Marana High Plains Effluent Recharge Project

A Multi-purpose Recharge Facility

In Pima County Arizona

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Contributing Partners

- Pima County Flood Control District
- U. S. Bureau of Reclamation
- Arizona Water Protection Fund
- Town of Marana

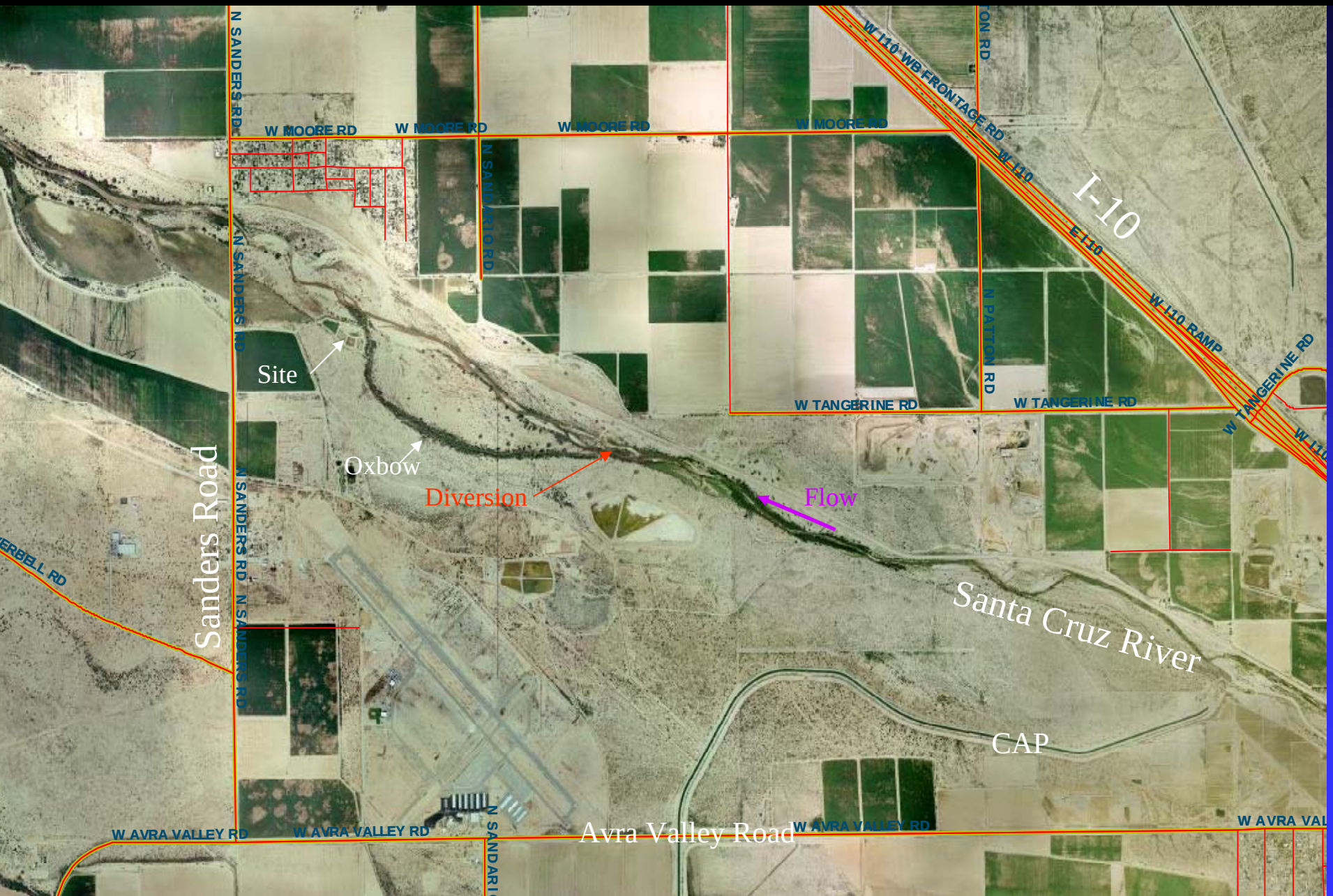
Original Project Objectives

- Evaluate infiltration rates in basins with side slopes vegetated with emergent plants and riparian trees, and in basins with native grasses tolerant of periodic inundation.
- Re-vegetate areas outside of the recharge basins with plants that will improve wildlife habitat value.
- Characterize wildlife, aquatic macro-invertebrates, and vegetative resources associated with an effluent dominant stream.

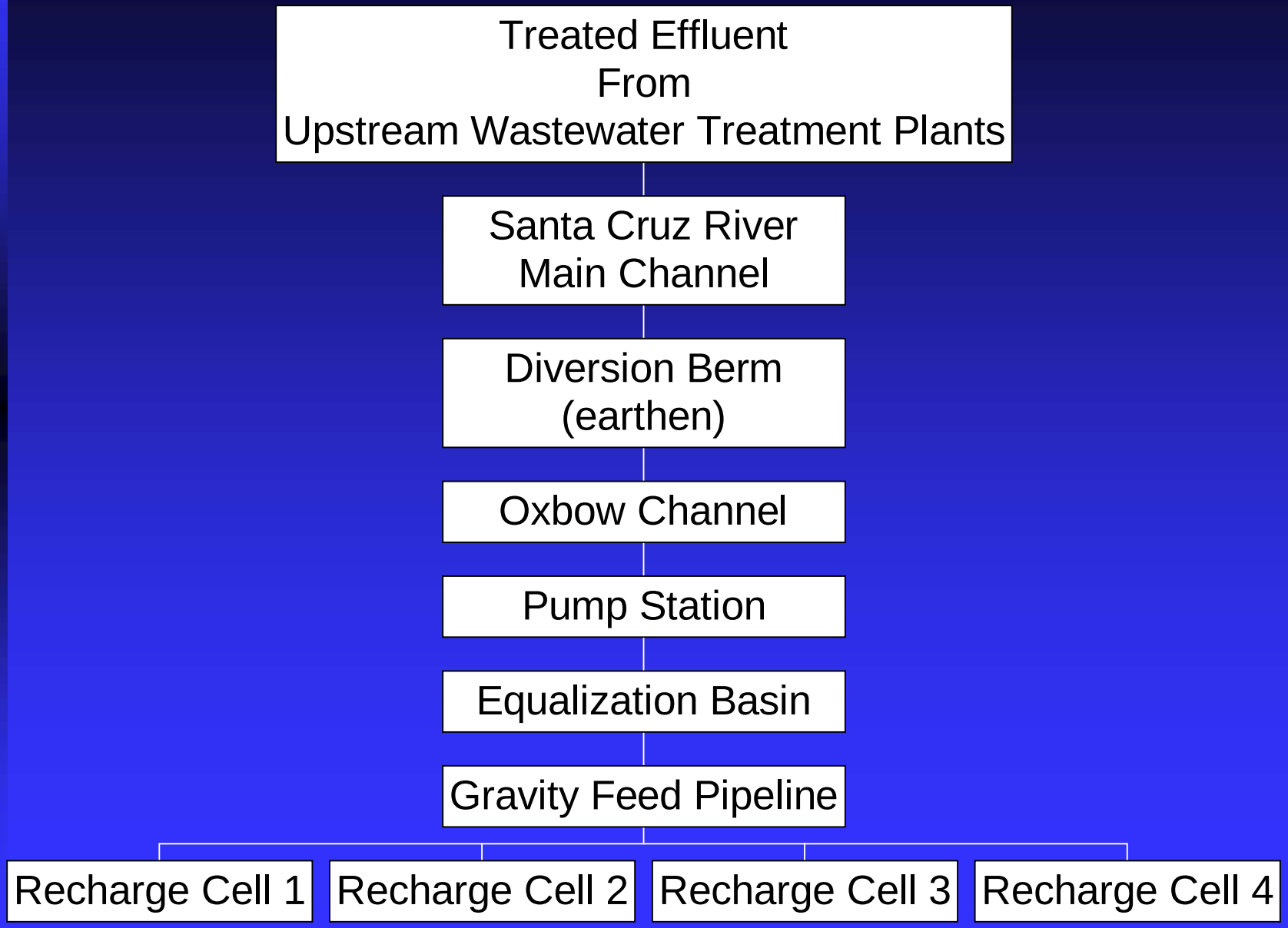
Project Objectives (continued)

- Identify and monitor biological effects resulting from establishing other habitat now rare to the area and increasing riparian vegetation.
- Provide trails, literature and interpretive signs describing the pilot project and supply linkage to a longer riverine trail.
- Increase recharge capacity based on four years of pilot operation

LOCATION MAP



Effluent Delivery



Effluent Delivery

- Based on daily cycle of discharges from upstream treatment plants.
- Peak flows on-site normally occur in late morning and early evening hours.
- Impacted by storm water events in the Santa Cruz River that wash out the diversion berm used to divert flows into the oxbow channel.

Oxbow Channel

Oxbow Channel

- Remnant channel of Santa Cruz River.
- Surface water diverted into channel using earthen berm.
- Water flows ~ 1.2 miles down channel to Project.
- Lush riparian habitat exists along entire channel.
- Maintained by diversion

Wet Well

- Collects flows in oxbow channel for pump station.
- Some flow is diverted by local rancher to irrigated fields.
- Excess flows are diverted back to Santa Cruz River channel.

Non- Clogging, Submersible Pumps (2)

- Flows conveyed into 8” pipeline.
- Pumps designed for lead/lag operation.
- Shut down at low water levels in oxbow channel.
- Flow meter installed to measure total delivery to Project.

Equalization Basin

- Provides more constant source of effluent.
- Serves as settling basin for removal of clogging materials.
- Level sensor turns pumps on at low water levels and shuts them down at high water levels.
- Incidental recharge counted for credits.

Recharge Cells (4)

- Effluent passes through motorized control valves, fed by gravity to distribution line.
- Level sensors are used to automatically open and close valves based on pre-set water levels (3” low, 12” high).
- Valves can be closed manually during scheduled drying cycles.
- Cells had different treatments to study effects on infiltration.

Multi-use Facility

- Recharges water into the local aquifer.
- 100% of the recharge credits are accrued and used to offset pumping in other areas.
- Riparian enhancement provided through direct plantings and by recruitment via effluent influx into the area.
- Educational signage provided along pathways around facility.
- Recreational benefits include hiking and bird watching from greater bird activity in area.

Monitoring

- Daily inflows into Project compiled for the USF Permit, Water Storage and Recovery Well Permits.
- Water levels recorded at on-site wells (bi-weekly) and off-site wells (monthly) for USF Permit.
- Water quality sampling is performed monthly for nutrients (Nitrogen) and quarterly for total metals and VOCs for the APP.
- Bird monitoring
- Biological monitoring

Maintenance

- Basins scraped and ripped periodically (~ 6 mo.- yr.) to break up clogging layers and increase infiltration.
- Basins wetted and dried based on infiltration rates
- Diversion berm periodically repaired due to wash out from stormwater runoff.
- Vegetation pruned and weeds removed to facilitate maintenance of recharge equipment.

Recharge Operations

- Facility operations began on February 18, 2003.
- Recharge originally conducted using a seven-day wet/dry cycle. Now based on infiltration rates/
- Recharge was high (1-3 ft/dy) Oct 08-March 09.
- Periodic wash outs of the diversion berm and mechanical failures with the equipment limit overall recharge.

Monthly Recharge (2008)

Month	Recharge (acre-feet)
January	32.56
February	10.78
March	35.76
April	18.05
May	20.81
June	24.55
July	3.43
August	0.00
September	0.00
October	46.42
November	81.52
December	74.40
Total	348.28

Infiltration Rates

- Determined using volumetric method (total flow/wetted acreage).
- Wetted acreage provided by daily operator through visual observation.
- No significant differences over the pilot period 2003-2007 in the non-vegetated basins (Cells 1, 2) versus Basin 3 with vegetation on side slopes.
- Rates for the vegetated basin (Cell 4) were significantly lower than other three basins.

Environmental Benefits

- Successful establishment of native riparian vegetation planted on-site.
- Successful recruitment of saltbush, grasses and forbs due to effluent influx.
- 83 species of birds have been observed at the project site from 2002 – 2006
- Butterfly species increased from 8 species observed in 1998 to 32 species observed from 2002 – 2006 (19 species observed in 2004)
- Effluent diverted into oxbow channel has created a dense ribbon of riparian vegetation (cottonwood, willow, etc.) along 1.25 miles extending from the diversion berm to the Project.

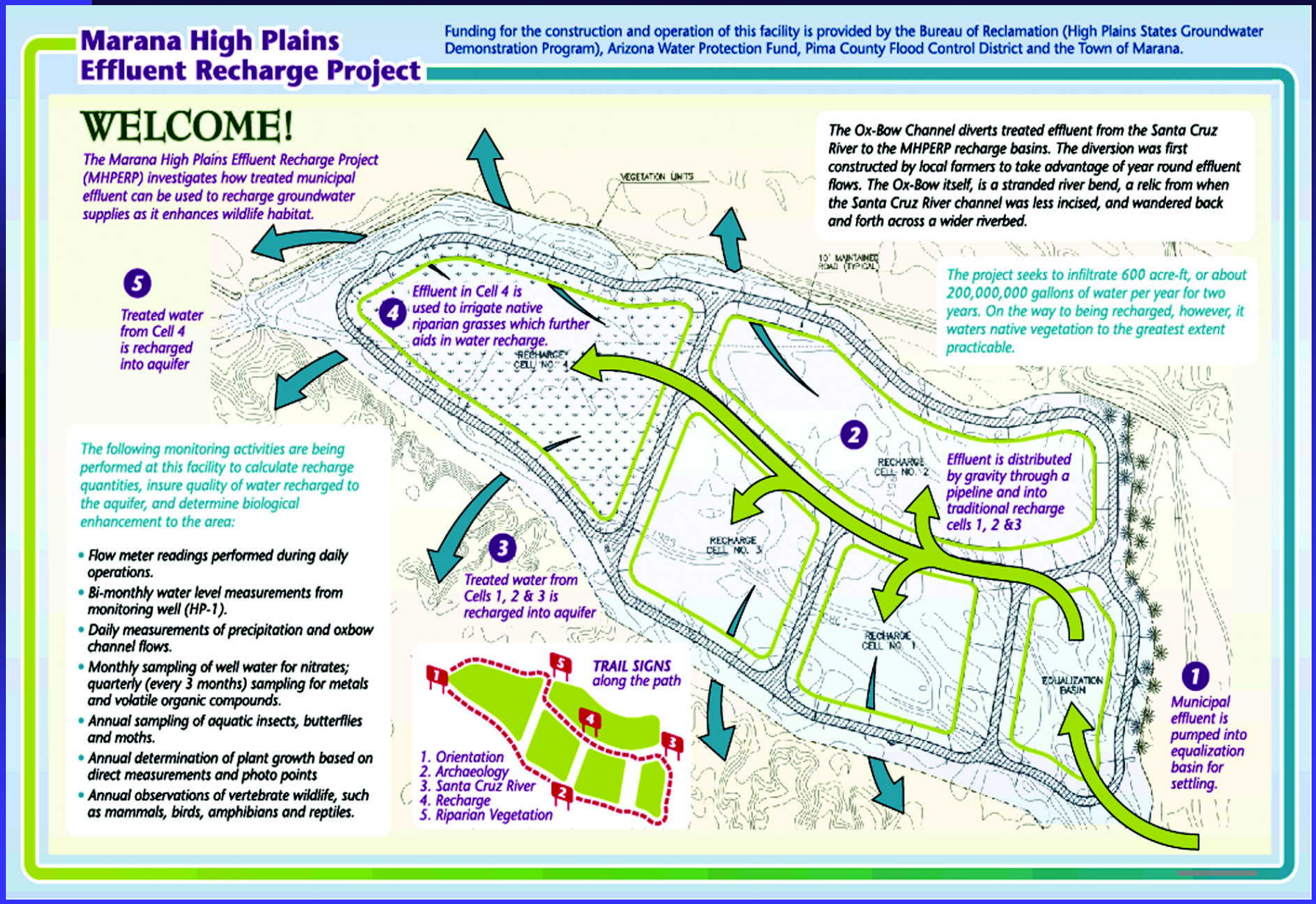
Established Vegetation

Elderberry planted along Recharge Cell #4, April 2004

Riparian Vegetation

Oxbow channel east of Project, April 2004

Educational Signage



Educational Signage

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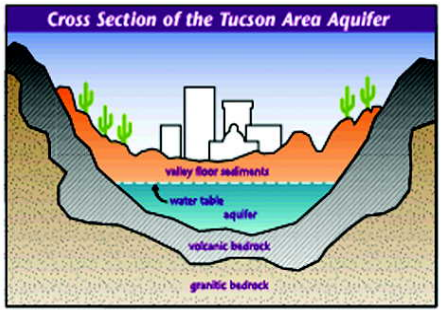
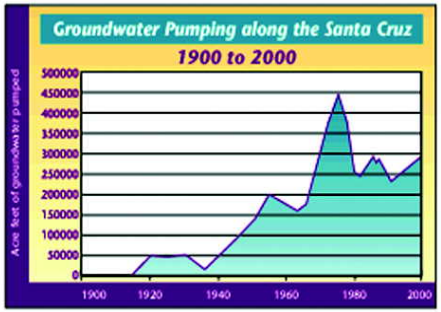
Funding for the construction and operation of this facility is provided by the Bureau of Reclamation (High Plains States Groundwater Demonstration Program), Arizona Water Protection Fund, Pima County Flood Control District and the Town of Marana.

GROUNDWATER RECHARGE

You only get out what you put in...

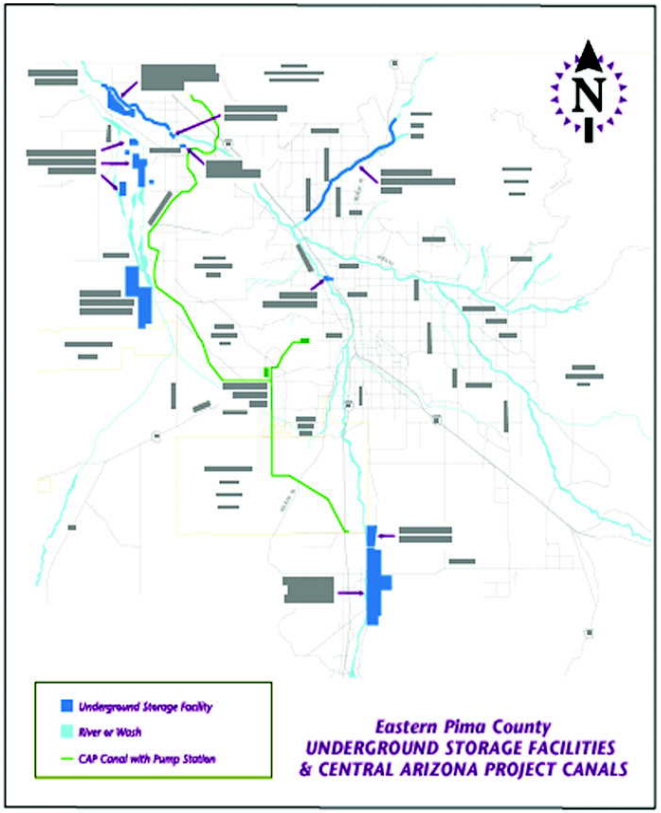


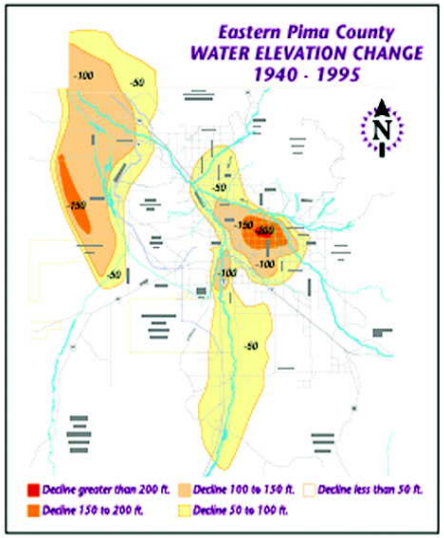
Aquifers are like checking accounts— withdrawals can exceed balances for only so long

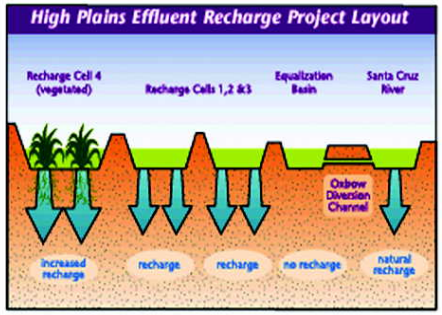


In Southern Arizona, growth has been rapid for the past fifty years, and is reflected in the groundwater pumping records shown above.

With only rainfall to replace all the water that's been removed from the aquifer, groundwater levels have dropped throughout the Santa Cruz River Basin.







Recharge projects such as this one use treated wastewater from the nearby river to restore depleted groundwater supplies, a necessity for sustaining populations and continued growth.

Related efforts to recharge Tucson's aquifers are going on throughout the basin. Both the City and the County are recharging both treated effluent and Central Arizona Project water in an effort to stem further groundwater depletion and help the community reach 'sustainable yield' by the year 2020.

Educational Signage

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RIPARIAN VEGETATION

The word "Riparian" from the Latin 'riparius', or river is an adjective that describes things which live on river banks. Plants, birds and animals typically associated with streamside environments are described as 'riparian' in nature.

The riparian environment extends beyond the actual river bank, however, to include the boundaries of the floodplain and anywhere groundwater is close enough to the surface to support riparian vegetation.

Riparian areas are often called "streams of life" and the "lifeblood" of the desert. While they occupy less than one percent of the lands in Arizona, riparian areas help sustain populations of 60 to 75% of the state's resident wildlife species.

While walking the grounds of the Marana High Plains Effluent Recharge Project, watch for some of these important native riparian plant species that are being introduced in concert with efforts to restore our depleted groundwater resources.

NON-NATIVE SPECIES
Man made changes in the environment include the introduction of species that can negatively influence riparian environments by changing flood regimes, increasing fire potential, altering water chemistry or by direct competition with native plants and wildlife.

FREMONT COTTONWOOD
(Populus Fremontii)
Preferred by beavers for food and dam building, it is favored by people for it's expansive shade and beauty.

FLAT-TOP BUCKWHEAT
(Eriogonum fasciculatum)
Bees are attracted to it's pollen. Some varieties were used as analgesics by Native Americans.

GOODDING WILLOW,
(Salix gooddingii)
The largest willow species in Arizona. It's deep root system stabilizes soil and prevents erosion

CATCLAW ACACIA
(Acacia Greggii)
The thorns of this shrub are short, curved and very sharp. Also called the 'Wait-a Minute-Bush'. The seed pods are edible. The flowers attract bees and other insects.

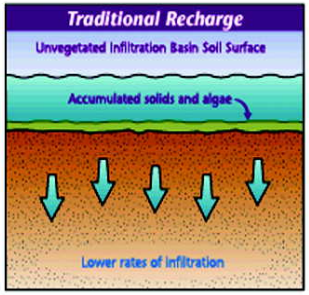
TAMARISK or SALT CEDAR
(Tamarix chinensis)
Tamarisk can cause serious harm to native vegetation by increasing fire frequency and intensity, soil salinity, and water availablity in riparian areas. Unpalatable foliage, limited fruits and seeds, and poor structure for cover make it unsuitable for most wildlife.

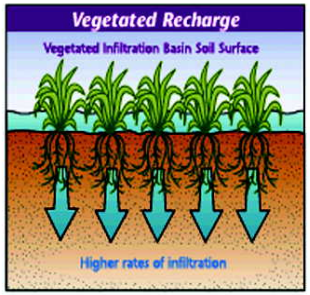
CREOSOTE BUSH
(Larrea tridentatata)
Some varieties are among the oldest living plants, up to 11,000 years. Produces a distinctive fragrance after a rain. Used as a glue and for medicinal products by Native Americans.

SCREWBEAN MESQUITE
(Propsosis pubescens)
The seed pods were an important and nutritious food source for Native Americans. The wood, roots and bark were used for many products

How Vegetation Helps Recharge

Infiltration rates are impeded by accumulation of solids and algae, compaction by raindrops and drying by the sun. Unvegetated recharge beds must be rested at regular intervals and frequently tilled with mechanical devices, both of which restrict operation and increase cost.





Continuous growth of riparian grasses, adapted to survive periodic flooding, breaks up the surface clogging layer, provides shade, which surpresses algal growth and delays drying, all of which contribute to increased infiltration.

Note the different Riparian plant communities that are located throughout the project.

Significance of Multi-Purpose Facilities

- Provide benefits beyond recharge to the underlying aquifer.
- Provide quality habitat for wildlife in the surrounding area.
- Provide resources for migrating neotropical birds.
- Provide recreational opportunities.
- Educate the public.

THE END