

Brenda Garcia

From: Nancy Freeman [nancy.freeman@cox.net]
Sent: Tuesday, December 01, 2009 3:07 PM
To: Melaney Seacat; Nicole Ewing-Gavin
Subject: Tucson- Pima County Water Study Comments

Dear Friends, The WISPS website refused to take my comments--even though I eliminated the www. links.

Here is what I wrote, but keep in mind, for your reading ease, they will be posted on the Groundwater Awareness League website: www.g-a-l.info/study-comments.htm by tomorrow morning. Thanks for all your good work.

To: Tucson-Pima County Water Study Committee

From: Groundwater Awareness League
 P. O. Box 934
 Green Valley, AZ 85622
 520/207-6506
info@g-a-l.info

Date: December 1, 2009

Re: Comments on Draft Phase II Report

I think that the staff and committee have produced a truly excellent report with excellent ideas from the best of minds. The question remains: How to implement the ideas? I would suggest that an overseer job be created for each of the sections. This does not mean hiring new people, it means moving existing personnel to the new positions. These overseers would coordinate and evaluate all projects done in the assigned section.

Since I have not been able to attend Phase II as often as Phase I, some of my comments may be redundant to areas touched on in the report. However, I would like to emphasize some of the areas with clear details, as I think some of the details and facts have fallen through the cracks in getting the big picture. The comments cover the following concerns:

Concern I: Sustainable water supply for the region
 Concern II: Effective use of recycled water on turf
 Concern III: Stormwater Management
 Concern IV: Placement of new growth

Concern I: Sustainable water supply for the region

II. SHARED GOALS AND RECOMMENDATIONS (page 6)

The principal area of concern is the fact that the main user of CAP renewable water supply, Tucson Water, is recharging the CAP water in the Avra Valley Basin, which is a separate basin from the Tucson Basin. A recent Tucson Water Company report states that "our groundwater levels are rising." Upon examination of the statement, one finds that is misleading. While it is true the levels are rising in Avra Valley where CAP water is being recharged, and they are rising in the central well field where pumping has ceased—not necessarily from new water. The rise in the central well field could be simply from the water leveling out from the deep cones of depression caused by the traditional pumping.¹ Since the two basins are effectively not connected, so the recharge in Avra Valley will never balance out any pumping or overdraft in the Tucson Basin. There is a small connection "the narrows," but that passage drains from the Tucson Basin into the Avra Valley Basin and does not amount to much.

Tucson Water personnel maintain they "plan" to replace all of their groundwater pumping with direct delivery from

the Avra Valley recharge basins. However, this is impossible because of a number of the Tucson Water wells that are in outlying areas and not connected to the central system at all.

The numbers you have given in your report are not the current numbers (shown below), but future goals. When will those goals be reached? In the mean time, what is the amount of groundwater being pumped now through 2025 in the Tucson Basin?

How many acre feet will continue to be pumped outside the central region? How many Tucson Water wells are not connected to the central pipeline, therefore, will always be dependent on groundwater? How long will the Tucson Basin sustain this overdraft?

CAP 144,191
 CAGRDR 12,500
 Incidental Recharge 5,500
 Local Groundwater 24,750
 Effluent 30,500

Houghton/southlands region is being considered as prime areas for future development, yet there are no renewable supplies in that region at all. At the present, Vail and Corona de Tucson are drawing on aquifers with no recharge in the region. The ADWR Regional Flow Model for the Tucson AMA will be helpful in making an inventory of how much groundwater is being pumped in each outlying area.

GOAL #4: GROWTH SHOULD PAY FOR ITSELF OVER TIME AND BE FINANCIALLY SUSTAINABLE

The CAGRDR and the ADD water project make this goal totally impossible:

ADD water project is now under discussion. The ADD water project is to support CAGRDR, an entity that is mandated to provide replenishment water for new developments.

If there is a new development after 1995, the development has to connect to a local water provider, or join CAGRDR as a member land. Homeowners in member lands have to pay for the replenishment of their water use through CAGRDR, with figures of usage provided by their water company. In other words, new development has to pay for its water use. However, if a local water provider is used, then the cost of the replenishment for new developments is taken on by the entire pool of water users.

This situation is very precarious for the future, as the CAGRDR through ADD is looking at very expensive ways to get more water. CAGRDR was created after all the allocations for CAP water were taken. Currently, they are using CAP water, but they have a low priority. In 2009, for the first time all excess CAP water was taken, making the CAGRDR water supply precarious. They are projecting they will have CAP water for 20 years, but only have been guaranteed excess water for 5 years. At the present time, the fee for CAP excess water is \$133 per acre foot. The cost of water projected for the proposed ADD projects is some \$2,000 per acre foot. So the price of water will be going up, and it will be paid for by the current water users who had their homes long before the 1995 mandate.

Report from U. S. Water News, July 1, 2008

Found at u.s. water website: uswaternews.com/archives/arcsupply/8capxoffi7.html

CAP officials look for future Arizona water solutions

TUCSON, Ariz. — The combined population of three of Arizona's most populous counties could double in 40 years and that has water experts dreaming up plans for the future.

One scenario could have three desalination plants on line by 2048 to increase the supply of Central Arizona Project water flowing to Phoenix and Tucson.

One plant could be removing salt from seawater along the Gulf of California in the Mexican state of Sonora — and its booty is shared by Arizona, California, Nevada and Mexico — and two other plants may be treating salt-laden groundwater in the areas of Buckeye and Gila Bend.

Experts also hope a huge nuclear power plant may be in operation along the Gulf of California in Sonora, producing 600 megawatts of power to provide the juice for the adjoining seawater desalination plant.

And by 2048, construction could be underway to expand the size of the concrete CAP canal running from the Colorado River to Tucson to deliver up to 2.2 million acre-feet of water a year. Currently, the aqueduct can deliver 1.8 million-acre feet.

The three-county Central Arizona Water Conservation District, which oversees the CAP, is looking at how the state could furnish water to support a 2048 population of 11.5 million in Pima, Pinal and Maricopa counties compared with less than six million today...

The project can be done at a hefty price tag for the environment and for the taxpayers. However, since this report emphasizes the need for water for the environment, it does seem counter-productive to turn the Sea of Cortez into a "dead sea." Second, the cost of the proposed nuclear power plant will be in the billions (no mention of solar energy). Third, the desalinization plant will cost over \$1 billion up, as that was the price tag of the Federal desalinization plant in Yuma that operated for 4 months. Then there is the cost of the pipeline to bring the water upstream to Havasu City where it can be put into the CAP pipeline.

The ADD second project idea is to pump out three aquifers: Butler Valley, Harquahala and McMullen Valley for "new" water for the CAP pipeline. I have no information on the habitat of plant, bird and animal life these aquifers are supporting. This study needs to be done before these aquifers are "mined" dry to serve water in Tucson.

From planning study-page 14: One contributor to this issue is the large unincorporated area in Pima County that does not generate the revenue that incorporated areas do (no sales tax and less state shared revenue coming in). In the past this issue has been framed as an annexation/no annexation debate. A sustainable water future is one in which we move beyond annexation debates and instead focus on fiscal sustainability for our entire community. Fiscal sustainability considers the life cycle cost of development, including how ongoing maintenance and the provision of public services are paid for in addition to upfront capital costs. It also addresses the adequacy of revenues collected to provide necessary public services, fairness and equity related to who pays for services, who receives services, and the level of investment we are making throughout the community.

This scenario is not necessarily the case. While Green Valley property owners pay in some \$32 to 34 million in Pima County property taxes each year. It is impossible to get any numbers out of the county as to a dollar amount of services Green Valley is getting for their money. The money often goes to the pool that can finance projects within Tucson City limits. This rift between where County taxes are collected and where the money is spent is worth looking into. I think there's a good chance that you will find it is the opposite—that the outlying areas are feeding the inner areas.

The Flood Control District (which I will cover later) is one example. They have a budget of \$58 million (compared to \$18 million for the state Arizona Dept. of Water Resources). The Flood Control District monies do not go to Green Valley, or any of the regions in the southeast that are troubled with horrific flooding.

There is a good possibility that this tendency with money spent would also hold for the Transportation Dept.

Other Sustainable Concerns:

1) Filling up landfills with old toilets

The replacing of old toilets with low flow ones is a good idea in commercial, school or office spaces where there is a large use of the toilets. However, in home settings, the majority of people are never at home. When we were in a drought situation in the 1970's in San Francisco, everyone just put a one-half gallon to one gallon (according to what worked) plastic jug filled with water in their toilet tank, thereby making the toilet used less water each flush. Again, this is an example of a simple, inexpensive answer, instead of government big-ticket rebates, landfill purchases, and hauling costs.

2) Native and desert plants not available in major nursery outlets

It is estimated that over some 60% of the water use is for out of doors. While we want water available to keep trees and plants alive, we should be more selective. ADWR provides a list of trees and plants that can be used for highway and commons areas. Why can't the County adopt the same rules for nurseries in the County. One objection is that Walmart, Home Depot, Target, etc. get their plants from somewhere in Arkansas or California. This ordinance would mean that there would be new growers and expansion of the current ones in Pima County region that specialize in native plants. Therefore, Walmart, etc. would buy locally and save on gasoline and trucking costs.

Concern II: Effective use of recycled water on turf

Water Supply

- Increase the use of reclaimed or recycled water on turf irrigation to substitute for groundwater use (Page 23)

I maintain that there should be satellite wastewater treatment plants, placed where there is are customers for effluent. The standard excuse for not using treated effluent on golf courses, school yards and similar facilities is that it is too expensive to pump the effluent up from Roger or Ina Road treatment plants to the places where it can

be used. However, has a study been done of the cost effectiveness of having satellite treatment plants in the regions where the wastewater is produced and sites are available to use the wastewater. This has recently been accomplished with the Vail region, which for years had been piping its wastewater over to Roger Rd., never to be seen again by the Vail residents. This practice is particularly egregious when noted that there is no recharge available for groundwater pumping in the Vail region at all.

Originally, when Tucson was small it was appropriate to use a drainage system to collect all the wastewater downhill at Roger Road and Ina Road. However, Tucson has expanded and the places where effluent can be used have multiplied, so that wastewater is being piped from some 15 miles away. Pima County Wastewater has not kept up with the times and insists on doing things the way they always have.

According to Jackson Jenkins of Pima County Wastewater Dept., only 17 of the 63 golf courses in Pima County were using effluent in 2009. I don't think this is acceptable. At a recent meeting, Chris Avery of Tucson Water mentioned that some schools could not afford the retrofitting. Seven hundred and twenty million dollars (\$720,000,000) are available for new multi-million dollar treatment plants, but not for retrofitting to use the effluent. Even a multi-million dollar pipeline is being constructed to move excess effluent from one plant to another. So funds available, it's a matter of reorganizing priorities according to new realities. Further, CAGR D gives small grants every year for water conservation projects. Surely, they would be amiable to fund schools retrofitting to be able to use wastewater. (Attachment I)

The Green Valley example has to be highlighted in the historical records of Pima County wastewater "management." Green Valley Wastewater Treatment Plant was out of compliance with ADEQ specifications (2002). Instead of providing funds for repairing the plant, Pima County negotiated a deal with the Quail Creek (in incorporated Sahuarita) developer to bring the plant up to standard in exchange for the wastewater. This deal was made in spite of the fact that there is a sizeable population in Green Valley that had been paying wastewater fees for years, and Pima County property taxes and has eight golf courses on which the effluent could be used.

Pima County did not even require that Quail Creek use the wastewater directly, so Quail Creek created recharge basins at the Green Valley treatment plant, and continues to pump groundwater for their extensive golf greens, and landscaping that includes turf and water features. In the past year, wastewater was connected for direct use on the lawn for a 2-acre Dog Park.

Concern III: Stormwater Management

I simply do not agree with Suzanne Shields statement the night of the Flood Control presentation in response to Mark Stratton's questioned as to why the stormwater could not be managed upstream, so that it does not pour into the city streets." Ms. Shields stated, "There is too much water." This statement does not hold up to facts since when stormwater gathers and pours down into the city, there is going to be more water to be dealt with. Further, many cities, including Phoenix and Denver, have reservoirs on every side of town, which serve as wonderful recreational facilities. Ms. Shield's further insinuation that there is not enough money does not hold up since the Flood Control Dist. never spends its entire budget even though it has money for contracts with consultants for studies that are never followed up on. Further, note the preponderance of Flood Control studies and projects within the Tucson City limits.

After stating that City and County should take steps to encourage growth and new development in areas identified as most suitable for development the following were listed in the report. If the County wants to develop in the south and southeast region, it must put up the capital to allay the flooding problems.

GOAL #2: DIRECT GROWTH TO SUITABLE GROWTH AREAS (page 9-10)

- Outside of the Conservation Lands System
- Within the Houghton corridor
- Within the Southlands area
- Within the Southwest area

I challenge the suitability of the Houghton corridor and the proposed development along Sahuarita Rd. unless extensive infrastructure is completed to capture the stormwater and put it to some good use, such as using dry wells to assist it to augment groundwater levels, restoring and creating riparian areas, or slowing it for use on existing plant life. To put in the flood control facilities and infrastructure first is an absolute necessity.

The Lee Moore Wash study has been completed at a cost of over \$1 million to taxpayers, which covers the

Houghton corridor. What specifications did it include for infrastructure to control flooding in the region? It is now known where the sheet flow occurs—although Flood Control personnel always knew where it was because the Pima Flood Control data base has maps with more details than the Lee Moore Wash study produced, including depth of flows.

For over \$1 million, the County now has an official map so that they can force residents in the sheet flood regions to sign a “Covenant” (Attachment II) that the County is not responsible for any damage to the structures they themselves permit. Consider the question: Why wasn’t \$1 million spent to put in some infrastructure to capture and allay the flood waters?

It is notable that the number of studies the Flood Control Dist. pays contractors to do always outnumbers the number of projects that are accomplished. The Flood Control website [<http://rfcd.pima.gov>] shows some 55 studies with sixteen of the studies done since 2000. Note that all 55 studies were conducted by consultants, not Flood Control Dist. personnel. (Attachment III)

The Flood Control project page (Attachment IV) only shows four infrastructure projects, either in process or completed. However, no timeline is given as is done in the studies page.

One example of a proposed development is in the Avis Acres region which has a horrific sheet flow. If the proposed development is to be accomplished, the county or the developers who own land in the region have to get together and make a comprehensive plan for this region. The main excuse used by the Flood Control Dist. is that all these homes are wild cat, so they can’t do anything. However, every home and every structure had to have a permit from the County. Further, most of them fit the actual description of wild cat—subdividing up to five times to avoid water rules. There is no evidence of such organization in most of the development in this region. In any event, the worse offenses are due to planned, platted, and approved developments. There is such a development right at the south-east corner of Sahuarita Rd. and Kolb. [Sycamore Canyon Estates, platted and approved in 1997 although it was in a wash.] There is a county ordinance that there should not be more flow out of the subdivision than flows into it. However, there is no monitoring and no compliance.

In the October Pima County Planning and Zoning Commission meeting, a letter was read from Michele Davis, a resident of Avis Acres, stating

With each new development that goes in we have to adjust to the fall-out. Each monsoon season brings trepidation as we don’t know how the water will flow due to what has been built since the last rain. We woke up on morning [summer, 1999] to find 18” of mud in our garage, anything that was not nailed down outside had been washed away and our full-size truck was stuck in a stand of trees... the only thing that stopped it from being washed away.

We, along with our neighbors, went house to house to look for our belongings and to put the word out as to what new things had shown up on our place, so that others could find their property. Never before had this happened [20 years resident], but we adjusted. We hired a backhoe to clean out the washes on our 10-acre property, as this flood [1999] had filled them in. We used that dirt to build a burm in front of our house to try to protect it. The next flood that came through filled in the washes again and jumped that burm of dirt. Again came the backhoe and the burm went higher....

A new development was put in and it changed the course of the water flow yet again. This time it jogged up on a neighbor’s property and then bounced back to the original wash, but took about 15 feet of my property with it....

The stories and the hardships caused by Pima County Development Services and Pima County Flood Control go on and on—even in approved, platted developments. I have spoken of them in several hearings and documented them on website pages. Here are two shocking examples:

Found on groundwater awareness league website:
g-a-l.info/SahuaritaHighlands.htm
g-a-l.info/SanPedroEstates.htm

The County is betraying its citizens, many of whom are living on family property bought in the 1970’s, with permitting of properties in these flood zones with no flood abatement infrastructure at all.

It should be recognized that the Transportation Dept. and its practices along the highways and byways have contributed to flooding. For example, culverts and ditches are silted up along the roads, so that stormwater backs

up only private property, and public roads. There are instances in the original (but not incorporated) Sahuarita region along Sahuarita Rd. that the Transportation Dept. blocked washes and piles up dirt along side of the roads to wash into the road at the next major rain event. In the past year, we have had some positive results with working with the Transportation Dept., but there is a lot more to be done.

Further, there is a disconnect between the Transportation Dept. and the Flood Control Dist. For example, culverts and ditches were cleared along Sahuarita Rd., which was good for the people where stormwater was backing up on their property, but what affect was the greater amount of water having and/or would have on the properties downstream? No one analyses this scenario.

Further, there is a disconnect between the Sheriff's Department, Transportation Dept. and Flood Control Dist. when there is a swift water rescue. The Sheriff's Dept. does not notify the Transportation Dept. or the Flood Control Dist. of the incidents.

Concern IV: Placement of new growth

Problems with the Comprehensive Plan

The citizens were misled on water issues when the Comprehensive Plan was formulated. Using the Kolb Rd. – Sahuarita Rd. region for an example. The residents were told that Tucson Water was going to provide water supply to new development. They did not realize that Tucson Water was going to pump from a supply well one one-half miles away, and if that well wasn't enough, Tucson Water would drill another one. The pumping would eventually impact the private exempt wells, how soon would depend on the number of houses served. There would be a further encroachment into the rural resident's, since there is a new state statute that if there is a water company to hook on to the residents are obliged to do so. This would mean that if a current resident wanted to dig a new well, or split their acreage, there is a possibility they would have to hook onto the new local water provider. The residents were not informed of these aspects of the water reality.

Further, the south and southeast regions do not have any renewable supplies available. Flood Control insists that capturing the stormwater will not augment groundwater levels, but they have no figures to show this to be a fact. It should be noted that stormwater is not considered to be renewable supplies. Even though Chandler showed good augmentation with their stormwater facilities, ADWR would not approve this method for their "renewable supply" requirements. However, the groundwater table was raised.

As you can see by the map below from the 2006 ADWR Report Regional Groundwater Flow Model of the Tucson Active Management Area, groundwater levels are predicted to decline considerable in the "southlands" and surrounding areas. Note: the map did not copy. It can be found on page 101 of the ADWR report, which is available online on ADWR website:
adwr.state.az.us/AzDWR/Hydrology/Modeling/documents/Modeling_Report_13.pdf

Attachment I: CAGR D grant info

02/02/2009 CAGR D Awards \$20,000 To Non-profit Organizations

Five grants totaling \$20,000 has been awarded by Central Arizona Groundwater Replenishment District (CAGR D) to nonprofit organizations for water conservation projects that reduce groundwater use within the CAGR D Member Lands and/or Member Service Areas.

The recipients are from CAGR D's three county (Maricopa, Pinal and Pima) service area and the amounts range from \$4,250 for turf conversion in Green Valley to \$4,250 for a Smart Controller Water Conservation Project in Queen Creek. The CAGR D grants and recipients:

- \$4,250 to convert about 12,000 square feet of turf to xeriscape in the Canoa Northwest subdivision which is in Green Valley in Pima County.
- \$4,250 to convert turf to xeriscape on the north side of West Palm Valley Blvd. between 133rd Drive and 132nd Drive in Litchfield Park.
- \$4,250 to purchase and install monitoring equipment and smart water controllers throughout Cortina in Queen Creek.
- \$4,250 to convert turf to xeriscape in University East in Queen Creek.
- \$3,000 for the installation of AQUA Conserve ET controllers for Sossaman Estates HOA in Queen Creek.

CAGR D will make up to \$20,000 in grants available twice a year under its Conservation Grant Program. CAGR D was established in 1993 by the state legislature to serve as a groundwater replenishment entity for its members. CAGR D's main responsibility is to replenish groundwater used by its member property owners and water

providers. CAGR is operated by the Central Arizona Water Conservation District (CAWCD) which also oversees the operations of Central Arizona Project.

For more information contact Marsha Esmeier at mesmirer@cap-az.com or call 623-869-2380.

Attachment II: Pima County Covenant

Attachment One: Covenant that must be signed by anyone building or improving property in flood plain as determined by Pima County—not FEMA Note: scan did not copy, covenant can be found at Groundwater Awareness League website
g-a-l.info/Covenant.htm

Attachment III: Flood Control Studies

Floodplain Studies

(mapping, basin management plans, etc.)

Active Floodplain Studies

- Lee Moore Wash Basin Management Study, Stantec Consultants

Completed Floodplain Studies

Special Study floodplain mapping project reports can be found on the Reports Page [contents below] 51 studies with 12 + 4 other studies since 2000 (noted in red). Note that all 55 studies were conducted by consultants, not the Flood Control Dist. personnel.

- Special Study 01 - Drainage Report for Arivaca Area Plan, Blanton & Co. 3/21/72
- Special Study 02 - Critical Watershed Management Plan Ruthrauff Road Area, Cella Barr Associates, May 13, 1983
- Special Study 03 - Flecha Caida Flood Improvement Study, Simons, Li & Associates, 1/28/86
- Special Study 04 - Tucson Mountain Basin Study, Camp Dresser & McKee, Inc., March 15, 1986
- Special Study 05 - Highlands Wash Basin Management Plan Report, A-N West, Inc., July 15, 1986 and Phase III Final Report, Camp Dresser & McKee, Inc., 1/25/90
- Special Study 06 - Riverside Terrace Basin Management Plan, Dooley-Jones & Associates, 3/13/87
- Special Study 07 - Ventana Canyon Estates, Erosion Setback Limits, Osborn, Petterson, Walbert and Associates, 2/4/88
- Special Study 08 - Millstone Manor No. 6, PCDOT&FCD, 6/20/88
- Special Study 09 - Sutherland Wash, H&H Report, PC DOT&FCD, 8/9/88
- Special Study 10 - Lee Moore Wash Watershed, PC DOT&FCD, 12/29/88
- Special Study 11 - Green Valley Drainageway No.9, CMG Drainage Engineering Inc., 1/12/89
- Special Study 12 - Valley View Wash, Flecha Caida Flood Phase 2, Simons, Li & Associates, Inc., 2/15/89 and
- Special Study 13 - Holladay Street & Forrest Avenue Watershed Study, McGovern, MacVittie Lodge & Dean, Inc., 1/22/90 and Drainage Relief Assessment for the Drexel/Westover Intersection, CMG Drainage Engineering, Inc., 11/25/91
- Special Study 14 - Southwest Basin Management Study, Anderson, Passarelli & Associates, 11/27/90
- Special Study 15 - Black Wash Drainage Analysis, Administrative Floodway, 7/00/90
- Special Study 16 - [Upper] Canada Del Oro Wash Letter of Map Revision Study, David Evans and Associates, 10/28/04
- Special Study 17 - Fortyniner's Interior Drainage Improvements, PC DOT&FCD, January 1992
- Special Study 18 - Soldier Trail Wash Floodplain Delineation, Arroyo Engineering, Inc., 6/29/94
- Special Study 19 - Tortolita Mountains Geomorphic Assessment, Arizona Geological Survey, June 1992
- Special Study 20 - Valencia Wash Basin Management Study, Alpha Engineering, 3/8/93
- Special Study 21 - Upper Carmack, South Branch, Sub-Basin Management Study, Robert L. Shand, P.E., Drainage & Flood-Control Engineering, 7/24/92
- Special Study 22 - 27 Mile Wash Flood Plain Delineation Study, Collins-Pina Consulting Engineers Inc., August 1992
- Special Study 23 - TanqueVerde Creek Management Study, Johnson-Brittain & Associates, July 30, 1993.
- Special Study 24 - Tortolita Area Basin Management Plan, Ph I, Ph IIB, Cella Barr Associates, 8/3/93
- Special Study 25 - Mt. Lemmon Culvert Study, CMG, Drainage Engineering, Inc., 11/19/93, and Final Drainage Report for Summerhaven Village Center, CMG Drainage Engineering, Inc., 9/13/05
- Special Study 26 - Southwest Basin Management Study Ph. II Part A, Volume 1 and Volume 2 Cella Barr Associates, 4/29/94
- Special Study 27 - New Tucson, Units 21, 22, 23, 24 & 27, Erosion-Hazard Setback Analysis for Unit 23, Martin-

- Mcltosh, 1/23/95. Hydrologic and Hydraulic Report for Units 22, 23 and 24, DJA Job No. 84-077.01. Hydrology Report, New Tucson, Unit 27, Environmental Engineering Consultants, 9/5/96
- Special Study 28 - Hydrology/Hydraulics Report for Demetrie Wash, McGovern, MacVittie, Lodge & Associates, Inc., 10/13/94
 - Special Study 29 - San Joaquin Estates Floodplain Status Hydrology Report for San Joaquin Estates -- Improvement Plans Lots 268 thru 290, Trimble Engineering, Inc., 3/22/87 and Drainage Reports for Phases III-A, IV and V of San Joaquin Estates, CMG Drainage Engineering, Inc., 5/31/89.
 - Special Study 30 - Hydrologic/Hydraulic Report for Palo Verde Ranch, ICON Consultants USA, Inc., 7/1/94
 - Special Study 31 - Brawley Wash Floodplain Study, Simons, Li & Associates, Inc., 9/6/96
 - Special Study 32 - New Tucson Units 26, 28, 29 & 30, ICON Consultants USA, Inc., 9/9/96 and Addendum I, ICON, 3/29/06 and Addendum II, ICON, 5/15/06
 - Special Study 33 - Milagrosa Hills Wash, Calle de Samuel to Agua Caliente Confluence, Simons, Li & Associates, 3/13/98
 - Special Study 34 - 49ers Country Club Lots 315 to 324, McGovern, MacVittie, Lodge & Associates, Inc., 8/15/95
 - Special Study 35 - Earp Wash, DJA Engineering Corp., 3/4/99
 - Special Study 36 - Camino Real Wash Letter of Map Revision, (Large File: 200 MB PDF format) Castro Engineering an JE Fuller Hydrology & Geomorphology, Inc., 2/23/2009
 - Special Study 37 - Camino de Oeste Wash, Arroyo Engineering, Inc., January 1999
 - Special Study 38 - Sahuarita Basin Management Study, CMG Drainage Engineering Inc., 1/5/00
 - Special Study 39 - HEC-1 and FLO 2-D Models for Finger Rock Wash, CMG Drainage Engineering Inc., 10/6/00 and Lower Finger Rock Wash, CMG Drainage Engineering Inc., Revised 2/28/94
 - Special Study 40 - Mission Wash Study for FEMA, McGovern, MacVittie, Lodge & Associates, unknown date
 - Special Study 41 - Chaparral Heights -- annexed by Oro Valley.
 - Special Study 42 - Brawley Wash Primary Flood Corridor Study, Simons, Li & Associates, 6/1/99
 - Special Study 43 - Idle Hour Wash Letter of Map Revision, Simons, Lie & Associates, 3/24/95
 - Special Study 44 - Central Arizona Project (CAP) Tucson Aqueduct, Bureau of Reclamation, U.S. Dept. of the Interior, Reach 3 May 1982, Reach 4 April 1984, Reach 5 June 1983
 - Special Study 45 - Summerhaven Hydrologic and Hydraulic Analysis, URS, 12/30/03
 - Special Study 46 - Sheet Flood Mapping for Unincorporated Pima County, PCRFC, 8/8/07
 - Special Study 47 - Silverbell Trails Estates, Delph Engineering, Inc., 10/1/03
 - Special Study 48 - Hacienda Sol Wash Floodplain Analysis, PC RFCD, 3/14/08 and Floodplain Analysis for an unnamed wash at the Intersection of Hacienda del Sol Road and River Road, PC RFCD, 3/14/08
 - Special Study 49 - Diamond Bell Ranch Hydrology, Psomas, 10/12/07
 - Special Study 50 - Floodplain Study for Flecha Caida Ranch Estates #9, Including Portions of Flecha Caida Ranch Estates #1 and #2 and Las Lomas de Catalina, JE Fuller Hydrology & Geomorphology Inc., 4/8/08
 - Special Study 51 - Floodplain Analysis for Tanuri Wash, (Large File: 136 MB PDF format), PCRFC, 6/2/08
- Other studies:
- Lee Moore Wash Basin Management Study (In progress)
 - July 31, 2006 Flood and Debris Flow Event
 - Drainage Study for the Curley School Detention Basin, Ajo, Arizona, DMJM Harris, January 2006. (10 MB PDF file)
 - Photographs of Walk-Through Inspection of Curley School Detention Basin (PDF)

Attachment IV: Flood Control District Drainage Infrastructure Projects

Drainage Infrastructure Projects (bank protection, drainage, etc.)

Active Drainage Infrastructure Projects

- Pantano Wash Bank Protection: Speedway Blvd. to Tanque Verde Rd. (Tucson)
 - Arroyo Chico Multi-Use Project (Tucson)
 - Mission View Wash Drainage Improvements (Tucson)
- ##### Completed Drainage Infrastructure Projects
- Camino Verde/Black Wash Box Culvert (

Environmental Projects

(restoration, riparian habitat, etc.)

Active Riparian Habitat and Ecosystem Restoration Projects

- Arroyo Chico Multi-Use Project (Tucson)
- Big Wash Rehabilitation (Oro Valley)(PDF format)

- El Rio Antiguo
- El Rio Medio (Tucson)
- Paseo de las Iglesias (Tucson)
- Tres Rios del Norte

Completed Riparian Habitat Restoration and Ecosystem Restoration Projects

- Cañada del Oro Ecological Reconnaissance (Oro Valley)
- Cienega Bottomlands Restoration Project (Pima County)
- Cortaro Mesquite Bosque Construction Project (
- Kino Environmental Restoration Project (KERP) (Tucson)
- Pantano Jungle Restoration Project (Pima County)
- Rillito River/Swan Wetlands Ecosystem Restoration Project (Tucson)

Water Resources Projects

Active Water Resources Projects

- Avra Riparian Restoration and Groundwater Replenishment Project (Pima County)

Completed Water Resources Projects

- Marana High Plains Effluent Recharge Project (Marana)

Other Projects

(Linear parks, culverts, etc.)

Active Other Projects

- Canada del Oro Wash Linear Park: Thornydale to Magee
- Rillito River Linear Park from Alvernon Way to Craycroft Road (Tucson)
- Santa Cruz River Linear Park from Grant Road to Camino del Cerro River Park (Tucson)
- Omni/Canada del Oro Wash Riverpark Project (Oro Valley)

Thanks,
Nancy Freeman
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