Monticello Motor Club
Acoustical Mitigation Study

SLIDES PRESENTATION

MAY 7, 2013

Monticello Motor Club
Acoustical Mitigation Study

PURPOSE OF STUDY

- Noise Study conducted in Fall of 2012 indicated elevated noise levels from race events in one area South of MMC property (bungalow community near Rupp Road)
- Evaluate mitigation options for areas South of MMC property
- AKRF contracted by Township of Thompson to investigate and evaluate effectiveness of mitigation options, and optimize solutions as appropriate

MITIGATION OPTIONS

- **SOUND BARRIERS** – examined sound barriers of various sizes and locations
- **SOUND MASKING** – no reduction of sound, but to use pleasant / soothing sound to mask out audible noise from race events
- **RECEPTOR CONTROLS** – examined acoustical upgrades for homes

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SOUND BARRIER BASICS

Barrier Parameter P

$P = A + B - C$

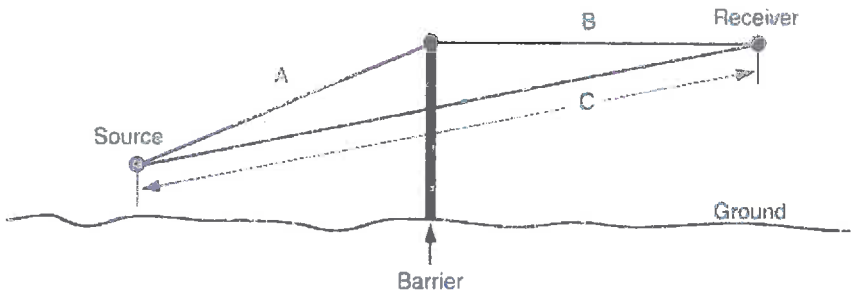

Diagram for Point Noise Source Showing Path-Length Difference "P"

PATH LENGTH DIFFERENCE "P" (feet)	BEST CASE ATTENUATION OR INSERTION LOSS (decibels dBA)
0.25	3
0.50	5
1.0	8
2.0	11
6.0	15
10.0	16
20.0	16

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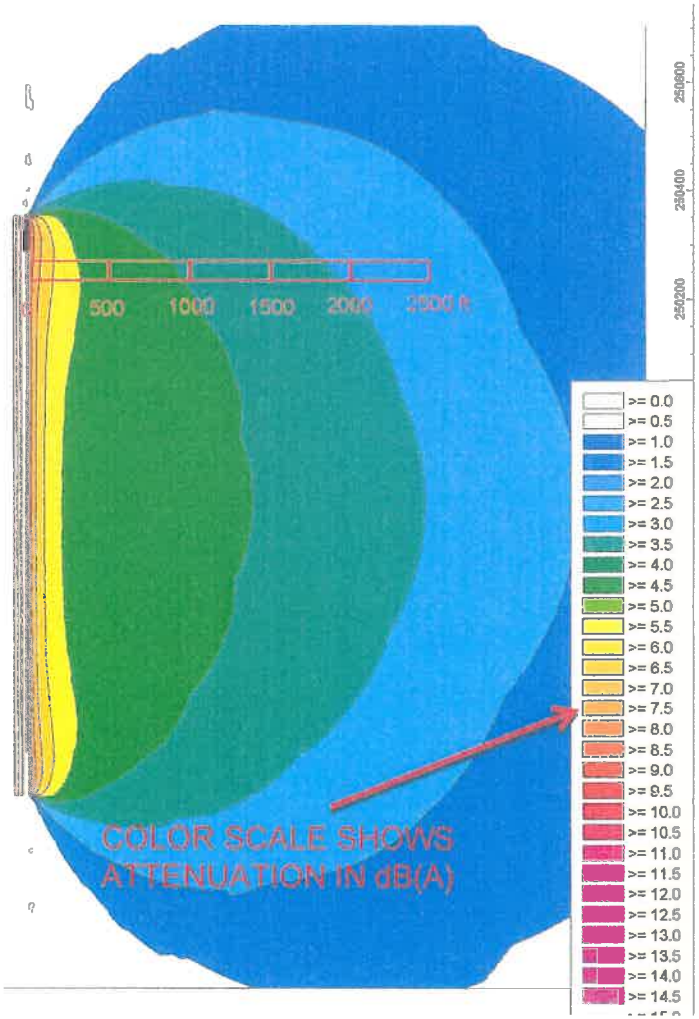
SOUND BARRIER EXAMPLE – TYPICAL HIGHWAY



ATTENUATION vs. DISTANCE

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Our analysis of Sound Barrier options utilizes CadnaA computer-based noise modeling software for following reasons :

- Leading State-of-the-Art Computer-Based Acoustical Modeling Software
- Extremely Useful in evaluation of mitigation – In particular noise barriers, berms and other shielding effects
- Helpful in presentation – color contours depicting acoustical effects such as attenuation
- Allows virtually limitless modifications and iterations
- AKRF has years of experience in utilizing CadnaA – including racetrack projects
- Accounts for many acoustical effects such as:
  - ❑ Topography / Elevations
  - ❑ Sound Source Directivity
  - ❑ Foliage
  - ❑ Acoustical Shielding
  - ❑ Diffraction
  - ❑ Reflections

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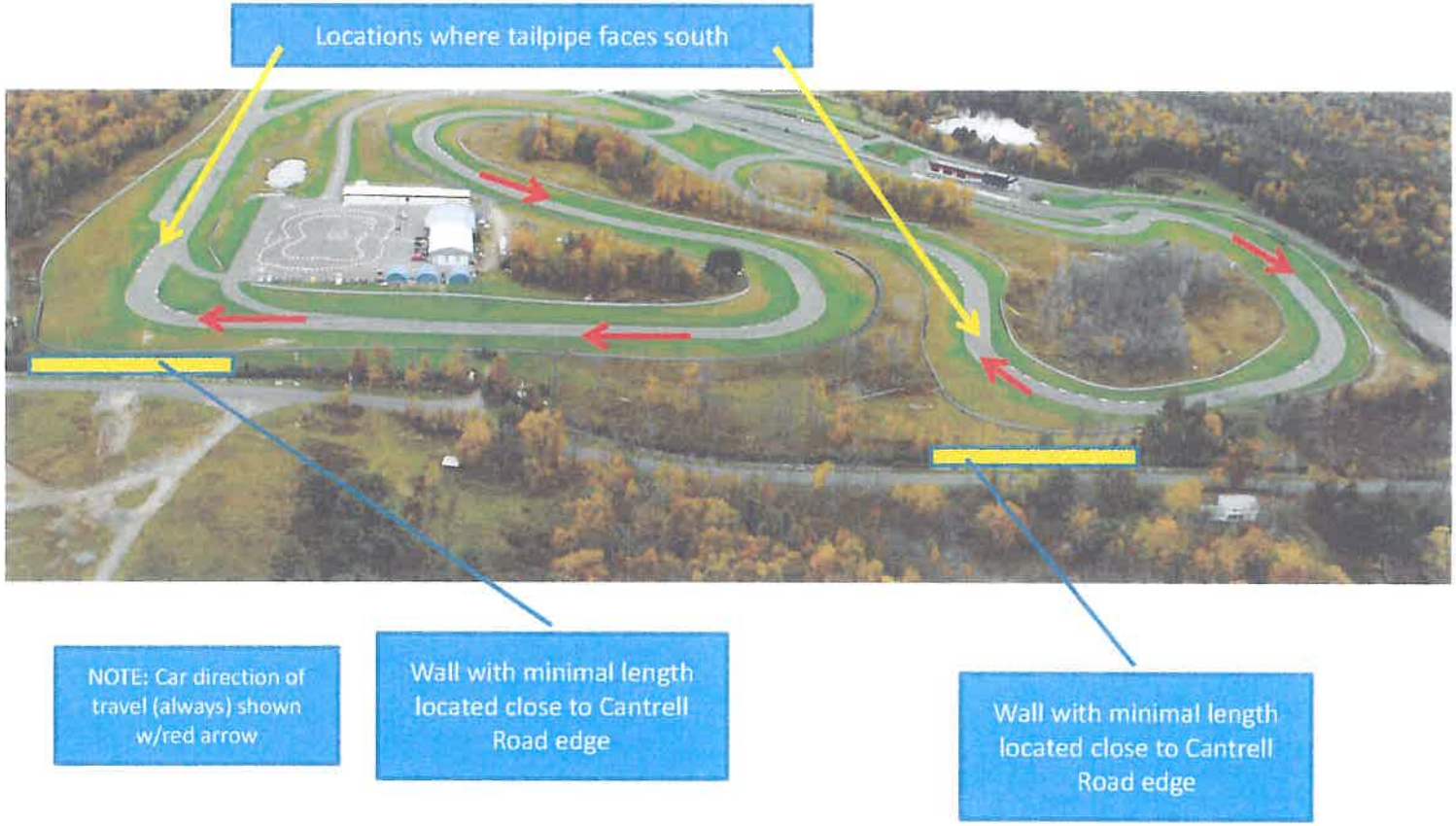
SOUND BARRIER OPTION - "A"



INITIAL EVALUATION PARAMETERS (28k sq ft):

- ❑ **BARRIER HEIGHT – 20 FEET (Above Ground)**
- ❑ **BARRIER LENGTH – 700 FEET (Each)**

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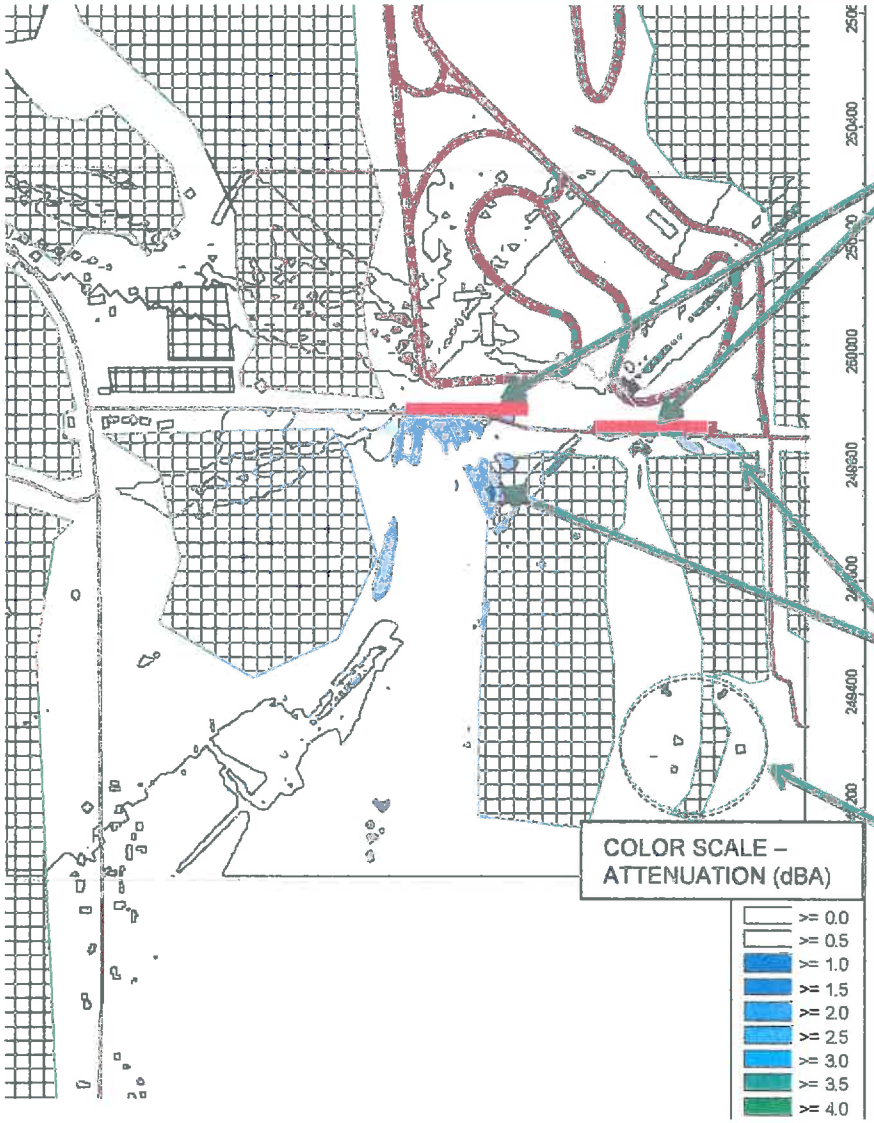
OPTION - "A" ACOUSTICAL MODELING RESULTS



SOUND BARRIERS

LOCALIZED SOUND ATTENUATION

BUNGALOW COMMUNITY NEAR RUPP ROAD

HATCHED INDICATES WOODED AREAS

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SOUND BARRIER OPTION - "B"

SOUND BARRIERS AS CLOSE TO TRACK AS POSSIBLE

SOUND BARRIERS ALONG SAFETY GUARDRAIL – SLIGHTLY CURVED

INITIAL EVALUATION PARAMETERS (20k sq ft):

- ❑ BARRIER HEIGHT – 20 FEET (Above Ground)
- ❑ BARRIER LENGTH – 500 FEET (Each)

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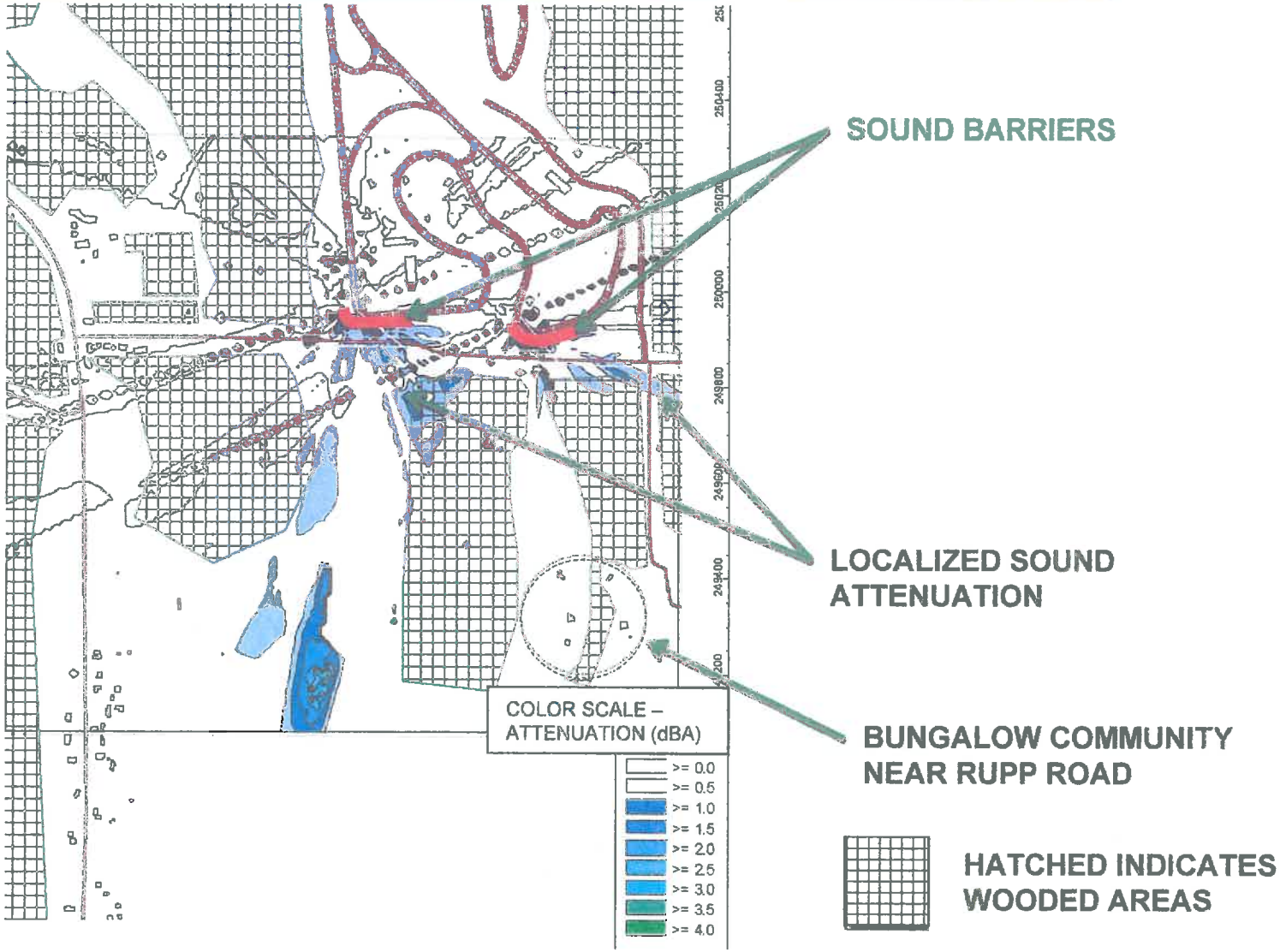
OPTION - "B" ACOUSTICAL MODELING RESULTS



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SOUND BARRIER OPTION - "C"

SOUND BARRIERS ALONG SOUTH EDGE OF CANTRELL ROAD

INITIAL EVALUATION PARAMETERS (40k sq ft):

- BARRIER HEIGHT – 20 FEET (Above Ground)
- BARRIER LENGTH – 1000 FEET (Each)

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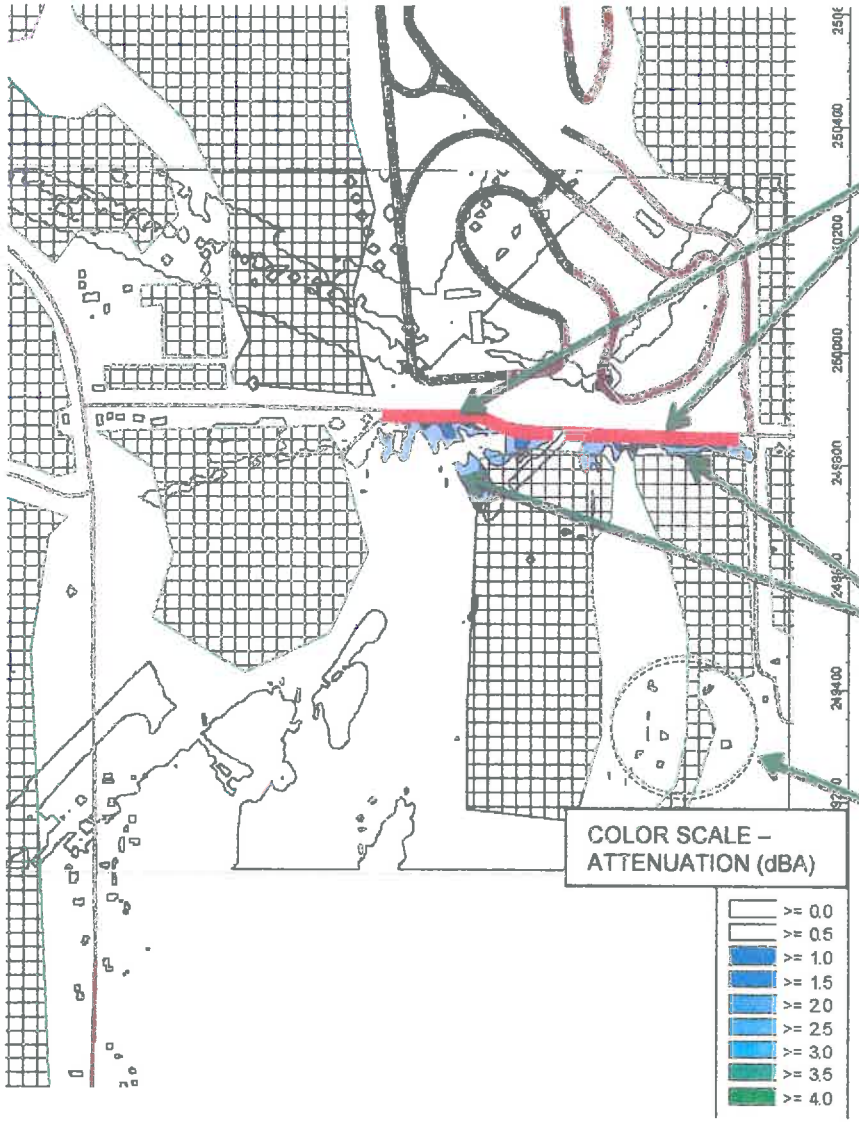
OPTION - "C" ACOUSTICAL MODELING RESULTS



SOUND BARRIERS

LOCALIZED SOUND ATTENUATION

BUNGALOW COMMUNITY NEAR RUPP ROAD

HATCHED INDICATES WOODED AREAS

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SOUND BARRIER OPTION - "D"

SOUND BARRIER ALONG NORTH EDGE OF BUNGALOW COMMUNITY

INITIAL EVALUATION PARAMETERS (11k sq ft):

- ❑ **BARRIER HEIGHT – 20 FEET (Above Ground)**
- ❑ **BARRIER LENGTH – 550 FEET**

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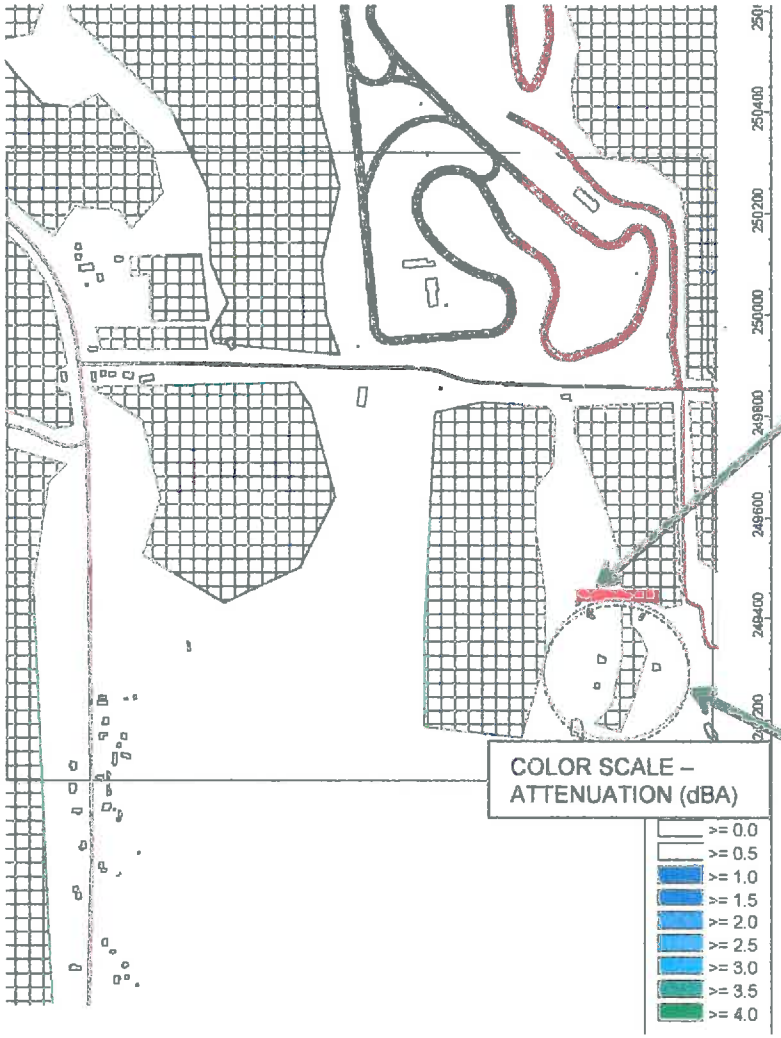
OPTION - "D" ACOUSTICAL MODELING RESULTS



SOUND BARRIER

NOTE: NO LOCALIZED SOUND ATTENUATION BENEFIT ANTICIPATED

BUNGALOW COMMUNITY NEAR RUPP ROAD

HATCHED INDICATES WOODED AREAS

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EXTREME SOUND BARRIERS

ALTHOUGH FEASIBLE IN THEORY, YET IMPRACTICAL AND LIKELY IMPOSSIBLE TO BUILD, AKRF EXAMINED SOME EXTREME CASE SOUND BARRIERS AS FOLLOWS –

PRISON WALL SCENARIO – A SOUND BARRIER AROUND ENTIRE MMC PROPERTY:

- BARRIER HEIGHT – 20 FEET (Above Ground)
- BARRIER LENGTH – 12,150 FEET (approx.)
- TOTAL AREA – 243k sq ft

HUGE CONTINUOUS WALL – A SOUND BARRIER ALONG MMC / CANTRELL RD.:

- BARRIER HEIGHT – 40 FEET and 60 FEET !!!!!! (Above Ground)
- BARRIER LENGTH – 2,400 FEET (approx.)
- TOTAL AREA – 96k and 144k sq ft, respectively

Note: a 60-foot barrier would be roughly 5-stories tall and would require significant reinforcement and bracing for wind loads, etc. It is generally impractical to construct sound barrier walls over 20-feet tall.

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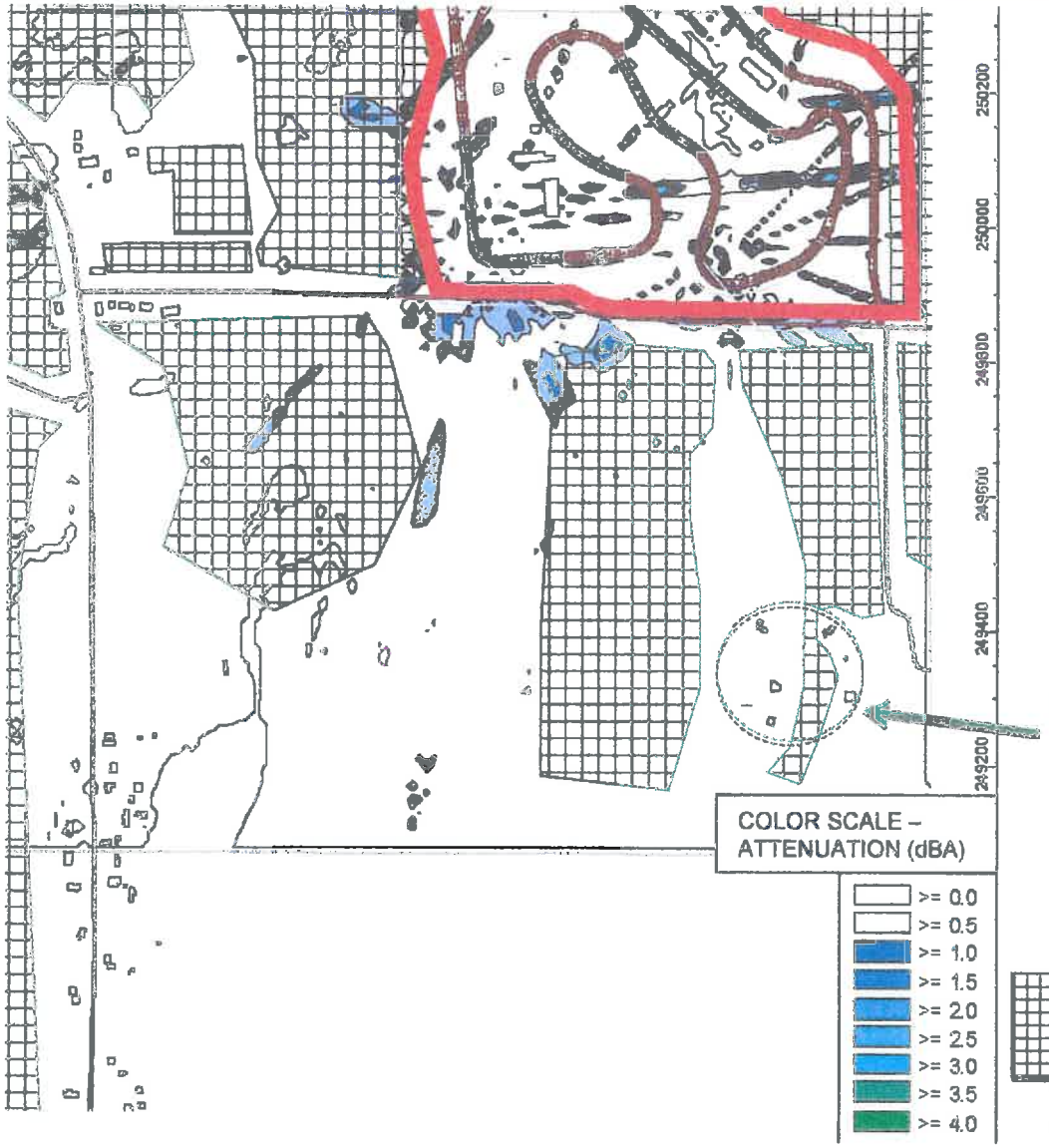
PRISON WALL ACOUSTICAL MODELING RESULTS



BUNGALOW COMMUNITY NEAR RUPP ROAD

HATCHED INDICATES WOODED AREAS

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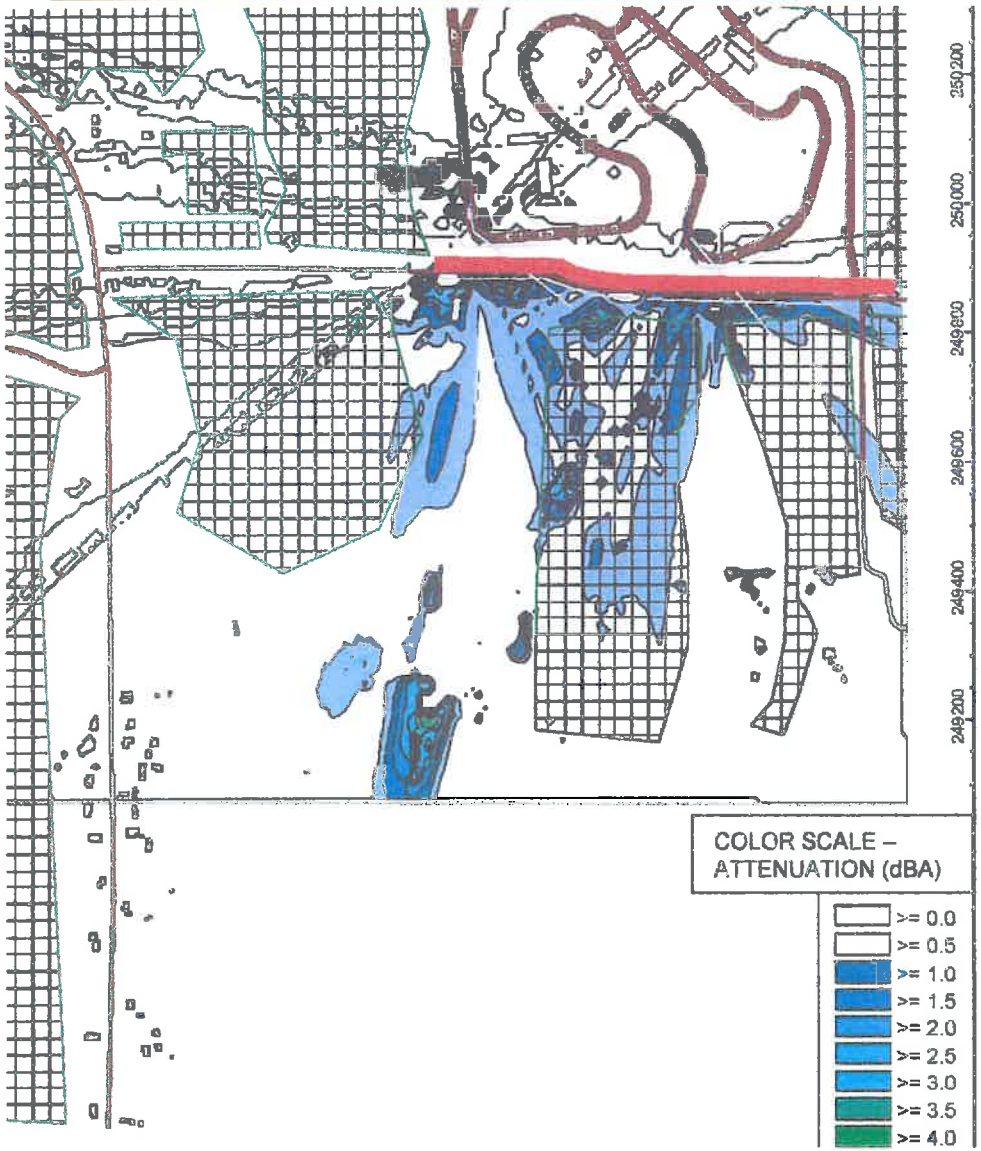
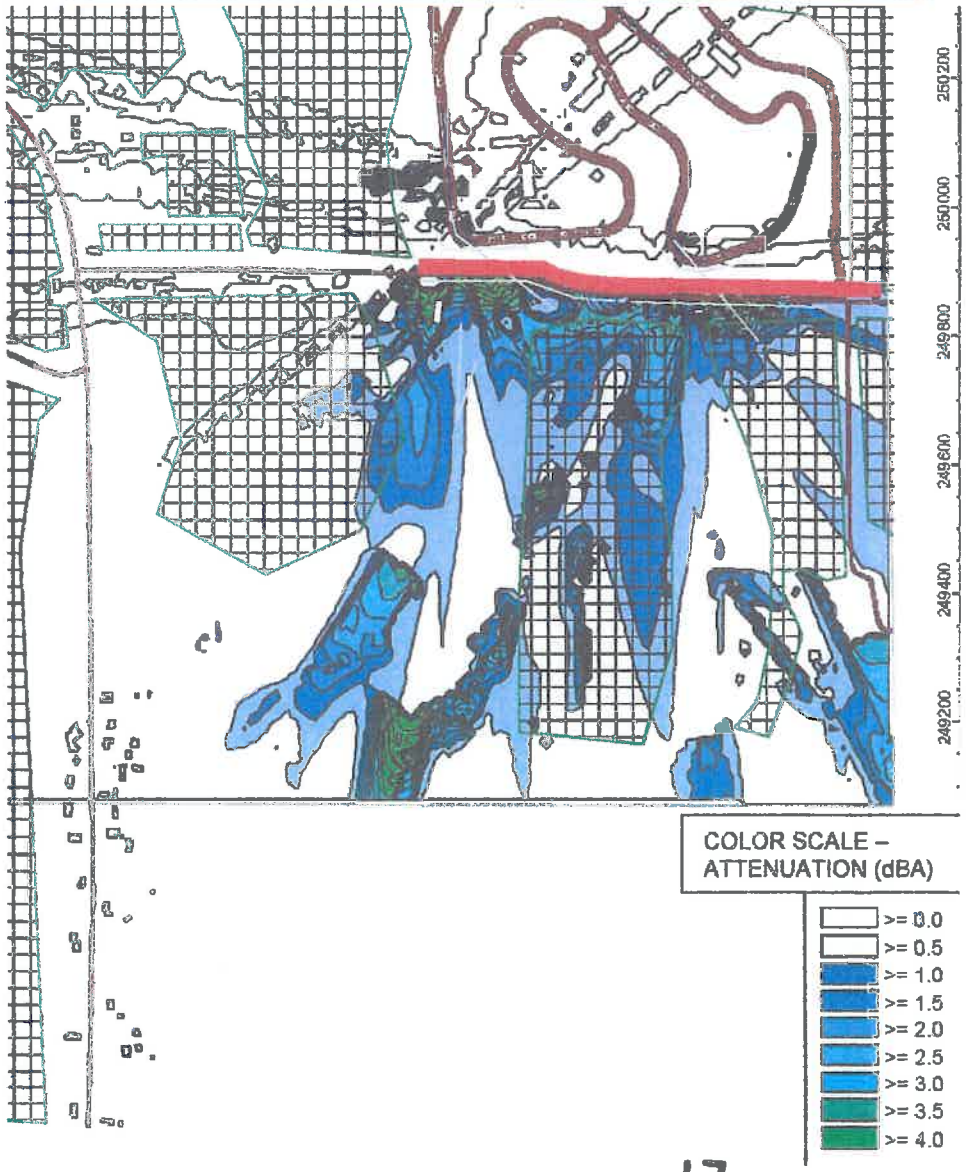
40' HIGH WALL MODELING RESULTS



60' HIGH WALL MODELING RESULTS



WHY AREN'T SOUND BARRIERS PERFORMING BETTER??

- At CLOSEST LOCATION between track and properties South (distance approximately 1,600 feet) path-length distance "P" offered by any sound barrier is minimal
- Elevation changes negatively impact path-length distance "P"
- Refraction
- Complex Noise Sources (Race Cars)
- Parts of racetrack would not be shielded by theoretical sound barriers examined in the study

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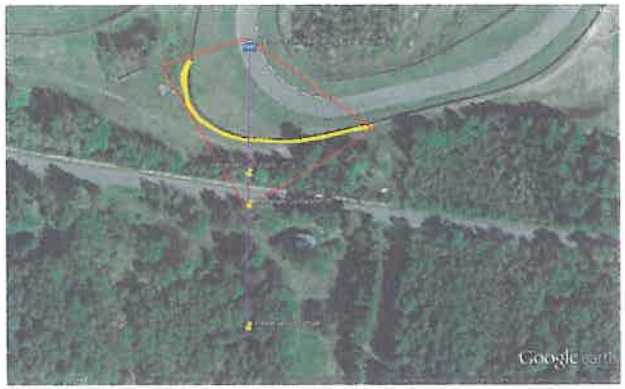
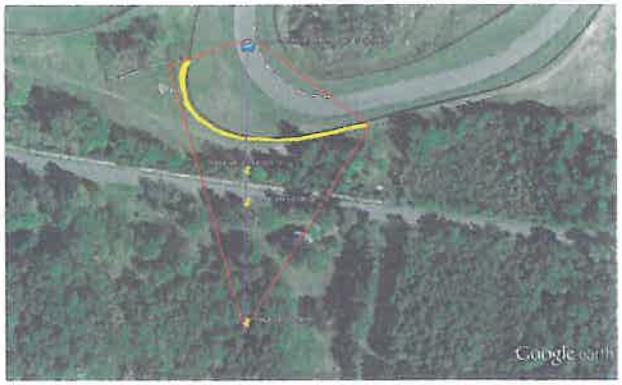
EFFECT OF REFRACTION –

SIMPLIFIED POINT NOISE SORUCE





Receiver Location Shown on Figure	Distance "A" (feet)	Distance "B" (feet)	Distance "C" – Direct Line of Site (feet)	Path Length Difference "P" (feet) P = A + B -C	APPROX ATTENUATION OR INSERTION LOSS (decibels dBA)
A	174.41	78.16	242.09	10.48	11
B	174.41	139.46	299.78	14.10	11
C	174.41	372.17	532.77	13.81	11

EFFECTS OF RACE CAR AS A NOISE SOURCE

- Race Cars are Moving Point Sources of Noise
- During Race – Many Moving Point Sources of Noise
- At Any Given Time – Moving at Different Locations on Race Track
- Depending on Location – Much Different Power Application and thus Noise Level
- Noise from tailpipe (exhaust) can be very "directional" depending on vehicle speed and power application

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FEDERAL HIGHWAY ADMIN (FHWA) AND NY STATE DEPT OF TRANPORTATION (NYSDOT) CRITERIA FOR CONSIDERATION OF SOUND BARRIERS

FEASIBILITY		YES	NO
Engineering Considerations	Can the Measure Be Built?		
Noise Reduction (Acoustical Feasibility)	Does the proposed mitigation measure provide a reduction of at least 5 dB(A) at the majority of impacted receptors?		
RESONABLENESS			
Viewpoints of Benefited Property Owners and Residents	Were responses obtained from at least half of the benefited property owners and residents?		
	Do a majority of the responses favor the measure?		
Cost Index	If a berm: Is the total estimated cost of the proposed berm less than $80,000 per benefited receptor?		
	If a barrier: Is the propose barrier less than 2,000 square feet per benefited receptor?		
Noise Reduction Design Goal	Do a majority of the benefited receptors achieve the Noise Reduction Design Goal of 7 dB(A)?		

If ALL of the questions can be answered "YES", then the measure is considered reasonable and feasible

SOUND BARRIERS WON'T WORK

- Ineffective due to elevation changes and refraction
- Ineffective due to minimal Path Length Difference at impacted properties
- Ineffective due to multiple sound sources (race cars) in all locations of track at any given time – not a simple point (or line) source of noise
- Only appreciable reduction of sound is in very close proximity to sound barriers – not at impacted properties
- Even extreme measures (Prison Wall, Very High Wall) provide no signficant benefit at impacted properties
- Would not be considered Feasible or Reasonable under FHWA or NYSDOT criteria

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SOUND MASKING BASICS

- Covering of unwanted distracting sound with soothing, more natural sounds and less intrusive sounds.
- This would NOT reduce racetrack sounds
- In order to be effective, must be at least as loud sound level at receptors as the racetrack noise (i.e., 44-63 dB(A) based on Rupp Road noise receptor)
- Is more effective if sound masking sound level is louder than unwanted (racetrack) noise level

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SOUND MASKING ANALYSIS

POND ALONG NORTH EDGE OF BUNGALOW COMMUNITY

POND WOULD INCLUDE THREE (3) FOUNTAINS – APPROX 10-FEET HIGH

INITIAL EVALUATION PARAMETERS:

- REFERENCE SOUND LEVEL FOR ONE (1) FOUNTAIN 72 dB(A) @ 6 FEET
- APPROX DISTANCE FROM FOUNTAIN LINE TO HOMES 120 FEET

SOUND MASKING WON'T WORK

- Resultant Sound Levels from fountains anticipated to be between 45-47 dB(A) at closest residences
- Resulting Sound Levels from fountains would be lower at residences farther from fountains
- Noise levels from racing events ranged from 44 – 63 dB(A) based on Rupp Road noise receptor
- Although fountains may work as sound masking for some race events, sound masking effects would not benefit residences for louder racing events

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RECEPTOR CONTROLS BASICS

- Improve Sound Transmission Loss of residence exterior construction
- Traditionally, windows are the weakest component of a residence with regards to Sound Transmission Loss
- Windows must be CLOSED for acoustical benefit of Sound Transmission Loss
- For CLOSED window conditions, alternate forms of ventilation must also be considered

RECEPTOR CONTROL SUMMARY

- With good sound attenuating windows and alternate forms of ventilation (through-window or through-wall air-conditioning) it is reasonable to assume 15 to 18 dB(A) reduction in outdoor sounds
- This would be anticipated to reduce worst-case racetrack sounds to quietest ambient sound levels in residences
- This only reduces racetrack noise within residences and under closed-window conditions
- No benefit to outdoor noise (e.g., someone's porch)

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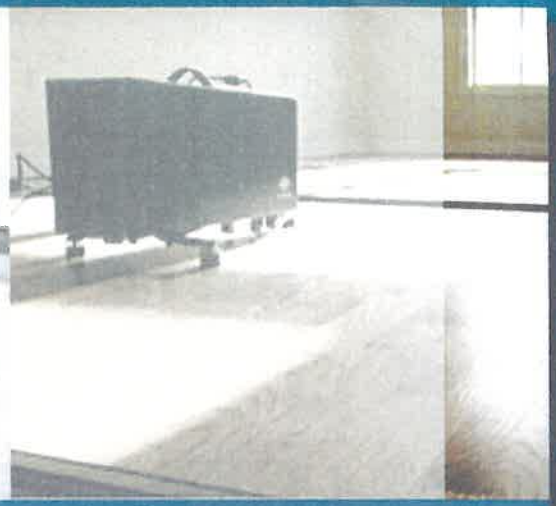

Questions & Answers