

## 2.6 DAM/LEVEE FAILURE

### DAM FAILURE

A dam is defined as an artificial barrier that does or may impound water or other liquefied material. Upground reservoirs and lagoons are considered dams per Ohio Administrative Code (OAC) 1501:21-3-01. Most commonly, a dam is constructed across a stream channel to impound water for recreation, flood control, or other uses. Upground reservoirs and lagoons are common for drinking water supply and water treatment. Some flood control dams, often referred to as “dry dams”, only impound water during wet or flooding conditions. A dam failure is defined as an uncontrolled release of impounded water. The most common causes of dam failures include dam overtopping, excessive seepage, and structural failure of a component. Despite efforts to provide sufficient structural integrity and to perform inspection and maintenance, problems can develop that can lead to failure. While most dams have storage volumes small enough that failures would have little or no consequences, dams with large storage amounts could cause significant flooding downstream.

Dam failures can result from any one or a combination of the following causes:

- Prolonged periods of rainfall and flooding;
- Inadequate spillway capacity, resulting in excess overtopping flows;
- Internal erosion caused by embankment or foundation leakage or piping;
- Improper maintenance, including failure to remove trees, repair internal seepage problems, replace lost material from the cross section of the dam and abutments, or maintain gates, valves, and other operational components;
- Improper design, including the use of improper construction materials and construction practices;
- Improper operation, including the failure to remove or open gates or valves during high flow periods;
- Failure of upstream dams on the same waterway that release water to a downstream dam;
- Earthquakes, which typically cause longitudinal cracks at the tops of the embankments that can weaken entire structures.

In terms of emergency management and planning, dam failures are analyzed as either sunny day failures or flood condition failures. Sunny day failures occur during a non- flooding situation with the reservoir near normal pool level. Flood condition failures usually involve periods of heavy rainfall and high river flows, which can exacerbate inadequate spillway capacity. Improper design of a spillway or operation of gates during high flows can lead to excessive water pressure and subsequent failure as well. Even though both types of failures can be disastrous, it can be assumed that a sunny day failure would be more catastrophic due to its unanticipated occurrence and the lack of time to warn residents downstream.

Dams are complicated structures, and it can be difficult to predict how a structure will respond to distress “... the modes and causes of failure are varied, multiple, and often complex and interrelated, i.e., often the triggering cause may not truly have resulted in failure had the dam not had a secondary weakness. These causes illustrate the need for careful, critical review of all facets of a dam” (Safety of Existing Dams, 1983).

## LEVEE FAILURE

A levee is any artificial barrier together with appurtenant works that will divert or restrain the flow of a stream or other body of water for the purpose of protecting an area from inundation by flood waters. Generally, a levee is subjected to water loading during a few days or weeks each year; unlike most dams that retain water most of the time.

A levee breach results when a portion of the levee breaks away, providing an opening for water to flood the landward side of the structure. Such breaches can be caused by surface erosion due to water velocities, or they can be the result of subsurface actions. Subsurface actions usually involve sand boils whereby the upward pressure of water flowing through porous soil under the levee exceeds the static pressure of the soil weight above it (i.e., under-seepage). These boils can indicate instability of the levee foundation given the liquefied substrate below it, leading the way to breaching. Levee overtopping is similar to dam overtopping in that the flood waters simply exceed the design capacity of the structure, thus flowing over the lowest crest of the system. Such overtopping can lead to erosion on the landward side which, subsequently, can lead to breaching. In order to prevent this type landward erosion, many levees are reinforced or armored with rocks or concrete.

## AUTHORITY AND RESPONSIBILITY

The Ohio Department of Natural Resources, Division of Water Resources - Dam Safety Program (DSP) has the responsibility to ensure that human life, health and property are protected from dam and levee failures. The program achieves its core purpose by performing the following main functions:

- Emergency response – Assessing the conditions of dams during severe floods and emergency's, taking action to correct dams that pose an immediate threat to public safety, providing timely and best-available information to other agencies and the public during disasters, and supporting mandate Ohio Revised Code (ORC) Section 1521.062;
- Construction permits – Ensuring that dams and levees are designed and constructed in accordance with proper engineering standards and Ohio Administrative Code (OAC) Rules 1501:21-1-01 through 1501:21-23-01, reviewing construction plans and specifications, performing calculations and investigations, issuing permits, and monitoring/approving construction;
- Repairs and modifications -- Ensuring that dams and levees are repaired in accordance with proper engineering standards and OAC rules, reviewing construction plans and specifications, performing calculations and investigations, issuing permits, and monitoring/approving construction, and supporting mandate ORC Section 1521.062;
- Periodic safety inspections –Inspecting Class I-III dams once every five years, monitoring the overall condition of Ohio's dams, providing data for the National Inventory of Dams (NID), and supporting mandate ORC Section 1521.062;
- Emergency Action Plans – Requiring all Class I, II, and III dam owners to develop an Emergency Action Plan (EAP). Class I dams are required to have an inundation study preformed evaluating dam failure, typically during a probable maximum flood event, 100- year flood, and during a sunny dam failure per OAC 1501:21-15-07;
- Enforcement – Requiring dam and levee owners to improve safety when efforts for voluntary compliance have been unsuccessful (OAC 1501:21-23) and focusing on Class I dams with dense populations downstream; and

- Public information – Providing data security for Ohio EMA, US Army Corps of Engineers (USACE), the National Guard, Ohio EPA, as well as the state and federal legislatures, providing dam and levee owners and engineers with technical information and access to division files, educating the public about dam safety and providing quality data, and giving presentations for EPA, Water Management Association of Ohio (WMAO), and the Ohio Lake Communities Association (OLCA). However, some data regarding the safety of infrastructure (such as inundation maps and EAPs) cannot be distributed to unauthorized personnel per ORC 149.433(a).

The ORC provides the authority for the program to regulate dam and levee safety, and dictates the responsibilities of the program as well as the responsibilities of the dam and levee owners. The program has jurisdiction over approximately 2,474 dams in Ohio, of which 366 are Class I (highest hazard); DSP does not have jurisdiction over Federal dams. USACE presides over most of those Federal dams in Ohio, and ensures they are operated and maintained properly.

Many levees in Ohio are owned and maintained by local communities, with a few levees being owned and maintained by the USACE. While a federal inventory of levees is complete, the methodology for evaluating the effects of levees on flood hazards is in flux. This will be discussed later in this section.

## RISK ASSESSMENT

### DAMS—CLASSIFICATION

In Ohio, there are 5,753 known existing structures that retain or detain water, and these are included in ODNR's inventory of dams (DSP data, December 2023). Many of the structures in that count have been properly abandoned, are exempt from DSP jurisdiction, or are proposed dams. As such the focus of this section will include dams that are under the jurisdiction of the DSP. The ODNR DSP classifies dams as Class I, Class II, Class III, and Class IV dams, with generally Class I being the highest risk and Class IV the lowest risk (see Table 2.6.a). The classification of a dam is based on three factors: the dam's height, storage capacity, and potential downstream hazard. The height of the dam is the vertical distance from the crest to the downstream toe. The storage capacity is the volume of water that the dam can impound at the top of dam (crest) elevation. The downstream hazard consists of roads, buildings, homes, and other structures that would be damaged in the event of a dam failure. Potential for loss of life is also evaluated.

The USACE's National Inventory of Dams (NID) compiles information about dams from a variety of agencies with an inventory of dams. Some of the partners that contribute data to the NID include ODNR DSP, Department of the Interior (National Park Service and Mine Safety and Health), USDA (Forest Service and Natural Resources Conservation Service), USACE, and Federal Energy Regulatory Commission. For a dam to be included in the NID it must meet at least one of the following criteria. 1) High hazard potential classification - loss of human life is likely if the dam fails; 2) Significant hazard potential classification - no probable loss of human life but can cause economic loss; environmental damage, disruption of lifeline facilities, or impact other concerns; 3) Equal or exceed 25 feet in height and exceed 15 acre-feet in storage; 4) Equal or exceed 50 acre-feet storage and exceed 6 feet in height. In addition to specifying the ODNR Classification System, Table 2.6.a summarizes how the ODNR DSP classification corresponds with the hazard class in the NID.

Table 2.6.a

Ohio and Federal Dam Classification Systems				
Ohio Dam Classification	Hazard Description	Height (ft)	Storage (ac-ft)	Corresponding NID Classification
Class I	Probable loss of life, serious hazard to health, structural damage to high value property (i.e., homes, industries, major public utilities)	>60	>5,000	High
Class II	Flood water damage to homes, businesses, industrial structures (no loss of life envisioned), damage to state and interstate highways, railroads, only access to residential areas	>40	>500	Significant
Class III	Damage to low value non- residential structures, local roads, agricultural crops and livestock	>25	>50	Low
Class IV	Losses restricted mainly to the dam	£25	£50	Other
Exempt	N/A	< 6	15 ac-ft. OR <10 ft & ≤50 ac-ft.	N/A

Source: Ohio Department of Natural Resources, Division of Water Resources, Dam Safety Program

When assessing risk for dams, various dam failure scenarios must be considered, and they include failures when the dam is at normal pool level (sunny day) and failures during significant flood events (rainy day). Each of the three factors is evaluated, and the final classification of the dam is based on the highest individual factor. The classification of a dam can change based on future development along the downstream channel. It is important to note all classes are required to have Emergency Action Plans (EAPs) and Class I dams are required to include dam failure inundation mapping. This update will focus on Class I dams as they are deemed as having the most potential for loss of life, greatest hazards to health, and causing the most structural damage should any of them fail. Classes II and III also will be evaluated to a slight degree since their failure would most likely result in damages to homes, businesses, infrastructure, but no loss of life is likely.

#### LOCATION— DAMS

There are 366 Class I dams, 561 Class II, 438 Class III, and 1,034 Class IV dams regulated by ODNR DSP in Ohio. Region 1 has many fewer dams than regions 2 and 3. This may be largely due to the topography as Region 1 is relatively flatter than Regions 2 and 3.

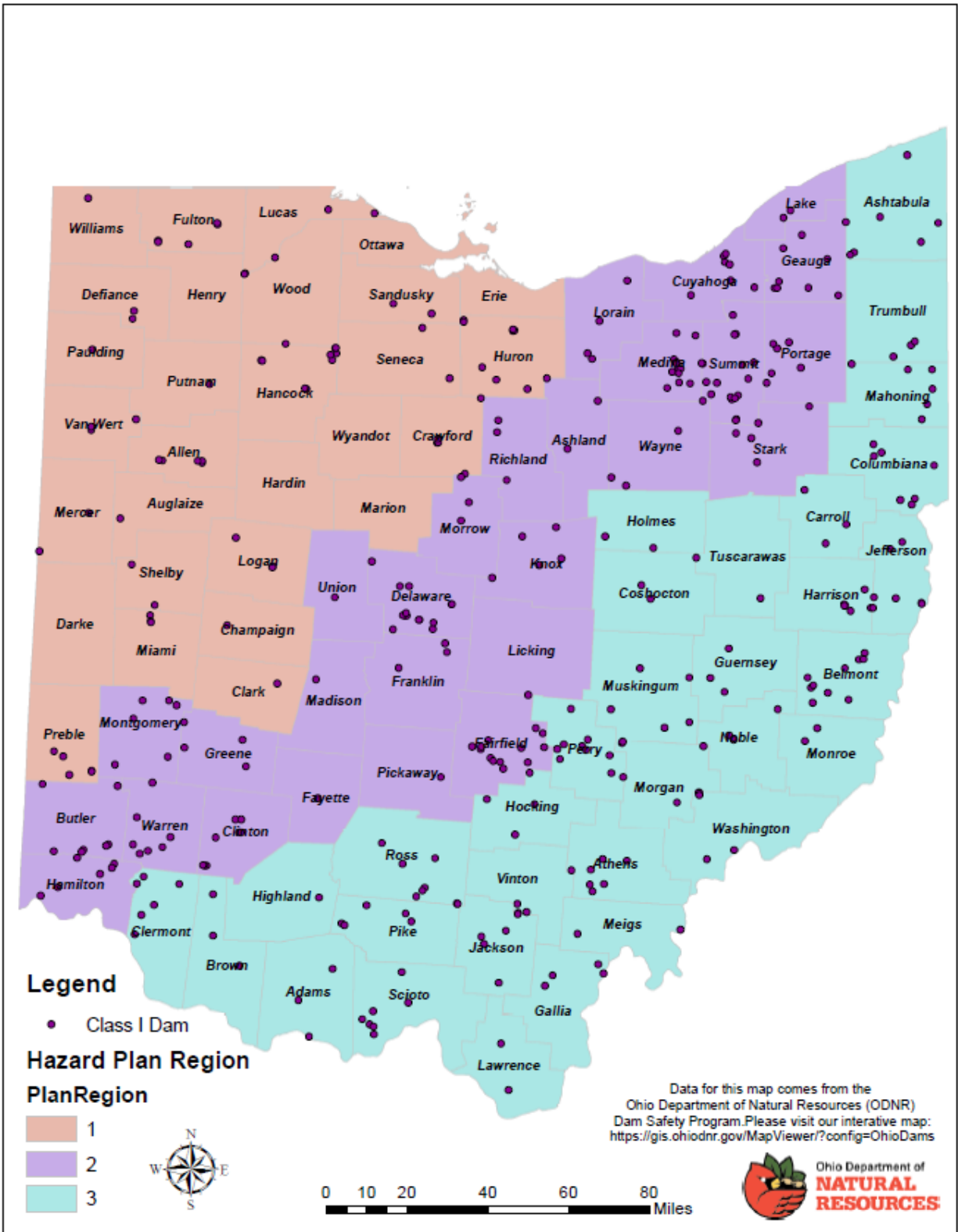
- Region 1 has a total of 381 dams consisting of 81 Class I, 85 Class II, 64 III, and 161 Class IV.
- Region 2 has a total of 1,148 dams consisting of 169 Class I, 239 Class II, 250 Class III, and 448 Class IV dams.
- Region 3 has a total of 1,048 dams consisting of 172 Class I, 255 Class II, 222 Class III, and 399 Class IV dams.
- Additionally, there are approximately 3,354 “other” structures throughout the state that are proposed, unclassified, exempt, and/or abandoned.

The ODNR DSP maintains an online Dam Locator to assist the public, local officials, and other partners to [view basic information about dams in the State of Ohio](#). Table 2.6.b summaries the distribution of the various classes of dams by region and further by county. See Map 2.6.a displays the location of Class I dams in Ohio.

**Table 2.6.b**

Dam Inventory by County and Dam Classification														
Region 1					Region 2					Region 3				
County	Class I	Class II	Class III and IV	Total	County	Class I	Class II	Class III and IV	Total	County	Class I	Class II	Class III and IV	Total
Allen	5	3	15	23	Ashland	5	8	31	44	Adams	3	7	14	24
Auglaize	1	1	3	5	Butler	7	7	35	49	Ashtabula	6	13	37	56
Champaign	1	7	8	16	Clinton	8	10	15	33	Athens	7	2	12	21
Clark	2	3	11	16	Cuyahoga	7	8	9	24	Belmont	11	4	34	49
Crawford	5	2	18	25	Delaware	16	5	29	50	Brown	3	10	24	37
Darke	0	3	8	11	Fairfield	14	16	35	65	Carroll	3	7	38	48
Defiance	2	5	9	16	Fayette	1	1	3	5	Clermont	8	20	34	62
Erie	0	0	6	6	Franklin	5	13	16	34	Columbiana	9	22	34	65
Fulton	5	3	1	9	Geauga	9	11	35	55	Coshocton	4	5	22	31
Hancock	9	3	2	14	Greene	4	5	20	29	Gallia	4	5	8	17
Hardin	0	1	8	9	Hamilton	8	18	23	49	Guernsey	6	13	27	46
Henry	0	1	1	2	Knox	6	7	14	27	Harrison	9	9	25	43
Huron	10	5	18	33	Lake	1	3	13	17	Highland	3	5	12	20
Logan	3	5	16	24	Licking	2	8	49	59	Hocking	4	8	15	27
Lucas	2	4	0	6	Lorain	4	6	36	46	Holmes	2	2	12	16
Marion	0	2	5	7	Madison	1	2	2	5	Jackson	5	8	17	30
Mercer	2	4	2	8	Medina	14	26	89	129	Jefferson	7	14	25	46
Miami	3	3	11	17	Montgomery	6	2	11	19	Lawrence	4	4	5	13
Ottawa	0	2	3	5	Morrow	3	8	22	33	Mahoning	6	6	23	35
Paulding	1	1	6	8	Pickaway	2	3	20	25	Meigs	2	5	8	15
Preble	5	3	24	32	Portage	8	7	37	52	Monroe	2	6	11	19
Putnam	1	2	3	6	Richland	3	5	18	26	Morgan	1	10	15	26
Sandusky	1	0	2	3	Stark	4	20	42	66	Muskingum	6	14	40	60
Seneca	2	5	5	12	Summit	18	15	40	73	Noble	3	5	9	17
Shelby	2	3	12	17	Union	1	4	5	10	Perry	12	12	16	40
Van Wert	3	0	1	4	Warren	12	15	67	94	Pike	8	1	8	17
Williams	1	5	17	23	Wayne	2	6	22	30	Ross	6	9	14	29
Wood	5	4	0	9	<b>Total</b>	<b>171</b>	<b>239</b>	<b>738</b>	<b>1148</b>	Scioto	9	4	7	20
Wyandot	0	5	10	15						Trumbull	5	8	23	36
<b>Total</b>	<b>71</b>	<b>85</b>	<b>225</b>	<b>381</b>						Tuscarawas	6	5	26	37
										Vinton	3	3	12	18
										Washington	5	9	14	28
										<b>Total</b>	<b>172</b>	<b>255</b>	<b>621</b>	<b>1048</b>

Map 2.6.a — Class I Dam Locations in Ohio



**LOCATION— LEVEES**

There are two primary sources of levee data for the State of Ohio- The US Army Corp of Engineers National Levee Database (NLD) and the Ohio Department of Natural Resources Dam Safety Program. Section 2.6, Dam and Levee Failure, will be utilizing NLD Data for assessing levee and levee risks in Ohio. Although the National Levee Database is dynamic in nature, it provides static information regarding levee location and potential consequences, which can aid in decision making and better flood risk management. As of June 2023, the database identifies 149 levee system in Ohio.

For the most current list of levees and their protected areas in Ohio, refer to the [National Levee Database](#).

**Table 2.6.c**

Levee Inventory and Potential Consequences							
County	OEMA Region	Levee Systems	Levee Miles	Leveed Area (mi <sup>2</sup> )	Population at Risk	Buildings at Risk	Property Value
Butler	2	7	13.07	4.34	14,225	3,615	\$ 2,933,448,936
Carroll and Stark	3 and 2	1	0.91	0.11	380	142	\$ 88,900,000
Columbiana	3	1	2.85	0.45	1,868	1,113	\$ 250,209,774
Cuyahoga	2	1	0.28	0.01	148	32	\$ 10,259,040
Erie	1	2	1.72	0.62	410	234	\$ 51,282,636
Fairfield	2	2	2.48	0.83	1,050	330	\$ 224,765,426
Franklin	2	3	9.51	4.83	15,250	4,688	\$ 2,409,064,347
Guernsey	3	2	1.87	0.24	979	162	\$ 190,824,338
Hamilton	2	9	9.70	5.22	14,814	1,742	\$ 2,769,832,530
Hocking	3	1	0.27	0.03	90	47	\$ 35,009,336
Knox	2	6	5.26	1.06	3,780	1,100	\$ 1,048,146,246
Lake	2	1	0.22	0.03	217	105	\$ 30,574,370
Lawrence	3	2	6.83	2.35	9,377	4,943	\$ 1,306,517,060
Licking	2	1	1.23	0.16	671	283	\$ 63,380,640
Lorain	2	1	0.98	0.25	0	0	\$ -
Lucas	1	3	13.26	3.97	3,598	1,770	\$ 588,477,420
Lucas and Ottawa	1	1	3.60	0.42	0	0	\$ -
Marion	1	1	0.96	0.23	234	234	\$ 121,000,000
Miami	1	6	5.89	1.98	46,533	10,715	\$ 9,659,934,425
Montgomery	2	18	35.39	11.36	134,760	24,312	\$ 28,204,735,676
Muskingum and Perry	3	1	1.16	0.11	384	324	\$ 85,748,340
Ottawa	1	60	64.73	8.79	33,391	7,602	\$ 7,496,620,584
Ottawa and Sandusky	1	1	1.87	0.12	3	1	\$ 498,778
Perry	3	1	0.64	0.19	1,053	302	\$ 201,182,764
Pike	3	4	5.12	1.81	192	10	\$ 580,805,876
Richland	2	1	0.19	0.02	0	1	\$ -
Ross	3	1	3.80	2.15	9,407	3,999	\$ 2,051,408,100
Sandusky	1	3	5.53	1.30	2,756	1,342	\$ 477,547,495
Scioto	3	1	7.83	2.99	11,062	4,717	\$ 2,652,305,730
Stark	2	3	5.14	0.83	2,321	704	\$ 435,490,930
Tuscarawas	3	1	0.76	0.11	124	68	\$ 71,300,000
Warren	2	3	3.30	0.38	2,325	695	\$ 424,852,893
<b>Grand Total</b>		<b>149</b>	<b>216.35</b>	<b>57.32</b>	<b>311,402</b>	<b>75,332</b>	<b>\$ 64,464,123,691</b>

Source: [USACE National Levee Database](#)

The USACE NLD classifies levee risk characteristics in their Levee Safety Action Classification Table (LSAC). The LSAC is a classification system designed to take into account the probability of the levees being loaded (Hazard), existing condition of the levee, the current and future maintenance of the levee (Performance), and the Consequences if a levee were to fail or be overwhelmed. In Ohio, there are no levee systems rated as Very High, only *one* levee system is rated High, *six* as Moderate, *18* as low, and the remaining were not screened. See Table 2.6.d for the LSAC classifications, and table 2.6.e for a list of Moderate and High LSAC Rated Levee systems in Ohio.

Table 2.6.d

USACE Levee Safety Action Classification Table <sup>1</sup> , EC 1165-2-218		
Risk	Risk Characteristics of this Class	Actions for Levee Systems and Leveed Areas in this Class <i>(Adapt actions to specific levee system conditions.)</i>
Very High (1)	Likelihood of inundation due to breach and/or system component malfunction in combination with loss of life, economic, or environmental consequences results in very high risk.	Based on risk drivers, take immediate action to implement interim risk reduction measures. Increase frequency of levee monitoring, communicate risk characteristics to the community within an expedited timeframe; verify emergency plans and flood inundation maps are current; ensure community is aware of flood warning systems and evacuation procedures; and, recommend purchase of flood insurance. Support risk reduction actions as very high priority.
High (2)	Likelihood of inundation due to breach and/or system component malfunction in combination with loss of life, economic, or environmental consequences results in high risk.	Based on risk drivers, implement interim risk reduction measures. Increase frequency of levee monitoring; communicate risk characteristics to the community within an expedited timeframe; verify emergency plans and flood inundation maps are current; ensure community is aware of flood warning and evacuation procedures; and, recommend purchase of flood insurance. Support risk reduction actions as high priority.
Moderate (3)	Likelihood of inundation due to breach and/or system component malfunction in combination with loss of life, economic, or environmental consequences results in moderate risk.	Based on risk drivers, implement interim risk reduction measures as appropriate. Verify risk information is current and implement routine monitoring program; assure O&M is up to date; communicate risk characteristics to the community in a timely manner; verify emergency plans and flood inundation maps are current; ensure community is aware of flood warning and evacuation procedures; and, recommend purchase of flood insurance. Support risk reduction actions as a priority.
Low (4)	Likelihood of inundation due to breach and/or system component malfunction in combination with loss of life, economic, or environmental consequences results in low risk.	Verify risk information is current and implement routine monitoring program and interim risk reduction measures if appropriate; assure O&M is up to date; communicate risk characteristics to the community as appropriate; verify emergency plans and flood inundation maps are current; ensure community is aware of flood warning and evacuation procedures; and, recommend purchase of flood insurance. Support risk reduction actions to further reduce risk to as low as practicable.
Very Low (5)	Likelihood of inundation due to breach and/or system component malfunction in combination with loss of life, economic, or environmental consequences results in very low risk.	Continue to implement routine levee monitoring program, including operation and maintenance, inspections, and monitoring of risk. Communicate risk characteristics to the community as appropriate; verify emergency plans and flood inundation maps are current; ensure community is aware of flood warning and evacuation procedures; and recommend purchase of flood insurance.
No Verdict		Not enough information is available to assign an LSAC.

1- Levee risk is the risk that exists due to the presence of the levee system and this is the risk used to inform the decision on the LSAC assignment. The information presented in this table does not reflect the overtopping without breach risk associated with the presence or operation of the levee system. Source: [USACE Levee Safety Action Classification](#)

Table 2.6.e

Moderate and High LSAC Rated Levee Systems in Ohio								
LSAC Rating	System Name	County	Region	Levee Miles	Leveed Area (mi <sup>2</sup> )	Population at Risk	Buildings at Risk	Property Value
High	Portsmouth-New Boston, OH, LPP	Scioto	3	7.83	2.99	11,062	4,717	\$ 2,652,305,730
Moderate	Cincinnati Levee System	Hamilton	2	1.39	3.41	12,163	1,500	\$ 2,090,491,260
Moderate	Chillicothe, OH, LPP	Ross	3	3.80	2.15	9,407	3,999	\$ 2,051,408,100
Moderate	West Columbus, OH, LPP	Franklin	2	7.14	4.55	13,684	4,680	\$ 2,032,031,550
Moderate	Ironton LPP	Lawrence	3	5.05	1.90	7,904	4,180	\$ 1,193,727,950
Moderate	Wellsville, OH	Columbiana	3	2.85	0.45	1,868	1,113	\$ 250,209,774
Moderate	Massillon, OH, LPP - East	Stark	2	2.18	0.31	1,166	349	\$ 170,001,290
				30.24	15.76	57,254	20,538	\$ 10,440,175,654

## LOCAL HAZARD MITIGATION PLAN DATA

As counties update their LHMP, ODNR DSP is available to provide up to date dam information for their counties. Part of a dam participating in the High Hazard Potential Dam Grant requires counties to update their LHMP to address all dam risk, which ODNR DSP plays a key role. Below is a high-level overview of some of the counties dam risk sections.

**STARK COUNTY:** According to flood studies on file with the Stark County EMA, many communities in the county could be affected by a dam failure event. In an event that the Dover and Bolivar dams are at the emergency spillway, back up flooding along the Tuscarawas River through Stark County would significantly impact the Village of Navarre, as well as affect the cities of Massillon and Canal Fulton. Flooding in Navarre would far surpass 500-year flood levels, placing much of the village's downtown under water. Similar studies for Atwood Lake and the Beach City Dam, on file with the county EMA, indicate similar concerns. After an extensive examination of spreadsheet calculations, vulnerability assessments show that 28,288 structures could be damaged with an estimated loss of \$1,019,132,000.

**DELAWARE COUNTY:** Dam failure is a significant concern for Delaware County. As of June 2018, there are 88 dams and reservoirs located within the county that could result in significant losses if they were to fail or become overtopped. These include 16 Class I dams, 13 Class II and III dams, and 24 Class IV dams. The Hoover Dam structure is located within Blendon Township in Franklin County, but a significant portion of its reservoir exists within Delaware County and should be considered a potential hazard to Delaware County residents (see Section 2.2). The Dams located within Delaware County are regulated by the U.S. Army Corp of Engineers (USACE), Ohio Department of Natural Resources (Division of Water) (ODNR) and Federal Energy Regulatory Commission (FERC).

For the 2013 Delaware County Hazard Mitigation Plan, local GIS inundation maps for all of the dams, except for the Sunbury and Ashley reservoirs, were overlaid onto the Auditor's parcel data and this determined the number of structures at-risk within each jurisdiction. Delaware, Powell, and Shawnee Hills are the only cities or villages that contain at-risk populations or structures due to their proximity to crucial rivers and reservoirs. Delaware City contains a staggering 1,458 vulnerable structures valued at over \$300 million because the densely populated city lies directly south of the dam, in the direct pathway of the water's direction. In addition, there are over 2,000 vulnerable structures that lie outside of the county's municipalities, particularly since the majority of the dams and reservoirs are a sizeable distance from them. The 2013 Delaware County Multi-Hazard Mitigation Plan estimates that a total of 3,734 structures could be damaged with an estimated loss of \$909,122,500.

## PAST OCCURRENCES

The 2008 State Hazard Mitigation Plan Update referenced “The National Performance of Dams Partnership,” a cooperative effort of engineers and dam safety professionals in the U.S. who retrieve, archive, and disseminate information on dam performance in order to list dam incidents and failures throughout the state. According to this database, Ohio experienced 273 dam incidents from 1882 to 2001. Because dam classification can be dynamic, a more complete database was developed by DSP for a span of years ranging from 1852 to 2014. (Please note the DSP data list incidents/failures dating back to 1852, However, the DSP was not created until 1963. Therefore, not all data provided to Ohio EMA were collected by DSP). Table 2.6.f lists the dam failures and incidents for Class I and II dams throughout the state. Due to limitations in data, incidents since 2014 could not be obtained when updating the 2023 State Hazard Mitigation Plan.

There has been little property damage that has resulted from a dam failure alone, as dam failures are few in Ohio. However, there has been property damage due to a combination of downstream flooding from excessive precipitation and dam failure. Unfortunately, it is difficult to assess which property damage was a direct result of the dam failure and which damage was a result of downstream flooding due to excessive precipitation. There has been some infrastructure loss in terms of roads washing away, but there has been no loss of critical facilities due to dam failure to date. It should be noted that DSP does not have much data showing property damages and losses; such data are generally unavailable as there has not been a large dam failure in Ohio for many years. The comments associated with each incident or failure in Table 2.6.f rarely contains such loss information.

There are no documented instances of levee breaches whereby structures or properties were damaged in Ohio as such data are generally unavailable and undocumented. This does not mean there is minimal risk behind these levees; it means more effort needs to be exerted in the collection of such data. However, according to DSP records, in 1997 the Green Acres Levee (Pike County) was overtopped by a flood estimated to be a 100-year event. Several homes were flooded as a result, but no specific damage data could be found for this update.

Table 2.6.f

Ohio High Hazard Dam Incidents/Failures From 1852 to 2014					
County	OEMA Region	DSP Class	Dam Name	Incident Year	Incident Description
Sandusky	1	I	BALLVILLE DAM	1913	Dam failed with 1913 flood; no damage downstream reported.
Huron	1	I	NORWALK LOWER RESERVOIR	1969	Dam failed; no damage downstream noted. Dam was rebuilt with berm and drainage.
Huron	1	I	GREENWICH RESERVOIR DAM	1969	Dam partially failed; no damage downstream noted.
Lucas	1	II	SWANTON UPGROUND RESERVOIR	1970	Dam failure in 1970, but was repaired.
Defiance	1	II	INDEPENDENCE DAM	1982	Left abutment was overtopped and damaged.
Seneca	1	II	MOHAWK LAKE DAM	1910, 1963	Dam failure in 1910 resulted in replacement; dam failure in 1963 resulted in repairs. No damage downstream reported.
Williams	1	I	LAKE SENECA DAM	1973, 1996	Overflow spillway failed in 1973 and 1996; no damage downstream reported.

County	OEMA Region	DSP Class	Dam Name	Incident Year	Incident Description
Wyandot	1	I	KILLDEER UPGROUND RESERVOIR	1979, 2004	Leak and slide indicated in 1979, and multiple slides indicated in 2004.
Huron	1	I	HOLIDAY LAKE DAM	1982, 2007	Left sidewall failed in 1982. A shallow slide was noted in 2007.
Stark	2	II	WILLOWDALE LAKE DAM	1923	Original dam failed and was rebuilt in 1924, with multiple repairs through the present.
Geauga	2	II	PAW PAW LAKE DAM	1941	Dam failed and was rebuilt in 1941; no damage downstream was reported.
Knox	2	I	KNOX LAKE DAM	1950	Seepage was noted and spillway failed.
Licking	2	II	NEWARK LOW HEAD DAM	1959	Dam washed out in 1959, but was rebuilt.
Medina	2	I	RAVENS WOOD LAKE DAM	1973	Original dam failed and was rebuilt in 1973.
Summit	2	I	LAKE LITCHFIELD DAM	1973	Embankment failed during construction.
Wayne	2	I	CHIPPEWA CREEK STRUCTURE VII-C	1973	Foundation failure during construction; no damage indicated downstream.
Cuyahoga	2	II	MARSHFIELD LAKE DAM	1973	Dam breached under order; no damages reported; rebuilt in 1977.
Portage	2	I	BRIMFIELD LAKE DAM	1979	Dam nearly failed due to overtopping; no damage downstream reported.
Geauga	2	I	TANGLEWOOD LAKE DAM	1981	Spillway partially failed, but was repaired; no damage downstream noted.
Fairfield	2	I	RUSHCREEK STRUCTURE NO. VI-A	1982	An abutment leakage was noted and repaired.
Hamilton	2	II	HERMITAGE CLUB LAKE DAM	1982	Intense storm resulted in dam overtopping; no damage downstream reported.
Franklin	2	II	TIMBERLAKE NO. 1 DAM	1984	Drain pipe failed, but was repaired.
Lake	2	I	BRIGHTWOOD LAKE DAM	1985	A resident near the emergency spillway stated the dam overtopped; no damage downstream reported.
Portage	2	II	AURORA POND DAM	1985	Dam failed and was rebuilt around 1985.
Delaware	2	I	LEXINGTON GLEN DAM	1987	Dam failed due to erosion on the emergency spillway and four erosion fills on the downstream slope.
Licking	2	II	GOSS LAKE DAM	1990	Floodwaters caused partial failure of principal spillway; no damage downstream noted.
Warren	2	II	WATER'S EDGE DAM	1993	Dam was rebuilt in 1993 after failure.
Morrow	2	I	CANDLEWOOD LAKE DAM	1998	Approximately 3-4' noted in the emergency spillway.
Medina	2	II	RPM LAKE DAM	1998	Principal spillway failure; repairs made in 1998.
Medina	2	I	PISCHIERI POND DAM	1999	Dam was breached in controlled manner due to detection of void in dam; no damage downstream.
Richland	2	I	SHELBY UPGROUND RESERVOIR NO. 2	2001	Seepage was noted through reservoir due to field tile; repairs were made accordingly.
Warren	2	I	PINE HILL LAKE DAM	2001	Emergency spillway flowed; no damage downstream reported.
Stark	2	II	MORELLI POND DAM	2003	Causeway breached due to a compromise in left end of dam; no damage downstream reported.
Summit	2	II	VIRGINIA KENDALL PARK DAM	2003	Dam failure in late 1970s, and was overtopped in 2003; no damage downstream noted.
Summit	2	II	LAKE FOREST DAM	2003	Dam experienced a flood of record in 2003; no damage downstream reported.
Summit	2	II	CITY OF HUDSON UPPER LAKE DAM	2003	Dam overtopped; no downstream damage noted.
Summit	2	II	CITY OF HUDSON LOWER LAKE DAM	2003	Dam overtopped; no downstream damage noted.
Cuyahoga	2	I	BRIAR HILL LAKE DAM	2006	Dam possibly overtopped; no damage downstream noted.

County	OEMA Region	DSP Class	Dam Name	Incident Year	Incident Description
Geauga	2	I	MONT-MERE LAKE DAM	2006	Water was 1-1.5' below top of dam; dam never overtopped.
Lake	2	I	HOOSE ROAD RETENTION DAM	2006	Water was 1-2' above emergency spillway elevation.
Summit	2	II	CAMP JULIA CROWELL LAKE DAM	2006	Severe erosion was noted on the left side of the emergency spillway.
Lorain	2	II	BRENTWOOD LAKE DAM	2009	Spillway failed. ODNR issued an order for the dam to be repaired or breached. The dam was breached.
Geauga	2	II	KENSTON LAKE DAM	2010	Spillway clogged and the dam overtopped. ODNR issued an order for the dam to be repaired or breached. The dam was breached. Pipe jacked and bored through the dam, eliminating the reservoir and making the dam a roadway embankment.
Summit	2	II	THE MEADOWS DAM	2012	Spillway failed. ODNR issued an order for the dam to be repaired or breached. The dam was breached.
Fairfield	2	I	PINE LAKE ESTATES DAM	2013	Spillway failure
Delaware	2	I	SUNBURY UPGROUND RESERVOIR NO. 1	1960s	Dam overtopped; no downstream damage noted.
Geauga	2	II	KENSTON LAKE DAM	1970s	Downstream face slipped.
Geauga	2	II	BURTON LAKE DAM	1970s, 1997	Dam breached in the 1970s, and seepage boils were noted in 1997.
Medina	2	I	RUSTIC HILLS LAKE DAM	1980, 2003	Dam failed in 1980, and emergency spillway failed in 2003 which caused overtopping; no damage downstream reported.
Columbiana	3	I	GUILFORD LAKE DAM	1852	Dam breached; no downstream damage noted.
Jackson	3	I	WELLSTON RESERVOIR DAM	1937	A slide was noted.
Hocking	3	I	LAKE LOGAN DAM	1950	Dam was breached upon initial filling; no damage downstream noted. Dam was redesigned in 1952 and rebuilt in 1954.
Morgan	3	I	CROOKSVILLE RESERVOIR NO. 1 DAM	1950	Dam noted as probably overtopping; no damage downstream indicated.
Muskingum	3	II	MUSKINGUM RIVER LOCK AND DAM NO. 10	1951	Dam failed in 1951; no damage downstream reported.
Morgan	3	II	MUSKINGUM RIVER LOCK AND DAM NO. 7	1959	Dam failed in 1959; no damage downstream reported.
Columbiana	3	II	SLATES LAKE DAM	1965	Dam failed during initial filling of lake due to seepage around spillway pipe; no damage downstream indicated.
Perry	3	II	MERKLE DAM	1972	Dam washed out but was rebuilt in 1972.
Athens	3	I	ATHENS FISH AND GAME CLUB LAKE DAM	1975	Dam was deemed unsafe due to seepage and a slide and was breached; no downstream damage reported. It was reconstructed in 1978.
Carroll	3	II	ROHR DAM	1975	Failure indicated at right end of dam; no damage downstream reported.
Guernsey	3	I	LUBURGH LAKE DAM	1979	A downstream slope slide was noted and repaired.
Ross	3	I	KNOLES POND DAM	1979	Lake was drained for repairs.
Athens	3	II	RAINBOW LAKE DAM	1979	Slide was noted in the downstream slope near right abutment, and was fixed.
Ashtabula	3	II	ELKEM FLUID WASTE POND 3A	1980	Slide was noted in the downstream slope, and was fixed.
Belmont	3	I	ST. CLAIRSVILLE RESERVOIR NO. 2 DAM	1980	A sinkhole was noted in the upstream slope.
Scioto	3	II	ELKS COUNTRY CLUB LAKE DAM	1980	33' long slide on the downstream slope; repaired, but slipped again.
Morgan	3	I	CROOKSVILLE RESERVOIR NO. 2 DAM	1984	Slide was noted in the downstream slope, and was fixed.
Carroll	3	II	BOY SCOUT DAM	1984	Upstream slope failed during construction.

County	OEMA Region	DSP Class	Dam Name	Incident Year	Incident Description
Jackson	3	I	OAK HILL UPGROUND RESERVOIR	1986	Multiple slides were noted.
Trumbull	3	II	NEWTON FALLS LOW HEAD DAM	1988	Hole was noted in spillway.
Harrison	3	II	SELESKI LAKE NO. 2 DAM	1989	Dam overtopped at left end; no damage downstream reported.
Lawrence	3	II	SMITH HOLLOW DAM	1989	Spillway failed; no damage downstream reported.
Perry	3	I	SHELTON LAKE DAM	1990	Dam overtopped; no downstream damage noted.
Perry	3	II	TECUMSEH LAKE DAM	1990	Dam was overtopped by 1-2'; no damage downstream was reported.
Jefferson	3	II	LAKE HENRY DAM	1993	Original principal spillway was blocked.
Ross	3	I	CALDWELL LAKE DAM	1994	Sink hole was noted and repaired.
Washington	3	II	CHOPPER'S LAKE DAM	1994	Dam breached due to heavy rainfall with erosion of earth adjacent to spillway; no downstream damage noted.
Brown	3	I	RUSSELLVILLE RESERVOIR DAM	1997	Dam was overtopped; no damage noted downstream.
Scioto	3	I	ROOSEVELT LAKE DAM	1997	Dam overtopped; no downstream damage noted.
Scioto	3	II	LAKE MARGARET DAM	1997	Dam overtopped in 1997, but repaired in 2002. No damage downstream noted.
Guernsey	3	I	SALT FORK LAKE DAM	1998	Dam overtopped; no downstream damage noted.
Clermont	3	II	BECKJORD ASH POND C DAM	1999	Elbow of pipe and riser collapsed.
Columbiana	3	II	WOODLAND LAKE DAM	2003	Dam overtopped; no downstream damage noted.
Belmont	3	I	MEIGS-PHILLIPS I NO. 1 DAM	2004	Severe erosion was noted in the emergency spillway.
Jefferson	3	I	JEFFERSON LAKE DAM	2004	Dam was within 0.5' of overtopping two times in one year.
Jefferson	3	I	WILLIAMS LAKE DAM	2004	Dam overtopped twice in same year; no damage downstream reported.
Perry	3	I	ALTIERS LAKE DAM	2004	Flood event resulted in pool being 3-4' above normal; dam did not overtop.
Belmont	3	I	BARNESVILLE LAKE DAM	2005	A shallow slide was noted on the downstream slope.
Columbiana	3	I	Buckeye Water District Reservoir	2008	N/A
Tuscarawas	3	I	SUGARCREEK SPORTSMAN CLUB Dam	2010	Seepage.
Ashtabula	3	II	GERLAT LAKE DAM	2011	Spillway failed. ODNR issued an order for the dam to be repaired or breached. The dam was breached.
Hocking	3	I	LAKE OF THE FOUR SEASONS DAM	2013	Upstream slope earth slide.
Columbiana	3	II	SEVAKEEN COUNTRY CLUB LAKE DAM	1930s	Dam breached and rebuilt; no downstream damage noted.
Pike	3	I	LAKE WHITE DAM	1964, 1994	Dam overtopped in 1964 and 1994; no damage downstream reported.
Columbiana	3	II	WESTVILLE LAKE DAM	1980, 1982, 1994	Breach in the south dike indicated in 1980; another breach indicated in 1982; portion of replacement spillway washed out during construction in 1994. No damage downstream was reported.

Source: ODNR—Division of Water Resources, Dam Safety Program, Dam Inventory Data.

## PROBABILITY OF OCCURRENCE

From 1852 to 2014, there were 103 documented Class I and II dam incidents/failures that were generally minor and resulted in little property damage (Table 2.6.f). Based on these past events, there is seemingly a 64% (103 incidents/162 years observed) annual chance of Class I/II dam incident/failure in any given year. However, from a dam safety perspective, past occurrences of incidents/failure are not a predictor of future failures.

There are no documented instances of levee breaches whereby structures or properties were damaged in Ohio as such data are generally unavailable and undocumented. This does not mean that there is a zero percent chance of levee failure within the state, but more effort needs to be exerted in the collection of such data in order to produce a more accurate probability statement.

For reasons previously mentioned, and some of which are uncontrollable by humans, it is possible a dam or levee can fail at any time, given the right circumstances. However, the probability of future occurrence is reduced due to proactive preventative action on the part of ODNR, DSP and individual dam and levee owners. As previously discussed in this section, the DSP provides oversight to dam/levee repairs, oversees and issues construction permits, enforces safety standards and mandates, conducts periodic safety inspections, and provides public information to levee owners, engineers, and the general public. This proactive approach to managing dam and levee safety in Ohio reduces the number of losses to property and life as a result of dam or levee failures or near failures.

## VULNERABILITY ANALYSIS & LOSS ESTIMATION

### DAMS – METHODOLOGY

Ideally all dams in the State of Ohio would have inundation mapping performed so dam safety officials, local officials, and first responders would be aware of the risk. Per Ohio Administrative Code 1501:21-15-07 all Class I dam owners must provide an inundation study and map along with their EAP. While voluntary compliance is not at 100%, the DSP has a relative idea of the impacts of dam failure and many of these dams do have an approved EAP complete with inundation mapping.

Under Ohio Revised Code 149.433(a) Class I dams are considered infrastructure and information regarding the safety of infrastructure cannot be distributed to unauthorized personnel due to security concerns. This means inundation maps and EAPs cannot be widely distributed, However, local EMAs and DSP are copy holders of the EAPs for all dams.

In an ongoing effort, ODNR DSP is utilizing Decision Support System for Water Infrastructure Security (DSS-WISE) Lite (<https://dsswiseweb.ncche.olemiss.edu/userpages/about.php>) to develop inundation areas for Class I Dams, initially focusing on dams that do not have an approved EAP. As part of this analysis, daytime and nighttime PAR are calculated to help planners and responders understand the differing impacts that a dam failure may have dependent on if people are out of their residence at a place of employment or at school (daytime) or at their residence, likely sleeping (nighttime).

ODNR DSP helps the United States Army Corps of Engineers update the National Inventory of Dams (NID) yearly. This information can be found on the NID website: <https://nid.sec.usace.army.mil/#/>. See Table 2.6.g for a listing of Class I Dams and their EAP Status. As of December 2023, over 265 Class I Dams with EAPs have inundation studies and inundation maps to help identify downstream risk.

Table 2.6.g

Ohio Class I Dam with EAP Status				
NID Number	Name	County	OEMA Region	EAP Status
OH03174	WILLIAMS RESERVOIR	ALLEN	1	Approved
OH00525	BRESLER UPGROUND RESERVOIR	ALLEN	1	Approved
OH00522	LOST CREEK UPGROUND RESERVOIR	ALLEN	1	Approved
OH00520	FERGUSON UPGROUND RESERVOIR	ALLEN	1	Approved
OH00521	METZGER UPGROUND RESERVOIR	ALLEN	1	Approved
OH00581	GRAND LAKE ST. MARYS - EAST EMBANKMENT	AUGLAIZE	1	Approved
OH00077	STROMAN LAKE DAM	CHAMPAIGN	1	Approved
OH00444	CLARK LAKE DAM	CLARK	1	Approved
OH00153	BUCYRUS RESERVOIR NO. 3 DAM	CRAWFORD	1	Approved
OH00150	POWERS UPGROUND RESERVOIR	CRAWFORD	1	Cursory
OH01467	BUCYRUS UPGROUND RESERVOIR NO. 4	CRAWFORD	1	Approved
OH00704	CELERYVILLE UPGROUND RESERVOIR	CRAWFORD	1	Cursory
OH00151	BUCYRUS RESERVOIR NO. 1 DAM	CRAWFORD	1	Approved
OH00385	DEFIANCE POWER DAM	DEFIANCE	1	Approved
OH03143	DEFIANCE UPGROUND RESERVOIR	DEFIANCE	1	Approved
OH00791	ARCHBOLD UPGROUND RESERVOIR NO. 1	FULTON	1	Approved
OH00420	DELTA RESERVOIR NO. 1	FULTON	1	Not Approved
OH01592	DELTA UPGROUND RESERVOIR NO. 2	FULTON	1	Not Approved
OH00789	WAUSEON UPGROUND RESERVOIR NO. 2	FULTON	1	Approved
OH00792	ARCHBOLD UPGROUND RESERVOIR NO. 2	FULTON	1	Approved
OH00788	FOSTORIA UPGROUND RESERVOIR NO. 5	HANCOCK	1	Approved
OH00783	McCOMB UPGROUND RESERVOIR NO. 1	HANCOCK	1	Approved
OH01089	McCOMB UPGROUND RESERVOIR NO. 2	HANCOCK	1	Approved
OH00785	LAKE LAMBERJACK UPGROUND RESERVOIR	HANCOCK	1	Approved
OH00787	LAKE MOTTRAM UPGROUND RESERVOIR	HANCOCK	1	Approved
OH00784	LAKE MOSIER UPGROUND RESERVOIR	HANCOCK	1	Approved
OH02730	VETERANS MEMORIAL RESERVOIR	HANCOCK	1	Cursory
OH00758	FINDLAY UPGROUND RESERVOIR NO. 1	HANCOCK	1	Approved
OH00782	FINDLAY UPGROUND RESERVOIR NO. 2	HANCOCK	1	Approved
OH00222	HOLIDAY LAKE DAM	HURON	1	Approved
OH00217	GREENWICH RESERVOIR DAM	HURON	1	Approved
OH00952	NEW LONDON RESERVOIR	HURON	1	Approved
OH00804	BELLEVUE UPGROUND RESERVOIR NO. 1	HURON	1	Approved
OH00805	BELLEVUE UPGROUND RESERVOIR NO. 3	HURON	1	Approved
OH00806	BELLEVUE UPGROUND RESERVOIR NO. 4	HURON	1	Approved
OH00761	NORWALK MEMORIAL RESERVOIR	HURON	1	Approved
OH00762	NORWALK UPPER RESERVOIR	HURON	1	Approved
OH00763	NORWALK LOWER RESERVOIR	HURON	1	Approved
OH00775	WILLARD CITY UPGROUND RESERVOIR	HURON	1	Approved
OH01944	PINE LAKE DAM	LOGAN	1	Not Approved
OH00980	BRIARWOOD SPORTSMAN'S CLUB NO. 11 DAM	LOGAN	1	Not Approved
OH00596	INDIAN LAKE DAM	LOGAN	1	Cursory
OH01977	COLLINS PARK WTP SLUDGE LAGOONS B & C	LUCAS	1	Approved
OH03218	HOWARD FARM DAM	LUCAS	1	Approved
OH00579	UPPER WABASH STRUCTURE NO. 3 DAM	MERCER	1	Approved
OH00580	GRAND LAKE ST. MARYS - WEST EMBANKMENT	MERCER	1	Approved
OH02103	ECHO LAKE DAM	MIAMI	1	Approved
OH02104	FRANZ POND DAM	MIAMI	1	Approved
OH00515	SWIFT RUN LAKE DAM	MIAMI	1	Approved
OH00476	PAULDING UPGROUND RESERVOIR	PAULDING	1	Cursory
OH00154	PARADISE LAKES - NORTH LAKE DAM	PREBLE	1	Cursory
OH00155	PARADISE LAKES - SOUTH LAKE DAM	PREBLE	1	Cursory
OH00159	FOUR EAGLES LAKE DAM	PREBLE	1	Approved
OH00434	RUSH RUN LAKE DAM	PREBLE	1	Approved
OH00156	LAKE LAKENGREN DAM	PREBLE	1	Cursory
OH01058	OTTAWA UPGROUND RESERVOIR	PUTNAM	1	Approved
OH03201	FREMONT UPGROUND RESERVOIR	SANDUSKY	1	Approved
OH00754	RACCOON CREEK UPGROUND RESERVOIR	SANDUSKY	1	Approved
OH00469	BEAVER CREEK UPGROUND RESERVOIR	SENECA	1	Approved
OH03137	ATTICA UPGROUND RESERVOIR #2	SENECA	1	Approved
OH00391	LOCKINGTON DAM	SHELBY	1	Approved
OH00442	LAKE LORAMIE DAM	SHELBY	1	Approved
OH03148	DELPHOS RESERVOIR DAM	VAN WERT	1	Approved
OH00768	VAN WERT UPGROUND RESERVOIR NO. 1	VAN WERT	1	Cursory
OH03144	VAN WERT UPGROUND RESERVOIR NO. 3	VAN WERT	1	Approved
OH00382	LAKE SENECA DAM	WILLIAMS	1	Cursory

NID Number	Name	County	OEMA Region	EAP Status
OH02768	PROVIDENCE DAM	WOOD	1	Approved
OH02769	GRAND RAPIDS DAM	WOOD	1	Approved
OH02767	BOWLING GREEN UPGROUND RES & SLUDGE LGNS	WOOD	1	Approved
OH00777	NORTH BALTIMORE UG RES NO. 1 & 2	WOOD	1	Approved
OH01144	ARTESIAN LAKE DAM	ASHLAND	2	Not Approved
OH00095	CINNAMON LAKE DAM	ASHLAND	2	Approved
OH01292	STONEGATE POND DAM	BUTLER	2	Cursory
OH02911	FAIRFIELD DETENTION "A" DAM	BUTLER	2	Approved
OH02920	FAIRFIELD DETENTION "C" DAM	BUTLER	2	Approved
OH01294	SWAN LAKE DAM	BUTLER	2	Approved
OH00177	CHARYLIE'S LAKE DAM	BUTLER	2	Not Approved
OH00174	ROSS TRAILS LAKE DAM	BUTLER	2	Approved
OH00575	ACTON LAKE DAM	BUTLER	2	Approved
OH01013	CLINTON COUNTY TRIBUTARY NO. 4 DAM	CLINTON	2	Approved
OH01014	CLINTON COUNTY TRIBUTARY NO. 1 DAM	CLINTON	2	Approved
OH00967	BLANCHESTER RESERVOIR NO. 3 DAM	CLINTON	2	Approved
OH03109	BLANCHESTER RESERVOIR NO. 6 DAM	CLINTON	2	Approved
OH00781	BLANCHESTER RESERVOIR NO. 4 DAM	CLINTON	2	Not Approved
OH00764	WILMINGTON UPGROUND RESERVOIR NO. 1	CLINTON	2	Approved
OH00765	WILMINGTON UPGROUND RESERVOIR NO. 2	CLINTON	2	Approved
OH00500	COWAN LAKE DAM	CLINTON	2	Approved
OH00352	LOWER SHAKER LAKE DAM	CUYAHOGA	2	Approved
OH00353	UPPER SHAKER LAKE DAM	CUYAHOGA	2	Approved
OH02943	KERRUSH STORMWATER CONTROL FACILITY DAM	CUYAHOGA	2	Approved
OH00918	FOREST HILL PARK DAM NO. 2	CUYAHOGA	2	Cursory
OH00945	LAKEVIEW CEMETERY FLOOD CONTROL DAM	CUYAHOGA	2	Approved
OH01483	BRIAR HILL LAKE DAM	CUYAHOGA	2	Cursory
OH01487	HOLLENBECK LAKE DAM	CUYAHOGA	2	Approved
OH03191	JOHN R. DOUTT UPGROUND RESERVOIR	DELAWARE	2	Approved
OH01522	HORACE TROOP POND DAM	DELAWARE	2	Not Approved
OH03173	TIMBER LAKE LIBERTY DAM	DELAWARE	2	Cursory
OH02737	LEXINGTON GLEN DAM	DELAWARE	2	Cursory
OH01513	DEL-CO UPLAND STORAGE RESERVOIR NO. 2	DELAWARE	2	Approved
OH02882	DEL-CO UPLAND STORAGE RESERVOIR NO. 3	DELAWARE	2	Approved
OH02886	DEL-CO UPLAND STORAGE RESERVOIR NO. 4	DELAWARE	2	Approved
OH00812	SUNBURY UPGROUND RESERVOIR NO. 1	DELAWARE	2	Approved
OH00747	SUNBURY UPGROUND RESERVOIR NO. 2	DELAWARE	2	Approved
OH03066	DEL-CO UPLAND STORAGE RESERVOIR NO. 5	DELAWARE	2	Approved
OH00748	WESTERVILLE RESERVOIR DAM	DELAWARE	2	Approved
OH00752	CAMP GREENWOOD LAKE DAM	DELAWARE	2	Approved
OH03129	ALUM CREEK UPGROUND RESERVOIR NO. 2	DELAWARE	2	Approved
OH02905	ALUM CREEK UPGROUND RESERVOIR	DELAWARE	2	Approved
OH00751	O'SHAUGHNESSY RESERVOIR DAM	DELAWARE	2	Approved
OH02899	HUNTERS RUN STRUCTURE R-42	FAIRFIELD	2	Approved
OH00725	RUSHCREEK STRUCTURE NO. V-C	FAIRFIELD	2	Approved
OH02848	TARHE DRY DAM	FAIRFIELD	2	Approved
OH00716	HUNTERS RUN STRUCTURE NO. 1	FAIRFIELD	2	Approved
OH00719	HUNTERS RUN STRUCTURE NO. 4	FAIRFIELD	2	Approved
OH00718	HUNTERS RUN STRUCTURE NO. 3	FAIRFIELD	2	Cursory
OH00721	HUNTERS RUN STRUCTURE NO. 6	FAIRFIELD	2	Cursory
OH00722	HUNTERS RUN STRUCTURE NO. 8	FAIRFIELD	2	Approved
OH00714	HUNTERS RUN STRUCTURE NO. 9	FAIRFIELD	2	Approved
OH00727	RUSHCREEK STRUCTURE NO. VII-E	FAIRFIELD	2	Cursory
OH01077	RUSHCREEK STRUCTURE NO. VI-D	FAIRFIELD	2	Cursory
OH02679	RUSHCREEK STRUCTURE NO. VII-A	FAIRFIELD	2	Cursory
OH01564	RUSHCREEK STRUCTURE NO. VI-A	FAIRFIELD	2	Cursory
OH00948	PINE LAKE ESTATES DAM	FAIRFIELD	2	Approved
OH00627	WASHINGTON COURT HOUSE UG NO. 1 DAM	FAYETTE	2	Cursory
OH00736	THOREAU POND DAM	FRANKLIN	2	Approved
OH00740	JULIAN GRIGGS DAM	FRANKLIN	2	Approved
OH00737	HOOVER DAM	FRANKLIN	2	Approved
OH01005	SCHLOSS POND DAM	GEAUGA	2	Cursory
OH00365	MONT-MERE LAKE DAM	GEAUGA	2	Approved
OH01621	LAKE-IN-THE-WOODS DAM	GEAUGA	2	Cursory
OH01629	SHADOW HILL LAKE DAM	GEAUGA	2	Not Approved
OH00358	LAKE LUCERNE DAM	GEAUGA	2	Approved
OH00359	TANGLEWOOD LAKE DAM	GEAUGA	2	Not Approved
OH01622	LOECY POND DAM	GEAUGA	2	Approved
OH00755	EAST BRANCH RESERVOIR DAM	GEAUGA	2	Approved

NID Number	Name	County	OEMA Region	EAP Status
OH00756	BRIDGE CREEK DAM	GEAUGA	2	Approved
OH00426	HUFFMAN DAM	GREENE	2	Approved
OH01648	DOMINICK LOFINO PARK LAKE DAM	GREENE	2	Cursory
OH00807	CEDARVILLE UPGROUND RESERVOIR	GREENE	2	Not Approved
OH00206	LAKE SHAWNEE DAM	GREENE	2	Approved
OH00936	CHATEAU LAKES NO. 1 DAM	HAMILTON	2	Approved
OH02907	WRIGHT FARM WEST DETENTION BASIN DAM	HAMILTON	2	Cursory
OH00991	SHARONVILLE RETENTION DAM	HAMILTON	2	Approved
OH03050	ASTON OAKS LAKE DAM	HAMILTON	2	Approved
OH01703	LINCOLN HEIGHTS UPGROUND RESERVOIR	HAMILTON	2	Approved
OH00191	KREIS DAM	HAMILTON	2	Approved
OH00346	LAKE VIERING DAM	KNOX	2	Not Approved
OH03205	LAKE DAMASCUS DAM	KNOX	2	Cursory
OH01856	KNOX CATTLE COMPANY DAM	KNOX	2	Not Approved
OH00638	KNOX LAKE DAM	KNOX	2	Approved
OH00345	APPLE VALLEY LAKE DAM	KNOX	2	Approved
OH02833	HOOSE ROAD RETENTION DAM	LAKE	2	Approved
OH00474	BUCKEYE LAKE DAM	LICKING	2	Approved
OH00472	DAWES ARBORETUM LAKE DAM	LICKING	2	Not Approved
OH00438	FINDLEY LAKE DAM	LORAIN	2	Approved
OH02990	WILLOWAY UPGROUND NO. 5 DAM	LORAIN	2	Approved
OH00112	OBERLIN UPGROUND RESERVOIR	LORAIN	2	Approved
OH00774	WELLINGTON UPGROUND RESERVOIR	LORAIN	2	Approved
OH00068	LAKE CHOCTAW DAM	MADISON	2	Approved
OH02010	CHIPPEWA CREEK STRUCTURE III-A	MEDINA	2	Approved
OH01085	CHIPPEWA CREEK STRUCTURE VIII-C	MEDINA	2	Approved
OH00616	SIEDEL LAKE DAM	MEDINA	2	Approved
OH01081	BLUE HERON LAKE NO. 1 DAM	MEDINA	2	Cursory
OH00614	BLUE HERON LAKE NO. 5 DAM	MEDINA	2	Cursory
OH02713	RIDGEWOOD LAKE DAM	MEDINA	2	Not Approved
OH00622	LAKE MEDINA DAM	MEDINA	2	Approved
OH00607	RUSTIC HILLS LAKE DAM	MEDINA	2	Approved
OH03057	BRYE LAKE DAM	MEDINA	2	Not Approved
OH00621	HINCKLEY LAKE DAM	MEDINA	2	Approved
OH00623	LAKE BRUNSWICK DAM	MEDINA	2	Approved
OH00600	RAVENS WOOD LAKE DAM	MEDINA	2	Approved
OH02086	LAKE HAVEN DAM	MEDINA	2	Not Approved
OH00615	SEVEN SPRINGS LAKE DAM	MEDINA	2	Approved
OH00425	GERMANTOWN DAM	MONTGOMERY	2	Approved
OH00427	TAYLORSVILLE DAM	MONTGOMERY	2	Approved
OH00431	ENGLEWOOD DAM	MONTGOMERY	2	Approved
OH02129	NEWFIELDS DEVELOPMENT LAKE DAM	MONTGOMERY	2	Approved
OH00423	LAKE MARINOLE DAM	MONTGOMERY	2	Approved
OH00428	SPRING LAKE DAM	MONTGOMERY	2	Not Approved
OH00689	MOUNT GILEAD LOWER LAKE DAM	MORROW	2	Approved
OH00686	AMICKS UPGROUND RESERVOIR	MORROW	2	Cursory
OH00688	CANDLEWOOD LAKE DAM	MORROW	2	Approved
OH00643	HARGUS LAKE DAM	PICKAWAY	2	Approved
OH00670	TUCAWAY LAKE DAM	PORTAGE	2	Not Approved
OH02729	HICKORY HILLS PARK LAKE DAM	PORTAGE	2	Not Approved
OH03217	CAMP SPELMAN LAKE DAM	PORTAGE	2	Approved
OH02286	BRIMFIELD LAKE DAM	PORTAGE	2	Approved
OH00665	MOGADORE RESERVOIR DAM	PORTAGE	2	Approved
OH00668	LAKE ROCKWELL DAM	PORTAGE	2	Approved
OH02853	SHELBY UPGROUND RESERVOIR NO. 3	RICHLAND	2	Approved
OH00778	CLEAR FORK RESERVOIR DAM	RICHLAND	2	Approved
OH00455	SHELBY UPGROUND RESERVOIR NO. 2	RICHLAND	2	Approved
OH03146	MARATHON BRINE POND DAM	STARK	2	Approved
OH02437	LORDS LAKE DAM	STARK	2	Approved
OH00241	DALE WALBORN RESERVOIR DAM	STARK	2	Approved
OH03146	MARATHON BRINE POND DAM	STARK	2	Approved
OH00236	LAKE CABLE DAM	STARK	2	Approved
OH00481	GORGE PLANT DAM	SUMMIT	2	Approved
OH02471	SILVER CREEK LAKE DAM	SUMMIT	2	Approved
OH03185	ZIMBER DITCH DETENTION BASIN B	SUMMIT	2	Approved
OH00479	COMET LAKE DAM	SUMMIT	2	Approved
OH02472	STEEPLECHASE LAKE DAM	SUMMIT	2	Approved
OH00489	LAKE BUTLER DAM	SUMMIT	2	Approved
OH00933	LAKE LITCHFIELD DAM	SUMMIT	2	Approved

NID Number	Name	County	OEMA Region	EAP Status
OH02854	SWAN LAKE DAM	SUMMIT	2	Not Approved
OH00487	LOYAL OAK LAKE DAM	SUMMIT	2	Approved
OH03044	CHARBONNEAU LAKE DAM	SUMMIT	2	Approved
OH02470	RESERVOIR PARK UPGROUND	SUMMIT	2	Cursory
OH00485	TUSCARAWAS RIVER DIVERSION DAM	SUMMIT	2	Approved
OH00584	NIMISILA RESERVOIR DAM	SUMMIT	2	Approved
OH00486	LAKE DOROTHY DAM	SUMMIT	2	Approved
OH00588	EAST RESERVOIR DAM	SUMMIT	2	Approved
OH00587	NORTH RESERVOIR DAM	SUMMIT	2	Approved
OH00585	WEST RESERVOIR DAM	SUMMIT	2	Approved
OH00483	WOLF CREEK DAM	SUMMIT	2	Approved
OH03166	MARYSVILLE UPGROUND RESERVOIR	UNION	2	Approved
OH00553	SHAKER RUN DAM	WARREN	2	Approved
OH00547	LILLEY LAKE DAM	WARREN	2	Not Approved
OH00532	CLASSICWAY FARM LAKE DAM	WARREN	2	Not Approved
OH00542	PINE HILL LAKE DAM	WARREN	2	Approved
OH00540	LANDEN FARM LAKE DAM	WARREN	2	Approved
OH02594	REMICK LAKE DAM	WARREN	2	Approved
OH00533	SUNRISE LAKE DAM	WARREN	2	Approved
OH00926	CHIPPEWA CREEK STRUCTURE VII-C	WAYNE	2	Approved
OH00436	SHREVE LAKE DAM	WAYNE	2	Approved
OH00254	MINERAL SPRINGS RESORT LAKE DAM	ADAMS	3	Approved
OH00259	ADAMS LAKE DAM	ADAMS	3	Approved
OH01127	KILLEN STATION ASH DISPOSAL DIKE	ADAMS	3	Cursory
OH00392	LOWER JEFFCO LAKE DAM	ASHTABULA	3	Not Approved
OH00396	CAMP WHITEWOOD LAKE DAM	ASHTABULA	3	Not Approved
OH00938	HOLIDAY CAMPLANDS LAKE DAM	ASHTABULA	3	Approved
OH01191	NAJI LAKE DAM	ASHTABULA	3	Not Approved
OH00407	ASHTABULA COUNTY OUTDOOR CLUB LAKE DAM	ASHTABULA	3	Approved
OH00397	ROAMING ROCK SHORES LAKE DAM	ASHTABULA	3	Approved
OH00084	MARGARET CREEK STRUCTURE NO. 4	ATHENS	3	Approved
OH00086	DOW LAKE DAM	ATHENS	3	Approved
OH00960	MARGARET CREEK STRUCTURE NO. 1	ATHENS	3	Approved
OH00081	NESBITT POND DAM	ATHENS	3	Not Approved
OH00706	MARGARET CREEK STRUCTURE NO. 6	ATHENS	3	Approved
OH00083	MARGARET CREEK STRUCTURE NO. 2	ATHENS	3	Not Approved
OH01218	BELMONT HILLS COUNTRY CLUB LAKE DAM	BELMONT	3	Approved
OH00300	BARNESVILLE RESERVOIR NO. 2 DAM	BELMONT	3	Approved
OH00299	BARNESVILLE RESERVOIR NO. 1 DAM	BELMONT	3	Approved
OH00793	ST. CLAIRSVILLE RESERVOIR NO. 1 DAM	BELMONT	3	Approved
OH01229	MEIGS-PHILLIPS I NO. 1 DAM	BELMONT	3	Approved
OH00877	BARNESVILLE LAKE DAM	BELMONT	3	Approved
OH00753	BARNESVILLE RESERVOIR NO. 3 DAM	BELMONT	3	Approved
OH00794	ST. CLAIRSVILLE RESERVOIR NO. 2 DAM	BELMONT	3	Approved
OH00292	BELMONT LAKE DAM	BELMONT	3	Approved
OH01099	THE OHIO VALLEY COAL SLURRY DISPOSAL DAM	BELMONT	3	Approved
OH00293	BETHESDA RESERVOIR DAM	BELMONT	3	Approved
OH01002	MOUNT ORAB UPGROUND RESERVOIR NO. 2	BROWN	3	Approved
OH01249	FAYETTEVILLE HIGH SCHOOL LAKE DAM	BROWN	3	Not Approved
OH00162	LAKE WAYNOKA DAM	BROWN	3	Approved
OH00462	PUSKARICH LAKE DAM	CARROLL	3	Cursory
OH00459	VO-ASH LAKE DAM	CARROLL	3	Approved
OH00467	LAKE MOHAWK DAM	CARROLL	3	Approved
OH01358	GALLEY HILL LAKE DAM	CLERMONT	3	Approved
OH03032	EQUINUS (LEGENDARY RUN) LAKE DAM	CLERMONT	3	Approved
OH00271	CLERMONT GOLF LIMITED LAKE DAM	CLERMONT	3	Cursory
OH03006	MARGE SCHOTT LAKE DAM	CLERMONT	3	Approved
OH01391	WILLOWBROOK LAKE DAM	CLERMONT	3	Approved
OH00269	STONELICK LAKE DAM	CLERMONT	3	Approved
OH00315	LAKE TOMAHAWK DAM	COLUMBIANA	3	Approved
OH03145	BUCKEYE WATER DISTRICT RESERVOIR	COLUMBIANA	3	Approved
OH00321	SALEM RESERVOIR (SOUTH EMBANKMENT)	COLUMBIANA	3	Approved
OH00307	WELLSVILLE RESERVOIR DAM	COLUMBIANA	3	Approved
OH00322	SPRING VALLEY PARK LAKE DAM	COLUMBIANA	3	Approved
OH00635	HIGHLANDTOWN LAKE DAM	COLUMBIANA	3	Approved
OH00636	GUILFORD LAKE DAM	COLUMBIANA	3	Approved
OH00310	BIBBEE'S LITTLE ROCK LAKE DAM	COLUMBIANA	3	Not Approved
OH03216	BUCKEYE WATER DISTRICT RESERVOIR II	COLUMBIANA	3	Approved
OH00038	SUNSET LAKE DAM	COSHOCTON	3	Approved

NID Number	Name	County	OEMA Region	EAP Status
OH00285	RIO GRANDE RESERVOIR	GALLIA	3	Approved
OH00283	TYCOON LAKE DAM	GALLIA	3	Approved
OH00971	GAVIN BOTTOM ASH POND	GALLIA	3	Cursory
OH00919	STINGY RUN FLY ASH DAM	GALLIA	3	Cursory
OH00051	INDIAN LAKES REC. AREA LOWER LAKE DAM	GUERNSEY	3	Cursory
OH00053	LUBURGH LAKE DAM	GUERNSEY	3	Approved
OH00433	SALT FORK LAKE DAM	GUERNSEY	3	Approved
OH00879	STEVENS LAKE DAM	HARRISON	3	Not Approved
OH00896	VARKONY POND DAM	HARRISON	3	Not Approved
OH00141	SALLY BUFFALO PARK LAKE DAM	HARRISON	3	Approved
OH01736	SALLY BUFFALO PARK LAKE NO. 4 DAM	HARRISON	3	Approved
OH01111	SALLY BUFFALO PARK LAKE NO. 2 DAM	HARRISON	3	Approved
OH00129	GEORGETOWN PLANT FRESHWATER DAM	HARRISON	3	Not Approved
OH00302	ROCKY FORK LAKE DAM	HIGHLAND	3	Approved
OH01764	HOLIDAY HAVEN LAKE DAM I	HOCKING	3	Cursory
OH00251	LAKE OF THE FOUR SEASONS DAM	HOCKING	3	Cursory
OH00260	LAKE LOGAN DAM	HOCKING	3	Approved
OH00249	OLD MAN'S CAVE LAKE DAM	HOCKING	3	Approved
OH00065	BETHANY LAKE DAM	HOLMES	3	Cursory
OH00063	LAKE BUCKHORN DAM	HOLMES	3	Approved
OH01807	FAIRGREENS GOLF CLUB DAM	JACKSON	3	Not Approved
OH00813	WELLSTON RESERVOIR DAM	JACKSON	3	Cursory
OH00510	LAKE KATHARINE LAKE DAM	JACKSON	3	Approved
OH00642	JACKSON LAKE DAM	JACKSON	3	Approved
OH00508	JISCO LAKE DAM	JACKSON	3	Approved
OH00507	HAMMERTOWN LAKE DAM	JACKSON	3	Approved
OH00920	CARDINAL FLY ASH NO. 1 DAM	JEFFERSON	3	Approved
OH00123	FRIENDSHIP PARK LAKE DAM	JEFFERSON	3	Approved
OH00121	PINE VALLEY SPORTSMEN'S LAKE NO. 4 DAM	JEFFERSON	3	Not Approved
OH00497	JEFFERSON LAKE DAM	JEFFERSON	3	Approved
OH00862	BASICH LAKE DAM	JEFFERSON	3	Cursory
OH01826	CARDINAL FLY ASH NO. 2 DAM	JEFFERSON	3	Approved
OH00707	LAKE AUSTIN DAM	JEFFERSON	3	Approved
OH00953	IZAACK WALTON LAKE DAM	LAWRENCE	3	Cursory
OH00145	WALLER LAKE DAM	LAWRENCE	3	Cursory
OH00632	PINE LAKE DAM	MAHONING	3	Approved
OH03105	YOUNGSTOWN UPGROUND RESERVOIR	MAHONING	3	Approved
OH00629	LAKE HAMILTON DAM	MAHONING	3	Approved
OH00628	McKELVEY LAKE DAM	MAHONING	3	Approved
OH00631	EVANS LAKE DAM	MAHONING	3	Approved
OH00419	LAKE MILTON DAM	MAHONING	3	Approved
OH00440	FORKED RUN LAKE DAM	MEIGS	3	Approved
OH02094	MEIGS MINE NO. 1 SLURRY IMPOUNDMENT	MEIGS	3	Cursory
OH00441	MONROE LAKE DAM	MONROE	3	Approved
OH03177	WOODSFIELD RESERVOIR DAM NO. 3	MONROE	3	Not Approved
OH00696	MUSKINGUM RIVER LOCK AND DAM NO. 6	MORGAN	3	Approved
OH02226	ZANESVILLE STATE NURSERY LAKE DAM	MUSKINGUM	3	Approved
OH00055	DEER LAKE DAM	MUSKINGUM	3	Not Approved
OH02190	MUSKINGUM COLLEGE LAKE DAM	MUSKINGUM	3	Approved
OH00841	INTERNATIONAL ANIMAL PRESERVE POND DAM #10	MUSKINGUM	3	Approved
OH00061	BLUE ROCK LAKE DAM	MUSKINGUM	3	Approved
OH03060	CLINE LAKE DAM	NOBLE	3	Approved
OH00708	CALDWELL LAKE DAM	NOBLE	3	Approved
OH00437	WOLF RUN LAKE DAM	NOBLE	3	Approved
OH00654	ESSINGTON LAKE DAM	PERRY	3	Cursory
OH02243	ALLEN NO. 1 DAM	PERRY	3	Not Approved
OH02844	RUSHCREEK STRUCTURE NO. II	PERRY	3	Approved
OH00660	RUSHCREEK STRUCTURE NO. III-A	PERRY	3	Cursory
OH02254	RUSHCREEK STRUCTURE NO. IV-C	PERRY	3	Cursory
OH03076	RUSHCREEK STRUCTURE NO. III-C	PERRY	3	Cursory
OH00649	ALTIERS LAKE DAM	PERRY	3	Not Approved
OH00648	SAN TOY DAM	PERRY	3	Approved
OH00661	GLASS ROCK LAKE DAM	PERRY	3	Cursory
OH00655	PERRY RECLAMATION DAM NO. 3	PERRY	3	Approved
OH00653	RUSH CREEK STRUCTURE NO. 1-B	PERRY	3	Cursory
OH00798	NEW LEXINGTON RESERVOIR DAM	PERRY	3	Not Approved
OH00198	LONG'S RETREAT LAKE DAM	PIKE	3	Approved
OH00446	LAKE WHITE DAM	PIKE	3	Approved
OH00200	PIKE LAKE DAM	PIKE	3	Approved

NID Number	Name	County	OEMA Region	EAP Status
OH02277	ARNETT LAKE DAM	PIKE	3	Not Approved
OH00197	CAVE LAKE DAM	PIKE	3	Approved
OH02356	BROWN & HASKINS LAKE DAM	ROSS	3	Cursory
OH00025	WHITE TURKEY LAKE DAM	ROSS	3	Approved
OH00443	ROSS LAKE DAM	ROSS	3	Approved
OH00766	SOUTHERN SILICA POND NO. 1 DAM	ROSS	3	Cursory
OH00767	SOUTHERN SILICA POND NO. 2 DAM	ROSS	3	Not Approved
OH00023	CALDWELL LAKE DAM	ROSS	3	Approved
OH00498	BEAR CREEK LAKE DAM	SCIOTO	3	Approved
OH02376	KINSKEY LAKE DAM	SCIOTO	3	Not Approved
OH02390	WOLF DEN LAKE DAM	SCIOTO	3	Approved
OH02385	POND LICK LAKE DAM	SCIOTO	3	Approved
OH00291	BIG BEAR LAKE DAM	SCIOTO	3	Not Approved
OH00644	TURKEY CREEK LAKE DAM	SCIOTO	3	Approved
OH00286	ROOSEVELT LAKE DAM	SCIOTO	3	Approved
OH02380	LAKE EMMA	SCIOTO	3	Not Approved
OH00336	PLEASANT VALLEY LAKE DAM	TRUMBULL	3	Not Approved
OH00634	UPPER GIRARD LAKE DAM	TRUMBULL	3	Approved
OH00337	MINERAL RIDGE DAM	TRUMBULL	3	Approved
OH00334	COALBURG LAKE DAM	TRUMBULL	3	Cursory
OH02525	SUGARCREEK SPORTSMAN CLUB LAKE DAM	TUSCARAWAS	3	Not Approved
OH00074	LAKE ALMA DAM	VINTON	3	Approved
OH00073	LAKE RUPERT DAM	VINTON	3	Approved
OH02839	SANDS HILL SLURRY IMPOUNDMENT DAM	VINTON	3	Not Approved
OH00445	VETO LAKE DAM	WASHINGTON	3	Approved
OH00973	MUSKINGUM RIVER LOWER FLY ASH DAM	WASHINGTON	3	Approved
OH00972	MUSKINGUM RIVER MIDDLE FLY ASH DAM	WASHINGTON	3	Approved
OH01100	ERAMET WASTE RETENTION DAM	WASHINGTON	3	Approved
OH00989	MUSKINGUM RIVER UPPER FLY ASH DAM	WASHINGTON	3	Approved

Source: Ohio Department of Natural Resources Dam Safety Program, December 2023.

Assessing the hazard that a dam poses to downstream areas can be divided into three analyses: (1) analysis of an uncontrolled release of the reservoir, (2) analysis of the inundation from the uncontrolled release, and (3) analysis of the consequence of the release. In other words, a dam fails, the failure causes flooding downstream, and the flooding has negative impacts on people or property. Each of these analyses includes substantial uncertainty. Legitimate estimates of discharge from a breach can differ by over 200%. Discharge from a dam breach is usually several times the one percent-annual-chance flood, and, therefore, typical flood studies are of limited use in estimating the extent of flooding. Dam failure inundation studies require specialized hydraulic modeling software and experience. Determining the impact of flooding is also difficult to accomplish, especially for estimating loss of life. Loss of life is a function of the time of day, warning time, awareness of those affected, and failure scenario. Many dam safety agencies have used “population at risk” (PAR), a more quantifiable measurement of the impact to human life, rather than “loss of life.” PAR is the number of people in structures within the inundation area that would be subject to significant, personal danger, if they took no action to evacuate.

Another factor in assessing the hazard that a dam poses is the dam’s condition. Assessing the condition of a dam can be an extensive and expensive process. ODNR’s Dam Safety Program inspects all regulated dams once every 5 years. As part of that inspection, the dam’s history is reviewed including original construction plans, previous inspection reports, investigations and studies, “Operation, Maintenance, and Inspection Manuals”, “Emergency Action Plans”, calculations, and any other available information. During the inspection, an assessment of the downstream area is made to verify the classification of the dam. If the inspection, combined with the dam’s history and potential downstream impacts, reveals concerns with the dam’s condition, the DSP takes enforcement action through the Ohio Attorney General’s office as needed.

As mentioned at the beginning of this section, emergency managers usually categorize dam failures as either sunny-day failures or rainy-day failures. Sunny day failures occur during a non-flooding situation with the reservoir near normal pool level. Rainy day failures usually involve periods of rainfall and flooding. Improper design of a spillway or careless operation of gates during high flows can lead to dam overtopping, excessive water pressure, and subsequent failure. Even though both types of failures can be disastrous, it can be assumed that a sunny day failure would be more catastrophic due to its unanticipated occurrence and the lack of time to warn residents downstream. The impacts of a dam failure are contingent on many factors and, therefore, cannot be concisely described.

In the mid the 2000’s the DSP program incorporated an assessment to estimate a dam’s risk to infrastructure and population at risk. The assessment looks at sunny day and rainy-day failures to categorize if infrastructure (roads, structures, water treatment facilities, etc.) would be damaged. This assessment is revisited when a dam is inspected as part of the 5-year inspection cycle. Table 2.6.h contains rough estimates of the downstream impacts of dam failures for the Class I dams that have an estimated Sunny Day People-at-Risk (PAR) greater than 50.

Infrastructure damage categorization is as follows:

- “Low” 1-3 impacted,
- “Medium” 10-50 impacted,
- “High” 51-150 impacted, and
- “Very high” over 150 impacted.

PAR is categorized in the following way:

- “Low” is less than 100 people,
- “Medium” is 101-200 people, and
- “High” is more than 200 people.

The condition of the dams in table 2.6.h is not a factor of the estimated damage or PAR levels. Because of the uncertainty of determining precisely who and what will be impacted by a dam failure, a scale was developed by the DSP to categorize dams based on their estimated impact to lives and structures downstream. The “Very high, high, medium, and low” scale is based on the PAR and was developed using experience with flood modeling, aerial photographs, field observations, and engineering judgment. The Damage and PAR levels are periodically updated by DSP staff as new data is obtained.

## DAMS – RESULTS

**Table 2.6.h**

Class I Dams, Estimated Downstream Damage Level and Estimated Population At-Risk (PAR) by County						
County	OEMA Region	Dam Name	Sunny Day Infrastructure Damage Level	Sunny Day PAR Level	Rainy Day Infrastructure Damage Level	Rainy Day PAR Level
Allen	1	Ferguson Upground Reservoir	High	Medium	Very High	Medium
Allen	1	Metzger Upground Reservoir	Medium	Medium	Very High	Medium
Allen	1	Lost Creek Upground Reservoir	Medium	Low	Medium	Low
Crawford	1	Bucyrus Reservoir No. 1 Dam	Medium	Low	Medium	Low
Hancock	1	Veterans Memorial Reservoir	Medium	Low	Medium	Low
Huron	1	Willard City Upground Reservoir	Medium	Low	Medium	Low
Huron	1	Norwalk Memorial Reservoir	High	Low	High	Low
Huron	1	Norwalk Upper Reservoir	High	Low	High	Low

County	OEMA Region	Dam Name	Sunny Day Infrastructure Damage Level	Sunny Day PAR Level	Rainy Day Infrastructure Damage Level	Rainy Day PAR Level
Huron	1	Norwalk Lower Reservoir	High	Low	High	Low
Shelby	1	Lockington Dam	--	Low	Very High	Medium
Shelby	1	Lake Loramie Dam	Medium	Low	Medium	Low
Butler	2	Fairfield Detention "A" Dam	--	Low	Medium	Low
Butler	2	Fairfield Detention "C" Dam	--	Low	Medium	Low
Butler	2	Acton Lake Dam	High	Low	High	Low
Clinton	2	Wilmington Upground Reservoir No. 2	Medium	Low	Medium	Low
Cuyahoga	2	Lakeview Cemetery Flood Control Dam	--	Low	High	Medium
Delaware	2	Alum Creek Upground Reservoir	High	Low	High	Low
Delaware	2	O'Shaughnessy Reservoir Dam	Very High	Low	Very High	Low
Franklin	2	Hoover Dam	Very High	High	Very High	High
Franklin	2	Julian Griggs Dam	High	Low	High	Low
Geauga	2	Bridge Creek Dam	Very High	Medium	Very High	Medium
Greene	2	Huffman Dam	--	Low	Very High	Medium
Knox	2	Apple Valley Lake Dam	High	Low	High	Low
Licking	2	Buckeye Lake Dam	Very High	High	Very High	Medium
Montgomery	2	Germantown Dam	--	Low	Very High	Medium
Montgomery	2	Taylorville Dam	--	Low	Very High	Medium
Montgomery	2	Englewood Dam	--	Low	Very High	High
Portage	2	Mogadore Reservoir Dam	High	Medium	High	Medium
Portage	2	Lake Rockwell Dam	High	Medium	Very High	Medium
Richland	2	Clear Fork Reservoir Dam	Medium	Low	High	Medium
Summit	2	West Reservoir Dam	High	Low	High	Low
Summit	2	Wolf Creek Dam	Very High	High	Very High	High
Summit	2	Tuscarawas River Diversion Dam	Medium	Low	High	Low
Summit	2	North Reservoir Dam	Medium	Low	Medium	Low
Summit	2	East Reservoir Dam	Medium	Low	Medium	Low
Summit	2	Lake Dorothy Dam	Medium	Low	High	Low
Ashtabula	3	Roaming Rock Shores Lake Dam	High	Medium	High	Medium
Belmont	3	Belmont Lake Dam	Medium	Low	High	Medium
Clermont	3	Stonelick Lake Dam	High	Medium	Medium	Low
Columbiana	3	Guilford Lake Dam	High	Medium	Medium	Low
Gallia	3	Gavin Bottom Ash Pond	Medium	Low	Medium	Low
Gallia	3	Stingy Run Fly Ash Dam	Very High	Medium	Very High	High
Guernsey	3	Salt Fork Lake Dam	Very High	Medium	Very High	Medium
Highland	3	Rocky Fork Lake Dam	Very High	High	Very High	High
Holmes	3	Lake Buckhorn Dam	Medium	Low	Medium	Low
Jefferson	3	Cardinal Fly Ash No. 2 Dam	Very High	Low	Very High	Low
Jefferson	3	Lake Austin Dam	High	Low	High	Low
Mahoning	3	Evans Lake Dam	High	Medium	Very High	Medium
Mahoning	3	McKelvey Lake Dam	High	Medium	High	Medium
Mahoning	3	Lake Hamilton Dam	Medium	Low	High	Low
Mahoning	3	Lake Milton Dam	Very High	High	Very High	High
Noble	3	Wolf Run Lake Dam	Very High	Medium	Very High	Medium
Noble	3	Caldwell Lake Dam	High	Medium	High	Medium
Scioto	3	Turkey Creek Lake Dam	High	Medium	Medium	Low
Trumbull	3	Mineral Ridge Dam	Very High	High	Very High	High
Washington	3	Eramet Waste Retention Dam	High	Medium	High	Medium

Source: Ohio Department of Natural Resources Dam Safety Program, "Population at Risk" Evaluation

## LEVEES – METHODOLOGY

Levee vulnerability was included as “Risk Characteristics” for each Levee system in the US Army Corp of Engineers National Levee Database (NLD). A risk classification was not assessed for every levee, however there are no levee systems rated as Very High, only one levee system is rated High, six as Moderate, 18 as low, and the remaining were not screened. The Risk Characteristics for each levee system was assessed to estimate the number of people and buildings at risk, as well as the property value exposed. The risk characteristics are as summarized in table 2.6.c and 2.6.e above.

## LEVEES – RESULTS

Statewide, there are 149 levee systems in the National Levee Database that protect an area of approximately 57.32 mi<sup>2</sup>. Within this area resides an estimated 311,402 people and 75,332 structures, and an estimated property value of \$64,464,123,691.

- In Region 1, there are 77 levee systems that protect an area of approximately 17.43 mi<sup>2</sup>. Within this area resides an estimated 86,925 people and 21,898 structures, and an estimated property value of \$18,395,361,338. One of these levee systems extend into Monroe County which is in Region 3.
- In Region 2, there are 56 levee systems that protect an area of approximately 29.34 mi<sup>2</sup>. Within this area resides an estimated 189,561 people, 37,607 structures, and an estimated property value of \$38,554,551,035.
- In Region 3, there are 11 levee systems that protect an area of approximately 10.58 mi<sup>2</sup>. Within this area resides an estimated 34,916 people, 15,827 structures, and an estimated property value of \$7,514,211,318. One of these levee systems extend into Stark County which is in Region 2.

## STATE-OWNED AND STATE-LEASED CRITICAL FACILITIES VULNERABILITY ANALYSIS & LOSS ESTIMATION

### DAM VULNERABILITY METHODOLOGY

As discussed in Section 2.1, the Department of Administrative Services maintains a database of all state-owned and state-leased facilities. These data were obtained for this enhanced plan update, and facilities were categorized based on their critical and non-critical nature (per the definition provided in Section 2.1). For dam failures, inundation mapping for Class I dams owned and operated by the USACE were available. This mapping was coupled with the coordinates of state-owned and state-leased facilities to determine the state properties are at risk given a dam failure that matches the assumptions made during the inundation analyses.

This methodology was used for assessing state-owned and state-leased facilities vulnerable to Class I dams owned and operated by the USACE. Specifically, the inundation areas of 16 dams were analyzed.

**RESULTS**

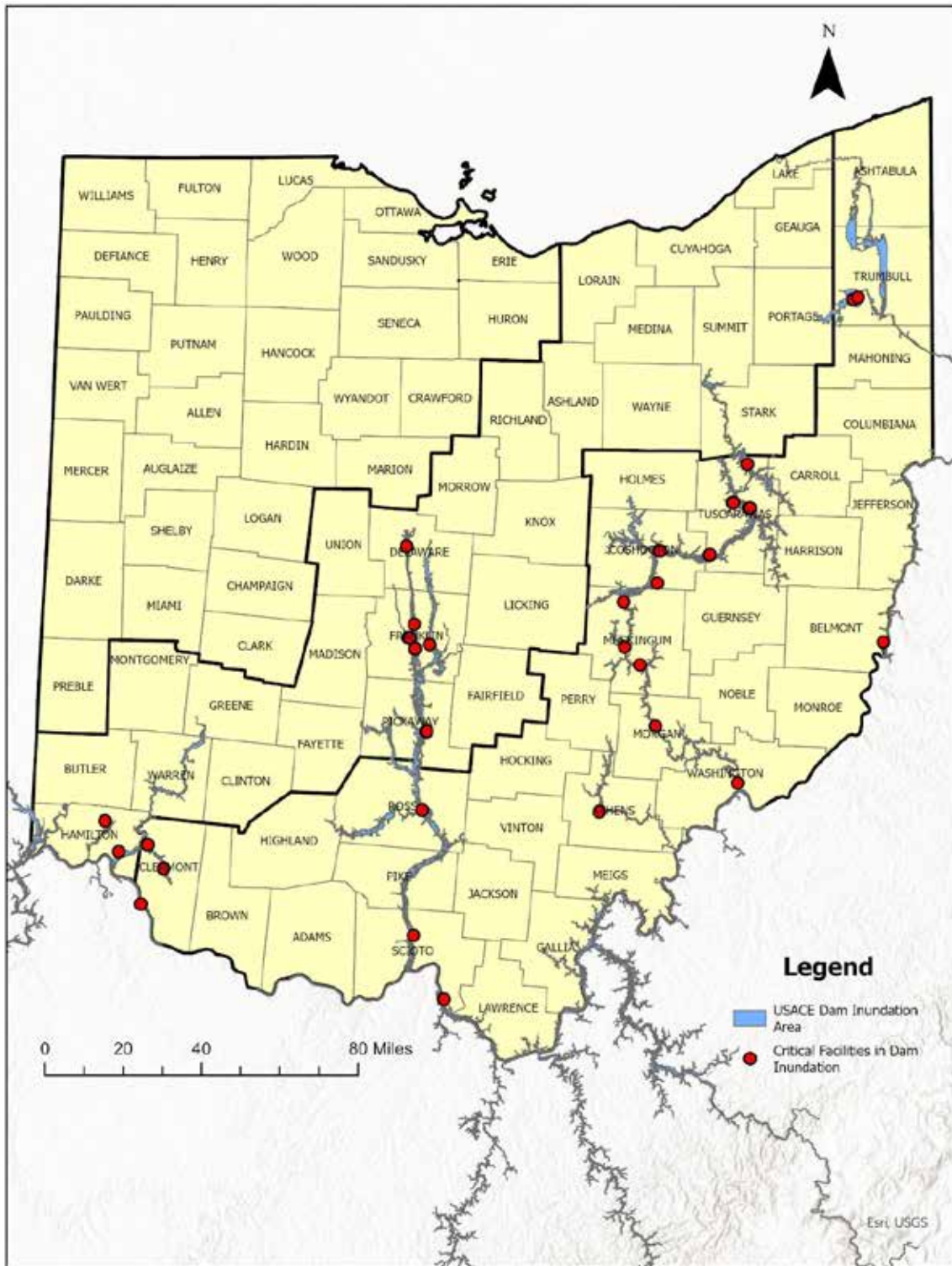
Table 2.6.j shows the numbers of state-owned and state-leased facilities potentially affected by an event equivalent to the spillway design flood with dam failure, and their replacement costs. There are a total of 148 critical facilities within the inundation areas of listed USACE dams.

Region 2 has 48 critical facilities with a total replacement cost of \$262,329,722. Region 3 has 100 facilities with a total replacement cost of \$154,634,166. Region 1 did not have any critical facilities within these inundation areas.

**Table 2.6.j— State-owned and State-leased Critical Facilities within USACE Dam Inundation Areas**

USACE DAM County	OEMA Region	Number of CF	Replacement Costs
<b>ALUM CREEK DAM</b>			
FRANKLIN	2	2	\$ 55,525,979
<b>BLUESTONE DAM</b>			
SCIOTO	3	4	\$ 47,247,200
<b>BOLIVAR DAM</b>			
COSHOCTON	3	8	\$ 9,400,669
MORGAN	3	1	\$ 34,340
MUSKINGUM	3	1	\$ 258,017
TUSCARAWAS	3	15	\$ 41,598,780
<b>DELAWARE DAM</b>			
DELAWARE	2	1	\$ 45,665
FRANKLIN	2	24	\$ 152,230,767
PICKAWAY	2	17	\$ 37,146,600
SCIOTO	3	1	\$ 657,000
<b>DOVER DAM</b>			
TUSCARAWAS	3	21	\$ 1,876,140
WASHINGTON	3	3	\$ 5,827,804
<b>KINZUA DAM</b>			
BELMONT	3	8	\$ 794,717
<b>MICHAEL J KIRWAN DAM</b>			
TRUMBULL	3	3	\$ 412,970
<b>MOHAWK DAM</b>			
COSHOCTON	3	1	\$ 568,568
MUSKINGUM	3	6	\$ 1,091,427
TUSCARAWAS	3	1	\$ 45,150
<b>PAINT CREEK DAM</b>			
ROSS	3	7	\$ 1,338,100
<b>TOM JENKINS DAM</b>			
ATHENS	3	10	\$ 40,515,100
<b>WEST FORK OF MILL CREEK LAKE DAM</b>			
HAMILTON	2	3	\$ 17,349,071
<b>WILLIAM H HARSHA LAKE DAM</b>			
CLERMONT	3	10	\$ 2,968,184
HAMILTON	2	1	\$ 31,640
<b>Grand Total</b>		<b>148</b>	<b>\$ 416,963,888</b>

Map 2.6.b— State-owned and State-leased Critical Facilities within USACE Dam Inundation Areas



### STATE OWNED DAMS

In addition to State owned critical facilities that may be impacted by dam failures, the State of Ohio, Department of Natural Resources also owns and maintains 57 Class I Dams. Of these 57 dams, 56 have EAPs complete with inundation maps while 1 has a cursory EAP that contains some level of downstream hazard map. Please see Map 2.6.c which depicts the location of these dams throughout the state followed by table 2.6.k for the name of the dam and the NID number of the ODNR Dams. Future updates to this plan will include analysis of these maps in coordination with the ODNR using the same methodology described previously.

Map 2.6.c — State Owned Class I Dams

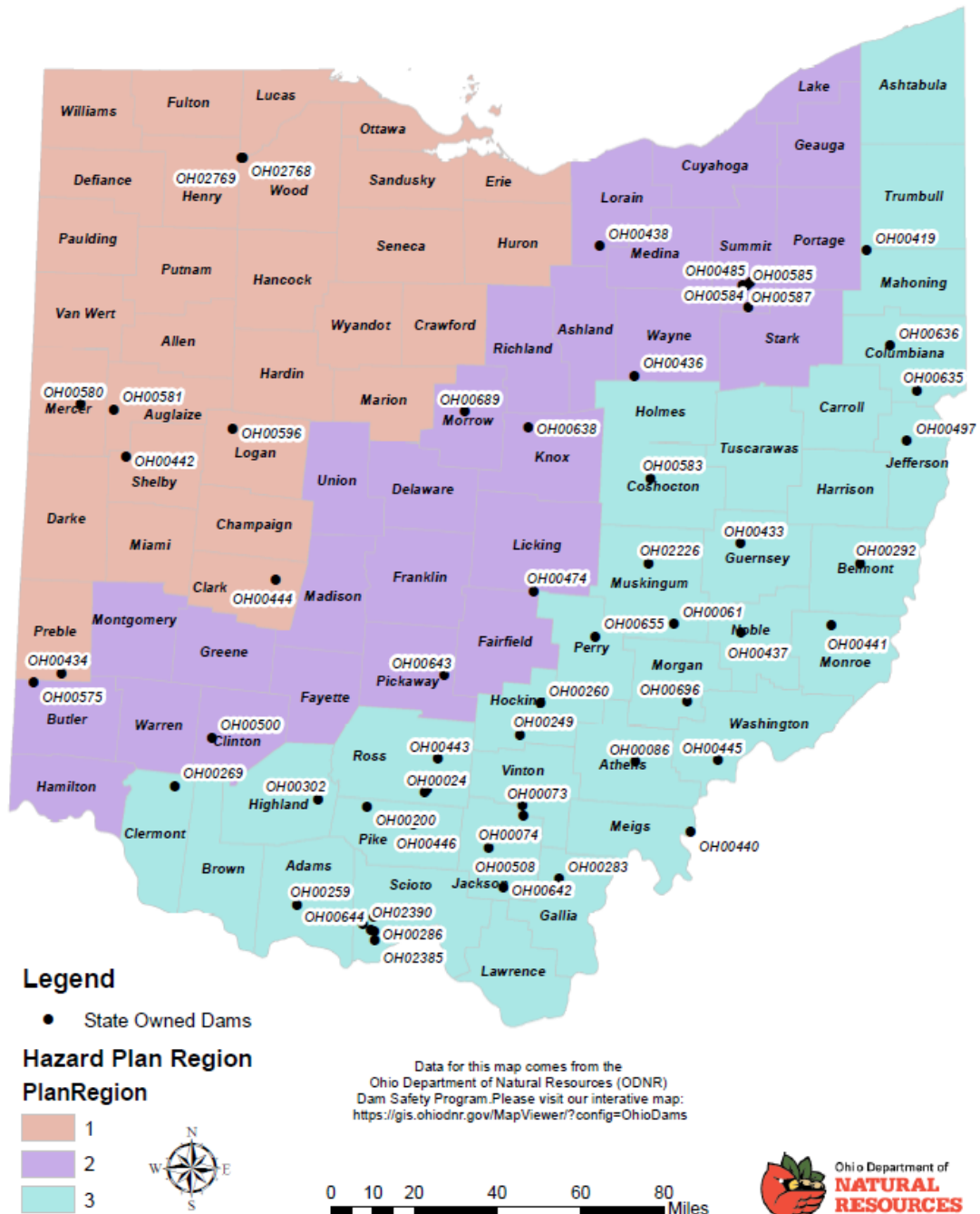


Table 2.6.k — State Owned Class I Dams

NID Number	NAME	County	OEMA Region
OH00575	ACTON LAKE DAM	BUTLER	2
OH00259	ADAMS LAKE DAM	ADAMS	1
OH00498	BEAR CREEK LAKE DAM	SCIOTO	3
OH00292	BELMONT LAKE DAM	BELMONT	3
OH00061	BLUE ROCK LAKE DAM	MUSKINGUM	3
OH00474	BUCKEYE LAKE DAM	LICKING	2
OH00023	CALDWELL LAKE DAM	ROSS	3
OH00444	CLARK LAKE DAM	CLARK	1
OH00500	COWAN LAKE DAM	CLINTON	2
OH00086	DOW LAKE DAM	ATHENS	3
OH00588	EAST RESERVOIR DAM	SUMMIT	2
OH00654	ESSINGTON LAKE DAM	PERRY	3
OH00438	FINDLEY LAKE DAM	LORAIN	2
OH00440	FORKED RUN LAKE DAM	MEIGS	3
OH00159	FOUR EAGLES LAKE DAM	PREBLE	1
OH00581	GRAND LAKE ST. MARYS - EAST EMBANKMENT	AUGLAIZE	1
OH00580	GRAND LAKE ST. MARYS - WEST EMBANKMENT	MERCER	1
OH02769	GRAND RAPIDS DAM	WOOD	1
OH00636	GUILFORD LAKE DAM	COLUMBIANA	3
OH00643	HARGUS LAKE DAM	PICKAWAY	2
OH00635	HIGHLANDTOWN LAKE DAM	COLUMBIANA	3
OH00596	INDIAN LAKE DAM	LOGAN	1
OH00642	JACKSON LAKE DAM	JACKSON	3
OH00497	JEFFERSON LAKE DAM	JEFFERSON	3
OH00638	KNOX LAKE DAM	KNOX	2
OH00074	LAKE ALMA DAM	VINTON	3
OH00510	LAKE KATHARINE LAKE DAM	JACKSON	3
OH00260	LAKE LOGAN DAM	HOCKING	3
OH00442	LAKE LORAMIE DAM	SHELBY	1
OH00419	LAKE MILTON DAM	MAHONING	3
OH00073	LAKE RUPERT DAM	VINTON	3
OH00446	LAKE WHITE DAM	PIKE	3
OH00441	MONROE LAKE DAM	MONROE	3
OH00689	MOUNT GILEAD LOWER LAKE DAM	MORROW	2
OH00696	MUSKINGUM RIVER LOCK AND DAM NO. 6	MORGAN	3
OH00584	NIMISILA RESERVOIR DAM	SUMMIT	2
OH00587	NORTH RESERVOIR DAM	SUMMIT	2
OH00249	OLD MAN'S CAVE LAKE DAM	HOCKING	3
OH00655	PERRY RECLAMATION DAM NO. 3	PERRY	3
OH00200	PIKE LAKE DAM	PIKE	3
OH02385	POND LICK LAKE DAM	SCIOTO	3
OH02768	PROVIDENCE DAM	WOOD	1
OH00302	ROCKY FORK LAKE DAM	HIGHLAND	3
OH00286	ROOSEVELT LAKE DAM	SCIOTO	3
OH00443	ROSS LAKE DAM	ROSS	3
OH00434	RUSH RUN LAKE DAM	PREBLE	1
OH00433	SALT FORK LAKE DAM	GUERNSEY	3
OH00436	SHREVE LAKE DAM	WAYNE	2
OH00269	STONELICK LAKE DAM	CLERMONT	3
OH00644	TURKEY CREEK LAKE DAM	SCIOTO	3
OH00485	TUSCARAWAS RIVER DIVERSION DAM	SUMMIT	2
OH00283	TYCOON LAKE DAM	GALLIA	3
OH00445	VETO LAKE DAM	WASHINGTON	3
OH00585	WEST RESERVOIR DAM	SUMMIT	2
OH00437	WOLF RUN LAKE DAM	NOBLE	3
OH02390	WOLFDEN LAKE DAM	SCIOTO	3
OH02226	ZANESVILLE STATE NURSERY LAKE DAM	MUSKINGUM	3

Source: Ohio Department of Natural Resources Dam Safety Program

**LEEVE VULNERABILITY METHODOLOGY**

As referenced in Table 2.6.c, the National Levee Database lists 149 levee systems in Ohio. Each one of these levees protects a defined area. Each of these leveed areas were used to intersect with the list of State-owned and State-leased critical facilities in Ohio.

**RESULTS**

Table 2.6.m shows that there are 80 State-owned and State-leased critical facilities in Ohio that are protected by levees listed in the National Levee Database. The total value of these structures amount to approximately \$198 million.

- Region 1 has 40 state-owned and state-leased critical facilities with a total replacement cost of \$38,766,857.
- Region 2 has 29 state-owned and state-leased critical facilities with a total replacement cost of \$156,431,312. The vast majority of this is in Franklin County with 23 facilities at \$152,147,643.
- Region 3 has 11 state-owned and state-leased critical facilities with a total replacement cost of \$3,529,142.

**Table 2.6.l**

<b>State-owned and State-leased Critical Facilities in Levee-Protected Areas</b>			
<b>USACE DAM County</b>	<b>OEMA Region</b>	<b>Number of CF</b>	<b>Replacement Costs</b>
<b>Camp Perry 7</b>			
OTTAWA	1	36	\$ 34,797,636
<b>City of Dayton Levee 10</b>			
MONTGOMERY	2	3	\$ 871,658
<b>Hamilton Local Flood Protection (HAML5)</b>			
BUTLER	2	1	\$ 166,486
<b>Ironton LPP</b>			
LAWRENCE	3	9	\$ 3,335,811
<b>Middletown Local Flood Protection</b>			
BUTLER	2	2	\$ 3,245,525
<b>Piqua Local Flood Protection (PIQR1)</b>			
MIAMI	1	3	\$ 3,941,499
<b>Portsmouth-New Boston, OH, LPP</b>			
SCIOTO	3	2	\$ 193,331
<b>Sandusky River - Fremont - Left Bank</b>			
SANDUSKY	1	1	\$ 27,722
<b>West Columbus, OH, LPP</b>			
FRANKLIN	2	23	\$ 152,147,643
<b>Grand Total</b>		<b>80</b>	<b>\$ 198,727,311</b>

Map 2.6.d — State-owned and State-leased Critical Facilities in Levee-Protected Areas

