

# Coastal Structures Risk Communication of the Great Lakes Districts of the US Army Corps of Engineers



US Army Corps of Engineers  
**BUILDING STRONG**®

# Introduction and Agenda

---

## **Purpose:**

Communicate the risk of breakwater and structure conditions to local stakeholders and navigation system users. With a focus on structure condition, function, and economic consequences of coastal structures on the Great Lakes.

## **Focus Topics:**

1. Coastal Structure Risk Communication
2. Condition Assessment of Coastal Structures
3. Harbor Infrastructure Inventory Process
4. Next Steps and Open Discussion



# Regional Risk Communication Meetings



# Great Lakes Navigation System (GLNS)

60 Commercial Projects, including 45 with structures  
79 Recreational Projects, including 61 with structures



# Great Lakes Navigation System (GLNS)

---

- 104+ miles of navigation structures on the Great Lakes
- Structures include piers, jetties, revetments, and breakwaters
- Most were built between 1860 and 1940
- Jetties and piers were constructed perpendicular to shore to keep the channel open for navigation
- Off shore breakwaters were constructed to allow safe navigation entry to harbors and channels



# Navigation structures are regularly subjected to extreme winds and waves



# ... and ice forces

---



**BUILDING STRONG®**

# Typical Coastal Structures



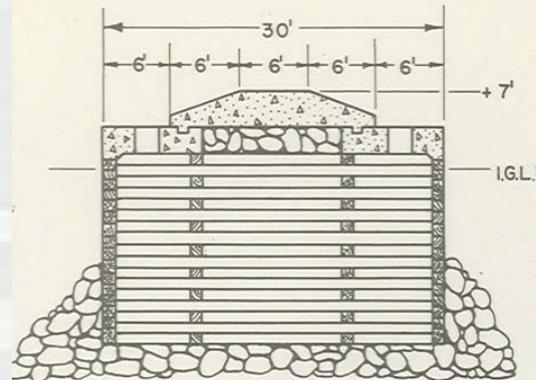
Steel Sheet  
Pile  
Structures



Rubble  
Mound/Laid-Up  
Stone Structures



Other  
Components:  
safety  
(railings,  
walking  
surface, etc.)



Typical Wood  
Crib/ Concrete  
Cap Structures  
Cross-section



# Structure Function/Consequences

---



*Calumet Harbor, IL&IN*

**Contain and reduce shoaling in navigation channel**



*Milwaukee Harbor, WI*

**Protect navigation channel and shoreline infrastructure**



*St. Joseph Harbor, MI*

**Control wave climate within navigation channel and harbor**



# Coastal Structure Risk Communication

---

Program Objective: Communicate the risk of breakwater and structure conditions to local stakeholders and navigation system users

## Process:

1. Conduct Condition Assessments
  - Commercial Harbors- Use detailed Breakwater Assessment Team (BAT) Evaluation
  - Recreational Harbors- Rely on expert elicitation
2. Conduct Harbor Infrastructure Inventory on all structures
3. Prepare summary document that conveys the current condition of the harbor infrastructure as well as the risk involved in the event of failure
4. Share with stakeholders in regional meetings



# Great Lakes Structure Condition

---

- 50% of GL coastal structures were built before WWI
- Over 80% of all coastal structures exceed 50 years of age
- 45% have never undergone any significant repair effort due to funding constraints
- Over 30% of structures have timber crib core sections; recent low water levels have accelerated deterioration of the wood



# Regional Condition Assessments

---

A Great Lakes regional team was established in 2008 to conduct Asset Management-based condition assessments of all Great Lakes commercial navigation structures; the Team works with USACE Engineering Research and Development Center and collaborates with the National Coastal Asset Management Board.

- Assessments completed to date
- Conditions assessment by segments: 45% of structures are rated C or worse
  - 22 miles (21%) rated C – Probably inadequate
  - 22 miles (21%) rated D - Inadequate
  - 3 miles (3%) rated F – Failed
- Cost to conduct major repair of structures: \$15 – 20M per mile

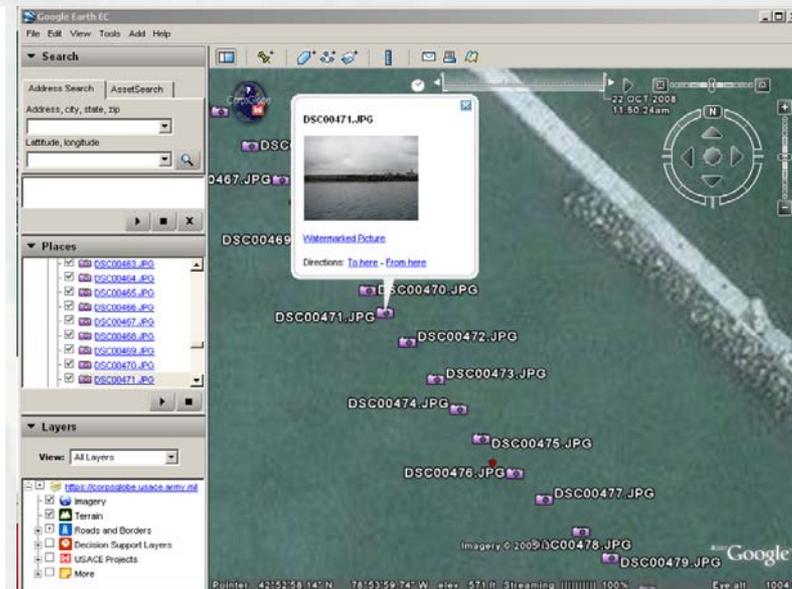


**BUILDING STRONG®**

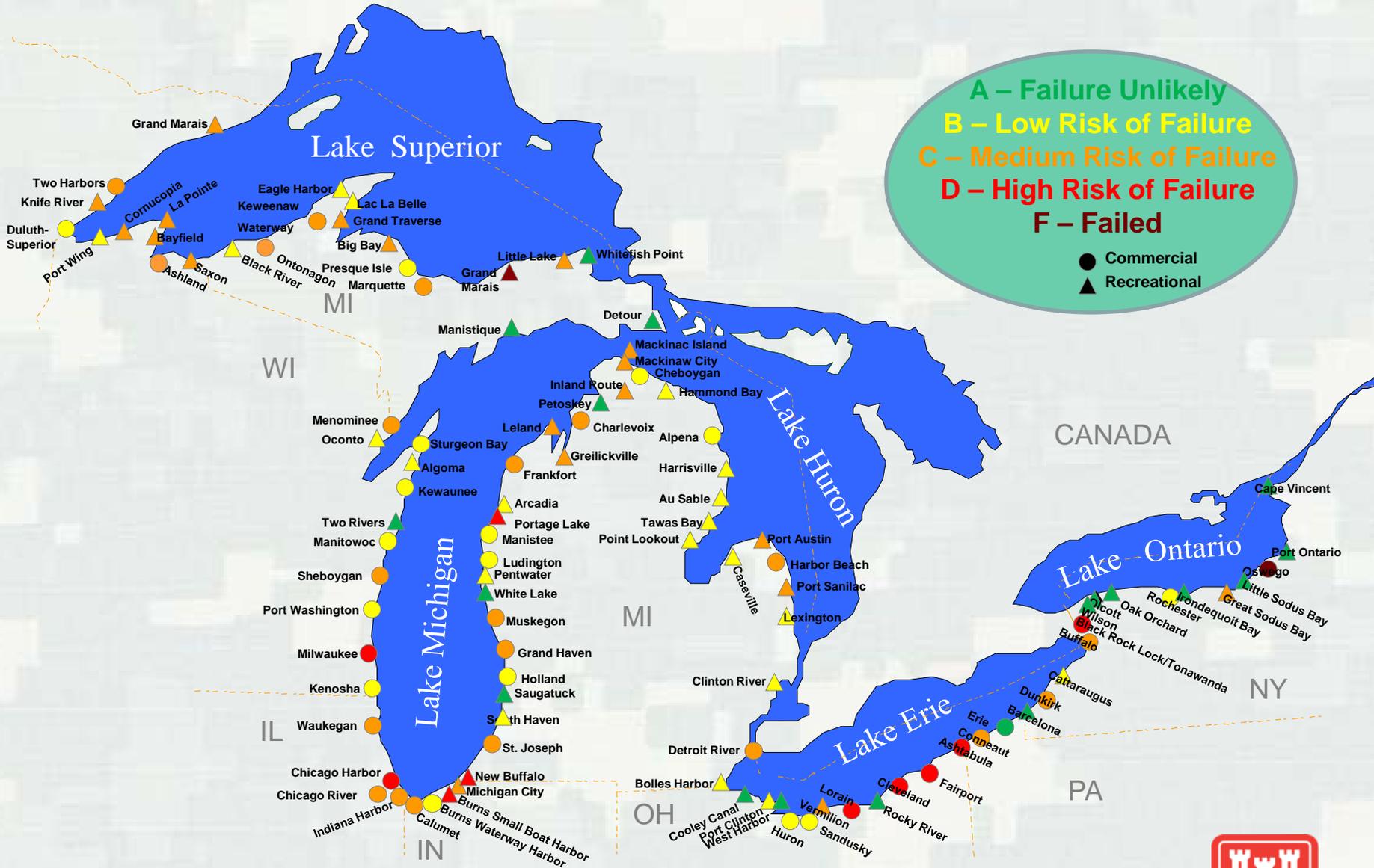
# Regional Condition Assessments

- Structural Index is developed from assessment of major structure components / parameters with most direct link to structure reliability and function
- The structural index value is converted to an A thru F condition level which is used to communicate risk for planning and budgeting purposes
- Collecting complete continuous overlapping still photography and video of each structure at each project. Photos are labeled and geotagged for easy reference in Google Earth.

Condition Classification	Definitions
A Adequate	<ul style="list-style-type: none"> <li>- There is a high level of confidence that the project will perform well under the designed operating conditions. This confidence level is supported by data, studies or observed project characteristics which are judged to meet current engineering or industry standards.</li> <li>- There is a limited probability that the verified degraded conditions will cause an inefficient operation, or degradation or loss of service.</li> </ul>
B Probably Adequate	<ul style="list-style-type: none"> <li>- There is a low level of confidence that the project will perform well under designed operating conditions, and may not specifically meet engineering or industry standards. The project may require additional investigation or studies to confirm adequacy.</li> <li>- There is a low probability that the verified degraded conditions will result in inefficient operation, or degradation or loss of service.</li> </ul>
C Probably Inadequate	<ul style="list-style-type: none"> <li>- There is a low level of confidence that the project will not perform well under designed operating conditions. The project does not meet current engineering or industry standards. The project may require additional investigation or studies to confirm adequacy.</li> <li>- There is a moderate probability that the verified degraded conditions will result in inefficient operation, or degradation or loss of service.</li> </ul>
D Inadequate	<ul style="list-style-type: none"> <li>- There is a high level of confidence that the project will not perform well under designed operating conditions. Physical signs of distress and deterioration are present. Analysis indicates that factors of safety are near limit state. The project deficiencies are serious enough that the project no longer performs at a satisfactory level of performance or service.</li> <li>- There is a high probability that the verified degraded conditions will result in inefficient operation, or degradation or loss of service.</li> </ul>
F Failed	<ul style="list-style-type: none"> <li>- The project has FAILED.</li> <li>- Historically the project regularly experiences scheduled or unscheduled closures or loss of service for repairs.</li> </ul>



# Harbor Structure Condition Assessments



# Harbor Infrastructure Inventory Process

---

- Gather information on critical infrastructure protected by federally maintained navigation structures
  - ▶ Review Documents:
    - Project Drawings
    - Harbor Fact Sheet
    - Aerial/Satellite Photography; Photo document critical infrastructure
  - ▶ Identify Critical Infrastructure to Visit
  - ▶ Research Identified Critical Infrastructure
- Site Visit Tasks
  - ▶ Met with Local Officials, Port Authority, Harbor Master, when available
  - ▶ Visit Identified Areas/Critical Infrastructure & Gather Information
- Post Site Visit Tasks
  - ▶ Create Report Following the Standard Report Template



# Harbor Infrastructure Inventory Report Content

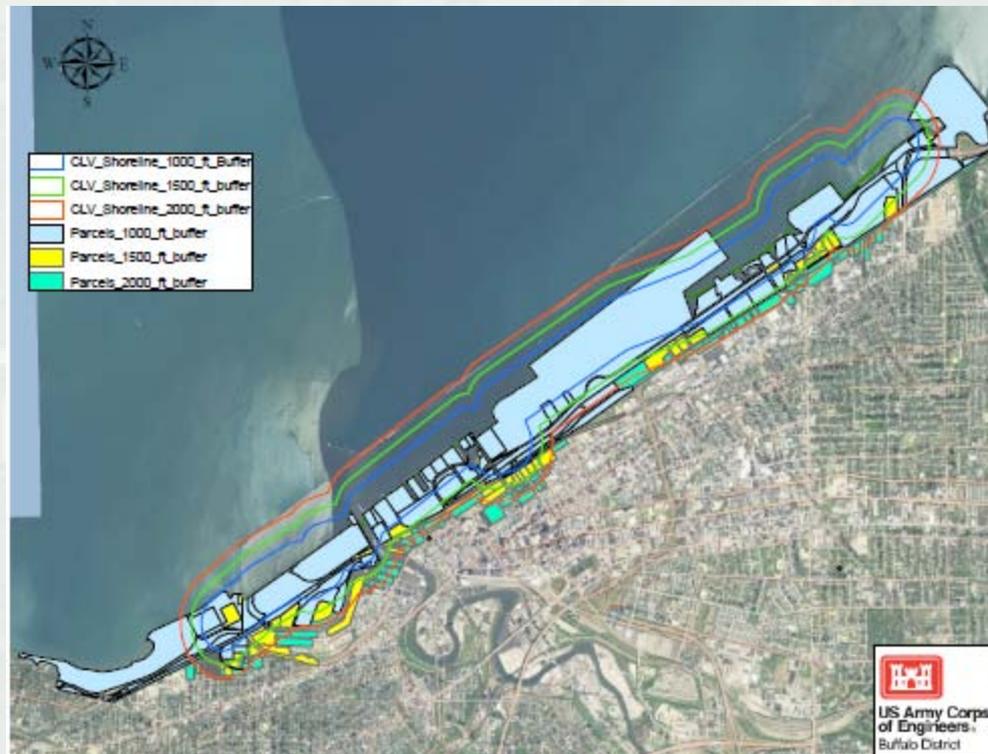
---

- **HARBOR LOCATION**
- **PROJECT DESCRIPTION**
  - Authorization, harbor type (commercial or recreational), length of breakwater structures and channel
- **DATE OF SITE VISIT**
- **SUMMARY OF STRUCTURES**
  - Lists all structures and facilities that are believed to be protected by the federal navigation structures; also identify any other potential stakeholders
- **SUMMARY OF IMPACT**
  - Summarizes any potential damage that could be experienced if the federal breakwater fails.
- **DESCRIPTION OF STRUCTURES**
  - Aerial photo with all potential affected structures shown along with pictures and a brief description of each potentially affected structure

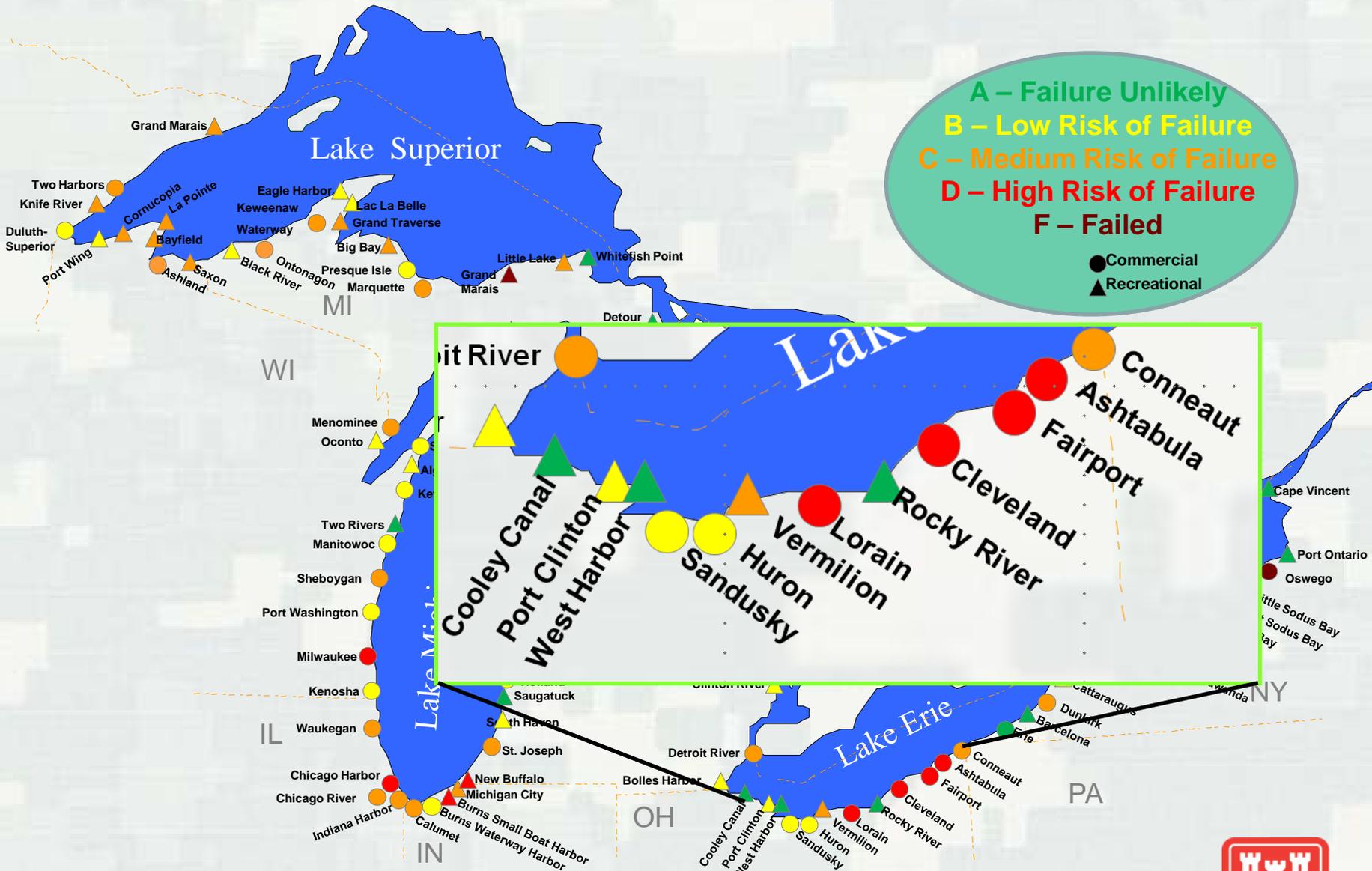


# High Level Display of Potential Impact Areas

- Three potential impact areas were defined at 500 ft intervals
- Shows potential value of land and infrastructure within each “potential impact area” based on tax assessment data



# Harbor Structure Condition Assessments



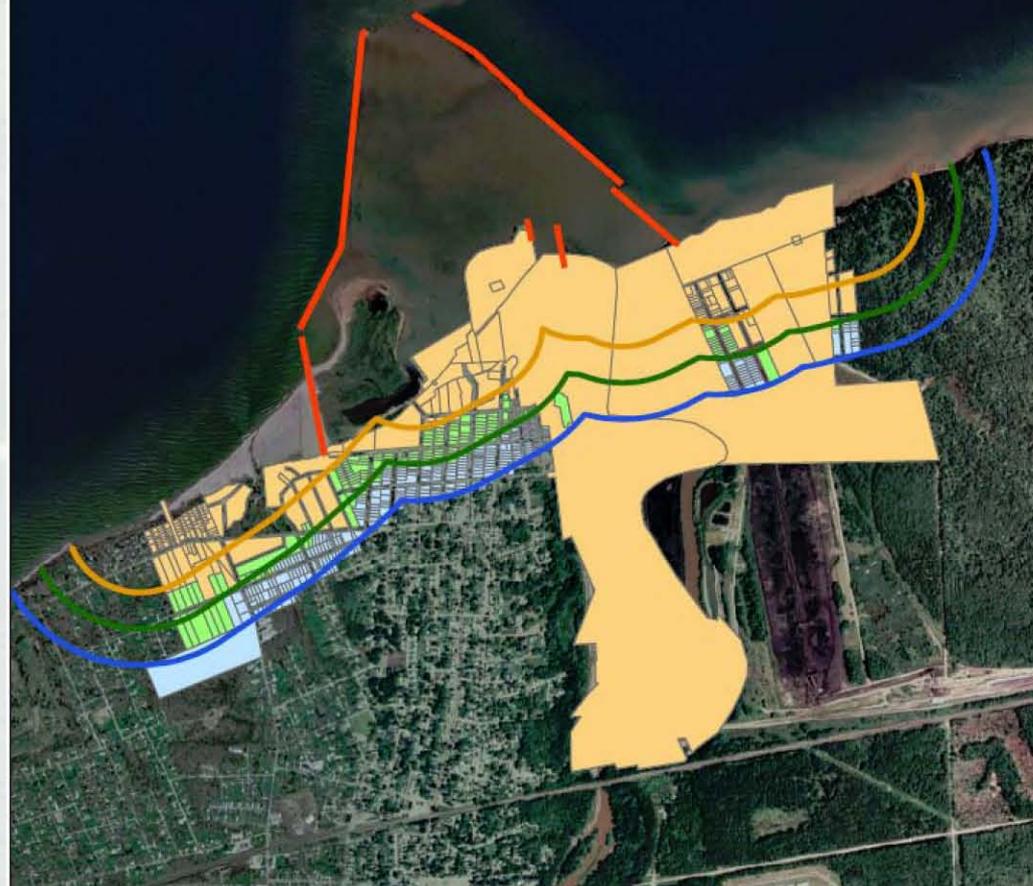
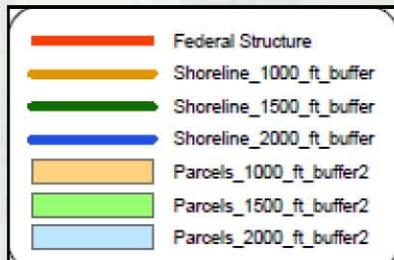
# Conneaut Harbor





# Conneaut Harbor: Potential Impact Areas

Buffer Feet	Land Value	Improvements Value	Total Assesed Value
1,000	\$24M	\$12M	\$36M
1,500	\$29M	\$21M	\$50M
2,000	\$30M	\$37M	\$67M



# Ashtabula Harbor



**BUILDING STRONG®**

# Ashtabula Harbor:

**\$65M** estimated cost to upgrade D rated structures to an acceptable level of risk (Level B)

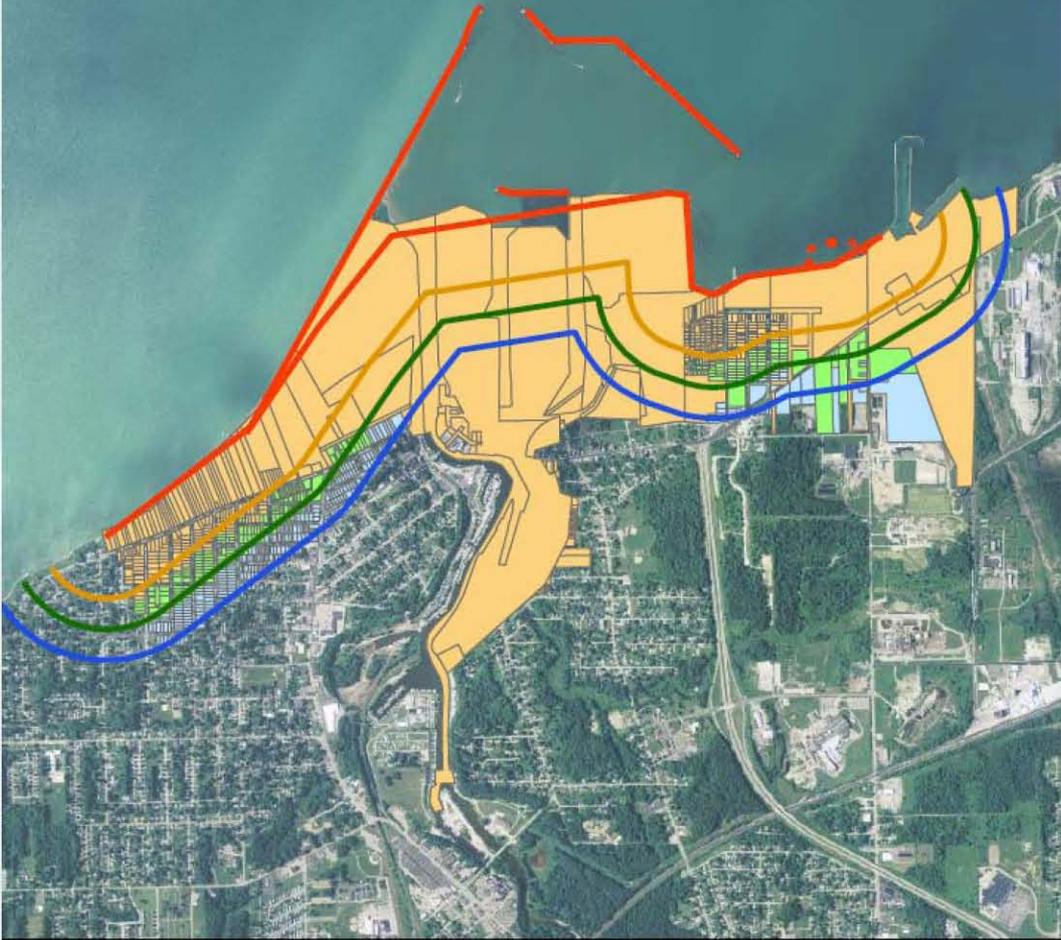
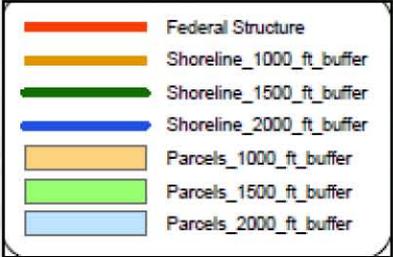


- 1. Walnut Beach Park
- 2. Norfolk Southern – Ashtabula Coal Dock
- 3. U.S. Coast Guard Station Ashtabula
- 4. Ashtabula Transient Boat Dock
- 5. R.W. Sidley, Inc.
- 6. Pinney Dock and Transport Company
- 7. Lakeshore Park

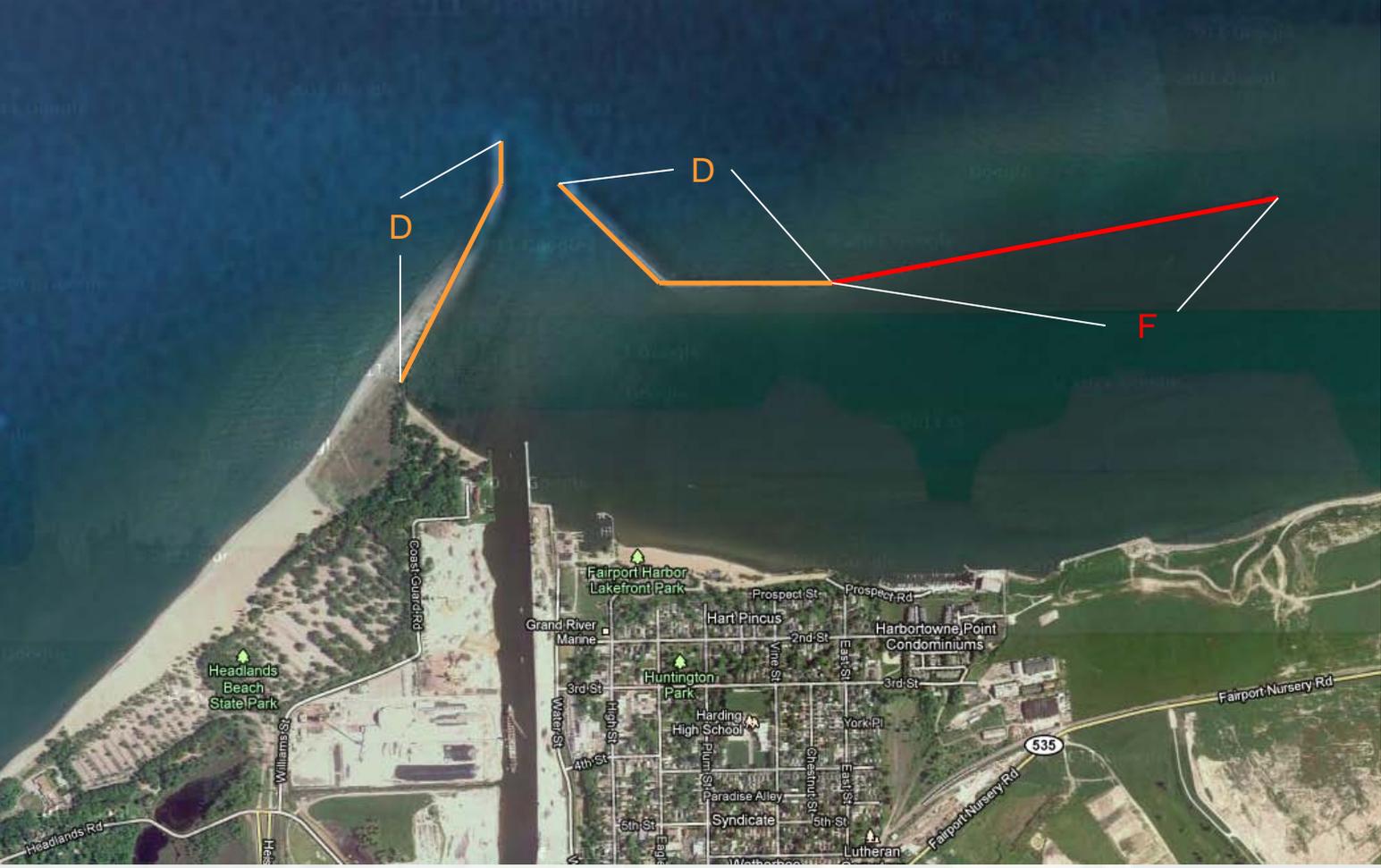


# Ashtabula Harbor: Potential Impact Areas

Buffer Feet	Land Value	Improvements Value	Total Value
1,000	\$32M	\$36M	\$68M
1,500	\$39M	\$46M	\$85M
2,000	\$43M	\$61M	\$104M



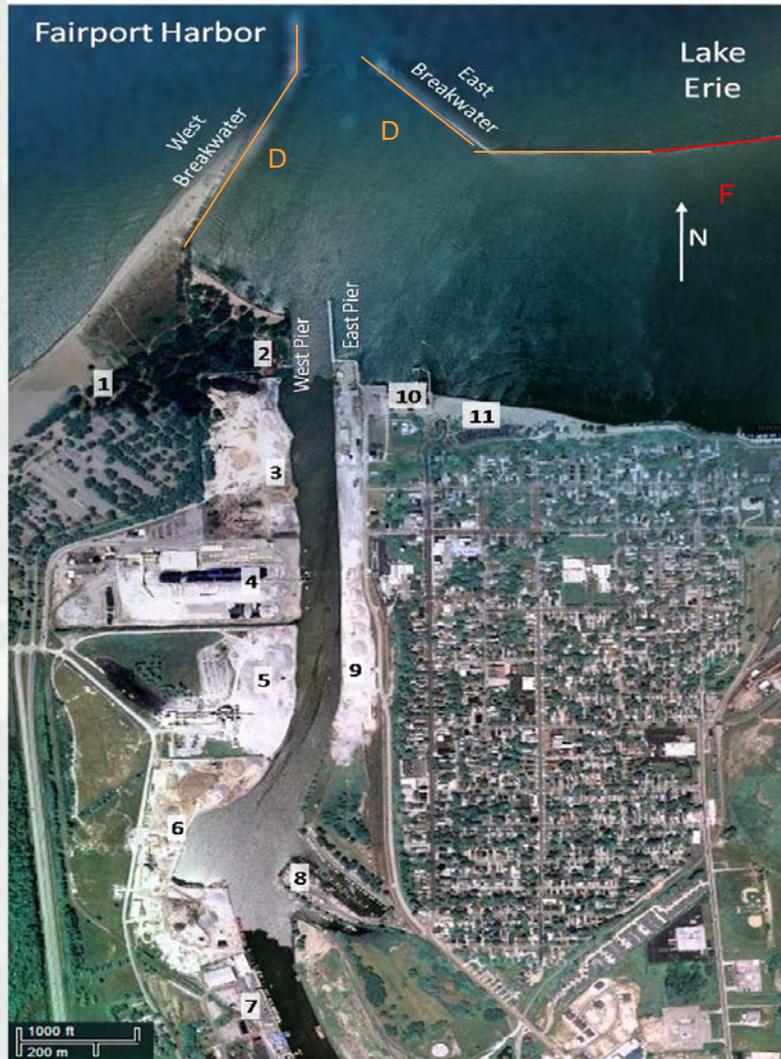
# Fairport Harbor



**BUILDING STRONG®**

# Fairport Harbor:

**\$33M** estimated cost to upgrade D rated structures to an acceptable level of risk (Level B)

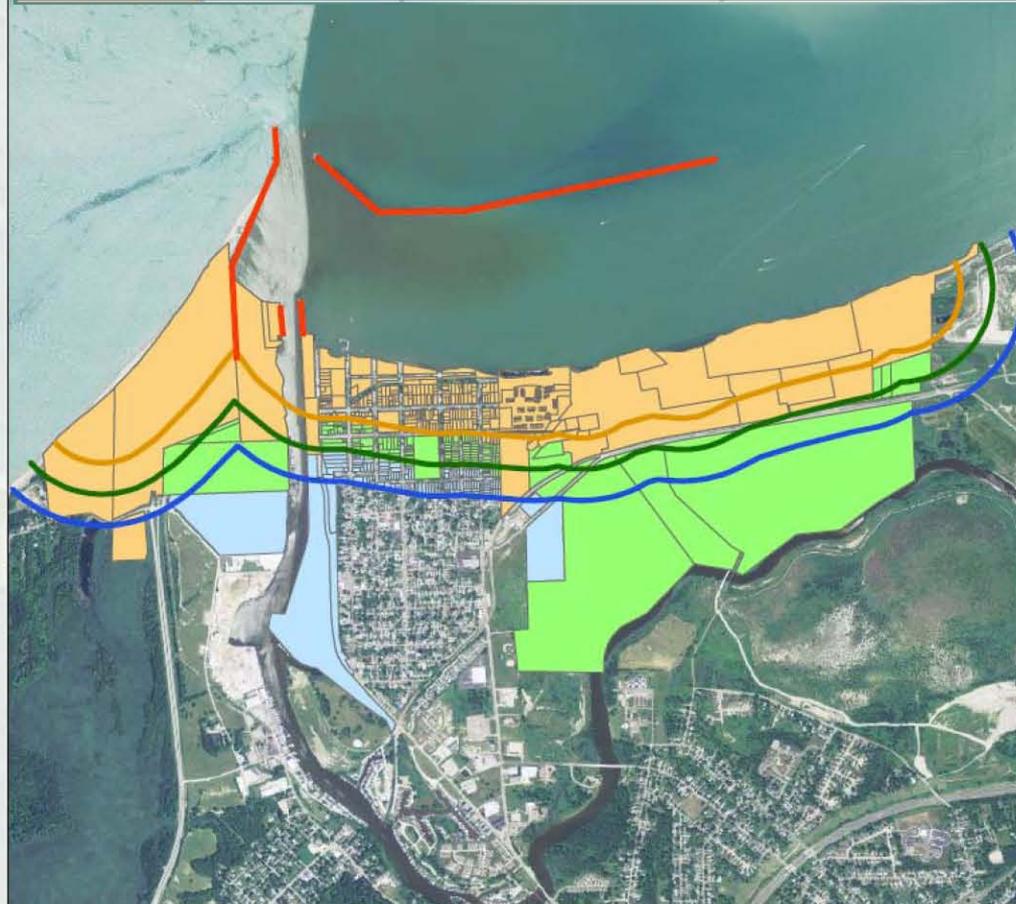
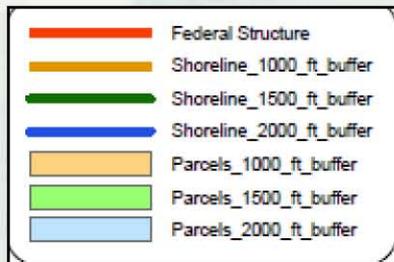


1. Headlands Beach State Park
2. U.S. Coast Guard Search and Rescue Station Fairport Harbor
3. R.W. Sidley, Inc.
4. Morton International, Inc.
5. Carmeuse Lime
6. Osborn Concrete and Stone
7. Grand River Marine Co. – Grand River
8. Grand River Marine Co. – Fairport
9. Osborn Concrete and Stone – Fairport Dock
10. Fairport Port Authority Boat Launch Ramp
11. Fairport Harbor Lakefront Park

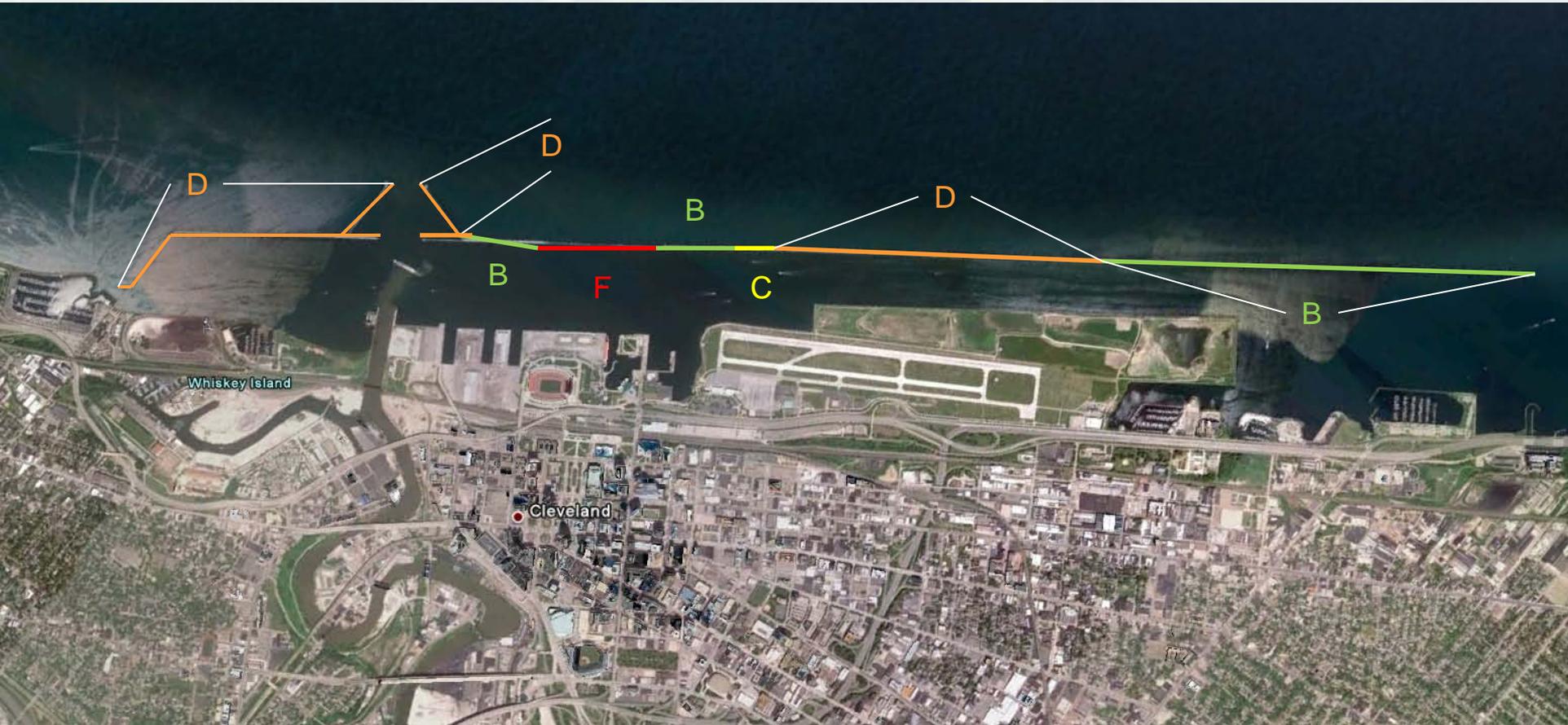


# Fairport Harbor: Potential Impact Areas

Buffer Feet	Land Value	Improvements Value	Total Value
1,000	\$17M	\$28M	\$45M
1,500	\$21M	\$42M	\$63M
2,000	\$31M	\$53M	\$84M



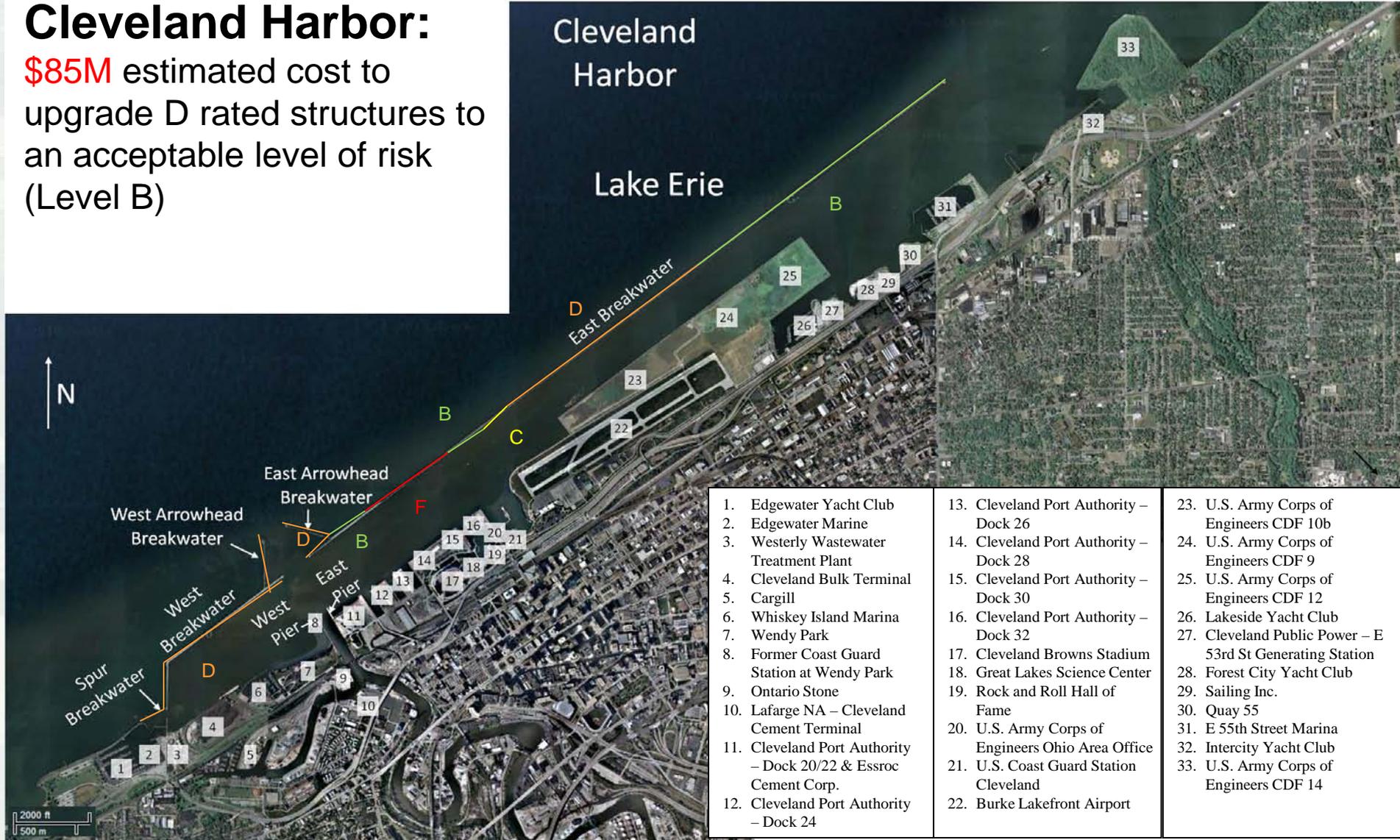
# Cleveland Harbor



**BUILDING STRONG®**

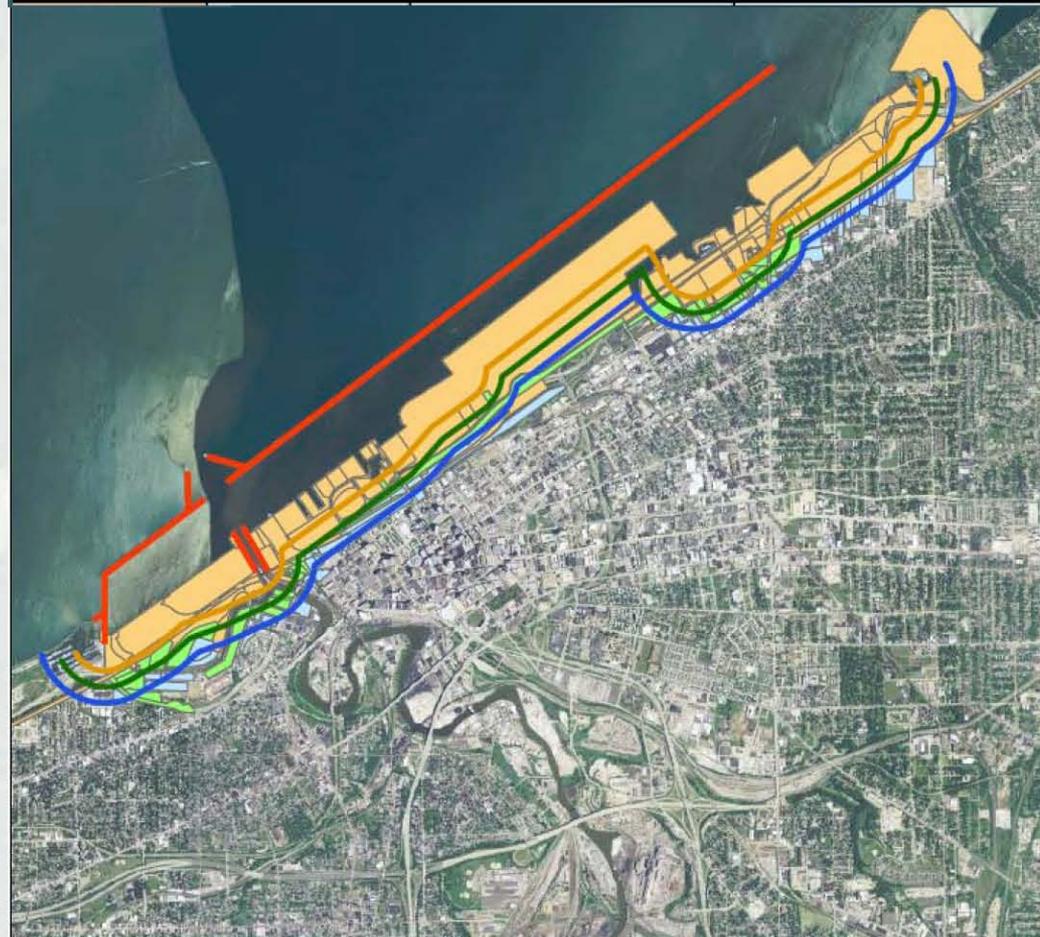
# Cleveland Harbor:

**\$85M** estimated cost to upgrade D rated structures to an acceptable level of risk (Level B)

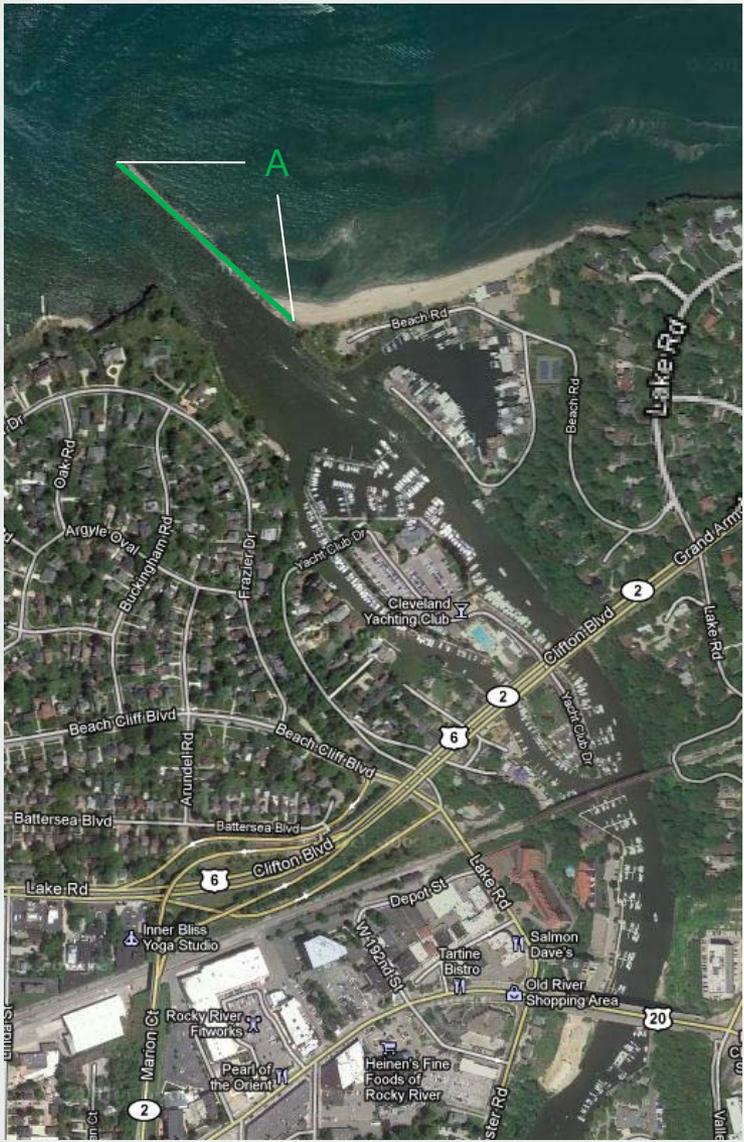


# Cleveland Harbor: Potential Impact Areas

Buffer Feet	Land Value	Improvements Value	Total Value
1,000	\$309M	\$640M	\$949M
1,500	\$350M	\$668M	\$1.02B
2,000	\$430M	\$770M	\$1.20B



# Rocky River Harbor

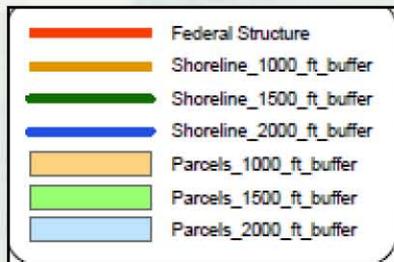


# Rocky River Harbor:

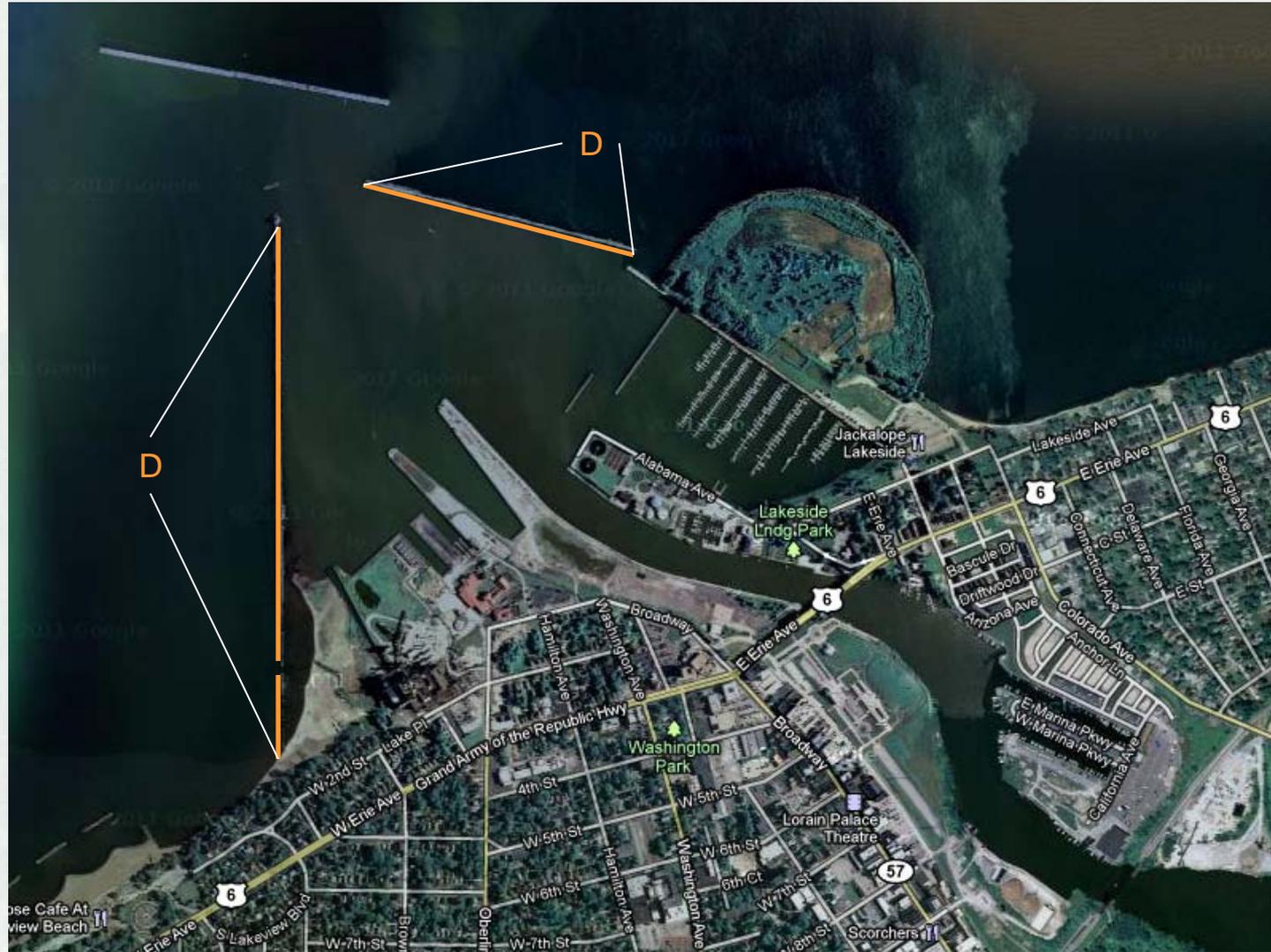


# Rocky River Harbor: Potential Impact Areas

Buffer Feet	Land Value	Improvements Value	Total Value
1,000	\$16M	\$41M	\$57M
1,500	\$21M	\$55M	\$76M
2,000	\$27M	\$66M	\$93M



# Lorain Harbor



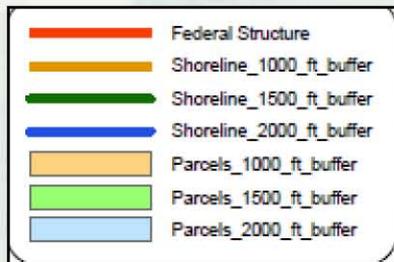
# Lorain Harbor:

**\$30M** estimated cost to upgrade D rated structures to an acceptable level of risk (Level B)



# Lorain Harbor: Potential Impact Areas

Buffer Feet	Land Value	Improvements Value	Total Value
1,000	\$21M	\$89M	\$110M
1,500	\$28M	\$105M	\$133M
2,000	\$34M	\$130M	\$164M



# Vermilion Harbor



**BUILDING STRONG®**

# Vermilion Harbor:

**\$9M** estimated cost to upgrade C rated structures to an acceptable level of risk (Level B)

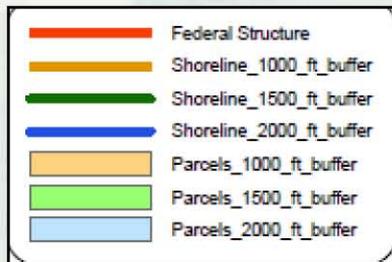


1. Assorted Marinas along the Vermilion River
2. City of Vermilion Water Treatment Plant and Vermilion Port Authority Transient Docks
3. Vermilion Lagoons' Association



# Vermilion Harbor: Potential Impact Areas

Buffer Feet	Land Value	Improvements Value	Total Value
1,000	\$52M	\$27M	\$79M
1,500	\$63M	\$34M	\$97M
2,000	\$66M	\$39M	\$105M



# Huron Harbor



**BUILDING STRONG®**

# Huron Harbor:

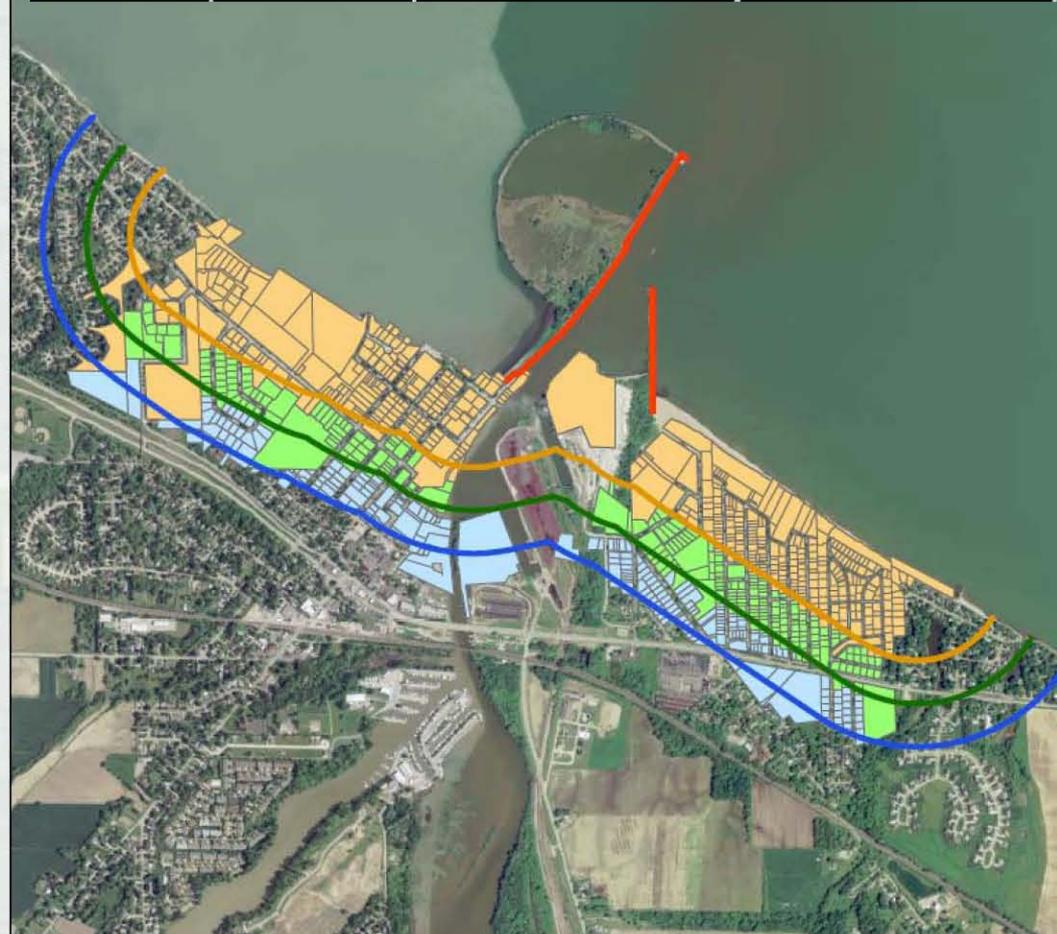
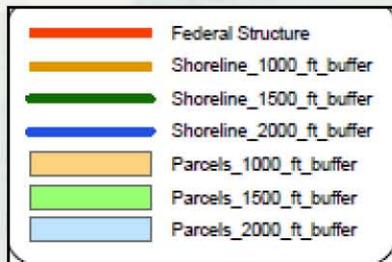


1. Nickel Plate Beach
2. Huron Lime, Inc.
3. Huron Ore Docks
4. City of Huron – former ConAgra Plant
5. State of Ohio Boat Launch
6. Harbor North
7. Huron Yacht Club
8. Huron Municipal Boat Basin
9. U.S. Army Corps of Engineers Combined Disposal Facility



# Huron Harbor: Potential Impact Areas

Buffer Feet	Land Value	Improvements Value	Total Value
1,000	\$45M	\$52M	\$97M
1,500	\$62M	\$75M	\$137M
2,000	\$72M	\$96M	\$168M



# Sandusky Harbor



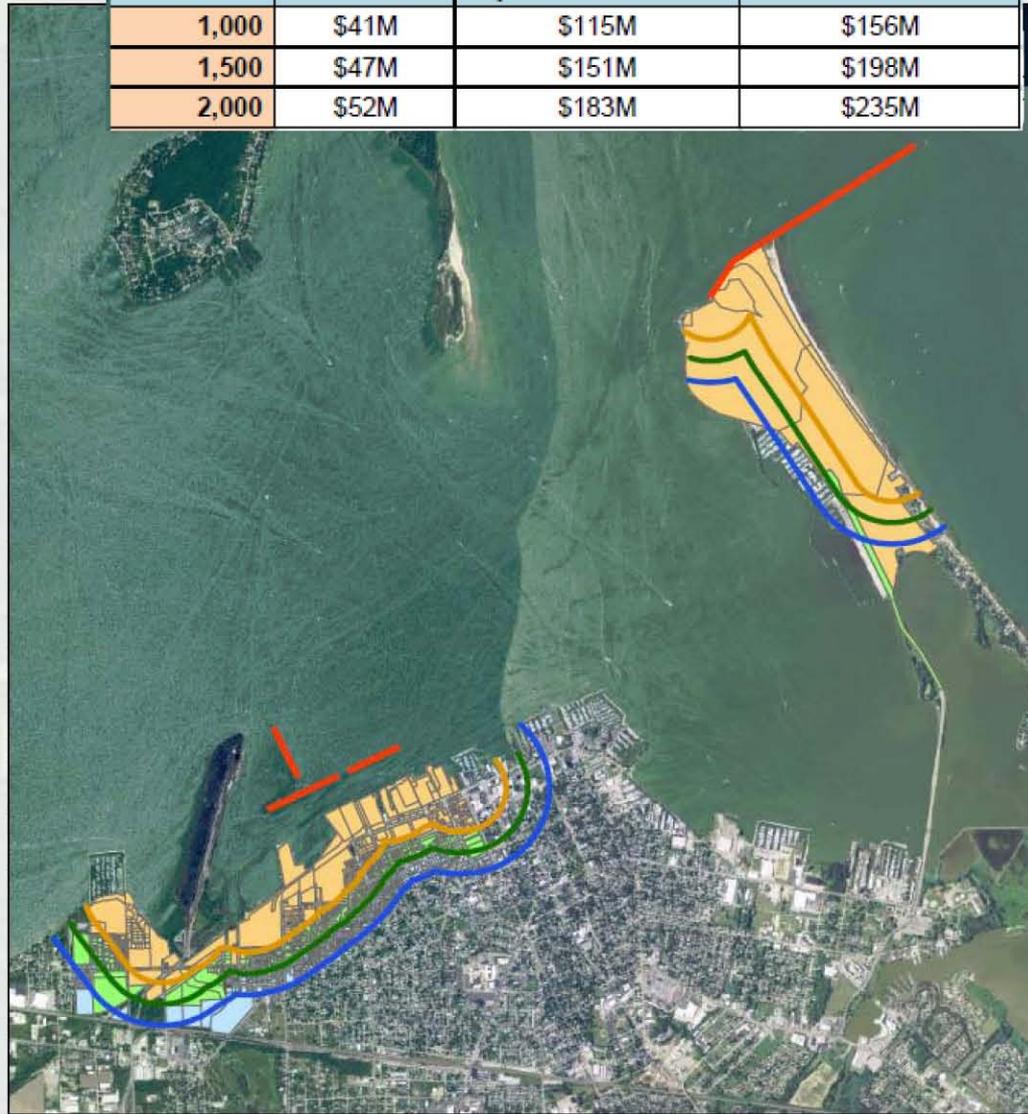
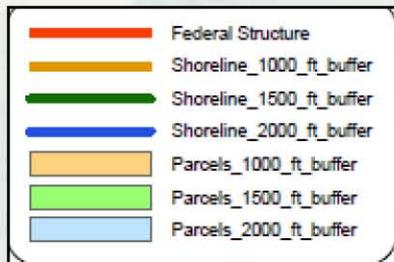
# Sandusky Harbor:

**\$7M** estimated cost to upgrade C rated structures to an acceptable level of risk (Level B)



# Sandusky Harbor: Potential Impact Areas

Buffer Feet	Land Value	Improvements Value	Total Value
1,000	\$41M	\$115M	\$156M
1,500	\$47M	\$151M	\$198M
2,000	\$52M	\$183M	\$235M



# West Harbor



# West Harbor:

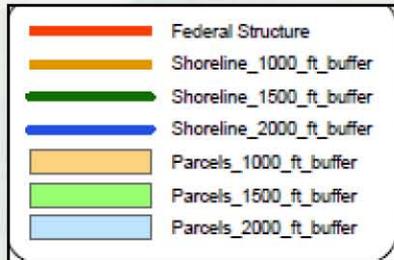


1. Harbor Island Association
2. Gem Beach Marina
3. Fox Haven Marina
4. Moore Marina
5. Catawba Moorings
6. Herl's Harbor
7. Additional Marinas in West Harbor
8. Anchors Away Marina
9. East Harbor State Park Marina – Run By Hoyt Marine



# West Harbor: Potential Impact Areas

Buffer Feet	Land Value	Improvements Value	Total Value
1,000	\$64M	\$11M	\$75M
1,500	\$67M	\$14M	\$81M
2,000	\$93M	\$14M	\$107M



# Port Clinton Harbor

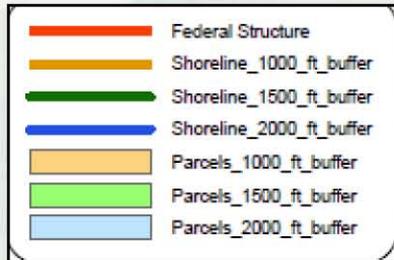


# Port Clinton Harbor:



# Port Clinton Harbor: Potential Impact Areas

Buffer Feet	Land Value	Improvements Value	Total Value
1,000	\$7M	\$4M	\$11M
1,500	\$12M	\$13M	\$25M
2,000	\$19M	\$25M	\$44M



# Cooley Canal Harbor



# Cooley Canal Harbor:

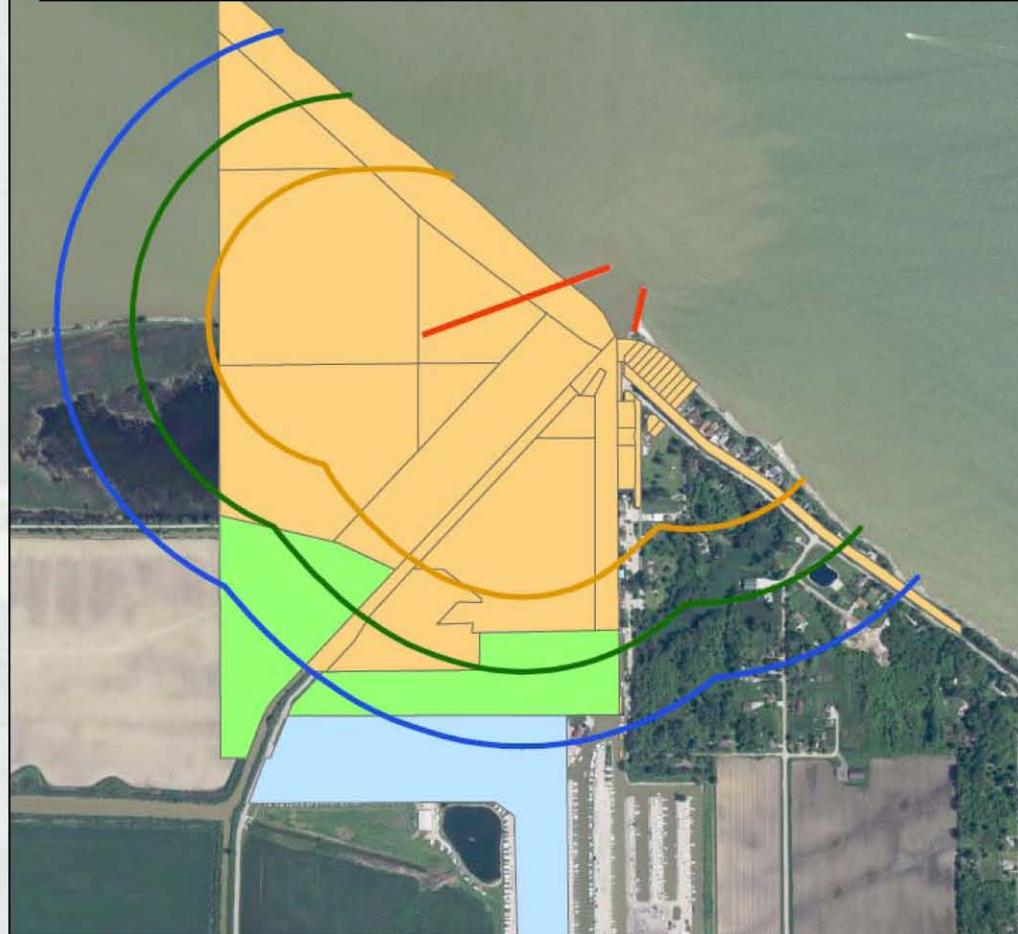
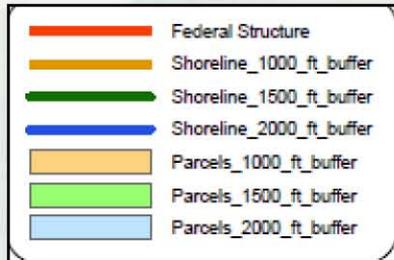


- 1. Cedar Point National Wildlife Refuge
- 2. Bitter End Restaurant and Bar at the Anchor Pointe Marina
- 3. Anchor Pointe Marina
- 4. Lucas County Cooley Canal Boat Ramps
- 5. Meinke Marina



# Cooley Canal Harbor: Potential Impact Areas

Buffer Feet	Land Value	Improvements Value	Total Value
1,000	\$255K	\$1M	\$1M
1,500	\$312K	\$1M	\$1M
2,000	\$1M	\$1M	\$2M



# What Can Be Done?

---

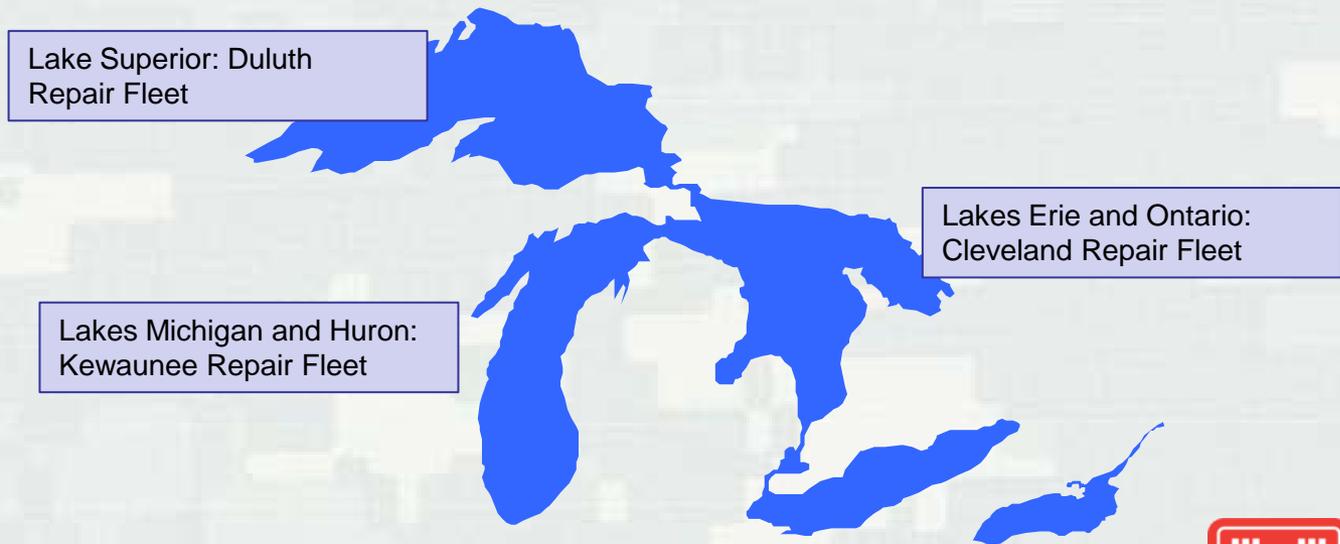
- Federal Funding
  - ▶ Funding request through the Federal Budget process each fiscal year
    - Contract structural repair
    - Government floating plant repair
- Local Funding
  - ▶ Mechanisms in place to accept local funding
- Transfer to State/Local Entity
  - ▶ Section 216 Process



# Great Lakes Repair Fleet

---

- Three repair fleets – one in LRB and two in LRE conduct all of the most urgent repair needs on navigation structures in the five Great Lakes.
- Place stone in weakened sections of structures and CDFs, conduct welding repairs on steel sheeting to retain encapsulation of fill stone; repair safety ladders, signs, and railings; remove obstructions from harbor navigation channels; and are available for a wide variety of “emergency” work including debris removal, lock repair, and other unanticipated repair needs.



# Questions?



®