



U.S. ARMY CORPS OF ENGINEERS

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**Woodtick Peninsula Section 204 Beneficial Use  
of Dredged Material for Ecosystem Restoration  
Project**  
Monroe County, MI

**Ecological Output Analysis Report**



3/25/2022

**WOODTICK PENINSULA SECTION 204 BENEFICIAL USE OF  
DREDGED MATERIAL FOR ECOSYSTEM RESTORATION  
PROJECT**

**DRAFT  
ECOLOGICAL OUTPUT ANALYSIS REPORT**

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***Monroe County, Michigan***  
***3/25/2022***

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## Acronyms and Abbreviations

CAP	Continuing Authorities Program
CDF	Confined Disposal Facility
EGLE	Michigan Department of Environment, Great Lakes, and Energy (Formerly Michigan Department of Environmental Quality)
HEP	habitat evaluation procedure
L-QHEI	Lake Erie/ Lacustrary Qualitative Habitat Evaluation Index
MDNR	Michigan Department of Natural Resources
OEPA	Ohio Environmental Protection Agency
RSM	Regional Sediment Management
TNC	The Nature Conservancy
USACE	United States Army Corps of Engineers
USFWS	United States Fish and Wildlife Service
WHSRN	Western Hemisphere Shorebird Reserve Network

# 1. Study Information

## 1.1 Study Authority

The U.S. Army Corps of Engineers (USACE), Detroit District initiated a study under Section 204 of the 2007 Water Resources and Development Act, also known as Regional Sediment Management (RSM). It is a Continuing Authorities Program (CAP) which focuses on water resource related projects of relatively smaller scope, cost and complexity. Traditional USACE civil works projects are of wider scope and complexity and are specifically authorized by Congress. The CAP is a delegated authority to plan, design, and construct certain types of water resource and environmental restoration projects without specific Congressional authorization. This study authority allows the USACE to evaluate opportunities to beneficially reuse dredged material for ecosystem restoration.

## 1.2 Purpose and Need

The purpose of this study is to determine the ecological output resulting from various alternatives using dredged material from the Toledo Harbor Federal Navigation Project to restore Great Lakes coastal wetland habitat at Woodtick Peninsula. This report evaluates the outputs from an ecological perspective and does not include information regarding the social or economic benefits resulting from the restoration measures. This report documents the existing and future ecological outputs of each proposed project alternative, as well as the ecological outputs without the project. The proposed project alternatives were developed cooperatively by the USACE-Detroit District and Michigan Department of Natural Resources (MDNR).

## 1.3 Background and Scope

Woodtick Peninsula is in southeastern Michigan along the western shoreline of Lake Erie, located in Monroe County, Michigan. Woodtick Peninsula is owned by the MDNR. The peninsula is in an area of Lake Erie commonly referred to as North Maumee Bay. Woodtick Peninsula is located approximately 45 miles southwest of Detroit, Michigan and, at its most southern point, 5 miles north of Toledo, Ohio.

Woodtick Peninsula is a natural shoreline feature located within the Erie Marsh Preserve and Erie State Game Area (owned by the Michigan Department of Natural Resources and The Nature Conservancy, respectively). Wetlands in the Western Lake Erie Region are identified as one of 34 unique habitat areas in the North American Waterfowl Management Plan (USFWS, 1986) and one of 43 areas of greatest continental significance to North American ducks, geese, and swans (USFWS, 2012). In September of 2000, Woodtick Peninsula and nearby wetlands were designated as a site of regional importance in the Western Hemisphere Shorebird Reserve Network (WHSRN, 2021). Erie Marsh, located to the west of Woodtick Peninsula, is 2,149 acres in size, represents 11% of the remaining marshland in Lake Erie, and is a conservation target for the restoration of Lake Erie (TNC, 2012). Since the year 1993, 38 species of shorebirds (WHSRN, 2021) and 300 species of birds have been reported in Erie Marsh, which highlights the importance of Woodtick Peninsula as a protective barrier for this critical bird habitat. Additionally, Woodtick Peninsula contains shallow water habitat and coastal wetlands that are important spawning, nursery, and feeding habitat for a wide variety of game and forage fishes. This makes western Lake Erie an attractive and popular sport fishing destination in the Midwest and Great Lakes.

Woodtick peninsula is a fine sand feature that was likely created by littoral movements of sand from the north down the Detroit River. Prior to European settlement and development of Monroe County, the peninsula extended south from the shoreline as an unbroken barrier beach approximately 19,000 feet in length and a maximum width of 2,600. Historical National Oceanic and Atmospheric Administration nautical charts of this area show Woodtick Peninsula as a series of islands separated by natural and man-made channels with an approximate 3.75-mile length, 500 to 1,500 feet width. The J.R. Whiting Generating Plant, a coal-fired powerplant, operated from 1952 until final decommissioning in April 2016 by Consumers Energy Company on the northern end of Woodtick Peninsula. During that time, a channel was dredged along the western side of Woodtick Peninsula to provide cooling water for the powerplant and physically cut off the DNR property from surrounding wetlands.



In recent decades, shoreward migration of the peninsula (i.e., loss of wetlands on the lake-most side) and reduction in its size has been accelerated by high lake levels, erosion, breaching, and probably starvation of sand sources from the north (Meadows et al., 1992). Woodtick Peninsula is now an irregular shape of varying width (Johnston et al., 2007a ) and adjacent shorelines have been diked and reinforced to counter more extreme waves events not attenuated by the peninsula (Anderson et al., 2021 ).

#### **1.4 The Toledo Harbor Federal Navigation Channel**

The Toledo Harbor Federal Navigation Channel is a 25-mile long Federal channel that is maintained to authorized depths to support commercial navigation. There is an 18-mile Lake Approach Channel in Maumee Bay, which has authorized dimensions of 28 feet deep and 500 feet wide from the mouth of the Maumee River (Mile 0), through Maumee Bay to deep water in Lake Erie (Lake Mile (LM) 18). The Maumee River Channel is a 7-mile long channel in the lower Maumee River with has authorized dimensions between 25 – 27 feet and authorized widths ranging from 200 – 400 feet wide.

To keep the Port operating, contractors for the USACE dredged approximately 400,000 – 1.1 million cubic yards of material annually. This amount varies by year based on target areas in the channel, lake levels and available funding. Historically, most of the sediments dredged from the federal navigation channel were disposed of in the open lake disposal location. Starting in 2020, USACE started placing dredged material in the Toledo Port Authority’s Confined Disposal Facility (CDF). For the foreseeable future, it is assumed that dredged material will not be placed in the open lake placement site.

## **2. Ecological Output Analysis Methodology**

Many methods are available to measure current ecosystem resource conditions and to predict the future conditions of those resources. Habitat assessment methods developed for individual species may have limitations when used to assess ecosystem restoration problems and objectives. For example, in applying the Bluebook Habitat

Suitability Indices (HSI) set forth by the U.S. Fish and Wildlife Service, ecological assessment of an entire biotic community is often based upon one to a few species that is considered representative of the whole biotic community (USFWS, 1980). This species-specific approach to habitat assessment does not consider communities of organisms and typically considers habitat in isolation from its ecosystem context.

The assessment methodology selected for this project is community-based and governed by its ability to meet the needs of the study goals, objectives, and level of detail. In this assessment, the habitat evaluation procedure (HEP) framework was followed to establish a quality score for shoreline habitats surrounding Woodtick Peninsula. This habitat assessment was developed to evaluate the ecological value of the existing without-project conditions and future with-project conditions for the various alternatives associated with four potential project sites. Habitat values for the with and without project conditions for each alternative was determined by conducting the Lake Erie/Lacustrary Qualitative Habitat Evaluation Index (L-QHEI) developed by the Ohio Environmental Protection Agency (OEPA 2010).

## **2.1 Lake Erie Qualitative Habitat Evaluation Index (L-QHEI)**

In 2021, a USACE team evaluated the wetland habitat at Woodtick Peninsula using a Lacustrary Qualitative Habitat Evaluation Index (L-QHEI) approach (OEPA, 2010). This method was developed based on Lake Erie shoreline habitat types found in Ohio but is readily applicable to Woodtick Peninsula. This index provides a score from 0-100, with 100 being the best, based on five metrics of habitat: (1) substrate, (2) cover types, (3) shoreline morphology, (4) riparian zone and bank erosion, and (5) aquatic vegetation quality.

Woodtick Peninsula was evaluated by a USACE team from Detroit and Buffalo Districts in June 2021 using the L-QHEI field assessment sheet. The Peninsula was assessed at 20 sites circling the peninsula spaced roughly 1600 feet (500m) on the leeward side and 3300 feet (1000m) apart on the lakeward side with the sampling occurring within 200-1000 feet of the shoreline (60-300m).

To assess the future condition with restoration, LQHEI scores were predicted that could be attained at the completion of each restoration alternative. These scores represent the targets for each restoration alternative. The existing LQHEI scores were compared for the sites along which each action is proposed, to the predicted LQHEI score for the action.

## 2.2 Ecological Output Analysis Calculations

The L-QHEI scores were determined for the existing and predicted future conditions for each of the seven alternatives in the final array of alternatives. To adhere to the HEP framework, the LQHEI scores were standardized to a scale between 0 and 1 by dividing by 100. The standardized LQHEI scores were then multiplied by the acres of the project area to equal the habitat units (HU) of the existing and future conditions for a given alternative (Equation 1).

$$\text{Equation 1: } HU = \frac{L\text{-}QHEI_{score}}{100} \times \text{Acres}$$

Habitat units represent the quality of habitat provided by an area over the course of one year. The without-project scenarios for each alternative assume that the existing condition will be maintained into the future, therefore the habitat units are unlikely to change over a 50-year period. However, the with-project scenarios for each alternative have increasing annual habitat units based upon the time needed for the proposed restored habitat to reach maturity. The with project habitat units calculated represent the habitat quality once it has reached successional maturity.

A literature review was performed to accurately assign successional trajectories to the various habitats to be restored and/or created. The primary habitat type that would be restored or created in the project alternatives are coastal wetlands. Synthesis of wetland restoration trajectories consistently suggests that the rates of return to reference levels are relatively rapid (less than a decade) for plant biomass and wildlife use (Skelly et al. 1999, Stevens et al. 2003, Batzer et al. 2006, Nedland et al. 2007). Based upon this information, 10 years was set as the time needed for restored wetlands to reach successional maturity.

## 3. Results

### 3.1 Alternative 1 – No Action

#### 3.1.1 Existing Condition

Woodtick Peninsula is a natural shoreline feature located within the Erie Marsh Preserve and Erie State Game Area. It consists of habitats classified as Great Lakes marsh, coastal marshes, and open water of Lake Erie. The Great Lakes marsh contains three zones: southern wet meadow, emergent marsh, and submergent marsh (Cohen et al., 2020; Kost et al., 2007). In particular, Woodtick peninsula is a lacustrine wetland with a primary configuration of a barrier-protected wetland that provides physical protection from Lake Erie while allowing water level and chemical influences. Great Lakes coastal marshes provide important structural habitat and primary production to support terrestrial and aquatic ecosystems (Jude and Pappas, 1992). Both Erie Marsh Preserve and Erie State Game Area are classified as Great Lakes marsh, with all three zones represented in various locations. This combination creates high-quality wildlife habitat that supports the highest species diversity of any Great Lakes ecosystem (TNC, 2012).

East and southeast of Woodtick Peninsula is Lake Erie, the shallowest and most productive of the Great Lakes (Leach, 1993). The western basin of Lake Erie (west of a line drawn between Cedar Point, Ohio and Point Pelee, Ontario) is the shallowest portion of Lake Erie with a maximum depth of 36 feet (11m) and has the heaviest sediment load (Allinger and Reavie, 2013). This basin of the lake is rarely stratified (i.e. well mixed), but when it does stratify tends to be associated with hypoxia (Allinger and Reavie, 2013.).

The average L-QHEI score across all sites was 51, with a low score of 39 and a high score of 66.5. The average score of the leeward side was 47 and the lakeward side was 56. Leeward sites had lower quality substrate (average 7.6) but higher aquatic vegetation quality (average 4) scores. Lakeward sites had higher substrate (average 20)

and near-zero vegetation scores (average 0.3) on account of those sites being a sand shelf with almost no vegetation at all. These indicate that Woodtick Peninsula supports two primary wetland habitats, Lake Erie sandy shoreline and sand/mudflats, and submerged wetlands with vegetation. Given that the maximum score for aquatic vegetation quality is 30 points, the leeward wetlands had poor vegetation and L-QHEI scores in general.

### **3.1.2 Future Condition**

Alternative 1 would consist of continuation of the current dredged material disposal practice during dredging of Toledo Harbor, OH that consists of disposal into a Confined Disposal Facility (CDF). No placement of dredged material would occur near or on Woodtick Peninsula. Erosion is expected to continue along Woodtick Peninsula, especially near the southern end where exposed land is present. The previously dredged channel for the decommissioned powerplant will not occur and the channel will slowly fill in, which may lead to slow spread of submergent wetlands. For the purposes of this evaluation, it is assumed that the average L-QHEI score will not change significantly.

## **3.2 Alternative 2A and 2B – Rebuild peninsula**

### **3.2.1 Existing Condition**

This Alternative will involve placement of material on the leeward side of the peninsula. This site has shallow water (~2 feet deep) and submerged aquatic vegetation nearshore to the peninsula (Figure 1) and then a rapid deepening to 12-15 feet in the remnants of the dredged channel for the decommissioned power plant (Figure 2). It is estimated that there is approximately 47 acres of submerged at this site. The average L-QHEI score of the sites assessed within the footprint was 47 with the lowest score of 39.33 at approximately the mid-point of the peninsula (moving north to south) and the highest score of 56 towards the southern end of the peninsula.

Submerged aquatic vegetation observed included pond lilies, pond weed, wild celery, cattails, and Eurasian milfoil. Wetland and migratory birds frequent the area, and were

observed during the assessment, as were other aquatic species such as turtles and muskrat. This area is assumed to provide fish spawning and nursery habitat as 82 different fish species are either resident or migrate seasonally into coastal wetlands of the Great Lakes to use as nursery, spawning, or shelter habitat (Jude and Pappas, 1992). Fish sampling in the study area has identified 35 fish species from 13 families in Woodtick Peninsula wetlands.



Figure 1: Leeward side of Woodtick Peninsula looking towards the peninsula from the historically dredged channel. Submerged vegetation is throughout the shallows extending away from the peninsula towards the channel.

### **3.2.2 Future Condition**

The rebuild peninsula Alternatives include the creation of submerged marsh through placement of dredged material to an elevation of 570.75 ft. with a 1:20 slope to a bottom elevation of 562 ft. At this placement elevation, it is assumed that the final elevation would be under at least six inches of water for at least 50% of the year. The low water datum for Lake Erie is currently 569.2 ft (International Great Lakes Datum, 1985). Keeping the dredged material submerged for 50% or more of the year will discourage *phragmites spp.* colonization. This will allow for recolonization of the placement area



with submerged aquatic vegetation to include pond lilies, pond weed, wild celery, and waterweed. A key constraint for Alternative 2A and 2B is ensuring access around the peninsula for recreational boaters. This is achieved by sloping dredged material starting at the Peninsula away to an elevation of 562 ft near the far edge. This will allow a small part of the channel to remain at a depth between 3 – 7 ft. It is assumed this part of the channel would be too deep for submergent wetlands to establish and thereby recreational boaters can access the large water body north of Woodtick Peninsula.

Alternatives 2A and 2B would create between 108 – 121 acres of shallow marsh habitat suitable for establishment of submerged aquatic vegetation (SAV) with a predicted L-QHEI score of 62. The primary increase in L-QHEI score would be in the Aquatic Vegetation Quality score from an average of 3.5 to a predicted score of 16. This would be realized through an increase in the diversity and coverage of SAV; more species would be common or abundantly present.



Figure 2: Leeward side of Woodtick Peninsula (right) and the historically dredged channel (running from top left to bottom right). Submerged vegetation beds exist in the shallows close to the peninsula.

### 3.3 Alternative 3A – Rebuild peninsula + Lakeside reef

#### 3.3.1 Existing Condition

Alternative 3A includes placement of material on both the leeward and lakeward side of the peninsula. The leeward site consists of approximately 47 acres of submerged wetlands (described in Section 3.2.1). The lakeward site is a sand and gravel beach (Figure 3) that gently slopes to a sand flat that extends hundreds of yards away from the beach (slope <15%). The lakeward side is characterized by open water with a shallow (1.5-2 feet) sand flat with no vegetation (Figure 4). Aquatic habitat appears to be sparse and largely poor quality while the shoreline morphology and shoreline-related cover are of higher quality. The lakeward sites had an average L-QHEI score of 56 and the assessment site directly within the Future Condition area had a L-QHEI of 57.5.



Figure 3: Lakeward-facing side of Woodtick Peninsula with some sandy beach and overhanging vegetation.

#### 3.3.2 Future Condition

Dredged material would be hydraulically placed on the leeward side to an elevation of 570.75 ft with a 1:20 slope to bottom elevation of 562 ft for a dredged placement



footprint of approximately 129 acres. On the lakeside of the peninsula, dredged material would be placed to an elevation of approximately 574 ft within a 40-acre footprint, and an artificial reef approximately 11.5 acres in size would be created with geosynthetic containers (GSCs) placed offshore and covered with stone rip-rap. These containers would be placed in roughly a rectangle shape to an elevation of approximately 566.2 – 566.5 ft. After placement, plantings with native species and phragmites control methods would occur in the placement area.



Figure 4: Lakeward side of Woodtick Peninsula and nearshore shallows. The submerged zone is a sand flat with no vegetation.

Alternative 3A would create approximately 108 acres of shallow marsh habitat suitable for establishment of SAV, 40 acres of emergent marsh, and 11.5 acres of submergent/emergent reef. Some of these new/created habitat units will require the conversion of existing habitat to a new habitat type (such as submergent to emergent wetland) for a total habitat acreage of 159.85 acres with a predicted L-QHEI score of 56. The primary increase in L-QHEI score would be in the Aquatic Vegetation Quality score

from an average of 3.5 to a predicted score of 16 on the leeward side. This would be realized through an increase in the diversity and coverage of SAV; more species would be common or abundantly present. On the lakeward side, the Aquatic Vegetation Quality score would change from an average of 0.5 to a -1 as the shallow water habitat will be elevated above the water and potentially allowing for more planktonic algae to grow in the nearshore environment. The emergent habitat would be of similar or better diversity and quality than the surrounding peninsula habitat.

### **3.4 Alternative 4A and 4B – Dredge material placement at southern end of peninsula + Offshore reef**

#### ***3.4.1 Existing Condition***

This Alternative will include placement of material on the leeward side and southern end of the peninsula. Combined, all sites had an average L-QHEI score of 48. The leeward site consists of approximately 47 acres of submerged wetlands (described in Section 3.2.1) with an average L-QHEI score 47.7. The southern end of the peninsula consists of a sand and gravel beach with vegetation and woody debris overhanging a shallow sand flat that gently slopes into open water habitat. The site at the southern tip of the peninsula has a L-QHEI score of 58.





Figure 5: The southern tip of Woodtick Peninsula. This site has sand beach and overhanging vegetation but no submerged vegetation.

### **3.4.2 Future Condition**

On the leeward side of the peninsula dredged material would be hydraulically placed to an elevation of 570.75 ft with a 1:20 slope to a bottom elevation of 562 ft. Alternative 4A would have a placement footprint of 115.3 acres and Alternative 4B would have a placement footprint of 116.3 acres. Both alternatives include the creation of an artificial reef placed in roughly a curved line to elevations of 566.2 – 566.5 ft and approximately 450 in length.

The leeward placement area will create approximately 102 acres of submergent wetland habitat suitable for establishment of SAV, and a submergent/emergent reef less than one acre in area. Both alternatives have a predicted future L-QHEI score of 68. The primary increase in L-QHEI score would be in the Aquatic Vegetation Quality score from an average of 3.5 to a predicted score of 16 on the leeward side. This would be realized

through an increase in the diversity and coverage of SAV; more species would be common or abundantly present.

### **3.5 Alternative 5 – Dredge material placement at southern end of peninsula + Two offshore reefs**

#### ***3.5.1 Existing Condition***

Alternative 5 all features from Alternative 4A (Section 3.4), plus the lakeside placement area and offshore reef from Alternative 3A (Section 3.3). This would encompass submerged wetland habitat and open lake coastal habitat on both sides of the peninsula described in previous sections. These sites have an average L-QHEI score of 50, however the average for the leeward side is 46, the lakeward side is 62, and the southern tip is 58.

#### ***3.5.2 Future Condition***

Alternative 5 would have a dredged material placement footprint of approximately 167 acres. A majority of the material will be placed on the leeward side, followed by the lakeward creation of emergent habitat, and then the artificial reefs on the lakeward side and southern tip. This will create approximately 102 acres of shallow marsh habitat, 40 acres of emergent marsh, and 12 acres of submergent/emergent reef. This alternative would have a predicted future L-QHEI score of 59, combining all sites. The primary increase in L-QHEI score would be in the Aquatic Vegetation Quality score from an average of 3.5 to a predicted score of 16 on the leeward side. This would be realized through an increase in the diversity and coverage of SAV; more species would be common or abundantly present. On the lakeward side, the Aquatic Vegetation Quality score would change from an average of 0.5 to a -1 as the shallow water habitat will be elevated above the water and potentially allowing for more planktonic algae to grow in the nearshore environment. The emergent habitat would be of similar or better diversity and quality than the surrounding peninsula habitat.

### **3.6 Comparison of Project Alternatives**

This study shows that the existing conditions at all of the proposed project areas

have habitats of varying quality as evaluated by L-QHEI modeling (Table 1). Of the existing habitats, the lakeward side of the peninsula represents the habitat with the greatest L-QHEI score with an average of 56 across 7 sites. The lowest L-QHEI scores recorded were on the leeward side of the peninsula, with a low score of 39. The highest L-QHEI score for the predicted future condition was a score of 68 and associated with the creation of submergent wetlands along the southern end of the leeward side of the peninsula and an offshore reef off of the peninsula’s southern tip (Table 1).

Alternative & Location	Description	Acres	# of L-QHEI sites	L-QHEI <sub>existing</sub>	L-QHEI <sub>w/ project</sub>
2A – Leeward Channel	Submerged aquatic bed	129	8	47.2	62
2B – Leeward Channel	Submerged aquatic bed	142	8	47.2	62
3A - Leeward Channel & Lakeward Reef	Submerged aquatic bed, emergent bed, submerged/emergent reef	180.5	9	50.2	56
4A – Southern End and Reef	Submerged aquatic bed, submerged/emergent reef	115.3	9	48.4	68
4B – Southern End and Reef	Submerged aquatic bed, submerged/emergent reef	116.3	9	48.4	68
5A – Southern End, Lakeward Reef, Southern Reef	Submerged aquatic bed, emergent bed, submerged/emergent reef	167	11	50.9	59

Table 1: L-QHEI scores for existing and predicted future conditions for potential alternatives. Existing scores combined the L-QHEI scores for all assessment sites that are located within the footprint of the Alternative.

The with-project L-QHEI scores were greater than the without-project scores for all of the alternatives evaluated. Due to the existing sparse aquatic vegetation present at most of the sites, the L-QHEI metric that increased the most between the existing and with-project condition was the aquatic vegetation quality (L-QHEI metric 5). This metric is responsible for an increase of between 6 and 16 points over the existing conditions depending upon the alternative. Alternative 5A presents the greatest ecological outputs both through the increase in habitat units (HUs) and average annual habitat units (AAHU, a measure of change over the 50-year life of the project), as this alternative involves the largest area being considered for restoration (Table 2). Alternative 3A scored nearly as high in HU and AAHU). Alternative 2A had the lowest ecological outputs. The successional trajectories of the with-project scenarios of all alternatives over the first 50 years after project construction is presented in Figure 6.

## 4 Conclusions

The habitat assessment conducted on the existing and future habitat quality of the

Woodtick Peninsula Section 204 project has provided an estimation of which alternatives would provide the greatest amount of ecological benefits. All seven with-project alternatives would return greater ecological benefits than their respective existing habitat conditions. The Southern End submergent wetland and lakeward and southern reef creation (Alternative 5A) has the potential to provide the greatest amount of ecological benefits throughout the first 50 years after project implementation, providing an increase of 51.5 AAHU's compared to the existing condition. The next highest ecologically beneficial alternative was leeward channel placement and lakeward reef (Alternative 3A), providing an increase of 50.3 AAHU's. Strictly from an ecological perspective, the Southern End submergent wetland and lakeward and southern reef creation should be considered the preferred plan. The habitat assessment performed in this study provides a framework for assessing the ecological progress of the selected restoration project.

Alternative & Location	Acres	Habitat Acres		L-QHEI Scores		Habitat Units (HU)		Average Annual Habitat Units (AAHU)		
		w/o	w/	L-QHEI <sub>w/o</sub>	L-QHEI <sub>w/</sub>	HU <sub>w/o</sub>	HU <sub>w/</sub>	AAHU <sub>w/o</sub>	AAHU <sub>w/</sub>	ΔAAHU
2A – Leeward Channel	129	47.4	108.4	47.2	62	22.4	67.2	22.4	61.1	38.8
2B – Leeward Channel	142	47.4	121.4	47.2	62	22.4	75.2	22.4	68.5	46.1
3A - Leeward Channel & Lakeward Reef	180.5	61.3	159.9	50.9	56	31.2	89.5	31.2	81.5	50.3
4A – Southern End and Reef	115.3	47.4	102.3	48.4	68	23.0	69.6	22.4	63.3	40.4
4B – Southern End and Reef	116.3	47.4	103.3	48.4	68	23.0	70.3	22.4	63.9	41.0
5A – Southern End, Lakeward Reef, Southern Reef	167	61.3	154.0	50.9	59	31.2	90.9	31.2	82.7	51.5

Table 2: Detailed analysis of each alternative's with- and without-project habitat units (HU) and average annual habitat units (AAHU). Habitat units were based on the estimation of habitat acres, which is the acres of target habit the project would be creating which consisted of submergent and emergent wetland or reef habitat, excluding deep water/channel habitat.

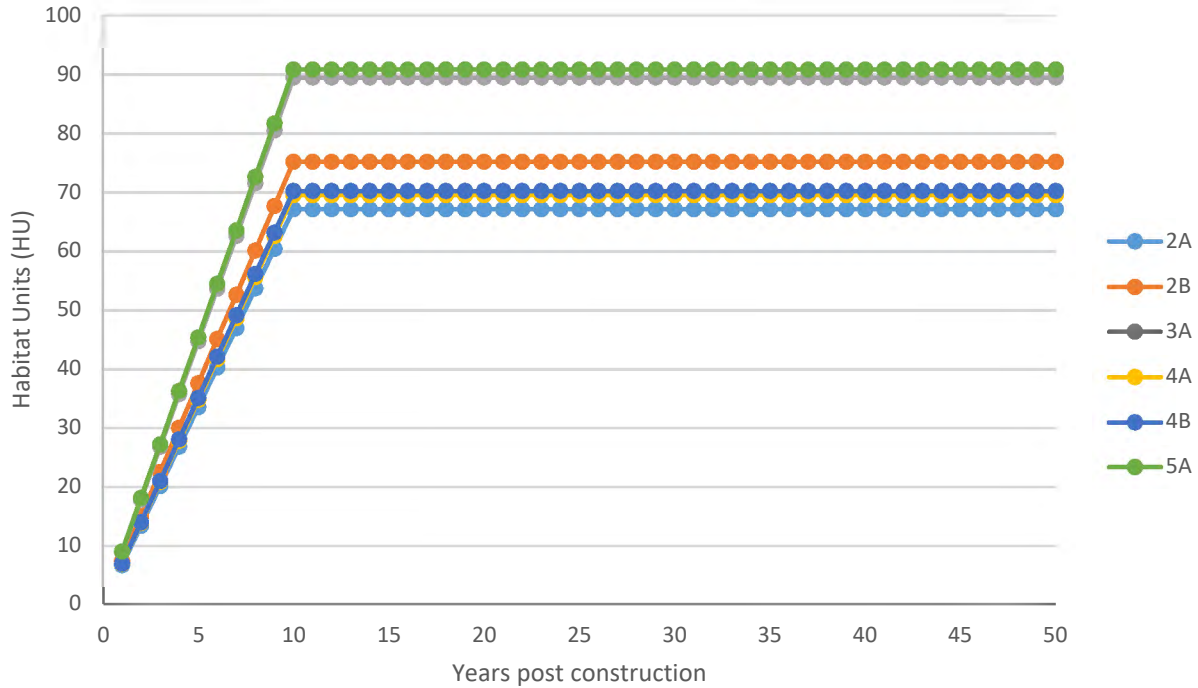


Figure 6: Habitat Units for each alternative over the 50-year lifespan of the project.

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