A Salty Tale...
Malaga Bend on the Pecos River

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A Salty Tale...

- Historical context
- Background
- History
- Update
U.S. Topographical Engineers and the Camel Corps

- “Camels crossing a West Texas stream” - From a painting by an unknown soldier who may have been with the Echols or Hartz “topographical engineering” expeditions
- Same location as Pope’s expedition
- Corps of topographical engineers surveyed and documented hydrographical features
- Looking for convenient routes west, such as river crossings and water sources
Captain John Pope’s Expedition and Artesian well drilling site

Gave up looking for fresh water after 3 years

Landmark on Goodnight-Loving Cattle Trail
Crossing the Pecos River

- Little fresh water and dangerous crossings
- Horsehead Crossing

**Butterfield Overland Stage Route used crossings**

- Pope’s Crossing inundated by Red Bluff Reservoir in 1936
Pecos River

- Rio de las Vacas...Rio Salado...Rio Puerco...Rio Pecos
- 929 miles long
- Over 44,000 square miles drainage area
- National Wild and Scenic River in headwaters (20.5 mi)
- Average daily flows (Tx A&M and IBWC)
  - ~90 cfs at Malaga Bend
  - ~33 cfs at Girvin
  - ~265 cfs at Langtry
- ~222,000 acre feet into Lake Amistad
Salinity Sources at Malaga Bend

- Permian period shallow sea - 245 million years ago
- Sea advanced and retreated
- Formation of evaporite deposits
- Groundwater dissolution formed collapsed sinkholes
- Pecos River salt springs
  - Up to ~172,000 tons per year
  - Salinity up to 4,100 ppm
- As flows declined in river = less dilution made conditions worse

from Miyamoto & others (2007)
Salinity Impacts

- **Red Bluff Reservoir**
  - Salt loading total = 560,000+ tons per year
    - 478,000 tons per year from Pecos R.
    - 80,000 tons per year from Delaware R.
  - Reservoir Outflow
    - 410,000 tons/year
    - TDS of water = 6,000 ppm
    - Too high for most crops
    - Marginal for livestock
    - Limits biodiversity of species
  - Salinity at Girvin: 12,000 ppm

- **Salt loading for Lake Amistad**
  - 26% from Pecos River (<10% flow)
  - Upper limit of drinking water standards
    from Miyamoto & others (2007-8)
Springs and Seeps discharging into the Pecos River at Malaga Bend

from Malaga Bend Experimental Salinity Alleviation Project – A Comprehensive Interim Report, Eddy Co., NM, 1970
By John S. Havens, prepared for the USGS in cooperation with the Pecos River Commission
1938-1955 – PRC was active in sponsoring reports that identified brine discharge near Malaga Bend

USGS proposed solution of pumping brine to lower aquifer and reduce discharge

1958 – Congress Authorizes Water Salvage Alleviation Project
  • McMillan Delta Salvage Channel
  • Brine pumping at Malaga Bend

First salt control project of its kind in the U.S.
  • Construction by Bureau of Reclamation
  • Data collection by USGS
  • Right of way acquired by New Mexico
  • Operation and maintenance by Texas
Malaga Bend Salinity Alleviation Project

- **1963:** Pumping starts
  - **220 ft well, ~2 miles of pipe**
  - Discharge to unlined but compacted 50-acre evaporation pond called Anderson Lake

- **Pumping from 1963 to 1976**
  - By December 1964, 1,000 acre-feet of water pumped removing 300,000 tons of salt
  - Decreased brine inflow to river by 70%
  - About 3,878 acre-feet of brine is pumped

- **1970, 1976, 1979, 1980:** USGS reports with concerns mounting over leakage from disposal lake

- **1972-1977:** Brine pumped to Culberson County (Texas) for enhanced oil recovery (EOR) but stops due to pump and casing problems

From Havens, 1970.
Recent Salinity Control History

- **1992**: Private companies propose to pump at Malaga Bend to “harvest” salt for sale
- **1993**: Pumping stops due to:
  - A need to re-engineer the pond
  - Concerns that pond was hazard to water fowl
  - Lack of interest by United Salt Company to operate facility
- **2000 - 2005**: Private companies were once again offering proposals to mine salt
- **2010**: Pecos River Water Quality Coalition Forms
  - Coordinate efforts of PRC, lawmakers, stakeholders and Federal and State agencies
- **2012**: Pecos Initial Assessment by U.S. Army Corps of Engineers and conducted by USGS
- **2013**: Southwest Salt Company begins Malaga Bend project
- **2013**: Pecos Watershed Assessment Project
  - Part of Rio Grande Salinity Management Program
  - Non-Federal sponsors: Texas TCEQ and New Mexico ISC
  - Funds provided by Texas Water Development Board
  - Contracts and Agreements signed in March 2014
  - Kickoff Meeting in May
Current Malaga Bend Project

• **2012**: Pecos River Compact Commissioners work with Southwest Salt, a private company, to pump well again to produce salt

• **2013**: Pumping Begins
Pipeline/Ditch from Well to Ponds

- Pump at Well C-2713
- 2.5-mile pipeline
- Three 20-acre evaporation ponds (so far)
- Processing plant constructed
Well C-2713 at Malaga Bend

- Well drilled into brine aquifer in Salado Formation
- Can produce 250,000 tons of salt per year
  - Would require up to 8 ponds
- Pond permit from New Mexico Environmental Dept. allows 4 ponds
- By end of 2014 - selling salt
- By end of 2015 - rate to increase to 6,000 tons per month
- By mid-2016 - plan to increase to 90,000 tons per year
New Ponds in Operation

- In 2013, 221 acre feet pumped to ponds
- 250 gallons per minute
- 90,000 tons of salt
- 1 foot of base salt required
- 1 foot of salt expected per year
- Salt can be harvested after 18 months
Onsite Processing Plant

- Processing facility and equipment
- Salt for water softening and cattle feed
- Initial delivery by truck
- Ultimately delivery by rail
Malaga Bend Requirements for Pecos River Master Manual - 2012

- USGS Gages
  - Malaga Bend
  - Pierce Canyon Crossing
- Water Quality Testing
  - Center of Excellence for Hazardous Materials Management (CEHMM)
  - Twice a month
- Gain in Total Daily Salt Load
  - \(< 367.7 \text{T/day} \)
Quick Checks for Results

Malaga Bend Average Daily Salt Gain
Between Upstream and Downstream Stations

Not to Exceed value of 367.7 tons/day
TDS Concentrations vs. Flow

**TDS vs. Flow**

- **Pre-Pumping**
  - Equation: \( y = -0.0318x + 6.3738 \)
  - \( R^2 = 0.5405 \)

- **Post-Pumping**
  - Equation: \( y = -0.0411x + 5.3765 \)
  - \( R^2 = 0.4833 \)

Diagram shows data points and trend lines for TDS concentration vs. real-time flow (cfs) before and after pumping.
#1 - Looking Upstream from Dog Town Road

- Photos courtesy of Abe Van Luik
- Thoughts and Places.org, 2011
- Pre-project conditions
#2 - Looking Downstream from Dog Town Road Bridge
#3 - Looking Across River from Old USGS Pump

- Starting to see salt deposits
#4 - Continuing Around the Bend
Salt Deposits beginning to diminish
#6 – Old Evaporative Ponds in 2011

- Left over from last attempt
QUESTIONS?

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References

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