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RE: Village at Squaw Valley Specific Plan DEIR—review of impacts to sensitive habitats

Dear Laurel:

The Conservation Biology Institute (CBI) is a 501(c)3 organization that works collaboratively to conserve biological diversity in its natural state through applied research, education, planning, and community service. CBI's extensive partner network includes academic institutions, state and federal agencies, and other non-profit environmental organizations. CBI combines strengths across multiple disciplines ranging from conservation planning to habitat management and monitoring to ecological modeling of species populations, landscape connectivity, climate change, and fire.

We have reviewed the Village at Squaw Valley Specific Plan Draft Environmental Impact Report (DEIR) (Ascent Environmental, Inc. 2015) and submit these comments regarding impacts to and mitigation for sensitive riparian and wetland habitats (Section 6, Biological Resources). We comment on other sections and issues when relevant to these habitats. Our analyses have been informed through discussion with Dr. Tom Myers, hydrological consultant, and review of his Technical Memorandum on impacts to the Olympic Valley aquifer. Other documents or data reviewed are included in the reference section of this letter.

Sincerely,

Patricia Gordon-Reedy

Patricia Gordon-Reedy
Vegetation Ecologist/Botanist

Summary

Our review of sensitive habitats assessed whether (1) existing conditions are adequately described, (2) direct and indirect impacts are adequately addressed and analyzed and (3) proposed mitigation is adequate to compensate for project impacts. Based on our review, we find that the DEIR has several deficiencies:

- The description of sensitive habitats onsite is incomplete, ambiguous, and not consistently accounted for in the impacts assessment. Thus, it is unclear if the proposed restoration adequately mitigates for the project's impacts.
- As the level of groundwater drawdown has not been accurately assessed, impacts to vegetation may be more widespread than calculated, and the proposed creek restoration will likely not be successful.
- The DEIR does not consider or adequately address all impacts to sensitive habitat from project implementation (including direct, indirect, or cumulative impacts).
- Proposed mitigation measures are insufficiently detailed to determine their adequacy to offset project impacts.
- Groundwater drawdown will be exacerbated by climate change, which cumulatively will cause greater changes in vegetation communities, and may contribute to greenhouse gases.

We elaborate on these issues below. It is our recommendation that deficiencies be addressed and the DEIR revised and recirculated for further review prior to certifying the document.

Comments

The description of sensitive habitats onsite is incomplete, ambiguous, and not consistently accounted for in the impacts assessment.

Section 6.1.3 Biological Communities

Table 6-1. This table indicates 4.16 acres of riparian habitat onsite, with 1.9 acres of this total (46%) impacted by project implementation. However, riparian habitat in perennial and intermittent streams has not been quantified. Therefore, the DEIR underestimates total riparian acreage and impacts to riparian habitat onsite.

Alderleaf Coffeeberry Scrub. The DEIR (p. 6-10) indicates that 0.10 acre of alderleaf coffeeberry scrub occurs on the East Parcel and sewer line corridor near the western edge of the project site. An additional 0.25 acre of alderleaf coffeeberry scrub occurs onsite but is included under seep vegetation. The DEIR should provide the rationale for separating alderleaf coffeeberry scrub into two categories.

Intermittent Stream. The DEIR (p. 6-11) indicates that fairly dense willows occur in association with downstream portions of a 'small, unnamed intermittent stream' onsite. Table 6-1 indicates that riparian vegetation (which would include dense willows) within intermittent streams has not been quantified. It is unclear whether the acreage of these dense willows has been calculated or considered in project impacts (see Table 6-1). Likewise, it is unclear whether hydrophytic and willow riparian scrub in intermittent streams in the Village Core area or water tank parcel have been calculated or considered in project impacts (see Table 6-1). If these acreages have not been quantified, the DEIR underestimates total riparian acreage and impacts to riparian habitat onsite.

Seep. See comments above related to alderleaf coffeeberry scrub.

Perennial Stream. The DEIR (p. 6-12) indicates that willow and alder line the channel of the perennial Truckee River on the most eastern section of the sewer line corridor. It is unclear whether this riparian habitat has been calculated or considered in project impacts (see Table 6-1). If not, the DEIR underestimates total riparian acreage and impacts to riparian habitat onsite.

Riparian. The DEIR (p. 6-12) indicates that riparian vegetation on the project site (4.16 acres) is 'slightly underrepresented' in acreage calculations because it was not always delineated separately from perennial or intermittent stream in biological resource reports. The DEIR should provide a more precise accounting of riparian vegetation in perennial or intermittent streams so that impacts and mitigation ratios can be accurately assessed.

The DEIR's description of "riparian" identifies (1) riparian vegetation, which includes black cottonwood (*Populus trichocarpa*), mountain alder (*Alnus incana* ssp. *tenuifolia*), and shining willow (*Salix lucida*), and (2) riparian scrub, which includes mountain alder, mountain ash (*Sorbus californica*), mountain dogwood (*Cornus sericea*), and willows (*Salix* spp.). The DEIR should identify whether riparian vegetation, as described, constitutes woodland or scrub habitat, since this may have implications for mitigation ratios and restoration planning.

Seasonal Wetland. Seasonal wetlands (p. 6-13) include habitat dominated by both willow scrub and herbaceous perennial vegetation. The DEIR should provide the rational for including willow scrub in this category rather than in the willow scrub category.

Wet Meadow. The DEIR (p. 6-13) indicates that no wetland delineation has been conducted for wet meadow habitat along the sewer line corridor. Thus, wet meadow acreages and impacts may be underestimated.

Willow Alder Scrub. As with alderleaf coffeeberry scrub, willow alder scrub is recognized as a stand-alone sensitive habitat, but some willow alder scrub acreage is included in a seep category (DEIR, p. 6-14). The DEIR should provide the rationale for separating this association into two categories.

Willow Scrub. This sensitive habitat is also recognized as a stand-alone sensitive habitat, but some of its acreage is included in a wet meadow category (DEIR, p. 6-14). The DEIR should provide the rationale for separating this association into two categories.

Section 6.17 Waters of the U.S.

General Comment. The DEIR (p. 6-25) indicates that the wetland delineation and constraints map was conducted for portions of the project site only. The DEIR should indicate whether additional waters of the U.S. may be present onsite that may be impacted by project implementation.

Table 6-4. The DEIR should separate wet meadow from seasonal wetlands in this table, and provide a total acreage for wet meadows.

Table 6-4 indicates that acreage discrepancies between Tables 6-1 and 6-4 are due to rounding. However, this "rounding" results in a fairly sizeable acreage discrepancy between the two tables with respect to sensitive habitats (12.54 acres in Table 6-1 versus 8.233 acres in Table 6-4). The DEIR should resolve these discrepancies because they may have implications for mitigation.

Total acreage of intermittent stream is listed as 5.229 acres in Table 6-4 and 5.32 acres in Table 6-1. The DEIR should clarify whether this discrepancy is due to rounding or reflects acreage that is not jurisdictional waters of the U.S.

Impacts to vegetation may be more widespread than calculated due to groundwater drawdown; the DEIR does not consider all impacts to sensitive habitats from project implementation

Section 6.3.4 Impact Analysis

General Comment. The impact analysis should include a table of impacted acres by habitat that differentiates between impacts to sensitive habitats at creek bed level versus impacts above creek bed levels. This is important because groundwater modeling is specific to the creek bed of Squaw Creek or areas where the creek bed is less than one foot from the bank (DEIR, p. 6-41).

Impact 6-1: Removal or Degradation of Sensitive Habitats (Operations)

General Comments. Groundwater pumping and drawdown can lower groundwater levels below the depth that sensitive riparian and wetland habitats need to survive (Konikow 2013). The assessment of impacts to sensitive habitats (e.g., jurisdictional wetlands, wet meadows, and riparian vegetation) is based on simulated groundwater elevations in the Water Supply Assessment (WSA) (DEIR, pp. 6-42-6-43). Myers (2015a,b) has indicated there are inaccuracies in the WSA groundwater modeling that affect future groundwater projections. In addition, groundwater modeling results apply only to sensitive habitats in the creek bed of Squaw Creek and areas where the creek bed is less than one foot from the bank, and does not factor in climate change projections that could affect future groundwater drawdown levels. Because of the relationship between groundwater levels and these sensitive habitats, accurate groundwater modeling is critical to the impact analysis. Based on current modeling, the DEIR likely underestimates impacts to sensitive habitats.

Riparian Vegetation. The DEIR (p. 6-42) states that most literature on groundwater decline impacts is associated with riparian species that are not present onsite, including Fremont cottonwood (*Populus fremontii*) and black willow (*Salix gooddingii*). However, a number of studies have assessed impacts in the eastern Sierra Nevada to black cottonwood (*Populus trichocarpa*), a riparian tree species that occurs onsite. These studies documented higher mortality, lower density, and lower canopy foliage density for black cottonwoods under water stress, although some of these effects were not apparent over the short-term (e.g., 5 years) (Stromberg and Patten 1990, 1992, 1996, DiSalvo and Hart 2002). Because these studies are available, the DEIR could have and should consider both short- and long-term direct (mortality) and indirect (reduced health and vigor) impacts to riparian vegetation from groundwater drawdown.

The impact analysis for riparian vegetation used an absolute depth <10 feet from the surface as a threshold to determine potential mortality of established and shallow-rooted riparian trees (DEIR, p. 6-42). Cottonwood mortality has been reported from depths of 3-8 feet from the surface, and at shallower depths (1.5-3 feet from the surface) riparian trees may experience reduced growth or crown dieback that could impact tree health and vigor over the long-term or reduce resiliency to climate change and other disturbances (Lite and Stromberg 2005, Shafroth et al. 2000, Scott et al. 1999, Rood and Mahoney 1990, Condra 1944). The threshold depth should be reevaluated to assess whether it is appropriate for riparian species onsite, particularly in view of changing climatic conditions. Further, the impact analysis should consider both direct (mortality) and indirect (reduced health and vigor) impacts to riparian vegetation from groundwater drawdown.

The DEIR (pp. 6-42-43) states that 'any declines in groundwater depth resulting from water use for the proposed project and other development in Olympic Valley would be gradual, occurring slowly over many years...' However, this assessment uses inaccurate groundwater modeling (Myers 2015a,b), does not consider the compounding effects of climate change on the amount or timing of available surface or groundwater (Null et al. 2010), and does not consider long-term, sub-lethal stress to riparian vegetation from lowered groundwater depths (e.g., Lite and Stromberg 2005, Shafroth et al. 2000, Scott et al. 1999, Stromberg and Patten 1992). These stressors could result in diminished habitat quality and persistence. The analysis of project impacts to riparian vegetation should consider all potential impacts.

The DEIR (p. 6-43) states that 'riparian tree seedlings from species such as cottonwood and willow require water tables within 3.3 feet of the ground surface (Shafroth et al 2000).' However, cottonwood seed germination requires moist seed beds (soil surface) up to a month after seed deposition for germination and seedling survival (Steinberg 2001, Braatne et al. 1996, Haeussler et al. 1990, DeBell 1990). By focusing only on what seedlings need and ignoring germination requirements, the DEIR underestimates impacts on riparian persistence, maintenance, and restoration potential. The DEIR should consider all conditions required for seedling germination, establishment, and survival. Further, the DEIR should provide evidence that hydrological conditions (soil moisture, depth to groundwater) will be present at the appropriate time of year and for a sufficient duration to support riparian seed germination and seedling establishment.

The DEIR (p. 6-43) states that 'black cottonwood regenerates primarily through suckering from adult trees.' This statement discounts the importance of seed germination and establishment to long-term riparian persistence. Seed is a primary mode of reproduction for cottonwoods (Hines 1999). For many cottonwood species, suckering/sprouting ability declines as trees age (Read 1958 *in* Rood and Mahoney 1990). While suckering/sprouting can benefit habitat by providing additional structure, long-term riparian maintenance requires recruitment of new individuals through seed germination and seedling establishment.

The DEIR (p. 6-43) states that while 'the number of years with suitable conditions would be reduced slightly with future groundwater withdrawals for East cells, conditions are likely to remain adequate to support a multi-aged riparian system since many perennial riparian species reproduce through clones, suckers, or intermittent periods of seedling establishment every 5-10 years (Steinberg 2001).' The DEIR concludes that 'changes to East Cells A and B groundwater levels should therefore continue to allow for enough years of potential establishment and survival and long-term maintenance of riparian vegetation within the upper meadow reach without restoration.' However, the analysis does not provide evidence to support the contention that a 10-20% increase in years with unsuitable conditions for seedling germination/survival would not affect riparian health/persistence, nor does the assessment consider the compounding effects of climate change on conditions for establishment and survival of perennial riparian species.

Seedling establishment is episodic and requires complementary seed production and hydrologic events (Rood and Mahoney 1990, Steinberg 2001, Braatne et al. 1996, Haeussler et al. 1990). Rates of seedling establishment may become less frequent in the future due to a reduction in the snowpack, increased precipitation and runoff earlier in the season, and an elongated dry period. In addition, the sprouting ability of black cottonwood declines with age (Rood and Mahoney 1990). Long-term persistence of riparian vegetation depends on establishment of new trees to compensate for those that senesce or die (Rood and Mahoney 1990). Accordingly, the assessment of impacts to riparian vegetation should use revised groundwater modeling results (see first comment under Impact 6-1) and factor in climate change simulations to determine future site conditions under project implementation, including the ability to support riparian vegetation.

The DEIR (pp. 6-43-44) states that 'groundwater withdrawals to support the Specific Plan and other development, if managed as currently modelled, are unlikely to result in mortality to established perennial riparian vegetation within the western channel or upper meadow reach of Squaw Creek - the areas most affected by groundwater withdrawal.' However, the DEIR also acknowledges that groundwater withdrawals will lower groundwater elevations relative to baseline conditions (DEIR, p. 13-64) and project-related drawdown will be greater in the summer months (DEIR p. 13-13), which already experience the lowest flow/groundwater levels. Further, groundwater drawdown is expected to be exacerbated by changing climatic conditions (e.g., Myers 2015a,b, Sierra Nevada Alliance 2010). The DEIR should include revised groundwater modeling with climate change simulations to provide a more accurate assessment of future groundwater conditions (including drawdown and recharge) and allow for a more accurate analysis of impacts to established perennial vegetation, including mortality and reduced health/vigor.

The DEIR (p. 6-44) states that riparian vegetation above creek level may potentially die from groundwater drawdown or experience a significant degradation of suitable conditions for seedling/sapling establishment and survival. This conclusion is made with inaccurate groundwater modeling and without consideration of the potential effects of climate change. Impacts to riparian vegetation above creek level should be quantified using revised groundwater modeling that considers climate change with future simulations.

The DEIR does not address other indirect impacts to riparian habitat (at or above from creek level) from groundwater drawdown. For example, loss or degradation of riparian habitat could affect streambank stability, since the root systems of riparian trees and shrubs stabilize soils and reduce erosion.

The DEIR (p. 6-44) states that 'lowered groundwater elevations could also affect planting and restoration success during any creek restoration undertaken in the project area.' Because the project will cause increased drawdown beyond that predicted by the current groundwater modeling, and these drawdown effects will be further compounded by climate change (Myers 2015a), restoration potential and success must be reevaluated using revised groundwater modeling that considers climate change with future simulations. In addition, reference sites should be selected to determine suitable conditions or targets for riparian restoration, if this information is not otherwise available. Reference sites serve as models for restoration planning, design, and implementation by providing information on vegetation succession, structure, and ecosystem functions. Reference sites should be similar to the target site with respect to existing physical conditions (e.g., soils, topography) and projected restoration outcomes (e.g., hydrology, ecosystem functions, vegetation composition/structure). Reference sites should be in proximity to the project site (e.g., stream corridor, watershed), and support minimally disturbed conditions (Stillwater Sciences 2012).

<u>Meadow Vegetation</u>. The DEIR (p. 6-44) indicates that baseline and non-project groundwater depths in the upper meadow reaches of the Squaw Creek (East Cells A-C) only drop below 3.3 feet (1 m) during the driest months of some years. The DEIR further states that these cells would continue to have groundwater within 3.3 feet of the surface during the *majority of growing season months* during most years, although the number of years that the threshold would be exceeded would increase. In the driest years (10-20% of years), there would be seasons where groundwater levels drop below the threshold of meadow functionality for the majority of the growing season near Squaw Creek. As stated previously, current estimations of groundwater levels as a result of project implementation are inaccurate and do not consider the compounding effects of climate change on groundwater drawdown or recharge; thus, impacts to meadow vegetation are likely underestimated.

The DEIR (p. 6-44) states that 'since meadows are composed of annual plants that have adapted to variable water conditions, reduced vegetation productivity or earlier die off of annual vegetation due to lower water levels or dry years is a regular part of ecosystem function' and 'meadow vegetation will return in wetter years.' Based on habitat descriptions (Section 6.1.3), it appears that the majority of plants in wet and dry meadows onsite are herbaceous, *perennial* species rather than *annual* species. Annual and perennial herbaceous species may be subject to different types of impacts, as discussed below.

The DEIR (p. 6-44) concludes that 'impacts to meadow vegetation in the upper reaches of Squaw Creek meadows would not be substantial since any reduction in meadow vegetation or vegetation productivity during dry years would be minimal and temporary.' The DEIR indicates that baseline and non-project groundwater depths only drop below 3.3 feet during *the driest months* of *some years*, while groundwater depths with project implementation will drop below 3.3 feet during the *growing season months*. This is an important distinction because increased drawdowns that lengthen the dry period during the growing season could result in plant mortality over time. Evidence suggests that impacts to meadow vegetation from groundwater drawdown in summer are greatest following a dry winter (Cooper et al. 2015). Further, changes in baseline groundwater levels, even if within 3.3 feet of the surface, could result in shifts in meadow species composition, since species or species-groups have different water requirements (e.g., Allen-Diaz 1991). Many perennial herbaceous meadow plants are rhizomatous species that may experience above-ground die-off during dry periods, but regenerate from below-ground root stock under favorable conditions. Although these species are adapted to natural fluctuations in climatic conditions that affect growth in some years, a permanent change in condition to more frequent years of lower groundwater levels would constitute an additional stress that could result in plant mortality over time.

Habitat descriptions (Section 6.1.3) list a few annual plants species in meadows onsite. Many annual plants rely on soil seed banks for germination and growth. Changes in groundwater levels during the growing season could result in annual plant mortality prior to seed set, which would reduce inputs to the soil seed bank and adversely affect long-term species persistence and native meadow species diversity.

The impact analysis does not provide evidence to support the contention that groundwater drawdown during the growing season months will not result in direct or indirect impacts to meadow vegetation. Of particular importance is the timing and duration of the drawdown. Further, the impact analysis should be based on revised groundwater modeling that considers the compounding effects of climate change on groundwater drawdown.

Loss of both annual and perennial herbaceous meadow species would provide gaps for colonization by species adapted to drier conditions, including upland trees, shrubs (e.g., Darrouzet-Nardi et al. 2006), and invasive plant species. Colonization by invasive annual grasses could increase fire potential per the grass-fire cycle (D'Antonio and Vitousek 1992). One invasive annual grass observed in disturbed areas onsite, cheatgrass (*Bromus tectorum*), contributes to increased fire frequency in sagebrush communities (Baker 2006) and has already altered the fire season in some areas of the eastern Sierra Nevada (Slaton and Stone 2013). The DEIR should consider these potential indirect impacts to meadow vegetation.

Restoration Potential. The DEIR (p. 6-45) indicates that proposed restoration would result in a net increase of wetted habitat and seasonal wetlands, but provides no indication of what types of habitats would be restored or whether the target restoration acreages are feasible or sustainable in the long-term. The anticipated wetland habitat increases are based on inaccurate groundwater modeling and do not consider the compounding effects of climate change on groundwater drawdown. An assessment of restoration feasibility and success should be based on (1) revised groundwater modeling that incorporates climate change simulations, (2) hydrologic modeling that incorporates plant species distribution models (e.g., Hammersmark et al. 2010), and (3) wetland species-specific data from literature or reference sites.

A goal of the conceptual restoration plan is to 'offset current and historical impacts to the channel through improvement of aquatic, riparian, and wetland habitat.' (Balance Hydrologics, Inc. 2014). However, the restoration plan focuses primarily on aquatic rather than riparian or wetland habitat, and does not provide evidence that impacts to sensitive habitats would be mitigated.

Proposed mitigation measures are insufficiently detailed to determine their adequacy to offset project impacts

Section 6.3.4 Impact Analysis

Mitigation Measure 6-1a: Wetland Delineations

The DEIR (p. 6-46) calls for surveys of sensitive natural communities and a delineation of waters of the U.S. prior to the start of onsite construction activities, and further indicates that impacted habitat shall be replaced on a 1:1 no net loss basis. Deferring identification of sensitive natural communities and additional waters of the U.S. (potentially including wetlands) precludes analysis of all project impacts and reduces the potential for project redesign to avoid potentially significant biological resources. All project impacts should be quantified as part of the EIR process.

The DEIR (p. 6-47) states that 'this project plans to construct all or a portion of replacement wetlands onsite.' However, there is no indication of which riparian/wetland species/habitats will be replaced, whether the proposed project hydrology (including groundwater levels with project implementation) will support wetland replacement on a short- or long-term basis, whether supplemental irrigation will be required, and what the demands of that irrigation may be on groundwater levels. In the absence of these details, the DEIR lacks evidence for its conclusion that the project's impacts to wetlands would be mitigated to a less than significant level.

The DEIR (p. 6-47) further indicates that all or a part of wetland or riparian mitigation may occur offsite, presumably through a mitigation bank. The DEIR should identify County-qualified mitigation banks in the project area with mitigation credits available for in-kind habitat compensation or potential offsite areas suitable for wetland/riparian habitat construction.

Mitigation Measure 6-1b: Ecological Performance Standards

In addition to the ecological performance standards listed in the DEIR (p. 6-49), monitoring of riparian restoration success should include indicators of riparian tree stress, such as reduced density, growth, and crown die-back.

Mitigation Measure 6-1c: Monitor and Respond to Groundwater Effects

This mitigation measure calls for a 5-year monitoring period to record responses of riparian and meadow vegetation to groundwater level declines (DEIR, p. 6-49). Groundwater level declines may result in a range of impacts to sensitive habitats that can manifest over short- or long timeframes, depending on level, timing, and duration of the drawdown (Stromberg and Patten 1990, 1992, 1996, Scott et al. 1999, DiSalvo and Hart 2002). For example, rapid and sustained drawdowns may result in immediate vegetation mortality, whereas more gradual drawdowns that cause sustained or repeated stress to vegetation may result in reduced growth, reduced reproductive output, and eventual mortality over a longer time period (>5 years). Accordingly, monitoring of vegetation responses to groundwater level declines should occur over a longer time period (e.g., >6-10 years or longer).

Significance after Mitigation (Mitigation Measures 6-1a – 6-1d)

The DEIR (p. 6-50) indicates that with implementation of mitigation measures 6-1a through 6-1d, impacts to sensitive habitats would be less than significant. However, the DEIR (1) has not addressed or quantified all potential impacts to sensitive habitats onsite, (2) does not provide evidence that the built project will support restored wetland and riparian habitat onsite, and (3) has not identified potential offsite mitigation banks or restoration sites. Given these shortcomings, the DEIR lacks the necessary evidence to conclude that impacts to sensitive habitats would be less than significant.

Groundwater drawdown will be exacerbated by climate change and may contribute to greenhouse gases; the DEIR does not consider or adequately address all impacts to sensitive habitat from project implementation (including direct, indirect, or cumulative impacts)

Section 16: Greenhouse Gases and Climate Change

General Comment. The DEIR does not consider the effects of climate change on groundwater modeling or biological resources. As a result, potential impacts to sensitive biological resources from project implementation are likely underestimated. For example, project impacts from groundwater drawdown may be intensified as a result of climate change due to global warming. Vegetation communities such as riparian and wetland habitats that are already stressed by historic groundwater drawdowns and that will be further impacted by project-related drawdowns will be particularly vulnerable to climate change stressors (Cummings and Nydick 2013). Climate change projections should be incorporated into groundwater modeling and considered in the analysis of biological impacts and restoration plan design. Without an assessment of all potential impacts, proposed mitigation measures may not be sufficient to offset the combined effects of project implementation and climate change on biological resources (Siegel et al. 2007).

Greenhouse Gas Emissions. The DEIR (p. 16-13) estimated the loss of sequestered carbon based on types and amounts of vegetation that would be removed permanently due to construction, per Table 6-1. As discussed above, impacts to biological resources are likely underestimated based on inaccurate groundwater modeling and failure to consider the compounding effects of climate change. Therefore, sequestered carbon losses are likely underestimated.

It is unclear whether estimates of sequestered carbon losses considered impacts to wet meadows at or above streambed level. Wet meadows store large amounts of soil organic carbon compared with surrounding uplands and function as important carbon sinks (Norton et al. 2014). This function is dependent on the maintenance of wet or saturated conditions. Deteriorating or drying meadows act as a carbon source, releasing sequestered carbon into the atmosphere where it contributes to greenhouse gas emissions and exacerbates global warming (Kayranli et al. 2010, Norton et al. 2011, Badiou et al. 2011, Norton et al. 2014). The DEIR must consider potential impacts to wet meadows with respect to loss of sequestered carbon.

Impact 16-3: Impacts of Climate Change on the Project

The DEIR (pp. 16-20-16-21) states that 'although there is a strong scientific consensus that global climate change is occurring and is influenced by human activity, there is less certainty as to the timing, severity, and potential consequences of the climate phenomena, particularly at specific locations.' Note that scientists are in agreement that the Sierra Nevada will experience increased temperatures. Existing climate data and climate change modeling projections indicate a decreased snow pack, earlier and more rapid snowmelt, longer and more severe droughts during the growing season, shifts in plant species composition, increases in invasive plant populations, increases in fire probability, and increased flooding and erosive events (Cummings and Nydick 2013, Stillwater Sciences 2012, Das et al. 2011, Sierra Nevada Alliance 2010, Young et al. 2009; Cayan et al. 2008; Peterson et al. 2008, Vicuna et al. 2007, Mote 2005, Dettinger et al. 2004, Hayhoe et al. 2004, and others). The DEIR should consider existing climate data and climate change projections in groundwater modeling, biological impact analysis, and restoration plan design.

The DEIR (pp. 16-20-16-21) addresses potential climate change impacts to land uses and facilities, but does not address potential climate change impacts to biological resources. Project impacts that will be intensified by climate change include hydrological changes (e.g., groundwater drawdown, timing and duration of surface flows) that will affect sensitive habitats, habitat type conversions (and potential loss of wildlife habitat) due to drying conditions or repeated wildfire, and increased erosion following wildfire (e.g., Pauseus and Keeley 2014, Stillwater Sciences 2012, Sierra Nevada Alliance 2010, Westerling 2006). Climate change is also expected to facilitate the spread of invasive plant species as thermal barriers to invasion are removed. Invasive plants may out-compete native plants for resources, draw down water tables, alter food web dynamics for animals, and result in a shift in species composition, altered hydrology, and wetland structure (Sierra Nevada Alliance 2010, Belnap et al. 2005, Ehrenfeld 2003, Evans et al. 2001, Cox 1999, Wilcove et al. 1998, D'Antonio and Vitousek 1992, Huenneke et al. 1990, Vitousek et al. 1990, and many others). The DEIR fails to address all potential impacts to biological resources from climate change.

Section 18-1: Cumulative Impacts

Cumulative impacts result from past, present, and reasonably foreseeable future actions. The DEIR (p. 18-10) mentions historic losses to meadows in the region but does not adequately discuss existing or future impacts to this habitat onsite. Sierra Nevada meadows have been identified as one of the most altered, impacted, and at-risk landscapes in the range (Viers et al. 2013). In this context, any additional meadow losses or degradation could constitute significant cumulative impacts.

Impact 18-6: Cumulative Effects on Sensitive Habitats

The DEIR (p. 18-10) states that 'Mitigation Measures 6-1a through 6-1d would reduce cumulative project impacts to sensitive habitats to less-than significant because these measures would ensure that the Specific Plan results in no net loss of sensitive habitats.' However, the DEIR has not addressed or quantified all potential impacts to sensitive habitats. The cumulative impact analysis must consider the combined effect of direct and indirect impacts from all project components, and then identify feasible mitigation for the combined impacts.

The DEIR (p. 18-10) concludes that the Specific Plan would not contribute considerably to the overall significant cumulative effect on sensitive habitats in the Tahoe-Truckee region because of proposed mitigation measures. As discussed above, there are substantial flaws in the DEIR's proposed mitigation measures for the porject's impacts to sensitive habitats. For this reason, the DEIR cannot rely on these measures to conclude that impacts would be less than significant. In addition, this assessment of impacts to sensitive habitats is based on current groundwater modeling that is inaccurate and does not consider the compounding effects of climate change. The DEIR should assess impacts based on revised groundwater modeling that considers the compounding effects of climate change and reach a conclusion regarding the project's contribution to cumulative impacts based on that analysis.

The DEIR (p. 18-10) identifies several probable future projects in the region (DEIR, Table 18-2, pp. 18-3-18-5) but does not actually evaluate the combined effects of these projects. At a minimum, the analysis should consider cumulative impacts to sensitive habitats for those projects that are approved, under construction, or finalized, and evaluate the combined effects of those projects.

References

Allen-Diaz, B. 1991. Water table and plant species relationships in Sierra Nevada meadows. The American Midland Naturalist 126(1):30-43.

Ascent Environmental, Inc. 2015. Draft environmental impact report: Village at Squaw Valley Specific Plan. Prepared for Placer County, Planning Services Division, Auburn, CA. State Clearinghouse # 2012102023. May.

Badiou, P., R. McDougal, D. Pennock and B. Clark. 2011. Greenhouse gas emissions and carbon sequestration potential in restored wetlands of the Canadian prairie pothole region. Wetlands Ecology and Management 19:237-256.

Baker, W.L. 2006. Fire and restoration of sagebrush ecosystems. Wildlife Society Bulletin 34(1):177-185.

Balance Hydrologics, Inc. 2014. Design basis report: Squaw Creek restoration, Squaw Valley Specific Plan, Placer County, California. Prepared for Squaw Valley Ski Holdings, LLC. June. 32 pp. + tables, figures, and appendices.

Belnap, J., S.L. Phillips, S.K. Sherrod, and A. Moldenke. 2005. Soil biota can change after exotic plant invasions: does this affect ecosystem processes? Ecology 86:3007-3017.

Braatne, J.H., S.B. Rood, and P.E. Heilman. 1996. Life history, ecology and conservation of riparian cottonwoods in North America. *In* Biology of *Populus* and its implications for management and conservation. Stettler, R.F, G.A. Bradshaw, P.E. Heilman, and T.M. Hinckley, eds. NRC Research Press, Ottawa, Ontario, Canada.

Cayan D.R., E.P. Maurer, M.D. Dettinger, M. Tyree, and K. Hayhoe. 2008. Climate change scenarios for the California region. Climate Change 87:21-42.

Condra, G.E. 1944. Drought, its effects and measures of control in Nebraska. Nebraska Conservation Bulletin 25. Lincoln, NE. 43 pp.

Cooper, D.J., E.C. Wolf, M.J. Ronayne, and J.W. Roche. 2015. Effects of groundwater pumping on the sustainability of a mountain wetland complex, Yosemite National Park, California. Journal of Hydrology: Regional Studies 3:87-105.

Cox, G.W. 1999. Alien species in North America and Hawaii: impacts on natural ecosystems. Island Press, Washington, D.C. 400 pp.

Cummings, K. and K. Nydick. 2013. Wetland meadows: a southern Sierra adaptation workshop information brief. Visalia, CA. 5 pp.

D'Antonio, C.M. and P.M. Vitousek. 1992. Biological invasions by exotic grasses, the grass/fire cycle, and global change. Annual Review of Ecology and Systematics 23:63-87.

Darrouzet-Nardi, A., C.M. D'Antonio, and T.E. Dawson. 2006. Depth of water acquisition by invading shrubs and resident herbs in a Sierra Nevada meadow. Plant and Soil 285:31-43.

Das T., D.W. Pierce, D.R. Cayan, J.A. Vano, and D.P. Lettenmaier. 2011. The importance of warm season warming to western US streamflow changes. Geophysical Research Letters 38.

DeBell, D.S. 1990. *Populus trichocarpa* Torr.& Gray.; Black cottonwood. *In:* Silvics of North America, volume 2, Hardwoods. Pp. 570-57 *in* Burns, R.M. and B.H. Honkaka, eds., U.S. Forest Service, U.S. Department of Agriculture.

Dettinger, M.D., D.R. Cayan, M. Meyer, and A.E. Jeton. 2004. Simulated hydrologic responses to climate variations and change in the Merced, Carson, and American River basins, Sierra Nevada, California, 1900-2099. Climate Change 62:283-317.

DiSalvo, A.G. and S.C. Hart. 2002. Climatic and stream-flow controls on tree growth in a western montane riparian forest. Environmental Management 30:678-691.

Ehrenfeld, J.G. 2003. Effects of exotic plant invasions on soil nutrient cycling processes. Ecosystems 6(6):503-523.

Evans, R.D., R. Rimer, L. Sperry, and J. Belnap. 2001. Exotic plant invasion alters nitrogen dynamics in an arid grassland. Ecological Applications 11:1301-1310.

Hauessler, S., D. Coates, and J. Mather. 1990. Autecology of common plants in British Columbia: a literature review. FRDA Report 158. Forestry Canada and B.C. Ministry of Forests, Victoria, BC.

Hammersmark C.T., S.Z. Dobrowski, M.C. Rains, and J.F. Mount. 2010. Simulated effects of stream restoration on the distribution of wet-meadow vegetation. Restoration Ecology 18:882-893.

Hayhoe K., D. Cayan, C.B. Field, P.C. Frumhoff, E.P. Maurer, N.L. Miller, S.C. Moser, S.H. Schneider, K.N. Cahill, E.E. Cleland, L. Dale, R. Drapek, R.M. Hanemann, L.S. Kalkstein, J. Lenihan, C.K. Lunch, R.P. Neilson, S.C. Sheridan, and J.H. Verville. 2004. Emissions pathways, climate change, and impacts on California. Proceedings of the National Academy of Sciences of the United States of America 101:12422-12427.

Hines, C.A. 1999. Evaluating the restoration potential of black cottonwood (*Populus trichocarpa*) from multiple scales of observation, Grande Ronde River Basin, Oregon, USA (M.S. Thesis, Oregon State University, Corvallis, Oregon).

Huenneke, L.F., S.P. Hamburg, R. Koide, H.A. Mooney, and P.M. Vitousek. 1990. Effects of soil resources on plant invasions and community structure in Californian serpentine grassland. Ecology 71:478-491.

Kayranli B, M. Scholz, A. Mustafa, and Å Hedmark. 2010. Carbon storage and fluxes within freshwater wetlands: a critical review. Wetlands 30:111–124.

Konikow, L.F. 2013. Groundwater depletion in the United States (1900-2008). U.S. Geological Survey scientific investigations report. 63 pp. http://pubs.usgs.gov/sir/2013/5079.

Lite, S.J. and J.C. Stromberg. 2005. Surface water and ground-water thresholds for maintaining *Populus-Salix* forests, San Pedro River, Arizona. Biological Conservation 125:153-167.

Mote P.W., A.F. Hamlet, M.P. Clark, and D.P. Lettenmaier. 2005. Declining mountain snowpack in western North America. Bulletin of the American Meteorological Society 86(1): 39–49.

Myers, T. 2015a. Draft technical memorandum: review of draft Environmental Impact Review, Village at Squaw Valley. Prepared for Sierra Watch. June. 37 pp.

Myers, T. 2015b. Draft technical memorandum: review of Water Supply Assessment, Village and Squaw Valley. Prepared for Sierra Watch. May. 23 pp. + attachment.

Norton J.B., L.J. Jungst, U. Norton, H.R. Olsen, K.W. Tate, and W.R. Horwath. 2011. Soil carbon and nitrogen storage in upper montane riparian meadows. Ecosystems 14:1217–1231.

Norton, J.B., H.R. Olsen, L.J. Jungst, D.E. Legg, and W.R. Horwath. 2014. Soil carbon and nitrogen storage in alluvial wet meadows of the southern Sierra Nevada Mountains, USA. Journal of Soils Sediments 14:34-43.

Null S.E., J.H. Viers, and J.F. Mount. 2010. Hydrologic response and watershed sensitivity to climate warming in California's Sierra Nevada. Plos One 5.

Pausas, J.G., and J.E. Keeley. 2014. Abrupt climate-independent fire regime changes. Ecosystems DOI: 10.1007/s10021-014-9773-5.

Peterson, D.H., I. Stewart, and F. Murphy. 2008. Principal hydrologic responses to climatic and geologic variability in the Sierra Nevada, California. San Francisco Estuary and Watershed Science 6(1):Article 3.

Read, R.A. 1958. Silvical characteristics of plains cottonwood. Rocky Mountain Forest Range Experiment Station, paper 33. Fort Collins, Colorado. *In* Rood, S.B. and J.M. Mahoney. 1990. Collapse of riparian poplar forests downstream from dams in western prairies: probable causes and prospects for mitigation. Environmental Management 14(4):451-464.

Rood, S.B. and J.M. Mahoney. 1990. Collapse of riparian poplar forests downstream from dams in western prairies: probable causes and prospects for mitigation. Environmental Management 14(4):451-464.

Scott, M.L., P.B. Shafroth, and G.T. Auble. 1999. Responses of riparian cottonwoods to alluvial water table declines. Environmental Management 23:347–358.

Shafroth, P.B., J.C. Stromberg, and D.T. Patten. 2000. Woody riparian vegetation response to different alluvial water table regimes. Western North American Naturalist 60:66–76.

Shafroth P.B., J.C. Stromberg, and D.T. Patten. 2002. Riparian vegetation response to altered disturbance and stress regimes. Ecological Applications 12:107-123.

Siegel, K., M. Vespa, and B. Nowicki. 2007. The California Environmental Quality Act: on the front lines of California's fight against global warming. Center for Biological Diversity, San Francisco, CA. 14 pp.

Sierra Nevada Alliance. 2010. Sierra climate change toolkit: planning ahead to protect Sierra natural resources and rural communities, 3rd edition. 123 pp.

Slaton, M.R., and H.E. Stone. 2013. Natural range of variation (NRV) for pinyon-juniper in the bioregional assessment area, including the Sierra Nevada, southern Cascades, and Modoc and Inyo National Forests. U.S. Department of Agriculture, Forest Service, Pacific Southwest region, Vallejo, CA.

Steinberg, P.D. 2001. *Populus balsamifera* subsp. *trichocarpa*. *In* Fire Effects Information System. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory (Producer). http://www.fs.fed.us/database/feis/

Stillwater Sciences. 2012. A guide for restoring functionality to mountain meadows of the Sierra Nevada. Technical memorandum prepared for American Rivers, Nevada City, CA. 52 pp. + appendices.

Stromberg, J.C., and D.T. Patten. 1990. Riparian vegetation instream flow requirements: a case study from a diverted stream in the eastern Sierra Nevada, California, USA. Environmental Management 14:185–194.

Stromberg, J.C. and D.T. Patten. 1992. Mortality and age of black cottonwood stands along diverted and undiverted streams in the eastern Sierra Nevada, California. Madroño 39:205-223.

Stromberg, J.C. and D.T. Patten. 1996. Instream flow and cottonwood growth in the eastern Sierra Nevada of California, USA. Regulated Rivers: Research and Management 12(1):1-12.

Vicuna, S., E.P. Maurer, B. Joyce, J.A. Dracup, and D. Purkey. 2007. The sensitivity of California water resources to climate change scenarios. Journal of the American Water Resources Association 43:482-498.

Viers, J.H., S.E. Purdy, R.A. Peek, A. Fryjoff-Hung, N.R. Santos, .JV.E. Katz, J.D. Emmons, D.V. Dolan, and S.M. Yarnell. 2013. Montane meadows in the Sierra Nevada: changing hydroclimatic conditions and concepts for vulnerability assessment. Center for Watershed Sciences technical report (CWS-2013-01), University of California, Davis. 63 pp.

Vitousek, P.M. 1990. Biological invasions and ecosystem processes: towards an integration of population biology and ecosystem studies. Oikos 57:7-13.

Westerling, A.L., H.G. Hidalgo, D.R. Cayan, and T.W. Swetnam. 2006. Increases in western U.S. forest wildfire associated with warming and advances in the timing of spring. Science 313:940–943.

Wilcove, D.S., D. Rothstein, J. Dubow, A. Phillips, and E. Losos. 1998. Quantifying threats to imperiled species in the United States. BioScience 48:607-615.

Young, C.A., M.I. Escobar-Arias, M. Fernandes, B. Joyce, M. Kiparsky, J.F. Mount, V.K. Mehta, D. Purkey, J.H. Viers, and D. Yates. 2009. Modeling the hydrology of climate change in California's Sierra Nevada for subwatershed scale adaptation. Journal of the American Water Resources Association 45:1409-1423.