Potential for water-resource management using a Water-Use Conveyance Model database linked to Stream Stats: Maryland BRAC water-use database

April 19, 2010

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Water-Use Conveyance Model Database linked to Stream Stats

- Important considerations in man's use of water
- Integrating State and other databases
- The water-use conveyance model database
- The database and water-resource management
- Integration with stream stats
- Questions that can be addressed with this tool

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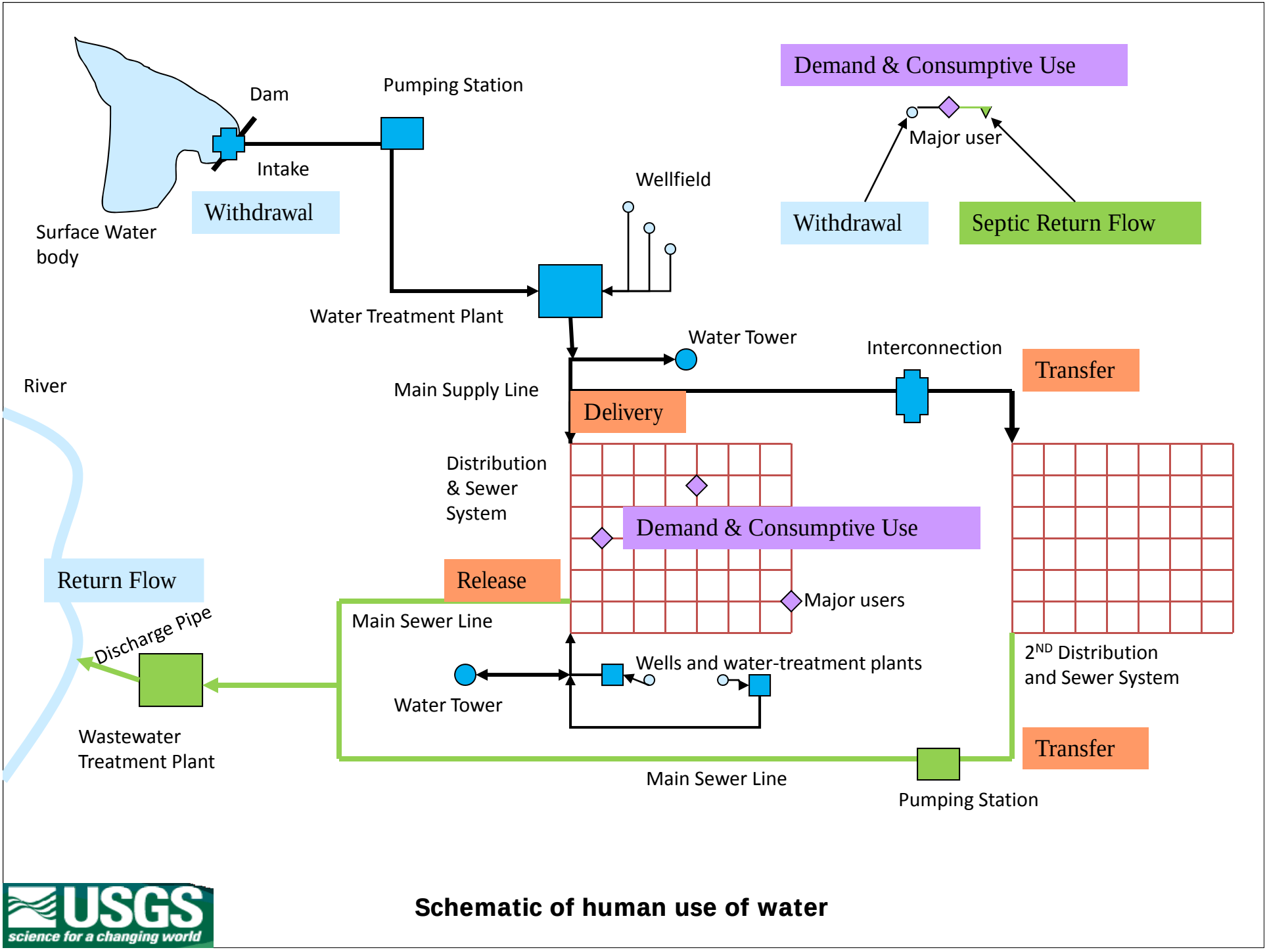

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Schematic of human use of water

Important water-use considerations

- Amount over time
  - Default is Mgal/d; Other possible options could be gal/d; Tgal/month; ft^3/sec if desired
  - Annual, seasonal, monthly, daily, hourly
- Category
  - Domestic use
  - Non-domestic use (commercial, industrial, golf-course irrigation, field and nursery irrigation, mining)
  - Non-domestic withdrawal without use (dewatering, remediation, cooling, hydraulic testing)

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Important water-use considerations

- Relationship of **demand** to ancillary data
  - Domestic per capita demand (regression model)
  - Industrial per employee per SIC code (D&B)
  - Commercial per facility (by type (motel) and size) (non-community systems in SDWIS)
  - Irrigation per acre or per golf-course hole
  - Mix of non-domestic employees per TAZ
- Future demand
  - Estimates of future population, employees, acres

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Components of the database

1. Major (permitted) withdrawal and demand (Allocation & Drinking Water & Geological Survey)
2. Major (permitted) return flow (NPDES)
3. Estimated minor demand and consumptive use, withdrawal and return flow (multiple sources)
4. Domestic demand, withdrawal, return flow
5. Areas of withdrawal versus delivery; return flow versus sewering
6. Projected demand

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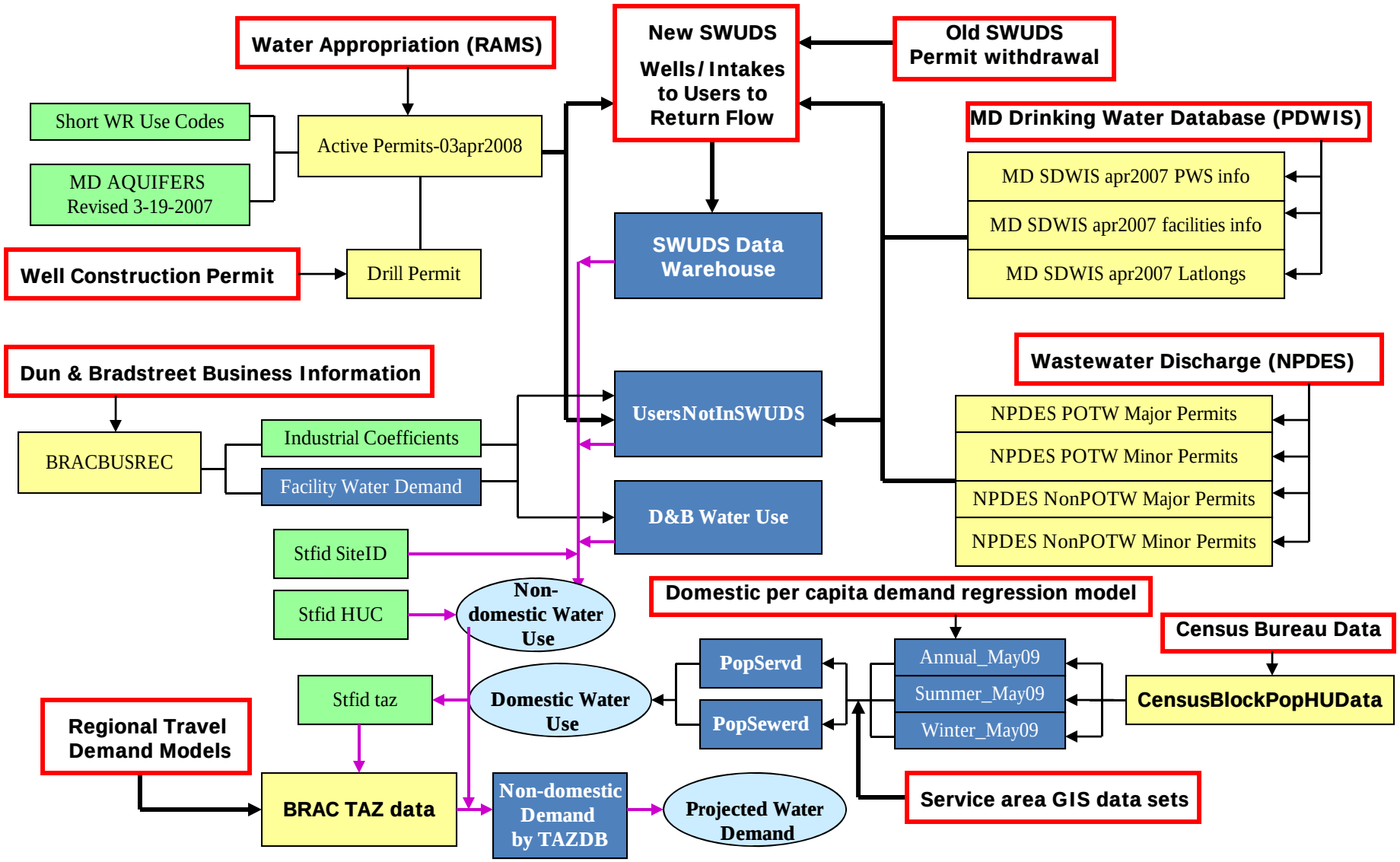
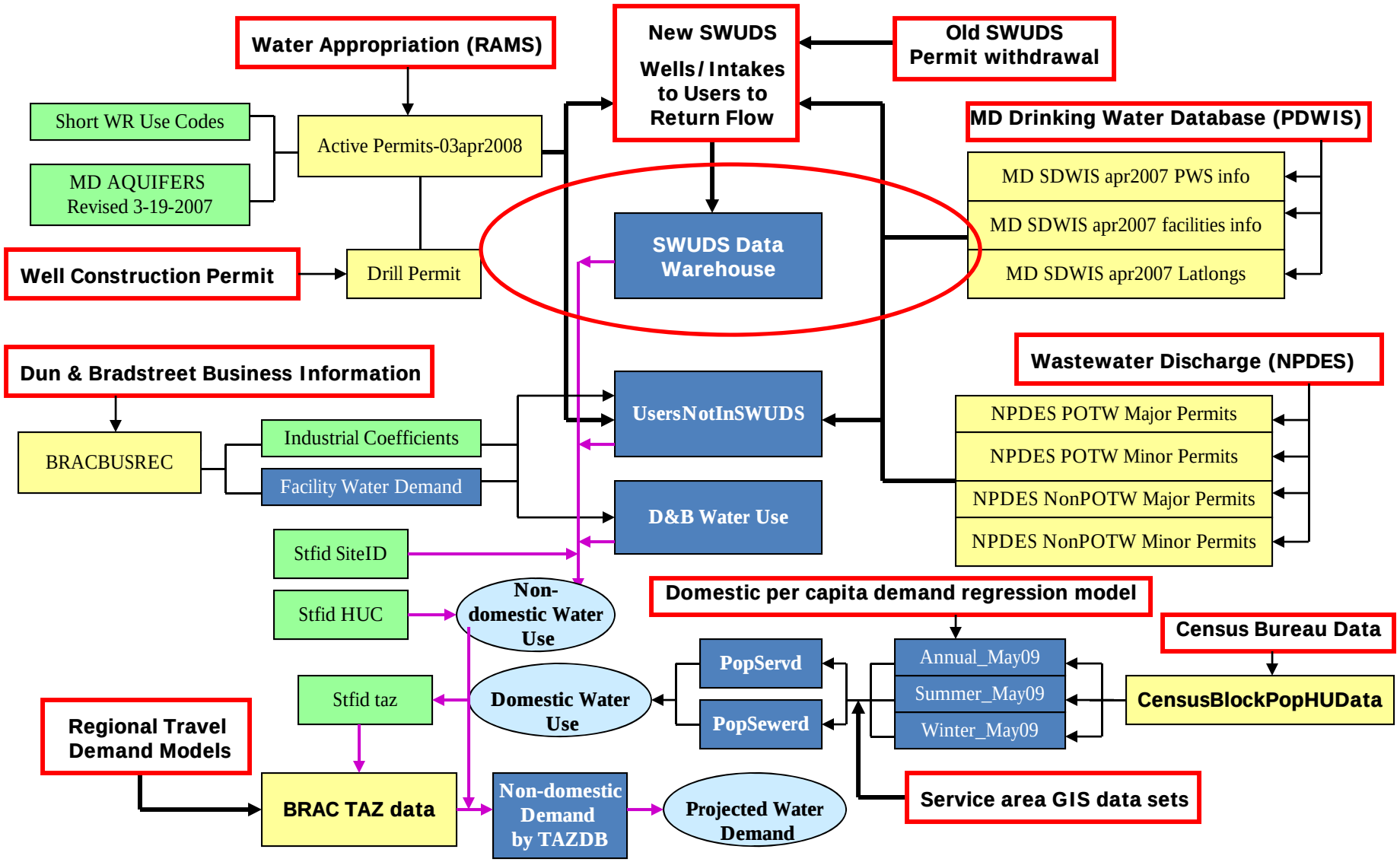


Structure of the Interim Maryland BRAC Water-Use database (IMBWUD) including sources of data.



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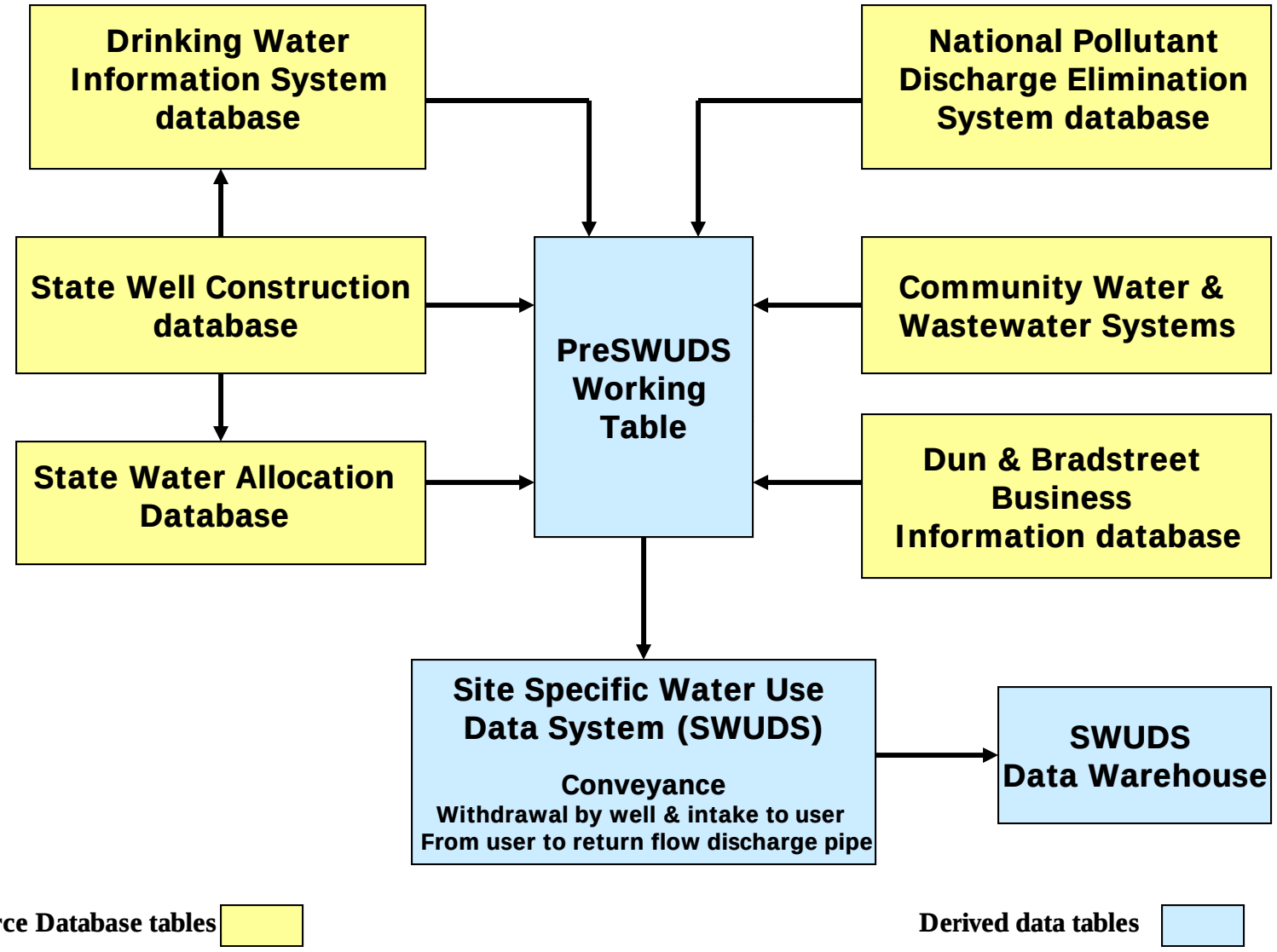

Databases used in construction of the Site Specific Water Use Data System conveyance database.

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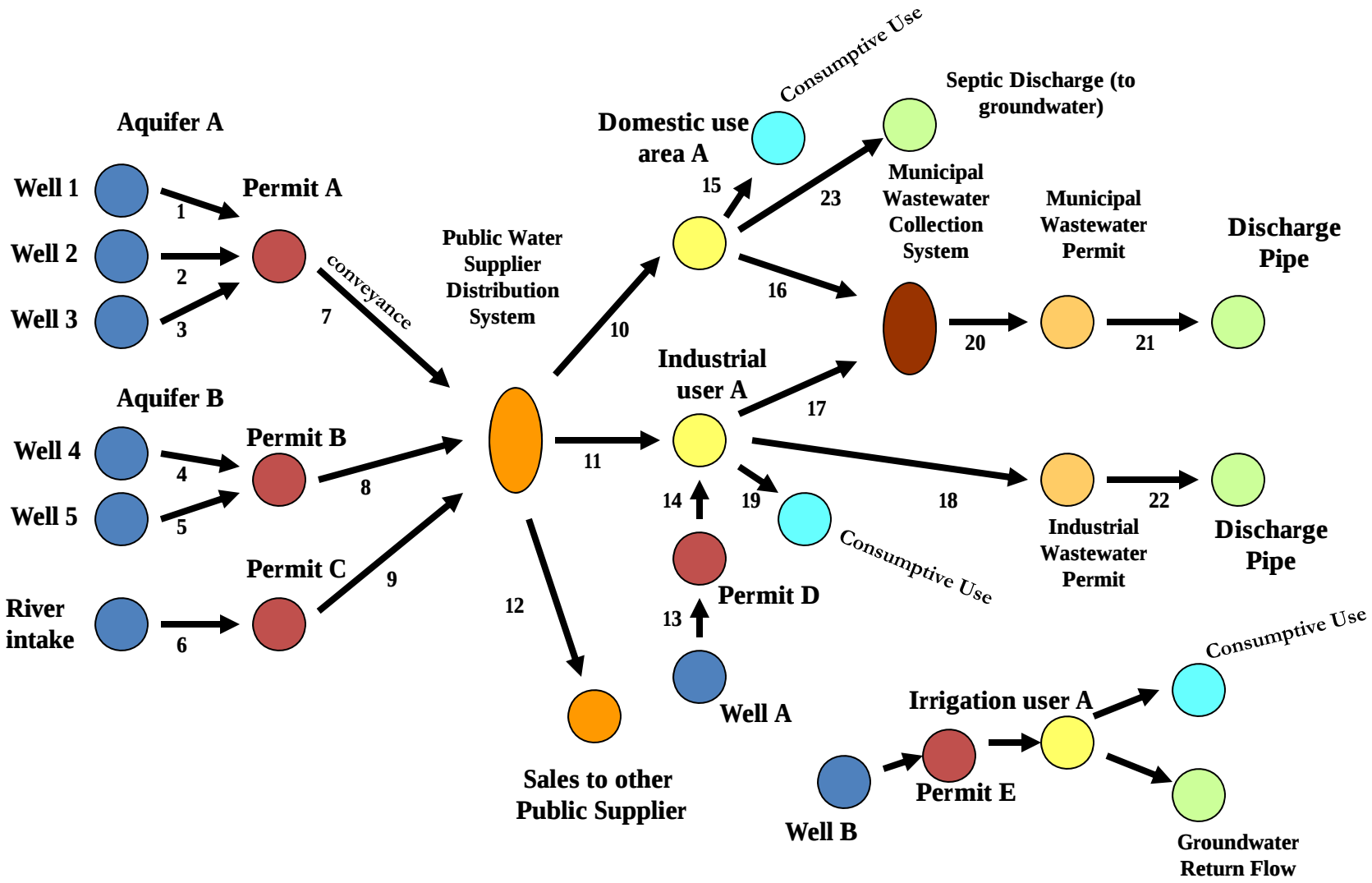

1 = Conveyance Number

Conveyance Data Model used in SWUDS

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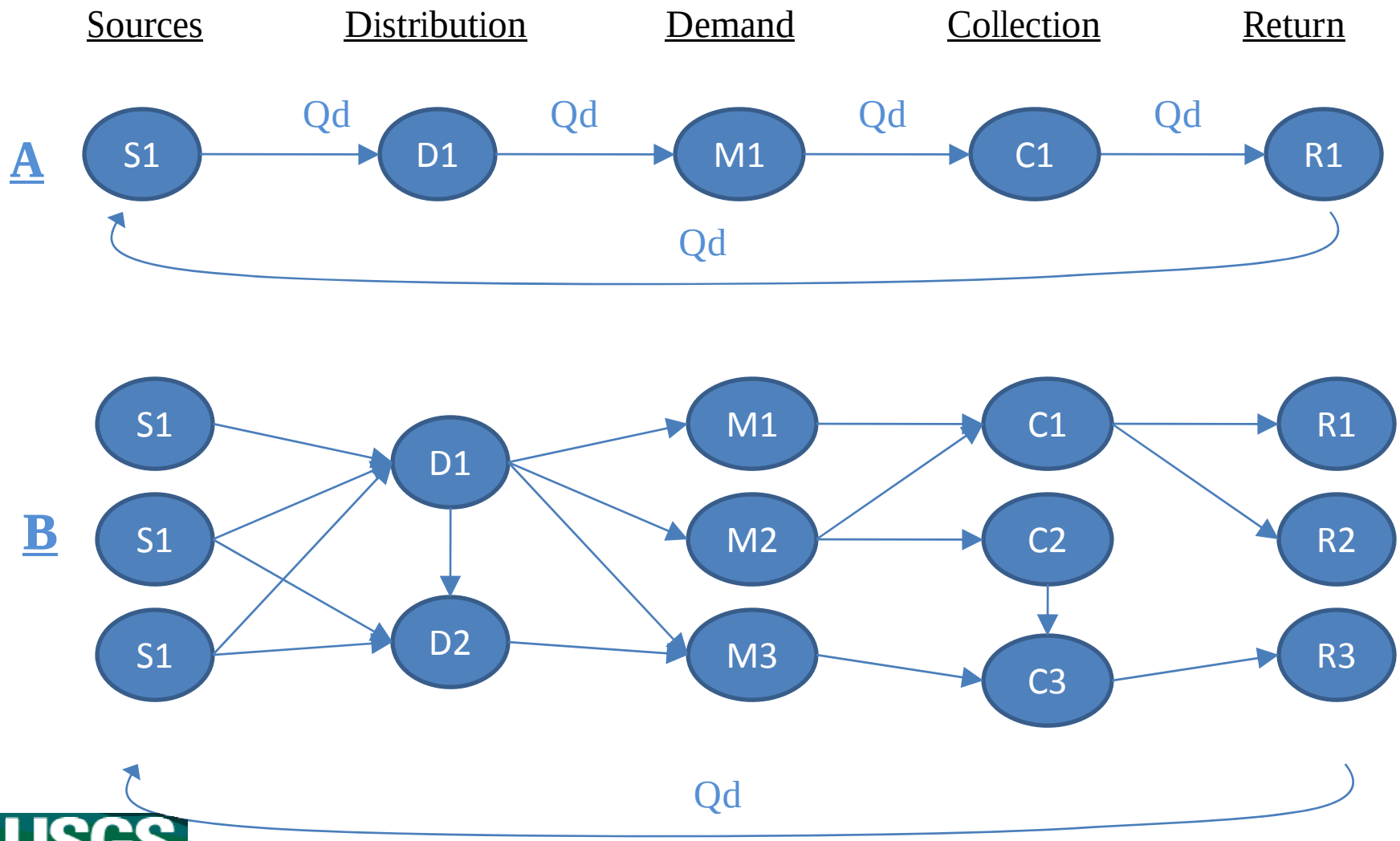
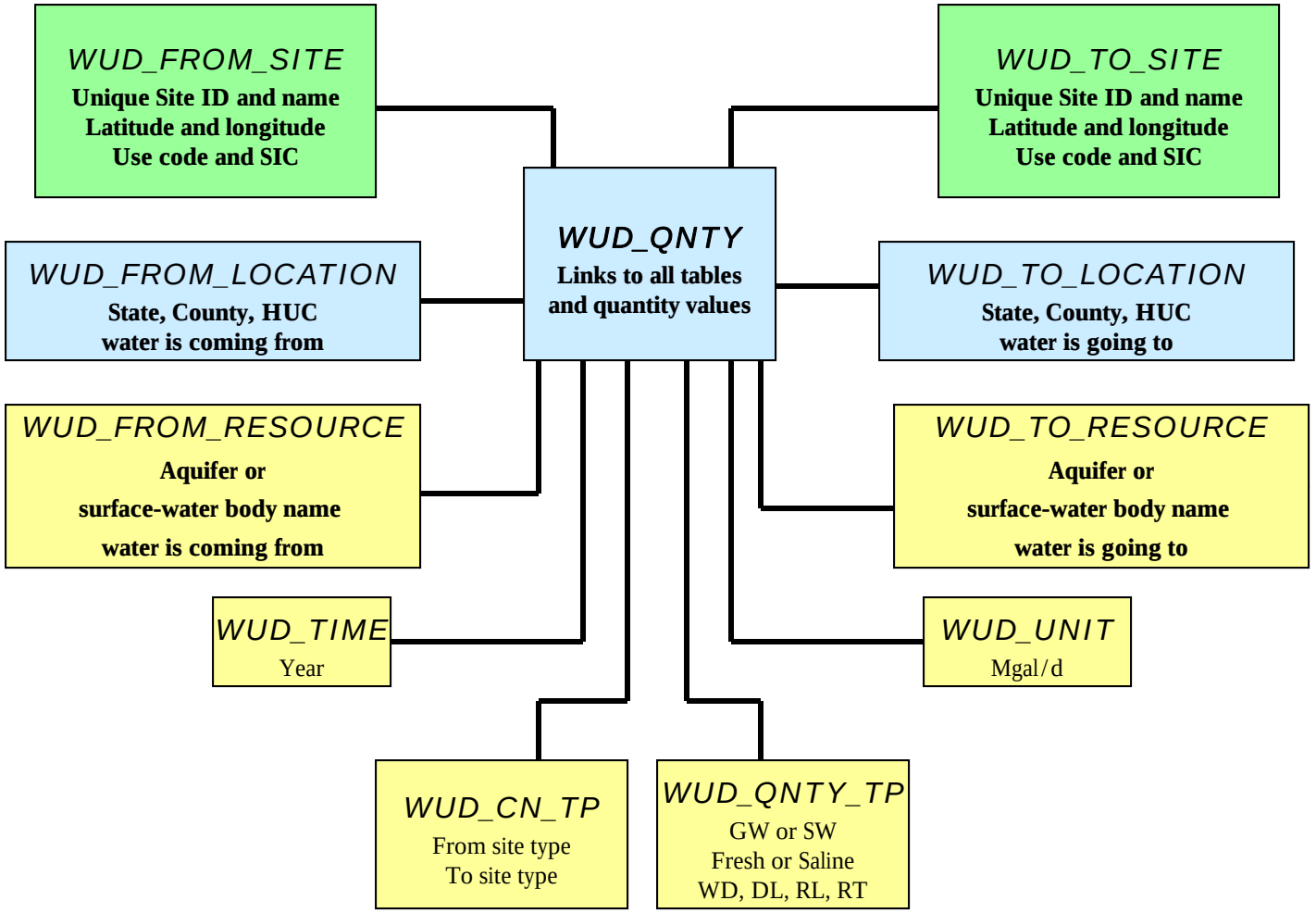
The logical basis for our water-use data schema can be thought of as a “link-node” system. (Tessler and others)





WUD = Water Use Data

QNTY = Quantity

SIC = Standard Industrial Classification Code

TP = Type CN = Conveyance

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Data tables in the SWUDS Data Warehouse

Demand drives withdrawal and return flow

- Quantify demand and consumptive use by sector
- Understanding how demand is met
  - Self supply withdrawal by resource and basin
  - Public supply withdrawal from sources within basin
  - Import of water
- Understanding where the water goes after use
  - Septic flow to groundwater
  - Sewered return flow to resources within basin
  - Export of wastewater

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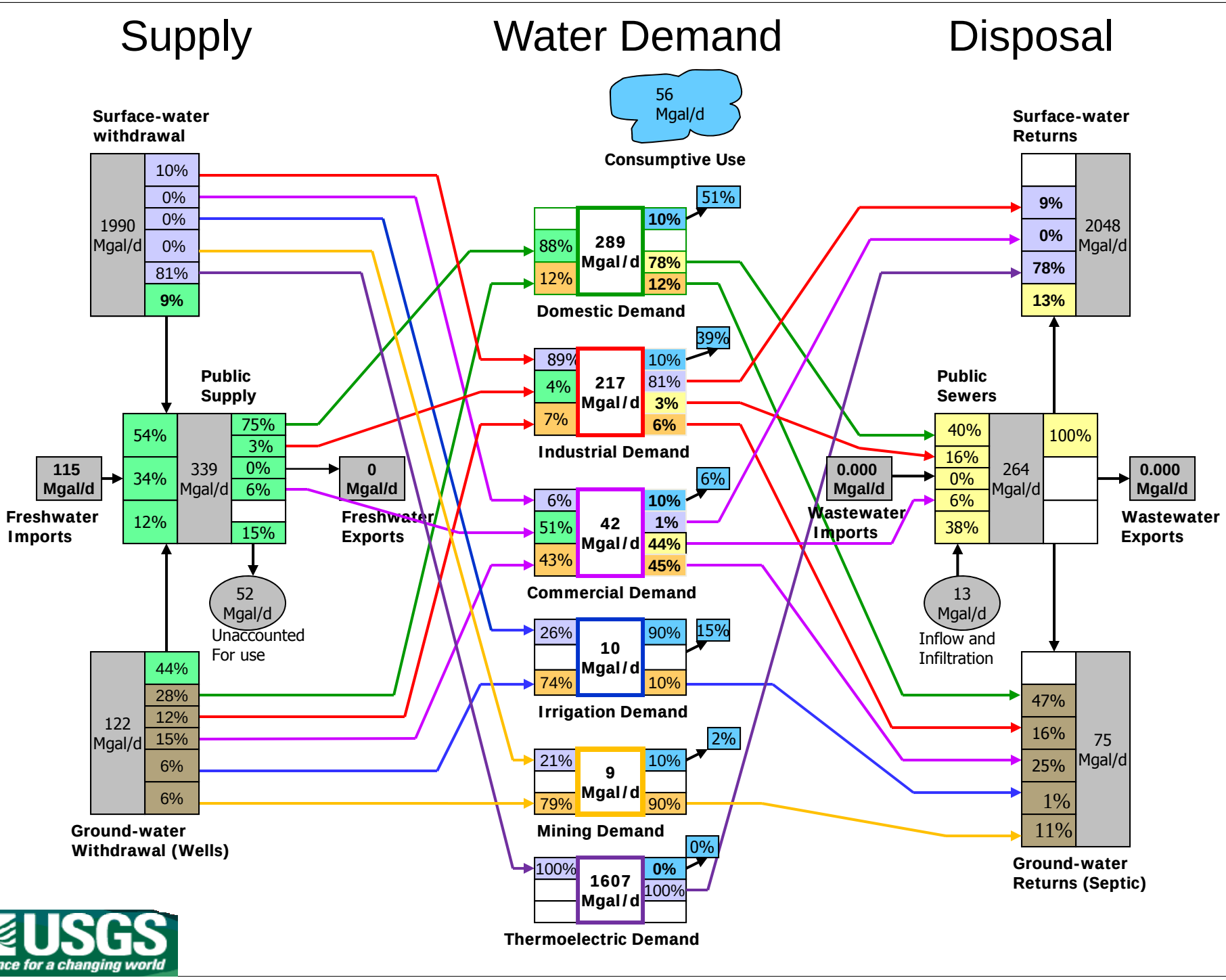
Supply
Water Demand
Disposal
56
Mgal/d
Consumptive Use
Surface-water
withdrawal
1990
Mgal/d
10%
0%
0%
0%
81%
9%
Public
Supply
54%
34%
12%
339
Mgal/d
75%
3%
0%
6%
15%
115
Mgal/d
Freshwater
Imports
0
Mgal/d
Freshwater
Exports
52
Mgal/d
Unaccounted
For use
122
Mgal/d
44%
28%
12%
15%
6%
6%
Ground-water
Withdrawal (Wells)
88%
12%
289
Mgal/d
10%
78%
12%
51%
Domestic Demand
89%
4%
7%
217
Mgal/d
10%
81%
3%
6%
39%
Industrial Demand
6%
51%
43%
42
Mgal/d
10%
1%
44%
45%
6%
Commercial Demand
26%
74%
10
Mgal/d
90%
10%
15%
Irrigation Demand
21%
79%
9
Mgal/d
10%
90%
2%
Mining Demand
100%
1607
Mgal/d
0%
100%
0%
Thermoelectric Demand
Surface-water
Returns
9%
0%
78%
13%
2048
Mgal/d
Public
Sewers
40%
16%
0%
6%
38%
264
Mgal/d
100%
0.000
Mgal/d
Wastewater
Imports
0.000
Mgal/d
Wastewater
Exports
13
Mgal/d
Inflow and
Infiltration
47%
16%
25%
1%
11%
75
Mgal/d
Ground-water
Returns (Septic)
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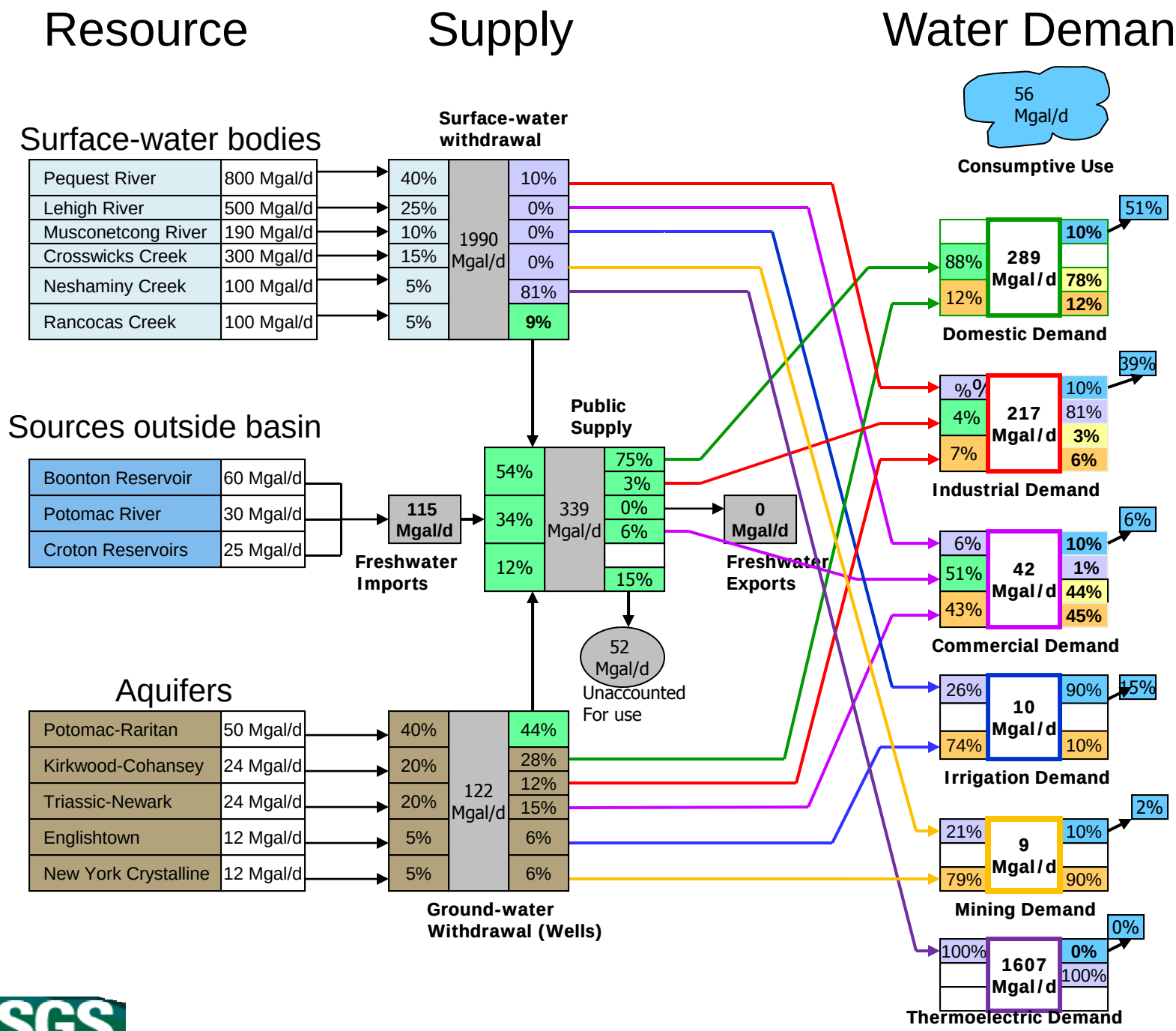
Resource
Supply
Water Demand
Surface-water bodies
Pequest River 800 Mgal/d
Lehigh River 500 Mgal/d
Musconetcong River 190 Mgal/d
Crosswicks Creek 300 Mgal/d
Neshaminy Creek 100 Mgal/d
Rancocas Creek 100 Mgal/d
Surface-water withdrawal
40% 25% 10% 15% 5% 5%
1990 Mgal/d
10% 0% 0% 0% 81% 9%
Sources outside basin
Boonton Reservoir 60 Mgal/d
Potomac River 30 Mgal/d
Croton Reservoirs 25 Mgal/d
115 Mgal/d
Freshwater Imports
Public Supply
54% 34% 12%
339 Mgal/d
75% 3% 0% 6% 15%
0 Mgal/d
Freshwater Exports
52 Mgal/d
Unaccounted For use
Aquifers
Potomac-Raritan 50 Mgal/d
Kirkwood-Cohansey 24 Mgal/d
Triassic-Newark 24 Mgal/d
Englishtown 12 Mgal/d
New York Crystalline 12 Mgal/d
40% 20% 20% 5% 5%
122 Mgal/d
44% 28% 12% 15% 6% 6%
Ground-water Withdrawal (Wells)
56 Mgal/d
Consumptive Use
88% 12%
289 Mgal/d
10% 78% 12%
51%
Domestic Demand
4% 7%
217 Mgal/d
10% 81% 3% 6%
39%
Industrial Demand
6% 51% 43%
42 Mgal/d
10% 1% 44% 45%
6%
Commercial Demand
26% 74%
10 Mgal/d
90% 10%
15%
Irrigation Demand
21% 79%
9 Mgal/d
10% 90%
2%
Mining Demand
100%
1607 Mgal/d
0% 100%
0%
Thermoelectric Demand
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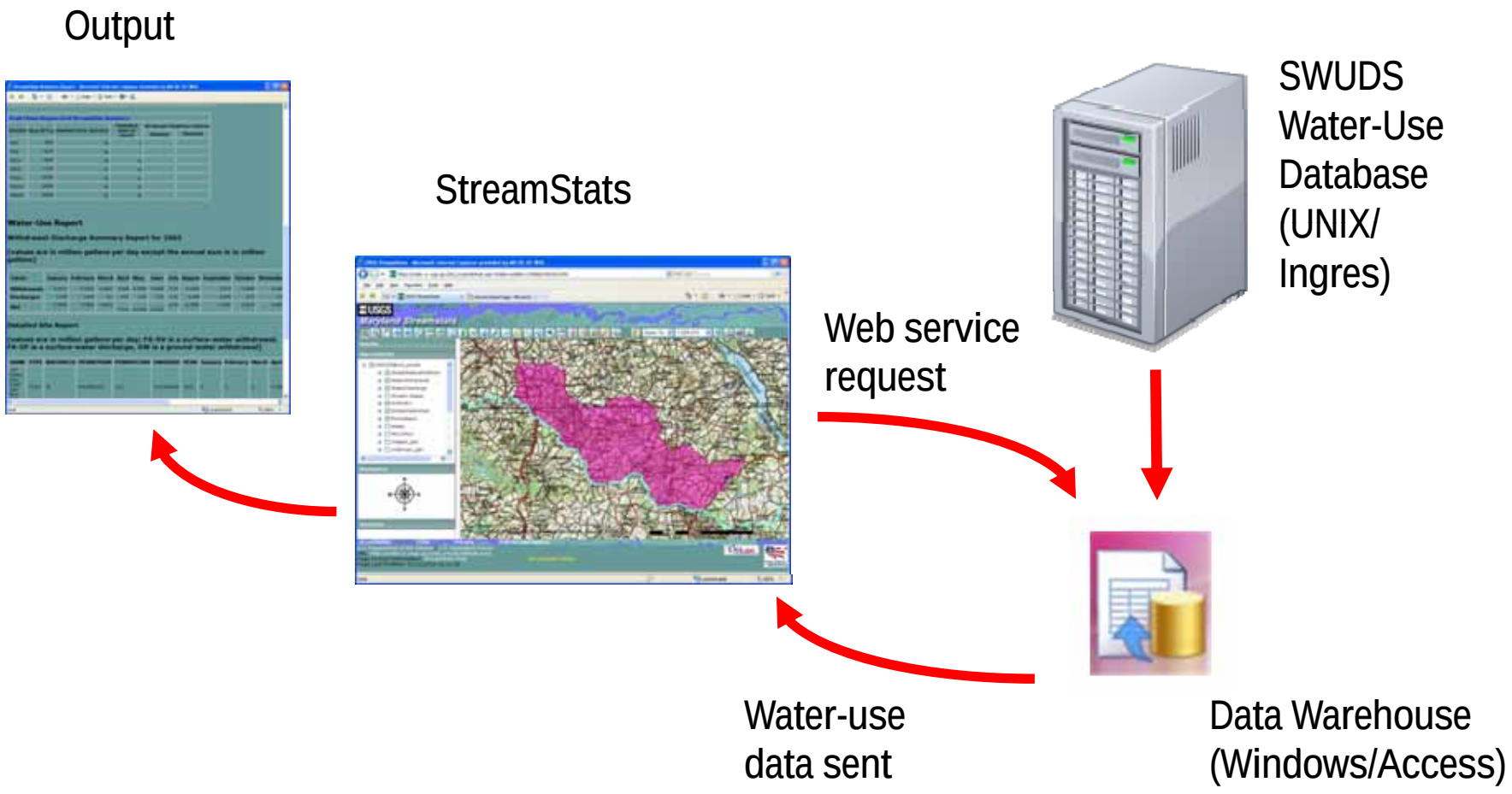
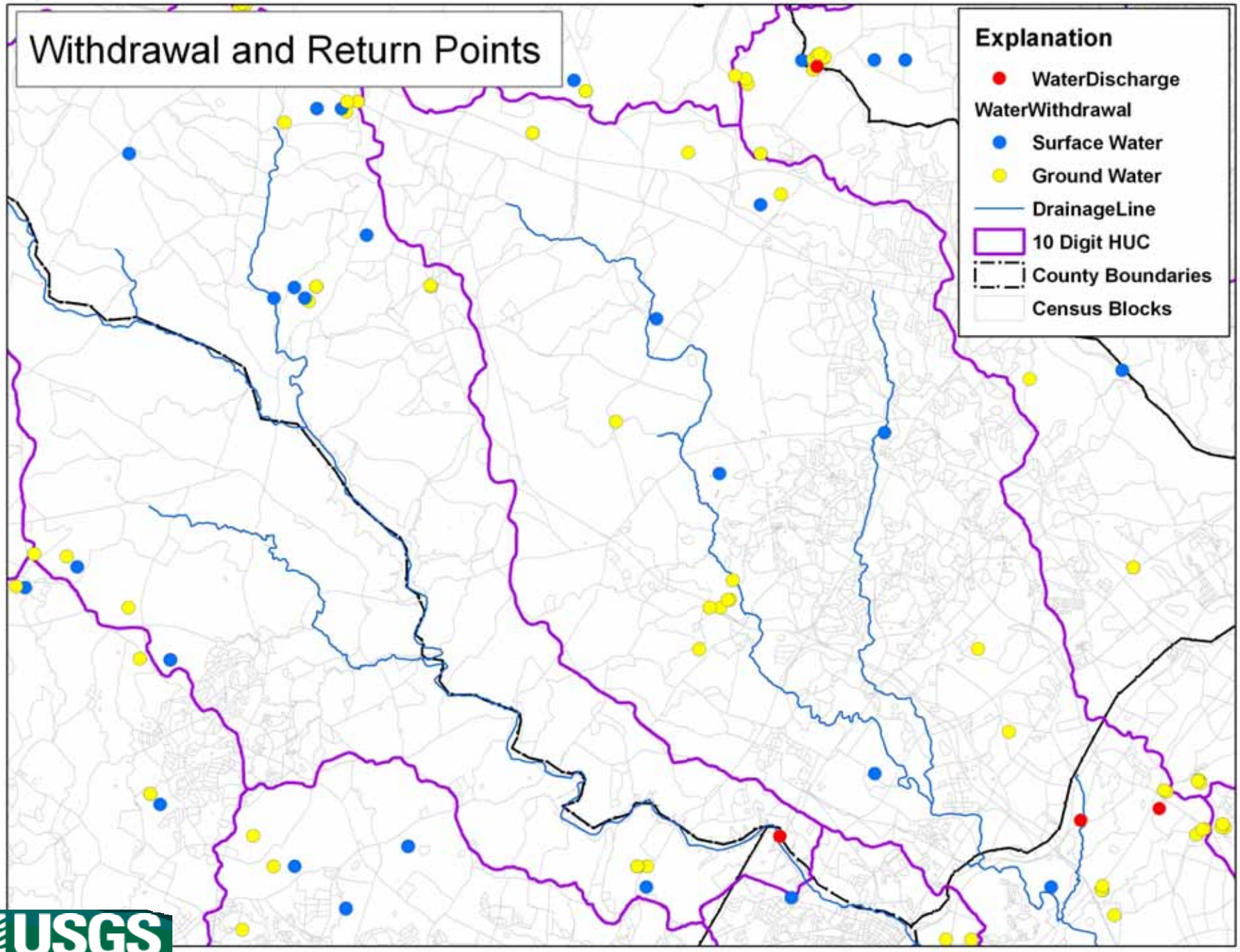
Water-Use Stream Stats Linkage





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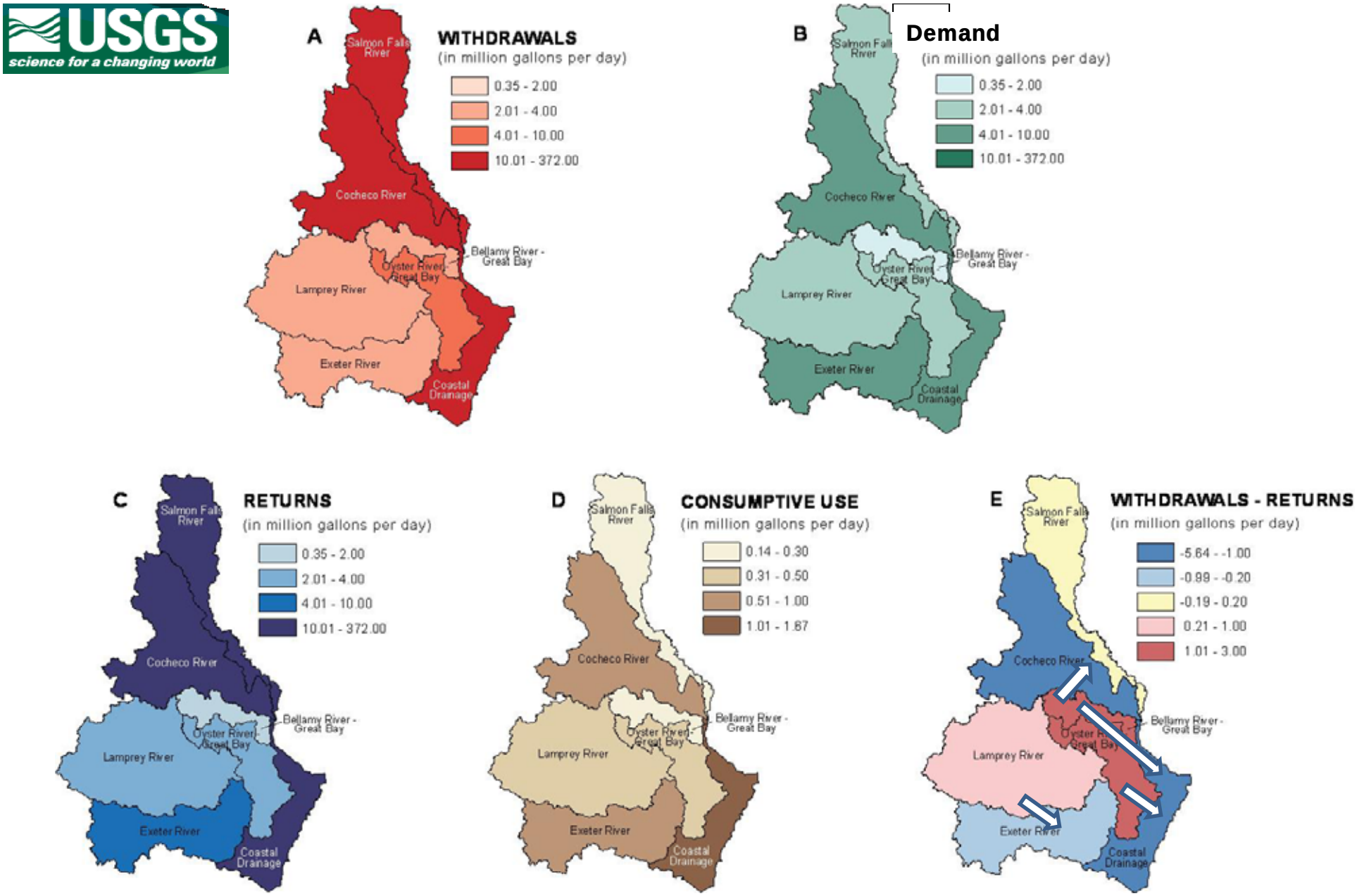
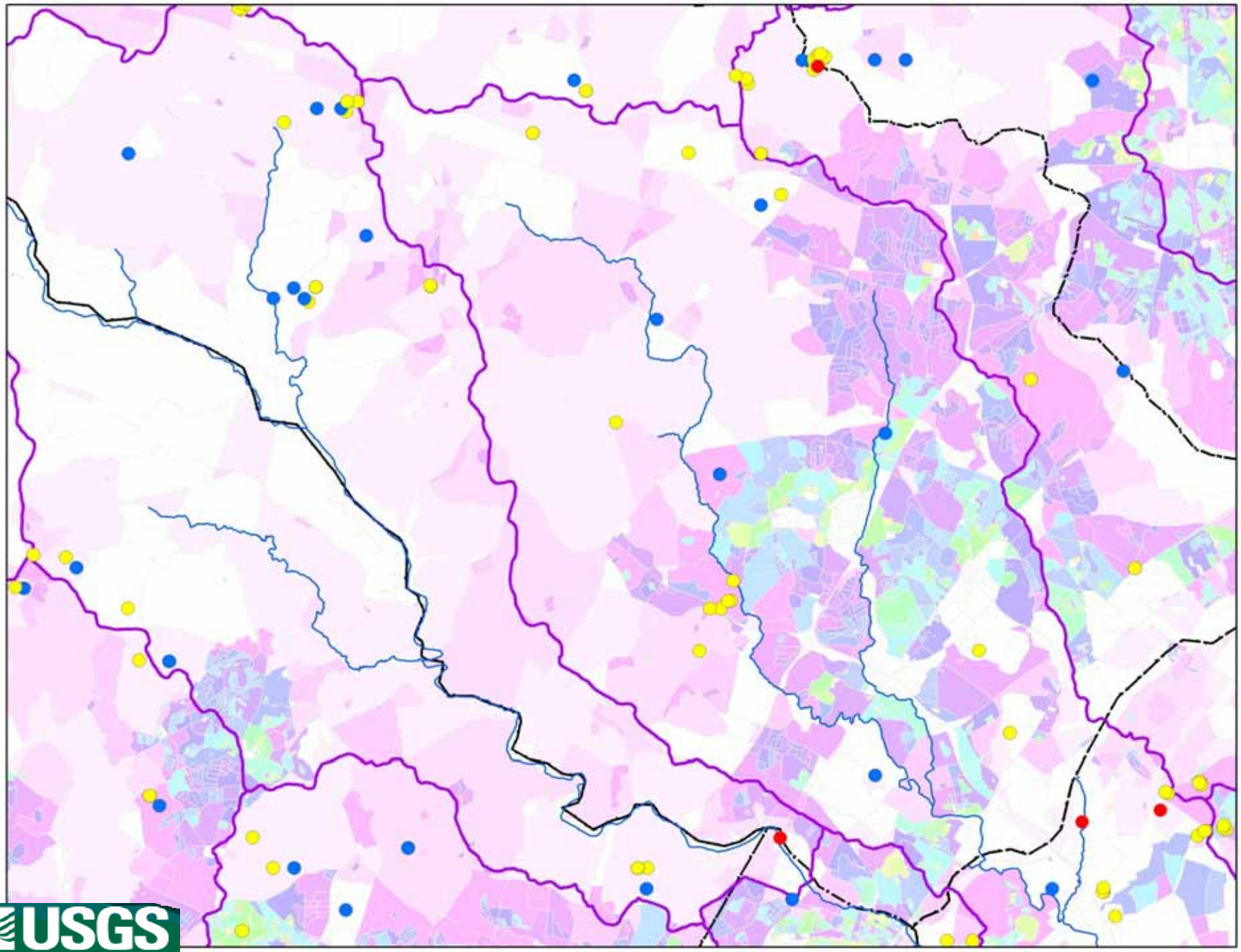


Comparison of different aspects of water use by subbasin

20% of demand is met through freshwater interbasin transfers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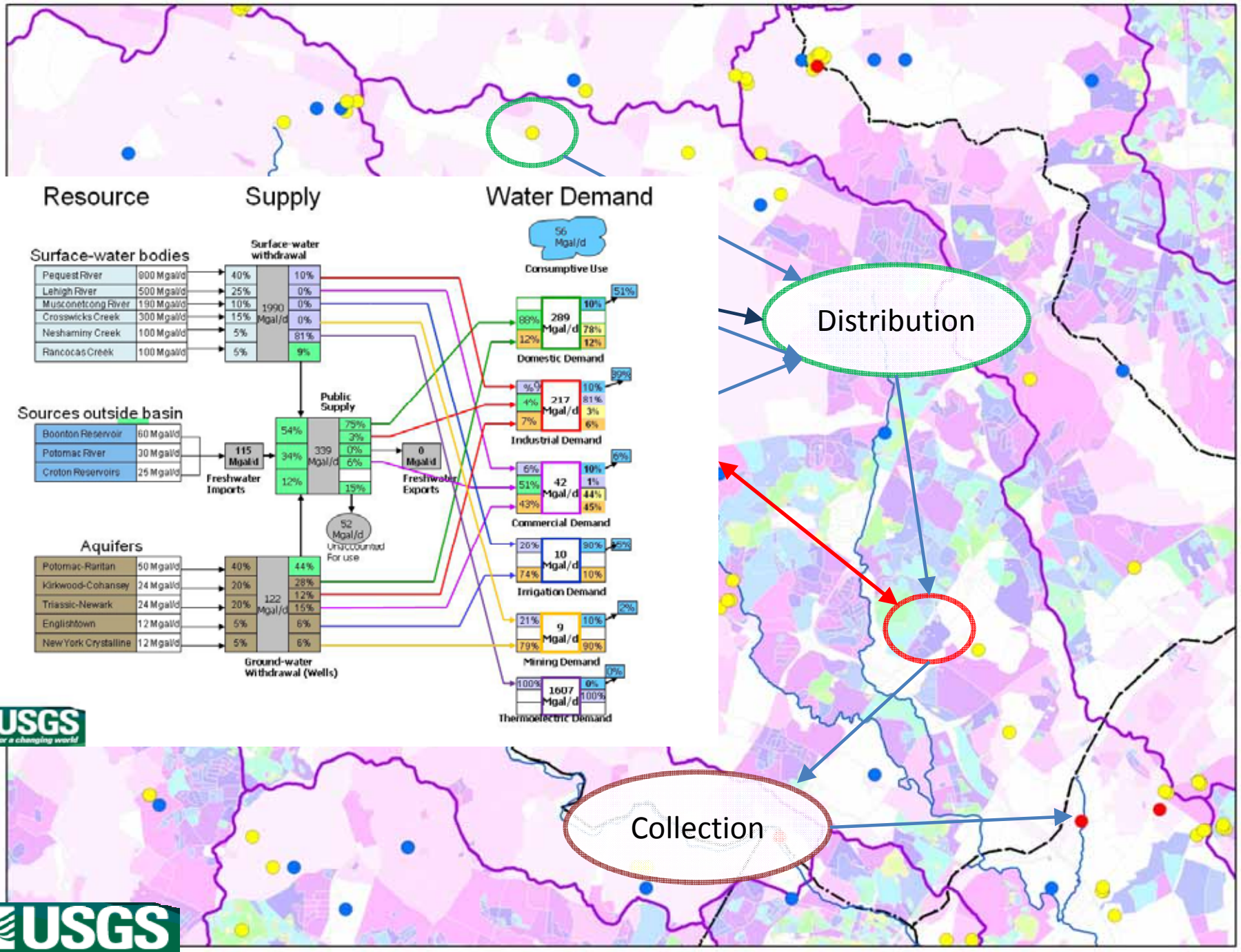
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20% 74%
10 Mgal/d
90% 10%
Irrigation Demand
21% 79%
9 Mgal/d
10% 90%
2%
Mining Demand
100%
1607 Mgal/d
0% 100%
0%
Thermoelectric Demand
Distribution
Collection
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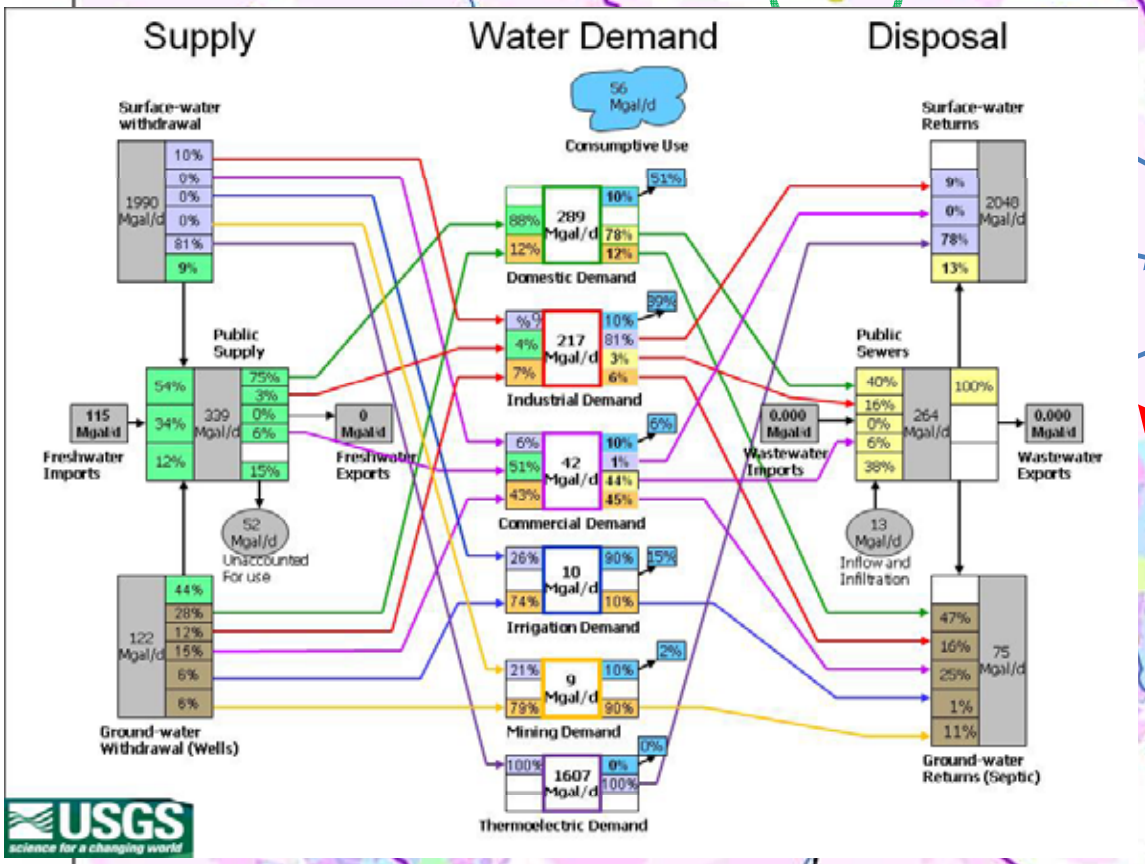

Distribution

Collection

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Where did the water go that was withdrawn in the basin?

- Returned to surface water
- Returned to groundwater through septic systems
- Evaporated, evapo-transpired, or incorporated into products (consumptive use)
- Transferred for use outside the basin
- Released to sewer systems that discharge outside basin

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Where did the water come from that was returned in the basin?

- Withdrawn from surface water
- Withdrawn from groundwater by major users
- Withdrawn from groundwater by minor users
- Transferred in for use from outside the basin
- Transferred in through sewer systems that received wastewater from outside basin

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What is the impact of water use on streamflow?

- Location, quantity, and timing of surface-water withdrawal and return flow (daily scale)
- Location, quantity, and timing of groundwater withdrawal and return flow (monthly or weekly scale).
- Location, quantity, and timing of control-structure operation (daily scale)
- How much of the difference between withdrawal and return flow is due to interbasin transfers or consumptive use?

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QUESTIONS?