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Winter 2022-2023 Southern California Gas Company Reliability Assessment: Hydraulic Modeling

November 30, 2022

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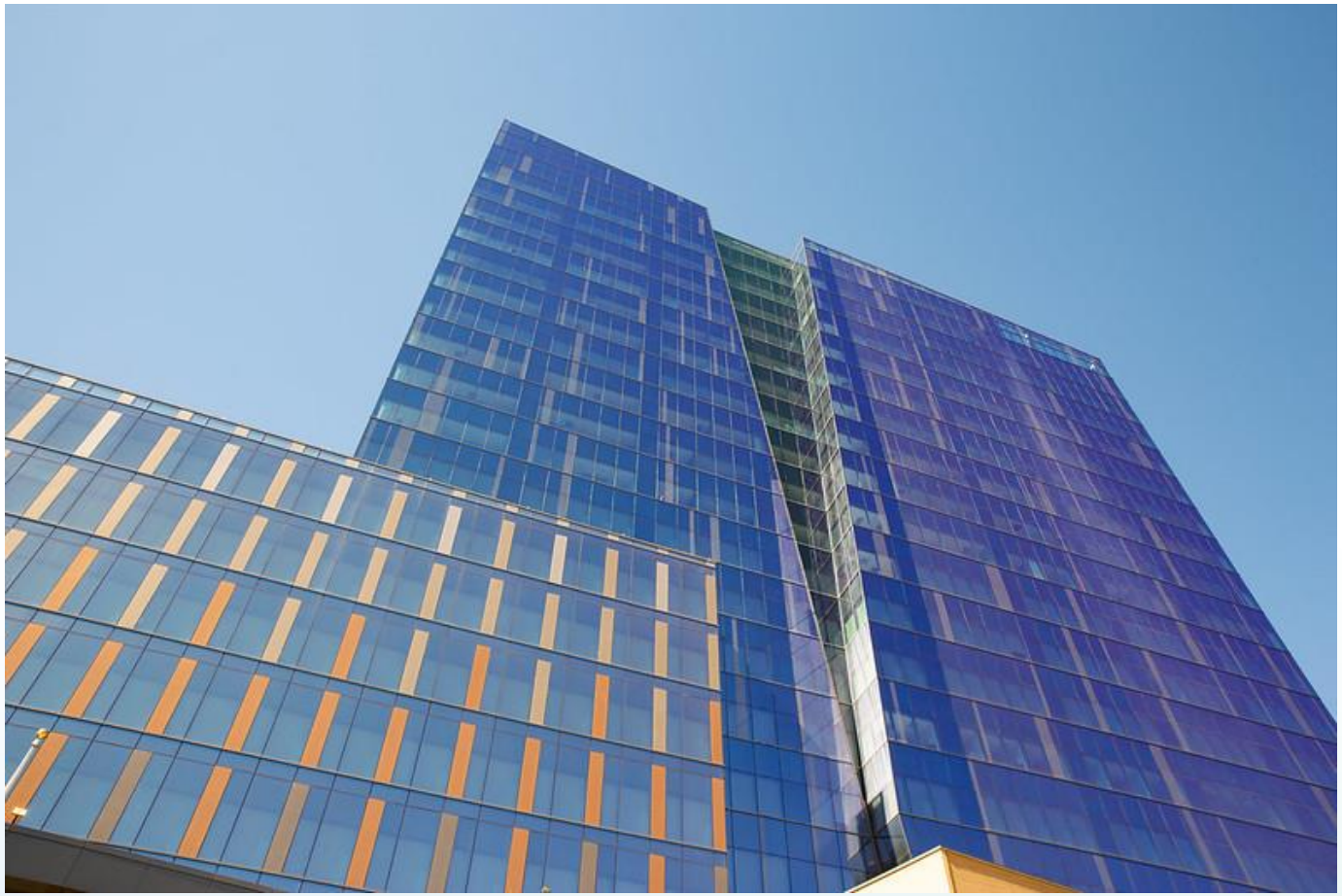
Energy Assessments Division, Supply Analysis Branch

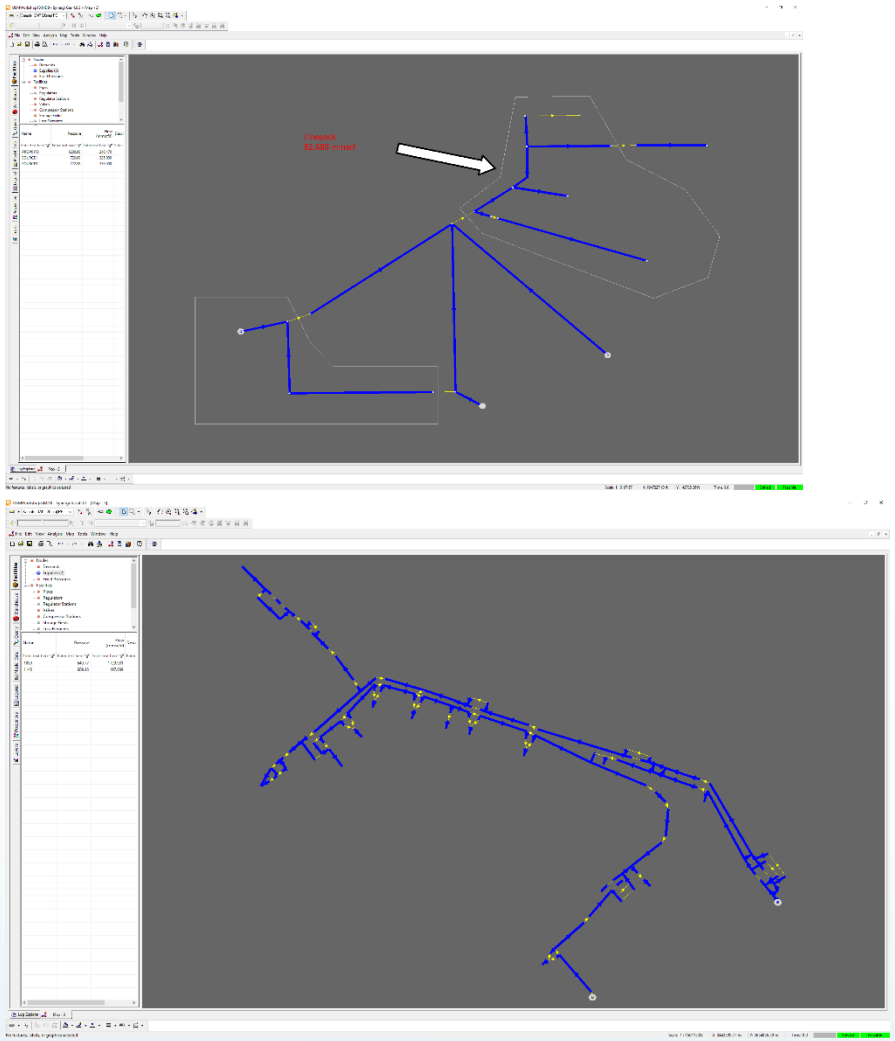
Gas Utilities Submit Hydraulic Models to CEC



Picture downloaded from CEC website

- Required under Title 20, Division 2, Chapter 3, Article 1 Section 1314 of the California Code of Regulations
- Submittals include the following:
  - System minimum and maximum allowable pressures
  - Demand scenarios
  - Load profiles
- Regulations allow for automatic confidential designation

What is Hydraulic Modeling?



- Gas equivalent of a “power flow model”
- Simulate system operations
- Evaluate ability to serve load under conditions
- Utilities use this to evaluate needs for new capacity.
- Explores a moment in time (steady state) or over a period of time (transient state)
- Uses engineering pressure flow equations

Images courtesy of DNV.

What's In Hydraulic Modeling Files?

- System specifications
  - Pipeline lengths and diameters
- Maximum and minimum operating pressures
- System components
  - Valves, compressors, and regulators, etc.
- System supply and demand

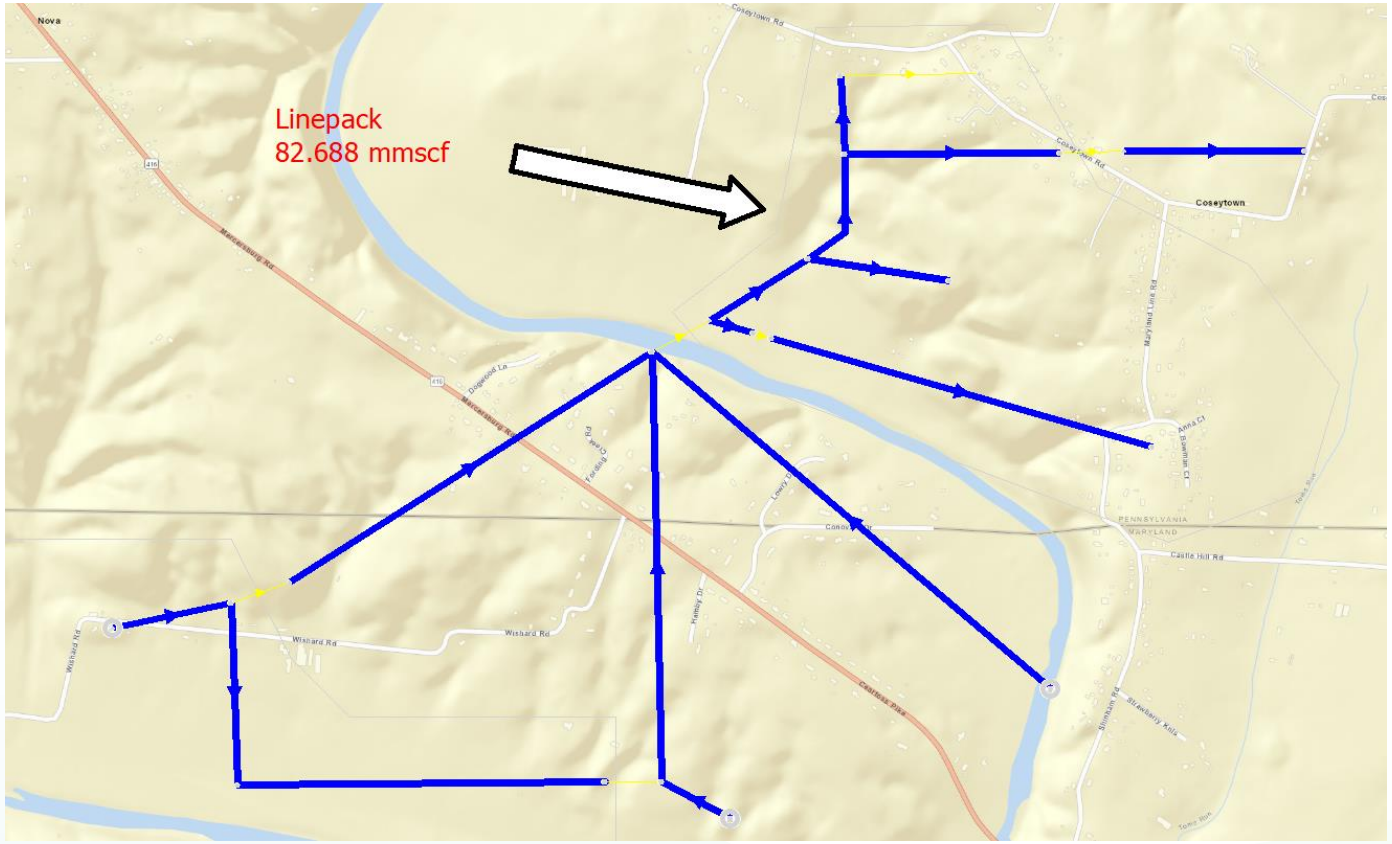
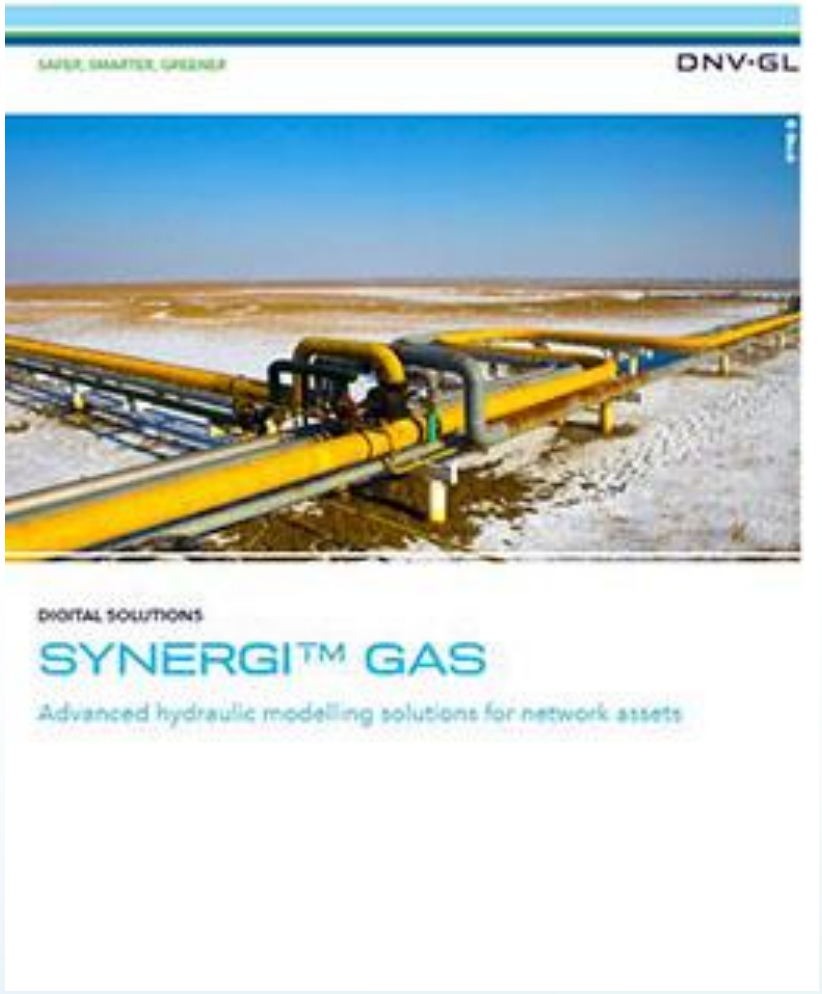


Image courtesy of DNV.

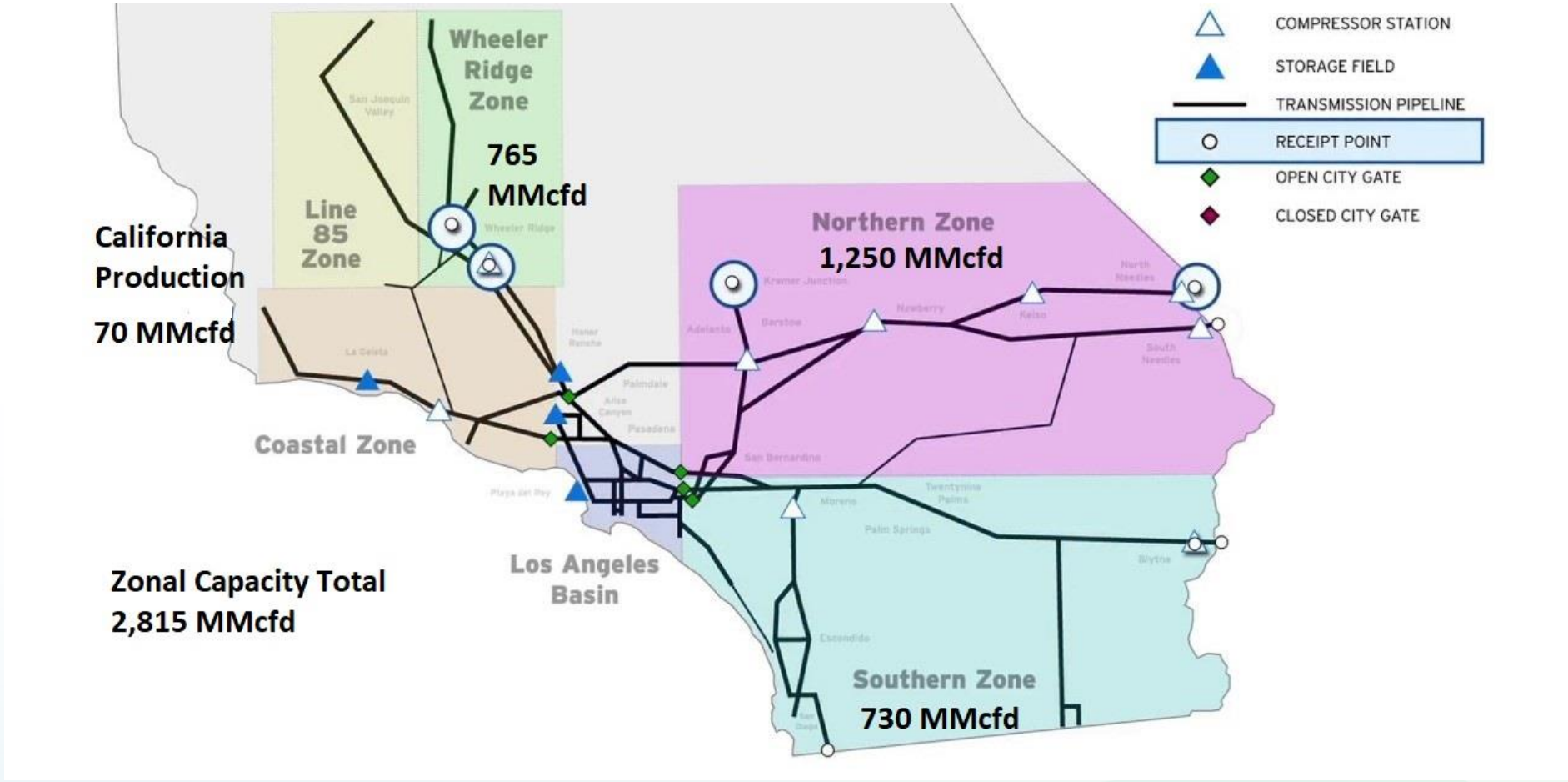
Hydraulic Modeling Software Platform - Synergi Gas



- Reads Microsoft Access files
- Used by most large natural gas utilities in the United States
- Developed in the 1970s by Stoner and Associates of Mechanicsburg, PA
- Now owned by Oslo, Norway based DNV

Image courtesy of DNV.

SoCalGas Transmission System (Modified With CEC Staff Assumptions)



Graphic downloaded from SoCalGas website at: https://www.socalgas.com/stay-safe/pipeline-and-storage-safety/natural-gas-transmission

Simulating Winter 2022-23 On The SoCalGas System

- Ran simulations several times until solving without violations
- Constant, rateable deliveries of 2,815 MMcfd
- Incorporated Cold Day and Extreme Peak Day Demands
  - Case 1- ~4.7 Bcfd
  - Case 2- Just under 5 Bcfd
- Demand includes:
  - Power plants
  - Other large customers
  - Points at which gas is delivered to lower pressure systems
- Modeled in both steady and transient states

Photos courtesy of Google Images, the CEC, Prexels, and Microsoft PowerPoint.

Transient Simulation of the SoCalGas System

- SoCalGas system is linepack poor per April 2016 Joint Agency Technical Report.
  - Transient modeling can monitor intraday linepack changes.
  - Must restore system linepack to the levels seen at the beginning of the gas day
- Simulating packing and drafting
  - Packing- Supply greater than demand
  - Drafting- Demand greater than supply
  - Watching pressures
- Intraday adjustments:
  - Storage withdrawals
  - Regulator settings

Photo courtesy of the City of Santa Clarita.

Transient Simulation of the SoCalGas System

- SoCalGas system is linepack poor per April 2016 Joint Agency Technical Report.
  - Transient modeling can monitor intraday linepack changes.
  - Must restore system linepack to the levels seen at the beginning of the gas day
  - Curtailments may be needed if linepack can't be restored
- Simulating packing and drafting
  - Packing- Supply greater than demand
  - Drafting- Demand greater than supply
  - Watching pressures
- Intraday adjustments:
  - Storage withdrawals
  - Regulator settings
- Curtailments needed if system cannot run within constraints

Photo courtesy of Microsoft PowerPoint.

Results

- Case 1 and Case 2 simulations used storage withdrawals of approximately 1,850 MMcfd
- Case 1
  - SoCalGas system can meet all of the demand for that scenario without curtailment
- Case 2
  - Staff curtailed 277 MMcf/d to preserve acceptable operating pressures while enabling linepack restoration
  - Pressures drop below MinOp without curtailment on the Southern System
- Results match both the deterministic and stochastic hourly gas balance results
- Multi-day cold weather events with additional infrastructure outages can increase risk of curtailment

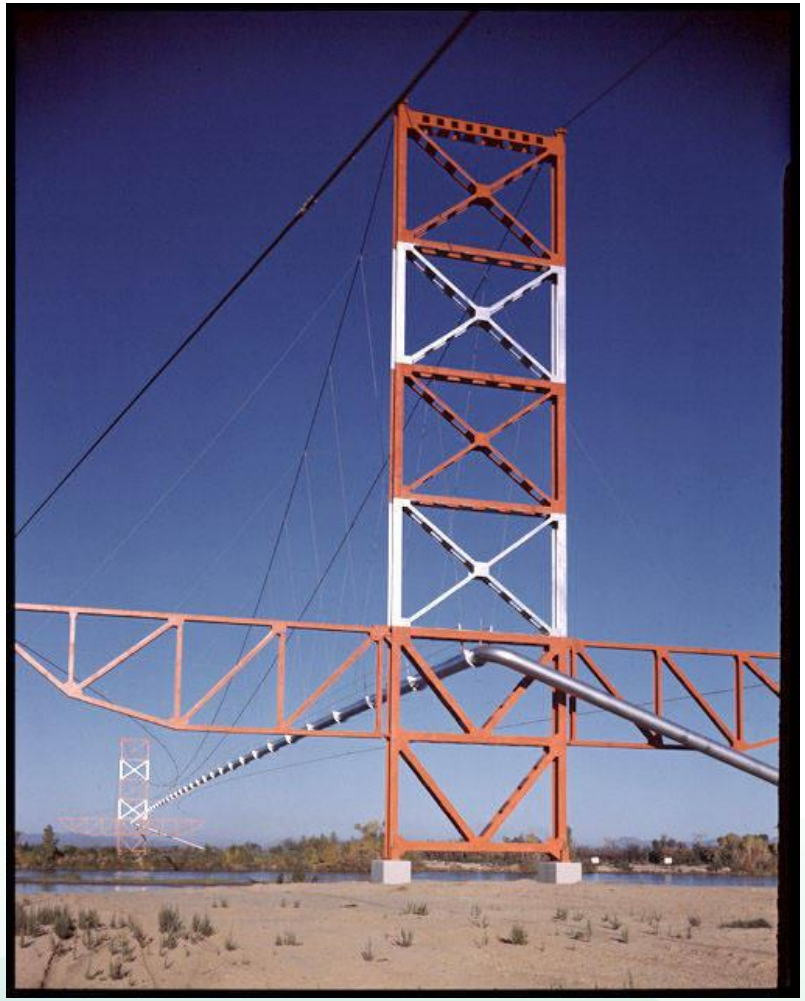


Photo courtesy of Northern Arizona University.