June 30, 2020
Ms. Marcia Gilles
Acting District Ranger
c/o Matt Klein, Realty Specialist
White River National Forest
PO Box 190
Minturn, CO 81645
Submitted via project webpage:
https://cara.ecosystem-management.org/Public/CommentInput?Project=58221

RE: Scoping Comments on Homestake Partners' Proposed Whitney Creek Geotechnical Investigation

Dear Ms. Gilles and White River National Forest,

Please accept these comments on the Whitney Creek Geotechnical Investigation proposed by Homestake Partners (the Partners) and currently under consideration for a special use permit from the Forest Service. The comments are submitted on behalf of Wilderness Workshop (WW), Center for Biological Diversity, The Wilderness Society, Conservation Colorado, Wild Connections, The Quiet Use Coalition, Rocky Smith, and The San Luis Valley Ecosystem Council.

Wilderness Workshop (WW) is a non-profit, membership-based organization with a mission of protecting and conserving the wilderness and natural landscapes of the WRNF, and adjacent public lands. WW is based in Carbondale, Colorado, and engages in research, education, legal advocacy and grassroots organizing to protect the ecological integrity of surrounding public lands. WW was founded in 1967 and has over 700 members, many of whom have interests in the creeks, wetlands, wilderness and roadless areas impacted by the Partners' proposal.

The Center for Biological Diversity is a nonprofit organization dedicated to the preservation and restoration of biodiversity, native species, and ecosystems, with headquarters in Tucson, Arizona and offices throughout the country, including in Denver and Crested Butte, Colorado.

The Wilderness Society is the leading conservation organization working to unite people to protect America's wild places. Founded in 1935, and now with more than one million members and supporters, The Wilderness Society has led the effort to permanently protect 111 million acres of wilderness and to ensure sound management of our shared national public lands.

Conservation Colorado works to protect Colorado's climate, air, land, water, and communities through organizing, advocacy, and elections. Protecting our environment means preserving what we love about Colorado. Our stunning mountains, open vistas, and rushing rivers inspire us and connect us to the majesty of nature. Unfortunately, our amazing state faces grave threats.

Wild Connections is a registered 501(c)(3) nonprofit organization that has worked to identify, protect, and restore wildlands, native species, and biological diversity in the Arkansas and South Platte watersheds for the past 25 years.

The Quiet Use Coalition is a 23 year-old non-profit organization working to preserve and create quiet use areas on our public lands and waters, while protecting natural soundscapes and wildlife habitat.

Rocky Smith has 40 years' experience in examining projects, plans, policies, regulations, laws, and science relating to management of national forests across the nation, especially in Colorado.

The San Luis Valley Ecosystem Council helps to safeguard over 3.1 million acres of public lands and natural resources in six counties comprising the San Luis Valley, noted for its unchanged landscapes, biological richness, early settlement traditions, and rural lifestyles.

As a primary matter, thank you for opening a scoping process on the proposed Whitney Creek Geotechnical Investigation. We are grateful for the opportunity to comment and look forward to continuing to participate in this process as it moves forward.

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c. USFS and the Partners must further clarify the relationship of the project to the Eagle River Memorandum of Understanding
d. These processes must be public-facing, and not conducted largely by third-party consultants

VI. USFS MUST ANALYZE CUMULATIVE IMPACTS OF THE PROPOSED ACTION

I. INTRODUCTION

We primarily object to the Forest Service's plan to categorically exclude the proposed geotechnical investigation from further analysis under the National Environmental Policy Act (NEPA). As detailed throughout these comments, we believe that to comply with federal law the Forest Service cannot prepare a categorical exclusion. Instead, USFS must perform a thorough NEPA analysis – at least an Environmental Assessment (EA) – of the proposed action.

The Partners plan a subsurface exploration and a seismic survey. The subsurface exploration would involve drilling ten holes, each 150 feet deep.[1] The drill pad for each hole would require a cleared area spanning 40 feet x 20 feet – 800 square feet total.[2] Each site would be accessed by a ten foot wide road.[3] Using these roads, the Partners would transport to each site a drill rig – which is 8 feet wide, 22 feet long, and 8 feet high – along with a "small utility vehicle," pulling a trailer, and a skid steer.[4] The seismic survey involves use of geophones to analyze seismic conditions beneath two potential dam alignments for a planned Whitney Reservoir; the geophones emit repeated sound bursts at 170 decibels, as loud as a shotgun blast.[5]

This geotechnical investigation would have significant impact on at least three extraordinary circumstance resource conditions – wetlands, wilderness, and a roadless area – and therefore cannot be categorically excluded from NEPA environmental analysis. Subsurface exploration would take place in wetlands, including potential fens. Sound from the subsurface exploration and seismic survey would carry into the Holy Cross Wilderness, and roads to the drill sites would extend to within 100 feet of the wilderness boundary. The seismic survey, running the length of two potential dam alignments, would intrude into a designated roadless area.

Further, we are concerned about incomplete information in the proposal. The WRNF's scoping letter does not specify which categorical exclusion USFS intends to apply to the proposed action, an extraordinary omission. In any event, it is unlikely that the Partners could comply with the terms of a categorical exclusion – trying to do so would mean rushing the geotechnical investigation, with impacts on bird populations. The Partners' proposal does not mention important resource conditions, including that the Colorado Wetland Inventory (CWI) lists

[1] *See Technical Report* at 6.
[2] *Id*. at 13.
[3] *Id*. at 12.
[4] *Id*. at 10.
[5] *Id*. at 2, 5, and see *infra* note 54.

potential fens in the project area. In fact, one of the proposed drilling sites is on top of an already-mapped potential fen.

Finally, the project is connected to the planned Whitney Reservoir, so the cumulative and reasonably foreseeable impacts of the geotechnical investigation include the reservoir. USFS must analyze those cumulative impacts in an EA or Environmental Impact Statement (EIS).

The Forest Service's NEPA Handbook makes clear

> Scoping is important to discover information that could point to the need for an EA or EIS versus a CE. Scoping is the means to identify the presence or absence of any extraordinary circumstances that would warrant further documentation in an EA or EIS. Scoping should also reveal any past, present, or reasonably foreseeable future actions with the potential to create uncertainty over the significance of cumulative effects.[6]

We offer here five comments on the proposed action in line with these aims of the scoping process. Each indicates additional action the WRNF or the Partners must take; most indicate that the geotechnical investigation cannot be categorically excluded from NEPA analysis.

First, the project has significant impact on three resources which the Forest designates as involving "extraordinary circumstances."[7] The geotechnical investigation is ineligible for a categorical exclusion (CE) because it would or might significantly impact wetlands – including potential fens – and designated wilderness and roadless areas.[8]

Second, the WRNF writes in its letter soliciting public comment that "a Categorical Exclusion (CatEx) will be prepared pursuant to the National Environmental Policy Act (NEPA) to disclose the potential effects of the Proposed Action."[9] But it does not specify in the scoping letter which categorical exclusion it thinks appropriate. This is not normal practice for the WRNF, and it makes it impossible for the public to adequately understand the WRNF's analysis of the Partners' plan. The WRNF should clearly identify a specific CE and restart the scoping period.

Third, we are concerned that the Partners will not be able to comply with the terms of the categorical exclusion, 36 CFR § 220.6(e)(8), which WRNF mentions on the Whitney Creek Geotechnical Investigation Project Detail webpage – though not, as noted above, in its scoping letter.[10] The proposed road construction and drilling would have to be rushed to fit the requirement that this work be completed in less than one calendar year. This rushed process would significantly impact avian breeding season in the project area.

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[6] *FSH 1909.15 - National Environmental Policy Act Handbook* at 31.3.
[7] *See* 36 CFR § 220.6(b).
[8] *See Id*. and 40 CFR § 1508.4.
[9] *Whitney Creek Geotechnical Investigation Public Comment Letter* (May 28, 2020) at 1.
[10] *See Whitney Creek Geotechnical Investigation Project Detail*, https://www.fs.usda.gov/project/?project=58221&exp=detail (last visited June 29, 2020).

Fourth, the plan for the proposed action is incomplete and must be substantially revised to consider at least four additional issues:

1. The Partners have omitted from their proposal consideration of four potential fens, listed in the Colorado Wetland Inventory, in the area designated for subsurface exploration around potential dam alignment B.[11] These must be mapped, and results released to the public, before drilling can begin.

2. The Partners' Technical Report fails to adequately consider substantial existing research on the Homestake Shear Zone (HSZ), the major geological feature in Homestake Valley. Drilling in the HSZ could have repercussions for the stability of the Valley's rock-bed – and any dam built in the area could be seismically unstable.

3. The Partners fail to consider the WRNF's suggestion that the Partners need not complete all ten proposed borings.[12] If, for example, borings A1a/b, A2, A4, or A5 revealed a fatal flaw, the Partners would not need to drill boring A3 – and therefore would not need to cross Homestake Creek. The Partners must consider this mitigation suggestion, as well as other alternatives.

4. The Partners' plans seem inconsistent with the terms of the Eagle River Memorandum of Understanding (ERMOU). That document, which the Partners signed in 1998, makes clear that all parties aim to reduce environmental impact, and that this might mean that a project on lower Homestake Creek would be disfavored.[13] The Partners have known for two decades that any project in this area would have considerable environmental impacts, especially on wetlands. They should consider other options before relying on this proposed action.

Each of these issues, and others raised during the scoping period, should be considered in a public-facing process. For example, third-party consultants should not be responsible for mapping fens without oversight by the public and the WRNF.

Fifth, the purpose and need for the geotechnical investigation is to support development of a plan to construct a dam in Homestake Valley. Construction of the dam is therefore reasonably foreseeable and must be considered in the cumulative impact analysis for this project.

We appreciate the WRNF's commitment to protecting wetlands, fens, headwater streams and watersheds, wilderness and roadless areas. These are values WW and all signatories to these

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[11] *See Colorado Wetland Inventory Map*, https://csurams.maps.arcgis.com/apps/webappviewer/index.html?id=a8e43760cb934a5084e89e46922580cc (last visited June 22, 2020). The Colorado Wetland Inventory data notes that the potential fens in the Homestake Valley were mapped by the WRNF in the 1980s.

[12] *See Addendum to Technical Report, WRNF Comments* (March 20, 2020) at 3.

[13] *See Memorandum of Understanding Among the Cities of Aurora and Colorado Springs, Colorado River Water Conservation District, Climax Molybdenum Company, and the Vail Consortium* (April 21, 1998) at 1, 5.

comments share. Our comments aim to bring the Partners into compliance with NEPA and in line with these commitments, articulated federal law and by USFS and other federal agencies.

II. Extraordinary circumstances exist that prohibit the use of a categorical exclusion

USFS regulations list certain "extraordinary circumstances in which a normally excluded action may have a significant environmental effect."[14] The Forest Service's NEPA Handbook stipulates that the presence of an extraordinary circumstance requires preparation of an EA or EIS if there is a certain degree of "cause-effect relationship between a proposed action and the potential effect on these resource conditions."[15] The Handbook identifies seven resource conditions which constitute extraordinary circumstances. At least three of these are implicated in the proposed geotechnical investigation.

2) Flood plains, wetlands, or municipal watersheds;
3) Congressionally designated areas, such as wilderness, wilderness study areas, or national recreation areas; . . .
4) Inventoried roadless areas or potential wilderness areas. . . .[16]

The proposed action might or would significantly impact each of the three resource conditions listed above. The Partners will cross wetlands with heavy equipment to reach several boring sites.[17] As noted above, soil samples they analyzed as well as existing, publicly available fen maps indicate the presence of fens, a special kind of wetland, in the area.[18] The Partners' seismic survey, using a geophone which emits repeated sonic blasts at 170 decibels, is meant to run the length of two possible dam alignments, B and C.[19] Each of these extends into roadless area.[20] Several of their proposed drilling locations are adjacent to Holy Cross Wilderness Area, and their geophone survey would presumably extend along dam alignments B and C to edge of the wilderness boundary.[21] This means sound from the drilling and the seismic survey would spill into the wilderness area, disturbing for weeks an area meant to be defined by its "solitude" and to be a space "where the earth and its community of life are untrammeled by man."[22]

WRNF cannot categorically exclude from NEPA analysis projects which might impact extraordinary circumstances resources. The first lines of USFS' NEPA Handbook make clear that "a proposed action may be categorically excluded from further analysis and documentation in an EIS or EA *only if* there are no extraordinary circumstances related to the proposed action

[14] 40 CFR § 1508.4.
[15] 36 CFR § 220.6(b).
[16] *Id*.
[17] *See Technical Report* at 17.
[18] See *Addendum to Technical Report, WRNF Comments* (March 20, 2020) at 3 and *Colorado Wetland Inventory*, *supra* note 11.
[19] *See Technical Report* at 2.
[20] *Addendum to Technical Report, WRNF Comments* (March 20, 2020) at Map 4.
[21] *Id*. at Map 1.
[22] 16 U.S.C. § 1131(c).

[emphasis added]."[23] The drilling would likely have significant impact on wetlands and potential fens. It would also impact wilderness and roadless areas. The Handbook adds "If the responsible official determines, based on scoping, that it is uncertain whether the proposed action may have a significant effect on the environment, prepare an EA."[24] The impacts of the proposed action on three extraordinary circumstances resource conditions are at least uncertain. WRNF must at least prepare an EA.

a. The proposed action may or will have significant impact on wetlands

The WRNF must further consider the project's impact on protected wetlands and alternatives to these impacts. Executive Order 11990 establishes authority for federal agencies to restrict projects on wetlands and requires cooperation between federal agencies in protecting wetlands:

> When Federally-owned wetlands or portions of wetlands are proposed for lease, easement, right-of-way or disposal to non-Federal public or private parties, the Federal agency shall (a) reference in the conveyance those uses that are restricted under identified Federal, State, or local wetlands regulations; and (b) attach other appropriate restrictions to the uses of properties by the grantee or purchaser and any successor, except where prohibited by law; or (c) withhold such properties from disposal.[25]

Under the Forest Service's definition, a special use permit like the one for which the Homestake Partners have applied is "a legal document such as a permit, term permit, lease, or easement, which allows occupancy, use, rights, or privileges of agency land."[26] The special use permit would grant the Homestake Partners rights to use USFS land. This means the proposed action is clearly subject to regulation under Executive Order 11990.

USFS regulations elaborate on Executive Order 11990. The Forest Service's Region 2 Watershed Conservation Practices (WCP) Handbook directs that projects should "Keep ground vehicles out of wetlands unless protected by at least 1 foot of packed snow or 2 inches of frozen soil."[27] The 2002 WRNF Land and Resource Management Plan (LRMP) adds that projects should "Keep vehicles and equipment out of streams, lakes, and wetlands except to cross at designated points, build crossings, do restoration work, or where protected by one foot of snowpack or frozen soil."[28] Contravening these directives, the Partners plan to move heavy drilling equipment through Homestake Creek and surrounding wetlands during August and September.[29]

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[23] 36 CFR 220.6(a).
[24] 36 CFR § 220.6(c).
[25] 42 FR 26961, 3 CFR, 1977 Comp. at 121.
[26] *Special-use Permit Application, US Forest Service*, https://www.fs.usda.gov/working-with-us/contracts-commercial-permits/special-use-permit-application (accessed June 22, 2020).
[27] FSH 2905.25 – *Watershed Conservation Practices Handbook* 10(12.4)(1)(a).
[28] *White River National Forest Land and Resource Management Plan - 2002 Revision* at 2-6.
[29] *See Technical Report* at 21.

Additionally, the WCP Handbook commands: "Do not disrupt water supply or drainage patterns into wetlands."[30] The Partners' use of around 20,000 gallons of water from Homestake Creek to complete their drilling and their transport of a drill rig across the Creek runs contrary to this mandate.[31] Finally, the WCP Handbook asks that projects "Keep roads and trails out of wetlands unless there is no other practicable alternative."[32] As discussed below, in section V.c, the Partners have practicable alternatives to conducting this work in wetlands. The roads they plan to clear to the boring sites – although they will be temporary – do not comply with USFS' best practices for mitigating damage to wetlands.

USFS should be especially careful to implement protective measures for wetlands in the proposed project area along Homestake Creek. Interviewed last year, WRNF Supervisor Scott Fitzwilliams noted of the project area "this is one of the finest wetlands we can find in our forest — it's unbelievable."[33] A recent WRNF report on restoration of wetlands in Camp Hale — a report in which the Partners collaborated — noted generally that

> Riparian and wetland communities are the most ecologically productive landscapes in this Colorado high country, sustaining a high diversity of plant and wildlife species. They are also the rarest. Up to 80% of the wildlife species in Colorado depend on wetlands and riparian areas for some part of their life cycle, but these areas currently occupy only 1.5% of the land area in the state. Wetlands also help sustain water flows in streams and rivers, recharge groundwater supplies, provide temporary storage for flood waters, and slow the flow of water so that impurities settle out of the supply.[34]

Colorado's streams, watersheds, wildlife, landscapes, and humans can ill afford to lose more wetland. The disparities between the Partners' proposal and Forest Service WCP regulations must be resolved, and alternatives must be considered, before the project begins. This must occur through an EA – or an EIS – because impact or possible impact on wetlands is an extraordinary circumstance.[35] Already, the Partners' plan does not comply with Forest Service WCP regulations regarding wetlands. This indicates that it will have an impact on wetlands of greater significance than the Forest Service generally allows. Moreover, the full significance of the project's impact on wetlands is as yet uncertain because of striking factual omission in the Partners' plan: the Partners do not provide or discuss publicly available maps showing how much wetland will be impacted.

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[30] FSH 2905.25 – *Watershed Conservation Practices Handbook* 10(12.4)(1)(a).
[31] *See Addendum to Technical Report, WRNF Comments* (March 20, 2020) at 5.
[32] FSH 2905.25 – *Watershed Conservation Practices Handbook* 10(12.4)(1)(b).
[33] Scott Fitzwilliams qtd. in Brent Gardner-Smith, *Aurora, Colo. Springs seek to drill on lower Homestake Creek dam sites*, Aspen Journalism, https://www.aspenjournalism.org/2019/07/17/aurora-colo-springs-seek-to-drill-on-lower-homestake-creek-dam-sites/ (July 17, 2019). *See also* our comment on public availability of this document, *infra* note 77.
[34] *Camp Hale-Eagle River Headwaters Restoration Project: Collaborative Recommendations for Restoration and Management* (2015) at 12.
[35] *See* 40 CFR § 1508.4.

We have provided, in Appendix I, this publicly available map of wetlands in the Homestake Valley. In Appendix II, we have mapped the wetlands in Homestake Valley in relation to the proposed roads and drilling sites. This map relies on Colorado Wetland Inventory (CWI) data easily accessed online and discussed further in section V.a. It reveals the types of wetlands – from palustrine to riverine; some modified by beavers, some seasonally flooded, some continuously saturated – which data from the CWI and the National Wetland Inventory (NWI) indicate are present in the project area.

The USFS NEPA Handbook stipulates that if a proposed action may have or would have a significant effect on an extraordinary circumstance resource condition, that action cannot be categorically excluded from NEPA analysis.[36] The significance of the proposed action's impact on wetlands, or at least uncertainty surrounding the project's impact on wetlands, means that WRNF cannot categorically exclude this proposed action. Further NEPA analysis and disclosure are required before the geotechnical investigation can begin.

b. The proposed action may or will have significant impact on potential fens

The Forest Service and the Fish and Wildlife Service (FWS) both mandate complete protection of fens in the project area. USFS' WCP Handbook plainly states that projects in Region 2 national forests must "Avoid any loss of rare wetlands such as fens and springs. NOTE: These wetlands cannot be replaced in-kind."[37] The WCP also stipulates that projects must "Avoid long-term reduction in organic ground cover and organic soil layers in any wetland (including peat in fens)"; this "protects vital ecological functions."[38] A 1999 directive from FWS declares that one of its "wetland priorities in Region 6 (the Mountain-Prairie Region) is the protection and conservation of fens."[39] Fens fall within the FWS' Resource Category 1 Habitats, for which the "mitigation" goal is "no loss of existing habitat . . . because of the irreplaceability of the type of habitat."[40] They are irreplaceable in part because they represent thousands of years of accretion: most fens in Colorado are 8,000 to 12,000 years old.[41] They also "perform numerous essential ecosystem functions, including water storage and conservation, carbon sequestration, habitat for sensitive plants species and communities and important wildlife refugia."[42]

USFS' Region 2, which includes Colorado, has developed a specific policy on fens which incorporates the 1999 directive. The policy notes

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[36] 36 CFR § 220.6(b).
[37] FSH 2905.25 – *Watershed Conservation Practices Handbook* 10(12.4).
[38] *Id*.
[39] *FWS R6 Regional Policy on the Protection of Fens* at 1. Colorado falls within FWS' Region 6, which also encompasses Kansas, Montana, Nebraska, North Dakota, South Dakota, Utah, and Wyoming. *See Region 6 – Mountain Prairie*, https://www.fws.gov/endangered/regions/index.html (last visited June 29, 2020).
[40] *Id*. at 2. As noted below, the Forest Service calls fens "essentially irreplaceable." *Region 2 Wetland Protection - Fens, File Code 2070/2520-7/2620* (March 19, 2002) at 1.
[41] Barry C. Johnston, et. al., *Inventory of Fens in a Large Landscape of West-Central Colorado* (2012) at 7.
[42] Delia Malone, *et. al.*, *Wetland Mapping and Fen Survey in the WRNF* (2011) at 10.

> [M]any of the fens of Colorado are over 10,000 years old, with organic soil accumulation rates ranging from about 4 to 16 inches per thousand years. Because the rate of accumulation is so slow, these ecosystems are essentially irreplaceable.
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> The U.S. Fish and Wildlife Service, Mountain-Prairie Region, has made conservation and protection of fens one of their wetland priorities. . . . Furthermore, the Mountain-Prairie Region has determined that all functioning fens fall within their Resource Category 1. This means that the goal is no loss of existing habitat value, and that every reasonable effort should be made to avoid impacting these habitats. Mitigation for loss of fens is problematic, as there are no known methods to create new functional fens.[43]

The existence of potential fens in the project area, described in section V.a below, is an extraordinary circumstance: fens are included in USFS' definition of wetlands, and they are also protected by additional FWS and USFS regulations.[44] Several drill sites are close to fens or — at least in one case — on top of a fen.[45] The 2011 WRNF fen study notes "Hydrologic and vegetation alteration were the primary ultimate causes of fen impairment. Development activities that resulted in hydrologic alteration included water diversions, ditching, and roads. Vegetation disturbance is also a factor in fen degradation." [46] The proposed geotechnical investigation includes road building, water diversion, and vegetation disturbance: all significant impacts because they result in fen impairment, or worse. The project will clearly have a significant impact on fens.

WRNF cannot categorically exclude projects which significantly impact fens, an extraordinary circumstance resource condition which is given heightened protection by USFS and FWS regulations.[47] As explained in section V.a, the Partners' soil samples and the CWI map indicate there are potential fens in the region. The WRNF must clearly map all fens in the project before drilling begins, and it should make these maps available to the public. It must also analyze the effects of the proposed drilling in wetland and likely fen areas before drilling begins. WRNF must engage in NEPA analysis because the proposed action may or will have significant impact on irreplaceable fens.

c. The proposed action may or will have significant impact on wilderness and roadless areas

The Partners claim in their response to WRNF's comments that "No borings, access, or other activities are proposed within designated wilderness or Colorado Roadless Areas."[48] This is not

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[43] *Region 2 Wetland Protection - Fens, File Code 2070/2520-7/2620* (March 19, 2002) at 1.
[44] *See* FSH 2905.25 – *Watershed Conservation Practices Handbook* 10(12.4). This section of the WCP labels fens a "rare wetland."
[45] *See* Appendix IV.
[46] *Id*.
[47] *See* 36 CFR § 220.6(c), 36 CFR § 220.6(b), and USFS and FWS regulations cited above.
[48] *Addendum to Technical Report, WRNF Comments* (March 20, 2020) at 2.

true. In their Technical Report, the Partners note plans to complete geophysical surveys along two dam alignments, each of which extends into a roadless area. The Report provides that "Geophysical survey activities would not occur within designated Wilderness areas."[49] But it specifically notes that surveying "may occur within designated Roadless areas."[50]

The Colorado Roadless Rule requires that "Environmental documentation . . . be prepared pursuant to Section 102 of the National Environmental Policy Act, 40 CFR part 1500, and 36 CFR part 220 [the Forest Service's NEPA Handbook] for any proposed action within a Colorado Roadless Area."[51] The Regulatory Certifications section of USFS' comments on the Roadless Rule, as recorded in the Federal Register, explains further that "Before authorizing land use activities in roadless areas, the Forest Service must complete a more detailed and site-specific environmental analysis pursuant to NEPA and its implementing regulations."[52] Because the USFS considers the presence of a roadless area an extraordinary circumstance, a categorical exclusion is not the proper environmental documentation under the Roadless Rule. USFS' NEPA Handbook indicates a proposed action is ineligible for a categorical exclusion if it may have significant impact on a roadless area.[53]

The impact of this project on the roadless area might, or will, be significant: surveying dam alignments B and C using a geophone would require emitting bursts of sound at 170 decibels, as loud as a shotgun blast, ten times per day over a period of perhaps two weeks.[54] The Roadless Rule and the NEPA Handbook make clear that WRNF must prepare additional environmental analysis of the geotechnical investigation as it would impact the roadless area in Homestake Valley. And though the Partners will not conduct activities in the Holy Cross Wilderness Area, sound from the geophone and from drilling would be easily heard within the wilderness boundary. The Homestake Valley is a steep-walled mountain valley, and it is especially narrow in the project area: sound is magnified in the valley floor and is carried far up hillsides. It would, for example, be easily heard for more than a mile on the Whitney Creek Trail in the wilderness area. Indeed, the wilderness boundary is removed from several proposed sites, especially A5 and D1a, and from dam alignments B and C by only a few feet.[55]

A thorough analysis of the impacts of the proposed action on the natural soundscape and the resulting impacts on resources such as wildlife and recreation is crucial to the NEPA process. In 2016, the United States District Court for the District of Utah found that the Bureau of Land Management failed to take a hard look at noise impacts associated with a natural gas

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[49] *Id*.
[50] *Id*.
[51] 36 CFR § 294.45(a).
[52] *Colorado Roadless Rule*, 77 Fed. Reg. 128 (July 3, 2012) at 39,591.
[53] *See* 36 CFR § 220.6(b).
[54] The Department of Defense's Hearing Center of Excellence notes that "exposure to sounds higher than 110 decibels can cause instantaneous hearing loss." *High Decibel Levels, DOD Hearing Center of Excellence*, https://hearing.health.mil/Prevention/Causes-of-Injury/High-Decibel-Levels (last visited June 23, 2020). The range between 170-190 decibels is commensurate with "a shot gun blast or a rocket lift off." *Id*. *See also Technical Report* at 5.
[55] *See Addendum to Technical Report, WRNF Comments* (March 20, 2020) at Maps 1-4.

development project, noting BLM failed to follow any scientific protocol for assessing noise impacts from drilling the proposed wells.[56] Similarly, for this project, USFS must complete scientifically sound analysis of potential noise impacts before approving decisions associated with this project.

We are also concerned about the Partners' plan to cut roads, through wetlands, to the boundary of the wilderness area and the roadless area. Borings A1a and A1b, A5, A4, D1a would require cutting roads extending close to the wilderness boundary. A5, in particular, comes within 100 feet of the wilderness boundary. Borings A3, D2, and D3 come close to the roadless boundary; A3 and D3 within a few hundred feet. The Partners present no plan to block access to these roads from Homestake Road, which on weekends during the summer is full of dispersed campers and jeep drivers. When the Partners stop work over the weekend, these roads would be left open to users of Homestake Road, who might see them as new paths to access the wilderness boundary, perhaps with motorized vehicles, and as roads leading into the roadless area. These indirect effects must be analyzed in a NEPA document, with mitigation measures as appropriate. Multiple uses of roads cut for the drill rig would further damage wetlands and potential fens in the project area. They would increase potential for roads to be created in the roadless area by continued use of the same cleared path into the roadless area. They would degrade the solitude found in and the non-mechanized nature of wilderness.

If subsurface and geophysical investigations are permitted, they will extend, physically and sonically, into a wilderness and a roadless area, and they will make the wilderness boundary accessible by road. WRNF must analyze this impact on protected, extraordinary circumstance resource conditions through a detailed NEPA process.

We note that the Bureau of Land Management recently proposed to categorically exclude from NEPA a project, analogous to this one, to drill test wells associated with a proposed expansion of the Mid Continent Limestone Quarry near Glenwood Springs. The agency realized that a categorical exclusion was inappropriate for the project and is currently preparing an EA to adequately analyze potential impacts of the test wells, stating that an EA will enable the BLM to "do a more detailed analysis of the potential impacts of drilling the wells."[57]

III. USFS must specify an applicable categorical exclusion in its scoping letter and restart scoping

Interpreting NEPA, the Council on Environmental Quality (CEQ) defines a categorical exclusion as:

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[56] *S. Utah Wilderness Alliance v. U.S. Dep't of Interior*, No. 2:13-cv-01060-EJF, 2016 U.S. Dist. LEXIS 140624, (Oct. 3, 2016) at *20-24.

[57] *See* Jason Blevins, *BLM, citing public ire, demands intensive review of test bores before mine above Glenwood Springs can expand*, https://coloradosun.com/2019/12/13/blm-glenwood-springs-nepa-review-limestone-quarry/ (Dec. 13, 2019).

> a category of actions which do not individually or cumulatively have a significant effect on the human environment and which have been found to have no such effect in procedures [e.g. the Forest Service's NEPA Handbook] adopted by a Federal agency in implementation of these regulations and for which, therefore, neither an environmental assessment nor an environmental impact statement is required.[58]

The WRNF indicates in its comments on the Homestake Partners' application that it "feels confident that analysis is likely to be a Categorical Exclusion."[59] If it believes a CE is warranted, it is typical for the WRNF to specify the category appropriate to the proposed action in its scoping letter. However, in its Whitney Creek Geotechnical Investigation scoping letter, the WRNF does not specify a category. It says only "A Categorical Exclusion (CatEx) will be prepared pursuant to the National Environmental Policy Act (NEPA) to disclose the potential effects of the Proposed Action."[60] Two pages later it explains "Decisions that are categorically excluded from documentation in an Environmental Assessment (EA) or Environmental Impact Statement (EIS) are not subject to an administrative review process (pre-decisional objection process) (Agriculture Act of 2014, Subtitle A, Sec. 8006)."[61] WRNF's single mention of a specific CE is on the Project Detail webpage.[62] But this is not the page linked to in emails sent to invite public comment, and a specific CE is not mentioned in any of the project documents available on USFS' website. It would be difficult for members of the public to find out which CE might apply to this proposed action.

This is a significant omission. Scoping is normally the only opportunity for public comment on proposed actions which are categorically excluded from documentation under NEPA. USFS' NEPA Handbook makes clear the that public comment through scoping is crucial in uncovering information useful to the USFS as it makes a decision on the proposed action. The Handbook notes "Scoping is important to discover information that could point to the need for an EA or EIS versus a CE.[63] The public must have full information from USFS to play this key role in the scoping process. Regarding actions which USFS thinks might be categorically excluded from environmental analysis, the key piece of information is the category the USFS thinks is applicable to the project.

The USFS recognizes the importance of this information: if a CE might apply to a proposed action, it is extremely unusual for a scoping letter from the WRNF to omit mention of the specific CE which might apply. We have reviewed each of the publicly available scoping letters sent by the WRNF to solicit comment on proposed actions which might be eligible for CEs during its April-June Schedule of Proposed Actions (SOPA) period. Each one of these letters

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[58] 40 CFR § 1508.4
[59] *Addendum to Technical Report, WRNF Comments* (March 20, 2020) at 1.
[60] *Whitney Creek Geotechnical Investigation Scoping Letter* (May 28, 2020) at 1.
[61] *Id*. at 3.
[62] *See Whitney Creek Geotechnical Investigation Project Detail*, https://www.fs.usda.gov/project/?project=58221&exp=detail (last visited June 29, 2020).
[63] *FSH 1909.15 - National Environmental Policy Act Handbook* at 31.3.

indicates clearly which CE the WRNF thinks applies to the proposed action. Though there are more in the April-June SOPA period, we list below five examples from that timeframe.

In the first paragraph of its White River Forest Health and Fuels Management Project proposed action, the WRNF writes:

> This project is currently being considered categorically excluded from documentation in an environmental assessment or environmental impact statement under 36 CFR 220.6 (e)(6) - Timber stand and/or wildlife habitat improvement activities that do not include the use of herbicides or do not require more than 1 mile of low standard road construction.[64]

Writing to ask for comments on proposed Peak One and Pine Cove Campground Improvement Projects, the WRNF includes a section titled Categorical Exclusion. It reads in part:

> This proposal is consistent with category CFR § 220.6(d)(5): "Repair and maintenance of recreation sites and facilities."[65]

Welcoming comment on plans for hazardous fuel reduction, forest restoration, and wildlife habitat improvement on Derby Mesa, the WRNF notes:

> This project is currently being considered for categorical exclusion from documentation in an environmental assessment or environmental impact statement under one or both of the following authorities:
> 36 CFR 220.6(e)(6) – Timber stand and/or wildlife habitat improvement activities that do not include the use of herbicides or do not require more than 1 miles of low standard road construction.
> Sections 605 of HFRA (16 U.S.C.6591d) – Wildfire Resilience. Hazardous fuels reduction projects in designated areas on National Forest System lands.[66]

In its letter soliciting comments on Keystone Ski Resort's proposal to replace and remove chairlifts in Keystone ski area, the WRNF includes a section on the appropriate categorical exclusion which reads in part:

> The proposed project is consistent with category 36 CFR § 220.6(e)(3): "Approval, modification or continuation of minor special uses of National Forest System lands that require less than five contiguous acres of land."[67]

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[64] *White River Forest Health and Fuels Management Project Scoping Letter* (Jan. 1, 2019) at 1.
[65] *Peak One and Pine Cove Campground Scoping Letter* (Oct. 1, 2019) at 2-3.
[66] *Derby Mesa Scoping Letter* (Feb. 3, 2020) at 1.
[67] *Keystone Chairlift Removal/Replacement Scoping Letter* (Feb. 5, 2020) at 2.

Soliciting comments on the Peak 7 Hazardous Fuels Reduction Project at Breckenridge, the WRNF notes in the second paragraph of its letter:

> This project is currently being considered for categorical exclusion from documentation in an environmental assessment or environmental impact statement using the following authority:
> Sections 605 of HFRA (16 U.S.C.6591d) – Wildfire Resilience. Hazardous fuels reduction projects in designated areas on National Forest System lands. The hazardous fuels project is within an insect and disease treatment area that was designated by the Secretary under HFRA section 602(b) by March 23, 2018. (HFRA, Section 605(c)(2)(C)).[68]

We also examined WRNF's current SOPA report. Here, too, the WRNF always lists the proposed CE in the scoping letter. For example, in a scoping letter dated May 12 – two weeks before the WRNF solicited comments on the Whitney Creek Geotechnical Investigation – the WRNF, as is typical, includes a section titled Categorical Exclusion. As with other scoping letters, it lists the specific CE being considered:

> This action can be categorically excluded from documentation in an environmental impact statement or environmental assessment as it is a routine activity within an approved category of exclusion under 36 CFR 220.6(d): (1) Prohibition to provide short term resource protection or to protect public health and safety.[69]

We cannot find a single other recent scoping letter regarding a project eligible for a CE where the WRNF did not inform the public of the specific CE it was considering. If the WRNF insists on documenting this project with a CE – a decision with which we do not agree– we ask the WRNF to comply with its usual standards by, first, issuing a new scoping letter which specifies the CE under consideration and, second, restarting the comment period for this proposed action so that the public has time to understand this fundamental aspect of the proposed action.

IV. It is unlikely that the Partners will be able to comply with category (e)(8)

The CE which the WRNF mentions on its Whitney Creek Geotechnical Investigation Project Detail page is 36 CFR § 220.6(e)(8). This category excludes from further environmental analysis

> Short-term (1 year or less) mineral, energy, or geophysical investigations and their incidental support activities that may require cross-country travel by vehicles and equipment, construction of less than 1 mile of low standard road, or use and minor repair of existing roads. Examples include but are not limited to:
> (i) Authorizing geophysical investigations which use existing roads that may require incidental repair to reach sites for drilling core holes, temperature gradients, or seismic shot holes . . .

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[68] *Peak 7 Hazardous Fuels Reduction Project Scoping Letter* (Feb. 10, 2020) at 1.
[69] *Wildwood Put-in Scoping Letter* (May 12, 2020) at 1.

> (vi) Approving a plan for exploration which authorizes repair of an existing road and the construction of 1/3 mile of temporary road; clearing vegetation from an acre of land for trenches, drill pads or support facilities.[70]

We are concerned the Partners' timeline, as detailed in its Technical Report and in its responses to WRNF's comments, makes it unlikely that the drilling aspect of its geotechnical investigation will comply with (e)(8)'s "short-term" framework.

In the Report, the Partners note that "up to five days would be required for each boring." [71] They propose ten borings; this means the drilling could take as many as fifty days. The Partners also write that "work will be completed during the week, avoiding the busier weekend times" when Homestake Road is used for access to recreation and wilderness areas.[72] And they agree that that "if feasible" they will remove trees for roads and for drill pads outside of avian breeding season, which runs from March 15-August 1.[73] They also will not drill after snowfall.[74] In the Homestake Valley, snow falls as early as the beginning of October.[75] If the Partners begin drilling on August 1, 2020 and end on October 9, 2020 they would have fifty weekdays to drill. But this would mean beginning construction of ten ten-foot-wide roads, with a length totaling around 3,000 feet, and of drill pads, each 800 square feet, in July – during avian breeding season.[76] Indeed, the Partners seem to accept that the project may have impact on bird populations. A 2016 study of possible subsurface investigations commissioned by parties to the ERMOU – of which the Partners are one – noted that one task necessary to complete the subsurface investigation would be to "Subcontract with earthwork contractors and foresters to remove trees and construct access routes to the boring locations *prior to* mobilization of the drillers [emphasis added]."[77] Based on the Partners' proposed timeline, by which drilling would begin on August 1, this would have to occur in July.

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[70] 36 CFR § 220.6(e)(8).
[71] *Technical Report* at 6.
[72] *Id*. at 24.
[73] *Id*. at 17.
[74] *Addendum to Technical Report, WRNF Comments* (March 20, 2020) at 3.
[75] Data from the Colorado Climate Center indicate that in 2015 snowfall in Vail, Colorado – miles from the project area and the nearest monitoring site which recorded snowfall data during the period 2015-2019 – began on October 23. In 2016, it began on October 6; in 2017, on October 9; in 2018, on October 30; in 2019, on October 10. *See Colorado State Climate Center - Vail*, https://climate.colostate.edu/data_access.html (last visited June 29, 2020).
[76] The Partners' maps are not detailed enough for us to state precisely the length of the roads which will be constructed; in any case, the Partners' planned locations for roads and boring locations, as noted in section V.a below, may vary significantly. It would be helpful for public engagement if the WRNF released more specific plans for road length and boring location as these are developed – keeping in mind that under 36 CFR § 220.6(e)(8), if this is the applicable CE, roads should not be longer than 1 mile.
[77] *Subsurface Investigations - ERMOU Whitney Creek Reservoir Alternatives*, https://www.documentcloud.org/documents/3093472-2016-3Q-ERMOU-Project-Investigations.html#document/p2/a316874 (June 2, 2016). This document, like other memos from Colorado River District quarterly board meetings, is publicly available. It was uploaded to Document Cloud by Brett Gardner-Smith at Aspen Journalism.

Moreover, it is difficult to understand the Partners' timeline, because they give conflicting reports of it. Regarding possible impacts to the Canada lynx, a federally threatened species, they say "work would be conducted over a short period (approximately five to six weeks)."[78] But their explication of the timeframe needed to complete subsurface exploration indicates drilling might take as many ten weeks: five weekdays for each of ten boreholes. They also write "it is possible that the work could be completed in multiple periods that are months apart."[79] This unclear, and possibly extended, timeline does not comply with (e)(8). In *Uranium Watch v. U.S. Forest Service*, the United States District Court for the District of Utah confirmed that "1 year or less" does not refer to 365 total days worked on the project nor to single a calendar year running from January-January; rather, it refers to a single 365-day year. There, the worry was that exploratory holes "will remain longer than one year" because they might not be reclaimed "until the following season."[80] The court held that "'the following season' does not mean 'after one year,'" and that reclamation work might continue into the following season.[81] But its decision did not mean that the holes might remain for longer than a year. Allowing multiple, non-continuous periods of use — for example, twelve months over a period of twelve years — would make a mockery of (e)(8)'s "short-term" requirement.

The Partners' timeline is unclear, and our analysis of it suggests they may be unable to finish work during the 365-day period allowed by (e)(8). The Forest Service NEPA Handbook does not allow actions which admit of this degree of uncertainty regarding the impact that this action, because of its duration, may have on the environment. An EA must be prepared if it is "uncertain whether the proposed action may have a significant effect on the environment."[82] We ask that the WRNF work with the Partners to clarify their timeline and, if they may be unable to complete work in "less than 1 year," that an EA be prepared.

V. USFS and the Partners must address these additional issues

a. USFS and the Partners must note existing maps showing potential fens in the project area, and must develop further mapping before drilling begins

The WRNF notes that there may be fens — a particular, and particularly protected, kind of wetland — in the project area in its comments on the Partners' Technical Report. Indeed, the WRNF makes clear in its comments "USFS Region 2 direction states that all fen impacts must be

[78] *Technical Report* at 22.
[79] *Id*. at 19.
[80] *Uranium Watch v. U.S. Forest Serv.* 2:10CV721DAK (D. Utah 2014) at 12.
[81] *Id*.
[82] 36 CFR § 220.6(c).

avoided entirely."[83] In line with this directive, WRNF asks "What about fens — were they mapped? If so, how?"[84] The Partners respond:

> A total of 12 samples were collected and analyzed by the Colorado State University Soil, Water, and Plant Testing Laboratory to determine the amount of organic carbon and clay content of the soils. Of the 12 samples, five of the soil samples have histosol surface horizons with greater than 16 inches of organic soils and met the depth and organic carbon criteria to be designated as a fen; however, there are no fens in/near the project area related to this application.[85]

It is not true that "there are no fens in/near the project area related to this application." This is evident from the Partners' own soil analysis and from an existing map which catalogues several potential fens in the Homestake Valley.

First, the Partners' own soil analysis indicates the presence of fens in the region. A 2012 report by Forest Service scientists on fens in the Grand Mesa, Uncompahgre, and Gunnison National Forests — forests neighboring the WRNF in western Colorado — defines fens as "wetlands with at least 40 cm [15.784 inches] of organic soils [histosols] that consist of at least 12-18% organic-carbon content."[86] The Partners report that nearly half of the soil samples they tested had histosols which reached 16 inches deep and had the requisite organic-carbon content. The Partners' assertion that there are no fens in or near the project area seems to rely on the fact that the Forest Service has not officially designated fens in the project area. This is a misdirection: if soil samples indicate that fens are present, as they do here, the Partners must provide this data to the WRNF and the public, and they must clearly map fens in the project area.

Second, the Partners should have relied on an existing map of potential fens in the Homestake Valley. The Colorado Wetland Inventory — developed by the Colorado Natural Heritage Program (CNHP) and incorporated in the Fish and Wildlife Service's National Wetland Inventory (NWI) — maps four "potential fens" in the immediate project area.[87] In fact some of the proposed boring sites correspond precisely with areas mapped as potential fens. For example, a point on the eastern end of a fen mapped by the CWI is at coordinates 39.4292, -106.40870. Boring site B2 is at coordinates 39.429296, -106.408740.[88] The only difference between these two coordinates is that the latitudes given by the Partners list two further decimal points —

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[83] *Addendum to Technical Report, WRNF Comments* (March 20, 2020) at 3. The WRNF is referring to the directive, from USFS' Region 2 Water Conservation Practices Handbook, to "Avoid any loss of rare wetlands such as fens and springs. NOTE: These wetlands cannot be replaced in-kind." *FSH 2905.25 - Water Conservation Practices Handbook* at 10(12.4). We discuss this directive in section II.b, above.

[84] *Id*.

[85] *Id*.

[86] Barry C. Johnston, et. al., *Inventory of Fens in a Large Landscape of West-Central Colorado* (2012) at 7.

[87] *Colorado Wetland Inventory Map*, *supra* note 11. The fens in the project area are fens 4181, 4198, 7957, and 7959 on the CWI map. Appendices III and IV represent graphically the proximity of the project area to already-mapped potential fens and the overlap between the project area and these potential fens.

[88] *Id*. and *Addendum to Technical Report, WRNF Comments* (March 20, 2020) at Table 1.

they are slightly more precise than the coordinates mapped by the CWI. Otherwise, the locations are precisely the same.

Moreover, the Partners' subsurface explorations would extend further into potential fens than just this coordinate point: the drilling rig would require 800 square feet of cleared area and each road used to access boring sites would be ten feet wide.[89] The location of these roads "may vary in alignment up to approximately 50 feet," and boring locations "may vary in location up to approximately 100 feet."[90] This variation means that the Partners' potential roads and boring locations around alignment B would likely occur in already-mapped potential fens.

Impacts to potential fens would occur from use of the equipment described above, from coring down as much as 150 feet below the ground surface,[91] and because each "bore hole would be filled from the bottom to about 2 feet below the ground surface with cement-bentonite and the remaining 2 feet backfilled with native earth material from the boring."[92] This could disrupt the underground flow of water necessary for maintenance of each fen. Underground water flow defines fens: a 1998 USFS report on peatlands in the Rocky Mountains notes "Fens are *minerotrophic,* receiving nutrients from water that has percolated through mineral soil and bedrock, or which has run off from uplands into a surface source such as a creek before entering the fen."[93]

The label "potential fen" is common on the CWI map: most fens in Colorado are labeled "potential fens." This is because "few land management agencies have a complete inventory of fens within their lands . . . To fill this data gap, CNHP is mapping fens through aerial photo interpretation for . . . the U.S. Forest Service (USFS). . . . For each project, potential fens are identified from digital aerial photography," using pictures taken by FWS in the 1980s.[94] The

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[89] *Technical Report* at 12-13.

[90] *Id*. The Partners' maps are not fine-grained enough to clearly represent the length of roads which would be constructed to reach boring locations along potential dam alignment B.

[91] *Technical Report* at 6.

[92] *Id*. at 14-15.

[93] Steve W. Chadde, *et. al.*, *Peatlands on National Forests of the Northern Rocky Mountains: Ecology and Conservation*, Rocky Mountain Region General Technical Report - RMRS-GTR-11 (July 1998) at 8.

[94] *Fen Mapping, Colorado Wetland Information Center*, https://cnhp.colostate.edu/cwic/wetlandtypes/fen-mapping/ (last visited June 22, 2020). The Glenwood Springs Post Independent elaborates on the CHNP's mapping methodology:

> The fen project builds on work done in the early 1980s by the U.S. Fish and Wildlife Service through the National Wetland Inventory. At the time, scientists used U.S. Geological Survey quadrangle maps and their working knowledge of forest ecosystems to develop blueprint-type paper maps pinpointing wetland sites, [John] Proctor [then-WRNF forest botanist] said.
>
> That work yielded thousands of wetland sites, each numbered with a wetland coding system.
>
> Over the past two years, Colorado Natural Heritage Program scientists zoned in on the White River National Forest, pairing the 1980's coding system with modern aerial color photography and digital mapping to narrow the 30-year-old wetland survey to 5,544 possible fen sites, including 1,592 high-probability sites. *See* Heather McGregor*, Forest fens foster Ice Age relict plants*, Glenwood Post Independent, https://www.postindependent.com/news/forest-fens-foster-ice-age-relict-plants/ (Sept. 18, 2011).

WRNF has previously used CWI data to establish the existence of fens. In 2011, for example, a team from WRNF joined a biologist with the CNHP to visit 25 potential fens in areas close to roads on the CWI map: "all but one of the summer's 25 sites turned out to be high quality fens."[95] The CWI data, combined with evidence from physical samples taken by the Partners that there are soils which qualify as fens in the area, is enough for the Forest Service to conclude that there may be, or are, fens in the project area – and to further investigate.

Indeed, USFS is obliged to definitively map all fens in the project area, and to update existing data. USFS' obligation to map fens stems in part from the 1999 directive from the Fish and Wildlife Service, which specifically focuses on fens and peatlands in Colorado.[96] The FWS directive declares that one of its "wetland priorities in Region 6 (the Mountain-Prairie Region) is the protection and conservation of fens."[97] FWS documents the location of some fens in the directive, but it also encourages "other agencies to help gather this important documentation.[98] This means that the directive is prospective, requiring federal agencies to keep identifying fens, and that it is cooperative, asking federal agencies like the Forest Service help in this prospective work. FWS elaborates on these prospective and cooperative aspects when it notes that, "for example, the locations of fens should also be obtained (a) when wetland delineations are conducted in conjunction with project planning and development of permit applications under Section 404 of the Clean Water Act. . . ."[99] It adds that "these wetland delineations should identify any fens in the project impact area and distinguish them from other wetland types. Fens identified during these delineations should be added to the regulatory agencies' databases and considered to be categorized as Resource Category 1 Habitats." [100]

Though the Partners have not yet submitted a Section 404 application, they are now engaged in planning and development of this application. In their Technical Report, the Partners note that "where temporary wetland or waters disturbance is unavoidable, applicable 404 permitting would be secured from the U.S. Army Corps of Engineers (Corps)."[101] The Partners are preparing to conduct activities in potential fens, in wetlands, and in Homestake Creek. "Temporary wetland or waters disturbance" *is* unavoidable in the proposed subsurface exploration, so a permit from the Corps must be secured before the project can be approved. The Partners are certainly in the planning and development stage of this application now. FWS is clear that fen mapping should occur during planning and development of a Section 404 application, not once the application has been submitted. So, now is the time to map fens.

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[95] McGregor*, supra* note 94.

[96] Colorado's fens are explicitly mentioned in the text of the FWS R6 Regional Policy on the Protection of Fens. We note also that USFS, the Fish and Wildlife Service, and the Army Corps of Engineers have often coordinated best management practices regarding documenting and protecting fens: in 1995, these agencies helped to create a document titled "Forested Wetlands: Functions, Benefits and the Use of Best Management Practices." USFS' support for the CWI and the WRNF's question to the Partners about fen mapping, quoted above, both indicate that mapping is one of the best practices USFS uses in areas which have fens.

[97] *FWS R6 Regional Policy on the Protection of Fens* at 1.

[98] *Id*. at 2.

[99] *Id*.

[100] *Id*.

[101] *Technical Report* at 17.

Further, such information should be developed for the Forest Service NEPA process to inform the USFS' decisionmaking, and not provided only to the Corps.

WRNF must identify fens in the project area before it grants a categorical exclusion, or otherwise approves this project. Failing to do so would contravene USFS and FWS regulations prioritizing protection of fens and would "frustrate the fundamental purpose of NEPA, which is to ensure that federal agencies take a 'hard look' at the environmental consequences of their actions, early enough so that it can serve as an important contribution to the decision making process."[102]

At Appendix III, we have attached a map of the potential fens in the Homestake Valley which are included in the Colorado Wetland Inventory. At Appendix IV, we show the project area for the proposed action, and the overlap between proposed drilling sites and fens. The WRNF is required to act on this preliminary information and to identify and map all fens in the region before the proposed action begins.

We note, also, mention of fens in the project area in a 2016 memo directed to the board of the Colorado River District, which joined the Partners in signing the ERMOU. The memo indicates that "Drilling at the Whitney Creek site(s) is contingent on two factors." The second factor is securing a USFS special use permit; the first factor is that "If fen wetlands are found and determined to be a fatal flaw then no geotechnical work will take place."[103]

We also want to convey at this point our concern that the Partners intend to ultimately pursue a project which contravenes FWS regulations. The Partners have spent years and tens of thousands of dollars – as of November 2019, $300,000 from Aurora and around $10,000 from Colorado Springs – to fund the Rocky Mountain Fen Research Project, which aims to "explore various means of mitigating high altitude fens in areas impacted by development or natural degradation."[104] The Rocky Mountain Fen Research Project hopes to do this by "translocat[ing]" fen plant species from "an area where [they] would be covered, inundated, drained, or in some way damaged" to places where they "could continue to function as a fen."[105] It is no accident that the project has focused on research near Leadville, a few miles from the Homestake Valley. Indeed, its lead scientist notes that the Partners, along with other cities, have funded the project because they "wanted to figure out how to do this right so they could actually permit their projects," Whitney Reservoir foremost among them.[106] On a tour last year of potential

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[102] *California v. Norton*, 311 F.3d 1162, 1175 (9th Cir. 2002).
[103] John Currier, *ERMOU Project Investigations Memorandum*, https://www.documentcloud.org/documents/3093472-2016-3Q-ERMOU-Project-Investigations.html#document/p2/a316874 (July 7, 2016) at 2.
[104] Sarah Tory, *Efforts to relocate an ancient wetland could help determine the fate of a water project on lower Homestake Creek*, Aspen Journalism (Nov. 2019) and *The Rocky Mountain Fen Research Project*, https://coloradomtn.edu/wp-content/uploads/filebase/programs/nrm/Rocky_Mtn_Fen_Research_Project.pdf (last visited June 22, 2020) at 1.
[105] *The Rocky Mountain Fen Project*, *supra* note 104, at 2.
[106] Tory, *supra* note 104.

Whitney Reservoir sites, Kathy Kitzmann, a water resources principal at Aurora Water, said of the fen research project Aurora and Colorado Springs has funded "we are excited about proving that you can restore and rehabilitate fens." [107] But the current FWS directive on fens holds that "On-site or in-kind replacement of peat wetlands [i.e. fens] is not thought to be possible."[108] It appears the Partners' intended proposal is inconsistent with the FWS guidelines.

b. The Partners must engage with existing research on the Homestake Shear Zone

Geologists began researching the approximately eight mile wide major shear zone which they call the Homestake Shear Zone (HSZ) in the 1960s.[109] The Partners' planned subsurface exploration is meant to probe this shear zone: in a table listing proposed boring locations, they remark that the purpose of five of the ten proposed borings is to analyze a shear zone in the Homestake Valley.[110] However, this is the only mention of a shear zone in the Homestake Valley in the materials the Partners have submitted to WRNF. The Partners do not engage with a significant body of geological literature on the HSZ which is visible in the lower Homestake Valley. Indeed, the HSZ is "best exposed on the east side of the range in the deep glacial valley of Homestake Creek that coincides with the shear zone for ~8 km north-east of Homestake Reservoir," precisely in the project area.[111]

This omission has potentially serious implications. W. Steiner and MD Zoback et. al., among others, document rock mechanics challenges associated with drilling or tunneling in shear zones.[112] Moreover, Zoback notes that "geologic observations of exhumed faults" can reveal important information about shear zones.[113] The HSZ presents precisely such an opportunity. It is one of a handful of sites worldwide where pseudotachylites, glassy layers formed by intense friction created during earthquakes and colloquially called "fossil earthquakes," are visible in exposed rock formations.[114] We ask that the WRNF and the Partners consider this literature on drilling in shear zones, examine the "fossil earthquakes" which might reveal information about the shear zone that would allow the Partners to drill fewer bore holes, and specifically consider existing research on the HSZ before the proposed action is approved.

c. WRNF must analyze alternatives, including the Forest Service's own suggestion that all ten borings might not be necessary

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[107] Kitzmann qtd. in Tory, *supra* note 104.
[108] *FWS R6 Regional Policy on the Protection of Fens* at 6.
[109] *See* Ogden Tweto and P. K. Sims, *Precambrian Ancestry of the Colorado Mineral Belt*, 74 Geological Society of America Bulletin 991 at 1001.
[110] *Addendum to Technical Report, WRNF Comments* (March 20, 2020) at Table 1.
[111] Colin A. Shaw and Joseph L. Allen, *Field rheology and structural evolution of the Homestake shear zone, Colorado*, 42.1 Rocky Mountain Geology 31 at 32.
[112] W. Steiner, *Experience with shear zones at the edge of an intrusive body during tunnel construction* in Eberhardt, Stead, and Morrison, eds., *Rock Mechanics: Meeting Society's Challenges and Demands* at 1175. MD Zoback, *et. al.*, *The Role of Fault-Zone Drilling*,
[113] Zoback, *supra* note 112.
[114] *See* Shaw and Allen, *supra* note 111.

USFS' WCP Handbook mandates "In the water influence zone [WIZ] next to perennial and intermittent streams, lakes, and wetlands, allow only those actions that maintain or improve long-term stream health and riparian ecosystem condition."[115] The project area is indisputably in the water influence zone: Appendix I shows that it is surrounded by wetlands, and all of the borings would occur within a thousand feet of Homestake Creek – some would occur much closer to the creek. We see no way in which the proposed action would maintain or improve the long-term health of Homestake Creek and the riparian zone surrounding: the geotechnical investigation will require, among other impacts, removing water from Homestake Creek, drilling on wetlands and potential fens, and crossing Homestake Creek with a heavy drill rig.

Indeed, in pursuit of this mandate to maintain or improve WIZ health, the WCP stipulates that projects should "Keep heavy equipment out of streams, swales, and lakes, except to cross at designated points."[116] The drill rig is heavy equipment. Though the Partners do not specify the type of drill rig they plan to use, they write that it would be either a buggy- or track-mounted rig. The Partners report that the height of the drill rig, with its mast up, would be 30 feet.[117] The Central Mine Equipment 850, a comparable track-mounted drill rig with a 27-foot mast, weighs 28,660 pounds, or 14.33 tons.[118] The WCP makes clear that this kind of equipment generally should be kept out of a stream like Homestake Creek. If it enters the stream at all, it should be only at a designated point. But the Partners have not designated such a location. In fact, as mentioned above, their Technical Report notes that the location of roads may vary by up to 50 feet.[119]

The WCP adds that projects should "Keep the number of stream crossings and the extent of sediment sources to a practicable minimum."[120] Here, the WRNF has presented a practicable alternative to at least some of the Partners' planned activity in wetlands and across Homestake Creek. In its comments on the Partners' Technical Report, the WRNF ask about borings for alignment A: "Are all 10 borings necessary? Must the boring across the creek occur if the two borings on the near side of the creek reveal unfavorable results?"[121] The Partners reply that they would not be able to conduct this assessment as to whether further borings would be necessary in the field.[122] They plan to proceed with all of the borings along alignment A. Reaching one of these, boring A3, requires crossing Homestake Creek where the creek bank is steep and the creek itself is wide – an area where it would be difficult to move heavy machinery without causing significant impact to the stream's banks and bed. The WRNF cannot accept the

[115] FSH 2905.25 – *Watershed Conservation Practices Handbook* 10(12.1).
[116] *Id*. at 12.1(c).
[117] *See Technical Report* at 10.
[118] *See CME 850 Track Mounted Drill Rig*, Mining Life, https://mininglifeonline.net/equipment/mud-rotary---core-drilling-rigs/cme-850---track-mounted-drill-rig/1676 (last visited June 29, 2020).
[119] *Id*. The Partners' maps are not fine-grained enough to clearly represent the length of roads which would be constructed to reach boring locations along potential dam alignment B.
[120] *Id*. at 13.1.
[121] *Addendum to Technical Report, WRNF Comments* (March 20, 2020) at 3.
[122] *Id*.

Partners' response if it is to take a "hard look" at the environmental impacts of the planned subsurface exploration.[123]

Indeed, NEPA's mandated hard look requires consideration of alternatives. NEPA generally requires the lead agency for a given project to conduct an alternatives analysis for "any proposal which involves unresolved conflicts concerning alternative uses of available resources."[124] The regulations further specify that the agency must "rigorously explore and objectively evaluate all reasonable alternatives" including those "reasonable alternatives not within the jurisdiction of the lead agency," so as to "provid[e] a clear basis for choice among options."[125] This requirement applies equally to EAs and EISs.[126]

The purpose of NEPA's alternatives requirement is to ensure agencies do not undertake projects "without intense consideration of other more ecologically sound courses of action, including shelving the entire project, or of accomplishing the same result by entirely different means."[127] The CEQ regulations instruct agencies to consider alternatives to their proposed action that will have less of an environmental impact, specifically stating that "[f]ederal agencies shall to the fullest extent possible. . . . Use the NEPA process to identify and assess the reasonable alternatives to proposed actions that will avoid or minimize adverse effects of these actions upon the quality of the human environment."[128] The WRNF's suggestion that not all ten borings are necessary – and especially that boring A3 might not be needed – is an avenue for mitigating the impact of the proposed action, and USFS must consider that alternative in the NEPA analysis. USFS should additionally consider any other reasonable alternatives that would avoid, minimize or mitigate environmental impacts, such as alternate locations, or that borings proceed in stages, so that A3 would not be drilled if other borings along the proposed A dam alignment revealed a fatal flaw.

d. USFS and the Partners must further clarify the relationship of the project to the Eagle River Memorandum of Understanding (ERMOU)

In its scoping letter for the proposed action, the WRNF explains that

> The Cities [sic] of Aurora and Colorado Springs (Homestake Partners) along with west slope interests are parties to the 1998 Eagle River Memorandum of Understanding (ERMOU) with the objective to develop a joint use water project in the Upper Eagle River basin that minimizes environmental impacts, is cost effective, technically feasible,

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[123] *Robertson v. Methow Valley Citizens Council*, 490 U.S. 332, 350 (1989).
[124] 42 U.S.C. § 4332(2)(e).
[125] 40 C.F.R. § 1502.14.
[126] *See Davis v. Mineta*, 302 F.3d 1104, 1120 (10th Cir. 2002); *Bob Marshall Alliance v. Hodel*, 852 F.2d 1223, 1228-29 (9th Cir. 1988).
[127] *Envnt'l Defense Fund., Inc. v. U.S. Army Corps. of Eng'rs*, 492 F.2d 1123, 1135 (5th Cir. 1974); *see also Or. Envtl. Council v. Kunzman,* 614 F.Supp. 657, 659-660 (D. Or. 1985) (stating that the alternatives that must be considered under NEPA are those that would "avoid or minimize" adverse environmental effects).
[128] 40 C.F.R. § 1500.2(e); *see also*, 40 C.F.R. §§ 1502.14, 1502.16.

> can be permitted by local, state and federal agencies, and provides 20,000 acre-feet of average annual water yield for the Cities, 10,000 acre-feet of firm water yield for west slope interests, and 3,000 acre-feet of storage capacity for Climax.[129]

It adds that the proposed geotechnical investigation is meant to help the Partners achieve the ERMOU objectives:

> The Homestake Partners are proceeding with identification of feasible alternatives to meet the ERMOU objectives. The Homestake Partners submitted an application to WRNF for a SUP to conduct Geotechnical Investigations including geophysical survey and subsurface exploration as part of evaluating Homestake Valley dam construction feasibility.[130]

Indeed, the WRNF notes that "The purpose of the project [the proposed geotechnical investigation] is to evaluate opportunities to construct reservoir storage to develop a portion of the yield contemplated in the 1998 Eagle River Memorandum of Understanding (ERMOU)."[131]

The ERMOU is the document which governs the Partners' proposed activities in the Homestake Valley. We ask that the Partners and the WRNF consider whether the proposed action is consistent with the terms of the MOU.

This is especially necessary because the ERMOU specially provides that "environmental investigations [for a planned reservoir project] will include identifying wetlands and the costs of mitigating the damage to wetlands for each alternative."[132] The parties reiterate this agreement to map wetlands when they stipulate

> Specifically, the environmental investigations will include:
> a. Compiling reports and other documents with information relevant to existing wetlands, threatened and endangered species and water quality in the vicinity of the project components.
> b. Identifying and quantifying wetlands areas from field reconnaissance and aerial photography for each project component.[133]

As noted in section V.a above, the Partners have not adequately identified and quantified wetland areas because they have not clearly mapped fens in the project area. We understand that the ERMOU is not necessarily an enforceable legal document, but we think that as the Partners work on projects contemplated in the ERMOU they are, and would want to be, bound by its terms. Because the WRNF mentions the ERMOU as the catalyst for the proposed action,

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[129] *Whitney Creek Geotechnical Investigation Scoping Letter* (May 28, 2020) at 1.
[130] *Id*.
[131] *Id*. at 2.
[132] *Memorandum of Understanding Among the Cities of Aurora and Colorado Springs, Colorado River Water Conservation District, Climax Molybdenum Company, and the Vail Consortium* (April 21, 1998) at 4.
[133] *Id*.

we are convinced the WRNF has a role to play in engaging with the Partners over their obligations under the terms of the ERMOU.

Further, the ERMOU makes clear that the Partners have known about potential environmental impacts associated with building a reservoir along Homestake Creek for more than twenty years. The ERMOU incorporates findings from "a preliminary environmental analysis" for potential reservoir sites along Homestake Creek, including for a "lower Homestake reservoir."[134] This analysis "identified potentially significant environmental concerns associated with wetland inundation along Homestake Creek and encroachment upon wilderness lands."[135] The Partners have up-to-date data on these impacts: 2016 study commissioned by parties to the ERMOU found that the planned Whitney Reservoir would potentially impact 26-180 acres of wetlands.[136]

That is, the concerns we raise in section II – that the proposed action will significantly impact wetlands and wilderness, and therefore does not comply with NEPA and other federal laws – are recurring and longstanding. They cut against the aim of the Partners, as articulated in the ERMOU, to develop a project which "minimizes environmental impacts" and "can be permitted by [among others] . . . federal agencies."[137]

e. These processes must be public-facing, and not conducted exclusively by third-party consultants

The Partners have "decided to hire third-party consultants in order to support the WRNF in conducting certain tasks within the environmental analysis."[138] WRNF asks, in a letter to the Partners, that the Partners cease coordination with third-party consultants who have developed the environmental analyses included in the Technical Report.[139] This is appropriate. We note also that WRNF often engages in public processes as it conducts environmental analyses. Because public interest in this project is, and will continue to be, substantial, and because third-party consultants will be involved, we ask that certain aspects of the research done in preparation for the proposed action be public. Fen mapping, for example, should be conducted with public observers, and existing data, such as the locations of the soil samples analyzed at CSU, should be shared with the public. With regard to fens, this might be seen as a continuation of the USFS' work with the Colorado Wetland Inventory, which makes fen mapping publicly available.

VI. USFS must analyze cumulative impacts of the proposed action

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[134] *Id*. at 5, 2.
[135] *Id*. at 5.
[136] *Eagle River Memorandum of Understanding Project Alternatives Study - Phase 2, Table 1-6. Potential Environmental Issues*, https://www.documentcloud.org/documents/3093472-2016-3Q-ERMOU-Project-Investigations.html#document/p2/a316874 (Apr. 19, 2016) at 1-14.
[137] *Id*. at 1.
[138] *Letter to Kathleen Kitzmann and Maria Pastore* (Feb. 20, 2020) at 1.
[139] *Id*.

The Forest Service must conduct cumulative impact analysis that evaluates the proposed action in the context of other activities that are impacting or could reasonably impact similar resources. In particular, WRNF must analyze the fact that the geotechnical investigation is being proposed in order to support the planned Whitney Reservoir – a 6850-20,000 acre-foot reservoir, spanning a significant portion of the lower Homestake Valley[140] – and that therefore the reservoir is a reasonably foreseeable future action.

NEPA regulations define "cumulative impact" as:

> the impact on the environment which results from the *incremental impact of the action when added to other past, present, and reasonably foreseeable future actions* regardless of what agency (Federal or non-Federal) or person undertakes such other actions. *Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time* [emphasis added].[141]

WRNF must prepare an EA or EIS for this project that evaluates cumulative impacts associated with development of the Whitney Reservoir, which is related to this project. A failure to include a cumulative impact analysis of additional development which is already planned in the project area – and, indeed, which is the reason for the proposed action – renders NEPA analysis insufficient.[142]

We understand that the geotechnical investigation is a "fatal-flaw level reservoir siting study" which would allow the Partners to determine the location and size of any planned dam.[143] This means that there will be specifics of any plan to build Whitney Reservoir which may not be known before the geotechnical investigation is conducted. Still, the WRNF is obliged to analyze a significant number of interim issues related to a plan to build Whitney Reservoir before it begins drilling. Some of these issues include:

1. The presence of fens which could be drained or drowned by the dam.

2. More general impacts on wetlands and riparian areas within and surrounding the planned dam alignments.

3. Broader consequences for the Eagle River Watershed which would result from the planned reservoir project, analyzed at least in part using tools from the Eagle River Watershed Council's ongoing analysis of flows in the Eagle River watershed.

4. Stability of the reservoir given that it would be located in the Homestake Shear Zone.

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[140] *Technical Report* at 1. *See also* Chuck Baker qtd. in Grant Stringer, *Aurora, Colorado Springs move toward building additional Homestake reservoir*, Aurora Sentinel (July 24, 2019).
[141] 40 C.F.R. § 1508.7.
[142] *See*, *e.g.*, *Kern v. U.S. Bureau of Land Management*, 284 F.3d 1062, 1078 (9th Cir. 2002).
[143] *Technical Report* at 1.

5. Impacts on endangered plant and animal species in Homestake Creek and the surrounding wetlands and fens. This includes impacts on habitat for the federally threatened Canada lynx and on elk winter range.

6. Consequences to land and animal health of excising as many as 497 acres from the Holy Cross Wilderness.

7. Detrimental consequences to wilderness values of extending a road into what is now the Holy Cross Wilderness, and of destroying part of the Whitney Creek Trail in the Holy Cross Wilderness.

8. Legal consequences and consequences for protected land of the planned extension of dam walls into a designated Colorado roadless area.

9. Greenhouse gas emissions related to dam construction and implications for climate change.

Each of these are reasonably foreseeable impacts of the dam which could, and must, be analyzed in the NEPA process for the geotechnical investigation.

Furthermore, USFS should provide an explanation in the EA for why the geotechnical investigation is not considered a "connected action" to the Whitney Reservoir. The geotechnical investigation is mutually dependent on and is justified by the dam: without the investigation, the dam project cannot proceed, and without the aim of building Whitney Reservoir, the Whitney Creek geotechnical investigation would not have been proposed. Statute, confirmed often by the 10th Circuit, requires that an action which is an "interdependent part[] of a larger action and depend[s] on the larger action for [its] justification be considered an action connected with the larger action."[144] Agencies must describe connected actions in a single environmental review.[145]

The Partners have themselves established this connection between the proposed geotechnical investigation and planned dam construction. They write in their application for a special use permit that "the objective of this investigation is to evaluate opportunities to construct reservoir storage . . . specifically, the subsurface explorations . . . would provide valuable

[144] 40 C.F.R. § 1508.25(a)(1)(iii).

[145] 40 C.F.R. § 1508.25(a); *Klamath-Siskiyou Wildlands Ctr. v. U.S. Bureau of Land Mgmt.*, 387 F.3d 999 (9th Cir. 2004). The purpose of this requirement "is to prevent an agency from dividing a project into multiple 'actions,' each of which individually has an insignificant environmental impact, but which collectively have a substantial impact." *Great Basin Mine Watch v. Hankins*, 456 F.3d 955, 969 (9th Cir. 2006) (internal quotation marks omitted). Where the proposed actions are "similar," the agency also should assess them in the same document when doing so provides "the best way to assess adequately the combined impacts of similar actions." *Klamath-Siskiyou*, 387 F.3d at 999.

information regarding the suitability of the area for development."[146] They have tailored each part of the geotechnical investigation to possible reservoir construction: they note in their responses to WRNF comments that "each of the borings listed in Table 1 are required to support selection of the preferred dam alignment."[147] The WRNF writes in its own gloss on the geotechnical investigation that "the purpose of the project is to evaluate opportunities to construct reservoir storage. . . . Specifically, the Proposed Action would provide valuable information regarding the suitability of the Homestake Valley area for potential future reservoir development."[148]

Construction of a reservoir in the Homestake Valley is not a "speculative or hypothetical project[]," so theoretical as to make it a disconnected action.[149] The Partners' own statements make clear that they see the geotechnical investigation as connected to the dam project. Kathy Kitzmann said last year of the geotechnical investigation "We are in preparation to permit this overall project, to try and get that larger application in, so every piece of the project has had more time and effort spent on it."[150] Kevin Lusk, the principal engineer at Colorado Springs Utilities, adds, regarding the reservoir project, "'We've been serious about it for the last 20 years.' And [Lusk] said the recent drilling application 'is another step in the continuum from concept to reality.'"[151]

Moreover, the Partners have made concrete plans for the dam. In 2018, Aurora spent $4.1 million on a 150-acre ranch in the Homestake Valley.[152] The Partners would drown this land if a reservoir was built; it would account for around half of the surface area of the largest dam they envision building.[153] In April 2019, the Partners met with staff at the offices of six members of the Colorado congressional delegation to present their plans to carve out 497 acres from the Holy Cross Wilderness to facilitate reservoir construction.[154] And as described previously in these comments, the Partners have invested years and hundreds of thousands of dollars to fund the Rocky Mountain Fen Research Project which aims to "explore various means of mitigating high altitude fens in areas impacted by development or natural degradation."[155]

Now is the proper time to consider these impacts. CEQ regulations state that "Agencies may prepare an environmental assessment on any action at any time in order to assist agency

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[146] *Application* at 2.
[147] *Addendum to Technical Report, WRNF Comments* (March 20, 2020) at 3
[148] *Whitney Creek Geotechnical Investigation Scoping Letter* (May 28, 2020) at 2.
[149] *See Wyoming v. U.S. Dept. of Agric.*, 661 F.3d 1209, 1253 (10th Cir. 2011).
[150] Kitzmann qtd. in Gardner-Smith, *supra* note 33.
[151] Lusk qtd. in Gardner-Smith, *supra* note 33.
[152] *See*, *inter alia*, Gardner-Smith, *supra note* 33.
[153] *Id*.
[154] See, *inter alia*, Gardner-Smith, *supra* note 33.
[155] Sarah Tory, *Efforts to relocate an ancient wetland could help determine the fate of a water project on lower Homestake Creek*, Aspen Journalism (Nov. 2019) and *The Rocky Mountain Fen Research Project*, https://coloradomtn.edu/wp-content/uploads/filebase/programs/nrm/Rocky_Mtn_Fen_Research_Project.pdf (last visited June 22, 2020) at 1.

planning and decisionmaking."[156] Courts, interpreting these regulations, note that WRNF must analyze the environmental impact of these connected actions during scoping: "In determining the 'scope' of a proposed project, the responsible Forest Service officer is required to consider the cumulative impacts of connected, cumulative, and similar actions, and is required to produce an EA if the proposed project may have a significant effect on the environment."[157]

The Whitney Creek geotechnical investigation is justified by and interdependent on a planned dam in the lower Homestake Valley which would share a name with this geotechnical investigation. The WRNF must analyze the dam as a reasonably foreseeable future action, and also explain why it is not considered a "connected action" to the geotechnical investigation.

In conclusion, the WRNF must conduct comprehensive NEPA analysis to appropriately analyze the many valuable resources that may be impacted by this proposal, with multiple opportunities for public participation. The Whitney Creek geotechnical investigation and the Whitney Reservoir might directly, indirectly, and cumulatively have a significant effect on wetlands — especially fens — and on roadless and on wilderness areas.[158] The Partners' statements and actions make clear that these impacts are significant: they contemplate drowning or draining acres of wetlands and potential fens, removing hundreds of acres from the Holy Cross Wilderness, and extending a dam wall into a Colorado roadless area. The Partners' funding of the Rocky Mountain Fen Research Project reveals their understanding that the dam will have significant impact on fens; separately, a 2016 study estimates that the dam would impact 26-180 acres of wetland.[159] The Partners' briefing of Colorado congressional delegation staff makes clear that the planned reservoir would have significant impact on wilderness: a road would be relocated onto steep hillsides which are now part of the Holy Cross Wilderness. Finally, each of the maps provided by the Partners shows dam walls extending into a designated Colorado roadless area.

The first step in evaluating this proposal undoubtedly requires preparation of at least an EA before the geotechnical investigation proceeds. The EA should analyze the impact of the geotechnical investigation on wetlands and take seriously possible alternatives which would mitigate impact; it should map fens and acknowledge that there can be no impact on these irreplaceable resources; it should analyze the effects of subsurface and geophysical investigations on wilderness and roadless areas.

It should also analyze the reasonably foreseeable impacts of the Whitney Reservoir project. It should carefully consider the impact of the dam on wetlands, including fens, wilderness, and roadless areas. It should take into account plans to construct pumpbacks into the proposed

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[156] 40 CFR § 1501.3(b).
[157] *Sierra Club v. Bosworth*, 510 F.3d 1016, 1027 (9th Cir. 2007).
[158] CEQ regulations mention direct and indirect *impacts* as well as cumulative *effects*. They provide that "effects and impacts as used in these [NEPA-interpreting] regulations are synonymous." 40 CFR § 1508.8(b).
[159] *See Eagle River Memorandum of Understanding Project Alternatives Study - Phase 2, Table 1-6*, *supra* note 137.

reservoir from Fall Creek, Peterson Creek, and likely the Eagle River.[160] It should calculate the toll that drawing 20,000 acre feet per year, all of this removed from the Eagle River watershed, will take on the Eagle River watershed, paying attention to changes to the population of the Eagle Valley since the ERMOU was signed. It should develop alternative plans, including a no action alternative, under 40 CFR § 1508.25(b).

The Homestake Valley is extraordinary, as are its wetlands and fens and the animals which rely upon them. This proposal, which would likely significantly impact the Valley's natural environment, must be analyzed with the care mandated under federal law.

Thank you for your consideration of these comments.

Sincerely,

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[160] Regarding planned pumpbacks, *see id*. at 1-2 ("The new reservoir would be used to capture water from Homestake Creek and to store water diverted and conveyed from the Eagle River at Camp Hale and possibly from Fall Creek and Peterson Creek north of the Holy Cross Wilderness area") and Stringer, *supra* note 141 at Map 2. Among problems with pumping water from high alpine Fall and Peterson Creeks, we note that pumpbacks from the Eagle River near Camp Hale have the potential to disturb wetlands around Camp Hale which the Partners are working with the National Forest Foundation to restore. *See Camp Hale-Eagle River Headwaters Restoration Project*, *supra* note 34 at 4.

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Cc Fish and Wildlife Service
Environmental Protection Agency

Maps:
Appendix I: Map of Wetlands in Project Area
Appendix II: Map of Wetlands and Proposed Boring Sites
Appendix III: Map of Fens in Project Area
Appendix IV: Map of Fens and Proposed Boring Sites

Other Resources:

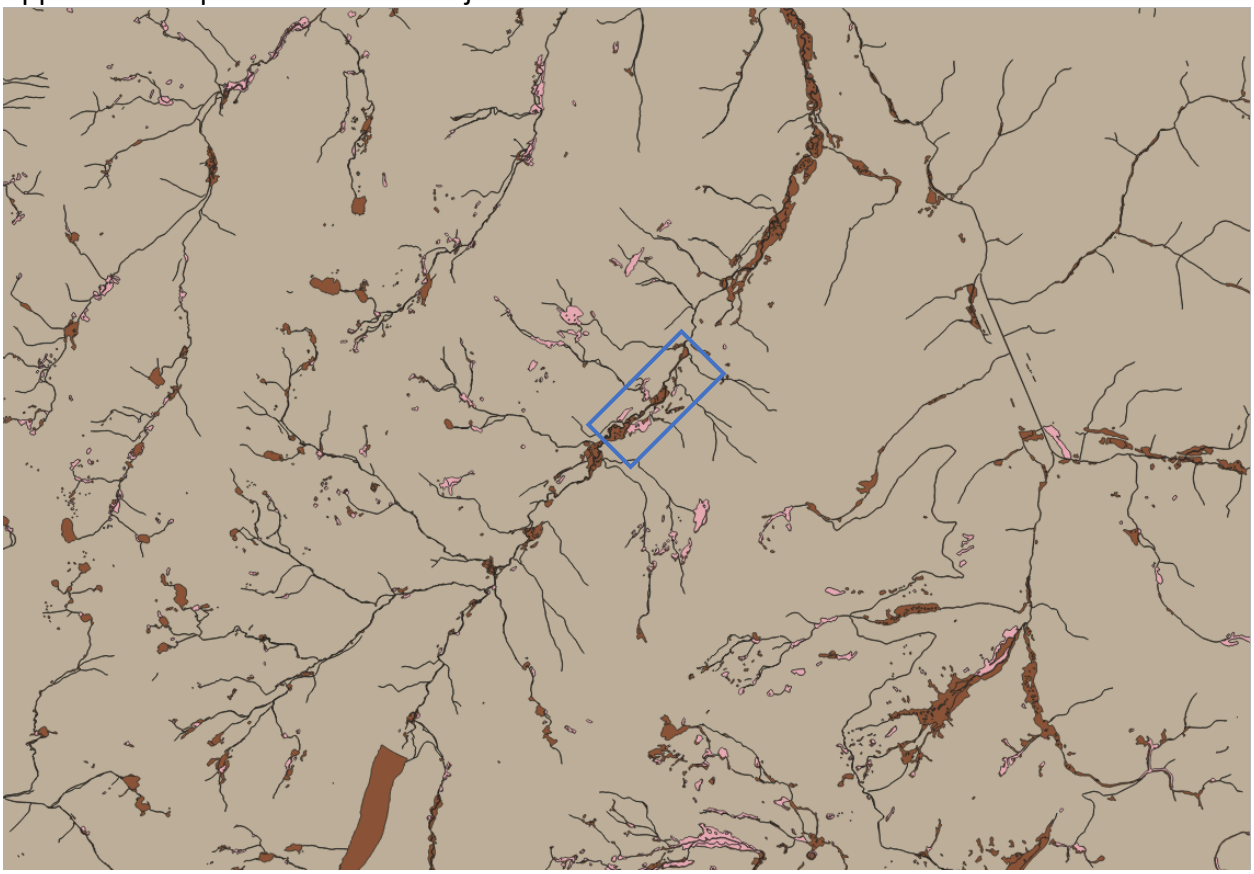
Appendix V: ERMOU Project Investigations Memorandum, Eagle River Memorandum of Understanding Project Alternatives Study - Phase 2, Subsurface Investigations - ERMOU Whitney Creek Reservoir Alternatives
Appendix VI: Tory, *Efforts to relocate an ancient wetland could help determine the fate of a water project on lower Homestake Creek*
Appendix VII: Gardner-Smith, *Aurora, Colo. Springs seek to drill on lower Homestake Creek dam sites*
Appendix VIII: Stringer, *Aurora, Colorado Springs move toward building additional Homestake reservoir*
Appendix IX: McGregor, *Forest fens foster Ice Age relict plants*
Appendix X: Rocky Mountain Fen Research Project
Appendix XI: Geologic Map of the Homestake and Slide Lake Shear Zones, Eagle and Lake Counties, Colorado

NOTE: The license for the Colorado Natural Heritage Project's Colorado Wetland Inventory has expired, and they are working now to bring it back online. We will update the WRNF as soon as the CWI map is back online: it is the most comprehensive publicly available map of wetlands in Colorado, and is easily navigable. Data for wetland – displayed in brown below – is available online via the National Wetland Inventory. But because of licensing issues around fens mapped by the CNHP, data for potential fens – displayed in pink below – is not available online while the CWI is offline.

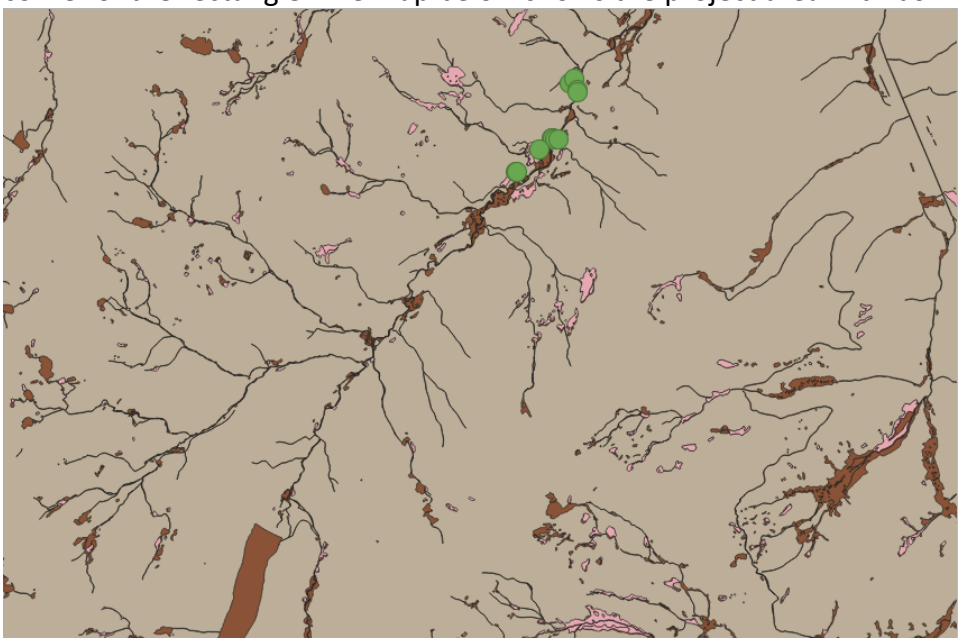
We list here, for reference, the coordinates of the proposed boring sites, mapped below:

A1a — 39.43509, -106.401119
A1b — 39.434949, -106.400899
A2 — 39.434891, -106.400341
A3 — 39.434803, -106.399689
A4 — 39.344127, -106.402728
A5 — 39.433153, -106.403802
B1 — 39.429560, -106.408883
B2 — 39.429296, -106.408740
D1a — 39.444258, -106.397185
D1b — 39.444908, -106.397185
D2 — 39.443031, -106.395546
D3 — 39.442753, -106.395510

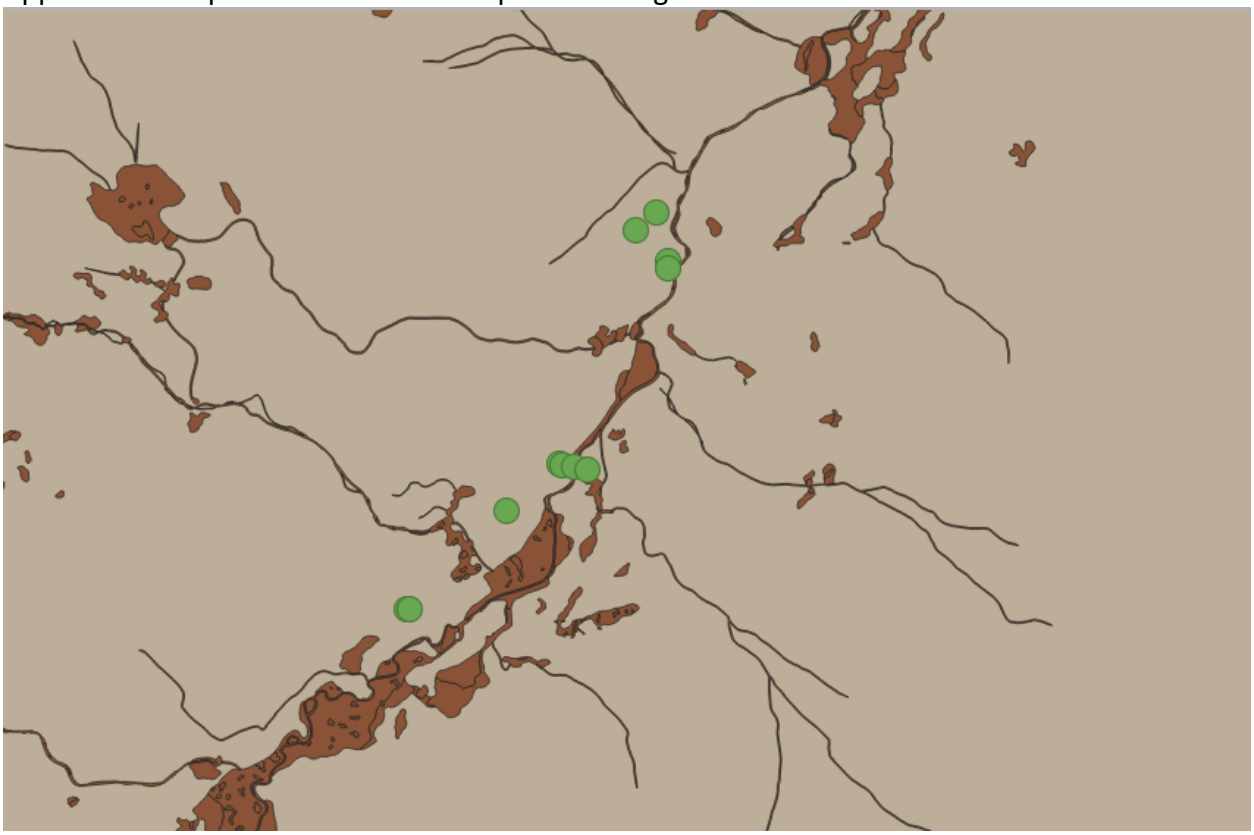
Appendix I: Map of Wetlands in Project Area



Fens are marked in pink, and wetlands and riparian areas in brown. Homestake Reservoir is visible at the bottom right, and Homestake Creek descends from it toward the project area. The rectangle delimits the project area. Whitney Creek flows into Homestake Creek at the left-most corner of the rectangle. The map below shows the project area with boring sites marked.

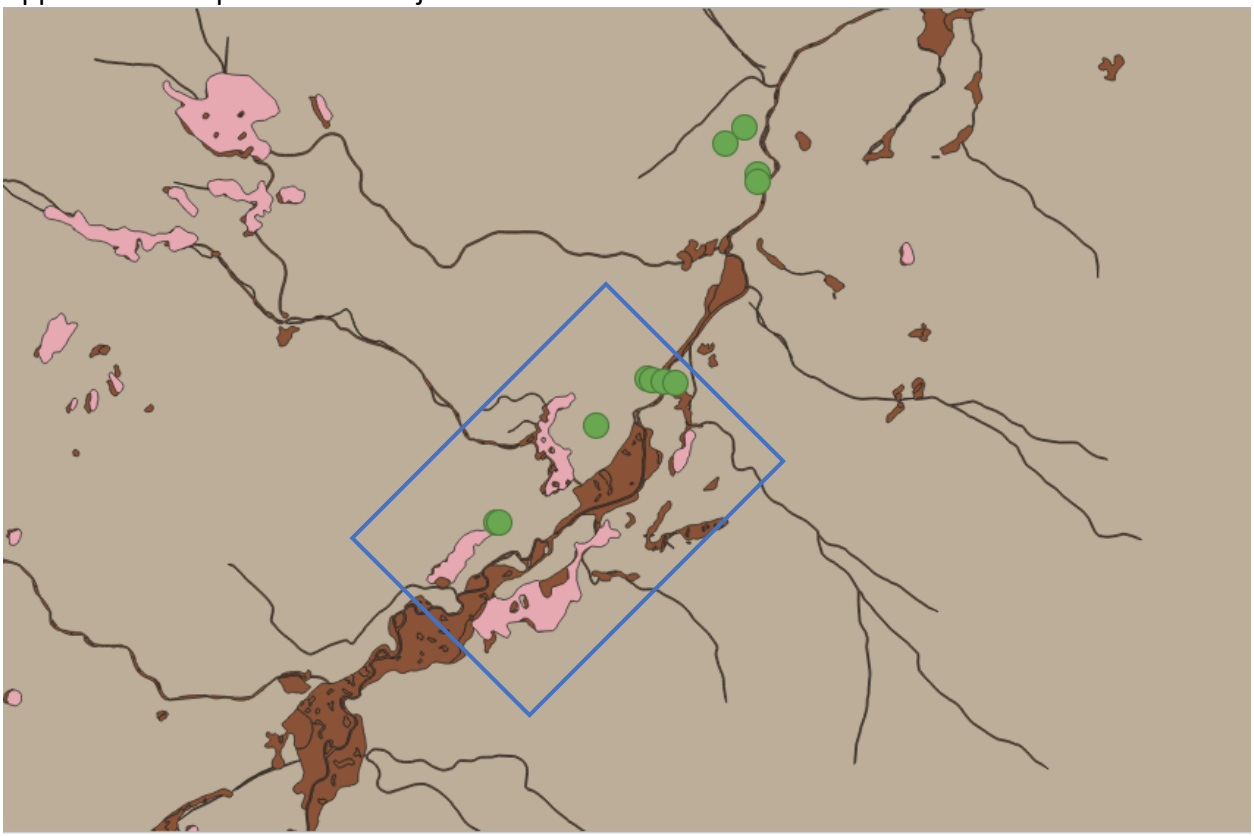


Appendix II: Map of Wetlands and Proposed Boring Sites



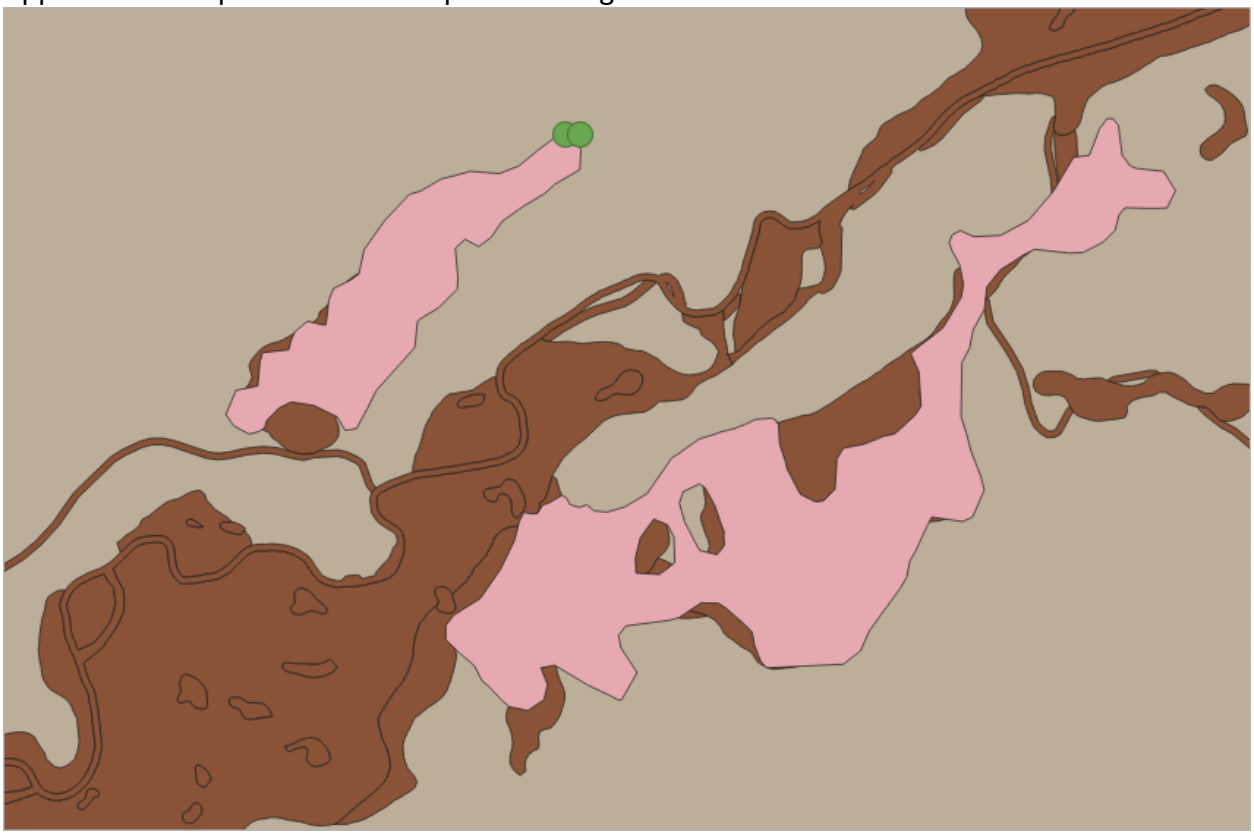
The two B boring sites are at the bottom left; the next cluster is the A sites; the final cluster is the D sites. This map does not include riparian metadata – the whole project area is a riparian zone, and this makes the wetlands difficult to distinguish – or potential fen locations.

Appendix III: Map of Fens in Project Area



Boring sites are marked in green. Again, the B cluster is at bottom, followed downstream by the A cluster and the D cluster; wetlands, generally, are in brown and potential fens – fens being a specific kind of wetland – are in pink. The four potential fens mentioned in the comments above are grouped next to the road, within the rectangle.

Appendix IV: Map of Fens and Proposed Boring Sites



This map focuses on the drilling locations for alternative B. Both, as marked, are located at the corner of a potential fen.

We attach, below, a link to a Google Drive file, which can be viewed using GIS software, that collates the information displayed above. The layers marked in the maps included here are "Whit Final," which marks the boring sites, "Fens_from_Web_Jan2019," "CO_Riparian," "CO_Wetlands," "CO_Wetlands_Historic_Map_Info," "CO_Wetlands_Project_Metadata," and "Colorado."

Google Drive link:

https://drive.google.com/file/d/10kvSttcx7FNQC8r3l4zt3F9LdCMs_ZF0/view?usp=sharing

Appendix V

Colorado River District
Protecting Western Colorado Water Since 1937

MEMORANDUM
7/7/2016

TO: **BOARD OF DIRECTORS, CRWCD ENTERPRISE**
ERIC KUHN, GENERAL MANAGER
PETER FLEMING, ESQ.

FROM: **JOHN CURRIER, P.E. CHIEF ENGINEER**

SUBJECT: **ERMOU PROJECT INVESTIGATIONS**

Board action requested. *Staff requests Board authorization to amend contract CA15035 with Wilson Water Group upwards by $136,000, to a total of $297,000. The requested increase will cover the River District's 25% share of feasibility level geotechnical field investigations at the existing Eagle Park Reservoir dam and at two alternative Whitney Creek Reservoir dam sites.*

Note. *The amount requested is based on a draft scope of work for the Eagle Park Reservoir portion of the work. This scope will be finalized prior to the board meeting and the specific amount requested will be adjusted accordingly.*

Contract Summary

- The River District has been funding 25% of Eagle River MOU investigations under the arrangement originally contemplated in the 1998 MOU for feasibility level investigations. Other funders at 25% each are; 1) Climax, 2) the Cities (Colorado Springs and Aurora), and 3) Eagle River entities (Eagle River Water and Sanitation District, Upper Eagle Regional Water Authority and Vail Associates).

- We recommend that this be the last request under the 25% cost share arrangement. Project investigations are clearly reaching the point contemplated in the ERMOU where parties should participate according to the percentage of project yield to be acquired.

- In July 2015 the Board authorized entering into an $86,000 contract with Wilson Water Group to fund the 25% River District share of *Eagle River MOU Project Alternatives Study – Phase 2*.

- In March 2016 the Board authorized an $80,500 contract amendment to fund additional work requested by the ERMOU parties. This included evaluating several additional Whitney Ck. reservoir alternatives, Camp Hale restoration coordination with the National Forest Foundation plus Whitney Creek wetlands investigations and permitting for the Whitney Creek geotechnical work.

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In March we notified the board that geotechnical work for the Whitney Creek sites was estimated at $107,500 (River District 25%) but we recommended that the board hold off authorization pending completion of wetlands (fen) investigations.

Scope of Work for Requested Contract Amendment

The requested authorization includes:

1. *Geotechnical investigations at Eagle Park Reservoir ($62,500 River District 25%)*[1].

   One of the findings of the Phase 2 Study was a determination that the cost of enlarging Eagle Park Reservoir from 3,300 AF to 7,950 AF is very dependent on the cost of required foundation treatment. The high estimate is $70.8 million, the low estimate is $39.1 million, a $30+ million swing depending on required foundation treatment.

   The West Slope ERMOU parties believe that an Eagle Park enlargement may ultimately be very attractive because the environmental and permitting issues are much, much simpler than a Whitney Creek alternative. Given the foundation treatment cost implications the West Slope parties argued that geotechnical work at Eagle Park is just as important as it is at Whitney Creek and should be conducted as soon as possible under the current 25% cost share arrangement.

2. *Geotechnical investigations on one or two alternative Whitney Ck. dam axes (up to $73,000 River District 25%).*

   Three borings will be drilled along the dam axis of the preferred site to better characterize the foundation conditions and determine the required foundation treatment.

   If the foundation conditions at the preferred site are determined to be unfavorable for dam construction then three borings will be drilled along an alternative dam alignment.

   Drilling at the Whitney Creek site(s) is contingent on two factors:

   a. If fen wetlands are found and determined to be a fatal flaw then no geotechnical work will take place. If fens are found I expect a lengthy debate about the quantity and quality of fens required to be a fatal flaw. Wetlands investigations are currently underway.

   b. The receipt of a Forest Service permit to conduct the drilling. It is generally understood that a permit will be issued, but due to USFS staffing constraints it may not be issued in time for the work to be completed this year.

[1] Preliminary cost estimate. A specific scope of work and cost estimate will be available by the board meeting date.

Moving Forward

The Phase 2 Study is a good catalyst for discussions among the ERMOU parties on how to move an ERMOU project forward. Over the next 6 months or longer, we expect a lot of discussion by the parties, both internally and together, on how to move forward from here. Questions include:

1. How much of the contemplated ERMOU yield does each party realistically need?
2. Can the parties show purpose and need for the yield?
3. When is that yield needed?
4. Are the parties ready to start project permitting?
5. Based on all of the above how should costs be allocated going forward?

The River District has told the parties that we do not anticipate needing a lot of yield out of a future project, possibly several hundred acre-feet. The Enterprise currently owns 431 AF in the Eagle River basin of which 176 AF remains to be contracted. The amount under contract has not increased significantly since 2003 and we do not expect significant increases in the near future.

In closing, the origin and evolution of the ERMOU has followed a lengthy and winding path, dating back to Eagle County's denial of a 1041 permit for the Homestake II project. At some point, possibly October, we would like to provide the Board a thorough review of the ERMOU origin and evolution.

Attachments (available on web site)

1) 1998 ERMOU Executive Summary
2) 2016 ERMOU Phase 2 Study Executive Summary
3) Whitney Creek Geotechnical Investigation SOW

EAGLE RIVER MEMORANDUM OF UNDERSTANDING

Executive Summary

1. Parties. Cities of Aurora and Colorado Springs, Colorado River Water Conservation District, Cyprus Climax Metals Company, and the Vail Consortium consisting of the Eagle River Water and Sanitation District, Upper Eagle Regional Water Authority and Vail Associates, Inc.

2. Objective. Development of a joint use water project that meets the water requirements of the participants, minimizes the environmental impact, is technically feasible and cost effective.

3. Process. The parties have agreed to study four joint use project alternatives. They are a Climax based alternative, Homestake Creek based alternative, Camp Hale groundwater recharged reservoir, and mixtures of the above. The parties also agree to undertake an analysis of the feasibility of an alternative that utilizes a pumpback from Ruedi Reservoir to Boustead Tunnel.

4. Scope of Study. (a) The study of the project alternatives will analyze the yield, technical feasibility, cost, environmental impacts and permitting of the four alternatives. An initial written report which compares and ranks the various alternatives on each of the foregoing aspects of the study and a preliminary environmental analysis of the alternatives have been completed. The MOU provides more detailed levels of engineering and environmental study to initiate permitting, additional water right applications, and detailed design work as various phases of any final joint use project are selected and developed.

(b) The cost of the initial written report is being split 25% by the Cities, 25% by Climax, 25% by the River District and 25% by the Vail Consortium. Future studies are to be split according to the percentage of project yield to be acquired by a given party.

5. Preliminary Findings. The MOU recognizes that the preliminary environmental analysis of the joint use project alternatives has identified significant environmental concerns associated with the Homestake Creek based alternatives. Hence, these alternatives are no longer considered leading or preferred alternatives for purposes of the MOU.

6. Yield. The MOU provides for the River District and Vail Consortium to obtain up to 10,000 af of firm annual yield; the Cities to obtain up to 20,000 af of yield on a 25 year rolling average (plus the potential additional increment detailed in paragraph 6(d) below); and Climax to obtain up to 3000 af of storage space.

7. Project Phasing. (a) Phase 1 is the existing, reclaimed Eagle Park Reservoir which is to provide 2013 af of firm annual yield. All of this phase is allocated to the Vail Consortium and the River District.

(b) Phase 2 is the next 2000 af to 4000 af of firm annual yield to be developed by the parties. It is anticipated this yield will result from an enlargement of Eagle Park Reservoir or the reclamation of Robinson Reservoir. The first 2000 af of Phase 2 will be split 50% by the Vail Consortium/River District and 50% by the Cities. Should the yield of Phase 2 exceed 2000 af, the Cities shall have the first right of refusal of any increment between 2000 af and 4000 af of Phase 2 (4000 af and 6000 af of the combined yields of Phases 1 and 2).

(c) Phase 3 is all remaining yield of any joint use project. Up to the yield limits set forth in paragraph 6 above, the parties shall have a pro rata right of first refusal to any yield of Phase 3. In addition, the Vail Consortium/River District shall have the option to purchase from the Cities up to 1000 af of the firm yield of Phase 2. The option price is the price paid by the Cities plus an intervening inflation index. This option is provided as it is anticipated that the cost of Phases 1 and 2 will be substantially less than the cost of any Phase 3 water, and will enable the Vail Consortium and River District to obtain up to 4000 af of Phase 1 and 2.

(d) To the extent the Vail Consortium/River District do not exercise their first refusal rights to the Phase 3 water, then the Cities may acquire this yield to the extent they make available to the Vail Consortium/River District at no cost one acre foot for every acre foot in excess of the 20,000 af rolling average. In other words, if the total yield of all project phases is 30,000 af and the west slope entities only acquire 4000 af of Phases 1 and 2, then the Cities could use up to 23,000 af if they make 3000 af available to the west slope entities at no cost. This is an important mechanism for the west slope to share in a portion of Phase 3 which may be cost prohibitive to the west slope.

8. Interim Supply. To the extent any subsequent project phases temporarily disrupt the operation of Eagle Park Reservoir, during the period of disruption the Cities shall make up to 2013 af of firm annual yield available to the west slope entities from Homestake Reservoir.

9. Permitting. The MOU contains a detailed provision on the nature and scope of the federal, state and local permits which the parties shall mutually cooperate to obtain for the various phases of any joint use project selected by the parties. The obligation to support the issuance of such project permits shall continue even if a party chooses not to participate in a given project phase. The failure by the Vail Consortium/River District to meet this obligation shall void the Cities' subordination to the Eagle Park Reservoir project (project Phases 1 and 2).

10. Ditch & Reservoir Company. The MOU provides for the possible formation of a nonprofit, ditch and reservoir company to hold title to any joint use project developed by the parties, and the general parameters of the structure of such a company.

11. Water Rights. The Cities agree to withdraw their statements of opposition to the pending and proposed applications regarding the Eagle Park Reservoir project and agree to subordinate their water rights to Phases 1 and 2 of the project (the first 4000 af of firm annual yield). In turn, the Vail Consortium, River District and Climax agree not to oppose the Cities' pending applications for the Camp Hale and Eagle River conjunctive use water rights; provided, however, that the River District shall retain special rights to review certain aspects of the Cities' applications.

12. Replacement Water Requirement. In consideration for the foregoing subordination, and conditioned upon the Vail Consortium/River District's purchase of Phase 1 of the Eagle Park Reservoir project, these western slope entities agree to annually provide to the Cities the following amounts of replacement water from Green Mountain, Ruedi or Wolford Reservoirs for the following projects:

Eagle Arkansas Project - 150 af
Camp Hale Project - 225 af

The replacement water is to be provided only in the event a joint use project is not developed and the Cities independently develop certain identified rights.

13. Homestake Exchange. The existing three year 300 af exchange agreement with Aurora is expanded into a 25 year agreement whereby the Cities shall release 500 af per year from Homestake Reservoir for the benefit of the Vail Consortium and the River District. In return, these western slope entities make available to the Cities 800 af of water per year from Green Mountain, Ruedi and/or Wolford Reservoirs. Provided, there is no breach of the MOU, the Vail Consortium and River District shall have the right to extend this exchange in perpetuity.

14. Joint Use Project Water Rights. The MOU provides a list of water rights which the parties pledge to make available to any joint use project developed by the parties. The Cities also agree to cap the yield of their Eagle River basin water rights at the yield amounts contained in the MOU (e.g. the 20,000 af to 23,000 af running average depending on the amount of Phase 3 water purchased by the western slope).

15. Project Cost Sharing. The MOU leaves for future negotiations the sharing of costs for the construction, operation and maintenance of Phase 3 of the project.

DRAFT
TECHNICAL REPORT

EAGLE RIVER MEMORANDUM OF UNDERSTANDING
PROJECT ALTERNATIVES STUDY – PHASE 2

Prepared for:

Aurora Water
Climax Molybdenum Company
Colorado River Water Conservation District
Colorado Springs Utilities
Eagle Park Reservoir Company
Eagle River Water and Sanitation District
Upper Eagle Regional Water Authority
Vail Associates, Inc.

Prepared by:

Wilson Water Group, LLC
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W.W. Wheeler & Associates, Inc.

April 19, 2016

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Section 1 Executive Summary

1.1 Purpose

The Eagle River Memorandum of Understanding (ERMOU) Project Alternatives Study Phase 2 (Study) provides evaluations of project alternatives to develop water storage and conveyance projects in the Eagle River basin for West Slope and East Slope interests. The purpose of this report is to present methodology and results of engineering, costing, water yield, and environmental evaluations associated with the Study.

1.2 Background and Objectives

The ERMOU contemplates development of a joint East Slope / West Slope water supply project to be located in the headwaters of the Eagle River watershed in Eagle County, Colorado. Cooperative partners and signatories to the ERMOU are the cities of Aurora and Colorado Springs, the Colorado River Water Conservation District, Climax Molybdenum Company, and the Vail Consortium comprised of Eagle River Water and Sanitation District, Upper Eagle Regional Water Authority, and Vail Associates (Partners). The ERMOU was executed in 1998.

The primary objectives of the ERMOU are as follows:

- West Slope Water Users: Develop a firm dry year yield of 10,000 acre-feet (ac-ft) per year.
- Aurora and Colorado Springs: Develop an average yield of 20,000 ac-ft per year.
- Climax: Develop an additional 3,000 ac-ft of water storage.

Numerous development alternatives for the ERMOU have been considered and evaluated by the Partners. These evaluations focused on individual projects at multiple locations in the Eagle River basin, but did not identify how project yields could be developed through a combination of projects. This Study was performed to evaluate combinations of water storage/conveyance projects in the Eagle River basin for the Partners, including two levels of evaluation as follows.

- **Tier 1 – Feasibility-Level Study:** Tier 1 evaluations were completed for three project alternatives (Eagle Park Reservoir, Whitney Creek Reservoir, and Bolts Lake) that were identified in Phase 1 of the Study as requiring additional feasibility-level study. These three alternatives are considered key facilities with good potential to contribute to ERMOU water yield objectives and that require refined information and decision processes for feasibility-level evaluation.

- **Tier 2 – Preliminary-Level Review:** Tier 2 evaluations were completed for four project alternatives (Wolcott Reservoir, Piney River Reservoir, Iron Mountain Reservoir, and Eagle-Arkansas Ditch) that were identified in Phase 1 of the Study as requiring additional preliminary-level review. These four alternatives require compilation of more preliminary information to assess their potential to contribute to ERMOU water yield objectives. The Wolcott Reservoir site is the only Tier 2 project alternative for which engineering, costing, water yield, and environmental evaluations were performed.

Following are descriptions of the three ERMOU Tier 1 project alternatives and the four ERMOU Tier 2 project alternatives, all located in Eagle County, Colorado. **Figure B-1** presents a site location map.

Eagle Park Reservoir

Eagle Park Reservoir is located near the western boundary of Climax Molybdenum Mine near Fremont Pass. The reservoir was formerly used by Climax as a tailings pond, and was later rehabilitated as a fresh water reservoir for augmentation, municipal, and instream uses by downstream entities including Vail Resorts, Eagle River Water and Sanitation District, the Upper Eagle Regional Water Authority, and the Colorado River Water Conservation District. The reservoir would be enlarged to store water from the East Fork Eagle River watershed for use by Climax and West Slope ERMOU Partners, or transferred to the Arkansas River basin for use by East Slope ERMOU Partners. This Study evaluated feasibility of an enlargement of the reservoir and added diversion and conveyance facilities to meet a portion of ERMOU yield objectives.

Whitney Creek Reservoir

The Whitney Creek Reservoir site would be located in the Homestake Creek valley downstream of the confluence with Whitney Creek. The new reservoir would be used to capture water from Homestake Creek and to store water diverted and conveyed from the Eagle River at Camp Hale and possibly from Fall Creek and Peterson Creek north of the Holy Cross Wilderness area. Project water stored in the reservoir would be transferred by pump to Homestake Reservoir for use by East Slope ERMOU Partners, or released to Homestake Creek for use by West Slope ERMOU Partners. This Study evaluated feasibility of various reservoir sizes and various diversion and conveyance facilities to meet a portion of ERMOU yield objectives.

Bolts Lake

Bolts Lake, located along the Eagle River just south of the town of Minturn, was constructed at the turn of the last century and historically used as a recreational fishing and boating pond. The dam was breached in 1997 and currently does not store water. Bolts Lake would be restored and used to store water from the Eagle River or Cross Creek that would be released for use by West Slope ERMOU Partners. This Study evaluated the feasibility of replacing the existing dam and developing new diversion and conveyance facilities to meet a portion of West Slope ERMOU yield objectives.

Wolcott Reservoir

The Wolcott Reservoir site would be located approximately one mile north of Interstate 70 near Wolcott, Colorado on Alkali Creek. The new reservoir would store water from Alkali Creek and the Eagle River and release it at Dowds Junction for West Slope uses. This Study evaluated feasibility of a reservoir and diversion and conveyance facilities to meet West Slope ERMOU yield objectives.

Piney River Reservoir

Piney River Reservoir was initially identified by Denver Water as part of their Eagle-Piney Eagle-Colorado project as a potential extension of its Robert Tunnel Collection System. Subsequently, a smaller version of that concept was proposed to store water from the Piney River and its tributaries, deliver it to Red Sandstone Creek basin, and gravity flow to Gore Creek and the Eagle River. This Study provides a summary of key operational, hydrologic, and environmental components concerning preliminary feasibility as an ERMOU project.

Iron Mountain Reservoir

Iron Mountain Reservoir is the principal feature of the Red Cliff Project initially conceived as an on-channel reservoir on Homestake Creek. Homestake Creek yield to the reservoir was to be supplemented by supply from the Eagle River and Fall and Peterson Creeks. The project was also conceived to include hydropower infrastructure and operations. This Study provides a summary of existing information concerning preliminary feasibility as an ERMOU project.

Eagle-Arkansas Ditch

The Eagle-Arkansas Ditch is a concept that would divert water from the East Fork and South Fork Eagle River drainage basins and convey the water by gravity to the Arkansas River basin for use by East Slope interests. This Study provides a summary of existing information concerning preliminary feasibility as an ERMOU project.

1.3 Results and Conclusions

ERMOU projects and facilities identified in this Study would provide a wide range of feasible options to meet portions of ERMOU yield objectives. Following are results and conclusions associated with engineering and cost evaluations, water supply and project yield evaluations, and environmental evaluations.

Engineering and Costs

This Study includes feasibility-level engineering evaluations and new cost opinions for project components that had not been previously evaluated by others, as well as updated cost opinions for project components previously evaluated by others. Evaluations are consistent with a Class 5 level study as defined by the Association for the Advancement of Cost Engineering (AACE), which provides a level of project definition up to two percent, and a cost opinion reliability from minus 20–50 percent to plus 30–100 percent. Evaluations were performed using simplified engineering analyses with limited data and relied significantly on engineering judgement and experience with similar projects. Cost opinions were completed for various facility configurations associated with Eagle Park Reservoir, Whitney Creek Reservoir, Bolts Lake, and Wolcott Reservoir, as presented in **Table 1-1**. Detailed descriptions of these facilities are provided in **Section 3.2**.

Table 1-1. Opinion of Probable Construction Costs – ERMOU Project Alternatives

Component	Conveyance Origin	Capacity	Average Pump Rate (ac-ft/yr)	Capital Cost ($M)	Fixed O&M Cost[4] ($M)	Variable O&M Cost[4] ($M)	Total Cost[5] ($M)
Eagle Park Reservoir							
Dam[1]	-	7,950 ac-ft	-	$ 68.4	$ 2.4	$ -	$ 70.8
Dam[2]	-	7,950 ac-ft	-	$ 37.8	$ 1.3	$ -	$ 39.1
Pipe/Pump	Eagle R blw Resolution Ck	40 cfs	8,000	$ 88.2	$ 12.0	$ 41.8	$ 142.0
Pipe/Pump	Eagle R blw Resolution Ck	40 cfs	5,000	$ 88.2	$ 12.0	$ 35.5	$ 135.7
Pipe/Pump	Eagle R blw Resolution Ck	150 cfs	8,000	$ 177.4	$ 28.1	$ 112.5	$ 318.0
Pipe/Pump	Eagle R blw Resolution Ck	150 cfs	5,000	$ 177.4	$ 28.1	$ 106.0	$ 311.5
Pipe/Pump	E Fk Eagle R blw Jones G	100 cfs	8,000	$ 93.0	$ 15.1	$ 68.6	$ 176.7
Pipe/Pump	E Fk Eagle R blw Jones G	100 cfs	5,000	$ 93.0	$ 15.1	$ 63.1	$ 171.2
Pipe/Pump	E Fork Eagle R (exist PS)	50 cfs	1,500	$ 30.1	$ 5.2	$ 8.5	$ 43.8
Pipe/Pump	Eagle Park Res to Chalk Ck	50 cfs	7,000	$ 37.0	$ 5.1	$ 21.7	$ 63.8
Pipe/Pump	Eagle Park Res to Chalk Ck	50 cfs	3,500	$ 37.0	$ 5.1	$ 18.2	$ 60.3
Whitney Creek Reservoir							
Dam-Alt 1	-	4,600 ac-ft	-	$ 67.9	$ 2.4	$ -	$ 70.3
Dam-Alt 2	-	6,850 ac-ft	-	$ 82.0	$ 2.9	$ -	$ 84.9
Dam-Alt 3	-	20,000 ac-ft	-	$ 106.8	$ 3.8	$ -	$ 110.6
Dam-Alt 4	-	1,000 ac-ft	-	$ 45.9	$ 1.6	$ -	$ 47.5
Pipe[3]	Eagle R blw Resolution Ck	200 cfs	-	$ 44.7	$ 2.7	$ -	$ 47.4
Tunnel	Eagle R blw Resolution Ck	200 cfs	-	$ 92.2	$ 2.8	$ -	$ 95.0
Tunnel	Fall/Peterson Creeks	200 cfs	-	$ 135.7	$ 4.8	$ -	$ 140.5
Pipe/Pump[3]	Homestake Reservoir	200 cfs	20,000	$ 203.5	$ 21.7	$ 113.8	$ 339.0
Pipe/Pump[3]	Homestake Reservoir	200 cfs	13,000	$ 203.5	$ 21.7	$ 103.7	$ 328.9
Bolts Lake							
Dam/Liner	-	1,200 ac-ft	-	$ 28.9	$ 1.0	$ -	$ 29.9
Pipe/Pump	Eagle R (Div Str No. 2)	50 cfs	600	$ 21.5	$ 5.0	$ 0.8	$ 27.3
Pipe/Pump	Eagle R (Div Str No. 3)	50 cfs	600	$ 17.7	$ 4.9	$ 1.1	$ 23.7
Wolcott Reservoir							
Dam	-	45,000 ac-ft	-	$ 216.0	$ 6.7	$ -	$ 222.7
Pipe/Pump	Eagle R nr Alkali Ck	150 cfs	13,000	$ 38.2	$ 9.0	$ 25.3	$ 72.5
Pipe/Pump	Eagle R nr Dowds Jct	175 cfs	13,000	$ 130.7	$ 8.4	$ 11.3	$ 150.4

1. Foundation seepage improvements below existing and new dam
2. Foundation seepage improvements below new dam only
3. Based on 54-inch diameter pipe
4. O&M costs represent present day costs based on 50-year life-span, 6.3 % interest rate, 3.8% inflation rate
5. Costs for property acquisition and easements are not included; costs for conveyance facilities are based on unit costs developed by Black and Veatch (2009), escalated to 2016 dollars

Water Supply and Project Yield

Water yield evaluations were completed for varied configurations (current and potential) of Eagle Park Reservoir, Whitney Creek Reservoir, Bolts Lake, and Wolcott Reservoir. Evaluations included analyses of the amount of water supply and project yield that could be available for each alternative (project scenarios) and for combinations of scenarios (project portfolios). Primary objectives of these evaluations were to estimate firm dry year yield for West Slope supply and average yield for East Slope supply through operation of the project alternatives and to develop preliminary capacity needs for project conveyance and storage facilities.

Water supply and project yield were evaluated with a daily simulation model of the Eagle River watershed that simulates project water conveyance and storage for the historical 1946 through 2014 period. Yield estimates for 13 ERMOU scenarios associated with Eagle Park Reservoir (5 scenarios), Whitney Creek Reservoir (6 scenarios), Bolts Lake (1 scenario), and Wolcott Reservoir (1 scenario) were combined with cost opinions described in the previous section, resulting in cost/yield estimates for each of the 13 scenarios. Descriptions of the scenarios are provided in **Table 1-2**. Cost/yield estimates for each of the scenarios are presented in **Table 1-3**. Specific scenarios associated with Eagle Park Reservoir (EP4 and EP5) and Whitney Creek Reservoir (WC1, WC2, WC3, and WC5) each include five cost/yield estimates to represent a range of yield ratios balanced between West Slope and East Slope uses. Water supply and project yield evaluations are presented in their entirety in **Section 4**.

Table 1-2. ERMOU Scenarios

Scenario	Description
Eagle Park Reservoir	
EP1	An enlarged Eagle Park Reservoir (**7,950 ac-ft**) would receive water from the existing pump station and pipeline (**6 cfs**) located on the East Fork Eagle River, and the system would be operated exclusively for West Slope purposes.
EP2	Same configuration as **Scenario EP1**, except the existing pump station and pipeline would be replaced with an enlarged conveyance system (**25-50 cfs**). The system would be operated exclusively for West Slope purposes.
EP3	An enlarged Eagle Park Reservoir (**7,950 ac-ft**) would receive water from a new pump station and pipeline (**40 cfs**) from the Eagle River below Resolution Creek, and the system would be operated exclusively for West Slope purposes.
EP4	An enlarged Eagle Park Reservoir (**7,950 ac-ft**) would receive water from a new pump station and pipeline (**100 cfs**) from the East Fork Eagle River below Jones Gulch, and water could be transferred from Eagle Park Reservoir to Chalk Creek in the Arkansas River basin with a new pump station and pipeline (**50 cfs**). The system would be operated for both West Slope and East Slope purposes.
EP5	An enlarged Eagle Park Reservoir (**7,950 ac-ft**) would receive water from a new pump station and pipeline (**150 cfs**) from the Eagle River below Resolution Creek, and water could be transferred from Eagle Park Reservoir to Chalk Creek in the Arkansas River basin with a new pump station and pipeline (**50 cfs**). The system would be operated for both West Slope and East Slope purposes.
Whitney Creek Reservoir	
WC1	This scenario represents a reservoir size where encroachment of the Holy Cross Wilderness area would not occur from either construction activities or reservoir inundation. A new Whitney Creek Reservoir (**4,600 ac-ft**) would receive water from Homestake Creek and from the Eagle River below Resolution Creek through a new tunnel (**200 cfs**), and water would be transferred from Whitney Creek Reservoir to Homestake Reservoir with a new pump station and pipeline (**200 cfs**). The system could be operated for both West Slope and East Slope purposes.
WC2	Same configuration as **Scenario WC1**, except with a reservoir size (**6,850 ac-ft**) where encroachment of the Holy Cross Wilderness area would not occur from construction activities, but may occur from reservoir inundation. The system could be operated for both West Slope and East Slope purposes.
WC3	Same configuration as **Scenario WC1**, except with a relatively large reservoir size (**20,000 ac-ft**) with associated construction activities and reservoir inundation that would not be constrained by the existing Holy Cross Wilderness area boundary (i.e. that a Wilderness boundary adjustment could be secured). The system could be operated for both West Slope and East Slope purposes.
WC4	Same configuration as **Scenario WC1** except with a relatively small off-channel reservoir with a size (**1,000 ac-ft**) and location intended to reduce environmental impact and not encroach on the Holy Cross Wilderness area. The system would be operated as a forebay exclusively for East Slope purposes to transfer water to Homestake Reservoir; water could be released from Homestake Reservoir for West Slope purposes.
WC5	Same configuration as **Scenario WC3** with added water supply through a new tunnel (**200 cfs**) from Fall and Peterson Creeks. The system could be operated for both West Slope and East Slope purposes.
WC6	Same configuration as **Scenario WC4** with added water supply through a new tunnel (**200 cfs**) from Fall and Peterson Creeks. The system would be operated as a forebay exclusively for East Slope purposes to transfer water to Homestake Reservoir; water could be released from Homestake Reservoir for West Slope purposes.
Bolts Lake	
BL1	An upgraded Bolts Lake (**1,200 ac-ft**) would receive water from a new pump station and pipeline (**50 cfs**) from the Eagle River, and the system would be operated exclusively for West Slope purposes.
Wolcott Reservoir	
WR1	A new Wolcott Reservoir (**45,000 ac-ft**) would receive water from a new pump station and pipeline (**175 cfs**) from the Eagle River at Dowds Junction, and the system would be operated exclusively for West Slope purposes.

Table 1-3. Cost/Yield Estimates – ERMOU Scenarios

Scenario	Water Source	Capacity (cfs)		Capital Cost[1] ($M)	New Storage (ac-ft)	New Annual Yield[2] (ac-ft)			Cost/Yield ($/ac-ft)
		From Source	To E. Slope			W.Slope Firm	E.Slope Average	Total	
Eagle Park Reservoir									
EP1	E Fk Eagle R	6	0	$ 70.8	4,650	1,500	0	1,500	$ 47,200
EP2		50	0	$ 114.6	4,650	1,750	0	1,750	$ 65,486
EP3	Eagle R blw Res Ck	40	0	$ 212.8	4,650	3,000	0	3,000	$ 70,933
EP4	E Fk Eagle R blw Jones G	100	50	$ 311.3	4,650	0	4,200	4,200	$ 74,119
						250	3,700	3,950	$ 78,810
						1,100	3,200	4,300	$ 72,395
						1,750	2,800	4,550	$ 68,418
						2,250	1,800	4,050	$ 76,864
EP5	Eagle R blw Resolution Ck	150	50	$ 452.6	4,650	0	10,700	10,700	$ 42,299
						500	9,400	9,900	$ 45,717
						1,500	7,900	9,400	$ 48,149
						2,250	6,400	8,650	$ 52,324
						3,000	4,500	7,500	$ 60,347
Whitney Creek Reservoir									
WC1	Eagle R blw Resolution Ck	200	200	$ 504.3	4,600	500	16,900	17,400	$ 28,983
						1,250	16,200	17,450	$ 28,900
						1,750	15,500	17,250	$ 29,235
						2,250	14,700	16,950	$ 29,752
						2,500	12,700	15,200	$ 33,178
WC2		200	200	$ 518.9	6,850	750	16,800	17,550	$ 29,567
						1,750	16,100	17,850	$ 29,070
						2,500	15,300	17,800	$ 29,152
						3,000	14,500	17,500	$ 29,651
						3,750	12,300	16,050	$ 32,330
WC3		200	200	$ 544.6	20,000	2,250	16,100	18,350	$ 29,678
						4,250	14,800	19,050	$ 28,588
						6,500	13,300	19,800	$ 27,505
						8,750	11,700	20,450	$ 26,631
						10,000	9,500	19,500	$ 27,928
WC4		200	200	$ 481.5	1,000	-	15,600	15,600	$ 30,865
WC5	Eagle R blw Resolution Ck + Fall/Peterson Creeks	200	200	$ 685.1	20,000	2,750	23,100	25,850	$ 26,503
						5,000	21,600	26,600	$ 25,756
						7,000	19,700	26,700	$ 25,659
						9,000	16,900	25,900	$ 26,452
						11,000	13,500	24,500	$ 27,963
WC6		200	200	$ 622.0	1,000	-	19,900	19,900	$ 31,256
Bolts Lake									
BL1	Eagle R Bolts	50	0	$ 57.2	1,200	1,000	0	1,000	$ 57,200
Wolcott Reservoir									
WR1	Eagle R Dowds	175	0	$ 373.1	45,000	21,000	0	21,000	$ 17,767

[1] Capital costs associated with Eagle Park Res include seepage improvements below existing dam and new dam, which could be substantially reduced if not required below existing dam. See Table 1-1 for further reference.

[2] Eagle Park Res yields do not include storage allocation for Climax or use of existing 3,300 ac-ft storage. W Slope firm yields would be reduced by approximately 500 ac-ft for every 1,500 ac-ft of Eagle Park Res storage allocated to Climax. Recent model simulations of existing Eagle Park Res system result in existing W Slope firm yield of 1,750 ac-ft, which may differ from previous estimates by others due to recent hydrology/model refinements. Total yield estimates may represent best case; actual future operational mitigation strategies may substantially reduce yield.

Yield and cost results presented in **Table 1-3** for Eagle Park Reservoir and for Whitney Creek Reservoir are shown graphically on **Figure 1-1** and **Figure 1-2**, respectively, which are intended to illustrate the potential balance between West Slope firm yield and East Slope average yield that may be obtained through alternative operational strategies.

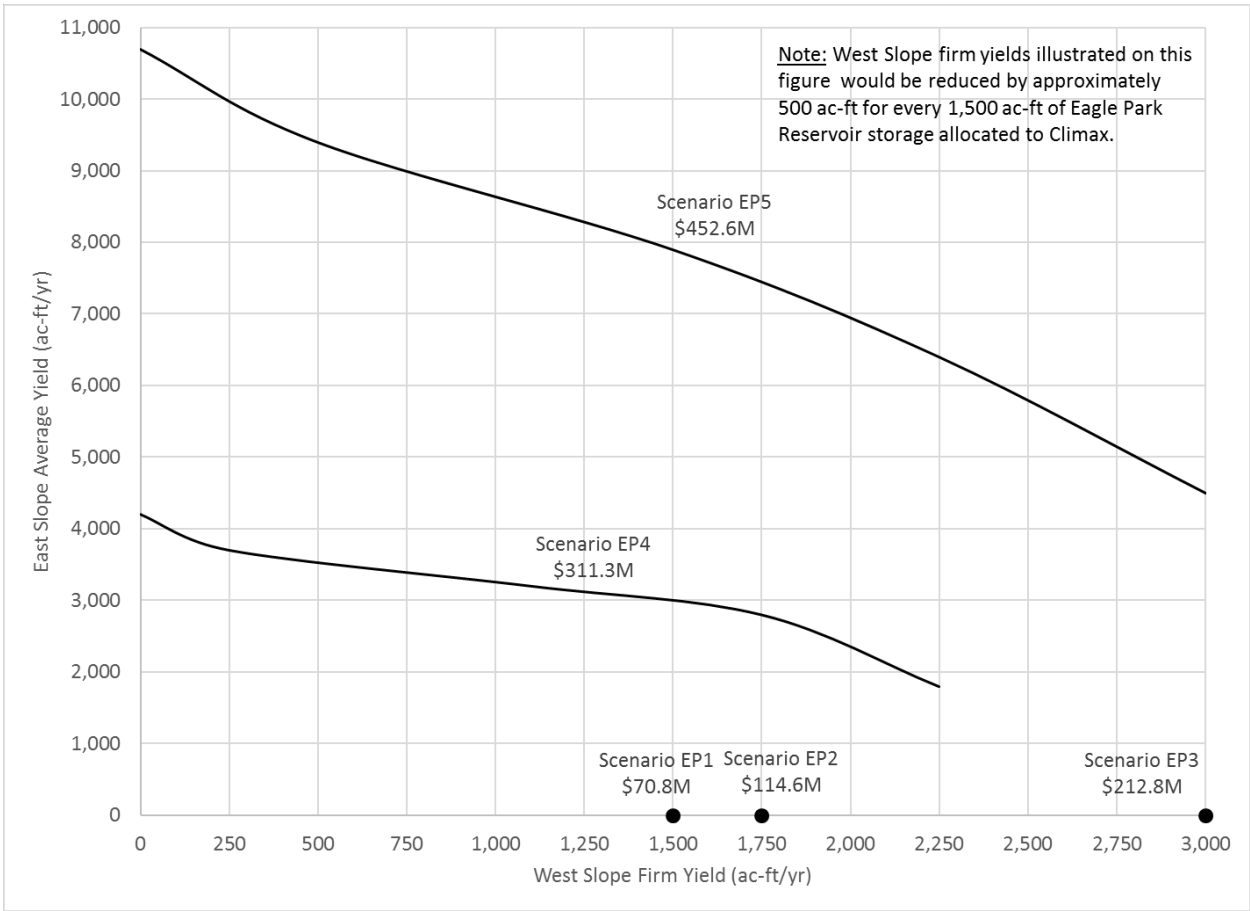

Figure 1-1. Yield Estimates – Eagle Park Reservoir Scenarios

As an example illustrated on **Figure 1-1**, Scenario EP2 (enlarged 7,950 ac-ft reservoir and enlarged 50 cfs pump station with water supply from the East Fork Eagle River, costing an estimated $114.6 million) could attain up to 1,750 ac-ft/yr of new West Slope firm yield with no average yield allocated to the East Slope. Alternatively, as also illustrated on **Figure 1-1**, Scenario EP5 (enlarged 7,950 ac-ft reservoir and new 150 cfs pump station with water supply from the Eagle River below Resolution Creek, costing an estimated $452.6 million) could attain up to 3,000 ac-ft/yr of new West Slope firm yield combined with approximately 4,500 ac-ft/yr of new East Slope average yield.

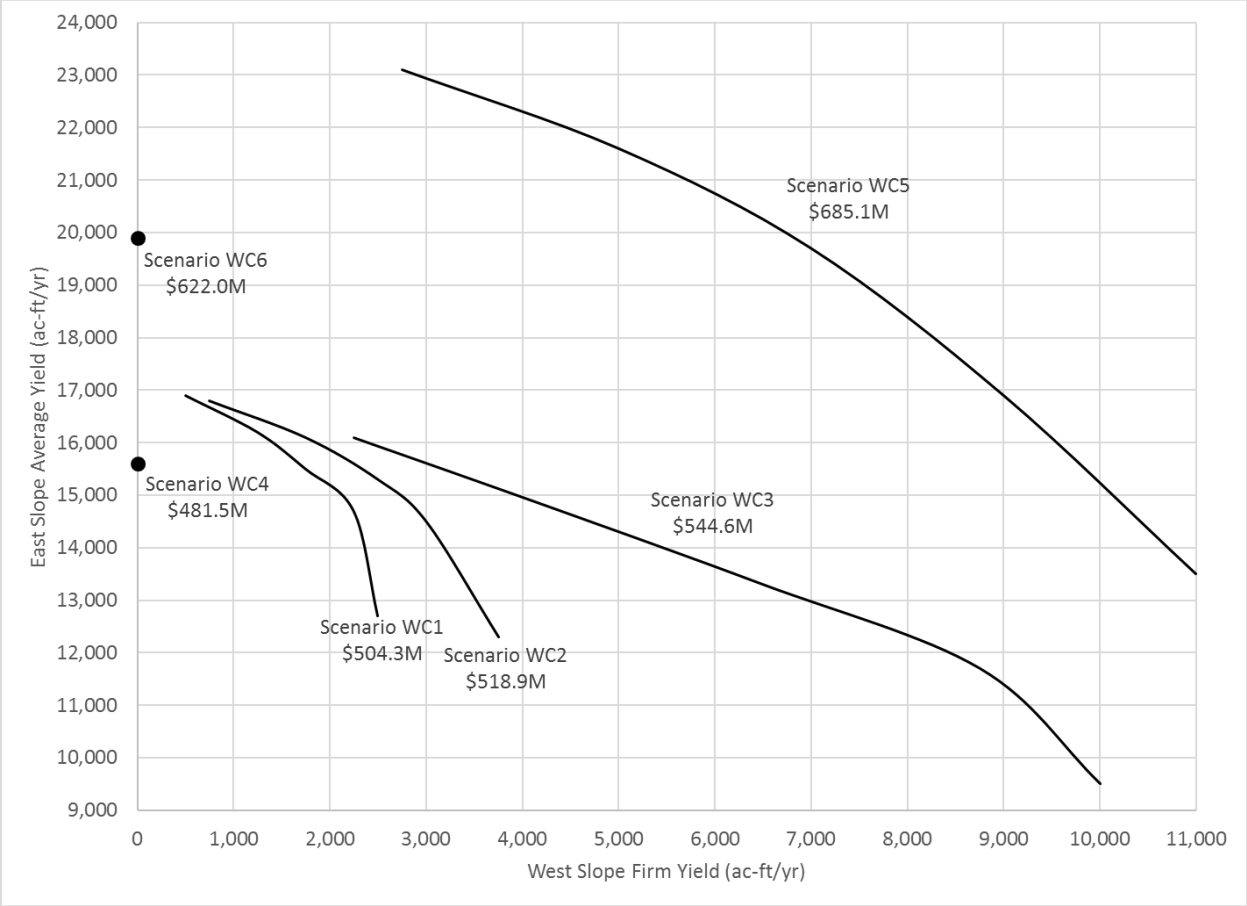

Figure 1-2. Yield Estimates – Whitney Creek Reservoir Scenarios

As an example illustrated on **Figure 1-2**, Scenario WC6 (relatively small off-channel forebay system with channel gravity-fed water supplies from Homestake Creek and tunnel gravity-fed water supplies from the Eagle River and Fall/Peterson Creeks, costing an estimated $622.0 million) could attain nearly 20,000 ac-ft/yr of East Slope average yield with no firm yield allocated to the West Slope. Alternatively, as also illustrated on **Figure 1-2**, Scenario WC5 (relatively large on-channel reservoir system with similar supplies as Scenario WC6, costing an estimated $685.1 million) could attain nearly 20,000 ac-ft/yr of East Slope average yield combined with approximately 7,000 ac-ft/yr of West Slope firm yield.

Information above presents cost/yield results for multiple variations of project scenarios to assess their potential to individually contribute to ERMOU objectives. This section presents cost/yield results for project portfolios to assess the potential for multiple scenarios to collectively contribute to ERMOU objectives. Twelve project portfolios, each with three variations of storage allocated to Climax, were evaluated with the same daily simulation model that was used to estimate yields for project scenarios in the previous section. Descriptions of the portfolios are provided in **Table 1-4**. Cost/yield estimates for each of the portfolios are presented in **Table 1-5**. Specific portfolios (3-6, 9, and 10) each include five cost/yield estimates to represent a range of yield ratios balanced between West Slope and East Slope uses. Model simulations indicate that West Slope firm yields presented in **Table 1-5** would be reduced by approximately 500 ac-ft for every 1,500 ac-ft of Eagle Park Reservoir storage allocated to Climax.

Table 1-4. ERMOU Portfolios

Portfolios 1-6 include a common Eagle Park Reservoir configuration (**EP1**) with varying configurations of Whitney Creek Reservoir (**Scenarios WC4, WC6, WC1, WC2, WC3, and WC5**) to represent incrementally increasing levels of expected yield and incrementally increasing levels of expected environmental impacts associated with Whitney Creek Reservoir alternatives.
• **Portfolio 1** combines **Scenarios EP1 and WC4**. An enlarged Eagle Park Reservoir (**7,950 ac-ft**) would receive water from the existing pump station and pipeline (**6 cfs**) located on the East Fork Eagle River. A relatively small off-channel Whitney Creek Reservoir (**1,000 ac-ft**) would receive water from Homestake Creek, and from the Eagle River below Resolution Ck through a new tunnel (**200 cfs**), and water would be transferred from Whitney Creek Reservoir to Homestake Reservoir with a new pump station/pipeline (**200 cfs**).
• **Portfolio 2** combines **Scenarios EP1 and WC6** (same configuration as Portfolio 1 except the 1,000 ac-ft off-channel Whitney Creek Reservoir would also receive water from Fall and Peterson Creeks through a new tunnel of **200 cfs**).
• **Portfolio 3** combines **Scenarios EP1 and WC1** (same configuration as Portfolio 1 except Whitney Creek Reservoir would be **4,600 ac-ft**).
• **Portfolio 4** combines **Scenarios EP1 and WC2** (same configuration as Portfolio 1 except Whitney Creek Reservoir would be **6,850 ac-ft**).
• **Portfolio 5** combines **Scenarios EP1 and WC3** (same configuration as Portfolio 1 except Whitney Creek Reservoir would be **20,000 ac-ft**).
• **Portfolio 6** combines **Scenarios EP1 and WC5** (same configuration as Portfolio 5 except the 20,000 ac-ft Whitney Creek Reservoir would also receive water from Fall and Peterson Creeks through a new tunnel of **200 cfs**).
Portfolios 7-10 include a common Whitney Reservoir configuration (**WC6**) as Portfolio 2 (**1,000 ac-ft** off-channel Whitney Creek Reservoir with added water supply from Fall and Peterson Creeks) with varying configurations of Eagle Park Reservoir (**Scenarios EP2, EP3, EP4, and EP5**) to represent incrementally increasing levels of expected yield and incrementally increasing levels of expected environmental impacts associated with Eagle Park Reservoir alternatives.
• **Portfolio 7** combines **Scenarios EP2 and WC6** (same configuration as Portfolio 2, except the existing pump station and pipeline on the East Fork Eagle River would be replaced with an enlarged conveyance system of **25-50 cfs** to supply Eagle Park Reservoir).
• **Portfolio 8** combines **Scenarios EP3 and WC6** (same configuration as Portfolio 7, except the existing pump station and pipeline on the East Fork Eagle River would be replaced with a new pump station and pipeline of **40 cfs** from the Eagle River below Resolution Creek to supply Eagle Park Reservoir).
• **Portfolio 9** combines **Scenarios EP4 and WC6** (same configuration as Portfolio 7, except the existing pump station and pipeline on the East Fork Eagle River would be replaced with a new pump station and pipeline of **100 cfs** from the East Fork Eagle River below Jones Gulch to supply Eagle Park Reservoir, and water could be transferred from Eagle Park Reservoir to Chalk Creek in the Arkansas River basin with a new pump station and pipeline of **50 cfs**).
• **Portfolio 10** combines **Scenarios EP5 and WC6** (same configuration as Portfolio 7, except the existing pump station and pipeline on the East Fork Eagle River would be replaced with a new pump station and pipeline of **150 cfs** from the Eagle River below Resolution Creek to supply Eagle Park Reservoir, and water could be transferred from Eagle Park Reservoir to Chalk Creek in the Arkansas River basin with a new pump station and pipeline of **50 cfs**).
Portfolios 11 and 12 represent the same configurations as Portfolios 7 and 8, respectively, except each Portfolio would also include an upgraded Bolts Lake (**1,200 ac-ft**) that would receive water from a new pump station and pipeline (**50 cfs**) from the Eagle River.
• **Portfolio 11** combines **Scenarios EP2, WC6, and BL1**.
• **Portfolio 12** combines **Scenarios EP3, WC6, and BL1**.

[1] Each portfolio was evaluated with three variations of Eagle Park Reservoir storage capacity allocated to Climax:

- **Variation 1:** No storage allocated to Climax
- **Variation 2:** 1,500 ac-ft of storage allocated to Climax
- **Variation 3:** 3,000 ac-ft of storage allocated to Climax

Table 1-5. Cost/Yield Estimates – ERMOU Portfolios

Portfolio	Scenarios	Capital Cost ($M)[1]	New Storage (ac-ft)	New Annual Yield[2] (ac-ft/yr)			Cost/Yield ($/ac-ft)
				W. Slope Firm	E. Slope Average	Total	
1	EP1+WC4	$552.3	5,650	1,550	13,000	14,550	$37,959
2	EP1+WC6	$692.8	5,650	1,550	17,200	18,750	$36,949
3	EP1+WC1	$575.1	9,250	2,050	16,200	18,250	$31,512
				2,800	15,500	18,300	$31,426
				3,250	14,900	18,150	$31,686
				3,550	14,400	17,950	$32,039
				4,050	12,300	16,350	$35,174
4	EP1+WC2	$589.7	11,500	2,250	16,100	18,350	$32,136
				3,250	15,400	18,650	$31,619
				4,050	14,700	18,750	$31,451
				4,550	14,000	18,550	$31,790
				5,250	11,800	17,050	$34,587
5	EP1+WC3	$615.4	24,650	3,750	15,300	19,050	$32,304
				5,800	14,100	19,900	$30,925
				8,050	12,600	20,650	$29,801
				10,250	11,000	21,250	$28,960
				12,050	8,800	20,850	$29,516
6	EP1+WC5	$755.9	24,650	4,300	22,500	26,800	$28,205
				6,550	20,900	27,450	$27,537
				8,550	19,300	27,850	$27,142
				10,550	16,600	27,150	$27,842
				12,550	13,200	25,750	$29,355
7	EP2+WC6	$736.6	5,650	1,750	19,600	21,350	$34,501
8	EP3+WC6	$834.8	5,650	3,000	18,200	21,200	$39,377
9	EP4+WC6	$933.3	5,650	0	22,400	22,400	$41,665
				250	22,000	22,250	$41,946
				1,000	21,500	22,500	$41,480
				1,750	21,000	22,750	$41,024
				2,250	20,200	22,450	$41,572
10	EP5+WC6	$1,074.6	5,650	0	23,900	23,900	$44,962
				500	22,800	23,300	$46,120
				1,500	21,600	23,100	$46,519
				2,250	20,700	22,950	$46,824
				3,000	20,000	23,000	$46,722
11	EP2+WC6+BL1	$793.8	6,850	2,750	19,500	22,250	$35,676
12	EP3+WC6+BL1	$892.0	6,850	4,000	18,200	22,200	$40,180

[1] Capital costs associated with Eagle Park Res include seepage improvements below existing dam and new dam, which could be substantially reduced if not required below existing dam. See Table 1-1 for further reference.

[2] Eagle Park Res yields do not include storage allocation for Climax or use of existing 3,300 ac-ft storage. W Slope firm yields would be reduced by approximately 500 ac-ft for every 1,500 ac-ft of Eagle Park Res storage allocated to Climax. Recent model simulations of existing Eagle Park Res system result in existing W Slope firm yield of 1,750 ac-ft, which may differ from previous estimates by others due to recent hydrology/model refinements. Total yield estimates may represent best case; actual future operational mitigation strategies may substantially reduce yield.

Yield and cost results presented in **Table 1-5** are shown graphically on **Figure 1-3**, which is intended to illustrate the potential balance between West Slope firm yield and East Slope average yield that may be obtained through alternative operational strategies. Model simulations indicate that West Slope firm yields presented on **Figure 1-3** would be reduced by approximately 500 ac-ft for every 1,500 ac-ft of Eagle Park Reservoir storage allocated to Climax.

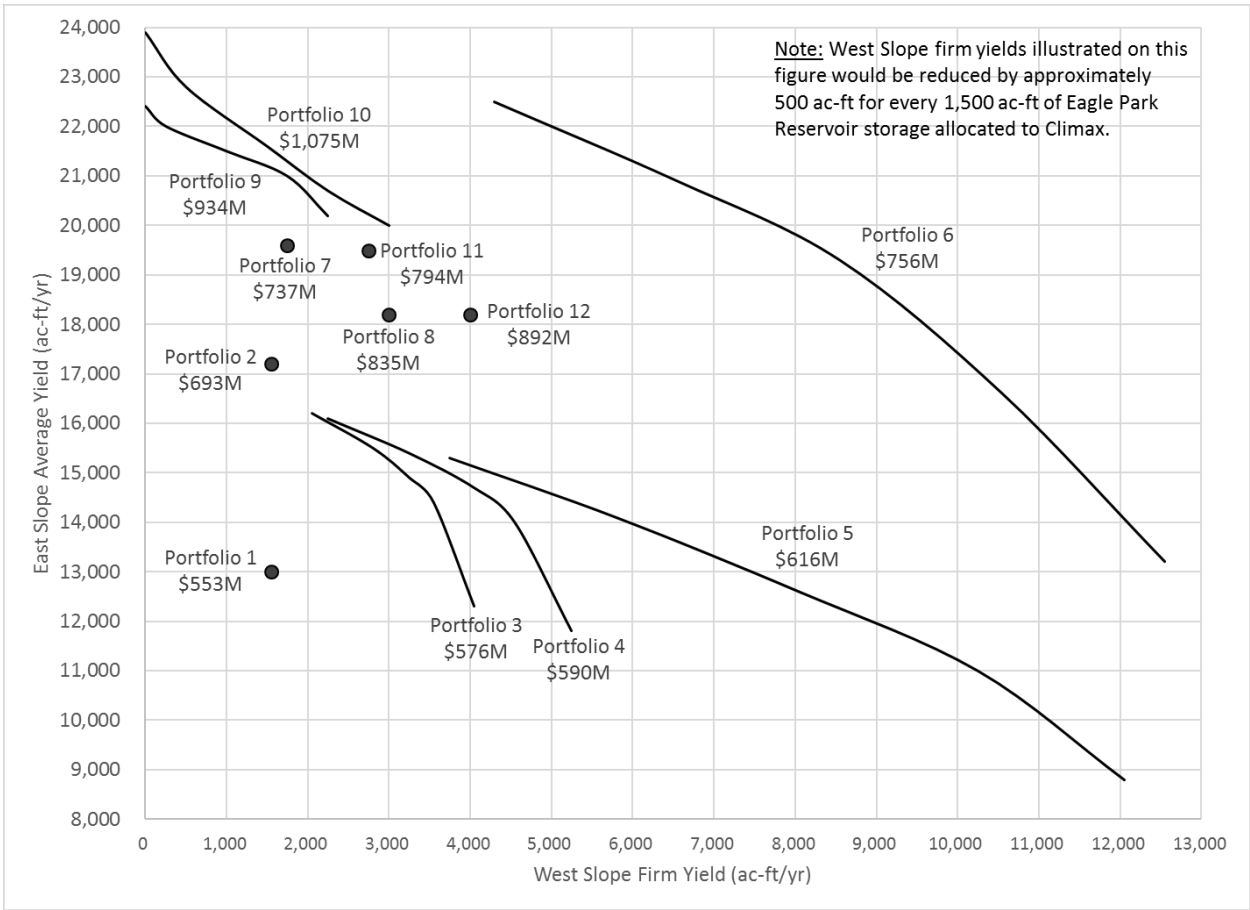

Figure 1-3. Yield Estimates – ERMOU Portfolios

As an example illustrated on **Figure 1-3**, Portfolio 1 (enlarged 7,950 ac-ft Eagle Park Reservoir and existing 6 cfs pump station with water supply from the East Fork Eagle River, combined with a relatively small off-channel Whitney Creek forebay system with channel gravity-fed water supplies from Homestake Creek and tunnel gravity-fed water supplies from the Eagle River, costing a combined estimated $553 million) could attain approximately 13,000 ac-ft/yr of East Slope average yield combined with approximately 1,500 ac-ft/yr of West Slope firm yield. Alternatively, as also illustrated on **Figure 1-3**, Portfolio 5 (the same Eagle Park Reservoir configuration as Portfolio 1, combined with a relatively large on-channel Whitney Creek Reservoir system with similar supplies as Portfolio 1, costing a combined estimated $616 million) could attain the same East Slope average yield as Portfolio 1 (approximately 13,000 ac-ft/yr) combined with approximately 7,000 ac-ft/yr of West Slope firm yield.

Environmental Requirements and Issues

Development of ERMOU facilities, including dams and reservoirs, pipelines, pump stations, and diversion facilities would require compliance with multiple federal, state, and local regulatory requirements. In most cases, the permitting requirements for the different options considered in the investigation will be nearly the same, but the environmental issues associated with individual facilities could be highly variable depending upon their specific locations and impacts. The major federal, state, and local permitting and approval requirements for the ERMOU project alternatives addressed in this Study are listed below. Detailed descriptions of these requirements are provided in **Section 5.1**.

- Federal Agencies
    - USDA Forest Service Special Use Permit and/or Rights-of-Way
    - U.S. Army Corps of Engineers – Section 404 Dredge and Fill Permit
    - U.S. Environmental Protection Agency – NEPA and 404 Permit Review
    - U.S. Fish and Wildlife Service – Endangered Species Act, Section 7 Consultation
    - U.S. Advisory Council on Historic Preservation – Cultural Resource Clearance
- State Agencies
    - Colorado Department of Public Health and Environment (CDPHE) – Water Quality Control Division – Clean Water Act, Section 401 Water Quality Certification
    - CDPHE – Air Pollution Control Division – Air Emissions Permit
    - Colorado Parks and Wildlife – referral agency for fish, wildlife, and recreation issues
    - Colorado Water Conservation Board – instream flow water rights issues
    - Colorado Department of Transportation – construction access and transportation issues
- Local Agencies
    - Eagle County – 1041 Land Use Permit
    - Town of Minturn – potential design review and grading/building permits

All Federal, State, and Local requirements summarized above would be applicable for Eagle Park Reservoir Enlargement, Whitney Creek Reservoir alternatives, Wolcott Reservoir, and likely Bolts Lake. For Bolts Lake, it is possible that U.S. Forest Service and Eagle County 1041 permitting would not be required if the reservoir and diversion from the Eagle River could be configured so that all project facilities are located on private lands within the Town of Minturn. For the larger capacity Whitney Creek Reservoir, congressional approval would be required to modify the boundary of the Holy Cross Wilderness Area.

Environmental permitting issues and mitigation requirements associated with Eagle Park Reservoir, Whitney Creek Reservoir, Bolts Lake, and Wolcott Reservoir were investigated based upon information readily available from resource databases and previous studies. This assessment of environmental permitting issues should be considered “preliminary” because site specific field investigations have not been conducted to verify the accuracy and completeness of the currently available information. **Table 1-6** provides a list of potentially significant environmental permitting issues identified for the ERMOU project alternatives. Additional details regarding these potential issues are provided in **Section 5.2**.

Table 1-6. Potential Environmental Issues – ERMOU Project Alternatives

Potential Issue[1]	Eagle Park Reservoir	Whitney Creek Reservoir	Bolts Lake	Wolcott Reservoir
Wetlands (potential impacted acres)	Up to 15	26–180	Up to 12	Up to 113
Wilderness and Roadless Areas	No	Yes[2]	No	No
USFS Forest Management Plan Amendments	Unlikely	Yes	No	No
Wildlife Habitat and Fisheries	Yes	Yes	Yes	Yes
Threatened and Endangered Species	Yes	Yes	Yes	Yes
Hydrology and Water Quality	Yes	Yes	Yes	Yes
Recreation	Unlikely	Yes	Unlikely	Unlikely

[1] Site specific investigations are required to fully understand the extent of potential impacts (adverse and beneficial) and to identify mitigation strategies, including possibilities for modifications of project facilities and operations to avoid and minimize adverse impacts.

[2] Potential Wilderness issues for two of four alternatives

1.4 Next Steps

The ERMOU Technical Advisors request ERMOU stakeholder review, comments, and discussion on the content and results of this Study and on the timing of and commitment to ERMOU project development. Should the ERMOU Partners elect to further evaluate specific project components presented in this report, the ERMOU Technical Advisors believe that collection of additional data and completion of additional evaluations, as summarized below, would significantly improve the reliability of the evaluations presented in this report. Next steps described below should be carefully coordinated between each technical discipline and with consideration for legal, economic, and institutional issues.

Engineering and Costs

Next steps for engineering and cost evaluations include obtaining additional data and performing more refined engineering analyses for preferred dam and reservoir facilities, identifying land ownership/ easement needs and corresponding potential acquisition costs, and performing optimization of hydraulic conveyance facilities to better identify pump and pipeline sizes. **High priority, near-term next steps include field geotechnical investigations associated with Whitney Creek Reservoir alternatives.** Additional detail on next steps are provided in **Section 6.1**.

Water Supply and Project Yield

Next steps for water supply and project yield evaluations include refined analyses to support and inform specific Partner objectives and next steps identified for the engineering and environmental disciplines. Corresponding evaluations would include added assessment of legal water availability and refined project water demands, operational constraints, and integration with existing water supply systems. **High priority, near-term next steps include identification of Homestake Reservoir system capacity constraints and evaluation of existing conditional water rights and potential hydrologic impacts associated with preferred ERMOU project portfolios.** Additional detail on next steps are provided in **Section 6.2**.

Environmental Requirements and Issues

Next steps for environmental evaluations include further site specific investigations to fully understand the extent of potential adverse and beneficial impacts and possibilities for modifications of project facilities and operations to avoid and minimize adverse impacts, and to identify mitigation strategies. **High priority, near-term next steps include continued coordination with USFS on the Camp Hale Wetland Reconstruction, Holy Cross Wilderness Boundary, and pending SF-299 permit application, including wetland investigations, environmental field surveys, and public outreach needed to proceed with subsurface explorations associated with the Whitney Creek Reservoir alternatives.** Additional detail on next steps are provided in **Section 6.3**.

Scope of Services

To: ERMOU Partners
From: ERMOU Technical Advisors
Date: 6/2/2016
Re: Subsurface Investigations – ERMOU Whitney Creek Reservoir Alternatives

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The ERMOU Technical Advisors are pleased to provide to the ERMOU Partners this scope of services to complete subsurface investigations associated with ERMOU Whitney Creek Reservoir alternatives. This work is being completed as part of priority ERMOU activities summarized in our ERMOU next steps memo that was submitted to the Partners in February 2016. RJH Consultants, Inc. will complete the work under the direction of WWG.

Background

The ERMOU Technical Advisors recently completed a draft study that evaluated feasibility of various reservoir sizes at the Whitney Creek Reservoir site (Site) to meet a portion of ERMOU water yield objectives. The study recommended subsurface investigations to improve the reliability of the feasibility-level evaluations. A US Forest Service (USFS) permit application is currently under USFS review to allow these investigations to be completed. As documented in the permit application, the subsurface investigations include two potential dam and reservoir sites: Site 2 and Site 3.

In September 2014, RJH performed a field investigation at the Site that included geologic mapping and geophysical seismic refraction surveys. The field investigation concluded that there were many geologic similarities between Site 2 and Site 3. Based on elevation and environmental considerations and evaluations performed in 2016, Site 2 was selected by the ERMOU Partners to be the preferred site.

In November 2015, RJH prepared Appendix 1 – Technical Report, which is being used by the ERMOU Partners to support obtainment of the USFS permit for the proposed subsurface investigation.

In 2016, RJH developed feasibility-level evaluations for four dam and reservoir alternatives at the Site as part of a larger study for the ERMOU Partners to evaluate water storage and conveyance facilities at the Site and other sites in the Eagle River basin. The evaluations consisted of developing embankment and ancillary facilities concepts and layouts, identifying concepts for seepage and foundation treatments, and developing cost opinions. The foundation treatment selected for this study consisted of installing a concrete plinth with rock anchors and a triple-row grout curtain at the upstream toe. Foundation treatment costs were significant and comprised about a third to a half of the total construction costs. However, there is significant uncertainty associated with the costs of foundation treatments because of limited subsurface data. Acquiring additional subsurface data would allow the foundation treatment concept to be better defined and reduce uncertainty in the cost opinion.

Unexploded ordnances (UXOs) have historically been identified within the Homestake Creek valley as a result of military training exercises previously conducted at Camp Hale. It is understood that the U.S. Army Corps of Engineers (USACE) previously completed a surface clearance of the Project vicinity. 75-mm projectiles and small arms were identified in the vicinity of the Site, and it is understood that identified UXOs were either removed or destroyed onsite. During our field investigations in September 2014, glass vials were observed on the ground surface, and five magnetic anomalies were identified that were not attributable to “hot rocks” (rocks that emit a magnetic response) or metallic debris visible on the ground surface.

Objectives

The objectives of this work are as follows:

1. Perform subsurface explorations (borings) to accomplish:
    - Calibrate and better interpret the geophysical seismic refraction survey results.
    - Evaluate the seepage properties of the foundation materials.
    - Evaluate the weathering and fracturing profiles within the bedrock, both within shear zones and away from shear zones.
    - Obtain data that could be used to refine the design concept and reduce the cost uncertainty in the foundation treatment.
2. Refine the interpretation of the subsurface conditions, foundation treatment concept, and cost opinion.

Scope of Services

Subsurface investigations will be completed in four discreet tasks as follows.

Task 1 – Site 2 Exploration

Objective: Perform a subsurface exploration at Site 2.

Subtasks:

1. Complete UXO awareness training, and prepare a Site-Specific Health and Safety Plan (HASP) prior to performing field work.
2. Subcontract with a UXO technician. Review Site 2 access routes and boring locations with the UXO technician in the field, and perform a UXO survey of work areas prior to construction of access routes described in the USFS permit.
3. Subcontract with earthwork contractors and foresters to remove trees and construct access routes to the boring locations prior to mobilization of the drillers.
4. Coordinate utility clearances with Colorado 811 prior to Site 2 subsurface work.
5. Subcontract with a driller. Advance three borings at Site 2 at the general locations shown on Figure 1. The estimated depths of the borings are provided in Table 1. The borings will be advanced through surficial materials using a combination of hollow stem augers, casing advancer, or N-sized wireline rock coring techniques as necessary to advance the boring to bedrock. The borings will be advanced through bedrock using N-sized wireline rock coring techniques.

Table 1 – Site 2 Boring Summary

Boring ID	Orientation	Estimated Depth to Bedrock (ft)	Estimated Total Depth (ft)	General Purpose
B-2-1	Angled left[1]	35	100	Investigate Shear Zone 2B[2] near maximum dam section
B-2-2	Vertical	25	100	Investigate bedrock away from shear zones
B-2-3	Angled right[1]	10	150	Investigate Shear Zone 2E[2]

1 While looking downstream.
2 Shear Zone nomenclature is based on the *Phase I Investigation Memorandum* (RJH, 2015).

6. Sampling while drilling with hollow stem augers or casing advancer in vertical boreholes will generally be performed at approximate 5-foot intervals using either a standard split-spoon sampler (ASTM D 1586) or a California sampler (ASTM D 3550). Continuous core sampling will be performed while rock coring. Prepare field logs that document drilling conditions, describe the recovered materials, report sample recovery, record blowcounts for each 6-inch interval of drive samples, record and report sample recovery, and calculate and report rock quality designation (RQD) for all rock cores. Rock core will be

placed in wooden core boxes. Photograph selected split-spoon samples and all recovered rock core. RJH will store soil and rock samples not subject to laboratory testing for 12 months.

7. Collect bulk soil samples (cuttings) from the borings.
8. Conduct in-situ hydraulic conductivity testing (Packer testing) in bedrock using a single Packer apparatus. Tests will be performed from the top down as the boring advances. Test intervals will generally range from 5 to 15 feet long and will include up to 5 pressure steps per test. RJH anticipates performing an estimated 18 Packer tests. These tests are intended to provide seepage data through bedrock to better understand bedrock hydraulic conductivity.
9. Backfill the borings with cement-bentonite grout.
10. Perform laboratory tests on representative samples from the borings to characterize materials. The expected laboratory tests are summarized in Table 2.

Table 2 – Site 2 Laboratory Testing Schedule

Test	Number of Tests
Moisture and Density	8
Unconfined Compressive Strength	8
Grain Size Distribution	6

11. Perform quality assurance review of collected samples and field logs by a senior engineer/geologist.
12. Prepare final boring logs based on the field logs, quality assurance review, and laboratory test results.
13. Prepare a Geotechnical Data Report to present the data collected from the subsurface investigation. The report will include text that describes the data collection methods and findings; plan, profile, and section figures that graphically present geologic contacts and interpreted subsurface profiles as appropriate; and appendices with photographs, boring logs, packer test results, and laboratory test data.

Deliverables:

- One electronic copy of the Geotechnical Data Report in both Microsoft Word and .pdf formats.

Task 2 – Site 3 Exploration (optional)

Objective: Perform additional mobilizations and perform a subsurface exploration at Site 3.

Subtasks:

1. Amend the UXO technician subcontract to include work at Site 3. Review Site 3 access routes and boring locations with the UXO technician in the field, and perform a UXO survey of work areas prior to construction of access routes. The access route and boring locations at Site 3 are shown on Figure 2.
2. Coordinate utility clearances with Colorado 811 prior to Site 3 subsurface work.
3. Subcontract with earthwork contractors and foresters to remove trees and construct access routes to the boring locations prior to mobilization of the drillers.
4. Amend the driller subcontract to include work at Site 3. Advance four borings at Site 3 at the locations shown on Figure 2. The estimated depths of the borings are provided in Table 3. The borings will be advanced through surficial materials using a combination of hollow stem augers, casing advancer, or N-sized wireline rock coring techniques as necessary to advance the boring to bedrock. The borings will be advanced through bedrock using N-sized wireline rock coring techniques.

Table 3 – Site 3 Boring Summary

Boring ID	Orientation	Estimated Depth to Bedrock (ft)	Estimated Total Depth (ft)	General Purpose
B-3-1	Vertical	20	75	Investigate bedrock away from shear zones and near maximum dam section
B-3-2	Angled right[1]	10	100	Investigate Shear Zone 3D[2]
B-3-3	Angled left[1]	15	100	Investigate Shear Zone 3E[2]
B-3-4	Angled left[1]	10	90	Investigate Shear Zone 3C[2]

1 While looking downstream.
2 Shear Zone nomenclature is based on the *Phase I Investigation Memorandum* (RJH, 2015).

5. Conduct in-situ hydraulic conductivity testing (Packer testing) as described in Task 2. RJH anticipates performing an estimated 21 Packer tests.
6. Sample, log, backfill borings, perform laboratory tests, review data, and prepare boring logs as described in Task 2.

Deliverables:

- None. Data from Task 3 will be incorporated into the Geotechnical Data Report as part of Task 2.

Task 3 – Update Feasibility-Level Dam Concept and Cost Estimate

Objective: Update the dam concepts for foundation treatment and cost estimates from the Phase 2 Study based on the new subsurface data collected during Task 2 and Task 3.

Subtasks:

1. Compare the data from the borings with the geophysical seismic refraction survey results obtained in 2014. Develop correlations between bedrock engineering properties (weathering, fracturing, and hydraulic conductivity) and seismic velocity. Update our interpretation of subsurface conditions.
2. Update the concepts for foundation treatment (i.e., grouting) for the Whitney Creek dam considered during the Phase 2 Study. Concepts for the above-ground facilities (embankment and appurtenance facilities) will not be updated.
3. Update the cost estimates for foundation treatment. Cost estimates will be updated based on changes in estimated quantities; unit prices will not be updated.
4. Prepare a brief memorandum to present the updated subsurface interpretation, foundation treatment concepts, and cost estimates.

Deliverables:

- One electronic copy of the memorandum in both Microsoft Word and .pdf formats.

Task 4 – Project Management and Meetings

Objective: RJH will provide schedule, cost and financial reporting; manage and coordinate the work of RJH and subconsultants; perform quality assurance reviews; participate in management of the Project; participate in meetings with WWG, the ERMOU Partners, the USFS, and others, as needed.

Subtasks:

1. Manage and coordinate the work including staffing the job, invoicing, progress reporting, and quality assurance reviews.
2. Hold regular staff meetings to coordinate various work tasks needed to manage delivery of the Project.
3. Participate in one meeting with the USFS prior to receiving permits to perform the work.
4. Participate in two meetings with WWG and the ERMOU Partners. The meetings will be held in Vail, Colorado.

5. Prepare invoices and written monthly progress updates that will include an overview of work accomplished during the previous month; summary of any concerns or unanticipated issues; and contract budget, monthly invoiced amounts, cumulative amount invoiced by task, a summary of the hours by individual for the invoice period, and subcontract costs.
6. Maintain a schedule for the work.

Deliverables:

- Monthly invoices and progress reports.
- Updated schedule, as required.

Estimated Schedule

Work can begin upon receipt of a Notice to Proceed. The preferred time for fieldwork is July or August because the snowpack will have melted and stream flows will be lower in Homestake Creek. Durations for drilling are estimated to be about 10 to 12 work-days for Task 2 and 11 to 14 work-days for Task 3. The Geotechnical Data Report is estimated to be completed within 8 weeks after completion of drilling, and the memorandum presenting the updated concept and cost can be completed within 4 weeks after completion of the Geotechnical Data Report.

Estimated Costs

We propose to complete the above scope of services on a time and expenses basis according to the estimated schedules and costs listed in the table below. Costs are presented both as total costs and 25% pro-rata share per ERMOU Partner.

Task	Estimated Cost	
	Total	**25% Pro-Rata**
1 Site 2 Exploration	$119,700	$29,925
2 Site 3 Exploration (optional)	$125,300	$31,325
3 Update Feasibility-Level Dam Concept/Cost Estimate	$18,200	$4,550
4 Project Management and Meetings	$28,800	$7,200
Total Tasks 1, 3, 4	**$166,700**	**$41,675**
Total Tasks 1, 2, 3, 4	**$292,000**	**$73,000**

Cost estimates for each of the tasks have been developed based on current understanding of the work and estimating the level of effort and direct costs that are expected to be required to perform the work. WWG and RJH recognize that the actual level of effort to complete a particular task for this phase of work could be more or less than estimated. We will invoice monthly based on the work completed and will not exceed this estimated amount without prior authorization from the ERMOU Partners.

Figure 1. Access route and boring locations at Site 2.

Figure 2. Access routes and boring locations at Site 3.

VailDaily

Efforts to relocate an ancient wetland could help determine the fate of a water project on Lower Homestake Creek

Fens, which are groundwater-fed wetlands filled with organic 'peat,' are among the state's most biodiverse and fragile environments

News FOLLOW NEWS | November 17, 2019

Sarah Tory
Aspen Journalism

A wetland area along Homestake Creek in an area that would be flooded by a potential Whitney Reservoir. The cities of Aurora and Colorado Springs are looking to develop additional water in Eagle County and divert it to the Front Range.
Brent Gardner-Smith | Aspen Journalism

LAKE COUNTY — One morning last month, Brad Johnson arrived at a patch of rippling yellow grasses alongside U.S. 24, a few miles south of Leadville in the upper Arkansas River valley. Sandwiched among a cluster of abandoned ranch buildings, a string of power lines and a small pond, it is an unassuming place — except, of course, for its views of 14,000-foot peaks rising across the valley.

But appearances can be deceiving. The rather ordinary-looking property was a fen, which is a groundwater-fed wetland filled with organic "peat" soils that began forming during the last ice age and that give fens their springy feel.

"It's like walking on a sponge," Johnson said, marching across the marshy ground, stopping every now and then to point out a rare sedge or grass species.

Johnson was visiting the fen to record groundwater measurements before winter sets in. As the lead scientist for the Rocky Mountain Fen Research Project, Johnson is part of an effort spearheaded and paid for by Aurora Water and the Board of Water Works of Pueblo to study new ways to restore fens.

The research could help facilitate future water development in Colorado, such as the potential Whitney Reservoir project, part of a 20-year water-development plan from Aurora Water and Colorado Springs Utilities for the upper Eagle River watershed. The utilities, working together as Homestake Partners, are looking at building the reservoir in the Homestake Creek valley, south of Minturn, in an area that probably contains fens, which could hinder the project.

Aurora and Colorado Springs are working together on the reservoir project, and Aurora and Pueblo are funding the fens research. Although the Whitney project is not directly tied to the fen project, if the research efforts are successful, they could help Aurora and Colorado Springs secure a permit approval for the reservoir — and maybe alter the fate of an ecosystem.

Irreplaceable resources

If you've walked through Colorado's high country, chances are you've walked by a fen, which are among the state's most biodiverse and fragile environments. To protect fens, the U.S. Fish and Wildlife Service and the Environmental Protection Agency drafted a "fen policy" in 1996. The policy, amended in 1999, determined that fens are irreplaceable resources because their soils take so long to regenerate. "On-site or in-kind replacement of peatlands is not possible," the policy reads.

Inside the Fish and Wildlife Service, however, a different interpretation emerged. "Irreplaceable" became "unmitigable," making it difficult or impossible to secure approval for any project that would severely impact fens.

Although Johnson is in favor of fen conservation, the Fish and Wildlife Service's "unmitigable" interpretation bothered him. Not only was that status not supported by the fen policy itself, he believes saying "no" all the time is not in the best interest of fens.

Brad Johnson, the lead scientist for the Rocky Mountain Fen Research Project, at the project site in the Upper Arkansas River Valley. Launched by two Front Range water utilities in 2003, the project is studying a new way to mitigate potential impacts to fens, an ecologically rich and fragile wetland found throughout Colorados' high country.
Sarah Tory | Aspen Journalism

"My fear is that if we don't have the means of mitigating our impacts, we'll just impact them," he said.

Eventually, Johnson believes, conservationists will have to make some concessions to development. But by researching better mitigation techniques, he hopes he can help preserve fens in the long run.

An organ transplant

For water utilities, fens have been particularly troublesome. Fens like to form in high-alpine valleys, the places best suited for dams and water reservoirs that take water from rivers mostly on the Western Slope and pump it over the mountains to supply the Front Range's growing population.

But the fen policy has stymied many of the utilities' plans to develop new water projects. Those defeats helped spur Front Range utilities to start researching new mitigation strategies that would help them comply with environmental regulations — and get around the fen policy.

"They wanted to figure out how to do this right so they could actually permit their projects," Johnson said.

Through the fen-research project, Aurora and Pueblo saw an opportunity to address the fen policy's requirement that a project offset unavoidable impacts to a fen by restoring an equivalent amount of fen elsewhere.

Cutline: Brad Johnson, a wetland ecologist for the Rocky Mountain Fen Research Project, takes groundwater measurements at the research site near Leadville, while his dogs, Katie and Hayden watch. The cities of Aurora and Colorado Springs are looking to develop additional water in Eagle County and divert it to the Front Range.
Sarah Tory | Aspen Journalism

Since the fen project began 16 years ago, Aurora and Pueblo have invested $300,000 and $64,000 in the research, respectively. More recently, other funders have joined the effort, including the Colorado Water Conservation Board ($100,000).

After a number of fits and starts, Johnson three years ago settled on a design for the research that would test whether it's ecologically possible to transplant fen soils from one location to another. First, Johnson restored the original groundwater spring at the old Hayden Ranch property. Then, he and a team of helpers removed blocks of soil from another degraded fen site and reassembled them, like an organ transplant, at the "receiver" site, where the restored spring now flows through veinlike cobble bars and sandbars, feeding the transplanted fen.

Positive signs

It's still too early to know whether the project could eventually serve as a fen-mitigation strategy for a new reservoir, but Johnson is optimistic about the results thus far. In 2017, after just one growing season, he was shocked to discover 67 different plant species growing at the transplanted fen site — compared with just 10 at the donor site. He was thrilled by the news. The data showed that the transplanted fen ecosystem is thriving.

That's good news for utilities such as Aurora, too.

A week after Johnson visited the Rocky Mountain Fen Project site, Kathy Kitzmann gave a tour of the wetland-filled valley formed by Homestake Creek where Aurora and Colorado Springs are planning to build Whitney Reservoir.

Kitzmann, a water resources principal for Aurora Water, drove down the bumpy, snow-covered road that winds along the valley bottom, pointing to the two creeks that would — along with Homestake Creek and the Eagle River, near Camp Hale — help fill the reservoir. A pump station would send the water upvalley to the existing Homestake Reservoir and then through another series of tunnels to the Front Range.

Fen soils are made of a rich, organic peat material that take thousands of years to form and require a constant groundwater source to survive. At the Rocky Mountain Fen Research Project, scientists transplanted fen soils from another site to the "receiver" site south of Leadville where they restored a groundwater spring to sustain the transplanted soils.

Sarah Tory | Aspen Journalism

In the lower part of the valley, Kitzmann stopped at the first of four potential reservoir sites — ranging in size from 6,000 acre-feet to 20,000 acre-feet — that the utilities have identified for the project and the wetlands it would inundate.

"You can sort of see why it wouldn't be the best, just given the vastness of the wetlands," Kitzmann said.

Farther along, the valley becomes more canyonlike, with higher rocky walls and fewer wetlands — probably offering a better reservoir site, said Kitzmann, although the permitting agencies won't know for sure until they complete their initial feasibility studies.

In June, Aurora and Colorado Springs submitted a permit application to the U.S. Forest Service to perform exploratory drilling and other mapping and surveying work, but the agency has not yet approved the permit.

Potential fen impacts are just one of several environmental hurdles facing the project. One of the Whitney alternatives would encroach on the Holy Cross Wilderness. Aurora and Colorado Springs have proposed moving the wilderness boundary, if necessary, to accommodate the reservoir.

It's also likely that the wetlands in the Homestake Valley contain fens, but until the utilities conduct wetland studies around the proposed reservoir sites next summer, the scope of the impacts remains uncertain.

Environmental groups including Colorado Headwaters, a nonprofit, oppose the Whitney Reservoir project, arguing that it would destroy one of the state's most valuable wetlands, as well as an important habitat for wildlife and rare native plants.

In the meantime, Aurora is hopeful that Johnson's research might one day help solve some of the environmental problems around new water development. "We are excited about proving that you can restore and rehabilitate fens," Kitzmann said.

Inevitable impacts

But is a transplanted fen as good as not touching one in the first place?

A Fish and Wildlife Service spokesperson said fens are still designated a "Resource Category 1," which means that the appropriate type of mitigation is avoidance, or "no loss."

White River National Forest supervisor Scott Fitzwilliams echoed the spokesperson's statement, noting that land managers place a high emphasis on protection for fens: "It's really hard to replace a wetland in these high elevations."

Johnson, asked whether he was worried that his research into fen mitigation might end up facilitating the kinds of projects that are most damaging to fens. He sighed. "I'm sensitive to that," he said.

But like it or not, Johnson believes that more impacts to fens are inevitable. As Colorado's population grows, water utilities will have to build new reservoirs, the state will need new roads and ski resorts will want to expand.

"I can't argue with whether they should get built," he said. "I'm just a wetlands guy."

Editor's note: Aspen Journalism collaborates with the Vail Daily and other Swift Communications newspapers on coverage of water and rivers. For more, go to aspenjournalism.org.

Appendix VII

Aurora, Colo. Springs seek to drill on lower Homestake Creek dam sites
By **Brent Gardner-Smith** July 17, 2019

MORE

BRENT GARDNER-SMITH/ASPEN JOURNALISM
Homestake Creek, flowing toward the Eagle River, near the Alternative A dam site being studied by Aurora Water and Colorado Springs Utilities, about three miles up Homestake Road from U.S. 24. The photo was taken on July 13, 2019.

MINTURN — The cities of Aurora and Colorado Springs are increasing their efforts to develop a reservoir on lower Homestake Creek in the Eagle River basin that would hold between 6,850 acre-feet and 20,000 acre-feet of water.

The two Front Range cities, working together as Homestake Partners, have filed an application with the U.S. Forest Service to drill test bores at four potential dam sites on the creek, renowned for its complex wetlands.

They briefed members of Colorado's Congressional delegation in April about federal legislation they are drafting that would adjust the Holy Cross Wilderness boundary near the dam sites.

And Aurora spent $4.1 million in 2018 to purchase a 150-acre private inholding parcel that accounts for about half the surface area of the 20,000-acre-foot version of the reservoir, removing one obstacle in the way of submitting a comprehensive land-use application to the Forest Service.

“We are in preparation to permit this overall project, to try and get that larger application in, so every piece of the project has had more time and effort spent on it,” said Kathy Kitzmann, a water resources principal with Aurora Water.

Brent Gardner-Smith/Aspen Journalism
One of four potential dam sites on lower Homestake Creek, about four miles above U.S. 24, between Minturn and Leadville. From this location, the dam that forms Homestake Reservoir higher up the creek can be seen.

Eagle River MOU

The Whitney Reservoir project is defined in part by the Eagle River Memorandum of Understanding, a 1998 agreement that gives Aurora and Colorado Springs a basis to pursue 20,000 acre-feet of water from the Western Slope.

Parties to the MOU include Aurora, Colorado Springs, Climax Molybdenum Co., Colorado River Water Conservation District, Eagle River Water and Sanitation District, Upper Eagle Regional Water Authority, and Vail Associates.

Peter Fleming, the River District's general counsel, told the district's board in a July 1 memo that the River District is "not participating in any Homestake Creek based alternative at this time, this effort is now being carried forward solely by the Homestake Partners."

Under the MOU, various parties can pursue projects on their own, and the other parties are bound to support those efforts, but only to the degree that a proposed project meets the objectives of the MOU, including whether a project "minimizes environmental impacts."

Brent Gardner-Smith/Aspen Journalism

A view, from the Alternative A dam site, of the Homestake Creek valley. The triangle shape in the distance is the dam that forms Homestake Reservoir.

Serious intent

Whitney Reservoir takes its name from Whitney Creek, which flows into Homestake Creek just above the four potential dam alignments now being studied. The dam that would form Whitney Reservoir would stand across Homestake Creek, not Whitney Creek. Homestake Creek flows into the Eagle River at Red Cliff.

Asked how serious the two cities are about the Whitney Reservoir project, Kevin Lusk, the principal engineer at Colorado Springs Utilities, said, “We’ve been serious about it for the last 20 years.”

And he said the recent drilling application “is another step in the continuum from concept to reality.”

On June 25, the two cities submitted an application with the Eagle-Holy Cross Ranger District for permission from the White River National Forest to drill 13 test bores 150 feet to explore the geology under the four sites.

The sites are clustered on the creek between 3 and 5 miles above the intersection of U.S. 24 and Homestake Road, shown as Forest Road 703 on most maps. The intersection is not far below Camp Hale, between Minturn and Leadville.

The drilling application says Aurora and Colorado Springs are conducting “a fatal-flaw level reservoir siting study” that “comprises subsurface exploration to evaluate feasibility of dam construction on lower Homestake Creek.”

White River National Forest supervisor Scott Fitzwilliams said review of the drilling application itself is “fairly standard stuff.”

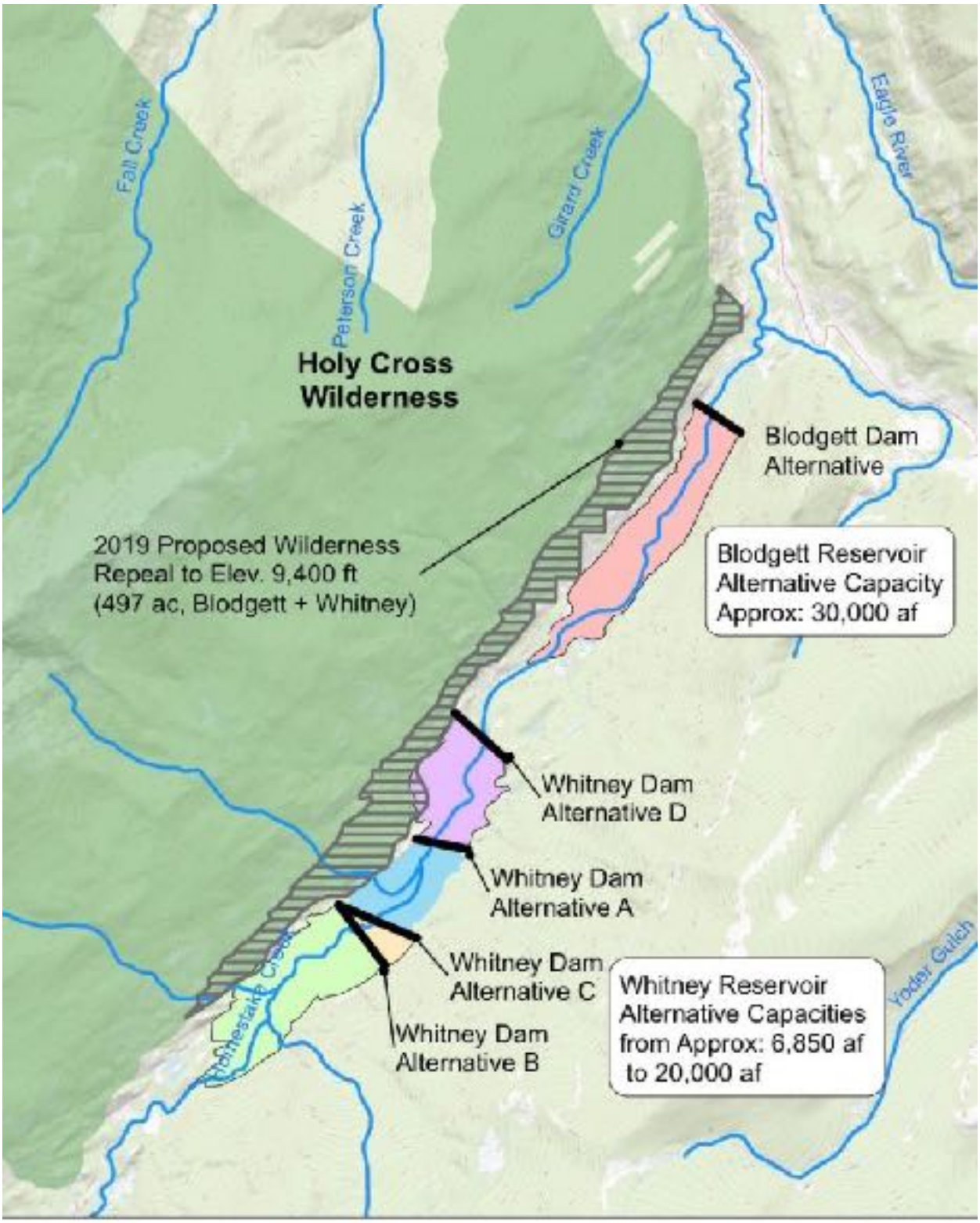
“We’ll definitely send out a scoping statement, asking for public comment, but it won’t be about a dam,” he said. “It will be about drilling the holes.”

Each of the 13 borings would take up to five days to drill, so there could be 65 days of drilling this fall or, if the application is not approved this year, in 2020, according to Lusk.

The project includes taking a “track-mounted drill rig or a buggy-mounted drill rig,” a “utility vehicle pulling a small trailer” and a “track-mounted skid steer” onto public lands along 10-foot-wide “temporary access routes.”

The drill rigs are about 8 feet wide, 22 feet long and 8 feet high. To get the rigs to drilling sites, some wetlands may need to be crossed and trees will be cut as necessary.

The information about the geology under the four sites will help determine the size of a dam on a given alignment and how much water a reservoir would hold, Lusk said. And that could affect how much wilderness area might be encroached on.



PROPOSED WILDERNESS BOUNDARY ADJUSTMENTS
Whitney and Blodgett Reservoirs
Eagle County, Colorado

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Source: Aurora Water
A map prepared by Aurora Water that shows a potential 500-acre adjustment to the Holy Cross Wilderness boundary near the potential Whitney Reservoir on lower Homestake Creek. The map as current as of July 16, 2019.

Wilderness boundary

Given that Aurora and Colorado Springs are still working through various options, it's not clear yet how big of an adjustment to the wilderness boundary they might ultimately seek from Congress.

The current proposed legislation developed by the cities asks to remove 497 acres from the wilderness boundary, but it is also expected to include a reversion provision so if all 497 acres are not needed, the boundary adjustment could be reduced.

According to Lusk, in one the of the alternatives studied, about 80 acres would need to be removed from the wilderness area if Whitney Reservoir was to hold 20,000 acre feet of water. However, the cities have yet to rule out the option of building an alternate reservoir below the Whitney Reservoir location – Blodgett Reservoir – which could require a larger boundary adjustment, although not the full 497 acres.

An adjustment to a wilderness boundary requires an act of Congress and the president's signature. In April, representatives from the two cities described the potential boundary change to staffers of U.S. Sens. Michael Bennet and Cory Gardner and U.S. Reps. Scott Tipton, Jason Crow, Joe Neguse and Doug Lamborn.

Fitzwilliams said Monday the Forest Service won't accept a full-blown land-use application for Whitney Reservoir until the wilderness boundary issue has been worked out through federal legislation, if that is still needed after the final version of the reservoir is better defined.

Kitzmann said she is reaching out to stakeholders to continue to refine the legislative language and the map showing the extent of the proposed boundary change.

Brent Gardner-Smith/Aspen Journalism
A wetland area along Homestake Creek in an area that would be flooded by a potential Whitney Reservoir. Aurora and Colorado Springs, seeking to build the reservoir, have recently submitted a drilling application to the U.S. Forest Service to search for fatal flaws in the geology under four potential dam alignments.

Wetlands and fens

On another front, Aurora Water and Colorado Springs Utilities staffers are hosting a tour this week for the directors of the Colorado Water Conservation Board of the Homestake Plant and Fen Relocation Project, near Leadville.

The CWCB directors, holding their July meeting in Leadville, also will hear a presentation at their meeting about the fen-relocation effort, which consists of moving "fen-like organic soils and plant life" from one location in blocks or bales to another location and "reassembling them in a specially prepared groundwater-fed basin."

Many regulatory agencies do not believe it's possible to re-create complex fen wetlands, according to a CWCB staff memo, but that regulatory stance "may be related to the lack of scientific investigation on fen mitigation."

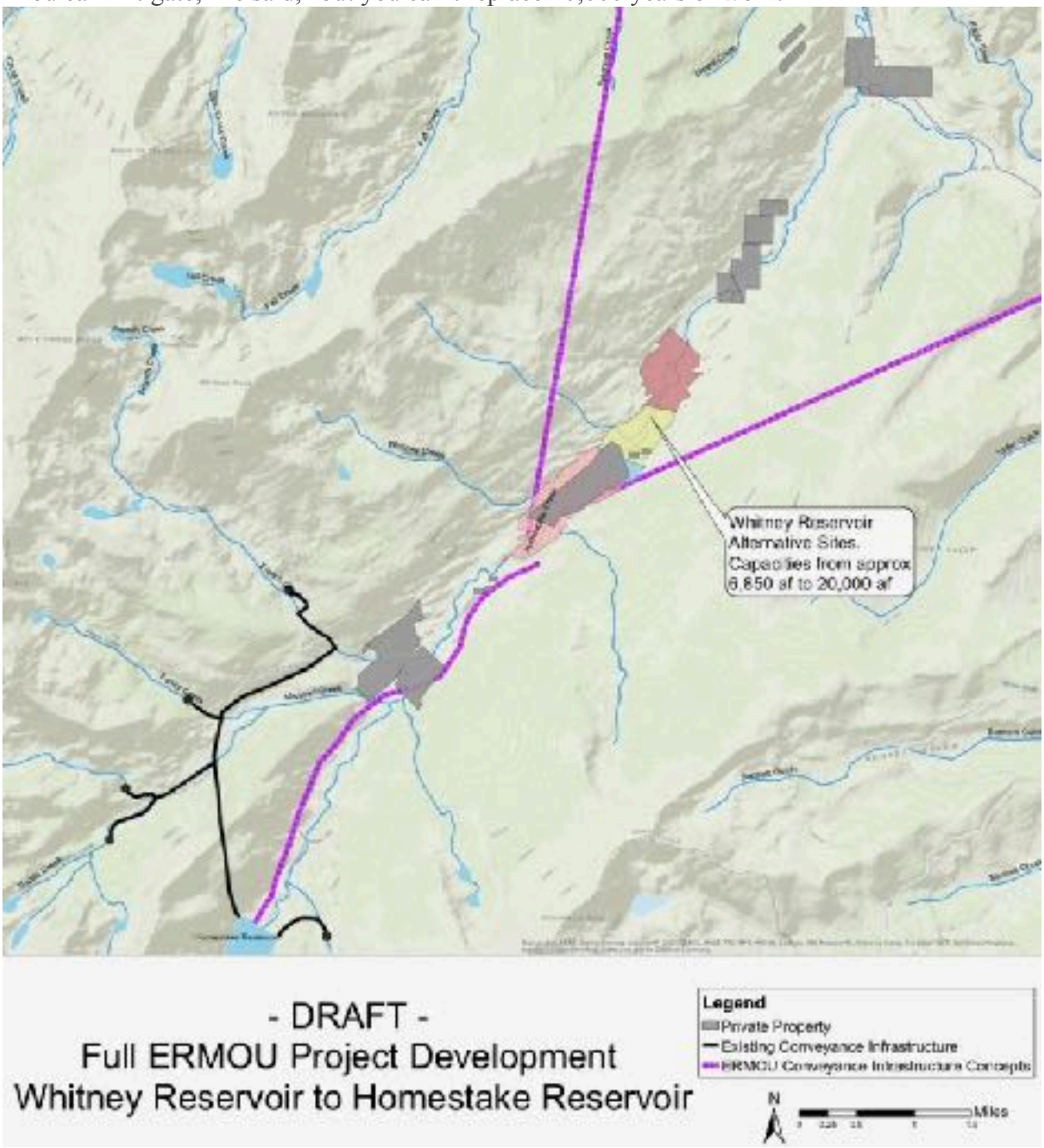
A 2016 study estimated between 26 and 180 acres of wetlands on lower Homestake Creek would be impacted by Whitney Reservoir.

"This is one of the finest wetlands we can find on our forest — it's unbelievable," Fitzwilliams said. "From an environmental impact standpoint, this would not be a project that we would be favorable to."

But Lusk said the fen-relocation project near Leadville is “proof of concept” that replacing fens, while “a tough nut to crack,” can be done.

Fitzwilliams may be hard to persuade.

“You can mitigate,” he said, “but you can’t replace 10,000 years of work.”



Source: Colorado Springs Utilities

A map from Colorado Springs Utilities that shows how tunnels could bring water to Whitney Reservoir from Fall and Peterson creeks, and from the Eagle River. The map also shows the route of a pipeline to pump water from Whitney Reservoir to Homestake Reservoir.

Brent Gardner-Smith/Aspen Journalism
Homestake Reservoir, which is partially in Pitkin County, but mainly in Eagle County. Below the reservoir the Homestake Creek valley is visible, as well as short section of what's known as Homestake Road. Water held in the potential Whitney Reservoir would be pumped up to Homestake Reservoir and then sent to the Front Range.

Forebay and pumping

Despite the wetlands and wilderness challenges, Lusk and Kitzmann said no fatal flaws have been found yet in what they view as an important future element of their water-supply systems.

The new reservoir would serve as a collection point for water brought in via tunnels from the Eagle River and Fall and Peterson creeks, and for water captured from Homestake Creek.

The reservoir would also serve as a forebay, as the water captured in Whitney Reservoir would be pumped 7 miles up to Homestake Reservoir. Once there, it can be sent through a tunnel under the Continental Divide to Turquoise Reservoir, near Leadville, and then on to Aurora and Colorado Springs.

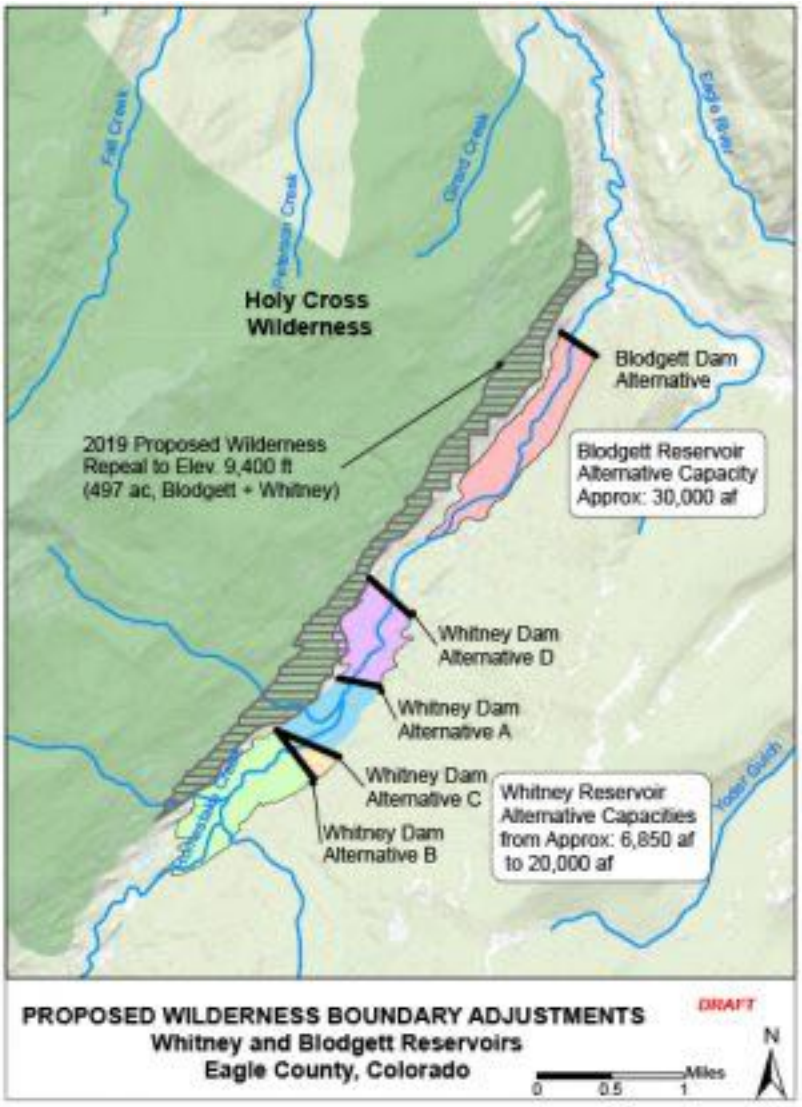
The two cities own and manage Homestake Reservoir, the upper end of which is in Pitkin County. The reservoir opened in 1967 and normally stores 43,600 acre-feet of water from seven high-mountain creeks behind a 231-foot-tall dam. About 25,000 acre-feet a year is sent through the Homestake Tunnel each year to the Front Range.

Homestake Partners also has a conditional water-storage right from 1995 to store 9,300 acre-feet of water behind a potential 110-foot-tall dam in what is called Blodgett Reservoir, located on Homestake Creek below the Whitney Reservoir sites. Blodgett Reservoir also has a longer history, and has been viewed as an alternate location for older water rights – appropriated in 1952 and adjudicated in 1962 – that are tied to Homestake Reservoir.

Appendix VIII

Aurora, Colorado Springs move toward building additional Homestake reservoir

By **Grant Stringer** - July 24, 2019



AURORA | Aurora is determined to build another mountain water reservoir to make use of water rights currently rushing down the Colorado River.

Local officials say damming a creek between Leadville and Minturn — and routing water normally flowing into the Colorado River — is necessary to sate the future thirsts of a city growing on land where water is scarce.

Aurora Water and Colorado Springs Utilities recently applied together for a permit to drill underground near the creek and test where a large Whitney Reservoir would be best situated.

Aspen Journalism first reported the early step to build the reservoir.

For the dam, the utilities are eyeing four possible locations about six miles southwest of Red Cliff.

But damming Homestake Creek would also require moving the boundary of the Holy Cross Wilderness, affecting ancient, pristine wetlands.

Greg Baker, Aurora Water's manager of public relations, said the Whitney Reservoir could be built in 25 years if key steps such as test drilling on Forest Service land are approved.

Baker said it's another creative step to make sure that Aurora doesn't go dry.

"You don't leave anything on the table when you're in Colorado, because most of the water has been appropriated in river basins," he said.

Baker said the reservoir could eventually hold anywhere from 9,000 acre-feet to 19,000 acre-feet of water. The water would then be pumped near Leadville and travel to the Front Range through tunnels to the South Platte River basin.

Currently, only Aurora and Colorado Springs would benefit, Baker said.

The project is another alliance between Aurora Water and Colorado Springs Utilities. The two cities — the state's largest behind Denver — are both growing quickly. Baker said the new reservoir could help ensure the taps keep flowing, especially in an era with snowpack decreases that imperil creeks and rivers.

The two city utilities, jointly called Homestake Partners, entered into a pact about 20 years ago with various mountain water authorities to build water infrastructure such as the Whitney Reservoir.

Water from these projects, including the Whitney Reservoir, are typically split between the partners. Baker said Aurora is entitled to about 10,000 acre-feet of water rights it owns but has not developed.

The Whitney Reservoir project could help make up for that deficit, Baker said.

Baker said Homestake Partners first started contemplating the Whitney Reservoir project about five years ago and conducted some preliminary research.

Homestake Partners filed its application to the Forest Service last month, which is still considering the permit request.

The plan calls for building temporary roads through Forest Service woods and drilling in four possible locations on Homestake Creek. The testing would ensure that the areas are structurally sound enough to hold the large reservoir, Baker said. He's hoping that work can begin this summer, before the winter snow renders the sites inaccessible.

The water entity will also study how the reservoir would impact the local environment. That process in particular is slow-moving, officials said.

Building the dam would require years of environmental studies, but the drilling permit application cites important wetlands and endangered species in the area.

So-called fen wetlands in the area are are challenge. The wetlands take thousands of years to develop and are "hotspots of biodiversity," according to the Forest Service website.

The ancient wetlands are also hard to replicate if destroyed elsewhere, but Baker said Aurora would try to. A pilot project near Leadville has seen some success, he said, and Aurora Water will work to convince the Environmental Protection Agency of the plan.

Various endangered fish species would be downriver from the dam, including "critical" habitats of Bonytail chub, Colorado pikeminnow, humpback chub and razorback sucker.

That has drawn scrutiny from Trout Unlimited, a national conservation group protecting rivers.

"We will look closely at the environmental impacts of the proposal," said Drew Peternell, director of Trout Unlimited's Colorado Water Project. "In particular, we will be interested in assuring that the project does not negatively impact stream flows or fish habitat in the Eagle and Colorado Rivers," he said, referencing the river connecting the creek to the Colorado River.

Baker said the reservoir would also require moving Homestake Road, a popular route for recreation, into the nearby Holy Cross Wilderness.

Redrawing the 114,000-acre wilderness border would require Congressional legislation, Baker said. About 500 acres of the wilderness would be lost.

However, Baker said Aurora is open to buying and replacing the land elsewhere on the wilderness boundary. He said legislation is pending following a meeting with the Colorado congressional delegation.

Aurora is also buying up land that could be impacted by the Whitney Reservoir.

The city bought a 150-acre parcel of land in 2018 for more than $4 million, and plans to buy more.

Although the two-decade process for building the dam is a long one, Baker is optimistic.

“We’re not seeing anything that is a show stopper,” he said.

POST INDEPENDENT

Forest fens foster Ice Age relict plants

News FOLLOW NEWS | September 18, 2011

Heather McGregor
Post Independent Editor
Glenwood Springs, CO Colorado

John Proctor Special to the Post Independent
ALL |

GLENWOOD SPRINGS, Colorado – Forest botanist John Proctor says the White River National Forest could contain nearly 15,000 acres of fens – a rare ecosystem that harbors relict plant species dating back to the last Ice Age.

A fen is a type of wetland that has a deep layer of soil mainly composed of decaying organic material, called "peat," and very little dirt. A fen stays saturated year round, filled to the brim with cold groundwater. It stays chilly through the summer, and barely freezes in the winter months when covered by an insulating blanket of snow.

"It's a low-oxygen, saturated condition, so the rate of accumulation of dead plant material is greater than the rate of decomposition," Proctor said.

Only a few plant species can grow in these conditions: certain sedges, rushes, mosses, grasses and forbs, such as wire sedge, lesser panicled sedge, bog sedge, spike rush, peat moss, narrow-leaf cottongrass, marsh cinquefoil and bog buckbean.

Most grasses, shrubs and trees on Earth are rooted in soil that dries out enough between storms to allow oxygen to reach their roots. Fen species must be able to live rooted in a saturated, chilled, low-nutrient tangle of roots and slowly decaying plant material.

Fens tend to occur in basins, around open water ponds, or on gentle slopes with blocked drainage. And fens form very, very slowly. A fen in the Rockies will accumulate peat at the rate of 3.5 to 18 inches per 1,000 years, Proctor said.

"Because the accumulation of peat in fens is so slow, these ecosystems are essentially irreplaceable," he said. "Fens are relicts from the glacial past. Many are more than 6,000 years old."

Fens filter and hold clean water, serving as high country reservoirs that help keep streams flowing past the runoff season. They also store high levels of carbon, helping to offset climate change.

Fens also contain a climatological record of pollen, plant and insect species that can give scientists a view into the past, much like glacial ice cores.

Now that possible fens have been located in more than 5,500 sites across the 2.3-million-acre national forest, Proctor has started what will be a long process of ground-truth field surveys.

Not all these areas will turn out to actually be fens. Some will be more ordinary wetlands, open ponds or meadows.

Proctor worked this summer with two Forest Service technicians and a biologist with Colorado State University's Colorado Natural Heritage Program to visit 25 possible fens.

The team focused on sites that are outside wilderness areas and close to roads in the forest. This subset of possible fens would be at the highest risk for damage from development, visitation or motorized use.

The ground-truth work continues this fall with biology students from the Colorado Mountain College Leadville campus.

All but one of the summer's 25 sites turned out to be high quality fens.

"We're on the right track," Proctor said. "The only place it didn't play out was on Middle Thompson."

On his desk in the White River National Forest headquarters office in downtown Glenwood Springs, Proctor has two large Ziploc bags containing foot-deep plug samples taken from two fen sites: one from the Fryingpan basin east of Basalt and one from the Middle Thompson Creek area west of Carbondale.

"Hold these, and you'll see what I mean," he said.

Indeed, the Fryingpan plug is surprisingly light for its size, while the Middle Thompson plug is a heavy clump of mostly dirt. The Fryingpan plug is less than half dirt, sifted in around a loose pack of roots and decaying plant material.

Proctor expects that of the 5,544 possible fens on the White River National Forest, only 1,592 are of a high probability to actually be true, high-quality fens.

The fen project builds on work done in the early 1980s by the U.S. Fish and Wildlife Service through the National Wetland Inventory. At the time, scientists used U.S. Geological Survey quadrangle maps and their working knowledge of forest ecosystems to develop blueprint-type paper maps pinpointing wetland sites, Proctor said.

That work yielded thousands of wetland sites, each numbered with a wetland coding system.

Over the past two years, Colorado Natural Heritage Program scientists zoned in on the White River National Forest, pairing the 1980's coding system with modern aerial color photography and digital mapping to narrow the 30-year-old wetland survey to 5,544 possible fen sites, including 1,592 high-probability sites.

"The Colorado Natural Heritage Program's methodology and painstaking work made this project possible," Proctor said.

On his computer screen, Proctor clicks on a large-scale map of the whole White River National Forest. Clumps of blue dots appear in many areas, representing the 5,544 possible fen sites.

Zooming in to the digital maps, the screen displays a single quadrangle and its fen sites.

Even closer zooming brings up amoeba-shaped blobs outlined in bright pink, blue or green overlaid on aerial summertime photos. These are the lines on the landscape that separate a fen from an open pond, marsh or uplands where normal soil or rock exist.

The outline colors separate the blobs into low-, medium- and high-probability fens. Reaching this level of fen identification is the result of careful comparisons, quadrangle by quadrangle, of topographic contours and the color and texture of open spaces as seen in aerial photos.

Nearly two-thirds of the possible fen sites and fen acreage in the White River National Forest is inside wilderness areas.

While it will be noteworthy to verify and catalog these areas, Proctor is focused on fens outside wilderness boundaries, where damage is more likely to occur.

For example, several fens were confirmed this summer in the broad tundra at the summit of Independence Pass. It's an area that gets a lot of visitation, mostly by motorists taking a short hike on the defined paths.

Another confirmed fen of 35 acres surrounds Lily Pad Lake in the Fryingpan basin. A Forest Service road passes along one side of the fen, and erosion from the road is feeding stormwater runoff, dirt and nutrients into the fen. It is upsetting the natural balance and killing fen vegetation.

"If you lose the peat in one part, the whole thing can come unraveled," Proctor said.

So Forest Service officials are considering several options for the short stretch of road that passes by the fen to redirect the runoff.

On Independence Pass, the Warren Lakes area will be the site of an effort this fall to restore fens that were badly damaged in the 1930s by peat mining. The work will attempt to stop up the channels cut in the peat so the fen can fill up with water again. The hope is that once the fen is fully saturated, the peat will begin to gradually fill back in.

Between further on-the-ground surveys to verify more fen sites, and projects to repair and restore damaged fens, the Forest Service will have the opportunity to employ people over the coming years, Proctor said.

The overall goal for surveying and repair projects is to protect and preserve the forest's fens as reservoirs of clean water and rare plants, and as a glimpse into the glacial past.

Appendix X

STUDENTS MONITORING WELLS AND PIEZOMETERS

Fen Description

High altitude fens are a peat-based wetland that require thousands of years to develop. This lengthy time-span for fen development is primarily due to environmental constraints of high-altitude climates. Fen wetlands require specific hydrologic, chemical and topographical conditions for their development making this study crucial in the development of the experimental mitigation design. Therefore, a considerable amount of data is currently being collected and analyzed by NRM along with a certified professional wetland scientist and a board of professionals.

Student Skills

- Wetland Delineation Methods
- Water Quality (Temperature, pH, Conductivity, Total Dissolved Solids) Meter Application
- Water Sample Collection and Processing
- Soil Sampling and Testing
- Water Well and Piezometer Installation and Monitoring
- Stream Flow Measurements
- Data Documentation and Processing
- Interpersonal Communication
- GIS Mapping
- Redox Measurements

STUDENTS ASSESSING SOURCE POND CONDITIONS

Study Team

US Fish & Wildlife Service (USFWS)
US Environmental Protection Agency (USEPA)
US Army Corps of Engineers (USACE)
Brad Johnson, Ph. D., Professional Wetland Scientist

Funding Partners

City of Aurora
Board of Water Works of Pueblo
Colorado Springs Utilities

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901 S. Hwy 24
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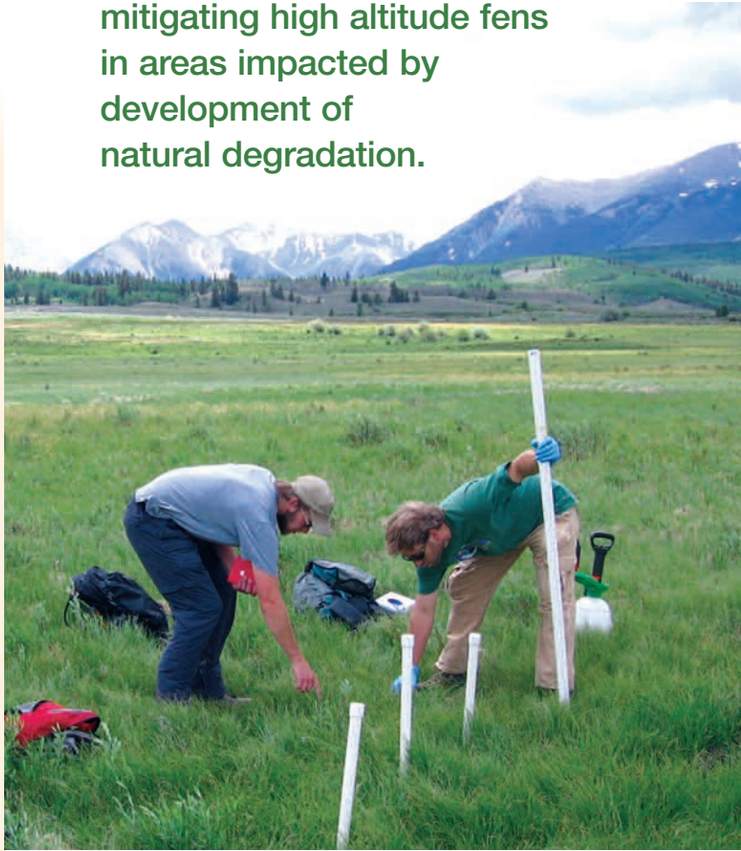
CMC-NRM
719.486.4222

4.7 500M

Colorado Mountain College

The Rocky Mountain Fen Research Project

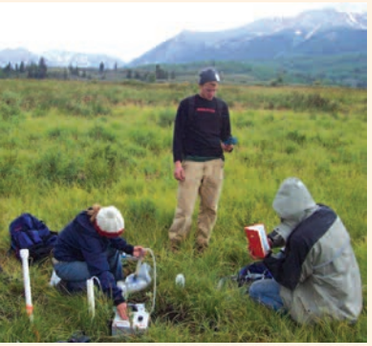
A study designed to explore various means of mitigating high altitude fens in areas impacted by development of natural degradation.



SCOPE OF WOR

Te Rocky Mountain Fen Researc Project (RMFRP)

is a study designed to explore various means of mitigating high altitude fens in areas impacted by development or natural degradation.



NRM STUDENTS TA ING WATER SAMPLES

A fen is a special type of wetland whose impacts cannot be satisfactorily mitigated according to Army Corp of Engineers and the U.S. Fish and Wildlife Service guidelines. This unmitigable status may be related to the lack of scientific investigation related to fen mitigation. The City of Aurora Utilities Department (Aurora) and the Board of Water Works of Pueblo, Colorado (Pueblo) contacted Colorado Mountain College Natural Resource Management Program (CMC NRM) to develop a research pro ect to investigate potential means of successfully mitigating fen impacts. The pro ect is administered and facilitated by CMC NRM with a technical team overseeing the development of the pro ect. The technical team includes a fen expert and remediation construction representative as well as members from the US Fish & Wildlife Service, Army Corp of Engineers, and US EPA. The representation of the federal agencies on the technical team speaks to the importance of this scientific research pro ect and fen mitigation. This study will bolster the scientific knowledge of fen mitigation on many fronts including transplantation, creation and restoration. Many of the components of the pro ect will be applicable not ust to fen impact mitigation, but to wetland mitigation in general increasing the significance of the pro ect.

A fen is a special type of wetland whose impacts cannot be satisfactorily mitigated according to Army Corp of Engineers and the U.S. Fish and Wildlife Service guidelines.

The pro ect focuses on developing techniques to translocate a fen from an area where it would be covered, inundated, drained or in some way damaged, to a location where it would be out of harms way and could continue to function as a fen. This scenario of transplantation is only one of many conceivable situations in which the techniques that would be developed by the study could impart significant benefit to both society and the natural resources of Colorado.

STUDENTS TA ING CORE SAMPLES DURING WINTER

STUDENTS PARTICIPATED IN PUMP TESTING

All the necessary approvals from the Army Corp of Engineers, the U.S. Fish and Wildlife Service, the State of Colorado Mined Land Reclamation Board and the Colorado Division of Wildlife necessary to harvest and move the fen have been received. It is also important to note that a Clean Water Act permit is not necessary for the activities of this study. A cookie-cutter: approach using heavy equipment designed for this specific application will be used to disassemble a portion of an intact fen, transport the harvested organic soils and plant life intact, and reassemble the living mantel in a specially prepared basin. The receiver basin has been designed to mimic the form and function of natural fen basins. Baseline monitoring of the donor fen is ongoing and a rigorous and intensive monitoring program will be instituted to determine the success of the transplantation procedure.

SOIL CORE SAMPLES TA EN B STUDENTS

Student utcomes

The Natural Resource Management (NRM) program at Colorado Mountain College (CMC) provides real life pro ect learning for students. By applying classroom knowledge and techniques to actual field pro ects, students greatly enhance their learning experience and develop a more complete understanding of these concepts. Students have the rare opportunity to directly interact with environmental professionals from private companies, as well as state and federal agencies, providing additional educational opportunities and networking. Exposure to real life pro ects and professionals expands students understanding of environmental issues and the ethics of research, remediation and restoration.

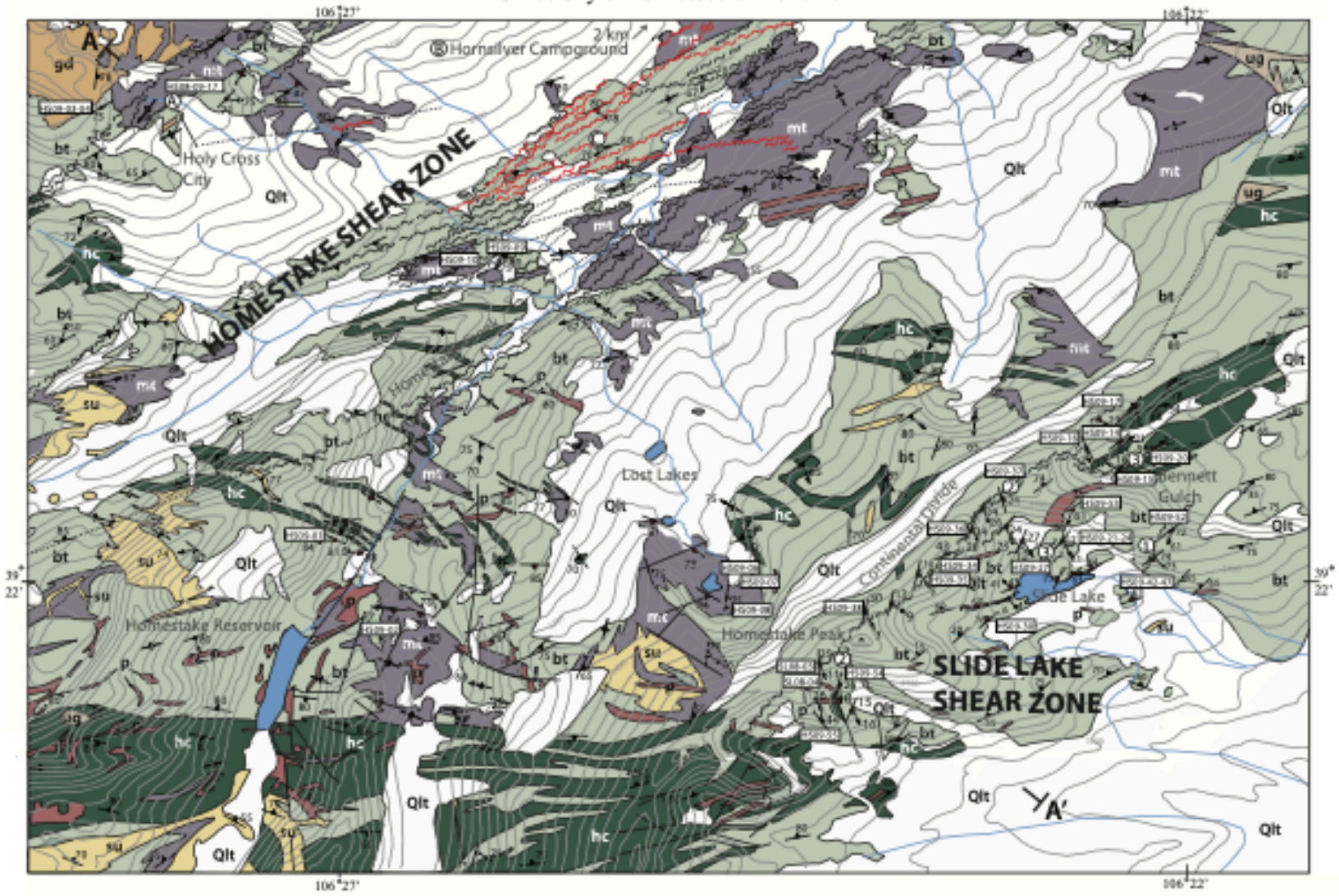
The RMFRP is enabling students to
Develop research skills
Develop ethical practices
Acquire knowledge on fen wetland science
Acquire knowledge on wetland delineation steps
Acquire knowledge on environmental issues
Communicate with federal agencies and a wetland scientist
Collect hydrologic, chemical, and soil data
ASTM Application
Data synthesis and interpretation

STUDENTS LEARNING INSTALLATION, PROCEDURES AND USE OF REDO PROBES

Appendix XI

Geologic Map of the Homestake and Slide Lake shear zones, Eagle and Lake Counties, Colorado

Mapping by Liz Lee, Micah Jessup, and Donnie Hicks
The Department of Earth and Planetary Sciences
University of Tennessee - Knoxville



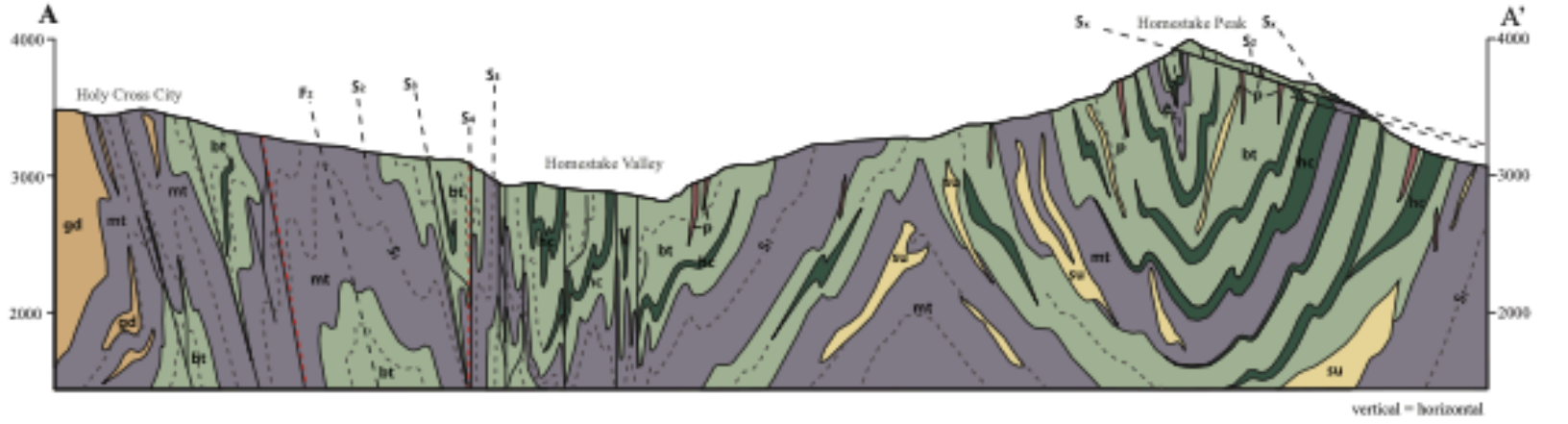
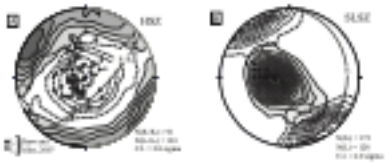
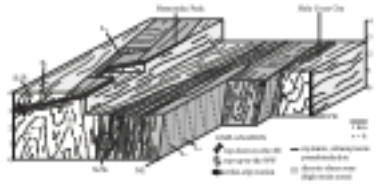


Plate 1: Geologic map of the HSZ and SLSZ, Eagle and Lake counties, Colorado

Generalized map (above) of Colorado, showing Proterozoic exposure (dark gray polygon in center of state), Proterozoic shear zones (small black lines), and the location of the Colorado Mineral Belt (CMB). Also showing the two major USGS 7.5 minute series topographic maps used for this study.



Lower hemisphere equal area stereonets showing foliation and lineation relationships in the field area. Black planes represent average S3 foliation plane and shaded contours represent poles to foliation for all measured S3 planes. Stretching lineations from this study represented by dashed contour lines. Stretching lineations from Shaw and Allen (2007) denoted with "x" and "o". (A) HSZ S3 average (056, 79°SE), L3 (88° → 209), and L4 (80° → 120). (B) SLSZ average Sx (003, 17°SE) and Lx (085° → 154).



Block diagram of the SLSZ and HSZ viewed to the south. Foliation relationships and shear sense are shown. Black arrows represent top-down-to-the-SE, gray arrows represent top-up-to-the-NW shear sense. Lineations denoted as dashed lines on foliation plane.

Scale 1:24,000

1 0.5 0 1

kilometers

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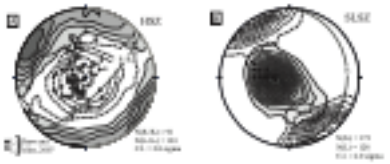

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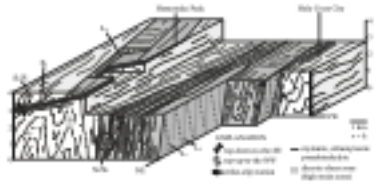

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