

**AGENDA  
OURAY CITY COUNCIL**

**Monday, July 22, 2024 - 11:00 AM**

**Ouray Community Center  
320 6th Ave  
Ouray, CO 81427**

**Ouray City Council Work Session**

- Changes to this agenda can be found on the bulletin board at City Hall
- Electronic copies of the Council Packet are available on the City website at [www.cityofouray.com](http://www.cityofouray.com). A hard copy of the Packet is also available at the Administrative Office for interested citizens.
- Notice is hereby given that a majority or quorum of the Planning Commission, Community Economic Development Committee, Beautification Committee, Tourism Advisory Committee, and/or Parks and Recreation Committee may be present at the above noticed City Council meeting to discuss any or all of the matters on the agenda below for Council consideration

1. CALL TO ORDER
2. DISCUSSION ITEMS
  - a. Library Addition (Work Session will move to the Ouray Library)
  - b. Fire Hall Addition (Work Session will move to the Ouray Fire Hall)
  - c. Fellin Park Stage and Banner Stand (Work Session will move to Fellin Park)



**McKAY CONANT HOOVER INC**  
Acoustics and Media Systems Consultants

David A Conant, FASA  
K Anthony Hoover, FASA, INCE Bd. Cert.

Randal B Willis, P.E.

Zachery O L'Italien  
Henry W Ashburn

**TO:** Jim Kehoe, Principal  
KEO studioworks

**FROM:** Henry Ashburn, Senior Consultant  
**cc:** Tony Hoover, Principal  
McKay Conant Hoover, Inc

**SUBJECT:** Ouray Fellin Park Acoustic Assessment Summary  
MCH Project #24026

**DATE:** 10 July 2024

**Page 1 of 7**

This memo summarizes our acoustic measurements and critical listening exercises at Fellin Park in Ouray, CO on June 27, 2024. The goal was to assess and report on the acoustic quality of the venue's audience area given the mobile stage, audio system, and mountainside site configuration for the final Mountain Air Music Series show of the 2024 season.

## A. INTRODUCTION

For 14 years, Ouray, CO has hosted the Mountain Air Music Series at Fellin Park, which features music performances of all genres, free of charge, drawing up to 3,000 attendees from Ouray and surrounding towns. The venue is situated between steep mountains, and the typical site orientation for music events is such that the audio system is directed toward the mountain faces rather than down the length of town between the flanking mountains. Advancements in audio system technology and tuning have improved over the years to help concentrate sound coverage onto the audience area. It is our understanding that in recent years, there have been no reported complaints of poor intelligibility or dissatisfaction with the acoustic quality of the venue.

With the design of a permanent stage for Fellin Park underway, the results of this assessment will be used to help inform design and site decisions. The remainder of this document addresses observations, measurements, and experiences from June 27, 2024, and the "temporary" conditions existing at that time.

## B. STAGE/AUDIO INFORMATION

Stage: SL100 (facing approximately NE)

Audio System (provided by Valkyrie Productions): PK SOUND

(6) T8 boxes per side

Bottom of array ~10' above grade

Top 3 boxes ~60° horizontal, steered toward house right

Bottom 3 boxes ~120° horizontal

(6) T18 subwoofers

(3) discrete stacks of (2) subs, all forward firing, steered toward house right

# Ouray Fellin Park Acoustic Assessment Summary

KEO studioworks

10 July 2024



Figure 1: Site configuration on June 27, 2024



Figure 2: Stage configuration on June 27, 2024

Ouray Fellin Park Acoustic Assessment Summary

KEO studioworks

10 July 2024



*Figure 3: Array side profile*



*Figure 3: Array front profile*



*Figure 4: Geographical features behind audience area*

### C. WEATHER CONDITIONS

1. Initial Measurements (12:30pm-2:00pm)  
Conditions: Fair to overcast, slight precipitation  
Temperature: 80°F-85°F  
Wind: Up to 8 mph from N & E
2. Post-Soundcheck  
Conditions: Significant precipitation, nearby lightning preventing groups from performing  
Temperature: 60°F  
Wind: Gusts up to 30 mph from all directions

### D. ACOUSTIC MEASUREMENT INSTRUMENTATION

Acoustic responses of the venue were collected using the instrumentation described below.

Table 1: Measurement Instrumentation

	Equipment Type	Make/Model	Serial Number
Acoustic Test Signals	Measurement Microphone	Earthworks M30	4520A
	Computer	MacBook Pro Retina	
	Audio Interface	Focusrite Scarlett 18i20	
Background Noise	Handheld Sound Level Analyzer	Brüel & Kjær 2270	3011351

### E. MEASUREMENT PROCESS

Swept sine and band-passed click track audio test signals were played through the tuned audio system. The test signals were recorded at 10 distributed receiver locations with the measurement microphone.

### F. METRICS

The following metrics were selected to quantify the severity of reflections from nearby geographical features:

1. Echo Detectability, after Dietsch & Kraak (Acustica, Vol. 60, 1986)  
This criterion establishes time delay and decibel level values for which single reflections from hard, sound-reflective surfaces in a performance venue can become problematic. Generally, problematic sound reflections are those returning to listener more than 50-80ms after initial arrival of sound from sound source, at significant decibel level above the general reverberation and background noise. These reflections can interfere with the intelligibility of spoken word and music if not properly addressed. The time delay and decibel level range selected for this report is an interpolated dataset to suit popular music and typical speech.
2. Clarity (C<sub>50</sub>), ISO 3382 (Acoustics – measurement of room acoustic parameters, 1997-2022)  
C<sub>50</sub> is a standardized metric that quantifies the clarity of speech or vocals by comparing the early arriving sound energy (within the first 50ms) to the late arriving sound energy (after 50ms). Long reverberation and long-delayed reflections negatively impact Clarity. High Clarity values (around 5dB and above) are preferred for speech and high-tempo transient music. Negative values (-4dB to

0dB) can exist and still yield reasonably good Clarity, such as for spaces that are designed for specific orchestral or choral music performances, which benefit from longer reverberation and blending.

Outdoor venues with low reverberation time and minimal reflective surfaces typically exhibit high Clarity values, though the metric can be influenced by surrounding topography.

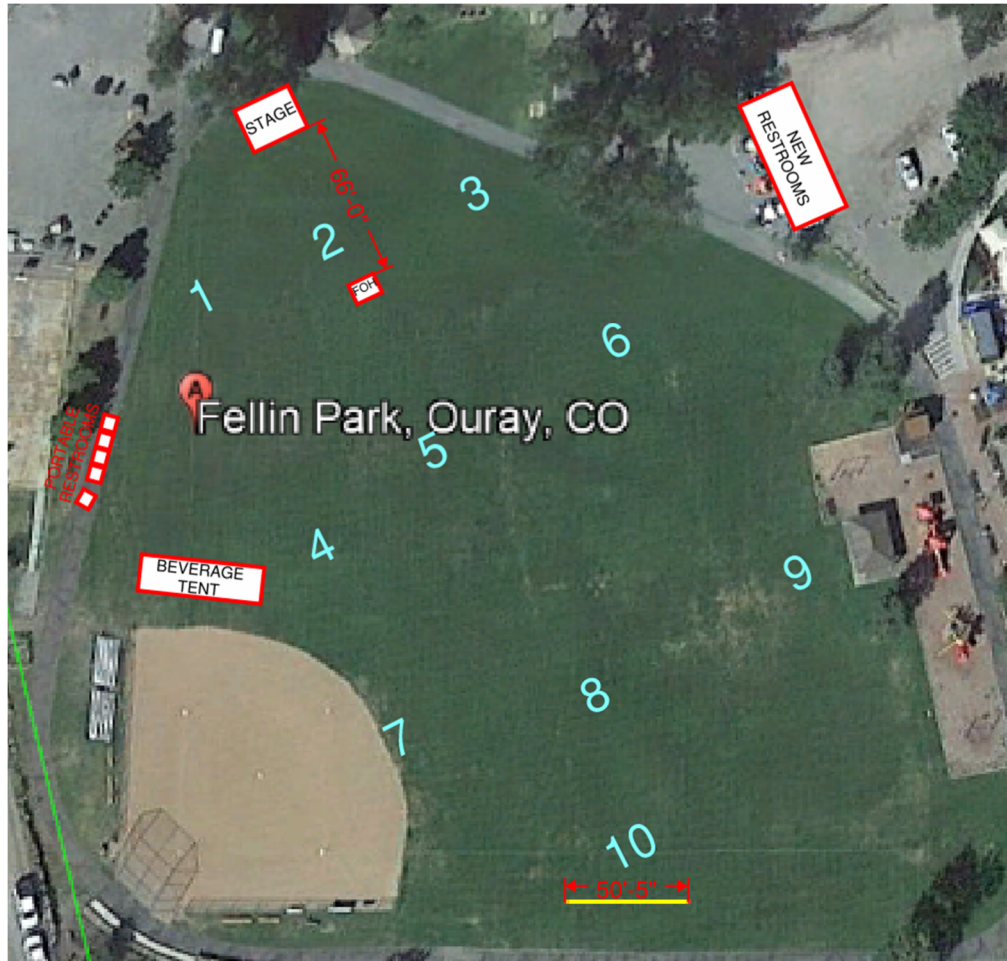


Figure 5: Measurement locations

## G. CRITICAL LISTENING OBSERVATIONS

From listening to the test signals and pre-recorded music, the venue generally sounded as anticipated. The surrounding geographical features revealed some audible reflections and modest reverberation, especially when excited with loud transient test signals. The reverberation and reflections were somewhat apparent in large part because we were listening for them, however in our opinion, said reflections were insufficient to negatively impact speech intelligibility or clarity of music for the average concert attendee. Depending on where on the field we were listening, localization of the reverberation changed from the northern mountain faces to the southern mountain faces.

Due to the complexity of the terrain and geometry of the topography, a small collection of minor reflections was audible not a singular, strong echo that would have a greater negative impact on sound quality.

During critical listening of live music groups (very brief soundcheck and first group performance only), lower sound levels did not excite the mountain faces as much as the test signals and pre-recorded music. We perceived the surrounding topography as providing a slight natural “reverb” with reasonable delay. Subjectively, this was more of a beneficial “sweetener” alluding to the surrounding landscape rather than an obstacle to overcome.

Prior to the first music performance, announcements were provided by a female speaker. During our survey of the audience area during the announcements, intelligibility remained strong. The speech was clear and understandable with minimal effort even at the rear audience area.

One small region near the baseball field’s second base did exhibit more pronounced reflections from behind the audience area, and we believe the reflections are from surfaces other than the mountain faces. Similarly, surrounding buildings such as the new restrooms also provided reflections as described further in Section H.

Due to wind gusts after the measurements, the PA was lowered to the ground and later hoisted back to show trim height prior to top of show. There was minimal change in the acoustic response of the venue due to PA movement during this process.

## H. MEASUREMENT RESULTS

### 1. Echo Detectability

Figures 7-17 depict high frequency click track excitation results across the 10 receiver measurement locations. Low frequency and mid frequency clicks did not sufficiently excite the mountain surfaces for us to conduct time analysis studies. Time is portrayed on the X axis, and level (dB) is portrayed on the Y axis. The initial time arrival of the test signal at the microphone location is the first (largest) peak of energy notated with a red dot. Prominent reflections after the initial time arrival are notated with additional red dots. Prominent time delays are generally between 50ms and 250ms. Nearly all prominent reflection decibel levels fall below the speech/music Echo Detectability threshold criterion (red region) and therefore are not flagged as particularly problematic to the average listener.

The obvious reflections between 50ms and 250ms generally correspond to energy returning from surrounding structures and the partial height terrace wall behind home plate. Figures 18-27 illustrate calculated distance contours (red ellipses) for these reflections.

Prominent discrete reflections from the surrounding geographical features, if they were to appear in the measurements, would be to the right of the purple line in each chart. Some reverberant energy is present in those zones, and some specific reflections are notable, however the levels are relatively low compared to reflections in the earlier time arrival window.

### 2. Clarity – $C_{50}$

Figure 28 depicts all average clarity values in third octave bands for each receiver location. Variation as shown is common/typical. As confirmed by critical listening of speech and music, all

## Ouray Fellin Park Acoustic Assessment Summary

KEO studioworks

10 July 2024



audience areas were measured to have good-to-excellent  $C_{50}$  across the frequency spectrum. Of the measured frequencies (ignoring very low frequencies which were masked by background noise), 1kHz-2kHz exhibited minor reduction in  $C_{50}$  but remained within acceptable limits. Overall, Figure 28 shows that  $C_{50}$  greatly exceeded 5dB indicating very high clarity.

### I. CONCLUSION

It is our opinion that practical minor adjustments to stage location and orientation would yield negligible improvement (if any) to the overall sound quality of the venue. Major adjustments such as  $\pm 90^\circ$  rotation of the stage to distribute sound down the length of the town between the mountain surfaces could further reduce geographical contributions to reverberant energy and reflections, however reflections from surrounding structures would remain, and the site does not appear to be conducive to a  $90^\circ$  rotation for seating arrangement and loading purposes.

Design and tuning of any future audio systems remains important, and we believe that optimization of system coverage and steering could possibly yield minor measurable improvements to the sound quality influenced by surrounding topography and would improve on the direct sound quality. We understand the permanent stage will have a larger PA with higher trim height than what was observed during our visit, which would enhance sound quality by increasing the downward vertical coverage angle and further reducing spillover/bleed onto the surrounding geographical features.

Thank you for the opportunity to provide our measurement and critical listening. We hope this summary provides sufficient information for KEO studioworks and the City of Ouray to continue design development of the future permanent Fellin Park stage.

Please reach out for any clarifications or questions.

Sincerely,

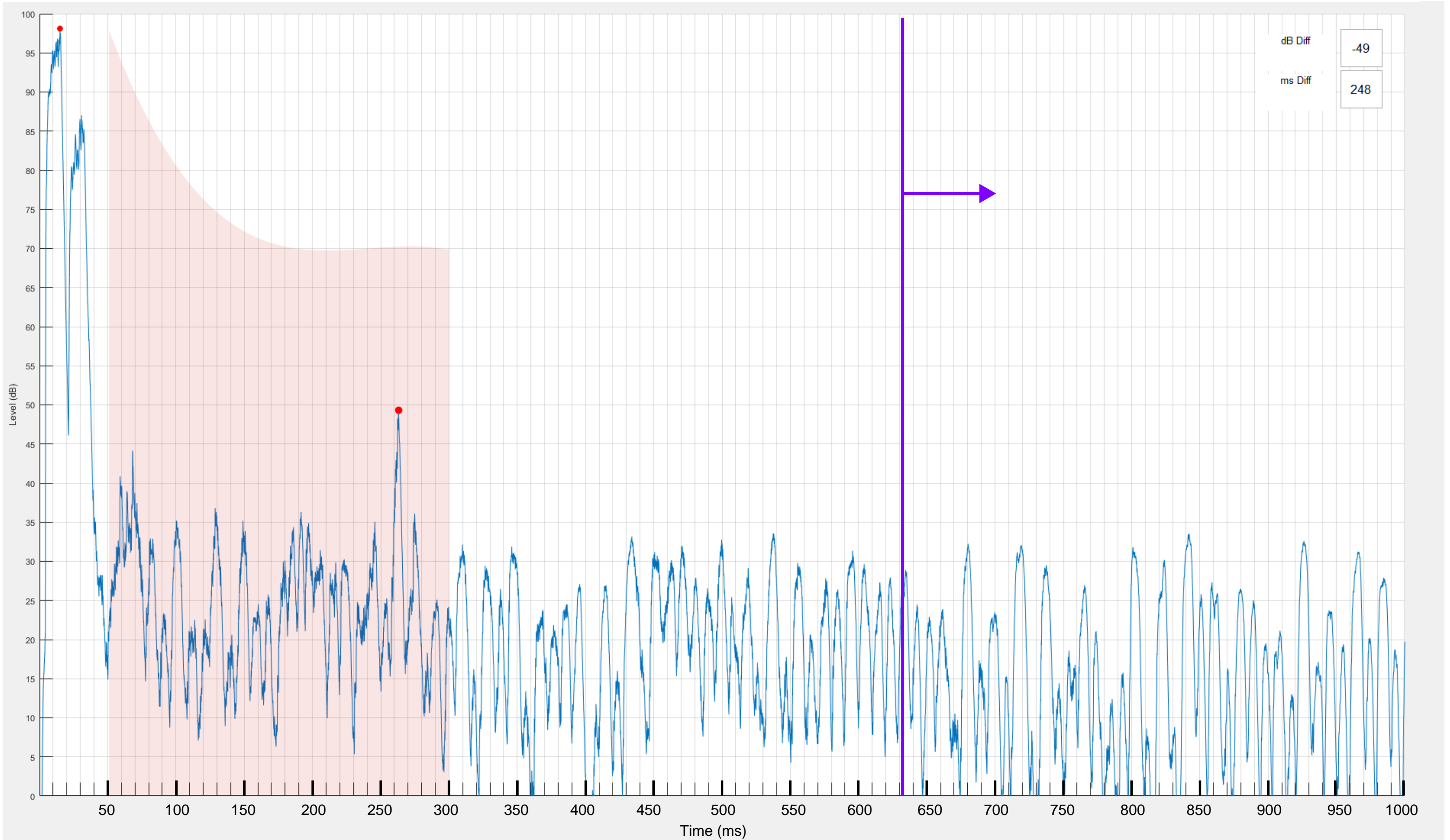
**MCKAY CONANT HOOVER INC**

A handwritten signature in black ink, appearing to read 'Henry'.

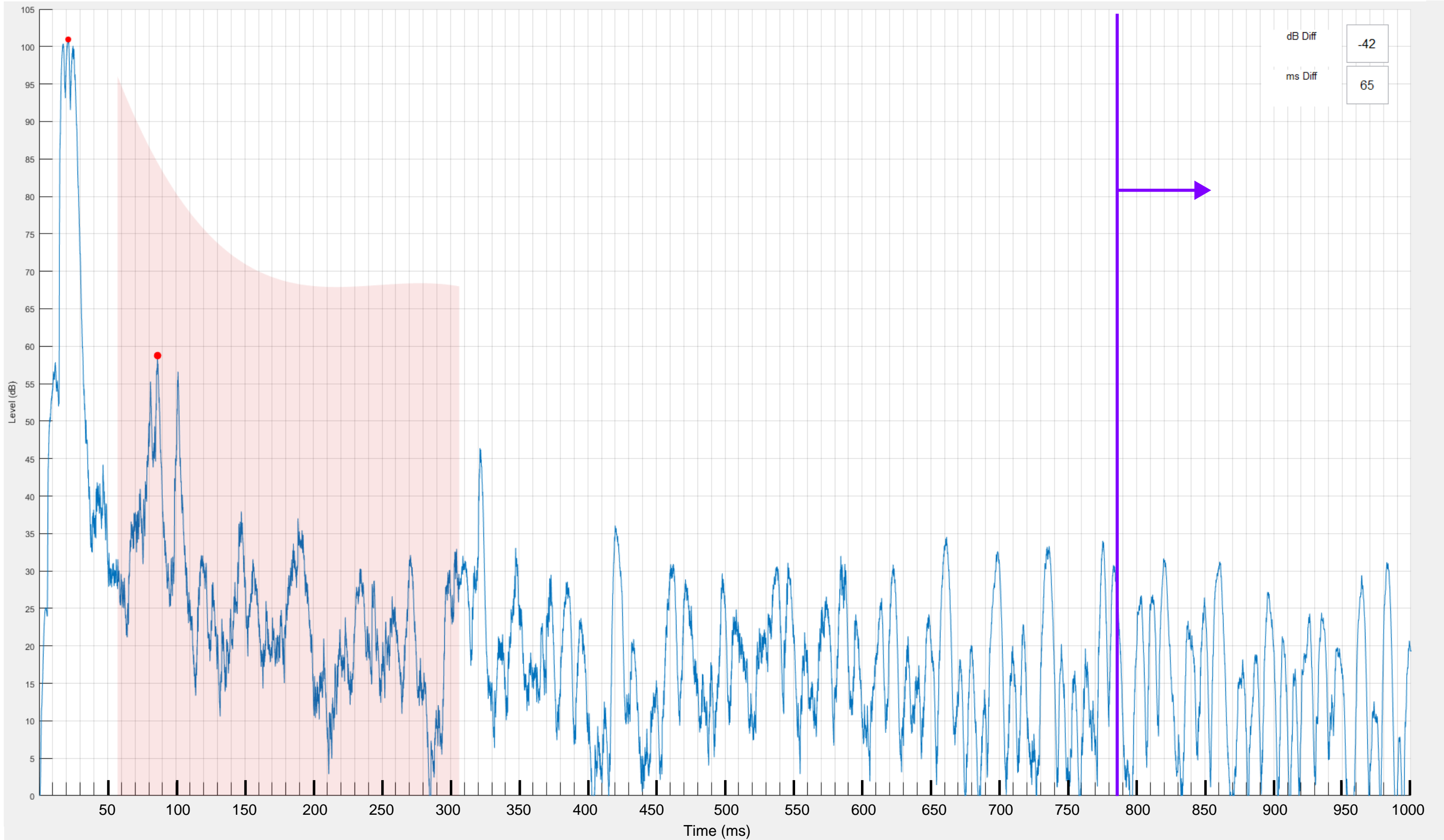
Henry Ashburn  
Senior Consultant

cc: Tony Hover, Dave Conant, Randy Willis | MCH

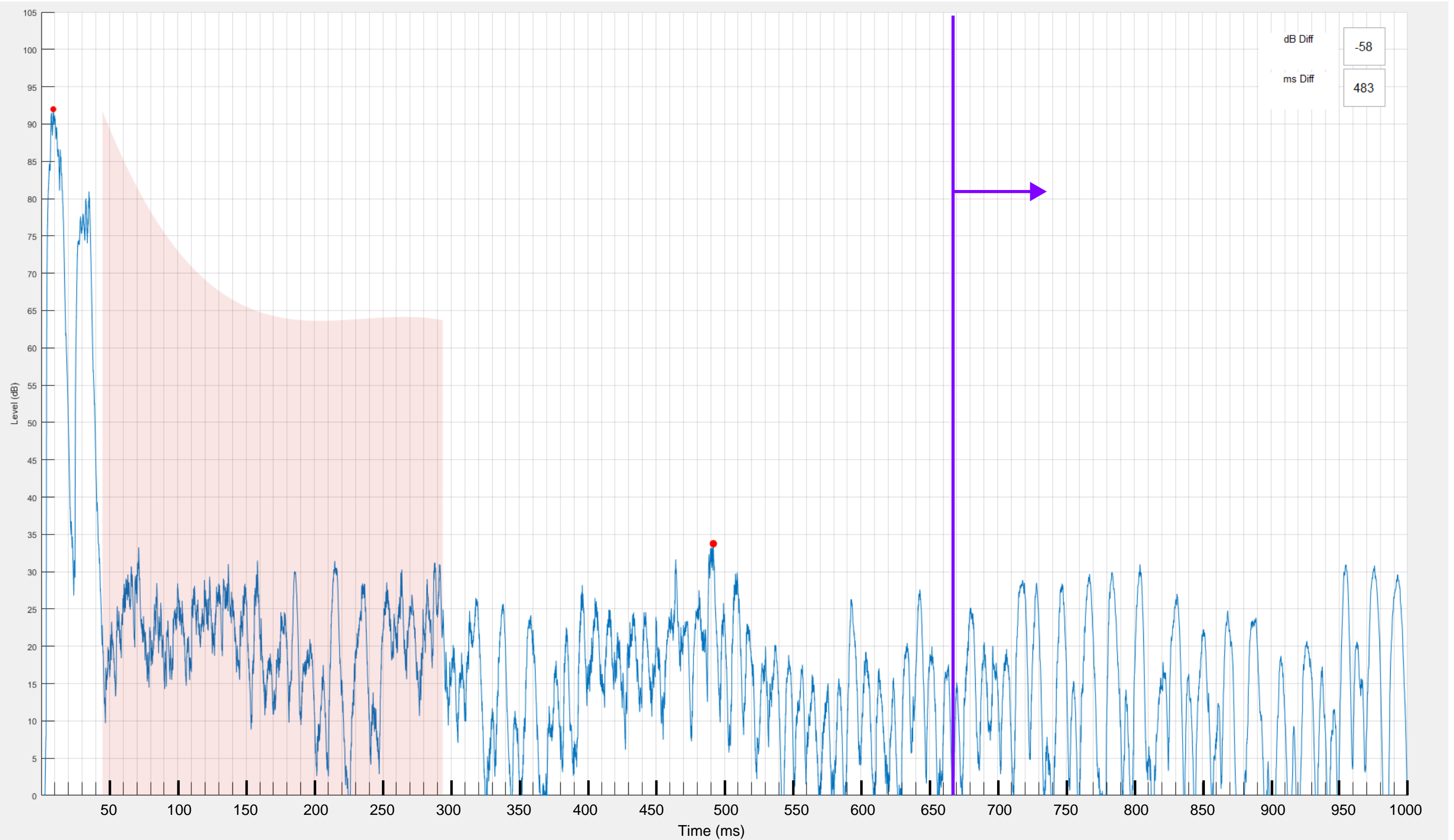
# R1 High-Frequency Click Track



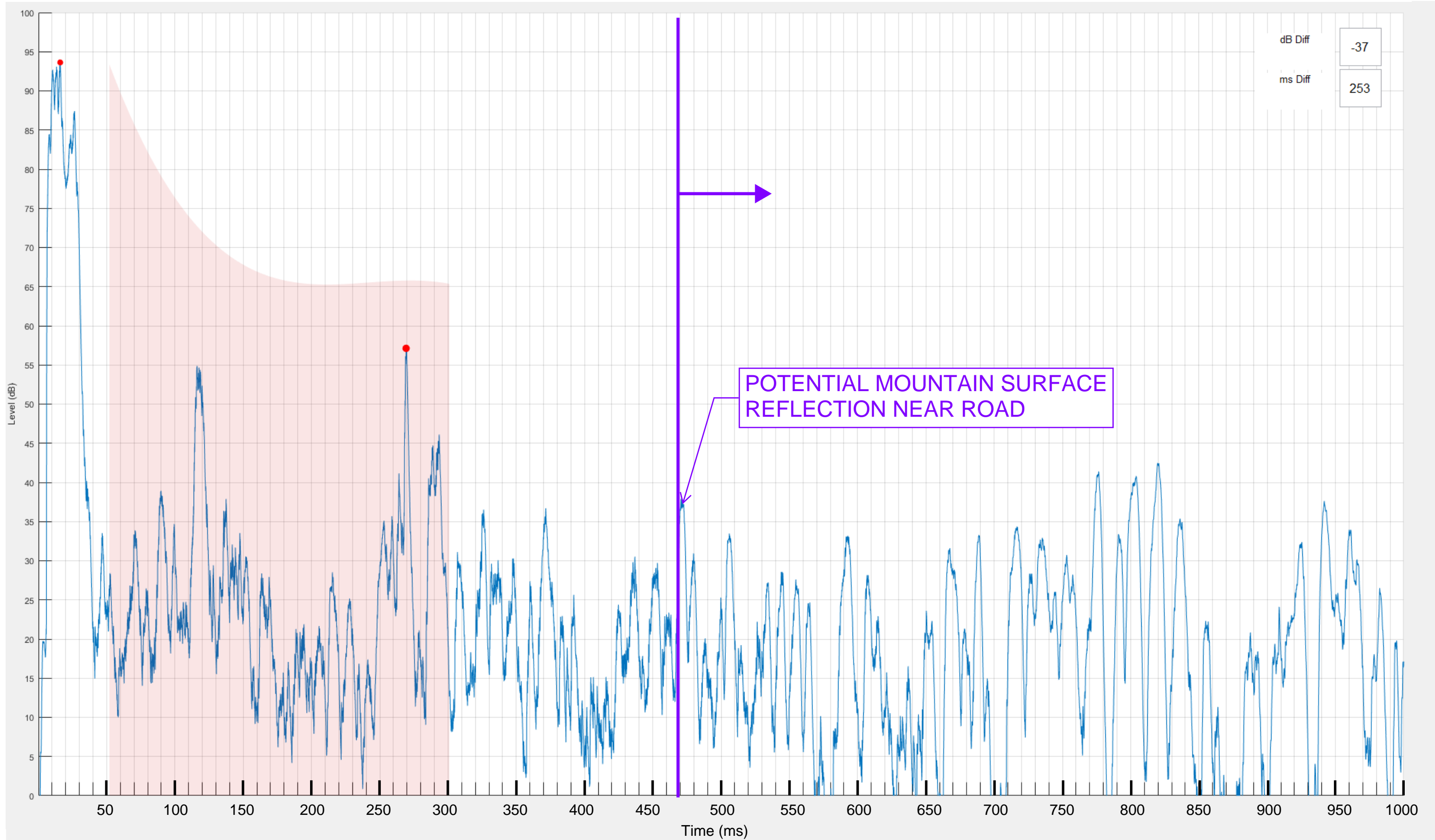
# R2 High-Frequency Click Track



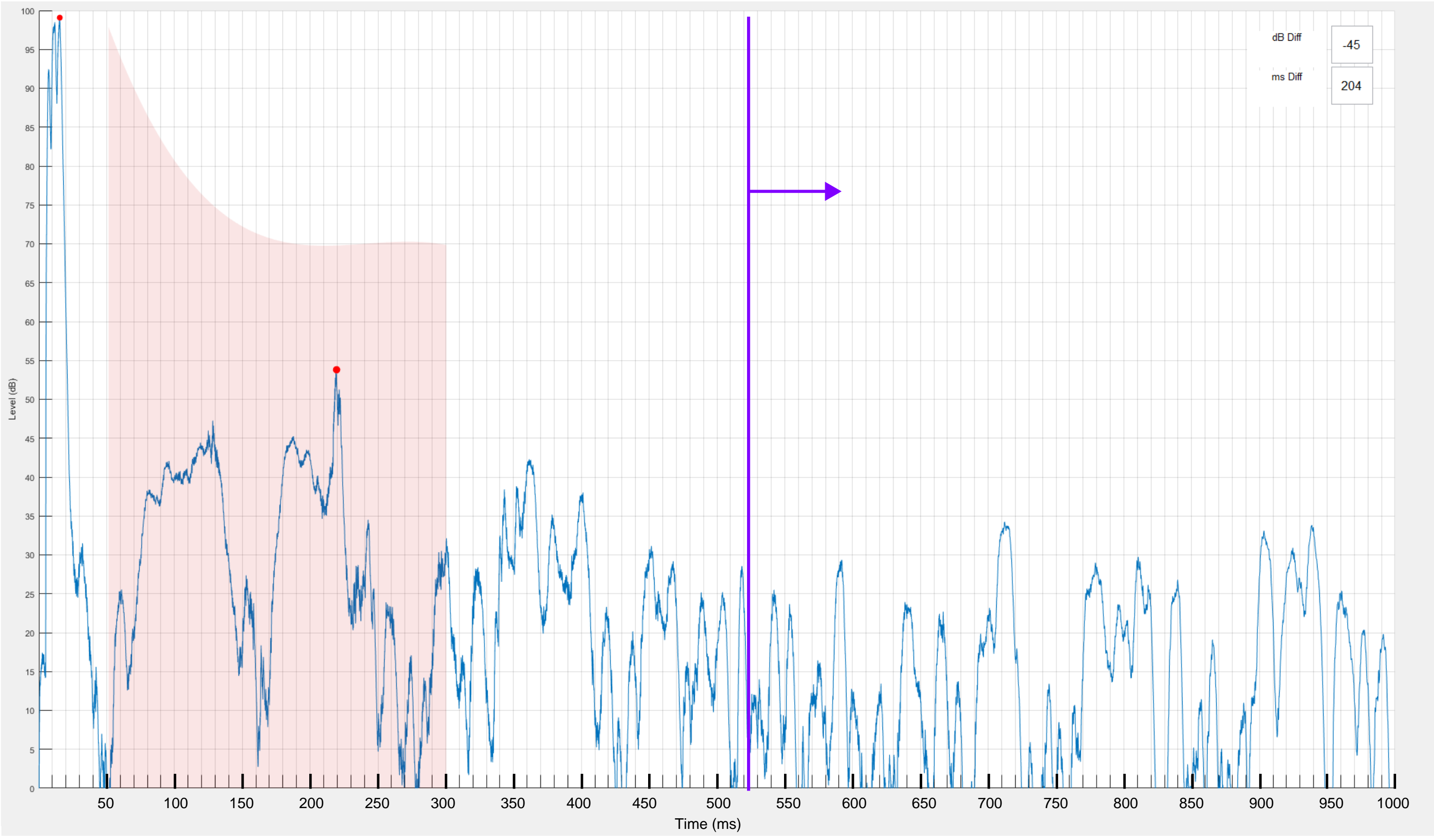
### R3 High-Frequency Click Track



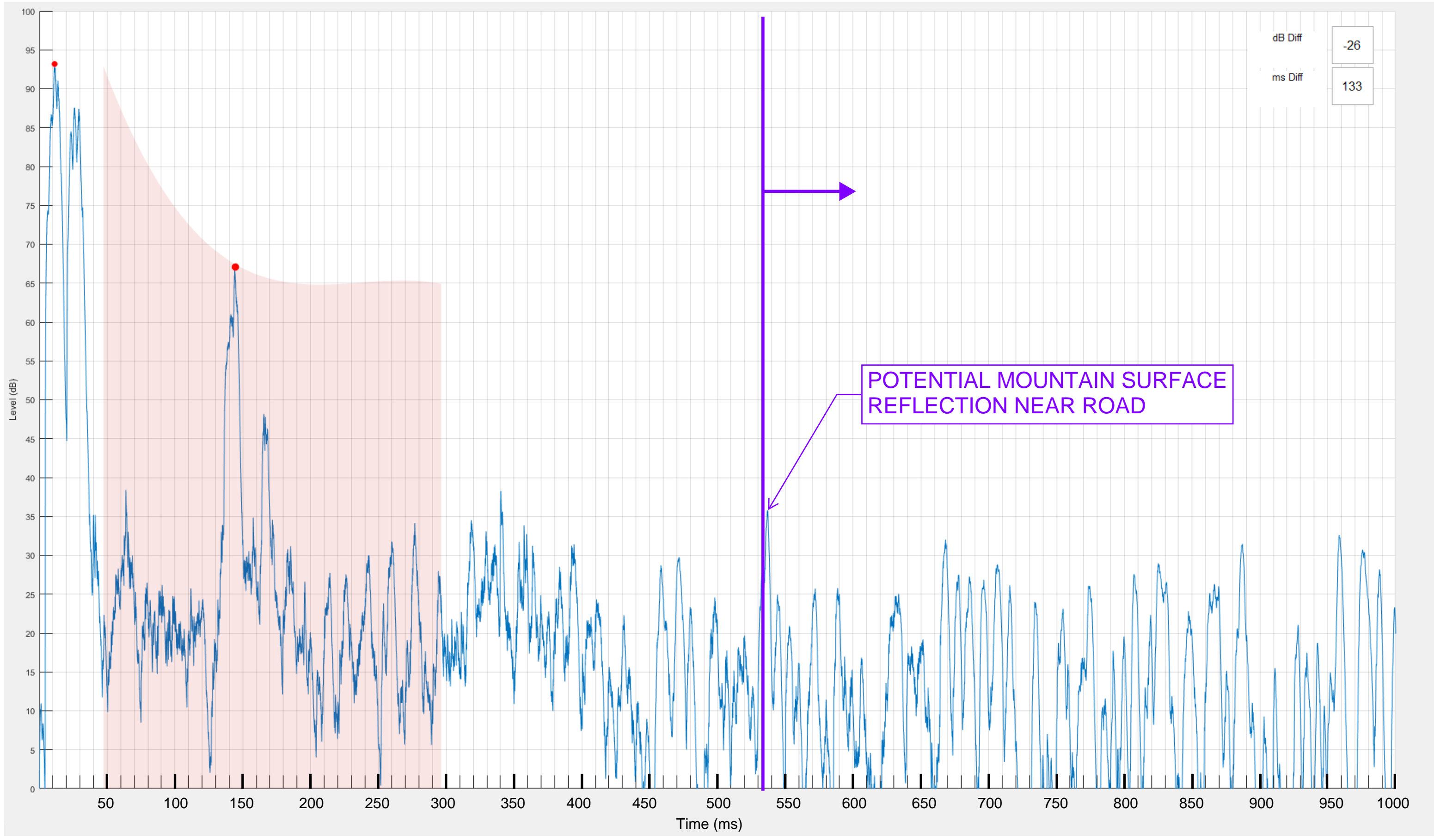
# R4 High-Frequency Click Track



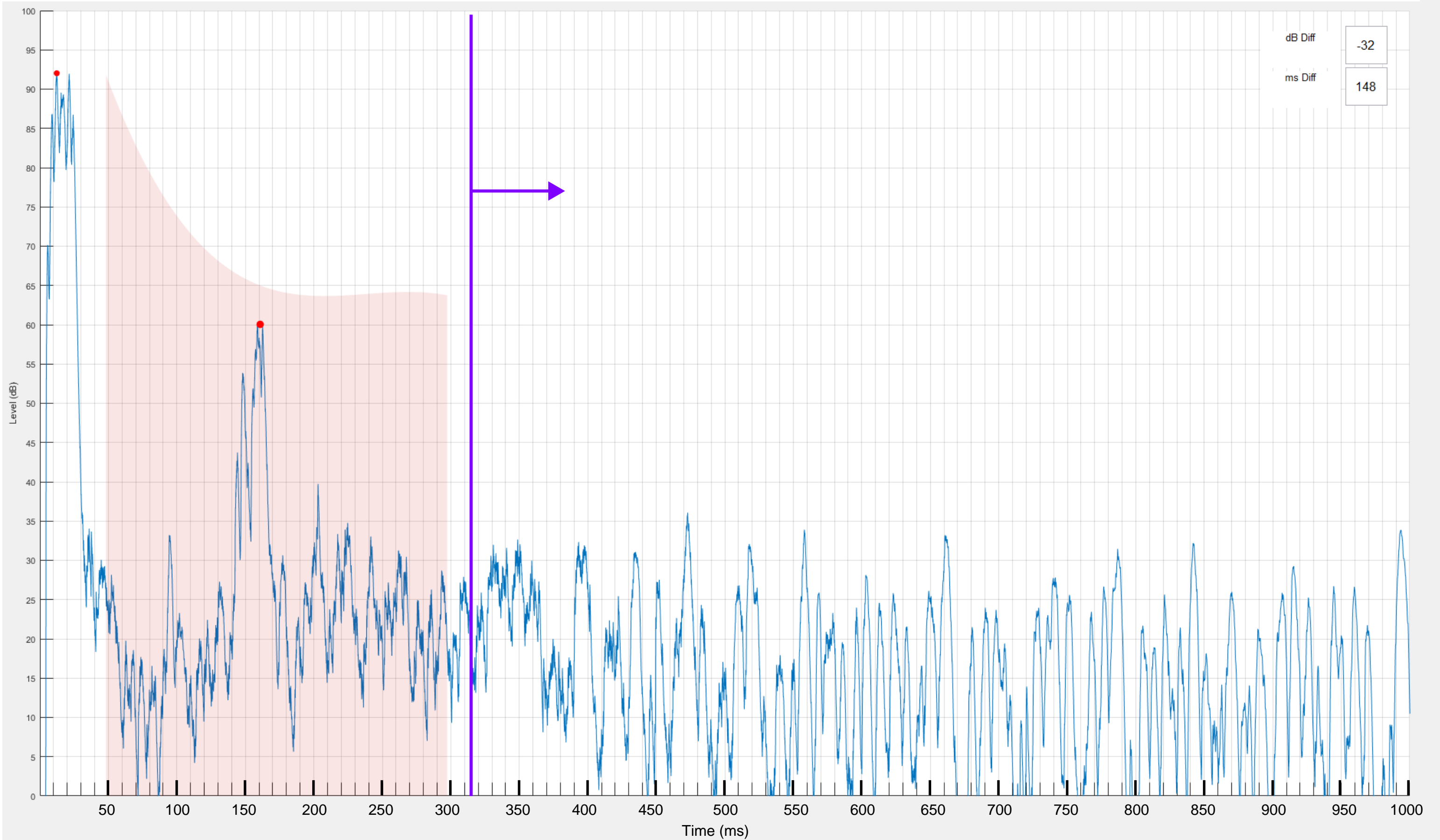
# R5 High-Frequency Click Track



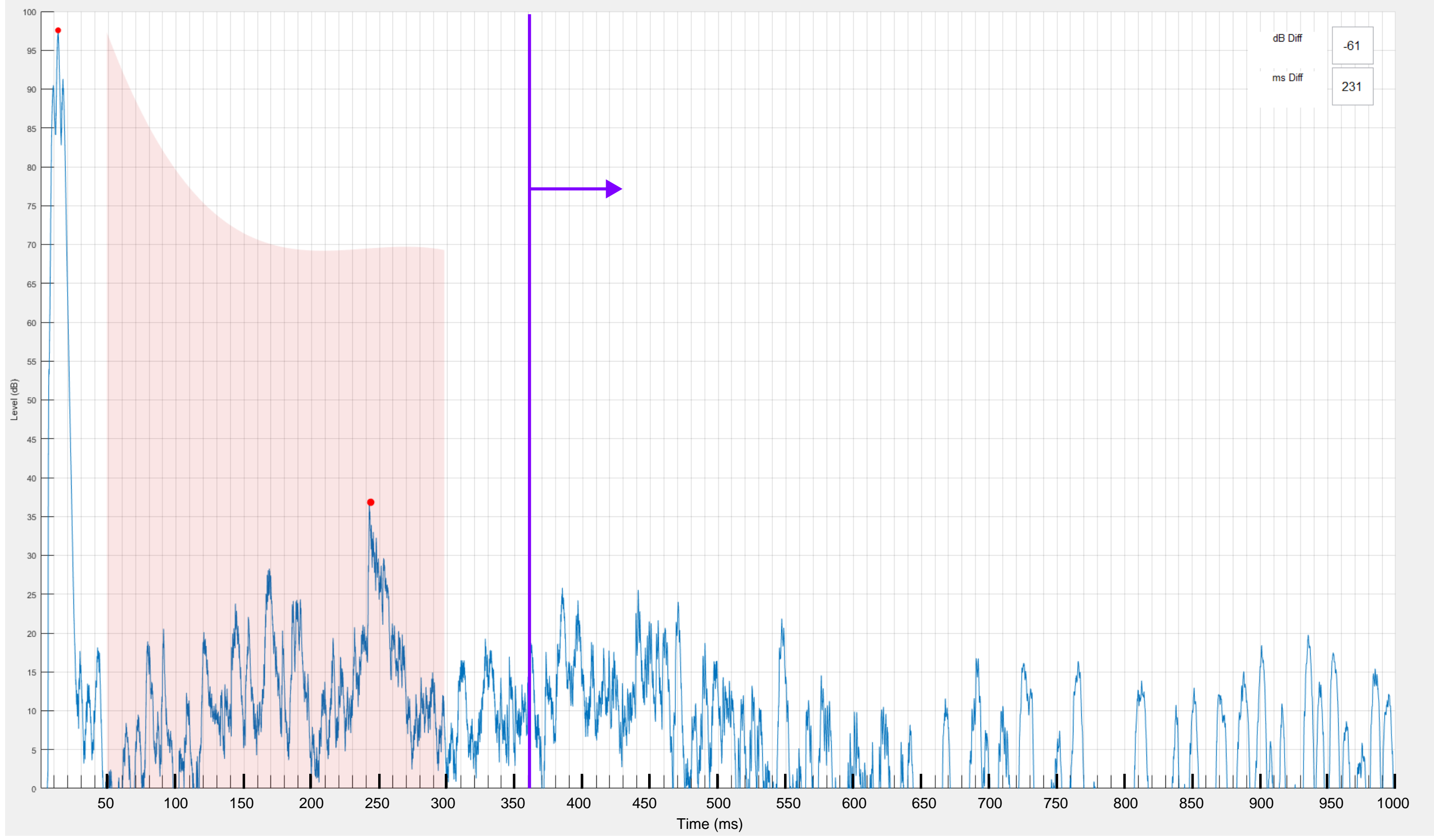
# R6 High-Frequency Click Track



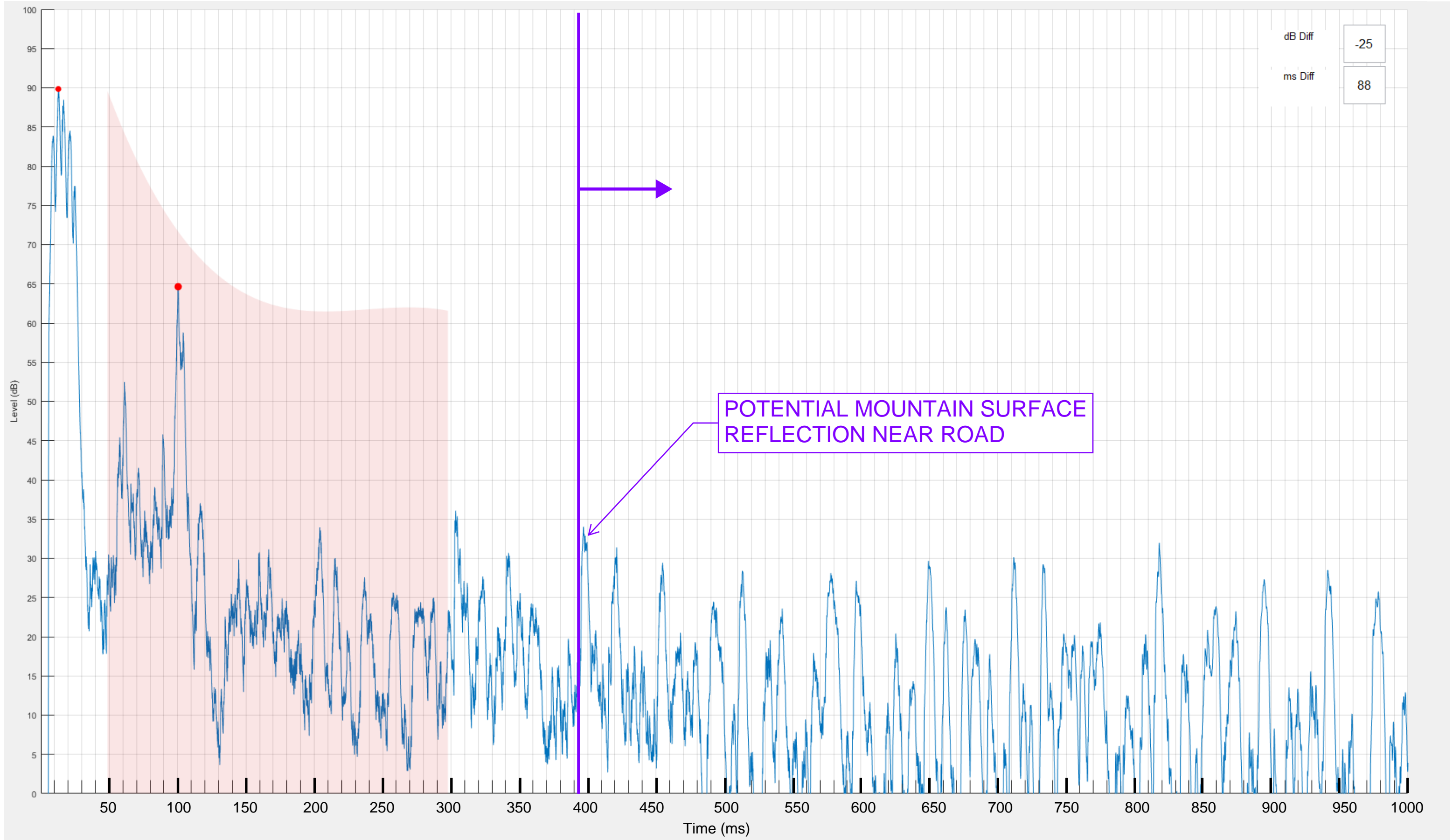
# R7 High-Frequency Click Track



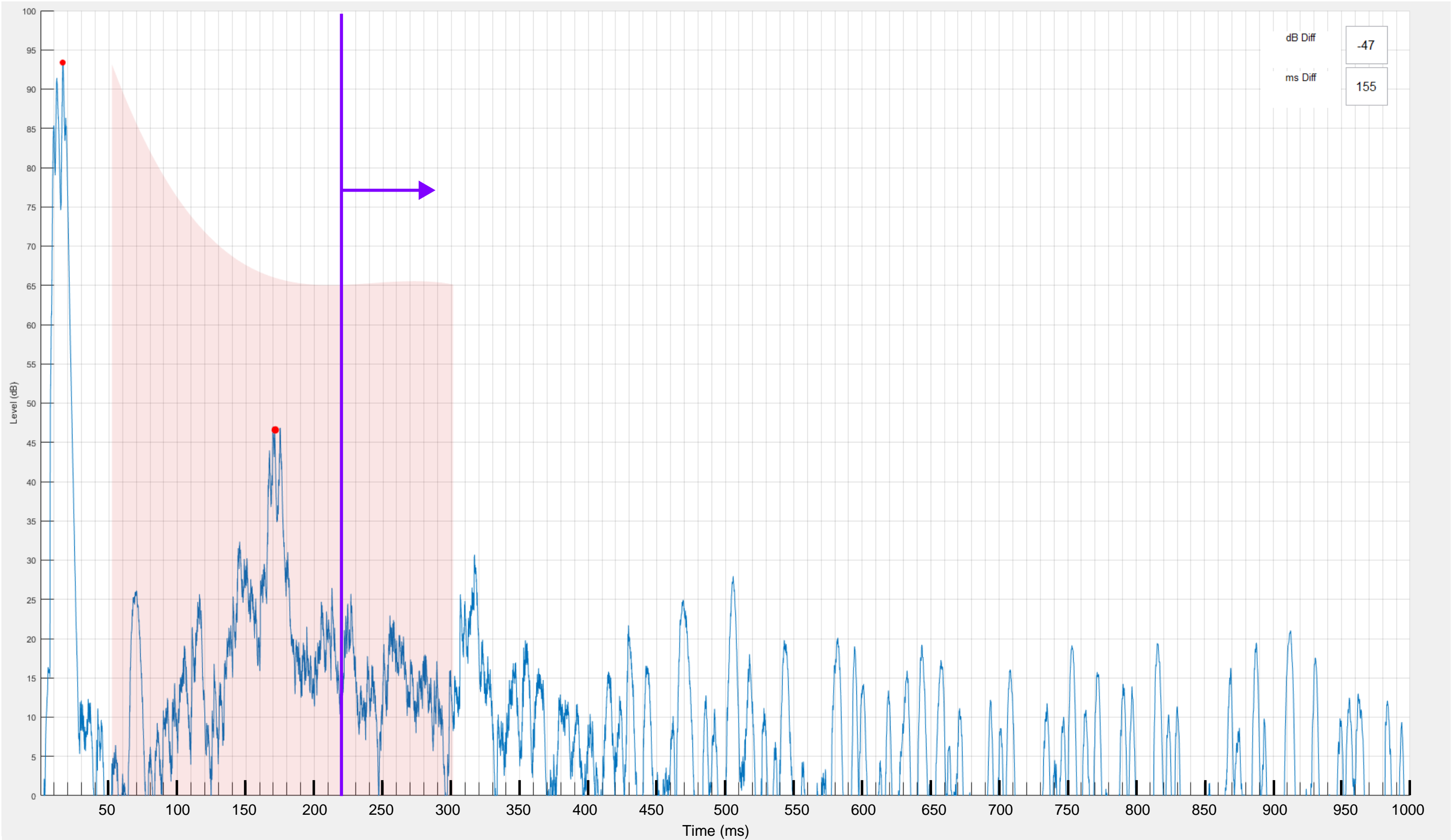
### R8 High-Frequency Click Track



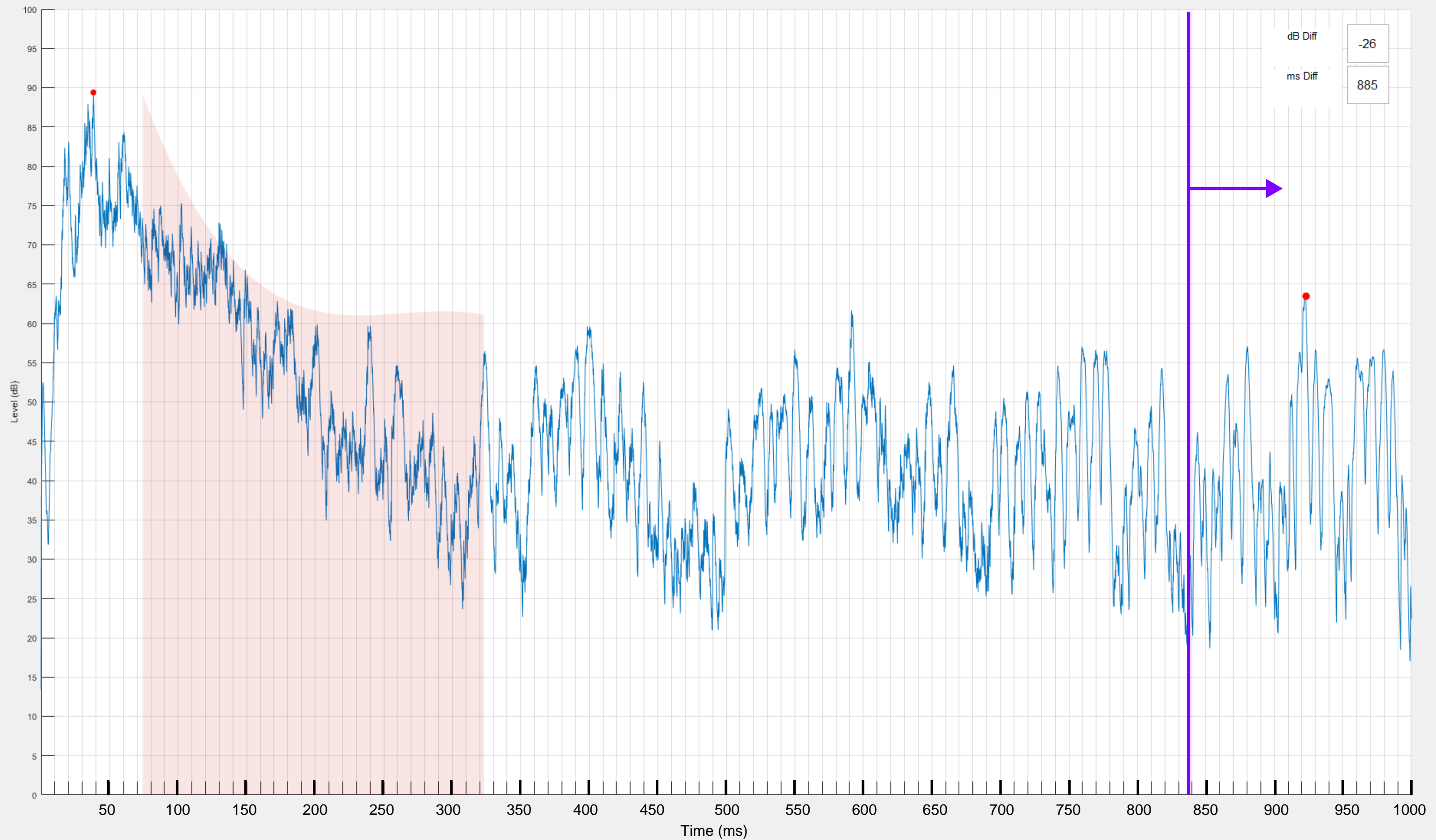
# R9 High-Frequency Click Track



# R10 High-Frequency Click Track



# STAGE High-Frequency Click Track



R1

FIGURE 18





R3

FIGURE 20

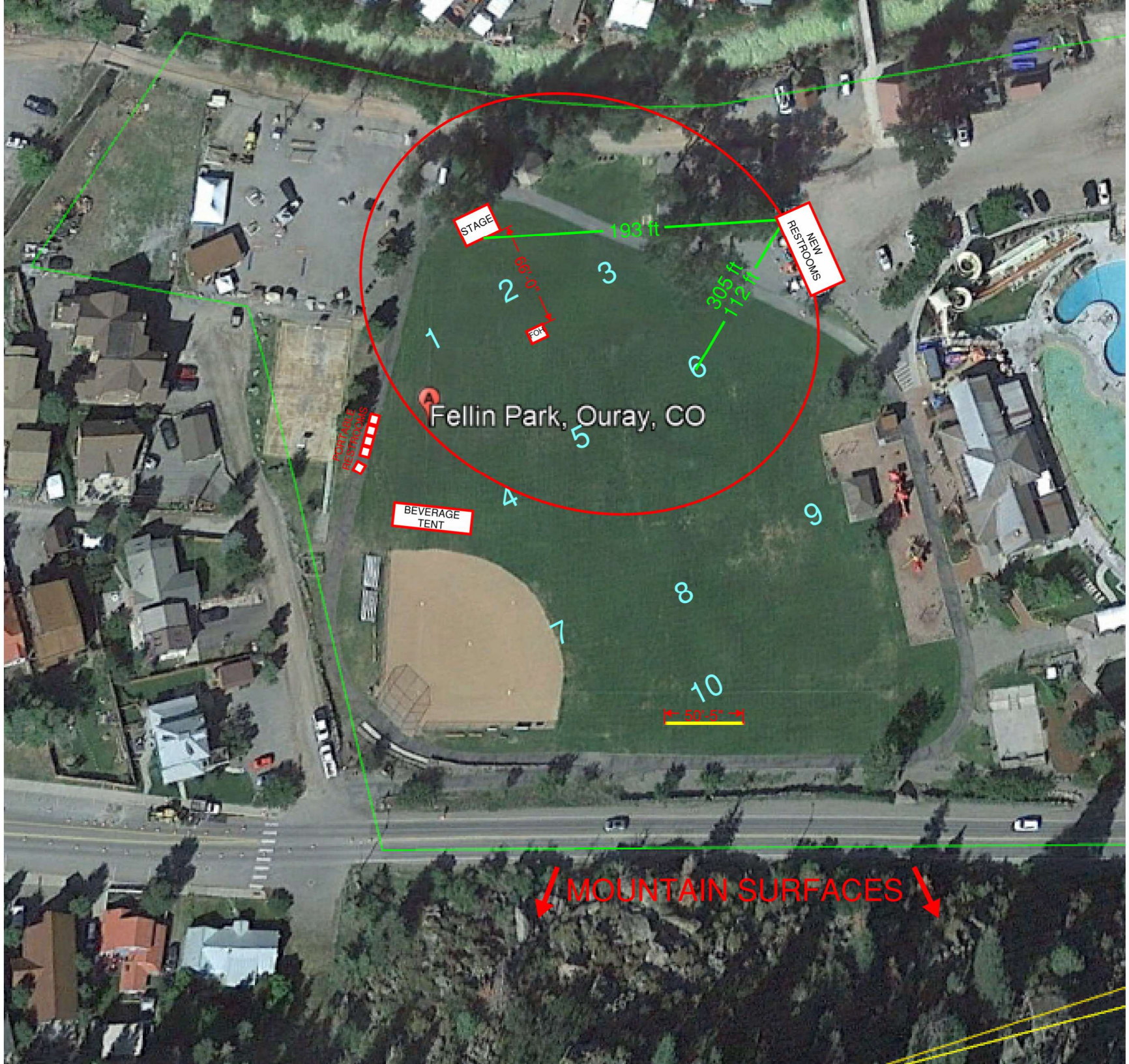




R5

FIGURE 22





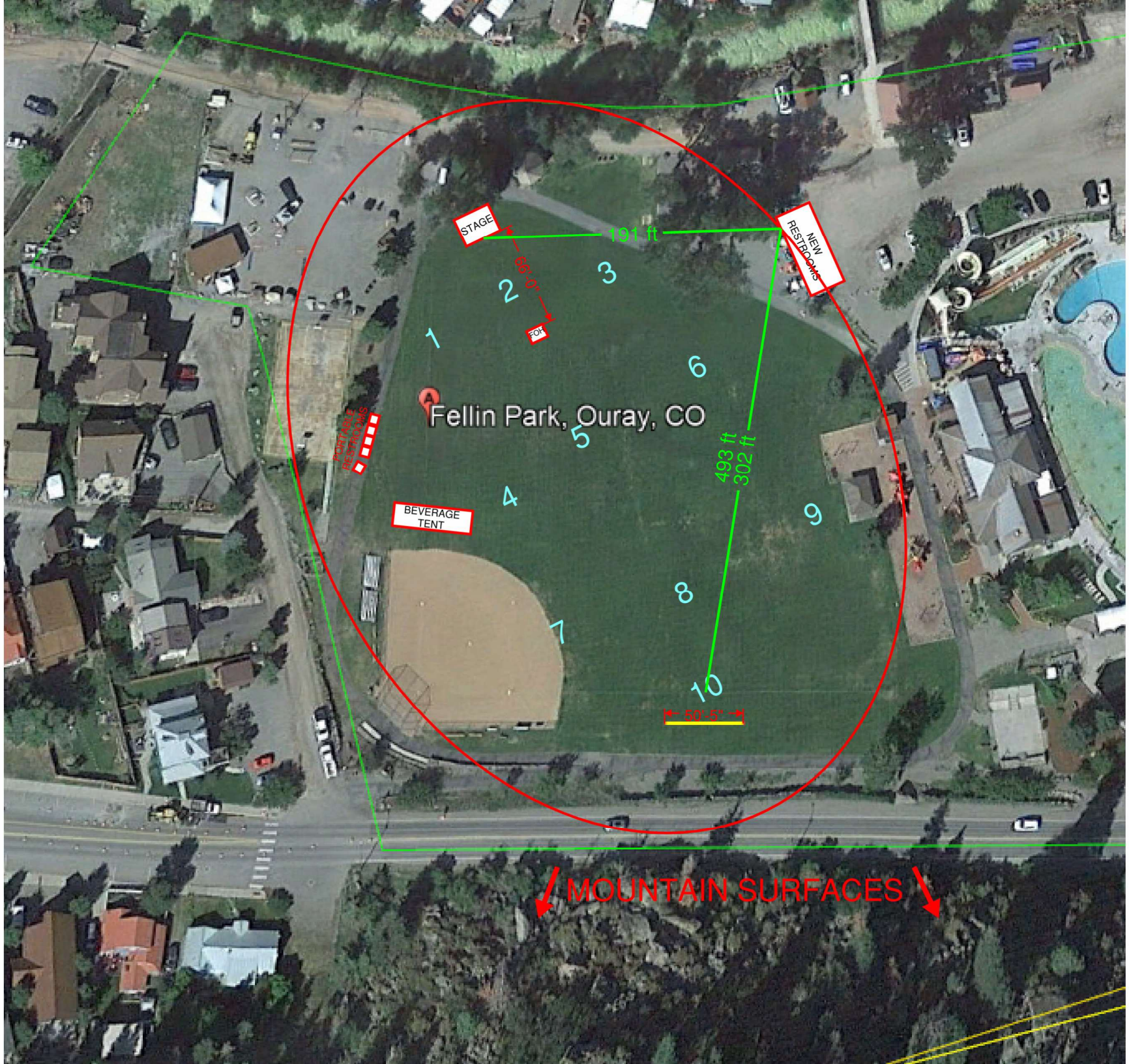






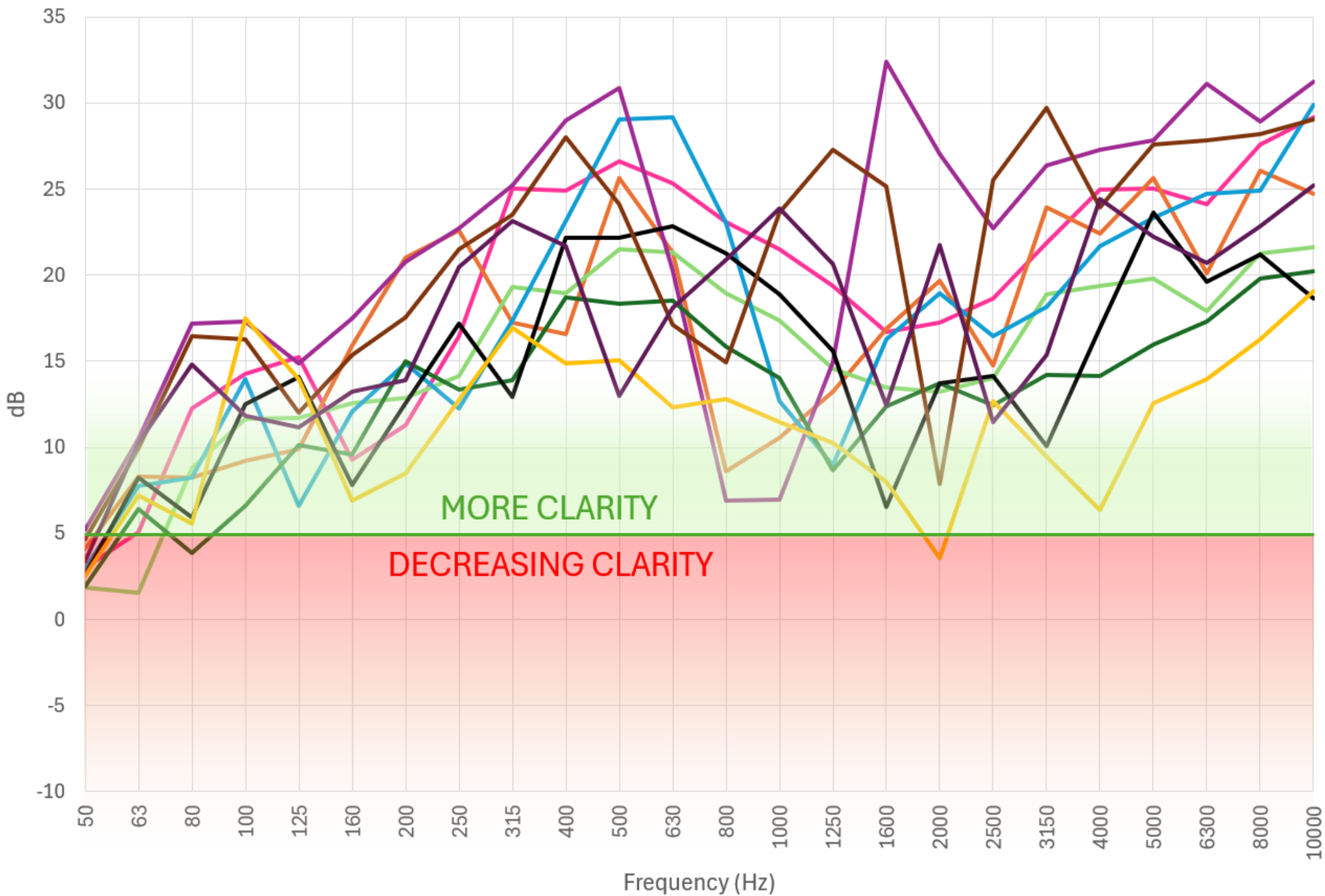
R10

FIGURE 27



# Average Clarity ( $C_{50}$ )

FIGURE 28



R1 (21) R2 (16) R3 (17) R4 (20) R5 (21) R6 (15) R7 (17) R8 (22) R9 (11) R10 (18)



# FELIN PARK STAGE

OURAY, CO



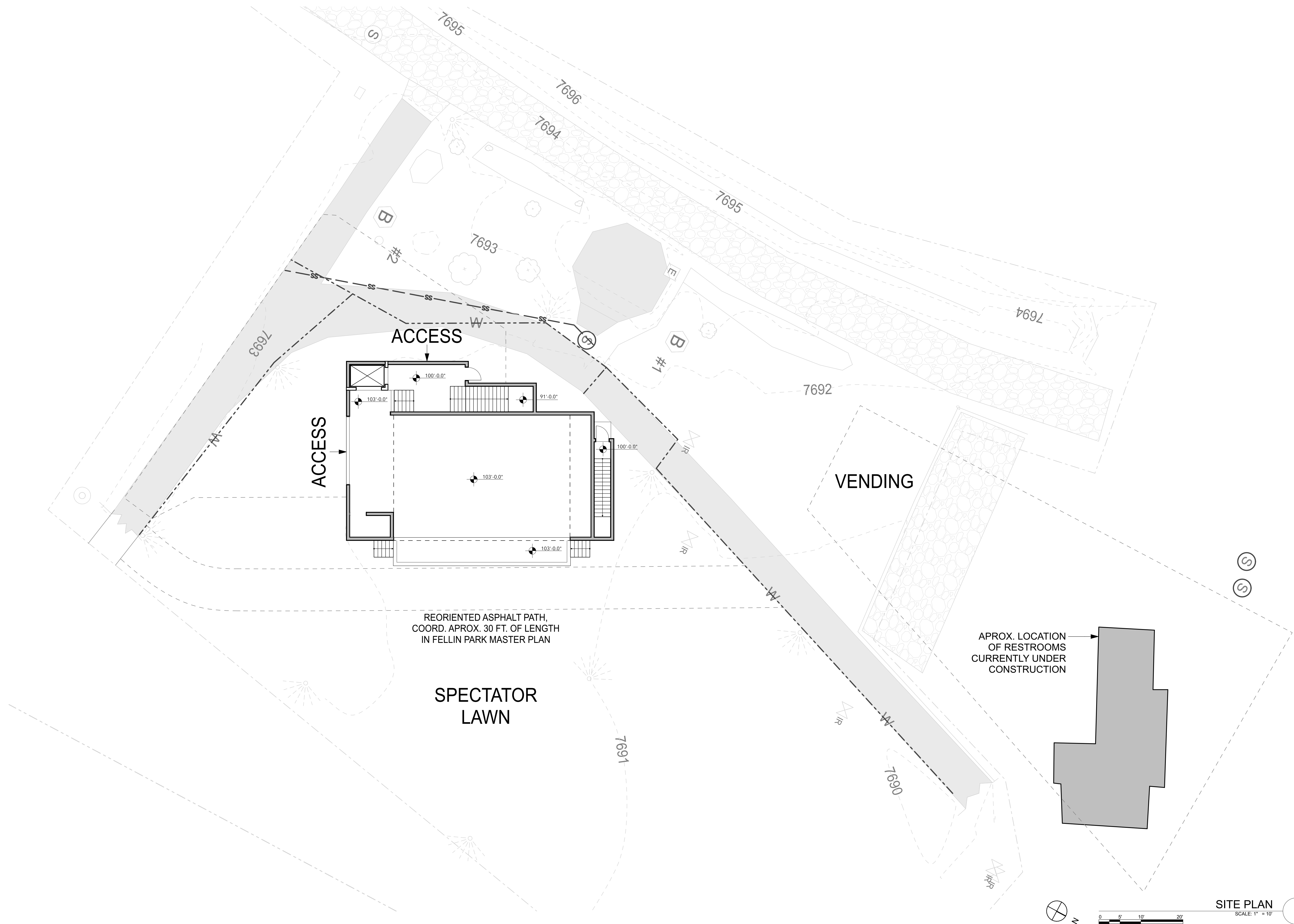
SCHEMATIC DESIGN DRAFT  
DATE: 1/30/2024

KEO  
studioworks

PO BOX 3371 ASPEN, CO 81612  
970-319-1229

FELLIN PARK STAGE

FELLIN PARK,  
OURAY, CO 81427



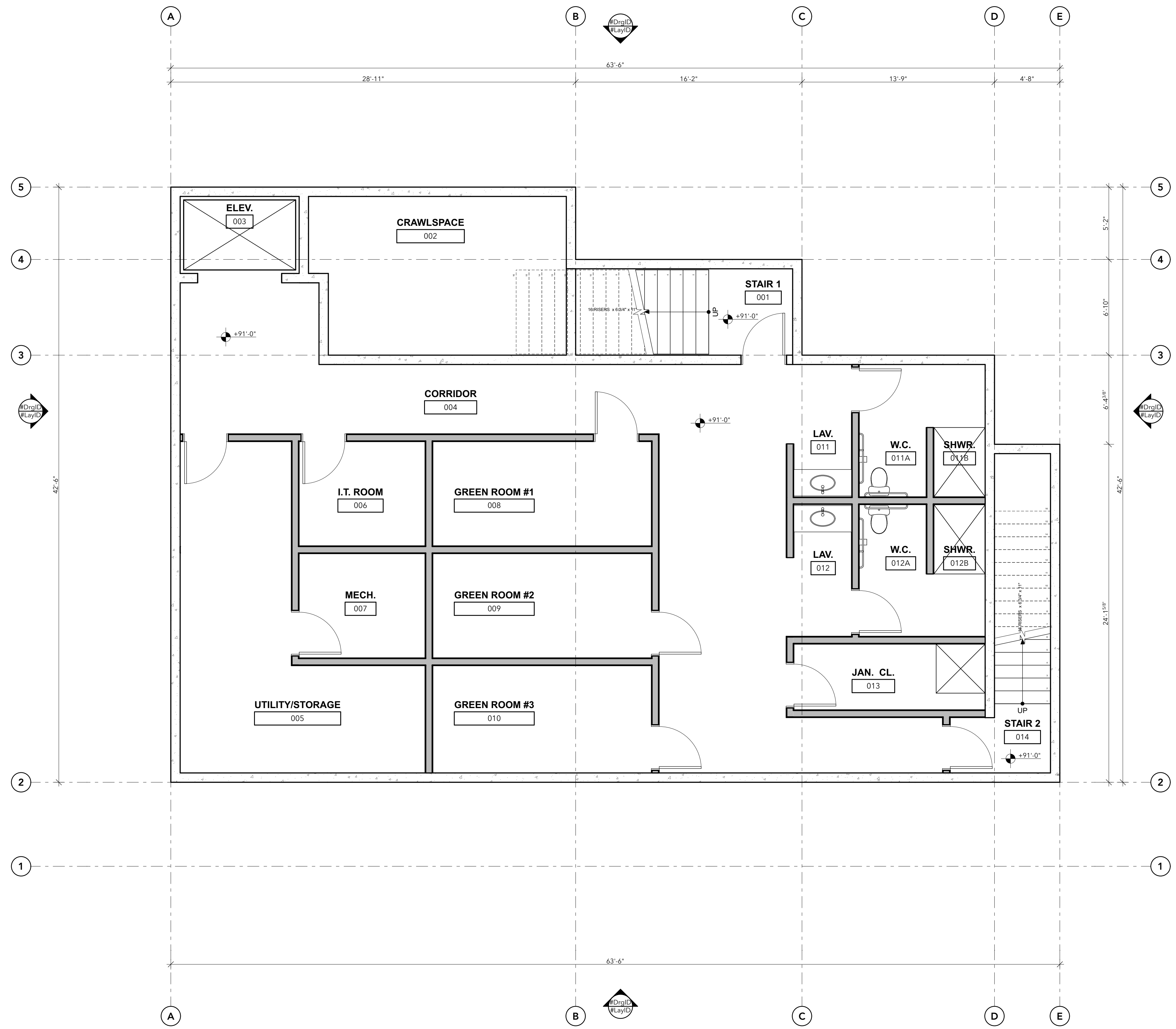
DATE	ISSUANCE
1/30/24	SD DRAFT

SITE PLAN

SITE PLAN  
SCALE: 1" = 10'

1

A100



FELLIN PARK STAGE

FELLIN PARK,  
OURAY, CO 81427

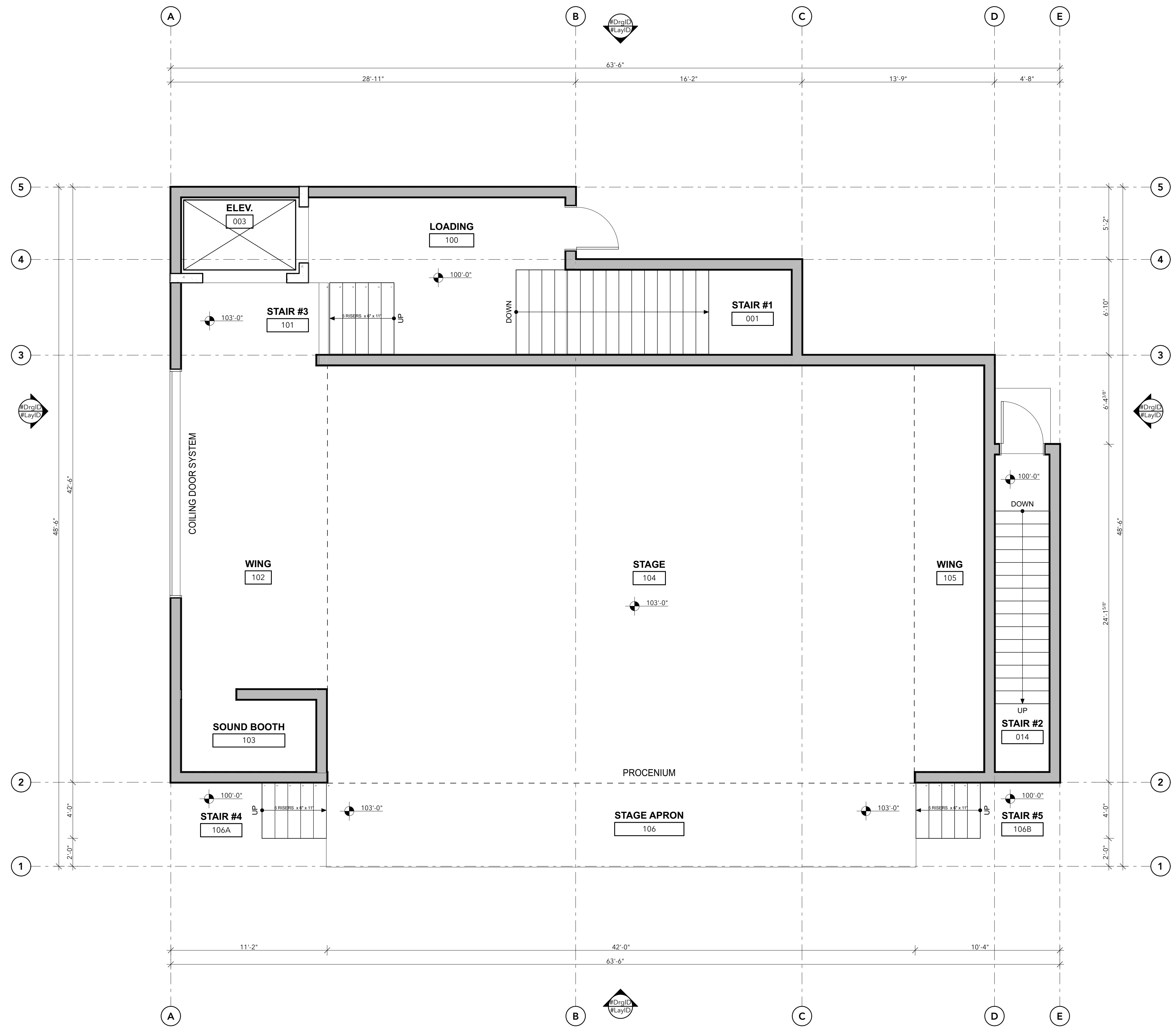
DATE 1/30/24  
ISSUANCE SD DRAFT

LOWER LEVEL  
PLAN

LOWER LEVEL PLAN  
SCALE: 1/4" = 1'-0"

A101

FELLIN PARK STAGE  
FELLIN PARK,  
OURAY, CO 81427



DATE 1/30/24  
ISSUANCE SD DRAFT

STAGE LEVEL  
PLAN

STAGE LEVEL PLAN  
SCALE: 1/4" = 1'-0" 1

A102

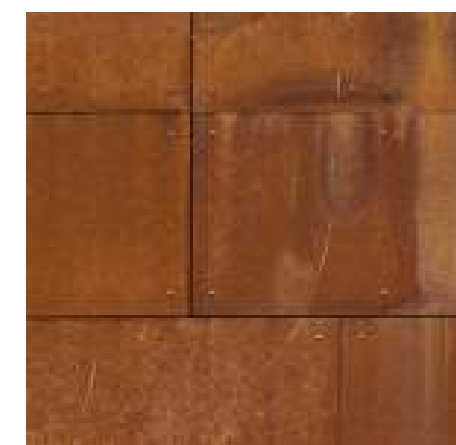


PREFINISHED 7/8"  
CORRUGATED SIDING

4 SOUTH ELEVATION  
3/16 + 1' - 0"



MILLED ROUGH SAWN  
PREWEATHERED TIMBER

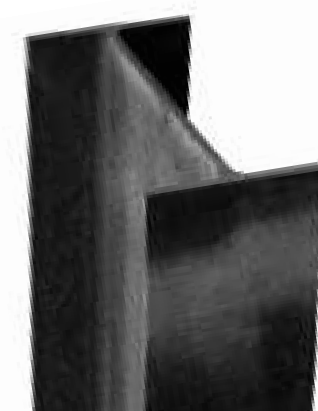


24ga. RUSTED METAL  
SIDING - FLAT LOCK SEAM

2 NORTH ELEVATION  
3/16 + 1' - 0"



24ga. PREFINISHED RUST  
COLOR ROOFING

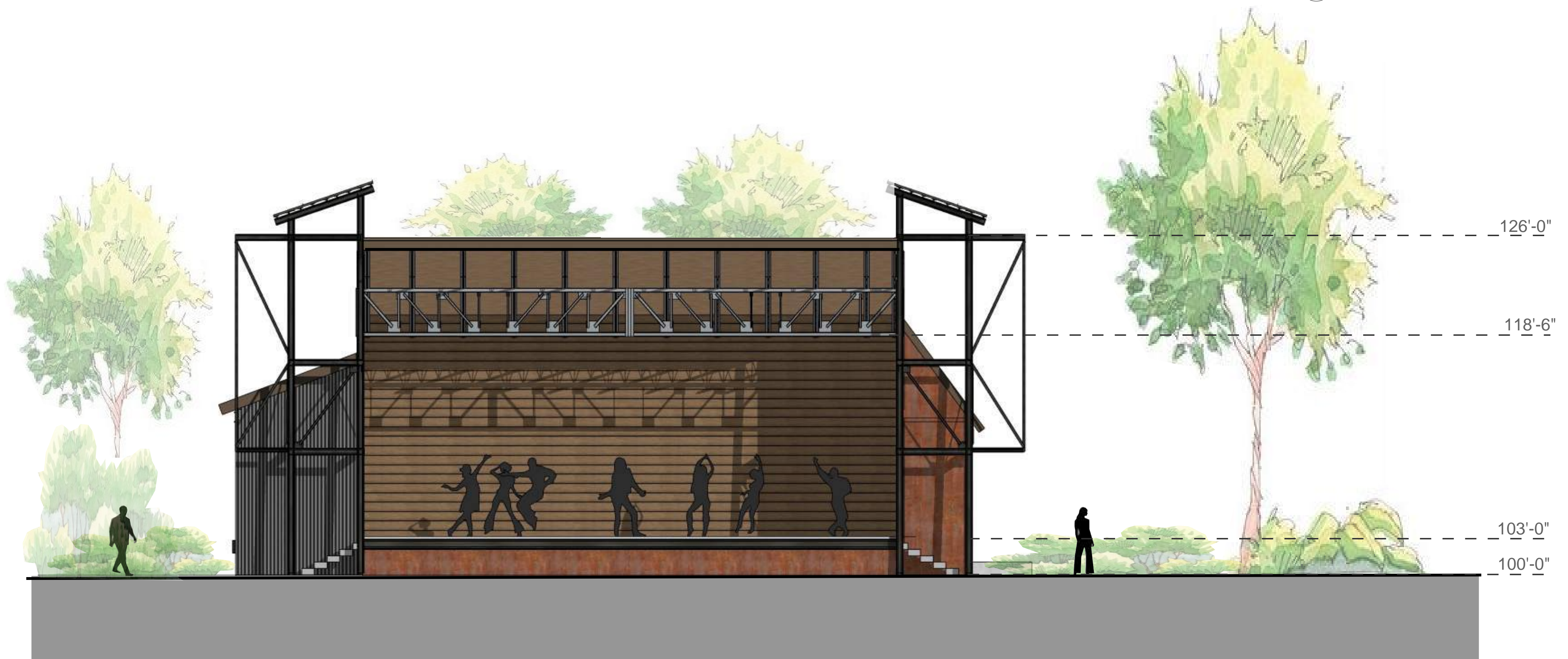


EXPOSED STEEL STRUCTURE  
PREFINISHED CLEARCOAT

**MATERIAL LEGEND**



2 SOUTH ELEVATION  
3/16 + 1' - 0"



1 EAST ELEVATION  
3/16 + 1' - 0"

DATE 1/30/24  
ISSUANCE SD DRAFT

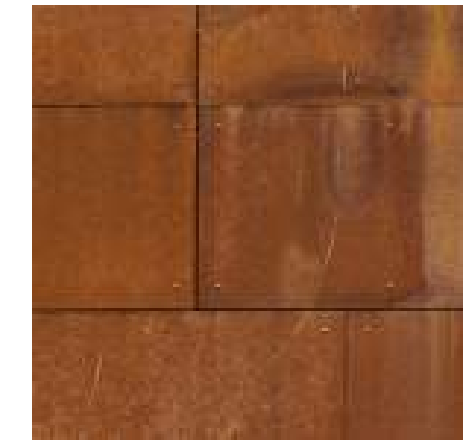
ELEVATIONS



PREFINISHED 7/8" CORRUGATED SIDING



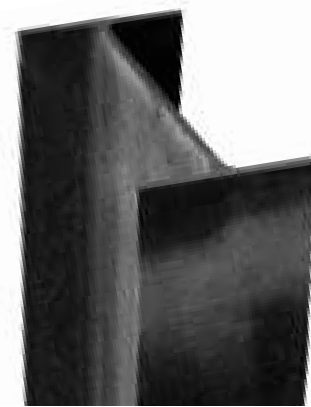
MILLED ROUGH SAWN PREWEATHERED TIMBER



24ga. RUSTED METAL SIDING - FLAT LOCK SEAM



24ga. PREFINISHED RUST COLOR ROOFING



EXPOSED STEEL STRUCTURE PREFINISHED CLEARCOAT

**MATERIAL LEGEND**



2 SOUTH ELEVATION  
 3/16" = 1' - 0"



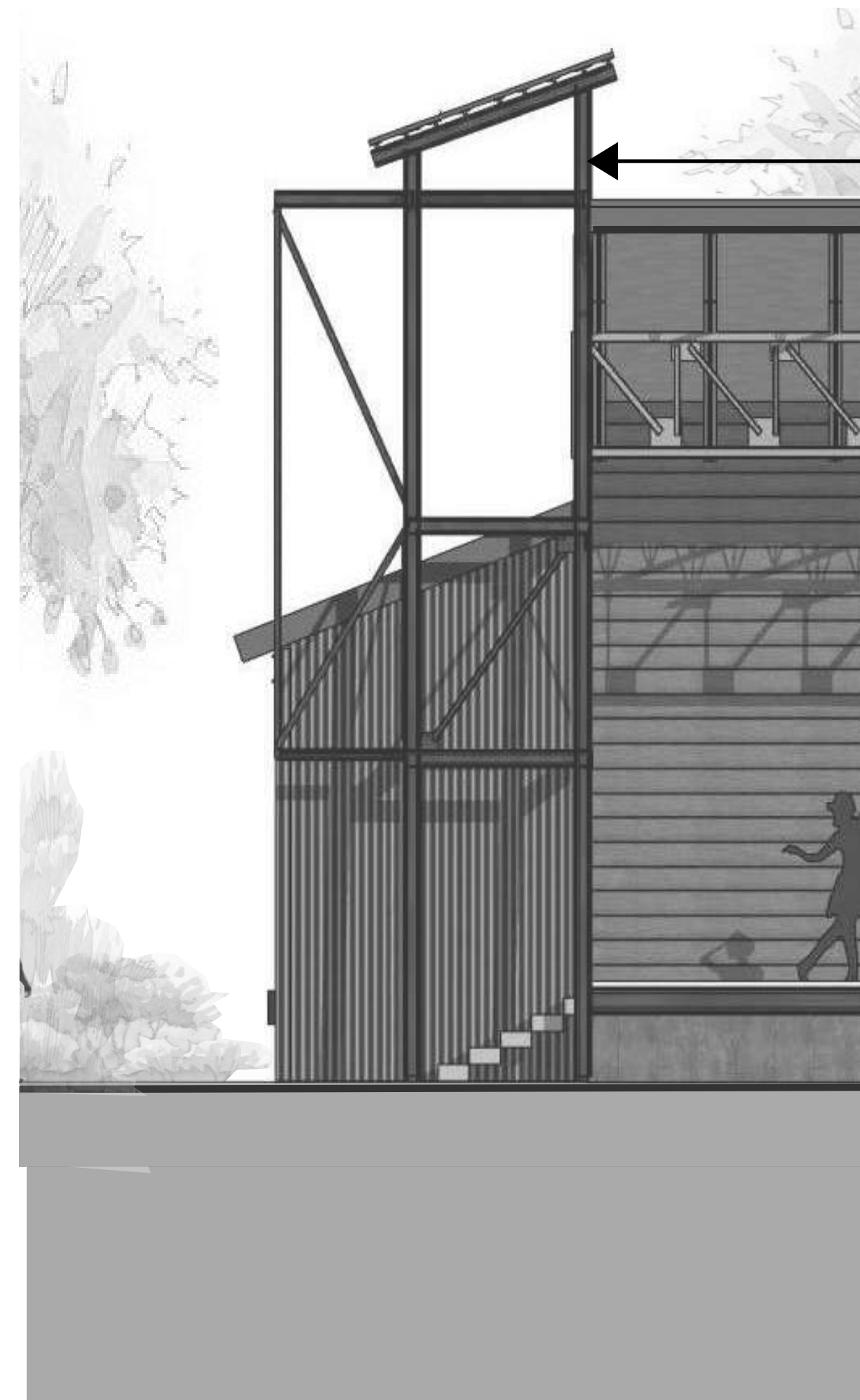
1 WEST ELEVATION  
 3/16" = 1' - 0"

DATE 1/30/24 ISSUANCE SD DRAFT

ELEVATIONS

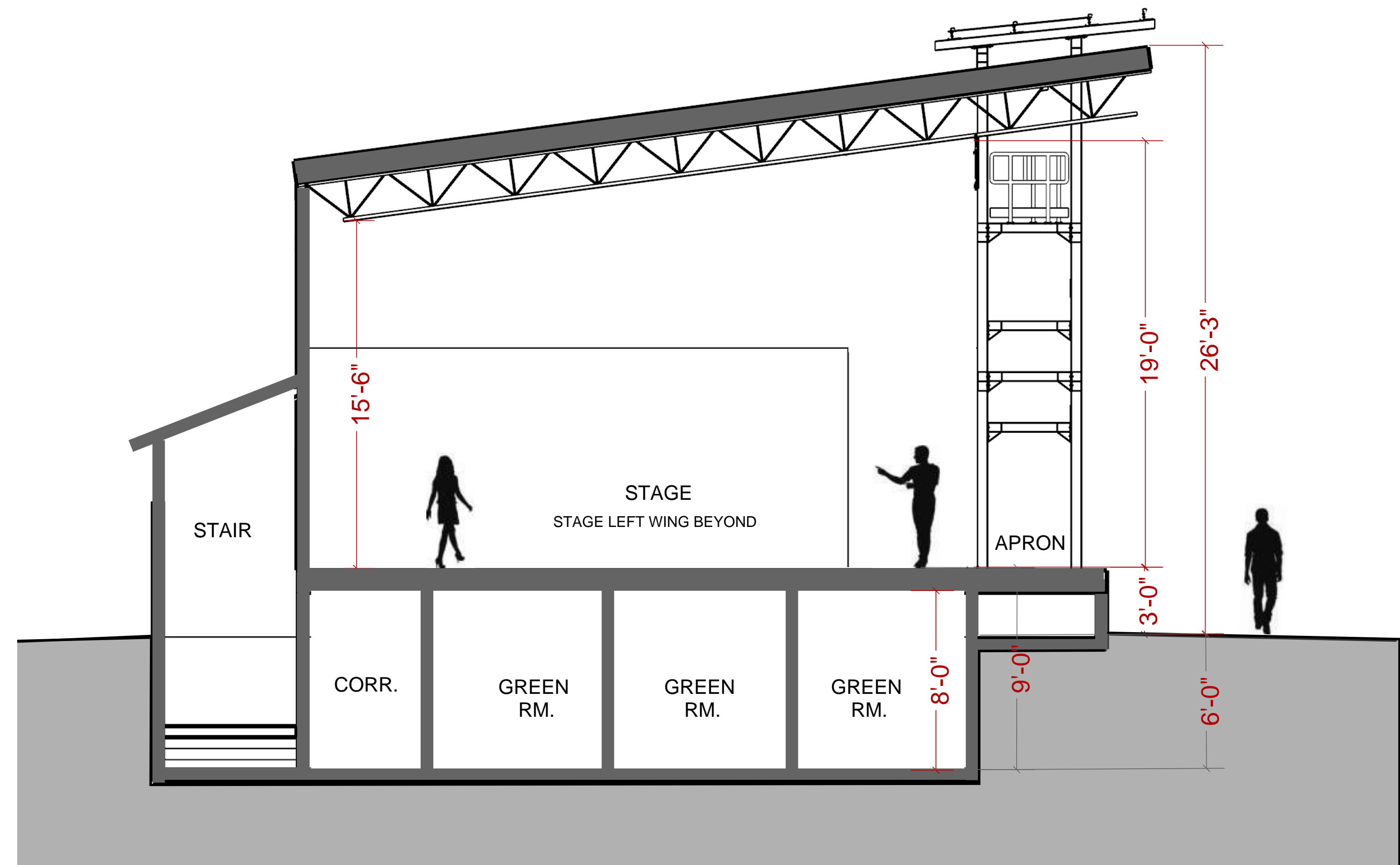
FELLIN PARK STAGE

FELLIN PARK,  
OURAY, CO 81427



SPEAKER TOWER DETAIL:  
STEEL BEAM I-SECTIONS FOR SPEAKER  
MOUNTS AND BANNER ADVERTISING

1 SPEAKER TOWER ELEV.  
1/4" = 1' - 0"



1 SECTION - NORTH  
1/4" = 1' - 0"

DATE 1/30/24  
ISSUANCE SD DRAFT

SECTIONS

A401