

Sundar, Danielle

From: Fox, Lori
Sent: Friday, September 25, 2009 3:26 PM
To: Sundar, Danielle
Subject: FW: CAHA Analysis

Follow Up Flag: Follow up
Flag Status: Blue

Attachments: CAHA Acoustical Snapshot.doc; Example Impact Thresholds.doc



CAHA Acoustical Snapshot.doc (...)
 Example Impact Thresholds.doc (...)

For CAHA admin... Emails with two files attached.

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-----Original Message-----

From: Sandra_Hamilton@nps.gov [mailto:Sandra_Hamilton@nps.gov]
 Sent: Wednesday, August 05, 2009 2:26 PM
 To: Fox, Lori; Wetmore, Doug; Van Dyke, Nancy
 Cc: Niosi, Dan
 Subject: Fw: CAHA Analysis

Hi Lori / Dan

Here is the report of the work the sounds program had done at CAHA.
 (See attached file: CAHA Acoustical Snapshot.doc)

They are doing the metrics and modeling for the park over the summer (done in Sept). I left a voice mail for Frank yesterday and again today about setting up a call on the CAHA work after you've looked at it and to ask for some info about BITH that Dan needs for BISO.

Sandy

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----- Forwarded by Sandra Hamilton/DENVER/NPS on 08/05/2009 02:19 PM -----

Frank
Turina/FTCOLLINS/
NPS

06/11/2009 11:33
AM

To
Sandra Hamilton/DENVER/NPS@NPS
cc
Kurt Fristrup/FTCOLLINS/NPS@NPS
Subject
CAHA Analysis(Document link: Sandra
Hamilton)

Hi Sandy,

Attached are some example impact thresholds that we are incorporating into an upcoming Soundscape Management Plan at Zion. At this point they are preliminary and will need to be adjusted for CAHA. Also, they use metrics that we have not yet calculated for CAHA. If we proceed with a full analysis, we will calculate the required metrics. These should give you a sense of the approach we would take for CAHA.

Based on the data that we have, I would anticipate that we will be finding moderate impacts from noise to both visitors and wildlife (since noise from autos at 25 mph are above ambient levels up to 250m from the source). The exact impact level would depend on the density, levels, and timing of the traffic on the beach. I think I already asked for that information and was told that the park doesn't have accurate traffic counts. Is that correct?

I am a bit tentative to make definitive impact determination based on the preliminary analysis we have conducted so far. Since this plan is controversial may be litigated, I think our noise analysis should be more comprehensive. This would involve using an acoustic model to anticipate the effects of various traffic levels and management alternatives. I had a discussion with our acoustic staff and they felt they could complete the modeling this summer. We could have a complete analysis by September. If we find that the impacts don't really reach moderate levels, we can always dismiss the topic at that point and the decision would be well supported.

Let's talk about this a bit more when you get a chance.

(See attached file: Example Impact Thresholds.doc)

Frank Turina
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When quiet is all around, with no sounds but natural ones - bird songs, wind, washing of waters against shores - the stage is always set for meditation and reflection.
-- Sigurd Olsen

Sandra

0023761

Hamilton/DENVER/N
PS
06/08/2009 01:16
PM

To
Frank Turina/FTCOLLINS/NPS@NPS
cc
Subject
meeting

Hi Frank,

Thanks for all the good information Friday. Here's the reminder that you're coming here at 10:00 on Monday, 6/16/09 to help me with sounds thresholds and impacts for CAHA. And you were going to send me some examples to adapt to CAHA in the meantime this week. Thanks, Frank.

Sandy

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National Park Service
U.S. Department of the Interior

Natural Resource Program Center
Natural Sounds Program



Cape Hatteras National Seashore

Acoustical Monitoring Snapshot

April 2009

Background Information

The Natural Sounds Program received a technical assistance request from Cape Hatteras National Seashore (CAHA) for acoustical monitoring. The purpose of this monitoring was to capture the Seashore's natural ambient and estimate noise impacts from ORV use. To capture the natural ambient, two sites were monitored for 31 days. This briefing serves as a preliminary snapshot of the acoustical conditions at the long-term monitoring sites. This briefing also addresses potential impacts from ORV noise. Additional information, including the calculated natural ambient, will be provided in a full acoustic monitoring report that will follow, pending further analysis. Table 1 describes the location and characteristics of the long-term monitoring site.

Table 1. Study area

Site	Site Name	Dates		Vegetation	Elevation (m)	Latitude	Longitude
		Deployed					
CH1	Bodie Island	05/06/2008 –		Woody Wetlands/Mixed Forest	1	35.82550	75.56966
	Bone Yard	06/02/2009					
CH2	Cape Point	05/06/2008 –		Woody Wetlands/Shrubland	1	35.23439	75.54999
		06/02/2009					

Metrics

In order to understand the implications of the acoustic data fully, it is important to describe the distribution of sound levels in relation to potential functional effects. Table 2 presents park sound sources and common sound sources with their corresponding A-weighted decibel levels (dBA). The dBA is a logarithmic measure of sound energy that approximates human hearing sensitivity (Harris, 1998, p. 1.16).

Table 2. Interpreting sound levels

Park Sound Sources	Common Sound Sources	dBA
Volcano crater (HALE)	Human breathing at 3m	10
Leaves rustling (CANY)	Whispering	20
Crickets at 5m (ZION)	Residential area at night	40
Conversation at 5m (WHMI)	Busy restaurant	60
Snowcoach at 30m (YELL)	Curbside of busy street	80
Thunder (ARCH)	Jackhammer at 2m	100
Military jet at 100m AGL(YUCH)	Train horn at 1m	120

Note: An increase of 10dBA represents a tenfold multiplication of energy

Table 3 summarizes sound level values that relate to human health and speech, as documented in

the scientific literature. Human responses can serve as a proxy for potential impacts to other vertebrates because humans have more sensitive hearing at low frequencies than most species (Dooling and Popper, 2007, p. 5).

Table 3. Explanation of sound level values

Sound Levels (dBA)	Relevance
35	Blood pressure and heart rate increase in sleeping humans (Haralabidis et al., 2008)
45	World Health Organization's recommendation for maximum noise levels inside bedrooms (Berglund, Lindvall, and Schwela, 1999)
52	Speech interference for interpretive programs (U.S. Environmental Protection Agency, 1974)
60	Speech interruption for normal conversation (U.S. Environmental Protection Agency, 1974)

Table 4 reports the percent of time that measured levels were above the values in Table 3. The top value in each cell focuses on frequencies affected by transportation noise whereas the lower values use the conventional full frequency range.

Table 4. Percent time above metrics

Site	% Time above sound level: 0700 to 1900				% Time above sound level: 1900 to 0700			
	35 dBA	45 dBA	52 dBA	60 dBA	35 dBA	45 dBA	52 dBA	60 dBA
CH1	56.84	2.51	0.55	0.08	58.96	0.50	0.05	0.01
	85.24	10.50	1.40	0.12	98.46	22.23	2.01	0.12
CH2	48.18	2.45	0.49	0.09	92.09	16.30	0.08	0.01
	82.75	9.13	1.06	0.14	99.96	46.06	16.20	0.03

Exceedence levels (L_x) are metrics used to describe acoustical data. They represent the dBA exceeded x percent of the time during the given measurement period (e.g. L_{90} is the dBA that has been exceeded 90% of the time). Table 5 reports the L_{90} , L_{50} , and L_{10} values for the sites measured in CAHA. The top value in each cell focuses on frequencies affected by transportation noise whereas the lower values use the conventional full frequency range. The L_{90} can be used to approximate natural ambient conditions.

Table 5. Exceedence levels for existing conditions

Site	Exceedence levels (dBA): 0700 to 1900			Exceedence levels (dBA): 1900 to 0700		
	L_{90}	L_{50}	L_{10}	L_{90}	L_{50}	L_{10}
CH1	33.6	36.0	39.9	33.8	35.6	38.4
	36.8	39.3	43.9	40.0	42.3	44.8
CH2	33.4	35.9	39.5	41.0	43.0	44.6
	35.9	38.0	43.0	46.1	47.2	48.8

Figures 1 and 2 plot the dB levels for 33 one-third octave band frequencies over the day and night periods at CH1 and CH2, respectively. The grayed area represents sound levels outside of the typical range of human hearing. The typical frequency levels for transportation, conversation and songbirds are presented on the figure as examples for interpretation of the data. These ranges are estimates and are not vehicle-, species-, or habitat- specific.

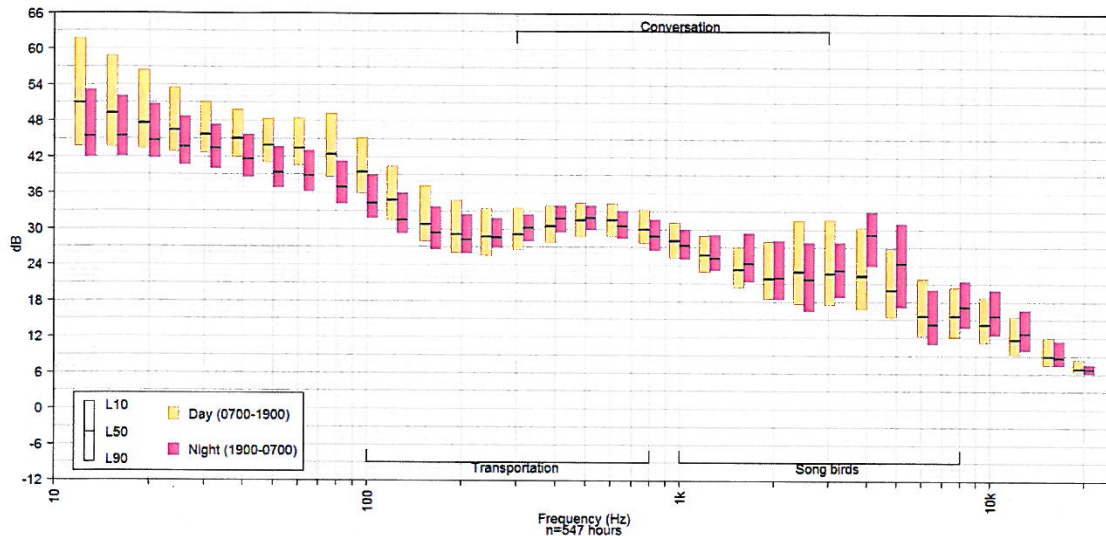


Figure 1. Day and night dB levels for 33 one-third octave bands at CH1

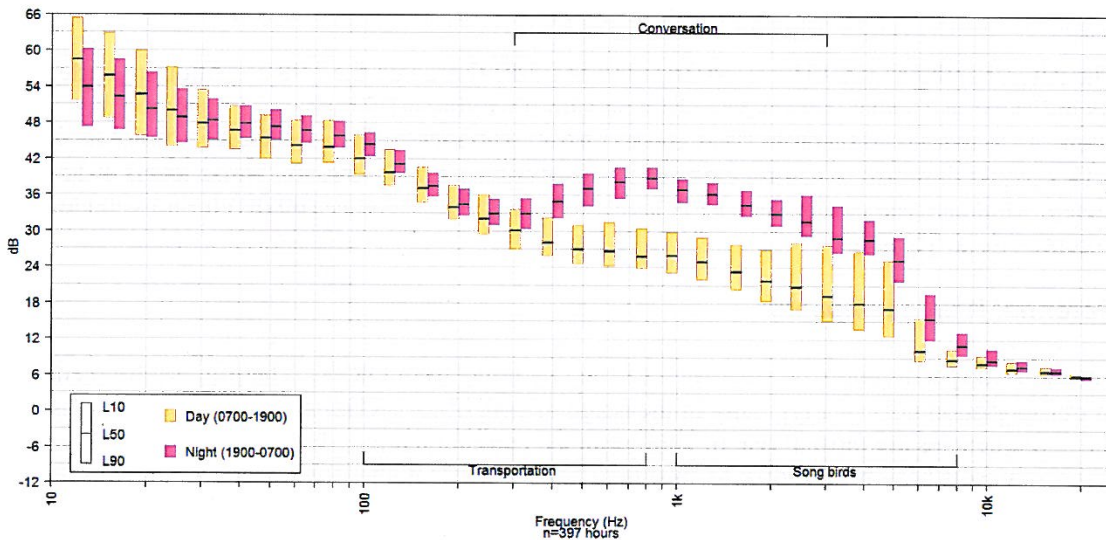


Figure 2. Day and night dB levels for 33 one-third octave bands at CH2

Noise Impacts from ORVs

OHV noise levels were calculated at various distances using standard air absorption based on the annual average atmospheric conditions at CAHA. OHV noise is calculated according to operating conditions, such as speed and throttle, for various OHV types such as ATV, cars/trucks, and motorcycles. The noise levels for cars can also be applied to standard light trucks.

To understand increases due to groups of vehicles, 3 dB should be added for each doubling of vehicles. For example, a group of two ATVs will be 3 dB higher than the calculation for one, and a group of four ATVs will be 6 dB higher than the calculation for one. Similarly, a group of eight ATVs will be 9 dB higher than one. The levels were calculated in order to give planners information to determine impacts for OHV usage according to speed and operating conditions.

Results of the analysis are provided in Table 6. The table indicates sound levels from various vehicle types and speeds at specific distances from the source (4m, 15m, 50m, etc.)

Vehicle	Reference Measures		Other Distance (meters)					
	Src LpA @	Distance	4	15	50	150	250	500
ATV cruising at 30 mph (based on MC 1/2 load spectrum and 79 dBA at 4m)	79	4	79.0	67.4	56.7	46.6	41.6	34.6
ATV cruising at 15 mph (based on MC 1/2 load spectrum and 74 dBA at 4m)	74	4	74.0	62.4	51.7	41.6	36.6	29.6
Auto at 15 mph (FHWA)	52	15.24	64.0	52.5	41.7	31.5	26.4	19.0
Auto at 25 mph (FHWA)	59	15.24	71.0	59.4	48.7	38.5	33.4	26.0
Motorcycle at 15 mph (FHWA)	59	15.24	71.2	59.6	48.9	38.6	33.6	26.3
Motorcycle at 25 mph (FHWA)	66	15.24	77.7	66.1	55.3	45.1	40.0	32.6

Table 6 Noise levels from vehicles at various distances from the source.

The natural ambient at CAHA is estimated to be 33dB (based on the L90 condition in Table 5). As indicated in Table 6, noise levels from an auto travelling at 25 mph or 15 mph would attenuate to natural ambient levels at approximately 250 meters from the source. Noise levels for ATVs would diminish to natural ambient levels at approximately 500 m. Noise levels at 15 meters would exceed or approach EPA levels for speech interference (60 dB) for all vehicles except autos at 15 mph.

Potential Wildlife Impacts

Several bird species could be adversely affected by noise from ORVs. The primary frequencies in transportation noise are typically in the range of 100Hz to 1 KHz. Species with calls close to those frequencies are most at risk of compromised communication. Even species with higher frequency calls have been shown to shift their calls towards higher frequencies in the presence of transportation noise (Slabbekoorn & den Boer-Visser, 2006). Table 7 indicates potential impacts to bird species at CAHA.

Species	Potential effect
piping plover	1-3 kHz call with most energy around 2 kHz-- acoustic communication could be compromised. Could be impacted by shifting the frequency of the calls away from the transportation noise (see Slabbekoorn and Boer-Visser 2006)
black skimmer	Fundamental frequency of call is at and below 2 kHz-- acoustic communication could be compromised. Could be impacted by shifting the frequency of the calls away from the transportation noise (see Slabbekoorn and Boer-Visser 2006)

wilson's plover	Most acoustic energy in the call occurs below 3 kHz-- acoustic communication could be compromised. Could be impacted by shifting the frequency of the calls away from the transportation noise (see Slabbekoorn and Boer-Visser 2006)
least tern	Could be impacted by shifting the frequency of the calls away from the transportation noise (see Slabbekoorn and Boer-Visser 2006)
common tern	Could be impacted by shifting the frequency of the calls away from the transportation noise (see Slabbekoorn and Boer-Visser 2006)
gull-billed tern	Could be impacted by shifting the frequency of the calls away from the transportation noise (see Slabbekoorn and Boer-Visser 2006)

In addition, studies of the effects of underwater levels of anthropogenic noise on sea turtles have suggested that turtles may be adversely affected by noise. Samuel et al. (2005) conclude that “continued exposure to existing high levels of pervasive anthropogenic noise in vital sea turtle habitats and any increase in noise could affect sea turtle behavior and ecology.” The results of the study suggest that terrestrial noise may affect turtle behavior in a similar fashion.

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Soundscape Thresholds

Threshold/ Management Zone		Definition
Negligible	Natural or Wilderness	The action is short- term (less than 1 week) and noise will not exceed moderate levels. Otherwise, noise created by the action is audible less than 5% (%TA<5) of the time in less than 10% of the area. Change in exposure is < 0.5 dBA for less than 50% of the day. Change in exposure is < 0.5dBA for less than 20% of the day in sensitive areas (e.g. slot canyons, technical climbing areas).
	Developed Area	The action is short- term (less than 1 week) and noise will not exceed moderate levels. Otherwise, noise created by the action is audible less than 20% (%TA<20) of the time in less than 30% of the area. Change in exposure is (< 1dBA) in less than 20% of the area.
Minor	Natural or Wilderness	The action is short- term (between 1 and 2 weeks) and noise will not exceed moderate levels. Otherwise, noise created by the action is audible less than 10% (%TA<10) of the time in less than 20% of the area change in exposure is < 1dBA in less than 20% of the area. Change in exposure < 0.5dBA for less than 30% of the day in sensitive areas (e.g. slot canyons, technical climbing areas).
	Developed Area	The action is short- term (between 1 and 2 weeks) and noise will not exceed moderate levels. Otherwise, noise created by the action is audible less than 30% (%TA<30) of the time in less than 40% of the area. Change in exposure is < 3dBA in less than 20% of the area.
Moderate	Natural or Wilderness	Noise created by the action is audible less than 40% (%TA<40) of the time in less than 20% of the area. Change in exposure is < 3dBA in less than 10% of the area. Change in exposure is < 3dBA for less than 20% of the day in sensitive areas (e.g. slot canyons, technical climbing areas).
	Developed Area	Noise created by the action is audible less than 50% (%TA<50) of the time in less than 40% of the area. Change in exposure is <3dBA in less than 30% of the area.
Major	Natural or Wilderness	Noise created by the action is audible more than 40% (%TA<40) of the time in more than 20% of the area. Change in exposure is 3dBA or more in more than 10% of the area. Change in exposure is 3dBA or more for more than 20% of the day in sensitive areas (e.g. slot canyons, technical climbing areas).
	Developed Area	Noise created by the action is audible more than 50% (%TA<50) of the time in more than 40% of the area. Change in exposure is 3dBA or more in more than 30% of the area.

Wildlife Impact Thresholds

Table 3.1. Thresholds for Analysis of Wildlife Impacts [Loss of listening Area, Alerting Distance, NFI, etc]

Threshold	Definition
<i>Negligible impacts</i>	<ul style="list-style-type: none"> ▪ Noise levels will cause a 50% reduction in listening area during 10% day over 10% of habitat ▪ Noise levels will cause a XX% reduction in alerting distance during XX% day over XX% of habitat ▪ NFI will decrease by XX% Can we calculate this or estimate? (recovery) ▪ Other factors
<i>Low impacts</i>	<ul style="list-style-type: none"> ▪ Noise levels will cause a XX% reduction in listening area during XX% day over XX% of habitat ▪ Audibility? ▪ Noise levels will cause a XX% reduction in alerting distance during XX% day over XX% of habitat ▪ NFI will decrease by XX% Can we calculate this or estimate? (recovery) ▪ Other factors

<i>Moderate impacts</i>	<ul style="list-style-type: none"> ▪ Noise levels will cause a XX% reduction in listening area during XX% day over XX% of habitat ▪ Audibility? ▪ Noise levels will cause a XX% reduction in alerting distance during XX% day over XX% of habitat ▪ NFI will decrease by XX% Can we calculate this or estimate? (recovery) ▪ Other factors
<i>High impacts</i>	<ul style="list-style-type: none"> ▪ Noise levels will cause a XX% reduction in listening area during XX% day over XX% of habitat ▪ Audibility? ▪ Noise levels will cause a XX% reduction in alerting distance during XX% day over XX% of habitat ▪ NFI will decrease by XX% Can we calculate this or estimate? (recovery) ▪ Other factors

² "Species of concern" include Federal or state- listed threatened, endangered, and candidate species, species of local economic importance, or other species of particular concern

³"Habitat" is refers to the physical landscape and its ecosystem components.

Visitor Experience Impact Thresholds

Table 3.2 Analysis of Visitor Experience Impacts

Threshold/ Management Zone		Definition
Negligible	<i>Natural or Wilderness</i>	The action is short- term (less than 1 week) and noise will not exceed moderate levels. Otherwise, noise created by the action is audible less than 5% (%TA<5) of the time in less than 10% of the area. Listening area is reduced by <10% (change in exposure < 0.5 dBA) for less than 50% of the day. Alerting distance is reduced by less than 10% (change in exposure < 0.5dBA) for less than 20% of the day in sensitive areas (e.g. slot canyons, technical climbing areas). The action exceeds thresholds for speech interference (general conversation, interpretive programs, climbing/canyoneering) less than 1% of the day (~7 minutes) in 30% of the area
	<i>Developed Area</i>	The action is short- term (less than 1 week) and noise will not exceed moderate levels. Otherwise, noise created by the action is audible less than 20% (%TA<20) of the time in less than 30% of the area. Listening area is reduced by less than 20% (change in exposure < 1dBA) in less than 20% of the area. The action exceeds thresholds for speech interference (general conversation, interpretive programs) less than 3% of the day (~22 minutes) in less than 20% of the area
Minor	<i>Natural or Wilderness</i>	The action is short- term (between 1 and 2 weeks) and noise will not exceed moderate levels. Otherwise, noise created by the action is audible less than 10% (%TA<10) of the time in less than 20% of the area. Listening area is reduced by less than 20% (change in exposure < 1dBA) in less than 20% of the area. Alerting distance is reduced by less than 10% (change in exposure < 0.5dBA) for less than 30% of the day in sensitive areas (e.g. slot canyons, technical climbing areas). The action exceeds thresholds for speech interference (general conversation, interpretive programs, climbing/canyoneering) less than 2% of the day (~15 minutes) in less than 30% of the area
	<i>Developed Area</i>	The action is short- term (between 1 and 2 weeks) will not exceed moderate levels. Otherwise, noise created by the action is audible less than 30% (%TA<30) of the time in less than 40% of the area. Listening area is reduced by less than 50% (change in exposure < 3dBA) in less than 20% of the area. The action exceeds thresholds for speech interference (general conversation, interpretive programs) less than 5% of the day (~36 minutes) in less than 20% of the area

Threshold/ Management Zone		Definition
Moderate	<i>Natural or Wilderness</i>	Noise created by the action is audible less than 40% (%TA<40) of the time in less than 20% of the area. Listening area is reduced by less than 50% (change in exposure < 3dBA) in less than 10% of the area. Alerting distance is reduced by less than 50% (change in exposure < 3dBA) for less than 20% of the day in sensitive areas (e.g. slot canyons, technical climbing areas). The action exceeds thresholds for speech interference (general conversation, interpretive programs, climbing/canyoneering) less than 5% of the day (~36 minutes) in 30% of the area.
	<i>Developed Area</i>	Noise created by the action is audible less than 50% (%TA<50) of the time in less than 40% of the area. Listening area is reduced by less than 50% (change in exposure < 3dBA) in less than 30% of the area. The action exceeds thresholds for speech interference (general conversation, interpretive programs) less than 5% of the day (~36 minutes) in less than 30% of the area.
Major	<i>Natural or Wilderness</i>	Noise created by the action is audible more than 40% (%TA<40) of the time in more than 20% of the area. Listening area is reduced by 50% or more (change in exposure 3dBA) in more than 10% of the area. Alerting distance is reduced by 50% or more (change in exposure > 3dBA) for more than 20% of the day in sensitive areas (e.g. slot canyons, technical climbing areas). The action exceeds thresholds for speech interference (general conversation, interpretive programs, climbing/canyoneering) more than 5% of the day (~36 minutes) in 30% of the area.
	<i>Developed Area</i>	Noise created by the action is audible more than 50% (%TA<50) of the time in more than 40% of the area. Listening area is reduced by 50% or more (change in exposure 3dBA) in more than 30% of the area. The action exceeds thresholds for speech interference (general conversation, interpretive programs) more than 5% of the day (~36 minutes) in 30% of the area.

Cultural Resource Impact Thresholds

Table 3.3. Thresholds for Analysis of Cultural Resource Impacts

Threshold	Definition
<i>Negligible impacts</i>	<ul style="list-style-type: none"> ▪ There are no significant cultural/religious/ethnographic resources to be affected, or; ▪ There is no change in sound as it relates to cultural management objectives.
<i>Low impacts</i>	<ul style="list-style-type: none"> ▪ Significant cultural, religious or ethnographic resources are present, and; ▪ Changes in the ambient sound environment occur, but remain consistent with the cultural setting as provided in management objectives or other plans.
<i>Moderate impacts</i>	<ul style="list-style-type: none"> ▪ Significant cultural, religious or ethnographic resources are present, and; ▪ Human- caused noise is perceived as inappropriate to the cultural, religious or ethnographic setting and the management objectives for the area, and; ▪ Noise impacts are commonly, but not always, audible during times when interpretive programs, religious ceremonies, or cultural appreciation and silent times are being conducted.

Threshold	Definition
<i>High impacts</i>	<ul style="list-style-type: none"><li data-bbox="537 310 1391 369">▪ Cultural, religious or ethnographic resources are important to the purposes and values the park, and;<li data-bbox="537 390 1391 449">▪ Human- caused noise is perceived as inappropriate to the cultural, religious or ethnographic setting and the management objectives for the area, and;<li data-bbox="537 470 1391 527">▪ Noise impacts are frequently audible during times when interpretive programs, religious ceremonies, or cultural appreciation and silent times are being conducted.