VWP CIA Summary (TEMPLATE)

JK

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This is an R Markdown document. This will serve as the template for VWP Project Model Summaries moving forward. For related GitHub issue see <https://github.com/HARPgroup/vahydro/issues/317>.

# VAHydro Model Boilerplate:

## VAHydro

The comprehensive VAHydro hydrologic model is used to evaluate instream and off-stream beneficial uses for surface water withdrawals throughout Virginia. The VAHydro model simulates streamflow with inputs such as precipitation, climate, land use, and topography, as well as local data collected through DEQ water supply planning and reporting programs including all known withdrawals and discharges, as well as operational rules of VWP permits and major hydrologic features such as reservoirs.

The VAHydro model is built on rainfall-evaporation-runoff (RER) time-series from the Chesapeake Bay Model Phase 6 which runs from 1984-2014 in the Chesapeake Bay watershed drainage, and 1984-2005 in the rivers flowing outside of the Chesapeake Bay watershed, aka the “southern rivers.” The VAHydro model features high-resolution hydrologic subsections called “river segments” (over 600 river segments in total), roughly the size of HUC 10 hydrologic units, with additional high-resolution segments added for VWP modeling projects as needed.

## CIA

DEQ assesses water supply sustainability through Cumulative Impact Analysis (CIA) modeling. CIA is a modeling and analysis approach that takes into account the varied hydrologic process occurring throughout a river network (including meteorology and human water use). By simulating a daily water balance for every individual river segment within a watershed, DEQ is able to evaluate the potential “cumulative impact” of all streamflow changes occurring upstream of any location within the river network, as well as the downstream impact of individual permitted withdrawal operations.

The goal of the folloing analysis was to estimate the cumulative impacts of all existing water users in addition to the requested water withdrawal upon existing beneficial uses, including both in-stream and off-stream uses.

# Project Introduction (To be provided by permit writer)

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## Location Map

*No location map available for this facility model*

# Model Overview and Scenario Descriptions

**River Model Description** River segment model overview not provided.

**Facility & Intake Model Description** The James River Correctional Center intake from the James River is located near the confluence with Beaverdam Creek. The facility returns process water flows to Beaverdam creek, and transfers water to Goochland County.

The following model scenarios were simulated in order to determine the most effective means of meeting the project need and all other in-stream beneficial uses:

* **Current permit, 2.0 mgd and 90% Flow-By** (Current Permit) - Details about this scenario to be used in the introduction to scenario analyses (but this is *not* the scenario analyses, that happens in scenario\_analysis).
* **Descriptive name for titles, ex: Proposed permit conditions with 90% flowby** (3.0 MGD, 90% Flow-by) - Details about this scenario to be used in the introduction to scenario analyses (but this is *not* the scenario analyses, that happens in scenario\_analysis).

# Intake Site Description & Current Estimated Stream Flows

**Table 1:** Modeled monthly current flow statistics for James River intake in cubic feet per second (cfs). Columns show the minimum (Min) and average (Mean) modeled flow, and a range of non-exceedence flow percentiles, that is, the column header indicates the percent of flows that do *not* exceed the given value. For example, the “10%” states that only 10% of flows in the given month are expected to be less than the indicated value, and therefore, 90% of the flows in that month are expected to be greater than the given value. For example, in the table below the 10% column states that 10% of flows within the month of January would be less than 3076.2cfs.

| **Month** | **Min** | **5%** | **10%** | **25%** | **30%** | **50%** | **Mean** |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Jan | 1,748.9 | 2,595.3 | 3,076.2 | 4,781.0 | 5,519.9 | 7,524.5 | 9,810.4 |
| Feb | 1,754.7 | 3,318.8 | 4,080.5 | 5,555.4 | 5,990.2 | 7,877.2 | 10,173.3 |
| Mar | 1,641.0 | 3,716.6 | 4,353.2 | 6,459.7 | 7,217.1 | 9,663.1 | 12,246.1 |
| Apr | 2,396.4 | 3,305.6 | 3,693.3 | 5,389.6 | 5,815.5 | 7,951.5 | 11,167.1 |
| May | 1,930.4 | 2,835.2 | 3,242.3 | 4,399.3 | 4,921.6 | 6,663.3 | 8,435.9 |
| Jun | 1,248.8 | 1,728.2 | 2,205.2 | 2,974.3 | 3,256.8 | 4,282.9 | 6,118.3 |
| Jul | 1,022.5 | 1,244.7 | 1,488.9 | 1,879.6 | 1,995.3 | 2,584.9 | 4,063.3 |
| Aug | 735.7 | 959.0 | 1,170.2 | 1,514.6 | 1,619.7 | 2,282.0 | 2,993.2 |
| Sep | 655.9 | 988.7 | 1,136.1 | 1,405.6 | 1,529.2 | 2,135.7 | 4,904.1 |
| Oct | 567.1 | 901.1 | 1,096.3 | 1,630.8 | 1,875.1 | 2,678.0 | 5,184.8 |
| Nov | 513.5 | 820.2 | 1,140.9 | 1,993.4 | 2,211.8 | 3,828.5 | 6,595.0 |
| Dec | 569.5 | 1,048.2 | 1,861.2 | 4,013.2 | 4,593.7 | 6,706.4 | 8,636.5 |

# Model Summary Results - Conclusion/Recommendation

* **Current permit, 2.0 mgd and 90% Flow-By** - Outcomes from the particular set of operational rules and scenario conditions. Ex: The 90% flow-by scenario results in more flexibility to pump under extremely dry conditions, as compared to the current static MIF permit condition. As a result, the operation is able to meet offstream need during all simulated periods, with a small amount of water remaining during the lowest simulated flow.
* **Descriptive name for titles, ex: Proposed permit conditions with 90% flowby** - Outcomes from the particular set of operational rules and scenario conditions. Ex: The 90% flow-by scenario results in more flexibility to pump under extremely dry conditions, as compared to the current static MIF permit condition. As a result, the operation is able to meet offstream need during all simulated periods, with a small amount of water remaining during the lowest simulated flow.

# Stats Comparison Table:

| **Description** | **Current Permit** | **3.0 MGD, 90% Flow-by** |
| --- | --- | --- |
| runid | 400 | 600 |
| River Segment Model Statistics: |  |  |
| Flow Out (cfs) | 7403.29 | 7403.34 |
| Flow Baseline (cfs) | 7573.15 | 7573.13 |
| Minimum Days of Storage Remaining |  |  |
| 30 Day Low Flow (cfs) | 568.60 | 568.81 |
| 90 Day Low Flow (cfs) | 1004.41 | 1004.33 |
| Consumptive Use Fraction | 0.02 | 0.02 |
| Cumulative Withdrawal (mgd) | 310.96 | 311.11 |
| Cumulative Point Source (mgd) | 201.17 | 201.36 |
| Richness Change (abs) | -0.1 | -0.1 |
| Richness Change (%) | -0.21 | -0.21 |
| Facility Model Statistics: |  |  |
| Withdrawal (mgd) | 1.95 | 2.90 |
| Point Source (mgd) | 1.75 | 2.61 |
| Maximum 30 day potential unmet demand (mgd) | 0 | 0 |

# Reservoir Storage Plots:

## This property does not exist

[1] “No riverseg impoundment for run id 400”

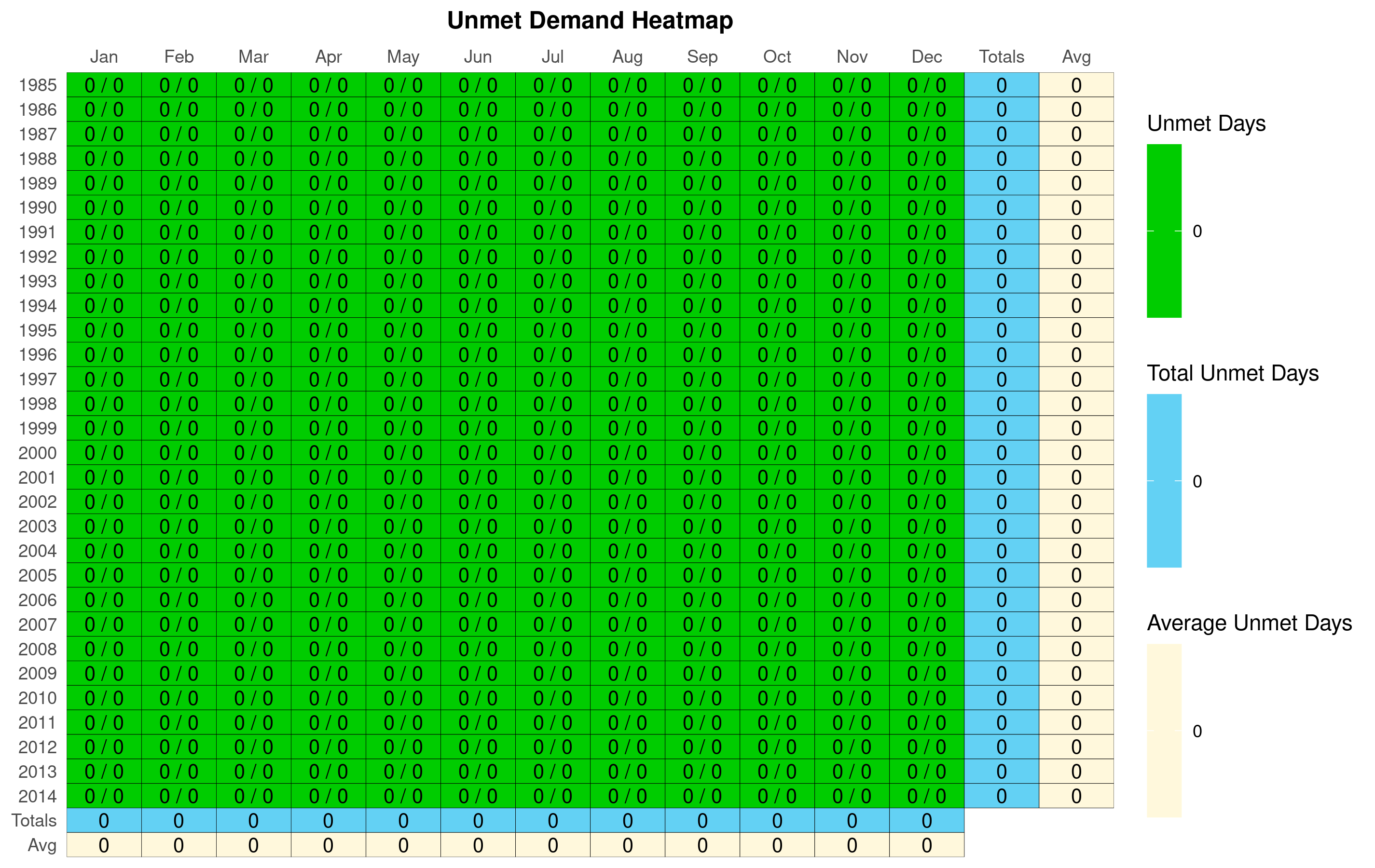
## This property does not exist

[1] “No riverseg impoundment for run id 600”

# Unmet Demand Heatmaps:

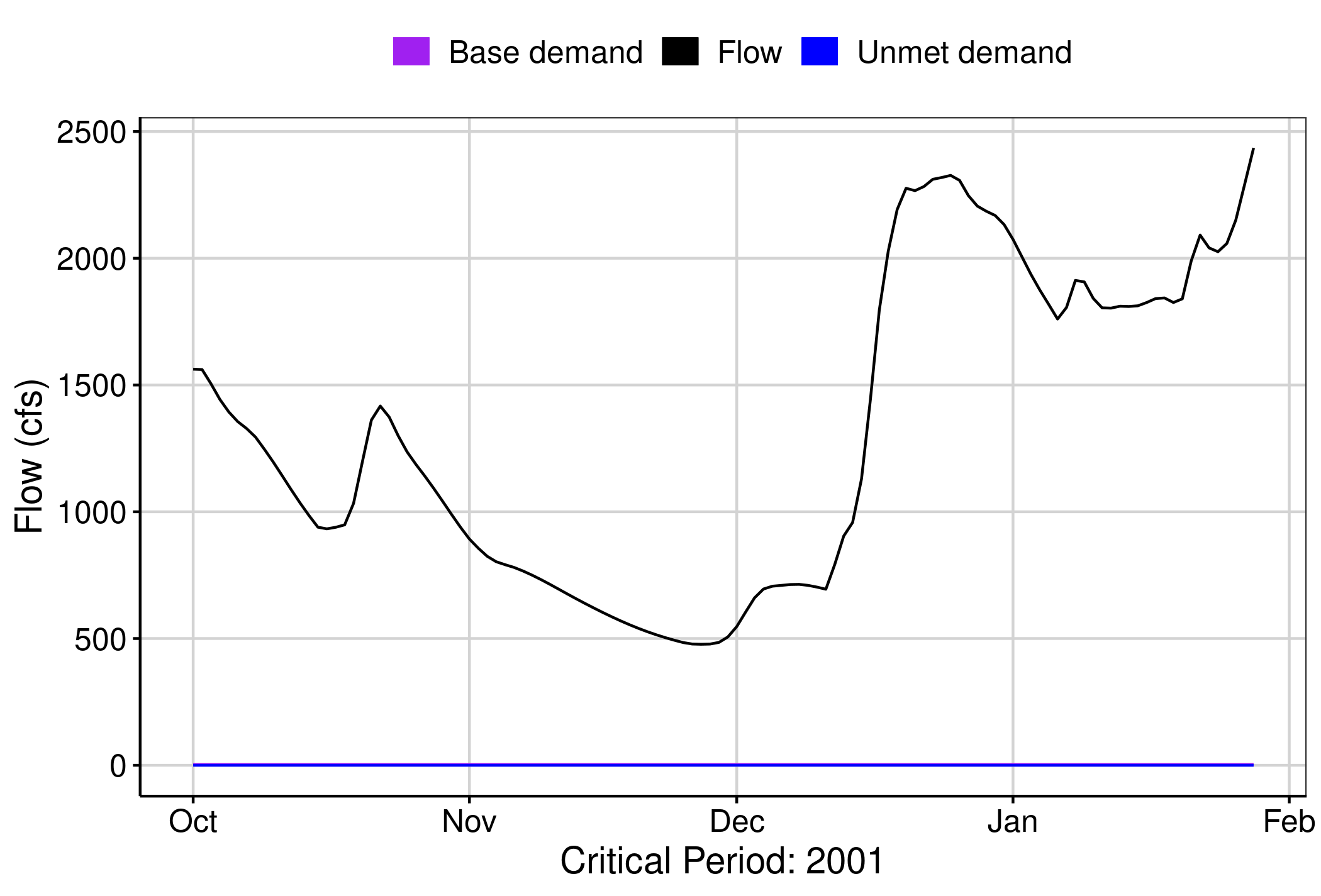
## Number of properties found: 1

## Reservoir Storage: Current Permit



## Number of properties found: 1

## Unmet Demand: Current Permit

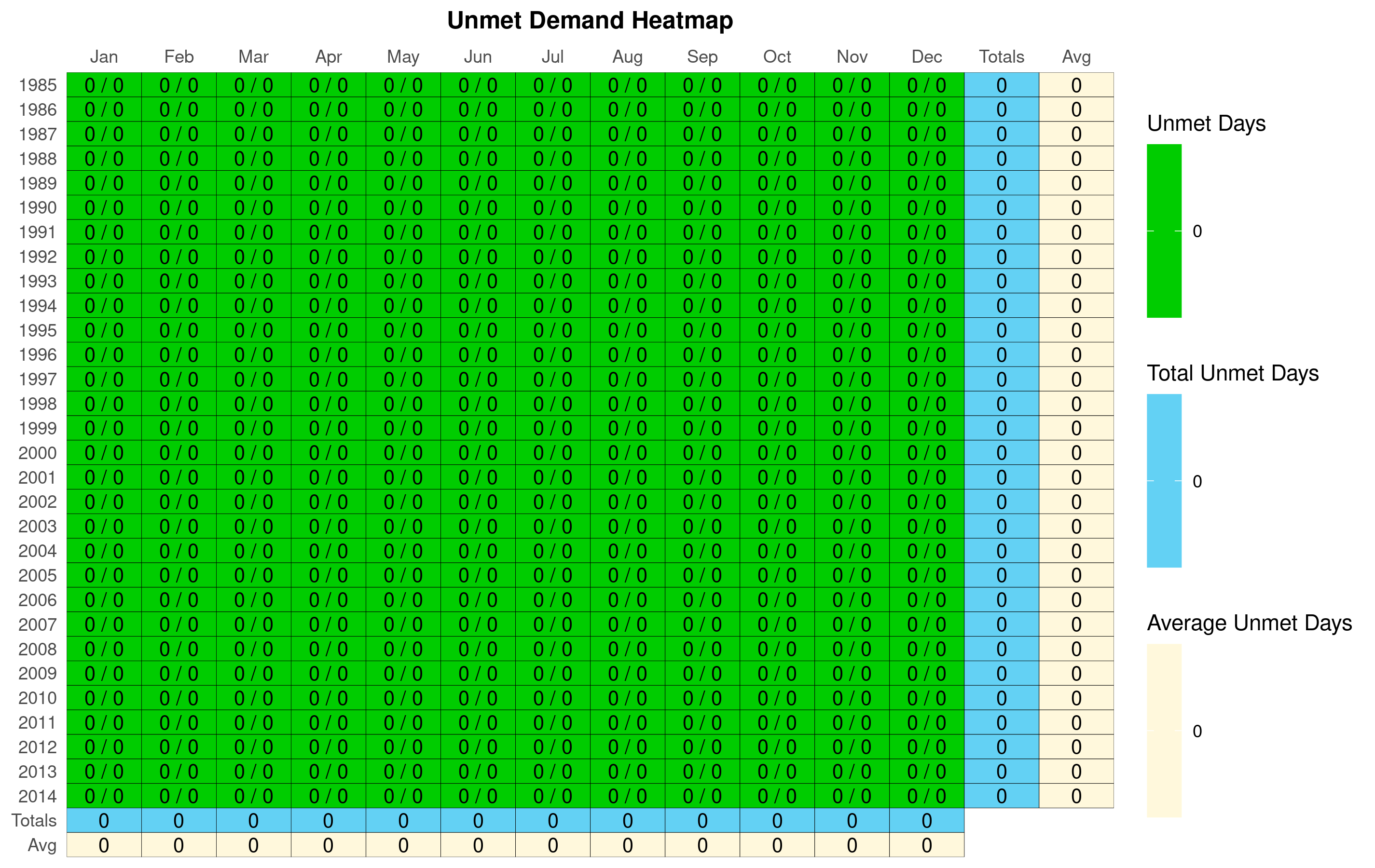


## This property does not exist

[1] “No local facility impoundment for Current Permit”

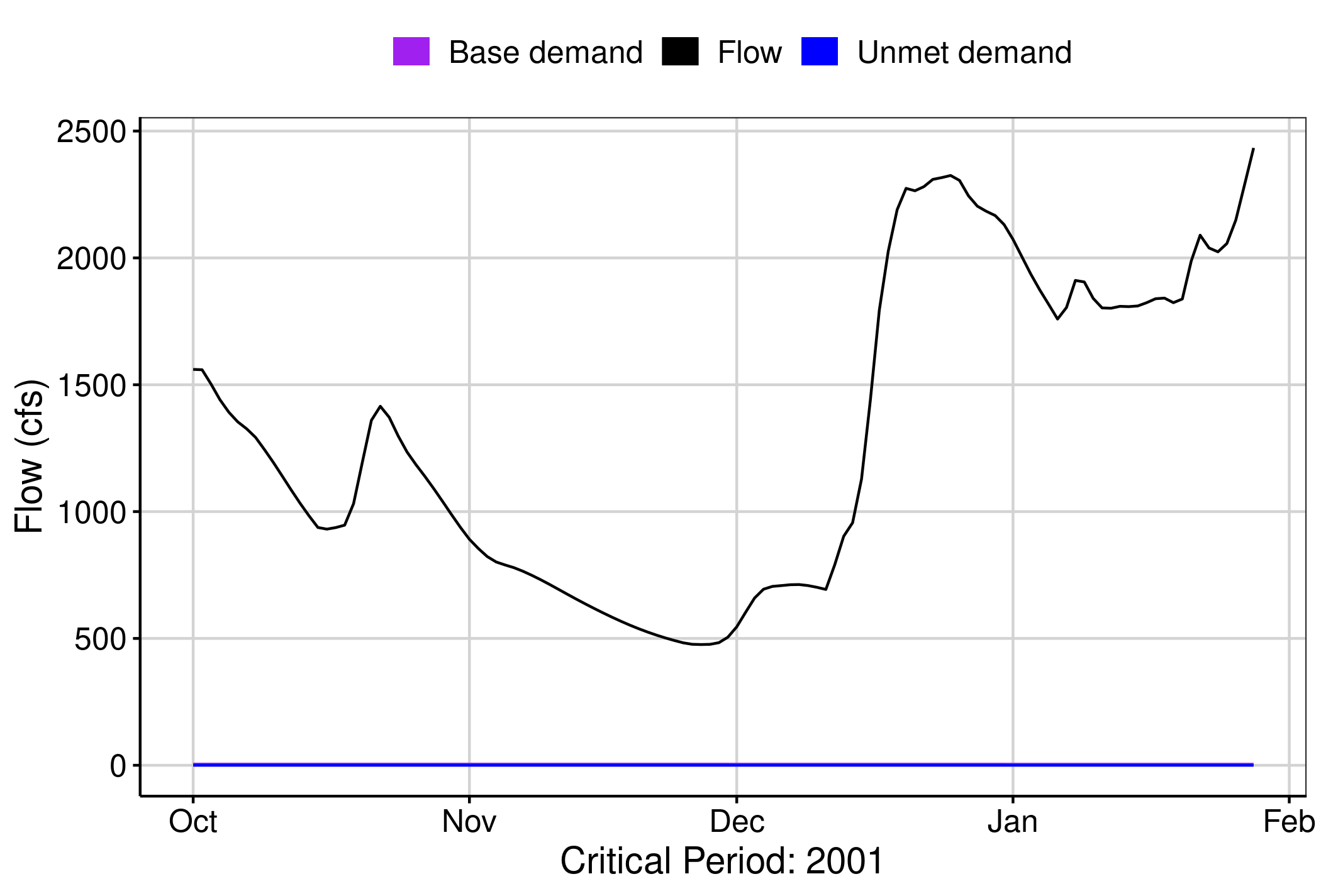
## Number of properties found: 1

## Reservoir Storage: 3.0 MGD, 90% Flow-by



## Number of properties found: 1

## Unmet Demand: 3.0 MGD, 90% Flow-by

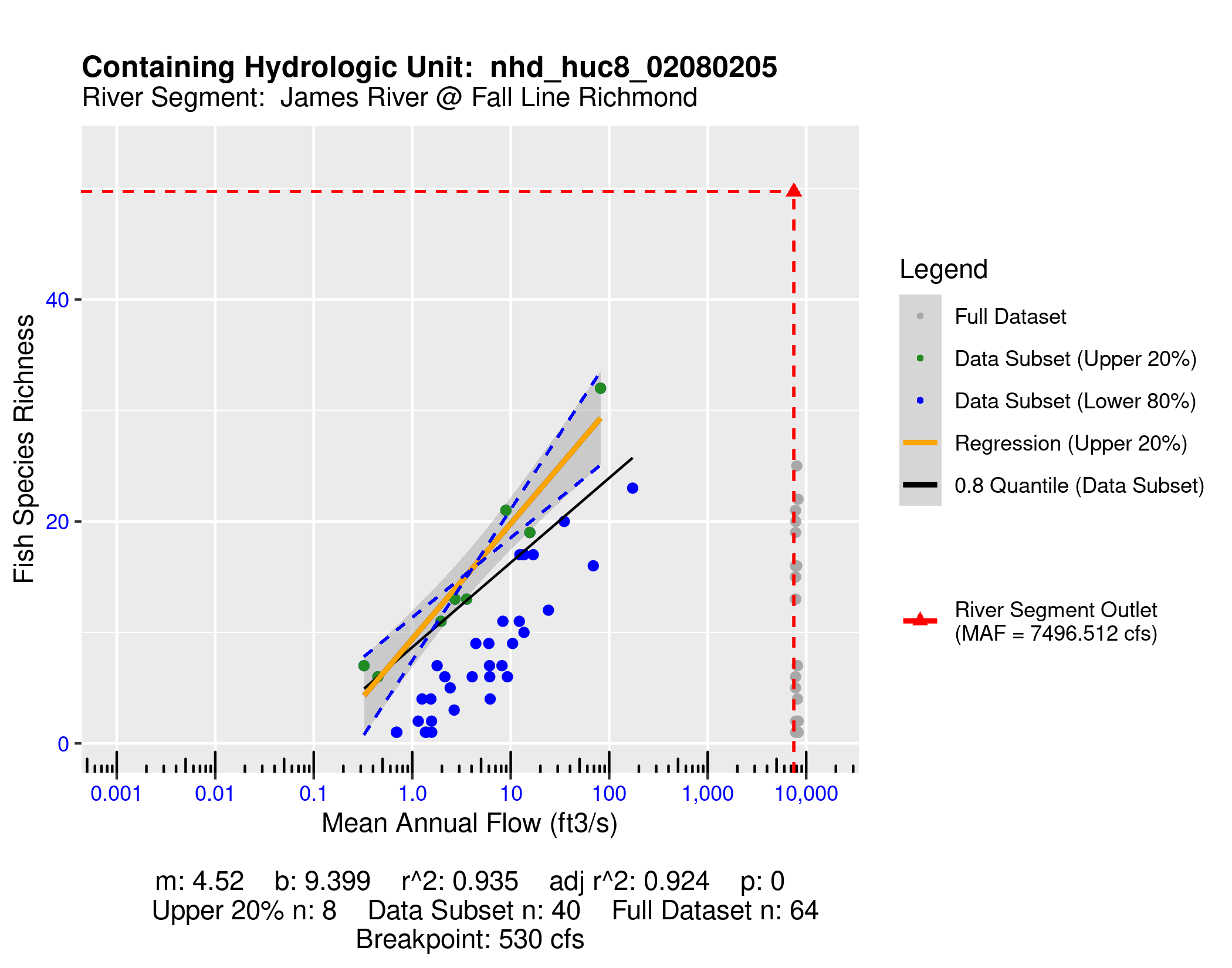


## This property does not exist

[1] “No local facility impoundment for 3.0 MGD, 90% Flow-by”

# Ecological Impacts Assessment:

## Elfgen:



## Habitat (If Applicable):

# Additional Sections

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