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IN THE THIRD JUDICIAL DISTRICT COURT

SALT LAKE COUNTY, STATE OF UTAH

LAKE RESTORATION SOLUTIONS LLC, a Delaware limited liability company, Plaintiff, v. BENJAMIN ABBOTT, an individual Defendant.	**ANSWER, ANTI-SLAPP STATEMENT, AND COUNTERCLAIM** Civil No. 220900164 Judge: Laura Scott

Defendant Benjamin Abbott ("Professor Abbott") hereby responds to the Complaint filed against him by Lake Restoration Solutions, LLC ("LRS"), submits his affidavit and evidence that the Complaint is a strategic lawsuit against public participation (a "SLAPP Action") in violation of Utah's Citizen Participation in Government Act (the "Anti-SLAPP Statute"), and asserts a counterclaim against LRS for costs, attorney fees, and compensatory damages under the Anti-SLAPP Statute.

INTRODUCTION

Professor Ben Abbott has not made any false or defamatory statements concerning LRS's proposal to dredge, develop, and potentially destroy Utah Lake. Professor Abbott's statements have been truthful, well-considered, and offered solely with the intention of promoting science-based governance of public resources. His statements about LRS's efforts find support in publicly available information—often information published by LRS or its leadership team. There is nothing unlawful about Professor Abbott's criticism of LRS, its proposal, or its management.

Rather, Professor Abbott's conduct is at the heart of the American political system that encourages—and provides special privileges and protections for—speech on matters of public concern, including matters involving valuable public resources. LRS should be held to account for attempting to weaponize the judicial system to silence a critic and prevent fruitful public discourse and policymaking.

FREE SPEECH RIGHTS AND THE PUBLIC INTEREST

Speech on matters of public concern "is at the heart of the First Amendment's protection." *Dun & Bradstreet, Inc. v. Greenmoss Builders, Inc.*, 472 U.S. 749, 758–59 (1985) (cleaned up). In fact, "[t]he First Amendment was fashioned to assure unfettered interchange of ideas for the bringing about of political and social changes desired by the people." *Id*. (citation omitted). Thus, "speech on public issues occupies the highest rung of the hierarchy of First Amendment values and is entitled to special protection." *Id*. (cleaned up). No action for

defamation, such as this one, can arrive at court "without its companion and antagonist, the First Amendment, in tow." *O'Connor v. Burningham*, 165 P.3d 1214, 1222 (Utah 2007).

Utah's constitution similarly and independently protects our citizens' freedom of speech, stating that "[n]o law shall be passed to abridge or restrain the freedom of speech." Utah Const. art. I, § 15. "Those who won our independence believed that the final end of the state was to make men free to develop their faculties and that public discussion is a political duty." *Mast v. Overson*, 971 P.2d 928, 931–32 (Utah Ct. App. 1998) (quoting *Whitney v. California,* 274 U.S. 357, 375 (1927) (Brandeis, J., concurring) (cleaned up)).

This case involves a controversial matter of public concern, the outcome of which will permanently affect the general public of Utah as beneficiaries of Utah Lake. During the ongoing Utah State legislative session, LRS is continuing its aggressive, years-long campaign to lobby legislators and further its plan to "divest" the state of portions of Utah Lake. LRS wants to privatize and develop thousands of acres of Utah Lake—an irreplaceable public resource—in exchange for its purported plan to "restore" the lake by fundamentally transforming it. Many people, including Professor Abbott (an ecosystem ecologist), oppose LRS's efforts to privatize and develop portions of the lake and dispute the scientific viability of LRS's planned methods of "restoration," and have sought to educate and influence city, state, and federal policymakers to prevent the project.

LRS, however, has no stomach for the "unfettered interchange of ideas" guaranteed by both the Federal and Utah Constitutions. Instead, LRS has filed this SLAPP action to chill discussion of its plan and for the express purpose of muzzling one if its most outspoken and knowledgeable critics. Rather than simply engage with Professor Abbott on the issues, LRS

served its SLAPP lawsuit the day that Professor Abbott was scheduled to speak at a public event organized by a Utah State Representative and just one week before Utah's 45-day legislative session. This lawsuit is a clear attempt to prevent Professor Abbott, and discourage other critics of the project, from engaging with lawmakers and the public on any of the several pieces of legislation affecting the future of Utah Lake during the 2022 legislative session.

BACKGROUND FACTS

Professor Abbott is a credentialed and well-respected ecosystem ecologist and is an Assistant Professor of Ecosystem Ecology in Brigham Young University's Department of Plant and Wildlife Sciences. Abbott Aff. ¶ 2, attached as Exhibit A; Abbott CV, attached as Exhibit B. In 2009, Professor Abbott earned his B.S. from Utah State University in Watershed and Earth Science where he worked as an undergraduate researcher in both Utah and Alaska studying water quality, hydrology, lake ecosystems, and eutrophication (the consequences of excess nutrients, including algal blooms). Abbott Aff. ¶ 3. In 2014, Professor Abbott earned his Ph.D. in ecosystem ecology from the University of Alaska Fairbanks where he studied biogeochemical cycles, soil hydrology, ecological disturbance, and science-policy interactions. *Id.* ¶ 4.

From 2014 to 2016, Professor Abbott worked as a postdoctoral researcher for the French National Centre for Scientific Research ("CNRS") in Rennes, France. *Id.* ¶ 5. In his postdoctoral work, Professor Abbott researched eutrophication, ecological restoration of rivers and lakes, sustainable agriculture, and groundwater-surface-water interactions. *Id.* ¶ 6. From 2016 to 2017, Professor Abbott worked as a postdoctoral researcher for Michigan State University, working in ecohydrology, water quality, and water security. *Id.* ¶ 7. In 2017, Professor Abbott accepted a position at Brigham Young University ("BYU") where he has

focused on aquatic ecology, catchment hydrology, science writing, environmental policy, and the effects of urban and agricultural activity around Utah Lake. *Id*. ¶ 8. Since accepting the position at BYU and moving home to Utah, Professor Abbott has been continuously involved in researching and assisting in environmental improvement initiatives related to Utah Lake. *Id*. ¶ 9.

It is difficult to overstate the ecological importance of Utah Lake. *Id*. ¶ 10. As the largest freshwater lake in the state, Utah Lake is a keystone ecosystem that provides invaluable ecosystem services, including pollution removal, habitat for tens of millions of birds and fish, recreation and human-nature engagement, and regulation of local climate. *Id*. ¶ 11. Utah Lake's natural characteristics—especially its shallowness and naturally cloudy water—have made it more resilient than most water bodies to human pressures. *Id*. ¶ 12. However, the cumulative effects of water diversions, pollution inputs, and invasive species have triggered major changes to the lake, including a drying event in the 1930s and a shift from emergent vegetation to algae and cyanobacteria in the mid-20th century. *Id*. ¶ 13. Thanks to decades of increasing research and scientifically-sound restoration efforts, including broad participation from the community, Utah Lake is on the road to recovery. *Id*. ¶ 14; *see also* Getting to Know Utah Lake at 22-24, attached as Exhibit C. For example, the overall amount and duration of harmful algal blooms have decreased in the past 35 years, invasive species removal programs have made progress, and habitat restoration projects have been extremely successful. Abbott Aff. ¶ 15. Another example of this progress is the recovery of the native June Sucker fish, which was classified as endangered in 1986 (with no reproducing adults observed in Utah Lake) but down-listed to threatened in 2021 with approximately 4000 spawning adults observed. *Id*. ¶ 16.

In the past several years, LRS has thrust itself to the forefront of a controversy regarding the future of public resources in and around Utah Lake. On November 13, 2017, LRS filed a land exchange proposal with Utah's Division of Forestry, Fire and State Lands to "exchange" a "TBD" number of acres of Utah Lake (public land) to LRS (the "Exchange Application"). *See* LRS DFFS App., attached as Exhibit D. Specifically, LRS sought approval to dredge Utah Lake, create artificial islands with the dredged material, and to take private possession of a "TBD" swath of the constructed land "to pay for a portion of these restoration activities" (the "LRS Project"). *Id*. at 5.

Months later, the Utah legislature passed 2018 HB 272—the "Utah Lake Restoration Act"—which granted the Division of Forestry, Fire, and State Lands the ability (subject to the approval of the Legislative Management Committee) to waive the asset exchange requirement applicable when LRS applied for the exchange. *See* Utah Admin. Code R652-80-200; R652-30-500(2). Instead, the Utah Lake Restoration Act allows the Division to dispose of "appropriately available" state lands in exchange for the promise of a satisfactory comprehensive restoration project alone. *See* Utah Code § 65A-15-201. The effort to pass 2018 HB 272 was controversial and was expressly and publicly tied to the LRS Project. *See* Brian Maffly, *Lawmakers back giving developers parts of Utah Lake for an island subdivision – in exchange for fixing the polluted lake's many problems*, Salt Lake Tribune, Feb. 21, 2018, copy attached as Exhibit E ("HB272 would clear a path for developers' ambitious and unprecedented proposal to dredge the lake, using the fill to create up to 20,000 acres of islands inhabited by 250,000 to 500,000 people, connected to the rest of Utah County by four causeways.").

Because of his expertise as an ecosystem ecologist, and because of his specific expertise with the issues faced by Utah Lake, Professor Abbott was invited to speak publicly—both at community events and to governmental bodies—about the LRS Project. Abbott Aff. ¶ 17. As he learned more about the LRS Project, Professor Abbott became increasingly alarmed by LRS's proposed methods, its apparent focus on development rather than ecological restoration, and the credentials of the project team publicized by LRS. *Id*. ¶ 18. As a scientist and a Utahn, and as one of Utah's most knowledgeable experts on the ecology of Utah Lake, Professor Abbott felt compelled to speak out and voice his opinion that the LRS Proposal is not in line with best practices in restoration ecology and would irreversibly damage one of Utah's most critical public assets. *Id*. ¶ 19.

In short, Professor Abbott believes that the LRS Project would have a devastating impact on the recovery of the Utah Lake ecosystem, potentially causing irreparable harm to the lake. *Id*. ¶ 20. Some of the harms include: (1) deepening and dividing the lake, which would reduce water column mixing and exacerbate the consequences of algal blooms, including hypoxic dead zones, pollutant release from sediment, and fish kills; (2) loss of natural evaporation, which would reduce the lake's pollution removal capacity, decrease local humidity and precipitation, and increase flood risk during high water years; (3) unprecedented freshwater dredging, which would destroy the lakebed biodiversity, potentially reducing pollutant removal and releasing pollutants that are currently safely immobilized by the lakebed; (4) artificially clarifying the water, which could stimulate algal and cyanobacterial growth; and (5) fundamental modifications to the lake's hydrology, chemistry, and food web, which could render the lake permanently dependent on

active human intervention by replacing the lake's natural resilience with costly technological substitutes such as the proposed water circulators and mechanical biofilters. *Id.* ¶ 21.

In addition to the ecological risks of the proposed changes, Professor Abbott believes that LRS is undermining crucial education and outreach activities by falsely claiming that Utah Lake used to be a clear-water lake, that waves and evaporation are damaging, that sediment is heavily polluted, that algal blooms are worsening, that the lake is rapidly deteriorating, and that restoration efforts have been ineffective. *Id.* ¶ 22. LRS's consistent portrayal of Utah Lake as a "broken ecosystem" in a "downward spiral" discourage visitation to Utah Lake and unfairly stoke discontent about ongoing restoration efforts. *Id.* ¶ 23.

In the spring of 2021, Professor Abbott learned that LRS had met with members of the Utah State Legislature and governor's office and had given an account of the lake that did not correspond with available scientific evidence. *Id.* ¶ 24. In response, Professor Abbott and a team of scientists, natural resource managers, citizens, and community partners organized the Utah Lake Symposium event held at Utah Valley University in August 2021. *Id.* ¶ 25. State and local governmental officials attended the symposium which discussed Utah Lake and current lake-related projects, including the LRS proposal. *Id.* ¶ 26. Professor Abbott became convinced that repealing or amending the 2018 HB 272 was necessary for the ongoing protection of the lake. *Id.* ¶ 27. He also began speaking out about the Utah Lake Authority bill, which was being prepared for resubmission in the 2022 session. *Id.* ¶ 28.

Despite a near (if not total) consensus among Utah's scientific community that the proposed LRS Project is ill-advised, Professor Abbott learned in the fall of 2021 that the Governor's Office of Economic Opportunity had allegedly issued a statement in support of the

LRS Project. *Id*. ¶ 29. Professor Abbott also learned that LRS intended to host a "Meet the Experts" lunch at the Utah State Capitol with representatives from "federal, state, and local agencies." *Id*. ¶ 30; *see* Meet the Experts Invitation, attached as Exhibit F. Professor Abbott grew concerned that the previously published warnings of the scientific community were not being heard because they were too long, too technical, and not sufficiently direct. Abbott Aff. ¶ 31. Consequently, Professor Abbott wrote a post on his personal blog called "Seven problems with the Utah Lake islands proposal." *Id*. ¶ 32; *see* Blog Post, attached as Exhibit G. The post directed readers to LRS's proposal, linked to background information on the lake, and encouraged readers to support repeal of 2018 HB 272 (which had increased the likelihood of Utah Lake alterations and land transfers). Abbott Aff. ¶ 33; *see* Blog Post.

On November 30, 2021, Professor Abbott emailed a link to his blog to two members of the governor's office. Abbott Aff. ¶ 34. Shortly thereafter, on December 2, 2021, Professor Abbott learned that LRS's "Meet the Experts" event had been postponed. *Id*. ¶ 35.

In December 2021, Professor Abbott was invited by Conserve Utah Valley—a local volunteer organization and registered 501(c)(3)—to meet with Representative Keven Stratton to discuss possible legislative actions relating to the 2018 HB 272. *Id*. ¶ 36. Representative Stratton acknowledged the need of improving the process set forth by HB 272 and proposed a "Utah Lake Summit" to bring together political, environmental, and development interests to discuss Utah Lake legislation. *Id*. ¶ 37. The Utah Lake Summit was scheduled for January 11, 2022. *Id*. ¶ 38. Representative Stratton asked Professor Abbott to give the plenary presentation about Utah Lake. *Id*. ¶ 39.

Also in December 2021, Professor Abbott contributed to an expert letter (the "Expert Letter") with 116 other scientists, engineers, natural resource managers, recreation managers, education specialists, and lawyers knowledgeable about the issues facing Utah Lake. *Id*. ¶ 40. The express purpose of the Expert Letter was to "urge local, state, and federal leaders to oppose [the LRS Project] and make whatever changes are necessary to prevent similar projects in the future." Expert Letter at 2, attached as Exhibit H. In late December, another Utah State Representative invited Professor Abbott to a meeting with Lieutenant Governor Deidre Henderson to discuss Utah Lake and share the expert letter. Abbott Aff. ¶ 41. After that meeting, Professor Abbott published the letter on December 29, 2021. *Id*. ¶ 42.

On January 11, 2022—hours before he was scheduled to speak at Representative Stratton's Utah Lake Summit and only a week before the start of Utah's 45-day legislative session—LRS served Professor Abbott with the Complaint in this action. *Id*. ¶ 43. LRS seeks a judgment of three million dollars against Professor Abbott and seeks an unconstitutional order preventing Professor Abbott from, among other things, making "derogatory" remarks about LRS.

UTAH'S ANTI-SLAPP STATUTE

Utah's Anti-SLAPP Statute states:

> (1) A defendant in an action who believes that the action is primarily based on, relates to, or is in response to an act of the defendant while participating in the process of government and is done primarily to harass the defendant, may file:
>
> > (a) an answer supported by an affidavit of the defendant detailing his belief that the action is designed to prevent, interfere with, or chill public participation in the process of government, and specifying in

> detail the conduct asserted to be the participation in the process of government believed to give rise to the complaint; and
>
> (b) a motion for judgment on the pleadings in accordance with the Utah Rules of Civil Procedure 12(c).

Utah Code § 78B-6-1403.

Under the statute, "process of government" means "the mechanisms and procedures by which the legislative and executive branches of government make decisions, and the activities leading up to the decisions, including the exercise by a citizen of the right to influence those decisions under the First Amendment to the U.S. Constitution." Utah Code § 78B-6-1402(4). Through his opposition to the LRS Project, Professor Abbott sought to influence decision-making at the Division of Forestry, Fire, and State Lands, the Office of the Governor, the Utah County Commission, city council members and other decision-makers in Utah Valley, and state legislators. Abbott Aff. ¶ 44. Professor Abbott's efforts to oppose the LRS Project is a "process of government" under the definition provided by the legislature in the Anti-SLAPP Statute. *See Anderson Dev. Co. v. Tobias*, 2005 UT 36, ¶¶ 5, 50 (holding that "vocal opposition to [a] zoning application," including distribution of fliers to city residents, was "participation in the process of government.").

As set forth above, Professor Abbott believes that LRS's three-million-dollar lawsuit against him "is designed to prevent, interfere with, or chill" his public participation in the processes of government. Abbott Aff. ¶ 45. LRS hopes to push its agenda through the 2022 Utah legislative session, through urgent municipal policy decisions, and through pending regulatory proceedings, without the opposition of one of its most knowledgeable and outspoken critics. LRS's lawsuit violates Utah's Anti-SLAPP Statute.

RESPONSE TO MATERIAL ALLEGATIONS

1. This is an action for defamation and false light concerning Defendant Abbott's repeated false statements about lake Restoration and the Utah Lake Restoration Project ("Project"). The Project is a comprehensive plan for restoring and enhancing Utah Lake ("Proposal")

RESPONSE: Professor Abbott admits LRS has sued him for defamation and false light. Professor Abbott denies that LRS's claims have any valid basis in fact or law. He denies that his statements were false as a matter of fact, and he denies that any statement raised by LRS, as a matter of law, could be defamatory. Professor Abbot also denies that the LRS Project is a comprehensive plan for "restoring" and "enhancing" Utah Lake.

2. As Abbott knows, the Project will be subject to a rigorous review process through, among other things, the Army Corps of Engineers ("USACE"), in consultation with the U.S. Environmental Protection Agency ("EPA") and other federal and state agencies, including the National Environmental Policy Act ("NEPA") review process.

RESPONSE: Professor Abbott denies this allegation to the extent it suggests that private citizens should not voice opinions or independently evaluate public initiatives simply because government agencies are also involved. Professor Abbott also denies that he knows the federal regulatory process will be rigorous and denies LRS's allegation to the extent it suggests knowledge of federal legal and regulatory process diminishes Professor Abbott's right to share relevant information and science regarding the LRS Project.

3. While Lake Restoration looks forward to demonstrating the viability of the Project to the USACE through the NEPA review process, this lawsuit does not concern NEPA or the merits of the Project. Rather, this case concerns the many demonstrably false statements Abbott has made in a misguided and wrongful campaign to turn public opinion against Lake Restoration and the Project. Thus, while Lake Restoration welcomes fulsome, fact based-discussion of the Project (about which Lake Restoration has repeatedly invited public feedback), Abbott is not entitled to poison the debate with his false and defamatory statements—which he has promulgated on multiple forums, including Twitter, Facebook, public meetings, and his own personal blog.

RESPONSE: Professor Abbot denies this allegation. LRS's actions suggest that it does not want public involvement (*i.e.*, opposition or criticism) until it has the resources, permitting, and legislative support to overcome it.

4. For example, Abbott has falsely claimed—with no truth whatsoever—that Lake Restoration "has shady foreign funding" that "comes from Dubai." It does not. Abbott has also falsely asserted that Lake Restoration "has no scientists on its team." It does. And Abbott has falsely claimed that "no researchers are willing" to work for Lake Restoration, and that "no one in the research or management communities thinks [the Project] is a good idea." None of these things is true, and no privilege shields Abbott from his lies.

RESPONSE: Professor Abbott denies that he made any false or defamatory statement. He denies that his statements were false as a matter of fact, and he denies that any statement raised by LRS, as a matter of law, could be defamatory. Moreover, each of Professor Abbott's statements are protected by applicable privileges and constitutional guarantees, including, without limitation, the public interest privilege, the *Noerr-Pennington* doctrine, the fair comment privilege, and/or the legislative proceeding privilege.

5. Lake Restoration plans to donate the damages recovered from this action to one or more qualified 501(c)(3) non-profit organizations committed to water conservation and environmental sustainability.

RESPONSE: This statement is not an allegation, but is merely an attempt by LRS to make its three-million-dollar lawsuit against Professor Abbott more palatable to the public. Further, Professor Abbott lacks information sufficient to form a belief about the truth or falsity of this statement.

10. In January 2018, Lake Restoration Published a Proposal for the Project. In general, the Proposal contemplates dredging much of Utah Lake and restoring native plants and animals to their natural habitats.

RESPONSE: Professor Abbott admits only that the plan LRS submitted to government agencies in January 2018 outlines a plan to dredge Utah Lake and "contemplates" restoring

native plants and animals.[1] LRS omits that its plan also contemplates the privatization and commercial development of large portions of the lake. Professor Abbott denies any suggestion that LRS's Project would be ecologically beneficial, or that its proposed methods are scientifically sound.

11. Abbott vehemently opposes the Project.

RESPONSE: Admitted. Based on his education, experience, and research as a Ph.D. ecosystem ecologist with particular expertise on Utah Lake, Professor Abbott believes that the LRS Project would cause massive and irreversible ecological damage to Utah Lake and its environs. Professor Abbott also finds the Project unacceptable because of its disregard of community, history, and local cultural values.

12. In an attempt to turn public opinion against Lake Restoration and the Project, Abbott has made a series of false, misleading, and defamatory statements.

RESPONSE: Professor Abbott denies that he made any false, misleading, and/or defamatory statements. He denies that his statements were false as a matter of fact, and he denies that any statement raised by LRS, as a matter of law, could be defamatory. Professor Abbott admits that he has been working to educate the public, relevant government agencies, executive officeholders, and legislators about the risks and harms associated with the LRS Project. Moreover, each of Professor Abbott's statements are protected by applicable privileges and constitutional guarantees, including, without limitation, the public interest privilege, the *Noerr-Pennington* doctrine, the fair comment privilege, and/or the legislative proceeding privilege.

[1] The risks and harms of environmental dredging are outlined at Getting to Know Utah Lake at 26-30, Ex. C.

13-14. [Specific allegedly defamatory statements]

Lack of Professional Scientific Support:

RESPONSE: LRS contends that the following portion of Professor Abbott's blog post contains defamatory statements:

> **Problem #6. The project has no scientists on its team.** This is one of the strangest and most troubling aspects of this proposal. For any legitimate restoration project, you assemble a team of researchers, engineers, and legal experts to ensure an efficient, effective, and safe process. While there are several engineers and lawyers involved, the team appears to be primarily real estate entrepreneurs. There are no PhD-level environmental or ecological scientists on the team, though their "senior scientist" did earn a master's degree in biology in 1996. The developers know this is extremely unusual for a project this size because they have been trying to recruit researchers from all over Utah. They have made job offers to several faculty at BYU and even tried to snatch a graduating Ph.D. student from my department to lend some credibility to their proposal.
>
> The fact that no researchers are willing to take their generous salary highlights another particularity about this project: no one in the research or management communities thinks it is a good idea. With most environmental proposals, there is heated debate and disagreement about pros and cons. I have spoken with more than 100 researchers from across the state and beyond, and all of them think this project is a horrible idea. It has dozens of poison pills and no upside for Utah Lake or the people of Utah.

See Blog Post at 6, Ex. G. LRS claims these and other similar statements about the lack of Ph.D-level scientists on LRS's team are false because "(1) Lake Restoration has engaged and contracted with highly-qualified scientists, including Ph.D.-level scientists, to work on the Project and the Proposal; and (ii) because those scientists and other third-party scientists and environmentalists think the Project is a good idea."

Professor Abbott denies that he made any false or defamatory statements. Specifically, LRS published and shared several presentations related to the LRS Project that included a description of its "Team." Although LRS may be using a different definition of scientist, or may

now allege that it has undisclosed but qualified scientists as members of its "Team," the team roster available to Professor Abbott and published by LRS prior to Professor Abbott's blog post did not include any Ph.D.-level scientists *See e.g.*, Extracted LRS "Team" Slides, attached as Exhibit I. Professor Abbott denies that his statements were false as a matter of fact, and he denies that any statement raised by LRS, as a matter of law, could be defamatory.

"Shady Foreign Funding"

RESPONSE: LRS claims that it was defamatory for Professor Abbott to state that LRS has "shady foreign funding" that "ostensibly comes from Dubai." *See* Blog Post at 6-7, Ex. G. LRS also challenges statements Professor Abbott made at a Provo City Council work meeting (for the express purpose of influencing government policymaking and processes) that LRS has "financing from out of the country" and has received "international funding."

Professor Abbott denies that he made any false or defamatory statements. Specifically, on February 20, 2019, Professor Abbott met with LRS co-founders Todd and Ben Parker, and LRS's chief design director, Robert Scott, at the Lindon Marina. During that meeting, Todd Parker said there were global investors for the project. *See* Katie England, *Plan to build islands on Utah Lake discussed at Lindon Marina*, Daily Herald, Feb. 21, 2019, https://www.heraldextra.com/news/2019/feb/21/plan-to-build-islands-on-utah-lake-discussed-at-lindon-marina/ ("Parker said there are global investors ready to fund the project in phases."). After that meeting, Todd Parker and Robert Scott mentioned the project had funding and expertise from Dubai.

More recently, LRS's current CEO has been quoted in the media stating that LRS has $6 billion lined up in funding, but that LRS cannot identify potential funders "because of

nondisclosure agreements." *See* Brian Maffly, *Will EPA help fund Utah Lake island-building project?*, Salt Lake Tribune, Dec. 7, 2021, https://www.sltrib.com/news/environment/2021/12/07/will-epa-help-fund-utah/. Professor Abbott's statement that LRS's undisclosed funding is "shady" is protected by the First Amendment and article 1, § 15 of the Utah Constitution as an opinion and fair comment.

SEC Filing

RESPONSE: Professor Abbott denies that he made any false or defamatory statements. Specifically, he denies that his statements were false, and he denies that these statements could be defamatory as a matter of law. On October 16, 2020, LRS filed a Notice of Exempt Offering of Securities with the SEC and stated that its "total offering amount" was $15,000,000. Of that, LRS indicated that the "total amount sold" was $200,000. *See* SEC Filing, attached as Exhibit J.

Utah State's Loan Guarantees

RESPONSE: Professor Abbott denies that he made any false or defamatory statements. Specifically, he denies that his statements were false, and he denies that these statements could be defamatory as a matter of law. LRS secured a $10 million loan guarantee for its project from the Utah legislature during the 2021 session. Professor Abbott met with his state representative and senator in December, and both indicated that the state could have financial liability as a result of this guarantee.

Privatization of the Lakebed and Creation of Private Islands

RESPONSE: Professor Abbott denies that he made any false or defamatory statements. LRS has repeatedly stated that it intends to create private islands from dredged materials (*i.e.* lake bed), and that it intends to cover one-fifth of the surface area of Utah Lake with islands.

LRS's application to Utah's Division of Forestry, Fire, and State Lands seeks privatization of a "TBD" number of acres. *See* LRS DFFS App., Ex. D.

Professor Abbott's Meetings with LRS

RESPONSE: Professor Abbott denies that he made any false or defamatory statements regarding the fact that he "met repeatedly with developers." Specifically, Professor Abbott met with LRS co-founder Todd Parker on May 15, 2018 at a public event held at the Orem Public Library. Professor Abbott met with LRS co-founders, Todd Parker and Ben Parker, and LRS's chief design director, Robert Scott, on February 20, 2019 at the Lindon Marina.

RESPONSE TO REMAINING ALLEGATIONS

Parties, Jurisdiction and Venue

6. Professor Abbott lacks knowledge and information to form a belief as to LRS's incorporation and principal place of business and, on that basis, denies the statements contained in paragraph 6.

7. Professor Abbott admits that he is a Utah citizen and resident of Utah County.

8. Paragraph 8 states a legal conclusion to which no response is required.

9. Paragraph 9 states a legal conclusion to which no response is required.

First Cause of Action – Defamation

16. Professor Abbott incorporates by this reference his statements made above as if fully set forth here.

17. Professor Abbott admits that he has publicly opposed LRS's Project, and that he has done so through engagement on social media, by publishing open letters "urg[ing] local, state, and federal leaders to oppose [the LRS Project]," and by speaking at public community and

governmental meetings. Professor Abbott denies that any of his statements were false or defamatory.

18. Denied.

19. Denied.

20. Denied.

21. Denied. Professor Abbott specifically denies that any of his statements were false or defamatory.

22. Denied. Professor Abbott specifically denies that any of his statements were false or defamatory.

23. Denied. Professor Abbott specifically denies that any of his statements were false or defamatory and denies that LRS is entitled to any amount of damages. Professor Abbott avers that the excessive and legally untenable damages claimed by LRS are an effort by LRS to harass, intimidate, punish, and maliciously inhibit Professor Abbott exercising his constitutional free speech rights.

Second Cause of Action – False Light

24. Professor Abbott incorporates by this reference his statements made above as if fully set forth here.

25. Professor Abbott admits that he has publicly opposed LRS's Project. Professor Abbott denies that any of his statements were false or defamatory and denies that his statements placed LRS before the public in a false light.

26. Professor Abbott denies that any of his statements were false or defamatory and denies that his statements placed LRS before the public in a false light.

27. Denied. Professor Abbott specifically denies that any of his statements were false or defamatory.

28. Denied. Professor Abbott specifically denies that any of his statements were false or defamatory, and denies that his statements placed LRS before the public in a false light.

29. Denied. Professor Abbott specifically denies that any of his statements were false or defamatory, denies that they placed LRS before the public in a false light, and denies that LRS is entitled to any amount of damages. Professor Abbott avers that the excessive and legally untenable damages claimed by LRS are an effort by LRS to harass, intimidate, punish, and maliciously inhibit Professor Abbott exercising his constitutional free speech rights.

Third Cause of Action – Intentional Interference with Prospective Economic Relations

30. Professor Abbott incorporates by this reference his statements made above as if fully set forth here.

31. Professor Abbott denies that any of his statements were false or defamatory. Moreover, every statement made by Professor Abbott is privileged and cannot support a claim for intentional interference with prospective economic relations.

32. Professor Abbott admits that he has publicly opposed LRS's Project. Professor Abbott denies that any of his statements were false or defamatory. Professor Abbott denies making any comment directly to LRS's "prospective investors" unless, by "prospective investors," LRS means the Utah legislature, governor's office, Utah municipalities, or Utah taxpayers.

33. Denied. Professor Abbott denies that any of his statements were false or defamatory. Moreover, every statement made by Professor Abbott is privileged and cannot support a claim for intentional interference with prospective economic relations.

34. Denied. Professor Abbott specifically denies that LRS is entitled to any amount of damages and avers that the excessive and legally untenable damages claimed by LRS are an effort by LRS to harass, intimidate, punish, and maliciously inhibit Professor Abbott exercising his constitutional free speech rights.

GENERAL DENIAL

Professor Abbott denies all statements contained in the Complaint not specifically admitted in this Answer, Anti-SLAPP Statement, and Counterclaim. Professor Abbott specifically denies all statements contained in LRS's prayer for relief, and specifically denies all titles, headings, assertions, allegations, and other recitations not specifically admitted.

AFFIRMATIVE DEFENSES

1. LRS's Complaint fails to state a claim upon which relief may be granted.

2. LRS's claims are barred because Professor Abbott's statements are true or substantially true.

3. LRS's claims are barred because Professor Abbott's statements are privileged. For example, and without limitation, Professor Abbott's statements are protected by the public interest privilege, the *Noerr-Pennington* doctrine, the legislative proceeding/witness privilege, and the fair comment privilege.

4. LRS's claims are barred because Professor Abbott's statements are non-actionable statements of opinion.

5. LRS is barred from obtaining its requested relief by article 1, § 15 of the Utah Constitution.

6. LRS is barred from obtaining its requested relief by the First Amendment to the United States Constitution.

7. LRS's claims are barred because LRS has not demonstrated (and cannot demonstrate) the requisite standard of fault.

8. LRS's claims are barred because Professor Abbott's actions and statements are legally justified.

9. LRS's claims are barred, in whole or in part, by the applicable statute of limitations.

10. LRS's claims are barred because it was not damaged by any wrongful act or statement of Professor Abbott.

11. LRS's claims are barred because any damage suffered by LRS was caused by LRS's own actions, and/or by intervening or superseding events over which Professor Abbott had no control.

12. LRS's claims for damages are barred because they are too remote and speculative, and/or because LRS has failed to mitigate, minimize, or avoid its damages (if any).

COUNTERCLAIM UNDER UTAH'S ANTI-SLAPP STATUTE

Professor Abbott asserts an Anti-SLAPP counterclaim against LRS pursuant to Utah Code § 78B-6-1405 and alleges as follows:

1. Professor Abbott is a resident of Utah County.

2. On information and belief, LRS is a Delaware limited liability company with its principal place of business in Lehi, Utah.

3. LRS has filed suit against Professor Abbott for an action involving public participation in the process of government.

4. LRS filed its lawsuit primarily to harass Professor Abbott.

5. LRS's action is designed to prevent, interfere with, and chill Professor Abbott's public participation in the process of government.

6. LRS's action was commenced and continued without a substantial basis in fact and law and cannot be supported by a substantial argument for the extension, modification, or reversal of existing law.

7. Further, LRS's action was commenced and continued for the purpose of harassing, intimidating, punishing, or otherwise maliciously inhibiting Professor Abbott's free exercise of rights granted under the First Amendment to the U.S. Constitution.

WHEREFORE, Professor Abbott prays as follows:

1. That the Court enter judgment in favor of Professor Abbott and against LRS on all claims asserted by LRS or Professor Abbott;

2. That the Court award damages to Professor Abbott and against LRS pursuant to Utah Code § 78B-6-1405(1) for Professor Abbotts' costs and reasonable attorney fees, and for other compensatory damages.

3. For such further and other relief as the Court may deem appropriate.

DATED this 1st day of February, 2022.

/s/ Whitney Hulet Krogue
Whitney Hulet Krogue
RAY QUINNEY & NEBEKER P.C.

Adam Alba
MAGLEBY CATAXINOS & GREENWOOD

Attorneys for Defendant Benjamin Abbott

CERTIFICATE OF SERVICE

I hereby certify that on this 1st day of February, 2022, I electronically filed the foregoing **ANSWER, ANTI-SLAPP STATEMENT, AND COUNTERCLAIM** with the Clerk of the Court using the Utah Trial Court/ECF System which sent notification of such filing to the following:

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Attorneys for Plaintiff Lake Restorations LLC

/s/ Natalie Bottema

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EXHIBIT A

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IN THE THIRD JUDICIAL DISTRICT COURT

SALT LAKE COUNTY, STATE OF UTAH

LAKE RESTORATION SOLUTIONS LLC, a Delaware limited liability company, Plaintiff, v. BENJAMIN ABBOTT, an individual Defendant.	**AFFIDAVIT OF BENJAMIN ABBOTT** Civil No. 220900164 Judge: Laura Scott

I, Benjamin Abbott, under penalty of perjury declare as follows:

1. I am over the age of twenty-one years old and competent to testify regarding the facts set forth herein, which are based on my personal knowledge.

2. I am a credentialed and well-respected ecosystem ecologist. I am an Assistant Professor of Ecosystem Ecology in Brigham Young University's Department of Plant and Wildlife Sciences. A true and correct copy of my *curriculum vitae* is attached to the Answer, Anti-SLAPP Statement, and Counterclaim filed in this action.

3. In 2009, I earned my B.S. from Utah State University in Watershed and Earth Science where I worked as an undergraduate researcher in both Utah and Alaska studying water

quality, hydrology, lake ecosystems, and eutrophication (the consequences of excess nutrients, including algal blooms).

4. In 2014, I earned my Ph.D. in ecosystem ecology from the University of Alaska Fairbanks where I studied biogeochemical cycles, soil hydrology, ecological disturbance, and science-policy interactions.

5. From 2014 to 2016, I worked as a postdoctoral researcher for the French National Centre for Scientific Research ("CNRS") in Rennes, France.

6. In my postdoctoral work, I researched eutrophication, ecological restoration of rivers and lakes, sustainable agriculture, and groundwater-surface-water interactions.

7. From 2016 to 2017, I worked as a postdoctoral researcher for Michigan State University, working in ecohydrology, water quality, and water security.

8. In 2017, I accepted a position at Brigham Young University ("BYU") where I have focused on aquatic ecology, catchment hydrology, science writing, environmental policy, and the effects of urban and agricultural activity around Utah Lake.

9. Since accepting the position at BYU and moving home to Utah, I have been continuously involved in researching and assisting in environmental improvement initiatives related to Utah Lake.

10. It is difficult to overstate the ecological importance of Utah Lake.

11. As the largest freshwater lake in the state, Utah Lake is a keystone ecosystem that provides invaluable ecosystem services, including pollution removal, habitat for tens of millions of birds and fish, recreation and human-nature engagement, and regulation of local climate.

12. Utah Lake's natural characteristics—especially its shallowness and naturally cloudy water—have made it more resilient than most water bodies to human pressures.

13. However, the cumulative effects of water diversions, pollution inputs, and invasive species have triggered major changes to the lake, including a drying event in the 1930s and a shift from emergent vegetation to algae and cyanobacteria in the mid-20th century.

14. Thanks to decades of increasing research and scientifically-sound restoration efforts, including broad participation from the community, Utah Lake is on the road to recovery.

15. For example, the overall amount and duration of harmful algal blooms have decreased in the past 35 years, invasive species removal programs have made progress, and habitat restoration projects have been extremely successful.

16. One example of this progress is the recovery of the native June Sucker fish, which was classified as endangered in 1986 (with no reproducing adults observed in Utah Lake) but down-listed to threatened in 2021 with approximately 4000 spawning adults observed.

17. Because of my expertise as an ecosystem ecologist, and because of my specific expertise with the issues faced by Utah Lake, I was invited to speak publicly—both at community events and to governmental bodies—about the LRS Project.

18. As I learned more about the LRS Project, I became increasingly alarmed by LRS's proposed methods, its apparent focus on development rather than ecological restoration, and the credentials of the project team publicized by LRS.

19. As a scientist and a Utahn, and as one of Utah's most knowledgeable experts on the ecology of Utah Lake, I felt compelled to speak out and voice my opinion that the LRS

Proposal is not in line with best practices in restoration ecology and would irreversibly damage one of Utah's most critical public assets.

20. In short, I believe that the LRS Project would have a devastating impact on the recovery of the Utah Lake ecosystem, potentially causing irreparable harm to the lake.

21. Some of the harms include: (1) deepening and dividing the lake, which would reduce water column mixing and exacerbate the consequences of algal blooms, including hypoxic dead zones, pollutant release from sediment, and fish kills; (2) loss of natural evaporation, which would reduce the lake's pollution removal capacity, decrease local humidity and precipitation, and increase flood risk during high water years; (3) unprecedented freshwater dredging, which would destroy the lakebed biodiversity, potentially reducing pollutant removal and releasing pollutants that are currently safely immobilized by the lakebed; (4) artificially clarifying the water, which could stimulate algal and cyanobacterial growth; and (5) fundamental modifications to the lake's hydrology, chemistry, and food web, which could render the lake permanently dependent on active human intervention by replacing the lake's natural resilience with costly technological substitutes such as the proposed water circulators and mechanical biofilters.

22. In addition to the ecological risks of the proposed changes, I believe that LRS is undermining crucial education and outreach activities by falsely claiming that Utah Lake used to be a clear-water lake, that waves and evaporation are damaging, that sediment is heavily polluted, that algal blooms are worsening, that the lake is rapidly deteriorating, and that restoration efforts have been ineffective.

23. I believe that LRS's consistent portrayal of Utah Lake as a "broken ecosystem" in a "downward spiral" discourage visitation to Utah Lake and unfairly stoke discontent about ongoing restoration efforts.

24. In the spring of 2021, I learned that LRS had met with members of the Utah State Legislature and governor's office and had given an account of the lake that did not correspond with available scientific evidence.

25. In response, I worked with a team of scientists, natural resource managers, citizens, and community partners to organize the Utah Lake Symposium event held at Utah Valley University in August 2021.

26. State and local governmental officials attended the symposium which discussed Utah Lake and current lake-related projects, including the LRS proposal.

27. Eventually, I became convinced that repealing or amending the 2018 HB 272 was necessary for the ongoing protection of the lake.

28. I also began speaking out about the Utah Lake Authority bill, which was being prepared for resubmission in the 2022 session.

29. Despite a near (if not total) consensus among Utah's scientific community that the proposed LRS Project is ill-advised, I learned in the fall of 2021 that the Governor's Office of Economic Opportunity had allegedly issued a statement in support of the LRS Project.

30. I also learned that LRS intended to host a "Meet the Experts" lunch at the Utah State Capitol.

31. I grew concerned that the previously published warnings of the scientific community were not being heard because they were too long, too technical, and not sufficiently direct.

32. Consequently, I wrote a post on my personal blog called "Seven problems with the Utah Lake islands proposal." A true and correct copy of my blog post is attached to the Answer, Anti-SLAPP Statement, and Counterclaim filed in this action.

33. The post directed readers to LRS's proposal, linked to background information on the lake, and encouraged readers to support repeal of 2018 HB 272 (which had increased the likelihood of Utah Lake alterations and land transfers).

34. On November 30, 2021, I emailed a link to my blog to two members of the governor's office.

35. Shortly thereafter, on December 2, 2021, I learned that LRS's "Meet the Experts" event had been postponed.

36. In December 2021, I was invited by Conserve Utah Valley—a local volunteer organization and registered 501(c)(3)—to meet with Representative Keven Stratton to discuss possible legislative actions relating to the 2018 HB 272.

37. Representative Stratton acknowledged the need of improving the process set forth by HB 272 and proposed a "Utah Lake Summit" to bring together political, environmental, and development interests to discuss Utah Lake legislation.

38. The Utah Lake Summit was scheduled for January 11, 2022.

39. Representative Stratton asked me to give the plenary presentation about Utah Lake.

40. Also in December 2021, I contributed to an expert letter (the "Expert Letter") with 116 other scientists, engineers, natural resource managers, recreation managers, education specialists, and lawyers knowledgeable about the issues facing Utah Lake. A true and correct copy of that Expert Letter is attached to the Answer, Anti-SLAPP Statement, and Counterclaim filed in this action.

41. In late December, another Utah State Representative invited me to a meeting with Lieutenant Governor Deidre Henderson to discuss Utah Lake and share the expert letter.

42. After that meeting, I published the letter on December 29, 2021.

43. I was served with a copy of LRS's Complaint on January 11, 2022—hours before I was scheduled to speak at Representative Stratton's Utah Lake Summit and only a week before the start of Utah's 45-day legislative session.

44. Through my opposition to the LRS Project, I sought to influence decision-making at the Division of Forestry, Fire, and State Lands, the Office of the Governor, the Utah County Commission, city council members and other decision-makers in Utah Valley, and state legislators.

45. I believe that LRS's three-million-dollar lawsuit against me "is designed to prevent, interfere with, or chill" my public participation in the processes of government.

DATED this 31st day of January, 2022.

Professor Benjamin Abbott, Ph.D.

EXHIBIT B

Dr. Benjamin W. Abbott

Assistant Professor of Ecosystem Ecology
Brigham Young University
Department of Plant and Wildlife Sciences
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Research interests

Ecosystem ecology, Ecohydrology, Terrestrial-aquatic interactions, Permafrost, Disturbance, Aquatic ecology, Human health, Limnology, Environmental and economic sustainability, Expert assessment, Climate change, Global water cycle, Statistics, Science communication and policy

Education

University of Alaska Fairbanks, Ph.D., December 2014. Department of Biology and Wildlife. Adviser: Jeremy B. Jones. Dissertation: *Permafrost in a warmer world: net ecosystem carbon imbalance*

Utah State University, B.S., April 2009. Major: Watershed and Earth Science. Minors: French & English. Adviser: Chris Luecke. Undergraduate research project: *Energy pathways and food sources: stable isotope analysis in an Arctic lake*

Professional experience

Assistant professor, Brigham Young University	2017-present
Postdoctoral fellow, Michigan State University	2016-2017
Marie Curie postdoctoral fellow, Université de Rennes 1	2014-16
Research and teaching assistant, University of Alaska Fairbanks	2009-14
Staff writer: natural resources and science correspondent for the *Utah Statesman*	2008-09
Undergraduate researcher, *Limnology,* Utah State University	2007-09

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(s)S Bratsman, **BW Abbott**, A Rocha, JP Zarnetske, WB Bowden, F Iannucci, RJ Frei, R Watts, A Shogren, M Baker, G Carling, L Ludwig. **2019**. *Persistent nitrogen flux from tundra ten years after massive wildfire*. Society for Freshwater Science annual meeting. Salt Lake City, UT.

(i)**BW Abbott**, R Pomerance, S Natali. **2018**. *Permafrost carbon outreach and activism opportunities*, Permafrost Carbon Network Annual Meeting. Washington D.C.

(s)SS Sayedi, **BW Abbott**, J Frederick, BF Thornton, J Vonk, P Overduin, A Maslakov, EAG Schuur, T Zhang, CC Mu, AD McGuire, K Schreiner, JD Joo, E Pizhankova, A Gavrilov, JP Zarnetske, K

Schaefer. **2018**. *Expert assessment of subsea permafrost and related emissions.* Permafrost Carbon Network Annual Meeting. Washington D.C.

(i)**BW Abbott. 2018**. *Spatial stability of water quality provides a shortcut to solving eutrophication*. Utah State University, Watershed and Earth System Science department seminar, Logan, Utah.

(s)M Buhman, **BW Abbott**, K Bishop, JP Zarnetske, G Pinay. 2018. *Global water cycle diagrams minimize human influence and over-represent water security.* Salt Lake City Watershed Symposium. Salt Lake City, Utah.

BW Abbott, E Wologo, S Textor, S Shakil, S Zolkos, S Ewing, R Spencer, M Baker, S Tank, J O'Donnell, KP Wickland, J Lee-Cullin, JP Zarnetske, F Liu, Yang, P Kortelainen, J Kolehmainen, J Dean, J Vonk, RM Holmes, G Pinay, PJ Mann, (s)J Howe. 2018. *Could priming and nutrient effects from degrading permafrost alter dissolved organic matter dynamics in permafrost rivers?* European Conference on Permafrost. Chamonix, France.

(s)BJ Frei, (s)N Griffin, **BW Abbott**, Z Aanderud, JP Zarnetske, WB Bowden, F Iannuci. *Untangling terrestrial and aquatic controls on carbon, nutrients, and microorganisms in Arctic stream networks.* **2018**. European Conference on Permafrost. Chamonix, France.

(i)**BW Abbott**, T Kolbe, JR de Dreuzy, C Vautier, J Marçais, Zahra Thomas, F Moatar, L Aquilina, T Labasque, JP Zarnetske, C Lécuyer, G Pinay. **2018**. *Limits and location of denitrification at catchment scales: can hyporheic and riparian removal solve diffuse nutrient pollution?* Society for Freshwater Science. Detroit, Michigan.

(i)**BW Abbott**, Z Aanderud, G Carling, N Hansen. **2018**. *Cultivating stewardship and improving water quality in the Utah Lake watershed.* Provo River Watershed Council. Orem, Utah.

BW Abbott, K Bishop, JP Zarnetske, C Minaudo, FS Chapin III, D Ellison, S Krause, DM Hannah, G Pinay. **2017**. *Global Water Cycle Diagrams Minimize Human Influence and Over-represent Water Security.* American Geophysical Union, Fall Meeting. New Orleans, Los Angeles.

(i)**BW Abbott**, G Grua, JP Zarnetske, F Moatar, G Pinay. **2017**. *Stable spatial patterns of nitrate in headwater stream networks allows identification and mitigation of critical source areas.* Managing Global Resources for a Secure Future. Tampa, Florida.

(i)**BW Abbott 2017**. *Unexpected spatial stability of water chemistry in headwater stream networks.* Idaho State University Department of Geoscience Seminar. Pocatello, Idaho.

(i)**BW Abbott**, G Grua, JP Zarnetske, F Moatar, T Kolbe, G Pinay. **2017**. *Stable spatial structure and strong temporal synchrony of water quality in stream networks.* Gordon Research Conference, Catchment Science: Interactions of Hydrology, Biology, and Geochemistry. Lewiston, Maine.

****BW Abbott**, G Grua, JP Zarnetske, F Moatar, L Barbe, T Kolbe, S Gu, AC Pierson-Wickmann, P Davy, G Pinay. **2017**. *Stable spatial structure and strong temporal synchrony of water quality in stream networks.* HydroEco: ecology-hydrology-human interactions in a changing world. Birmingham, UK (Best oral presentation).

(i)**BW Abbott**. **2016**. *The biggest terrestrial tipping point or a potential carbon sink? 124 experts weigh in on the permafrost carbon feedback.* Chrono-Environnement Seminar at the Université de Franche-Comté. Besançon, France.

(i)**BW Abbott**. **2016**. *Using expert assessment to conceptualize climate-vegetation-wildfire interactions: constraining baselines, quantifying risk, and identifying key uncertainties.* Plenary talk at the Global Paleofire Workshop: Fire History Baselines by Biome. Bordeaux, France.

BW Abbott, G Pinay, G Gruau, J Zarnetske, Z Thomas, S Gu, T Kolbe, F Moatar, L Barbe, O Fovet, AC Pierson-Wickmann. **2016**. *Where and how often do we need to measure water quality to learn how to improve it?* 5th international EcoSummit; Ecological Sustainability: Engineering Change. Montpellier, France.

BW Abbott, JB Jones, JR Larouche, SE Godsey, AW Balser. **2016**. *Lateral and vertical fluxes of carbon and nitrogen from upland thermokarst.* Eleventh International Conference On Permafrost (ICOP). Potsdam, Germany.

(i)**BW Abbott**, G Pinay, T Kolbe, J Marçais, G Gruau, T Labasque, L Aquilina, JR de Dreuzy, Z Thomas, Camille Vautier, Carolyn Oldham. **2016**. *Using multi-tracer inference to move beyond single-catchment ecohydrology.* Seminar at the University of Birmingham School of Biosciences and Geography.

BW Abbott, G Pinay, Z Thomas, T Kolbe, JR de Dreuzy, T Labasque, L Aquilina. **2015**. *Controls on carbon and nutrient dynamics in agricultural catchments across temporal and spatial scales*, seminar for the National Institute for Agricultural Research (INRA), Rennes, France.

BW Abbott, JB Jones, JR Larouche, WB Bowden, SE Godsey. **2015**. *Patterns and persistence of hydrological carbon and nutrient export from collapsing permafrost*, HydroEco. Vienna, Austria.

BW Abbott, JB Jones, MS Bret-Harte, FS Chapin III, EAG Schuur. **2015**. *Permafrost dans un monde qui se réchauffe : un écosystème en déséquilibre,* OSUR seminar. Rennes, France.

EAG Schuur, **BW Abbott**. **2014**. *Expert assessment of vulnerability of carbon pools in the permafrost zone to climate change,* 3rd Carbon Pools in Permafrost (CAPP) workshop, Stockholm, Sweden.

JE Vonk, **BW Abbott**, PJ Mann, JB Jones, JR Larouch, A Davydova, N Zimov, WB Bowden, RGM Spencer. **2014**. *Biodegradability of dissolved organic matter from collapsing permafrost in Siberia and Alaska,* 4th European Conference on Permafrost. Évora, Portugal.

BW Abbott, JB Jones, EAG Schuur, WB Bowden, FS Chapin III, H Epstein, M Flannigan, TK Harms, TN Hollingsworth, M Mack, SM Natali, AV Rocha, SE Tank, MR Turetsky, JE Vonk, KP Wickland. **2013**. *Can increased biomass offset carbon release from permafrost region soils, streams, and wildfire: an expert elicitation?* American Geophysical Union, Fall Meeting. San Francisco, California.

BW Abbott, JB Jones, JR Larouche, WB Bowden. **2013**. *Dissolved organic carbon biodegradability from collapsing permafrost on the North Slope of Alaska*, Midnight Sun Science Symposium. Fairbanks, Alaska (2nd prize).

BW Abbott, JB Jones, JR Larouche, WB Bowden. **2012**. *Hydrologic and gaseous export of carbon and nitrogen from upland thermokarst features on the North Slope of Alaska*, Tenth International Conference on Permafrost (TICOP). Salekhard, Siberia.

SE Godsey, **BW Abbott**. **2012**. *Interdisciplinary Permafrost Research*, Permafrost Young Researchers Network Workshop. Salekhard, Siberia.

BW Abbott, JB Jones, EAG Schuur. **2012**. *Carbon from the far north. When and how much*, Midnight Sun Science Symposium. Fairbanks, Alaska.

(i)**BW Abbott**, EAG Schuur, JB Jones. **2011**. *Timing and magnitude of CO_2 and CH_4 release from the permafrost region: an expert elicitation*, American Geophysical Union, Fall Meeting. San Francisco, California (Outstanding Student Paper Award: Global Environmental Change).

JL Larouche, **BW Abbott**, JB Jones, WB Bowden. **2011**. *Amount and lability of dissolved organic carbon entering arctic streams from landscapes disturbed by fire and thermokarst terrain, North Slope, Alaska*. American Geophysical Union, Fall Meeting. San Francisco, California.

JB Jones, **BW Abbott**. **2011**. *Hydrobiogeochemistry of the Arctic System: Climate Change and the Impacts of Permafrost Thaw on Stream Hydrology and Elemental Fluxes*. Introduction to Changing Permafrost in the Arctic Landscape, online lecture series.

BW Abbott, JB Jones, TK Harms. **2011**. *How much carbon and nitrogen come out of a thermokarst and why?* Arctic System Science Thermokarst Project online seminar.

BW Abbott, JB Jones. **2010**. *Carbon export from thermokarst features on the North Slope*, Biology Graduate Student Symposium. Fairbanks, Alaska.

BW Abbott, WA Wurtsbaugh. **2008**. *Nutrient limitation in Cutler Reservoir: will phosphorus reduction affect eutrophication,* Spring Runoff Conference. Logan, Utah (2nd prize).

Scientific posters

(s)SS Sayedi, **BW Abbott**, B Vannière, BA Leys, D Colombaroli, G Gil-Romera, JC Aleman, MM Slowinski, AL Daniau. *Expert Assessment of Past and Future Changes in Global Fire Regimes*, (2019), American Geophysical Union Fall Meeting. San Francisco, California.

(s)RJ Frei, **BW Abbott**, G Loosle, C Vargas, A Norris, L Peterson, A Hopkins, G Cano, RD Sabo, J Brahney. *Transforming Student Projects into Publishable Research: A Case Study with 6 Undergraduates and the EPA's National Assessment of Water Quality*, (2019), American Geophysical Union Fall Meeting. San Francisco, California.

(s)I Errigo, **BW Abbott**, J Reimer, J Glenn, RA Chaney, A Freeman, RJ Frei, PD Howe, DL Mendoza, S Bratsman, A Stacey, D Wilson, L Lange. *Human Health and Economic Costs of Air Pollution in Utah: An Expert Assessment,* (2019), American Geophysical Union Fall Meeting. San Francisco, California.

BW Abbott, AV Rocha, A Shogren, JP Zarnetske, F Iannucci, WB Bowden, S Bratsman, R Watts, RA Fulweber, RJ Frei, A Huebner, S Ludwig, GT Carling. *Tundra Wildfire Triggers Long-Term Lateral Nitrogen Loss*, (2019), American Geophysical Union Fall Meeting. San Francisco, California.

(s) B Brown, J Maxwell, C Minaudo, S St. Clair, **BW Abbott**. *Modeling Fire-Induced Changes to River Status with Deep Learning*, (2019), Salt Lake City Watershed Symposium. Salt Lake City, Utah.

(s)L Patch, RJ Frei, T Crandall, R Watts, EF Jones, **BW Abbott**. *Wildfire and water quality: using fluorescence spectroscopy to predict the biodegradability of dissolved organic matter*, (2019), Salt Lake City Watershed Symposium. Salt Lake City, Utah.

(s, i)SS Sayedi, **BW Abbott**, J Frederick, BF Thornton, J Vonk, P Overduin, A Maslakov, EAG Schuur, T Zhang, CC Mu, AD McGuire, K Schreiner, JD Joo, E Pizhankova, A Gavrilov, JP Zarnetske, K Schaefer. *Expert assessment of organic carbon stocks and vulnerability in subsea permafrost* (2019), Arctic Futures 2050. Washington DC.

BW Abbott, K Bishop, JP Zarnetske, FS Chapin III, RJ Frei, DM Hannah, S Krause, G Pinay. *Human domination of the global water cycle absent from depictions and perceptions*, (2019), Gordon Research Conference, Catchment Science: Interactions of Hydrology, Biology, and Geochemistry. Andover, New Hampshire.

BW Abbott, JP Zarnetske, WB Bowden, F Iannucci, AJ Shogren, N Griffin, S Bratsman, R Watts. *Carbon and nutrient dynamics in Arctic stream networks determined with catchment-scale estimates of redox reactions* (2019), Spring Runoff Conference. Logan, Utah.

(s)S Bratsman, **BW Abbott**, A Rocha, JP Zarnetske, WB Bowden, F Iannucci, A Shogren, M Baker, G Carling, L Ludwig. *Persistent nitrogen flux from tundra ten years after massive wildfire*, (2019), Spring Runoff Conference. Logan, Utah.

(s)EF Jones, T Crandall, RJ Frei, R Shoemaker, R Watts, ZT Aanderud, **BW Abbott**. *Using citizen science to locate nutrient sources and foster community connection in the Utah Lake Watershed* (2019), Spring Runoff Conference. Logan, Utah.

(s)L Lange, **BW Abbott**, I Errigo, E Van Der Linden. *Mapping waterborne pathogens in Ecuador* (2019), Spring Runoff Conference. Logan, Utah.

(s)L Patch, O Bochet, L Bethencourt, A Dufresne, J Farasin, M Pedrot, T Labasque, E Chatton, N Lavenant, C Petton, **BW Abbott**, L Aquilina, T Le Borgne. *Groundwater mixing in subsurface fractures triggers massive microbial mats*. (2019), Spring Runoff Conference. Logan, Utah.

(s)Z Webber, **BW Abbott**, SI St Clair. *The Sunflower Project: using sunflowers to provide clean water to those living in areas polluted by uranium mining via partnership with high-school-aged students* (2019), Spring Runoff Conference. Logan, Utah.

(s)SS Sayedi, C Abrahamian, **BW Abbott**, R Dupas, C Minaudo, Z Thomas. *Temporal stability of water chemistry spatial patterns across temperate ecoregions* (2019), Spring Runoff Conference. Logan, Utah.

(s)A Stacey, **BW Abbott**, K Bishop, JP Zarnetske, FS Chapin III, A Huebner, RJ Frei, G Pinay. *Water cycle diagrams minimize human influence and over-represent water security* (2019), Spring Runoff Conference. Logan, Utah.

(s)C Vargas, T Kolbe, JR dr Dreuzy, **BW Abbott**, et al. *Aquifers determine nutrient removal capacity at the catchment scale more than riparian and hyporheic zones* (2019), Spring Runoff Conference. Logan, Utah.

(s)SS Sayedi, **BW Abbott**, J Frederick, BF Thornton, J Vonk, P Overduin, A Maslakov, EAG Schuur, T Zhang, CC Mu, AD McGuire, K Schreiner, JD Joo, E Pizhankova, A Gavrilov, JP Zarnetske, K Schaefer. *Expert assessment of subsea permafrost and related emissions* (2018), American Geophysical Union Fall Meeting. Washington DC.

(s)RJ Frei, **BW Abbott**, R Dupas, S Gu, G Gruau, F Moatar, G Pinay, *Using biogeochemical tracers to quantify catchment resilience to nutrient loading* (2018), Salt lake City Watershed Symposium.

(s)RJ Frei, **BW Abbott**, R Dupas, S Gu, G Gruau, F Moatar, G Pinay, *Constraining resilience: common flowpaths or stoichiometric controls on DOC and NO3- concentrations?* (2018), Utah State University Spring Runoff Conerence. Logan, Utah.

BW Abbott, EAG Schuur, JB Jones, FS Chapin III, and the Permafrost Carbon Network (2015), *Arctic and boreal biomass offsets little or none of permafrost carbon release from soils, streams, and wildfire*. Krycklan Symposium. Umeå, Sweden.

(i)**BW Abbott**, EAG Schuur, JB Jones, FS Chapin III, and the Permafrost Carbon Network (2015), *The biggest terrestrial tipping point or a potential carbon sink? 124 experts weigh in on the permafrost carbon feedback*. Our Common Future under Climate Change. Paris, France.

T Kolbe, **BW Abbott**, Z Thomas, JR de Dreuzy, C Vautier, T Labasque, L Aquilina, G Pinay (2015), *Coupling 3D groundwater modelling with CFC-based age dating to evaluate residence time distribution in the aquifer of an agricultural catchment*, HydroEco. Vienna, Austria.

M Fritz, **BW Abbott**, N Belova, E Altug, D Frolov, J Lepage, Y Ma, A Morgenstern, M Oliva, A Schneider, J Stanilovskaya, S Tomaskovicova, A Niewendam (2014), *The Permafrost Young Researchers Network (PYRN): Integrating priorities for permafrost research over the next generation,* 4th European Conference on Permafrost. Évora, Portugal.

****BW Abbott**, JB Jones, JR Larouche, WB Bowden (2013), *Carbon and nitrogen release from thawing permafrost: upland thermokarst,* Midnight Sun Science Symposium. Fairbanks, Alaska (1st prize).

BW Abbott, JB Jones, JR Larouche, WB Bowden (2012), *Carbon and nitrogen release from thawing permafrost: the biogeochemical physiology of upland thermokarst*, American Geophysical Union, Fall Meeting. San Francisco, California.

BW Abbott, JB Jones, JR Larouche, WB Bowden (2011), *The effects of thermokarst on terrestrial-aquatic linkages and stream chemistry in Arctic Alaska,* North American Benthological Society Annual Meeting. Providence, Rhode Island.

BW Abbott, JB Jones, TK Harms (2010), *Impacts of thermokarst formation on soil carbon dynamics on the North Slope of Alaska,* American Geophysical Union, Fall Meeting. San Francisco, California.

Proposals and grants

External funding

NSF Arctic System Science. Brothers, Budy, Abbott, Devlin. *Biomass Trajectories for Arctic Lake Food Webs*. $1.4 million, $320,711 to Abbott. Declined, 2021

NSF Critical Zone Observatories. Perdrial, Abbott, Harpold, et al., *Collaborative Research: Network Cluster: Using Big Data approaches to assess ecohydrological resilience across scales*. $3.2 million, $357,883 to Abbott. **Funded**, 2020

Provo River Watershed Council. *Cultivating stewardship and improving water quality in the Utah Lake watershed*. $1,000. **Funded**, 2020

NSF E.H.R. Core Research. Nixon and Abbott, *Elementary teachers' informal learning of science content with innovative water cycle materials*. $490,597. Declined, 2020

NSF MathBio. Sudakov, Abbott, and Aanderud, *Collaborative research: Stochastic modeling of microbial dynamics during soil disturbance*. $215,471. Declined, 2019

Utah Division of Natural Resources. St Clair, Abbott, Frandsen, Nelson, *Megafire impacts on terrestrial and aquatic ecosystems and management interventions to protect wildlife habitat and watershed hydrology.* $497,946. **Funded**, 2019

Utah Division of Natural Resources. St Clair, Abbott, *Instrumentation of Pole Creek Fire.* $42,254. **Funded**, 2019

Provo River Watershed Council. *Cultivating stewardship and improving water quality in the Utah Lake watershed*. $1,000. **Funded**, 2019

NSF Arctic System Science. Brothers, Budy, Abbott, Devlin. *Biomass Trajectories for Arctic Lake Food Webs*. $253,336. Declined, 2019

Utah Department of Environmental Quality. Aanderud, Baker, Abbott, Buck, Jones. *Utah Lake Bioassays to investigate nutrient limitation in Utah Lake*. $79,643. **Funded**, 2019

NSF ANS. Abbott, Zarnetske, Shogren, O'Donnell, Bowden, *COLLABORATIVE RESEARCH - Constraining fate and function of permafrost nutrients with direct multi-scale observations: Stream networks as indicators of watershed processes*. $1.34 million, $469,943 to Abbott. **Funded**, 2019

Roger and Victoria Sant Educational Endowment for a Sustainable Environment. Abbott, Aanderud, Carling, Hansen, Frandsen, and Jones, *Cultivating stewardship and improving water quality in the Utah Lake watershed*. $14,500. **Funded**, 2018

NSF DEB RAPID. Abbott and St Clair, *The effects of mega-fires on ecosystem succession and resilience to continued disturbance in the western U.S*. $200,000. Declined, 2018

NSF SitS. Abbott, Sudakov, and Aanderud, *Stochastic models of soil disturbance and microbial dynamics: predicting permafrost climate feedbacks*. $299,000. Not invited for full proposal, 2018

DOE. Abbott, Zarnetske, Bowden, and O'Donnell, *Constraining the fate and function of permafrost nutrients with direct multi-scale observations*. $299,927. Declined, 2018

NSF EPSCoR Research Infrastructure Improvement. Godsey and Abbott, *Water Quality in the West*. $10,000. **Funded**, 2018

Arctic Data Center and NCEAS. Brothers et al. (including Abbott), *From NEP to TEK: Linking biogeochemical predictions to environmental observations in northern communities*. $54,600. Call was cancelled, 2018

DOE. Frederick, Abbott, and Thornton, *Size and vulnerability of subsea permafrost carbon stocks: an expert assessment*. $120,000. Not invited for full proposal, 2017

DOE. Aanderud, Sudakov, and Abbott, *Integrating microbial succession into simulations of the permafrost climate feedback with stochastic models*. $298,000. Not invited for full proposal, 2017

NSF ANS. Sudakov and Abbott, *Stochastic modeling and analysis of abrupt change in permafrost ecosystems: connecting microbiology, vegetation, and climate*. $300,000. Declined, 2018

Roger and Victoria Sant Educational Endowment for a Sustainable Environment. Abbott, Aanderud, Carling, and Hansen, *Cultivating stewardship and improving water quality in the Utah Lake watershed*. $10,000. Declined, 2017

Thomas Jefferson Fund, Dupas and Abbott, *Leveraging new data streams to improve understanding and management of freshwater ecosystems in a changing world*. $20,000. Declined, 2017

Agence Nationale de la Recherche. Gruau et al. (including Abbott), *Headwater catchment controls on the stoichiometry and ecological impacts of nutrient fluxes (HEADWATER)*. €501,000. Declined, 2017

Institut Polaire Français. Pétillon, Marguerie, Vernon, van Baaren, Francez, Pinay, and Abbott, *Impacts of climatic and environmental changes on functioning and diversity of Arctic Canadian ecosystems* (ICE-Canada). $150,000. Declined, 2016

Agence Nationale de la Recherche. Aquilina et al. (including Abbott), *Environment Lab: a laboratory for ecological transition*. €10,141,912. Declined, 2016

Agence Nationale de la Recherche. Davy et al. (including Abbott), *Environment Lab: eLABo*. €1,200,000. Declined, 2016

NSF-EAR Postdoctoral Fellowship. Abbott, *Dissolved organic matter bioavailability regulates carbon export from the critical zone*. Declined, 2016

Internal funding

BYU Interdisciplinary Research Origination Awards. Abbott, Nixon, Song-Glenn, Ames, Bailey, Carling, LeMonte, Gill, Hopkins, *Transforming water education to address the global water crisis*. $120,000. **Funded**, 2021

Life Sciences College Mentoring Supplement Award (CEMENT). Abbott. $5,000. **Funded**, 2020

BYU Graduate School, High Impact Doctoral Research Assistantship (HIDRA). Zhang and Abbott, *Arctic river networks reveal terrestrial and aquatic signals of ecosystem change*. $90,000. **Funded**, 2020

Life Sciences Teaching Enhancement Grant (TEG). *Addressing the global water crisis by catalyzing systems thinking about the water cycle*. $5,000. **Funded**, 2020

BYU Interdisciplinary Research Origination Awards. Abbott, Nixon, Song-Glenn, Ames, Carling, Gill, Hopkins, *Transforming water education to address the global water crisis*. $119,500. Declined, 2020

BYU Interdisciplinary Research Origination Awards. Daniels, Sun, Abbott, Blades, Hawkins, *Harnessing public and expert input to improve air quality policy: are the experts or the people better at convincing elected municipal politicians to act on air pollution?* $40,000. Declined, 2020

Life Sciences College Mentoring Supplement Award (CEMENT). Abbott. $5,000. **Funded**, 2019

BYU J. Reuben Clark, Jr. Grant. Daniels, Abbott, Karpowitz, Ridge, *Fostering stewardship by overcoming partisan obstacles through environmental messaging*. $25,000. Declined, 2019

BYU College of Life Sciences Graduate Mentoring Assistantship. Abbott and Crandall, *The effects of megafires on ecosystem recovery and human water security in Utah*. $14,440. **Funded**, 2019

BYU Interdisciplinary Research Origination Awards. Abbott, Ames, Song-Glenn, Nixon, Hopkins, Gill, Carling, *We are teaching the water cycle wrong: fixing misconceptions of water in the Anthropocene*. $119,500. Declined, 2019

BYU Graduate School, High Impact Doctoral Research Assistantship (HIDRA). Sayedi and Abbott, *Combining expert opinions to assess risk of dangerous change in Earth Systems: permafrost collapse, global wildfire, and water security*. $90,000. **Funded**, 2018

Teaching and advising experience

Teaching :

Climate Change: Science and Solutions (BYU)	2020-present
Global Arctic Introduction to the Permafrost Climate Feedback (EPFL)	2020
ESS Capstone: Advanced Data Analysis and Writing (BYU)	2019-present
Environmental Biology (BYU)	2018-19
Watershed Ecology (BYU)	2018-present
Teaching assistant, *Microbiology* (UAF)	2014
Instructor, *Ecological Background for Resilience and Adaptation,* (UAF)	2012
Instructor, *Changing permafrost in the arctic landscape*, (UAF online course)	2011
Teaching fellow, *Oceanography* (USU)	2007

Guest lecturer:

Environmental Law and Policy (BYU)	2021
Hydrology (Drake University)	2020-present
Conservation Genomics (BYU)	2019-present
Science Methods for School Teachers (BYU)	2019
Charles Redd Center for Western Studies (BYU)	2018/19
Climate Change (Utah Valley University)	2017/18
Wetlands (Université de Rennes 1)	2016
Landscape ecology (Université de Rennes 2)	2015
Microbiology (UAF)	2014
Principles of Ecology and *Methods for Interdisciplinary Research* (UAF)	2012/13
Stream Ecology (UAF)	2011
Plant ecophysiology (UAF)	2010

Graduate students advised (8 M.S., 3 Ph.D.):

Aria McComber, M.S., *The corporate sustainability paradox: corporate and public preference for achieving circular life cycles for electronics* (2021, BYU)

Qiwen Zhang, Ph.D., *Arctic river networks reveal terrestrial and aquatic signals of ecosystem change* (2020, BYU)

Samuel Bratsman, M.S., *Nutrient and microbial interactions structure lake and stream network biogeochemistry* (2020, BYU)

Leslie Lange, M.S., *Improving science education and illuminating links between water quality and socioeconomic development* (2020, BYU)

Isabella Errigo, M.S., *eDNA reveals divergent successional trajectories in aquatic ecosystems affected by megafire* (2020, BYU)

Adam Norris, M.S., *Effects of megafire on soil and stream processes* (2020, BYU)

Brian Brown, M.S., *Machine learning techniques reveal watershed response to wildfire and climate change* (2019, BYU)

Sara Sayedi, Ph.D., *Combining expert opinion to assess risk of dangerous change in Earth systems: permafrost collapse, global wildfire, and water security* (2018, BYU)

Trevor Crandall, M.S., *Water quality in semi-arid ecosystems: wildfire and wastewater in the western U.S.* (2018, BYU)

Camille Vautier, Ph.D. co-adviser, *Biological degradation at hydrological interfaces* (2016, ECOBIO Rennes)

Adélaïde Duval, M.S. co-adviser, *How do microbial community and biogeochemical fluxes respond to different land use histories?* (2016, ECOBIO/OSUR Rennes)

Charly David, M.S. co-adviser, *Dynamic imaging of hydrological exchange and degradation at river-groundwater interfaces* (2015, Géosciences Rennes and Agrocampus Ouest)

Madiha Khadraoui, M.S., *Biogeochemical characterization of denitrification in agricultural landscapes* (2015, ECOBIO/OSUR Rennes)

Undergraduate students advised (90 from 2017-present):

Rebecca Frei, Rachel Watts, Samuel Bratsman, Rhetta Shoemaker, Camila Vargas, Nicholas Suiter, Andrew Luymes, Jansen Howe, Madeline Buhman, Elizabeth Peterson, Leika Patch, Leslie Lange, Isabella Errigo, Zak Webber, Amanda Huebner, Isaac St. Clair, Allie Tuttle, Cecily Nicoll, Audrey Stacey, Audrey Goates, Abigail Banks, Haley Moon, Caleb Cline, Mary Proteau, Russell Anderson, Marina Pfeil Merritt, Heidi Wilding, Emilee Severe, Mitchell Greenhalgh, Chelsea Abrahamian, Thomas Stanford, Derrek Wilson, Tessa Meredith, Elizabeth Kujanpää, Adam Norris, Noelle Ackerman, Kallin Austin, Elizabeth Buening, Emma Butler, Taylor Chattin, Meiyu Chen, Vivine Chen, Matthew Daw, Grace Day, Kristian Dorman, Madalynn

Drennan, Zachary Eliason, Alora Gubler, Margaret Hancock, Shannon Lambson, Justin Lemke, Kylee Mecate, Megan Nebeker, Luke Oldham, Ryan Packham, Sarah Peterson Chan, Shiloh Ploeg, Sarah Rollins, Tori Simpson, Jacob Spencer, Austin Kallin, Eric Ball, Sarah Buening, Elisabeth Currit, Brooke Frandsen, Alora Gubler, Margaret Hancock, Kennedy Jones, Whitney Kingsolver, Lexanne Klimes, Abigail Packard, Madalynn Sweet, Hunter Hassell, Addison Bliss, Morgan Cardon, Danny Dudley, Sara Frutos, Jacquelyn Land, Katie Lawrence, Alex Long, Ethan McQuhae, Flynn Moore, Rachel Poulsen, Nathan Thompson, Hannah Butterfield, Tessa Cantrell, Emma Finlayson, Carter Flint, Kayla Sorenson, Katy Thomas

Service

University, college, and department service

Brigham Young University Sustainability Working Group	2021-present
S-REACH (Science REsearch for AChieving High-school students) faculty mentor	2021
Plant and Wildlife Sciences Hiring Committee	2020
Hiring committee for the BYU sustainability director	2020
Hiring committee for the EAL and Public Health technician	2020
Faculty adviser to the Environmental Science & Sustainability club	2019-present
Faculty adviser to the Mountaineering club	2020-present
Department website committee	2018-present
Committee for the evaluation of undergraduate research	2018-present

Workshops and conferences organized

Planning committee chair, *Utah Lake Symposium* (2021, Orem, Utah)

Session contributor, *Great Ideas for Teaching (GIFTs) Climate Change at the Undergraduate Level* American Geophysical Union annual meeting (2021, New Orleans, Louisiana)

Session chair, *European Geophysical Union General Assembly* (2021, Vienna, Austria)

- *Data-driven analysis of water quality to understand solute and particulate export mechanisms in catchments*

Organizing committee and presenter, *Faith is action: stewardship and the climate crisis* (2020, Salt Lake City, Utah)

Session chair, *European Geophysical Union General Assembly* (2020, Vienna, Austria)

- *Data-driven analysis of water quality to understand solute and particulate export mechanisms in catchments*

Organizing committee, *Society of Freshwater Sciences Annual Meeting* (2019, Salt Lake City, Utah)

Session Chair, *American Geophysical Union Fall Meeting* (2018, Washington D.C.)

- *Advances in Monitoring and Modeling of Subsea Permafrost*

Board member of the International Scientific Committee for the *European Conference on Permafrost* (2018, Chamonix-Mont-Blanc, France)

Conference organizer, *Water Quality in the West* (2018, Pocatello, Idaho)

Session chair, *American Geophysical Union Fall Meeting* (2017, New Orleans, Louisiana)

- *Vulnerability of Permafrost Carbon to Climate Change*. EAG Schuur, BW Abbott
- *Linking catchment biogeochemistry and hydrology to understand freshwater landscapes in the Anthropocene*. T Burt, BW Abbott, F Worrall
- *Interdisciplinary Approaches to Conceptualizing Nonlinear Changes in Permafrost Landscapes*. M Turetsky, T Douglas, BW Abbott

Workshop organizer, *Where land becomes stream: connecting spatial and temporal scales to better understand and manage catchment ecosystems* (2017, Rennes, France)

Workshop organizer, *Connectivity in fractured landscapes: soils, streams, and subterranean circulation* (2016, Rennes, France)

Workshop organizer, *Interfaces Joint Field Experiment* (2016, Pleine-Fougères, France)
Workshop organizer, *Small Catchment Ecohydrology Workshop* (2015, Rennes, France)
Conference assistant, *Vulnerability of Permafrost Carbon Research Coordination Network Synthesis Workshop* (2011, Seattle, USA)

Graduate committee service (10 M.S., 4 Ph.D.)

Jeremy Stanley Bekker, M.S., *Online Mindfulness Curriculum* (2022, Psychology)
Logan Kalaiwaipono Ellis, M.S., *Sediment and nutrients from invasive ungulates affects indigenous fishing practices in Molokai* (2020, BYU Biology)
Isabella Errigo, M.S., *Using environmental DNA to assess native and nonnative fish and invertebrate recovery following a megafire* (2020, BYU Plant and Wildlife Sciences)
Forrest Jensen, M.S., *Quantifying informal learning pathways for K-12 science teachers* (2020, BYU Teacher Education)
Kaylee Tanner, M.S., *New methods for remote sensing of water quality: from drones to Landsat* (2020, BYU Civil Engineering)
Rachel Watts, M.S., *Quantifying local to global dust inputs as controls on stream nutrient concentration* (2020, USU Watershed Sciences)
Devri Adams, Ph.D., *Postfire successional trajectories of forests under grazing pressure* (2019, BYU Plant and Wildlife Sciences)
Madeleine Malmfeldt, M.S., *Creating an early warning detection network for harmful algal blooms* (2019, BYU, Plant and Wildlife Sciences)
Gabriella L. Lawson, M.S., *Nutrient or light limitation in Utah Lake: The 9-billion-dollar question* (2019, BYU, Plant and Wildlife Sciences)
Jordan Maxwell, Ph.D., *Disturbance effects on ecosystem health and services in a mixed-aspen conifer forest* (2018, BYU, Plant and Wildlife Sciences)
Antoine Casquin, Ph.D., *Effects of landscape spatial structure on lateral C-N-P fluxes*, (2018, INRA, Agrocampus Ouest)
Erin F. Jones, Ph.D., *Biologic and Hydrologic Controls of Water Quality in Urbanizing Semi-Arid Watersheds* (2017, BYU, Plant and Wildlife Sciences)
Scott Collins, M.S., *Population dynamics of cyanobacterial communities in harmful algal blooms on Utah Lake* (2017, BYU, Plant and Wildlife Sciences)
Natalie S. Barkdull, M.S., *Hydrological and biological response of high-mountain glaciers to climate change* (2017, BYU, Geological Sciences)

Reviewer for 47 international journals (190 reviews: https://publons.com/author/1214688)

Agriculture Ecosystems and Environment. Analytical Chemistry. Arctic, Antarctic, and Alpine Research. Arctic Science. Atmosphere. Biogeochemistry. Biogeosciences. Biology and Fertility of Soils. Chemical Geology. Cryosphere. Ecosystems. Environmental Science & Technology. Freshwater Science. Geophysical Research Letters. Global Biogeochemical Cycles. Global Change Biology. Hydrogeology Journal. Hydrological Processes. Hydrology and Earth System Sciences. International Journal of Environmental Research and Public Health. Journal of Geophysical Research. Journal of Geophysical Research: Biogeosciences. Journal of Hydrology. Land Degradation & Development. Landscape Ecology. Limnologica. Limnology and Oceanography. Limnology and Oceanography: Methods. Microbial Ecology. Nature Communications. Nutrient Cycling in Agroecosystems. PeerJ. Permafrost and Periglacial Processes. PLOS One. Progress in Physical Geography. Remote Sensing of Environment. Science Advances. Science of the Total Environment. Science China: Earth Sciences. Scientific Reports. Sedimentary Geology. Soil Biology and Biochemistry. The Cryosphere. Water. Water Research. Water Resources Research.

Reviewer for 7 funding agencies

ArcticNet. AVOID 2. Earthwatch. I-SITE. National Science Center, Poland. Propolar. U.S. National Science Foundation.

Other service

Board member of the Utah Valley Sustainability Coalition	2019-Present
BYU representative to the Consortium of Universities for the Advancement of Hydrologic Science, Inc. (CUAHSI)	2018-Present
Review Board member for Biogeochemistry	2017-Present
Board member of LDS Earth Stewardship	2019-Present
Board member of Mormon Environmental Stewardship Alliance	2019-Present
Guest Editor for PLOS ONE collection on Freshwater Ecosystems	2020-21
Scientific contributor to Wildfires in Utah Art, Homes and Lands (BDAC)	2021
Scientific consultant for the Utah Governor's office on COVID-19	2020
Scientific consultant for the Provo City Council on COVID-19 and masks	2020
Ambassador for AGU's Voices for Science program	2019
Planning Committee for the Society for Freshwater Sciences	2018-19
Guest Editor for Science of the Total Environment	2017-18
Guest Editor for Frontiers in Ecology and Evolution	2017-18
Public relations representative for the Brittany Armorique LTER	2014-16
Executive committee member Permafrost Young Researchers Network	2012-14
National representative for the USA in Permafrost Young Researchers Network	2011-14
Co-founder and executive committee chair of UAF Green Bikes program	2010-14
Translation editor for Russian submissions to the TICOP proceedings	2012
Web designer and organizer of the UAF Midnight Sun Science Symposium	2012
Fairbanks North Star Borough Outdoor Days radio telemetry station	2011
Co-chair of the UAF Review of Infrastructure, Sustainability, and Energy board	2010-13

Outreach and media

Author of blog: *approximately limitless*	2011-present
Director of the Utah Lake Collaborative participatory science project	2018-present
Frequent guest on BYU Radio ("Top of Mind" and "Constant Wonder)	2018-present
Scientific docent for BYU MOA's exhibit "Far Out: The West Re-Seen"	2020-2021
Commentator on "The Crossroads Series" by PBS NOVA	2020
Editor and art contributor to the Wikipedia article on the Water Cycle	2020
Scientific contributor for the Salt Lake Tribune on air pollution	2020
Guest writer for Salt Lake Tribune on Earth Day	2020
Press conference on the Clean Car Standards (Union of Concerned Scientists)	2019
Artistic contributor to BYU's "Silent Spring in the Anthropocene" (Frank McEntire)	2019
Panelist: Rapid Growth and its Consequences in Utah	2019
Panelist: Millennial Political Engagement: Attitudes about Climate Change (BYU)	2019
Moderator for BYU Republicans and Democrats events on Climate Change	2019
UVEF Panelist: Wildfires, Drought, Air Pollution: The Growing Climate Crisis	2018
Contributor for Yale Climate Connections	2018
Journal cover photo, Ecology Letters	2018
Scientific panel Utah Valley Earth Stewardship Forum on Utah Lake	2018
Scientific briefing for Congressman John Curtis	2018
Scientific panel for Citizen's Climate Lobby	2018
Global Arctic MOOC, École Polytechnique Fédérale de Lausanne	2018
Consultant and vocal artist for Air Transit (BYU Dance)	2018
Scientific contributor for the Deseret News and Salt Lake Tribune	2018
Scientific consultant for Tipping points documentary by Unboxed media	2012-13

Scientific consultant for *Climate Hunters* by Netherlands Public Broadcasting	2012-13
Contributor: *River Conservation: Challenges and Opportunities*, Fundación BBVA	2013
Journal cover photo, Journal of Plankton Research	2012 May
Contributor for Yale forum on Climate Change and the Media	2012
Article, *Life in Fairbanks*, UAF website	2010
Article, *America's Greenest Hotels: Where luxury meets ecology*, Forbes Traveler	2008
Article, *The cost of living*, USU Natural Resources Almanac	2007

Scholarships and awards

College Undergraduate Research Awards (E. Severe, M. Merritt, B. Frandsen)	2021
Excellence in Research Award for Plant and Wildlife Sciences	2020
High Impact Doctoral Research Assistant Grant (Qiwen Zhang)	2020
College Undergraduate Research Awards (M. Greenhalgh, H. Moon, A. Norris, T Stanford)	2020
Voices for Science Policy Fellowship	2019
College Undergraduate Research Awards (I. Errigo, L. Lange, R. Watts, R. Frei)	2019
High Impact Doctoral Research Assistant Grant (Sara Sayedi)	2018
Office of Research and Creative Activities Grant (Rebecca Frei)	2018
Innovation Working Group: Water Quality in the West	2018
Top Peer Reviewer (Publons)	2017-20
Editor's selection for Most Innovative Articles of the Year (ERL)	2016
Early Career Scientist Award (Arctic LTER)	2016-17
Marie Curie fellowship	2014-16
Ted McHenry Biology Field Research Fund	2013-14
IAB Director's Travel Award	2013
College of Natural Science and Mathematics Travel Grant	2013
Graduate School Travel Grant	2013
UAF Dissertation Completion Fellowship	2013
Midnight Sun Science Symposium, 1st and 2nd prizes	2013
Mike Ardaw Trust Scholarship	2012-13
George Happ Biomedical Graduate Scholarship	2012-13
IAB Director's Travel Award	2012
AGU Outstanding Student Paper Award: Global Environmental Change	2011
United States Permafrost Association AGU travel grant	2011
W. Scott Parish Memorial Scholarship	2011-12
Alaska EPSCoR travel grant	2010
UAF Office of Sustainability SIREN grant for UAF Green Bikes program	2010
USU Watershed Sciences Outstanding Senior	2009
Quinney Scholar Educational Enhancement Grant	2008
USU College of Humanities, Arts and Social Sciences, Hubbard Scholarship	2007-08
Undergraduate Research and Creative Opportunity grant	2007
Undergraduate Teaching Fellow of the Year: Utah State University	2007
USU College of Natural Resources, Quinney Scholarship	2002-08

Skills and interests

Languages: English (native speaker), French (fluent)

Field experience: More than 10 years' experience sampling water (rivers, soil water, precipitation, and groundwater), soil, surface and ground ice, vegetation, and gasses for biogeochemical analyses including stable and radioactive isotopes, fluxes of carbon, nitrogen, sediment, and

other elements. Experience and safety certification in Arctic, desert, and agricultural environments.

Laboratory experience: More than 10 years' experience with analysis and experimentation including dissolved organic matter bioavailability, aerobic and anaerobic soil incubations, elemental analysis CNHS, mass spectrometry, gas chromatography, ion chromatography, dissolved and particulate carbon analysis, fluorometry, water isotope analysis, and diverse methods development.

Software and programming: Programming and visual design in R, MATLAB, Python, and Visual Basic. Database management with Microsoft Access and MySQL. Experience with MODFLOW, ModelMuse, QGIS, Whitebox, and ArcGIS. Competent in wide range of analyzer software (e.g. Costech, Dionex, Horiba, LI-COR, s::can).

Project management: Long-distance collaboration; development of quantitative surveys (expert assessment); workshop and conference organization; design and implementation of collaborative, long-term field campaigns; management of synthesis and meta-analysis projects.

Statistics and modeling: Mixed-modeling, multiple regression, boosted regression trees, Bayesian inverse modeling, end member analysis, multivariate analysis, hydrological modeling, reactive transport modeling.

Hobbies: Cycling, folk music, creative writing, poetry, backcountry skiing, houseplants, dumpster diving, solar production and storage.

EXHIBIT C

Getting to know the Utah Lake Ecosystem

Benjamin W. Abbott[1], Isabella Errigo[1], Andrew Follett[2], Gabriella Lawson[1], Mary Murdock Meyer[3], Haley Moon[1], Kevin Shurtleff[4], Joshua J. LeMonte[5], Mary Proteau[1], Kristina Davis[6], Kaye Nelson[6], Sam Rushforth[7], Scott Abbott[8], and Weihong Wang[9].

[1]BYU Plant and Wildlife Sciences, [2]Yale Law School, [3]Timpanogos Nation, [4]UVU Chemistry, [5]BYU Geological Sciences, [6]Conserve Utah Valley, [7]UVU emeritus Dean of Science, [8]UVU Integrated Studies, [9]UVU Earth Science

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Photo by Justin Lehman

Thank you for taking the time to learn about Utah Lake, the huge and unique waterbody at the heart of Utah Valley. Though it is one of the largest freshwater lakes west of the Mississippi River, many in our community know little about its history, ecology, and importance to our future. As the population of our valley grows, we need to understand Utah Lake so we can preserve and protect this keystone ecosystem for future generations.

While we know humans can live in harmony with Utah Lake (the Timpanogos Nation and their predecessors did so for thousands of years), the lake is facing unprecedented challenges. With 600,000 people now living in its watershed, Utah Lake suffers from harmful algal blooms, invasive species, and reduced water flow from diversions and climate change.

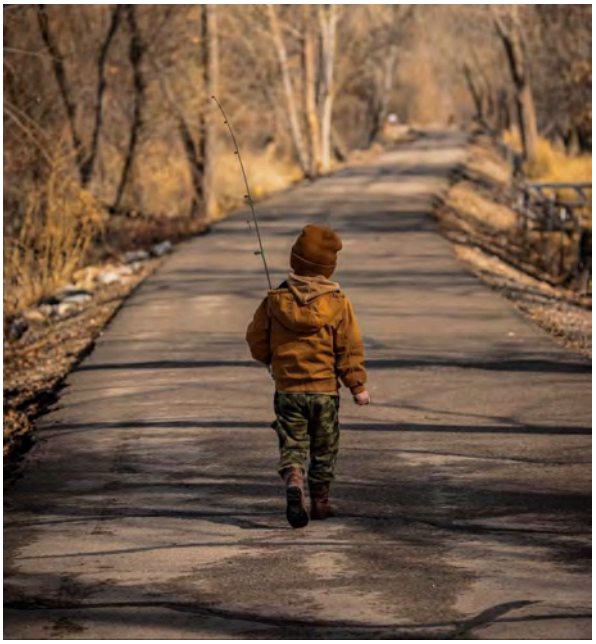
Unfortunately, some people have tried to politicize and monetize Utah Lake by making unfounded claims about its status and future. We often see opinion pieces and social media posts that describe an alternative reality where the lake is portrayed as poisoned, gross, or dying. There are even proposals being considered by the state legislature that would destroy the natural characteristics of the lake with artificial islands and highways.

As a group of concerned researchers and residents of Utah Valley, we have put together this article to help deepen our understanding and improve our stewardship of Utah Lake. We draw on more than 70 scientific studies, including work presented at the first Utah Lake Symposium by researchers, managers, citizen scientists, and community leaders, including the Timpanogos Nation. The questions in this article explore proven practices that could rejuvenate Utah Lake, address threats and challenges ahead, and highlight the dozens of restoration projects that are already making real progress.

We point out that no amount of ecological work can replace the need to rehabilitate our relationship with Utah Lake. The photographs in this document were generously contributed by residents of Utah Valley and the surrounding communities. If you want to dive deeper, visit utahlake.byu.edu and check out the references at the bottom of the document. If you find an error or know of a resource that we've missed, please let us know, and we'll update the article as soon as we can.

With gratitude and hope,

Benjamin W. Abbott
Assistant Professor of Ecosystem Ecology
Brigham Young University
Office: 801-422-8000



A child heads to Utah Lake to fish (Travis McCabe)

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An American kestrel keeps watch over Utah Lake (Travis McCabe)

Quick facts about Utah Lake

Dimensions

- **Surface area:** ~145 square miles (3rd largest freshwater lake in the western U.S.)
- **Elevation:** 4489' above sea level (this "Compromise level" was set by law in 1885 and updated in 1986)
- **Depth:** 9' (average), 18' (maximum)
- **Watershed size:** 2950 square miles

Map of the Utah Lake watershed. Data from the Utah Geospatial Resource Center

People

- **First settlement:** Unknown, but at least 10,000 years ago
- **Indigenous people:** The Timpanogos Nation of the Shoshone Tribe
- **Current population:** ~600,000 in the watershed
- **Projected population in 2050:** 1,300,000

Biodiversity

- **Species:** >500 invertebrates, >400 diatoms, 226 birds, >150 algae and cyanobacteria, 49 mammals, 18 fish, 16 amphibians & reptiles
- **Habitat:** ~30,000 acres of wetlands, ~10 million fish, >35 million migratory birds

Sandhill cranes nesting on Utah Lake. (Chuck Castleton).

Hydrology

- **Water volume**: 902,000 acre-feet
- **Water inflow:** 930,000 acre-feet/year
  - Rivers: 45%
  - Groundwater: 41%
  - Direct precipitation: 14%
- **Water outflow:** 930,000 acre-feet/year
  - Jordan River: 46%
  - Evaporation: 38%
  - Groundwater: 16%
- **Water residence time:** 6 months

Executive summary (a five-minute overview)

A VIBRANT OASIS AT THE HEART OF UTAH VALLEY

Utah Lake is a keystone ecosystem and the centerpiece of our community. This spectacular lake provides critical habitat, abundant recreational opportunities, and invaluable ecosystem services such as removing pollution and creating local precipitation. For example, 35 million migratory birds fuel up or nest in and around the lake every year, and our world-class snow depends in part on the evaporation from Utah Lake. Protecting this unique ecosystem is our duty and opportunity to ensure a flourishing Utah Valley for our children.

A springtime view of Utah Lake from Little Rock Canyon in Provo.

CENTURIES OF SUSTENANCE AND COMMUNITY

Children play on the shore of Utah Lake in Vineyard during the summer.

People have inhabited the shores of Utah Lake for at least 10,000 years. At that time, there were 13 native fish species, a different plant community, and dozens of native mollusks that created a truly unique and resilient food web. Utah Lake sustained Native Americans such as the Timpanogos Nation and later the Mormon settlers, who would not have survived their first winters without the abundant fish and wildlife. Despite changes to the lake's hydrology and biology, Utah Lake remained the cultural center of Utah Valley with resorts, dance boats, and air tours through the 1900s.

FALSE NARRATIVES ABOUT UTAH LAKE'S PAST AND FUTURE

Utah Lake is one of the most misunderstood ecosystems in our state. Contrary to false claims of pending destruction, Utah Lake is on the road to recovery in many ways. The native June Sucker are rebounding, water flow has been increased by cooperative agreements, and wastewater improvements are reducing nutrient loading. Harmful algal blooms are on the decline for most of the lake, and we have the opportunity of further restoration with research and creative public-private partnerships.

Children play on the lake ice in the winter.

CLEAR AND PRESENT DANGER

Some of the misinformation about Utah Lake has been spread intentionally by developers who want to permanently change the lake. Drastic proposals to build islands or causeways would irreversibly damage Utah Lake, costing taxpayers millions and depriving future generations of the lake's beauty and ecosystem services. In this time of dramatic change, we need evidence-based management and legislation to protect and restore this unique, beautiful, and dynamic lake.

A juvenile northern harrier learns to hunt near Utah Lake (Travis McCabe)

PROGRESS AND PRIORITIES

Over the past 30 years, hundreds of projects have contributed to the conservation and restoration of Utah Lake. Wildlife protections, delta restorations, wastewater treatment, and invasive species removal are making measurable progress. Greater support for conservation and research will have big dividends for all the inhabitants (human, fish, and otherwise) of Utah Valley. Specifically, we recommend:

- Fostering community connection and understanding through education and recreation
- Restoring the lake's natural hydrology by returning more water to its tributaries
- Reducing pollutants by upgrading wastewater treatment and improving nutrient management in the watershed
- Removing invasive species in ecologically sound ways
- Ensuring that development around the lake follows best practices considering long-term quality of life and conservation of natural environments
- Protecting the lake from irresponsible and dangerous proposals that threaten its health and our future

Boaters enjoy the south end of Utah Lake (Jared Tamez).

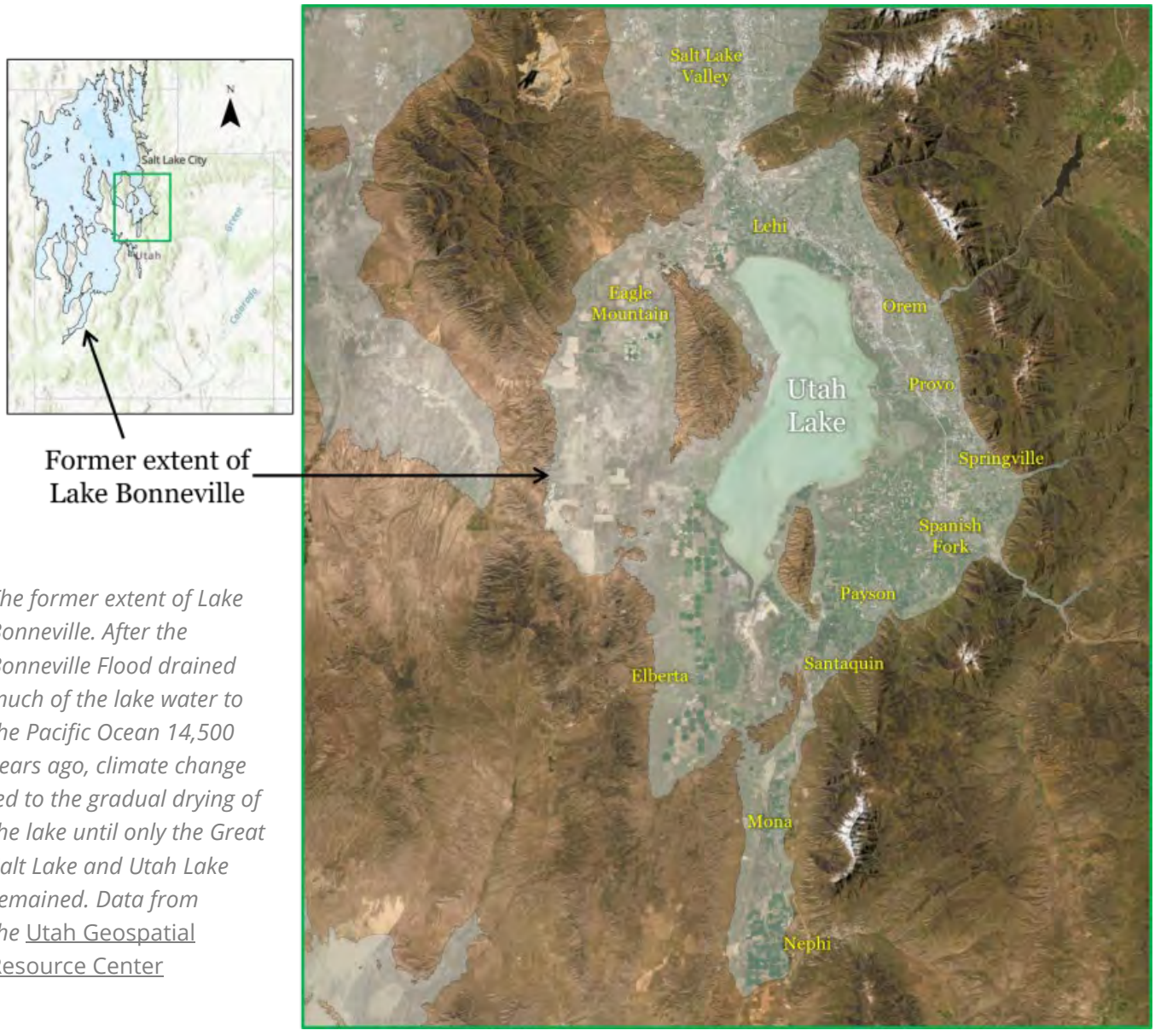
Frequently asked questions about Utah Lake

A view of the lake from Inlet Park, Saratoga Springs (Preston Holman).

What is the history of Utah Lake?

THE DEEP PAST

Utah Lake has a long and fascinating geological and human history. For example, if you were standing on the shore of Utah Lake 20,000 years ago, you would be covered by 500 feet of water! At that time, an inland sea named Lake Bonneville covered much of Utah. Tributaries to Lake Bonneville deposited sediment that created a flat valley floor and benches where many of our towns and cities are now built. Like the Utah Lake system today, Lake Bonneville didn't have an outlet to the ocean. Around 15,000 years ago, water levels got so high that the lake spilled into the Snake River Valley in Idaho. In just a few days, much of the lake drained to the Pacific in the second largest known flood in geologic history.



The former extent of Lake Bonneville. After the Bonneville Flood drained much of the lake water to the Pacific Ocean 14,500 years ago, climate change led to the gradual drying of the lake until only the Great Salt Lake and Utah Lake remained. Data from the Utah Geospatial Resource Center

The drier climate after this Bonneville Flood resulted in the lake eventually shrinking until only the Great Salt Lake, Utah Lake, and Sevier Lake remained. From about 5,000 years ago until the 1800s, Utah Lake has fluctuated around its current elevation of 4,500’ above sea level.

Painting of Chief Walkara by Solomon Carvalho (1854).

THE PEOPLES OF UTAH LAKE

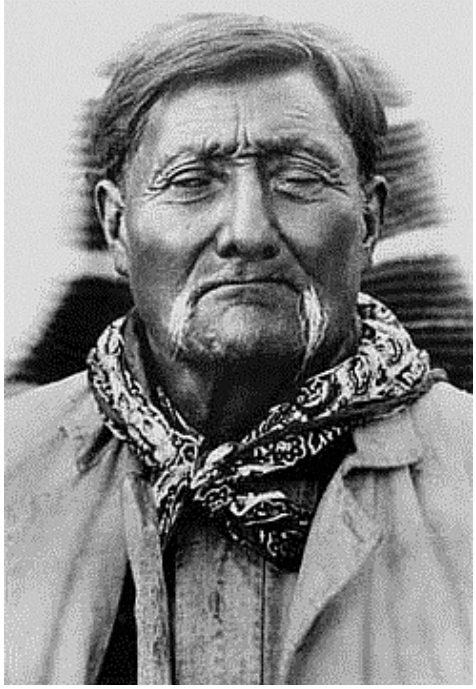
The Utah Lake area has been a crossroads of humanity for at least 12,000 years. That’s when the Clovis people populated parts of the Great Basin. Later, the Fremont and Numic peoples (ancestors of the Shoshone and Paiute) were joined in about 1400 AD by the Athapascans (ancestors to the Navajo and Apache tribes). Until the end of the 1800s, the Utah Lake area was primarily inhabited by the Shoshone, Paiute, and Goshute peoples (more detailed history here).

The first contact with Europeans is believed to have occurred in 1776, when Father Silvestre Velez de Escalante passed through Utah Valley. The Snake-Shoshone Timpanogostzis Nation (hereafter Timpanogos Nation) inhabited a large portion of central and eastern Utah at that time, led by Chief Turunianchi. The Timpanogos and associated bands likely numbered 70,000 or more and often congregated around Lake Timpanogos, now known as Utah Lake. Lake Timpanogos was described as an oasis because of the abundant freshwater fish, water birds, and other wildlife that occupied its shallow waters, wetlands, and river deltas. The abundant reeds around and within the lake were known as *Eu-tah*, potentially the origin of the name Utah. Young reeds were used for weaving, and mature reeds were used to make arrows. Though the Timpanogos are often mistakenly referred to as Ute, they are a part of the Shoshone Tribe (detailed history written by the Timpanogos here).

In 1847, Brigham Young arrived with the Mormon Pioneers in the Salt Lake Valley. The seven grandsons of Chief Turiunachi led the Timpanogos at that time, including Chiefs Sowiette, Walkara, Tabby, and Sanpitch.

Mule deer on the lakeshore (Travis McCabe).

In 1849, Young sent settlers south to establish Fort Utah on the banks of the Timpanogos River—now known as the Provo River. After only a few months of cooperation, relations between the Mormons and the Timpanogos soured. In January of 1850, three Mormon settlers murdered a Timpanogos man known as "Old Bishop" after accusing him of stealing a shirt. Fearing the response of the Timpanogos and Brigham Young, who had warned



Photograph of Chief Tabby, who negotiated peace in 1867.

the settlers not to engage in violence, the men dumped Old Bishop's body in the Provo River. When he was found, the Timpanogos retaliated by stealing and killing some of the settlers' livestock.

After repeated letters and visits to Salt Lake, the settlers at Fort Utah eventually convinced Brigham Young to send the militia to exterminate any hostile Timpanogos men, though they did not disclose their murder of Old Bishop, which had instigated the conflict. The years of violence that followed are called Walkara's War. The Timpanogos Chiefs and many others negotiated and fought to protect their homeland and people, eventually resulting in a temporary peace agreement with Young.

A period of relative peace ensued between the Timpanogos and Mormon settlers. During crop failures in 1855-1856, fish from Utah Lake saved many settlers from starvation in both the Utah valley and Salt Lake Valley.

In 1865, tensions escalated again in what is called the Black Hawk War, which resulted in the death of hundreds of Native Timpanogos. There were brutal encounters throughout Utah Valley and the surrounding area. Chief Tabby eventually negotiated a peace treaty with Joseph Stacey Murdock, the local leader of the Mormon settlers who took and later married Secunup, the daughter of Chief Aeropean. Chief Tabby led the Timpanogos to join the Northern Shoshone in the Uinta Valley Reservation, which had been created by President Abraham Lincoln in 1861.

In the decades that followed, the Timpanogos were largely forgotten. In the 1880s, four Ute Bands were relocated to the Uinta Reservation, where they were recognized as the Ute Indian Tribe. Because the Timpanogos had been referred to as Utah Indians, many mistakenly assumed they were a part of the same group. The Timpanogos Nation lives to this day on the Uinta Valley Reservation and throughout Utah. They are led by Chief Executive Mary Murdock Meyer, who is a contributor to this article and the great great great granddaughter of Chief Walkara on her mother's side and Chief Aeropean on her father's side.

Chief Executive Mary Murdock Meyer, current leader of the Timpanogos Nation.

GROWING POPULATION AND GROWING PRESSURE

In the following century, Utah Valley saw rapid growth and change. Widespread agriculture and a growing population led to ditches, canals, and eventually the rerouting of the entire Provo River from Provo Bay to the northwest, where it currently enters Utah Lake. There were diversions in all the major tributaries to Utah Lake (Provo, Spanish Fork, American Fork, Hobble Creek, Benjamin Slough, and Currant Creek). Some tributaries became seasonally dry (Provo River) or permanently disconnected from the lake (Hobble Creek). As the water flow to Utah Lake decreased, the pollution delivery skyrocketed. Sewage, industrial, and agricultural runoff from the surrounding cities and farms added nutrients, pesticides, metals, and other pollutants. These contaminants were dumped directly in the lake or were transported there by rivers and groundwater.

Harvest of June Sucker and other native fish from the shore of Utah Lake in 1855. Courtesy of the June Sucker Recovery history.

In addition to the loss of water and increase in pollution, overfishing was causing large declines in the native fish populations. Up to that point, Utah Lake had been an incredibly productive fishery. After the completion of the Transcontinental Railroad—which enabled rapid transport of live fish—the settlers started introducing new species in an attempt to rejuvenate the commercial and subsistence fishery of Utah Lake. Black bullhead catfish were introduced in 1872. In 1883, there was an initial release of 200 baby common carp. Largemouth bass followed in 1890. Some of these fish did reproduce rapidly, but they put

pressure on the native species, permanently changing the lake's food webs. The intentional or accidental introduction of plants such as phragmites and salt cedar further changed the ecosystem.

A great blue heron and a Cooper's hawk hunt amid invasive phragmites in Utah Lake (Travis McCabe).

Through all this change, Utah Lake remained important culturally, economically, and ecologically. Native and introduced fish species were a major food source and the lake was the center of community activities. Resorts sprung up around the lake, including pavilions, a dance boat, horse tracks, and performance halls (for details about this period, check out the Utah Lake Legacy film produced by the June Sucker Recovery Implementation Program). In the 1900s, recreationalists took to the lake in sailboats, motorboats, and even airplanes.

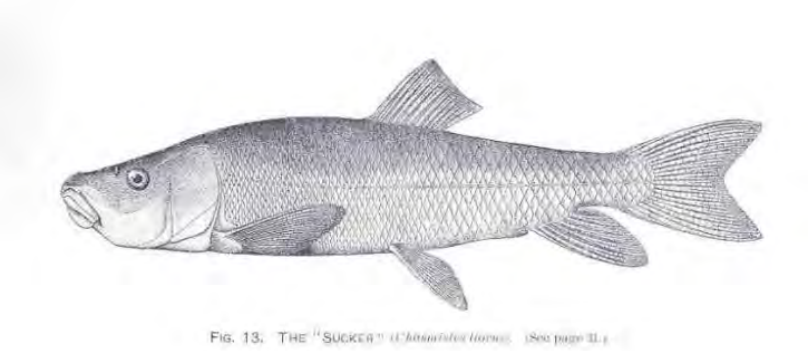
ROCK BOTTOM

The darkest period ecologically for Utah Lake arguably occurred during the Dust Bowl of the 1930s. The lake level dropped 12 feet because of persistent drought conditions and new water diversions (including the world's largest pumping station at the time). Except for a few pools, Utah Lake was reduced to a dry lakebed. With no water in the lake, the Jordan River (Utah Lake's sole outlet) stopped flowing, cutting off irrigation for much of Salt Lake County. The Utah governor drove a pickup truck across the lakebed to inspect the situation, declaring a state of emergency. The temporary loss of the lake modified local climate and devastated agriculture and property values in both Utah and Salt Lake counties.

Utah Lake in 1935 at 12' below compromise. Photo courtesy of Roland Strong.

Together, the loss of water, increase in pollution, and introduction of invasive species caused permanent damage to the lake's biodiversity. The Utah sculpin went extinct and 10 other native fish were extirpated (eliminated locally). Native mollusks and plants were also extirpated or pushed to extinction, triggering major changes in the aquatic and terrestrial environment that make up the Utah Lake ecosystem.

THE RIVER TO RECOVERY



Drawing of the June Sucker, one of 13 native Utah Lake Fish (by David Starr 1891).

After the trauma of the lake drying out, management and governance of the Utah Lake watershed changed course. Limits on diversions were implemented and projects to measure and manage river flow were put in place. Coordination among communities increased with the creation of major water projects, including some that piped in water from the Colorado River basin, which is just to the southeast of the Utah Lake watershed. As the population grew, both state and federal regulation of water quality led lakeside communities to start treating their wastewater in the 1950s, reducing nutrient pollution to the lake.

These conservation and restoration efforts got a huge boost in the 1980s when the June Sucker—one of the last surviving native fish—was recognized as an endangered species. Listed in 1987, there were only a few hundred June Sucker remaining in the lake. The endangered status led to greater funding and the creation of a comprehensive restoration plan that involved regulators, water users, developers, wastewater facilities, and fisheries across the state.

Map of the Provo River Delta Restoration, one of the many ongoing restoration projects on and around Utah Lake. Courtesy of Melissa Stamp.

In 1999, nine local, state, and federal organizations agreed to a comprehensive program to restore habitat and protect the June Sucker. Working collaboratively, water flow was restored to the Provo River, Hobble Creek was reconnected to the lake, nutrient standards were tightened for wastewater, and ongoing habitat restoration improved the quality and amount of healthy lakeshore and lakebed. Because of this progress, the June Sucker was downlisted from endangered to threatened in 2021.

Why should we care about Utah Lake?

Utah Lake is more than just a scenic backdrop for selfies, though it does support a growing number of nature and event photographers. This lake is of enormous importance to Utah Valley culturally, ecologically, and economically.

In the vast, arid expanse of the Great Basin (200,000 square miles of landlocked mountains and valleys), Utah Lake is a vibrant oasis of water and wetland. The lake provides habitat for hundreds of invertebrates, 226 species of birds, 49 mammals, 18 fish, and 16 amphibians and reptiles. Its wetlands and shorelines are a major migration corridor for 35 million birds, including cranes, eagles, pelicans, and shorebirds that come from as far as Alaska and Patagonia to nest or feed. The deltas and lakebed are as productive as tropical rainforests per square foot, supporting a dense food web of plants, invertebrates (mollusks, insects, arachnids, etc.), and consumers (fish, birds, mammals, and people).

A sailboat crosses the north side of Utah Lake (Angie Hatch).

The lake freely provides ecosystem services that most of us never think about. Utah Lake supports everything from skiing at Sundance, to growing our famous Utah cherries, to enjoying our clean mountain environment. For example, Utah Lake removes hundreds of tons of excess nutrients such as nitrogen and phosphorus from our wastewater, and it processes or stores other pollutants including arsenic, mercury, and sulfur from coal-fired powerplants. Utah Lake regulates our local climate, with its evaporation decreasing summer temperatures and providing a source of moisture for rain and snow in the Wasatch and Uinta Mountains. Additionally, the water in and from Utah Lake protects our air quality by preventing the lakebed from becoming a major source of dangerous dust. This may not sound like a big deal, but areas that have neglected their terminal lakes (lakes without an outlet) such as Owen's Lake in California have ended up spending tens of millions each year to keep down the dust.

Utah Lake provides world class recreational opportunities (check out the Utah Lake Commission's list of 29 things to do at Utah Lake). The number of motor and sailboats on the lake is increasing, and improved access now allows the launching of canoes, kayaks, and rafts along most of the east shore.

Parasailer and rafters enjoy the east shore of Utah Lake (Lanea Shutt).

Marinas around the lake provide access for boaters who sail, water ski, kayak, windsurf, fish, and hunt. Most fish and birds in Utah Lake are safe to eat, and you can check current consumption advisories here. The growing trail system is providing easier access to shorelines and wetlands for all members of our community to spot wildlife, catch fish, paddleboard, or just enjoy the beautiful environment. A large group of professional and amateur photographers work on Utah Lake. Nature, family, and event shoots are extremely popular, with the Utah Lake Photography clubs on Facebook and Instagram claiming nearly 2,000 members.

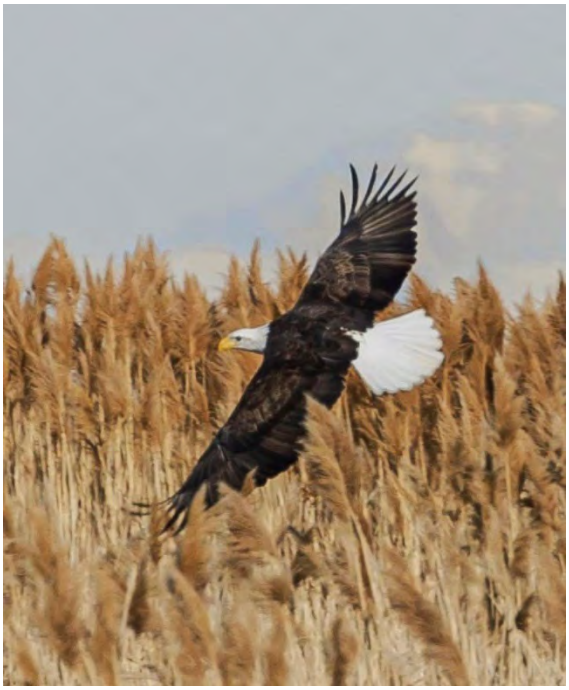
Many in our valley also recognize the spiritual importance of Utah Lake. These lands and waters were sacred to the Timpanogos Nation and other indigenous peoples as well as the Mormon Pioneers who would not have survived their first winters without the bounty of the lake. Whatever our personal history and beliefs, conserving the unique beauty and functions of Utah Lake reverences these lands and brings our community together.

What was Utah Lake like ecologically before European settlement?

We are still learning a lot about the ecological history of Utah Lake, but what we do know provides important context for current conservation and restoration efforts.

One of the biggest changes in the lake is the loss of native species and the introduction of invasive ones. Virtually every group of plants, animals, and microorganisms have been affected. Only two of the original 13 native fish species survive in Utah Lake, and the loss of native mollusks (snails, mussels, and clams) continues to this day. Combine this with changes in both water and land plants, and Utah Lake is a very different ecosystem than the Native Timpanogos would have experienced!

List of native fish that occurred in Utah Lake before European settlement. Image from the Utah Lake Commission.



A bald eagle, one of the many birds of prey that depend on Utah Lake, hunts amidst the invasive phragmites reeds (Travis McCabe).

Fifteen non-native fish species, including carp, walleye, bass, catfish, and most recently pike have become established in the lake, where they now eat other fish or disturb the lakebed. Likewise, the non-native common reed *phragmites* was introduced as a decorative plant, but it now dominates many of the waterways and lakeshores around Utah Lake. These changes in ecological community have fundamentally changed how Utah Lake works. Despite what we see in movies, both extinction and the establishment of invasive species are effectively permanent.

The historical clarity of Utah Lake is a point of controversy and continued research. While lake cores do suggest that there was a shift in lake clarity in the 1960s or 1970s, two factors suggest that Utah Lake has always been relatively cloudy. First, the unique hydrology of the lake causes the constant

formation of calcite in the water, which removes phosphorus and creates a unique milky color. These processes protect the lake from nutrient pollution and are caused by evaporation, which concentrates minerals in the lake water (think of hard water scale deposits on a boiling pan). Second, because Utah Lake is so large and shallow, wind action can easily stir up sediment from the lakebed. However, it is likely that Utah Lake was somewhat clearer in the past than it is today for several reasons:

1. There was greater water flow to the lake through rivers
2. There were no carp
3. There was more submerged vegetation that could prevent waves and sediment mixing along the lakeshore
4. There were native mollusks that filtered the water.

Even at that time, the lake was likely a beautiful milky or muddy color for much of the year, except for during snowmelt and periods of little wind when clams and other bivalves could filter the water.

The hydrology of Utah Lake was very different before the water projects of the 1900s. The lake level used to fluctuate more depending on the time of year and amount of snowmelt. Being a large shallow lake, small changes in water level translated into a dynamic shoreline and system of wetlands around much of the lake. Humans now control the amount of water getting to the lake—diverting much of the natural flow and importing water from outside of the basin with pipelines and tunnels. This has the advantage of providing water during drought years and protecting human buildings around the lake, but it comes at the cost of degrading habitat and harming species that depend on natural fluctuations in water flow.

Dr. Janice Brahney collects a sediment core from Utah Lake as part of the Utah Lake Water Quality Study.

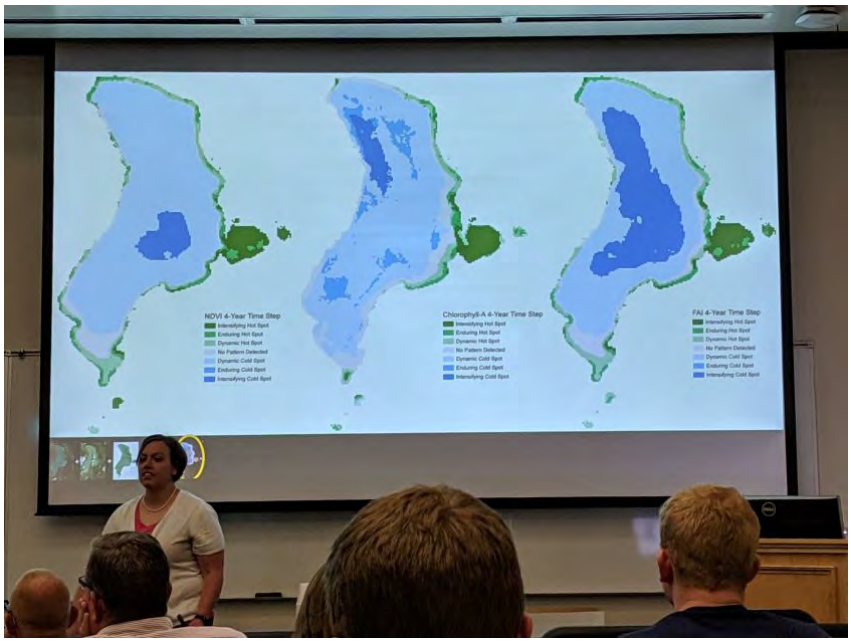
One thing that hasn't changed substantially is the depth of the lake. Utah Lake has always been shallow. Its bathymetry (underwater topography) was determined by Lake Bonneville, which deposited thick sediments that now make up the living lakebed. Despite claims that Utah Lake used to be deeper, analysis of sediment cores show it has always been a huge and shallow waterbody (see section on dredging for more detail).

Why does Utah Lake have algal blooms?

THE GLOBAL NUTRIENT OVERLOAD

Like many waterbodies in the U.S. and globally, Utah Lake has been overfertilized, creating a condition called *eutrophication*. Almost everything humans do—from growing food to using fossil fuels to flushing the toilet—adds nutrients to the environment. Because of this global nutrient overload, approximately 2 in 3 freshwater and estuarine ecosystems worldwide are experiencing various levels of eutrophication. When an ecosystem is overfertilized or *eutrophic*, there can be an overgrowth of algae and cyanobacteria (another family of photosynthesizers). Besides being unsightly, these blooms can be harmful in two ways. First, the cyanobacteria can produce powerful toxins that can sicken people and animals who are exposed to the water. Second, the overgrowth can create so much organic material that oxygen gets depleted in the water, creating a *dead zone* where no fish or other animals can survive.

Given the amount of nutrients in Utah Lake, it is classified as hypereutrophic—the highest award in a contest you don't want to win. However, Utah Lake only experiences occasional blooms usually only over a portion of the lake. In fact, Utah Lake was just ranked in the lowest category of algal bloom severity and persistence by a nationwide satellite study this year—cleaner than many lakes and reservoirs in Utah. If Utah Lake is hypereutrophic, why doesn't it have more frequent and severe blooms?



Shanae Tate (M.S. BYU) presents a 34-year satellite analysis of algal bloom intensity on Utah Lake.

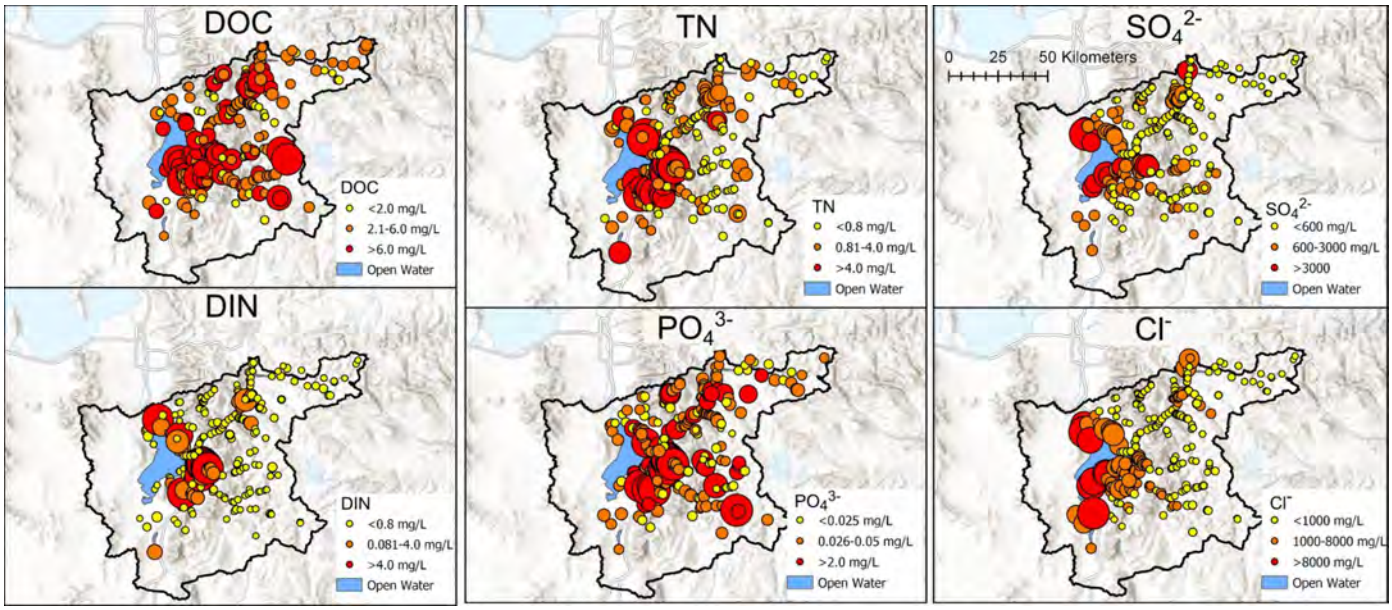
The answer is that the characteristics of Utah Lake make it extremely resilient to algal blooms. Three factors prevent the lake from looking like pea soup year-round. First, the cloudy water of the lake limits light availability, slowing growth of both algae and cyanobacteria below the lake surface. Second, the high rate of evaporation causes constant formation of calcite, which scrubs nutrients from the water or make them difficult for the algae to use. Third, the shallow and wide bathymetry of the lake means that even when blooms occur, they don't create a dead zone because the water is so well mixed. The shallow, well-mixed water also limits the release of phosphorus and other pollutants from the sediment, which become mobile when oxygen is depleted (see section on dredging).

Ultimately, the characteristics that people complain about the most are some of Utah Lake's most important assets!

SOURCES OF NUTRIENTS IN THE UTAH LAKE WATERSHED

So where are the nutrients coming from? Congratulations, you just asked **the most controversial question about Utah Lake!** It is true that we still have a lot to learn about nutrient cycling in Utah Lake, and we need continued research. However, there is an emerging picture of where nutrients come from and how they affect the lake system.

More than a decade ago, the Utah Division of Water Quality commissioned a comprehensive study of Utah Lake nutrients to answer this question. They found that 77% of the phosphorus came from wastewater treatment plants, with the remaining portion coming from agricultural and urban runoff and natural sources. Like any research project, this study had its limitations, for example, it didn't measure stormwater inputs into the lake. Predictably, some people and organizations challenged the finding that nutrients are mainly from wastewater, and the debate has been raging ever since. Some have claimed that dust deposition from the West Desert or nutrient release from the sediment are much more important than nutrients from human wastewater. The scientific process requires people to challenge each other, so these alternative explanations are actually very useful. Let's test them against the available evidence.



Maps of nutrient and solute concentrations in the Utah Lake watershed. For both nitrogen (N) and phosphorus (P), concentrations are highest in the urban and agricultural portions of the watershed, indicating human sources (Jones et al., 2021).

First, it's important to know that not all nutrients are created equal. The total amount of phosphorus or nitrogen in the water can be much larger than the fraction that is available for algae and cyanobacteria. Additionally, many forms of nutrients are bound up in organic materials or protected by mineral compounds. It is only the free and *reactive* nutrients

(such as phosphate, nitrate, and ammonium) that can easily be used by algae and cyanobacteria. It is true that dust and river water are often high in total nutrients because of the types of rocks in our mountains, but these natural sources are usually very low in reactive nutrients. This has been confirmed by several studies, including a large citizen science project that collected samples from nearly all the waterbodies in the watershed. On the other hand, wastewater outflows contain the yummiest imaginable nutrients in wonderfully clear water—a perfect recipe for a bloom.

More convincingly, there is a distinct human fingerprint where the blooms are occurring. While blooms are infrequent and have actually decreased for most of the lake over the past 35 years, there are persistent hot spots in Provo Bay and the east shoreline where wastewater treatment plants discharge into the lake. If dust or the natural sediment were causing the blooms, we would expect a consistent pattern across the whole lake, or even more powerful blooms on the west and south side of the lake where there is more evaporation and dust.

A research technician collects incubation bottles from one of the Utah Lake study locations. Gabriella Lawson (M.S. BYU) led the largest nutrient experiment ever on Utah Lake in 2019-2020.

But are we sure that reducing wastewater nutrients would help? **This is likely the second most controversial question about Utah Lake!** Some people have claimed that because nutrient levels are so high in the lake, even if we reduced human inputs, it wouldn't make any difference. Like the dust and sediment arguments, this is a reasonable hypothesis, but it isn't supported by the evidence. A series of nutrient addition and removal experiments just finished last year have definitively shown that nutrients are the factor that limits blooms throughout the year in all portions of the lake. This likely comes back to the total versus reactive nutrient question. While Utah Lake is high in total nutrients (TP and TN), the available fraction of those nutrients is low enough to limit the initiation and spread of blooms for most of the year.

WHAT CAN WE DO TO REDUCE THE BLOOMS?

If nutrients are causing the blooms, what is the best way to reduce nutrient availability in the lake? **You can now shout controversy BINGO because this question is just as contested as the last two!** If you express nutrient concentration in Utah Lake as a mathematical formula, you'd get something like this:

$$Nutrient\ concentration = \frac{(\text{nutrient input to the lake } - \text{nutrient removal in the lake})}{\text{water flow to the lake}}$$

Even if you don't love math, you can hopefully see that there are multiple ways of reducing nutrient availability. First, we could continue working with farmers and cities to reduce water use, allowing more natural flow to the lake. Second, we could lower nutrient inputs by improving wastewater treatment, reducing stormwater inputs, and improving agricultural practices. Third, we could enhance nutrient removal processes by restoring wetlands, protecting the lakebed, and dismissing any proposals that would reduce evaporation such as building islands. Fourth, we could continue researching nutrient cycles in the lake and testing targeted interventions in high-risk bays and marinas, such as localized dredging, chemical treatment, and algae harvesting. Fifth, we could do all the above. Pro-tip from a teacher: pick all the above.

LOOKING TO THE FUTURE

Dr. Zach Aanderud takes his Environmental Science & Sustainability students on a fieldtrip to Utah Lake.

While nutrients are clearly a big part of the problem, remember that everything is connected in complex ecosystems. Water temperature and lake level are strongly correlated with the severity of blooms on Utah Lake, with worse blooms in warmer years when the water level is low. Two factors likely contribute to these correlations. First, algae and cyanobacteria can replicate faster in warmer water. Second, because wastewater nutrient inputs are constant (in flood and drought, we all use the toilet about the same), the lake experiences higher nutrient concentrations in low water years. These interactions highlight both opportunities and threats. On the threat side, climate change and more demand for agricultural water are making it harder to prevent blooms on Utah Lake. On the opportunity side, we could get more bang for our buck if we both reduce nutrient inputs by upgrading treatment plants and increase natural water flow to the lake by cooperating with farmers and cities.

There is one point about Utah Lake nutrients that we hope is agreed upon: divisions and finger pointing are not helpful. Though wastewater plants are often viewed as villains, we are all part of the problem (everyone poops). We need to view the wastewater plants as indispensable allies, not enemies. They have already implemented many measures to reduce nutrient pollution, including tertiary treatment in some plants. We should thank them for their progress and provide the resources to further reduce nutrients. We also need to look upstream (figuratively) of the treatment plants. To get where we want to go, we need integrated approaches that manage nutrient sources at the watershed level, not only at the end of the line. This is a challenge but also a huge opportunity based on experience from other areas affected by blooms. Implementing nutrient reduction and recapture strategies could create local business opportunities, increase our water and nutrient security, reduce our water and fertilizer expenses, and result in a cleaner and healthier environment.

Cooperation on nutrient and water management will only become more important in the future. The population of the Utah Lake watershed is expected to double by 2050. We are not going to make progress unless we exercise great foresight and investment now.

If we live in a desert, why do we have such a huge lake?

First off, Utah Valley isn't technically a desert. With just over 17" of precipitation annually, central Utah is solidly in the *semiarid* zone (deserts have less than 10" of precipitation). But the question of why Utah Lake exists is still a great one. In the huge expanse of the dry Great Basin, Utah Lake is a rare gem of freshwater and vegetation. Like most things about it, the hydrology of Utah Lake is complicated and fascinating.

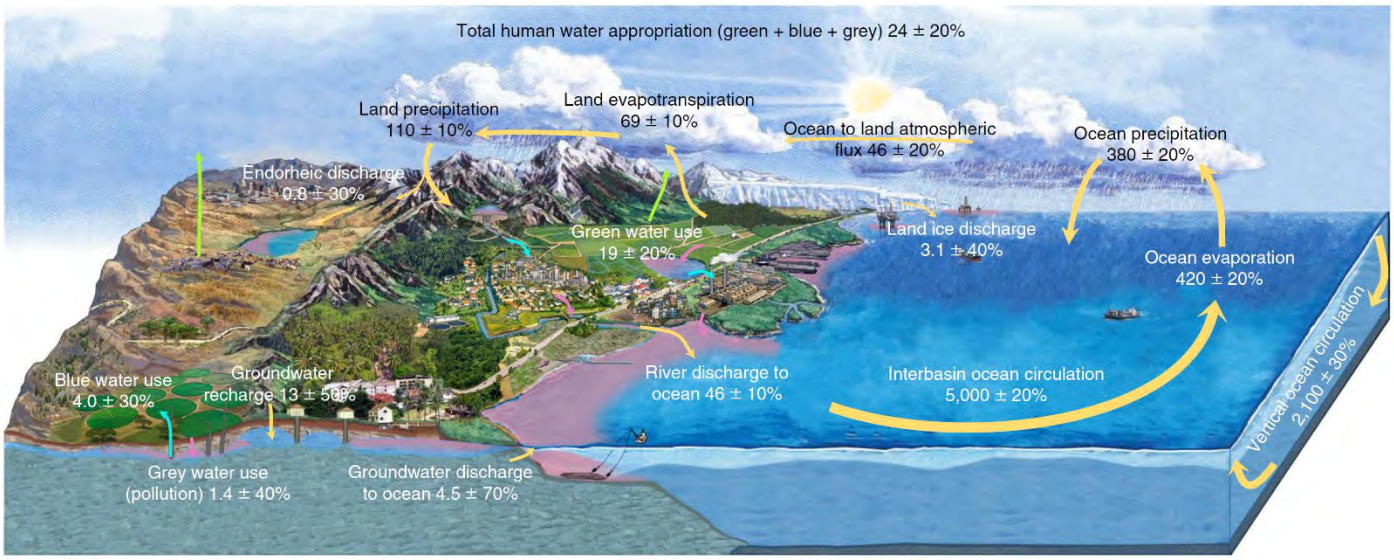
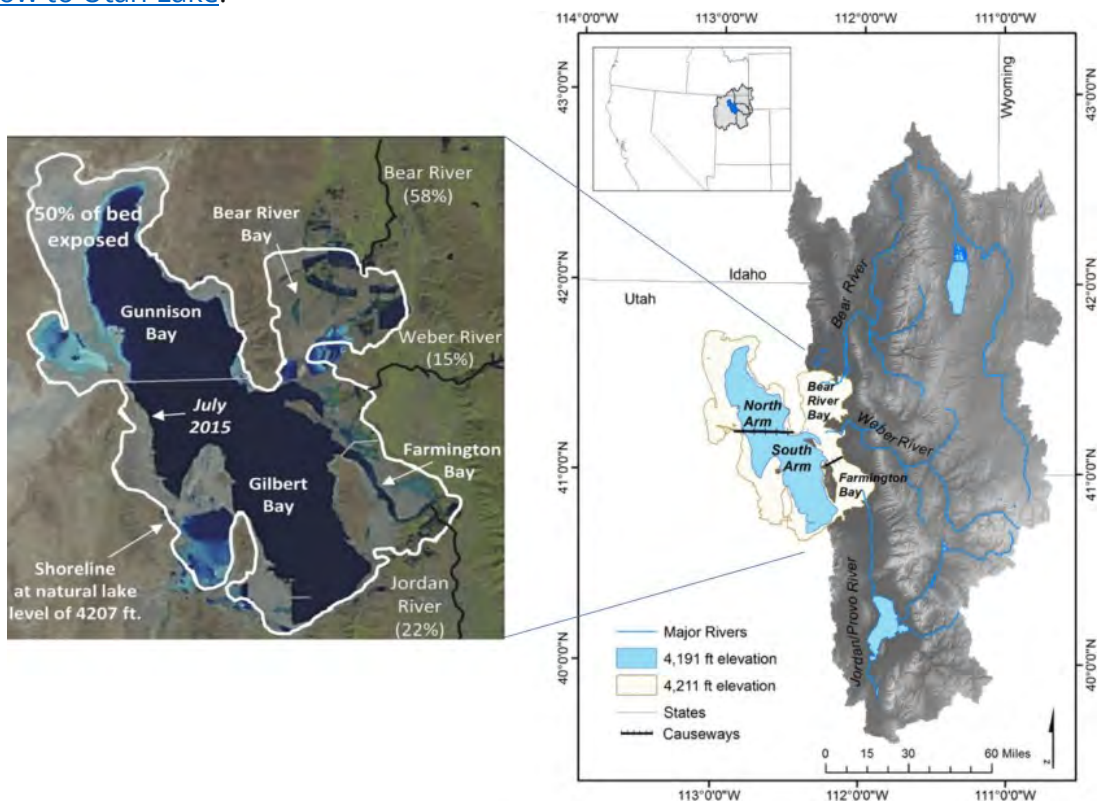


Diagram of the global water cycle, showing the importance of upwind evaporation for endorheic or terminal basins like Utah Lake and the Great Salt Lake. Units are in thousands of cubic kilometers of water per year (Utah Lake contains approximately 1 cubic kilometer of water).

Because this area is relatively dry, one of the distinguishing characteristics of Utah Lake is its enormous watershed (area of land that contributes runoff and groundwater to the lake).

Nearly 3,000 square miles of mountains and valleys are needed to provide enough water flow to keep Utah Lake wet. Compare that to Lake Tahoe, which has about the same area as Utah Lake but only a 500 square-mile watershed! Because it drains such a huge area, Utah Lake is very sensitive to changes in land use, water diversions, and climate.

There are three basic ways that water gets to Utah Lake: 1. Rivers and streams flow into the lake (45% of inflow), 2. Groundwater seeps into the lake through springs and sediments (41%), and 3. Rain and snow fall directly into the lake (14%). Now that we know how water gets into the lake, where does it go from there? Just like the inflows, there are three major options: 1. Lake water flows through the Jordan River toward the Great Salt Lake (46% of outflow), 2. Lake water evaporates back to atmosphere (38%), and 3. Lake water seeps back into the ground, mostly toward the north (16%). Though these inflows and outflows seem straightforward, they are very difficult to measure, and we are still learning a lot about the lake's hydrology. In fact, a study came out last year that more than tripled estimates of groundwater flow to Utah Lake!



Maps of the Great Salt Lake watershed showing the size of the lake at different elevations. The level of the Great Salt Lake reached 4,190' in July of 2021. Credit: Wayne Wurtsbaugh and team at USU.

Some people wrongly assume that evaporation and river flow to the Great Salt Lake are wastes of water. When you understand the hydrology of the lake, you see that these water flows are crucial to maintaining a thriving and healthy local environment. First, water that evaporates from Utah Lake provides an important source of downwind rainfall and snow. In fact, landlocked areas like ours receive more than two thirds of their precipitation from upwind evaporation and transpiration from land and lakes. In the water cycle, nothing is wasted! Second, this evaporation increases local humidity and decreases temperature (like a giant evaporative cooler). In a single year, evaporation from the lake sucks about a trillion megajoules of energy from the atmosphere—that's enough energy to power all of

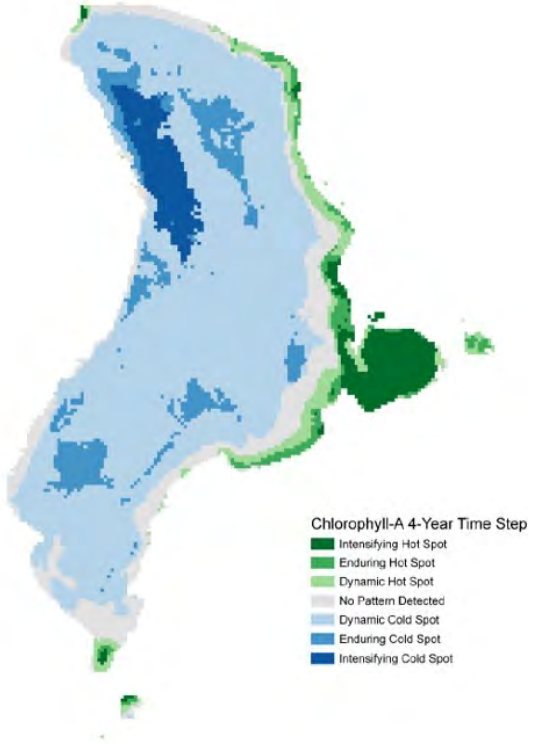
Utah's electricity for 6.5 years! Third, the water flowing through the Jordan River valley is the lifeblood of the Great Salt Lake. Like Utah Lake, the Great Salt Lake provides invaluable habitat and serves as a cornerstone of Utah's identity and economy. Fourth, evaporation from Utah Lake is an important release valve when water levels get too high. For example, in the spring of 1983, record snowpack led to catastrophic flooding along the Wasatch Front.

While terminal lakes are drying up around the world, mainly because of excessive diversions, we need to protect the Utah Lake and Great Salt Lake to avoid air pollution, loss of habitat, loss of tourism, and damage to local quality of life. Climate change has already made our droughts more intense and precipitation less reliable. Looking to the future, we will need to reduce water use and eliminate greenhouse gas emissions to preserve our beautiful and unique environment. Utahns currently use more water per capita than almost any state in the U.S., leaving us lots of room for improvement in agricultural, urban, and domestic water use.

Is Utah Lake getting better or worse?

This is one of the most important and complex management questions. Unsurprisingly, the answer is it depends on what you are talking about.

Let's start with the harmful algal blooms (see the section on blooms for more detail). You may have recently heard about the blooms that affect parts of Utah Lake most years. Increased public awareness of blooms is a good thing, but it's important to remember that this does not mean blooms are a new or worsening problem. Over the past 35 years, the overall amount and duration of blooms have decreased, likely due to improved wastewater treatment and restoration of water flow to the lake. However, blooms in Provo Bay and on the east shore are persistent hot spots with blooms occurring in 30 of the last 34 years. Because the trails and marinas along the east shore are where most people interact with the lake, there is a widespread belief that things are getting worse. This is reinforced by the fact that when a bloom appears, it gets a lot of media attention, but when a bloom disappears (usually just a week or two later), most people never hear about it. Continued reduction in wastewater, urban, and agricultural nutrient sources combined with increased water flow will accelerate the decrease in blooms.



Satellite analysis of chlorophyll (an indicator of algal blooms) over the past 35 years. Blue colors indicate a decrease in blooms, gray colors show no trends, and green colors indicate an increase in blooms (Tate 2020).

While we cannot bring the many extinct Utah Lake species back from the dead, we can establish more natural water quantity and quality to restore some of the extirpated (locally eliminated) species and work to manage the invasive species such as carp and phragmites. The invasive species removal programs have made real progress—removing millions of tons of fish and cutting down hundreds of acres of phragmites. However, invasive removal is an uphill battle. There are virtually no examples of the complete elimination of invasive species from an area as large as the Utah Lake watershed. We can reduce numbers, but it is likely impossible to completely remove the carp and phragmites that now inhabit our lake. This is not completely a bad thing, because both of these species provide ecosystem services, including collecting and removing nutrients and other pollutants, and serving as habitat and food for other species.

A belted kingfisher looks for a meal (Travis McCabe).

Talking about habitat and wildlife, the story is more straightforward. The restoration efforts surrounding the June Sucker and other species have been extremely successful. Minimum fish flows have been established for Provo River and Hobble Creek, creating access to habitat even during the worst drought years. Likewise, large areas of wetland and delta habitat have been created or protected, and this is only increasing with current conservation projects. Fish, birds, and the people who love them are very happy with the notable improvements in the Utah Lake ecosystem over the past few decades.

A juvenile June Sucker. This endemic fish went from no reproducing adults in the late 1990s to more than 4,000 spawning in 2021 (Riley Nelson).

There is another dimension of Utah Lake that is perhaps as or more important than the ecology and hydrology: our community's relationship with the lake. Thirty years ago, it was very common to spend time on and around Utah Lake. Many of us grew up swimming, fishing, waterskiing, and camping around Utah Lake. Even though the ecological status of the lake is better today than it was then, many people have negative attitudes towards the lake and visitation has dropped substantially. This has led to calls to dredge the entire lake, make radical changes to governance, or even cover it with artificial islands. These extreme proposals are a symptom of our loss of connection and understanding with this beautiful waterbody. One of the most important things we can do for Utah Lake is to talk about it, share our photos, and invite our friends to discover this unique ecosystem.

Undated photo of a motorboat on Utah Lake. Courtesy of the Utah State Historical Society. More historical photos here.

Who owns Utah Lake?

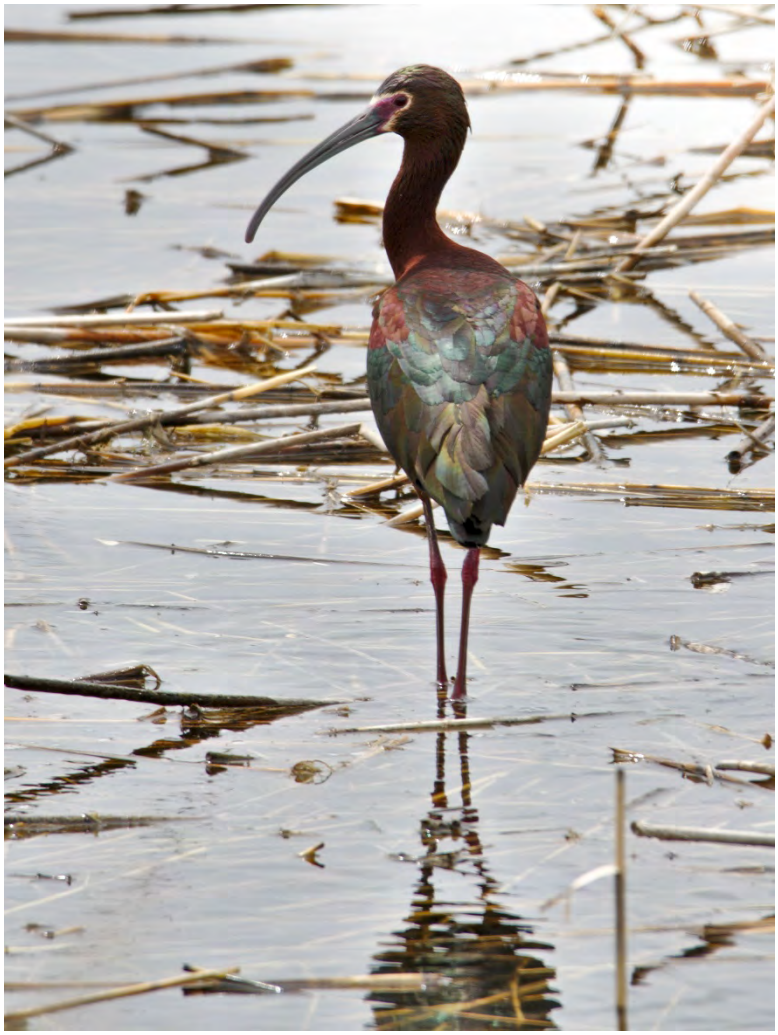
The State of Utah is legally responsible to manage Utah Lake. The Utah Division of Forestry, Fire, & State Lands (FFSL) is the agency tasked with overseeing the lakebed. Lands, lakebeds, and riverbeds protected by the state in this way are referred to as *sovereign lands*. The state holds and manages sovereign lands according to the public trust doctrine, a legal principle that has been established by multiple sources, including the Utah Constitution, state legislation, state common law, and possibly federal constitutional law. The public trust doctrine requires Utah to act as a trustee to hold the lake for the benefit of all Utahns—present and future. However, the state's authority and responsibility to protect Utah Lake in this way have been challenged multiple times in recent history.

A child plays on the steps of the Utah Capitol.

During the 1970s oil crisis, the U.S. federal government issued oil and gas leases for drilling underneath Utah Lake. Local citizens and lawmakers were alarmed that this could cause pollution and

permanent damage to the lake. The Utah government filed a lawsuit that was finally decided in the U.S. Supreme Court in 1987. The Supreme Court upheld Utah's responsibility and right to the bed of Utah Lake, reaffirming that Utah acquired the lakebed and other sovereign lands at statehood under the equal footing doctrine.

Disputes over Utah Lake and other nearby waterbodies have further clarified legal responsibility. In 1990 the Utah Supreme Court ruled that the *"essence of [the public trust] doctrine is that navigable waters should not be given without restriction to private parties and should be preserved for the general public for uses such as commerce, navigation, and fishing."* The court specified that even leasing of these lands can be invalidated. A 2019 ruling by the Utah Supreme Court specified that *"the abdication of the general control of the state over lands under the navigable waters of an entire harbor or bay, or of a sea or lake. . . is viewed as a gross infringement of the public trust doctrine."*



Aware of Utah Lake's controversial legal footing, a glossy ibis tiptoes across the reeds (Russell Hatch).

The most overt and effective challenge to the public trust doctrine started in 2017. A limited liability company wanted to build 20,000 acres of artificial islands within Utah Lake. The company—misleadingly named *Lake Restoration Solutions*—proposed to destroy the lake's natural characteristics by creating deeper channels, disturbing healthy sediment, altering water circulation, and killing all the fish in the lake. They claimed that this "restoration" was necessary because of nutrient-laden sediment, despite multiple lake coring studies that have shown Utah Lake's sediment has natural levels of nutrients (see the section on dredging). They proposed to pay for the radical reengineering of the lake by selling real-estate on their artificial islands, where they planned to house 500,000 people.

In 2017, the company pitched the islands plan to state legislators and lobbied them to pass a law allowing the transfer of the lakebed to a private corporation. In January of 2018, Representative Mike McKell of Spanish Fork introduced the Utah Lake Restoration Act (H.B. 272), which would allow the state to dispose of sovereign lands in exchange for "comprehensive restoration" of the lake system. Despite the law's clear constitutional

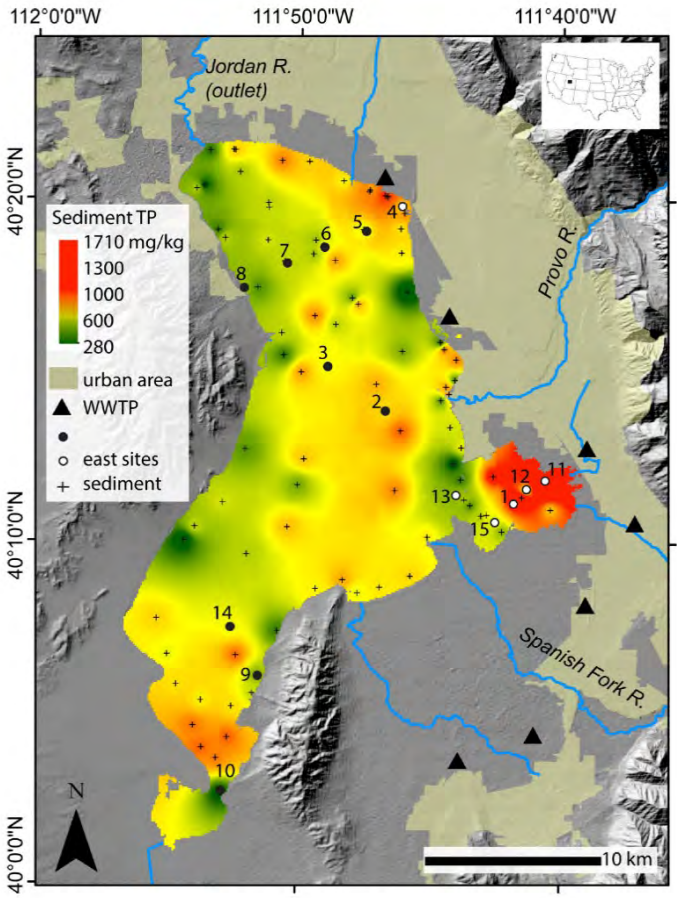
problems and the infeasibility of the island proposal, H.B. 272 passed with overwhelming support in both the house and senate. This law—now codified as U.C.A. § 65A-15—hasn't yet been tested in court, but if the legislature attempts to transfer large portions of the lakebed to private parties, they would almost certainly run into legal barriers. For example, the transfer must not interfere with the existing public trust doctrine, and it would be reviewable by the state courts, who have previously policed the doctrine quite strictly. Though the financing, legality, and ecology of the island proposal are dubious at best, the proposal remains at large (see section on threats to Utah Lake).

In addition to the public trust doctrine in state law, several federal environmental statutes regulate changes to lake management. The National Environmental Policy Act (NEPA) requires thorough environmental assessments before large engineering projects could move forward. NEPA specifically mandates an environmental impact statement (EIS), which takes an average of 4.5 years to complete. Given its unprecedented scope, a massive ecosystem engineering proposal like the islands project should be expected to be among the longest ever NEPA processes, potentially lasting more than a decade or two. Additionally, dredging or filling Utah Lake or adjacent wetlands would require deniable permits and significant study under U.S. law (33 U.S.C.A. § 1344). Any action that may affect endangered or threatened species, such as the June Sucker, would require consultation and input from still *more* federal agencies, and actions seen as too risky may be precluded by certain Endangered Species Act provisions (16 U.S.C.A. § 1536(a)(2)).

Does Utah Lake need to be dredged?

If you've ever talked about Utah Lake on social media, chances are someone proposed to dredge the lake and "start over." There is something intuitive and attractive about this argument, but as usual, the reality is much more complex. Before getting into the nitty gritty details of dredging, let's look at the unique geology and sediment of Utah Lake.

The silt, clay, gravel, and cobbles below Utah Lake go very deep. There is potentially up to 10,000 ft of unconsolidated sediment underneath the lake. This material and the bedrock under it are dissected by multiple seismically active faults. This is one reason Utah Lake has so many springs.

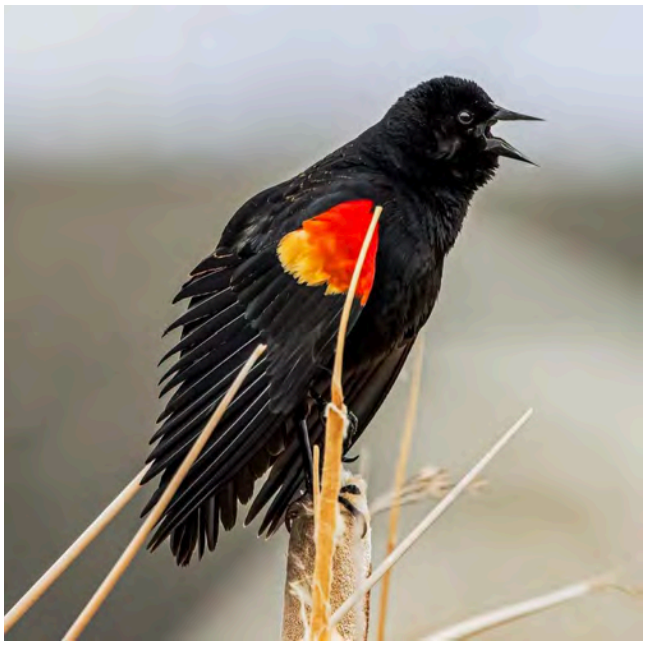


Multiple coring studies have found that the sediment of Utah Lake has natural levels of phosphorus, except areas receiving wastewater effluent (Abu-Hmeidan et al., 2018 and Randall et al., 2019)

People often assume that the lakebed is polluted with nutrients and that the lake is filling up with sediment. Both these beliefs are incorrect, or at least incomplete. Multiple studies have shown that the lakebed has natural levels of phosphorus and very low levels of other pollutants in the sediment. Concerning the claim that Utah Lake is filling up with sediment, this is technically correct, but the question is, how quickly? Rates of sedimentation (accumulation of material on the lakebed) are extremely slow, ranging from 1 to 2 mm a year. This means that it takes around 25 years for the lakebed to rise an inch, which is very similar to the deposition rate of the past 10,000 years based on lake core studies.

A snowy plover hunts for invertebrates. This is one of hundreds of species that depend on the productive sediment of Utah Lake (Jeremy Bekker).

Another common misconception is that the Geneva Steel mill and wastewater outflows have permanently polluted the lake. The mill operated from 1944 to 2001 and did produce air, soil, and water pollution, mainly from the coal used in the steelmaking. However, heavy metal concentrations in lake water and sediment are generally low. For example, lead concentration in three sediment cores ranged from <10 mg/kg below 30 cm and ~40 mg/kg near the surface. Likewise, copper and zinc concentrations ranged from 10 mg/kg to 100 mg/kg (Williams, 2021). These levels are well below the EPA's limits of 420 mg/kg for lead, 4300 mg/kg for copper, and 7500 mg/kg for zinc. Utah Lake's clean sediments can be attributed to the lake's natural characteristics and improved management of pollutant sources in its large watershed.



A red-winged blackbird calls from atop a cattail. Aquatic vegetation such as cattails helps concentrate and remove pollutants in the water and sediment (Travis McCabe).

Now that we have some background, let's talk about the proposals to dredge Utah Lake. Dredging is the excavation of material from an underwater environment. It is most often used in marine environments such as ocean ports to keep channels open for large ships. *Environmental dredging* is the targeted removal of material contaminated with persistent pollutants that pose a risk to human health or the environment. While lakebed sediments are extremely effective at removing or immobilizing most pollutants, there are some "forever chemicals" that can require mechanical cleanup.

A 3-dimensional rendering of Utah Lake from the southwest.

Whether for navigation or environmental cleanup, dredging has serious downsides. First, it damages the community of organisms in and on the lakebed. Benthic (bottom-dwelling) microorganisms have amazing abilities to remove or immobilize pollution, including excess nutrients, organic pollutants, and some harmful metals. The benthic community plays such an important role in purifying the lake water that it is often described as the lake's liver. This is an important reason why Utah Lake's sediments are in such good shape despite decades of nutrient loading from wastewater. Dredging can damage the microbial community and alter the water flow through the sediment, decreasing nutrient removal by the lakebed and therefore increasing nutrient levels in the water column. Consequently, the use of dredging to remove excess nutrients is rare and controversial.

Another problem with dredging is that it can unearth natural and artificial pollutants that were safely stored in the sediment. Lakes receive large amounts of dissolved and particulate material from rivers, groundwater, and atmospheric deposition. Most of this material is harmless or even beneficial, such as the sediment and natural nutrients that support the lake's habitat and food webs. However, potentially toxic chemicals also make their way into lakes including mercury and other heavy metals from coal burning and gold

mining, arsenic and selenium from groundwater, and a host of human-made compounds such as persistent organic pollutants and petroleum products. Biological and chemical processes in the lake water and sediment can deactivate, break down, or bury most of these pollutants. However, many pollutants are sensitive to changes in oxygen, and dredging can trigger large releases that can last for years or decades. Consequently—except for rare cases of extreme pollution—the best practice is to allow sediments to naturally stabilize pollutants in the lake while working to eliminate external sources. In time, contaminated material is further protected as it is covered by clean sediment, a process called *natural capping*.

Light from Saratoga Springs reflects off a partly frozen Utah Lake (Mandy Jensen).

While most discussion of dredging revolves around removing pollutants, there are proposals to dredge Utah Lake for recreational and development purposes. These proposals are the most problematic because deepening the lake would destroy the distinct hydrology and biogeochemistry that have helped protect it from human pressure. A deeper lake, divided into multiple basins, would quickly stratify (separate into layers due to temperature and salinity), potentially creating an anoxic dead layer and killing most animal life in the lakebed. As mentioned above, changes in oxygen could also trigger the release of nutrients and toxins from the sediment, with reactive phosphorus and methylated mercury being of particular concern. We should be extremely cautious before changing the fundamental characteristics of this unique water body. In other wide and shallow lakes,

including the Great Salt Lake, the construction of deeper channels, causeways, or artificial islands has created a suite of expensive and damaging unintended outcomes.

Waves of water in the lake and sky (Kathy Van Wagoner).

There are also legal, financial, and technical barriers to dredging Utah Lake. Because it is expensive and environmentally damaging, dredging is carefully regulated by multiple state and federal laws (see section on who owns Utah Lake). The environmental impact statement for a project as large as dredging Utah Lake would likely take decades. It would also be the largest and most expensive freshwater dredging project in the history of the world. Currently, the Hudson River Cleanup holds that title, with 2.7 million cubic yards of sediment removed over 10 years. According to the proponents of the artificial island project, dredging Utah Lake would require approximately 1 billion cubic yards of sediment to be removed. That would make the project 370-times larger than the already enormous Hudson River project. This could easily cost $10 billion while providing no ecological benefit to the lake system.

Rather than dredging, we should prioritize reducing pollutant delivery to Utah Lake, preserving a healthy microbial and invertebrate community in the lakebed and lakeshore, and protecting the natural sediment structure.

Lake ice buckles against the shore (Justin Lehman).

What are the biggest threats to Utah Lake?

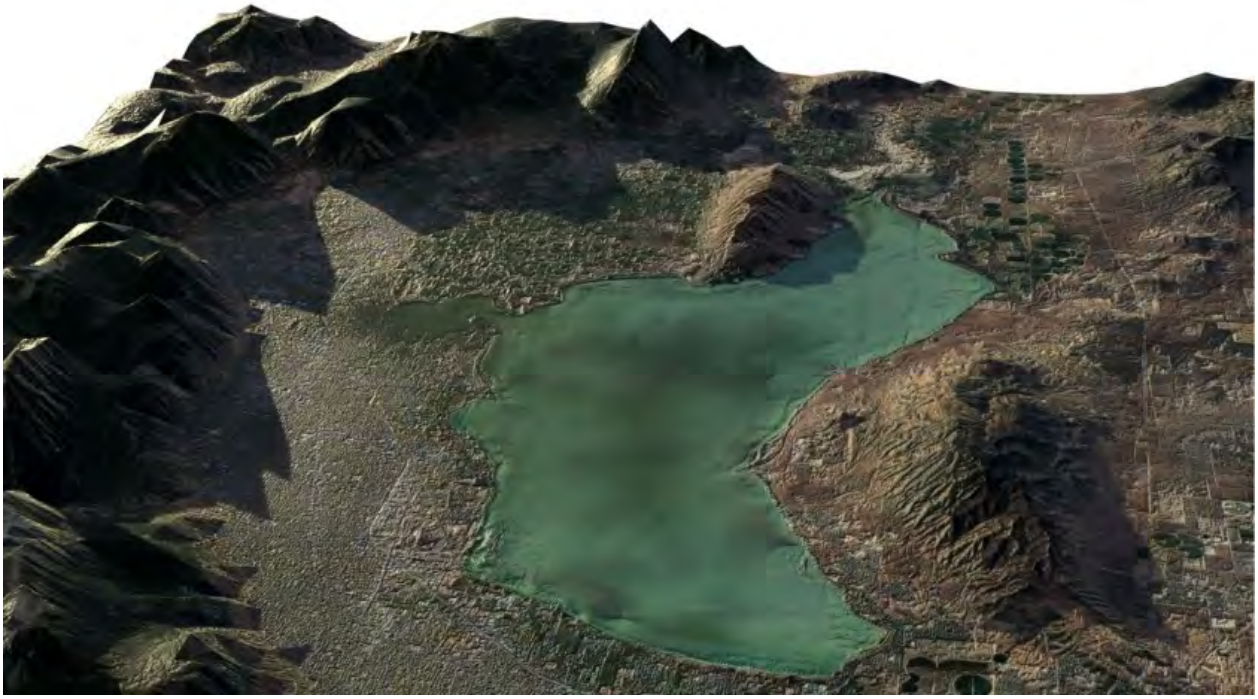
Though many aspects of the Utah Lake system are improving, there are real threats ahead. The most immediate are proposals to create artificial islands and to form a Utah Lake Authority patterned after the Inland Port Authority.

The proposal to create giant islands across a third of the lake surface alleges to be an all-in-one solution for all of Utah Lake's problems. The developers claim they would remove all invasive species, create a deep and clear lake, and increase available water for the valley. In reality, this proposal would change the nature of Utah Lake so drastically our ancestors wouldn't even recognize it. The problems with this project have been enumerated in detail elsewhere, including these two op-eds from when the proposal first came to light in 2018: *The present, future and past of Utah Lake* and *Keep Utah Lake shallow and wet*. Briefly, this project depends on a false pretense that the lake is dying, it ignores virtually everything we know about the lake's ecology, and it would blast a cultural crater so deep in the heart of our community that our ancestors and children would never let us rest. Ecologically, this proposal would remove all three of the natural protections that make Utah Lake resilient to nutrient loading (cloudy water, evaporative precipitation of nutrients, and a shallow and wide bathymetry—see the section on algal blooms).

A boy playing on Utah Lake's ice encourages us to protect this natural wonder (Travis McCabe).

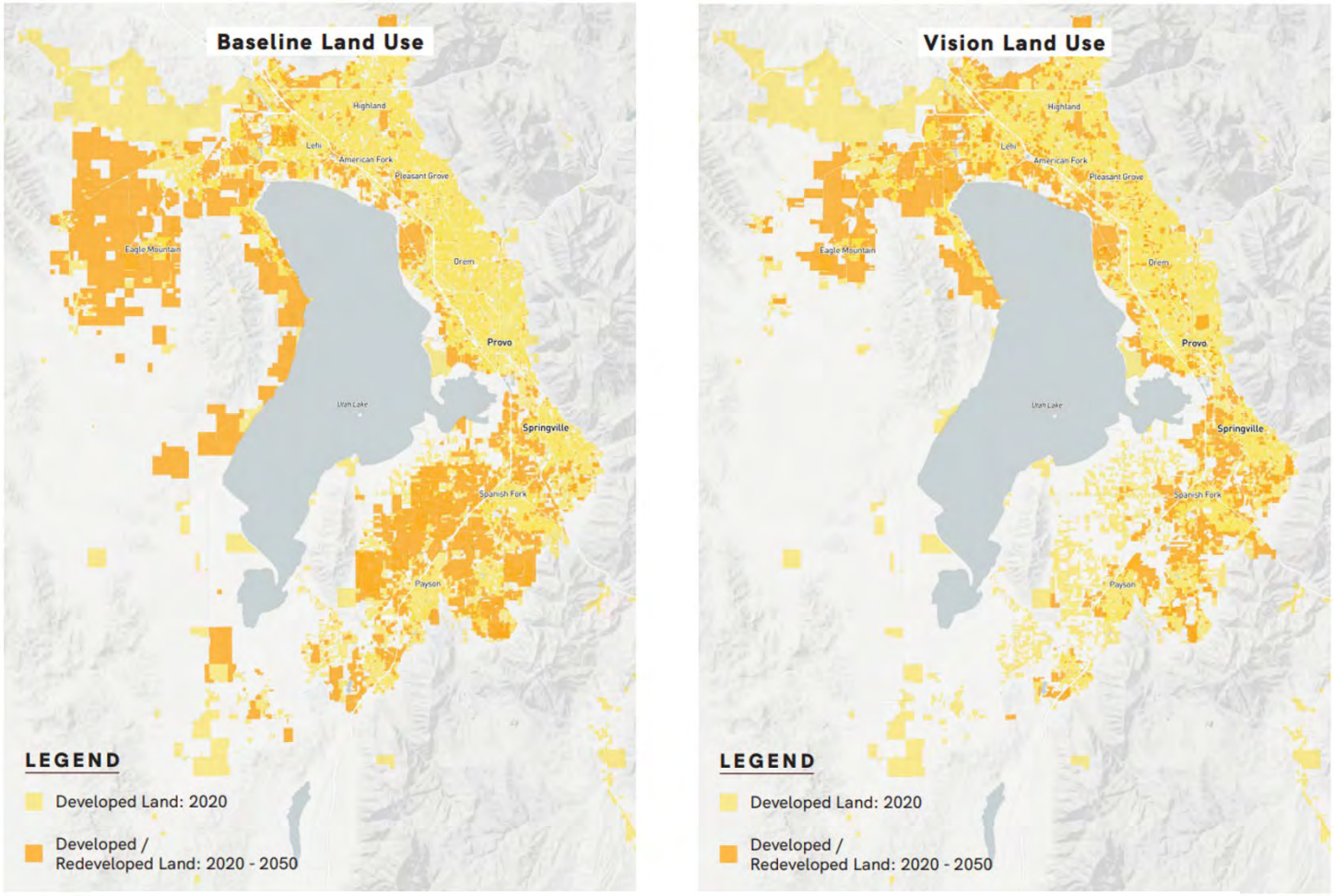
More generally, these kinds of "moonshot" projects with outside investors have been proposed before. Right here in Utah Valley, we flirted with the idea of a ski resort behind Y Mountain for more than 30 years. The investors never showed up and the proposal ended with nothing but bankruptcy and a heap of wasted taxpayer dollars to show for it. These large miracle solutions are always just what they seem: too good to be true. True ecological restoration takes scientific evidence, community engagement, and persistent collaboration.

The Utah Lake Authority proposal is more complex. The stated goals of increasing resources available for restoration are justified. However, the draft legislation which failed this year did not involve local cities and water users in its design and approach. With revision, there could be improvements to the governance of Utah Lake. However, if the proposal is just a smokescreen for the islands project, it is no better than the islands project.



3-D render of the lake from the north showing the extent of urban and agricultural land use in the surrounding area. Even without artificial islands, Utah Lake has a big crowd to please.

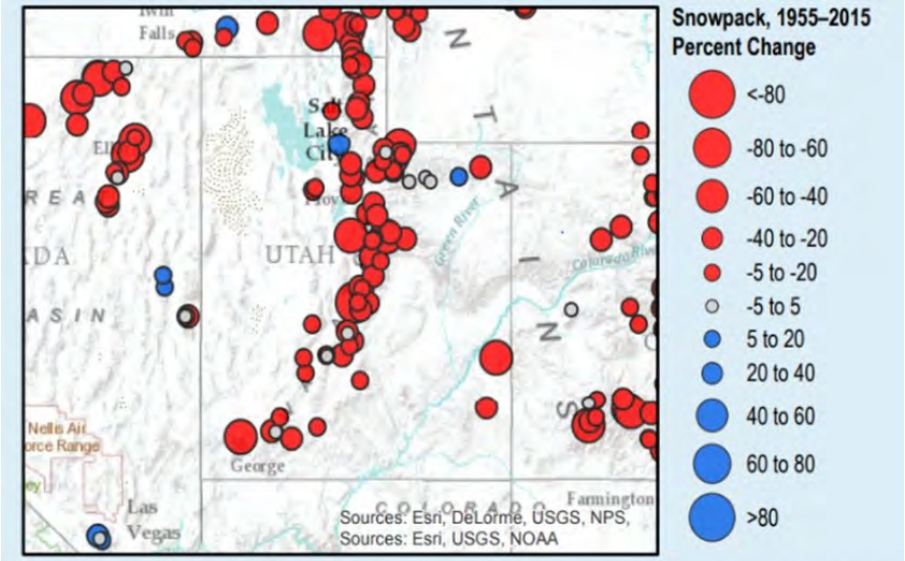
There are other threats to Utah Lake beyond islands and legislation. Population growth and development around the lake could threaten habitat and increase nutrient loading. Unless development is done wisely and strategically, things could get worse for Utah Lake in a big way. Protecting the lake from major modifications such as causeways and islands is the most conservative and safe pathway forward. For example, the causeways built across the Great Salt Lake triggered unexpected changes in the lake's hydrology and biogeochemistry, leading to economic damages and the most toxic concentrations of methylmercury ever observed. On the other hand, smart development coupled with conservation of sensitive areas could be a boon for the lake. If water is returned to the lake's tributaries and nutrients are removed from wastewater via enhanced treatment, growth is not incompatible with a vibrant and recovering Utah Lake.



Maps by Envision Utah showing the difference between unplanned sprawl (left) and strategic growth (right). Both scenarios account for the same increases in valley population.

Another serious threat for Utah Lake is climate change. We are currently in the most extreme megadrought (>10-year dry period) in the last 400 years and likely in the past 2,000 years. This megadrought is attributable to human disruption of the climate. Looking into the future, climate models project that the Utah Lake watershed will continue to receive approximately the same amount of precipitation as in the past. However, this precipitation will be less consistent, and there will be a shift from snow to rain. At the same

time, increased evaporation and demand for irrigation water in the warmer temperatures will result in less water available to sustain Utah Lake and the downstream Great Salt Lake. We need to be looking ahead and working on climate solutions now to ensure that our lake can continue to thrive in the future.



Trends in April snowpack, 1955–2013. Snowpack has declined at most monitoring sites in Utah and the Upper Colorado River Basin. Source: EPA.

Direct measurements of snowpack in Utah's mountains show an average decline of 20% since the 1950s, with 92% of all sites decreasing.

The final threat to the lake is societal apathy and disconnection. There are rampant misconceptions about Utah Lake, including beliefs that the lake is toxic, poisoned, or drying out. These beliefs have stopped many in Utah Valley from visiting and caring about Utah Lake. We can each do our part by visiting the lake and sharing our love of it with our neighbors and leaders.

What can be done to improve and protect Utah Lake?

Around and within Utah Lake, dozens of restoration projects are ongoing. These diverse projects are being led by individual citizens, cities, the county, the state, and the federal government. The Utah Lake Commission has a list of many such projects here. Even more conservation and restoration projects are on the horizon, ranging from expansion of trails and access points to the creation of new water laws that favor conservation.

Community members gather on a Saturday morning to collect water samples from throughout the Utah Lake watershed as a part of the Utah Lake Research Collaborative.

Continuing and expanding existing conservation efforts could have large payoffs for the status and future of Utah Lake. Here are seven prioritized recommendations:

1. Rehabilitate our cultural connection with the lake through outreach and education
2. Reduce nutrients from wastewater plants and other sources by upgrading facilities and improving urban and agricultural practices
3. Increase river flow to the lake through cooperative agreements with farmers and cities
4. Continue habitat restoration efforts around the lake and its tributaries
5. Support research on the lake's ecology and sustainable practices for its watershed
6. Continue removing invasive species such as carp and phragmites in ecologically sensitive and sound ways
7. Integrate the health and conservation of Utah Lake into strategic planning of future development in the valley

Lights reflect off the water while Mount Cascade looms in the background (Chuck Castleton).

How can I learn more?

1. The Utah Lake Commission maintains the official website for Utah Lake, which has great photos, blog posts, and even a podcast on science, restoration, and recreation: utahlake.org
2. The June Sucker Recovery Implementation Program has great articles, photos, and activities: June Sucker Recovery
3. The Utah Reclamation Mitigation and Conservation Commission has excellent information on Utah Lake and its connected rivers and wetlands: URMCC
4. The Wikipedia page on Utah Lake has some good basic information and links to other resources: Utah Lake Wikipedia
5. The Central Utah Water Conservancy District has some great card games and activities that can help you learn about and protect Utah Lake and its watershed: CUWCD
6. The Provo River Delta project is seeking to restore habitat for the June Sucker and other species: Provo River Delta
7. The Valley Visioning project commissioned by the Utah County Council of Governments provides excellent resources on possible futures for Utah Valley, including development around Utah Lake: Envision Utah

Shards of ice on the east shore (Jared Tamez).

Ancient Remnant

Mighty sentinels once threatened
By the overspill
A dwindling reminder
Of Ancient Bonneville

A forgotten reflection
Of times when we weren't here
Now a smaller body
Shifting from year to year

Life force in the desert
For native tribes for years
Refuge in the mountains
For searching pioneers

Unique in all its features
From its closed watershed
And salty destination
To its shallow bed

Churned by wind
Warmed by sunlight
Surrounded by mountains
Frequented by bird in flight

Other nearby bodies
Are artificial, manmade
But this water body
Needs no upgrade

We are stewards of history
Charged with preserving
Not polluting
A watery memory worth conserving

By Sierra Nichols

Gulls scatter in the mist from a dock on Utah Bay (Chuck Castleton).

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For all of us, becoming indigenous to place means living as if your children's future mattered. To take care of the land as if our lives, both material and spiritual, depended on it.

ROBIN WALL KIMMERER

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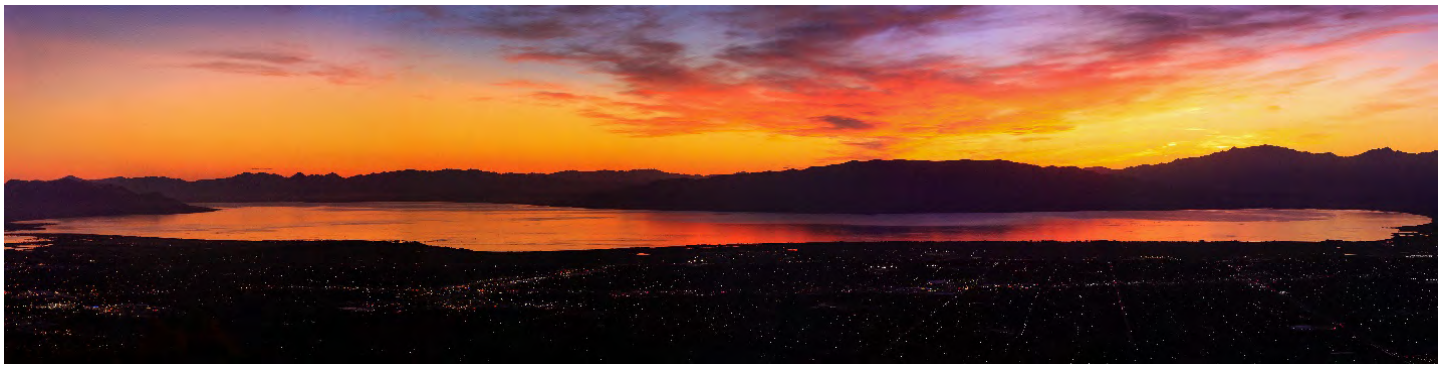

Utah Lake sunset (James Huston).

EXHIBIT D

RECEIVED
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DIVISION OF FORESTRY
FIRE & STATE LANDS

The State Of Utah
Division Of Forestry, Fire And State Lands
EXCHANGE APPLICATION

APPLICATION NO: _____ FUND: _____ DATE: November 13, 2017

APPLICANT INFORMATION:

Name(s Lake Restoration Solutions, Inc.

Address [redacted]

Phone: [redacted]

For Agency use only:

Lessee Number: _____

Legal Description Number: _____

I (we) hereby make application, pursuant to Chapter 7 of Title 65A, as amended, and Division rule, to exchange the following described private lands situated in Utah County for the following described sovereign lands situated in Utah County.

PRIVATE LAND:

Subdivision	Township	Range	Meridian	Section(s)	Acres
(Attach additional sheets if necessary)				Total Acres	

SOVEREIGN LAND:

Subdivision	Township	Range	Meridian	Section(s)	Acres
Utah Lake					TBD
(Attach additional sheets if necessary)				Total Acres	TBD

I hereby acknowledge that submission of this application will initiate a competitive process and provides no right of priority. The Division reserves the right to reject this application at any time prior to the conveyance of properties. Applicants acquire no vested rights prior to issuance of a patent.

I further acknowledge that information contained on this application may become a public record prior to the conclusion of the competitive period unless evidence of business confidentiality is submitted in writing (see reverse).

Applicant's Signature

Chief Executive Officer

Title

Note: A non-refundable application fee of $1,000.00 must accompany this application.

Utah Lake Restoration

One of the largest natural lakes in the Western United States, Utah Lake, is a significant freshwater resource for the State of Utah. When pioneers arrived in the valley in the mid 1800's, Utah Lake was a clear water lake with a vibrant ecosystem of freshwater vegetation, aquatic and terrestrial species, shorebirds, and waterfowl. Since then, the water quality and ecological integrity of the lake has significantly deteriorated.

The importance of Utah Lake, both ecologically and from a resource standpoint cannot be overstated. Utah Lake Commission guidance documents explain the importance of the Lake, "Utah Lake is a focal point of natural resource systems that contribute to the environmental health, economic prosperity and quality of life of area residents and visitors."

In addition to being a significant water storage and supply resource, the lake is important ecologically. The lake is home to many endemic fish, aquatic, and terrestrial species. Utah Lake is also an important part of the Great Basin Flyway for migratory bird species. Tens of thousands of birds utilize the lake every year for nesting, brood rearing, and during spring and fall migrations. The Lake's potential as a recreational, ecological, and water resource cannot be overstated.

In recent years, the ecological impairment of Utah Lake has become a significant concern. During the summer months water quality degradation, including significant algal blooms and e-coli outbreaks, has led to weeks-long closures of the lake. This past year, during the prime recreational summer months, there were only between 10 and 30 boats on the lake most days. What this means, is that despite its easy accessibility to 2 million residents along the Wasatch Front, Utah Lake is significantly underutilized as a recreational destination.

The concerns on the lake are not limited to algal blooms. Loss of aquatic plant species from invasive carp on the lake, heavy phosphorous and nitrogen loading, invasive plant species, and other factors have transformed the lake. Instead of a clean, clear water lake, Utah Lake is now considered to be a turbid, hyper-eutrophic lake with significantly degraded water quality. This not only presents significant challenges from a water supply standpoint, the water has also degraded to the point where it is impacting the natural lake ecosystem. Many of the terrestrial and aquatic species that utilize Utah Lake have been adversely affected by the diminished water quality, loss of native plant and animal species, algal blooms, and fluctuating lake levels. Despite the efforts by the Utah Lake Commission and the State of Utah, Utah Lake continues to further degrade. Without significant and comprehensive restoration efforts, the future of Utah Lake, its plants, animal species, and use of the lake by residents of the State of Utah remains uncertain.

Recognizing the challenges on the lake and the need for restoration of the lake, during the 2016 legislative session the Utah Legislature passed a Concurrent Resolution urging restoration of Utah Lake. The resolution, H.C.R. 26, sponsored by Representative Mike McKell and Senator Deidre Henderson passed with significant bi-partisan support. The resolution reads as follows:

Be it resolved by the Legislature of the state of Utah, the Governor concurring therein:

WHEREAS, the state of Utah is committed to conserving Utah Lake, restoring Utah Lake's water quality, improving habitat for fish and wildlife, and enhancing recreational opportunities for Utah's citizens;

WHEREAS, Utah Lake is the largest natural freshwater lake in the state of Utah;

WHEREAS, Utah Lake has an extensive shoreline, offers prime recreational opportunities, and serves a vital water storage and supply function to residents of the Wasatch Front, which includes Utah County and Salt Lake County;

WHEREAS, multiple factors have presented significant challenges to Utah Lake, including algal blooms, loss of native vegetation, invasive fish and plant species, loss of littoral zone plants, suspended silt on the lake bottom, and reduced water clarity;

WHEREAS, the state of Utah has begun experimental restoration of various aspects of Utah Lake, including removing invasive Phragmites, removing non-native carp, restoring the native June sucker, and other efforts, to improve water quality through partnerships between the Department of Natural Resources, the Division of Wildlife Resources, the Division of Water Quality, and the Utah Lake Commission;

WHEREAS, more comprehensive and extensive restoration investment, planning, and implementation are needed to address the issues facing Utah Lake; and

WHEREAS, the state of Utah is committed to work in collaboration with local stakeholders to speed the restoration of Utah Lake for the benefit of aquatic species, wildlife, and Utah's citizens:

NOW, THEREFORE, BE IT RESOLVED that the Legislature of the state of Utah, the Governor concurring therein, urges an acceleration of comprehensive solutions to restore Utah Lake and improve its water quality.

BE IT FURTHER RESOLVED that the Legislature and the Governor urge solutions to address challenges to Utah Lake, including water clarity, water quality, invasive species, and preserving the storage and water supply functions.

BE IT FURTHER RESOLVED that the Legislature and the Governor urge solutions to restore a vibrant fishery, including restoring the Bonneville cutthroat trout population and recovering the June sucker, while improving habitat for waterfowl and other wildlife species.

BE IT FURTHER RESOLVED that the Legislature and the Governor urge solutions to remove invasive plant species, restore littoral zone plant communities, and restore native plant species on Utah Lake's shoreline should be accelerated.

BE IT FURTHER RESOLVED that the Legislature and the Governor urge solutions to maximize and ensure recreational access and opportunities on Utah Lake, while also improving the use of the lake for Utah and its citizens.

BE IT FURTHER RESOLVED that copies of this resolution be forwarded to the Department of Natural Resources, the Division of Wildlife Resources, the Division of Water Quality, and the Utah Lake Commission, to encourage pursuit of all reasonably available solutions to accelerate comprehensive and lasting restoration of Utah Lake.

The promise of a fully restored Utah lake is significant. However, restoration of Utah Lake will require tremendous financial and infrastructure investments to implement the comprehensive solutions needed. These solutions must address challenges presented by the shallow lake, nutrient loading, algal blooms, and invasive plant and animal species on the lake.

The Arches proposes a comprehensive and accelerated restoration of Utah Lake called the Utah Lake Comprehensive Restoration Project. This application is submitted to start the formal process of applying as the contractor for the State of Utah to begin the process of comprehensive lake restoration. The Utah Lake Comprehensive Restoration Project will restore Utah Lake in a manner that meets all of the objectives set forth by the Utah Legislature in H.C.R. 26.

The Utah Lake Comprehensive Restoration Project is designed to protect and promote public trust values on Utah Lake. The public trust values enhanced by the Utah Lake Restoration Project include, but are not limited to:

- Restoring water clarity and water quality
- Conserving water resources in and around the lake
- Preserving the water storage and water supply functions of the lake
- Removing invasive Phragmites and carp species from the lake
- Restoring littoral zone and other plant communities
- Restoring and conserving native fish and other aquatic species including the Bonneville Cutthroat Trout and June Sucker
- Increasing the suitability of the lake and its surrounding areas for shore birds, waterfowl, and other avian species
- Improving navigability of the lake
- Maximizing and ensuring recreational access and opportunities on Utah Lake
- Enhancing recreational opportunities on the lake and otherwise improving the use of the lake for residents and visitors

The Utah Lake Comprehensive Restoration Project will likely become the largest environmental restoration project in the country. At the appropriate time and at the direction of the Utah Department of Forestry, Fire, and State Lands, we will submit a detailed proposal outlining the Utah Lake Comprehensive Restoration Project, including the engineering and infrastructure aspects of the project and the likely cost associated with fully implementing design, infrastructure, engineering, and environmental restoration of Utah Lake.

The Comprehensive Lake Restoration Project will involve significant infrastructure activities and design including dredging and creation of one or more islands within the lake. This will require significant planning, permitting, and related activities before these activities can begin. The exact acreage will be determined based on engineering requirements and in consultation with the State of Utah. Some of the new real-estate will remain open to the public while a portion will be exchanged to generate revenues to help pay for the costs of restoration activities. As a result, a component of this project involves the disposition of sovereign lands as well as the creation of additional recreation areas for the public. As such, this application is for consideration not only of the dredging of Utah Lake, but also the disposition of some land to pay for a portion of these restoration activities.

As daunting and intractable as many of the challenges on the lake currently are, through years of research and study, our team has developed the engineering, design, and infrastructure solutions necessary to comprehensively restore Utah Lake with all of its original vibrancy and ecological integrity. In addition to the work of our team, we recognize that successful restoration of the lake will also require significant collaboration by the state, local governments, stakeholders, and Utah residents. We are committed to working with all state, local government agencies and interested stakeholders on an ongoing basis throughout this process.

Restoring Utah Lake is long overdue. Considering the size, location, and ecological importance of Utah Lake, the promise of comprehensive restoration is an objective worthy of such monumental collaboration and investment by the state and its citizens.

EXHIBIT E

Lawmakers back giving developers parts of Utah Lake for an island subdivision — in exchange for fixing the polluted lake's many problems

By Brian Maffly | Feb. 21, 2018, 3:10 p.m. | Updated: March 5, 2018, 1:23 p.m.

Utah Lake is an ecological wreck and state lawmakers hope to see major improvements without spending a nickel — but it may cost them some lakebed.

A bill advancing to the Utah House of Representatives would authorize giving big swaths of the West's third-largest freshwater body over to developers if they can show

that turning these state-owned "sovereign lands" into island subdivisions will improve Utah Lake's water quality.

The lake — long a disposal site for sewage — has been plagued with suspended sediments, excessive nutrients that feed algal blooms, and a proliferation of nonnative carp in its waters and phragmites clogging some of its shore lands, along with a loss of vegetation in other areas.

"We have layers of phosphorus. We have dumped far too long and have a serious problem," Rep. Michael McKell, sponsor of HB272, told the House Natural Resources committee Wednesday. His bill envisions a comprehensive fix, engineered with help from the the private sector.

"We have had a number of projects that have had an impact but at the end of the day, it is a significant problem in Utah Lake and to really take it to the next level is going to take some significant investment," said McKell, R-Spanish Fork. "There is not reasonable funding to take on that investment. We have seen estimates in the billions, $6 to $7 billion to really restore the lake."

HB272 would clear a path for developers' ambitious and unprecedented proposal to dredge the lake, using the fill to create up to 20,000 acres of islands inhabited by 250,000 to 500,000 people, connected to the rest of Utah County by four causeways.

A group called Lake Restoration Solutions Inc. submitted such a proposal to the Utah Division of Forestry, Fire and State Lands (FFSL), which administers the beds of Utah's navigable waterways.

But state law prohibits disposing of sovereign lands, which are to be held in perpetuity and in the public trust for all Utahns, critics contend.

"You can't exchange land for 100 percent cash. This proposal is a backdoor approach to

exchange sovereign lands for cash, or service, not even cash. State law doesn't allow that," said Jeff Salt, executive director of Friends of Utah Lake.

Salt said he has grave concerns about the island proposal, not least because the lake's geology is not suited to the project.

Al Hartmann | The Salt Lake Tribune Jamie Reynolds, USU master's student, weighs a netted carp, left, and Utah Division of Wildlife Resources worker Thomas Murdock tosses another back into the lake after measuring it during the annual carp survey at Utah Lake Tuesday, Aug. 19. DNR uses two boats with the long nets to haul up carp and record their condition for scientific research aimed at improving the management of a planted fish that has displaced natives.

"The fine sediments are deep, they are unconsolidated. It's not sound to build a house, let alone a whole island of houses," he said. "If you put that many people out there with four causeways, if there is an earthquake, how do you get those people off that island before they are flooded and drowned?"

Salt and others also voiced dismay that the bill would cut out public input.

"We want a voice in the process. It is not enough to be informed of a decision that is already made," said Michael Mason. "Our concern is that a proposal would move forward outside the public eye."

That comment drew a rebuke Wednesday from Rep. Mike Noel, R-Kanab.

"This is the public input. We are the elected representatives. We are the ones making the actual decision. Their representatives will be there to vote," Noel lectured Mason. "This is a republican form of government. We are elected to make those questions and dig into it."

McKell's bill would authorize the Utah Division of Forestry, Fire and State Lands to dispose of the bed as "compensation for the [lake's] comprehensive restoration" — but only with major conditions.

State officials would have to conclude the project will improve water quality and clarity; conserve water; enhance the lake's water storage ability; remove invasive plants and fish, such as phragmites and carp; restore plant communities and native fish, including Bonneville cutthroat trout and June sucker; enhance bird habitat; and improve navigability and recreational access.

Rick Egan | The Salt Lake TribuneDiscolored water in Utah Lake, near the Lindon Marina. Crews took samples of a mile-long algal bloom at Utah Lake on Wednesday evening. They'll know today if it's toxic and if they'll need to enforce closures. Thursday, July 14, 2016.

But what if the developer goes bankrupt or otherwise fails to deliver after getting the land? asked Rep. Joel Briscoe, D-Salt Lake City.

"We have safeguards in place, significant bonding, significant guarantees," responded McKell.

Lake Restoration Solutions' proposal — which officials at the state Division of Forestry, Fire and State Lands are now evaluating — would sculpt islands on about 30 square miles of lakebed, or about 20 percent of the total lake, whose average depth is now 10.5 feet.

The dredging necessary would drop the lake floor by a few feet, potentially deepening the lake and adding to its water storage capacity.

HB272 would also require the state officials to consider the proposal's capacity to generate revenue for state and local governments; its ability to improve surrounding state property; the developer's ability to execute and complete the project satisfactorily; and the desirability of the land use made possible by the project.

The Natural Resources committee advanced the bill to the House floor, Reps. Briscoe and Susan Duckworth, also D-Salt Lake City, voting against it.

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EXHIBIT F

SUBJECT: Meet the Experts Event
FROM: Ryan Benson, Utah Lake Restoration Project <hilary@wfandco.com>
TO: Tara <tmckee@utah.gov>
DATE: 22/11/2021 19:41

View this email in your browser

MEET THE EXPERTS

Tuesday, December 7, 2021, at 11:30 a.m.

Utah State Capitol Building
Hall of Governors
350 State Street
Salt Lake City, UT 84103

Lunch will be served.

Dear Tara,

You are cordially invited to join us and others from federal, state, and local agencies at an event to Meet the Experts who are working to restore Utah Lake.

Lake Restoration Solutions is starting the environmental permitting process for the Utah Lake Restoration Project, which is the next step in actualizing the project. This event is an opportunity for federal, state, and local agency representatives to hear about the project, meet the team of experts leading the effort, and talk with the team members and others involved in the project.

The event will include a formal presentation, a question-and-answer session, informational boards and materials, and the opportunity to speak one-on-one with the team of experts and others attending the

event.

The Utah Lake Restoration Project is a comprehensive plan to turn back the clock on 150 years of degradation. The project will restore the lake's ecosystem and improve its water quality so both people and wildlife can enjoy the many benefits of a revitalized Utah Lake. The $6.4 billion project is the largest freshwater cleanup project in the nation and Lake Restoration Solutions has assembled the team and the capital to effectuate this incredible vision.

Please RSVP to Hilary Robertson at hilary@wfandco.com or 801-349-5890.

Sincerely,

Ryan Benson, CEO
Lake Restoration Solutions

LAKE RESTORATION SOLUTIONS

www.lakerestorationsolutions.com

SUBJECT: Postponed: Meet the Experts Event
FROM: Ryan Benson, Utah Lake Restoration Project <hilary@wfandco.com>

TO: Tara <tmckee@utah.gov>
DATE: 02/12/2021 09:32

View this email in your browser

UTAH LAKE RESTORATION PROJECT

Dear Tara,

Considering the holidays and the feedback we have received, we have decided to reschedule the Utah Lake Restoration Project's Meet The Experts event that was planned for December 7. We apologize for any inconvenience to those of you who have rsvp'd. We will follow up with you when we have a new date identified. We look forward to introducing you to our world-class team of professionals and sharing more exciting information about the Utah Lake Restoration Project.

Sincerely,

Ryan Benson, CEO
Lake Restoration Solutions

LAKE RESTORATION SOLUTIONS

www.lakerestorationsolutions.com

EXHIBIT G

Letting some of it trickle out while trying to soak it all in

Sunday, November 28, 2021

Seven problems with the Utah Lake islands proposal

As you may have heard, there is a truly epic project brewing in Utah Valley. In 2017, a limited liability company proposed to build 20,000 acres of artificial islands in Utah Lake, claiming this would somehow help the ecosystem. In 2018, the Utah legislature passed House Bill 272, which opened the door to transferring the lakebed from the people of Utah to a private corporation. Since that time, the lake developers have been solidifying political support and lining up financing, including a $10 million loan guarantee approved by the legislature last year without any public vetting. They are having a major lobbying dinner at the state capitol next week. The company says they are motivated by a desire to restore the lake, describing their project as a "comprehensive restoration." Here is the full text of their proposal.

After interacting with them for years, I have major doubts about their intentions and methods. While there are literally hundreds of ecological, financial, and legal problems with their proposal, I've summarized seven of my main concerns below. If you want to dig deeper, check out this new article called "Getting to know Utah Lake." There are also several op-eds that have been written on this topic, including *The present, future and past of Utah Lake* in the Deseret News and *Keep Utah Lake shallow and wet* in the Salt Lake Tribune. If you prefer video format, here is a presentation I gave at the Salt Lake Watershed Symposium earlier this month: *Is Utah Lake a Steaming Failure or a Gleaming Success?*

Buckled ice on Utah Lake (Justin Lehman)

Problem #1. The project is built on false premises. The developers claim that 1. Utah Lake's condition is bad and getting worse, 2. The lake needs to be dredged, and 3. The lake used to be deep and clear. These claims couldn't be farther from the truth. Utah Lake has always been shallow and cloudy. In fact, these are some of the attributes that make the lake so remarkably resilient. Multiple studies have found that Utah Lake's status is better than most water bodies in the U.S., and its sediment is not contaminated—it is clean and crucial to the health of the lake. Dredging would cause immense damage to the lake ecosystem while not providing any ecological benefit.

Hundreds of science-based restoration projects have put the lake on the road to recovery. Cooperative agreements with farmers and other water users have restored river flow to the lake, and upgraded wastewater treatment plants are decreasing nutrient flows to the lake. Invasive species removal has been effective, reducing carp biomass by 80% and restoring native plants along the lakeshore. The Hobble Creek and Provo River Delta restoration projects have been immensely successful, increasing public access to the lake and improving habitat. In response to these efforts, algal blooms are decreasing, native species are returning, and public use of the lake is on the rise. Thanks to this progress, the native June Sucker was downlisted from endangered to threatened just this year. Why would we make such a drastic change when things are finally going the right direction?

A juvenile June Sucker. This endemic fish went from no reproducing adults in the late 1990s to more than 4,000 spawning in 2021 (Riley Nelson)

Problem #2. Building islands would destroy the attributes that make Utah Lake resilient and reduce ecosystem services it freely provides. The unique characteristics of Utah Lake have helped it maintain much of its function despite decades of abuse. First, about a third of the water that enters the lake evaporates to the atmosphere. This causes the constant formation of calcite (the source of the lake's beautiful cloudy color), which makes nutrients in the lake unavailable to algae. Second, the water's cloudiness slows the cyanobacterial blooms that affect most water bodies more often and intensely than Utah Lake. Third, the lake's shallowness prevents the worst effects of algal blooms when they do occur. In deep lakes, blooms consume all the oxygen in the deep water, which causes fish kills and massive release of pollutants from the sediment.

The islands proposal would destroy all three of these attributes: reducing the lake's surface area, allowing more light to stimulate algal growth, and creating multiple deep channels in the lakebed. This would damage the invaluable ecosystem services the lake freely provides us, including increasing local precipitation, cooling the valley during summer extremes, removing nutrients, providing world-class opportunities for recreation and photography, and creating habitat. Indeed, the lake is currently a hot spot of biodiversity, providing habitat for nearly 1,500 species, including 10 million fish, 35 million water birds, and 69 kinds of mammals, amphibians, and reptiles. How would a project that directly destroys the resilient qualities of the lake make things better?

Lights reflect off the water while Mount Cascade looms in the background (Chuck Castleton)

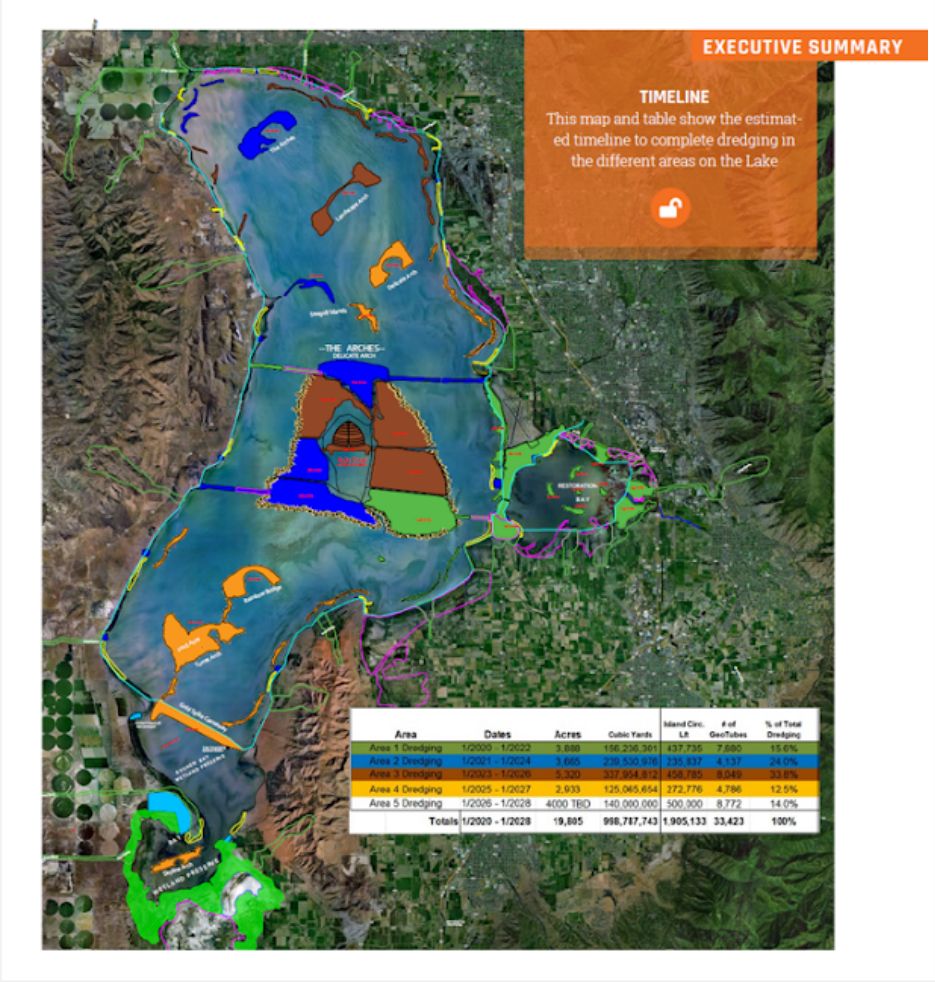
Problem #3. This proposal would permanently deface our valley and dishonor the legacy left by our ancestors. Anyone who has hiked Timpanogos or any of the surrounding mountains knows that Utah Lake is the centerpiece of our community. The developers propose to build massive islands housing half a million people in the shape of arches, beehives, railroad spikes, and seagulls. This would destroy views of the lake and make our valley unrecognizable to our ancestors. Before European contact, Utah Lake supported the Timpanogos Nation for generations—we now know that people have been living in this area for more than 20,000 years. When the Mormon Pioneers arrived, fish from the lake saved the settlers along the Wasatch Front during crop failures in 1855 and 1856. After disasters during the Dust Bowl, our ancestors carefully regulated water diversions to make sure Utah Lake would be preserved. Will we honor that legacy or desecrate a lake that so many have worked to protect?

Harvest of June Sucker and other native fish from the shore of Utah Lake in 1855. Courtesy of the June Sucker Recovery history.

Problem #4. The project is very likely impossible. It is very common for developers to underestimate the technical challenges and economic costs of projects they are pitching. The larger the project, the greater the potential for overconfidence. Let's compare this proposal to similar large projects. The world's largest dredged island is the Kansai International Airport, which was built in Osaka Bay in Japan. The island is around 2,500 acres. It took 23 years to plan, permit, and build, costing around $20 billion. Despite careful engineering and environmental surveys, when they began building on the island, it sunk 27 feet into the sediment. The Utah Lake islands would be 20,000 acres: 8-times larger than Kansai island. Additionally, the bed of Utah Lake is unconsolidated marl—which has much less structural integrity than the Holocene clay in Osaka Bay.

On the dredging side, the Hudson River Cleanup currently holds the record for the largest freshwater dredging project: 2.7 million cubic yards of sediment removed over 10 years for a cost of $1.6 billion. According to the island developers, dredging Utah Lake would involve removing 1 billion cubic yards of sediment, making the project 370-times larger than the already enormous Hudson River project.

Despite the truly unprecedented size of this project, the developers are claiming they can do it for $2.6 billion in just 8 years. This seems like either a textbook case of engineering hubris or intentional false advertising. Independent estimates suggest the project could cost $10 to $90 billion while providing no ecological benefit to the lake system.



The Executive Summary from the islands project, showing the size and shape of the proposed work.

Problem #5. The project is very likely illegal and will probably never get permitted. By law and precedent, Utah Lake must be managed according to the public trust doctrine. This legal framework requires the state of Utah to act as a trustee to hold the lake (and other waterbodies) for the benefit of all Utahns—present and future. This doctrine has been challenged multiple times in other water bodies around the state, but the Utah Supreme Court and U.S. Supreme Court have defended it quite fiercely. This is why the island developers' first step was to lobby the legislature to change the law. In January of 2018, Representative Mike McKell of Spanish Fork introduced the Utah Lake Restoration Act (H.B. 272), which would allow the state to dispose of sovereign lands in exchange for "comprehensive restoration" of the lake system. Despite the law's clear constitutional problems and the infeasibility of the island proposal, H.B. 272 passed with overwhelming support in both the house and senate. This law hasn't yet been tested in court, but if the legislature attempts to transfer large portions of the lakebed to private parties, they would almost certainly be sued.

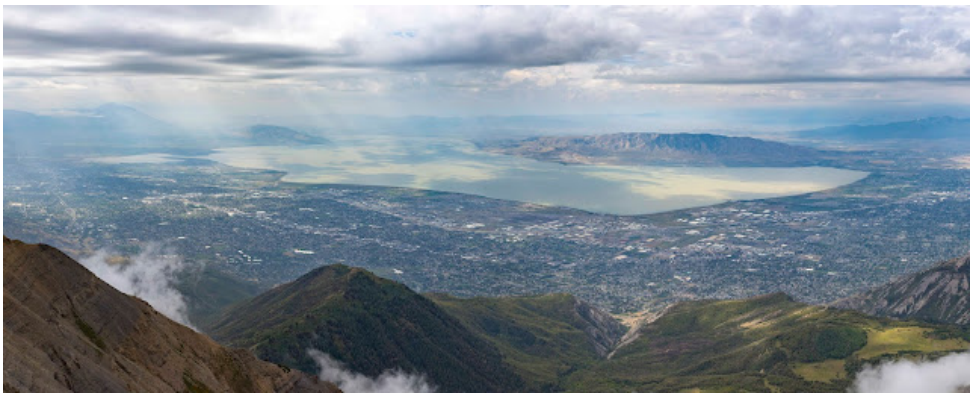
Previous disputes over Utah Lake and other nearby waterbodies provide a hint of how that might go. In 1990 the Utah Supreme Court ruled that the *"essence of [the public trust] doctrine is that navigable waters should not be given without restriction to private parties and should be preserved for the general public for uses such as commerce, navigation, and fishing."* The court specified that even leasing of these lands can be challenged. A 2019 ruling by the Utah Supreme Court specified that *"the abdication of the general control of the state over lands under the navigable waters of an entire harbor or bay, or of a sea or lake. . . is viewed as a gross infringement of the public trust doctrine."*

Even if the project didn't get tangled in state and federal court, there is still the question of permitting. All such projects are required to do an environmental impact study, which typically takes 10 years or more (this legal panel at the Utah Lake Symposium discussed the law and permitting challenges this project will face).

A juvenile northern harrier learns to hunt near Utah Lake (Travis McCabe).

Problem #6. The project has no scientists on its team. This is one of the strangest and most troubling aspects of this proposal. For any legitimate restoration project, you assemble a team of researchers, engineers, and legal experts to ensure an efficient, effective, and safe process. While there are several engineers and lawyers involved, the team appears to be primarily real estate entrepreneurs. There are no PhD-level environmental or ecological scientists on the team, though their "senior scientist" did earn a master's degree in biology in 1996. The developers know this is extremely unusual for a project this size because they have been trying to recruit researchers from all over Utah. They have made job offers to several faculty at BYU and even tried to snatch a graduating Ph.D. student from my department to lend some credibility to their proposal.

The fact that no researchers are willing to take their generous salary highlights another particularity about this project: no one in the research or management communities thinks it is a good idea. With most environmental proposals, there is heated debate and disagreement about pros and cons. I have spoken with more than 100 researchers from across the state and beyond, and all of them think this project is a horrible idea. It has dozens of poison pills and no upside for Utah Lake or the people of Utah.



Utah Lake as seen from Mount Timpanogos (Jeff Beck).

Problem #7. The project has shady foreign funding. The developers claim to have $6.4 billion lined up in investments. This money ostensibly comes from Dubai, where the famous Palm Islands were constructed in the early 2000s. Those islands have been both a, ecological and economic failure. They have caused massive erosion of Dubai's coastline, extensive algal blooms, and widespread

asphyxiation of corals and other marine life. Though $6.4 billion is woefully inadequate to complete the described work (see problem 5), it would still make the Utah Lake islands the largest private restoration project in history. More to the point, if they have so much money lined up, why are they still fundraising? Last year, they tried to raise $15 million on the SEC but ended up with only $200,000—potentially from a single investor. They told the state legislature that they had applied for $200 million from the EPA (rejected this fall), which helped them get a $10 million loan guarantee slipped into the Utah state budget last year. Now they are working with a PR firm Halcyon host a series of fundraising events with celebrity concerts costing $1 million.

These kinds of "moonshot" projects with outside investors have been proposed before. Right here in Utah Valley, we flirted with the idea of a ski resort behind Y Mountain for more than 30 years. The investors never showed up and the proposal ended with nothing but bankruptcy and a heap of wasted taxpayer dollars to show for it. These large miracle solutions are always just what they seem: too good to be true. True ecological restoration takes scientific evidence, community engagement, and persistent collaboration. If we allow the island developers to start this project, we may end up with an injured lake and an enormous mess of half-built islands to clean up.

Light from Saratoga Springs reflects off a partly frozen Utah Lake (Mandy Jensen).

So what can we do? The best way to permanently stop this dangerous proposal is to repeal H.B. 272. This is the law that allows the legislature to dispose of our public trust lands in exchange for the islands project. It was passed in 2018 without much opposition or fanfare (coverage here), but it has left the door open for foreign investors to .

A more complicated issue is the Utah Lake Authority bill, which failed earlier this year. A revised version will be considered in the 2022 session starting in January. The bill would create an independent body, similar to the Inland Port Authority, to oversee projects within and around Utah Lake. It is not associated with the islands project, but my concern is that it completely reworks the governance of Utah Lake right when we are making measurable progress. While the revised bill has not yet been made public, I worry that it could threaten the important gains that have been made over the past decade. While increased coordination among stakeholders around the lake could be a plus, the authority could also make modification of the lakebed and surrounding area more likely. Utah Lake has been saved from the costly and damaging alterations that have been made to the Great Salt Lake (diversions, causeways, and artificial bays have resulted in major hydrological and toxicological problems).

Perhaps most importantly, we need to share the positive message of a lake in recovery. Utah Lake is a beautiful and sacred place, and it needs our support and love. We will only convince the legislature and the people of Utah Valley to turn their hearts back to the lake if we can show them its value and central role in our history and future. Please share the *Getting to know Utah Lake* article with your family, friends, and representatives at the city and state level. Please visit Utah Lake and share its unique beauty with all you know.

> Utah, I ask that you please take heed to what the experts opposing this project have to say. Our people and the reeds around this lake give you your name. We stand in favor of restoring the lake to its natural beauty but have to oppose privatizing and desecrating this historic sacred site.
>
> -Mary Murdock Meyer, Chief Executive of the Timpanogos Nation, August 2021

Utah Lake Sunset (Preston Holman).

Sign this petition by Conserve Utah Valley and a coalition of community and conservation groups to stop the island developments.

Ben Abbott is a professor of aquatic ecology at Brigham Young University. He has been studying reservoirs, lakes, and river networks throughout Utah and Idaho since 2009. The scientific and legal claims made in this blogpost are based on a synthesis of over 70 studies and reports on Utah Lake, which was published this August: "Getting to know Utah Lake."

Posted by Benabbo at 6:43 PM

14 comments:

Vote for Clean Air Utah November 28, 2021 at 7:44 PM

Excellent commentary and summary of the situation! The "restoration" and island development as proposed by the developer must not happen, must not be approved. It would be a huge disaster for the lake, for Utah Valley and for all generations.

Reply

Will November 29, 2021 at 5:59 AM

Your point about the cloudiness of the lake is not well proved. The lake used to be clear until we polluted it and killed off the plant life.

Reply

Replies

David November 29, 2021 at 2:11 PM

Actually Will, despite the narrative that is communicated in local k-12 schools (in large part to historic misunderstandings) the ecology and mounting scientific evidence of Utah lake and others like it point to a much different story that should be rectified in local school curriculum.

Benabbo November 29, 2021 at 3:15 PM

There's a great summary of the most comprehensive paleolimnological study on this question here: https://pws.byu.edu/utah-lake/what-did-utah-lake-look-like-200-years-ago-janice-brahney. Basically, there was a state change in the 60s or 70s where the lake did become more cloudy because of a combination of algal blooms and carp. However, even before then, the lake was not a clearwater or deep lake. The water may have been clear during parts of the year--for example during snowmelt or when the bivalves that used to live in the lake filtered the water--but most of the year, it likely looked similar to what it does now.

Reply

Unknown November 29, 2021 at 5:59 AM

Generations of my family have loved Utah Lake. We have seen so many changes happen on and around the lake. It makes me sick that any type of developement like this would even be considered!Our family uses the lake year round for paddleboarding, fishing, bird watching and enjoying the beauty of nature. We always see other families enjoying the lake as well. Developing islands on Utah Lake will destroy it! Can't we just leave

our precious lake alone and stop trying to "enhance" it. If developers are allowed to keep taking away from our lakes and mountains there will be nothing left of our beautiful Utah. The developers keep getting richer while taking away from our scenic beauty. STOP this from happening!

Reply

Cissy November 29, 2021 at 6:26 AM

Thank you for this helpful information. I plan to send this and my own thoughts to our state legislators as well as the Orem city council (my residence) who ought to weigh in. Could you consider adding your qualifications and links to sources? I think that would be valuable to legislators and others who read this.

Reply

Replies

Benabbo November 29, 2021 at 3:15 PM

Thanks Cissy. I just added my qualifications at the bottom of the article and a link to the scientific report where more than 70 sources are provided.

Reply

Garmon November 29, 2021 at 9:44 AM

I wonder why the risk of liquefaction hasn't been raised. It's such a bad idea to put structures out in all that saturated sediment.

Reply

Replies

Benabbo November 29, 2021 at 3:17 PM

This is another important issue, which the developers claim to have solved with their "geotubes"--long plastic socks where they put the dredged sediment to dewater. I don't believe the method has ever been used with a marl sediment such as Utah Lake though.

Reply

Unknown November 29, 2021 at 8:23 PM

That's a beautiful picture of the ice-berm after spring break-up. I seem to remember that in the spring of 1984 or 5 There was a mountain of ice driven inland by the wind and piled 12 feet high just north of the steel mill. So how high should we build those islands to get above maximum lake level and ice-jams? How much weight will the lake-bed sediments take before failure. You might go visit the BYU geology department and ask 'em to tell you stories about raising the railroad causeway across the rising Great Salt lake in 1984, and how much it finally cost to get the job done.

Reply

Replies

Benabbo November 30, 2021 at 6:47 AM

Thanks for your comment and recommendation. We have heard from the geology and biology departments about the causeway in Great Salt Lake and a proposed dike/causeway in Utah Lake. The sediment was so unconsolidated, that they estimated they would have to dredge a half-mile-wide band just to get it above water line.

Reply

Richard W. Cleveland December 14, 2021 at 2:27 PM

Not a good idea, plain and simple! DO NOT DO THIS UTAH!

Reply

Unknown December 15, 2021 at 2:18 PM

I don’t car for the idea of the islands. I do like the idea of dredging. The idea that the lake has always been the level and shouldn’t or can’t be deeper makes no sense. It is as if sedimentation and dams are foreign concepts to the author. Given that there is a dam at the outlet of Utah lake, dredging would deepen the lake and decrease the turbidity of the water and allow for vegetation to take root, producing a clearer lake and potentially more robust fishery and recreation experience. The size of the island is ridulous. Even if they were approved for one (let alone the others). The main one should not be so large. And why not something with a more natural shape? The gaudy shapes of arches is tacky at best.

Reply

Benabbo December 16, 2021 at 5:30 AM

Thanks for your comment. The sedimentation in Utah Lake is really interesting. The best estimates from lake cores indicate that sediment is accumulating on the lakebed at a rate of 1 to 2 mm a year (about 4 inches a century). The dam at the Jordan River doesn't accumulate much sediment because the larger particles have a chance to settle out near the deltas, but the large dams up Provo Canyon and the small ones in the other tributaries have decreased sediment delivery to the lake. Agricultural and urban activity have made up for that, resulting in a rate that is similar to what was going on before European settlement.

Here is a nice presentation by Dr. Janice Brahney on the pre-settlement status of the lake: https://pws.byu.edu/utah-lake/what-did-utah-lake-look-like-200-years-ago-janice-brahney

And this document gets into the details about the past and present. The "Does Utah Lake Need to Be Dredged" section starting on page 26 might be particularly helpful: https://pws.byu.edu/0000017b-379a-dfb0-a77b-3fdeb3070000/getting-to-know-utah-lake

Reply

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About Ben

Learn more about Ben Abbott's research and join his team here.

Download Ben's music

Though he's not a great musician, Ben has made a few recordings through the years. Here is a folder where you can download the albums: Ben's music. You can watch some of the recordings on his YouTube channel or SoundCloud site.

Popular Posts

50 below birthday

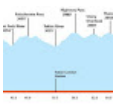
We celebrated Ingrid's birthday yesterday. It was -50F but her friends still braved the cold to come and high-five her f...

Seven problems with the Utah Lake islands proposal

As you may have heard, there is a truly epic project brewing in Utah Valley. In 2017, a limited liability company proposed to build 20,000 ...

Seven years and 21 days

Today marks the seventh anniversary of 21 days after Rachel and I were married. We met at Utah State in 2003 when I was 17. During my Mo...



Biking the Denali Park Road as a family

On the 5th and 6th of July, Rachel, Ingrid, Henry, our friend Will, and I biked the Denali Park Road from Wonder Lake to the park entran...

You say tomato, I say GMO

Between Istanbul, the Brexit, and Donald Trump, you might have missed the hot debate raging in the journal Trends in Plant Science on gen...

Early arrival

Wednesday was a blustery day. Red in the morning sailor's warning. Rachel had been having irregular contractions since abou...

Gun control and alcohol

A well regulated Militia, being necessary to the security of a free State, the right of the people to keep and bear Arms, shall not be infr...

To race or to ride? 2014 White Mountains 100

I got my first sunburn of the year last week during the White Mountains 100. Here is a video of the start taken by an NSA drone. Th...

FAQs about the COVID-19 and masks study

When my students and I started our review of the science on COVID-19 and masks , I had no idea how much of a response it would trigger. Usu...

France vs USA

Living in a different country opens your mind to a different culture and challenges your deepest assumptions and expectations. More import...

EXHIBIT H

To whom it may concern, December 29, 2021

As independent scientists, engineers, natural resource managers, recreation managers, and environmental lawyers, we feel compelled to raise a voice of warning about a proposal that could severely damage Utah Lake.

Utah Lake is the largest freshwater lake in Utah and a keystone ecosystem in western North America. The lake creates billions of dollars of value by providing world-class recreational opportunities, water rights, enhanced property values, pollution removal, local precipitation, and habitat for 50 million birds, fish, and other wildlife. Utah Lake has great historical and cultural significance as the homeland of the Timpanogos Nation and the source of food that saved the Mormon Pioneers during crop failures in 1854 and 1855. Decades of local, state, and federal restoration efforts within and around Utah Lake have resulted in ecological recovery, including declining algal blooms, removal of invasive species, recovery of the endangered June Sucker fish (downlisted in 2021), healthy sediments, and establishment of senior water rights protecting the lake level despite the ongoing megadrought.

In 2018, the *Utah Lake Amendments* (HB 272) weakened constitutional protection for Utah Lake, opening the lakebed to possible development. Since then, a company called Lake Restoration Solutions (LRS) has been seeking support for a proposal to build 20,000 acres of artificial islands on Utah Lake (1/5th of the lake's surface). Here is the project website and proposal. LRS claims their project will provide "comprehensive restoration" of the lake ecosystem at no cost to the people of Utah, referencing $6.4 billion in undisclosed investments and connections with artificial islands built in Dubai. In 2021, LRS requested and received $10 million in loan guarantees from the Utah Legislature. In August of 2021, they requested $893 million in federal loans through the Environmental Protection Agency (EPA) Water Infrastructure Finance and Innovation Act (WIFIA) program, but they were not invited to submit a proposal.

As a group of experts, we have serious concerns about the viability of the LRS proposal, including:

1. ***Intentional disregard of available science about the lake's history, status, and trajectory:*** LRS falsely claims that Utah Lake used to be deep and clear, that waves and evaporation are damaging, that sediment is heavily polluted, that algal blooms are worsening, and that the lake is deteriorating. These claims contradict virtually all scientific evidence, including the state's ongoing Utah Lake Water Quality Study, which has been presented at events attended by LRS.
2. ***Departure from the principles and methods of ecological restoration:*** LRS proposes to dredge the entire lakebed, create artificial islands to house 500,000 people, split the lake into dozens of small and deep impoundments, kill all 10 million fish with rotenone, and then use mechanical water circulators to prevent thermal stratification and dead zones. These efforts do not align with restoration best practices and are likely to reverse the lake's recovery.
3. ***Unprecedented size and scope:*** LRS claims that similar projects have been successfully completed elsewhere. In fact, the proposed islands would be 8-times larger than the world's biggest dredged island (Kansai Airport), and the dredging would be 370-times larger than the largest freshwater dredging project ever completed (Hudson River Cleanup).
4. ***Inadequate expertise:*** Large restoration projects in sensitive ecological areas typically involve teams of researchers, engineers, legal experts, local stakeholders, and government oversight. On the ecological side, LRS has no Ph.D. scientists on their team. On the engineering and legal sides, no project of this scope has been completed anywhere in the world.
5. ***False claims of endorsement and permitting:*** To reassure local and state leaders, LRS has claimed to have endorsement, permitting, or financing from the EPA, Army Corps of Engineers, FFSL, Utah Governor's Office, Utah Legislature, and the Utah Lake Commission. We have heard from most of these entities, none of which have endorsed the project.
6. ***Flawed model:*** LRS' chief design director Robert Scott designed the failed "Palm Deira" in Dubai, which appears to be the inspiration for this project. Even with nearly unlimited money from the Sheikh of Dubai, the island developer Nakheel incurred tens of billions of dollars in debt, only completing 1 of 4

planned archipelagos. Even the partial construction of those islands created massive ecological damage including creation of algal blooms, degradation of water quality, erosion of coastlines, and asphyxiation of sea life. The proposed Utah Lake islands would be 14-times larger than the only completed island project in Dubai (Palm Jumeirah).

7. ***Legal and permitting barriers:*** The LRS proposal depends on the largest privatization of sovereign state land in Utah history. While the 2018 *Utah Lake Amendments* make this theoretically possible, the transfer would likely result in judicial challenges based on the public trust doctrine. Utah courts have policed this doctrine strictly, including a 2019 clarification by the Utah Supreme Court (USAC v. VR Acquisitions). At the federal level, this project would be the largest destruction of lake and wetland habitat in modern U.S. history. The islands would cover 1/5th of the lake area, and the dredging to build them would impact the entire lake and surrounding shoreline (at least 150 square miles). The Environmental Impact Statement would likely take more than a decade before being rejected given the requirements of the National Environmental Policy Act, Clean Water Act, and the Rivers and Harbors Appropriation Act.
8. ***Shifting liability:*** The LRS proposal imposes enormous economic and environmental risk on the citizens of Utah while providing no opportunity for reward. Project failure during design or permitting would leave the state with loan guarantees and reduced credibility regarding management of sovereign state lands. Project failure during construction or development would leave the people of Utah with a multi-billion-dollar cleanup and decades of lost restoration and recreation potential. Even the unlikely prospect of project completion would create a permanently diminished lake stripped of the natural characteristics that have sustained its ongoing recovery.

We urge local, state, and federal leaders to oppose this project and make whatever changes are necessary to prevent similar projects in the future. The 2018 *Utah Lake Amendments* and continued state support of this project damage Utah's credibility and amplify LRS' efforts to spread misinformation about the status and recovery of Utah Lake. Their claims have influenced public perception and shaped the political debate over Utah Lake, undermining legitimate restoration and education efforts.

In this time of dramatic change, we need evidence-based management and legislation to protect this unique, beautiful, and dynamic lake. Utah Lake has sustained our predecessors and ancestors for thousands of years. It is now our opportunity and responsibility to sustain Utah Lake for future generations.

Sincerely,

The undersigned

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Byron Adams	Ph.D., Brigham Young University, Ecology/environmental science
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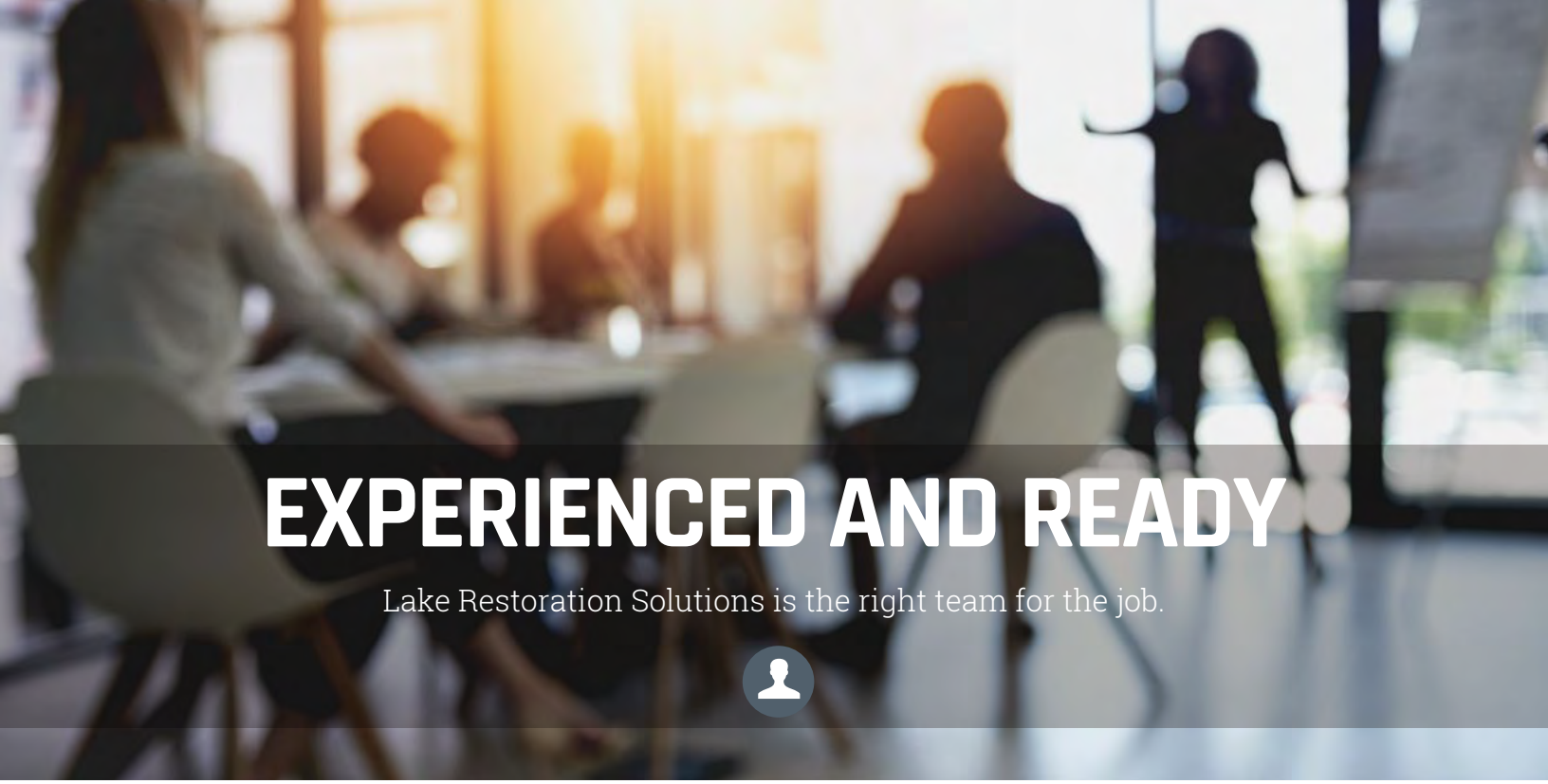
Keryn Ross	M.S., Brigham Young University, Geology/physical science
Joshua Roundy	Ph.D., University of Kansas, Geology/physical science
Sam Rushforth	Ph.D., Owner, Manager, Rushforth Phycology, Ecology/environmental science
John C Schmidt	Ph.D., Utah State University, Geology/physical science
Michael T. Searcy	Ph.D., Brigham Young University, Indigenous/traditional ecological knowledge
Jake M. Serago, P.E.	M.S., Professional Engineer, Engineering
Erin C. Seybold	Ph.D., University of Kansas, Ecology/environmental science
Kevin Shurtleff	Ph.D., Utah Valley University, Ecology/environmental science
Andrew South	Ph.D., Brigham Young University, Engineering
John R. Spear	Ph.D., Colorado School of Mines, Ecology/environmental science
Lee Stanish	Ph.D., University of Colorado, Ecology/environmental science
Sam StClair	Ph.D., Brigham Young University, Ecological Society of America, Ecology
Dan Stephen	Ph.D., Utah Valley University, Geology/physical science
Ryan Stewart	Ph.D., Brigham Young University, Ecology/environmental science
Alyssa J Traughber	B.S., Ecology/environmental science
Nancy Van Wagoner	PhD, Thompson Rivers University, Geology/physical science
Kathryn Ellen Van Wagoner	Ph.D., Weber State University, Recreation/community design
Sara Wall	M.S., Utah State University, Geology/physical science
Weihong Wang	Ph.D., Utah Valley University, Ecology/environmental science
Samuel A Wells	Ph.D., Southern Utah University, Freshwater Biologist
Clayton White	Ph.D., Brigham Young University, Ecology/environmental science
Dr. C. David Whiteman	Ph.D., University of Utah, Geology/physical science
Dr. Peter R Wilcock	Ph.D., Utah State University, Geology/physical science
Dr. Wayne Wurtsbaugh	Ph.D., Professor Emeritus, Utah State University, Ecology/environmental science
Jay Zarnetske	Ph.D., Michigan State University, Geology/physical science

In addition to these 109 public signatories, 8 additional experts in lake ecology, water resources, recreation management, or atmospheric science signed anonymously because of employer restrictions or political considerations.

EXHIBIT I



EXPERIENCED AND READY

Lake Restoration Solutions is the right team for the job.

BEN PARKER - Founder/Project Director

Working half of his professional career overseas as construction manager and 2IC of multi-billion dollar projects, Ben brings with him a unique understanding of construction management and environmental engineering solutions. Project history includes working in Madagascar, Mongolia, Zambia, and Panama.

As a native of Utah County, Ben spent his early years living and recreating on Utah Lake. Witnessing firsthand the degradation of the Lake has lead him to invest the last ten years in research and collaboration for the Utah Lake Restoration Project.

ROBERT SCOTT - Chief Design Director

As a senior urban designer for large-scale public and private sector oriented projects, Bob excels in land-use planning, site design, and master planning for cities, land developers, and state organizations. His 40 years of experience have taken him to the United Arab Emirates, Saudi Arabia, United States, and Canada. He lived in Dubai for 10 years as the lead design manager for the Palm Deira.

RANDY FINDLAY - Senior Project Manager

Randy is a seasoned and mature Project Manager and Engineer with over 30 years of experience in numerous relevant industries, such as Mining, Mass Earthworks, Soils Engineering, and Dam Construction including remote deployments around the world. He has completed $40.3 billion in projects during his career. Randy has been involved in the early development of the proposal including constructibility, feasibility studies, preliminary engineering, budgeting and technical writings to support Project execution.

CINDY SMITH - EIS Management Director

With more than 40 years of experience in environmental consulting throughout the western United States, Cindy has a strong understanding of federal land planning and associated laws, regulations, and policies. Her experience ranges from inter-disciplinary environmental project management, resource management planning, resource inventory and impact assessment, mitigation planning, and National Environmental Policy Act (NEPA) preparation.

DAVID HARRIS Chief Landscape Designer

Dave has over 27 years of experience in landscape architecture, urban design, and planning services. During his employment with EDAW/AECOM he managed and lead multi-disciplinary projects and master planned communities in the US, Dubai, Abu Dhabi and the Kingdom of Bahrain. He has managed and directed sustainable projects, such as LEED Platinum certified facilities, and is experienced in developing sustainable, low-impact developments.

TODD J. PARKER - Co-Founder, CIO

Backed by over 20 years of experience in information systems and technology, Todd brings a broad range of skills to the project. His focus with clients has been on federal, state, and local compliance to regulatory laws and business policy through automated business rules. He was project lead for the largest Oracle project in the world ($300m) in 2001-2003 for the Great Atlantic and Pacific Tea Company. Past clients include Harvard, Rockefeller, Barrick Gold Corporation, Intermountain Healthcare, as well as U.S. Departments of Energy, Interior, and Defense.

SCOTT PETERS - Senior Landscape Architect

Scott is a Professional Landscape Architect with 23 years of experience on over 200 projects globally with extensive experience collaborating with interdisciplinary teams of architects, engineers, planners, biologists, archaeologists, and other resource specialists on a wide range of projects to develop thriving and sustainable communities while protecting and restoring the environment.

RYAN BENSON - Counsel

Ryan advises the team on legal, political, planning, and conservation issues. He is a Harvard educated attorney with 17 years experience working on a wide variety of complex legal issues. He has extensive experience with important conservation and political issues, including endangered species, at the state and federal level.

ROGER BROOKS - Project Marketing Strategist

Roger brings 36 years of experience working with nearly a thousand communities, as well as many states, provinces, national parks, and countries in their branding, marketing, and product development. He is the go-to expert for anyone with ties to the travel industry or in downtown development.

ALBERTO CASAS - Project Environmental Director

Alberto brings significant experience in engineering, construction and management of structural, environmental and civil projects globally. Experience directly managing, all communications and reporting of compliance issues for First Quantum Minerals, Cobre Panama project from 2011 into 2018. VP of Latin America for MWH for 16 years in Brazil with fiscal P&L responsibility.

DR. ALAN WATT - Risk Management and Financial Affairs Director

Alan is Head of Internal Audit at High Speed 2 Ltd, the $75 billion project to build a new high-speed railway between London and the north of England. Before joining High Speed 2 Alan worked as Head of Internal Audit and Risk for First Quantum Minerals Ltd. ('FQML') between 2010 and 2015, where he had worldwide responsibility for audit and risk on FQML's entire portfolio of projects, including the $6.5-billion Cobre Panama Copper Mining Project, the $2 billion Zambian Trident copper project and the $2 billion revenue Kansanshi copper mine in Zambia.

JOHN RAPKOCH - Principal Engineer

John brings 27 years of process and project engineering experience to the Utah Lake Restoration Project Team. Experienced in Power Services, LNG, Petrochemical facility design and construction through commissioning. John has global experience in the processing and optimization of ongoing operations and provides seasoned, mature asset with excellent leadership and analytical prowess.

ERIC T. ALLRED - Project Safety Manager

Eric has 20 year's of experience in professional occupational safety and health including work for large organizations including: Northrop Grumman, Bechtel Nevada (Maintenance and Operation Government Contract), CH2M Hill (design build), Rio Tinto (US and International), and the National Nuclear Security Administration within the United States Department of Energy. Mr. Allred has covered all aspects of the comprehensive practice of occupational safety and health with experience in heavy construction, mining, and manufacturing.

Lake Restoration Solutions, Inc.

UTAH LAKE
RESTORATION PROJECT

TEAM

RYAN BENSON
Chief Executive Officer
Lake Restorations Solutions

KLAIR WHITE
Chief Financial Officer
Lake Restorations Solutions

ROBERT SCOTT
Dir. of Planning & Design
Lake Restorations Solutions

JON BENSON
Chief Operating Officer
Lake Restorations Solutions

RUDY BONAPARTE
Sr. Principal Engineer
Geosyntec

ANCIL TAYLOR
Dredging Technical Consultant
Lake Restorations Solutions

HOWARD CUMBERLAND
Senior Marine Scientist
Geosyntec

ROBERT ANNEAR, PHD
Sr. Water Resources Engineer
Geosyntec

RODOLFO SANCIO
Sr. Geotechnical Engineer
Geosyntec

LINDSAY HADLEY
Chief Executive Officer
Halcyon

EXHIBIT J

The Securities and Exchange Commission has not necessarily reviewed the information in this filing and has not determined if it is accurate and complete.
The reader should not assume that the information is accurate and complete.

UNITED STATES SECURITIES AND EXCHANGE COMMISSION

Washington, D.C. 20549

FORM D

Notice of Exempt Offering of Securities

OMB APPROVAL	
OMB Number:	3235-0076
Estimated average burden hours per response:	4.00

1. Issuer's Identity

CIK (Filer ID Number)
0001828565

Previous Names: [X] None

Name of Issuer
Lake Restoration Solutions, LLC

Jurisdiction of Incorporation/Organization
DELAWARE

Year of Incorporation/Organization
[ ] Over Five Years Ago
[X] Within Last Five Years (Specify Year) 2017
[ ] Yet to Be Formed

Entity Type
[ ] Corporation
[ ] Limited Partnership
[X] Limited Liability Company
[ ] General Partnership
[ ] Business Trust
[ ] Other (Specify)

2. Principal Place of Business and Contact Information

Name of Issuer
Lake Restoration Solutions, LLC

Street Address 1
3300 N TRIUMPH BOULEVARD, SUITE 100

Street Address 2

City	State/Province/Country	ZIP/PostalCode	Phone Number of Issuer
LEHI	UTAH	84043	214-295-3161

3. Related Persons

Last Name	First Name	Middle Name
Benson	Ryan	

Street Address 1
3300 N. Triumph Boulevard, Suite 100

Street Address 2

City	State/Province/Country	ZIP/PostalCode
Lehi	UTAH	84043

Relationship: [X] Executive Officer [ ] Director [X] Promoter

Clarification of Response (if Necessary):

4. Industry Group

[ ] Agriculture
Health Care
[ ] Retailing

- [ ]
- Banking & Financial Services
  - [ ] Commercial Banking
  - [ ] Insurance
  - [ ] Investing
  - [ ] Investment Banking
  - [ ] Pooled Investment Fund
    - Is the issuer registered as an investment company under the Investment Company Act of 1940?
      - [ ] Yes
      - [ ] No
  - [ ] Other Banking & Financial Services
- [ ] Business Services
- Energy
  - [ ] Coal Mining
  - [ ] Electric Utilities
  - [ ] Energy Conservation
  - [X] Environmental Services
  - [ ] Oil & Gas
  - [ ] Other Energy
- [ ] Biotechnology
- [ ] Health Insurance
- [ ] Hospitals & Physicians
- [ ] Pharmaceuticals
- [ ] Other Health Care
- [ ] Manufacturing
- Real Estate
  - [ ] Commercial
  - [ ] Construction
  - [ ] REITS & Finance
  - [ ] Residential
  - [ ] Other Real Estate
- [ ]
- [ ] Restaurants
- Technology
  - [ ] Computers
  - [ ] Telecommunications
  - [ ] Other Technology
- Travel
  - [ ] Airlines & Airports
  - [ ] Lodging & Conventions
  - [ ] Tourism & Travel Services
  - [ ] Other Travel
- [ ] Other

5. Issuer Size

Revenue Range	OR	Aggregate Net Asset Value Range
[ ] No Revenues		[ ] No Aggregate Net Asset Value
[ ] $1 - $1,000,000		[ ] $1 - $5,000,000
[ ] $1,000,001 - $5,000,000		[ ] $5,000,001 - $25,000,000
[ ] $5,000,001 - $25,000,000		[ ] $25,000,001 - $50,000,000
[ ] $25,000,001 - $100,000,000		[ ] $50,000,001 - $100,000,000
[ ] Over $100,000,000		[ ] Over $100,000,000
[X] Decline to Disclose		[ ] Decline to Disclose
[ ] Not Applicable		[ ] Not Applicable

6. Federal Exemption(s) and Exclusion(s) Claimed (select all that apply)

- [ ] Rule 504(b)(1) (not (i), (ii) or (iii))
- [ ] Rule 504 (b)(1)(i)
- [ ] Rule 504 (b)(1)(ii)
- [ ] Rule 504 (b)(1)(iii)
- [X] Rule 506(b)
- [ ]
- [ ] Investment Company Act Section 3(c)
  - [ ] Section 3(c)(1)
  - [ ] Section 3(c)(2)
  - [ ] Section 3(c)(3)
  - [ ] Section 3(c)(9)
  - [ ] Section 3(c)(10)
  - [ ] Section 3(c)(11)
  - [ ]

☐ Rule 506(c)	☐ Section 3(c)(4)	☐ Section 3(c)(12)
☐ Securities Act Section 4(a)(5)	☐ Section 3(c)(5)	☐ Section 3(c)(13)
	☐ Section 3(c)(6)	☐ Section 3(c)(14)
	☐ Section 3(c)(7)	

7. Type of Filing

☒ New Notice Date of First Sale 2020-09-25 ☐ First Sale Yet to Occur

☐ Amendment

8. Duration of Offering

Does the Issuer intend this offering to last more than one year? ☒ Yes ☐ No

9. Type(s) of Securities Offered (select all that apply)

☒ Equity	☐ Pooled Investment Fund Interests
☐ Debt	☐ Tenant-in-Common Securities
☐ Option, Warrant or Other Right to Acquire Another Security	☐ Mineral Property Securities
☐ Security to be Acquired Upon Exercise of Option, Warrant or Other Right to Acquire Security	☐ Other (describe)

10. Business Combination Transaction

Is this offering being made in connection with a business combination transaction, such as a merger, acquisition or exchange offer? ☐ Yes ☒ No

Clarification of Response (if Necessary):

11. Minimum Investment

Minimum investment accepted from any outside investor $0 USD

12. Sales Compensation

Recipient

Recipient CRD Number ☒ None

(Associated) Broker or Dealer ☒ None

(Associated) Broker or Dealer CRD Number ☒ None

Street Address 1

Street Address 2

City

State/Province/Country

ZIP/Postal Code

State(s) of Solicitation (select all that apply)
Check “All States” or check individual States

☐ All States

☐ Foreign/non-US

13. Offering and Sales Amounts

Total Offering Amount	$15,000,000 USD	or ☐ Indefinite
Total Amount Sold	$200,000 USD	
Total Remaining to be Sold	$14,800,000 USD	or ☐ Indefinite

Clarification of Response (if Necessary):

14. Investors

☐ Select if securities in the offering have been or may be sold to persons who do not qualify as accredited investors, and enter the number of such non-accredited investors who already have invested in the offering.

Regardless of whether securities in the offering have been or may be sold to persons who do not qualify as accredited investors, enter the total number of investors who already have invested in the offering: 1

15. Sales Commissions & Finder's Fees Expenses

Provide separately the amounts of sales commissions and finders fees expenses, if any. If the amount of an expenditure is not known, provide an estimate and check the box next to the amount.

Sales Commissions $0 USD ☐ Estimate

Finders' Fees $0 USD ☐ Estimate

Clarification of Response (if Necessary):

16. Use of Proceeds

Provide the amount of the gross proceeds of the offering that has been or is proposed to be used for payments to any of the persons required to be named as executive officers, directors or promoters in response to Item 3 above. If the amount is unknown, provide an estimate and check the box next to the amount.

$0 USD ☐ Estimate

Clarification of Response (if Necessary):

Signature and Submission

Please verify the information you have entered and review the Terms of Submission below before signing and clicking SUBMIT below to file this notice.

Terms of Submission

In submitting this notice, each issuer named above is:

- Notifying the SEC and/or each State in which this notice is filed of the offering of securities described and undertaking to furnish them, upon written request, in the accordance with applicable law, the information furnished to offerees.*
- Irrevocably appointing each of the Secretary of the SEC and, the Securities Administrator or other legally designated officer of the State in which the issuer maintains its principal place of business and any State in which this notice is filed, as its agents for service of process, and agreeing that these persons may accept service on its behalf, of any notice, process or pleading, and further agreeing that such service may be made by registered or certified mail, in any Federal or state action, administrative proceeding, or arbitration brought against the issuer in any place subject to the jurisdiction of the United States, if the action, proceeding or arbitration (a) arises out of any activity in connection with the offering of securities that is the subject of this notice, and (b) is founded, directly or indirectly, upon the provisions of: (i) the Securities Act of 1933, the Securities Exchange Act of 1934, the Trust Indenture Act of 1939, the Investment Company Act of 1940, or the Investment Advisers Act of 1940, or any rule or regulation under any of these statutes, or (ii) the laws of the State in which the issuer maintains its principal place of business or any State in which this notice is filed.
- Certifying that, if the issuer is claiming a Regulation D exemption for the offering, the issuer is not disqualified from relying on Rule 504 or Rule 506 for one of the reasons stated in Rule 504(b)(3) or Rule 506(d).

Each Issuer identified above has read this notice, knows the contents to be true, and has duly caused this notice to be signed on its behalf by the undersigned duly authorized person.

For signature, type in the signer's name or other letters or characters adopted or authorized as the signer's signature.

Issuer	Signature	Name of Signer	Title	Date
Lake Restoration Solutions, LLC	Ryan Benson	Ryan Benson	Manager	2020-10-16

Persons who respond to the collection of information contained in this form are not required to respond unless the form displays a currently valid OMB number.

* This undertaking does not affect any limits Section 102(a) of the National Securities Markets Improvement Act of 1996 ("NSMIA") [Pub. L. No. 104-290, 110 Stat. 3416 (Oct. 11, 1996)] imposes on the ability of States to require information. As a result, if the securities that are the subject of this Form D are "covered securities" for purposes of NSMIA, whether in all instances or due to the nature of the offering that is the subject of this Form D, States cannot routinely require offering materials under this undertaking or otherwise and can require offering materials only to the extent NSMIA permits them to do so under NSMIA's preservation of their anti-fraud authority.