

## Topics to address at October 3, 2017 NMCAPE Meeting

I thought I'd start with offering some of my perspectives. When I get to the Engineering piece of this talk, I'd really like to turn this into more of a discussion than a monologue. First, from someone looking at this process from the outside, I want to say that I admire the efforts and dedication from all parties, whether opposed or for a Unit on the Gila. This River is near and dear to many people, for many reasons. There's never enough money for all the worthy water projects in the area. And the AWSA doesn't make it easy to build a Unit. There is no doubt that creating water projects from scratch is challenging and will require incredible effort.

I think it's important to remember some key points associated with this potential unit project and decision. First, this is an opportunity for New Mexico. The State has been given funding opportunities for diversion and non-diversion projects. The AWSA provides the State with an opportunity to obtain additional water. This decision process has been difficult; the benefit-cost ratio from previous studies illustrate the challenges associated with diversion. Concepts have morphed from extensive and expensive regional water systems to an achievable and affordable agricultural project. While not always smooth and comfortable, the process has done what it needed to do, that is focus in on a project within the funding confines of the AWSA and provide benefits to the area.

While there will never be agreement among all parties, it's important to make the best decision possible at this time. The effects of this decision will continue to ripple down for years, affecting things like operation and maintenance costs, the environment, regional water needs, and agricultural and irrigation facilities. So it's important to take the time necessary to work this out at this late stage, even if it requires additional time.

The over-riding point I want to make is that while there is the appearance that an ag project in the Cliff-Gila valley will benefit few, the actual project encompasses much more than that. New Mexico would begin to be able to utilize the water they are entitled to. This may be the first step toward something that could look entirely different 50 or 100 years from now, depending on how water needs evolve in the future. If this first step is taken, it would secure and utilize the AWSA water and initiate the CUFA, which is absolutely essential since this is one piece that has the potential to expire someday if not launched. A long-range view should be considered, with the question being, what is the best thing for New Mexico decades from now, not necessarily tomorrow.

Now I'd like to shift to engineering and potential project components.

1. As you all know, the decision on a project is entirely the Entity's; I'm here to assist with technical information to help with the decision process.
2. AECOM's work up to this point has provided a lot of necessary and critical information. However, there are concerns being raised regarding the total cost of alternatives, whether there are simpler, less O&M- and pumping-intensive alternatives available, and about storage space and recovery effectiveness of the ASR concept. Specifically, people have

inquired about more straightforward gravity-flow alternatives with surface storage. To that end, I'd like to chase out some additional information Reclamation has regarding gravity alternatives, and provide some general thoughts on non-pumping alternatives.

3. General gravity-flow overview, advantages, disadvantages
  - a. Advantages
    - i. Little or no electrical power costs
    - ii. There's a simplicity when compared with irrigation systems requiring lifting water to storage which involve operating and maintaining pumping plants, electrical systems. Also additional skilled labor is required which translates to more costs.
    - iii. Irrigators in the area are familiar with gravity flow systems, been irrigating this way for many decades.
  - b. Disadvantages
    - i. Limited to achievable elevations for storage.
4. Where water could be stored in a purely gravity-flow system
  - a. On-farm storage ponds – Storage volumes, lining, cost per acre, expandable, can build gravity-flow project using only the \$34 M. This concept has been around GBIC floted it in their Tiier 2 proosal back 2013. Reclamtion evaluated the conept in our 2014 Appraisal Level Analysis. We like the concept; gravity-flow conveyance, expandable, gravity-flow discharge. We looked at lined ponds for direct delivery and discussed unlined ponds that could be used for recharge and recovery, essentially ASR. AECOM's on-farm storage ponds are all unlined and used for ASR. A combination of lined and unlined ponds is possible. The interesting thing about on-farm ponds is overall storage can be easily added later. A project like this can be constructed using only the \$344 million construction dollars. And that includes a new diversion, conveyance, and storage. (Lining @ \$2.40/sf = \$104,000. Pond construction @ \$200,000/ac for 15-foot deep hydraulic depth. Total cost of \$300,000/ac for 15 ac-ft of storage)
  - b. Side-canyon dams – Storage volumes from our May 30, 2017 report, cost of dams, cost of lining (\$3.15/sf),
5. Diversions
  - a. Typical Gated Diversion – Simplified operation
  - b. Obermeyer Gates – Concerns about mechanical O&M
  - c. Coanda – Cost and maintenance concerns replacing screens every 3 years. And lose about 6 feet of elevation, which is critical for side-canyon storage alternatives.
6. Conveyance – Existing alignments good for on-farm storage ponds, probably need improvements for increased ditch capacity. New alignments required to deliver to side-channel reservoirs.

Diversions Near Upper Gila Diversion Alternatives  
New Mexico Unit of AWSA  
Appraisal Level Analysis  
Bureau of Reclamation, Phoenix Area Office  
May 30, 2017

- I. General - Possible diversion points along the upper Gila River were evaluated, along with associated gravity flow conveyance alignments, and storage reservoir volumes. All work was performed at the appraisal level; no site work or on-site investigations were performed. Appraisal level cost estimates were developed. Land owners were not contacted regarding any component of this project. Average water yield from the Gila River watershed has been estimated by others, and was not included in this scope of work.

The figure included with this package shows conveyance and storage alternatives associated with each diversion location. The spreadsheet provides additional numerical data and costs related to the alternatives.

- II. Diversions – Two possible diversion locations were studied. Diversion 5 is located approximately two and one-half miles downstream of the Upper Gila gaging station, just below the confluence of the Gila River and Mogollon Creek. Diversion 6 is located three miles downstream of the gaging station near the existing Upper Gila Diversion. Both diversion locations are off National Forest and Wilderness.

Diversions were assumed to be concrete structures, roughly 500 feet in length. Steel mechanical gates would control flows at the canal intake. The remaining floodplain width not spanned by the concrete crest would have slurry walls and soil embankments to direct stream flows over the concrete section and prevent bypassing of the structure from lateral erosion and movement of the stream.

For each site, the invert of the canal intake at the diversion was assumed to be 6 feet higher than the existing stream thalweg.

- III. Conveyance Channels – For the purposes of this analysis and cost estimates, conveyances were assumed to be open channel, lined concrete canals. The canals slope at a typical industry standard of 0.0003. Cost estimates were prepared for channel capacities of both 175 cfs and 350 cfs.

Optimization of conveyance channels may eventually include siphons or overchutes at cross drainages, tunnels, or slope changes to reduce costs. However, these items were not considered at this time since the potential cost savings are within the margin of error at appraisal level.

Both diversions locations have sections of conveyance channels that pass through National Forest, as does the existing Fort West Ditch.

- IV. Storage Reservoirs – Storage reservoir capacities are limited by the conveyance channel outlet elevation into the reservoirs. The storage capacities shown on the figures.

For cost estimating purposes, the storage reservoir dams are assumed to be earth-fill embankments with concrete lined spillways and low level river outlet works. Reservoir lining is not included in the cost estimates.

All storage reservoirs are outside Wilderness and National Forest.

- V. Cost Estimates – January 2017 costs were used for this estimate. Costs estimates are at appraisal level, which in this case means existing information was utilized, and no field work, site visits, or site investigations were performed. Contingencies for Design and Construction of 17% and 25%, respectively, were used. Non-contract costs for design, investigations, contracting, construction management, and close-out were estimated to be 25%.

- VI. Conclusions

A gravity flow diversion, conveyance, and storage project downstream of Mogollon Creek is physically achievable. But, additional analysis is necessary to determine if the storage volumes satisfy the CAP Entity's project requirements. And further field investigations would be needed to ensure a thorough understanding of project-wide engineering challenges and costs.

Land ownership information and field and geologic investigations are the most significant unknowns associated with this concept.

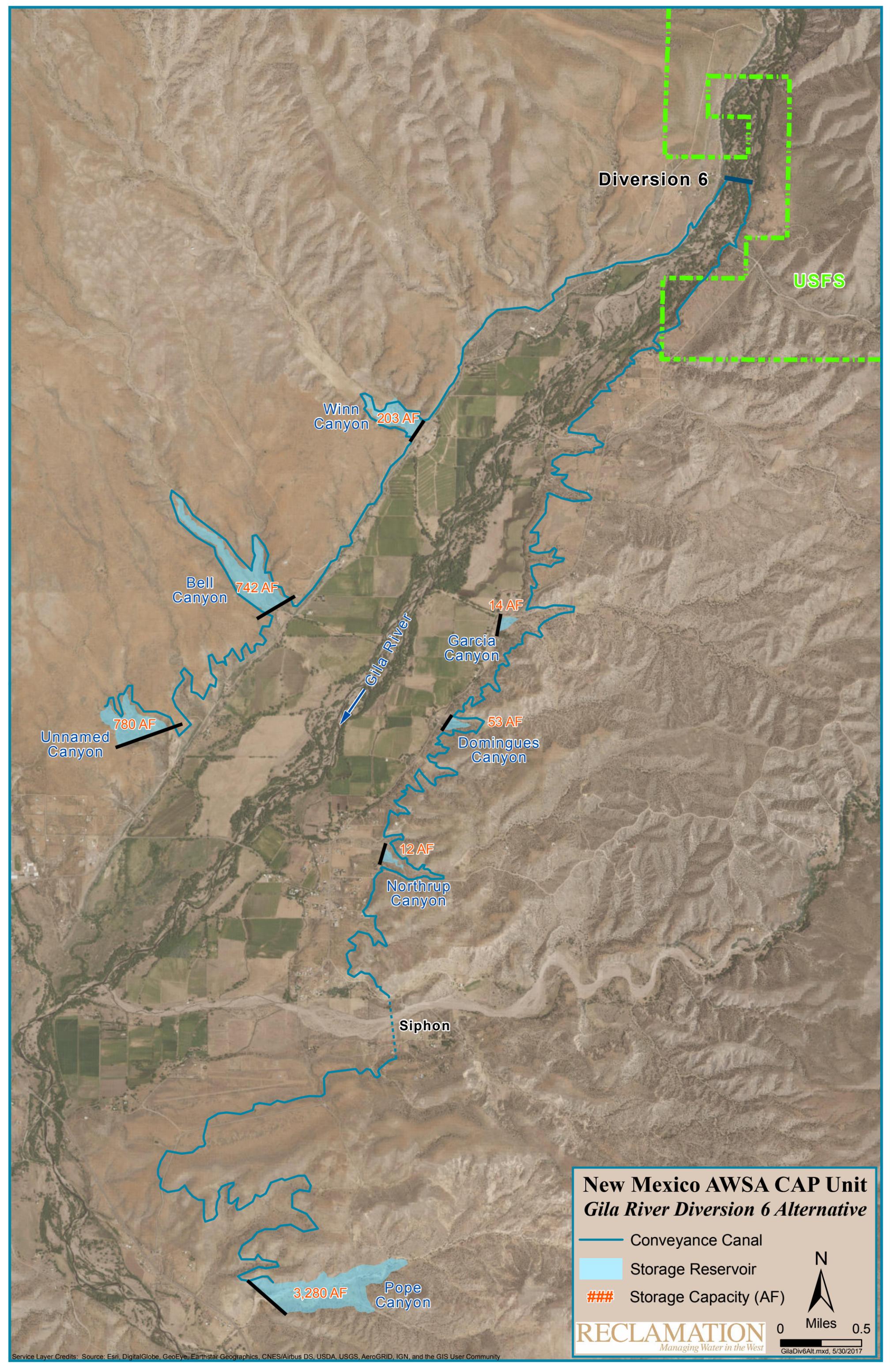
New Mexico Unit of AWSA  
 Diversions Near Existing Upper Gila Diversion  
 May 30, 2017  
 Bureau of Reclamation, Phoenix Area Office, Arizona

Diversion Point Canal Invert Elevation (6 feet above river thalweg)*		
Diversion Point	Canal Intake Elevation (Ft)	Location (Approx)
5	4620	33 02 15.36N, 108 32 00.41W
6	4610	33 01 46.04N, 108 32 04.58W

Diversions Near Existing Upper Gila Diversion - All Alternatives incorporate gravity fed conveyances

Storage Reservoir Site	Diversion Point	Canal Length (FT)	Canal Elevation Loss (FT)	Canal Outlet Elevation (FT)	Top of Res Storage Elevation (FT)**	Dam Crest Elevation (FT)***	Reservoir Thalweg Elev (FT)	Top of Res Sediment Elevation (FT)	Reservoir Storage Capacity (Cu Yd)	Reservoir Storage Capacity (AC-FT)	Diversion Structure Cost	Conveyance Cost (175 CFS)	Conveyance Cost (350 CFS)	Storage Dam Cost****	Total Cost (with 175 CFS Canal)*****	Total Cost (with 350 CFS Canal)*****
Maldonado Canyon	5	16217	5	4615	4587	4600	4578	4588	0	0	\$9,584,000	\$5,352,000	\$6,649,000	N/A	\$14,936,000	\$16,233,000
	6	13217	4	4606	4655	4668		10	0	0	\$11,340,000	\$4,362,000	\$5,419,000	N/A	\$15,702,000	\$16,759,000
Guerrero Canyon	5	20321	6	4614	4614	4627	4619	4629	0	0	\$9,584,000	\$6,706,000	\$8,332,000	N/A	\$16,290,000	\$17,916,000
	6	17321	5	4605	4655	4668		10	0	0	\$11,340,000	\$5,716,000	\$7,102,000	N/A	\$17,056,000	\$18,442,000
Garcia Canyon	5	30797	9	4611	4611	4624	4577	4587	407,762	253	\$9,584,000	\$10,164,000	\$12,849,800	\$12,624,360	\$32,372,360	\$35,058,160
	6	27797	8	4602	4587	4600	4573	4583	22,371	14	\$11,340,000	\$9,174,000	\$11,397,000	\$6,555,950	\$27,069,950	\$29,292,950
Domingues Canyon	5	40646	12	4608	4608	4621	4562	4572	175,283	109	\$9,584,000	\$13,414,000	\$16,665,000	\$12,389,220	\$35,387,220	\$38,638,220
	6	31065	9	4601	4587	4600	4549	4559	85,615	53	\$11,340,000	\$10,252,000	\$12,737,000	\$7,949,070	\$29,541,070	\$32,026,070
Northrup Canyon	5	54699	16	4604	4604	4617	4573	4583	259,856	161	\$9,584,000	\$18,051,000	\$22,427,000	\$10,468,310	\$38,103,310	\$42,479,310
	6	42402	13	4597	4582	4595	4568	4578	18,917	12	\$11,340,000	\$13,993,000	\$17,385,000	\$6,410,700	\$31,743,700	\$35,135,700
Pope Canyon	5	97820	34	4586	4586	4599	4496	4506	6,738,747	4177	\$9,584,000	\$32,281,000	\$41,152,060	\$40,430,090	\$82,295,090	\$91,166,150
	6	94820	33	4577	4577	4590	4498	4508	5,292,467	3280	\$11,340,000	\$31,291,000	\$38,877,000	\$36,028,860	\$78,659,860	\$86,245,860
Winn Canyon	5	18177	5	4615	4615	4628	4583	4593	789,096	489	\$9,584,000	\$5,999,000	\$7,453,000	\$10,703,380	\$26,286,380	\$27,740,380
	6	15177	5	4605	4605	4618	4583	4593	328,018	203	\$11,340,000	\$5,009,000	\$6,223,000	\$8,354,980	\$24,703,980	\$25,917,980
Bell Canyon	5	31143	9	4611	4611	4624	4561	4571	2,203,026	1366	\$9,584,000	\$10,278,000	\$12,769,000	\$29,677,120	\$49,539,120	\$52,030,120
	6	28143	8	4602	4602	4615	4558	4568	1,197,787	742	\$11,340,000	\$9,288,000	\$11,539,000	\$20,038,680	\$40,666,680	\$42,917,680
Unnamed Canyon	5	55808	17	4603	4595	4608	4517	4527	1,254,385	778	\$9,584,000	\$18,417,000	\$22,882,000	\$48,569,950	\$76,570,950	\$81,035,950
	6	52808	16	4595	4595	4608	4517	4527	1,254,385	778	\$11,340,000	\$17,427,000	\$21,652,000	\$48,569,950	\$77,336,950	\$81,561,950

\*Assume the invert elevation of the conveyance canal intake is 6 feet higher than the river thalweg.  
 \*\*Canal outlet dumps water into canyon offshoots which flow to main storage canyon  
 \*\*\*Dam crest elev = canal outlet invert elev + 13 ft to account for freeboard and spillway flows  
 \*\*\*\*Does not include cost of lining reservoir  
 \*\*\*\*\*Cost estimates are in January 2017 dollars



Diversion 6

USFS

Winn Canyon 203 AF

Bell Canyon 742 AF

Unnamed Canyon 780 AF

Gila River

14 AF

Garcia Canyon

53 AF

Domingues Canyon

12 AF

Northrup Canyon

Siphon

3,280 AF Pope Canyon

**New Mexico AWSA CAP Unit  
Gila River Diversion 6 Alternative**

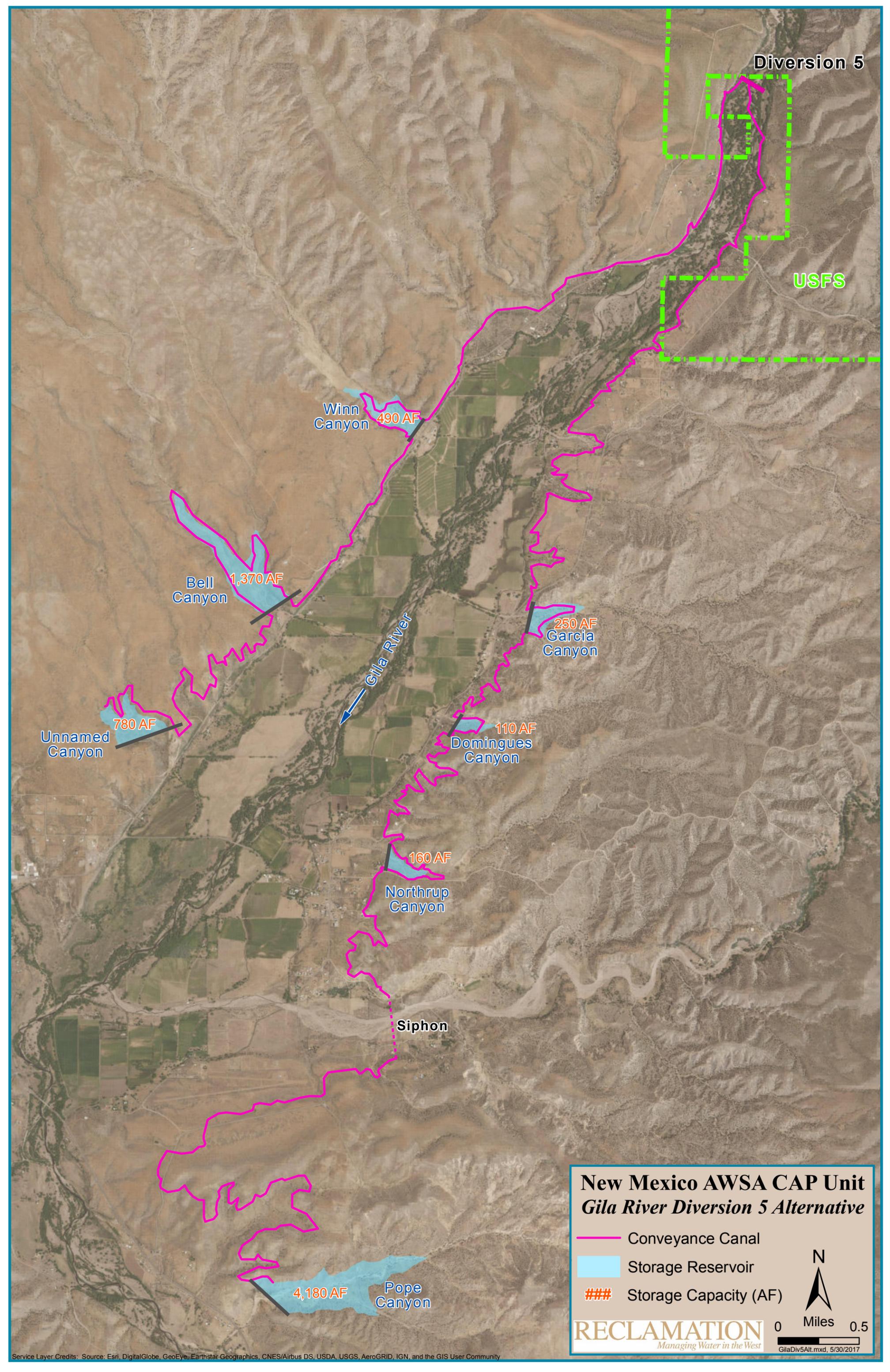
-  Conveyance Canal
-  Storage Reservoir
-  Storage Capacity (AF)



0 Miles 0.5

**RECLAMATION**  
Managing Water in the West

GilaDiv6Alt.mxd, 5/30/2017



Diversion 5

USFS

Winn Canyon 490 AF

Bell Canyon 1,370 AF

Unnamed Canyon 780 AF

250 AF Garcia Canyon

110 AF Domingues Canyon

160 AF Northrup Canyon

Siphon

4,180 AF Pope Canyon

Gila River

**New Mexico AWSA CAP Unit  
Gila River Diversion 5 Alternative**

- Conveyance Canal
- Storage Reservoir
- ### Storage Capacity (AF)



0 Miles 0.5

**RECLAMATION**  
Managing Water in the West

GilaDiv5Alt.mxd, 5/30/2017