

**SUMMARY OF UPSTREAM AND DOWNSTREAM  
FISH PASSAGE AT THE  
YORK HAVEN HYDROELECTRIC PROJECT  
IN 2017**

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## EXECUTIVE SUMMARY

The fish ladder was opened on 1 April allowing volitional (unmanned) passage for 54 days prior to initiating manned Fishway operation. In 2017, the Fishway was manned on a total of 19 days between 24 May and 11 June. After manned operation ended on 11 June, the fish ladder and North fixed wheel gate were set to deliver a minimum flow of 400 cfs into the East Channel. Although the fishway could have been closed on 15 December, the availability of crews and staging of material delayed the actual closure of the facility. Fishway closure began on 16 December and was completed by 22 December.

During manned Fishway operation some 29,548 fish of 12 taxa were enumerated as they passed upstream into Lake Frederic. Gizzard shad (25,620) was the dominant fish species passed and comprised over 86.7% of the fish passed. Some 62 American shad were counted as they passed through the ladder. Other predominant fishes passed included channel catfish (1,622), smallmouth bass (743) quillback (627), walleye (370) and carp (361). Passage varied daily and ranged from 3,648 fish on 3 June when 12.3% of the season total was passed to 482 fish on 9 June.

A total of 62 American shad passed upstream through the ladder in 2017. American shad passed upstream between 25 May and 11 June. American shad were collected and passed at water temperatures of 61.5°F to 70.0°F, River flows of 25,200 cfs to 69,000 cfs and East Channel flows of 2,050 cfs to 9,200 cfs. Some 52 shad (83.8%) passed before 1300 hrs. Hourly passage varied from 1 to 4 shad.

Downstream passage of adult American shad was expected to occur from 1 May to 30 June. The forebay Sluice Gate was generally opened as required (~370 cfs) for 2 hours in May and June when river flow exceeded hydraulic capacity. No physical observations of post-spawned adult American shad were noted by Station personnel.

The forebay Sluice Gate was generally left opened daily from 1 October to 30 November to provide downstream passage of juvenile shad. During debris sluicing activities, the operators may have closed the sluice gate occasionally for short periods early in the morning (0600 hrs to 0800 hrs) during the week.

During the fall juvenile shad outmigration period, river flow remained relatively stable during most of October ranging from 4,440 cfs to 10,400 cfs before increasing to 88,300 cfs on 31 October. River flows dropped off to 34,100 cfs by 7 November. River flows increased slightly to 50,200 cfs on 9 November and this was followed by a steady decline to 19,500 cfs on 18 November. Flows increased a second time to 32,600 cfs on 22 November before declining to 18,200 cfs on 30 November when the downstream passage season ended. Average daily water temperature during the fall downstream migration period (1 October to 31 November) dropped over 30 degrees and ranged from a high of 71.2°F to a low of 41.0°F.

## **1.0 INTRODUCTION**

In 1993, York Haven Power Company (YHPC), the licensees of the Safe Harbor and Holtwood Projects, the U.S. Department of the Interior represented by the Fish and Wildlife Service (“USFWS”), the Susquehanna River Basin Commission (“SRBC”), the states of Maryland and Pennsylvania and their involved agencies – Maryland Department of Natural Resources (“MDNR”), Pennsylvania Fish and Boat Commission (“PFBC”) and Pennsylvania Department of Environmental Resources (“PADEP”), and two other parties signed the Susquehanna River Fish Passage Settlement Agreement.

This agreement established for each project a Fish Passage Technical Advisory Committee (“FPTAC”) comprised of representatives of the affected licensee, USFWS, PFBC and MDNR. Each FPTAC is responsible for reviewing and monitoring the design, construction, maintenance and operation of the fish passage facilities at the respective project, preparing an annual report, and recommending studies and/or modifications to improve upstream and downstream passage. As in previous years, objectives of 2017 operation were to monitor passage of migratory and resident fishes through the Fishway during the spring migration and continue to assess operation. Cube Hydro Partners, LLC and YHPC personnel hosted a conference call with the York Haven FPTAC on May 18, 2017 to discuss Fishway operation.

## **2.0 YORK HAVEN FISHWAY OPERATIONS**

The installation and operation of the Fishway are part of a cooperative private, state and federal effort to restore American shad (*Alosa sapidissima*) and other migratory fish to the Susquehanna River. In 1997, YHPC and the resource agencies reached a new settlement agreement to revise the type and location of the York Haven fish passage facility. The Fishway is located in Dauphin County, Pennsylvania at the Three Mile Island end of the East Channel Dam at the York Haven Hydroelectric Project (FERC No. 1888). The Fishway was placed in service by YHPC in April 2000. Upstream and downstream Fishway operation is provided for in the Project's new FERC License (FERC, 2015) and the Pennsylvania Department of Environmental Protection Water Quality Certification (PA DEP, 2014) issued on December 15, 2015 and 19 August 2014, respectively.

Fishway operation coincides with a springtime minimum flow release. As part of the 1997 agreement and in accordance with its new License and Water Quality Certification, YHP agreed to maintain a spill of up to 4,000 cfs over the Main Dam and a minimum release of approximately 2,000 cfs in the East Channel through the Fishway during spring operation. River flow in excess of spring minimum flow requirements and station capacity is spilled over the Main and East Channel Dams and through the Fishway. A nominal 2,000 cfs East Channel minimum flow is released through the fishway 24 hrs a day during the entire Fishway operating season. When River flows are less than 23,000 cfs, a nominal minimum spill of 4,000 cfs is maintained over the Main Dam during daily Fishway operation by reducing the number of Units in operation.

### **2.1 Project Operation**

The hydroelectric station located in York Haven, Pennsylvania built in 1904, is situated on the River (river mile 55) in Dauphin and York counties, Pennsylvania (Figure 1). It is the fourth upstream hydroelectric facility on the River. The Project is a 20-unit run-of-river facility capable of producing approximately 19 MW and has an estimated hydraulic capacity of 17,000 cfs. It includes two dams that impound approximately 5 miles of the River forming Lake Frederic. The Main Dam is approximately 5,000 ft long, with a maximum height of 17 ft. The East Channel Dam

is approximately 925 ft long with a maximum height of 9 ft. When River flow exceeds station hydraulic capacity (55% of the year), water is spilled over the two dams.

## **2.2 Fishway Design and Operation**

### **2.2.1 Fishway Design**

Fishway design incorporated numerous criteria established by the USFWS and the other resource agencies. The Fishway has an operating limit of 150,000 cfs River flow (East Channel flow limit of approximately 22,000 cfs). The Fishway includes two sections; a “weir cut” and a vertical notch fish ladder. Figure 2 provides the general arrangement of the Fishway. A detailed description of the Fishway and its major components is located in 2000 and 2001 summary reports (Kleinschmidt 2000 & 2002).

### **2.2.2 Fishway Operation**

Fishway preparations began in early March and volitional passage (unmanned) began on 1 April. Only the entrance and exit gate were open during a 53-day unmanned period of Fishway operation between 1 April and 23 May.

Manned Fishway operation, commenced on Thursday 24 May, 4 days after the Safe Harbor Fish Lift had passed 1,319 American shad. In 2017, the Fishway was manned on a total of 19 days between 24 May and 11 June. Fish were counted and allowed to pass upstream between 0800 hrs and 1600 hrs. Given that no shad were observed passing the ladder since 19 May a 23-day period, manned Fishway operation ended at 1600 hrs on 11 June, two days after the Safe Harbor fish lift was shut down for the 2017 season.

Between 24 May and 11 June, both fixed wheel gates and the diffuser gate were opened. These gates remained opened throughout the spawning migration. The entrance gate was the only gate that was adjusted throughout the season. This gate was adjusted manually maintaining a 0.4-ft to 1.0-ft differential between the surface water elevation downstream of the entrance and the water elevation in the diffuser area of the fish ladder. This range of settings resulted in an average velocity of 4 ft/sec to 9.0 ft/sec at the entrance to the ladder. The 7-ft wide stop gate, located between the weir and the fish ladder entrance, remained closed during the entire period of operation.

Excluding the first and last day of manned operation, the Fishway was typically staffed by one person. This person, a biologist or technician, adjusted the position of the entrance gate, counted and recorded the number of fish that passed through the ladder hourly, removed debris from the exit of the ladder, made visual observations of fish activity and movement in and through the ladder, and made observations once each day below the Main Dam. These individuals also recorded water elevations several times each day on staff gauges located throughout the Fishway.

After manned Fishway operation ended on 11 June, the South fixed wheel gate was closed and the North fixed wheel gate and ladder were set to deliver a minimum flow of 400 cfs into the East Channel. The Fishway was set to deliver a minimum stream flow of at least 400 cfs to the East Channel. Although the fishway could have been closed on 15 December according to the Projects License and 401 Water Quality Certification, the availability of crews and staging of material delayed the actual closure of the facility. Fishway closure began on 16 December and was completed by 22 December.

## **2.3 Fish Counts**

Fish that passed through the ladder were identified to species and enumerated as they passed the counting window by a biologist and/or technician. A description of the procedures used to count fish is described in prior annual operating reports (Kleinschmidt 2000 and 2002). Fish passage by the viewing window was controlled by opening or closing an aluminum grating gate with an electric hoist that was controlled from inside the viewing room. The stop gate was opened each morning at 0800 hrs and closed nightly at 1600 hrs when the Fishway was manned. Occasionally, it was closed for brief periods of time as needed each day to enable personnel manning the Fishway to remove debris from screens and the fishway exit other conduct other activities. In addition, in an effort to improve viewing, the adjustable crowder screen was adjusted as needed to allow all fish that passed to be observed. Gate settings on the days the Fishway was manned varied from 20 to 24 inches.

As in previous seasons, fish passage data was entered on a field data sheet and uploaded into a computer. Files were uploaded each evening, checked and corrected as necessary. Data reporting was PC-based and accomplished by program scripts, or macros, created within Microsoft Excel spreadsheets. Passage data and operational conditions were supplied electronically to YHPC's on-site coordinator/manager and other appropriate YHPC personnel on a daily basis. Passage information was subsequently provided electronically by YHPC personnel to members of the FPTAC.

## **2.4 Results**

### **2.4.1 Spring Fishway Operation**

#### **2.4.1.1 Relative Abundance**

The number of fish that passed through the York Haven fish ladder is presented in Table 1. During manned Fishway operation some 29,548 fish of 12 taxa were enumerated as they passed upstream into Lake Frederic. Gizzard shad (25,620) was the dominant fish species passed and comprised over 86.7% of the fish passed. Some 62 American shad were counted as they passed through the ladder. Other predominant fishes passed included channel catfish (1,622), smallmouth bass (743) quillback (627), walleye (370) and carp (361). Passage varied daily and ranged from 3,648 fish on 3 June when 12.3% of the season total was passed to 482 fish on 9 June.

NOAA engineer, Bjorn Lake, scheduled a site visit on 26 April and the fishway engineer determined that the Fishway was being operated as designed and no operational issues were noted.

#### **2.4.1.2 American Shad Passage**

A total of 62 American shad passed upstream through the ladder in 2017. American shad passed upstream between 25 May and 11 June. American shad were collected and passed at water temperatures of 61.5°F to 70.0°F, River flows of 25,200 cfs to 69,000 cfs and East Channel flows of 2,050 cfs to 9,200 cfs (Tables 2 and 3, Figures 3 and 4).

The hourly passage of American shad through the fish ladder is given in Table 4. Some 52 shad (83.8%) passed before 1300 hrs. Hourly passage varied from 1 to 4 shad.

### **2.4.1.3 Other Alosids**

No other alosids (alewife, blueback herring and hickory shad) were observed passing through the ladder (Table 1).

### **2.4.1.4 Observations**

Observations were made at the “weir cut” occasionally each day in an attempt to see if American shad or other fishes passed upstream through this section of the Fishway. On several occasions gizzard shad, carp, and quillback shad were observed trying to swim over the 67 ft. weir. However, no fish were observed trying to swim through the fixed wheel gates.

## **3.0 DOWNSTREAM FISH PASSAGE**

The Projects recently issued FERC license and new Water Quality Certification provide for downstream passage of adult and juvenile shad. Downstream passage of adult shad is expected to occur from 1 May to 30 June while downstream passage of juvenile shad is anticipated to occur from 1 October through 30 November.

### **3.1 Adult Passage**

Downstream passage of adult shad was expected to occur from 1 May to 30 June. When River flows exceed the sum of Project Hydraulic Capacity, and required flows through the East Channel and required flows (if any) over the Main Dam, the Project, according to its FERC License and 401 Water Quality Certification, the Station is to open and spill water via the forebay Sluice Gate (~370 cfs) to the extent practicable for a period of 1 to 2 hours during the morning on weekdays, subject to Project personnel availability and access requirements for operations and maintenance purposes. Spilling may be provided in connection with opening of Forebay Sluice Gate for purposes of passing debris.

Downstream passage of adult American shad was expected to occur from 1 May to 30 June. The forebay Sluice Gate was generally opened as required (~370 cfs) for 2 hours in May and June when river flow exceeded hydraulic capacity. No physical observations of post-spawned adult American shad were noted by Station personnel.

### **3.2 Juvenile Passage**

During the juvenile American shad Passage Period (JASPP), 1 October to 30 November, the Project is to operate its turbines in the following order. Depending on available River flow, Units 1-6 (Propeller Units) may be operated without restriction up to available River flow, Unit 14 (larger single Francis Unit) may be operated if River flows exceeds capacity of Units 1-6 and Units 7-13 and Units 15-20 (double Francis Units may be operated in ascending order if river flows exceeds capacity of Units 1-6 and Unit 14 during the JASPP. During the downstream juvenile passage period, the Station is to open and spill water via the Forebay Sluice Gate (~370 cfs) between the hours of 5 PM to 11 PM EST. If during the downstream passage period, River flow exceeds the sum of Project hydraulic capacity, required flows through the East Channel and required flows (if any), the Project is also to open and spill water via the Forebay Sluice Gate to the extent practicable for 1 to 2 hours during the morning, subject to Project access requirements for operations and maintenance purposes.

In accordance with the Projects new FERC License and 401 Water Quality Certification, the Sluice Gate was generally left opened daily from 1 October to 30 November to provide downstream passage of juvenile shad. During debris sluicing activities, the operators may have closed the sluice gate occasionally for short periods early in the morning (0600 hrs to 0800 hrs) during the week.

During the fall juvenile shad outmigration period, River flow remained relatively stable during most of October ranging from 4,440 cfs to 10,400 cfs before increasing to 88,300 cfs on 31 October. River flows dropped off to 34,100 cfs by 7 November. River flows increased slightly to 50,200 cfs on 9 November and this was followed by a steady decline to 19,500 cfs on 18 November. Flows increased a second time to 32,600 cfs on 22 November before declining to 18,200 cfs on 30 November when the downstream passage season ended. Average daily water temperature during the fall downstream migration period (1 October to 31 November) dropped over 30 degrees and ranged from a high of 71.2°F to a low of 41.0°F.

#### **4.0 LITERATURE CITED**

Commonwealth of Pennsylvania Department of Environmental Protection. August 19, 2014, Water Quality Certification for the York Haven Hydroelectric Project and Related Mitigation, DEP File No. EA67-023: York Haven Power Company, LLC, 65 pp.

Federal Energy Regulatory Commission, December 15, 2015. Order Issuing New License for York Haven Power Company, LLC. 135 pp.

Kleinschmidt. 2000. Summary of operation at the York Haven Fishway in 2000. Prepared for York Haven Power Company, GPU Energy by Kleinschmidt, Strasburg, Pennsylvania. 21 pp.

Kleinschmidt. 2002. Summary of operation at the York Haven Fishway in 2001. Prepared for York Haven Power Company, GPU Energy/FirstEnergy by Kleinschmidt, Strasburg, Pennsylvania. 21 pp.

## TABLES

**Table 1. Summary of the daily number of fish that passed by the York Haven Hydroelectric Project through the serpentine vertical notch ladder at the East Channel Dam in 2017.**

| Date                    | 24-May     | 25-May       | 26-May       | 27-May     | 28-May     | 29-May       | 30-May       | 31-May       | 1-Jun        | 2-Jun        |
|-------------------------|------------|--------------|--------------|------------|------------|--------------|--------------|--------------|--------------|--------------|
| Observation Time (hrs.) | 8.0        | 8.0          | 8.0          | 8.0        | 8.0        | 8.0          | 8.0          | 8.0          | 7.0          | 8.0          |
| Water Temperature (°F)  | 64.0       | 61.5         | 62.5         | 63.0       | 64.5       | 64.5         | 64.0         | 67.0         | 67.5         | 67.5         |
| AMERICAN SHAD           | 0          | 3            | 0            | 3          | 13         | 9            | 3            | 5            | 2            | 8            |
| ALEWIFE                 | 0          | 0            | 0            | 0          | 0          | 0            | 0            | 0            | 0            | 0            |
| BLUEBACK HERRING        | 0          | 0            | 0            | 0          | 0          | 0            | 0            | 0            | 0            | 0            |
| GIZZARD SHAD            | 818        | 1,303        | 1,496        | 646        | 686        | 1,296        | 1,298        | 1,319        | 1,129        | 3,182        |
| HICKORY SHAD            | 0          | 0            | 0            | 0          | 0          | 0            | 0            | 0            | 0            | 0            |
| STRIPED BASS            | 0          | 2            | 0            | 0          | 0          | 0            | 0            | 0            | 0            | 0            |
| WHITE PERCH             | 0          | 0            | 0            | 0          | 0          | 0            | 0            | 0            | 0            | 0            |
| AMERICAN EEL            | 0          | 0            | 0            | 0          | 0          | 0            | 0            | 0            | 0            | 0            |
| BROWN TROUT             | 0          | 0            | 1            | 0          | 0          | 0            | 0            | 0            | 0            | 0            |
| MUSKELLUNGE             | 0          | 0            | 0            | 0          | 0          | 0            | 0            | 0            | 0            | 0            |
| CARP                    | 1          | 16           | 29           | 23         | 17         | 26           | 22           | 23           | 4            | 12           |
| QUILLBACK               | 66         | 174          | 100          | 24         | 23         | 45           | 9            | 11           | 0            | 14           |
| WHITE SUCKER            | 0          | 0            | 0            | 0          | 0          | 0            | 0            | 0            | 0            | 0            |
| SHORTHEAD. REDHORSE     | 1          | 0            | 0            | 0          | 0          | 0            | 0            | 0            | 0            | 0            |
| CHANNEL CATFISH         | 16         | 8            | 4            | 23         | 28         | 33           | 77           | 37           | 284          | 352          |
| REDBREAST SUNFISH       | 0          | 0            | 0            | 0          | 0          | 0            | 0            | 0            | 0            | 0            |
| SMALLMOUTH BASS         | 42         | 124          | 102          | 39         | 145        | 64           | 10           | 52           | 3            | 8            |
| WALLEYE                 | 25         | 65           | 93           | 35         | 43         | 26           | 5            | 1            | 4            | 28           |
| RIVER CHUB              | 0          | 0            | 0            | 0          | 0          | 0            | 0            | 0            | 0            | 0            |
| NORTHERN HOG SUCKER     | 0          | 0            | 0            | 0          | 0          | 0            | 0            | 0            | 0            | 0            |
| FLATHEAD CATFISH        | 2          | 2            | 2            | 6          | 13         | 11           | 32           | 4            | 18           | 8            |
| STRIPED BASS HYBRID     | 0          | 0            | 0            | 0          | 0          | 0            | 0            | 0            | 0            | 0            |
| <b>Total</b>            | <b>971</b> | <b>1,697</b> | <b>1,827</b> | <b>799</b> | <b>968</b> | <b>1,510</b> | <b>1,456</b> | <b>1,452</b> | <b>1,444</b> | <b>3,612</b> |

**Note:** On 1 June log removed from top of north wheel gate, opened gate 100% at 1500 hrs (Gate opened 2 ft prior to this).

Table 1. (continued)

|                         | Date  | 3-Jun        | 4-Jun        | 5-Jun        | 6-Jun        | 7-Jun      | 8-Jun      | 9-Jun      | 10-Jun     | 11-Jun     | Total         |
|-------------------------|-------|--------------|--------------|--------------|--------------|------------|------------|------------|------------|------------|---------------|
| Observation Time (hrs.) | 8.0   | 8.0          | 8.0          | 8.0          | 8.0          | 8.0        | 8.0        | 8.0        | 8.0        | 8.0        | 151           |
| Water Temperature (°F)  | 67.5  | 66.5         | 64.5         | 65.0         | 64.0         | 66.0       | 67.5       | 67.5       | 67.5       | 70.0       |               |
| AMERICAN SHAD           | 11    | 1            | 0            | 1            | 1            | 0          | 1          | 0          | 1          | 1          | 62            |
| ALEWIFE                 | 0     | 0            | 0            | 0            | 0            | 0          | 0          | 0          | 0          | 0          | 0             |
| BLUEBACK HERRING        | 0     | 0            | 0            | 0            | 0            | 0          | 0          | 0          | 0          | 0          | 0             |
| GIZZARD SHAD            | 3,394 | 2,746        | 1,983        | 1,697        | 804          | 512        | 326        | 400        | 585        |            | 25,620        |
| HICKORY SHAD            | 0     | 0            | 0            | 0            | 0            | 0          | 0          | 0          | 0          | 0          | 0             |
| STRIPED BASS            | 0     | 0            | 0            | 0            | 0            | 0          | 0          | 0          | 0          | 0          | 2             |
| WHITE PERCH             | 0     | 0            | 0            | 0            | 0            | 0          | 0          | 0          | 0          | 0          | 0             |
| AMERICAN EEL            | 0     | 0            | 0            | 0            | 0            | 0          | 0          | 0          | 0          | 0          | 0             |
| BROWN TROUT             | 0     | 0            | 0            | 0            | 0            | 0          | 0          | 0          | 0          | 0          | 1             |
| MUSKELLUNGE             | 0     | 0            | 1            | 0            | 0            | 0          | 0          | 0          | 0          | 0          | 1             |
| CARP                    | 4     | 63           | 6            | 13           | 12           | 12         | 6          | 43         | 29         |            | 361           |
| QUILLBACK               | 9     | 27           | 14           | 43           | 31           | 12         | 8          | 10         | 7          |            | 627           |
| WHITE SUCKER            | 0     | 0            | 0            | 0            | 0            | 0          | 0          | 0          | 0          | 0          | 0             |
| SHORTHEAD. REDHORSE     | 0     | 0            | 0            | 0            | 0            | 0          | 0          | 0          | 0          | 0          | 1             |
| CHANNEL CATFISH         | 204   | 118          | 46           | 25           | 73           | 62         | 129        | 63         | 40         |            | 1,622         |
| REDBREAST SUNFISH       | 0     | 0            | 0            | 0            | 0            | 0          | 0          | 0          | 0          | 0          | 0             |
| SMALLMOUTH BASS         | 3     | 7            | 10           | 48           | 60           | 26         | 0          | 0          | 0          |            | 743           |
| WALLEYE                 | 13    | 6            | 1            | 6            | 3            | 4          | 5          | 4          | 3          |            | 370           |
| RIVER CHUB              | 0     | 0            | 0            | 0            | 0            | 0          | 0          | 0          | 0          | 0          | 0             |
| NORTHERN HOG SUCKER     | 0     | 0            | 0            | 0            | 0            | 0          | 0          | 0          | 0          | 0          | 0             |
| FLATHEAD CATFISH        | 10    | 1            | 0            | 2            | 0            | 1          | 7          | 16         | 3          |            | 138           |
| STRIPED BASS HYBRID     | 0     | 0            | 0            | 0            | 0            | 0          | 0          | 0          | 0          | 0          | 0             |
|                         |       |              |              |              |              |            |            |            |            |            | 0             |
| <b>Total</b>            |       | <b>3,648</b> | <b>2,969</b> | <b>2,061</b> | <b>1,835</b> | <b>984</b> | <b>629</b> | <b>482</b> | <b>536</b> | <b>668</b> | <b>29,548</b> |

**Table 2. Summary of daily average river flow (USGS, Harrisburg Gage), average flow in the East channel, sum of average flow from power station and main dam, water temperature, secchi, stop log gate position, and East channel and fishway water elevations during operation of the York Haven fishway complex in 2017.**

| Date   | River Flow (cfs) | East Channel Flow (cfs) | Main Channel Flow (cfs) | Water Temp. (°F) | Secchi (in) |      |      | Stop Log Gate | Elevation (ft) |       |       |           |       |       |
|--------|------------------|-------------------------|-------------------------|------------------|-------------|------|------|---------------|----------------|-------|-------|-----------|-------|-------|
|        |                  |                         |                         |                  | Avg.        | Min. | Max. |               | Head Pond      |       |       | Tailwater |       |       |
|        |                  |                         |                         |                  |             |      |      | Avg.          | Min.           | Max.  | Avg.  | Min.      | Max.  |       |
| 24-May | 25,800           | 2,000                   | 23,800                  | 64.0             | 24          | 24   | 24   | Closed        | 278.5          | 278.4 | 278.5 | 272.6     | 272.4 | 272.6 |
| 25-May | 25,200           | 2,050                   | 23,150                  | 61.5             | 24          | 24   | 24   | Closed        | 278.8          | 278.6 | 279.0 | 272.8     | 272.5 | 273.1 |
| 26-May | 26,300           | 2,075                   | 24,225                  | 62.5             | 24          | 24   | 24   | Closed        | 278.9          | 278.8 | 279.0 | 273.3     | 273.3 | 273.4 |
| 27-May | 30,300           | 2,900                   | 27,400                  | 63.0             | 24          | 24   | 24   | Closed        | 279.3          | 279.3 | 279.3 | 273.4     | 273.4 | 273.4 |
| 28-May | 32,000           | 3,200                   | 28,800                  | 64.5             | 24          | 24   | 24   | Closed        | 279.4          | 279.3 | 279.4 | 273.8     | 273.8 | 273.9 |
| 29-May | 31,600           | 3,400                   | 28,200                  | 64.5             | 24          | 23   | 24   | Closed        | 279.5          | 279.5 | 279.5 | 273.9     | 273.8 | 273.9 |
| 30-May | 33,000           | 4,400                   | 28,600                  | 64.0             | 21          | 19   | 24   | Closed        | 279.8          | 279.6 | 279.9 | 273.9     | 273.7 | 274.0 |
| 31-May | 48,600           | 5,200                   | 43,400                  | 67.0             | 24          | 24   | 24   | Closed        | 280.1          | 280.0 | 280.1 | 274.5     | 274.4 | 274.6 |
| 1-Jun  | 66,600           | 9,200                   | 57,400                  | 67.5             | 21          | 17   | 24   | Closed        | 280.7          | 280.7 | 280.7 | 276.1     | 275.9 | 276.2 |
| 2-Jun  | 69,000           | 9,200                   | 59,800                  | 67.5             | 19          | 18   | 20   | Closed        | 280.7          | 280.7 | 280.7 | 276.3     | 276.3 | 276.4 |
| 3-Jun  | 62,800           | 7,500                   | 55,300                  | 67.5             | 22          | 21   | 23   | Closed        | 280.5          | 280.5 | 280.6 | 276.0     | 276.0 | 276.0 |
| 4-Jun  | 54,600           | 7,000                   | 47,600                  | 66.5             | 24          | 24   | 24   | Closed        | 280.3          | 280.3 | 280.4 | 275.5     | 275.4 | 275.6 |
| 5-Jun  | 46,100           | 5,500                   | 40,600                  | 64.5             | 24          | 24   | 24   | Closed        | 280.1          | 280.1 | 280.2 | 274.9     | 274.8 | 275.0 |
| 6-Jun  | 39,600           | 5,200                   | 34,400                  | 65.0             | 24          | 24   | 24   | Closed        | 280.0          | 280.0 | 280.1 | 274.5     | 274.4 | 274.5 |
| 7-Jun  | 38,300           | 4,800                   | 33,500                  | 64.0             | 24          | 24   | 24   | Closed        | 279.8          | 279.7 | 279.8 | 274.3     | 274.2 | 274.4 |
| 8-Jun  | 47,800           | 4,800                   | 43,000                  | 66.0             | 24          | 24   | 24   | Closed        | 279.8          | 279.7 | 279.9 | 274.6     | 274.5 | 274.6 |
| 9-Jun  | 60,100           | 7,000                   | 53,100                  | 67.5             | 19          | 19   | 19   | Closed        | 280.3          | 280.3 | 280.4 | 275.4     | 275.4 | 275.7 |
| 10-Jun | 57,100           | 7,250                   | 49,850                  | 67.5             | 22          | 22   | 22   | Closed        | 280.4          | 280.3 | 280.4 | 275.5     | 275.5 | 275.6 |
| 11-Jun | 48,900           | 5,500                   | 43,400                  | 70.0             | 23          | 23   | 23   | Closed        | 280.1          | 280.0 | 280.1 | 275.0     | 275.0 | 275.1 |

Table 3. Summary of surface water elevations recorded during operation of the York Haven Fishway in 2017.

| Date   | River Flow (cfs) | Elevation (ft) |      |      |           |      |      |                |      |      |             |      |      |                     |      |      |                        |      |      |               |      |      |
|--------|------------------|----------------|------|------|-----------|------|------|----------------|------|------|-------------|------|------|---------------------|------|------|------------------------|------|------|---------------|------|------|
|        |                  | Head Pond      |      |      | Tailwater |      |      | Inside Fishway |      |      | Inside Weir |      |      | Above Counting Room |      |      | Below Fixed Wheel Gate |      |      | Counting Room |      |      |
|        |                  | Avg.           | Min. | Max. | Avg.      | Min. | Max. | Avg.           | Min. | Max. | Avg.        | Min. | Max. | Avg.                | Min. | Max. | Avg.                   | Min. | Max. | Avg.          | Min. | Max. |
| 24 May | 25,800           | 2785           | 2784 | 2785 | 2726      | 2724 | 2726 |                |      |      |             |      |      |                     |      |      |                        |      |      |               |      |      |
| 25 May | 25,200           | 2788           | 2786 | 2790 | 2728      | 2725 | 2731 | 2742           | 2739 | 2745 | 2762        | 2761 | 2764 | 2784                | 2783 | 2785 | 2763                   | 2761 | 2765 | 2784          | 2782 | 2785 |
| 26 May | 26,300           | 2789           | 2788 | 2790 | 2733      | 2733 | 2734 | 2744           | 2743 | 2744 | 2763        | 2762 | 2763 | 2786                | 2785 | 2786 | 2759                   | 2759 | 2760 | 2786          | 2785 | 2786 |
| 27 May | 30,300           | 2793           | 2793 | 2793 | 2734      | 2734 | 2734 | 2744           | 2744 | 2745 | 2764        | 2763 | 2764 | 2789                | 2788 | 2790 | 2760                   | 2759 | 2761 | 2788          | 2787 | 2789 |
| 28 May | 32,000           | 2794           | 2793 | 2794 | 2738      | 2738 | 2739 | 2746           | 2745 | 2746 | 2765        | 2764 | 2765 | 2790                | 2789 | 2790 | 2761                   | 2760 | 2761 | 2789          | 2789 | 2789 |
| 29 May | 31,600           | 2795           | 2795 | 2795 | 2739      | 2738 | 2739 | 2745           | 2744 | 2745 | 2765        | 2764 | 2765 | 2789                | 2789 | 2789 | 2760                   | 2760 | 2761 | 2789          | 2788 | 2789 |
| 30 May | 33,000           | 2798           | 2796 | 2799 | 2739      | 2737 | 2740 | 2748           | 2747 | 2748 | 2764        | 2764 | 2764 | 2792                | 2791 | 2793 | 2761                   | 2760 | 2761 | 2791          | 2789 | 2792 |
| 31 May | 48,600           | 2801           | 2800 | 2801 | 2745      | 2744 | 2746 | 2751           | 2750 | 2752 | 2768        | 2767 | 2769 | 2797                | 2796 | 2798 | 2762                   | 2761 | 2763 | 2795          | 2795 | 2796 |
| 1 Jun  | 66,600           | 2807           | 2807 | 2807 | 2761      | 2759 | 2762 | 2764           | 2761 | 2766 | 2773        | 2771 | 2775 | 2804                | 2803 | 2804 | 2807                   | 2807 | 2807 | 2803          | 2801 | 2804 |
| 2 Jun  | 69,000           | 2807           | 2807 | 2807 | 2763      | 2763 | 2764 | 2767           | 2766 | 2768 | 2786        | 2785 | 2787 | 2803                | 2803 | 2803 | 2782                   | 2781 | 2782 | 2801          | 2801 | 2802 |
| 3 Jun  | 62,800           | 2805           | 2805 | 2806 | 2760      | 2760 | 2760 | 2764           | 2764 | 2765 | 2784        | 2784 | 2784 | 2801                | 2801 | 2802 | 2780                   | 2780 | 2781 | 2800          | 2799 | 2800 |
| 4 Jun  | 54,600           | 2803           | 2803 | 2804 | 2755      | 2754 | 2756 | 2760           | 2760 | 2761 | 2783        | 2782 | 2784 | 2797                | 2797 | 2798 | 2780                   | 2779 | 2780 | 2796          | 2795 | 2796 |
| 5 Jun  | 46,100           | 2801           | 2801 | 2802 | 2749      | 2748 | 2750 | 2756           | 2755 | 2757 | 2780        | 2779 | 2780 | 2794                | 2793 | 2794 | 2777                   | 2777 | 2778 | 2792          | 2791 | 2792 |
| 6 Jun  | 39,600           | 2800           | 2800 | 2801 | 2745      | 2744 | 2745 | 2753           | 2753 | 2753 | 2778        | 2778 | 2779 | 2790                | 2789 | 2791 | 2775                   | 2775 | 2776 | 2785          | 2784 | 2787 |
| 7 Jun  | 38,300           | 2798           | 2797 | 2798 | 2743      | 2742 | 2744 | 2752           | 2752 | 2753 | 2778        | 2779 | 2779 | 2789                | 2789 | 2789 | 2775                   | 2775 | 2775 | 2788          | 2788 | 2788 |
| 8 Jun  | 47,800           | 2798           | 2797 | 2799 | 2746      | 2745 | 2746 | 2754           | 2753 | 2755 | 2779        | 2779 | 2779 | 2791                | 2790 | 2791 | 2776                   | 2776 | 2777 | 2790          | 2789 | 2794 |
| 9 Jun  | 60,100           | 2803           | 2803 | 2804 | 2754      | 2754 | 2757 | 2760           | 2759 | 2762 | 2781        | 2780 | 2780 | 2783                | 2783 | 2783 | 2779                   | 2779 | 2780 | 2798          | 2798 | 2799 |
| 10 Jun | 57,100           | 2804           | 2803 | 2804 | 2755      | 2755 | 2756 | 2761           | 2760 | 2761 | 2782        | 2782 | 2783 | 2799                | 2798 | 2800 | 2780                   | 2780 | 2780 | 2797          | 2796 | 2798 |
| 11 Jun | 48,900           | 2801           | 2800 | 2801 | 2750      | 2750 | 2751 | 2758           | 2757 | 2758 | 2781        | 2780 | 2782 | 2796                | 2796 | 2797 | 2778                   | 2777 | 2779 | 2793          | 2792 | 2794 |

**Table 4. Hourly summary of American shad passage through the serpentine vertical notch fish ladder at the York Haven Hydroelectric Project in 2017.**

| Date                            | 24-May   | 25-May   | 26-May   | 27-May   | 28-May    | 29-May   | 30-May   | 31-May   | 1-Jun     | 2-Jun        | 3-Jun     |
|---------------------------------|----------|----------|----------|----------|-----------|----------|----------|----------|-----------|--------------|-----------|
| <b>Observation Time (Start)</b> | 0800     | 0800     | 0800     | 0800     | 0800      | 0800     | 0800     | 0800     | 0800      | 0800         | 0800      |
| <b>Observation Time (End)</b>   | 1600     | 1600     | 1600     | 1600     | 1600      | 1600     | 1600     | 1600     | 1600      | 1600         | 1600      |
| <b>Military Time (Hours)</b>    |          |          |          |          |           |          |          |          |           |              |           |
| <b>0800 - 0859</b>              | 0        | 0        | 0        | 1        | 0         | 3        | 0        | 0        | 0         | 4            | 0         |
| <b>0900 - 0959</b>              | 0        | 2        | 0        | 0        | 4         | 1        | 0        | 0        | 0         | 1            | 0         |
| <b>1000 - 1059</b>              | 0        | 0        | 0        | 0        | 3         | 3        | 1        | 1        | 1         | 0            | 1         |
| <b>1100 - 1159</b>              | 0        | 0        | 0        | 1        | 1         | 1        | 0        | 3        | 1         | 0            | 4         |
| <b>1200 - 1259</b>              | 0        | 1        | 0        | 0        | 2         | 1        | 0        | 0        | *         | 2            | 4         |
| <b>1300 - 1359</b>              | 0        | 0        | 0        | 1        | 0         | 0        | 0        | 0        | 0         | 0            | 1         |
| <b>1400 - 1459</b>              | 0        | 0        | 0        | 0        | 2         | 0        | 1        | 1        | 0         | 0            | 1         |
| <b>1500 - 1559</b>              | 0        | 0        | 0        | 0        | 1         | 0        | 1        | 0        | 0         | 1            | 0         |
| <b>Total Catch</b>              | <b>0</b> | <b>3</b> | <b>0</b> | <b>3</b> | <b>13</b> | <b>9</b> | <b>3</b> | <b>5</b> | <b>2</b>  | <b>8</b>     | <b>11</b> |
| Date                            | 4-Jun    | 5-Jun    | 6-Jun    | 7-Jun    | 8-Jun     | 9-Jun    | 10-Jun   | 11-Jun   | Total     | %            |           |
| <b>Observation Time (Start)</b> | 0800     | 0800     | 0800     | 0800     | 0800      | 0800     | 0800     | 0800     |           |              |           |
| <b>Observation Time (End)</b>   | 1600     | 1600     | 1600     | 1600     | 1600      | 1600     | 1600     | 1600     |           |              |           |
| <b>Military Time (Hours)</b>    |          |          |          |          |           |          |          |          |           |              |           |
| <b>0800 - 0859</b>              | 0        | 0        | 0        | 1        | 0         | 1        | 0        | 0        | <b>10</b> | <b>16.1</b>  |           |
| <b>0900 - 0959</b>              | 0        | 0        | 0        | 0        | 0         | 0        | 0        | 0        | <b>8</b>  | <b>12.9</b>  |           |
| <b>1000 - 1059</b>              | 0        | 0        | 1        | 0        | 0         | 0        | 0        | 0        | <b>11</b> | <b>17.7</b>  |           |
| <b>1100 - 1159</b>              | 0        | 0        | 0        | 0        | 0         | 0        | 0        | 1        | <b>12</b> | <b>19.4</b>  |           |
| <b>1200 - 1259</b>              | 1        | 0        | 0        | 0        | 0         | 0        | 0        | 0        | <b>11</b> | <b>17.7</b>  |           |
| <b>1300 - 1359</b>              | 0        | 0        | 0        | 0        | 0         | 0        | 0        | 0        | <b>2</b>  | <b>3.2</b>   |           |
| <b>1400 - 1459</b>              | 0        | 0        | 0        | 0        | 0         | 0        | 0        | 0        | <b>5</b>  | <b>8.1</b>   |           |
| <b>1500 - 1559</b>              | 0        | 0        | 0        | 0        | 0         | 0        | 0        | 0        | <b>3</b>  | <b>4.8</b>   |           |
| <b>Total Catch</b>              | <b>1</b> | <b>0</b> | <b>1</b> | <b>1</b> | <b>0</b>  | <b>1</b> | <b>0</b> | <b>1</b> | <b>62</b> | <b>100.0</b> |           |

\* Viewing gate closed to clean debris/sediment out of fishway exit gate pocket.

## FIGURES

Figure 1. General Layout of the York Haven Hydroelectric Project Showing the Location of the Fishway

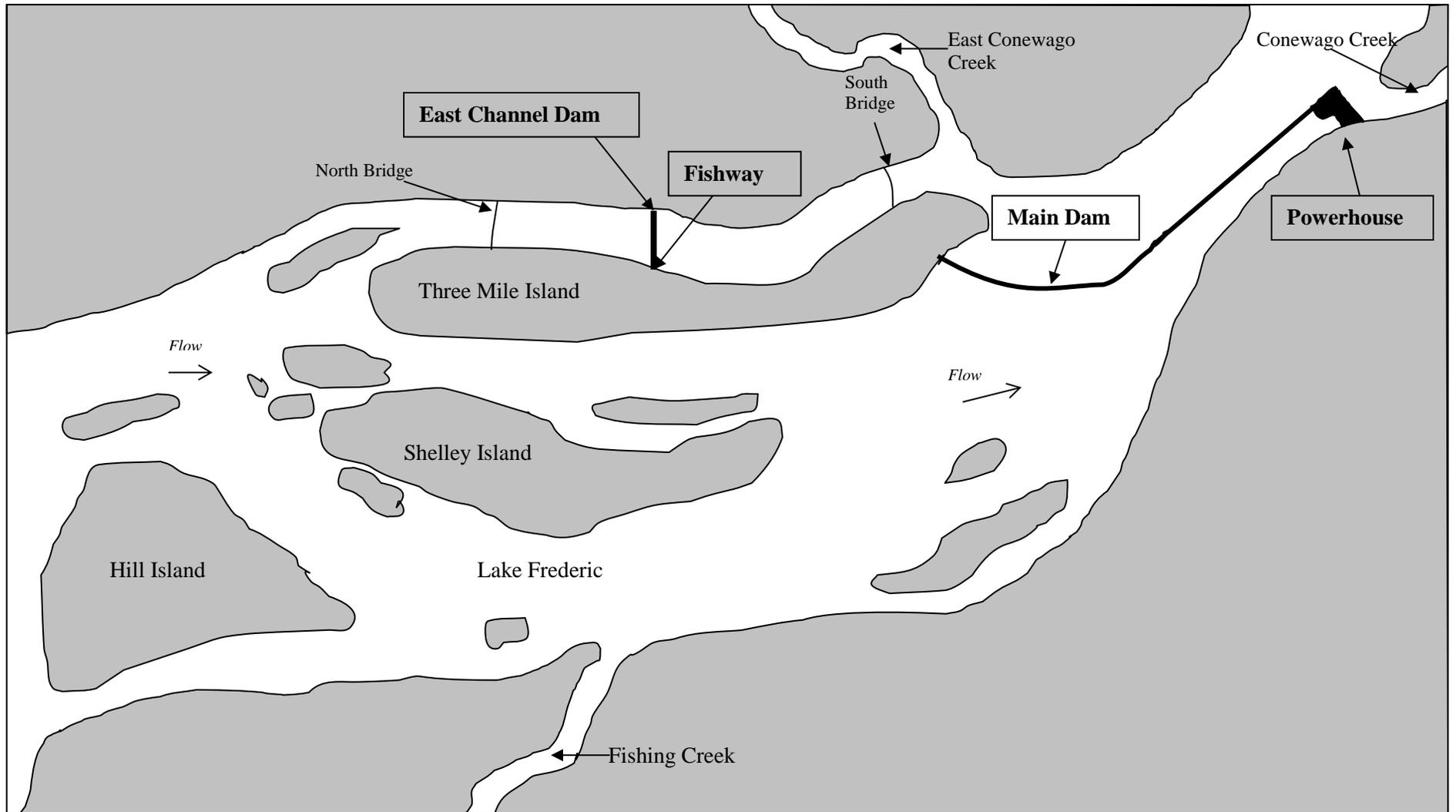


Figure 2. General Arrangement - York Haven Fishway

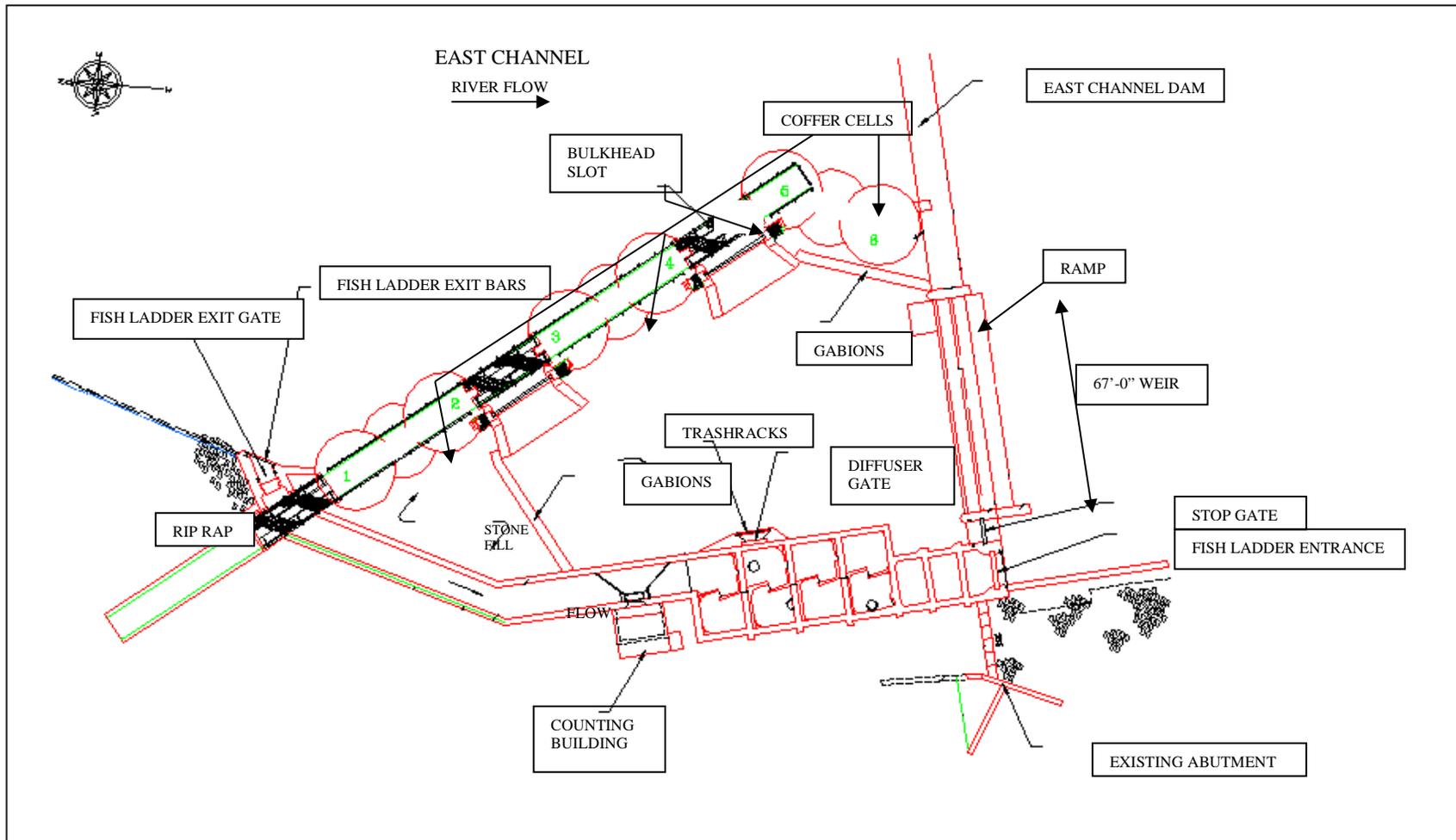


Figure 3. Plot of River Flow (x 1000 cfs) & Water Temperature (F) in Relation to the Daily American Shad Passage at the York Haven Fishway in Spring 2017

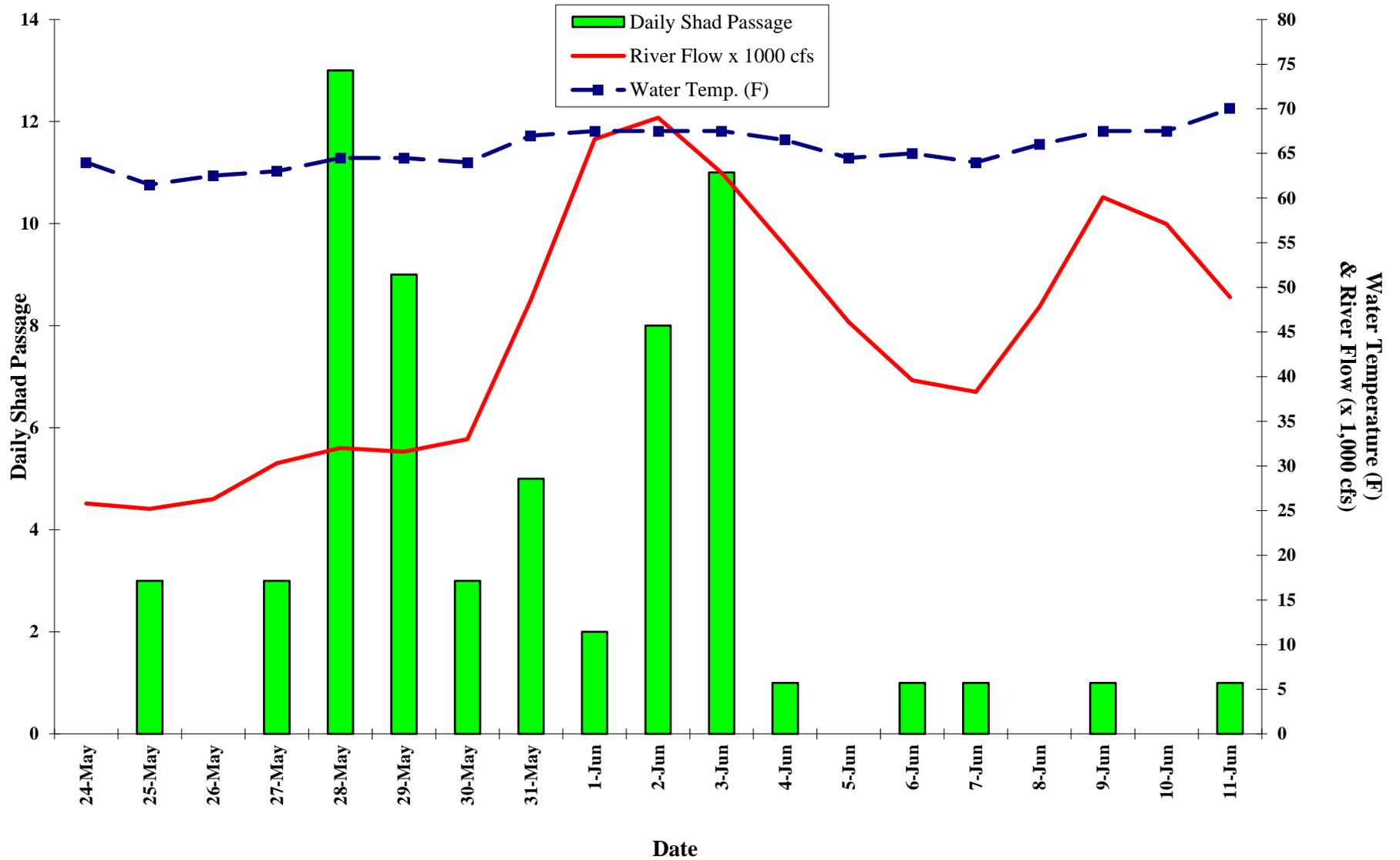


Figure 4. Plot of River Flow (x 1000 cfs) & East Channel Flow (x 1000 cfs) in Relation to the Daily American Shad Passage at the York Haven Fishway in Spring 2017

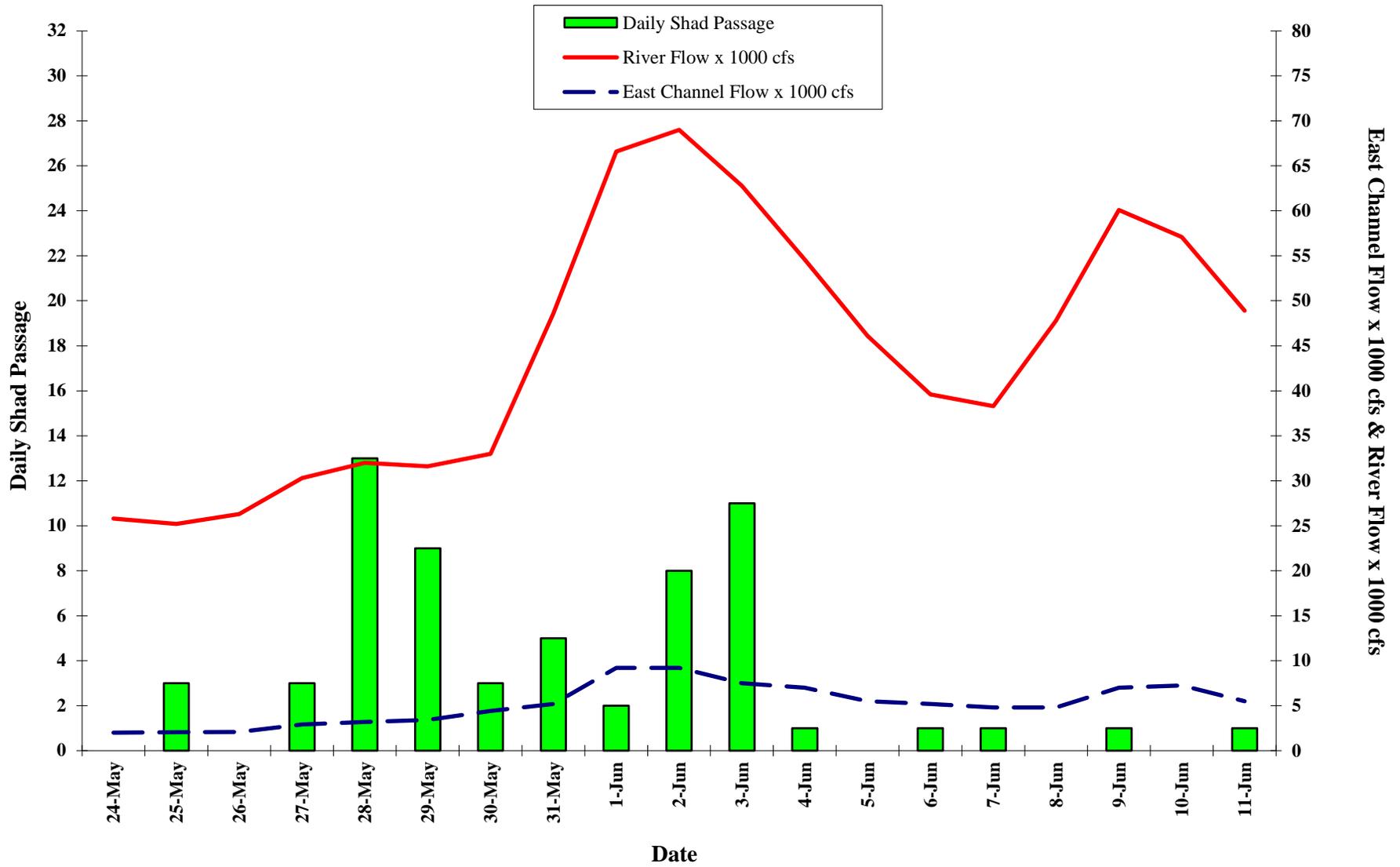


Figure 5. Plot of River Flow (cfs) at the USGS Harrisburg Station (#01570500) on the Susquehanna River and Average Daily Water Temperature at the York Haven Power Station, 1 October to 30 November, 2017

