Honorable Governor Herbert
Utah State Capitol Complex
350 North State Street, Suite 200
PO Box 142220
Salt Lake City, Utah 84114

Honorable President Niederhauser
Utah State Senate
320 State Capitol
PO Box 145115
Salt Lake City, Utah 84114

Honorable Speaker Hughes
Utah House of Representatives
350 North State Street, Suite 350
PO Box 145030
Salt Lake City, Utah 84114

January 10, 2017

Dear Governor Hebert, President Niederhauser, and Speaker Hughes:

We have carefully investigated the claims raised in the letter and accompanying report which the Washington County Water Conservancy District ("the District") sent to you on Sept. 28, 2016 concerning the economic burden of the Lake Powell Pipeline ("LPP"), and found them completely without merit. Nothing in the District's letter changes our opinion that the District's financial model only has the District repaying 28% of Utah taxpayers' costs, nor our opinion that the District would have to dramatically increase water rates and/or impact fees in Washington County in order for state taxpayers to be repaid the LPP costs. We have attached a full analysis but our conclusions can be summarized quite briefly.

The District's strangest claim is that we underestimated "actual" water rates by 430% because we said the current water price per 1000 gallons is $0.45 whereas the St. George average retail price is $2.40. The Washington County Water Conservancy District is, as it surely knows, a water wholesaler, which receives $0.45 per 1000 gallons as we stated. The City of St. George is a water retailer which has nothing to do with the Lake Powell Pipeline, so the financial details of its water sales are completely irrelevant to the LPP. Why the District thinks the financial status of a completely independent governmental body is pertinent to the District's ability to repay the LPP is a mystery.

The District also complains that we assume the LPP will cost what the Utah Board of Water Resources said in 2012 the LPP will cost—a complaint hardly worth addressing, except to note that the LPP will almost surely cost *more* than its 2012 estimate. The

District complains that we called their financial analysis a "model," as if the word we called it mattered; and anyway, the consultant who built it for them called it a "model" as well. Finally, the District feels the fall in water demand which we project is unrealistically large. We did not conduct our analysis based on 'feelings' but on the results of many of studies of water demand, which predict that if water prices really were to go up by 576% then the demand for water really would fall by the amount we specified. The District writes that that estimate "is misplaced given water is an essential human commodity," but it is a water consumption level higher than the one that currently exists in San Francisco, California, a city which supports a vibrant economy.

The detailed analysis follows.

Sincerely,

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Detailed Response to the WCWCD's letter of 9/28/2016

Each item below starts with a quotation from the District's letter. Our response follows.

1. *"The district will repay the costs of the Lake Powell Pipeline, including the "reimbursable preconstruction costs, construction costs, and interest on those costs within the time period specified" in accordance to the terms of the Lake Powell Pipeline Development Act (Utah Code 73-28-403) and will pay operations and maintenance costs, as outlined in Utah Code 73-28-404."*
   The District paid hundreds of thousands of dollars for a financial model that included neither repayment of interest on the State's bonds nor operations and maintenance expenses. Anyone who doubts this is welcome to see for themselves by obtaining the District's model from the Internet, where we have posted it (in its original, uncorrected form) at `http://content.csbs.utah.edu/~lozada/Research/WCWCD%20Model%2011%20November%202013%20Meeting%20%28Working%20Draft%29.xlsx`.

2. *"The professors, in coordination with the Utah Rivers Council, are misrepresenting an interactive worksheet prepared for a 2013 focus group exercise as a 'district model' or 'repayment plan.' "*
   The District claims the repayment model they created through a paid consultant was not a repayment 'model' but instead simply an 'exercise' to educate the local community. The analysis is not dependent on what word is used. We used the word "model" to describe the District's spreadsheet. The District's consultant used exactly the same word in the public presentation at the District headquarters held on Nov. 21, 2013. This meeting of the District's "Community Integrated Resource Planning Advisory Committee" ("CIRPAC") was recorded and can be seen on YouTube. The District's consultant used the word "model" to describe his work at minutes 2:40 and 11:40 of Part 7 of the video (`https://www.youtube.com/watch?v=TwVXUXsrSZI`) and minutes 00:59 and 2:45 of Part 8 of the video (`https://youtu.be/oQUVq70Fs7g`). We suggest you watch these videos for yourself to determine whether the District presented to the community their document as a repayment model.

   Furthermore, when the District's consultant told the public and the news media that the pipeline would cost water users "about $52 per year," the District's spreadsheet was used in exactly the same manner as we have used ours: both are financial models to approximate the pipeline's repayment burden given various assumptions on costs, interest rates, and other data.

3. *"The claim that the district will only pay for '28 percent' of the project cost is the result of misuse of the worksheet."*
   The claim that the district will only pay for "28 percent" of the project cost is the result of the worksheet's omission of interest payments.

4. *The project cost used in the worksheet ($969 million) was the anticipated cost to the district based on the then-current estimate of the Utah Division of Water*

Resources, excluding the portion of costs for Kane County Water Conservancy District.

The repayment problems would not be eliminated with the District's number. Furthermore, our estimates came from the Utah Board of Water Resources' February 2, 2012 *Modified Draft Study Report 10: Socioeconomics and Water Resource Economics*, page 5-3 and 5-6 (excluding the portion of costs for Kane County Water Conservancy District, and adjusted for timing as described in tab "DSWRESR" of our speadsheet). This document obviously existed when the District's worksheet was made in 2013.

5. *The professors' analysis claims Washington County residents currently pay $0.45 per 1,000 gallons of water and that paying for the pipeline would necessitate 'raising water rates by more than 570 percent.' In fact, the average residential water user in St. George (the county's largest population center) currently pays an average of approximately $2.52 per 1,000 gallons of water. Adjusting for a conservative average water cost for all consumers (residential and non-residential) of $2.40 per 1,000 gallons, the professors underestimated actual water rates by approximately 430 percent (see appendix item C)."*

   We underestimated nothing. We used the wholesale price. The District wants to use the retail price. But the District is a wholesaler. It does not get the retail price. The retail price belongs to the retailer, not to the District. So the retail price has nothing to do with the District's ability to repay anything. The District is comparing apples to oranges.

   Either the District actually thinks it can spend money received from water sales by the City of St. George, or it does not. If it does not, then the District is making mistakes analyzed in this letter's Appendix. If it does, that constitutes a disturbing claim that raises major questions about the ability of the District and its consultants to understand that the basic concepts of debt, borrowing and repayment imply that the District cannot spend money that is not theirs, and that the retail price of the water collected by the City of St. George is not available to the District, which is a totally separate agency regardless of the fact that it also happens to be a water supplier. The Comprehensive Annual Financial Report for the City of St. George for the fiscal year 2014 indicates that St. George collected $18 million in revenues through its water sales, but that the costs of its water deliveries were $14 million. If the District is implying that these net revenues are available to the District for its own debt payments, the appropriate response shock and dismay.

6. *Based on the claim that water rates would increase 570 percent, the professors applied a 'law of demand' calculation that assumes water demand will decrease 5 percent for every 10 percent increase in the price (see appendix item C). This formula leads to the insupportable claim that water demand in Washington County would be 8 percent lower than it was in 2010 despite a population increase of more than 250 percent (Governor's Office of Management & Budget, 2012 Baseline Projections). Per capita water use will continue to decrease in the future with*

improved conservation, new technology and a larger/denser population; however, we must be realistic about water use in our planning efforts. The professors project a future water use that has not been achieved to date in any community in the nation."

The assumption that water will decline by 5% for every 10% increase in the water price is based studies of actual water use, including water use in Utah. An exhaustive list of these studies was provided in Appendix H (pages 30–44) of our original report of Fall 2015 (`http://content.csbs.utah.edu/~lozada/Research/2015_LPP_Economic_Analysis.pdf`). The 2014 Audit of Division of Water Resources called attention to the need to relate water and price.

Water use in our analysis is forecast to go down to 53 gallons per capita per day ("GPCD") by 2060 in the "low-cost" scenario (little pumped storage) with half the costs obtained from water rates. In September 2014, GPCD was less than 50 in the California cities of Santa Cruz and San Francisco, and "Australian households use an average of 54 GPCD for both indoor and outdoor uses. . . [having] decreased their water use dramatically in response to a decade of drought[1]." The forecast is not unreasonable, especially in the context of the 576% increase in water rates needed to pay for the pipeline.

7. *"District rates will increase as the costs to deliver, treat and store water increase. The use of the asserted demand price inflation formula is misplaced given water is an essential human commodity."*

   We agree that water is an essential human commodity: however, the many uses to which water is put by humans are not all essential. Washington County's water use in gallons per capita per day is one of the highest in the nation.

The District's final paragraph assures the reader that the District is committed to determining whether or not it can repay the pipeline *after* it spends many million dollars designing the pipeline. It seems that a prudent agent would instead determine what the District could afford *before* spending large sums of money on a design which might be unaffordable. If the District ever decides to engage in prudent planning, it is welcome to use our model, which we have provided to anyone free of charge, as its starting point.

[1] `http://pacinst.org/new-data-show-residential-per-capita-water-use-across-california/`.

Appendix: Wholesale and Retail Demand Curves with Markup Pricing
by Gabriel A. Lozada

We did not consider retail water rates because they are irrelevant: retail water providers will not be repaying the pipeline. Nevertheless, retail water rates are the most substantive part of the District's response and the sole concern of its accompanying document "The Relationship Between Water Cost and Water Prices: A Review and Analysis of Errors Identified in Utah Professors' Analysis of the Lake Powell Pipeline Project," so an in-depth response is warranted.

Refer to p. 31 of the District's accompanying document. The gray line is the wholesale demand for water, which we used in our calculations. The District points out that the retail demand for water is the blue line, which lies above the gray line. For example, as they point out, if the wholesale price of water is \$0.45 per thousand gallons, then the retail price is much more, \$2.40 per thousand gallons according to them. In the diagram, we only considered the \$7.2 million raised at the wholesale level, not the \$38.8 million raised at the retail level. But this was no oversight, or "underestimate," on our part. The District has to pay back the pipeline, and it only gets (in this example) \$7.2 million. The rest of the \$38.8 million does not belong to the District: it belongs to someone else (the water retailer). So the rest of the \$38.8 million is irrelevant to repaying the pipeline. Taking it into account would be a significant overestimate of the amount of money available to the District for repayment.

The difference between \$2.40 and \$0.45 reflects a "markup" of $2.40/0.45 - 1 = 433\%$ between the wholesale price and the retail price. In other words, to get the retail price from the wholesale price, one would multiply \$0.45 by $1 + 433\%$, which is $\$0.45 \times (1 + 4.33) = \$0.45 \times 5.33 = \$2.40$. Conversely, to get the wholesale price from the retail price, one would divide the retail price, \$2.40, by 5.33, getting $2.40/5.33 = 0.45$.

Now consider p. 33 of their document. On that page, the District calculates how to raise an additional \$50.2 M − \$38.8 M = \$11.4 M (or \$11.5 M with rounding). They claim \$50.2 M can be raised along the blue line: at a price of \$4.02 per thousand gallons, 12.4 B gallons of water are sold and \$50.2 M is received by the retailer. True: but how much of that would be received by the District, which is the entity that needs the \$50.2 M? Only \$9.4 M (which is $\$0.75 \times 12.48$). The reason is that if the markup stays at 433%, then the \$4.02 retail price corresponds to a $\$4.02/5.33 = \$0.75$ wholesale price. That is the price per gallon which the District would get—and it is on the gray line (as one can see by inspecting the height of the gray line along the left-hand vertical dashed red line: it is \$0.75). So we are back to where we began: the gray line is relevant. The blue line is a red herring.

The District then implies that even if our wholesale model is correct, the associated retail-level price changes would be more gentle. That is not right either. The District writes (in its letter, not in the accompanying report) that water rates per thousand gallons at the wholesale level are \$0.45 and at the retail level are \$2.52, a markup of approximately 430%. If wholesale water rates have to increase by 576%, as in one of the situations mentioned in our 2015 letter to you, then with a fixed markup the retail water

rates would have to increase by *exactly the same 576%*. This is simply because if

$$\begin{aligned}
\text{old retail price} &= (1 + 430\%) \times \text{old wholesale price}, \qquad \text{and if} \\
\text{new wholesale price} &= 576\% \times \text{old wholesale price}, \qquad \text{then:} \\
\text{new retail price} &= (1 + 430\%) \times \text{new wholesale price} \\
&= (1 + 430\%) \times 576\% \times \text{old wholesale price} \\
&= 576\% \times \text{old retail price}\,.
\end{aligned}$$

Furthermore, with the above figures, prices would rise to $\$0.45 \times (1 + 576\%) = \$3.04$ at the wholesale level and to $\$2.52 \times (1 + 576\%) = \$17.04$ at the retail level, so that in terms of "dollars per gallon" rather than percentages, the required retail price changes are not *less* than the required wholesale price changes but *more* than the required wholesale price changes. We conclude that the net result of the District's letter of September 28 is to strengthen the case we made to you in our previous letters.

In summary, if the wholesale price of water goes up by "x" percent, if the markup stays the same then the retail price of water will also go up by "x" percent. So the water price percentage increases we reported are apply equally to the retail and the wholesale level.

The distinction between wholesale and retail data does raise a potential technical issue which the District did not point out. The section below ends this Appendix by analyzing that technical issue and proving that our original analysis was correct, assuming a fixed markup.

If the markup is *not* fixed, a more complicated analysis would have to be performed. We have not performed this analysis, and neither has the District. The District says nothing about the markup being fixed or not, but if it thinks the markup is not fixed, it should extend our model to cover that case.

Wholesale and Retail Demand Curve Shapes with Markup Pricing

We assumed before, on the basis of strong empirical evidence which we specified in detail in our report of 2015, that

$$Q \propto P^{-1/2}$$

where Q is the quantity of water sold and P is its price (the symbol $\propto$ means "is proportional to"). The following question could be raised: if this relationship holds at the *retail* level, what is the relationship between *wholesale* quantity and price?

Proposition. *If $Q \propto P^{-1/2}$ at the retail level, and retail price is a constant markup over wholesale price, then $Q \propto P^{-1/2}$ at the wholesale level as well.*

Proof. Clearly $Q_{retail} = Q_{wholesale} = Q$. With markup pricing,

$$P_{retail} = (1+m)\, P_{wholesale} \tag{1}$$

where m represents the markup.

One can rewrite the assumption that $Q_{retail} \propto P_{retail}^{-1/2}$ using c as the constant of proportionality:

$$Q_{retail} = c\, P_{retail}^{-1/2}\,.$$

Then

$$\begin{aligned} Q_{wholesale} &= Q_{retail} = c\,P_{retail}^{-1/2} = c\,[(1+m)\,P_{wholesale}]^{-1/2} \\ &= c\,(1+m)^{-1/2} \cdot P_{wholesale}^{-1/2} \\ &= \hat{c}\,P_{wholesale}^{-1/2} \end{aligned}$$

for $\hat{c} = c\,(1+m)^{-1/2}$. ∎

It follows that even though our data is from the wholesale level, it is still true that $Q \propto P^{-1/2}$. The constant of proportionality between the left-hand side and the right-hand side is different in the retail versus the wholesale markets, but since we have data both on $Q_{wholesale}$ and on $P_{wholesale}$, we can (and did) solve for the correct constant of proportionality, called $\hat{c}$ above.