Historical Perspectives on Power Plant Water Supply in the Delaware River Basin

Water Resources Association

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"Ancient" Chronology

- 1954 – Supreme Court Amended Decree
- 1955 – Flooding (Connie, Diane)
- 1961 – The Compact; DRBC organized
- 1962 – Corps of Engineers' "Delaware River Basin Report"
- 1962 – First DRBC "Comp" Plan – Tocks Island was "keystone" reservoir (flood control, water supply, recreation, hydropower)
- "Drought of the 60s"
  - Concern for "salinity encroachment"
  - 1965 - NYC suspends Montague (Decree) releases, DRBC emergency
  - DRBC policy: 3,000 cfs objective at Trenton
- Late 1960s – Push for Tocks Island and environmental opposition ("Save the Delaware"), Viet Nam War

"Old" Electric Utility Structure

- Vertically integrated
- Highly regulated by public utility commissions
- Generation facility costs in "rate base"
- Minimal competition among utilities
- Considerable cooperation, including common approaches to resolving water resource-related issues

Story begins – late 1960s and early 1970s

- Demand for electricity doubling every ten years
- Generation planning (siting potential power plants) became a large effort on part of electric utilities
- This included planning for jointly-owned generating facilities, including consideration of multi-unit "energy parks" (mostly central PA)
- Primary planned capacity in DRB was nuclear, with lesser amount of fossil and some hydro

Joint utility water resource planning in Basin

- DRBC uncertainty about prospects for Tocks coupled with concern for many "proposed" power plants led to formation of Delaware River Basin Electric Utilities Group and first two DRBEUG reports:
  - 1971 "Master Siting Study" (first of a series; 15-year projections of planned/proposed generating capacity and water need)
  - 1972 "Water Reservoir Study for Power Systems," map screening study (>100 potential sites) for supplemental water supply in DRB; 7 "high priority" sites, 14 "priority" sites. (Merrill Creek was not identified!)

Utility "Master Siting Studies" (15-year forecasts)

- 1971 MSS showed nearly three dozen major planned/proposed generating units in DRB; included 13 nuclear plants (mostly two units)
  - Limerick, Salem and Hope Creek 1, eventually constructed
  - Others mostly with now-forgotten names
  - Total DRB capacity: 34,000 MW; about 550 cfs (consumptive water use)
- 1974, 1975, 1978, 1981 MSSs
  - Gradual diminution of new capacity
  - Only major new planned/proposed plant was Summit (nuclear)
  - Planned/proposed capacity in DRB fell to about 10,000 MW, future average water need (adjusted for "relative effect factor" since 1974) fell to 125 cfs
- 1989 - Last MSS; no major (baseload) additions except Limerick 2

1985-86 DRBEUG "Technical Support Document"

- DRBC
  - Sought to develop "depletive water use budget"
  - Requested DRBEUG report on updated forecasts and estimated historical water consumptive use
- Report provided:
  - monthly full-load consumptive use, unit by unit
  - technical details of consumptive use calculations, including uniform method for estimating in-river evaporation due to heated discharges

Fallout from Tocks Island

- DRBC mandated provision of supplemental supply in Limerick (1973, 1975), Hope Creek (1975) dockets subject to its finding of basin supply inadequacy
  - DRBC involved in AEC/NRC licensing
- Tocks deferred by DRBC governors in 1975 (de-authorized in 1978)
- DRBC determined to protect low flow at Trenton (salt front) without Tocks
- Trexler Lake proposed (utility stop-gap pending local water supply need) but never constructed

Merrill Creek Reservoir – 1976

- DRBC confirms need for "supplemental water supply storage" for Limerick and Hope Creek
  - Storage considered essential for other "new" plants
- Utility reservoir studies (following initial 1972 study) narrowed sites to four "final" sites:
  - Red Creek
  - Mill Creek
  - Little Martins Creek
  - Merrill Creek (a late "find," first identified in 1976)

Merrill Creek Reservoir – 1977

- Merrill Creek selected as best choice
  - Site mostly owned by Ingersoll-Rand, only 4 or 5 residences, no farmland
  - Small dam and pond already existed on stream
- DRBC requires "applicants" to submit application, with environmental report to construct supplemental storage.
- "Merrill Creek Owners Group" submits application to construct MCR
- Design capacity: 46,000 acre-feet; could provide 200 cfs for 115 days

Merrill Creek Reservoir – 1978-84

- 1978 – Warren County Referendum: 4-to-1 "no" vote on question "Should Merrill Creek Dam be constructed?"
- 1981 – DRBC "Level B" Study included MCR in preferred strategy
- 1982 – DRBC Draft EIS
- 1982-83 – "Good Faith Agreement" included MCR
- 1984 – DRBC Final EIS – design need 168 cfs
- 1984 – Docket No. D-77-110 CP approved
  - Release water to the Delaware River to compensate for consumptive water use when Trenton flow < 3,000 cfs
  - Serve "post-compact" units only

Merrill Creek Reservoir – 1985-90

- 1985-87 – MCR Constructed
- 1988 – Filled (pumped from Delaware River) and became operational
- 1990 – MCOG applies and DRBC approves “voluntary” use of reservoir to serve all generating units, to avoid curtailment during drought

Factors changing the "status quo," reducing perceived need for generation (1970s, 80s, 90s)

- Oil embargo
- Conservation ethic --> utility conservation and demand-side management programs
- Environmental considerations
- Emergence of NUGs, IPPs (PURPA, 1978)
- Uncertainties of load growth and need for generating facilities
- State "deregulation" – competitive generation market
  - PA (1996), NJ (1997), DE (1999)
  - Generating facilities no longer in "rate base" – no guarantees of return on investment
  - Advantage to generation assets with short development periods, relatively minimal environmental impact, and "quick" payback
- Divestiture of generation facilities; separation of generation assets from regulated "utility" business

Effects of competition in the “generation” sector

- Greater focus on “cost”
- Reluctance to cooperate, share plans, projections and costs
- Confidentiality of data; proprietary information
- Short-range “futures”
- Company mergers, spinoffs for economic and administrative efficiency, including corporate specialization in generation types (e.g., nuclear, gas-fired)

"Real" data from 1996

- Source: DRBC's "Water Resources Plan for the Delaware River Basin" (2004)
- Power plant consumptive use – 93 mgd (145 cfs)
  - About one-third of total in-basin consumptive use
  - About 9% of total basin consumptive/depletive use, including NYC and NJ diversions
- Educated "guess" – water use amounts haven't changed significantly since 1996

Merrill Creek Reservoir - current status

- Serves 40+ electric generating units
- Several units added since 1990 are independent or third-party-owned units, not owned/operated by MCR owner entities
- No new units have been added since 2003
- Ensures power plant consumptive water use has no effect on critical low inflows to Delaware River Estuary ("salt front")
- Allows continued operation of generating units (no load curtailment) during drought
- Reservoir, visitors' center and adjacent project lands are popular for public recreation and environmental education
- Provides small amount of flood control

Current trend – reducing power plant water use?

- Retirement of old plants
  - Environmental (air, water) regulations
  - Relative inefficiency
- Current relative low cost of natural gas favors operation of relatively water-efficient generation (combustion turbines, combined cycle units)
- More renewables in grid (state renewable/alternative energy portfolio standards, dispersed locations including customer sites)
- Re-emergence of conservation and demand-side management programs (e.g., customer load management, time-of-day pricing, government subsidies for customer self-service)

On the other hand …. (?)

- Nuclear resurgence?
- Elimination of once-through ("open cycle") cooling systems in favor of higher consumptive water use, closed-cycle ("cooling tower") systems?
- Effect of all-electric automobiles?

Future power plant water supply reservoir capacity?

- Might a need arise for more supplemental storage in DRB?
  - Increase in power plant consumptive water use?
  - Changes in DRBC's Basin operations "rules"?
- Viable alternatives?
  - Power plant river following?
  - Non-evaporative ("dry") cooling systems?
  - Existing reservoir expansion or conversion?
  - Underground water storage?
  - Disregard for extreme low flows in river or salt front?
  - ?????
- Could a new reservoir be built today in the DRB?