



City and Borough of Juneau
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TO: Mayor Weldon and Assembly
DATE: August 19, 2024
FROM: Robert Barr, Deputy City Manager
RE: Flooding related to Suicide Basin releases

This memo identifies some Glacial Lake Outburst Flood (GLOF) prevention and mitigation ideas. At this stage, no idea has been omitted and more ideas will surface through the public process.

Importantly, we were lucky in 2024 because the river started low. We did not see much rain prior to, during, or immediately after the 2024 GLOF. A higher river level would have likely resulted in more significant flooding. This supports the need to act. In our typical rainy environment, a similarly sized release next year will likely be more destructive.

Need for regulatory exemptions for immediate solutions

All the conceptual ideas in this memo require a broad coalition of support and regulatory exemptions. Through usual processes, federal projects at this scale take many years. The GLOF in Mendenhall Valley is an exceptional situation that will require exceptions to the usual processes that can only be secured through political mandate. Our federally elected representatives – all have visited and toured the impacted areas – are aware of this challenge and have committed to assist.

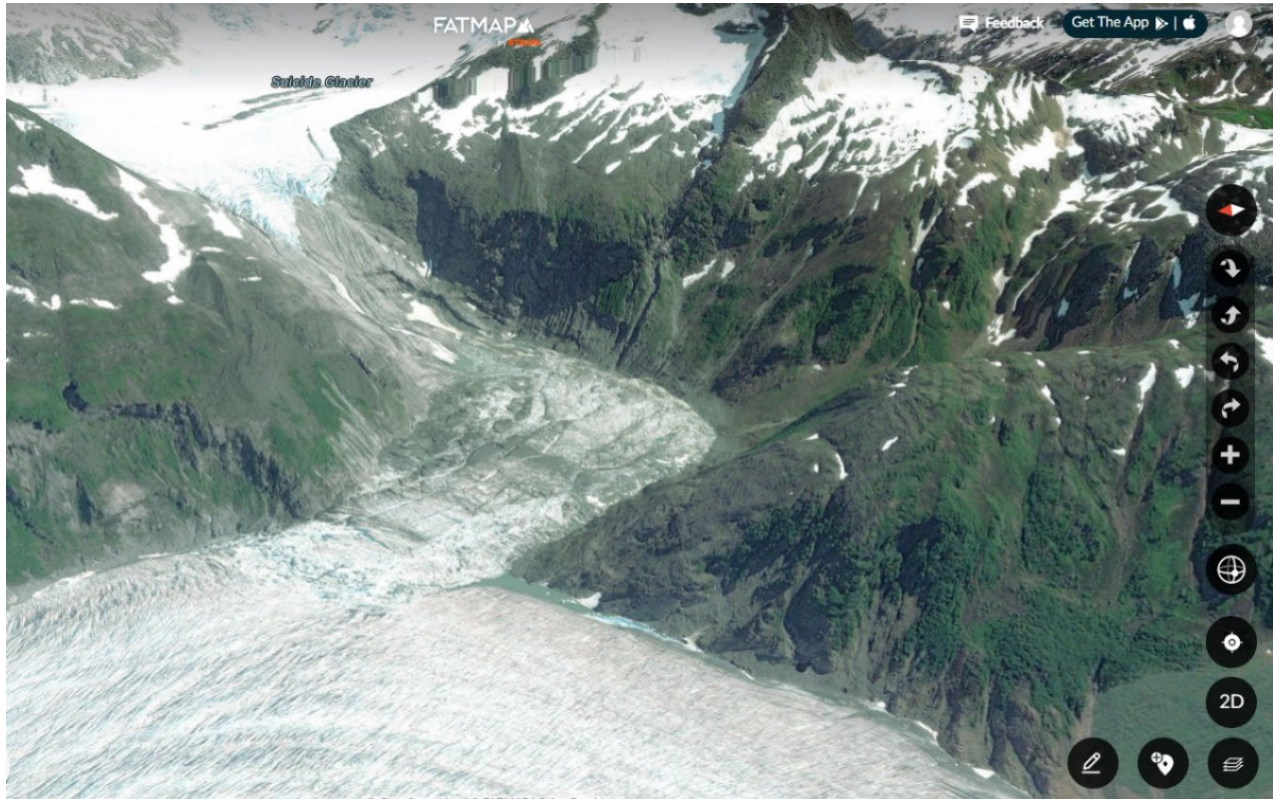
Importantly, time is of the essence to provide solutions before the next GLOF. Most of these mitigation or prevention ideas would need to be exempted from typical large-project processes (think Juneau-Douglas North Crossing) to provide their intended benefits. Failing to act quickly on meaningful solutions could result in financial ruin to many GLOF victims and economic distress for the community. However, the challenges associated with obtaining these exemptions and the associated public decision-making analysis cannot be underestimated and may be impossible without bold actions in Congress.

For context, one usual process for mitigating recurring flooding of this magnitude involves a study period of 3-5 years, which is predicated on Congress first appropriating \$2-3M for the U.S. Army Corps of Engineers (ACOE) to initiate the flood study and the community matching those funds. Dependent on the outcome of the study, a construction project can follow, requiring up to a 35% local match¹. CBJ put in a request to join the study queue after last year's flood. In initial conversations with ACOE this year they have been receptive to initiating a request.

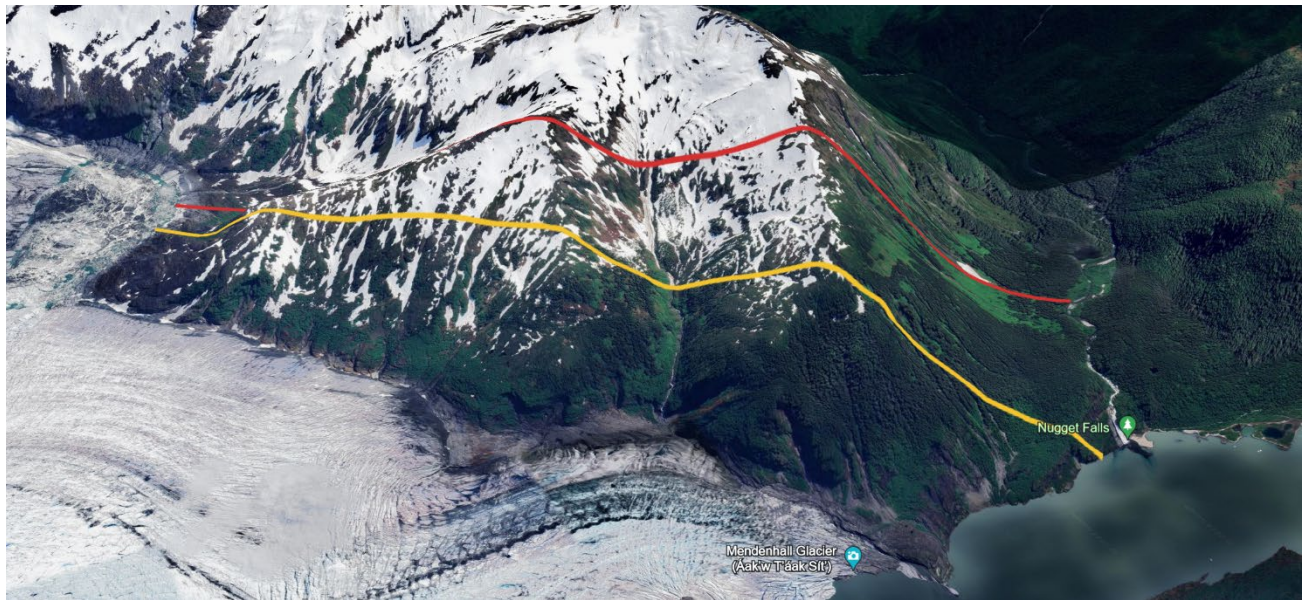
The concepts below are not presented in any order. No attempt at ranking has been made. All would require significant hydrology and geotechnical analysis that has not happened – these are concepts only.

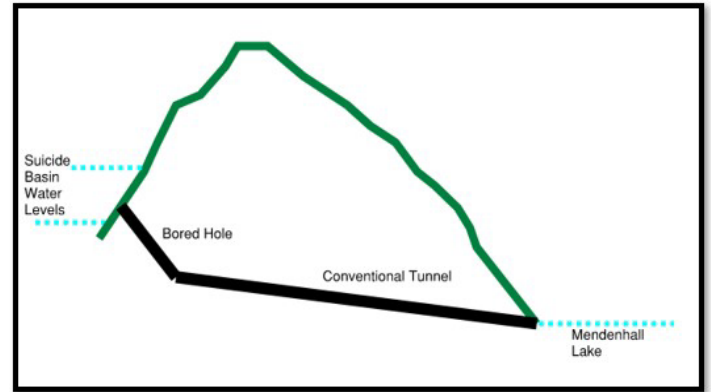
¹ ACOE S14 Program

Suicide Basin / K'óox Kaadí Basin



This image depicts Suicide Basin / K'óox Kaadí Basin in the center, which is just a couple miles from the residential core of the Mendenhall Valley. In the upper left, you can see Suicide Glacier. Suicide Glacier has retreated and instead of filling the basin with glacial ice, the meltwater from the glacier now pools in the basin in the summer. On the right and in the foreground is Mt. Bullard. One of the ideas below involves tunneling through Mt. Bullard to provide a drain for Suicide Basin.





Mt. Bullard Tunnel/Borehole

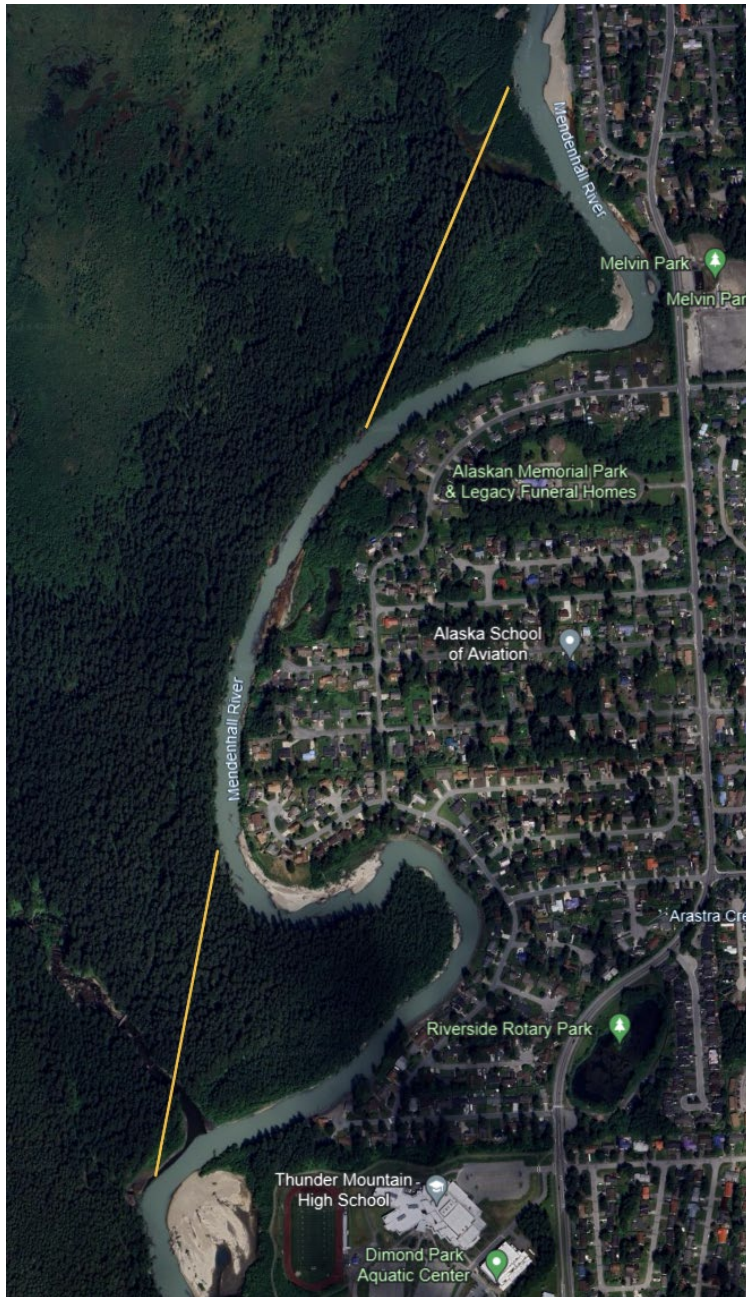
The first image above depicts the potential path of tunnels between Suicide Basin and Nugget Creek (red) and Suicide Basin and Mendenhall Lake (yellow). As shown, these paths are about 2.45 miles long. Nugget Creek drains into Nugget falls and is generally accessible on foot from the East Glacier Trail. The second and third images depict a tunnel as well as a concept cross-section.

Both options envision a borehole drilled through Mt. Bullard at an appropriate slope such that Suicide Basin slowly drains into Mendenhall Lake instead of the recent outburst events.

Questions/unknowns include:

- Slope of tunnel: There is approximately a thousand feet of elevation between the likely intake level at the basin and Mendenhall Lake
- Tailings: Dealing with excavated rock
- Tunnel Diameter: very early educated guesses range from 6 to 15 feet.
- Water Flow: The volume of water per hour that is necessary to prevent a 2023 or 2024 magnitude GLOF
- Whether Nugget Creek could conceivably accommodate the volumes necessary and the environmental + economic impacts at the creek and lake
- How to address ice/rock blockages at the basin
- Site access infrastructure requirements – any Nugget Creek site is likely accessible by helicopter only

Trench New Channels



This option envisions trenching two supplemental channels at points where the Mendenhall River curves, theoretically enabling water from a GLOF to drain to the ocean quicker than it can right now, which could increase the river's overall ability to carry the ~14.6 billion gallons² of extra water that we see in a GLOF. Unlike other potential options, this one could occur entirely on CBJ owned property which could ease, but not eliminate, permitting challenges. If federal funding is used, NEPA³ and associated requirements would be problematic.

The oxbow (right image) is an example of the river changing in a similar manner naturally.

Questions/unknowns include:

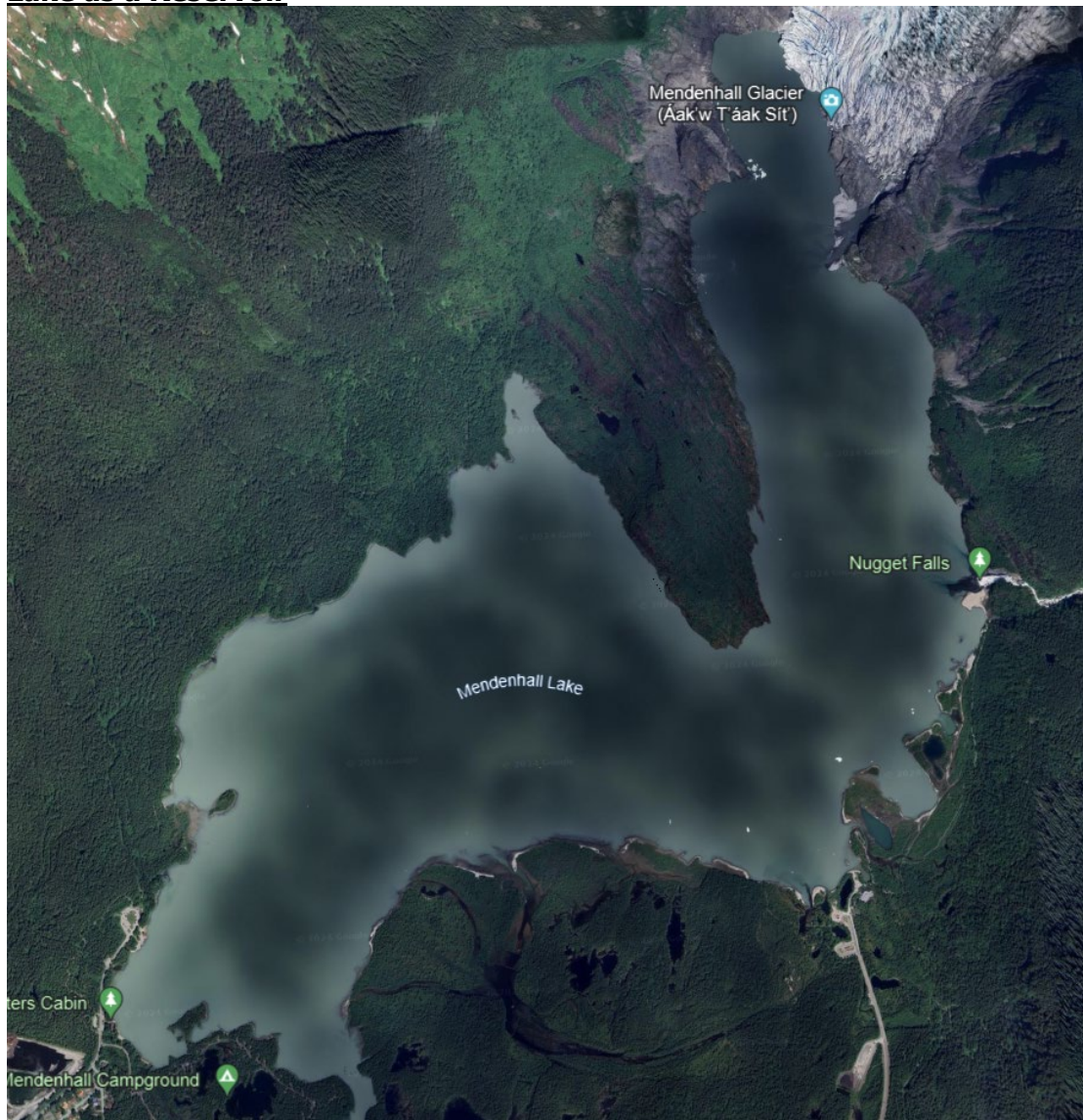
- Neighboring parcels include the University and Southeast Alaska Land Trust who may be impacted

² For context, this is about 12 times the amount of potable water Juneau uses in a year.

³ National Environmental Policy Act

- The magnitude of earth removal – these potential channels combined are nearly three quarters of a mile long.
 - The necessary width and depth of the channels
 - The lower channel crosses and would change Montana Creek
 - The amount of infrastructure necessary for site access
 - A faster river may create other unintended consequences that we have not yet seen due to the natural slowing (and flooding) that currently occurs
 - A “quick and dirty” project may result in increased earth/debris in lower sections of the river.
 - A very preliminary budget estimate for two channels, with appropriate slopes, armoring, and sufficient depth/width to care for likely volume is \$24M.
 - There may be related options that involve dredging / gravel removal of much smaller portions of the existing river instead of creating new channels.
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Lake as a Reservoir



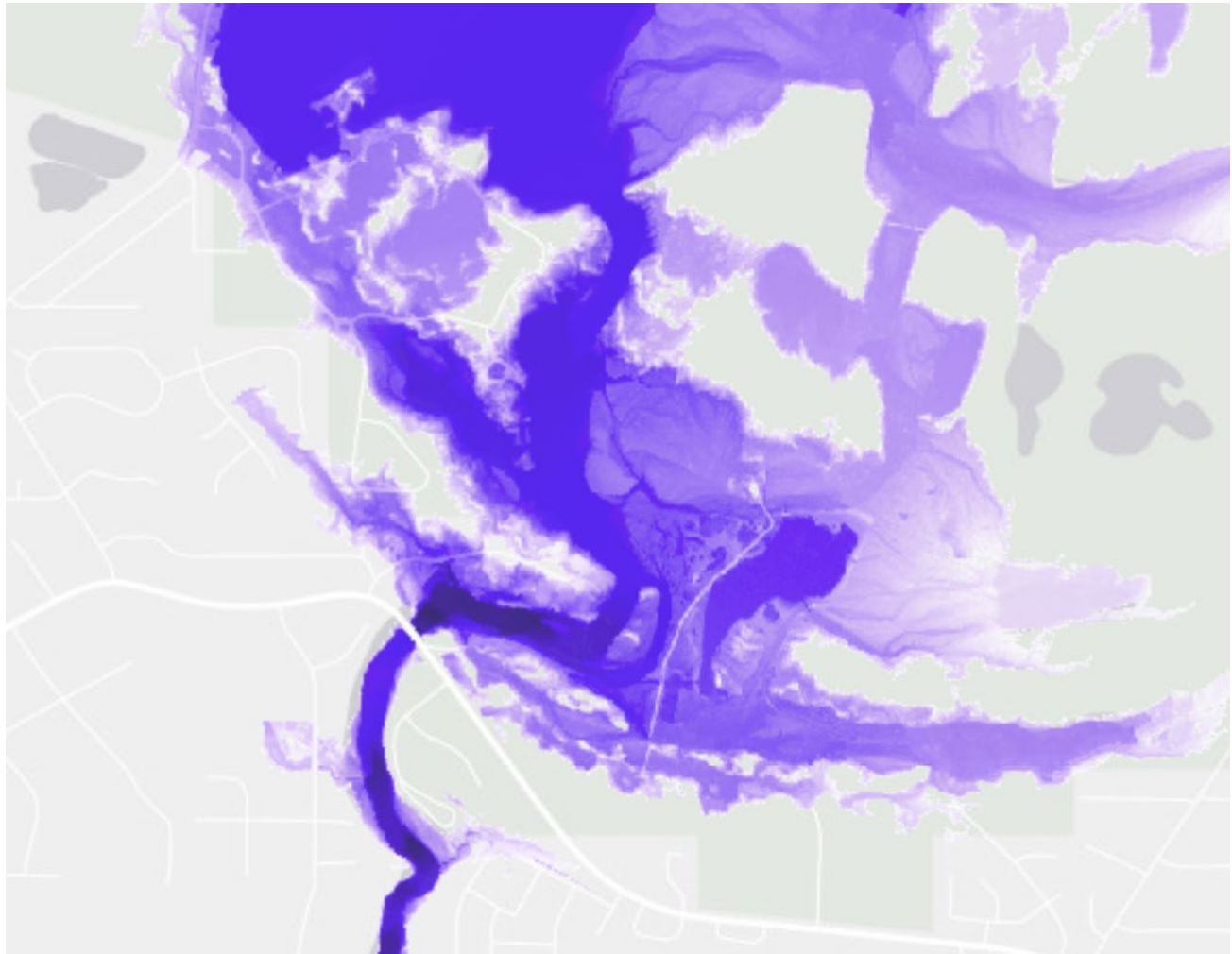
Mendenhall Lake contains about twice as much water, by volume, as Suicide Basin released this year. This concept involves draining some portion of the lake, either by pump or by siphon, as the

basin fills so that when the basin releases, the lake is able to absorb a fraction of the basin's total output. It would need to be a large enough fraction to turn a ~16 foot event into a ~13 foot event, with room to spare.

Questions/unknowns:

- The lake fills with water from many natural sources, the rate at which water is pumped/siphoned from the lake would need to exceed the rate at which it naturally fills
 - To make a meaningful difference in a GLOF, the lake may need to be lowered below the inlet elevation of the river. This would mean the river would slow to whatever rate we were able to pump lakewater into it in the days/weeks leading up to a GLOF.
 - If we assume a fast river scours itself and maintains/gains depth overtime, a slow river may become shallower over time, losing overall carrying capacity.
 - The napkin math from the engineers on this concept indicates this would require many large pumps operating 24/7 for weeks or months to pump sufficient water out of the lake to blunt a basin release.
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Controlled Release / Dikes / Dredging

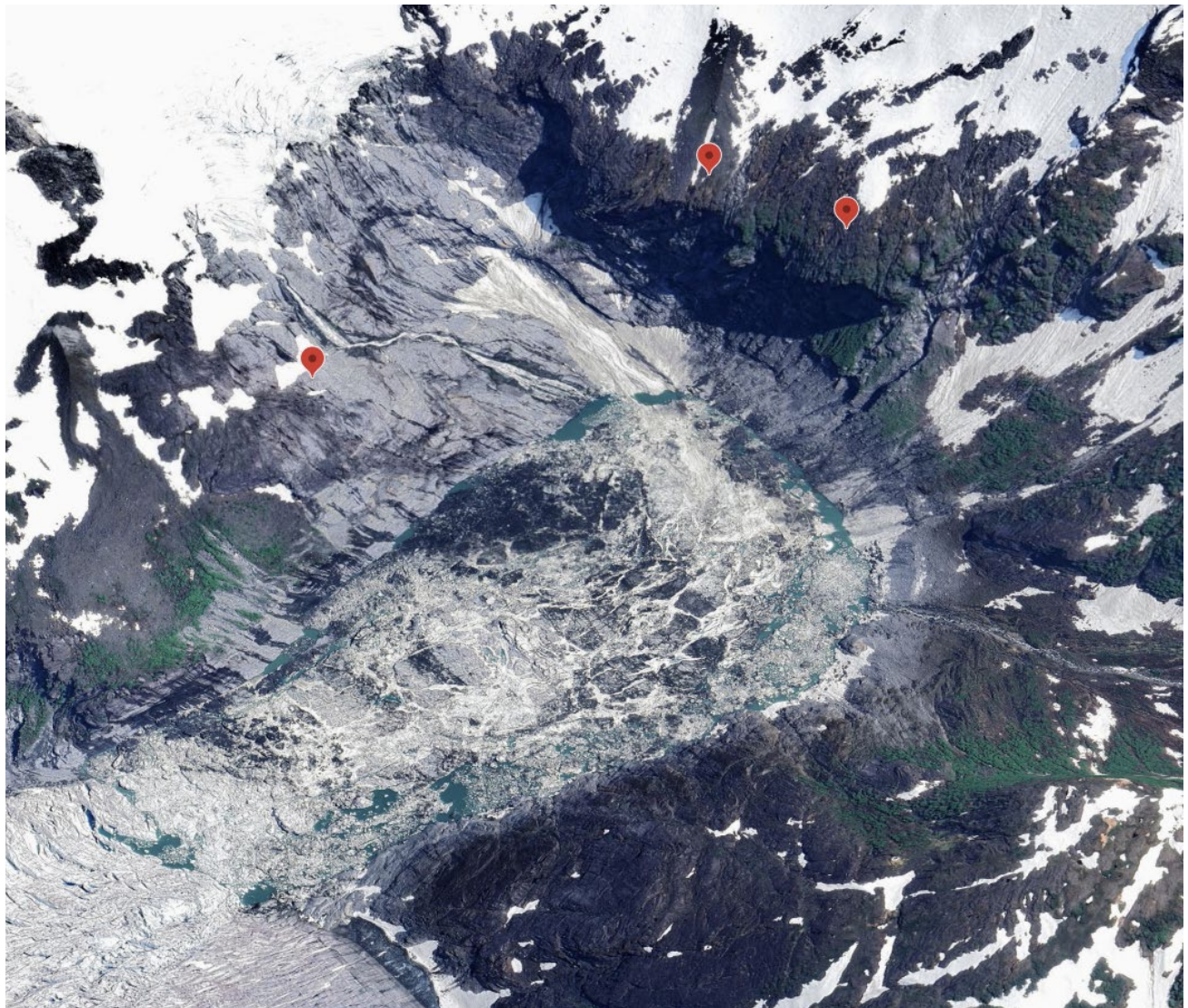


Related to the lake as a reservoir concept, this concept imagines increasing the capacity of the lake by creating earthen dikes at its low points around the circumference of the lake with a controlled release mechanism to limit the volume of water entering the river channel. The image depicts our

existing inundation maps at the 16' level, which would provide a starting point (along with new maps, which we have requested) for determining the ideal placement of dikes and related systems. The lake/river inlet is in the center top of the image. The Mendenhall Loop bridge is in the lower left, and the Dredge Lake neighborhood in the lower right.

In lieu of directly increasing the carrying capacity of the lake with dikes, an alternative⁴ would be to dredge – make deeper – the point at which the lake meets the river, allowing the lake to drain more fully. This would still likely require a system to contain the GLOF in the lowered lake and control the rate at which water from a GLOF enters the river.

Fill the Basin with Rock



In the image of the basin above, there are relatively few steep slopes but there are some with overhung rocks. Those that exist are marked with red pins.

This concept imagines blasting areas around the basin and using that rock to partially fill the basin, reducing its total capacity. Reducing the capacity of the basin by ~1 billion gallons (2024 release:

⁴ Or addition. These two concepts are not mutually exclusive.

~14.6 billion gallons) would take approximately 5 million cubic yards of rock, or around 350,000 dump truck loads.

Questions/unknowns:

- Moving the rock the 0.25-0.5 miles from the most likely blasting area to the basin itself is probably not possible with traditional drill & blast means
- The potential for unintended consequences is high
- 1 billion gallons of displacement is not likely sufficient to prevent major floods

Flood Fighting



Unlike the options above, another option is to employ traditional flood fighting options – sandbags and sandbag equivalents – that could be procured and installed to attempt to protect private and/or public property. Multiple options exist.

Other options that property owners may consider that are outside the scope of this memo include, but are not limited to: raising the height of structures and/or reconstructing first floors with wet or dry floodproofing methods.

Liability, funding, maintenance

In any of these options, we will face the usual liability question when contemplating changing natural environments, which is that if CBJ changes something, CBJ may become liable for the negative impacts of that changed thing. Lengthy projects with comprehensive alternative analysis and study periods can help mitigate that risk. Expedited projects that skip those steps likely exacerbate that risk.

From a funding perspective, if we seek and receive federal funding, we will need to stomach a significant local cost share. The two likely fund sources for a local cost share are a local improvement district (LID) for the impacted properties or the general fund.

In most cases, maintenance costs would be substantial and would need to be evaluated alongside the merits/demerits of any given concept.

Recommendation:

This memo is presented primarily as information. A letter from the Mayor and President Peterson seeks the formation of a working group to further brainstorm and refine these concepts.

Staff recommend the Assembly bring this topic to a Committee of the Whole meeting after the working group has formed and had its first meeting.