GRASSY MOUNTAIN MINE PROJECT

Noise Monitoring Plan

Submitted to:

Department of Geology and Mineral Industries
229 Broadalbin St. SW
Albany, Oregon 97321 USA

Prepared by:

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May 2023

CALICO RESOURCES

REVISION LOG

DATE	AUTHOR / EDITOR	DESCRIPTION
May 2023	SLR International Corporation	Initial draft of the document.

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ACRONYMS

°F	degrees Fahrenheit
BLM	Bureau of Land Management
Calico	Calico Resources USA Corp
CFR	Code of Federal Regulations
CPA	Consolidated Permit Application
dB	decibel
dBA	A-weighted decibel
dBC	C-weighted decibel
ESS	Environmental and Safety Superintendent
ft	foot/feet
GIS	Geographic Information Systems
ISO	International Organization for Standardization
kg	kilogram
km	kilometer
LCE	C-weighted sound exposure level
m	meter
MFO	Malheur County Field Office
NEPA	National Environmental Policy Act
OAR	Oregon Administrative Rules
ODA	Oregon Department of Agriculture
ODFW	Oregon Department of Fish and Wildlife
ORS	Oregon Revised Statutes
Permit Area	Mine and Process Area and the Access Road Area
Plan	Noise Monitoring Plan
Project	Grassy Mountain Mine Project
RCNM	Roadway Construction Noise Model
TSF	Tailings Storage Facility
TWRSF	Temporary Waste Rock Storage Facility
WRCC	Western Regional Climate Center

1. PROJECT OVERVIEW

This Noise Monitoring Plan (Plan) has been prepared in support of the Grassy Mountain Mine Project (Project) located in Malheur County, Oregon, and has been included as part of the Consolidated Permit Application (CPA).

The Project is located approximately 22 miles south-southwest of Vale (Map 1) and consists of two areas: the Mine and Process Area and the Access Road Area (Permit Area) (Map 2). The Mine and Process Area is located on three patented lode mining claims and unpatented lode mining claims that cover an estimated 886 acres. These patented and unpatented lode mining claims are part of a larger land position that includes 419 unpatented lode mining claims and nine mill site claims on lands administered by the Bureau of Land Management (BLM). All proposed mining would occur on the patented claims, with some mine facilities on unpatented claims. The Mine and Process Area is in all or portions of Sections 5 through 8, Township 22 South, Range 44 East (T22S, R44E) (Willamette Meridian).

The Access Road Area is located on public land administered by the BLM, and private land controlled by others (Map 2). A portion of the Access Road Area is a Malheur County Road named Twin Springs Road. The Access Road Area extends north from the Mine and Process Area to Russell Road, a paved Malheur County Road. The Access Road Area is in portions of Section 5, T22S, R44E, Sections 3, 10, 11, 14, 15, 21 through 23, 28, 29, and 32, T21S, R44E, Sections 1, 12 through 14, 23, 26, 27, and 34, T20S, R44E, Sections 6 and 7, T20S, R45E, and Sections 22, 23, 26, 35, and 36, T19S, R44E (Willamette Meridian). The width of the Access Road Area is 300 feet (ft; 150 ft on either side of the access road centerline) to accommodate possible minor widening or re-routing, and a potential powerline adjacent to the access road. There are several areas shown that are significantly wider than 300 ft on the Permit Area Map (Map 2), which are areas where the final alignment has not yet been determined. The final engineering of the road will be consistent throughout, and within the Permit Area. The Access Road Area also includes a buffer on either side of the proposed road width for the collection of environmental baseline data. The road corridor will be 30 ft wide, which includes a 20 ft wide road travel width (10 ft on either side of the road centerline), 2 ft wide shoulders on each side of the road, minimum 1 ft wide ditches on each side of the road, and appropriate cut and fill. The Access Road Area totals approximately 876 acres.

1.1 PROJECT ACTIVITIES

Calico Resources USA Corp (Calico) plans to construct, operate, reclaim, and close an underground mining and precious metal milling operation. In general, the proposed mining and precious metal processing operations will consist of an underground mine and ore processing facilities, including a conventional Mill and Tailings Storage Facility (TSF) and a Temporary Waste Rock Storage Facility (TWRSF), as well as other support facilities. The Project will include the following major components:

- One underground mine;
- One TWRSF;
- One carbon-in-leach processing plant;
- One borrow pit area;
- One TSF;
- Run-of-mine ore stockpile;
- One reclaim pond;

- A water supply well field and pipeline, associated water delivery pipelines, and power;
- A power substation and distribution system, including the new Idaho Power powerline that will connect to the substation;
- One ventilation shaft;
- Access and haul roads;
- Ancillary facilities that include the following: haul, secondary, and exploration roads; truck workshop; warehouse; stormwater diversions; sediment control basins; reagent and fuel storage; storage and laydown yards; explosive magazines; fresh water storage; monitoring wells; meteorological station; an administration/security building; borrow areas; growth media stockpiles; a landfill; and solid and hazardous waste management facilities to manage wastes; and
- Reclamation and closure, including the potential development of an evaporation cell for the TSF.

1.2 PREVIOUS SURVEYS

A *Noise Baseline Report* (CANI, 2019) was prepared in October 2018 and revised in February 2019 by Creative Acoustics Northwest, Inc. on behalf of Calico. The *Noise Baseline Report* is included in the CPA as Appendix B11.

1.3 ENVIRONMENTAL SETTING

The Permit Area is in the Sourdough and Grassy Mountains at elevations ranging between 3,250 and 4,800 ft above mean sea level (amsl). According to the Western Regional Climate Center (WRCC), the average maximum temperature recorded at the Owyhee Dam, Oregon field station, located approximately five miles east of the Permit Area, is 93.6 degrees Fahrenheit (°F) in July, and the average minimum temperature is 22.4°F in January. The average annual precipitation is 9.12 inches and tends to peak in May (WRCC, 2016).

2. PURPOSE AND OBJECTIVES

The purpose of the Noise Monitoring Plan (NMP) is to provide the framework needed to monitor noise during construction, operation, and blasting at the Project per Oregon Administrative Rules (OAR) Chapter 340 Division 35, *Noise Control Regulations,* and monitoring for the *Wildlife Protection Plan* (MB&G, 2023; CPA Appendix D14).

The metrics for construction and operation include two situations 1) exceedance of a maximum noise level, and 2) exceedance of the existing background ambient noise level, plus 10 dBA. The metrics for blasting only include exceedance of a maximum noise level.

3. COMPLIANCE OBLIGATIONS, GUIDANCE, AND BEST MANAGEMENT PRACTICES

3.1 REGULATORY STRUCTURE

3.1.1 STATE REGULATIONS

Noise Control Regulations at OAR Chapter 340 Division 35 are applicable to the NMP. Noise produced during construction and operation, including blasting, are to be measured at an appropriate measurement point, with those measurement points further being classified as Noise Sensitive Property, and the more restrictive Quiet Area. DEQ industrial and commercial noise source standard tables are presented in Figures 1 through 3.

OAR 340-035-0035
Table 8
New Industrial and Commercial Noise Source Standards
Allowable Statistical Noise Levels in Any One Hour

7:00 a.m. – 10:00 p.m.	10:00 p.m. – 7:00 a.m.
L_{50} – 55 dBA	L_{50} – 50 dBA
L_{10} – 60 dBA	L_{10} – 55 dBA
L_1 – 75 dBA	L_1 – 60 dBA

Figure 1: DEQ Table 8, New Industrial and Commercial Noise Source Standards Allowable Statistical Noise Levels in Any One Hour

OAR 340-035-0035
Table 9
Industrial and Commercial Noise Source Standards for Quiet Areas
Allowable Statistical Noise Levels in Any One Hour

	7:00 a.m. – 10:00 p.m.	10:00 p.m. – 7:00 a.m.
L_{50}	50 dBA	45 dBA
L_{10}	55 dBA	50dBA
L_1	60 dBA	55dBA

Figure 2: DEQ Table 9, Industrial and Commercial Noise Source Standards for Quiet Areas Allowable Statistical Noise Levels in Any One Hour

OAR 340-035-0035
Table 10
Median Octave Band Standards
For Industrial and Commercial Noise Sources
Allowable Octave Band Sound Pressure Levels

Octave Band Frequency (Hz)	7:00 a.m. – 10:00 p.m.	10:00 p.m. – 7:00 a.m.
31.5	68	65
63	65	62
125	61	56
250	55	50
500	52	46
1000	49	43
2000	46	40
4000	43	37
8000	40	34

Figure 3: DEQ Table 10, Median Octave Band Standards for Industrial and Commercial Noise Sources Allowable Octave Band Sound Pressure Levels

To illustrate the logic behind compliance with the State's regulations around construction and operation, the single most restrictive metric is chosen – the Nighttime Quiet Area L50 at 45 dBA. The Noise Model Summary (BKL, 2023; Appendix A) provides predicted noise levels for construction, operation, and blasting, with these predicted noise levels graphically presented as noise contours (as provided in Maps 3, 4, and 5).

- For construction, the 45 dBA contour tends to average approximately at or within the Property Boundary to 0.5 mile away.
- For operation, the 45 dBA contour tends to average approximately 0.5 mile away.
- For blasting, the maximum allowable noise level during the day is 98 dBC, with the predicted 90 dBC contour completely within 0.5 mile of the Property Boundary.

As mentioned in the *Noise Baseline Report* (CANI, 2019), the closest Noise Sensitive Property would be Lake Owyhee State Park at approximately 6.5 miles away. Because the distance to the predicted 45 dBA contour is far less than the distance to the nearest appropriate measurement point, compliance with the State's regulations around construction and operation should be expected.

Compliance with the State's regulations around blasting should also be expected.

3.1.2 MALHEUR COUNTY COMPREHENSIVE PLAN

Goal 6, Policies 12 and 13 in the Malheur County Comprehensive Plan are applicable to the NMP. Goal 6, Policy 12 requires consideration of the projects noise production without specifying metrics. Goal 6, Policy 13 requires, for the County's purposes, compliance with the State's regulations around noise. As

mentioned in Section 3.1.1, compliance with the State's regulations is expected. Additionally, the State's regulations are expected to be adhered to within approximately 0.5 mile of the Project, so consideration for the County's goals is also expected.

3.2 GUIDELINES AND BEST MANAGEMENT PRACTICES

3.2.1 NOISE MEASUREMENTS

All noise measurements should be conducted with equipment and personnel adhering to NPCS-1, *Sound Measurement Procedures Manual* (DEQ, 1983), and NPCS-2, *Requirements for Sound Measurement Instruments and Personnel* (DEQ, n.d.). Three measurement sites should be selected; one to represent noise impacts due to the project site, one to represent noise impacts to the access road, and one to represent noise impacts due to blasting. NPSC-1 and NPSC-2 are included as Appendix B and Appendix C.

4. NOISE PREDICTION

BKL was engaged to predict the noise levels from the proposed Grassy Mountain Mine (the Project) located near the city of Vale in Malheur County in Oregon. Sound levels contours as developed by BKL for the Project do not project levels expected to impact grazing by livestock. The area immediately outside the Project fence during operation, based on BKL modeling and as shown in Maps 3, 4, and 5, noise will be attenuated to a maximum of approximately 50 dB. According to Dr. Salah Hamed Esmail (2017), "Cattle may tolerate moderate levels of noise and may easily adapt to an intensity level of 60-90 dB." He further concludes a behavioral response for cattle is expected between 80 and 90 dB. Owen (2017) reported that livestock can habituate reasonably quickly to loud sounds 90-120 dBA based on rail train development studies in the UK. The noise model results are in the BKL (2023) summary correspondence dated April 5, 2023. Noise grid maps from BKL (2023) are included in this NMP as Maps 3 through 5.

The following activities were modeled during normal operations with regard to noise levels:

- Construction;
- Access Road expansion work and Access Road Operations;
- Noxious weed management and revegetation activities; and
- Reclamation activities.

4.1 NOISE PREDICTION RESULTS

Noise prediction results from the noise modeling are summarized in grid maps by scenario: construction, operations and blasting.

4.1.1 CONSTRUCTION

A grid noise map at 1.5 meters (m) above ground with a resolution of 20 m by 20 m for the study area was calculated. The grid noise map is included as Map 3.

4.1.2 OPERATIONS

A grid noise map at 1.5 m above ground with a resolution of 20 m by 20 m for the study area was calculated. The grid noise map is included as Map 4.

4.1.3 BLASTING

A grid noise map at 1.5 m above ground with a resolution of 20 m by 20 m for the study area for the Construction blast event was calculated. The grid noise map is included as Map 5.

5. NOISE MONITORING

5.1 NOISE MONITORING LOCATIONS

Three monitoring location distances are proposed, as follows:

- The site to represent noise impacts due to the project site during construction and operation should be located approximately 3 miles/5 kilometers (km) due south of the project property to avoid noise impacts from the road. A sound level meter in this location should measure Lmax in dBA, L50 in dBA (1 hour), L10 in dBA (1 hour), and L01 in dBA (1 hour), all at Fast response.
- The site to represent noise impacts due to the access road during construction and operation should be located approximately 3,281 ft/1,000 m east or west of the access road, and, greater than approximately 3.5 miles/5.5 km away from the project property to avoid noise impacts from the project property. A sound level meter in this location should measure Lmax in dBA, L50 in dBA (1 hour), L10 in dBA (1 hour), and L01 in dBA (1 hour), all at Fast response.
- The site to represent noise impacts due to blasting during construction and operation should be located approximately 0.5 miles east of the project property line. A sound level meter in this location should measure Lmax in dBA, L50 in dBA (1 hour), L10 in dBA (1 hour), and L01 in dBA (1 hour), all at Fast response. Additionally, this sound level meter should measure Lmax in dBC at Slow response.

5.2 EQUIPMENT AND PROCEDURES

OAR 340-035-0035 provides noise standards for equipment; exceptions are found at OAR 340-035-0010. Figures 1 through 3 present DEQ's noise source standards tables.

Specific equipment and procedures are outlined in NPCS-1, *Sound Measurement Procedures Manual* (DEQ, 1983), and NPCS-2, *Requirements for Sound Measurement Instruments and Personnel* (DEQ, n.d.).

5.3 MONITORING FREQUENCY

Routine monitoring will be conducted annually at the three proposed locations and is expected to occur during all hours of operational activities.

During road construction activity, noise monitoring will be conducted monthly during construction activity. During the operations phase, quarterly monitoring will occur for one year. The purpose is to measure impacts of traffic and equipment associated with the access road construction period and operations period at the monitoring locations, as predicted in the BLK access road scenario. This monitoring will reflect actual conditions and determine if mitigation measures are necessary. If mitigation is not necessary or mitigation measures have been fully implemented, monitoring will be reduced to annually.

5.4 REPORTING

Noise monitoring results will be reported as a part of the fourth quarter monitoring report as described in the *Wildlife Protection Plan* (MB&G, 2023; CPA Appendix D14) and in accordance with issued permits.

6. MITIGATION MEASURES

Calico will coordinate with ODFW regarding mitigation measures consistent with the Wildlife Mitigation Plan. In the event ongoing noise monitoring indicates operational noise exceeds the expected levels disclosed in Section 3.1.1, Calico will coordinate with ODFW and other agencies as noted by permit to propose and incorporate reduction components for machinery. Confirmation monitoring will be completed following the implementation of mitigation measures.

7. REFERENCES

BKL. 2023. Grassy Mountain Mine, Oregon, Noise Model Summary correspondence. April 5.

Creative Acoustics Northwest, Inc. (CANI). 2019. Noise Baseline Report. Prepared for Calico Resources USA Corp. in October 2018 and revised in February 2019.

Esmail, Salah Hamed. 2017. Effects of noise on cattle performance - Dairy Global. November 23. Accessed May 3, 2023.

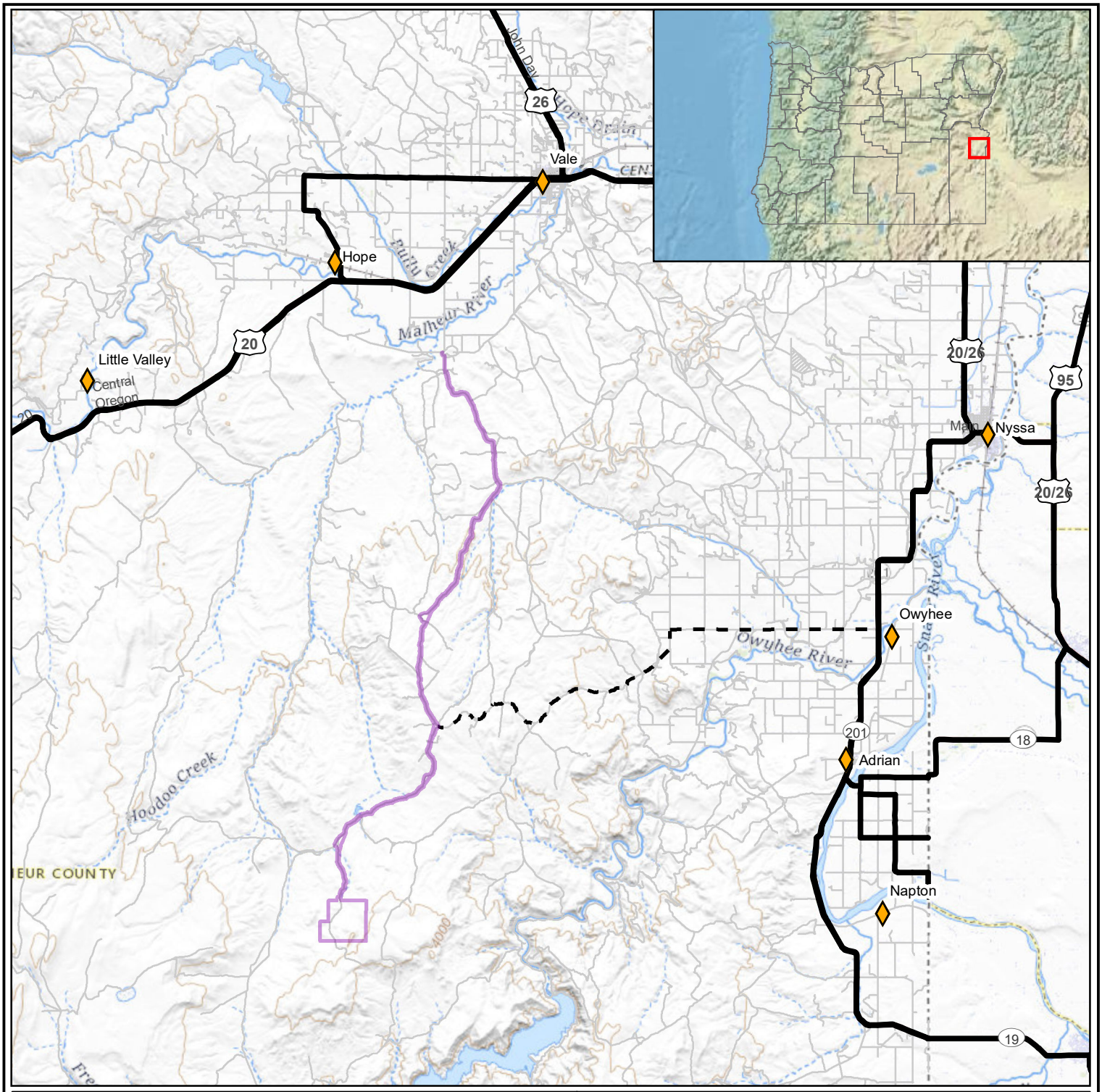
Mason, Bruce & Girard, Inc. (MB&G). 2023. The Grassy Mountain Mine Project, Revised Wildlife Protection Plan. Malheur County, Oregon. Prepared for Calico Resources USA Corp. May 2.

Owen, D. 2017. High speed 2 limited, phase one: Noise effects on livestock (No. 236118-57/ ROI- Issue 2). Ove Arup & Partners Ltd. February 1. Report (publishing.service.gov.uk). Accessed May 3, 2023.

State of Oregon Department of Environmental Quality (DEQ). 1983. Noise Pollution Control Section (NPCS) Procedure Manual NPCS-1, Sound Measurement Procedures Manual. Published in 1974, revised May 6, 1983.

----------. n.d. Procedure Manual NPCS-2, Requirements for Sound Measurement Instruments and Personnel.

MAPS



Legend

- PoO Boundary
- Emergency Access Road
- Roads

1 ":4 Miles

0 1 2 4Miles

Scale as shown when plotted at 8.5"x11".

N W E S

Notes:

1. Figure references 1983 UTM zone 11N datum.
2. Road and highway system were referenced from the Bureau of land Management.

Site/Report:

Calico Resources USA Corp.
Grassy Mountain Mine

Noise Monitoring Plan

Map:

Location Map

CALICO RESOURCES	Date: May, 2023		Map: 1
	Project No: 108.02203.00003		
	By: MS	Chk'd: TM	

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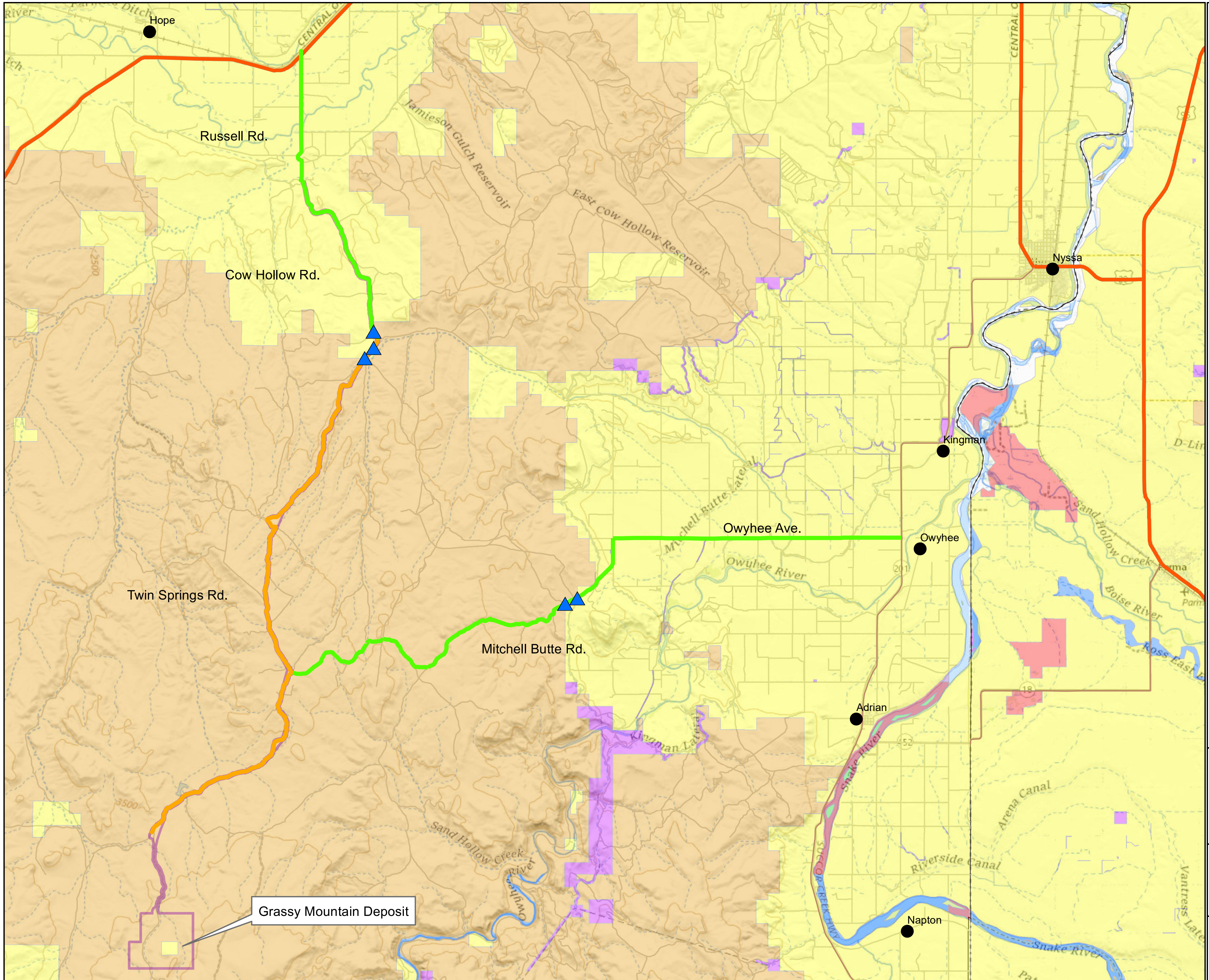

Legend

- PoO Boundary
- Cities of Oregon_ USA
- BLM Land Vehicle Access Point
- Highway
- Major Road
- Local Road
- County Road
- Federal Road

Land Status

- Bureau of Land Management
- Bureau of Reclamation
- Private Individual or Company
- State Agency
- U.S. Fish and Wildlife Service
- Undetermined
- Water

1 ":2 Miles

0 0.5 1 2 Miles

N E S W

Scale as shown when plotted at 11"x17".

Notes:

1. Figure references 1983 UTM zone 11N datum.
2. Road and highway system were referenced from the Bureau of land Management.
3. Land status was referenced from the Bureau of Land Management database, BLM Idaho Surface Management Agency 2020 and OR BLM Status Line 2021.

Site/Report:

Calico Resources USA Corp.
Grassy Mountain Mine

Noise Monitoring Plan

Map:

Vicinity and Access Map

CALICO RESOURCES	Date: May, 2023		Map: 2
	Project No: 108.02203.00003		
	By: MS	Chk'd: TB	

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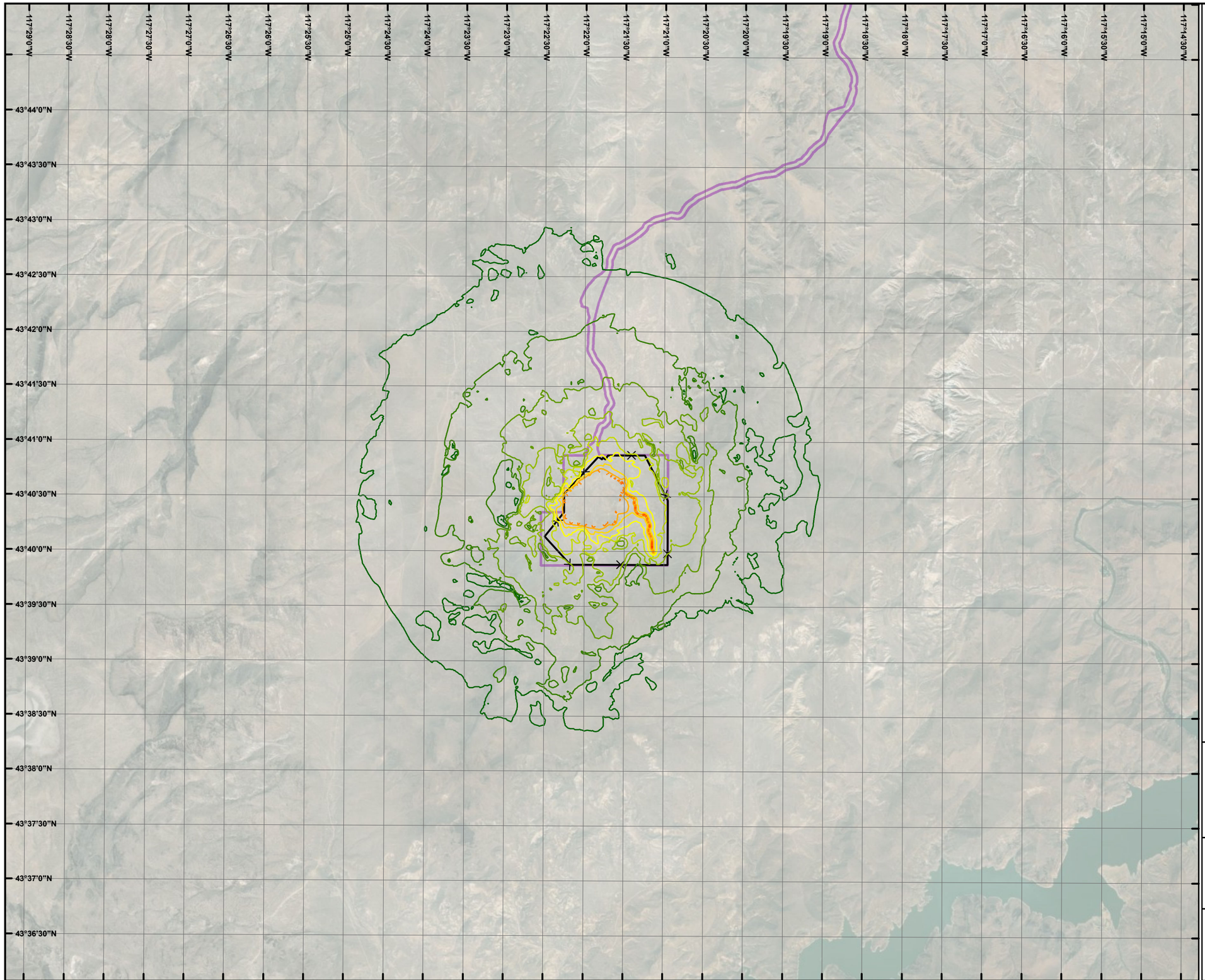

Legend

- PoO Boundary
- Fence Line
- 25 dBA
- 30 dBA
- 35 dBA
- 40 dBA
- 45 dBA
- 50 dBA
- 55 dBA
- 60 dBA
- 65 dBA
- 70 dBA
- 75 dBA

1 " = 1 Mile

0 0.25 0.5 1 Miles

N W E S

Scale as shown when plotted at 11"x17".

Notes:

1. Figure references 1983 UTM zone 11N datum.
2. Topography and facility layout provided by others.
3. Noise prediction modeling was performed by BKL, 2023.

Site/Report:

Calico Resources USA Corp.
Grassy Mountain Mine

Noise Monitoring Plan

Map:

Construction 1.5m High
20x20 L50 20230403

CALICO RESOURCES	Date: May, 2023		Map: 3
	Project No: 108.02203.00003		
	By: MS	Chk'd: HB	

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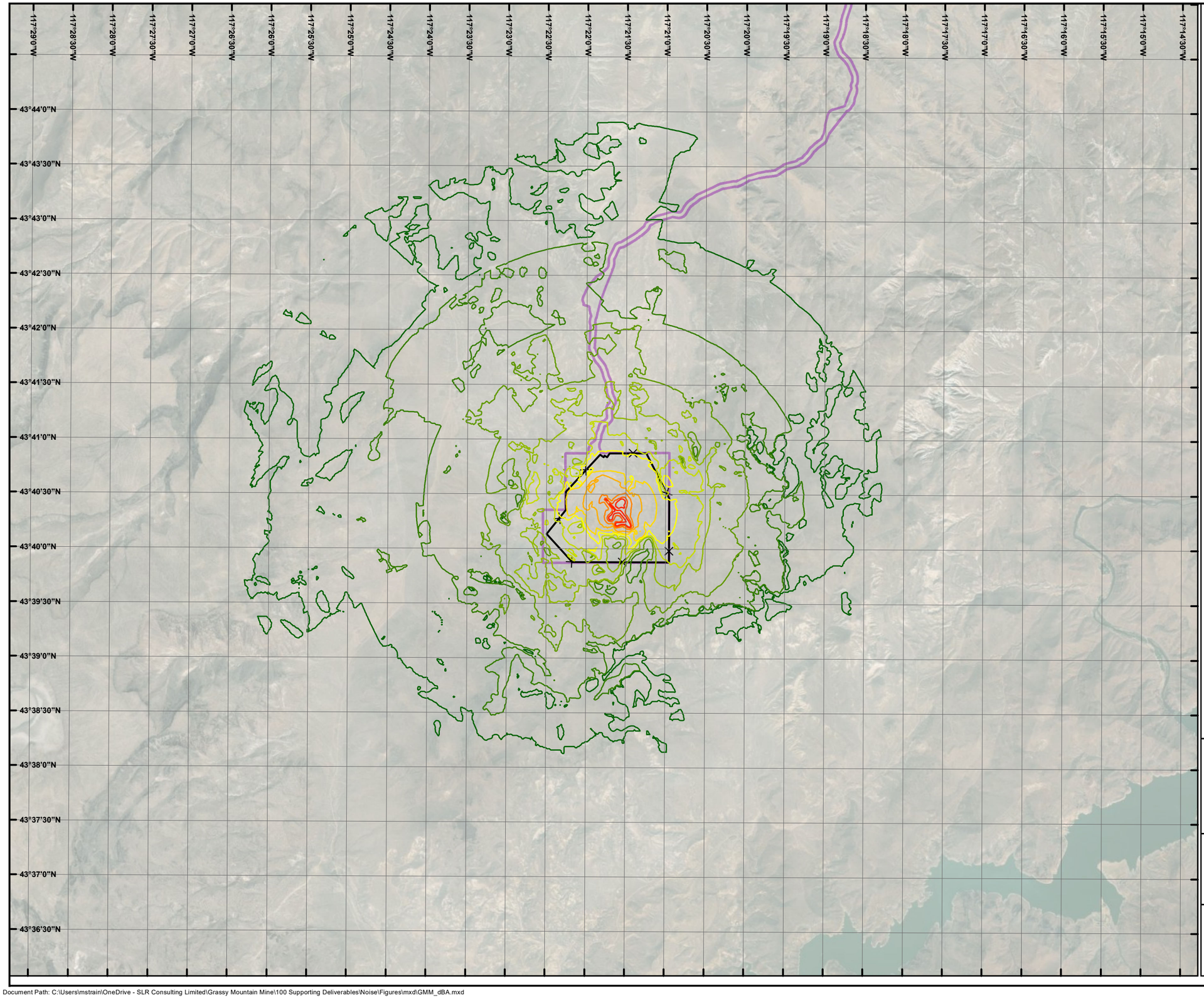

Legend

- PoO Boundary
- Fence Line
- 25 dBA
- 30 dBA
- 35 dBA
- 40 dBA
- 45 dBA
- 50 dBA
- 55 dBA
- 60 dBA
- 65 dBA
- 70 dBA
- 75 dBA

1 " = 1 Mile

0 0.25 0.5 1 Miles

N W E S

Scale as shown when plotted at 11"x17".

Notes:

1. Figure references 1983 UTM zone 11N datum.
2. Topography and facility layout provided by others.
3. Noise prediction modeling was performed by BKL, 2023.

Site/Report:

Calico Resources USA Corp.
Grassy Mountain Mine

Noise Monitoring Plan

Map:

Operation 1.5m High
20x20 L50 20230403

CALICO RESOURCES

Date:	May, 2023		Map:
Project No:	108.02203.00003		4
By:	MS	Chk'd: HB	

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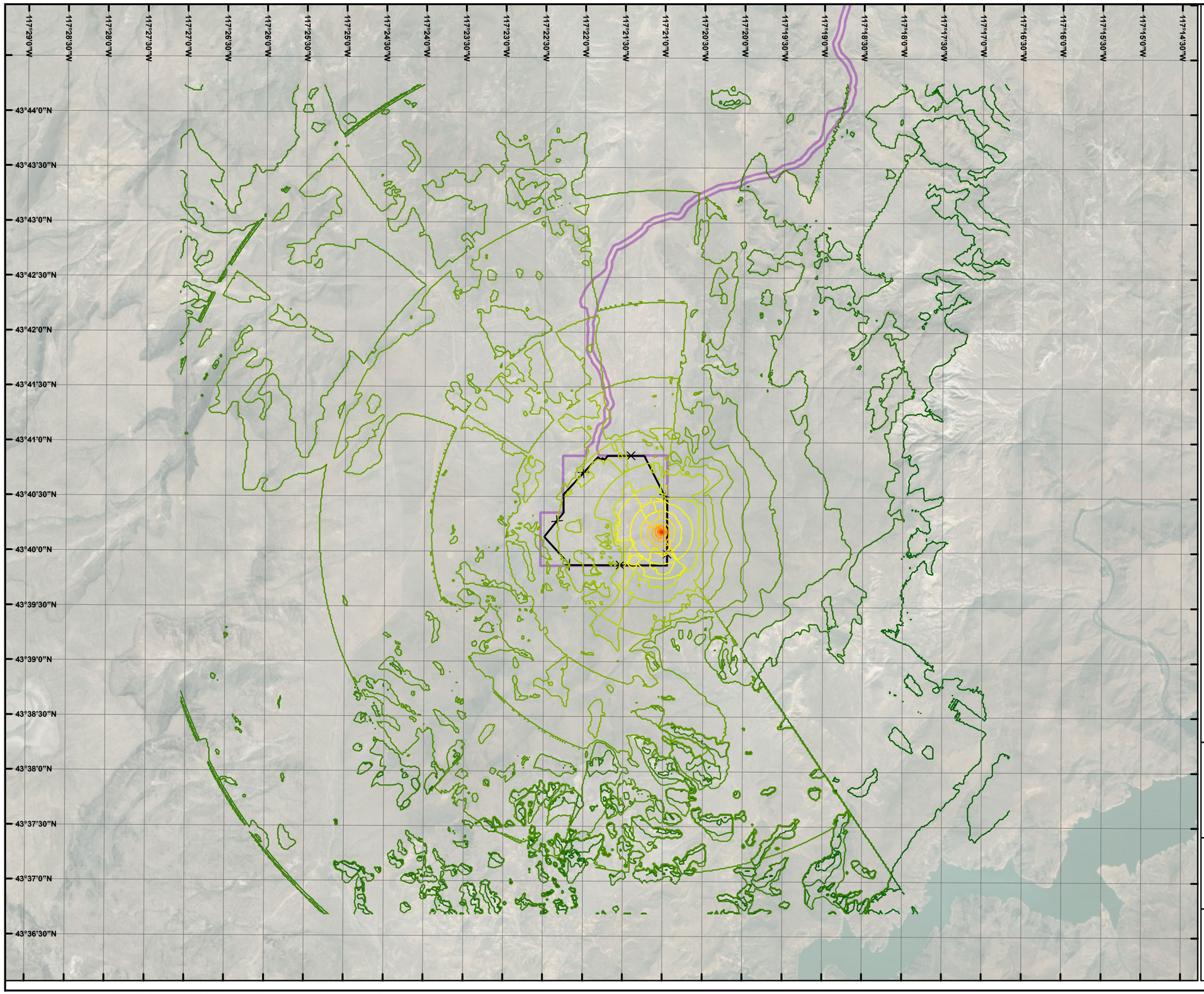

Legend

- PoO Boundary
- Fence Line
- 30 dBA
- 35 dBA
- 40 dBA
- 45 dBA
- 50 dBA
- 55 dBA
- 60 dBA
- 65 dBA
- 70 dBA
- 75 dBA
- 80 dBA
- 85 dBA
- 90 dBA
- 95 dBA
- 100 dBA
- 105 dBA
- 110 dBA
- 115 dBA
- 120 dBA
- 125 dBA

1 " = 1 Mile

0 0.25 0.5 1 Miles

N W E S

Scale as shown when plotted at 11"x17".

Notes:

1. Figure references 1983 UTM zone 11N datum.
2. Topography and facility layout provided by others.
3. Noise prediction modeling was performed by BKL, 2023.

Site/Report:

Calico Resources USA Corp.
Grassy Mountain Mine

Noise Monitoring Plan

Map:

Blasting 1.5m High 20x20
LCmax(slow) 20230405

CALICO RESOURCES	Date: May, 2023		Map: 5
	Project No: 108.02203.00003		
	By: MS	Chk'd: HB	

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APPENDIX A

BKL NOISE MODEL SUMMARY

301 – 3999 Henning Drive, Burnaby, BC, Canada V5C 6P9
T 604-988-2508 W www.bkl.ca E sound@bkl.ca

April 5, 2023

File: 0639-23A-R0

Paramount Gold Nevada
665 Anderson Street
Winnemucca, NV, USA
89445

Attention: Glen Van Treek

Dear Glen,

Re: Grassy Mountain Mine, Oregon
Noise Model Summary

BKL has been engaged to predict the noise levels from the proposed Grassy Mountain Mine (the Project) located near the city of Vale in Malheur County in Oregon. The noise model results will be used to provide input for other consultants to respond to information requests from the regulator.

Limitations

We understand that the Oregon Department of Fish and Wildlife (ODFW) has requested additional information regarding noise levels for the purpose of considering wildlife. The ODFW specifically mentioned the following activities to be of interest with regard to noise levels:

- Construction;
- Road expansion work;
- Noxious weed management and revegetation activities; and
- Reclamation activities.

Through communication with the client, it was confirmed that BKL would model the Construction and Operations stages at the mine site and will provide predicted noise levels for the access road.

The other stages mentioned by ODFW have less equipment to consider and therefore a 3-D noise model may not be required. Therefore, these stages are excluded from BKL's analysis and should be addressed by the local noise consultant.

Project Context

Correspondence with ODFW have referenced the *Nevada Department of Wildlife Interim Sage-Grouse Noise Protocol Clarifications* document as an appropriate framework for assessment. Previous acoustic related work for the Project included preparation of a Noise Baseline Report which was issued by Creative Acoustics Northwest in October 2018 and included details on the measured baseline noise levels in the vicinity of the site.

In addition to the ODFW request, we understand that the noise modelling results are also of interest for other receptors including grazing animals and residential and sensitive areas (as per email dated February 28, 2023). Paramount Gold's local noise consultant has provided guidance on the appropriate noise metrics for the assessment of these receptors.

BKL attended a meeting with USFWS and ODFW on March 21, 2023, where the regulators requested that the study area be extended to include the predicted Project noise levels to at least 10 dB above the background noise level (L90 dBA). As part of determining the study area, the Noise Baseline Report was reviewed to determine the existing background noise level in the vicinity of the site.

Model Setup

Based on the above, we understand the following noise metrics are relevant for the noise model:

- For Construction and Operations: L50 (1 hour) dBA
- L10 (1 hour) dBA
- L1 (1 hour) dBA

For blasting events:

- Lmax (slow) dBC

As operations and construction will operate 24hrs per day and seven days per week and mobile sources such as trucks will operate for at least 1 hour per day, the predicted L50 (1 hour), L10 (1 hour) and L1 (1 hour) levels from the model can be compared to the day and night criteria.

Given that the operations and construction noise sources are continuous for the assessment time period of 1 hour, the L50, L10 and L1 predicted metrics will all be the same value. This is consistent with the statement in the *Oregon Department of Transportation Quarry Noise Model User Guide and Technical Reference* document which states *"It is possible that statistical metrics for different times (i.e. L10 and L50) can have the same dBA values."*.

The Oregon wildlife requirements are for specific time frames covering more than one hour namely (0400-0900, 1800-1000 and 0000-2400). However, as the operations at the site are 24 hours a day, 7 days a week and the activities are not expected to fluctuate significantly hour to hour, the modelled noise levels for one hour period can be considered relevant for all required time frames.

The Cadna 3-D noise modelling software used by BKL implements the International Organisation for Standardization (ISO) *Acoustics – Attenuation of Sound During Propagation Outdoors – Part 2: General Method of Calculation ISO 9613-2:1996* prediction standard. ISO 9613-2 describes a method for calculating the attenuation of sound during propagation outdoors in order to predict the levels of

environmental noise at a distance from a variety of sources. The method predicts the equivalent continuous A-weighted sound pressure level under meteorological conditions favourable for sound propagation, namely downwind propagation or under a well-developed moderate ground-based temperature inversion. We consider the ISO 9613-2 standard suitable for the prediction of Construction and Operations noise and have used this on many other mine projects.

Blasting events are a highly impulsive noise source and therefore, ISO 9613-2 is not appropriate. For blasting events, the *ANSI S12.17-1996 Impulse Sound Propagation for Environmental Noise* issued by the American National Standards Institute in 1996 has been used to predicted the C-weighted sound exposure level (LCE). Based on measurement and reference data, is can be estimated that the LCE for a single blast event is approximately equivalent to the LCmax (slow) level plus 5.4 dB. For this assessment, the predicted LCmax (slow) level for a blast event has been determined by subtracting 5.4 dB from the predicted LCE level.

Wherever possible, the noise levels for the model have been taken from the noise data sheets for the selected items of equipment and from the FHWA Roadway Construction Noise Model (RCNM) database. Where RCNM or site-specific data was not available, noise source data from BKL's database based on measurements at other project sites were used.

Study Area

In this context, the background noise level is defined at the L90 dBA level for the following time frames: 24hrs, between 0400 and 0900 and between 1800 and 1000 (as per the Oregon wildlife requirement and confirmed by OCFW). While it was not possible to extract the L90 level for the defined time frames from the Noise Baseline Report, we could review the hourly measurement data contained in the Noise Baseline Report to estimate the lowest existing L90 level for the relevant time periods. This way, the definition of the study area is based on the lowest existing L90 level which would be sufficient for the most sensitive points of reception. Based on our review of the measurement data, the lowest L90 levels measured was 18 dBA L90 which occurred at Site B on Day 2 (May 4, 2018) between 0400 and 0900 hours. Therefore, the study area has been extended so the predicted Project levels as low as background plus 10 (18+10=28 dBA) have been calculated.

Noise Modelling Scenarios

The Grassy Mountain Mine is an underground mine with above ground processing site. Access to the mine site is via an access road. Based on the information provided, the following noise sources are to be included in the model:

- Above ground processing plant buildings;
- Haul routes on the site which connect the underground mine roads to the processing area;
- Ventilation fans; and
- Blasting at the quarry site.

The noise data used for the model are provided in Table 1 and Table 2 below.

Table 1: Modelled Noise Source Summary – Construction

Name	Location	# of items	Sound Power Level per equipment (dBA)	Source
Excavator	Tailings Storage Facility (TSF) + process plant area	4	108	RCNM
Dozer	TSF + process plant area	2	112	RCNM
Grader	TSF + process plant area	2	110	RCNM
Articulated Haul Truck	TSF + process plant area	10	113	RCNM
Water Truck	TSF + process plant area	2	113	RCNM
Compactor	TSF + process plant area	2	114	RCNM
Tractor & Disk	TSF + process plant area	1	110	RCNM
Skidsteer	TSF + process plant area	1	104	RCNM
Telehandler	TSF + process plant area	1	120	RCNM
Generator	process plant area	1	111	BKL database
Haul Truck	on-site road to quarry	1	110	BKL database

Table 2: Modelled Noise Source Summary – Operations

Name	Location	# of items	Sound Power Level (dBA)	Source
Haul Truck (44.2 t)	TSF haul road + on-site road	3	110	BKL database
Front End Loader (16.4 t)	TSF haul road + on-site road	1	111	project spec
Dozer (20.4 t)	TSF haul road + on-site road	1	111	project spec
Emulsion Loader	TSF haul road + on-site road	1	107	RCNM
Motor Grader	TSF haul road + on-site road	1	110	RCNM
Lube Truck	TSF haul road + on-site road	1	104	RCNM
Water Truck	TSF haul road + on-site road	1	104	RCNM
Truck to haul cement	on-site road	1	113	RCNM
Telehandler	on-site road	1	120	RCNM
Shotcrete Sprayer	on-site road	1	118	RCNM
Shotcrete Truck	on-site road	1	113	RCNM
Backfill Plant	mine portal	1	118	RCNM
Crusher #1	process plant area	1	118	BKL database
Crusher #2	process plant area	1	118	BKL database
Ball Mill and Hydrocyclone	process plant area	1	120	BKL database

Name	Location	# of items	Sound Power Level (dBA)	Source
Tanks and Pumps	process plant area	9	104	RCNM
Ventilation Fan	south of mine portal at grade	2	117	project spec
Baghouse/Dust Collector	process plant area	1	114	BKL database
Emergency Generator	process plant area	1	111	BKL database
Truck Workshop and Warehouse	process plant area	1	112	BKL database

The blasting events will be located in the Borrow Pit Area to the south-east of the site. The details for the blasting events are provided in Table 3. For the assessment, only the Construction blast scenario was modelled as this is considered the worst case due to the larger number of holes per delay compared to the Operations scenario.

Table 3: Blasting Input Information

Metric	Value
TNT mass equivalent per hole (kg)	8.2 kg/hole
Holes per delay	Construction: 58 Operations: 17
Charge burial depth (m)	6.1
Annual blast events	Construction: Over 29-day period Operations: Two per week

Access Road

In addition to the Operations and Construction stages on the site, we understand that the noise associated with the access road is of interest. The expected noise sources associated with the access road are provided in Table 4. For the Construction 1a and 1b scenarios, we understand that this is the maximum number of items of equipment that could operate with a 1 to 2 mile (1.6km to 3.2km) distance.

Table 4: Access Road Noise Sources

Scenario	Noise Sources	Quantity	Sound Power Level (dBA)	Comment on Metrics
Construction 1a	Scrapper	2	124	L50, L10, L1 dBA 1hour Will all the same value due to continuous operation of equipment within a 1 hour period
	Dozer	1	112	
	Grader	1	110	
Construction 1b	Truck	2	110	L50, L10, L1

Scenario	Noise Sources	Quantity	Sound Power Level (dBA)	Comment on Metrics
	Grader	1	110	dBA 1hour Will all the same value due to continuous operation of equipment within a 1 hour period
	Roller	1	114	
Operation	Vehicle passbys	Total of 43 movement on the road per day (approximately 2 per hour)	110	Given that there are only 53 trips on an average weekday, it is expected that elevated noise levels due to access road use will not be present for more than 6 minutes over a one hour period. Therefore, only the L1 will be relevant

Exclusions

Some items were excluded from the model as they were not expected to contribute to the overall noise levels due to the equipment operating underground or lower sound levels compared to the other sources on the site.

Equipment not included in the modelling:

- Vibration Trash Screen
- Agitator
- Assay Lab
- Vehicle Wash-bay

Results

Construction

A grid noise map at 1.5 metres above ground with a resolution of 20m by 20m m for the study area was calculated.

Operations

A grid noise map at 1.5 metres above ground with a resolution of 20m by 20 m for the study area was calculated.

Blasting

A grid noise map at 1.5 metres above ground with a resolution of 20m by 20m for the study area for the Construction blast event was calculated.

Access Road

As the access road covers a large distance, the predicted noise levels for a sample cross section have been provided at a centre point of the access road. This shows the condition of a gradual decline to the west of the road and gradual incline to the east of the road. It is assumed that the loudest item of equipment is located close to the cross-section point and the other items of equipment a within a one mile either side of the centre point.

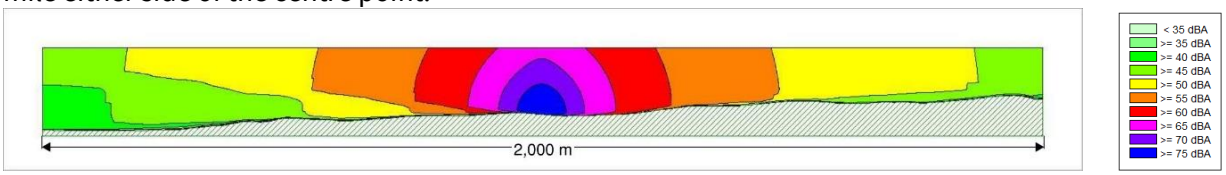

Figure 1: Access Road Construction Scenario 1A Vertical Cross-Section (L50, L10, L1 dBA – 1hour)

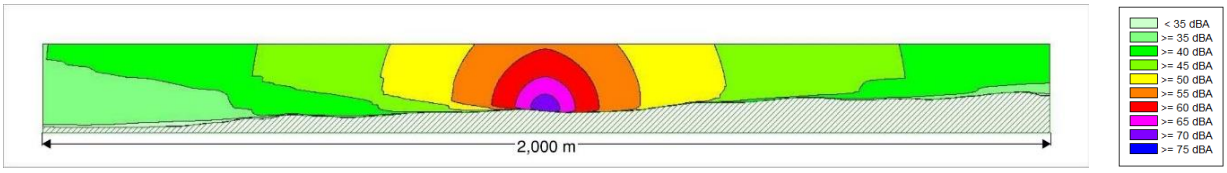

Figure 2: Access Road Construction Scenario 1B Vertical Cross-Section (L50, L10, L1 dBA – 1hour)

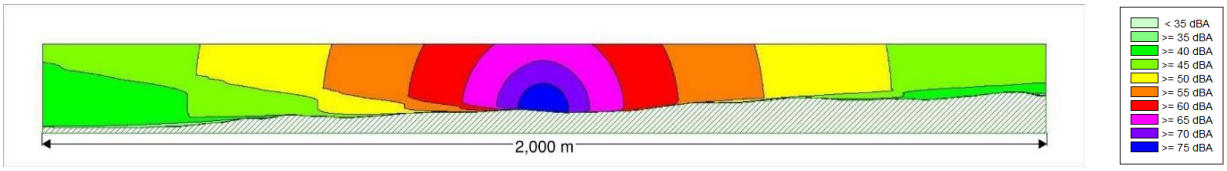

Figure 3: Access Road Operations Passby Vertical Cross-Section (L1 dBA – 1hour)

Model Setup

We have used proprietary 3-D noise modelling software Cadna/A to predict the noise levels in the areas of interest. The model set-up details are enclosed.

Table 5: Model Setup and Data Inputs Summary

Parameter	Value
Calculation Standard	■ ISO 9613-2:1996 ■ ANSI S12.17-1996
Ground Absorption	■ G = 0 (hard ground) for tailing areas ■ G = 1 (soft ground) for remaining area
Reflection Order	■ 1
Ground elevation contours	■ 2-foot (0.6 metre) contour lines and 5-foot (1.5 metres) contour lines provided by Paramount Gold Nevada for mine site and area adjacent to the mine site ■ 10-foot (3.0 metre) contour lines for the extended study were obtained from the United States Geological Survey Open Data Portal

Closure

This completes the summary of inputs, assumptions and methodology for the development of the Grassy Mountain Mine noise model.

Sincerely,

BKL Consultants Ltd.
per:

Brigette Martin
Acoustical Consultant
martin@bkl.ca

Enclosures: Construction noise contour file (DXF)
Operations noise contour file (DXF)
Blasting event (Construction) noise contour file (DXF)

APPENDIX B

SOUND MEASUREMENT PROCEDURES MANUAL (NPCS-1)

Sound Measurement Procedures Manual

NPCS - 1

State of Oregon
Department of
Environmental
Quality

REVISION RECORD

INSTRUCTIONS FOR USE: All revisions of this manual will be numbered to assure each manual holder that he has received all revisions. The date and initials of the person inserting revisions to the manual should be entered on this revision record opposite the appropriate revision number. If the sequence is broken, copies of the missing revisions may be requested from the Noise Control Section.

Rev. No.	Date Inserted	Initials	
1.	4-30-74	JH	[illegible]
2.	8-16-74	JH	[illegible]
3.	11-25-74	NT	[illegible]
4.	8-27-76	JH	EQC Amendments
5.	5-6-83	JH	EQC Amendments
6.			
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19.			

FOREWORD

The Sound Measurement Procedures Manual has been prepared to specify the equipment to be used and the procedures to be followed when measuring environmental noise. The procedures established in the manual, when carefully followed, will ensure that the noise readings obtained are accurate, will support enforcement action, and aid in reducing environmental noise.

The scope of this manual includes industrial noise, commercial noise, noise from races and racetracks, noise from public roads and ambient noise measurements. Individual motor vehicle noise measurements are covered in a separate manual.

The objective of the manual is to establish procedures to implement the provisions of the Environmental Quality Commission. Further, if the practices and procedures herein are adhered to, the result will be a uniform enforcement program which will accomplish the intent of the Legislature and fulfill the Commission's responsibility under ORS Chapter 467.

Office of the Administrator
Air Quality Control Division
Department of Environmental Quality

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LIST OF FIGURES

CHAPTER 1

INTRODUCTION

Policy

1.1.1 The Department of Environmental Quality, through the Noise Pollution Control Section shall establish a noise measurement program to implement the laws and regulations applying to environmental noise.

1.1.2 The Noise Pollution Control Section shall be responsible for the conformity of environmental noise measurement.

1.1.3 This manual contains procedures for the Noise Pollution Control Section, and all other persons taking environmental noise measurements. Guidance is provided in the "Comments".

1.2 Authority

Statutory and administrative law governing authority to the guidance and direction contained in the following sources:

a. Oregon Revised Statutes, Chapter 467, Sections 467.010, 467.020, 467.030, 467.040, 467.050, 467.990.

b. Oregon Administrative Rules, Chapter 340, Division 35, Department of Environmental Quality.

Instruments and Training

1.3.1 Specific requirements for instruments and personnel are defined under procedure manual, Noise Pollution Control Section - 2, Requirements for Sound Measuring Instruments and Personnel.

CHAPTER 2

INSTRUMENTATION

Sound Level Meters

The specifications for sound level meters (SLM) are defined in manual Noise Pollution Control Section (NPCS-2) Requirements for Sound Measuring Instruments and Personnel. The minimum meter required is a Type II as defined by American National Standard Institute Number S1.4-1971.

2.2 Accessories

The minimum accessories shall be a windscreen and an acoustically coupled calibrator.

Comment: Additional accessories that have been found to be valuable in gathering data are tabulated below:

(1) Noise data forms
(2) Clipboard
(3) Tripod
(4) Wind meter
(5) Sling psychrometer
(6) Screwdriver
(7) Spare batteries
(8) Watch with sweep second hand or digital equivalent

Tape Recorders and Level Recorders

Recording systems shall conform to NPCS-2.

Comment: The recording system should be able to duplicate the measurements as taken in the field. For tape recorders, a table of frequency response tolerances is given in SAE standards. Graphic level recorder systems standards are also described in the manual.

Octave Band Filter Sets

The octave band filter sets shall be those defined in NPCS-2.

Comment: These sets may either be integral to a sound level meter or they may be a separate piece of equipment.

Special Study Instruments

Comment: In some instances, special types of equipment may be found to be useful in studying a noise problem. The Department has several specialized noise instruments to be used in study situations. These instruments include a random noise generator, a loud speaker system, and a one-third octave band filter set.

One-Third Octave Band Filter Sets

The one-third octave band filter sets shall be those defined in NPCS-2.

Comment: These sets may be integral to a sound level meter or they may be a separate piece of equipment. Sets shall contain the preferred one-third octave band filters.

Impulse Meters

Impulse meters shall be those defined in NPCS-2.

Comment: These meters are integral to some Type I precision sound level meters set for a peak unweighted response. Blasting impulse noise is measured on a standard Type I or Type II meter set to the "C" weighting scale and the "SLOW" dumping response.

CHAPTER 3

INSTRUMENT CALIBRATION

General

All types of sound level meters shall be field calibrated immediately prior to use, using the procedures described in the factory instruction manual.

Battery Check

Batteries in both the meter and the calibrator shall be checked before calibration.

Instrument Calibration

The instrument shall be set to the correct level range, weighting scale and meter response. The calibrator shall be placed on the microphone of the meter. The output indicated on the meter shall then be adjusted to the correct calibration level.

Annual Calibration

Within a year prior to use, each sound level meter, including octave band filter and calibrator, shall receive a laboratory calibration in accordance with the manufacturer's specifications. This calibration shall be traceable to the National Bureau of Standards.

Comment: An inspection label may be attached to each instrument set to determine when the calibration was performed.

CHAPTER 4

ENVIRONMENTAL NOISE MEASUREMENT

4.1 Application

This chapter applies to ambient measurements, noise emissions from industrial facilities, and commercial facilities, and to ambient noise limits from motor vehicles. Individual motor vehicle noise measurements, airports and racetracks are covered in separate manuals.

4.1.2 Persons selected to measure environmental noise shall meet the requirements of NPCS-2 Requirements for Sound Measuring Instruments and Personnel.

Site Selection

4.2.1 The measurement location shall be at any point, no more than 25 feet from the noise sensitive building where the noise level is generally greatest, as illustrated in Figure 4-1.

If the noise sensitive building is closer than 25 feet from the property line, the measurement location shall be at any point on the property line, providing it is no more than 25 feet from the building, or at any other point within the noise sensitive property no more than 25 feet from the noise sensitive building, wherever the noise level is generally greatest, as illustrated in Figure 4-2. For any measurement, sound reflective surfaces shall not be closer than 10 feet from the measurement point.

Comment: Sound reflective surfaces do not include trees, shrubs, hedges or other vegetation.

Comment: Measurements for noise sensitive property on which the noise sensitive building lies within 10 feet of the noise sensitive property line may require sound level projection techniques described in 4.8 of the manual.

Equipment Set-Up

4.3.1 The sound level meter or microphone, either hand held or placed on a tripod, shall be 4 feet or more above the ground or floor surface.

4.3.2 Comment: A microphone extension cable may be used in areas where accessibility is difficult. Example: Changes in ground elevation, reflective surfaces, height or source or receiver.

Figure 4-1 Measurement Point 25 Feet From Building

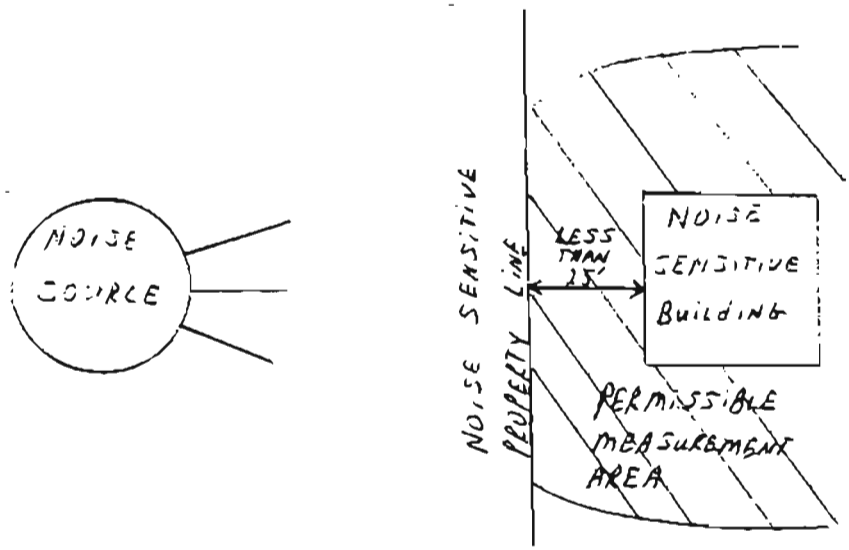


Figure 4-2 Measurement Point on Property Line

Instrument Calibration and Battery Check

4.4.1 Refer to Chapter 3 of NPCS-1 for instructions.

Noise Level Measurements

4.5.1 Comment: That information and data submitted to the Department should be recorded on Forms NPCS-4 and NPCS-5 as shown in Figure 4-3 and Figure 4-5, or on forms approved in writing by the Department.

4.5.2 Weather Conditions

a. The wind speed and direction shall be determined before measurements are taken and recorded on a form. Measurements shall not be taken when the wind speed exceeds 10 mph. The sound level meter windscreen shall always be installed on the microphone while taking measurements.

b. The relative humidity may be determined for the time measurements are taken. Measurements shall not be taken when precipitation affects results.

Comment: Measurements may be taken when the ground is wet if the readings are not influenced by motor vehicle tire noise on wet pavement.

c. Comment: The barometric pressure has an effect on the calibration level of most calibrators. This effect is usually small but can introduce some error under very low atmospheric pressure conditions or at high elevations. Typically no correction is needed at elevations below 2,000 feet. Above 2,000 feet elevation, the manufacturers correction factor must be applied to the instrument during calibration.

4.5.3 Determination of Meter Speed

a. Comment: The "FAST" meter speed is used for sounds of an essentially continuous nature. This speed is such that the indication instrument attains its final reading in approximately 0.2 seconds. In general, the "FAST" meter is used where meter fluctuations do not exceed 3 dB, or where the meter is required to follow fast changes in level such as an automobile or aircraft pass-by measurements.

b. Comment: The "SLOW" meter speed is used for sounds where the noise level fluctuates by + or - 3 dB and meter variations make the instrument display unreadable. The slower action of the meter provides an averaging effect that is helpful in measuring sounds of a rapidly varying nature or of low frequencies. However, for a noise pulse of 0.5 second duration, such a meter will typically read 2 to 6 dB low. It is not satisfactory for measuring intermittent sounds.

4.5.4 "A" Weighting Scale Measurements

Comment: Maximum noise level measurements with the "A" network weighting scale are taken with the sound level meter switched to the "A" network per the manufacturer's instructions. The meter must be properly positioned with respect to the noise source per the manufacturer's instructions. Information and data taken during the measurements should be recorded on Form NPCS-4 or equivalent as shown in Figure 4-3.

4.5.5 Statistical Noise

Comment: The statistical noise level is that noise level exceeded a stated percentage of the time. An $L_{10} = 65$ dBA means that in any consecutive 60 minute period of the day 65 dBA is equalled or exceeded only 10% of the time, or for a total of 6 minutes. Several procedures are in use by the Department to determine statistical noise levels and other methods may be approved in writing from the Department. Three acceptable procedures to determine the statistical noise level are presented in Section 6 of this Chapter. Information and data taken during the measurements should be recorded on Form NPCS-10-1 or equivalent as shown in Figure 4-9. Statistical calculations can be carried out on Forms NPCS-10-2 and NPCS-10-3 and should be summarized in "L" terminology on Form NPCS-4. An example of a completed Form NPCS-4 is presented in Figure 4.4.

4.5.6 Ambient Noise Determination

Comment: The ambient noise level is a composite of sounds from many sources near and afar. As the ambient noise level will be compared to the noise level with the source included in any consecutive 60 minute period, it is important that data is obtained in time periods of interest during the day and also both the week and

the weekend to obtain data which are representative. It is also important to note that the data must be taken without emphasis on either noise peaks or unusual quiet.

Measurements should not be taken in weather conditions which may create a bias in the data. Wet streets or snow accumulations could bias the data unless these conditions are typical for the community.

Measurements should be made at least at several appropriate locations within the sampling area under consideration. Measurements should be made randomly in the sense that each location and each sampling time has the same chance of being sampled and that the selection of any one factor in no way influences the choice of another. Measurements should be made on at least three separate days.

The ambient statistical noise levels obtained or predicted with the noise source in question operating, should include all noises generated by that source. This may include such sources as increased motor vehicle traffic noise, safety warning device noise, and other sounds that may be exempted from the rules due to other considerations.

Procedures to determine the L_{10} and L_{50}, statistical noise levels are presented in Section 6 of this Chapter. Information and data taken during the measurements should be recorded on Form NPCS-4 or equivalent as shown in Figure 4-4.

4.5.7 Octave Band Noise Measurement

Octave band noise measurements shall be made on an octave band frequency analyzer per document NPCS-2, Requirements for Sound Measuring Instruments and Personnel.

Comment: Octave band sound pressure levels may be measured in the same manner as the "A" weighting scale measurements, except that the octave band filters shall be used in place of the "A" weighting network. Information and data taken during the measurements should be recorded on Form NPCS-5 or equivalent as shown in Figure 4.5. An example of a completed form NPCS-5 is presented in Fig. 4-6.

4.5.8 Tape Recording

Comment: Tape recording of the noise and a calibration signal is optional. The tape recorder system must conform to the specifications defined in document NPCS-2 Requirements for Sound Measuring Instruments and Personnel.

4.5.9 One-Third Octave Band Noise Measurement

One-third octave band noise measurements shall be made on a one-third octave band frequency analyzer per document NPCS-2, Requirements for Sound Measuring Instruments and Personnel.

Comment: One-third octave band sound pressure levels may be measured in the same manner as the "A" weighting scale measurements, except that the one-third octave band filter shall be used in place of the "A" weighting network. Information and data taken during the measurements should be recorded on form NPCS-29 or equivalent as shown in Figure 4-7. An example is shown in Figure 4-8.

4.5.10 Impulse Measurements

Impulse measurements shall be made on meters per document NPCS-2, Requirements for Sound Measuring Instruments and Personnel. Impulse sound pressure levels are to be taken with the meter set to the linear unweighted scale with the peak detector circuit engaged for unweighted (dB) impulse measurements. For "C" weighted (dBC) impulse measurements the meter is set to the "C" weighting scale and the meter speed is set to the "SLOW" damping response.

Comment: Information and data should be recorded on Form NPCS-4 or equivalent as shown in Figure 4-3. An example of a completed form is presented in Figure 4-4.

DEPARTMENT OF ENVIRONMENTAL QUALITY

File _____

SOUND PRESSURE LEVEL DATA SHEETS

County

SOURCE _____ BY

_____ DATE

_____ SHEET

_____

COMPLAINANT _____

_____

COMPLAINT DATE _____

INSTRUMENTATION		
EQT	TYPE	SERIAL
SLM		
MIC		
FLTR		
CAL		
Windscreen ON OFF		

Time	Bat. Ck.	Cal. dB	°F dry bulb	°F wet bulb	% RH	Press. mm Hg	Wind mph	Wind Direct

Measurement Position	Meter Fast/Slow	A Scale	C Scale	Linear Scale	L_1	L_{10}	L_{50}	Peak Impulse

Comments _____

_____

_____

_____

Form NPCS-4

INSTRUMENT SET-UP
CHECK-OFF LIST

- ☐ Site Selection
- ☐ SLM Position
- ☐ Battery Check
- ☐ Calibration Adjustment
- ☐ Wind Below 10 MPH
- ☐ Humidity Below 95%
- ☐ Windscreen

1. Days of Operation
   - A. Mon. - Fri.
   - B. Mon. - Sat.
   - C. Mon. - Sun.
2. Time of Operation
   - A. 8 a.m. - 5 p.m.
   - B. _ a.m. - _ p.m.
3. Number of Shifts
   - A. One
   - B. Two
   - C. Three
4. Distance from Receiver to source _____feet.
5. Visibility to Source
   - A. Direct _____
   - B. Hill or Berm
   - C. Trees _____
   - D. Other _____
6. Zoning
   - A. Residance _____
   - B. Plant or Facility _____
7. Who came first?
   - A. Residance...Date _____
   - B. Plant or Facility _____
8. Petition Submitted
   - A. Yes... Number _
   - B. No

SKETCH OF MEASUREMENT SITE AND SOURCE

REVERSE SIDE FORM NPCS-4
FIGURE 4-3

NPCS-4

DEPARTMENT OF ENVIRONMENTAL QUALITY

SOUND PRESSURE LEVEL DATA SHEETS

File Industry

County Multnomah

SOURCE Oregon Paving Co.
1000 SE 101st, Portland
Rock crusher

BY C. M. Sroka

DATE 6/6/74

SHEET 1/2

COMPLAINANT Mr. Eastland
155 SE Millman Dr, Portland

COMPLAINT DATE 5/10/74

INSTRUMENTATION		
EQT	TYPE	SERIAL
SLM	GR 1565B	
MIC	GR	
FLTR		
CAL	GR 1562	Del [illegible]
Windscreen (ON) OFF		

Time	Bat. Ck.	Cal. dB	°F dry bulb	°F wet bulb	% RH	Press. mm Hg	Wind mph	Wind Direct
1:45p	✓	114	67	51	29	—	0.5	W

Measurement Position	Meter Fast/Slow	A Scale	C Scale	Linear Scale	L_1	L_{10}	L_{50}	Peak Impulse
1	fast	78		85				106
2	fast				79	75	70	

Comments An occasional bus or truck; ambient noise without crusher operating is 51-57 dBA.

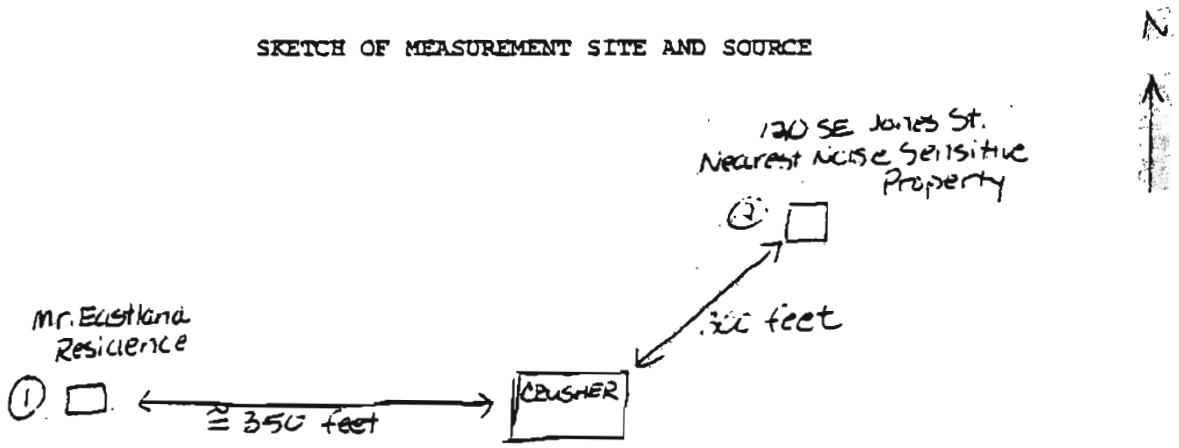
Example Form NPCS-4

INSTRUMENT SET-UP
CHECK-OFF LIST

- ☑ Site Selection
- ☑ SLM Position
- ☑ Battery Check
- ☑ Calibration Adjustment
- ☑ Wind Below 10 MPH
- ☑ Humidity Below 95%
- ☑ Windscreen

1. Days of Operation
   - (A) Mon. - Fri.
   - B. Mon. - Sat.
   - C. Mon. - Sun.
2. Time of Operation
   - A. 8 a.m. - 5 p.m.
   - (B) 6 a.m. - 9 p.m.
3. Number of Shifts
   - A. One
   - (B) Two
   - C. Three
4. Distance from Receiver to source 300-350 feet.
5. Visibility to Source
   - (A) Direct _____
   - B. Hill or Berm _____
   - C. Trees _____
   - D. Other _____
6. Zoning
   - (A) Residence _____
   - B. Plant or Facility _____
7. Who came first?
   - (A) Residence...Date _____
   - B. Plant or Facility
8. Petition Submitted
   - (A) Yes... Number 300 Sig?
   - B. No

SKETCH OF MEASUREMENT SITE AND SOURCE



Example Form NPCS-4
Figure 4-4 REVERSE SIDE FORM

DEPARTMENT OF ENVIRONMENTAL QUALITY

SOUND PRESSURE LEVEL DATA SHEETS

File _____

County _____

SOURCE _____

BY

DATE _____

SHEET 1

COMPLAINANT _____

COMPLAINT DATE _____

INSTRUMENTATION		
EQT	TYPE	SERIAL
SLM		
MIC		
FLTR		
CAL		
Windscreen ON OFF		

Time	Bat. Ck.	Cal. dB	°F dry bulb	°F wet bulb	% RH	Press. mm Hg	Wind mph	Wind Direct

Position	Fast/ Slow	A Scale	Lin. Scale	31.5 Hz	63 Hz	125 Hz	250 Hz	500 Hz	1000 Hz	2000 Hz	4000 Hz	8000 Hz

Comments _____

Form NPCS-5
Figure 4-5

NPCS-5

INSTRUMENT SET-UP
CHECK-OFF LIST

- ☐ Site Selection
- ☐ SLM Position
- ☐ Battery Check
- ☐ Calibration Adjustment
- ☐ Wind Below 10 MPH
- ☐ Humidity Below 95%
- ☐ Windscreen

1. Days of Operation
   - A. Mon. - Fri.
   - B. Mon. - Sat.
   - C. Mon. - Sun.
2. Time of Operation
   - A. 8 a.m. - 5 p.m.
   - B. _ a.m. - _ p.m.
3. Number of Shifts
   - A. One
   - B. Two
   - C. Three
4. Distance from Receiver to source _____feet.
5. Visibility to Source
   - A. Direct _____
   - B. Hill or Berm _____
   - C. Trees _____
   - D. Other _____
6. Zoning
   - A. Residence _____
   - B. Plant or Facility _____
7. Who came first?
   - A. Residence...Date _____
   - B. Plant or Facility _____
8. Petition Submitted
   - A. Yes... Number _____
   - B. No

SKETCH OF MEASUREMENT SITE AND SOURCE

FIGURE 4-5
REVERSE SIDE FORM NPCS-5

DEPARTMENT OF ENVIRONMENTAL QUALITY

SOUND PRESSURE LEVEL DATA SHEETS

File Industry

County Lane

SOURCE Sam's Sawmill
1200 East Road
Eugene

BY LCVR - GCS

DATE 4/27/74

SHEET 1 / 1

COMPLAINANT Mr. Ed Jones
100 North St., Eugene

COMPLAINT DATE April 19, 1974

INSTRUMENTATION		
EQT	TYPE	SERIAL
SLM	G.R. 1933	2250 1591
MIC	G.R.	[illegible]
FLTR	G.R.	1250
CAL	G.R. [illegible]	[illegible]
Windscreen ON OFF		

Time	Bat. Ck.	Cal. dB	°F dry bulb	°F wet bulb	% RH	Press. mm Hg	Wind mph	Wind Direct
3:40 pm	OK	114	67	51	47	—	4	W
4:07 pm	OK	114.0						

Position	Fast/ Slow	A Scale	Lin. Scale	31.5 Hz	63 Hz	125 Hz	250 Hz	500 Hz	1000 Hz	2000 Hz	4000 Hz	8000 Hz
1	S	47	63	55	55	54	54	50	44	38	30	[illegible]

Comments Measurements taken during "blower" operation. Readings taken from 3:51 through 4:02 pm.

Example Form NPCS-5
Figure 4-6

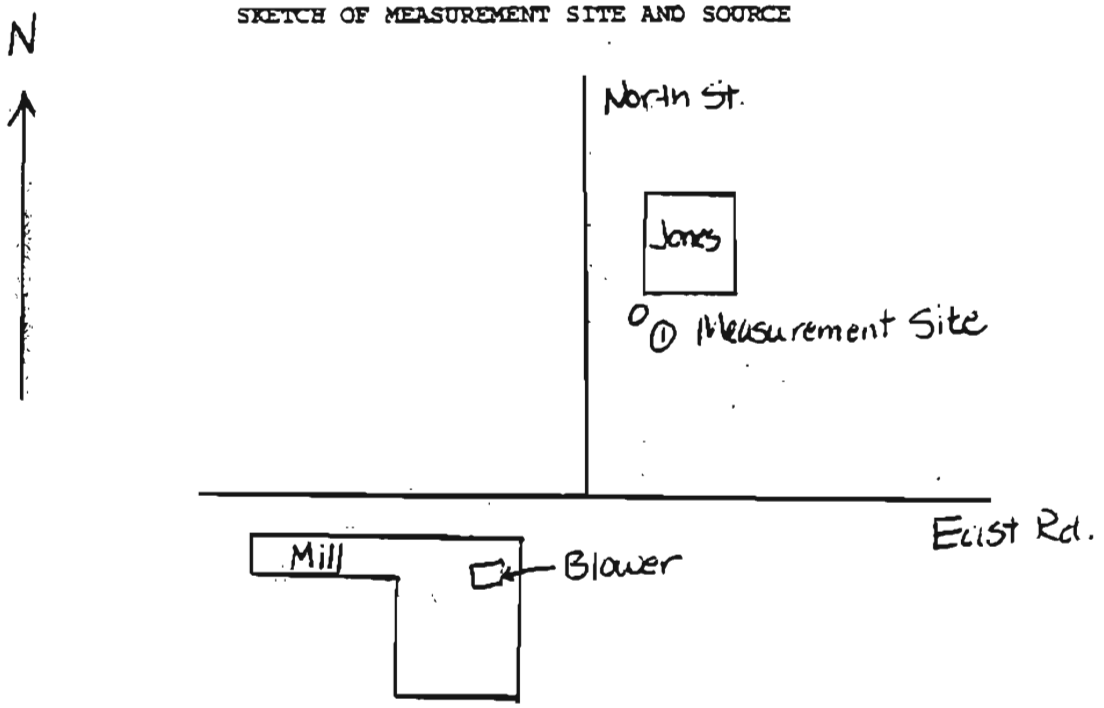
NPCS-5

INSTRUMENT SET-UP
CHECK-OFF LIST

- [x] Site Selection
- [x] SLM Position
- [x] Battery Check
- [x] Calibration Adjustment
- [x] Wind Below 10 MPH
- [x] Humidity Below 95%
- [x] Windscreen

1. Days of Operation
   - A. Mon. - Fri.
   - (B) Mon. - Sat.
   - C. Mon. - Sun.
2. Time of Operation
   - A. 8 a.m. - 5 p.m.
   - (B) 8 a.m. - 4 p.m.
3. Number of Shifts
   - A. One
   - (B) Two
   - C. Three
4. Distance from Receiver to source ≈300 feet.
5. Visibility to Source
   - A. Direct X
   - B. Hill or Berm
   - C. Trees
   - D. Other
6. Zoning
   - A. Residence X
   - B. Plant or Facility
7. Who came first?
   - (A) Residence...Date 1952
   - B. Plant or Facility
8. Petition Submitted
   - A. Yes... Number
   - (B) No

SKETCH OF MEASUREMENT SITE AND SOURCE



Example Form NPCS-5
Figure 4-6
REVERSE SIDE OF FORM

DEPARTMENT OF ENVIRONMENTAL QUALITY

1/3 OCTAVE BAND DATA SHEET

File

County _____

SOURCE _____ BY _____

_____ DATE

_____ SHEET

_____

COMPLAINANT _____

_____

COMPLAINT DATE _____

INSTRUMENTATION		
EQT	TYPE	SERIAL
SLM		
MIC		
FLTR		
CAL		

Windscreen ON OFF

Time	Bat. Ck.	Cal. dB	°F dry bulb	°F wet bulb	% RH	Press. mm Hg	Wind mph	Wind Direct

PREFERRED CENTER FREQUENCIES FOR 1/3 OCTAVE BANDS

osition	Lin. Scale	20 Hz	25 Hz	30 Hz	40 Hz	50 Hz	63 Hz	80 Hz	100 Hz	125 Hz	160 Hz	200 Hz	250 Hz	315 Hz	400 Hz
osition	500	630	800	1000	1250	1600	2000	2500	3150	4000	5000	6300	8000	10,000	12,500

omments _____

_____

_____

_____

Figure 4-7 Form NPCS-29

NPCS-29

DEPARTMENT OF ENVIRONMENTAL QUALITY

1/3 OCTAVE BAND DATA SHEET

I+C

File NP-ABC Lumber

County Coos

SOURCE ABC Lumber Co.
1000 "F" St.
Coos Bay, OR

BY B. Hammon

DATE 9-18-81

COMPLAINANT Mr. Joe Smith
1245 "D" St., Coos Bay

COMPLAINT DATE 9-16-81

INSTRUMENTATION		
EQT	TYPE	SERIAL
SLM	B+K 2209	396472
MIC	B+K 4145	311347
FLTR	B+K 1618	923111
CAL	B+K 4220	376042
MAG TAPE	B+K 7003	704619
Windscreen	(ON)	OFF

Time	Bat. Ck.	Cal. dB	°F dry bulb	°F wet bulb	% RH	Press. mm Hg	Wind mph	Wind Direct
2:00 PM	✓	124.0	66°	PARTLY CLOUDY			4-6	SW
3:10 PM	✓	124.0	69°	"			2-4	"

PREFERRED CENTER FREQUENCIES FOR /3 OCTAVE BANDS

Position	Lin. Scale	20 Hz	25 Hz	30 Hz	40 Hz	50 Hz	63 Hz	80 Hz	100 Hz	125 Hz	160 Hz	200 Hz	250 Hz	315 Hz	400 Hz
1	70	58	60	59	58	59	60	59	59	58	57	56	54	52	51

Position	500	630	800	1000	1250	1600	2000	2500	3150	4000	5000	6300	8000		
1	50	48	46	45	53	43	41	40	40	37	38	36	37	32	28

Comments SAMPLE TAKEN 2:13 TO 2:35 PM PDT. PRIMARY IS A LARGE SAW. PRODUCES WHINE IN 1250 Hz. BAND

NPCS-29

4.6 Statistical Noise Level Calculations

4.6.1 Hand Sample Method (Comment)

a. For this method use forms NPCS-10-1, NPCS-10-2, and NPCS-10-3 as shown in Figures 4-9 through 4-11 or equivalent.

b. Perform a short noise survey to determine the approximate range of sound levels produced by the noise source being investigated. Enter the approximate high and low noise levels as well as the central tendency on form NPCS-10-1. Use the minimum and maximum sound levels and the table at the back-bottom of form NPCS-10-1 to estimate the minimum number of good sound samples needed to be taken from the source in question. For example, in Figure 4-12 the noise varied from a high of approximately 67 dBA to a low of 61 dBA. This is a 6 dBA variation. The table on NPCS-10-1 indicates that a minimum of 132 good readings needs to be taken.

The table on NPCS-10-1 is designed to give an acceptable statistical confidence in the L_{10} and L_{50} noise level. For determining the L_1 noise level with confidence or for more complex noise sources, more noise samples than indicated in the table may be necessary.

c. Record the noise levels in dBA on Form NPCS-10-1 at five second intervals, at ten second intervals, or at fifteen second intervals. An example of such a measurement is presented in Figure 4-12. Note any unusual activity from the noise source in question. Also indicate all external or extraneous noise sources which may contaminate the noise reading. Examples include sounds from passing vehicle traffic and aircraft. The sound readings associated with these external sources will not be included in the statistical noise level calculations. If external sounds contaminate the measurements for a significant amount of time, it may be necessary to conduct the survey during a period of the day in which these other sources are absent or quieter.

d. Using Form NPCS-10-2, tally the recorded noise levels in 1 dBA increments as the example shows in Figure 4-13. Record on NPCS-2 only those sound levels which are legitimately associated with the source in question, ignoring all other contaminating sound levels.

In the "Number of Readings" column, sum the total readings at each dBA level. Using the "Number Greater Than" column, calculate the number of readings taken that are greater than each particular level. For example, in Figure 4-13 there are no readings greater than 74 dBA, hence the "Number Greater Than " is zero. There is one reading taken at a level greater than 73 dBA, and three (1 plus 2) readings greater than 72 dBA.

The percent greater than (% Greater Than) column contains the statistical percent for each dBA level. The percent is calculated by dividing the numbers in the "Number Greater Than" column by the total number of readings times 100. For example, the percent of 73 dBA is calculated as (1/194) x 100 = 0.5%, and the percent at 72 dBA is (3/194) x 100 = 1.5%.

e. Using Form NPCS-10-3, the dBA levels versus the "percent greater than" numbers are plotted. An example of this is shown in Figure 4-14.

From the resulting graph, the statistical noise level at any required percentage may be found. For example, the L_{50} and L_{10} are found to be 63 dBA and 66 dBA, respectively. Note that a normalized or randomly varying noise source will result in a straight line when plotted on form NPCS-10-3.

f. The results from the statistical survey are then summarized on form NPCS-4 (see Figure 4-4). On the back of NPCS-4 a sketch of the measurement site should be drawn.

g. A typical noise survey will require approximately 20 minutes of measuring to record the required number of samples at a 5-second sample interval. However, the noise standards for industrial and commercial noise sources (OAR 340-35-035) are specified for a one-hour (60 minute) period. Therefore, the noise investigator must ensure that the noise survey represents sounds that are typical of a full 60-minute operation of the noise source. If the source significantly changes its operation for the remainder of the hour, it is recommended that a full 60 minutes of samples are measured and recorded for the statistical analysis.

h. The documentation of the L_1 statistical noise level is often better accomplished by the "time above" method. For noise sources that operate for a short period of time at a constant sound level, an accurate determination of the L_1 noise level can be determined by measuring the total amount of time the noise source operates in a one-hour period. If

the source operates for a period of 36 seconds or greater within the hour (but less than 6 minutes), then the L_1 is equal to the measured noise level. If the source operates for 6 minutes or more during the hour, then the measured level is the L_{10} statistical noise level.

4.6.2 Noise Exposure Counter or Monitor Method

Comment: Statistical noise levels may be obtained through the use of several commercially designed devices that sample and classify the data.

4.6.3 Programmable Calculator Method

Comment: The noise staff of the Department has developed a program to calculate statistical noise levels on a Wang 600 series programmable calculator. This method will digitally make the necessary calculations after the analog noise data has been converted to digital data. As this method is specialized to the Department's facilities, it will not be presented here. A complete explanation of the method and program listing is on file at the Department in Manual NPCS-22, Analysis of Ambient Noise with the Wang 600 Series Programmable Calculator.

DEPARTMENT OF ENVIRONMENTAL QUALITY

STATISTICAL NOISE SURVEY

SOURCE: _____ DATE:

_____ BY:

MEASUREMENT SITE: _____ COUNTY: _____

_____ SHEET: /

Time	Bat.	Calibration dB	F dry bulb	F wet bulb	%RH	Press. mm Hg.	Wind MPH	Wind direct.

INSTRUMENTATION		
EQUT	TYPE	SERIAL
SLM		
MIC		
CAL		

WINDSCREEN: ON OFF

~ Range of Noise: Hi _____ dBA Low _____ dBA Central Tend. _____ dBA

Start Time: _____ Sample Interval: 5 10 15 seconds

DATA POINTS	SOUND PRESSURE LEVEL dBA					
1 - 6						
7 - 12						
13 - 18						
19 - 24						
25 - 30						
31 - 36						
37 - 42						
43 - 48						
47 - 54						
55 - 60						
61 - 66						
67 - 72						
73 - 78						
79 - 84						
85 - 90						
91 - 96						
97 - 102						
103 - 108						
109 - 114						
115 - 120						
121 - 126						
127 - 132						

Figure 4-9
Form NPCS-10-1

Note: See back for the minimum number of samples.
Indicate all missing data points and give an explanation.

NPCS-10-1

6/76

133 - 138						
139 - 144						
145 - 150						
151 - 156						
157 - 162						
163 - 168						
169 - 174						
175 - 180						
181 - 186						
187 - 192						
193 - 198						
199 - 204						
205 - 210						
211 - 216						
217 - 222						
223 - 228						
229 - 234						
235 - 240						
241 - 246						
247 - 252						
253 - 258						
259 - 264						
265 - 270						
271 - 276						
277 - 282						
283 - 288						
289 - 294						
295 - 300						
301 - 306						
307 - 312						
313 - 318						
319 - 324						
325 - 330						
331 - 336						

Figure 4-9
Reverse Side Form NPCS-10-1

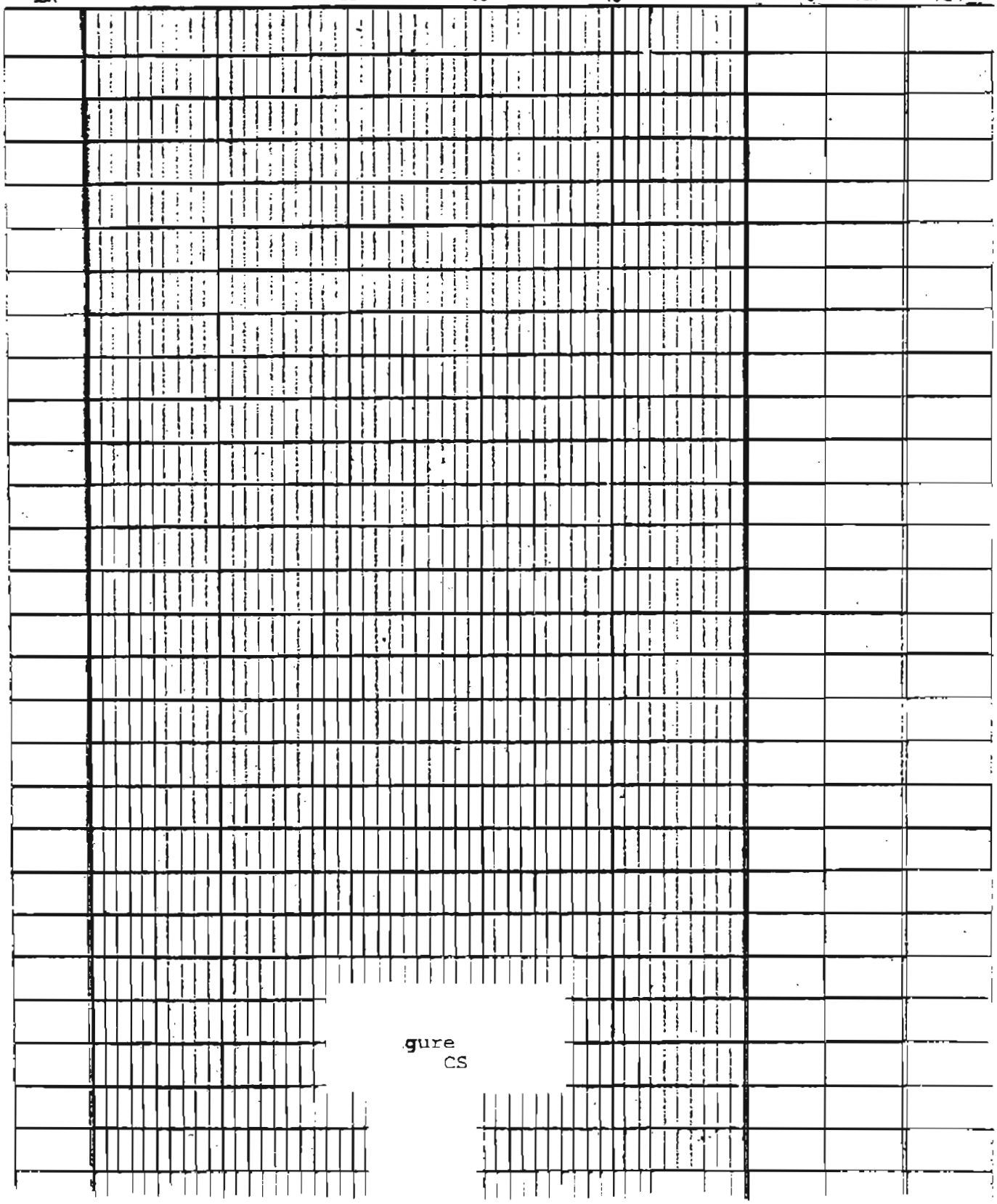
Maximum - Minimum Levels (difference in range)													
0-8	9	10	11	12	13	14	15	16	17	18	19	20	21
132	138	174	210	246	288	336	384	438	498	558	618	684	756
Minimum Number "Good" Samples													

Note: Indicate all missing data points and give an explanation. Additional data points may be needed to document an L_1 violation.

NPCS-10-1

DEPARTMEN OF ENVIRONMENTAL QUALITY
STATISTICAL COMPUTATION SHEE

te. _____ rce: _____ /



gure
CS

NPCS 2 6/76

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T ___/___

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URCE

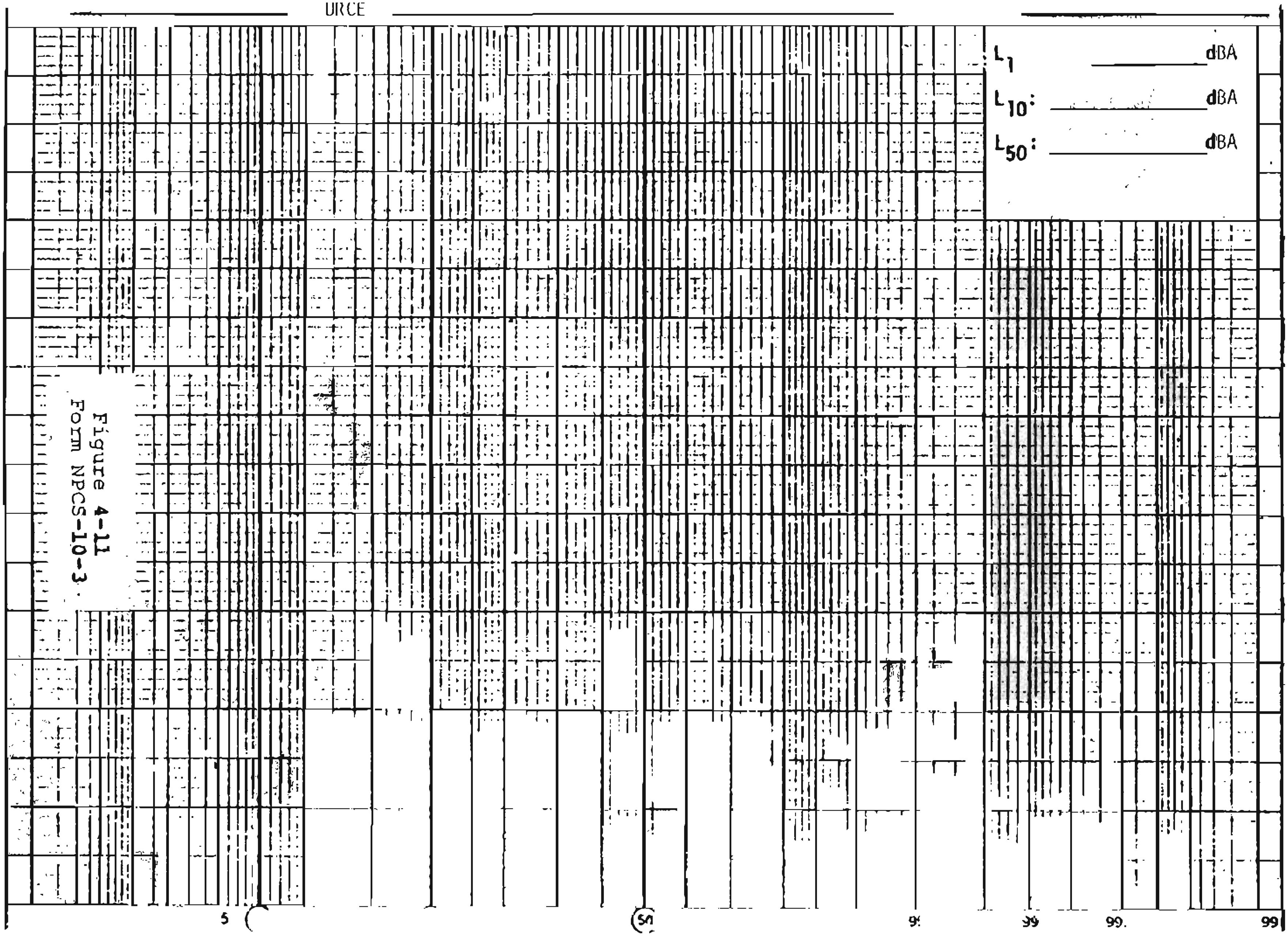


Figure 4-11
Form NPCS-10-3

NPCS 0 3

SOURCE: ACME WOOD PRODUCTS INC. DATE: 9-16-81

1581 S.W. 76TH (DEBARKER, SAW, CHIPPER) BY: GTW

MEASUREMENT SITE: SITE 1, MR & MRS. JONES' NSP COUNTY: MULT.

1576 S.W. 76TH, PORTLAND SHEET: 2/4

Time	Bat.	Calibration dB	F dry bulb	F		Press. mm Hg.	Wind MPH	Wind direct.
1410	✓	114.0					0-5	NW
1515	✓	114.0					2-6	NW

INSTRUMENTATION		
EQUT	TYPE	SERIAL
SLM	GR 1565	12345
MIC	1"	
CAL	GR 1987	1790

WINDSCREEN (ON) OFF

~ Range of Noise: Hi 67 dBA Low 61 dBA Central Tend. 63 dBA

Start Time: 1420 PDT Sample Interval: (5) 10 15 seconds

DATA POINTS	SOUND PRESSURE LEVEL dBA					
1 - 6	65	63	62	61	64	65
7 - 12	63	61	65	CAR	CAR	64
13 - 18	63	62	70	65	63	62
19 - 24	70	62	DOG	64	63	61
25 - 30	62	63	63	61	67	67
31 - 36	TRUCK →	T	T	64	66	65
37 - 42	62	63	64	63	62	64
43 - 48	63	63	64	63	73 R	62
47 - 54	63	63	65	62	64	63
55 - 60	61	64	65	63	63	65
61 - 66	65	66	64	61	62	66
67 - 72	60	61	63	63	64	70
73 - 78	72	61	73 R	74 R	64	64
79 - 84	63	62	60	65	62	64
85 - 90	61	62	67	63	JET	JET →
91 - 96	JET	JET	65	64	64	64
97 - 102	70 R	63	64	63	62	65
103 - 108	66	65	66	62	64	63
109 - 114	64	64	62	63	65	64
115 - 120	64	67	63	64	DOG	DOG
121 - 126	65	66	67	64	66	69
127 - 132	69	CAR	CAR	63	66	64

Note: See back for the minimum number of samples. NPCS-10-1
Indicate all missing data points and give an explanation.

6/76

133 - 138	63	66	65	64	63	66
139 - 144	62	63	65	64	63	64
145 - 150	64	64	65	66	62	64
151 - 156	66	63	68	63	63	63
157 - 162	62	63	64	63	63	62
163 - 168	63	65	64	62	63	68
169 - 174	← COMPLAINANT		TALKING →		64	61
175 - 180	63	63	63	64	63	65
181 - 186	64	61	61	BIRDS →	B	63
187 - 192	64	63	64	62	65	64
193 - 198	62	64	63	62	64	62
199 - 204	CAR	CAR	63	64	60	63
205 - 210	64	62	62	TRUCK →	T	T
211 - 216	T	T	T	63	64	64
217 - 222	69	63	65	63	65	63
223 - 228						
229 - 234						
235 - 240						
241 - 246						
247 - 252						
253 - 258						
259 - 264						
265 - 270						
271 - 276						
277 - 282						
283 - 288						
289 - 294						
295 - 300						
301 - 306						
307 - 312						
313 - 318						
319 - 324						
325 - 330						
331 - 336						

Maximum - Minimum Levels (difference in range)

0-8	9	10	11	12	13	14	15	16	17	18	19	20	21
132	138	174	210	246	288	336	384	438	498	558	618	684	756

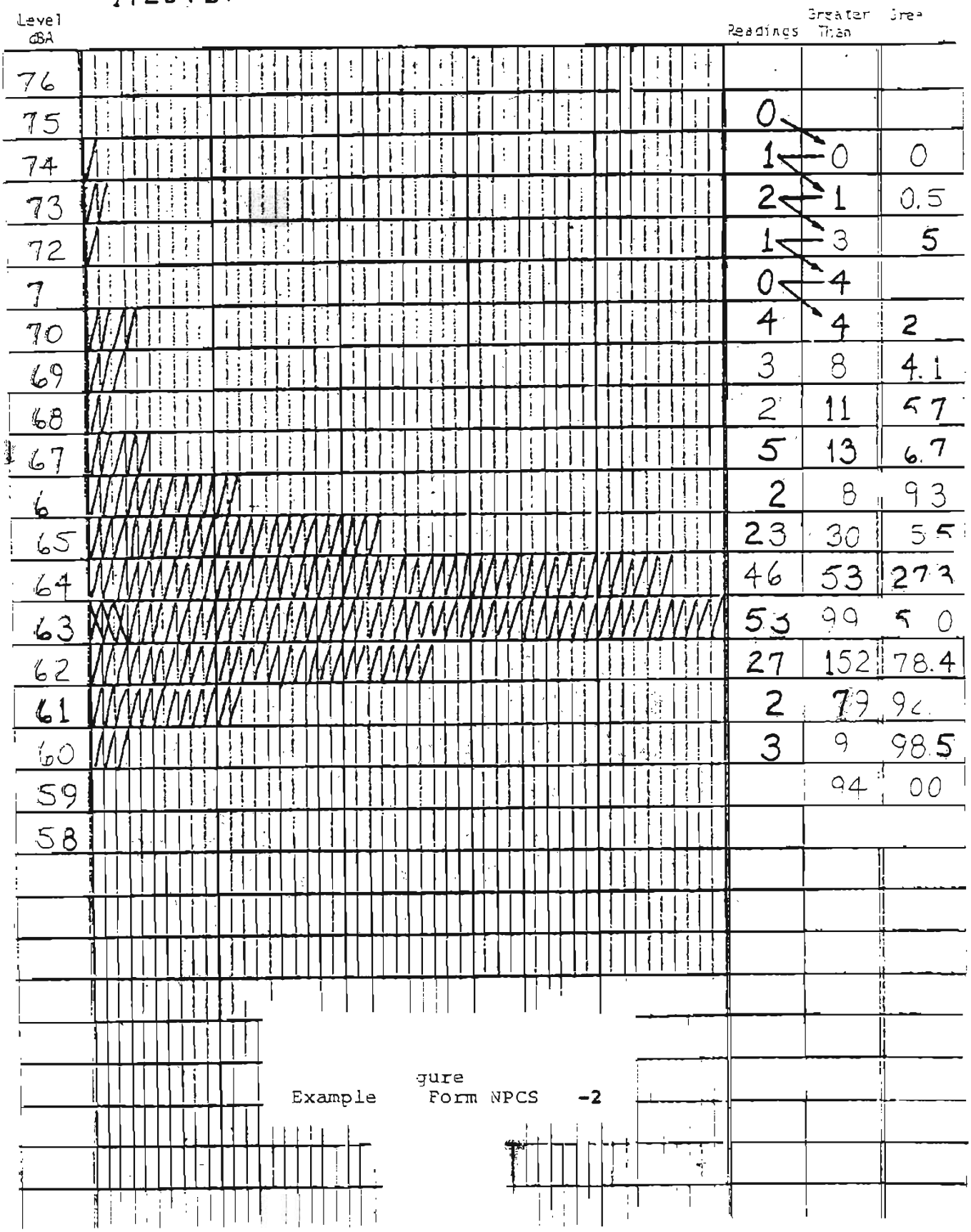
Minimum Number "Good" Samples

Additional data

NPCS-10-1

ICAL COMPI

Date 9-16-81 1420 PDT Source: ACME WOOD PRODUCTS INC. Sheet 3/4



Level dBA	Readings	Greater Than	Grea
76			
75	0		
74	1	0	0
73	2	1	0.5
72	1	3	5
7	0	4	
70	4	4	2
69	3	8	4.1
68	2	11	57
67	5	13	6.7
6	2	8	93
65	23	30	55
64	46	53	273
63	53	99	50
62	27	152	78.4
61	2	79	9[illegible]
60	3	9	98.5
59		94	00
58			

Example gure Form NPCS -2

NPCS 2

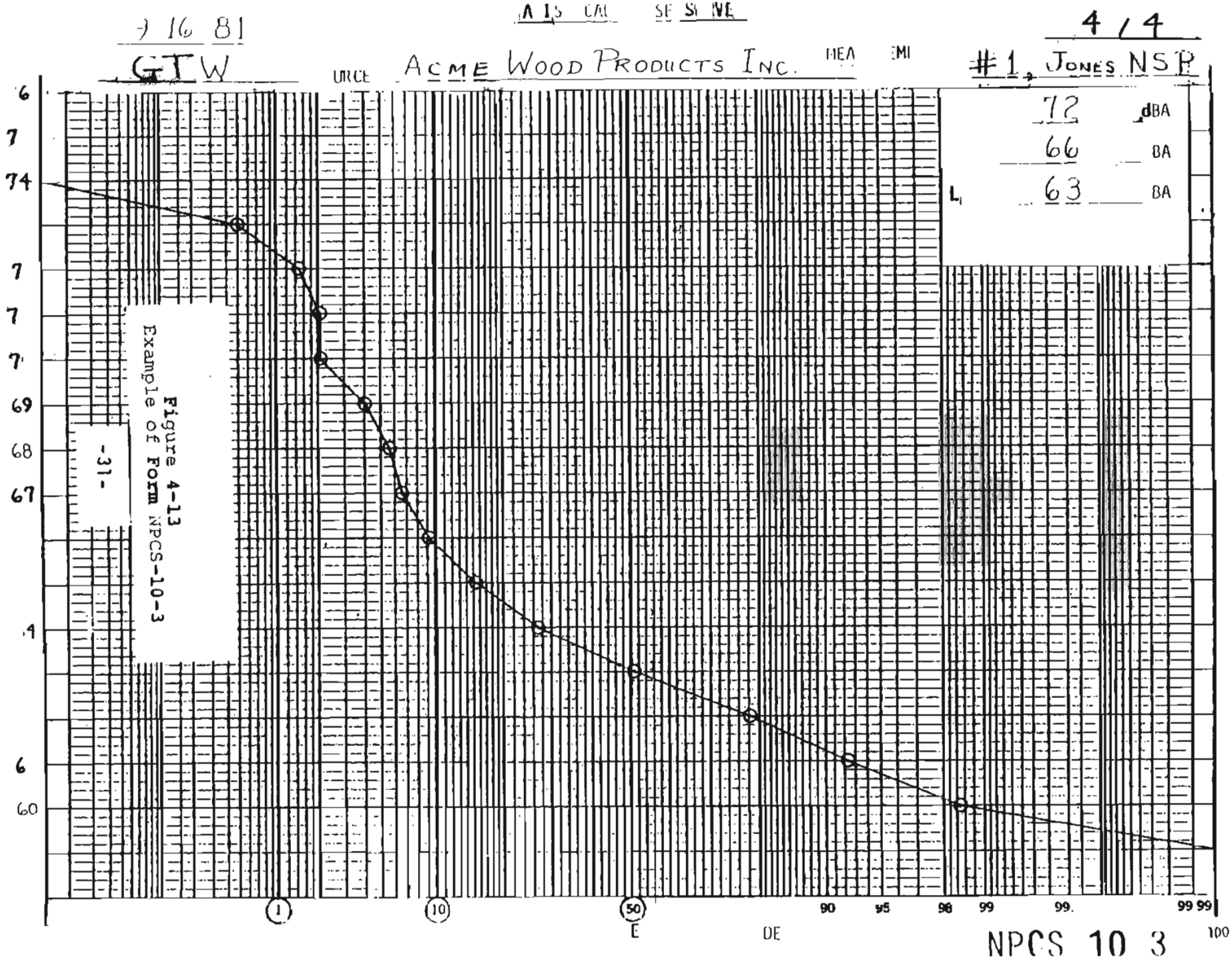


Figure 4-13
Example of Form NPCS-10-3

4.8.1 Point Source

Comment: The sound pressure level at a point r feet from a point source can be calculated from a sound pressure level measurement at a point r_o feet from the point source using the following equation:

$$SPL = SPL_o - 20 \log (r/r_o)$$

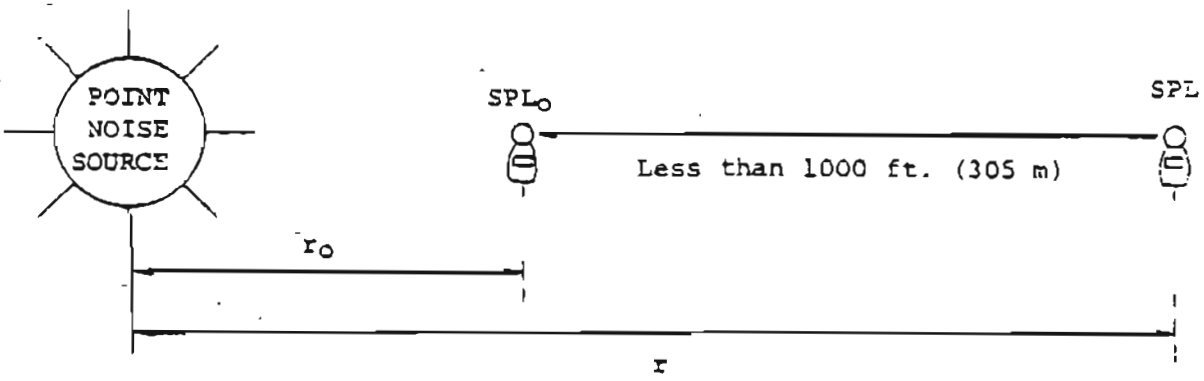
where:

SPL = sound pressure level at r feet from the source.

SPL_o = sound pressure level at r_o feet from the source. Note that r_o is a reference distance and that the distance r is always greater than r_o. The point r_o must be in the far field of the source.

Figure 4-15 illustrates a point source, such as an industrial site, and the distance at which the measurement SPL_o is taken and the distance where the required level, SPL is needed.

This projection technique is applicable only if the distance between r and r_o is less than 1000 feet. This projection technique should be used only when it is not practical to make a sound pressure level reading at r.



SOUND LEVEL ADJUSTMENT WITH DISTANCE

FIGURE 4-15

4.8.2 Line Source

Comment: The sound pressure level at a point r feet from a line source can be calculated from a sound pressure level measurement at a point r_o feet from the line source using the following equation:

$$SPL = SPL_o - 10 \log (r/r_o)$$

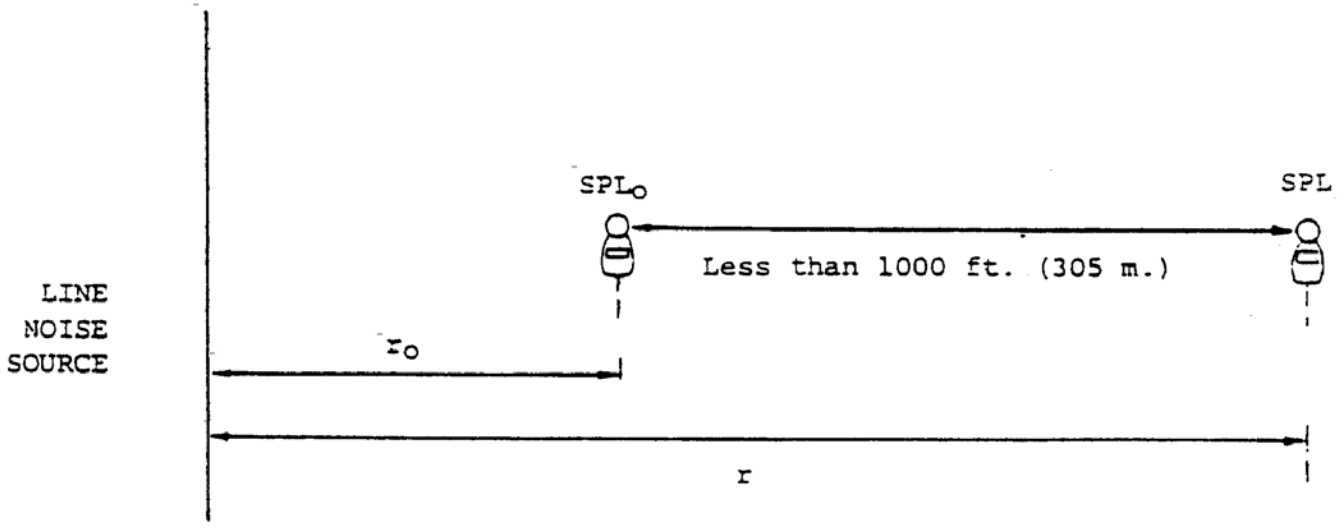
where:

SPL = sound pressure level at r feet from the source.

SPL_o = sound pressure level at r_o feet from the source. Note that r_o is a reference distance and that the distance r is always greater than r_o. The point r_o must be in the far field of the source.

Figure 4-16 illustrates a line source, such as a highway with closely spaced moving vehicles, and the distance at which the measurement, SPL_o is taken and the distance where the required level SPL is needed.

This projection technique is applicable only if the distance between r and r is less than 1000 feet. This projection technique should be used only when it is not practical to make a sound pressure level reading at point r.



LINE NOISE SOURCE DISTANCE ADJUSTMENT

FIGURE 4-16

APPENDIX C

SOUND MEASUREMENT INSTRUMENTS AND PERSONNEL (NPCS-2)

NPCS-2

State of Oregon
Department of
Environmental
Quality

Requirements

For

Sound

Measuring

Instruments

And

Personnel

Department of Environmental Quality
Air Quality Control Division
Noise Pollution Control Section

I. Instruments

Purpose: To ensure maximum practical accuracy in any particular instrument and to minimize the difference in corresponding readings with various makes and models of instruments.

A. Specifications for sound level meters

Scope: All sound level meters shall conform to American National Standard Institute Standard number S1.4-1971. A Type II specification is the minimum requirement for sound level meters. The minimum accessory requirements are a random incidence microphone, a windscreen, and an acoustically coupled calibrator.

B. Specifications for octave and third-octave band filter sets

Scope: All octave and third-octave band filter sets shall conform to American National Standard Institute Standard number S1.11-1966. Type O Class II is the minimum requirement for octave and third-octave band filter sets.

C. Specifications for tape recorders or graphic level recorders

Scope: Magnetic tape recorder systems and graphic level recorder systems shall conform to Society of Automotive Engineers Recommended Practice J184, qualifying a sound data acquisition system.

D. Specifications for impulse sound measuring equipment

Scope: Impulse sound measurement instruments shall conform to American National Standard Institute Standard Number S1.4-1971. A Type I specification is the minimum requirement for sound level meters with a peak detector circuit.

II. Personnel

Purpose: To ensure the quality of measurements

A. Personnel Qualifications

Scope: Personnel conducting sound measurements shall have been trained and experienced in the current techniques and principles of sound measuring instrumentation appropriate to the measurements being taken.