7/6/2020

Sent via email and UPS

County of Lake
Board of Supervisors
Attn: Carol Huchingson, County Administrative Officer
255 N. Forbes Street
Lakeport, CA 95453
Carol.huchingson@lakecountyca.gov

Re: Guenoc Valley Mixed-Use Planned Development Project Final Environmental Impact Report, SCH No. 2019049134

Dear Supervisors:

These comments are submitted on behalf of the Center for Biological Diversity (the "Center") regarding the Guenoc Valley Mixed-Use Planned Development Project (the "Project"). These comments follow our April 21, 2020 comments on the Draft Environmental Impact Report ("DEIR") for the Project, in which we raised serious concerns that the Project would have significant environmental impacts and identified numerous deficiencies in the DEIR. Unfortunately, instead of taking the opportunity to conduct more rigorous environmental review or revise the Project to reduce its significant impacts, Lake County (the "County") has responded largely by downplaying, obscuring, or denying the deficiencies in its environmental review. Furthermore, in the County's rush to approve the Project, it has robbed the public of adequate time to review the expansive environmental documents associated with the Project. The County should not approve the Project or certify the FEIR until, at a minimum, the County has rectified these deficiencies; otherwise, the County will be in violation of the California Environmental Quality Act ("CEQA"), Public Resources Code § 21000 et seq., and California Code of Regulations, title 14, § 15000 et seq ("CEQA Guidelines").

The Center is a non-profit, public interest environmental organization dedicated to the protection of native species and their habitats through science, policy, and environmental law. The Center has over 1.7 million members and online activists throughout California and the United States. The Center has worked for many years to protect imperiled plants and wildlife, open space, air and water quality, and overall quality of life for people of California, including Lake County.

I. The EIR's Analysis of and Mitigation for the Project's Impacts on Biological Resources is Inadequate

A. The FEIR Fails to Adequately Assess Impacts to Sensitive Habitats and Aquatic Resources and Relies on Insufficient Mitigation Ratios to Address Impacted Resources

The FEIR fails to adequately assess and mitigate impacts to aquatic resources and sensitive habitats and disregards the best available science. The FEIR states that "a set mitigation ratio with monitoring, adaptive management, and minimum success criteria, as presented within the Draft EIR, serves to effectively offset impacts" (FEIR at 3-48), yet the mitigation ratios and steps to ensure effective, ecologically functional mitigation are insufficient. MM 3.4-17 only requires a mitigation ratio of 2:1 for preservation/restoration/enhancement, while the mitigation ratio for created habitat is only 1:1 for aquatic resources. In addition, only lands selected for preservation are to be approved by the County, and for enhanced/restored/created mitigation, the "minimum success criteria" that "Mitigation shall be deemed complete once the qualified biologist has determined that the success of restoration or habitat creation activities meets or exceeds 80 percent" is vague and insufficient. There are no "defined success criteria" for aquatic resources mitigation as the FEIR states (FEIR at 3-48). Defined success criteria are only provided in MM 3.4-15, which also has a low mitigation ratio of 2:1 for preservation/restoration, stating that achieving 75% acreage with the "monitoring biologist [] consider[ing] percent cover, species composition, overall health of plantings, and other indicators when determining success of establishment" (FEIR at 3.4-97). This is only provided for some, not all, of the sensitive habitats, and it hardly constitutes as providing defined success criteria. What species will be included when determining species composition? Native/invasive plants? Vertebrates? Invertebrates? Will presence/absence surveys take into account breeding individuals vs. foraging individuals? How will such data be collected? Will survey protocols follow agency guidelines? What time of day or during what season will surveys be conducted? What are "other indicators" to be used? Will functional hydrology and soil health be considered? The proposed mitigation leaves the reader with more questions than answers regarding whether impacts due to the Project will be avoided, and if impacts are unavoidable, if they will be adequately minimized or mitigated to less than significant.

The FEIR states that "Simply requiring mitigation to occur at high ratios with no scientific basis would not serve to ensure mitigation. Rather, a set mitigation ratio with monitoring, adaptive management, and minimum success criteria, as presented within the Draft EIR, serves to effectively offset impacts." (FEIR at 3-48). This argument misses the point of the Center's comments, and disregards scientific studies that specifically speak to the need for higher mitigation ratios (along with long-term monitoring, identified and measurable success criteria, and adaptive management strategies) to improve chances of adequately mitigating impacts to habitats and species (Sudol and Ambrose 2002; Windmiller and Calhoun 2007; Matthews and Endress 2008; Moilanen et al. 2009; Stein et al. 2018). The FEIR needs to take into account that, due to the proposed Project, habitat loss and species displacement are immediate, while any gains from their mitigation is uncertain. Moilanen et al. (2009) found that "very high offset ratios may be needed to guarantee a robustly fair exchange" and that "considerations of uncertainty, correlated success/failure, and time discounting should be included in the determination of the offset ratio to avoid a significant risk that the exchange is unfavorable for conservation in the long run." The FEIR fails to consider the best available science and adequately assess and

mitigate impacts to aquatic resources and other sensitive habitats.

Given the importance of these heterogenous and varying aquatic resources to numerous native, rare, and special-status animals and plants, connectivity, and overall biodiversity, the FEIR should provide higher mitigation ratios that take the types of mitigation to be implemented into consideration, as not all mitigation is created equal. Preservation of existing habitat where sensitive and/or special-status species are known to occur through avoidance should be the primary focus, as restoration, enhancement, and creation of habitats can have limited success due to the challenges of establishing the appropriate hydrology (Sudol and Ambrose 2002; Windmiller and Calhoun 2007; Matthews and Endress 2008; Stein et al. 2018). For example, riparian/stream habitats are difficult to replace or create because of their complex hydrological, physical, and biotic structure, and it can take many years before an established riparian mitigation site might (or might not) become as ecologically functional as the lost habitat (Sudol and Ambrose 2002; Ambrose et al. 2006; Bronner et al. 2013). Adaptive management, collecting measurable performance standards based on habitat functions to determine mitigation success, and improved documentation strategies are necessary to increase the success rate mitigation for aquatic resources and sensitive habitat types, like riparian mitigation sites (Sudol and Ambrose 2002; Ambrose et al. 2006; Matthews and Endress 2008; Bronner et al. 2013).

Thus, if compensatory mitigation includes enhanced, restored, or created habitats, higher mitigation ratios coupled with extended years of effective monitoring and adaptive management strategies are needed to improve chances of establishing equivalent ecological function as the lost habitat (Sudol and Ambrose 2002; Ambrose et al. 2006; Windmiller and Calhoun 2007; Matthews and Endress 2008; Moilanen et al. 2009; Bronner et al. 2013; Stein et al. 2018). Mitigation ratios of 2:1 for preservation or restoration/enhancement and 1:1 for created habitat with unspecified, measurable success criteria and no requirement to implement adaptive management strategies are insufficient and do not align with current scientific knowledge. Mitigation for aquatic resources (and other sensitive habitats) should be at least 3:1 with in-kind preservation, 5:1 with restoration/enhancement, and 10:1 with created habitat. All mitigation (preservation, restoration/enhancement, creation of habitat of aquatic resources as well as other sensitive natural communities) should be implemented in consultation with local and regional biologists, indigenous groups, and government agencies, and protected in perpetuity, and the mitigation on these lands should include funded long-term monitoring, specified measurable success criteria, and adaptive management strategies. If higher mitigation ratios are not feasible, the FEIR must provide evidence and analysis supporting that conclusion. With one third of America's plant and animal species vulnerable to impacts from human activity and one fifth at risk of extinction (Stein et al 2018), it is crucial that strategies to prevent further degradation and loss of remaining aquatic resources, sensitive habitats, and biodiversity are explicit and scientifically sound. Again, the FEIR fails to adequately assess and mitigate impacts to aquatic resources, and the proposed mitigation is not founded in the best available science.

B. The EIR's Setbacks are Insufficient to Effectively Mitigate Impacts to Aquatic Resources, Including Riparian Corridors (Streams and Associated Upland Habitat), Wetlands, Ponds, and Reservoirs

Riparian ecosystems have long been recognized as biodiversity hotspots performing important ecological functions in a transition zone between freshwater systems and upland habitats. As the Center previously commented, many species that rely on these aquatic habitats also rely on the adjacent upland habitats (*e.g*., riparian areas along streams, and grassland habitat adjacent to wetlands). In fact, 60% of amphibian species, 16% of reptiles, 34% of birds and 12% of mammals in the Pacific Coast ecoregion (which includes Lake County) depend on riparian-stream systems for survival (Kelsey and West 1998). Many other species, including mountain lions and bobcats, often use riparian areas and natural ridgelines as migration corridors or foraging habitat (Dickson et al, 2005; Hilty & Merenlender, 2004; Jennings & Lewison, 2013; Jennings & Zeller, 2017). Additionally, fish rely on healthy upland areas to influence suitable spawning habitat (Lohse et al. 2008), and agricultural encroachment on these habitats and over-aggressive removal of riparian areas have been identified as a major driver of declines in freshwater and anadromous fish as well as California freshwater shrimp (*e.g*., Stillwater Sciences 2002; Lohse et al. 2008; Moyle et al. 2011). Loss of biodiversity due to lack of habitat contributes to ecosystem degradation, which will diminish a multitude of ecosystem services in the long-term.

Yet the FEIR disregards the Center's previous comments that are supported by scientific literature, stating that "While the statements that the commenter makes may be true for a given species within a specific context, they generally do not apply within the context of the Proposed Project and Lake County on the whole." (FEIR at 3-49). This logic is flawed and unsupported. The Project is located in an area identified by scientists as having high terrestrial and riparian permeability and linkage potential (Gray et al. 2018) with heterogeneous habitats associated with aquatic resources (almost 200 acres of riparian stream habitat [if not more] as well as over 400 acres of emergent wetlands, over 650 acres of ponds and reservoirs, over 122 acres of jurisdictional wetlands, and over 10 acres of jurisdictional open waters in the Project area. Dismissing studies that clearly demonstrate that a wide variety of wildlife, including special-status species known or have the potential to occur in the Project area, require large areas of intact upland habitat connected to aquatic resources (*i.e.*, riparian habitat, emergent wetlands, vernal pools, etc.) to survive and sustain healthy populations and ecosystems highlights the FEIR's failure to adequately assess and mitigate impacts to biological resources in the Project area. Setbacks of 20-30 ft from aquatic resources are insufficient to support the entire life cycle and metapopulation dynamics of special-status species like western pond turtles (*Actinemys marmorata*) and foothill yellow-legged frogs (FYLF; *Rana boylii*), both known to occur in and adjacent to the Project area. The FEIR fails to use the best available science, and instead suggests that the numerous studies that report the importance of riparian habitats to biodiversity and the need for adequate connectivity between aquatic resources and upland habitat somehow do not apply to the Project area, even when the studies specifically look at special-status species known to occur in the Project area.

For example, several studies highlighted in the Center's previous comments discuss life history and migration patterns of western pond turtles and FYLF (Twitty et al. 1967; Holland 1994; Semlitsch and Bodie 2003; Bury and Germano 2008; Zaragoza et al. 2015). Western pond turtles are known to nest as far as 1,312 feet from aquatic habitat and can be found overwintering up to 1640 feet from aquatic habitat, as well as migrating over 3,280 feet (1 km) (Holland 1994; Zaragoza et al. 2015), and Bury and Germano (2008) found that "most individuals rapidly depart

basking sites when disturbed by either visual or auditory stimuli of people (e.g., waving an arm, shouting) at distances of over 100 m [(328 feet)].” Adult FYLF have been observed in abandoned rodent burrows and under logs as far as 100 m (328 feet) from streams (Zeiner 1988) and juvenile FYLF have been found up to 600 feet upslope from their natal stream channel (Twitty et al. 1967). Yet the FEIR states that “western pond turtles and foothill yellow-legged frog (both of which are CDFW species of special concern) are more restricted in their ability to move far from streams because of a higher probability of desiccation and lower probability of finding adequate refuge relative to other parts of their range” because “the majority of the perennial and intermittent streams in the Area of Potential Effects have narrow riparian zones because of the well-drained soils and high prevalence of surface rock” (FEIR at 3-50) without providing any information to support their claim. This is conjecture and not founded on any science. Larger setbacks at aquatic resources that take into account connectivity with heterogeneous habitats, especially where special-status species are known to occur, have the potential to occur, or historically occurred, are needed to adequately minimize impacts to the species, populations, and ecosystems. The FEIR fails to adequately assess and mitigate impacts to aquatic resources and associated special-status species.

The FEIR misleadingly states that the federally threatened California red-legged frog (CRLF, *Rana draytonii*) “does not occur on the Guenoc Valley Site and is not documented to occur in Lake County” (FEIR at 3-49). Guenoc Valley and much of Lake County are within the current and historical range of CRLF. In fact, there are several recorded observations of CRLF in Lake County.[1] And although CRLF were not encountered in several potential locations in the Plan area, it is misleading to state that CRLF do not occur there. According to the USFWS 2005 CRLF survey protocol, “Multiple survey visits conducted throughout the survey-year (January through September) increases the likelihood of detecting the various life stages of the CRF. For example, adult frogs are most likely to be detected at night between January 1 and June 30, somewhere in the vicinity of a breeding location, whereas, sub-adults are most easily detected during the day from July 1 through September 30.” (USFWS 2005). But only targeted nighttime amphibian visual encounter surveys were conducted August 14-16, 2018 and May 14-15, 2019, which is insufficient to determine the presence or potential presence of CRLF in or adjacent to the Project area (Appendix BRA1 at 16). The USFWS recommends up to eight surveys within six weeks to detect CRLF, with two day surveys and four night surveys recommended during the breeding season (January 1 – June 30) and one day and one night survey during the non-breeding season, with each survey taking place at least seven days apart. (USFWS 2005). Surveys were not conducted following USFWS guidance and recommendations to optimize chances of CRLF detection. In addition, surveys were conducted at “selected habitats across the Property,” but the locations of the surveys are not provided in the appendix (Appendix BRA1 at 16). To conclude that CRLF “does not occur on the Guenoc Valley Site” (FEIR at 3-49) is an overstatement, as surveys were not optimal, and even if presence was not detected, it could be that they were present, but the surveyors did not see them. The FEIR fails to adequately describe, assess, and mitigate impacts to CRLF and other sensitive species that rely on aquatic resources and associated upland habitat.

[1] Data are available from the MVZ Herp Collection (Arctos) database, the Global Biodiversity Information Facility (GBIF; www.gbif.org), and Amphibiaweb (www.amphibiaweb.org).

Given that CRLF were historically present and are currently potentially present in the County and suitable habitat is present at the Project site, adequate setbacks and connectivity should be implemented. In a study that found radiotracked CRLFs moving up to 2.8 km (~1.7 mi) and a median distance of movement of 150 m (~492 ft) from breeding ponds, researchers aptly state that "maintaining populations of pond-breeding amphibians requires that all essential habitat components be protected; these include (1) breeding habitat, (2) nonbreeding habitat, and (3) migration corridors. In addition, a buffer is needed around all three areas to ensure that outside activities do not degrade any of the three habitat components."(Fellers and Kleeman 2007). Thus, at aquatic resources where CRLF are observed, potentially present, or were historically present, setbacks should at least 500 ft. Ideally, buffers should be even greater to accommodate the furthest dispersers, as larger buffers would allow for increased chances for establishment or re-establishment in unoccupied habitats, as often happens in metapopulation dynamics, or to increase resilience to climate change (Semlitsch and Bodie 2003; Cushman 2006). Again, the FEIR fails to consider the best available science to adequately assess and mitigate impacts to aquatic resources and the rare, sensitive, or special-status species that rely on the aquatic resources and connectivity with upland habitat.

These are just a few examples of how the FEIR inadequately assesses and mitigates impacts to aquatic resources, special-status species, and sensitive habitats. Note that this is not a comprehensive list of inadequacies that need to be addressed for the FEIR to comply with CEQA.

C. The FEIR Fails to Adequately Assess and Mitigate Impacts to Wildlife Movement and Habitat Connectivity

The FEIR states that while the site is "relatively large" and within the Pacific Flyway, "the Proposed Project does not propose modification of waterbodies in such a way that would make them significantly less useful as stopover points for migratory birds" (FEIR at 3-45). However, the FEIR fails to consider that if these heterogeneous habitats, like wetlands, streams, riparian habitats, grasslands, etc., are degraded in and around the Project site, they will no longer be able to support the numerous migratory birds that traverse the Pacific Flyway. As discussed previously, science has shown that 20- to 30-foot setbacks from aquatic resources is insufficient to protect the water quality and biodiversity of these systems. Without healthy ecosystems that support the vegetation and food resources (invertebrates, fish, herps, etc.) that many migratory birds rely on for rest, recovery, and nesting, the habitats in and adjacent to the Project area would no longer provide much needed connectivity for hundreds of millions of birds that traverse the Pacific Flyway throughout the year.

The FEIR goes on to state that designated open space, MM 3.4-17, and 20- to 30-foot setbacks from aquatic resources provide for regional movement while also providing habitat for less mobile species, like western pond turtles and FYLF (FEIR at 3-45). However, as discussed previously, the FEIR fails to consider the best available science, and the low mitigation ratios and minimal setbacks from aquatic resources are insufficient to support special-status animals and plants and overall biodiversity and ecosystem function in the Project area. And although the FEIR provides 1:1 mitigation of removed open space to preserved open space, the mitigation ratio should be higher, especially if the removed open space includes aquatic resources, sensitive

habitats, or habitat that supports or may support special-status species and/or is important to connectivity. And, as mentioned previously, all mitigation (preservation, restoration/enhancement, creation of habitat of aquatic resources as well as other sensitive natural communities), in designated open space or otherwise, should be implemented in consultation with local and regional biologists, indigenous groups, and government agencies. Mitigation lands should be protected in perpetuity, and the mitigation on these lands should include funded long-term monitoring, specified measurable success criteria, and adaptive management strategies. The proposed amendment to the Open Space Preservation Plan should include prioritization of preserving designated open space and avoiding removal, but if development occurs in designated open space then higher mitigation ratios that include long-term monitoring and adaptive management should be required.

The FEIR fails to adequately assess and mitigate impacts to functional connectivity. Although identifying designated open space with a minimum width of 475 ft and proposing 300-foot wide habitat and residential habitat easements to make up the FEIR's proposed wildlife paths through the Project area is a good start towards mitigating impacts to wildlife connectivity, it is insufficient and does not adequately consider the best available science. No movement studies were conducted in the area to determine that animals would actually move through the proposed wildlife paths, and the FEIR fails to consider edge effects of human activities on wildlife, wildlife movement, and habitat connectivity. As mentioned in the Center's previous comments, edge effects of development in and adjacent to open space will likely impact key, wide-ranging predators, such as mountain lions and bobcats (Crooks 2002; Riley et al. 2006; Delaney et al. 2010; Lee et al. 2012; Smith et al. 2015; Vickers et al. 2015; Smith et al. 2017; Wang et al. 2017), as well as smaller species with poor dispersal abilities, such as song birds, small mammals, and herpetofauna (Cushman 2006; Slabbekoorn and Ripmeester 2008; Benítez-López et al. 2010; Kociolek et al. 2011). Negative edge effects from human activity, such as traffic, lighting, noise, domestic pets, pollutants, invasive weeds, and increased fire frequency, have been found to be biologically significant up to 300 meters (~1000 feet) away from anthropogenic features in terrestrial systems (Environmental Law Institute 2003). In addition, the FEIR fails to consider, assess, or mitigate impacts to identified riparian and terrestrial least-cost pathways adjacent to the Project area (FEIR Habitat and Connectivity Assessment Appendix at 19-21). Thus, it is unclear if wildlife would move through the proposed wildlife paths; impacts due to the proposed Project would not be adequately mitigated in areas where the width of the designated open space is 475 ft wide or in 300-foot wide habitat or residential habitat easements, and the Project could have impacts to riparian and terrestrial permeability adjacent to the Project area. Although MM 3.4-19 requires wildlife-friendly fencing in some portions of the Project area and MM 3.4-21 was added to mitigate impacts of domestic cats (FEIR at 3.4-102), it is not enough to minimize impacts of human activities on wildlife movement and habitat connectivity.

The proposed development and roadways will increase traffic and further fragment the landscape, which could affect the diverse animals and plants in the area. For instance, field observations and controlled laboratory experiments have shown that traffic noise can significantly degrade habitat value for migrating songbirds (Ware et al. 2015). Subjects exposed to 55 and 61 dBA (simulated traffic noise) exhibited decreased feeding behavior and duration, as well as increased vigilance behavior (Ware et al. 2015). Such behavioral shifts increase the risk of starvation, thus decreasing survival rates. Another study also highlighted the detrimental

impacts of siting development near areas protected for wildlife. The study noted that "Anthropogenic noise 3 and 10 dB above natural sound levels . . . has documented effects on wildlife species richness, abundance, reproductive success, behavior, and physiology" (Buxton et al. 2017). The study further noted that "there is evidence of impacts across a wide range of species [] regardless of hearing sensitivity, including direct effects on invertebrates that lack ears and indirect effects on plants and entire ecological communities (*e.g.*, reduced seedling recruitment due to altered behavior of seed distributors)" (Buxton et al. 2017). Moreover, human transportation networks and development resulted in high noise exceedances in protected areas (Buxton et al. 2017).

In addition, preliminary results from studies underway by researchers at UC Davis and University of Southern California, as well as those by other researchers, suggest that the light, noise, and other aspects of roads can have negative impacts on wildlife numbers and diversity near the roadways (Shilling 2020; Vickers 2020). The researchers found a significant difference between species richness and species type, with lower richness and fewer species at along roadsides compared to background areas 1 km away from the roads (Shilling 2020). They also found that as traffic noises surpassed 60 dBC, the number of visits by small to large mammals decreased, and most of the species in their study avoid traffic noise (Shilling 2020). It is clear that different species have variable sensitivities to noise and light associated with development and transportation infrastructure; this can lead to changes in species distributions and population health and survival, which can have ecosystem-level impacts (*e.g.*, Suraci et al. 2019). The FEIR fails to adequately assess and mitigate impacts of edge effects on functional connectivity.

Edge effects of human activities have also been documented specifically on mountain lions. One study found that mountain lions are so fearful of humans and noise generated by humans that they will abandon the carcass of a deer and forgo the feeding opportunity just to avoid humans (Smith et al. 2017).[2] The study concluded that even "non-consumptive forms of human disturbance may alter the ecological role of large carnivores by affecting the link between these top predators and their prey" (Smith et al. 2017). In addition, mountain lions have been found to respond fearfully upon hearing human vocalizations, avoiding the area and moving more cautiously when hearing humans (Smith et al. 2017; Suraci et al. 2019). Other studies have demonstrated that mountain lion behavior is impacted when exposed to other evidence of human presence, such as lighting or vehicles/traffic (Wilmers et al. 2013; Smith et al. 2015; Wang et al. 2017). Mountain lions are protected under Prop 117 as a "specially protected species," and although they do not receive California Endangered Species Act (CESA) protections in the Project area, mountain lions in Southern California and along the Central Coast are candidates for CESA listing. This highlights the importance of mountain lions in California ecosystems. As the last remaining wide-ranging top predator in the region, the ability to move through large swaths of interconnected habitat is vital for genetic connectivity and their long-term survival. Impacts to mountain lions in the region could have severe ecological consequences; loss of the ecosystem engineer could have ripple effects on other plant and animal species, potentially leading to a decrease in biodiversity and diminished overall ecosystem function. Many

[2] *See also* Sean Greene, "How a fear of humans affects the lives of California's mountain lions," *Los Angeles Times* (June 27, 2017), available at http://beta.latimes.com/science/sciencenow/la-sci-sn-pumas-human-noise-20170627-story.html.

scavengers, including California condors, kit foxes, raptors, and numerous insects, would lose a reliable food source (Ruth and Elbroch 2014; Barry et al. 2019). Fish, birds, amphibians, reptiles, rare native plants, and butterflies would potentially diminish if this apex predator were lost (Ripple and Beschta 2006; Ripple and Beschta 2008; Ripple et al. 2014). Therefore, new development projects must carefully consider impacts to movement and connectivity for these and other wide-ranging carnivores. The FEIR fails to adequately assess and mitigate impacts to wildlife connectivity.

The FEIR fails to consider the need for corridor redundancy (*i.e*. the availability of alternative pathways for movement). Corridor redundancy is important in regional connectivity plans because it allows for improved functional connectivity and resilience. Compared to a single pathway, multiple connections between habitat patches increase the probability of movement across landscapes by a wider variety of species, and they provide more habitat for low-mobility species while still allowing for their dispersal (Mcrae et al., 2012; Olson & Burnett, 2008; Pinto & Keitt, 2008). In addition, corridor redundancy provides resilience to uncertainty, impacts of climate change, and extreme events, like flooding or wildfires, by providing alternate escape routes or refugia for animals seeking safety (Cushman et al., 2013; Mcrae et al., 2008; Mcrae et al., 2012; Olson & Burnett, 2008; Pinto & Keitt, 2008). Although the FEIR proposes 300-foot wide habitat and residential habitat easements for the proposed wildlife paths, they are insufficient to overcome edge effects for many species' movement, leaving only one constrained north-south pathway through the Project area via the designated open space while east-west movement is almost completely severed.

Corridor redundancy is critical when considering the impacts of climate change on wildlife movement and habitat connectivity. Climate change is increasing stress on species and ecosystems, causing changes in distribution, phenology, physiology, vital rates, genetics, ecosystem structure and processes, and increasing species extinction risk (Warren et al. 2011). A 2016 analysis found that climate-related local extinctions are already widespread and have occurred in hundreds of species, including almost half of the 976 species surveyed (Wiens 2016). A separate study estimated that nearly half of terrestrial non-flying threatened mammals and nearly one-quarter of threatened birds may have already been negatively impacted by climate change in at least part of their distribution (Pacifici et al. 2017). A 2016 meta-analysis reported that climate change is already impacting 82 percent of key ecological processes that form the foundation of healthy ecosystems and on which humans depend for basic needs (Scheffers et al. 2016). Genes are changing, species' physiology and physical features such as body size are changing, species are moving to try to keep pace with suitable climate space, species are shifting their timing of breeding and migration, and entire ecosystems are under stress (Parmesan and Yohe 2003; Root et al. 2003; Parmesan 2006; Chen et al. 2011; Maclean and Wilson 2011; Warren et al. 2011; Cahill et al. 2012). Therefore, functional habitat connectivity is critical for many animals and plants to adapt to climate change. Again, the FEIR failed to use the best available science and adequately assess and mitigate impacts to wildlife movement and functional connectivity.

D. The FEIR Fails to Adequately Assess and Mitigate Impacts to the Western Bumble Bee (*bombus occidentalis occidentalis*), a Candidate Species Under the California Endangered Species Act

The FEIR fails to analyze the Project's potentially significant impacts on the Western bumble bee. The Western bumble bee (*Bombus occidentalis occidentalis*) was listed by the California Fish and Game Commission as a candidate species under CESA in June 2019. Accordingly, the species' status as a candidate requires that it be included among the species analyzed in the FEIR. (FEIR at 3.4-23; Fish & Game Code § 2068.) Yet the FEIR for the Project did not include any evaluation of the proposed Project's impacts on the western bumble bee. Although the species' historical distribution covers the area of the Project site (The Xerces Society for Invertebrate Conservation 2018), the FEIR is entirely silent on the species and fails to include it in the list of special status species considered in the FEIR (FEIR at 3.4-24). Habitat loss, degradation, and modification due to agricultural intensification and urban development and the use of chemical contaminants (*e.g.*, insecticides, herbicides, fungicides) pose a significant threat to the bee's ability to survive and reproduce (The Xerces Society for Invertebrate Conservation 2018), yet this special-status species is not mentioned in the FEIR. Thus, the FEIR fails to adequately describe, assess, and mitigate impacts to the western bumble bee, a candidate species under CESA.

II. The EIR's Analysis of and Mitigation for the Project's Greenhouse Gas Emissions Remains Inadequate

The FEIR's analysis of the proposed Project's GHG emissions fails to correct the numerous deficiencies we identified in our comments on the DEIR and remains inadequate. The FEIR confirms once more that the Project would result in significant amounts of GHG emissions during construction and operation of the Project. (See FEIR p. 3.7-11, Table 3.7-1A [total annual construction emissions of 22,509 MT; p. 3.7-15, Table 3.7-3 total Project operational emissions with mitigation of 30,846 MT annually].) Yet it does not properly analyze or fully mitigate all of the Project's significant GHG impacts. (See Pub. Res. Code § 21002; CEQA Guidelines § 15126.2.) In particular, the EIR makes no real effort to reign in the Project's astounding increase in Vehicle Miles Traveled ("VMT"), the largest contributor by far to the Project's overall GHG emissions. Additionally, its proposed mitigation for the Project's VMT and GHG emissions is vague, improperly deferred, and unenforceable and the EIR fails to consider all feasible mitigation and alternatives to reduce the Project's GHG emissions impacts to less than significant levels.

A. The EIR Fails to Provide Enough Information About its Emissions and Mitigation Calculations to Allow for Informed Decision-making

As we explained in our comments on the DEIR, the document fails to provide readers with information essential to understanding its analysis of the Project's GHG emissions; the County merely dismissed instead of correcting this shortcoming. Although the Response to Comments encourages readers to consult the 24 pages of tables in its Appendix AIR, these tables simply present readers with raw data and no means for interpreting or understanding it. (See DEIR Appendix AIR.) An EIR must "disclose the analytic route the agency traveled from evidence to action." (*California Clean Energy Committee v. City of Woodland* (2014) 225 Cal.App.4th 173, 205 [internal punctuation omitted].) The County's reliance on 24 pages of tables containing numeric inputs for the subsequent several hundred pages of tables that together

constitute the GHG emissions analysis does not adequately apprise the public of how the County calculated the Project's GHG emissions.

Again, as we pointed out in our prior comments, EIR makes the same omission with respect to the purported effectiveness of its proposed mitigation measures. The EIR claims that the mitigation measures it proposes will result in FEIR p. 3.7-14 (Table 3.7-3 claiming that, with mitigation, total project emissions will be reduced by 30% to 30,846 MT annually, down from 44,162 MT annually without mitigation [Table 3.7-2]). Despite our prior concerns, the EIR still fails entirely to disclose how it arrived at these calculations for quantifying the mitigation measures' effectiveness in reducing or avoiding GHG emissions. Mitigation measures' effectiveness and enforceability must be supported by substantial evidence in the record. *Sacramento Old City Assn. v. City Council* (1991) 229 Cal.App.3d 1011, 1027. The County's response to our comments on this issue (the relevant Response to Comment 10-22) is wholly inadequate—it did not address or even acknowledge our concern regarding the lack of evidence to support the County's conclusions about the measures' estimated GHG reductions.

The EIR should be revised to include this information and recirculated so that the public can adequately review and comment on this crucial aspect of the DEIR's GHG analysis.

B. The EIR's Mitigation for the Project's GHG Emissions is Inadequate, Unenforceable, Vague, and/or Improperly Deferred

As we pointed out in our comments on the DEIR, the proposed mitigation for the Project's significant GHG impacts is badly lacking. The County's failure to reduce the Project's GHG emissions to less than significant undermines achievement of the statewide goals for GHG emissions reductions, including the following:

- Assembly Bill 32 (2006) requires statewide greenhouse gas reductions to 1990 levels by 2020 and continued reductions beyond 2020.
- Senate Bill 32 (2016) requires at least a 40 percent reduction in greenhouse gas emissions by 2030.
- Pursuant to Senate Bill 375 (2008), the California Air Resources Board establishes greenhouse gas reduction targets for metropolitan planning organizations (MPOs) to achieve based on land use patterns and transportation systems specified in Regional Transportation Plans and Sustainable Community Strategies. Current targets for the largest metropolitan planning organizations range from 13% to 16% reductions by 2035.
- Executive Order B-30-15 (2015) sets a GHG emissions reduction target of 40 percent below 1990 levels by 2030.
- Executive Order S-3-05 (2005) sets a GHG emissions reduction target of 80 percent below 1990 levels by 2050.
- Executive Order B-16-12 (2012) specifies a GHG emissions reduction target of 80 percent below 1990 levels by 2050 specifically for transportation.
- Senate Bill 391 requires the California Transportation Plan to support 80 percent reduction in GHGs below 1990 levels by 2050.

- The California Air Resources Board Mobile Source Strategy (2016) describes California's strategy for containing air pollutant emissions from vehicles, and quantifies VMT growth compatible with achieving state targets.
- The California Air Resources Board's 2017 Climate Change Scoping Plan Update: The Strategy for Achieving California's 2030 Greenhouse Gas Target describes California's strategy for containing greenhouse gas emissions from vehicles, and quantifies VMT growth compatible with achieving state targets.

As the Center explains below, the County should revise its mitigation for the Project's GHG impacts to ensure that it complies with CEQA, adopt additional feasible mitigation measures to reduce the Project's impacts to less than significant levels, and recirculate a revised EIR for public review and comment on the additional mitigation measures.

i. The EIR's Mitigation for the Project's Mobile Source Emissions Remains Inadequate and the EIR Fails to Adopt All Feasible Mitigation to Reduce or Avoid the Project's Significant Impacts

The Project's remote location and residential/resort uses will result in a significant increase in mobile source emissions. The majority of trips generated by the project will originate far from the project thus giving rise to high total and per capita VMT. (See FEIR at 3.13-2 [showing that a majority of Project-generated trips will involve travel to or from areas located miles from the Project site, with 29% to/from Clearlake or North, and 19% south of Middletown].) Transportation-generated (i.e., "mobile") GHG emissions account for an astounding 24,585 $MTCO_2e$ annually—over 79% of the Project's total mitigated operational emissions of 30,846 $MTCO_2e$ annually. (FEIR at p. 3.7-15, Table 3.7-3) What's more, the FEIR acknowledges that "the Proposed Project would not meet the recommended OPR threshold of a 15 percent reduction in per capita VMT over existing conditions. This would be a significant impact." (FEIR at p. 13.3-28.) In fact, the Projects impacts are much worse—they result in an *increase* in per capita VMT in Lake County from existing conditions, in both the short and the long term. (FEIR at p. 3.13-28, Table 3.13-7.)

As the California Supreme Court has observed: "the Scoping Plan … assumes continued growth and depends on *increased efficiency* and conservation in land use and transportation from all Californians." (*Center for Biological Diversity v. Department of Fish & Wildlife* (2015) 62 Cal.4th 204, 220.) More recently, the Fourth District Court of Appeal strongly affirmed the importance of reducing VMT in order to meet the state's GHG reduction targets, as described in the CARB Scoping Plan. The Court explained:

> [T]he 2017 CARB Scoping Plan . . . is the state's blueprint for meeting GHG emission reduction targets. (*Center for Biological Diversity, supra*, 62 Cal.4th at p. 220.) The Scoping Plan recognizes that in the past, "development patterns have led to sprawling suburban neighborhoods, a vast highway system, growth in automobile ownership, and under-prioritization of infrastructure for public transit and active transportation." The Scoping Plan states, "VMT reductions are necessary to achieve the 2030 target and must be part of any strategy evaluated in this Plan." (Italics added.) The Scoping Plan emphasizes that "California must

> reduce demand for driving" and "lower-VMT future development patterns are essential to achieving public health, equity, economic, and conservation goals."
>
> "Local land use decisions play a particularly critical role in reducing GHG emissions associated with the transportation sector . . . .
>
> "While the State can do more to accelerate and incentivize these local decisions, local actions that reduce VMT are also necessary to meet transportation sector-specific goals and achieve the 2030 target under [Sen. Bill No. 32.] Through developing the Scoping Plan, CARB staff is more convinced than ever that, in addition to achieving GHG reductions from cleaner fuels and vehicles, California must also reduce VMT." (Italics added.)
>
> VMT reduction is an integral part of California's strategy to reach 2030 and 2050 GHG emission reduction targets.

(*Golden Door Props. v. County of San Diego* (June 12, 2020, Nos. D075328, D075478, D075504) ___Cal.App.5th___ [2020 Cal. App. LEXIS 529, at *117-118].)

The 11th annual California Green Innovation Index, which tracks the state's annual progress in reducing GHG emissions found in 2019 that

> [G]iven that transportation is by far the largest-emitting sector—and with most of the emissions coming from on-road light-duty passenger vehicles—the current upward trajectory of VMT and surface transportation GHG emissions [in California] cannot continue if the state is to meet its climate goals.

(Next 10 2019 at p. 31.)[3] As the OPR Technical Advisory states, meeting statewide targets for GHG reductions "will require substantial reductions in existing VMT per capita to curb greenhouse gases." (OPR Technical Advisory 2017, p. 7; see also CARB 2017, p. 75 [Scoping Plan stating that "VMT reductions are necessary to achieve the 2030 [GHG emissions] target."].)

Yet the Project completely disregards the need to *reduce* VMT in order to ensure that the state can meet its statewide GHG reduction targets. Instead it results in a sharp *increase* in daily per capita VMT in Lake County from existing conditions (FEIR at p. 3.13-28, Table 3.13-7), which it acknowledges as a significant impact (FEIR at p. 13.3-28). And the project does not commit to *any reductions in mobile source GHG emissions from mitigation measures.* (FEIR at pp. 3.7-14 to – [Tables 3.7-2 and 3.7-3 showing that "mitigated" and "unmitigated" mobile source GHG emissions *remain exactly the same*].) The County cannot simply abandon its obligation to reduce the Project's greenhouse gas emissions from mobile sources.

The EIR relies on GHG mitigation measure MM 3.7-1, which, with respect to the Project's mobile emissions states:

[3] As of 2011, The transportation sector was the largest single contributor to California GHG emissions, accounting for 37 percent of all emissions; passenger vehicles accounted for almost three quarters of this total. (PPIC 2011.)

Transportation Demand Management Measures
Implement Mitigation Measure 3.13-4 to develop and implement a transportation demand management plan to achieve a reduction in vehicle miles traveled as a result of the Proposed Project. At a minimum these measures will include:
- Dedicate on-site parking for shared vehicles (vanpools/carpools).
- Provide adequate, safe, convenient, and secure on-site bicycle parking and storage in the commercial portion of the project.
- Use of an electric fleet for internal transport vehicles (excluding trucks and other ranch vehicles for on-going agricultural and grazing activities) to the extent feasible (no less than 75 percent), including the golf course.

(FEIR at 3.7-16.) Measure 3.7-1 incorporates by reference traffic mitigation measure MM 3.13-4, which the FEIR claims "would also reduce project GHG emissions by reducing the overall mobile trips generated by the Proposed Project." (FEIR at 3.7-14.) While the County has made some minor wording changes to the text of MM 3.13-4 and included for the first time in the FEIR an administrative draft Transportation Demand Management plan ("TDM")[4], these changes do not remedy the concerns we raised in our DEIR comments that the proposed mitigation is vague, improperly deferred, unenforceable, and the EIR does not demonstrate that it will be effective.

At first blush, measures MM 3.7-1, MM 3.13-4 and the TDM may appear substantive, but a closer examination reveals the measures to be toothless and to fall short of CEQA's standards for mitigation. Examples of such shortcomings in MM 3.13-4 include, but are not limited to:

- *Provide Shuttle Service* – the provision notes that "There are currently no plans for Lake Transit to run buses along Butts Canyon Road near the project site and the nearest bus stops are about six miles away in Middletown. While it is possible Lake Transit might consider adding a stop on Butts Canyon Road in the future to serve project employees, it is our understanding that there is no funding available for it at this time." Yet it does not commit to funding, expanding, or improving transit options that would connect the Project to Middletown and Clearlake. The provision states that "Alternatively, the project could potentially provide a frequent direct weekday shuttle service specifically for employees," but does not require it. Nor does the provision require *any* transit options for Project site residents (as opposed to guests or employees).

[4] In response to our comments on the DEIR, the County belatedly published an Appendix TDM to the FEIR. This document does not allay our prior concerns that the County is impermissibly deferring transportation demand management measures. We note that FEIR Appendix TDM is marked on its first page as a "Confidential Administrative Draft" and watermarked as "DRAFT" on every page—undermining any claim that it is final and binding on the Applicant. Moreover, the EIR's mitigation measures do not require County *approval* of the TDM—only that it be "submitted" by the Applicant, after which the County "shall verify compliance with the plan" though the County apparently has no ability to disapprove an inadequate plan. (FEIR at 3.13-36.) Finally, MM 3.13-4 lists "strategies shall be identified within the TDM plan" but stops conspicuously short of actually *requiring* implementation of those strategies.

- *TDM Coordinator* – The provision states that "Management shall designate a "TDM coordinator" to coordinate, monitor and publicize TDM activities. The effectiveness of providing a TDM Coordinator on auto mode share is uncertain but is generally seen as a supportive measure." While this idea behind this provision is laudable, there is no evidence of its effectiveness at contributing anything toward reducing the Project's GHG emissions.

Similarly, Appendix TDM describes 15 "strategies" to reduce VMT, but does not contain the requisite performance criteria. The language used to describe the other "strategies" is generally vague, aspirational, and lacking in specifics or actual enforceable requirements.

Nor does the administrative draft TDM contain any quantitative target or performance criteria for ensuring that a certain number of VMT reductions are actually achieved. Although the TDM purports to implement a monitoring and reporting program, in the absence of such standards or performance criteria, any such activities are meaningless. The administrative draft TDM states, "The Project sponsor shall adjust the TDM plan based on the monitoring results if they demonstrate that measures in the TDM plan are not achieving the reduction goal." But crucially, *there is no reduction goal*. This vague language is no substitute for concrete performance standards. Furthermore, taken together, MM 3.7-1, 3.13-4, and the administrative draft TDM allow the project applicant in the future to determine the extent it believes it is "feasible" to reduce VMT, with little or no oversight by the County and without standards by which to determine feasibility. This approach violates CEQA's standards for mitigation measures. (*See Golden Door Props. v. County of San Diego* (June 12, 2020, Nos. D075328, D075478, D075504) ___Cal.App.5th___ [2020 Cal. App. LEXIS 529, at *73-*75.)

Feasible mitigation measures for reducing VMT-associated GHG emissions exist that were not considered or evaluated in the EIR. These include, but are not limited to:

- Committing to Transit options. (See OPR Technical Advisory 2017 at 22.) Although MM 3.13-4 states that the Project "could potentially provide a frequent direct weekday shuttle service specifically for employees" it makes no commitment to providing any such service. (FEIR at 3.13-37). The Project should commit to running daily shuttle services to Middletown (and Clearlake) that are available to members of the public, not just employees. The FEIR similarly states that "While it is possible Lake Transit might consider adding a stop on Butts Canyon Road in the future to serve project employees, it is our understanding that there is no funding available for it at this time." (Id.) The Project should commit to funding a Lake Transit stop and service along Butts Canyon Road to serve project employees and residents.
- Committing to a hard limit on the total number of available parking spots on site and committing a fixed minimum ratio (for example, at least one third) of those sites to being restricted to use by rideshare/carpool/EV vehicles. (See OPR Technical Advisory 2017, p. 23; see also CAPCOA 2010 p. 207 [measure 3.3.1 Limit Parking Supply].)
- Committing to other mitigation measures from the OPR Technical Manual (OPR Technical Manual 2017, pp. 22-23), including but not limited to:
    - Incorporating affordable housing into the project, and providing increased onsite workforce housing to reduce employee commuting. (See also CAPCOA 2010 p.

176 [measure 3.1.6 Integrate Affordable and Below Market Rate Housing].) The administrative draft TDM's proposed measure 1.3.1 ("Workforce Housing") is non-committal, stating only that the Project "will provide up to 35 housing units on-site" and "up to 50 housing units offsite."

- Increasing the diversity of non-residential and commercial uses on site to include uses such as grocery stores, daycare, etc., within walking distance from residences within the Project area, which can allow Project residents to find desired handle daily shopping and service needs without leaving the project area. (See CARB 2017 at 76, urging mitigation that uses "community design" to reduce VMT.)

- Offsets as a mitigation measure of last resort (see additional discussion below).

Although the EIR and administrative draft TDM give lip service to a handful of these measures—they do not actually develop them in any detail, impose performance standards, ensure that they are enforceable, or attempt to quantify or otherwise evaluate their effectiveness. The County therefore cannot and does not evaluate their feasibility. The EIR's failure to adopt all feasible mitigation measures to reduce the Project's significant VMT-related GHG emissions violates CEQA. (See Pub. Res. Code § 21002.)

ii. The EIR's Mitigation for the Project's Non-Mobile Source Operational GHG Emissions Remains Inadequate and the EIR Fails to Adopt All Feasible Mitigation to Reduce or Avoid the Project's Significant Impacts

The text changes to MM 3. 7-1's provisions relating to the Project's non-mobile source operational GHG emissions do not remedy the deficiencies we identified in our comments on the DEIR.

Moreover, the Project fails to incorporate—and the EIR fails to consider—all feasible measures that could considerably reduce the Project's significant non mobile source GHG emissions. In particular, the County should consider the use of a legally adequate carbon offset program to offset the Project's unmitigated GHG emissions. Although any offset scheme must be carefully tailored to comply with CEQA's requirements (*see generally Golden Door Props. v. County of San Diego* (June 12, 2020, Nos. D075328, D075478, D075504) ___Cal.App.5th___ [2020 Cal. App. LEXIS 529]), carbon offsets should be considered as a last option for mitigation where no other options are available or feasible. The County appears not to have considered this option or determined whether it is feasible.

C. The Addition of a Transportation Demand Management Plan for the First Time After the Close of the Public Review Period for the Draft EIR Is Significant New Information Requiring Recirculation

The County included the administrative draft Transportation Demand Management Plan for the Project for the first time with its publication of the FEIR. It provided no reason or justification why this document was not disclosed earlier and made available for review with the DEIR so that the public could adequately comment on it. A lead agency is required to recirculate an EIR when significant new information is added to the EIR after the draft EIR is made available for public review. (CEQA Guidelines § 15088.5.) New information includes changes

in the project or environmental setting as well as additional data or other information. (Id.) New information is significant where the EIR is changed in a way that deprives the public of a meaningful opportunity to comment. Here, the TDM is significant new information requiring recirculation and the opportunity for public comment. (*See Spring Valley Lake Association v. City of Victorville* (2016) 248 Cal.App.4th 91, 108 [recirculation required where stormwater management plan was redesigned and revisions analyzed the project's consistency with several general plan air quality policies and implementation measures].)

III. The FEIR Fails to Adequately Assess and Mitigate Impacts to Water Quality and Climate Change Resilience

As mentioned in the Center's previous comments, science has shown that implementing adequate buffers throughout the catchment or watershed in addition to around the reservoir(s) is an effective strategy to keep pollutants and sedimentation out of reservoirs (Norris 1993; Whipple Jr. 1993). Researchers suggest that to reduce sedimentation and pollution in drinking water supplies a minimum 300-foot buffer should be established around reservoirs, and larger buffer zones should be established around upstream channels and tributaries closer to pollution sources of sediment and other pollutants (Nieswand et al. 1990; Norris 1993; Whipple Jr. 1993). Yet the FEIR rejects this information because the Center's recommended setbacks, which are based on scientific studies, are "not based on local research near the Guenoc Valley Site or the wildlife species that may occur there" (FEIR at 3-50). This is dangerous and backwards logic that threatens safe drinking water for communities, basically assuming that the Project area is not similarly subject to physics, chemistry, or hydrogeomorphic processes that have shaped other riparian systems. Scientific evidence suggests that setbacks of 20 to 30 feet will not adequately protect water quality from degrading due to sediment, turbidity, and other types of pollution, such as excessive nutrients (nitrogen and phosphorous) and pesticides. Larger buffer zones at reservoirs and along streams and wetlands upstream of the reservoirs would provide more stream bank stabilization, water quality protection, groundwater recharge, and flood control both locally and throughout the watershed (Nieswand et al. 1990; Norris 1993; Whipple Jr. 1993; Sabater et al. 2000; Lovell and Sullivan 2006). They would also protect communities from impacts due to climate change by buffering them from storms, minimizing impacts of floods, and providing water storage during drought (Environmental Law Institute 2008). Thus, the FEIR should require a minimum 300-foot buffer around reservoirs with a minimum of 200-300-foot setbacks from streams and wetlands, depending on whether the habitat supports, has the potential to support, or historically supported special-status and/or sensitive species, or if it provides important habitat connectivity.

Other studies have shown that land use patterns at the watershed scale are correlated with water quality, carbon sequestration, and the level of species abundance and biodiversity (Pess et al. 2002; Opperman et al. 2005; Lohse et al. 2008; Padilla et al. 2010; Grantham et al. 2012). For example, higher levels of vineyard/agricultural conversion and exurban development within watersheds have been associated with increased fine sediment inputs to streams (Opperman et al. 2005; Lohse et al. 2008), reduced diversity of aquatic macroinvertebrates (Lawrence et al. 2011), reduced abundance and diversity of native fishes (Pess et al. 2002; Lohse et al. 2008), and reduced carbon sequestration (Padilla et al. 2010). Meanwhile, forest cover, which includes woodlands adjacent to aquatic resources, plays a critical role in maintaining important water

resources for clean drinking water and agriculture. Reduced forest/woodland cover has been shown to result in increased runoff (*i.e.*, pollutants such as pesticides and fertilizers flowing into groundwater and surface waterways), erosion, sedimentation, and water temperatures; changes in channel morphology; decreased soil retention and fertility; and decreased terrestrial and aquatic biodiversity (Brown and Krygier 1970; Pess et al. 2002; Dahlgren et al. 2003; Houlahan and Findlay 2004; Opperman et al. 2005; Lohse et al. 2008; Elliot 2010; Lawrence et al. 2011; Moyle et al. 2011; Zhang and Hiscock 2011; Jedlicka et al. 2014). In addition, forests and woodlands are an important carbon sink that can help moderate the impacts of climate change (Padilla et al. 2010; Pan et al. 2011), and some researchers argue that at a global scale, trees are linked to increased precipitation and water availability (Ellison et al., 2012). These studies indicate that land use planning needs to consider impacts at the watershed scale to implement effective environmental protections that actually safeguard important natural resources like water quality and erosion control. Again, by implementing insufficient setbacks of 20-30 ft for aquatic resources and providing insufficient mitigation for oak woodlands and other vegetation and natural communities that stabilize soils, maintain high water quality, and sequester carbon without considering the watershed-level impacts, the FEIR fails to adequately assess and mitigate impacts to aquatic resources, water quality, and climate change resilience.

IV. The FEIR's Water Supply Analysis is Inadequate

The FEIR's water supply analysis fails to clearly demonstrate to the public and decision-makers that there will be sufficient long-term supplies to service the Project. The Project will use surface water rights previously granted for the Project site, but the FEIR and Water Supply Assessment ("WSA") are internally inconsistent in the quantities of surface water available. Furthermore, the FEIR and WSA fail to discuss the viability of long-term appropriations under existing permits in light of climate change's current and future impacts on regional surface water supplies in the Putah creek watershed.

A. The FEIR Fails to Properly Assess the Impacts of Climate Change on the Project's Surface Water Supply

The FEIR fails to adequately consider the impacts of climate change on the availability of increasingly scarce water resources in the western U.S. during the lifespan of the Project. California law requires agencies to discuss and disclose a proposed project's long-term future water supply. (See *Vineyard Area Citizens for Responsible Growth v. City of Rancho Cordova* (2007) 40 Cal.4th 412, 430-432 (hereinafter "*Vineyard*"); Water Code § 10910.) The FEIR finds the Project will have less than a significant impact on water supply related to sufficiency of water supply. (FEIR at 3.14-15.) This finding is based on the WSA, which describes the surface water rights that will provide non-potable water to a significant portion of the Project site. (WSA at 22.) The WSA does not discuss how climate change will the attendant shifts in precipitation regimes will impact the amount of water ***actually available*** under the existing appropriative rights. This shortcoming undermines the accuracy of the water supply analysis, and the finding of no significant impact based thereon.

Significant for the State, as well as the Project area, is climate change's impact on water supply. The Intergovernmental Panel on Climate Change ("IPCC") specifically identified the

American West as vulnerable, warning, "Projected warming in the western mountains by the mid-21st century is very likely to cause large decreases in snowpack, earlier snow melt, more winter rain events, increased peak winter flows and flooding, and reduced summer flows . . . ." (IPCC 2007b.) Recently, researchers found that an increase in atmospheric greenhouse gases has contributed to a "coming crisis in water supply for the western United States. . . ." (Barnett 2008.) Using several climate models and comparing the results, the researchers found that "warmer temperatures accompany" decreases in snow pack and precipitation and the timing of runoff, impacting river flow and water levels. (Barnett 2008.) These researchers concluded with high confidence that up to 60 percent of the "climate related trends of river flow, winter air temperature and snow pack between 1950-1999" are human induced. (Barnett 2008.) This, the researchers wrote, is "not good news for those living in the western United States." (Barnett 2008.)

The California Center on Climate Change has also recognized the problem climate change presents to the state's water supply and predicts that if GHG emissions continue under the business-as-usual scenario, snowpack could decline up to 70-90 percent, affecting winter recreation, water supply and natural ecosystems. (Cayan 2007.) Climate change will affect snowpack and precipitation levels, and California will face significant impacts, as its ecosystems depend upon relatively constant precipitation levels and water resources are already under strain. (Cayan 2007.) The decrease in snowpack in the Sierra Nevada will lead to a decrease in California's already "over-stretched" water supplies. (Cayan 2007.) It could also potentially reduce hydropower and lead to the loss of winter recreation. (Cayan 2007.) All of this means "major changes" in water management and allocation will have to be made. (Cayan 2007.) Thus, climate change may directly affect the ability to supply clean, affordable water to the residents, or change how the Project will utilize water, and it may also impact other activities outside the Project area, such as agriculture or offsite residential use.

B. The FEIR Fails to Demonstrate How Much Surface Water Will Actually be Available at Full Build-out of the Project

The FEIR and WSA base the analysis of surface water supplies on the assumption that the maximum amount that can be appropriated under existing permits will be available throughout the 20-year planning horizon. The future water supplies identified in an EIR "must bear a likelihood of actually proving available; speculative sources and unrealistic allocations ('paper water') are insufficient bases for decision-making under CEQA." (*Vineyard*, 40 Cal.4th at 432.) The discussion of the impacts related to likely future supplies must include an analysis of the "circumstances affecting the likelihood of the water's availability." (*ibid*.) Here, the WSA states that 10,394.5 acre-feet per year ("AFY")[5] are authorized for diversion and storage (WSA at 51), and 7,360 AFY are available to be withdrawn from storage (WSA at 52) in a normal year under current permits. While the WSA contains projections for available non-potable surface supply within the place of use ("POU") in critical dry and multiple dry year scenarios, any decrease due to dry conditions is calculated based on the maximum permitted appropriation amount. (*id*.) The WSA does not clearly demonstrate the historic yearly diversions under the existing permits. Instead, the WSA provides a table accounting for usage and carryover storage

[5] This total amount also includes 560 AFY from riparian rights along Bucksnort creek.

from 2011 to 2018. (WSA at 37.) This table does not illustrate how much water was diverted from the Putah creek watershed in any of those years. Such information would demonstrate how much of the total appropriative rights are actually received, and how those amounts, and the resulting carryover storage, compare to projected demand for non-potable use within the POU. Without accurate accounting of likely future supplies, the supply-demand projections in the WSA (WSA at 57) are unverifiable, rendering the FEIR's conclusions about water supply unsupported by substantial evidence.

The FEIR's analysis of non-potable surface water supplies is further undermined by internal inconsistencies regarding how much water is lost from reservoirs each year due to seepage and evaporation. Factual inconsistencies render the FEIR inadequate as an informational document. (*Vineyard*, 40 Cal.4th at 439 ["Factual inconsistencies and lack of clarity in the FEIR leave the reader—and the decision makers—without substantial evidence for concluding that sufficient water is, in fact, likely to be available …"].) The WSA contains different data regarding how much water was lost from reservoir storage each year due to evaporation and seepage, then uses a projection that is significantly lower than observed rates of loss when calculating available supplies to be withdrawn each year during Project operation. (WSA a 37-39.) The WSA projects normal year supply of 7,360 AFY, which accounts for 1,770 AFY of evaporative losses. (WSA at 39.) But the WSA also notes that reservoir losses were observed to be 2,320 AFY from 2009-2013 and 2,700 AFY for 2014-2018. (WSA at 37.) Further muddying the waters, Table 4-5 demonstrates usage and carryover storage for Project site reservoirs between 2011 and 2018, and the average loss from evaporation and seepage during that period is approximately 2,827 AFY. (WSA at 38.) The WSA doesn't explain how the 1,770 AFY number was calculated, nor does it address how that number is significantly different from the actual losses observed for Project site reservoirs. This lack of clarity is significant, when considering the narrow supply and demand margins for non-potable surface water in the POU during single dry, and multiple dry water years. Specifically, the WSA assessment anticipates a non-potable surplus in the POU of 573 AF in a single dry year, and 973 AF in multiple dry years by 2040. (WSA at 58.) These surplus amounts vanish when accounting for how much evaporative/seepage loss actually occurred on the Project site between 2011 and 2018.[6] The inaccurate accounting of available non-potable surface supplies within the POU leads the WSA to report a surplus in drought years, when in fact, there would be a deficiency under those scenarios when using historic evaporative/seepage losses for reservoirs on the Project site. This undermines the conclusion that sufficient non-potable surface water exists to serve the Project's demand within the POU.

The shortcomings in the WSA's analysis of available non-potable surface supplies within the POU are not rectified by the potential availability of groundwater. As noted above, the EIR must demonstrate how it will supply the Project's water through the 20-year planning horizon, and if there is uncertainty about the availability of supply, alternatives must be discussed and the impacts of their provision disclosed. (See *Vineyard*, 40 Cal.4th at 432.) If the EIR plans to supplement non-potable demand within the POU with groundwater, that amount of groundwater must be quantified and disclosed to the public in the EIR. While the EIR concludes there is

[6] Using actual average evaporative/seepage losses of 2,827 AFY, instead of the unsupported 1,770 AFY projection, the available supplies would be 1,057 AFY less than projected in all water year categories.

sufficient groundwater to the serve the Project's demands, specifically all potable demand and non-potable outside the POU (WSA at 54-55), the amount that will be used is critical in long-term regional supply analysis. As the EIR points out, Lake County is not required to have a Groundwater Sustainability Plan ("GSP") in place under the Sustainable Groundwater Management Act ("SGMA"). (FEIR at 3.9-19.) Nevertheless, the Lake County Groundwater Management Plan ("GMP") seeks to implement "County-wide initiatives to better understand and manage groundwater." (FEIR at 3.9-19.) The County's ability to coordinate groundwater management within the groundwater basin(s) necessitates a clear and accurate description of how much groundwater the Project will use. Unfortunately, the inadequate surface water supply analysis creates uncertainty in the Project's future supplies, and the potential availability of groundwater supplements was not quantified nor assessed in the EIR.

V. The EIR Lacks an Adequate Analysis of the Project's Impacts Relating to Wildfire and Emergency Evacuation

The Center's comments on the DEIR identified numerous inadequacies and shortcomings in the County's analysis of the Project's impacts relating to wildfire and wildfire emergency evacuation. Among other things, the DEIR failed to acknowledge the likelihood that the Project would increase the chance of wildfires while simultaneously impairing evacuation routes for existing residents. Unfortunately, the FEIR's response to comments and minor changes to the EIR and Wildfire Prevention Plan do nothing to remedy these deficiencies. Tellingly, the Planning Commission's staff report for the Project acknowledges (pp. 16-17) that "[i]n 2015, Lake County suffered three separate wildfires that burned approximately 171,000 acres of wild land, forest, and residential property, and resulted in the cumulative loss of 1,329 homes and damage of over 70 commercial properties." As we explained in our previous comments, the extremely high risk of wildfire in the area and the past history of large-scale repeated burnings at the Project site make it especially imperative that the County prepare an EIR that adequately discloses and analyzes the Project's wildfire impacts, and considers mitigation and alternatives to reduce these impacts.

A. The EIR Continues to Ignore and Obscure the Increase in Fire Risk Resulting from the Project

The FEIR remains deficient because it fails to acknowledge or adequately analyze the increased risk of wildfire that results from development and increasing the intensity of use in undeveloped areas subject to wildfire. Indeed, the FEIR continues to downplay or ignore this effect, claiming, once more and without support, that the Project would *reduce* wildfire risk on the Project site. (FEIR at 3.16-10.) This conclusion is patently defective. The County cannot continue to ignore the abundant evidence in the record that locating homes in the wildland urban interface increases the risk of wildfire ignition.

In its comments on the DEIR, the Center submitted extensive evidence to the County, including numerous published, peer-reviewed studies by the nation's preeminent experts on wildfires, of the scientific consensus that housing and human infrastructure in fire-prone wildlands are the main drivers of fire ignitions and structure loss. (See, e.g., Syphard, et al. 2019.) The FEIR's Response to Comments does not address, discuss, or even acknowledge any

of this evidence. Instead, the FEIR's Response to Comments states merely, "The risk of human ignition of wildfires is considered in Impact 3.16-5 and addressed in the Wildfire Prevention Plan (Appendix FIRE of the Draft EIR)." (FEIR at 3-57 [Response O10-27].) But the County's response does not address the Center's comments. Instead of responding to the comment, or even addressing the effect of development in the Wildland Urban Interface on fire ignition risk, the County merely points to its Wildfire Prevention Plan. (FEIR at 3-57 [Response O10-28].) While a project-specific Wildfire Prevention Plan can conceivably reduce a project's wildfire impacts as compared to a hypothetical project without any wildfire prevention measures, the Wildfire Prevention Plan does not address—and the EIR does not disclose—the Project's potential to increase wildfire ignitions *as compared to existing conditions on the Project site*.

The County cannot ignore away the overwhelming evidence that that growth in the wildland-urban interface "often results in more wildfire ignitions, putting more lives and houses at risk." (Radeloff et al. 2018.) Developing housing in locations in California that currently have low or no density—such as the current Project site—dramatically *increases* the number of fires and the amount of area burned. *See* Keeley 2005; *see also* Syphard et al. 2013; Syphard et al. 2007 [stating that ninety-five percent of California's fires are caused by human activity].) Common anthropogenic causes of fire include arson/incendiary, equipment use, debris burning, smoking, vehicles, fireworks, electricity, and outdoor cooking. Additionally, structure fires can spread and initiate wildland fires.[7]

Drs. Alexandra Syphard and Jon Keeley, wildfire ecology experts who have been studying California wildfires and the relationship between wildfire and human activity for decades and have published hundreds of studies on the topic collectively, reiterate in an April 20, 2020 email that 95% of fires in California have been caused by humans, and when ignitions align with severe weather conditions, impacts are the most severe. (Syphard 2020.) They also state "as humans move farther east and into wildlands the likelihood of ignitions moving into those areas also increases." (Id.) There is insurmountable evidence from numerous studies which find that placing more sprawl development in fire-prone landscapes increases wildfire risk. The FEIR fails to consider the available science to adequately assess and mitigate the increase in wildfire risk due to the Project.

As one California court recently put it when finding the County of San Diego's EIR for a residential development project inadequate on these very grounds:

> [T]here is no discussion in the EIR of whether or how adding 1400 new residents into the area will affect the likelihood of wildfires. Adding this many residents into the Harmony Grove Project area is bound to affect the likelihood of fire given that, according to one report, 95% of modern wildfires in California are started by people. . . .The EIR should have addressed the issue. Although the EIR discusses

[7] In addition to the human-ignited 2015 Valley Fire, which we discussed in our comments on the DEIR, Lake County's 2016 Clayton Fire, which burned nearly 4,000 acres and destroyed 300 structures, was also human-ignited, according to Cal Fire. (CAL FIRE 2016.)

> what will be done to deal with wildfires, it does not address how adding new residents will affect the potential for wildfires to start.

(*Elfin Forest Harmony Grove Town Council v. County of San Diego* San Diego Sup. Ct. Case No. 37-2018-00042927-CU-TT-CTL, minute order dated Feb. 20, 2020 [included as reference].) Similarly here the EIR fails to address how adding up to 4,000 new residents to this demonstrably wildfire-prone location will affect the potential for wildfires to start.

Because it fails to acknowledge the significant wildfire impacts from increased risk of human ignition as a result of the Project, the EIR also fatally fails to mitigate them or consider alternatives to the Project that would reduce these impacts.

B. The EIR's Mitigation for the Project's Wildfire Impacts is Inadequate

As with the DEIR, the FEIR proposes only a single mitigation measure—MM 3.16-2—to reduce the Project's operational wildfire impacts (a single additional measure purports to mitigate all wildfire impacts from Project construction). (DEIR at 3.16-15 to -16.) As the Center previously commented:

> The [EIR] relies on MM 3.16-2 ("Post Wildfire Emergency Response") as the sole mitigation measure to reduce Impacts 3.16-4 and 3.16-5, which involve exposure of people and structures to wildfire. Yet, the measure is toothless and virtually meaningless; it defers preparation of the plan to an uncertain date, contains no standards to guide its preparation, is not enforceable, and does not include any concrete measures that can be shown to actually reduce wildfire impacts. In short, it fails to comply with *any* of CEQA's requirements for mitigation in an EIR.

The County did not respond to the Center's comments about the inadequacy of MM 3.16-2, or the untenability of relying on measure provides for the future preparation of a *post-wildfire* impacts study to reduce the risk of exposure from wildfires. Nor did the County make any attempt to defend MM 3.16-2's adequacy. Instead, the County apparently disclaims it, stating "No mitigation is identified because the Wildfire Prevention Plan adequately reduces the impact." (FEIR RTC, Response O10-30 [stating also, "Mitigation Measures 3.16-1 and 3.6-2 . . . alone would not be adequate, as the commenter notes."].) It then deflects to the Wildfire Prevention Plan (which, for the reasons described below is inadequate). The County cannot ignore the shortcomings in its mitigation measure MM 3.16-2—upon which the EIR relies to find that the Project's wildfire impacts would be less than significant—simply by pointing to *other* mitigation in the EIR.

i. The EIR Fails to Demonstrate That its Wildfire Prevention Plan Will "Reduce Wildfire Risks" to Less Than Significant

Like the DEIR, the FEIR continues to rely on a revised Wildfire Prevention Plan to "reduce risks in the area." (FEIR at 3.16-10.) The revised plan is included as the FEIR's Appendix FIRE. In our comments on the DEIR, we pointed out the Wildfire Prevention Plan's numerous flaws including a lack of evidence showing that its mitigation measures would be

effective; its vague, ill-defined, or improperly deferred measures; and the fact that most of its measures are not enforceable. In response, the plan was revised such that its property boundary fire breaks around homes will ostensibly be required prior to home construction and to make external sprinklers a requirement for some structures.

While commendable, these changes do not remedy the Wildfire Protection Plan's shortcomings. For example, the irrigated vineyards and grazing that make up two of the Wildfire Prevention Plan's three wildfire "prevention strategies" remain vague, ill-defined, and lack enforcement mechanisms or meaningful performance criteria to evaluate their effectiveness. (FEIR Appendix FIRE at p. 15.) And there are still no assurances that many of the measures will actually be implemented. For example, a substantial portion of the plan's projected irrigated "fire breaks" which it relies on to "reduc[e] the spread of wildfires throughout the site" are only "potential" vineyards. (FEIR Appendix FIRE at pp. 19, 2 [identifying "potential irrigated vineyards fire breaks" that will be leased and managed by third parties].)

The Wildfire Prevention Plan is also vague and aspirational at the level of individual residential units. We identified this shortcoming in our DEIR comments, pointing out for example that the plan states only that: "If a wildfire occurs, it poses a considerable risk to residential homes and their occupants. Homeowners *will be advised* to implement various wildfire prevention strategies." (FEIR Appendix FIRE at p. 23 [unchanged from the draft included with the DEIR].) The document then goes on to suggest "various [landscaping] strategies [that] can reduce wildfire risk where establishing a new landscape design." (*Id.* at p. 25.) Finally, the document notes that "residential buildings will abide by" state building codes (*id.* at p. 28) and suggests "interior strategies," such as smoke detectors, for reducing fire risk (*id.* at p. 29). But as Syphard and Keely explain, new construction built to state building codes "is not a panacea" and "MANY of the houses destroyed [in wildfires in California between 2013 and 2018] were newly built." (Syphard 2020.)

In response to the Center's concerns about the enforceability of measures to reduce wildfire risk, the FEIR claims that the mitigation measures imposed in the Wildfire Prevention Plan are enforceable because "Implementation of the Wildfire Prevention Plan (Revised Appendix FIRE of the Final EIR) will be made a condition of project approval, and therefore will be enforceable by the County." (FEIR RTC at 3-57.) First, this appears to be incorrect; the draft Conditions of Approval document published as Exhibit 15 to the Planning Commission's Staff Report for the Project is entirely silent as to the Wildfire Prevention Plan. Second, even if the Conditions of Approval did require "implementation" of the Wildfire Prevention Plan, the plan's measures themselves are largely optional or advisory and use aspirational, not mandatory, language.[8] (See FEIR Appendix FIRE at p. 28 [listing a "selection of strategies to prevent fires" none of which, except for exterior sprinklers, are required to be implemented by homeowners].) The EIR's failure to include enforceable, concrete mitigation with measurable performance standards violates CEQA. (*City of Santee v. Cnty. of San Diego* (1989) 214 Cal.App.3d 1438, 1454-55.)

[8] As we mentioned in our comments on the DEIR, oversight of the [Wildfire Prevention Plan's] management, operations, and enforcement will be in the hands and at the discretion of the future Homeowner's Association; this remains true of the revised Wildfire Prevention Plan (FEIR Appendix FIRE at p. 3), and the FEIR's Response to Comments did not address this comment.

Moreover, as the Center explained in its comments on the DEIR, the Wildfire Prevention Plan contains no data or analysis to support the EIR's conclusions that implementing the plan will reduce wildfire risk in any meaningful way. Instead, it provides only vague discussions of the measures that it claims can ameliorate wildfire risk, without making any attempt to quantify these assertions or support them with evidence. (The problem is compounded by the lack of any modeling of current or post-project wildfire behavior on the Project site, described in more detail below.) The FEIR makes no attempt to rectify this shortcoming or supply the missing evidence. Bare conclusions, even if true, are insufficient to fulfill the informational purpose of an EIR. (*Kings County Farm Bureau v. City of Hanford* (1990) 221 Cal.App.3d 692, 736.) The EIR's error is only compounded by the Wildfire Prevention Plan's failure to address or acknowledge the increase in wildfire risk that will result from the Project's increased potential for human ignitions.

C. The EIR Fails to Analyze the Impact to Biological Resources from Increased Fire Risk Resulting from the Project

The FEIR fails to account for the impact to biological resources from increased fire risk from the Project. As the Center pointed out in its comments on the DEIR, wildfires can be disastrous for plant and animal life. If native habitat fire regimes are disrupted, the habitats they provide can become degraded and when fires occur too frequently, type conversion occurs and the native shrublands are replaced by non-native grasses and forbs that burn more frequently and more easily, ultimately eliminating native habitats and biodiversity while increasing fire threat over time. The FEIR completely ignores the evidence submitted by the Center, including numerous peer-reviewed journal articles, that demonstrates the harms to wildlife, habitat, and connectivity from wildfires.

Instead, in its Response to Comments, the FEIR states that "Effects of changes in wildfire frequency and intensity on biological resources, including habitat, are acknowledged in the discussion of effects related to climate change on page 3.7-3 of the Draft EIR." (FEIR RTC at 3-57 [Response O10-29].) It goes on to claim that because the EIR finds "the Proposed Project would not result in significant impacts associated with wildfire ignition, additional discussion regarding the indirect consequences of wildfire on biological habitats is not warranted." (*Id*.) But merely acknowledging that climate change will likely result in wildfire frequency and intensity and stating that it may have an effect on biological resources is not a substitute for evaluating the impact that the Project's increased risk of wildfire ignitions will have on wildlife and habitat. The EIR should be revised to include this analysis and recirculated.

D. The EIR's Description of Existing Wildfire Conditions on the Project Site is Inadequate

The Wildfire Prevention Plan and EIR fail to adequately describe the existing wildfire conditions on the Project site. It is standard practice when preparing an EIR for a residential development project of this size and scope for experts to use modeling software, such as the industry-standard FlamMap, BehavePlus, or similar programs, to provide fire behavior modeling for the Project site. The analysis typically includes descriptions of the Project's site's topography, fuel loads, and wind patterns, and uses those inputs to anticipate wildfire conditions under various scenarios. For example, the Wildfire Protection Plan for the 2,135-home, 1,985-

acre Newland Sierra housing development in San Diego County, used both FlamMap and BehavePlus to estimate fire spread rate, flame length, and ember "spotting" distance. (Dudek 2018a. at p. 35; see also Dudek 2018b. [Fire Protection Plan for Otay Village 14 residential development in San Diego County, using BehavePlus modeling])[9]

In sharp contrast, the FEIR's Wildfire Prevention Plan is strikingly devoid of detail. Although it contains generalized descriptions of the site's vegetation, wind patterns and topography (FEIR Appendix FIRE at pp. 10-14), *it makes no attempt to use this information to model likely fire conditions on the project site*. This is industry standard, critical information and, again, frequently and typically performed by agencies conducting environmental review for housing developments of this size and scope. The County should withhold approval of the project until it performs this critical analysis—including fire spread rates, fire direction, flame-length, and ember "spotting" distance under various scenarios on the Project site—and discloses it to the public in a recirculated EIR. The County has no excuse for failing to supply this analysis.

E. The EIR Fails to Analyze the Project's Impacts to Community Safety During a Wildfire Evacuation

In response to the Center's request that the County prepare a project-specific wildfire evacuation analysis and plan that addresses the Project's impacts on wildfire evacuation safety and times for Project residents and existing nearby residents, the County merely brushed off the Center's concerns, pointing again to the Wildfire Prevention Plan. However, that plan is *entirely silent* on the issue of evacuation and evacuation routes in the event of a wildfire. A mere four pages of the Wildfire Prevention Plan (consisting mostly of graphics) are devoted to "Wildfire Emergency Response," but these four pages focus entirely on fire suppression and response activities and *do not address resident evacuation at all*. (FEIR Appendix FIRE at 31-35.) We remain deeply concerned that the EIR makes no effort to calculate or disclose how adding a permanent population of 4,000 residents, plus additional thousands of visitors, will affect evacuation times and effectiveness for *new and existing residents* in, and in the vicinity of, the Project site.

As Dr. Thomas Cova is a leading expert on environmental hazards, transportation, and geographic information systems with a particular focus on wildfire evacuation planning, analysis, and modeling, whose work has been cited in EIRs for large scale residential development projects in California. Dr. Cova reviewed the FEIR for the Project (including Appendix FIRE) and provided comments in its evacuation analysis in a report attached as Exhibit 1 ("Cova Report"). As the Cova Report explains:

> Although the County is correct that there are numerous variables that inform estimates of evacuation times, this does not justify the decision to not perform an evacuation analysis. Project-specific evacuation analysis and modeling is not only

[9] The Center provides this documentation only to demonstrate that performing this type of analysis of fire conditions is not only possible—it is typical. The Center does not contend that this document's analysis is accurate or adequate. The Newland Sierra project was rejected by voter referendum in March 2020, in large part due to public concerns over fire safety.

> possible, agencies frequently perform it, especially for largescale residential and mixed-use development projects similar to the Guenoc Valley project.

(Exhibit 1 at 3 [stating also that "it is critical that the County evaluate lead time and evacuation time for the Guenoc Valley project under a range of likely scenarios."].)

Notwithstanding the EIR's failure to analyze the Project's impacts to community safety in the event of a wildfire, it is clear that the impacts will be significant. (Exhibit 1 at pp. 3-4.) As expert Dr. Cova explained, "there are numerous possible wildfire scenarios in this area under which emergency managers and evacuees would have less than the time it would take to evacuate the Guenoc Valley site" and "there is strong evidence that evacuation times could exceed lead times for the project, which could pose a serious threat to public safety." (*Id*. at pp. 4-5.) This is compounded by the fact that the Project site's evacuees must all travel through the bottleneck of Butts Canyon Rd., after leaving the Project site, providing "very limited directional egress for a community of this size given the wide range of locations and directions that a wildfire might approach the project ." (Exhibit 1 at p. 2.) It is unconscionable that despite this evidence of significant impacts to public safety if the Project is built, the FEIR does not disclose the effect on on evacuation times from adding thousands of additional residents to the Project area.

Furthermore, the FEIR's Responses to Comments failed to squarely address the concerns the Center raised regarding wildfires and community safety. Instead, the Response to Comments side-stepped or ignored our comments. In particular, in our comments on the DEIR we asked (underlined):

<u>What are the pre- and post-Project expected evacuation times for residents (both Project residents and nearby affected existing residents) fleeing wildfire in the vicinity of the Project site?</u> The County responded by stating that "While the County has performed extensive planning for wildfire safety and evacuation, it has not projected evacuation times, due to the number of variables." (FEIR RTC O20-31.) The fact that there are a "number of variables" does not excuse the County from performing this critical analysis. As the Cova Report explained, lead agencies frequently undertake this type of analysis for large scale residential development projects. For example, the EIR for the 2,135-home, 1,985-acre Newland Sierra housing development in San Diego County included a project-specific evacuation plan that, *inter alia*, estimated the total number of vehicles on the project site, estimated the time required to evacuate everyone from the project site, and estimated the roadway capacity in the event of an evacuation. (Dudek 2017.)[10] The County cannot simply throw up its hands and declare that this routine analysis is not possible here. The public has a right to know how the Project will affect evacuation times for Project residents and existing residents in the vicinity.

<u>What will the Level of Service be for emergency egress routes from the Project vicinity in the event a wildfire-driven evacuation becomes necessary?</u> The County's response stated that the Level of Service "would not be likely to be relevant in a rural area during a wildfire emergency,

[10] Again, the Center provides this document only to demonstrate that this performing this type of project-specific evacuation analysis is both possible and typical. The Center does not contend that this document's analysis is accurate or adequate.

as shown on these tables, levels of service at project intersections on evacuation routes would generally be acceptable." (FEIR RTC O20-31.) This is patently incorrect. The tables referenced by the County's response indicate that the intersection at Butts Canyon Rd. and Hwy 29 will drop from current peak-hour levels to an "F" rated[11] Level of Service, with 50-minute delays. Given that Butts Canyon Rd. is the *only* egress road for the Project, in the event of a wildfire evacuation requiring project residents (and other nearby residents using Butts Canyon Rd. east of Hwy 29) to evacuate westward, several thousand residents will need to pass through this intersection. If such an evacuation event were to occur during peak-hour times, 50 additional minutes' worth of delay at this intersection would have a significant impact on evacuee safety. The EIR does not disclose this impact or attempt to mitigate it.

What, if any, alternative evacuation routes will be available for residents and nearby community members in the event that Project-generated evacuation traffic makes Butts Canyon Rd. and/or Hwy 29 or 175 impassable? The County's response provides a link to the Lake County Evacuation Map (which shows no alternative evacuation routes for the Project site), and states, "[t]his map shows all of the existing and potential evacuation routes serving the county and the project site." In so doing, the County entirely sidesteps the question and—like the EIR—fails to disclose that there is no alternative evacuation route in the event that Butts Canyon Rd. becomes impassable due to gridlock, vehicle collisions, being overtaken by wildfire, or other reasons.[12] As the Cova Report explains: "[I]n the event of a wildfire, *all evacuation traffic from the project site must flow through Butts Canyon Road, a two lane rural highway*. This is a significant bottleneck and there are no alternative evacuation routes in the event that Butts Canyon Road becomes impassable." (Cova Report at 2 [emphasis in original].) Accordingly, the County has failed in its obligation to consider alternatives to the Project to mitigate the Project's significant impacts community safety.

What effect will resident evacuation on Butts Canyon Rd. and/or Hwy 29 or 175 have on the ability and timing for first responders who are responding to wildfire in the vicinity of the Project? The County simply stated: "evacuation in the event of a wildfire is managed by the Lake County Sheriff's Department in coordination with other emergency responders through the Emergency Services agency." This statement of jurisdictional responsibility does not even attempt to answer the Center's question about the *impact* that traffic from the Project site will have on response times for first responders attempting to provide fire suppression or medical assistance.

Finally, in response to our request for project specific analysis, the County's Response to Comments refers readers to a hyperlink to a webpage with the Lake County Community Wildfire Prevention Plan. (FEIR RTC at 3-59.) But as we explained in our previous comments, this plan was prepared in August 2009, prior to the Project, and does not anticipate or address the Project in any way nor account for the thousands of additional evacuees and vehicles *from this Project* that will flood the region in the event of a wildfire in the vicinity of the Project. It does not and cannot substitute for the project-specific analysis that CEQA requires. As with the EIR found

[11] An "F" rated Level of Service means that the intersection suffers from "extreme congestion, with very high delays and long queues unacceptable to most drivers." (FEIR at 3.13-12 [Table 3.13-3].)

[12] As the Camp Fire and Tubbs Fire recently demonstrated, vehicle-clogged roadways overtaken by fire in an evacuation is an especially dangerous scenario. (Arthur 2019, Diskin 2019.)

deficient in *California Clean Energy Commission v. County of Placer* (Dec. 22, 2015, No. C072680) ___Cal.App.5th___ [2015 Cal. App. Unpub. LEXIS 9360, at *1, *78] the FEIR still says "nothing about the impact of the increased population density created by the Project on emergency evacuations in the event a wildfire does occur, nothing about the effect of such evacuations on access for emergency responders and suggested no mitigation measures to address any such concerns."

The public—including future residents of the Project, and existing residents nearby who will be relying on Butts Canyon Rd. for evacuation—have a right to know the full extent of the Project's impacts on wildfire evacuation. The County's failure to analyze or disclose these impacts prejudicially impedes informed decision-making and informed public participation. (*See Sierra Club v. County of Fresno*, (2018) 6 Cal.5th 502, 515.)

F. The EIR Fails to Adequately Evaluate the Project's Cumulative Wildfire Impacts

As we pointed out in our comments on the DEIR, the EIR provides only a single, conclusory paragraph dismissing cumulative wildfire impacts with virtually no analysis. The FEIR acknowledges that "Development of these [other planned] projects [in the near vicinity] would introduce new people and infrastructure to the area. Increased development could potentially add more opportunities for igniting fires, more fuel, and make emergency response operations more complex." (FEIR at 3.16-15.) Then, it concludes, without further analysis and in reliance on its own Wildfire Prevention Plan and two mitigation measures that cumulative wildfire impacts from the Project will be less than significant. (Id.) The FEIR's Response to Comments essentially concedes that its cumulative analysis adds nothing to its analysis of the Project's individual. Quoting the FEIR, the Response to Comments states, "[b]ecause of the discussed factors, the Proposed Project in combination with future projects in the region will not create a significant impact." (FEIR RTC Response O10-32.) But the "discussed factors" is merely a reference to the EIR's analysis of the Project's individual impacts. Merely mentioning two other projects in the vicinity and concluding that there can be no cumulative wildfire impacts is no substitute for the analysis that CEQA and the CEQA guidelines require. The EIR should be revised and recirculated to correct this deficiency.

VI. Conclusion

Thank you for the opportunity to submit comments on the Final Environmental Impact Report for the Guenoc Valley Mixed-Use Planned Development Project. The Center urges the Board not to approve this Project, and at the very least to delay its consideration of the Project until the public has had adequate time to review and comment on the voluminous FEIR and other documents.

Given the possibility that the Center will be required to pursue legal remedies in order to ensure that the County complies with its legal obligations including those arising under CEQA, we would like to remind the County of its duty to maintain and preserve all documents and communications that may constitute part of the "administrative record" of this proceeding. The administrative record encompasses any and all documents and communications that relate to any and all actions taken by the County with respect to the Project, and includes "pretty much

everything that ever came near a proposed [project] or [] the agency's compliance with CEQA . . . ." (*County of Orange v. Superior Court* (2003) 113 Cal.App.4th 1, 8.) The administrative record further includes all correspondence, emails, and text messages sent to or received by the County's representatives or employees, that relate to the Project, including any correspondence, emails, and text messages sent between the County's representatives or employees and the Applicant's representatives or employees. Maintenance and preservation of the administrative record requires that, *inter alia*, the County (1) suspend all data destruction policies; and (2) preserve all relevant hardware unless an exact replica of each file is made.

Please do not hesitate to contact the Center with any questions at the number or email listed below.

Sincerely,

Ross Middlemiss
Staff Attorney
Center for Biological Diversity
1212 Broadway, Suite #800
Oakland, CA 94612
Tel: (510) 844-7100
rmiddlemiss@biologicaldiversity.org

cc:

Supervisor Moke Simon – moke.simon@lakecountyca.gov

Supervisor Bruno Sabatier – Bruno.sabatier@lakecountyca.gov

Supervisor Eddie Crandell – eddie.crandell@lakecountyca.gov

Supervisor Tina Scott – tina.scott@lakecountyca.gov

Supervisor Rob Brown – rob.brown@lakecountyca.gov

Principal Planner Mark Roberts – mark.robers@lakecountyca.gov

References

Ambrose, R. F., Callaway, J. C., & Lee, S. F. (2006). *An evaluation of compensatory mitigation projects permitted under Clean Water Act Section 401 by the Los Angeles Regional Quality Control Board, 1991-2002*. *California State Water Resources Control Board*. Los Angeles, CA.

Arthur, D. (2019, May 2). Fleeing Fire Is Common In California. Redding Record Searchlight. Available at: https://www.redding.com/in-depth/news/2019/04/25/california-wildfire-evacuation-plans-not-required/3304823002/.

Barnett et al., "Human-Induced Changes in the Hydrology of the Western United States," Science, Jan. 31, 2008. http://tenaya.ucsd.edu/~dettinge/barnett08.pdf.

Barry, J. M., Elbroch, L. M., Aiello-lammens, M. E., Sarno, R. J., Seelye, L., Kusler, A., & Quigley, H. B. (2019). Pumas as ecosystem engineers: ungulate carcasses support beetle assemblages in the Greater Yellowstone Ecosystem. *Oecologia*, (189), 577–586.

Benítez-López, A., Alkemade, R., & Verweij, P. A. (2010). The impacts of roads and other infrastructure on mammal and bird populations: A meta-analysis. *Biological Conservation*, *143*, 1307–1316.

Bronner, C. E., Bartlett, A. M., Whiteway, S. L., Lambert, D. C., Bennett, S. J., & Rabideau, A. J. (2013). An Assessment of U.S. Stream Compensatory Mitigation Policy: Necessary Changes to Protect Ecosystem Functions and Services. *Journal of the American Water Resources Association*, *49*(2), 449–462. https://doi.org/10.1111/jawr.12034

Brown, G. W., & Krygier, J. T. (1970). Effects of Clear-Cutting on Stream Temperature. *Water Resources Research*, *6*(4), 1133–1139.

Bury, R. B., & Germano, D. J. (2008). Actinemys marmorata (Baird and Girard 1852) – Western Pond Turtle, Pacific Pond Turtle. *Conservation Biology of Freshwater Turtles and Tortoises*.

Buxton, R. T., Mckenna, M. F., Mennitt, D., Fristrup, K., Crooks, K., Angeloni, L., & Wittemyer, G. (2017). Noise pollution is pervasive in U.S. protected areas. *Science*, *356*, 531–533.

Cahill, A. E., Aiello-Lammens, M. E., Fisher-Reid, M. C., Hua, X., Karanewsky, C. J., Ryu, H. Y., … Wiens, J. J. (2012). How does climate change cause extinction? *Proceedings of the Royal Society B: Biological Sciences*, *280*, 20121890.

CAL FIRE. (2016). Incident Report for Clayton Fire. Available at: https://fire.ca.gov/incident/?incident=a0950d5e-6f35-4023-bb60-6737146ba7bd.

California Air Resources Board (CARB). (November 2017). California's 2017 Climate Change Scoping Plan: The strategy for achieving California's 2030 greenhouse gas target.

Cayan 2007, California Climate Change Center, *Our Changing Climate: Assessing the Risks to California* CEC-500-2006-077 (2006). http://meteora.ucsd.edu/cap/pdffiles/CA_climate_Scenarios.pdf.

Chen, I.-C., Hill, J. K., Ohlemüller, R., Roy, D. B., & Thomas, C. D. (2011). Rapid range shifts of species associated with high levels of climate warming. *Science*, *333*, 1024–1026.

Crooks, K. R. (2002). Relative sensitivities of mammalian carnivores to habitat fragmentation. *Conservation Biology*, *16*(2), 488–502.

Cushman, S. A. (2006). Effects of habitat loss and fragmentation on amphibians: A review and prospectus. *Biological Conservation*, *128*, 231–240.

Cushman, S. A., McRae, B., Adriaensen, F., Beier, P., Shirley, M., & Zeller, K. (2013). Biological corridors and connectivity. In D. W. Macdonald & K. J. Willis (Eds.), *Key Topics in Conservation Biology 2* (First Edit, pp. 384–403). John Wiley & Sons, Ltd.

Dahlgren, R. A., Horwath, W. R., Tate, K. W., & Camping, T. J. (2003). Blue oak enhance soil quality in California oak woodlands. *California Agriculture*, *57*(2), 42–47.

Delaney, K. S., Riley, S. P. D., & Fisher, R. N. (2010). A rapid, strong, and convergent genetic response to urban habitat fragmentation in four divergent and widespread vertebrates. *PLoS ONE*, *5*(9), 1–11.

Dickson, B. G., Jennes, J. S., & Beier, P. (2005). Influence of Vegetation, Topography, and Roads on Cougar Movement in Southern California. *Journal of Wildlife Management*, *69*(1), 264–276.

Diskin, M. and Wylodge, E. (2019, April 25). California towns at risk from fires often have few ways out. *AP News.* Available at: https://apnews.com/e856b9efef7b426a90fd175510cd54dd.

Dudek. (2017). Draft Wildland Fire Evacuation Plan for Newland Sierra, San Diego County.

Dudek. (2018a). Approval Draft Fire Protection Plan for the Newland Sierra Project [Excerpts].

Dudek. (2018b). Otay Ranch Village 14 and Planning Areas 16/19 Fire Protection Plan [Excerpts].

Elfin Forest Harmony Grove Town Council v. County of San Diego San Diego Sup. Ct. Case No. 37-2018-00042927-CU-TT-CTL, minute order dated Feb. 20, 2020.

Elliot, W. J. (2010). Effects of Forest Biomass Use on Watershed Processes in the Western

United States. *Western Journal of Applied Forestry*, *25*(1), 12–17.

Ellison, D., Futter, M. N., & Bishop, K. (2012). On the forest cover-water yield debate: From demand- to supply-side thinking. *Global Change Biology*, *18*(3), 806–820.

Environmental Law Institute. (2003). *Conservation thresholds for land use planners*. *Environmental Law*.

Environmental Law Institute. (2008). *Planner's Guide to Wetland Buffers for Local Governments*. *Environmental Law Institute*.

Fellers, G. M. and, & Kleeman, P. M. (2007). California Red-Legged Frog (Rana draytonii) Movement and Habitat Use : Implications for Conservation. *Journal of Herpetology*, *41*(2), 276–286.

Grantham, T. E., Newburn, D. A., Mccarthy, M. A., & Merenlender, A. M. (2012). The role of streamflow and land use in limiting oversummer survival of juvenile steelhead in California streams. *Transactions of the American Fisheries Society*, *141*, 585–598.

Gray, M., Comendant, T., Micheli, L., & Merenlender, A. M. (2018). *Building Landscape Connectivity for Climate Adaptation: Mayacamas to Beryessa Connectivity Network (M2B)*.

Greene, S. (2017, June 27). How a fear of humans affects the lives of California's mountain lions. *LA Times*.

Hilty, J. A., & Merenlender, A. M. (2004). Use of Riparian Corridors and Vineyards by Mammalian Predators in Northern California. *Conservation Biology*, *18*(1), 126–135.

Holland, D. C. (1994). *The Western Pond Turtle: Habitat and History*. Portland, OR. https://doi.org/10.2172/171287

Houlahan, J. E., & Findlay, C. S. (2004). Estimating the "critical" distance at which adjacent land-use degrades wetland water and sediment quality. *Landscape Ecology*, *19*(6), 677–690.

IPCC 2007b. Technical Summary in "Climate Change 2007: Impacts, Adaptation, and Vulnerability (M. Parry et al., eds. Cambridge Univ. Press 2007). https://www.ipcc.ch/pdf/assessment-report/ar4/wg2/ar4_wg2_full_report.pdf.

Jedlicka, J. A., Greenberg, R., & Raimondi, P. T. (2014). Vineyard and riparian habitat, not nest box presence, alter avian community composition. *The Wilson Journal of Ornithology*, *126*(1), 60–68.

Jennings, M., & Lewison, R. (2013). *Planning for Connectivity Under Climate Change: Using Bobcat Movement To Assess Landscape Connectivity Across San Diego County's Open Space*.

Jennings, M., & Zeller, K. (2017). *Comprehensive Mmulti-species Connectivity Assessment and*

Planning for the Highway 67 Region of San Diego County, California.

Keely, J. E. (2005). Fire history of the San Francisco East Bay region and implications for landscape patterns. *Int J Wildl Fire*, 14, 285–296.

Kelsey, K.A. and S.D. West. 1998. Riparian Wildlife. Pp 235-258. In: River ecology and management: lessons from the Pacific Coastal ecoregion. R.J. Naiman and R.E. Bibly (eds). New York: Springer-Verlag. (Not provided.)

Kociolek, A. V., Clevenger, A. P., St. Clair, C. C., & Proppe, D. S. (2011). Effects of Road Networks on Bird Populations. *Conservation Biology*, *25*(2), 241–249.

Lawrence, J. E., Deitch, M. J., & Resh, V. H. (2011). Effects of vineyard coverage and extent on benthic macroinvertebrates in streams of Northern California. *Annales de Limnologie - International Journal of Limnology*, *47*(4), 347–354.

Lee, J. S., Ruell, E. W., Boydston, E. E., Lyren, L. M., Alonso, R. S., Troyer, J. L., … Vandewoude, S. (2012). Gene flow and pathogen transmission among bobcats (Lynx rufus) in a fragmented urban landscape. *Molecular Ecology*, *21*(7), 1617–1631.

Lohse, K. A., Newburn, D. A., Opperman, J. J., & Merenlender, A. M. (2008). Forecasting relative impacts of land use on anadromous fish habitat to guide conservation planning. *Ecological Applications*, *18*(2), 467–482.

Lovell, S. T., & Sullivan, W. C. (2006). Environmental benefits of conservation buffers in the United States: Evidence, promise, and open questions. *Agriculture, Ecosystems and Environment*, *112*(4), 249–260.

Maclean, I. M. D., & Wilson, R. J. (2011). Recent ecological responses to climate change support predictions of high extinction risk. *Proceedings of the National Academy of Sciences*, *108*(30), 12337–12342.

Matthews, J. W., & Endress, A. G. (2008). Performance criteria, compliance success, and vegetation development in compensatory mitigation wetlands. *Environmental Management*, *41*(1), 130–141.

Mcrae, B. H., Dickson, B. G., Keitt, T. H., & Shah, V. B. (2008). Using circuit theory to model connectivity in ecology , evolution , and conservation. *Ecology*, *89*(10), 2712–2724.

Mcrae, B. H., Hall, S. A., Beier, P., & Theobald, D. M. (2012). Where to restore ecological connectivity? Detecting barriers and quantifying restoration benefits. *PLoS ONE*, *7*(12), e52604.

Moilanen, A., Van Teeffelen, A. J. A., Ben-Haim, Y., & Ferrier, S. (2009). How much compensation is enough? A framework for incorporating uncertainty and time discounting when calculating offset ratios for impacted habitat. *Restoration Ecology*, *17*(4), 470–478.

Moyle, P. B., Katz, J. V. E., & Quiñones, R. M. (2011). Rapid decline of California's native inland fishes: A status assessment. *Biological Conservation*, *144*, 2414–2423.

Next10. (2019). 2019 California Green Innovation Index (11th ed.). Available at: https://www.next10.org/sites/default/files/2019-10/2019-california-green-innovation-index-final.pdf

Nieswand, G. H., Hordon, R. M., Shelton, T. B., Chavooshian, B. B., & Blarr, S. (1990). Buffer strips to protect water supply reservoirs: a model and recommendations. *Journal of the American Water Resources Association*, *26*(6), 959–966.

Norris, V. (1993). Review Article: The use of buffer zones to protect water quality: A review. *Water Resources Management*, *7*(4), 257–272.

Olson, D. H., & Burnett, K. M. (2013). Geometry of forest landscape connectivity: pathways for persistence. In *Density Management in the 21st Century: West Side Story: Proceedings of the Density Management Workshop, 4-6 October 2011, Corvalllis, Oregon.*

Opperman, J. J., Lohse, K. A., Brooks, C., Kelly, N. M., & Merenlender, A. M. (2005). Influence of land use on fine sediment in salmonid spawning gravels within the Russian River Basin, California. *Canadian Journal of Fisheries and Aquatic Sciences*, *62*(12), 2740–2751.

Pacifici, M., Visconti, P., Butchart, S. H. M., Watson, J. E. M., Cassola, F. M., & Rondinini, C. (2017). Species' traits influenced their response to recent climate change. *Nature Climate Change*, *7*(3), 205–208.

Padilla, F. M., Vidal, B., Sánchez, J., & Pugnaire, F. I. (2010). Land-use changes and carbon sequestration through the twentieth century in a Mediterranean mountain ecosystem: Implications for land management. *Journal of Environmental Management*, *91*(12), 2688–2695.

Pan, Y., Birdsey, R. A., Fang, J., Houghton, R., Kauppi, P. E., Kurz, W. A., … Hayes, D. (2011). A large and persitent carbon sink in the world's forests. *Science*, *333*, 988–993.

Parmesan, C. (2006). Ecological and Evolutionary Responses to Recent Climate Change. *Annual Review of Ecology, Evolution, and Systematics*, *37*, 637–669.

Parmesan, C., & Yohe, G. (2003). A globally coherent fingerprint of climate change ipacts across natural systems. *Nature*, *421*(2), 37–42.

Pess, G. R., Montgomery, D. R., Steel, E. A., Bilby, R. E., Feist, B. E., & Greenberg, H. M. (2002). Landscape characteristics, land use, and coho salmon (Oncorhynchus kisutch) abundance, Snohomish River, Wash., U.S.A. *Canadian Journal of Fisheries and Aquatic Sciences*, *59*(4), 613–623.

Pinto, N., & Keitt, T. H. (2008). Beyond the least-cost path: Evaluating corridor redundancy using a graph- theoretic approach. *Landscape Ecology*, *24*(2), 253–266.

Public Policy Institute of California (PPIC). (2011). Driving Change: Reducing Vehicle Miles Traveled In California. Available at: https://pdfs.semanticscholar.org/f37d/be25d870ed5816443ac10ef88f794dfc0232.pdf?_ga=2.110314501.1621577387.1594053941-1205516604.1593733842

Riley, S. P. D., Pollinger, J. P., Sauvajot, R. M., York, E. C., Bromley, C., Fuller, T. K., & Wayne, R. K. (2006). A southern California freeway is a physical and social barrier to gene flow in carnivores. *Molecular Ecology*, *15*, 1733–1741.

Ripple, W. J., & Beschta, R. L. (2006). Linking a cougar decline , trophic cascade , and catastrophic regime shift in Zion National Park. *Biological Conservation*, *133*, 397–408.

Ripple, W. J., & Beschta, R. L. (2008). Trophic cascades involving cougar, mule deer, and black oaks in Yosemite National Park. *Biological Conservation*, *141*, 1249–1256.

Ripple, W. J., Estes, J. A., Beschta, R. L., Wilmers, C. C., Ritchie, E. G., Hebblewhite, M., … Wirsing, A. J. (2014). Status and ecological effects of the world ’s largest carnivores. *Science*, *343*(6167), 1241484.

Root, T. L., Price, J. T., Hall, K. R., Schneider, S. H., Resenzweig, C., & Pounds, J. A. (2003). Fingerprints of global warming on wild animals and plants. *Nature*, *421*, 57–60.

Ruth, T. K., & Elbroch, L. M. (2014). The carcass chronicles : carnivory, nutrient flow, and biodiversity. *Wild Felid Monitor*, 14–19.

Sabater, F., Butturini, A., Marti, E., Munoz, I., Romani, A., Wray, J., & Sabater, S. (2000). Effects of riparian vegetation removal on nutrient retention in a Mediterranean stream. *Journal of the North American Benthological Society*, *19*(4), 609–620.

Scheffers, B. R., De Meester, L., Bridge, T. C. L., Hoffmann, A. A., Pandolfi, J. M., Corlett, R. T., … Watson, J. E. M. (2016). The broad footprint of climate change from genes to biomes to people. *Science*, *354*(6313).

Semlitsch, R. D., & Bodie, J. R. (2003). Biological criteria for buffer zones around wetlands and riparian habitats for amphibians and reptiles. *Conservation Biology*, *17*(5), 1219–1228.

Shilling, F. (2020). Wildlife Behavior in Response to Traffic Disturbance Wildlife Behavior in Response to Traffic Disturbance.

Slabbekoorn, H., & Ripmeester, E. A. P. (2008). Birdsong and anthropogenic noise: implications and applications for conservation. *Molecular Ecology*, *17*, 72–83.

Smith, J. A., Suraci, J. P., Clinchy, M., Crawford, A., Roberts, D., Zanette, L. Y., & Wilmers, C.

C. (2017). Fear of the human 'super predator' reduces feeding time in large carnivores. *Proceedings of the Royal Society B: Biological Sciences*, *284*(1857), 20170433.

Smith, J. A., Wang, Y., & Wilmers, C. C. (2015). Top carnivores increase their kill rates on prey as a response to human-induced fear. *Proceedings of the Royal Society B: Biological Sciences*, *282*(1802).

Stein, B. A., Edelson, N., Anderson, L., Kanter, J. J., & Stemler, J. (2018). *Reversing America's Wildlife Crisis*. Washington, D.C.

Stillwater Sciences. (2002). *Napa River Basin Limiting Factors Analysis*.

Sudol, M. F., & Ambrose, R. F. (2002). The US Clean Water Act and habitat replacement: Evaluation of mitigation sites in Orange County, California, USA. *Environmental Management*, *30*(5), 727–734.

Suraci, J. P., Clinchy, M., Zanette, L. Y., & Wilmers, C. C. (2019). Fear of humans as apex predators has landscape-scale impacts from mountain lions to mice. *Ecology Letters*.

Syphard, A.D. (2020). Personal email communication to D. Silver, April 20, 2020.

Syphard, A. D., Rustigian-romsos, H., Mann, M., Conlisk, E., Moritz, M. A., & Ackerly, D. (2019). The relative influence of climate and housing development on current and projected future fire patterns and structure loss across three California landscapes. *Global Environmental Change*, *56*, 41–55. https://doi.org/10.1016/j.gloenvcha.2019.03.007

Syphard, A.D., Bar Massada, A., Butsic, V., Keeley, J.E. (2013). Land Use Planning and Wildfire: Development Policies Influence Future Probability of Housing Loss. *PLoS ONE*, *8*(8), e71708.

Syphard, A. D., et al. (2007). Human Influence on California Fire Regimes. *Ecological Application*, *17*(5), 1388–1402.

The Xerces Society for Invertebrate Conservation. (2018). *A Petition to the State of California Fish and Game Commission to List the Crotch bumble bee (Bombus crotchii), Franklin's bumble bee (Bombus franklini), Suckley cucko bumble bee (Bombus suckleyi), and wetsern bumble bee (Bombus occidentalis occidentalis)*.

Twitty, V., Grant, D., & Anderson, O. (1967). Amphibian orientation : An unexpected observation. *Science*, *155*(3760), 352–353.

USFWS. (2005). *Revised Guidance on Site Assessment and Field Surveys for the California Red-legged Frog*.

Vickers, T. W. (2020). Project Title: Santa Ana Mountains to eastern Peninsular Range Conservation Connectivity Infrastructure Planning Project for Interstate 15 and Closely

Associated Roadways.

Vickers, T. W., Sanchez, J. N., Johnson, C. K., Morrison, S. A., Botta, R., Smith, T., … Boyce, W. M. (2015). Survival and mortality of pumas (Puma concolor) in a fragmented, urbanizing landscape. *PLoS ONE*, *10*(7), 1–18.

Wang, Y., Smith, J. A., & Wilmers, C. C. (2017). Residential development alters behavior, movement, and energetics in a top carnivore. *PlosOne*, 1–17.

Ware, H. E., Mcclure, C. J. W., Carlisle, J. D., & Barber, J. R. (2015). A phantom road experiment reveals traffic noise is an invisible source of habitat degradation. *Proceedings of the National Academy of Sciences*, *112*(39), 12105–12109.

Warren, R., Price, J., Fischlin, A., de la Nava Santos, S., & Midgley, G. (2011). Increasing impacts of climate change upon ecosystems with increasing global mean temperature rise. *Climatic Change*, *106*(2), 141–177.

Whipple Jr., W. (1993). Buffer zones around water-supply reservoirs. *Journal of Water Resources Planning and Management*, *119*(4), 495–499.

Wiens, J. J. (2016). Climate-related local extinctions are already widespread among plant and animal species. *PLoS Biology*, *14*(12), 1–18. https://doi.org/10.1371/journal.pbio.2001104

Wilmers, C. C., Wang, Y., Nickel, B., Houghtaling, P., Shakeri, Y., Allen, M. L., … Williams, T. (2013). Scale dependent behavioral responses to human development by a large predator, the puma. *PLoS ONE*, *8*(4).

Windmiller, B., & Calhoun, A. (2007). Conserving Vernal Pool Wildlife in Urbanizing Landscapes. In *Science and Conservation of Vernal Pools in Northeastern North America* (pp. 233–251).

Zaragoza, G., Rose, J. P., Purcell, K., & Todd, B. D. (2015). Terrestrial Habitat use by Western Pond Turtles (Actinemys marmorata) in the Sierra Foothills. *Journal of Herpetology*, *49*(3), 437–441. https://doi.org/10.1670/13-154

Zeiner, D.C., W.F. Laudenslayer, Jr. and K.E. Mayer, eds. 1988. California's Wildlife, Volume 1, Amphibians and Reptiles. California Department of Fish and Game. 272 pp. (Not provided.)

Zhang, H., & Hiscock, K. M. (2011). Modelling the effect of forest cover in mitigating nitrate contamination of groundwater: a case study of the Sherwood Sandstone aquifer in the East Midlands, UK. *Journal of Hydrology*, *399*, 212–225.

Exhibit 1

Cova Report

Prepared by Thomas J. Cova, Ph.D., Evacuation Consultant, Salt Lake City, UT

Dated: July 2, 2020

Subject: Evacuation analysis and planning for the proposed Guenoc Valley Mixed Use Planned Development Project in Lake County, CA

SUMMARY

I have reviewed the Environmental Impact Report (EIR) and Wildfire Prevention Plan for the Guenoc Valley project. The Guenoc Valley project site is in a very high fire hazard area evidenced by recent fast-moving, intense wildfires in the Project vicinity that caused loss of life. The project is large and proposes to add thousands of people to a very sparsely populated area with a limited transportation network. The EIR does not evaluate or disclose the wildfire evacuation risks associated with introducing this many people and vehicles to the project area and does not include a detailed wildfire evacuation plan to protect the safety of the residents. Prior to approving the project, the County should prepare a project-specific evacuation plan that addresses, at a bare minimum: 1) the possible range of evacuation times for residents and visitors, 2) the possible range of lead times available to act in an urgent wildfire, 3) the pattern of evacuation road traffic on primary access roads from the site to major evacuation routes in the Countywide evacuation plan, and 3) detailed alternative plans for protecting residents and visitors when roads become impassible or the time required to evacuate is greater than the time available.

ANALYSIS

The Project Configuration Allows Only One Evacuation Route for Several Thousand Residents

The Guenoc Valley Site consists of 16,000 acres in southwest Lake County, California. The project will include 400 hotel rooms, 450 guest resort residential units, 1400 residential estates, and 500 workforce co-housing units. The EIR proposes 753 total parking spaces for Phase 1 but does not mention how many there might be when the project is complete or how many vehicles are likely to be on the project site, on average, after the project is complete. However, given the number of proposed units (and conservatively assuming one vehicle per unit when California's average number of vehicles per household is two), the site is likely to house at least 2750 vehicles on site when it is completed (i.e. 400 + 450 + 1400 + 500). While some of these units may have no vehicles, and others may have 2 or more, a range of at least two to three thousand vehicles is a reasonable starting assumption for evacuation planning for this project.

Access to the project site is via Butts Canyon Road from Middletown (7 miles to the west), although Butts Canyon Road continues south from the project site to Pope Valley (12 miles to its south). There are no alternative routes in or out of the project site. The Final EIR's Response to Comments O10-31 references the Lake County Evacuation map and states:

> *Regarding the commenter's question "what, if any, alternative evacuation routes will be available for residents and nearby community members in the event that Proposed Project-generated evacuation traffic makes Butts Canyon Rd. and/or Hwy 29 or 175 impassable", as noted on page 3.16-7 of the Draft EIR, the Lake County Wildfire Protection Plan provides an evacuation route map (URL in figure 1). This map shows all of the existing*

and potential evacuation routes serving the county and the project site. The Wildfire Prevention Plan for the Proposed Project includes plans for determining whether evacuation routes are unsafe, and designated meeting locations.

An excerpt of this map around the project site is provided in Figure 1. The map shows that the initial evacuation route is Butts Canyon Road north (and then to SR-29 North or South or SR-175 north), or south to Pope Valley (not shown on map because it's in Napa County). There are no evacuation routes to the east or north of the project site, so evacuees would have to travel southwest to Butts Canyon Road and then either northwest to Middletown or southeast to Pope Valley. This is very limited directional egress for a community of this size given the wide range of locations and directions that a wildfire might approach the project.

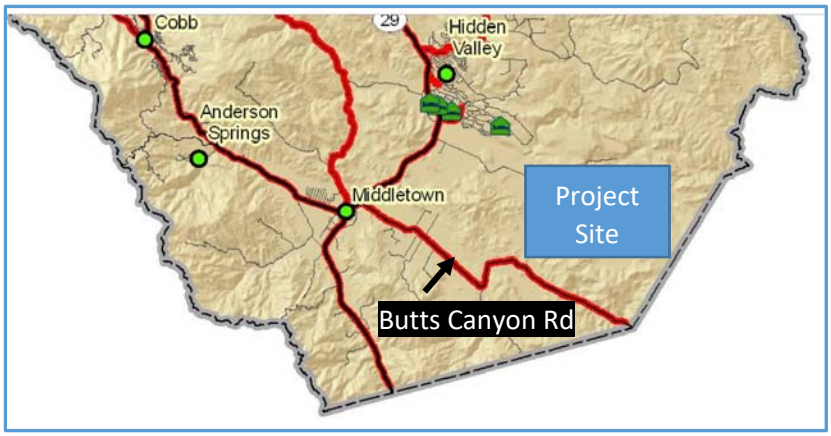

Figure 1. An excerpt taken from the Lake County evacuation map does not show an evacuation route in the project area. (URL: http://www.lakecountyca.gov/Assets/County+Site/Fire+Safe+Council/cwpp/Evacuation.jpg).

In other words, in the event of a wildfire, all evacuation traffic from the project site must flow through Butts Canyon Road, a two lane rural highway. This is a significant bottleneck and there are no alternative evacuation routes in the event that Butts Canyon Road becomes impassable.

The EIR Does Not Analyze the Project's Wildfire Evacuation Impacts

The project configuration presents an immediate concern due to the limited evacuation egress for project residents and workers trying to reach Butts Canyon Road in an urgent evacuation. Given this concern, and the history of wildfires on the project site, it is critical that the County perform a project-specific wildfire evacuation analysis that includes available lead times and evacuation times under a variety of scenarios.

As noted in the Final EIR Response to Comments O10-31, the time necessary to safely clear the project site can vary according to a number of factors:

Regarding the commenter's question "what are the pre- and post-Project expected evacuation times for residents (both Project residents and nearby affected existing residents) fleeing wildfire in the vicinity of the Project site," evacuation times would vary

based on a large number of factors, including day of the week, time of day, the fire's location, behavior, winds, and terrain. While the County has performed extensive planning for wildfire safety and evacuation, it has not projected evacuation times, due to the number of variables.

Although the County is correct that there are numerous variables that inform estimates of evacuation times, this does not justify the decision to not perform an evacuation analysis. Project-specific evacuation analysis and modeling is not only possible, agencies frequently perform it, especially for largescale residential and mixed-use development projects similar to the Guenoc Valley project.

The Project's Wildfire Evacuation Impacts Are Significant

There are two key variables that determine the success of an evacuation in getting residents to safety: the time available to protect people (lead time) and the time it takes to protect them (evacuation time). Some of the variables mentioned by the County above (e.g. fire location, behavior, winds and terrain) are important inputs for estimating the lead time that would be available to protect residents. A fire that ignites near the project site (location) and spreads rapidly towards it (winds, behavior, terrain, direction) may offer little time for emergency managers to conduct an orderly evacuation of the site. Similarly, the day-of-week and time-of-day are variables affecting the evacuation time. For example, the number of evacuees (residents and visitors) and vehicles that might be on the project site due to weekends, holidays, or events (e.g. sports, music, weddings) will affect the evacuation time.

Wildfire safety hazards arise when the lead time is less than the evacuation time, and the difference between the two is a primary cause of fatalities in evacuations. For example, in the 2018 Camp Fire in Paradise, the city evacuation plan called for 2 to 3 hours to safely evacuate the town (evacuation time), but the fire only offered 1.5 hours from its ignition to its impact on structures on the east side of Paradise (lead time). Because of the large number of residents and vehicles that will be added to the area by the project and the recent history of intense, fast-moving wildfires (see the Wildfire Prevention Plan), it is critical that the County evaluate lead time and evacuation time for the Guenoc Valley project under a range of likely scenarios.

Gross estimates for evacuation time can be calculated using simple assumptions about warning time, response time, vehicle loading, and road capacity. Figure 2 shows the proposed transportation network on the south end of the project that would provide emergency access to Butts Canyon Road (the evacuation route from the project to Middletown or Pope Valley). Note that there are three access points to the project site along Butts Canyon Road (BCR) labeled *Primary Entrance Option 1 (PE1), Primary Entrance Option 2 (PE2), and Secondary Entrance (SE).* Although PE1 and PE2 provide two access points, they quickly merge into one access road to the northeast which create a bottleneck for evacuation purposes. This means that there are effectively two means of egress to Butts Canyon Road from the project: the Primary Exit (PE), which splits and leads to two access points, and the Secondary Exit (SE).

Assuming that the PE and SE both have one traffic lane out each (leaving one lane for emergency vehicle ingress, as is typical), and assuming that each exiting lane can serve a range of 600 to 1200 vehicles per hour (vph) depending on many factors (e.g. merging, intersection control, car-following behavior), then the total egress from the site to BCR could range from 1200 to a high of 2400 vph. In supply-demand terms, this would be an estimate of the "supply" available to serve the evacuees as they leave the site.

As noted above, there could be a range of 2000-3000 vehicles on the project site depending on the time of day, day of week, or special events, and this would be the "demand" in an evacuation. Dividing the vehicle demand by the exit road supply, the minimum time to evacuate this site could range from an ideal case of lower demand and higher capacity (2000 vehicles / 2400 vph = 0.83 hours) to a much worse case of higher demand and lower capacity (3000 vehicles / 1200 vph = 2.5 hours).

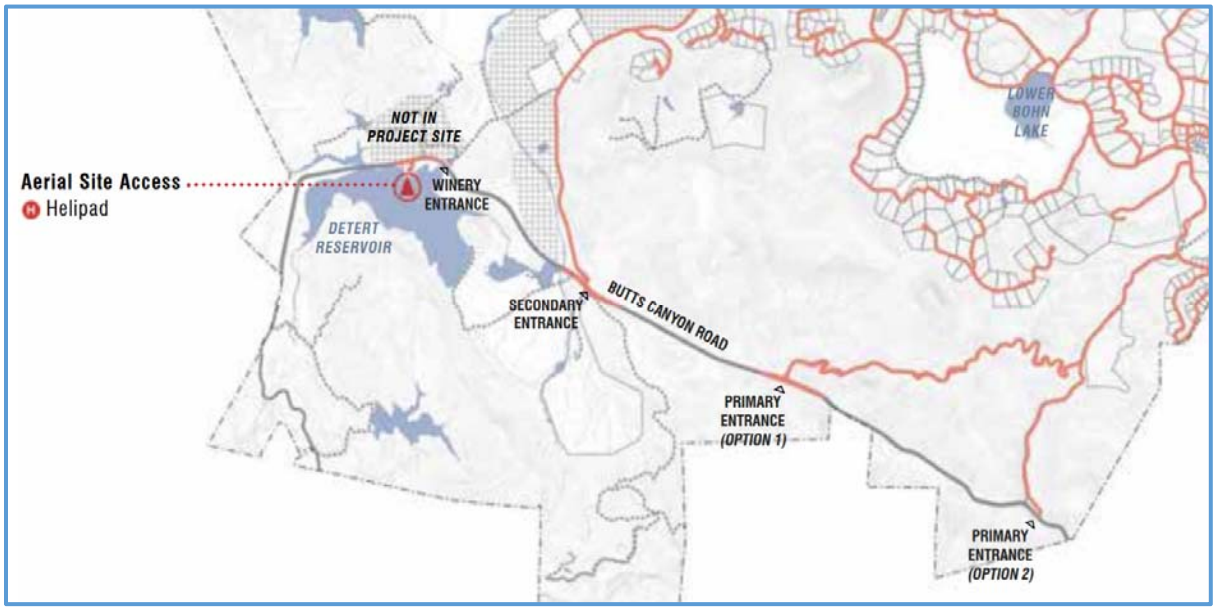

Figure 2. The transportation network that will connect the project site to Butts Canyon Road.

As noted above the second factor that influences the outcome of a wildfire evacuation is the lead time. The question becomes one of whether a wildfire in the vicinity of the project site might offer less than the time to evacuate the community (1 to 2.5 hours), leaving some evacuees at risk of being caught in-transit when the wildfire overtakes the community. This presents an extremely high safety threat. When persons are in vehicles on a road when fire is burning in the immediate area, visibility conditions may become so poor that the vehicles drive off the road or crash into other vehicles and/or flames and heat may overcome the occupants. On-road fatalities occurred, for example, during the 2003 Cedar Fire in San Diego County and the 2018 Camp Fire originating in Paradise. The EIR and Wildfire Prevention Plan provide little detail and no modeling regarding wildfire behavior and spread rate. However, based on the wildfire history of this region as detailed in the EIR and Wildfire Prevention Plan, there are numerous possible wildfire scenarios in this area under which emergency managers and evacuees would have less than the time it would take to evacuate the Guenoc Valley site.

Additionally, the 2.5 hour evacuation time could be much longer if warning time is prolonged or key intersections are not controlled by law enforcement. These intersections include the two PE's and the SE, as well as the point where BCR intersects with Highway 29. If traffic flow problems occur at any of these locations due to adverse events (e.g. wildfire blocking an exit, abandoned vehicles, or gridlock),

the evacuation could lead to fatalities similar to the 2018 Camp Fire in Paradise or the 2017 Tubbs Fire in Santa Rosa.

In short, the County did not perform a project-specific wildfire evacuation analysis. Even in the absence of such analysis, there is strong evidence that evacuation times could exceed lead times for the project, which could pose a serious threat to public safety.

The EIR's Description of Shelter-in-Place Strategies Is Inadequate

As scenarios can be identified where not everyone in the project site would be able to get out in time, the Final EIR (p. 3.16-9) mentions six designated shelter-in-place meeting and staging areas as a back-up option:

> *"The Community Wildfire Protection Plan identifies evacuation routes in the County. Butts Canyon Road is identified as an emergency evacuation route. Depending on where the fire is located, people at the Guenoc Valley Site would be directed to exit the site via the primary roadways to Butts Canyon Road or as a last resort would shelter in place at the six Designated Meeting and Staging Areas. As shown on Figure 2-10, the Proposed Project includes an extensive circulation system with roadways large enough for emergency access vehicles. In addition, these roadways would typically have 50 feet of defensible space cleared on each side of the roadway for a total fire break of 150 feet. Impacts to adopted emergency response or evacuation plans would be less-than-significant. Impacts related to traffic and emergency routes are addressed in Section 3.13 Transportation and Traffic.*
>
> *Depending on the circumstances of a wildfire emergency, it may be difficult to evacuate. In this situation, residents, visitors, and employees will be directed to gather at designated meeting & staging areas where they will be provided information and assistance.*

These six designated meeting and staging areas (DMSA) are shown in Figure 2-10 in the EIR but the locations are vague and the capacities are not given. In order to be effective, these DMSAs would need to be easily accessible (including for disabled people and pedestrians) and provide enough protection for residents to survive a wildfire with an intensity in line with recent past wildfires. Additionally, it is critical that the location of, and access routes to, DMSAs are well publicized and made clear to residents and visitors to the project site through education, signage, and other means. The lack of adequate description in the EIR or Wildfire Prevention Plan of the DMSAs' location, capacity, and protection level is a significant shortcoming; these should be addressed in detail in a project-specific evacuation analysis and plan.

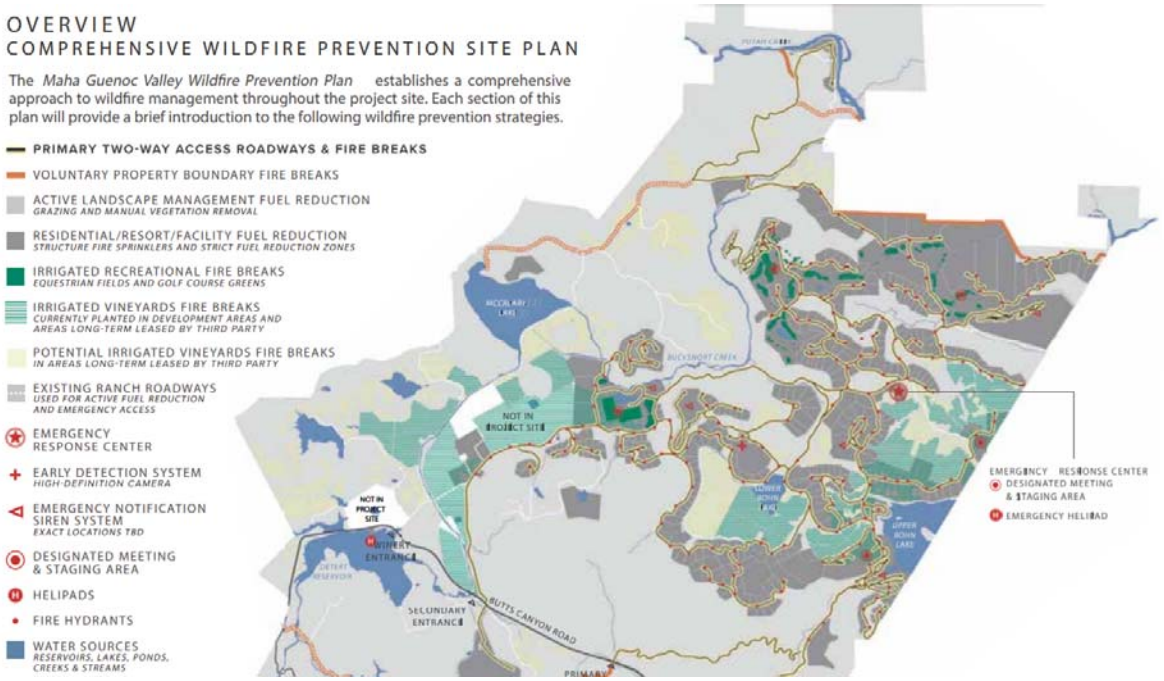

Figure 3. The designated meeting and staging areas are not very visible or easy to assess.

CONCLUSION

The Guenoc Valley project anticipates housing thousands of residents and visitors on a Project site historically susceptible to fire and in a region where large-scale wildfire evacuations have recently been necessary. The project offers only two primary means of egress to Butts Canyon Road, which only offers one direction for evacuees to escape (southwest) from the project site, and then only two directions to travel from there (northwest or southeast on Butts Canyon Road). The evacuation vehicle capacity offered by these roads is relatively low, and a rough estimate is that they could serve 1200 to 2400 vehicles departing per hour. On a given summer weekend day, it's not unlikely that it could take a few hours to evacuate this project site, and there are numerous plausible wildfire scenarios where this much time might not be available. Shelter-in-place is likely to be used in some scenarios where not everyone can evacuate in time, but it is not taken very seriously in the EIR or Wildfire Prevention Plan, which do not describe the access, capacity, and protection level that the various staging areas would offer. I strongly recommend that the County prepare a detailed and comprehensive evacuation plan for this project.

Thomas J. Cova, Ph.D.

CREDENTIALS

I received a Doctor of Philosophy (Ph.D.) degree from the University of California Santa Barbara in 1999 in the field of Geography; a Masters of Science (M.S.) degree from the same university in 1995; and a Bachelor's of Science (B.S.) degree in Computer and Information Science from the University of Oregon in 1986. I am currently a Professor of Geography and the University of Utah. My expertise is in environmental hazards, transportation, and geographic information systems with a particular focus on wildfire evacuation planning, analysis, and modeling. I proposed a set of standards for transportation egress (exit capability) in wildfire areas that was adopted by the National Fire Protection Agency in 2008 in their Standards for the Protection of Life and Property in Wildfires. I received research grants from the National Science Foundation to study: 1) the 2003 Southern California Wildfires, 2) Protective Action Decision Making in regards to evacuation versus shelter-in-place, and 3) Protective Action Triggers (decision points regarding when to order an evacuation). In 2017 I published an article with my collaborators on warning triggers in environmental hazards that described the issues that arise in deciding when to order an evacuation or other protective action.[1] In 2013, along with my collaborators, I analyzed community egress in fire-prone areas of the western U.S. to identify those that might face difficulty evacuating due to traffic congestion.[2] In 2011, I developed a decision model with my collaborators to aid in deciding whether evacuation or shelter-in-place is the best decision in a wildfire.[3] My work has been cited in fire evacuation plans prepared in conjunction with Environmental Impact Reports in California.

REFERENCES

[1] Cova, T. J., Dennison, P. E., Li, D., Drews, F. A., Siebeneck, L. K., & Lindell, M. K. (2017). Warning triggers in environmental hazards: who should be warned to do what and when? *Risk Analysis*, 37(4), 601-611.

[2] Cova, T.J., Theobald, D.M., Normal, J.B., Siebeneck, L.K. (2013) Mapping evacuation vulnerability in the western US: the limits of infrastructure. *GeoJournal*, 78(2): 273-285.

[3] Cova, T.J., Dennison, P.E., Drews, F.A. (2011) Modeling evacuate versus shelter-in-place decisions in wildfires. *Sustainability*, 3(10): 1662-1687.

Thomas J. Cova

Department of Geography
University of Utah
207 Building 73 (The Old Law School)
Salt Lake City, Utah 84112-9155
cova@geog.utah.edu, 801-581-7930, FAX: 801-581-8219,

Education

1999	Ph.D., Geography, University of California Santa Barbara. Dissertation: *A general framework for optimal site search*.
1995	M.A., Geography, University of California Santa Barbara. Thesis: *A spatial search for neighborhoods that may be difficult to evacuate.*
1986	B.S., Computer and Information Science, University of Oregon. Minor in math; emphasis in software engineering.

Research and Teaching Interests

Environmental Hazards, Emergency Management, Geographic Information Science, Transportation, Sustainability, Coupled Natural-Human Systems.

Professional Experience

2012 –	Professor, Department of Geography, University of Utah.
2005 – 2012	Associate Professor, Department of Geography, U. of Utah.
1999 – 2005	Assistant Professor, Department of Geography, U. of Utah.
1993 – 1996	Research Assistant, National Center for Geographic Information and Analysis (NCGIA), UC Santa Barbara.
1992 – 1997	Teaching Assistant, Department of Geography, UCSB.
1987 – 1992	Systems Analyst, Matthew Bender & Co., Oakland, California.

Other Professional Activities

2014 – 2018	Director, *Certificate in Environmental Hazards & Emergency Management*, Department of Geography, University of Utah.
2003 – 2018	Director, *Center for Natural & Technological Hazards*, Department of Geography, University of Utah.

2001 – 2016 Director, Certificate in Geographic Information Science, Department of Geography, University of Utah.

2011 – 2013 Chair, Hazards, Disasters & Risk Specialty Group, Association of American Geographers, Washington, D.C.

2007 – 2008 Program Chair, 5th International Conference in Geographic Information Science (GIScience 2008), Park City, Utah.

2005 – 2008 Chair (Vice Chair, Past Chair), GIS Specialty Group, Association of American Geographers, Washington, D.C.

2005 – 2008 Chair, Research Projects Committee, University Consortium for Geographic Information Science (UCGIS).

2004 – 2006 Secretary/Treasurer, GIS Specialty Group, Association of American Geographers, Washington, D.C.

2001 – 2003 Academic Councilor, GIS Specialty Group, Association of American Geographers, Washington, D.C.

1999 – 2003 Associate Director for Research, Center for Natural & Technological Hazards, Department of Geography, U of Utah.

Editorial Board Memberships

2020 – *International Journal of Geographical Information Science*

2018 – *Journal of Applied Geography*

2011 – *Journal of Geography & Natural Disasters*.

2011 – 2014 *Journal of Spatial Science*

2009 – 2011 *Professional Geographer*

2001 – 2004 *Computers, Environment & Urban Systems*

Professional Honors and Awards

2016 Excellence in Mentoring Award, College of Social & Behavioral Science (CSBS), University of Utah.

2014 – 2016 Advisor, *Enabling the Next Generation of Hazards Researchers*, D. Thomas, S. Brody, & B. Gerber (PIs), National Science Foundation, CMMI-IMEE.

2008 – 2010 Mentor, *Enabling the Next Generation of Hazards Researchers*, Tom Birkland (PI), National Science Foundation, CMMI-IMEE.

2005 John I. Davidson Award for Practical Papers, American Society for Photogrammetry & Remote Sensing – with P. Sutton and D. Theobald.

2005 Leica Geosystems Award for Best Scientific Paper in Remote Sensing, American Society for Photogrammetry & Remote Sensing (ASPRS) – with P. Sutton and D. Theobald.

2003 – 2005 Fellow, *Enabling the Next Generation of Hazards Researchers*, Raymond Burby (PI), National Science Foundation, CMMI-IMEE.

2003 University Consortium for Geographic Information Science (UCGIS) Young Scholar's Award.

1996 – 1999 Dwight D. Eisenhower Doctoral Fellowship, National Highway Institute, Federal Highway Admin., Dept. of Transportation.

1995 International Geographic Information Foundation (IGIF) Award for Best Student Paper, GIS/LIS '95, Nashville, TN.

1995 Outstanding Student in Transportation, UC Santa Barbara, Western Coal Transportation Association.

RESEARCH AND SCHOLARSHIP

Edited volumes and special issues

2017 Cova, T.J. and Tsou, M., *GIS Methods and Techniques*. Vol 1. in *Comprehensive Geographic Information Systems, B. Huang (EIC).* Oxford:Elsevier.

2011 Cova, T.J. and Miles, S.B. (Eds). *Disaster Risk Reduction and Sustainable Development*, Sustainability (ISSN 2071-1050).

2008 Cova, T.J., Miller, H., Beard, K., Frank, A., Goodchild, M. (Eds.), *Geographic Information Science: 5th International Conference (GIScience 2008),* Park City, Utah. Lecture Notes in Computer Science 5266, Springer-Verlag, Berlin.

Journal articles
(Student advisees underlined)

2019 Li, D., Cova, T.J., Dennison, P.E. Why do we need a national address point database to improve wildfire public safety in the US? *International Journal of Disaster Risk Reduction, https://doi.org/10.1016/j.ijdrr.2019.101237*

2018 Li, D., Cova, T.J., Dennison, P.E. Setting wildfire evacuation triggers by coupling fire and traffic simulation models: a spatio-temporal GIS approach. *Fire Technology, 55: 617-642*.

2017 Li, D., Cova, T.J., Dennison, P.E. Setting wildfire evacuation triggers using reverse geocoding. *Applied Geography*, 84: 14-27.

2017 Cova, T.J., Dennison, P.E., Li, D., Drews, F.A., Siebeneck, L.K., Lindell, M.K., Warning triggers in environmental hazards: who should be warned to do what and when? *Risk Analysis*, 37(4): 601-611.

2016 Nicoll, K.A., Cova, T.J., Siebeneck, L.K., Martineau, E. Assessing "preparedness elevated": seismic risk perception and household adjustment in Salt Lake City, Utah. *Journal of Geography & Natural Disasters, 6: 168.*

2015 Li, D., Cova, T.J., Dennison, P.E., A household-level approach to staging wildfire evacuation warnings using trigger modeling. *Computers, Environment, & Urban Systems,* 54:56-67.

2015 Drews, F.A., Siebeneck, L.K., Cova, T.J., Information search and decision making in computer based wildfire simulations. *Journal of Cognitive Engineering and Decision Making*. 9(3): 229-240.

2015 Hile, R. and Cova, T.J. (2015) Exploratory testing of an artificial neural network classification for enhancement of the social vulnerability index. *ISPRS International Journal of Geo-Information,* 4(4): 1774-1790.

2014 Drews, F.A., Musters, A., Siebeneck, L.K., and Cova, T.J. Environmental factors that affect wildfire protective-action recommendations. *International Journal of Emergency Management,* 10(2): 153-168.

2014 Siebeneck, L.K., and Cova, T.J. Risk communication after disaster: re-entry following the 2008 Cedar River Flood. *Natural Hazards Review,* 15: 158-166.

2014 Dennison, P.E., Fryer, G.K., and Cova, T.J., Identification of fire fighter safety zones using lidar, *Environmental Modelling and Software*, 59: 91-97.

2013 Fryer, G., Dennison, P.E. and Cova, T.J. Wildland firefighter entrapment avoidance: modeling evacuation triggers. *International Journal of Wildland Fire,* 22(7): 883-893.

2013 Cova, T.J., Theobald, D.M, Norman, J., and Siebeneck, L.K., Mapping wildfire evacuation vulnerability in the western US: the limits of infrastructure. *Geojournal*, 78(2): 273-285.

2012 Siebeneck, L.K. and Cova, T.J., Spatial and temporal variation in evacuee risk perception throughout the evacuation and return-entry process. *Risk Analysis*, 32(9), 1468-1480.

2011 Cova, T.J., Dennison, P.E., Drews, F.A., Modeling evacuate versus shelter-in-place decisions in wildfires. *Sustainability,* 3(10): 1662-1687.

2011 Cao, L., Cova, T.J., Dennison, P.E., and Dearing, M.D., Using MODIS imagery to predict hantavirus risk. *Global Ecology and Biogeography,* 20: 620-629.

2011 Kobayashi, T., Medina, R., and Cova, T.J., Visualizing diurnal population change in urban areas for emergency management. *Professional Geographer*, 63: 113-130.

2011 Larsen, J.C., Dennison, P.E., Cova, T.J., Jones, C. Evaluating dynamic wildfire evacuation trigger buffers using the 2003 Cedar Fire. *Applied Geography,* 3: 12-19.

2010 Pultar, E., Cova, T.J., Yuan, M., and Goodchild, M.F., EDGIS: a dynamic GIS based on space-time points. *International Journal of Geographical Information Science*, 24: 329-346.

2010 Moffatt, S.F. and Cova, T.J., Parcel-scale earthquake loss estimation with HAZUS: a case-study in Salt Lake County, Utah. *Cartography and Geographic Information Science*, 37: 17-29.

2010 Anguelova, Z., Stow, D.A., Kaiser, J., Dennison, P.E., Cova, T.J., Integrating fire behavior and pedestrian mobility models

to assess potential risk to humans from wildfires within the US-Mexico border zone. *Professional Geographer*, 62: 230-247.

2009 Cova, T.J., Drews, F.A., Siebeneck, L.K. and Musters, A., Protective actions in wildfires: evacuate or shelter-in-place? *Natural Hazards Review*, 10(4): 151-162.

2009 Pultar, E., Raubal, M., Cova, T.J., Goodchild, M.F. Dynamic GIS case studies: wildfire evacuation and volunteered geographic information. *Transactions in GIS*, 13: 84-104.

2008 Siebeneck, L.K., and Cova, T.J., An assessment of the return-entry process for Hurricane Rita 2005. *International Journal of Mass Emergencies and Disasters*, 26(2): 91-111.

2007 Goodchild, M.F., Yuan, M., and Cova, T.J., Towards a theory of geographic representation. *International Journal of Geographical Information Science*, 21(3): 239-260.

2007 Kim, T.H., and Cova, T.J., Tweening grammars: deformation rules for representing change between discrete geographic entities. *Computers, Environment & Urban Systems,* 31(3): 317-336.

2007 Dennison, P.E., Cova, T.J., and Moritz, M.A., WUIVAC: A wildfire evacuation trigger model applied in strategic scenarios. *Natural Hazards*, 40, 181-199.

2007 VanLooy, J. and Cova, T.J., A GIS-based index for comparing airline flight path vulnerability to volcanoes. *Professional Geographer*, 59(1): 74-86.

2006 Sutton, P.C., Cova, T.J., Elvidge, C., Mapping "Exurbia" in the conterminous U.S. using nighttime satellite imagery. *Geocarto International*, 21(2): 39-45.

2006 Kim, T.H., Cova, T.J., and Brunelle, A., Exploratory map animation for post-event analysis of wildfire protective action recommendations. *Natural Hazards Review*, 7(1): 1-11.

2005 Cova, T.J., Dennison, P.E., Kim, T.H., and Moritz, M.A., Setting wildfire evacuation trigger-points using fire spread modeling and GIS. *Transactions in GIS*, 9(4): 603-617.

2005 Cova, T.J., Public safety in the urban-wildland interface: Should fire-prone communities have a maximum occupancy? *Natural Hazards Review*, 6(3): 99-108.

2004 Cova, T.J., Sutton, P.A, Theobald, D.M., Exurban change detection in fire-prone areas with nighttime satellite imagery. *Photogrammetric Engineering & Remote Sensing,* 70: 1249-1257.

2003 Cova, T.J., and Johnson, J.P., A network flow model for lane-based evacuation routing. *Transportation Research Part A: Policy and Practice*, 37: 579-604.

2002 Cova, T.J. and Johnson, J.P., Microsimulation of neighborhood evacuations in the urban-wildland interface. *Environment and Planning A,* 34: 2211-2229.

2002 Cova, T.J. and Goodchild, M.F., Extending geographic representation to include fields of spatial objects. *International Journal of Geographic Information Science,* 16: 509-532.

2000 Cova, T.J., and Church, R.L., Contiguity constraints for single-region site search problems. *Geographical Analysis*, 32: 306-329.

2000 Church, R.L., and Cova, T.J., Mapping evacuation risk on transportation networks with a spatial optimization model. *Transportation Research Part C: Emerging Technologies*, 8: 321-336.

2000 Cova, T.J., and Church, R.L., Exploratory spatial optimization in site search: a neighborhood operator approach. *Computers, Environment, & Urban Systems*, 24: 401-419.

2000 Radke, J., Cova, T.J., Sheridan, M.F., Troy, A., Lan, M., and Johnson, R., Application challenges for GIScience: implications for research, education, and policy for risk assessment, emergency preparedness and response, *Urban and Regional Information Systems Association (URISA) Journal*, 12: 15-30.

1997 Cova, T.J., and Church, R.L., Modeling community evacuation vulnerability using GIS. *International Journal of Geographical Information Science*, 8: *763-784.*

Book Chapters and Sections

2019 Cova, T.J., *Evacuation*. Encyclopedia of Wildfires and Wildland-Urban Interface (WUI) Fires.

2017 Cova, T.J., Data model: o-fields and f-objects. The International Encyclopedia of Geography, 1-5.

2016 Cova, T.J., Evacuation Planning, in *Encyclopedia of Transportation*, SAGE Publications, M. Garrett (ed.), pp.

2004 Cova, T.J., and Conger, S., Transportation hazards, in *Handbook of Transportation Engineering*, M. Kutz (ed.), pp. 17.1-17.24.

1999 Cova, T.J., GIS in emergency management. In *Geographic Information Systems: Principles, Techniques, Applications, and Management*, Longley, P., Goodchild, M.F., Maguire D., Rhind D. (eds), pp. 845-858.

Conference Papers and Posters

2019 Cova, T.J., Geosimulating hazard warning triggers: geometry, dynamics, and timing. *GeoCompuation '19*, September 19, Queenstown, New Zealand.

2015 Li, D., Cova, T.J., Dennison, P.E., An open-source software system for setting wildfire evacuation triggers. ACM SIGSPATIAL EM-GIS'15, November 3, 2015, Seattle, WA.

2013 Cova, T.J., Dennison, P.E., and Drews, F.A. Protective-action Triggers: Modeling and Analysis. *Natural Hazards Workshop*, University of Colorado, Boulder, July (poster).

2012 Cova, T.J., Dennison, P.E., and Drews, F.A. Protective-action Triggers. *Natural Hazards Workshop*, University of Colorado, Boulder, July (poster).

2012 Cova, T.J., Dennison, P.E., and Drews, F.A. Protective-action Triggers. National Science Foundation-CMMI Innovation Conference, Boston, July (poster).

2009 Siebeneck, L.K. and Cova, T.J. Current Research at the Center for Natural and Technological Hazards. *Natural Hazards Workshop*, U. of Colorado, Boulder, July (poster).

2008 Cova, T.J. et al., Protective actions in wildfire: the incident commander perspective. *Pacific Coast Fire Conference*, San Diego, November (poster).

2005 Yuan, M., Goodchild, M.F., Cova, T.J., Towards a general theory of geographic representation in GIS (poster*). Conference on Spatial Information Theory (COSIT) 2005*, Ellicottville, New York, September (poster).

2005 Kim, T.H., and Cova, T.J., Tweening Grammars: Deformation Rules for Representing Change between Discrete Geographic Entities*. Geocomputation 2005,* Ann Arbor, MI, August*.*

2001 Cova, T.J. and Johnson, J.P., Evacuation analysis and planning tools inspired by the East Bay Hills Fire, *California's 2001 Wildfire Conference: 10 years after the 1991 East Bay Hills Fire*, Oakland, October.

2001 Hepner, G.F., Cova, T.J., Forster, R.R., and Miller, H.J., Use of remote sensing and geospatial analysis for transportation hazard assessment: an integrated university, government and private sector consortium, *IEEE/ISPRS Joint Workshop on Remote Sensing and Data Fusion over Urban Areas Proceedings*, IEEE-01EX482,Rome, Italy, pp.241-244.

2000 Atwood, G., and Cova, T.J., Using GIS and linear referencing to analyze the 1980s shorelines of Great Salt Lake, Utah, USA. *4th International Conference on Integrating GIS and Environmental Modeling (GIS/EM4): Problems, Prospects and Research Needs*. Banff, Alberta, Canada, September 2-8.

1997 Cova, T.J., and Church, R.L., An algorithm for identifying nodal clusters in a transportation network. *University Consortium for Geographic Information Science (UCGIS) Summer Retreat*, Bar Harbor, Maine, June 15-21.

1995 Cova, T.J., and Church, R.L., A spatial search for neighborhoods that may be difficult to evacuate, *Proceedings GIS/LIS '95*, ACSM/ASPRS, Nashville, TN, vol. 1, 203-212.

1995 Goodchild, M.F., Cova, T.J. and Ehlschlaeger, C., Mean geographic objects: extending the concept of central tendency to complex spatial objects in GIS, *Proceedings GIS/LIS '95*, ACSM/ASPRS, Nashville, TN, vol. 1, 354-364.

1994 Cova, T.J. and Goodchild, M.F., Spatially distributed navigable databases for intelligent vehicle highway systems, *Proceedings GIS/LIS '94*, ACSM, Phoenix, AZ, 191-200.

Other Publications

2018 Wei, R., Golub, A., Wang, L., Cova, T.J. *Evaluating and enhancing public transit systems for operational efficiency and access equity.* TREC Final Report, NITC-RR-1024.

2018 Wei, R., Golub, A., Wang, L., Cova, T.J. *Integrated performance measures: transit equity & efficiency*. TREC Final Report, NITC-RR-1024.

2008 Siebeneck, L.K. and Cova, T.J. Risk perception associated with the evacuation and return-entry process of the Cedar Rapids, Iowa flood. Quick Response Research Report, Natural Hazards Center, University of Colorado, Boulder.

2006 Cova, T.J., *Concerning Stonegate and Public Safety*. North County Times, San Diego, California, Nov. 3.

2002 Cova, T.J., Like a bat out of hell: simulating wildfire evacuations in the urban interface, *Wildland Firefighter Magazine*, November, 24-29.

2000 Cova, T.J., When all hell breaks loose: firestorm evacuation analysis and planning with GIS, *GIS Visions Newsletter*, August, The GIS Cafe.

2000 Cova, T.J. (2000) Wildfire evacuation. *New York Times letter to the Editor*, June 6.

1996 Church, R., Cova, T., Gerges, R., Goodchild, M., Conference on object orientation and navigable databases: report of the meeting. *NCGIA Technical Report 96-9.*

1994 Church, R., Coughlan, D., Cova, T., Goodchild, M., Gottsegen, J., Lemberg, D., Gerges, R., Caltrans Agreement 65T155, Final Report, *NCGIA Technical Report 94-6*.

Invited Lectures, Presentations and Participation

2019 “Public safety in the wildland-urban interface.” Department of Geography, University of Alabama, Tuscaloosa, November.

2019 “Public safety in the wildland-urban interface.” Department of Geography, Texas A&M (TAMU), College Station, February.

2018 “ESRI Science Symposium.” Panelist, ESRI Conference, San Diego, July.

2018 "Public safety in the wildland-urban interface." Living with Fire in California's Coast Ranges, Sonoma, May.

2017 "Improving situational awareness in wildfire evacuations with volunteered geographic information." NSF IBSS/IMEE Summer Workshop, San Diego, August.

2014 "Modeling adaptive warnings with geographic trigger points." Department of Geography, SDSU, San Diego, CA, April 18.

2013 "Wildfires and geo-targeted warnings." Geo-targeted Alerts and Warnings Workshop. *National Academy of Sciences*, Washington DC, February 21-22.

2012 "Evacuation planning in the wildland-urban interface." California Joint Fire Science Program, Webinar Speakers Series, September.

2010 "Evacuating threatened populations in disasters: space, time & information." University of Minnesota, Spatial Speakers Series (Geography/CS/CE), April.

2009 "The art and science of evacuation modeling." Utah Governor's Conf. in Emergency Management, Provo, May.

2008 "GIScience and public safety." Brigham Young University, November.

2007 "Fire, climate and insurance." Panel Discussion. Leonardo Museum, Salt Lake City, November.

2007 "GIScience and public safety." University of Northern Iowa, April.

2006 "Evacuation and/or Shelter in Place." Panel Discussion, Firewise Conference: Backyards & Beyond, Denver, CO, Nov.

2006 "Evacuation modeling and planning." Colorado Springs Fire Department, Colorado Springs, CO, October.

2006 "Evacuation modeling and planning." Sante Fe Complexity Institute, Sante Fe, NM, August.

2006 "Evacuation modeling and planning." Colorado Wildfire Conference. Vail, CO, April, $1000.

2006 "Dynamic GIS: in search of the killer app." Center for Geocomputation, National U. of Ireland, Maynooth, April.

2006 “Setting wildfire evacuation trigger points with GIS.” University Consortium for Geographic Information Science, Winter meeting, Washington, DC.

2005 “Setting wildfire evacuation trigger points with GIS.” Pennsylvania State University, State College, PA, November.

2004 “The role of scale in ecological modeling,” NSF PI meeting for Ecology of Infectious Diseases, Washington D.C., September.

2004 “The 2003 Southern California wildfires: Evacuate and/or or shelter-in-place,” Natural Hazards Workshop, Boulder, CO.

2004 “When all hell breaks loose: new methods for wildfire evacuation planning,” colloquium, Department of Geography, University of Denver, February.

2004 “When all hell breaks loose: new methods for wildfire evacuation planning,” Colorado Governor’s Conference and Colorado Emergency Management Association (CEMA) Conference, Boulder, CO, February.

2004 “When all hell breaks loose: new methods for wildfire evacuation planning,” colloquium, Department of Geography, University of California Los Angeles, February.

2003 “When all hell breaks loose: new methods for wildfire evacuation planning,” colloquium, Natural Resources Ecology Lab (NREL), Colorado State University, April.

2003 “When all hell breaks loose: new methods for wildfire evacuation planning,” Departmental colloquium, Department of Geography, University of Arizona, January.

2002 “When all hell breaks loose: new methods for wildfire evacuation planning,” Departmental colloquium, Department of Geography, Western Michigan University, November.

2001 "Regional evacuation analysis in fire-prone areas with limited egress," Departmental colloquium, Department of Geography, University of Denver, May.

2000 “Integrating Site Search Models and GIS,” Colloquium, Department of Geography, Arizona State University, Feb.

1999 “Site Search Problems and GIS,” Colloquium, Department of Geography, University of Utah.

1996 "A spatial search for neighborhoods that may be difficult to evacuate," Colloquium, Department of Geography, UC Santa Barbara.

1995 "A spatial search for neighborhoods that may be difficult to evacuate," Regional Research Lab, Bhopal, India.

1995 "A spatial search for neighborhoods that may be difficult to evacuate," Indian Institute of Technology, Bombay. India.

Papers Presented at Professional Conferences

2018 Cova, T.J., GIScience & Emergency Management: where do we go from here? Association of American Geographers Annual Meeting, New Orleans, LA, April.

2017 Cova, T.J., Simulating warning triggers. Association of American Geographers Annual Meeting, Boston, MA, CA, April.

2016 Cova, T.J., Spatio-temporal representation in modeling evacuation warning triggers. Association of American Geographers Annual Meeting, San Francisco, CA, March.

2015 Cova, T.J. and Jankowski, P., Spatial uncertainty in object-fields: the case of site suitability. Association of American Geographers Annual Meeting, Chicago, IL, April.

2014 Cova, T.J. and Jankowski, P., Spatial uncertainty in object-fields: the case of site suitability. International Conference on Geographic Information Science (GIScience '14), Vienna, Austria, September.

2013 Cova, T.J., Dennison, P.E. and Drews, F.A., Protective-action triggers: modeling and analysis. *Association of American Geographers Annual Meeting*, Los Angeles, CA, April.

2012 Cova, T.J., Dennison, P.E. and Drews, F.A., Protective-action triggers. Poster presented at the Natural Hazards Workshop, University of Colorado, Boulder, July.

2012 Cova, T.J., Dennison, P.E. and Drews, F.A., Protective-action triggers. Poster presented at the NSF CMMI Innovation Conference, Boston, July.

2012 Cova, T.J., Dennison, P.E. and Drews, F.A., Protective-action triggers, *Association of American Geographers Annual Meeting,* New York, NY, February.

2011 Cova, T.J., Modeling stay-or-go decisions in wildfires, *Association of American Geographers Annual Meeting,* Seattle, WA, April.

2010 Cova, T.J., Theobald, D.M. and Norman, III, J., Mapping wildfire evacuation vulnerability in the West, *Association of American Geographers Annual Meeting,* Wash. D.C., April.

2010 Cova, T.J., and Van Drimmelen, M.N., Family gathering in evacuations: the 2007 Angora Wildfire as a case study. *National Evacuation Conference*, New Orleans, February.

2010 Siebeneck, L.K., Cova, T.J., Drews, F.A., and Musters, A. Evacuation and shelter-in-place in wildfires: The incident commander perspective. *Great Basin Incident Command Team Meetings*, Reno, April.

2009 Cova, T.J. et al., Protective action decision making in wildfires: the incident commander perspective. *Association of American Geographers Annual Meeting,* Las Vegas, March.

2009 Siebeneck, L.K. and Cova, T.J. Using GIS to explore evacuee behavior before, during and after the 2008 Cedar Rapids Flood. *Association of American Geographers Annual Meeting*, Las Vegas, March.

2009 Lindell, M.K., Prater, C.S., Siebeneck, L.K. and Cova, T.J. Hurricane Ike Reentry. *National Hurricane Conference*, Austin, March.

2008 Cova, T.J., Simulating evacuation shadows, *Association of American Geographers Annual Meeting,* Boston, April.

2007 Cova, T.J., An agent-based approach to modeling warning diffusion in emergencies, *Association of American Geographers Annual Meeting,* San Francisco, March.

2006 Cova, T.J., New GIS-based measures of wildfire evacuation vulnerability and associated algorithms. *Association of American Geographers Annual Meeting,* Denver, March.

2005 Cova, T.J., Dennison, P.E., Kim, T.H., and Moritz, M.A., Setting wildfire evacuation trigger-points using fire spread

modeling and GIS. *Association of American Geographers Annual Meeting,* Denver, March.

2004 Cova, T.J., Sutton, P.C., and Theobald, D.M. Light my fire proneness: residential change detection in the urban-wildland interface with nighttime satellite imagery, *Association of American Geographers Annual Meeting*, Philadelphia, March.

2004 Cova, T.J. and Johnson, J.P., A network flow model for lane-based evacuation routing. *Transportation Research Board (TRB) Annual Conference*, Washington, D.C., January.

2003 Cova, T.J. Lane-based evacuation routing, *Association of American Geographers Annual Meeting*, New Orleans, March.

2002 Cova, T.J., Extending geographic representation to include fields of spatial objects, *GIScience 2002*, Boulder, September.

2002 Husdal, J. and Cova, T.J., A spatial framework for modeling hazards to transportation systems, *Association of American GeographersAnnual Meeting,* Los Angeles, March.

2001 Cova, T.J. and Johnson, J.P., Evacuation analysis and planning tools inspired by the East Bay Hills Fire, *California's 2001 Wildfire Conference: 10 years after the 1991 East Bay Hills Fire*, Oakland, October.

2001 Cova, T.J., Husdal, J., Miller, H.J., A spatial framework for modeling hazards to transportation networks, *Geographic Information Systems for Transportation Conference (GIS-T 2001*), Washington DC, April.

2001 Cova, T.J., Miller, H.J., Husdal, J., A spatial framework for modeling hazards to transportation systems, *Association of American Geographers Annual Meeting*, New York, New York, February.

2000 Cova, T.J., Church, R.L., Goodchild, M.F., Extending geographic representation to include fields of spatial objects, *GIScience 2000,* Savannah, Georgia, November.

2000 Cova, T.J. Microscopic simulation in regional evacuation: an experimental perspective, *Association of American Geographers Annual Meeting*, Pittsburgh, Pennsylvania, March.

1999 Cova, T.J., and Church, R.L., “Exploratory spatial optimization and site search: a neighborhood operator approach,” *Geocomputation ’99*, Mary Washington College, Fredricksburg, Virginia.

1999 Cova, T.J., and Church, R.L., “Integrating models for optimal site selection with GIS: problems and prospects,” *Association of American Geographer Annual Meeting*, Honolulu, Hawaii, March 29.

1998 Cova, T.J., and Church, R.L., “A spatial analytic approach to modeling neighborhood evacuation egress,” *Association of American Geographers Annual Meeting,* Boston, Massachusetts.

1997 Church, R.L., and Cova, T.J., “Location search strategies and GIS: a case example applied to identifying difficult to evacuate neighborhoods,” *Regional Science Association Annual Meeting*, November, Buffalo.

1997 Cova, T.J. and Church, R.L., “An algorithm for identifying nodal clusters in a transportation network,” *University Consortium for Geographic Information Science (UCGIS) Summer Retreat*, Bar Harbor, June.

1996 Cova, T.J., Church, R.L., “A spatial search for difficult neighborhoods to evacuate using GIS,” *GIS and Hazards Session*, *Association of American Geographers Annual Meeting*, Charlotte, April.

1995 Cova, T.J., Church, R.L., “A spatial search for neighborhoods that may be difficult to evacuate,” *GIS/LIS ’95*, Nashville, November.

1995 Goodchild, M.F., Cova, T.J. and Ehlschlaeger, C., “Mean geographic objects: extending the concept of central tendency to complex spatial objects in GIS,” *GIS/LIS ‘95*, Nashville, November.

1994 Cova, T.J. and Goodchild, M.F., “Spatially distributed navigable databases for intelligent vehicle highway systems,” *GIS/LIS ’94*, Phoenix, November.

Grants

Externally funded

2019 – Cova, T.J. (PI), Collins, T.W., Grineski, S.E., Norton, T., *Enabling the Next Generation of Hazards Researchers*. National Science Foundation. Division of Civil, Mechanical & Manufacturing Innovation (CMMI): Humans, Disasters & the Built Environment (HDBE), $480,634.

2018 – Smith, K. (PI), Cova, T.J., Waitzman, N., Perlich, P., Kowaleski-Jones, L. Research Data Center: Wasatch Front Research Data Center. National Science Foundation, Division of Social Economic Sciences, $298,625.

2017 – 2019 Shoaf, K. (PI) and Cova, T.J. *RAPID: Evacuation Decision-making process of Hospital Administrators in Hurricane Harvey*. National Science Foundation, Civil Mechanical and Manufacturing Innovation – Infrastructure Management and Extreme Events, $49,301.

2011 – 2015 Cova, T.J. (PI), Dennison, P.E. and Drews, F.A., *Protective action triggers*. National Science Foundation, Civil Mechanical and Manufacturing Innovation – Infrastructure Management and Extreme Events, $419,784.

2012 – 2014 Cova, T.J. (PI), *State Hazard Mitigation Mapping II.* Utah Division of Emergency Management, $51,608.

2011 – 2012 Cova, T.J. (PI), *State Hazard Mitigation Mapping.* Utah Division of Emergency Management, $51,608.

2007 – 2010 Cova, T.J. (PI) and Drews, F.A. *Protective-action decision making in wildfires.* National Science Foundation, Civil Mechanical and Manufacturing Innovation – Infrastructure Management and Extreme Events, $288,438.

2004– 2006 Yuan, M. (PI), Goodchild, M.F., and Cova, T.J. *Integration of geographic complexity and dynamics into geographic information systems,* National Science Foundation, Social and Behavioral Science—Geography and Spatial Sci., $250,000.

2003– 2004 Cova, T.J. (PI) *Mapping the 2003 Southern California Wildfire Evacuations*, National Science Foundation, Small Grants for Exploratory Research (SGER), CMMI-IMEE, $14,950.

2003 –2008 Dearing, M.D. (PI), Adler, F.R., Cova, T.J., and St. Joer, S. *The effect of anthropogenic disturbance on the dynamics of*

Sin Nombre, National Science Foundation and NIH, Ecology of Infectious Diseases, $1,933,943.

2000–2004 Hepner, G.F. (PI), Miller, H.J., Forster, R.R., and Cova, T.J. *National Consortium for Remote Sensing in Transportation: Hazards (NCRST-H),* U.S. Department of Transportation, $437,659.

2000–2001 Cova, T.J. (PI) *Modeling human vulnerability to environmental hazards*, Salt Lake City and Federal Emergency Management Agency (FEMA), $20,000.

Internally funded

2004 Cova, T.J. (PI) and Sobek, A. *DIGIT Lab GPS Support*, U. of Utah Technology Instrumentation Grant, $15,000.

2003 Cova, T.J. (PI) *New methods for wildfire evacuation analysis*, Proposal Initiative Grant, College of Social and Behavioral Science, University of Utah, $4000.

1999 Cova, T.J. (PI) *Microscopic traffic simulation of regional evacuations: computational experiments in a controlled environment*, Faculty Research Grant (FRG), University Research Committee, University of Utah, $5980.

1999 Cova, T.J. (PI) *Regional evacuation analysis in fire prone areas with limited egress*, Proposal Initiative Grant, College of Social and Behavioral Science, University of Utah, $4000.

Media Outreach

2019 Krieger, L., "Camp Fire: when survival means shelter." *San Jose Mercury News*, Feb. 3.

2018 Romero, S., Arango, T., and Fuller, T. "A frantic call, a neighbor's knock, but few official alerts as wildfire closed in." *New York Times*, Nov. 21.

2018 Serna, J., St. John, P., Lin, R-G. "Disaster after disaster, California keeps falling short on evacuating people from harm's way." *Los Angeles Times*, Nov. 28.

2018 Simon, M. "How California needs to adapt to survive future fires." *Wired Magazine*, Nov. 15.

2018 O'Neill, S. "Year-round wildfire season means always living evacuation ready." Morning Addition, *National Public Radio*, Sep. 25.

2017 Mortensen, M. "System used for Amber Alerts can also warn of other emergencies." Utah Public Radio, Dec. 19.

2013 Ryman, A. and Hotstege, S. "Yarnell evacuation flawed and chaotic, experts say." *Arizona Republic and USA Today*, Nov.

2013 Bryson, D., and Campoy, A. "Quick fire response pays off: Colorado credits early alerts with limiting deaths from state's worst-ever blaze." *The Wall Street Journal*, June 17.

2013 Beri, A. "Due to the sequester: people are going to be unsafe, homes are going to burn." *Tampa Bay Times*, Feb.

2012 Zaffos, J. "What the High Park Fire can teach us about protecting homes." *High Country News*, July.

2012 Meyer, J.P. and Olinger, D., "Tapes show Waldo Canyon fire evacuations delayed two hours." *The Denver Post*. July.

2011 Siegel L, and Rogers, N. "Monitoring killer mice from space." *USA Today*, *SLTribune, Fox 13 News, KCPW*, Feb. 15.

2010 Cowan, J., "Esplin defends stay or go policy." *Australian Broadcast Corporation (ABC)*, April 30.

2010 Bachelard, M., "Should the fire-threatened stay or go? That is still the question." *The Age*, Australia, May 2.

2008 Boxall, B., "A Santa Barbara area canyon's residents are among many Californian's living in harm's way in fire-prone areas." *Los Angeles Times*, July 31.

2007 Welch, W.M. et al., "Staggering numbers flee among fear and uncertainty." *USA Today*, Oct. 24.

2007 Krasny, M., "Angora Wildfire Panel Discussion." *KQED Radio*, San Francisco, June 27.

2004 Wimmer, N., "Growing number of communities pose fire hazard." *KSL Channel 5,* Salt Lake City, July 22.

2004 Disaster News Network, "The face of evacuation procedures might be changing as a result of lessons learned from last year's fierce wildfires in California."

2004 Perkins, S., "Night space images show development." *Science News*, Week of April 3rd, 165 (14): 222.

2003 Keahey, J., "Canyon fire trap feared." *SL Tribune*, June.

TEACHING AND MENTORING

Undergraduate Courses

Geoprogramming (~30 students)
Introduction to Geographic Information Systems (~60 students).
Human Geography (~40 students).
Geography of Disasters and Emergency Management (~20 students).
Methods in GIS (~40 students).

Graduate Courses

GIS & Python (~20 students)
Spatial Databases (~30 students)
Seminars: Hazards Geography, Transportation, Vulnerability, GIScience.

Graduate Student Advising

Chaired Ph.D. Committees

2017-	Coleman, A.	Geographic data fusion for disaster management
2016	Li, D.	Modeling wildfire evacuation triggers as a coupled natural-human system (Asst. Professor South Dakota State University)
2010	Siebeneck, L.	Examining the geographic dimensions of risk perception, communication and response during the evacuation and return-entry process. (Assoc. Professor, U. of North Texas)
2010	Cao, L.	Anthropogenic habitat disturbance and the dynamics of hantavirus using remote sensing, GIS, and a spatially explicit agent-based model. (Postdoc, Kelly Lab, UC Berkeley)

Chaired M.S. committees

2019-	Riyadh, A.	Flood resilience in Dhaka, Bangladesh
2018-	Huang, Z.	Autonomous vehicles in hurricane evacuation.
2019	Kar, A.	Optimal vehicle routing in disasters
2017	Yi, Y.	A web-GIS application for house loss notification in wildfires
2017	Latham, P.	Evaluating the effects of snowstorm frequency and depth on skier behavior in Big Cottonwood Canyon, Utah
2016	Bishop, S.	Spatial access and local demand for emergency medical services in Utah
2015	Hile, R.	Exploratory testing of an artificial network classification for enhancement of a social vulnerability index
2015	Unger, C.	Creating spatial data infrastructure to facilitate the collection and dissemination of geospatial data to aid in disaster management
2014	Klein, K.	Tracking a wildfire in areas of high relief using volunteered geographic information: a viewshed application
2012	Amussen, F.	Greek island social networks and the maritime shipping dominance they created (technical report)
2012	Martineau, E.	Earthquake risk perception in Salt Lake City, Utah
2010	Smith, K.	Developing emergency preparedness indices for local government

2010	VanDrimmelen, M.	Family gathering in emergencies: the 2007 Angora Wildfire as a case study
2007	Pultar, E.	GISED: a dynamic GIS based on space-time points
2007	Siebeneck, L.	An assessment of the return-entry process for Hurricane Rita, 2005
2007	Johnson, J.	Microsimulation of neighborhood-scale evacuations
2004	Chang, W.	An activity-based approach to modeling wildfire evacuations

Membership on Ph.D Committees

2017	Campbell, M.	Wildland firefighter travel times
2016	Zhang, L.	Economic geography of China
2015	Huang, H.	Spatial analysis and economic geography
2014	Lao, H.	Spatial analysis, GIS, and economic geography
2013	Burgess, A.	Hydrologic implications of dust in snow in the Upper Colorado River Basin
2012	Davis, J.	
2012	Li, Y.	
2011	Hadley, H.	Transit sources of salinity loading in the San Rafael River, Upper Colorado River Basin, Utah
2009	Medina, R.	Use of complexity theory to understand the geographical dynamics of terrorist networks
2008	McNeally, P.	Holistic geographical visualization of spatial data with applications in avalanche forecasting
2008	Sobek, A.	Generating synthetic space-time paths using a cloning algorithm on activity behavior data
2007	Clay, C.	Biology
2006	Backus, V.	Assessing connectivity among grizzly bear populations near the U.S.-Canada border
2006	Atwood, G.	Shoreline superelevation: evidence of coastal processes of Great Salt Lake, Utah
2006	White, D.	Chronic technological hazard: the case of agricultural pesticides in the Imperial Valley, California
2005	Ahmed, N.	Time-space transformations of geographic space to explore, analyze and communicate transportation systems
2004	Shoukrey, N.	Using remote sensing and GIS for monitoring settlement growth expansion in the eastern part of the Nile Delta Governorates in Egypt (1975-1998)
2004	Hernandez, M.	A Procedural Model for Developing a GIS-Based Multiple Natural Hazard Assessment: Case Study-Southern Davis County, Utah
2003	Wu, Y-H.	Dynamic models of space-time accessibility

2003	Hung, M.	Using the V-I-S model to analyze urban environments from TM imagery
2002	Baumgrass, L.	Initiation of snowmelt on the North Slope of Alaska as observed with spaceborne passive microwave data

Membership on M.S. Committees

2015	Farnham, D.	Food security and drought in Ghana
2015	Fu, L.	Analyzing route choice of bicyclists in Salt Lake City
2014	Li, X.	Spatial representation in the social interaction potential metric: an analysis of scale and parameter sensitivity
2013	Johnson, D.	Parks, Recreation & Tourism
2012	Fryer, G.	Wildland firefighter entrapment avoidance: developing evacuation trigger points utilizing the WUIVAC fire spread model.
2011	Groeneveld, J.	An agent-based model of bicyclists accessing light-rail in Salt Lake City
2011	Matheson, D.S.	Evaluating the effects of spatial resolution on hyperspectral fire detection and temperature retrieval
2010	Larsen, J.	Analysis of wildfire evacuation trigger-buffer modeling from the 2003 Cedar Fire, California.
2010	Smith, G.	Development of a flash flood potential index using physiographic data sets within a geographic information system
2010	Song, Y.	Visual exploration of a large traffic database using traffic cubes
2010	Evans, J.	Parks, Recreation & Tourism
2008	Naisbitt, W.	Avalanche frequency and magnitude: using power-law exponents to investigate snow-avalanche size proportions through time and space.
2008	Kim, H.C.	Civil Engineering
2007	Gilman, T.	Evaluating transportation alternatives using a time geographic accessibility measure
2004	Baurah, A.	An integration of active microwave remote sensing and a snowmelt runoff model for stream flow prediction in the Kuparak Watershed, Arctic Alaska
2004	Bosler, J.	A Development Response to Santaquin City's Natural Disasters.
2004	Bridwell, S.	Space-time masking techniques for privacy protection in location-based services

2004	Deeb, E.	Monitoring Snowpack Evolution Using Interferometric Synthetic Aperture Radar (InSAR) on the North Slope of Alaska, USA
2004	Sobek, A.	Access-U: a web-based navigation tool for disabled students at the University of Utah
2003	Barney, C.	Locating hierarchical urban service centers along the Wasatch Front using GIS location-allocation algorithms
2002	Koenig, L.	Evaluation of passive microwave snow water equivalent algorithms in the depth hoar dominated snowpack of the Kuparuk River Watershed, Alaska, USA
2002	Larsen, C.	Family & Consumer Studies
2002	Krokoski, J.	Geology & Geophysics
2000	Granberg, B.	Automated routing and permitting system for Utah Department of Transportation
2000	Bohn, A.	An integrated analysis of the Tijuana River Watershed: application of the BASINS model to an under-monitored binational watershed

Graduate student awards

2015	R. Hile., M.A. Geography: Jeanne X. Kasperson Award, Hazards, Risk & Disasters Specialty Group, Association of American Geographers.
2015	D. Li, Ph.D. Geography: Jeanne X. Kasperson Award, Hazards, Risk & Disasters Specialty Group, Association of American Geographers.
2012	K. Klein, M.A. Geography: *Jeanne X. Kasperson Award*, Hazards, Risk & Disasters Specialty Group, Association of American Geographers.
2010	L. Cao, Ph.D. Geography: *Student Paper Award*, Spatial Analysis and Modeling (SAM) Specialty Group, Association of American Geographers.
2008	L. Siebeneck, M.A. Geography: *Jeanne X. Kasperson Award*, Hazards Specialty Group, Association of American Geographers.
2007	E. Pultar, M.A. Geography: *Best Paper*, GIS Specialty Group, Association of American Geographers.
2006	J. VanLooy (not primary advisor): *Best Paper*, Rocky Mountain Regional Meeting, Association of American Geographers.

Undergraduate Mentoring and Advising

2015	Mentor, Marli Stevens, Undergraduate Research Opportunity Program: “Margin of Licensed Dog and Cat Populations and Adoptions from Animal Shelters in Utah in 2013-2014.”

2015— Advisor, Undergraduate Hazards & Emergency Management Certificate students (~10 students so far).

2006—2010 Advisor, Stewart Moffat, Honor's B.S. in Undergraduate Studies: Disaster Management (published journal article).

2005—2007 Advisor, Brian Williams, B.S. in Undergraduate Studies: Comprehensive Emergency Management.

2001— Advisor, Undergraduate GIS Certificate Students (> 100 students).

Junior Faculty Mentoring

2017— Andrew Linke, Department of Geography, University of Utah
2014—2017 Ran Wei, Department of Geography, University of Utah
2011—2014 Steven Farber, Department of Geography, University of Utah
2009—2011 Scott Miles, Dept. of Geography, Western Washington U.
2009—2011 Timothy W. Collins, Department of Sociology, UT El Paso

SERVICE

Referee Duties

Journals
Applied Geography
Annals of the Association of American Geographers
Cartographica
Computers Environment & Urban Systems
Disasters
Environmental Hazards: Policy and Practice
Geographical Analysis
Geoinformatica
International Journal of Geographical Information Science
Journal of Geographical Systems
Journal of Transport Geography
Natural Hazards
Natural Hazards Review
Networks and Spatial Economics
Photogrammetric Engineering and Remote Sensing
Professional Geographer
Society & Natural Resources
Transportation Research A: Policy & Practice
Transportation Research B: Methodological
Transportation Research C: Emerging Technologies
Transactions in GIS

National Science Foundation Panels
Decision Risk and Uncertainty (1)
Geography and Spatial Science, Doctoral Dissertation Improvement Grant (4)
Civil & Mech. Systems – Infrastructure Management and Extreme Events (2)
Civil & Mech. Systems - Rural Resiliency (1)
NSF and NIH: Big Data (1)
Hazards SEES: Type 2 (1)

Proposals
Center for Disaster Management & Humanitarian Assistance
Faculty Research Grants, University of Utah (3)

External Promotional Reviews
Full Professor (5), Associate Professor (12)

Activities at Professional Conferences

2000 – 2018	**Paper session co-organizer, chair,** "Hazards, GIS and Remote Sensing" session, Annual Meeting of the Association of American Geographers.
2002 – 2003	**Paper session organizer, chair, and judge, "**GIS Specialty Group Student Paper Competition," Association of American Geographers Annual Meeting.
1999	**Paper session organizer**, "Location Modeling and GIS," Annual Meeting of the Association of American Geographers, Honolulu, Hawaii, March.

University Service

2019 –	RPT Standards Committee, Office of the AVP for Faculty
2014 – 2017	Member, Academic Senate
2014 – 2017	Member, University Promotion & Tenure Advisory Committee (UPTAC)
2011 –	Member, Social Science General Education Committee
1999 – 2009	Delegate, University Consortium for GIScience
2013	Member, Graduate Research Fellowship (GRF) Committee
2010 – 2012	Member Student Evaluations Committee, Undergrad. Studies
2009 – 2012	Member, Graduate Council, College of Soc. and Beh. Science
2003 – 2004	Member, Instit. Review Board (IRB) Protocol Committee
2001 – 2004	Member, Social Science General Education Committee

College Service: Social & Behavioral Science

2014 –	Chair, Review, Promotion & Tenure Committee
2012 – 2014	Member, College Review, Promotion, & Tenure Committee
2015	Member, Superior Teaching Committee
2011 – 2012	Chair, Superior Teaching Committee

2007 Member, Search Committee, Inst. of Public and Intern Affairs
2005, 2006 Member, Superior Research Committee
2002, 2004 Member, Superior Teaching Committee

Departmental Service: Geography

2015 – Member, Undergraduate Committee
2014 –2017 Representative, University Academic Senate
2014 – Director, Certificate in Hazards & Emergency Management
2014 Author, Proposal for Cert. in Hazards & Emergency Manage.
2012 – Chair, Review, Promotion & Tenure Committee
2013 Chair, Search Committee for GIScience Position
2012 Co-author, Proposal for MS in GIScience
2011 – 2012 Director of Graduate Studies
2010 Search Committee Chair, Human Geography Position
2004 – 2015 Member, Graduate Admissions Committee
2004 – 2008 Member, Colloquium Committee
2000 – Chair, Geographic Information Science Area Committee