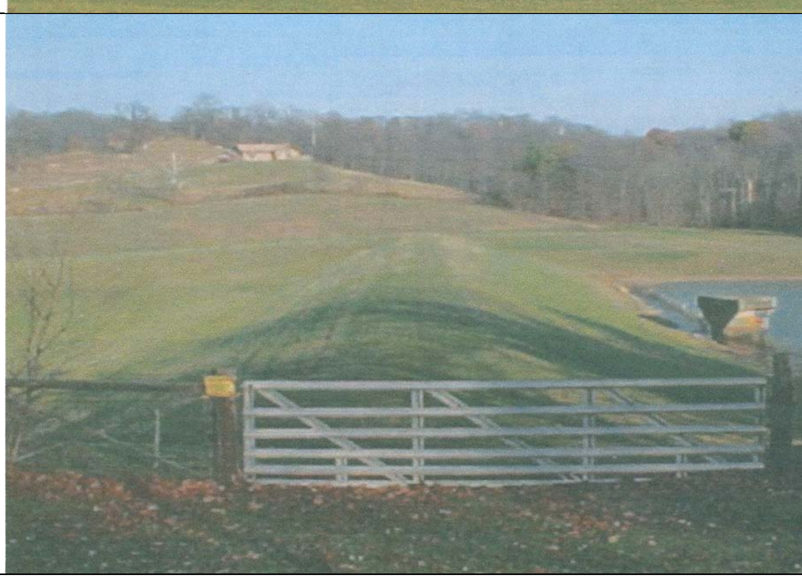
Rehabilitation Assessment Report
Margaret Creek Site 1 – Meeks Lake
Athens County, Ohio

	Aerial View
	Looking West from Auxiliary Spillway to Pool and Dam Embankment.
	Looking East from Hebbardsville Road (County Road 19) toward Principal Spillway Riser and Dam Embankment with Auxiliary Spillway in the background.

Prepared by: Natural Resources Conservation Service
Columbus, Ohio
September 2010

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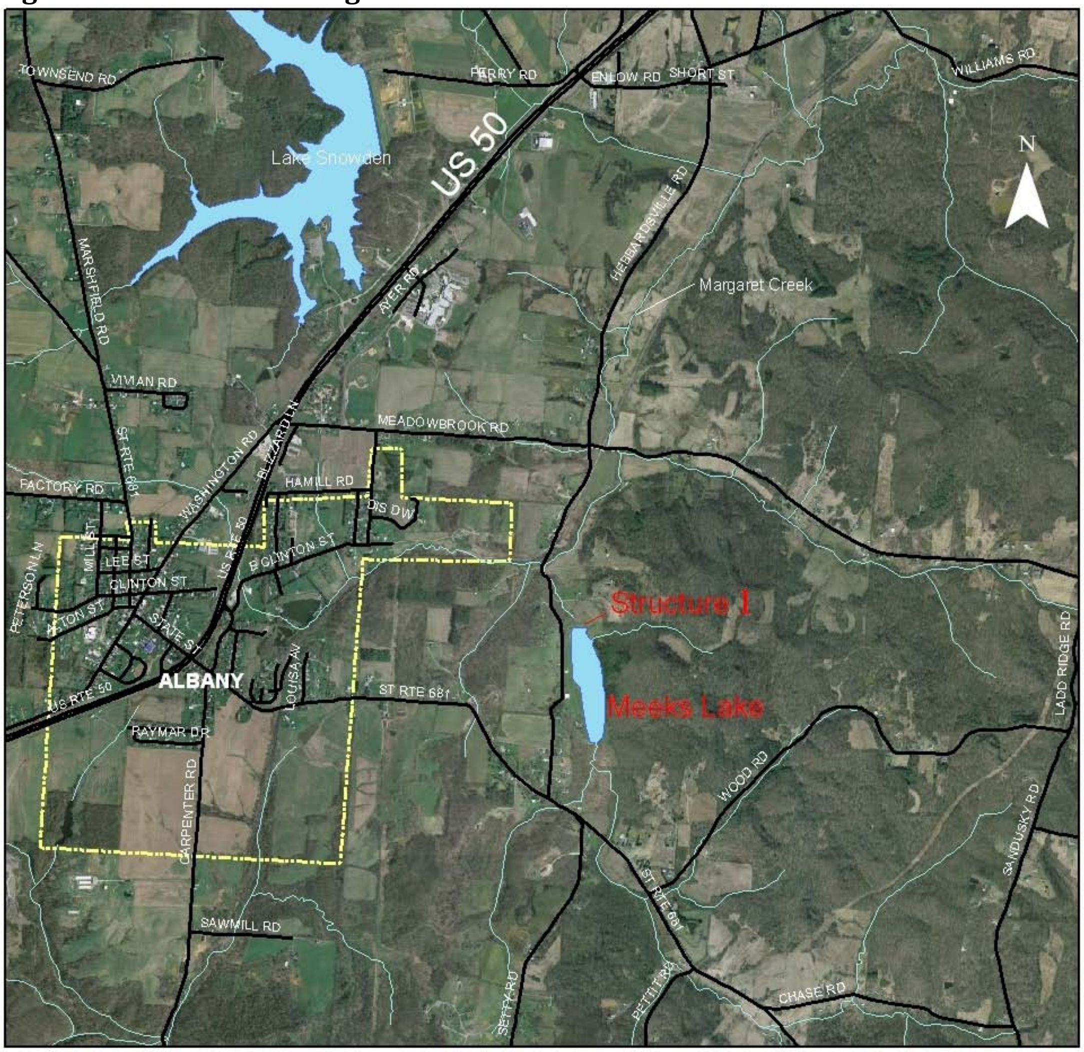
Project Location

Margaret Creek Site 1 (Meeks Lake) is the furthest upstream flood control structure of a total of 5 structures on Margaret Creek and is located 1 mile east of Albany, Ohio and 8 miles southwest of Athens, Ohio. Margaret Creek has a total drainage area of 38,400 acres and flows into the Hocking River in the City of Athens, county seat of Athens County.

Figure 1 – Location of Margaret Creek Site 1



Description of Margaret Creek Site 1

Meeks Lake dam is a flood control structure built in 1972 and is owned and operated by the Margaret Creek Conservancy District, subdistrict of the Hocking Conservancy District. Site 1 has a permanent pool of 17 acres and a total watershed area of 3.5 square miles.

The dam is 32 feet high above the channel bottom and approximately 500 feet long. It has a 14 foot top width, 3 to 1 horizontal to vertical slope on the upstream side and the downstream slope is 2 ½ to 1. The principal spillway is a 36 inch reinforced concrete pressure pipe with a reinforced concrete riser with a standard covered top. The principal spillway will pass approximately 172 cfs and 196 cfs at the crest of the auxiliary spillway (716.4, NAVD'88) and at the top of dam (723.4, NAVD'88), respectively. The auxiliary earth spillway is 120 feet wide, 3 to 1 side slopes, with a 30 foot long control section and passes about 6,740 cfs at the top of dam elevation.

In addition to the sediment storage, the dam provides 404 acre-feet of floodwater retarding volume below the auxiliary spillway crest. The National Inventory of Dams (NID) number is OH00960.

Sponsors of Margaret Creek Watershed

The Margaret Creek Watershed sponsors include the Margaret Creek Conservancy District, subdistrict of the Hocking Conservancy District. Also serving as sponsors are the Athens Soil and Water Conservation District and the Athens County Board of Commissioners, the Village of Albany and the State of Ohio.

Plan View

Figure 2 – Plan View of Existing Meeks Lake Dam and Auxiliary Spillway

Brief History and Existing Condition

The original Watershed Work Plan for the Margaret Creek Watershed was developed by the Natural Resources Conservation Service (then Soil Conservation Service in 1966.) Margaret Creek 1 is one of five floodwater-retarding structures built within the Margaret Creek watershed from 1967 to 1972 under the authority of the Watershed Protection and Flood Prevention Act (Public Law 566, 83rd Congress). Margaret Creek 1 was constructed in 1972.

Meeks Lake dam was designed as a "Significant" hazard class dam (old Class "B") for the single purpose of flood control. It included capacity for 100 years of sediment accumulation (148 Ac. Ft.) with half allocated to the permanent pool and half to the flood pool.

The structure is in overall good condition. Meeks Lake is used by its owner for recreation in the form of a water ski school. The auxiliary spillway has seldom, if ever, flowed. The top of the principal spillway riser was submerged but the auxiliary had no flow during the 5 inch rain of Hurricane Ivan September 17-18, 2004. Likewise there was no auxiliary flow during the 5+ inch rainfall of Hurricane Frances 9 days earlier.

Hazard Classification

Meeks Lake dam was originally designed and constructed in 1972 as a "significant" hazard structure. It originally protected agricultural flood plain and had a county road about 0.6 miles downstream and another two railroad crossings within another 0.8 miles. No loss of life was envisioned if the dam were to fail.

The ODNR, Division of Water, Dam Safety Engineering, has regulatory responsibility for dam safety in Ohio. Due to development in the downstream floodplain, ODNR re-classified the dam in 1990 to a high hazard class structure. Today, a house sits about 550 feet directly downstream of the dam and two additional dwellings also lie within the breach inundation area within 0.6 miles downstream of the dam where probable loss of human life could occur from a dam failure. Some 7 additional houses also are in the breach inundation area that could suffer damages. The ODNR latest inventory sheet shows they last inspected the dam on 5/23/2007. ODNR Dam Safety and NRCS criteria require high hazard structures to safely pass 100% of the Probable Maximum Flood (PMF). From ODNR calculations, in its existing condition, the PMF would overtop the dam for 1.3 hours at a maximum depth of 1.9 feet. As described in the Breach Analysis section below, NRCS concurs with this reclassification of Meeks Lake's hazard class. A revised breach inundation map is included at the end of this assessment. An Emergency Action Plan is on file with the ODNR for this structure.

Status of Operation and Maintenance

The Margaret Creek Conservancy District (MCCD) performs the Operation and Maintenance (O&M) on Meeks Lake dam as part of their O&M responsibility for the four dams in the watershed. Their maintenance agreement for Margaret Creek site 1 was signed on July 12, 1972 and expires in 2072. The conservancy district performs the required annual inspections and NRCS has assisted with these annual inspections. Additional inspections are performed by the Hocking Conservancy District/Margaret Creek Conservancy Sub-district after heavy rainfall events or other special situations. The ODNR, Division of Dam Safety, inspects the dam on a 5 year rotation schedule with the last inspection occurring on 5/23/2007. Items noted in the most recent ODNR inspection include the following: The owner must monitor the flow and condition of the toe drains monthly for any signs of increase flow, muddy flow, or instability on or adjacent to the embankment and remove the vegetation from the concrete slabs adjacent to the stilling basin. During the annual inspection in April 2010 the following was noted: 1) Foundation drain partly submerged and rodent guard missing. 2) Outlet channel partly obstructed. 3) Some fence repair needed.

Rehabilitation Needs

The rehabilitation of Site 1, Meeks Lake dam, is concentrated on the need to upgrade the dam to meet ODNR and NRCS high hazard criteria. No other structural items of major concern are noted about this dam. The rehabilitation program requires that the useful life of the structure must be extended beyond the original evaluated life. The evaluated life for Margaret Creek 1 must extend past the year 2072. General rehabilitation work would include:

1. Modify the dam and auxiliary spillway to safely pass or contain the larger runoff from the rainfall required for design of a high hazard structure. This may consist of raising the dam and/or widening the emergency spillway, adding a roller compacted concrete (RCC) chute spillway through the dam, or combinations of these.
2. Ensure that appurtenant structures (riser tower, internal drains, etc.) meet current NRCS and State Dam Safety criteria.
3. Ensure that the sediment pool has a minimum sediment storage capacity that matches the rehabilitated evaluation life period.

Eligibility for Dam Rehabilitation Program

Margaret Creek Site 1 is eligible for NRCS assistance authorized under the Rehabilitation provisions (PL 106-472) of the Small Watershed Program (PL 566). Funding for rehabilitation is based upon a priority ranking system, which considers the potential for dam failure and the potential consequences of dam failure. High hazard structures are given a higher ranking for funding than low hazard structures. A completed Evaluation of Potential Rehabilitation Projects spreadsheet is included in Attachment B of this report.

The Sponsors of the potential rehabilitation project should be aware that additional landrights might be required for construction. The Sponsors are responsible for paying this cost but this cost can be included in the total project cost of the rehabilitation project.

The rehabilitation provisions of the PL 106-472 can provide 65% of the total rehabilitation cost, but shall not exceed 100% of the actual construction costs incurred in the rehabilitation. Total rehabilitation cost for the project shall include all costs associated with all components of the project, including acquisition of land, easements, rights-of-way, project administration, non-Federal technical assistance (TA), non-structural measures, contracting, and construction. The cost of TA provided by NRCS shall not be considered part of the total cost of the rehabilitation project. If the Sponsors provide or otherwise obtain TA for planning, design, and/or construction, the TA cost is included in the computation of total cost of the rehabilitation project. The Sponsor is responsible for the cost of all water, mineral, and other resource rights and all federal, state, and local permits, which are not considered part of the total cost of the rehabilitation project. The Sponsors' 35% can be in the form of cash, in-kind services, the value of land rights in addition to those acquired for the current project, or any combination of these items.

Potential for Addressing Other Resource Needs

If rehabilitation is pursued, the Sponsors will have the opportunity to investigate the addition of other purposes to the site. There are no known additional resource needs at this time.

Potential Scope of the Rehabilitation Project

Hydrology and Hydraulics Background – With its existing spillways, the dam would need to be about 5.5 feet taller to pass the PMF without overtopping. A number of combinations of widening the auxiliary spillway and raising the dam could provide the necessary modifications to safely pass the PMF event. The following table summarizes the combinations as determined from running the Sites 2005.1.4 computer program. The following table also incorporates the necessary raising of the auxiliary spillway crest from 716.4 to 717.4 to meet NRCS criteria of not using a vegetated auxiliary spillway more frequently than the 1% chance storm event for a high hazard structure.

Table 1 - Auxiliary Spillway / Top of Dam Combinations

Auxiliary Spillway B.W.(ft.)	Increase in Spillway Width (ft.)	Required Top of Dam (NAVD-ft.)	Increase In Dam Height (ft)	Alternative Number
120	0	728.9	5.5	N/A
140	20	728.3	4.9	N/A
145	25	728.1	4.7	2
150	30	728.0	4.6	N/A
200	80	726.8	3.4	1
300	180	725.2	1.8	N/A

The 300 foot bottom width was not considered further because it would not fit before hitting an existing house. Further, it would require using a splitter dike which would increase costs. Also, raising the dam without widening the spillway was also not further considered since the flood pool upstream of the structure encroaches on several houses and roads. This upstream flood pool is an obstacle for all alternatives that raise the dam since the existing flood pool already encroaches on two houses.

All elevations referenced in the following discussion of alternatives use the NAVD of 1988 datum.

The following is a discussion of the potential rehabilitation alternatives that exist for the site.

1. **Alternative 1** – This alternative widens the auxiliary spillway from 120 feet to 200 feet and raises the top of dam 3.4 feet to elevation 726.8. Widening the auxiliary spillway to 200 feet is about the maximum feasible from the standpoint of the available room on the right abutment before getting too close to an existing house. Therefore, this alternative minimizes the rise in the top of dam obtainable from widening the existing auxiliary spillway. (There is a county road close by on the left side, opposite the existing auxiliary spillway, which precludes adding a second auxiliary spillway in the left abutment.)

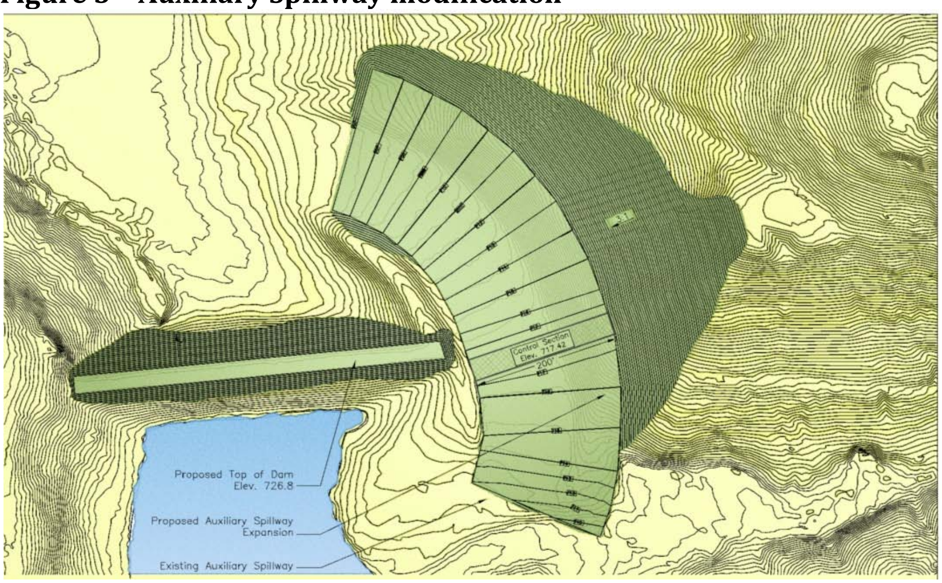
   Approximately 46,000 Cubic Yards (Cu. Yds.) of material would be excavated by widening the spillway. The amount of fill needed to raise the auxiliary spillway 1 foot and raise the dam 3.4 feet amounts to 7,450 Cu. Yds. This leaves over 38,000 Cu. Yds. of excavated material that must be piled or otherwise moved off site.

Raising the top of dam flood pool to 726.8 increases the depth of flooding on the two houses already in the existing top-of-dam flood pool and probably brings two additional houses within the flood pool. It also increases the potential depth of flooding on two county roads and one state highway in the upstream flood pool.

So as not to encroach on the existing pool and principal spillway riser, raising the dam would be accomplished by adding fill to the top of dam and to the downstream slope so as to maintain a 2 ½ to 1, horizontal to vertical, slope on the downstream side of the dam. The impact basin would either have to be moved and the principal spillway pipe extended or it could possibly be protected by adding some walls on the sides and upstream side.

See Table 3 for a summary of alternatives. See Table 4 for the estimated quantities and cost for this alternative.

Figure 3 – Auxiliary Spillway modification



2. **Alternative 2** – This alternative is similar to the first in combining the widening of the auxiliary spillway with raising the dam. It adjusts the combination by balancing the cuts and fills to be approximately equal, resulting in a 145 foot bottom width and a top of dam at elevation 728.1. Thus, this alternative raises the dam by 4.7 feet, 1.3 feet more than alternative 1. The table below shows the summary of cuts and fills for the various combinations. In order to have enough fill material out of the auxiliary spillway, it must be wider than 140 feet. At 145 feet, there is a little cushion of more excavation material than required for fill material.

Table 2 - Alternative to Balance Cut and Fills			
Auxiliary Spillway B.W.(ft.)	Required Top of Dam (NAVD-ft.)	Earthfill for Dam and Aux. Spillway (Cu.Yds.)	Excavation for Auxiliary Spillway (Cu.Yds.)
140	728.3	11,500	10,200
145	728.1	11,100	12,650
150	728.0	10,700	15,100
200	726.8	7,500	46,100

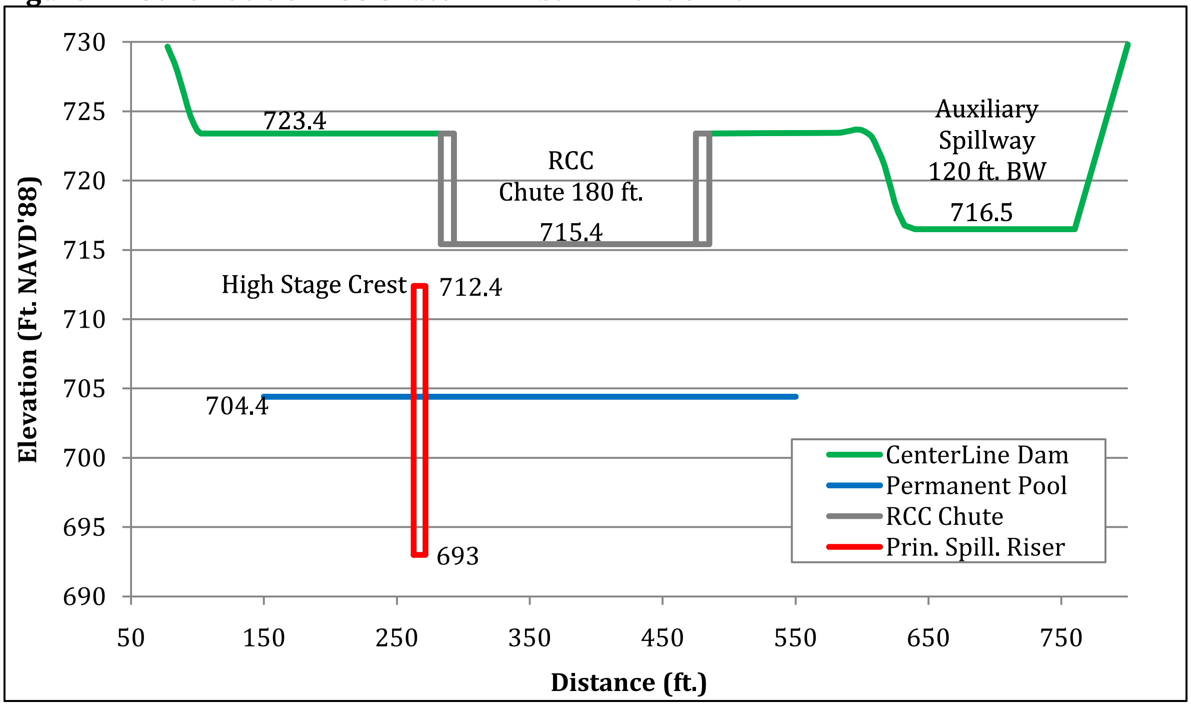
Although this alternative balances cut and fills and thereby reduces cost and removes the need for a large waste area for excavation material, it is burdened with the problems of making the dam taller mentioned in alternative 1. This alternative increases the depth of flooding of 4 homes in the upstream flood pool and the depth of flooding on two county roads and one state highway in the event of a PMF storm. The additional fill on the dam will require extending the principal spillway pipe and replacing the impact basin.

Also, the greater depth of flow in the auxiliary spillway makes armoring of the spillway necessary to achieve stability and integrity during passage of the PMF storm. Significant cost is added to this alternative for RCC or articulated block armoring of the control and exit section of the auxiliary spillway.

See Table 3 for a summary of alternatives. See Table 4 for the estimated quantities and cost for this alternative.

3. **Alternative 3** – This alternative uses a 180 foot wide Roller Compacted Concrete (RCC) chute placed in the existing dam at elevation 715.4 (1 foot below existing auxiliary crest) and thereby removes the need to raise the dam. This width should fit in the embankment on the east side of the principal spillway. This would be an 8 foot deep cut through the existing embankment, with a crest 11 feet above the permanent pool elevation and 3 feet above the principal spillway high stage crest. The existing vegetative auxiliary spillway will remain at 120 foot bottom width although it needs to be raised 0.1 foot to elevation 716.5. (To be able to leave the existing vegetative spillway at its present elevation requires the RCC to be put 0.2 feet lower at elevation 715.2. The downside to lowering the RCC spillway is that it allows greater discharges at lower frequency storms. This could be done but see the related discussion following.)

Figure 4 – Schematic of RCC Chute in Embankment of Dam



The existing dam releases a peak discharge of 173 cfs during a 1% chance design storm of 24-hour duration. The dam modified as in alternative 3 would release 463 cfs from the same storm. This increase appears relatively small so as not to cause flooding of any homes due to this change. A discharge of 463 cfs will not flood the home immediately downstream of the dam. Homes further downstream are subject to a much larger, uncontrolled, drainage area that out sizes the 290 cfs increase from this alternative.

See Table 3 for a summary of alternatives. See Table 4 for the estimated quantities and cost for this alternative.

4. **Alternative 4** – This alternative maintains the existing top of dam elevation by widening the vegetative auxiliary spillway to 200 feet wide (at 0.5 foot higher crest than existing) and adding a 180 foot wide RCC spillway in the existing embankment at elevation 716.4. In other words, no auxiliary spillway is added with a crest below the existing auxiliary spillway elevation of 716.4.

   A 1% chance, 24-hour duration, design storm would discharge 389 cfs through the alternative #4 dam. This is only 74 cfs less than alternative #3 but alternative #3 did not have to widen the vegetative auxiliary spillway and thus had no excavation quantity or need to find a waste disposal area. Thus, it seems alternative #3 would be a much more cost effective choice.

   See Table 3 for a summary of alternatives. See Table 4 for the estimated quantities and cost for this alternative.

Table 3 - Summary of Alternatives

Alternative	Top of dam raised by (ft.)	Auxiliary Crest raised by (ft.)	Auxiliary Spillway widened by (ft.)	RCC weir width (ft.)	RCC weir elevation (ft.NAVD)
1	3.4	1.0	80	N/A	N/A
2	4.7	1.0	25	N/A	N/A
3	0	0.1	0	180	715.4
4	0	0.5	80	180	716.4

Table 4 - Estimated Quantity and Cost Table 1/

Alternative	Estimated Quantities of Major Components	Estimated Total Cost Range for Alternative ($1,000s) 2/
1	Common excavation: 46,100 Cu. Yds. Earthfill: 7,500 Cu. Yds. Principal spillway pipe 20ft extension Replace impact basin	$ 440 – 500
2	Common Excavation: 12,600 Cu. Yds. Earthfill: 11,100 Cu. Yds. RCC for Aux. Spillway: 5,600 Cu. Yds. Principal spillway pipe 20ft extension Replace impact basin	$ 1,070 – 1,230
3	RCC for Chute in embankment: 5,200 Cu. Yds.	$ 770 – 890
4	Common excavation: 46,100 Cu. Yds. Earthfill in Aux. Spillway: 500 Cy. Yds. RCC for Chute in embankment: 5,350 Cu. Yds.	$ 1,110 – 1,270

1/ The quantities and costs are preliminary estimates only.
2/ Estimated cost includes costs for major components plus additional items not detailed in this preliminary estimate. These additional items include such things as unforeseen components, mobilization, clearing and grubbing, topsoiling, seeding, contractor quality control, construction survey, and erosion & sediment control. These non-detailed items were estimated at from 35% to 55% of the estimated total cost of the major components to obtain the estimated range of total cost for each alternative.

Rehabilitation Process

The Sponsors, because Sites 1 and 6 had been reclassified as high hazard dams, sent a letter dated September 27, 2007, requesting NRCS to conduct a rehabilitation assessment of these structures. The assessment for Site 6 (Fox Lake) has already been completed and submitted.

If Site 1 is selected for planning, the site will go through the conventional watershed planning process with consideration and evaluation of all potential alternatives and their impacts (economically, environmentally, socially, etc.). During the planning process, there will be opportunities for public participation and comment.
The estimated time frames for the activities are:

- Planning: 1 year minimum
- Design: 1 year
- Implementation: 1 year

Breach Analysis

A breach analysis for Margaret Creek 1 (Meeks Lake) was conducted to confirm the hazard classification of the dam. A "sunny day" breach was assumed with failure occurring when water reached the auxiliary spillway crest elevation. A "Sunny Day" breach discharge of 13,910 cfs was calculated using NRCS *Technical Release 60 (TR-60)* criteria. This peak discharge was then used to calculate the breach hydrograph using criteria in NRCS *TR-66, Simplified Dam Breach Routing Procedure.* Flood elevations and discharges expected downstream were determined by routing this breach hydrograph downstream of the dam using NRCS *TR-20, Computer Program for Project Formulation, Hydrology.* A breach inundation map is included at the end of this assessment for this Sunny Day breach. From the breach inundation map, three homes are inside the inundation area within the first 0.6 miles downstream of the dam that would have probable loss of life. Some 7 additional houses lie on the edge of the breach inundation area that could also suffer property loss during a breach. There is potential for loss of life in the event of a "Sunny Day" dam failure. Therefore, this breach analysis confirms that Site 1 has been properly reclassified as a high hazard structure, as also concluded by the Ohio DNR, Dam Safety Division.

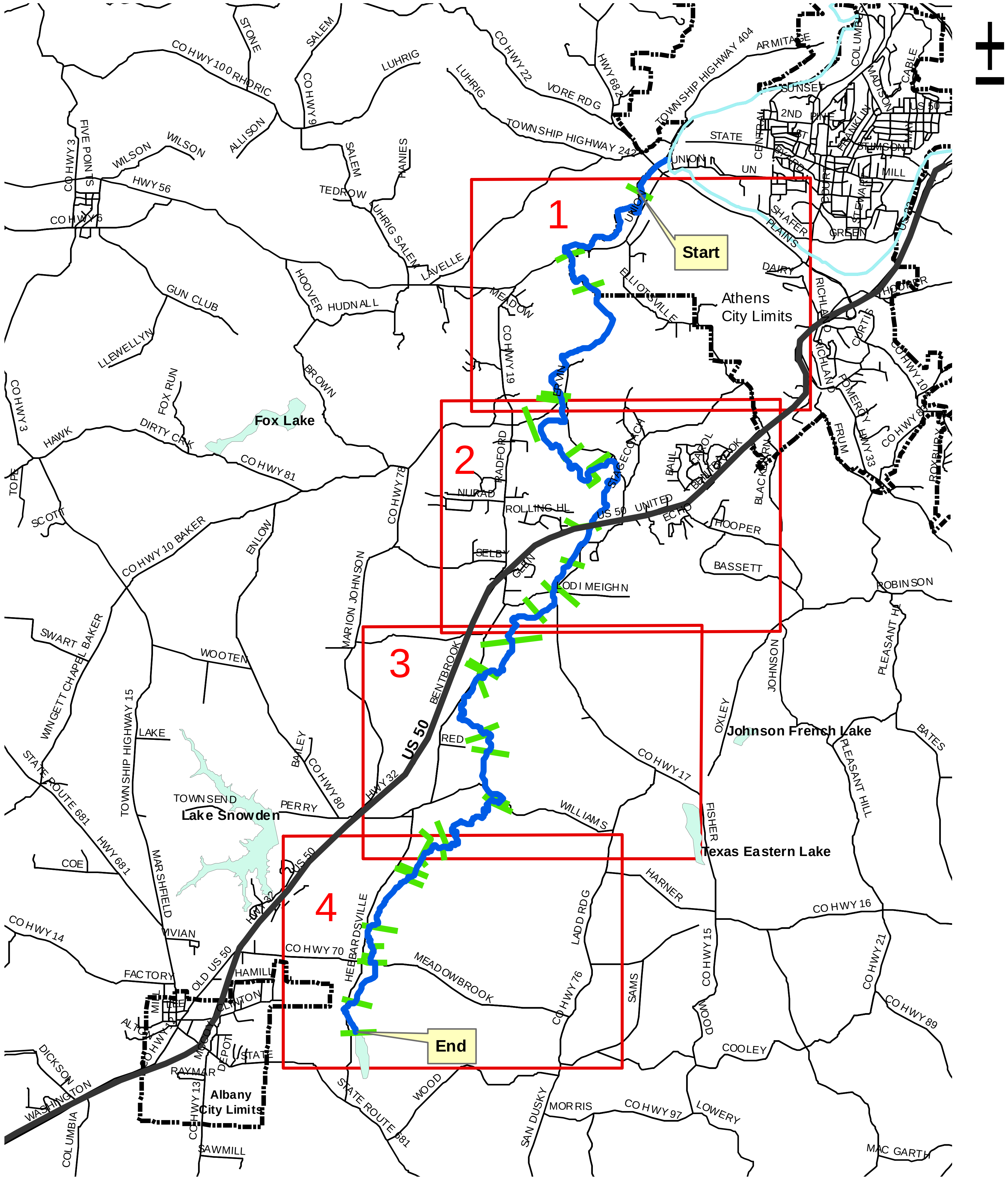
James N. Stafford

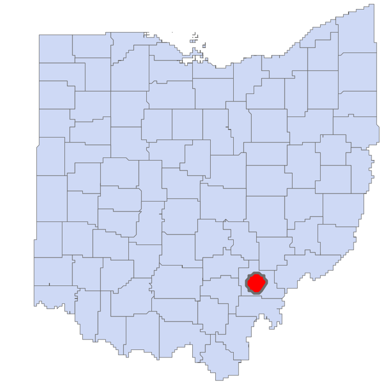
James N. Stafford, P.E.
Hydraulic Engineer

Michael J. Monnin

Michael J. Monnin, P.E.
State Conservation Engineer

Attachment A





Index Sheet

Margaret Creek No. 1
Dam Breach Inundation Map

Athens County Ohio

August 2010

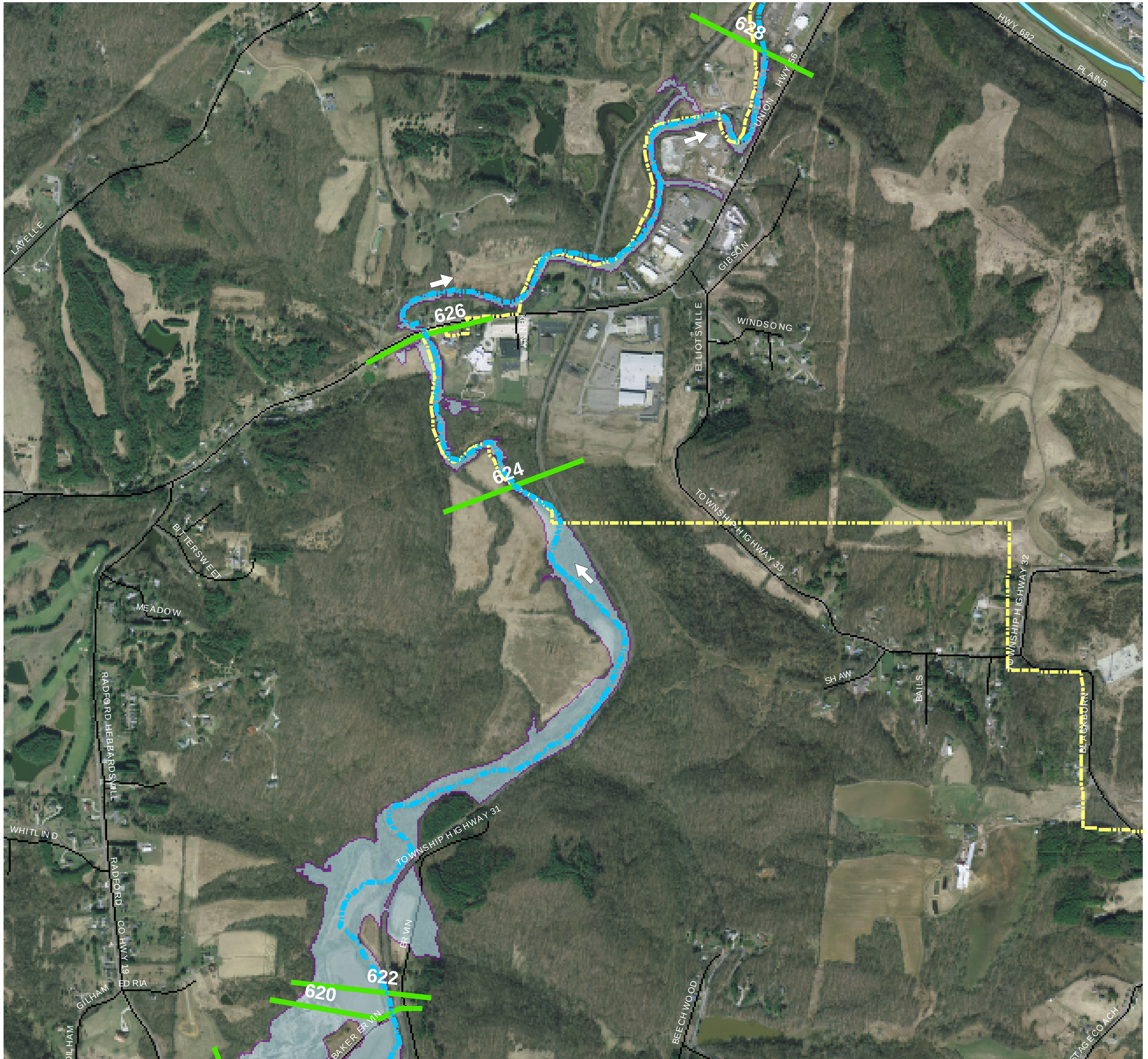
Legend

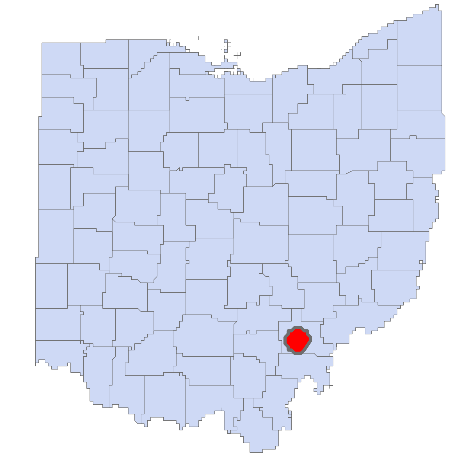
- Sections
- Inundation Area
- Sheet Coverage
- City Boundary
- Hocking River

Natural Resources
Conservation Service

5,000 2,500 0 5,000 10,000 Feet

Attachment A





Sheet 1

Margaret Creek No. 1
Dam Breach Inundation Map

Athens County Ohio

August 2010

Legend

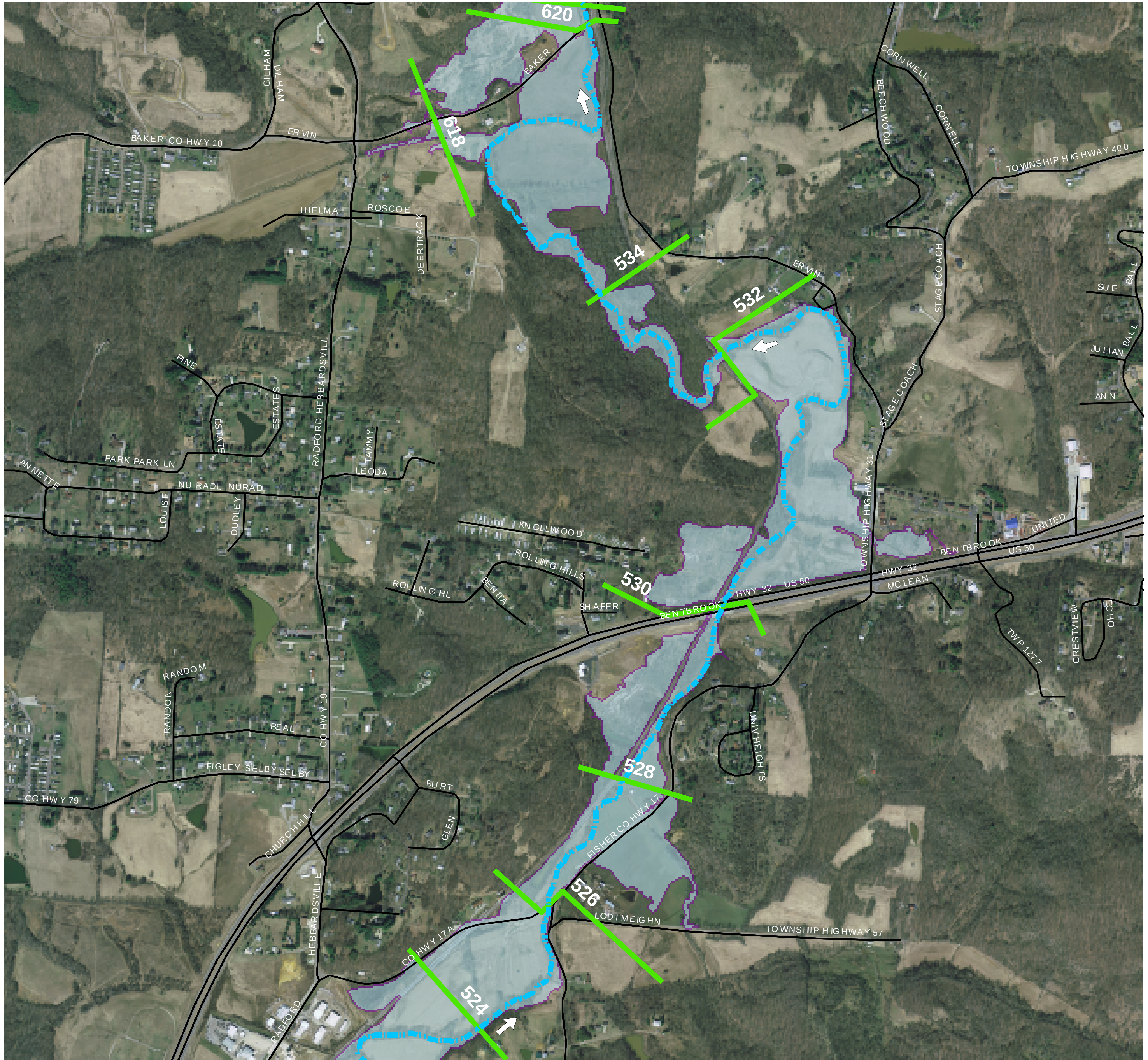
- Flooded Area
- Margaret Creek
- Hocking River
- City Limits
- 100 - Sections

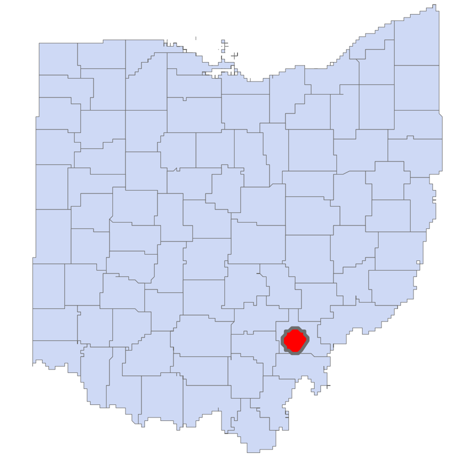
NRCS

Natural Resources Conservation Service

1,000 500 0 1,000 2,000 Feet

Attachment A





Sheet 2

Margaret Creek No. 1
Dam Breach Inundation Map

Athens County Ohio

August 2010

Legend

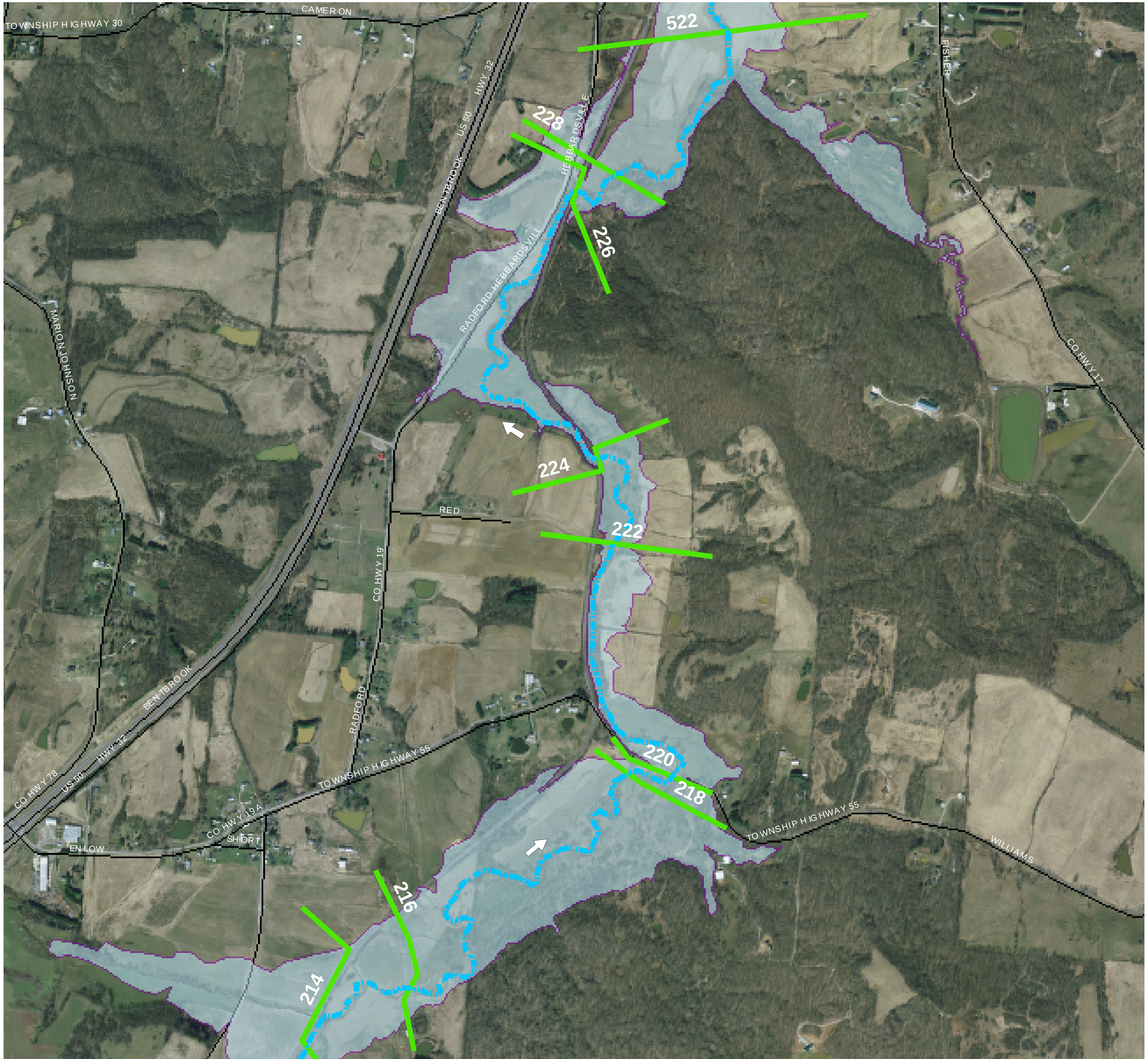
- Flooded Area
- Margaret Creek
- Hocking River
- City Limits
- **100** - Sections

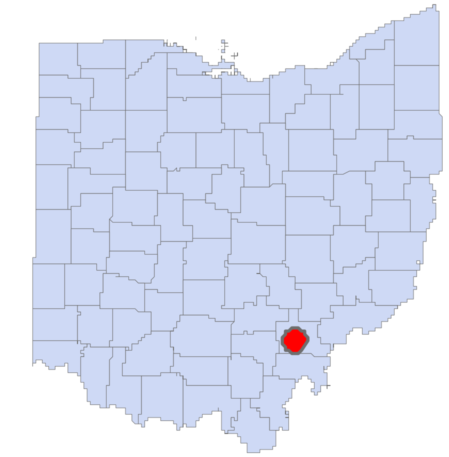
NRCS

Natural Resources
Conservation Service

1,000 500 0 1,000 2,000 Feet

Attachment A





Sheet 3

Margaret Creek No. 1
Dam Breach Inundation Map

Athens County Ohio

August 2010

Legend

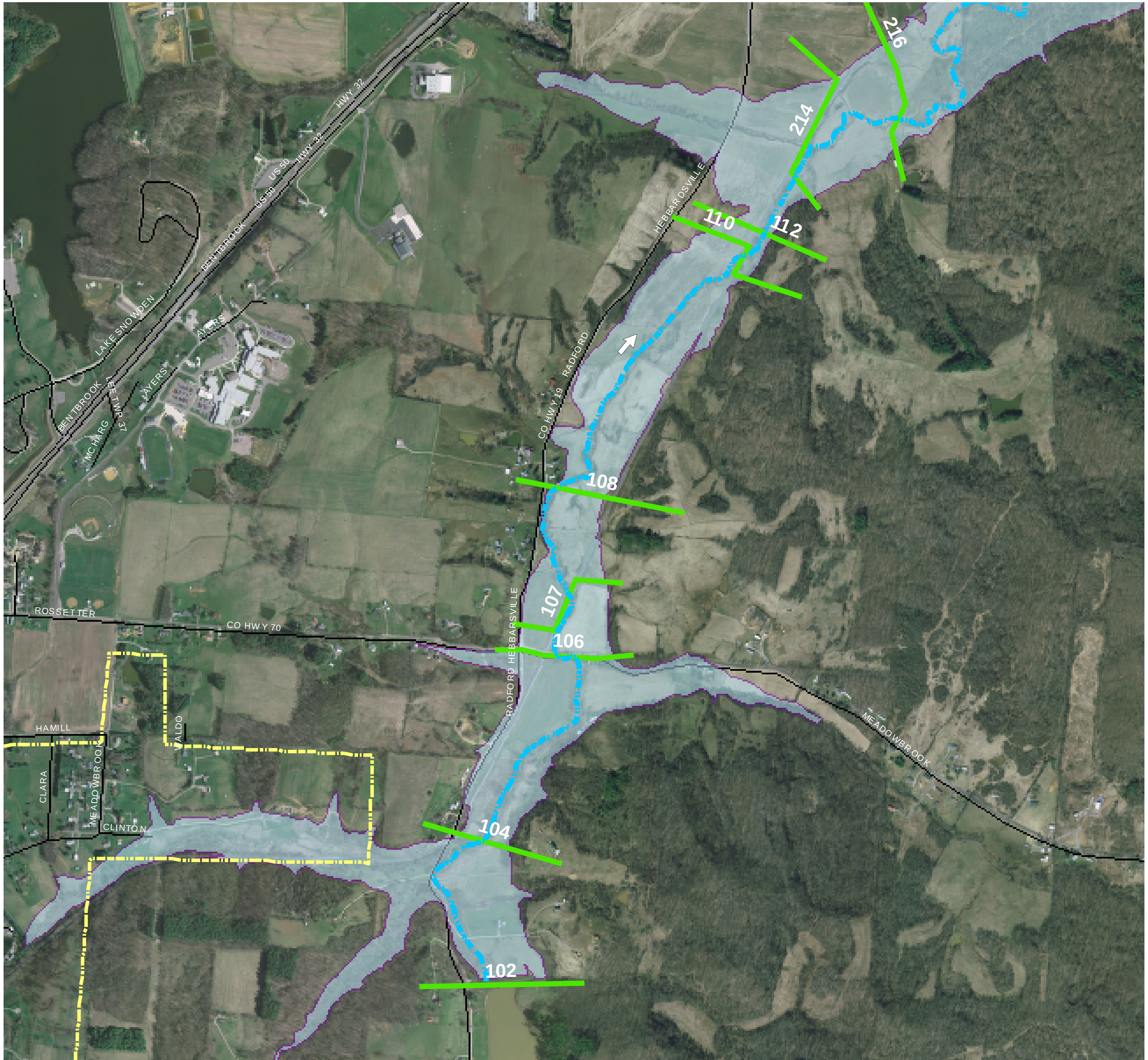
- Flooded Area
- Margaret Creek
- Hocking River
- City Limits
100 - Sections

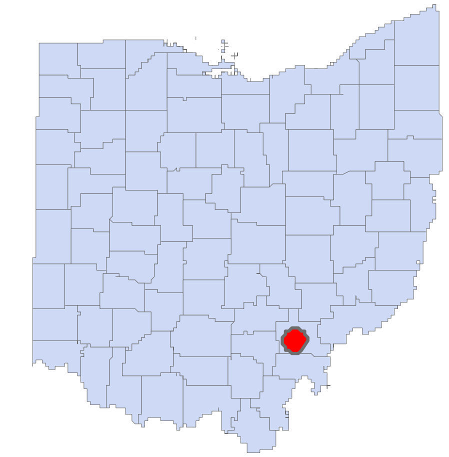
NRCS

Natural Resources
Conservation Service

1,000 500 0 1,000 2,000 Feet

Attachment A





Map 4

Margaret Creek No. 1 Dam Breach Inundation Map

Athens County Ohio

August 2010

Legend

- Flooded Area
- Margaret Creek
- Hocking River
- City Limits
100 - Sections

Natural Resources Conservation Service

1,000 500 0 1,000 2,000 Feet

Attachment B

EVALUATION OF POTENTIAL REHABILITATION PROJECTS								
STATE	OH	**DAM**	Margaret Creek 1 (Meeks Lake)	**BY**	SJ	**DATE**	9-20-10	
YEAR BUILT			1972	**DESIGN HAZARD CLASS**	S	**DRAINAGE AREA**	3.42	mi2
WORK PLAN DATE			1965	**CURRENT HAZARD CLASS**	H	**DAM HEIGHT**	32	ft
sht 1 of 5	**CONSEQUENCES OF DAM FAILURE**						ver 100101	

POTENTIAL DAM FAILURE:				
Total Failure Index			119	A
POTENTIAL LOSS OF LIFE:				
Maximum Population-at-Risk [PAR]		(number)	15	B
Total Risk Index			71	C
POTENTIAL LOSS OF PROPERTY:				
Identify major community affected by breach and rate impact as High (H), Medium (M), Low (L) or None(blank)				
Community	Albany	(H,M,L,-)	H	D
Number of homes, businesses, major buildings		(number)	10	E
POTENTIAL LIFELINE DISRUPTION:				
Water supply, identify community disrupted by dam failure, and estimate number/amount				
Municipal sole source	Users	(number)	0	F
Supplemental source	Users	(number)	0	G
Irrigation water	Storage	(Ac-Ft)	0	H
POTENTIAL INFRASTRUCTURE DISRUPTION:				
Transportation system crossings, identify major crossing rendered unusable by dam failure, and estimate number				
Major/Interstate	Roads	(number)	0	I
Secondary/County	CR 70, TR 55, CR 31 Roads	(number)	3	J
POTENTIAL ADVERSE IMPACTS ON THE ENVIRONMENT:				
Describe impacts and rate each as High (H), Medium (M), Low (L), or None (blank)				
Threatened & endangered species		(H,M,L,-)	L	K
Sensitive riparian areas		(H,M,L,-)	L	L
Contaminated reservoir sediment		(H,M,L,-)	L	M
Wetland and wildlife habitat		(H,M,L,-)	L	N
Other		(H,M,L,-)		O
POTENTIAL ADVERSE SOCIAL IMPACTS:				
Describe impacts and rate each as High (H), Medium (M), Low (L) or None(blank)				
Known cultural resources		(H,M,L,-)	L	P
Historic preservation issues		(H,M,L,-)	L	Q
Socially disadvantaged community		(H,M,L,-)	L	R
POTENTIAL ADVERSE ECONOMIC IMPACTS:				
Average annual benefits attributed to this dam, updated workplan value		($)		S
Changes in benefits since workplan; Increase(I), No change(NC), Decrease(D)		(I,NC,D)		T
Low income families impacted		(number)		U
INPUT BY STATE DAM SAFETY AGENCY:				
State dam safety order issued for repair, modification, removal issued, Yes(Y), No(N)		(Y,N)	Y	V
State Dam Safety Agency Priority, High(H), Medium(M), Low(L), None(blank)		(H,M,L,-)	H	W
OTHER CONSIDERATIONS:				
Identify any other considerations and rate as High(H), Medium(M), Low(L) or None(blank)				
		(H,M,L,-)		X
		(H,M,L,-)		Y

Attachment B

EVALUATION OF POTENTIAL REHABILITATION PROJECTS							
STATE	OH	**DAM**	Margaret Creek 1 (Meeks Lake)	**BY**	SJ	**DATE**	9-20-10
sht 2 of 5	**FAILURE & RISK INDEXES**						ver 102201

Adopted from Bureau of Reclamation "Risk Based Profile System"
see: http://www.usbr.gov/dsis/risk/rbpsdocumentation.pdf

LIFE LOSS:

Population-at-Risk [PAR], see NRCS dams inventory definition (number of people)

Estimate PAR for static loading failure, typically assume water at top of dam	15	A
Estimate PAR for hydrologic loading failure, typically assume water at top of dam	15	B
Estimate PAR for seismic loading failure, typically assume water at ES crest (sunny day failure)	15	C

Fatality Rates [FR] from dam breach
Adopted from BuRec "A Procedure for Estimating Loss of Life Caused by Dam Failure" DSO-99-06
see: http://www.usbr.gov/research/dam_safety/documents/dso-99-06.pdf
Flood Severity/Lethality [DV] is the average depth [D] times velocity [V] across flood plain (ft2/sec)
DV= (breach discharge - bank full discharge) / breach floodplain width
Warning Time [T] between failure warning and flood wave at population (minutes)
Flood Severity Understanding [U] of the warning issuer of the likely flooding magnitude

scenario	breach discharge	bankfull discharge	breach width	DV	warning time	under-standing
	(cfs)	(cfs)	(ft)	(ft2/sec)	(minutes)	(N/A or Vague)
Static	37000	150	550	67	5	vague
Hydrologic	37000	150	550	67	5	vague
Seismic	14000	150	500	28	5	vague

For	DV>50	T=0	U=N/A (no warning)	FR=0.15
For	DV>50	T<60	U=vague	FR=0.04
For	DV>50	T>60	U=vague	FR=0.03
For	DV<50	T=0	U=N/A (no warning)	FR=0.01
For	DV<50	T<60	U=vague	FR=0.007
For	DV<50	T>60	U=vague	FR=0.0003

Estimate FR for static loading failure scenario	0.04	D
Estimate FR for hydrologic loading failure scenario	0.04	E
Estimate FR for seismic loading failure scenario	0.007	F

Scenario	Load Factor	Response Factor	Failure Index	Fatality Rate	PAR	Risk Index
Static	1	52	52	0.04	15	31
Hydrologic	*	*	67	0.04	15	40
Seismic	0.00	#DIV/0!	0	0.007	15	0
		TOTAL=	119		TOTAL=	71

Attachment B

EVALUATION OF POTENTIAL REHABILITATION PROJECTS			
STATE OH **DAM** Margaret Creek 1 (Meeks Lake) **BY** SJ **DATE**	9-20-10		
sht 3 of 5 — **STATIC FAILURE INDEX**	ver 100101		
PRINCIPAL SPILLWAY SYSTEM (60 points max): (total points)	33		A
Downstream filter or filter zone around conduit (yes=0 or no=10)		10	B
Conduit trench deep (>2d) and narrow (<3d) and steep sideslope (<2:1) (no=0 or yes=10)		3	C
Principal spillway system (inlet, pipe, or outlet) in deteriorated condition (no=0 or yes=10)		0	D
Conduit has seepage cutoff collars or other compaction adverse features (no=0 or yes=10)		10	E
Conduit contains open joints, open cracks, steady seepage (no=0 or yes=10)		0	F
Conduit founded on competent bedrock (yes=0 or no=10)		10	G
Reservoir control gate located at outlet of conduit (no=0 or yes=10)		0	H
RESERVOIR FILLING HISTORY (75 points max): (total points)	10		I
Reservoir has filled to x% of effective height (earth spillway crest minus original streambed)		95	J
(<50%=75 or 51-75%=50 or 76-90%=25 or 91-95%=10 or 96-100%=5 or >100%=0)		10	K
SEEPAGE AND DEFORMATION (85 points max): (total points)			L
Seepage carrying fines, or seepage increases with reservoir elevation increases, or sinkholes/jugholes exist in embankment (no=0 or yes=80)		0	M
Large amounts of seepage (no=0 or yes=6)		0	N
Visible and significant slope movement or sloughing (no=0 or yes=6)		0	O
Longitudinal or transverse embankment cracking greater than one foot in depth (no=0 or yes=6)		0	P
Sinkholes/depressions within two times effective height of the dam, either face (no=0 or yes=6)		0	Q
Poor top of dam condition, eroded, trees, rodent holes, settlement (no=0 or yes=6)		0	R
Abnormally wet areas at downstream toe/groin of embankment (no=0 or yes=6)		0	S
Inadequate slope protection against erosion by rainfall or waves (no=0 or yes=6)		0	T
FOUNDATION GEOLOGY (41 points max): (total points)			U
Highly fractures rock under core (no=0 or treated=3 or untreated=30)		0	V
Karst terrain and soluble rock (gypsum or limestone) (no=0 or treated=3 or untreated=30)		0	W
Collapsible soils (no=0 or treated=3 or untreated=30)		0	X
Significant stress relief fractures in abutments (no=0 or treated=3 or untreated=30)		0	Y
History of underground mining under embankment area (no=0 or treated=3 or untreated=30)		0	Z
Coarse grained and highly permeable soils (no=0 or yes=3)		0	AA
Presence of weak layers/conditions diminishing embankment stability (no=0 or yes=3)		0	AB
Erodible soils (sandy/silty materials) or weakly cemented rock (no=0 or yes=3)		0	AC
Reservoir area prone to landslides that could cause overtopping (no=0 or yes=3)		0	AD
EMBANKMENT DESIGN AND CONSTRUCTION (24 points max): (total points)	3		AE
Filters for core or foundation or incompatibility between zones (no=3 or yes=0)		3	AF
Embankment or foundation drainage system (yes=0 or no=4)		0	AG
Erodible core material (sands, silts, dispersive clays) (no=0 or yes=4)		0	AH
Incomplete or no foundation cutoff of shallow permeable layers (no=0 or yes=4)		0	AI
Poorly placed earthfill, inadequate density (no=0 or yes=4)		0	AJ
Gate features to drain reservoir (yes=0 or no=4)		0	AK
EMBANKMENT MONITORING (15 points max): (total points)	6		AL
Instruments (except surficial survey points) installed at dam (yes=0 or no=3)		3	AM
Installed instruments routinely read and evaluated (yes=0 or no=3)		3	AN
Visual inspection of dam by engineer less often than yearly (no=0 or yes=3)		0	AO
Good physical/visual access to downstream groin/toe for inspection (yes=0 or no=3)		0	AP
STATIC FAILURE INDEX: A+I+L+U+AE+AL		52	AQ

Attachment B

EVALUATION OF POTENTIAL REHABILITATION PROJECTS							
STATE	OH	**DAM**	Margaret Creek 1 (Meeks Lake)	**BY**	SJ	**DATE**	9-21-10
sht 4 of 5	**HYDROLOGIC FAILURE INDEX**						ver 100101

HYDROLOGIC LOADING:						
Total Spillway Capacity (PS&ES) for 6hr storm [Pfb], Work Plan Tbl 3 (rainfall inches)					13	A
Obtained from Work Plan Tbl 3, or dams inventory data, or computer routings						
100 year, 6hr rainfall [P100] (inches)					4.25	B
Probable Maximum Precipitation [PMP] (inches)					27.2	C
if Pfb <	P100 =	4.25	enter	40		
if Pfb =	P100+0.2(PMP-P100) =	8.84	enter	25		
if Pfb =	P100+0.4(PMP-P100) =	13.43	enter	15		
if Pfb =	P100+0.6(PMP-P100) =	18.02	enter	7		
if Pfb =	P100+0.8(PMP-P100) =	22.61	enter	3		
if Pfb =	PMP =	27.2	enter	1		
Enter interpolated value					15.9	D
HYDROLOGIC UNCERTAINTY:						
Drainage Area [DA] (square miles)					3.42	E
DA<10 enter 1.5 ; 10<DA<20 enter 1.4 ; 20<DA<50 enter 1.3 ; DA=>50 enter 1.2					1.5	F
PIPE SPILLWAY PLUGGING:						
Pipe Diameter [D] (inches)					36	G
D<12 enter 1.1; 12<=D<24 enter 1.0; 24<=D enter 0.9					0.9	H
Riser & trash rack type:						
Non-standardized inlet enter 1.1, Open Top riser enter 1.0; Covered or Baffle Top enter 0.9					0.9	I
EARTH SPILLWAY FLOW:						
Earth spillway flow depth [Des] from top of dam to spillway crest (feet)(10' max)					7	J
DAM EROSION RESISTANCE:						
Non-plastic (PI<10) fill enter 2.0 ; Plastic core enter 1.7 ; Overtopping armoring enter 0.8					1.7	K
Vegetal Cover Factor [Cf], see SITES or AH667					0.87	L
http://www.pswcrl.ars.usda.gov/ah667/ah667.htm						
Cf <0.4 enter 1.1; Cf < 0.7 enter 1.0; Cf<1.0 enter 0.9; larger Cf enter 0.8					0.9	M
EARTH SPILLWAY EROSION RESISTANCE:						
Low, can be excavated with hand tools, enter 2.0						
PI>10 and SPT blows<8, PI<10 and SPT blows>8, Kh<0.10, seismic velocity<2000fps						
Moderate, can be excavated with construction equipment, easy ripping, enter 1.2						
PI>10 and SPT blows>8, PI<10 and SPT blows>30, Kh<10, seismic velocity<7000fps						
High, very hard ripping, requires drilling and blasting, enter 0.2						
moderately hard rock, Kh>10, seismic velocity>7000fps					1.2	N
Vegetal Cover Factor [Cf], see SITES or AH667					0.87	O
Cf <0.4 enter 1.1; Cf < 0.7 enter 1.0; Cf<1.0 enter 0.9; larger Cf enter 0.8					0.9	P
HYDROLOGIC FAILURE INDEX:						
dam overtopping breach: (2)(D)(F)(H)(I)(K)(M)					59	Q
earth spillway breach: (D+5J)(F)(H)(I)(N)(P)					67	R
larger of (2)(D)(F)(H)(I)(K)(M) or (D+5J)(F)(H)(I)(N)(P) but less than 300					67	S

Attachment B

EVALUATION OF POTENTIAL REHABILITATION PROJECTS							
STATE	OH	DAM	Margaret Creek 1 (Meeks Lake)	BY	SJ	DATE	9-21-10
sht 5 of 5	SEISMIC FAILURE INDEX						ver 102201

SEISMIC LOADING:		
Latitude (degrees.decimal)	39.226	A
Longitude (degrees.decimal)	82.176	B
See "http://eqint.cr.usgs.gov/eq/html/lookup.shtml"		
PGA [peak ground acceleration] for 2% chance in 50 years, see NEHRP maps (%g)	5.51	C
if PGA is less than 10% g, enter 0		
if PGA is between 10% g and 19% g, enter 0.15		
if PGA is between 20% g and 39% g, enter 0.30		
if PGA is between 40% g and 59% g, enter 0.65		
if PGA is greater than 60% g, enter 1.0	0	D
FOUNDATION LIQUEFACTION:		
Select only one of the following foundation conditions which best represents the site		
Loose alluvium, lacustrine, loess materials (no=0 or yes=10)		E
Bedrock, glacial till, highly clayey materials (no=0 or yes=5)	5	F
EMBANKMENT FREEBOARD FOR FOUNDATION LIQUEFACTION:		
Dam height for seismic event is the height from top of dam to downstream channel bottom (ft)	32	G
Freeboard for seismic event is the depth from top of dam to assumed pool surface (ft)	19	H
Freeboard percent of dam height (%)	59	I
if Freeboard is less than 25% of dam height, enter 10		
if Freeboard is 25% to 50% of dam height, enter 5		
if Freeboard is more than 50% of dam height, enter 1	1	J
EMBANKMENT FREEBOARD FOR EMBANKMENT CRACKING:		
Freeboard is less than or equal to 15 feet (no=0 or yes=1)	0	K
EMBANKMENT CRACKING:		
Embankment contains self-healing filter zones (no=4 or yes=0)		L
SEISMIC FAILURE INDEX:		
(D) ((E)(J) + (F)(K+1)(L+1)) but less than 100	0	M

Michael J. Morris

State Conservation Engineer's Signature

concurring with technical content of sheets 2 thru 5