

Final Report:
Five Year Post-construction Monitoring of the
Unionid Community near the Braidwood
Station Kankakee River Discharge

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1.0 Introduction

In 2010, Exelon's Braidwood Station (Braidwood) constructed a diffuser pipe across the Kankakee River to replace its existing discharge canal. Before the pipe's construction, two prior surveys for unionids (freshwater mussels), which were conducted in the Kankakee River near the proposed diffuser pipe location, indicated that unionids (including Illinois listed species) were present (HDR, 2008; ESI, 2009). Braidwood applied for and received an incidental take authorization (ITA) from the Illinois Department of Natural Resources (IDNR) (Appendix A) in 2009. The ITA required a mussel relocation effort to minimize construction impacts to the resident mussel community, specifically Illinois listed species. ESI conducted this relocation in 2010 prior to the diffuser pipe's construction (ESI, 2010). The ITA also required a 5-year post-construction monitoring survey to determine if Illinois-listed species have colonized/recolonized the area. This report discusses and provides results of that survey.

The Kankakee River harbors a diverse unionid community that includes Illinois and federal listed species. Unionid studies from 2008 to 2015 (this study) identified 22 live unionid species (Table 1-1), including four Illinois listed species (*Ligumia recta*, *Cyclonaias tuberculata*, *Elliptio dilatata* and *Venustaconcha ellipsiformis*). In addition, a shell of a federally listed species (*Plethobasus cyphus*) was observed in 2008. Results of this study provide insight on the potential impacts from construction and operation of the diffuser from 2010 to 2015.

In-stream construction activity, such as construction of the diffuser pipe, may disrupt the substrate and, consequently, the animals living in the substrate. Unionids within the area directly affected by construction could be impacted by equipment or permanently buried under excavation spoil. Disruption of the substrate could result in displacement of unionids to unsuitable habitat, which could lead to reduced fitness or death. Construction activities could also lead to altered flow patterns that may increase sedimentation, which is a putative source of unionid declines throughout North America (Fuller, 1974; Aldridge et al., 1987; Williams et al., 1993; Box and Mossa, 1999). Construction impacts to unionids have successfully been minimized by reducing the area used for constructing and relocating unionids from areas of unavoidable impact (Dunn et al., 2000). Both of these approaches for minimizing potential construction impacts were implemented at Braidwood.

Discharge of water can also affect freshwater mussels, as this group of animals is more sensitive than other aquatic organisms to some pollutants (i.e., ammonia, copper), but less sensitive to others (i.e., pesticides and solvents) (see Cope et al., 2008 and references therein). Freshwater mussels could also be affected by thermal effluent. Recent studies indicate thermal tolerances (LT50) of juvenile mussel species ranges from 33.3 to 37.2° C (Archambault et al., 2014). Unionids did not seem to be affected by Quad Cities Nuclear Station thermal discharge, which also uses a diffuser pipe (Dunn and Petro, 2011). The diffuser pipe constructed at Braidwood should reduce any effects of thermal and other effluent constituents.

To satisfy the ITA permit requirements, Ecological Specialists, Inc. (ESI) was contracted to survey for unionids within areas potentially impacted by diffuser construction. The objective of this unionid study was to determine the distribution

and species composition (specifically federally- and Illinois-listed species) of unionids within previously surveyed areas. Additionally, in response to U.S. Fish & Wildlife Service concerns regarding potential impacts to *P. cyphus* (DOI letter to NRC, May 8, 2015; Appendix B), further intensive sampling was added adjacent to the diffuser location and downstream to increase likelihood of finding this species, if present. This report summarizes the results of the unionid and habitat survey that was conducted in the project area on 1-2 September 2015.

2.0 Methods

This study repeated the 2008 study (ESI, 2009) and was supplemented with additional sampling to increase probability of finding federally-listed species. Semi-quantitative, quantitative, and qualitative sampling methods were used to evaluate the unionid community in the Kankakee River potentially impacted by construction and operation of the diffuser. The objective of semi-quantitative sampling was to determine unionid distribution. For semi-quantitative sampling, five 200 m transects were placed parallel to the flow starting approximately 60 m upstream of the diffuser; similar to positioning in 2008 (Figure 2-1). Transect 1 (T1) was positioned about 10 m from the right descending bank (RDB) and Transects 2 through 5 (T2 – 5) were spaced approximately 15 – 30 m across the width of the river adjacent to Transect 1. A diver traversed each transect, collecting all unionids within 1 m of the line in 10 m sections for a total of 20 samples per transect.

More intensive sampling was conducted in three areas: an area along the RDB where previous studies found higher than average mussel abundance, an area along and adjacent to the present diffuser, and an area downstream of the diffuser (Figure 2-1). The latter two areas were targeted as areas where relocation occurred in 2010 and areas potentially affected by diffuser construction and operation. Intensive sampling involved collection of both qualitative and quantitative samples. The objective of qualitative sampling was to estimate species richness. The number of species collected is directly related to the number of individuals collected, and qualitative sampling is the most efficient means of collecting a high number of mussels (Kovalak et al., 1986). However, qualitative and semi-quantitative sampling is biased toward larger and more sculptured individuals and only collects the fraction of the unionid community that resides on the substrate surface (see Dunn, 2000 and references therein). Quantitative sampling is less biased, as the sample includes all substrate to a depth of 15 cm. For each sample, all substrate within a 0.25 m² quadrat was excavated to a depth of 15 cm into an attached 6 mm mesh bag. The sampler was retrieved by the surface crew and contents sieved through 12 and 6 mm mesh sieves, then searched for unionids. Quantitative sampling was used to estimate unionid density and species abundance, and to detect juveniles. Five 10-min. qualitative samples and five 0.25-m² quantitative whole substrate samples were collected in each of the three more intensively sampled areas.

Live unionids were identified, counted, and recorded as adult or juvenile (≤ 5 yrs; external annuli count). Species designated in Illinois as endangered, threatened, or of special concern were measured (mm) and aged (external annuli count). Depth (m) and substrate (Wentworth scale; Wentworth, 1922) were also recorded at each semi-quantitative and quantitative sample. Live individuals were returned to the point of collection.

3.0 Results

A total of 456 live unionids of 16 species were collected during the survey. *Actinonaias ligamentina* (n = 393) was the most abundant, accounting for over 80% of the total live individuals (Table 1-1). Sixteen (16) or fewer live individuals of each of the 15 other species were collected (Table 3-1). Three (3) species (*Cyclonaias tuberculata*, *Elliptio dilatata*, and *Ligumia recta*) are listed as Threatened and one as a species of Special Concern (*Venustaconcha ellipsiformis*) by the IDNR. Characteristics of listed species are presented in Appendix C. Three (3) juvenile and one freshly dead unionids were collected. No federally listed species was collected.

Similar to previous study results, unionids were sparsely scattered throughout the survey area (Figure 3-1). The majority of Illinois listed species were collected within the middle of the river and adjacent and downstream of the diffuser (Table 3-2). An average of 2.64 unionids were collected per 10-m² sample over the study area. Five (5) live unionids were collected from the 15 quantitative samples within the three intensive sample areas resulting in an average of 1.33 unionids / m². The catch per unit effort (CPUE; number live unionids collected per min. of effort) from the 15 qualitative samples was 2.49 (Table 3-1).

Also similar to observations from previous studies, habitat varied little throughout the survey area with exception of shallower depths near the banks. River habitat within the survey area was a run (depth of water covers substrate and flow is primarily laminar). Depths ranged from 0.9 – 2.7 m (Table 3-3; Figure 3-2). Substrate was generally a mix of boulder, cobble, gravel, and sand with scattered bedrock. In general, more cobble was observed near the center of the river while boulder and sand were more prevalent along the banks (Figure 3-2). The majority of substrate constituents were coarse (gravel or larger), as few areas contained much sand and no silt was observed. As in previous studies, no obvious correlation between unionid presence and habitat characteristics was observed.

4.0 Discussion

4.1 Unionid Community as a Whole

Study results suggest habitat within the study area has not changed post-construction or within 5 years of diffuser operation, and therefore remains marginal habitat for unionids. Coarse substrate with few finer particulates was present throughout the survey area in both 2008 and 2015. The Kankakee River near the Braidwood Diffuser can be characterized as a run with very coarse substrate. Runs often harbor good mussel communities; however, abundant and species-rich unionid communities in the Kankakee River appear to be found more frequently in riffles and below dams (Suloway, 1981). For example, two sites sampled in the Kankakee River in 2002 resulted in twice as many species and 17 times more live unionids in the riffle site than the site with a run habitat (ESI, 2003). Substrate surrounding the Braidwood diffuser also is not ideal for mussels; mussels are primarily found buried in finer substrate between coarser substrate, and finer substrate needed for burrowing was lacking at this site. Substrate contained higher proportions of finer particles (sand and silt) at a site approximately 10 km downstream of the Braidwood diffuser, and 24 live species, including one federally endangered *P. cyphus* were collected (ESI, 2015). Finer substrate tends to settle among coarser material in areas with lower shear stress. Shear stress in the channel near the Braidwood diffuser may be too high to allow sufficient finer substrate accumulation, preventing the formation of a permanent mussel community. Rather, mussels that are part of the bedload may be transported in and out of the area during high discharge events.

Community characteristics, including species abundance, distribution, and CPUE, have not declined since the relocation effort, construction, and operation of the diffuser, indicating the unionid community has not been negatively impacted since 2010. Species abundances were similar among study years with *A. ligamentina* being the dominant species and 16 live species being collected in both 2010 and 2015. As in previous years, unionid distribution was scattered throughout the study area (Figure 3-1). CPUE in qualitative samples averaged 0.48 and 0.54 unionids / min. in 2008 and 2010, respectively, and 2.49 in 2015 (Table 3-1). In addition, the number of live unionids per 10 m² transect section averaged 1.20 in 2008 and 2.64 in 2015 (Table 3-1). Neither metric decreased after relocation, construction, and operation.

Without extensive quantitative sampling to establish baseline data pre-construction and several years of monitoring data post-construction, assessing whether the apparent increase in CPUE over time is real or an artifact of sampling is difficult. Unionids migrate vertically, and the percentage of unionids near the substrate/water interface tends to vary with season and species, which may be due to water temperature, disturbance (abrupt changes in temperature, velocity, water level, turbidity), and/or reproductive activity (Haag, 2012; Dunn, pers. observation). The 2008 survey was conducted in October, the 2010 relocation in July, and this survey in early September. Lower current velocities creating easier sampling conditions in 2015 may also have contributed to the increased CPUE in both sample methods. The lack of finer substrate for burrowing may also contribute to the difference in CPUE. Unionids that are not burrowed into the substrate during high discharge events are moved and deposited with the bedload. The lack of finer substrate for burrowing in this area may result in dynamic conditions, with individuals potentially moving in and out of the area, especially within the middle of the river, during high flow events. A denser, stable, and reproducing unionid community upstream, probably in a riffle habitat, may seed the study area. Alternately, the diffuser may have increased substrate stability in the area,

creating habitat more suitable for unionids than that of previous years. Although substrate stability did not appear to differ between surveys, differences between suitable and unsuitable substrate conditions can be subtle. In any case, metrics from this study compared to past studies have not declined, and have actually increased, indicating no negative effects to the unionid community.

4.2 Illinois State Listed Species

A total of 3 Illinois threatened species (*C. tuberculata*, *E. dilatata*, and *L. recta*) and one Illinois Special Concern species (*V. ellipsiformis*) were collected within the study area (Table 1-1). Unionids in previous studies were scattered throughout the site in low density (HDR, 2008; ESI, 2009; ESI, 2010), but concentrated in two areas along the banks: one on the left descending bank (LDB) upstream of the diffuser location (HDR, 2008; not shown on Figure 2-1) and one on the RDB (ESI, 2009) directly in-line with the diffuser (“Right Descending Bank” area on Figure 2-1). Both federally- and state-listed species were associated with these areas: in the HDR study, a federally-listed *P. cyphyus* shell was found along the LDB, and in the ESI study, all Illinois listed species were found along the RDB. However, in this study the majority of Illinois listed species were found within the middle of the river downstream of the diffuser (Table 3-2). More individuals of Illinois listed species were found in this study compared to previous studies. This suggests that construction and operation of the diffuser since 2010 has not adversely impacted Illinois listed species within the study area. These species and others have recolonized construction and mixing zone areas, and do not appear to be affected by plant operation.

4.3 Federally Listed Species

No live federally protected species have been observed within the study area in the past 20 years (ESI, 2012), although they have been recently been found in the lower Kankakee River. ESI collected one live individual approximately 10 km downstream of the study area in 2014 (ESI, 2015), and a freshly dead *P. cyphyus* shell was found in 2008 along the LDB upstream of the Braidwood now-retired discharge canal (HDR, 2008). Although no live individuals have been observed in the study area, individuals may be moved in and out of the area with the bedload. Most species collected at this site occur at low frequencies, and detection of rare species proves difficult, even with extensive sampling. Therefore, the presence of *P. cyphyus* cannot be ruled out, and one could move into the study area in the future. However, since unionids do not seem to be affected by current operations, as live individuals occur within and downstream of the mixing zone, the construction and/or operation of the Braidwood diffuser should not impact the population of *P. cyphyus* within the Kankakee River. If operating conditions remain similar to the past 10 years, *P. cyphyus* should not be affected.

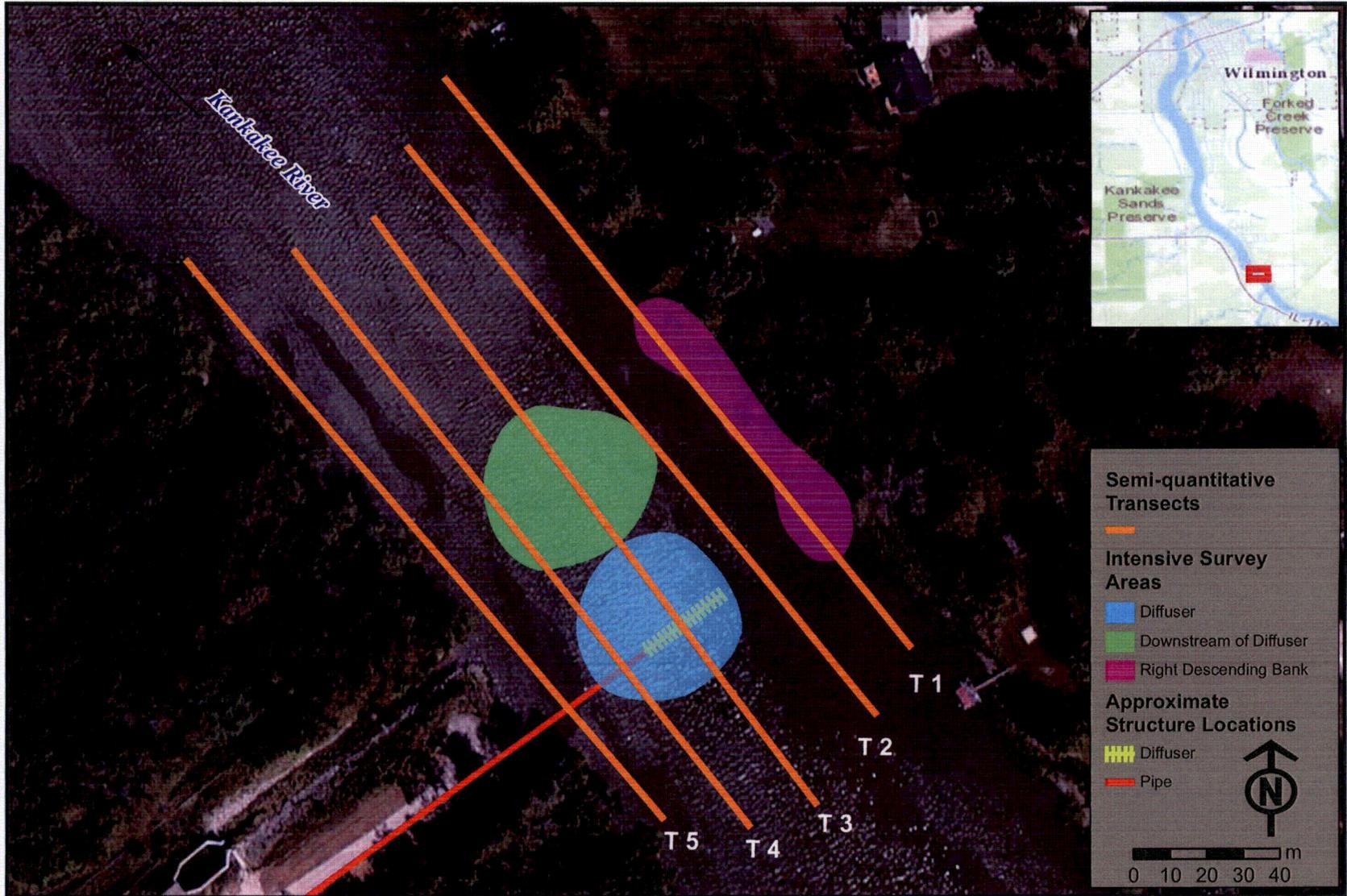
5.0 Conclusion

The area in the Kankakee River adjacent to the now-retired discharge canal and Braidwood's new diffuser harbors a species rich, yet scattered and sparse, unionid community including Illinois-listed species. No live federally-listed species have been observed in the past 20 years near the Braidwood discharge site; the closest known recent live collection was a *P. cyphus* approximately 10 km downstream in 2014. The Braidwood diffuser site was extensively searched in this study, with the purpose of increasing the likelihood of finding additional specimens of this federally-listed species, if present, but none were found. Illinois-listed species were collected within the study area, as they have been in the past, but with no evidence of adverse impacts resulting from the construction of the new diffuser. The new diffuser was expected to reduce potential operational impacts to unionids and other aquatic fauna and their habitat in comparison to the now-retired discharge canal, which was a single point source of all the discharged water with more potential to impact the habitat and water quality. Data collected in this study appear to support that theory, and the new diffuser should continue to have little to no impact during future operation.

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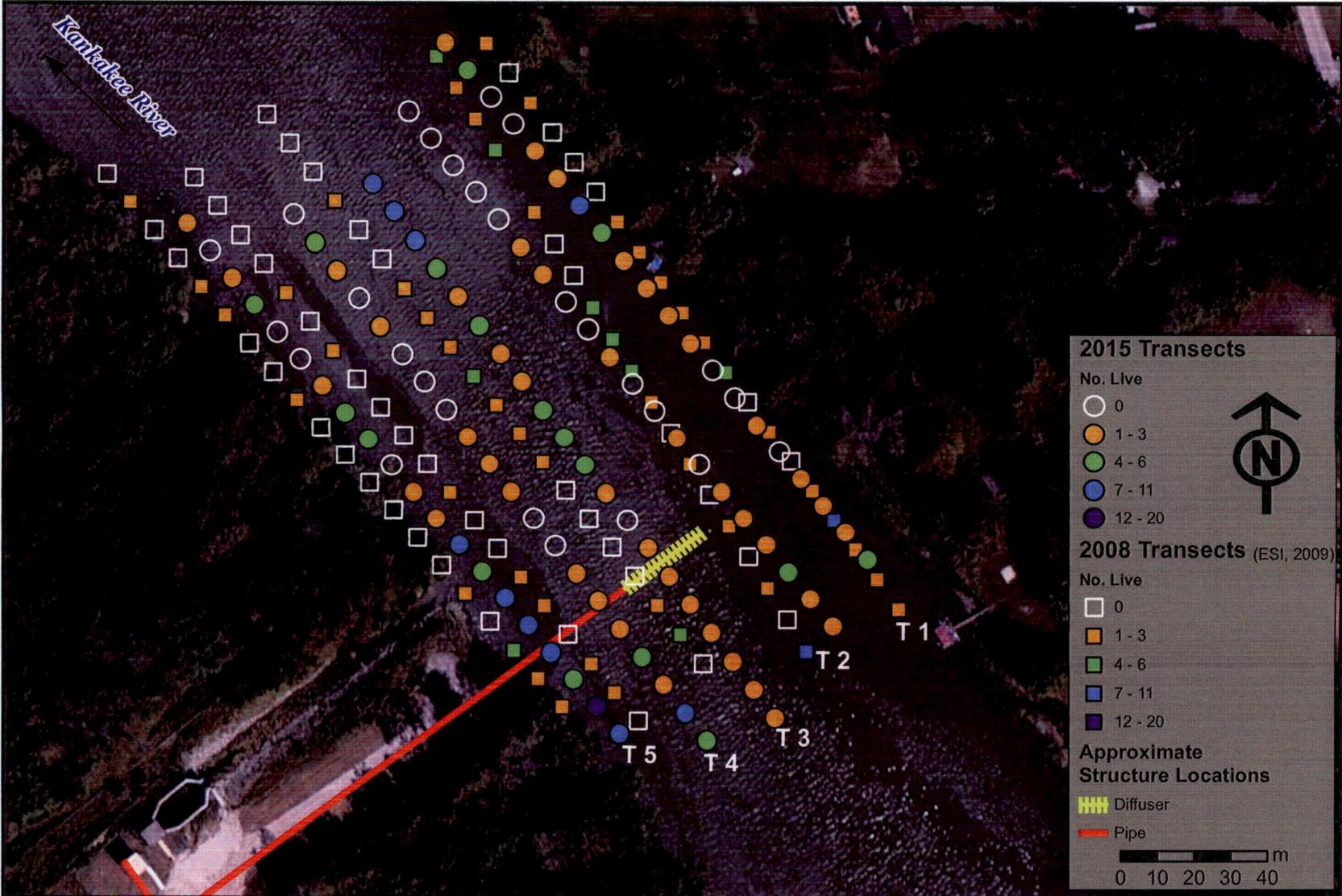
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Figure 2-1. Unionid sample areas in the Kankakee River near the Braidwood Station discharge, 2015.

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Figure 3-1. Live unionids collected along sampling transects in the Kankakee River near the Braidwood Station discharge, 2008 and 2015.

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Table 1-1. Unionids collected near the Braidwood Station discharge from 2008 to 2015, Illinois, Kankakee River.

Species ² by Tribe	August 2008 (HDR, 2008)		October 2008 (ESI, 2009)		July 2010 (ESI, 2010)		September 2015 (this study)		All Recent Studies (ESI, 2009; HDR, 2008; ESI, 2010; ESI, 2015)
	No. Live ¹	% Abundance	No. Live	% Abundance	No. Live	% Abundance	No. Live	% Abundance	Collected Live
<u>Amblemini</u>									
<i>Amblema plicata</i>	28	13.3	13	10.3	37	4.1	13	2.9	X
<u>Pleurobemini</u>									
<i>Cyclonaias tuberculata</i> (IT) ³	3	1.4	1	0.8	8	0.9	6	1.3	X
<i>Elliptio dilatata</i> (IT)	R	0.0	2	1.6	0	0.0	1	0.2	X
<i>Fusconaia flava</i>	D	0.0	1	0.8	6	0.7	0	0.0	X
<i>Plethobasus cyphus</i> (FE)	D	0.0	0	0.0	0	0.0	0	0.0	
<i>Pleurobema sintoxia</i>	5	2.4	0	0.0	4	0.4	0	0.0	X
<u>Quadrluini</u>									
<i>Megalonaias nervosa</i>	D	0.0	2	1.6	0	0.0	2	0.4	X
<i>Quadrula metanevra</i>	2	1.0	1	0.8	7	0.8	4	0.9	X
<i>Quadrula p. pustulosa</i>	12	5.7	1	0.8	WD ⁴	0.0	WD	0.0	X
<i>Quadrula quadrula</i>	0	0.0	0	0.0	WD	0.0	1	0.2	X
<u>Anodontini</u>									
<i>Alasmidonta marginata</i>	D	0.0	0	0.0	0	0	1	0.2	X
<i>Lasmigona c. complanata</i>	10	4.8	0	0.0	2	0.2	1	0.2	X
<i>Lasmigona costata</i>	13	6.2	1	0.8	11	1.2	2	0.4	X
<i>Pyganodon grandis</i>	3	1.4	0	0.0	1	0.1	0	0.0	X
<i>Strophitus undulatus</i>	D	0.0	0	0.0	2	0.2	0	0.0	X
<i>Utterbackia imbecillis</i>	7	3.3	1	0.8	0	0.0	0	0.0	X
<u>Lampsilini</u>									
<i>Actinonaias ligamentina</i>	115	54.8	97	77.0	798	87.6	393	86.2	X
<i>Lampsilis cardium</i>	3	1.4	2	1.6	14	1.5	8	1.8	X
<i>Lampsilis siliquoidea</i>	5	2.4	0	0.0	4	0.4	3	0.7	X
<i>Leptodea fragilis</i>	3	1.4	2	1.6	5	0.5	2	0.4	X
<i>Ligumia recta</i> (IT)	D	0.0	0	0.0	8	0.9	16	3.5	X
<i>Potamilus alatus</i>	D	0.0	0	0.0	2	0.2	2	0.4	X
<i>Venustaconcha ellipsiformis</i> (SC)	1	0.5	2	1.6	2	0.2	1	0.2	X
Total Live	210	100.0	126	100.0	911	100.0	456	100.0	
Total Number of Live Species	14		13		16		16		
Total Number of Live Species for All Recent Studies									22

¹D = collected only a fresh-dead shell; R = collected as a relic shell (HDR, 2008)²Turgeon et al. (1998)³IT = Illinois state threatened; FE = federally endangered; SC = Illinois Special Concern species (IESPB, 2015)⁴Weathered Dead shell

Table 3-1. Unionids and community characteristics collected by sample method near the Braidwood Station discharge, Illinois, Kankakee River, September 2015.

Species by Tribe		Quantitative	Qualitative	Semi-quantitative	Total
Amblemini	<i>Amblema plicata</i>	0	1	12	13
Pleurobemini	<i>Cyclonaias tuberculata</i> (IT) ¹	0	4	2	6
	<i>Elliptio dilatata</i> (IT)	0	0	1	1
Quadrulini	<i>Megalonaias nervosa</i>	0	0	2	2
	<i>Quadrula metanevra</i>	0	2	2	4
	<i>Quadrula p. pustulosa</i>	WD ²	0	0	WD
	<i>Quadrula quadrula</i>	0	0	1	1
Anodontini	<i>Alasmidonta marginata</i>	0	1	0	1
	<i>Lasmigona c. complanata</i>	0	0	1	1
	<i>Lasmigona costata</i>	0	0	2	2
Lampsilini	<i>Actinonaias ligamentina</i>	4	166	223	393
	<i>Lampsilis cardium</i>	1	5	2	8
	<i>Lampsilis siliquoidea</i>	0	2	1	3
	<i>Leptodea fragilis</i>	0	0	2	2
	<i>Ligumia recta</i> (IT)	0	6	10	16
	<i>Potamilus alatus</i>	0	0	2	2
	<i>Venustaconcha ellipsiformis</i> (SC)	0	0	1	1
Total Live		5	187	264	456
Total Live Species		2	8	15	16
Effort		15 - 0.25 m ²	15 - 5 min.	100 - 10 m ²	
No. Freshly Dead Shells		1	0	0	1
No. Juveniles		0	2	1	3
Community Characteristics					
<u>Density (no. live / m²)</u>					
2015 (this study)		1.33			
2008 ³		0.80			
<u>Catch per Unit Effort (no. live / min.)</u>					
2015 (this study)			2.49		
2010 (relocation) ⁴			0.54		
2008 ³			0.48		
<u>Ave. No. Live / 10 m²</u>					
2015 (this study)				2.64	
2008 ³				1.20	

¹IT = Illinois state threatened; FE = federally endangered; SC = Illinois Special Concern species (IESPB, 2015)

²Weathered Dead shell

³(ESI, 2009)

⁴(ESI, 2010)

Table 3-2. Distribution of Illinois-listed species near the Braidwood Station discharge, Illinois, Kankakee River, September 2015.

Location / Sample ¹	Species				Total	
	<i>Cyclonaias tuberculata</i>	<i>Elliptio dilatata</i>	<i>Ligumia recta</i>	<i>Venustaconcha ellipsiformis</i>		
<u>Right Descending Bank</u>						
RDB Qualitative	1	0	0	0	1	
Total RDB	1	0	0	0	1	
<hr/>						
<u>Middle River</u>						
Transect 2	20 - 30 ²	0	0	1	0	1
Transect 3	10 - 20	0	0	1	0	1
	40 - 50	0	0	1	0	1
	50 - 60	0	0	0	1	1
	90 - 100	0	0	1	0	1
	100 - 110	1	0	0	0	1
	110 - 120	0	0	1	0	1
	120 - 130	0	0	1	0	1
	140 - 150	0	0	1	0	1
	170 - 180	1	0	0	0	1
190 - 200	0	1	0	0	1	
Transect 4	170 - 180	0	0	1	0	1
Diffuser Intensive Area Qualitative		0	0	3	0	3
Downstream of Diffuser Intensive Area Qualitative		3	0	3	0	6
Total Middle		5	1	14	1	21
<hr/>						
<u>Left Descending Bank</u>						
Transect 5	30 - 40	0	0	1	0	1
	120 - 130	0	0	1	0	1
Total LDB		0	0	2	0	2
<hr/>						
Total		0	1	16	1	24

¹Only samples where listed species were collected are presented. No IL-listed species were collected along Transect 1.

²Sample section along transect in meters

Table 3-3. Depths, substrate, and number live unionids collected along sample transects near the Braidwood Station discharge, Illinois, Kankakee River, 2015. (page 1 of 2)

Transect	Distance Along Transect (m)		No. Live Unionids	Depth (m)	Substrate (%)				
	Min.	Max.			Bedrock	Boulder	Cobble	Gravel	Sand
1	0	10	6	1.2	0	0	0	0	100
	10	20	1	1.2	0	50	0	25	25
	20	30	2	1.2	0	50	0	25	25
	30	40	1	1.2	0	50	0	25	25
	40	50	0	1.2	0	80	0	0	20
	50	60	2	1.2	0	80	0	0	20
	60	70	0	1.2	0	20	0	0	80
	70	80	0	1.5	0	20	0	0	80
	80	90	1	1.5	0	100	0	0	0
	90	100	1	1.5	0	90	0	0	10
	100	110	3	1.2	0	90	0	0	10
	110	120	1	1.2	0	90	0	0	10
	120	130	5	1.2	0	20	0	0	80
	130	140	7	1.2	0	0	0	0	100
	140	150	1	1.5	0	25	0	25	50
	150	160	2	1.2	0	100	0	0	0
	160	170	0	1.5	0	50	0	0	50
	170	180	0	1.5	50	50	0	0	0
	180	190	5	1.5	50	50	0	0	0
190	200	1	1.5	0	25	0	25	50	
2	0	10	1	0.9	0	20	70	0	10
	10	20	2	0.9	0	20	70	0	10
	20	30	4	1.2	0	20	70	0	10
	30	40	2	1.2	0	20	70	0	10
	40	50	2	1.2	0	20	70	0	10
	50	60	1	1.5	0	20	70	0	10
	60	70	0	1.5	0	20	80	0	0
	70	80	1	1.8	0	0	10	0	90
	80	90	0	1.8	0	0	10	0	90
	90	100	0	1.8	100	0	0	0	0
	100	110	2	1.8	0	10	80	10	0
	110	120	0	1.5	0	10	80	10	0
	120	130	0	1.5	0	10	0	80	10
	130	140	1	1.8	0	10	0	80	10
	140	150	1	2.1	0	10	0	80	10
	150	160	0	2.4	90	0	0	0	10
	160	170	0	2.4	90	0	0	0	10
	170	180	0	2.4	100	0	0	0	0
	180	190	0	2.7	0	10	80	0	10
190	200	0	2.7	0	10	80	0	10	
3	0	10	2	2.4	0	0	80	0	20
	10	20	3	2.4	0	0	80	10	10
	20	30	2	2.7	0	0	80	10	10
	30	40	2	2.7	0	0	80	0	20
	40	50	3	2.7	0	0	80	0	20
	50	60	3	2.4	0	0	80	0	20
	60	70	1	2.4	0	0	80	0	20
	70	80	0	2.4	0	0	80	0	20
	80	90	3	2.4	0	0	80	0	20
	90	100	4	2.7	0	0	80	0	20

Table 3-3. Depths, substrate, and number live unionids collected along sample transects near the Braidwood Station discharge, Illinois, Kankakee River, 2015. (page 2 of 2)

Transect	Distance Along Transect (m)		No. Live Unionids	Depth (m)	Substrate (%)				
	Min.	Max.			Bedrock	Boulder	Cobble	Gravel	Sand
3 (cont.)	100	110	5	2.7	0	0	80	0	20
	110	120	4	2.7	0	0	80	0	20
	120	130	2	2.7	0	0	80	0	20
	130	140	3	2.7	0	0	80	0	20
	140	150	4	2.7	0	0	80	0	20
	150	160	3	2.4	0	0	80	0	20
	160	170	6	2.4	0	0	80	0	20
	170	180	8	2.4	0	0	80	0	20
	180	190	8	2.4	0	0	80	0	20
	190	200	7	2.4	0	0	80	0	20
4	0	10	4	2.1	0	10	80	0	10
	10	20	7	2.1	0	10	80	0	10
	20	30	2	2.1	0	0	80	10	10
	30	40	4	2.1	100	0	0	0	0
	40	50	1	1.8	0	10	80	10	0
	50	60	3	1.8	0	10	80	10	0
	60	70	1	1.8	0	10	80	10	0
	70	80	0	1.8	0	0	0	90	10
	80	90	0	2.4	100	0	0	0	0
	90	100	3	2.4	0	0	80	10	10
	100	110	3	1.8	0	0	80	10	10
	110	120	2	1.8	0	0	80	10	10
	120	130	0	1.5	0	0	80	10	10
	130	140	0	1.5	0	0	10	80	10
	140	150	0	1.5	0	0	10	80	10
	150	160	2	1.8	0	0	10	80	10
	160	170	0	1.8	100	0	0	0	0
	170	180	3	1.8	0	0	80	20	0
	180	190	4	1.5	0	0	80	20	0
190	200	0	1.5	0	10	80	10	0	
5	0	10	11	1.2	0	60	0	20	20
	10	20	20	1.2	0	60	0	20	20
	20	30	6	0.9	0	80	0	20	0
	30	40	8	0.9	0	25	0	25	50
	40	50	7	0.9	0	80	0	20	0
	50	60	8	0.9	0	50	25	25	0
	60	70	5	0.9	0	100	0	0	0
	70	80	8	0.9	0	25	25	25	25
	80	90	3	0.9	0	25	25	25	25
	90	100	3	0.9	100	0	0	0	0
	100	110	0	0.9	0	25	25	0	50
	110	120	6	0.9	0	25	25	0	50
	120	130	4	0.9	0	25	25	0	50
	130	140	1	0.9	0	25	25	0	50
	140	150	0	0.9	0	80	0	0	20
	150	160	0	0.9	0	80	0	0	20
	160	170	4	0.9	0	80	0	0	20
	170	180	1	0.9	0	80	0	0	20
	180	190	0	0.9	0	80	0	0	20
190	200	1	0.9	0	80	0	0	20	

Appendix A. Incidental Take Authorization.



Mostardi Platt
Environmental

1520 Kensington Road, Suite 204
Oak Brook, Illinois 60523-2139
Phone 630-993-2100
Fax 630-993-9017
www.mostardiplatten.com

January 18, 2010

Joseph A. Kath
Endangered Species Manager
IDNR – Office of Resource Conservation
One Natural Resources Way
Springfield, IL 62702-1271

**Re: Threatened and Endangered Species Issues – Incidental Take Authorization (ITA)
Exelon Nuclear Braidwood Station River Diffuser Project**

Dear Mr. Kath:

Attached is the signed “Authorization and Implementing Agreement” for the Exelon Nuclear Braidwood Station River Diffuser Project. The ITA Agreement was signed by Mr. Lawrence M. Coyle, Plant Manager. For reference, the U.S. Army Corps of Engineers permit number is LRC-2008-340 and the IDNR permit application number for the cofferdam construction is IDNR 2009107.

Thank you for your continued assistance with this project. Please contact me at 630-993-2127 if there are any questions.

Respectfully submitted:

MOSTARDI PLATT ENVIRONMENTAL

Joseph J. Macak III
Principal Consultant

Enclosures

cc: Mr. Lawrence Coyle, Exelon Nuclear
Mr. Raymond Hall, Exelon Nuclear
Mr. Dominic Imburgia, Exelon Nuclear
Mr. John Petro, Exelon Nuclear
Mr. Bryan Risley, Exelon Nuclear
Ms. Kate Bliss, Project Manager, Chicago District USACE LRC-2008-340
Ms. Jeannette Schiller, IDNR Bartlett Office, IDNR 2009107



Illinois
Department of
Natural Resources

One Natural Resources Way • Springfield, Illinois 62702-1271

<http://dnr.state.il.us>

December 17, 2009

Mr. Thomas I. Hiebert
Mostardi Platt Environmental
1520 Kensington Road - Suite 204
Oak Brook, Illinois 60523-2139

RE: *Exelon's Braidwood Nuclear Generating Station - Plant outfall and Multiport diffuser
Kankakee River, Will County, Illinois
Threatened and Endangered Species Issues - Incidental Take Authorization*

Dear Mr. Hiebert:

Pursuant to the Illinois Endangered Species Protection Act (520 ILCS 10/5.5) the Exelon/Braidwood Generating Station outfall and multiport diffuser (new outfall and multiport diffuser) for the incidental take of the State threatened black sandshell mussel (*Ligumia recta*), purple wartyback mussel (*Cyclonaias tuberculaya*), sheepnose mussel (*Plethobasus cyphus*), spike mussel (*Elliptio dilatata*), pallid shiner fish (*Hybopsis amnis*), river redhorse fish (*Moxostoma carinatum*), and the western sand darter (*Ammorcrypta clarum*) impacting the Kankakee River in Will County, Illinois is hereby granted, subject to the terms and conditions described in the attached Authorization and Implementing Agreement. The Illinois Department of Natural Resources has determined that this authorized take is incidental to the construction of a new outfall and multiport diffuser impacting the Kankakee River in Will County, Illinois.

Please have an authorized Exelon/Braidwood Official(s) sign the last page of both copies of the Authorization and Implementing Agreement and return **one complete** copy to my the attention. Upon receipt by the Department, this authorization shall be effective.

Thank you for your cooperation and assistance during the incidental take preparation and review process. Please do not hesitate to contact our office at (217)782-6384 with any questions or comments you may have regarding this authorization agreement.

Sincerely,

Joseph A. Kath
Endangered Species Manager
IDNR-Office of Resource Conservation

Enclosures

Authorization for Incidental Take and Implementing Agreement

Pursuant to the Illinois Endangered Species Protection Act (520 ILCS 10/5.5) the Exelon/Braidwood Generating Station outfall and multiport diffuser (new outfall and multiport diffuser) for the incidental take of the State threatened black sandshell mussel (*Ligumia recta*), purple wartyback mussel (*Cyclonaias tuberculaya*), sheepnose mussel (*Plethobasus cyphus*), spike mussel (*Elliptio dilatata*), pallid shiner fish (*Hybopsis amnis*), river redhorse fish (*Moxostoma carinatum*), and the western sand darter (*Ammorcrypta clarum*) impacting the Kankakee River in Will County, Illinois (as described/shown in the conservation plan received by the Department on 11 May, 2009) is hereby granted, subject to the terms and conditions described in the attached Authorization and Implementing Agreement. The Illinois Department of Natural Resources has determined that this authorized take is incidental to the construction of a new outfall and multiport diffuser impacting the Kankakee River in Will County, Illinois.

Procedural History

Mostardi Platt Environmental (MPE), acting as environmental consultant for the Exelon Nuclear-Braidwood Generating Station prepared a conservation plan as described by the Illinois Endangered Species Protection Act (520 ILCS 10/5.5). That plan and MPE's request for authorization for incidental take of the State threatened black sandshell mussel (*Ligumia recta*), purple wartyback mussel (*Cyclonaias tuberculaya*), sheepnose mussel (*Plethobasus cyphus*), spike mussel (*Elliptio dilatata*), pallid shiner fish (*Hybopsis amnis*), river redhorse fish (*Moxostoma carinatum*), and the western sand darter (*Ammorcrypta clarum*) were received by the Illinois Department of Natural Resources (Department) on 11 May, 2009. Public notice of MPE's request for authorization of incidental take of these listed species was published in the Northwest Daily Herald (Official State newspaper) and the Braidwood/Free Press (Braidwood, Wilimington, and Coal City, Illinois) on August 21, 26, and 28, 2009 as well as September 2, 4, and 9, 2009. Public comments on MPE's conservation plan were accepted by the Department until October 9, 2009. No comments were received by the public during the period of August 21 through October 9, 2009.

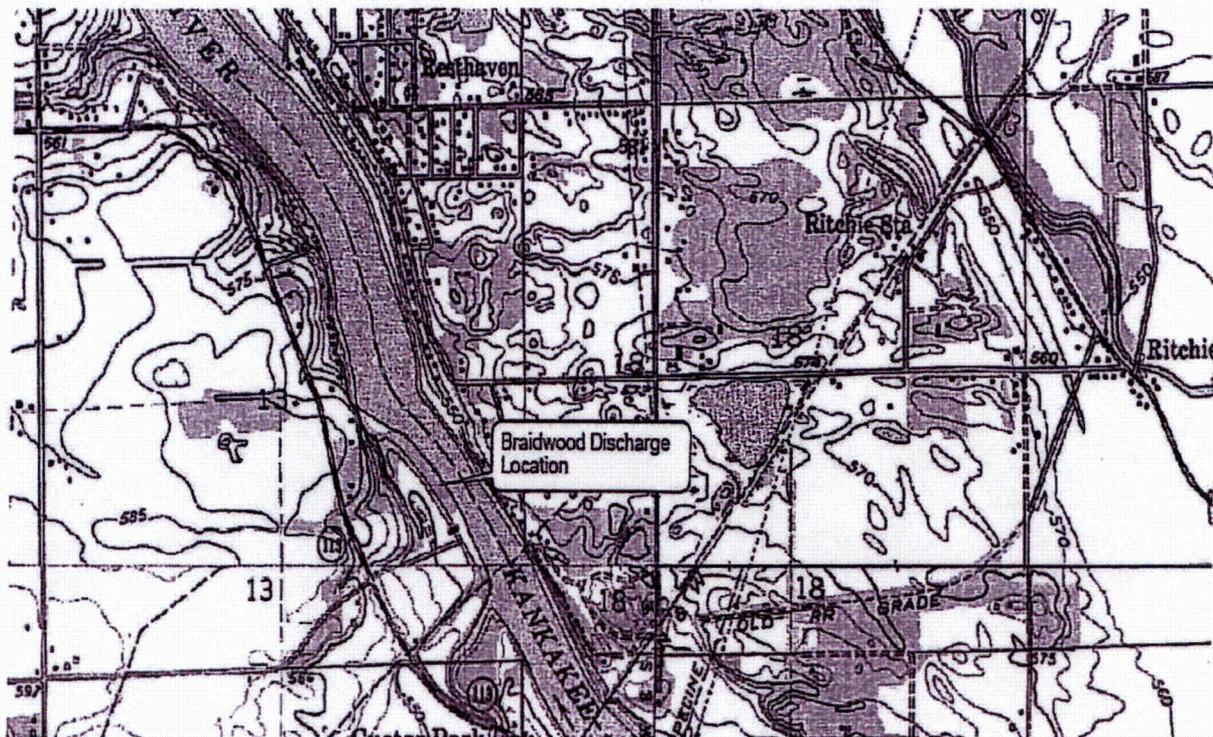
Exelon Corporation, Braidwood Generating Station (Braidwood) will be installing a multiport diffuser in the Kankakee River that would more than likely result in significant environmental benefits over the existing river outfall that would continue operation only as back-up to the diffuser. This project will have an in-stream construction zone of approximately 132 feet by 245 feet.

The Braidwood Generating Station is a nominal 2,362 MW base load generating facility located in Will County, Illinois, approximately 20 miles south of Joliet, Illinois. The facility, which serves northeastern Illinois, consists of two Westinghouse pressurized water reactors. Unit 1 began operation on July 2, 1987, and Unit 2 began operation on May 5, 1988. Commercial operation began in May and October 1988, respectively. The license expiration date is October 17, 2026 for Unit 1, and December 18, 2027 for Unit 2.

Braidwood is owned by Exelon Corporation, and operated by one of its business units-Exelon Nuclear. Braidwood is built on a 4,457-acre site, and its 2,537-acre cooling pond was formed from scarred farming land and an old strip mine.

Braidwood has been coordinating this project with MOSTARDI PLATT ENVIRONMENTAL (MPE) as the lead consultant dealing with: U.S. Army Corps of Engineers (USACE) permitting, Illinois Department of Natural Resources (IDNR) incidental take permitting, Illinois Environmental Protection Agency (IEPA) National Pollutant Discharge Elimination System (NPDES) permit modifications and 401 Water Quality Certification, and the Illinois Historic Preservation Agency (IHPA) for impact on cultural and historical resources.

The location of the existing cooling lake outfall is shown below. Two (2) recent biological surveys of the proposed in-river construction site have been conducted. HDR Engineering, Inc. (HDR) performed a survey for fish and mussels in August 2008. Ecological Specialists, Inc. (ESI) conducted a more comprehensive follow-up mussel survey in October 2008. The surveys identified two (2) State listed T&E fish species and three (3) State listed T&E mussel species and one (1) species of special concern in the project area.



A preliminary review of fish and freshwater mussel studies conducted in this general reach of the river indicated that fish monitoring, including the proposed area for diffuser pipe placement, has been conducted annually for the past 30 years (with the exception of 1980)(HDR|LMS, 2008); but that, while several freshwater mussel surveys had been conducted in the river between Kankakee and Wilmington in the past, none had been conducted at the proposed site.

Compliance with the Endangered Species Protection Act

The Illinois Endangered Species Protection Act includes six (6) criteria which must be met for the authorization of incidental take of an endangered or threatened species. These criteria and the Department's determination for each criteria are listed below.

1. The taking will not be the purpose of, but will only be incidental to, the carrying out of an otherwise lawful activity:

The stated and apparent purpose of this proposed action is to construct a new outfall and multipoint diffuser for "Braidwood" impacting a portion of the Kankakee River in Will County, Illinois. This portion of the Kankakee River potentially contains habitat for freshwater mussels and fish, including State listed species. In the course of these construction activities, *HDR and/or ESI* (acting as subcontracting environmental consultants) shall relocate all observed/captured mussels and fish (listed or non-listed species) disturbed by construction, hence a technical "taking" of these species. Such taking is not the purpose of the activities proposed by Braidwood but is incidental to the carrying out of a lawful activity.

Overall, Braidwood is proposing to replace the existing Braidwood Nuclear Station Cooling Pond discharge (shoreline discharge channel) with a diffuser pipe placed on the bottom of the Kankakee River extending across the river near the location of the current discharge channel. A preliminary review of fish and freshwater mussel studies conducted in this general reach of the river indicated that fish monitoring, including the proposed area for diffuser pipe placement, has been conducted annually for the past 30 years (with the exception of 1980)(HDR|LMS, 2008); but that, while several freshwater mussel surveys had been conducted in the river between Kankakee and Wilmington in the past, none had been conducted at the proposed site.

In retrospect, the Kankakee River supports some of Illinois' most diverse and abundant mussel populations with 27 extant and 40 historical species. It was surveyed several times for mussels in the 20th century. Some regard the mussel populations of the Kankakee River to be of national importance. Several freshwater mussel species currently listed as either endangered or threatened by the State of Illinois were collected during these earlier surveys. No freshwater mussel species currently listed as threatened or endangered by the Federal government have been reported in this reach of the Kankakee River.

To limit impact on the unionid community, the multiport diffuser will be placed in an area of the river known to be nearly devoid of mussels and from which no specimens representing State-listed species were taken. Because the diffuser will only traverse a nominal 60% of the Kankakee River, there will likely be minimal impact on the unionid population known to inhabit the near-shoreline opposite and downstream of the existing outfall and new diffuser installation site.

Early diffuser designs studied by Braidwood included diffusers crossing the entire width of the river. The final design minimized the width by locating the multiport diffuser in a 20 meter section of the deepest, middle portion of the river. By minimizing the width, the diffuser can be constructed with one (1) single cofferdam installation and avoid the area on the opposite shoreline where mussel species had a higher density.

2. The parties to the conservation plan will, to the maximum extent practicable, minimize and mitigate the impact caused by the taking.

The Braidwood conservation plan stated that freshwater mussel and fish surveys, and subsequent relocations, shall be conducted prior to initiation of in-stream construction and most likely during the spring/summer while water temperatures are at or above 50 degrees Fahrenheit. All mussels and fish observed/captured (listed or non-listed species) are to be relocated in order to minimize impacts. Mussel surveys shall be conducted using standard survey techniques including searching by feel to methodically cover the area to be disturbed by the project (viewing boxes, wading in shallow water, SCUBA in deeper water-if applicable). All mussels found will be identified to species. Mussels shall be relocated into areas of suitable habitat, in the same stream/river, preferably upstream of the construction site. Specifically, the transplant site will be close to the collection area and have similar to better water quality and substrate. The proposed contractor is Ecological Specialists, Inc. (ESI) that has worked on several similar projects and have extensive experience with Midwestern mussels. Braidwood shall provide the Department (Attn: Joseph Kath) with a report detailing the results of all mussel surveys and relocation efforts within 45 days of completing all surveys/relocations.

In addition, all fish retained within the cofferdam during dewatering shall be netted and immediately returned to the river as addressed in the 2009 Conservation Plan. Overall, mussel and fish surveys and related relocations shall occur only after Department authorization and prior to any construction activities.

The river diffuser project will require the construction of a temporary cofferdam approximately 132 feet by 245 feet. The cofferdam will consist of sheet pile with rock backfill. After the cofferdam is constructed, the area will be dewatered to allow for construction of the river diffuser beneath the river bottom. Upon completion of the construction program, the sheet pile and temporary rock backfill will be removed from the river and the area will return to its natural state. In the absence of any conservation plan, there would be the potential for mussel and fish species to be adversely impacted or killed since the area would be temporarily drained and filled (gravel).

Fisheries

Two (2) state protected species of fish, the pallid shiner and river redhorse, were taken during the survey conducted August 2008. None of the state-listed specimens were taken in the immediate proximity of the proposed project and are not expected to pose a regulatory effect on the permitting process. Fish are motile and often occupy different areas under varying flow and environmental conditions. Project related effects to state-listed fish species are expected to be minimal if any. Fish would most likely not be attracted to the construction activity and daytime noise associated with sheet pile driving.

The mitigation of incidental take of fish during construction should more than likely be fairly simple. The IDNR fisheries specialists shall be notified (per their request) of the dewatering of the cofferdam area following its construction. The water contained within the cofferdam will be pumped back to the river. As the water level recedes, all fish retained within the cofferdam will be netted and safely/humanely returned to the river. No construction shall take place during the spawning season of the last three weeks of May, and first week of June. This activity will be photographed and documented in a formal diffuser construction report and shall be made available to the Department upon request.

Mussels

Two (2) Illinois protected species (*C. tuberculata*, *E. dilitata*) and one (1) Illinois Special Concern species (*V. ellipsiformis*) and the Federal Candidate species *P. cyphus* were present. Habitat within the survey area is not typically ideal for unionids within the Kankakee River. Run habitats within the Kankakee River, like the habitat within the survey area, are not known to foster abundant and species-rich unionid communities. Other Kankakee River surveys have shown that unionid communities in pools or runs generally ranked low in abundance and diversity compared to areas with riffles or dam tail waters. Although the survey area appears to contain a relatively moderate to high species richness, unionid density was relatively low and unionids were scattered throughout the survey site.

In-stream construction activity may disrupt the substrate and, consequently, the animals living in the substrate. Unionids within the area directly affected by construction could be crushed by equipment or permanently buried under excavation spoil. Disruption of the substrate could result in displacement of unionids to unsuitable habitat, which could lead to reduced fitness or death. Construction activities could also lead to altered flow patterns that may increase sedimentation, which is a putative source of unionid declines throughout North America. Construction impacts to unionids have successfully been mitigated by minimizing the area used for constructing and relocating unionids from areas of unavoidable impact.

Exelon Nuclear/Braidwood shall perform a pre-construction mussel survey, coordinated by a qualified diver(s), to locate and move/relocate any and all mussels within the impact area in the deeper portions of the river, or through wading in the shallower portions of the river. This survey shall be performed within 30 days of the start of construction.

Mussels in the construction area will be relocated to areas of suitable habitat. The relocation site will be located in the Kankakee River, relatively close to the project site upstream of the construction activities. It will contain similar or better water quality and substrate. An area has been identified approximately 1,000 feet upstream of the proposed construction area known to contain a relatively dense mussel population. This area will be considered for the relocation site. The IDNR shall be notified 14 days prior to the start of this survey activity.

The mussel survey and relocation activity shall also be documented in a formal diffuser construction report. The report will discuss the methods of the mussel relocations, and include a quantification of the relative number and species of mussels relocated. The report will also identify any state-listed species that are relocated, if any. This report shall be made available to the Department upon request.

To minimize the extent and duration of project-related disturbance to the Kankakee River and any potential for indirect impacts on mussels or mussel habitat, Braidwood shall implement sediment control and construction management measures during construction. These measures will include use of the cofferdam, plus silt fencing or other sediment control measures to limit downstream sedimentation during construction. The in-stream construction will take approximately 150 days and any potential short-term effects will be limited to this time period.

3. The parties to the conservation plan will ensure that adequate funding for the conservation plan will be provided:

Braidwood Station confirms that adequate funding exists to support and implement all (mitigation) activities described in the official 2009 Conservation Plan. Braidwood has committed to budget and authorize, during their Fiscal Year 2009-2010 budget appropriation ordinance, adequate funding to provide for project construction activities and implementation of all mitigation activities required and described in the official conservation plan.

4. Based on the best available scientific data, the Department has determined that the taking will not reduce the likelihood of the survival or recovery of the endangered species or threatened species in the wild in Illinois, the biotic community of which the species is a part, or the habitat essential to the species' existence in Illinois:

Construction and operation of Braidwood's multiport diffuser project in Will County, Illinois will more than likely not reduce the likelihood of the survival of state-listed threatened or endangered mussels in Illinois.

For the purposes of biological comparison, HDR Engineering, Inc. (HDR) completed an investigation of fish and freshwater mussel studies in the river and proposed diffuser area in August 2008. In addition, Ecological Specialists, Inc. (ESI) completed a characterization of unionid communities near Braidwood's diffuser project to investigate freshwater mussels in the proposed diffuser area in October 2008.

For the purposes of biological comparison, it should be noted that the freshwater mussel and fish fauna of the Kankakee River, HDR identified 212 live mussels from 15 species in August 2008 and ESI identified 126 live mussels and 13 species in October 2008. Three (3) purple wartyback mussels were collected upstream of the discharge channel with one (1) fresh dead sheepsnose shell and relic spike and black sandshell mussels by HDR.

HDR identified 1,308 fish consisting of 45 taxa (43 species) dominated by longer sunfish (26.5%), spotfin shiner (13.1%), bluntnose minnow (11.7%), rock bass (5.3%), smallmouth bass (4.8%) and largemouth bass (4.8%) from electroshocking. HDR also completed seining which included 686 fish comprised of 22 taxa (20 species) dominated by spotfin shiner (36.2%), bluntnose minnow (15.3%), striped shiner (11.7%), sand shiner (9.0%), and Johnny darter (8.3%). According to HDR, none of the three (3) state listed fish species were taken within the immediate proximity of the proposed diffuser.

The black sandshell mussel (*Ligumia recta*) is listed as threatened in Illinois because of its range and it was formerly widespread in the state where it was found in medium to large river systems. Although it is possible that live individuals of the black sandshell are present in the project area, it is unlikely due to the fact that only one (1) was found alive in August 2008 and one (1) was found dead in October 2008.

The purple wartyback mussel (*Cyclonaias tuberculata*) is listed as threatened in Illinois and was once widespread in Illinois including the Kankakee River. It is possible that live individuals of the purple wartyback are present in the project area, since three (3) were found alive in August 2008 and one (1) alive in October 2008.

The sheepsnose mussel (*Plethobasus cyphus*) is listed as endangered in Illinois because its range and abundance have declined in recent decades. It was formerly widespread in the state where it was found in medium to large river systems. Currently, it is found in small, isolated populations in rivers including the Kankakee River. Although it is possible that live individuals of the sheepsnose are present in the project area, it is unlikely due to the fact one (1) was found dead in August 2008 and none (0) were found dead in October 2008.

The spike mussel (*Elliptio dilatata*) is listed as threatened in Illinois because it was formerly wide spread in Illinois, including the Kankakee River. Although it is possible that live individuals of the spike are present in the project area, it is unlikely due to the fact that a relic shell was in August 2008 and two (2) were collected alive in October 2008.

The pallid shiner fish (*Hybopsis amnis*) is listed as threatened in Illinois and found in medium to large rivers and streams. Commonly, this fish is found in the sand and mud in shallow, slow-moving, moderately clear, warm, and well-oxygenated waters. Two (2) were identified by HDR in 2008 downstream from the discharge channel, near a sand bar drop off.

The river redhorse fish (*Moxostoma carinatum*) is listed as threatened in Illinois and is found in swift waters of large rivers, lower portions of main tributaries, reservoirs, and pools over clean gravel and rubble. One (1) was identified by HDR in 2008 collected upstream from the discharge channel.

The western sand darter fish (*Ammocrypta clarum*) is listed as threatened in Illinois and is found in medium to large streams with sandy areas and moderate current. HDR identified no (0) western sand darter fish in August 2008.

Any live animals that are overlooked during the relocation effort could be at risk of injury or death as a result of construction activities. The relocation of all mussels and fish encountered will make it unlikely that a significant number of individuals will be exposed to threats related to the Exelon Nuclear plant outfall and multipoint diffuser project in Braidwood, Illinois. Relocation can be used to recolonize areas where previous populations were extirpated, to remove mussels from proposed construction sites, to boost numbers of endangered species. The survival of relocated mussels is closely linked to habitat quality.

As stated in the official conservation plan, Braidwood shall implement sediment control and construction management measures to minimize the extent and duration of project related disturbance to the Kankakee River and any potential for direct/indirect impacts on mussels and/or mussel habitat. These measures will include the use of cofferdams, silt fencing, or other sediment control measures to limit downstream sedimentation during construction. The in-stream construction will take approximately 150 days and any potential short-term effects will most likely be limited to this time period. All mussels shall be relocated from the outfall mixing zone limiting long-term operational effects.

For further purposes of *Statewide* biological comparison, it should be noted that the freshwater mussel fauna of the Fox River and its tributaries in Illinois and Wisconsin were surveyed by Department staff during the summers of 1997-2001. A total of 3,585 live individuals comprised of 23 species were collected from 96 sampling stations. Of this total, 60 spike mussels (*Elliptio dilatata*) and four (4) black sandshell mussels (*Ligumia recta*) were collected.

The black sandshell mussel (*Ligumia recta*) is listed as threatened in Illinois because its range and abundance have declined in recent decades. This species was once fairly widespread in the state where it was found in most of the major river systems, but is now known from less than 25% of the counties with historic records. Although it is possible that live individuals of the black sandshell are present in the project area, it is unlikely due to the fact that only one (1) dead, weathered shell of spike and black sandshell mussels were found in the project area. Any live animals that are overlooked during the relocation effort could be at risk of injury or death as a result of construction activities. The relocation of all mussels encountered will make it unlikely that a significant number of individuals will be exposed to threats related to the Braidwood plant outfall and multipoint diffuser project in Will County, Illinois.

As stated in the April 1996 Technical Report (working draft) titled - "Measures to minimize harm to *Lampsilis higginsi* [federally endangered Higgins Eye mussel] caused by passage of commercial navigation vessels in the upper Mississippi River" [prepared by the U.S. Army Corps of Engineers-Waterways Experiment Station]: Relocation is one of several methods that can be used to protect freshwater mussels. Relocation can be used to recolonize areas where previous populations were extirpated, to remove mussels from proposed construction sites, to boost numbers of endangered species, or to protect against high densities of the zebra mussel (*Dreissena polymorpha*). The survival of relocated mussels is closely linked to habitat quality.

Relocation sites should have the same conditions of substratum type and stability, and water velocity as the original habitat. Research from the federally endangered Higgins Eye mussel (*Lampsilis higginsi*) recovery team, under the guidance of the United States Fish and Wildlife Service, has determined that minimal mortality (<12%) and high recovery rate (>88%) were shown when aerial exposure of mussels was less than four (4) hours and when relocations were conducted in spring or autumn when air (12-18 C) and water temperature (15-23 C) were moderate.

5. Any measures required under Section 5.5 of the Illinois Endangered Species Protection Act [520 ILCS 10/5.5 - 17 IL. Adm. Code Part 1080.40(b)], will be performed:

Additional measures are listed below under "Authorization." This authorization is, by definition, subject to those terms and conditions and official Exelon Corporation/Braidwood Generating Station signature(s) on this authorization indicates their commitment to performing those measures.

6. The public has received notice of the application and has had the opportunity to comment before the Department made any decision regarding the application:

Mostardi Platt Environmental (MPE), acting as environmental consultant for the Exelon Nuclear-Braidwood Generating Station prepared a conservation plan as described by the Illinois Endangered Species Protection Act (520 ILCS 10/5.5). That plan and MPE's request for authorization for incidental take of the State threatened black sandshell mussel (*Ligumia recta*), purple wartyback mussel (*Cyclonaias tuberculaya*), sheepnose mussel (*Plethobasus cyphus*), spike mussel (*Elliptio dilatata*), pallid shiner fish (*Hybopsis amnis*), river redhorse fish (*Moxostoma carinatum*), and the western sand darter (*Ammocrypta clarum*) were received by the Illinois Department of Natural Resources (Department) on 11 May, 2009. Public notice of MPE's request for authorization of incidental take of these listed species was published in the Northwest Daily Herald (Official State newspaper) and the Braidwood/Free Press (Braidwood, Wilington, and Coal City, Illinois) on August 21, 26, and 28, 2009 as well as September 2, 4, and 9, 2009.

Public comments on MPE's conservation plan were accepted by the Department until October 9, 2009. No comments were received by the public during the period of August 21 through October 9, 2009.

Authorization

It is the determination of the Department that the measures to be implemented by Mostardi Platt Environmental (MPE), acting as environmental consultant for the Exelon Nuclear-Braidwood Generating Station, would adequately minimize and mitigate for the anticipated taking (relocation) of a small number of the State threatened black sandshell mussel (*Ligumia recta*), purple wartyback mussel (*Cyclonaias tuberculaya*), sheepnose mussel (*Plethobasus cyphus*), spike mussel (*Elliptio dilatata*), pallid shiner fish (*Hybopsis amnis*), river redhorse fish (*Moxostoma carinatum*), and/or the western sand darter (*Ammocrypta clarum*) impacting the Kankakee River in Will County. Further, it is our opinion that the take (relocation) authorized herein would not diminish the likelihood of the survival of the above listed species in the wild within the State of Illinois, the biotic community of which the species is a part or the habitat essential to the species' existence in Illinois.

Pursuant to Section 5.5 of the Illinois Endangered Species Protection Act [520 ILCS 10/5.5 - 17 IL. Adm. Code Part 1080.40(b)], this authorization is issued subject to the following additional terms and conditions:

1. This authorization is effective upon signature by the Department and shall remain in effect for a period of five (5) years after completion of the construction of a multiport diffuser impacting the Kankakee River in Will County, Illinois, unless terminated as pursuant to Section 5.5 of the Illinois Endangered Species Protection Act [520 ILCS 10/5.5 - 17 IL. Adm. Code Part 1080.80].
2. Freshwater mussel surveys shall be conducted prior to construction activities (related to a new multiport diffuser impacting the Kankakee River) in the area(s) of direct impact, as well as the immediate downstream reaches (100 feet downstream). All mussels observed (listed or non-listed species) are to be relocated in order to minimize impacts. Mussel surveys will be conducted using standard survey techniques including searching by feel to methodically cover the area to be disturbed by the project (viewing boxes, wading in shallow water, SCUBA in deeper water-if applicable). All mussels found will be identified to species. Mussels shall be relocated into areas of suitable habitat, in the same stream, preferably upstream of the construction site. Specifically, the transplant site will be close to the collection area and have similar to better water quality and substrate. MPE (or another qualified ecological consultant) shall provide the Department with a report detailing the results of all mussel surveys and relocation efforts within 45 days of completing all surveys/relocations.

3. Regardless of whether any live black sandshell (*Ligumia recta*), purple wartyback (*Cyclonaias tuberculata*), sheepnose (*Plethobasus cyphus*), and/or spike (*Elliptio dilatata*) live mussels and/or any other live Federal or State endangered or threatened mussels are removed and/or relocated within the Will County, Illinois construction zone (approximately 132 feet by 245 feet) at Braidwood, either solely and/or through a qualified environmental consultant(s), Exelon Nuclear-Braidwood shall perform (or cause to be performed) a survey of the entire construction zone +/- 300 feet in the (fifth) 5th year following initial operation of the river diffuser. The purpose of the survey is to determine if these listed species have colonized/recolonized areas directly impacted by the river diffuser construction and operation. Again, this survey shall be conducted at five (5) years after the start of operation for the river diffuser. Braidwood, either solely or through its environmental consultant, shall provide a copy of these survey reports to the Department within 45 days of survey completion. In addition, Braidwood shall continue to perform their annual fisheries surveys in order to document that the river diffuser project had no adverse impact on the aquatic environment. These annual fisheries reports shall be made available to the Department upon request.

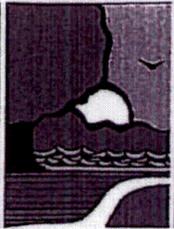
4. All mussels encountered within the State of Illinois during this project shall be subject to the general U.S. Fish and Wildlife Service handling protocol for determining presence/absence of species as found in "Section H" of the attached Federal Fish and Wildlife document.

5. The mitigation of incidental take of fish during Braidwood construction shall involve the following: The local IDNR fisheries specialist(s) shall be notified prior to dewatering of the cofferdam area following its construction. The water contained within the cofferdam will be pumped back to the river. As the water level recedes, all fish retained within the cofferdam will be netted and safely/humanely returned to the river. No construction shall take place during the spawning season of the last three weeks of May, and first week of June. This dewatering activity will be photographed and documented in a formal diffuser construction report and shall be made available to the Department upon request.

6. The effective period of this authorization may be altered by mutual agreement between Exelon Nuclear-Braidwood Generating Station and the Department only.

7. This authorization may be revoked pursuant to Section 5.5 of the Illinois Endangered Species Protection Act [520 ILCS 10/5.5 - 17 IL. Adm. Code Part 1080.80] if the Department finds that the Exelon Nuclear-Braidwood Generating Station has failed to comply with any of these terms and conditions and/or has been responsible for the unauthorized taking (relocation) of the State threatened black sandshell mussel (*Ligumia recta*), purple wartyback mussel (*Cyclonaias tuberculata*), sheepnose mussel (*Plethobasus cyphus*), spike mussel (*Elliptio dilatata*), pallid shiner fish (*Hybopsis amnis*), river redhorse fish (*Moxostoma carinatum*), and/or the western sand darter (*Ammocrypta clarum*) impacting the Kankakee River in Will County, Illinois

8. The Exelon Nuclear-Braidwood Generating Station Official(s) identified below is authorized to execute this agreement. Execution by such Exelon Nuclear-Braidwood Generating Station Official(s) indicates acceptance of all terms and conditions described in this agreement.

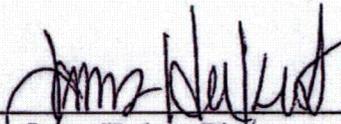


Illinois
Department of
Natural Resources

One Natural Resources Way • Springfield, Illinois 62702-1271

<http://dnr.state.il.us>

For the IL. Department of Natural Resources



Dr. James Herkert, Director
IDNR-Office of Resource Conservation

12-17-09
Date Signed

For the Exelon Nuclear-Braidwood Generating
Station



Signature

LAWRENCE M. COYLE / Plant Manager
Please print name and official title

1/13/10
Date Signed

Appendix B. Department of Interior Letter to the Nuclear Regulatory Commission.



IN REPLY REFER TO:

United States Department of the Interior

OFFICE OF THE SECRETARY
Office of Environmental Policy and Compliance
Custom House, Room 244
200 Chestnut Street
Philadelphia, Pennsylvania 19106-2904

May 8, 2015

9043.1
ER 15/0189

David Wrona
United States Nuclear Regulatory Commission
Mail Stop: 3WFN, 06A44M
Washington, DC 20555-0001

Dear Mr. Wrona:

As requested, the Department of the Interior (Department) has reviewed the Draft Supplement to the Generic Environmental Impact Statement (DSEIS) for the proposed license renewal of Braidwood Station, Units 1 and 2, in Braidwood, Illinois. With respect to those portions of the DSEIS for which the Department or its bureaus have jurisdiction or special expertise, the Department offers the following comments and recommendations for your consideration:

Section 3.8 - Federally Protected Species and Habitats **3.8.2 - Federally Protected Species and Habitats Considered**

The DSEIS lists the northern long-eared bat (*Myotis septentrionalis*) as a proposed species. The northern long-eared bat is now listed as threatened under the Endangered Species Act (ESA). This change should be reflected in the Final SEIS.

The DSEIS describes that the sauger (*Sander canadense*) is the only known fish host for sheepsnose mussel (*Plethobasus cyphus*) glochidia. This should be changed to: "the sauger is the only known natural host for the sheepsnose." According to the 2012 Federal Register Final Rule (77 FR 14914): "little is known regarding host fish of the sheepsnose. Until recently the only cited host for this species came from a 1914 report that found glochidia naturally attached to sauger (*Sander canadense*) in the wild. No confirmation of successful transformation was recorded in this early report (Surber 1913, p. 110; Wilson 1914, pp. 338–340). However, recent laboratory studies at the Genoa National Fish Hatchery, the University of Minnesota, and Ohio State University have successfully transformed sheepsnose glochidia on fathead minnow (*Pimephales promelas*), creek chub (*Semotilus atromaculatus*), central stoneroller (*Campostoma anomalum*), and brook stickleback (*Culaea inconstans*) (Watters et al. 2005, pp. 11–12; Brady

2008, pers. comm.; Watters 2008, pers. comm.). Although these are identified as suitable hosts in laboratory studies, natural interactions between the aforementioned fishes and the sheepsnose seem rare and infrequent due to habitat preferences. Fish that frequent medium to large rivers near mussel beds, like the sauger, may act as hosts in the natural environment.” Additionally, the Genoa National Fish Hatchery has identified the golden shiner (*Notemigonus crysoleucas*) as another host fish of the sheepsnose in laboratory studies and has propagated the sheepsnose and raised the golden shiner for possible reintroduction of the sheepsnose in its natural habitat. This section of the Final SEIS should be changed to reflect other potential hosts for the sheepsnose.

Section 4.7

4.7.1 Proposed Action

This section discusses impingement and entrainment of aquatic organisms. The DSEIS concludes that: “No noticeable changes in the mussel community have occurred since Braidwood began operating. Thus, impingement and entrainment of mussel glochidia through impingement of host fish appears to have a SMALL impact on the mussel community in the vicinity of Braidwood.” The DSEIS notes that the sauger has not been collected as part of past impingement studies. The DSEIS also notes that the golden shiner and fathead minnow have been collected as part of past impingement studies. The Final SEIS should account for the possibility of the sheepsnose using the golden shiner or fathead minnow as host species.

4.8 - Special Status Species and Habitats

4.8.1 - Special Status Species and Habitats Impacts of License Renewal (Proposed Action)

The U.S. Nuclear Regulatory Commission (NRC) used the DSEIS to fulfill its obligation to prepare a biological assessment under section 7 of the ESA. The NRC concluded that the proposed action would have no effect on the following species: snuffbox mussel (*Epioblasma triquetra*), Hine's emerald dragonfly (*Somatochlora hineana*), eastern prairie fringed orchid (*Platanthera leucophaea*), lakeside daisy (*Hymenopsis herbacea*), leafy-prairie clover (*Dalea foliosa*), and Mead's milkweed (*Asclepias meadii*). Effect determinations were not made for the two candidate species: rattlesnake-master borer moth (*Papaipema eryngii*) and the eastern massasauga (*Sistrurus catenatus*); however, determinations should be made in the Final SEIS. Based on the information provided in the DSEIS, we conclude that the project is expected to have no effect on these species.

We do not concur with NRC's determination of “may affect, not likely to adversely affect” for the endangered sheepsnose (*Plethobasus cyphus*). At this time we cannot concur that the project would not adversely affect the sheepsnose mussel, due to the lack of recent survey information in the project area and because other potential host species (i.e., golden shiner and fathead minnow) were not considered as part of the impact analysis for the sheepsnose. In order for the Department to assess potential impacts to the sheepsnose, we recommend that mussel surveys be conducted to assess current presence and status of the endangered mussel in the project area. Mussel surveys should be coordinated with the U.S. Fish and Wildlife Service's (Service) Chicago Illinois Field Office. The mussel survey report should be submitted to the Service for their review.

The DSEIS states that: “Sheepsnose larvae are indirectly susceptible to impingement and

entrainment of host fish, and the only known host species for sheepsnose is sauger. Juvenile and adult sauger were not reported in surveys of the Kankakee River near the Braidwood intake or impingement collections in 1988 and 1989, and eggs and larvae were not reported from samples in the river or from entrainment collections in the same years (EA Engineering 1990). Monitoring studies of fish in the Kankakee River near Braidwood in the last 5 years also has not reported sauger in the collections (e.g., HDR 2009, 2013, 2014). Assuming that the results reflect future conditions, the indirect effect of impingement and entrainment on sheepsnose host species from now until 20 years beyond the expiration of Braidwood's present operating licenses is likely to be insignificant. Some unionid species may have one host species, and others more than one, and future studies may identify additional sheepsnose host species that might modify this conclusion.

Sheepsnose are also susceptible from direct and indirect effects (through host fish species) of Braidwood's effluent due to temperature and current alterations and to chemical contaminants. The IEPA, not the NRC, regulates the discharge through its Illinois NPDES permitting program to insure protection of aquatic species, and Braidwood must have an Illinois NPDES permit to operate. In view of these observations, the NRC staff concludes that snuffbox may occur near Braidwood but that the continued operation of Braidwood **may, but is not likely to, adversely affect the species.**"

Mussel surveys for the Braidwood Station were most recently conducted in 2009 by Ecological Specialists, Inc. (ESI). Initial surveys were conducted by HDR Engineering (HDR) in 2008 (when a fresh dead sheepsnose was collected in the Kankakee River in the vicinity of the Braidwood discharge diffuser). Due to the lack of recent survey information in the project area, we cannot concur with the applicant's effect determination of "may affect, not likely to adversely affect." We recommend that mussel surveys be conducted in the areas covered by the past HDR and ESI studies to determine if the sheepsnose may be adversely affected by the proposed project. The NRC should also supplement its impact analysis for the sheepsnose to include the golden shiner and fathead minnow as potential natural host species.

The NRC concluded that the project "may affect, but is not likely to adversely affect" the northern long-eared bat. The DSEIS indicates that: "Over the duration of the proposed license renewal term, Exelon (2013c) reports no plans for landscape-altering activities, such as those that might adversely affect northern long-ear bats." If no tree clearing is proposed as part of the proposed action, the applicant should make a "no effect" determination for the species. If tree clearing is proposed, Exelon should quantify the amount of tree clearing and provide that information to the Service. Recent mist-net surveys have captured the northern long-eared bat in close proximity to the Braidwood Station.

Thank you for the opportunity to provide comments. This letter provides comment under the authority of, and in accordance with, the provisions of the National Environmental Policy Act of 1969 (83 Stat. 852, as amended P.L. 91-190, 42 U.S.C. 4321 et seq.), the Fish and Wildlife Coordination Act of 1956 (48 Stat. 401, as amended; 16 U.S.C. 661 et seq.), the Endangered Species Act of 1973 (87 Stat. 884, as amended; 16 U.S.C. 1531 et seq.), the Migratory Bird Treaty Act (40 Stat. 755, as amended; 16 U.S.C. 703 et seq.), and the Bald and Golden Eagle Protection Act (54 Stat. 250, as amended; 16 U.S.C. 668-668d).

The Department looks forward to continued coordination with the NRC and the Applicant to ensure that project impacts to resources of concern to the Department are adequately addressed. For matters related to fish and wildlife resources and federally listed threatened and endangered species, please continue to coordinate with Mr. Shawn Cirton, U.S. Fish and Wildlife Service, 1250 South Grove Ave., Suite 103, Barrington, Illinois 60010, phone (847) 381-2253, extension 19, fax (847) 381-2285.

We appreciate the opportunity to provide these comments.

Sincerely,

A handwritten signature in black ink, appearing to read "Lindy Nelson", with a long horizontal flourish extending to the right.

Lindy Nelson
Regional Environmental Officer

cc: Shawn Cirton, FWS

Appendix C. Characteristics of Illinois-listed species collected near Braidwood Station discharge, Illinois, Kankakee River, 2015.

Appendix C. Characteristics of Illinois-listed species collected near Braidwood Station discharge, Illinois, Kankakee River, 2015.

Species by Tribe	Age (annuli count)	Length (mm)	Sex / Gravidity
<u>Pleurobemini</u>			
<i>Cyclonaias tuberculata</i>	20	78	
<i>Cyclonaias tuberculata</i>	26	96	
<i>Cyclonaias tuberculata</i>	7	43	
<i>Cyclonaias tuberculata</i>	12	68	
<i>Cyclonaias tuberculata</i>	21	91	
<i>Cyclonaias tuberculata</i>	11	67	
<i>Elliptio dilatata</i>	27	122	
<u>Lampsilini</u>			
<i>Ligumia recta</i>	16	140	Female Not Gravid
<i>Ligumia recta</i>	16	140	Female Not Gravid
<i>Ligumia recta</i>	12	130	Female Gravid
<i>Ligumia recta</i>	15	129	Female Not Gravid
<i>Ligumia recta</i>	13	135	Female Gravid
<i>Ligumia recta</i>	11	123	Male
<i>Ligumia recta</i>	15	137	Male
<i>Ligumia recta</i>	14	137	Female Gravid
<i>Ligumia recta</i>	12	144	Male
<i>Ligumia recta</i>	14	141	Male
<i>Ligumia recta</i>	16	144	Male
<i>Ligumia recta</i>	13	130	Female Gravid
<i>Ligumia recta</i>	18	132	Female Gravid
<i>Ligumia recta</i>	13	132	Female Gravid
<i>Ligumia recta</i>	15	139	Male
<i>Ligumia recta</i>	13	123	Female Gravid
<i>Venustaconcha ellipsiformis</i>	17	78	