United States Department of the Interior

FISH AND WILDLIFE SERVICE
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IN REPLY REFER TO:

FWS/RIFO

October 23, 2018

G. Ward Lenz, Chief Regulatory Branch
Attn: Eugene Walsh
U.S. Army Corps of Engineers
Rock Island District
Clock Tower Building, P. O. Box 2004
Rock Island, Illinois 61204-2004

Dear Mr. Lenz:

This document transmits the U.S. Fish and Wildlife Service's (Service) biological opinion for the proposed improvements by Cargill, Inc. (Cargill) (CEMVR-OD-P-2015-1511), at an existing barge load-out facility in Mississippi River Pool 17 at River Mile 454.2R, Muscatine, Muscatine County, Iowa. Improvements include a new and larger 36' cell around an existing cell, installation of 8 new breasting pipe piles/dolphins in the up-river and down-river direction of the main cell, and removal of 5 existing breasting piles, and replacement of an existing open belt conveyer with an enclosed one. The U.S. Army Corps of Engineers (Corps) is proposing to authorize the placement of fill within waters of the United States under Section 404 of the Clean Water Act and Section 10 (Rivers and Harbors Act) for this project. Formal consultation under Section 7 of the Endangered Species Act (Act) was initiated by your office on September 26, 2018, since the project may impact the federally endangered Higgins eye pearlymussel (*Lampsilis higginsii*).

This biological opinion is based on Service records and existing literature concerning the distribution of mussel resources in the Upper Mississippi River as well as a biological assessment and information provided by your office and Helms & Associates. A complete administrative record of this consultation is on file at this office.

Sincerely,

Kraig McPeek
Field Supervisor
Illinois-Iowa Field Office

Enclosure

United States Department of the Interior

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IL-IA FO

FISH AND WILDLIFE SERVICE
Rock Island Field Office
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Moline, Illinois 61265
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Biological Opinion

For the Proposed Improvements at an Existing Barge Load-Out Facility
(Pool 17, River Mile 454.2R) of the Mississippi River,
Muscatine, Muscatine County, Iowa, by Cargill, Inc.
CEMVR-OD-P-2015-1511

Prepared by:
U.S. Fish and Wildlife Service
Illinois-Iowa Field Office

Submitted to:
U.S. Army Corps of Engineers
Rock Island District
Clock Tower Building, P. O. Box 2004
Rock Island, Illinois 61204-2004

Kraig McPeek
Field Supervisor
Illinois – Iowa Field Offic

10/25/2018
Date

BIOLOGICAL OPINION

I. Description of Proposed Action

The federal action evaluated in this Biological Opinion (BO) is the issuance of a Section 404 Clean Water Act permit by the United States (US) Army Corps of Engineers (the Corps) to the applicant, Cargill, Inc. (Cargill) to authorize the placement of fill within Waters of the US and a section 10 (Rivers and Harbors Act) permit for improvements to an existing barge load-out facility within navigable waters of the US.

The U.S. Fish and Wildlife Service (Service) is issuing this BO pursuant to section 7 of the Endangered Species Act (ESA). Direct and indirect effects of the proposed action and the interrelated or interdependent activities are analyzed to ensure they are not likely to jeopardize the continued existence of federally listed or proposed endangered or threatened species. Direct effects are immediate effects of the proposed action on the species or its habitat, including the effects of interrelated actions and interdependent actions. Indirect effects of a proposed action includes, "...effects that are caused by or result from the action, are later in time but are reasonably certain to occur..." Interdependent actions have no independent utility apart from the proposed action, and interrelated actions are part of a larger action and depend on the larger action for their justification (50 CFR §402.02).

1.1 Project Description

Cargill is proposing to make improvements to an existing barge load-out facility in Pool 17 of the Mississippi River (RM 454.2R), Muscatine, Muscatine County, Iowa (41°24'31.45246"N, 91°03'35.56657"W) (Section 2, Township 76N, Range 2W) which will require the 404 Clean Water Act permit and the Section 10 Rivers and Harbors Act permit. The Cargill, Muscatine facility is where grain is out-bounded to river barges via a belt conveyor and shipped to the gulf ports in Louisiana for export. Cargill's existing Muscatine grain facility includes a grain storage space, two truck unload pits, and a barge loading system that is beyond its useful life. Needed infrastructure upgrades to the dock structures will improve the safety and well-being of Cargill's employees and tug service employees working in the area. Barge loading is one of the highest risk tasks that includes working over water, pinch points, snapping cables/ropes, trip hazards, hot/cold conditions, and changing river currents/elevations. The project proposed will improve overall safety of the facility with safer egress on/off barges, and will reduce line of fire hazards, modernize winch systems, and improve engineered processes for increased safety.

Cargill proposes to install a new/larger 36' cell around an existing 24' cell, to install 8 new breasting pipe piles/dolphins in the up-river and down-river direction of the main cell, to remove 5 existing breasting piles, and to replace the existing open belt conveyer with an enclosed one. The 8 new breasting pipe pile/dolphins include six 3-pile and two 4-pile dolphins. The plumb piles for each have a diameter of 48 inches, and the batter piles have a diameter of 20 inches. The five existing piles which will be removed have an estimated diameter of six feet each. The combined cluster for each of these piles is roughly 30 square feet.

Spud placement for the construction project totals 13 spuds. Spud placement for removing existing piles will include placement of five spuds measuring 24 inches each. Three will be located upstream of the center cell and two will be downstream. The new mooring line and eight new dolphins will be four feet further away from shore compared to the existing piles. Thus the construction spud placement, which will include eight spuds measuring 24 inches each, will also be four feet further into the channel. The construction scope of work includes partially demolishing the dock structure/piles and installing a new

dock structure with breasting piles that enables safe handling of barges. Barge traffic is not expected to increase post-construction.

Collectively, the proposed improvements to the facility comprise an impact area in the river bottom of approximately 264 square meters.

Steps in the construction process include:

- Conduct soil borings along the base of the levee
- Demolish existing barge loadout conveyor, tower, spout, walkway and the existing breasting piles
- Install new/larger 36' cell around the existing 24' cell (will minimize river disturbance)
- Remove 5 existing steel and timber piles with an estimated diameter of six feet each
- Install 8 new breasting pipe piles/dolphins in the up-river and down-river direction of the main cell
- Install 5 spuds measuring 24 inches each for removing 5 existing piles
- Install 8 spuds measuring 24 inches each for construction of 8 new dolphins
- Install new structural steel tower on new cell (above water)
- Install new support bridge and conveyor between the facility and the new tower
- Install new winches and cable on the main cell that will be rigged to barges
- Install spout and egress
- Complete electrical and commission equipment

For removal of the three steel dolphins (including the existing steel cell planned for expansion), a metal plate will be welded to the side; the vibratory hammer will grab it to extract the dolphin. For the three timber clusters, the process is about the same, only a timber clamp will be used on the vibratory hammer. If there is large section loss during extraction of the timber dolphins, divers will be used to cut off the cluster at the mudline; during this process, the section is connected to the work barge such that no material impacts the Action Area. A material barge will be used to stage the extracted dolphins. The conservative timeline for removal is one dolphin every two days. Demolition work is proposed to begin near the end of December; with six dolphins to remove at two days per dolphin, it is expected the demolition will take two and a half weeks. (Anticipated dates: December 19, 2018 through January 4, 2019 due to the holidays)

After demolition, the plan is to wrap the center cell. The template will be put on, the sheets will be driven using a vibratory hammer, and it will be filled with aggregate. This is estimated to take 1.5-2 weeks to complete. (Anticipated dates: January 7-18, 2019)

For construction of the 8 new dolphins, a survey will be completed with templates to ensure correct location to drive piles. A vibratory hammer will be used to drive the piles. Though it is not expected to be needed, a diesel hammer will be used if refusal is encountered before reaching targeted embedment depths. It is expected to take approximately 1.5 weeks to construct a tripod dolphin: 3-4 days to drive the piles with the balance going to fit-up, installing a gusset plate, cap plate, filling with rock, and welding. (Anticipated dates: January 21 through April 12, 2019)

1.2 Action Area

The project will occur within Pool 17 of the Mississippi River near River Mile (RM 454.2R), along the right descending bankline.

50 CFR §402.2 defines an "action area" as "all areas to be affected directly or indirectly by the federal action and not merely the immediate area involved in the action." Therefore, all areas which could experience measurable environmental effects resulting from construction, operation, and maintenance of the facility improvements; cell expansion, dolphin structures and conveyor belt, will be considered part of the action area. All environmental effects that may provoke a response in federally endangered mussels are considered. Therefore, the action area of this project includes:

- the footprint of the new/large 36' cell around an existing 24' cell
- the footprint of each of the 8 new breasting pipe piles/dolphins in the up-river and down-river direction of the main cell,
- the footprint of 5 existing breasting piles,
- the footprint of each of the thirteen 24-in diameter work barge spud locations,
- replacement of the existing open belt conveyer with an enclosed conveyor,
- a 5-ft buffer around each of the 8 new dolphin structures,
- a 5-ft buffer around each of the 5 existing breasting piles to be removed,
- a 5-ft buffer around the 36' cell (created around the existing 24'cell),
- the staging areas for construction materials, including an on-shore site immediately adjacent to the construction area and the existing dock structure, and
- access routes between the staging areas and the proposed dolphin locations.

The total area of impact within the Mississippi River is approximately 264 square meters. A mussel relocation area has not yet been determined, but will be included within the action area once approval is obtained from the USFWS and the State of Iowa.

1.3 Conservation Measures

Conservation measures represent actions taken to benefit or promote recovery of the species. These actions taken by the federal agency and/or applicant serve to minimize or compensate for project effects on the species under review and are included as an integral portion of the proposed action.

The Service recognizes that, individually and/or cumulatively, these conservation measures could contribute to the avoidance and minimization of adverse effects to the Higgins eye, but that these measures do not eliminate all adverse effects that may result from the proposed actions.

To minimize the effects of the action on the Higgins eye pearlymussel (Higgins eye) and the mussel resources in the area, Cargill will ensure that the contractor performing the work will only conduct construction activities within the action area, as discussed herein, in order to minimize impacts to freshwater mussel resources.

To further minimize and mitigate the effects of the action on the Higgins eye mussel, Cargill plans to relocate all mussels out of the action area (excluding the spud areas), prior to construction. All mussel relocation protocols will be as follows: Helms and Associates shall conduct the relocation, utilizing personnel who possess expertise in collecting and identifying freshwater mussels. The search for mussels will occur within the footprint of each of the eight proposed breasting dolphins and within a 5-foot buffer surrounding, within a 5-foot buffer surrounding the five existing piles, and within the new expanded location for the existing 24' cell and within a 5-foot buffer surrounding. The method of hand-picking while wading or hand-picking while diving may be used, depending on the depth of the river. Mussels

collected from the project location will be relocated to an area with suitable substrate and similar unionid assemblages. The relocation area or areas will be determined by Helms and Associates prior to relocation efforts and approved by IADNR and the Service. Relocation area(s) will be beyond the limits of the mussel search. The temporary holding of all collected mussels will be in containers that allow the animal to remain moist and uncrowded, such as mesh bags that will be placed in the river until the search is completed. The relocation will occur prior to construction during the fall months in 2018 or 2019 to accommodate the construction schedule.

II. Status of the Higgins eye pearlymussel (*Lampsilis higginsii)* and Habitat

2.1 Species/critical habitat description

Higgins eye is the federally-listed species in or near the proposed action area that may be affected by the project. The Higgins eye is a medium-sized (approximately four inches in length) and oval or elliptical freshwater mussel with a smooth, yellow, yellowish green or brown outer shell and green rays (Baker 1928, USFWS 1983). The shells are thick, inflated, and sexually dimorphic. The shell is broadly rounded anterior and with a pointed posterior in males or sharply truncated with post-basal swelling in females (USFWS 2004, 2016). The elevated and swollen beak is forward of the central dorsal margin with sculpturing of a few ridges that are slightly looped (Baker 1928). The inside or nacre of the shell is silvery white or salmon-colored and iridescent (Baker 1928, USFWS 2016). The surface of the shell is marked with irregular growth lines that are well developed and darker during rest periods. The hinge is very large with erect pseudocardinals that can be triangular or pyramidal. Beak cavities are deep and contain the dorsal muscle scars. Anterior adductor scar is deeply excavated and the posterior scar is distinct (Baker 1928).

The Higgins eye feeds by filtering food particles from the water column using the large lamellibranch gills as feeding organs (USFWS 2004). The specific food habits of the species are unknown, but other juvenile and adult freshwater mussels have been documented to feed on detritus, diatoms, phytoplankton and zooplankton (Churchill and Lewis 1924). The diet of Higgins eye glochidia (larvae), like other freshwater mussels, is comprised of fish body fluids (once encysted).

The Higgins eye has been characterized as a large river mussel species. The species may be primarily adapted to large river habitats with low to moderate current of <1 m/s during low discharge periods (USFWS 2004). Davis and Hart (1995) indicated that it was found in the more "riverine" areas and in the tailwater reaches of other Mississippi River navigation pools.

Higgins eye has been found in various substrates from sand to boulders (USFWS 2004). In some studies, the species could be found in stable gravelly sand, but not in areas of unstable shifting coarse sands (Miller and Payne 1996, USFWS 2004). Fuller (1978) indicates this species may be found in 8-15 feet of water in mud with a mixture of gravel and stones. Cawley (1996) found that Higgins eye were most common in sand/gravel substrate. Miller and Payne (1996) considered substratum that was free of plants and consisted of stable, gravelly sand as suitable for this species; however, others have found the species within areas of rooted plants (USFWS 2004) and in boulder substrates associated with bridge piers (ESI 2014, Helms 2006). Some substrates this species has not been associated with include firmly packed clay, flocculent silt, organic material, bedrock, or unstable moving sand (Wilcox et al. 1993). Information on habitat associations or requirements for the juvenile stage were not found.

Higgins eye is commonly found in dense mussel beds with various other species. The species has been

found with a minimum of two and a maximum of 36 other species, according to Cawley (1996). The species typically accounts for a small percentage of the overall species diversity (USFWS 2004). Other species Higgins eye has been found with include threeridge (*Amblema plicata*), pimpleback (*Quadrula pustulosa*), Wabash pigtoe (*Fusconaia flava*), and plain pocketbook (*Lampsilis cardium*) (Heath 1995).

2.2 Life history

The reproductive cycle of the Higgins eye is similar to that of many native freshwater mussels (USFWS 2004). Males release sperm into the water column, often in packets known as volvocoid bodies. The sperm travel downstream and are taken in by the females through their incurrent siphons during feeding and respiration (Fuller 1978). The females retain fertilized eggs in their gills until the glochidia fully develop. Higgins eye is bradytictic, meaning a long term brooder. Spawning occurs in the summer, observed by Baker (1928) to be between May and September and larvae are retained through winter (USFWS 2004). Glochidial release has been observed between May and September by Surber (1912) and during June and July by Waller and Holland-Bartels (1988). This species "lures" host fish by protruding its mantle and gills containing glochidia between the mantle flaps. When the gill tissue is attacked by a fish, glochidia are released. This process enhances the chances glochidia will find the gills of fish to parasitize. The glochidia must attach to the appropriate fish species, which they parasitize for a short time while developing into juvenile mussels. Juvenile development has been observed to take 4-6 weeks in captive breeding (MCT 2002). Reproduction begins early in Higgins eye, typically between age 1-3 years (Haag 2012).

Glochidia host fish were generalized by Waller and Holland-Bartels (1988) as being percids and centrarchids. Early studies indicated that sauger (*Sander canadensis*) and freshwater drum (*Aplodinotus grunniens*) were suitable glochidial fish hosts (Surber 1912, Wilson 1916, Coker et al. 1921, Hove and Kapuscinski 2002). Waller and Holland-Bartels (1988) found four species of fish were suitable hosts, due to a high number of glochidia transformation to juvenile, including largemouth bass (*Micropterus salmoides*), smallmouth bass (*Micropterus dolomieu*), walleye (*Sander vitreus*) and yellow perch (*Perca flavescens*). Other species had lower transformation glochidia to juvenile transformation rates and were considered marginal hosts. These species included green sunfish (*Lepomis cyanellus*), bluegill (*Lepomis macrochirus*), and northern pike (*Esox lucius*) (Waller and Holland-Bartels 1988). Hove and Kapuscinski (2002) later identified black crappie (*Pomoxis nigromaculatus*) as an additional host species.

2.3 Population Dynamics

It is difficult to locate information on populations of Higgins eye that are currently reproducing, however, information has been collected at some EHAs within the last 10 years. The Higgins eye population at Prairie du Chien, Wisconsin, on the upper Mississippi River, exhibited recruitment in 2005 and 2006, but evidence of recruitment was not observed during surveys in 2008 (Miller and Payne 2007, MCT 2008). In 2006, recruitment was also observed at the Cassville MRP 11 EHA on the UMR in Wisconsin. Gravid females and individuals ranging in age from 3–15 years old were present at this location (MCT 2007).

Miller and Payne (2007), in regards to Higgins eye, state in their reexamination paper:

"In river reaches unaffected by zebra mussels Dreissena polymorpha, L. higginsii mean density ranged from 0.0 to 1.4 m–2 (average = 0.25 m–2) and it comprised less than 2% of the unionid fauna. Recent distribution and abundance data indicate that the range of L. higginsii populations was misrepresented on historical maps and suggest that populations were in fact either absent or very

uncommon both at the periphery of their historical range and in small tributaries where they were reported historically. Although this species has always been rare, it can usually be found in appropriate habitats within its current range. It was listed as endangered before there were data on its density, recruitment, and relative abundance. Although it was nearly extirpated by D. polymorpha in the late 1990s, L. higginsii appears to be resilient to zebra mussel infestations. A multi-agency conservation plan is now being implemented to reintroduce this species into small and medium-sized rivers within and outside its historical range. Our data indicate that this species is not in imminent danger of extinction, has always been rare, and is not adapted to small rivers. It would be more realistic, and beneficial to L. higginsii, to implement strategies that protect all unionid species and the habitats upon which they depend."

In other words, Miller and Payne (2007) observed Higgins eye populations to be persisting at the similar population percentages, despite the presence of zebra mussels.

2.4 Status and Distribution

The Higgins eye was listed as an endangered species by the Service on June 14, 1976 (Federal Register, 41 FR 24062 24067). The initial recovery plan (USFWS 1983) indicated that Higgins eye may have never been abundant within its range. Major reasons for listing Higgins eye as federally endangered were the decrease in both abundance and range of the species (USFWS 1983). The species depends on deep and free flowing rivers with clean water, which are rare due to the presence of lock and dams (USFWS 2016). Coker (1919) indicated that the species was becoming increasingly rare even at the end of the 1800s; however, Miller and Payne (2007) reviewed historical information and data and agreed with the initial recovery plan that Higgins eye was never abundant. There were few records of live specimens from the early 1900s until the enactment of the ESA in 1973 and this was a major factor in its listing in 1976. Currently, zebra mussels (*Dreissena polymorpha*) have been negatively impacting many mussel species within the upper Mississippi River, including Higgins eye. The zebra mussel can affect native mussel species by direct attachment to the outside shell surface which can limit their movement and their siphoning ability. Indirectly, zebra mussels represent competition for food and can affect water quality (USFWS 2004).

Higgins eye is the only freshwater mussel endemic to the Upper Mississippi province, which includes the entire Mississippi River system upstream of the mouth of the Ohio River (excluding most of the Missouri River system) (Haag 2012). The first Higgins eye recovery plan listed the historic distribution of the species to include the main stem of the Mississippi River north of St. Louis, Missouri and south of St. Paul, Minnesota; the Sangamon and Rock Rivers in Illinois; the Wisconsin and St. Croix Rivers in Wisconsin; and the Minnesota River in Minnesota (USFWS 1983). Recently, live Higgins eye have been found in parts of the following rivers: the UMR north of Lock and Dam 19 at Keokuk, Iowa, and in three tributaries of the Mississippi River - the St. Croix River between Minnesota and Wisconsin, the Wisconsin River in Wisconsin, and the lower Rock River in Illinois. The species' current range is about 50 percent of its historic distribution which extended as far south as St. Louis, Missouri, and in several additional tributaries of the Mississippi River (USFWS 2004). The historical distribution of Higgins eye is not known with certainty.

The 1983 recovery plan listed seven locations as primary habitats and nine locations as potential secondary habitats (USFWS 1983). The revised recovery plan lists 10 EHA, six of which are in the Mississippi River (USFWS 2004):

- Whiskey Rock (MRP 9; Lansing, Iowa)
- Harpers Slough (MRP 10; near Harpers Ferry, Iowa)
- Prairie du Chien, Wisconsin (MRP 10; main and east channel)
- McMillan Island (MRP 10; Guttenberg, Iowa)
- Cordova, Illinois (MRP 14)
- Sylvan Slough (MRP 15; Moline, Illinois)

In 2008, four additional EHAs were added for the Mississippi River (USFWS 2008):

- Cassville (MRP 11; Cassville, Wisconsin)
- Lansing (MRP 9, Near Lansing, Iowa)
- Buffalo (MRP 16, Buffalo, Iowa)
- Hanson's Slough (MRP 14)

EHAs are locations where Higgins eye are currently reproducing and the recovery plans have designated to be important for the recovery of the species. The revised recovery plan describes two main objectives that indicate the Service's current management direction (USFWS 2004):

1) Preserving the Higgins eye and its EHAs.
2) Enhancing the abundance and viability of the Higgins eye in areas where it currently exists and restoring populations within its historical range.

The greatest numbers of Higgins eye in the upper Mississippi River occur from MRP 6 to MRP 17 (Cawley 1996). This species has been extirpated from its more southerly locations, such as the Illinois River basin and from the Mississippi River between MRP 18 – 26. It was historically sampled in MRP 19, 20, 21, 23, and at the mouth of the Kaskaskia River south of the Lock and Dam system in Illinois (Stodola 2013).

Between 1998 and 2000, the Corps proposed the operation and maintenance of the existing 9-foot Channel Project on the UMR for another 50 years, which initiated formal consultation under Section 7 of ESA for impacts to Higgins eye. To avoid jeopardy to the species, the Service required the Corps to establish new and viable populations of Higgins eye in areas of the upper Mississippi River and tributaries that are distanced from zebra mussels. Since 2000, 10 relocations and reintroductions have occurred in the MRP 2, 3, 4, and 16, and in the Wisconsin River, Rock River, Iowa River, Cedar River, and the Wapsipinicon River (MCT 2002, 2003). Roughly half of these reintroductions have been confirmed successful, including MRP 2 and 3 where mussels were scrubbed of zebra mussels affixed to their shells.

The closest essential habitat areas upstream from the Cargill, Muscatine location is in MRP 16 near MR Mile 470-471. One is located at Mississippi River RM 510 at the Hanson Slough Pool 14 RM 509.1-510.1

(Ecological Specialists, Inc., 2008). In October 2014, Helms & Associates conducted a mussel survey (Helms & Associates, 2014) at Hanson Slough, Pool 14 RM 510.0 in Clinton County, Iowa. This survey produced four Higgins eye pearly mussels. The other essential habitat site is the designated 1.8- mile long segment in Sylvan Sough Pool 15 (RM 483.0-484.8). The State of Illinois has designated this area as a mussel sanctuary. These beds are located upstream from the Action Area and are not expected to be impacted as a result of the construction action.

Current known extant populations of Higgins eye near the project area include populations in MRP 17 in the Lock and Dam 17 tailwaters and downstream near RM 451.

2.5 Analysis of the species/critical habitat likely to be affected

No critical habitat has been designated for this species.

III. Environmental Baseline Conditions in the Project Area

The purpose of this section is to analyze the effects on the species and/or critical habitat at the action level. For example, the following issues are considered:

- Percent or amount of the species range in the action area
- Whether effects are quantitative and/or qualitative
- The distribution of affected versus unaffected habitat

3.1 Status of the species within the action area

The project area was surveyed by Helms and Associates on September 19, 2017 (see full results in Helms and Associates Mussel Survey for Cargill, Inc., Muscatine, Iowa at an Existing Barge Load-Out Facility (#1605)). In accordance with the project layout map provided by the applicant on September 26, 2018, the survey area consisted of four quarter-meter samples at six locations around the load out cell and two locations around each of the four pile locations.

Substrate sampling provided both quantitative and qualitative samples, while timed searches provided qualitative samples. Sampling consisted of four quarter-meter substrate samples at six locations around the load out cell and two locations around each of the four pile locations. Five-minute timed dive searches were conducted at seven of 14 locations. These included three locations around the load out cell and one location at each of the four pile sites. Thus, sampling effort totaled 56 quarter-meter substrate samples (14 m2) of surface area and 35 minutes of timed dive searches. Three hundred nineteen mussels representing 21 species were collected at this site. These included two living species of threatened or endangered mussels. The state threatened butterfly was the most numerous, with seven specimens contributing 2.2 % of the catch (n = 7). The second was Higgins eye pearly mussel. Higgins eye pearly mussel is both federal and state endangered. Two specimens contributed 0.6 % of the catch (n = 2). Methodology, results and conclusions are presented in the mussel survey report #1605.

3.2 Percent or amount of the species range in the action area

In comparison to the other federally listed mussel species occupying the Upper Mississippi River, Higgins eye, which is limited to the UMR basin, is not as widely distributed. However, within its range it has been described as "widespread" and "common" (Miller and Payne 2007). Higgins eye generally comprises a very small proportion of the assemblage at any given site and is considered abundant when densities exceed 0.25/m^2 (USFWS 2008). The southern most viable reproductive population is believed to be in Sylvan Slough stretching upstream along the left descending bank (ESI 2015, ESI 2014, Hornbach et al. 1995). The data of ESI (2015, 2014) were used to estimate population size in the vicinity of the EHA in Sylvan Slough using observed densities. The estimated size of the Higgins eye population in these areas is approximately 15,000 individuals. Although this potentially represents a fairly large population it is not an isolated example as several other populations of equal or greater size exist within its range.

Additional mussel resources have been identified immediately upstream and downstream from the project although Higgins eye were not specifically identified. Records from the 1984 survey immediately upstream indicated a diverse bed with 22 species. The downstream population is less diverse but still had 15 species identified in 2006. There is potential for Higgins eye to in both of these mussel beds.

3.3 Whether effects are quantitative, qualitative, or both

Although direct effects from the proposed action such as cell expansion, cell placement and barge spudding can be quantified, Indirect effects from suspended sediment plumes, noise and vibration, lost reproductive opportunities, etc. can only be described qualitatively. Most of the indirect effects will be discrete localized events. Others, such as water quality effects from increased suspended sediment are expected to be minimal and not extend much downstream of the mussel relocation buffer areas.

3.4 Factors Affecting Species within the Action Area

This analysis describes factors affecting the environment of the species within the action area. The baseline includes State, tribal, local, and private actions already affecting the species or that will occur contemporaneously with the consultation in progress. The environmental baseline also includes unrelated Federal actions affecting the species that have completed formal or informal consultation.

Sediment

Due to their filter feeding behavior, freshwater mussels take in chemicals within the water column and their gills, mantle, and kidneys are exposed to these pollutants. The specific organs within mussels in which heavy metals bioaccumulate seems to be dependent on the metal and may be related the presence of binding sites of tissues (Naimo 1995).

Lock and Dam System

Lock and dam systems on large rivers may be negatively affecting Higgins eye by genetically isolating populations within man-made pools. Studies done on Higgins eye genetics observed a high degree of genetic variation within populations. The genetic variability is higher in Higgins eye than found in other endangered species. However, there have been relatively few studies done (USFWS 2004).

Increased sedimentation can occur in areas of the UMR due to lock and dam construction. Sediment deposition and siltation have occurred in various pools along the Mississippi River; however, Higgins eye is generally not affected by these factors. The sedimentation and siltation tend to occur on backwaters and

Higgins eye habitats are found in the main channel or bordering the main channel (USFWS 2004).

Zebra Mussels

Zebra mussels were discovered in the UMR in 1991. They are currently found in MRP 17, throughout the UMR system, in many of its tributaries, and inland lakes. Zebra mussels have contributed to a sharp decline in freshwater mussel populations since their introduction, competing for the same resources, and attaching directly to freshwater mussels using adhesive structures called byssal threads.

From 1992-1996, UMR Pool 8 saw increases of zebra mussel densities from 1/m^2 to 15,000/m^2 (USGS 2001). Farr and Miller (2003 unpublished data) recorded increasing zebra mussel densities in Pool 10 from 1993 up to four (4) years of densities ~10,000/m^2 by 2002. Coinciding with zebra mussel increases, unionid densities decreased markedly from ~50/m^2 to next to nothing in 2002. Concurrently, Higgins eye densities plummeted from nearly 1/m^2 in 1995 to next to nothing in 2001-2003. After initial invasion and as populations increased, zebra mussels had their greatest effects on native mussel communities by attaching to the hard substrata of native mussel shells and inhibiting filtration. After the initial stage of invasion, impacts are less predictable, and more likely to be caused by indirect effects through changes in the ecosystem (Karatayev & Burlakova 2015). While distribution of the invasive zebra mussel continues to expand in the US every year (USGS 2015), habitats where populations were established in the 1990's have already experienced the largest direct environmental impacts.

IV. Effects of the Proposed Action

"Effects of the action" refers to the direct and indirect effects of an action on ESA-listed species and designated critical habitat, together with the effects of other activities interrelated and interdependent with that action which will be added to the environmental baseline. The ESA defines direct effects as those immediate effects of the project on the species or its habitat. Indirect effects are those caused by the proposed action and that occur later in time, but are still reasonably certain to occur (50 CFR §402.2). Interrelated actions are those that are part of a larger action and depend on that larger action for their justification. Interdependent actions are those that have no independent utility apart from the action under consideration. When conducting an effects analysis, the Service must consider the direct and indirect effects of the proposed action in conjunction with the effects of other past and present federal, state, or private activities within the action area. The Service must also consider the cumulative effects of future state or private activities that are reasonably certain to occur within the action area. Below, we assessed each of the various project components and their anticipated effects on the Higgins eye mussel. Avoidance and minimization measures are considered part of the proposed action, so the effects of these measure in reducing, or partially offsetting effects on the Higgins eye mussel are considered as well.

Within the action area, direct mussel habitat disturbance in the form of work barge anchorage, cell expansion, and dolphin installation and removal are proposed adjacent to the existing Cargill facility location. Therefore, mussel relocation has been proposed. Helms and Associates conducted a freshwater mussel survey of the area surrounding the proposed dolphin installations (Helms and Associates 2017). The freshwater mussel relocation will be the first step in the proposed project schedule and is expected to begin in mid either late fall 2018, depending on temperatures and river levels, or the fall of 2019. Construction of the proposed improvements is scheduled to take place during the winter following the relocation. The construction period is expected to last approximately 18 weeks. In-water work is expected to occur during the entire construction period.

The life cycle of mussels, including sedentary habits, filter feeding, and respiration through gills cause them to be vulnerable to instream construction. Short term effects of the construction include the vibration and localized sediment plumes generated from installing and removing the dolphin structures into and from the riverbed. While most of the habitat impacts will be short term and occur during construction, long term effects are also expected including mussel relocation, a change in the substrate composition surrounding the new and removed dolphin structures, loss of or changes in suitability of habitat in the footprint of the new and removed dolphin structures, and changes in how the current moves around the new structures and through areas where structures have been removed.

Relocation of mussels from this project area will reduce the density and species richness within the mussel bed in the aquatic action area and, as a result, Higgins eye will be adversely affected within the action area. Higgins eye is commonly found in densely populated mussel beds with various species present and may be located within the mussel bed immediately upstream from the action. The closest known population of Higgins eye is a considerable distance upstream from the project area. The project footprint is relatively small compared to the size of the mussel resource. The relocation will result in an overall reduction in population size in the action area, however, we expect low mortality of the relocated mussels. Higgins eye will only be relocated into a mussel bed of similar substrate and mussel assemblage and these relocated mussels are likely to add to the population size within the relocation site.

Direct Effects

Relocation

Cargill has agreed to relocate all native mussels, including Higgins eye individuals, from the action area (except the spud areas) and monitor the success of these relocation efforts. The direct effects of the mussel relocation effort prior to the proposed improvement construction include harassment, harm, and mortality to mussels, as well as loss of habitat. The direct effects to mussels during relocation will be partially offset by the minimization of lethal take to mussel individuals from construction and demolition activities. Any mussel removed from the action area will be subject to harassment from collection and handling. Based on the 2017 mussel survey densities report by Helms and Associates (2017), it is currently estimated that approximately 4493 mussels will be relocated, including 30 Higgins eye (USFWS unpublished estimates). A 5% mortality rate for mussels during relocation is expected, though the percentage depends on the species. This low mortality percentage can be accomplished by following guidelines during relocation such as: avoidance of temperature extremes (both air and water), use of biologists with unionid experience for collection and relocation, minimization of the duration mussels are exposed to air (less than four hours), and selection of appropriate relocation areas for the species (Dunn et al. 1999).

Previous surveys have demonstrated that it is difficult to find all specimens of Higgins eye in the river therefore we believe some individuals may be missed and left within the action area. Small mussels <1 inch will likely be missed altogether during the relocation effort. Recruitment of Higgins eye was not detected during the survey. As a result, it is difficult to estimate mortality of mussels <1 inch in size, but numbers are expected to be low. Mussels outside of the 5-ft diameter buffer of the dolphins and cell, and within the work barge spuds areas will be left in place.

Direct take of Higgins eye will occur incidental to mussel relocation efforts in the form of stress on mussels, interruption of normal behavior patterns, and the potential for direct mortality. Direct mortality of any Higgins eye remaining after mussel relocation could occur as a result of installation of the existing cell expansion, eight new breasting dolphin structures, removal of five existing breasting dolphin structures,

including localized vibration and sedimentation. Direct take may result with spudding of the work barges as no relocation will be conducted in these areas.

Barges

Direct effects to mussels from barges traveling to the construction area, and placement of spuds for anchorage in the proposed dolphin construction area include mortality by crushing, burying, and scouring. Spudding barges will affect a 24-square inch area of the riverbed for each of the thirteen spuds. The location of barges before the time of construction is impossible to predict with any certainty as their location will be dependent on the type of equipment used, water levels, etc. Therefore, mussels will not be relocated from these areas. Direct mortality of Higgins eye may result within the spudding areas from crushing.

Dolphin Installation

Dolphin installation and removal will directly impact mussels left behind in the proposed construction footprint. They will likely be crushed and buried during pile hammer drilling, dewatering, and concrete pouring. The drilling will likely cause vibration for an extended period of time. There is little information on how vibration affects mussels, but a study by Aldridge et al. (1987) observed that frequent turbulence lowered mussel nitrogen excretion rates, which indicates they experienced reduced filter clearance rates, but it will likely be harmful in affecting their normal behavior. These effects are likely to be mitigated as construction will occur during the winter months when the mussels are not active. Habitat will be permanently lost or altered within the footprints of the expansion of the existing cell, installation of the eight new dolphin structures and removal of five existing dolphin structures, which is a direct effect to Higgins eye.

The permanent placement of the existing cell expansion, new dolphin structures, and removal of five existing dolphin structures in the river will change localized patterns of flow divergence and convergence. Differences in velocity patterns would be limited to areas in the immediate vicinity of the piers. It is anticipated that changes in flow patterns and microhabitat variables (e.g., depth, velocity, substrate composition, sheer stress) important to mussels (Morales et al. 2006, Allen and Vaughn 2010) and their fish hosts (Aadland 1991) will be localized and minimal.

Mussels and their fish hosts may also be directly affected by vibration and other physical disturbances resulting from dolphin construction. Wysocki et al. (2006) and Gutreuter et al. (2006) observed fish with stress symptoms and reduced fish abundance in areas of persistent noise and vibration. Although the vibration duration is anticipated to be minimal, such stressors may cause behavioral avoidance in potential fish hosts. If suitable host fish are not in the location of gravid female mussels, due to construction activities causing vibrations in the water, increased suspended solids, and other undesirable environmental conditions for fish, reproductive opportunities will be lost, potentially affecting the viability of these populations in future years.

Accidental Spills

Pollution caused by spills of materials being loaded and unloaded at the staging areas could impact mussels near the dolphin construction area. Adult mussels are easily harmed by toxins and degraded water quality from pollution because of their sedentary life. This is likely a negligible effect.

Indirect Effects

Indirect effects may occur as a result of short term changes in water quality and substrate due to construction activities. Construction may result in changes in flow patterns which may alter existing substrates and habitat suitability; however, we do not anticipate any substantial long-term flow or substrate changes as a result of this project. These indirect effects would be difficult to quantify and are not expected to alter the overall distribution of mussels in the Mississippi River.

Beneficial Effects

Beneficial effects may result from the construction of the expanded and new breasting dolphins, and enclosed conveyer belt at the Cargill, Muscatine barge load-out facility. The increased protection to the dock structure, resulting from the expanded and new dolphin installations will reduce the potential for barge accidents. This will reduce the likelihood of spills resulting from the grain loading activity and potential riverbed disturbances from dislodging barges. Barge traffic is not anticipated to increase as a result of the construction of the new breasting dolphins.

V. Cumulative Effects

Cumulative effects include the effects of future state, tribal, local, or private actions that are reasonably certain to occur in the action area considered in this BO. Future federal actions that are unrelated to the proposed action are not considered in this section because they would require separate consultation pursuant to section 7 of the ESA. This section analyzes the added impact from cumulative effects.

The Service is unaware of any other tribal, state, local, or private actions presently occurring or that are reasonably certain to occur in the future, which would destroy, modify, or curtail the mussel habitat within the action area. Therefore, we do not anticipate significant cumulative effects from the proposed action, combined with other reasonably foreseeable non-federal actions.

Factors other than the proposed efficiency and safety improvements construction which may affect mussel resources in the study area include industrial, urban, and agricultural pollutants; cumulative sedimentation and water quality problems associated with development and land use practices in the floodplain and watershed; and climatic extremes (droughts and floods). These factors will continue to have impacts on native mussels and any other resources in the project area regardless of whether the improvements are constructed.

VI. Conclusion

After reviewing the current status of the Higgins eye pearlymussel, the environmental baseline conditions for the action area, and the effects of the proposed action, it is the Service's biological opinion that the proposed action is not likely to jeopardize the continued existence of the species.

VII. Incidental Take Statement

Section 9 of the Act and Federal regulation pursuant to Section 4(d) of the Act prohibits the take of endangered and threatened species without special exemption. Take is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such activity. Harm is further defined by the Service to include significant habitat modification or degradation that results in

death or injury to listed species by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering. Harass is defined by the Service as intentional or negligent actions that create the likelihood of injury to listed species to such an extent as to significantly disrupt normal behavior patterns which include, but are not limited to, breeding, feeding, and sheltering. Incidental take is defined as take incidental to, and not the purpose of, the carrying out of an otherwise lawful activity. Under the terms of Section 7(b)(4) and Section 7(o)(2), take incidental to and not an intended part of the agency action is not considered prohibited taking under the Act, provided such taking is in compliance with the terms and conditions of this Incidental Take Statement.

The measures described below are non-discretionary and must be undertaken by the Corps, so that they become binding conditions of any grant, permit, or contract, as appropriate, for the exemption in Section 7(o)(2) to apply. The Corps has a continuing duty to regulate the activity covered by this incidental take statement through enforceable terms that are added to any grant, permit, or contract, the protective coverage of section 7(o)(2) may lapse. If the Corps fails to assume and implement the terms and conditions, the protective coverage of Section 7(o)(2) may lapse. In order to monitor the impact of incidental take, Corps must report the progress of the action and its impact on the species to the Service as specified in the incidental take statement (50 CFR, 402.14(I)(3)).

Because incidental take is defined as take that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity, this Incidental Take Statement is valid only upon receipt by Cargill and the Corps of all appropriate authorizations and permits from federal, state, and local permitting authorities. These permits/authorizations may include, but are not limited to, a permit under section 404 of the Clean Water Act from the Corps and a section 10 Rivers and Harbors Act permit.

Amount or Extent of Take

The Service anticipates that take in the form of killing, harm, or harassment (as defined in 50 CFR §17.3) will occur as a result of the proposed actions. We anticipate that Higgins eye will be taken during the mussel relocation and within the footprints of the expansion area of the existing cell, eight new dolphin structures, removal of five existing steel and timber dolphin structures, and in 15 barge spudding locations. Mortality and injury may also occur outside these directly-affected areas during and after relocation and construction due to sedimentation and changes to hydrology related to the cell expansion and construction and removal of dolphin structures.

Stress, short-term reproductive impairment, and limited mortality, due to changes in hydrology and construction-induced deposition, are possible within the buffered areas. Stressors include low oxygen, decreased food and sperm availability in the water column, and increased silt and other suspended sediments. The project will also result in loss of mussel habitat within the footprint of the dolphin structures. These events could result in harm to Higgins eye and the glochidial life stage. The extent of these adverse effects is dependent on implementation of avoidance and minimization measures.

Take was estimated for listed mussel species based on data gathered during a mussel survey within the action area in 2017 (Helms and Associates 2017). Helms and Associates (2017) estimated the number of mussels within area surrounding the proposed improvement construction locations. This survey area includes all anticipated areas of river bed impact. Spatial data from the project area, mussel densities, and qualitative sampling data were used to estimate populations. The total take estimates are a result of both construction and relocation activities.

The Service anticipates 30 Higgins eye individuals could be taken as a result of this proposed action. This level of take includes individuals that are both relocated and missed, and assumes that the area of direct impact, including buffer areas, totals approximately 264 square meters, that the overall mussel density is 10.76 mussels per square meter, and that Higgins eye will make up 0.6 percent of the mussel community associated with the cell expansion and breasting dolphin installation and removal project within Pool 17 of the Mississippi River (RM 454.2R), located near Muscatine, Muscatine County, Iowa (Helms & Associates, 2017). As a result of low recruitment within the action area and no evidence of Higgins eye recruitment, juveniles <1 inch in size are not included in this estimate, although mortality of juveniles is possible.

Effect of the Take

The Service has determined that based on the proposed project and the conservation measures described, these levels of anticipated take are not likely to result in jeopardy to the Higgins eye mussel for the Cargill existing barge load-out facility construction project. No critical habitat will be affected by the project; therefore, the project will not result in adverse modification of critical habitat.

Reasonable and Prudent Measures

The Service believes the following reasonable and prudent measures are necessary and appropriate to minimize the effects of the project on Higgins eye pearlymussel.

1. Prior to construction in the river, relocate all unionids from within the action area (except spud locations) to a suitable habitat area that will not be adversely influenced by the construction or other adverse impacts. Relocation must be conducted by a qualified malacologist.

2. Relocate removed mussels to an appropriate location when water and air temperatures are at least 40 degrees Fahrenheit in the fall of 2018 or fall of 2019.

3. Monitoring of the existing mussel bed and the "marked transplants" will be performed in years 1, 3, and 6 (2019, 2021, and 2025) for 2018 construction, or (2020, 2022, and 2026) for 2019 construction. Monitoring methods and criteria will be established prior to construction. Monitoring reports will be submitted to the Service and Iowa DNR after each monitoring effort.

4. At present, it is expected that no additional seasonal or temporary work pads will be built outside the work zone. Thus, this area does not need to be searched for mussels. However, should this design feature change, any previously undisturbed area within the new footprint plus a 10-foot buffer should be searched for mussels.

Terms and Conditions

To be exempt from the prohibitions of Section 9 of the Act, the Corps must comply with the following terms and conditions for implementation and reporting of the reasonable and prudent measures described above. These terms and conditions are non-discretionary.

1. The proposed project components (e.g., breasting dolphin installation and spudding of work barges) will occur as planned and as documented in the BA and the project plans.

2. The Corps will ensure that one or more qualified mussel biologists will undertake an intensive mussel salvage effort within the 240 square meter project impact area (area minus spud locations), as defined in the Conservation Measures and Reasonable and Prudent Measures of this BO.

3. Mussel relocation activities will be thoroughly coordinated with the construction contractor to ensure that the impact areas are properly identified and cleared of mussels. The Service will be notified prior to conducting the mussel survey and relocation.

4. A proposed relocation site will be identified by the mussel relocation contractor and submitted to the Service and the IADNR for approval. Relocation activities must not commence prior to receipt of Service approval. To obtain approval, it must be demonstrated that the relocation area has suitable habitat for mussels (as determined by depth, flow, substrate, and presence of an existing mussel community).

5. All Higgins eye pearlymussel specimens will be uniquely marked on their shells, measured, aged, sexed, and noted as to their condition and extent of zebra mussel coverage. They will be cleaned of all visible zebra mussels, transported to the release site, and hand-placed in the substrate in a position appropriate for respiration of the animal. Locations will be recorded using Global Positioning System technology or another equally precise methodology.

6. A report will be provided to the Service within 30 days following the relocation effort indicating the number of Higgins eye pearlymussel individuals that were relocated, their original locations, where they were relocated to, their sizes, ages, sex, condition, and state of zebra mussel coverage. Habitat conditions at the relocation area must also be clearly documented.

7. The contractor conducting the relocation will secure the appropriate permits from the Service and the IADNR and will comply with any terms and conditions stated in such permits.

VIII. Conservation Recommendations

Section 7(a)(I) of the Act directs Federal agencies to utilize their authorities to further the purposes of the Act by carrying out conservation programs for the benefit of endangered and threatened species. Conservation recommendations are discretionary agency activities to minimize or avoid adverse effects of a proposed action on listed species or critical habitat, to help implement recovery plans or to develop information.

In addition to the BMPs and the measures to minimize take, a mussel bed monitoring plan has been conceptualized to aid in adaptive management of the area for mussel bed preservation and/or enhancement. Mussel surveys would occur one, two and three years after construction is completed surrounding the new breasting dolphin structures and at the relocation site. The Service and IADNR would receive the reports for their review and records.

1. Establish a policy with Cargill to incorporate conservation measures for Higgins eye pearlymussel into barge traffic activities on the Mississippi River. Maintenance activities to be considered include the spill prevention associated off-loading, and avoiding or minimizing use of heavy equipment and fill material in the river channel.

In order for the Service to be kept informed of actions minimizing or avoiding adverse effects or benefiting listed species or their habitats, please notify our office of the implementation of any conservation recommendations.

IX. Reinitation Notice

The Service believes approximately 30 Higgins eye pearlymussel individuals will be incidentally taken as a result of the proposed action. The reasonable and prudent measures, with their implementing terms and conditions, are designed to minimize the impact of incidental take that might otherwise result from the proposed action. If, during the course of the action, this level of incidental take is exceeded, such incidental take represents new information requiring reinitiation of consultation and review of the reasonable and prudent measures provided. The Federal agency must immediately provide an explanation of the causes of the taking and review with the Service the need for possible modification of the reasonable and prudent measures.

This concludes formal consultation with Corps on the action outlined in the request. As provided in 50 CFR 402.16, reinitiation of formal consultation is required where discretionary Federal agency involvement or control over the action has been retained (or is authorized by law) and if: (1) the amount or extent of incidental take is exceeded; (2) new information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not considered in this opinion; (3) the agency action is subsequently modified in a manner that causes an effect to the listed species or critical habitat not considered in this opinion; or (4) a new species is listed or critical habitat designated that may be affected by the action. In instances where the amount or extent of incidental take is exceeded, any operations causing such take must cease pending reinitiation.

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