Dowagiac River 2011 Survey Report

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Introduction

The Dowagiac River arises in Van Buren County near the city of Decatur, flows southwesterly through Cass County, and enters the St. Joseph River near the city of Niles in Berrien County. The Dowagiac River watershed encompasses an area of 286 square miles (Cass County Conservation District 2002) and has a mean annual discharge of 299 cfs at the United States Geological Survey gauge site in Sumnerville. Deposits of glacial outwash sand and gravel and ice contact sand and gravel cover most of the watershed. Although the headwaters flow through poorly drained organic soils, well-drained sandy loams and loams are the dominant soil types throughout most of the Dowagiac River basin. These coarse-textured materials, coupled with the hilly topography, allow substantial groundwater contributions to the Dowagiac River system. Monitoring at several sites along the mainstem Dowagiac River in 1997 revealed mean July water temperatures ranging from 64.6 ^{o}F at Indian Lake Road to 67.6 ^{o}F at 46th Street.

Agriculture (55%) and forests and wetlands (34%) are the primary land uses in the Dowagiac River watershed (Cass County Conservation District 2002). Large portions of the watershed have been modified to facilitate agricultural production. Wetlands have been tiled and drained. The Dowagiac River and many of its tributaries have been channelized, and aquatic habitats continue to be affected by periodic drain maintenance activities such as dredging or large woody structure removal. The gradient of the river is low (approximately 3.2 ft/mile; Cass County Conservation District 2002). However, water velocities are higher than expected for this gradient because the stream is confined to a straight narrow channel with sparse woody structure. The Pucker Street Dam is the only fish passage barrier on the mainstem. This dam is located about 3 miles upstream of the confluence with the St. Joseph River.

The Dowagiac River has been managed to provide a coldwater fishery for more than a century. From 1874 through 1964, various species of trout and salmon were stocked in the Dowagiac River and tributary streams. Since that time, only brown trout have been stocked in the Dowagiac River. In recent years, yearling Gilchrist Creek strain brown trout have been stocked annually at seven locations along the river from M-51 to Losensky Park (Table 1; Figure 1). The portion of the Dowagiac River upstream of the Pucker Street Dam is classified as a Type 4 trout stream (brown trout possession season = last Saturday in April through September 30; brown trout minimum size limit = 10 inches), whereas the reach downstream of the dam is classified as a Type 3 trout stream (brown trout possession season = all year; brown trout minimum size limit = 15 inches).

An electrofishing survey conducted in 1958 indicated that there was some carryover of brown trout, and fish as large as 26 inches were observed. Survival to age 2 was minimal for stocked rainbow trout and brook trout. During 1969-1977, multiple electrofishing surveys were conducted at various locations from Dewey Lake Road to Arthur Dodd Memorial Park (Dodd Park). Only 14 brown trout were collected during these surveys, and most of these fish were captured near Dewey Lake Road. Due to water depths and current velocities, sampling efficiency was low at the Dodd Park and M-62 sampling stations.

Intensive fish community surveys were conducted at six locations along the Dowagiac River from Atwood Road to M-139 (Old US-31) during 1988-1989 (Wesley and Duffy 2001). Rotenone (a natural fish toxicant) was used to kill fish within discrete stations ranging in length from 482 ft to 1,020 ft and block nets were used to collect fish as they drifted downstream. (Note: The lower block net at Dodd Park

was ripped by the current, so the effective sampling station length was only 286 ft at that site.) Species diversity ranged from 18 species at Dodd Park to 24 species at Sink Road. The brown trout catch at each site varied from 9 fish at Frost Road to 56 fish at Sink Road. Only two young-of-year (YOY) brown trout were captured at Sink Road and no YOYs were collected at the other sites. Thus, there appeared to be little natural recruitment of brown trout in the Dowagiac River. Brown trout growth was above average, and the largest fish collected was 23 inches. The most abundant non-game species in the catch were white sucker, common shiner, and mottled sculpin.

There are two dams on the St. Joseph River downstream of the Dowagiac River confluence. Fish ladders were installed at the Berrien Springs Dam in 1975 and the Buchanan Dam in 1990. These fish ladders allow potamodromous salmonids from Lake Michigan to migrate up the Dowagiac River as far as the Pucker Street Dam. Steelhead, Chinook salmon, and coho salmon are stocked in the St. Joseph River. No steelhead or salmon are stocked in the Dowagiac River, but natural reproduction of these species has been documented in this system. Creel surveys conducted on the Dowagiac River downstream of the Pucker Street Dam during 1992-2004 indicated that the most abundant species in the harvest were steelhead, Chinook salmon, and coho salmon (Gunderman, in press). Brown trout composed 5.5% of the total harvest.

In 1998, an electrofishing survey was conducted on a 3,150 ft station located approximately halfway between Pucker Street Dam and M-139. Capture efficiency was poor due to the rapid current velocity in this reach. Thirty-nine brown trout and 28 juvenile steelhead were collected. Two YOY brown were captured, indicating that some natural recruitment occurs downstream of the Pucker Street Dam. Growth was above average for steelhead and brown trout.

In the late 1990s, a local group known as MEANDRS (Meeting the Ecological and Agricultural Needs within the Dowagiac River System) began working with the Michigan Department of Natural Resources (MDNR), the Michigan Department of Environmental Quality (MDEQ), and the Cass County Parks and Recreation Department to redirect a channelized portion of the Dowagiac River into a historic meander at Dodd Park. In an effort to gather pre-treatment data, stream shockers were used to collect fish on the channelized stream reach at Dodd Park and at an un-channelized site near Kinzie Road in 2000. As noted during previous surveys, electrofishing efficiency was poor due to water depths and current velocities within the sampling stations. Seventeen fish species were collected at Kinzie Road, compared to only 10 species at Dodd Park. In terms of numbers, white sucker and johnny darter were the most abundant species at both stations. One YOY brown trout was captured at Dodd Park. Eight brown trout (total length = 3-16 inches) were collected at Kinzie Road, including one YOY fish.

Personnel from MDNR and MDEQ conducted another pre-treatment survey on the channelized stream reach at Dodd Park in 2006. An intermediate boomshocker was used during this effort, which greatly improved sampling efficiency. Brown trout were collected during four electrofishing runs and a population estimate was generated using the multi-pass depletion method. The brown trout catch declined from 37 fish during the first run to 8 fish on the fourth run. The population estimate was 78 fish or 282 fish/mile. The total length range for brown trout was 5-14 inches. No YOY fish were captured in 2006.

During 2005-2006, dredging was completed and grade control structures were installed in the historic meander at Dodd Park. Crews attempted to divert the stream into the meander in October 2006. This attempt failed due to high flows and inadequate fill materials, and flow was split between the straight channel and the meander for several months. The diversion finally was completed during the summer of 2007. The abandoned channel was converted into three wetland pools. These pools currently connect to a

small stream that flows for 0.75 miles through a historic meander to the southeast before entering the mainstem Dowagiac River.

Materials and Methods

Personnel from MDNR and MDEQ conducted sampling on September 21, 2011 to assess the effects of the meander restoration on the fish community at Dodd Park. A stream shocker (250 V, 3 probes) was used to collect fish in the downstream portion of the meander. The station began 30 ft upstream of the pedestrian bridge and extended 1,100 ft upstream (Figure 2). Fish were collected during a single pass while moving in an upstream direction. An intermediate boomshocker (250 V, 2 netters) was used to capture fish in the upstream portion of the meander. Sampling began at the diversion and extended downstream 1,000 ft. Fish were collected during a single pass while moving in a downstream direction. There was some overlap between the stream shocker and intermediate boomshocker sampling stations. Total length was recorded for all fish. Scale samples were collected from brown trout for age determination.

A laser level, laser detector, and survey rod were used to determine water depths and stream bed elevations in the restored meander during June-July 2011. Longitudinal data were collected in the thalweg from the downstream end of the canoe launch to the upstream end of the meander (Figure 3). Cross-sectional data were collected at five sites in the meander and at the first riffle downstream of the meander. The 2011 elevation data were compared to pre-diversion data from April 2006 to evaluate changes in channel morphology since the diversion of flow into the meander.

Results

Fifty-six brown trout were collected during the 2011 survey. Thirty-one fish were captured with the stream shocker and 25 fish were captured with the boomshocker. The total length range for brown trout was 3-16 inches (Figure 4). Thirteen percent of the brown trout were of legal size (total length $\geq$ 10 inches). Yearlings and age 2 fish composed 93% of the catch (Figure 5). Only one YOY brown trout was captured. Mean lengths-at-age were similar to statewide averages (Figure 6).

Eighteen additional fish species were collected during the 2011 survey (Table 2). The most common non-trout species were white sucker and northern hog sucker. Coldwater and transitional fish species made up 78% of the catch by number and 81% of the catch by weight.

The longitudinal profile of the meander changed considerably from 2006 to 2011 (Figure 7). The elevation of the riffle immediately downstream of the diversion decreased by 3 ft during this period. Prior to the diversion of water into the meander, there was a thick layer of silt at this location. By 2011, the silt had eroded and coarser substrates (e.g., gravel and cobble) predominated. On average, the stream bed elevation in the upper two-thirds of the meander declined by approximately 1 ft from 2006 to 2011. This pattern was less evident downstream near the constructed riffles. Cross-sections through the first riffle upstream of the pedestrian bridge (#2) revealed little change in channel morphology since 2006 (Figures 8 and 9). The next riffle upstream (#3) partially failed resulting in a deeper thalweg on the west side of the channel, while sand deposition formed a point bar on the east side of the channel. (Note: Five cross-sections were completed in 2006. Most of the stakes used to mark the 2006 cross-section sites could not be located in 2011 and presumably had been removed by park visitors. Thus, only the two sites that could be accurately identified are discussed in this section.) Relative to 2006 conditions, the stream bed gradient within the meander was lower and more uniform in 2011.

Analysis and Discussion

Multiple factors must be considered when comparing the 2011 electrofishing results to data from previous surveys. (1) During all surveys, water depths and current velocities limited fish capture efficiency. (2) Sampling equipment was not consistent across years. (3) There was some overlap between the intermediate boomshocker and stream shocker stations in 2011. Thus, the sampling conducted in 2011 was not completely analogous to a single-pass survey.

Despite these limitations, some conclusions can be inferred from the 2011 data. Brown trout abundance in the meander in 2011 appeared to be equal to or slightly higher than that recorded for the former channelized stream reach in 2006. Fifty-six brown trout were captured in 2011. In 2006, 37 brown trout were collected during the first pass, and a total of 58 brown trout were collected during the first two passes. The age structure of the brown trout population at Dodd Park was similar in 2006 and 2011, with age 1-2 fish composing about 90% of the catch. The scarcity of age 3 and older brown trout at Dodd Park likely can be attributed to harvest and a lack of holding cover (e.g., logjams) for large trout in the former channelized reach and in the meander.

Although qualitative observations indicate that gravel substrates are common within the meander, there continues to be little natural recruitment of brown trout in the Dowagiac River at Dodd Park. Current velocities appear to be limiting natural recruitment in this system. High current velocities can hinder brown trout recruitment through redd scouring (Spina 2001) and downstream displacement of fry (Ottaway and Forrest 1983; Nuhfer et al. 1994).

Anecdotal observations suggest that restoration of the meander has increased fishing activity at Dodd Park. Although the meander still is a challenging stream to wade under most flow conditions, the presence of riffles and point bars makes this stream reach more accessible for wading anglers than the former channelized reach. Anglers frequently were observed fishing from shore at the diversion or wading within the meander during the 2011 elevation surveys, whereas anglers rarely were observed in the channelized stream reach downstream of the meander.

Agriculture is the predominant land use within the Dowagiac River watershed, and irrigation commonly is used to enhance agricultural production. Since July 9, 2009, Part 327 of Public Act 451 requires all large-quantity withdrawals (defined as 70 gallons per minute [100,000 gallons per day] or greater) to be registered with MDEQ. A water withdrawal assessment tool (WWAT) was created to facilitate estimation of the ecological effects of proposed withdrawals (Hamilton and Seelbach 2011). If a proposed withdrawal is predicted to have adverse effects on the fish community, the applicant is directed to pursue alternative options (e.g., digging a deeper well, finding a different location for a well, or acquiring water from other farmers within the sub-watershed that are not using all of their permitted withdrawal capacity). One factor that influences water withdrawal calculations is the thermal classification of the stream. Mean July water temperature and the species composition of the fish community are used to assign stream segments to a particular thermal class. The portion of the Dowagiac River from the mouth upstream to the confluence with Silver Creek currently is classified as a cold transitional stream. The species composition of the fish community within the meander in 2011 and water temperature data collected in 1997 support this classification (Lyons et al. 2009).

When the meander at Dodd Park was reconnected, riparian property owners were concerned about the effects on water levels upstream of the diversion. Hydrologic models predicted that diversion of water

into the meander would raise the water surface elevation by approximately 18 inches under normal flow conditions. However, the 100 year flood elevation was predicted to remain unchanged and the 500 year flood elevation was predicted to decrease by about 2 inches due to the increase in floodplain connectivity at Dodd Park. The elevations of the riffles in the upstream portion of the meander have declined since the diversion of water into the channel. Thus, the effects of the diversion on upstream water levels should be diminished relative to 2007 conditions.

In general stream bank erosion within the meander has been limited, but bank sloughing did occur on the outside bend upstream of the pedestrian bridge. This problem was addressed through a collaborative effort involving the Cass County Parks and Recreation Department, MEANDRS, Trout Unlimited, the St. Joseph River Valley Fly Fishers, and MDNR. A combination of riprap, root wads, and lunker structures were used to stop bank erosion and provide fish cover in this portion of the meander.

Management Recommendations

Human activities within the watershed have resulted in marked changes in the hydrology and channel morphology of the Dowagiac River. High current velocities, erosion and sedimentation, and a lack of woody cover currently limit production of brown trout and other fish species in this system. Six management goals have been developed for the Dowagiac River. Goal 1: Create areas with relatively low current velocities within the river. Goal 2: Reduce fluctuations in stream discharge. Goal 3: Increase fish cover within the Dowagiac River. Goal 4: Reduce erosion and sedimentation. Goal 5: Collect additional water temperature data to assess thermal classifications within the Dowagiac River watershed. Goal 6: Maintain the existing brown trout population through continued stocking.

The Pokagon Band of Potawatomi Indians and Inter-Fluve, Inc. are evaluating the feasibility of reconnecting flow through a historic meander of the Dowagiac River between Sink Road and Crystal Springs Road. This project would assist with attainment of Goals 1 and 2 by decreasing the stream gradient and increasing floodplain connectivity within the project area. Fisheries Division personnel will provide technical assistance as required during the planning and implementation of this project. Fisheries Division also will work with the county drain commissioners to restore floodplain connectivity at other locations within the watershed. This could be accomplished by cutting berms or creating a floodplain within the banks (i.e., a two-stage ditch). Another approach for reducing fluctuations in discharge is to slow the movement of runoff into the river through restoration of wetlands. The Friends of the St. Joe River (Friends) received funding from the United States Environmental Protection Agency to conduct a functional assessment of all historic and existing wetlands within the St. Joseph River watershed, and Fisheries Division has provided in-kind match for this project. The wetland assessment is nearly completed. The Friends and partner organizations have used this tool to identify high quality wetlands for protection (e.g., conservation easements) and potential sites for wetland restoration. This information will be relayed to local units of government so that they can incorporate wetland conservation and restoration planning into their zoning and ordinances. The wetlands tool also has been used to identify and invite landowners to wetland protection and restoration workshops, and some wetland restoration projects already are underway as a result of these efforts.

Large woody structure has been cleared from many stream reaches to facilitate rapid downstream transport of water. The removal of large woody structure affects fish directly by reducing habitat complexity and abundance of holding cover and affects fish indirectly by reducing abundance of aquatic insects. Fisheries Division will work with the county drain commissioners to develop options for retaining fish cover (i.e., Goal 3) while meeting the needs of the adjacent landowners.

At many locations within the watershed (e.g., the headwaters of the mainstem) stream banks are steep and vegetated buffer strips are narrow or absent. Thus, sediment is a major pollutant in this system (Cass County Conservation District 2002). Goals 1, 2, and 4 are inter-related, and the measures discussed for Goals 1 and 2 also will facilitate progress toward accomplishing Goal 4. Fisheries Division personnel have identified problem areas (e.g., sloughing banks or areas where livestock have unrestricted access to the stream) and collaborated with MDEQ, the Michigan Department of Agriculture and Rural Development, riparian landowners, and other partners to stop erosion at these sites. Fisheries Division will continue to work with our partners to identify erosion and sedimentation sites and implement practices to reduce sediment inputs and rehabilitate aquatic habitat at these locations.

Fisheries Division already has initiated actions to accomplish Goal 5. Onset® StowAway XTI temperature loggers were deployed at 32 locations along the Dowagiac River and tributary streams during late May-early June 2012. These loggers were programmed to record the water temperature every 72 minutes. During May-June 2013, Fisheries Division personnel will retrieve the loggers and download the data. Temperature loggers will be re-deployed at the same locations to collect water temperature data through spring 2014. The data gathered from this effort will be used to further evaluate and refine the WWAT thermal classifications for stream segments within the watershed.

Although natural recruitment of brown trout has been documented in tributary streams (e.g., Pokagon Creek), natural recruitment of brown trout in the mainstem Dowagiac River is not sufficient to maintain the existing fishery. Fisheries Division will continue annual stocking of yearling Gilchrist Creek strain brown trout at M-51, Middle Crossing Road, M-62, Sink Road, Indian Lake Road, Kinzie Road, and Losensky Park. The total annual stocking target for the six sites upstream of the Pucker Street Dam is 7,000 fish (75/acre). The annual stocking target for the stream reach downstream of the Pucker Street Dam is 6,800 fish (200/acre).

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Table 1.–Brown trout (Gilchrist Creek strain) stocking in the Dowagiac River, 2007-2011. All fish were stocked as yearlings.

Year	Location	Number	Mean total length (inches)
2007	M-51	940	6.84
	Middle Crossing Road	940	6.84
	M-62	940	6.84
	Sink Road	1,420	6.84
	Indian Lake Road	1,420	6.84
	Kinzie Road	940	6.84
	Losensky Park	5,320	6.84
2008	M-51	1,000	4.71
	Middle Crossing Road	1,000	4.71
	M-62	1,000	4.71
	Sink Road	1,500	4.71
	Indian Lake Road	1,500	4.71
	Kinzie Road	1,000	4.71
	Losensky Park	6,800	4.71
2009	M-51	990	4.46
	Middle Crossing Road	990	4.46
	M-62	990	4.46
	Sink Road	1,440	4.46
	Indian Lake Road	1,440	4.46
	Kinzie Road	1,100	4.41
	Losensky Park	8,160	4.41
2010	M-51	1,100	5.33
	Middle Crossing Road	1,100	5.33
	M-62	1,100	5.33
	Sink Road	1,500	5.33
	Indian Lake Road	1,500	5.33
	Kinzie Road	1,100	4.86
	Losensky Park	7,900	4.86
2011	M-51	900	4.78
	Middle Crossing Road	900	4.78
	M-62	900	4.78
	Sink Road	1,350	4.78
	Indian Lake Road	1,350	4.78
	Kinzie Road	900	4.82
	Losensky Park	6,120	4.82

Table 2.–Numbers, calculated weights, total lengths, and thermal classifications for fish species collected in the Dowagiac River at Arthur Dodd Memorial Park on September 21, 2011. Thermal classifications are from Lyons et al. (2009).

Species	Number	Percent by number	Weight (lb)	Percent by weight	Total length range (inches)	Thermal classification
Brown trout	56	28.7	11.4	16.8	3-16	Coldwater
White sucker	33	16.9	28.1	41.3	2-16	Transitional
Northern hog sucker	30	15.4	14.7	21.6	5-13	Transitional
Creek chub	20	10.3	0.6	0.9	2-9	Transitional
Common shiner	16	8.2	2.1	3.1	2-8	Warmwater
Mottled sculpin	13	6.7	0.2	0.2	1-3	Coldwater
Bluegill	5	2.6	0.5	0.7	4-5	Warmwater
Grass pickerel	5	2.6	0.2	0.3	3-7	Warmwater
Yellow bullhead	3	1.5	0.6	0.9	2-10	Warmwater
Rainbow darter	3	1.5	0.0	0.0	1-2	Warmwater
Rock bass	2	1.0	0.7	1.0	4-9	Warmwater
Largemouth bass	2	1.0	0.1	0.1	3-5	Warmwater
Common carp	1	0.5	6.8	10.0	24	Warmwater
Greater redhorse	1	0.5	1.6	2.3	16	Warmwater
Hybrid sunfish	1	0.5	0.2	0.3	6	Warmwater
Pumpkinseed	1	0.5	0.1	0.2	5	Warmwater
Bowfin	1	0.5	0.1	0.1	5	Warmwater
Green sunfish	1	0.5	0.0	0.0	3	Warmwater
Bluntnose minnow	1	0.5	0.0	0.0	2	Warmwater
Total	195		68.0			

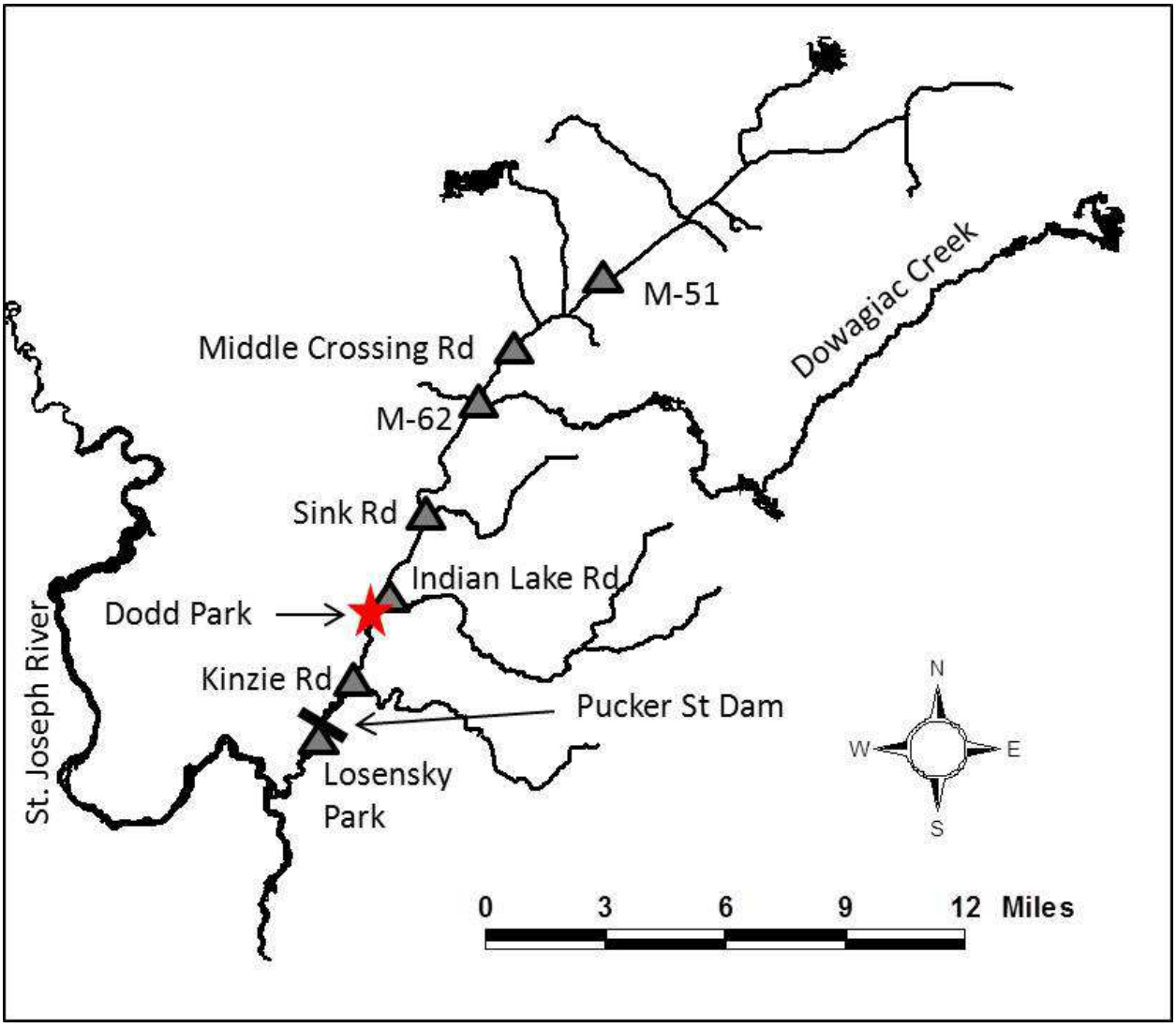


Figure 1.–Brown trout stocking locations (triangles) on the Dowagiac River, 2007-2011.

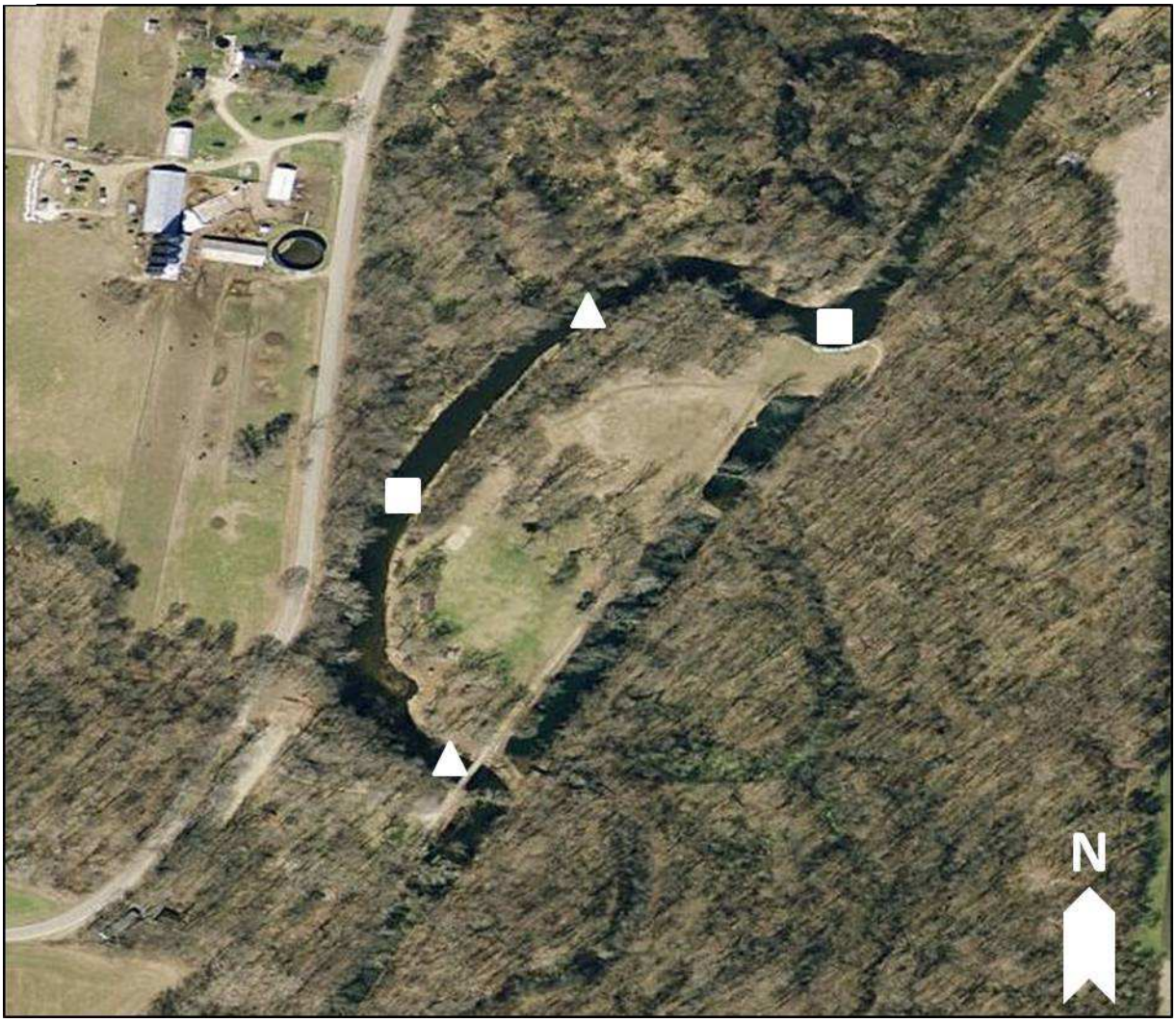


Figure 2.–Electrofishing stations on the Dowagiac River at Arthur Dodd Memorial Park, September 21, 2011. The triangles indicate the boundaries of the stream shocker station and the squares indicate the boundaries of the intermediate boomshocker station. Image from Bing Maps (www.bing.com/maps).

Figure 3.–Elevation survey locations on the Dowagiac River at Arthur Dodd Memorial Park, June-July 2011. Diamonds indicate the upstream and downstream boundaries of the longitudinal survey. The lines indicate sites where cross-sectional data were collected. Image from Bing Maps (www.bing.com/maps).

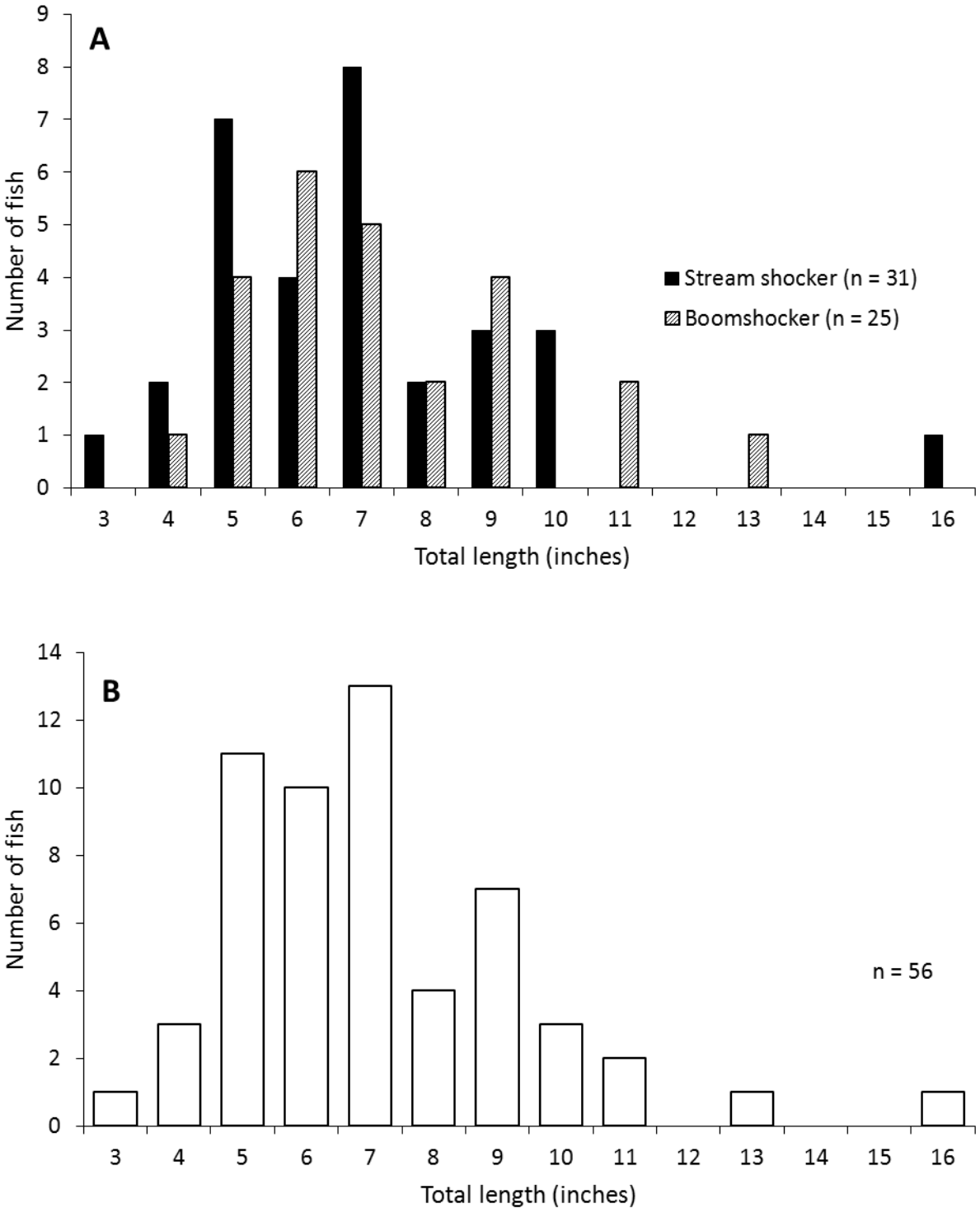


Figure 4.–Length frequency distributions for brown trout captured in the Dowagiac River at Arthur Dodd Memorial Park on September 21, 2011 with (A) each gear type and (B) all sampling gear.

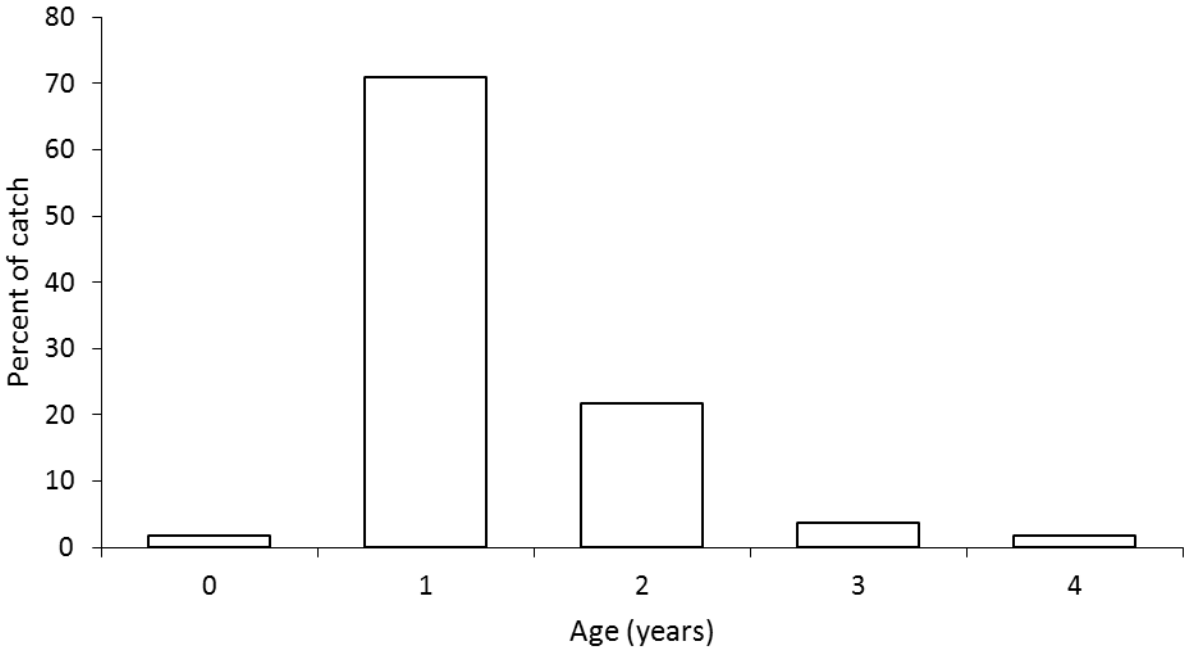


Figure 5.–Age frequency distribution for brown trout captured in the Dowagiac River at Arthur Dodd Memorial Park on September 21, 2011.

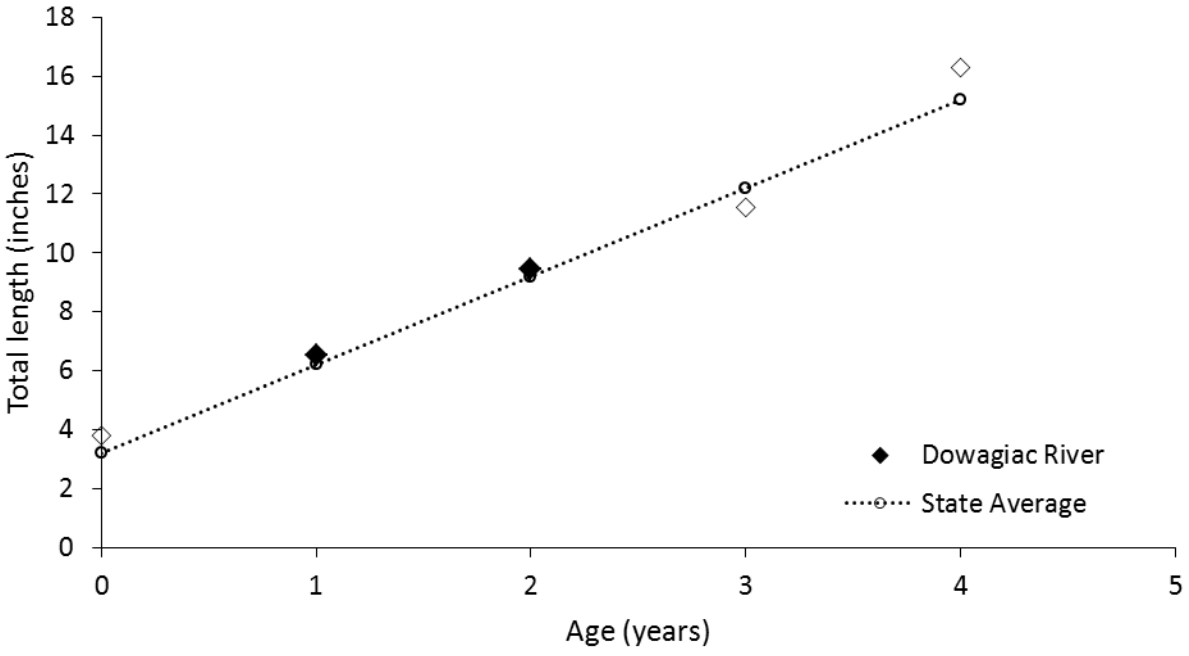


Figure 6.–Mean lengths-at-age for brown trout captured in the Dowagiac River at Arthur Dodd Memorial Park on September 21, 2011. Hollow diamonds denote age classes represented by less than 5 individuals. State average lengths are from Schneider et al. (2000).

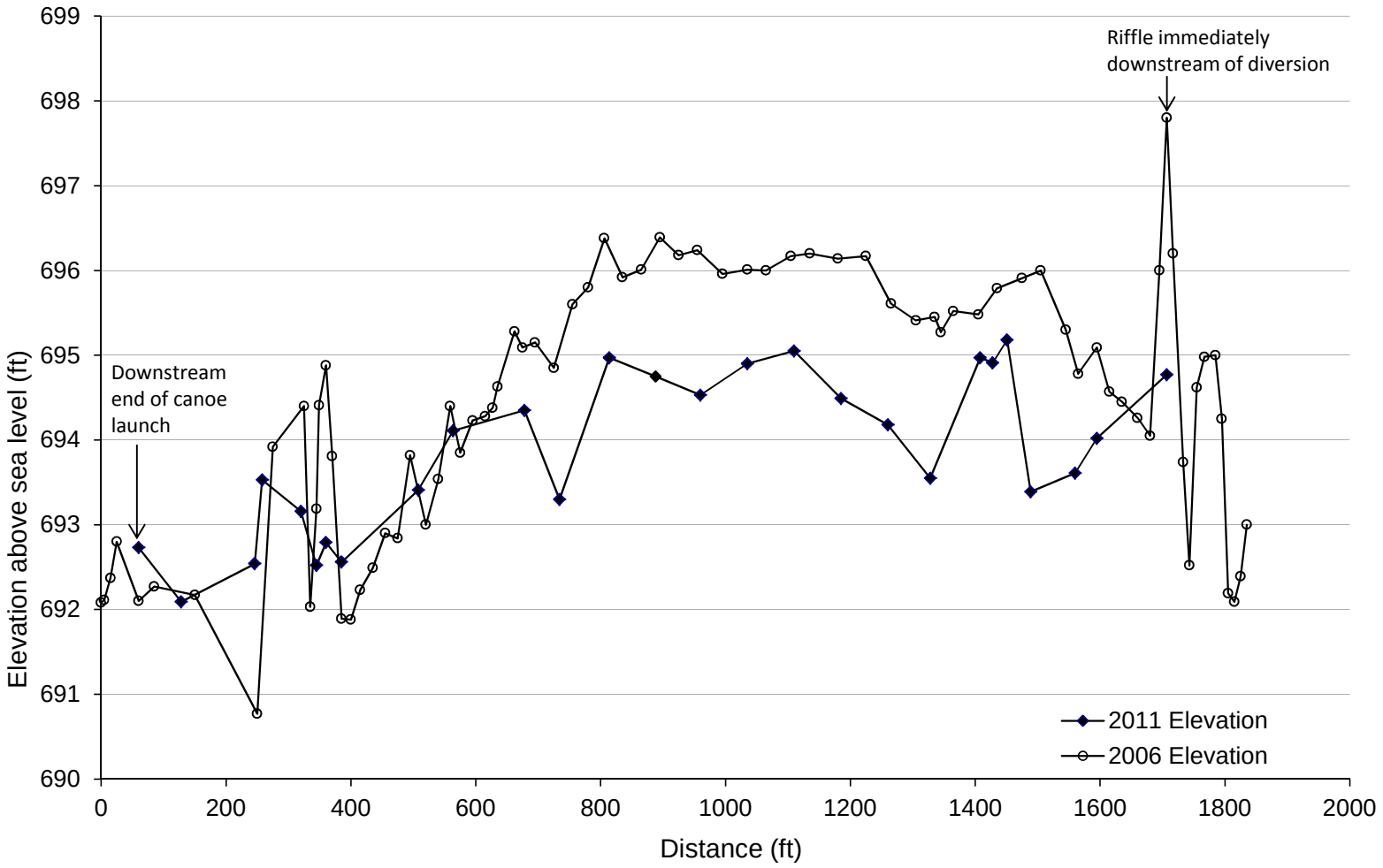


Figure 7.–Longitudinal profiles for the Dowagiac River at Arthur Dodd Memorial Park in 2006 and 2011.

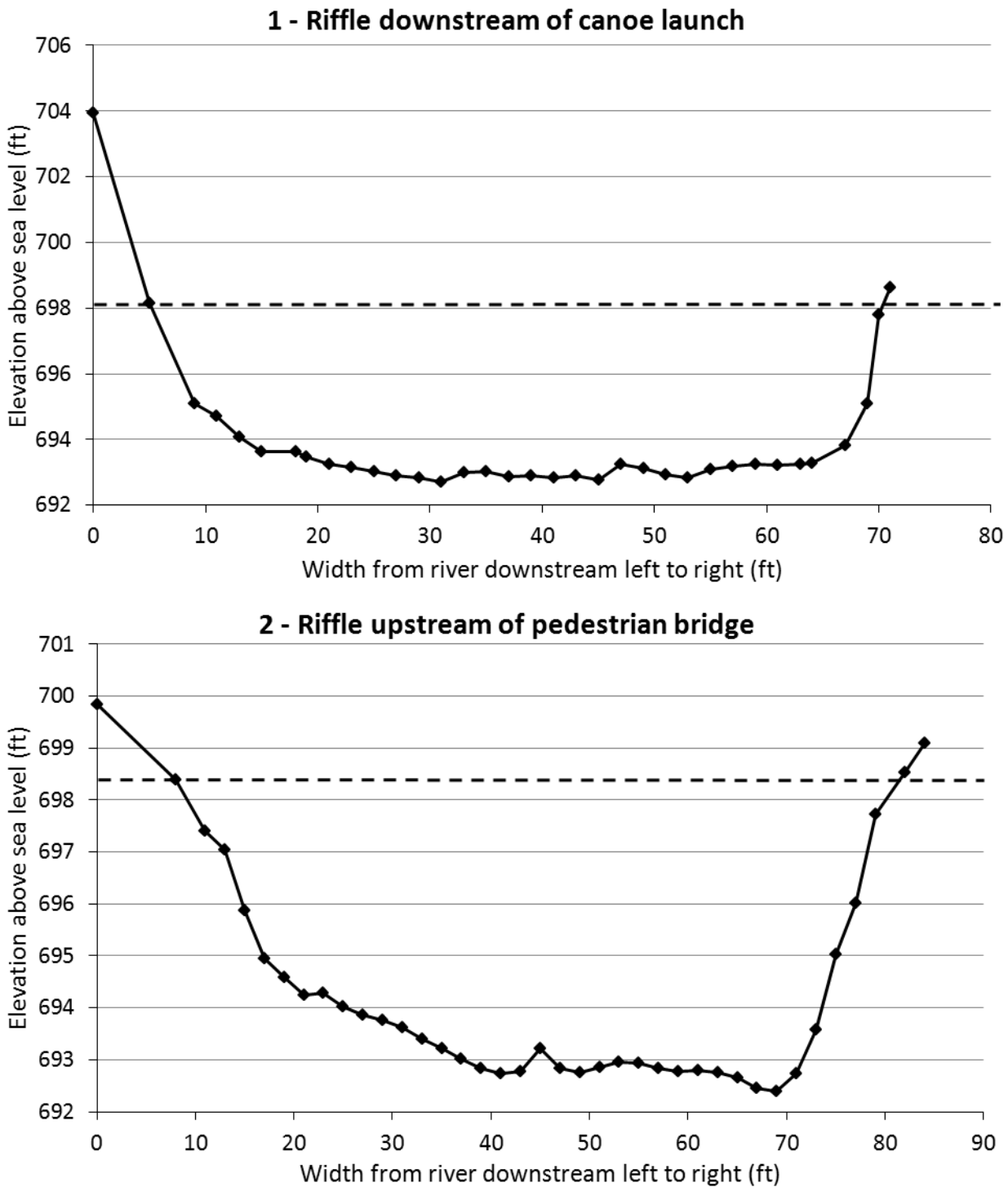
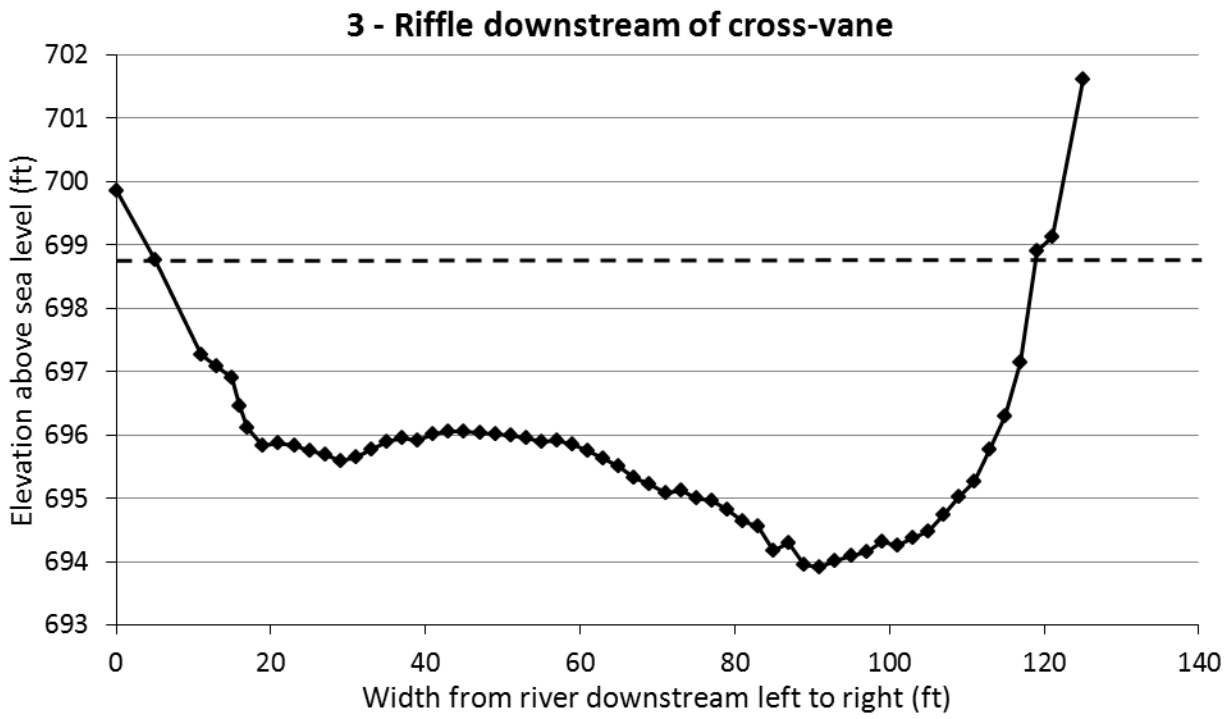


Figure 8a.–Channel cross-sections at various locations along the Dowagiac River at Arthur Dodd Memorial Park, June-July 2011. Dashed lines denote bankfull elevations. See Figure 3 for cross-section locations.



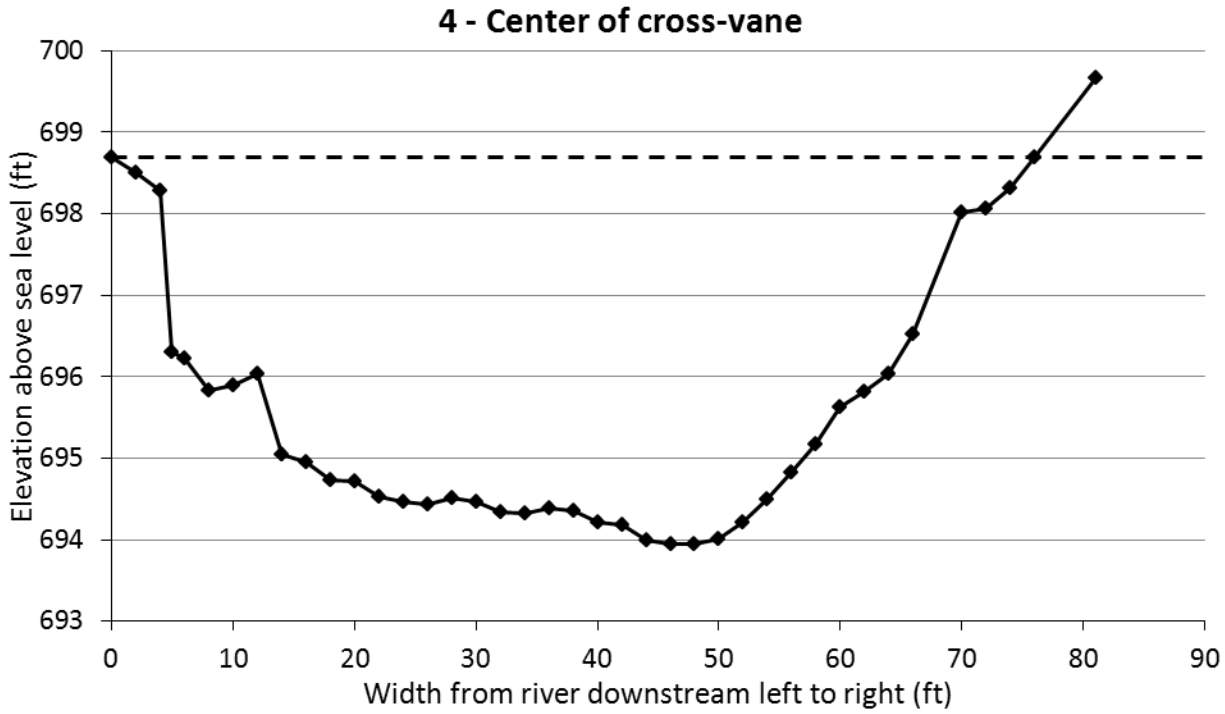


Figure 8b.–Channel cross-sections at various locations along the Dowagiac River at Arthur Dodd Memorial Park, June-July 2011. Dashed lines denote bankfull elevations. See Figure 3 for cross-section locations.

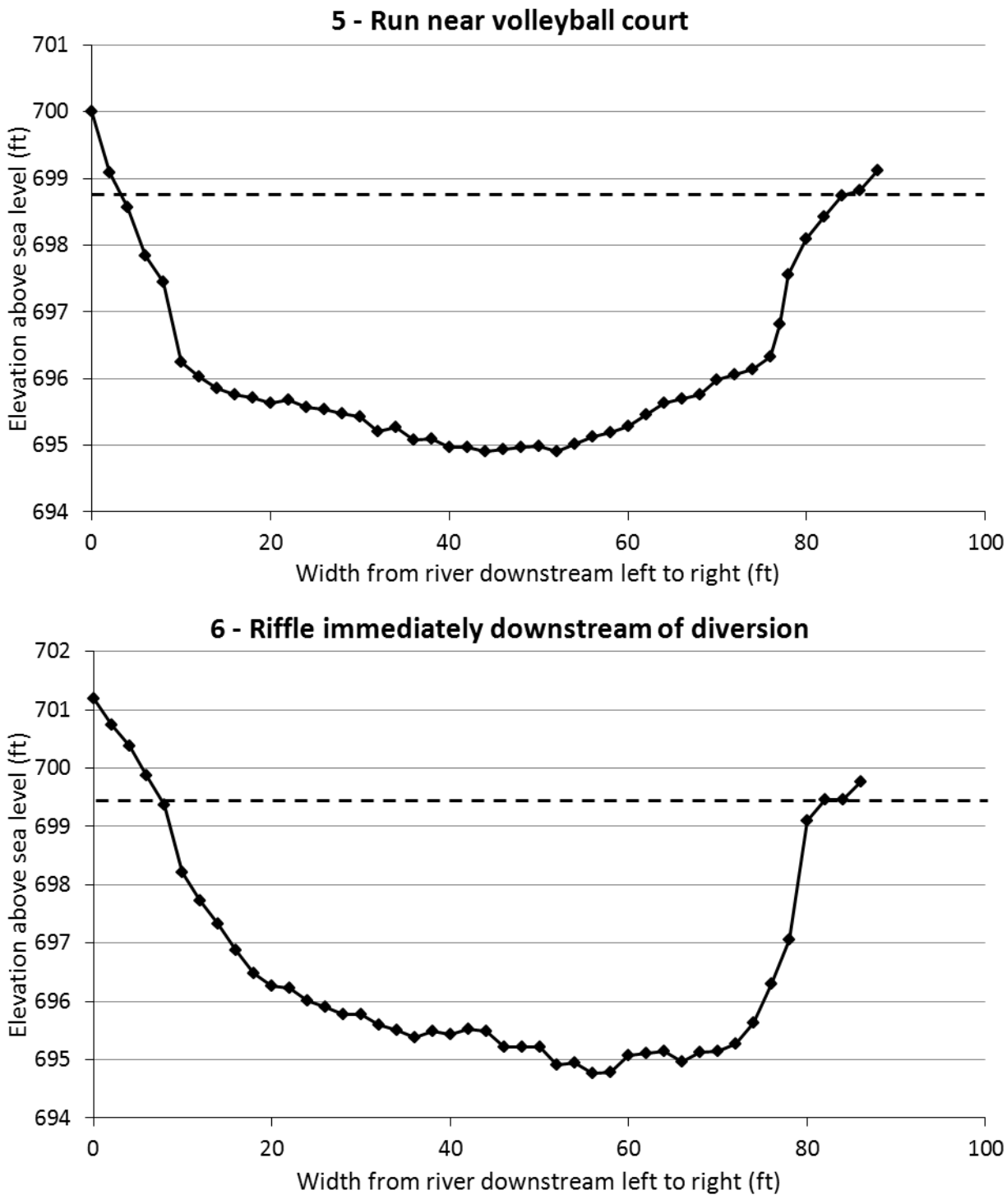


Figure 8c.–Channel cross-sections at various locations along the Dowagiac River at Arthur Dodd Memorial Park, June-July 2011. Dashed lines denote bankfull elevations. See Figure 3 for cross-section locations.

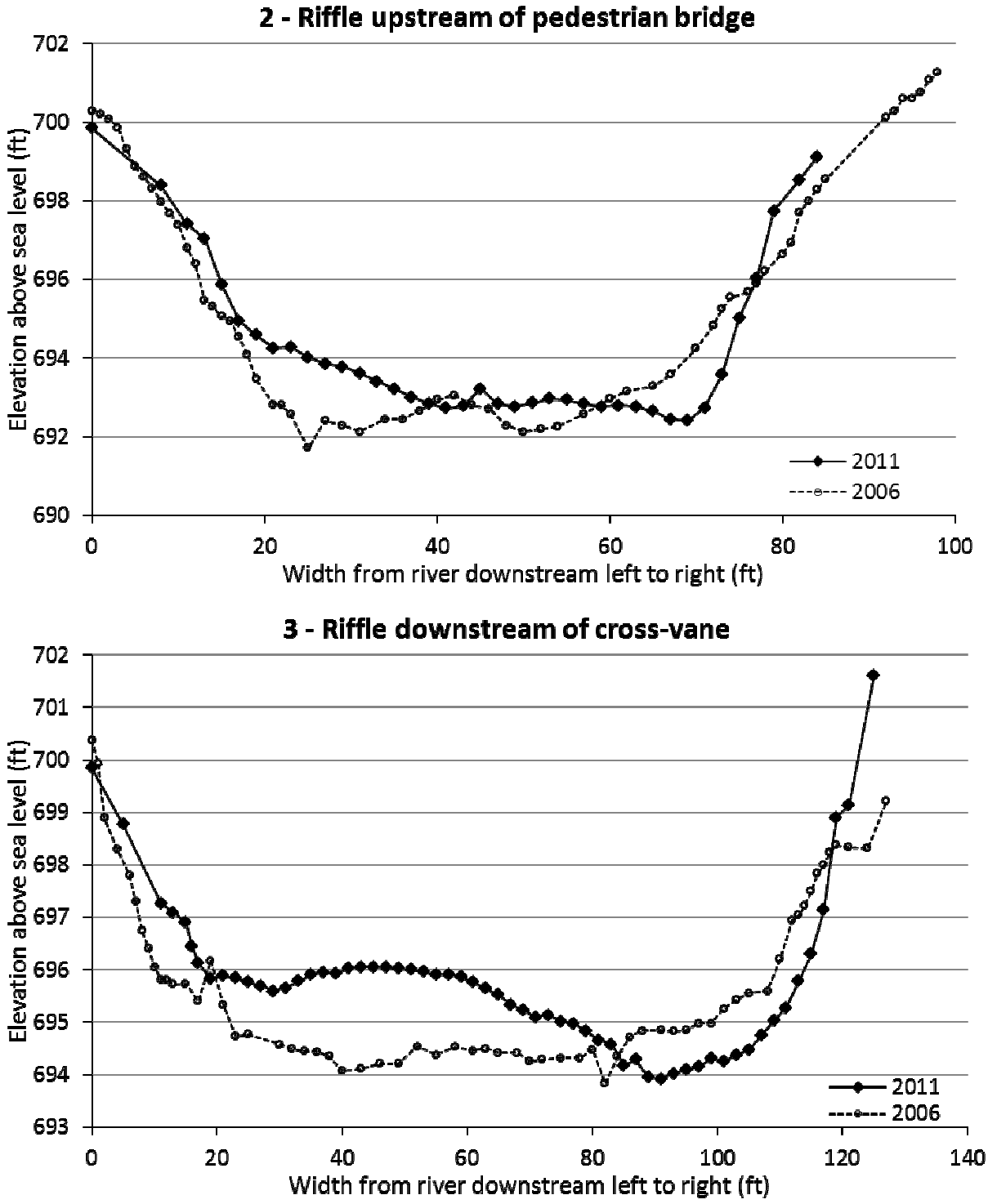


Figure 9.–Channel cross-sections at two sites along the Dowagiac River at Arthur Dodd Memorial Park, June-July 2011 and April 2006. See Figure 3 for cross-section locations.