

Lake Toxaway Community Association, Inc.

EMERGENCY ACTION PLAN

**Lake Toxaway Dam
Transylvania County, North Carolina
TRANS-024**

REVISED: August 11, 2010



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Lake Toxaway Community Association, Inc.
EMERGENCY ACTION PLAN
Lake Toxaway Dam

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1.0 INTRODUCTION

1.1 PURPOSE OF PLAN

The purpose of this document is to provide for monitoring of the Lake Toxaway Dam under various conditions so that an emergency situation at the dam will be properly noted and reported to agencies and persons affected. This document also provides a plan for the orderly evacuation of downstream residents to a place of safety in the event of a potential dam failure and also when major flood flows occur.

1.2 BRIEF OF DAM FEATURES

1.2.1 Construction History

Lake Toxaway Dam was originally constructed in approximately 1890 and breached in approximately 1916 during a severe storm event. The dam was subsequently reconstructed in 1960 and 1961. During reconstruction, a 48-inch diameter corrugated steel pipe (CSP) was installed to serve as a reservoir drain. This conduit is not part of the dam spillway system and is used only to lower the reservoir below the normal pool level (3008.21). The Phase 1 Report indicates that the CSP drain conduit was founded on a concrete cradle.

AG&E (now a part of Schnabel Engineering) designed the repairs and improvements for Lake Toxaway Dam. These included addition of a 16-inch diameter ductile iron pipe cold-water, minimum release siphon system required by NCDENR Division of Water Quality, and slip lining the 48-inch diameter CMP reservoir drain pipe with a 35.5-inch inside diameter HDPE liner pipe with the annular space grouted with cementitious grout. The design report and construction drawings were reviewed and approved by NCDENR Dam Safety Office for repairs for construction on November 16, 1999. Construction of these improvements and repairs were completed in 2001. Record drawings for these repairs were submitted to the NC Dam Safety Office on November 5, 2002.

Schnabel Engineering designed recent repairs consisting of the addition of an embankment drain system for Lake Toxaway Dam. The design report and construction drawings were reviewed and approved by NCDENR Dam Safety Office for repairs for construction on October 18, 2002. Construction of these improvements and repairs were completed in 2002. Record drawings for these repairs were submitted to the NC Dam Safety Office on January 29, 2003.

1.2.2 General Features

Location - Lake Toxaway Dam is located on the Toxaway River immediately upstream from U.S. Highway 64 at approximately 35° 7' 50" North Latitude, 82° 56' 0" West Longitude. The dam is located on the Reid, N.C.-S.C., U.S. Geological Survey 7.5 Minute Quadrangle Map. The reservoir and drainage area are located on the Reid, N.C.-S.C. and the Lake Toxaway, N.C., U.S. Geological Survey 7.5 Minute Quadrangle Maps.

Ownership - The Lake Toxaway Community Association, Inc. is the owner of the dam. Correspondence to the owner should be forwarded to:

Lake Toxaway Community Association, Inc.
P.O. Box 100
Lake Toxaway, NC 28747
Telephone (828) 966-9453

Purpose of Dam – Lake Toxaway provides an amenity for the Lake Toxaway Estates and a source of recreation such as boating, swimming and fishing for residents of the Lake Toxaway Estates. The reservoir also provides a valuable fish and wildlife habitat.

1.2.3 Pertinent Data For Dam

Size and Hazard Classification - The COE Phase 1 Report indicates the Lake Toxaway Dam has a structural height of 59.6 feet and maximum storage capacity of approximately 21,550 acre-feet. In accordance with North Carolina Administrative Code, Title 15A, Subchapter 2K, Paragraph

.0205(e), this dam warrants a large-size classification (storage capacity greater than 7,500 acre-feet and less than 50,000 acre-feet and structural height of greater than 50 feet but less than 100 feet).

The Division of Land Resources has assigned a high hazard classification to Lake Toxaway Dam based on the proximity of US Highway 64 downstream from the dam. This highway is located approximately 1000 feet downstream of the embankment. Schnabel Engineering concurs that a high hazard classification is warranted for this dam.

Drainage Area - The dam has a contributory drainage area of approximately 4,927.2 acres or 7.7 square miles (sq.m.)

Dam - Type: Earthfill
 Length: 700 feet
 Average Top Width: 25 feet

Elevation - Normal Pool Elevation: 3008.21 feet
 Top of Dam Elevation: 3019.19 feet

Reservoir Surface - Normal Pool: 527.6 acres

Storage - Normal Pool: 15,680 acre-feet
 Top of Dam: 21,550 acre-feet

1.3 HOW TO USE THIS DOCUMENT

Persons using this plan will find a sequence of actions to be taken depending on rainfall and site conditions. Section 2.0 is provided to help identify and evaluate conditions that may lead to the failure of an earth dam. The following is a summary of Section 3.0, Monitoring Plan, for where to find specific monitoring, reporting, and evacuation requirements.

- A. Normal Conditions - Dam will be inspected according to prescribed schedule and checked for items specified in Section 3.1.
- B. Adverse Conditions - Dam will be inspected by a more frequent schedule as prescribed and checked for items specified in Section 3.2.
- C. Standby Alert - Dam has specific problems that could lead to failure. Constant surveillance is required. Notification of agencies is required as specified in Section 3.3. Setting up of communications network when necessary. Emergency repairs if feasible.
- D. Evacuation Conditions - Dam may fail at any time. Evacuation order to be given, by qualified person, if necessary. See details for procedures in Section 3.4.

2.0 EMERGENCY DETECTION AND EVALUATION

2.1 IDENTIFICATION OF EMERGENCY CONDITIONS

The owner of Lake Toxaway Dam must be knowledgeable of the potential problems, which can lead to failure of a dam. These people regularly view the structure and, therefore, need to be able to recognize potential problems so that failure can be avoided. If a problem is detected early enough, an engineer experienced with the design of dams should be contacted to recommend corrective measures so that such measures can be implemented. Acting promptly may avoid possible dam failure and the resulting effects downstream of the dam.

Since only surficial inspections of a dam can usually be made, it is imperative that the owners and other maintenance personnel be aware of the prominent types of failure and their telltale signs. Earth dam failures can be grouped into three general categories, which are: overtopping failures, seepage failures, and structural failures. A brief discussion of each type follows.

2.2 TYPES OF EARTH DAM FAILURES

Overtopping Failures

Overtopping failures result from the erosive action of water on the embankment. Erosion is due to uncontrolled flow of water over, around, and adjacent to the dam. Earth embankments are not intended to be overtopped, and therefore are particularly susceptible to soil erosion. Once erosion has begun during overtopping, it is almost impossible to stop. A well-vegetated earth embankment may withstand limited overtopping if its top is level and water flows over the top and down the downstream slope as an evenly distributed sheet without becoming concentrated. The owner should closely monitor the reservoir pool level during severe storms.

Seepage Failures

All earth dams have seepage resulting from water percolating slowly through the dam and its foundation. Seepage must, however, be controlled in both velocity and quantity. If uncontrolled, it can progressively erode soil from the embankment or its foundation, resulting in rapid failure of the dam. Erosion of the soils begins at the downstream side of the embankment, either in the dam proper or the foundation, progressively works toward the reservoir, and eventually develops a “pipe” or direct conduit to the reservoir. This phenomenon is known as “piping”. Piping action can be recognized by an increased seepage flow rate, the discharge of muddy water or discolored water, sinkholes on or near the embankment, or a whirlpool in the reservoir. Once a whirlpool (eddy) is observed on the reservoir surface, complete failure of the dam can occur in a matter of hours or even minutes. Fully developed piping is virtually impossible to control and will likely cause failure.

Seepage can also cause slope failure by creating high pressures in the soil pores or by saturating the slope. The pressure of seepage within an embankment is difficult to determine without proper instrumentation. A slope that becomes saturated and develops slides may be showing signs of excessive seepage pressure.

Structural Failures

Structural failures can occur in either the embankment or the appurtenances such as spillways. Structural failure of a spillway, lake drain or other appurtenance may lead to failure of the embankment. Cracking, settlement, and slides are the more common signs of structural failure of embankments. Large cracks in either an appurtenance or the embankment, major settlement, and major slides will require emergency measures to ensure safety, especially if these problems occur suddenly. The lake level should be lowered, the appropriate authorities notified, and professional engineering advice sought. If the observer is uncertain as to the seriousness of the problem, the appropriate Land Quality Section field office or State Warning Point should be contacted immediately.

The three types of failures previously described are often interrelated in a complex manner. For example, uncontrolled seepage may weaken the soil and lead to a structural failure. A structural failure may shorten the seepage path and lead to a piping failure. Surface erosion may result in structural failure.

Apparent minor defects such as cracks or sinkholes in the embankment may be the first visual sign of a major problem that could lead to failure of the structure. Someone experienced in dam design and construction should evaluate the seriousness of all deficiencies. A qualified professional engineer can recommend appropriate temporary and permanent remedial measures.

ACTION

FREQUENCY

DRAIN GATE

- Maintain the 48-inch diameter drain gate operating mechanism by lubricating the lift nut and stem threads.
- Exercise the drain gate by opening fully and maintaining flow for five minutes.

Semiannually

Annually

3.2 ADVERSE CONDITIONS

PRIMARY RESPONSIBILITY

Advanced Grounds Maintenance, Inc.

Name

P.O. Box 247, Sapphire, NC 28774

Address

(828) 226-4575

(864) 868-0590

Office Phone

Home Phone

BACKUP RESPONSIBILITY

West Grading, Carmen West

Name

Rt. 2 Box 316-AA, Horse Shoe, NC 28742

Address

(828) 891-4717

(828) 421-3865

Office Phone

Cell Phone

During extended heavy rainfall periods when the pond level is above normal pool elevation and rising, certain dam features should be inspected more often as specified in this section.

ACTION

FREQUENCY

PRIMARY SPILLWAY

- Maintain an unobstructed inlet area and spillway by removing any debris.

Daily

3.3 STANDBY ALERT

When on-site conditions include any of the following:

- Water level is 7.0 feet from top of dam and impending heavy rains (i.e. hurricane) in the immediate forecast, or
- There is a deep surface slope failure of the downstream slope of the dam and the water level in the pond has not been lowered, or
- There is significant water seepage on the downstream face or toe of the dam and the water is muddy.
- Seismic (earthquake) event with noticeable effects on the dam or seepage through the dam.

The responsible person identified below shall begin constant surveillance, make standby alert notifications, start emergency communications if conditions become worse, and begin emergency repairs for any of the listed conditions on page 7.

DIAL 911

David McNeil	Emergency Services Director
Kevin Shook	Communications Director
Gerald Gross	Fire Marshall
Bobby Cooper	EMS

PRIMARY RESPONSIBILITY

Kevin Shook, Communications Director
Emergency Management Coordinator,
Transylvania County

Name

155 Public Safety Way, Brevard, NC 28712

Address

911

Office Phone

Home Phone

828-884-3108

BACKUP RESPONSIBILITY

N/A

Name

Address

Office Phone

Home Phone

ACTION

- Begin constant surveillance of the dam.
- Send the following Standby Alert Notification to the following Officials listed below:

Standby Alert Notification: The responsible person shall phone each official in sequence and deliver the following statement: This is _____ advising you that we are starting constant surveillance of Lake Toxaway Dam according to the monitoring and emergency warning plan. We are notifying you, _____, _____ of this condition, and will inform you if a decision to evacuate or cancellation of the surveillance has been made.

Officials to receive Standby Alert Notification:

_____ Lake Toxaway CA	(828) 966-9453	(828) 775-3447
	Day Phone	Night Phone
_____ DENR Regional Dam Safety Engineer		(828) 296-4500
	Day Phone	Night Phone
_____ Office of Emergency Services	911	
	Day Phone	Night Phone
_____ Sheriff's Department	911	
	Phone	

After the Standby Alert Notifications have been sent, continue with the following actions as needed:

ACTION

- Start emergency communications network, if necessary based upon the continuing deterioration of site conditions.
- Begin emergency repairs for each of the following conditions:

CONDITION	EMERGENCY MEASURE
a. Soil/sand boils on downstream slope or near toe of dam.	Place a sand bag dike around the boil area to develop tailwater depth over the boil, thereby reducing the total hydrostatic head.
b. Water is overtopping the dam and creating a gully in the downstream slope of the embankment.	Place a sandbag dike along the top of the dam at the gully location to divert the water away from the gully head cut.
c. Unusual seepage flows are observed at joints and cracks through dam.	Consult with DENR dam safety engineer. Potential measure is to lower reservoir level.

SOURCE OF MATERIALS AND LABOR

Sand:	McNeely	<u>McNeely Store and Rental</u>
		Company
		<u>Mac McNeely</u>
		Contact Person
Sand Bags:	McNeely	<u>Hwy 64, PO Box 40, Sapphire, NC 28774</u>
		Address
		<u>(828) 966-4484</u>
		Office Phone
Equipment and Labor for filling and placing sandbags:		Home Phone

3.4 EVACUATION CONDITIONS

During overtopping of the dam, significant deep sloughing of downstream slope of dam, or very high flood flows, the responsible personnel must be prepared to monitor conditions continuously and initiate the evacuation plan at the appropriate time if needed.

RESPONSIBILITY

DENR Regional Office

Name

Address

(828) 296-4500

Office Phone

Home Phone

If DENR Dam Safety Engineer is not present,

RESPONSIBILITY

Transylvania Cty Emergency Mgt Office

Kevin Shook

Name

155 Public Safety Way, Brevard, NC 28712

Address

911

(828) 884-3108

Office Phone

Home Phone

828-884-3108

ACTION

- Monitor dam condition continuously; issue evacuation order If Necessary, such as when it appears that failure is imminent.

4.0 EMERGENCY WARNING AND EVACUATION PLAN

If an evacuation order is given, proceed immediately with Emergency Warning Plan, as follows:

4.1 NOTIFICATION

PRIMARY RESPONSIBILITY

Transylvania Cty Emergency Mgt Office
Kevin Shook

Name

155 Public Safety Way, Brevard, NC
28712

Address

911

Office Phone

Home Phone

828-884-3108

BACKUP RESPONSIBILITY

IPM Corp.

Name

PO Box 580, Arden, NC 28704

Address

(828) 650-6870

(828) 885-2162

Office Phone

Home Phone

ACTION

- Notify officials according to check list and wording below:
- Have the LTCA staff at the Transylvania County Communications Center during Standby Alert Situation..

Check when notified:

Transylvania County Emergency
Management Office

911

Phone

Transylvania County Emergency Management Office will be responsible for giving the evacuation notice, notifying local and required officials and the public.

4.2 EVACUATION

The details of the Evacuation should follow a plan worked out in advance with cooperation with the Office of Emergency Services.

RESPONSIBILITY

Transylvania County Emergency Management Office

911 or (828) 884-3108

Phone

ACTION

- Evacuate the area within the shaded area as marked on the Inundation Map.
- Place barricades at street locations shown on the Inundation Map to prevent vehicle entry (DOT responsibility)
- Notification of Utilities; Check when notified:

Comporium	Telephone	(828) 884-3950	611
		Day Phone	Night Phone
Haywood	Electric	(828) 966-4251	(800) 951-6088
		Day Phone	Night Phone
N/A	Gas		
		Day Phone	Night Phone
N/A	Water		
		Day Phone	Night Phone
N/A	Sewage		
		Day Phone	Night Phone
NCDOT	Road	(919) 733-2520	

5.0 POST EVACUATION PROCEDURES

RESPONSIBILITY

Transylvania County Emergency Management
Office

Name

155 Public Safety Way, Brevard, NC 28712

Address

911

Office Phone

Home Phone

828-884-3108

5.1 NO FAILURE OF DAM - CANCELLATION OF EVACUATION

ACTION

- Should no failure occur and the hazard passes, request the responsible Emergency Management officials to cancel the evacuation and declare hazard secured.
- Mobilize clean up crews and equipment as needed.
- Coordinate with DENR or Engineer for all past emergency dam inspections and repairs.

5.2 FAILURE OF DAM - OFFICIALS TO BE NOTIFIED, CLEANUP OPERATIONS

Should failure occur, Officials should be notified immediately.

RESPONSIBILITY

Transylvania County Emergency
Management Office

Name

155 Public Safety Way, Brevard, NC 28712

Address

911

Office Phone

Home Phone

828-884-3108

ACTION

- Notify Officials according to checklist below:

Check when notified:

_____ Lake Toxaway CA	(828) 966-9453	(828) 775-3447
	Day Phone	Night Phone
_____ DENR Regional Dam Safety Engineer		(828) 296-4500
	Day Phone	Night Phone
_____ Office of Emergency Services	911	
	Day Phone	Night Phone
_____ Sheriff's Department	911	
_____ ECS LLP Carolinas		
_____ Russell Bendel	(336) 856-7150	(336) 420-1565
	Phone	

ACTION

- Mobilize cleanup crews and equipment.

6.0 DOWNSTREAM AREA MAP

The Downstream Area Map (Attachment 1) may be used by the Transylvania County Emergency Management Office. This attached map is a copy of the USGS Topographic Map - Reid Quadrangle from Maptech. When an evacuation order is given, all people located in the vicinity of the Toxaway River and Gorges State Park should be warned and those in low-lying areas should be evacuated or moved to higher ground immediately. Highway 64 may be overtopped when a breach of the dam occurs or during a significant storm event. This road should be barricaded to prevent vehicle entry on each side of the bridge in the event of a dam failure.

7.0 SIGNATURE AND DISTRIBUTION LIST FOR THIS DOCUMENT

Signatures: The undersigned state that they have read and understand this plan and will carry out the tasks assigned to them.

NAME/TITLE

DATE

David McNeil, Emergency Management

Greg Willis, Lake Toxaway Fire Chief

David Mahoney, Sheriff, Transylvania County

Bobby Smith, Advanced Grounds Maint. Inc.

Carmen West, West Grading

LTCA files

Kit Garren, President, IPM Corp.

Russell Bendel, ECS LLP Carolinas

(Prepared by)

(DENR Approval)

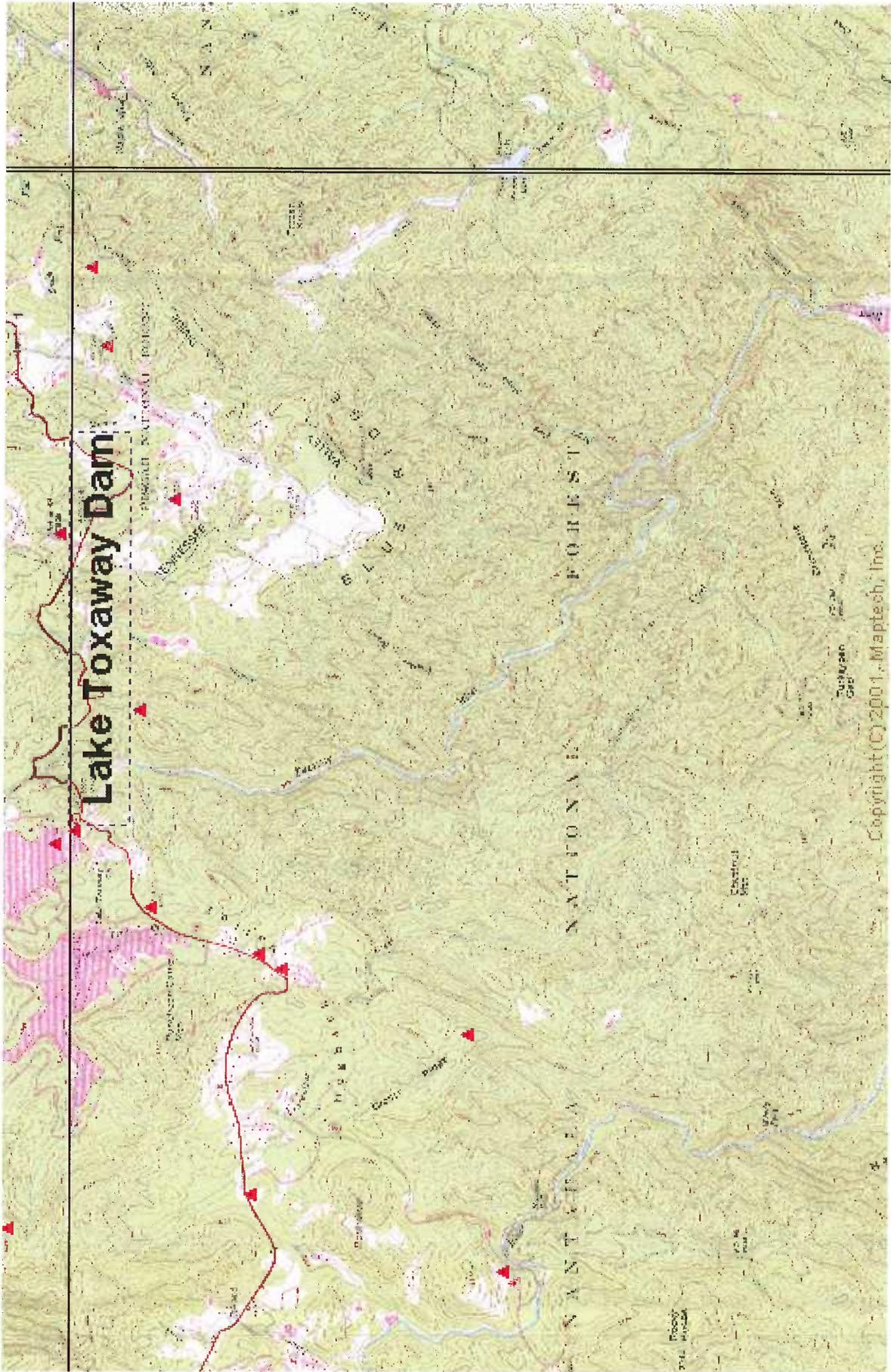
Title

DISTRIBUTION:

Name and Address of each Person or Office

NAME	ADDRESS
David McNeil, Emergency Management	155 Public Safety Way, Brevard, NC 28712
Greg Willis, Lake Toxaway Fire Chief	PO Box 35, Lake Toxaway, NC 28747
David Mahoney, Sheriff, Transylvania County	207 S. Broad Street, Brevard, NC 28712
Bobby Smith, Adv. Grounds. Maint. Inc.	PO Box 247, Sapphire, NC 28774
Carmen West, Grading Contractor	Rt. 2, Box 316-AA, Horse Shoe, NC 28742
LTCA Files	PO Box 100, Lake Toxaway, NC 28747
Kit Garren, President, IPM Corp.	PO Box 580, Arden, NC 28704
Russell Bendel, ECS LLP Carolinas	14026 Thunderbolt Place, Suite 500, Chantilly, VA 20151

ATTACHMENT 1
DOWNSTREAM AREA MAP



Lake Toxaway Dam

NATIONAL FOREST

Copyright (C) 2001, Maptech, Inc.



Northward point

1300

64

231

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SPOT IMAGE

Google

83°07'23.89"N 82°55'54.15"W elev. 2953 ft Jul 2006 Eye alt 6956 ft