UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
GREATER ATLANTIC REGIONAL FISHERIES OFFICE
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JAN 28 2016

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US Army Corps of Engineers
Norfolk District
Regulatory Office
Received by: RLS
Date: Jan 28, 2016

Re: NAO-2012-00080 Dominion Surry-Skiffes Creek-Whealton Transmission Line Project

Dear Mr. Steffey,

On April 16, 2014, we completed informal consultation, pursuant to section 7 of the Endangered Species Act (ESA) of 1973, as amended, with the Army Corps of Engineers, Norfolk District (ACOE) regarding Dominion Virginia Power's proposed Surry-Skiffes Creek-Whealton 500 kV aerial transmission line project on the James River. In your June 10, 2015 letter, you requested re-initiation of that consultation to consider changes to the proposed action, as well as to consider new information about listed species in the action area, and you determined that effects of the modified project are not likely to adversely affect any ESA listed species under our jurisdiction. After receiving a follow-up letter on November 25, 2015, and additional information on December 17, 2015 and December 29, 2015, we have reviewed all materials related to the project.

Re-initiation of consultation is required where discretionary federal involvement or control over the action has been retained or is authorized by law and: (a) the amount or extent of taking specified in the incidental take statement is exceeded; (b) new information reveals effects of the action that may not have been previously considered; (c) the identified action is subsequently modified in a manner that causes an effect to listed species; or (d) a new species is listed or critical habitat designated that may be affected by the identified action.

In 2014, the proposed action was determined as "not likely to adversely affect" listed species, and we concurred with this finding; therefore, no incidental take was exempted. Based on the information you have provided, we have determined that the changes to the proposed action may cause effects to Atlantic sturgeon (the only listed species in the action area), to an extent that was not previously considered in our April 2014 letter of concurrence. Additionally, new information about Atlantic sturgeon in the action area triggers the need to reanalyze the effects of the action on Atlantic sturgeon. Thus, for the reasons set forth above, we have determined that re-initiation of consultation is appropriate. Also, we concur with your determination that the modified project and new information is not likely to adversely affect listed species. Our supporting analysis is presented below.

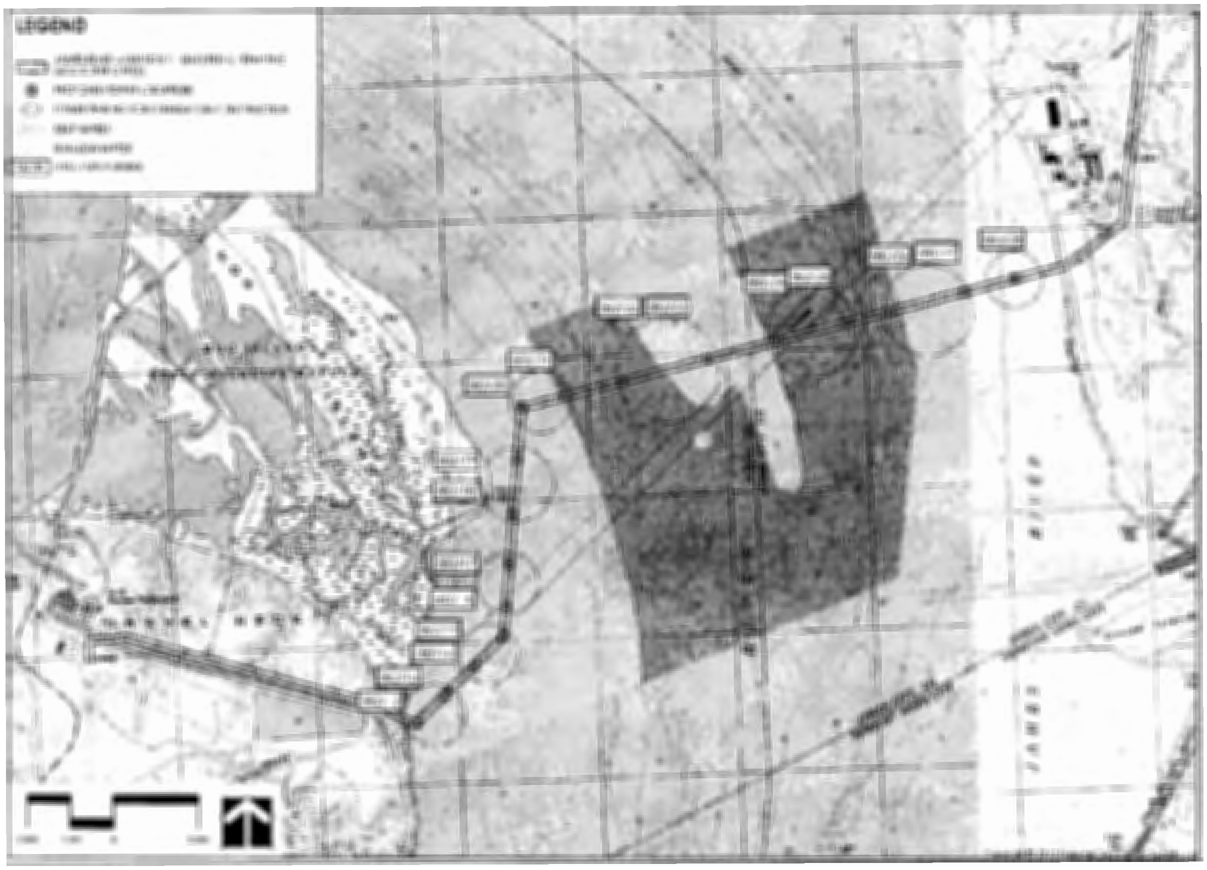
Changes to the Proposed Action

A description of the proposed action was included in our April 16, 2014, letter of concurrence. We incorporate that description by reference. With the exception of the changes described below, the proposed action remains as described in the April 2014, letter of concurrence. The action still includes the installation of an aerial transmission line across the James River that will require the placement of 17 in-stream towers and 4 fender protection systems. The site location remains at approximately 30 miles upstream from the confluence with Chesapeake Bay, where the river is 2.84 miles (14,767 feet) wide, and water depths range from 2 to 20 feet. Changes to the action include an increase in direct impacts to subaqueous bottom from 1,142 square feet to 2,712 square feet. Changes also include an increase in the number and type of piles from a previous total of 552 steel piles to 656 steel or fiber hollow piles, ranging in diameter from 24 to 30 inches rather than 18 to 30 inches. There will be a total of 49,211 square feet of subtidal encroachment (i.e., shading, water column occupation above the substrate from towers, etc.).

Each of the 17 towers is constructed of steel lattice with four separate foundation leg supports. Cumulatively these foundation supports will consist of 416 24-inch outer diameter steel piles, each installed within a 26-inch outer diameter protective fiberglass sleeve. The steel piles will be driven with an impact hammer, and the fiberglass sleeves will be handjetted. The sleeves will still be backfilled with grout, but the concrete caps will now be placed approximately 7 feet above mean high water (MHW) rather than 6 feet. The four fender systems will be installed adjacent to the Tribell Shoal Federal Navigation Channel and Secondary Barge Channel. Each fender will be 600 linear feet, rather than 528 feet, and constructed with 12-inch by 12-inch fiberglass reinforced timber wales attached to 30-inch hollow fiber piles on 10-foot centers. Installation of fiber piles will be via impact or vibratory hammer. Five wales will be attached to each fiber pile starting at approximately MHW elevation and extending 9 feet above MHW to the top of the pile. Each sea timber wale will be spaced using 8-inch by 12-inch by 12-inch sea timber blocks. A total of 60 fiber piles will be used for each of the four fender systems for a total of 240 piles. Bubble curtains will be used at all times during all pile driving activities. Ramp-up methods, which will gradually increase impact hammer intensity over the course of a single pile installation, will also be used.

The construction timing has changed to reflect new information about Atlantic sturgeon in the action area. Since the April 2014 consultation, it is now understood that Atlantic sturgeon make fall spawning runs in the James River, and stage in the deep water portions of the action area, near the federal channel from late spring (May-June) until November, and then travel upstream from the action area to spawn between August and November, after which the fish rapidly exit the river (Balazik *et al.* 2012; Balazik and Musick 2015). In recognition of the importance of this new information, the applicant will adhere to time of year restrictions (TOYR) for all work performed in deep water habitat within the action area in order to avoid Atlantic sturgeon staging prior to their fall spawning run. Towers 21, 22, 24, 25, and 26 are all located within deep water habitat, and work will only occur on these towers between November 16 and February 14 of any given year. Adherence to this work schedule also considers and avoids the spring anadromous fish spawning runs that occur from approximately March through May when fish travel through the deep water portions of the action area, as well as potentially opportunistically feed and utilize nearby shallow water habitat. The applicant has provided maps that indicate that deep water habitat in the action area and surrounding portions of the James River range in depth from approximately 10-20 feet. Shallow water ranges from 2-10 feet. As depicted in Figure 1, the linear extent of the transmission line in the river is approximately 23,867 feet (approximately 9,000 liner feet along the western shore of the river and 14,767 feet across). This equates to a cross-sectional portion of the James River of approximately 132,903,000 square feet that encompasses the action area (which is discussed below), as well as the surrounding Atlantic sturgeon habitat along the length and width of the river where the transmission line will be constructed. The tower construction in deep water habitat will occur in a cross-sectional deep water area equating to approximately72,250,000 square feet, and includes the action area. In order to accomplish all work on the towers in deep water habitat, multiple pile driving rigs may be used during the time frame of November 16 to February 14. All work on towers in shallow water (towers 12-20, 23, 27, and 28) will proceed during the time of year restriction (February 15 to November 15). There is approximately 60,653,000 square feet of shallow habitat in the same cross-section area where the transmission line will be constructed, also encompassing the action area. Vessels associated with the action include one crane barge and one material barge, 1-2 tugboats, and several crew vessels during operations.

Figure 1. Transmission Line Crossing and Surrounding Deep and Shallow Water Habitat



Action Area

The action area is defined as "all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action" (50 CFR§402.02). The action area for this project consists of the entire length of the 23,867 feet of the transmission line across the James River (including the aerial lines) , all subtidal areas where direct, permanent impacts from tower installation will occur (cumulatively 2,712 square feet), all subtidal encroachment areas (i.e., where towers will now shade previously open substrate) (cumulatively 49,211 square feet), and where the effects of pile driving (i.e., increases in underwater noise, suspended sediment; as described in the effects section below) will be experienced in the James River (See Figure 2).

Figure 2. Summary of Subtidal Impacts

Structure No.	Impact No.	Tower Design/ Foundation System	Size of Tower Footprint (ft. x ft.)	Permanent River Bottom Impact (SF)	Subaqueous Encroachment (SF)	# of Pilings
582/12	PU1	5V DEA/PP8	58 x 58	118	3364	32
582/13	PU2	5V HT/PP4	39 x 32	59	1248	16
582/14	PU3	5V HT/PP4	39 x 32	59	1248	16
582/15	PU4	5V HA/PP8	51 x 51	118	2601	32
582/16	PU5	5V HT/PP4	39 x 32	59	1248	16
582/17	PU6	5V HT/PP4	39 x 32	59	1248	16
582/18	PU7	5V HT/PP4	45 x 37	59	1665	16
582/19	PU8	5V HT/PP4	45 x 37	59	1665	16
582/20	PU9	5V DEA/PP8	58 x 58	118	3364	32
582/21	PU10	Channel Crossing/PP10	72 x 72	148	5184	40
582/22	PU11	Channel Crossing/PP10	72 x 72	148	5184	40
582/23	PU12	5V HT/PP4	52 x 42	59	2184	16
582/24	PU13	5V HT/PP4	52 x 42	59	2184	16
582/25	PU14	Channel Crossing/PP10	68 x 68	148	4624	40
582/26	PU15	Channel Crossing/PP10	68 x 68	148	4624	40
582/27	PU16	5V HT/PP4	50 x 40	59	2000	16
582/28	PU17	5V HT/PP4	50 x 40	59	2000	16
582/21 Fender	PU40	-	-	294	894	60
582/22 Fender	PU40	-	-	294	894	60
582/25 Fender	PU41	-	-	294	894	60
582/26 Fender	PU41	-	-	294	894	60
		Total		**2,712**	**49,211**	**656**

Analysis of similar pile driving activities indicates that the effects of increased underwater noise are likely to be experienced within a 230-foot radius of the piles to be driven. Elevated suspended sediments caused by pile driving are expected to be minor and will dissipate to background levels within approximately 300-feet of the impacted area. Therefore, the action area for this project is the project footprint and a 300 foot radius from any area where pile driving occurs along the width and length of the James River where the towers and fender systems will be constructed, as well as all vessel courses related to the action. These areas are within the larger mapped area of habitat for Atlantic sturgeon depicted in Figure 1, and are expected to encompass all of the direct and indirect effects of the proposed action.

The action area is located at river mile 30 of the James River, and is characterized by soft sediment shallow and deep water habitat. Data indicates that Atlantic sturgeon use this portion of the river as pre-spawning staging for fall spawning runs (Greenlee pers comm; Balazik and Musick 2015). It is likely that foraging resources and adequate current velocities, and other physical factors are present at this site to support the aggregation of Atlantic sturgeon.

NMFS listed species in Action Area

Sea Turtles

Four species of ESA-listed threatened or endangered sea turtles under our jurisdiction may be found seasonally in the coastal waters of Virginia: federally threatened Northwest Atlantic Ocean Distinct Population Segment (DPS) of loggerhead (*Caretta caretta*), and the federally endangered Kemp's ridley (*Lepidochelys kempi*), green (*Chelonia mydas*) and leatherback (*Dermochelys coriacea*) sea turtles, although the latter species tends to frequent offshore habitats. Sea turtles are expected to be in the Chesapeake Bay during warmer months. This typically equates to April through November in Virginia waters (Morreale 1999; Morreale 2003; Morreale and Standora 2005; Shoop and Kenney 1992).

Sea turtles may move into the lower James River near the confluence with the Chesapeake Bay to opportunistically forage in appropriate habitat. However, we do not expect them to move further upstream into the James River for a number of reasons including: 1) rapid reductions in salinity in the river with increasing distance from the confluence of the James River and the Chesapeake Bay, and 2) the consequent reduction in suitable sea turtle prey in these less saline habitats. As such, sea turtles are not expected to be present in the action area, which is located approximately 30 miles upstream of the confluence of the James River and the Chesapeake Bay. As such, no effects to sea turtles will occur and they will not be considered further in this consultation.

Atlantic sturgeon

Atlantic sturgeon (*Acipenser oxyrinchus oxyrinchus*) originating from the New York Bight, Chesapeake Bay, South Atlantic, and Carolina DPSs are listed as endangered, while the Gulf of Maine DPS is listed as threatened. The marine range of all five DPSs extends along the Atlantic coast from Canada to Cape Canaveral, Florida. Based on the best available information, Atlantic sturgeon originating from any of five DPSs could occur in the James River; however, it is likely that the majority of Atlantic sturgeon in the action area would be from the Chesapeake Bay DPS, whom spawn in the James River (Damon-Randall *et al.* 2013).

Atlantic sturgeon spawn in their natal river, with spring spawning migrations generally occurring during April-May in Mid-Atlantic systems (Murawski and Pacheco 1977; Smith 1985; Bain 1997; Smith and Clugston 1997; Caron *et al.* 2002). Upon reaching a size of approximately 28.3-36.2 inches, Atlantic sturgeon subadults move out of their natal river to coastal waters, where they may undertake long range migrations. Tagging and genetic data indicate that subadult and adult Atlantic sturgeon may travel widely once they emigrate from rivers.

In rivers and estuaries, Atlantic sturgeon typically use the deepest waters available; however, Atlantic sturgeon also occur over shallow (8 feet), tidally influenced mud and/or sand flats, and mixed cobble substrates (Savoy and Pacileo 2003). Occurrence in these shallow waters is thought to be tied to the presence of benthic resources and foraging.

As mentioned above, fish from the Chesapeake Bay DPS spawn in upstream reaches of the James River. Based on modeling work using features associated with spawning habitat (e.g., suitable substrate), Bushnoe *et al.* (2005) concluded that the Turkey Island oxbow and the James

Neck oxbow (both above river mile 75) were potential spawning sites for Atlantic sturgeon in the James River. Environmental cues appear to play a strong role in use of the James River by adult, spring spawning, Chesapeake Bay DPS, Atlantic sturgeon (Hager 2011). Adult sturgeon enter the river in spring and occur from river mile 18 to river mile 67 before moving back downstream in June (Hager 2011). No early life stages (ELS) are expected to be present in the action area due to its location in the lower James River (river mile 30) with saline conditions. ELS cannot withstand exposure to salinity.

Balazik *et al.* (2012) tracked mature Atlantic sturgeon in the freshwater portion of the James River between August and the end of November, indicating an additional fall spawn in Mid-Atlantic systems. In the James River, fall Atlantic sturgeon spawners stage from April through August or September in Burwells Bay to Hog Island (river mile 30), which is located within the action area. Data indicates the fish are present from April/May through November (Greenlee pers comm and Balazik pers comm). Females remain in the area prior to spawning even when males move upstream in the fall. Females travel rapidly upstream to river mile 75 (Turkey Neck Oxbow and Presquile Isle National Wildlife Refuge (NWR)) in a 48 hour span and then normally come return to the staging area within river mile 30 post-spawn. Adults then begin to disperse to sites down river throughout the rest of the fall, occupying only lower river sites by November (Hager 2011; Balazik *et al.* 2012; Balazik and Musick 2015). Adults are undetected on the tracking array and are presumed to be out of the river by November/December (Hager 2011; Balazik *et al.* 2012, Balazik and Musick 2015). The condition of the tracked fish at capture (e.g., adults expressing milt or eggs), the rapid upstream movement of adults in both the spring and fall, and the aggregation of adults relative to the salt wedge provide further evidence of both a spring and fall Atlantic sturgeon spawning season the James River (NMFS and USFWS; 2007; Hager 2011; Balazik *et al.* 2012; Balazik and Musick 2015).

Effects of the Action

Acoustic Effects

Pile driving produces underwater sound pressure waves that can affect aquatic species, including sturgeon. Effects to fish can range from temporary avoidance of an area to death due to injury of internal organs, such as swim bladders. The type and size of pile, installation method (i.e., vibratory vs. impact hammer), size of the organism (smaller individuals are more susceptible to effects) and particular species, and distance from the sound source (i.e., sound dissipates over distance so noise levels are greater closer to the source) all contribute to the likelihood of effects to an individual. Generally, the larger the pile and the closer an individual is to the pile, the greater the likelihood of effects.

Table 1 shows the number and type of pile that will be used for this project. All piles will be driven into the river bottom using an impact hammer. Vibratory hammers may be used for fender installation, but we will assume a worst-case scenario for impact hammering in our analysis. As noted, fiberglass sleeves will be handjetted around 24-inch steel piles. We do not expect increased noise above any injury or behavioral thresholds related to this activity because 1) the lack of large machinery/hammering on the sleeves, and 2) the fluidizing of sediments, allowing the sleeves to slide into place with the guidance of divers. These factors reduce any risk of increased noise related to the activity.

Table 1. Pile Driving Associated with Proposed Project

Purpose of Pile Driving	Water Depth	Type of Pile	Number of Piles	Installation Time (per pile)	Hammer Type
Tower Construction	2-20 feet	24"steel pile	416	Unknown	Impact hammer
Fender System	15-20 feet	30" fiber pile	240	Unknown	Impact and/or Vibratory hammer

The applicant did not provide underwater noise estimates for the piles that will be installed. Instead, we conservatively use proxy measurements taken from similar projects in ICF Jones & Stokes and Illingworth and Rodkin, Inc. 2009, 2012 (see Tables 2 & 3).

Table 2. Proxy Project for Estimating Underwater Noise

Project Location	Water Depth	Type of Pile	Hammer Type	Attenuation rate
Rodeo Dock Repair—Rodeo, CA—San Francisco Bay	~15 feet	24" Steel Pipe	Diesel Impact hammer	5 dB / 33 feet
Richmond-San Rafael Bridge, San Francisco Bay, CA	~12-15 feet	30" Steel Pipe	Diesel Impact	5 dB/ 33 feet

The proxy projects for steel and fiber pile installation provides measurements from projects that employed a non-cushioned impact hammer for pile installation. The proposed project will not use a cushion block with impact hammers, but will use bubble curtains to attenuate noise from pile driving. Vibratory hammers may be used in some instances on fiber piles, but as noted we have assumed a worst-case scenario for the most conservative analysis based on steel piles of comparable size using an impact hammer with bubble curtains. According to the best available information, bubble curtains provide approximately 10 dB of attenuation under conservative circumstances (ICF Jones & Stokes and Illingworth and Rodkin, Inc. 2009). As the exact attenuation level to be achieved is unknown, we assume a 10 dB reduction in noise from bubble curtain usage; therefore, the noise level shown in Table 3 displays a 10 dB reduction from the values provided in ICF Jones & Stokes and Illingworth and Rodkin, Inc. 2009, 2012.

Table 3. Proxy-Based Estimate for Underwater Noise Levels Produced by Pile Driving (Measured at 33 feet from Pile Being Driven with Bubble Curtains)

Type of Pile	Hammer Type	Estimated Peak Noise Level (dB_{Peak})	Estimated Single Strike Sound Exposure Level (sSEL)	Estimated Pressure Level (dB_{RMS})
24" Steel Pile	Impact Hammer —no cushion block	193	167	180
30" Steel Pile (proxy for fiber pile)	Impact Hammer —no cushion block	195	170	180

The sound levels in Table 3 are an estimate and will likely vary depending on the geometry and boundaries of the surrounding underwater and benthic environment (i.e. shallow/deep water, shoaled portions of channels, obstacles in the waterway). As the distance from the source increases, underwater sound levels produced by pile driving dissipate rapidly. Underwater noise will attenuate approximately 5 dB every 33 feet (ICF Jones & Stokes and Illingworth and Rodkin Inc. 2009, 2012). If significant obstacles or variable bathymetry are present in an area, attenuation may occur more rapidly, dampening the sound pressure by an even greater factor.

Background Information on Noise and Sturgeon

Sturgeon rely primarily on particle motion to detect sounds (Lovell *et al.* 2005). While there are no data either in terms of hearing sensitivity or structure of the auditory system for Atlantic and shortnose sturgeon, there are data for the closely related lake sturgeon (Lovell *et al.* 2005, Meyer *et al.* 2010), which because of the biological similarities, for the purpose of considering acoustic impacts, are a good surrogate for Atlantic and shortnose sturgeon. The available data suggest that lake sturgeon can hear sounds from below 100 Hz to 800 Hz (Lovell *et al.* 2005, Meyer *et al.* 2010). However, since these two studies examined responses of the ear and did not examine whether fish would behaviorally respond to sounds, it is hard to determine thresholds for hearing (that is, the lowest sound levels that an animal can hear at a particular frequency) using information from these studies. The best available information indicates that Atlantic and shortnose sturgeon are not capable of hearing noise in frequencies above 1000 Hz (1 kHz) (Popper 2005). Sturgeon are categorized as hearing "generalists" or "non-specialists" (Popper 2005). Sturgeon do not have any specializations, such as a coupling between the swim bladder and inner ear, to enhance their hearing capabilities, which makes these fish less sensitive to sound than hearing specialists. Low-frequency impulsive energies, including pile driving, cause swim bladders to vibrate, which can cause damage to tissues and organs as well as to the swim bladder (Halvorsen *et al.* 2012a). Sturgeon have a physostomous (open) swim bladder, meaning there is a connection between the swim bladder and the gut (Halvorsen *et al.* 2012a). Fish with physostomous swim bladders, including Atlantic and shortnose sturgeon, are able to expel air, which can diminish tension on the swim bladder and reduce damaging effects during exposure to impulsive sounds. Fish with physostomous swim bladders are expected to be less susceptible to injury from exposure to impulsive sounds, such as pile driving, than fish with physoclistous (no connection to the gut) swim bladders (Halvorsen *et al.* 2012a).

If a noise is within a fish's hearing range and is loud enough to be detected, effects can range from mortality to a minor change in behavior (e.g., startle), with the severity of effects increasing with the loudness and duration of the noise (Hastings and Popper 2005). The actual nature of effects and the distance from the source at which they could be experienced will vary and depend on a large number of factors, such as fish hearing sensitivity, source level, how the sounds propagate away from the source and the resultant sound level at the fish, whether the fish stays in the vicinity of the source, the motivation level of the fish, etc.

Criteria for Assessing the Potential for Physiological Effects to Sturgeon

The Fisheries Hydroacoustic Working Group (FHWG) was formed in 2004 and consists of our own biologists, as well as those from USFWS, FHWA, and the California, Washington, and Oregon DOTs, supported by national experts on sound propagation activities that affect fish and wildlife species of concern. In June 2008, the agencies signed a Memorandum of Agreement documenting criteria for assessing physiological effects of pile driving on fish. The criteria were developed for the acoustic levels at which physiological effects to fish could be expected. It should be noted that these are onset of physiological effects (Stadler and Woodbury 2009), and not levels at which fish are necessarily mortally damaged. These criteria were developed to apply to all species, including listed green sturgeon, which are biologically similar to Atlantic and shortnose sturgeon and, for these purposes, is considered a surrogate. The interim criteria are:

- Peak Sound Pressure Level (SPL): 206 decibels relative to 1 micro-Pascal (dB re 1 μPa) (206 dB_{Peak}).
- Cumulative Sound Exposure Level (cSEL): 187 decibels relative to 1 micro-Pascal-squared second (dB re 1 μPa^2-s) for fishes above 2 grams (0.07 ounces) (187 dBcSEL).
- cSEL: 183 dB re 1 μPa^2-s for fishes below 2 grams (0.07 ounces) (183 dBcSEL).

At this time, these criteria represent the best available information on the thresholds at which physiological effects to sturgeon from exposure to impulsive noise, such as pile driving, are likely to occur. It is important to note that physiological effects may range from minor injuries from which individuals are anticipated to completely recover with no impact to fitness to significant injuries that will lead to death. The severity of injury is related to the distance from the pile being installed and the duration of exposure. The closer the fish is to the source and the greater the duration of the exposure, the higher likelihood of significant injury.

Since the FHWG criteria were published, two papers relevant to assessing the effects of pile driving noise on fish have been published. Halvorsen *et al.* (2011) documented effects of pile driving sounds (recorded by actual pile driving operations) under simulated free-field acoustic conditions where fish could be exposed to signals that were precisely controlled in terms of number of strikes, strike intensity, and other parameters. The study used Chinook salmon and determined that onset of physiological effects that have the potential of reduced fitness, and thus a potential effect on survival, started at above 210 dB re $1\mu Pa^2$-s cSEL. Smaller injuries, such as ruptured capillaries near the fins, which the authors noted were not expected to impact fitness, occurred at lower noise levels. Chinook salmon are hearing generalists with physostomous swim bladders. Results from Halvorsen *et al.* (2012a) suggest that the overall response to noise between chinook salmon and lake sturgeon is similar.

Halvorsen *et al.* (2012b) exposed lake sturgeon to pile driving noise in a laboratory setting. Lake sturgeon were exposed to a series of trials beginning with a cSEL of 216 dB re $1uPa^2$-s (derived from 960 pile strikes and 186 dB re $1uPa^2$-s sSEL). Following testing, fish were euthanized and examined for external and internal signs of barotrauma. None of the lake sturgeon died as a result of noise exposure. Lake sturgeon exhibited no external injuries in any of the treatments but internal examination revealed injuries consisting of hematomas on the swim bladder, kidney, and intestines (characterized by the authors as "moderate" injuries) and partially deflated swim bladders (characterized by the authors as "minor" injuries). The author concludes that an appropriate cSEL criteria for injury is 207 dB re $1uPa^2$-s.

It is important to note that both Halvorsen papers (2012a, 2012b) used a response weighted index (RWI) to categorize injuries as mild, moderate, or mortal. Mild injuries (RWI 1) were determined by the authors to be non-life threatening. The authors made their recommendations for noise exposure thresholds at the RWI 2 level and used the mean RWI level for different exposures. Because we consider even mild injuries to be physiological effects and we are concerned about the potential starting point for physiological effects and not the mean, for the purposes of this consultation we will use the FHWG criteria to assess the potential physiological effects of noise on Atlantic and shortnose sturgeon and not the criteria recommended by Halvorson *et al.* (2012a, 2012b). Therefore, we will consider the potential for physiological effects upon exposure to impulsive noise of 206 dB_{Peak} and 187 dBcSEL. Use of the 183 dBcSEL threshold is not appropriate for this consultation because all sturgeon in the action area will be larger than 2 grams (given the time of year restriction on pile driving, we expect any sturgeon in the action area will be past this life stage). As explained here, physiological effects from noise exposure can range from minor injuries that a fish is expected to completely recover from with no impairment to survival to major injuries that increase the potential for mortality or result in death.

Available Information for Assessing Behavioral Effects on Sturgeon

To date, neither we nor the FHWG have published criteria for underwater noise levels resulting in behavioral responses. However, in practice, we rely on a level of 150 dB re 1uPa RMS as a conservative indicator as to when a behavioral response can be expected in fish exposed to impulsive noise such as pile driving. This level is based on the available literature where fish behavior has been observed (see Fewtrell 2003 and Mueller-Blenkle *et al.* 2010). Because sturgeon are hearing generalists with physostomous swim bladders, it is reasonable to assume they are not more sensitive to noise than other fish (hearing specialists and generalists) whose behavioral responses have been studied (e.g., Fewtrell 2003 and Mueller-Blenkle *et al.* 2010). Therefore, fish behavior responses and noise thresholds reported in Fewtrell 2003 and Mueller-Blenkle *et al.* 2010 are a reasonable conservative indicator of when sturgeon can be expected to respond behaviorally to noise.

Fewtrell (2003) exposed caged fish to air gun arrays. Fewtrell reported altered behavioral responses (alarm responses, faster swimming speeds) for fish exposed to noise of 158-163 dB re 1uPa. Consistent startle responses were observed at noise levels of 167-181 dB re 1uPa (in striped trumpeters). Alarm responses became more frequent at noise levels above 170 dB re 1uPa. Fewtrell reports that avoidance behavior is expected at noise levels lower than that required to produce a startle response.

Mueller-Blenkle *et al.* (2010) played back pile-driving noise to cod and sole held in two large net pens. Movements of fish were tracked and received sound pressure levels were measured. The authors noted a significant movement response to the pile-driving stimulus in both species at received SPL of 144-156 dB re 1uPa peak (cod) and 140-161 dB re 1uPa peak (sole). Indications of directional movements away from the sound source were noted in both species.

We are aware of only one study that has attempted to assess the behavioral responses of sturgeon to underwater noise. A monitoring plan is currently being implemented at the Tappan Zee Bridge replacement project (Hudson River, New York) using acoustic telemetry receivers to examine the behavior of acoustically tagged sturgeon. During the installation of test piles, the movements of tagged Atlantic sturgeon were monitored with a series of acoustic receivers. Tagged Atlantic sturgeon spent significantly less time in the detection area (an area that encompassed the 206 dB re 1uPa peak, 187 dB re 1uPa 2s cSEL and 150 dB re 1uPa RMS SPL isopleths), during active impact pile driving compared to that time period just prior to the work window. Results of this study indicate that sturgeon are likely to avoid areas with potentially injurious levels of noise (AKRF and Popper (2012a, 2012b)). However, due to limitations of the study design, it is not possible to establish the threshold noise level that results in behavioral modification or avoidance of Atlantic sturgeon. Monitoring is ongoing as the bridge project progresses. To date, hundreds of tagged sturgeon have been documented in the project area; however, no sturgeon have been injured or killed as a result of exposure to pile-driving noise.

For the purposes of this analysis, we will use 150 dB re 1 μPa RMS as a conservative indicator of the noise level at which there is the potential for behavioral effects, provided the operational frequency of the source falls within the hearing range of the species of concern. That is not to say that exposure to noise levels of 150 dB re 1 μPa RMS will always result in behavioral modifications or that any behavioral modifications will rise to the level of "take" (i.e., harm or harassment) but that there is a potential, upon exposure to noise at this level, to experience some behavioral response. We expect that behavioral responses could range from a temporary startle to avoidance of the area with disturbing levels of sound. The effect of any anticipated response on individuals will be considered in the effects analysis below.

Physiological Effects of Pile Driving to Sturgeon

As described above, exposure to underwater noise levels of 206 dB_{Peak} and 187 dB_{cSEL} can result in injury to sturgeon. Generally speaking, we expect sturgeon to leave the area before injurious levels of noise are reached. This is because pile driving hammers have a ramp up period, so the first several blows produce less noise than estimated in Table 3. As we expect sturgeon to modify their behavior and leave the area in a matter of seconds, sturgeon will swim away from the pile before any injury thresholds are reached. We expect only subadult and adult sturgeon in the action area. Exposure to peak pressure levels that may result in injury (i.e., 206 dB_{Peak}) are not reached with the usage of bubble curtains (see Table 4).

Table 4: Estimated Distances to Injury and Behavioral Thresholds

Type of Pile	**Hammer Type**	**Distance to 206dB_{Peak} (injury)**	**Distance to sSEL of 150 dB (surrogate for 187 dB_{cSEL}- injury)**	**Distance to Behavioral Disturbance Threshold (150 dB_{RMS})**
24" Steel Pile	Impact Hammer	Not reached	135 feet	230 feet
30" Steel Pile (proxy for fiber pile)	Impact Hammer	Not reached	164 feet	230 feet

In addition to the "peak" exposure criteria which relates to the energy received from a single pile strike, the potential for injury exists for multiple exposures to noise over a period of time; this is accounted for by the cSEL threshold. The cSEL is not an instantaneous maximum noise level, but is a measure of the accumulated energy over a specific period of time (e.g., the period of time it takes to install a pile). When it is not possible to accurately calculate the distance to the 187 dB re 1uPa cSEL re: 1μPa^2•s isopleth, we calculate the distance to the 150 dB re 1uPa sSEL isopleth.[1] The further a fish is away from the pile being driven, the more strikes it must be

[1] The Practical Spreading Loss Model is used to determine underwater noise attenuation rates and can be used to calculate the distance at which a specific noise value (e.g., cSEL) is attained. This model is not a reliable predictor of attenuation in shallow, relatively confined waters such as the action area which borders the shoreline. For that reason, we are not using that model to estimate the distance to the 187 dB re 1uPa^2s criteria. Rather, we estimate the distance to the 150 dB re 1uPa sSEL isopleth, using reported attenuation rates not the practical spreading loss model. Regardless of the number of pile strikes a fish is exposed to, we recognize there is no potential for injury to a fish exposed to noise below 150 dB re 1uPa sSEL (see Stadler and Woodbury 2009). Calculating the distance to the 150 dB re 1uPa sSEL isopleth allows us to calculate the distance from the pile at which there is no potential for physiological effects, including injury. We assume for these analyses, that a fish that remains between the pile and the 150 dB re 1uPa sSEL isopleth could be injured although we cannot accurately predict how close a fish would need to be or for how long it would need to stay there. Injury is extremely unlikely to occur because we expect sturgeon to modify their behavior (i.e., avoid an ensonified area) upon exposure to underwater noise levels of 150 dB re 1 µPaRMS, which will be attained at a greater distance than the injury threshold, as described above.

exposed to accumulate enough energy to result in injury. At some distance from the pile, a fish is far enough away that, regardless of the number of strikes it is exposed to, the energy accumulated is low enough that there is no potential for injury. This distance is where the 150 dB re 1uPa sSEL isopleth occurs (Stadler and Woodbury 2009). A fish located outside of this isopleth has no potential for injury, regardless of the number of pile strikes it is exposed to (i.e., sound levels will not accumulate to injurious levels).

For this project, the distance to the 150 dB sSEL isopleth is no greater than 164 feet. In order to be exposed to potentially injurious levels of noise during installation of the piles, a sturgeon would need to be within 135-164 feet (depending on pile size and material) of the pile being driven to be exposed to this noise for any prolonged time period. This is extremely unlikely to occur because we expect sturgeon to modify their behavior (i.e., avoid an ensonified area) upon exposure to underwater noise levels of 150 dB re 1 μPaRMS. Given that a sturgeon would be exposed to levels of noise that cause behavioral modification (at 230 feet) before being exposed to injurious levels of noise (at 135-164 feet), we expect sturgeon would swim away from the sound source and not be exposed to potentially injurious levels of underwater noise. If any sturgeon are within 135-164 feet (depending on material type) of the pile at the time pile driving commences, we still do not expect injury to occur. As mentioned above, pile driving hammers have a ramp up period, so the first several blows produce less noise than estimated in Table 3. Also, the cSEL injury threshold is cumulative (requiring prolonged exposure to the noise at that level). We expect sturgeon to leave the area in a matter of seconds once pile driving commences. Therefore, they will exit the 135-164 foot radius of the pile before cumulative effects reach the cSEL injury threshold.

Behavioral Effects of Pile Driving to Sturgeon

Behavioral effects, such as avoidance or disruption of foraging activities, may occur in sturgeon exposed to noise above 150 dB re 1 μPa_{RMS}. We expect underwater noise levels to be below 150 dB_{RMS} at distances beyond approximately 230 feet from the pile being installed.[2] Should sturgeon move into the action area where the 150 dB_{RMS} isopleth extends, as described above, it is reasonable to assume that a sturgeon, upon detecting underwater noise levels of 150 dB_{RMS}, will modify its behavior such that it redirects its course of movement away from the ensonified area and therefore, away from the action area. If any movements away from the ensonified area do occur,they will be very short distances requiring such small expenditures of energy as to be unable to be meaningfully detected. As such, it is extremely unlikely that these movements will affect essential sturgeon behaviors (e.g., spawning, foraging, resting, and migration), and therefore any effects are discountable and insignificant.

Summary of Noise Effects

Because the TOYR will be adhered to in deep water habitat for construction of the towers (towers 21, 22, and 24-26) and fender systems located therein, there will be no effects from increased noise related to 24-inch steel or 30-inch fiber pile driving . Piles will be installed

[2] Attenuation distances to the injury and behavior thresholds were estimated via the equation: $R_1=R_2+((RMS - Injury/Behavior Noise Threshold)/Attenuation rate)*10 m)$ (Stadler and Woodbury 2009); where R_1=the distance (in meters) to the injury/behavior threshold level (e.g., 150dB_{RMS}), R_2=distance of the measured RMS level for the pile of interest (10 m/33feet); Attenuation rate=5dB/10m or 33 feet.

between November 16th and February 14th of any given year in deep water habitat, when Atlantic sturgeon are not present within the James River. No pile driving will be performed in deep water portions of the action area (as mapped in your letter), located within a larger, approximately 72,250,000 square foot cross-sectional area of deep water habitat near river mile 30 (that mirrors the linear path of the transmission line), between February 15th and November 15th, which encompasses the times of year that spring and fall spawning fish migrate through the deep water portion of the action area and fall spawning fish stage there, while feeding and resting. No spawning or ELS occur in the action area because of their intolerance to salinity.

Pile driving of 24-inch steel piles in shallow water habitat in the action area within an approximate 60,653,000 square foot cross-sectional portion of shallow water habitat within the James River around river mile 30, where Atlantic sturgeon are known to occur, will proceed during the TOYR (from February 15th to November 15th). This includes construction of towers 12-20, 23, 27, and 28. As discussed, Atlantic sturgeon stage for fall spawning in the deep water portions of the action area, however, they may opportunistically forage in shallow water habitat where prey is available. As detailed above, fish are able to move away from ensonified areas when pile driving is occurring. These ensonified areas will only encompass a small percentage of the overall habitat available in the river (230 foot radius from pile being driven where the width of the river is 14,767 feet wide), and in a cross-sectional portion of the river where the entire length of the transmission line will occur of 132,903,000 square feet. As such, we concur that all effects from pile driving while fish are present within the action area, are insignificant and/or discountable, and thus we concur that all pile driving activities will not likely adversely affect Atlantic sturgeon.

Water Quality Effects

The tower and fender system construction may cause a temporary increase in the amount of turbidity in the action area; however, suspended sediment is expected to settle out of the water column within a few hours and any increase in turbidity will be short term and limited in scope.

Using available information, we expect pile driving activities to produce total suspended solids (TSS) concentrations of approximately 5 to 10 mg/L within approximately 300 feet of the pile being driven (FHWA 2012). The small resulting sediment plume is expected to settle out of the water column within a few hours once pile driving ends.

Studies of the effects of turbid water on fish suggest that concentrations of suspended solids can reach thousands of milligrams per liter before an acute toxic reaction is expected (Burton 1993). The TSS levels expected for pile driving (5 to 10 mg/L) are below those shown to have adverse effect on fish (580 mg/L for the most sensitive species, with 1,000 mg/L more typical; see summary of scientific literature in Burton 1993) and benthic communities (390 mg/L (EPA 1986)). As the TSS levels will not reach levels that are toxic to benthic communities, the proposed action is extremely unlikely to result in reductions in the quality or quantity of sturgeon prey currently available.

TSS is most likely to affect sturgeon if a plume causes a barrier to normal behaviors. However, the increase in TSS levels expected for pile driving (5 to 10 mg/L) is so minor that any effect of sediment plumes caused by the proposed action on sturgeon movements or behavior will be undetectable because we expect sturgeon to either swim through the plume or make small evasive movements to avoid it. Additionally, this increase in turbidity is below levels known to adversely affect benthic communities and as such, any effects to sturgeon prey will be undetectable. Based on the best available information, the effects of suspended sediment resulting from pile installation on sturgeon will be insignificant.

Habitat Effects

The tower and fender system piles will permanently alter portions of the substrate in the action area by direct removal of habitat (permanent river bottom impact from pile driving and fender installation), and shading (subtidal encroachment). Shading from the installation of the towers and fender systems can impact the benthic communities by reducing photosynthesis in these areas, which forms the basis of benthic food chains. This may reduce the overall forage base in the shaded area. Although some benthic habitat will be permanently shaded, the area covered by the towers and fender system within the action area is small compared to the cross-section of available habitat at river mile 30 of the James River that includes the linear length of the transmission line along the western shore and across the river.

The applicant has estimated that approximately 2,712 square feet of permanent impacts to the river bottom will occur as a result of the action. This equates to 0.002% of the 132,930,000 square foot cross section of the James River that includes the shore length extent and cross river extent of the transmission line, inclusive of the action area. When broken down further, approximately 0.003% of the 72,250,000 square feet of deep water habitat will be permanently altered in the same cross sectional area, and 0.0014% of shallow water habitat will be permanently altered. Approximately 0.04% of the total cross sectional area will be shaded because of the action, and similarly 0.04% of deep and shallow water habitat, separately, will be shaded. Overall, this equates to very small reductions in available benthic habitat due to permanent alteration and shading, as a result of the action. If Atlantic sturgeon are in the action area, the action will not measurably reduce their ability to opportunistically forage, rest, and migrate in nearby suitable habitat near river mile 30, which has been identified as an aggregation area for sturgeon. Any reductions in foraging, resting, or migration as a result of habitat loss related to the action will be so small they cannot be detected. As such, all effects will be insignificant.

Vessel Interactions

While the exact number of Atlantic sturgeon killed as a result of being struck by boat hulls or propellers is unknown, it is a concern in some areas. During project construction, small incremental increases in vessel traffic in the James River will occur (*i.e.*, barges, support vessels, etc.). Regardless of the number of barges and trips used for the proposed project (one crane barge and one material barge, 1-2 tugboats, and several crew vessels during operations), there is still the potential that Atlantic sturgeon could be struck by a vessel during its transit to and from action area or within the action area. We have considered the likelihood that an increase in vessel traffic associated with the project increases the risk of interactions between sturgeon and vessels in the project area, compared to baseline conditions. Given the large volume of traffic in the action area, the increase in traffic associated with the project (only at most 5-7 additional vessels) is extremely small. Based on this information, the effects of vessel traffic on sturgeon from this project are insignificant.

Conclusions
Based on the analysis that any effects to ESA-listed species will be insignificant or discountable, we are able to concur with your determination that re-initiation of this consultation was necessary and that the modified proposed action is not likely to adversely affect any listed species under our jurisdiction. Therefore, no further consultation pursuant to section 7 of the ESA is required. Reinitiation of consultation is required and shall be requested by the Federal agency or by the Service, where discretionary Federal involvement or control over the action has been retained or is authorized by law and: (a) if new information reveals effects of the action that may affect listed species or critical habitat in a manner or to an extent not previously considered in the consultation; (b) if the identified action is subsequently modified in a manner that causes an effect to the listed species or critical habitat that was not considered in the consultation; or (c) if a new species is listed or critical habitat designated that may be affected by the identified action. No take is anticipated or exempted. If there is any incidental take of a listed species, reinitiation would be required. Should you have any questions about this correspondence, please contact Chris Vaccaro at (978) 281-9167 or by e-mail (Christine.Vaccaro@noaa.gov).

Essential Fish Habitat
The Magnuson Stevens Fishery Conservation and Management Act (MSA) requires federal agencies to consult with us on any action or proposed action authorized, funded, or undertaken by the agency that may adversely affect essential fish habitat (EFH) identified under the MSA. As you know the James River in the vicinity of the project is designated as essential fish habitat (EFH) for 14 federally managed species. In addition to Atlantic sturgeon, the area is also designated a confirmed anadromous fish use area by the Virginia Department of Game and Inland Fisheries for 6 species including American shad, hickory shad, striped bass, alewife, blueback herring, and yellow perch.

Provided the mitigation measures proposed by Dominion as outlined in your letter dated November 25, 2015, and the conservation recommendations protective of Atlantic sturgeon provided here are incorporated into the means and methods of the project, construction of the 17 aerial transmission towers and 4 fender protection systems will not have a significant adverse effect on EFH. Any impacts to the migration and spawning of anadromous species have been minimized to the extent practicable and will localized and temporary in nature. If you have any questions regarding impacts to EFH or anadromous species, please contact Mr. David O'Brien, NOAA Habitat Conservation Division (804-684-7828, david.l.o'brien@noaa.gov).

Sincerely,

Kimberly Damon-Randall
Assistant Regional Administrator
for Protected Resources

PCTS: NER-2016-13041
File Code: H:\Section 7 Team\Section 7\Non-Fisheries\ACOE\Informal\2016\Norfolk\NAO-2012-00080_Dominion Crossing Reinitiation

Ec: O'Brien, NMFS/HCD
Vaccaro, NMFS/PRD
Christine Conrad, Stantec
Courtney Fisher, Stantec

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