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DRAFT Position Paper, Storage and Management of Program Water
WAM Topic #19
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1. BACKGROUND – Managing and Storing Program Water

This paper addresses the possibilities to store and manage all waters made available by and for the Collaborative Program (Program). For the most part, the water to be stored and managed for this Program is already stored and managed in some fashion. Although it is always possible conditions could change to make more water come into the basin, the only thing under our control is the timing of available water being stored and released. Therefore, we currently have a certain amount of physical storage capacity that might be utilized for this program, and we currently manage the volume of water we reasonably can expect in the future. The difficulties that must be negotiated are timing and pool limitations on physical storage space, congressional authorizations of projects, complex accounting that attempts to minimize negative impacts to water users, basins, states, and Mexico, and meeting the many competing needs on the Rio Grande system.

The existing reservoirs that potentially could store and release for the recovery of the listed species (Rio Grande Silvery Minnow and Southwestern Willow Flycatcher) in the Rio Grande between Cochiti and Elephant Butte include Heron, El Vado, Abiquiu, Cochiti, Jemez Canyon, and of course the groundwater aquifers (not explored here). The reservoirs vary greatly in authorized operations, as much as in their abilities to capture surface-water runoff. Among alternatives, it may be most advantageous to utilize more than one location for Program storage, to provide sufficient storage capacity along with the flexibility to work with locally varying hydrology.

2. EXISTING STORAGE RESERVOIRS
    a. Heron
        i. Description: Heron is a USBR dam & reservoir, constructed as a primary feature of the San Juan-Chama Project. Public Law 87-483 authorized it in 1962 for project water supply storage and construction was completed in June 1971. The Project authorities are the Colorado River Storage Project Act of April 11, 1956 (70 Stat. 105), and the San Juan-Chama Project Act of June 13, 1962 (76 Stat. 96).
            1. Limitation: Section 8(d) reads "the amount of water diverted in the Rio Grande Basin for uses served by the San Juan-Chama project shall be limited in any calendar year to the amount of imported water available to such uses from importation to and storage in the Rio Grande Basin in that year;" (No carryover). Secretary must comply with all applicable provisions of the Colorado River compact, the Upper Colorado River Basin compact, the Boulder Canyon Project Act, the Boulder Canyon Project Adjustment Act, the Colorado River Storage Project Act and the treaty with the United Mexican States.

        Heron is located in a very small watershed, but is designed to store up to 400,000 acre-feet of water imported from the San Juan Basin, and to supply a firm yield allocation to 16 contractors of 96,200 acre-feet per year. It is not authorized to store native water, (although the accounting methods do not allow accurate

monitoring except at the end of each month.) It is characteristically stable in surface elevation, generally only subject to relatively slow fill and drawdown rates.

b. El Vado
    i. Description: El Vado is an MRGCD-constructed dam, operated by USBR primarily for water supply for MRGCD, with Indian water storage and Rio Chama acequia (senior water rights) provisions included. Although not a flood control facility, it is subject to the Flood Control Act of 1948 (Act of June 30, 1948, ch. 771, 62 Stat. 1171), which approved a comprehensive plan for the Rio Grande Basin as set forth in reports prepared by the Chief of Engineers and the Bureau of Reclamation. Completion of the approved plan was authorized by the Flood Control Act of May 17, 1950 (P.L. 516, 81st Cong., 2d session).
        1. Limitation: subarticle (d) states that "At all times when New Mexico shall have accrued debits as defined by the Rio Grande Compact all reservoirs constructed as a part of the project shall be operated solely for flood control except as otherwise required by the Rio Grande Compact, and at all times all project works shall be operated in conformity with the Rio Grande Compact as it is administered by the Rio Grande Compact Commission." It also states that "In the administration of the provisions of this Act all water in the Middle Rio Grande Valley in New Mexico shall be deemed to be useful primarily for domestic, municipal, and irrigation purposes."

    El Vado is authorized to store both native and SJ-C waters, with a total capacity of approximately 186,000 acre-feet. Typical operations include filling during spring runoff, and drawdown during irrigation season, with maintenance needs for keeping water off the regulated spillway gate during the winter freeze (approximately 125,000 acre-feet or less). It provides “run-of-the-river” power generation through operations by Los Alamos County, whenever flows and elevations fit criteria. It is generally understood and accepted that El Vado can fill and drawdown substantially within periods of a year or two.

c. Abiquiu
    i. Description: Abiquiu is a Corps of Engineers dam and reservoir completed in February 1963, under authority of the Flood Control Act of 1948, as a flood and sediment control facility with a flood pool of 502,000 acre-feet and an original sediment reserve pool of 77,039 established in 1963. Public Law 97-140, authorizes Abiquiu to store up to 200,000 acre-feet of SJ-C water within an easement in flood and sediment space. The top of this easement (owned by Albuquerque) is 6220.0 feet (which correlates to the original 200,000 acre-feet based upon sediment accumulation at that time). Public Law 100-522, October 1988, authorizes the Corps to store up to 200,000 acre-feet of native water within the unused space of the SJ-C pool, (in other words makes the same easement space available to native if not occupied by SJ-C.) This SJ-C easement therefore takes up approximately 140,000 acre-feet of the flood pool, and the approximately 43,000 acre-feet of remaining unused sediment pool. As of January 1, 2003, the total remaining allocated storage space (not occupied by sediment) below elevation 6220.0 is 183,099 acre-feet. Of this amount, the City of Albuquerque has contracted rights to store up to 170,900 acre-feet, and other contractors who have agreements with the City to store within the easement can use the remaining space in accordance with an annually updated sedimentation report and reallocation by the Corps. They may store either within the Albuquerque’s

170,900 acre-feet of space, or in addition to it if agreed to by the Corps. Accumulating sediment displaces contractor and (the prospective) native storage; therefore the available easement space decreases over time. The City of Albuquerque's space is the last to be displaced, occurring after all other contractors' space is filled in with sediment. In April 1986, Los Alamos County was issued a license to operate the newly constructed Abiquiu hydroelectric power plant. Abiquiu operates to a channel capacity of 1800 cfs to prevent flood damage on the Rio Chama, in a concerted effort to prevent flows above 3000 cfs at and below the confluence with the Rio Ojo Caliente. Abiquiu retains flood flows under such conditions, and evacuates them either at earliest possible time, or in a prescribed manner as described in PL 86-645: In the case of native water stuck in Abiquiu after July 1 and when Otowi drops below 1500 cfs, the water is held as "carryover" storage, then evacuated after irrigation season. Abiquiu has been used lately through a Conservation Storage Agreement between the Compact States and others, with a Deviation granted by the Corps, and a permit by the State Engineer, to capture and release waters in a beneficial way for endangered species. Also, an emergency drought agreement was enacted in 2003 to exchange relinquished Compact Credit water in Elephant Butte for storage of native flows in Abiquiu (and El Vado) as a special exception from the requirements of Article VII in the Compact (which prohibits such storage under the low Rio Grande Project storage conditions). These agreements demonstrate and exercise potential flexibilities in the operations of Abiquiu, given collaboration between affected parties.

d. Cochiti
    i. Description: Cochiti is a Corps of Engineers dam and reservoir completed in August 1975, under authority of the Flood Control Act of 1960, and Public Law 86-645, as a flood control reservoir with an authorized permanent pool, and a maximum pool capacity of 725,000 acre-feet. Cochiti serves as the primary flood protection structure for the most populous areas of New Mexico, in the middle Rio Grande. Authority was also granted by the 1960 Act for the permanent recreation pool exempted from the Compact and the Middle Rio Grande Project, as long as water to fill and maintain it comes from outside the Rio Grande Basin (SJ-C as per Public Law 88-293, in this case.) The losses are replaced annually with SJ-C water as needed up to 5000 acre-feet, to maintain 1200 surface acres of open water. To maintain this pool, Cochiti typically stores in the range of 50,000 acre-feet, gradually evaporating and seeping down during the calendar year, and being replenished with SJ-C from Heron usually during the following winter. Cochiti captures sediment, and this sediment accumulation is tracked through the years, and displaces water of the permanent pool. Cochiti typically passes all inflow except when holding back flood inflows or refilling the permanent pool, and is operated to keep native waters evacuated from the reservoir, year-round. As the Rio Grande (mainstem) reservoir above Elephant Butte, it directly controls Rio Grande flows into the middle valley. Currently observed channel capacity release from Cochiti is 7000 cfs (at the Albuquerque gage at Central Bridge), with the most critical choke point being at the San Marcial railroad bridge 205 miles downstream (at approximately 4500 cfs capacity.) It must operate in concert with Jemez Canyon (Jemez River tributary below Cochiti) to maintain these flows, therefore sometimes must curtail releases to combine with those from Jemez Canyon for no more than 7000 cfs total at Albuquerque. Cochiti Dam and Lake

are on Pueblo de Cochiti land, obtained through an Easement and Agreement granted in November 1965. The Cochiti and Sili Diversions at the top of the MRGCD are directly below the dam, and Angostura, Isleta, and San Acacia diversion dams are located successively downstream towards Elephant Butte.

e. Jemez Canyon
    i. Description: Jemez Canyon is a Corps of Engineers dam and reservoir completed in October 1953, under authority of the Flood Control Acts of 1948 and 1950, and Public Laws 80-858 and 81-516, as a flood control and sediment retention reservoir. Jemez has a capacity of approximately 100,000 acre-feet, which includes a 73,000 acre-foot flood pool and a remaining sediment reserve pool of approximately 24,000 acre-feet. It serves along with Cochiti as a flood protection structure for the metropolitan and rural areas of the middle Rio Grande. The dam and reservoir are on Santa Ana Pueblo lands. In 1979 NMISC established with the Corps through MOU, a 2000 acre-foot sediment pool, and in 1986 expanded it to a total sediment capacity of 44,000 acre-feet, to be filled and maintained with SJ-C water and eventually displaced by sediment. The MOU expired December 31, 2001, and Jemez waters were gradually released in accordance with the agreement to benefit the silvery minnow. The reason for discontinuing sediment retention and a sediment pool at Jemez (and the MOU) has been to help get sediment back into the Rio Grande to create improved habitat areas. Since the expiration, Jemez has allowed all but excessive flood-threatening inflows to pass through without storage.

3. MAINSTEM STORAGE

The potential to add a mainstem reservoir to help with New Mexico water shortages has been discussed many times in recent history. Recognizing a lack of storage space relative to multi-use demands, the alternative to build another reservoir has received some attention. The "Wagon Wheel Gap" site has often been mentioned as a good location to increase upstream storage and decrease evaporation losses to serve New Mexico's water needs. (However, it is difficult to see how environmental problems often attributed to the building of dams, might champion the building of more dams at other locations?) Authorization and construction of another dam would go well beyond the 10-year period of the Program. Nevertheless, the ability to capitalize and store surplus waters during wet periods for the dry times is an option that merits mention.

4. MANAGING PROGRAM WATER

Much of the impact of adding Program water will be in the administration and management, through decision-making and record-keeping. The statement in the introduction that we already store and release all the water we can reasonably expect is a testimony to this: There's essentially no more water to be had – it's a matter of optimizing our management of what we already have! It would be an omission to focus on getting the ability to physically store water in reservoirs, without considering how that water will be accounted for and moved through the system, and who will do it.

a. Decisions & Operations
    i. Description: Water stored and managed for the Program will be in the mix of all waters and programs when it comes to operational decision-making. The system of storing and releasing all types of water in the Rio Grande is very complex and it will become more so upon the addition of a new designation of water, possibly

in multiple reservoirs. Consequently, sophisticated management and decision techniques tend to require enactment by the people who currently do hands-on operations and accounting. The most obvious choice for the primary Program water manager, USBR, has been the lead decision-maker and accountant on waters supplied from reservoirs for the many demands, made so by their mission and functions within the water community, and their required impartiality between states and local governments. However, drought and ever increasing and competing demands have pulled representatives from other entities into the daily operations process. To ensure balanced decision-making, and to keep all partnering agencies involved in real-time operations, conference calls have been occurring as often as needed for the past several years. These calls would remain a vital part of operations, and Program water would join the other special purposes considered in the calls. It may be the best option to make an entity such as NMISC the steward of the Program water, and in consultation with USBR and others, have it stored and released in a carefully administered fashion.

b. Accounting System
    i. Description: The implementation of a new storage/management system will necessarily include accounting methods to track Program water, along with all other designations of water. The accounting will consider what water type(s) are included, and how to distribute losses in an equitable manner. There are several categories of accounting associated with the additional storage of Program water: Physical-reservoir, San Juan-Chama, Rio Grande Compact, and a new method for tracking the Program water are all part of the total accounting needed. The first three are in place, but are affected by Program water, therefore are subject to survey for equity. The last is probably not too costly to implement, but still must be developed and put into practice.
c. Delivery Assurance
    i. Description: A key issue of managing Program water is the fairly apportioned and timely delivery of the water. With so many competing interests and organizations with hands-on the transport of and access to water, the ubiquitous measuring error, and the highly variable and uncertain hydrologic conditions affecting transport, it is not trivial to accurately deliver water to demand points. A system of monitoring and accounting is needed to provide reasonable accuracy and assurance of the delivery of Program waters as they move with waters for other purposes, with an appropriate allowance for sharing the transport/loss and gaging uncertainties. A significant amount of uncertainty is inherent in delivering, measuring, and accounting for water, and it must be accepted that accounting numbers will not reflect exact physical proportions of water.
d. End-Of-Year Reporting
    i. Description: As an extension of the accounting system, the management of Program water will require a system of reporting to stakeholders, the public, and the Compact Commission. This necessary reporting will require development and inclusion into existing accounting reports for other waters.

5. ALTERNATIVES

This paper focuses on determining the storage and management actions suggested under the Water Acquisition Management (WAM) Committee's charge. How the water is made available is covered in other papers. The method of acquiring water however does have physical and locational

implications on storage and release, therefore, cannot be completely isolated. For example, if a sufficient volume of water cannot be physically captured at a site, and exchanges are not allowed, then specifying a storage intention there is unrealistic. The current assumed amount needed for the Program is 50,000 acre-feet, although this is very subjective, and up for recommendation by another paper.

What we are attempting to do is point out options that have the most promise of success. Due to the political and legal nature of any actions, and the difficulty in reassuring every one of the technical and accounting impacts associated with any action, what appears to be the common sense choice of storage and management, may not work out to be the best option. For example, if Cochiti appeared to be the best option, but was determined untouchable due to issues with Pueblo de Cochiti and the other Pueblos, then another reservoir might become the best option. Any change to operations of any of the reservoirs would have some impact to Rio Grande Compact deliveries, and would require offset accounting and reporting, accordingly. Also, increased storage at any reservoir will incrementally increase losses, and these additional losses should be borne by Program water.

1. Alternative No. 1: HERON STORAGE: Capture all inflowing native water in Heron and maintain a Program pool. Heron averages about 15,000 acre-feet of native water per year, which is believed well short of sustained Program needs, so it would require further supplemental water, probably in the amount of 35,000 acre-feet, which should be obtained and stored elsewhere, (unless this amount can be leased SJ-C). Heron can have years like 2002 where the native inflow totaled just 1724 acre-feet, so reserve storage would be needed for drought. In preparation for the program releases to begin, several years' supply should be stored, ideally. This amount would ensure at least 1-year full supply.
    a. Problems:
        i. Heron's legislated authorization needs to be changed.
        ii. Heron's native watershed is very small, yielding only 15,000 acre-feet per year on average. (SJ-C diversions provide by far the most inflows.)
        iii. If Heron should be capable of filling with SJ-C diversions, the stored Program water will require evacuation to make room. This is necessary to avoid impact to the SJ-C project by Program water.
        iv. Heron almost certainly will require assistance from other reservoirs to provide a sustainable amount of Program water.
        v. 5-cfs leaks continually: This would probably need to become SJ-C delivery to contractors to avoid lost native storage. The losses associated with premature contractor deliveries to downstream storage should be borne by Program water.
        vi. Heron has release restrictions for public safety when covered in ice.
        vii. Heron's (sophisticated) accounting methods will need reworking, and/or some method of accounting of Program water will be needed.
    b. Benefits:
        i. The lowest possible losses of Program water will occur.
        ii. It has the most authorized water supply space of the five reservoirs.
        iii. Heron can make releases more sporadically and without channel capacity concerns due to a lack of flooding threats or minimum flow deficiencies between it and El Vado.
        iv. Heron will utilize an updated accounting method allowing native storage, and hopefully including daily resolution of losses, instead of monthly.

v. Existing downstream supply reservoirs will receive some operational relief from Heron's new, more flexible operation.

2. Alternative No. 2: EL VADO STORAGE: El Vado currently has the best authorization and flexibility to store Program water, being able to do it now without any permitting. It benefits from most of the Rio Chama native flow as seen coming in at La Puente streamgage and from Heron. Essentially all SJ-C is bypassed or stored in El Vado.
    a. Problems:
        i. Approval by MRGCD, and physically available space are required to store.
        ii. El Vado is the storage reservoir for Prior & Paramount waters to supplement native flows in times of shortage. These highest priority rights cannot be jeopardized by other storage needs.
        iii. There is no access to mainstem Rio Grande flows. Accounting exchanges would be needed if mainstem flow would effectively be captured.
        iv. El Vado needs to fill if possible each spring runoff to maximize irrigation supply, and MRGCD cannot afford to relinquish any space during this time.
        v. El Vado is a couple of water-flow days above the habitat areas.
        vi. There are special maintenance needs for keeping storage levels down below spillway gate crest or running anti-ice bubblers during freezing times.
        vii. El Vado attempts to provide "Wild and Scenic" reach flows and seasonal rafting flows, to benefit wildlife and recreation, and attempts to maintain minimum fishery flows year-round.
    b. Benefits:
        i. El Vado is currently operated to store Rio Grande water as well as SJ-C water.
        ii. There are lots of opportunities to capture both types of water: SJ-C and RG.
        iii. El Vado has low loss rates compared to downstream reservoirs.
        iv. Being high in the system, it has the potential to benefit the most needs and interests through carefully managed releases.
3. Alternative No. 3: ABIQUIU STORAGE: Abiquiu bypasses on average, approximately 1/3 of the native yield of the Rio Grande system in New Mexico, and all of the SJ-C (not lost or stored above Abiquiu) passes through or stops there. It therefore has the 2nd best location (behind Cochiti) of the five existing storage reservoirs, for the purposes of capturing water for Program use. The easement to store SJ-C is limited to no greater than the elevation 6220.0 feet, and lies mostly within the flood pool, and partially within the sediment reserve pool. Above current sediment storage, this translates to approximately 183,000 acre-feet of space that is contracted out to the City of Albuquerque in the amount of 170,900, and subcontracted to other SJ-C contractors for the remainder. As in other alternatives, a multiple-year supply is assumed to be a necessity to ensure water for sustainability of the Program deliveries.
    a. Problems:
        i. Arrangements with Albuquerque and others, and physically available space would be required to store.
        ii. A permit from the State Engineer is needed to store native waters.
        iii. A permanent Corps re-regulation of Abiquiu's operations would be required.
        iv. There is no access to mainstem Rio Grande flows. Accounting exchanges would be needed if mainstem flow would effectively be captured.
        v. Program waters, like SJ-C contractor waters, would require evacuation in the event of flood operations, and Program waters would be first out.
        vi. Enhanced accounting would be required for Abiquiu operations.
        vii. Abiquiu is a couple of water-flow days above the habitat areas.

b. Benefits:
    i. Abiquiu is currently authorized to store Rio Grande water.
    ii. On the long-term, Albuquerque will not be able to keep their SJ-C pool full, so there should be space for Program water.
    iii. There are lots of opportunities to capture both types of water: SJ-C and RG.
    iv. Abiquiu has reasonably low loss rates compared to downstream reservoirs.
    v. Abiquiu has proven to be the most practical and flexible option for additional storage for the Conservation and Emergency Drought agreements of 2001 and 2003, respectively.

4. Alternative No. 4: COCHITI STORAGE: As with all other alternatives, multiple year's waters should be stored for use by the Program, and special accounting enhancements are needed.
    a. Problems:
        i. Pueblo de Cochiti would need to approve any alternate operations.
        ii. Cochiti is not authorized to store any water except floodwaters (during and after events), and a permanent "recreation pool", which was filled by and is replenished by supplemental SJ-C water.
        iii. It has a wetlands/habitat area at the headwaters, which could be harmed by increased storage and periodic filling and drawdown.
        iv. Loss rates are higher than reservoirs higher in the system.
    b. Benefits:
        i. Cochiti is located at the top of the habitat, which is most convenient for time-critical operations.
        ii. It is the only mainstem reservoir of the five, managing waters from both the Rio Grande and Rio Chama – It has the best capture potential.
        iii. Cochiti has the most available conservation space.
        iv. It is not currently involved in supply operations (except that waters for all downstream demands pass through), therefore adds completely new storage space to the system.
5. Alternative No. 5: JEMEZ CANYON STORAGE: Again, multiple year's waters should be stored for use by the Program, and special accounting enhancements are needed. Jemez Canyon is not storing water except excessive flood inflows since the sediment pool agreement expired on December 31, 2000.
    a. Problems:
        i. Santa Ana Pueblo would need to approve any new operations and storage.
        ii. Jemez Canyon is not authorized to store any water except floodwaters (during events and post-event evacuations), and a permanent "sediment reserve pool", the remaining space of which was filled by and replenished by supplemental SJ-C water.
        iii. The agreement with NMISC to store in the sediment reserve pool has expired, and is not intended for renewal.
        iv. Jemez Canyon would require OSE permitting to store native waters.
        v. It would require re-regulation approval by the Corps.
        vi. It has a very limited ability to capture and store water, having a reduced watershed.
        vii. Available (sediment reserve pool) space is currently approximately 24,400 acre-feet. Any more would intrude into the flood pool.
        viii. The inflows, although intermittent, are relied upon to be bypassed to assist Cochiti outflows in meeting downstream flow demands.

ix. It was determined Jemez Canyon needs to bypass flows to supply sediment to the middle Rio Grande.
x. Loss rates are higher than reservoirs higher in the system.

b. Benefits:
i. Jemez Canyon releases join the Rio Grande within the habitat, which is most convenient for time-critical operations.
ii. It is the only reservoir completely unused and physically available to store.
iii. Storing water would provide some wildlife and recreational benefits.

6. FURTHER ALTERNATIVES: COMBINATIONS OF RESERVOIRS
7. RECOMMENDATIONS