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September 13, 2017

VIA E-MAIL (COURTESY COPY TO FOLLOW BY U.S. MAIL)

Ms. Julie Crocker
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Re: Proposed Incidental Take Permit and Habitat Conservation Plan, and Draft Environmental Assessment, for Virginia Electric and Power Company's Chesterfield Power Station; Docket ID NOAA-NMFS-2017-0051

Dear Ms. Crocker,

On behalf of the James River Association (JRA), the Southern Environmental Law Center (SELC) respectfully submits these comments on the proposed Incidental Take Permit (ITP) and Habitat Conservation Plan (HCP), and Draft Environmental Assessment (EA). In light of significant substantive and procedural deficiencies discussed herein, we respectfully request that the National Marine Fisheries Services (NMFS) deny Virginia Electric and Power Company's (Dominion) application. Rather than issue the permit as written—an action that would violate the Endangered Species Act, the National Environmental Policy Act, and relevant implementing regulations—NMFS should require Dominion to resubmit a new application that remedies these deficiencies.

As proposed, this permit would authorize Dominion to take as many as tens of thousands of endangered Atlantic sturgeon over the course of a decade, dramatically reducing the likelihood of the survival and recovery of this important and historical species in the James River. Dominion does not propose implementing any changes to its harmful operations at Chesterfield Power Station (CPS), and would not undertake any measures to preserve or restore actual habitat.

The fundamental deficiency at the heart of Dominion's application and NMFS' draft EA is the failure to conduct an adequate analysis of the threats posed to James River Atlantic sturgeon by CPS. First, by failing to consider the best available scientific information, Dominion significantly understates the likely effect its cooling water system is having on Atlantic sturgeon.

The water intakes, located in the worst possible location for Atlantic sturgeon, are likely killing thousands or even tens of thousands of early life stage sturgeon, as well as exhausted adults who have drained their energy reserves during spawning. Second, Dominion disregards entirely the effects of its unchecked thermal pollution on the Atlantic sturgeon's recovery. The extremely hot water being discharged from the plant not only kills early life stage sturgeon and harms juveniles and adults, but the thermal plume surrounding the plant likely acts as a physical barrier, preventing migrating sturgeon from reaching critical spawning habitat. By relying on Dominion's severe understatement of the likely impacts to Atlantic sturgeon and the population as a whole, NMFS reaches the unsupported conclusion that issuing this permit will not appreciably reduce the likelihood of the survival and recovery of the Atlantic sturgeon population. That conclusion is incorrect and unsupported. The effects of CPS on Atlantic sturgeon are likely severe, and issuing this permit as proposed would constitute a violation of the ESA and implementing regulations.

Dominion also fails to propose any mitigation measures, instead proposing to continue operations unchanged. Dominion attempts to justify its inadequate approach by relying on faulty conclusions about the plant's effects on Atlantic sturgeon. Rather than undertaking measures to minimize and mitigate impacts to the maximum extent possible, as required by law, Dominion proposes taking no measures. Nor does Dominion propose conserving any actual habitat, despite the fact that the James River has now been designated as critical habitat for Atlantic sturgeon, i.e., habitat essential to the recovery of the species. Dominion also fails to protect or restore real habitat, instead offering to donate the dead fish that are taken at Chesterfield Power Station to researchers. Issuing a permit despite these clear failures would constitute a violation by NMFS of the ESA's requirement that an applicant mitigate and minimize such impacts to the maximum extent practicable.

In addition to these violations of the ESA, issuing the proposed permit without further analysis would violate the procedural requirements of NEPA. Rather than undertaking its own independent assessment, NMFS simply accepts Dominion's improper conclusions at face value, failing even to prepare a full environmental impact statement. Moreover, despite acknowledging fundamental uncertainties about the James River Atlantic sturgeon—which would render it logically impossible to conclude that Chesterfield Power Station is not having a significant impact on the sturgeon—NMFS nonetheless concludes the impact is not significant. This is not only illogical, but also contrary to NMFS' own guidelines. The best available information indicates that Chesterfield Power Station is having a major deleterious impact on Atlantic sturgeon, but to the extent any uncertainty exists about its effect, NMFS should not issue this permit.

For these reasons, and as described in more detail herein, the issuance of this proposed permit would violate the Endangered Species Act, NEPA, and implementing regulations, and should be denied. NMFS should require Dominion to refile its application to rectify these legal deficiencies. In particular, Dominion should be required to (i) fully consider the real risks posed by the CWIS using the best available information, including by improving the quality of its entrainment study, and submit a more accurate estimate of take or identify what additional information is needed in order to do so; (ii) fully analyze the thermal effects that CPS is likely having on Atlantic sturgeon, including to the extent possible, an estimate of such takes and an analysis of how the current thermal plume surrounding CPS is affecting spawning; (iii) fully

analyze the effects that noise and vibration effects associated with vessel movements and maintenance activities are likely having on Atlantic sturgeon; (iv) consider in detail a full suite of mitigation measures at CPS, including time-of-year restrictions, seasonal operational changes, changes to its CWIS, including installing a re-circulating cooling water system, variable speed pumps, or small mesh screens, as well as interim measures that could be implemented immediately; (v) evaluate and propose actual habitat conservation measures designed to offset anticipated takes, including through habitat restoration and other efforts that could directly benefit recovery; and (vi) evaluate and propose substantial measures to support, assist, and fund critical research needed to fill in fundamental gaps in our understanding of the James River Atlantic sturgeon and ultimately advance recovery of the species and its habitat.

I. FACTUAL BACKGROUND

To assist with these comments, SELC and JRA retained Dr. Boyd Kynard, a sturgeon expert with decades of behavioral experience and research. Dr. Kynard's report and supporting materials are attached to these comments.[1]

A. The James River and Chesterfield Power Station

The James River is Virginia's largest river and tributary to the Chesapeake Bay. Beginning in the Allegheny and Blue Ridge Mountains, the river flows for 340 miles all the way to its mouth in Hampton Roads.[2] The river is steeped in history, including important historical sites such as the original Jamestown settlement and Virginia's first colonial capital at Williamsburg.

The Chesterfield Power Station (CPS) is located directly on the lower section of the James River, which includes waters below the fall line at Richmond downstream to the river's mouth into the Chesapeake Bay at Hampton Roads. CPS is the largest fossil-fueled power plant in Virginia, burning on average 8,400 tons of coal every day.[3]

CPS sits within the James River Oxbows section of the Captain John Smith Chesapeake National Historic Trail, an area frequented by approximately 145,000 children and adults every year. This area includes the Dutch Gap Conservation Area, Henricus Historical Park (a reconstruction of the second oldest English settlement), Deep Bottom Park, and Presquile National Wildlife Refuge. Visitors to this area partake in numerous boating, fishing, historical,

[1] Attachment 1, B. Kynard, PhD., Effects of Chesterfield Power Station, James River, Virginia on Atlantic Sturgeon (Sept. 8, 2017) ("Kynard Report"); Attachment 2, Curriculum Vitae of B. Kynard; Attachment 3, Selected Literature Cited in Kynard Report.

[2] Attachment 4, James River Association, About the James River, *available at* https://jrava.org/about-the-james-river/.

[3] Attachment 5, Dominion Energy Virginia, Chesterfield Power Station, "Brief Facts," *available at* https://www.dominionenergy.com/about-us/making-energy/coal-oil/chesterfield-power-station.

and other recreational activities in the lands and waters directly adjacent to CPS.[4] Dutch Gap Conservation Area, in particular, lies immediately adjacent to the site and abuts the approximately 14 million tons of coal ash buried in unlined impoundments at CPS.[5]

B. Atlantic Sturgeon

1. History and Importance to the James River

The endangered Atlantic sturgeon is a prehistoric fish, with a fossil record dating back at least 85 million years.[6] The stunning fish can grow as long as 14 feet and live up to 60 years.[7] Harvest records show that the James River historically supported a large population of Atlantic sturgeon,[8] and the now endangered fish became a critical figure in the formation of our country, intertwined with the James River and Virginia's history for centuries. During the "Starving Time" at Jamestown in the early 17th century, for example, settlers turned to the plentiful Atlantic sturgeon to survive. According to one U.S. Fish & Wildlife Services biologist, "[i]f there were to be a national fish, it should be the Atlantic sturgeon. Without sturgeon, there's a good chance we would not be having this conversation in English right now," referring to the near demise of Jamestown.[9]

From colonial times to the turn of the 20th century, Atlantic sturgeon meat, eggs, and oil formed an important export industry.[10] Harvests peaked in the late 1800s, however, and by the 1920s, the average annual harvest had plummeted by more than 90 percent. The James River Atlantic sturgeon—a fish that had been spawning in the river for millions of years and were so vital to the colonists—were thought to be extinct, with no recorded sightings in the James for almost a century.[11] In 1998, the Atlantic Marine Fisheries Commission shut down the entire coast to Atlantic sturgeon fishing, with stock assessments indicating that only "remnant populations" remained along the East Coast.[12]

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[4] Attachment 6, National Park Service, U.S. Dep't of the Interior, Making the Trail Visible and Visitor Ready: Progress on the James River Segment (Dec. 2013).

[5] Attachment 7, Chesterfield County, Parks and Recreation, Dutch Gap Conservation – Outdoor Programs; Attachment 8, Chesterfield County, Map of Dutch Gap Conservation Area.

[6] Attachment 9, NOAA, Chesapeake Bay Office, Atlantic sturgeon Fish Facts, *available at* https://chesapeakebay.noaa.gov/fish-facts/atlantic-sturgeon.

[7] *Id.*

[8] Kynard Report at 3.

[9] Attachment 10, Hunter Reardon, *Out of the Depths*, Richmond Magazine (Feb. 26, 2014), *available at* http://richmondmagazine.com/news/features/out-of-the-depths-02-26-2014/.

[10] Attachment 9, NOAA, Chesapeake Bay Office, Atlantic sturgeon Fish Facts.

[11] Attachment 10, Hunter Reardon, *Out of the Depths*, Richmond Magazine (Feb. 26, 2014).

[12] Attachment 9, NOAA, Chesapeake Bay Office, Atlantic sturgeon Fish Facts.

2. The Endangered Status of Atlantic Sturgeon

On February 6, 2012, following public comment, the National Oceanic and Atmospheric Administration (NOAA) listed several Distinct Population Segments (DPS) of the Atlantic sturgeon as endangered species under the Endangered Species Act.[13] Pursuant to this listing, the Chesapeake Bay DPS of the Atlantic sturgeon became an endangered species. As described by NOAA, there had been "increased sightings and captures of Atlantic sturgeon in the James River, which comprises the only known spawning river for the [Chesapeake Bay] DPS."[14] NOAA acknowledged that there was not enough evidence to confirm an increased abundance of Atlantic sturgeon in the James River, but noted that the increased sightings may have been in part due to an improvement in water quality following the passage of the Clean Water Act. Despite the possibility of an increasing population, NOAA explained that there remained "significant threats" to the Chesapeake Bay DPS of the Atlantic sturgeon from persistent degraded water quality and habitat impacts.[15]

On June 3, 2016, NOAA proposed designating a large portion of the James River as critical habitat for the Atlantic sturgeon.[16] The proposed critical habitat stretched from Bosher's Dam (at the fall line, a few miles upstream of Richmond), all the way to the Chesapeake Bay, encompassing the stretch of the James River adjacent to the CPS.[17]

The Critical Habitat was finalized on August 17, 2017.[18] NMFS concluded that "each of these DPSs is at a low level of abundance and that successful reproduction and recruitment,

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[13] Threatened and Endangered Status for Distinct Population Segments of Atlantic Sturgeon in the Northeast Region, 77 Fed. Reg. 5880 (Feb. 6, 2012).

[14] *Id.* at 5883.

[15] *Id.*; *see also* Endangered Species Act Section 7 Consultation: Programmatic Biological Opinion on the U.S. Environmental Protection Agency's Issuance and Implementation of the Final Regulations, Section 316(b) of the Clean Water Act, Appendix C: Additional Species Specific Effects Analysis for Species Under Jurisdiction of NMFS, at 46 (May 19, 2014) (Effects on Sturgeon from Cooling Water intake Structures likely to include "impingement or entrainment, thermal discharges, chemical discharges, and the indirect effect of prey and habitat reduction").

[16] Designation of Critical Habitat for the Gulf of Maine, New York Bight, and Chesapeake Bay Distinct Population Segments of Atlantic Sturgeon, 81 Fed. Reg. 35,701 (June 3, 2016).

[17] SELC and JRA submitted comments supporting the designation of the James River as critical habitat. *See* Attachment 13, Southern Environmental Law Center and James River Association, Comments on Proposed Designations of Critical Habitat for the Gulf of Maine, New York Bight, and Chesapeake Bay Distinct Population Segments of the Atlantic Sturgeon, 81 Fed. Reg. 35,701 (June 3, 2016) and for the Endangered Carolina and South Atlantic Distinct Population Segments of Atlantic Sturgeon, 81 Fed. Reg. 36,078 (June 3, 2016).

[18] NOAA, Endangered and Threatened Species; Designation of Critical Habitat for the Endangered New York Bight, Chesapeake Bay, Carolina and South Atlantic Distinct Population Segments of Atlantic Sturgeon and the Threatened Gulf of Maine Distinct Population Segment of Atlantic Sturgeon, 82 Fed. Reg. 39160 ("Final Critical Habitat") (Aug. 17, 2017).

which are essential to the conservation of the species, occur in a limited number of rivers for each DPS."[19] NMFS selected the James River as one such river, finding that it contains the "physical features essential to the conservation of the species and that may require special management considerations or protection . . . ." Moreover, the James River is the only Chesapeake Bay river with a known Atlantic sturgeon population and definitive evidence of spawning.[20] Thus, the survival and recovery of the Atlantic sturgeon in the James River are critical to the survival and recovery of the entire Chesapeake Bay DPS, with one study estimating that the James River Atlantic sturgeon constitute 92 percent of the entire population segment.[21]

The precise status of the James River population of Atlantic sturgeon is highly uncertain. Available information, however, indicates that the population remains tenuous with very little evidence of successful spawning. Existing data indicates the James River likely contains very few juveniles and spawning females.[22] While hundreds of adult males have been caught and many tagged, significantly fewer females have been caught, and catches of juveniles have been extremely limited. These relative catch rates indicate the James River population is suffering from low levels of reproductive success.

Although the Atlantic sturgeon is still facing a critical threat to its recovery in the James River, it has become an important symbol for the city of Richmond and the surrounding region. In recent years, boat operators have provided river tours to allow the public to view breaching sturgeon during spawning periods, including specifically at Dutch Gap near CPS.[23] A Richmond craft brewer has dedicated a beer to the Atlantic sturgeon, sharing its profits with JRA to assist in the species' recovery.[24] Local schools are also engaging with Virginia Commonwealth University's Rice Rivers Center's Adopt a Sturgeon and Sturgeon Tracking programs.[25] The James River sturgeon even has a Facebook page where everyone can follow the ongoing recovery efforts.[26]

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[19] Final Critical Habitat at 39161.

[20] Kynard Report at 4-5.

[21] *Id.* at 5.

[22] *Id.* at 7.

[23] Attachment 10, Hunter Reardon, *Out of the Depths*, Richmond Magazine (Feb. 26, 2014); Attachment 24, Discover the James, Atlantic Sturgeon Tour, *available at* http://discoverthejames.com/?q=content/atlantic-sturgeon-tour.

[24] Attachment 11, Hardywood Parkcraft Brewery, The Great Return, *available at* https://hardywood.com/beers/great-return.

[25] Virginia Commonwealth University, Community Engagement K-12 Programs, VCU Rice Rivers Center, (September 11, 2017), *available at* http://www.ricerivers.vcu.edu/community-engagement/k-12-programs/.

[26] James River Sturgeon, Facebook, (September 11, 2017), *available at* https://www.facebook.com/JamesRiverSturgeon.

3. Atlantic Sturgeon Spawning Considerations for the James River

Successful spawning of James River Atlantic sturgeon depends on a number factors, many of which are directly affected by the operations at CPS.[27]

James River Atlantic sturgeon likely have two spawning races, a spring run (April to May) and fall run (September to October),[28] which are likely triggered by day length (photoperiod).[29] While photoperiod appears to be the trigger, many other conditions are required during these windows for spawning to be successful. NMFS, for example, has already identified several physical features that, according to its analysis, are "essential to the conservation of the species that may require special management considerations or protections." These conditions include but are not limited to (1) hard bottom substrate for settlement of fertilized eggs, refuge, growth, and development of early life stages; (2) aquatic habitat with a gradual downstream salinity gradient and soft substrate for juvenile development; (3) water of appropriate depth and absent physical barriers such as thermal plumes, including for the unimpeded movement of adults to and from spawning sites and for the staging, resting, or holding of spawning condition adults; and (4) water, particularly in the bottom meter of the water column, with the temperature, salinity, and oxygen levels to support spawning and larval growth and development (e.g., 13 °C to 26 °C for spawning habitat).[30]

Several of these factors, pertinent to Dominion's ITP application, are discussed in turn below.

(a) Physical Barriers to Suitable Spawning Habitat

Existing data indicates a number of potentially suitable rocky reaches exist in the James River, including many at or upstream of CPS.[31] As NMFS has acknowledged, however, "availability of hard-bottom habitat remains relatively limited in the James River and appears to be significantly reduced compared to the amount of available hard-bottom habitat described in historic records."[32] Thus, one important consideration in the recovery of Atlantic sturgeon is eliminating any physical barriers, including thermal plumes, that could prevent sturgeon from reaching suitable hard bottom substrate. Maintaining this physical access over time is particularly critical for sturgeon, since research indicates Atlantic sturgeon are likely to return to the same spawning reach year after year.[33]

Although very little information is known about spawning activities in the James River, the availability of suitable hard-bottom habitat upstream of CPS has been confirmed. The death of two Atlantic sturgeon, just several days old, during a study at CPS in the fall of 2015, provides

[27] Kynard Report at 5.

[28] *Id.* at 6.

[29] *Id.* at 7, 9-10.

[30] Final Critical Habitat at 39,161.

[31] Kynard Report at 6.

[32] 81 Fed. Reg. at 35,704.

[33] Kynard Report at 6.

the best evidence that such habitat exists at or upstream of CPS.[34] As explained in more detail below, these Atlantic sturgeon were likely free embryos. Without any real swimming ability,[35] the death of these two Atlantic sturgeon means suitable hard bottom substrate must exist at or upstream of CPS. Other data on James River Atlantic sturgeon, including the impingement of a likely post-spawned female at CPS, further confirms that spawning likely occurs upstream of CPS, near the fall line.[36] Thus, it is critical that CPS and its operations do not act as a physical barrier, cutting off spawning adults from spawning reaches.

(b) Water Temperature

Water temperature (and the related dissolved oxygen content) is also a critical factor for successful spawning and recovery of the species. Available information indicates that Atlantic sturgeon do not spawn in water temperatures higher than 25 or 26 °C, and are likely to avoid such temperatures,[37] a fact that Dominion acknowledges in its HCP.[38] Thus, as NMFS has already acknowledged in its critical habitat work, research indicates that a thermal plume of water that exceeds this temperature could act as a physical barrier to spawning by Atlantic sturgeon.

Data for the James River indicates that temperatures can exceed this threshold at or near CPS during the fall spawning season, even without any additional heat from CPS operations.[39] Thus, with the river already on the cusp of (or even over) an acceptable spawning temperature, it is critical that unnecessary heat not be added to the system during the spawning window.[40]

Not only can a thermal plume act as a physical barrier to spawning, it can injure, harm, or even kill Atlantic sturgeon. Available research indicates that early life stage Atlantic sturgeon are extremely sensitive to temperature.[41] No documented Atlantic sturgeon spawning site has had a river temperature higher than 25 °C, and a river temperature of 30 °C, for example, likely results in high mortality rates of early life stage Atlantic sturgeon.[42]

Juvenile Atlantic sturgeon also exhibit sub-lethal behavioral effects in elevated river temperatures. At 28 C, juveniles exhibit poor feeding and growth rates.[43] Adult Atlantic sturgeon are also likely to exhibit sub-lethal effects at a slightly higher temperature, such as 30 °C, although more research is needed.[44] A thermal plume can also lower dissolved oxygen

[34] *Id.* at 7.

[35] *Id.* at 11.

[36] *Id.* at 7.

[37] *Id.* at 8-9, 19.

[38] HCP at 8.

[39] Kynard Report at 19-20.

[40] *Id.* at 22.

[41] *Id.* at 23.

[42] *Id.* at 23.

[43] *Id.* at 9.

[44] *Id.* at 9.

content, posing another threat to Atlantic sturgeon. Studies show that juvenile Atlantic sturgeon appear to be particularly sensitive to low dissolved oxygen levels.[45]

(c) Water Withdrawals

Water withdrawals can also pose a significant threat to Atlantic sturgeon through both impingement (where a fish is trapped against a screen or other barrier structure) and entrainment (where a fish actually passes through a water intake). While a mature Atlantic sturgeon in good physiological condition generally could escape water intake velocities such as those present at CPS, exhausted, post-spawning adults of either sex cannot. Atlantic sturgeon do not forage in freshwater during migration and use up energy reserves in their swim upstream to spawning reaches. Having exhausted energy reserves, these post-spawned adults lack the swimming ability to escape such withdrawals and are therefore susceptible to impingement.[46]

Early life stage Atlantic sturgeon, including free embryos and larvae, are also highly susceptible to entrainment. Lacking any meaningful swimming ability, free embryos will drift with the current.[47] Larvae, on the other hand, have a stronger swimming ability but also have an innate drive to move with the flow of water.[48] Thus, both free embryos and larvae are likely to be entrained by water intakes—the free embryo because it cannot escape the flow, and the larva because of innate behavior to remain in the flow.

Importantly, there will be no evidence of impingement or entrainment of early life stage Atlantic sturgeon in the ordinary course of water withdrawals. The fragile bodies of Atlantic sturgeon free embryos and larvae are broken into unidentifiable pieces or completely destroyed if impinged or entrained,[49] thus preventing detection of these deaths.

Deep water intakes pose an even greater threat to Atlantic sturgeon. Research on the dispersal of early life stages of other sturgeon species strongly suggests that Atlantic sturgeon will similarly disperse in deep water near the bottom.[50] Likewise, exhausted, post-spawned adults will drift or weakly swim downstream in the channel near the bottom.[51] Thus, deep water intakes near the bottom of a river are more likely to entrain and impinge Atlantic sturgeon.

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[45] *Id.* at 13-14; *see also* Attachment 23, D. H. Secor and T.E. Gunderson, *Effects of hypoxia and temperature on survival, growth, and respiration of juvenile Atlantic sturgeon,* Acipenser oxyrinchus, Fishery Bulletin 96(3) (1998); Attachment 25, Atlantic sturgeon (Ch. 8), *Atlantic Coast Diadromous Fish Habitat: A Review of Utilization, Threats, Recommendations for Conservation, and Research Needs,* Atlantic States Marine Fisheries Commission (Jan. 2009) at 231-32.

[46] Kynard Report at 14.

[47] *Id.* at 16.

[48] *Id.*

[49] *Id.*

[50] *Id.* at 17.

[51] *Id.* at 14-15.

(d) Vessel Movements and Maintenance Activities

Migrating sturgeon are also susceptible to injury, harassment, or other harm from vessel movement and certain maintenance activities. Although Atlantic sturgeon are susceptible to vessel strikes, particularly from deep draft vessels, like all North American sturgeon species, they are also highly sensitive to low frequency noise and vibration associated with vessel movements and maintenance activities.[52] This sensitivity is especially true for narrow sections of the river, such as at CPS, where the river is approximately 400 feet wide.[53] If these activities occur during spawning periods, the associated noise and vibration could result in Atlantic sturgeon stopping or delaying their migration to spawning reaches.[54]

C. Chesterfield Power Station Operations

The CPS facility has six power generation turbines, which burn coal, primarily, as well as natural gas.[55] The 1,640-MW facility runs continuously, including during critical Atlantic sturgeon spawning periods.[56]

CPS sits directly on the James River, approximately 21 river kilometers downstream of the fall line at Richmond.[57] The facility is located on the south side of the river along a sharp, outside bend of a curve, where the river is roughly 400 feet wide with a channel depth of about 31 feet.[58] Water flowing downstream is pushed to the outside of this curve, sweeping directly across the structures at CPS, including the cooling water intake structures and the heated water discharge areas.[59] In terms of impingement and entrainment effects, as well as thermal effects, CPS could not be located in a worse position.

1. Cooling Water Withdrawals

CPS withdraws large volumes of water from the main channel of the James River through five submerged intakes (cooling water intake structures, or "CWIS") to cool its turbine steam during power generation.[60] CPS employs an antiquated and inefficient "once-through" cooling system. In this type of cooling system, water is withdrawn from the source and passed through a series of heat exchangers, which condense and cool the turbine steam, before the now heated

[52] *Id.* at 31.

[53] *Id.*

[54] *Id.* at 31-32.

[55] Attachment 5, Dominion Energy Virginia, Chesterfield Power Station, Brief Facts; Kynard Report at 2.

[56] Attachment 5, Dominion Energy Virginia, Chesterfield Power Station, Brief Facts; Kynard Report at 2.

[57] Kynard Report at 2.

[58] *Id.*

[59] *Id.*

[60] *Id.*

water is discharged back into the environment.[61] This type of cooling system places tremendous stress on the water source and drastically increases the likelihood of impingement or entrainment. Not only is this system inefficient and harmful, it is unnecessary. Many power plants have been constructed or retro-fitted with dry cooling systems (which require virtually no water) or re-circulating cooling systems (which withdraw a fraction of the water required by once-through systems, typically cutting water withdrawals by more than 90%).[62]

CPS exemplifies the risks, stresses, and inefficiencies associated with once-through cooling systems. To cool its turbine steam, the CWIS at CPS is designed (and allowed) to withdraw 1.058 billion gallons of water from the James River every day. More than 98 percent of this water is used as cooling water.[63] While one or more pumps may be out of operation occasionally due to maintenance needs or energy demand, all pumps are typically in operation.[64] Importantly, the CWIS pumps at CPS "do not have variable speed capabilities, meaning that they are either in operation or are out of operation."[65]

In addition, the CWIS are located near the bottom of the channel.[66] Based on the best available information concerning the behavior of early life stage and exhausted, post-spawned adult Atlantic sturgeon, the CWIS at CPS are located in one of the worst possible locations in terms of takes. In other words, the position and location of the CWIS at CPS maximizes take of this endangered species.[67] As explained above, dispersing early life stage Atlantic sturgeon, as well as post-spawned adults, will remain near the bottom in the fast-moving water of the channel. This is precisely the water that will be swept into the CWIS, which are located on the outside curve, beside the channel, near the bottom. Any Atlantic sturgeon present are thus likely to be swept directly toward the CWIS.

The best available information about the James River Atlantic sturgeon indicates that thousands, if not tens of thousands, of early life stage Atlantic sturgeon are likely to be entrained at CPS.[68] Although much more data about the population needs to be gathered to increase accuracy, existing information indicates only a small number of spawning females return to the James River. From the eggs produced by these females, the best (and only) available information predicts that approximately 292,000 larvae would be produced annually.[69] With the

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[61] *Id.* at 2-3.

[62] Attachment 14, R. Stewart, et al., *Horizontal cooling towers: riverine ecosystem services and the fate of thermoelectric heat in the contemporary Northeast US*, IOP Publishing, Envt'l Res. Letter 8 (2013).

[63] ITP Application § 5.1.1.

[64] *Id.* & Appendix A § 2.2.1.

[65] *See* Attachment 12, Southern Environmental Law Center and James River Association, Final Comments on Draft VPDES Permit No. VA0004146, Dominion Chesterfield Power Station (July 21, 2016) at 33 (quoting Fact Sheet Attachment 7).

[66] Kynard Report at 1, 18.

[67] *Id.* at 17.

[68] *Id.* at 18.

[69] *Id.*

CWIS in the worst possible location—on the outside edge of a curve, in fast-moving water near the bottom—tens of thousands of these larvae would likely be entrained at CPS. Since evidence suggests low reproductive success in the James River, each larva is important to the population. The death of a such a large proportion of larvae represents a severe threat to the species' recovery. The estimated larval-to-juvenile survival rate is 5 percent, meaning it is likely that CPS is killing larvae that would have eventually matured into many hundreds of juvenile sturgeon, if not more.[70] Because these early life stage sturgeon will dissolve in the CWIS, it is impossible to determine how many endangered Atlantic sturgeon have been killed at CPS during its decades of operations, or how these levels of takes have stunted the James River population.

The high potential for entrainment at CPS is most clearly demonstrated by the actual entrainment of two free embryos on October 7 and 8, 2015, during a study of the CWIS at CPS. During this study, a pump was located at CWIS approximately 1 meter from the bottom—precisely where early life stage Atlantic sturgeon are likely to be present.[71] Although the study only captured (and killed) two free embryos, all available information suggests the major dispersal would not have occurred until days or even a week after the two free embryos were collected.[72] Unless disturbed or mal-developed, free embryos are not expected to disperse from a spawning site,[73] and major dispersal typically occurs when Atlantic sturgeon reach the larval stage.[74] Thus, if Dominion had continued the entrainment study throughout the potential dispersal period, it is likely that many dispersing larvae would have been captured.[75] Of course, CPS remained in full operation during this spawning period, and thus it is highly likely that thousands or tens of thousands of dispersing larvae were in fact killed in the CWIS, but were broken apart and never discovered.[76] [77]

In addition to early life stages, the CWIS is likely impinging a number of post-spawned, adult Atlantic sturgeon. As explained above, these fish are exhausted and cannot escape the intake velocity at CPS. In fact, such a take has already been documented at CPS. On October 3, 2015, an adult was impinged on a CPS trash rack.[78] The Atlantic sturgeon, bloodied and injured, was released without being sexed. Several days later, the two Atlantic sturgeon free embryos

[70] *Id.* at 27.

[71] *Id.* at 17.

[72] *Id.* at 16-17.

[73] *Id.* at 11.

[74] *Id.* at 12.

[75] *Id.* at 17.

[76] *Id.*

[77] Pursuant to its Clean Water Act permit, Dominion is required to complete its impingement and entrainment studies 270 days prior to the expiration of its permit, September 30, 2021, although the permit expiration date can be (and for CPS, historically has been) extended by multiple years. Chesterfield Power Station, VPDES Permit No. VA0004146 (Sept. 23, 2017). Dominion, however, could complete these studies well in advance of this permit deadline. *See* Attachment 12, Southern Environmental Law Center and James River Association, Final Comments on Draft VPDES Permit No. VA0004146, Dominion Chesterfield Power Station (July 21, 2016).

[78] Kynard Report at 14.

discussed above were discovered during the study of the CWIS at CPS.[79] Given the timing of these events, it is likely that spawning occurred on October 1 or 2, and the impinged adult was a post-spawned female.[80]

2. Thermal Discharges

Electric power generation has a profound impact on the temperature of a river, especially on the James River. In the northeast and mid-Atlantic, the James River is one of the most polluted rivers in terms of heat added from thermoelectric power plants.[81] One study found that thermoelectric plants along the James River basin raised the river's water temperature by 3.9 °C annually at the point of discharge to the Chesapeake Bay, and in summer, by 8.2 °C.[82] Among the eight river basins examined in the study, the temperature increases in the James River ranked the highest by a wide margin, even though the amount of electricity generated by these thermoelectric plants was in the bottom half of all basins.[83] In other words, thermoelectric plants along the James River discharge significantly more heat to the river and ultimately the Chesapeake Bay, without providing a comparable amount of electricity to the community.

One of the main drivers for this thermal pollution is the reliance of power plants, including CPS, on outdated once-through cooling systems. As explained previously, such systems are inefficient and impose tremendous burdens on the river system. After the cooling water is heated at CPS, it is discharged directly back into the main channel of the James River as well as an old oxbow (Farrar Gut) that rejoins the main channel about a mile downstream of CPS.[84] Although heat is a pollutant under the Clean Water Act, the cooling water discharge at CPS is not subject to any temperature limit.[85] Many other states set actual temperature limits, including at least 14 states that prohibit discharges exceeding 90 °F (32 °C), since such discharges are presumptively harmful to fish and other wildlife.[86] But Dominion is authorized to discharge water as hot as it chooses, routinely discharging water approaching 130 °F (54 °C).

Temperatures these high cause scalding burns to humans. For fish, including Atlantic sturgeon, these temperatures can be lethal and can also significantly reduce critical dissolved

[79] *Id.* at 14.

[80] *Id.* at 14-15.

[81] Attachment 14, R. Stewart, et al., *Horizontal cooling towers: riverine ecosystem services and the fate of thermoelectric heat in the contemporary Northeast US*, IOP Publishing, Envt'l Res. Letter 8 (2013).

[82] *Id.* at 4 (Table 1).

[83] *Id.*

[84] Attachment 15, Chesterfield Power Station, VPDES Permit No. VA0004146, Fact Sheet Attachment 4.a (Sept. 23, 2016).

[85] Attachment 16, Chesterfield Power Station, VPDES Permit No. VA0004146, Fact Sheet (Sept. 23, 2016) at 9-11 (cooling water discharge limit expressed in BTU per hour, without any temperature limit).

[86] Attachment 18, Energy and Water in a Warming World Initiative, *Freshwater Use by U.S. Power Plants* (Nov. 2011) at pp. 25, 28-29.

oxygen levels. The thermal pollution at CPS, which has continued largely unchecked for decades, has a dramatic effect on the ecosystem. In July of this year, for example, a fish kill was discovered at CPS when the temperature in the oxbow reached 115 °F. The fish kill was only discovered thanks to temperature sensors installed by JRA, which registered the extremely high water temperature. The investigation is ongoing, but at least 200 fish (predominantly white perch) were killed.[87]

To justify its discharge of scalding water back into the river, Dominion relies on an outdated and flawed study issued in 2003, which in turn relied on data from 1997 and 1998.[88] That data is now 20 years old. That study is outdated and flawed for a number of reasons. First, the study relied on non-continuously monitored data to compare actual and modeled temperatures and, moreover, attempted to do so in a tidal area. This is not an accurate methodology and the conclusions from this study are simply not reliable.[89] Second, the data the study relied on is now two decades old and no longer applies to present conditions. The temperature of the river has changed significantly since then, as have the operations at CPS.[90] Dominion's own data indicates that that CPS now discharges water that is approximately 5 to 7 °C hotter than it did 20 years ago, and at a rate about 10 percent greater.[91] For these reasons, the outdated study tells us almost nothing about the thermal plume surrounding CPS today or its likely effect on sturgeon.[92]

Even assuming the accuracy of Dominion's 20-year-old study, the available information indicates the thermal pollution at CPS is likely having a serious effect on Atlantic sturgeon and spawning activities. First, the thermal plume surrounding CPS is likely acting as a physical

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[87] Attachment 19, Email Chain from J. Brunkow to H. Deihls (VDEQ) re: Fish Kill and Water Temps in Farrar Gut (July 2017); Attachment 20, Photograph of Fish Kill at Chesterfield Power Station (July 2017).

[88] Attachment 26, HydroQual, Thermal Modeling of Chesterfield Power Station on the James River and Farrar Gut (2003).

[89] Kynard Report at 19.

[90] *Id.* at 3.

[91] *Compare* Attachment 26, Hydroqual Study (2003) (maximum discharge temperature of approximately 45 °C for units 4, 5, and 6) *with* Attachment 21, Chesterfield Power Station, VPDES Permit No. VA0004146, Fact Sheet, Attachment 5.b (90th percentile discharge temperature of 51.7 °C); *compare* Hydroqual Study (2003) (maximum discharge temperature of approximately 40 °C) *with* Attachment 22, Chesterfield Power Station, VPDES Permit No. VA0004146, Fact Sheet Attachment 5.a (90th percentile discharge temperature of 45 °C).

[92] Pursuant to its Clean Water Act permit, Dominion is required to complete its updated thermal study 270 days prior to the expiration of its permit, September 30, 2021, although the permit expiration date can be (and for CPS, historically has been) extended by multiple years. *See* Attachment 17, Chesterfield Power Station, VPDES Permit No. VA0004146 (Sept. 23, 2017). Dominion, however, could complete its thermal study well in advance of this permit deadline. *See* Attachment 12, Southern Environmental Law Center and James River Association, Final Comments on Draft VPDES Permit No. VA0004146, Dominion Chesterfield Power Station (July 21, 2016).

barrier, preventing spawning adults from migrating upstream past CPS to known spawning reaches.[93] Second, the plume is likely causing high mortality rates among early life stage Atlantic sturgeon that, if they are not first killed in the CWIS, are then exposed to the hot discharges just downstream.[94] Finally, the thermal plume is contributing significant heat to the river, raising its overall temperature and likely leading to significant effects on juveniles and migrating adults, both of which are sensitive to river temperatures and exhibit sub-lethal effects.[95]

II. LEGAL BACKGROUND

A. Endangered Species Act

The Endangered Species Act (ESA) aims to conserve endangered and threatened species and the ecosystems on which those species depend.[96] To that end, the ESA requires that all federal agencies exercise their authority to conserve ESA-listed species.[97] Moreover, the ESA requires that the Fish and Wildlife Service (FWS or the Service) and National Marine Fisheries Service (NMFS or the Service) act as expert agencies and take steps to protect and recover listed species.[98]

Section 9 of the ESA makes it unlawful for any person to "take" listed species.[99] The term "take" is broadly defined to include "harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or [ ] attempt to engage in any such conduct."[100]

Section 10 provides an exception to Section 9's take prohibition.[101] A private party may apply for an incidental take permit by developing a habitat conservation plan (HCP).[102] The HCP must detail the anticipated impact of the proposed activity on the species and its habitat, the likelihood of restoration of the affected habitat, proposed minimization, mitigation, and monitoring steps, and alternatives to the proposed take that were considered and the reasons they were rejected.[103] The plan must be "based on the best scientific and commercial data available."[104]

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[93] Kynard Report at 20-21.

[94] *Id.* at 23.

[95] *Id.* at 9, 23.

[96] 16 U.S.C. § 1531(b).

[97] *Id.* § 1531(c)(1).

[98] *Id.* §§ 1532(15); 1533.

[99] *Id.* § 1538(a)(1); 50 C.F.R. §§ 17.21, 17.31.

[100] 16 U.S.C. § 1532(19).

[101] *Id.* § 1539.

[102] *Id.*

[103] 50 C.F.R. § 222.307(b)(5)

[104] *Id.*

In deciding to issue an ITP, the Service must find that "the applicant will, to the maximum extent practicable, minimize and mitigate impacts of the taking" and that "the taking will not appreciably reduce the likelihood of survival and recovery of the species in the wild."[105] In issuing a permit, the Service must consider the "use of best available technology for minimizing or mitigating impacts" and "potential severity of direct, indirect, and cumulative impacts on the species . . . and habitat."[106]

Finally, when determining the appropriate duration of a permit, NMFS regulations require the Administrator to consider "the extent to which the conservation plan is likely to enhance the habitat of the endangered species or to increase the long-term survivability of the species."[107] The Handbook counsels against issuing a permit or, at a minimum, limiting the duration, where there is uncertainty surrounding the impacts of the take or insufficient knowledge leading to an inability to develop a conservation strategy to offset those impacts.[108]

Deciding whether to issue an ITP pursuant to Section 9 also triggers Section 7 consultation.[109] Section 7 of the ESA requires that, "in consultation with and with the Assistance of the [Service]," each federal agency shall "insure that any action authorized, funded or carried out by such agency . . . is not likely to jeopardize the continued existence of any" listed species.[110] When the expert agency (NMFS or FWS) is also the acting agency, that agency must initiate intra-Service consultation.[111] The regulations require that the acting agency make an initial determination of whether its activities "may affect" a listed species.[112] Once it determines that an action "may affect" a listed species or critical habitat, the action agency must engage in "formal consultation" with the Service unless the Service concurs in writing that the action is "not likely to adversely affect" the species.[113]

B. National Environmental Policy Act

Deciding whether to issue an ITP also triggers the National Environmental Policy Act (NEPA). [114] NEPA requires that federal agencies prepare a "detailed" environmental impact statement (EIS) for every "major federal action significantly affecting the quality of the human environment."[115] Where the significance of an action is unclear, agencies may prepare an EA and

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[105] *Id.* § 222.307 (c)(2)

[106] *Id.* § 222.307 (c)(1)

[107] *Id.* § 222.307 (e)

[108] FWS and Nat'l Marine Fisheries Service, *Habitat Conservation Planning and Incidental Take Permit Processing Handbook* (December 2016) ("Handbook"), at 7-5, 12-8 to 12-10.

[109] *Id.* at 1-9.

[110] 16 U.S.C. § 1536.

[111] Handbook at 1-9.

[112] *Id.*

[113] *Id.* at 14-24.

[114] *Id.* at 1-10.

[115] 42 U.S.C. § 4332(C); *see, e.g., Dep't of Transp. v. Pub. Citizen,* 541 U.S. 752, 757 (2004).

either make a finding of no significant impact or conclude that an EIS is necessary.[116] The regulations mandate that an EA discuss the need for the proposed action, alternatives to it, and the environmental impacts of the action and alternatives.[117]

In a NEPA alternatives analysis, agencies should consider alternatives related to the purpose and need of the federal action; i.e., responding to the permit request, while fulfilling conservation obligations under the ESA.[118] The alternatives analysis for issuing an ITP must include a "no-action" alternative.[119] In the context of permitting decisions, "no-action" means "no change" from current *no take* management levels or, if take cannot be avoided through current management or modification, then "no-action" will mean no project.[120]

In conducting an EA, and deciding whether an EIS is required, factors counseling in favor of issuing an EIS include: (1) whether the effects are highly uncertain or involve unknown risks, (2) whether the action may adversely affect an ESA-listed species or its critical habitat, (3) unique geographical characteristics of the area such as proximity to park lands or ecologically critical areas, (4) whether the action affects public health and safety, and (5) whether the action may establish a precedent for future actions with significant effects.[121] Where such factors are present, an EIS should be prepared.

The foregoing EA analysis is required to ensure agency decisionmakers consider accurate, high-quality information about environmental impacts and to make this information available to the public and encourage involvement in decisionmaking.[122] An agency action is arbitrary and capricious where the agency has "entirely failed to consider an important aspect of the problem, offered an explanation for its decision that runs counter to the evidence before the agency, or is so implausible that it could not be ascribed to a difference in view or the product of agency expertise."[123] A decision, premised on uncertainty, to move forward with a proposed project prior to a full examination of the impacts in an EIS is not consistent with the strict procedural duties mandated by NEPA.

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[116] 40 C.F.R. § 1508.9.

[117] *Id.*

[118] Handbook at 5-7.

[119] *Id.* at 13-7.

[120] *Id.* (emphasis added).

[121] 40 C.F.R. § 1508.27(b)(1)-(10).

[122] *See* 40 C.F.R. §§ 1500.1(b), 1500.2(d); *Hughes River Watershed Conservancy v. Glickman*, 81 F.3d 437, 443, 446-48 (4th Cir. 1996).

[123] *Motor Vehicle Mfrs. Ass'n v. State Farm Mut. Auto. Ins. Co.*, 463 U.S. 29, 43 (1983)).

III. PERMITTING DOCUMENTS

A. Dominion's Incidental Take Permit Application

According to its ITP application, Dominion seeks to take endangered Atlantic sturgeon at CPS for a period of 10 years.[124] Dominion seeks coverage for its normal CWIS operations, offering no modification or changes, as well as coverage for takes likely to occur in connection with its impingement and entrainment study being completed pursuant to its Clean Water Act permit.[125] Because Dominion incorrectly concludes other takes are not likely to occur, including takes relating to its thermal pollution, Dominion's application does not seek coverage for these other activities.

Dominion's application contains a number of serious flaws and insufficiencies, described in turn below.

For example, by failing to consider the most current scientific data, the application significantly underestimates the amount of take due to impingement and entrainment in the CWIS.[126] Dominion bases its entrainment take estimate on the two free embryo Atlantic sturgeon that were entrained in 2015, using those two sturgeon as an estimate of total entrainment.[127] This is not a valid methodology.[128] The entrainment study in which the free embryos were killed was performed over a 24-hour period. Dispersal of early life stage Atlantic sturgeon, however, occurs over a period of multiple weeks.[129] Dominion's small snapshot, taken before major dispersal likely occurred, in no way provides a complete picture of entrainment effects at CPS. Moreover, the capture of only free embryos during the 24-hour period indicates that the major dispersal of Atlantic sturgeon larvae had not yet occurred while the entrainment study was being performed, likely occurring after the study period had already ended.[130] Thus, the actual total entrainment that occurred in 2015 is likely to be orders of magnitude greater than incorrectly assumed by Dominion. Had the entrainment study been properly continued throughout the dispersal, the take would likely have measured in the thousands or tens of thousands.

Dominion's conceptual population dynamics model is also inaccurate. Most fundamentally, Dominion assumes a population size of 300 adults, an estimate that is not based on any real science.[131] The population size is simply not known at this point.[132] Dominion then uses this flawed estimate to justify a number of speculative assumptions, again, not based on the

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[124] ITP Application § 1.3.

[125] *Id.* §§ 5.1.1, 5.1.2.

[126] Kynard Report at 26.

[127] HCP § 3.2.

[128] Kynard Report at 25.

[129] *Id.* at 25.

[130] *Id.* at 25-26.

[131] *Id.* at 26.

[132] *Id.*

best available information. For example, Dominion assumes a sex ratio of 50:50 and that 30 to 75 mature pre-spawning females would be present in any year, but there are no studies to support these assumptions.[133] There is no scientific data available on the number of females in the James River, their body size, or number of eggs spawned in any year, and existing catch rates suggest a far lower female to male ratio.[134] Dominion also assumes that all females spawn every two to five years, yet studies indicate that sturgeon may spawn much less frequently and that in some years zero spawning occurs.[135] Reliance on these faulty assumptions, not based on the best available information, has led Dominion to greatly overestimate reproduction and the number of larvae produced each year in the James River.[136]

By combining these two errors—drastically underestimating the number of larvae to be entrained at CWIS, and then significantly overstating the total number of early life stage Atlantic sturgeon that may encounter the CWIS—Dominion incorrectly concludes that CPS only has the potential to affect a small fraction of Atlantic sturgeon. This is not correct. The CWIS at CPS are likely having a serious impact on early life stage Atlantic sturgeon, entraining a large proportion during successful spawning periods.[137]

Furthermore, even if Dominion's take estimate were accurate, taking 8,460 larvae over a 10 year period is still a significant impact on the sturgeon's recovery. Without that take, those 8,460 larvae would likely have resulted in several hundred juveniles, which would represent a critical step in recovery efforts.[138]

Dominion also improperly dismisses the risk of impingement to adult Atlantic sturgeon, focusing instead on the swimming abilities of healthy adults.[139] Dominion again does not base this conclusion on the best available information, failing to consider research that shows exhausted, post-spawned adults lack the swimming ability to escape water withdrawal velocities such as those present at CPS.[140] Moreover, Dominion fails to consider that the adult that was impinged at CPS in October 2015, during a critical spawning window and just a few days before free embryos were killed, was likely an exhausted, post-spawned adult.

In addition, Dominion's application summarily dismisses the risk of take posed by the thermal pollution at CPS. As described previously, Dominion's sole justification for dismissing this significant risk is based on an outdated, flawed study of river conditions and CPS operations 20 years ago. Both river conditions and operations at CPS have changed significantly. The best available information indicates the river is several degrees hotter during the fall spawning period than it was 20 years ago, and the plant is now discharging hotter water and more of it. Available

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[133] *Id.*

[134] *Id.*

[135] *Id.*

[136] *Id.*

[137] *Id.* at 18, 25-27.

[138] *Id.* at 27.

[139] HCP § 2.1.1.

[140] Kynard Report at 15, 25.

scientific research also indicates that the thermal plume surrounding CPS is likely acting as a physical barrier, preventing spawning adult Atlantic sturgeon from migrating upstream past CPS to spawning reaches. In addition, the thermal plume is likely causing significant mortalities of highly temperature-sensitive early life stage Atlantic sturgeon and sub-lethal harm to juveniles and adults in the James River.

Finally, Dominion fails to consider the harmful effects of noise and vibration resulting from vessel movements and maintenance activities on spawning Atlantic sturgeon, despite the best available information indicating such effects can significantly harm sturgeon and interfere with successful spawning.[141]

Despite the significant threats to Atlantic sturgeon posed by CPS, Dominion requests to operate CPS normally for a period of 10 years, without any operational changes, any structural changes, or even any interim mitigation measures that could help reduce takes as it gathers more information in its impingement and entrainment studies, and its thermal study. Based on its flawed take estimate, for example, Dominion proposes "no additional measures to avoid or minimize take" associated with the CWIS.[142] Likewise, Dominion dismisses the significant thermal effects present at CPS, proposing "no additional conservation measures," because "no direct or indirect effects of the CWIS on Atlantic Sturgeon are expected from the cooling water discharge . . . ." Dominion summarily rejects consideration of seasonal operational changes, as well as changes to its CWIS, because of time and expense concerns, downplaying the significant threats CPS operations poses to the species.[143]

Similar to its rejection of any mitigation measures, Dominion's proposed habitat conservation plan does not involve conserving any habitat.[144] Rather, Dominion's inadequate proposed habitat conservation plan involves donating Atlantic sturgeon that are killed at CPS to research,[145] and providing three receivers to assist in existing tracking programs.[146]

B. Draft Environmental Assessment

The Draft Environmental Assessment (EA) issued by NMFS fails to identify or remedy the many fundamental problems present in Dominion's ITP application.

For example, the Draft EA accepts Dominion's flawed take estimate at face value,[147] despite available information indicating that the actual take resulting from the CWIS at CPS will be much higher, measuring in the thousands or tens of thousands. Similarly, the Draft EA fails to consider that exhausted, post-spawned adults can be impinged in the CWIS at CPS, and fails to consider the significant effects thermal pollution at CPS is having on the survival and recovery

[141] *Id.* at 31-32.

[142] HCP § 4.3.1.

[143] *Id.* §§ 5.2.1, 5.2.2.

[144] *Id.* § 4.4.

[145] *Id.* § 4.4.1.

[146] *Id.* § 4.4.2.

[147] Draft EA at 22-23.

of Atlantic sturgeon. By accepting these flawed estimates and studies, and ignoring best available information to the contrary, NMFS incorrectly concludes that the threat to sturgeon posed by CPS is minimal, that no real mitigation measures are required, and that no meaningful habitat conservation measures are required.

The alternatives analysis contained in the Draft EA is also flawed. For example, NMFS considers a "no action" alternative that is contrary to its own guidance. Under the "no action" alternative, NMFS assumes that no ITP would be issued, and therefore Dominion's proposals to assist with existing research would not happen. But it also assumes, incorrectly, that Dominion could operate the plant without any changes.[148] Dominion has already acknowledged that its operations are likely to result in take. Operating the plant in this way would likely result in numerous violations of the Endangered Species Act. No-action alternatives are required to consider alternatives at "no take" levels. NMFS also rejects a five-year permit term alternative, again relying primarily on the incorrect assumption that impingement and entrainment are rare events at CPS.[149]

IV. ISSUANCE OF THE PROPOSED INCIDENTAL TAKE PERMIT WOULD VIOLATE THE ENDANGERED SPECIES ACT AND IMPLEMENTING REGULATIONS.

Due to a number of fundamental deficiencies in the ITP application, issuance of the permit as currently written would violate the ESA and implementing regulations.[150]

A. Dominion Has Not Provided a Conservation Plan Consistent With Express Requirements.

An applicant for an incidental take permit must provide a conservation plan that, based on the best scientific and commercial data available, specifies the anticipated impact of the proposed activity on the species, its habitat, and the likelihood of restoration of the affected habitat.[151]

Dominion has failed to use the best information available to estimate the anticipated take and impact on the affected habitat. In estimating the amount of take due to the CWIS at CPS, for example, Dominion relies on improper assumptions that are not based on science. Dominion

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[148] *Id.* at 7, 26-27.

[149] *Id.* at 28.

[150] In addition, in its official public notice seeking comments on the ITP application, NMFS included an incorrect link in its instructions for electronic submissions. NOAA, Endangered Species File No. 21516, Request for Public Comments, 82 Fed. Reg. 37849 (Aug. 14, 2017) ("Public Notice"). Members of the public who sought to submit comments using the link in the official public notice were directed to an error page. SELC notified NMFS of this error on September 12, 2017 and requested a reasonable extension of the comment deadline given the fact that NMFS' error may have resulted in members of the public being prevented from filing comments. NMFS declined this request.

[151] 50 C.F.R. § 222.307(b)(5).

bases its annual take estimate on the take of two free embryos in 2015 during a single 24-hour sampling period, improperly taking this snapshot study and scaling the results to estimate total entrainment. But in fact, all available information indicates that total entrainment, had the sampling continued throughout the likely dispersal phase as it should have, would have been orders of magnitude greater, numbering in the thousands or tens of thousands. But Dominion did not continue the study and instead, thousands of dispersing larvae were likely killed and destroyed in the CWIS, evading any detection. Dominion's estimate is also fundamentally flawed through its use of a population estimate (300 spawning adults) not based in science, a sex ratio (50:50) not grounded in any study and contrary to research indicating few females in the James River population, and an assumed recurring spawning period (between two and five years) that fails to reflect research indicating spawning is likely to occur much more infrequently.[152]

Importantly, because of critical flaws in Dominion's entrainment study design, the results of those studies will still not allow for an accurate prediction of entrainment effects at CPS. As described previously, Dominion's entrainment study relies on twice per month sampling (with samples collected every 6 hours in a 24 hour period).[153] In essence, Dominion will take a snapshot every two weeks. But dispersal can happen over the course of a few days or a week. Without sustained sampling during the entire spawning window, it is entirely possible that Dominion will miss the entire dispersal altogether, or it may only catch the beginning or tail end of dispersal, when the numbers of dispersing early life stage sturgeon are low. Only taking a snapshot does not allow for an estimate of total entrainment to be made with any semblance of accuracy.

Dominion also fails to address the fact that its operations have been ongoing for decades. Thus, CPS has likely already resulted in the take of untold numbers of early life stage Atlantic sturgeon over the course of many years. In other words, it is possible, if not probable, that CPS has stunted the recovery of Atlantic sturgeon in the James River for many years. Yet Dominion's take estimate does not take into consideration the cumulative effects that its operations have had on the James River spawning population.[154]

In addition, Dominion fails almost entirely to consider the likely impacts the thermal pollution at CPS is having on Atlantic sturgeon and the critical habitat at CPS, relying exclusively on a flawed, 20 year old study. Atlantic sturgeon, however, are likely to avoid river temperatures higher than 26 °C. Even Dominion's own study suggests this avoidance is exactly what is occurring at CPS due to the hot water discharges. Thus, the thermal discharges at CPS are likely acting as a physical barrier, preventing pre-spawning adults from reaching spawning locations at or upstream of CPS. The thermal pollution is also likely killing a large proportion of early life stage Atlantic sturgeon, which are highly sensitive to water temperature, as well as harming juveniles and adults.

Likewise, Dominion fails entirely to consider the fact that the James River, including at CPS, has now been designated as critical habitat for the Atlantic sturgeon. Dominion's HCP

[152] Kynard Report at 7, 26.

[153] ITP Application, Appendix A at 31.

[154] 50 C.F.R. § 222.307(c)(1)(ii).

does not address this fact, nor does it consider how the CWIS or thermal pollution is affecting such habitat. Although the critical habitat was finalized after Dominion submitted its application, such timing does not alter the requirements of an incidental take permit application. The ITP application directly affects critical habitat, yet this important consideration is entirely unaddressed. Even if the James River had not been designated critical habitat, Dominion's application would still be legally insufficient. An ITP application must consider habitat impacts using the best available information,[155] yet Dominion fails to consider the impacts of CPS to habitat in any meaningful way. The deficiency of Dominion's analysis of habitat impacts is simply made more apparent now that NMFS has designated the James River as critical habitat.

Because Dominion has not submitted a conservation plan based on the best scientific and commercial data, as expressly required by the ESA and implementing regulations, NMFS cannot legally issue the permit in its current form.[156]

B. Issuing the Proposed ITP Will Appreciably Reduce the Likelihood of Survival and Recovery of the Endangered Atlantic Sturgeon in the James River.

In order to issue an incidental take permit, the Assistant Administrator must find that the "taking will not appreciably reduce the likelihood of the survival and recovery of the species in the wild."[157] Such a finding cannot be supported here.

The James River Atlantic sturgeon are critical to the survival of the entire Chesapeake Bay DPS. One study estimates James River sturgeon make up 92 percent of the entire population segment.[158] In terms of spawning population, that number may be even higher. For example, just five years ago, the James River represented the only known spawning river for the entire Chesapeake Bay DPS, according to NMFS.[159] Although limited spawning evidence in two other rivers now exists, the "James River spawning population remains critical to the survival and recovery of the Chesapeake Bay DPS as a whole."[160]

Thus, the significant effects the CWIS and thermal pollution at CPS are likely having on Atlantic sturgeon pose a significant threat to the entire population segment. The best available scientific information indicates that Dominion's CWIS operations at CPS are likely resulting in the death of thousands or even tens of thousands of early life stage Atlantic sturgeon during successful spawning periods. Without these takes, hundreds or even thousands more juveniles would likely be alive and growing in the James River—a critical step towards recovery for a slow-growing, late-maturing species. But issuing the proposed ITP will allow these takes to

[155] *Id.* § 222.307(b)(5)(ii).

[156] *Id.* § 222.307(b)(5).

[157] *Id.* 222.307(c)(2)(iii).

[158] Kynard Report at 5.

[159] 77 Fed. Reg. 5883.

[160] Kynard Report at 5.

continue unchecked for 10 years, significantly and adversely affecting reproductive success and ensuring that the recovery of the Chesapeake Bay DPS remains at risk.[161]

Along these lines, issuing the 10-year permit as requested is contrary to NMFS' own guidance. Existing data indicates CPS is having a significant effect on the survival and recovery of the Atlantic sturgeon, but to the extent uncertainties exist, NMFS' own guidelines counsel against issuing this permit or, at a minimum, limiting its duration.[162]

C. The Proposed ITP Fails to Mitigate and Minimize Impacts to Atlantic Sturgeon, Conserves No Habitat, and is Otherwise Legally Inadequate.

NMFS must also find that the "applicant will, to the maximum extent practicable, monitor, minimize, and mitigate the impacts of such taking."[163] With no changes to operations at CPS, and no habitat conservation, Dominion's HCP does not fulfill this requirement.[164]

Based on its flawed and legally insufficient analysis of the CWIS and thermal effects at CPS, Dominion dismisses the need for any mitigation measures, including structural or operational changes. Downplaying the significant effects on Atlantic sturgeon, Dominion summarily rejects changes that could reduce takes of endangered sturgeon as too expensive or time-consuming. For example, Dominion rejects seasonal changes to its operations without any analysis.[165] Dominion could modify its CWIS, installing a more efficient re-circulating cooling system or installing variable speed pumps that could reduce intake volume and velocity during key spawning periods. But Dominion rejects any such modifications to its CWIS, again without meaningful analysis.[166]

Dominion claims such modifications are not appropriate, in large part, because it needs to complete its impingement and entrainment studies.[167] Dominion fails to acknowledge, however, that it requires at most three years of data to complete such studies,[168] and thus, these studies do not support the issuance of a 10-year permit. Dominion also fails to consider interim measures that could reduce the impact to sturgeon while it completes its studies. For example, Dominion could install finer mesh that would reduce impingement, or a guiding net to steer exhausted, post-spawned adults away from the CWIS.[169]

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[161] Handbook at 12-3.

[162] *Id.* at 7-5, 12-8 to -10.

[163] 50 C.F.R. 222.307(c)(2)(ii).

[164] Handbook at 3-19 (noting that Services "must not use … research/recovery permitting interchangeably).

[165] HCP § 5.2.1.

[166] *Id.* § 5.2.2.

[167] *Id.*

[168] Draft EA at 10.

[169] Kynard Report at 29-30.

Because Dominion improperly disregards thermal impacts, it considers no mitigation measures whatsoever, such as a cooling pond or a re-circulating cooling system that would drastically reduce the thermal pollution entering the river.[170] Given the likelihood that CPS is having a significant effect on the survival and recovery of the Atlantic sturgeon, Dominion's proposal of no mitigation measures does not fulfill the requirement that the applicant minimize and mitigate the impacts of such taking "to the *maximum extent practicable*."[171]

D. NMFS Must Issue a Biological Opinion Under Section 7 of the ESA.

If an agency action "may affect" a listed species or critical habitat, the acting agency must engage in "formal consultation" with the Service.[172] According to its public notice, NMFS will be evaluating whether to do so after this public comment period has ended.[173] Given the likely impact at issue here, and other uncertainties that could help be resolved through formal consultation, NMFS must conduct a formal intra-Service consultation in accordance with Section 7 of the ESA and issue a Biological Opinion.

As described throughout these comments, issuing the proposed ITP is likely to adversely affect Atlantic sturgeon in a number of ways. The harmful effects of the CWIS and thermal pollution at CPS are likely to result in significant takes of Atlantic sturgeon and dramatically interfere with spawning. These activities, if authorized by the ITP, are likely to threaten the survival and recovery of the Chesapeake Bay DPS as a whole. Moreover, given the significant uncertainties about numerous critical issues, including the spawning population size, the sex ratio, and the precise location of spawning reaches—uncertainties already acknowledged by NMFS[174]—a formal consultation would allow NMFS to help develop this information and thereby better understand the actual impacts CPS is having on Atlantic sturgeon.

V. THE DRAFT ENVIRONMENTAL ASSESSMENT FAILS TO SATISFY THE REQUIREMENTS OF NEPA.

In connection with the ITP application, NMFS has issued only a draft environmental assessment. Federal agencies, however, must prepare a "detailed" EIS when a major federal action significantly affects the quality of the human environment.[175] Moreover, an agency cannot fail to consider important aspects of problems, or offer explanations for decisions that run counter to the evidence before the agency.[176] A decision, premised on uncertainty, to move forward with a proposed project prior to a full examination of the impacts in an EIS, is not consistent with the strict procedural duties mandated by NEPA.

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[170] *See* HCP § 5.2.6.

[171] 50 C.F.R. 222.307(c)(2)(ii) (emphasis supplied).

[172] Handbook at 14-24.

[173] Public Notice at 37,581.

[174] Draft EA at 27.

[175] 42 U.S.C. § 4332(C); *see, e.g., Dep't of Transp. v. Pub. Citizen*, 541 U.S. 752, 757 (2004).

[176] *Motor Vehicle Mfrs. Ass'n v. State Farm Mut. Auto. Ins. Co.*, 463 U.S. 29, 43 (1983)).

For the reasons describe below, this Draft EA fails to comply with these requirements, with multiple factors warranting a full EIS review. NMFS should not issue any incidental take permit until it has undertaken this more fulsome review and issued a draft EIS.

A. NMFS Should Have Prepared an EIS Since the Best Available Science Indicates the Issuance of This Permit Will Significantly Affect the Endangered Atlantic Sturgeon.

NMFS has an independent duty to investigate the likely impact of issuing an incidental take permit, rather than relying on Dominion's own representations.[177] Here, the best available science indicates the issuance of this permit will have a significant impact on sturgeon, due to both the impingement and entrainment effects of the CWIS and the thermal plume surrounding CPS. Although uncertainty remains as to precise figures, in all likelihood, the amount of take from the CWIS likely numbers in the thousands or tens of thousands. The thermal plume is also likely having a dramatic effect of reproductive success and survival. The best available science indicates that the thermal plume is acting as a physical barrier preventing upstream migration for spawning, killing early life stage sturgeon and otherwise harming juveniles and adults.

Yet in its draft EA, NMFS fails to conduct an adequate, independent investigation into any of these impacts. Instead, NMFS accepts Dominion's flawed take estimates—estimates that are based on speculative assumptions not grounded in any science—without undertaking its own analysis. NMFS also accepts Dominion's conclusion that there is no appreciable thermal effects, allowing Dominion to rely on a fundamentally flawed study that examined 20-year-old data no longer applicable to the current river conditions or plant operations. NMFS fails entirely to consider the effects of noise and vibration from certain activities at CPS, activities that could easily be made subject to time-of-year restrictions during critical spawning windows.

Given that the best available science indicates CPS is having a significant impact of the survival and recovery of James River Atlantic sturgeon and the Chesapeake Bay DPS, NMFS should conduct and issue for public comment a full EIS.[178]

B. An EIS is Also Warranted Since the Proposed Action Takes Place In and Significantly Impacts Critical Habitat.

An EIS should also be prepared in circumstances where the agency action may adversely affect critical habitat of an endangered species and ecologically critical areas.[179] NMFS finalized critical habitat for Atlantic sturgeon on August 17, 2017, designating the entirety of the Lower James River, including at CPS.

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[177] *Webster v. U.S. Dep't of Agriculture*, 685 F.3d 411, 423 (4th Cir. 2012); *Van Abbema*, 807 F.2d at 643 (vacating grant of permit and finding that when information is specifically and credibly challenged as inaccurate, the Corps has an independent duty to investigate the specific factual challenges made by plaintiffs to reports).

[178] 40 C.F.R. § 1508.27(b)(3), (9).

[179] *Id.* § 1508.27(b)(9).

Here, the best available science indicates that the proposed action will significantly impact designated critical habitat and ecologically critical areas. Yet again, NMFS fails to consider this significant effect, allowing Dominion to continue operations at current management levels. CWIS operations at Chesterfield are removing habitat for early life stage sturgeon and exhausted post-spawned adults by creating an area near the bottom of the channel where the endangered fish are likely to be caught in the CWIS flow and impinged or entrained. The CWIS area of influence is the precise habitat where Atlantic sturgeon—both dispersing early life stages and pre- and post- spawning adults—are most likely to be found. Similarly, the thermal plume is also likely acting as a physical barrier to spawning adults, preventing them from reaching spawning locations at or upstream of CPS. Thus, the thermal plume is not only preventing critical habitat from being used for spawning in the immediate vicinity, but it is also preventing sturgeon from accessing suitable habitat further upstream. The thermal issues are further compounded as the heat flows downstream, contributing to a warming of the river to sub-lethal temperatures for juveniles and migrating adults near the saltwater interface.

Given the significant effects the action is likely to have on critical habitat, NMFS should conduct a more thorough impacts analysis in an EIS.[180]

C. The High Levels of Uncertainty Concerning the James River Population, Reproductive Success, and Other Important Issues Should Have Triggered an EIS.

In determining significance of the impact, the agency should consider "[t]he degree to which the possible effects on the human environment are highly uncertain[.]"[181] Since a number of important uncertainties exist, as plainly acknowledged in the draft EA itself, NMFS should conduct a full EIS.[182]

For example, one of the fundamental flaws in Dominion's take estimate stems from speculative assumptions, not based on science, about the spawning population present in the James River. NMFS even acknowledges these key uncertainties, stating, for example, that there is "limited understanding of Atlantic sturgeon biology, ecology, population dynamics, and of the specific stressors that cause the Chesapeake Bay DPS of Atlantic sturgeon to be endangered."[183] In the James River, NMFS states that "fundamental knowledge gaps persist regarding population size and age structure, specific locations and extent of viable spawning habitat, sex ratios of spawning cohorts, natural mortality and growth rates of early life stages, timing and pathways of larval and juvenile stage migrations, and habitat and environmental requirements."[184]

These foundational uncertainties raise the question of how NMFS is able to conclude that the issuance of the ITP application will not pose a significant threat to Atlantic sturgeon. The existence of "fundamental knowledge gaps" would logically prevent the agency from reaching

[180] *Id.* § 1508.27(b)(3).

[181] *Id.* § 1508.27(b)(5).

[182] *Id.* § 1508.27(b)(5).

[183] Draft EA at 27.

[184] *Id.* at 27.

such a conclusion. Indeed, courts have held that "uncertainty concerning the effects of important aspects of the proposed action on the [species] preclude[s] a 'finding' that the effects of the proposed action … would not be significant[.]"[185]

Moreover, these knowledge gaps should be addressed by researchers and scientists using careful application of the scientific method. Dominion is not a scientist, nor is CPS a laboratory.[186] Operating a power plant that happens to kill potentially tens of thousands of endangered Atlantic sturgeon, and thereafter donating the dead fish to researchers, will not fill these knowledge gaps, nor would it be the proper way to do so. A better way, for example, would be for NMFS to engage in formal consultation and complete a Biological Opinion. Dominion's purported contributions to the scientific understanding of James River Atlantic sturgeon are negligible and in no way sufficient to negate the dramatic effect CPS is already having on the population's recovery and survival.

D. Alternatives analysis is fundamentally flawed and contrary to requirements.

NMFS' entire alternatives analysis is also fundamentally flawed. Most fundamentally, each alternative analyzed fails to meet one of the main purposes of the action, i.e., NMFS fulfilling their "conservation obligations under section 10 of the ESA."[187] None of the alternatives include, for example, any actual habitat conservation measures, or structural or operational changes at CPS that could reduce or minimize its effects on Atlantic sturgeon.

In particular, the first "no-action" alternative improperly formulates what would occur if no permit were to be issued. Issuing of an ITP requires NMFS to consider a "no-action" alternative in which there is no take or, if the take is unavoidable, no project.[188] Contrary to this guidance, NMFS' "no-action" alternative in the draft EA would allow Dominion to continue operating at current management levels. But Dominion has already acknowledged that current management levels likely result in takes, and thus, NMFS "no-action" alternative envisions Dominion operation in perpetual violation of the ESA. This is not proper. Under a correct "no-action" alternative, Dominion would not be allowed to operate at current operation levels because these levels result in the take of an ESA-listed species.

The analysis of Alternative 2 (the proposed plan) is flawed in its failure to consider mitigation and monitoring as two distinct requirements. Guidance requires the use of monitoring

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[185] *Sierra Club v. Norton*, 207 F. Supp. 2d 1310, 1331, 1334 (S.D. Ala. 2002) (also noting that "it would seem that any alleged 'finding' that the project will not significantly affect the species is the purest sophistry."); *see also Nat'l Parks & Conservation Ass'n v. Babbitt*, 241 F.3d 722, 731-32 (9th Cir. 2001) (finding that "[p]reparation of an EIS is mandated where uncertainty may be resolved by further collection of data" and that "[t]he purpose of an EIS is to obviate the need to speculation by insuring that available data are gathered and analyzed prior to implementation of the proposed action.") (quotations omitted).

[186] Handbook at 3-21 (noting that take due to monitoring activities should be covered in an ITP, NMFS "must also consider the qualifications of those who would perform such work").

[187] *Id.* at 5-7.

[188] *Id.* at 13-7.

in order to assess the effectiveness of mitigation and restoration efforts.[189] Contrary to this guidance, the Alternative 2 analysis accepts monitoring as Dominion's sole mitigation measure. This merging of monitoring and mitigation clearly runs counter to NMFS' duty to consider appropriate alternatives in its NEPA analysis.[190]

The analysis of Alternative 3 also runs counter to NMFS' own guidance. In Alternative 3, NMFS considers a five-year permit duration, but uses uncertainty of the impact to find in favor of the longer permit duration. Similar to Alternative 2, this analysis is contrary to guidance, which counsels in favor of a shorter permit duration where there is a greater degree of uncertainty.[191]

VI. CONCLUSION

CPS is likely having a major deleterious effect on the survival and recovery of the James River Atlantic sturgeon and the Chesapeake Bay DPS. Given these effects, and the inadequacies of the ITP application and the draft EA, we respectfully request that NMFS deny the permit as written.

NMFS should instruct Dominion to resubmit its application to resolve a number of deficiencies. Dominion should be required to:

(1) Fully consider the real risks posed by the CWIS using the best available information, including by improving the quality of its entrainment study, and submit a more accurate estimate of take or identify what additional information is needed in order to do so;

(2) Fully analyze the thermal effects that CPS is likely having on Atlantic sturgeon, including to the extent possible, an estimate of such takes and an analysis of how the current thermal plume surrounding CPS is affecting spawning;

(3) Fully analyze the effects that noise and vibration effects associated with vessel movements and maintenance activities are likely having on Atlantic sturgeon;

(4) Consider in detail a full suite of mitigation measures at CPS, including time-of-year restrictions, seasonal operational changes, changes to its CWIS, including installing a re-circulating cooling water system, variable speed pumps, or small mesh screens, as well as interim measures that could be implemented immediately;

(5) Evaluate and propose actual habitat conservation measures designed to offset anticipated takes, including through habitat restoration and other efforts that could directly benefit species recovery; and

[189] *Id.* at 10-3.

[190] 42 U.S.C. § 4332(E).

[191] Handbook at 12-9.

(6) Evaluate and propose substantial measures to support, assist, and fund critical research needed to fill in fundamental gaps in our understanding of the James River Atlantic sturgeon and ultimately advance recovery of the species and its habitat.

In addition, NMFS should perform a full EIS for the issuance of this permit due to the likely significant effects on the recovery of the population. Likewise, NMFS should initiate formal consultation in accordance with Section 7 of the ESA and issue a Biological Opinion.

Finally, SELC and JRA, along with Dr. Kynard, request to meet with NMFS at its Gloucester office, in order to discuss these issues in person, prior to any permit issuance.

Thank you for your consideration of these comments.

Sincerely,

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Encls:
See Attachments

ATTACHMENTS

Attachment	Title / Description
1	B. Kynard, PhD., Effects of Chesterfield Power Station, James River, Virginia on Atlantic Sturgeon (Sept. 8, 2017)
2	Curriculum Vitae of B. Kynard
3	Selected Literature Cited in Kynard Report
4	James River Association, About the James River, *available at* https://jrava.org/about-the-james-river/
5	Dominion Energy Virginia, Chesterfield Power Station, Brief Facts, *available at* https://www.dominionenergy.com/about-us/making-energy/coal-oil/chesterfield-power-station
6	National Park Service, US Dep't of the Interior, Making the Trail Visible and Visitor Ready: Progress on the James River Segment (Dec. 2013)
7	Chesterfield County, Parks and Recreation, Dutch Gap Conservation Area - Outdoor Programs, *available at* http://www.chesterfield.gov/DutchGap/
8	Chesterfield County, Parks and Recreation, Map of Dutch Gap Conservation Area
9	National Oceanic and Atmospheric Administration, Chesapeake Bay Office, Atlantic Sturgeon Fish Facts, *available at* https://chesapeakebay.noaa.gov/fish-facts/atlantic-sturgeon
10	Hunter Reardon, *Out of the Depths*, Richmond Magazine (Feb. 26, 2014), *available at* http://richmondmagazine.com/news/features/out-of-the-depths-02-26-2014/
11	Hardywood Parkcraft Brewery, The Great Return, *available at* https://hardywood.com/beers/great-return/
12	Southern Environmental Law Center and James River Association, Final Comments on Draft VPDES Permit No. VA0004146, Dominion Chesterfield Power Station (July 21, 2016).
13	Southern Environmental Law Center and James River Association, Comments on Proposed Designations of Critical Habitat for the Gulf of Maine, New York Bight, and Chesapeake Bay Distinct Population Segments of the Atlantic Sturgeon, 81 Fed. Reg. 35,701 (June 3, 2016) and for the Endangered Carolina and South Atlantic Distinct Population Segments of Atlantic Sturgeon, 81 Fed. Reg. 36,078 (June 3, 2016)
14	R. Stewart, et al., *Horizontal cooling towers: riverine ecosystem services and the fate of thermoelectric heat in the contemporary Northeast US*, IOP Publishing, Envt'l Res. Letter 8 (2013)
15	Chesterfield Power Station, VPDES Permit No. VA0004146, Fact Sheet Attachment 4.a (Sept. 23, 2016)

16	Chesterfield Power Station, VPDES Permit No. VA0004146, Fact Sheet (Sept. 23, 2016)
17	Chesterfield Power Station, VPDES Permit No. VA0004146 (Sept. 23, 2017)
18	Energy and Water in a Warming World Initiative, *Freshwater Use by U.S. Power Plants* (Nov. 2011) at pp. 25, 28-29
19	Email Chain from J. Brunkow to H. Deihls (VDEQ) re: Fish Kill and Water Temps in Farrar Gut (July 2017)
20	Photograph of Fish Kill at Chesterfield Power Station (July 2017)
21	Chesterfield Power Station, VPDES Permit No. VA0004146, Fact Sheet, Attachment 5.b
22	Chesterfield Power Station, VPDES Permit No. VA0004146, Fact Sheet Attachment 5.a
23	D. H. Secor & T. E. Gunderson, *Effects of hypoxia and temperature on survival, growth, and respiration of juvenile Atlantic sturgeon, Acipenser oxyrinchus*, Fishery Bulletin 96(3) (1998)
24	Discover the James, Atlantic Sturgeon Tour, *available at* http://discoverthejames.com/?q=content/atlantic-sturgeon-tour
25	Atlantic States Marine Fisheries Commission, Atlantic Coast Diadromous Fish Habitat: A Review of Utilization, Threats, Recommendations for Conservation, and Research Needs (Jan. 2009)
26	HydroQual, Thermal Modeling of Chesterfield Power Station on the James River and Farrar Gut (2003)