Hayward Hydroelectric Project
FERC Project No. 2417

Exhibit A
Description of Project

Draft License Application

Prepared for

Northern States Power Company
a Wisconsin Corporation

Prepared by

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APPENDICES

LIST OF ABBREVIATIONS

Applicant........................Northern State Power Company, a Wisconsin corporation
cfs..................................cubic feet per second
DSM ....demand side management
FERC.............................Federal Energy Regulatory Commission
FLA................................Final License Application
FOE ....Focus on Energy
kV ....Kilovolt
kVA................................Kilovolt Ampere
kW ....Kilowatt
Licensee ....Northern States Power Company, a Wisconsin corporation
MSL ....mean sea level
MWh ....Megawatt-hours
NGVD ....National Geodetic Vertical Datum, 1929
NSPW............................Northern States Power Company, a Wisconsin corporation
O&M ....Operation and management
Project ....Hayward Hydroelectric Project
PURPA ....Public Utility Regulatory Policies Act
USGS ....United States Geological Survey

1. Project Description

Northern States Power Company, a Wisconsin Corporation (NSPW, Licensee or Applicant) is the owner and operator of the Hayward Hydroelectric Project (Project). The Project is located on the Namekagon River in the City of Hayward and Town of Hayward, Sawyer County, Wisconsin approximately 50 miles southwest of the City of Ashland, Wisconsin and 120 miles northeast of the City of Minneapolis, Minnesota. **Appendix A-1** includes a map depicting the general location of the Project. **Appendix A-2** includes an aerial photograph showing the Project's primary facilities. The Project has an authorized capacity of 168 kilowatts (kW) and includes a reservoir, dam, powerhouse with intake channel, tailrace or tailwater, transmission equipment, and appurtenant equipment. These features are described in the following paragraphs.[1]

2. Description of Dam Structures

The dam is approximately 442 feet long[2] and 15 feet high.[3] From left to right looking downstream, the main structures of the dam consist of a left earth embankment, a concrete overflow spillway, a middle earth embankment, a powerhouse with intake channel, and a right earth embankment.

2.1 Earth Embankments

The dam contains three earth embankments. From a perspective of looking downstream, there is the left earth embankment, the middle earth embankment, and the right earth embankment. The concrete overflow spillway separates the left and middle embankments and the powerhouse with the intake channel separates the middle and right embankments.

2.1.1 Left Earth Embankment

The left earth embankment extends 24 feet[4] from the left bank to the left abutment of the concrete overflow spillway. It is 85 feet wide at its base[5] and 15 feet high. It has a top elevation of approximately 1,190.0 feet National Geodetic Vertical Datum (NGVD).[6]

The earth embankment is vegetated with grass and weeds. The left concrete overflow spillway abutment serves as both a retaining wall for the left embankment and a training wall for spillway flows. The concrete wall is approximately 85 feet long and extends from the upstream end of the upstream apron to approximately 20 feet beyond the downstream end of the concrete overflow spillway apron.

The wall is a cantilever type retaining wall approximately 1 foot thick with a base slab approximately 2 feet wide and 1 foot thick. The height of the wall varies from approximately 4 feet

[1] Unless otherwise cited, all facility description attributes are from the Supporting Technical Information Document dated June 2010 (NSPW, 2010).
[2] Left earth embankment 24 feet, concrete overflow spillway 120 feet, middle earth embankment 80 feet, powerhouse 18 feet, and right earth embankment 200 feet.
[3] Crest elevation of right earth embankment is 1188.5 feet NGVD and foot of apron on the concrete overflow spillway is 1,173.8 feet NGVD per Exhibit F-1.
[4] Distance scaled from the Final Construction Report for the Left Embankment Modifications Record Drawing C-02. Accession No. 20160107-0211.
[5] 85 feet is the length of the left spillway abutment wall.
[6] Maximum height determined from the Final Construction Report for the Left Embankment Modifications Record Drawing C-02. Accession No. 20160107-0211 and for the purposes of this application mean sea level (MSL) and NGVD are considered the same datum.

adjacent to the crest to approximately 10 feet at the downstream end of the spillway apron. The top of the sheetpile wall is anchored into the base of the concrete retaining wall with a concrete cap and anchor bolts. It is tied with steel rods to a steel sheetpile deadman buried in the left earth embankment. The upstream and downstream sides of the embankment are covered with filter fabric and riprap.

2.1.2 Middle Earth Embankment

The middle earth embankment extends approximately 80 feet from the right abutment of the concrete overflow spillway to the powerhouse. It is approximately 143 feet wide at its base from the upstream sheetpile wall to the nominal tailwater elevation of 1,171.1 feet NGVD and 17 feet high.

On the upstream side of the middle earth embankment, a steel sheetpile wall extends from the left side of the intake channel to the right side of the overflow spillway. The top elevation of the sheeting is approximately 1,188.3 feet NGVD. The downstream side of the sheetpiling is capped with concrete.

On the downstream side of the middle earth embankment, a concrete retaining wall extends from the left downstream side of the powerhouse approximately 30 feet. The retaining wall is approximately 11 inches thick at the top, 15 feet high, and is a gravity type retaining wall. The downstream slope of the remainder of the middle earth embankment between the retaining wall and concrete overflow spillway right abutment is approximately 4:1.

2.1.3 Right Earth Embankment

The right earth embankment extends approximately 200 feet from the right abutment of the powerhouse to the right bank. It is approximately 65 feet wide[7] at its base from the upstream side of the crest to the nominal tailwater elevation of 1,171.1 feet NGVD and 15.5 feet high.[8]

The crest of the earth embankment, which also serves as a gravel access road, has an elevation of 1,188.5 feet NGVD. Along its upstream slope a concrete training wall extends approximately 23 feet upstream and to the right of the intake channel. The wall is approximately 18 to 24 inches thick at the top.

On the downstream side of the right earth embankment adjacent to the powerhouse is a buried concrete retaining wall. The concrete retaining wall is covered and supported on the downstream side by granular backfill at a variable slope of approximately 3:1 at the right bank to approximately 1.5:1 adjacent to the powerhouse. The downstream end of the embankment is covered with filter fabric and riprap. The buried wall is approximately 90 feet long with two separate sections; a 27-foot long section adjacent to the powerhouse and a 63-foot long section. The 63-foot section is offset approximately 5 feet upstream from the right end of the 27-foot long section and extends to the right. Both sections are gravity type retaining walls. The retaining wall is approximately 11 inches thick at the top and widens toward the base and is approximately 8 feet high.

[7] Distance scaled from Exhibit F-1.
[8] Crest elevation of right earth embankment is 1,188.5 feet NGVD and nominal tailwater elevation is 1,173.0 feet NGVD per Exhibit F-1.

2.2 Concrete Overflow Spillway

The concrete overflow spillway is approximately 120 feet long from the left earth embankment to the middle earth embankment. It is approximately 50 feet wide[9] from the upstream edge of the horizontal apron to the downstream edge of the sheetpile cutoff wall for a height of 13.7 feet.[10]

It consists of rock-filled timber cribbing with a concrete overlay which was refurbished in 2012. Beginning upstream, the overflow spillway includes a sloping or near horizontal upstream apron, a crest section with piers, a steel operator's bridge, removable steel bulkheads with removable timber stoplogs on top in bays 3-10 located on the left side of the spillway and a slide gate in bays 1 and 2, a sloped rollway, a horizontal apron, and a downstream sheetpile cutoff wall. The elevation at the crest is 1,183.4 feet NGVD and the downstream end of the spillway has an elevation of approximately 1,173.8 feet NGVD.

The width of the steel bulkhead bays 3-10 are as follows respectively: 11.5 feet, 11.7 feet, 11.3 feet, 11.6 feet, 11.5 feet, 11.5 feet, 11.35 feet, and 6.1 feet. Each steel bulkhead is 3.2 feet high with two removable timber stop logs on top for a maximum design elevation of 1,187.60 feet NGVD. The bulkheads and boards can be lifted with a chain hoist on the monorail system.

The slide gates in bays 1 and 2 have a nominal width of 9.5 feet and 11.5 feet, respectively. Each gate is 4.6 feet high with a maximum design elevation of approximately 1,188.0 feet NGVD. Each slide gate is lifted with a manually operated gear box.

The eight steel bulkhead bays and two slide gate openings are separated by concrete piers with a nominal width of 16 inches. The upstream noses of the pier slope upstream and downward at approximately a 15-degree angle from vertical. Slots are vertical and for the bulkhead bays are located approximately 5 feet downstream from the upstream noses.

2.3 Powerhouse with Intake Channel

The powerhouse structure is approximately 18 feet long (left to right) and extends 24 feet downstream. The powerhouse has a concrete substructure and a brick masonry wall superstructure which extends approximately 27.5 feet from the generator floor to the roof. The concrete substructure walls are approximately 1.5 feet thick.

The top of the concrete substructure has an approximate elevation of 1,191.5 feet NGVD and the approximate elevation of the draft tube invert is 1,164.7 feet NGVD giving it an overall height of 26.8 feet.

The top of the generator floor has an approximate elevation of 1,190.3 feet NGVD. The draft tube is approximately 6.3 feet high.

[9] Distance scaled from Exhibit F-1.
[10] Top of spillway pier elevation of 1,187.5 feet NGVD to foot of apron on the concrete overflow spillway (1,173.8 feet) NGVD per Exhibit F-1.

2.3.1 Intake Channel

The intake channel is 42 feet long and consists of the concrete intake structure, steel trashrack, steel bulkhead, access bridge and channel. The top of the side walls have an approximate elevation of 1,188.8 feet NGVD. The intake channel structure sill is at an approximate elevation of 1,176.1 feet NGVD and the channel width varies linearly from approximately 13 feet on the upstream side of the access bridge to approximately 8 feet on the downstream side of the bridge and remains 8 feet wide to the powerhouse.

At the upstream end of the intake channel are stoplog slots which are built into the concrete channel side walls. Downstream of the stoplog slots is a steel trashrack mounted near-vertical across the intake. An 8-foot-wide concrete access bridge spans the intake channel downstream of the trashrack. Metal grating covers the top of the intake channel from the access bridge to the powerhouse.

The trashracks are 12.8 feet wide and 10.9 feet high at the minimum reservoir elevation of 1,187.0 feet NGVD. They have a clear spacing of 1.5 inches (NSPW, 1991) and a bar width of 0.25-inches with the top of the racks angled downstream approximately 10° from vertical.

The trashrack is raked manually as needed during normal working hours. Trash is removed and disposed with other trash at the facility. The remaining debris is passed downstream. Raking is not required during the winter season.[11]

2.3.2 Turbine

The Project contains one S. Morgan Smith vertical Francis-Type turbine rated for 280 horsepower at 180 revolutions per minute. The runner diameter is 60 inches with a peripheral velocity of 47 feet per second (NSPW, 1991). The turbine has a minimum hydraulic capacity of 120 cubic feet per second (cfs) and a maximum hydraulic capacity of 178 cfs at a net head of 17 feet (NSPW, 1991).

The average head at the Project is 17 feet (NSPW, 1991).

2.3.3 Generator

The Project contains one 480-volt generator manufactured by the Northwestern Electric Equipment Company. It has a nameplate rating of 168 kW at 80% power factor.

2.3.4 Tailwater

The Project tailwater or tailrace extends approximately 200 feet downstream of the powerhouse before its confluence with the Namekagon River. The tailwater has a depth of 8 feet at the downstream side of the powerhouse at a normal tailwater elevation of 1,171.1 feet NGVD. The Project boundary extends downstream on the Namekagon River for an additional 400 feet downstream of the tailwater.

3. Description of Reservoir

The reservoir (Lake Hayward) encompasses approximately 247 acres with a gross storage capacity of approximately 1,234 acre-feet at the maximum reservoir elevation of 1,187.5 feet NGVD. It has a maximum depth of 17 feet at the dam and an estimated average depth of 5 feet (NSPW, 1991). The

[11] Raking frequency will be provided in the FLA.

substrate consists of 60% sand, 8% gravel, 0% rock, and 32% muck (WI Department of Natural Resources, n.d.). The drainage area at the Project is 206 square miles (NSPW, 1991).

4. Transmission Equipment

There is a 150-foot-long, 480-volt, three phase underground xx conductor transmission line extending from the powerhouse to a 300 kilovolt Ampere (kVA), 277 volt to 12.5 kilovolt (kV) step-up pad mounted transformer.[12] The high voltage side of the transformer is the point of interconnect with NSPW's non-project distribution system and NSPW is the entity receiving the Project generation.

5. Appurtenant Equipment

Appurtenant equipment includes, but is not limited to, bearing lubrication systems, powerhouse ventilation systems, protective devices, and metering devices.

6. Project Operation

The Project currently operates in a run-of-river mode where the discharge measured immediately downstream of the Project tailrace approximates the sum of inflows into the Project reservoir. The mode of operation minimizes the potential for adverse impacts on water quality, aquatic habitat, and other aquatic resource values. At all times, NSPW will act to minimize the fluctuation of the reservoir and maintain the elevation between 1,187.0 and 1,187.5 feet NGVD while targeting 1,187.4 feet. NSPW will not operate the Project between the low and high elevation on a daily basis for peaking purposes.

A minimum flow of 8 cfs or inflow, whichever is less, is currently released into the bypassed reach for the protection of fish and wildlife resources and water quality. The second slide gate is opened three inches year-round to pass the minimum flow.

Under the proposed operation, just prior to spring runoff, or for emergency purposes, the Applicant may need to deviate from the maximum reservoir elevation (by no more than an increase of 0.5 feet) to remove ice from the downstream side of the dam for dam safety purposes. The duration of the deviation shall be no longer than necessary (typically less than a few days) to remove the ice and will be conducted as a planned deviation under the requirements outlined in Section 4.5 of Exhibit E.

NSPW is not proposing any material changes to operations under the subsequent license.[13]

The Project is operated in conjunction with the Trego Project located approximately 30 river miles downstream. An operator is assigned to oversee the daily operation and routine maintenance of both Projects. Eight-hour coverage is provided five days a week, Monday-Friday. The operator for the facility is on call 24 hours per day, seven days per week. The plant is manually operated with controls installed for automatic shutdown in case of operational emergencies. Whenever a unit or plant shutdown occurs, or if there is a high or low water alarm, the continually staffed control center at the Licensee's Wissota Hydroelectric Project is automatically notified.

[12] Size of transmission line will be provided in FLA.
[13] Due to the short duration of the ice removal events, and their timing during high-inflow periods (which matches the natural hydrologic cycle), the proposed planned deviations for ice removal are not considered a material change in operations.

For emergency operation of the facility, an operator is available 24 hours a day and can also be supported by the operator from White River Project, local line crews, the Ashland Bay Front Plant maintenance staff, and personnel from NSPW's Hydro Maintenance Department in Chippewa Falls, Wisconsin.

7. Safe Management, Operation, and Maintenance

NSPW has a robust Owners Dam Safety Program (ODSP) that incorporates all dam safety inspection requirements, monitoring responsibilities, and communications as required by the Federal Energy Regulatory Commission (FERC) for a dam of this classification. NSPW also ensures that adequate resources are available to fulfill all the requirements and obligations under the ODSP. The ODSP was revised and submitted to FERC on June 28, 2019 (NSPW, 2019).

NSPW developed a public safety plan in consultation with the FERC. The plan is reviewed on an annual basis to determine if changes are necessary. The plan was last updated in 2015 (NSPW, 2015).

As a result of a July 2016 flood incident, the spillway rating curve was updated and submitted to the Commission on May 31, 2017.[14]

8. Average Annual Generation

Average annual generation for the Hayward Project averaged approximately 826 Megawatt-hours[15] (MWh) for the five-year period ending in 2022.

9. River Flow Characteristics

Streamflow information from the United States Geological Survey (USGS) Gaging Station No. 05331833 was used to develop flow duration curves for the Namekagon River. The gage location has a drainage area of 126 square miles. Based on the gaging data from March 1996 to December 2021, the mean flow for the period at the Project was 225 cfs; the maximum annual calendar year flow was 343 cfs in 2016; and the minimum annual calendar year flow was 128 cfs in 2009.

Streamflow duration data show the percentage of time a given flow is equaled or exceeded. Monthly flow duration curves and the annual exceedance table are based on data collected for the period of record from January 1996 to December 2021 and are included in **Appendix A-3**.

NSPW is not proposing any material changes to Project operations.[16]

10. Purpose of the Project

The purpose of the Project is to generate renewable hydroelectric energy. NSPW is a public utility that produces, purchases, transmits, and distributes power to retail customers. The power generated by the Hayward Hydroelectric Project is delivered to NSPW's system for sale to customers.

[14] Accession No. 20170531-5159.
[15] There was no generation in the entire 2018 period. In 2019, no generation occurred during the period January through October 2019. In 2021 no generation occurred in July and October.
[16] Due to the short duration of the ice removal events, and their timing during high-inflow periods (which matches the natural hydrologic cycle), the proposed planned deviations for ice removal are not considered a material change in operations.

11. Estimated Project Cost

The Project is an existing FERC licensed facility. As of December 31, 2022 the net book value (net investment) was calculated at $xx,xxx and the gross book value was calculated at $xxx,xxx.[17] These figures include the land and land rights, structures and improvements, waterway improvements, generating equipment, accessories, and miscellaneous equipment.

12. Estimated Costs of Proposed Environmental Measures[18]

The estimated capital and additional annual Operation and Maintenance (O&M) costs for proposed environmental measures are outlined in **Table A-1**.

Table A-1 Estimated Capital and Additional O&M Costs for Proposed Environmental Measures at the Hayward Project

<table>
<tr><th colspan="2">Item</th><th>Capital Cost</th><th>O&M Cost</th></tr>
<tr><td colspan="2">Develop Aquatic and Terrestrial Species Plan and conduct biennial invasive surveys.</td><td>$40,000</td><td>$30,000[19]</td></tr>
<tr><td colspan="2">Conduct shoreline erosion surveys every 10 years.</td><td>$0</td><td>N/A[20]</td></tr>
<tr><td colspan="2">Develop Historic Properties Management Plan in consultation with the Wisconsin SHPO and interested Native American Nations to follow requirements outlined in the Programmatic Agreement.</td><td>$20,000</td><td>$25,000[21]</td></tr>
<tr><td colspan="2">Develop an Operation Monitoring Plan to include deviation reporting and agency consultation requirements.</td><td>$30,000</td><td>$5,000</td></tr>
<tr><td rowspan="7">Recreational Measures</td><td>Review and maintain or improve signage, including a Part 8 sign, at the Canoe Portage Take-Out and Carry-In Access site to meet current standards.</td><td>$5,000</td><td>$0</td></tr>
<tr><td>Install and maintain portable restroom facilities at the Canoe Portage Take-Out and Carry-In Access site during the open water recreation season.</td><td>$0</td><td>$7,500</td></tr>
<tr><td>Coordinate with WDNR to obtain current invasive species signage for installation at the Canoe Portage Put-In site</td><td>$0</td><td>$0</td></tr>
<tr><td>Review and maintain or improve signage, including a Part 8 sign, at the Canoe Portage Trail and Put-In site.</td><td>$5,0000</td><td>$0</td></tr>
<tr><td>Conduct routine maintenance of NSPW’s FERC-approved recreation sites over term of license.</td><td>$0</td><td>$2,000</td></tr>
<tr><td>Implement the Cave Bat BITP/A for any routine vegetation maintenance at NSPW’s FERC-approved recreation sites.</td><td>$0</td><td>$1,000</td></tr>
<tr><td>Implement Wood Turtle BITP/A for maintenance work at NSPW’s FERC-approved recreation sites as long as turtle remains a listed species.</td><td>$0</td><td>$1,000</td></tr>
<tr><td colspan="2">Total Cost</td><td>$100,000</td><td>$N/A[22]</td></tr>
</table>

[17] These costs will be included in the FLA.
[18] The costs included in this section are new costs to the Project for the environmental measures and do not include the previous costs for similar measures implemented under the current license. The costs for the similar measures implemented under the current license are included in the historical O&M costs outlined in Section 17.
[19] $30,000 is the additional cost per survey event, every other year.
[20] Cost for shoreline erosion survey is listed with the cost for the HPMP survey every 10 years.
[21] $20,000 is the additional cost per survey event every 10 years. $5,000 is the annual cost to implement the HPMP.
[22] The total O&M costs are not listed here because not all the costs are incurred annually.

13. License Application Development Costs

The costs for NSPW to relicense the Hayward Project under the Traditional Licensing Process through the filing of the Final License Application (FLA) are estimated at $xxx,xxx.[23]

14. Estimated Value of On-Peak and Off-Peak Power

The Project operates in a run-of-river mode of operation; therefore, this section is not applicable.

15. Average Annual Increase or Decrease in Project Generation and Value of Power Due to Changes in Project Operations

NSPW is not proposing any material changes in the operation of the Project.[24] Therefore, no changes in generation are expected and the average annual amount and value of project power for the term of the new license is projected to remain the same.

16. Remaining Undepreciated Net Investment, or Book Value, of the Project

The undepreciated net investment of the Project is $xx,xxx (book cost of $x,xxx,xxx less accumulated depreciation of $x,xxx,xxx).[25]

17. Annual Operation and Management Costs

The average annual cost to operate and maintain the Hayward Project for the period 2018-2022 is $xxx,xxx.[26] These costs are outlined in **Table A-2** and include general O&M expenses, insurance, taxes, and depreciation. A breakdown of the individual components of the general O&M expense category is shown in **Table A-3**.

Table A-2 Annual Operation and Management Costs

Item	Cost
General O & M Expenses (5-year average)	$xxx,xxx
Insurance	N/A[27]
2021 Property Taxes	$xx,xxx
2021 Depreciation	$xx,xxx
Average Annual O & M Cost	**$xxx,xxx**

[23] Relicensing costs will be included in the FLA.
[24] Planned deviations for ice removal are not expected to impact the amount of generation produced at the project due to their short duration and timing during high inflow events, likely when river flows exceed the hydraulic capacity of the single generating unit.
[25] These costs will be provided in the FLA.
[26] O& M costs, insurance, taxes, and depreciation will be provided in the FLA.
[27] NSPW pays a lump sum for insurance costs per operating company (i.e., NSPW, NSPM), therefore there are no insurance costs specific to the Hayward Project.

Table A-3 Cost Breakdown of General O&M Expense Category[28] (2018 to 2022)[29]

Cost	2018	2019	2020	2021	2022	2018-2022 Mean
Employee Expenses						
Labor						
Materials & Commodities						
IT Costs						
Miscellaneous						
Outside Services						
Total General O&M Costs	**$xxx,xxx**	**$xxx,xxx**	**$xxx,xxx**	**$xxx,xxx**	**$xxx,xxx**	**$xxx,xxx**

18. One-Line Diagram of Electrical Circuits

The One-line Diagram of Electrical Circuits is included in **Appendix A-4**.

19. Lands of the United States

The Project is located within the Wild and Scenic Rivers System as part of the St. Croix National Scenic Riverway, which was established as a result of the enactment by Congress of the Wild and Scenic Rivers Act in 1968 (National Park Service, n.d.a). However, there are no federal land reservations within the current or proposed Project boundaries.

20. Public Utilities Regulatory Policy Act

The Licensee reserves any future rights it may have under the Public Utility Regulatory Policies Act (PURPA) as it pertains to the Project.

21. Supporting Design Report

The supporting design report is considered Critical Energy Infrastructure Information and has been filed as such as a separate document.

22. Applicant's Electricity Consumption Efficiency Improvement Programs

The Applicant is committed to energy conservation by using demand side management (DSM) measures as a means to meet customer energy needs. Cost-effective DSM resources, in the form of capacity and energy savings, are in essence "purchased" from the customer through incentives, subsidies, rate structures, or other means needed to meet system DSM goals and commitments. NSPW offers programs for its residential, commercial, and agricultural customers. Specific options in these programs include but are not limited to:

[28] Includes administrative costs.
[29] O& M cost breakdown will be provided in the FLA.

Residential Programs

- Residential Rate Plans
    - Time of Day Service
    - Optional Off-Peak Service
    - Savers Switch Credit
- Residential Rewards {Focus on Energy (FOE)[30]}
    - Energy Saving Tips
    - Home rebates
        - Home Performance
        - Simple Energy Efficiency
        - New Homes
- Renewable Choices
    - Renewable Connect
    - Solar Connect Community
    - Net metering

Business Programs

- Equipment Rebates
- Energy Audits
- Renewable Programs
    - Renewable Connect
    - Solar
    - Working with Third Party Providers
- Energy Efficient Buildings
    - Multi-Family Building Efficiency (FOE)
    - Custom Efficiency
    - Efficient Facilities (FOE)
    - Energy Benchmarking
- Rate Programs
    - Electric Rate Savings
    - Savers Switch for Business

Farm Programs

- Farm Rewiring
- Agriculture and Farm Rebates

The Applicant's conservation programs have been approved by the Public Service Commission of Wisconsin.

[30] Funded through the Focus on Energy® program. Focus on Energy® is Wisconsin's energy efficiency and renewable resource program. It is funded by Wisconsin's investor-owned utilities and participating municipal and electric cooperative utilities, including NSPW's parent company, Xcel Energy.

23. Works Cited

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NSPW. (2015). *Revised Public Safety Plans (NSP-Wisconsin, NSP-Minnesota)et. al. under P-1982, et. al., FERC Accession No 20150831-5285.* August 31, 2015.

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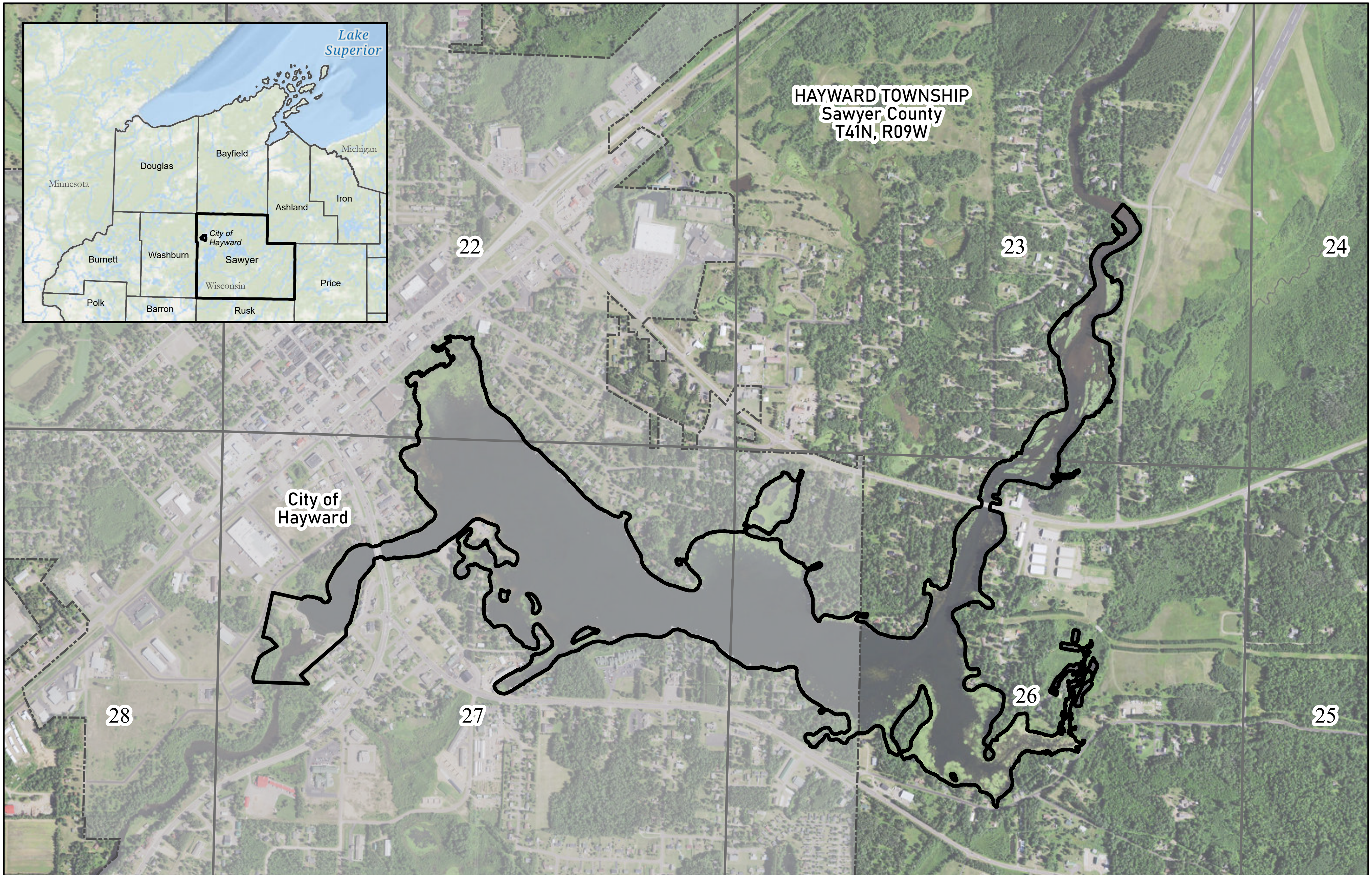
US Geological Survey. (n.d.). *StreamStats*. Retrieved November 2, 2022, from USGS: https://streamstats.usgs.gov/ss/

WI Department of Natural Resources. (n.d.). *Hayward Lake*. Retrieved April 13, 2023, from WDNR Find A Lake: https://dnr.wi.gov/lakes/lakepages/LakeDetail.aspx?wbic=2725500.

APPENDIX A-1 General Location of the Hayward Project



Proposed Project Boundary

Municipal Boundary

Section

Note: the impounded Proposed Project Boundary is established at elevation 1,187.5 feet NGVD 1929.

N

0 1,000 2,000 Feet

Hayward Hydroelectric Project
Orthophotographic Map

FERC No. 2417

Source Layer: WI 2022 NAIP (natural color, 0.6-meter resolution); ; Wisconsin Department of Natural Resources GIS Open Data Portal

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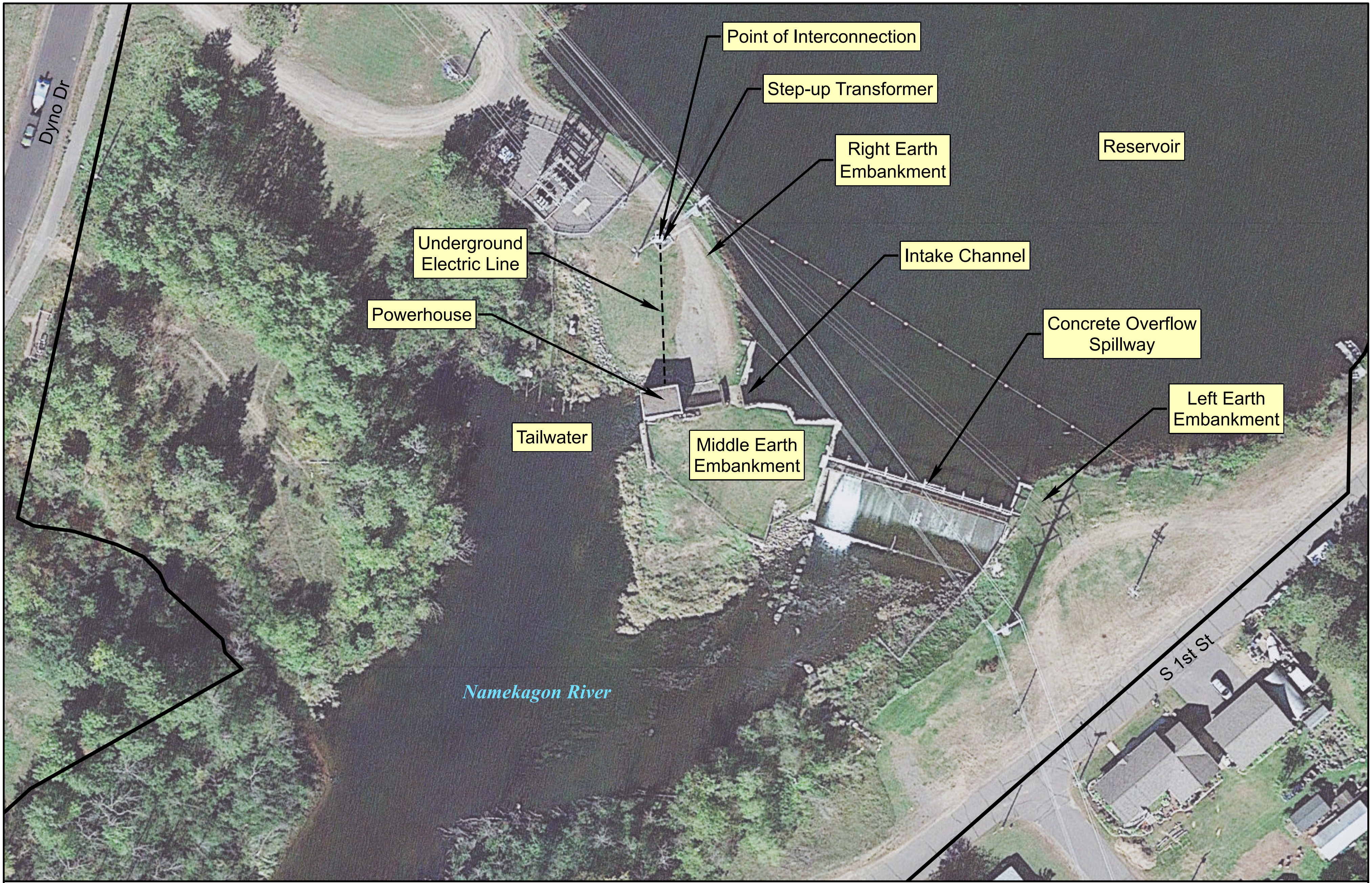
APPENDIX A-2 Hayward Project Facilities



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Proposed Project Boundary

Note: the impounded Proposed Project Boundary is established at elevation 1,187.5 feet NGVD 1929.

N

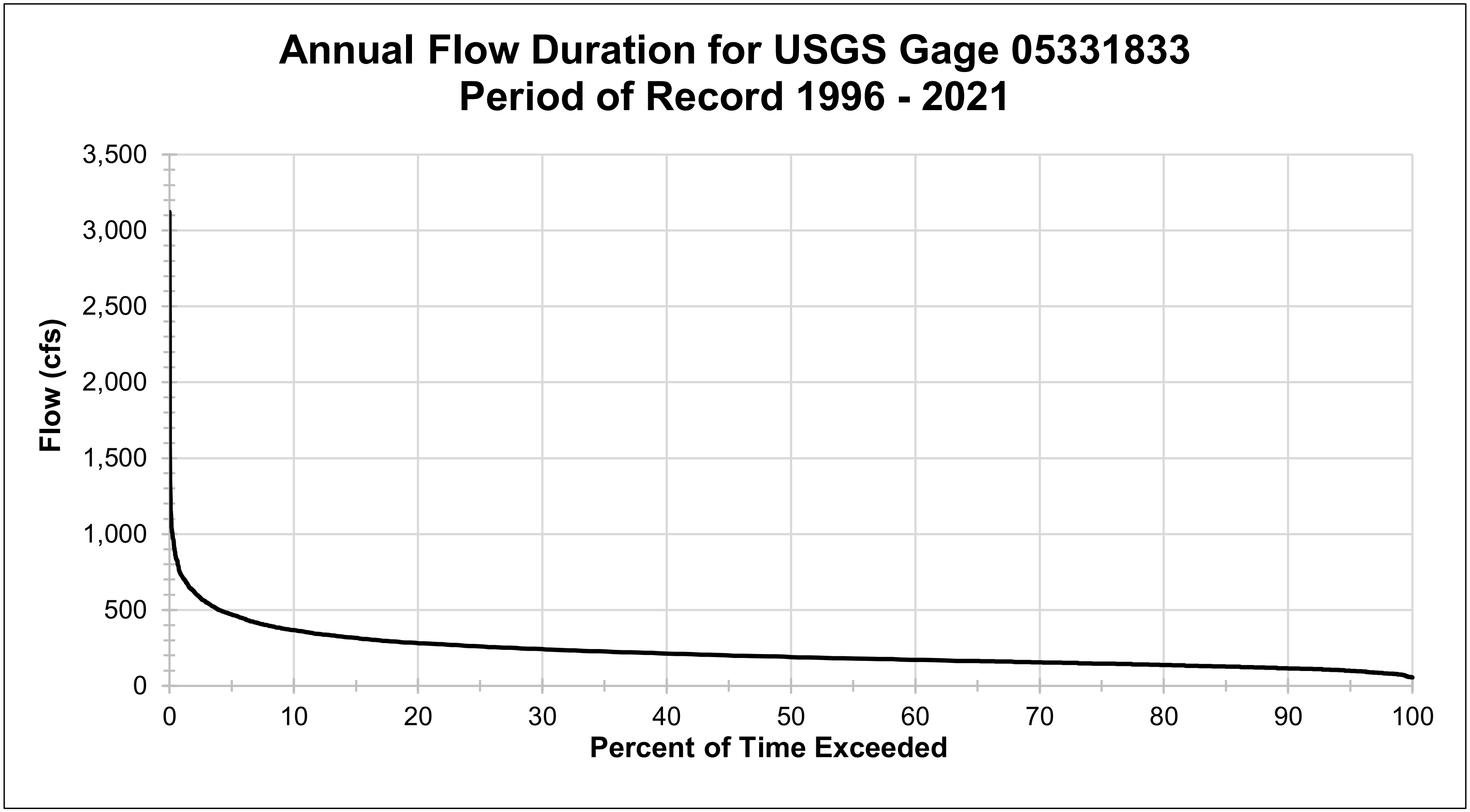
0 60 120 Feet

Hayward Hydroelectric Project
Project Facilities

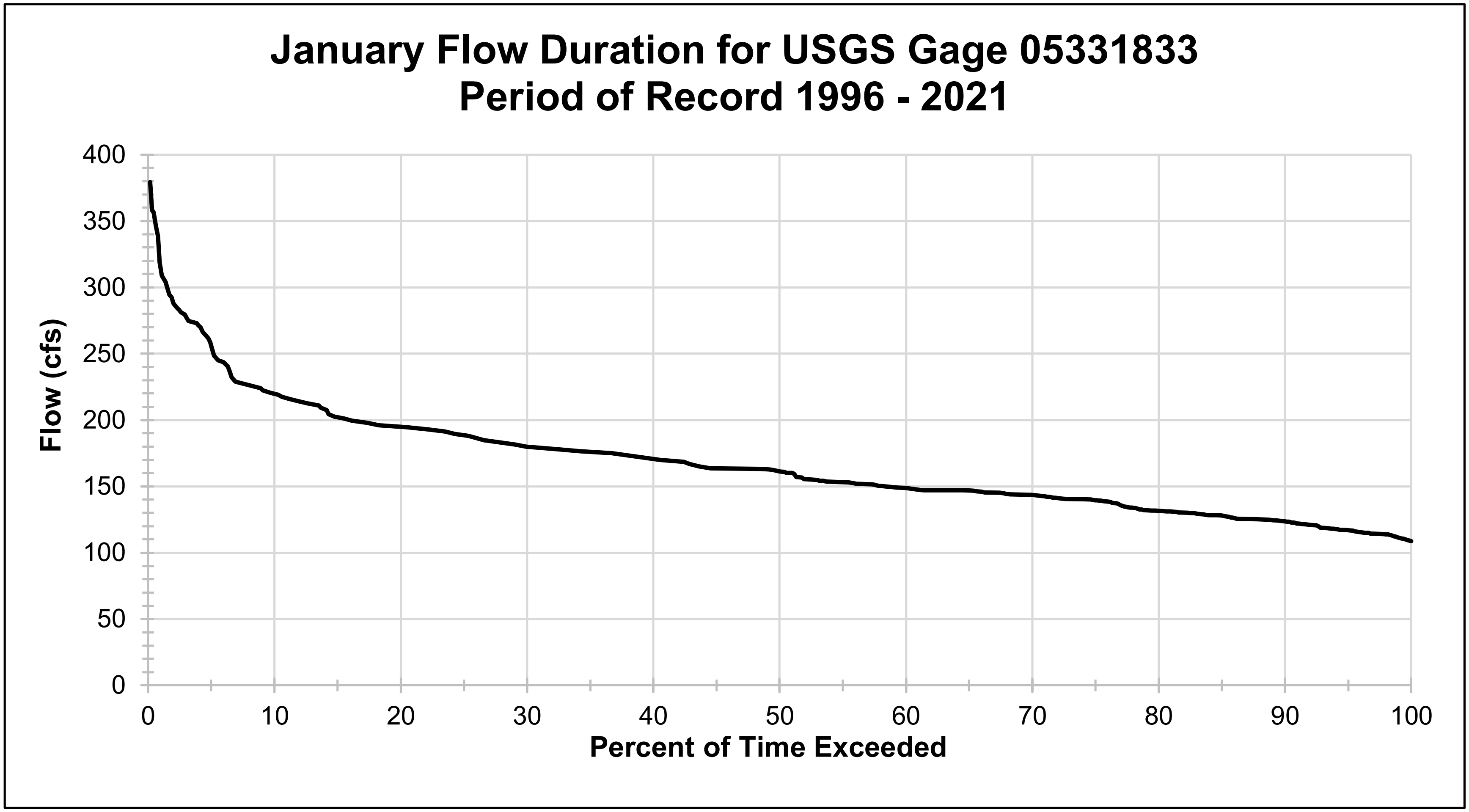
FERC No. 2417

Source Layer: Google Earth, image date 09/28/2015

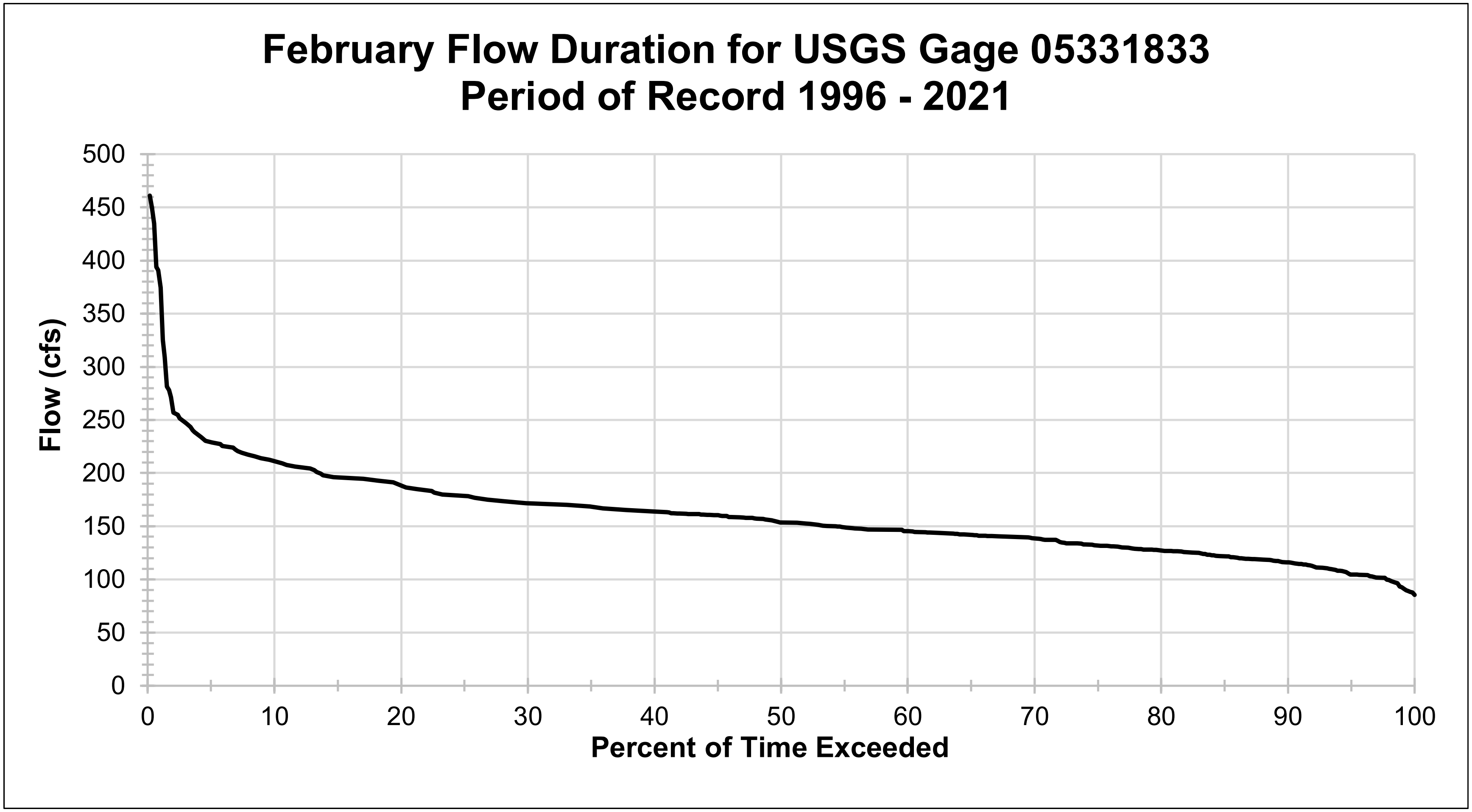
APPENDIX A-3 Hayward Project Annual Flow Duration Curves and Exceedance Table



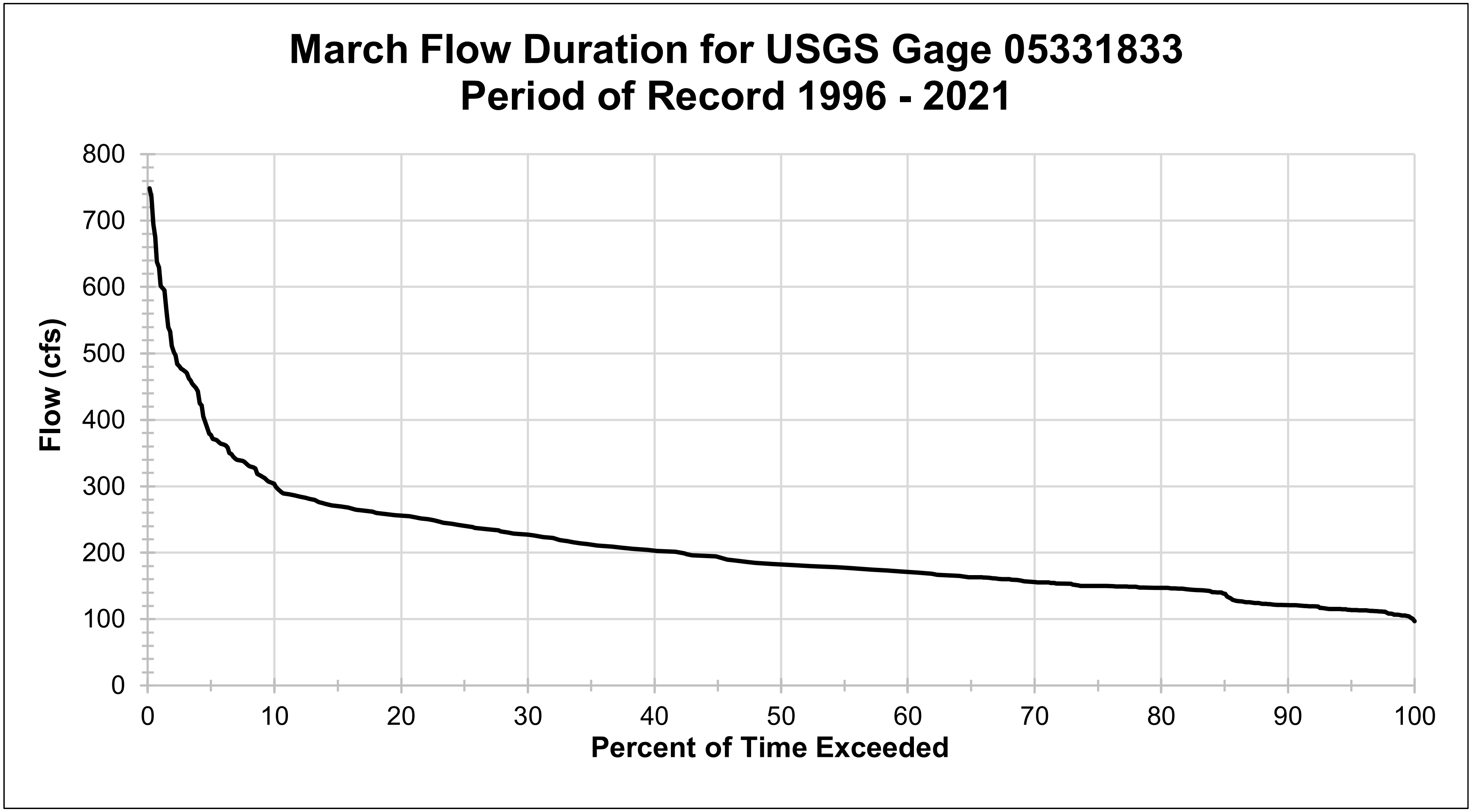
Annual Flow Duration for USGS Gage 05331833
Period of Record 1996 - 2021
Flow (cfs)
3,500
3,000
2,500
2,000
1,500
1,000
500
0
0
10
20
30
40
50
60
70
80
90
100
Percent of Time Exceeded

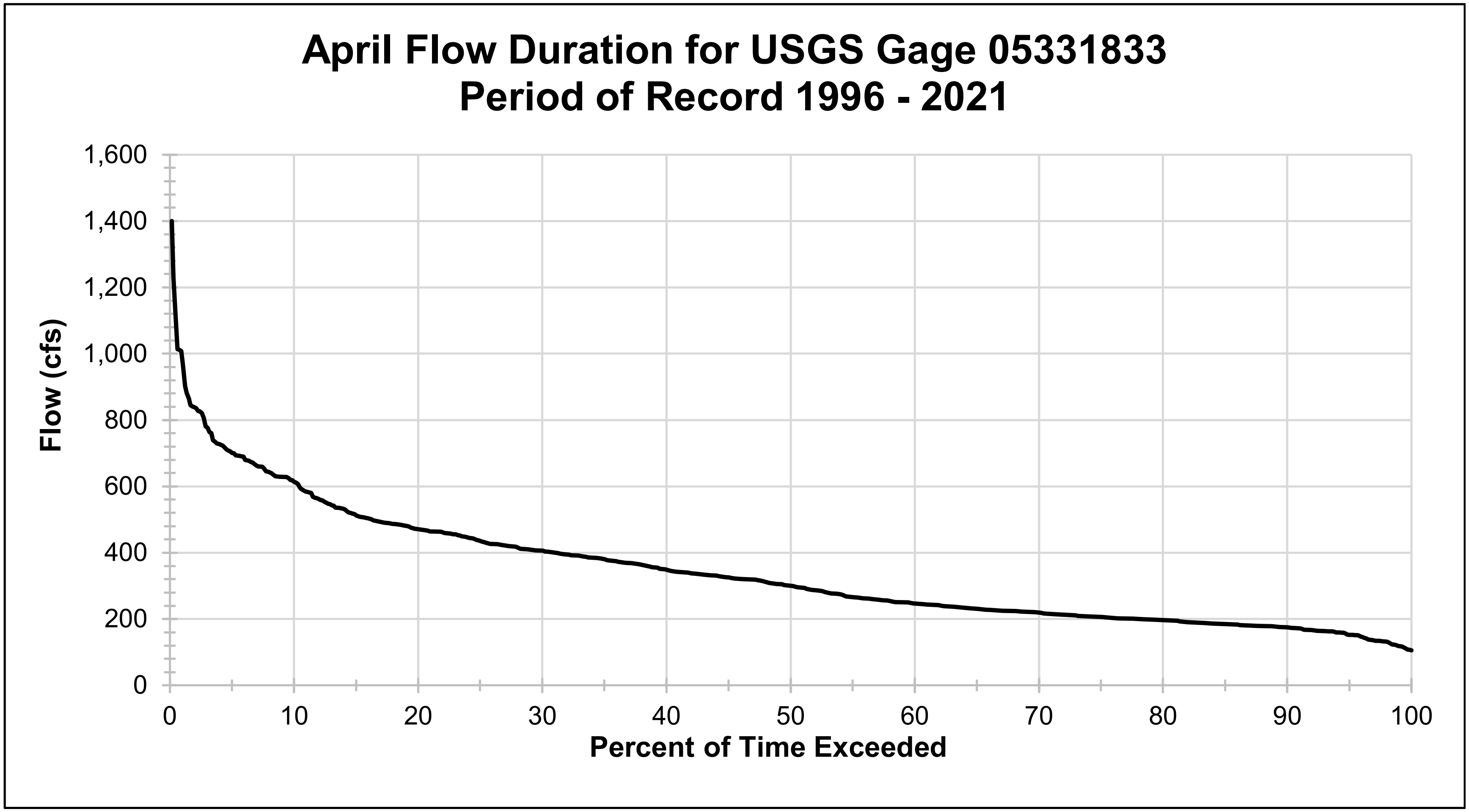


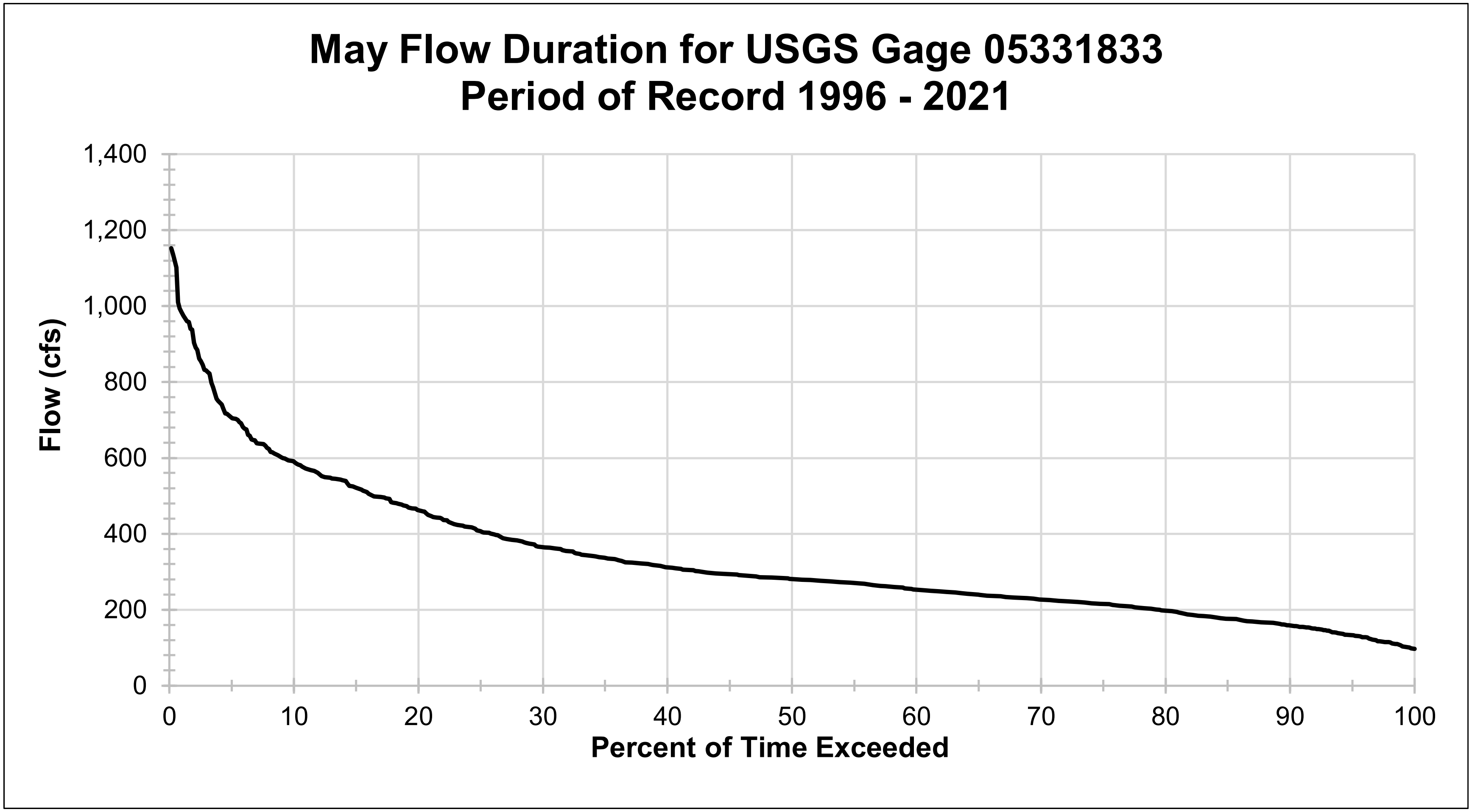
January Flow Duration for USGS Gage 05331833
Period of Record 1996 - 2021
Flow (cfs)
400
350
300
250
200
150
100
50
0
0
10
20
30
40
50
60
70
80
90
100
Percent of Time Exceeded

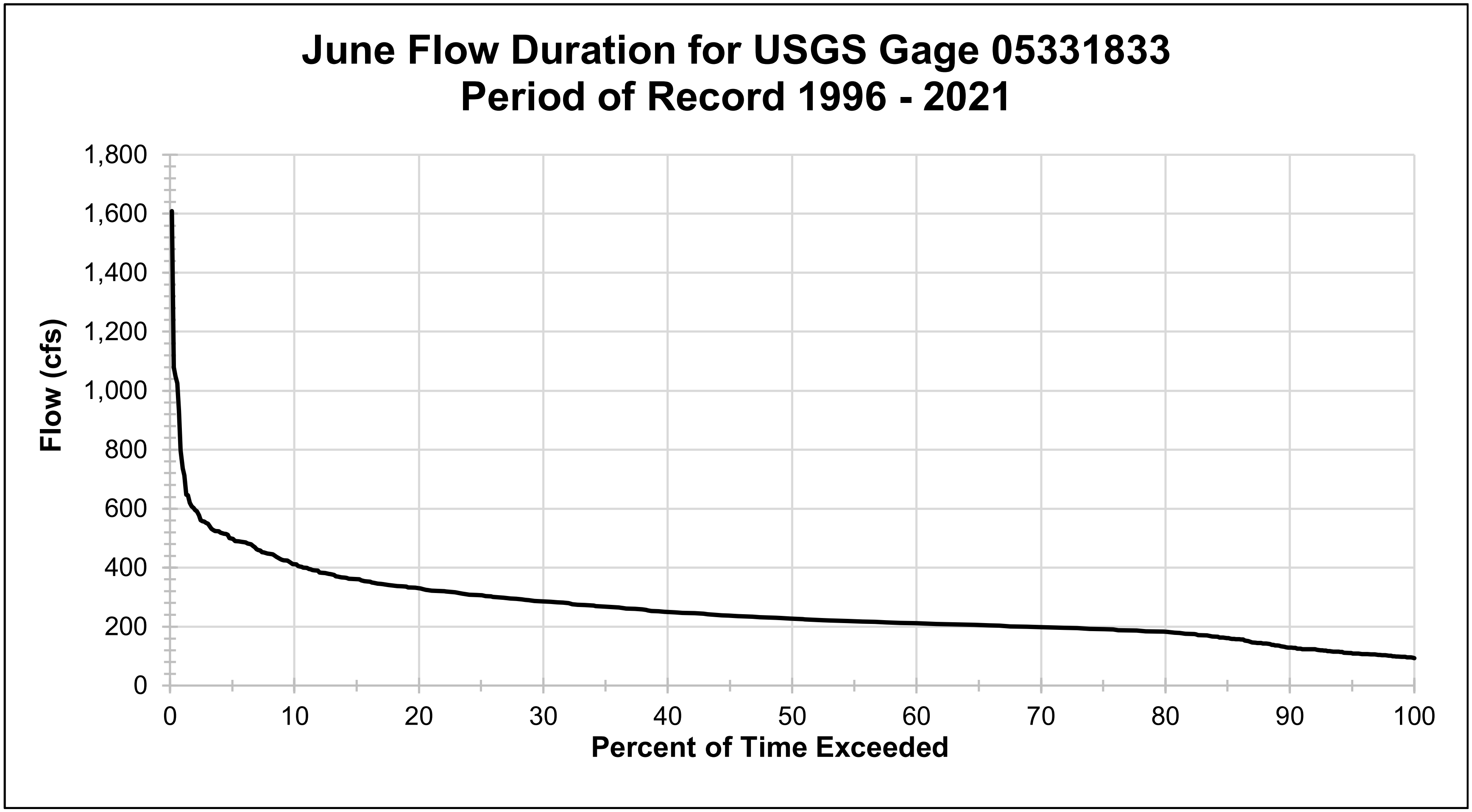


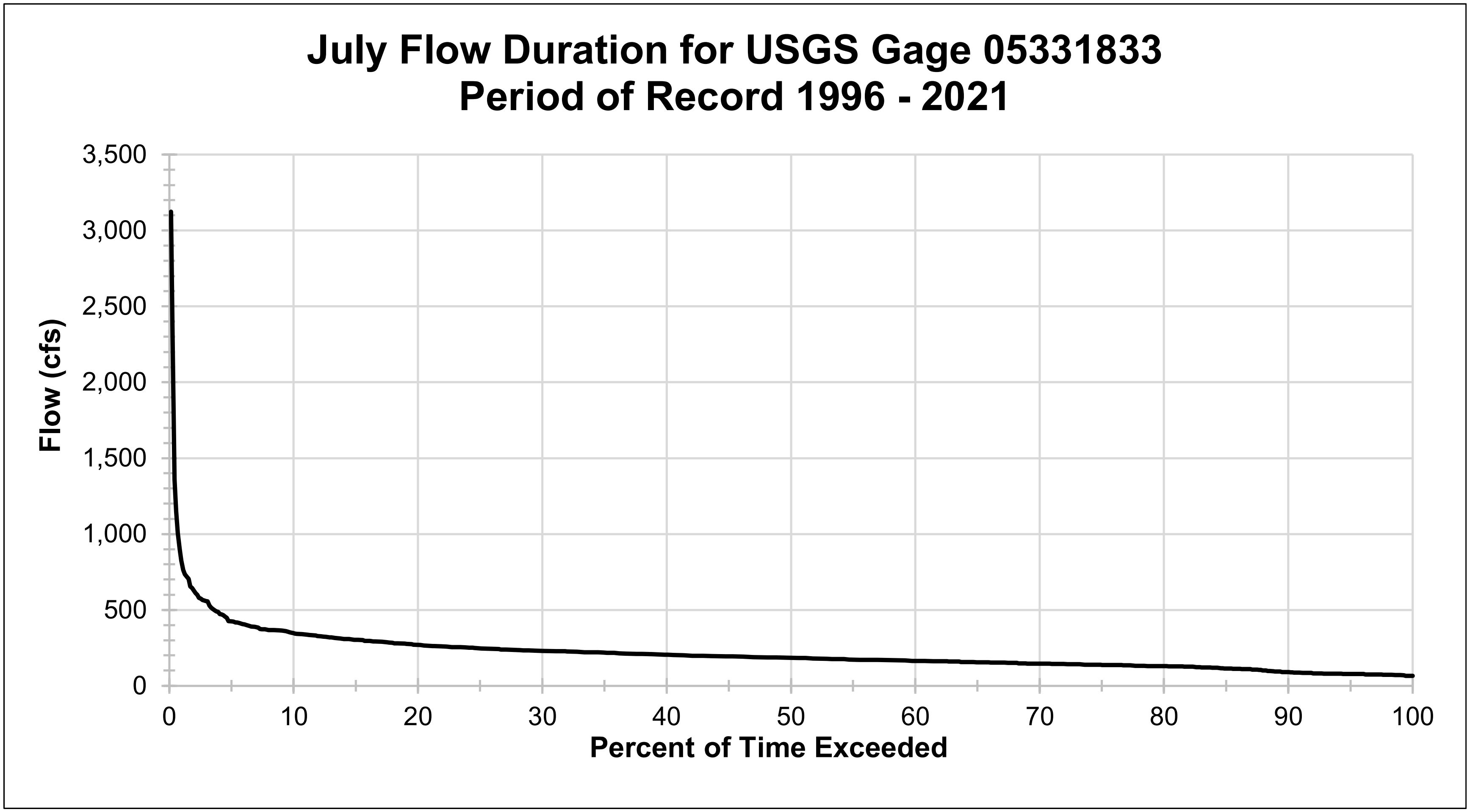
February Flow Duration for USGS Gage 05331833
Period of Record 1996 - 2021
Flow (cfs)
500
450
400
350
300
250
200
150
100
50
0
0
10
20
30
40
50
60
70
80
90
100
Percent of Time Exceeded

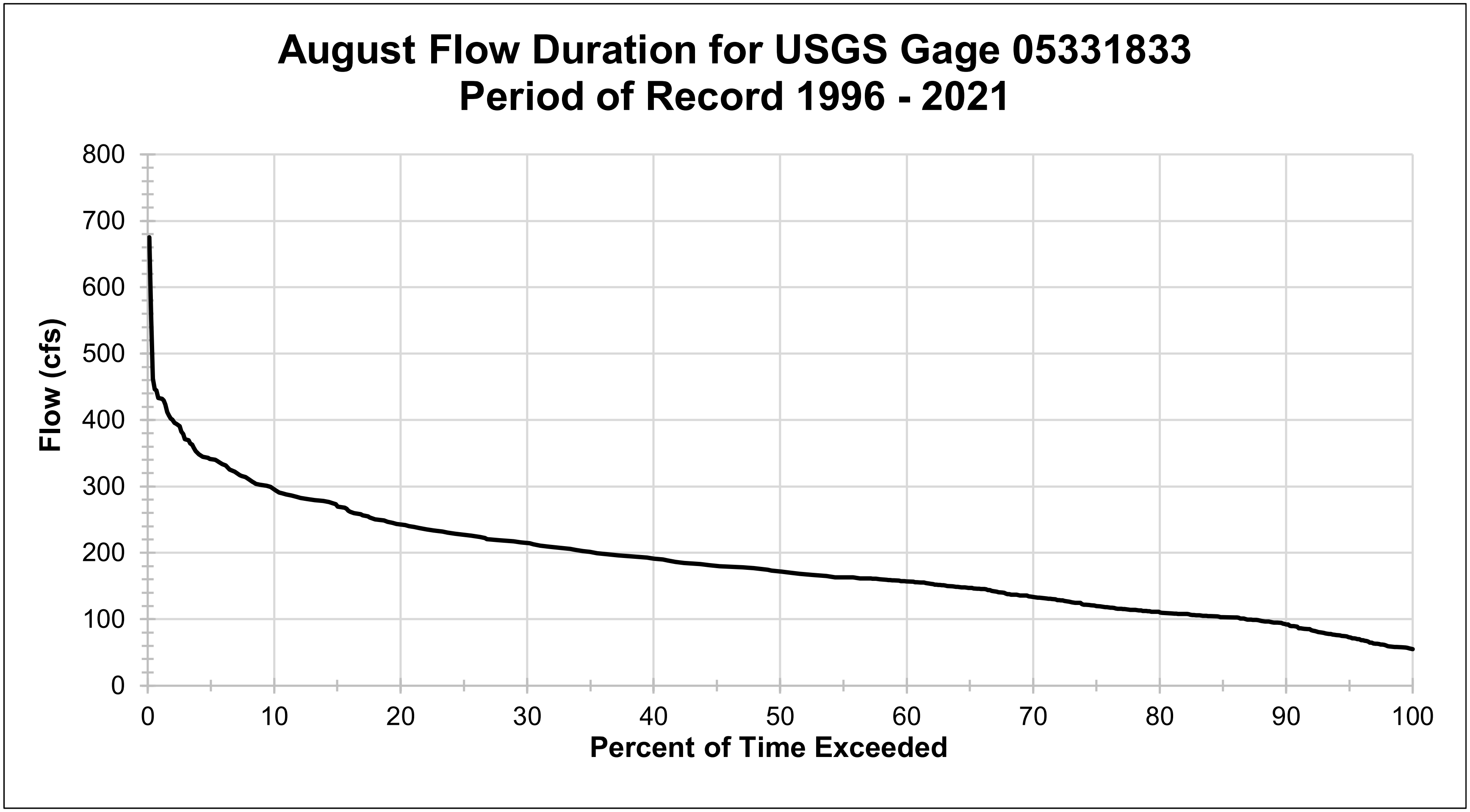

March Flow Duration for USGS Gage 05331833
Period of Record 1996 - 2021
Flow (cfs)
800
700
600
500
400
300
200
100
0
0
10
20
30
40
50
60
70
80
90
100
Percent of Time Exceeded


April Flow Duration for USGS Gage 05331833
Period of Record 1996 - 2021
Flow (cfs)
1,600
1,400
1,200
1,000
800
600
400
200
0
0
10
20
30
40
50
60
70
80
90
100
Percent of Time Exceeded

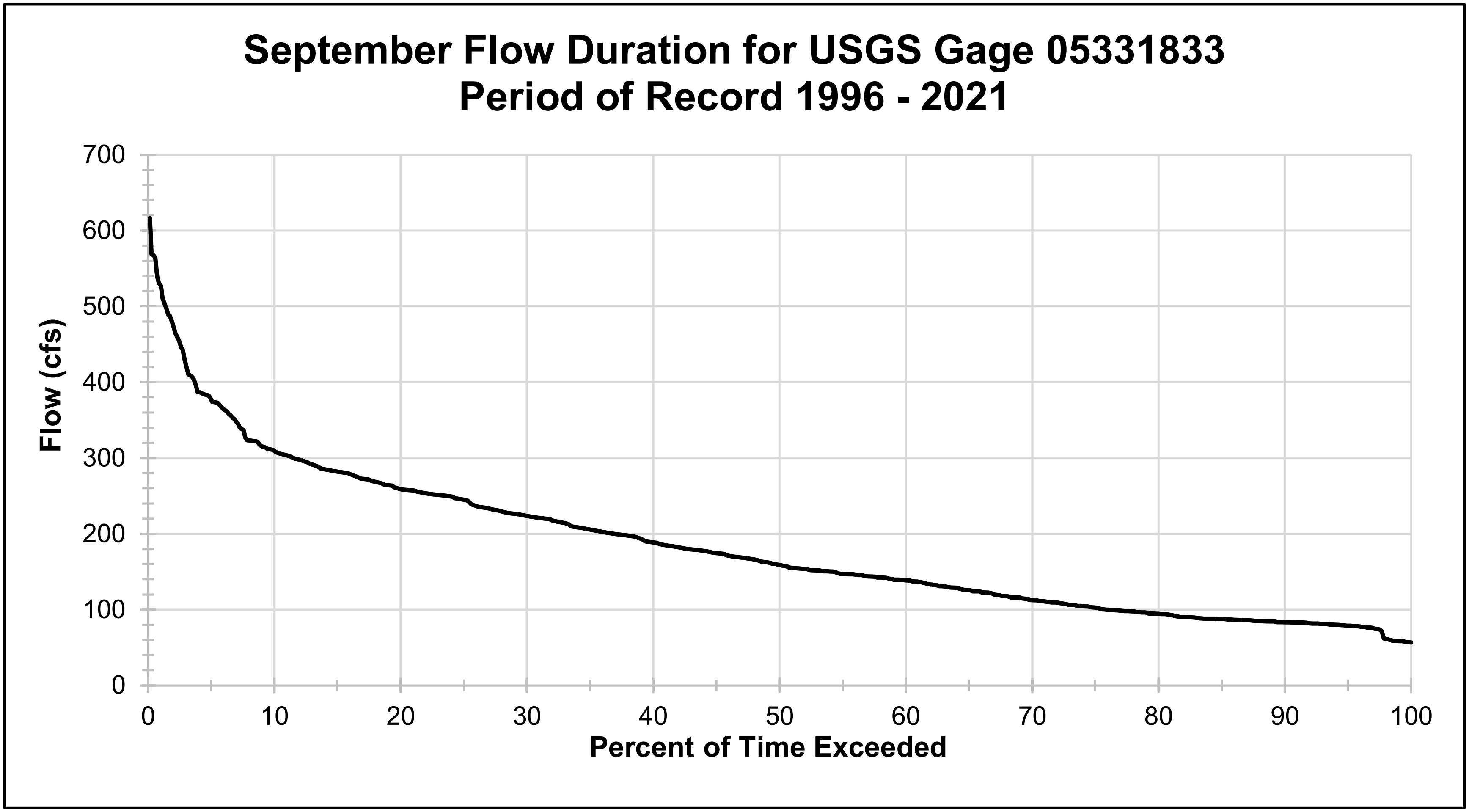

May Flow Duration for USGS Gage 05331833
Period of Record 1996 - 2021
Flow (cfs)
1,400
1,200
1,000
800
600
400
200
0
0
10
20
30
40
50
60
70
80
90
100
Percent of Time Exceeded


June Flow Duration for USGS Gage 05331833
Period of Record 1996 - 2021
Flow (cfs)
1,800
1,600
1,400
1,200
1,000
800
600
400
200
0
0
10
20
30
40
50
60
70
80
90
100
Percent of Time Exceeded

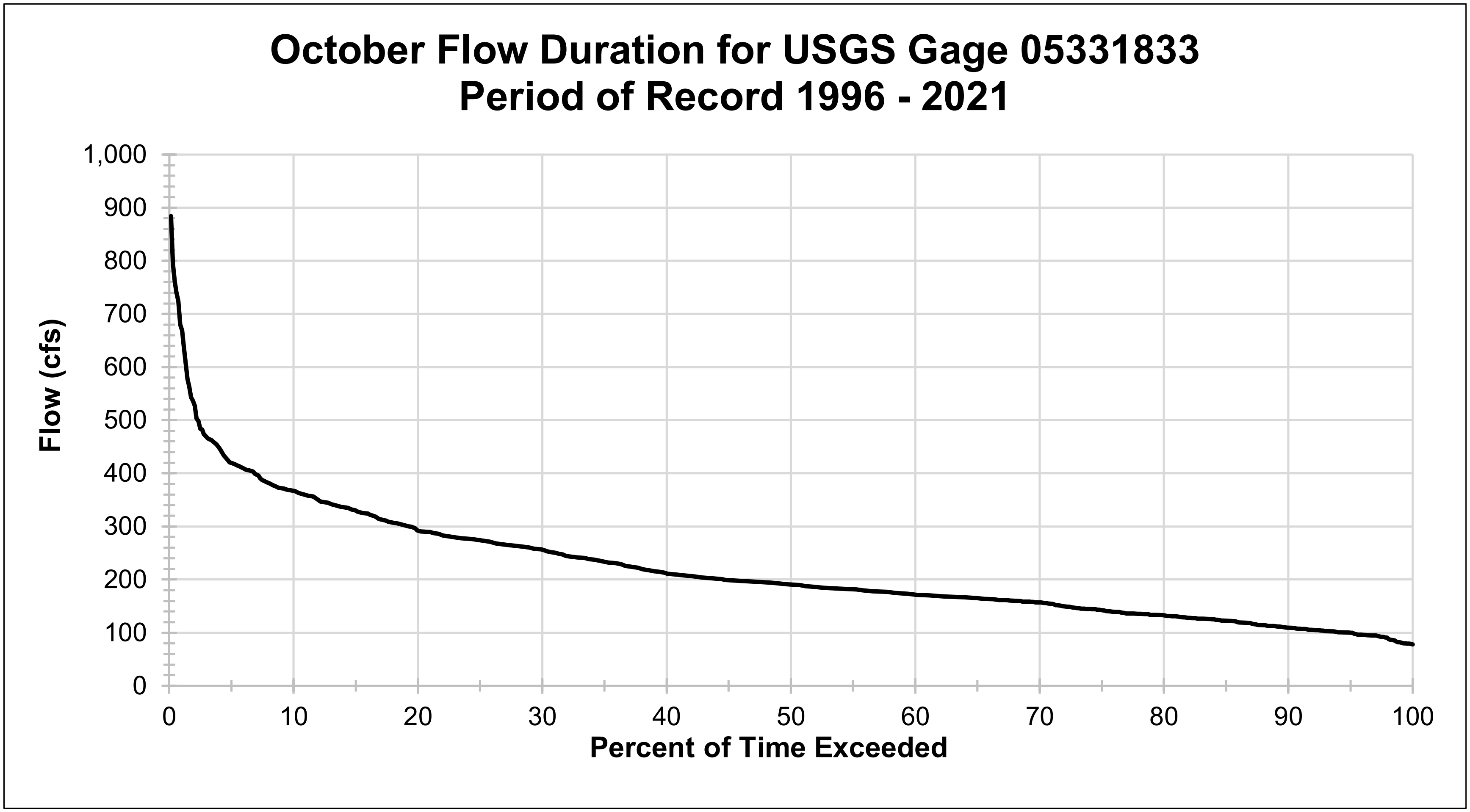

July Flow Duration for USGS Gage 05331833
Period of Record 1996 - 2021
Flow (cfs)
3,500
3,000
2,500
2,000
1,500
1,000
500
0
0
10
20
30
40
50
60
70
80
90
100
Percent of Time Exceeded

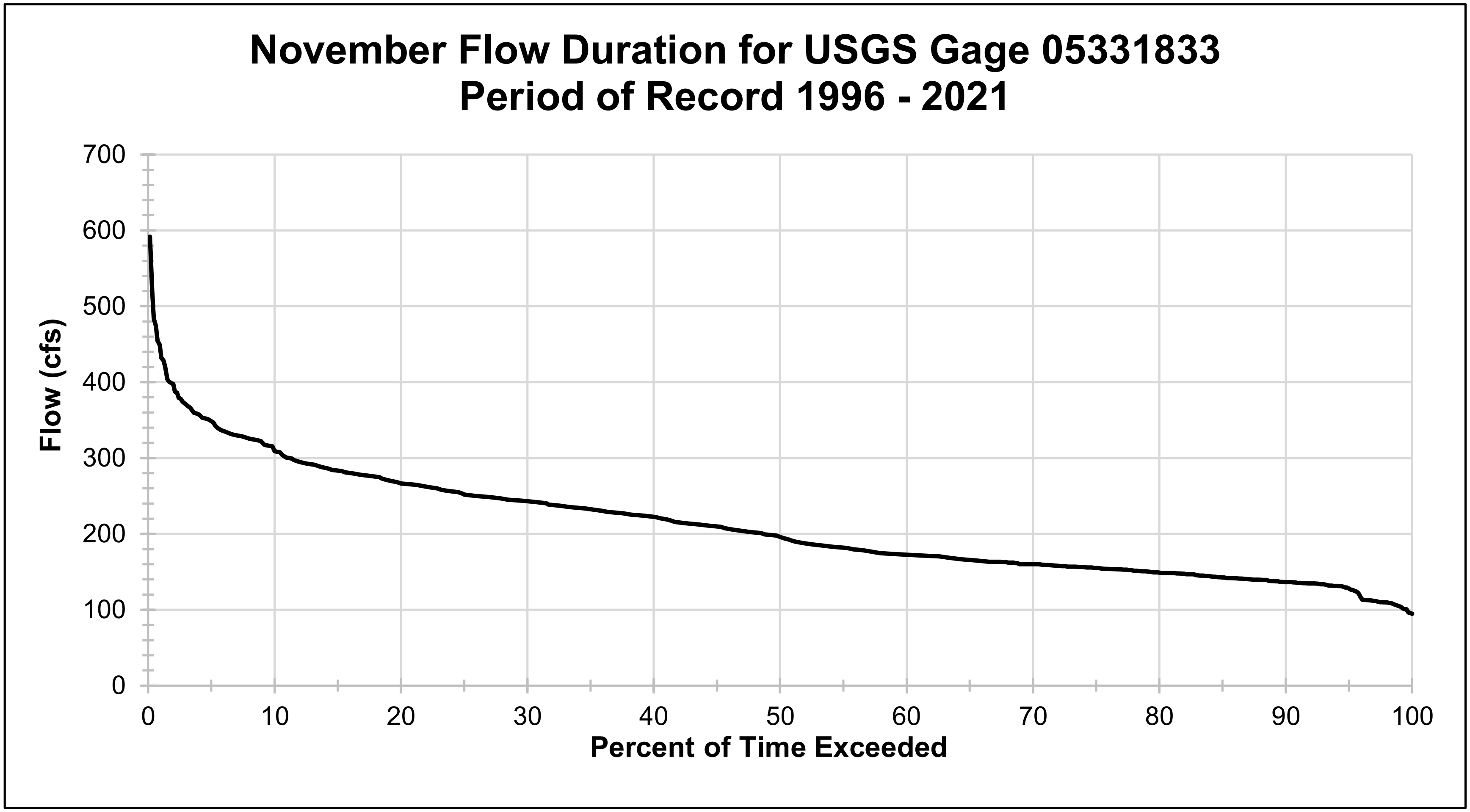


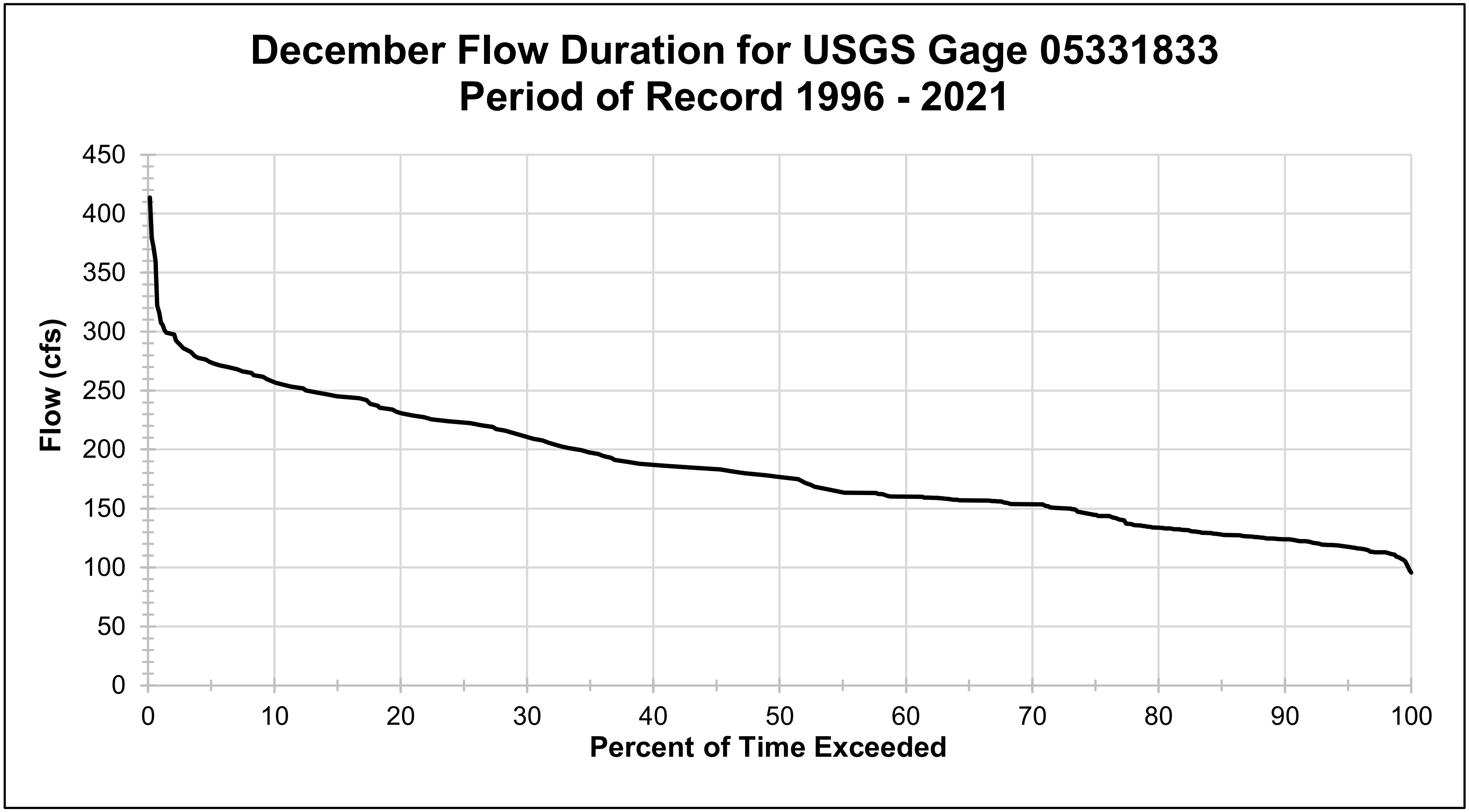
August Flow Duration for USGS Gage 05331833
Period of Record 1996 - 2021
Flow (cfs)
800
700
600
500
400
300
200
100
0
0
10
20
30
40
50
60
70
80
90
100
Percent of Time Exceeded



September Flow Duration for USGS Gage 05331833
Period of Record 1996 - 2021
Flow (cfs)
700
600
500
400
300
200
100
0
0
10
20
30
40
50
60
70
80
90
100
Percent of Time Exceeded


October Flow Duration for USGS Gage 05331833
Period of Record 1996 - 2021
Flow (cfs)
1,000
900
800
700
600
500
400
300
200
100
0
0
10
20
30
40
50
60
70
80
90
100
Percent of Time Exceeded


November Flow Duration for USGS Gage 05331833
Period of Record 1996 - 2021
Flow (cfs)
700
600
500
400
300
200
100
0
0
10
20
30
40
50
60
70
80
90
100
Percent of Time Exceeded

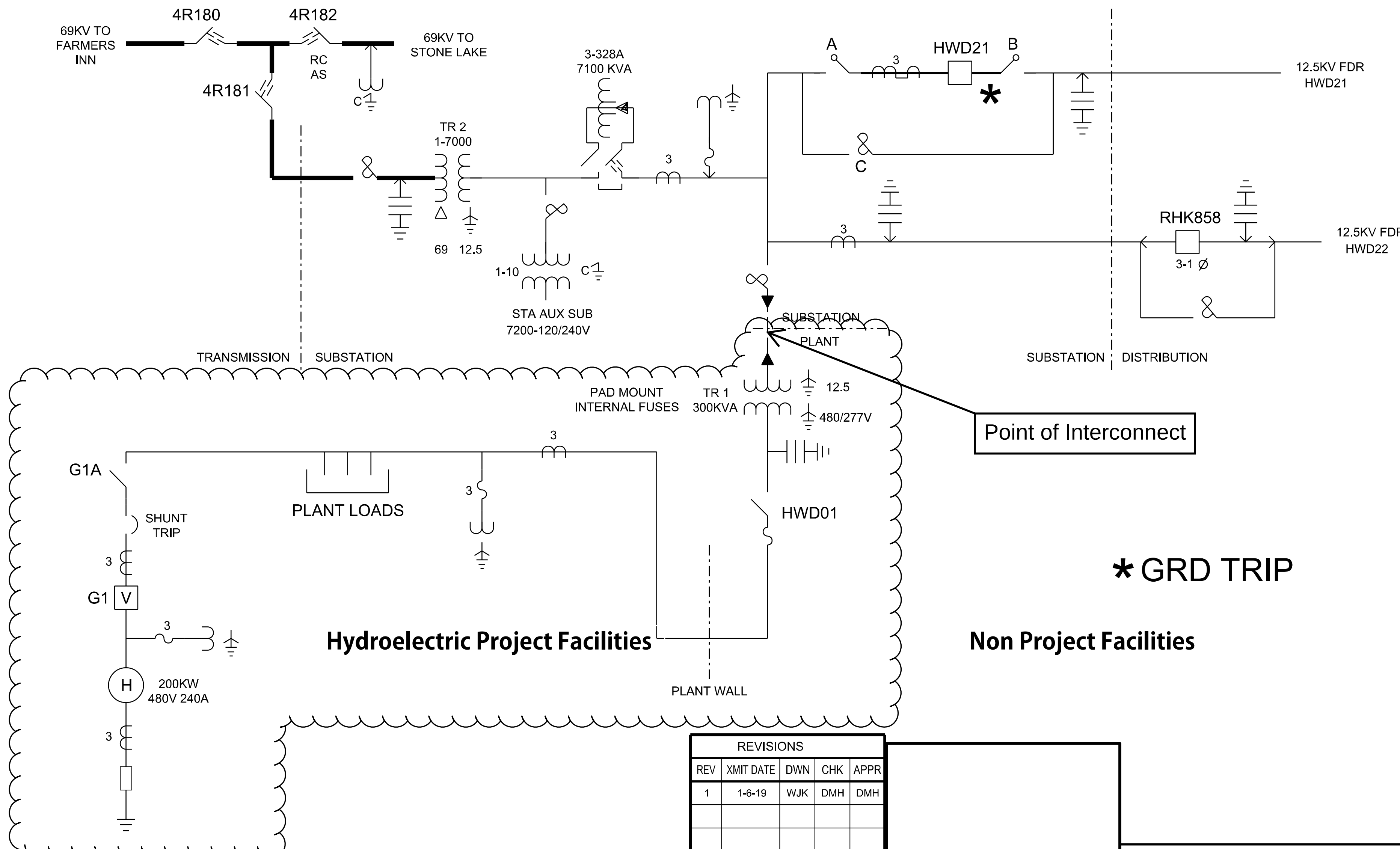


December Flow Duration for USGS Gage 05331833
Period of Record 1996 - 2021
Flow (cfs)
450
400
350
300
250
200
150
100
50
0
0
10
20
30
40
50
60
70
80
90
100
Percent of Time Exceeded

Flow Duration for USGS Gage 05331833 (Period of Record 1996 - 2021)

Percent of Time	January	February	March	April	May	June	July	August	September	October	November	December	Annual
95	117	105	114	153	133	110	78	73	79	101	128	118	99
90	124	116	121	175	159	129	91	93	83	110	137	124	115
85	128	122	139	185	177	161	115	103	88	123	143	129	127
80	132	128	147	198	198	183	129	111	94	133	149	134	137
75	140	132	150	208	216	193	138	120	103	143	155	145	147
70	144	139	157	221	227	199	146	134	113	157	160	154	155
65	147	142	163	232	240	206	156	147	126	165	167	157	163
60	149	146	172	247	253	211	165	157	139	173	173	160	172
55	154	149	178	268	271	219	173	163	147	183	183	167	180
50	162	154	183	302	281	227	185	173	159	191	196	177	191
45	163	160	195	327	294	237	195	181	175	199	211	185	201
40	172	165	204	350	312	250	206	193	190	213	224	188	214
35	177	168	213	383	337	268	219	201	206	234	234	198	227
30	180	172	229	407	366	286	232	216	224	257	244	211	242
25	190	180	242	437	407	307	249	227	245	275	252	224	260
20	196	191	257	472	463	332	271	244	262	293	266	232	283
15	203	196	271	517	525	361	304	273	283	330	284	245	316
10	221	213	304	618	592	412	347	298	311	369	309	258	368

APPENDIX A-4 Hayward Project One-Line Diagram of Electrical Circuits



REVISIONS

REV	XMIT DATE	DWN	CHK	APPR
1	1-6-19	WJK	DMH	DMH

FOR DRAWING REFERENCE AND REVISION INFORMATION SEE PHYSICAL INDEX SHEET.

REV	DATE	WBS 4	REVISION DESCRIPTION
1A	12/13/2018	D.0005055.016.001.001	HWD - UPDATE SUB OL FOR RECORD

ISSUED BY ENGINEERING DEPT FOR: RECORD

HAYWARD SUBSTATION HWD
OPERATIONS ONE-LINE DIAGRAM
69-12.5KV

Xcel Energy | NE - 120148 | SCALE NONE | REV 1

NE-120148.DGN

12/14/2018 8:52:12 AM