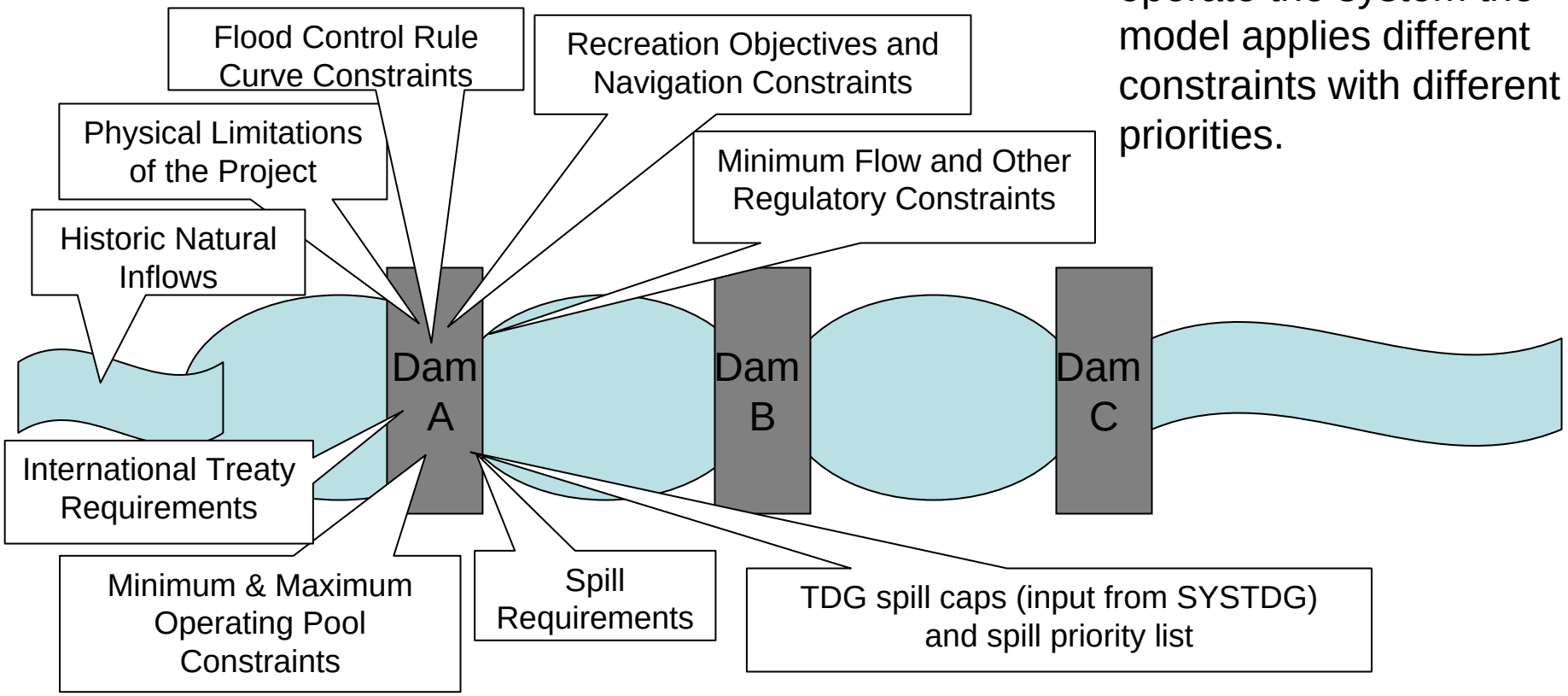
# HYDSIM Overview

- HYDSIM models the operation of over 70 federal and non-federal dams in the Columbia Basin.
  - using 70 years of month-average historical runoff data
  - applying today's operating rules, objectives, and estimates to these historic water conditions

➢ HYDSIM simulates the operation of today's hydrosystem using realistic, varying water conditions.

For each month of the 70 years of historical inflow data HYDSIM evaluates how the system would operate with current requirements and targets.

When deciding how to operate the system the model applies different constraints with different priorities.



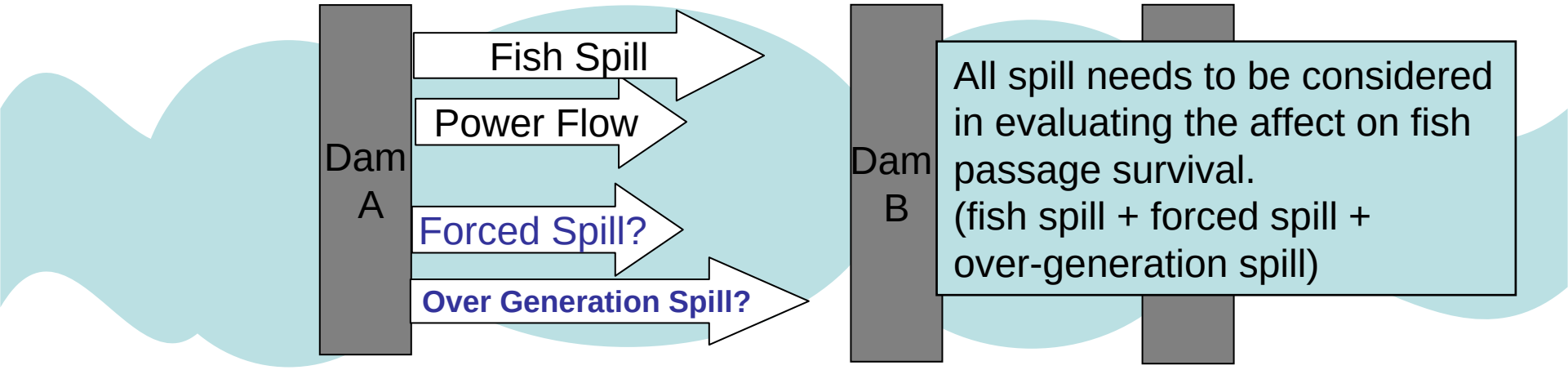

These factors allow the model to determine how much flow needs to pass each project in the system each month.

The model also determines which route the flow will pass each dam each month: through turbines, spill, or other routes.

The model provides for required spill for fish passage

The model also considers power needs of the region.

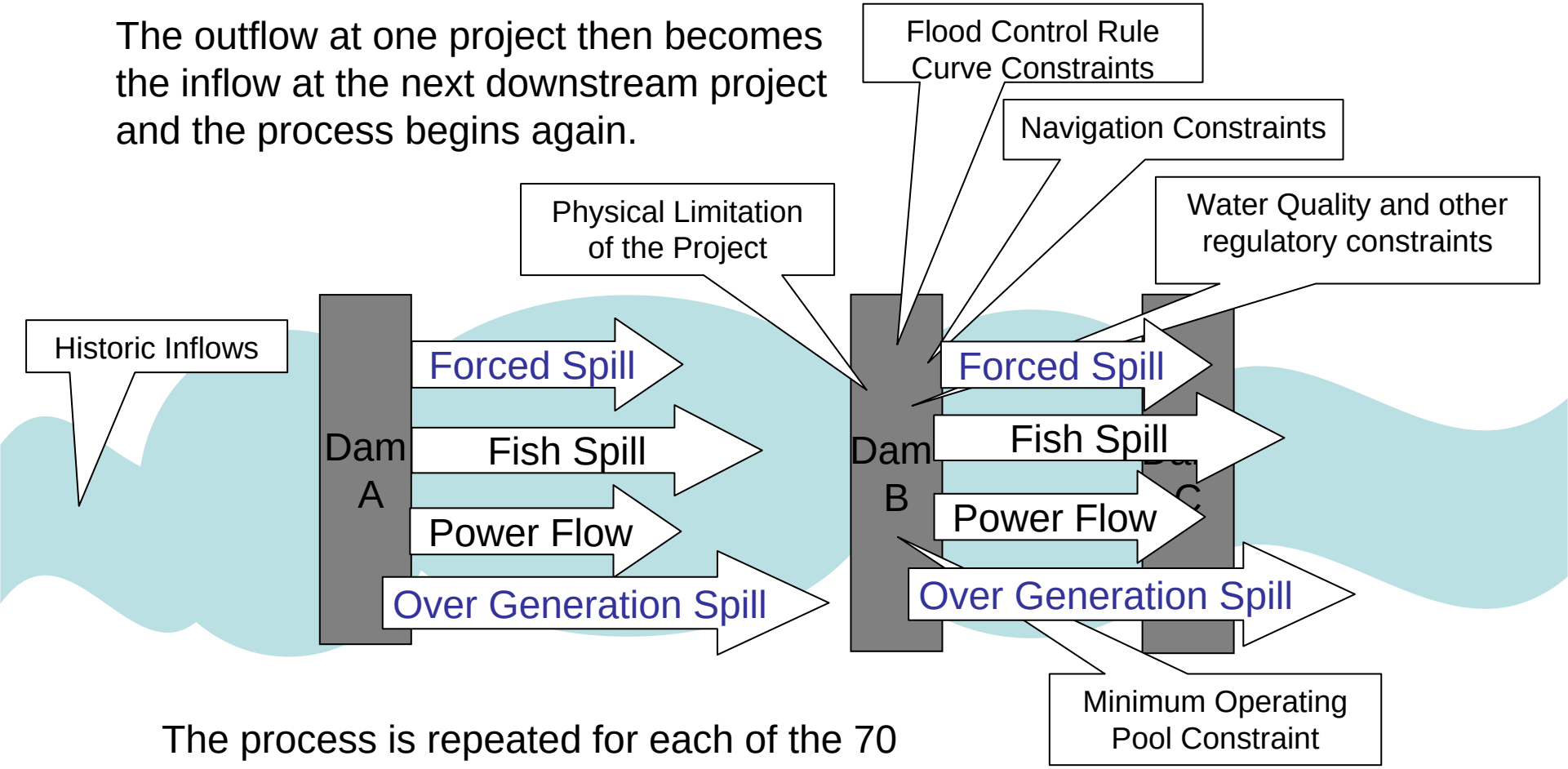
It provides for flow through the turbines to meet regional power demand.




The flow that needs to pass the project in excess of powerhouse capacity is called Forced Spill.

When there is not sufficient demand in the region for the power then some additional water is spilled and called Over-Generation Spill.

The outflow at one project then becomes the inflow at the next downstream project and the process begins again.




The process is repeated for each of the 70 plus projects for each historic water year. HYDSIM produces monthly results by project for each water year.

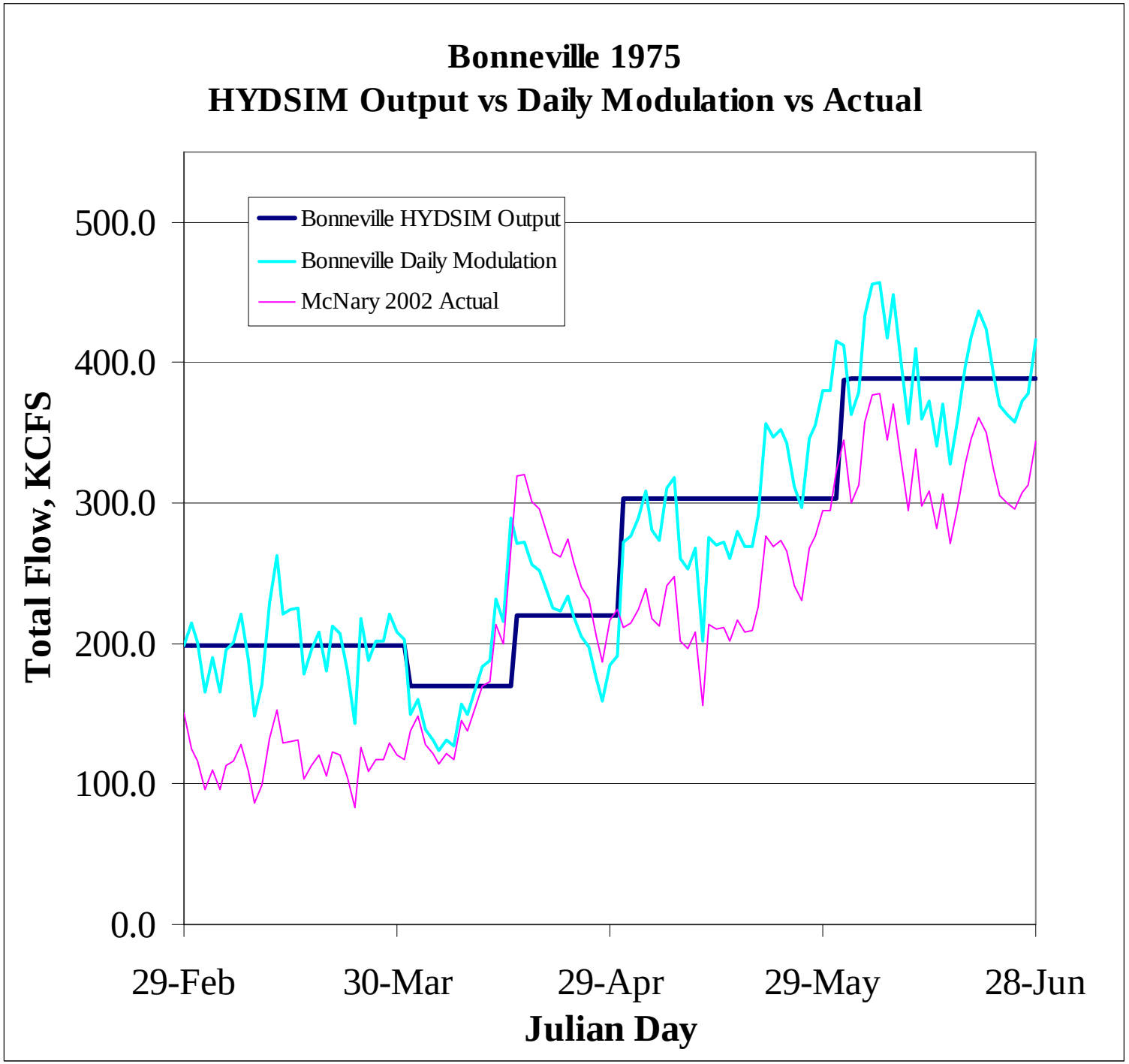
# Why is it important to model these other types of spill in this context?

| | 04/30/07 | 05/31/07 | 06/30/07 | 07/31/07 |
|---|---|---|---|---|
| 1928-29 | 0 | 2000 | 2887 | 9750 |
| 1929-30 | 6000 | 2000 | 2887 | 9750 |
| 1930-31 | 0 | 2000 | 2887 | 9750 |
| 1931-32 | 0 | 0 | 0 | 9750 |
| 1932-33 | 6000 | 2000 | 0 | 0 |
| 1933-34 | 0 | 2000 | 2887 | 9750 |
| 1934-35 | 6000 | 2000 | 2887 | 9750 |
| 1935-36 | 6000 | 2000 | 0 | 9750 |
| 1936-37 | 6000 | 2000 | 2887 | 9750 |
| 1937-38 | 0 | 0 | 2887 | 9750 |
| 1938-39 | 6000 | 2000 | 2887 | 9750 |
| 1939-40 | 6000 | 2000 | 2887 | 2681 |
| 1940-41 | 0 | 2000 | 2887 | 9750 |
| 1941-42 | 6000 | 2000 | 0 | 9750 |
| 1942-43 | 0 | 0 | 0 | 9750 |
| 1943-44 | 0 | 2000 | 2887 | 8180 |
| 1944-45 | 0 | 2000 | 2887 | 9750 |
| 1945-46 | 0 | 0 | 2887 | 9750 |
| 1946-47 | 6000 | 0 | 2887 | 9750 |
| 1947-48 | 6000 | 0 | 0 | 0 |
| 1948-49 | -6997 | 0 | 2887 | 9750 |
| 1949-50 | 6000 | 0 | 0 | 9750 |
| 1950-51 | 0 | 0 | 2887 | 0 |
| 1951-52 | 0 | 0 | 2887 | 9750 |
| 1952-53 | 6000 | 2000 | 0 | 0 |
| 1953-54 | 6000 | 0 | 0 | 0 |
| 1954-55 | 6000 | 2000 | 0 | 0 |
| 1955-56 | 0 | 0 | 0 | 0 |
| 1956-57 | 6000 | 0 | 0 | 9750 |
| 1957-58 | 193 | 0 | 0 | 9750 |
| 1958-59 | 6000 | 0 | 0 | 9750 |
| 1959-60 | 6000 | 2000 | 0 | 9750 |
| 1960-61 | 6000 | 2000 | 0 | 9750 |
| 1961-62 | 0 | 2000 | 0 | 9750 |
| 1962-63 | 6000 | 2000 | 2887 | 9750 |
| 1963-64 | 6000 | 2000 | 0 | 0 |
| 1964-65 | 0 | 0 | 0 | 9750 |
| 1965-66 | 6000 | 2000 | 2887 | 9750 |
| 1966-67 | 6000 | 2000 | 0 | 0 |
| 1967-68 | 6000 | 2000 | -260 | 9750 |
| 1968-69 | 0 | 0 | 0 | 9750 |
| 1969-70 | 6000 | 2000 | 0 | 9750 |
| 1970-71 | -4764 | 0 | 0 | 0 |
| 1971-72 | 6000 | 0 | 0 | 0 |
| 1972-73 | 0 | 2000 | 2887 | 9750 |
| 1973-74 | 0 | 0 | 0 | 0 |
| 1974-75 | 6000 | 0 | 0 | 0 |
| 1975-76 | 0 | 0 | 0 | 0 |
| 1976-77 | 0 | 2000 | 2887 | 0 |
| 1977-78 | 6000 | 0 | 2887 | 9750 |
| 1978-79 | 6000 | 2000 | 2887 | 9750 |
| 1979-80 | 6000 | 0 | 2887 | 9750 |
| 1980-81 | 6000 | 2000 | 0 | 0 |
| 1981-82 | 6000 | 0 | 0 | 9750 |
| 1982-83 | 6000 | 0 | 0 | 0 |
| 1983-84 | 0 | 2000 | 0 | 0 |
| 1984-85 | 6000 | 2000 | 2887 | 9750 |
| 1985-86 | 6000 | 2000 | 2887 | 9750 |
| 1986-87 | 6000 | 2000 | 2887 | 9750 |
| 1987-88 | 6000 | 2000 | 2887 | 9750 |
| 1988-89 | 1365 | 2000 | 2887 | 4643 |
| 1989-90 | 0 | 2000 | 0 | 9750 |
| 1990-91 | 6000 | 2000 | 2887 | 0 |
| 1991-92 | 0 | 2000 | 2887 | 9750 |
| 1992-93 | 6000 | 2000 | 2887 | 9750 |
| 1993-94 | 6000 | 2000 | 2887 | 9750 |
| 1994-95 | 6000 | 2000 | 2887 | 9750 |
| 1995-96 | 0 | 0 | 0 | 0 |
| 1996-97 | 0 | 0 | 0 | 0 |
| 1997-98 | 6000 | 0 | 0 | 9750 |
| Avg | 3369 | 1171 | 1399 | 6629 |

- There can be significant amounts of forced and overgeneration spill, particularly during the spring fish passage season.
- Sometimes, changing the spill gas cap makes no difference to the total spill.

# HYDSIM to Compass

- Month-average output from HYDSIM is converted to daily input for Compass.
  - Flow and spill at the eight mainstem dams
- In order to provide a realistically-shaped set of daily flow and spill, one year of flow shapes from the recent past ten years is applied to each of the 70 years modeled in HYDSIM.


Bonneville 1975
HYDSIM Output vs Daily Modulation vs Actual
Bonneville HYDSIM Output
Bonneville Daily Modulation
McNary 2002 Actual
500.0
400.0
300.0
200.0
100.0
0.0
Total Flow, KCFS
29-Feb
30-Mar
29-Apr
29-May
28-Jun
Julian Day