TIER-1 APPLICATION TO THE NEW MEXICO INTERSTATE STREAM COMMISSION FOR NEW MEXICO UNIT OR WATER UTILIZATION ALTERNATIVE UNDER THE ARIZONA WATER SETTLEMENTS ACT

APPLICANT INFORMATION (PRINT OR **DATE: July 14, 2011**

1. Legal Name: Allyson Siwik	2. Organization: Gila Conservation Coalition
3. Address (street, city, county, state, and zip code): 305A North Cooper St. Silver City, NM 88061	4. Name, email, and phone number of contract person: Allyson Siwik 575.538.8078 info@gilaconservation.org
5. TYPE OF APPLICATION (check one): [X] Final [ ] Preliminary for review [ ] Revised	6. TYPE OF APPLICANT (CHECK BOX): [ ] local governments or municipalities [ ] soil and water conservation districts, irrigation districts or commissions, acequias, or other political subdivision of the State of New Mexico [ ] institutions of higher education or a consortium of such institutions [X] non-profit organizations or associations [ ] private individual/s [ ] federal agency (ies) [ ] Other (specify)
7. BRIEF PROJECT DESCRIPTION: Agricultural Conservation to Reduce Net Depletions to Groundwater Project to be administered by the Water Trust Board. SWNM irrigators to apply to WTB for funding of agriculture water efficiency projects.	
8. AREAS AFFECTED (describe by county, municipality, township, etc. as applicable): Luna County Hidalgo County Grant County Catron County	

9. TOTAL FUNDING REQUESTED (in $1,000):				
2012: $1.34M	2013: $1.34M	2014: $1.34M	2015: $1.34M	2016: $1.34M
2017: $1.34M	2018: $1.34M	2019: $1.34M	2020: $1.34M	2021: $1.34M

10a. **TO THE BEST OF MY KNOWLEDGE AND BELIEF, ALL DATA IN THIS APPLICATION ARE TRUE AND CORRECT, THE DOCUMENT HAS BEEN DULY AUTHORIZED BY THE GOVERNI9NG BODY OF THE APPLICANT AND THE APPLICANT WILL COMPLY WITH THE ATTACHED REQUIREMENTS AND ASSURANCES IF THE PROPOSAL IS ACCEPTED.**

10b. TYPED OR PRINTED NAME OF AUTHORIZED REPRESENTATIVE:	11. TITLE:	12. PHONE NUMBER:
Allyson Siwik	Executive Director	575.538.8078

13. SIGNATURE:	DATE:
Allyson S. Siwik	7/13/11

14. Evaluation criteria. Comprehensive responses to criteria A through D should be supported where possible by the best available science and scientific data, studies, models, and, where applicable, cite state, regional, or other water plans. Where such data and information is not available, applications should include best estimates and describe how such information would be obtained. Applications that do not include the requested information will not satisfy Tier-1 standards and, therefore, will not be eligible for Tier-2 consideration. Use Form 14a if needed.

A. State whether the proposal is for the "New Mexico Unit," a "water utilization alternative," or both.

This project is for a **WATER UTILIZATION ALTERNATIVE** that proposes to implement drip irrigation, Low Energy Precision Application (LEPA), and/or other water conserving techniques in Luna, Hidalgo, Grant and Catron counties on farms where appropriate.

Irrigated agriculture is the single largest component of water demand in the Southwest Water Planning Region, accounting for 87% percent of total withdrawals and 76% of total depletions for the region in 2005.[1] Due to the significant amount of flood irrigation in southwestern New Mexico, great potential exists to reduce agricultural water consumption through the installation of water-efficient technologies.[2] Drip, or "micro," irrigation uses polyethylene tubing or tape to deliver small amounts of water directly to the plant root zone. Drip irrigation has a water-use efficiency of 80-95 percent, compared to 40-50 percent for flood irrigation, resulting in an estimated water savings of 50 percent.[3] Other benefits of drip irrigation include improved yields, lower chemical costs, lower fertilizer costs, and lower seed costs.[4] The costs for design, materials, and installation of drip irrigation range from $1,000 to $2,000 per acre; the higher end of the cost range typically involves burying the tubing. The latter sub-surface systems have an estimated lifetime of 10 years.[5]

On farms where drip irrigation is inappropriate or too expensive, Low Energy Precision Application (LEPA) could provide improved irrigation application efficiencies of 95% with a total water savings of 37% when used in conjunction with furrow dike systems.[6] According to the High Plains Underground Water Conservation District No. 1, a national leader in improved irrigation technologies given drawdown of the Ogalalla Aquifer, "Since water is applied at low pressure in the furrow, wind drift and evaporation losses are virtually eliminated [using LEPA systems]. As a result, only five percent of the water pumped through the system is lost. Most irrigators use furrow dikes and/or chiseling in the furrow beneath the

[1] AMEC, SWNM Regional Water Supply Study 2010, p. ES-6.
[2] DBSA, SWNM Regional Water Plan, p.8-39.
[3] Vickers, Amy. Handbook of Water Use and Conservation, WaterPlow Press, Amherst, MA, 2001, p.333, p. 341.
[4] New Mexico State University, Drip Irrigation for Row Crops, Cooperative Extension Service, Circular 573, 2000, p. 34.
[5] Vickers, p. 383; NMSU, p. 4; personal communication with Luis Garcia, Deming office, Natural Resources Conservation Service, 9/2/09; NMSU, p. 34.
[6] Coastal Bend, TX Regional Water Plan p. 4C.2-8 http://www.nueces-ra.org/CP/RWPG/ipp/pdfs/v2_section4c_02.pdf

LEPA system to maximize the uniform water application."[7] Other benefits of LEPA systems include energy savings of 35 – 50%, reduced disease problems due to less wetting of foliage, and easier application of chemicals.[8] The costs of LEPA systems is $400/acre. Furrow dikes require special tillage equipment and costs $5 to $30 per acre to install.[9]

The high up-front costs of installing drip irrigation and LEPA systems are a major barrier for farmers. The SWNM regional water plan points out that providing farmers with financing for drip is important.[10] The $66 million subsidy from the AWSA presents an opportunity to fund conversions to drip irrigation and other water-efficient technologies on farms in the southwest region of New Mexico. In Luna County, the Natural Resources Conservation Service (NRCS) in Deming estimates it has converted 75 percent of the agricultural acreage in Luna County to drip between 2001 - 2009 through its Environmental Quality Incentives Program (EQIP).[11] The EQIP program reimburses at least 50 percent of the costs of the conversion. More recently, the Agricultural Water Enhancement Program (AWEP) is providing $2.4 million in conservation funding and technical assistance to save water with improved irrigation systems on farms (59 fields) in Luna County over a four year period.[12] According to Black Range RC&D, LEPA systems are more appropriate than drip irrigation for Hidalgo County farms in the Animas Basin.[13]

Using AWSA funding for installation of water-efficient technologies would allow AWEP/EQIP money to go even further. Given the average 10-year lifetime of drip systems, by the time AWSA funds are available beginning in 2012, a portion of the irrigated acreage currently in drip in Luna County would need an upgrade, so the funds would be useful across the region.

This project proposes to implement drip irrigation primarily in Luna County and LEPA in the other three counties as appropriate. The consumptive right for the net water savings would be purchased using AWSA funding and retired to replenish the aquifer and mitigate groundwater mining.

B. Describe how the proposal will meet a "water supply demand" in the Southwest New Mexico Water Planning Region, comprised of Catron, Grant, Hidalgo and Luna Counties.

According to the Southwest New Mexico Regional Water Plan, "Improvements to irrigation efficiency would decrease pumping and diversion costs, decrease the rate of groundwater decline, and potentially

[7] http://www.hpwd.com/conservation/ag1.asp
[8] Texas Water Development Board http://www.twdb.state.tx.us/assistance/conservation/conservationpublications/agbrochure.pdf
[9] Coastal Bend, TX Regional Water Plan p. 4C.2-8 http://www.nueces-ra.org/CP/RWPG/ipp/pdfs/v2_section4c_02.pdf
[10] DBSA, SWNM Regional Water Plan p. 8-58.
[11] Personal communication with Luis Garcia, Deming office, Natural Resources Conservation Service, 9/2/09.
[12] Natural Resource Conservation Service, February 2010 http://www.nm.nrcs.usda.gov/news/showcase/conshow_deming_awep.pdf
[13] Personal communication, Rich Olson, Black Range RC&D, July 6, 2011.

leave more water in surface water bodies or make more water available for other beneficial uses in the Southwest Region at large."[14]

Of late a somewhat clouded debate has occurred regarding the "efficiency", or "inefficiency" of flood, sprinkler and drip irrigation. Much of this debate clears once the terms "transpiration," "evapo-transpiration," and "evaporation" are agreed upon.

Transpiration, an evaporative function, is "the process of water loss through the stomata cells of plants" (Physical Geography.Net). Evapotranspiration is sometimes defined as a vague admixture of transpiration and evaporation; this is not helpful as the one describes water turned to vapor through plants; the other as water turned to vapor in the absences of plants, and the relative quantities are never detailed. More properly, evapotranspiration is the broad-based use of water by plants, including transpiration, absorption and use of water for growth by plant roots, leaves etc. A prominent critic of drip irrigation, Frank Ward of NMSU, in "Water Conservation In Irrigation Can Increase Water Use," defines evapotranspiration (ET) as "the depletion or loss of water associated with plant water use." That's inclusive, makes sense and is plain enough. This proposal simply refers to "evapotransporation" as "plant water uptake" – it's a horse apiece (same thing!).

From his definition of ET as plant water use, Ward then makes the puzzling statement: "Water diverted from its natural course (or presumably pumped to the surface) and applied in irrigation in excess of ET is not lost because it returns to the basin from which it was withdrawn via surface runoff or deep percolation." Well some of it does; but much of it is lost to the basin by transformation into the atmosphere as a gas (water vapor) through simple evaporation. Under flood or traditional sprinkler irrigation, from 25% to 50% of the applied water may be lost to evaporation, depending on climate, soil etc, according to USGS. Meanwhile, "evaporation losses in areas irrigated with drip are reduced to virtually zero," according to Texas A&M Cooperative Extension.[15]

Much of the discussion about agricultural water conservation resulting in increased depletions has been in the context of riparian irrigation systems (Ward,[16] Samani and Skaggs[17], King[18]). However, in mined groundwater basins, such as the Mimbres and Animas Basins where there is "weak or long term connection between surface and groundwater the return flow efficiency is very small in human timescales" according to Phil King of NMSU, and the perspective is quite different. "Maybe if we wait until the next ice age, things will be better; some of that water will work its way down, but I don't think

[14] DBSA, SWNM Regional Water Plan, p. 8-52.

[15] Cooper, John. "Conserving Water through Better Irrigation Management," Texas A&M Cooperative Extension.http://www.co.denton.tx.us/dept/horticulture/MGardeners/pdf/Conserving%20Water%20Through%20Better%20Irrigation%20Management.pdf

[16] Ward, F., Water conservation in irrigation can increase water use, Proceedings of the National Academy of Sciences, vol. 105, no. 47, November 25, 2008.

[17] Samani and Skaggs "Efficient Irrigation for Water Conservation in the Rio Grande Basin" 2009.

[18] King, P. "Return Flow Efficiency" Water Resources Research Institute October 2008. p. 1- 5.

that is a functional business. Thus the reduction of these non-consumptive losses is generally less important. In other words, if you do improve your efficiency, and turn mined water straight into yield, that is a good thing. What you do in this example is a very different conceptual approach than from a riparian system." [19]

In sum, it would appear that while drip shows a 20% (+/-) addition in water plant uptake (ET), with a consequent increase in crop yield, it retains approximately double that in savings from evaporative loss when juxtaposed with flood irrigation. Thus an advantage to drip as to efficiency and reduced depletion as detailed below.

For this analysis, the water savings from conversion to water-efficient irrigation technologies accounts for the change in evapotranspiration (plant water uptake) due to increased yields as well as the ultimate fate of the water savings from increased efficiency. If farmers put more acres into production so that they make full use of their diversion right, then the net savings from converting to drip irrigation will be greatly reduced. A recent study by the National Academy of Sciences points out these issues and suggests several ways to realize the water savings of drip irrigation, including retiring unused water rights, deficit irrigation that would keep yields at prior levels, and/or switching to crops that use less water.[20] (It should be noted that under the AWEP, NRCS requires as a condition of the contract that farmers agree not to irrigate additional acreage from water savings over the 10 year period of the program.) To address these issues, this analysis a) assumes that AWSA funding would be used to purchase and retire the unused water rights resulting from increased efficiency, and b) factors in an increase in evapotranspiration to 80 percent to reflect increased yields.[21]

The net water savings per acre for drip irrigation are calculated using the following assumptions as an upper bound of potential water savings for this project:

- Reduction in water diversions is 50% (this is the high end of the range reported by NRCS for Deming, NM[22])
- Evapotranspiration with drip is 80%[23]
- Water diversion right is 2.5 ac-ft/acre/year[24]
- Water consumption right is 1.6 ac-ft/acre/year[25]
- Unused diversion rights are purchased and retired.

[19] King, p. 6.
[20] Ward, p. 18219.
[21] Ward, p. 18218.
[22] Agricultural Water Enhancement Program report for Deming, NM February 2010 http://www.nm.nrcs.usda.gov/news/showcase/conshow_deming_awep.pdf
[23] Ward, p.18216.
[24] Personal communication with Luis Garcia, Deming office, Natural Resources Conservation Service, 9/2/09.
[25] Ibid.

With drip irrigation, these assumptions result in a **net water savings of 0.6 ac-ft/acre/year**, calculated as follows:

Without drip, water consumption = 1.6 ac-ft/acre/year
With drip, 50% less water is diverted, and 80% goes to evapotranspiration, so the water consumption = 2.5 ac-ft/acre/yr diversion x 50% reduction x 80% evapotranspiration = 1.0 ac-ft/acre/yr

Savings with drip = 1.6 ac-ft/acre/yr - 1.0 ac-ft/acre/yr = 0.6 ac-ft/acre/year

Thus net depletions to the aquifer would be reduced by 0.6 acre-feet/acre/year from conversion to drip. Examining the data reported by DBSA to the AWSA Stakeholders, groundwater diversions from irrigated agriculture in Luna County decreased 55,000 acre-feet/year from 1995 (120,000 acre-feet/year) to 2005 (65,000 acre-feet/year) the period in which 75% of Luna County's irrigated acreage was converted to drip.[26] A portion of this decrease in withdrawals from the Mimbres aquifer can be attributed to farm retirement (approximately 9,000 acres were retired or lay fallow over the same period = 22,500 acre-feet/year assuming 2.5 acre-feet/acre diversion right), but much of this decline (97,500 acre-feet) could be due to conversion to more water-efficient technologies such as drip irrigation.

A professional assessment has been conducted to evaluate the needs, costs, and water savings for conversion to drip in the 4-county area:[27]

- Implementation of conversion of 2,470 irrigated acres to drip in Luna County would cost $517/acre-foot, save 1,482 acre-feet of water per year with a total program cost of $9.8 million (amortized over 20 years).
- Implementation of conversion of 914 irrigated acres to drip irrigation in Hidalgo County would cost $517/acre-foot, save 546 acre-feet of water per year with total program cost of $3.6 million (amortized over 20 years).

C. Describe how the proposal considers the Gila environment and describe how any negative impacts might be mitigated.

The SWNM Regional Water Plan states that "Ecosystem impacts should be minimal if on-farm projects are planned and designed to avoid impacts to on-farm ecosystems."[28]

According to farmers' experiences in Texas, "hundreds of LEPA systems have been installed, and are in operation today, and experience has shown that there are not any significant environmental issues

[26] http://www.awsaplanning.com/Studies_files/DBS%26A%20Presentation%206-17-2009.pdf
[27] Rice, Jennie. "Cost-Effective Utilization of Arizona Water Settlement Act Subsidies for Southwestern New Mexico," in press.
[28] DBSA, SWNM Regional Water Plan 2005, p. 8-58.

associated with this water management strategy. For example, this method improves water use efficiency without making changes to wildlife habitat. This method of application, when coupled with furrow dikes reduces runoff of both applied irrigation water and rainfall. The results are reduced transport of sediment and any fertilizers or other chemicals that have been applied to the crops. Thus, the proposed conservation practices do not have potential adverse effects, and in fact have potentially beneficial environmental effects."[29]

D. Describe how the proposal considers the historic uses of and future demands for water in the Southwest New Mexico Water Planning Region and the traditions, cultures and customs affecting those uses.

Implementation of water conserving technologies on farms throughout southwestern New Mexico is a means to make this historical agricultural use of water more efficient in order to decrease the amount of groundwater mining occurring in the Mimbres Basin aquifer and other groundwater basins in the region.

[29] Coastal Bend, TX Regional Water Plan p. 4C.2-8 http://www.nueces-ra.org/CP/RWPG/ipp/pdfs/v2_section4c_02.pdf