The City of Greeley Water & Sewer Board has signed an agreement with Wingfoot, LLC to acquire credits in a privately owned ground water aquifer on the Terry Ranch near the Wyoming border. Greeley intends to utilize ground water wells to satisfy the drinking water demand for Greeley’s projected future population growth. This is a significant departure from the City’s historical and successful acquisition of high-quality surface water supplies collected, managed, and stored in surface reservoirs. Greeley has historically been first in line to enjoy the Rocky Mountain snowmelt before other downstream cities. These downstream cities to the east have had to drink well water which is lower in quality and higher in hardness and other contaminates such as uranium, arsenic and selenium.

The Terry Ranch underground aquifer project is an example of the current trend called “aquifer storage and recovery” (ASR). The Terry Ranch aquifer is a non-replenishing aquifer and will require treated drinking water from the Bellvue Water Treatment Plant to be pumped into it to create a supply of water to be recovered later when it is needed.

Aquifer storage and recovery (ASR) is part of the solution to the global problem of managing water resources to meet existing and future freshwater demands. However, the metaphoric “ASR bubble” has been burst with the realization that ASR systems are more physically and chemically complex than the general conceptualization.\(^1\)

ASR does not work everywhere. The performance of ASR systems is highly dependent on site-specific hydrogeology. Unlike purely extractive wellfields, successful ASR systems must inject and recover freshwater with minimal changes in water quality. The ASR system performance thus depends on the hydraulics of the storage zone aquifer and confining strata and the interaction of stored water with native groundwater and aquifer rock or sediment.

Interaction of the stored water with the rock sediment is the fatal flaw in the Wingfoot/Terry Ranch Project. The Wingfoot/Terry Ranch aquifer is very likely to contain the same roll front uranium ore bodies characteristic of other areas of the Cheyenne Basin (See Map of Principal Sandstone Hosted Uranium Districts in the Western United States). For example, the area just south of Terry Ranch has been explored, and several minable uranium ore bodies were located. The proposed mining method to extract the uranium from the Powertech Study Area (shown in Exhibit A) near Nunn, Colorado involved pumping oxidizing water into the aquifer, thus dissolving the uranium in the aquifer and extracting the water to recover the uranium solution. In essence, the Powertech uranium mining project is almost identical to the proposed Wingfoot ASR project. The Wingfoot ASR project will involve injecting treated drinking water into the aquifer. The treated drinking water will react with the uranium ore bodies thus dissolving the uranium, and the uranium laden water will be brought to the surface. The uranium and

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other contaminants are removed to some degree and what remains is sent into the Bellvue transmission line and either sent directly to Greeley water customers or is blended in with the treated water from the Poudre River in an attempt to meet the Safe Drinking Water Act maximum contaminant level regulations.

It is neither reasonable nor responsible to expect the water extracted from the aquifer for drinking water purposes at some time in the future, to be the same quality as the water pumped into the Terry Ranch aquifer from the Bellvue Water Treatment Plant (BWTP). Predicting the degradation of stored water quality will be difficult with such a short time (7-months) to perform diligence testing and pilot studies.

The Denver Water Department is looking into ASR but will allocate several years to do the diligence and pilot studies necessary to make a prudent decision about the usability of the water under Denver. The portion of the Denver Basin that they are studying does not appear to have the same uranium issues as the portion of the basin under Terry Ranch. The City of Greeley’s 7-month “diligence “period will at best produce some testing on the existing underground water quality. This extremely short testing period does not allow for determining the long-term effect of pumping treated water from the (BWTP) into the aquifer.

The treated water from the BWTP will typically be supersaturated with dissolved oxygen and will have some chlorine added for disinfection purposes. One must realize that the uranium ore was apparently precipitated under reducing geochemical conditions which were caused by one or more of a variety of reducing agents within the sandstone.2 Uranium is mobile under oxidizing conditions and precipitates under reducing conditions. When treated drinking water is injected into the aquifer, it will ultimately encounter any stable precipitated uranium ore bodies and will alter the oxidation-reduction geochemistry that originally precipitated the uranium in the sandstone. The uranium will be dissolved and begin to migrate. After a period of years, the water extracted from the aquifer will have a much higher concentration of uranium, arsenic and other contaminants than water being tested during the 7-month diligence period. In the long run, the disturbance of the uranium ore bodies may contribute to the failure of this aquifer storage and recovery project.

The aquifer storage and recovery project proposed by Wingfoot LLC at Terry Ranch poses a significant risk of failure due to the probability of uranium ore body presence in the aquifer. The discovery, at a future time, of extremely high uranium concentrations in the water stored by Greeley for future use will expose the City of Greeley to a colossal loss without remedy from Wingfoot LLC. Other parties depending on the aquifer may experience the same type of loss and seek remedy from the City of Greeley for their part in the project.

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Is the City of Greeley willing to take the risk, if it understands what the colossal loss includes?

- Water supply for future growth if the Wingfoot ASR Project fails
- The 10,000 acre-foot conditional decree to enlarge Milton Seaman Reservoir
- Drought protection from an enlarged Milton Seaman Dam
- The opportunity to improve the reliability and operability of the Cache la Poudre System
- Opportunity to acquire water rights or shares other than Wingfoot credits
- Possibility of lawsuits from other parties dependent on the aquifer in its present state
- Enforcement actions from Federal and State regulatory agencies
- Monetary resources (the citizens’ money)
- City of Greeley’s reputation for excellent drinking water quality
- Public health

ASR may seem like the simple solution to the complex problem of providing water to a great and growing city, but it is neither simple nor a solution in this case. The fatal flaw of the Wingfoot/Terry Ranch ASR project should be painfully obvious. The presence of uranium ore bodies in the aquifer make the project highly questionable and riddled with too much risk when the City of Greeley has better alternatives.

LOCATIONS OF PRINCIPAL SANDSTONE HOSTED URANIUM DISTRICTS IN THE WESTERN UNITED STATES
The Terry Ranch study area is located within the Cheyenne River, a sub-basin of the greater Bow River drainage, which is bounded on the west by the Dakota Plateau. As a result of the Dakota Plateau and the Cheyenne River, the river flows in a generally northerly direction.

As a result of uplift of the ancestral Rocky Mountains to the west, the study area of the Cheyenne River is dominated by sediments that are in part non-marine deposits of the Web. The study area is flanked by the Cheyenne River and the Wingfoot-Terry Ranch area. The Wingfoot-Terry Ranch area consists of interbedded sand deposits. These deposits composed of the last two formations exposed in the Terry Ranch Sandstone Formation. The Wingfoot-Terry Ranch area is rich in uranium deposits and is known for its occurrence of uranium in the Terry Ranch Sandstone. The Wingfoot-Terry Ranch area is also known for its occurrence of uranium in the Terry Ranch Sandstone.

NOTE: URANIUM CONCENTRATIONS EXCEEDING FEDERAL REGULATIONS HAVE BEEN FOUND IN THE GROUND WATER AT TERRY RANCH. IT IS HIGHLY LIKELY THAT SIGNIFICANT URANIUM ORE BODIES, SIMILAR TO THOSE FOUND IN THE POWERTECH STUDY AREA EXIST IN THE TERRY RANCH SANDSTONE AQUIFER PROPOSED FOR GREELEY'S DRINKING WATER SUPPLY. DISTURBANCE OF THE URANIUM ORE BODIES BY INJECTION OF WATER TO RECHARGE THE AQUIFER IS LIKELY TO RESULT IN DISSOLVING THE URANIUM ORE AND ELEVATING THE CONCENTRATION OF URANIUM IN THE GROUND WATER TOO HIGH TO FEASIBLY TREAT.