APPENDIX H
Water Supply / Public Works Assessment Module

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Introduction

Many watersheds provide water used for irrigation, domestic use, fish hatcheries, etc. In addition, public roads, bridges, parks, and other capital improvements are present in many watersheds. Watershed processes such as mass wasting, surface erosion, rain-on-snow-events, etc., can impact water supplies and public works. Most commonly, water supplies are impacted by processes that change water quality in streams, rivers, and lakes. Surface erosion-related increases in turbidity or nutrient releases following timber harvest are two possible examples of watershed processes impacting water quality. By contrast, public works are most commonly impacted by changes in peak flows that lead to flood damage. For example, timber harvest could decrease hydrologic maturity in a watershed, leading to increased peak flows that damage bridges. Certain public works are also sensitive to mass wasting, to changes in stream-borne sediment loads, or to leave trees.

The Level 1 module is an office-based procedure that identifies water supply sources and the location and type of public works in the watershed. The vulnerability of these resources is assessed using information such as location on floodplain, water quality requirements, etc. Level 2 methods utilize the data collected in Level 1, but require field visits and additional data analysis to further refine estimates of sensitivity. Methods for water supply and public works are presented separately below. Figure H-1 summarizes the steps used in these procedures.

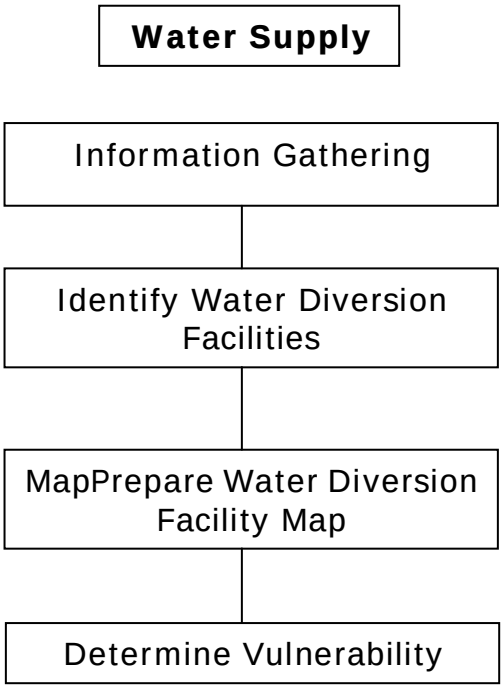

Figure H-1: Water supply assessment flow chart.

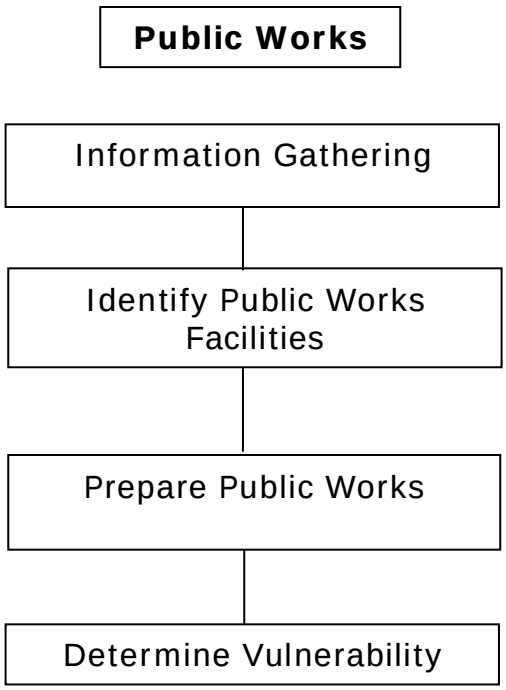

Figure H-2: Public works assessment flow chart

Water Supply Procedures

Critical Questions

Is water being diverted out of the watershed?

Are there irrigation diversions?

Are there domestic water supply diversions?

Are there other diversions?

If water supply diversions exist, then:

Is the water diversion sensitive to changes in one or more of the five input variables? (Consider both the physical structure and the water being diverted.)

Is it sensitive to fine sediment inputs?

Is it sensitive to coarse sediment inputs?

Is it sensitive to increased water temperatures?

Is it sensitive to changes in peak or base flows?

Is it sensitive to nutrient inputs?

Level 1 Assessment

The Level 1 assessment uses interviews, topographic maps, and aerial photos to identify the location and type of water diversion facilities present in the watershed. If diversion facilities are present, the water quality requirements of these diversions are used to determine sensitivity to changes in each of five input variables: fine sediment, coarse sediment, water temperature, flow changes, and nutrient inputs. Results of the analysis are presented as a graphical overlay supplemented by analysis reports for each diversion facility.

Objectives

1. Identify the location of all water supply diversions.

2. Classify diversions according to use (e.g., irrigation).

3. Use diversion type to determine sensitivity to each of the five input variables.

Qualifications

Skills

Mapping and aerial photography interpretation.

Assumptions

- Water quality requirements for diversions are determined by the type of water use (e.g., irrigation).

Information Gathering

The following information sources are needed for the interpretive steps of this module.

Maps

USGS topographic maps (WAU Base Map).

Photographs

Aerial photographs of the stream-bearing portion of the watershed. Obtain the most current photos available.

Personal and first-hand knowledge of the area

- Conduct interviews with appropriate resource managers to acquire local knowledge. Conduct interviews using Form H-1 Interviews focus on the location of diversion facilities, how the diverted water is used, and the sensitivity of the diversion to various potential impacts. Interviews are also

used to determine if diversions of water originating in the watershed occur outside the analysis area (i.e., in downstream reaches outside of the WAU). State Departments of Wildlife, Fisheries, Ecology, and Natural Resources may have staff with experience in the watershed. Additional contacts are irrigation districts, the Soil Conservation Service, municipal water offices, and county planning agencies.

- If the drainage is within the usual and accustomed area of any federally recognized treaty tribes, contact these tribes to determine appropriate resource management personnel.

- Consult DNR's GIS ownership coverage or the county assessor's office to determine ownership information on any diversion facilities. Contact and interview these owners.

Analysis Procedure

Steps

Identify Water Diversion Facilities

- Review USGS topographic maps. Look along stream network for dashed lines labeled "aqueduct" or "pipeline." Alternately, look for offshoots of the main channel labeled "aqueduct" or "canal" These offshoots will often be straight, narrow channels that rapidly move away from the main channel. Many diversions will originate near the base of dams.

- Look for facilities labeled "hatchery" along the stream network.

- Aerial photos can be examined to identify diversions or diversion facilities that may have been installed since the USGS maps were printed.

- If no diversion facilities are noted in maps, photos, or in interviews, then the watershed has no sensitivity with respect to water supply, and the analysis is completed.

Prepare Water Diversion Facility Map

If any diversion facilities are located, then prepare an acetate overlay of the watershed base map. Identify the location of any diversions. An example is illustrated in Figure H-3.

Determine Water Supply Facility Vulnerability

Review each water supply diversion and decide if the primary use is for irrigation, domestic supply, fish hatchery, power generation, or other.

For each of the diversions identified in the base map overlay, list the vulnerability to each of the input variables (see Figure H-3 Label this overlay as Map H-1 Water Supply Vulnerability.

Table H-1: Water Supply Facility Vulnerability Table

Diversion	Input Variable				
Type	**Fine Sediment**	**Coarse Sediment**	**Water Temp.**	**Flows Peak/Base**	**Nutrient Input**
Irrigation	Low	High	Low	High/High	Low
Domestic	High	High	Low	High/High	High
Power Generation	High	High	Low	Low/High	Low
Hatchery	High	High	High	High/High	High
Other*					

Use this table to assess the vulnerability of each diversion facility to the five input variables.

Calls from this table can be modified based on interviews and personal information. The basis for such modification must be documented on Form H-2. Modifications to calls would most likely be based on the design of the diversion facility. For example, water supplies taken from reservoirs may be insensitive to peak flows due to storage capacity of the reservoir. In contrast, streamside canals and aqueducts could be very sensitive to peak flows.

*Other diversion types must be analyzed using project specific information.

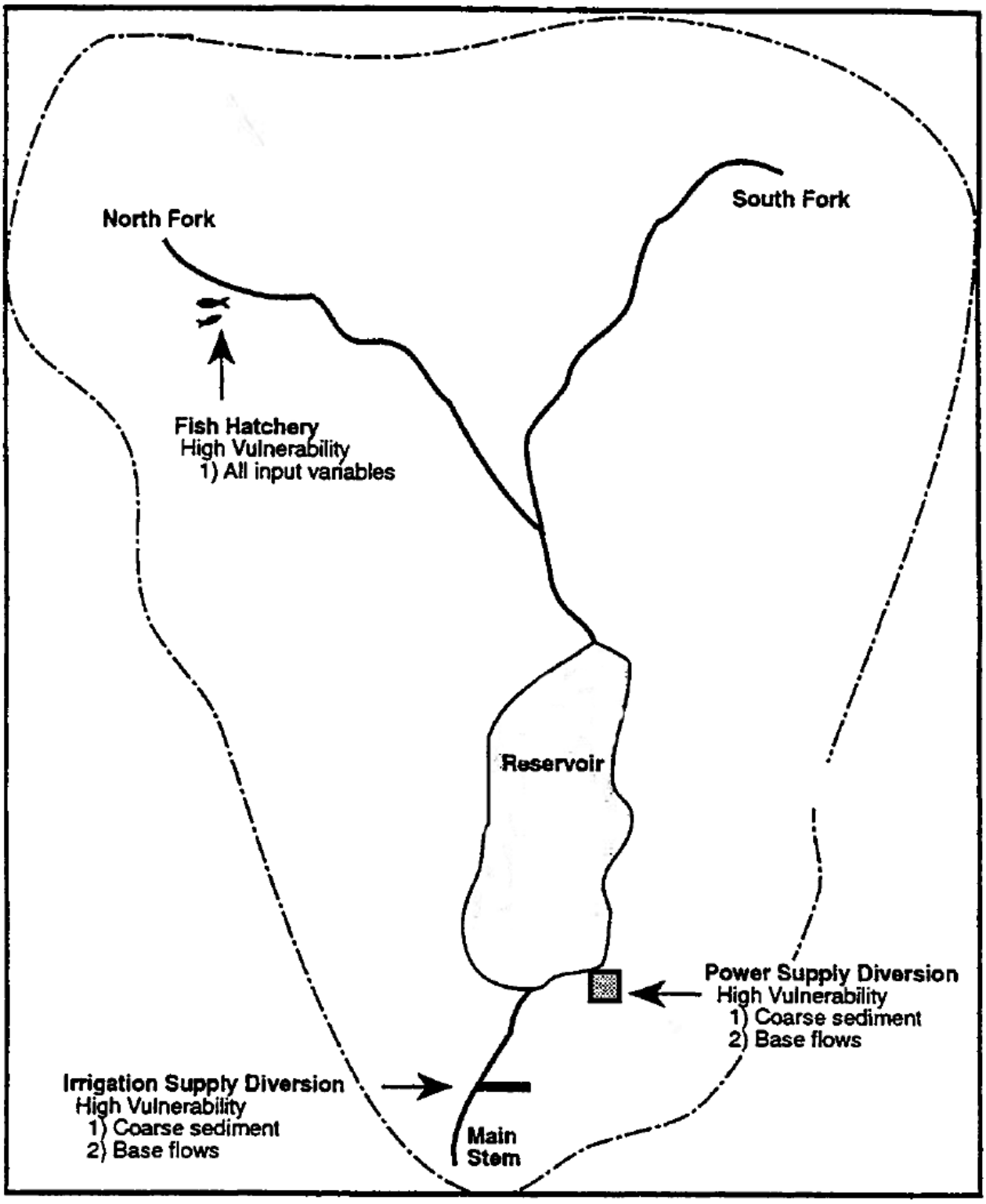

Figure H-3: Examples of vulnerability

Note: Map symbology will be provided at training

Public Works Procedures

Critical Questions

What public works are present in the watershed?

What public works are sensitive to changes in one or more of the three input variables?

Which are sensitive to peak flow changes?

Which are sensitive to mass-wasting events?

Which are sensitive to coarse sediment inputs?

Level 1 Assessment

The Level 1 assessment utilizes interviews, topographic maps, and aerial photos to identify the location and type of public works present in the watershed. The location and/or type of facilities present are then used to determine vulnerability to changes in each of three variables: peak flows, mass wasting, and coarse sediment. Sensitivity for one category of public works, power lines, is assessed separately by evaluating the potential for damage from wind throw trees. Results of the analysis are presented as a graphical overlay of the WAU base map.

Objectives

1. Identify the location of all public works.

2. Use location and type of public work to determine vulnerability to each of the three input variables.

Qualifications

Skills

Mapping and aerial photography interpretation.

Assumptions

- Vulnerability of public works to peak flow changes can be determined from position on the floodplain.
- Vulnerability of public works to mass wasting can be determined from position relative to impact areas identified in the mass-wasting module.
- Vulnerability of public works to coarse sediment inputs can be determined by the type of public work being analyzed.

Information Gathering

Maps

- USGS topographic maps (WAU Base Map).
- Federal Emergency Management Agency (FEMA) flood hazard maps.
- Soil survey maps. (Available at Photo & Map Sales or DNR Info. Management.

Photographs

Aerial photographs of the watershed - obtain the most current photos available.

Personal and first-hand knowledge of the area

Conduct interviews with state and county transportation departments or other appropriate entities (e.g., U.S. Forest Service, private landowners) to obtain information on roads and bridges in the watershed. If dams, power lines, railroad lines, parks, or other public works are present, conduct interviews with individuals familiar with these facilities. Use Form H-3 for all interviews.

Analysis Procedure

Steps Identify Public Works Facilities

Review USGS maps and aerial photos to identify the locations of public works. Common public works include:

- Roads
- Bridges
- Power Lines and Structures
- Railroad Lines
- Pipelines
- Fish Hatcheries
- Parks
- Buildings

Prepare Public Works Map

Prepare an acetate overlay of the WAU base map. Identify the location and type of all public works in the watershed. An example is illustrated in Figure H-4.

Determine Public Work Vulnerability

Assess the vulnerability of these resources to changes in peak flow as follows:

Review FEMA flood hazard maps to identify the 50-year and 100-year floodplains. If FEMA maps are not available, contact the emergency management division of the county sheriff's office or the county surface water management division to obtain floodplain information.

Identify those public works located on the 50-year or 100-year floodplains.

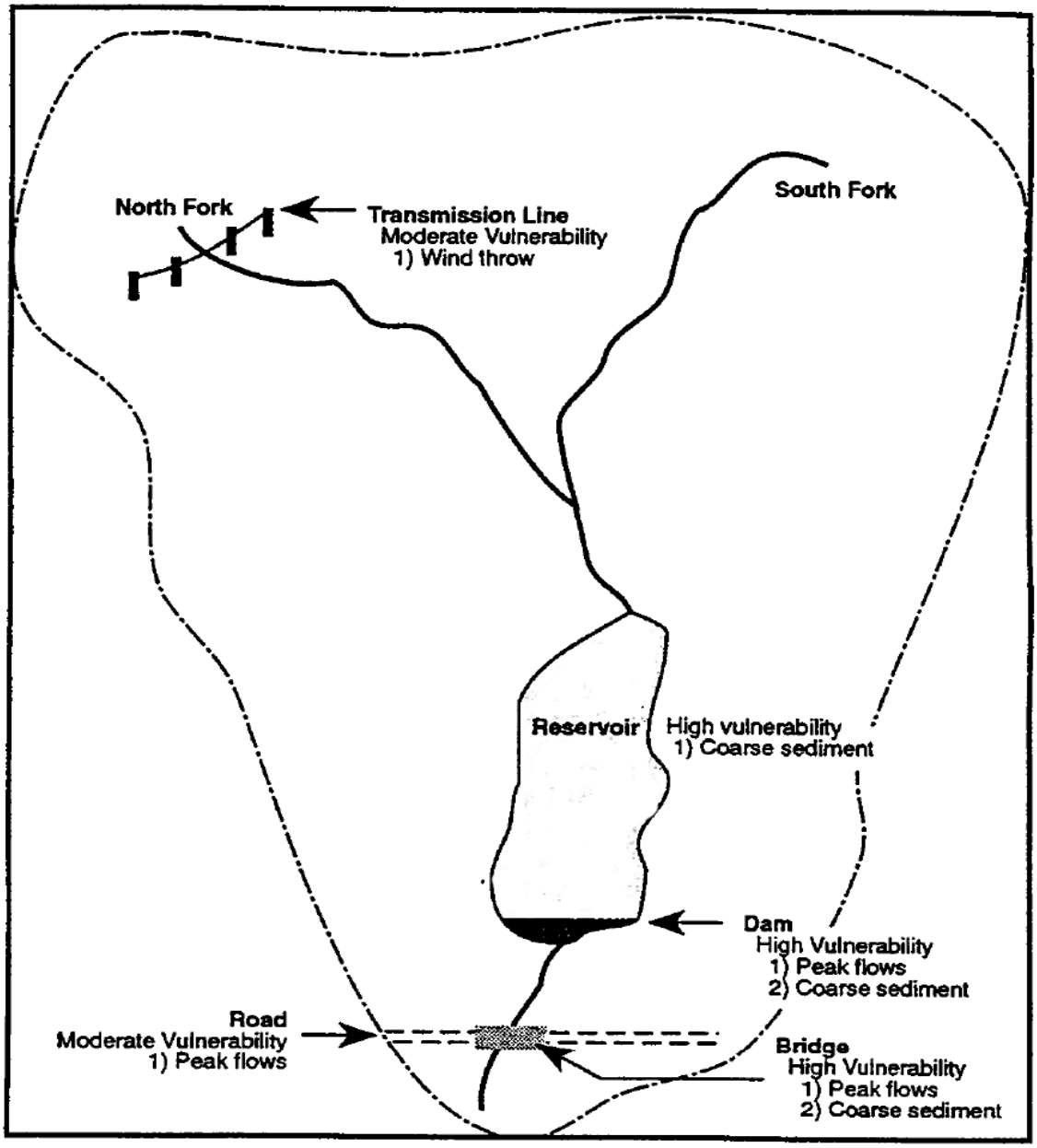

Figure H-4: Examples of vulnerability

Note: Map symbology will be provided at training.

Assign a vulnerability for each facility to peak flow changes using the following table:

Table H-2: Vulnerability of public works to peak flow changes.

Located on 100-year Floodplain?	Located on 50-year Floodplain?	Vulnerability to Peak Flow Changes
N	N	Low
Y	N	Moderate
Y	Y	High

For each of the public works identified in the base map overlay, list the vulnerability to changes in peak flow. Label this overlay as "Map H-2 Public Works Vulnerability."

Assess the vulnerability of each public work to mass wasting as follows:

Review the landslide potential map prepared as part of the mass-wasting module. Identify areas of high and moderate potential.

Determine which, if any, of the public resources are downslope of high and moderate mass-wasting potential areas.

Assign a vulnerability for each facility to mass wasting using the following table:

Table H-3: Vulnerability of Public Works to Mass Wasting

Downslope of Moderate Hazard Area	Downslope of High Hazard Area?	Vulnerability to Mass Wasting
N	N	Low
Y	N	Moderate
Y	Y	High

For each of the public works identified in the base map overlay, list the vulnerability to changes in mass wasting.

The vulnerability of public works to coarse sediment is assumed in Level 1 to depend on the type of facility being analyzed. For example, coarse sediment inputs can result in channel filling and widening. Consequently, bridges and roads running along floodplains are more sensitive to coarse sediment than public works located away from stream channels. The following table identifies sensitivity to coarse sediment for several types of public works. Individual calls

can be modified using project specific information if available. The basis for modifying calls must be recorded on Form H-4.

Table H-4: Vulnerability of public works to coarse sediment

Public Work	Vulnerability to Coarse Sediment
Bridges over streams	High
Other bridges	Low
Floodplain roads	High
Other roads	Low
Reservoirs/lakes	High
Streamside parks/buildings	High

Use the above table to assign a vulnerability for each public work to coarse sediment.

For each of the public works identified in the base map overlay, list the vulnerability to coarse sediment (see Figure H-4).

Assess the vulnerability of power line facilities to wind throw as follows:

- Use aerial photos to determine the distance between transmission lines and any trees along the right-of-way.
- Use results from the riparian function module's analysis of tree maturity to assign vegetation into one of three maturity classes: young, mature, or old.
- Use the following table to determine power line vulnerability to hazard trees.

Table H-5: Power line vulnerability to hazard trees

Tree Maturity	Distance to Treeline		
	<100 ft.	100'-150'	>150'
Young	L	L	L
Mature	H	M	L
Old	H	H	L

The probability of wind throw increases when trees along the right-of-way are confined to buffer strips. Review of the site with utility related foresters is recommended.

Power lines or line segments identified as being subject to a moderate or high potential impact should be identified in the base map overlay (see Figure H-4).

Water Supply / Public Works Assessment Report

I. Title page with name of watershed analysis, name of module, level of analysis, signature of qualified analyst(s), and date

II. Table of contents

III. Maps
- Water supply vulnerability (map H-1)
- Public works vulnerability map (map H-2)

IV. Summary Data
- Water supply assessment interview (form H-1)
- Water supply assessment modification of vulnerability call (form H-2)
- Public works assessment interview (form H-3)
- Public works assessment modification of vulnerability call (form H-4)

V. Summary Text
- Watershed overview
- Summary of water-diversion types, locations, and vulnerabilities to input variables
- Summary of public-works types, locations, and vulnerabilities to input variables
- Descriptions of any deviations from the standard methods and why the changes were necessary
- Discussion of analyst's confidence in work products
- Does module report address all critical questions?

VI. VI. Other Information (optional)
- Monitoring strategies and design and implementation suggestions
- Learning resources (a.k.a., references, bibliography) section
- Acknowledgments section

Form H-1: Water supply assessment Interview

Person Interviewed _____ Representing _____

Address _____ Date Interviewed _____

Phone #

Specific experience in watershed being analyzed? (Y/N)

If yes, detail.

Are water supply diversions present?
Where are the diversions located?

What is diverted water used for?

Is diversion sensitive to fine sediment inputs?

Is diversion sensitive to coarse sediment inputs?

Is diversion sensitive to temperature increases?

Is diversion sensitive to changes in flow?

Is diversion sensitive to nutrient inputs?

Are any fish hatcheries located in the watershed?

Are there any diversions of water from this watershed in areas downstream of the WAU?

Form H-2: Water supply assessment

Modification of Vulnerability Call

Diversion _____ Input Variable _____

Vulnerability Assigned in Table H3 _____

Modified Vulnerability Rating _____

Basis for Modification

Form H-3: Public works assessment interview

Person Interviewed _____ Representing _____

Address _____ Date Interviewed _____

Phone #

Specific experience in watershed being analyzed? (Y/N)

If yes, detail

What public works is interviewee familiar with?

Where are the public works located?

Are the public works being used/maintained?

Are they sensitive to changes in peak flows?

Are they sensitive to mass wasting?

Are they sensitive to coarse sediment inputs?

Are unstable soils or hazard trees located along power lines or structures?

Form H-4: Public works assessment

Modification of Vulnerability Call

Public Work _____ Input Variable _____

Vulnerability Assigned in Table H4 _____

Modified Vulnerability Rating _____

Basis for Modification