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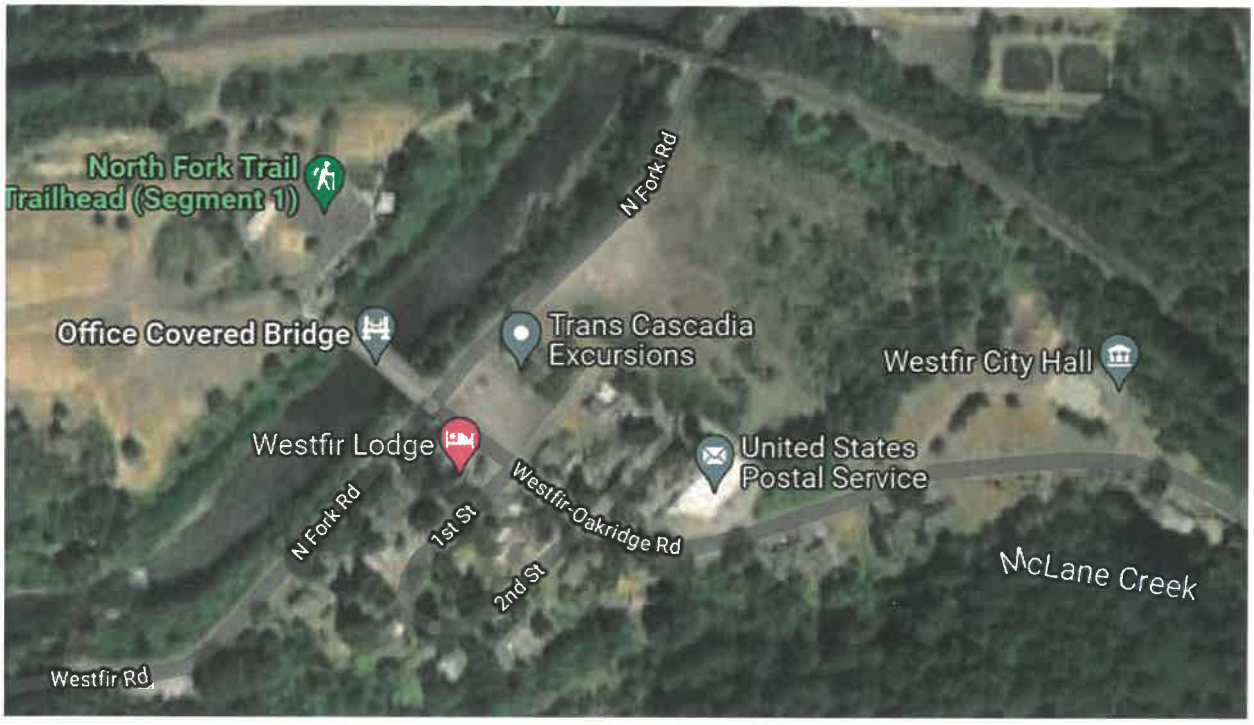
Jan 19, 2021

RE: Community Noise Study for Trans Cascadia Excursions

This report addresses the relationship between a proposed campground site and the surrounding neighborhood, from a noise impact perspective. The campground site is backed up to the railroad tracks and is located as far from the nearby neighborhood as possible. The site development was modified to include sound barriers and other mitigation measures. The result is that the anticipated noise generated in the campground will be mitigated sufficiently so that the existing quality of life will not be adversely degraded.

A) Overview

The area of interest is around the intersection of the Office Bridge, N Fork Rd and West Oak Rd. It also is the entrance to the Aufderheide Scenic Drive. There are homes along 1st and 2nd streets on both sides of West Oak. The concern is for the compatibility of the proposed new campsite with the existing neighborhood. Here we are looking at the sound and noise aspects.



There is a Westfir City Park, North Fork Trail Trailhead, directly across the river with bathrooms, information center, picnic tables, parking lot and a shelter for large gatherings. It is about 500' away from and elevated about 15' above the residential area across the river. The trailhead, activity area and traffic is similar to that planned for the campsite across the river. The distance between the proposed campsite is on the average also about 500' from the neighbors across West Oak Rd.

The Westfir Lodge at the corner of Westfir and West Oak Roads provides lodging, outdoor activity space, food, store and the Cascades Outdoor center, which generally provides similar activities and services as the proposed Trans Cascadia Excursions operation across the street.

There are three groups of houses, the closest group is across West Oak Rd along the ends of 1st and 2nd Streets. The next closest group are those along the far side of West Oak Rd. The third group are those within the U shaped joined end of 1st and 2nd Streets, on the far side of West Oak Rd.

The terrain is a low piece of fairly flat land surrounded by steep rock cliffs to the north and steep wooded hills otherwise. The rock cliff and trees provide an echo type of sound quality to this area. There is a small Post Office to the north of West Oak Rd which still does provide some traffic and load/unload noise. There used to be a market and mail processing center in this same building. Mail semitruck delivery still occurs.

All in all, the activities proposed to be added to this small community by the Trans Cascadia Excursion project are similar to those already existing in the immediate area.

B) Noise Survey

Noise survey was conducted with a calibrated Rion NA-28, top of the line sound meter/data logger/sound analyzer. A wind ball was used although there was no wind. Meter was hand held.

A noise survey was conducted at the East end of Westfir, in the area Southeast of the Office Bridge, 8 to 9 am Tues, Dec 14, 2021. It included homes along 1st and 2nd Streets on the NE side of West Oak Rd, homes along West Oak Rd between the Office Bridge and the old Post Office, the Trans Cascadia Excursions parking lot and the intended camping lot behind.

The background noise level was 40 to 41 dBA and was due to rough water noise emitted from the river both up and down stream of the Office Bridge. This background noise seemed to uniformly be distributed throughout the area. There was no wind or noise from wind in the trees. Two types of noise readings were taken, C weighted and A weighted. A weighted is adjusted for the average hearing efficiency of humans while C weighted is not.

0090 – 45 dBC background noise in the Trans Cascadia Excursions parking lot, flat spectrum
0091 – same location, 73.9 dBC to 76 dBC pickup heading north on West Oak uphill location
0092 - 45 dBC background noise back of post office. somewhat flat spectrum
0093 - 46.5 dBC, 40.2 dBA classic haystack, background noise in campground, river noise

0094 89 dBC – 73 dBA Car door slam at 6 feet fairly flat hay stack
0095 Train engine/horn visible 84 dBC , 78 dBA
0096 Train slightly later, engine/horn still visible same readings 83.6 dBC, 77.6 dBA
0097 Train engine/horn down around the bend, 83.1 dBC or 76.4 dBA haystack shaped
0098 Train cars middle 78.8 dBC 68.6 dBA
0099 Train cars near end 77.4 dBC, flat A spectrum, 62.6 dBA

A highway mail truck and trailer was pulled up around 8:30 am at post office rear door, unloading mail. Changed C to A so I get both C and A weighting. A large pickup truck drove up West Oak Road towards Oakridge. It registered 76 dBC which is about 70 dBA when it was 500 to 600' away. Traffic was not more than 10 vehicles, most all were pickups, during the one hour of testing

A freight train heading north ran on elevated tracks traveled in an arc around the north edge of this area as it made a 90 degree turn over the river. It was about 750' from West Oak Rd and about 430' from the sound meter. The engine/horn section produced 78 dBA, the train cars produced noise in the 62 to 68 dBA range.

C) Site Plan

The site plan for the Trans Cascadia Excursions operation wraps around the close set of houses, located at the north end of 1st and 2nd Streets and bounded to the west by the large wall of the old Post Office. These houses are in the 100 to 200 foot range of the Trans Cascadia Excursions activities.

The noise mitigation plan for this close in house group is to add a sound berm on the northeast side of the houses and a sound fence on the northwest side.

The berm will be 8 feet high, which is enough to cast an acoustic shadow onto the homes and protect these homes from the closeness of the Trans Cascadia Excursions operations and camping.

The Berm will be planted and landscaped. An 8' berm will provide 10 dB attenuation between the nearby homes and the Trans Cascadia Excursions operation. This will reduce the noise from the Trans Cascadia Excursions operation below the noise level across Westfir Rd, which is some 500' distant and more.

The houses located SW across West Oak Rd. are generally 500' from the campground and more. In addition to the distance, there are a number of existing noise mitigating factors already in place and in addition, berms and sound walls will be added.

The Lodge, the berm and houses at the NE end of 1st and 2nd Streets as well as the post office building act as preexisting sound barriers.

Noise Impact Examples:

1) A person yelling at their friend produces about 74 dBA sound level at 3.3'. At 100', this noise is reduced by 20 Log 3.3/100 = -30 dBA. 74 – 30 is 44 dBA, slightly above the background noise floor, without any secondary mitigation. At 500', the shout drops 3.5 dB down to 40 dBA, the same as the background noise level, rendering it essentially just barely audible. The campground is located in a favorable location, as far away as possible from the neighborhood. The distance combined with the background noise floor protects most of the neighbors from intruding noise.

2) As a second example, in a car camp there will be car doors opening and closing. Another test was performed, and the noise was 73 dBA at 6'. At 100' we have 20 Log 6/100 = -24.5 dBA. A hard, large door slam will register 48 dBA at the closest house, or 100'. Because there is a 10 dB berm, this thud will drop down to 38 dBA, again below the background noise level, which was measured at 40 dBA, therefore inaudible.

3) It is easy to imagine the sound of a car stereo playing with the doors open. Sound level 6' from the open door will be about that of a raised voice, 65 dBA. At 100', the level should drop 25 dBA, down to 40 dBA, which is the background noise floor. Hence inaudible.

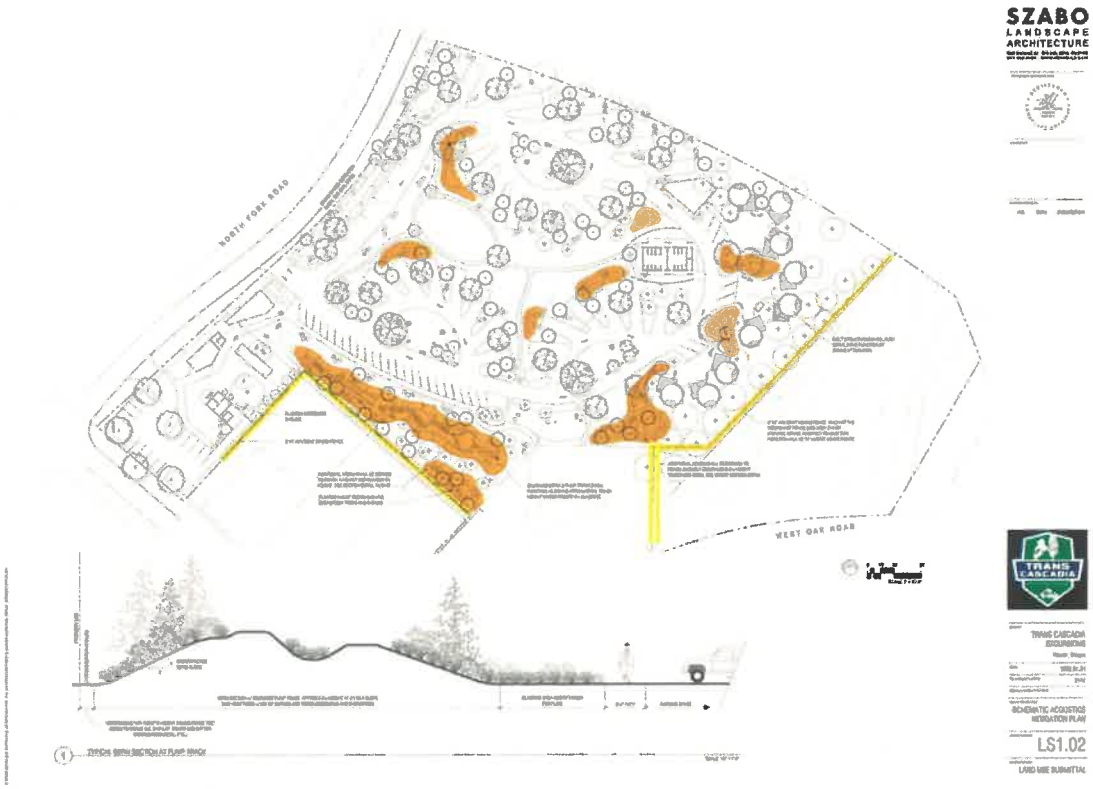
4) The fourth and final example is when a horn goes off in a parking lot. Car horns are about 100 dBA at 3' and what is heard 100' away is 30 dB lower or 70 dBA. Add a 10 dB berm and we are down to 60 dBA, which is the sound level of a just slightly raised normal voice. At 500' distant and with no berm, the horn will register 100 - 44.5 = 55 dBA, which is the loudness of a conversational voice.

What we see with these examples is that for the most part, except a horn honk, the noise from the campsite will be nearly inaudible, to either berms or distance. More specifically, the Lane County noise code, which limits noise crossing residential property lines to not exceed 50 dBA at night (after 10pm) and 60 dBA during the daytime (after 7am), is not expected to be exceeded.

In general, an intruding noise that is as loud as the background noise level is not heard as an intrusion by the listener, it is masked by the background noise. Conversely, an intruding noise that is 30 dB louder than the background noise level is so loud that it is not masked by the background noise and is heard as an intruding noise. The cutoff for this sound masking effect is 10 dB above ambience. In all the examples, the intruding noise is less than 10 dB above the 40 dBA ambience.

D) Noise Mitigation

The revised site plan is shown below. It shows sound berms as oblong orange shapes and sound fencing as yellow highlighted lines. Berms are on the order of 8' high and the sound fence is 8' high.
There are two sections of sound fencing. One L shaped section wraps around the most nearby homes, located at the dead ends of first and second streets, across West Oak Rd as shown here. The other is at the elevated edge of the campground.



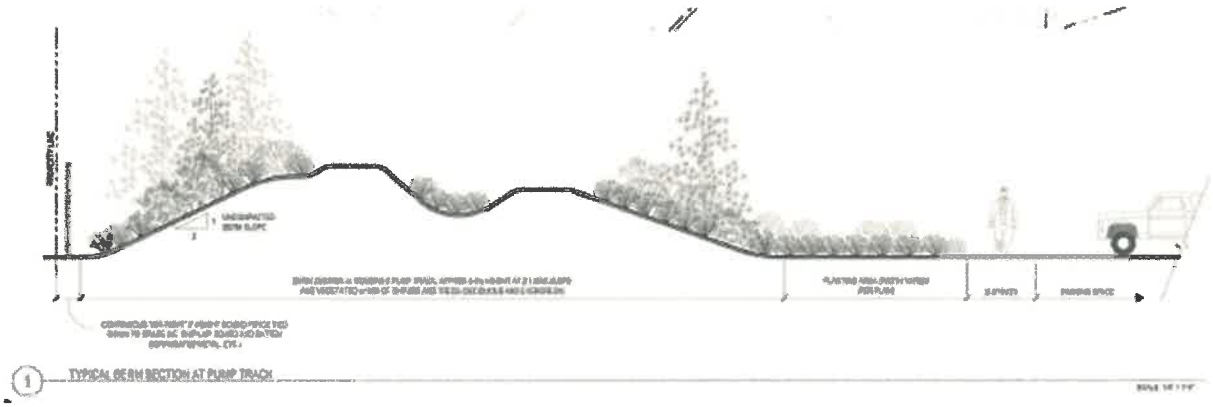
The noise mitigation has been focused on the basics, distance, background noise floor, existing sound barriers and new sound barriers, berms and fences. Additional mitigation has been integrated into the site plan. Berms are intersperced throughout the campgrounds. This will help to retain the feeling of outdoor camping and as well develop a sense of privacy or sonic distance between campsite groups.

The camping spaces will be studded with hillocks or mounds that act as sound deflectors within the camp itself. It will have groups of vehicles and a camp bathhouse which also act as sound deflectors within the camp. Around the SW perimeter of the campsite, in addition to a sound berm will be numerous large 24' diameter geodome lodging cabins which also act to block and scatter sound.

1) One section of this L sound fence blocks noise from the northwest, the café, outdoor eating and visiting areas. The other leg of the L is to block noise from the parking area and the camp sites in general. It is comprised of a sound berm plus a sound fence.

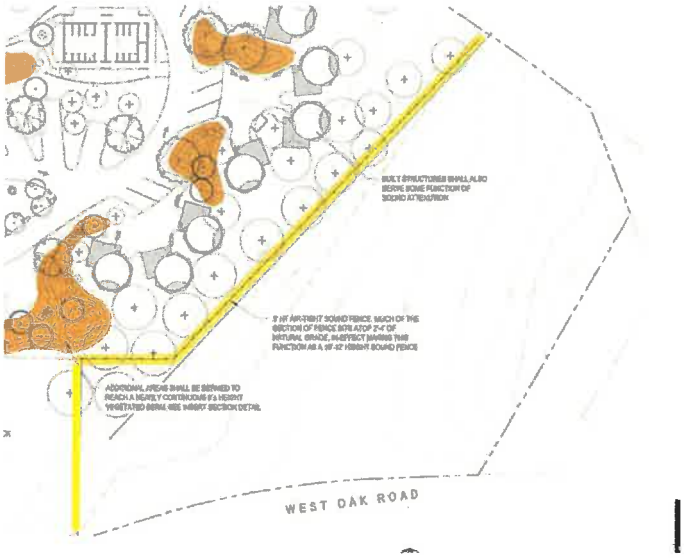
The berm + fence is a two-stage sound barrier. The berm blocks sound by absorbing some of it and scattering the rest upwards into the sky.

A sound fence is located just outside of the berm. It reflects noise from the camping area that passes over the top of the berm and is bending back down. The fence backscatters sound onto the sloped berm surface where it is absorbed or reflected skywards.



On the far side of the sound fence is a combination sound berm/pump track. The pump track will be a bike trail build on the berm. The height of the trail varies but the height of the berm remains constant. The pump track will be located on the far side of the berm. It adds a novel activity space to the campgrounds while retaining the sound barrier effect between the campgrounds and the neighboring homes.

2) The second section of the fence is along the elevated SW edge of the campgrounds. Campground elevation is 1084'. Fence base elevation is 1087 to 1089'. Fence height is an additional 8', up to 1096' elevation.



To illustrate the sound shadow effect of this sound fence. Consider the house and barn located at 47456 West Oak Rd, on a flat area at elevation 1092' and about 50' south of the center of the road. The front of the house is about 130' from the sound fence.

The sound fence rises up to 1096' elevation, which 4' above the ground level of the house at 1092' elevation. The voice of a camper located 120' inside the sound fence is 5' above the ground level, 1084'EL + 5 = 1087' EL, which is 9' below the top of the fence. The camping area is located 250' from the front of this house. The sound shadow cast onto the front of the house is 13' above the ground, and 8' above someone standing near the front of the house.

The top of the sound fence breaks the line of sight between the sound source and sound receiver by 3' which produces a sound barrier effect of about -7 dB. Add this to the attenuation of sound due to distance effect of 250' which is 20 Log 3/250 = -38 dB, the total is -45 dB. A loud sound registering 85 dBA at 3' will be reduced by -45 dB down to 40 dBA, which is the loudness of the background noise level.

E) Overview of Sound Barriers

Two traditional sound barriers have been mentioned, a sound fence and an earthen berm. However, there are other sound barrier options which will provide the same sound barrier effects. Each option has its unique characteristics but as well, each sound barrier serves to block noise between one side to the other.

Standard Sound Fence: The traditional sound fence, wood, metal or concrete reflects sound back towards where the sound comes from. The sound fence needs to weight at least 1 psf and be air-tight, including at the ground. Both sides of the fence are reflective which means each side of the fence reflects sound back towards where it came from. Usually, the line of sight between the sound source and sound receiver needs to be blocked.

Sound Berm: The sound berm is sloped ground and has no vertical sound reflecting surface. Sound is absorbed by the berm, depending on how soft the surface is and reflected skyward depending on how hard the surface is. Either way it retains a look and sound, the feeling of openness. The berm has one drawback, the footprint on the ground is large. Berm width can be shortened up by shoring up the base of the berm with some sort of short wall, anything that can support the lateral force that tries to push

the wall over. A zigzag pattern in the shoring adds the benefit of corners which greatly strengthen the resistance to overturning. Old railroad ties are a common shoring method, staked into the ground. Stacking concrete blocks stacked is another. A shored berm with a short sound fence on top is a popular way to reduce the footprint of the berm.

Hay Bales: Frequently used in noise control projects are haybales. It is low cost and easy to stack and makes an excellent temporary sound wall. It can be covered with the monofilament screen used in greenhouses or a similar geotextile used in road grading to protect the hay from weather, sun and rain. Hay bale sound walls absorb and block sound at the same time. They do have to be stacked tightly together so sound cannot breach the wall through sound tunnels.

Gabion Walls: These are heavy screen cages filled with rock. They are often used to shore up dirt. Although attractive, they only work as sound barriers in the treble or high frequency range. The lower frequency range, the vowel and voice range have long wavelengths and pass right through the air gaps in the wall.

Gravel Berms: Gravel Berms are less expensive in cost compared to dirt berms. Gravel costs less than dirt and is easier to handle. Gravel berm sides can be partially covered with dirt to create planting areas. Gravel berms can have steeper sides than dirt berms, hence a smaller footprint.

Existing Buildings: Existing buildings, particularly their roofs cast large sound shadows into the distance. Although buildings are not usually positioned because of their sound barrier effect, sound sources can be located behind buildings to take advantage of their sound barrier effect.

E) Conclusion

Based on my site visit, noise readings and subsequent work, I expect that adding the Trans Cascadia Excursions project to the empty lots between West Oak Rd and the train tracks will be a reasonable fit into the existing community. Not only should its operation not exceed Lane County noise limits, peak noise events heard at neighboring homes will be well within 10 dB of the sound masking ambient noise floor. This means Trans Cascadia Excursions complies with Westfir's nuisance noise regulation.

The ambient noise floor from the river and as well wind in the trees is fairly raised, creating a sound masking noise floor and making this location well suited to handle the non-industrial noises from a park/camp across the street. In addition, this is not introducing a new and unusual noise as there are already two existing operations of similar noise generating nature, the Westfir Lodge and across the river the Westfir Portal Parking and Trail Head area across the river.

The same noise will sound differently depending on the amount and types of mitigation are present between the noise source and sound receiver. In all cases, the mitigation measures are appropriate to the neighborhood.

1) Close-up direct noise, such as could take place with the nearby neighbors located north of West Oak Rd. They have a clear line of sight to the nearby development which would be bothersome except that the site plan specifies sound berms and fencing to block the close-in noise. Only a few houses, those at the East end of 1st and 2nd Streets are close-up sound receivers. Sound fence and or berms mitigate this aspect of community fit.

2) Distant direct noise, such as those areas across West Oak Rd, including the uphill homes. Here we have the benefit of distance, but still, the perimeter of the site is to be fit with a sound fence and or berm, sufficiently high to block the direct line of sight. Included here are the distributed berms inside the campground. The distance combined with sound fence and berms mitigate this aspect of community fit.

3) Indirect noise, where the line of sight is blocked but the noise is still heard. All the homes across West Oak Rd have this natural setting, tall trees amongst and behind the homes and steep rock walls behind the homes, creates a low level multiply reflected reverberant kind of echo that fills the woods with additional ambience helping to diminish the clarity of distant distinct sounds. This is a unique benefit to the homes across West Oak Rd.

4) Traffic is another factor regarding noise impacts. There are two traffic generating operations on the property of the development. 1) The parking lot in front of the Old Log Scale Shack and 2) Driveways and parking areas withing the campgrounds. Additionally, there is the increase in street traffic. These new noise sources may be noticed at times but because of setback distances and sound barriers, combined with the preexisting ambient noise, they will not become a significant impact.

This location seems well suited to the potential new noise expected to be generated by the Trans Cascadia Excursions development.

Sincerely

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