

Appendix 9.6: Dead Horse Bay

Written by Erin Giese and Dr. James Horn

Location (centroid)	Lat. 44.610301°, Lon. -88.006404° ¹ (NAD 1983, UTM Zone 16N)															
Total Area (ha)	167.79 ha															
Area Public Land (ha)	The boundaries of the Dead Horse Bay priority area are located within the coastal zone/waters of the bay of Green Bay and are thus public. Depending on lake levels, parts of the west shore and Longtail Point may overlap with the boundaries of the Dead Horse Bay priority area, which are both privately and publicly owned ² .															
Area of Habitat Types Present (ha) and Percent of Each Habitat Type	<p>Dominant Habitat Types: These habitat types were documented during a July 2015 habitat mapping effort led by the University of Wisconsin-Green Bay Cofrin Center for Biodiversity (CCB) across the Lower Green Bay and Fox River Area of Concern (LGB&FR AOC)³. Habitat types within Dead Horse Bay are displayed as a static map at the bottom of this document. Note that the extent of submergent marsh was refined by the CCB's 2017 submerged aquatic vegetation field surveys. There is a total of 167.76 ha of natural habitat in Dead Horse Bay.</p> <table border="1"> <thead> <tr> <th>Habitat Type</th> <th>Area (ha)</th> <th>Percent</th> </tr> </thead> <tbody> <tr> <td>Emergent Marsh (High Energy Coastal)</td> <td>5.19</td> <td>3.10</td> </tr> <tr> <td>Green Bay Open Water</td> <td>135.64</td> <td>80.86</td> </tr> <tr> <td>Hardwood Swamp</td> <td>0.03</td> <td>0.02</td> </tr> <tr> <td>Submergent Marsh</td> <td>26.90</td> <td>16.03</td> </tr> </tbody> </table> <p><i>Disclaimer!</i> Because this priority area is located within the Great Lakes coastal zone, the amount of habitat types can vary drastically across years and even within years (or months) due to changing Great Lakes water levels, precipitation, and seiche. Within this priority area specifically, the amounts of emergent and submergent marsh are known to fluctuate significantly from year to year and within years. The habitat types listed above and mapped below are based on a field effort conducted in July 2015. Plants recorded in the "Natural Habitat Communities and Significant Plants" section were primarily documented in July 2015 and late summer/fall 2016 and 2017. Great Lakes water levels were much higher in 2016 and 2017 than in July 2015.</p>	Habitat Type	Area (ha)	Percent	Emergent Marsh (High Energy Coastal)	5.19	3.10	Green Bay Open Water	135.64	80.86	Hardwood Swamp	0.03	0.02	Submergent Marsh	26.90	16.03
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General Description	Dead Horse Bay is a part of Green Bay's west shore wetland complex and has been called the "armpit" of Longtail Point being sandwiched in between the west shore and Longtail Point. It largely consists of open water as well as one of the largest and highest quality submergent marshes in the entire LGB&FR AOC, which includes a few small pockets of wild celery (<i>Vallisneria americana</i>) along this priority area's eastern border adjacent to Longtail Point. The Longtail Point peninsula offers protection from wave action to the Dead Horse Bay-west shore wetland complex, which promotes growing conditions for aquatic and submergent plants. The amount and types of habitats may vary depending on lake levels within this rather dynamic Great Lakes coastal system. The effects of lake levels on the amount of emergent and submergent marsh and open water can be seen in aerial imagery from 1938, 1960, and 2014 in comparison to the extremely high lake levels in the 1970s (aerial image from 1978) on the Brown County Online GIS Portal ² . Rafts of over 20 migratory waterfowl species have been reported within Dead Horse Bay in 2016 and 2017 within the open water and submergent marsh, including American Coot (<i>Fulica americana</i>), scaup, Common Goldeneye															

¹ File "AOC_PriorityAreas.v09_20171212.shp"

² Brown County Online GIS Portal:

<https://browncounty.maps.arcgis.com/apps/webappviewer/index.html?id=61fba3fd419045e48aa6ba759838387c>

³ LGB&FR AOC 2015 habitat field mapping effort

	<p>(<i>Bucephala clangula</i>), Gadwall (<i>Anas strepera</i>), teal, mergansers, and more⁴, though it is already known as an important migratory waterfowl stopover site⁵. Canvasbacks especially used Dead Horse Bay⁶. Some of these ducks feed on aquatic plant seeds while others forage on zebra mussels (<i>Dreissena polymorpha</i>) and aquatic insects, such as worms (subclass Oligochaeta) and chironomids (family Chironomidae)⁵. Dead Horse Bay is popular for fishing and duck hunting. While there are extensive beds of native submerged aquatic vegetation, there is great potential for this site to be enhanced and expanded as well as managed for invasive plant species, such as Eurasian watermilfoil (<i>Myriophyllum spicatum</i>). Several research projects have taken place in Dead Horse Bay in recent years, including multiple fish studies (e.g., WDNR, U.S. Fish and Wildlife Service, UW-Green Bay)^{7,8}, submerged aquatic vegetation survey (UW-Green Bay),⁹ migratory waterfowl survey (UW-Green Bay)¹⁰, and invertebrate study (UW-Green Bay)¹¹.</p>
<p>Special Features</p>	<ul style="list-style-type: none"> • Contains one of the highest quality submergent marshes in the entire LGB&FR AOC. • Part of the larger west shore wetland complex of lower Green Bay. • Important waterfowl migratory bird stopover site¹² and fish habitat.
<p>Natural Habitat Communities and Significant Plants (ordered in terms of ecological importance and size/amount)</p>	<p>The majority of the Dead Horse Bay priority area is open water. Unfortunately, like most of Green Bay, water quality is relatively poor¹³. In fact, on a scale ranging from “excellent” to “highly degraded,” waters near Longtail Point have been classified as “very degraded¹³.” Poor water quality, which in this case is largely due to high nutrient loadings from non-point source runoff from agricultural and developed lands, can negatively affect which aquatic and submergent plants are able to thrive. Water levels can also affect which plants colonize areas like Dead Horse Bay. Yet, despite lower Green Bay’s poor water quality, Dead Horse Bay contains one of the highest quality submergent marshes in the entire LGB&FR AOC. The most extensive beds of submerged aquatic vegetation are found along the northeastern edge of the west shore, western edge of Longtail Point, and in the northernmost portion of the “armpit” of Longtail Point.</p> <p>Native plants include:</p> <ul style="list-style-type: none"> • Wild celery (<i>Vallisneria americana</i>) • Bladderwort (<i>Utricularia vulgaris</i>) • Coontail (<i>Ceratophyllum demersum</i>) • Turion duckweed (<i>Lemna turionifera</i>) • Slender riccia (<i>Riccia fluitans</i>, a thallose liverwort) • Forked duckweed (<i>Lemna trisulca</i>) • Sago pondweed (<i>Stuckenia pectinata</i>) • Great duckweed (<i>Spirodela polyrrhiza</i>) • Turion duckweed (<i>Lemna turionifera</i>) • Sessile-fruited arrowhead (<i>Sagittaria rigida</i>) • Bull-head pond-lily (<i>Nuphar variegata</i>) • Nodding water-nymph (<i>Najas flexilis</i>)

⁴ LGB&FR AOC comprehensive biota database: file “AOCBiota_DB_ShareableVersion_20171213.accdb”

⁵ Vicky Harris 1998 master’s thesis

⁶ Personal communication with Thomas Erdman on 13 January 2016

⁷ Disterhaft 2013 Master’s Thesis entitled “Changes in fish assemblages of Lake Michigan’s Green Bay following the introduction of Dreissenid mussels and round goby (*Neogobius melanostomus*) during 1980-2010”

⁸ UW-Green Bay Aquatic Ecology and Fisheries Lab fish project on nearshore-wetland habitat led by Dr. Patrick Forsythe and Dr. Christopher Houghton; surveys from 2014 and 2015.

⁹ AOC Submergent Aquatic Vegetation Surveys led by Dr. James Horn and Dr. Amy Wolf, 2017

¹⁰ AOC Migratory Waterfowl Surveys by Tom Prestby, 2016-2017

¹¹ Schneider & Sager 2007: “Structure & ordination of epiphytic invertebrate communities of four coastal wetlands in Green Bay, Lake Michigan”

¹² Epstein et al. 2002: “A data compilation and assessment of coastal wetlands of Wisconsin’s Great Lakes”

¹³ Chow-Fraser 2006: “Development of the wetland Water Quality Index for assessing the quality of Great Lakes coastal wetlands”

	<p>Along the eastern edge of the west shore and western edge of Longtail Point, there is also emergent high energy marsh. Although hybrid cattail (<i>Typha × glauca</i>) and common reed (<i>Phragmites australis</i>; hereafter referred to as “<i>Phragmites</i>”) dominate these marshes, they also harbor significant populations of river bulrush (<i>Bolboschoenus fluviatilis</i>) and floating-leaved bur-reed (<i>Sparganium fluctuans</i>).</p>
<p>Significant Animals</p>	<p>Birds:</p> <ul style="list-style-type: none"> • >200 bird species have been reported using the west shore of Green Bay, though Dead Horse Bay provides important stopover and post-breeding season habitat for migratory waterfowl and waterbirds, including⁴: <ul style="list-style-type: none"> ○ American Coot (<i>Fulica americana</i>) ○ Greater Scaup (<i>Aythya marila</i>) ○ Lesser Scaup (<i>Aythya affinis</i>), state special concern species, listed as a Wisconsin Wildlife Action Plan Species of Greatest Concern, and regional priority species from the North American Waterfowl Management Plan ○ Common Goldeneye (<i>Bucephala clangula</i>), state special concern species ○ Gadwall (<i>Anas strepera</i>) ○ Blue-winged Teal (<i>Anas discors</i>), a state special concern species and listed as a Wisconsin Wildlife Action Plan Species of Greatest Concern ○ Green-winged Teal (<i>Anas carolinensis</i>) ○ Hooded Merganser (<i>Lophodytes cucullatus</i>), a regional priority species from the North American Waterfowl Management Plan ○ Common Merganser (<i>Mergus merganser</i>) ○ Pied-billed Grebe (<i>Podilymbus podiceps</i>), listed on the Upper Mississippi River/Great Lakes Waterbird Conservation Plan ○ Black Tern (<i>Chlidonias niger</i>), state endangered, federally listed species of concern, listed as a Wisconsin Wildlife Action Plan Species of Greatest Concern, and listed on the Upper Mississippi River/Great Lakes Waterbird Conservation Plan ○ Forster’s Tern (<i>Sterna forsteri</i>), state endangered and listed as a Wisconsin Wildlife Action Plan Species of Greatest Concern • Many species are known to breed within the emergent marshes of the western edge of Longtail Point and eastern edge of the west shore¹⁴: <ul style="list-style-type: none"> ○ Forster’s Tern, Marsh Wren (<i>Cistothorus palustris</i>), Red-winged Blackbird (<i>Agelaius phoeniceus</i>), American Coot, Common Gallinule (<i>Gallinula galeata</i>), Yellow-headed Blackbird (<i>Xanthocephalus xanthocephalus</i>), and others <p>Fish:</p> <ul style="list-style-type: none"> • Although >80 fish species have been recorded in the pelagic zone of the lower bay, some of which may use Dead Horse Bay. Species that use the bay, include⁴: <ul style="list-style-type: none"> ○ One federally endangered species: chinook salmon (<i>Oncorhynchus tshawytscha</i>) ○ Three state special concern species, including: American eel (<i>Anguilla rostrata</i>), banded killifish (<i>Fundulus diaphanus</i>), and lake sturgeon (<i>Acipenser fulvescens</i>) ○ One International Union for Conservation of Nature-listed species as vulnerable (bloater [<i>Coregonus hoyi</i>]) and one as endangered (American eel) ○ Two globally list species (G3 = vulnerable): redbside dace (<i>Clinostomus elongatus</i>) and lake sturgeon (<i>Acipenser fulvescens</i>) ○ Northern pike (<i>Esox lucius</i>) traverse through Dead Horse Bay to reach west shore wetlands for spawning

¹⁴ Wisconsin Breeding Bird Atlas II Project (2015-2019): http://ebird.org/ebird/atlaswi/block/4408758NW?atlasPeriod=EBIRD_ATL_WI_2015&rank=mrec&hs_sortBy=category&hs_o=desc (as of 19 Oct 2016) and http://ebird.org/ebird/atlaswi/block/4408851NE?atlasPeriod=EBIRD_ATL_WI_2015&rank=mrec&hs_sortBy=category&hs_o=desc (as of 19 Oct 2016)

	<p>Mammals:</p> <ul style="list-style-type: none"> Although ~50 mammal species are known to or are expected to occur along the west shore (as noted in Roznik 1979)¹⁵, only a few likely use the emergent and submergent marshes of Dead Horse Bay, including muskrat (<i>Ondatra zibethicus</i>), North American river otter (<i>Lontra canadensis</i>), and American mink (<i>Neovison vison</i>)^{16,17}. <p>Mollusks:</p> <ul style="list-style-type: none"> Within the pelagic zone of the lower bay, the following have been recorded: <ul style="list-style-type: none"> Freshwater clams: fingernail clam (<i>Sphaerium</i> sp.), pea clam (<i>Pisidium</i> sp.) Three snails: mud bithynia (<i>Bithynia tentaculata</i>), river snail species (<i>Campeloma</i> sp.), and valve species (<i>Valvata</i> sp.) <p>Arthropods:</p> <ul style="list-style-type: none"> Several species have been recorded in the pelagic zone of the lower bay in the 1990s, including: <ul style="list-style-type: none"> Long-horn caddisfly (<i>Oecetis</i> sp.)⁴ Buzzer midge (<i>Chironomus plumosus</i>)⁴ Green midge (<i>Tanytarsus</i> sp.)⁴ Riffle beetle species (<i>Ordobrevia</i> sp.) from 2007⁴ Non-biting midges (<i>Polypedilum</i> sp., <i>Paratanytarsus</i> sp., <i>Parachironomus</i> sp., and <i>Parakiefferiella</i> sp.) from 1995¹¹ <p>Annelids:</p> <ul style="list-style-type: none"> Aquatic oligochaete worms have been recorded in the pelagic zone of the lower bay in the early 1990s, including⁴: <ul style="list-style-type: none"> <i>Aulodrilus americanus</i> <i>Dero digitate</i> <i>Nais pardalis</i> <i>Potamothrix moldaviensis</i> <i>Nais communis</i>
Habitat Quality	Overall, the ecological quality of Dead Horse Bay is relatively low due to poor water quality and the presence of invasive plant species in the submergent and emergent marshes. That being said, there are pockets of native submerged aquatic plants, which provide habitat for fish, waterfowl, and aquatic invertebrates.
Significant Invasive Species Issues	<p>Invasive Plant Species: Each of these species outcompetes and crowds out native plants^{3,9}:</p> <ul style="list-style-type: none"> Eurasian water-milfoil (<i>Myriophyllum spicatum</i>) <ul style="list-style-type: none"> Found within the submergent marsh Common reed (<i>Phragmites australis</i>) <ul style="list-style-type: none"> Some <i>Phragmites</i> occurs along the edges of the Dead Horse Bay priority area along the west shore and Longtail Point within the emergent marsh; some management has occurred in recent years in open areas (2011-12, 2015-16). Hybrid cattail (<i>Typha</i> × <i>glauca</i>) <ul style="list-style-type: none"> Some hybrid cattail occurs along the edges of the Dead Horse Bay priority area along the west shore and Longtail Point within the emergent marsh; management unknown.

¹⁵ Green Bay West Shores Master Plan Concept Element 1979 by Roznik et al.

¹⁶ Wisconsin Department of Natural Resources Technical Report PUB-LF-073.

¹⁷ Wisconsin Department of Natural Resources 2015 muskrat house survey; noted in file "AOC_ProjectCatalogue_20160922.xlsx"

	<p>Invasive Animal Species:</p> <ul style="list-style-type: none"> • <i>Fish</i>⁴ <ul style="list-style-type: none"> ○ Alewife (<i>Alosa pseudoharengus</i>)¹⁸ <ul style="list-style-type: none"> ▪ Poses a threat to native fish species by consuming zooplankton and disturbing the natural food web; not currently being managed ○ Common carp (<i>Cyprinus carpio</i>)¹⁹ <ul style="list-style-type: none"> ▪ Destroy vegetation by uprooting plants and increasing cloudiness of water; not currently being managed ○ Rainbow smelt (<i>Osmerus mordax</i>)²⁰ <ul style="list-style-type: none"> ▪ Negatively affect uncommon to rare native fish species; not currently being managed ○ Round goby (<i>Neogobius melanostomus</i>)²¹ <ul style="list-style-type: none"> ▪ Prey on small native fish and eggs (e.g., darters) and outcompete similarly sized native fish; not currently being managed ○ White perch (<i>Morone americana</i>)²² <ul style="list-style-type: none"> ▪ Prey on native fish eggs, such as walleye; not currently being managed • <i>Freshwater mussels</i> <ul style="list-style-type: none"> ○ Zebra mussel (<i>Dreissena polymorpha</i>)²³ <ul style="list-style-type: none"> ▪ Poses threat to native freshwater mussels; not currently being managed
<p>Management and Restoration Recommendations</p>	<ul style="list-style-type: none"> • Control introduced plant species (e.g., Eurasian watermilfoil) and maintain extensive and high quality submerged aquatic vegetation with native plants. • Determine substrate needs for target plant species and then enhance and restore substrate condition. • Protect, maintain, and expand submerged aquatic vegetation biodiversity hotspots. • Implement Upper Fox, Wolf, and Lower Fox basin's total maximum daily loads (TMDL) to improve water quality. • Promote best management practices and innovative nutrient management measures in Fox River watershed. • Develop or restore important fish spawning and nursery habitats, such as rocky reefs, gravel, cobble, woody debris, and sandy areas for shoreline fish. • Control invasive plant species (<i>Phragmites</i> + hybrid cattail) within the emergent marsh and maintain an appropriate mix of open water native emergent vegetation.
<p>Reference Links and Documents</p>	<p>Web Links:</p> <ul style="list-style-type: none"> • Drone footage of Dead Horse Bay from 2016: https://www.youtube.com/watch?v=lnhn5iZT8-Y

¹⁸ Fuller, P., E. Maynard, D. Raikow, J. Larson, A. Fusaro, and M. Neilson. 2016. *Alosa pseudoharengus*. USGS Nonindigenous Aquatic Species Database, Gainesville, FL. <https://nas.er.usgs.gov/queries/factsheet.aspx?SpeciesID=490> Revision Date: 9/25/2015. Accessed 17 Oct 2016.

¹⁹ Nico, L., E. Maynard, P.J. Schofield, M. Cannister, J. Larson, A. Fusaro, and M. Neilson. 2016. *Cyprinus carpio*. USGS Nonindigenous Aquatic Species Database, Gainesville, FL. <https://nas.er.usgs.gov/queries/FactSheet.aspx?SpeciesID=4> Revision Date: 7/15/2015. Accessed 17 Oct 2016.

²⁰ Fuller, P., E. Maynard, J. Larson, A. Fusaro, T.H. Makled, and M. Neilson. 2016. *Osmerus mordax*. USGS Nonindigenous Aquatic Species Database, Gainesville, FL. <https://nas.er.usgs.gov/queries/FactSheet.aspx?SpeciesID=796> Revision Date: 9/29/2015. Accessed on 17 Oct 2016.

²¹ Fuller, P., A. Benson, E. Maynard, M. Neilson, J. Larson, and A. Fusaro. 2016. *Neogobius melanostomus*. USGS Nonindigenous Aquatic Species Database, Gainesville, FL. <https://nas.er.usgs.gov/queries/FactSheet.aspx?SpeciesID=713> Revision Date: 1/7/2016. Accessed on 17 Oct 2016.

²² Fuller, P., E. Maynard, D. Raikow, J. Larson, A. Fusaro, and M. Neilson. 2016. *Morone americana*. USGS Nonindigenous Aquatic Species Database, Gainesville, FL. <https://nas.er.usgs.gov/queries/FactSheet.aspx?SpeciesID=777> Revision Date: 1/15/2016. Accessed on 17 Oct 2016.

²³ Wisconsin Department of Natural Resources Technical Report PUBL ER-818 2010

	<p>Reference Documents:</p> <ul style="list-style-type: none"> • Chow-Fraser P. 2006. Development of the wetland Water Quality Index for assessing the quality of Great Lakes coastal wetlands. In: Simon TP, Stewart PM (eds) Coastal wetlands of the Laurentian Great Lakes: health, habitat and indicators. Indiana Biological Survey, Bloomington, IN, pp 137-166. • Disterhaft, K. 2013. Changes in fish assemblages of Lake Michigan's Green Bay following the introduction of Dreissenid mussels and round goby (<i>Neogobius melanostomus</i>) during 1980-2010. Master's thesis from the University of Wisconsin-Green Bay. • Frieswyk, C.B., C.A. Johnston, and J.B. Zedler. 2007. Identifying and characterizing dominant plants as an indicator of community condition. Journal of Great Lakes Research. 33(3):125-135. <ul style="list-style-type: none"> ○ Available: http://glei.nrri.umn.edu/default/documents/frieswyk_jglr_2007.pdf • Harris, V.A. 1998. Waterfowl use of lower Green Bay before (1977-78) and after (1994-97) zebra mussel invasion. Master's thesis from the University of Wisconsin-Green Bay. • Mossman, M.J. 1989. Wisconsin Forster's Tern Recovery Plan. Passenger Pigeon 51(2):171-186. http://images.library.wisc.edu/EcoNatRes/EFacs/PassPigeon/ppv51no02/reference/econatres.pp51n02.mossman.pdf • Schneider, P. and P.E. Sager. 2007. Structure and ordination of epiphytic invertebrate communities of four coastal wetlands in Green Bay, Lake Michigan. Journal of Great Lakes Research 33:342-357. • Wisconsin Department of Natural Resources. 2013. Regional and property analysis: Green Bay Planning Group. Technical Report PUB-LF-073. • Wisconsin Department of Natural Resources. 2014. Green Bay Planning Group Master Plan. Technical Report PUB-LF-075.
<p>Site History (e.g., original vegetation, past conservation projects)</p>	<p>In the early 1630s, Frenchman Jean Nicolet first arrived in lower Green Bay when it was primarily inhabited by Native American tribes²⁴. Lower Green Bay consisted of large beds of wild rice (<i>Zizania</i> sp.) and wild celery (<i>Vallisneria americana</i>), extensive emergent marsh (<i>Schoenoplectus</i> spp., cattail), sedge meadows (<i>Calamagrostis canadensis</i>), shrub carr (e.g., <i>Cornus</i> spp., <i>Salix</i> spp.), swamps, and wet conifer forest (black spruce [<i>Picea mariana</i>], balsam fir [<i>Abies balsamea</i>])^{25,26,27,28,29}. Between the late 1600s and 1800s, European fur trade, duck hunting, fishing, logging, shipping, and agriculture were important early industries in lower Green Bay^{30,31,32}. In the early 1800s, there were a few small settlements and farms of Europeans and Native Americans in the lower Bay³¹.</p>

²⁴ Jean Nicolet: French Explorer. By The Editors of Encyclopaedia Britannica. Available: <https://www.britannica.com/biography/Jean-Nicolet> (accessed on 24 Oct 2016).

²⁵ Arthur C. Neville's Map of Historic Sites on Green Bay, Wisconsin 1669-1689. Available: <http://s3.amazonaws.com/labaye/data/Bay%20Settlement%20Map%20W1%20Historical%20Bulletin%201926.pdf> (accessed on 24 Oct 2016).

²⁶ Survey of the N.W. Lakes: East Shore of Green Bay 1843. Available: <http://s3.amazonaws.com/labaye/data/1843%20East%20Shore%20of%20Green%20Bay.jpg> (accessed on 24 Oct 2016).

²⁷ 1845 Chart of Green Bay. Available <http://s3.amazonaws.com/labaye/data/1845%20Chart%20of%20Green%20Bay.pdf> (accessed on 24 Oct 2016).

²⁸ 1820s Fox River Military Road Map to Ft. Crawford. Available: <http://s3.amazonaws.com/labaye/data/1820s%20Fox%20River%20Military%20Road%20Map%20to%20Ft.%20Crawford.pdf> (accessed on 24 Oct 2016).

²⁹ UW-Green Bay personal communication with Thomas Erdman.

³⁰ City of Green Bay's History Webpage: <http://www.ci.green-bay.wi.us/history/1800s.html> (accessed on 20 Oct 2016).

³¹ Excerpt from "Recollections of Green Bay in 1816-17" by James W. Biddle. Available: <http://s3.amazonaws.com/labaye/data/Recollections%20of%20Green%20Bay%20in%201816-1817.pdf> (accessed on 24 Oct 2016).

³² The Early Outposts of Wisconsin: Green Bay for Two-Hundred Years, 1639-1839. Available: <http://labaye.org/item/70/2810> (accessed on 25 Oct 2016).

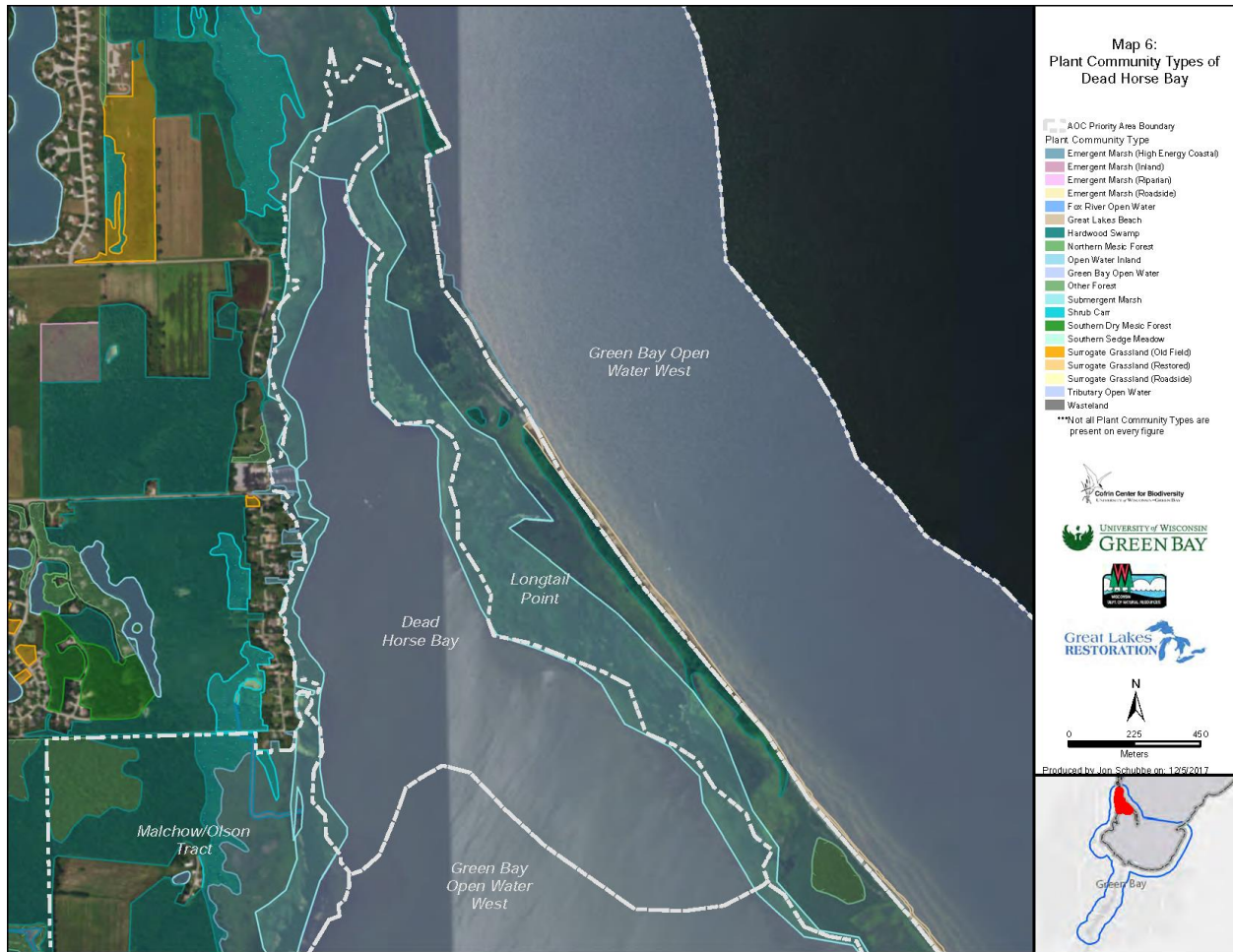
	<p>Prior to the arrival of many invasive plants species in the late 1990s, the emergent marsh at Longtail Point (which likely included the outer edges of Dead Horse Bay) consisted of soft-stem bulrush (<i>Schoenoplectus tabernaemontani</i>) and three-square bulrush (<i>Schoenoplectus pungens</i>). There also used to be a sedge meadow consisting of blue-joint grass (<i>Calamagrostis canadensis</i>) and cattails (<i>Typha latifolia</i>), hardwood swamp, and a small amount of shrub carr. From the 1960s through the early 1980s, Forster's Terns regularly nested on floating mats of vegetation at Longtail Point³³.</p> <p>Today, Dead Horse Bay is a popular location for fishing and duck hunting, but it has also been an important study site for many researchers in recent years, particularly fish research. In collaboration with the WDNR, UW-Green Bay graduate student, Katherine Disterhaft, investigated changes in fish assemblages in the bay of Green Bay since the introduction of invasive zebra and quagga mussels and round gobies between 1980 and 2010 for her master's thesis project. Fish data that Disterhaft used for her thesis are a part of a long-term fish monitoring effort in the bay of Green Bay led by the WDNR's Tammie Paoli³⁴. Dr. Patrick Forsythe and Dr. Christopher Houghton have been leading an investigation of coastal wetland-nearshore linkages of Green Bay sport fishes, which also includes invertebrate sampling³⁴. They plan to estimate the coastal wetland habitat that is used by sport fish species and to build habitat food webs³⁴. Two of their seven survey locations are in the LGB&FR AOC, namely Dead Horse Bay and Point Sable³⁴. The U.S. Fish and Wildlife Service coordinate an early detection and monitoring program of aquatic invasive species in Lake Michigan, and many of their sampling locations are in the LGB&FR AOC, including along the outer edges of Dead Horse Bay³⁴. They survey for ichthyoplankton, carp, macroinvertebrates, and nearshore fishes³⁴.</p> <p>UW-Green Bay's Patricia Schneider and Dr. Paul Sager conducted a study in 1995 to better understand epiphytic invertebrate communities in Green Bay coastal wetlands, one of which was in Dead Horse Bay¹¹. In the fall of 2017, the UW-Green Bay's Cofrin Center for Biodiversity's (CCB) Dr. Amy Wolf, Dr. James Horn, and Dr. Robert Howe mapped submerged aquatic vegetation beds throughout the LGB&FR AOC and found that Dead Horse Bay has one of the highest quality submergent marshes in the LGB&FR AOC⁹. In 2016-2017 under the guidance of CCB's Dr. Howe, Dr. Wolf, and Erin Giese, Tom Prestby surveyed migratory waterfowl within the LGB&FR AOC, including a sampling location on the west shore roughly facing the center of Dead Horse Bay and Longtail Point¹⁰. Waterfowl rafts were digitized into ArcGIS by Cody Becker.</p>
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³³ Mossman 1989: Wisconsin's Forster's Tern Recovery Plan:

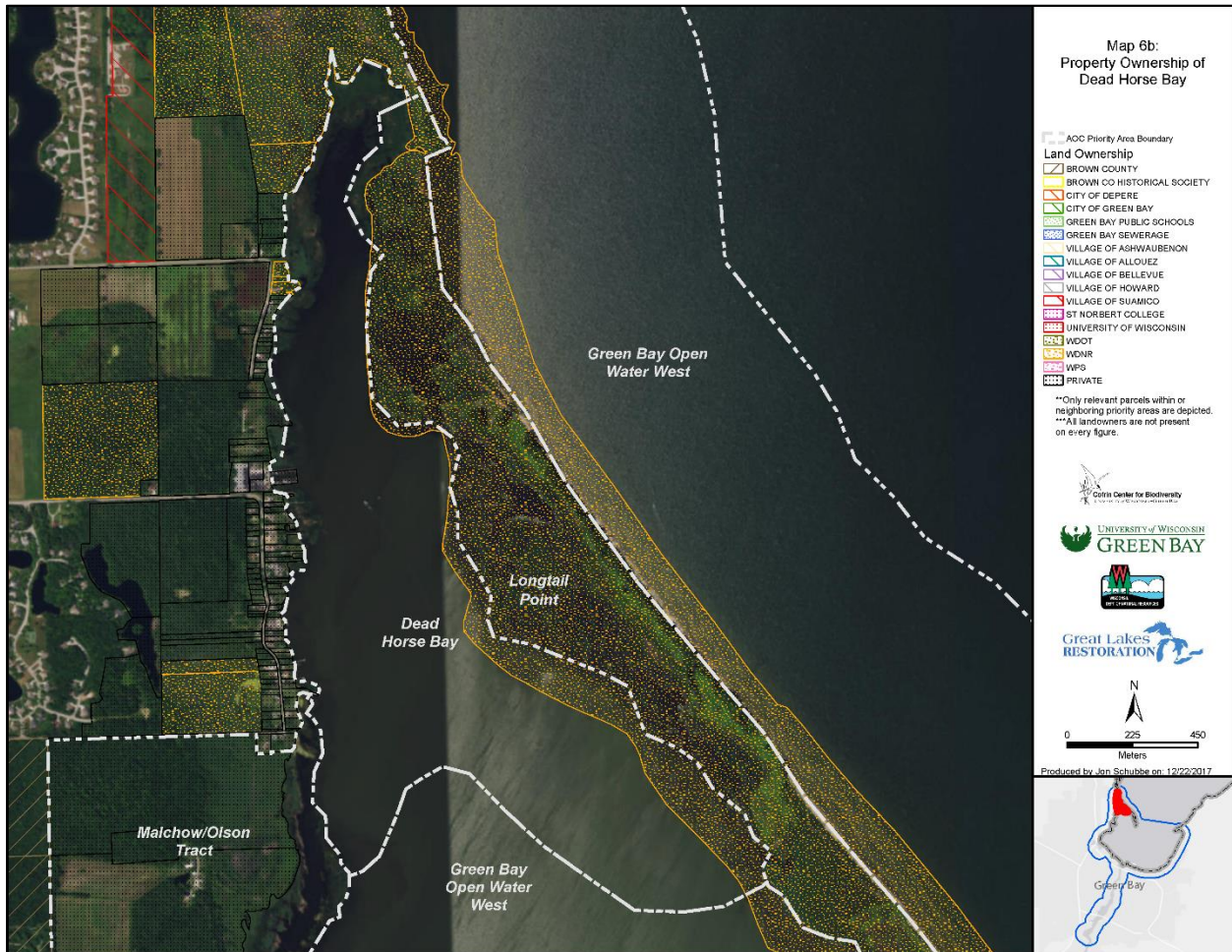
<http://images.library.wisc.edu/EcoNatRes/EFacs/PassPigeon/ppv51no02/reference/econatres.pp51n02.mmossman.pdf>

³⁴ Green Bay Fish Working Group Annual Meetings on 20 March 2015, 6 January 2016, and 4 January 2017

Map of Dead Horse Bay's plant communities, which are delineated based on the UW-Green Bay 2015 habitat mapping effort and 2017 submerged aquatic vegetation surveys. Map made by UW-Green Bay's Jon Schubbe.



Land ownership boundaries at Dead Horse Bay. Map made by UW-Green Bay's Jon Schubbe.



Photograph of Dead Horse Bay facing northwest. Photograph taken by Erin Giese on 2 December 2016.

