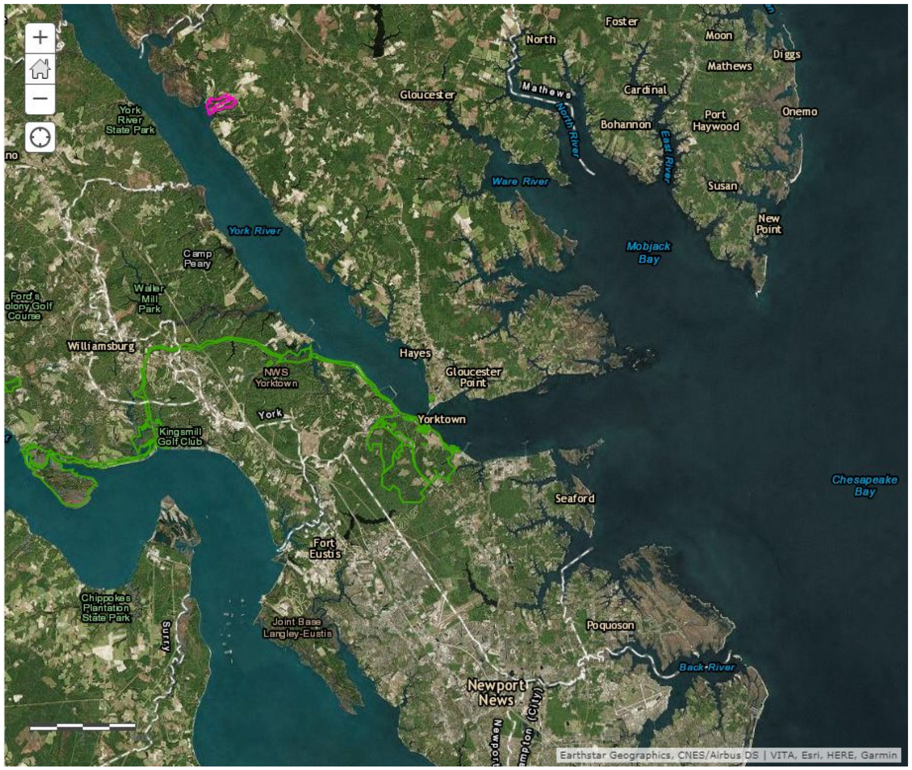
WERO Dam Removal and Habitat Restoration:

Initial Wetland Delineation Trip Report and Planning Status Summary 9/22/2017



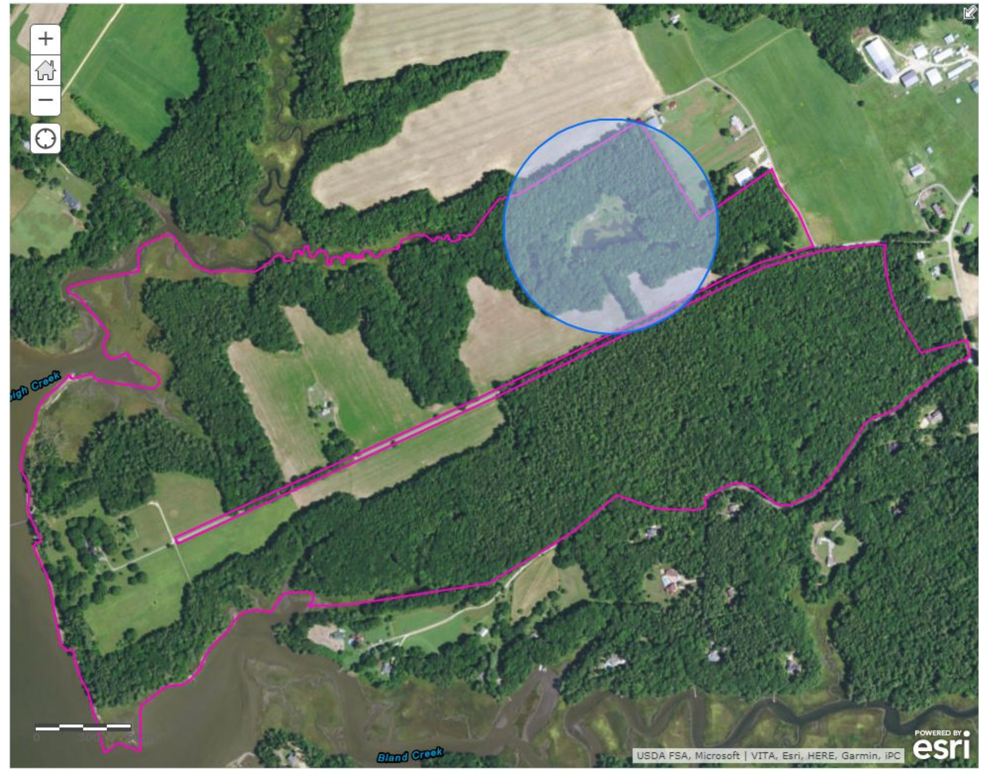


Figure 1: In the image on the Left – the Pink boundary is the location of WERO on the York River in relation to COLO (green boundary) and the Chesapeake Bay. This stretch of the York River is newly designated Critical Habitat for Atlantic Sturgeon. In the image on the Right - the blue circle indicates the location of the pond and dam(s) complex on WERO. https://nps.maps.arcgis.com/home/group.html?id=ede4d59c9fc14f22a972925ebcd3be76#overview.

Participants:

Marian Norris, NER Aquatic Ecologist; Dorothy Geyer, COLO Resource Manager; Carolyn Black, Chesapeake Conservancy; David Brown, Fairfield Foundation

Assumptions

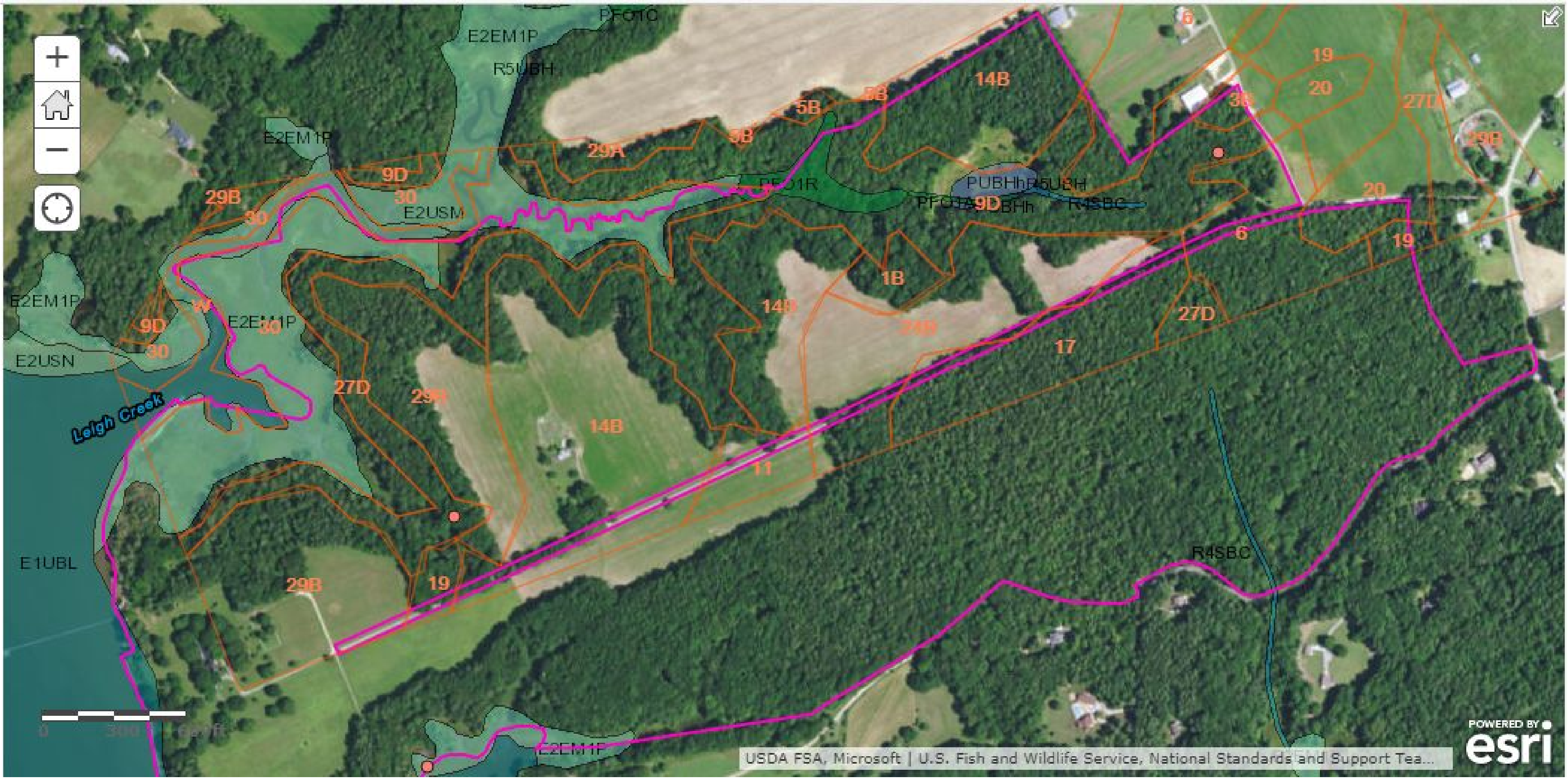


Figure 2: US Fish and Wildlife Service National Wetland Inventory data for Leigh Creek in blue and green polygons with black text and USDA NRCS Soil Survey data in orange outlines and text. This data is available in the WERO dam impacts analysis ArcGIS Online map, https://nps.maps.arcgis.com/home/webmap/viewer.html?webmap=c084c7c0c1f64e13b645f9d38353fc0c . It appeared that the pond and stream delineation would be a simple groundtruthing of the purple PUBHh pond outline and the blue R5UBH and R1SBO polygons. Reconnecting the hydrology of the system would be all the functional lift needed.

Figure 3: Images above and below are from the Rapid Assessment team in April 2017




Problem:

The man-made pond on Leigh Creek also serves as habitat for beavers which have identified the culvert as an ideal drainage point to block. Adjacent property owners have attributed flooding on their property to beaver blockage of the culvert (see photo to right) in the main downstream dam (9/22/2017 site visit identified a total of 3 dams surrounding the pond).

The pond was constructed by the previous land owner (Bob Ripley) in the 1990s for the purpose of training dogs and was not intended as a stormwater runoff retention structure (which most farm ponds are).

WERO management (CAJO) would ultimately like to remove the dam, restoring natural flow to the stream and wetlands complex behind it. Dam removal was identified as a priority during the site's rapid assessment due to the flooding issue it creates. The dam has required almost non-stop attention since acquisition for a completely unfunded site. Management has no choice but to seek its removal as soon as possible as required in Management Policies section 4.1.5 of the "restoration of...disrupted natural waterway..." and 9.5 concerning calling out for the deactivation of "existing (dam and reservoir) structures." Further, water backing up during rain events and beaver activity threatens adjoining private property. CAJO has asked for advice to initiate the process to seek the dam's removal.

A 20 foot deep sinkhole has opened on the top of the dam, right over the drain pipe (see Figures 4 to the left and 5 and 6 on the next pages) and is now 1/3 the width of the dam. According to Pete Penoyer, Hydrologist, NPS Water Resource Division, the sinkhole in the dam could be due to the beaver activity, if the dam became saturated. Mr. Ripley (former landowner) stated this has happened before and he would just fill the void. COLO Maintenance filled the void.

Figure 4: Sinkhole during Rapid Assessment Team visit in April 2017.

There Is a Sinkhole in the Pond Dam

Figure 5: Site photos from COLO maintenance (On Mon, Jul 3, 2017 at 7:30 AM, William McQuillen <william_mcquillen@nps.gov>, COLO Yorktown Maintenance). Since these photos COLO maintenance dumped two loads of dirt in the hole . The dump material sank and a 20 foot depression formed around the hole.

The hole in the top of the dam is increasing in size over time. In 5 months it has expanded from less than a foot in width to 6 or 7 feet. During the site visit on September 22nd the filled area was 1/3 the width of the dam (Figure 6). At this rate, with no additional material added (WERO is currently unfunded, COLO maintenance worked overtime at WERO in FY17 under WERO funding) the top of the dam will be completely breached within the year.

Based on the size of the dam (Table 1, next page) and the potential volume of water behind it, Mark E. Baker, Dam & Levee Safety Program Manager, WASO Transportation, 303-969-2921, determined the dam is non-jurisdictional and not eligible for NPS Dam & Levee Safety Program funding (personal communication, 11 July 2017).

Figure 6: Filled Sinkhole on 9/22/2017. The sinkhole is hypothesized to be directly above the bend in the drain pipe. The drain pipe extends straight into the dam from the pond off image to the left and then must bend sharply at some point in the dam for the end to be sited at the stream elevation 16-19 feet below the crest of the dam off image to the right. It is believed that the seam at the pipe bend is leaking, leading to dam failure from that point towards the stream (behind Dorothy Geyer in the picture).

The Elevation Difference Between the Pond and Stream is >10 feet

Table 1: Downstream Dam (now designated dam 1) and Pond Dimensions and Location calculated in July

Height from bottom to crest	8 feet on the upstream side, 24-26 feet downstream side with a pretty steep slope. The pipe running through the dam has a bend in it.
length of berm in stream	200 feet
Dam width	dam ranges from 50 to 75 feet thick at the top
volume of water	With a water level estimate of 16.9 feet, Tim Layton calculates 47,958 square feet or 1.10 acres of water behind the dam. The area depicted in blue in Figure 5 is 124,059.3 Sq Feet (US), and may be the more accurate depiction of the amount of water and sediment behind the dam

latitude and longitude	37.415791 -76.645499, in Google maps you will see a curved road depicted, this runs on top of the dam

Mark Killgore, VA DCR, Gloucester County Regional Dam Safety Engineer 804-786-1359 stated the dam was not on the Virginia registry and if less than 6 feet in height is not subject to state dam regulations. Based on the measurements COLO Maintenance took, it seems the dam should have been permitted by the state. Jim Brown, COLO Chief of Maintenance and Acting Deputy Superintendent, met with CHBA staff and Marian Norris on Tuesday July 11th. Regional staff have also offered engineering contracts to assess the dam for repair (Richard Chilcoat, NER Dam and Safety Coordinator, Mark_Alexander@nps.gov, NER Lead Engineer). This should be done.

There are 3 Dams forming the Pond

A second dam, which has served as vehicle access and Tim Layton proposed as part of the trail system, occurs in the woods upstream of the first dam (Figure 7).

Figure 7: Second dam in the woods, photographed by Timothy Layton, Rapid Assessment Team, April 2017 on the left and Marian Norris 9/22/2017 on the right. Dam dimensions are 24 feet wide by 2.3 feet tall and the sediment level is halfway up the pipes. In September the vegetation is functionally emergent wetland.

Figure 8: Extent of second dam and ponding on either side

Figure 9: There is a 3rd outfall in the woods, which implies that the ground above and behind it is another dam, somewhere in the tree line at the back of the bottom right picture.

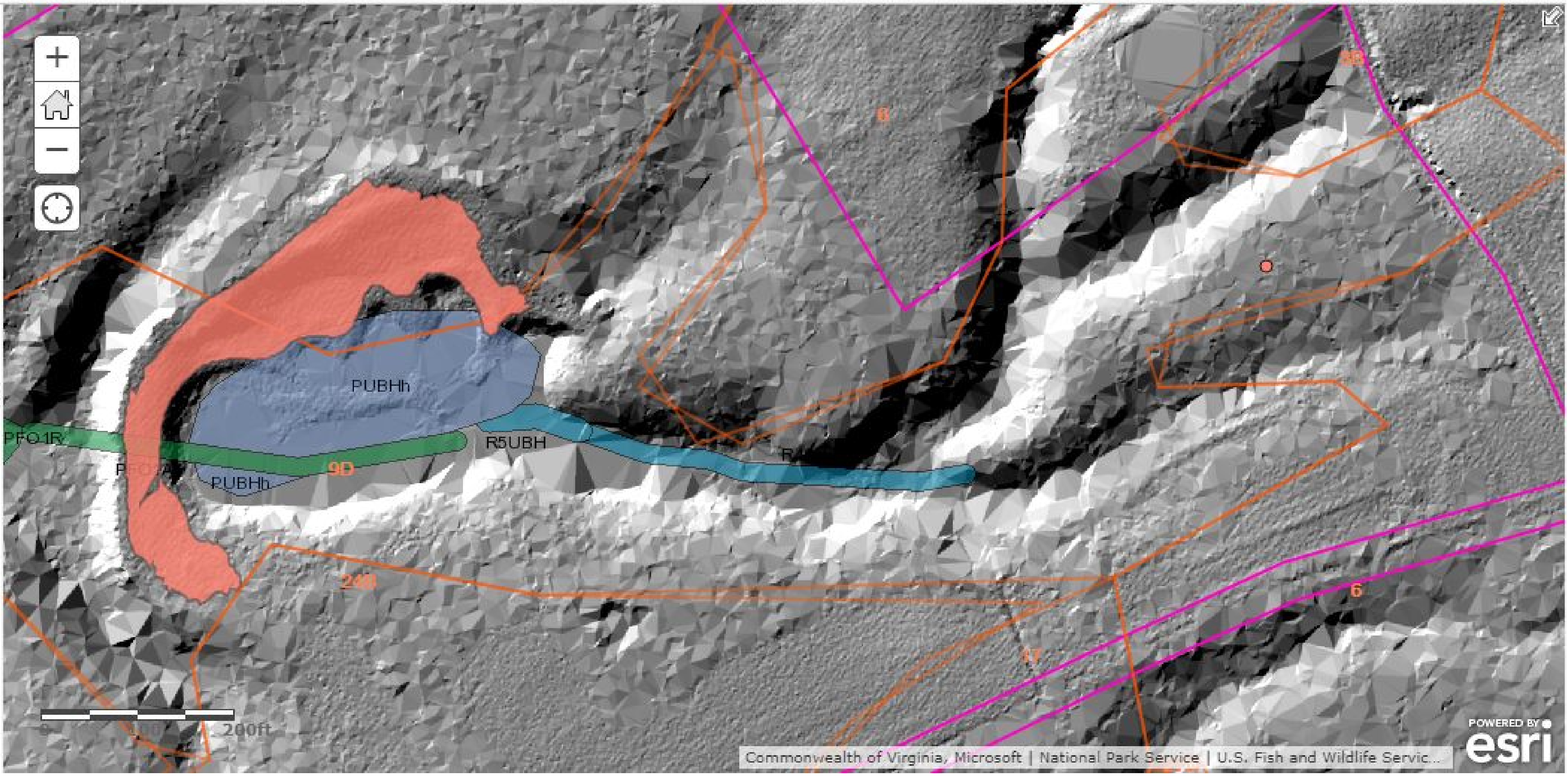


Figure 10: Full extent of the "dam" to be removed. This needs to be surveyed by a proper engineer, probably during leaf-off. We GPS'd it on 9/22/2017 under tree canopy.. Dam 2 in the woods also needs to be surveyed and it's removal or replacement with a more water and sediment pervious structure determined.

The Pond Is Full of Sediment

The pond/wetland area extends farther upstream than expected and includes a greater extent and diversity of wetlands than anticipated. Given the extent of the area, it was not possible to delineate in one day and it was apparent that project planning would require a greater array of data than originally planned for collection.

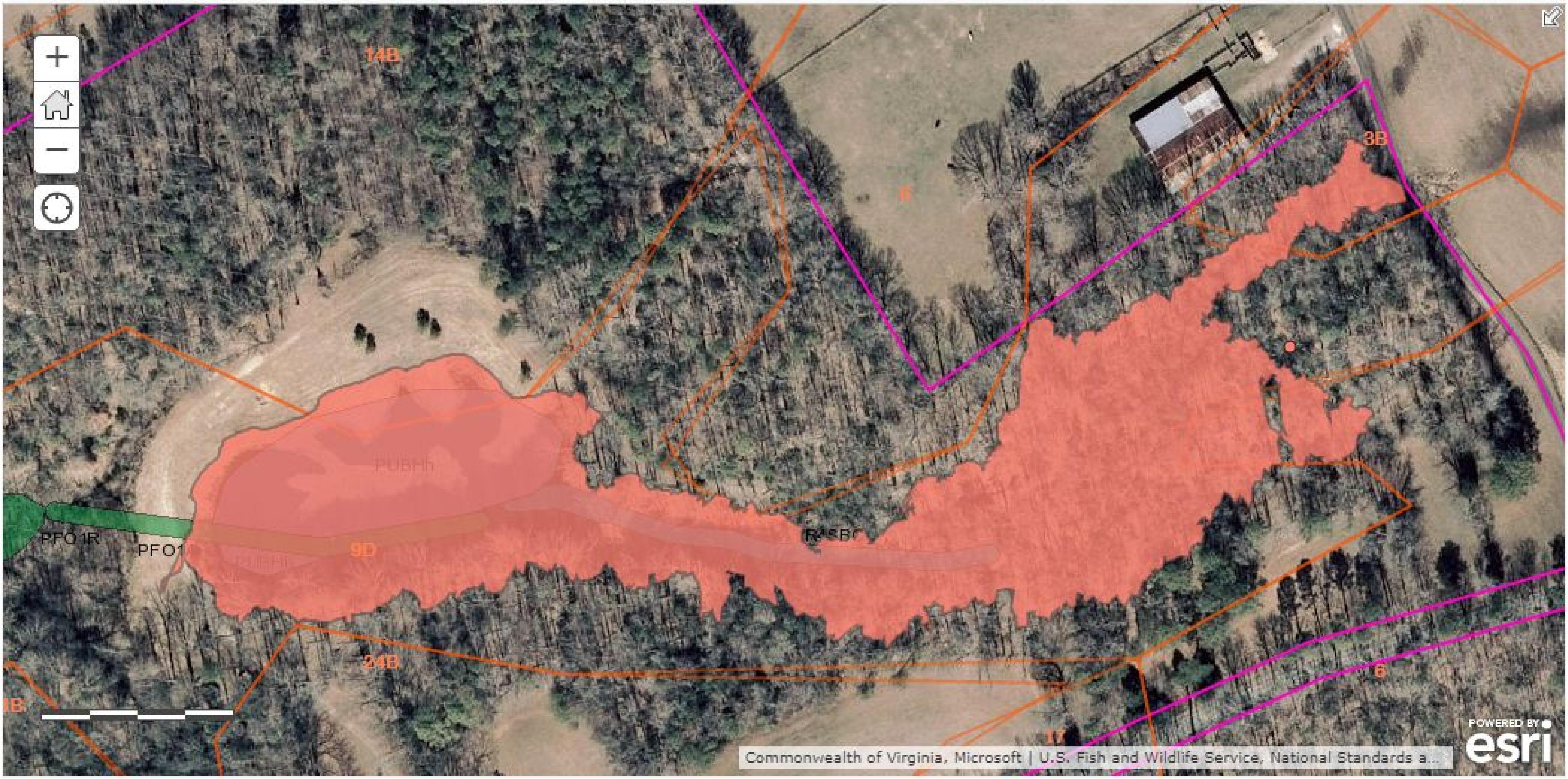


Figure 11: GPS'd extent of Leigh Creek wetlands area above the dam in WERO. This area is wetlands because it has accumulated sediment behind dams 1 and 2.

Figure 12: If the dam fails, then the dam and wetlands' sediment load becomes the dredge / fill deposited into the downstream wetlands and critical and essential fish habitat. Therefore maintaining the dam until the sediment can be dredged and the dam properly removed without spilling material into the stream is important. Funding is the issue.

The headwaters for the pond extend uphill into the neighbor's property which is all field (Figures 5).

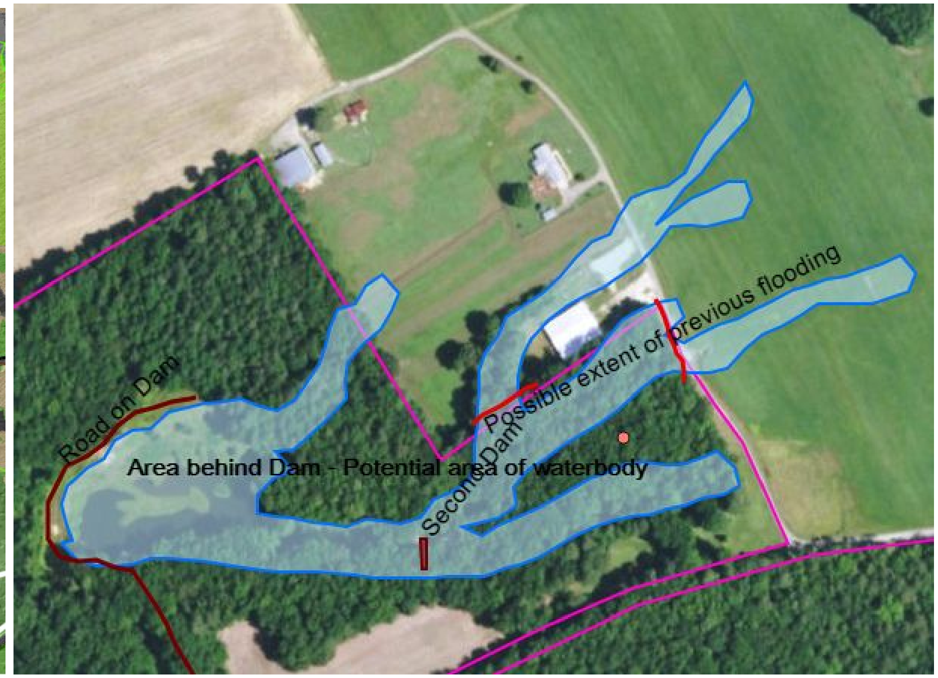


Figure 13: Left image: WERO as depicted in ArcGIS Online NPS layers and tools, including boundary survey (white line), LIDAR hillshade, and Virginia Land Cover data. The elevation difference between the dam and the downstream channel is evident in this image. The filled red circle indicates a spring. The headwaters appear to be springfed and those of the portion of Leigh Creek feeding the dam pond begin on the neighbors' properties in the northeast / top right corner of the imageRight image: Freehand drawn impoundment area behind the downstream dam (in blue), road and downstream dam (in brown), approximate location of second dam (brown rectangle), and reported extent of previous flooding. Note location of red circle indicating spring on the top of the hill between tributaries. Spring locations requires verification.

Leigh Creek in Google Earth from 1994 through 2016

Figure14: Google Earth Pro image of 3051 Ginney Hill Road, Gloucester, VA in March 1994. Note the road that follows the current (2017)line of the dam. This road is not depicted on any of the park documentation.And the dam was not present in 1994. The agricultural development of the headwaters was in place in 1994, and the headwaters are very clear on the neighbors' properties.

Figure 15: By June 2003, the next available Google Earth imagery, the dam was in place. Water level in the downstream portion of the WERO branch of Lewis Creek is lower.

Figure 16: June 2005, work on the dam continues

Figure 17: May 2006, upstream fields may have converted to pasture per Chuck Hunt

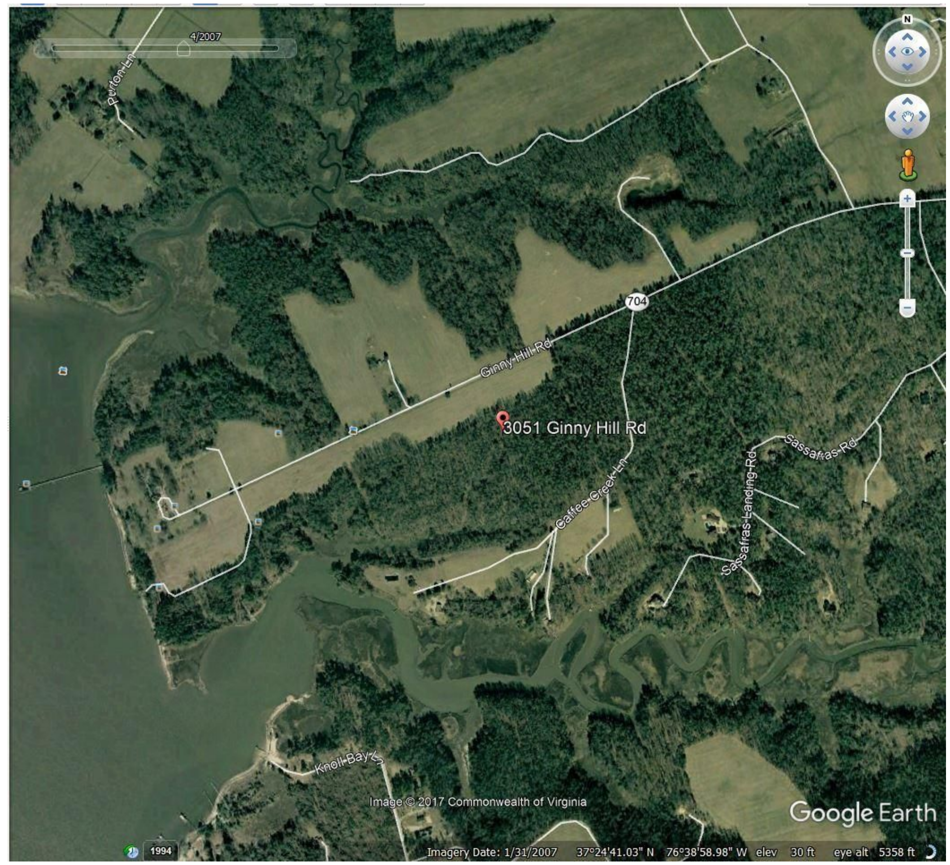


Figure 18: January 2007

Figure 19: May 2008

Figure 20: April 2010

Figure 21: January 2011, from this point on vegetation grows in somewhat but there are no discernible changes in the pond and dam configuration. the field in which the headwaters are located does appear to change in wet and dry and vegetation conditions.

Figure 22: June 2011

Figure 23: October 2013

Figure 24: April 2014

Figure 25: November 2015

Figure 26:WERO November 2016 in Google Earth Pro.

Not an Ideal Place for a Dam

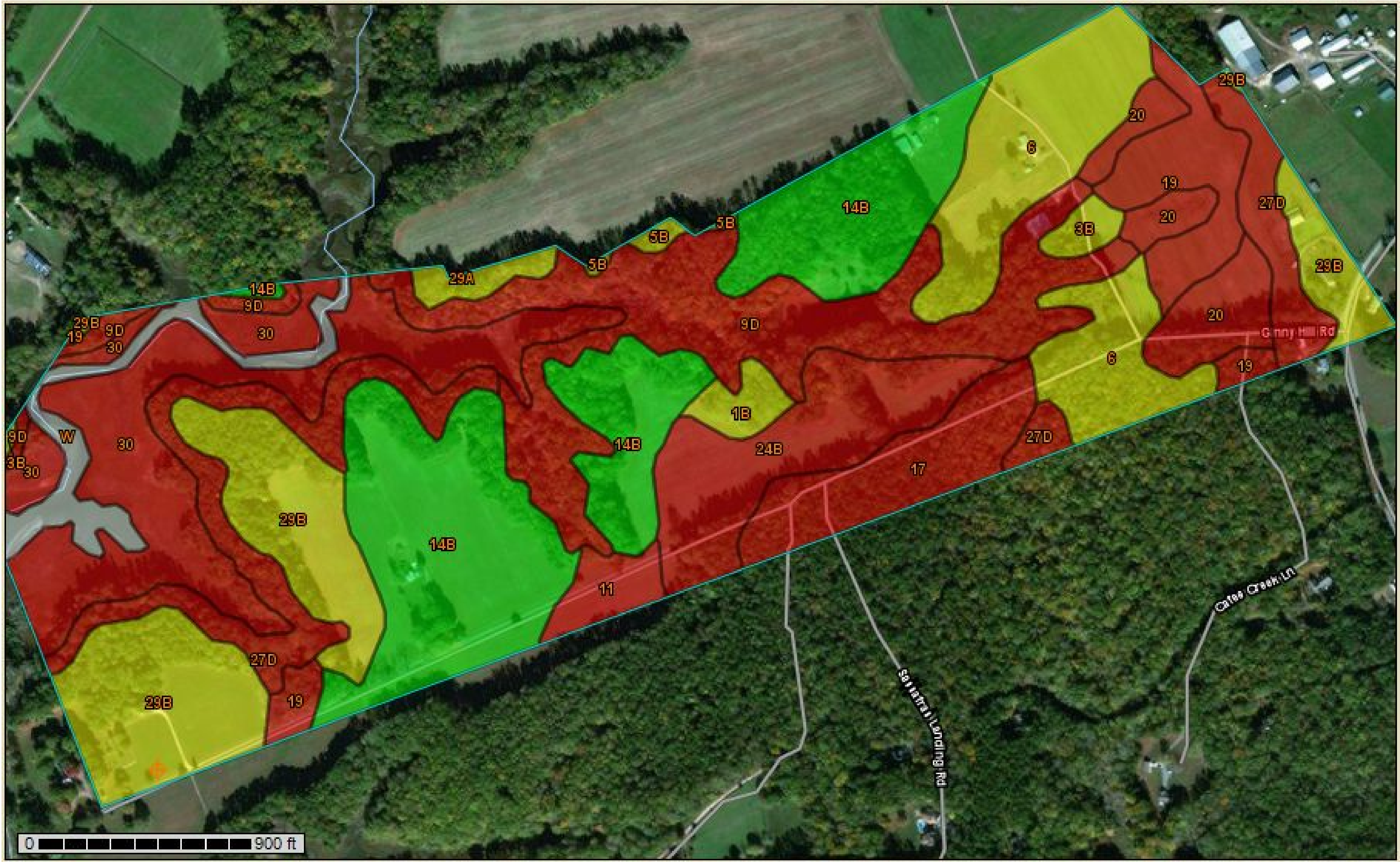


Figure 27: NRCS WebSoil Embankment / Levee / Dam suitability Rating   Soil classes W, 30, 27D, 9D, and 14B correspond to Leigh Creek in WERO, and 20 corresponds to the headwaters on the neighbors' property. The soils in Leigh Creek corresponding to the dam location, 9D, are not recommended for embankment, dam, or levee construction because they are steep, piping would be an issue, and they are dusty (?).

The Headwaters Are Not ideal Farmland

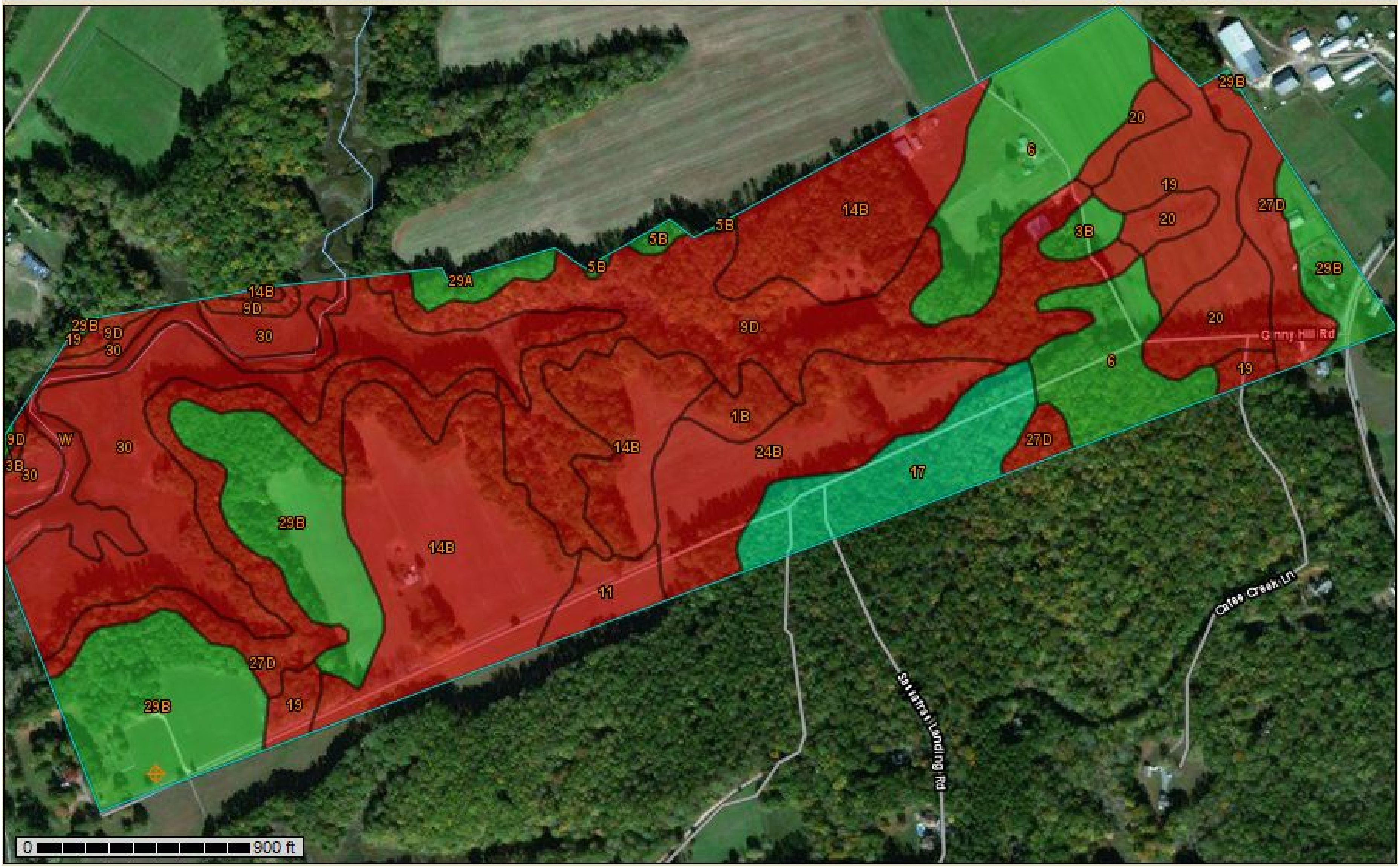


Figure 28: NRCS WebSoils Farmland Classification for WERO Leigh Creek watershed. Areas in red are not recommended for agriculture, areas in green are prime farmland, area in blue is prime farmland if drained. Soil classes W, 30, 27D, 9D, and 14B correspond to Leigh Creek in WERO, and 20 corresponds to the headwaters on the neighbors' property. All are not prime farmland.

Wetland Delineation and Functional ASsessment for the full System will take a week

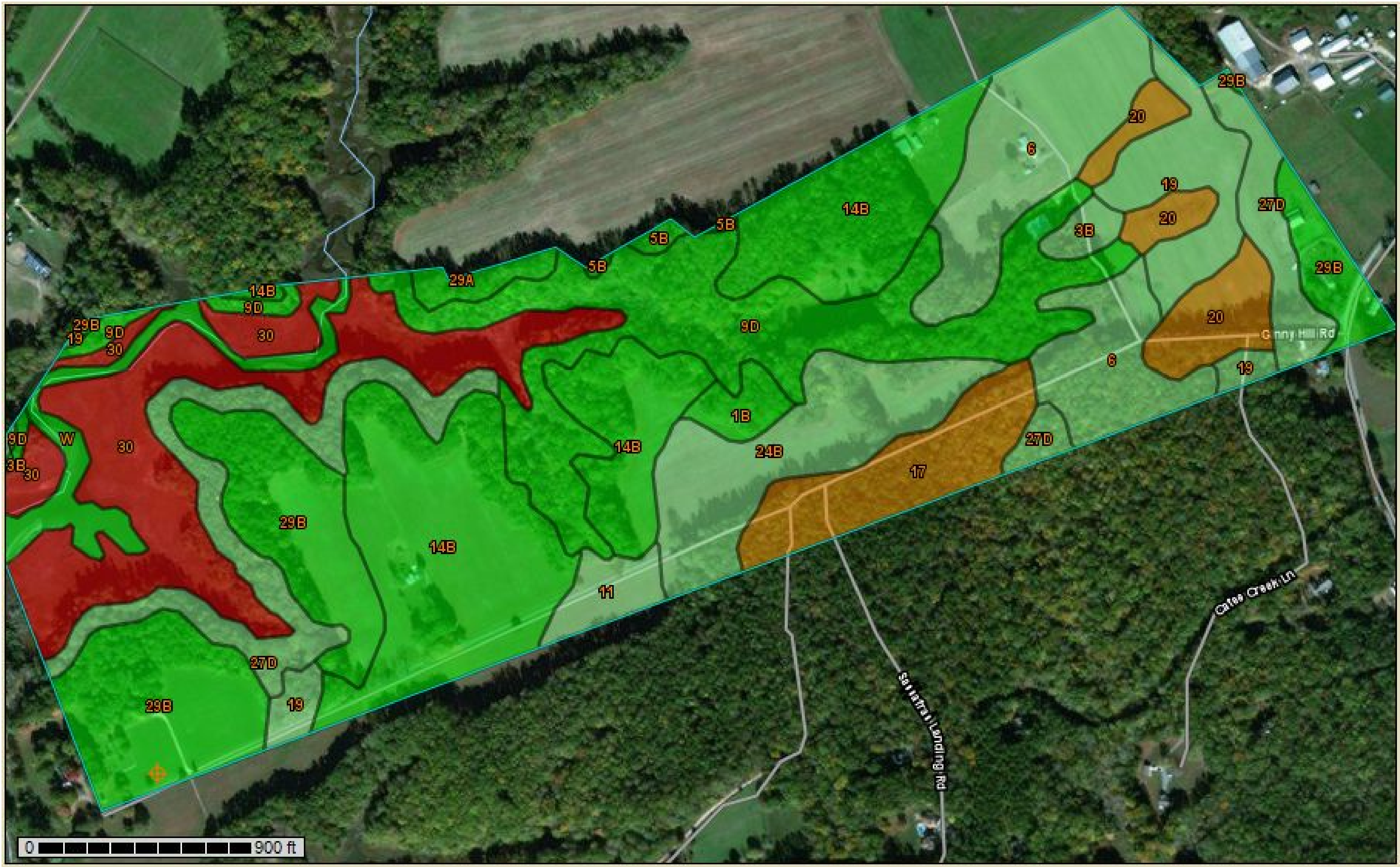


Figure 29: NRCS WebSoils Hydric Soils Classification for WERO Leigh Creek watershed. Areas in red are hydric soils, areas in green are not considered hydric soils, though the upstream wetland is included in these polygons which is why field soils data needs to be collected, areas in blue contain hydric soils in the mix. Soil classes W, 30, 27D, 9D, and 14B correspond to Leigh Creek in WERO, and 20 corresponds to the headwaters on the neighbors' property. Of these, only 30 is listed as Hydric Soil, 20 and 27D contain percentages of hydric soils. 9 D and 14B are considered to not be hydric.

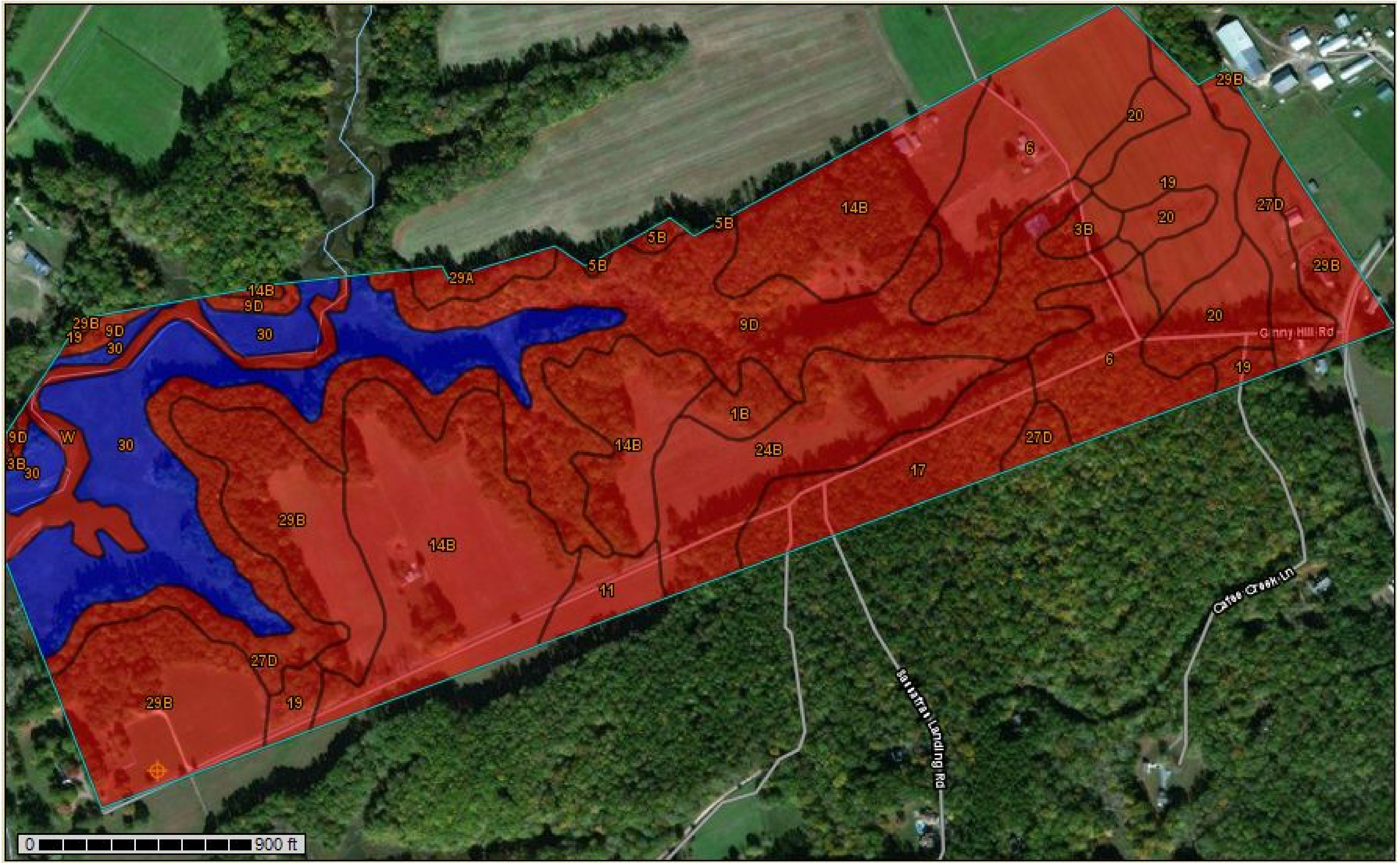


Figure 30: Flood Frequency Class. Soil classes W, 30, 27D, 9D, and 14B correspond to Leigh Creek in WERO, and 20 corresponds to the headwaters on the neighbors' property. 30 is frequently floode, and corresponds to the SEtuarine classes on the Wetlands Mapper (NWI 2.0)

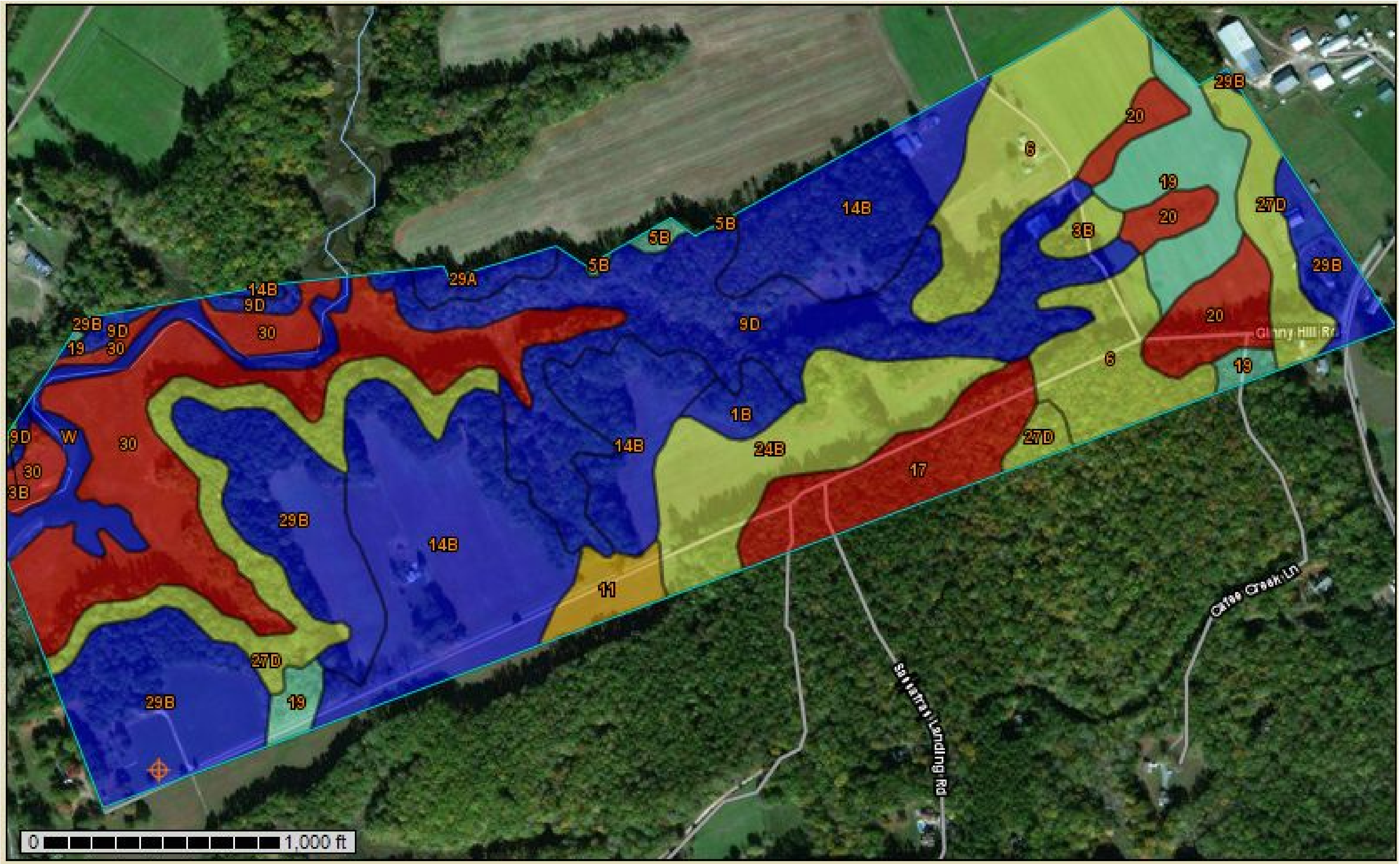


Figure 31: NRCS WebSoil Depth to Water Table

Additional Information Required:

(1) Put together excel spreadsheet for GPSd dam area to put it into FMSS

apply for cyclic maintenance for dam study / maintenance

(2)Check elevations (how?)

Does Tim Layton have Digital Elevation Models from LIDAR? Supposedly Tim Layton has produced a technical drawing based on LiDAR elevations, where is this? What is the height of the dam above the stream?

(3)Groundwater study of head of dam into groundwater and backing up underground into the headwater springs?

Clarify with eastern neighbors how / where the water has previously backed up

(4)Engineering evaluation of the extent of the dam and the quantity of sediment behind it

how much material needs to be removed, and what can be done to keep the dam stable

(5) Request aerial photos from the 1930s

which Meg Waters should have, is there a difference in the watershed between then and the construction of the pond dam?.

(6) Request Mr Ripley's before and after photographs of the dam construction

Did he install the concrete pad on the main dam at the downstream edge?

The 2nd berm with the end of the pipe at an upward angle in the woods was this intended as an outfall or an inflow?

How long is the pipe in dam1?

  What is it's diameter?

  Material?

  Age?

  Where is the bend in the pipe?

  What is the angle?

  How long is the pipe to the bend?

  How long is the pipe from the bend to the outfall?

  How far is the bend in the pipe from the start of the sinkhole?

  How deep is the pipe in the dam?

How long did it take to build dam1?

When did construction start?

When did construction end? In Google Earth it appears to have ended initially in 2006 with some additional material added in 2010.

Where did the material come from? The archaeologist's hypothesize from the north side of the pond area and make recommendations based on that assumption.

How much material was used?

How deep was the pond?

How high was the dam above the pond bottom? Above the stream channel?

Was there a natural structure here he built from?

How much maintenance was required?

How often did material need to be added?

How much?

How often and where did sinkholes develop? How deep or how much material to fill?

Do a series of cross-sectional sketches with him

(6) Second site visit by to complete the wetlands delineation, mapping, functional assessment and other data collection

Monday

Morning -Travel

early afternoon -walk the site with Bob Ripley and Clem ? and take copious notes on the design and construction process

-complete flagging the area upstream of the dam and determine locations for soil cores.

Tuesday

Morning -complete flagging upstream area, collect vegetation data

(1) 1 or more 30" radius plots in each vegetation community/soil combination (see figure , data sheet in each plot, GPS center point, 1. In the formerly mowed grass, 2. On the island, 3. In the woods on each tributary

-Carolyn GPS's the sediment edge, dams 2 & 3, and the location of each pipe end

-Dorothy completes functional assessment forms

Afternoon -soil data with Fairfield Foundation Archaeologist present (Ashleigh?)

-GPS the flagged wetland boundary

-Carolyn in a kayak measures water and sediment depth and takes pH and salinity readings in the pond and tributaries, GPS's the point at which water depth=/> 2.5 meters & rooted vegetation no longer present = deepwater habitat edge of the wetlands

- Dorothy completes functional assessment forms

Wednesday -walk and flag downstream of the dam, where is Head of tide (HOT)?, take salinity and pH measurements laong the length, note changes in bottom material and vegetation and flag individual FGDC wetlands classes for delineation, Someone checks for SAV in the channel and mouth in a kayak,

Thursday

Morning -collect soil data with Fairfield Archaeologist on the downstream portion, Someone completes functional assessment forms

Afternoon -GPS, Someone completes functional assessment forms

Friday -drive back to DC, complete voucher, write up data

(a) Delineate water resources onsite to USACE standards using the Atlantic & Gulf Coast Regional Supplement and to complete a NPS Water Resources Division Wetland and Floodplain Statement of Findings. Pete Sharpe recommends that any riverine habitats (streams) should be delineated using their ordinary high water marks (OHWM) or if that is too difficult their top of bank points. Pete also recommends providing additional upland data sheets if the wetland/upland boundary isn't clear cut There should be at least one data sheet per wetland and per Cowardin community type within said wetland.Mapping of the wetland in GPS should be to FGDC wetland mapping standards and USFWS data collection requirements. Sub-meter GPS accuracy sufficient not require surveying in the delineation, if require more detail would be for the specific area to be constructed. USACE site visit would be confirming flagging and polygon in the field with submeter x,y coordinates. Precision and accuracy of z not an issue until engineering design. Capture upland groundwater features (seeps,. springs) in delineation. Go to Gloucester County online property database to get the data on the tax maps and plat information for the pre-application. USACE would not permit if there would be impacts to NHPA or ESA resources, but they expect NPS to be lead on the NMFS and SHPO consultation and Effect Determination with VA DHS (Keith Goodwin, personal Communication, 7/21/2017).

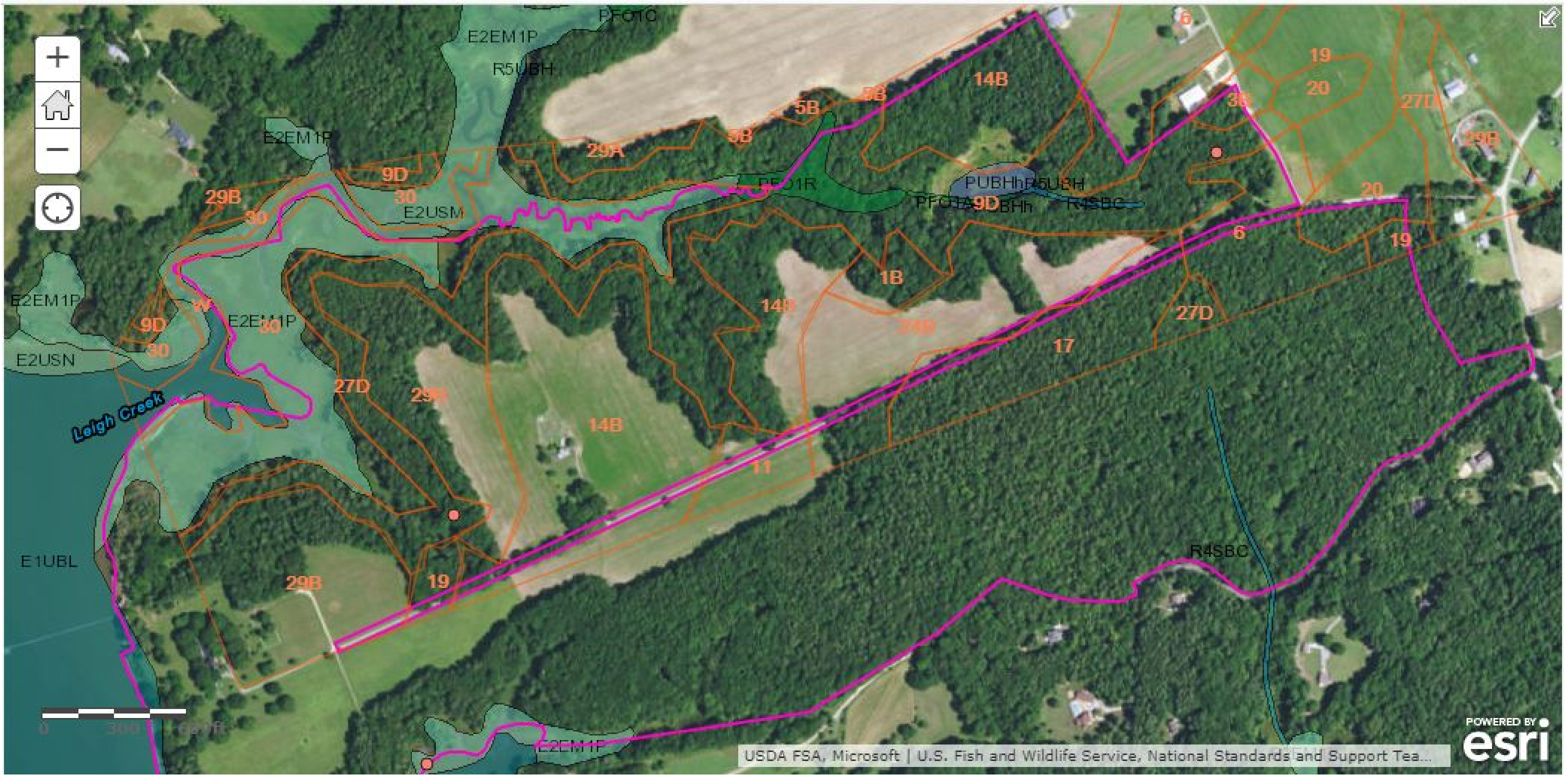


Figure 29: Combination of Soil classes and NWI classes overlain 2016 vegetation ArcGIS Online. Each vegetation * soil * water regime combination requires documentation on USACE data sheets and mapping as a separate wetland class with on the ground field collection of vegetation community, soil composition, and hydrology data. https://www.fws.gov/wetlands/data/mapper.html Based on imagery from 2012

Table 2: CAlculation of Number of plots and types needed for WERO

FGDC System	**FGDC subsystem**	**Vegetation Type**	**Soil Class**	**NWI Class**
estuarine (salinty>0.5)	subtidal	submerged herbaceous	W	E1UBL, E2USM, E2EM1P
estuarine (salinty>0.5)	subtidal	emergent herbaceous	W	E1UBL, E2USM, E2EM1P
estuarine (salinty>0.5)	intertidal	emergent herbaceous	30	E2USM, E2EM1P
estuarine (salinty>0.5)	intertidal	scrub shrub / forested	30,	E2USM, E2EM1P
riverine (salinity<0.5)	tidal	submerged	W, 30	E2EM1P

riverine	lower perennial	submerged, emergent herbaceous	30, 9D	E2EM1P, PFO1A, PFO1R
riverine	upper perennial	submerged, emergent herbaceous	9D	R5UBH, R4SBC
riverine	intermittent	submerged, emergent herbaceous	9D, 20	R4SBC
palustrine		emergent herbaceous	30, 27D, 9D, 14B, 27B, 20, 6	PUBHh,
palustrine		scrub/shrub	30, 27D, 9D, 14B, 27B, 20, 6	
palustrine		forested	30, 27D, 9D, 14B, 27B, 20, 6	PFO1A, PFO1R
palustrine				

- Define the drainage area for Leigh Creek. https://nps.maps.arcgis.com/home/webmap/viewer.html?webmap=c8a37c8277994121a2012d87a3ddf70b.
- Include Survey of seeps and springs in the drainage. Possibly determine groundwatershed (rather pie in the sky). Is there karst? The immediate geologic layers are unconsolidated sand layer and gravel layer, to sure which is on top, but would conduct lots of water, what is the bedrock beneath? How deep to bedrock? Where is the groundwater table?
- Determine the amount of water behind the dam in this drainage area, including that supplied by the seeps/springs at the upland end of the drainage
- Confirm no SAV present, as indicated in VIMS imagery: http://web.vims.edu/bio/sav/flexmaplarge/ grid cell GR121
- location of head of tide, salinity and pH throughout the drainage, Location of Head of Tide and tidal period? DEtermine pH and salinity throughout. These delineate estuarine wetlands in the downstream section. Add water gauges? Map extent of flooding. Consider SLR and storm surge projections.
- depth of water in pond and channel - where >2.5 m and no rooted vegetation = water boundary of wetlands and beginning of deepwater habitat
- Determine if the sediment behind the dam requires removal and how much material is in the dam and where to dispose of it.
- PHIL engineering and Jennifer McConoughey for PEPC. Joel Wagoner or Kevin Noon at WRD would approve the WSOF which would include the stream delineation. Dave Hayes, ROVA, has experience with dredging in a historical landscape compliance.
- Example PRWI Quantico Creek Lakes 2 & 5 (same lake) dredged in 2003-2004, Lake 1 dredged 2002, Lake 4 2005-2006 except put the dredge upstream of Lake 1, Lake 3 and Carter's pond in tributaries to Quantico Creek were never dredged. All dredged Lakes are full again.

Carter's Pond dam is leaking. Check the Cabin Camp CLRs. Also PMIS statements for amount dredged out. Cyclic 5-20 years automatically. Check

(6) Consult with National Marine Fisheries Service and US Fish and Wildlife Service on fish and wildlife impacts from any sediment release resulting from the dam removal.

USACE expects us to take the lead on this, and it is required for them to approve a permit. Confirm no USFWS critical habitat present , as indicated by https://services.arcgis.com/QVENGdaPbd4LUkLV/ArcGIS/rest/services/USFWS_Critical_Habitat/FeatureServer. The area of the York River on which WERO is located is proposed Critical Habitat by NMFS for the Atlantic Sturgeon (https://www.greateratlantic.fisheries.noaa.gov/protected/atlsturgeon/docs/2016-12743_fr_notice.pdf). Consultation is required with NMFS for both Critical Habitat for endangered species, as well as Essential Fish Habitat. Any Critical Habitat designations have to be addressed in compliance. Addressing Essential Fish Habitat is ultimately NPS's decision, though that decision does need to be documented in the compliance process.

(7) Submit delineation map and data sheets and dam dimensions with the pre-application USACE Section 404 permit form to CENAO.REG_ROD@usace.army.mil and CC keith.r.goodwin@usace.army.mil.

Keith Goodwin is our USACE project manager. He is in the Gloucester Field Office and can be reached at 757-613-5431. Keith did the permitting for the shoreline engineering at WERO. He recommends contacting VIMS – they did the engineering and implementation of the most recent shoreline work. This shoul dprobably be a joint permit with USACE and Virginia Marine Resource Commission (VMRC) Habitat Management Division: http://www.mrc.virginia.gov/regulations/hm-permits.shtm

Werowocomoco Archaeological Recommendations

The 2012 archaeological assessment did not include the portion of the property on which the dam and pond are located. The Archaeological Team visited the site on 7/21/2017:

Dog Training Pond / Drainage Restoration Project
July 25, 2017
Joel Dukes and Meg Watters Wilkes, NRAP

On July 20 Dukes and Wilkes from Northeast Region Archaeology Program (NRAP) visited WERO and studied the dam and culverts associated with the dog training pond. The images below (Figure 1, Figure2) identify an area that has been previously impacted by construction of the pond and thus characterized as low sensitivity for any remaining intact archaeological resources.

Removal of the culvert at the head of the pond (on the eastern end) can be conducted by removing the culvert pipes and the soil around them. It is likely that there is some sedimentation in the areas on either side of the culvert pipes, some of this can also be removed if necessary. The edges (sides of the drainage) of this area however should not be excavated without further inquiry to archaeological impact.

The polygon on Figures 1 & 2 identifies the previously disturbed area where no archaeological investigations or monitoring need to take place during removal of the western culvert/dam. It appears the southern bank of the pond has not been impacted previously by the creation of this water feature and should not be disturbed by the activities related to the restoration of the natural drainage.

These observations refer specifically to the removal of the culvert and earthen features that have been installed by the previous land owner. Further consideration of archaeological impact includes:

1. It appears that the dam was created with soil taken from the north side of the drainage. Soil excavated from the dam could be redeposited in this area without impacts to cultural resources. If earth is removed from the drainage restoration project site and redeposited within park boundaries and outside of the disturbed area indicated on Figures 1 & 2, NRAP should be consulted.
2. This review does not include consideration of the ravine downstream of the drainage. This area should be investigated and discussed regarding the impact of the restoration project.
3. The removal of the culverts and restoration project should be done in consultation with the invested tribal representatives.

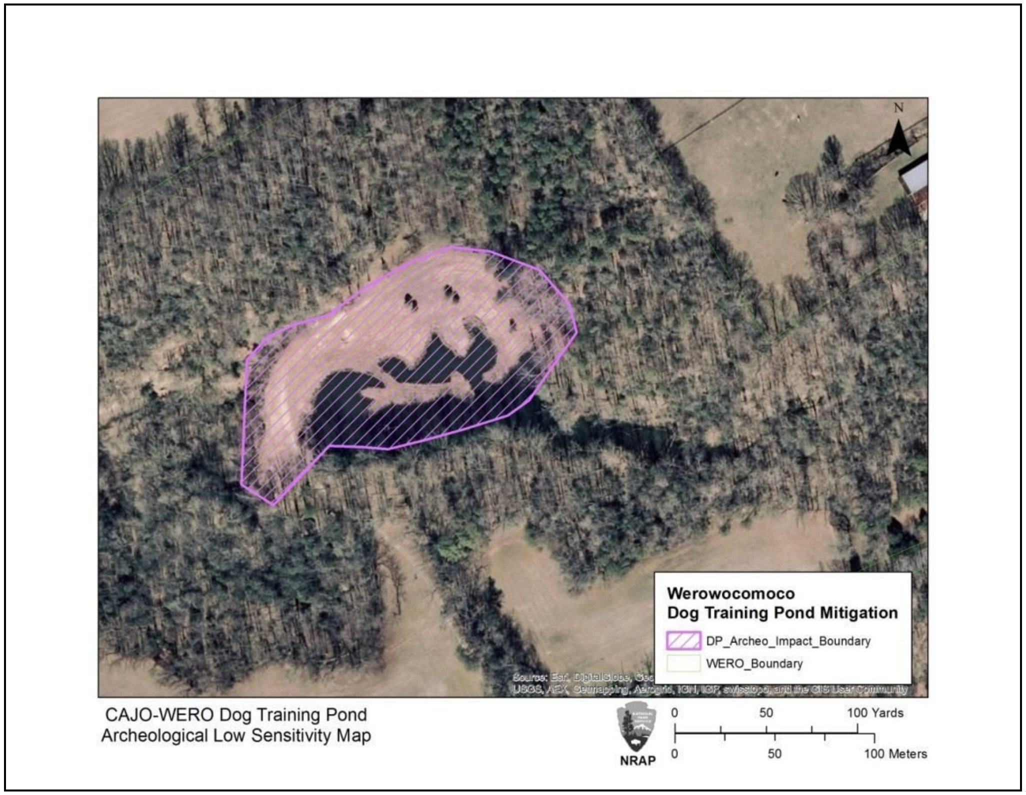


Figure 17 Area of low archaeological sensitivity that does not require archaeological monitoring.

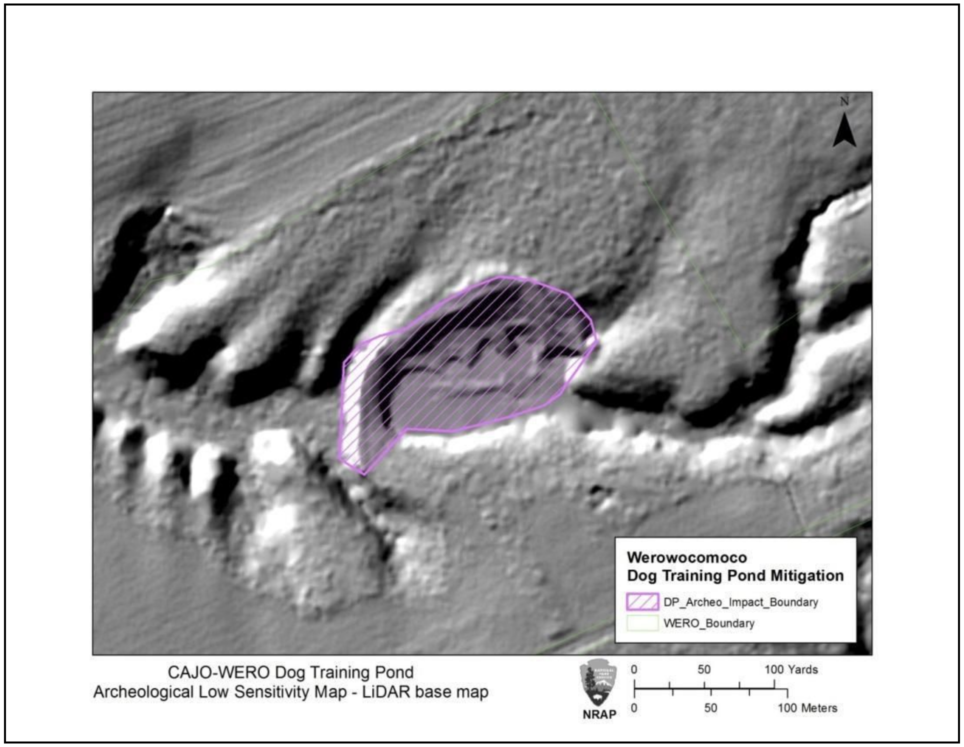


Figure 18 Area of low archaeological sensitivity that does not require archaeological monitoring overlain on bare earth LiDAR base map.

Results of Wetland Delineation

Soils

Recommendations for Restoration (in progress)

David recommended perform archaeology on the stream bed now because the water level on 9/22/2017 was the lowest he has ever seen it. He has known Bob Ripley for years.

The Rapid Assessment Team found this property to be in good shape with respect to natural resources. It has had heavy use in the immediate past agriculture (80+ years from referenced aerial maps). Where the forest has regenerated there is a diversity in tree species (mixed loblolly and hardwoods: beech, oak, tulip maple with sweet gum and sycamore in the wetter areas), diverse canopy height (in most areas) and evidence of regeneration and an herbaceous layer (mostly). Although there are a few invasive plant species present, they are controllable at this stage and the forested areas look healthy and without visual evidence of disease.

The herbaceous layer in the forest floor in not particularly diverse as expected with a closed canopy, but several fern species are present in wetter areas and a herbaceous layer exists in canopy gaps. There is a very diverse bird community that could be enhanced with a meadow restoration. Waterways look healthy and there is evidence of shellfish, crustaceans, and an active small mammal population. Snapping and box turtles.

As a more rural area there are periods of quiet and natural soundscape, however military instillations nearby punctuate the soundscape with load low flying aircraft and artillery noise.

There were deer seen on the property and evidence of browse activity but this was limited.

Is any of the land in ag? Much of this was plowed. Current open areas are mowed. These are weedy species and opportunities for a sustainable diverse native species meadow management plan could exist in the future.

Is there habitat connectivity? Limits to forested areas. Waterways, tidal salt marshes yes.

Are there physical barriers to habitat connectivity? Development

Are there steep, fractured, rocky slopes? Some embankments are steep and subject to erosions

Are there powerlines, or utility right of ways? Residential powerline along center drive.

Are there indications of past historical use (e.g., relic orchards, hedgerows, horticultural species)? Yes there are old fruit trees and evidence of horticultural species (lilies, crepe myrtle) around old home sites.

Could there be beneficial night sky/natural sound resources? Yes

Flooding / Coastal Erosion

There is an area of clear cut up to the bluff edge outside of the property. The cause of action unknown but it could be due to development (housing) in desire of a view. Erosion in this area (not NPS) may impact waterways.

Are there channels with flowing water? Yes. Rivers and wet drainage areas in forested areas and Tidal marshes along property edges are close to cultural sites, but overflow from upland areas does not appear to threaten the cultural or visitor resources. The shoreline areas are very threatened an in many areas erosion is evident. Rip rap was placed along some of the shoreline. Though this is somewhat contradicted by the following statement: "Are there indications of erosion or frequent flooding that threaten park structures? Yes. Tidal marsh areas and beaver activity."

riprapped York River waterfront

At least part of the historic Werowocomoco village site already is under the York River due to coastal erosion. Where water has undercut the riverbank, shell and other materials of site occupation are visible and exposed. Life tenant Bob Ripley feels that about 15' of the shoreline was destroyed in the last big storm.

Rip rap was recently added to the shoreline, but this is not a permanent fix, and only moves the problem downstream. Careful documentation and analysis by coastal hydrologists will be necessary to develop a long-term management strategy as the shore continues to recede. Given the rapidity of climate change and sea level rise, this is another significant, priority challenge for the park that has been referenced in the attached sections.

Riparian Buffer Zones

These areas are in place and protected under easement; subject to Chesapeake Watershed setbacks. Some along shore, but limited 3-10 meters, these should be widened as much as possible. Some of the area has been replanted in marsh grass. There is often a steep bank or areas where it has been undercut. The bank edge is forested and has shrubs, many of them may collapse with additional erosion. There are areas where buffer is missing.


Appendix: Soils Notes

20—Ochraquults, nearly level

Map Unit Setting

- *National map unit symbol:* 3zs6
- *Mean annual precipitation:* 40 to 55 inches
- *Mean annual air temperature:* 57 to 61 degrees F
- *Frost-free period:* 165 to 196 days
- *Farmland classification:* Not prime farmland

Map Unit Composition

- *Ochraquults and similar soils:* 95 percent
- *Estimates are based on observations, descriptions, and transects of the mapunit.*

Description of Ochraquults

Setting

- *Landform:* Flats
- *Landform position (three-dimensional):* Tread
- *Down-slope shape:* Linear
- *Across-slope shape:* Linear
- *Parent material:* Marine deposits

Typical profile

- *H1 - 0 to 12 inches:* fine sandy loam
- *H2 - 12 to 72 inches:* loam

Properties and qualities

- *Slope:* 0 to 2 percent
- *Depth to restrictive feature:* More than 80 inches
- *Natural drainage class:* Poorly drained
- *Runoff class:* Low
- *Capacity of the most limiting layer to transmit water (Ksat):*Moderately high to high (0.57 to 1.98 in/hr)
- *Depth to water table:* About 0 to 12 inches
- *Frequency of flooding:* None
- *Frequency of ponding:* None
- *Available water storage in profile:* High (about 9.5 inches)

Interpretive groups

- *Land capability classification (irrigated):* None specified
- *Land capability classification (nonirrigated):* 4w
- *Hydrologic Soil Group:* B/D
- *Hydric soil rating:* Yes

6—Eunola fine sandy loam

Map Unit Setting

- *National map unit symbol:* 3zt0
- *Elevation:* 120 to 450 feet
- *Mean annual precipitation:* 40 to 55 inches
- *Mean annual air temperature:* 57 to 61 degrees F
- *Frost-free period:* 165 to 196 days
- *Farmland classification:* All areas are prime farmland

Map Unit Composition

- *Eunola and similar soils:* 75 percent
- *Minor components:* 3 percent
- *Estimates are based on observations, descriptions, and transects of the mapunit.*

Description of Eunola

Setting

- *Landform:* Marine terraces
- *Landform position (three-dimensional):* Tread
- *Down-slope shape:* Convex
- *Across-slope shape:* Convex
- *Parent material:* Marine deposits

Typical profile

- *H1 - 0 to 9 inches:* fine sandy loam
- *H2 - 9 to 63 inches:* sandy clay loam

Properties and qualities

- *Slope:* 0 to 2 percent
- *Depth to restrictive feature:* More than 80 inches
- *Natural drainage class:* Moderately well drained
- *Runoff class:* Very low
- *Capacity of the most limiting layer to transmit water (Ksat):* Moderately high to high (0.57 to 1.98 in/hr)
- *Depth to water table:* About 18 to 30 inches
- *Frequency of flooding:* None
- *Frequency of ponding:* None
- *Available water storage in profile:* Moderate (about 8.4 inches)

Interpretive groups

- *Land capability classification (irrigated):* None specified
- *Land capability classification (nonirrigated):* 2w
- *Hydrologic Soil Group:* C
- *Hydric soil rating:* No

Minor Components

Ochraquults

- *Percent of map unit:* 3 percent
- *Landform:* Flats
- *Landform position (three-dimensional):* Tread
- *Down-slope shape:* Linear
- *Across-slope shape:* Linear
- *Hydric soil rating:* Yes

14B—Kenansville loamy fine sand, 0 to 4 percent slopes

Map Unit Setting

- *National map unit symbol:* 3zrz
- *Mean annual precipitation:* 40 to 55 inches
- *Mean annual air temperature:* 57 to 61 degrees F
- *Frost-free period:* 165 to 196 days
- *Farmland classification:* Not prime farmland

Map Unit Composition

- *Kenansville and similar soils:* 85 percent
- *Estimates are based on observations, descriptions, and transects of the mapunit.*

Description of Kenansville

Setting

- *Landform:* Marine terraces
- *Landform position (three-dimensional):* Tread
- *Down-slope shape:* Convex
- *Across-slope shape:* Convex
- *Parent material:* Marine deposits

Typical profile

- *H1 - 0 to 29 inches:* loamy fine sand
- *H2 - 29 to 54 inches:* sandy loam
- *H3 - 54 to 60 inches:* loamy sand

Properties and qualities

- *Slope:* 0 to 4 percent
- *Depth to restrictive feature:* More than 80 inches
- *Natural drainage class:* Well drained
- *Runoff class:* Negligible
- *Capacity of the most limiting layer to transmit water (Ksat):* Moderately high to high (0.57 to 5.95 in/hr)
- *Depth to water table:* More than 80 inches
- *Frequency of flooding:* None
- *Frequency of ponding:* None
- *Available water storage in profile:* Low (about 5.2 inches)

Interpretive groups

- *Land capability classification (irrigated):* None specified
- *Land capability classification (nonirrigated):* 2s
- *Hydrologic Soil Group:* A
- *Hydric soil rating:* No

9D—Hapludults, steep

Map Unit Setting

- *National map unit symbol:* 3zt4
- *Mean annual precipitation:* 40 to 55 inches
- *Mean annual air temperature:* 57 to 61 degrees F
- *Frost-free period:* 165 to 196 days
- *Farmland classification:* Not prime farmland

Map Unit Composition

- *Hapludults and similar soils:* 90 percent
- *Estimates are based on observations, descriptions, and transects of the mapunit.*

Setting

- *Landform:* Marine terraces
- *Landform position (three-dimensional):* Riser
- *Down-slope shape:* Convex
- *Across-slope shape:* Convex
- *Parent material:* Marine deposits

Typical profile

- *H1 - 0 to 8 inches:* fine sandy loam
- *H2 - 8 to 41 inches:* fine sandy loam
- *H3 - 41 to 70 inches:* sandy loam

Properties and qualities

- *Slope:* 15 to 30 percent
- *Depth to restrictive feature:* More than 80 inches
- *Natural drainage class:* Moderately well drained
- *Runoff class:* Very high
- *Capacity of the most limiting layer to transmit water (Ksat):* Very low to moderately high (0.00 to 0.57 in/hr)
- *Depth to water table:* More than 80 inches
- *Frequency of flooding:* None
- *Frequency of ponding:* None
- *Available water storage in profile:* Moderate (about 9.0 inches)

Interpretive groups

- *Land capability classification (irrigated):* None specified
- *Land capability classification (nonirrigated):* 4e

- *Hydrologic Soil Group:* B
- *Hydric soil rating:* No

20—Ochraquults, nearly level

Map Unit Setting

- *National map unit symbol:* 3zs6
- *Mean annual precipitation:* 40 to 55 inches
- *Mean annual air temperature:* 57 to 61 degrees F
- *Frost-free period:* 165 to 196 days
- *Farmland classification:* Not prime farmland

Map Unit Composition

- *Ochraquults and similar soils:* 95 percent
- Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Ochraquults

Setting

- *Landform:* Flats
- *Landform position (three-dimensional):* Tread
- *Down-slope shape:* Linear
- *Across-slope shape:* Linear
- *Parent material:* Marine deposits

Typical profile

- *H1 - 0 to 12 inches:* fine sandy loam
- *H2 - 12 to 72 inches:* loam

Properties and qualities

- *Slope:* 0 to 2 percent
- *Depth to restrictive feature:* More than 80 inches
- *Natural drainage class:* Poorly drained
- *Runoff class:* Low
- *Capacity of the most limiting layer to transmit water (Ksat):*Moderately high to high (0.57 to 1.98 in/hr)
- *Depth to water table:* About 0 to 12 inches
- *Frequency of flooding:* None
- *Frequency of ponding:* None
- *Available water storage in profile:* High (about 9.5 inches)

Interpretive groups

- *Land capability classification (irrigated):* None specified
- *Land capability classification (nonirrigated):* 4w
- *Hydrologic Soil Group:* B/D
- *Hydric soil rating:* Yes

27D—Psamments-Hapludults complex, steep

Map Unit Setting

- *National map unit symbol:* 3zsg
- *Elevation:* 30 to 170 feet
- *Mean annual precipitation:* 40 to 55 inches
- *Mean annual air temperature:* 57 to 61 degrees F
- *Frost-free period:* 165 to 196 days
- *Farmland classification:* Not prime farmland

Map Unit Composition

- *Psamments and similar soils:* 50 percent
- *Hapludults and similar soils:* 30 percent
- *Minor components:* 5 percent
- *Estimates are based on observations, descriptions, and transects of the mapunit.*

Description of Psamments

Setting

- *Landform:* Marine terraces
- *Landform position (three-dimensional):* Riser
- *Down-slope shape:* Convex
- *Across-slope shape:* Convex
- *Parent material:* Marine deposits

Typical profile

- *H1 - 0 to 6 inches:* fine sand
- *H2 - 6 to 60 inches:* sand

Properties and qualities

- *Slope:* 15 to 50 percent
- *Depth to restrictive feature:* More than 80 inches
- *Natural drainage class:* Moderately well drained
- *Runoff class:* Low
- *Capacity of the most limiting layer to transmit water (Ksat):* High to very high (5.95 to 19.98 in/hr)
- *Depth to water table:* About 24 to 36 inches
- *Frequency of flooding:* None
- *Frequency of ponding:* None

- *Available water storage in profile:* Low (about 3.7 inches)

Interpretive groups

- *Land capability classification (irrigated):* None specified
- *Land capability classification (nonirrigated):* 7e
- *Hydrologic Soil Group:* A
- *Hydric soil rating:* No

Description of Hapludults

Setting

- *Parent material:* Marine deposits

Typical profile

- *H1 - 0 to 8 inches:* fine sandy loam
- *H2 - 8 to 41 inches:* fine sandy loam
- *H3 - 41 to 70 inches:* stratified sandy loam to sandy clay loam

Properties and qualities

- *Slope:* 15 to 50 percent
- *Depth to restrictive feature:* More than 80 inches
- *Natural drainage class:* Moderately well drained
- *Runoff class:* Very high
- *Capacity of the most limiting layer to transmit water (Ksat):* Very low to moderately high (0.00 to 0.57 in/hr)
- *Depth to water table:* About 18 to 36 inches
- *Frequency of flooding:* None
- *Frequency of ponding:* None
- *Available water storage in profile:* Moderate (about 9.0 inches)

Interpretive groups

- *Land capability classification (irrigated):* None specified
- *Land capability classification (nonirrigated):* 7e
- *Hydrologic Soil Group:* B/D
- *Hydric soil rating:* No

Minor Components

Lumbee

- *Percent of map unit:* 5 percent
- *Landform:* Flats
- *Landform position (three-dimensional):* Tread
- *Down-slope shape:* Linear
- *Across-slope shape:* Linear
- *Hydric soil rating:* Yes

30—Sulfaquents, frequently flooded

Map Unit Setting

- *National map unit symbol:* 3zsq
- *Mean annual precipitation:* 40 to 55 inches
- *Mean annual air temperature:* 57 to 61 degrees F
- *Frost-free period:* 165 to 196 days
- *Farmland classification:* Not prime farmland

Map Unit Composition

- *Sulfaquents and similar soils:* 90 percent
- *Minor components:* 10 percent
- *Estimates are based on observations, descriptions, and transects of the mapunit.*

Description of Sulfaquents

Setting

- *Landform:* Salt marshes
- *Landform position (three-dimensional):* Tread
- *Down-slope shape:* Linear
- *Across-slope shape:* Linear
- *Parent material:* Marine deposits

Typical profile

- *H1 - 0 to 20 inches:* mucky silty clay loam
- *H2 - 20 to 60 inches:* mucky silty clay
- *H3 - 60 to 80 inches:* mucky silty clay loam

Properties and qualities

- *Slope:* 0 to 2 percent
- *Depth to restrictive feature:* More than 80 inches
- *Natural drainage class:* Very poorly drained
- *Runoff class:* Negligible
- *Capacity of the most limiting layer to transmit water (Ksat):* Very low to moderately low (0.00 to 0.06 in/hr)
- *Depth to water table:* About 0 inches
- *Frequency of flooding:* Very frequent
- *Frequency of ponding:* None
- *Available water storage in profile:* High (about 9.6 inches)

Interpretive groups

- *Land capability classification (irrigated):* None specified
- *Land capability classification (nonirrigated):* 8w
- *Hydrologic Soil Group:* D
- *Hydric soil rating:* Yes

Minor Components

Fluvaquents

- *Percent of map unit:* 10 percent
- *Landform:* Flood plains

- *Landform position (three-dimensional):* Tread
- *Down-slope shape:* Linear
- *Across-slope shape:* Linear
- *Hydric soil rating:* Yes

W—Water

Map Unit Setting

- *National map unit symbol:* 3zt6
- *Mean annual precipitation:* 40 to 55 inches
- *Mean annual air temperature:* 57 to 61 degrees F
- *Frost-free period:* 165 to 196 days
- *Farmland classification:* Not prime farmland

Map Unit Composition

- *Water:* 100 percent
- *Estimates are based on observations, descriptions, and transects of the mapunit.*