18 May 2018

Mr. Todd Suess, Superintendent
Mojave National Preserve
2701 Barstow Road
Barstow, California 92311

RE: Mojave National Preserve (MNP) Management Plan for Developed Water Sources and Environmental Assessment, February 2018

Dear Superintendent Suess:

The Wild Sheep Foundation (WSF) and the undersigned WSF Chapters & Affiliates (C&As) submit these comments on behalf of thousands of hunters and other conservationists dedicated to wild sheep. We have over 40 years' experience and over $120 million invested in restoration of wild sheep (primarily by trap and transplant work) to expand wild sheep herds. Our privately-funded foundation has long endowed the Rocky Crate/Wild Sheep Foundation Endowed Chair for Wild Sheep Disease Research at Washington State University. WSF annually generates approximately 40% of ALL wild sheep license and tag revenue to state wildlife agencies for their wild sheep management programs.

We see the proposed MNP plan for developed water sources as an affront to our efforts on behalf of wild sheep. We recommend abandoning this plan altogether and instead engaging with sportsmen and other conservationists to determine where water devices are most necessary and how they will be maintained, added to, or removed, accordingly. The only option for salvaging this plan is to conduct a regional analysis of the many factors, including wildlife movements and hydrology at a landscape-scale, that operate both on and around the Preserve, with effects running both ways, inside and outside MNP.

Aside from issues analyzed erroneously and incompletely, the plan is completely blind to the effects that removing water devices will have on conservation stewardship and recreation opportunities, including hunting. These issues are explicitly dismissed from analysis, having been declared insignificant.

No reference is made to USDI Secretarial Orders 3362, 3356, and 3347, or to Executive Order 13443—each of which directs federal agencies in various ways to advance conservation stewardship and increase outdoor recreation opportunities, including hunting. Nor is any reference made to how this plan comports with efforts by the National Park Service to comply with those Secretarial Orders.

This fatal disregard for a primary issue at the same time dismisses the related benefits of engaging hunter and other conservationist groups in doing the work and bearing the costs of installation and maintenance of these structures. These volunteer work parties are themselves part of the recruitment and retention of sportsmen and women conservationists by engaging them in the on-the-ground labor of stewardship.

Aside from the omission of hunting as a relevant issue, the plan and analysis are flawed in many ways on the issues that are considered.

GENERAL COMMENTS

The Draft Management Plan and Environmental Assessment (DMPEA)[1] contains the following chapters. (1) Purpose and need for action; (2) Water resource management alternatives; (3) Affected environment; (4) Environmental consequences; (5) Consultation and coordination; (6) References; and, (7) Appendices consisting of a minimum requirements analysis and development of a resource utilization distribution (RUD). The RUD was developed using telemetry information on 15 female bighorn sheep from a single population. Location data

[1] National Park Service. 2018. Management plan for developed water sources and environmental assessment. Mojave National Preserve, Barstow, California, USA.

encompassed ~78 sheep-months but were restricted to the months of July, August, and September (or parts thereof) from 2013 to 2017.[2]

As an organization that has been the primary advocate for conservation of wild sheep in North America for more than 40 years, WSF and our C&As have grave concerns about actions proposed in the DMPEA. Although our emphasis historically has been, and will continue to be, on habitat protection and population health of those specialized ungulates, we also advocate for healthy habitats that benefit all species of wildlife. Hence, we are extremely concerned that each of the alternatives included in the DMPEA places conservation and appropriate management of habitat upon which bighorn sheep—and many species with which they are sympatric—on a lower level of concern than that of compliance with legislation that clearly identified conservation as one of the basic purposes of wilderness ("…wilderness areas shall be devoted to the public purposes of recreational, scenic, scientific, educational, conservation, and historical use")[3], and that is repeated in subsequent legislation that established the Mojave National Preserve.[4] Wildlife clearly is a resource of importance to the American public, and wildlife conservation and habitat management to conserve wildlife are issues compatible with the Wilderness Act, and must be elevated to the level of recognition provided all other aspects of wilderness.[5] [6] To that end, we believe the DMPEA fails.

We reviewed each section of the DMPEA in its entirety, focusing intently on material included therein. Early on, it became apparent that the DMPEA has compliance with the Wilderness Act of 1964[7] and the California Desert Protection Act of 1994[8] as its priority, while attempting to 'mitigate' impacts of removal of water sources used by bighorn sheep by shifting patterns of use of those large mammals and other wildlife that would be affected by the redistribution of wildlife water developments. Further, the DMPEA ignores potential impacts of removal of more than 50% of the existing water developments designed to benefit small game (SGWD), the majority of which are utilized by a variety of wildlife—both game and nongame—and all of which have been in place for >50 years. Twenty-six of these SGWDs are located in designated critical habitat for desert tortoise, and some tortoises have become dependent on them as a source of water.[9] [10] Moreover, additional SGWDs would be blocked to prevent tortoises from entering them, and numerous other SGWDs would be completely disabled.[11] Tortoises remain listed by the federal government as threatened[12] and also are listed by the state of California as threatened. [13] It is incongruous that a proposal to place even an individual tortoise at risk would be posited by MNP in the interest of maintaining spiritual[14] [15] and sociological[16] values, or other intangibles, in order to comply with the Wilderness Act.

It is our position that it is not possible to prepare a management plan for developed water sources in the absence of close coordination and complete agreement with the California Department of Wildlife (CDFW) and the Nevada Department of Wildlife, the agencies with statutory authority for the conservation of resident wildlife

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[2] Hughson, D. 2018. Desert bighorn sheep habitat analysis. Appendix B *in* Management plan for developed water sources and environmental assessment. Mojave National Preserve, Barstow, California, USA.

[3] Section 4(b), US Congress (1964).

[4] Section 2(b)(1)(A), US Congress (1994).

[5] Bleich (2014).

[6] Bleich (2016).

[7] US Congress. 1964. Wilderness Act. Public law 88–577, 88th Congress of the United States, second session. Washington, D.C.

[8] US Congress. 1994. California Desert Protection Act. Public law 103–433, 103rd Congress of the United States, third session. Washington, D.C.

[9] DMPEA, page 51.

[10] DMPEA, page 51.

[11] DMPEA, page 51

[12] Kurth, J. W. 2017. Endangered and threatened wildlife and plants; 90-day findings on two petitions. Federal Register Vol. 82(74):18409–18411.

[13] Biogeographic Data Branch. 2017. State and federally listed endangered & threatened animals of California. October 2017. California Department of Fish and Wildlife, Sacramento, California, USA. Available at <file:///C:/Users/owner/Downloads/CNDDB_Endangered_and_Threatened_Animals_List.pdf>. Accessed 18 April 2018.

[14] Tin, T. 2012. Wilderness spirituality. International Journal of Wilderness 18:3,24.

[15] Fredrickson, L. M., and D. H. Anderson. 1999. A qualitative exploration of the wilderness experience as a source of spiritual inspiration. Journal of Environmental Psychology 19:21–39.

[16] Spurr 1966.

in California and Nevada, respectively. Indeed, state law [17] directs the CDFW and the California Fish and Game Commission, "… to create, foster, and actively participate in effective partnerships and collaborations with other agencies and stakeholders to achieve shared goals and to better integrate fish and wildlife resource conservation and management with the natural resource management responsibilities of other agencies." The Wild Sheep Foundation submits that such has not occurred with respect to development of the DMPEA, as described here and in the following comments.

The California Department of Fish and Wildlife has, for several years, been preparing a detailed management plan for bighorn sheep (hereafter BHS Plan), but that has not been circulated for public review or approved for implementation. [18] The BHS Plan is to be based on the strategy that bighorn sheep will be best conserved on a metapopulation basis, as described in numerous professional papers or conservation strategies. [19] [20] [21] [22] [23] [24] [25] [26] [27] Ironically, the DMPEA notes the value of such an approach, but limits proposed alternatives and actions to any that would occur *inside* the borders of MNP. [28] An inter-agency regional habitat planning approach to be coordinated by the Bureau of Land Management and involving the National Park Service, U.S. Fish and Wildlife Service, and the California Department of Fish and Game (now CDFW) earlier was identified as the most effective way to ensure the health and function of bighorn sheep metapopulations in southeastern California. [29] Progress on that effort was stymied by personnel transfers and compounded further in 1994 by the California Desert Protection Act (CDPA). Wild Sheep Foundation stresses that such an approach is far preferable to the alternatives proposed in the DMPEA because potential opportunities to maintain metapopulation function outside MNP will not be realized. The DMPEA fails in its understanding that populations of bighorn sheep resident within MNP contribute to metapopulation function and population dynamics of bighorn sheep external to MNP, and that metapopulation function and population dynamics external to MNP contribute to metapopulation function within MNP. [30] Interagency competition [31] and compliance with legislation that likely was well-intentioned but turned out to have unintended consequences [32] should not preclude an opportunity to address issues of conservation at the landscape level. [33] For these reasons, WSF strongly urges a landscape-level approach, rather than the piece-meal approach advocated in the DMPEA, to resolve issues related to conservation

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[17] Section 703.5, California Fish and Game Code (2017).

[18] R. Vu, California Department of Fish and Wildlife (CDFW), personal communication, 18 April 2018.

[19] Schwartz, O.A., V.C. Bleich, and S.A. Holl. 1986. Genetics and the conservation of mountain sheep Ovis canadensis nelsoni. Biological Conservation 37:179–190.

[20] Bleich, V.C., J.D. Wehausen, and S.A. Holl. 1990. Desert-dwelling mountain sheep: conservation implications of a naturally fragmented distribution. Conservation Biology 4:383–390.

[21] Torres, S.G., V.C. Bleich, and J.D. Wehausen. 1994. Status of bighorn sheep in California, 1993. Desert Bighorn Council Transactions 38:17–28.

[22] Bleich, V.C., J. D. Wehausen, R. R. Ramey II, and J. L. Rechel. 1996. Metapopulation theory and mountain sheep: implications for conservation. Pages 353–373 *in* D. R. McCullough, editor. Metapopulations and Wildlife Conservation. Island Press, Covelo, California, USA.

[23] Epps, C.W., J. D. Wehausen, V. C. Bleich, S. G. Torres, and J. S. Brashares. 2007. Optimizing dispersal and corridor models using landscape genetics. Journal of Applied Ecology 44:714–724.

[24] Epps, C. W., J. D. Wehausen, J. D., P. J. Palsboll, and D. R. McCullough. 2010. Using genetic tools to track desert bighorn sheep colonizations. Journal of Wildlife Management 74:522–531.

[25] Epps, C. W., V. C. Bleich, J. D. Wehausen, and S. G. Torres. 2003. Status of bighorn sheep in California. Desert Bighorn Council Transactions 47:20–35.

[26] Abella, R., V. C. Bleich, R. A. Botta, B. J. Gonzales, T. R. Stephenson, S. G. Torres, and J. D. Wehausen. 2011. Status of bighorn sheep in California — 2011. Desert Bighorn Council Transactions 51:54–68.

[27] Brewer, C., et al. 2014. Bighorn sheep: conservation challenges and management strategies for the 21st century. Western Association of Fish and Wildlife Agencies Wild Sheep Working Group, Cheyenne, Wyoming, USA.

[28] DMPEA, page iii

[29] Torres, S. G., V. C. Bleich, and A. M. Pauli. 1993. Status of bighorn sheep in California, 1992. Desert Bighorn Council Transactions 37:47–52.

[30] Epps, C. W., R. S. Crowhurst, and B. S. Nickerson. *In press*. Assessing changes in functional connectivity in a desert bighorn sheep metapopulation after two generations. Molecular Ecology (Firs Look). DOI 10.1111/mec.14586

[31] Grumbine, R. E. 1990. Viable populations, reserve size, and federal lands management: a critique. Conservation Biology 4:127–134.

[32] Thomas, J. W. 2004. The management of the federal lands —where now? Fair Chase 19(2):12.

[33] Salwasser et al. 1987.

of bighorn sheep in what CDFW has identified as the Central Mojave Metapopulaton Fragment.[34] Such an approach necessarily will involve preparation of an Environmental Impact Statement (EIS) in lieu of multiple Environmental Assessments subject to various interpretations as leadership changes within the involved agencies. Inconsistencies in interpretation and personal philosophies of agency personnel have been identified repeatedly as primary issues facing wildlife conservation in legislated wilderness. [35] [36] [37]

MNP leadership has acknowledged and clearly understands that what occurs outside of MNP affects what occurs inside MNP, and that what occurs inside MNP affects what occurs outside MNP. [38] Further, MNP leadership recognized that ecology was not a serious consideration in the drafting of California Desert Protection Act or subsequent legislation and was in full agreement that the term 'untrammeled' as used in the Wilderness Act of 1964 does not mean "virgin" or unaltered, although many individuals and organizations choose to redefine that word to their advantage. MNP leadership also acknowledged that virtually every wilderness area established in the Mojave Desert [as a result of the CDPA] suffered from an absence of ecological forethought, and that wildlife water developments within those areas need not be removed due to the[ir] location in wilderness because they were present prior to the wilderness areas being established. [39]

There clearly is a need for a regional approach to the management of these wide-ranging, specialized ungulates (see, for example, the strategy developed by NPS employees for the Colorado Plateau). [40] Thus, any approach that assumes impacts originating outside of MNP can be ignored yet fails to emphasize opportunities inside MNP that would minimize those impacts is fallacious reasoning and fails to acknowledge the importance of conservation strides that have been achieved. The concept that 'unnatural' existing developments in wilderness areas cannot be defended without acknowledgment that anthropogenic factors have impacted some species and that maintenance of community and ecological structure is defensible in today's world (Soule 1987). [41] WSF contends that efforts to conserve certain species and to ensure maintenance of community or ecological structure are sometimes best carried out in wilderness areas. Unfortunately, the DMPEA prioritizes the intangible values attributed to wilderness areas over the many successful efforts implemented to conserve one of the world's most iconic large mammals.

CONCLUSIONS BASED ON THE BIGHORN SHEEP HABITAT ANALYSIS ARE FLAWED

Three of the four alternatives considered in this plan reflect assessments based on a model that is incomplete and, thus, cannot be used to inform management decisions that potentially will affect persistence of bighorn sheep within MNP. The author of the model apparently used a "cook-book" approach in model development, but it clearly demonstrates a lack of familiarity with the biology of bighorn sheep.

The author ran in to model convergence issues and simply decided to ignore those models and resort to the next best option. Additionally, the author stated that there were complications in comparing geographically different areas with differing geology and vegetation types; this could have been avoided, however, with some *a priori* thought as to how predictions would be extrapolated (see comments below). Further, the model is not based on the best available science (a basic tenet of the National Park Service) and, thus, fails to meet an essential expectation that clearly emphasizes use of the "best available science" when making resource management

[34] Abella et al. (2011).

[35] Bleich, V. C. 1999. Wildlife conservation and wilderness management: uncommon objectives and conflicting philosophies. North American Wild Sheep Conference Proceedings 2:195–205.

[36] Bleich, V. C. 2005. Politics, promises, and illogical legislation confound wildlife conservation. Wildlife Society Bulletin 33:66–73.

[37] Bleich, V. C. 2016. Wildlife conservation and wilderness: wishful thinking? Natural Areas Journal 36:202–206.

[38] Results of a meeting with MNP leadership on 24 February 2017 as memorialized in a memo from V. Bleich to S. Marschke of the Society for the Conservation of Bighorn Sheep (SCBS) and dated 1 April 2017.

[39] Results of a meeting with MNP leadership on 24 February 2017 as memorialized in a memo from V. Bleich to S. Marschke of the Society for the Conservation of Bighorn Sheep (SCBS) and dated 1 April 2017.

[40] Singer, F. J., V. C. Bleich, and M. A. Gudorf. 2000. Restoration of bighorn sheep metapopulations in and near western national parks. Restoration Ecology 8(4S):14–24.

[41] Soule, M. E. 1987. Introduction. Pages 1–10 *in* M. E. Soule, editor. Viable populations for conservation. Cambridge University Press, Cambridge, United Kingdom.

decisions, as emphasized in NPS training programs. [42] Moreover, the statement that "The [environmental] analysis is informed by the best available applicable scientific literature and studies…" [43] is misleading, at best. As a result, the model fails to meet not only the agency's internal expectations and, by association, calls into question the entire DMPEA. WSF further contends that parameters considered in the modeling process were inadequate in that the author did not consider several variables known to be important to bighorn sheep habitat. In the following sections, WSF provides detailed critiques of (A) the model development process itself; (B) the biological shortcomings associated with variable selection; and (C) other biological characteristics of bighorn sheep and their habitat that were not considered.

A. General shortcomings involved in model development.

(1) First and foremost, it is of upmost concern that the author ran into model convergence issues and simply decided to ignore those models and resort to the next best option (a mere 1% of the relative likelihood of the top model). Indeed, the author stated that there were complications in comparing geographically different areas with differing geology and vegetation types, but this could have been avoided with some *a priori* thought as to how predictions would be extrapolated.

(2) In Table 2, the author reports all model combinations that were tested for this analysis. [44] The author resorted to model #3 because of convergence issues and prediction complications in the first two models. Beyond the author's reasoning for that, the author did not test all biological meaningful combinations of the variables they were modeling. The model that was used for prediction (Distance to Water by Slope interaction + Elevation by Ruggedness interaction) was not modeled with simple additive terms to assess within the model ranking (AIC). Exclusion of the full additive model in addition to many more untested models leaves a high level of uncertainty with respect to whether the model used for predictions and inference is even viable.

(3) The author mentions that a random effect for animal ID and distance to water did not converge. This leads us to believe that application of a random effect within the modeling framework was not used correctly. The random effect should be the entirety of an animal's location data and associated random points (i.e., the animal ID number), thereby allowing both a varying slope and intercept for all co-variates tested within the model (Boyce et al. 2002, Manly et al. 2007). [45] [46] With the heterogeneity known to exist from animal to animal (behavior, nutritional requirements, specific life-history stage, age etc.), results from this analysis could dramatically shift with inclusion of the correct random effect. This leads us to question the integrity of the results the management conclusions are drawn upon.

(4) The author mentions uncertainty for the amount of random locations to be used for the modeling undertaken by MNP. There was no reported measure of how this number was derived except for mentioning, "I followed the lead of Hoglander et al. (2015) [47] in using 500 randomly selected locations, but this might not be enough". [48] Variation in the used-random location ratio can drastically alter results if too few or too many random locations are selected. [49] Simply evaluating the running mean of the landscape variables selected at various random locations would show if "available" was correctly quantified for the landscape. In the absence of a measure of correct proportions of used-random locations, the results well may be lacking in informative nature.

(5) Returning to the issue of model convergence noted above. Convergence issues can arise when using complex categorical variables such as the vegetation type layer used in the model. If there are little to no used

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[42] National Park Service. 2018. Resource essentials. Accessed 23 April 2018. Available at: https://www.nps.gov/training/essentials/html/resource_management_topic.html.

[43] DMPEA, page 121.

[44] Hughson (2018).

[45] Boyce, M.S., Vernier, P.R., Nielsen, S.E. and Schmiegelow, F.K., 2002. Evaluating resource selection functions. Ecological Modelling 157:281–300.

[46] Manly, B.F.L., L. McDonald, D. L. Thomas, T. L. McDonald, and W. P. Erickson. 2007. Resource selection by animals: statistical design and analysis for field studies. Springer Science + Business Media LLC, New York, New York, USA.

[47] Hoglander, C., B. G. Dickson, S. S. Rosenstock, and J. J. Anderson. 2015. Landscape models of space use by desert bighorn sheep in the Sonoran Desert of southwestern Arizona. Journal of Wildlife Management 79:77–91.

[48] Hughson (2018).

[49] Johnson, D. H. 1980. The comparison of usage and availability measurements for evaluating resource preference. Ecology 61:65–71.

points in a vegetation type, and several or many random points in that same vegetation type, convergence cannot be expected because a proper estimate of effect cannot be derived within the modeling framework. [50] Moreover, the author did not mention what vegetation type was used as the reference for all other vegetation type beta estimates. When modeling within the R function *lme()*, categorical variables must be organized in the dataset as the first alphabetical variable is used as a reference for the relative effect (or in this case selection) of the others. [51] If the reference variable does not have an approximate 1:1 ratio of used to random locations, estimates for other vegetation types will be skewed. The author did exclude the vegetation variable from the final conclusion, but the lack of correct beta estimates with inclusion of vegetation type may shift the overall effect of other variables. As a result, the beta estimate shift could have profound ramifications for making management decisions based on minor shifts in probability of usage for hypothetical water developments.

B. Biological shortcomings involved in model development.

(1) The model was based on telemetry data obtained from 15 female bighorn sheep at a single location (the limestone massifs at, and proximate to, Old Dad Peak within MNP) for a very limited amount of time ($\bar{x}$ = 5.2 months/collared individual from 2013 to 2017) as calculated from information provided in Appendix B. [52]

(2) Telemetry data were collected following a massive disease-mediated die-off of bighorn sheep, which resulted in loss of >40% of animals in the vicinity of the Old Dad and Vermin water developments and >50% of animals in the vicinity of the Kerr wildlife water development. [53] Thus, distribution of telemetered female bighorn sheep used to develop the model likely differed, perhaps even substantially, from what it was prior to the massive number of deaths that occurred; this potential bias was ignored in model development.

(3) The model included locational data from only 3 months per year (July, August, September), or portions thereof, for the 15 female bighorn sheep. [54] Habitat selection by females during the remainder of the year was ignored entirely, but that information is available in the peer-reviewed literature. [55] In essence, the modeler has ignored much of the annual life history needs of bighorn sheep by considering only habitat use during the hottest time of the year.

(4) Differential habitat use by male and female bighorn sheep during most of the year was not considered in model development. [56] [57] [58] Failure to consider both males and females in making management decisions can result in benefits to one sex over the other [59] [60] and, thereby, fail to meet conservation objectives at the level of the population. [61] [62] Different parts of a mountain range can be used primarily by one sex or the other, with the

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[50] Alldredge, J. R. and J. Griswold. 2006. Design and analysis of resource selection studies for categorical resource variables. Journal of Wildlife Management 70:337–346.

[51] R Core Team. 2017. R: A language and environment for statistical computing. R Foundation for Statistical Computing, Vienna, Austria.

[52] Hughson (2018).

[53] DMPEA, Appendix 1, page 7.

[54] Hughson (2018).

[55] Bleich, V. C., R. T. Bowyer, and J. D. Wehausen. 1997. Sexual segregation in mountain sheep: resources or predation? Wildlife Monographs 134:1–50.

[56] Bleich et al. (1997).

[57] Mooring, M. S., T. A. Fitzpatrick, J. E. Benjamin, I. C. Fraser, T. T. Nishihira, D. D. Reisig, and E. M. Rominger. 2003. Sexual segregation in desert bighorn sheep (*Ovis canadensis mexicana*). Behaviour 140:183–207.

[58] Ruckstuhl, K. E., and M. Festa-Bianchet. 2001. Group choice by subadult bighorn rams: trade-offs between foraging efficiency and predator avoidance. Ethology 107:161–172.

[59] Bowyer, R. T., B. M. Pierce, L. K. Duffy, and D. A. Haggstrom. 2001. Sexual segregation in moose: effects of habitat manipulation. Alces 37:109–122.

[60] Stewart, K. M., T. E. Fulbright, D. L. Drawe, and R. T. Bowyer. 2003. Sexual segregation in white-tailed deer: responses to habitat manipulations. Wildlife Society Bulletin 31:1210–1217.

[61] Bowyer, R. T. 2004. Sexual segregation in ruminants: definitions, hypotheses, and implications for conservation and management. Journal of Mammalogy 85:1039–1052.

[62] Rubin, E. S., and V. C. Bleich. 2005. Sexual segregation: a necessary consideration in wildlife conservation. Pages 379–391 *in* K. E. Ruckstuhl and P. Neuhaus, editors. Sexual segregation in vertebrates: ecology of the two sexes. Cambridge University Press, Cambridge, United Kingdom.

result that males and females use separate water sources. [63] [64] Thus, it is inappropriate to speculate that needs of both male and female bighorn sheep will be met if the proposed relocation of water sources is implemented. Further, it is unclear why the modeler chose only to consider female bighorn sheep in model development.

(5) The model considered elevation, but it is unclear how that metric is presented. To be meaningful to bighorn sheep in this model, elevation must be expressed in a relative, rather than absolute (i.e., meters above sea level), context. For example, bighorn sheep occur at elevations near sea level elsewhere in California and nearby Arizona [65] [66] [67] [68] [69], and absolute elevation as a meaningful metric by which to gauge habitat selection has been called into question by other investigators. [70] Thus, use of this metric as a variable in the modeling exercise is mysterious.

(6) The author failed to consider many variables that may have biological integrity in terms of predicting animal landscape use (i.e. Normalized Difference in Vegetation Index [NDVI], shrub cover, North-South facing slopes, etc.). All the aforementioned, yet excluded, variables are quite simple to extract and include in such analyses. Exclusion of those variables leads WSF to further question the validity of the results.

(7) Failure to include a measure of forage quality in the model invalidates its usefulness. Normalized Difference in Vegetation Index is a remotely-sensed measure of the amount of "greenness" on the landscape. NDVI imagery can be obtained at various spatial resolutions and temporal frequencies and is often used to investigate environmental change or vegetative community composition.[71] Further, NDVI as an index to forage quality is a useful tool for comparing habitat patches of potentially differing qualities that may be a higher priority for conservation action—including addition of anthropogenic water sources—or to identify areas with poorer forage conditions that do not warrant expending conservation resources, and NDVI previously has been shown to be useful in understanding the relationship between the location and quality of key resources and space use by desert ungulates occupying MNP [72] [73] [74] and is readily available for that geographic area. [75] [76]

(8) Even more concerning is the acknowledgement that a shortcoming of the model is that forage quality was not a consideration in model development. [77] This is especially perplexing given the demonstrated utility of satellite-derived indices, since such information was used by previous authors working in MNP [78] [79] and its importance in modeling exercises for bighorn sheep elsewhere has been demonstrated. [80] Moreover, given the availability of NDVI data, it is unclear why the author of the model would not have considered ΔNDVI in model

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[63] Whiting, J. C. 2008. Behavior and ecology of reintroduced Rocky Mountain bighorn sheep. Ph.D. dissertation, Idaho State University, Pocatello, USA.

[64] Whiting, J. C., R. T. Bowyer, J. T. Flinders, V. C. Bleich, and J. G. Kie. 2010. Sexual segregation and use of water by bighorn sheep: implications for conservation. Animal Conservation 13:541–548.

[65] Welles, R. E., and F. B. Welles. 1961. The bighorn of Death Valley. National Park Service Fauna Series 6:1–242.

[66] Weaver, R. A., and J. L. Mensch. 1969. A report on desert bighorn sheep in eastern Imperial County. Final Report, Federal Aid in Wildlife Restoration Project W-51-R-14. California Department of Fish and Game, Sacramento, USA.

[67] Russo, J. P. 1956. The desert bighorn in Arizona. Arizona Game and Fish Department Wildlife Bulletin 1:1–153.

[68] Andrew, N. G. 1994. Demography and habitat use of desert-dwelling mountain sheep in the East Chocolate Mountains, Imperial County, California. M.S. Thesis, University of Rhode Island, Kingston, USA.

[69] Hoglander et al. (2015).

[70] Bleich et al. (1997).

[71] Pettorelli, N., J. OP. Vik, A. Mysterud, J.-M. Gaillard, C. J. Tucker, and N. C. Stenseth. 2005. Using the satellite-derived NDVI to assess ecological responses to environmental change. Trends in Ecology and Evolution 20:503–-510.

[72] Creech, T. G., C. W. Epps, R. J. Monello, and J. D. Wehausen. 2016. Predicting diet quality and genetic diversity of a desert-adapted ungulate with NDVI. Journal of Arid Environments 127:160–170.

[73] Hoglander et al. (2015).

[74] Heffelfinger, L. J., K. M. Stewart, A. P. Bush, J. S. Sedinger, N. W. Darby, and V. C. Bleich. 2018. Timing of precipitation in an arid environment: effects on population performance of a large herbivore. Ecology and Evolution 2017:1–13 (early view). DOI: 10.1002/ece3.3718

[75] LANDFIRE. 2014. Existing vegetation cover, LANDFIRE 1.4.0. U.S. Department of the Interior, Geological Survey. Available at https://www.landfire.gov/NationalProductDescriptions23.php

[76] Climate Engine. 2018. Desert Research Institute and University of Idaho. http://climateengine.org.

[77] Hughson (2018).

[78] Creech et al. (2016).

[79] Heffelfinger et al. (2018).

[80] Hoglander et al. (2015).

development, given its inclusion by others [81] (albeit during seasons other than summer, which again begs the question of why the author limited the modeling exercise to the months of July, August, and September).

(9) NDVI was not included when assessing resource selection by bighorn sheep because the author claimed it was more suited for a time-varying model. [82] It remains unclear why the author would not have developed a time-varying model, rather than an overly simplistic single-season model. For example, NPS requested, partially funded, and then supported for a period of time a mule deer investigation that relied on NDVI to assess resource selection during various life history stages. [83] Understanding the relationship between forage quality and water development site selection is important to understanding the outcome of management practices. NDVI measures are easily obtainable and there is no excuse for disregarding any kind of measure of forage quality when evaluating resource selection of bighorn sheep.

(10) Use of AIC in model selection should be based on an *a priori* set of attributes that are likely to inform the model based on their suspected relationship to the question under consideration. [84] Thus, the technique should eliminate what some have referred to as "trolling for relationships". Inclusion of geology is perplexing, given that we are aware of no other such consideration in the professional literature, and reflects a lack of familiarity with the ecology of bighorn sheep. Further, it suggests an uninformed inclusion of that variable in the modeling process.

(11) The author dismissed the use of many variables that may have biological integrity in terms of predicting landscape use by bighorn sheep yet, for some reason, included geology. Excluded variables are quite simple to extract and include in such analyses. Exclusion of those variables leads WSF, and bighorn sheep biologists in particular, to question the results. For example, additional variables important to bighorn sheep, among which are openness (an index to safety [i.e., predator detection] for females and young) and vegetation type (an index to forage availability), were not considered. [85] The author attempted to include a surrogate for vegetation type (but see comments regarding model convergence, above), but the same shortcomings apply to vegetation type as to geological characteristics: rupicolous scrub, the vegetation type selected strongly by bighorn sheep in the modeled area apparently does not occur at locations at which replacement (North Piute) or 'additional' (Vontrigger Spring, Ginn Mine Spring) anthropogenic water sources are suggested. Moreover, vegetation type maps are not restricted to the source referred to by the author of the model and exacerbates our concerns about the modeling effort.

C. Other considerations of bighorn sheep and their habitat that were ignored.

In addition to problems associated with model development, input, and application there are other points that were not considered. Given that bighorn sheep populations have responded very positively to water development in MNP, it is the position of WSF that every variable that could conceivably affect population performance as a result of removal or 'replacement' of existing water sources must be a serious consideration.

(1) Micronutrients are important to ruminants and play a crucial role in overall animal health through disease resistance [86], recruitment [87], and vital rates. [88] As a result, availability of trace minerals is an important

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[81] Hoglander et al. (2015).

[82] Hughson (2018).

[83] Heffelfinger, L. J. 2017. Factors Influencing Population Performance and Tradeoffs Associated with Reproduction of a Large Herbivore. M.S. Thesis, University of Nevada, Reno, USA.

[84] Aldredge and Griswold (2006).

[85] McCarty, C. W., and J. A. Bailey. 1994. Habitat requirements of desert bighorn sheep. Terrestrial Wildlife Research Special Report 69. Colorado Division of Wildlife, Denver, USA.

[86] Failla, M. L. 2003. Trace elements and host defense: recent advances and continuing challenges. Journal of Nutrition 133:1443S-1447S.

[87] O'Hara, T. M., G. Carroll, P. Barboza, K. Mueller, J. Blake, V. Woshner, and C. Willeto. 2001. Mineral and heavy metal status as related to a mortality event and poor recruitment in a moose population in Alaska. Journal of Wildlife Diseases 37:509-522.

[88] Flueck, W. T. 1994. Effect of trace elements on population dynamics: selenium deficiency in free-ranging black-tailed deer. Ecology 75:807-812.

nutritional consideration. [89] [90] [91] Hence, micronutrients are an important consideration in the ecology of bighorn sheep but vary both among and within mountain ranges or localized areas. [92] [93] An assumption that no difference exists between micronutrient availability at Old Dad Peak and associated limestone massifs and elsewhere in MNP (areas surrounding Ginn Mine Spring, the proposed Piute North development, or Vontrigger Spring) is unsupportable given results of prior investigations.

(2) There was a failure to consider the potential for differences in forage quality among various locations from which water developments are to be removed and those that have been preselected in the DMPEA as replacement locations. Differences in forage quality are apparent even within areas utilized primarily by male bighorn sheep at Old Dad Peak when compared to areas used primarily by females. [94] Moreover, even small changes in nutrient intake can profoundly affect population performance of ungulate populations [95], and this cannot be ignored when proposing relocation of water sources. An expectation that no difference in forage quality will exist between areas from which water sources are to be removed or where water sources are proposed to be developed is unfounded, and there is a need to evaluate forage quality on a localized scale. [96]

As mentioned earlier, the model [97] was developed strictly on a seasonal basis that included only the months of July, August, and September, and over a limited length of time. That distance to water was an important variable in that model during summer is surprising to no one familiar with the biology of desert bighorn sheep given results of previous investigations [98] [99] [100] and the inability of bighorn sheep to meet water intake needs from forage alone during hot periods. [101] Other investigators, however, reported that distance from water did not affect intensity of space use by bighorn sheep in the summer, but that non-summer season relative space use was greater for areas farther from perennial sources of water. [102] Further, differences existed in distances to water among seasons; the fact that the mean distance from water that female bighorn sheep occurred during summer ($\bar{x}$ = 2,971 m) was essentially identical to that during spring ($\bar{x}$ = 2,838 m) yet was far less during autumn ($\bar{x}$ = 1,538 m) at Old Dad Peak [103] calls into question the decision to filter location data by season. [104] Moreover, the coefficients of variation (CV) during spring (123.7%) and summer (98.8%) were remarkably large, albeit similar; CV during autumn (212.3) was even larger. [105] These results strongly suggest that population density at Old Dad Peak, which approached 270 female bighorn sheep/1,000 km^2 at the time, [106] had a profound effect on distribution and habitat selection. The far-lower density of female bighorn sheep during 2013–2017 [107] may well have produced results

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[89] Fox, L. M., P. R. Krausman, M. L. Morrison, and T. H. Noon. 2000. Mineral content of Sonoran pronghorn forage. California Fish and Game 86:159–174.

[90] McKinney, T., and T. H. Noon. 2002. Mineral concentrations of desert bighorn sheep forages in the Mazatzal Mountains, Arizona. Desert Bighorn Council Transactions 46:25-38.

[91] Fox, L. M., P. R. Krausman, M. L. Morrison, and T. H. Noon. 2000. Mineral content of Sonoran pronghorn forage. California Fish and Game 86:159–174.

[92] Fox et al. (2000).

[93] Bleich, V. C., M. W. Oehler, and R. T. Bowyer. 2017. Mineral content of forage plants of mountain sheep, Mojave Desert, USA. California Fish and Game 103:55–65.

[94] Bleich, V. C., R. T. Bowyer, D. J. Clark, and T. O. Clark. 1992. An analysis of forage used by mountain sheep in the eastern Mojave Desert, California. Desert Bighorn Council Transactions 36:41–47.

[95] White, R. G. 1983. Foraging patterns and their multiplier effect on productivity of northern ungulates. Oikos 40:377–384.

[96] Bleich et al. (1992).

[97] Hughson (2018).

[98] Andrew, N. G., V. C. Bleich, and P. V. August. 1999. Habitat selection by mountain sheep in the Sonoran Desert: implications for conservation in the United States and Mexico. California Wildlife Conservation Bulletin 12:1–30.

[99] Bleich et al. (1997).

[100] Anderson, D. J. 2018. Bighorn sheep conservation within mine-influenced landscapes: management implications and opportunities. M.S. Thesis, Green Mountain College, Poultney, Vermont, USA.

[101] Turner, J. C. 1973. Water, energy and electrolyte balance in the desert bighorn sheep, *Ovis canadensis*. Ph.D. Dissertation, University of California, Riverside, USA.

[102] Hoglander et al. (2015).

[103] Oehler, M. W., R. T. Bowyer, and V. C. Bleich. 2003. Home ranges of female mountain sheep: effects of precipitation in a desert ecosystem. Mammalia 67:385–401.

[104] Hughson (2018).

[105] Oehler et al. (2003).

[106] Jaeger et al. (1991).

[107] DMPEA, Appendix 1, page 7.

not representative of habitat selection prior to the reduction in population size. Thus, those results are not reliable estimates of the situation prior to the outbreak of respiratory disease, and use of the model to contrive support for relocation of the large mammal water developments was, at best, inappropriate.

MNP employees cannot be certain that water was available at the Vermin water development the entire period during which data were collected for use in model development. [108] An assumption that water source was functional during the entire period of model development creates even less confidence in the results. Moreover, the Vermin Water Development is known to not have been functional during almost all of 2012 up through mid-June 2013, when personnel from the Society for the Conservation of Bighorn Sheep performed maintenance and provisioned it with water. [109] Even if the Vermin Water Development was functional the entire period that telemetry data were collected for the modeling exercise, water was not available at that location during the previous 18 months, a period that includes the entire previous "hot season" and likely affected the way female bighorn sheep used that water source during July, August, and September the first year it was available. This potential bias against use of that water source cannot be dismissed.

FORAGE AND SEASON, AND THEIR IMPORTANCE FOR DIET QUALITY AND DEMOGRAPHY ARE IGNORED

Forage quality is an important driver of population performance in bighorn sheep and other ruminants, [110] [111] [112] and such has been demonstrated to be the case in MNP. [113] Indeed, newly-emergent grasses and forbs following precipitation events play a major role in recruitment and survival of young. [114] [115] There are trade-offs associated with 'decisions' made by animals, and those decisions generally revolve around the risk associated with being in a specific place relative to the benefits of being in that particular location; similarly, there are tradeoffs with decisions made by humans on behalf of animals that are not acknowledged in the DMPEA.

Among Cervids and Bovids, such as bighorn sheep and mule deer, risks and benefits of being in a particular location generally involve tradeoffs associated with the risk of predation relative to the benefits associated with nutrient acquisition. [116] [117] [118] [119] In combination, these have a profound influence on the ways that animals select habitat. [120] [121] Neither the model nor the DMPEA, or any other aspect of the 'plan' acknowledges the significance of the nutritional benefits incurred by bighorn sheep on the project site. Thus, an additional and major weakness is the failure to recognize the potential importance of lower-elevation habitats in terms of the nutritional benefits available to bighorn sheep in such areas. For example, the author of the model makes a special point of noting, "Interestingly, the 95% volumetric isoclines also include sand dunes on the southwest side and alluvial fans on the northwest side in addition to the rugged, rocky terrain. Although most of

[108] E-mail from N. Darby to V. Bleich dated 24 February 2018.
[109] Personal communication from T. Anderson (SCBS) to V. Bleich, 25 April 2018 at 1117.
[110] White (1983).
[111] Parker, K. L., Barboza, P. S., & Gillingham, M. P. (2009). Nutrition integrates environmental responses of ungulates. Functional Ecology 23:57–69.
[112] Wehausen, J. D., V. C. Bleich, B. Blong, and T. L. Russi. 1987. Recruitment dynamics in a southern California mountain sheep population. Journal of Wildlife Management 51:86–98.
[113] Heffelfinger et al. (2018).
[114] Wehausen et al. (1987).
[115] Heffelfinger et al. (2018).
[116] Festa-Bianchet, M. 1988. Seasonal range selection in bighorn sheep: conflicts between forage quality, forage quantity, and predator avoidance. Oecologia 75:580-586.
[117] Molvar, E, M., and R. T. Bowyer. 1994. Costs and benefits of group living in a recently social ungulate: the Alaskan moose. Journal of Mammalogy 75:621-630.
[118] Nicholson, M. C., R. T. Bowyer and J. G. Kie. 1997. Habitat selection and survival of mule deer: tradeoffs associated with migration. Journal of Mammalogy 78:483-504.
[119] Bleich, V. C., R. T. Bowyer, and J. D. Wehausen. 1997. Sexual segregation in mountain sheep: resources or predation? Wildlife Monographs 134:1-50.
[120] Pierce, B. M., R. T. Bowyer, and V. C. Bleich. 2004. Habitat selection by mule deer: forage benefits or risk of predation? Journal of Wildlife Management 68:533-541.
[121] Bleich et al. (1997).

the collar locations occur in the rocky outcrops, a few points in the sandy areas suggest occasional use or crossing." [122] Clearly, that statement demonstrates a lack of familiarity with the biology of bighorn sheep and the nutrient advantages associated with such areas, as well as with the current literature that clearly portrays use of such areas. [123]

Low-lying areas, such as those sand dunes and desert washes, are among the most productive areas in desert habitats and support higher cover of vegetation and far greater plant biomass than surrounding upland areas. [124] [125] Moreover, research conducted specifically in the area for which the model was developed indicate that Dune Habitat had the greatest relative cover (2.47±5.47 [SD] of the vegetation types used by bighorn sheep in a long-term investigation: Transition Zone (2.04±2.99), Desert Wash (1.73±4.11), Creosote Bush Scrub (1.38±2.25), *Yucca-Ephedra* Scrub (1.08±1.94) and Rupicolous Scrub (0.32±0.82). [126] Ironically, the area highlighted by the author of the model as being so important was characterized by the least amount of vegetation. Moreover, a dataset that was heavily filtered to ensure independence and a lack of auto-correlation among telemetry locations (unlike the model relied upon in support of alternative locations of water developments) [127] and published in the peer-reviewed literature [128] clearly indicates the value of the sandy areas referenced by the author of the model.

The relative availability of potential forage among the six habitat types (% vegetative cover × proportion of range) also pointed to the importance of dune habitat as a source of nutrients. Compared to Rupicolous Scrub, the vegetation type characteristic on the limestone massifs where the model was developed, Dune Habitat relative availability of potential forage was ~5× greater. Moreover, relative availability of potential forage was ~20× greater in Creosote Bush Scrub, and ~12× greater in the Transition Zone. [129]

Sand dunes and washes likely are not used on a year-round basis but they are, at times, very important to bighorn sheep for nutrient acquisition. The presence of bighorn sheep in these areas is consistent with utilization of those low-elevation habitats for the purposes of acquiring high-quality forage (i.e., newly-emergent or actively growing vegetation, which is highest in moisture content, digestibility, and crude protein). [130] [131] Indeed, Dune Habitat has the highest proportion of perennial grasses and annual plants among the 6 vegetation types regularly used by bighorn sheep in the area from which data used in model development were obtained. [132]

Forage used by desert bighorn sheep reflects an increase in forage quality or diet quality in the spring growing season [133] [134] [135] [136] [137] during late gestation or for recovery or enhancement of body condition either, or

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[122] Hughson (2018).

[123] Bleich, V. C., J. C. Whiting, J. G. Kie, and R. T. Bowyer. 2016. Roads, routes and rams: does sexual segregation contribute to anthropogenic risk in a desert-dwelling ungulate? Wildlife Research 43:380-388.

[124] Andrew, N. G. 1994. Demography and habitat use of desert-dwelling mountain sheep in the East Chocolate Mountains, Imperial County, California. MS Thesis, University of Rhode Island, Kingston, Rhode Island, USA.

[125] Marshal, J. P., P. R. Krausman, and V. C. Bleich. 2005. Dynamics of mule deer forage in the Sonoran Desert. Journal of Arid Environments 60:593-609.

[126] Bleich, V. C. 1993. Sexual segregation in desert-dwelling mountain sheep. Ph.D. Dissertation, University of Alaska Fairbanks, Fairbanks, Alaska, USA.

[127] Hughson (2018).

[128] Bleich, V. C., J. C. Whiting, J. G. Kie, and R. T. Bowyer. 2016. Roads, routes and rams: does sexual segregation contribute to anthropogenic risk in a desert-dwelling ungulate? Wildlife Research 43:380-388.

[129] Bleich et al. (1997).

[130] Marshal, J. P., Marshal, J. P., P. R. Krausman, and V. C. Bleich. 2005. Rainfall, temperature, and forage dynamics affect nutritional quality of desert mule deer forage. Rangeland Ecology and Management 58:360-365.

[131] Bleich et al. (1997).

[132] Andrew (1994).

[133] Bleich et al. (1997).

[134] Bleich**,** V. C., R. T. Bowyer, D. J. Clark, and T. O. Clark. 1992. Quality of forages eaten by mountain sheep in the eastern Mojave Desert, California. Desert Bighorn Council Transactions 36:41–47.

[135] Oehler et al. (2003).

[136] Oehler, M. W., V. C. Bleich, R. T. Bowyer, and M. C. Nicholson. 2005. Mountain sheep and mining: implications for conservation and management. California Fish and Game 91:149–178.

[137] Wehausen, J. D. 2005. Nutrient predictability, birthing seasons, and lamb recruitment for desert bighorn sheep. Pages 37–50 *in* J. Goerrissen and J. M André, editors. Sweeney Granite Mountains Desert Research Center 1978–2003: A Quarter Century of Research and Teaching. University of California Natural Reserve Program, Riverside, California, USA.

both, of which can have a profound effect on recruitment or reproduction the following year, [138] [139] with resultant implications for reproduction and recruitment rates of bighorn sheep in desert environments. [140] The DMPEA fails to recognize the potential importance of these sand dunes when advocating that the Kerr Water Development be relocated to an area north of its current location and fails to analyze the potential effect on the reproductive performance of female bighorn sheep that occupy the limestone massifs south of the Jackass Canyon Road. These low-lying areas are used by bighorn sheep for foraging, and such use may occur only for short periods of time but can play critically important roles in the life history of bighorn sheep, particularly during years when forage production is poor. Indeed, patterns and amounts of precipitation and resultant productivity of vegetation [141] [142] affect the distribution of mule deer and bighorn sheep in MNP and, ultimately, the probability of persistence of populations of the latter, if not both, species. [143] [144] The DMPEA is remiss in not recognizing the potential value of sand dune habitat to be import to bighorn sheep occupying nearby stereotypical bighorn sheep habitat (i.e., the limestone massifs), and in not discussing the significance of the potential availability of the loss of such habitat if the Kerr Water Development is relocated with a resultant decline in use of that habitat because of the additional distance that female bighorn sheep must travel to access it. The importance of missing this is noted below.

Desert bighorn sheep generally give birth from January to April, [145] [146] a pattern consistent with the birthing period of bighorn sheep in the eastern Mojave Desert [147] where young generally are born during March and April coincident with the peak in diet quality in that region. [148] The relationship of diet quality to lamb survival until summer is well documented in the eastern Mojave Desert, and is a reflection of the amount of body growth incurred by lambs during spring and its importance to attaining as much mass as possible before onset of hot summer conditions and a concomitant decline in diet quality. [149] Moreover, adequate high-quality diets, which typically occur during spring, are important to female ungulates that use those resources to recoup, or attain, body condition adequate for ovulation prior to the following breeding season despite a period of depressed diet quality typical of hot summer months, [150] a pattern that is reflected among mule deer that are sympatric with bighorn sheep in MNP. [151] To ignore the potential impact of decreased use of areas by female bighorn sheep that may not have access to such a resource because of relocation of an existing, long-established, and heavily-used wildlife water development is unacceptable to us.

THE BASES FOR SELECTION OF ORIGINAL LOCATIONS ARE NOT CONSIDERED

Relocation of the Kerr Wildlife Water Development to an area outside of legislated wilderness, but in the absence of a full understanding of the basic nutritional ecology of bighorn sheep, is an untenable proposal. Even more egregious, however, was the failure to consider the ramifications of relocating the Kerr Wildlife Water Development to an area that will be readily accessible to tourists and others that will have access to it along the existing road through Jackass Canyon that 'separates' two areas of legislated wilderness. This road is open to traffic but is used on an irregular and unpredictable basis. Moreover, there is no way of predicting what the actions

[138] Heffelfinger et al. (2018).
[139] Monteith, K. M., V. C. Bleich, T. R. Stephenson, B. M. Pierce, M. M. Conner, J. G. Kie, and R. T. Bowyer. 2014. Life history characteristics of mule deer: effects of nutrition in a variable environment. Wildlife Monographs 186:1–63.
[140] Wehausen (2005).
[141] Heffelfinger et al. (2018).
[142] Wehausen (2005).
[143] Oehler et al. (2003).
[144] Oehler et al. (2005).
[145] Witham, J. H. 1983. Desert bighorn sheep in southwest Arizona. Ph.D. Dissertation, Colorado State University, Fort Collins, USA.
[146] Rubin, E. S., W. M. Boyce, and V. C. Bleich. 2000. Reproductive strategies of desert bighorn sheep. Journal of Mammalogy 81:769–786.
[147] Wehausen, J. D. 1991. Some potentially adaptive characters of mountain sheep populations in the Owens Valley region. Pages 256–267 *in* C. A. Hall, Jr., V. Doyle-Jones, and B. Widawski, editors. Natural history of eastern California and high-altitude research. University of California White Mountain Research Station, Bishop, USA.
[148] Wehausen (2005).
[149] Wehausen (2005).
[150] Wehausen (2005).
[151] Heffelfinger (2018).

of individuals will be when bighorn sheep are observed. Thus, the proposed relocation site has potentially onerous ramifications for bighorn sheep that might attempt to use it. We detail those foreseeable consequences in the following paragraphs. To understand the ramifications of relocating water sources simply for logistical reasons [152] or because their locations in wilderness have presented MNP managers with challenges,[153] it is necessary to understand why the original locations were selected. The same rationale will apply to those water sources developed for bighorn sheep (Kerr, Vermin), or for both bighorn sheep and mule deer (Bicket-Landells), that were developed after those recommended by Weaver and his collaborators had been completed.

The seasonal presence of bighorn sheep, inaccessible locations or, at best, locations with difficult human access, and suitable geological characteristics were the primary considerations when water development sites were selected by Richard A. Weaver and colleagues after years of extensive, on-the-ground work in the late 1960s and early 1970s. [154] [155] [156] [157] [158] [159] [160] [161] [162] [163] [164] [165] [166] [167] As a result of those efforts, a total of 22 anthropogenic water sources were constructed. [168] One such water source was developed at Pyramid Peak in 1970 at a site in Death Valley National Monument that was selected and developed cooperatively by the Department of Fish and Game and the National Park Service. Three other anthropogenic sources (Dolomite Canyon, Last Chance, Dry Mountain) were established in cooperation with the Bureau of Land Management based on Weaver's extensive field work, and a fourth was developed cooperatively with BLM in the late 1980s to move bighorn sheep northward in the Last Chance Range and help to restore use by bighorn sheep to Sand Spring, located on the east side of that mountain range. Following transfer of BLM lands to NPS and creation of Death Valley National Park with the passage of the CDPA in 1994, NPS removed the water sources at Little Chute, Pyramid

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[152] DMPEA, page 32.

[153] DMPEA, page 88.

[154] Weaver, R. A., J. L. Mensch, and W. V. Fait. 1968. A survey of the California desert bighorn (*Ovis canadensis*) in San Diego County. Pittman-Robertson Project Report W–51–R–14. Wildlife Management Branch, California Department of Fish and Game, Sacramento, USA.

[155] Weaver, R. A., and J. L. Mensch. 1969. A report on desert bighorn sheep in eastern Imperial County. Pittman-Robertson Project Report W-51-R-14. Wildlife Management Branch, California Department of Fish and Game, Sacramento, USA.

[156] Weaver, R. A., J. L. Mensch, and R. D. Thomas. 1969. A report on desert bighorn sheep in northeastern San Bernardino County. Pittman-Robertson Project Report W–51–R– 14. Wildlife Management Branch, California Department of Fish and Game, Sacramento, USA.

[157] Weaver, R. A., and J. L. Mensch. 1970. Bighorn sheep in northwestern San Bernardino and southwestern Inyo counties. Wildlife Management Administrative Report 70–3. Wildlife Management Branch, California Department of Fish and Game, Sacramento, USA.

[158] Weaver, R. A., and J. L. Mensch. 1970. Bighorn sheep in southern Riverside County. Wildlife Management Administrative Report 70–5. Wildlife Management Branch, California Department of Fish and Game, Sacramento, USA.

[159] Weaver, R. A., and J. L. Mensch. 1970. Desert bighorn sheep in northern Inyo and southern Mono counties. Wildlife Management Administrative Report 70–7. Wildlife Management Branch, California Department of Fish and Game, Sacramento, USA.

[160] Weaver, R. A., and J. L. Mensch. 1971. Bighorn sheep in northeastern Riverside County. Wildlife Management Administrative Report 71–1. Wildlife Management Branch, California Department of Fish and Game, Sacramento, USA.

[161] Weaver, R. A., and J. L. Mensch. 1971. Bighorn sheep in southwestern San Bernardino [County]. Wildlife Management Administrative Report 71–2. Wildlife Management Branch, California Department of Fish and Game, Sacramento, USA.

[162] Weaver, R. A., and J. Hall. 1971. Bighorn sheep in Joshua Tree National Monument and adjacent areas. Wildlife Management Administrative Report 71–7. Wildlife Management Branch, California Department of Fish and Game, Sacramento, USA.

[163] Weaver, R. A., and J. Hall. 1971. Desert bighorn sheep in southeastern San Bernardino County. Wildlife Management Administrative Report 71–8. Wildlife Management Branch, California Department of Fish and Game, Sacramento, USA.

[164] Weaver, R. A., J. L. Mensch, W. Timmerman, and J. M. Hall. 1972. Bighorn sheep in the San Gabriel and San Bernardino mountains. Wildlife Management Administrative Report 72–2. Wildlife Management Branch, California Department of Fish and Game, Sacramento, USA.

[165] Weaver, R. A., and J. M. Hall. 1972. Bighorn sheep in the Clark, Kingston and Nopah mountain ranges (San Bernardino and Inyo counties). Wildlife Management Administrative Report 72–3. Wildlife Management Branch, California Department of Fish and Game, Sacramento, USA.

[166] Weaver, R. A. 1972. Desert bighorn sheep in Death Valley National Monument and adjacent areas. Wildlife Management Administrative Report 72–4. Wildlife Management Branch, California Department of Fish and Game, Sacramento, USA.

[167] Weaver, R. A. 1972. California bighorn in the Sierra Nevada mountain range. Wildlife Management Administrative Report 72–7. Wildlife Management Branch, California Department of Fish and Game, Sacramento, USA.

[168] Bleich, V. C., and A. M. Pauli. 1990. Mechanical evaluation of artificial watering devices built for mountain sheep in California. Pages 65–72 *in* G. K. Tsukamoto and S. J. Stiver, editors. Wildlife water development. Nevada Department of Wildlife, Reno, USA.

Peak, and Dolomite Canyon. Each of the 5 water sources predated the CDPA and creation of Death Valley National Park (DVNP) in 1994. Further, early NPS investigators had championed the importance of water to bighorn sheep in Death Valley [169] [170] [171]and worked cooperatively with CDFG to ensure availability of that resource for the benefit of bighorn sheep. It is disconcerting, however, that the three water sources were removed by NPS, in direct contradiction to recommendations of current investigators, who concluded with the admonition, "Given that this system lacks large fenced highways or canals, which are known to limit gene flow (Epps, et al., 2005), the primary means of maintaining genetic diversity and gene flow in this system is to maintain the bighorn sheep populations themselves. *This requires ensuring that water sources throughout the system stay accessible to desert bighorn sheep* [emphasis added]". [172]

In response to Weaver's field work, three water sources were developed cooperatively with the Bureau of Land Management in the area that became Mojave National Preserve with passage of the CDPA in 1994. These were located at Old Dad Peak, Kelso Peak, and in the Piute Range, on the extreme eastern boundary of MNP. Subsequently, two additional wildlife water sources were developed specifically for bighorn sheep (Vermin and Kerr), and a third (Bicket-Landells) was developed on the north side of Clark Mountain to serve both bighorn sheep and mule deer. [173] The Bicket-Landells water source is located at the site of a tragic accident that occurred when BLM Wildlife Biologist Jim Bicket observed a group of bighorn sheep at that location, and the pilot turned the helicopter and encountered an unforeseen and uncorrectable situation because of wind direction. [174]

It has been necessary to provide this background information because the location of these catchments ensured no ready human access, albeit legal. Records indicate that no vandalism occurred between 1971 (the year the first water source was provided) and 1988, following a thorough mechanical evaluation. [175] Remoteness of these locations is, in part, the reason for the absence of vandalism. All six of the anthropogenic water sources located in MNP are also in remote or largely-inaccessible locations. NPS proposes to eliminate two of these (Piute and Bicket-Landells), and to relocate two others (Kerr, and Vermin) outside of wilderness and in areas that are adjacent to roadways and largely accessible to the public. NPS also claims new water sources would be developed at North Piute, Ginn Spring, and Vontrigger Spring. [176] WSF is not familiar with the proposed location for North Piute, but Ginn Spring apparently is an old mine site and presumably is accessible by vehicle. Moreover, Vontrigger Spring is located in Lanfair Valley and is accessible by vehicle from Lanfair Road, which receives heavy use.

Visitor use is extremely heavy in Lanfair Valley, Vontrigger Spring is a very popular area for hunting upland game, and the relative intensity of upland game hunting was greater in Lanfair Valley than in any other geographic location in MNP. [177] [178] In short, establishing a wildlife water source at Vontrigger Spring will expose that water source to a large amount of human activity and, potentially to vandalism. Moreover, water is available at Hogeyboom Well, approximately 2 miles from Vontrigger Spring, bighorn sheep have been observed crossing Lanfair Road while moving in the direction of Hogeyboom Well, and bighorn sheep have been observed at that location. [179]

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[169] Dixon, J. S., and E. L. Sumner, Jr. 1939. A survey of desert bighorn in Death Valley National Monument, summer of 1938. California Fish and Game 25:72–95.

[170] Welles, R. E., and F. B. Welles. 1959. Preliminary study of wildlife water sources in Death Valley National Monument. Report XVII. Manuscript on file at Death Valley National Park.

[171] Welles and Welles (1961).

[172] Epps, C. W., T. G. Creech, R. S. Crowhurst, J. D. Wehausen, W. B. Sloan, J. R. Jaeger, K. M. Longshore, and R. J. Monello. 2016. Fifty years after Welles and Welles: distribution and genetic structure of desert bighorn sheep in Death Valley National Park. Proceedings of the Death Valley Natural History Conference 1:71–93.

[173] The Bicket-Landells wildlife water source was developed near the location of a fatal helicopter crash on 6 October 1986 that killed helicopter pilot Don Landells and BLM Wildlife Biologist Jim Bicket, and in which CDFG Wildlife Biologist was critically injured.

[174] R. A. Weaver, personal communication with V. Bleich, 8 October 1986, in a Las Vegas, Nevada, hospital.

[175] Bleich and Pauli (1990).

[176] DMPEA Table S-1.

[177] Personal communication with A. M. Pauli (CDFG Wildlife Biologist, retired), 1 May 2018.

[178] Bleich, V. C., and A. M. Pauli. 1999. Distribution and intensity of hunting and trapping activity in the East Mojave National Scenic Area, California. California Fish and Game 85:148–160.

[179] Personal communication with C. McDonald, Water for Wildlife Foundation, 1 May 2018.

NPS proposes to remove the existing Kerr Wildlife Water Development simply because it is in a wilderness area. NPS proposes to establish a new water source (New Kerr) in a location along the Jackass Canyon Road [apparently on NPS property through which the Southern California Edison Company has a right-of-way]. [180] That road is accessible by vehicles traveling along the powerline corridor, and is used by recreationists and other travelers on a year-round basis. Similarly, NPS proposes to remove the existing Vermin Wildlife Water Development simply because it is in a wilderness area. NPS then proposes to establish a new water source (New Vermin) at the end of an open road that terminates near the Old Dad Mountain Mine and Bighorn Mine. [181]

NPS claims that "… relocating guzzlers to more accessible, non-wilderness sites could allow for less refilling (by using new guzzler designs at better intake locations) and better access for monitoring and maintenance." [182] NPS leadership has acknowledged that establishing water sources might be *logistically desirable* (emphasis added). [183] NPS also has noted that, "Moving a guzzler to a more accessible location, however, may result in reduced use by bighorn due to proximity to human presence." [184] NPS further states that removal and relocation of these wildlife water sources would occur, "…only if monitoring indicated that new relocated guzzlers are sufficiently used by bighorn populations". [185] NPS also notes that, "All of the big game guzzlers are in wilderness designated by the 1994 CDPA." NPS further states, "This has proven to be a challenge for the maintenance, monitoring, and water replenishment necessary for the guzzlers to function." NPS has granted a special use permit to allow these activities to be carried out, most of which is carried out by volunteers [and not by MNP employees]. [186] [187]

It is the position of WSF that invoking a change in location because it is 'logistically desirable' or because MNP personnel have found maintenance of water sources that existed prior to creation of wilderness and establishment of MNP in 1994 to be challenging is not a defensible action given the uncertainties of removing or relocating water sources and the unknown behavioral or demographic responses of bighorn sheep dependent upon those sources. Moreover, MNP leadership has agreed that there was an absence of ecological forethought prior to establishment of the wilderness areas throughout the Mojave Desert (including MNP), and that existence of wildlife water developments within those wilderness areas need not be removed due to location in wilderness because they were present prior to the wilderness areas being established. [188] To reiterate, the primary rationale for removing those water sources is captured in the statement in DMPEA that the water sources have been, "a challenge for the maintenance, monitoring, and water replenishment necessary for the guzzlers to function." [189]

In addition to concerns about potential vandalism, the DMPEA fails to include discussions regarding the (A) metapopulation biology of bighorn sheep; (B) their predator evasion strategies; (C) behavioral or demographic consequences of proposed actions; (D) potential of proposed actions to increase poaching; (E) compatibility of wildlife water sources with legislated wilderness; (F) existing wildlife conservation plans; (G) factual errors that are included; and, (H) certain curiosities associated with the history and preparation of the DMPEA. Until each of these issues is addressed fully, and an informed decision can be made regarding removal or relocation of large mammal water sources, WSF asserts that NPS is failing to meet its obligations consistent with the National Environmental Policy Act. Detailed comments germane to each of these concerns follow.

Metapopulation Function, Corridors, and Bighorn Sheep Conservation

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[180] DMPEA Page 32.
[181] DMPEA Page 32.
[182] DMPEA, page 32.
[183] Results of a meeting with MNP leadership on 24 February 2017 as memorialized in a memo from V. Bleich to S. Marschke of the Society for the Conservation of Bighorn Sheep (SCBS) and dated 1 April 2017.
[184] DMPEA Page 32.
[185] DMPEA Page 32.
[186] DMPEA Page 88.
[187] National Park Service (NPS). 2008. Special Use Permit – Replenishment of Kelso and Kerr Guzzlers. Permit # PWR-MOJA-9500-8-0040. Issued to Mr. Conrad Jones, California Department of Fish and Game. July 11.
[188] Results of a meeting with MNP leadership on 24 February 2017 as memorialized in a memo from V. Bleich to S. Marschke of the Society for the Conservation of Bighorn Sheep (SCBS) and dated 1 April 2017.
[189] DMPEA Page 88.

Bighorn sheep are specialized ungulates that occur in a naturally-fragmented distribution and in a metapopulation structure. [190] [191] [192] [193] [194] These points are acknowledged in the DMPEA. The conservation strategy for bighorn sheep employed by CDFW is based on a metapopulation approach, [195] [196] [197] a point, however, that does not appear in the DMPEA.

In the absence of recognition of the CDFW strategy for bighorn sheep conservation, WSF contends that it is premature for MNP to be proposing plans for "movement corridors" within MNP in the absence of consideration of movement corridors that might best be coordinated with other land management agencies and CDFW. This is especially so when areas outside of MNP likely are more important for enhancing opportunities for movement between occupied habitat within MNP and proximate areas, whether currently occupied or not. Moreover, an important area that is utilized by female mountain sheep and their offspring, and likely serves as a stepping-stone to mountain ranges west of MNP is not considered. Although female bighorn sheep appear to have colonized new areas in the Mojave Desert, [198] such events occur very unpredictably and are infrequent because of the conservative behavior of females. [199]

As currently posited in the DMPEA, a water development at Vontrigger Spring will do little, if anything on behalf of metapopulation structure; male bighorn sheep have been confirmed to move between Hackberry Mountain and the Piute Range (and make use of the Piute Water Development). [200] [201] Moreover, water is already available a short distance (<3 km) from Vontrigger Spring, yet NPS proposes to eliminate that water source. [202] Removing a water source (Hogeyboom Well) that has evidence of current use by bighorn sheep [203] and replacing it with a water source in a novel location and but a short distance away generates the perception of promoting a "migration corridor" [204] but makes no sense when movements by bighorn sheep between Hackberry Mountain and the Piute Range already occur. Further, the DMPEA asserts, "The new Vontrigger Spring source would connect habitat between the Hackberry Mountains and Piute Spring, and … be important for restoring the bighorn sheep migration corridor across I-40". [205] The distance between Vontrigger Spring and I-40 is 25 km, and this statement is conjecture, at best. There are other locations where development of a water source would do more to promote the potential for connectivity to bighorn sheep habitat in locations east and outside of MNP as well as south of I-40, also outside of MNP. Such locations should be considered in an EIS addressing bighorn sheep habitat enhancement and conservation on a regional scale, rather than simply within a unit of NPS. With

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[190] Schwartz, O. A., V. C. Bleich, and S. A. Holl. 1986. Genetics and the conservation of mountain sheep *Ovis canadensis nelsoni*. Biological Conservation 37:179–190.

[191] Bleich, V. C., J. D. Wehausen, and S. A. Holl. 1990. Desert-dwelling mountain sheep: conservation implications of a naturally fragmented distribution. Conservation Biology 4:383–390.

[192] Bleich, V. C., J. D. Wehausen, R. R. Ramey II, and J. L. Rechel. 1996. Metapopulation theory and mountain sheep: implications for conservation. Pages 353–373 *in* D. R. McCullough, editor. Metapopulations and wildlife conservation. Island Press, Covelo, California, USA.

[193] Epps, C. W., P. J. Palsboll, J. D. Wehausen, G. K. Roderick, and D. R. McCullough. 2006. Elevation and connectivity define genetic refugia for mountain sheep as climate warms. Molecular Ecology 15:4295–4302.

[194] Epps, C. W., J. D. Wehausen, V. C. Bleich, S. G. Torres, and J. S. Brashares. 2007. Optimizing dispersal and corridor models using landscape genetics. Journal of Applied Ecology 44:714–724.

[195] Torres, S. G., V. C. Bleich, and J. D. Wehausen. 1996. Status of bighorn sheep in California, 1995. Desert Bighorn Council Transactions 40:27–34.

[196] Epps, C. W., V. C. Bleich, J. D. Wehausen, and S. G. Torres. 2003. Status of bighorn sheep in California. Desert Bighorn Council Transactions 47:20–35.

[197] Abella, R., V. C. Bleich, R. A. Botta, B. J. Gonzales, T. R. Stephenson, S. G. Torres, and J. D. Wehausen. 2011. Status of bighorn sheep in California — 2011. Desert Bighorn Council Transactions 51:54–68.

[198] Epps, C. W., J. D. Wehausen, P. J. Palsboll, and D. R. McCullough. 2010. Using genetic tools to track desert bighorn sheep colonizations. Journal of Wildlife Management 74:522-531.

[199] Geist, V. 1970. Mountain sheep: a study in behavior and evolution. University of Chicago Press, Chicago, Illinois, USA.

[200] Photograph of male bighorn sheep collared at Hackberry Mountain that was taken at Piute Wildlife Water Source and provided by John Voigt of SCBS and dated 14 September [2017].

[201] Epps, C. W., R. S. Crowhurst, and S. N. Nickerson. 2018. Assessing changes in functional connectivity in a desert bighorn sheep metapopulation after two generations. Molecular Ecology: *in press*.

[202] Personal communication with C. McDonald, Water for Wildlife Foundation, 1 May 2018.

[203] Personal communication with C. McDonald, Water for Wildlife Foundation, 1 May 2018.

[204] DMPEA page vi, and elsewhere in the document many times.

[205] DMPEA page 31.

movements of bighorn sheep between the Piute Range and Hackberry Mountain already confirmed, efforts to promote connectivity are best expended elsewhere.

In lieu of attempting to enhance a movement "corridor" between Hackberry Mountain (i.e., Hackberry Spring) and Piute Spring (between which movement already occurs, as noted above), bighorn sheep conservation would be better served if MNP were to ensure that existing opportunities for movement between occupied patches of habitat are not diminished. For example, inter-mountain movements have involved animals crossing vast expanses of habitat that has never been considered representative of bighorn sheep habitat. [206] Provision of water can be of benefit in several ways in that water (1) allows mountain sheep to make use of otherwise suitable habitat that lacks reliable sources of surface water; (2) increase the probability of pioneering individuals encountering surface water in areas that otherwise provide suitable habitat; (3) enhance the likelihood of immigrants encountering conspecifics; or, (4) increase survival rates during periods of thermal stress or drought. [207] Placing water within 3 km of an existing source when movement already is known to occur between the targeted habitat patches, however, is not a meaningful objective and is not based on any understanding of bighorn sheep behavior or ecology. Meanwhile, the previously stated intent of MNP to improve existing roadways with the intent of enhancing human safety or increasing speed limits [208] has onerous implications bighorn sheep and is antithetical to conserving those iconic ungulates.

Developing an "additional" water source at Ginn Spring to enhance connectivity between the Piute Range and points north of Interstate 15 can be viewed as an exercise in appeasement more so than an exercise in wildlife habitat management or wildlife conservation. Further, using that water source to argue that MNP is creating additional "dry season habitat" [209] is absurd because bighorn sheep do not inhabit the Ivanpah Range. [210] [211] The plan also states, "A new water source at Ginn Mine Spring (Ginn Spring) in the Mescal/Ivanpah Range would be important for restoring the bighorn sheep migration corridor across I-15, as it would connect the New York/Castle Mountains and the Clark Mountain Range. [212] Currently, no sheep occupy the Mescal Range or Ivanpah Range, and Ginn Spring is located ~15 km south of Interstate Highway 15 (I-15). Further, a water source that is available to bighorn sheep exists at the Morningstar Mine, several kilometers closer to I-15 than is Ginn Spring. Both of these are between the locations of the proposed "Piute North" water development (which also is described as enhancing connectivity "between [unidentified] habitat areas". [213] It is clear, however, that this would occur at the expense of compromising the quality of currently-occupied habitat in the Piute Range itself, and that currently supports an apparently healthy population of bighorn sheep. [214] [215]

The DMPEA fails to adequately describe the location of the aforementioned "habitat areas" and, without that information, removal of a water source upon which a population of bighorn sheep is dependent and "replacement" of that source many kilometers from the current water source can infer neither a benefit nor a scenario resulting in no change. Moreover, the DMPEA makes no mention of the need to maintain and ensure availability of water at existing springs in the Castle Mountains (located northeast of the New York Mountains), an area that historically has been used heavily by bighorn sheep. [216] [217] Moreover, the New York Mountains, an area the DMPEA states will be linked to areas north of I-15 by the proposed water developments at Ginn Spring and New Piute, do not support a population of bighorn sheep [218] [219] and have been described as "poor habitat"

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[206] Epps et al. (2007). Supplementary Appendix 3.

[207] Bleich, V. C. 2009. Factors to consider when reprovisioning water developments used by mountain sheep. California Fish and Game 95:153–159.

[208] National Park Service, http://parkplanning.nps.gov/document.cfm?park ID = 322&projectID = 48144&documentID = 56961, accessed 15 January 2014.

[209] DMPEA page ix, and elsewhere throughout the document many times.

[210] Epps et al. (2003).

[211] Abella et al. (2011).

[212] DMPEA page 31.

[213] DMPEA, page 9 and elsewhere throughout the document.

[214] Epps, C. W., V. C. Bleich, J. D. Wehausen, and S. G. Torres. Status of bighorn sheep in California. Desert Bighorn Council Transactions 47:20–35.

[215] Abella et al. (2011).

[216] Weaver et al. (1969).

[217] V. C. Bleich, personal observations as recorded in field notes, July–September 1973.

[218] Epps et al. (2003).

[219] Abella et al. (2011).

that "may never have supported a population of bighorn sheep." [220] Indeed, the New York Mountains west of Ivanpah Road historically were not occupied bighorn sheep habitat and were used, at best, by males wandering to the west from the Castle Mountains. [221] [222] Hence, any perceived benefit of developing a water source at Ginn Spring—which is located in a mountain range not occupied by bighorn sheep and a few kilometers from an existing water source at the Morningstar Mine—and claiming it will enhance connectivity between the New York Mountains—which also are not occupied by bighorn sheep—to habitat north of I-15 is, at best, absurd.

Within MNP there is, however, another option for enhancing the availability of "dry season habitat" that has been ignored completely. Female bighorn sheep are known to migrate westward from Old Dad Peak to Cowhole Mountain, and females and their offspring are known to use Cowhole Mountain during the spring and parts of summer during some years, with numerous females and young having been observed at that location in the past. [223] [224] Moreover, male bighorn sheep visit Cowhole Mountain, and likely utilize Cowhole Mountain during movements between Old Dad Peak and the Soda Mountains and, more recently to the North Bristol Mountains and Granite Mountains. [225] [226] [227] Cowhole Mountain can be described as stereotypical bighorn sheep habitat (i.e., it is rugged, broken terrain) and is located proximate to dune habitat in the Devils Playground, a habitat type that produces exceptional amounts of ephemeral forage during years of adequate amounts and timing precipitation. The availability and importance of such high-quality forage has been detailed elsewhere in this document. [228] [229] [230] [231] [232] [233] [234] [235]

Safety and proximity of Dune Habitat to Cowhole Mountain likely explain use of that area by females and young when ephemeral vegetation is available, but Cowhole Mountain, and Little Cowhole Mountain to the north, lack a permanent water source. It is WSF's opinion that doing so in either location would do more to enhance connectivity between Old Dad Peak and the Soda Mountains than proposals involving development of Piute North (which carries with it the concomitant elimination of the existing Piute water source) and could result in establishment of permanently occupied habitat midway between Old Dad Peak and the Soda Mountains. Thus, WSF contends that the DMPEA has failed to consider proposals, both inside and outside of the boundary that would be of far greater benefit to the conservation of bighorn sheep than any of the current alternatives involving water developments at Piute North, Ginn Spring, or Vontrigger Spring, especially when those proposals are considered in the context of the relocation of the Kerr and Vermin water sources, and the removal of the existing Piute and Bicket-Landells water sources.

In a similar manner, development of an anthropogenic water source at Homer Mountain east of MNP and located between the Piute Range and the Dead Mountains likely will be of greater value in maintaining connectivity than will new locations proposed within MNP. Further, Homer Mountain is proximate to the Sacramento Mountains, albeit north of Interstate Highway 40. Existing large underpasses exist along I-40 between Homer Mountain and the Sacramento Mountains and would facilitate such movements. WSF contends that a proposed water source at Homer Mountain will better serve issues of connectivity than will those proposed to be developed at Ginn Spring or Vontrigger Spring.

The DMPEA fails to consider options that would benefit bighorn sheep both inside and outside of MNP, and further advances the need for a regional approach to habitat conservation and preparation of an Environmental

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[220] Epps et al. (2003).
[221] Weaver, R. A. 1957. Status of the bighorn sheep in California. Desert Bighorn Council Transactions 1:8–11.
[222] Bleich, V. C., and R. A. Weaver. 2007. Status of mountain sheep in California: comparisons between 1957 and 2007. Desert Bighorn Council Transactions 49:55–67.
[223] V. C. Bleich, unpublished aerial telemetry data, 1986–1990.
[224] V. C. Bleich, unpublished aerial survey results, 1986–1990.
[225] V. C. Bleich, unpublished aerial telemetry data, 1986–1990.
[226] Bleich et al. (2016).
[227] P. Prentice, California Department of Fish and Wildlife, personal communication, 4 May 2018.
[228] Bleich et al. (1992).
[229] Andrew (1994).
[230] Oehler et al. (2003).
[231] Bleich et al. (1997).
[232] Marshal et al. (2005).
[233] Wehausen (2005).
[234] Oehler et al. (2005).
[235] Heffelfinger et al. (2005).

Impact Statement addressing federal land management in the Central Mojave Metapopulation Fragment. [236] [237] Moreover, (1) public sentiment that the positions of the National Park Service warrant revision continues to increase; (2) there is recognition that lands managed by NPS are, in some situations, the best locations to mitigate for losses or other impacts occurring outside of such lands; and (3) there is increasing recognition that the legislative process has burdened agencies with legislation that makes it virtually impossible to avoid conflict. [238] [239] [240] It is clear that a call for adequate, science-based management of NPS lands and a revision of the NPS Mission Statement is overdue. As stated recently, "… progressive revision to the mission of the NPS, or at least its implementation, may be prudent in today's perilous times. The revised mission should be unencumbered by government bureaucracy and should rapidly implement strategies to preserve biodiversity. Augmenting populations before their extirpation or to bolster genetic diversity is exactly the type of strategy that the NPS should consider". [241] Further, others have articulated clearly that, "…we need to have policies that allow for management intervention. The U.S. Wilderness Act for instance … stipulates restraint in human activity and has no specific requirements that ensure the persistence of wildlife or habitat." [242]

It is our position that MNP can best contribute to conservation issues and, especially those involving the contentious issue of bighorn sheep conservation, by withdrawing this DMPEA, and working jointly with other conservation agencies to produce a management plan and EIS that will fulfill the obligation of NPS to preserve "… the natural and cultural resources and values of the National Park System for the enjoyment, education, and inspiration of this and future generations [and] … cooperates with partners to extend the benefits of natural and cultural resource conservation and outdoor recreation throughout this country …". [243] The current DMPEA fails to meet that obligation.

(B) Predator Evasion Strategies of Bighorn Sheep Are Ignored

Bighorn sheep are habitat specialists, and rely on open habitats to detect threats, a point not even acknowledged in the DMPEA. Bighorn sheep also rely on steep and rugged terrain to evade predators; females and young are especially vulnerable to predation, and occupy habitat that is much lower in risk of predation than areas utilized by males during the year. [244] Additionally, predator abundance is lower in areas utilized primarily by females and young when compared to areas exploited by males. [245]

Coyotes are the most abundant predators in habitats utilized primarily by males in MNP but are very uncommon in areas used primarily by females and young. [246] When female bighorn sheep encounter coyotes in areas lacking adequate ruggedness, the most common response is to flee; indeed, females employ a general strategy of flight when in open terrain and stand their ground or act aggressively when they encounter coyotes in escape terrain. [247] Proposals to relocate the Vermin Water source and the Kerr Water Source to areas of "unconsolidated young alluvium [i.e., sandy washes]" would "take advantage of the watershed at the Big Horn and Old Dad Mountain mines … while the Kerr relocation site (New Kerr) would use the large watershed that is constricted at its outlet by Jackass Canyon [through which a road passes]", respectively. [248] Relocation of those water sources would require that they be placed in locations (i.e., sandy washes) where female desert bighorn sheep would be more vulnerable to predation than at the current location of the two water sources, and place offspring at far greater risk than to which they currently exposed at current locations of the water sources. Further,

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[236] Epps et al. (2003).
[237] Abella et al. (2011).
[238] Roemer, G. W. 2013. National Park Service needs proactive strategy. Science 341:456.
[239] Bleich (2016).
[240] Thomas, J. W. 2004. The management of the federal lands: where now? Fair Chase 19(2):12.
[241] Roemer (2013).
[242] Parigi, T. 2011. Adapting to climate change. The Wildlife Professional 5(4):10.
[243] NPS. 2018. About us. Available at <https://www.nps.gov/aboutus/index.htm> Accessed 6 May 2018.
[244] Bleich et al. (1997).
[245] Bleich et al. (1997).
[246] Bleich et al. (1997).
[247] Bleich, V. C. 1996. Mountain sheep and coyotes: patterns of predator evasion in a mountain ungulate. Journal of Mammalogy 80:283–289.
[248] DMPEA page 32.

no information is provided regarding terrain in which a "replacement" for the existing Piute water source would be placed and, in the absence of any such discussion, the assumption must be made that it would be located along side or at the end of a road outside of wilderness. WSF arrived at this conclusion based on the attributes associated with the desired conditions at locations for New Kerr and New Vermin (i.e., freshly deposited alluvium) and that females and offspring would thereby be exposed to additional risks of predation currently not experienced at the existing Piute water source.

Proposals to remove the existing Vermin and Kerr water sources and relocate them to new locations removed from escape terrain, and the absence of any description of the terrain in which the New Piute water source would be developed in lieu of the existing Piute water source have ignored the behavioral responses of bighorn sheep to the risk of predation, [249] [250] the additional risks that would result from moving existing water sources that are heavily used by female bighorn sheep and their offspring to much risker locations, [251] and the demographic consequences that could result from increased predation on females and young. In the absence of such consideration, the DMPEA fails to address the consequences of the plan to relocate the existing Vermin and Kerr water sources, and to remove the existing Piute water source and establish a New Piute water source at an undescribed location. WSF contends that the DMPEA is, thus, inadequate in assessing the proposed actions as they relate to the predator-evasion strategies of bighorn sheep, as well as the potential for increased predation on females and young.

The DMPEA inadequately addresses the relocation of the existing Kerr and Vermin water sources, development of "new" water sources at Vontrigger Spring and in the Piute Range, and development of a water source at Ginn Spring in the context of the behavior of bighorn sheep. In order to ensure that the new locations are logistically easy to refill, they must be placed along roads and the DMPEA acknowledges that, "Moving a guzzler to a more accessible location … may result in reduced use by bighorn due to proximity to human presence." [252] "Reduced use" is not quantified, however, nor are the consequences of reduced use. Moreover, the DMPEA ignores the behavioral responses of bighorn sheep, the potential for abandonment of formerly-used habitat, and the resultant indirect demographic consequences associated with disturbance that is unpredictable, inconsistent, and not benign.[253]

WSF contends that informed decisions cannot occur in the absence of further analysis because of the vast literature existing on the subject, and the known consequences of unpredictable disturbance on ungulates in general. The statement that, "Removal and relocation of these guzzlers would only occur if monitoring indicated that new relocated guzzlers are sufficiently used by bighorn populations" [254] is nonsensical. In order to determine that relocated "guzzlers" are "sufficiently used" they would have had to have been relocated earlier. Further, long-term and intense anthropogenic disturbance can cause shifts in habitat use that may not be detected until after habitat is abandoned and the demographic consequences become apparent. [255] [256] Moreover, use (or sufficient use—a phrase defined nowhere in the DMPEA) does not equate to an absence of demographic impacts. Declining populations of long-lived large mammals may persist for many years and, thereby, may be unable to escape an extinction vortex, [257] albeit unrealized, because basic demographic considerations (e.g., reproduction, recruitment, survival) were ignored. Thus, any implication that new water sources that are "sufficiently used" are adequate substitutes for existing water sources is conjectural. Further, any assumption that density of bighorn sheep (i.e., they are established and use an area) can be used as an indicator of habitat quality (or as an indicator

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[249] Bleich, V. C. 1996b. Interactions between coyotes (*Canis latrans*) and mountain sheep (*Ovis canadensis*). Southwestern Naturalist 41:81–82.

[250] Bleich et al. (1997).

[251] Bleich (1996).

[252] DMPEA page 32.

[253] Wiedmann, B. P., and V. C. Bleich. 2014. Demographic responses of bighorn sheep to recreational activities: a trial of a trail. Wildlife Society Bulletin 38:773–782.

[254] DMPEA page 32.

[255] Longshore, K., C. Lowery, and D. B. Thompson. 2013. Detecting short term responses to weekend recreation activity: desert bighorn sheep avoidance of hiking trails. Wildlife Society Bulletin 37:698–706.

[256] Wiedmann and Bleich (2014).

[257] Gilpin, M. E. and M. E. Soule. 1986. Minimum viable populations: processes of extinction. Pages 19–34 in M. E. Soule, editor. Conservation biology: the science of scarcity and diversity. Sinauer Associates, Snderland, Massachusetts, USA.

of population performance) is questionable. [258] Moreover, habitat use (the way an animal uses a collection of physical and biological entities in a habitat) does not equate to habitat selection (a series of innate and learned behavioral decisions made by an animal about what habitat it would use at different scales of the environment), and neither infer anything about habitat quality (the ability of the area to provide conditions appropriate for individual and population persistence). [259] Indeed, a positive correlation of density with habitat quality in specific instances cannot be assumed in the absence of supporting demographic data. [260]

The lack of attention to these details, and to similar details throughout the DMPEA, negates any value associated with the proposals or alternatives as they are presented. It is our position that any alternatives must consider impacts to bighorn sheep (and other wildlife) in the context of what is known about the biology and ecology of the species; such is lacking throughout the document.

(C) Consequences of Disturbance in the Context of Predation Risk are not Considered

Two fundamental questions that relate directly to the responses of wildlife to environmental disturbance have been posited: (1) how is the spatial distribution of animals affected; and, (2) does (or did) the disturbance result in effects that ultimately had demographic consequences for the perturbed population? [261] Bighorn sheep and other large mammals can be sensitive to human presence, and such can influence the quality of habitat even in the absence of activities that alter the landscape, such as urban development. [262] [263] [264] [265] [266] Indeed, disturbance in the form of human activity has been demonstrated to affect how animals assess predation risk, and the concept of a "human-footprint" and its associated effects warrant consideration when assessing effects of disturbance of wildlife. [267] Clearly, the concept of disturbance was ignored in the DMPEA when proposing locations for the New Kerr and Vermin water sources, and the proposed New Piute and Ginn Mine water sources, and the proposed development in the Vontrigger Hills at Vontrigger Spring, one of the most heavily used areas in MNP. [268]

Disturbance can be viewed as a form of predation risk. [269] Habitat selection, as a response to disturbance, can be viewed as a tradeoff between the costs and benefits of being in a particular area at a particular time. [270] Anti-predator mechanisms employed by large mammals can be either direct (flight or aggression) or indirect (vigilance, social behavior, or use of specific habitats). [271] Direct and indirect threats, however, both can result in decreased individual fitness or demographic consequences as a result of modified nutrient intake, disruption of mating activities, or disrupted parental care. [272] Further, high levels of disturbance perceived as predation risk can cause potential prey (in this case, bighorn sheep) to divert time and energy away from acquisition of nutrients or

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[258] Van Horne, B. 1983. Density as a misleading indicator of habitat quality. Journal of Wildlife Management 47:893–891.

[259] Morrison, M. L., B. G. Marcot, R. W. Mannan. 2006. Wildlife–Habitat relationships, concepts and applications, Third Edition. Island Press, Washington, D.C., USA.

[260] Van Horne (1983).

[261] Moorcroft, P. R. 2012. Mechanistic approaches to understanding and predicting mammalian space use: recent advances, future directions. Journal of Mammalogy 93:903–916.

[262] Miller, S. G., R. L. Knight, and C. K. Miller. Wildlife responses to pedestrians and dogs. Wildlife Society Bulletin 29:124–132.

[263] Taylor, A. R., and R. L. Knight. 2003. Wildlife responses to recreation and associated visitor perception. Ecological Applications 13:951–963.

[264] Stankowich, T. 2008. Ungulate flight responses to human disturbance: a review and meta-analysis. Biological Conservation 141:2159–2173.

[265] Longshore et al. (2013).

[266] Wiedmann and Bleich (2014).

[267] Price, M. V., E. H. Strombom, and D. T. Blumstein. 2014. Human activity affects the perception of risk by mule deer. Current Zoology 60:693–699.

[268] Bleich and Pauli (1990).

[269] Lima, S. L., and L. M. Dill. 1990. Behavioral decisions made under the risk of predation. Canadian Journal of Zoology 68:619–640.

[270] Sih, A. 1980. Optimal behavior: can foragers balance two conflicting demands? Science 210:1041–1042.

[271] Kruuk, H. 1964. Predators and anti-predator behavior of the black-headed gull (*Larus ridibundus* L.). Behaviour 11 supplement: 1-129

[272] Hik, D. S. 1995. Does risk of predation influence population dynamics? Wildlife Research 22:115–129.

water and can manifest in a decline in body condition that affects reproductive success or survival. [273] [274] Moreover, animals already in poor condition, whether from poor forage availability in spring resulting from an absence of rainfall the preceding fall or because of reproductive costs, may be especially susceptible to disturbance perceived as predation risk and experience increased rates of predation while searching for safer places to forage or, in the case of bighorn sheep, for alternative water sources that are perceived as more safe because of a lesser risk of unpredictable disturbance. [275] [276] [277] [278]

Bighorn sheep are adaptable [279] and can become acclimated to some sources of disturbance *if the disturbance is predictable, consistent, and benign*. [280] For example, female bighorn sheep in Joshua Tree National Park that were excluded from preferred habitat during weekends when visitor use *on trails* was high but drifted closer to those trails on weekdays when use was low or non-existent suggested that that those responses were temporary. [281] In other examples, bighorn sheep did not react negatively to hikers *on trails* in the Sierra Nevada or were not displaced by individuals riding mountain bikes *on trails* or at mining operations where equipment was operated in the same manner *in the same places* (on roads, in pits, or on benches associated with the mines). [282] [283] [284][285] [286] [287] [288] In these examples, the disturbance was predictable (people on trails stayed on trails, mining equipment was on a mine road, and the activity was always the same in both cases).

In other situations, bighorn sheep reacted negatively to off-trail cross-country travel by fleeing from perturbations that occurred in unexpected locations. [289] Bighorn sheep also abandoned a traditional birthing area because of unpredictable human disturbance, a situation that resulted in extreme demographic consequences for that population. [290] In both situations, unpredictable disturbance that occurred at irregular intervals, in novel locations, and in which the source of disturbance was not consistent resulted in reactions or behaviors by bighorn sheep that would be expected if they were being stalked by a predator. Moreover, bighorn sheep appear not to acclimate readily to sources of disturbance that are novel, and energetic demands associated with that behavioral trait have consequences for population performance and, ultimately, management and conservation. [291]

Sources of disturbance associated with vehicle access on an irregular basis, behavioral reactions of bighorn sheep—especially females with offspring that are especially sensitive to unanticipated disturbance—and the uncertain behavior of humans encountering bighorn sheep along the roads or other readily accessible locations at which the New Vermin, New Kerr, New Piute, Vontrigger, and Ginn Spring water sources are proposed to be

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[273] Lima and Dill (1990).

[274] Morris, D. W., and D. L. Davidson. 2000. Optimally foraging mice match patch use with habitat differences in fitness. Ecology 81:2061–2066.

[275] McNamara, J. M., and A. I. Houston. 1987. Starvation and predation as factors limiting population size. Ecology 68:1515-1519.

[276] Hik (1995).

[277] Sinclair, A. R. E., and P. Arcese. 1995. Population consequences of predation-sensitive foraging: the Serengeti wildebeest. Ecology 76:882-891.

[278] Sweitzer, R. A. 1996. Predation or starvation: consequences of foraging decisions by porcupines (*Erethizon dorsatum*). Journal of Mammalogy 77:1068-1077.

[279] Geist, V. 1975. On the management of mountain sheep: theoretical considerations. Pages 77–105 in J. B. Trefethen, editor. The wild sheep in modern North America. Winchester Press, New York, New York, USA.

[280] Wiedmann and Bleich (2014).

[281] Longshore et al. (2013).

[282] Hicks, L. L., and J. M. Elder. 1979. Human disturbance of Sierra Nevada bighorn sheep. Journal of Wildlife Management 43:909–915.

[283] Papouchis, C. M., F. J. Singer, and W. B. Sloan. 2001. Responses of desert bighorn sheep to increased human recreation. Journal of Wildlife Management 65:573–582.

[284] MacCallum, B. N., and V. Geist. 1992. Mountain restoration: soil and surface wildlife habitat. Geojorunal 27:23–46.

[285] Bleich, V. C., J. H. Davis, J. P. Marshal, S. G. Torres, and B. J. Gonzales. 2009. Mining activity and habitat use by mountain sheep (*Ovis canadensis*). European Journal of Wildlife Research 55:183–191.

[286] Jansen, B. D., P. R. Krausman, J. R. Heffelfinger, and J. C. deVos. 2006. Bighorn sheep selection of habitat features in an active copper mine. Wildlife Society Bulletin 34:1121–1126.

[287] Jansen, B. D., P. R. Krausman, J. R. Heffelfinger, and J. C. deVos. 2007. Influence of mining on behavior of bighorn sheep. Southwestern Naturalist 52:418–423.

[288] Anderson (2018).

[289] Papouchis et al. (2001).

[290] Wiedmann and Bleich (2014).

[291] Bleich, V. C., R. T. Bowyer, A. M. Pauli, M. C. Nicholson, and R. A. Anthes. 1994. Mountain sheep *Ovis canadensis* and helicopter surveys: ramifications for the conservation of large mammals. Biological Conservation 70:1–7.

located dictate that a thorough evaluation of the behavioral responses and subsequent fitness of individual bighorn sheep be evaluated prior to any such consideration.

The Wild Sheep Foundation contends that the absence of any forethought regarding reactions of bighorn sheep to sources of disturbance that are not predictable, consistent, and benign, combined with the lack of understanding of the importance of the reactions of bighorn sheep to unanticipated or unusual sources of disturbance, dictates that the DMPEA is inadequate in its proposal to relocate existing water sources or establish new water sources in an effort to comply with legislation that clearly places a higher value on intangibles such as spirituality [292] [293] or solitude. [294] Bighorn sheep attempting to make use of one or more newly-established water sources would surely be exposed to irregular and unpredictable sources of disturbance, a lack of consistency in the timing of such disturbance, and differing and unpredictable behaviors of humans that encounter bighorn sheep in the proposed locations. Such recommendations are antithetical to the concept of wildlife conservation, especially given repeated references to the need to act on behalf of bighorn sheep given the threat of climate change. [295]

The Wild Sheep Foundation further argues that these impacts conflict with efforts to conserve wildlife by relocating existing wildlife water sources or constructing new water sources that are readily accessible by humans (as opposed to the carefully selected locations of existing anthropogenic water sources; see section above titled, "The bases for selection of original locations are not considered in proposals to remove or relocate water sources") and, especially, humans using motorized transport. Consideration of the potential demographic consequences of the reactions of bighorn sheep to such disturbance warrants a detailed analysis prior to implementation. As such, the DMPEA fails to disclose the potential consequences of the proposed action(s) and, at the least, mandates preparation of an EIS. Indeed, MNP originally had contracted with ERO Resources Corporation of Denver, Colorado for preparation of an EIS. [296] [297]

A representative of ERO confirmed that representatives of the firm had spent no time on the ground in MNP, but that they used "NPS field data" when preparing the DMPEA. [298] Further, a representative of MNP confirmed that, "Their [ERO's] scope of work did not include spending time on the ground or providing specialized scientific expertise. Mojave NP paid ERO exactly $0 for producing the document. The contract was executed, and is managed by, a Washington office". [299] Why an Environmental Assessment was prepared in lieu of the original contract for an Environmental Impact Statement has not been disclosed, nor has the reason that one or more individuals familiar with the ecology of bighorn sheep were not responsible for preparing the DMPEA.

(D) Proposed Actions Will Increase Opportunities for Poaching

Bighorn sheep are among the most desired big game species in North America, and hunting opportunities for these iconic animals is extremely limited. [300] Hunting of bighorn sheep in California became illegal in 1878, in part because of unregulated take, but a very limited opportunity to hunt bighorn sheep was restored in 1987. [301]

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[292] Tin, T. 2012. Wilderness spirituality. International Journal of Wilderness 18:3,24.

[293] Ashley, P. 2012. Confirming the spiritual value of wilderness. International Journal of Wilderness 18:4-8.

[294] Briggs, J., J. Rinella, and L. Marin. 2011. Using acoustical data to manage for solitude in wilderness areas. Park Science 28:81-83.

[295] DMPEA, page i and ≥ 29 additional references to climate change throughout the DMPEA.

[296] MNP Task Order T2310100007, dated 23 September 2010, for Contract GS -10F-0302L.

[297] MNP Task Order P17PD00257, dated 28 December 2016, for Contract GS10F0302L.

[298] Telephone conversation between V. Bleich and Bill Mangle of ERO Resources Corporation on 27 April 2018.

[299] E-mail from D. Hughson to V. Bleich dated 30 April 2018.

[300] Monteith, K. L., R. A. Long, T. R. Stephenson, V. C. Bleich, R. T. Bowyer, and T. N. LaSharr. 2018. Horn Size and Nutrition in Mountain Sheep: Can Ewe Handle the Truth? Journal of Wildlife Management 82:67–84.

[301] Bleich, V. C. 2006. Mountain sheep in California: perspectives on the past, and prospects for the future. Biennial Symposium of the Northern Wild Sheep and Goat Council 15:1–13.

Ironically, the first area to be opened to hunting was in the California Desert Conservation Area (which became MNP in 1994) [302] and the hunt area included Old Dad Peak and the Kelso Mountains. [303]

Early on, illegal killing of bighorn sheep (i.e., poaching) was identified as a major law enforcement issue. [304] It was noted that, "Illegal shooting of bighorn undoubtedly has more effect on sheep populations than all other forms of predation combined. Some areas are more readily accessible to human use than are others, and *it is these more accessible areas that are most subject to poaching. As more access is gained to remote areas, it is likely that illegal shooting will increase* and increased patrol efforts may be needed to safeguard sheep in these areas. [emphasis added]". [305] Research results continue to affirm the nexus between ready access and illegal killing of large mammals. [306] [307]

Bighorn sheep are especially vulnerable to poaching during summer, "…when the bighorn concentrate around water holes. A man with a high-powered rifle could easily eliminate a herd of bighorn in a few days by shooting the animals that come to drink. Those animals that were not killed would be forced away by the activity of the hunter and might not return…". [308] Indeed, a single individual was responsible for the illegal killing of, or assisting others to kill, about 150 desert bighorn sheep over a two-year period in California. [309] [310] Relocating existing WWSs that are essentially cryptic by moving them closer to roads, to human activity, or to new areas simply to facilitate logistical issues is not in the best interest of bighorn sheep. WSF adamantly opposes any such moves.

(E) Existing Wildlife Water Sources are Compatible with Wilderness

Efforts to conserve bighorn sheep, mule deer and other species of desert wildlife by enhancing habitat have been ongoing for many decades. [311] [312] [313] [314] Intensive efforts in the Mojave Desert of California have been cooperative ventures with the USDI Bureau of Land Management, the Department of Defense and, in the past, the National Park Service (also a USDI agency). Emphasis has been based on (1) maintenance of surface water at existing springs to ensure availability of that resource to desert wildlife and, (2) provision of additional water at anthropogenic sources as part of a comprehensive effort to extend seasonal range and increase survival of bighorn sheep inhabiting those arid landscapes. [315] [316] These actions are compatible with "conservation' in

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[302] Bleich and Pauli (1999).

[303] Bleich, V. C., R. L. Vernoy and R. A. Weaver. 1987. Mountain sheep management plan: Old Dad Peak Management Unit. California Department of Fish and Game, Sacramento, USA.

[304] Buechner, H. K. 1960). The bighorn sheep in the United States, its past, present, and future. Wildlife Mongraphs 4:1–174.

[305] Weaver et al. (1969).

[306] Powell, R. A., J. W. Zimmerman, D. F. Seaman, and J. F. Gilliam. 1996. Demographic analyses of a hunted black bear population with access to a refuge. Conservation Biology 10:224–234.

[307] Donadio, E., and S. W. Buskirk. 2006. Flight behavior in guanacos and vicunas in areas with and without poaching in western Argentina. Biological Conservation 127:139–145.

[308] Charles G. Hansen, as quoted by Kelley, W. E. 1980. Hunting. Pages 336–342 *in* G. Monson and L. Sumner, editors. The desert bighorn: its life history, ecology, and management. University of Arizona Press, Tucson, USA.

[309] Story in the Los Angeles Times dated 6 October 1970.

[310] Story in the Arizona Daily Star dated 17 December 1971.

[311] Yoakum, J. D., W. P. Dasmann, H. R. Sandrson, C. M. Nixon, and H. S. Crawford. 1980. Habitat improvement techniques. Pages 329–403 *in* S. D. Schemnitz, editor. Wildlife management techniques manual. Fourth edition. The Wildlife Society, Washington, D.C., USA.

[312] Kie, J. G., V. C. Bleich, A. L. Medina, J. D. Yoakum, and J. W. Thomas. 1994. Managing rangelands for wildlife. Pages 663–688 in T. A. Bookhout, editor. Research and management techniques for wildlife habitat. Fifth edition. The Wildlife Society, Washington, D.C., USA.

[313] Bleich, V. C., J. G. Kie, E. R. Loft, T. R. Stephenson, M. W. Oehler, Sr., and A. L. Medina. 2005. Managing rangelands for wildlife. Pages 873–897 *in* C. E. Braun, editor. Techniques for wildlife investigations and management. Sixth edition. The Wildlife Society, Bethesda, Maryland, USA.

[314] Bleich, V. C., J. G. Kie, E. R. Loft, T. R. Stephenson, M. W. Oehler, Sr., and A. L. Medina. 2012. Managing rangelands for wildlife. Pages 75–94 *in* N. J. Silvy, editor. The wildlife management techniques manual. Volume 2: Management. Seventh edition. The Johns Hopkins University Press, Baltimore, Maryland, USA.

[315] Weaver, R. A., F. Vernoy, and B. Craig. 1959. Game water development on the desert. California Fish and Game 45: 333–342.

[316] Weaver, R. A. 1972. California's bighorn management plan. Desert Bighorn Council Transactions 17: 22-42.

wilderness areas, as specified in the Wilderness Act. [317] Moreover, the CDPA did not disallow the presence of wildlife water sources (WWSs), nor prohibit construction of additional sources, if any such action complied with the National Environmental Policy Act. [318] This is especially perplexing despite the existence of hundreds, if not thousands, of kilometers of roads, widespread evidence of mining activity, and dozens—if not hundreds— of additional anthropogenic features distributed among virtually all wilderness areas designated by the CDPA. [319]

MNP management has acknowledged that "… wildlife water developments within those wilderness areas need not be removed due to the location in wilderness, because they were present prior to the wilderness areas being established". [320] WSF questions any plan to remove or replace anthropogenic water sources that have been of benefit to bighorn sheep and other species of wildlife and have been in place for decades prior to the existence of MNP. Thus, WSF opposes any proposal to do so until potential impacts to bighorn sheep and other wildlife have been fully evaluated and shown to not be problematic in the context of impacts to individuals, populations, and ultimately at the landscape level.

(F) The DMPEA Ignored Existing Management Plans

At least two management plans have been developed for bighorn sheep occupying MNP, but neither is acknowledged in the DMPEA. The first, the current management plan for the Old Dad Peak Management Unit, was published by the California Department of Fish and Game (now California Department of Fish and Wildlife [CDFW] in 1987. [321] The second is a plan developed cooperatively by the Bureau of Land Management and CDFG [322] in accordance with the Sikes Act (as amended). [323] Both these plans call for additional anthropogenic wildlife water sources and maintenance of natural water sources to enhance populations of bighorn sheep, and specifically within the area encompassed by MNP. The latter plan also specifies that, "… management of the public lands designated as part of the National Wilderness Preservation System [is] to preserve and protect their wilderness character, provide for their use and enjoyment by the American people in a manner that will leave them unimpaired for future use and enjoyment as wilderness, and allow for recreational, scenic, scientific, educational, *conservation, and historical use* [emphasis added]" [324]

NPS wilderness management policy appears to be identical to those specified on lands managed by BLM and also includes the phrase, "…and allow for …conservation and historical use". [325] As such, we contend that NPS policy does not differ from that of the Bureau of Land Management. WSF also believes that "conservation and historical use" as stated in both BLM and NPS policy statements are consistent with management of the purpose for which wilderness areas are established, and thereby do not preclude the presence of anthropogenic water sources in wilderness (as acknowledged by MNP management). [326] Additionally, WSF extends this interpretation to include anthropogenic water sources for small animals (referred to as small game guzzlers throughout the DMPEA), all of which were in existence when wilderness legislation was passed and the presence of which did not disqualify parts of MNP from designation as wilderness. Further, we insist that the continued maintenance of natural water sources to ensure availability of surface water to bighorn sheep and other wildlife

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[317] US Congress. 1964. Wilderness Act. Public law 88–577, 88th Congress of the United States, second session. Washington, D.C.

[318] U. S. Congress. 1994. California Desert Protection Act. Public law 103–433, 103rd Congress of the United States, third session. Washington, D.C.

[319] Bleich (2005).

[320] Results of a meeting with MNP leadership on 24 February 2017 as memorialized in a memo from V. Bleich to S. Marschke of the Society for the Conservation of Bighorn Sheep (SCBS) and dated 1 April 2017.

[321] Bleich et al. (1987).

[322] Bureau of Land Management and California Department of Fish and Game. 1989. Old Dad Peak mountain sheep habitat management plan (CA-06WHA-W23). USDI Bureau of Land Management and California Department of Fish and Game, Sacramento, California, USA.

[323] U.S. Congress. 1974. An Act to extend and expand the authority for carrying out conservation and rehabilitation programs on military reservations, and to authorize the implementation of such programs on certain public lands. Public Law 93-452, 93rd Congress of the United States, second session. Washington, D.C., USA.

[324] 43CFR 8560

[325] National Park Service. 2006. National Park Service wilderness management policies-chapter 6: wilderness preservation and management. Available at https://www.nps.gov/subjects/wilderness/upload/2006_WildernessManagementPolicies.pdf

[326] Results of a meeting with MNP leadership on 24 February 2017 as memorialized in a memo from V. Bleich to S. Marschke of the Society for the Conservation of Bighorn Sheep (SCBS) and dated 1 April 2017.

be consistent with wildlife conservation, and we find that the DMPEA ensures MNP will minimize any commitment to ensure availability of surface water at such locations. That is unacceptable.

In addition to ignoring previously published management plans and their objectives for population management and habitat management on behalf of bighorn sheep, the DMPEA likely fails to meet objectives of the revised statewide management plan for bighorn sheep that is being prepared by CDFW and is nearing completion. Indeed, the Executive Summary of the DMPEA states that the DMPEA will improve coordination between the Preserve and the Department of Fish and Wildlife. [327] The DMPEA, however, fails to acknowledge the legislated responsibilities of CDFW in the plan, despite having been requested to do so by CDFW. [328] Both the California Fish and Game Code and the CDPA note that CDFW's responsibility extends beyond the plants and animals themselves to include habitat management.

The California Department of Fish and Wildlife's ability to manage wildlife in the Mojave Desert is directly linked to and cannot be separated from both natural and artificial surface water available in desert ecosystems, and the Department's position is that big and small game guzzlers are beneficial to a multitude of wildlife including, but not limited to, bighorn sheep and upland birds, respectively. [329] Moreover, many additional comments from CDFW regarding the internal draft appear to have been ignored. For example, CDFW requested additional information regarding the rationale for evaluating or maintaining a very limited number of natural water sources, but no such information was forthcoming. Additional examples include the lack of a response to the criticism that "dry habitat acres" in the Mescal and Ivanpah mountain ranges being included as positive changes to "desert bighorn sheep habitat" because those ranges currently are unoccupied. [330] As noted in comments from CDFW, "Gaining 4,814 acres of unoccupied habitat is not comparable to losing 2,634 acres of critical bighorn habitat in the Old Dad Mountains [*sic*]. By taking the acreage for the Mescal/Ivanpah range out of the calculations for Alternative 3, the changed bighorn habitat drops to a low of -2,233 acres and a high of -3,833 acres. These numbers present a more accurate account of how Alternative 3, the Preserve's Preferred Alternative, does in fact have a negative impact on habitat conservation and desert bighorn sheep."

WSF finds that the DMPEA fails to adequately address this concern. In addition, CDFW noted, "It is the Department's Mission not only to manage wildlife, but also the habitat on which they depend. The Department believes that both big and small game drinkers are the necessary minimum requirements to continue meeting the Department's policies and objectives as defined by the *Fish and Game code 1801*…including, but not limited to, maintaining healthy and viable populations of wildlife for both conservation purposes and hunting opportunities and the habitat in which they live. The very foundation on which the Preserve was created (*Title V, Section 506*, above) supports the Department's actions in this regard." These points, along with many others voiced by CDFW, are neither acknowledged nor responded to in the DMPEA. Moreover, WSF notes that the CDFW position on hunting opportunity is consistent with Secretarial Orders 3362, 3356, and 3347, and Executive Order 13443—each of which directs federal agencies in various ways to advance conservation stewardship and increase outdoor recreation opportunities, including hunting, and none of which are referenced in the DMPEA.

WSF notes that the policies of both BLM and NPS with respect to wilderness management are just that: policies. It is also clear that policies can be revised, and such may be necessary to resolve conflicts between management objectives for "wilderness" and management objectives for conservation, one of the several attributes that is foundational to the concept of "wilderness". Wilderness objectives and wildlife conservation objectives, however, are not necessarily compatible [331] but, again, conservation is an objective of wilderness designation. If these apparent policy conflicts cannot be resolved, it is possible that resolution to the question of stewardship responsibilities within MNP will be resolved only through legal action. [332] Moreover, the concept of "historical use" must be redefined, because wildlife conservation and associated activities have been implemented historically and were ongoing uses, as was ranching, in those areas designated as wilderness in MNP.

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[327] DMPEA, page i.

[328] Letter from T. O. Smith (CDFW) to T. Suess (MNP) dated 14 April 2017 and commenting on the Internal Draft Water Resources Plan and Environmental Impact Statement.

[329] Letter from T. O. Smith (CDFW) to T. Suess (MNP) dated 14 April 2017 and commenting on the Internal Draft Water Resources Plan and Environmental Impact Statement.

[330] Abella et al. (2011).

[331] Bleich (2016).

[332] Bleich (2006).

WSF further finds that the DMPEA did not receive the proper review from MNP staff prior to being released for public review and contains factual errors that are historically inaccurate. For example, reference is made to land management agencies and local volunteers constructing "guzzlers." [333] All small game guzzlers in MNP were constructed by personnel from the CDFG and funded through Federal Aid in Wildlife Restoration Project W-26-D, and not by volunteers or land management agencies. In another example, MNP contends that, "… there is no reliable or standardized population estimator that allows managers to estimate annual populations. [334] CDFG (now CDFW) personnel have conducted annual surveys since 1984 and began marking bighorn sheep with telemetry collars in 1986 and have used mark-recapture techniques [335] or double-sampling methods [336] to estimate the population of bighorn sheep (and associated confidence intervals) at Old Dad Peak and in the Kelso Mountains. This effort continued each year until 2010 when a tragic helicopter accident took the lives of the pilot and three CDFG employees. Moreover, other investigators for many years have been employing remote cameras to develop population estimates of female bighorn sheep based on the presence of individually-identifiable animals, whether marked with collars or via natural markings. [337] [338] It is noteworthy that methodologies are becoming increasingly sophisticated, yet the DMPEA offers no suggestions to improve existing methods despite its criticism of past methods and its determination that such methods are not capable of detecting effects of guzzler removals [or replacements]. [339] Thus, in the absence of any more robust method of determining "use" at newly- placed wildlife water sources, combined with an absence of the recognition of demographic consequences that could occur, the DMPEA unwittingly acknowledges an inability to evaluate the consequences of the proposed actions. [340]

Additional examples occur, but requests both from private citizens and WSF for an extension of time adequate to allow a more complete review and preparation of comments was repeatedly denied by MNP management. [341] [342] We regret that denial of an additional extension has prevented us from being able to provide additional examples of the shortcomings and misinformation included in the DMPEA. Thus, our comments are not as complete as would be the case if an additional extension for comments had been granted.

(H) Numerous Curiosities Regarding History and Preparation of the DMPEA Exist

In 2010, NPS, on behalf of MNP, began a process to contract with ERO Resources Corporation, Denver, Colorado, for preparation of a Water Resources Management Plan and Environmental Impact Statement for Mojave National Preserve. [343] That contract appears to have been supplemented with an additional contract in 2016, once again addressing preparation of a Water Resources Management Plan and Environmental Impact Statement for Mojave National Preserve. [344] Further, in 2013, MNP and the California Department of Fish and Wildlife (CDFW) entered into a cooperative agreement regarding preparation of a Water Resources Management Plan/Environmental Impact Statement that identified CDFW as a cooperator in the preparation of the Water

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[333] DMPEA, page 7.
[334] DMPEA, page 30.
[335] Overton, W. S. 1971. Estimating the numbers of animals in wildlife populations. Pages 403–455 *in* R. H. Giles Jr., editor. Wildlife management techniques. Third edition. The Wildlife Society, Washington, D.C., USA.
[336] Graham, A., and R. Bell. 1989. Investigating observer bias in aerial survey by simultaneous double-counts. Journal of Wildlife Management 53:1009–1016.
[337] Jaeger, J. R., J. D. Wehausen, and V. C. Bleich. 1991. Evaluation of time-lapse photography to evaluate population parameters. Desert Bighorn Council Transactions 35:5–8.
[338] Wehausen, J. D. 2017. Paper presented at the Biannual California Bighorn Sheep Summit, 4 December 2017, Ontario, California.
[339] DMPEA, page 30.
[340] DMPEA, page 30.
[341] E-mail correspondence from T. Suess (MNP) to V. Bleich (private citizen) dated 3 May 2018, noting that, "At this time we [MNP] do not feel an additional extension is needed."
[342] T. Suess (MNP) verbally denied an additional (verbal) request for an additional extension of time to adequately review and comment on the DMPEA during a meeting attended by representatives of WSF, CA WSF, NPCA, CLF, SCBS, BCHA, and MNP personnel in Barstow, California, on 7 May 2018.
[343] National Park Service Task Order xx.
[344] National Park Service Task Order xx.

Resources Management Plan/Environmental Impact Statement, the purpose of which was to "… guide future management of ground and surface water sources within Mojave National Preserve". [345]

Change orders subsequently were issued for both contracts. With one exception, each change order continued to reference preparation of the Water Resources Management Plan/Environmental Impact Statement. Several change orders were issued for Task Order P17PD00257, and several others were issued for Task Order P10PD75694. The majority of these change orders were simple, among which were modifications to completion dates, changes in contracting officers, and minor changes to the work orders. It was not until November 2017, however, that the scope of work for task order P17PD00257 was modified through modification 0002 that altered the contract by calling for preparation of an *environmental assessment* in lieu of an *environmental impact statement*. Moreover, modification 0004 to task order P17PD00257 makes reference to an environmental assessment for the first time in the title of the document, and each time "EIS" appeared in the text it was changed to "EA". Modification 0004 appears also to call for preparation of a Finding of No Significant Impact (FONSI), implying that MNP already had decided that the EA would result in a FONSI without having received any public review or input.

As concerned Americans and ardent conservationists, we request an explanation of the rationale for the change from what was clearly specified to be an Environmental Impact Statement for a water resources management plan to develop "a comprehensive ecosystem-scale management plan for springs, seeps, water diversions, and artificial water sources" to an EA for a management plan addressing only developed water sources. Please include an explanation for that change in your response to this letter, the name(s) of the person(s) responsible for making that decision, and how changing the EIS that was contracted for to an EA fulfilled the obligation and commitment to produce an Environmental Impact Statement.

SUMMARY COMMENTS

We have spent many hours reviewing the draft management plan for developed water sources and environmental assessment (hereafter, DMPEA), which was prepared by contractors on behalf of Mojave National Preserve (MNP) and dated February 2018. In addition, we examined other sources of information, either available in the professional literature or based on personal accounts that had been included to substantiate opinions, conjecture, and other information included in support of the preferred alternative. We have read the DMPEA in its entirety and examined all sections thoroughly in the process. We also used the Freedom of Information Act to obtain materials necessary to better understand how preparation of the DMPEA evolved over the years. Additionally, we consulted experts in the fields of desert ecology, population biology, bighorn sheep conservation and management, population genetics, habitat selection, statistics, and veterinary medicine. Further, we spoke with individuals that are listed as technical contributors to the DMPEA, MNP staff, employees of ERO Resources Corporation of Denver, Colorado (the consulting firm that prepared the DMPEA), personnel representing other agencies, representatives of conservation organizations, and prominent researchers from several academic institutions. WSF relied on an extensive amount of professional literature to further inform our review and to substantiate our subsequent position.

WSF finds the DMPEA to be in direct conflict with Department of the Interior (DOI) Secretarial Orders. As an agency within the DOI, NPS must be aware that the order calls for expansion of hunting opportunities and access for hunting on those lands managed by agencies within DOI. Prior to 1994, previous efforts to establish a national park in that part of the Mojave Desert failed repeatedly when considered by Congress. MNP exists specifically as a national preserve, and not as a national park, because legislation accommodated hunting and other activities that occurred prior to MNP being legislated into existence. [346] Had that not been specified in the CDPA, the area would still be under the authority of the Bureau of Land Management, and not NPS. As an agency within DOI, however, WSF expects MNP to comply with any orders or directives to enhance hunting opportunities or access on lands managed by DOI.

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[345] Memorandum of Understanding between the National Park Service and California Department of Fish and Wildlife and signed by K. Nicol (CDFW) on 12 February 2013 and S. DuBois (MNP) on 21 February 2013.

[346] U. S. Congress. 1994. California Desert Protection Act. Public law 103–433, 103rd Congress of the United States, third session. Washington, D.C.

WSF finds the proposals to eliminate the Bicket-Landells Wildlife Water Source (WWS) and the removal of the Piute WWS to be unacceptable. Additionally, the proposed "relocation" of the Kerr and Vermin WWSs to areas that are logistically easier to deal with also are unacceptable; MNP proposes to relocate both sources to locations that are logistically friendlier yet offers no assurances that conservation of bighorn sheep will not be compromised by those actions. Further, establishing a WWS at New Piute has onerous consequences for bighorn sheep now occupying the Piute Range, despite conjecture that it will enhance connectivity to points further north and without acknowledging that the role of the existing Piute WWD plays in maintaining the bighorn sheep population in that range will be traded away. WWSs proposed to be placed at Ginn Spring, in the Vontrigger Hills, and at North Piute are conjectural in terms of their anticipated benefits to enhancing "connectivity". Removal and relocation of any existing WWS will NOT enhance hunting opportunity but, through the tradeoffs associated with such actions, could place existing populations in jeopardy. Moreover, development of 3 other water sources at the proposed locations will not enhance hunter opportunity or access, or even enhance the probability of connectivity.

WSF finds each of the proposed alternatives presented to be insufficient to ensure persistence of bighorn sheep within MNP and, moreover, to be contrary to the conservation of bighorn sheep at the level of the landscape. For the time being, only alternative 1, the "no action" alternative is acceptable. We suggest the DMPEA be abandoned and followed by preparation of a joint document addressing the conservation of, and improvements to, habitat for bighorn sheep and other wildlife and to incorporate all federal and state lands lying between interstate highways 15 and 40, and eastward to the Colorado River and those mountain ranges proximate to MNP and located east of the California-Nevada state line. Such an approach must necessarily be consistent with Secretarial and Executives Orders and must involve all agencies with land management responsibilities in that area, as well as the state agencies that are the trustees for wildlife in California and Nevada.

We advocate this approach in part because the issues raised repeatedly in the DMPEA center largely on several factors that are of consequence to the conservation of bighorn sheep. Among these are (1) questions related to wilderness management and differences of opinion on what constitutes appropriate levels of conservation activities within such areas; (2) impending climate change; (3) recognition of the role that actions within MNP have an effect outside of MNP; [347] [348] (4) the absence of an ecological perspective when considering the impacts of wilderness designation on wildlife conservation; [349] and, (5) the fact that no wilderness area in the Mojave Desert is large enough to stand alone in terms of the conservation needs of large, vagile mammals, of which bighorn sheep are exemplary.[350]

Adopting a "plan" for managing developed water sources solely within MNP fails to address the landscape-level needs for conservation of bighorn sheep as well as all other wildlife. Such an approach will enable all concerned agencies to balance conservation objectives for bighorn sheep, the restoration of ecosystem process to the extent possible, comply with Secretarial and Executive Orders, and meet objectives of all concerned agencies simultaneously. To accomplish this task, preparation of an environmental impact statement will be required; an EA simply is neither adequate nor appropriate.

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[347] Bleich, V. C. 2014. Thoughts on the Wilderness Act. Wildlife Professional 8(4):7.

[348] Bleich, V. C. 2016. Wildlife conservation and wilderness: wishful thinking? Natural Areas Journal 36:202–206.

[349] Spurr, S.H. 1966. Wilderness management. University of California, School of Natural Resources, Berkeley. The Horace M. Albright Lecture in Conservation 6:1-17. Available at <http://nature.berkeley. edu/site/lectures/albright/1966.php>. Accessed 19 December 2014.

[350] Salwasser, H., C. Schonewald-Cox, and R. Baker. 1987. The role of interagency cooperation in managing for viable populations. Pages 159–173 *in* M. E. Soule, editor. Viable populations for conservation. Cambridge University Press, Cambridge, United Kingdom.

Sincerely,

Wild Sheep Foundation

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Chairman of the Board
Wild Sheep Foundation

Gray N. Thornton
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Affirmed By:
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Society for the Conservation of Bighorn Sheep
Fraternity of the Desert Bighorn
Arizona Desert Bighorn Sheep Society
New Mexico Chapter Wild Sheep Foundation
Nevada Bighorns Unlimited – Reno
Washington Chapter Wild Sheep Foundation
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Iowa Chapter Foundation for North American Wild Sheep
Idaho Chapter Wild Sheep Foundation
Rocky Mountain Goat Alliance
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