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June 19, 2019

VIA EMAIL: mowens@utah.gov
Marie E. Owens, P.E., Director
Division of Drinking Water
UTAH DEPARTMENT OF ENVIRONMENTAL QUALITY
P.O. Box 144830
Salt Lake City, Utah 84114-4830

cc: Holly Mullen, Communications and Engagement Manager (holly.mullen@slcgov.com)
Sam Grenlie, P.E., Utah DDW (sgrenlie@utah.gov)
Kelsey Lindquist, Senior Planner, Salt Lake City Historic Landmark Commission (Kelsey.lindquist@slcgov.com)

Re: 4th Avenue Well – 4th Avenue Well (WS017); DDW Matter No.: Salt Lake City Water System, System #18026, File #11680

Director Owens:

This letter is to request notice of any final order approving Salt Lake City construction plans related to the design of the Salt Lake City Department of Public Utilities ("DPU") proposed well at 4th Avenue and Canyon Road (the "Well") pursuant to Utah Admin. Code R309-500-6, to the final issuance of an operating permit pursuant to Utah Admin. Code R309-500-9, or the granting of any exceptions to construction standards pursuant to Utah Admin. Code R309-500-4(1)(b) and-or R309-105-6(2)(b). It is my intention to appeal any approval of permit issued by the Utah Division of Drinking Water ("DDW") for any rebuilt and expanded 4th Avenue Well design similar to those proposed by the DPU on May 9, 2019, as shown in Figure 1, on the grounds described below. I request that notice be given to me of any such final orders at the email listed above so I may exercise within 10 days, a right-of-appeal pursuant to Utah Admin. Code R305-7 *et seq* and R305-7-611.

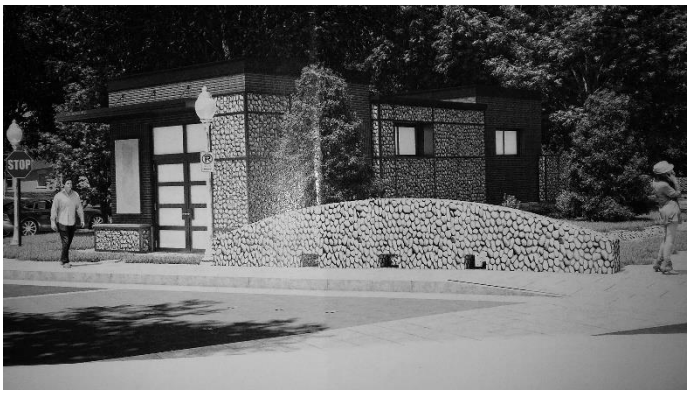

Figure 1 - Excerpt from DPU Architectural Rendering showing daytime view from south east. May 9, 2019.

The DDW may wish to consider the following additional information regarding flood and seismic risks at the proposed 4th Avenue and North Canyon Road location. I understand that the DDW and the Salt Lake City DPU are currently undergoing a pre-construction administrative review[1] of the proposed Well building construction.[2] These are non-appealable interlocutory matters. I intend to appeal any final approval of any structure in the form of the above concept design on the grounds that:

Failure to Adequately Address Flooding Risk

1) The proposed concept design is insufficiently protected against flood waters as required by Utah Admin. Code R309-540-5(1)(a), Facility Design and Operation: Pump Stations - Pumping Facilities (effective April 1, 2019),[3] which states in part, that:

> (ii) the access to the pump station shall be six inches above the surrounding ground and the station located at an elevation which is *a minimum of* three feet above the 100-year flood elevation, or *three feet above the highest recorded flood elevation, which ever is higher*, or protected to such elevations . . . (emphasis added).

There is ample historical evidence that 4th Avenue and North Canyon Road has been repeatedly flooded by the high-snow pack runoff waters of City Creek Canyon and is at risk or has been flooded by cloudburst flooding.[4] The proposed Well building is located in the

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[1] Utah Code Admin. R309-500-6(2).

[2] Letter by S. Grenlie, P.E., DDW, to B. McIntire, SLC DPU, dated May 22, 2019.

[3] url: https://rules.utah.gov/publicat/code/r309/r309-540.htm.

[4] *See discussion* and supporting academic references in Letter by K. Fisher to SLC DPU dated May 25, 2019 (url: http://fisherka.csolutionshosting.net/misc/FourthAveWell/20190525WellCommentFloodingFinal.pdf). For easy reference, the key documents and academic and research articles regarding

geological stream bed of City Creek. As a result of the 1983 state-wide floods from high-snowpack melting, the DPU's predecessor spent about $1,000,000 repairing flood damage to roads from North Temple and State Street north to Memory Grove.[5] The City replaced 1,040 feet of 6" inch pipeline excavated and damaged by flood waters between 4th Avenue and Memory Grove, 18 subsurface sewer and water connections in the area were destroyed, and the foundations of the old Brick Tank house north of Memory Grove were undermined (*id*). Historically, three cloudburst floods from nearby Salt Lake Salient canyons have sent waves of water into the city causing severe damage: the 1945 Perry's Hollow flood (2,400 cfs down M and N Streets to South Temple and moving 500 lb boulders); the 1916 Dry Canyon flood (a 4 to 10 foot wall of water went down Virginia Street and Second and Third Avenue west to 200 South and 900 East moving 1,000 to 1,500 lb boulders); and the 1918 West Capitol cloudburst flood (burying properties at 200 West in up to 1 foot of mud).[6]

To my knowledge and upon information and belief, the DPU has not submitted an application for an exception to this requirement pursuant to UAC R309-105-6(2)(b).

Failure to Adequately Address Seismic Risk

2) The proposed concept design is insufficiently protected against special seismic risks as required by Utah Admin. Code R309-500-12 - Other Permits, which states, in part that "[w]ater systems may be required to comply with other permitting requirements before beginning construction of drinking water projects or placing new facilities into service." A site specific seismic risk analysis is required for the proposed Well by the International Building Code.

The proposed chemical treatment plant is located in area that is at high risk for ground liquefaction during a magnitude 7.0 earthquake. [7] The proposed well-site and all the conceivable alternative relocation sites are located in an area where earthquake experts predict severe seismic shaking during a catastrophic earthquake.[8] Experts predict that in an anticipated 7.0 mag

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historical flooding from high-snow packs and cloudburst floods are listed with retrieval urls where available in the Addendum. Copies of documents not available by internet download are available from this writer on request.

[5] Excerpts from SLC DPU GRAMA production to K. Fisher, June 13, 2019 (url: http://fisherka.csolutionshosting.net/misc/FourthAveWell/20190617ExcerptsfromDPUProductionre4thAveWell.pdf).

[6] *See* Addendum for historical references. Floods from both of the Perry's Hollow and Dry Fork salient side canyons are now controlled by combined road-flood structures. No such flood control structures exist in the City Creek Canyon drainage).

[7] Bartlett, S. F., Hinckley, D. W., and Gerber, T. M. (2016). Figure C-1 in: Liquefaction-Induced Ground Displacement Hazard Maps for a M7.0 Scenario Event on the Salt Lake City Segment of the Wasatch Fault Zone, Salt Lake County, Utah. Salt Lake City, Utah. (url: http://www.civil.utah.edu/~bartlett/ULAG/Liquefaction Maps Text.pdf).

[8] Wong, I., Silva, W., Wright, D., Olig, S., Ashland, F., Gregor, N., … Jordan, S. (2002). Ground-shaking Map for Magnitude 7.0 Earthquake on the Wasatch Fault Salt Lake City, Utah Metropolitan Area (Public Information Maps No. P-76). Salt Lake City, Utah. (url: https://geology.utah/hazards/earthquakes-faults/ground-shaking/); Bartlett, S. F., Hinckley, D. W., and Gerber, T. M. (2016). Figure C-1 in: Liquefaction-Induced Ground Displacement

earthquake, the ground in Memory Grove will move horizontally between 0.3 and 1.0 meters. Horizontal accelerations will be between 0.9 and 1.0 standard gravities (g_n). During such an earthquake event, there will be an estimated 2,000 to 2,500 deaths, and the estimated number of injured persons needing hospital care is between 7,400 and 9,300.[9]

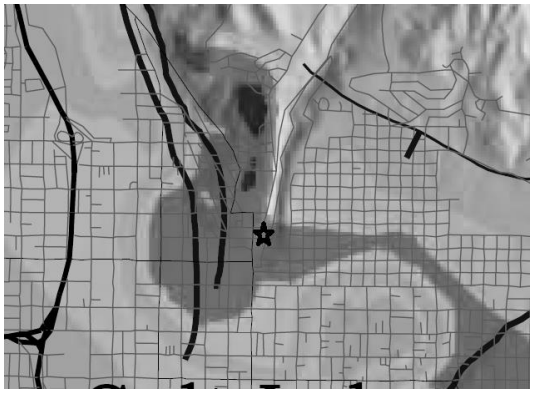

Figure 2 – Excerpt - Ground Shaking Map from Wong 2002. Notes: The proposed DPU facility is marked with a star in an MMI IX predicted shaking region. The faults to the immediate west are extensions of the Warm Springs Fault and have been active in the last 15, 000 years.

A building officer should conclude that an IBC site-specific seismic analysis is required. The IBC based on national earthquake risk maps[10] imposes supplemental load design requirements that depend on the proposed use of the structure. The proposed structure is a chemical plant. The IBC has two types of classifications based on type-of-use that are related to the Well: the Well is a Class III structure that houses toxic chemicals or is a Class IV structure that is used to maintain water pressure[11]. Class III and IV risk buildings can only be reduced to a Class II structure requiring lower physical reinforcement based on a site-specific hazard assessment.

The second type of IBC classification related seismic risk relevant to the proposed Well site is based on expected ground accelerations from national maps. Seismic Design Class A has the lowest accelerations during an earthquake; Class F the highest anticipated accelerations. Various online calculators simplify the process of determining risk and load factors applicable to

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Hazard Maps for a M7.0 Scenario Event on the Salt Lake City Segment of the Wasatch Fault Zone, Salt Lake County, Utah. Salt Lake City, Utah. (url: http://www.civil.utah.edu/~bartlett/ULAG/Liquefaction Maps Text.pdf).

[9] Earthquake Engineering Research Institute, U. C. (2015). Scenario for a Magnitude 7.0 Earthquake on the Wasatch Fault – Salt Lake City Segment: Hazards and Loss Estimates. Salt Lake City, Utah, at 3 (url: https://dem.utah.gov/wp-content/uploads/sites/18/2015/03/RS1058_EERI_SLC_EQ_Scenario.pdf).

[10] USGS. U.S. Seismic Hazard Maps. (url: https://earthquake.usgs.gov/hazards/hazmaps/); IBC § 1613.

[11] IBC § 1604.

a United States address.[12] The Applied Technology Council seismic map risk calculator indicates that the proposed 4th Avenue Well site is Seismic Class D.[13]

Under Section 1803 of the IBC, a *building official* must require a geotechnical analysis of the risk of seismic shaking and liquefaction for any Class D site.

From the DPU's concept drawings, I estimate that the chemical tank will contain approximately 2,100 gallons of concentrated sodium hypochlorite (3 foot diameter and 10 foot height). During earthquake liquefaction and container failure, the liquid chemical would then flow and mix with ground water that has pooled at the surface.

I am not an engineer; however, based on my review of the documents and concept drawings made public by the DPU, I am informed and believe that the proposed chemical treatment plant structure is not being designed to higher levels of earthquake risk that might be identified by a site-specific seismic risk assessment required in these premises by the International Building Code. To my knowledge, the DPU has not done a site-specific seismic risk analysis.

To my knowledge and upon information and belief, the DPU has not submitted an application for an exception to this requirement pursuant to UAC R309-105-6(2)(b).

Failure to Adequately Address Unauthorized Entry Risk

3) The proposed concept design is insufficiently protected against unauthorized entry as required by Utah Admin. Code R309-540-5(1)(a)(v), which requires that, "the station is protected to prevent vandalism and entrance by animals or unauthorized persons".[14] Statements made by the DPU or its consulting experts readily admit that it is not possible to comply with this requirement.[15] An initial DPU analysis done after the August meeting acknowledged that due to the nature of the proposed site, it was impractical to install security fencing normally required to prevent theft, vandalism or terrorist attacks on the chemical facility:

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[12] Applied Technology Council Hazards by Location Application. Accessed June 3, 2019 (url: https://hazards.atcouncil.org/).

[13] ATC Report dated June 3, 2019, Attachment "A", hereto.

[14] Similarly, 6 C.F.R. Part 27 requires that for certain "high risk" chemical containing facilities, a Department. of Homeland Security ("DHS") security vulnerability assessment may be required. 6 C.F.R. §§ 27.215, 27.230 (performance standards) and 27.240.

[15] Memorandum by B. McIntire to K. Lindquist, Salt Lake City Planning Department dated August 30, 2018, re: Open House Public Comment Responses (hereafter "August 2018 Comments") (url: https://docs.wixstatic.com/ugd/80b28b_0bc4214b1c61450897cfbd5cc5a0e6ee.pdf); Bowen Collins and Associates, circa August 2018, re: Salt Lake City Planning Commission Assessment Memorandum (hereafter the "Bowen First Memorandum") (url: https://docs.wixstatic.com/ugd/80b28b_0e07c5f9e8ff4047a4bd9405ee4d95cf.pdf).

> Typically, culinary well buildings are completely enclosed with fencing to reduce the threat from potential vandalism, theft, and terrorism. The limited space available significantly prevents the ability to properly secure the location (August 2018 Comment Analysis at 4).

The Bowen First Memorandum also recognized the infeasibility of erecting security fencing at the site:

> Fencing to restrict access to the well site is normally recommended to prevent vandalism or other unauthorized access. Due to the location of the well and the minimal existing set-backs, fencing does not appear to be feasible (Bowen Memo. at 3).

To my knowledge and upon information and belief, the DPU has not submitted an application for an exception to this requirement pursuant to UAC R309-105-6(2)(b).

An Economic Hardship Exception is Not Warranted.

Finally, the DPU may in applications for an exception from DDW construction requirements or during the DDW review process may argue economic hardship. Such a claim would be unfounded. Whether a particular public infrastructure improvement is unreasonably expensive depends on its importance to the community and the projected gross and net revenues expected to be received over the lifespan the facility. Net revenues from the current or proposed Well design are not available publically available. But gross revenue data sufficient to make a simple estimate of the economic value of the future value of the Well's gross revenue stream is publicly available.

The June 2018 water rate structure for the DPU[16] recites that residential users are charged at a rate of 748 gallons per "Unit Measure" at a cost of $1.85 per unit. A typical City residential consumers in the Block 2 category are using between 11 and 30 "unit measures" per month. This implies that the mean revenues per gallon of water sold are 0.0025 dollars per gallon[17] or about 400 gallons for one dollar. Assume that the rate of growth in DPU water rates is 2 percent per year and the long-term rate of inflation over 100 years is 3.22%.[18]

The DPU has stated that the 4th Avenue Well Water typically supplies 3 to 7 million gallons of water per day during the summer and dry seasons months.[19] Assume this covers the 5

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[16] DPU. June 2018. Water Rates (url: http://www.slcdocs.com/utilities/PDF%20Files/UtilityRates/WaterrateswebCurrent.pdf).

[17] $1.85 / 748 gallons = 0.0025 dollars per gallon.

[18] 1913-2013 based on CPI (https://inflationdata.com/Inflation/Inflation_Rate/Long_Term_Inflation.asp).

[19] Memorandum by David E. Hansen, Hansen, Allen and Luce, Inc., to B. Stewart, Salt Lake Department of Public Utilities, re: 4th Avenue Well Assessment (hereafter "HAL Report") at 1 (url: https://docs.wixstatic.com/ugd/80b28b_3607f771b2984d63a44ce7a4c3d1c7a9.pdf). (3 to 7 million gallons per day); *see* Semerad, T. April 30, 2019. The fight over pump house pits needs of Salt Lake City's thirsty downtown against a quiet neighborhood in Memory Grove. The Salt Lake Tribune (3 to 7 million gallons per day) (url:

months from June to October (or 150 days) and the mean delivered volume is 5 million gallons per day. Assume the useful life-span of the pump station and chlorination plant is 75 years.

Based on these simplifying assumptions, the present annual estimated revenue stream to the City from the 4th Ave Well has an economic value of $1,875,000 USD per five-month long summer season.[20] (In comparison, the 2017 Annual Report for the DPU recites $72,699,328 in revenues from all of the DPUs water sales.[21]) Over a 75 year life span, the total amount of revenues that the City will collect selling 4th Avenue Well water, not adjusted for 2% compounded growth or discounted for inflation, is $140,625,000.[22] With water rates growing at approximately 2% per year and over 75 years, the total amount collected by the City from the stream of future revenues will be $326,639,265[23] If the $326,639,265 is discounted to present value at a 3.22% long-term annual inflation rate, then the present value of that future income stream is $84,848,491.[24]

The DPU has the revenue stream needed to build a proposed Well and chemical treatment plant that complies with state DDW regulations.

The complex design and engineering challenges presented by the proposed Well have conflicting constraints. If the DPU submits a design that complies with applicable state water quality laws as discussed above, the design will be so massive that it will be plainly incompatible with obtaining a zoning special exception from the City's Historic Landmark Commission. If the applicant proposes a design that is small enough to be compatible with Memory Grove residential pocket historic district, the design will probably not meet state design requirements for public water facilities. Ultimately, these conflicting design objectives are not capable of being resolved and the dilemma weighs in favor of siting the chemical treatment plant elsewhere.

I encourage the Utah DDW to use its administrative powers to direct the DPU to propose and request an exception for a design that consists of a small intermediary transmission pump house at 4th Avenue and North Canyon Road that sends the water for chlorination and fluoridation at a separate chemical treatment plant. City owned land is available within 1,000 feet – not in the direct geologic streambed of City Creek – at which it would be appropriate to locate a separate chemical treatment plant.

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https://www.sltrib.com/news/2019/04/30/residents-mouth-memory/); Stevens, Taylor. June 6, 2019. Pump house fight in Memory Grove neighborhood takes center stage during Salt Lake City budget hearing. The Salt Lake Tribune (url: https://www.sltrib.com/news/politics/2019/06/05/salt-lake-city-budget/).

[20] 5,000,000 gallons per day x 150 days x 0.0025 per gallon. $1.85 per unit / 748 gallons = $0.0025 per gallon in revenues.

[21] DPU. 2018. 2017 DPU Annual Report (url: http://www.slcdocs.com/utilities/PDF%20Files/Annual%20Reports/Annual%20PU%202017.pdf).

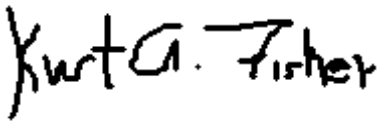
[22] $1,875,000 per year x 75 years.

[23] Excel Formula: -FV(0.02,75,1875000,0,1).

[24] Excel Formula: -PV(0.0322,75,1875000,326639265,1).

Again, I request special notice of any final approvals or orders as outlined above. Please feel free to contact me with any questions that you may have by the means listed above.

Very Truly Yours



Kurt A. Fisher

Addendum

Key Historical Salt Lake City Creek Floods and Northern Utah Cloudburst Flooding Documents, Research and Academic Articles[25]

Excerpts from SLC DPU GRAMA production to K. Fisher, June 13, 2019 (url: http://fisherka.csolutionshosting.net/misc/FourthAveWell/20190617ExcerptsfromDPUProductionre4thAveWell.pdf).

> As a result of the 1983 state-wide floods, the DPU's predecessor spent about $1,000,000 repairing flood damage to roads from North Temple and State Street north to Memory Grove. The City replaced 1,040 feet of 6" inch pipeline excavated and damaged by flood waters between 4th Avenue and Memory Grove, 18 subsurface sewer and water connections in the area were destroyed, and the foundations of the old Brick Tank house north of Memory Grove were undermined.

Nicoli, K. and Lundeen, Z. J., University of Utah. (2016). A case study: geomorphic effects of the 2009 Big Pole fire, Skull Valley, Utah (Vignettes: Key Concepts in Geomorphology). Northfield, Minnesota. (url: http://serc.carleton.edu/47063).

> Recent example of the effects of cloudburst flooding in northern Utah. In a large Skull Valley canyon fire covering about 41,000 acres. Such fires decrease soil permeability by 9 to 100 times. *See also* Craddock, below. During subsequent heavy rains in Skull Valley, large sheet flows occurred and craved 1 meter deep rills in the alluvium. Historically, a similar incident occurred a Dry Creek Canyon. In 1915, there was a large 4 square mile fire in the Canyon that spread over the Salt Lake City Salient southern city-facing hillside. *See* Salt Lake Telegram and Tribune, 1915, below. Woolley records that on July 25, 1916, a Dry Creek Canyon cloudburst sent a 4 to 10 foot wall of water down City Creek and into city, along with mud, boulders and cattle (below, Salt Lake Tribune July 25, 1916).

Wirth, Craig (KUTV News). May 12, 2014. Remembering the flood of '83. KUTV News. At min. 1:35. (url: https://www.abc4.com/wirth/wirth-watching-remembering-the-salt-lake-city-flood-of-83/204262974)

Salt Lake Tribune, and Smart, C. (2011, Apr 29). River on State Street unlikely in 2011, official says. Salt Lake City Tribune. Salt Lake City, Utah. ProQuest No. 864039697. (Retrospective

[25] In reverse chronological order.

article in which Salt Lake Councilperson describes sandbagging efforts to control 1952 flood; available through Proquest (https://www.proquest.com/) or copy on file with this author).

Honker, A. M. (1999). "Been Grazed Almost to Extinction": The Environment, Human Action, and Utah Flooding, 1900-1940. Utah Historical Quarterly, 76(1), 23–47 (url: http://heritage.utah.gov/history/quarterly) (Includes review and photographs of Salt Lake City Creek flooding, in particular, in 1909. Overviews high-snow melt verses cloudburst flooding in northern Utah).

Salt Lake Tribune, June 3, 1983 and July 22, 1983. Reproduced in Salt Tribune. 1983. *Spirit of Survival: Utah Floods of 1983* (Available at Reference Desk, Main Branch, Salt Lake City Public Library and Special Collections, Marriott Library, University of Utah, Call No. F830 .S657).

Boyce, R. R. (1958). A historical geography of Salt Lake City, Utah. Thesis. Masters. Department of Geography, University of Utah at 41 re 1876). (On file at Special Collections, Marriott Library, University of Utah; copy in author's possession).

Salt Lake Tribune. April 30, 1952 (Available through https://go.newspapers.com/, re: floods of 1952).

Woolley, R. R. (1946). Cloudburst Floods in Utah: 1850-1938. Washington, D.C. at 96-120 (url: http://pubs.er.usgs.gov/publication/wsp994)

> Woolley listed numerous cloudbursts floods that have come across the Avenues District and from City Creek and across the proposed Well site and into the downtown: (Woolley 1946). Summer cloudburst floods included: June 13th, 1854 (city streets flooded), September 11th, 1864 (heavy flooding of North Temple from City Creek), August 25th, 1872 (downtown flooded), July 23rd, 1874 (downtown flooded from City Creek), August 1st, 1874 (Lindsey Gardens areas flooded as in 1945), August 8th, 1884 (North Temple flooded from City Creek), July 26th, 1893 (cloudburst flooded basements in city), July 19th, 1912 (1 inch fell in 1 hour filled South Temple with sand and mud from above), July 25th, 1916 (cloudburst sent a 10 foot wall of water into city along with mud, boulders and cattle), July 30th, 1930 (cloudburst over Emigration, Red Butte, and Parley's Canyons washed out highway north of Salt Lake and washed away three homes with damages of 500,000 USD), and August 13th, 1931 (four to 12 inches of water swept through streets and 12 feet of debris washed over road near Beck Hot Springs).

Craddock, G. W. (1945). The Salt Lake City Flood, 1945. Proceedings of the Utah Academy of Sciences, Arts and Letters, 23, 51–61. (On file with the Special Collections, Marriott Library, University of Utah; copy in author's possession).

Salt Lake Telegram, August 20 and 27, 1945 (Available through https://go.newspapers.com/; copy in author's possession).

Utah Flood Commission. (1931). Torrential floods in Northern Utah, 1930. Logan: Agricultural Experiment Station, Utah State Agricultural College. On file at Special Collections, Marriott Library, University of Utah. (url:.http://www.lib.utah.edu).

Salt Lake Telegram. Sept. 24, 1918. Property Damaged by Big Cloudburst. (A cloudburst flood swept down West Capitol Hill and buried properties at 200 West in up to 1 foot of mud.) (url: https://newspapers.lib.utah.edu/ark:/87278/s6d80jz5).

Salt Lake Tribune. July 25, 1916. Cloudburst Kills Cattle in Canyon. (url: https://newspapers.lib.utah.edu/ark:/87278/s6j10wfd)

> "A cloudburst breaking in Dry canyon during the electrical storm of yesterday emerged from the ravine a solid ten-foot wall of rushing water, carrying with it eight head of cattle and rocks weighing from 1000 to 1500 pounds, swirling them along as lightly as feathers. Following the course of the old waterway, the waters rushed through Popperton place, down Second and Third Avenues, turning on Ninth East to the Second South conduit before the force of the flood was spent. In the residence district of Popperton place and the avenues the telephone poles showed that the water mark to have been four feet."

Salt Lake Tribune. August 6, 1915. City's Watershed Suffers from Fire. (url: https://newspapers.lib.utah.edu/ark:/87278/s6tf17rk/14627562)

Salt Lake Telegram. August 5, 1915. Big Damage Caused by Brush Fire in City Creek. (url: https://newspapers.lib.utah.edu/ark:/87278/s6km0kdd/19586313 , re: 4 square mile brush fire in City Creek Canyon that crossed city-side ridgeline).

Salt Lake Telegram, June 19th, 1903. Salt Lake City in Path of Cloudburst, Should It Break in City Creek. (url: https://newspapers.lib.utah.edu/ar/87278/s6ck2gdq)