

Impacts of Flow Diversion on Effluent Infiltration

Santa Cruz River Research Days 2013
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WRRC
WATER RESOURCES RESEARCH CENTER



USGS-Trico

PCRFC

USGS-Cortaro

Pima County Regional FLOOD CONTROL DISTRICT



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(520) 243-1800, FAX: (520) 243-1821
<http://www.rfcd.pima.gov>



Map1 RFCD Project Site

- RFCD Project**
- Project #1
 - Project #2

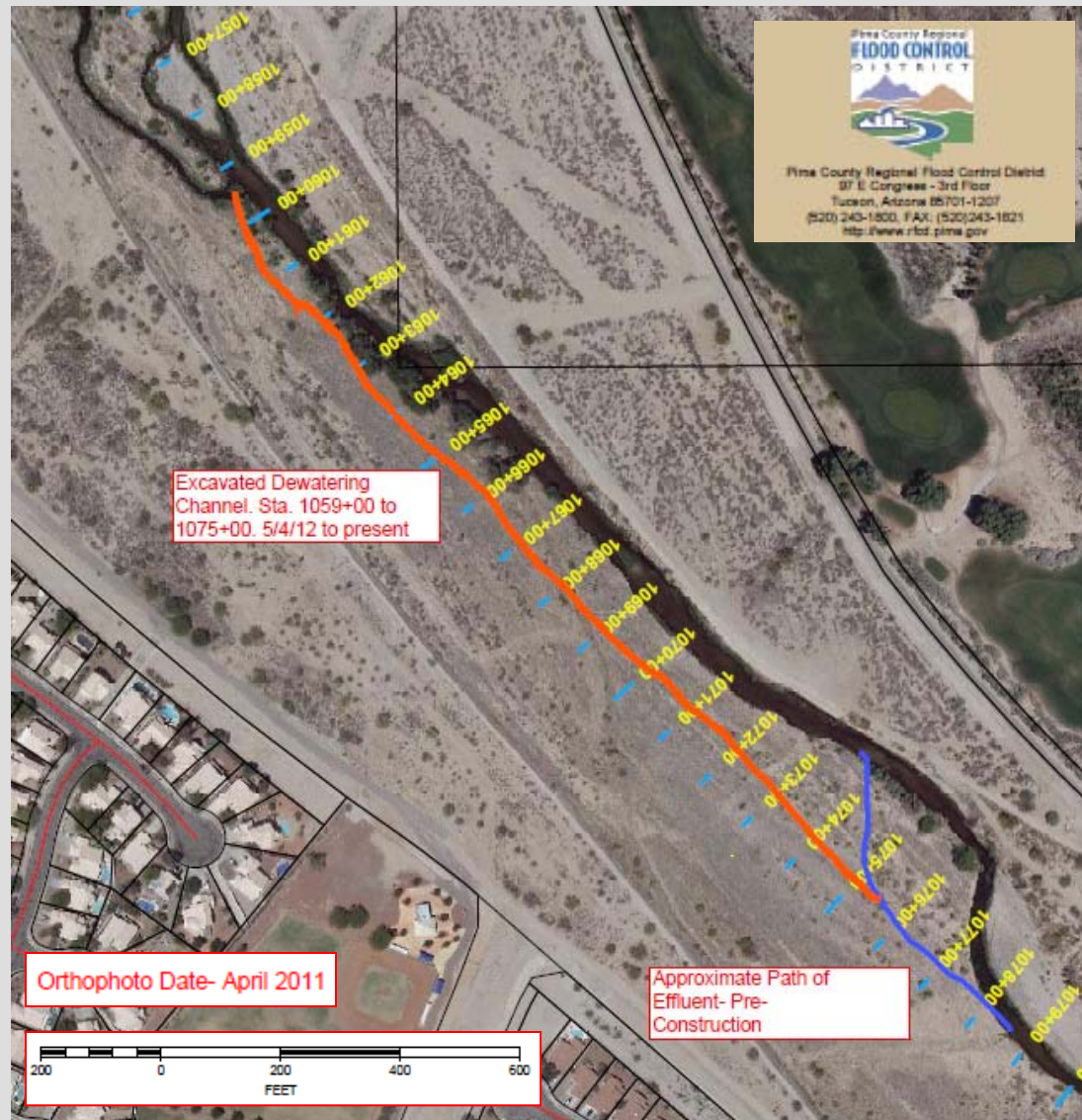


The information depicted on this display is the result of digital analyses performed on a variety of databases provided and maintained by several governmental agencies. The accuracy of the information presented is limited to the collective accuracy of these databases on the date of the analysis. The Pima County Regional Flood Control District makes no claims regarding the accuracy of the information depicted herein.

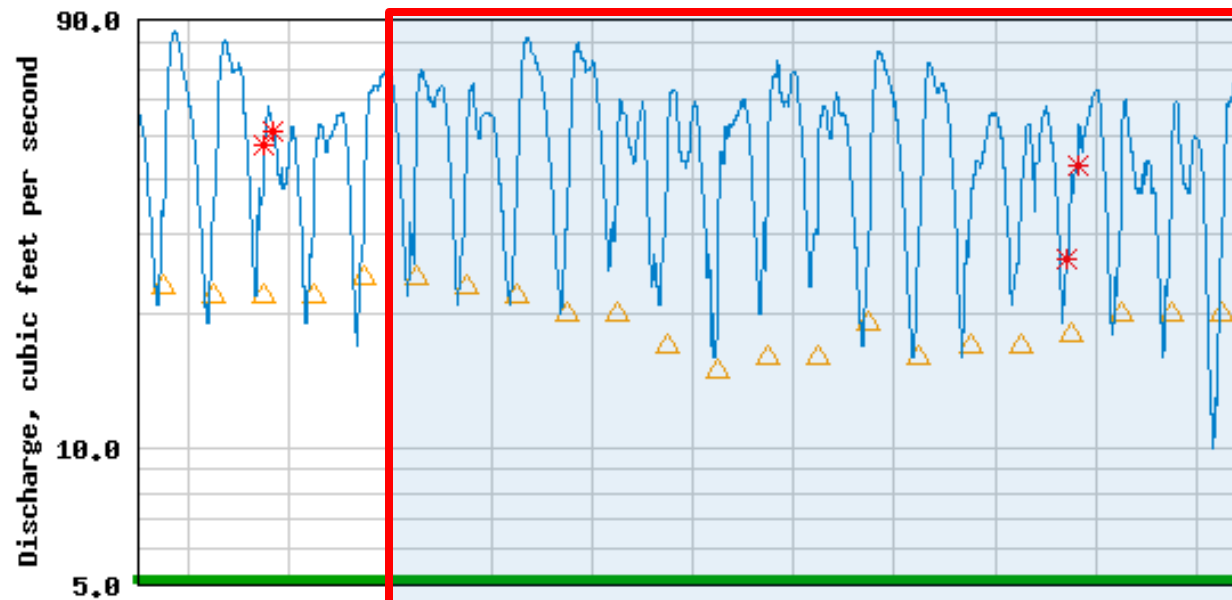
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Project #1:

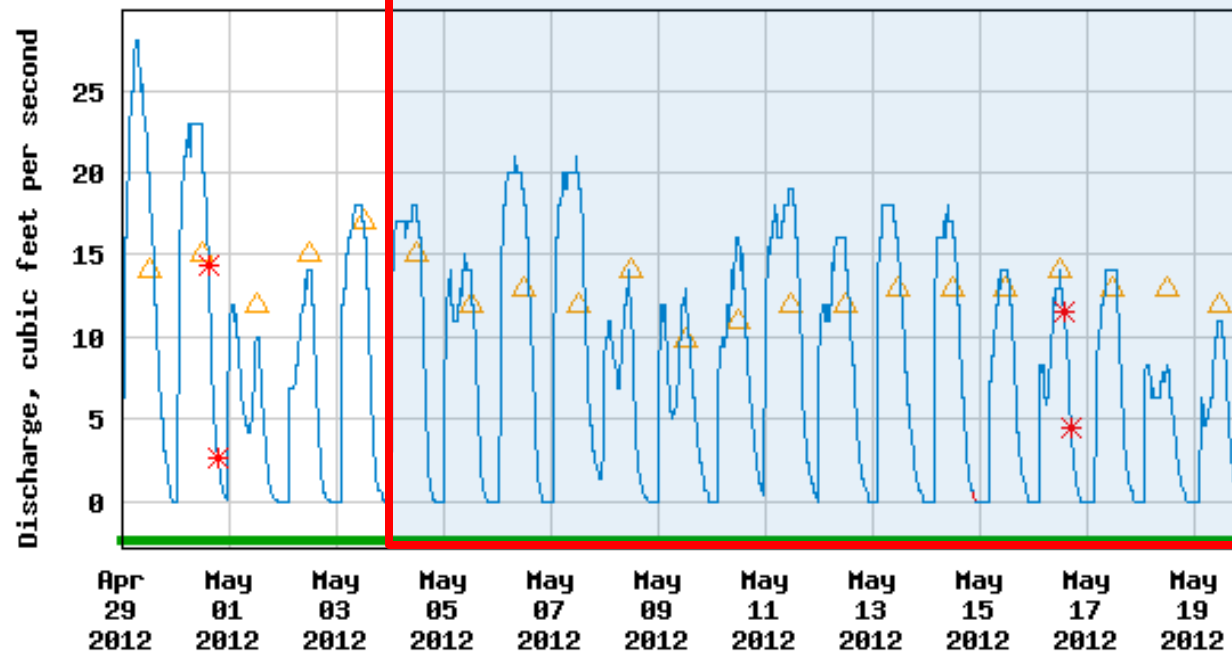
- ▶ Type: Excavation
- ▶ May 4, 2012
- ▶ Approx. Length: 1600'
- ▶ Cost: ~\$24K



USGS 09486500 SANTA CRUZ RIVER AT CORTARO, AZ

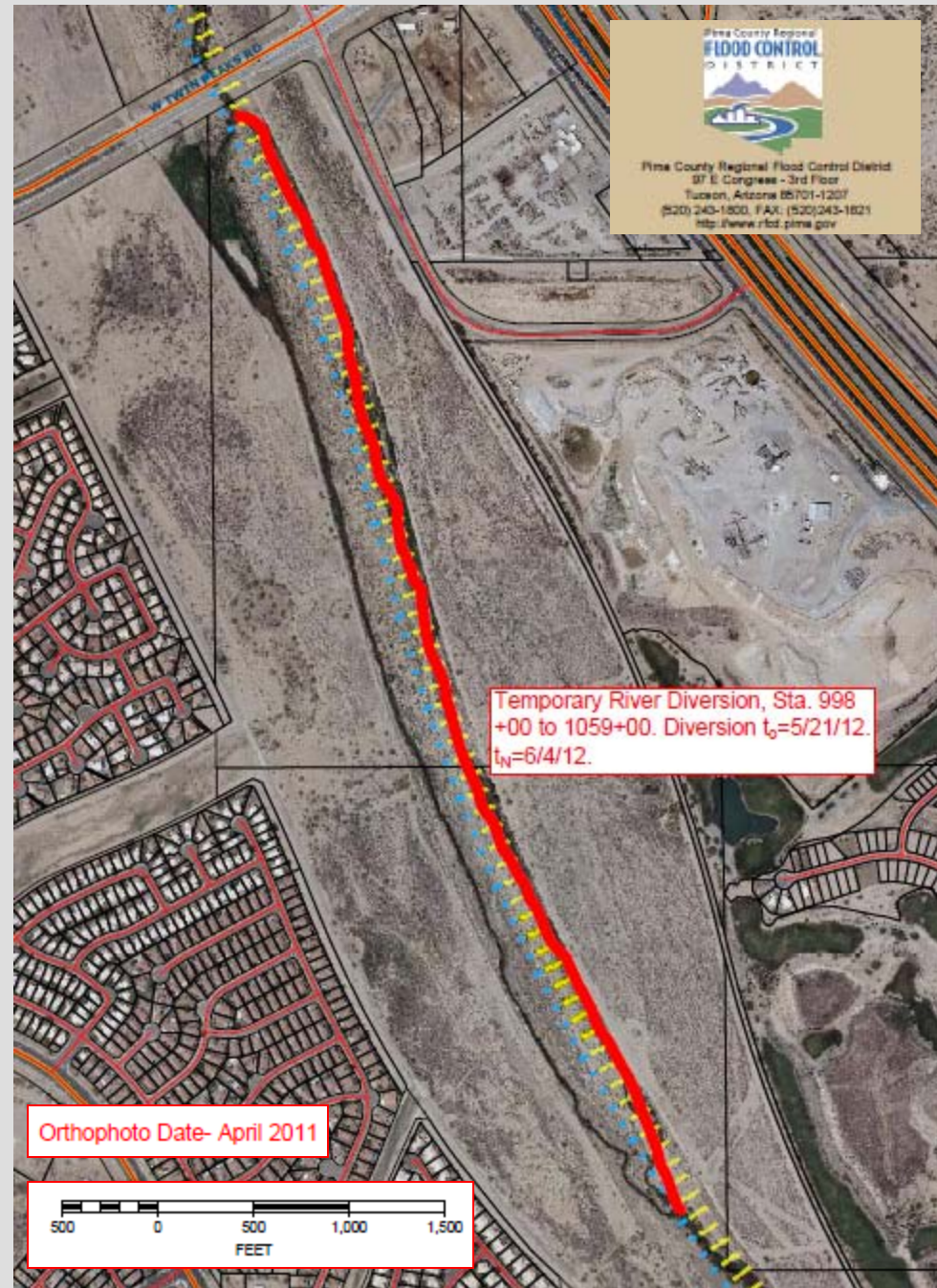


USGS 09486520 SANTA CRUZ RIVER AT TRICO ROAD, NR MARANA, AZ.

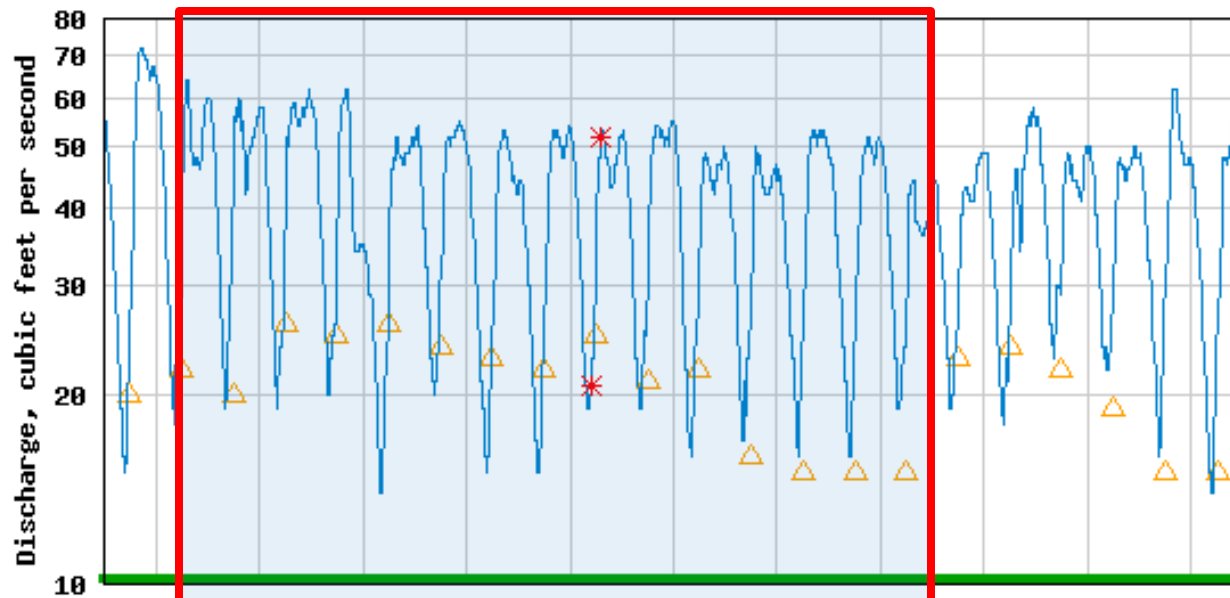


Project #2

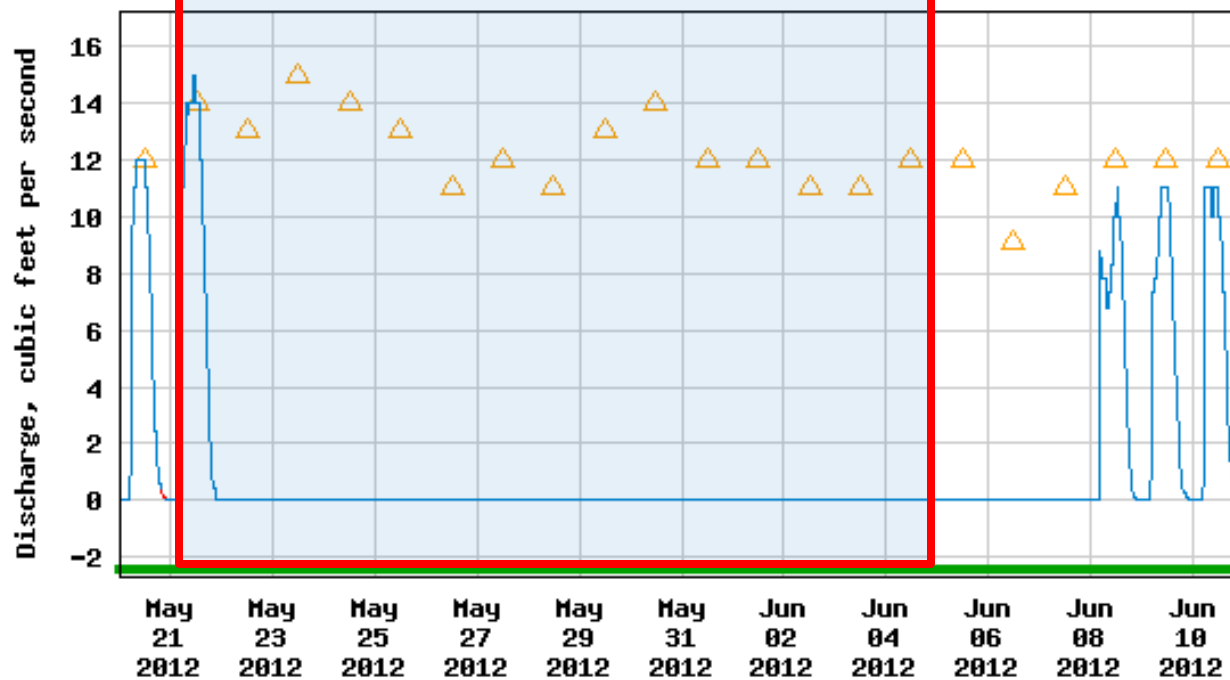
- ▶ Type: Diversion
- ▶ May 21, 2012 – June 4, 2012
- ▶ 14 days
- ▶ Approx. Length: 6100'
- ▶ Cost: minimal



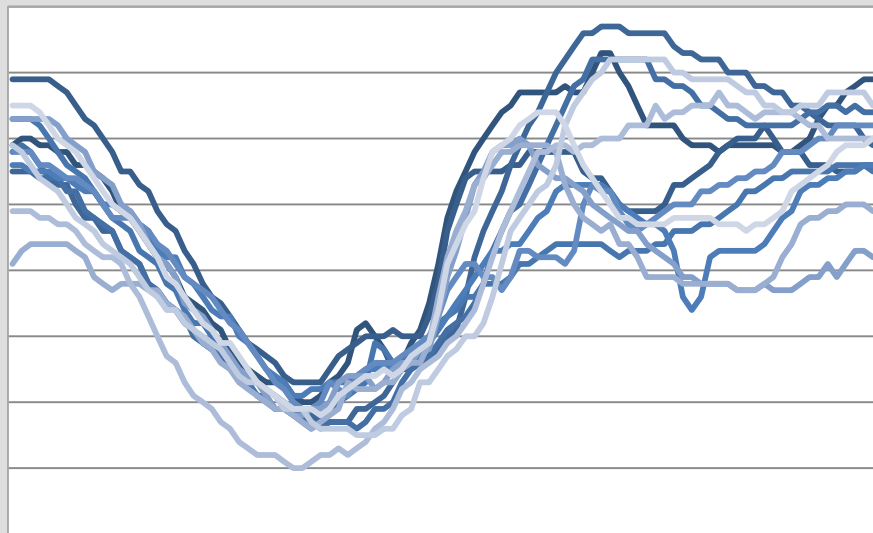
USGS 09486500 SANTA CRUZ RIVER AT CORTARO, AZ



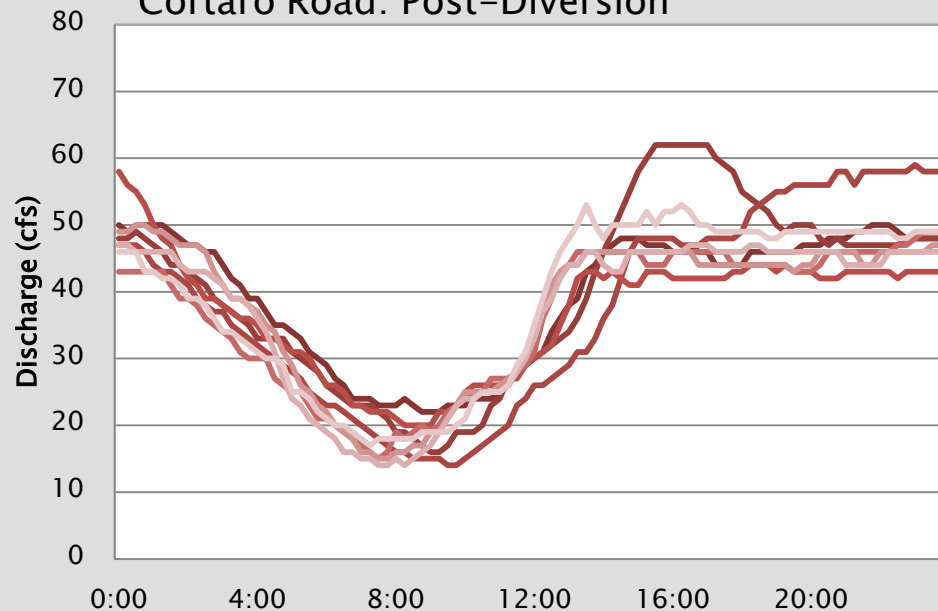
USGS 09486520 SANTA CRUZ RIVER AT TRICO ROAD, NR MARANA, AZ.



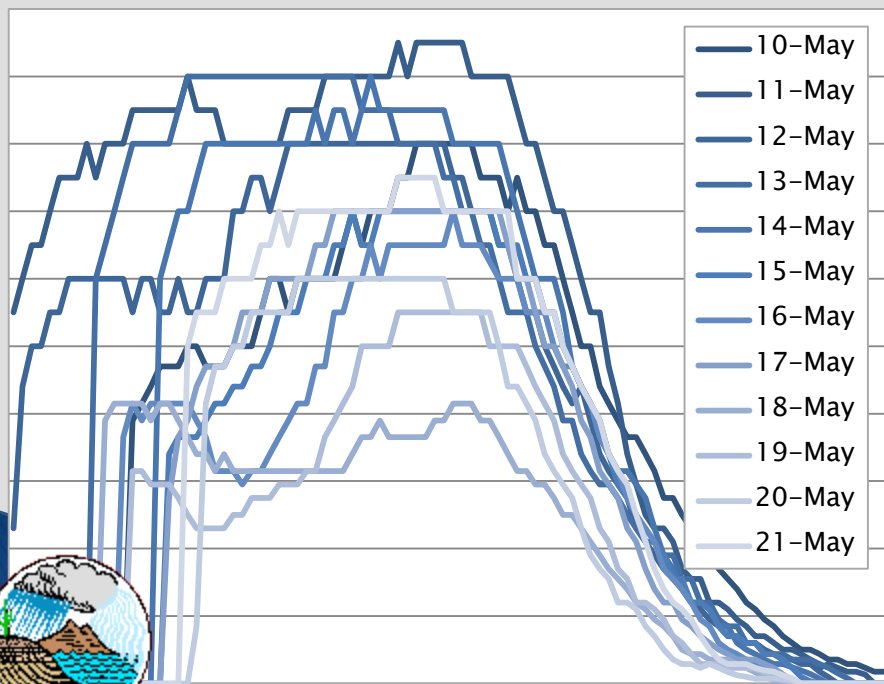
Cortaro Road: Pre-Diversion



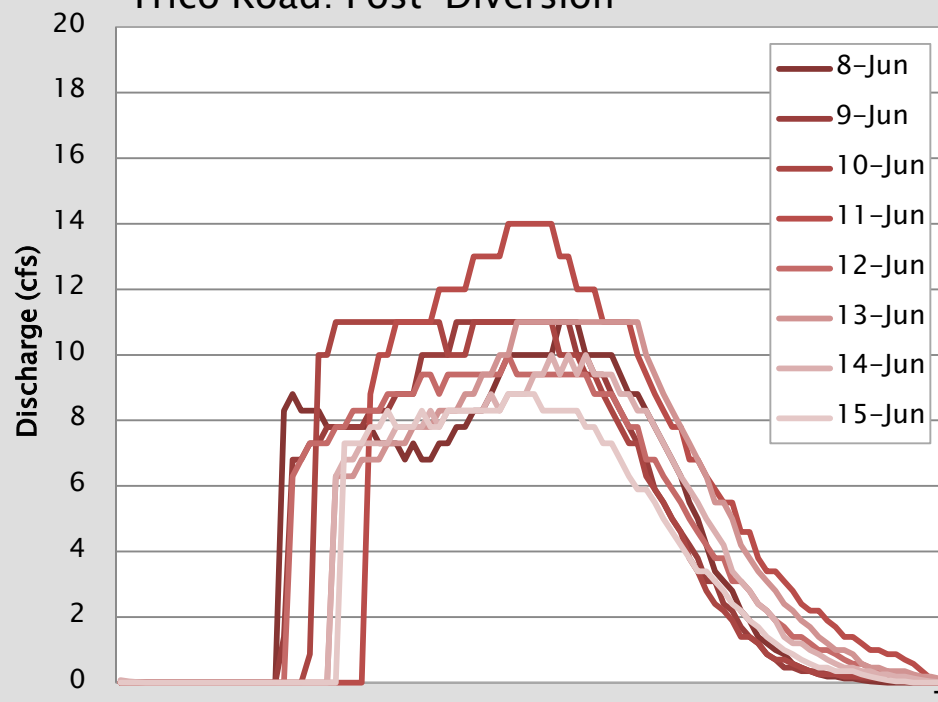
Cortaro Road: Post-Diversion



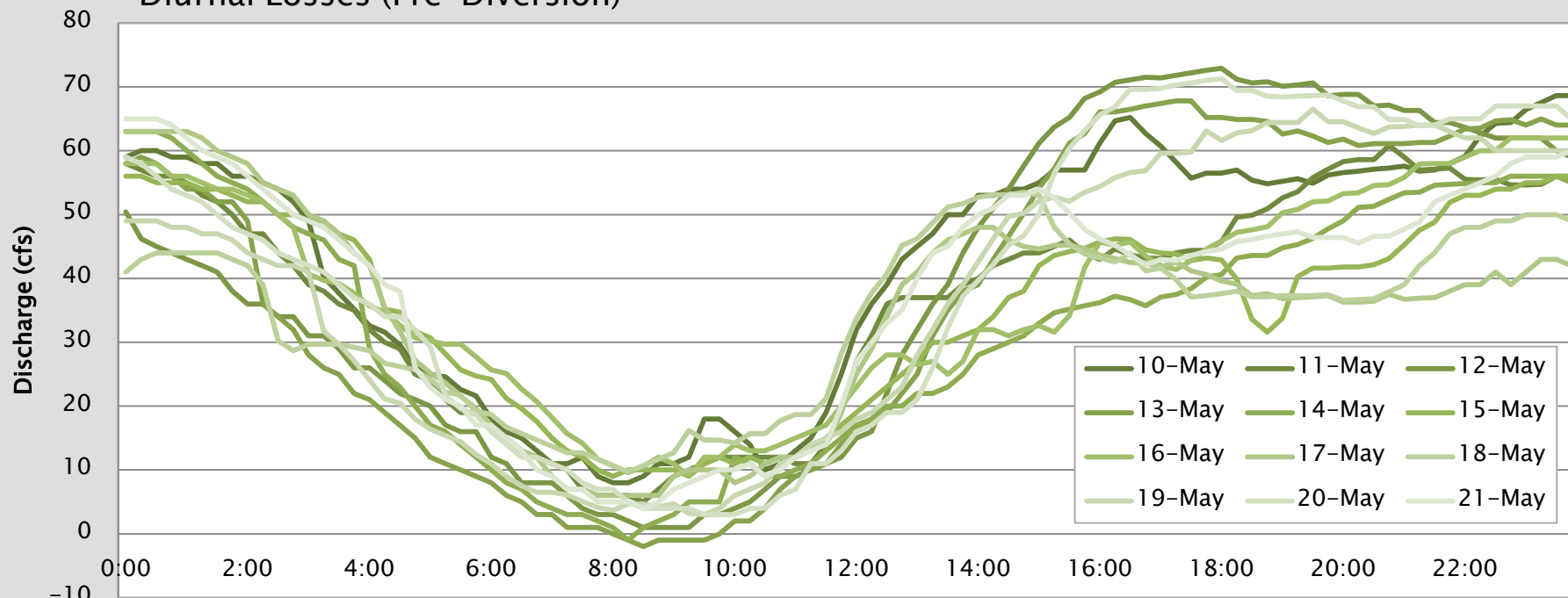
Trico Road: Pre-Diversion



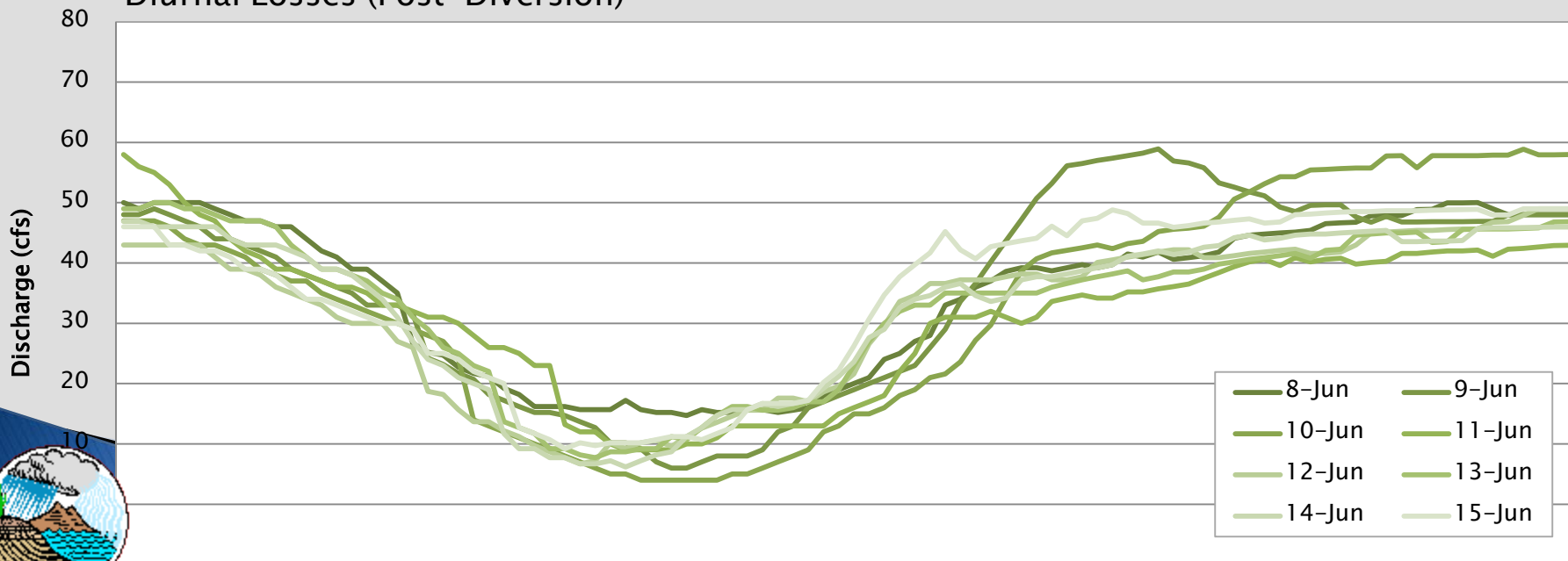
Trico Road: Post-Diversion



Diurnal Losses (Pre-Diversion)



Diurnal Losses (Post-Diversion)



Peak Discharge Attenuation: Cortaro Road to Trico Road



Distance $\approx$ 16.4 miles

Velocity $\approx$ 1.3 mph (1.9 fps)



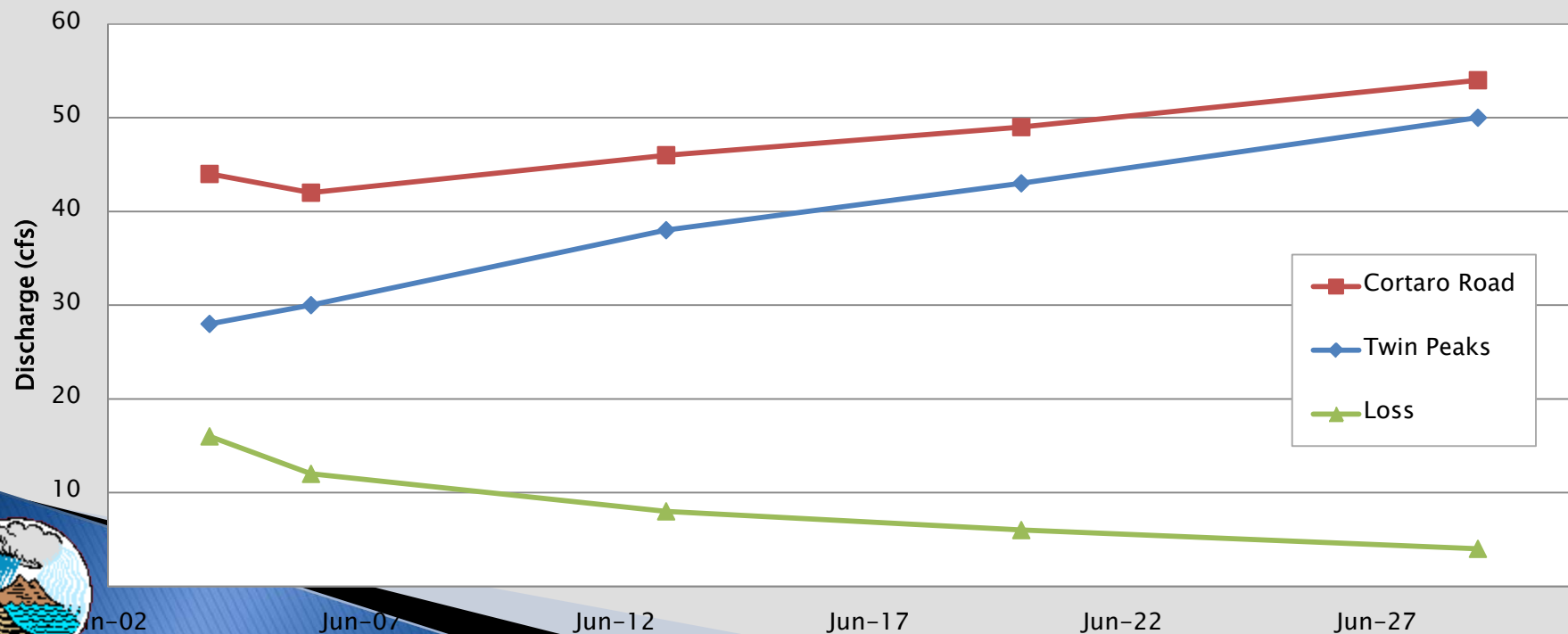
Streamflow Gauging: Twin Peaks Road

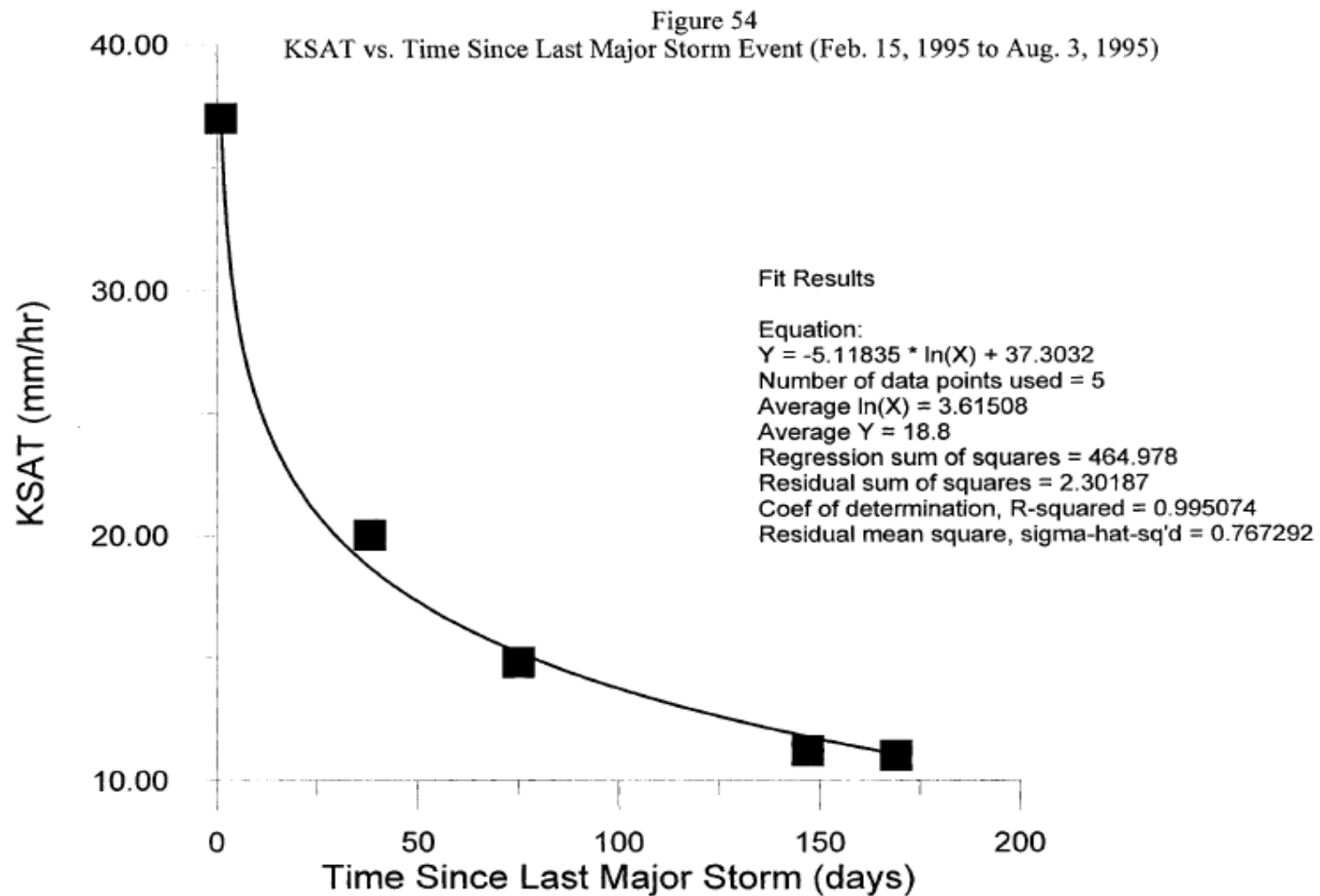


Date	Twin Peaks*			Cortaro Road: Discharge (cfs)			
	Time		Discharge (cfs)	Time	PCRFGD	USGS	
	start	end			Calibration	Provisional	Approved
Jun-04	4:45 PM	5:15 PM	28	10:15 AM	--	23	25
Jun-06	5:10 PM	5:30 PM	30	10:30 AM	22	24	25
Jun-13	5:15 PM	5:45 PM	38	10:45 AM	--	24	27
Jun-20	5:10 PM	5:35 PM	43	3:45 PM	49	6	12%
Jun-29	4:40 PM	5:15 PM	50	3:20 PM	54	4	7%

* approx. 2.1 miles downstream of Cortaro Road

** approx. 1.6 hours prior to Twin Peaks measurement

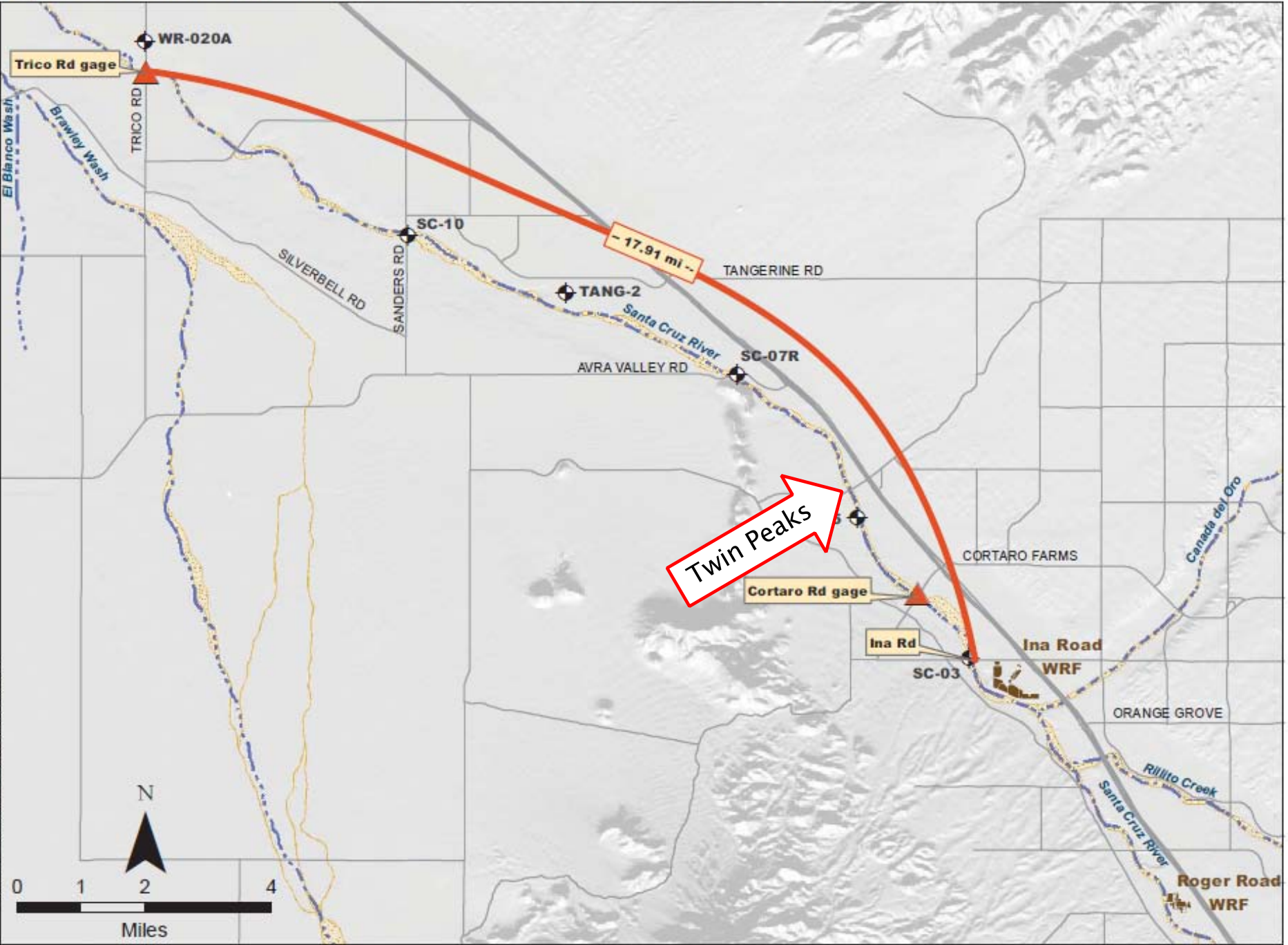




(Lacher, 1996)

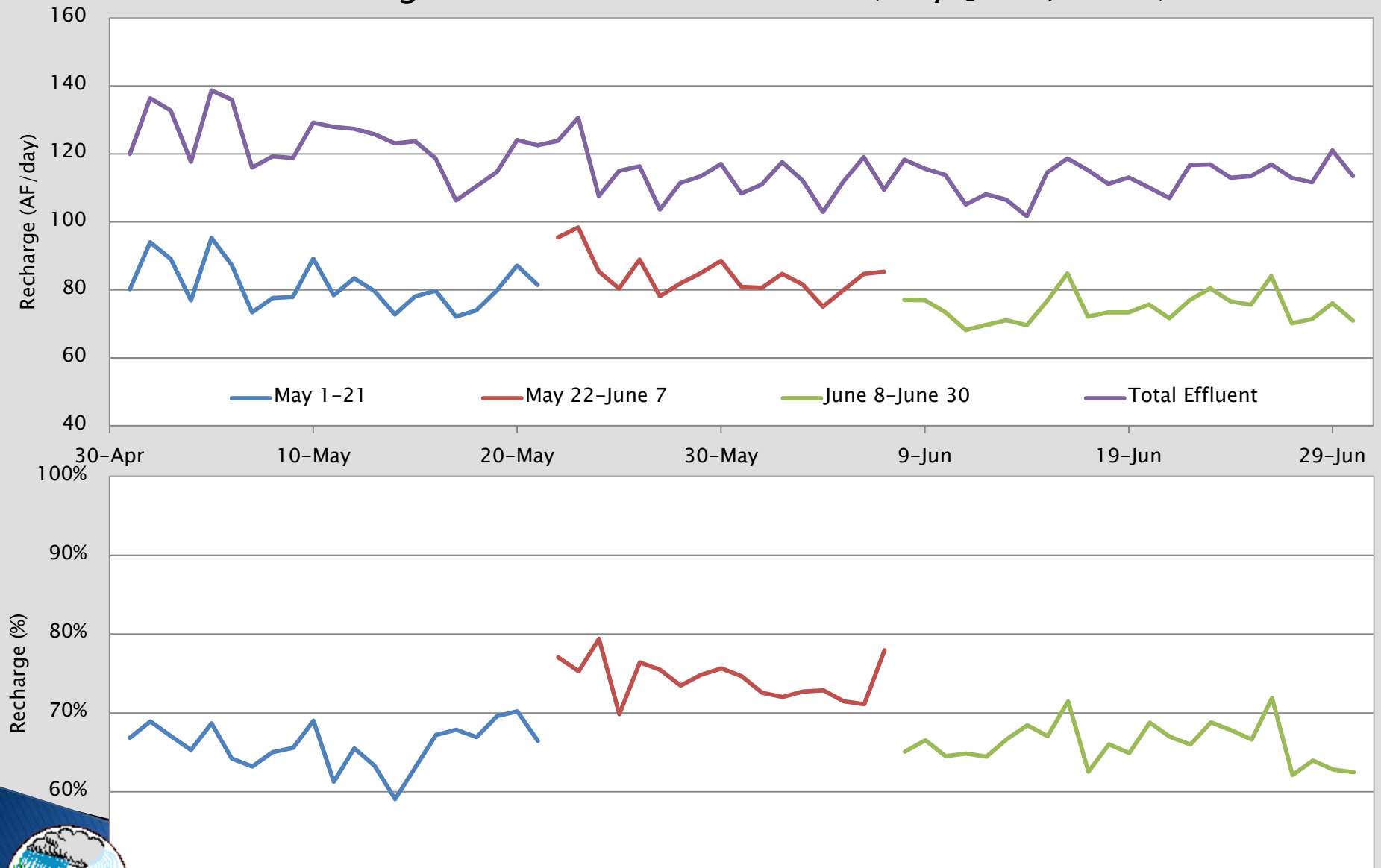


Figure 1: Location Map for Lower Santa Cruz River Managed Recharge Project



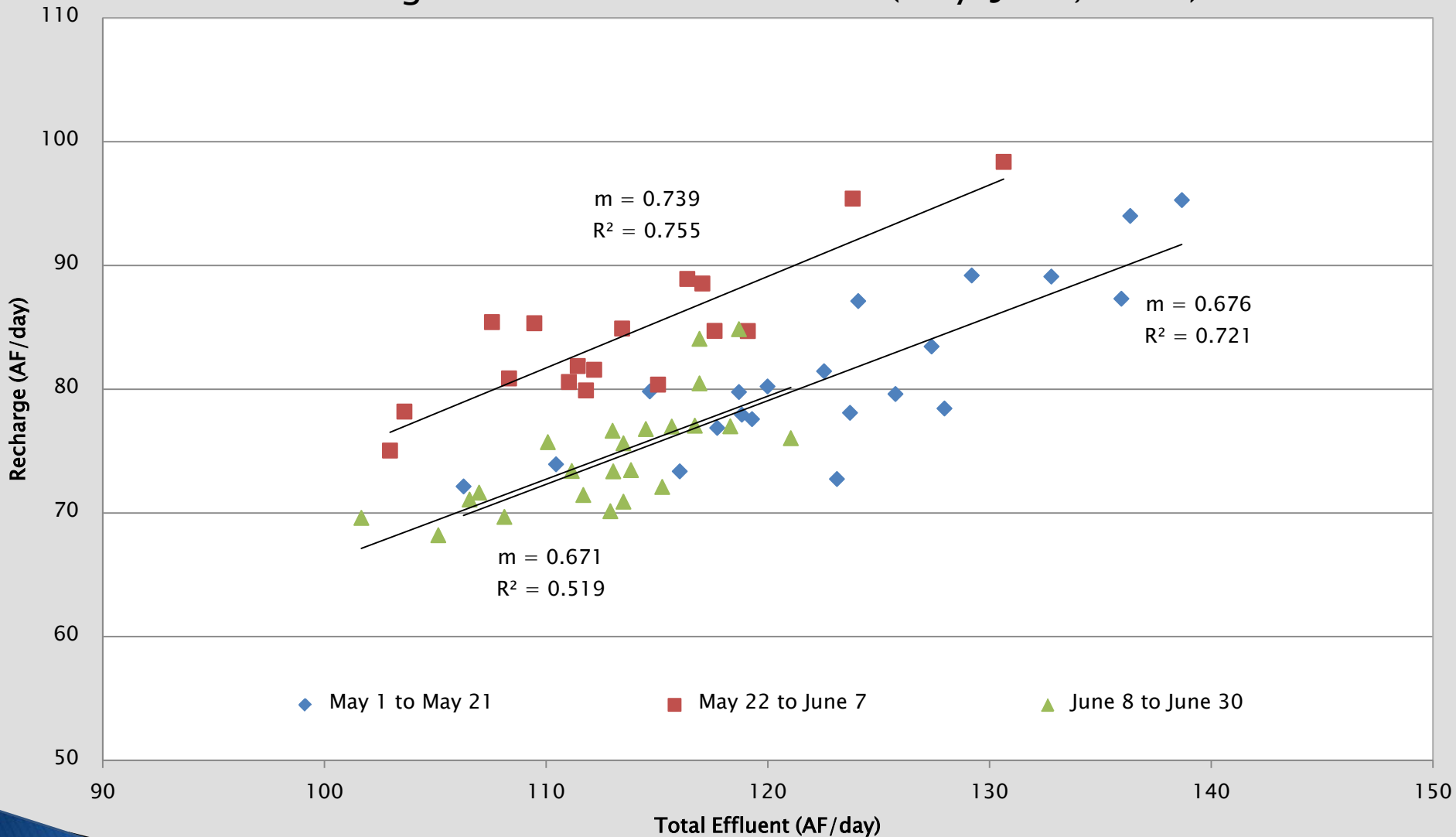
Lower Santa Cruz River Managed Recharge Project

Recharge: Ina Road to Trico Road (May–June, 2012)



Lower Santa Cruz River Managed Recharge Project

Recharge: Ina Road to Trico Road (May–June, 2012)



“Active” Managed Recharge

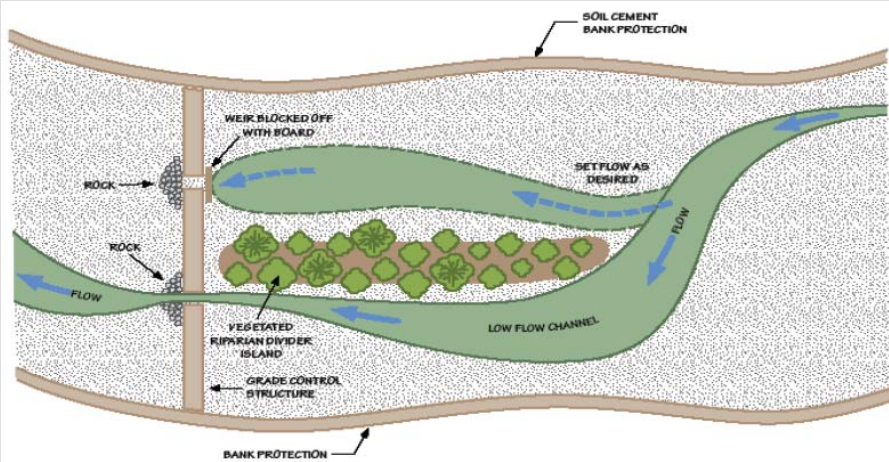


Figure 4-6
PLAN VIEW of WEIRS at GRADE CONTROL STRUCTURE
Santa Cruz River – Continental Ranch Area

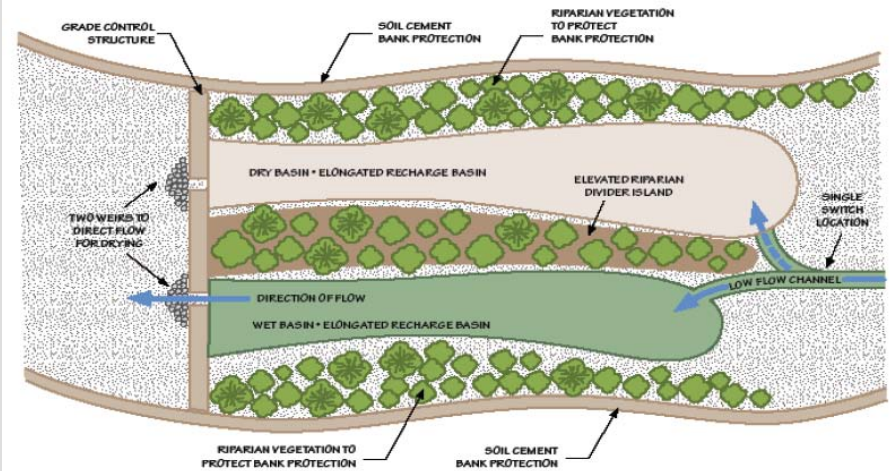


Figure 4-7
PARALLEL BASINS at GRADE CONTROL STRUCTURE
Santa Cruz River – Continental Ranch Area

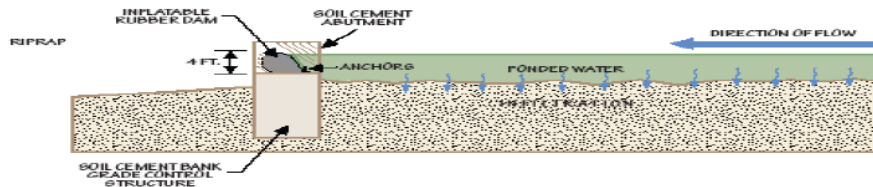


Figure 4-10
INFLATABLE RUBBER DAM on GRADE CONTROL STRUCTURE
Santa Cruz River – Continental Ranch Area

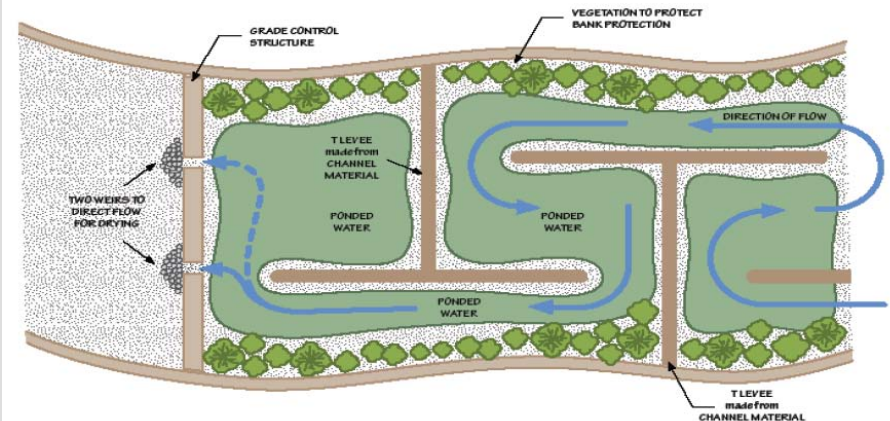


Figure 4-8
T-LEEVE SYSTEM TIED INTO BANK PROTECTION and GRADE CONTROL STRUCTURE
Santa Cruz River – Continental Ranch Area

Constructed Recharge Facilities on the Santa Cruz River
(PCRFGD, 2008)

RECLAMATION

Managing Water in the West

**Enhanced Recharge
Demonstration Project, Increasing
Treated Effluent Recharge Rates in
the Santa Cruz River, Tucson,
Arizona**



Photo Source: Google Earth, April 26, 2011



U.S. Department of the Interior
Bureau of Reclamation
Phoenix Area Office

April 2012



Photo 2. – Removal of Excavated Material during Excavation.

Photo by Carol Hansen.

Infiltration Rates

- ▶ 4–5x greater after maintenance
- ▶ decreased over time



Photo 12. – Mudcracks in Channel 1 after 7 Days of Drying during First Maintenance Event. Brad Despaigne is crossing channel.

Photo taken by Deborah Tosline.



Photo 17. – Buried Upstream Flume after July 5th and 6th Stormflows.

Photo taken by Deborah Tosline.



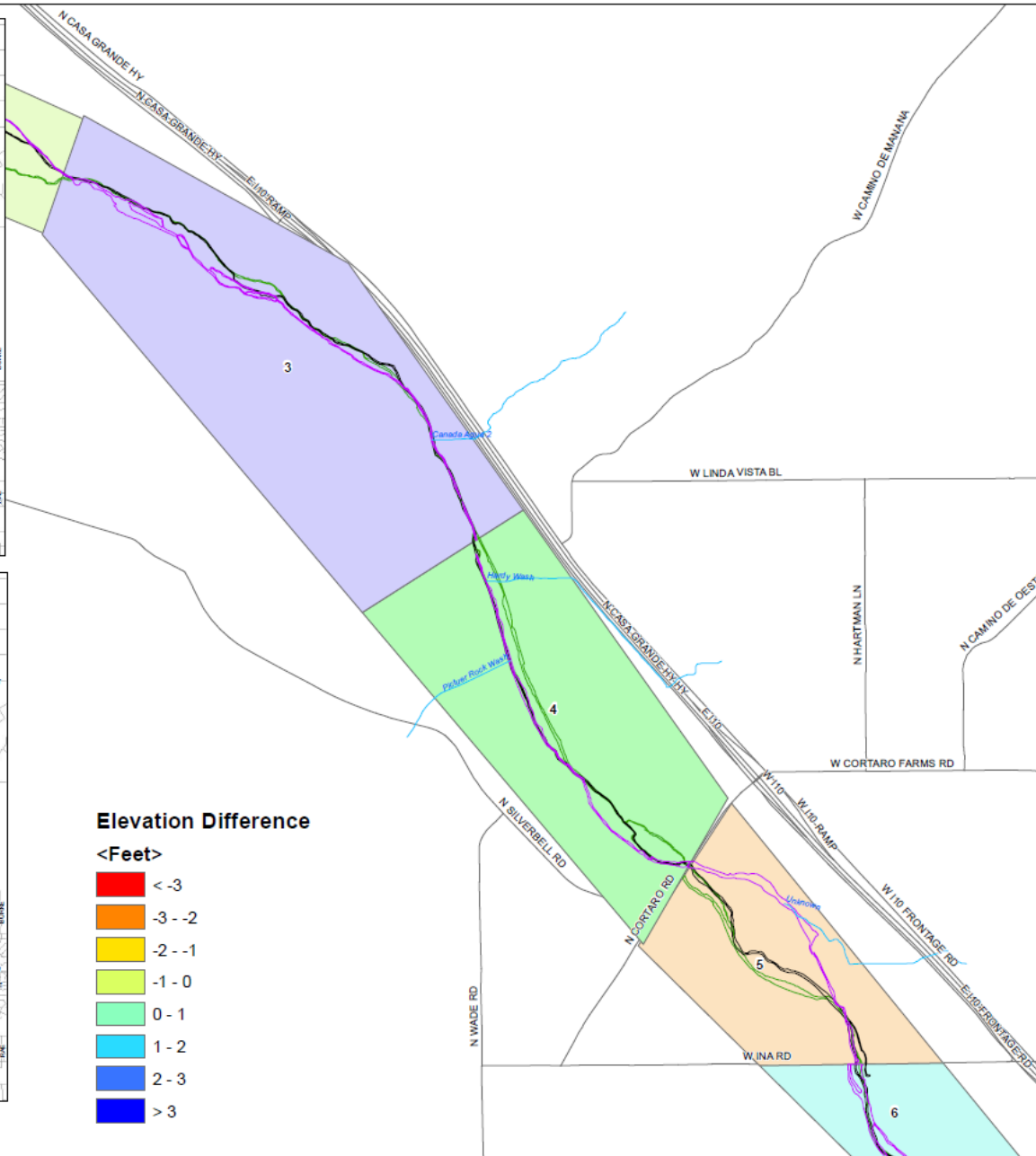
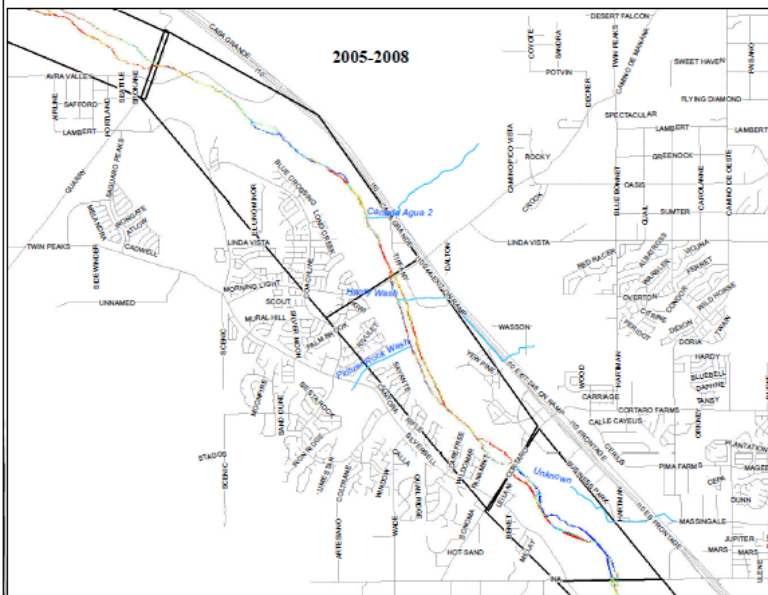
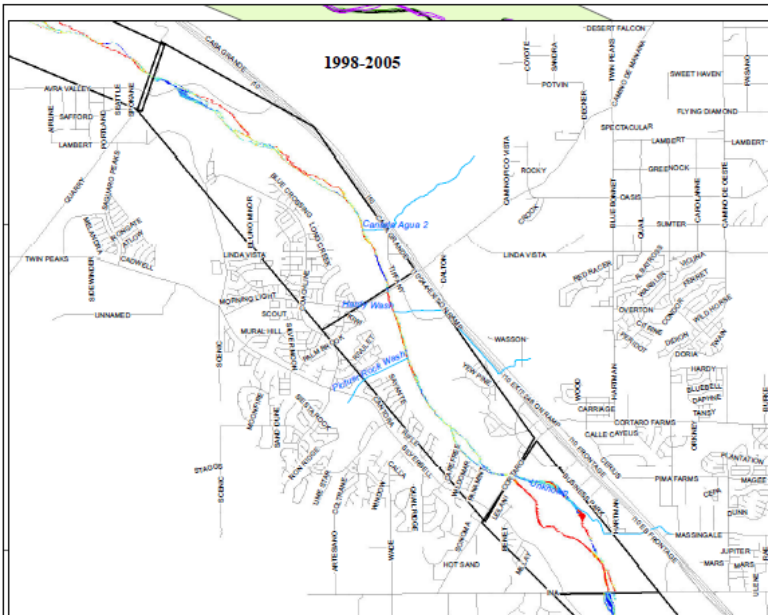


Exhibit 2.3 Reach 3, 4 and 5

Reach	4	5	6	7
1				
2				
3				
4				
5				
6				
7				

Low Flow Channel 1998

Low Flow Channel 2005

Low Flow Channel 2008



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Conclusions

- ▶ Excavation
 - Costly and Ineffective, many opportunities
 - Unknown soils and compacting
- ▶ Diversion
 - Minimal costs, limited opportunities
 - Preferred routs and existing vegetation
 - Increased infiltration reduced over time
- ▶ 14 days of drying conditions
- ▶ 17 days of no flow at Trico Road
- ▶ 8.2 % increase in recharge



Implications

- ▶ Lower Santa Cruz *Managed* Recharge Project
 - ... is designed and managed to utilize *the natural channel of a stream to store water underground...* (A.R.S. §45–802.01.12)
- ▶ ROMP improvements
 - Increase in infiltration (?)
- ▶ Recharge credits and cut to the aquifer
 - 50–50



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Photo: daronshade (panoramio.com)



A.R.S. §45–802.01.12

- ▶ "Managed underground storage facility" means a facility that meets the requirements of section 45–811.01 and that is designed and managed to utilize the natural channel of a stream to store water underground pursuant to permits issued under this chapter through artificial and controlled releases of water other than surface water naturally present in the stream. Surface water flowing in its natural channel is not a managed underground storage facility.

