Brookfield

Brookfield Renewable
Erie Boulevard Hydropower, L.P.
33 West 1st Street South
Fulton, New York 13069

Tel 315.593.3118
Fax 315.598.4831
www.brookfieldrenewable.com

August 13, 2018

VIA ELECTRONIC FILING

Honorable Kimberly D. Bose, Secretary
Federal Energy Regulatory Commission
888 First Street, NE
Washington DC 20426

West Canada Creek Hydroelectric Project (FERC No. 2701)
<u>Erie Response to FERC Additional Information Request - Volume I -Public Domain</u>

Dear Secretary Bose:

Erie Boulevard Hydropower, L.P. (Erie or Licensee), a Brookfield Renewable company, is the Licensee, owner and operator of the West Canada Creek Hydroelectric Project (FERC No. 2701) (Project). The West Canada Creek Project consists of two developments, Prospect and Trenton, and is located on West Canada Creek in Oneida and Herkimer counties, New York. The current license for the West Canada Creek Project expires on February 28, 2023. Erie is pursuing a new license for the Project using the Commission's Integrated Licensing Process (ILP). On February 28, 2018, Erie filed a Notice of Intent (NOI) and Pre-Application Document (PAD) with the Federal Energy Commission (FERC or Commission) to initiate the ILP.

On April 30, 2018, FERC issued a notice of the PAD and NOI filing and commencement of the pre-filing process and requested comments and study requests. FERC concurrently issued Scoping Document 1 (SD1) for the Project to identify the subject areas to be addressed in FERC's environmental analysis of the Project relicensing pursuant to the National Environmental Policy Act (NEPA). On May 30 and May 31, 2018, FERC held the agency and public scoping meetings at the Town of Trenton Municipal Center in Barneveld, New York, and a site visit on May 30, 2018 at the Project. Comments on the PAD and study requests were due on June 29, 2018.

By letter dated June 28, 2018, FERC submitted an Additional Information Request (AIR) and comments on the PAD to Erie, requesting that Erie provide additional information FERC deemed necessary to adequately assess potential project effects on environmental resources (see Attachment A). FERC requested that Erie provide responses to the AIR with the PSP, unless otherwise specified in the additional information request.

Following are Erie's responses to FERC's Schedule A – Comments on the PAD and Additional Information, as requested in FERC's letter dated June 28, 2018. Public domain attachments referenced in the AIR response are provided as referenced. Some of the information included in Erie's AIR response is Privileged Information as defined by the Commission at 18 CFR § 388.112, and this information has been removed from the public version of the AIR response.

In accordance with the Commission's filing guidelines, all Privileged is included in a separate filing that has been clearly labeled as Privileged. Referenced attachments that contain Privileged Information are provided under separate cover in Volume II, as referenced.

FERC AIR 1: *On page 4-4 of the PAD, you state that the main spillway is a 306-foot-long by 45- foot-high concrete overflow spillway. However, the 1983 License Order describes the Prospect Dam as a 306-foot-long and 52-foot-high concrete overflow dam. Please clarify the dimensions of the concrete overflow dam.*

Erie Response

The Prospect main concrete overflow dam is 306-feet-long by approximately 45-feet-high. The height of the dam is measured from an average toe elevation of 1,117.0 ft. to the top of the flashboards in the needle beam bays, elevation 1,162.3 ft.

FERC AIR 2: *On page 4-8 of the PAD, you state that the Trenton Dam is a 288-foot-long by approximately 55-foot-high concrete and masonry dam. However, the 1983 License Order describes the Trenton Dam as a 288-foot-long and 60-foot-high concrete and masonry dam. Please clarify the dimensions of the concrete and masonry dam.*

Erie Response

The Trenton main concrete dam is 288-feet-long by approximately 61-feet-high. The height of the dam is measured from an average toe elevation of 966.0 ft to the top of the parapet wall on the non-overflow section, elevation 1,026.9 ft.

FERC AIR 3: *On page 4-4 of the PAD, you state that Prospect's dependable capacity is 11.2 megawatts (MW) for the summer period and 13.5 MW for the winter period. So that staff can calculate the annual power cost, please provide the average duration (days) of the summer and winter periods.*

Erie Response

According to the New York Independent System Operator (NYISO) Load & Capacity Data Report (NYISO 2017), the summer capability period is from May 1 to October 31, or 184 days, and the winter capability period is from November 1 of the current year to April 30 of the next year, or 181 days.

References

New York Independent System Operator (NYISO). 2017. Load & Capacity Data Report. Available: http://www.nyiso.com/public/webdocs/markets_operations/services/planning/Documents_and_Resources/Planning_Data_and_Reference_Docs/Data_and_Reference_Docs/2017_Load_and_Capacity_Data_Report.pdf.

FERC AIR 4: *On page 4-8 of the PAD, you state that Trenton's dependable capacity is 20.8 MW for the summer period and 23.2 MW for the winter period. So that staff can calculate the annual power cost, please provide the average duration (days) of the summer and winter periods.*

Erie Response

According to the NYISO Load & Capacity Data Report (NYISO 2017), the summer capability period is from May 1 to October 31, or 184 days, and the winter capability period is from November 1 of the current year to April 30 of the next year, or 181 days.

References

New York Independent System Operator (NYISO). 2017. Load & Capacity Data Report. Available: http://www.nyiso.com/public/webdocs/markets_operations/services/planning/Documents_and_Resources/Planning_Data_and_Reference_Docs/Data_and_Reference_Docs/2017_Load_and_Capacity_Data_Report.pdf.

FERC AIR 5: *On page 4-13 of the PAD, you state that Hinckley Reservoir is operated in accordance with the 2012 Operating Diagram and governed by legally binding agreements between the New York State Canal Corporation (Canal Corporation), Mohawk Valley Water Authority, and Erie Boulevard Hydroelectric, L.P. (Erie). So that staff can better understand the past and present flow regulation and hydropower operation in West Canada Creek, please provide a copy of the current operating agreement as well as any previous operating agreements between Erie and the Canal Corporation. In addition, please describe the purpose of the most recent operating agreement and 2012 Operating Diagram and why Erie's previous agreement with the Canal Corporation was updated.*

Erie Response

Erie contacted FERC staff to request a 90-day extension for the filing of the response to AIR items 5 and 8 and received clarification that Erie could provide an update on the anticipated date for filing of the AIR responses (correspondence with Nick Ettema, FERC on August 6, 2018).

Erie is reviewing information pertaining to AIR 5 and 8 and will include FERC's requested information on or before November 11, 2018.

FERC AIR 6: *On page 5-57 of the PAD, you describe the Fisherman Alert System at the Trenton Development. However, no information is provided regarding the alert system at the Prospect Development that was observed during the environmental site review. Please describe the existing alert systems and alert procedures in detail for both developments. Please provide an approximate maximum range for the sirens at both developments.*

Erie Response

Prospect Development Alert System

Erie maintain a programmable logic controller (PLC) controlled public safety siren/strobe combination at the Prospect dam. The alert system is programmed to activate the siren and strobe with the operation and movement of the Prospect Tainter gates. In addition, Erie personnel visibly check the Prospect bypass reach prior to initially opening the Tainter gates.

Erie conducted a test on July 16, 2018, to identify the approximate audible range of the sirens at both Prospect and Trenton developments. The weather was sunny with light winds and temperature of approximately 85 degrees. At the Prospect Development, the siren could be heard in the Prospect bypass reach gorge approximately 0.6 miles downstream of the Prospect dam.

Trenton Development Alert System

Erie maintains a Fishermen Alert System (FAS) below the Trenton Powerhouse. The FAS includes one siren/strobe combination located at the Trenton Powerhouse, one siren/strobe combination adjacent to Nine Mile Creek Feeder Dam, and one solar powered strobe located on Dover Bridge. The FAS is activated prior to loading any unit or increasing the flow out of the Trenton Powerhouse. Additionally, the FAS is activated prior to releasing any flows at the Trenton Dam. The system is equipped with a PLC that will either sound the siren or light the strobe. During daylight hours (6 am to 9 pm) the PLC is programmed to activate both the siren and the strobe. During night time hours (9 pm to 6 am) the PLC will activate only the strobe and not the siren to minimize the disturbance to local residents during times when they may be sleeping. The FAS can be activated by operations personnel located at Trenton Falls Station, or via a Supervisory Control and Data Acquisition (SCADA) command originated from the North American System Control Center (NASCC). In addition, Erie personnel visibly check the bypass reach prior to initially opening the flood gate.

Erie conducted a test on July 16, 2018, to identify the approximate audible range of the sirens at both Prospect and Trenton developments. The weather was sunny with light winds and temperature of approximately 85 degrees. At the Trenton Development, the siren could be heard downstream in the West Canada Creek approximately 0.8 miles downstream of the Trenton station.

Waterline

Erie provides information regarding flow releases at the Trenton Powerhouse via Waterline, a publicly accessible website and toll-free phone line. Waterline is updated daily and based on river gauge information and calculated estimated flows. The Waterline information provides general river flow conditions and forecasts. The information is based on approximate forecasts and actual flows can vary and change quickly at any time. The Waterline information should be used as an additional source of information and reference of potential flow changes. Users are encouraged to always be alert and wear an approved flotation device and to never go in or near the water until the user knows and accepts the risks in the area (Waterline 2018).

References

Waterline. 2018. Waterline Website – West Canada Creek at Trenton Falls. Available: http://www.h2oline.com/default.aspx?pg=si&op=365124 Accessed July 2018.

FERC AIR 7*: On pages 5-25 to 5-26 of the PAD, you describe habitat conditions for fish downstream of the Trenton Falls Development based on existing studies. So that staff can adequately review existing information regarding fish habitat downstream of the Trenton Falls Development, please file a copy of the existing studies including Niagara Mohawk Power Company's 1981 Habitat-Flow Assessment, Icthyological Associates' 1981 Fish Habitat-Flow Relationship study, and Icthyological Associates' 1981 Temperature Monitoring study.*

Erie Response

Attachment B provides a copy of:

Ichthyological Associates Inc. 1981a. Fish Habitat-Flow Relationship at Six Study Releases Below Trenton Hydroelectric Station on West Canada Creek, New York, During August and September 1980, Prepared by Ichthyological Associates Inc., for Niagara Mohawk Power Corporation, February 1981.

Ichthyological Associates Inc. 1981b. Temperature Monitoring, West Canada Creek, Oneida and Herkimer Counties, New York, June-September 1980. Prepared by Ichthyological Associates Inc., for Niagara Mohawk Power Corporation, February 1981.

FERC AIR 8*: At the public scoping meeting on May 30, 2018, a member of the public inquired about the effects of the removal of Gray's Reservoir, a reservoir previously located upstream of Hinckley Reservoir on Black Creek, on downstream hydropower operations. So that staff can evaluate potential cumulative effects of the elimination of Gray's Reservoir on flows in West Canada Creek, please describe any changes in flow releases or hydropower operation at the West Canada Creek Project as a result of the removal of Gray's Reservoir.*

Erie Response

Erie contacted FERC staff to request a 90-day extension for the filing of the response to AIR items 5 and 8 and received clarification that Erie could provide an update on the anticipated date for filing of the AIR responses (correspondence with Nick Ettema, FERC on August 6, 2018). Erie is reviewing information pertaining to AIR 5 and 8 and will include FERC's requested information on or before November 11, 2018.

FERC AIR 9*: Table 5-15, on page 5-36 of the PAD, lists the acreage and specific classifications for National Wetland Inventory (NWI) mapped wetlands in the project area. This table and figure 5-6 on page 5-37, indicate that 0.19 acre of wetlands occur in the Prospect Development area of the project boundary which has a daily reservoir fluctuation of up to 5 feet. However, during the environmental site review, staff observed a small wetland near the Prospect boat launch that was not included in the NWI map. It is not clear if the NWI map is capturing all the wetlands in the project boundary. Therefore, please include a ground-truthing component of the NWI map as part of your proposed aquatic habitat mapping study described on page 6-5 of the PAD.*

Erie Response

As described in the West Canada Creek Project PSP, Erie has included a ground-truthing task of the National Wetlands Inventory (NWI) and New York State Department of Environmental Conservation (NYSDEC) wetlands data for lands within the Project boundary shoreline fluctuation zones as a component of Erie's proposed Aquatic Mesohabitat Assessment Study and proposed Impoundment Shoreline Characterization Study. Erie will include relevant data pertaining to wetlands within the project boundary as part of the Initial Study Report and the license application.

FERC AIR 10*: At the public scoping meeting on May 30, 2018, New York State Department of Environmental Conservation staff stated that there was a known bald eagle nest near the Prospect Development. However, you do not provide any information about this nest in your PAD. So that Commission staff can determine the potential effects of continued project operation on bald eagles, please include a map in your license application indicating the location of the known bald eagle nest and its distance from the project boundary. Please file this information as privileged.*

Erie Response

On July 9, 2018, Erie contacted the NYSDEC, Division of Fish and Wildlife in order to obtain information regarding the presence of bald eagle nests within the project boundary of the West Canada Creek Project. On July 10, 2018, Andy MacDuff, Regional Wildlife Manager, Division of Fish and Wildlife, NYSDEC provided information regarding a known bald eagle nest in the vicinity of the existing project boundary. Erie is filing with FERC as Privileged Information Attachment C, providing a copy of the correspondence with NYSDEC, as well as a map denoting the approximate location of any identified bald eagle nests in the Project vicinity as indicated by the NYSDEC. Erie will provide any additional information as part of its draft license application and will file any additional information as Privileged Information.

FERC AIR 11*: So that staff can better understand historic resources at the project, please provide a more detailed description of the project's history, including a timeline of development. Although the project was not licensed by the Commission until 1983, please start the timeline with construction of the original power station in 1901. Within the timeline, please also include a description of all redevelopment and rehabilitation activities that have occurred during the project's history, including the dates of construction of the dams and any associated facilities. Additionally, there is little information in the project record that describes the circumstances behind Niagara Mohawk Power Corporation seeking a Commission license in 1983 for an 80-year-old project. If this information is available, please provide it. Finally, please file a copy of the 1993 Historic American Engineering Record (HAER) for the Trenton Development. This information can be provided in the draft license application/preliminary licensing proposal that is due in October 2020.*

Erie Response

Erie is reviewing the West Canada Creek Project's history and will include FERC's requested timeline and information pertaining to the circumstances behind Niagara Mohawk Power Corporation seeking a Commission license in 1983 for an 80-year-old project as part of, or before the filing of the Project's draft license application/preliminary licensing proposal filing on October 1, 2020. Erie is filing with FERC as Privileged Information, Attachment D that provides the Historic American Engineering Record (HAER) reports (HAER 1993a, 1993b) for the Trenton Falls Hydroelectric Station.

References

Historic American Engineering Record (HAER). 1993a. HAER NY-155, Trenton Falls Hydroelectric Station, Oneida County, New York, 1993. Available: https://www.loc.gov/item/ny1368/ Accessed December 2017.

Historic American Engineering Record (HAER). 1993b. HAER NY-155-B, Trenton Falls Hydroelectric Station, Oneida County, New York, 1993. Available: https://www.loc.gov/item/ny1984/

FERC AIR 12*: On page 5-77 of the PAD, you state that a cultural resources survey was performed in 1978 by Pratt and Pratt Archeological Consultants as part of the previous redevelopment at the Trenton Development. So that staff can understand the extent of the only cultural resources survey that has been completed at that development, please provide a copy of any report(s) from that survey. The thoroughness of the report(s) will help staff determine if additional cultural resources surveys of the project are necessary.*

Erie Response

Pratt and Pratt Archeological Consultants (Pratt and Pratt) conducted a field inspection of the Project in October and November 1978. The work for the report took place during August through November which included literature search and field inspection. Erie is filing with FERC as, Privileged Information, Attachment E that provides the Pratt and Pratt (1978) Cultural Resources Survey associated with the West Canada Creek Project.

Erie received notification from the Oneida Indian Nation (email dated April 4, 2018, from Jesse Bergevin, Historic Resources Specialist, that the Oneida Indian Nation has no comments or concerns regarding the Project (see documentation of correspondence in Attachment F).

In addition, please see response to AIR 11 and referenced HAER documentation for Trenton Station, and response to AIR 13 and referenced Attachments. Erie is reviewing Project files and will provide any additional discovered cultural resources surveys or reports associated with the Project as part of, or before the filing of the Project's draft license application/preliminary licensing proposal filing on October 1, 2020.

<u>References</u>

Pratt and Pratt Archeological Consultants. 1978. Cultural Resources Survey of the Proposed Trenton Redevelopment Project.

FERC AIR 13*: As stated in the PAD, the licensee, in partnership with the Town of Trenton, has provided controlled public access to view the scenic Trenton Falls Gorge for 1 or 2 weekends in the spring and the fall annually since 2007 via the Trenton Falls Scenic trails. The primary trail is a 0.75-mile-long crushed stone trail that starts at the Trenton Falls facility entrance/parking area, passes adjacent to project facilities, traverses along sections of the project penstock, and ends at the Trenton Falls Hydro Dam Overlook. There also are two wood mulch secondary trails (totaling approximately 0.5 mile), that provide views of the lower high falls and upper high falls, and an additional four wood mulch secondary trails (totaling approximately 0.6 mile) through a wooded and meadow landscape and a picnic area in the general vicinity of the primary trail.*

On page 5-53 of the PAD, you state that the Trenton Falls Scenic Trail "traverses along adjacent areas of historic interest, such as the site of the historic Trenton Falls Hotel;" however, none of these historic sites are identified or discussed further in the PAD. In addition, at the May 30, 2018 environmental site review, it was mentioned that the Trenton Falls Scenic Trail also traverses adjacent to a cemetery; however, that cemetery is not mentioned in the PAD. So that staff can better understand the archaeologic and historic setting of the project area, please provide a list of any archaeological or historic areas of interest that are located along or adjacent to the Trenton Falls Scenic Trail, a description of the areas, and where the areas are located in relation to the project boundary. Please also conduct a search of the New York State Cultural Resources Information System for the area along and adjacent to the Trenton Falls

Scenic Trail in order to identify whether there are any archeological sites, New York State and National Register of Historic Places (National Register)-listed properties, properties determined eligible for the National Register, and/or previous cultural resources surveys identified in this area. Although the area of potential effect (APE), as required under section 106 of the National Historic Preservation Act [36 CFR Part 800.16(d)], has not yet been defined, the trail provides public access to the project and should be considered to be within any APE that will be defined. As a result, if the information requested above is unavailable, additional studies may be necessary to identify cultural resources and determine project effects within the APE, including along the Trenton Falls Scenic Trail.

Erie Response

Following is the response to additional information pertaining to the site of the historic hotel and the Sherman Moore Cemetery. Erie is filing with FERC as Privileged Information, Attachment G, the response to the Cultural Resource Information System (CRIS) review.

Both the Sherman Moore Cemetery and the site of the former Moore Hotel are located along Sherman Moore Cemetery Trail (Trail Number 2) as depicted on Figure 1. The Sherman Moore cemetery is the final resting place of the Sherman and Moore family members. The site of the historic hotel is the location of the former Rural Resort opened in 1823, then converted in 1851 and renamed Moore Hotel, then converted and renamed Hotel Trenton in 1902, and subsequently dismantled in 1945.

Following (see Table 1) is general timeline and brief summary of Trenton Falls history relative to John Sherman, the former hotel and the Sherman Moore Cemetery. John Sherman, "The Father of Trenton Falls," began his lifetime fascination with the falls as a visitor in 1806. Within several years, John Sherman purchased land (approximately 60 acres) on the west bank and in 1822, he built a cottage that evolved into the family residence and a lodge for day visitors, called the Rural Resort.

After John Sherman's death in 1828, Michael Moore married John Sherman's daughter Maria in 1831, and takes over the management of the Rural Resort. Due to increased patronage, Michael Moore constructed the Moore's Hotel to replace the smaller Rural Resort in 1851. Maria Sherman Moore and Michael Moore, continued the operation and built Moore's Hotel, beginning the golden age of Trenton Falls. During the next several decades, it attracted many notables of the period, including artists, writers, reporters, politicians, geologists, and palynologists.

In 1863, William Seward, the Secretary of State under President Lincoln, organized a tour for foreign diplomats to show them the extent of the north's resources, and to convince them that the Union Army would win the Civil War. Seward invited the diplomats to stay at Moore Hotel and to view Trenton Falls (Cornell, et al 2004). See Photo 1 and Photo 2 of the historic marker commemorating this event.

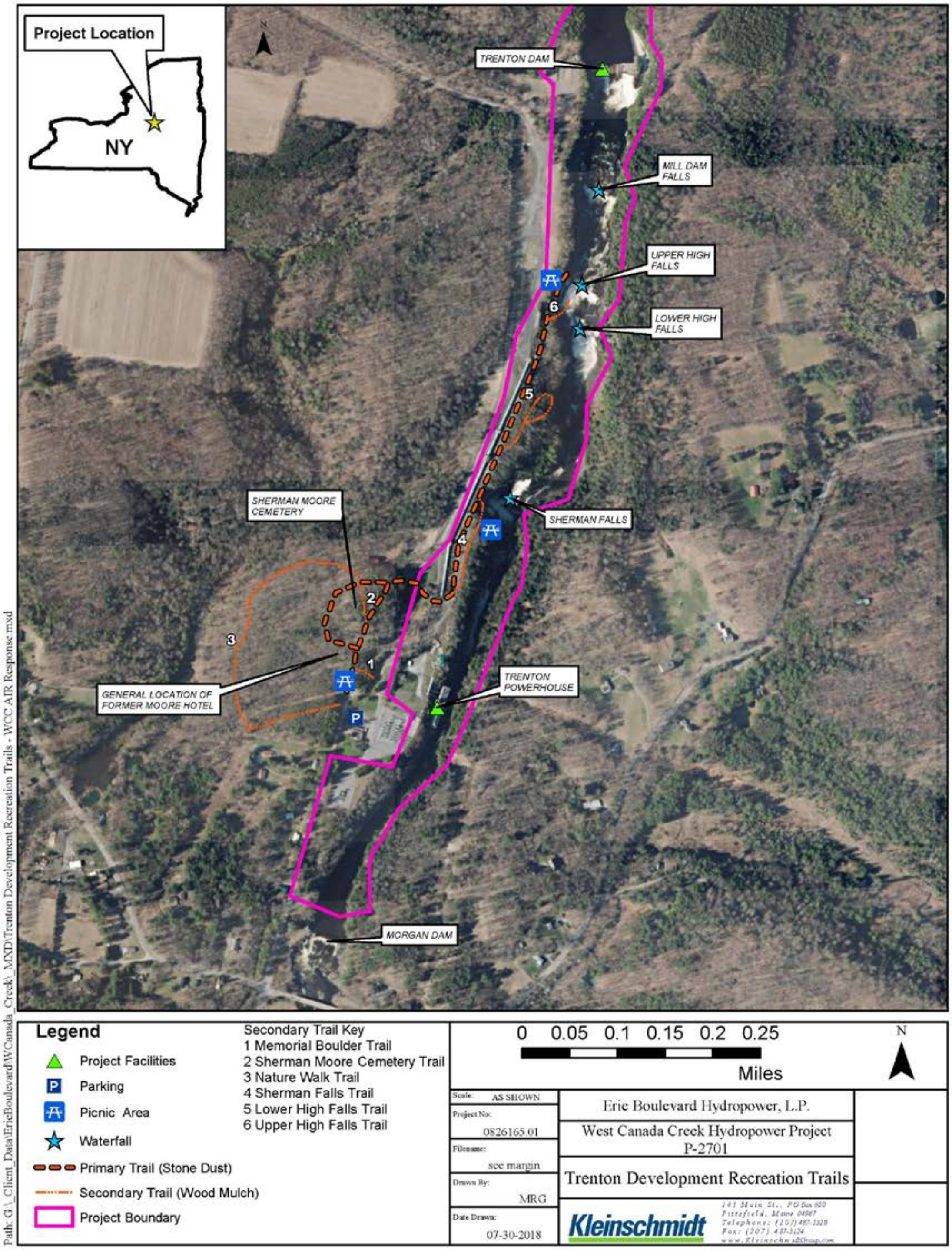


FIGURE 1 LOCATION OF SHERMAN MOORE CEMETERY AND FORMER HOTEL SITE

TABLE 1 FORMER HOTEL AND SHERMAN MOORE CEMETERY TIMELINE OF KEY EVENTS

DATE	EVENT
1805	John Sherman first visits the falls and views it from “Carmichael’s Point”. This is an overlook on the west bank overlooking High Falls
1822 - 1825	John Sherman purchases 60 acres of land along Trenton Falls Gorge and opens a small commercial enterprise, The Rural Resort.
1828	Death of John Sherman and burial in cemetery (now known as Sherman Moore Cemetery) which subsequently additional family members were buried
1831	Michael Moore marries Sherman’s daughter Maria and takes over the management of the resort.
1851	Increased patronage led Moore to construct Moore’s Hotel to replace the smaller Rural Resort.
1855	Mohawk and Malone Railroad reaches the Town of Trenton. The railroad delivers thousands of visitors to the gorge each year.
1863	Secretary of State William Seward hosts a meeting of diplomats from seven nations.
1897 - 1901	The Utica Electric Light and Power Company acquires Moore’s hotels and lands and secures water rights to West Canada Creek and begins construction of the Trenton dam and powerhouse
1902	Moore’s Hotel reopened as Trenton Hotel
1923	Trenton Hotel converted to recreation club for power company employees
1945	Recreation club dismantled after roof collapse

By the late 1880’s, however, additional new transportation improvements enabled the Adirondacks and the St. Lawrence River’s Thousand Islands to be more accessible, and tourism interest at Trenton tapered off (HAER 1993a, 1993b) The Moore Hotel closed in 1899 when the property was sold to Utica Electric Light and Power Company for the hydroelectric development. Moore Hotel was renovated and reopened as in 1902, as Hotel Trenton, but due to lack of visitors, the hotel was partially dismantled and converted to a recreation club for the power company employees in 1923. In 1945, heavy snow collapsed the roof of the remaining structure, and the remaining structure was then dismantled. See Photo 3 for a historic picture of the Moore Hotel and Photo 4 for current view of the site of the former hotel.

At his request, John Sherman was buried at the top of the hill in the cemetery. Also buried in the cemetery are various members of the Sherman and Moore families, including Michael Moore. John Sherman’s wife, three of his children, two grandchildren, two great-grandchildren, and a dedicated employee of 40 years are also buried at the cemetery. See Photo 5 for picture of cemetery and Photo 6 for interpretive signage at the Project describing the cemetery and information about the Sherman and Moore family.

PHOTO 1 HISTORIC MARKER

PHOTO 2 LOCATION OF HISTORIC MARKER

PHOTO 3 HISTORIC PICTURE OF MOORE HOTEL

PHOTO 4 CURRENT VIEW OF THE SITE OF THE FORMER MOORE HOTEL

PHOTO 5 SHERMAN MOORE CEMETERY

References

Cornell, Sean R., Carlton E. Brett, and Frances R. Caudill. 2004. Social History of the Trenton Falls Area, part of Geologic Overview of the Trenton Group at West Canada Creek, New York, as part of the work supported by the National Science Foundation under Grant No. 9987499, Harvard University. Available at: https://trenton.mcz.harvard.edu/ Accessed July 2018.

Historic American Engineering Record (HAER). 1993a. HAER NY-155, Trenton Falls Hydroelectric Station, Oneida County, New York, 1993. Available: https://www.loc.gov/item/ny1368/ Accessed December 2017.

Historic American Engineering Record (HAER). 1993b. HAER NY-155-B, Trenton Falls Hydroelectric Station, Oneida County, New York, 1993. Available: https://www.loc.gov/item/ny1984/

Pratt and Pratt Archeological Consultants. 1978. Cultural Resources Survey of the Proposed Trenton Redevelopment Project.

New York State Office of Parks, Recreation and Historic Preservation (NYOPRHP). 2018. 2018. Cultural Resource Information System (CRIS). Available: https://cris.parks.ny.gov/ Accessed July 2018

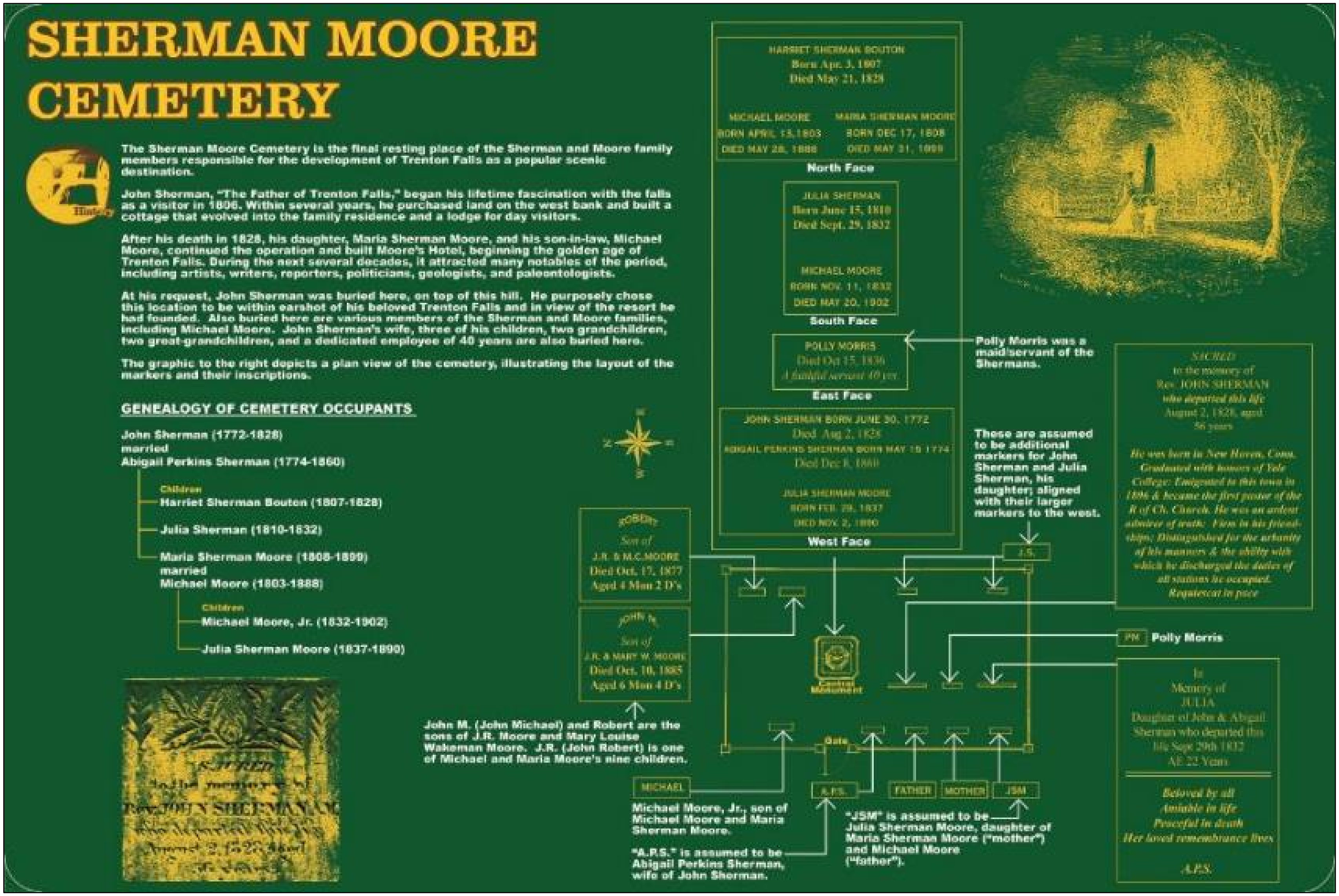


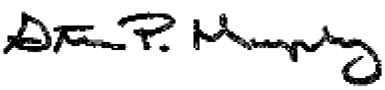
PHOTO 6 MOORE CEMETERY INTERPRETIVE SIGN

Summary

The public domain AIR electronic files can be downloaded through FERC's eLibrary at https://www.ferc.gov/docs-filing/elibrary.asp by searching under the Project's docket P-2701, and can also be downloaded from the Project's relicensing website at: http://www.westcanadacreekproject.com.

Erie looks forward to working with FERC staff, agencies, Indian tribes, local governments, non-governmental organizations, and members of the public to develop a license application and supporting record that fully meets regulatory requirements in relicensing of the West Canada Creek Project. If you have any questions concerning this AIR filing, or need additional information, please contact me at (315) 598-6130 or via email at steven.murphy@brookfieldrenewable.com.

Sincerely,



Steven Murphy
Director, Licensing
Brookfield Renewable

Attachments: AIR Response – Volume I
cc: Distribution List
Jon Elmer
Pat Storms
Rick Heysler

West Canada Creek Hydroelectric Project (P-2701)
Distribution List

Federal Governmental Agencies

John Eddins
Archaeologist/Program Analyst
Advisory Council on Historic Preservation
Office of Federal Agency Programs
401 F Street NW, Suite 308
Washington, DC 20001-2637
jeddins@achp.gov

Bruce Maytubby
Bureau of Indian Affairs
Eastern Regional Office
545 Marriott Drive, Suite 700
Nashville, TN 37214
Bruce.Maytubby@bia.gov

John Bullard
National Oceanic and Atmospheric Administration
Greater Atlantic Regional Fisheries Office
55 Great Republic Drive
Gloucester, MA 01930-2276
John.Bullard@noaa.gov

Joseph Seebode
Deputy District Engineer
U.S. Army Corps of Engineers, New York District
26 Federal Plaza
New York, NY 10278-0090

Andrew Raddant
Regional Environmental Officer
U.S. Department of the Interior
Office of Environmental Policy and Compliance, Northeast Region
15 State Street, 8th Floor
Boston, MA 02109
andrew_raddant@ios.doi.gov

Andrew Tittler
Agency Counsel
U.S. Department of the Interior
One Gateway Center
Suite 612
Newton, MA 02458
andrew.tittler@sol.doi.gov

Peter Lopez
Deputy Regional Administrator
U.S. Environmental Protection Agency, Region 2
290 Broadway
New York, NY 10007-1866
lopez.peter@epa.gov

David Stilwell
U.S. Fish and Wildlife Service
New York Field Office, Region 5
3817 Luker Road
Cortland, NY 13045
david_stilwell@fws.gov

Steve Patch
U.S. Fish and Wildlife Service
New York Field Office, Region 5
3817 Luker Road
Cortland, NY 13045
stephen_patch@fws.gov

John Wiley
U.S. Fish and Wildlife Service
New York Field Office, Region 5
3817 Luker Road
Cortland, NY 13045
john_wiley@fws.gov

Kevin Mendik
Environmental Protection Specialist
U.S. National Park Service
15 State Street
Boston, MA 02109
Kevin_Mendik@nps.gov

Duncan Hay
National Park Service, Northeast Region
15 State Street
Boston, MA 02109
duncan_hay@nps.gov

State Governmental Agencies

Jonathan Binder
Chief, Energy and Climate Change Section
Office of General Counsel, New York State
Department of Environmental Conservation
625 Broadway
Albany, NY 12233-0001
jonathan.binder@dec.ny.gov

Chris Hogan
New York State Department of
Environmental Conservation
625 Broadway, 4th Floor
Albany, NY 12233
cmhogan@gw.dec.state.ny.us

Todd Phillips
New York State Department of
Environmental Conservation
Division of Environmental Permits, Region
6 Utica Sub Office
207 Genesee Street
Utica, NY 13501
todd.phillips@dec.ny.gov

Terry Tyoe
Regional Permit Administrator
New York State Department of
Environmental Conservation
Division of Environmental Permits, Region
6 Utica Sub Office
Utica State Office Building
207 Genesee Street, Room 1404
Utica, NY 13501-2885
dep.r6@dec.ny.gov

Sita Crounse
Office of General Counsel, New York State
Department of Environmental Conservation
625 Broadway
Albany, NY 12207
Sita.Crounse@dec.ny.gov

Russell McCullough
Acting Regional Fisheries Manager
New York State Department of
Environmental Conservation
317 Washington Street
Watertown, NY 13601
russell.mccullough@dec.ny.gov

Richard McDonald
Aquatic Biologist
New York State Department of
Environmental Conservation
317 Washington Street
Watertown, NY 13601
richard.mcdonald @dec.ny.gov

David Erway
Aquatic Biologist
New York State Department of
Environmental Conservation
Utica, NY 13501
david.erway@dec.ny.gov

Matt Walter
Habitat Biologist
New York State Department of
Environmental Conservation
207 Genessee Street
Utica, NY 13501
matthew.walter@dec.ny.gov

Christopher Balk
Habitat Manager
New York State Department of
Environmental Conservation
317 Washington Street
Watertown, NY 13601
christopher.balk@dec.ny.gov

West Canada Creek Hydroelectric Project (P-2701)
Distribution List

Thomas Vigneault
Regional Water Engineer
New York State Department of
Environmental Conservation
Utica, NY 13501
thomas.vigneault@dec.ny.gov

Hon. Kathleen H. Burgess
Secretary to the Commission
New York State Public Service Commission
Empire State Plaza
Agency Building 3
Albany, NY 12223-1350
secretary@dps.ny.gov

James Denn
Public Information Officer
New York State Public Service Commission
Empire State Plaza
Agency Building 3
Albany, NY 12223-1350
james.denn@dps.ny.gov

Mark E. Slade
Director, Licensing
New York Power Authority
123 Main Street
White Plains, NY 10601
Mark.Slade@nypa.gov

John Callaghan
Acting Executive Deputy Director of Canals
New York State Canal Corporation
30 S. Pearl Street, 5th Floor
Albany, NY 12207
John.Callaghan@canals.ny.gov

Howard Goebel, PE,PH
Deputy Director
New York State Canal Corporation
30 S. Pearl Street
Albany, NY 12207

Thomas McDonald, PE
Professional Engineer II (C/E)
New York State Canal Corporation
30 S. Pearl Street
Albany, NY 12207-2058

Rose Harvey
Commissioner
New York State Office of Parks, Recreation,
& Historic Preservation
Empire State Plaza
Agency Building 1
Albany, NY 12238
Rose.Harvey@parks.ny.gov

Michael Lynch
Division Director
New York State Division for Historic
Preservation
Peebles Island State Park
P.O. Box 189
Waterford, NY 12188-0189

Joanne Mitchell
Assistant Regional Manager
New York State Office of Parks, Recreation,
& Historic Preservation
Central Regional Office
6105 E. Seneca Turnpike
Jamesville, NY 13078

Matthew Maraglio
Coastal Review Specialist
New York Department of State
Office of Coastal, Local Government, and
Community Sustainability
One Commerce Plaza
99 Washington Avenue
Albany, NY 12231-0001
Matthew.Maraglio@dos.ny.gov

West Canada Creek Hydroelectric Project (P-2701)
Distribution List

Jeffrey Zappieri
Supervisor
New York Department of State
Division of Coastal Resources, Consistency Review Unit
One Commerce Plaza
99 Washington Avenue
Albany, NY 12231-0001
Jeffrey.zappieri@dos.state.ny.us

Legislative Bodies

Kirsten Gillibrand
U.S. Senate
Leo W. O'Brien Federal Office Building
11A Clinton Avenue, Room 821
Albany, NY 12207

Charles Schumer
U.S. Senate
100 South Clinton Street, Room 841
Syracuse, NY 13261

Elise Stefanik
U.S. Congress
88 Public Square, Suite A
Watertown, NY 13601

Claudia Tenney
U.S. Congress
555 French Road Suite 101
New Hartford, NY 13414

Peggy Rodriguez
Office of Governor Andrew Cuomo
207 Genesee Street, Room 707
Utica, NY 13502

Marc Butler
New York State Assembly, District 118
235 North Prospect Street
Herkimer, NY 13350
ButlerM@nyassembly.gov

Joseph Griffo
New York State Senate, District 47
207 Genesee Street, Room 408
Utica, NY 13501
griffo@nysenate.gov

James Tedisco
New York State Senate, District 49
636 Plank Road, 2nd Floor
Clifton Park, NY 12065-2046
tedisco@nysenate.gov

Counties

Sylvia Rowna
Herkimer County Clerk
109 Mary Street, Suite 1111
Herkimer, NY 13350

Patrick Russell
District 15, County Legislature
Herkimer County
109 Mary Street, Suite 1310
Herkimer, NY 13350
legislatorrussell@roadrunner.com

James Wallace
County Administrator
Herkimer County
109 Mary Street, Suite 1310
Herkimer, NY 13350

William Weakly
District 17, County Legislature
Herkimer County
109 Mary Street, Suite 1310
Herkimer, NY 13350
wweakley@ntcnet.com

West Canada Creek Hydroelectric Project (P-2701)
Distribution List

Sandra DePerno
Oneida County Clerk
Oneida County
Oneida County Office Buildings
800 Park Avenue
Utica, NY 13501
countyclerk@ocgov.net

Anthony Picente
Executive
Oneida County
Oneida County Office Buildings
800 Park Avenue #10
Utica, NY 13501
ce@ocgov.net

Les Porter
District 6 County Board Legislator
Oneida County
P.O. Box 236
Remsen, NY 13438
lporter@ocgov.net

Philip Sacco
District 9 County Board Legislator
Oneida County
11371 Bell Hill Road
Deerfield, NY 13502
psacco@ocgov.net

Towns

Frances Donley
Supervisor
Town of Russia
8916 N. Main Street
PO Box 126
Poland, NY 13431
supervisor@ntcnet.com

Roger Helmer
Supervisor
Town of Remsen
PO Box 308
10540 Academy Lane
Remsen, NY 13438
remsensupervisor@roadrunner.com

Joseph Smith
Supervisor
Town of Trenton
PO Box 206
8520 Old Poland Road
Barneveld, NY 13304
supervisor@town.trenton.ny.us

Tribes

Ray Hallbritter
National Representative
Oneida Indian Nation
2037 Dreamcatcher Plaza
Oneida, NY 13421

Jesse Bergevin
Historian
Oneida Indian Nation
2037 Dreamcatcher Plaza
Oneida, NY 13421
jbergevin@oneida-nation.org

Michael Conners, Jr.
Tribal Chief
Saint Regis Mohawk Tribe
412 State Route 37
Akwesasne, NY 13655

Beverly Cook
Tribal Chief
Saint Regis Mohawk Tribe
412 State Route 37
Akwesasne, NY 13655

Ken Jock
Environmental Director
Saint Regis Mohawk Tribe
412 State Route 37
Akwesasne, NY 13655

Arnold Printup
Saint Regis Mohawk Tribe
412 State Route 37
Akwesasne, NY 13655
arnold.printup@srmt-nsn.gov

Eric Thompson
Tribal Chief
Saint Regis Mohawk Tribe
412 State Route 37
Akwesasne, NY 13655

Tehassi Hill
Chairman
Oneida Tribe of Indians of Wisconsin
PO Box 365
Oneida, WI 54155-0365

Non-Governmental Organizations

Bob Irvin
President
American Rivers
1101 14th Street NW, Suite 1400
Washington, DC 20005
birvin@americanrivers.org

Robert Nasdor
Northeast Stewardship Director
American Whitewater
365 Boston Post Road, Suite 250
Sudbury, MA 01776
bob@americanwhitewater.org

David Klein
The Nature Conservancy
Central and Western New York Chapter
1048 University Avenue
Rochester, NY 14067
dklein@tnc.org

Paul Sitroli
Co-Chair
Adirondack Mountain Club, Iroquois Chapter
9435 Chapman Road
New Hartford, NY 12413
psirtoli@hotmail.com

Doug Tinkler
Co-Chair
Adirondack Mountain Club, Iroquois Chapter
4 Clintonview Road
New Hartford, NY 12413
dt46x40@yahoo.com

Brian Sanders
Conservation
Adirondack Mountain Club, Iroquois Chapter
7 Bolton Road
New Hartford, NY 13413

David Corr
Mohawk Valley Chapter of Trout Unlimited
New York Conservation Fund Advisory Board
28 Sanger Avenue
New Hartford, NY 12413

Pat Becher
Executive Director
Mohawk Valley Water Authority
1 Kennedy Plaza #3
Utica, NY 13502
pbecher@mvwa.us

William Wellman
Region 5 Vice President
New York State Council of Trout Unlimited
7 Helen Street
Plattsburgh, NY 12901

West Canada Creek Hydroelectric Project (P-2701)
Distribution List

Paul W. Miller
New York State Council of Trout Unlimited
3825 Miller Road
Blossvale, NY 13308
pmiller3825@yahoo.com

John Montefusco
CEO
Trout Power
PO Box 51
Cold Brook, NY 13324

Kathy Kellogg
West Canada Riverkeepers/West Canada Watershed Alliance
8180 State Route 28
Barneveld, NY 13304
kathlog@msn.com

Blake Bellinger
Citizens for Hinckley
PO Box 382
Fultonville, NY 12072
Bla19ke@yahoo.com

Brookfield

Jon Elmer
Director, Operations
Brookfield Renewable
800 Starbuck Avenue, Suite 802
Watertown, NY 13601
jon.elmer@brookfieldrenewable.com

Pat Storms
Senior Manager, Operations
Brookfield Renewable
800 Starbuck Avenue, Suite 802
Watertown, NY 13601
patrick.storms@brookfieldrenewable.com

Rick Heysler
Manager, Operations
Brookfield Renewable
8526 Trenton Falls Road
Barneveld, NY 13304
richard.heysler@brookfieldrenewable.com

Steve Murphy
Director, Licensing
Brookfield Renewable
33 West 1st Street, South
Fulton, NY 13069
steven.murphy@brookfieldrenewable.com

ATTACHMENT A

FERC'S SCHEDULE A – COMMENTS ON THE PAD AND ADDITIONAL INFORMATION DATED JUNE 28, 2018

FEDERAL ENERGY REGULATORY COMMISSION
WASHINGTON, DC 20426
June 28, 2018

OFFICE OF ENERGY PROJECTS

Project No. 2701-059 – New York
West Canada Creek Hydroelectric Project
Erie Boulevard Hydroelectric, L.P.

Steven Murphy, Director of Licensing
Brookfield Renewable
33 West 1st Street South
Fulton, NY 13069

Reference: Comments on the Pre-Application Document (PAD) and Request for Additional Information

Dear Mr. Murphy:

After reviewing the West Canada Creek Hydroelectric Project's (West Canada Creek Project) Pre-Application Document (PAD) and participating in the May 30 and 31, 2018 scoping meetings and the May 30, 2018 environmental site review, we have determined that additional information is needed to adequately assess potential project effects on environmental resources. We provide comments on the PAD and our additional information requests in Schedule A. Please file your responses to Schedule A with your proposed study plan that is due on August 13, 2018, unless otherwise specified in the additional information request.

Staff may determine a need for additional studies or information upon receipt and review of scoping comments, study requests, and your proposed study plan. As necessary, we will request additional information, studies, and/or provide additional input on proposed or requested studies after you file the proposed study plan.

Please include a master schedule in your proposed study plan that includes the steps for conducting each proposed study (i.e., data collection, data analysis, consultation, and report preparation), the distribution of progress reports, the filing date of the initial study report, and the date of the initial study report meeting. Finally, if you are likely to propose any plans for protection, mitigation, or enhancement measures, drafts of those plans should be filed, if possible, with the study report.

If you have any questions, please contact Nicholas Ettema at (202) 502-6565, or via email at nicholas.ettema@ferc.gov.

Sincerely,

John B. Smith, Chief
Mid-Atlantic Branch
Division of Hydropower Licensing

Enclosures: Schedule A

SCHEDULE A

COMMENTS ON THE PAD AND ADDITTIONAL INFORMATION

Project Facilities

1. On page 4-4 of the PAD, you state that the main spillway is a 306-foot-long by 45-foot-high concrete overflow spillway. However, the 1983 License Order describes the Prospect Dam as a 306-foot-long and *52-foot-high* concrete overflow dam. Please clarify the dimensions of the concrete overflow dam.

2. On page 4-8 of the PAD, you state that the Trenton Dam is a 288-foot-long by approximately 55-foot-high concrete and masonry dam. However, the 1983 License Order describes the Trenton Dam as a 288-foot-long and *60-foot-high* concrete and masonry dam. Please clarify the dimensions of the concrete and masonry dam.

Project Operations

3. On page 4-4 of the PAD, you state that Prospect's dependable capacity is 11.2 megawatts (MW) for the summer period and 13.5 MW for the winter period. So that staff can calculate the annual power cost, please provide the average duration (days) of the summer and winter periods.

4. On page 4-8 of the PAD, you state that Trenton's dependable capacity is 20.8 MW for the summer period and 23.2 MW for the winter period. So that staff can calculate the annual power cost, please provide the average duration (days) of the summer and winter periods.

5. On page 4-13 of the PAD, you state that Hinckley Reservoir is operated in accordance with the 2012 Operating Diagram and governed by legally binding agreements between the New York State Canal Corporation (Canal Corporation), Mohawk Valley Water Authority, and Erie Boulevard Hydroelectric, L.P. (Erie). So that staff can better understand the past and present flow regulation and hydropower operation in West Canada Creek, please provide a copy of the current operating agreement as well as any previous operating agreements between Erie and the Canal Corporation. In addition please describe the purpose of the most recent operating agreement and 2012 Operating Diagram and why Erie's previous agreement with the Canal Corporation was updated.

Project Safety

6. On page 5-57 of the PAD, you describe the Fisherman Alert System at the Trenton Development. However, no information is provided regarding the alert system at the Prospect Development that was observed during the environmental site review. Please describe the existing alert systems and alert procedures in detail for both developments. Please provide an approximate maximum range for the sirens at both developments.

Aquatic Resources

7. On pages 5-25 to 5-26 of the PAD, you describe habitat conditions for fish downstream of the Trenton Falls Development based on existing studies. So that staff can adequately review existing information regarding fish habitat downstream of the Trenton Falls Development, please file a copy of the existing studies including Niagara Mohawk Power Company's 1981 Habitat-Flow Assessment, Icthyological Associates' 1981 Fish Habitat-Flow Relationship study, and Icthyological Associates' 1981 Temperature Monitoring study.

8. At the public scoping meeting on May 30, 2018, a member of the public inquired about the effects of the removal of Gray's Reservoir, a reservoir previously located upstream of Hinckley Reservoir on Black Creek, on downstream hydropower operations. So that staff can evaluate potential cumulative effects of the elimination of Gray's Reservoir on flows in West Canada Creek, please describe any changes in flow releases or hydropower operation at the West Canada Creek Project as a result of the removal of Gray's Reservoir.

Terrestrial Resources

9. Table 5-15, on page 5-36 of the PAD, lists the acreage and specific classifications for National Wetland Inventory (NWI) mapped wetlands in the project area. This table and figure 5-6 on page 5-37, indicate that 0.19 acre of wetlands occur in the Prospect Development area of the project boundary which has a daily reservoir fluctuation of up to 5 feet. However, during the environmental site review, staff observed a small wetland near the Prospect boat launch that was not included in the NWI map. It is not clear if the NWI map is capturing all the wetlands in the project boundary. Therefore, please include a ground-truthing component of the NWI map as part of your proposed aquatic habitat mapping study described on page 6-5 of the PAD.

10. At the public scoping meeting on May 30, 2018, New York State Department of Environmental Conservation staff stated that there was a known bald eagle nest near the Prospect Development. However, you do not provide any information about this nest in your PAD. So that Commission staff can determine the potential effects of continued project operation on bald eagles, please include a map in your license application

indicating the location of the known bald eagle nest and its distance from the project boundary. Please file this information as privileged.

Cultural Resources

11. So that staff can better understand historic resources at the project, please provide a more detailed description of the project's history, including a timeline of development. Although the project was not licensed by the Commission until 1983, please start the timeline with construction of the original power station in 1901. Within the timeline, please also include a description of all redevelopment and rehabilitation activities that have occurred during the project's history, including the dates of construction of the dams and any associated facilities. Additionally, there is little information in the project record that describes the circumstances behind Niagara Mohawk Power Corporation seeking a Commission license in 1983 for an 80-year-old project. If this information is available, please provide it. Finally, please file a copy of the 1993 Historic American Engineering Record (HAER) for the Trenton Development. This information can be provided in the draft license application/preliminary licensing proposal that is due in October 2020.

12. On page 5-77 of the PAD, you state that a cultural resources survey was performed in 1978 by Pratt and Pratt Archeological Consultants as part of the previous redevelopment at the Trenton Development. So that staff can understand the extent of the only cultural resources survey that has been completed at that development, please provide a copy of any report(s) from that survey. The thoroughness of the report(s) will help staff determine if additional cultural resources surveys of the project are necessary.

13. As stated in the PAD, the licensee, in partnership with the Town of Trenton, has provided controlled public access to view the scenic Trenton Falls Gorge for 1 or 2 weekends in the spring and the fall annually since 2007 via the Trenton Falls Scenic trails. The primary trail is a 0.75-mile-long crushed stone trail that starts at the Trenton Falls facility entrance/parking area, passes adjacent to project facilities, traverses along sections of the project penstock, and ends at the Trenton Falls Hydro Dam Overlook. There also are two wood mulch secondary trails (totaling approximately 0.5 mile), that provide views of the lower high falls and upper high falls, and an additional four wood mulch secondary trails (totaling approximately 0.6 mile) through a wooded and meadow landscape and a picnic area in the general vicinity of the primary trail.

On page 5-53 of the PAD, you state that the Trenton Falls Scenic Trail "traverses along adjacent areas of historic interest, such as the site of the historic Trenton Falls Hotel;" however, none of these historic sites are identified or discussed further in the PAD. In addition, at the May 30, 2018 environmental site review, it was mentioned that the Trenton Falls Scenic Trail also traverses adjacent to a cemetery; however, that cemetery is not mentioned in the PAD. So that staff can better understand the archaeologic and historic setting of the project area, please provide a list of any archaeological or historic areas of interest that are located along or adjacent to the Trenton Falls Scenic Trail, a description of the areas, and where the areas are located in relation to the project boundary. Please also conduct a search of the New York State Cultural Resources Information System for the area along and adjacent to the Trenton Falls Scenic Trail in order to identify whether there are any archeological sites, New York State and National Register of Historic Places (National Register)-listed properties, properties determined eligible for the National Register, and/or previous cultural resources surveys identified in this area. Although the area of potential effect (APE), as required under section 106 of the National Historic Preservation Act [36 CFR Part 800.16(d)], has not yet been defined, the trail provides public access to the project and should be considered to be within any APE that will be defined. As a result, if the information requested above is unavailable, additional studies may be necessary to identify cultural resources and determine project effects within the APE, including along the Trenton Falls Scenic Trail.

ATTACHMENT B

ATTACHMENTS FOR RESPONSE TO FERC AIR 7 – AQUATIC RESOURCES PREVIOUS STUDIES

Ichthyological Associates Inc. 1981a. Fish Habitat-Flow Relationship at Six Study Releases Below Trenton Hydroelectric Station on West Canada Creek, New York, During August and September 1980, Prepared by Ichthyological Associates Inc., for Niagara Mohawk Power Corporation, February 1981.

Ichthyological Associates Inc. 1981b. Temperature Monitoring, West Canada Creek, Oneida and Herkimer Counties, New York, June-September 1980. Prepared by Ichthyological Associates Inc., for Niagara Mohawk Power Corporation, February 1981.

FISH HABITAT-FLOW RELATIONSHIP AT SIX STUDY RELEASES BELOW TRENTON HYDROELECTRIC STATION ON WEST CANADA CREEK, NEW YORK, DURING AUGUST AND SEPTEMBER 1980

by

Terry R. Culp, M.S.
John Homa, Jr., B.S.
Jerry L. Platt, M.A.

Ichthyological Associates, Inc.
111 Main Street, P. O. Box 2
Stamford, New York 12167

for

Niagara Mohawk Power Corporation
300 Erie Boulevard West
Syracuse, New York 13202

ICHTHYOLOGICAL ASSOCIATES, INC.
EDWARD C. RANEY, Ph.D., PRESIDENT
301 Forest Drive, Ithaca, New York 14850

February 1981

ACKNOWLEDGMENTS

We wish to thank:

J. A. Miakisz, Associate Environmental Analyst, Niagara Mohawk Power Corporation (NMPC), and NMPC personnel at the Trenton Hydroelectric Station for providing test flows in West Canada Creek;

J. Douglas Sheppard, Reservoir Release Project Manager - Fisheries, Bureau of Environmental Protection, New York State Department of Environmental Conservation, for assistance in selecting reaches and locating transects;

New York State Department of Transportation personnel for providing diversion of water through the feeder canal.

The following Ichthyological Associates, Inc., personnel participated in this study:

FIELD PERSONNEL

Beth Adams
Dale Braue
Brian Bower
Scott Butler
Joan Carter
Joseph Castle
Richard Costanza
Phillip Englert
Joseph Fagnani
Joseph Freire
Matthew Hinge
Michael Iagnocco
Lawrence Leslie, Jr.
Paul Lomax
George Mayr
Douglas Micha
Robert Rode
David Schlesinger
Richard Stokes
Steven Terk
Tim Terk

LAB PERSONNEL

Barbara Arnt
Cathy Bylina
Joan Carter
Joseph Freire
George Mayr
Richard Stokes

COMPUTER PERSONNEL

Drusilla Abrams
Charles Miller
Della Wells

SECRETARIAL PERSONNEL

Karen Busche
Barbara Jean Denny

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INTRODUCTION

An investigation of the habitat-flow relationship at three reaches on West Canada Creek, Herkimer and Oneida counties, New York, below Niagara Mohawk Power Corporation's (NMPC's) Trenton Hydroelectric Station was conducted by Ichthyological Associates, Inc. (IA), during August and September 1980. The study objective was to determine the changes in the amount of usable fish habitat (in terms of weighted usable width) with six study releases fron the Trenton Station using a modification of the state-of-the-art incremental method developed by the U. S. Fish and Wildlife Service Instream Flow Service Group (IFG) (Bovee and Milhous 1978). The incremental method is used to quantify the usable habitat available for three life stages (adult, juvenile, fry) of brown trout and smallmouth bass. This information is then used to determine the adequacy of six NMPC nominal releases to provide usable habitat for these target species.

DESCRIPTION OF STUDY REACHES

Three study reaches on West Canada Creek below the Trenton Hydroelectric Station were examined (Table 1, Figs. 1-4).

Reaches 1 and 2 are located about 0.3 mi and 1.6 mi downstream of the Trenton Station, respectively. Both reaches lie within the special regulations section of West Canada Creek and support an important brown trout fishery. Located close to the station and upstream of the first major tributary, these reaches receive full effect of releases but limited accretion, except for ground water seepage.

Reach 3, which may represent important habitat for both brown trout and smallmouth bass, is located about 23.3 mi downstream from the Trenton Station, where accretion from tributaries, surface runoff, and ground water seepage is significant.

FISHERY RESOURCES

West Canada Creek is an important New York State trout stream and is heavily fished because of its proximity to Rome, Utica, and Little Falls. Brown (1973) reported West Canada Creek to be the eleventh most heavily fished body of water and the third most heavily fished river in the state.

As West Canada Creek flows from Hinckley Reservoir through bottom drawgates, it is clear, clean, and cold enough in the summer months to support trout. In 1975 the New York State Department of Environmental Conservation (NYSDEC) established a special regulations (3 fish/day limit, 12-inch minimum size, artificial lures only) section from the Dover Road bridge at Trenton Falls downstream 2.5 mi to the mouth of Cincinnati Creek. The NYSDEC annually stocks 4000 yearling brown trout in the special regulations area; a total of 88,900 and 50,000 yearling brown trout was stocked during 1976 and 1977, respectively, from the Trenton Development downstream 30 mi to the mouth at Herkimer (Hasse 1977). Where accessible, West Canada Creek is presently considered a successful "put-and-take" brown trout fishery.

In a stream survey of West Canada Creek made in 1976 by NYSDEC, brown trout was found to be the most abundant and widely distributed game species (Hasse 1977). Other game fishes observed were rainbow trout, brook trout, smallmouth bass, largemouth bass, and walleye. The smallmouth and largemouth bass were considered stunted. Twenty-five fishes were identified by NYSDEC during the 1976 survey, and three additional species were collected by IA personnel in 1980 (Table 2).

It is likely that the five species (carp, white perch, logperch, yellow perch, and walleye) that were collected only from the mouth of West Canada Creek upstream 0.4 mi originated in the Mohawk River (Hasse 1977). A brook trout (10.4 inches) and a brown trout fingerling (3.9 inches) were the only wild trout captured during the NYSDEC survey; Hasse (1977) concluded that these fish probably entered from one of the tributaries.

Brown trout, the most abundant, widely distributed, and fished for game species in West Canada Creek, was selected as the primary target species for the IA habitat-flow study at reaches 1, 2, and 3.

Smallmouth bass was selected as a target species at reach 3 because it is a potentially important game fish in lower West Canada Creek.

FIELD METHODS

Three study reaches on West Canada Creek were examined. Reach 1 (11 transects) was selected by IA personnel and reaches 2 (14 transects) and 3 (16 transects) by J. Douglas Sheppard, Reservoir Releases Project Manager - Fisheries, Bureau of Environmental Protection, NYSDEC, Albany.

Transects were established across hydraulic controls (e.g., head of riffle, head of pool) and major habitat types (riffle, run, pool) approximately perpendicular to the direction of flow. The location and number of transects at each reach were determined by NYSDEC and IA personnel. The location of some transects was limited by the proximity of suitable anchor trees.

Study reaches and location of transects were selected using the following guidelines:

1. The study reach should be representative of other portions of the stream.

2. At each reach habitat types and hydraulic controls should be proportionately represented through placement and number of transects.

Six study flows--160-D (160 cfs less approximately 75 cfs diversion through the "feeder canal" to the New York State Barge Canal), 160, 200, 250, 300, and 350 cfs--were released from the Trenton Hydroelectric Station in August and September 1980 (Table 3). Flows were allowed to stabilize for at least 1 hr at reach 1, 1.25 hr at reach 2, and 17 hr at reach 3. The travel time of the surge from the Trenton Station to reaches 1 and 2 was less than 0.5 hr and to reach 3 about 8.5 hr. Some transects were redone because of current meter malfunction, inclement weather, or failure to divert water through the New York State Department of Transportation feeder canal to provide the 160-D release for studies on 13 September 1980.

To set up a transect: (1) chain was wrapped around the near bank anchor tree; (2) fixed end of hand winch was attached to chain; (3) 1/8-inch diameter aircraft cable was hooked to the movable end of the hand winch, stretched across the stream, wrapped around the far bank anchor tree, and secured with two cable clamps; (4) hand winch was tightened to remove as much sag as possible; and (5) any needed adjustments were made to level the cable. The exact placement of the chain and cable on near and far bank anchor trees, respectively, was marked with nails and spray paint to ensure replication of transect position.

The distance from zero point to the near bank was recorded (Appendix 1). Using a predetermined interval width of 1.5, 3.0, 4.0, 6.0, or 8.0 ft, sampling points were marked with clothespins as the field crew moved along the cable (Tables 4-6). The interval width was chosen to provide a minimum of 20 sampling points per transect (see Bovee and Milhous 1978, p 68). The same interval width was used at each transect for all releases, with the following exceptions: reach 1, transect 5, 160-D cfs release; reach 2, transects 3, 9, 10, 12-14, 160-D cfs release; and reach 3, transect 5, 350 cfs release. At the 160-D cfs release a smaller sampling interval was used to ensure a minimum of 20 sampling points.

At each sampling point stage height, water velocity, and water depth were measured, and substrate type was recorded. Stage height and depth were measured using graduated (0.1-ft intervals) wading rods. Water velocity was determined using Gurley No. 665 direct reading current meter, Gurley No. 662 Price current meter, Mead Instruments model HP-302 open stream velocity probe, or Marsh-McBirney model 201 current meter. Velocity (fps) was measured at 0.4 of the water depth from the stream bottom (total depth $\leq$2.5 ft) and 0.2 and 0.8 of the water depth from the bottom and averaged (total depth >2.5 ft) (Appendix 2). Substrate type was classified using modified Wentworth Particle Size Scale, when applicable, and coded (Appendixes 3 and 4).

The distance from zero point to far bank was subsequently recorded and the transect dismantled.

Color 35-mm photographs were taken of each release at each reach (Fig. 5).

ANALYSIS METHOD

Discharge

Discharge (cfs) was calculated for each transect with each release using the formula:

$$Q = \sum_{i=1}^{n} W_i D_i V_i \qquad \text{where:}$$

Q is discharge (cfs), W_i is width (ft) of i^{th} interval, D_i is depth (ft) of i^{th} interval, and V_i is velocity (fps) of i^{th} interval. When current velocity was measured with a Gurley No. 622 mounted on a wading staff, rating table velocity was reduced by 2% (Teledyne Gurley 1977, p 20).

Transects were located to sample hydraulic controls and habitat types and were not intended to measure discharge. The discharge calculation, however, should approximate stream discharge even though measurements were not made in straight channels with smooth substrate and laminar flow nor were transects always located perpendicular to flow. It is assumed that NMPC releases were accurate and that discharge remained constant with each release. Results are based on the actual discharge measured but are expressed using the corresponding NMPC nominal release.

Probability-of-Use and Weighted Usable Width

Probability-of-use tables for brown trout (adult, juvenile, fry) and smallmouth bass (adult, juvenile, fry) at different depths, velocities, and substrate types were developed from IFG curves (Bovee 1978; IFG, unpublished data) (Tables 7 and 8). It is assumed that these curves, which were developed from a variety of sources, can be applied to target species in West Canada Creek. The maximum depth shown on each curve for brown trout adult, smallmouth bass adult, and smallmouth bass fry is 4.0, 6.0, and 4.0 ft, respectively. It is assumed that the probability-of-use for all depths beyond these points in West Canada Creek is 1.0 (K. D. Bovee, IFG, personal communication, 6 November 1980).

In developing the probability curves for brown trout and smallmouth bass, the following sizes were used to define each life stage for brown trout: adult, >8 inches and sexually mature; juvenile, 4 to 8 inches; fry, <4 inches; and for smallmouth bass: adult, >8 inches and sexually mature; juvenile, 1 to 8 inches; fry, <1 inch (K. D. Bovee, personal communication, 6 November 1980).

The composite probability-of-use at a given sampling point is the probability-of-use at that depth, velocity, and substrate and is calculated by multiplying probability-of-use for depth times probability-of-use for velocity times probability-of-use for substrate type.

Substrate data for probability-of-use analysis at each transect at different releases were standardized. The most accurate and consistent substrate classification was made at low flows. Therefore, at reaches 1 and 2 substrate classification for most sampling intervals was obtained from the 160 cfs release. As the releases increased and additional substrate was inundated, rankings from the 350 cfs release were utilized. At reach 3 substrate was ranked from the near shore to far shore high water mark at the predetermined sampling interval at each transect at the 160-D cfs release.

The composite probability-of-use for each sampling point along each transect was calculated and multiplied by the interval width to give weighted usable width per interval. Weighted usable widths per interval were summed to derive the weighted usable width per transect. Tables 10 and 11 indicate that occasionally a sampling point along a transect at reach 2 or 3 had been missed or added. To compensate for this discrepancy, the weighted usable width for that interval was determined by dividing the weighted usable width for the transect by the number of points sampled. This value was either added or subtracted to estimate the weighted usable width for that transect. At each release weighted usable widths per transect were summed and divided by the number of transects to derive the average weighted usable width of the reach.

Composite probability-of-use and weighted usable width were calculated manually for three life stages of brown trout at reaches 1 and 2. A Hewlett-Packard model 9830 computer at IA, Middletown, Delaware, was used to calculate these values for three life stages of both brown trout and smallmouth bass at reach 3.

Percent Usable Stream Width

Stream width (ft) was in most cases determined by subtracting near bank from far bank (Tables 9-11). When transects crossed an island (reach 2, transects 3-6 and reach 3, transects 2-4), stream width was determined by adding the distance from near bank to near bank of island and the distance from far bank of island to far bank. In some instances the near and far bank of island distances were estimated by adding one-half an interval width to the last sampling point before the island and first sampling point after the island. At a few transects two consecutive sampling points occupied exposed substratum (e.g., boulders), but there was water between the sampling points. Intervals thus affected were included in the stream width.

A small decrease in stream width with increased flow probably reflected accumulative measurement error and/or difficulty in determination of shoreline.

For each transect at each release the percent of stream width that is weighted usable width (percent usable stream width) was determined by dividing weighted usable width by stream width. At each release these values were then summed and divided by the number of transects to derive the percent usable stream width at the reach.

Average weighted usable width shows the actual amount of usable habitat (in ft) at a given release, whereas percent usable stream width shows what proportion of stream width is weighted usable width at a given release. As release increases the usable habitat may increase, suggesting a more desirable flow, while the percent usable stream width may remain the same or decrease (See Figs. 6 and 7, adult brown trout). Thus, both should be examined and compared in determining recommended releases.

QUALITY CONTROL

Generally, the same field crew worked the same transect with the same meter at all six releases unless prevented by meter malfunction or scheduling difficulty. Current meters were checked to meet manufacturers' specifications before and after every transect. These checks included >1-min free-spin for Gurley meters, battery tests, and calibration of the Marsh-McBirney. Readings from different current meters were periodically compared to ensure consistency of velocity measurements. Field personnel ranked substrates until classifications were consistent.

All manual calculations of discharge, composite probability-of-use, weighted usable width, and percent usable stream width were made twice. Computer entries and tabulation, and summarization of data underwent two or more independent cross-checks.

RESULTS

Calculated Discharge

Stream discharge (cfs) was calculated for each transect at reach 1 (11 transects), reach 2 (14 transects), and reach 3 (16 transects) at six different NMPC nominal releases (Tables 12-14).

Mean discharge ranged from 113.1 cfs at 160-D cfs release to 362.2 cfs at 350 cfs release at reach 1 and 126.0 to 371.8 at reach 2. At these reaches the calculated mean discharge was roughly similar to each NMPC release. At reach 3 mean discharge ranged from 229.5 cfs at 160-D cfs release to 527.3 cfs at 350 cfs release. The markedly higher calculated mean discharges at reach 3 reflect accretion (surface runoff, ground water seepage, and tributary influx) to West Canada Creek.

Calculated discharge varied among transects at the same reach and release, in part reflecting the fact that transects were located to calculate habitat availability, not discharge.

Calculated discharge in the feeder canal at Trenton was 77.6 cfs on 20 August 1980 and 71.3 cfs on 21 September 1980 (Table 15). Thus, the 160-D cfs release was about 82.4 cfs at most transects at reaches 1 and 2 and about 88.7 cfs at all transects at reach 3. Releases to the feeder canal can occur only if the taintor gate on the New York State Barge Canal diversion dam across West Canada Creek is closed. With the stop logs in place at the feeder canal gatehouse and the taintor gate closed, some leakage (about 16.7 cfs at 160 cfs release) occurs into the feeder canal.

Weighted Usable Habitat

The amount of potential, usable habitat, expressed as average weighted usable width and percent usable stream width, for three life stages (adult, juvenile, fry) of brown trout (reaches 1, 2, and 3) and smallmouth bass (reach 3) at six NMPC releases was determined.

Brown Trout at Reach 1

The change in average weighted usable width with NMPC release for three life stages of brown trout at reach 1 is presented in Tables 16-18 and Figure 6. Juvenile (30.6-37.8 ft) and fry (30.6-35.8 ft) brown trout have a similar and greater amount of potential habitat available than adult (16.5-19.6 ft) at all six releases. Usable habitat for juvenile peaks at 160-D cfs, gradually declines to 300 cfs, and then increases slightly at 350 cfs. Usable habitat for fry peaks at 160 cfs and shows two slightly smaller rises at 250 cfs and 350 cfs. Adult brown trout habitat gradually rises until it peaks at 250 cfs and then declines before rising slightly at 350 cfs.

The change in percent usable stream width with NMPC release for three life stages of brown trout at reach 1 is given in Tables 16-18 and Figure 7. Percent usable stream width is higher for juvenile (20.1-29.2%) and fry (20.6-28.6%) than for adult (12.4-14.9%). For juvenile and fry the percent usable stream width generally decreases as the release increases; for adult it remains about the same until 250 cfs, then begins to decrease.

Brown Trout at Reach 2

The change in average weighted usable width for brown trout at reach 2 is presented in Tables 19-21 and Figure 8. Juvenile (64.6-74.6 ft) and fry (65.0-72.7 ft) brown trout have a comparable and much higher amount of potential habitat available than adult (36.1-43.5 ft) at all six releases. The change in usable habitat with different releases for juvenile and fry show similar trends. The amount of usable habitat rises to a peak at 160 cfs release, declines slightly and undergoes a gradual increase to 300 cfs release, and then declines at 350 cfs release. Adult habitat attains a plateau at 160 cfs release and remains uniform as release increases.

The change in percent usable stream width for brown trout at reach 2 is given in Tables 19-21 and Figure 9. The percents usable stream width for juvenile (39.7-49.4%) and fry (39.0-47.4%) are similar and are much higher than for adult (24.7-30.0%). For juvenile and fry the percent usable habitat peaks at 160 cfs and gradually decreases as release increases (except slight increase for fry at 300 cfs). For adult this percent reaches a plateau at 160 cfs and declines at 350 cfs release.

Brown Trout at Reach 3

The change in average weighted usable width for brown trout at reach 3 is presented in Tables 22-24 and Figure 10. At all six releases fry brown trout (48.3-62.3 ft) have the greatest amount of usable habitat, followed by juvenile (42.0-53.9 ft) and adult (21.9-26.0 ft). For fry and juvenile the change in usable habitat with different releases shows similar trends. Usable habitat rises to a peak at 200 cfs release and then continuously declines as release increases. Adult habitat attains a plateau at 160 cfs release and, except for a small decline at 250 cfs, remains about the same as release increases.

The change in percent usable stream width of brown trout at reach 3 is given in Tables 22-24 and Figure 11. At all six releases the average percent usable stream width is highest for fry (24.9-34.2%), followed by juvenile (22.1-30.3%) and adult (15.1-17.2%). For fry and juvenile percent usable habitat rises to a peak at 200 cfs and then steadily declines as release increases. For adult this percent increases gradually to 200 cfs release, declines at 250 cfs, and remains about the same as release increases.

Smallmouth Bass at Reach 3

The change in average weighted usable width for three life stages of smallmouth bass at reach 3 is presented in Tables 25-27 and Figure 12. At all six releases juvenile smallmouth bass (26.5-39.9 ft) have the greatest amount of usable habitat, followed by adult (14.6-18.4 ft) and fry (2.8-5.1 ft). The amount of usable habitat for juvenile rises to a peak at 200 cfs, sharply declines at 250 cfs, and then continues to decline gradually. Potential habitat for adult gradually increases as release increases to peak at 300 cfs and then declines slightly at 350 cfs. Fry have little available habitat at all releases (5 ft or less), with less at higher releases.

The change in percent usable stream width is given in Tables 24-27 and Figure 13. The average percent usable stream width is highest at all six releases for juvenile (15.1-24.0%), followed by adult (10.6-11.7%) and fry (2.3-4.8%). For juvenile smallmouth bass percent usable habitat rises to peak at 200 cfs, sharply declines at 250 cfs, and continues to decline. For adult percent usable habitat fluctuates little. For fry percent usable habitat decreases as release increases.

Adult Brown Trout at Reaches 1, 2, and 3

At all releases adult brown trout have the greatest usable habitat at reach 2 (36.1-43.5 ft), less at reach 3 (21.9-26.0 ft), and least at reach 1 (16.5-19.6 ft) (Fig. 14).

Percent usable stream width is highest at reach 2 (24.7-30.0%), lower at reach 3 (15.1-17.2%), and lowest at reach 1 (12.4-14.9%) (Fig. 15).

Juvenile Brown Trout at Reaches 1, 2, and 3

The amount of usable habitat available at all releases for juvenile brown trout is highest at reach 2 (64.6-74.6 ft), less at reach 3 (42.0-53.9 ft), and least at reach 1 (30.6-37.8 ft) (Fig. 16).

Percent usable stream width is highest at reach 2 (39.7-49.4%) (Fig. 17). This percent is slightly higher at reach 3 (22.1-30.3%) than reach 1 (20.1-29.2%) for all except the 160-D release.

Fry Brown Trout at Reaches 1, 2, and 3

Fry brown trout at all releases have the most usable habitat at reach 2 (65.0-72.7 ft), less at reach 3 (48.3-62.3 ft), and least at reach 1 (30.6-35.8 ft) (Fig. 18).

Percent usable stream width is greatest at reach 2 (39.0-47.4%), less at reach 3 (24.9-34.2%), and least at reach 1 (20.6-28.6%) (Fig. 19).

Optimum Release

From the above discussion it is obvious that there was little change (<7.5 ft) in the amount of usable habitat with different releases at all reaches (see Fig. 14). The greatest amount of usable habitat was available for adult brown trout at 250 cfs, 300 cfs, and 200 cfs releases at reaches 1, 2, and 3, respectively. The percent usable stream width was highest at 200 cfs and 250 cfs at reach 1 and 200 cfs at reaches 2 and 3 (Fig. 15). There was little change (≤2.5%) in the percent with increasing or decreasing flows, except at 160-D cfs and 350 cfs at reach 2.

For juvenile brown trout the greatest amount of usable habitat and highest percent usable stream width occurred at 160-D cfs, 160 cfs, and 200 cfs at reaches 1, 2, and 3, respectively (Figs. 16 and 17).

For fry brown trout the greatest amount of usable habitat was available at 160 cfs at reaches 1 and 2 and 200 cfs at reach 3 (Fig. 18). The percent usable stream width was highest at 160-D cfs at reach 1, 160 cfs at reach 2, and 200 cfs at reach 3 (Fig. 19).

At reach 3 the greatest amount of usable habitat and highest percent usable stream width for adult smallmouth bass were at 300 cfs and for juvenile at 200 cfs (Figs. 12 and 13). Very little habitat was available for fry at all releases, but both usable habitat and percent usable stream width were greatest between the 160-D cfs and 200 cfs releases.

Minimum Release

For brown trout at reach 1 there is no sharp decrease in weighted usable habitat between 160-D cfs and 350 cfs releases (Fig. 6). The minimum release for all life stages is less than 160-D cfs release.

For brown trout at reaches 2 and 3, usable habitat shows a small decrease at 160-D cfs release, although there is no sharp decrease (Figs. 8 and 10). The minimum release for all life stages is less than 160-D cfs release.

For adult and fry smallmouth bass at reach 3, there is no sharp decrease in weighted usable habitat between 160-D cfs release and 350 cfs release (Fig. 12). For juvenile smallmouth bass there is only a slight decrease in usable habitat at 160-D cfs. The minimum flow for all life stages of smallmouth bass is below the

160-D cfs release.

CONCLUSIONS

The incremental method developed by IFG allows quantification of potential usable habitat available for a species and life history phase, in a given reach of stream, at different flow regimes (Bovee and Cochnauer 1977, p 29). In the incremental method usable habitat is calculated by a computer program (HABTAT) and is expressed as weighted usable area instead of weighted usable width. The method used in this study may not yield as complete a habitat-discharge analysis as the IFG incremental approach, but the general relationship between discharge and weighted usable width should be similar to the relationship between discharge and weighted usable area. This modified incremental approach is a good alternative to the IFG incremental approach, in that detailed surveying of the stream reach and access to the HABTAT computer program are unnecessary.

Review of fisheries resources in West Canada Creek below the Trenton Hydroelectric Station shows that there is a successful put-and-take brown trout fishery. Brown trout reproduction occurs only or mostly in tributary streams (Hasse 1977), and consequently, thousands of yearling brown trout are stocked annually. Thus, the brown trout is considered the most important game species in West Canada Creek, and the greatest emphasis in determining minimum and optimum flows should be placed on the adult life stage.

Usable habitat for adult brown trout remained fairly consistent between the 160 cfs and 350 cfs releases as did percent usable stream width between 160 cfs and 300 cfs releases (Tables 16, 19, and 22; Figs 14 and 15).

Thus, during August and September 1980 a minimum release of 160 cfs by NMPC provided optimum or near optimum flow for adult brown trout in West Canada Creek. Optimum or near optimum flow was also provided for fry and juvenile brown trout at 160 cfs release (Tables 17, 18, 20, 21, 23, and 24; Figs. 16-19). The minimum flow required to sustain short-term survival habitat for all life stages of brown trout was below the lowest flow studied (160-D cfs).

Fisheries data from West Canada Creek also indicate that in addition to brown trout, smallmouth bass are important at reach 3. Smallmouth bass are not stocked in West Canada Creek, and maintenance of a viable population is dependent on natural reproduction.

Usable habitat and percent usable stream width at reach 3 was low for both adult and fry smallmouth bass and remained fairly consistent over all releases studied (Tables 25 and 27; Figs. 12 and 13). Usable habitat and percent usable stream width for juvenile bass were greater than those for fry or adult at all releases and greatest between the 160 cfs and 200 cfs releases (Table 26). Thus, during August and September 1980 a minimum release of 160 cfs by NMPC provided optimum flow for juvenile smallmouth bass in West Canada Creek and near optimum flow for fry and adults. The minimum flow required to sustain short-term survival habitat for all life stages of smallmouth bass was below the lowest flow studied (160-D cfs).

Determination of usable habitat from the incremental approach should be treated in a relative rather than an absolute manner because these numbers represent potential habitat available to a certain species during a certain life history stage (Sheppard 1980, p 15). The incremental approach used in this study to determine usable habitat only considered substrate, velocity, and depth. Other physical and/or biological factors (e.g., temperature, water quality, food supply, flow regulation, and intra- and interspecific interactions) may prevent full utilization of all of the indicated habitat.

GLOSSARY

Note: Several definitions modified from Arnette (1976).

Accretion	A process of accumulation by flowing water, whether of silt, sand, pebbles, etc.
Anchor Tree	The trees on near and far shore to which transect cables are attached.
Composite Probability-of-Use	At a given sampling point the probability-of-use for a given species and life stage at that depth, velocity, and substrate. It is calculated by multiplying probability-of-use for depth times probability-of-use for velocity times probability-of-use for substrate type.
Depth	Distance from stream bed to water surface at a sampling point.
Discharge	The rate of flow, or volume of water flowing in a given stream at a given place and within a given period of time, expressed as cfs.
Far Bank	The distance from zero point to water's edge on opposite shore.
Flow	The movement of a stream of water and/or other mobile substances from place to place; total quantity carried by a stream.
Flow, Laminar	That type of flow in a stream of water in which each particle moves in a direction parallel to every other particle.
Flow, Minimum	The instantaneous flow required to sustain short-term survival of a given species and life stage.
Flow, Modified	The regulated discharge at a given point in a stream resulting from the combined effects of all upstream and at-site operations, diversions, return flows and consumptive uses.
Flow, Optimum	The discharge regime which allows for the maximum expression of the carrying capacity of any specified use in a stream. Any flow above or below this flow becomes limiting to the use under consideration.
Flow, Regulated	The flow in a stream that has been subjected to regulation by reservoirs, diversions or other works of man.
Habitat	The place where a population lives and its surroundings, both living and nonliving; includes the provision of life requirements such as food and shelter.
Hydraulic Control	A physical feature, natural or man-made, which indicates a stage-discharge relationship. The most notable attribute of a control is its influence on the hydraulic slope. Controls are reflected by a break or inflection in the slope of the water surface.
Interval Width	The distance between two sampling points.
Near Bank	The distance from zero point to water's edge on near shore.
Percent Usable Stream Width	The percent of stream width that is weighted usable width. It is determined by dividing weighted usable width by stream width.
Pool	A body of water or portion of a stream that is deep and quiet relative to the main current.
Regulation (Streamflow)	The procedure or actions involved in artificially modifying the flow of a stream so that its discharge at a specified point or points will serve a specified purpose or achieve a given objective.
Representative Reach	A stream reach that is representative of other portions of stream in terms of habitat diversity.
Riffle	A shallow rapids in an open stream, where the water surface is broken into waves by obstructions wholly or partly submerged.
Run	A stretch of relatively deep, fast flowing water, with the surface essentially nonturbulent.

GLOSSARY (CONTINUED)

Sampling Point	The point on transect cable at which measurements are made, measured in feet from zero point.
Stabilization Time	The amount of time required to stabilize a test flow at a given downstream reach once that flow is released.
Stage	The elevation of a water surface above or below an established datum or reference.
Stream Width	The total near bank to far bank distance across a stream channel, excluding islands. See Methods for further explanation.
Velocity	The distance traveled divided by the time required to travel that distance.
Weighted Usable Width	The amount of potential usable habitat available for a species and life history phase, at a given sampling interval, at different flows. It is calculated by multiplying composite probability-of-use at a sampling point times the interval width.
Zero Point	The starting point for measurements along a transect.

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Table 1. Location and description of study reaches 1, 2, and 3 in August and September 1980 on West Canada Creek, New York.

	Reach 1	Reach 2	Reach 3
Location	Just downstream from Dover Road bridge at Trenton Falls	Behind Nelson Adams farm on Partridge Hill Road, about 1 mi south of Trenton Falls	Just downstream from Ace of Diamond Mines Campground, about 0.5 mi south of Middleville
Distance downstream from Trenton Hydroelectric Station to head of reach	About 0.3 mi	About 1.6 mi	About 23.3 mi
Elevation	About 740 ft	About 725 ft	About 560 ft
Habitat type at 160 cfs release	50% riffle 30% run 20% pool	40% riffle 40% run 20% pool	70% riffle 15% run 15% pool

Table 2. Fishes collected in West Canada Creek by NYSDEC (Hasse 1977) and IA personnel.

Scientific Name	Common Name	Mouth to river mi 0.4	River mi 0.4 to 31.2
SALMONIDAE - Trouts			
Salmo gairdneri	Rainbow trout		X
Salmo trutta	Brown trout	X	X
Salvelinus fontinalis	Brook trout		X
CYPRINIDAE - Minnows			
Cyprinus carpio	Carp	X	
Exoglossum maxillingua	Cutlips minnow	X	X
Notropis cornutus	Common shiner	X	X
Pimephales notatus	Bluntnose minnow		X
Rhinichthys atratulus	Blacknose dace	X	X
Rhinichthys cataractae	Longnose dace	X	X
Semotilus atromaculatus	Creek chub		X
Semotilus corporalis	Fallfish	X	X
CATOSTOMIDAE - Suckers			
Catostomus catostomus	Longnose sucker	X	X
Catostomus commersoni	White sucker	X	X
Hypentelium nigricans	Northern hogsucker	X	X
ICTALURIDAE - Freshwater catfishes			
Ictalurus nebulosus	Brown bullhead	X	X
Noturus flavus	Stonecat	X	X
PERCOPSIDAE - Trout-perches			
_Percopsis omiscomaycus_*	Trout-perch		X
PERCICHTHYIDAE - Temperate basses			
Morone americana	White perch	X	
CENTRARCHIDAE - Sunfishes			
_Ambloplites rupestris_*	Rock bass		X
Lepomis gibbosus	Pumpkinseed		X
Lepomis macrochirus	Bluegill		X
Micropterus dolomieui	Smallmouth bass	X	X
Micropterus salmoides	Largemouth bass		X
PERCIDAE - Perches			
_Etheostoma flabellare_*	Fantail darter		X
Etheostoma olmstedi	Tessellated darter		X
Perca flavescens	Yellow perch	X	
Percina caproides	Logperch	X	
Stizostedion vitreum	Walleye	X	

* Additional species collected by IA personnel on 14 September 1980 at reach 2.

Table 3. Dates when field studies were conducted during August and September 1980 at reaches 1, 2, and 3 on West Canada Creek, New York.

	Reach 1						Reach 2						Reach 3					
Transect	160-D	160	200	250	300	350	160-D	160	200	250	300	350	160-D	160	200	250	300	350
1	20 Aug	6 Aug	7 Aug	8 Aug	9 Aug	10 Aug	21 Aug	13 Aug	14 Aug	15 Aug	16 Aug	17 Aug	21 Sep	24 Aug	28 Aug	29 Aug	31 Aug	23 Sep
2	20 Aug	6 Aug	7 Aug	8 Aug	9 Aug	10 Aug	21 Aug	13 Aug	14 Aug	15 Aug	16 Aug	17 Aug	21 Sep	24 Aug	28 Aug	29 Aug* 6 Sep	1 Sep# 7 Sep	23 Sep
3	20 Aug	6 Aug	7 Aug	8 Aug	9 Aug	10 Aug	21 Aug* 22 Sep	13 Aug	14 Aug	15 Aug	16 Aug	17 Aug	21 Sep	23 Aug	28 Aug	29 Aug	31 Aug* 7 Sep	23 Sep
4	20 Aug	6 Aug	7 Aug	8 Aug	9 Aug	10 Aug	21 Aug	13 Aug	14 Aug	15 Aug	16 Aug	17 Aug	20 Sep	23 Aug	28 Aug	30 Aug	31 Aug	24 Sep
5	20 Aug	6 Aug	7 Aug	8 Aug	9 Aug	10 Aug	21 Aug	13 Aug	14 Aug	15 Aug	16 Aug	17 Aug	21 Sep	23 Aug	28 Aug	30 Aug	31 Aug	5 Sep# 23 Sep
6	20 Aug	6 Aug	7 Aug	8 Aug	9 Aug	10 Aug* 23 Sep 24 Sep	21 Aug	13 Aug	14 Aug	15 Aug	16 Aug	17 Aug	20 Sep	23 Aug	27 Aug	30 Aug# 6 Sep	31 Aug	4 Sep
7	20 Aug* 21 Sep	6 Aug	7 Aug	8 Aug	9 Aug	10 Aug	21 Aug	13 Aug	14 Aug	15 Aug	16 Aug	17 Aug	22 Sep	23 Aug	27 Aug	30 Aug	31 Aug	4 Sep
8	20 Aug	6 Aug	7 Aug	8 Aug	9 Aug	10 Aug	21 Aug	13 Aug	14 Aug	15 Aug	16 Aug	17 Aug	20 Sep	23 Aug	27 Aug	30 Aug* 6 Sep	31 Aug* 7 Sep	4 Sep
9	20 Aug* 21 Sep	6 Aug	7 Aug	8 Aug	9 Aug	10 Aug	21 Aug* 22 Sep	13 Aug	14 Aug	15 Aug	16 Aug	17 Aug	20 Sep	23 Aug	27 Aug	29 Aug	31 Aug	4 Sep
10	20 Aug	6 Aug	7 Aug	8 Aug	9 Aug	10 Aug	21 Aug	13 Aug	14 Aug	15 Aug	16 Aug	17 Aug	13 Sep@ 20 Sep	23 Aug	27 Aug	29 Aug	31 Aug	4 Sep
11	20 Aug	6 Aug	7 Aug	8 Aug	9 Aug	10 Aug* 30 Sep	21 Aug	13 Aug	14 Aug	15 Aug	16 Aug	17 Aug* 23 Sep	13 Sep@ 20 Sep	23 Aug	27 Aug	29 Aug	31 Aug	4 Sep
12							21 Aug* 22 Sep	13 Aug	14 Aug	15 Aug	16 Aug	17 Aug	13 Sep@ 20 Sep	24 Aug	28 Aug	29 Aug	31 Aug	23 Sep
13							21 Aug	13 Aug	14 Aug	15 Aug	16 Aug	17 Aug	20 Sep	24 Aug	28 Aug	29 Aug	1 Sep# 7 Sep	24 Sep
14							21 Aug	13 Aug	14 Aug	15 Aug	16 Aug	17 Aug	21 Sep	23 Aug	27 Aug	30 Aug* 6 Sep	31 Aug	24 Sep* 30 Sep
15													21 Sep	23 Aug	27 Aug	30 Aug	31 Aug	5 Sep# 23 Sep
16													13 Sep@ 20 Sep	23 Aug	27 Aug	30 Aug# 6 Sep	31 Aug* 7 Sep	4 Sep

* Transect redone because of current meter malfunction.
\# Transect redone because of inclement weather.
@ Transect redone because New York State Department of Transportation did not divert water through feeder canal leading to the New York State Barge Canal as requested.

Table 4. Predetermined interval width (ft) used during August and September 1980 at reach 1, West Canada Creek, New York.

Transect	NMPC Nominal Release (cfs)					
	160-D	160	200	250	300	350
1	3.0	3.0	3.0	3.0	3.0	3.0
2	3.0	3.0	3.0	3.0	3.0	3.0
3	3.0	3.0	3.0	3.0	3.0	3.0
4	3.0	3.0	3.0	3.0	3.0	3.0
5	1.5	3.0	3.0	3.0	3.0	3.0
6	6.0	6.0	6.0	6.0	6.0	6.0
7	3.0	3.0	3.0	3.0	3.0	3.0
8	3.0	3.0	3.0	3.0	3.0	3.0
9	3.0	3.0	3.0	3.0	3.0	3.0
10	3.0	3.0	3.0	3.0	3.0	3.0
11	3.0	3.0	3.0	3.0	3.0	3.0

Table 5. Predetermined interval width (ft) used during August and September 1980 at reach 2, West Canada Creek, New York.

Transect	NMPC Nominal Release (cfs)					
	160-D	160	200	250	300	350
1	6.0	6.0	6.0	6.0	6.0	6.0
2	6.0	6.0	6.0	6.0	6.0	6.0
3	3.0	6.0	6.0	6.0	6.0	6.0
4	6.0	6.0	6.0	6.0	6.0	6.0
5	6.0	6.0	6.0	6.0	6.0	6.0
6	6.0	6.0	6.0	6.0	6.0	6.0
7	6.0	6.0	6.0	6.0	6.0	6.0
8	6.0	6.0	6.0	6.0	6.0	6.0
9	3.0	6.0	6.0	6.0	6.0	6.0
10	3.0	6.0	6.0	6.0	6.0	6.0
11	6.0	6.0	6.0	6.0	6.0	6.0
12	3.0	6.0	6.0	6.0	6.0	6.0
13	3.0	6.0	6.0	6.0	6.0	6.0
14	3.0	6.0	6.0	6.0	6.0	6.0

Table 6. Predetermined interval width (ft) used during August and September 1980 at reach 3, West Canada Creek, New York.

Transect	NMPC Nominal Release (cfs)					
	160-D	160	200	250	300	350
1	4.0	4.0	4.0	4.0	4.0	4.0
2	4.0	4.0	4.0	4.0	4.0	4.0
3	4.0	4.0	4.0	4.0	4.0	4.0
4	3.0	3.0	3.0	3.0	3.0	3.0
5	8.0	8.0	8.0	8.0	8.0	6.0
6	8.0	8.0	8.0	8.0	8.0	8.0
7	8.0	8.0	8.0	8.0	8.0	8.0
8	8.0	8.0	8.0	8.0	8.0	8.0
9	6.0	6.0	6.0	6.0	6.0	6.0
10	6.0	6.0	6.0	6.0	6.0	6.0
11	4.0	4.0	4.0	4.0	4.0	4.0
12	4.0	4.0	4.0	4.0	4.0	4.0
13	4.0	4.0	4.0	4.0	4.0	4.0
14	4.0	4.0	4.0	4.0	4.0	4.0
15	4.0	4.0	4.0	4.0	4.0	4.0
16	4.0	4.0	4.0	4.0	4.0	4.0

Table 7. Probability-of-use (PU) for three life stages of brown trout at different depths (ft), velocities (fps), and substrate types recorded (REC) (Bovee 1978).

Adult						Juvenile						Fry					
Depth		Velocity		Substrate		Depth		Velocity		Substrate		Depth		Velocity		Substrate	
REC	PU	REC	PU	REC	PU	REC	PU	REC	PU	REC	PU	REC	PU	REC	PU	REC	PU
0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00
0.10	0.00	0.10	1.00	0.25	0.08	0.10	0.09	0.10	1.00	0.25	0.06	0.10	0.05	0.10	1.00	0.25	0.05
0.20	0.00	0.20	1.00	0.33	0.12	0.20	0.15	0.20	1.00	0.33	0.08	0.20	0.12	0.20	1.00	0.33	0.07
0.30	0.00	0.30	1.00	0.50	0.16	0.30	0.24	0.30	1.00	0.50	0.11	0.30	0.24	0.30	1.00	0.50	0.10
0.40	0.00	0.40	1.00	0.67	0.22	0.40	0.52	0.40	0.97	0.67	0.14	0.40	0.37	0.40	1.00	0.67	0.13
0.50	0.00	0.50	1.00	0.75	0.25	0.50	0.93	0.50	0.93	0.75	0.16	0.50	0.64	0.50	1.00	0.75	0.14
0.60	0.00	0.60	1.00	1.00	0.31	0.60	0.98	0.60	0.87	1.00	0.20	0.60	0.88	0.60	1.00	1.00	0.19
0.70	0.00	0.70	1.00	1.25	0.31	0.70	1.00	0.70	0.80	1.25	0.20	0.70	0.97	0.70	1.00	1.25	0.19
0.80	0.08	0.80	1.00	1.33	0.31	0.80	1.00	0.80	0.74	1.33	0.20	0.80	0.99	0.80	1.00	1.33	0.19
0.90	0.32	0.90	0.98	1.50	0.31	0.90	1.00	0.90	0.69	1.50	0.20	0.90	1.00	0.90	1.00	1.50	0.19
1.00	0.56	1.00	0.88	1.67	0.31	1.00	1.00	1.00	0.66	1.67	0.20	1.00	1.00	1.00	1.00	1.67	0.19
1.10	0.61	1.10	0.72	1.75	0.31	1.10	1.00	1.10	0.64	1.75	0.20	1.10	1.00	1.10	1.00	1.75	0.19
1.20	0.62	1.20	0.64	2.00	0.31	1.20	1.00	1.20	0.61	2.00	0.20	1.20	1.00	1.20	0.96	2.00	0.19
1.30	0.63	1.30	0.58	2.25	0.33	1.30	1.00	1.30	0.58	2.25	0.20	1.30	1.00	1.30	0.85	2.25	0.20
1.40	0.64	1.40	0.56	2.33	0.34	1.40	1.00	1.40	0.56	2.33	0.20	1.40	1.00	1.40	0.75	2.33	0.21
1.50	0.64	1.50	0.54	2.50	0.35	1.50	1.00	1.50	0.53	2.50	0.20	1.50	1.00	1.50	0.66	2.50	0.22
1.60	0.65	1.60	0.52	2.67	0.37	1.60	1.00	1.60	0.49	2.67	0.21	1.60	1.00	1.60	0.56	2.67	0.24
1.70	0.67	1.70	0.49	2.75	0.38	1.70	1.00	1.70	0.45	2.75	0.22	1.70	1.00	1.70	0.49	2.75	0.26
1.80	0.68	1.80	0.46	3.00	0.42	1.80	1.00	1.80	0.40	3.00	0.26	1.80	0.99	1.80	0.42	3.00	0.30
1.90	0.70	1.90	0.42	3.25	0.49	1.90	1.00	1.90	0.35	3.25	0.44	1.90	0.97	1.90	0.36	3.25	0.36
2.00	0.72	2.00	0.36	3.33	0.52	2.00	1.00	2.00	0.30	3.33	0.49	2.00	0.92	2.00	0.30	3.33	0.40
2.10	0.76	2.10	0.31	3.50	0.56	2.10	1.00	2.10	0.26	3.50	0.56	2.10	0.87	2.10	0.26	3.50	0.48
2.20	0.80	2.20	0.27	3.67	0.62	2.20	1.00	2.20	0.22	3.67	0.62	2.20	0.80	2.20	0.20	3.67	0.56
2.30	0.90	2.30	0.24	3.75	0.68	2.30	1.00	2.30	0.18	3.75	0.65	2.30	0.72	2.30	0.17	3.75	0.64
2.40	0.96	2.40	0.21	4.00	0.90	2.40	1.00	2.40	0.15	4.00	0.71	2.40	0.60	2.40	0.13	4.00	0.94
2.50	1.00	2.50	0.18	4.25	1.00	2.50	1.00	2.50	0.14	4.25	0.76	2.50	0.52	2.50	0.09	4.25	1.00
2.60	1.00	2.60	0.16	4.33	1.00	2.60	1.00	2.60	0.13	4.33	0.77	2.60	0.47	2.60	0.06	4.33	1.00
2.70	1.00	2.70	0.15	4.50	1.00	2.70	1.00	2.70	0.13	4.50	0.78	2.70	0.43	2.70	0.04	4.50	1.00
2.80	1.00	2.80	0.14	4.67	1.00	2.80	0.98	2.80	0.12	4.67	0.80	2.80	0.40	2.80	0.02	4.67	1.00
2.90	1.00	2.90	0.13	4.75	1.00	2.90	0.95	2.90	0.11	4.75	0.81	2.90	0.38	2.90	0.01	4.75	1.00
3.00	1.00	3.00	0.12	5.00	1.00	3.00	0.88	3.00	0.10	5.00	0.85	3.00	0.36	3.00	0.00	5.00	1.00
3.10	1.00	3.10	0.11	5.25	1.00	3.10	0.65	3.10	0.08	5.25	0.88	3.10	0.35	3.10	0.00	5.25	0.98
3.20	1.00	3.20	0.10	5.33	1.00	3.20	0.53	3.20	0.05	5.33	0.92	3.20	0.33	3.20	0.00	5.33	0.97
3.30	1.00	3.30	0.09	5.50	1.00	3.30	0.46	3.30	0.00	5.50	0.97	3.30	0.29	3.30	0.00	5.50	0.95
3.40	1.00	3.40	0.08	5.67	1.00	3.40	0.41	3.40	0.00	5.67	1.00	3.40	0.25	3.40	0.00	5.67	0.94
3.50	1.00	3.50	0.08	5.75	0.99	3.50	0.35	3.50	0.00	5.75	1.00	3.50	0.23	3.50	0.00	5.75	0.92
3.60	1.00	3.60	0.07	6.00	0.88	3.60	0.31	3.60	0.00	6.00	1.00	3.60	0.19	3.60	0.00	6.00	0.87
3.70	1.00	3.70	0.07	6.25	0.52	3.70	0.27	3.70	0.00	6.25	0.94	3.70	0.16	3.70	0.00	6.25	0.79
3.80	1.00	3.80	0.06	6.33	0.44	3.80	0.26	3.80	0.00	6.33	0.76	3.80	0.14	3.80	0.00	6.33	0.73
3.90	1.00	3.90	0.06	6.50	0.32	3.90	0.25	3.90	0.00	6.50	0.40	3.90	0.12	3.90	0.00	6.50	0.64
4.00	1.00	4.00	0.06	6.67	0.27	4.00	0.24	4.00	0.00	6.67	0.27	4.00	0.11	4.00	0.00	6.67	0.56
-	-	4.10	0.06	6.75	0.24	4.10	0.23	-	-	6.75	0.21	4.10	0.10	-	-	6.75	0.48
-	-	4.20	0.05	7.00	0.16	4.20	0.22	-	-	7.00	0.13	4.20	0.08	-	-	7.00	0.16
-	-	4.30	0.05	7.25	0.10	4.30	0.21	-	-	7.25	0.06	4.30	0.07	-	-	7.25	0.06
-	-	4.40	0.04	7.33	0.09	4.40	0.19	-	-	7.33	0.04	4.40	0.06	-	-	7.33	0.04
-	-	4.50	0.04	7.50	0.06	4.50	0.18	-	-	7.50	0.03	4.50	0.06	-	-	7.50	0.02
-	-	4.60	0.04	7.67	0.04	4.60	0.16	-	-	7.67	0.02	4.60	0.05	-	-	7.67	0.02
-	-	4.70	0.04	7.75	0.03	4.70	0.13	-	-	7.75	0.02	4.70	0.04	-	-	7.75	0.01
-	-	4.80	0.04	8.00	0.00	4.80	0.11	-	-	8.00	0.00	4.80	0.03	-	-	8.00	0.00
-	-	4.90	0.04	-	-	4.90	0.10	-	-	-	-	4.90	0.02	-	-	-	-
-	-	5.00	0.03	-	-	5.00	0.09	-	-	-	-	5.00	0.00	-	-	-	-
-	-	5.10	0.03	-	-	5.10	0.08	-	-	-	-	5.10	0.00	-	-	-	-
-	-	5.20	0.02	-	-	5.20	0.07	-	-	-	-	5.20	0.00	-	-	-	-
-	-	5.30	0.02	-	-	5.30	0.06	-	-	-	-	5.30	0.00	-	-	-	-
-	-	5.40	0.02	-	-	5.40	0.05	-	-	-	-	5.40	0.00	-	-	-	-
-	-	5.50	0.01	-	-	5.50	0.04	-	-	-	-	5.50	0.00	-	-	-	-
-	-	5.60	0.01	-	-	5.60	0.02	-	-	-	-	5.60	0.00	-	-	-	-
-	-	5.70	0.01	-	-	5.70	0.01	-	-	-	-	5.70	0.00	-	-	-	-
-	-	5.80	0.00	-	-	5.80	0.00	-	-	-	-	5.80	0.00	-	-	-	-
-	-	5.90	0.00	-	-	5.90	0.00	-	-	-	-	5.90	0.00	-	-	-	-
-	-	6.00	0.00	-	-	6.00	0.00	-	-	-	-	6.00	0.00	-	-	-	-

Table 8. Probability-of-use (PU) for three life stages of smallmouth bass at different depths (ft), velocities (fps), and substrate types recorded (REC) (IFG, unpublished).

Adult						Juvenile						Fry					
Depth		Velocity		Substrate		Depth		Velocity		Substrate		Depth		Velocity		Substrate	
REC	PU	REC	PU	REC	PU	REC	PU	REC	PU	REC	PU	REC	PU	REC	PU	REC	PU
0.00	0.00	0.00	0.73	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00
0.10	0.01	0.10	0.74	0.25	0.00	0.10	0.01	0.10	1.00	0.25	0.00	0.10	0.00	0.10	1.00	0.25	0.00
0.20	0.02	0.20	0.75	0.33	0.00	0.20	0.03	0.20	1.00	0.33	0.00	0.20	0.00	0.20	1.00	0.33	0.00
0.30	0.03	0.30	0.76	0.50	0.00	0.30	0.06	0.30	1.00	0.50	0.00	0.30	0.00	0.30	1.00	0.50	0.00
0.40	0.04	0.40	0.78	0.67	0.00	0.40	0.08	0.40	1.00	0.67	0.00	0.40	0.00	0.40	1.00	0.67	0.00
0.50	0.05	0.50	0.80	0.75	0.00	0.50	0.12	0.50	1.00	0.75	0.00	0.50	0.00	0.50	1.00	0.75	0.00
0.60	0.06	0.60	0.83	1.00	0.00	0.60	0.15	0.60	1.00	1.00	0.00	0.60	0.00	0.60	0.93	1.00	0.00
0.70	0.07	0.70	0.86	1.25	0.00	0.70	0.22	0.70	1.00	1.25	0.00	0.70	0.01	0.70	0.81	1.25	0.00
0.80	0.08	0.80	0.89	1.33	0.00	0.80	0.28	0.80	1.00	1.33	0.00	0.80	0.01	0.80	0.52	1.33	0.00
0.90	0.09	0.90	0.94	1.50	0.00	0.90	0.38	0.90	1.00	1.50	0.00	0.90	0.02	0.90	0.18	1.50	0.00
1.00	0.10	1.00	0.94	1.67	0.00	1.00	0.52	1.00	1.00	1.67	0.00	1.00	0.02	1.00	0.06	1.67	0.00
1.10	0.10	1.10	0.96	1.75	0.00	1.10	0.80	1.10	1.00	1.75	0.00	1.10	0.04	1.10	0.01	1.75	0.00
1.20	0.11	1.20	0.97	2.00	0.00	1.20	0.96	1.20	0.97	2.00	0.00	1.20	0.05	1.20	0.00	2.00	0.00
1.30	0.12	1.30	0.98	2.25	0.02	1.30	1.00	1.30	0.56	2.25	0.02	1.30	0.06	1.30	0.00	2.25	0.01
1.40	0.13	1.40	1.00	2.33	0.04	1.40	1.00	1.40	0.31	2.33	0.03	1.40	0.09	1.40	0.00	2.33	0.02
1.50	0.14	1.50	1.00	2.50	0.06	1.50	1.00	1.50	0.20	2.50	0.06	1.50	0.13	1.50	0.00	2.50	0.03
1.60	0.15	1.60	1.00	2.67	0.08	1.60	1.00	1.60	0.13	2.67	0.08	1.60	0.17	1.60	0.00	2.67	0.04
1.70	0.16	1.70	0.98	2.75	0.10	1.70	1.00	1.70	0.08	2.75	0.90	1.70	0.22	1.70	0.00	2.75	0.04
1.80	0.17	1.80	0.97	3.00	0.14	1.80	1.00	1.80	0.04	3.00	0.12	1.80	0.26	1.80	0.00	3.00	0.08
1.90	0.18	1.90	0.95	3.25	0.23	1.90	1.00	1.90	0.02	3.25	0.20	1.90	0.31	1.90	0.00	3.25	0.12
2.00	0.19	2.00	0.92	3.33	0.28	2.00	1.00	2.00	0.00	3.33	0.25	2.00	0.36	2.00	0.00	3.33	0.14
2.10	0.20	2.10	0.90	3.50	0.36	2.10	1.00	-	-	3.50	0.32	2.10	0.44	-	-	3.50	0.17
2.20	0.21	2.20	0.81	3.67	0.47	2.20	1.00	-	-	3.67	0.42	2.20	0.52	-	-	3.67	0.20
2.30	0.22	2.30	0.64	3.75	0.55	2.30	1.00	-	-	3.75	0.52	2.30	0.72	-	-	3.75	0.24
2.40	0.23	2.40	0.45	4.00	0.84	2.40	1.00	-	-	4.00	0.84	2.40	0.82	-	-	4.00	0.31
2.50	0.24	2.50	0.34	4.25	1.00	2.50	1.00	-	-	4.25	1.00	2.50	0.89	-	-	4.25	0.42
2.60	0.25	2.60	0.27	4.33	1.00	2.60	1.00	-	-	4.33	1.00	2.60	0.91	-	-	4.33	0.50
2.70	0.26	2.70	0.19	4.50	1.00	2.70	1.00	-	-	4.50	1.00	2.70	0.92	-	-	4.50	0.58
2.80	0.27	2.80	0.12	4.67	1.00	2.80	1.00	-	-	4.67	1.00	2.80	0.94	-	-	4.67	0.63
2.90	0.28	2.90	0.08	4.75	1.00	2.90	1.00	-	-	4.75	1.00	2.90	0.94	-	-	4.75	0.66
3.00	0.29	3.00	0.06	5.00	1.00	3.00	0.99	-	-	5.00	1.00	3.00	0.95	-	-	5.00	0.82
3.10	0.30	3.10	0.05	5.25	1.00	3.10	0.95	-	-	5.25	1.00	3.10	0.96	-	-	5.25	1.00
3.20	0.32	3.20	0.02	5.33	1.00	3.20	0.90	-	-	5.33	1.00	3.20	0.96	-	-	5.33	1.00
3.30	0.33	3.30	0.00	5.50	1.00	3.30	0.84	-	-	5.50	1.00	3.30	0.97	-	-	5.50	1.00
3.40	0.35	3.40	0.00	5.67	1.00	3.40	0.79	-	-	5.67	1.00	3.40	0.98	-	-	5.67	0.99
3.50	0.36	3.50	0.00	5.75	1.00	3.50	0.72	-	-	5.75	1.00	3.50	0.99	-	-	5.75	0.92
3.60	0.39	3.60	0.00	6.00	1.00	3.60	0.66	-	-	6.00	1.00	3.60	1.00	-	-	6.00	0.72
3.70	0.40	3.70	0.00	6.25	1.00	3.70	0.61	-	-	6.25	1.00	3.70	1.00	-	-	6.25	0.52
3.80	0.42	3.80	0.00	6.33	1.00	3.80	0.58	-	-	6.33	1.00	3.80	1.00	-	-	6.33	0.44
3.90	0.44	3.90	0.00	6.50	1.00	3.90	0.54	-	-	6.50	1.00	3.90	1.00	-	-	6.50	0.28
4.00	0.46	4.00	0.00	6.67	1.00	4.00	0.52	-	-	6.67	1.00	4.00	1.00	-	-	6.67	0.14
4.10	0.49	-	-	6.75	1.00	4.10	0.49	-	-	6.75	1.00	-	-	-	-	6.75	0.09
4.20	0.52	-	-	7.00	1.00	4.20	0.46	-	-	7.00	0.99	-	-	-	-	7.00	0.00
4.30	0.54	-	-	7.25	0.86	4.30	0.43	-	-	7.25	0.88	-	-	-	-	7.25	0.00
4.40	0.58	-	-	7.33	0.68	4.40	0.41	-	-	7.33	0.68	-	-	-	-	7.33	0.00
4.50	0.63	-	-	7.50	0.36	4.50	0.39	-	-	7.50	0.40	-	-	-	-	7.50	0.00
4.60	0.68	-	-	7.67	0.22	4.60	0.37	-	-	7.67	0.22	-	-	-	-	7.67	0.00
4.70	0.76	-	-	7.75	0.12	4.70	0.34	-	-	7.75	0.14	-	-	-	-	7.75	0.00
4.80	0.84	-	-	8.00	0.00	4.80	0.33	-	-	8.00	0.00	-	-	-	-	8.00	0.00
4.90	0.93	-	-	-	-	4.90	0.31	-	-	-	-	-	-	-	-	-	-
5.00	0.95	-	-	-	-	5.00	0.29	-	-	-	-	-	-	-	-	-	-
5.10	0.96	-	-	-	-	5.10	0.28	-	-	-	-	-	-	-	-	-	-
5.20	0.98	-	-	-	-	5.20	0.26	-	-	-	-	-	-	-	-	-	-
5.30	1.00	-	-	-	-	5.30	0.25	-	-	-	-	-	-	-	-	-	-
5.40	1.00	-	-	-	-	5.40	0.24	-	-	-	-	-	-	-	-	-	-
5.50	1.00	-	-	-	-	5.50	0.22	-	-	-	-	-	-	-	-	-	-
5.60	1.00	-	-	-	-	5.60	0.20	-	-	-	-	-	-	-	-	-	-
5.70	1.00	-	-	-	-	5.70	0.19	-	-	-	-	-	-	-	-	-	-
5.80	1.00	-	-	-	-	5.80	0.17	-	-	-	-	-	-	-	-	-	-
5.90	1.00	-	-	-	-	5.90	0.15	-	-	-	-	-	-	-	-	-	-
6.00	1.00	-	-	-	-	6.00	0.14	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	6.10	0.12	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	6.20	0.12	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	6.30	0.11	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	6.40	0.09	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	6.50	0.08	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	6.60	0.07	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	6.70	0.06	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	6.80	0.05	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	6.90	0.04	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	7.00	0.04	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	7.10	0.03	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	7.20	0.02	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	7.30	0.02	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	7.40	0.02	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	7.50	0.01	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	7.60	0.01	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	7.70	0.01	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	7.80	0.00	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	7.90	0.00	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	8.00	0.00	-	-	-	-	-	-	-	-	-	-

Table 9. Stream width (ft) during August and September 1980 at reach 1, West Canada Creek, New York.

Transect	NMPC Nominal Release (cfs)					
	160-D	160	200	250	300	350
1	63.8	64.4	70.5	72.8	78.3	84.5
2	69.8	77.2	76.2	83.6	84.7	88.4
3	76.1	77.3	78.5	84.0	85.4	85.9
4	67.0	71.1	78.5	80.3	82.0	83.8
5	76.8	79.2	79.9	84.2	82.2	86.3
6	315.2	326.7	331.0	335.9	340.8	342.8
7	129.1	132.7	133.0	143.0	140.8	148.0
8	116.9	119.3	119.5	124.9	127.4	128.0
9	109.0	114.4	113.5	115.6	117.4	118.0
10	105.6	107.0	112.8	111.3	113.0	113.3
11	91.5	100.0	100.3	104.2	107.2	106.7

Table 10. Stream width (ft) during August and September 1980 at reach 2, West Canada Creek, New York.

Transect	NMPC Nominal Release (cfs)					
	160-D	160	200	250	300	350
1	156.0	160.3	162.9	168.9	169.7	176.0
2	154.4	155.4[c]	165.9	168.8	172.9	178.4
3[a]	125.6[b]	152.6[b]	154.9[b]	161.1[b]	162.3[b]	168.6[b]
4[a]	179.0[b]	211.9[b]	210.9[b,d]	213.8[b]	213.9[b,d]	216.1[b]
5[a]	161.1[b]	169.5[b]	187.7[b]	194.0[b]	201.1[b]	222.0[b]
6[a]	154.8[b]	173.4[b]	180.0[b]	185.0[b]	191.9[b]	193.3[b]
7	179.3	191.3	194.0	194.6[d]	195.7	198.8
8	158.8	164.1	167.6	169.2	169.5	189.7
9	ND*	128.3	130.3	131.7	132.2	134.0
10	116.9	119.8	119.1	119.8	123.8	146.1
11	130.3	132.1	133.1	134.4[e]	135.3	135.8
12	120.0	124.8[e]	125.1	127.6	128.2	130.2
13	99.2	102.8	105.8	121.8	122.5	124.9
14	122.3	142.1	ND	147.3	150.8	149.2

* ND = no data.
[a]Transect crosses an island.
[b]Stream width estimated because of island.
[c]Two interval widths added to stream width because of two missed sampling points.
[d]One interval width added to stream width because of one missed sampling point.
[e]One interval width subtracted from stream width because of added sampling point.

Table 11. Stream width (ft) during August and September 1980 at reach 3, West Canada Creek, New York.

Transect	NMPC Nominal Release (cfs)					
	160-D	160	200	250	300	350
1	150.6	152.6	155.9	153.1[d]	155.2	158.2
2[a]	131.7[b]	140.4[b]	141.0[b]	153.4	157.5	157.7[b]
3[a]	123.0[b]	136.5[b]	137.2[b]	145.7	145.2	150.5[b]
4[a]	113.6	122.1[b]	123.4[b]	147.2[b]	162.9	163.6
5	339.6	342.1	340.8	341.8	342.5	341.6
6	285.4	286.2	286.0	287.7	287.1	288.6
7	234.3	237.1	236.9	237.0	237.5	238.0
8	196.1[e]	199.2	198.4	205.3	204.6	216.2
9	170.0	173.0	172.7	181.0	192.9	193.2
10	186.8[e]	187.5	187.4	192.1	198.6	200.4
11	103.6	107.2	107.0	110.7	112.5	113.3
12	100.6	100.3	100.3	123.2	125.0	126.9[d]
13	97.0	105.8	106.6	110.1	114.5	115.6
14	96.0	102.4	103.0	102.8	111.1	110.2
15	105.8	113.7[e]	114.1	117.7	129.8	128.4
16	146.0	147.9[d]	149.0	162.7	163.6	169.2

[a]Transect crosses an island.
[b]Stream width estimated because of island.
[d]One interval width added to stream width because of missed sampling point.
[e]One interval width subtracted from stream width because of added sampling point.

Table 12. Calculated discharge (cfs) during August and September 1980 at reach 1, West Canada Creek, New York.

Transect	NMPC Nominal Release (cfs)					
	160-D*	160	200	250	300	350
1	133.3	187.9	240.7	283.0	297.3	359.5
2	134.6	188.8	279.6	307.7	366.8	458.2
3	131.9	184.2	269.6	296.8	395.4	420.0
4	137.5	185.9	230.2	272.8	373.2	402.0
5	129.3	155.9	209.3	182.9	266.4	320.6
6	131.9	211.6	247.6	289.9	326.4	279.5
7	76.3	160.1	186.6	228.3	315.9	367.0
8	85.3	163.6	165.2	213.0	270.7	314.4
9	78.4	166.5	190.4	219.5	317.2	347.8
10	93.4	179.6	186.6	238.6	348.1	324.5
11	111.8	174.5	189.7	177.1	175.9	390.9
Mean	113.1	178.0	217.8	246.3	313.9	362.2
SD	24.8	16.2	37.9	46.1	61.4	52.4
Minimum	76.3	155.9	165.2	177.1	175.9	279.5
Maximum	137.5	211.6	279.6	307.7	395.4	458.2

* 160-D was about 82.4 cfs at transects 1-6, 8, 10, and 11, and about 88.7 cfs at transects 7 and 9.

Table 13. Calculated discharge (cfs) during August and September 1980 at reach 2, West Canada Creek, New York.

Transect	NMPC Nominal Release (cfs)					
	160-D*	160	200	250	300	350
1	105.1	180.4	217.9	264.9	310.0	352.2
2	144.1	195.5	264.8	314.2	359.4	442.2
3	147.8	223.5	274.2	309.9	328.5	408.2
4	126.9	132.9	178.8	225.5	234.2	349.7
5	134.8	228.1	273.3	328.0	374.2	444.9
6	116.8	120.9	179.3	222.6	249.8	340.5
7	106.5	112.7	212.8	254.8	295.1	367.4
8	131.4	195.1	232.2	284.8	317.6	406.3
9	133.4	134.6	198.3	237.0	291.6	346.9
10	106.4	181.1	207.3	240.0	294.5	361.1
11	116.4	111.9	131.7	177.6	204.1	292.8
12	122.6	135.8	178.8	222.0	261.9	316.0
13	130.1	194.9	232.2	272.6	322.6	387.3
14	142.1	195.8	252.5	287.5	341.8	389.8
Mean	126.0	167.4	216.7	260.1	299.0	371.8
SD	14.2	41.0	41.6	42.4	48.1	44.2
Minimum	105.1	111.9	131.7	177.6	204.1	292.8
Maximum	147.8	228.1	274.2	328.0	374.2	444.9

* 160-D was about 82.4 cfs at transects 1, 2, 4-8, 10, 11, 13, and 14, and about 88.7 cfs at transects 3, 9, and 12.

Table 14. Calculated discharge (cfs) during August and September 1980 at reach 3, West Canada Creek, New York.

Transect	NMPC Nominal Release (cfs)					
	160-D*	160	200	250	300	350
1	199.3	243.8	306.2	340.3	506.7	485.0
2	200.4	194.0	201.8	340.8	400.6	512.4
3	248.6	173.5	109.7	319.8	414.2	503.6
4	235.4	294.9	354.8	437.3	584.6	514.3
5	262.2	356.0	359.6	432.9	559.0	527.0
6	208.2	295.3	314.5	387.0	484.3	564.1
7	207.2	289.7	301.5	376.5	507.9	595.1
8	250.2	123.4	128.5	384.0	414.5	561.4
9	219.6	276.4	312.9	374.2	502.4	599.1
10	226.7	309.9	302.2	386.8	522.9	539.8
11	269.7	324.6	320.2	391.7	547.9	639.3
12	205.0	242.7	291.9	331.1	423.4	451.7
13	250.3	279.8	317.7	363.7	436.8	458.1
14	199.8	272.1	290.6	385.4	527.9	476.3
15	231.4	290.4	304.1	374.6	453.2	486.1
16	257.4	229.7	243.8	426.6	507.6	523.1
Mean	229.5	262.3	278.8	378.3	487.1	527.3
SD	24.5	59.4	72.6	34.6	56.9	53.2
Minimum	199.3	123.4	109.7	319.8	400.6	451.7
Maximum	269.7	356.0	359.6	437.3	584.6	639.3

* 160-D was about 88.7 cfs.

Table 15. Calculated discharge during August and September 1980 at Trenton through the feeder canal to the New York State Barge Canal.

Date	Discharge (cfs)	Comments
20 Aug 80	77.6	Diversion for 160-D release at most transects at reaches 1 and 2. Taintor gate closed.
24 Aug 80	16.7	Leakage into diversion channel during 160 cfs release at reach 3. Taintor gate closed.
21 Sep 80	71.3	Diversion for 160-D release at reach 1, transects 7 and 9; reach 2, transects 3, 9, and 12; and reach 3, all transects. Taintor gate closed.
24 Sep 80	0.0	Leakage into diversion channel during 350 cfs release at reach 1, transect 6; reach 2, transect 11; and reach 3, transects 1-5 and 12-15. Taintor gate open.

Table 16. Weighted usable width (ft) and percent usable stream width for adult brown trout during August and September 1980 at reach 1, West Canada Creek, New York.

Transect	NMPC Nominal Release (cfs)											
	160-D		160		200		250		300		350	
	Weighted Usable Width (ft)	% Usable Stream Width	Weighted Usable Width (ft)	% Usable Stream Width	Weighted Usable Width (ft)	% Usable Stream Width	Weighted Usable Width (ft)	% Usable Stream Width	Weighted Usable Width (ft)	% Usable Stream Width	Weighted Usable Width (ft)	% Usable Stream Width
1	2.8	4.4	4.6	7.1	3.9	5.5	3.8	5.2	3.7	4.7	3.4	4.0
2	3.6	5.2	3.4	4.4	2.8	3.7	3.6	4.3	3.1	3.6	2.6	2.9
3	8.2	10.8	3.6	4.6	5.0	6.4	7.0	8.3	5.4	6.3	6.8	7.9
4	2.1	3.1	2.4	3.4	1.6	2.0	1.8	2.2	1.5	1.8	1.7	2.0
5	2.4	3.1	2.7	3.4	1.7	2.1	5.5	6.5	5.3	6.4	4.3	5.0
6	5.2	1.6	20.1	6.2	20.2	6.1	31.6	9.4	28.8	8.4	50.2	14.6
7	67.6	52.4	68.7	51.8	72.7	54.7	66.3	46.4	52.4	37.2	49.3	33.3
8	31.1	26.6	33.4	28.0	34.3	28.7	33.6	26.9	31.4	24.6	29.7	23.2
9	45.9	42.1	46.9	41.0	46.6	41.0	45.4	39.3	37.9	32.3	36.6	31.0
10	7.5	7.1	7.6	7.1	9.4	8.3	9.1	8.2	9.0	8.0	10.1	8.9
11	5.4	5.9	5.1	5.1	5.1	5.1	7.8	7.5	8.7	8.1	4.4	4.1
Average	16.5	14.8	18.0	14.7	18.5	14.9	19.6	14.9	17.0	12.8	18.1	12.4

Table 17. Weighted usable width (ft) and percent usable stream width for juvenile brown trout during August and September 1980 at reach 1, West Canada Creek, New York.

	NMPC Nominal Release (cfs)											
	160-D		160		200		250		300		350	
Transect	Weighted Usable Width (ft)	% Usable Stream Width	Weighted Usable Width (ft)	% Usable Stream Width	Weighted Usable Width (ft)	% Usable Stream Width	Weighted Usable Width (ft)	% Usable Stream Width	Weighted Usable Width (ft)	% Usable Stream Width	Weighted Usable Width (ft)	% Usable Stream Width
1	9.6	15.0	7.8	12.1	6.1	8.6	7.7	10.6	6.8	8.7	6.4	7.6
2	11.7	16.8	11.8	15.3	7.9	10.4	11.3	13.5	8.1	9.6	5.7	6.4
3	18.8	24.7	13.8	17.8	11.6	14.8	11.4	13.6	8.0	9.4	10.7	12.4
4	5.0	7.5	5.1	7.2	5.6	7.1	5.1	6.4	4.7	5.7	4.9	5.8
5	8.8	11.4	11.1	14.0	5.8	7.2	14.1	16.7	13.9	16.9	10.2	11.8
6	116.1	36.8	121.1	37.1	122.6	37.0	108.7	32.4	104.5	30.7	149.2	43.5
7	105.7	81.9	91.8	69.2	88.4	66.5	78.9	55.2	71.7	50.9	67.8	45.8
8	52.4	44.8	45.7	38.3	48.3	40.4	45.9	36.7	43.0	33.8	40.7	31.8
9	62.0	56.9	57.2	50.0	56.0	49.3	54.5	47.1	45.3	38.6	43.1	36.5
10	16.7	15.8	15.9	14.8	16.7	14.8	14.2	12.8	15.1	13.4	12.4	10.9
11	9.2	10.0	11.4	11.4	16.9	16.8	16.7	16.0	15.0	14.0	9.3	8.7
Average	37.8	29.2	35.7	26.1	35.1	24.8	33.5	23.7	30.6	21.1	32.8	20.1

Table 18. Weighted usable width (ft) and percent usable stream width for fry brown trout during August and September 1980 at reach 1, West Canada Creek, New York.

Transect	NMPC Nominal Release (cfs)											
	160-D		160		200		250		300		350	
	Weighted Usable Width (ft)	% Usable Stream Width	Weighted Usable Width (ft)	% Usable Stream Width	Weighted Usable Width (ft)	% Usable Stream Width	Weighted Usable Width (ft)	% Usable Stream Width	Weighted Usable Width (ft)	% Usable Stream Width	Weighted Usable Width (ft)	% Usable Stream Width
1	11.6	18.2	10.2	15.8	7.3	10.4	7.4	10.2	6.6	8.4	6.5	7.7
2	10.8	15.5	12.5	16.2	7.6	10.0	10.3	12.3	8.7	10.3	6.4	7.2
3	23.7	31.1	18.0	23.3	14.0	17.8	18.6	22.1	9.3	10.9	12.2	14.2
4	5.3	7.9	5.4	7.6	5.2	6.6	4.7	5.8	4.1	5.0	4.4	5.2
5	10.2	13.3	12.6	15.9	6.0	7.5	11.2	13.3	11.7	14.2	9.5	11.0
6	101.0	32.0	117.5	36.0	126.2	38.1	112.8	33.6	106.5	31.2	155.9	45.5
7	83.2	64.4	79.9	60.2	77.7	58.4	80.0	55.9	64.5	45.8	62.6	42.3
8	58.1	49.7	56.0	46.9	55.0	46.0	53.8	43.1	47.0	36.9	46.1	36.0
9	55.4	50.8	48.9	42.7	46.8	41.2	46.4	40.1	40.2	34.2	38.4	32.5
10	17.7	16.8	17.0	15.9	18.1	16.0	17.4	15.6	17.4	15.4	15.0	13.2
11	14.2	15.5	15.7	15.7	13.1	13.1	20.5	19.7	20.5	19.1	12.4	11.6
Average	35.6	28.6	35.8	26.9	34.3	24.1	34.8	24.7	30.6	21.0	33.6	20.6

Table 19. Weighted usable width (ft) and percent usable stream width for adult brown trout during August and September 1980 at reach 2, West Canada Creek, New York.

Transect	NMPC Nominal Release (cfs)											
	160-D		160		200		250		300		350	
	Weighted Usable Width (ft)	% Usable Stream Width	Weighted Usable Width (ft)	% Usable Stream Width	Weighted Usable Width (ft)	% Usable Stream Width	Weighted Usable Width (ft)	% Usable Stream Width	Weighted Usable Width (ft)	% Usable Stream Width	Weighted Usable Width (ft)	% Usable Stream Width
1	49.6	31.8	52.6	32.8	52.2	32.0	54.0	32.0	55.2	32.5	61.1	34.7
2	25.6	16.6	28.9[c]	18.6	29.0	17.5	30.9	18.3	30.9	17.9	33.8	18.9
3	19.9	15.8	29.1	19.1	29.7	19.2	31.1	19.3	35.6	21.9	31.9	18.9
4	20.3	11.3	32.2	15.2	30.6[d]	14.5	32.5	15.2	35.1[d]	16.4	31.4	14.5
5	21.2	13.2	14.2	8.4	12.5	6.6	12.0	6.2	12.4	6.2	14.1	6.4
6	25.6	16.5	41.3	23.8	42.6	23.7	39.0	21.1	40.7	21.2	36.6	18.9
7	25.0	13.9	42.1	22.0	29.4	15.2	33.0[d]	17.0	36.2	18.5	28.8	14.5
8	43.9	27.6	49.6	30.2	46.5	27.7	44.2	26.1	44.9	26.5	40.1	21.1
9	63.0	ND*	74.4	58.0	81.2	62.3	83.0	63.0	79.5	60.1	73.1	54.6
10	40.9	35.0	47.0	39.2	46.6	39.1	50.0	41.7	47.7	38.5	42.0	28.7
11	71.6	55.0	78.1	59.1	81.9	61.5	78.5[e]	58.4	85.3	63.0	81.0	59.6
12	67.2	56.0	70.8[e]	56.7	68.4	54.7	67.1	52.6	66.4	51.8	66.9	51.4
13	14.2	14.3	18.4	17.9	17.1	16.2	17.9	14.7	19.3	15.8	17.4	13.9
14	17.6	14.4	17.2	12.1	20.8	ND	22.7	15.4	19.8	13.1	19.6	13.1
Average	36.1	24.7	42.6	29.5	42.0	30.0	42.6	28.6	43.5	28.8	41.3	26.4

* ND = no data.
[c] Average weighted usable width per sampling interval added twice because of two missed sampling points.
[d] Average weighted usable width per sampling interval added once because of one missed sampling point.
[e] Average weighted usable width per sampling interval subtracted once because of one added sampling point.

Table 20. Weighted usable width (ft) and percent usable stream width for juvenile brown trout during August and September 1980 at reach 2, West Canada Creek, New York.

Transect	NMPC Nominal Release (cfs)											
	160-D		160		200		250		300		350	
	Weighted Usable Width (ft)	% Usable Stream Width	Weighted Usable Width (ft)	% Usable Stream Width	Weighted Usable Width (ft)	% Usable Stream Width	Weighted Usable Width (ft)	% Usable Stream Width	Weighted Usable Width (ft)	% Usable Stream Width	Weighted Usable Width (ft)	% Usable Stream Width
1	71.9	46.1	76.8	47.9	78.1	47.9	78.8	46.6	75.6	44.5	72.8	41.4
2	54.6	35.4	62.7[c]	40.3	68.1	41.0	72.7	43.1	74.5	43.1	68.6	38.4
3	55.5	44.2	57.1	37.4	55.7	36.0	58.3	36.2	64.4	39.7	66.6	39.5
4	64.0	35.8	97.5	46.0	97.2[d]	46.1	118.3	55.3	118.8[d]	55.5	100.0	46.3
5	67.4	41.8	50.5	29.8	49.6	26.4	48.6	25.0	49.3	24.5	50.5	22.7
6	64.1	41.4	103.0	59.4	96.1	53.4	93.6	50.6	92.8	48.4	77.9	40.3
7	82.0	45.7	116.2	60.7	101.8	52.5	108.1[d]	55.5	107.8	55.1	95.6	48.1
8	72.8	45.8	77.2	47.0	76.8	45.8	78.7	46.5	78.8	46.5	68.8	36.3
9	66.2	ND*	75.1	58.5	73.0	56.0	66.0	50.1	68.5	51.8	63.4	47.3
10	49.7	42.5	54.3	45.3	46.9	39.4	46.2	38.6	51.2	41.4	50.3	34.4
11	95.4	73.2	91.4	69.2	86.4	64.9	75.5[e]	56.2	75.0	55.4	64.3	47.3
12	76.6	63.8	85.4[e]	68.4	78.8	63.0	72.8	57.0	72.3	56.4	69.1	53.1
13	34.5	34.8	49.6	48.2	45.5	43.0	47.0	38.6	42.9	35.0	38.0	30.4
14	49.4	40.4	47.6	33.5	40.2	ND	47.2	32.0	41.8	27.7	44.8	30.0
Average	64.6	45.4	74.6	49.4	71.0	47.3	72.3	45.1	72.4	44.6	66.5	39.7

* ND = no data.
[c] Average weighted usable with per sampling interval added twice because of two missed sampling points.
[d] Average weighted usable with per sampling interval added once because of one missed sampling point.
[e] Average weighted usable with per sampling interval subtracted once because of one added sampling point.

Table 21. Weighted usable width (ft) and percent usable stream width for fry brown trout during August and September 1980 at reach 2, West Canada Creek, New York.

Transect	NMPC Nominal Release (cfs) 160-D Weighted Usable Width (ft)	160-D % Usable Stream Width	160 Weighted Usable Width (ft)	160 % Usable Stream Width	200 Weighted Usable Width (ft)	200 % Usable Stream Width	250 Weighted Usable Width (ft)	250 % Usable Stream Width	300 Weighted Usable Width (ft)	300 % Usable Stream Width	350 Weighted Usable Width (ft)	350 % Usable Stream Width
1	81.1	52.0	90.2	56.3	86.3	53.0	81.1	48.0	77.0	45.4	71.2	40.4
2	73.1	47.3	69.9[c]	45.0	69.8	42.1	74.6	44.2	76.3	44.1	74.5	41.8
3	57.7	45.9	58.6	38.4	56.3	36.3	55.6	34.5	57.6	35.5	51.5	30.5
4	60.3	33.7	93.4	44.1	95.8[d]	45.4	108.9	50.9	115.5[d]	54.0	105.0	48.6
5	67.6	42.0	50.9	30.0	44.5	23.7	43.5	22.4	43.3	21.5	41.0	18.5
6	73.1	47.2	110.5	63.7	109.7	60.9	111.2	60.1	115.6	60.2	97.8	50.6
7	82.8	46.2	118.7	62.0	105.5	54.4	111.9[d]	57.5	127.4	65.1	114.0	57.3
8	88.0	55.4	91.4	55.7	91.4	54.5	89.5	52.9	89.6	52.9	76.1	40.1
9	52.2	ND*	51.9	40.4	52.3	40.1	51.0	38.7	56.6	42.8	56.3	42.0
10	41.1	35.2	46.4	38.7	44.0	36.9	41.5	34.6	49.4	39.9	49.3	33.7
11	70.8	54.3	65.8	49.8	64.3	48.3	55.6[e]	41.4	57.9	42.8	51.3	37.8
12	64.9	54.1	71.8[e]	57.5	68.0	54.4	65.3	51.2	65.1	50.8	61.6	47.3
13	39.7	40.0	45.6	44.4	43.8	41.4	44.2	36.3	42.9	35.0	36.7	29.4
14	58.1	47.5	52.4	36.9	42.9	ND	50.2	34.1	41.6	27.6	40.8	27.3
Average	65.0	46.2	72.7	47.4	69.6	45.5	70.3	43.3	72.6	44.1	66.2	39.0

* ND = no data.

[c] Average weighted usable width per sampling interval added twice because of two missed sampling points.

[d] Average weighted usable width per sampling interval added once because of one missed sampling point.

[e] Average weighted usable width per sampling interval subtracted once because of one added sampling point.

Table 22. Weighted usable width (ft) and percent usable stream width for adult brown trout during August and September 1980 at reach 3, West Canada Creek, New York.

Transect	NMPC Nominal Release (cfs) 160-D Weighted Usable Width (ft)	160-D % Usable Stream Width	160 Weighted Usable Width (ft)	160 % Usable Stream Width	200 Weighted Usable Width (ft)	200 % Usable Stream Width	250 Weighted Usable Width (ft)	250 % Usable Stream Width	300 Weighted Usable Width (ft)	300 % Usable Stream Width	350 Weighted Usable Width (ft)	350 % Usable Stream Width
1	60.0	39.8	70.5	46.2	65.2	41.8	67.5[d]	44.1	73.9	47.6	73.6	46.5
2	31.8	24.1	34.8	24.8	33.4	23.7	25.3	16.5	24.5	15.6	19.5	12.4
3	6.0	4.9	17.0	12.4	24.5	17.8	12.6	8.6	6.8	4.7	5.8	3.8
4	5.2	4.6	4.4	3.6	5.2	4.2	3.7	2.5	3.9	2.4	4.6	2.8
5	4.0	1.2	6.2	1.8	8.6	2.5	11.3	3.3	13.7	4.0	19.0	5.6
6	43.6	15.3	52.6	18.4	45.6	15.9	43.8	15.2	51.8	18.0	50.3	17.4
7	26.7	11.4	28.1	11.8	29.8	12.6	26.3	11.1	24.9	10.5	22.4	9.4
8	23.0[e]	11.7	48.6	24.4	53.0	26.7	32.8	16.0	39.0	19.1	39.9	18.4
9	17.6	10.4	16.9	9.8	15.8	9.1	20.9	11.5	27.2	14.1	30.0	15.5
10	7.0[e]	3.7	13.1	7.0	11.9	6.4	13.4	7.0	19.4	9.8	23.1	11.5
11	13.3	12.8	8.7	8.1	10.6	9.9	9.7	8.8	11.9	10.6	10.6	9.4
12	21.0	20.9	20.6	20.5	19.6	19.5	19.7	16.0	20.3	16.2	20.4[d]	16.1
13	25.3	26.1	21.9	20.7	22.0	20.6	23.2	21.1	25.2	22.0	23.8	20.6
14	38.8	40.4	40.4	39.4	40.3	39.1	41.1	40.0	41.4	37.3	40.8	37.0
15	23.3	22.0	21.1[e]	18.6	21.8	19.1	18.3	15.5	17.8	13.7	17.0	13.2
16	4.4	3.0	7.5[d]	5.1	9.6	6.4	7.8	4.8	8.0	4.8	12.8	7.6
Average	21.9	15.8	25.8	17.0	26.0	17.2	23.6	15.1	25.6	15.6	25.8	15.4

[d] Average weighted usable width per sampling interval added once because of one missed sampling point.
[e] Average weighted usable width per sampling interval subtracted once because of one added sampling point.

Table 23. Weighted usable width (ft) and percent usable stream width for juvenile brown trout during August and September 1980 at reach 3, West Canada Creek, New York.

Transect	NMPC Nominal Release (cfs)											
	160-D		160		200		250		300		350	
	Weighted Usable Width (ft)	% Usable Stream Width	Weighted Usable Width (ft)	% Usable Stream Width	Weighted Usable Width (ft)	% Usable Stream Width	Weighted Usable Width (ft)	% Usable Stream Width	Weighted Usable Width (ft)	% Usable Stream Width	Weighted Usable Width (ft)	% Usable Stream Width
1	86.4	57.4	90.0	59.0	82.9	53.2	76.2[d]	49.8	65.6	42.3	69.7	44.0
2	39.1	29.7	43.4	30.9	53.5	37.9	43.9	28.6	44.0	27.9	41.1	26.1
3	23.6	19.2	52.3	38.3	65.0	47.4	40.2	27.6	25.8	17.8	20.0	13.3
4	22.1	19.4	18.8	15.4	18.7	15.2	14.7	10.0	13.7	8.4	13.1	8.0
5	59.5	17.5	71.3	20.8	77.6	22.8	67.6	19.8	81.6	23.8	76.1	22.3
6	131.9	46.2	121.3	42.4	116.6	40.8	107.1	37.2	102.3	35.6	94.3	32.7
7	89.0	38.0	84.9	35.8	86.9	36.7	80.5	34.0	67.4	28.4	57.0	23.9
8	89.0[e]	45.4	132.6	66.6	131.3	66.2	80.6	39.2	76.6	37.4	74.0	34.2
9	60.6	35.6	64.5	37.3	62.6	36.2	63.3	35.0	66.2	34.3	57.4	29.7
10	38.1[e]	20.4	46.8	25.0	49.4	26.4	52.6	27.4	52.3	26.3	51.3	25.6
11	19.6	18.9	19.5	18.2	23.2	21.7	24.8	22.4	22.6	20.1	19.5	17.2
12	2.8	2.8	2.6	2.6	2.7	2.7	3.0	2.4	11.0	8.8	8.5[d]	6.7
13	8.9	9.2	8.6	8.1	9.4	8.8	12.0	10.9	14.1	12.3	18.8	16.3
14	24.6	25.6	33.2	32.4	30.9	30.0	27.5	26.8	27.7	24.9	27.7	25.1
15	29.7	28.1	21.7[e]	19.1	21.5	18.8	18.5	15.7	19.5	15.0	16.3	12.7
16	14.6	10.0	29.2[d]	19.7	30.6	20.5	26.8	16.5	24.6	15.0	27.0	16.0
Average	46.2	26.5	52.5	29.5	53.9	30.3	46.2	25.2	44.7	23.6	42.0	22.1

[d] Average weighted usable width per sampling interval added once because of one missed sampling point.
[e] Average weighted usable width per sampling interval subtracted once because of one added sampling point.

Table 24. Weighted usable width (ft) and percent usable stream width for fry brown trout during August and September 1980 at reach 3, West Canada Creek, New York.

Transect	NMPC Nominal Release (cfs)											
	160-D		160		200		250		300		350	
	Weighted Usable Width (ft)	% Usable Stream Width	Weighted Usable Width (ft)	% Usable Stream Width	Weighted Usable Width (ft)	% Usable Stream Width	Weighted Usable Width (ft)	% Usable Stream Width	Weighted Usable Width (ft)	% Usable Stream Width	Weighted Usable Width (ft)	% Usable Stream Width
1	98.7	65.5	107.0	70.1	106.0	68.0	102.5[d]	66.9	92.8	59.8	92.9	58.7
2	41.5	31.5	51.1	36.4	54.1	38.4	50.9	33.2	50.5	32.1	49.4	31.3
3	29.8	24.2	57.0	41.8	77.6	56.6	50.7	34.8	30.8	21.2	21.2	14.1
4	21.8	19.2	21.2	17.4	21.0	17.0	16.1	10.9	14.0	8.6	14.5	8.9
5	69.4	20.4	78.0	22.8	81.4	23.9	74.5	21.8	83.5	24.4	82.5	24.2
6	186.5	65.3	179.6	62.8	167.8	58.7	148.4	51.6	133.5	46.5	122.5	42.4
7	114.9	49.0	102.8	43.4	107.2	45.2	91.1	38.4	68.9	29.0	59.3	24.9
8	108.5[e]	55.3	140.4	70.5	142.4	71.8	93.5	45.5	93.4	45.6	81.4	37.6
9	56.7	33.4	64.4	37.2	59.7	34.6	62.8	34.7	68.9	35.7	65.5	33.9
10	50.2[e]	26.9	60.6	32.3	61.9	33.0	69.0	35.9	71.1	35.8	76.9	38.4
11	18.9	18.2	17.2	16.0	19.8	18.5	19.8	17.9	21.8	19.4	15.4	13.6
12	1.8	1.8	1.8	1.8	1.8	1.8	2.0	1.6	9.3	7.4	7.4[d]	5.8
13	7.7	7.9	6.3	6.0	8.4	7.9	9.3	8.4	11.6	10.1	16.6	14.4
14	17.0	17.7	25.5	24.9	23.4	22.7	22.8	22.2	24.1	21.7	23.1	21.0
15	33.9	32.0	23.0[e]	20.2	27.6	24.2	18.7	15.9	18.6	14.3	18.1	14.1
16	17.6	12.0	37.7[d]	25.5	37.4	25.1	30.8	18.9	24.9	15.2	25.9	15.3
Average	54.7	30.0	60.8	33.1	62.3	34.2	53.9	28.7	51.1	26.7	48.3	24.9

[d]Average weighted usable width per sampling interval added once because of one missed sampling point.
[e]Average weighted usable width per sampling interval subtracted once because of one added sampling point.

Table 25. Weighted usable width (ft) and percent usable stream width for adult smallmouth bass during August and September 1980 at reach 3, West Canada Creek, New York.

Transect	NMPC Nominal Release (cfs) 160-D Weighted Usable Width (ft)	160-D % Usable Stream Width	160 Weighted Usable Width (ft)	160 % Usable Stream Width	200 Weighted Usable Width (ft)	200 % Usable Stream Width	250 Weighted Usable Width (ft)	250 % Usable Stream Width	300 Weighted Usable Width (ft)	300 % Usable Stream Width	350 Weighted Usable Width (ft)	350 % Usable Stream Width
1	22.6	15.0	25.6	16.8	27.5	17.6	29.7	19.4	31.9	20.6	31.1	19.6
2	17.7	13.4	20.5	14.6	21.2	15.0	22.8	14.9	25.0	15.9	21.1	13.4
3	5.2	4.2	7.1	5.2	11.0	8.0	6.4	4.4	6.9	4.8	4.9	3.2
4	4.0	3.5	4.3	3.5	4.0	3.2	3.2	2.2	2.6	1.6	3.0	1.8
5	10.4	3.1	13.0	3.8	15.4	4.5	13.6	4.0	14.1	4.1	14.9	4.4
6	20.3	7.1	24.0	8.4	23.9	8.4	24.0	8.3	28.0	9.8	28.5	9.9
7	16.2	6.9	18.4	7.8	18.1	7.6	19.9	8.4	18.8	7.9	17.6	7.4
8	16.7[e]	8.5	15.5	7.8	16.4	8.3	20.5	10.0	22.3	10.9	20.2	9.3
9	11.3	6.6	13.2	7.6	10.6	6.1	11.7	6.5	11.9	6.2	12.3	6.4
10	13.3[e]	7.1	16.4	8.7	17.1	9.1	14.9	7.8	15.5	7.8	12.8	6.4
11	7.1	6.8	6.5	6.1	7.3	6.8	7.6	6.9	8.0	7.1	7.4	6.5
12	25.4	25.2	26.2	26.1	26.8	26.7	27.7	22.5	29.1	23.3	30.6[d]	24.1
13	18.5	19.1	16.0	15.1	17.8	16.7	19.0	17.2	19.9	17.4	19.0	16.4
14	22.0	22.9	24.5	23.9	25.6	24.8	29.2	28.4	32.0	28.8	31.2	28.3
15	18.8	17.8	20.1[e]	17.7	17.9	15.7	22.5	19.1	22.3	17.2	21.2	16.5
16	4.8	3.3	7.3[d]	4.9	8.2	5.5	7.6	4.7	5.8	3.5	8.4	5.0
Average	14.6	10.6	16.2	11.1	16.8	11.5	17.5	11.5	18.4	11.7	17.8	11.2

[d] Average weighted usable width per sampling interval added once because of one missed sampling point.
[e] Average weighted usable width per sampling interval subtracted once because of one added sampling point.

Table 26. Weighted usable width (ft) and percent usable stream width for juvenile smallmouth bass during August and September 1980 at reach 3, West Canada Creek, New York.

Transect	NMPC Nominal Release (cfs)											
	160-D		160		200		250		300		350	
	Weighted Usable Width (ft)	% Usable Stream Width	Weighted Usable Width (ft)	% Usable Stream Width	Weighted Usable Width (ft)	% Usable Stream Width	Weighted Usable Width (ft)	% Usable Stream Width	Weighted Usable Width (ft)	% Usable Stream Width	Weighted Usable Width (ft)	% Usable Stream Width
1	76.8	51.0	85.9	56.3	78.5	50.4	77.3[d]	50.5	80.5	51.9	83.0	52.5
2	51.0	38.7	54.5	38.7	49.2	34.9	40.5	26.4	36.7	23.3	25.1	15.9
3	10.1	8.2	25.5	18.7	52.4	38.2	21.3	14.6	7.9	5.4	5.0	3.3
4	5.0	4.4	3.9	3.2	4.2	3.4	3.0	2.0	3.4	2.1	3.4	2.1
5	13.5	4.0	14.7	4.3	11.0	3.2	13.9	4.1	16.8	4.9	20.0	5.8
6	107.8	37.8	123.8	43.2	94.1	32.9	66.4	23.1	62.9	21.9	54.4	18.8
7	49.6	21.2	45.0	19.0	58.6	24.7	28.3	11.9	13.4	5.6	9.4	3.9
8	44.1[e]	22.5	96.9	48.6	106.0	53.4	29.5	14.4	43.7	21.4	37.6	17.4
9	25.9	15.2	21.9	12.6	17.9	10.4	21.6	11.9	33.8	17.5	37.2	19.2
10	24.3[e]	13.0	40.7	21.7	34.0	18.1	36.9	19.2	36.2	18.2	51.3	25.6
11	21.1	20.5	12.9	12.0	15.4	14.4	10.9	9.8	9.8	8.7	3.7	3.3
12	6.9	6.8	6.8	6.8	6.6	6.6	5.7	4.6	6.1	4.9	5.4[d]	4.2
13	13.7	14.1	11.9	11.2	10.5	9.8	11.5	10.4	13.8	12.0	13.0	11.2
14	28.3	29.5	33.0	32.2	31.4	30.5	32.4	31.5	32.2	29.0	33.2	30.1
15	37.4	35.3	25.6[e]	22.5	34.1	29.9	24.5	20.8	26.2	20.2	20.3	15.8
16	9.8	6.7	31.6[d]	21.4	34.8	23.4	19.0	11.7	12.6	7.7	22.2	13.1
Average	32.8	20.6	39.6	23.3	39.9	24.0	27.7	16.7	27.2	15.9	26.5	15.1

[d]Average weighted usable width per sampling interval added once because of one missed sampling point.
[e]Average weighted usable width per sampling interval subtracted once because of one added sampling point.

Table 27. Weighted usable width (ft) and percent usable stream width for fry smallmouth bass during August and September 1980 at reach 3, West Canada Creek, New York.

Transect	NMPC Nominal Release (cfs) 160-D Weighted Usable Width (ft)	160-D % Usable Stream Width	160 Weighted Usable Width (ft)	160 % Usable Stream Width	200 Weighted Usable Width (ft)	200 % Usable Stream Width	250 Weighted Usable Width (ft)	250 % Usable Stream Width	300 Weighted Usable Width (ft)	300 % Usable Stream Width	350 Weighted Usable Width (ft)	350 % Usable Stream Width
1	8.0	5.3	12.0	7.9	4.7	3.0	3.6[d]	2.3	5.4	3.5	5.4	3.4
2	5.0	3.8	5.8	4.1	6.6	4.7	0.6	0.4	1.1	0.7	0.6	0.4
3	0.0	0.0	0.5	0.4	1.4	1.0	0.4	0.3	0.0	0.0	0.0	0.0
4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.1	0.0
6	1.5	0.5	1.7	0.6	1.4	0.5	0.9	0.3	2.0	0.7	0.3	0.1
7	0.2	0.1	0.0	0.0	0.0	0.0	0.1	0.0	0.1	0.0	0.1	0.0
8	0.1[e]	0.0	2.2	1.1	4.5	2.3	0.0	0.0	0.0	0.0	0.1	0.0
9	0.7	0.4	0.2	0.1	1.2	0.7	0.5	0.3	0.4	0.2	0.5	0.2
10	0.2[e]	0.1	0.2	0.1	0.3	0.2	0.2	0.1	0.4	0.2	0.5	0.2
11	2.2	2.1	1.6	1.5	2.8	2.6	2.5	2.2	0.8	0.7	0.0	0.0
12	11.5	11.4	10.7	10.7	10.4	10.4	9.5	7.7	8.0	6.4	6.4[d]	5.0
13	15.7	16.2	13.6	12.8	14.0	13.1	13.1	11.9	13.3	11.6	12.9	11.2
14	30.9	32.2	29.0	28.3	29.5	28.6	23.2	22.6	13.3	12.0	20.6	18.7
15	4.7	4.4	3.8[e]	3.3	3.4	3.0	0.5	0.4	0.7	0.5	0.2	0.2
16	0.0	0.0	0.2[d]	0.1	0.2	0.1	0.4	0.2	0.2	0.1	3.7	2.2
Average	5.0	4.8	5.1	4.4	5.0	4.4	3.5	3.0	2.8	2.3	3.2	2.6

[d] Average weighted usable width per sampling interval added once because of one missed sampling point.
[e] Average weighted usable width per sampling interval subtracted once because of one added sampling point.

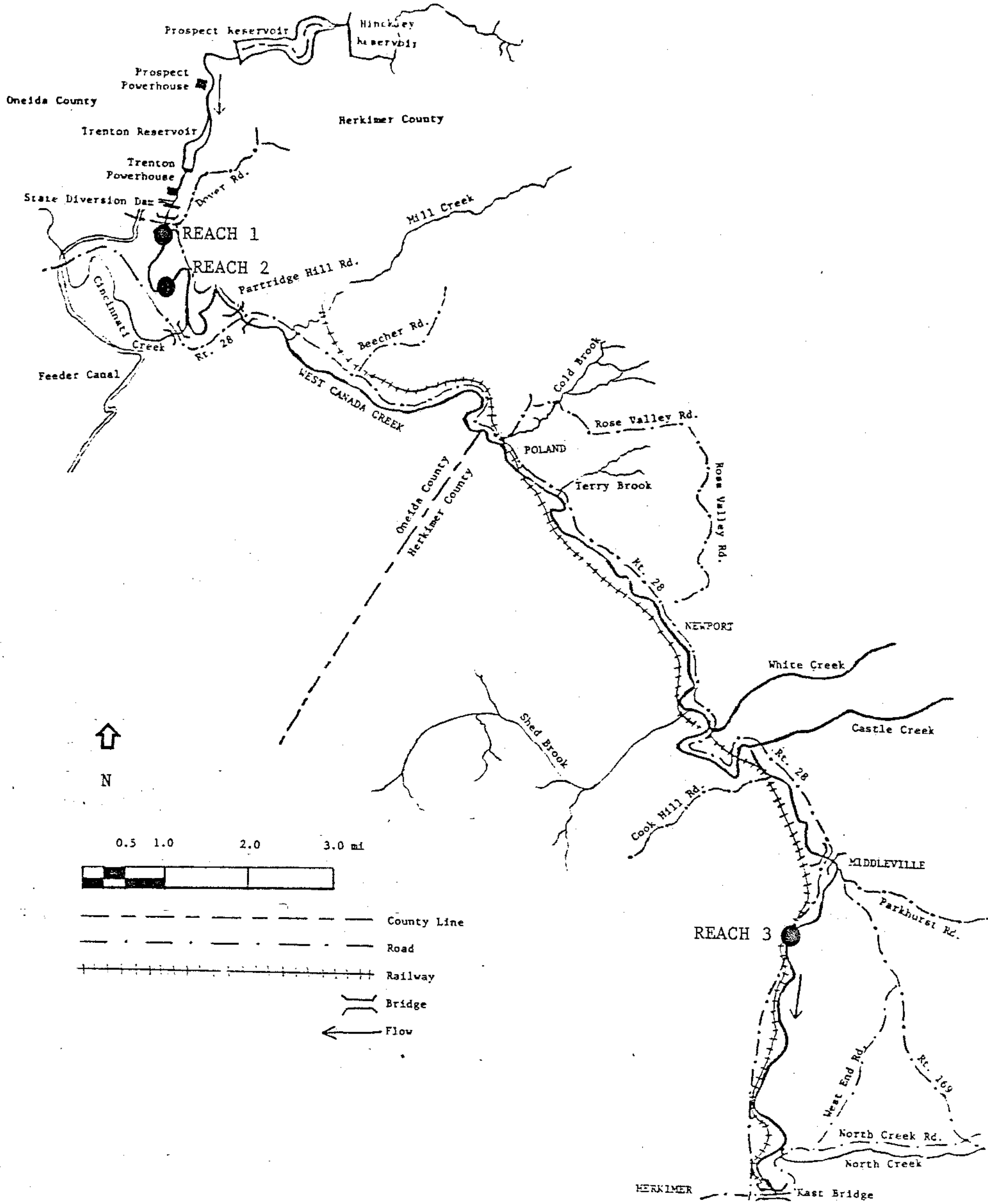


Fig. 1. Map showing location of habitat-flow study reaches 1, 2, and 3 sampled during August and September 1980 on West Canada Creek, New York.

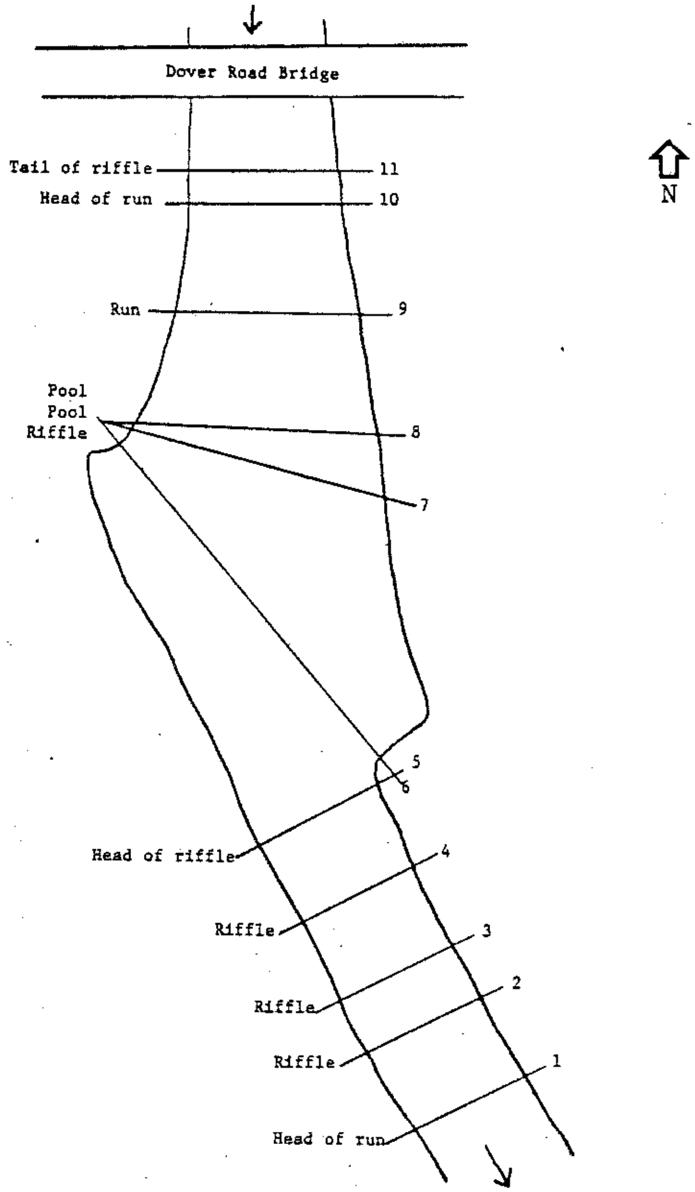


Fig. 2. Sketch map showing approximate location of transects and habitat type at 160 cfs release in August and September 1980 at reach 1, West Canada Creek, New York.

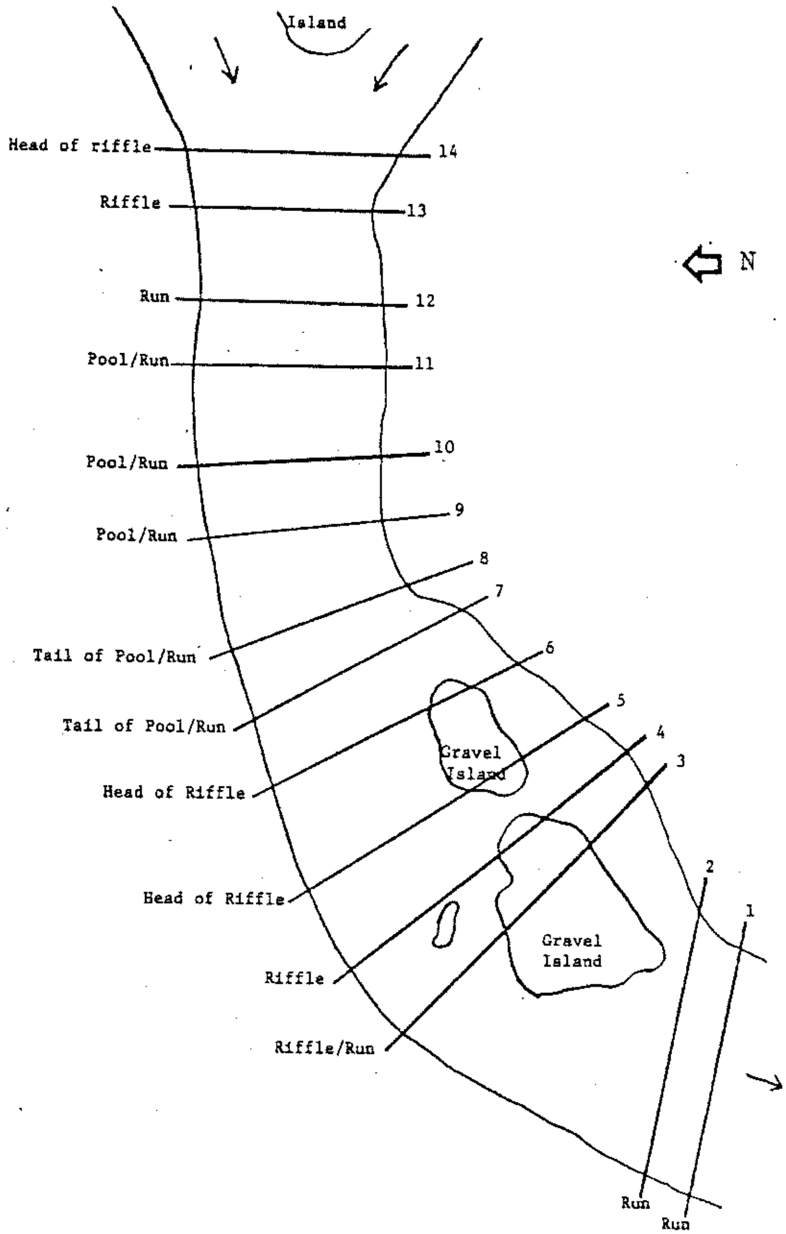


Fig. 3. Sketch map showing approximate location of transects and habitat type at 160 cfs release in August and September 1980 at reach 2, West Canada Creek, New York.

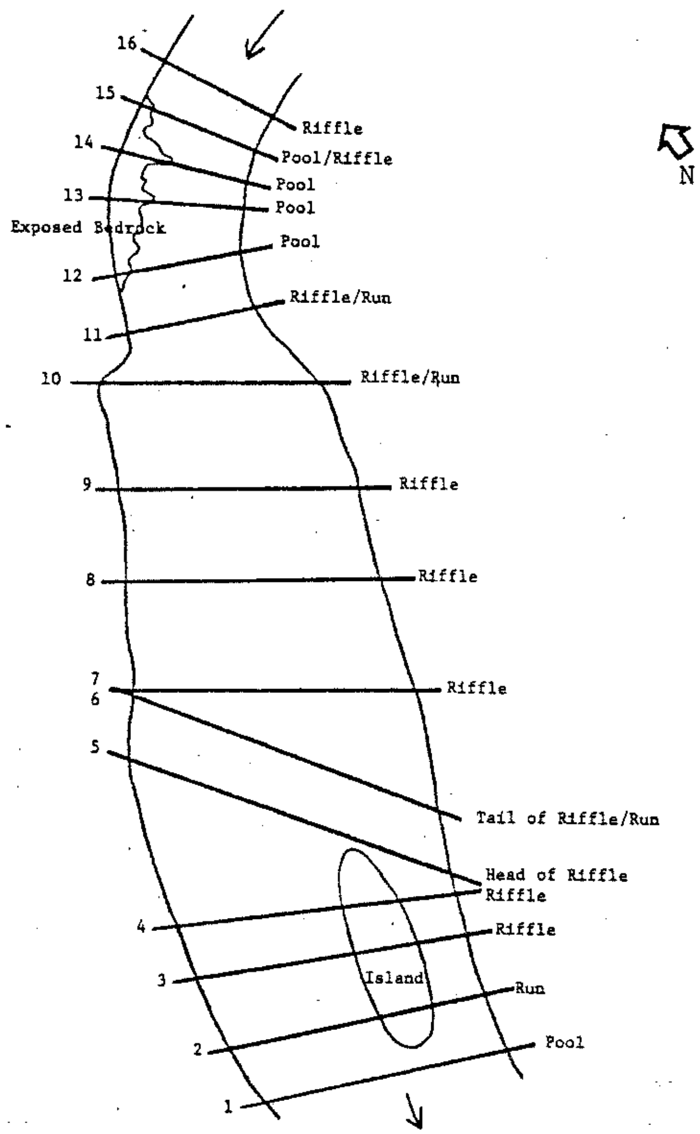
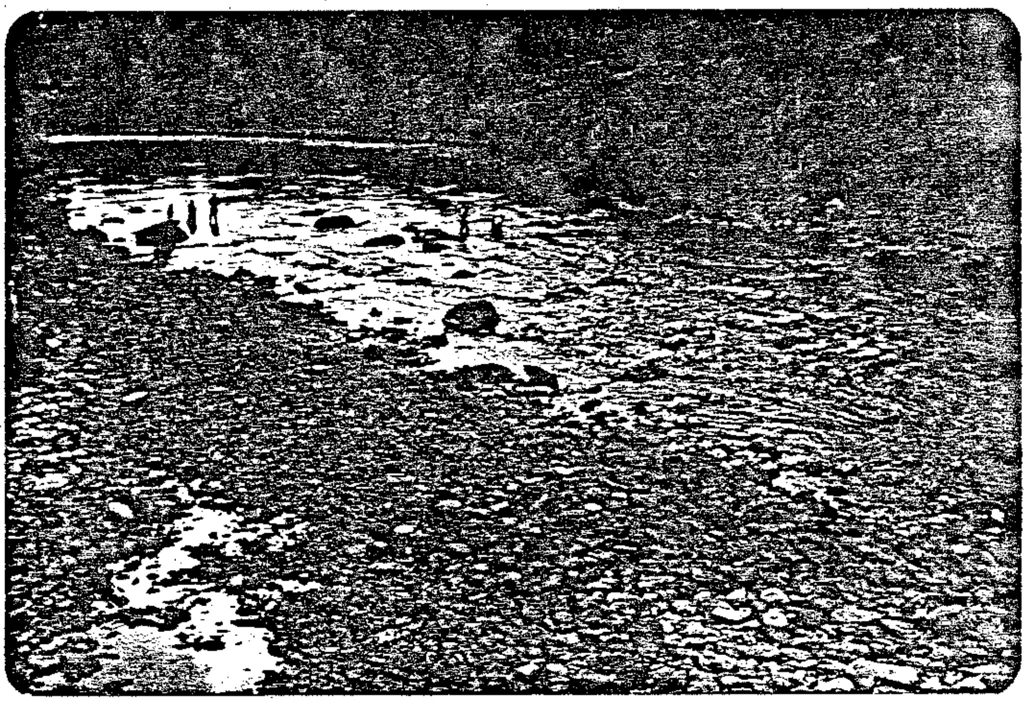
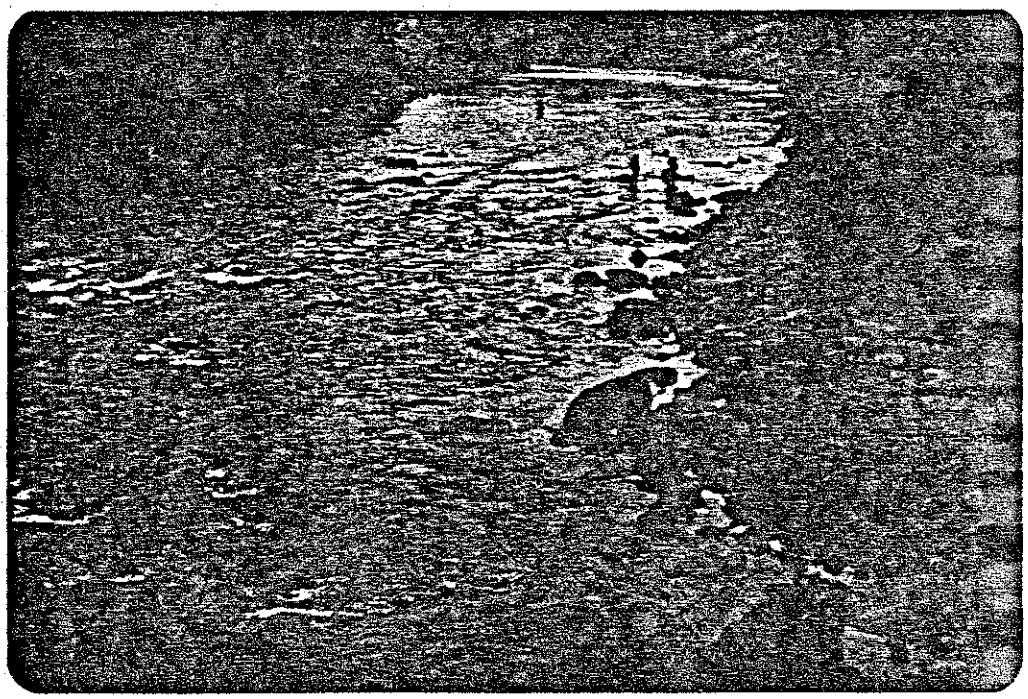


Fig. 4. Sketch map showing approximate location of transects and habitat type at 160 cfs release in August and September 1980 at reach 3, West Canada Creek, New York.

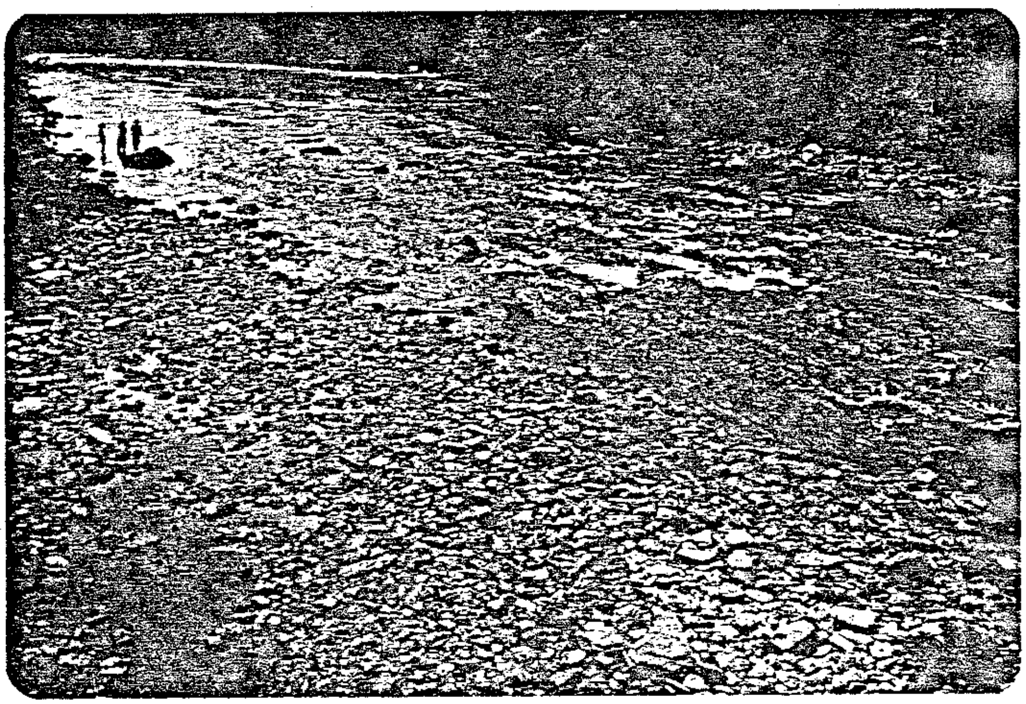


Reach 1
160-D cfs

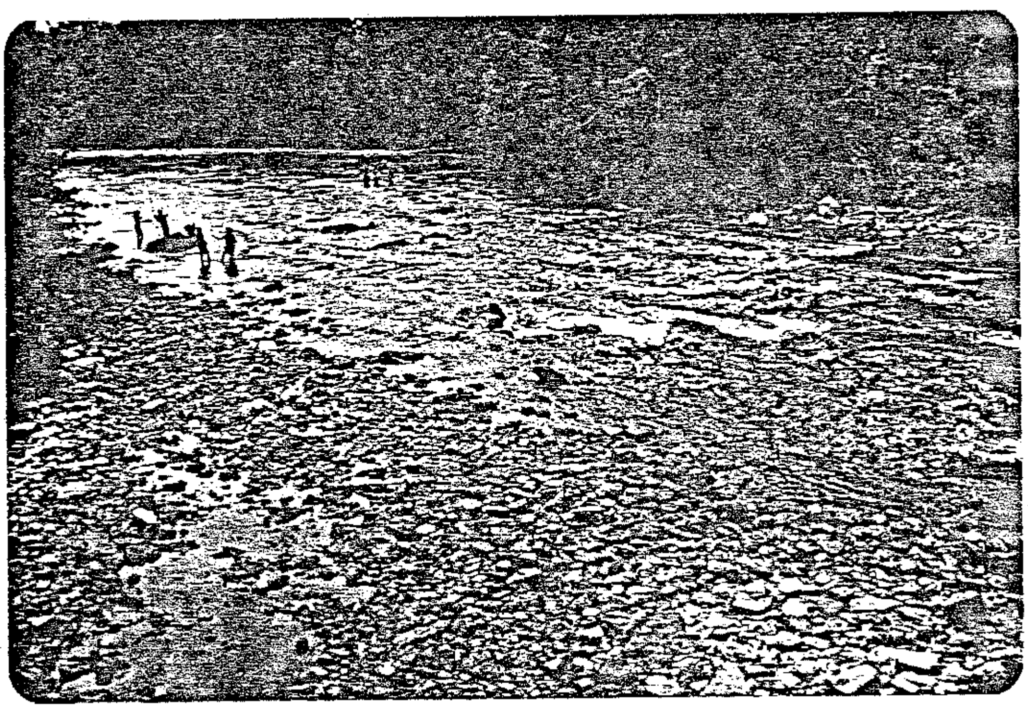


Reach 1
160 cfs

Fig. 5. Photographs of 160-D, 160, 200, 250, 300, and 350 cfs NMPC nominal releases during August and September 1980 at reaches 1, 2, and 3, West Canada Creek, New York.

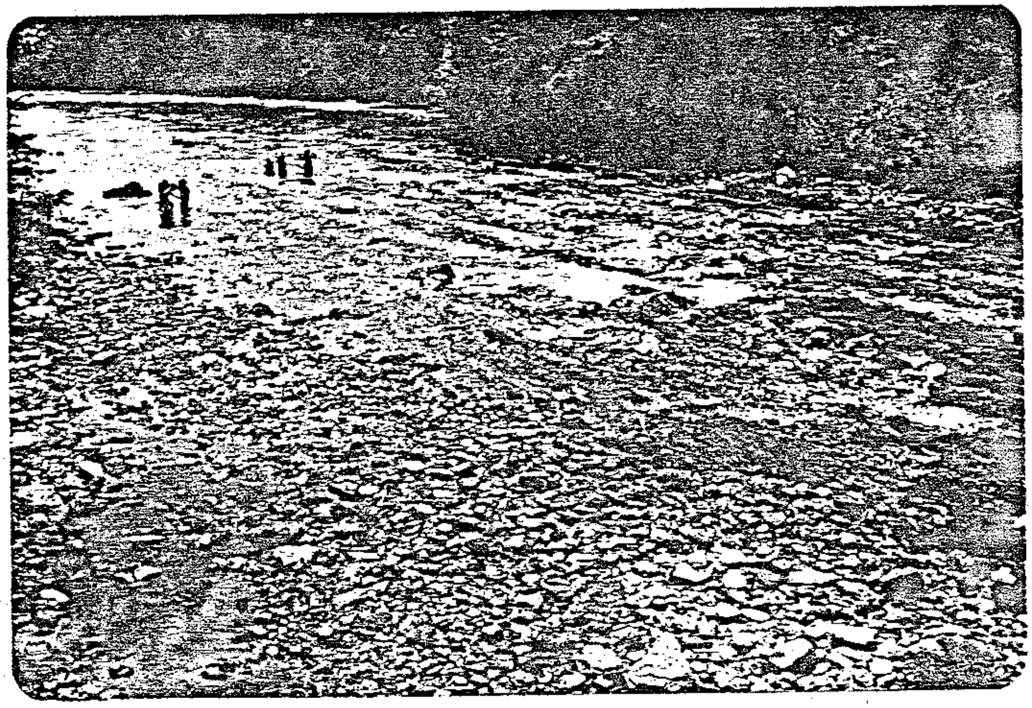


Reach 1
200 cfs

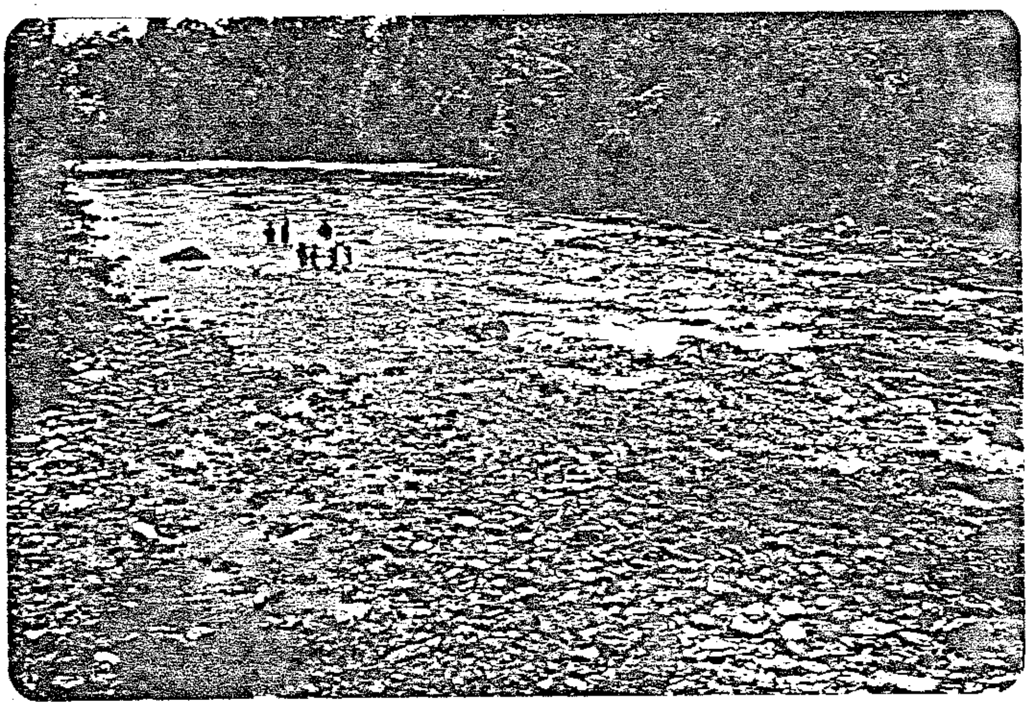


Reach 1
250 cfs

Fig. 5 - (Continued).

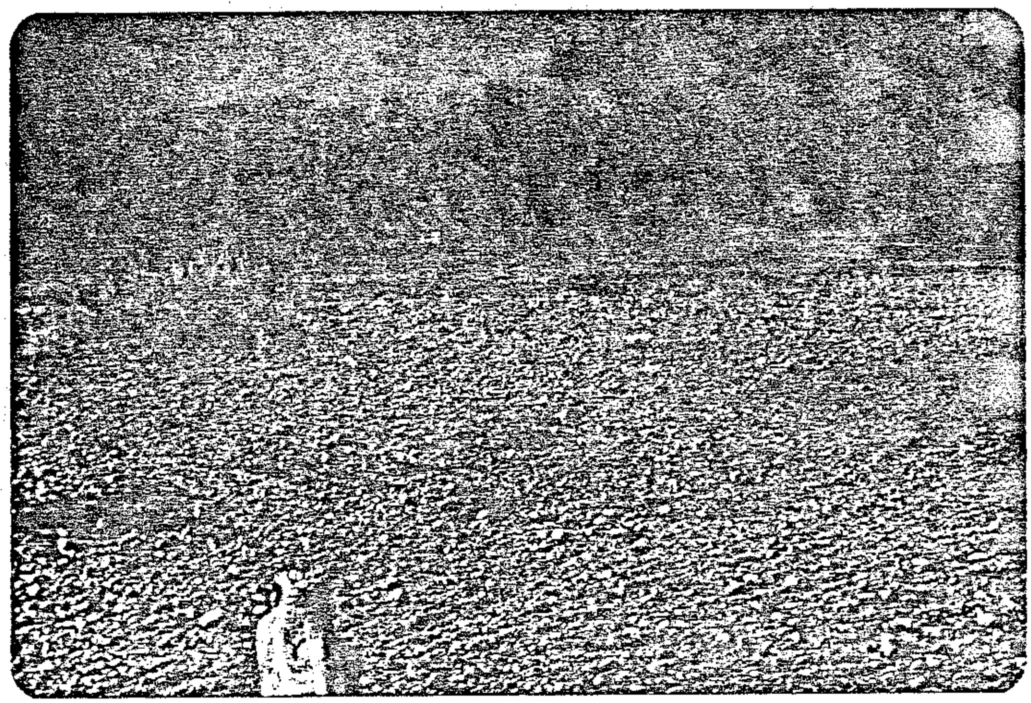


Reach 1
300 cfs

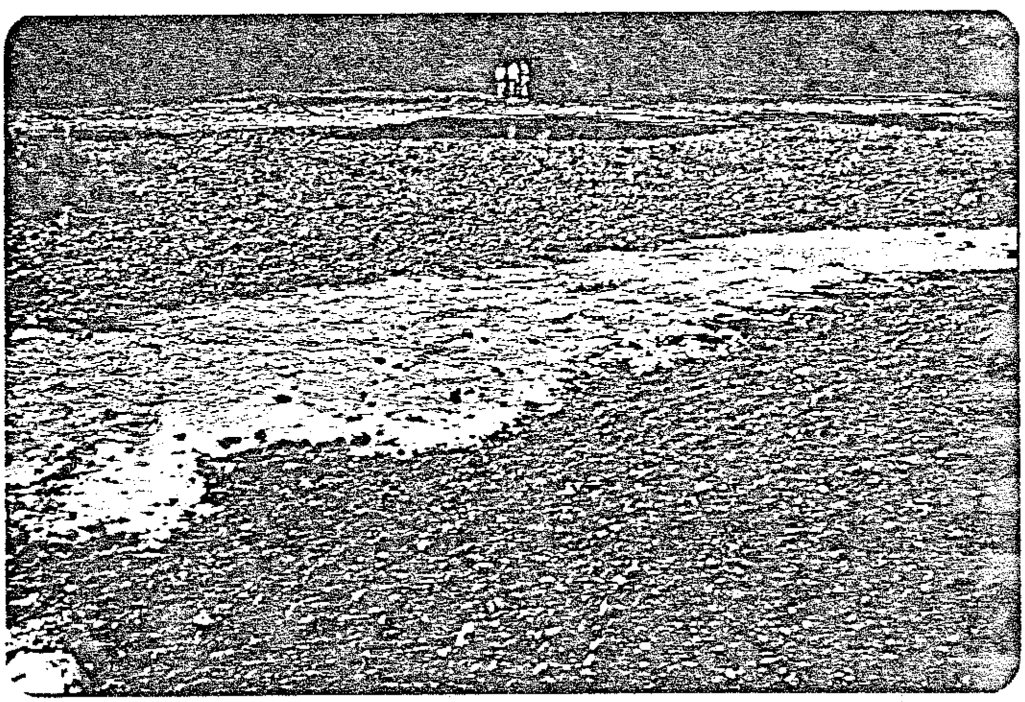


Reach 1
350 cfs

Fig. 5 - (Continued).

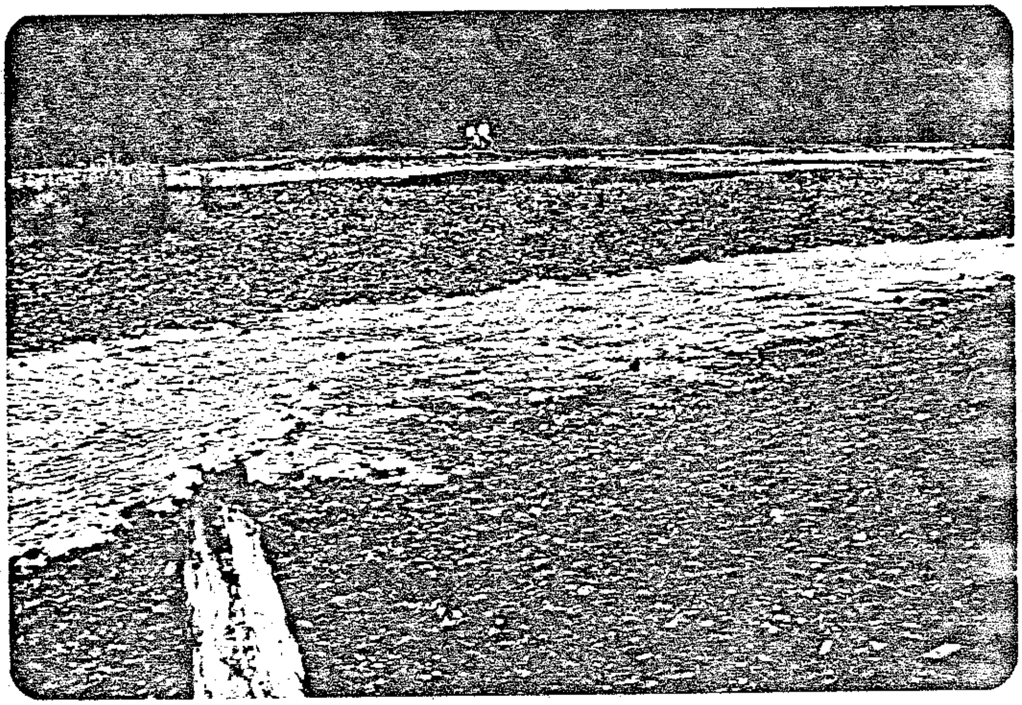


Reach 2
160-D cfs

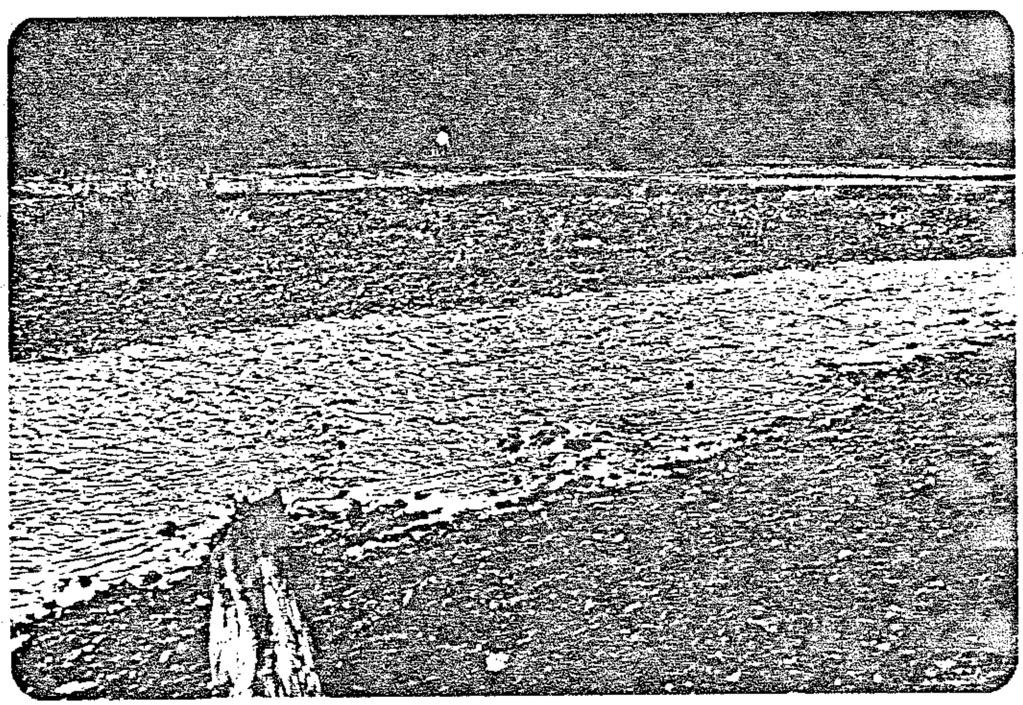


Reach 2
160 cfs

Fig. 5 - (Continued).

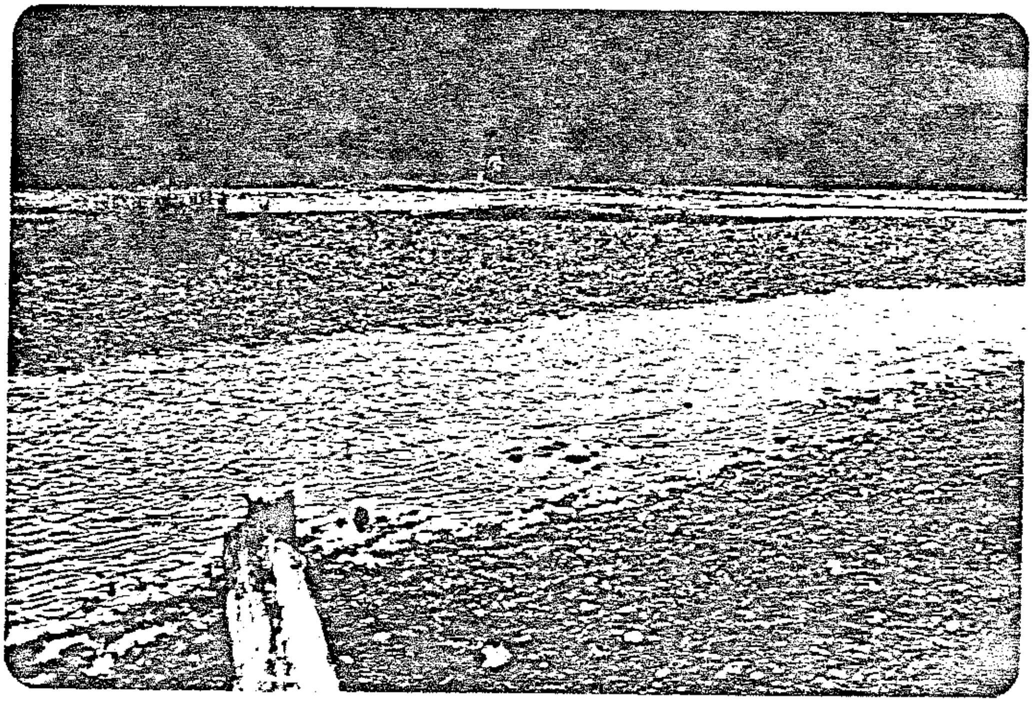


Reach 2
200 cfs

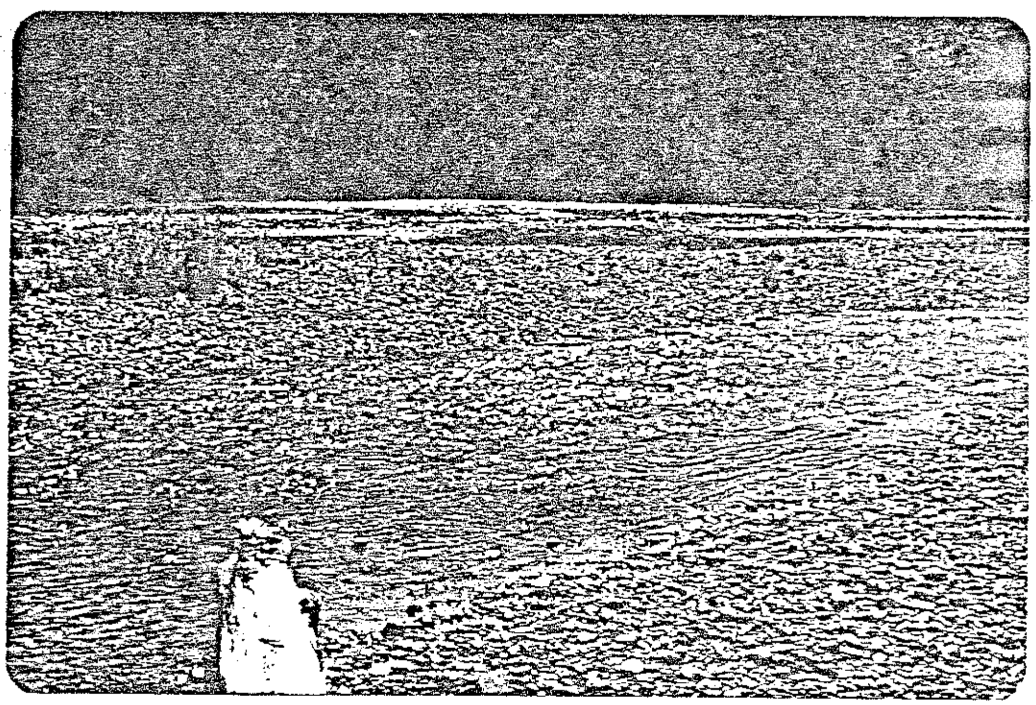


Reach 2
250 cfs

Fig. 5 - (Continued).

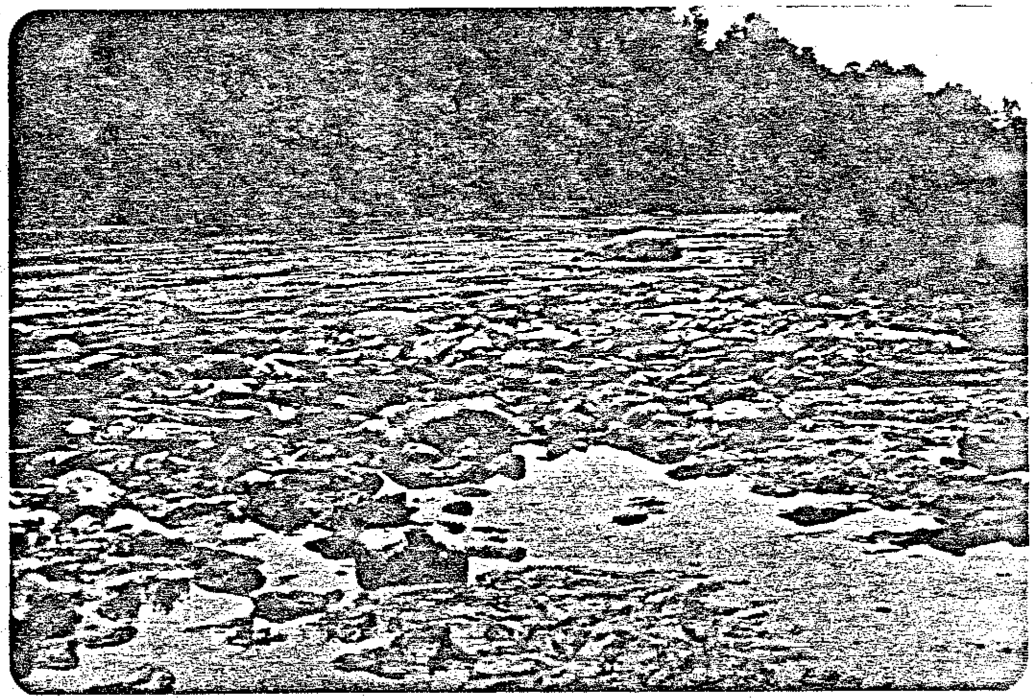


Reach 2
300 cfs



Reach 2
350 cfs

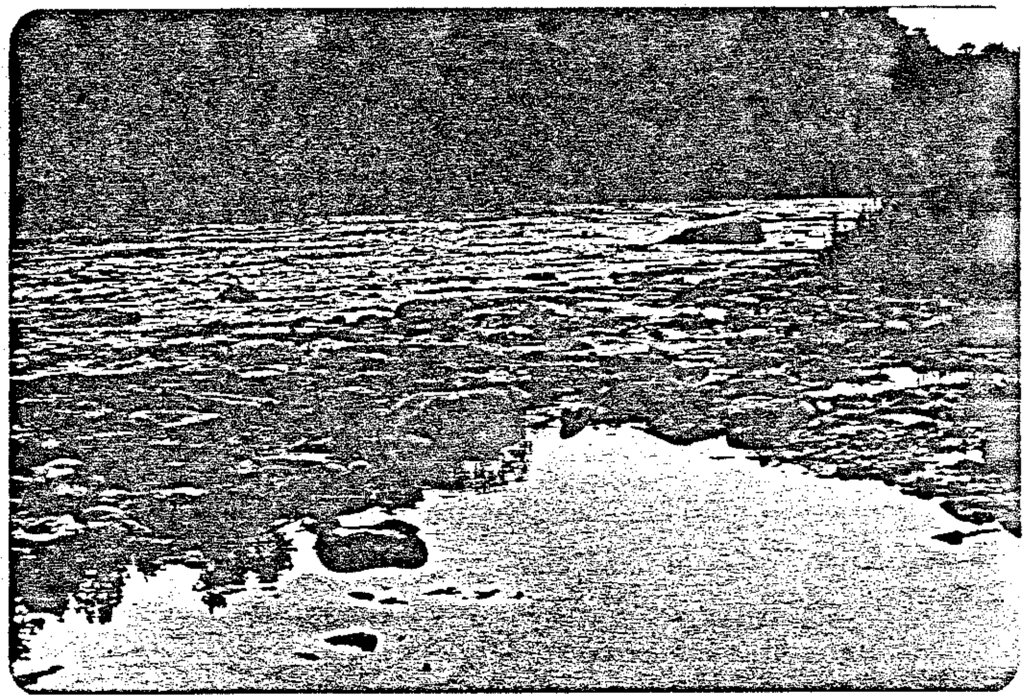
Fig. 5 - (Continued).



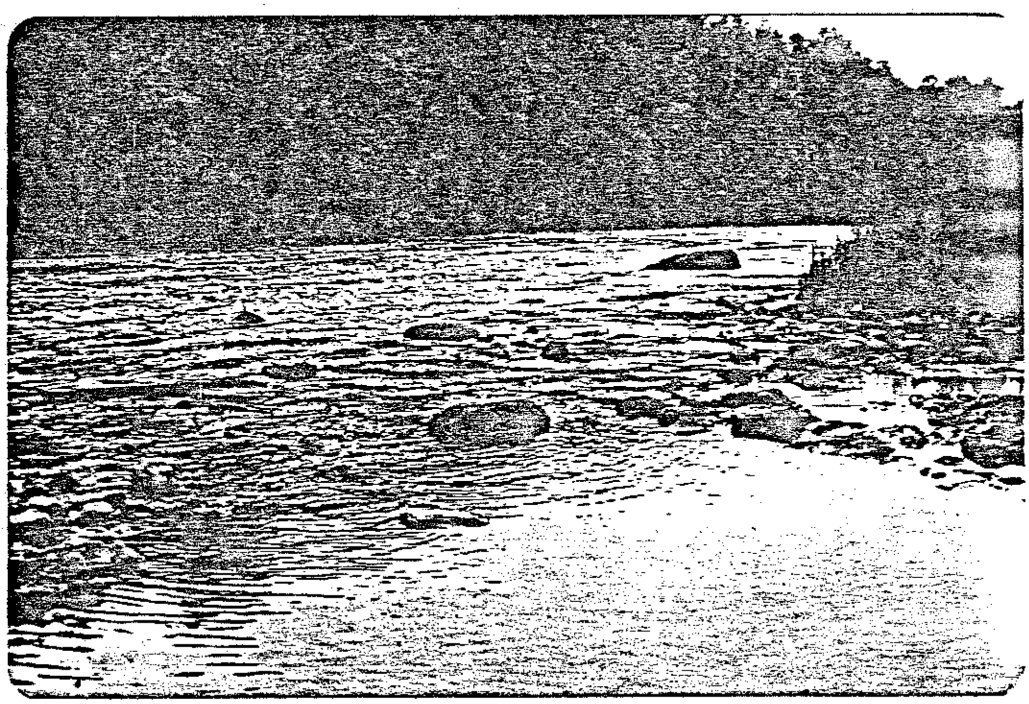
Reach 3
160-D cfs

Reach 3
160 cfs

Fig. 5 - (Continued).

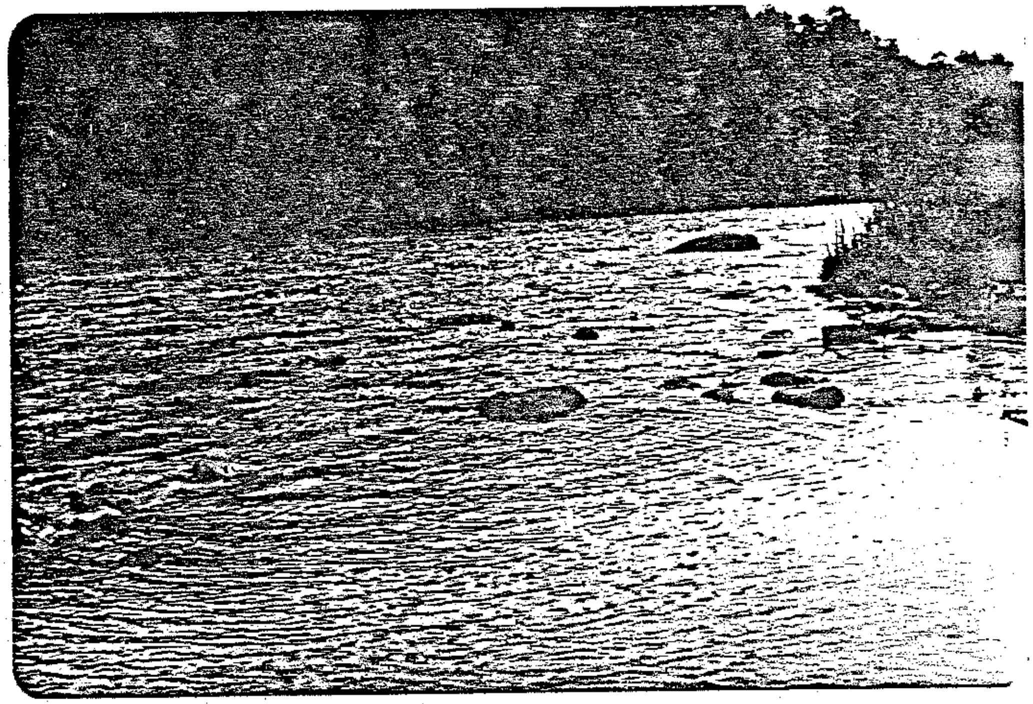


Reach 3
200 cfs



Reach 3
250 cfs

Fig. 5 - (Continued).



Reach 3
300 cfs

Reach 3
350 cfs

Fig. 5 - (Continued).

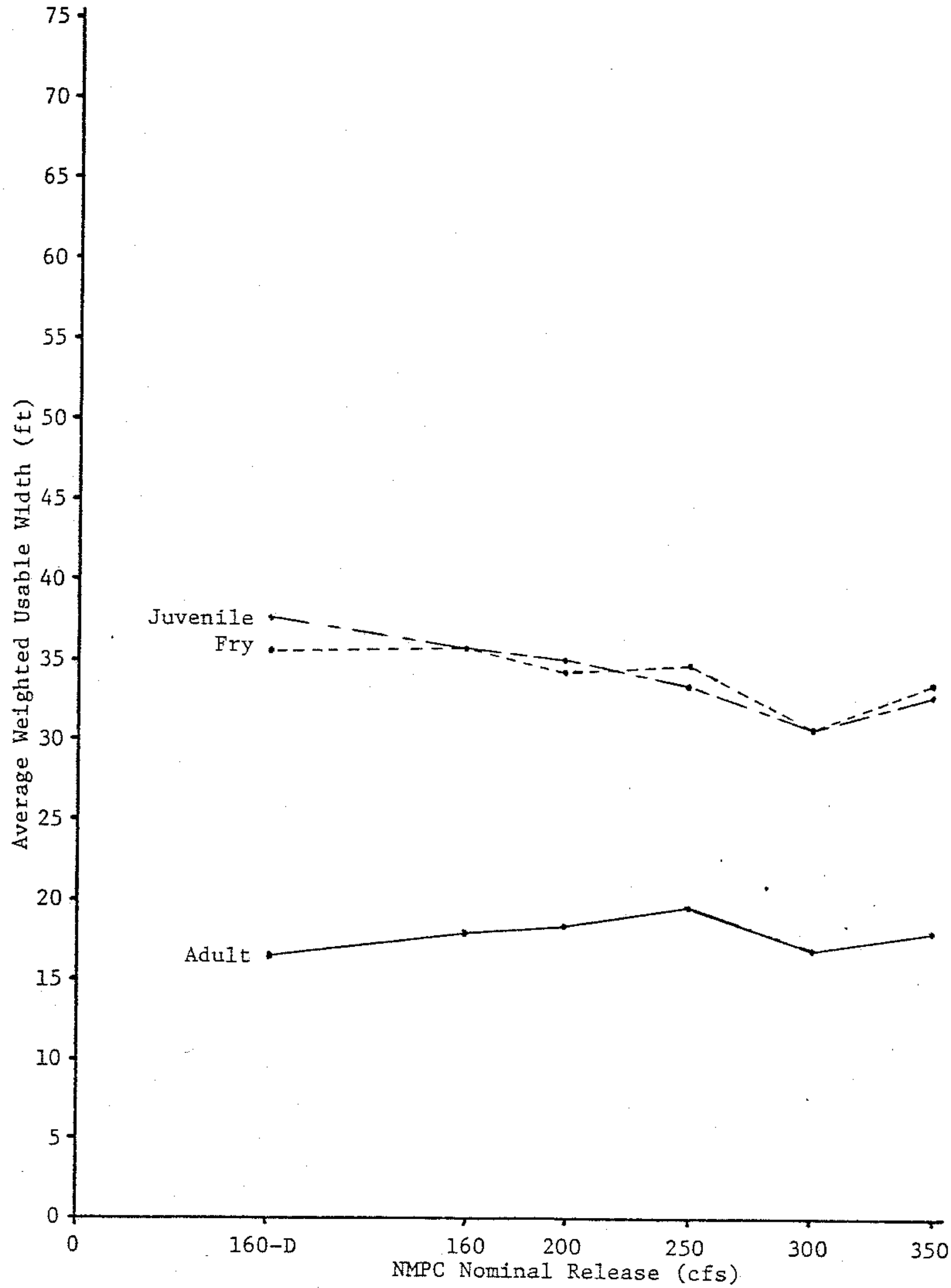


Fig. 6. Change in average weighted usable width (ft) with NMPC nominal release (cfs) for brown trout adult, juvenile, and fry during August and September 1980 at reach 1, West Canada Creek, New York.

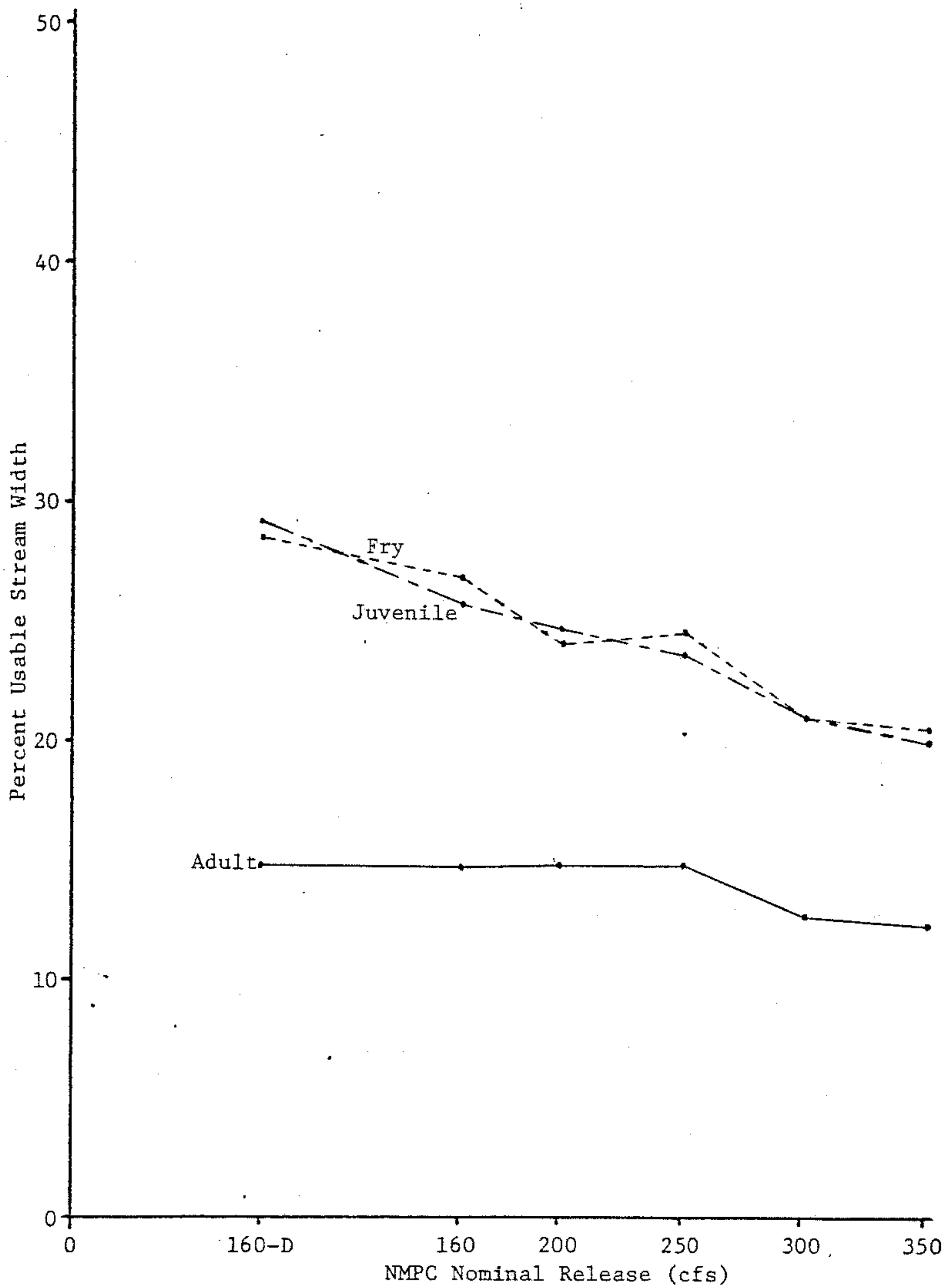


Fig. 7. Change in percent usable stream width with NMPC nominal release (cfs) for brown trout adult, juvenile, and fry during August and September 1980 at reach 1, West Canada Creek, New York.

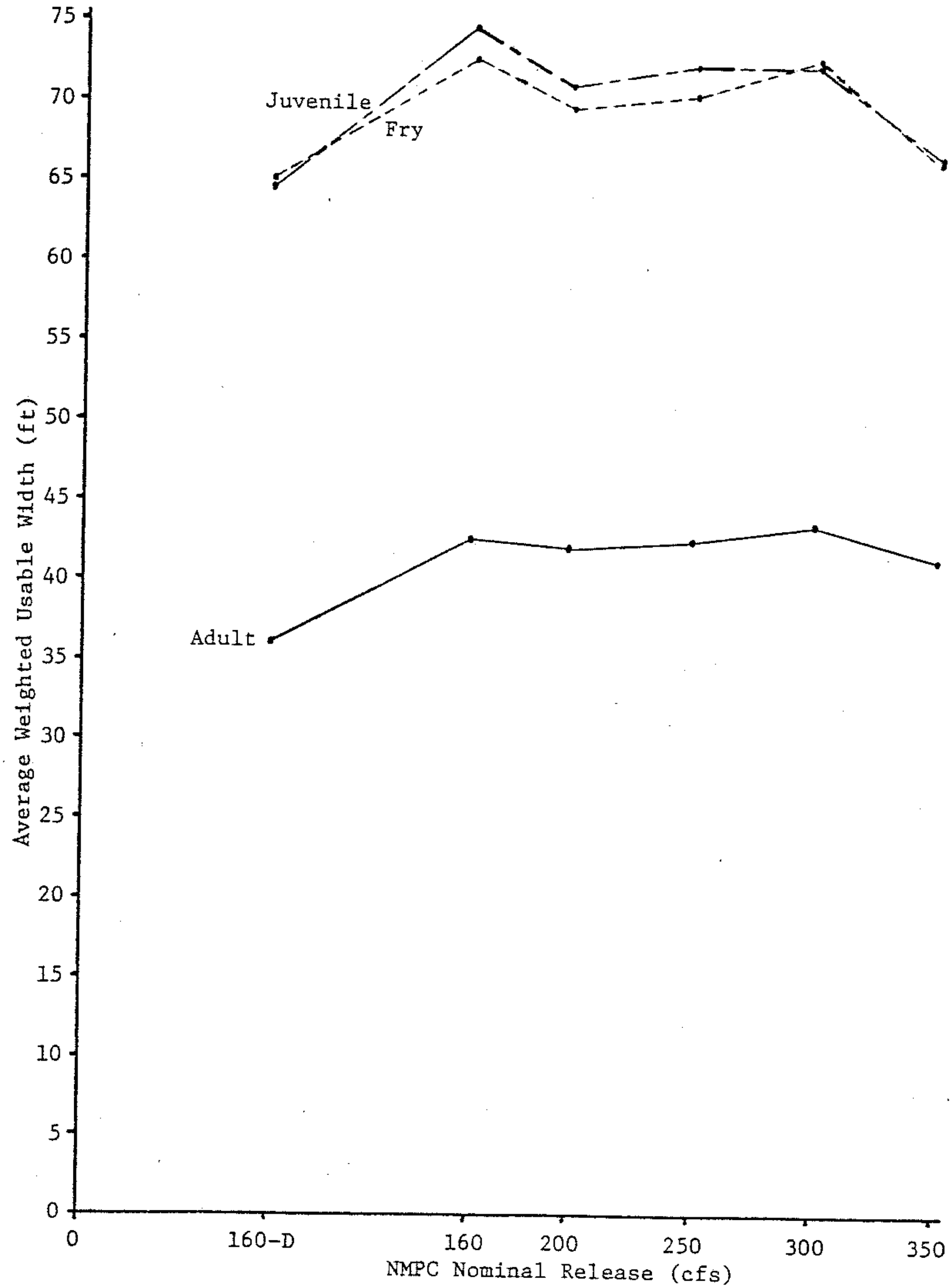


Fig. 8. Change in average weighted usable width (ft) with NMPC nominal release (cfs) for brown trout adult, juvenile, and fry during August and September 1980 at reach 2, West Canada Creek, New York.

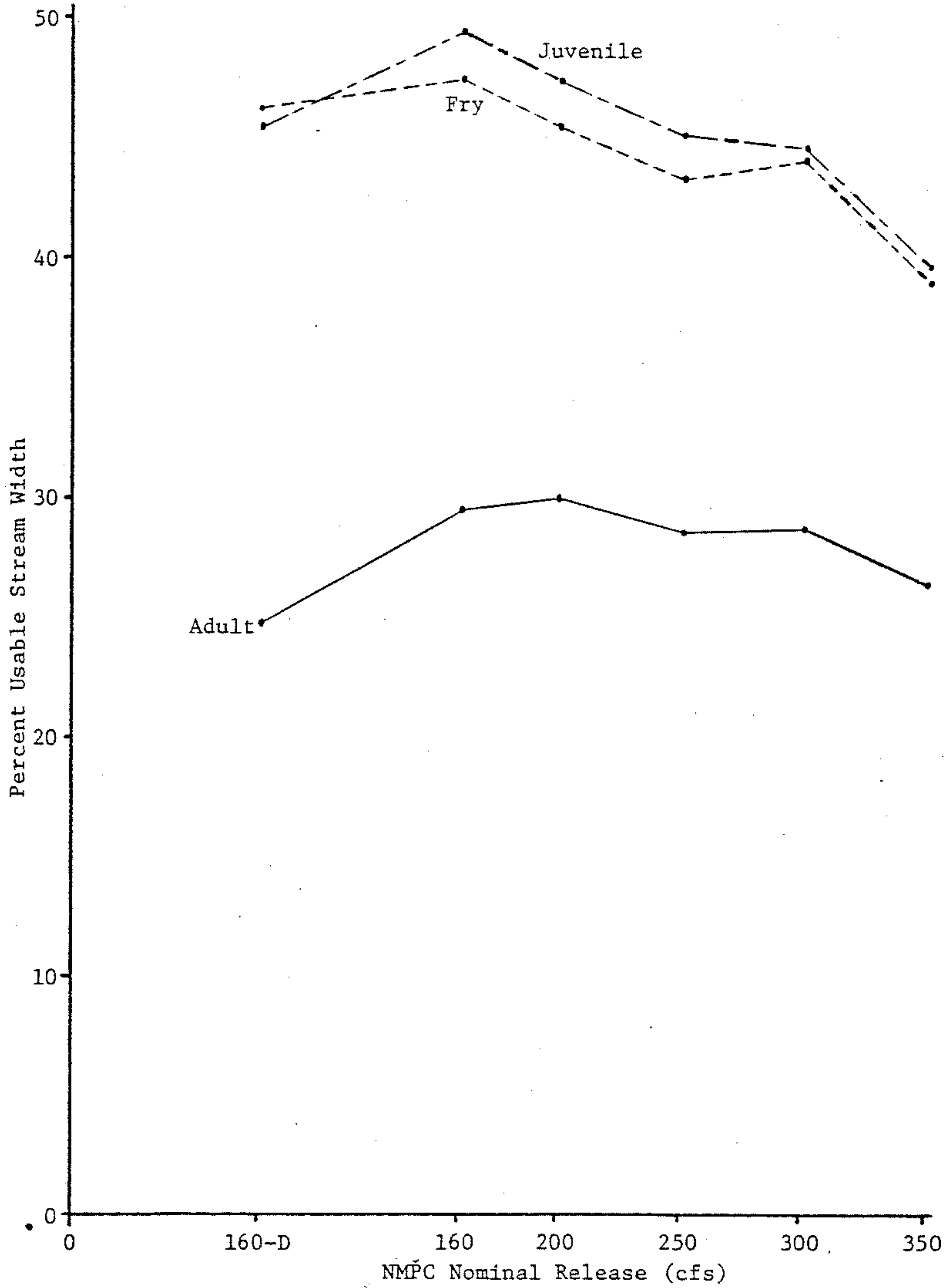


Fig. 9. Change in percent usable stream width with NMPC nominal release (cfs) for brown trout adult, juvenile, and fry during August and September 1980 at reach 2, West Canada Creek, New York.

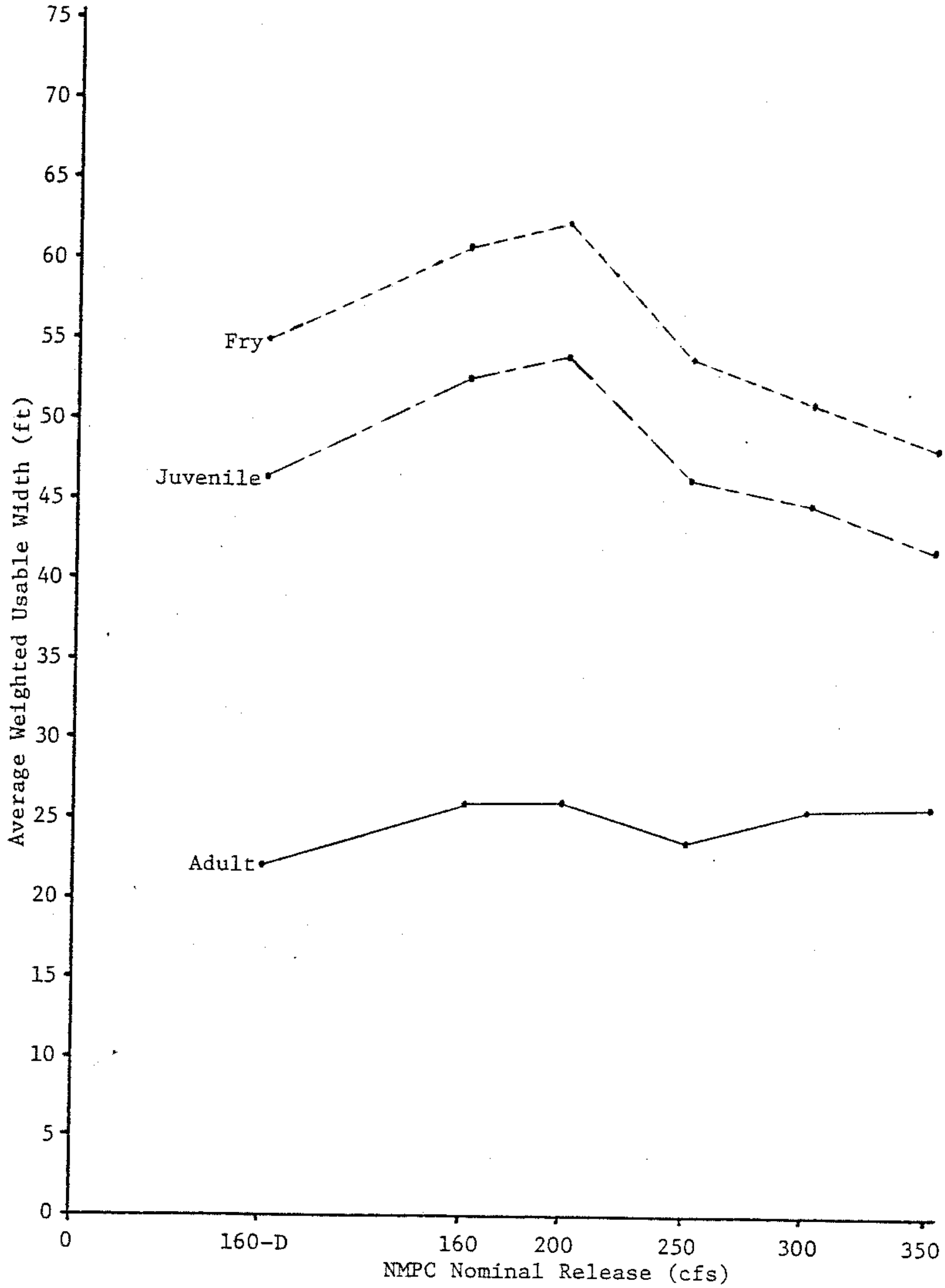


Fig. 10. Change in average weighted usable width (ft) with NMPC nominal release (cfs) for brown trout adult, juvenile, and fry during August and September 1980 at reach 3, West Canada Creek, New York.

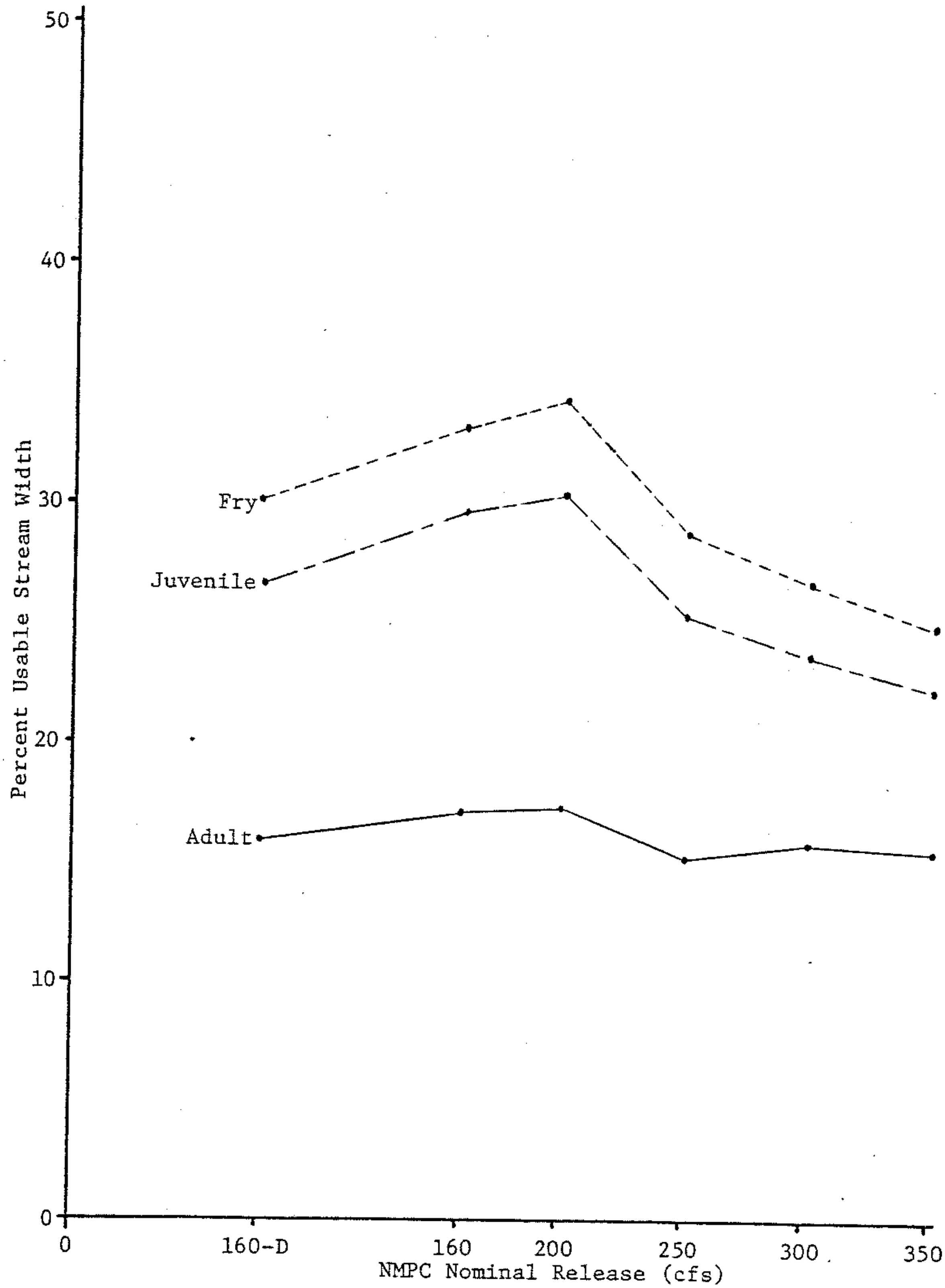


Fig. 11. Change in percent usable stream width with NMPC nominal release (cfs) for brown trout adult, juvenile, and fry during August and September 1980 at reach 3, West Canada Creek, New York.

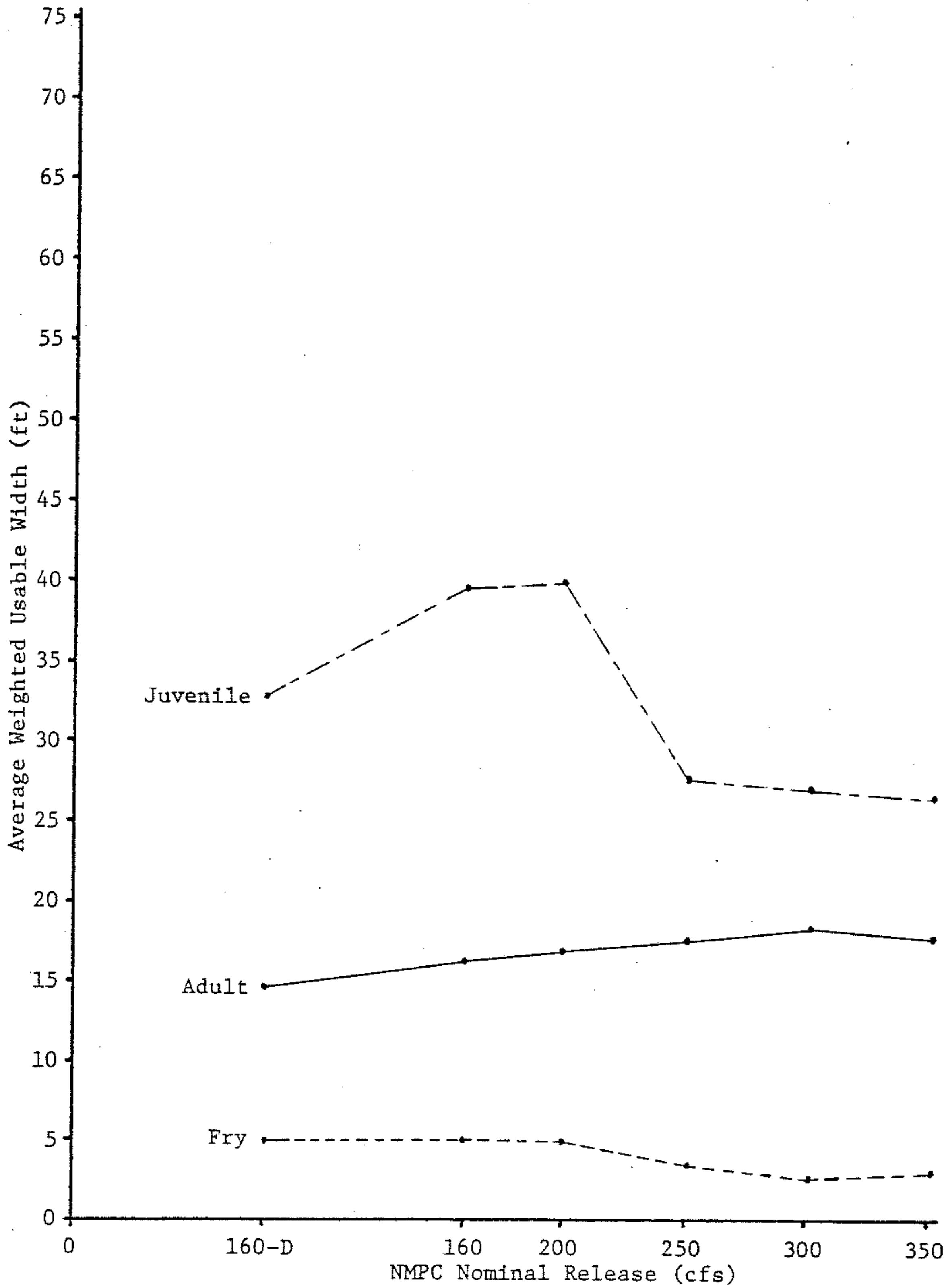


Fig. 12. Change in average weighted usable width (ft) with NMPC nominal release (cfs) for smallmouth bass adult, juvenile, and fry during August and September 1980 at reach 3, West Canada Creek, New York.

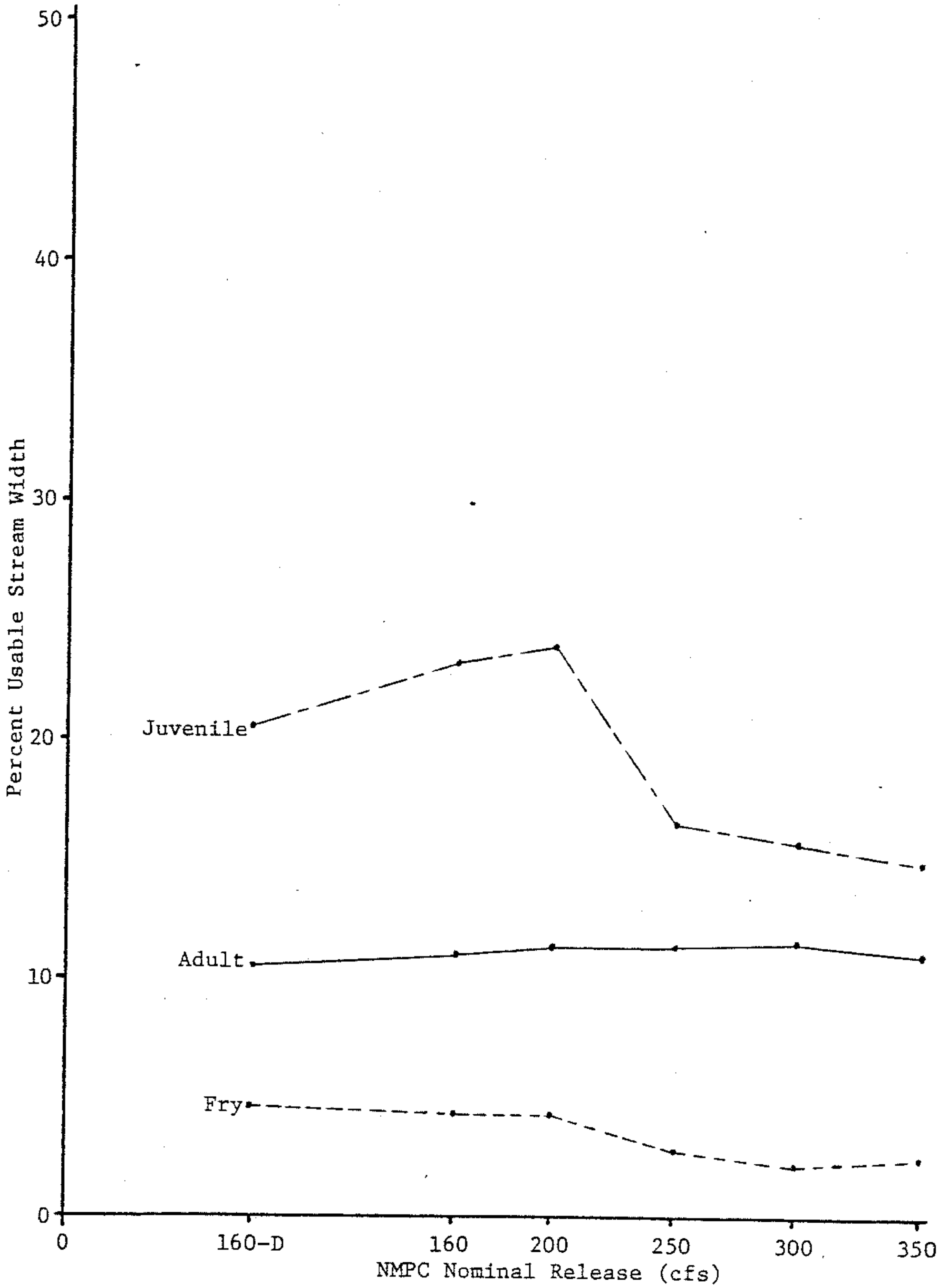


Fig. 13. Change in percent usable stream width with NMPC nominal release (cfs) for smallmouth bass adult, juvenile, and fry during August and September 1980 at reach 3, West Canada Creek, New York.

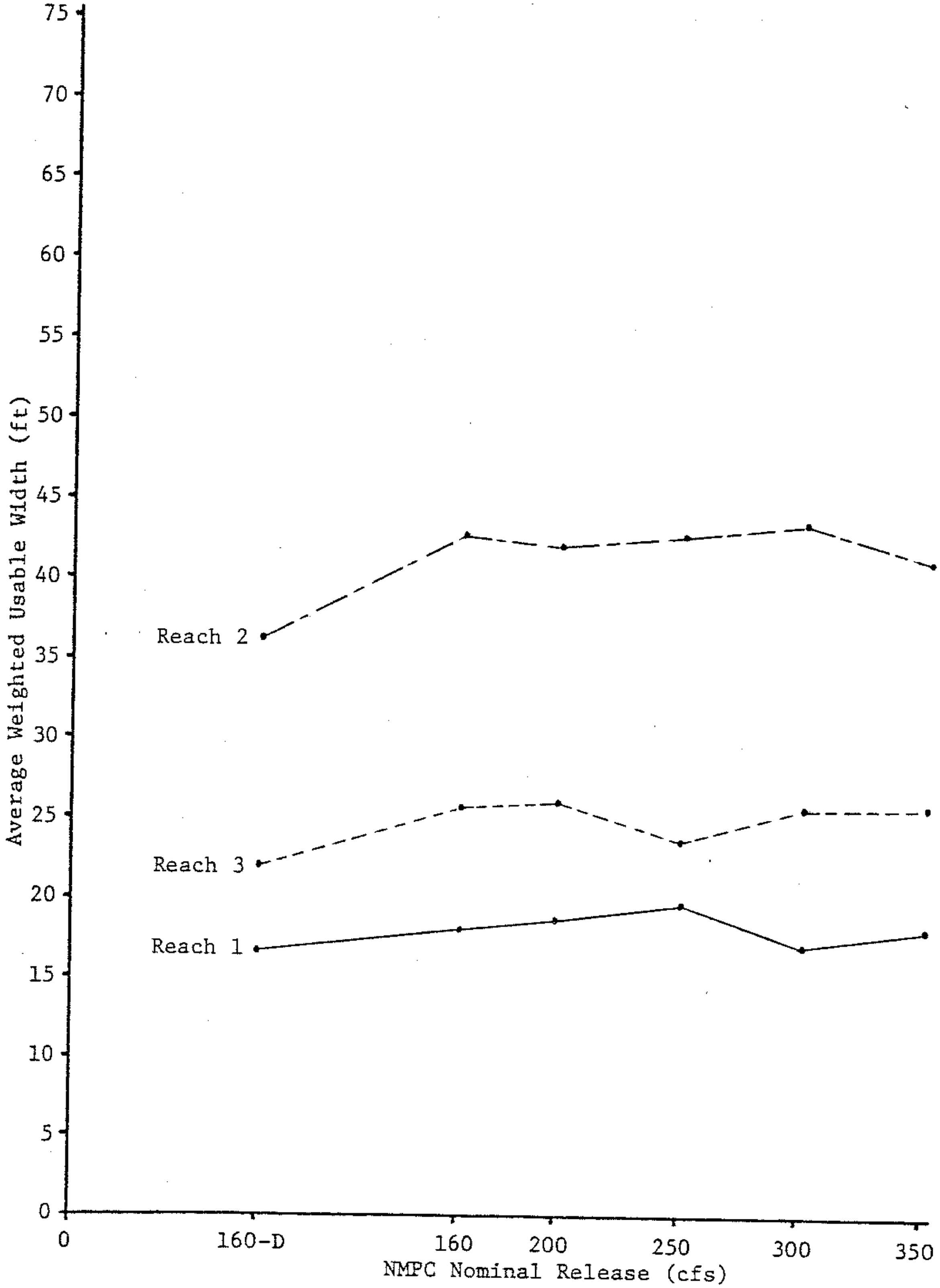


Fig. 14. Change in average weighted usable width (ft) with NMPC nominal release (cfs) for adult brown trout during August and September 1980 at reaches 1, 2, and 3, West Canada Creek, New York.

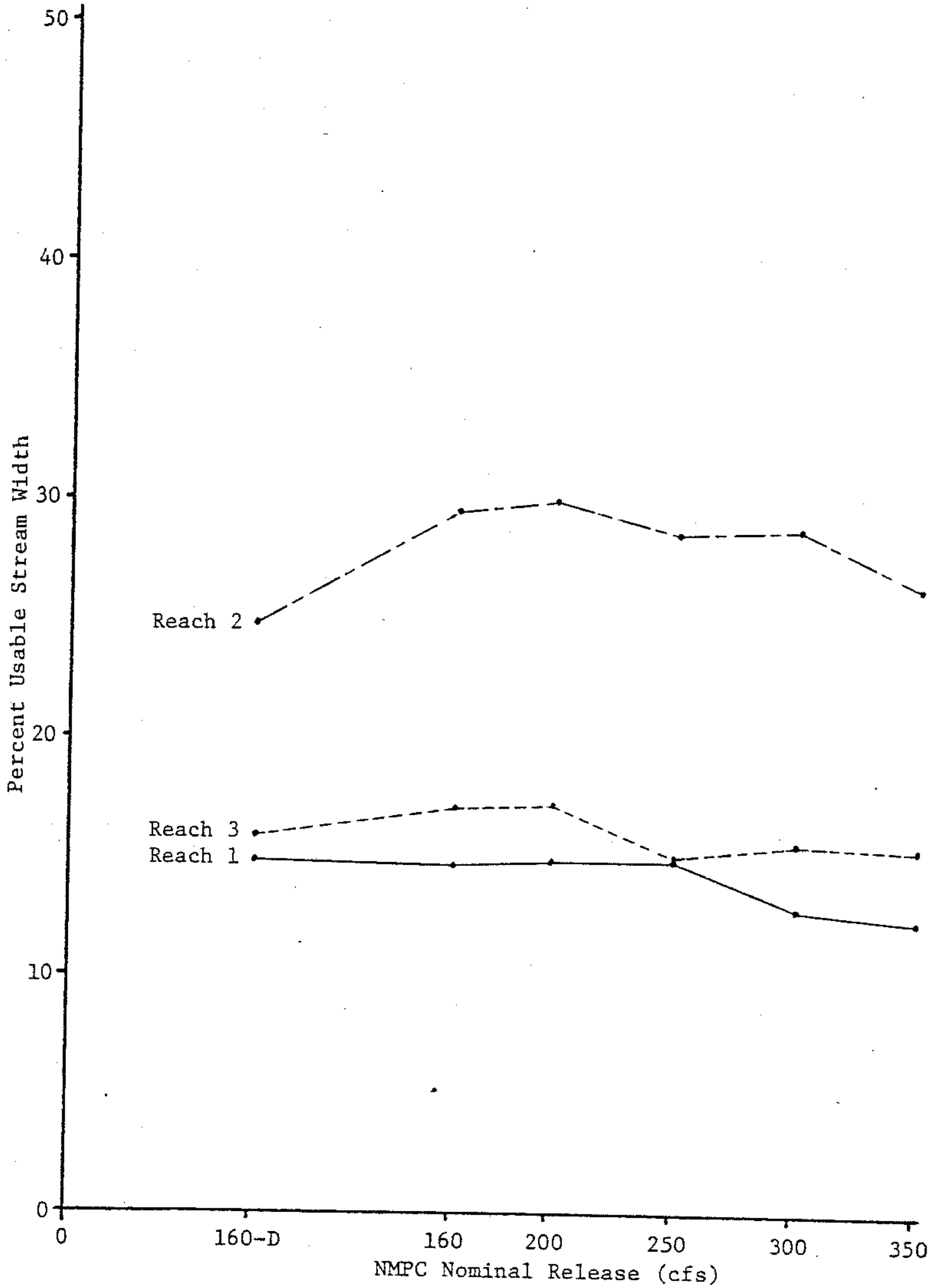


Fig. 15. Change in percent usable stream width with NMPC nominal release (cfs) for adult brown trout during August and September 1980 at reaches 1, 2, and 3, West Canada Creek, New York.

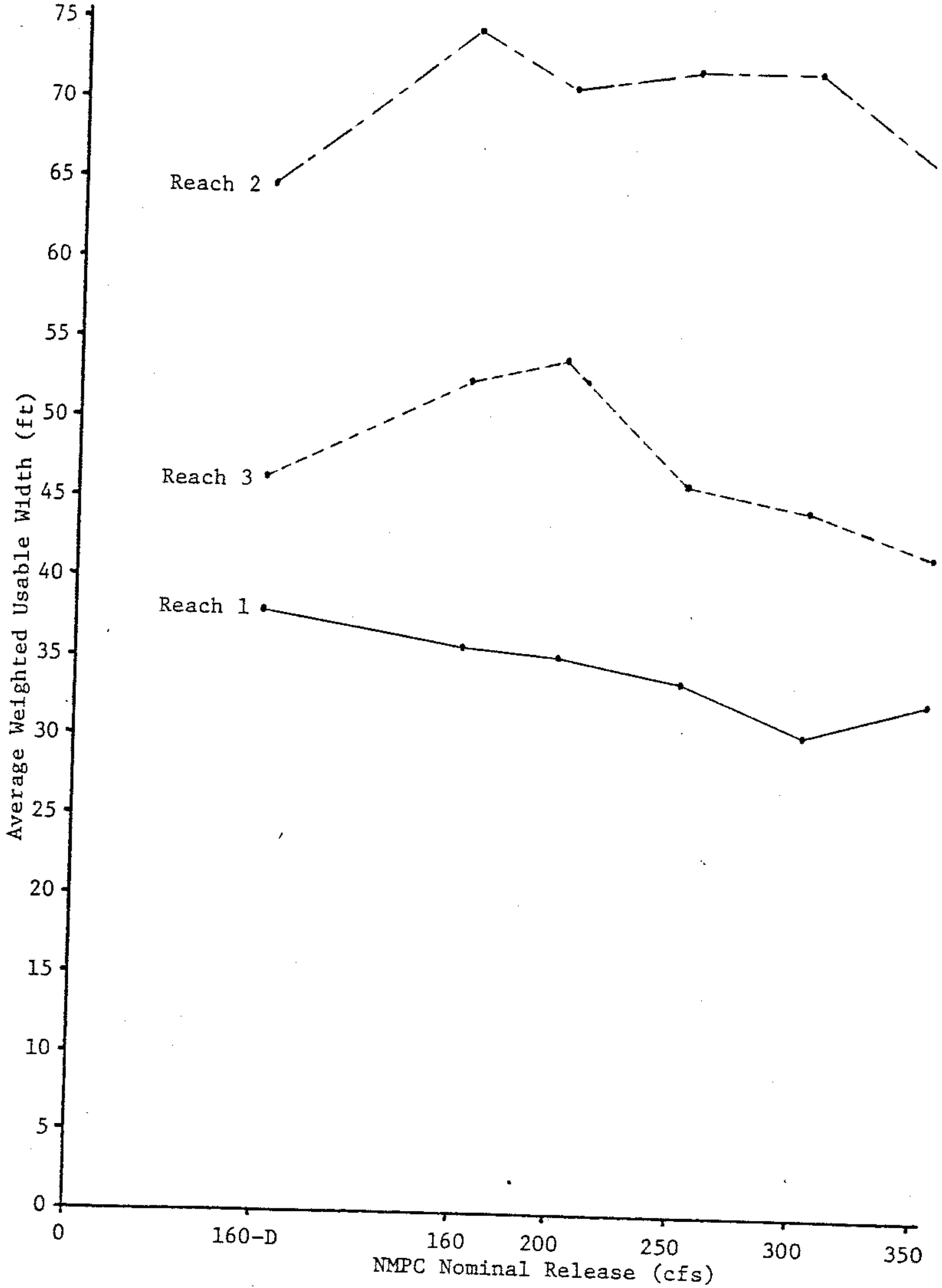


Fig. 16. Change in average weighted usable width (ft) with NMPC nominal release (cfs) for juvenile brown trout during August and September 1980 at reaches 1, 2, and 3, West Canada Creek, New York.

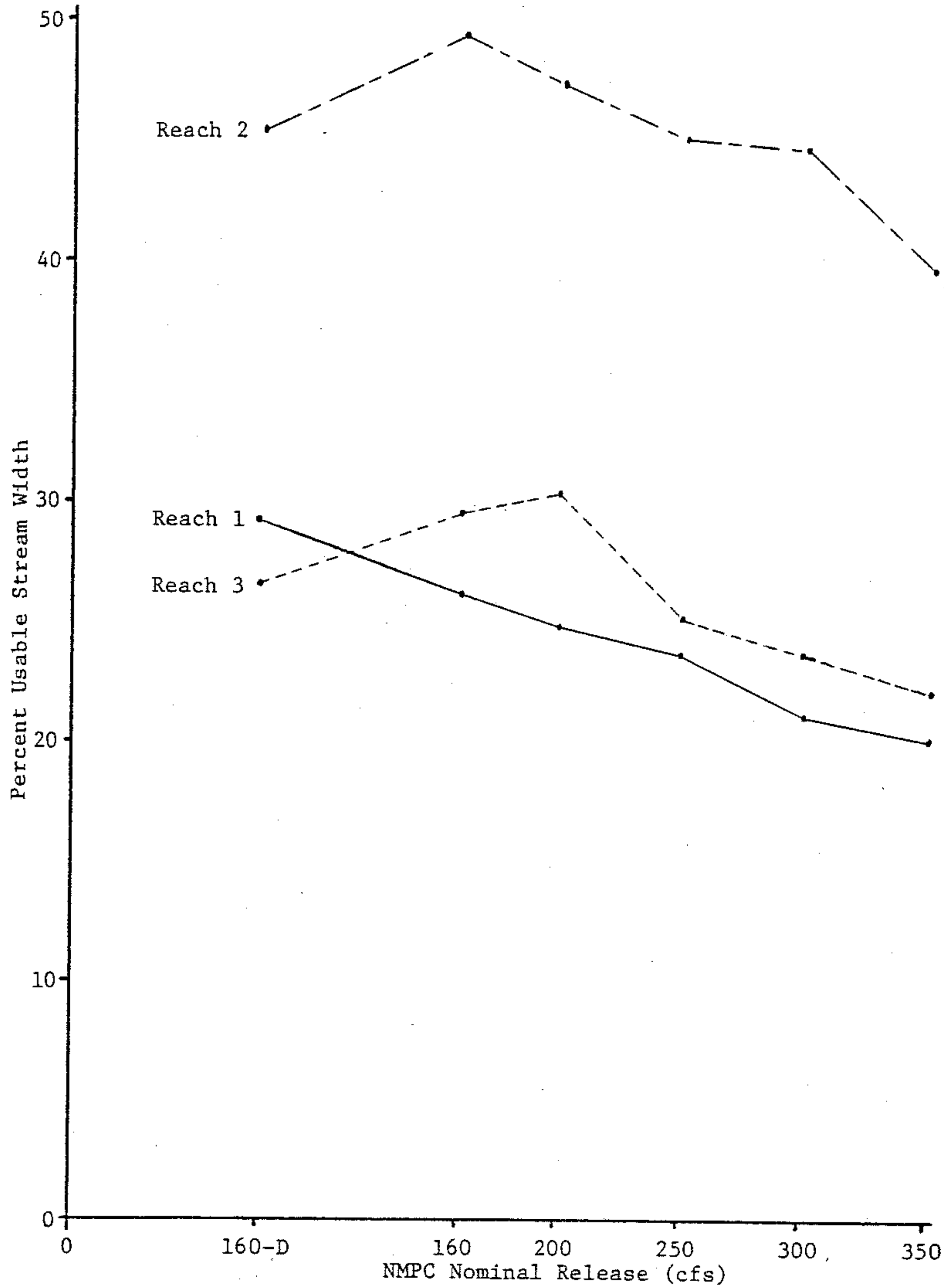


Fig. 17. Change in percent usable stream width with NMPC nominal release (cfs) for juvenile brown trout during August and September 1980 at reaches 1, 2, and 3, West Canada Creek, New York.

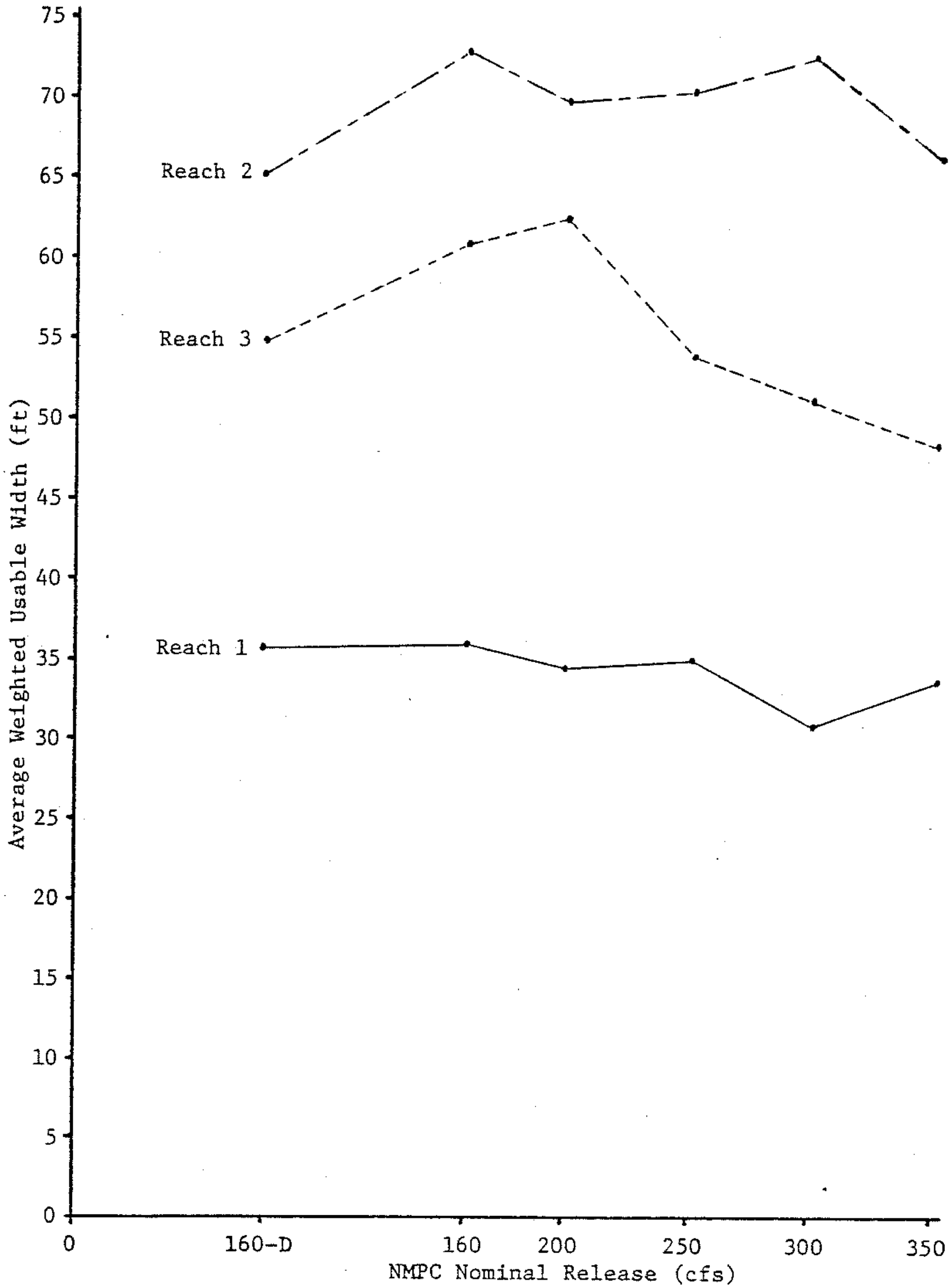


Fig. 18. Change in average weighted usable width (ft) with NMPC nominal release (cfs) for fry brown trout during August and September 1980 at reaches 1, 2, and 3, West Canada Creek, New York.

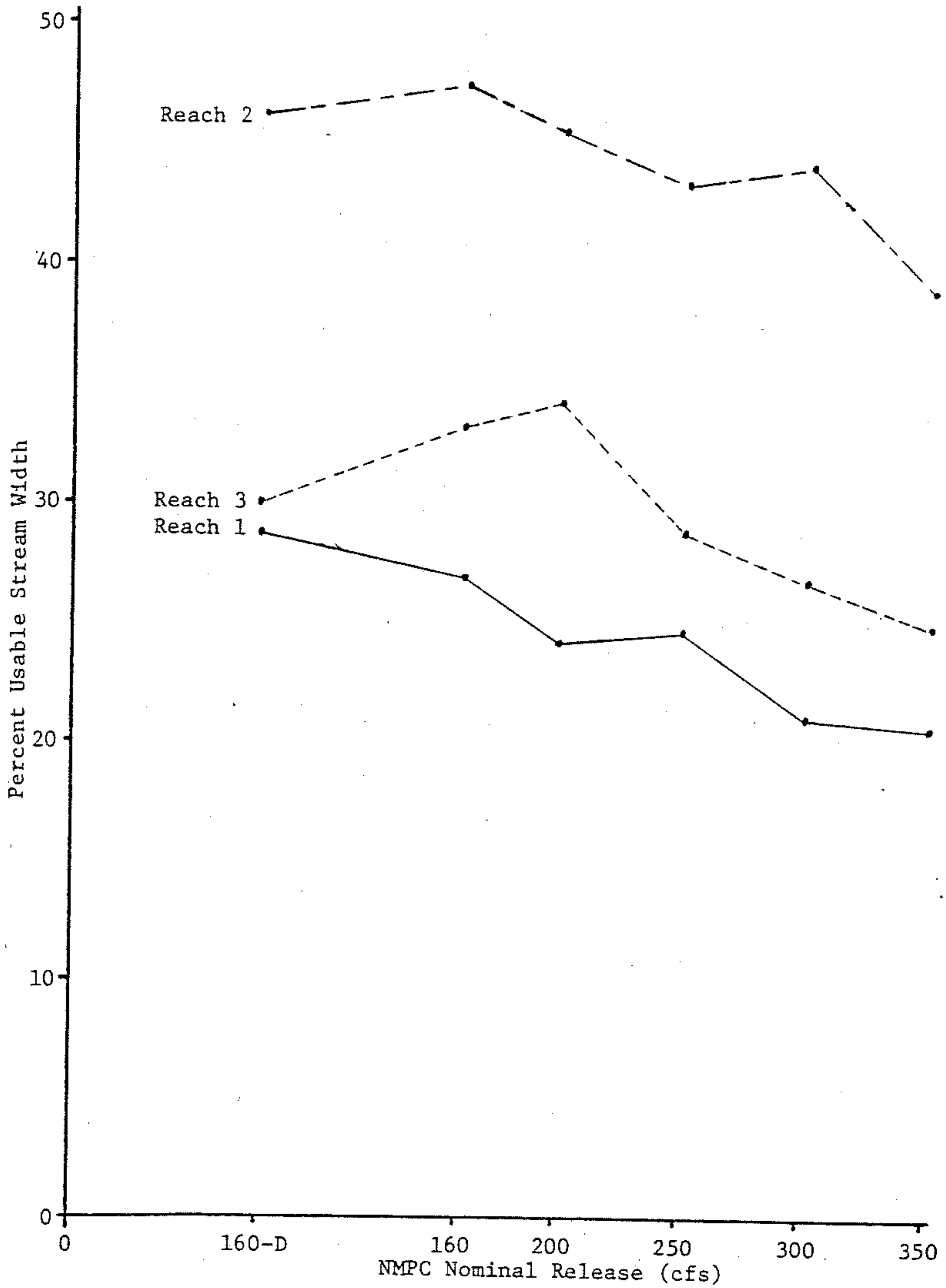


Fig. 19. Change in percent usable stream width with NMPC nominal release (cfs) for fry brown trout during August and September 1980 at reaches 1, 2, and 3, West Canada Creek, New York.

Appendix 1. Field data sheet used in IA habitat-flow study during August and September 1980 on West Canada Creek, New York.

IA HABITAT/FLOW ASSESSMENT

DATE: ____________________

STREAM: ____________________

AIR TEMP: ____________________

WATER TEMP: ____________________

WEATHER: ____________________

STATION: ____________________

TRANSECT #: ____________________

HABITAT TYPE: ____________________

NEAR BANK: ____________________
(ft from zero)

FAR BANK: ____________________
(ft from zero)

DATA COLLECTORS: Meter: ____________________

Data: ____________________

____

____

____

TIME: START ____________________ hr. FINISH: ____________________ hr.

WATER ____________________

TEST: START ____________________ FINISH ____________________

Page ________ of ________

RELEASE ____________________ cfs

SAMPLING POINT (ft from zero)	STAGE HEIGHT surface to cable (ft)	DEPTH bed to surface (ft)	VELOCITY (ft/sec) at .40 from bed	SUBSTRATE RANKING	COMPOSITE PROBABILITY for	INTERVAL WIDTH (ft)	WEIGHTED USABLE WIDTH (ft)	DISCHARGE (cfs)

* depth insufficient for velocity determination
GB = measurement taken on boulder
SW = standing waves
UC = "upstream" current
ES = exposed substrate
SDD = shoreline determination difficult
EC = eddy current

Appendix 2. Distance from stream bottom at which water velocity was measured at different water depths in IA habitat-flow study during August and September 1980 on West Canada Creek, New York.

DEPTH OF MEASUREMENT FOR CURRENT VELOCITY DETERMINATIONS

Depth of Water	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
Depth of measurement from stream bottom	*	*	*	*	0.16	0.20	0.24	0.28	0.32	0.36
Depth of Water	1.0	1.1	1.2	1.3	1.4	1.5	1.6	1.7	1.8	1.9
Depth of measurement from stream bottom	0.40	0.44	0.48	0.52	0.56	0.60	0.64	0.68	0.72	0.76
Depth of Water	2.0	2.1	2.2	2.3	2.4	2.5	2.6	2.7	2.8	2.9
Depth of measurement from stream bottom	0.80	0.84	0.88	0.92	0.96	1.00	2.08	2.16	2.24	2.32
							0.52	0.54	0.56	0.58
Depth of Water	3.0	3.1	3.2	3.3	3.4	3.5	3.6	3.7	3.8	3.9
Depth of measurement from stream bottom	2.40	2.48	2.56	2.64	2.72	2.80	2.88	2.96	3.04	3.12
	0.60	0.62	0.64	0.66	0.68	0.70	0.72	0.74	0.76	0.78
Depth of Water	4.0	4.1	4.2	4.3	4.4	4.5	4.6	4.7	4.8	4.9
Depth of measurement from stream bottom	3.20	3.28	3.36	3.44	3.52	3.60	3.68	3.76	3.84	3.92
	0.80	0.82	0.84	0.86	0.88	0.90	0.92	0.94	0.96	0.98
Depth of Water	5.0	5.1	5.2	5.3	5.4	5.5	5.6	5.7	5.8	5.9
Depth of measurement from stream bottom	4.00	4.08	4.16	4.24	4.32	4.40	4.48	4.56	4.64	4.72
	1.00	1.02	1.04	1.06	1.08	1.10	1.12	1.14	1.16	1.18
Depth of Water	6.0	6.1	6.2	6.3	6.4	6.5	6.6	6.7	6.8	6.9
Depth of measurement from stream bottom	4.80	4.88	4.96	5.04	5.12	5.20	5.28	5.36	5.44	5.52
	1.20	1.22	1.24	1.26	1.28	1.30	1.32	1.34	1.36	1.38
Depth of Water	7.0	7.1	7.2	7.3	7.4	7.5	7.6	7.7	7.8	7.9
Depth of measurement from stream bottom	5.60	5.68	5.76	5.84	5.92	6.00	6.08	6.16	6.24	6.32
	1.40	1.42	1.44	1.46	1.48	1.50	1.52	1.54	1.56	1.58
Depth of water	8.0	8.1	8.2	8.3	8.4	8.5	8.6	8.7	8.8	8.9
Depth of measurement from stream bottom	6.40	6.48	6.56	6.64	6.72	6.80	6.88	6.96	7.04	7.12
	1.60	1.62	1.64	1.66	1.68	1.70	1.72	1.74	1.76	1.78
Depth of Water	9.0	9.1	9.2	9.3	9.4	9.5	9.6	9.7	9.8	9.9
Depth of measurement from stream bottom	7.20	7.28	7.36	7.44	7.52	7.60	7.68	7.76	7.84	7.92
	1.80	1.82	1.84	1.86	1.88	1.90	1.92	1.94	1.96	1.98
Depth of Water	10.0									
Depth of measurement from stream bottom	8.00									
	2.00									

* Depth insufficient to determine discharge

Appendix 3. Modified Wentworth Particle Size Scale used in IA habitat-flow study during August and September 1980 on West Canada Creek, New York (Bovee and Cochnauer 1977, p 5).

	Range (mm)	Approximate Median (mm)
Mammoth boulder	4000	-
Very large boulder	3500-4000	3750
	3000-3500	3250
	2500-3000	2750
	2000-2500	2250
Large boulder	1650-2000	1825
	1330-1650	1490
	1000-1330	1165
Medium boulder	830-1000	915
	665- 830	750
	500- 665	580
Small boulder	415- 500	450
	335- 415	375
	250- 335	290
Large cobble	190- 250	220
	130- 190	160
Small cobble	100- 130	115
	64- 100	85
Very coarse gravel	50- 64	57
	32- 50	40
Coarse gravel	16- 32	24
Medium gravel	8- 16	12
Fine gravel	4- 8	6
Pea gravel	2- 4	3
Very coarse sand	1- 2	1.5
Sand	.062- 1	.5
Silt-clay	.062	-

Appendix 4. Numerical substrate code used in IA habitat-flow study during August and September 1980 on West Canada Creek, New York (Bovee and Cochnauer 1977, pp 5-6).

1	Plant detritus
2	Mud
3	Silt
4	Sand
5	Gravel
6	Rubble
7	Boulder
8	Bedrock

Notice that a mixture of two different (but adjacent) substrate types may be described by this code.

For example, a numeric code value of 5.5 refers to a bottom which is composed of a 50:50 mixture of gravel and rubble. A value of 4.2 would refer to a substrate which is 80% sand and 20% gravel, whereas a 4.8 value would be 20% sand and 80% gravel. Intermediate code values refer to a percentage mixture, not a size gradation.

TEMPERATURE MONITORING, WEST CANADA CREEK,

ONEIDA AND HERKIMER COUNTIES, NEW YORK

JUNE-SEPTEMBER 1980

by

Terry R. Culp, M.S.
John Homa, Jr., B.S.

Ichthyological Associates, Inc.
111 Main Street, P. O. Box 2
Stamford, New York 12167

for

Niagara Mohawk Power Corporation
300 Erie Boulevard West
Syracuse, New York 13202

ICHTHYOLOGICAL ASSOCIATES, INC.
EDWARD C. RANEY, Ph.D., PRESIDENT
301 Forest Drive, Ithaca, New York 14850

February 1981

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INTRODUCTION

Air temperature at Niagara Mohawk Power Corporation's (NMPC's) Trenton Hydroelectric Station (THS) and water temperature in West Canada Creek, Oneida and Herkimer counties, New York, along a 35.1-km section downstream from the station were monitored from 1 June through 30 September and from 28 June through 24 September 1980, respectively. The study purpose was to determine thermal suitability of West Canada Creek for maintenance of brown trout (*Salmo trutta*) and smallmouth bass (*Micropterus dolomieui*) in summer.

MATERIALS AND METHODS

Description and location of water and air temperature monitoring stations are given in Table 1 and Fig. 1. NMPC personnel recorded instantaneous daily air temperature (0700 hours June through August, 0800 hours in September) at the THS (Fred Hayes, NMPC, personal communication).

Water temperature was monitored continuously at five locations with seven-day recording thermometers (Partlow model RFT). Data charts were interpreted at the lab to the nearest one-half degree (C) each hour recorded. The Partlow thermometers were calibrated semiweekly by NMPC personnel against field thermometers, which were calibrated against a National Bureau of Standards certified thermometer (Fisher 75A-446 NBS 76). On days when calibration greater than 1 C was required, the data were not reported but were noted as "RM" (recorder malfunction). Mechanical failure and vandalism were also noted as RM. Mean, maximum, and minimum water temperature, and number of hours temperature was ≥19 C were calculated for each day sampled.

RESULTS AND DISCUSSION

Daily instantaneous air temperature recorded at the THS varied from -0.6 C on 29 September to 22.2 C on 20 July (Table 2).

Maximum water temperature (29.5 C) occurred at station 3 on 20 July and minimum water temperature (6.5 C) at stations 2 and 3 on 29 June (Table 3, Fig. 2). The greatest daily fluctuation in water temperature (12.5 C) was measured at station 3 on 18 July. Minimum and maximum daily water temperatures varied most at stations 2 and 3 and least at station 1. A deep-water release from Hinckley Reservoir provides thermal consistency at station 1.

Mean daily water temperature ranged from 9.2 C at station 3 on 29 June to 24.9 C at station 3 on 20 July (Table 3, Fig. 3). Mean daily water temperature from 28 June through 24 September averaged 19.3, 17.6, 18.8, 19.8, and 19.6 C at stations 1 through 5, respectively. Mean daily water temperature during the summer was generally lowest at station 2; springs immediately upstream from station 2 probably accounted for the lower temperature.

Optimum habitat for growth and feeding of brown trout generally occurs in water with temperatures not greater than 19 C (Table 4). The probability-of-use for brown trout is 1.0 (greatest use) for fry, juvenile, and adult at temperatures of 12.8-18.9 C (Table 5). The number of days of the total days sampled and the mean hours of these days (in parentheses) that water temperature was ≥19 C were 59 of 78 (23), 56 of 68 (12), 60 of 71 (17), 37 of 42 (20), and 73 of 83 (17) at stations 1 through 5, respectively (Table 3, Fig. 4).

Sheppard (1980) used two criteria to define thermal stress-days (TSD) for brown trout at one or more stations in a watershed: (1) any day when the temperature equals or exceeds 75 F (23.9 C) and/or (2) the water temperature equals or exceeds 72 F (22.2 C) for an entire 24-hour period. He further states "these temperature criteria were selected because of their relationship with the preferred temperature range and upper lethal temperatures for brown trout." Within part of the study section on West Canada Creek, TSD occurred on 33 of the 89 days monitored. Of the days sampled, 4 TSD of 78, 11 of 68, 20 of 71, 11 of 42, and 16 of 83 occurred at stations 1 through 5, respectively (Table 3). All TSD at the study area met criterion #1; in addition, TSD at station 1 on 23 and 25 August and at station 2 on 2 and 3 September met criterion #2. TSD were continuous from 29 August through 6 September at station 2, 25 August through 31 August and 2 through 4 September at station 3, and 16 through 21 July at station 4. At one or more stations TSD were recorded continuously from 16 through 21 July, 4 through 10 August, and 21 August through 6 September.

Optimal temperature for growth of smallmouth bass occurs at 26-29 C, and feeding rates are high to 27 C (Table 6). Probability-of-use is 1.0 for fry at 15.6-21.6 C and for juvenile and adult at 19.5-27.2 C (Table 7). High water temperature in West Canada Creek would not limit the juvenile or adult smallmouth bass, whereas fry may be somewhat limited. Engstrom-Heg (unpublished data, New York State Department of Environmental Conservation, Stamford) did not find smallmouth bass populations in large, low-gradient Catskill rivers below impoundments unless mean daily water temperature exceeded 70 F (21.1 C) for at least 27 days. Data from West Canada Creek indicate that this condition occurred only at station 3, where 27 of 71 days monitored exceeded 70 F (Table 3).

CONCLUSION

Water temperature data collected from 28 June through 24 September 1980 indicate that West Canada Creek from the THS to Kast Bridge is marginal for the maintenance of brown trout or smallmouth bass populations. Temperatures are generally in the range to which both fishes are adapted but are warmer than the ideal temperatures for brown trout and colder than for smallmouth bass.

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Table 1. Location and description of stations sampled for air temperature (AT) and continuous water temperature (WT) from June through September 1980, West Canada Creek, New York.

Station / Parameter	1 WT	2 WT	3 WT	4 WT	5 WT	Trenton Hydroelectric Station (THS) AT
Location	0.5 km downstream from THS, below Dover Rd. bridge	8.1 km downstream from THS at DEC access point north of Beecher Rd.	17.6 km downstream from THS at DEC access point south of Poland, New York	25.6 km downstream from THS at DEC access point north of Middleville	35.1 km downstream from THS, south of Kast Bridge	0.5 km upstream from state diversion dam
Elevation (m)	222	210	204	156	138	240
Habitat type	Riffle-run	Shallow pool	Pool	Shallow pool	Riffle-run	
Bankfull width (m)	30.01	15.37	34.51	17.22	38.74	

Table 2. Summary of daily air temperature data (F) recorded by NMPC personnel from 1 June through 30 September 1980 at the Trenton Hydroelectric Station, West Canada Creek, New York.

Month Time Day	Jun 0700	Jul 0700	Aug 0700	Sep 0800
1	50 (10.0)*	52 (11.1)	60 (15.6)	66 (18.9)
2	56 (13.3)	61 (16.1)	64 (17.8)	65 (18.3)
3	60 (15.6)	55 (12.8)	65 (18.3)	58 (14.4)
4	53 (11.7)	49 (9.4)	60 (15.6)	52 (11.1)
5	44 (6.7)	61 (16.1)	58 (14.4)	63 (17.2)
6	43 (6.1)	53 (11.7)	66 (18.9)	53 (11.7)
7	55 (12.8)	44 (6.7)	60 (15.6)	50 (10.0)
8	58 (14.4)	60 (15.6)	68 (20.0)	48 (8.9)
9	35 (1.7)	58 (14.4)	69 (20.6)	42 (5.6)
10	38 (3.3)	52 (11.1)	56 (13.3)	48 (8.9)
11	40 (4.4)	55 (12.8)	63 (17.2)	43 (6.1)
12	36 (2.2)	47 (8.3)	66 (18.9)	48 (8.9)
13	41 (5.0)	46 (7.8)	63 (17.2)	52 (11.1)
14	50 (10.0)	49 (9.4)	57 (13.9)	62 (16.7)
15	57 (13.9)	63 (17.2)	64 (17.8)	51 (10.6)
16	45 (7.2)	70 (21.1)	50 (10.0)	42 (5.2)
17	36 (2.2)	63 (17.2)	44 (6.7)	54 (12.2)
18	41 (5.0)	60 (15.6)	55 (12.8)	47 (8.3)
19	51 (10.6)	60 (15.6)	61 (16.1)	40 (4.4)
20	51 (10.6)	72 (22.2)	59 (15.0)	52 (11.1)
21	52 (11.1)	66 (18.9)	54 (12.2)	62 (16.7)
22	50 (10.0)	66 (18.9)	53 (11.7)	65 (18.3)
23	51 (10.6)	62 (16.7)	59 (15.0)	63 (17.2)
24	56 (13.3)	51 (10.6)	56 (13.3)	41 (5.0)
25	57 (13.9)	50 (10.0)	54 (12.2)	46 (7.8)
26	61 (16.1)	59 (15.0)	56 (13.3)	50 (10.0)
27	64 (17.8)	61 (16.1)	59 (15.0)	33 (0.6)
28	46 (7.8)	64 (17.8)	60 (15.6)	40 (4.4)
29	54 (12.2)	64 (17.8)	60 (15.6)	31 (-0.6)
30	57 (13.9)	61 (16.1)	62 (16.7)	50 (10.0)
31	-	53 (11.7)	63 (17.2)	-

* C temperature in parentheses.

Table 3. Summary of daily water temperature data (C) monitored by Partlow seven-day recording thermometers from 28 June through 24 September 1980, West Canada Creek, New York.

Date		Station* 1	2	3	4	5
28 Jun	Mean	-	-	-	15.3	16.2
	Maximum	-	-	-	17.5	17.5
	Minimum	-	-	-	14.0	15.0
	Hours ≥19 C	-	-	-	0	0
29 Jun	Mean	13.0	10.5	9.2	14.8	15.3
	Maximum	14.5	13.5	14.5	15.5	15.5
	Minimum	11.5	6.5	6.5	14.0	15.0
	Hours ≥19 C	0	0	0	0	0
30 Jun	Mean	12.8	RM**	13.4	14.9	15.3
	Maximum	13.5	-	14.5	15.5	17.0
	Minimum	12.5	-	10.0	14.5	14.5
	Hours ≥19 C	0	-	0	0	0
1 Jul	Mean	12.1	12.6	12.0	15.2	16.0
	Maximum	13.0	15.5	15.0	17.5	18.5
	Minimum	11.5	9.0	7.0	14.0	14.5
	Hours ≥19 C	0	0	0	0	0
2 Jul	Mean	12.6	RM	11.6	15.0	15.9
	Maximum	14.5	-	14.0	16.0	17.0
	Minimum	11.5	-	7.0	14.5	15.5
	Hours ≥19 C	0	-	0	0	0
3 Jul	Mean	11.7	RM	15.4	RM	17.2
	Maximum	13.0	-	20.5	-	21.5
	Minimum	10.0	-	8.5	-	15.0
	Hours ≥19 C	0	-	10	-	7
4 Jul	Mean	RM	RM	16.0	20.5	18.4
	Maximum	-	-	22.5	24.0	22.0
	Minimum	-	-	10.5	17.5	15.5
	Hours ≥19 C	-	-	6	15	11
5 Jul	Mean	16.0	12.8	15.3	19.8	17.6
	Maximum	16.5	15.0	20.0	21.0	18.5
	Minimum	15.5	10.0	10.5	18.5	16.5
	Hours ≥19 C	0	0	2	20	0
6 Jul	Mean	15.9	12.7	16.3	19.4	16.8
	Maximum	16.5	16.0	21.0	22.5	19.0
	Minimum	15.0	8.5	11.0	17.5	15.0
	Hours ≥19 C	0	0	6	13	5
7 Jul	Mean	15.1	12.7	16.7	19.2	17.0
	Maximum	16.0	16.5	20.5	22.5	20.5
	Minimum	13.5	8.5	10.5	16.5	14.5
	Hours ≥19 C	0	0	9	13	6
8 Jul	Mean	15.7	12.8	15.6	18.6	RM
	Maximum	16.5	15.0	19.0	19.5	-
	Minimum	15.0	9.5	11.0	18.0	-
	Hours ≥19 C	0	0	6	9	-
9 Jul	Mean	16.0	13.2	18.2	18.9	16.8
	Maximum	16.0	15.5	20.0	20.5	19.0
	Minimum	15.5	10.0	13.0	17.5	15.5
	Hours ≥19 C	0	0	10	12	4
10 Jul	Mean	15.5	RM	16.3	19.5	RM
	Maximum	16.5	-	20.0	22.5	-
	Minimum	14.0	-	10.0	17.5	-
	Hours ≥19 C	0	-	7	13	-

* Stations 4 and 5 first sampled 28 June; stations 1-3 first sampled 29 June.
** RM = recorder malfunction.
\# Number of days and mean hours of these days (in parentheses) that water temperature ≥19 C.
\#\# Total number of days sampled.

Table 3 - (Continued).

Date		Station 1	2	3	4	5
11 Jul	Mean	15.7	14.7	14.9	20.0	19.0
	Maximum	16.5	18.0	20.0	23.5	22.5
	Minimum	14.5	12.0	9.5	18.0	16.5
	Hours ≥19 C	0	0	9	17	12
12 Jul	Mean	15.2	RM	13.4	19.1	18.0
	Maximum	16.5	-	18.5	21.5	20.5
	Minimum	14.0	-	9.5	17.5	16.5
	Hours ≥19 C	0	-	0	14	6
13 Jul	Mean	15.5	RM	14.4	19.2	17.9
	Maximum	17.0	-	20.5	23.0	21.0
	Minimum	13.5	-	9.5	16.0	15.0
	Hours ≥19 C	0	-	5	12	9
14 Jul	Mean	16.0	RM	15.5	20.1	19.0
	Maximum	17.0	-	21.0	24.0	23.0
	Minimum	14.5	-	10.0	17.5	16.0
	Hours ≥19 C	0	-	8	15	12
15 Jul	Mean	16.4	RM	RM	20.2	19.1
	Maximum	17.0	-	-	22.0	22.0
	Minimum	16.0	-	-	19.5	17.5
	Hours ≥19 C	0	-	-	24	12
16 Jul	Mean	16.5	17.8	18.0	21.6	20.9
	Maximum	17.0	21.0	24.0	25.0	25.0
	Minimum	16.0	16.0	12.0	20.0	18.5
	Hours ≥19 C	0	10	12	24	15
17 Jul	Mean	RM	17.2	RM	21.1	20.1
	Maximum	-	21.0	-	24.0	23.0
	Minimum	-	15.0	-	19.5	18.5
	Hours ≥19 C	-	7	-	24	18
18 Jul	Mean	18.8	17.4	21.5	21.9	20.6
	Maximum	19.5	21.0	29.0	26.0	25.0
	Minimum	18.0	14.5	16.5	19.5	18.0
	Hours ≥19 C	14	8	12	24	17
19 Jul	Mean	19.6	17.8	23.3	21.5	20.2
	Maximum	20.5	21.0	28.5	24.0	23.0
	Minimum	18.5	15.0	17.0	19.5	18.0
	Hours ≥19 C	19	9	20	24	17
20 Jul	Mean	20.0	18.0	24.9	22.3	20.7
	Maximum	20.5	20.0	29.5	24.0	22.0
	Minimum	19.5	15.5	17.5	21.5	19.5
	Hours ≥19 C	24	9	21	24	24
21 Jul	Mean	19.7	19.0	RM	22.6	21.1
	Maximum	20.5	22.0	-	24.5	24.5
	Minimum	19.5	14.5	-	21.0	18.5
	Hours ≥19 C	24	14	-	24	23
22 Jul	Mean	19.5	18.9	RM	20.6	19.2
	Maximum	20.0	20.0	-	21.5	21.0
	Minimum	19.0	18.0	-	19.5	18.5
	Hours ≥19 C	24	12	-	24	12
23 Jul	Mean	19.0	18.1	19.3	20.3	19.5
	Maximum	19.0	20.5	21.5	21.5	22.0
	Minimum	18.5	14.0	11.5	19.5	18.5
	Hours ≥19 C	22	8	22	24	16
24 Jul	Mean	18.7	RM	18.1	20.0	19.4
	Maximum	19.5	-	22.0	22.0	22.0
	Minimum	17.5	-	12.0	18.5	17.5
	Hours ≥19 C	13	-	12	21	15
25 Jul	Mean	18.9	17.2	18.7	19.8	18.8
	Maximum	20.0	21.5	22.5	22.5	22.5
	Minimum	17.5	12.0	11.5	17.5	16.5
	Hours ≥19 C	15	8	13	15	12

Table 3 - (Continued).

Date		Station 1	2	3	4	5
26 Jul	Mean	19.4	17.0	16.8	20.2	19.3
	Maximum	20.5	21.0	22.0	22.5	21.5
	Minimum	18.5	12.5	11.0	18.5	17.5
	Hours ≥19 C	18	6	10	21	13
27 Jul	Mean	20.7	18.4	15.5	21.1	19.9
	Maximum	22.0	21.5	22.5	23.5	22.0
	Minimum	19.5	16.0	11.5	19.5	18.0
	Hours ≥19 C	24	11	4	24	15
28 Jul	Mean	20.6	18.1	17.3	20.6	19.3
	Maximum	21.0	20.5	22.0	22.0	20.5
	Minimum	20.5	15.0	11.5	20.0	18.5
	Hours ≥19 C	24	11	12	24	17
29 Jul	Mean	20.0	17.6	RM	19.7	19.1
	Maximum	20.5	19.5	-	20.0	20.5
	Minimum	19.5	15.0	-	19.5	18.0
	Hours ≥19 C	24	8	-	24	15
30 Jul	Mean	19.4	17.2	23.4	20.2	20.4
	Maximum	19.5	20.5	26.0	22.0	22.5
	Minimum	19.0	13.5	15.5	19.0	19.0
	Hours ≥19 C	24	10	23	24	24
31 Jul	Mean	19.3	17.3	18.1	20.0	RM
	Maximum	20.5	21.5	23.0	23.0	-
	Minimum	17.5	14.0	11.5	18.0	-
	Hours ≥19 C	16	9	11	16	-
1 Aug	Mean	19.8	17.4	16.9	18.6	18.3
	Maximum	20.5	19.5	21.0	20.0	19.5
	Minimum	19.0	14.0	11.5	18.0	18.0
	Hours ≥19 C	24	7	13	13	4
2 Aug	Mean	20.4	16.9	21.3	19.8	19.9
	Maximum	21.0	21.5	23.0	22.0	22.5
	Minimum	20.0	13.5	20.0	18.0	18.0
	Hours ≥19 C	24	6	24	14	15
3 Aug	Mean	20.7	17.7	21.4	20.2	20.5
	Maximum	21.0	20.5	22.0	20.5	22.0
	Minimum	20.5	16.5	20.5	20.0	19.5
	Hours ≥19 C	24	7	24	24	24
4 Aug	Mean	20.3	18.5	22.1	20.8	20.8
	Maximum	20.5	22.5	24.0	23.0	23.5
	Minimum	20.0	13.0	20.5	19.0	19.0
	Hours ≥19 C	24	15	24	24	24
5 Aug	Mean	20.7	18.6	21.8	20.8	21.5
	Maximum	21.5	23.5	24.5	23.0	24.5
	Minimum	20.0	12.5	20.0	18.5	19.0
	Hours ≥19 C	24	13	24	21	24
6 Aug	Mean	21.0	18.8	22.4	21.4	21.7
	Maximum	21.5	23.0	24.0	23.0	23.0
	Minimum	20.5	16.0	21.5	20.0	20.5
	Hours ≥19 C	24	13	24	24	24
7 Aug	Mean	20.9	RM	RM	22.2	22.4
	Maximum	21.5	-	-	24.5	25.5
	Minimum	20.0	-	-	20.0	20.0
	Hours ≥19 C	24	-	-	24	24
8 Aug	Mean	21.4	19.3	RM	22.6	22.9
	Maximum	22.0	24.0	-	24.0	25.5
	Minimum	21.0	14.0	-	21.5	21.5
	Hours ≥19 C	24	14	-	24	24
9 Aug	Mean	21.4	19.0	RM	22.7	22.9
	Maximum	21.5	24.0	-	24.0	24.5
	Minimum	21.0	14.0	-	21.5	21.5
	Hours ≥19 C	24	13	-	24	24

Table 3 - (Continued).

Date		Station 1	2	3	4	5
10 Aug	Mean	21.5	18.1	RM	RM	22.0
	Maximum	22.0	23.5	-	-	24.5
	Minimum	21.0	13.0	-	-	20.0
	Hours ≥19 C	24	11	-	-	24
11 Aug	Mean	21.7	19.2	RM	RM	20.4
	Maximum	22.0	21.5	-	-	21.5
	Minimum	21.5	16.0	-	-	20.0
	Hours ≥19 C	24	12	-	-	24
12 Aug	Mean	21.0	18.6	RM	RM	20.4
	Maximum	21.0	21.0	-	-	21.5
	Minimum	21.0	15.0	-	-	20.0
	Hours ≥19 C	24	13	-	-	24
13 Aug	Mean	20.8	17.6	21.5	RM	20.6
	Maximum	21.0	22.5	23.0	-	22.0
	Minimum	20.5	13.0	20.5	-	19.5
	Hours ≥19 C	24	8	24	-	24
14 Aug	Mean	21.0	RM	RM	RM	20.2
	Maximum	21.0	-	-	-	21.5
	Minimum	21.0	-	-	-	19.0
	Hours ≥19 C	24	-	-	-	24
15 Aug	Mean	21.1	RM	RM	RM	21.0
	Maximum	21.5	-	-	-	23.0
	Minimum	20.5	-	-	-	19.5
	Hours ≥19 C	24	-	-	-	24
16 Aug	Mean	20.6	RM	RM	RM	19.8
	Maximum	21.0	-	-	-	20.5
	Minimum	20.0	-	-	-	19.0
	Hours ≥19 C	24	-	-	-	24
17 Aug	Mean	20.6	RM	17.6	RM	19.6
	Maximum	21.0	-	19.5	-	22.5
	Minimum	20.0	-	15.5	-	17.0
	Hours ≥19 C	24	-	7	-	13
18 Aug	Mean	20.7	RM	RM	RM	19.8
	Maximum	21.0	-	-	-	21.5
	Minimum	20.0	-	-	-	18.0
	Hours ≥19 C	24	-	-	-	17
19 Aug	Mean	20.4	RM	RM	RM	20.3
	Maximum	21.0	-	-	-	22.5
	Minimum	18.5	-	-	-	19.0
	Hours ≥19 C	22	-	-	-	24
20 Aug	Mean	18.8	RM	21.4	RM	21.2
	Maximum	21.5	-	23.5	-	23.5
	Minimum	16.0	-	19.5	-	20.0
	Hours ≥19 C	10	-	24	-	24
21 Aug	Mean	RM	RM	21.6	RM	21.3
	Maximum	-	-	24.5	-	23.5
	Minimum	-	-	19.5	-	19.0
	Hours ≥19 C	-	-	24	-	24
22 Aug	Mean	22.7	18.1	21.4	RM	20.8
	Maximum	25.0	21.0	23.5	-	22.0
	Minimum	19.5	15.0	19.5	-	19.5
	Hours ≥19 C	24	12	24	-	24
23 Aug	Mean	24.5	17.6	22.3	RM	22.2
	Maximum	24.5	23.5	25.5	-	25.0
	Minimum	24.5	13.5	20.0	-	20.0
	Hours ≥19 C	24	10	24	-	24
24 Aug	Mean	24.7	18.1	20.9	RM	22.7
	Maximum	25.0	22.5	23.5	-	25.0
	Minimum	24.5	13.5	20.0	-	20.5
	Hours ≥19 C	24	13	24	-	24

Table 3 - (Continued).

Date		Station 1	2	3	4	5
25 Aug	Mean	24.7	19.2	21.9	RM	22.2
	Maximum	25.0	23.0	25.0	-	25.0
	Minimum	24.5	16.0	19.0	-	20.0
	Hours ≥19 C	24	12	24	-	24
26 Aug	Mean	RM	17.9	23.1	RM	21.9
	Maximum	-	21.5	25.5	-	23.5
	Minimum	-	14.5	20.0	-	20.5
	Hours ≥19 C	-	9	24	-	24
27 Aug	Mean	22.0	16.8	22.4	RM	22.4
	Maximum	22.0	23.0	26.0	-	25.0
	Minimum	22.0	13.0	20.5	-	20.5
	Hours ≥19 C	24	8	24	-	24
28 Aug	Mean	21.4	RM	22.1	RM	21.7
	Maximum	22.0	-	25.0	-	22.0
	Minimum	21.0	-	20.5	-	21.0
	Hours ≥19 C	24	-	24	-	24
29 Aug	Mean	21.0	22.0	22.8	RM	21.7
	Maximum	21.0	26.0	25.5	-	24.0
	Minimum	21.0	19.0	21.0	-	20.0
	Hours ≥19 C	24	24	24	-	24
30 Aug	Mean	21.2	22.0	22.2	RM	21.8
	Maximum	21.5	24.5	24.5	-	25.0
	Minimum	21.0	20.0	21.5	-	19.5
	Hours ≥19 C	24	24	24	-	24
31 Aug	Mean	21.5	22.5	22.9	RM	22.0
	Maximum	21.5	24.5	24.0	-	24.0
	Minimum	21.5	20.5	22.0	-	20.5
	Hours ≥19 C	24	24	24	-	24
1 Sep	Mean	21.0	22.0	22.6	RM	22.3
	Maximum	21.0	24.0	23.0	-	23.5
	Minimum	21.0	19.5	21.5	-	21.0
	Hours ≥19 C	24	24	24	-	24
2 Sep	Mean	21.0	22.7	23.9	RM	22.0
	Maximum	21.0	24.5	24.5	-	24.0
	Minimum	21.0	21.5	23.0	-	21.0
	Hours ≥19 C	24	24	24	-	24
3 Sep	Mean	20.5	22.1	23.2	RM	20.9
	Maximum	20.5	24.0	24.0	-	22.0
	Minimum	20.5	21.0	22.5	-	20.0
	Hours ≥19 C	24	24	24	-	24
4 Sep	Mean	21.1	21.6	22.4	RM	20.6
	Maximum	22.0	25.0	24.0	-	22.5
	Minimum	20.5	18.5	21.5	-	19.0
	Hours ≥19 C	24	23	24	-	24
5 Sep	Mean	22.0	21.3	22.0	RM	19.6
	Maximum	22.0	24.0	23.5	-	21.5
	Minimum	22.0	17.5	21.5	-	18.0
	Hours ≥19 C	24	22	24	-	17
6 Sep	Mean	21.8	20.6	20.8	RM	19.2
	Maximum	22.0	24.0	22.0	-	21.0
	Minimum	21.5	17.5	20.0	-	17.5
	Hours ≥19 C	24	22	24	-	13
7 Sep	Mean	21.5	20.6	20.6	RM	19.1
	Maximum	22.0	23.5	22.0	-	20.0
	Minimum	21.0	18.0	20.0	-	18.0
	Hours ≥19 C	24	21	24	-	15
8 Sep	Mean	21.1	19.4	21.3	RM	18.8
	Maximum	21.5	23.5	23.0	-	21.0
	Minimum	21.0	14.5	20.0	-	17.5
	Hours ≥19 C	24	15	24	-	10

Table 3 - (Continued).

Date		Station 1	2	3	4	5
9 Sep	Mean	20.4	17.8	RM	RM	17.9
	Maximum	20.5	21.0	-	-	19.5
	Minimum	20.0	14.0	-	-	16.5
	Hours ≥19 C	24	11	-	-	5
10 Sep	Mean	20.2	16.3	18.5	RM	18.4
	Maximum	20.5	20.5	19.5	-	19.5
	Minimum	20.0	12.5	17.0	-	17.5
	Hours ≥19 C	24	7	14	-	8
11 Sep	Mean	19.9	16.6	18.4	RM	18.2
	Maximum	20.0	20.5	20.5	-	20.5
	Minimum	19.5	11.5	16.0	-	16.5
	Hours ≥19 C	24	9	10	-	9
12 Sep	Mean	20.0	17.2	19.1	RM	18.6
	Maximum	20.0	20.0	20.0	-	20.0
	Minimum	20.0	12.5	17.5	-	18.0
	Hours ≥19 C	24	9	17	-	9
13 Sep	Mean	19.8	15.9	18.2	RM	18.5
	Maximum	20.0	20.0	19.5	-	19.5
	Minimum	19.5	12.0	17.0	-	17.5
	Hours ≥19 C	24	7	9	-	9
14 Sep	Mean	20.0	16.1	18.6	RM	18.7
	Maximum	20.0	19.5	19.5	-	19.0
	Minimum	20.0	13.0	17.5	-	18.5
	Hours ≥19 C	24	3	13	-	9
15 Sep	Mean	19.6	16.5	18.4	RM	17.7
	Maximum	20.0	20.0	19.5	-	18.5
	Minimum	19.0	13.0	17.0	-	17.0
	Hours ≥19 C	24	5	13	-	0
16 Sep	Mean	18.7	15.5	17.9	RM	RM
	Maximum	19.0	19.5	19.0	-	-
	Minimum	17.0	10.5	16.5	-	-
	Hours ≥19 C	19	5	8	-	-
17 Sep	Mean	18.0	16.4	17.4	RM	RM
	Maximum	18.5	18.0	18.5	-	-
	Minimum	17.0	14.5	16.0	-	-
	Hours ≥19 C	0	0	0	-	-
18 Sep	Mean	RM	15.3	17.1	RM	RM
	Maximum	-	18.0	18.0	-	-
	Minimum	-	11.5	15.5	-	-
	Hours ≥19 C	-	0	0	-	-
19 Sep	Mean	RM	15.0	16.6	RM	15.2
	Maximum	-	18.0	17.5	-	17.0
	Minimum	-	12.0	15.5	-	14.0
	Hours ≥19 C	-	0	0	-	0
20 Sep	Mean	RM	15.4	15.9	RM	15.8
	Maximum	-	19.0	18.0	-	17.5
	Minimum	-	12.0	14.5	-	14.0
	Hours ≥19 C	-	2	0	-	0
21 Sep	Mean	RM	16.9	16.9	RM	18.0
	Maximum	-	20.0	19.0	-	19.5
	Minimum	-	14.5	15.5	-	16.5
	Hours ≥19 C	-	7	5	-	10
22 Sep	Mean	RM	17.6	17.3	RM	19.1
	Maximum	-	21.0	19.5	-	20.5
	Minimum	-	15.5	15.5	-	18.0
	Hours ≥19 C	-	8	6	-	11
23 Sep	Mean	RM	17.7	17.7	RM	18.0
	Maximum	-	19.5	18.5	-	19.0
	Minimum	-	16.0	17.0	-	16.5
	Hours ≥19 C	-	6	0	-	4

Table 3 - (Continued).

Date		Station 1	2	3	4	5
24 Sep	Mean	17.5	16.2	16.4	RM	15.6
	Maximum	17.5	18.5	17.5	-	16.5
	Minimum	17.5	14.0	15.5	-	14.5
	Hours ≥19 C	0	0	0	-	0
28 Jun-24 Sep	Mean	19.3	17.6	18.8	19.8	19.6
	Standard deviation	2.80	2.54	3.34	2.07	1.99
	Maximum	25.0	26.0	29.5	26.0	25.5
	Minimum	10.0	6.5	6.5	14.0	14.0
	Hours ≥19 C#	59 (23)	56 (12)	60 (17)	37 (20)	73 (17)
	n##	78	68	71	42	83

Table 4. Optimum temperature ranges for growth and feeding of brown trout.* Source: Brown, H. W., 1974.

Age (years)	Growth Optima C	Growth Optima F	Feeding Optima C	Feeding Optima F	Author
0-½	12 10	53.6 50			Brown 1951
0-1			7-15	44.6-59	Myers 1946
½-1½	10-15	50-59	10	50	Pentelow 1939
½-1½	10-15	50-59			Wingfield 1940
1-2	12	53.6			Swift 1961
2-3	7-9 and 16-19	44.6-48.2 and 60.8-66.2	10-19	50-66.2	Brown 1946
3-4	8-12 and 15-16	46.4-58.6 and 59-60.8			Swift 1955
All ages			5-13 and 16-19	41-55.4 and 60.8-66.2	Gerrish 1935
All ages	15-19	59-66.2			Hewitt 1943

* Adapted from Frost and Brown 1967:139.

Table 5. Thermal probability-of-use for fry, juvenile, and adult brown trout. Values extrapolated from probability-of-use curves given in Bovee (1978).

Temperature F	(C)	Probability-of-Use for Fry, Juvenile, and Adult
<37	(2.8)	0.00
40	(4.45)	0.38
50	(10.0)	0.90
55	(12.8)	1.00
60	(15.56)	1.00
66	(18.9)	1.00
70	(21.1)	0.70
75	(23.9)	0.16
>79	(26.1)	0.00

Table 6. Temperature requirements for growth and feeding of smallmouth bass.

Parameter	Temperature (C)	Reference
Maximum weekly average temperature for growth, calculated according to the equation (using optimum temperature for growth) maximum weekly average temperature for growth = optimum temperature + 1/3 (ultimate incipient lethal temperature - optimum temperature).	29	EPA 1976
Optimum for growth	26.3 28 (3-5 year old fish) 28.3	Horning and Pearson 1973 Coutant 1975 Peek 1965
Average:	27.3	
Feeding	Uniformly high rate to 27 C	Coutant 1975

Table 7. Thermal probability-of-use (PU) for fry, juvenile, and adult smallmouth bass. (K. Bovee, U. S. Fish and Wildlife Service, Instream Flow Service Group, Fort Collins, Colo., personal communication, 2 March 1979).

Fry			Juvenile and Adult		
Temperature F	(C)	PU	Temperature F	(C)	PU
40	(4.44)	0.00	53	(11.67)	0.00
51	(10.56)	0.20	63	(17.22)	0.20
55	(12.78)	0.54	66	(18.89)	0.40
57	(13.98)	0.92	67	(19.44)	1.00
60	(15.56)	1.00	81	(27.22)	1.00
71	(21.67)	1.00	84	(28.89)	0.30
75	(23.89)	0.88	87	(30.56)	0.12
78	(25.56)	0.22	95	(35.00)	0.00
85	(29.44)	0.00			

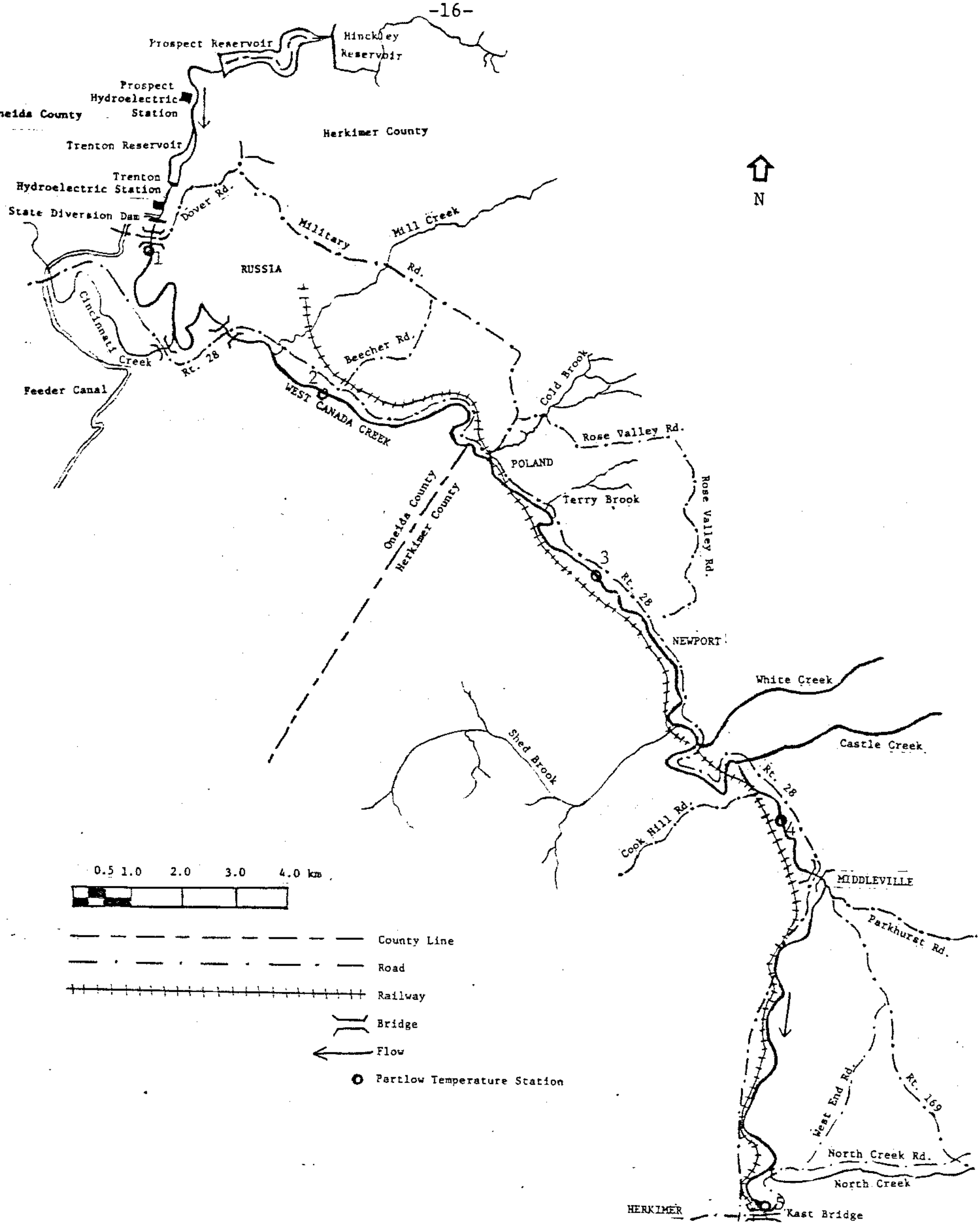

Fig. 1. Stations 1-5 sampled by Partlow seven-day recording thermometers from 28 June through 24 September 1980, West Canada Creek, New York.

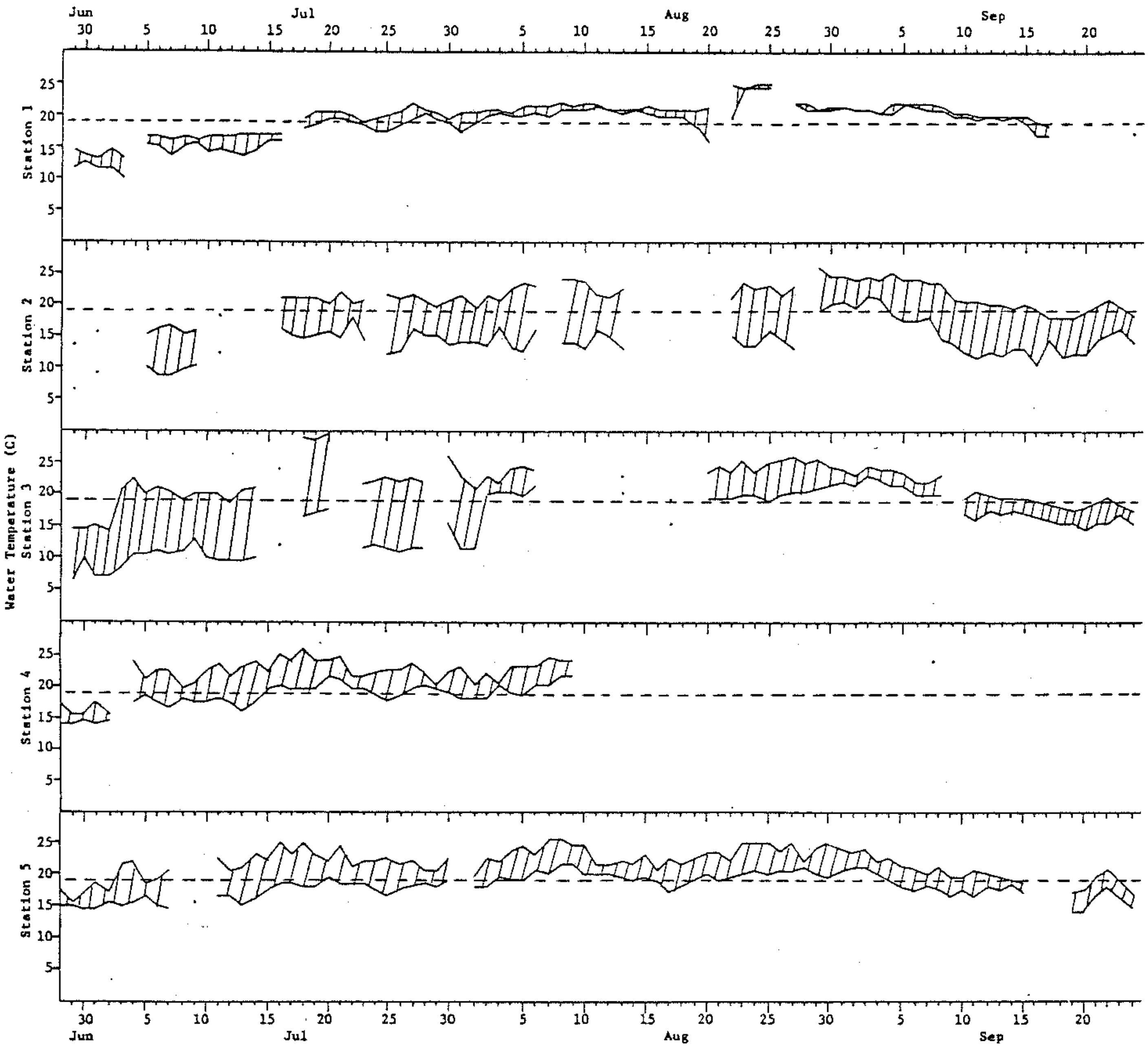

Fig. 2. Summary of daily minimum-maximum water temperature data (C) monitored by Partlow seven-day recording thermometers from 28 June through 24 September 1980, West Canada Creek, New York.

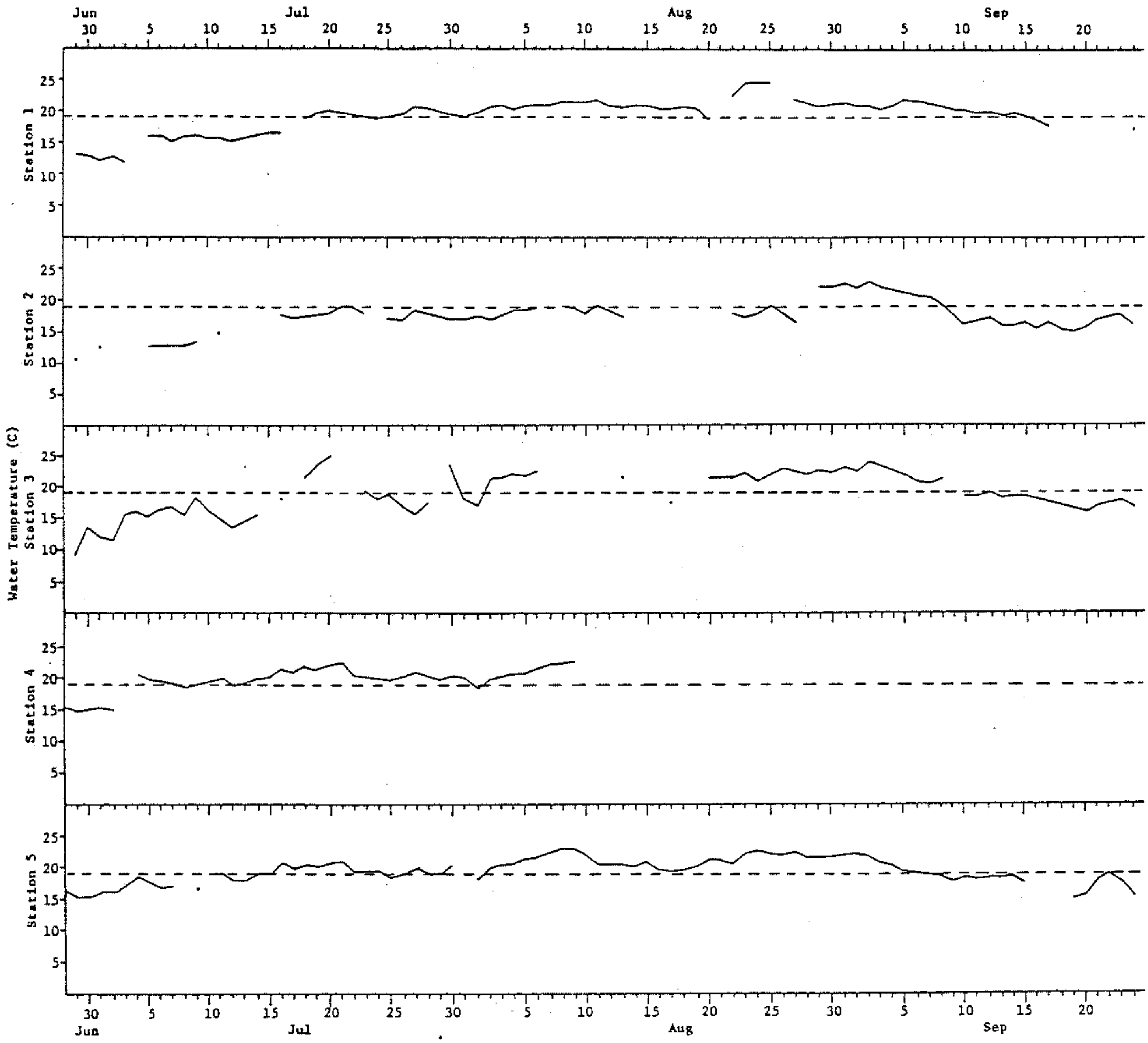

Fig. 3. Summary of mean daily water temperature data (C) monitored by Partlow seven-day recording thermometers from 28 June through 24 September 1980, West Canada Creek, New York.

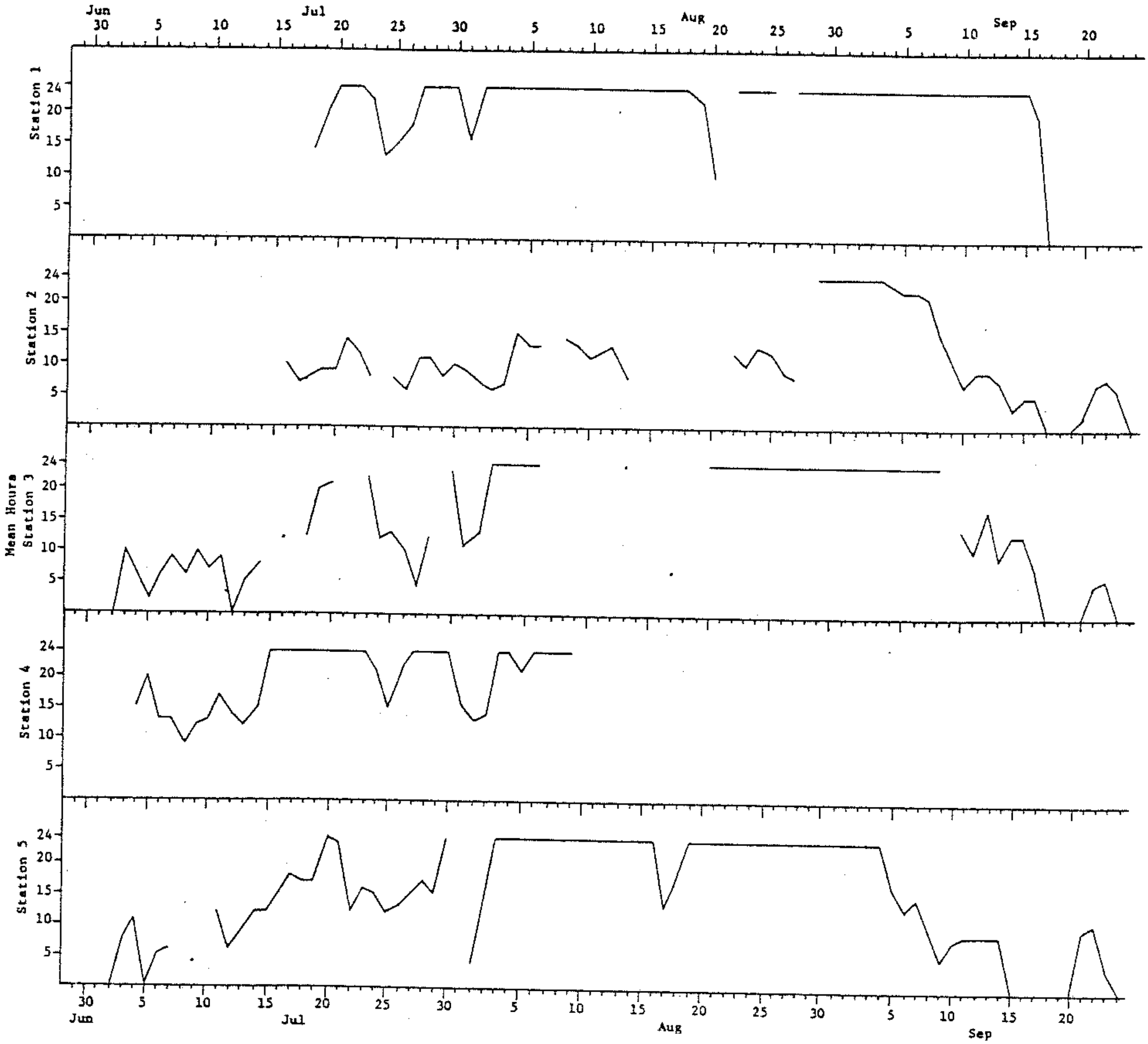

Fig. 4. Number of hours per day that water temperature (C) recorded by Partlow seven-day recording thermometers was ≥19 C from 28 June through 24 September 1980, West Canada Creek, New York.

ATTACHMENT C

RESPONSE TO FERC AIR 10 – TERRESTRIAL RESOURCES, BALD EAGLE

Response is filed as Privileged Information

See Volume II Attachment C

ATTACHMENT D

ATTACHMENT FOR RESPONSE TO FERC AIR 11 – CULTURAL RESOURCES PROJECT HISTORY

Response is filed as Privileged Information

See Volume II Attachment D

Attachment E

Attachment for Response to
FERC AIR 12 – Previous Cultural Resources Survey

Response is filed as Privileged Information

See Volume II Attachment E

ATTACHMENT F

CORRESPONDENCE FROM THE ONEIDA INDIAN NATION

Karen Klosowski

From: Teta Jungels
Sent: Wednesday, April 04, 2018 3:42 PM
To: Karen Klosowski
Subject: FW: West Canada Creek Hydroelectric Project (FERC No. 2701) Relicensing

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From: Jesse Bergevin [mailto:jbergevin@oneida-nation.org]
Sent: Wednesday, April 04, 2018 2:49 PM
To: Teta Jungels <Teta.Jungels@KleinschmidtGroup.com>
Subject: RE: West Canada Creek Hydroelectric Project (FERC No. 2701) Relicensing

Ms. Jungels,

One February 28, 2018, the Oneida Indian Nation (the "Nation") received and email and documentation from regarding the West Canada Creek Hydroelectric Project (FERC No. 2701) Relicensing (the"Project"). The Nation has no comments or concerns regarding the Project.

If you have any questions, please call me at (315) 829-8463.

Thank you,

Jesse Bergevin | Historic Resources Specialist
Oneida Indian Nation | 2037 Dream Catcher Plaza, Oneida, NY 13421-0662
jbergevin@oneida-nation.org **|** www.oneidaindiannation.com
315.829.8463 Office **|** 315.829.8473 Fax

From: Teta Jungels [mailto:Teta.Jungels@KleinschmidtGroup.com]
Sent: Wednesday, February 28, 2018 4:01 PM
To: Karen Klosowski
Cc: steven.murphy@brookfieldrenewable.com; jon.elmer@brookfieldrenewable.com; patrick.storms@brookfieldrenewable.com; richard.heysler@brookfieldrenewable.com
Subject: West Canada Creek Hydroelectric Project (FERC No. 2701) Relicensing

West Canada Creek Project Distribution List:

On behalf of Erie Boulevard Hydropower, L.P. (Erie) this email is to inform you that Erie has submitted to the Federal Energy Regulatory Commission (FERC) a Notification of Intent (NOI) and Pre-Application Document (PAD) for the relicensing of the West Canada Creek Hydroelectric Project (FERC No. 2701). The West Canada Creek Project consists of two developments, Prospect and Trenton, and is located on West Canada Creek in Oneida and Herkimer counties, New York.

Please see the attached cover letter for NOI and PAD filing that provides additional information. The NOI and PAD electronic files can be downloaded through FERC's eLibrary at https://www.ferc.gov/docs-filing/elibrary.asp by searching under the Project's docket P-2701. Materials can also be downloaded from the Project's relicensing website at: http://www.westcanadacreekproject.com.

If you would like to be removed from this distribution list or have updated contact information, please contact me at karen.klosowski@kleinschmidt.group.com.

If you have questions concerning the NOI or PAD, please contact Steve Murphy, Director, Licensing, Brookfield Renewable at steven.murphy@brookfieldrenewable.com.

Regards,

Teta

Teta Jungels
EAP Coordinator
Kleinschmidt
Office: 207.487.3328 Ext. 1221
www.KleinschmidtGroup.com

ATTACHMENT G

ATTACHMENT FOR RESPONSE TO
FERC AIR 13 – CULTURAL RESOURCES-TRENTON FALLS GORGE
CULTURAL RESOURCE INFORMATION SYSTEM REVIEW

Response is filed as Privileged Information

See Volume II Attachment G