STATE OF MAINE
DEPARTMENT OF ENVIRONMENTAL PROTECTION

IN RE PETITIONS FOR REVOCATION, MODIFICATION OR SUSPENSION OF PERMITS AND WATER QUALITY CERTIFICATIONS FOR THE LOCKWOOD, HYDRO KENNEBEC, SHAWMUT AND WESTON HYDRO PROJECTS

Merimil Limited Partnership Lockwood Hydro Project #L-20218-33-C-N	)	
Hydro Kennebec Limited Partnership Hydro-Kennebec Project #L-11244-35-A-N	)	**PRE-FILED DIRECT TESTIMONY OF SCOTT R. AULT ON BEHALF OF FPL ENERGY MAINE HYDRO, LLC AND MERIMIL LIMITED PARTNERSHIP (LOCKWOOD, SHAWMUT AND WESTON PROJECTS)**
FPL Energy Maine Hydro, LLC Shawmut Hydro Project #L-19751-33-A-M	)	
FPL Energy Maine Hydro, LLC Weston Hydro Project #L-17472-33-C-M	)	

Kleinschmidt
Energy & Water Resource Consultants

PRE-FILED DIRECT TESTIMONY AND EXHIBITS OF SCOTT R. AULT

- Downstream American eel passage at the Weston, Shawmut and Lockwood hydro projects.

- The petition for listing of American eel under the Endangered Species Act.

January 17, 2007

PRE-FILED DIRECT TESTIMONY AND EXHIBITS OF SCOTT R. AULT

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PRE-FILED DIRECT TESTIMONY AND EXHIBITS OF
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QUALIFICATIONS OF WITNESS

My name is Scott R. Ault. I am currently employed by Kleinschmidt Associates, a Maine corporation with offices in various locations throughout the United States. I work in the Strasburg, Pennsylvania office as a Senior Fisheries Biologist and Project Manager, specializing in upstream and downstream fish passage issues. I am also a Vice President of the company and I direct Kleinschmidt's Fish Passage and Protection Department.

I graduated from Millersville University in 1981 with a Bachelor of Science Degree in Biology. Since that time I have worked as a consulting fisheries biologist. The majority of my 24 year career has focused on studying the impact of hydroelectric operations on aquatic ecosystems. I have worked on entrainment, turbine mortality, and fish passage issues on the Columbia River in Washington and Oregon; the Snake River in Washington; the Clark Fork River in Idaho and Montana; 10 rivers in Michigan and Wisconsin; six rivers in New York; the Susquehanna River in Maryland and Pennsylvania; the Youghiogheny River in Pennsylvania; the Ohio River in West Virginia; the Shenandoah River in Virginia; the Roanoke River in North Carolina; and the Connecticut River in Massachusetts.

I have been working since 1994 on upstream and downstream passage issues for American eel (*Anguilla rostrata*) on the Shenandoah River, the Susquehanna River, the Connecticut River, the Roanoke River, and most notably, the St. Lawrence River in upstate New York where I assisted in the design, implementation, and evaluation of 10 years of study on American eel. These studies have included: determining the relative abundance and distribution of upstream migrating juvenile eels in the tailrace of the Moses-Saunders Power Dam (an 1800 megawatt hydroelectric facility that spans the St. Lawrence River between Massena, New York and Cornwall, Ontario); the conceptual design of an upstream eel passage facility for the hydroelectric station; field studies to determine the exit of the upstream eel passage facility to minimize fallback through the hydroelectric turbines; developing techniques to capture maturing downstream migrating eel and for differentiating maturing adult eels from yellow eels; developing techniques for tagging and tracking adult eels with hydrosonic telemetry equipment; conducting telemetry studies to determine the behavior of downstream migrating eels in relation to the Power Dam; conducting a large-scale prototype study to determine the effect of light on downstream migrating eels; and, developing conceptual plans and engineering assessments of passage facilities for downstream migrating eels at the Power Dam and other project related facilities. These experiences, as well as my work with eels in other river systems, are directly pertinent to the eel downstream passage issues subject to these proceedings.

PURPOSE AND SCOPE OF TESTIMONY

The two petitions being considered by the Board present, among other things, two allegations related to downstream eel passage measures at the Lockwood, Shawmut and Weston Hydroelectric Projects. Briefly, the allegations are that 1) there is a lack of safe and effective downstream passage for eels at the Projects, and 2) circumstances have changed since issuance of the water quality certifications that requires modification of the eel passage requirements or schedules contained in the certifications.

In considering these allegations, the Board must consider whether there is a "threat to human health or the environment" or whether there has been any "changes in circumstances or conditions" that might warrant modification of the existing certifications at these three hydroelectric projects.

The purpose of my testimony is to provide the Board with information that:

1) supports my conclusion that operation of the projects does not pose a threat to human health or the environment relative to the downstream passage of American eel; and,

2) demonstrates there are no changes in circumstances which could require modification of the State water quality certificates for the projects relative to the downstream passage of American eel.

SUMMARY OF TESTIMONY

It is my best professional judgment that these three projects do not threaten human health or the environment, nor are there any changes in circumstances or conditions that would justify modifying the project's existing water quality certifications relating to eel passage.

DO THE OPERATIONS OF THE PROJECTS, AS THEY RELATE TO DOWNSTREAM EEL PASSAGE, POSE A THREAT TO HUMAN HEALTH OR THE ENVIRONMENT?

- **What are the life history characteristics of the American eel?**

American eel is a fish species distributed in drainages along the western coast of the Atlantic Ocean from the northern portion of South America to Greenland. It exhibits a catadromous life history strategy, spawning at sea and migrating to coastal and freshwater environments where they grow to maturity (Tesch 1977). Adults begin spawning migrations from freshwater environs to the sea at ages generally ranging from 10 to 45 years. Spawning occurs in the Sargasso Sea in the southwestern North Atlantic Ocean. Mating is assumed to be random and adults die after spawning. Dispersal of the larvae (leptocephali) is thought to occur largely by passive drift (Kleckner and McCleave 1985) and recruitment to a specific watershed within the species distribution is therefore not dependent on the level of production of adults from that watershed. Life history scenarios in freshwater are thought to be different for male and female; centering on

minimizing the time to reach maturity for males compared to maximizing size at maturity for females (Oliveira 1999). In addition, male and female genders are often segregated within a specific watershed where males predominate in lower reaches of the drainage while females are more abundant in the upper reaches.

- **What is the incidence of mortality for downstream migrating eels on the Kennebec River?**

Mortality to adult eels on a downstream (seaward) migration can result from a number of natural and anthropogenic (human) causes but is thought to largely result from recreational and commercial fishing and passage at hydroelectric facilities (EPRI 2001). Recreational fishermen in Maine are permitted by law to harvest up to 50 eels per day while commercial harvest is unlimited. Commercial eel fisheries for downstream migrating adults use weirs that block a portion or all of the stream and often account for up to 30% mortality of the outmigrating population on a basin wide basis (Winter et al. 2006; McCleave 2001; Caron and Verreault 1997). Currently, there are two weir fisherman licensed by DMR to fish a total of three locations in Maine, two of these are on the Sebasticook River which is a tributary to the Kennebec. The DMR also issues commercial licenses for fishing with eel pots. In 2006 there were 22 eel pot licenses issued, at least two of these were for harvesting in Merrymeeting Bay downstream of the projects. (Gail Wippelhauser, DMR, personal communication with FPLE).

Mortality of downstream migrating eels associated with turbine passage has been estimated from various studies in the United States, Canada, and Europe and has been found to be extremely variable (EPRI 2001). It appears to be influenced by a number of factors including eel length, turbine size and type, and turbine rotational speed. Generally speaking, the highest injury and mortality rates have been exhibited at facilities with the smallest and fastest turbines and at facilities that have Kaplan or propeller type turbines versus Francis type turbines. The results of some studies however, do not follow expected trends and illustrate the extreme variability of data on this topic in the literature. For example, turbine passage mortality at a small Francis turbine on the Shenandoah River in Virginia was estimated at 9% while mortality at much larger and slower Francis turbines on the St. Lawrence River in Quebec was estimated at 16%, one would expect just the opposite.

Combined, the three FPLE facilities contain 19 turbines. Sixteen are Francis type turbines, one is a Kaplan type turbine, and two are tube type turbines. By station, Weston has four Francis turbines; Shawmut has six Francis turbines and two tube turbines; and Lockwood has six Francis turbines and one Kaplan turbine. Based on my experience and a review of the literature, I would expect that turbine passage mortality would be lowest through the Francis units and highest through the Kaplan and tube turbines.

In the pending case, the petitioners offer no site-specific data in their petitions on turbine passage mortality rates of downstream migrating eels at the Weston, Shawmut, or Lockwood Projects. Petitioner Watts asserts, however, that “tens of thousands of fish

have had their heads removed from their bodies…". I am not aware that anyone has either seen or documented any evidence of injuries of this magnitude at these facilities and the photographic "evidence" proffered by the petitioners appears to be from locations that are not the subject of these petitions.

As demonstrated in Mr. Richter's testimony, FPLE, in an effort to better understand the extent of turbine passage mortality at the three projects, began a program in 2004 of systematic searches for dead and injured eels in the tailrace of each project. The program started by conducting periodic checks of the tailraces during the 2004 fall migration season. Observations were made by wading. Information from these sampling episodes helped to identify areas where dead and injured eels collected in each of the tailraces and focused efforts and sampling techniques in 2005 and 2006. In 2005, observations were conducted in the morning generally on a daily basis from late August until mid-November at Lockwood and Shawmut and about three times per week at Weston. The program was repeated in 2006. In addition, FPLE experimented with a canoe, as well as an underwater camera to observe areas that could not be accessed by wading.

This observation program does not produce an exact count of the dead and injured eels because not all areas of the tailraces can be observed. However, it is my professional judgment that the program does provide meaningful data on the relative abundance and seasonal trend of dead and injured eels occurring at each project and this evidence indicates that mortality events of the magnitude asserted to have occurred by the petitioners have not been observed at these projects.

This opinion is based on experience conducting similar surveys for dead and injured fish at other hydroelectric facilities. For example, I have been involved in a systematic survey for dead and injured eels below the Moses-Saunders Power Dam on the St. Lawrence River since 1999. Despite the fact that the St. Lawrence River in this location is over 0.6 miles wide, we have been able to document relative abundance and weekly trends in mortality each year by systematically surveying specific locations where a combination of the bathymetry and the current create an area where injured or dead eels concentrate. I used similar sampling techniques to observe trends in angler induced striped bass mortality on the Susquehanna River below Conowingo Dam, another large river in comparison to the Kennebec. The sampling techniques used in these two examples are similar to the techniques used at Weston, Shawmut, and Lockwood by FPLE biologists and emphasize the point that this observation technique can provide an indication of the relative extent of mortality events if conducted in a consistent and systematic fashion. Therefore, it is my professional opinion that significant mortality events are not occurring at these facilities and that the continued operation of the projects as currently occurs poses no threat to human health or the environment.

- **Must additional downstream passage measures for American eel be implemented at the FPLE or Merimil projects at this time?**

Both of the petitioners are recommending that downstream passage for eels be addressed by providing immediate “safe passage” at each of the facilities, implying that adequate

passage does not already exist. Additionally, FOMB is specifically requesting that FPLE institute a program of "either seasonal nighttime turbine shutdowns or punch plate eel excluders over the intakes in combination with deep gate passage". Petitioners offer no site-specific facility or mortality data to document the need for these approaches, but nonetheless assert that implementing downstream passage of this nature is both appropriate and necessary at all three projects.

As indicated in Mr. Richter's testimony, FPLE currently provides downstream eel passage at each facility through a combination of opening sluice gates, opening deep gates, over spillways, and via turbines. Additionally, FPLE has committed to conducting telemetry studies on downstream migrating eels at Lockwood and Shawmut in 2007 and at Weston in 2008. The stated purpose[1] of these studies is "to determine what routes eels are using to migrate downstream through the Project(s) and whether Project measures, including the use of surface sluices, deep gates, spillways and other means, are passing eels effectively". It is my professional opinion that in the absence of the data that these studies will produce, it is premature to implement additional downstream passages measures at the three projects at this time for the following three reasons.

First, despite the fact that American eel and other *Anguillid* species throughout the world have received considerable attention in recent years, the scientific community's understanding of their habitats, status of the populations, and requirements for effective management of the species is far from complete. This is particularly true in relation to

[1] FPLE has developed study plans for evaluating downstream passage of eels at Lockwood, Shawmut, and Weston. These plans were reviewed by the resource agencies and submitted for MDEP and FERC approval on January 12, 2007.

understanding downstream migration habits, determining the need for passage measures at specific dams, and developing techniques for passage around dams when necessary to minimize impacts. The behavior of downstream migrating eels has been shown to be variable, particularly when encountering an obstacle such as a dam (EPRI 2001). Studies have shown that eels will pass downstream through turbines, sluice gates, deep gates, and over spillways, although the usage of these routes at any one facility and among different facilities can vary considerably (Winter et al 2006; Haro et al 2000(a); Durif et al 2002). In some studies, telemetered eels passed quickly through a hydroelectric dam (McGrath et al. 2002) while at others they delayed from several hours up to many days, swam back upstream and made several approaches to the dam, and generally exhibited behavior indicative of searching. Therefore, what may work effectively to pass eels with minimal mortality at Weston for example, may not work effectively at Shawmut or Lockwood. In my opinion, the fact that these facilities are structurally unique in terms of powerhouse orientation, sluice or deep gate location, and spillway configuration further compounds the problem of implementing successful and cost-effective downstream passage measures in the absence of sound data for intelligent decision making.

Second, although some hydroelectric facilities in the northeast and mid-Atlantic states have agreed to shutdown their turbines during nighttime hours in the fall to allow eels to pass through sluice gates or over a spillway, those facilities are generally very small and nighttime shutdowns for a period of a month or two are usually preferable, on an economic basis, as opposed to installing additional sluice gates[2] or maintaining devices at the turbine intakes to preclude the entry of eels. In some cases, these facilities are

[2] Sluice gates currently exist at the Lockwood, Shawmut, and Weston Projects.

unmanned and more economic to shut the units down during night time hours than to pay an employee to come back to the plant ahead of the regular work schedule and turn the units back on, even though eel passage for the night may be over. In contrast, the three FPLE facilities are relatively large and pass approximately 5,000 to 7,000 cfs, while generating 7.5 to 13 megawatts. Shutdown of these facilities or the expense of installation and maintenance for punch plate overlays or similar devices is not prudent in the absence of any data defining the best approach to providing passage or even the necessity of providing passage at all.

Third, it should be noted that even state-of-the-art downstream fish passage devices and measures are not 100% effective at passing fish and are not without risk of injury or death. Simply adding facilities where the design has not been properly supported by site-specific studies may result in improper location or operation of facilities and much wasted effort even if a particular passage technology has been used successfully at another location. The extent of use of existing passage routes and the extent of injury for all principle passage routes at a particular facility needs to be defined first in order to establish the most cost effective approach to downstream passage. In my professional opinion this should not be done without conducting the studies that FPLE has agreed to conduct.

In summary, based upon my experience as a fishery biologist and eel passage specialist, and given that:

1. there is lack of evidence of significant eel mortality at the Weston, Shawmut and Lockwood hydro projects, and

2. that downstream eel passage measures are already being implemented at each project, and

3. that downstream eel passage monitoring study plans have been submitted for each project,

it is my best professional judgment that existing downstream eel passage measures at the Lockwood, Shawmut, and Weston hydro projects are adequately supporting efforts to restore catadromous eels. Further, there is no need to modify the water quality certifications to advance the schedule for the provision of additional eel passage measures because such action will not advance the restoration of eels to the waters of the Kennebec River or to the population in general.

- **What is the best method to determine if additional downstream eel passage measures are required at the FPLE or Merimil projects?**

The most appropriate method to determine if additional downstream eel passage measures are required at the projects would come from studies that utilize direct observation of the behavior of migrating eels as they encounter each project. Observation of behavior can be conducted through direct visual observation or remotely by employing techniques such as telemetry, hydroacoustics, or an ultrasound DIDSON transducer (DIDSON camera). Direct visual observation is merely as it sounds, observing the

behavior of eels by watching them with the naked eye or through the use of a camera. Telemetry uses a radio or sonic transmitter to transmit a signal to a receiver and thus monitor the movements of a fish that are “carrying” the transmitters whereas hydroacoustics and the DIDSON camera monitor the movements of individual fish or schools of fish using sonar technology.

Of these approaches, direct visual observation would be very limited due to water clarity and the fact that most migration occurs at night. Although hydroacoustics or the DIDSON camera lend themselves very well to enumeration techniques, they offer limited capabilities to monitor fish behavior in a relatively large area and potentially may not be able to distinguish between one-time movements of many fish vs. repeated movements of a single fish. The best method to monitor the behavior of downstream migrating eels would be telemetry of individual test specimens implanted with radio or sonic transmitters. This technology has been the primary tool used on eels in North America, Europe, and New Zealand to study downstream migration behavior and behavior in relation to hydroelectric dams. Some limitations, such as obtaining sufficient sample sizes of downstream migrating eels, accurately differentiating migrant eels from resident eels prior to tagging, and the fact that some tag attachment methods (such as surgical implantation) may result in a short delay in migration behavior, have been recognized in this technology although researchers are finding methods to overcome them. Data from studies conducted in this nature would provide information an eel’s approach to the dams in relation to river flow and hydroelectric operation, the proportion of the downstream

migrating population using each available exit route under various operating conditions, and estimates of survival for eels that pass through the turbines.

As stated above, FPLE and Merimil have proposed to conduct telemetry studies at each of the three dams. Each of the studies will target a sample size of 30 to 50 eels and will monitor all possible passage routes under a number of different operational scenarios. The study plans have been reviewed by the resource agencies and were filed with the MDEP and FERC on January 12, 2007 for approval. Each study should ideally take between one to two years to complete with studies commencing at Lockwood and Shawmut this fall and at Weston in 2008. Based on my review of the study plans and experience with similar studies, it is my professional opinion that each of the plans present a sound scientific approach to determining the passage routes used by downstream migrating eels at the projects and are in line with other state-of-the–art studies. This information in turn, can and should be used to determine whether existing measures are effective at passing eels and if additional measures for downstream passage of eels need to be implemented at the projects.

Based on the information proved and the fact that FPLE is working collaboratively with the key fishery agencies under the 1998 KHDG Agreement to address downstream passage of eel at each of the projects it is my best professional judgment that continued operation of the projects while downstream passage studies are conducted does not pose a threat to human health or the environment. Therefore this criterion for modifying the Project's 401 Water Quality Certificates, as requested by Petitioners, has not been met.

HAVE THERE BEEN CHANGES IN ANY CONDITION OR CIRCUMSTANCE WHICH SHOULD REQUIRE MODIFICATION OF THE CERTIFICATIONS?

The petitioner Watts has asserted that the status review of American eel by the United States Department of the Interior to determine if this species should be included on the federal threatened and endangered species list constitutes a circumstance that did not exist when the water quality certificates were issued and that warrants revocation or modification to the water quality certificates for the projects. While this review has been a topic of considerable debate among the scientific community, no official decision has been made as to whether listing American eel as a threatened or endangered species is warranted. Consequently, it is premature to consider this requested review as a rationale for seeking the actions requested by petitioners.[3]

While there appears to be general agreement that a decline in population abundance may be occurring, explanations for the apparent decline are unknown due to substantial variation and incompleteness in data (Haro et al. 2000(b)). Researchers have cited a number of potential factors that may be influencing the population including disease, exploitation from commercial fishing, exotic parasites, pollution, habitat reduction and fragmentation, impacts from dams and hydroelectric facilities, and changes in the oceanic environment. Similar declines in the population of European and Japanese eels have been observed, indicating that factors impacting eel populations may be working simultaneously in different parts of the world.

[3] It is my understanding that the federal response to the petition for listing American eel under the Endangered Species Act should be completed by the end of January 2007.

Unfortunately, due to the unique life history characteristics of the eel (panmictic and semelparous (one-time spawning)), the contribution of any one potential factor to the apparent decline is not known. For example, the effect of watershed specific mortality on the American eel population as a whole is poorly understood because the actual contribution of individual watersheds from throughout the species range is not known. Some researchers (Lary and Busch 1997) have contended that larger more fecund females from northern latitudes of the species distribution would make greater contributions to the reproductive population than smaller less fecund fish from more southerly portions of their range. However, there is no data available to date on oceanic mortality and whether a larger eel from northern latitudes is more or less likely to migrate to the spawning grounds and reproduce successfully than a smaller eel from watersheds closer to the Sargasso Sea. A federal listing of the species would not change these circumstances, nor necessarily mean that impacts due to operation of the facilities were the most important factor contributing to the apparent decline.

While there have not been any changes in circumstances that require modification of the certificates, there in fact have been changes that benefit eel restoration efforts on the Kennebec River since the certificates were issued. Based on requirements of the 1998 KHDG Accord and in cooperation with Maine DMR, FPLE has been evaluating upstream eel passage at a number of facilities. This work includes the installation and operation of upstream eel passage at the FPLE Projects. In addition, downstream eel passage measures have been instituted at each of the projects. These measures will

benefit eel restoration efforts on the Kennebec by moving juvenile eels into upstream habitat and increasing overall escapement of adults after these fish have grown to adulthood. These collective measures, along with the significant funding of the removal of Edwards dam and fish restoration activities conducted by DMR, demonstrate FPLE's continued commitment to the resources of the Kennebec and implementation of the KHDG Accord.

In conclusion, based on the evidence cited above, it is my best professional judgment that there have not been any changes in conditions or circumstances that require modification of the terms of water quality certificates of the Lockwood, Shawmut or Weston projects regarding eel passage.

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Dated: January 8, 2007

Scott R. Ault

STATE OF Pennsylvania
COUNTY OF Lancaster

Personally appeared before me the above-named Scott R Ault and made oath that the foregoing is true and accurate to the best of his knowledge and belief.

Dated: January 8, 2007

Lori K Rineer
Notary Public
My Commission Expires:

COMMONWEALTH OF PENNSYLVANIA
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