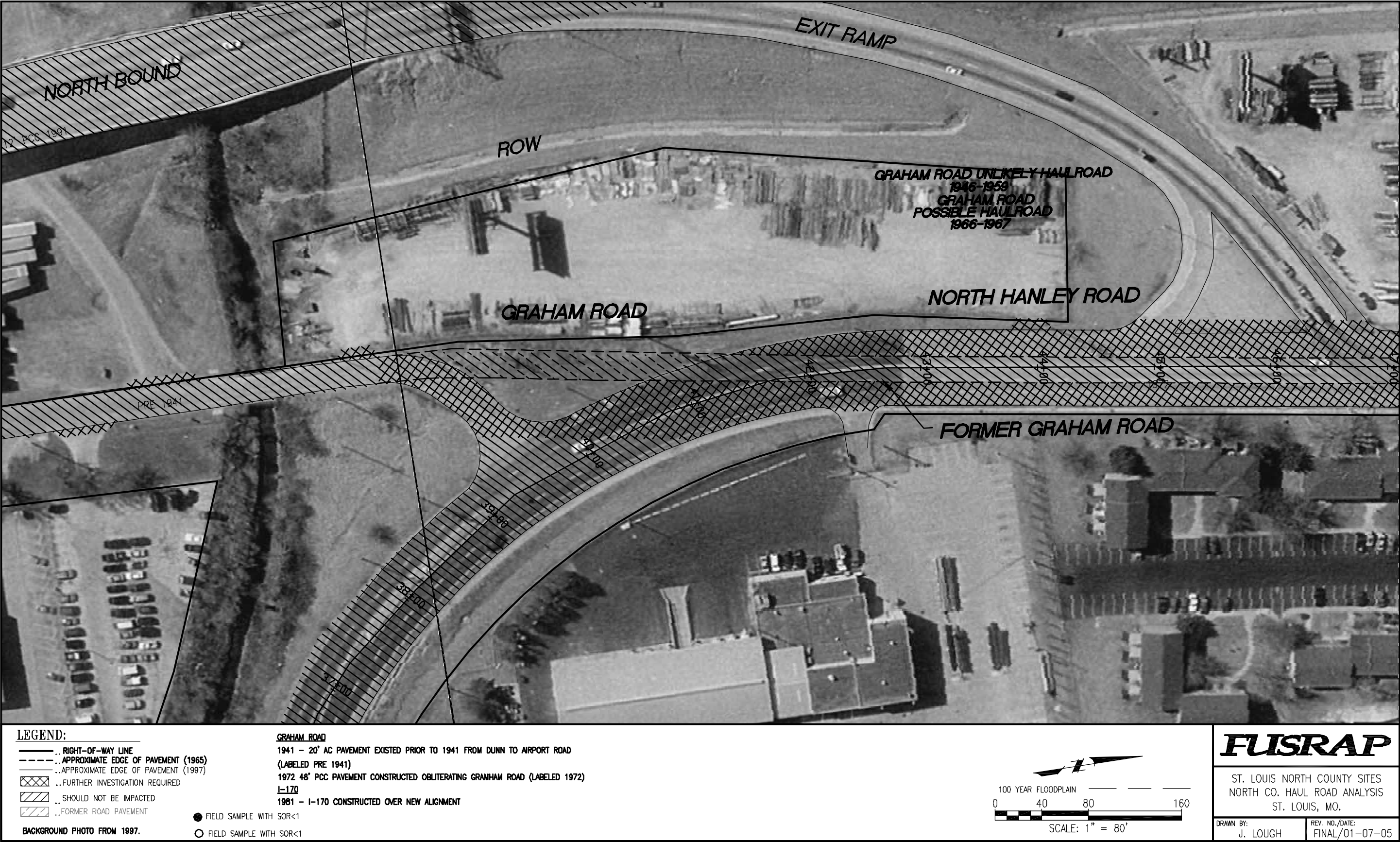


MATCH LINE HANLEY 3

FIGURE HANLEY 4.

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MATCH LINE HANLEY 6



MATCH LINE HANLEY 4

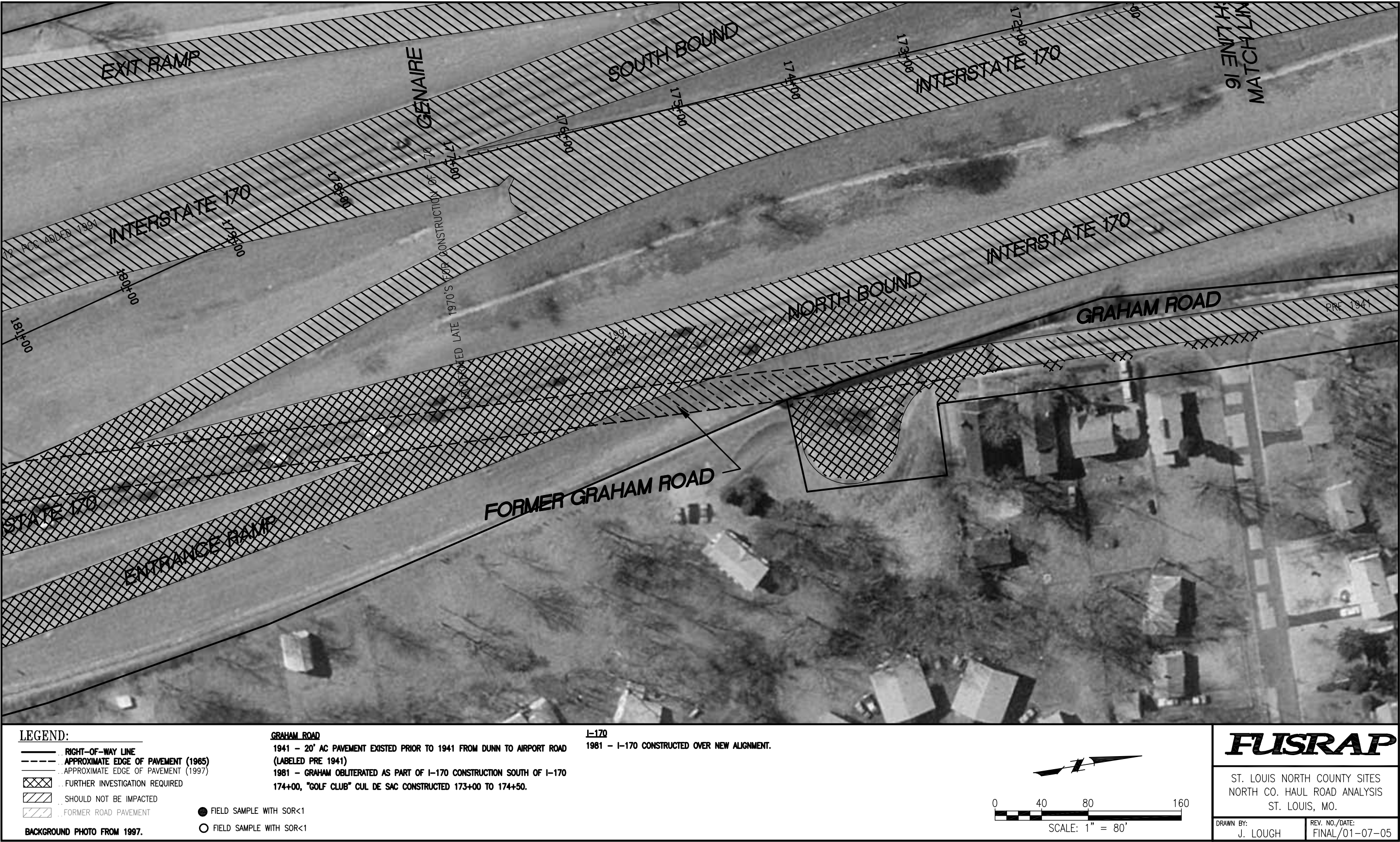
FIGURE HANLEY 5.



FIGURE HANLEY 6.

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MATCH LINE AIRPORT 3



MATCH LINE HANLEY 6

FIGURE HANLEY 7.

A.10 Pavement Evaluation of Airport Road

Background Information

Some reference stations along Airport Road are as follows:

- The intersection of McDonnell Boulevard and Airport Road is Station 0+00 (McDonnell Boulevard Station 96+44).
- The intersection of Airport Road and Brown Road is Station 5+12.
- The intersection of Airport Road and the west I-170 ramps is Station 22+50.

Evaluation of Aerial Photographs and Construction History Information

In the September 11, 1953, aerial photograph contained in the August 1992 EPA Region VII study, Airport Road is shown as a two-lane AC pavement.

In the June 1957 construction plans, a 20-foot PCC pavement is to be constructed, obliterating the older AC pavement from McDonnell Boulevard to Graham Road.

In the 1965 St. Louis County Aerial Photograph, Airport Road is shown as a two-lane pavement with wide shoulders or parking areas.

In the January 1966 construction plans, this 20-foot PCC pavement is to be incorporated into a new 60-foot-wide PCC pavement. The older pavement is the south 20 foot of the new pavement. The ROW is increased from 60 foot to 82 foot.

The 1968 USGS quad map shows Airport Road as a heavy-duty paved road between McDonnell Boulevard and Graham Road.

During the 1970s the pavement received an AC overlay.

In the 1983 construction plans, Airport Road is to be widened 4 foot on each side and given an AC overlay from Station 5+12 to 22+50. The ROW is shown to be 82 foot.

No anomalies were detected during the December 14, 1984, scan by EPA.

Summary of Critical Facts

Airport Road was in existence prior to 1941. The pre-1941 pavement consisted of an AC pavement in a 60-foot ROW. This pavement was obliterated in 1957 and replaced with a 20-foot PCC pavement. The pre-1941 pavement would have prevented direct impacts to the material under it, and the 1957 pavement should also be over material that had not been impacted. This 20-foot PCC pavement was incorporated into a 60-foot PCC pavement in the 1965 construction

plans. This additional pavement could have been over impacted material if this route was used for the 1946-to-1957 hauling activities. In 1983 the pavement was widened 4 foot on each side, resulting in a 68-foot PCC pavement with an AC-wearing surface. Additional construction occurred in 1983 as part of the construction of I-170. The 1957 pavement would have prevented direct impact to the material beneath. All of the subsequent widenings of the pavement were placed over impacted material.

Final Conclusions

The SLAPS to the HISS hauling activities: From 1966 and 1967 Airport Road was under construction. Portions of the roadway had hard-surfaced and impermeable pavements, and this pavement would have protected the material under it. It is possible that hauling occurred from the SLAPS to the HISS using this route. Any pavement widening constructed after 1969 could be over impacted material.

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MATCH LINE McDONNELL 9



MATCH LINE AIRPORT 2

LEGEND:

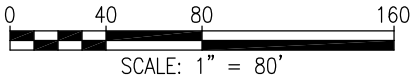
- RIGHT-OF-WAY LINE
- - - APPROXIMATE EDGE OF PAVEMENT (1965)
- - - APPROXIMATE EDGE OF PAVEMENT (1997)
- [Cross-hatched] FURTHER INVESTIGATION REQUIRED
- [Diagonal lines] SHOULD NOT BE IMPACTED
- [Horizontal lines] FORMER ROAD PAVEMENT
- FIELD SAMPLE WITH SOR>1
- FIELD SAMPLE WITH SOR<1

BACKGROUND PHOTO FROM 1997.

AIRPORT ROAD

- 1941 - AIRPORT ROAD EXISTED AS AN AC PAVEMENT
- 1957 - AC PAVEMENT OBLITERATED AND RECONSTRUCTED AS 20' PCC PAVEMENT - (LABELED 1957)
- 1965 - PCC PAVEMENT EXPANDED TO 60' WIDTH STATION - STATION 5+12 TO 22+50 - (LABELED 1965)
- 1970'S AC RESURFACE

- 1983 - PCC PAVEMENT EXPANDED TO 68' WIDTH AND AC RESURFACING - STATION 5+12 TO 22+50 - (LABELED 1983)
- MCDONNELL
- 1941 - 2 LANE AC ROADWAY BROWN RD 65+00 TO 109+12
- 1952 RECONSTRUCTED TO 44' PCC PAVEMENT - 87+21 TO 109+06
- 1988 - 44 AC RESURFACE WITH TURN LANE 65+00 TO 109+06
- 2002 - AC RESURFACE



FUSRAP

ST. LOUIS NORTH COUNTY SITES
NORTH CO. HAUL ROAD ANALYSIS
ST. LOUIS, MO.

DRAWN BY:
J. LOUGH

REV. NO./DATE:
FINAL/01-07-05

FIGURE AIRPORT 1



FIGURE AIRPORT 2.

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MATCH LINE AIRPORT 2

MATCH LINE I-7

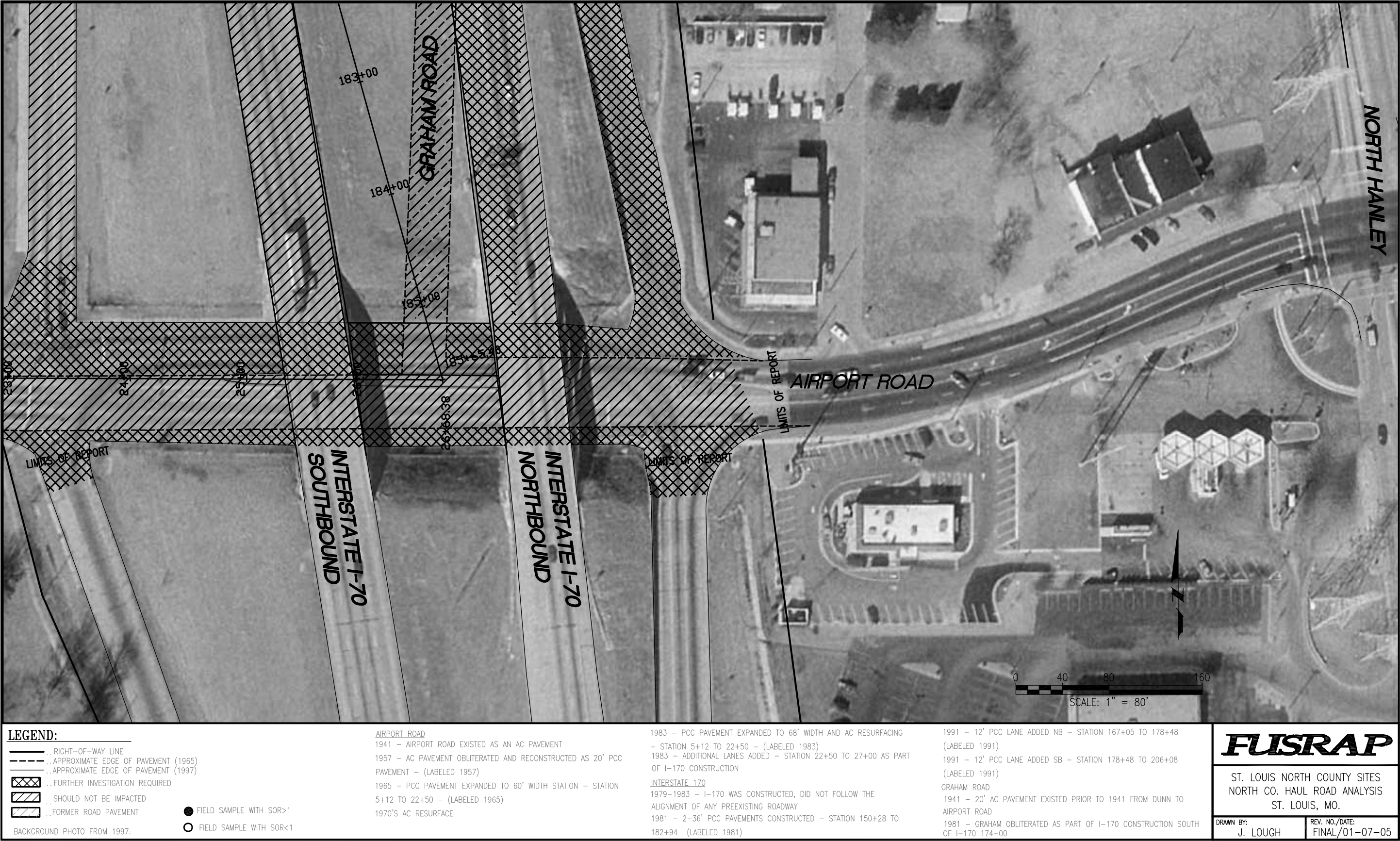


FIGURE AIRPORT 3.

A.11 Pavement Evaluation of Banshee Road

Background Information

The section of Banshee Road discussed is from McDonnell Boulevard on the east to Coldwater Creek on the west. Banshee Road was formerly known as Wabash Avenue. The road was created as a 60-foot-wide ROW some time prior to 1940.

Evaluation of Aerial Photographs and Construction History Information

In the July 29, 1941, aerial photograph contained in the August 1992 EPA Region VII study, Banshee Road is shown as a 60-foot-wide aggregate hauling road. The western approximately 600 foot of the roadway are PCC and are probably associated with an industrial facility adjoining the airport. In this photograph the road provides access for several large buildings with large parking areas north of the St. Louis Municipal Airport. The airport itself appears to be under construction.

A December 31, 1946, drawing from the AEC shows the road as a blacktop road.

In 1952 construction plans from MoDOT (Federal Project MO S-1207 [1]) for McDonnell Boulevard, Wabash Avenue is shown as a 40-foot-wide bituminous surface in a 60-foot ROW.

In the September 11, 1953, aerial photograph contained in the August 1992 EPA Region VII study, Banshee Road is shown as four-lane AC pavement. The eastern 200 foot has a batch-mixed AC surface placed as part of the 1952 McDonnell Boulevard construction, while the remainder of the road is of a darker material. The western PCC portion appears to have been overlaid with AC.

The 1954 USGS quad map, based on a 1952 aerial photograph, shows Banshee Road as a medium-duty paved road.

In the May 13, 1958, aerial photograph contained in the August 1992 EPA Region VII study, Banshee Road is shown as a four-lane AC pavement. The west 600 foot and the east 300 foot of the road are of batch-mixed and -placed AC material.

In the 1965 St. Louis County Aerial Photograph, Banshee Road is shown as a four-lane pavement with wide shoulders or parking areas.

In the October 10, 1965, aerial photograph contained in the August 1992 EPA Region VII study, Banshee Road does not appear to have changed in alignment, width, or pavement type since the 1958 photograph.

The 1968 USGS quad map shows Airport Road as a heavy-duty paved road between McDonnell Boulevard and Graham Road.

In the May 4, 1971, aerial photograph contained in the August 1992 EPA Region VII study, Banshee Road has received an AC overlay since the 1965 photograph.

In the May 6, 1974, aerial photograph contained in the August 1992 EPA Region VII study, Banshee Road does not appear to have changed in alignment, width, or pavement type since the 1971 photograph.

The 1974 USGS quad map shows Banshee Road as a medium-duty paved road between McDonnell Boulevard and Coldwater Creek. West of Coldwater Creek, Banshee is shown as a light-duty pavement. This pavement does not appear to extend to Lindbergh Boulevard.

In the December 22, 1980, aerial photograph contained in the August 1992 EPA Region VII study, Banshee Road does not appear to have changed in alignment, width, or pavement type since the 1974 photograph except that the western PCC portion has received an AC overlay.

In the May 1, 1984, aerial photograph contained in the August 1992 EPA Region VII study, Banshee Road does not appear to have changed in alignment, width, or pavement type since the 1980 photograph.

In the April 16, 1985, aerial photograph contained in the August 1992 EPA Region VII study, Banshee Road does not appear to have changed in alignment, width, or pavement type since the 1984 photograph.

In the April 16, 1990, aerial photograph contained in the August 1992 EPA Region VII study, Banshee Road has received an overlay on the most easterly portion of the roadway; the remaining pavement does not appear to have changed since the 1985 photograph.

During a 2003 site visit, Banshee was observed to be a four-lane undivided highway. It appeared to have a PCC base with 4 to 6 inches of AC overlay on top.

Summary of Critical Facts

Banshee Road was in existence prior to 1941. The pre-1941 pavement consisted of a four-lane PCC pavement on the west end and a 40-foot oil-and-chip pavement for the remainder of the roadway, all in a 60-foot ROW. A section of this pavement was obliterated in 1952 and replaced with a new AC pavement.

Final Conclusions

Based on the information available, Banshee Road has been surfaced since before activities started at the SLAPS; however, this surface would not have been substantial enough to protect the material under it from direct impact. There is no obvious reason why any hauling of materials associated with the SLAPS should have occurred on this roadway except for the hauling of fill material from airport construction in 1968. This road surface is directly south of the SLAPS with only the railroad between. However, it is possible that it might have been

impacted by mechanisms other than hauling, perhaps by wind or flooding from Coldwater Creek. All of Banshee between McDonnell Boulevard and the western limit of the Coldwater Creek floodplain is, therefore, possibly impacted material and should be sampled and tested.

Haulage from the HISS by railroad car would have used the main line track and possibly the siding. It is certain that hauling occurred on this lead track. This haulage activity may have impacted the adjoining road right way and this impacted material may have since been paved.

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FIGURE BANSHEE RD. 1.

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MATCHLINE BANSHEE RD. 1



FIGURE BANSHEE RD. 2.

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MATCHLINE BANSHEE RD. 2



MATCHLINE BANSHEE RD. 4

FIGURE BANSHEE RD. 3.

MATCHLINE BANSHEE RD. 3



MATCHLINE BANSHEE RD. 5

FIGURE BANSHEE RD. 4.

MATCHLINE BANSHEE RD. 4



MATCHLINE BANSHEE RD. 6

FIGURE BANSHEE RD. 5.



FIGURE BANSHEE RD. 6.

A.12 Pavement Evaluation of Polson Road

Evaluation of Aerial Photographs and Construction History Information

In the July 1950 survey plat by the Elbring Surveying Company, Polson Road is shown as a 20-foot and 18-foot private road. The north-south section is 20 foot wide, while the east-west portion is 18 foot wide.

In the September 11, 1953, aerial photograph contained in the August 1992 EPA Region VII study, a farm access road is shown in what is now the Polson Road alignment. This roadway is a dead-end road off of Dunn Road/Route 66 going south. This road does not have a hard surface; it might be an aggregate or unpaved roadway.

The 1954 USGS quad map based on a 1952 aerial photograph shows Polson as a light-duty roadway.

In the 1963 construction plans for I-270, Polson Drive is shown as a 20-foot private drive to the west of the property line. No pavement is shown in this ROW. An existing entrance road to the East property is shown.

In the October 10, 1965, aerial photograph contained in the August 1992 EPA Region VII study, Polson Road has become a side access road for large industrial plant. The road has been surfaced with AC.

The 1967 photograph from St. Louis County shows I-270 fully constructed, with Pershall Road as the south outer road. Polson Road now intersects Pershall Road, not Dunn Road. Approximately 400 foot of Polson Avenue has been obliterated. The remaining pavement does not appear to have changed in alignment, width, or pavement type since the 1965 photograph.

The 1968 USGS quad map shows Polson Road as a light-duty paved road.

In the May 4, 1971, aerial photograph contained in the August 1992 EPA Region VII study, additional buildings have been constructed along Polson Road. The road has been widened, but still does not have a hard-surface pavement.

In the May 6, 1974, aerial photograph contained in the August 1992 EPA Region VII study, Polson Road pavement appears to have been rehabilitated and overlain with AC.

The 1974 USGS quad map shows Polson Road as a light-duty paved road.

In the May 1, 1984, aerial photograph contained in the August 1992 EPA Region VII study, Polson Road does not appear to have changed in alignment, width, or pavement type since the 1974 photograph.

In a November 13, 1988, survey plat, Polson road is shown as a 20-foot-wide ROW out of Lot 4 of the Barney Hanley Estate. The road is 1,221 foot in length along the side of Lot 4 and then continues east along the north side of Lot 3 approximately 130 foot.

In the April 8, 1990, aerial photograph contained in the August 1992 EPA Region VII study, Polson Road pavement has been partially overlain with a new layer of AC.

The 2002 St. Louis County tax assessor's map shows Polson Lane as a 20-foot-wide private road from the south I-270/Pershall Road ROW line 971.60 foot. Polson Lane makes a tee at that point and runs east and west as an 18-foot-wide private road.

Summary of Critical Facts

Polson Road was an unpaved farm access road until at least 1953. It is believed that the 20-foot ROW was created to provide access to Lot 3 of the Barney Hanley Estate. Some time between 1953 and 1965, the road was paved with AC.

Prior to the construction of I-270, Polson Road connected to Dunn Road. Several hundred feet of Polson Road were obliterated in the construction of I-270.

There is no evidence that this road was ever used for hauling of materials, which would have impacted adjoining land. Because the road has always been a dead end, the reason for any hauling on the road is unclear.

Final Conclusions

Based on the information available, none of Polson Road had hard surface while hauling activities were occurring. That portion of the roadway within the floodplain of Coldwater Creek could be over impacted material. That portion of the pavement within 50 feet of the edge of the traveled way on Pershall Road could be over impacted material.

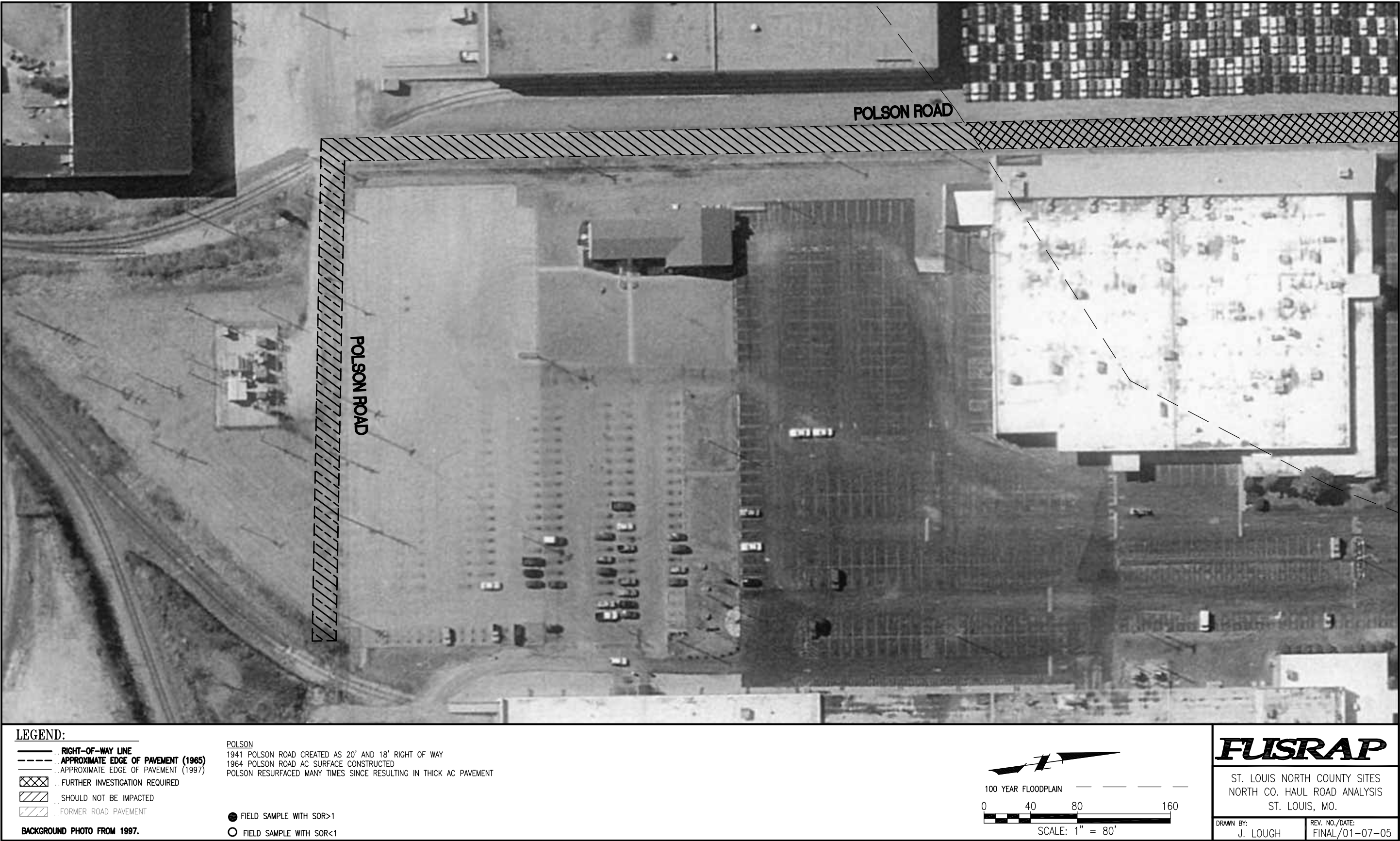


FIGURE POLSON 1.

A.13 Pavement Evaluation of Seeger Industrial Road

Evaluation of Aerial Photographs and Construction History Information

In the July 29, 1941, aerial photograph contained in the August 1992 EPA Region VII study, Seeger Industrial Road does not exist.

The July 1950 survey plat by the Elbring Surveying Company does not show Seeger Industrial Road.

In the September 11, 1953, aerial photograph contained in the August 1992 EPA Region VII study, a farm access road is shown in what is the current Seeger Industrial Road alignment. This roadway is off of Hazelwood Avenue going west. This road is an unpaved dirt track.

The 1954 USGS quad map based on a 1952 aerial photograph does not show Seeger Industrial Road.

In the May 13, 1958, aerial photograph contained in the August 1992 EPA Region VII study, the farm access road in the future Seeger Industrial Road alignment does not appear to have changed in alignment, width, or pavement type since the 1953 photograph.

In the October 10, 1965, aerial photograph contained in the August 1992 EPA Region VII study, the farm road in the alignment of the future Seeger Industrial Road appears to be abandoned and overgrown.

The 1967 photograph from St. Louis County shows the future Seeger Industrial Road without any roadway except for the eastern 300 foot, which appear to be an unpaved roadway.

The 1968 USGS quad map does not show Seeger Industrial Road.

The May 11, 1971, survey plat by Fleischer-Seeger Construction Company and Fowler, Placht, and Polk shows the creation of Seeger Industrial Drive as a 50-foot-wide private drive off of Hazelwood Avenue (80 foot wide) as part of the creation of the Gemini Industrial Park Annex.

In the May 4, 1971, aerial photograph contained in the August 1992 EPA Region VII study, additional buildings have been constructed along the west end of Seeger Industrial Road. Initial grading for the construction of this road is in progress.

In the May 6, 1974, aerial photograph contained in the August 1992 EPA Region VII study, Seeger Industrial Road has been paved with a two-lane PCC pavement including a golf club cul-de-sac. (A golf club cul-de-sac is a widened circular area used by vehicles to turn around, located to one side of the road alignment, giving the appearance of a golf club in plan view).

The 1974 USGS quad map shows Seeger Industrial Road as a light-duty paved road west of Hazelwood Avenue with a cul-de-sac.

In the December 12, 1980, aerial photograph contained in the August 1992 EPA Region VII study, the Seeger Industrial Road pavement does not seem to have changed since the 1974 photograph. Additional large buildings have been constructed off the roadway.

In the May 1, 1984, aerial photograph contained in the August 1992 EPA Region VII study, Seeger Industrial Road does not appear to have changed in alignment, width, or pavement type since the 1980 photograph.

In the April 16, 1985, aerial photograph contained in the August 1992 EPA Region VII study, Seeger Industrial Road does not appear to have changed in alignment, width, or pavement type since the 1984 photograph.

The February 2, 1989, survey plat by St. Charles Engineers shows Seeger Industrial Drive as a private road 50-foot wide.

In the April 8, 1990, aerial photograph contained in the August 1992 EPA Region VII study, the Seeger Industrial Road pavement does not appear to have changed in alignment, width, or pavement type since the 1985 photograph. The surrounding land is now fully developed, and additional pavement has been added to the western end of the roadway.

Summary of Critical Facts

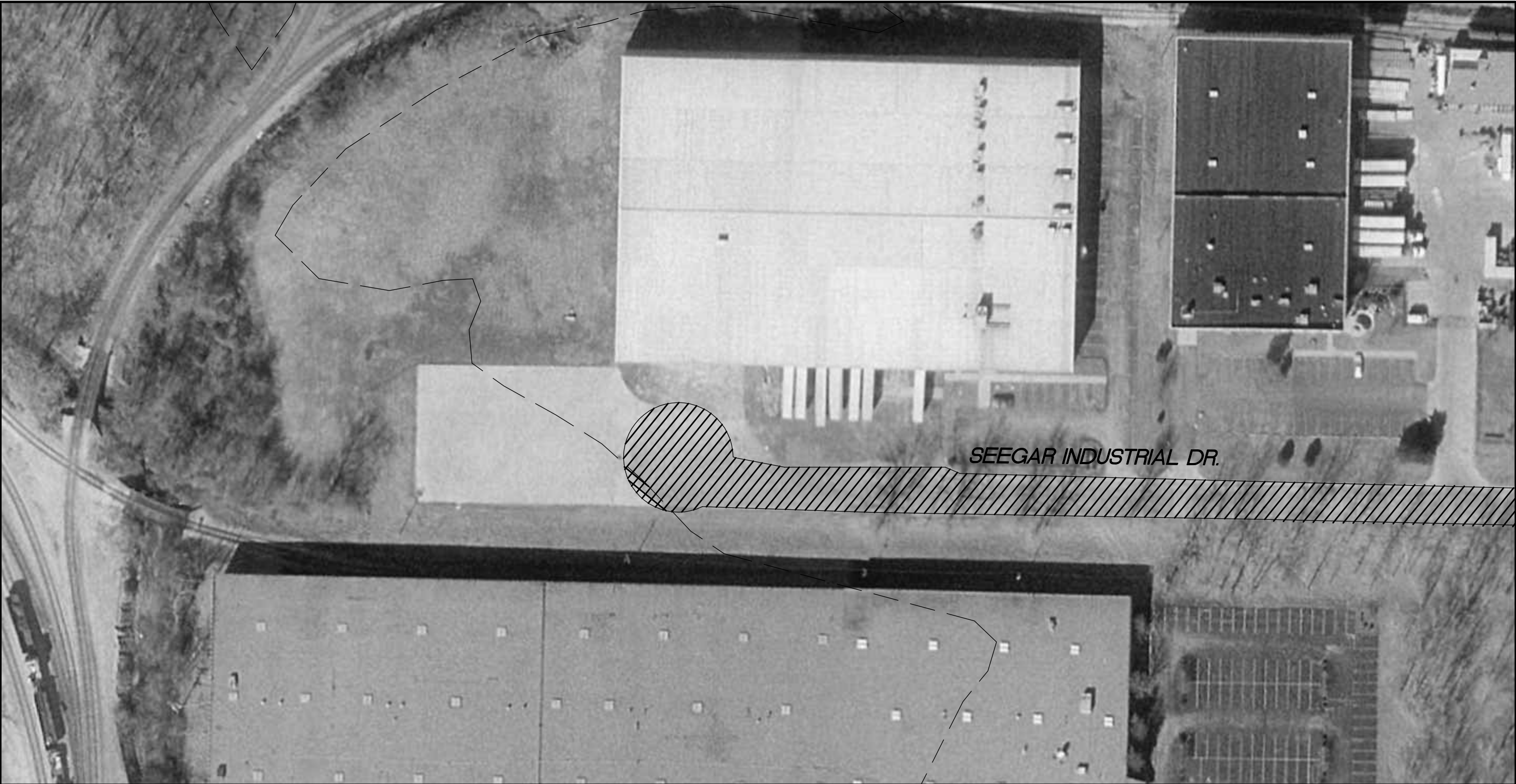
Seeger Industrial Road was created on June 21, 1971, by the city of Berkeley, Ordinance No. 1835, as part of the Gemini Industrial Park Annex industrial development. It is unusual compared to the remainder of the streets and roads reviewed in this report in that it is a private road, although it is subject to easements for public utility, sewer, drainage, and roadway purposes. This ROW is 50-foot wide, and the street pavement is PCC.

There is no evidence that this road was ever used for hauling of materials, which would have impacted adjoining land. Because the road has always been a dead end, the reason for any hauling on the road is unclear.

Final Conclusions

That portion of Seeger Industrial Road that lies within the floodplain of Coldwater Creek should be subjected to further investigation. That portion of Seeger Industrial Road pavement within 50 feet of the edge of the traveled way on Hazelwood Avenue could be over impacted material.

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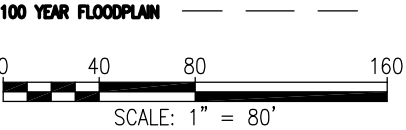


LEGEND:

- RIGHT-OF-WAY LINE
- APPROXIMATE EDGE OF PAVEMENT (1965)
- APPROXIMATE EDGE OF PAVEMENT (1997)
- XXXX FURTHER INVESTIGATION REQUIRED
- SHOULD NOT BE IMPACTED
- FORMER ROAD PAVEMENT
- FIELD SAMPLE WITH SOR>1
- FIELD SAMPLE WITH SOR<1

BACKGROUND PHOTO FROM 1997.

1971 SEEGAR INDUSTRIAL DR. CREATED
INITIAL PAVEMENT 2 LANE PCC WITH ROLLOVER CURB.
1985 TO 1990 CUL DE SAC AND STORM SEWER SYSTEM ADDED



FUSRAP

ST. LOUIS NORTH COUNTY SITES
NORTH CO. HAUL ROAD ANALYSIS
ST. LOUIS, MO.

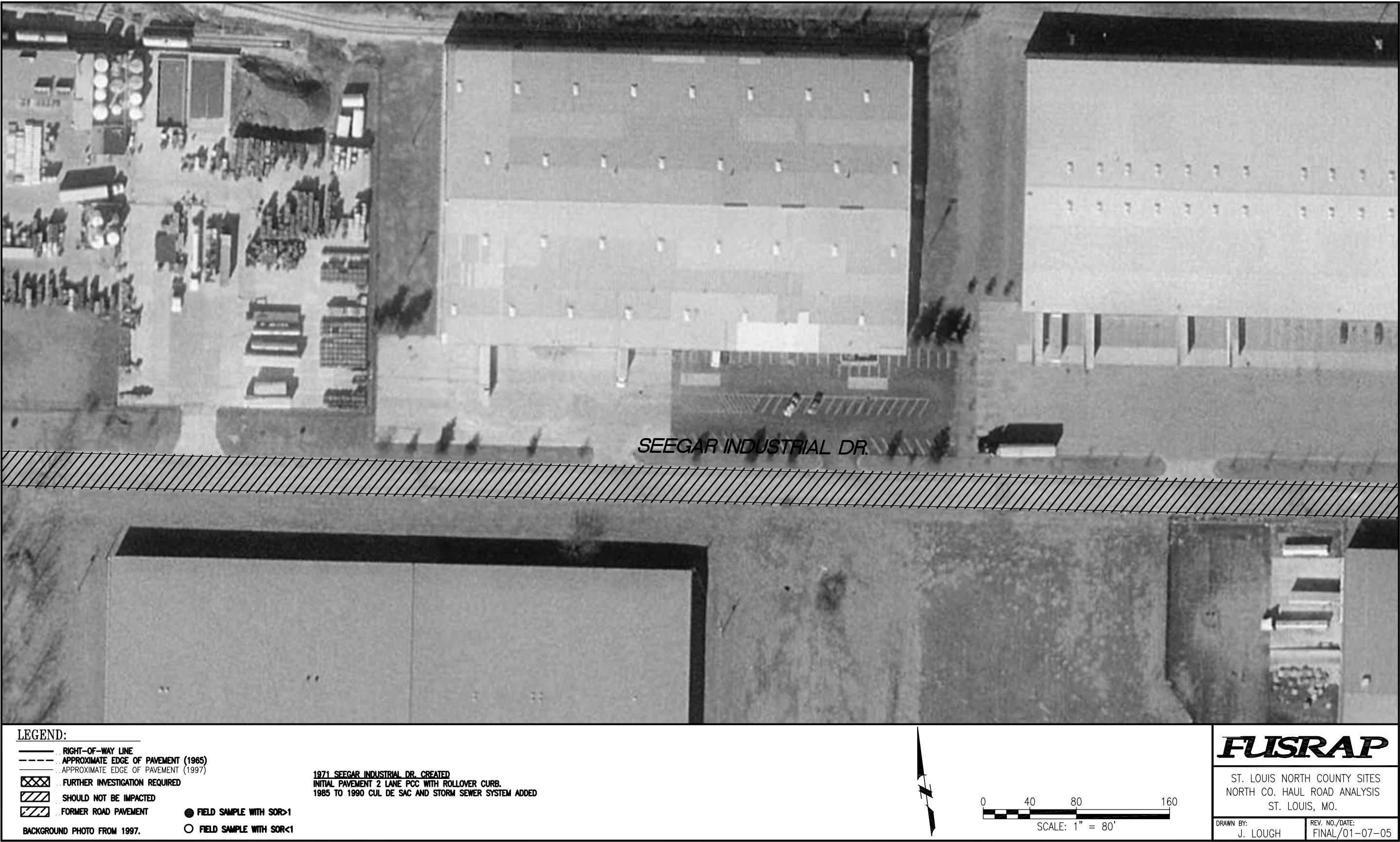
DRAWN BY:
J. LOUGH

REV. NO./DATE:
FINAL/01-07-05

FIGURE SEEGAR INDUSTRIAL 1.

MATCH LINE SEEGAR INDUSTRIAL 2

MATCH LINE SEEGAR INDUSTRIAL 1



MATCH LINE SEEGAR INDUSTRIAL 3

FIGURE SEEGAR INDUSTRIAL 2.

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MATCH LINE SEEGAR INDUSTRIAL 2



FIGURE SEEGAR INDUSTRIAL 3.

A.14 Pavement Evaluation of Nyflot Avenue

Evaluation of Aerial Photographs and Construction History Information

In the July 29, 1941, aerial photograph contained in the August 1992 EPA Region VII study, Nyflot Avenue is shown as a narrow, two-lane, AC-paved road.

In the September 11, 1953, aerial photograph contained in the August 1992 EPA Region VII study, Nyflot Avenue is shown connecting Hazelwood Avenue and Graham Road. The pavement does not appear to have changed in alignment, width, or pavement type since the 1941 photograph. The surrounding land is undeveloped farmland to the south and farmsteads or residential areas to the north.

In the May 13, 1958, aerial photograph contained in the August 1992 EPA Region VII study, additional residential development has occurred along Nyflot Avenue. The pavement does not appear to have changed in alignment, width, or pavement type since the 1953 photograph.

In the October 10, 1965, aerial photograph contained in the August 1992 EPA Region VII study, additional residential development has occurred along the north side of Nyflot Avenue and a large building, with “IGA” on the roof has been constructed to the south. The pavement has been resurfaced, but has not changed in width or alignment. A railroad spur has been constructed parallel to Nyflot just to the south.

The 1967 photograph from St. Louis County does not show any change in the pavement from the 1965 photograph.

The 1968 USGS quad map shows Nyflot Avenue as a light-duty paved road between Hazelwood Avenue and Graham Road.

In the May 4, 1971, aerial photograph contained in the August 1992 EPA Region VII study, the Nyflot Avenue pavement does not appear to have changed in alignment, width, or pavement type since the 1968 photograph.

In September 1, 1972, construction plans from the St. Louis County Department of Highways and Traffic for Graham Road, Frost Avenue to Dunn Road, Station 78+00 to 84+00, Nyflot Avenue is shown as a 40-foot-wide ROW containing a 28-foot-wide AC pavement and 2.5-foot-wide PCC curbs on each side.

The 1974 USGS quad map shows Nyflot Avenue as a light-duty paved road between Hazelwood Avenue and Graham Road. It appears unchanged from the 1968 USGS map.

In the May 6, 1974, aerial photograph contained in the August 1992 EPA Region VII study, Nyflot Avenue pavement has been rehabilitated with an AC overlay, and the eastern 200 foot appears to have been widened.

In the December 22, 1980, aerial photograph contained in the August 1992 EPA Region VII study, the Nyflot Avenue pavement does not seem to have changed since the 1974 photograph; however, I-170 has been constructed over the existing pavement.

In the May 1, 1984, aerial photograph contained in the August 1992 EPA Region VII study, Nyflot Avenue does not appear to have changed in alignment, width, or pavement type since the 1980 photograph.

In the April 16, 1985, aerial photograph contained in the August 1992 EPA Region VII study, Nyflot Avenue has received an AC overlay, but does not appear to have changed in alignment or width since the 1984 photograph.

In the December 1988 survey plat by St. Charles Consultants, Surveyors, & Engineers, Nyflot Avenue is shown with a 40-foot-wide ROW.

In the April 8, 1990, aerial photograph contained in the August 1992 EPA Region VII study, the Nyflot Avenue pavement does not appear to have changed in alignment, width, or pavement type since the 1985 photograph. The surrounding land is now fully developed, and additional pavement has been added to the western end of the roadway.

Summary of Critical Facts

Nyflot Avenue was in existence as a paved AC surface prior to the start of hauling activities. Some time prior to 1972 the original pavement was upgraded to include 2-1/2-foot PCC curbs and gutters.

There is no evidence that this road was ever used for hauling of materials, which would have impacted adjoining land. This road would not have been a reasonable hauling route for the transport of residue.

Final Conclusions

Based on the information available, the Nyflot Avenue pavement should have protected the material beneath from direct impact because there was a hard-surface AC pavement while hauling activities were occurring. Moreover, there is very little reason to expect that this road would have ever been exposed. The material beneath the AC pavement on Nyflot Avenue and the PCC curbs and gutters do not, therefore, need to be subjected to further investigation. There is no evidence that this road would have been subjected to impacts.

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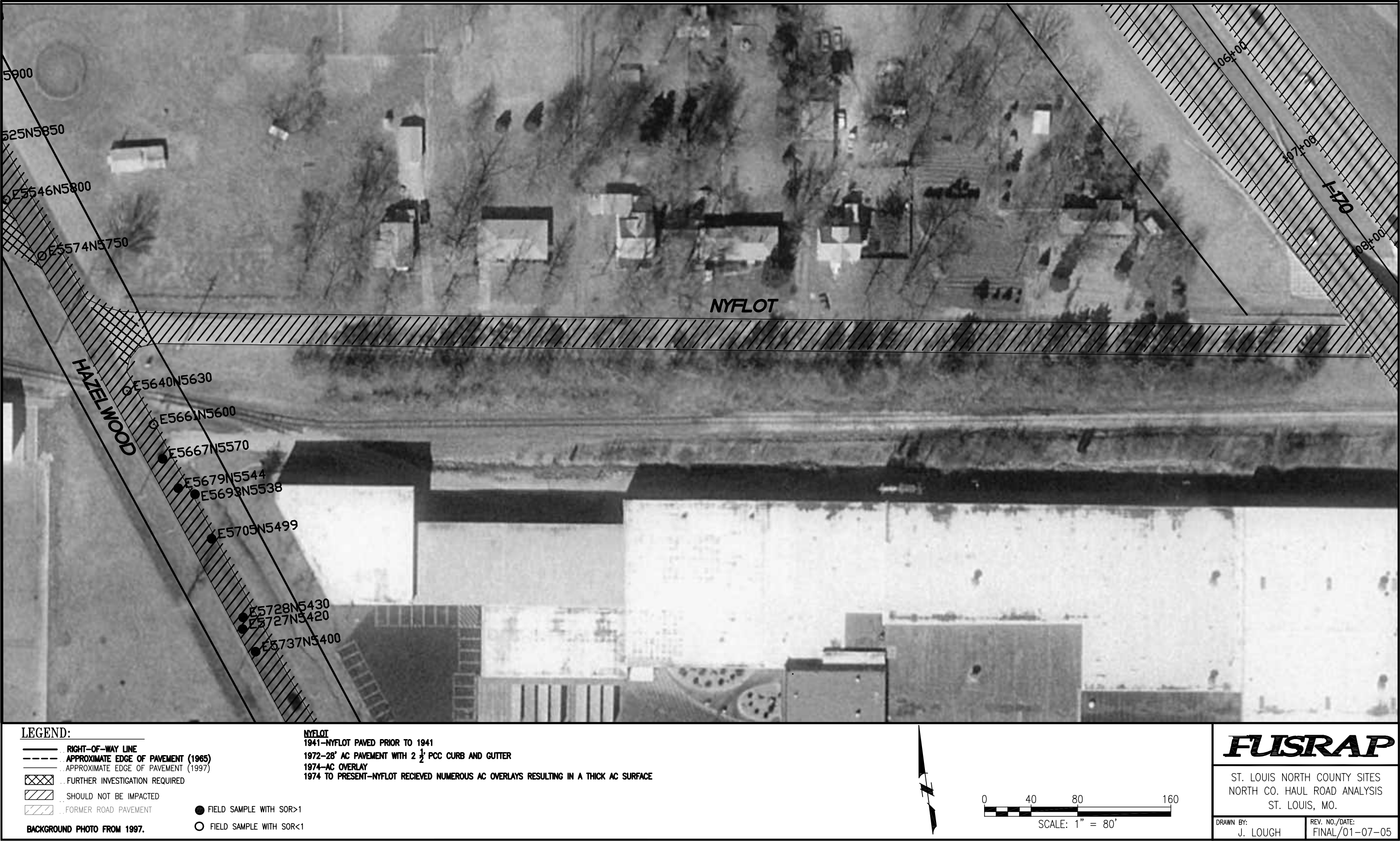


FIGURE NYFLOT 1.

MATCH LINE NYFLOT 1



FIGURE NYFLOT 2.

A.15 Selected Historical Documents

The following is a listing of selected documents reviewed for this report. The documents are listed in 5-year increments.

1940 to 1945

Radiological Survey of the Mallinckrodt Chemical Works, St. Louis, Missouri, by Oak Ridge National Laboratory, operated by Union Carbide Corporation for the U. S. Department of Energy. The date of this document is unclear, but it describes the work and decontamination efforts at Mallinckrodt Chemical Works from 1942 to 1962. DOE/EV-0005/27/ORNL-5715.

1955 to 1960

Memorandum, "Pitchblende AM-7 Raffinate at St. Louis Airport," dated 15 June 1956. This document describes some of the residue stored at the site.

Hamm Drayage Company 1957 Hauling Contract, by Mallinckrodt Chemical Works Uranium Division, dated 28 November 1956. *

Memorandum, "General Information," Airport Site, Robinson, Missouri, dated April 11, 1959. This document describes some of the residue stored at the site.

1960 to 1965

Memorandum, "Pre-Licensing Visit to the Contemporary Metals Corporation Proposed Facility at Hazelwood, Missouri, and Residue Stockpiles at Robinson, Missouri, Docket No. 40-6811," by United States Government Source and Special Nuclear Materials Branch, dated 15 September 1962.

Instructions and Information to Bidders for Sale of Property at Robertson, Missouri, by Atomic Energy Commission, dated 3 August 1964. *

1965 to 1970

Committee Report on Disposition of St. Louis Airport Storage Site, by Airport Committee, dated 5 November 1965.

Letter from Village of Hazelwood to Continental Mining and Milling Company regarding the possibility of erecting a manufacturing plant in Hazelwood (the HISS), dated 22 December 1965.

Letter from Braun Excavation Company to Continental Mining and Milling Company concerning bid for transport of materials between the SLAPS and the HISS, dated 27 December 1965.

* Materials obtained from Mallinckrodt files.

Bill of sale between the Atomic Energy Commission and Continental Mining and Milling Company for the SLAPS residues dated 25 February 1966.

Memorandum, "Disposition of the St. Louis Airport Storage Site," by Oak Ridge Operations, United States Government, dated 22 December 1966.

Memorandum, "Requirements for Surface Cleanup of the Airport Site," by United States Government, dated 25 July 1967.

1975 to 1980

An Aerial Radiological Survey of the Area Surrounding the Mallinckrodt Nuclear Maryland Heights Facility and Two Additional Sites, by the Remote Sensing Laboratory of the United States Department of Energy, dated September 1979.

1980 to 1985

Preliminary Radiological Survey of Proposed Street Right-of-Way at Futura Coatings, Inc., 9200 Latty Avenue Hazelwood, Missouri, by Oak Ridge Associated Universities for United States Nuclear Regulatory Commission, dated December 1981.

Compilation of Background Information Available to the U. S. Department of Energy on a 21.7-Acre Tract of City of St. Louis-Owned Airport Land Which May Be Conveyed to DOE Pursuant to Public Law 98-360, by U. S. Department of Energy, Oak Ridge Operations Office, Oak Ridge, Tennessee, dated January 1985.

Results of the Mobile Gamma Scanning Activities in Berkeley, Bridgeton, and Hazelwood, Missouri, by Oak Ridge National Laboratory, operated by Martin Marietta Energy Systems, Inc., for the U. S. Department of Energy, dated June 1985

Post-Remedial Action Report for the Hazelwood Site – 1984, by Bechtel National, Inc. for the U. S. Department of Energy, dated July 1985.

Memorandum, "Chronology of Events for Latty Avenue 1966 to 1985," dated 14 December 1985.

Results of the Radiation Measurements Taken of Transportation Routes (LMOO4) in Hazelwood, Missouri, by Oak Ridge National Laboratory, operated by Martin Marietta Energy Systems, Inc., for the U. S. Department of Energy, dated December 1986.

* Materials obtained from Mallinckrodt files

Radiological Survey of Latty Avenue in the Vicinity of the Former Cotter Site, Hazelwood/Berkeley, Missouri (LM001), by Oak Ridge National Laboratory, operated by Martin Marietta Energy Systems, Inc., for the U. S. Department of Energy, dated May 1987.

Results of Mobile Gamma Scanning Activities in St. Louis, Missouri, by Oak Ridge National Laboratory, operated by Martin Marietta Energy Systems, Inc., for the U. S. Department of Energy, dated June 1987.

1990 to 1995

Radiological Characterization Report for FUSRAP Properties in the St. Louis, Missouri, Area, by Bechtel National, Inc., for the U. S. Department of Energy, dated August 1990. (3 volumes)

St. Louis Airport/Hazelwood Interim Storage/Futura Coatings Company, St. Louis, St. Louis County, Missouri, by U. S. Department of Health and Human Services Public Health Service, dated 10 May 1991.

Engineering Evaluation/Cost Analysis Environmental Assessment for the Proposed Decontamination of Properties in the Vicinity of the Hazelwood Interim Storage Site, Hazelwood, Missouri, by Bechtel National, Inc., for the U. S. Department of Energy, dated March 1992.

* Materials obtained from Mallinckrodt files.

North St. Louis County Haul Road Analysis and Justification for Additional Investigation-Evaluation of
Inaccessible Materials Beneath Pavements

REFERENCE DOCUMENTS

History of Material Storage at the St. Louis Airport Storage Site

This is a summary of the licensed material that has been stored at the St. Louis Airport Storage Site (SLAPSS). The site is also referred to as the Robertson Airport Site and as the St. Louis-Lambert Airport Property. The 21.7 acre tract is located immediately north of the airport, and since 1946 has been used solely for storage.

Most of the materials stored at the site were residues generated by the Mallinckrodt Chemical Works during uranium processing operations for the Atomic Energy Commission from 1946 to 1953. The Manhattan Engineer District (MED) was granted consent to use and occupy the property on March 2, 1946; title was acquired by condemnation proceedings on January 3, 1947. Table 1 summarizes the material stored at the SLAPSS. Most material was removed from the site in the 1966 to 1969 time frame, although some contaminated wastes were buried on site.

The pitchblende raffinate, AM-7, was a product of operations at the Mallinckrodt Destrehan Street Refinery, St. Louis, Missouri, which used pitchblende ores as a feed for uranium production from 1946 until early in 1955. These ores were purchased from African Metals Corporation, with the contract requiring the U.S. to store the raffinate while African Metals retained ownership of all materials other than uranium. The raffinate was stored in bulk on the ground. About 350 tons of the AM-7 were processed in a pilot plant at Destrehan Street to recover ionium from 1955 to 1957, and returned to storage at SLAPSS. African Metals abandoned the material following decreases in the market values of the nickel, cobalt, and copper remaining in the raffinate. The AM-7 was part of the residue from the site sold in 1966 to Continental Mining and Milling Company, and was moved to the Latty, Missouri, Avenue site from 1966 to 1967.

Radium bearing residues, K-65, were also owned by African Metals and stored at the site from 1946 to 1948. Storage was originally planned to be in the concrete pit at the site, but due to health reasons was stored in drums. It was transferred to the Lake Ontario, New York, storage area in 1948 and 1949.



Barium sulphate cake residue, AJ-4, was another product of the Destrehan Street Refinery. Storage was in bulk on the ground. African Metals relinquished ownership of the barium cake, which was then part of the residue sold to Continental in 1966 and moved to the Latty Avenue, Missouri, site for storage. However, traces remained at the SLAPPS site, and were removed and disposed of at the Weldon Spring quarry in 1969 by the St. Louis-Lambert Airport Authority. The 8700 tons of leached barium sulphate cake stored at Latty Avenue were believed to be disposed at the West Lake Landfill by its owners, the Cotter Corporation, in 1973.

The AM-10 raffinate was a residue resulting from the processing of domestic ores at Destrehan Street. It was stored in bulk at SLAPSS, separately from the AM-7. It was part of the residues sold to Continental and removed in 1966-67.

Other miscellaneous residues which were sold to Continental were the C-6 Vitro residues and V-10 captured Japanese uranium-containing sands and precipitates. These materials were stored in approximately 2400 drums. They were transferred to the SLAPSS from Middlesex, New Jersey, in 1954 during closeout of that site.

The C-Liner slag consisted mainly of dolomite liner with less than 2% uranium content, and was stored in bulk on the ground. It resulted from the separation of slag from the reduction step in the Metal Plant at Plant 4 and later in Metal Plant 6E at Destrehan Street. Shipments began March 10, 1946 and lasted until early 1953 when the dolomite liner was replaced by a recycle Magnesium fluoride liner. Inventory as of April 11, 1959 showed 7,800 tons of C-Liner slag containing 122.3 tons of uranium. A portion was sent to Fernald for processing in the early 1960's; inventory as of November 1965 was 4,000 tons containing 49 tons uranium. The remainder was transferred to Continental in an amendment to the 1966 sale.

The interim residue plant tailings, C-701, were from operations at the Destrehan Street site, which commenced in 1955 to scalp the uranium content from the magnesium fluoride slag. The tailings were shipped to Fernald and

processed in the late 1950's, with the Fernald process rate increasing to about 600 tons per month in July 1959.

Approximately 55,000 empty 30- and 50- gallon drums and 3,500 tons of contaminated steel and alloy scrap had accumulated at the SLAPSS by 1959 as a result of operations by Mallinckrodt for the MED. The materials were sold primarily for metal salvage by 1962.

The only material remaining at the SLAPSS consists of buried scrap and wastes. Decontamination wastes, rubble, and scrap from removal of buildings at Destrehan Street between 1957 and 1962 are buried at the west end of the site. In addition, all structures at the SLAPSS were razed in 1969 and buried on site.

Table 1. Materials Stored at
St. Louis Airport Storage Site

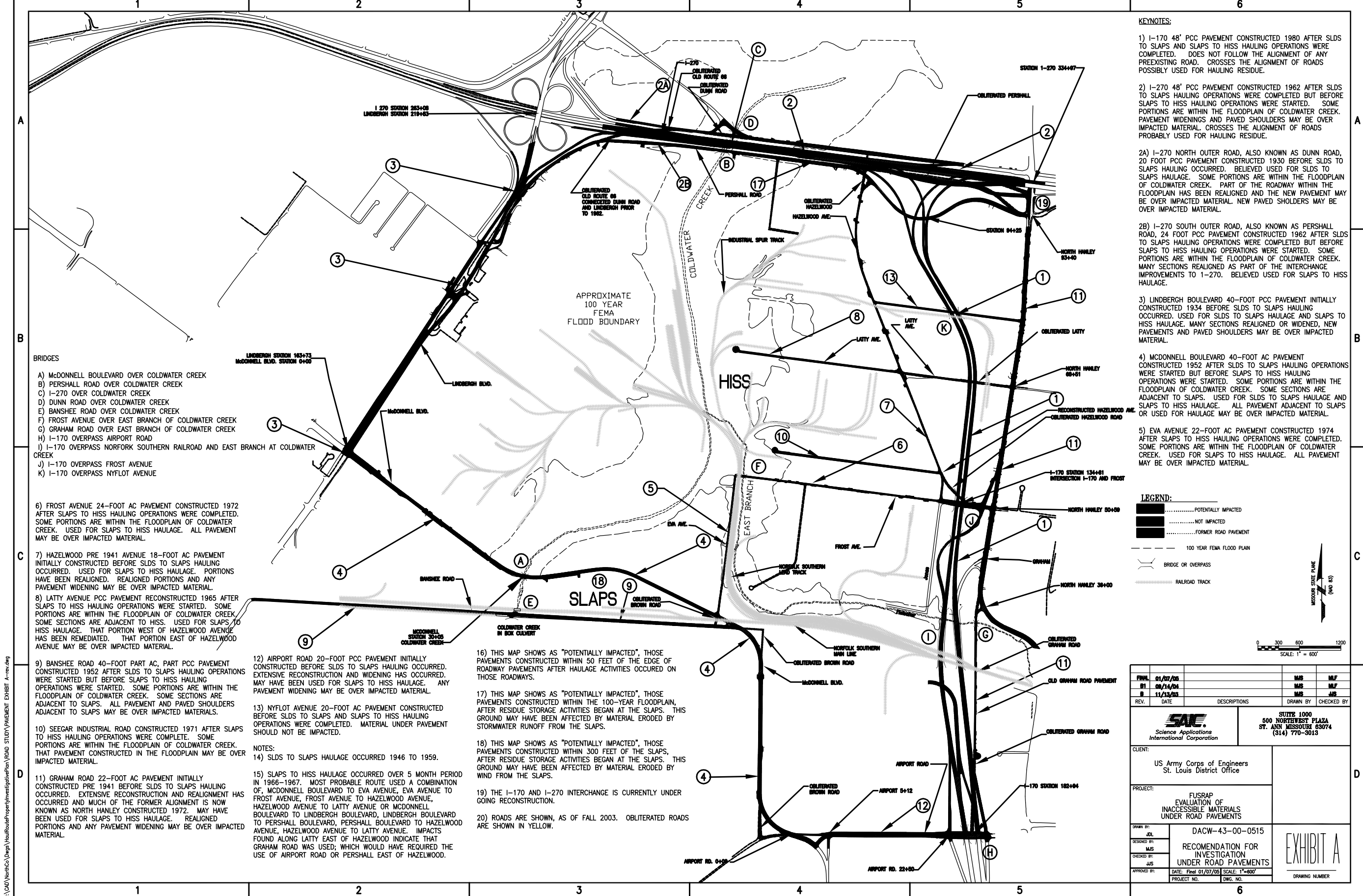
Designation	Material	Entry	Inventory Reports				Disposition	
			April 1959 (1)		June 1960 (2) August 1964 (2)		November 1965 (3)	
			Tonnage	Uranium Tonnage	Tonnage	Uranium Tonnage	Tonnage	Uranium Tonnage
AM-7	Pitchblende raffinate	'46 - '55 (4)	74000	113.2	74000	113	74000	113 '66 to Continental
K-65	Radium bearing residue	'46 - '48 (4)	0	0	0	0	0	'48 - '49 (7)
AJ-4	Barium sulphate cake, unleached	'46 - '55 (4)	1500	22	1500	22	1500	22 '66 to Continental
AJ-4	Barium sulphate cake, leached	'46 - '55 (4)	8700	7	8700	7	8700	7 (8)
AM-10	Colorado raffinate	'46 - '55 (4)	32500	47.6	32500	48	32500	48 '66 to Continental
C-6	Vitro residues	'54 from Middlesex	290	1.9	350	2	350	2 '66 to Continental
V-10	Captured Japanese U, precipitates	'54 from Middlesex	60	0.2	(incl. in above)		(incl. in above)	'66 to Continental
--	C-Liner slag	'46 - '53 (5)	7800	122.3			4000	49 (9)
C-701	Interim residue plant tailings	begin '55 (4)	7000	144.4	0	0	0	0 to Fernald '59
--	55,000 30- and 50- gallon drums	by '59 (4)	--	--	--	--	--	-- sold by '62
--	steel and alloy scrap	by '59 (4)	3500	--	--	--	--	-- sold by '62
--	waste, rubble, and scrap	(6)	--	--	--	--	--	-- (10)
--	structures on site	built '46 - '59	--	--	--	--	--	-- (11)

- Notes:
- (1) Reference: Airport Storage Inventory -- April 11, 1959.
 - (2) Reference: Invitations for bids, U.S. Atomic Energy Commission, St. Louis Area Office, June 10, 1960, and August 3, 1964.
 - (3) Reference: U.S. Atomic Energy Commission survey, November 1965.
 - (4) from Destrehan Street Refinery
 - (5) from Metal Plant at Plant 4 and Metal Plant 6E at Destrehan Street
 - (6) from removal of buildings at Destrehan Street between 1957 and 1962
 - (7) to Lake Ontario, New York, storage site
 - (8) to Continental in 1966, transferred to Latty Avenue, Missouri, and disposed of at West Lake Landfill by the Cotter Corporation in 1973
 - (9) portion sent to Fernald in early 1960's; remainder to Continental in 1966
 - (10) buried at west end from 1957 through 1962
 - (11) razed and buried on site in 1969

North St. Louis County Haul Road Analysis and Justification for Additional Investigation-Evaluation of
Inaccessible Materials Beneath Pavements

EXHIBIT A

Investigation Under Road Pavements

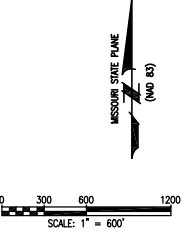


KEYNOTES:

- 1) I-170 48' PCC PAVEMENT CONSTRUCTED 1980 AFTER SLDS TO SLAPS AND SLAPS TO HISS HAULING OPERATIONS WERE COMPLETED. DOES NOT FOLLOW THE ALIGNMENT OF ANY PREEXISTING ROAD. CROSSES THE ALIGNMENT OF ROADS POSSIBLY USED FOR HAULING RESIDUE.
- 2) I-270 48' PCC PAVEMENT CONSTRUCTED 1962 AFTER SLDS TO SLAPS HAULING OPERATIONS WERE COMPLETED BUT BEFORE SLAPS TO HISS HAULING OPERATIONS WERE STARTED. SOME PORTIONS ARE WITHIN THE FLOODPLAIN OF COLDWATER CREEK. PAVEMENT WIDENINGS AND PAVED SHOULDERS MAY BE OVER IMPACTED MATERIAL. CROSSES THE ALIGNMENT OF ROADS PROBABLY USED FOR HAULING RESIDUE.
- 2A) I-270 NORTH OUTER ROAD, ALSO KNOWN AS DUNN ROAD, 20 FOOT PCC PAVEMENT CONSTRUCTED 1930 BEFORE SLDS TO SLAPS HAULING OCCURRED. BELIEVED USED FOR SLDS TO SLAPS HAULAGE. SOME PORTIONS ARE WITHIN THE FLOODPLAIN OF COLDWATER CREEK. PART OF THE ROADWAY WITHIN THE FLOODPLAIN HAS BEEN REALIGNED AND THE NEW PAVEMENT MAY BE OVER IMPACTED MATERIAL. NEW PAVED SHOULDERS MAY BE OVER IMPACTED MATERIAL.
- 2B) I-270 SOUTH OUTER ROAD, ALSO KNOWN AS PERSHALL ROAD, 24 FOOT PCC PAVEMENT CONSTRUCTED 1962 AFTER SLDS TO SLAPS HAULING OPERATIONS WERE COMPLETED BUT BEFORE SLAPS TO HISS HAULING OPERATIONS WERE STARTED. SOME PORTIONS ARE WITHIN THE FLOODPLAIN OF COLDWATER CREEK. MANY SECTIONS REALIGNED AS PART OF THE INTERCHANGE IMPROVEMENTS TO I-270. BELIEVED USED FOR SLAPS TO HISS HAULAGE.
- 3) LINDBERGH BOULEVARD 40-FOOT PCC PAVEMENT INITIALLY CONSTRUCTED 1934 BEFORE SLDS TO SLAPS HAULING OCCURRED. USED FOR SLDS TO SLAPS HAULAGE AND SLAPS TO HISS HAULAGE. MANY SECTIONS REALIGNED OR WIDENED, NEW PAVEMENTS AND PAVED SHOULDERS MAY BE OVER IMPACTED MATERIAL.
- 4) McDONNELL BOULEVARD 40-FOOT AC PAVEMENT CONSTRUCTED 1952 AFTER SLDS TO SLAPS HAULING OPERATIONS WERE STARTED BUT BEFORE SLAPS TO HISS HAULING OPERATIONS WERE STARTED. SOME PORTIONS ARE WITHIN THE FLOODPLAIN OF COLDWATER CREEK. SOME SECTIONS ARE ADJACENT TO SLAPS. USED FOR SLDS TO SLAPS HAULAGE AND SLAPS TO HISS HAULAGE. ALL PAVEMENT ADJACENT TO SLAPS OR USED FOR HAULAGE MAY BE OVER IMPACTED MATERIAL.
- 5) EVA AVENUE 22-FOOT AC PAVEMENT CONSTRUCTED 1974 AFTER SLAPS TO HISS HAULING OPERATIONS WERE COMPLETED. SOME PORTIONS ARE WITHIN THE FLOODPLAIN OF COLDWATER CREEK. USED FOR SLAPS TO HISS HAULAGE. ALL PAVEMENT MAY BE OVER IMPACTED MATERIAL.

LEGEND:

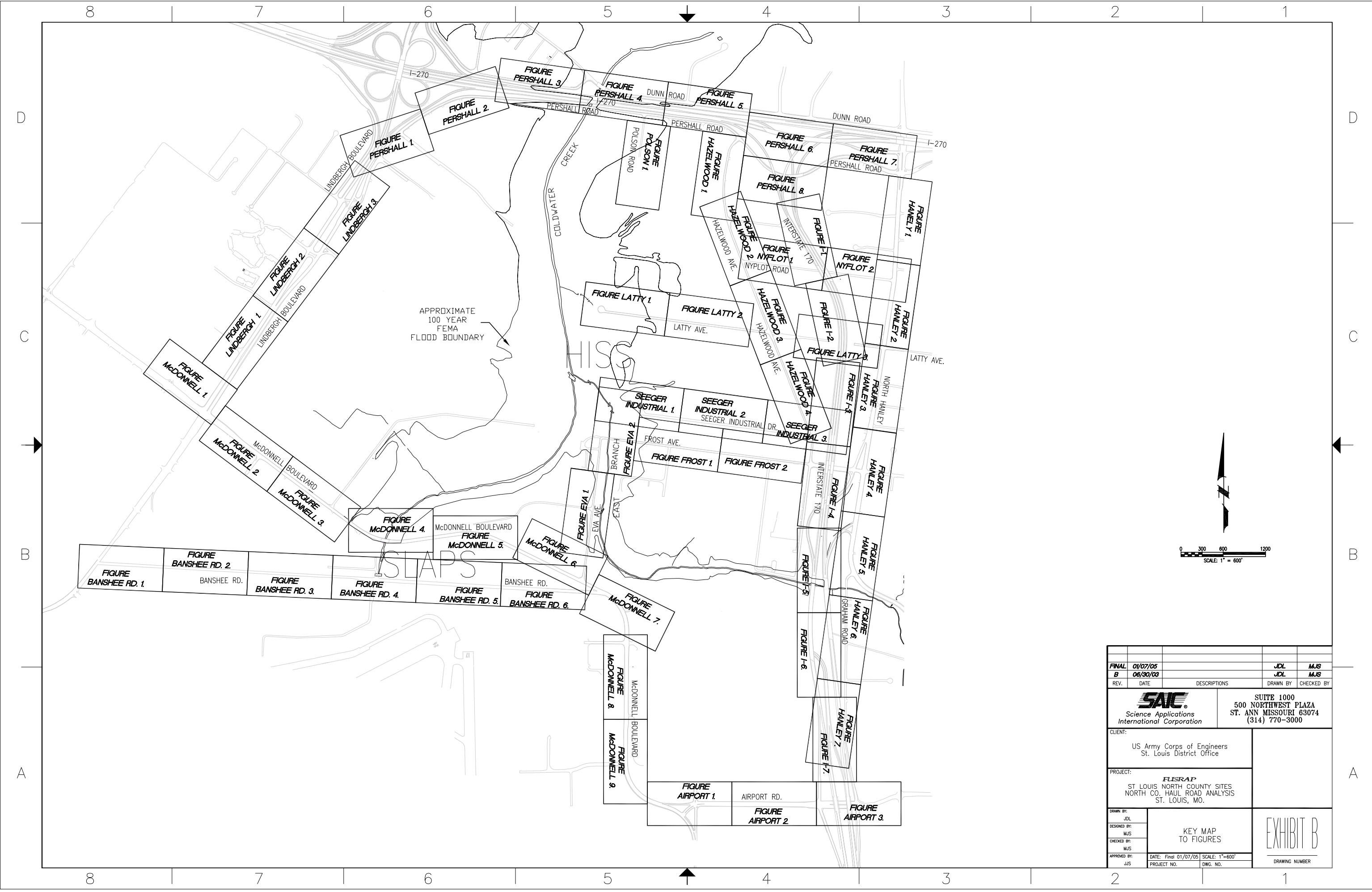
- POTENTIALLY IMPACTED
- NOT IMPACTED
- FORMER ROAD PAVEMENT
- 100 YEAR FEMA FLOOD PLAN
- BRIDGE OR OVERPASS
- RAILROAD TRACK




DATE	01/07/05	MR	MF
BY	08/14/04	MR	MF
REV	11/13/03	MR	MF
DATE	DESCRIPTIONS	DRAWN BY	CHECKED BY
SAIC Science Applications International Corporation		SUITE 1000 500 NORTHEAST PLAZA ST. LOUIS MISSOURI 63074 (314) 770-3013	
CLIENT:		US Army Corps of Engineers St. Louis District Office	
PROJECT:		FUSRAP EVALUATION OF INACCESSIBLE MATERIALS UNDER ROAD PAVEMENTS	
DRAWN BY:	JUL	DACW-43-00-0515	
DESIGNED BY:	MJS	RECOMMENDATION FOR INVESTIGATION UNDER ROAD PAVEMENTS	
CHECKED BY:	JJS	DATE: Final 01/07/05 SCALE: 1"=600'	
APPROVED BY:		PROJECT NO.	DWG. NO.
		EXHIBIT A	
		DRAWING NUMBER	

EXHIBIT B

Key Map of Figures Included in Appendices



FINAL	01/07/05		JDL	MJS
B	06/30/03		JDL	MJS
REV.	DATE	DESCRIPTIONS	DRAWN BY	CHECKED BY
 Science Applications International Corporation			SUITE 1000 500 NORTHWEST PLAZA ST. ANN MISSOURI 63074 (314) 770-3000	
CLIENT:				
US Army Corps of Engineers St. Louis District Office				
PROJECT:				
FUSRAP ST. LOUIS NORTH COUNTY SITES NORTH CO. HAUL ROAD ANALYSIS ST. LOUIS, MO.				
DRAWN BY:		KEY MAP TO FIGURES		
DESIGNED BY:				
CHECKED BY:				
MJS				
APPROVED BY:		EXHIBIT B		
JUS				
DATE: Final 01/07/05		SCALE: 1"=600'		
PROJECT NO.		DWG. NO.		
			DRAWING NUMBER	