N-61/UPRR Lake McConaughy Traffic Noise Study

Ogallala, Nebraska

Prepared for:

NDOR

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February 2005

Prepared for:

Nebraska Department of Roads
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Lincoln, Nebraska 68509-4759

EXECUTIVE SUMMARY

Nebraska Department of Roads (NDOR) has proposed improvements along Nebraska Highway 61 (N-61) near the north end of Lake McConaughy's Kingsley Dam. The project includes constructing a new viaduct along N-61 over the Union Pacific Railroad (UPRR) tracks approximately 750 feet south of the intersection with Nebraska Highway 92 (N-92). The proposed viaduct would be built along the existing N-61 alignment. In addition to the new grade separation, the project includes an asphalt overlay along N-61. The new surfacing would span approximately 0.85 miles, beginning near the north end of Kingsley Dam and terminating at the south end of the new viaduct.

The portion of N-61 under consideration is currently a two-lane, two-way roadway with a typical rural-highway cross section. The current plan is to maintain the two-lane cross section along the length of the project.

This report presents the results of a noise study performed near the proposed N-61 improvements. The scope of the project included the gathering of data to model the proposed site using the FHWA Traffic Noise Model (TNM Version 2.5), analysis using this data, and the presentation of the model results and conclusions regarding the need for noise abatement measures.

The following conclusions were made given the results of the noise analysis and application of the NDOR Noise Analysis and Abatement Policy.

1. Traffic noise at receiver locations adjacent to N-61 and N-92 is currently minimal due to the traffic demands along the roadways. Recent noise readings and analysis results indicate that noise impacts resulting from traffic along N-61 and N-92 do not currently exist at the adjacent receiver locations.

2. The traffic volumes along N-61 and N-92 are anticipated to increase through the 2027 horizon year. Although a corresponding increase in traffic noise is generally anticipated, the analysis results indicate that traffic noise levels will remain below the NAC levels at the adjacent receiver locations under the Build and No-Build conditions. No receiver impacts resulting from traffic noise were identified under the Build or No-Build scenarios for the future year analyses.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

SECTION 1.0 INTRODUCTION

1.1 PROJECT DESCRIPTION

Nebraska Department of Roads (NDOR) has proposed improvements along Nebraska Highway 61 (N-61) near the north end of Lake McConaughy's Kingsley Dam. The project includes constructing a new viaduct along N-61 over the Union Pacific Railroad (UPRR) tracks, approximately 750 feet south of the intersection with Nebraska Highway 92 (N-92). The proposed viaduct would be built along the existing N-61 alignment. In addition to the new grade separation, the project includes an asphalt overlay along N-61. The new surfacing would span approximately 0.85 miles, beginning near the north end of Kingsley Dam and terminating at the south end of the new viaduct. Refer to **Figure 1.1** for the project location.

The portion of N-61 under consideration is currently a two-lane, two-way roadway with a typical rural-highway cross section. The current plan is to maintain the two-lane cross section along the length of the project.

1.2 SCOPE OF THE DOCUMENT

This report presents the results of a noise study performed for the site of the proposed N-61 improvements located approximately nine miles northeast of Ogallala, Nebraska. The existing and future conditions at the site for the Build and No-Build alternatives were analyzed using the existing and projected traffic conditions and a computer noise model. This report presents the results and conclusions of that analysis.

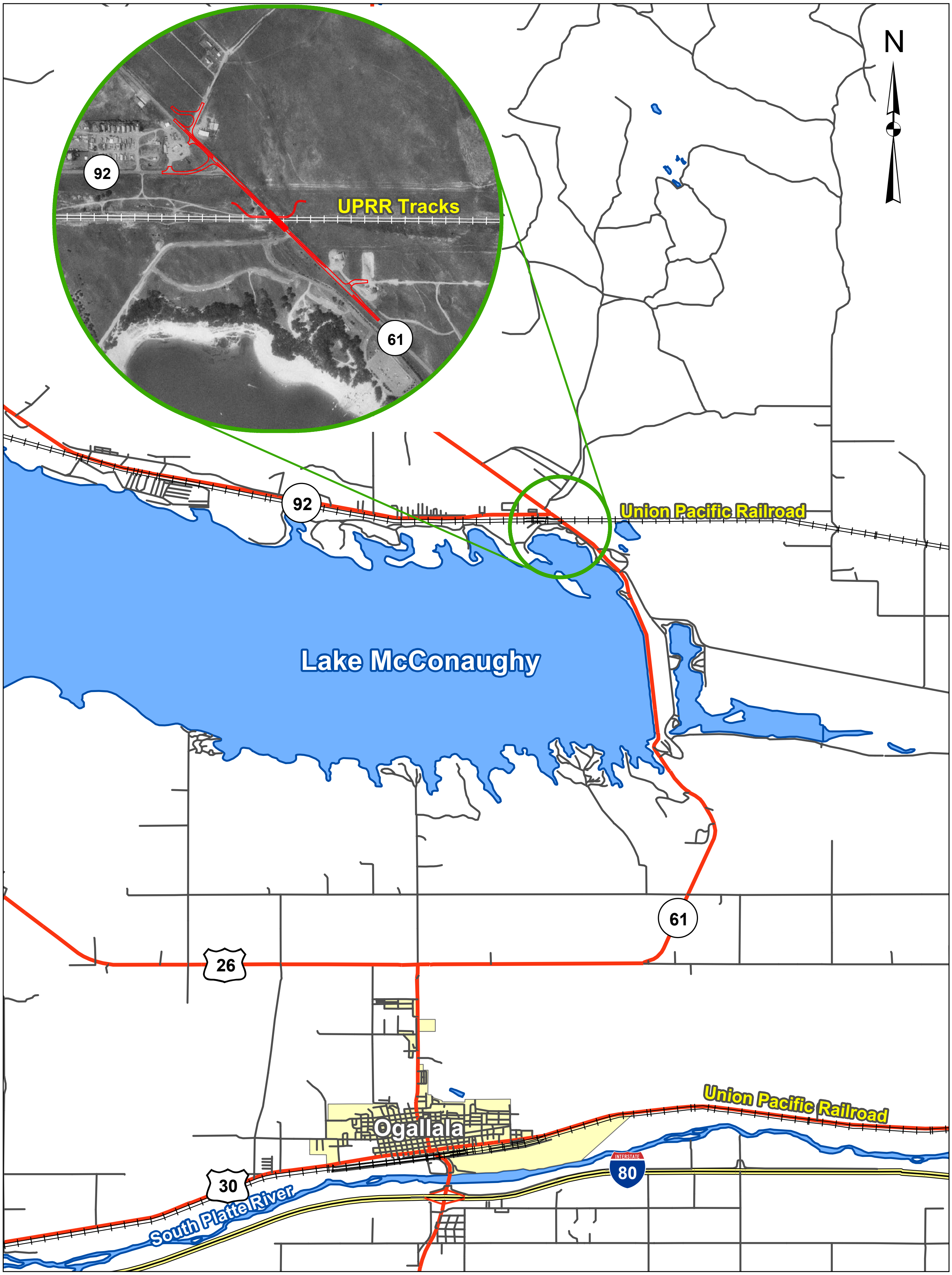

Figure 1.1
N-61 Improvement Project

1.3 NATURE OF NOISE

A general review of basic characteristics of sound is provided here as an introduction to the noise study. Sound that interferes with communications, sleep, or is greater than the threshold of pain is typically considered noise. Therefore, noise may be defined as any "unwanted sound".

Typically, sound is measured in decibels (dB), which is simply a unitless measure of sound pressure levels on a logarithmic scale. This logarithmic scale of decibels was chosen, since the range of sound pressure levels that the human ear can detect is extremely large. Using the logarithmic scale allows sound levels to be discussed with numerical values that typically range from 0 to 140 dB, as opposed to a range that includes several hundred thousands. The reference level of 0 decibels corresponds to a sound pressure level of 20 micropascals, the weakest sound that can be heard by the human ear under perfect conditions. In contrast, a sound level of 2 pascals, or 100,000 times the pressure, corresponds to a decibel level of 100. Traffic noise most frequently falls between 50 and 95 decibels. Listed below are several additional characteristics of sound.

- Noise level increases or decreases of 3 dB or less are generally considered imperceptible by humans.

- An increase of 10 decibels is typically perceived by most people as a doubling in "loudness".

- Sound heard by an individual is actually the sum of all the sound sources around them. An example of this is a person who hears traffic from a roadway, both down the road and the traffic that is passing directly in front of the observer.

- Sound typically travels in straight-line paths, however, sound, like light, can be refracted. Sound (especially low frequencies) therefore can "bend" over the top or around the side of obstacles in its path.

1.4 MEASUREMENT OF SOUND

The sound level meter is the standard device used to measure sound levels. The American Standards (ANSI 51.4-1971) specifies that sound level meters must have the capability to measure three alternate frequency response characteristics. These individual characteristics are designated "A", "B" and "C". The Federal Highway Administration (FHWA) has required that noise studies be completed using the "A" response characteristic, referred to as dBA. The "A" response characteristic weights the sound levels to include the human ear's reduced sensitivity to low and very high frequency sounds, the result is the "A"-weighted sound level correlates well to the subjective nature of human impression to loudness. **Table 1.1** shows selected decibel levels and sounds (in dBA) that are associated with them.

Table 1.1 Common Sound Levels

Common Sounds	Decibels (dBA)
Threshold of Pain	130
Turboprop Airplane	120
Rock Band	110
Jet Flyover @ 1000 ft	105
Lawn Mower @ 3 ft	95
Diesel Truck @ 50 ft	85
Diesel Truck @ 100 ft	80
Normal Speech @ 3 ft	65
Birds Chirping	50
Leaves Rustling	40
Quiet Whisper	30
Threshold of Hearing	0

1.5 APPLICABLE REGULATORY REQUIREMENTS

23 Code of Federal Regulations (CFR) Part 772 was written by the Federal Highway Administration (FHWA) to provide procedures for noise studies and the use of noise abatement measures. The purpose of this code is to help protect the public health and welfare, to supply noise abatement criteria, and to establish requirements for traffic noise information to be given to those officials who have planning and zoning authority in the project area.

23 CFR Part 772 contains criteria, which are based on the equivalent sound level descriptor L_{10} or L_{eq}. L_{10} is the sound level that is exceeded 10 percent of the time. L_{eq} is the average sound level, which over a period contains the same amount of sound energy as the varying levels of sound for the same time period. Typical noise studies will use a time period of one hour of traffic that is consistent with the peak hour. This equivalent sound level for one hour is denoted $L_{eq(h)}$. **Table 1.2** contains the upper limits of hourly desirable noise levels which are part of the Noise Abatement Criteria (NAC) established by 23 CFR Part 772. Any noise levels that approach or exceed these criteria would not be desirable and would be considered a noise impact. **Table 1.2** lists FHWA NAC for the five different activity categories.

The State of Nebraska definition for the approach criteria is within 1dB of the stated abatement criteria listed in **Table 1.2**, or 66 dBA for properties classified as Category B and 71 dBA for Category C properties, respectively. 23 CFR Part 772 also contains a section that discusses a criterion of substantial increase in sound levels. The State of Nebraska policy states that a substantial increase is 15 dBA.

The selection and analysis of all noise sensitive receptors is based on the data included in **Table 1.2**. Most areas come under Activity Categories B or C. Activity C mostly pertains to commercial land use or business offices, but would not necessarily include such things as a factory, machine shop or a service station. In addition, land uses such as storage facilities or warehouses are not typically considered noise sensitive receptors. The primary focus of the noise study is given to exterior activity areas, the reason for this is standard construction methods typically provide 15 to 25 dBA reduction in sound levels indoors. Therefore, all noise levels referred to in this report are to be considered exterior unless otherwise noted.

Table 1.2 23 CFR Part 772 Noise Abatement Criteria

Hourly A–Weighted Sound Level		
Activity Category	Hourly Noise Levels $L_{eq(h)}$ dBA	Description of Activity Category
A	57 (Exterior)	Lands on which serenity and quiet are of extra ordinary significance and serve an important public need and where the preservation of those qualities is essential if the area is to continue to serve its intended purpose.
B	67 (Exterior)	Picnic areas, recreation areas, play grounds, active sports areas, parks, residences, motels, hotels, schools, churches, libraries and hospitals.
C	72 (Exterior)	Developed lands, properties or activities not included in Categories A or B above.
D	---	Undeveloped lands.
E	52 (Interior)	Residences, motels, hotels, public meeting rooms, schools, churches, libraries, hospitals, and auditoriums.

Property adjacent to N-61 within the study area is composed of mixed land use, including a number of businesses and residences, as well as park and recreation areas. According to the noise abatement criteria contained in 23 CFR Part 772, these lands are classified as Activity Categories “B” and “C”.

1.6 NOISE PREDICTION METHOD

This noise study is representative of “peak hour” conditions and reports predicted noise levels in hourly L_{eq}, dBA. The traffic volumes used for the noise prediction in this report are Design Hourly Volumes (DHV).

Several different descriptors may be used to predict traffic noise. L_{eq} is typically used because it is reliable for both low and high traffic volume roadways. Additionally, the L_{eq} descriptor is easier for analysts to work with and is more flexible due to the fact noise levels other than those being analyzed, can be isolated and added or subtracted from the overall ambient noise level.

The Federal Highway Administration Traffic Noise Model (TNM Version 2.5) was used in this report to predict $L_{eq(h)}$ dBA noise levels. This method was developed and approved for use by the U.S. Department of Transportation Federal Highway Administration. The procedures included in the TNM allow the analysis of multiple traffic, roadway and receptor characteristics to be included in the sound level predictions.

SECTION 2.0 NOISE ANALYSIS

2.1 IDENTIFICATION OF NOISE SENSITIVE AREAS

A review of the land use information was collected and developed in support of the proposed project. Field surveys and aerial photos were used to identify noise sensitive receivers. **Figure 2.1** shows the area, land uses, and modeled receivers.

2.2 MODEL VALIDATION/SITE MONITORING

Generally, noise measurements are taken where noise impacts are expected or at any location where a sensitive receiver is located. For this project, noise readings were taken at ten locations to gain an understanding of the existing general noise conditions in the area. The measurements were taken near existing residences, businesses, and park areas adjacent to the roadways within the study area. The readings were taken at a height of five feet above ground level and ranged in duration from twenty to thirty minutes. During the measurements, the traffic volumes along the adjacent roadways were noted. Additionally, vehicles were classified according to the following categories: passenger vehicles, medium trucks, and heavy trucks.

A Casella CEL-480 integrating sound level meter was used to obtain the noise measurements. Calibrations were performed on the sound level meter before and after each sampling event using a Casella CEL-282 calibrator. Both the sound level meters and calibrator meet or exceed American National Standards Institute (ANSI) specifications required by federal regulations.

The measured noise readings were compared to the predicted sound levels from the TNM model in order to verify that the model is reproducing the existing sound conditions. The ability of the TNM to accurately predict sound levels on this project was demonstrated at receptor locations in which adjacent street traffic was the primary source of ambient noise in the area. At these locations, the predicted noise levels were within the accepted tolerance (3 dBA) of the field-measured noise levels. Receiver locations are displayed in **Figure 2.1**.

Although the model's prediction of traffic noise was verified at locations in which adjacent street traffic is the primary source of noise, it should be noted that some of the predicted sound levels were lower than sound readings taken in the field. This is due to the fact that the model does not account for other ambient noise in the area, including warning bells and train noise at the UPRR crossing.

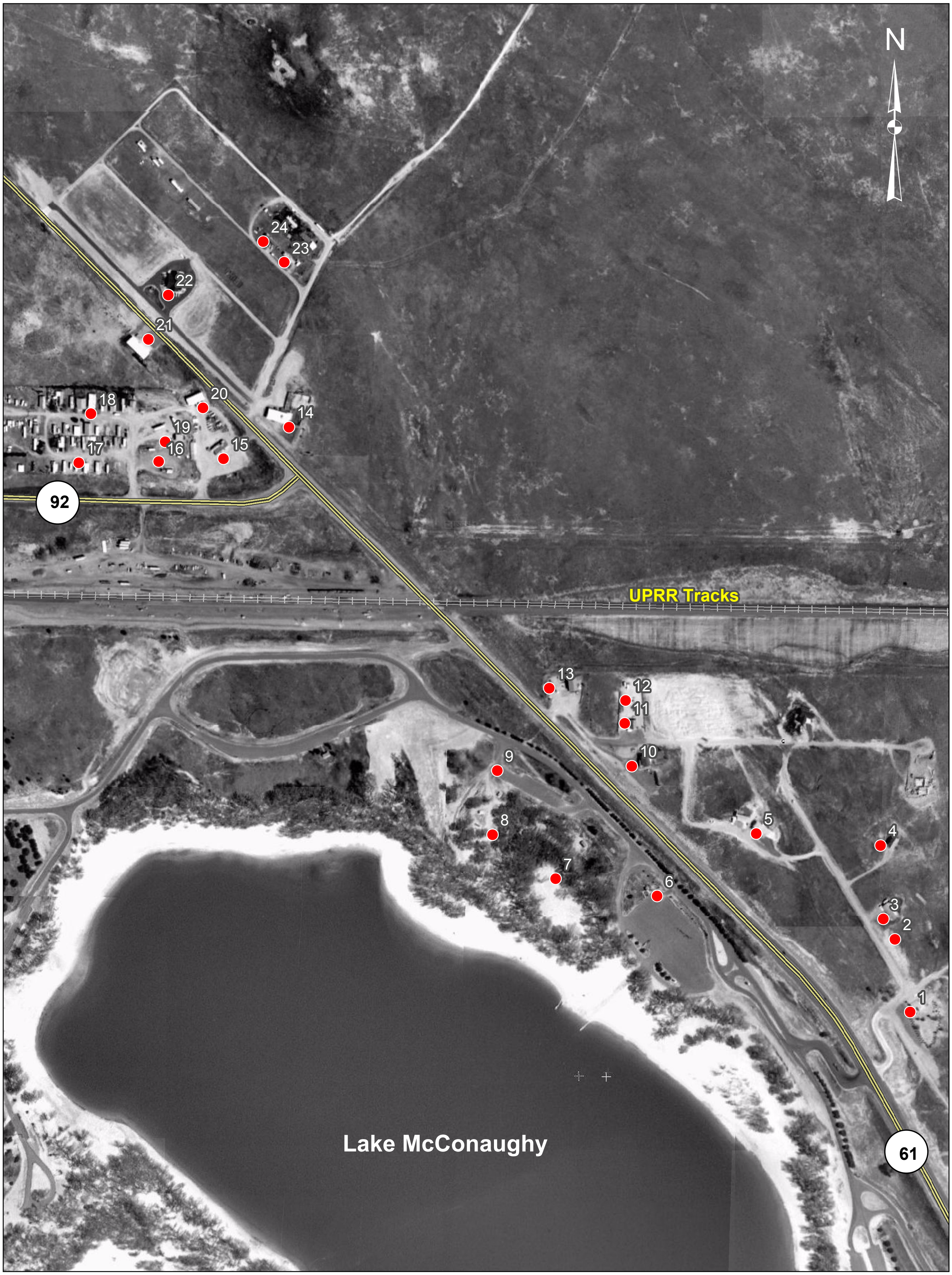

Figure 2.1
Reciever ID's

2.3 EXISTING AND FUTURE TRAFFIC NOISE LEVELS

2.3.1 Design Hourly Traffic Volume Data

This report includes the analysis of the existing and future noise conditions adjacent to N-61. The horizon year analyses were conducted for the year 2027 to provide a minimum 20-year planning period from the anticipated end of construction. The future year analyses were conducted under Build and No-Build scenarios.

Traffic volume data were necessary for the evaluation of the existing and future noise conditions along the project. Existing and future design hour traffic volumes and vehicle classification data along N-61 were obtained from an Engineering Review Report completed by NDOR for the project. The design hour traffic volumes and vehicle classification along N-92 were estimated through a recent data collection effort.

It should be noted that the horizon year traffic demands along N-61 and N-92 are not dependent on the completion of the proposed roadway improvements. As a result, the 2027 design hour traffic volumes utilized in the modeling analyses were identical under the Build and No-Build scenarios.

2.3.2 Existing & Future Noise Levels

The existing and horizon year traffic noise levels within the study area were estimated using TNM 2.5. It should again be noted that the alternatives that were investigated included the 2027 Build and No-Build alternatives. Noise levels are summarized in **Table 2.1**. Noise isopleths are shown in the **Appendix**.

The Federal Highway Administration (FHWA) Noise Abatement Criteria (NAC) is summarized in **Table 1.2**. NDOR policy generally considers that an impact occurs and abatement measures will be considered for receptors if either of the two following criteria is met:

1. The predicted design year noise levels approach or exceed the noise abatement criteria (NAC). NDOR has established that a noise level of one decibel less than the NAC in the FHWA Noise Standards constitutes “approaching” the NAC.
2. Predicted noise levels of 15 dBA or more above existing levels “substantially exceed” existing levels for the purposes of interpreting the FHWA noise standards. Absolute noise levels are an additional consideration in assessing the degree of impact associated with this increase in noise level.

Results of the noise analysis for the existing and future conditions are displayed in **Table 2.1**. As shown, there is currently minimal traffic noise at receiver locations adjacent toN-61 and N-92. The results correspond to the noise readings taken at these locations and are due to relatively minimal traffic demands on the adjacent roadways.

Results of the 2027 No-Build analysis indicate that traffic noise will increase slightly as the traffic demands on N-61 and N-92 increase. However, it is not anticipated that any receivers included in the study will be impacted with the future traffic volumes under the No-Build scenario.

The 2027 Build analysis results indicate that receivers adjacent to the project will not be impacted. Refer to **Table 2.1** for the analysis results under each scenario.

Table 2.1 2004 and 2027 Predicted Noise Levels

Receiver ID	Activity Category and Type		Impact Threshold [a]	Existing 2004	2027 No-Build	2027 Build
Receiver 1	C	Commercial	71	53	54	54
Receiver 2	B	Residence	66	49	50	50
Receiver 3	B	Residence	66	48	48	49
Receiver 4	B	Residence	66	44	45	45
Receiver 5	B	Residence	66	52	53	53
Receiver 6	B	Park Area	66	56	56	56
Receiver 7	B	Park Area	66	50	50	50
Receiver 8	B	Park Area	66	49	49	52
Receiver 9	B	Park Area	66	53	53	54
Receiver 10	B	Residence	66	59	60	60
Receiver 11	C	Commercial	71	54	55	55
Receiver 12	C	Commercial	71	51	52	52
Receiver 13	C	Commercial	71	61	62	60
Receiver 14	C	Commercial	71	61	61	62
Receiver 15	C	Commercial	71	57	57	58
Receiver 16	C	Commercial	71	54	54	55
Receiver 17	B	Residence	66	55	55	55
Receiver 18	B	Residence	66	51	51	51
Receiver 19	C	Commercial	71	53	54	54
Receiver 20	C	Commercial	71	61	62	62
Receiver 21	C	Commercial	71	63	64	64
Receiver 22	C	Commercial	71	58	59	59
Receiver 23	B	Residence	66	46	46	47
Receiver 24	B	Residence	66	46	46	46

[a] Minimum thresholds are based on NDOR policy with regard to the Noise Abatement Criteria (NAC) in FHWA Noise Standards

2.4 NOISE ABATEMENT MEASURES

Noise abatement measures should be considered where predicted traffic noise levels approach or exceed the noise abatement criteria, or when the predicted noise levels substantially exceed the existing noise levels (23 CFR 772, Section 722.11). The federal code requires that when a noise impact is identified abatement be considered. It should be noted that because abatement is considered does not necessarily mean it will be implemented. Issues of reasonableness and feasibility must be adequately demonstrated to justify the noise abatement measure. However, the following abatement measures may be considered:

2.4.1 Buffer Zones

The purpose of a buffer zone is to provide enough distance between the noise source and any future developments in order to minimize future noise impacts. Buying substantial right-of-way in undeveloped areas adds extra distance to allow for more noise reduction. For any developing area that is enclosed by roadways it would be difficult to provide additional buffer zone.

Buffer zones will not be implemented as an abatement measure for this project.

2.4.2 Alteration of Horizontal and Vertical Roadway Alignments

This noise abatement measure can be incorporated into a project to reduce traffic noise impacts where the receptors are typically towards one side of the project or where the elevation is relatively constant. Since sound intensity decreases with distance from the source, shifting the centerline away from the receptors may reduce the noise impacts.

The planned horizontal and vertical alignment along N-61 is controlled largely by the proposed viaduct over the UPRR railroad tracks and the Kingsley Dam south of the project. Furthermore, existing residential and commercial properties adjacent to the roadway limit the potential alignment alternatives. Shifting the alignment to reduce the impacts on one side of the roadway increases the impacts on the opposite side of the roadway. Additionally, the alteration of the vertical alignment is governed by safety (Design Standards) and the available right-of-way. As a result of these factors, significant modifications to the existing horizontal alignment were not considered.

2.4.3 Traffic Management Measures

These measures are evaluated as alternative noise abatement measures for reducing or eliminating noise impacts. The prohibition of certain vehicle types, mainly trucks, is an alternative noise abatement measure. Trucks can be prohibited from certain streets and roads. They can also be permitted to use designated streets or roads during certain hours of the day.

These options are not feasible for this project since the road serves as a major roadway in the area. A primary purpose of the roadway is to efficiently move traffic, including heavy trucks, through the area.

2.4.4 Noise Barriers

Noise barriers are considered as a possible means of noise abatement in areas where the traffic is creating a noise impact. Since a noise barrier has to be continuous and have substantial length and height to be effective, this adds to their high cost and adverse effects.

The implementation of noise barriers must be shown be to both *feasible* and *reasonable* based on NDOR criteria. Noise barriers are not proposed unless a single barrier on a *feasible* location can effectively reduce traffic noise for an impacted receiver at a *reasonable* cost. Since the analysis results indicate that no receivers adjacent to the project will be impacted, noise barriers were not considered.

2.5 CONSTRUCTION NOISE

The evaluation and control of construction noise must be considered as well as the traffic noise resulting from the completed project. Any construction noise concerns will be addressed by the construction project manager. Potential alternatives are briefly described below.

2.5.1 Design Considerations

This includes measures in the plans and specifications to minimize or eliminate adverse impacts. No specific measures have been included in the project at this time.

2.5.2 Community Awareness

It is important for people to be made aware of the possible inconvenience and to know its approximate duration so they can plan their activities accordingly. It is the policy of the Nebraska Department of Roads that information concerning the upcoming construction project be submitted to all local news media.

2.5.3 Source Control

Source control involves reducing noise impacts from construction by controlling the noise emissions at their source.

2.5.4 Site Control

Site control involves the specification of certain areas where extra precautions should be taken to minimize construction noise.

2.5.5 Time and Activity Constraints

Limiting work hours on a construction site can be beneficial during the hours of sleep or on Sundays and holidays. Exceptions due to weather, schedule, and a time related phase of construction work could occur.

SECTION 3.0 CONCLUSIONS

The completion of site inspections, future noise modeling, and evaluation of abatement options allow the following conclusions to be made:

1. Traffic noise at receiver locations adjacent to N-61 and N-92 is currently minimal due to the traffic demands along the roadways. Recent noise readings and analysis results indicate that noise impacts resulting from traffic along N-61 and N-92 do not currently exist at the adjacent receiver locations.

2. The traffic volumes along N-61 and N-92 are anticipated to increase through the 2027 horizon year. Although a corresponding increase in traffic noise is generally anticipated, the analysis results indicate that traffic noise levels will remain below the NAC levels at the adjacent receiver locations under the Build and No-Build conditions. No receiver impacts resulting from traffic noise were identified under the Build or No-Build scenarios for the future year analyses.

SECTION 4.0 REFERENCES

1. *Highway Traffic Noise Analysis and Abatement Policy and Guidance*, FHWA Office of Environment and Planning: Washington, D.C., June 1995.

2. *Measurement of Highway Related Noise*, FHWA, Washington, D.C., May 1996.

3. *23 Code of Federal Regulations (CFR) Part 772*.

4. *Noise Analysis and Abatement Policy*, Nebraska Department of Roads Project Development Division, Noise & Air Section, Lincoln, Nebraska, May 1998.

SECTION 5.0 LIST OF PREPARERS

This noise study was prepared by Kirkham Michael Consulting Engineers.

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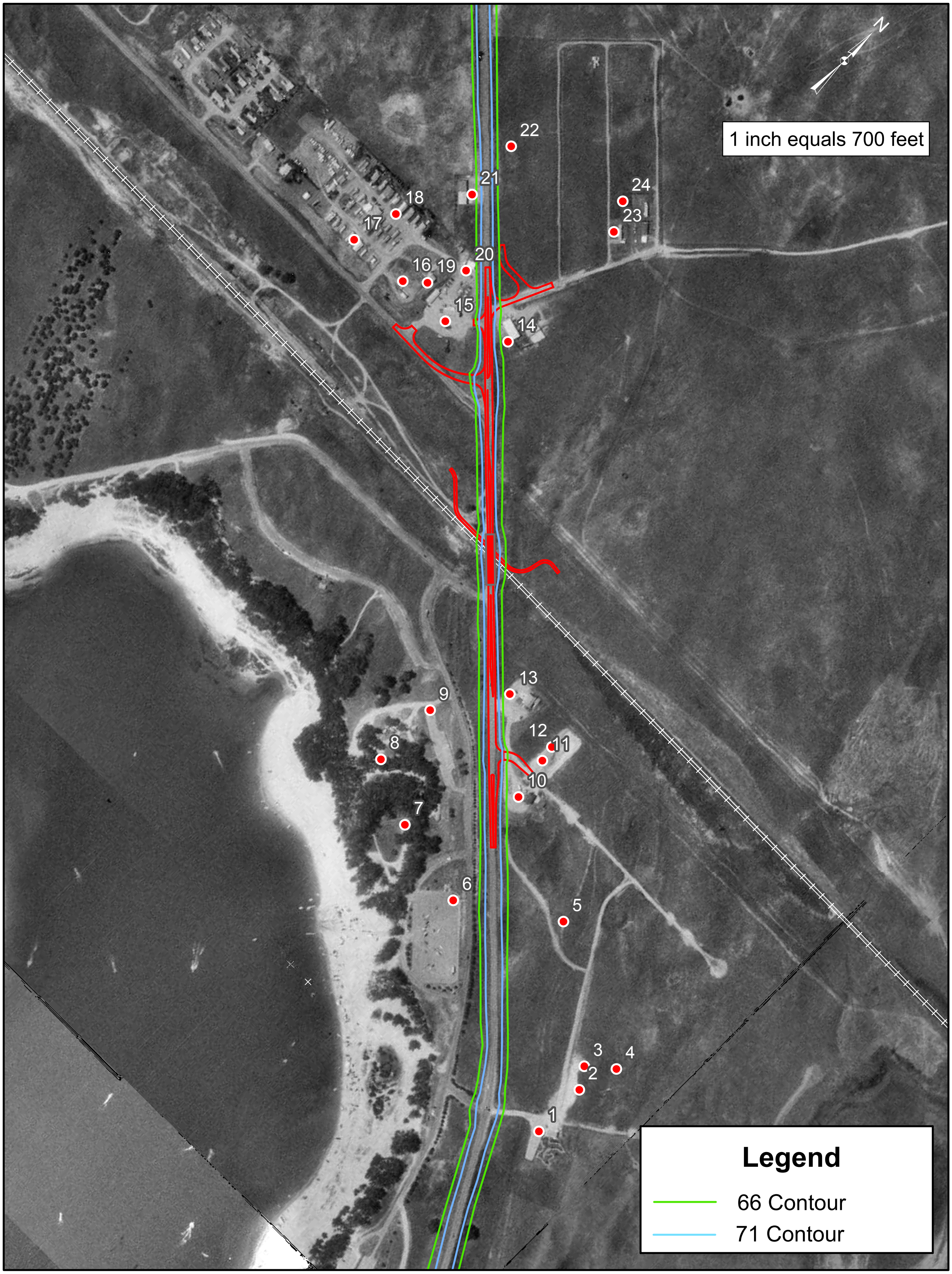
APPENDIX



2030 Build Noise Contours

Ogallala, Nebraska