LOW IMPACT HYDROPOWER INSTITUTE
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RE: Conowingo Hydroelectric Project (FERC No. 405)

To Whom It May Concern,

Stewards of the Lower Susquehanna, Inc., a non-profit community group of over 100 members dedicated to the preservation and improvement of the ecological health and aesthetics of the Lower Susquehanna River, and their representative, Michael Helfrich – Lower Susquehanna Riverkeeper, find that under current operational plans the Conowingo Hydroelectric Project has major impacts on the ecological health of the entire Susquehanna River watershed, an area of over 27,000 square miles. Our findings also show that the project has major impacts or potential impacts to the Chesapeake Bay. We believe the fisheries impacts may reach to the Atlantic Coastal Fishery through the dam’s contribution to the decline of the American eel, a species that was historically a high-nutrient food source consumed by Atlantic fish during the eels’ migration to and from the Susquehanna, as well as after their death upon completing spawning in the Sargasso Sea. For this reason and more that will be explained below, we ask you not to approve the request for low impact designation.

IMPACT TO MIGRATORY FISH SPECIES:

Juvenile Migration Upriver: To those of us studying the watershed and the impacts of the hydroelectric dams on the lower Susquehanna River, there are obvious glaring omissions to the information provided by the applicant regarding the American eel, and this species’ efforts to migrate in and out of what was historically the largest habitat for American eels on the entire U.S east coast. This dam has blocked the migrating young eels from over 98%, 27,000 square miles, or tens of thousands of river and stream miles of their native habitat.
American eel caught at base of Conowingo Hydroelectric Dam – July 21, 2007

The Maryland Department of Natural Resources, Maryland Biological Stream Survey (MBSS) Newsletter March 1999, Volume 6, Number 1 states:

"The most dramatic example of the decline of American eel abundance is dam construction on the Susquehanna River. Prior to the completion of Conowingo and three other mainstem dams in the 1920's, eels were common throughout the Susquehanna basin and were popular with anglers. To estimate the number of eels lost as a result of construction of Conowingo Dam, we used MBSS data on American eels from the Lower Susquehanna basin and extrapolated it to the rest of the basin above the dam. Our best conservative guess is that there are on the order of 11 million fewer eels in the Susquehanna basin today than in the 1920s."

"The magnitude of this loss is corroborated by the decline in the eel weir fishery in the Pennsylvania portion of the Susquehanna River. Before the mainstem dams were constructed, the annual harvest of eels in the river was nearly 1 million pounds. Since then, the annual harvest has been zero. Given the longevity of eels in streams (up to 20 years or more) and their large size, the loss of this species from streams above Conowingo Dam represents a significant ecosystem-level impact. Because adult eels migrate to the Sargasso Sea to spawn and die -- transporting their accumulated biomass and nutrient load out of Chesapeake Bay -- the loss of eels has increased nutrient loads in the basin and reduced them in the open ocean where they are more appreciated."

The applicant failed to include any information regarding the U.S. Fish and Wildlife Service’s experimental eel ramp studies done during the 2007 eel migration period. A project conducted by Steve Minkkinen of USFWS provided small prototype eel ladders and traps on the western shore of the Susquehanna below the Conowingo Dam. One conveyance was a 2–foot diameter plastic corrugated pipe, the other was a 1-foot wide fabric ramp, both set up with geo
fabric and a flow of water to attract the elvers (3 to 6-inch young eels). Nearly 4000 elvers climbed these ladders and were collected by the agency, proving that the dam is an impediment to the eels reaching their habitat. Here are some excerpts of the summary of these studies (study attached as attachment 1)

“American eel occupy a significant and unique niche in the estuarine and freshwater habitats of the Atlantic coast. Eels are a catadromous species that ascend freshwater environments as juveniles. These fish reside in riverine habitats until reaching maturity at which time they migrate to the Sargasso Sea where they spawn once and die. Larval eels are transported by ocean currents to rivers along the eastern seaboard of the continent. Unlike anadromous shad and herring, they have no particular homing instinct. Historically, American eels were very abundant in East Coast streams, comprising more than 25 percent of the total fish biomass in many locations. This abundance has declined from historic levels but remained relatively stable until the 1970s. More recently, fishermen, resource managers, and scientists have noticed a further decline in harvest from assessment data.”

“Although the Chesapeake Bay and tributaries support a large portion of the coastal eel population, eels have been essentially extirpated from the largest Chesapeake tributary, the Susquehanna River. The Susquehanna River basin comprises 43% of the Chesapeake Bay watershed. Construction of Conowingo Dam in 1928 effectively closed the river to upstream migration of elvers at river mile 10. Before mainstem dams were constructed, the annual harvest of silver eels in the Susquehanna River was nearly one million pounds. There is currently no commercial harvest (closed fishery in Pennsylvania) and very few fish (resulting from Pennsylvania Fish & Boat Commission stockings in the early 1980s) are taken by anglers above the dam. The Maryland Biological Stream Survey (MBSS) collects data in freshwater drainages of Maryland. Eel captures in this survey were collected for the Susquehanna River and tributaries in the vicinity of Conowingo Dam (Figure 1). This data reflects the fact that the dam blocks the upstream migration of eels. By extrapolating densities of eels captured in Maryland the MBSS survey estimated that there would be over 11 million eels in the Susquehanna watershed if their migration was not blocked by dams.”

“Mainstem Susquehanna fish passage facilities (lifts and ladder) were designed and sized to pass adult shad and herring and are not effective (due to attraction flow velocities and operating schedules) in passing juvenile eels (elvers) upriver. Specialized passages designed to accommodate eels are needed to allow them access to the watershed above dams.”

“Research conducted by the USGS, Northern Appalachian Research Laboratory indicates that American eel may be the primary fish host for the freshwater mussel, eastern elliptio (Elliptio complanata) (Lellis et al. 2001). The larval stage (glochidia) of freshwater mussels must parasitize a host fish to complete metamorphosis to the juvenile life stage. Some mussel species are generalists and can use multiple fish species as hosts while others are specialists that rely heavily on one or two host fish species to complete this life stage. Glochidia collected from eastern elliptio in Pine Creek (a tributary to the Susquehanna River) appear to have much higher metamorphosis success rates on American eels than on other fish species found in the river (Lellis et al. 2001).
Eastern elliptio is abundant throughout most of its range which spans the entire east coast. However, in comparison with other rivers such as the Delaware River where the eastern elliptio population is estimated to be in the millions (Lellis 2001), biologists have noticed a distinct absence of eastern elliptio abundance and recent recruitment to the Susquehanna River (personal communication, William Lellis, USGS, Wellsboro, PA). Low recruitment of eastern elliptio could be linked to the lack of eel passage over 4 dams in the Susquehanna River.

“If eels are essential to the reproduction of eastern elliptio or other freshwater mussel species, the implications of providing eel passage to freshwater mussel populations and in turn, ecosystem function could be significant. Similar to oysters in the Chesapeake Bay, freshwater mussels provide the service of natural filtration to the rivers and streams where they live. A healthy reproducing population of eastern elliptio could remove algae, sediment, and micronutrients from billions of gallons of Susquehanna River water each day. Restoring the upstream distribution of American eels and eastern elliptio could potentially improve water quality of not only the Susquehanna River but also the Chesapeake Bay. A research project to further evaluate the relationship between eastern elliptio and American eel has been funded under the USFWS, Region 5, Science Support Program during 2008.”

Estimated costs for eel ramps are minimal compared to the investments made to pass American Shad and other anadromous species. These cost estimates range from $100,000’s to $1 or 2 million, compared to the tens of millions of dollars that have been invested to mitigate blockages to anadromous species.

**Adult Spawning Migration Downriver:** During the adult female eels’ spawning migration out of the Susquehanna watershed, it can be assumed from studies on other dams that Conowingo Dam and the other two major hydroelectric dams upriver of Conowingo have a substantial and cumulative mortality rate. Studies on other dams in the U.S. and Canada have shown turbine mortality rates of the 3-foot female adult eels to be approximately 40 to 50%. If this is the rate for Conowingo, as well as Safe Harbor and Holtwood Dams upriver, the cumulative mortality rates equals 78 to 88%. If over decades we combine these survival rates for females passing all three dams of approximately 12 to 22% with the lack of any passage for the new generations of elvers trying to migrate to their habitat upstream we can see how we have come to the collapse of a native species that once accounted for 25% of the fish biomass of the Susquehanna River watershed.

Again, estimated costs for technology to corral or lure the downstream migrating eels is not cost prohibitive. Technologies, such as bright lights on skimmer walls and near turbines, have been shown to deflect up to 85% of the eels away from turbines. Other technologies, such as scent lures, are being researched and are very promising.

**American Eels Recorded at Conowingo Dam:** The most glaring omission by the applicant regarding eels is the account of eels caught in existing fish lifts. Though we do not contest the figures provided by the applicant, we do note significant changes in operations of the fish lifts that can account for massive reductions in the attractiveness of the lifts to American eel. Conowingo Dam changed their operating procedures by 1) changing the flow regime, increasing the flow to attract anadromous shad and herring, and 2) fish lifts were not run at night, the
the time of eel migration. American eels migrate along the river banks and bottoms and prefer very low flows. Increasing the “attractive” flows would actually drive eels away from the fish lifts. And obviously if the lifts are not operating during the main hours of eel migration, during the night, they will not capture eels. The omission of the change in operating procedures produces a false assessment of the need for eel passage, an assessment that would financially benefit the applicant at the expense of the environment and commercial fishing industry.

**Effects on Commercial Fishing:** Each female spawning eel carries 2 million eggs. After spawning the larvae float north on the Gulf Stream providing billions of meals for Atlantic Coastal fish. As they mature and enter the Chesapeake as elvers they provide food for Bay species such as the Striped Bass.

**SEDIMENT RETENTION AT CONOWINGO:**

Conowingo Reservoir has a capacity to retain approximately 250 million tons of sediment. Recent estimates suggest that we will reach full capacity within the next licensing period, possibly within 10 to 20 years.

During 4 days in 1972, the flood waters of Tropical Storm Agnes transported 4 years worth of sediment and pollutants down the Susquehanna River from New York and Pennsylvania. When the flood waters reached Maryland and the Conowingo Dam, the waters scoured another 8 to 10 years of pollutant-bearing sediment that had been trapped in the reservoir behind the dam. This “catastrophic pulse” of 14 years worth, or 30 million tons, of sediments combined with the surge of freshwater to inflict the biggest single damaging event ever recorded in the Chesapeake Bay. Over the past 35 years this sediment has accumulated to a level exceeding 1972 levels and scientists agree that the question is not if this will occur again, but only a matter of when.

The applicant has made no effort to find ways to mitigate the build up of sediment. Though the applicant did not create the sediment, the applicant did create the dam which is responsible for creating the “catastrophic pulse” scenario. Without the dam the sediment would have entered the Chesapeake, but would not have scoured such huge and dangerous amounts. The dam has created an imminent and substantial threat to the entire Chesapeake Bay. Please see the attached summary of the Chesapeake Bay Program’s Science and Technology Advisory Committee (STAC) report entitled “*The Impact of Susquehanna Sediments on the Chesapeake Bay*” (attachment 2) for more information on the impacts of the sediment.

**SUMMATION:**

For the previously outlined reasons, we ask the Low Impact Hydropower Institute to withhold approval of this application until the impacts referenced are mitigated.

Sincerely, Michael R Helfrich
Lower Susquehanna RIVERKEEPER®
American Eel sampling at Conowingo Dam 2007

Steve Minkkinen, Ian Park, Maryland Fishery Resources Office, 1/10/2007

Background

The Atlantic States Marine Fisheries Commission (ASMFC) is considering changes to its Interstate Fishery Management Plan for American Eel (Anguilla rostrata) (FMP). The American Eel Management Board (state directors) recently reviewed advice from the American Eel Technical Committee with respect to potential management changes needed to address modern population declines. The Board tasked the American Eel Plan Development Team with developing a Public Information Document (PID) to explore issues related to American eel management and potential changes to the FMP. Specifically addressed in the PID are efforts to modify fishing regulations and to provide safe upstream (elvers) and downstream (silver eels) passage at hydroelectric dams. Such improved passage for eels will increase habitat availability and improve escapement of adult eels.

American eel occupy a significant and unique niche in the estuarine and freshwater habitats of the Atlantic coast. Eels are a catadromous species that ascend freshwater environments as juveniles. These fish reside in riverine habitats until reaching maturity at which time they migrate to the Sargasso Sea where they spawn once and die. Larval eels are transported by ocean currents to rivers along the eastern seaboard of the continent. Unlike anadromous shad and herring, they have no particular homing instinct. Historically, American eels were very abundant in East Coast streams, comprising more than 25 percent of the total fish biomass in many locations. This abundance has declined from historic levels but remained relatively stable until the 1970s. More recently, fishermen, resource managers, and scientists have noticed a further decline in abundance from harvest and assessment data.

Although the Chesapeake Bay and tributaries support a large portion of the coastal eel population, eels have been essentially extirpated from the largest Chesapeake tributary, the Susquehanna River. The Susquehanna River basin comprises 43% of the Chesapeake Bay watershed. Construction of Conowingo Dam in 1928 effectively closed the river to upstream migration of elvers at river mile 10. Before mainstem dams were constructed, the annual harvest of silver eels in the Susquehanna River was nearly one million pounds. There is currently no commercial harvest (closed fishery in Pennsylvania) and very few fish (resulting from Pennsylvania Fish & Boat Commission stockings in the early 1980s) are taken by anglers above the dam. The Maryland Biological Stream Survey (MBSS) collects data in freshwater drainages of Maryland. Eel captures in this survey were collected for the Susquehanna River and tributaries in the vicinity of Conowingo Dam (Figure 1). This data reflects the fact that the dam blocks the upstream migration of eels. By extrapolating densities of eels captured in Maryland the MBSS survey estimated that there would be over 11 million eels in the Susquehanna watershed if their migration was not blocked by dams.

Mainstem Susquehanna fish passage facilities (lifts and ladder) were designed and sized to pass adult shad and herring and are not effective (due to attraction flow velocities and operating...
schedules) in passing juvenile eels (elvers) upriver. Specialized passages designed to accommodate eels are needed to allow them access to the watershed above dams.

Research conducted by the USGS, Northern Appalachian Research Laboratory indicates that American eel may be the primary fish host for the freshwater mussel, eastern elliptio (Elliptio complanata) (Lellis et al. 2001). The larval stage (glochidia) of freshwater mussels must parasitize a host fish to complete metamorphosis to the juvenile life stage. Some mussel species are generalists and can use multiple fish species as hosts while others are specialists that rely heavily on one or two host fish species to complete this life stage. Glochidia collected from eastern elliptio in Pine Creek (a tributary to the Susquehanna River) appear to have much higher metamorphosis success rates on American eels than on other fish species found in the river (Lellis et al. 2001).

Eastern elliptio is abundant throughout most of its range which spans the entire east coast. However, in comparison with other rivers such as the Delaware River where the eastern elliptio population is estimated to be in the millions (Lellis 2001), biologists have noticed a distinct absence of eastern elliptio abundance and recent recruitment to the Susquehanna River (personal communication, William Lellis, USGS, Wellsboro, PA). Low recruitment of eastern elliptio could be linked to the lack of eel passage over 4 dams in the Susquehanna River.

If eels are essential to the reproduction of eastern elliptio or other freshwater mussel species, the implications of providing eel passage to freshwater mussel populations and in turn, ecosystem function could be significant. Similar to oysters in the Chesapeake Bay, freshwater mussels provide the service of natural filtration to the rivers and streams where they live. A healthy reproducing population of eastern elliptio could remove algae, sediment, and micronutrients from billions of gallons of Susquehanna River water each day. Restoring the upstream distribution of American eels and eastern elliptio could potentially improve water quality of not only the Susquehanna River but also the Chesapeake Bay. A research project to further evaluate the relationship between eastern elliptio and American eel has been funded under the USFWS, Region 5, Science Support Program during 2008.

Survey methods and Equipment Placement

To determine the best method to reintroduce eels into the Susquehanna River above the Conowingo dam, we have collected baseline information on eel abundance, migration timing, catchability, and attraction parameters at the base of the Conowingo Dam since the spring of 2005. Baseline information from the study will assist in determining the potential for eel passage.

Sampling for eels took place from May 30 through August 8, 2007. Once again our sampling was limited to the west side of the dam; however this year we attempted to further develop our sampling efforts. As in previous years a modified Irish elver ramp was used to sample for elvers, and eel pots with a 6 mm square mesh, were set around the base of the West Fish Lift to catch larger eels. This year an experimental eel passage was created on the shore of the west bank in an attempt to further determine the population of juvenile eels at the base of Conowingo
Dam (Figure 2). River flows were collected from a USGS gauging station (USGS 01578310). Lunar fraction (percent moon illumination) was collected from the U.S. Naval Observatory (http://aa.usno.navy.mil/). The elver ramp was initially operated outside of the West Fish Lift raceway, but due to large fluctuations in the water levels caused by power generation, and a lack of rain, the ramp would become inoperable during periods of low water level. The ramp was moved to the shore adjacent to the West Fish Lift when elvers were observed in the rip rap where water was spilling over from our pump collection site. (Figure 3 and 4)

Results

Eels were captured throughout the period sampled, May 30th - August 8th (Table 1). Juvenile eel length frequencies ranged from 76 to 169 mm TL (Figure 5), and the length frequency of yellow and silver eels varied from 256 to 734 mm TL (Figure 6). Yellow and silver eels captured were sedated, measured, fin clipped, and had a Passive Integrated Transponder tag (PIT tag) inserted in the dorsal musculature and released. A total of 51 silver or yellow eels were captured and tagged, 28 of which were recaptured at a later date. Elvers were sedated, measured, counted, and in the occurrence of large numbers, eels were volumetrically counted. Elvers were then transported to Deer Creek and released above Wilson Mill dam. Several methods of collecting elvers were attempted and altered as the sampling season progressed. As mentioned before, the modified elver ramp was moved to shore, where elvers were observed. Once moved to shore, the Irish elver ramp was the most prevalent method of capturing elvers (Figure 7). It captured significantly more elvers than the eel passage that was created, however it is believed that this occurred as a result of location of the two. The over flow from the pump collection area was spilling into a slow moving eddy where the trickling effect of the spill was noticeable. However the eel passage was situated down river and we were attempting to collect elvers from a flowing section of river and that our attraction flow was unnoticeable to the eels.

We believe that abundance estimates have shown that silver and yellow eels become trap happy, or that they set up distinctive home ranges from which they do not emigrate or immigrate. Historically it was thought that eel migration was determined by water temperature and stream flow; we also compared landings to lunar phase. However looking at historical eel landings at Conowingo Dam, we believe that the elver migration up the Susquehanna is not readily influenced by environmental cues. However it does appear that historically elvers can be expected from the first week of May through the end of June.

In 2006 elvers were taken to Manning Hatchery and marked with oxytetracycline (OTC) for an age validation study. The elvers were collected in the West Fish Lift at Conowingo Dam and immersed in an OTC bath at a concentration of 550 ppm for 7 hours. After which the elvers were placed in a small pond on hatchery grounds and collected again a year later. A total of 31 elvers were harvested and sacrificed. Otoliths were removed and viewed under an ultraviolet light to view the OTC markings. The results of this study validate that American Eels form an annual growth ring on the otolith.
Citations:

Figure 1. Map of the Maryland Biological Stream Survey (MBSS) sampling sites of tributaries to the Susquehanna River in Maryland. Note the difference in densities of eels in tributaries below Conowingo Dam compared to above the Dam.
Figure 2. Experimental Eel passage below Conowingo Dam, 2006.

Figure 3.
Figure 4.

Figure 5. Length frequencies of elvers captured at the base of Conowingo Dam during 2007.
Figure 6.

Length Frequency of Mature Eels Captured at Conowingo Dam 2007

Figure 7.

Capture Selectivity by Gear Type

Sample Method

Number of Eels Collected
Table 1. Number of eels caught at the base of Conowingo Dam on the Susquehanna River by a Modified Irish Elver Ramp, Irish Elver Ramp, Eel Pots, and an Experimental Eel (data are combined for four pots per collection date).

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ATTACHMENT 2

Excerpts of the CBP STAC Report on Susquehanna Sediments

The Objective of the Workshop was to survey the possible consequences of the increased delivery of sediments from the Susquehanna River to the Chesapeake Bay as a result of the loss of retention of sediment storage in the reservoirs behind the existing dams on the river.

The material presented emphasized the complexity of the possible effects of increases in sediment discharge to the Bay and of the increase in severity of scouring events. This is compounded by our inability to forecast the timing or intensity of these scouring events in the river and reservoirs. Detailed predictions are therefore not possible but the consequences that can be predicted with most confidence are:

1) Increased loading of phosphorus in the Middle Bay below the Estuarine Turbidity Maximum zone (the ETM) from sediments that move beyond this zone during large-flow scouring events.

2) Increased needs for dredging the navigation channels in the Upper Bay as the overall load of sediment deposition in the Upper Bay increases. Past information shows that almost all of the sediment delivered by the Susquehanna River is deposited north of the Baltimore area. There is a tendency for high rates of accumulation of finer materials in the deeper channels. These areas are those where the greatest impacts from increased sediment delivery can be expected. If channel dredging continues it will have to be more frequent, and with increased costs.

3) Higher turbidity and faster sedimentation everywhere, but especially in the navigation channels. The range of flow dynamics will be increased, especially during storms. Without channel dredging there will be rapid channel filling, downstream displacement of the salt front, and possible major changes in circulation and sedimentation patterns.

4) Adverse effects on the recovery of Submerged Aquatic Vegetation (SAV) due to decreased light penetration. Most SAV species in the bay have high light requirements. Sediment solids are always a major factor and any increase in the amount present will be a serious hindrance to the recovery and re-establishment of the SAV population and the habitat which this provides for many of the Bay biota.

5) Benthic organisms will be adversely affected by increased sediment loads that increase the energetic costs from burial. Episodic deposition also rapidly increases mortality and recruitment. Young oysters are sensitive to increased sediment deposition and long-term community structures will be changed by the impoverishment of the macrofauna.

6) Potential effects of increased sediment loading on fish populations in the Upper Bay and the ETM include:

1) direct effects of feeding, clogged gill tissues and smothering of eggs;

2) indirect effects on the abundance of planktonic prey of larval and juvenile fish, and

3) habitat alterations through increased silting and sedimentation with changes in the location and mode of operation of the ETM.

To the extent that increased sediment loading in the Upper Chesapeake Bay will require more dredging and associated activities to maintain channels there may be an increased threat to spawning and nursery habitats for anadromous fishes: this may become an issue in the future.