RiverWare on the Snake River Plain

Timothy J Brewer, PE, D.WRE

August 28, 2019

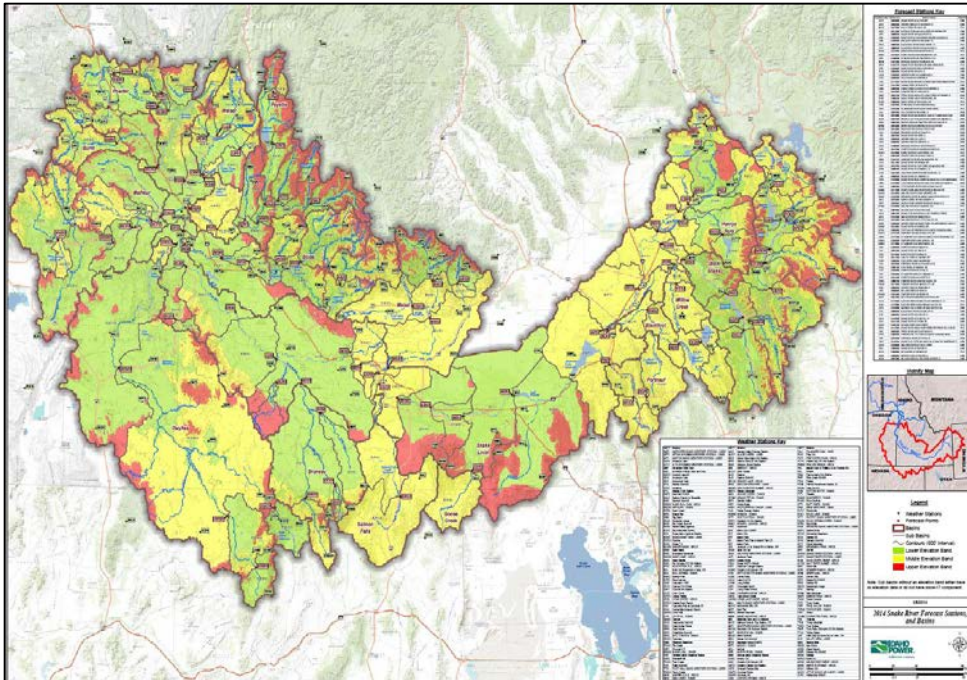# Idaho Power and the Snake River Basin

560,000 Customers

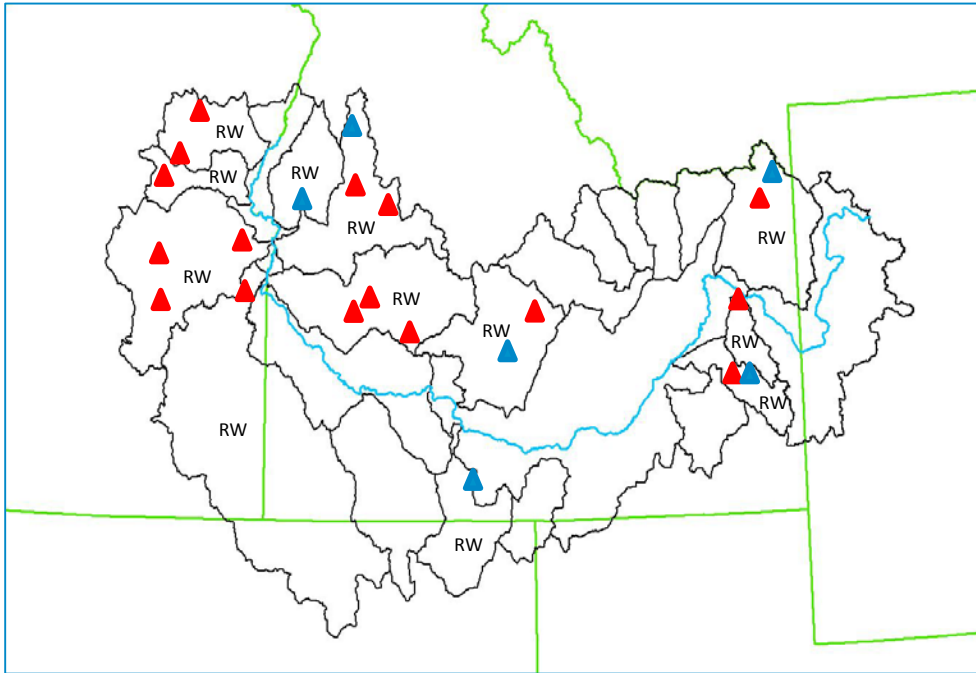24,000 mi² in
S Idaho and E Oregon

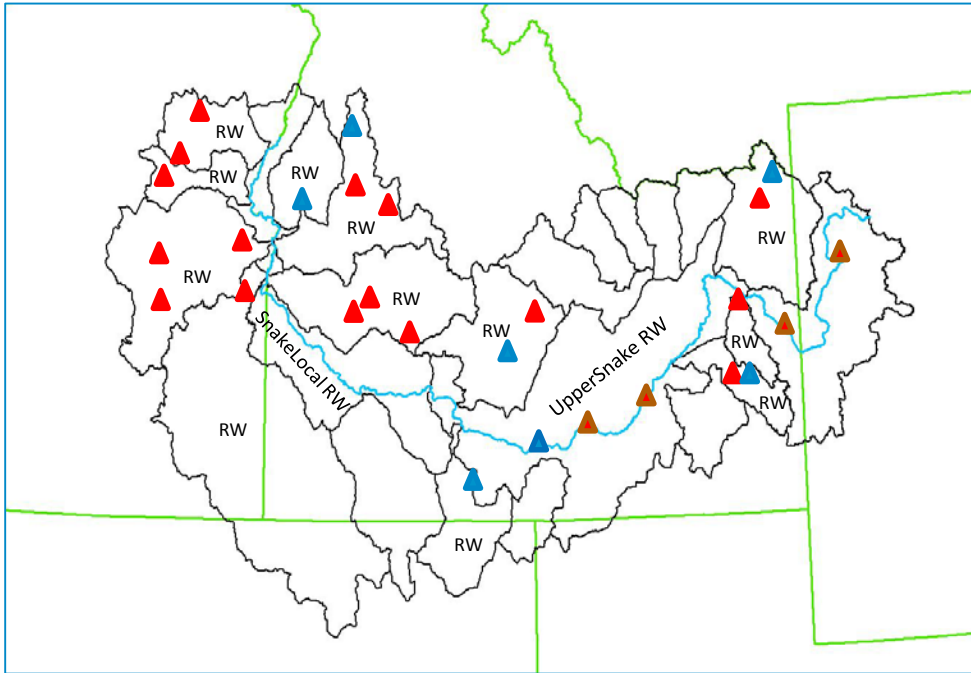1,700 MW hydropower capacity

Snake River Basin

NWSRFS Models
on the FEWS
platform

282 Elevation Bands
18 Forecast Groups
126 Forecast Points
378 Temp. Stations
366 Precip. Stations

RiverWare for Reservoirs and all Downstream routing
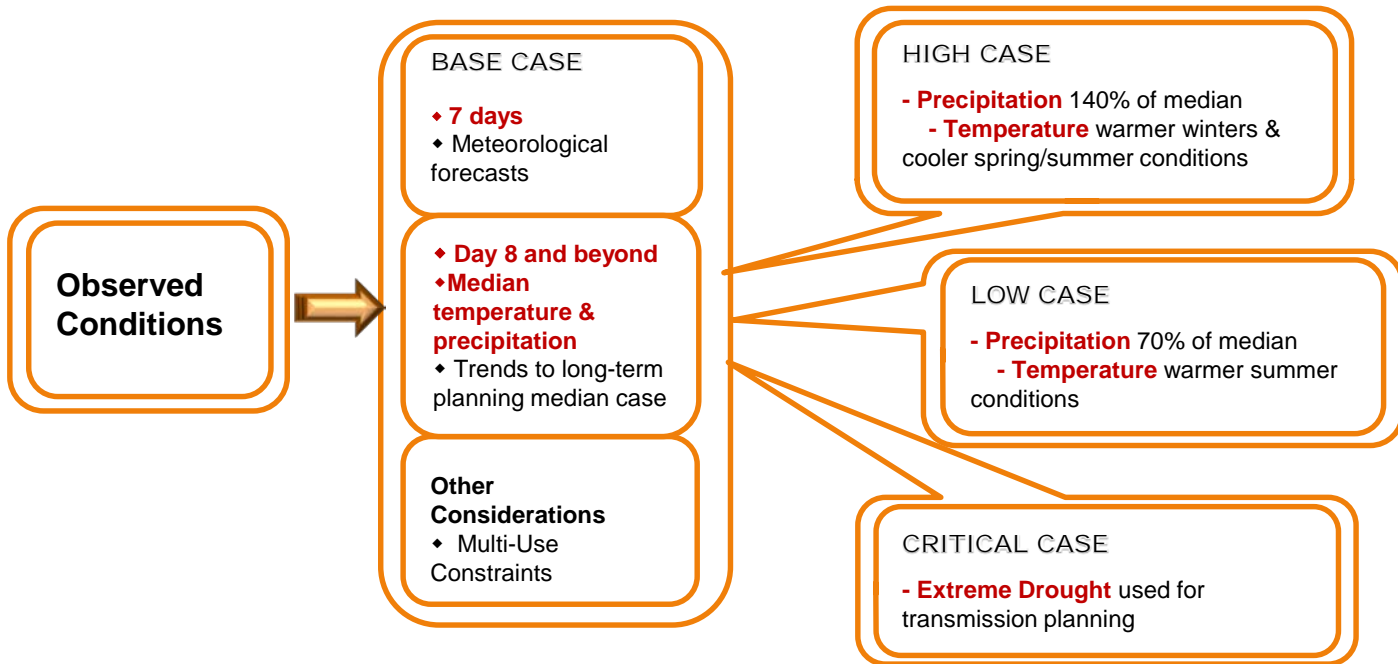
12 Tributary Models
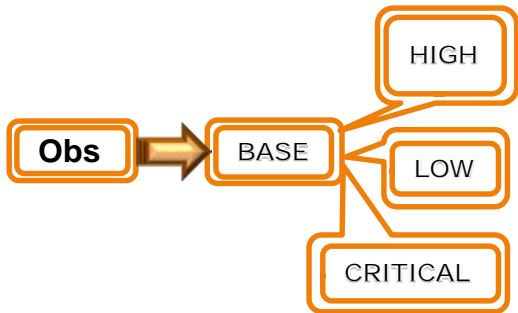
RiverWare for
Reservoirs and all
Downstream routing

12 Tributary Models

2 Mainstem Models

Streamflow "Cases"

Observed Conditions

BASE CASE

- **7 days**
- Meteorological forecasts

- **Day 8 and beyond**
- **Median temperature & precipitation**
- Trends to long-term planning median case

Other Considerations
- Multi-Use Constraints

HIGH CASE

- **Precipitation** 140% of median
  - **Temperature** warmer winters & cooler spring/summer conditions

LOW CASE

- **Precipitation** 70% of median
  - **Temperature** warmer summer conditions

CRITICAL CASE

- **Extreme Drought** used for transmission planning

Data and some operational constraints vary by case

Obs → BASE → HIGH / LOW / CRITICAL
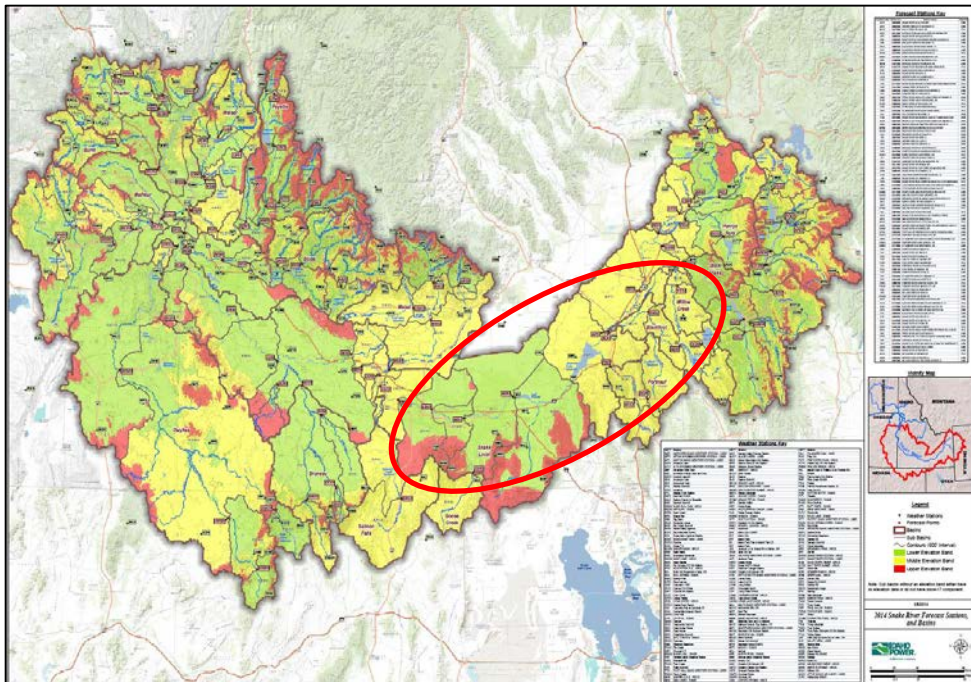
Interactive RW runs
Data - FEWS to/from holding slots
DMI Manager and Scripting move
    data and constraints to "Sim" slots

Headless RW runs
Data - FEWS to/from "Sim" slots
DMI Manager and Scripting move
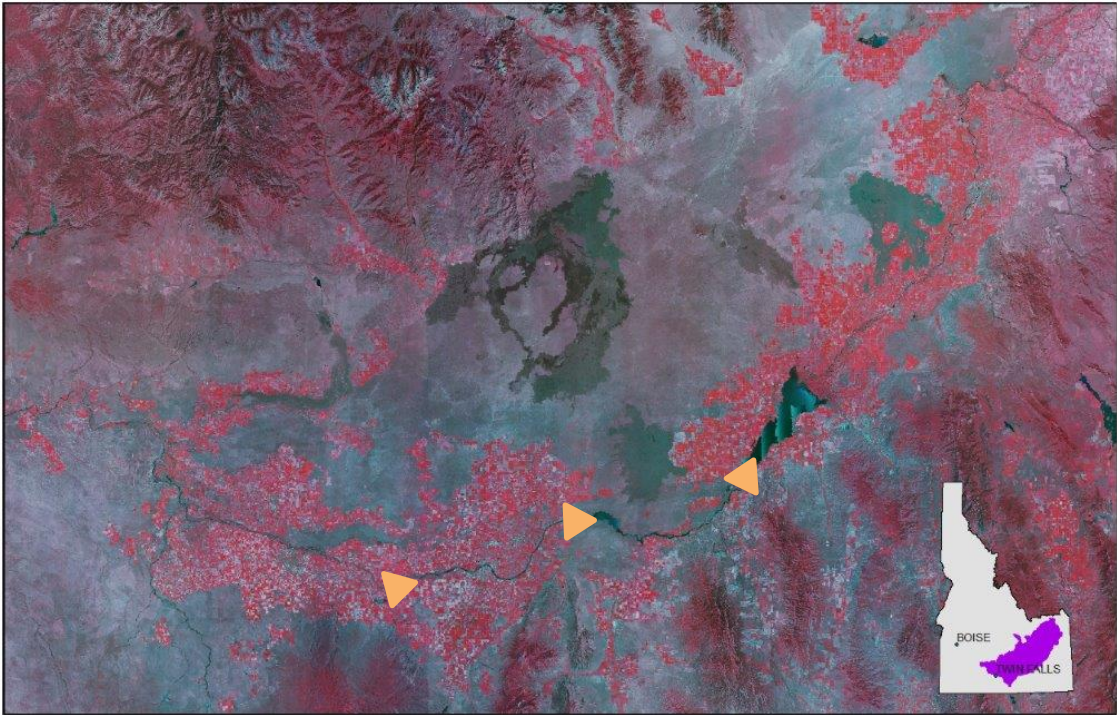   constraints to "Sim" slots

Snake River Basin

Focus on the most complex portion

Eastern Snake Plain

Irrigation on the Eastern Snake Plain

Surface water
2 million acres

Ground water
1 million acres

Aquifer Recharge

Non-irrigation season
Water availability varies
Weather and Canal limits

For 4 Lower Snake Dams

From Upper Snake
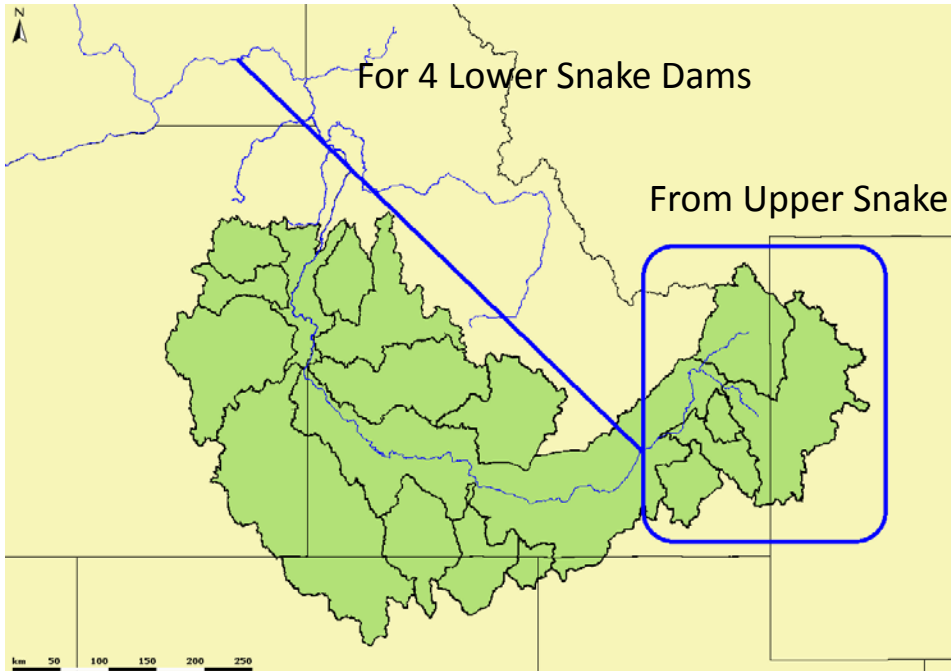
Flow augmentation for anadromous fish

Up to 225 Kaf/yr

2000 to 5000 cfs

Simulated Inflow

American Falls

Minidoka

Milner

ANN to Thousand Springs

SnakeLocal Model

UpperSnake Model

1. Recharge
2. Informal Flood control
3. Irrigation
4. Flow Augmentation
5. IPC Storage and Leased

- Incidental IPC generation at American Falls and Milner

- User specified releases

- Non-Irrigation

- American Falls and Minidoka minimum flows
- Target of zero flow at Milner

- Model diverts up to 1000 cfs developed recharge capacity
- Recharge limited by water supply and irrigation canal availability
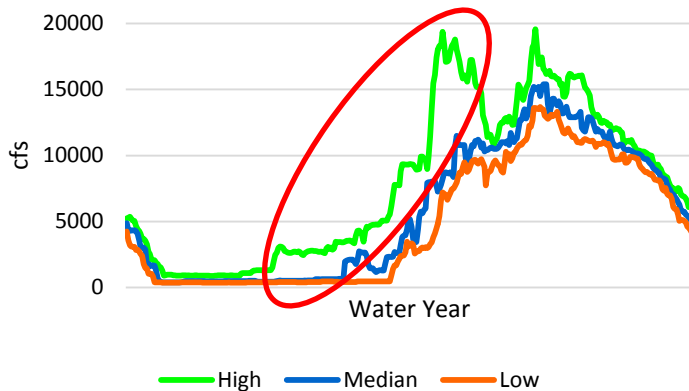
1. Recharge
2. Informal Flood Control
3. Irrigation

- Late-winter and springtime

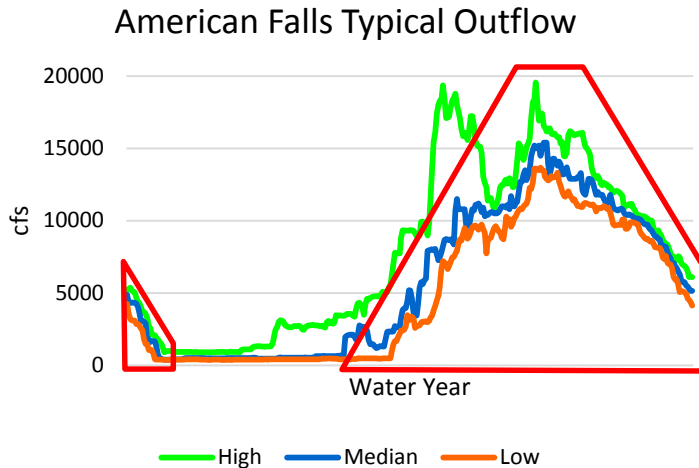- Varies by year based on USBR operational decisions

- Use target pool elevations by date
- Different tables for different water supply cases
- Periodic tables for multi-year runs

- User forecast slot for over-ride in current year

American Falls Typical Outflow

1. Recharge
2. Informal Flood control
3. Irrigation

- Spring, summer, and fall
- Varies by year based on weather and water supply
- Consumptive Use Demand computed – temperature, precipitation, crop types

- Flood control releases can be diverted for irrigation
- Model reduces irrigation diversions in low water supply years
- Model computes return flows - weather adjusted for wet periods

American Falls Typical Outflow

cfs — y-axis: 0, 5000, 10000, 15000, 20000

Water Year

High — Median — Low

1. Recharge

2. Informal Flood control

3. Irrigation

4. Flow Augmentation

5. IPC Storage and Leased

- Incidental IPC generation at American Falls and Milner

- User specified releases

- Summer after flood control
- Varies by year based on water supply

- Model computes available supply from leases from irrigators, USBR uncontracted storage, USBR powerhead
- Model computes the dates and rates of releases

- User can over-ride the storage calculations
- User can over-ride the release rates and dates for real-time forecasting

1. Recharge

2. Informal Flood control

3. Irrigation

4. Flow Augmentation

5. IPC Storage and Leased

- Incidental IPC generation at American Falls and Milner

- User specified releases

- Summer
- Storage varies slightly by water supply
- Leased availability varies annually

- Model uses average supply, release rate, and earliest start date
- Model delays releases until after flow augmentation

- User can over-ride average storage, release rates, and dates
- Can run concurrently with flow augmentation and each other

1. Recharge
2. Informal Flood control
3. Irrigation
4. Flow Augmentation
5. IPC Storage and Leased

- Generation not currently modeled

- Incidental in USBR's perspective
- IPC encourages operations within our plant capacities

- IPC generation at American Falls and Milner

- User specified releases

1. Recharge
2. Informal Flood control
3. Irrigation
4. Flow Augmentation
5. IPC Storage and Leased

- Incidental IPC generation at American Falls and Milner

- **User specified releases**

American Falls

- Typically based on USBR Ops plans
- User can specify by forecast case
- Over-rides simulated outflows
- Maintains water balance
- Gives guidance and confidence

Milner

- Used for SnakeLocal model
- User can specify by forecast case
- Compared to simulated as guidance

Future Enhancements

- Develop multi-decadal planning capability

  - Develop optimization model

    - ANN for Recharge returns

Questions?

My co-workers responsible for most of the work on this project:

Frank Gariglio PE,
John Hildreth PE,
Janak Timilsena PhD,
David Blew,
Kresta Davis-Butts

and
Deltares, USA