

WATER FOR THE SYNTHETIC FUELS INDUSTRY

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SYNTHETIC LIQUID FUEL OPTIONS

- BIO-FUELS
 - Irrigation and process water demands are huge
- COAL TO LIQUIDS
 - Process water demands are huge
- OIL SHALE
 - Process water demands are moderate
 - Process produces connate water
 - Un-appropriated water available
 - Ground water available

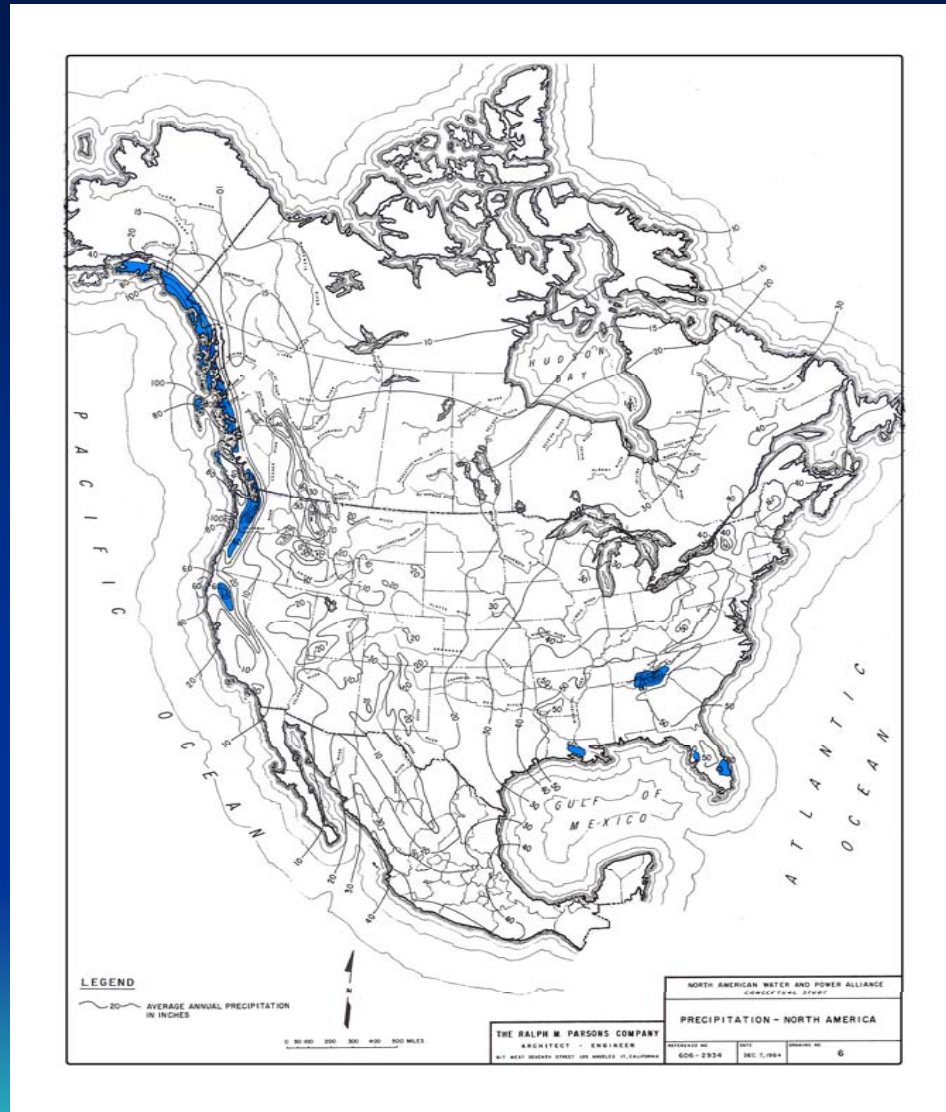


NATIONAL WATER PROBLEM

- Fresh water distribution does not match growing demand
- National water policy always a compromise between arid West and Eastern interests
- Implementation of water policy bifurcated between Corps of Engineers and Bureau of Reclamation - then came TVA

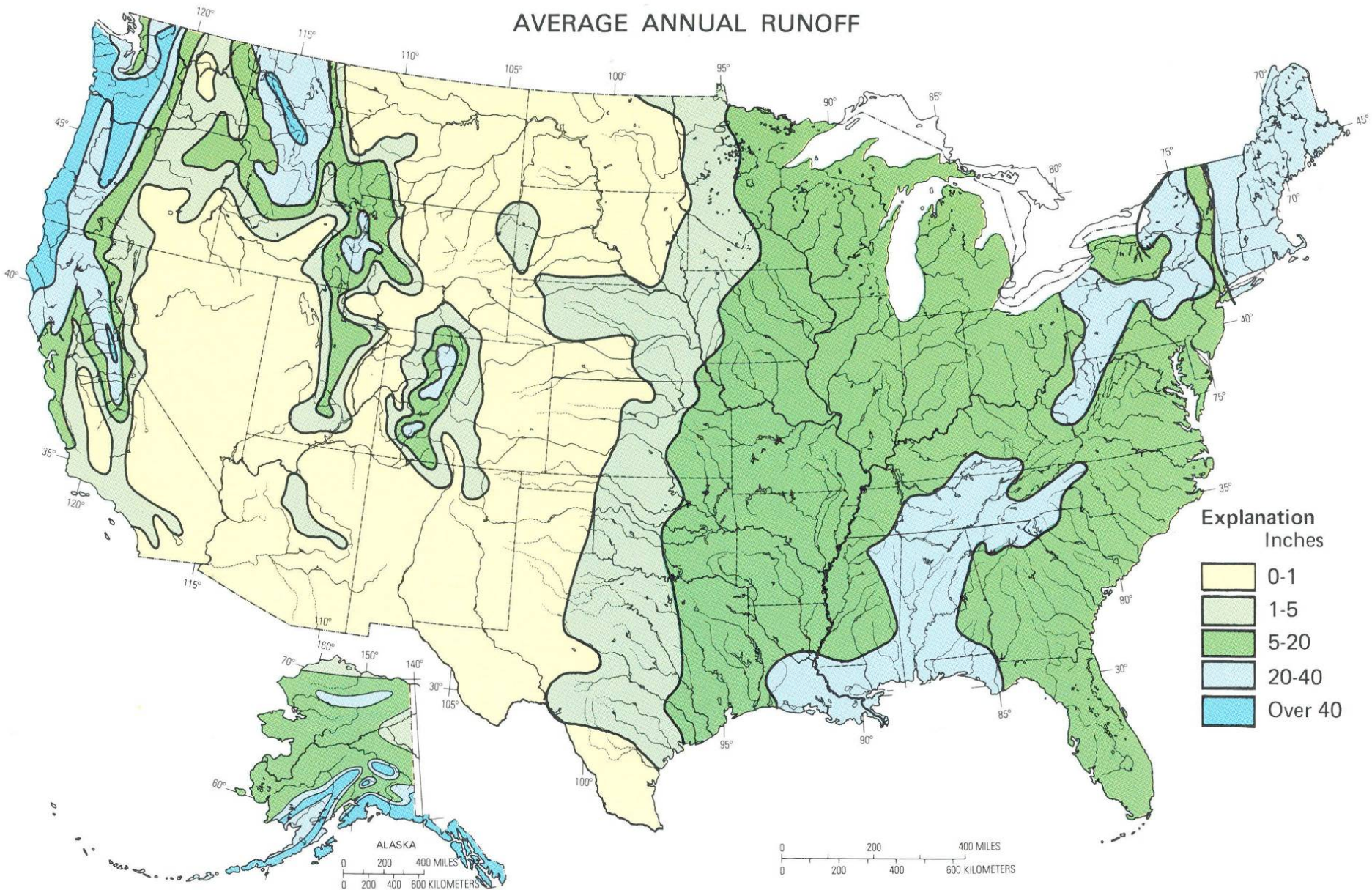


FRESH WATER DISTRIBUTION BY RAINFALL



EAST VERSUS WEST

AVERAGE ANNUAL RUNOFF



IMPLEMENTATION OF NATIONAL WATER POLICY

- TO UNDERSTAND THE FAILURE READ:
 - *CADILLAC DESERT*
- TO SEE THE WAY FORWARD READ:
 - U.S. WATER RESOURCES COUNCIL
WATER ASSESSMENTS
 - USGS *WATER FOR SYNTHETIC FUELS DEVELOPMENT Earth Science Considerations*
- FUTURE MUST ACCOMDATE:
 - TETON DAM FAILURE
 - END OF BIG DAM ERA
 - ENVIRONMENTAL ETHIC



NORTH AMERICAN WATER and POWER ALLIANCE (NAWAPA) Historic Overview

- 1950s - A continent-wide water resource plan envisioned by Donald Baker, a planning engineer at Los Angeles Dept. of Water and Power
- 1960s - Ralph M. Parsons takes the initiative and spends part of personal fortune and more than 10 years to develop concept
- 1964 - NAWAPA presented to U.S. Special Congressional Subcommittee on Western Water Resources; received endorsement



NORTH AMERICAN WATER and POWER ALLIANCE (NAWAPA) Historic Overview (cont.)

- 1966 to 1977 – Parsons continues to refine conceptual report
- 1986 – Marc Reisner's landmark book Cadillac Desert discusses NAWAPA in detail
- 1989 – San Jose State Univ. Economic Dept. conducts update of financial feasibility of NAWAPA; confirms program viability



NORTH AMERICAN WATER and POWER ALLIANCE (NAWAPA)

The Concept

- Divert water from a dozen wild rivers in North America to provide alternative water and electricity supplies to Canada, the United States and Northern Mexico; meets projected water and power needs for the next 100 years
- NAWAPA opens vast unused or underutilized areas for industrial and agricultural development and municipal use



NORTH AMERICAN WATER and POWER ALLIANCE (NAWAPA)

The Concept (cont.)

- Diverted water will be $< 17\%$ of high yield watersheds “wasting” to the sea
- Water is renewable, reliable and clean
- Water will be stored in an interconnected system of reservoirs across Canada and the United States
- Coast-to-coast navigable waterways, recreation, pollution control, water levels and flood control are additional benefits

NORTH AMERICAN WATER and POWER ALLIANCE (NAWAPA)


Some Statistics

- 110 million acre-feet of water west of Rocky Mts. would be diverted, collected, stored and delivered
- 48 million additional acre-feet east of the Rocky Mts. and Arctic Basins would be diverted into the Great Lakes
- The Rocky Mt. Trench (elev. 3000 ft.) would become a 500-mile long, 22-mile wide reservoir; 17 times capacity of Lake Mead



NORTH AMERICAN WATER and POWER ALLIANCE (NAWAPA)

Some Statistics (cont.)

- 100,000 megawatts of gross hydropower was to be produced; 20 times > Hoover Dam
 - 70,000 megawatts available to be sold; 30 megawatts would meet pumping and operations' needs of the program
 - Traditional engineering and construction means and methods approach
 - All government to all private financing options considered
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NORTH AMERICAN WATER and POWER ALLIANCE (NAWAPA) Some Statistics (cont.)

- Program costs (with all proposed elements) \$100 billion in 1966 dollars
- NAWAPA would have been the largest civil works project in history



THE WISCONSIN RIVER MODEL

STORAGE RESERVOIRS

	Full Acres
(1) Lac Vieux Desert	4,247
(2) Twin Lakes	3,535
(3) Buckatahon	922
(4) Long-on-Deerskin	2,353
(5) Little Deerskin	313
(6) Seven Mile	518
(7) Nine Mile	840
(8) Burnt Railways	7,626
(9) Sugar Camp	1,857
(10) Little St. Germain	1,008
(11) Big St. Germain	4,653
(12) Pickarel	786
(13) Rainbow	4,165
(14) North Pelican	1,295
(15) South Pelican	3,894
(16) Minocqua	6,066
(17) Squirrel	1,505
(18) Willow	6,392
(19) Rice	4,111
(20) Spirit	1,698
(21) Eau Claire	6,677
Total	61,282 Acres

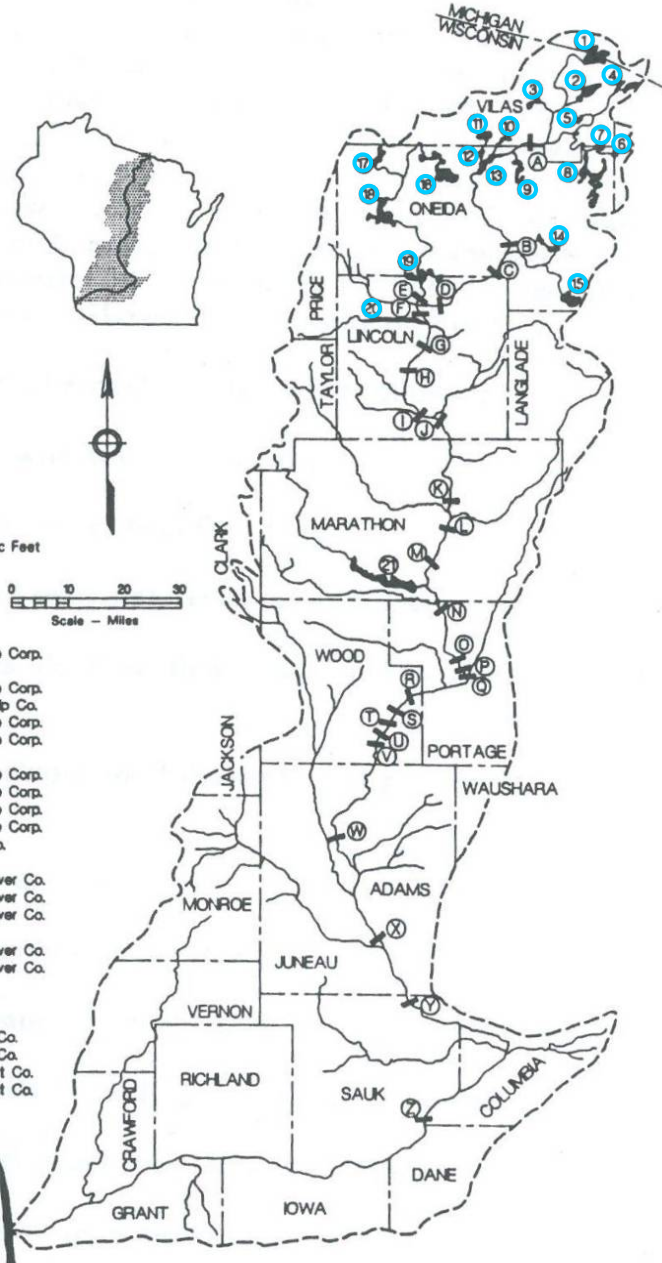
Total Usable Storage Capacity 15,766 Million Cubic Feet

HYDROELECTRIC POWER DAMS

(A) Otter Rapids	Wisconsin Public Service Corp.
(B) Rhinelander	Rhinelander Paper Co.
(C) Hat Rapids	Wisconsin Public Service Corp.
(D) Kings	Tomahawk Power & Pulp Co.
(E) Jersey City	Wisconsin Public Service Corp.
(F) Tomahawk	Wisconsin Public Service Corp.
(G) Grandmother	Nekoosa Packaging
(H) Grandfather	Wisconsin Public Service Corp.
(I) Alexander	Wisconsin Public Service Corp.
(J) Merrill	Wisconsin Public Service Corp.
(K) Wausau	Wisconsin Public Service Corp.
(L) Rothschild	Weyerhaeuser Paper Co.
(M) Mosinee	Moinee Paper Co.
(N) Dubay	Consolidated Water Power Co.
(O) Stevens Point	Consolidated Water Power Co.
(P) Wisconsin River Division	Consolidated Water Power Co.
(Q) Whiting Plover	Neenah Paper
(R) Birn	Consolidated Water Power Co.
(S) Wisconsin Rapids	Consolidated Water Power Co.
(T) Centralia	Nekoosa Papers Inc.
(U) Port Edwards	Nekoosa Papers Inc.
(V) Nekoosa	Nekoosa Papers Inc.
(W) Peterwall	Wisconsin River Power Co.
(X) Castle Rock	Wisconsin River Power Co.
(Y) Wisconsin Dells	Wisconsin Power & Light Co.
(Z) Prairie du Sac	Wisconsin Power & Light Co.

Controlled Drainage Area
Total Drainage Area

1931 square miles
12,000 square miles



IMPLEMENTATION OF WISCONSIN RIVER MODEL ON A CONTINENTAL SCALE

- SERIES OF PRIVATE WATER VENTURES
- UTILIZE HIGHEST ELEVATIONS IN SEVERAL WATERSHEDS TO LOCATE HUNDREDS OF SMALL RESERVOIRS
- USE GATHERING AND PIPELINE SYSTEMS SIMILAR TO OIL AND GAS INDUSTRY TO BRING WATER TO MARKET



ENVIRONMENTAL ACCEPTABILITY OF SMALL RESEVOIRS

- DUPLICATES WHAT 100 MILLION BEAVERS DID FOR THE ENVIRONMENT BEFORE THEY BECAME FUR HATS
- CAN BE REMOTELY MONITORED AND MANAGED BY SATELLITES AND COMPUTERS
- REPLENISH AQUIFERS
- COMPATIBLE WITH WATER LAWS AND DOCTRINE



SMALL RESERVOIRS AND WATER DOCTRINE

- SURFACE WATER SUBJECT TO:
 - Riparian Rights
 - Prior Appropriation
 - Hybrid Doctrine
 - Reserved Rights Doctrine
- GROUND WATER:
 - Owned by Surface Owner
- DIFFUSED WATER:
 - Owned by Surface Owner



FINANCIAL FEASIBILITY OF PRIVATE WATER VENTURES

IS THE SAN JOSE STATE ANALYSIS VALID?

CONSIDER THIS: The
Maryland Convenience Store Prices for:

Gasoline: \$3.20 per gallon

Bottled Water: \$6.40 per gallon



OIL AND GAS COMPANIES

- THINK NEW
- THINK WATER VENTURES
- BECOME AN OIL, GAS AND WATER COMPANY
- SOLVE ONE MORE PROBLEM FOR OIL SHALE

