The Design for the Wetland Restoration of a Freshwater Cranberry Bog in New England

Lee Weishar, Ph.D.; PWS

WOODS HOLE GROUP

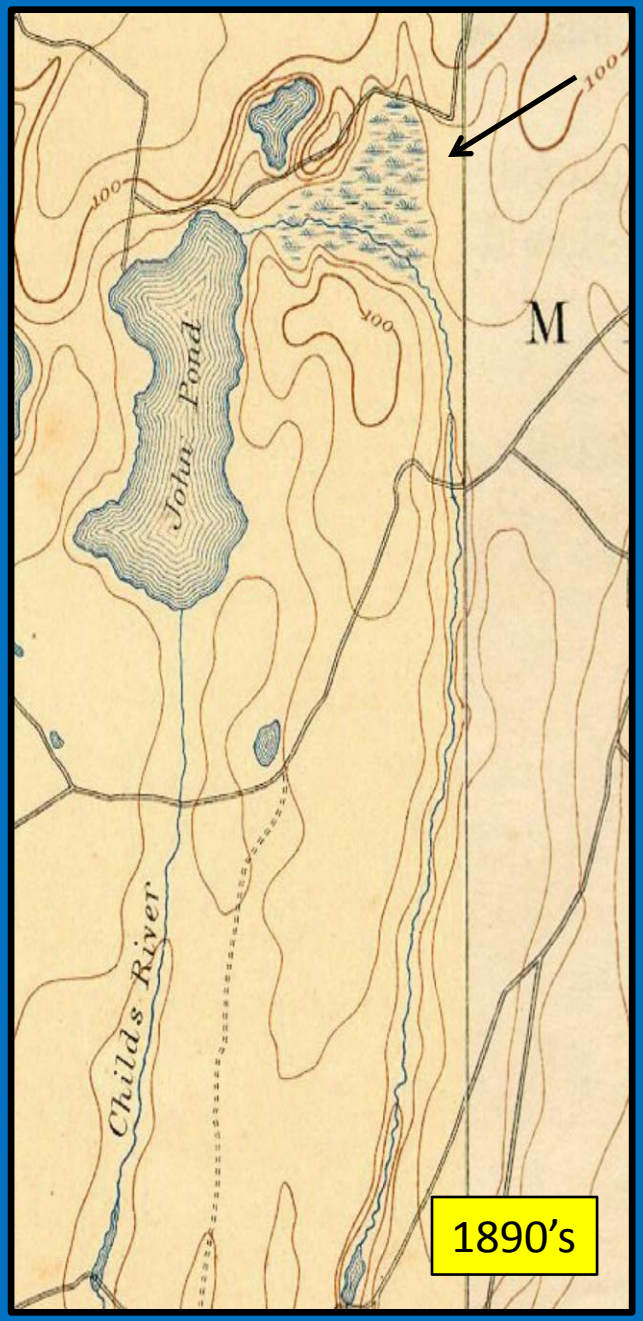
Points for Discussion

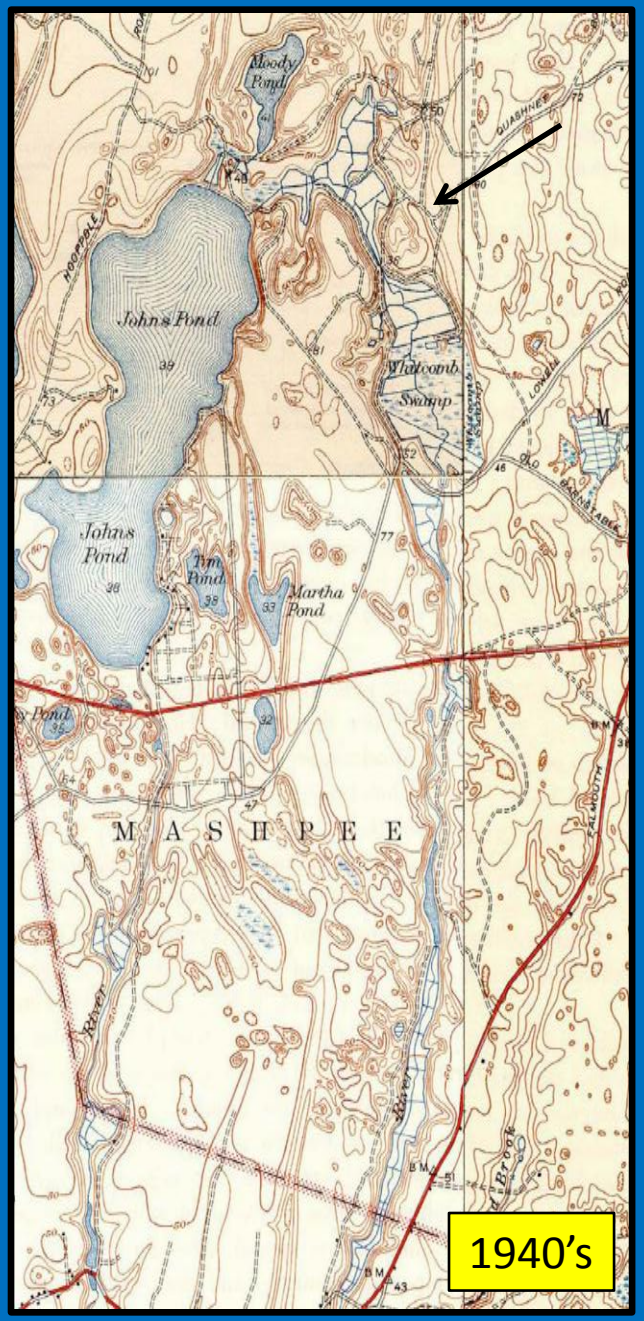
- History of the wetland (cranberry bog)
- Challenges for restoration
- Design alternatives
- Recommendations
- Status of Project
- Conclusions

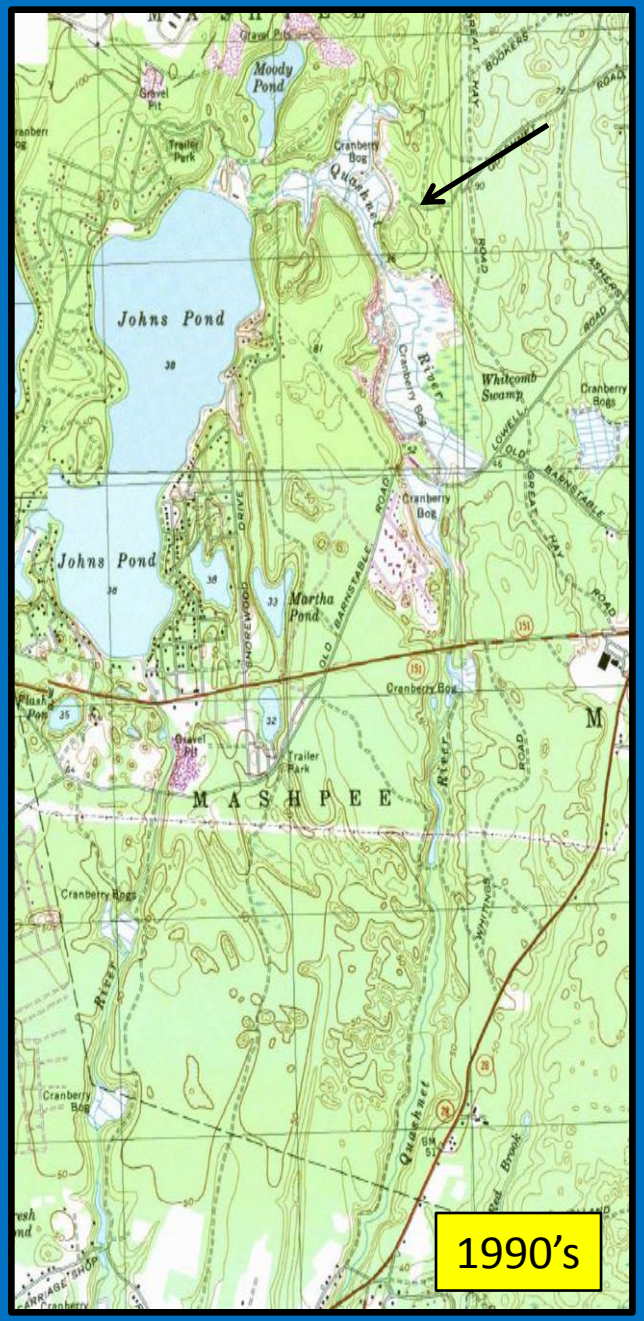
WOODS HOLE GROUP


Massachusetts
Connecticut
Rhode Island
Project Site
Data SIO, NOAA, U.S. Navy, NGA, GEBCO
Image © 2012 TerraMetrics
Image U.S. Geological Survey
© 2012 Google
45 mi
Google earth
41°57'30.39" N 71°31'36.38" W elev 373 ft
Eye alt 189.49 mi


STUDY AREA
JOHNS POND
CHILDS RIVER
QUASHNET RIVER
MOONAKIS RIVER
EEL POND
WAQUOIT BAY
CRANE WILDLIFE MANAGEMENT AREA
MASHPEE
COD
Ashumet Pond
Johns Pond
Coonamessett Pond
Hatchville
Smalltown
Waquoit Village
East Falmouth
Seconsett Island
Eel Pond
Washburn Island
Dead Neck
South Cape Beach
VINEYARD SOUND
GREAT NECK


John Pond
Childs River
M
1890's


Moody Pond
Johns Pond
Whitcomb Swamp
Johns Pond
Tim Pond
Martha Pond
MASHPEE
1940's


Moody Pond
Johns Pond
Whitcomb Swamp
Johns Pond
Martha Pond
MASHPEE
1990's

Site Demographics

- Quashnet River cranberry bog
  - Subdivided into 6 units (K1 – K6)
  - The entire site is approximately 24 hectares (60 acres)
  - The restoration plan called for restoring ~10 hectares (25 acres)
  - Natural wetland considerations
    - Quashnet River
    - Johns Pond Outlet
    - Cold groundwater seeps

WOODS HOLE GROUP

Challenges for the Restoration Design

- **Active Cranberry Bog**
- **Contaminated groundwater**
- **Active herring run (Alewives)**
- **Active trout spawning area**
- **Objectives**
  - **Restore/improve trout spawning**
  - **Maintain herring run**
  - **Maintain cranberry production**

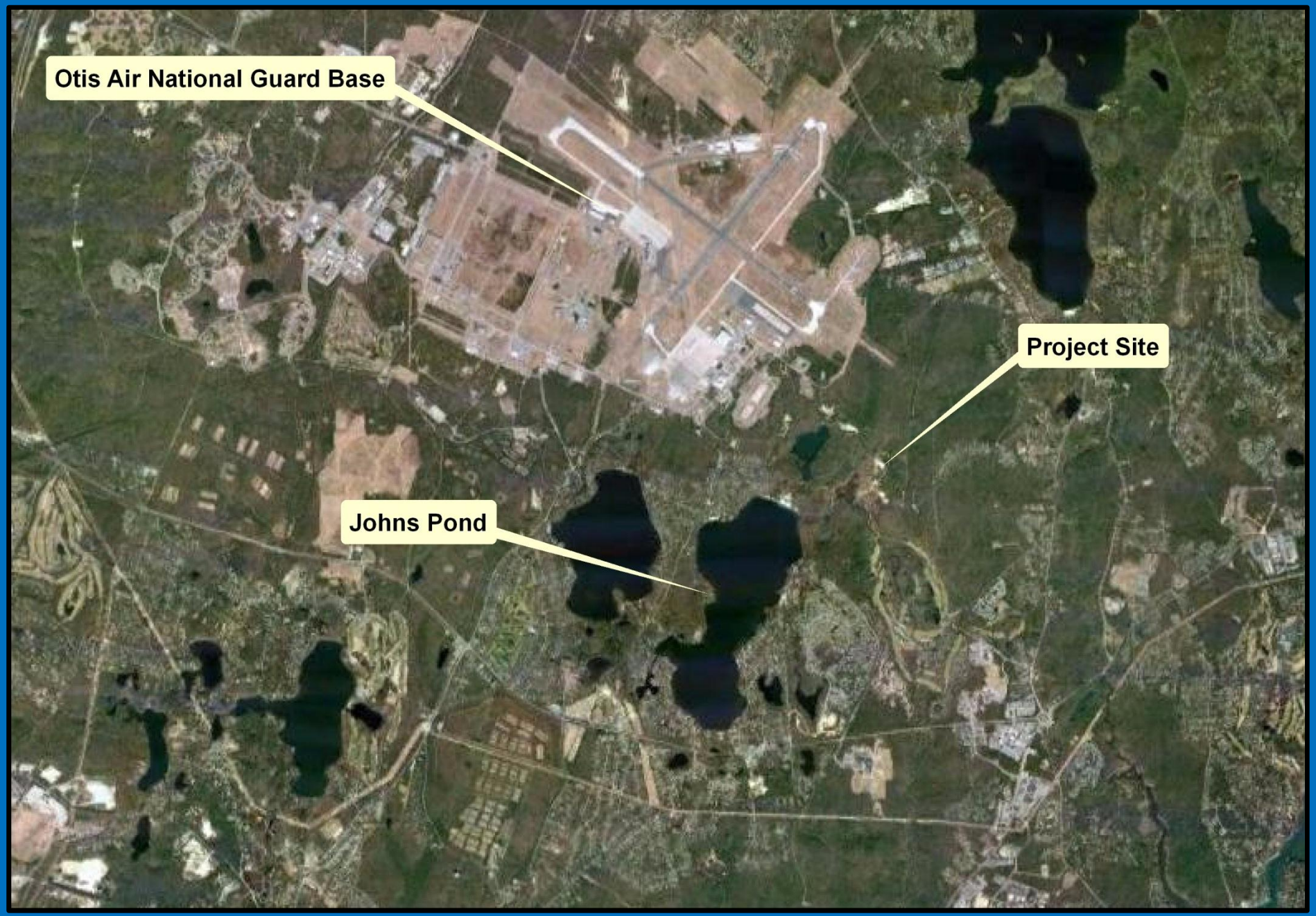
WOODS HOLE GROUP


K1
BOG
FS-1
TREATMENT
BUILDING
K2
BOG
K3
BOG
JOHNS POND
OUTLET
CULVERT
K4
BOG
K6
BOG
K5
BOG
BERM
FAILURE
QUASHNET RIVER

Challenges for the Restoration Design

- Active Cranberry Bog
- **Contaminated groundwater**
- Active herring run (Alewives)
- Active trout spawning area
- Objectives
  - Restore/improve trout spawning
  - Maintain herring run
  - Maintain cranberry production

WOODS HOLE GROUP

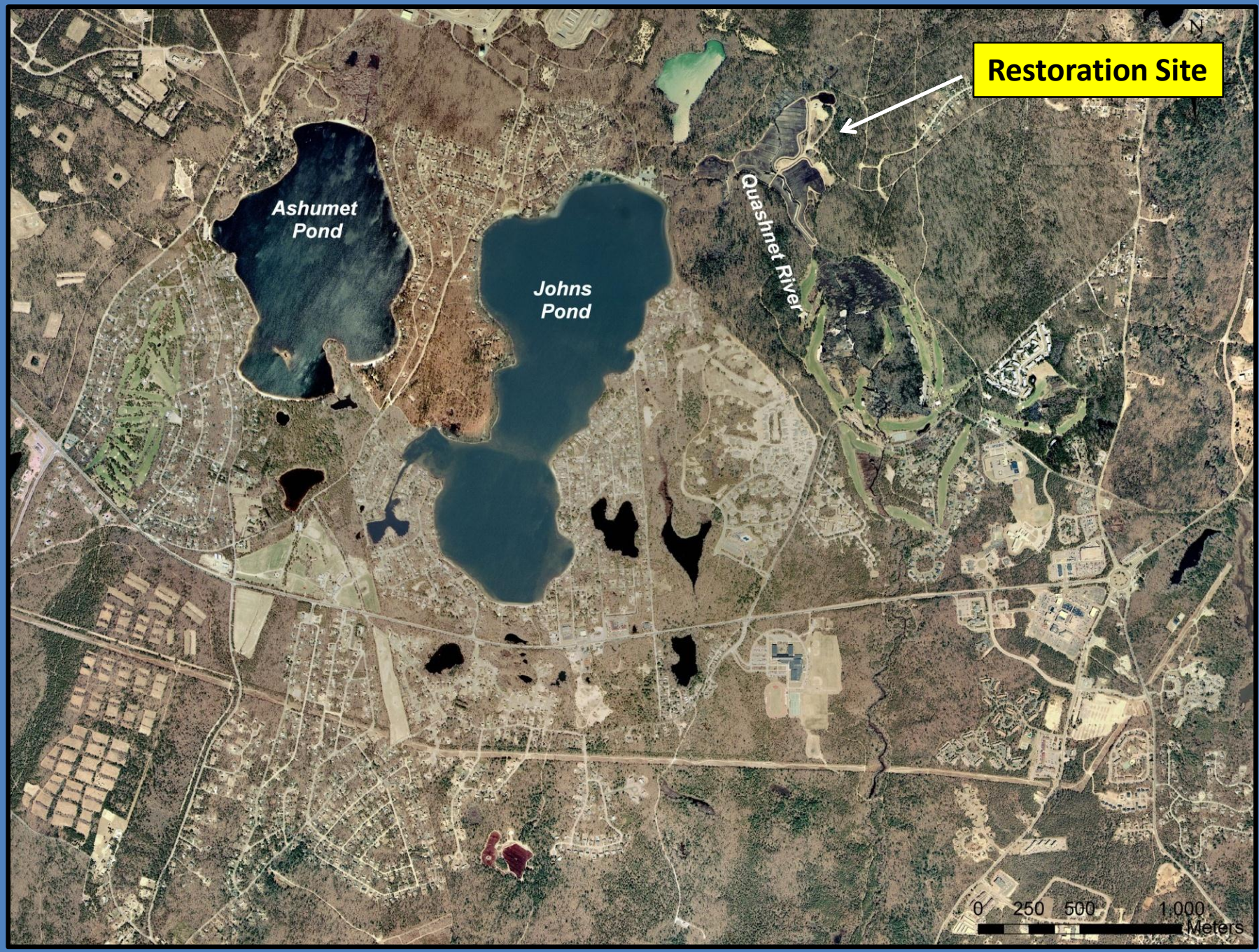

Otis Air National Guard Base
Project Site
Johns Pond


U.S. AIR FORCE
555
0-30555

Challenges for the Restoration Design

- Active Cranberry Bog
- Contaminated groundwater
- **Active herring run (Alewives)**
- Active trout spawning area
- Objectives
  - Restore/improve trout spawning
  - Maintain herring run
  - Maintain cranberry production

WOODS HOLE GROUP


Restoration Site
Ashumet Pond
Johns Pond
Quashnet River
N
0 250 500 1,000
Meters

Challenges for the Restoration Design

- Active Cranberry Bog
- Contaminated groundwater
- Active herring run (Alewives)
- **Active trout spawning area**
- Objectives
  - Restore/improve trout spawning
  - Maintain herring run
  - Maintain cranberry production

WOODS HOLE GROUP

Challenges for the Restoration Design

- Active Cranberry Bog
- Contaminated groundwater
- Active herring run (Alewives)
- Active trout spawning area
- **Objectives**
  - **Restore/improve trout spawning**
  - **Maintain herring run**
  - **Maintain cranberry production**

Restoration Approach

- Channel designs were modeled with HEC-RAS
- Three channel modifications were evaluated
  - Evaluate exiting conditions –pumping & no pumping
  - Partial channel realignment
  - Full channel realignment

WOODS HOLE GROUP


Low Flow, Low DO
K1
BOG
FS-1
TREATMENT
BUILDING
K2
BOG
K3
BOG
JOHNS POND
OUTLET
CULVERT
K4
BOG
K6
BOG
K5
BOG
BERM
FAILURE
QUASHNET RIVER

Restoration Alternatives

- Channel designs were modeled with HEC-RAS
- Three channel modifications were evaluated
  - Evaluate exiting conditions – pumping &no pumping
  - Partial channel realignment
  - Full channel realignment

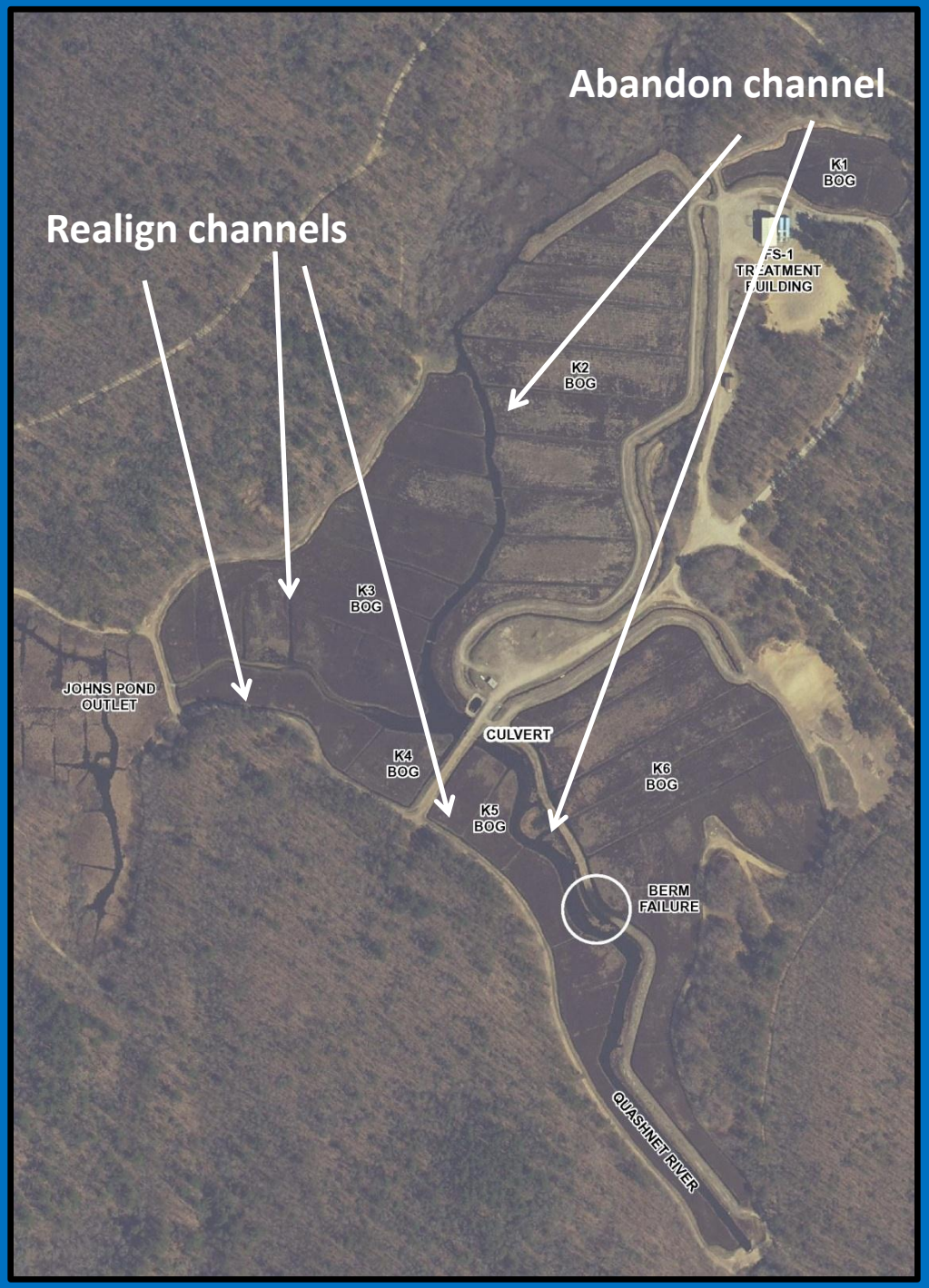
WOODS HOLE GROUP

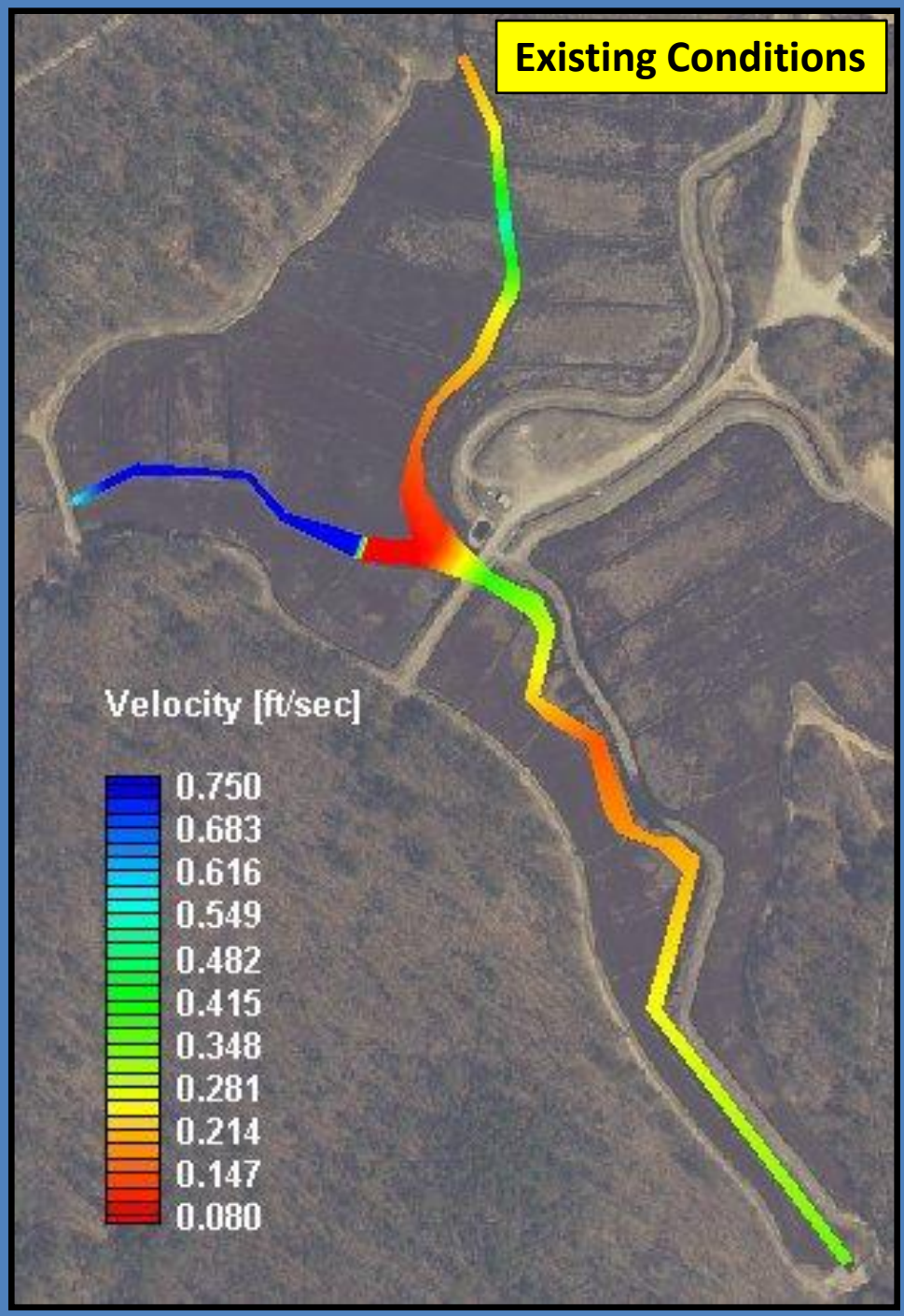

Leave this channel intact
K1
BOG
FS-1
TREATMENT
BUILDING
K2
BOG
K3
BOG
JOHNS POND
OUTLET
CULVERT
K4
BOG
K6
BOG
K5
BOG
BERM
FAILURE
Realign channel
QUASHNET RIVER

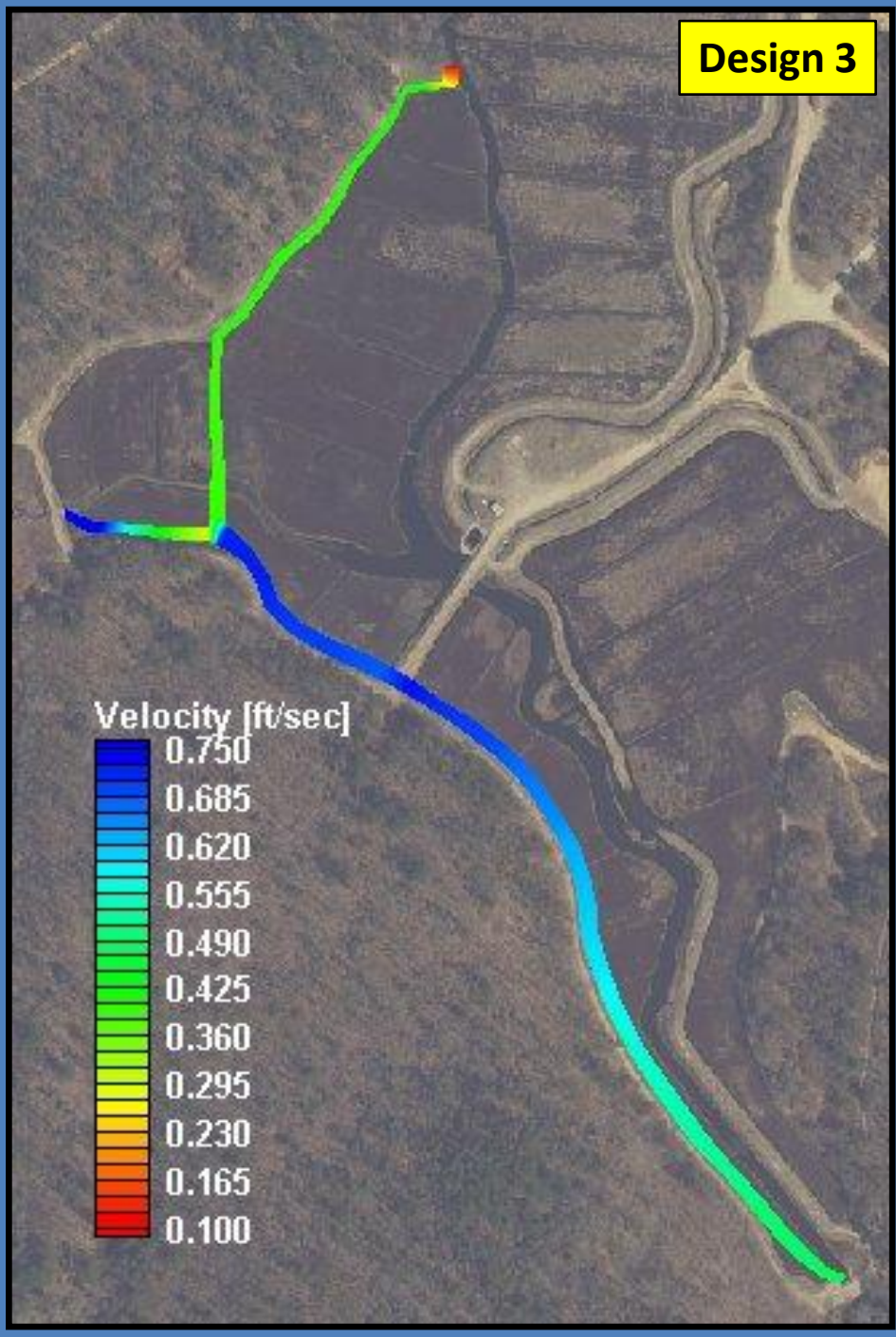
Restoration Alternatives

- Channel designs were modeled with HEC-RAS
- Three channel modifications were evaluated
  - Evaluate exiting conditions – pumping &no pumping
  - Partial channel realignment
  - Full channel realignment

WOODS HOLE GROUP


Abandon channel
Realign channels
K1
BOG
FS-1
TREATMENT
BUILDING
K2
BOG
K3
BOG
JOHNS POND
OUTLET
CULVERT
K4
BOG
K6
BOG
K5
BOG
BERM
FAILURE
QUASHNET RIVER


Existing Conditions
Velocity [ft/sec]
0.750
0.683
0.616
0.549
0.482
0.415
0.348
0.281
0.214
0.147
0.080


Design 3
Velocity [ft/sec]
0.750
0.685
0.620
0.555
0.490
0.425
0.360
0.295
0.230
0.165
0.100

Conclusions

- **The site is highly altered**
  - **Cranberry farming activities**
  - **Extensive groundwater pumping**
- **Feasibility study shows that restoration is possible**
  - **Improve trout spawning habitat**
  - **Maintain cranberry production**
  - **Maintain herring run**

WOODS HOLE GROUP