Salton Sea Ecosystem Restoration Plan Inflows/Modeling Working Group

June 13, 2005
Ontario, CA

Agenda

- Recap of last meeting and May 18 Advisory Committee Meeting
- Finalize QSA Inflows
- Refinement of historical hydrology
- Projected hydrology for No Action
- Proposed approach to variability
- Approach to model development
- Assignments for next meeting
- Upcoming workgroup meeting schedule

Recap of Previous Meeting

- Reviewed existing data and models
- Reviewed water budgets for Historic conditions, Baseline for the QSA and QSA
- Discussed approach to No Action
  - Inflows from Mexico
  - Local watershed contributions
  - Evaporation
- Introduction to modeling issues
- Action items

Finalize QSA Flows

- Based on model runs presented in QSA and IID EIR/EIS Addendum
- See Table 3 of Handout

Refinements to Historical Hydrology

- **San Felipe Creek and Salt Creek**
- **Other local watershed runoff**
- **Local groundwater inflows**
- **Evaporation**

San Felipe Creek Flows

*For discussion purposes only; results are preliminary

- **San Felipe Creek flows were measured (USGS No. 10255885) from Dec 1960 – Sep 1991**
- **Record extension through approximate relationship with high precipitation**
- **Low precipitation years discharge assumed to be represented by the average of similar years in the 1960-91 period**
- **Average annual discharge for 1950-1999 estimated to be 4,634 af**

San Felipe Creek Flows

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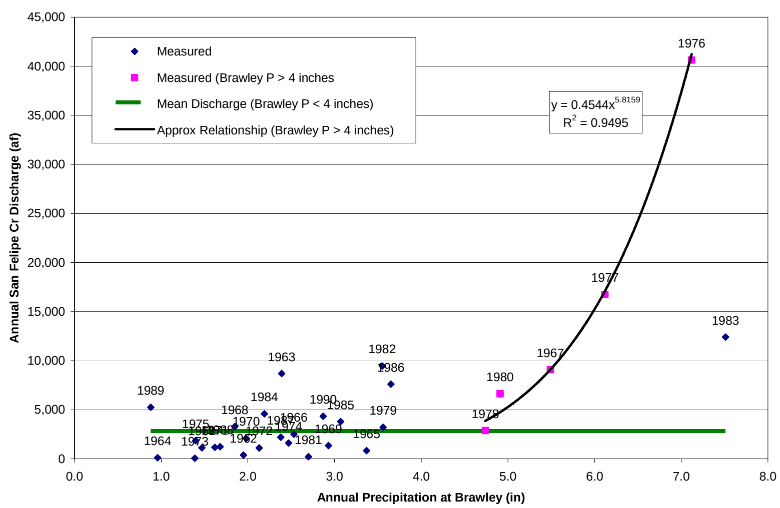
San Felipe Creek Discharge and Watershed Precipitation



Salt Creek Flows

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- **Salt Creek flows were measured (USGS No. 10254050) for Feb 1961 – Sep 1973 and Oct 1974 – present; some missing data in the early 1990s**
- **Separation of seepage/groundwater discharge baseflow from runoff needed**
- **Seepage/groundwater discharge pre-1961 assumed to be constant at 1961 levels**
- **Runoff from precipitation does not appear to materialize except in very high rainfall years**
- **Relationship developed relating runoff to Mecca precipitation, but not needed to fill in historic period (1950-60 was dry period)**
- **Average annual discharge for 1950-1999 estimated to be 4,174 af**

Salt Creek Flows

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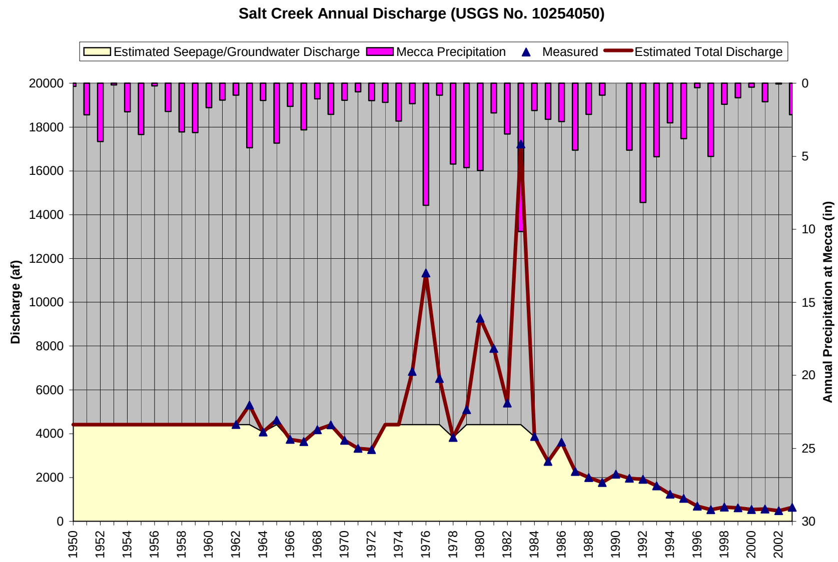

Other Local Surface Water and Groundwater Flows

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- **Remainder of local watershed discharge is ungaged**
- **Runoff from East shore assumed proportional to runoff from Salt Creek on an watershed area basis**
- **Runoff from West shore assumed proportional to runoff from San Felipe Creek on a partial watershed area basis**
- **Average annual runoff for 1950-1999 estimated to be 2,089 af**
- **Groundwater inflow (primarily from the west shore) assumed constant at 10,000 af/yr (Loeltz et al, 1975)**

***For discussion purposes only; results are preliminary**

Historical Inflow Summary

*For discussion purposes only; results are preliminary

- **Table**

Evaporation and Precipitation

- **Average annual evaporation estimated by Hely et al (1966) to be approximately 69 inches**
- **Determined by water budget, energy budget, and mass transfer techniques … compared to sunken pan rates**
- **Water budget approach the most practical for historical analysis**
- **Net evaporation can be calibrated from the water budget**

Net Evaporation

- Average annual precipitation for 1950-99 period is 2.7 inches (avg of Brawley and Mecca stations)
- Reasonable net evaporation would be approximately 66.3 inches per year
- Water budget calibration for 1950-1999 with estimated inflows results in average net evaporation of 66.1 inches per year
- No “unmeasured” terms are necessary

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Projected Hydrology for No Action

- Goals
- Limitations to “No Action” considerations
- Period of analysis
- Two step process
  - develop projected hydrology using existing conditions
  - adjust projected historical hydrology for “reasonably foreseeable” future actions
- Projected hydrology using existing conditions
- Adjustments to projected existing conditions hydrology
- Current state of hydrology for No Action
- Items remaining to be complete

Projected Hydrology under Existing Conditions

- Projected hydrology to span 2003-2077 period
- Where possible, climate data of 1925-1999 should be used for consistency with IID
- Historical refinements carried forward

Contributions to Inflow by IID and CVWD

- IID projected inflows based on model simulations using 1925-99 climate conditions and 1987-99 cropping patterns
- Estimated flows from IID to the Alamo River, New River, and to drains directly to the Sea
- CVWD provided projected inflows based on Coachella Valley Groundwater Management Plan simulations

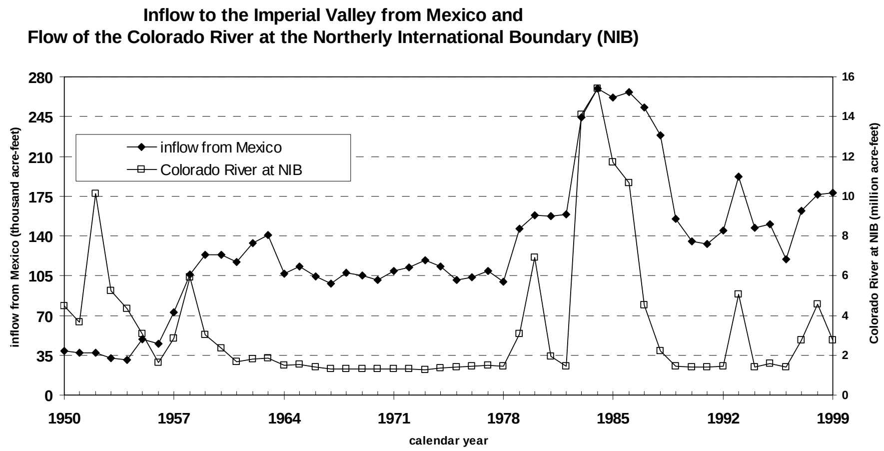
Contributions to Inflow from Local Watershed

- Salt Creek flows
  - assume seepage mitigation from Coachella Canal will maintain 623 af/yr
  - precipitation runoff related to Mecca rainfall (extended for 1925-99)
- San Felipe Creek flows developed using same approach as historic
  - extend record using Brawley rainfall records (extended for 1925-99)
- Ungaged watershed inflow developed using same approach as historic
  - assumed proportional to Salt and San Felipe Creek runoff
- Groundwater inflow assumed constant at 10,000 af/yr

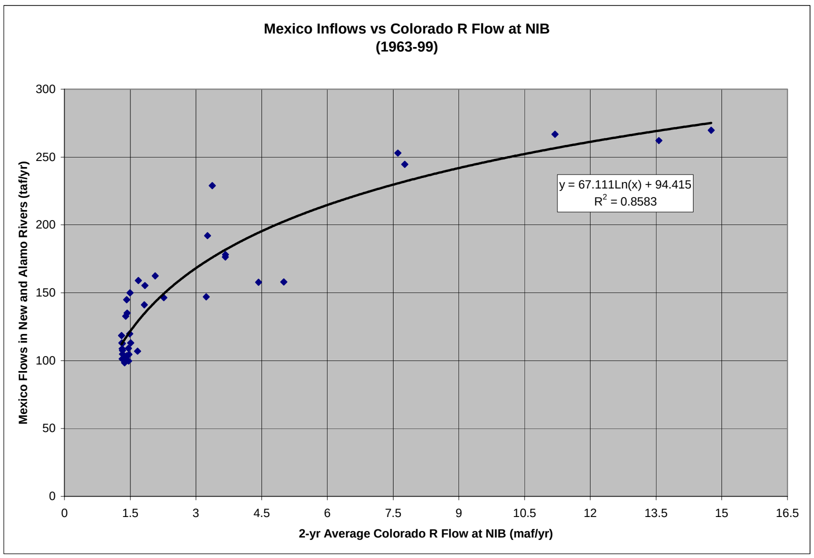
Mexico Inflows

- Inflows to the New and Alamo Rivers from Mexico indicate a correlation to flows into Mexico at the NIB (Colorado and Gila River contributions)
- Assuming Mexico drainage patterns/water use is similar to the recent past, then Mexico inflows can be approximated from a projected flow at the NIB
- Projection of future flows at the NIB?

Mexico Inflows and Flow at the NIB



Mexico Inflows and Flow at the NIB



Adjustments to Projected Existing Conditions Hydrology

- **QSA**
- **Mexico inflows**
- **Mexico power plants**
- **Mexico wastewater treatment plant**
- **Coachella Valley groundwater management**
- **Entitlement enforcement ?**

Other Adjustments to Mexico Inflows

No Action Inflow Assumptions differ from QSA Documents by including (annual flows averaged over 75 years):

- **Mexicali Power Plants ⇒ – 10,700 AF**
- **Mexicali Wastewater Treatment Plant ⇒ -21,400 AF**

Entitlement Enforcement

- **Entitlement Enforcement**
  - **Currently, 58,856 AF is deducted from projected diversions as a constant**
  - **Is there value in matching Entitlement Enforcement reduction to projected diversions rather than using average?**
  - **As is….could overestimate the low end and the high end**

Current State of Projected Hydrology for No Action

- **table of projected flows by component (revised table 4)**

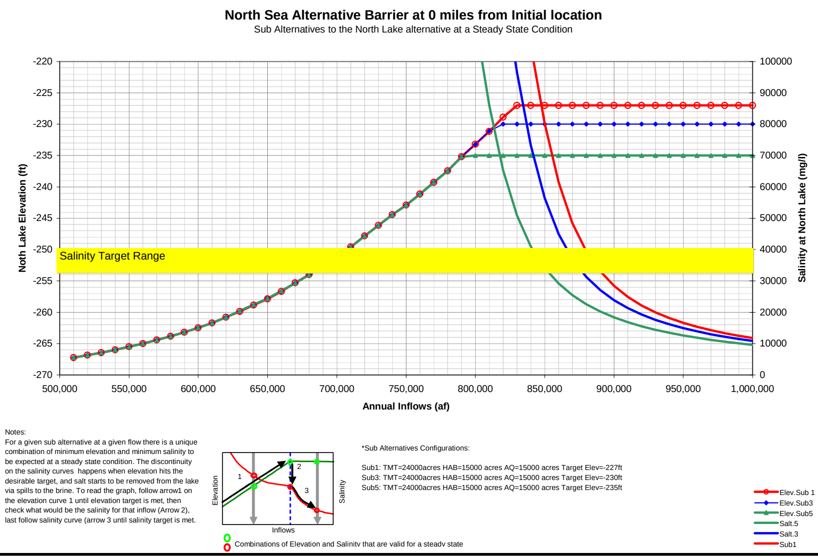
Remaining Items to Complete for No Action

- **Agree upon approach to Mexico inflows**
- **Refine calibrated evaporation rates**

Proposed Approach for Addressing Future Uncertainty

- **Variability and uncertainty**
- **Why does it matter?**
- **How will results be used?**
- **Proposed approach for planning for an uncertain future**
- **Sources of variability and uncertainty**
- **Discussion**

Sensitivity of Alternatives to Inflows (why does it matter?)



Use of Results from Uncertainty Analysis

- **Alternatives to be designed for various inflows**
- **Range of plausible inflows to be bracketed**
- **Provide clear, systematic basis for decision making**
- **Ultimately uncertainty analysis to be used by decision makers to select an alternative**

Proposed Approach

- Many sources of future uncertainty
- Uncertainties often dependent on policy-level decisions
- Proposing the use of alternative ***Future Hydrologic Scenarios*** in addition to No Action hydrology
  - Similar to what is being proposed in DWR's California Water Plan
  - "Current Trends", "Less Inflow Limiting", "More Inflow Limiting" scenarios to be used bookends
  - Other intermediate scenarios may be developed
- Consideration of ***factors*** that may influence inflows
- Table and discussion

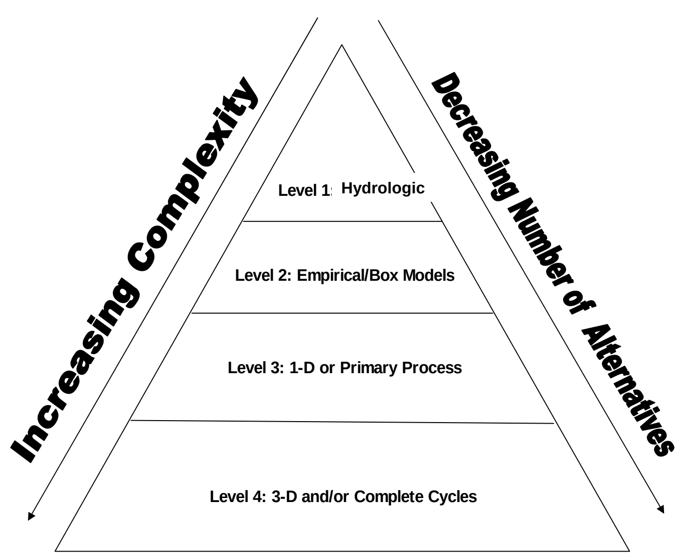
Factors That May Influence Inflow to the Sea

- **Preliminary list**

Approach to Model Development

- **Considering a suite of models to account for hydrologic balance, salt balance, water quality, hydraulics, circulation, and other issues**
- **Hydrologic model first to be developed/applied, others to follow …**
  - **Natural treatment hydraulics and performance**
  - **Sea water quality … nutrient and selenium dynamics**
  - **Sea hydrodynamics/circulation**
  - **others**

Levels of Analysis and Analytical Approach



Hydrologic Model Requirements

- Simulate future Salton Sea elevation and salinity under varying configurations and inflow assumptions
- Account for full water and salt balances
- Monthly and/or annual time steps
- Incorporate multiple impoundments and major components or processes of likely alternatives
- Optimize for simultaneous solution of elevation and salinity targets
- Stochastic simulation capability
- Incorporate evaporation and salt precipitation dynamics as function of salinity
- Publicly-available and documented
- Should include nutrient, selenium approximations? Other processes?

Proposed Hydrologic Modeling Approach

- Develop refined annual inflows and salt loads to represent No Action condition
- Disaggregate annual flows/loads for monthly patterns
- Component-based network of nodes (treatment, habitat, Sea, brine, air quality cells) and arcs (transfer of water/salt between nodes)
- Develop CALSIM-based model for monthly analysis – deterministic version
- Develop stochastic wrapper for uncertainty analysis

Other Key Modeling and Assumption Issues

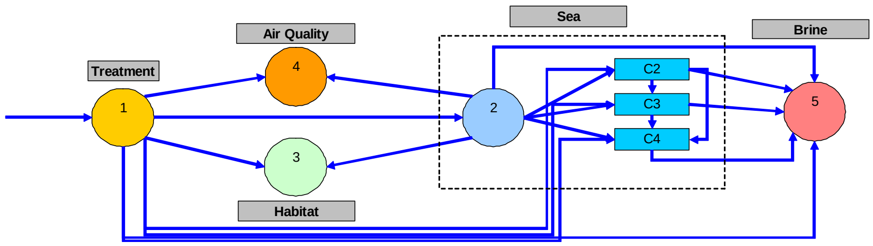
- **Salt loading assumptions**
- **Salt precipitation dynamics**
- **Evaporation-salinity relationships**
- **Consistency in use of climatic data**
- **Bathymetric survey data**

Proposed CALSIM Hydrologic Model of the Salton Sea

- **Three basic model elements: wetland, treatment, and sea elements**
- **Elements serve as approximation for water budgets of:**
  - **mechanical treatment system (MTS)**
  - **natural treatment system (NTS)**
  - **wetland habitat (HAB)**
  - **fresh or saline water impoundments (SEA)**
  - **air quality mitigation (AQM)**
- **Alternative configurations are approximated by connectivity of elements**
- **Water requirements for each are computed based on acreage, salinity, and elevation targets**
- **Priority weights are assigned to various connections to describe which objectives are to be achieved first**
- **"Intelligence" of model routes water in most efficient manner given input set of objectives**

Proposed CALSIM Hydrologic Model of the Salton Sea

PROPOSED MODEL STRUCTURE



- **Typical targets to be set will be**
  - **Elevation in one or more of the Sea elements**
  - **Salinity in one or more of the Sea elements**
  - **Blended salinity of delivered water at one or more of the wetland elements**
  - **Preferred flow paths to minimize spills or maximize water use efficiency**