

This document is a successful on-line grant application made to FEMA as part of their 2005 Pre-Disaster Mitigation program. This particular document was a request for funding of a portion of the Conduit Trestle work near Portland, Oregon. This submittal was accepted and the Portland Water Bureau received \$3 million in Federal funding for the project.

Please be aware that some portions of the on-line grant application may have changed since 2005.

For security reasons, some location specific information has been redacted.

## Subgrant Project Application

**Application Title:** Conduit Trestles at Diack's and Sester's Ponds

**Subgrant Applicant:** City of Portland Bureau of Water Works

**Application Number:** OR-2005-003

**Application Year:** 2005

**Grant Type:** Project Application

**Address:** 1900 North Interstate Building 355/EOC, Portland, OR 97227-1820

### Applicant Information

|   |  |
|---|--|
| Name of Applicant   | City of Portland Bureau of Water Works   |
| State   | OR                                       |
| Congressional District  |  |
| Type of Applicant   | Local Government                         |
| Legal status, function, and facilities owned:   |  |
| State Tax Number:   |  |
| Federal Tax Number:   | 93-6002236                               |
| Other type name:  |  |
| Federal Employer Identification Number(EIN). If Indian Tribe, this is Tribal Identification Number. | 93-6002236                               |
| What is your DUNS Number?   | 054971197 -                              |
| Are you the application preparer?   | Yes                                      |
| Is the application preparer the Point of Contact?   | No                                       |
| Is application subject to review by Executive Order 12372 Process?                                  | No. Program is not covered by E.O. 12372 |
| Is the applicant delinquent on any Federal debt?  | No                                       |
| Explanation:  |  |

Contact Information

Point of Contact Information

|                     |  |
|---------------------|--|
| Title               | Mr.                                    |
| First Name          | Perry                                  |
| Middle Initial      | W                                      |
| Last Name           | Hopkins                                |
| Title               | Emergency Manager                      |
| Agency/Organization | City of Portland Bureau of Water Works |
| Address 1           | 1900 North Interstate                  |
| Address 2           | Building 355/EOC                       |
| City                | Portland                               |
| State               | OR                                     |
| ZIP                 | 97227 - 1820                           |
| Phone               | 503-823-7074 Ext.                      |
| Fax                 | 503-823-6078                           |
| Email               | phopkins@water.ci.portland.or.us       |

Alternate Point of Contact Information

|                     |  |
|---------------------|--|
| Title               | Mr.                                    |
| First Name          | Michael                                |
| Middle Initial      | B                                      |
| Last Name           | Saling                                 |
| Title               | Supervising Engineer                   |
| Agency/Organization | City of Portland Bureau of Water Works |
| Address 1           | 1120 SW 5th Avenue, Rm 601             |
| Address 2           |  |
| City                | Portland                               |
| State               | OR                                     |
| ZIP                 | 97204                                  |
| Phone               | 503-823-7411 Ext.                      |
| Fax                 | 503-823-4500                           |
| Email               | msaling@water.ci.portland.or.us        |

Community Information

Please provide the name of each community that will benefit from this mitigation activity.

| State | County Code      | Community Name           | CID Number | CRS Community | CRS Rating | State Legislative District | US Congressional District |
|-------|------------------|--------------------------|------------|---------------|------------|----------------------------|---------------------------|
| OR    | 410183_QBM0Z0IB3 | <u>PORTLAND, CITY OF</u> | 410183     | Y             | 6          | 410183                     | 3                         |

Enter Community Profile information below.

[Help](#)

See attachment.

Comments

Attachments

Sec-2\_Community\_Prof\_11-29.pdf



Mitigation Plan Information

Is the entity that will benefit from the proposed activity covered by a current FEMA-approved multihazard mitigation plan in compliance with the Disaster Mitigation Act of 2000? Yes

If Yes, please answer the following:

What is the name of the plan? Portland's Natural Hazard Mitigation Plan  
 What is the type of plan? Local Multihazard Mitigation Plan  
 When was the current multihazard mitigation plan approved by FEMA? 12-09-2004

Describe how the proposed activity relates to or is consistent with the FEMA-approved mitigation plan.

The Conduit Trestles at Diack's and Sester's Ponds project is identified in Section 7 of the Plan dealing with Flood Hazards and Section 9 of the Plan dealing with Earthquake Hazards. The project is included in the Long Term Action items including "Long Term Flood #8" which states our desire to "upgrade trestles that carry the main conduits of the water delivery system." This action item addresses Goals 2 and 5 of the Plan. The project also is addressed in the Long Term Action item, "Long Term Earthquake #6" which states our desire to "assess the vulnerability of the water distribution system to seismic events and work toward hardening the system." This action item addresses Goal 2 of the Plan. The work at Diack's and Sester's is a major step in accomplishing the goals of the Plan. The executive summary and action matrix of the City's mitigation plan are attached below.

If No or Not Known, please answer the following:

Does the entity have any other mitigation plans adopted? Not Known

If Yes, please provide the following information.

| Plan Name | Plan Type | Date Adopted | Attachment |
|-----------|-----------|--------------|------------|
|-----------|-----------|--------------|------------|

Does the State/Tribe in which the entity is located have a current FEMA-approved mitigation plan in compliance with the Disaster Mitigation Act of 2000? Yes

If Yes, please answer the following:

What is the name of the plan? Oregon's State Natural Mitigation Plan  
 What is the type of plan? Standard State Multi-hazard Mitigation Plan  
 When was the current multihazard mitigation plan approved by FEMA? 11-01-2004

Describe how the proposed activity relates to or is consistent with the State/Tribe's FEMA-approved mitigation plan.

The trestle work at Diacks and Sesters Ponds helps mitigate potential damage from earthquakes, an important component of the State plan as discussed in the chapter from the document (attached below). A discussion of the consistency of this project with the plan is also attached below.

If you would like to make any comments, please enter them below.

To attach documents, click the *Attachments* button below.

- [Exec Summary 12-1.pdf](#)
- [matrixofactions\\_12-1.pdf](#)
- [OR-SNHMP\\_earthquake\\_chapter.pdf](#)
- [Oregon's NHMP Trestles.doc](#)

Mitigation Activity Information

What type of activity are you proposing? [Help](#)

401.1 Water and Sanitary Sewer System Protective Measures

If you selected Other or Miscellaneous, above, please specify:

Title of your proposed activity:

Conduit Trestles at Diack's and Sester's Ponds

Are you doing construction in this project?

Yes

If you would like to make any comments, please enter them below.

Preliminary plans/site plans for the work are attached. The Map of Trestle Locations, also attached, shows the larger area.

Attachments:

[Map of Trestle Locations.pdf](#)

[Diacks Site Plan.pdf](#)

[Sesters Site Plan.pdf](#)



## Problem Description

Please describe the problem to be mitigated. Include the geographic area in your description.

The Portland Water system is located in a high seismic hazard area. Seismic vulnerability studies, Dames & Moore (1996), EQE (1999) and Mohammadi (2000), G&E Engineering (2005), have identified major seismic vulnerabilities. Loss of water service to the more than 800,000 people served would result in enormous economic impacts (as per FEMA What is a Benefit?). This mitigation project is a seismic upgrade for two locations where conduits cross stream channels on trestles: Diack's Pond and Sestor's Pond locations. A representative latitude/longitude, midway between the Diack's Pond and Sestor's Pond project locations, was used for seismic hazard calculations using the seismic hazard data built into the BCA Earthquake Full Data Software.

Enter the Latitude and Longitude coordinates for the project area.

Latitude: 45.4776  
Longitude: 122.3085

Attachments:

[FM4101790450A.pdf](#)

## Hazard Information

Select hazards to be mitigated

If other hazards, please specify

If you would like to make any comments, please enter them below.

Seismic. Seismic hazards include ground shaking for both project sites as well as the potential for dam failures, erosion/scour of trestles, and landslide failures. The probabilistic risk evaluation for the entire Portland water supply system (Bull Run Conduits and grown water system) included quantitative vulnerability evaluations of potential failure modes for key elements of both water supply systems. See G&E Engineering Report (2005) Section 2, Geologic Hazards for discussion of seismic sources and seismic hazards for these locations.

Attachments:

## FIRM Information

Is the project located within a hazard area: No

If other identified high hazard area, please specify:

Is there a Flood Insurance Rate Map (FIRM) or Flood Hazard Boundary Map (FHBM) available for your project area? Yes

Enter FIRM Panel Number: 41017900450A

Is the project site marked on the map? Electronic map attached

Select Flood Zone Designation Area of minimal flood hazards (C, X)

Scope of Work

Describe the need for this activity, the problems it will address, the goals and objectives, and the methodology for implementing this activity.

Need for this Activity The Portland Water system is located in a high seismic hazard area. Seismic vulnerability studies, Dames & Moore (1996), EQE (1999) and Mohammadi (2000), G&E Engineering (2005), have identified major seismic vulnerabilities. Loss of water service to the more than 800,000 people served would result in enormous economic impacts (as per FEMA What is a Benefit?): \$106,192,000 per system day of lost water service. Problems it will address This mitigation project is a seismic upgrade for Bull Run conduits (water transmission pipes) at two locations identified as the most vulnerable crossings with the greatest potential for loss of water service: 1) Diack's Pond, the only location where all three conduits are co-located, and 2) Sestor's Pond, where two conduits are collocated. Goals and Objectives The primary goal is to minimize service outages and shorten restoration times for water service in future earthquakes. Methodology for implementing this activity At Diack's Pond, the existing non-engineered dam will be breached (drained) to obviate the potential for dam failure washing out the conduits. The existing stream channel will be channeled into a concrete box culvert under the pipes and pipes hardened against scour by concrete encasement, along with additional structural improvements. At Sestor's Pond, the conduits will be relocated downstream of the dam, relocated under the stream (below scour depth) and encased to further harden them

If you would like to make any comments, please enter them below.

Engineering report attached below.

Attachments:

[G&E Engineering Report\\_BullRun.pdf](#)

Enter Work Schedule .

| Description Of Task                                   | Starting Point | Unit Of Time | Duration | Unit Of Time | Work Complete By      |
|---|----------------|--------------|----------|--------------|-----------------------|
| Design  | 1              | DAYS         | 120      | DAYS         | Consultant            |
| Permitting  | 2              | DAYS         | 180      | DAYS         | Consultant            |
| Bidding   | 3              | DAYS         | 60       | DAYS         | Portland Water Bureau |
| Construction  | 4              | DAYS         | 210      | DAYS         | Contractor            |
| Estimate the total duration of the proposed activity: |                |              | 570      | DAYS         |                       |





## Decision Making Process

Describe the process you used to decide that this project is the best solution to the problem.

The seismic vulnerability of the entire Portland water system has been evaluated by a several seismic vulnerability engineering studies: Dames & Moore (1996), EQE (1999) and Mohammadi (2000), G&E Engineering (2005), have all identified major seismic vulnerabilities. This specific mitigation project was selected because the Diack's Pond and Sestor's Pond crossings are specifically identified as having both a high vulnerability and a high potential to extend the durations of loss of water service if they fail in future earthquakes.

Explain why this project is the best alternative.

Other stream crossings also have vulnerabilities, but to a lower extent than the crossings at Diack's Pond and Sestor's Pond and/or a significantly smaller impact of loss of water service because of the redundancy in the existing conduit system (3 conduits, with two interties between conduits). Thus, retrofit of other crossings, which is desirable and does further reduce likely future outages, would have much smaller positive impacts on restoring water service after a major earthquake than do the proposed projects at Diacks' Pond and Sestor's Pond. Thus, the proposed projects at Diack's Pond and Sestor's Pond are more cost-effective with higher BCRs than alternative trestle mitigation projects.

Comments:

Attachments:

## Water and Sanitary Sewer System Protective Measures

| Item Name                               | Cost Classification                  | Unit Quantity | Unit of Measure | Unit Cost (\$)  | Cost Estimate (\$) |
|---|--------------------------------------|---------------|-----------------|-----------------|--------------------|
| Sesters and Diacks - Pre-Award Planning | Administrative Expense               | 1.00          | Each            | \$ 20,998.00    | \$ 20,998.00       |
| Sesters Pond                            | Administrative Expense               | 1.00          | Each            | \$ 113,238.00   | \$ 113,238.00      |
| Diacks Pond                             | Administrative Expense               | 1.00          | Each            | \$ 48,072.00    | \$ 48,072.00       |
| Sesters Pond                            | Land, Structures, Right-of-way       | 1.00          | Each            | \$ 30,000.00    | \$ 30,000.00       |
| Diacks Pond                             | Land, Structures, Right-of-way       | 1.00          | Each            | \$ 3,000.00     | \$ 3,000.00        |
| Sesters Pond                            | Architectural Engineering Basic Fees | 1.00          | Each            | \$ 226,475.00   | \$ 226,475.00      |
| Diacks Pond                             | Architectural Engineering Basic Fees | 1.00          | Each            | \$ 96,143.00    | \$ 96,143.00       |
| Sesters Pond                            | Project Inspection Fees              | 1.00          | Each            | \$ 226,475.00   | \$ 226,475.00      |
| Diacks Pond                             | Project Inspection Fees              | 1.00          | Each            | \$ 96,143.00    | \$ 96,143.00       |
| Sesters Pond                            | Construction And Project Improvement | 1.00          | Each            | \$ 2,234,750.00 | \$ 2,234,750.00    |
| Diacks Pond                             | Construction And Project Improvement | 1.00          | Each            | \$ 958,430.00   | \$ 958,430.00      |
|   |                                      |               |                 | Total Cost      | \$ 4,053,724.00    |

**Total Project Cost Estimate: \$ 4,053,724.00**

Match Sources

|                              |                 |              |
|------------------------------|-----------------|--------------|
| Activity Cost Estimate       | \$ 4,053,724.00 |              |
| Federal Share Percentage     | 74.00602508%    |              |
| Non-Federal Share Percentage | 25.99397492%    |              |
|                              | Dollars         | Percentage   |
| Proposed Federal Share       | \$ 3,000,000.00 | 74.00602508% |
| Proposed Non-Federal Share   | \$ 1,053,724.00 | 25.99397492% |

Matching Funds

| Source Agency        | Name of Source Agency | Funding Type                        | Amount (\$)            | Action                       |
|----------------------|-----------------------|-------------------------------------|------------------------|------------------------------|
| Local Agency Funding | Portland Water Bureau | Other (Capital Improvement Program) | \$ 1,053,724.00        | <a href="#">View Details</a> |
| <b>Grand Total</b>   |                       |                                     | <b>\$ 1,053,724.00</b> |                              |

If you would like to make any comments, please enter them below.

For a more detailed cost estimate, see attachment "Diacks Sester Estimate" in Cost Effectiveness section.

Attachments



## Cost Effectiveness Information

Attach the Benefit Cost Analysis (BCA), if completed for this project

[PWB Bull Run BCA 01.xls](#)

What is the source and type of the problem?

The Portland Water system is located in a high seismic hazard area. Seismic vulnerability studies, Dames & Moore (1996), EQE (1999) and Mohammadi (2000), G&E Engineering (2005), have identified major seismic vulnerabilities in the water supply systems. Loss of water service to the more than 800,000 people served would result in enormous economic impacts (as per FEMA What is a Benefit?): \$106,192,000 per system day of lost water service. This specific mitigation project was selected because the Diack's Pond and Sestor's Pond crossings are specifically identified as having both a high vulnerability and a high potential to extend the durations of loss of water service if they fail in future earthquakes. Failure of these pipelines would result in extended durations of loss of water service for many customers.

How frequent is the event?

This project locations have a high level of seismic hazard, including not only ground motions but potential failures from failure of non-engineered dams that are immediately upstream of the Diack's Pond and Sester's Pond crossings. For reference, the ground motions for three return periods as calculated by the FEMA Earthquake Full Data Software Version 6.0 for this latitude/longitude for Type D, Firm Soil are attached below.

How severe is the damage?

Seismic vulnerability analyses of the whole Portland water supply system (G&E Engineering) has the following results for a PGA of 24% g (the midpoint of the 16% to 32% PGA bin in the FEMA BCA Earthquake Software: The above results show that system days of water outages are greatly reduced by the partial availability of the ground water system. That is, absent the ground water system, system days of outages from conduit failures would be much larger and the benefits of the proposed mitigation project would be much higher. However, even considering the ground water system there is still a substantial seismic vulnerability due to expected failures of key components of the ground water system (see G&E Engineering Report). Thus, there are very substantial benefits from the proposed project – a reduction in more than 3 system days of loss of water service, with a calculated benefit of avoiding about \$106,000,000 per day in economic impacts of loss of water service (as per FEMA What is a Benefit?).

What kinds of property are at risk?

The primary impact of damage to these pipelines are the major economic impacts from extended loss of water service to the more than 800,000 people served by Portland Water and the increased risk of fire following earthquake from loss of water service for fire flows.

Are there better, alternative ways to solve the problem?

No. Without the proposed mitigation actions at these eight highest hazard locations, failure of the transmission pipes will inevitably result in extended durations of loss of wafer service to a large number of people, with correspondingly enormous economic impacts. The proposed seismic retrofit targets the large diameter conduits ad the two locations with a combination of both the highest vulnerability and the largest impact on duration of loss of water service if they fail in future earthquakes: Diack's Pond and Sestor's pond. More expensive seismic retrofits targeting additional water system components were evaluated and rejected as not being as cost-effective as this project.

Are the mitigation project costs well documented and reasonable?

Yes

If you would like to make any comments, please enter them below.

Black & Veatch has completed preliminary design work for these crossing upgrades, along with engineering cost estimates (attached).

Attachments:

[G&E Engineering Report BullRun.pdf](#)

[Diacks Sesters Estimate 2 KAG.xls](#)

[Bull Run BCA Supporting Calcs.xls](#)

[InflationCalculator2005Water.xls](#)

[PWB Bull Run Data Documentation.doc](#)

| Date | Event | Damage History<br>Description of Damage<br>Total Amount of Damage | Amount of Damage |
|------|-------|---|------------------|
|      |       |   | \$ 0.00          |



**A. National Historic Preservation Act - Historic Buildings and Structures**

- \* 1. Does your project affect or is it in close proximity to any buildings or structures 50 years or more in age? No

If Yes, you must confirm that you have provided the following:

- The property address and original date of construction for each property affected (unless this information is already noted in the Properties section),
- A minimum of two color photographs showing at least three sides of each structure (Please label the photos accordingly),
- A diagram or USGS 1:24,000 scale quadrangle map displaying the relationship of the property(s) to the project area.

To help FEMA evaluate the impact of the project, please indicate below any other information you are providing:

- Information gathered about potential historic properties in the project area, including any evidence indicating the age of the building or structure and presence of buildings or structures that are listed or eligible for listing on the National Register of Historic Places or within or near a National Register listed or eligible historic district. Sources for this information may include the State Historic Preservation Officer, and/or the Tribal Historic Preservation Officer (SHPO/THPO), your local planning office, historic preservation organization, or historical society.
- Consideration of how the project design will minimize adverse effects on known or potential historic buildings or structures, and any alternatives considered or implemented to avoid or minimize effects on historic buildings or structures. Please address and note associated costs in your project budget.
- For acquisition/demolition projects affecting historic buildings or structures, any data regarding the consideration and feasibility of elevation, relocation, or flood proofing as alternatives to demolition.
- Attached materials or additional comments.

Comments:

Attachments:

**B. National Historic Preservation Act - Archeological Resources**

- \* 1. Does your project involve disturbance of ground? Yes

If Yes, you must confirm that you have provided the following:

- A description of the ground disturbance by giving the dimensions (area, volume, depth, etc.) and location
- The past use of the area to be disturbed, noting the extent of previously disturbed ground.
- A USGS 1:24,000 scale or other site map showing the location and extent of ground disturbance.

To help FEMA evaluate the impact of the project, please indicate below any other information you are providing:



- Any information about potential historic properties, including archeological sites, in the project area. Sources of this information may include SHPO/THPO, and/or the Tribe's cultural resources contact if no THPO is designated. Include, if possible, a map showing the relation of any identified historic properties to the project area.

- Attached materials or additional comments.

Comments:

Excavation at both sites will be required. See attachments for required information. The "site plans" show the preliminary plans and the localized project sites. The "pond" pdf's show the general area using the USGS map. The Ground Disturbance memo provides additional detail on ground disturbance. The "prelim" pdf shows aerials with existing vegetation.

Attachments:

- [Diack's Pond Site.pdf](#)
- [Sester's Pond.pdf](#)
- [Ground Disturbance.doc](#)
- [prelim.pdf](#)
- [Sesters Site Plan.pdf](#)
- [Diacks Site Plan.pdf](#)

**C. Endangered Species Act and Fish and Wildlife Coordination Act**

- \* 1. Are Federally listed threatened or endangered species or their critical habitat present in the area affected by the project? Yes

If Yes, you must confirm that you have provided the following:

- Information you obtained to identify species in or near the project area. Provide the source and date of the information cited.

To help FEMA evaluate the impact of the project, please indicate below any other information you are providing:

- Any request for information and associated response from the USFWS, the National Marine Fisheries Service (NMFS) (for affected ocean-going fish), or your State Wildlife Agency, regarding potential listed species present and potential of the project to impact those species.

- Attached materials or additional comments.

Comments:

The Oregon Natural Heritage Information Center (ONHIC) database shows the following federally listed threatened or endangered species as occurring within a two mile radius of the project vicinity: Chinook salmon (*Oncorhynchus tshawytscha*) and steelhead (*Oncorhynchus mykiss*). The need for a 404 Permit from USACE provides a federal nexus for ESA consultation at the Diack's Pond site. A biological assessment will be prepared to address the effects of this project on the species listed above. The apparent presence of natural migration barriers downstream would preclude any occurrence of ESA-protected fish in the site vicinity. However, it is possible that NOAA fisheries would take jurisdiction based on potential downstream effects to Sandy River populations of the steelhead trout and Chinook salmon.

- \* 2. Does your project remove or affect vegetation? Yes

If Yes, you must confirm that you have provided the following:

- Description of the amount (area) and type of vegetation to be removed or affected.

A site map showing the project area and the extent of vegetation affected.





- Photographs or digital images that show both the vegetation affected and the vegetation in context of its surroundings.

To help FEMA evaluate the impact of the project, please indicate below any other information you are providing:

- Attached materials or additional comments.

Comments:

Both projects will remove some vegetation. See attachments under B.

- \* 3. Is your project in, near (within 200 feet), or likely to affect any type of waterway or body of water? Yes

If Yes, and project is not within an existing building, you must confirm that you have provided the following:

- A USGS 1:24,000 scale quadrangle map showing the project activities in relation to all nearby water bodies (within 200 feet).
- Any information about the type of water body nearby including: its dimensions, the proximity of the project activity to the water body, and the expected and possible changes to the water body, if any. Identify all water bodies regardless whether you think there may be an effect
- A photograph or digital image of the site showing both the body of water and the project area.

To help FEMA evaluate the impact of the project, please indicate below any other information you are providing:

- Evidence of any discussions with the US Fish and Wildlife Service (USFWS), and/or your State Wildlife Agency concerning any potential impacts if there is the potential for the project to affect any water body.
- Attached materials or additional comments.

Comments:

Both projects will affect a waterway. See attachments under B.

Attachments:

Ground Disturbance.doc

#### **D. Clean Water Act, Rivers and Harbors Act, and Executive Order 11990 (Protection of Wetlands)**

- \* 1. Will the project involve dredging or disposal of dredged material, excavation, adding fill material or result in any modification to water bodies or wetlands designated as "waters of the U.S." as identified by the US Army Corps of Engineers or on the National Wetland Inventory? Yes

If Yes, you must confirm that you have provided the following:

- Documentation of the project location on a USGS 1:24,000 scale topographic map or image and a copy of a National Wetlands Inventory map or other available wetlands mapping information.



To help FEMA evaluate the impact of the project, please indicate below any other information you are providing:

- Request for information and response letter from the US Army Corps of Engineers and/or State resource agencies regarding the potential for wetlands, and applicability of permitting requirements.
- Evidence of alternatives considered to eliminate or minimize impacts to wetlands.
- Attached materials or additional comments.

Comments:

The Sandy, Oregon quadrangle of the National Wetlands Inventory (1981) depicts Sester's Pond and Diack's Pond as artificial impounded palustrine open water intermittently exposed/permanent wetlands. Local, state and federal agencies have concurrent jurisdiction over these sites. USACE, DSL, and Multnomah County are the agencies involved. The work at Diacks Pond will result in wetland fill and stream culverting at this site and would require the following: · Clean Water Act Section 404 Permit – U.S. Army Corps of Engineers · Clean Water Act Section 401 Water Quality Certification – Oregon Department of Environmental Quality · Removal-Fill Permit – Oregon Department of State Lands A single joint permit application will be prepared for submittal to the permitting agencies. The application will include a detailed alternatives analysis, conceptual drawings of each crossing as well as calculations of removal and fill quantities within wetlands and waters of the U.S. Impacts to wetland resources will require preparation of a compensatory wetland mitigation plan, which will be submitted as a component of the permit application. It is proposed that the wetland area immediately downstream of the upper earthen dam be enhanced and maintained as mitigation for the project impacts. At Sesters Pond we will be crossing the stream at this site and if trenching is involved would require the following: · Clean Water Act Section 404 Permit – U.S. Army Corps of Engineers · Clean Water Act Section 401 Water Quality Certification – Oregon Department of Environmental Quality · Removal-Fill Permit – Oregon Department of State Lands Modifying the alignment to cross the stream further downstream may also result in wetland impacts. A single joint permit application will be prepared for submittal to the permitting agencies. The application will include a detailed alternatives analysis, conceptual drawings of each crossing as well as calculations of removal and fill quantities within wetlands and waters of the U.S. Impacts to wetland resources will require preparation of a compensatory wetland mitigation plan, which will be submitted as a component of the permit application. It is proposed that the wetland area would be enhanced and maintained as mitigation for the project impacts.

Attachments:

**E. Executive Order 11988 (Floodplain Management)**

- \* 1. Does a Flood Insurance Rate Map (FIRM), Flood Hazard Boundary Map (FHBM), hydrologic study, or some other source indicate that the project is located in or will affect a 100 year floodplain, a 500 year floodplain if a critical facility, an identified regulatory floodway, or an area prone to flooding? No

If Yes, please indicate in the text box below any documentation to identify the means or the alternatives considered to eliminate or minimize impacts to floodplains (See the 8 step process found in 44 CFR Part 9.6.) to help FEMA evaluate the impact of the project:

- \* 2. Does the project alter a watercourse, water flow patterns, or a drainage way, regardless of its floodplain designation? Yes

If Yes, please indicate below any other information you are providing to help FEMA evaluate the impact of the project:

- Hydrologic/hydraulic information from a qualified engineer to demonstrate how drainage and flood flow patterns will be changed and to identify down and upstream effects.
- Evidence of any consultation with US Army Corps of Engineers (may be included under Part D



of the Environmental Information).

- Request for information and response letter from the State water resource agency, if applicable, with jurisdiction over modification of waterways.
- Attached materials or additional comments.

Comments:

The work at Sester's does not alter the drainage channel; we are buried below it. The work at Diack's includes installation of culverts beneath the conduits versus the open channel configuration that currently exists. Accordingly, we are altering the drainage channel in a minor way. An analysis is being performed to size the culverts as well as determining the flow that would come from a breach of the Diack dam. No upstream or downstream flow changes in the drainage will result from our project. We have consulted with the permitting agencies, completed a wetlands delineation and are in the process of completing the required permit applications. We are not dealing with a water course change that involves the State. We will deal with the county and USACE.

Attachments:

**F. Coastal Zone Management Act**

\* 1. Is the project located in the State's designated coastal zone? No

If Yes, please indicate below any other information you are providing to help FEMA evaluate the impact of the project:

- Information resulting from contact with the appropriate State agency that implements the coastal zone management program regarding the likelihood of the project's consistency with the State's coastal zone plan and any potential requirements affecting the cost or design of the proposed activity.
- Attached materials or additional comments.

Comments:

Attachments:

**G. Farmland Protection Policy Act**

\* 1. Will the project convert more than 5 acres of "prime or unique" farmland outside city limits to a non-agricultural use? No

Comments:

Attachments:

**H. RCRA and CERCLA (Hazardous and Toxic Materials)**

\* 1. Is there a reason to suspect there are contaminants from a current or past use on the property associated with the proposed project? No

If Yes, please indicate below any other information you are providing to help FEMA evaluate the impact



of the project:

- Comments and any relevant documentation.
- Results of any consultations with State or local agency to obtain permit with requirements for handling, disposing of or addressing the effects of hazardous or toxic materials related to project implementation.
- Attached materials or additional comments.

Comments:

\* 2. Are there any studies, investigations, or enforcement actions related to the property associated with the proposed project? No

If Yes, please indicate below any other information you are providing to help FEMA evaluate the impact of the project:

- Comments and any relevant documentation.
- Results of any consultations with State or local agency to obtain permit with requirements for handling, disposing of or addressing the effects of hazardous or toxic materials related to project implementation.
- Attached materials or additional comments.

Comments:

\* 3. Does any project construction or operation activities involve the use of hazardous or toxic materials? No

If Yes, please indicate below any other information you are providing to help FEMA evaluate the impact of the project:

- Comments and any relevant documentation.
- Results of any consultations with State or local agency to obtain permit with requirements for handling, disposing of or addressing the effects of hazardous or toxic materials related to project implementation.
- Attached materials or additional comments.

Comments:

\* 4. Do you know if any of the current or past land-uses of the property affected by the proposed project or of the adjacent properties are associated with hazardous or toxic materials? No

If Yes, please indicate below any other information you are providing to help FEMA evaluate the impact of the project:

- Comments and any relevant documentation.
- Results of any consultations with State or local agency to obtain permit with requirements for handling, disposing of or addressing the effects of hazardous or toxic materials related to project

implementation.

- Attached materials or additional comments.

Comments:

Attachments:

**I. Executive Order 12898, Environmental Justice for Low Income and Minority Populations**

- \* 1. Are there low income or minority populations in the project's area of effect or adjacent to the project area? No

If Yes, you must confirm that you have provided the following:

- Description of any disproportionate and adverse effects to these populations.

To help FEMA evaluate the impact of the project, please indicate below any other information you are providing:

- Description of the population affected and the portion of the population that would be disproportionately and adversely affected. Please include specific efforts to address the adverse impacts in your proposal narrative and budget.
- Attached materials or additional comments.

Comments:

Attachments:

**J. Other Environmental/Historic Preservation Laws or Issues**

- \* 1. Are there other environmental/historic preservation requirements associated with this project that you are aware of? No

If Yes, please indicate in the text box below a description of the requirements, issues or public involvement effort.

- \* 2. Are there controversial issues associated with this project? No

If Yes, please indicate in the text box below a description of the requirements, issues or public involvement effort.

- \* 3. Have you conducted any public meeting or solicited public input or comments on your specific proposed mitigation project? No

If Yes, please indicate in the text box below a description of the requirements, issues or public involvement effort.

Meetings have been held only with the local property owners.



Attachments:

### K. Summary and Cost of Potential Impacts

- \* 1. Having answered the questions in parts A. through J., have you identified any aspects of your proposed project that have the potential to impact environmental resources or historic properties? Yes

If Yes, you must confirm that you have:

- Evaluated these potential effects and provided the materials required in Parts A through J that identify the nature and extent of potential impacts to environmental resources and/or historic properties.
- Consulted with appropriate parties to identify any measures needed to avoid or minimize these impacts.
- Considered alternatives that could minimize both the impacts and the cost of the project.
- Made certain that the costs of any measures to treat adverse effects are realistically reflected in the project budget estimate.

Comments:

The work at Diacks Pond will result in wetland fill and stream culverting at this site and would require the following: · Clean Water Act Section 404 Permit – U.S. Army Corps of Engineers · Clean Water Act Section 401 Water Quality Certification – Oregon Department of Environmental Quality · Removal-Fill Permit – Oregon Department of State Lands A single joint permit application will be prepared for submittal to the permitting agencies. The application will include a detailed alternatives analysis, conceptual drawings of each crossing as well as calculations of removal and fill quantities within wetlands and waters of the U.S. Impacts to wetland resources will require preparation of a compensatory wetland mitigation plan, which will be submitted as a component of the permit application. It is proposed that the wetland area immediately downstream of the upper earthen dam be enhanced and maintained as mitigation for the project impacts. The work at Sesters Pond will require crossing the stream at this site and if trenching is involved would require the following: · Clean Water Act Section 404 Permit – U.S. Army Corps of Engineers · Clean Water Act Section 401 Water Quality Certification – Oregon Department of Environmental Quality · Removal-Fill Permit – Oregon Department of State Lands Modifying the alignment to cross the stream further downstream may also result in wetland impacts. A single joint permit application will be prepared for submittal to the permitting agencies. The application will include a detailed alternatives analysis, conceptual drawings of each crossing as well as calculations of removal and fill quantities within wetlands and waters of the U.S. Impacts to wetland resources will require preparation of a compensatory wetland mitigation plan, which will be submitted as a component of the permit application. It is proposed that the wetland area would be enhanced and maintained as mitigation for the project impacts.

Attachments:

Maintenance Schedule and Costs

Provide a maintenance schedule including cost information

The proposed improvements are a permanent solution to the seismic vulnerability. No additional maintenance is required to maintain the effectiveness of the upgrades.

Identify entity that will perform any long-term maintenance

If you would like to make any comments, please enter them below.

Attach letter from entity accepting performance responsibility



## Evaluation Information (Part 1 of 4)

|  |     |
|--|-----|
| Is the recipient participating in the <u>Community Rating System (CRS)</u> ?   | Yes |
| If yes, what is their <u>CRS</u> rating?   | 6   |
| Is the recipient a <u>Cooperating Technical Partner (CTP)</u> ?  | Yes |
| Is the recipient a <u>Firewise Community</u> ?   | No  |
| If yes, please provide their <u>Firewise Community</u> number.   |     |
| Has the recipient adopted building codes consistent with the <u>International Codes</u> ?                              | Yes |
| Has the recipient adopted the <u>National Fire Protection Association (NFPA) 5000 Code</u> ?                           | Yes |
| Have the recipient's building codes been assessed on the <u>Building Code Effectiveness Grading Schedule (BCEGS)</u> ? | Yes |
| If yes, what is their <u>BCEGS</u> rating?   | 2   |
| Is the recipient a <u>Disaster Resistant University</u> ?  | No  |
| Is the recipient a <u>Historically Black College or University or a Tribal College or University</u> ?                 | No  |



## Evaluation Information (Part 2 of 4)

Describe the desired outcome and methodology of the mitigation activity in terms of mitigation objectives to be achieved.

This project will fully meet the primary goal to reduce restoration times for water service in future earthquakes.

Describe performance expectations and timeline for interim milestones and overall completion of mitigation activity.

Final design of the project should be completed by July 2005. It is anticipated that all environmental permits will be completed by January 2006. By February 2006, we would advertise for bids and by April 2006 we would award the construction contract. Construction would likely begin by June of 2006 and continue through February of 2007.

Describe how you will manage the costs and schedule, and how you will ensure successful performance.

The Portland Water Bureau manages a Capital Improvement Program that ranges annually from \$20 million to \$55 million, and has extensive experience in managing project costs and schedules. We have experienced in-house engineering, project management, and construction management staff that can provide a variety of services. For this project, we would have an engineering consultant who would be responsible for the design. We will likely hire a consultant construction manager who would be tasked with managing the day-to-day costs and schedule associated with the construction. A Water Bureau project manager would provide oversight during design and construction phases to ensure successful performance.

Describe the staff and resources needed to implement this mitigation activity and the applicant's ability to provide these resources.

As stated above, the Water Bureau has sufficient staff and resources to make this project a success. A seasoned group of Water Bureau employees, knowledgeable consultants and a qualified contractor will make up an effective project team. There will be adequate funding provided by the Water Bureau to add to the grant money and ensure things go smoothly.

If applying for multiple mitigation activities, how do these activities relate?

The mitigation activities consist of the design and construction of the mitigation projects at Diack's and Sester's ponds. The activities will be closely coordinated.



## Evaluation Information (Part 3 of 4)

How will this mitigation activity leverage involvement of partners to enhance its outcome?

As the largest water utility in the State of Oregon, the Portland Water Bureau is looked on as a leader in the design and construction of water facilities and seismic upgrades. This project can serve as a demonstration project for other water utilities that may have similar situations. We will likely allow other utilities to observe the activities and the Water Bureau will likely share the results with others in the region through presentations at professional organization conferences.

How will this mitigation activity offer long-term financial and social benefits?

Damage to the conduits at these locations would result in interruption of water supply, property damage, and costly emergency repairs. Reducing the potential for water supply outages is a huge benefit both financially and socially.

How does this mitigation activity comply with Federal laws and Executive Orders, and how is it complementary to other Federal programs?

The activities will comply with Federal laws and Executive orders. The Water Bureau will involve the necessary regulatory agencies through the permitting process in order to accomplish this.

What outreach activities are planned relative to this mitigation activity (e.g., signs, press releases, success stories, developing package to share with other communities, losses avoided analysis) and/or how will this mitigation activity serve as a model for other communities (i.e. Do you intend to mentor other communities, Tribes or States? Do you intend to prepare a description of the process followed in this activity so that others may learn from the example?)?

Outreach activities on projects that reduce vulnerability are always a challenge due to the amount of information that can be provided. However, the Water Bureau plans to involve affected parties early and often to keep the project moving smoothly. As stated above, we anticipate that this project can be used as an example to those entities that have similar vulnerabilities and plan to have many presentations afterwards at professional conferences.



Evaluation Information (Part 4 of 4)

|  |   |
|--|---|
| Please provide the percent of the population benefiting from this mitigation activity. | 100.0   |
| Please explain your response.  | 100% of the more than 800,000 people served by Portland Water Bureau. |
| Net Present Value of Project Benefits (A)  | \$ 36921546.00  |
| Total Project Cost Estimate (B)  | \$ 4053724.00   |
| What is the Benefit Cost Ratio for the entire project (A/B)?                           | 9.108   |
| Analysis Type  | FEMA BCA software methodology   |
| What is the primary hazard data used for the BCA?                                      | Earthquake  |
| What secondary hazards were considered during the BCA?                                 | Fire, Flood   |
| Other Secondary Hazard   |   |
| Does this mitigation activity protect a critical facility?                             | Yes   |
| If yes, please select the type of critical facilities to be protected                  | Water Facilities  |
| Comments:  |   |
| Name   | Date Attached   |

| Comments and Attachments        |  |  |               |
|---------------------------------|--|--|---------------|
| Name of Section                 | Comment  | Attachment   | Date Attached |
| Community Information           |  | <a href="#">Sec-2_Community_Prof_11-29.pdf</a>         | 02-23-2005    |
|                                 |  | <a href="#">Exec_Summary_12-1.pdf</a>                  | 02-15-2005    |
| Mitigation Plan Information     |  | <a href="#">OR-SNHMP_earthquake_chapter.pdf</a>        | 02-23-2005    |
|                                 |  | <a href="#">matrixofactions_12-1.pdf</a>               | 02-23-2005    |
|                                 |  | <a href="#">Oregon's NHMP Trestles.doc</a>             | 02-25-2005    |
| Mitigation Activity Information | Preliminary plans/site plans for the work are attached. The Map of Trestle Locations, also attached, shows the larger area.  | <a href="#">Map of Trestle Locations.pdf</a>           | 02-23-2005    |
|                                 |  | <a href="#">Diacks Site Plan.pdf</a>                   | 02-23-2005    |
|                                 |  | <a href="#">Sesters Site Plan.pdf</a>                  | 02-23-2005    |
| Hazard Information              | Seismic. Seismic hazards include ground shaking for both project sites as well as the potential for dam failures, erosion/scour of trestles, and landslide failures. The probabilistic risk evaluation for the entire Portland water supply system (Bull Run Conduits and grown water system) included quantitative vulnerability evaluations of potential failure modes for key elements of both water supply systems. See G&E Engineering Report (2005) Section 2, Geologic Hazards for discussion of seismic sources and seismic hazards for these locations. | <a href="#">FM4101790450A.pdf</a>                      | 02-23-2005    |
| Scope of Work                   | Engineering report attached below.   | <a href="#">G&amp;E Engineering Report_BullRun.pdf</a> | 02-28-2005    |
| Match Sources                   | For a more detailed cost estimate, see attachment "Diacks Sester Estimate" in Cost Effectiveness section.  |  |               |
|                                 |  | <a href="#">G&amp;E Engineering Report_BullRun.pdf</a> | 02-28-2005    |
| Cost Effectiveness Information  | Black & Veatch has completed preliminary design work for these crossing upgrades, along with engineering cost estimates (attached).  | <a href="#">Diacks_Sesters_Estimate 2 KAG.xls</a>      | 02-18-2005    |
|                                 |  | <a href="#">Bull Run BCA Supporting Calcs.xls</a>      | 02-18-2005    |
|                                 |  | <a href="#">InflationCalculator2005Water.xls</a>       | 02-18-2005    |
|                                 |  | <a href="#">PWB Bull Run BCA 01.xls</a>                | 02-18-2005    |
|                                 |  | <a href="#">PWB Bull Run Data Documentation.doc</a>    | 02-18-2005    |



Assurances and Certifications

Please click the link in the status column to view forms.

Forms

Status

Part II: FEMA Form 20-16B, Assurances **Construction** Programs.

Complete

Part II: FEMA Form 20-16C, Certifications Regarding Lobbying; Debarment, Suspension and Other Responsibilities Matters; and Drug-Free Workplace Requirements.

Complete

Part III: SF-LLL, Disclosure of Lobbying Activities (Complete only if applying for a grant of more than \$100,000 and have lobbying activities using Non-Federal funds. See Form 20-16C for lobbying activities definition.)

Complete



## FEMA Form 20-16B, Assurances-Construction Programs

Public reporting burden for this collection of information is estimated to average 15 minutes per response, including time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding the burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to the Office of Management and Budget, Paperwork Reduction Project (0348-0042), Washington, DC 20503.

**PLEASE DO NOT RETURN YOUR COMPLETED FORM TO THE OFFICE OF MANAGEMENT AND BUDGET.**

**SEND IT TO THE ADDRESS PROVIDED BY THE SPONSORING AGENCY.**

**NOTE:** Certain of these assurances may not be applicable to your project or program. If you have questions, please contact the awarding agency. Further, certain Federal assistance awarding agencies may require applicants to certify to additional assurances. If such is the case, you will be notified.

As the duly authorized representative of the applicant, I certify that the applicant:

1. Has the legal authority to apply for Federal assistance, and the institutional, managerial and financial capability (including funds sufficient to pay the nonfederal share of project costs) to ensure proper planning, management and completion of the project described in this application.
2. Will give the awarding agency, the Comptroller General of the United States and, if appropriate, the State, through any authorized representative, access to and the right to examine all records, books, papers, or documents related to the assistance; and will establish a proper accounting system in accordance with generally accepted accounting standards or agency directives.
3. Will not dispose of, modify the use of, or change the terms of the real property title, or other interest in the site and facilities without permission and instructions from the awarding agency. Will record the Federal interest in the title of real property in accordance with awarding agency directives and will include a covenant in the title of real property acquired in whole or in part with Federal assistance funds to assure nondiscrimination during the useful life of the project.
4. Will comply with the requirements of the assistance awarding agency with regard to the drafting, review and approval of construction plans and specifications.
5. Will provide and maintain competent and adequate engineering supervision at the construction site to ensure that the complete work conforms with the approved plans and specifications and will furnish progress reports and such other information as may be required by the assistance awarding agency or state.
6. Will initiate and complete the work within the applicable time frame after receipt of approval of the awarding agency.
7. Will establish safeguards to prohibit employees from using their positions for a purpose that constitutes or presents the appearance of personal or organizational conflict of interest, or personal gain.
8. Will comply with the Intergovernmental Personnel Act of 1970 (42 USC Sections 4728-4763) relating to prescribed standards for merit systems for programs funded under one of the nineteen statutes or regulations specified in Appendix A of OPM's Standards for a Merit System of Personnel Administration (5 CFR 900, Subpart F).
9. Will comply with the Lead-Based Paint Poisoning Prevention Act (42 USC Section 4801 et seq.) which prohibits the use of lead based paint in construction or rehabilitation of residence structures.
10. Will comply with all Federal statutes relating to nondiscrimination. These include but are not limited to: (a) Title VI of the Civil Rights Act of 1964 (PL 88-352) which prohibits discrimination on the basis of race, color or national origin; (b) Title IX of the Education Amendments of 1972, as amended (20 USC Sections 1681- 1683, and 1685-1686), which prohibits discrimination on the basis of sex; (c) Section 504 of the Rehabilitation Act of 1973, as amended (29 USC Section 794), which prohibits discrimination on the basis of handicaps; (d) the Age Discrimination Act of 1975, as amended (42 USC Sections 6101-6107), which prohibits discrimination on the basis of age; (e) the Drug Abuse Office and Treatment Act of



- 1972 (PL 92-255), as amended, relating to nondiscrimination on the basis of drug abuse; (f) the Comprehensive Alcohol Abuse and Alcoholism Prevention, Treatment and Rehabilitation Act of 1970 (PL 91-616), as amended, relating to nondiscrimination on the basis of alcohol abuse or alcoholism; (g) Sections 523 and 527 of the Public Health Service Act of 1912 (42 USC Sections 290-dd-3 and 290-ee-3), as amended, relating to confidentiality of alcohol and drug abuse patient records; (h) Title VIII of the Civil Rights Act of 1968 (42 USC Section 3601 et seq.), as amended, relating to nondiscrimination in the sale, rental or financing of housing; (i) any other nondiscrimination provisions in the specific statute(s) under which application for Federal assistance is being made; and, (j) the requirements of any other nondiscrimination statute(s) which may apply to the application.
11. Will comply, or has already complied, with the requirements of Titles II and III of the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970 (PL 91-646) which provide for fair and equitable treatment of persons displaced or whose property is acquired as a result of Federal and Federally assisted programs. These requirements apply to all interests in real property acquired for project purposes regardless of Federal participation in purchases.
  12. Will comply with the provisions of the Hatch Act (5 USC Sections 1501-1508 and 7324-7328) which limit the political activities of employees whose principal employment activities are funded in whole or in part with Federal funds.
  13. Will comply, as applicable, with the provisions of the Davis-Bacon Act (40 USC Sections 276a to 276a-7), the Copeland Act (40 USC Section 276c and 18 USC Section 874), and the Contract Work Hours and Safety Standards Act (40 USC Sections 327-333) regarding labor standards for federally assisted construction subagreements.
  14. Will comply with flood insurance purchase requirements of Section 102(a) of the Flood Disaster Protection Act of 1973 (PL 93-234) which requires recipients in a special flood hazard area to participate in the program and to purchase flood insurance if the total cost of insurable construction and acquisition is \$10,000 or more.
  15. Will comply with environmental standards which may be prescribed pursuant to the following: (a) institution of environmental quality control measures under the National Environmental Policy Act of 1969 (PL 91-190) and Executive Order (EO) 11514; (b) notification of violating facilities pursuant to EO 11738; (c) protection of wetlands pursuant to EO 11990; (d) evaluation of flood hazards in floodplains in accordance with EO 11988; (e) assurance of project consistency with the approved State management program developed under the Coastal Zone Management Act of 1972 (16 USC Section 1451 et seq.); (f) conformity of Federal actions to State (Clean Air) Implementation Plans under Section 176(c) of the Clean Air Act of 1955, as amended (42 USC Section 7401 et seq.); (g) protection of underground sources of drinking water under the Safe Drinking Water Act of 1974, as amended (PL 93-523); and (h) protection of endangered species under the Endangered Species Act of 1973, as amended (PL 93-205).
  16. Will comply with the Wild and Scenic Rivers Act of 1968 (16 USC Section 1271 et seq.) related to protecting components or potential components of the national wild and scenic rivers system.
  17. Will assist the awarding agency in assuring compliance with Section 106 of the National Historic Preservation Act of 1966, as amended (16 USC Section 470), EO 11593 (identification and preservation of historic properties), and the Archaeological and Historic Preservation Act of 1974 (16 USC Section 469a-1 et seq.).
  18. Will cause to be performed the required financial and compliance audits in accordance with the Single Audit Act of 1984.
  19. Will comply with all applicable requirements of all other Federal laws, Executive Orders, regulations, and policies governing this program.
  20. It will comply with the minimum wage and maximum hour provisions of the Federal Fair Labor Standards Act (29 USC Section 201), as they apply to employees of institutions of higher education, hospitals, and other nonprofit organizations.
  21. It will obtain approval by the appropriate Federal agency of the final working drawings and specifications before the project is advertised or placed on the market for bidding; that it will construct the project, or cause it to be constructed, to final completion in accordance with the application and approved plans and specifications; that it will submit to the appropriate Federal agency for prior approval changes that alter the cost of the project, use of space, or



- functional layout, that it will not enter into a construction contract(s) for the project or undertake other activities until the conditions of the construction grant program(s) have been met.
22. It will operate and maintain the facility in accordance with the minimum standards as may be required or prescribed by the applicable Federal, State, and local agencies for the maintenance and operation of such facilities.
  23. It will require the facility to be designed to comply with the "American Standard Specification for Making Buildings and Facilities Accessible to, and Usable by, the Physically Handicapped," Number A117.- 1961, as modified (41 CFR 101-17.703). The applicant will be responsible for conducting inspections to ensure compliance with these specifications by the contractor.
  24. If any real property or structure thereon is provided or improved with the aid of Federal financial assistance extended to the applicant, this assurance shall obligate the applicant, or in the case of any transfer of such property, any transfer, for the period during which the real property, or structure is used for a purpose for which the Federal financial assistance is extended or for another purpose involving the provision of similar services or benefits.
  25. In making subgrants with nonprofit institutions under this Comprehensive Cooperative Agreement, it agrees that such grants will be subject to OMB Circular A-122, "Cost Principles for Nonprofit Organizations" included in Vol. 49, Federal Register, pages 18260 through 18277 (April 27, 1984).

I, Patricia Rueter, hereby sign this form as of 02-28-2005.



**You must read and sign these assurances by providing your password and checking the box at the bottom of this page.**

**Note:** Fields marked with an \* are required.

Certifications Regarding Lobbying; Debarment, Suspension and Other Responsibility Matters; and Drug-Free Workplace Requirements.

Applicants should refer to the regulations cited below to determine the certification to which they are required to attest. Applicants should also review the instructions for certification included in the regulations before completing this form. Signature on this form provides for compliance with certification requirements under 44 CFR Part 18, "New Restrictions on Lobbying; and 28 CFR Part 17, "Government-wide Debarment and suspension (Nonprocurement) and Government-wide Requirements for Drug-Free Workplace (Grants)." The certifications shall be treated as a material representation of fact upon which reliance will be placed when the Federal Emergency Management Agency (FEMA) determines to award the covered transaction, grant, or cooperative agreement.

#### 1. LOBBYING

A. As required by the section 1352, Title 31 of the US Code, and implemented at 44 CFR Part 18 for persons entering into a grant or cooperative agreement over \$100,000, as defined at 44 CFR Part 18, the applicant certifies that:

(a) No Federal appropriated funds have been paid or will be paid, by or on behalf of the undersigned, to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of congress, or an employee of a Member of Congress in connection with the making of any Federal grant, the entering into of any cooperative agreement and extension, continuation, renewal, amendment, or modification of any Federal grant or cooperative agreement;

(b) If any other funds than Federal appropriated funds have been paid or will be paid to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with this Federal grant or cooperative agreement, the undersigned shall complete and submit Standard Form LLL, "Disclosure of Lobbying Activities", in accordance with its instructions;

#### **Standard Form LLL Disclosure of Lobbying Activities Attached**

(c) The undersigned shall require that the language of this certification be included in the award documents for all the sub awards at all tiers (including subgrants, contracts under grants and cooperative agreements, and subcontract(s)) and that all subrecipients shall certify and disclose accordingly.

#### 2. DEBARMENT, SUSPENSION AND OTHER RESPONSIBILITY MATTERS (DIRECT RECIPIENT)

As required by Executive Order 12549, Debarment and Suspension, and implemented at 44 CFR Part 67, for prospective participants in primary covered transactions, as defined at 44 CFR Part 17, Section 17.510-A. The applicant certifies that it and its principals:

(a) Are not presently debarred, suspended, proposed for debarment, declared ineligible, sentenced to a denial of Federal benefits by a State or Federal court, or voluntarily excluded from covered transactions by any Federal department or agency;

(b) Have not within a three-year period preceding this application been convicted of or had a civilian judgment rendered against them for commission of fraud or a criminal offense in connection with obtaining, attempting to obtain, or perform a public (Federal, State, or local) transaction or contract under a public transaction; violation of Federal or State antitrust statutes or commission of embezzlement, theft, forgery, bribery, falsification or destruction of records, making false statements, or receiving stolen property;

(c) Are not presently indicted for or otherwise criminally or civilly charged by a governmental entity (Federal, State, or locally) with commission of any of the offenses enumerated in paragraph (1)(b)



of this certification; and

(d) Have not within a three-year period preceding this application had one or more public transactions (Federal, State, or local) terminated for cause or default; and

B. Where the applicant is unable to certify to any of the statements in this certification, he or she shall attach an explanation to this application.

Explanation:

### 3. DRUG-FREE WORKPLACE (GRANTEES OTHER THAN INDIVIDUALS)

As required by the Drug-Free Workplace Act of 1988, and implemented at 44 CFR Part 17, Subpart F, for grantees, as defined at 44 CFR part 17, Sections 17.615 and 17.623:

(A) The applicant certifies that it will continue to provide a drug-free workplace by:

(a) Publishing a statement notifying employees that the unlawful manufacture, distribution, dispensing, possession, or use of a controlled substance is prohibited in the grantee's workplace and specifying the actions that will be taken against employees for violation of such prohibition;

(b) Establishing an on-going drug free awareness program to inform employees about:

- (1) The dangers of drug abuse in the workplace;
- (2) The grantee's policy of maintaining a drug-free workplace;
- (3) Any available drug counseling, rehabilitation and employee assistance programs; and
- (4) The penalties that may be imposed upon employees for drug abuse violations occurring in the workplace;

(c) Making it a requirement that each employee to be engaged in the performance of the grant to be given a copy of the statement required by paragraph (a);

(d) Notifying the employee in the statement required by paragraph (a) that, as a condition of employment under the grant, the employee will:

- (1) Abide by the terms of the statement; and
- (2) Notify the employee in writing of his or her conviction for a violation of a criminal drug statute occurring in the workplace no later than five calendar days after such conviction.

(e) Notifying the agency, in writing within 10 calendar days after receiving notice under subparagraph (d)(2) from an employee or otherwise receiving actual notice of such conviction. Employers of convicted employees must provide notice, including position title, to the applicable FEMA awarding office, i.e. regional office or FEMA office.

(f) Taking one of the following actions against such an employee, within 30 calendar days of receiving notice under subparagraph (d)(2), with respect to any employee who is so convicted:

- (1) Taking appropriate personnel action against such an employee, up to and including termination, consistent with the requirements of the Rehabilitation Act of 1973, as amended; or
- (2) Require such employee to participate satisfactorily in a drug abuse assistance or rehabilitation program approved for such purposes by a Federal, State, or local health, law enforcement or other appropriate agency.

(g) Making a good effort to continue to maintain a drug free workplace through



implementation of paragraphs (a), (b), (c), (d), (e), and (f).

(B) The grantee may insert in the space provided below the site(s) for the performance of work done in connection with the specific grant:

Place of Performance

| Street           | City     | State | Zip        |
|------------------|----------|-------|------------|
| 1120 SW 5th Ave. | Portland | OR    | 97204-1912 |

Section 17.630 of the regulations provide that a grantee that is a State may elect to make one certification in each Federal fiscal year. A copy of which should be included with each application for FEMA funding. States and State agencies may elect to use a Statewide certification.

I, Patricia Rueter, hereby sign this form as of 02-28-2005.

**Disclosure of Lobbying Activities**

1. Type of Federal Action

Grant

2. Status of Federal Action  
Bid/Offer/Application

3. Report Type

Initial Filing

4. Name and Address of Reporting Entity:  
Reporting Entity Type: Subawardee

Tier (if known):  
Portland, City of  
1900 N. Interstate  
Portland  
OR  
97227  
1820  
Congressional District:

5. If Reporting Entity in No.4 is a Subawardee, Enter Name and Address of  
Prime:  
State of Oregon Emergency Management  
PO# 14370  
Salem  
OR  
97309  
5062

6. Federal Department/Agency  
FEMA

7. Federal Program Name/Description  
Pre-Disaster Mitigation

8. Federal Action Number *if Known*:

9. Award Amount *if Known*:

10a. Name and address of Lobbying Registrant:  
(if individual, last name, first name, MI)

10b. Individuals Performing Services:  
(including address if different from No.10a)  
(last name, first name, MI)

OR

OR

11. Information requested through this form is authorized by title 31 U.S.C. section 1352. This disclosure of lobbying activities is a material representation of fact upon which reliance was placed by the tier above when this transaction was made or entered into. This will be reported to the Congress semi-annually and will be available for public inspection. Any person who fails to file the required disclosure shall be subject to civil penalty of not less than \$10,000 and not more than \$100,000 for each such failure.

I, Patricia Rueter, hereby sign this form as of 02-28-2005.



**APPLICATION FOR  
FEDERAL ASSISTANCE  
(SF 424)**

2. DATE SUBMITTED  
02-28-2005

Applicant Identifier

1. TYPE OF SUBMISSION  
Construction

3. DATE RECEIVED BY  
STATE  
02-28-2005

State Application Identifier

4. DATE RECEIVED BY  
FEDERAL AGENCY

Federal Identifier

5. APPLICANT INFORMATION

Legal Name  
City of Portland Bureau of Water Works

Organizational Unit  
City of Portland Bureau of Water Works

Address  
1900 North Interstate, Building 355/EOC  
Portland, OR 97227-1820

Name and telephone number of the person to be contacted on  
matters involving this application  
Perry Hopkins, 503-823-7074

6. EMPLOYER IDENTIFICATION NUMBER (EIN)  
93-6002236

6.a. DUNS NUMBER  
054971197

7. TYPE OF APPLICANT  
Local Government

8. TYPE OF APPLICATION  
Project Application

9. NAME OF FEDERAL AGENCY  
Federal Emergency Management Agency

10. CATALOG OF FEDERAL DOMESTIC ASSISTANCE

11. DESCRIPTIVE TITLE OF APPLICANT'S PROJECT  
Conduit Trestles at Diack's and Sester's Ponds

12. AREAS AFFECTED BY PROJECT (cities, counties, states, etc.)  
CLACKAMAS COUNTY, MULTNOMAH COUNTY, WASHINGTON COUNTY

13. PROPOSED PROJECT:

Start Date:  
End Date :

14. CONGRESSIONAL DISTRICTS OF:

a. Applicant OR  
b. Project OR

15. ESTIMATED FUNDING

|                   |                 |
|-------------------|-----------------|
| a. Federal        | \$ 3,000,000.00 |
| b. Applicant      | \$ 0.00         |
| c. State          | \$ 0.00         |
| d. Local          | \$ 1,053,724.00 |
| e. Other          | \$ 0.00         |
| f. Program Income | \$ 0.00         |
| g. TOTAL          | \$ 4,053,724.00 |

16. IS APPLICATION SUBJECT TO REVIEW BY STATE  
EXECUTIVE ORDER 12372 PROCESS?  
No, Program is not covered by E.O. 12372

17. IS THE APPLICANT DELINQUENT ON ANY FEDERAL DEBT?  
No

a. Name of Authorized  
Representative  
Elise Marshall

b. Title

c. Telephone Number  
503-823-2686

d. Signature of Authorized Representative  
Elise Marshall

e. Date Signed  
02-28-2005





City of Portland  
Bureau of Water Works  
Conduit Trestle System Vulnerability Reduction Project  
February 22, 2005

Requested Information for FEMA Pre-Disaster Mitigation Grant Application

### **Diack's Pond**

\* A description of the ground disturbance with dimensions (area, volume, depth, etc.) and location.

Vulnerability mitigation at this site includes installing new culverts under the existing roadway and conduits.

During construction an area approximately 400 ft. x 250 ft. at the location of the trestles will potentially be disturbed at this site. An additional triangular area approximately 120 ft. x 340 ft. will potentially be used for construction staging. The total area disturbed during construction will be a maximum of approximately 2.76 acres.

The estimated volume of excavation required to construct the new culverts under the existing roadway and conduits is based on an average depth of excavation of 7 ft. over the area of the culverts to be installed under the roadway (approximately 50 ft. long x 20 ft. wide) and an average depth of excavation of 2 ft. over the area of the culverts to be installed under the conduits (approximately 65 ft. long x 20 ft. wide) for a total of approximately 355 cubic yards of excavation. Backfill around the new conduits and headwalls (approximately 115 ft. long x 25 ft. wide x 5 ft. deep), and fill to encapsulate the conduits (approximately 115 ft. long x 50 ft. wide x 5 ft. deep) will result in fill of approximately 1,600 cubic yards. The net result will be a fill of approximately 1,245 cubic yards.

The location of the ground disturbance will be confined within the limits of the temporary and permanent easements shown on the attached figure.

\* The past use of the area to be disturbed, noting the extent of previously disturbed ground.

The area to be disturbed is and has been occupied by the conduits. The extent of previous disturbance in this area during the original construction of the conduits most likely included an open-cut trench and a lay-down area for the pipe which was most likely along the existing roadway that runs parallel to the conduits. The project area is designated Commercial Forest Use (CFU).

\* A USGS 1:24,000 scale or other site map (electronic?) showing location and extent of ground disturbance.

See attached map showing site.

- \* Any information of potential historic properties, including archeological sites in the project area.

No, not that we are aware of.

### **Sester's Pond**

- \* A description of the ground disturbance with dimensions (area, volume, depth, etc.) and location.

Vulnerability mitigation at this site includes installation of approximately 585 feet of new steel pipe to reroute Conduit #2 away from the dam and approximately 610 feet of new steel pipe to reroute Conduit #4 away from the dam. The new conduits will cross the channel over 200 feet downstream of the dam. The conduits will be installed below the probable depth of scour and encased in concrete where they cross the channel.

During construction an area approximately 700 ft. x 400 ft. at the location of the trestles will potentially be disturbed at this site. The total area disturbed during construction will be a maximum of approximately 6.4 acres.

Bedding and fill will replace excavated material so there will be essentially no net fill at this location.

The location of the ground disturbance will be confined within the limits of the temporary and permanent easements shown on the attached figure.

- \* The past use of the area to be disturbed, noting the extent of previously disturbed ground.

The area to be disturbed is and has been occupied by the conduits and a wetland. The extent of previous disturbance in this area during the original construction of the conduits most likely included an open-cut trench and a lay-down area for the pipe. The project area is zoned Exclusive Farm Use (EFU).

- \* A USGS 1:24,000 scale or other site map (electronic?) showing location and extent of ground disturbance.

See attached map showing site.

- \* Any information of potential historic properties, including archeological sites in the project area.

No, not that we are aware of.



**What is a Benefit? values updated to 2005, using FEMA Inflation Calculator**

|   |                      |
|---|----------------------|
| Economic Impact of loss of water service            | \$113.46             |
| Fire following earthquake losses (moderate climate) | \$19.28              |
| <b>Total Economic Impact</b>                        | <b>\$132.74</b>      |
| Customers   | 800,000              |
| <b>Economic Impact/day</b>                          | <b>\$106,192,000</b> |

Equivalent "proxy" annual operating budget  
(daily economic impact/day x365) **\$38,760,080,000**  
This value is entered in the Full Data Software  
to give the correct economic impact per day of  
loss of water service.

Latitude Longitude  
Diack's Pond  
Sestor's Pond  
Midpoint  
Decimal degrees

|                            |                     |
|----------------------------|---------------------|
| <b>Total Benefits:</b>     | <b>\$36,921,546</b> |
| <b>Total Project Cost:</b> | <b>\$4,053,724</b>  |
| <b>BCR:</b>                | <b>9.11</b>         |

|           |             |
|-----------|-------------|
| Diacks    | \$1,201,786 |
| Sestors   | \$2,830,938 |
| Subtotal  | \$4,032,724 |
| Pre-award | \$21,000    |
| TOTAL     | \$4,053,724 |

**Selected Earthquake Frequency Data  
From FEMA/USGS Seismic Hazard Data  
in BCA Earthquake Full Data Software  
for this latitude/longitude**

|                    |                 |                |                |
|--------------------|-----------------|----------------|----------------|
| <b>Probability</b> | 10% in 50 years | 5% in 50 years | 2% in 50 years |
| <b>PGA (% g)</b>   | 24.0712         | 31.19          | 40.5419        |

Portland Water Bureau  
 Bull Run Water Supply Seismic Upgrades

| Site Name                          | Trestle #          | Reliability | Expected Flow (MGD) | Return-to-Service Time (days) | Site Name                         | Trestle # | Reliability | Expected Flow (MGD) | Return-to-Service Time (days) |
|------------------------------------|--------------------|-------------|---------------------|-------------------------------|-----------------------------------|-----------|-------------|---------------------|-------------------------------|
| <b>Expected Flow at PGA=0.24g</b>  |                    |             |                     |                               | <b>Expected Flow at PGA=0.12g</b> |           |             |                     |                               |
| <b>Segment 1</b>                   |                    |             |                     |                               |                                   |           |             |                     |                               |
| <b>Unmitigated Condition</b>       |                    |             |                     |                               |                                   |           |             |                     |                               |
| <b>Conduit 2</b>                   | Capacity = 50 MGD  |             |                     |                               |                                   |           |             |                     |                               |
| S-10                               | 20                 | 0.383       |                     | 30                            | S-10                              | 20        | 0.827       |                     | 30                            |
| Landslides & Buried Pip            |                    | 0.7         |                     | 7                             | Landslides & Buried P             |           | 0.85        |                     | 7                             |
|                                    |                    |             | <b>13.405</b>       |                               |                                   |           |             | <b>35.1475</b>      |                               |
| <b>Conduit 3</b>                   | Capacity = 75 MGD  |             |                     |                               |                                   |           |             |                     |                               |
|                                    | 22                 | 0.815       |                     | 21                            |                                   | 22        | 0.978       |                     | 21                            |
|                                    | 21                 | 0.907       |                     | 21                            |                                   | 21        | 0.992       |                     | 21                            |
| Larson's Bridge                    |                    | 1           |                     | 0                             | Larson's Bridge                   |           | 1           |                     | 0                             |
| Landslides & Buried Pip            |                    | 0.7         |                     | 7                             | Landslides & Buried P             |           | 0.85        |                     | 7                             |
|                                    |                    |             | <b>38.81</b>        |                               |                                   |           |             | <b>61.85</b>        |                               |
| <b>Conduit 4</b>                   | Capacity = 100 MGD |             |                     |                               |                                   |           |             |                     |                               |
| Landslides & Buried Pip            |                    | 0.7         |                     | 7                             | Landslides & Buried P             |           | 0.85        |                     | 7                             |
|                                    |                    |             | <b>70</b>           | <b>7</b>                      |                                   |           |             | <b>85</b>           |                               |
| <b>Total Segment 1 Unmitigated</b> |                    |             | <b>122.21</b>       |                               |                                   |           |             | <b>182.00</b>       |                               |
| <b>Mitigated Condition</b>         |                    |             |                     |                               |                                   |           |             |                     |                               |
| <b>Conduit 2</b>                   | Capacity = 50 MGD  |             |                     |                               |                                   |           |             |                     |                               |
| S-10                               | 20                 | 0.383       |                     | 0                             | S-10                              | 20        | 0.827       |                     | 0                             |
| Landslides & Buried Pip            |                    | 0.7         |                     | 7                             | Landslides & Buried P             |           | 0.85        |                     | 7                             |
|                                    |                    |             | <b>13.405</b>       |                               |                                   |           |             | <b>35.1475</b>      |                               |
| <b>Conduit 3</b>                   | Capacity = 75 MGD  |             |                     |                               |                                   |           |             |                     |                               |
|                                    | 22                 | 0.815       |                     | 21                            |                                   | 22        | 0.978       |                     | 21                            |
|                                    | 21                 | 0.907       |                     | 21                            |                                   | 21        | 0.992       |                     | 21                            |
| Larson's Bridge                    |                    | 1           |                     | 0                             | Larson's Bridge                   |           | 1           |                     | 0                             |
| Landslides & Buried Pip            |                    | 0.7         |                     | 7                             | Landslides & Buried P             |           | 0.85        |                     | 7                             |
|                                    |                    |             | <b>38.81</b>        |                               |                                   |           |             | <b>61.85</b>        |                               |
| <b>Conduit 4</b>                   | Capacity = 100 MGD |             |                     |                               |                                   |           |             |                     |                               |
| Landslides & Buried Pip            |                    | 0.7         |                     | 7                             | Landslides & Buried P             |           | 0.85        |                     | 7                             |
|                                    |                    |             | <b>70</b>           | <b>7</b>                      |                                   |           |             | <b>85</b>           |                               |
| <b>Total Segment 1 Mitigated</b>   |                    |             | <b>122.21</b>       |                               |                                   |           |             | <b>182.00</b>       |                               |
| <b>Segment 2</b>                   |                    |             |                     |                               |                                   |           |             |                     |                               |
| <b>Unmitigated Condition</b>       |                    |             |                     |                               |                                   |           |             |                     |                               |
| <b>Conduit 2</b>                   | Bowman's Bridge    |             | 1                   |                               | Bowman's Bridge                   |           | 1           |                     |                               |
| Ditch Camp                         | 15                 | 0.305       |                     | 30                            | Ditch Camp                        | 15        | 0.827       |                     | 30                            |
| Ditch Camp                         | 13                 | 0.01        |                     | 30                            | Ditch Camp                        | 13        | 0.453       |                     | 30                            |
| Ditch Camp                         | 11                 | 0.725       |                     | 30                            | Ditch Camp                        | 11        | 0.961       |                     | 30                            |
| Sandy River Crossing               |                    | 0.15        |                     | 30                            | Sandy River Crossing              |           | 0.45        |                     | 30                            |
| Landslides & Buried Pip            |                    | 0.7         |                     | 7                             | Landslides & Buried P             |           | 0.85        |                     | 7                             |
|                                    |                    |             | <b>0.01</b>         |                               |                                   |           |             | <b>6.89</b>         |                               |
| <b>Conduit 3</b>                   |                    |             |                     |                               |                                   |           |             |                     |                               |
|                                    | 19                 | 0.443       |                     | 14                            |                                   | 19        | 0.883       |                     | 14                            |
|                                    | 18                 | 1           |                     | 0                             |                                   | 18        | 1           |                     | 0                             |
|                                    | 17                 | 0.99        |                     | 21                            |                                   | 17        | 1           |                     | 0                             |
| Sandy River Crossing               |                    | 0.2         |                     | 30                            | Sandy River Crossing              |           | 0.5         |                     | 30                            |
| Landslides & Buried Pip            |                    | 0.7         |                     | 7                             | Landslides & Buried P             |           | 0.85        |                     | 7                             |
|                                    |                    |             | <b>4.60</b>         |                               |                                   |           |             | <b>28.15</b>        |                               |
| <b>Conduit 4</b>                   | Bowman's Bridge    |             | 1                   |                               | Bowman's Bridge                   |           | 1           |                     |                               |
|                                    |                    |             |                     | 0                             |                                   |           |             |                     | 0                             |



Portland Water Bureau  
 Bull Run Water Supply Seismic Upgrades

| Site Name                          | Trestle # | Reliability | Expected Flow (MGD) | Return-to-Service Time (days) | Site Name                          | Trestle # | Reliability | Expected Flow (MGD) | Return-to-Service Time (days) |
|------------------------------------|-----------|-------------|---------------------|-------------------------------|------------------------------------|-----------|-------------|---------------------|-------------------------------|
| <b>Expected Flow at PGA=0.24g</b>  |           |             |                     |                               | <b>Expected Flow at PGA=0.12g</b>  |           |             |                     |                               |
| Ditch Camp                         | 19        | 1           |                     | 0                             | Ditch Camp                         | 19        | 1           |                     | 0                             |
| Ditch Camp                         | 18        | 1           |                     | 0                             | Ditch Camp                         | 18        | 1           |                     | 0                             |
| Ditch Camp                         | 17        | 1           |                     | 0                             | Ditch Camp                         | 17        | 1           |                     | 0                             |
| Sandy River Crossing               |           | 0.15        |                     | 30                            | Sandy River Crossing               |           | 0.45        |                     | 30                            |
| Landslides & Buried Pip            |           | 0.7         |                     | 7                             | Landslides & Buried P              |           | 0.85        |                     | 7                             |
|                                    |           |             | <b>10.50</b>        |                               |                                    |           |             | <b>38.25</b>        |                               |
| <b>Total Segment 2 Unmitigated</b> |           |             | <b>15.12</b>        |                               | <b>Total Segment 2 Unmitigated</b> |           |             | <b>73.28</b>        |                               |
| <b>Mitigated Condition</b>         |           |             |                     |                               |                                    |           |             |                     |                               |
| <b>Conduit 2</b>                   |           |             |                     |                               |                                    |           |             |                     |                               |
| Bowman's Bridge                    |           | 1           |                     | 0                             | Bowman's Bridge                    |           | 1           |                     |                               |
| Ditch Camp                         | 15        | 0.305       |                     | 30                            | Ditch Camp                         | 15        | 0.827       |                     | 30                            |
| Ditch Camp                         | 13        | 0.01        |                     | 30                            | Ditch Camp                         | 13        | 0.453       |                     | 30                            |
| Ditch Camp                         | 11        | 0.725       |                     | 30                            | Ditch Camp                         | 11        | 0.961       |                     | 30                            |
| Sandy River Crossing               |           | 0.15        |                     | 30                            | Sandy River Crossing               |           | 0.45        |                     | 30                            |
| Landslides & Buried Pip            |           | 0.7         |                     | 7                             | Landslides & Buried P              |           | 0.85        |                     | 7                             |
|                                    |           |             | <b>0.01</b>         |                               |                                    |           |             | <b>6.89</b>         |                               |
| <b>Conduit 3</b>                   |           |             |                     |                               |                                    |           |             |                     |                               |
|                                    | 19        | 0.443       |                     | 14                            |                                    | 19        | 0.883       |                     | 14                            |
|                                    | 18        | 1           |                     | 0                             |                                    | 18        | 1           |                     | 0                             |
|                                    | 17        | 0.99        |                     | 21                            |                                    | 17        | 1           |                     | 0                             |
| Sandy River Crossing               |           | 0.2         |                     | 30                            | Sandy River Crossing               |           | 0.5         |                     | 30                            |
| Landslides & Buried Pip            |           | 0.7         |                     | 7                             | Landslides & Buried P              |           | 0.85        |                     | 7                             |
|                                    |           |             | <b>4.60</b>         |                               |                                    |           |             | <b>28.15</b>        |                               |
| <b>Conduit 4</b>                   |           |             |                     |                               |                                    |           |             |                     |                               |
| Bowman's Bridge                    |           | 1           |                     | 0                             | Bowman's Bridge                    |           | 1           |                     | 0                             |
| Ditch Camp                         | 19        | 1           |                     | 0                             | Ditch Camp                         | 19        | 1           |                     | 0                             |
| Ditch Camp                         | 18        | 1           |                     | 0                             | Ditch Camp                         | 18        | 1           |                     | 0                             |
| Ditch Camp                         | 17        | 1           |                     | 0                             | Ditch Camp                         | 17        | 1           |                     | 0                             |
| Sandy River Crossing               |           | 0.15        |                     | 30                            | Sandy River Crossing               |           | 0.45        |                     | 30                            |
| Landslides & Buried Pip            |           | 0.7         |                     | 7                             | Landslides & Buried P              |           | 0.85        |                     | 7                             |
|                                    |           |             | <b>10.50</b>        |                               |                                    |           |             | <b>38.25</b>        |                               |
| <b>Total Segment 2 Mitigated</b>   |           |             | <b>15.12</b>        |                               | <b>Total Segment 2 Mitigated</b>   |           |             | <b>73.28</b>        |                               |
| <b>Segment 3</b>                   |           |             |                     |                               |                                    |           |             |                     |                               |
| <b>Unmitigated Condition</b>       |           |             |                     |                               |                                    |           |             |                     |                               |
| <b>Conduit 2</b>                   |           |             |                     |                               |                                    |           |             |                     |                               |
| Diack's Earth Dam                  |           | 0.28        |                     | 30                            | Diack's Earth Dam                  |           | 0.72        |                     | 30                            |
| Diack's Pond                       | 8         | 0.911       |                     | 0                             | Diack's Poi                        | 8         | 0.992       |                     | 0                             |
| Sestor's Earth Dam                 |           | 0.28        |                     | 30                            | Sestor's Earth Dam                 |           | 0.72        |                     | 30                            |
| Sestor's Pon                       | 5         | 1           |                     | 0                             | Sestor's Pc                        | 5         | 1           |                     | 0                             |
|                                    | 4         | 0.994       |                     | 14                            |                                    | 4         | 1           |                     | 14                            |
|                                    | 2         | 0.724       |                     | 14                            |                                    | 2         | 0.961       |                     | 14                            |
|                                    | 1         | 1           |                     | 14                            |                                    | 1         | 1           |                     | 14                            |
|                                    | 0         | 0.383       |                     | 14                            |                                    | 0         | 0.827       |                     | 14                            |
| Landslides & Buried Pip            |           | 0.7         |                     | 7                             | Landslides & Buried P              |           | 0.85        |                     | 7                             |
|                                    |           |             | <b>0.69</b>         |                               |                                    |           |             | <b>17.37</b>        |                               |
| <b>Conduit 3</b>                   |           |             |                     |                               |                                    |           |             |                     |                               |
| Diack's Earth Dam                  |           | 0.28        |                     | 30                            | Diack's Earth Dam                  |           | 0.72        |                     | 30                            |
| Diack's Pond                       | 9         | 0.145       |                     | 0                             | Diack's Poi                        | 9         | 0.807       |                     | 0                             |
|                                    | 7         | 1           |                     | 0                             |                                    | 7         | 1           |                     | 0                             |
| Barlow HS                          | 3         | 0.01        |                     | 30                            | Barlow HS                          | 3         | 0.453       |                     | 30                            |
| Landslides & Buried Pip            |           | 0.7         |                     | 7                             | Landslides & Buried P              |           | 0.85        |                     | 7                             |
|                                    |           |             | <b>0.02</b>         |                               |                                    |           |             | <b>16.78</b>        |                               |

Portland Water Bureau  
 Bull Run Water Supply Seismic Upgrades

| Site Name   | Trestle # | Reliability | Expected Flow (MGD) | Return-to-Service Time (days) | Site Name                         | Trestle # | Reliability | Expected Flow (MGD) | Return-to-Service Time (days) |
|---|-----------|-------------|---------------------|-------------------------------|-----------------------------------|-----------|-------------|---------------------|-------------------------------|
| <b>Expected Flow at PGA=0.24g</b>                 |           |             |                     |                               | <b>Expected Flow at PGA=0.12g</b> |           |             |                     |                               |
| <b>Conduit 4</b>                                  |           |             |                     |                               |                                   |           |             |                     |                               |
| Diack's Earth Dam                                 |           | 0.28        |                     | 30                            | Diack's Earth Dam                 |           | 0.72        |                     | 30                            |
| Diack's Ponc                                      | 10        | 1           |                     | 0                             | Diack's Por                       | 10        | 1           |                     | 0                             |
| Sestor's Earth Dam                                |           | 0.28        |                     | 30                            | Sestor's Earth Dam                |           | 0.72        |                     | 30                            |
| Sestor's Pon                                      | 6         | 1           |                     | 0                             | Sestor's Pc                       | 6         | 1           |                     | 0                             |
| Landslides & Buried Pip                           |           | 0.7         |                     | 7                             | Landslides & Buried P             |           | 0.85        |                     | 7                             |
|   |           |             | <b>5.49</b>         |                               |                                   |           |             | <b>44.06</b>        |                               |
| <b>Total Segment 3 Unmitigated</b>                |           |             | <b>6.20</b>         |                               |                                   |           |             | <b>78.21</b>        |                               |
| <b>Mitigated Condition</b>                        |           |             |                     |                               |                                   |           |             |                     |                               |
| <b>Conduit 2</b>                                  |           |             |                     |                               |                                   |           |             |                     |                               |
| Diack's Earth Dam                                 |           | 1           |                     | 0                             | Diack's Earth Dam                 |           | 1           |                     | 0                             |
| Diack's Ponc                                      | 8         | 1           |                     | 0                             | Diack's Por                       | 8         | 1           |                     | 0                             |
| Sestor's Earth Dam                                |           | 1           |                     | 0                             | Sestor's Earth Dam                |           | 1           |                     | 0                             |
| Sestor's Pon                                      | 5         | 1           |                     | 0                             | Sestor's Pc                       | 5         | 1           |                     | 0                             |
|   | 4         | 0.994       |                     | 14                            |                                   | 4         | 1           |                     | 14                            |
|   | 2         | 0.724       |                     | 14                            |                                   | 2         | 0.961       |                     | 14                            |
|   | 1         | 1           |                     | 14                            |                                   | 1         | 1           |                     | 14                            |
|   | 0         | 0.383       |                     | 14                            |                                   | 0         | 0.827       |                     | 14                            |
| Landslides & Buried Pip                           |           | 0.7         |                     | 7                             | Landslides & Buried P             |           | 0.85        |                     | 7                             |
|   |           |             | <b>9.65</b>         |                               |                                   |           |             | <b>33.78</b>        |                               |
| <b>Conduit 3</b>                                  |           |             |                     |                               |                                   |           |             |                     |                               |
| Diack's Earth Dam                                 |           | 1           |                     | 0                             | Diack's Earth Dam                 |           | 1           |                     | 0                             |
| Diack's Ponc                                      | 9         | 1           |                     | 0                             | Diack's Por                       | 9         | 1           |                     | 0                             |
|   | 7         | 1           |                     | 0                             |                                   | 7         | 1           |                     | 0                             |
| Barlow HS   | 3         | 0.01        |                     | 30                            | Barlow HS                         | 3         | 0.453       |                     | 30                            |
| Landslides & Buried Pip                           |           | 0.7         |                     | 7                             | Landslides & Buried P             |           | 0.85        |                     | 7                             |
|   |           |             | <b>0.53</b>         |                               |                                   |           |             | <b>28.88</b>        |                               |
| <b>Conduit 4</b>                                  |           |             |                     |                               |                                   |           |             |                     |                               |
| Diack's Earth Dam                                 |           | 1           |                     | 0                             | Diack's Earth Dam                 |           | 1           |                     | 0                             |
| Diack's Ponc                                      | 10        | 1           |                     | 0                             | Diack's Por                       | 10        | 1           |                     | 0                             |
| Sestor's Earth Dam                                |           | 1           |                     | 0                             | Sestor's Earth Dam                |           | 1           |                     | 0                             |
| Sestor's Pon                                      | 6         | 1           |                     | 0                             | Sestor's Pc                       | 6         | 1           |                     | 0                             |
| Landslides & Buried Pip                           |           | 0.7         |                     | 7                             | Landslides & Buried P             |           | 0.85        |                     | 7                             |
|   |           |             | <b>70.00</b>        | <b>7</b>                      |                                   |           |             | <b>85.00</b>        |                               |
| <b>Total Segment 3 Mitigated</b>                  |           |             | <b>80.17</b>        |                               |                                   |           |             | <b>147.66</b>       | <b>0.00</b>                   |
| <b>Total Through Flow - Unmitigated Condition</b> |           |             | <b>6.20</b>         |                               |                                   |           |             | <b>73.28</b>        |                               |
| <b>Total Through Flow - Mitigated Condition</b>   |           |             | <b>15.12</b>        |                               |                                   |           |             | <b>73.28</b>        |                               |
| <b>Total Benefit</b>                              |           |             | <b>8.92</b>         |                               |                                   |           |             | <b>0.00</b>         |                               |
|   |           |             | MGD                 |                               |                                   |           |             | MGD                 |                               |



Repair Duration Calculation. Assumptions:

- Five (5) Big Pipe Repair Teams starting on Day 3 building up day 17
- GWS repairs start on Day 2 after earthquake and are completed day 30 with 95 MGD available on Day 30

0.24g PGA

Unmitigated Condition

|       |         | Calculation without GWS  |          |             |                                    |                  |        |         |                      |      |           | Calculation with GWS       |               |         |                      |              |                                 |   |                               |                             |                |                      |              |
|-------|---------|--------------------------|----------|-------------|------------------------------------|------------------|--------|---------|----------------------|------|-----------|----------------------------|---------------|---------|----------------------|--------------|---------------------------------|---|-------------------------------|-----------------------------|----------------|----------------------|--------------|
| Segmt | Conduit | Repair Description       | Duration | Team Number | Completion Date (Days after start) | Flow in Segments |        |         | Flow to Powell Butte | Days | MGD *days | Winter Calc (up to 100MGD) | Winter Demand | Loss    | Days Equivalent lost | Benefit Days | GWS Flow at beginning of period | Total Flow to Powell Butte (MGD) (Bull Run + GWS) | Total GWS flow in period (MG) | Total Flow (Bull Run + GWS) | Lost Flow (MG) | Days Equivalent Loss | Benefit Days |
|       |         |                          |          |             |                                    | 1                | 2      | 3       |                      |      |           |                            |               |         |                      |              |                                 |   |                               |                             |                |                      |              |
|       |         | Post Event               |          |             | 0                                  | 122.21           | 15.12  | 6.20    | 6.20                 | 9    | 55.78     | 55.78                      | 900           |         |                      |              | 26.6                            | 32.80   | 295.26                        | 351.04                      | 548.9551       |                      |              |
| 3     | 4       | Liquefactn & Buried Pipe | 7        | 1           | 9                                  | 122.21           | 15.12  | 8.55    | 8.55                 | 3    | 25.65     | 25.65                      | 300           |         |                      |              | 42.56                           | 51.11   | 137.94                        | 163.59                      | 136.409        |                      |              |
| 2     | 4       | Liquefactn & Buried Pipe | 7        | 2           | 12                                 | 152.21           | 19.62  | 8.55    | 8.55                 | 12   | 102.60    | 102.60                     | 1200          |         |                      |              | 49.4                            | 57.95   | 756.96                        | 859.56                      | 340.4361       |                      |              |
| 1     | 4       | Liquefactn & Buried Pipe | 7        | 5           | 24                                 | 152.21           | 19.62  | 31.23   | 19.62                | 15   | 294.25    | 294.25                     | 1500          |         |                      |              | 76.76                           | 96.38   | 1288.20                       | 5.398467                    |                |                      |              |
| 3     | 2,3,4   | Diack's Pond and Dam     | 30       | 3           | 39                                 | 152.21           | 19.62  | 31.23   | 19.62                | 0    | 0.00      | 0.00                       | 0             |         |                      |              | 95                              | 114.62  |                               | 1031.20                     |                | 10.31                |              |
| 3     | 2&4     | Sester's Dam and pond    | 30       | 1           | 39                                 | 152.21           | 19.62  | 110.17  | 19.62                | 4    | 78.47     | 78.47                      | 400           |         |                      |              | 95                              |   |                               |                             |                |                      |              |
| 2     | 4       | Sandy River              | 30       | 4           | 43                                 | 152.21           | 19.62  | 110.17  | 19.62                | 10   | 196.17    | 196.17                     | 1000          |         |                      |              |                                 |   |                               |                             |                |                      |              |
| 2     | 3       | Trestle 19               | 14       | 3           | 53                                 | 152.21           | 110.84 | 110.17  | 110.17               | 16   | 1762.75   | 752.92                     | 5300.00       | 4547.08 | 45.47                |              |                                 |   |                               |                             |                |                      |              |
| 3     | 3       | Barlow HS                | 30       | 1           | 69                                 | 152.21           | 110.84 | 162.147 | 110.84               | 0    | 0.00      |                            |               |         |                      |              |                                 |   |                               |                             |                |                      |              |
| 2     | 3       | Sandy River              | 30       | 2           | 69                                 | 152.21           | 151.99 | 162.147 | 151.99               |      |           |                            |               |         |                      |              |                                 |   |                               |                             |                |                      |              |

Mitigated Condition

|   |   |                          |      |   |    |        |        |         |        |    |        |        |   |         |       |       |       |        |        |        |          |  |      |      |
|---|---|--------------------------|------|---|----|--------|--------|---------|--------|----|--------|--------|---|---------|-------|-------|-------|--------|--------|--------|----------|--|------|------|
|   |   | Post Event               |      |   | 0  | 122.21 | 15.12  | 80.17   | 15.12  | 9  | 136.05 | 136.05 | Use lost days at winter demand rate, more realistic for economic impact |         |       |       | 26.6  | 41.72  | 295.26 | 431.31 | 468.6907 |  |      |      |
| 2 | 4 | Liquefactn & Buried Pipe | 7    | 1 | 9  | 122.21 | 19.62  | 80.17   | 19.62  | 3  | 58.85  | 58.85  |   |         |       |       | 42.56 | 62.18  | 137.94 | 196.79 | 103.2102 |  |      |      |
| 2 | 3 | Liquefactn & Buried Pipe | 7    | 2 | 12 | 122.21 | 21.59  | 80.17   | 21.59  | 8  | 172.72 | 172.72 |   |         |       |       | 49.4  | 70.99  | 495.52 | 668.24 | 131.7587 |  |      |      |
| 3 | 4 | Liquefactn & Buried Pipe | 7    | 4 | 20 | 122.21 | 21.59  | 110.17  | 21.59  | 3  | 64.77  | 64.77  |   |         |       |       | 67.64 | 89.23  | 216.60 | 281.37 | 10.00401 |  |      |      |
| 2 | 3 | Trestle 19               | 14.0 | 3 | 23 | 122.21 | 29.86  | 110.17  | 29.86  | 1  | 29.86  | 29.86  |   |         |       |       | 74.48 | 104.34 | 71.06  |        |          |  |      |      |
| 1 | 4 | Liquefactn & Buried Pipe | 7.00 | 5 | 24 | 152.21 | 29.86  | 110.17  | 29.86  | 15 | 447.92 | 447.92 |   |         |       |       | 76.76 | 106.62 | 575.70 |        |          |  |      |      |
| 2 | 4 | Sandy River              | 30   | 1 | 39 | 152.21 | 122.35 | 110.17  | 110.17 | 3  | 330.52 | 910.18 | 3900  | 2989.82 | 29.90 | 15.57 |       |        |        |        | 713.6636 |  | 7.14 | 3.18 |
| 2 | 3 | Sandy River              | 30   | 2 | 42 | 152.21 | 181.75 | 110.17  | 110.17 |    |        |        |   |         |       |       |       |        |        |        |          |  |      |      |
| 3 | 3 | Barlow HS                | 30   | 3 | 53 | 152.21 | 181.75 | 162.147 | 152.21 |    |        |        |   |         |       |       |       |        |        |        |          |  |      |      |

0.12g PGA

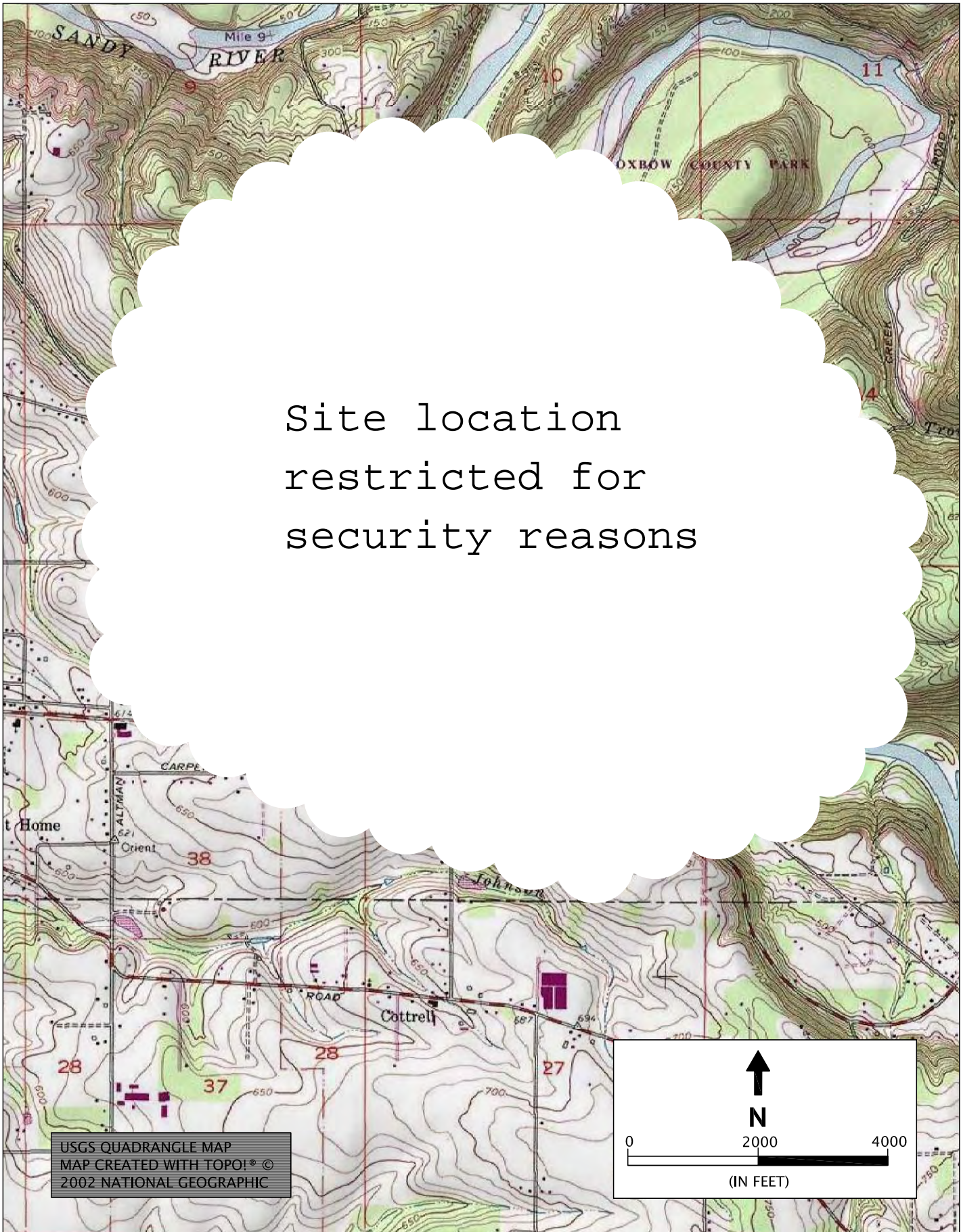
Note: For this earthquake, there is no benefit from the case where there is only one crew working, therefore there is no benefit if more than one crew is working.

Unmitigated Condition

| Segmt | Conduit | Repair Description       | Duration | Days after start | Flow in Segments |        |        | Flow to Powell Butte | Days | MGD *days | Winter Calc (up to 100MGD) | Winter Demand | Loss    | Days Equivalent lost | Benefit Days | GWS Flow | Total Flow | Lost Flow | Days Equivalent Loss | Benefit Days |
|-------|---------|--------------------------|----------|------------------|------------------|--------|--------|----------------------|------|-----------|----------------------------|---------------|---------|----------------------|--------------|----------|------------|-----------|----------------------|--------------|
|       |         |                          |          |                  | 1                | 2      | 3      |                      |      |           |                            |               |         |                      |              |          |            |           |                      |              |
|       |         | Post Event               |          | 0                | 182.00           | 73.28  | 78.21  | 73.28                | 7    | 512.97    | 512.97                     |               |         |                      |              | 82.65    | 155.93     | 0         | 0                    |              |
| 2     | 4       | Liquefactn & Buried Pipe | 7        | 7.00             | 182.00           | 80.03  | 78.21  | 78.21                | 7    | 547.49    | 547.49                     |               |         |                      |              | 85.53    |            |           |                      |              |
| 3     | 4       | Liquefactn & Buried Pipe | 7        | 14               | 182.00           | 80.03  | 85.99  | 80.03                | 7    | 560.22    | 560.22                     |               |         |                      |              | 88.41    |            |           |                      |              |
| 2     | 3       | Liquefactn & Buried Pipe | 7        | 21               | 182.00           | 85.00  | 85.99  | 85.00                | 7    | 594.99    | 594.99                     |               |         |                      |              | 91.30    |            |           |                      |              |
| 2     | 2       | Liquefactn & Buried Pipe | 7        | 28               | 182.00           | 86.21  | 85.99  | 85.99                | 7    | 2579.68   | 2579.68                    |               |         |                      |              | 94.18    |            |           |                      |              |
| 3     | 2,3,4   | Diack's Pond             | 30       | 58               | 182.00           | 86.21  | 125.20 | 86.21                | 30   | 2586.39   | 2586.39                    |               |         |                      |              | 95       |            |           |                      |              |
| 2     | 4       | Sandy River              | 30       | 88               | 182.00           | 141.21 | 125.20 | 125.20               | 30   |           |                            |               |         |                      |              | 95       |            |           |                      |              |
| 3     | 2,4     | Sester's Pond            | 30       | 118              | 182.00           | 141.21 | 162.66 | 141.21               |      |           | 7381.74                    | 8800          | 1418.26 | 14.18                |              |          |            |           |                      |              |
| 2     | 3       | Trestle 19               | 14       | 132              | 182.00           | 145.60 | 162.66 | 145.60               |      |           |                            |               |         |                      |              |          |            |           |                      |              |
| 2     | 2,4     | Ditch Camp               | 30       | 162              | 182.00           | 160    | 162.66 | 160.00               |      |           |                            |               |         |                      |              |          |            |           |                      |              |

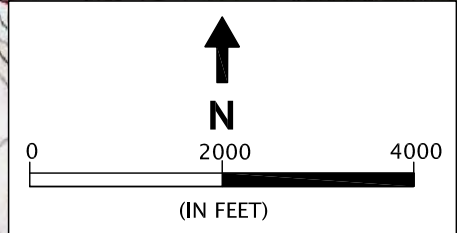
Mitigated Condition

|   |   |                          |    |    |        |          |        |        |   |        |         |      |        |      |      |        |        |   |   |  |
|---|---|--------------------------|----|----|--------|----------|--------|--------|---|--------|---------|------|--------|------|------|--------|--------|---|---|--|
|   |   | Post Event               |    | 0  | 182.00 | 73.28    | 147.66 | 73.28  | 7 | 512.97 | 512.97  |      |        |      |      | 82.65  | 155.93 | 0 | 0 |  |
| 2 | 4 | Liquefactn & Buried Pipe | 7  | 7  | 182.00 | 80.03    | 147.66 | 80.03  | 7 | 560.22 | 560.22  |      |        |      |      | 85.53  |        |   |   |  |
| 2 | 3 | Liquefactn & Buried Pipe | 7  | 14 | 182.00 | 85.00    | 147.66 | 85.00  | 7 | 594.99 | 594.99  |      |        |      |      | 88.41  |        |   |   |  |
| 2 | 2 | Liquefactn & Buried Pipe | 7  | 21 | 182.00 | 86.21296 | 147.66 | 86.21  | 7 |        | 1668.17 | 2100 | 431.83 | 4.32 | 9.86 |        |        |   |   |  |
| 2 | 4 | Sandy River              | 30 | 51 | 182.00 | 141.213  | 147.66 | 141.21 |   |        |         |      |        |      |      | 103.65 |        |   |   |  |



Jan 10, 2005 - 14:12:25 DWG Name: BlackVeaCo-1-01-02\_VM FIGURE DP-1.dwg Updated By: cmp

USGS QUADRANGLE MAP  
MAP CREATED WITH TOPO!® ©  
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**GEODESIGN** INC  
1201 SE Tech Center Drive - Suite 160  
Vancouver, WA 98683  
Off 360.693.8416 Fax 360.693.8426

BLACKVEACO-1-01-02

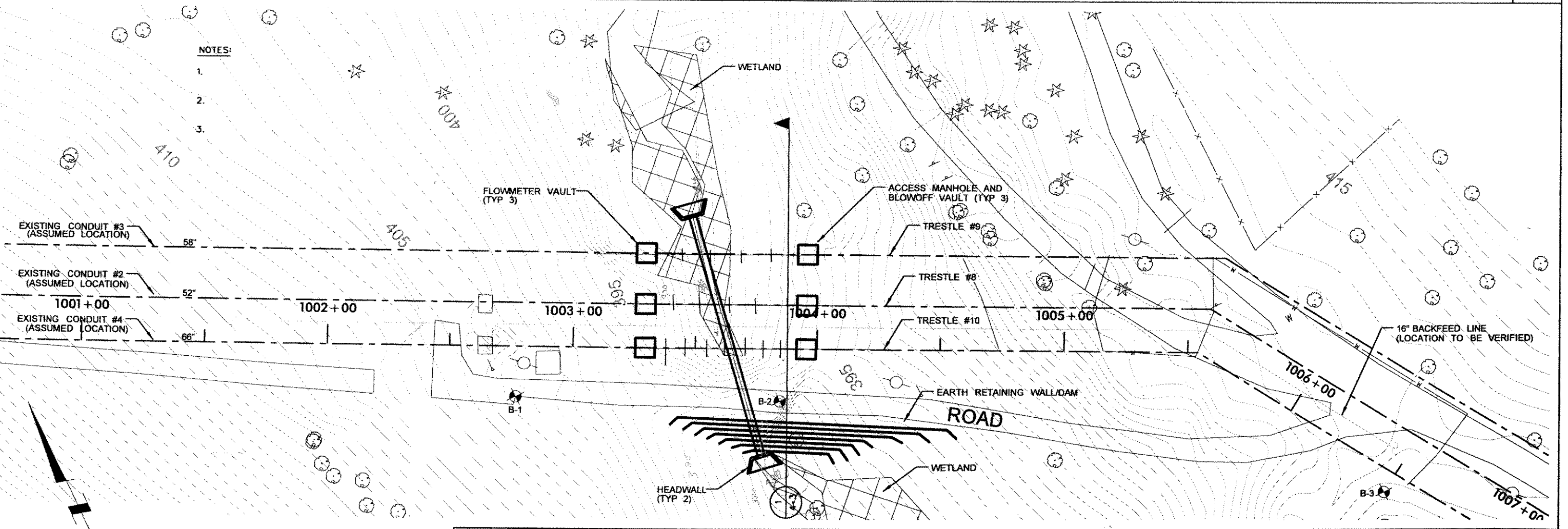
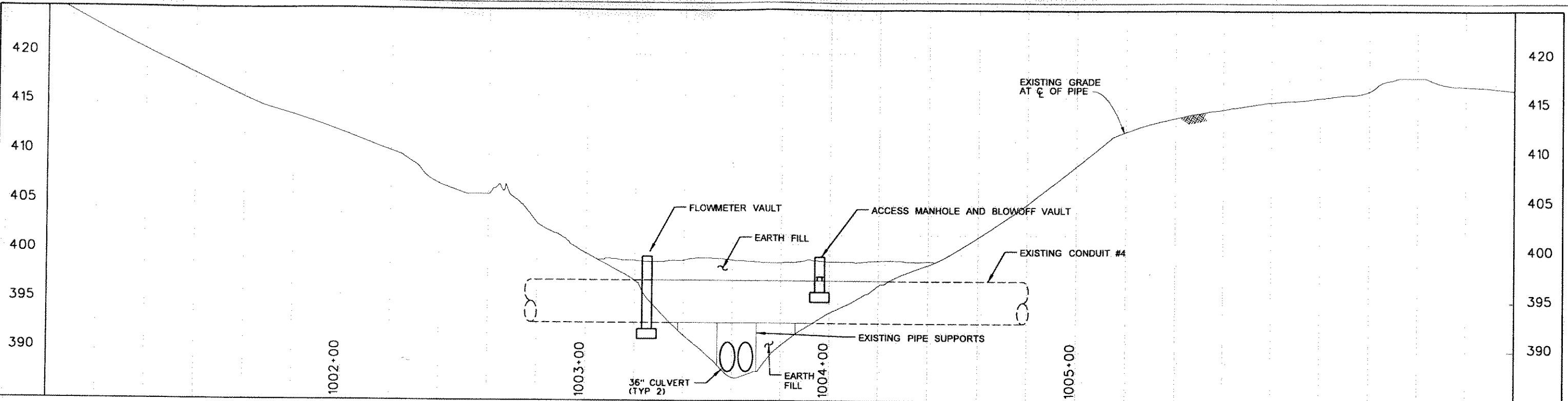
JANUARY 2005

VICINITY MAP

BULL RUN CONDUIT TRESTLES (DIACK'S POND)  
MULTNOMAH COUNTY, OR

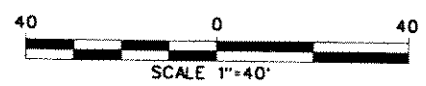
FIGURE DP-1





- NOTES:
- 1.
  - 2.
  - 3.

SDATES STIMES SEILES 01-17-2005



| WARNING  |  |
|--|--|
| IF THIS BAR DOES NOT MEASURE 1" THEN THE DRAWING IS NOT TO SCALE |  |

| REVISIONS | BY | DATE |
|-----------|----|------|
|           |    |      |
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| BOOK | PAGE |
|------|------|
|      |      |



CITY OF PORTLAND  
BUREAU OF WATER WORKS

SUBMITTED \_\_\_\_\_ DATE \_\_\_\_\_

\_\_\_\_\_ DATE \_\_\_\_\_

TRESTLES #8, #9, & #10

**DIACK'S POND**  
ALTERNATIVE DP-5  
BREACH DAM

PLAN AND PROFILE SHEET

|                  |           |
|------------------|-----------|
| DATE             | PROJ NO   |
|                  | 1/4 SEC   |
| SCALE V 1" = 10' | FILE NAME |
| H 1" = 40'       |           |
| DESIGN           | DRAWN BY  |
| CAD CK           | SURVEYED  |
|                  | SHEET     |
|                  | 4-2 OF    |



Engineer's Opinion of Probable Construction Cost - Preliminary Design Level (+30%, -20%)

Site: Sester's Pond  
 Alternative: SP-2

| Item  | Unit of Measure | Quantity Required | Unit Cost                                 | Total Cost          |
|---|-----------------|-------------------|---|---------------------|
| <b>CONSTRUCTION</b>                                   |                 |                   |   |                     |
| <b>MOBILIZATION/DEMOB (10% of Const. Cost)</b>        | Lump Sum        | 1                 | NA  | \$ 203,160          |
| <b>STEEL PIPE AND INSTALLATION</b>                    |                 |                   |   |                     |
| Diameter (in.) Condition                              |                 |                   |   |                     |
| 44 Earthen Shallow                                    | LF              | 435               | \$ 550.00                                 | \$ 239,250          |
| 56 Earthen Shallow                                    | LF              | 460               | \$ 700.00                                 | \$ 322,000          |
| 44 Earthen Deep                                       | LF              | 150               | \$ 1,045.00                               | \$ 156,750          |
| 56 Earthen Deep                                       | LF              | 150               | \$ 1,330.00                               | \$ 199,500          |
| <b>PIPE FITTINGS, CONNECTIONS AND APPURTENANCES</b>   |                 |                   |   |                     |
| Fittings / Bends                                      | EA              | 14                | \$ 8,906.25                               | \$ 124,690          |
| Standard Connection                                   | EA              | 2                 | \$ 6,750.00                               | \$ 13,500           |
| Lockbar Connection                                    | EA              | 2                 | \$ 16,250.00                              | \$ 32,500           |
| Air / Vac Vault                                       | EA              | 1                 | \$ 40,000.00                              | \$ 40,000           |
| Thrust Blocks   | EA              | 2                 | \$ 16,250.00                              | \$ 32,500           |
| Manway Access   | EA              | 2                 | \$ 48,906.25                              | \$ 97,820           |
| <b>SPECIAL PIPE CONSTRUCTION</b>                      |                 |                   |   |                     |
| Open Cut Pipe Armoring                                | LF              | 300               | \$ 1,125.00                               | \$ 337,500          |
| Special Shoring                                       | SF              | 3,600             | \$ 62.50                                  | \$ 225,000          |
| Tremie Slab   | CY              | 400               | \$ 375.00                                 | \$ 150,000          |
| <b>SITE WORK</b>                                      |                 |                   |   |                     |
| Pipe Inspection                                       | DAY             | 1                 | \$ 2,000.00                               | \$ 2,000            |
| Access Improvements                                   | LS              | 1                 | \$ 4,326.88                               | \$ 4,330            |
| Gravel Roadway and Staging Areas                      | YD <sup>2</sup> | 667               | \$ 10.98                                  | \$ 7,320            |
| Construction Entrance                                 | EA              | 1                 | \$ 1,756.89                               | \$ 1,760            |
| Erosion Control                                       | LF              | 500               | \$ 4.69                                   | \$ 2,350            |
| Demolition  | LF              | 360               | \$ 42.03                                  | \$ 15,130           |
| Clearing and Grubbing                                 | ACRE            | 1                 | \$ 5,593.75                               | \$ 5,600            |
| Tree Removal  | EA              | 10                | \$ 762.50                                 | \$ 7,630            |
| Tree Replacement                                      | EA              | 20                | \$ 450.00                                 | \$ 9,000            |
| Site Restoration                                      | ACRE            | 1                 | \$ 5,456.25                               | \$ 5,460            |
|   |                 |                   | Subtotal - Construction                   | \$ 2,234,750        |
| <b>EASEMENTS</b>                                      |                 |                   |   |                     |
| Permanent Easement                                    | ACRE            | 1                 | \$ 20,000.00                              | \$ 20,000           |
| Construction Easement                                 | ACRE            | 2                 | \$ 5,000.00                               | \$ 10,000           |
|   |                 |                   | Subtotal - Easement                       | \$ 30,000           |
| <b>ENGINEERING AND ADMINISTRATION</b>                 |                 |                   |   |                     |
| Design/Permitting - Consultant (10%)                  |                 |                   |   | \$ 226,475          |
| Inspection/Construction Management - Consultant (10%) |                 |                   |   | \$ 226,475          |
| Administration/Management - City (5%)                 |                 |                   |   | \$ 113,238          |
|   |                 |                   | Subtotal - Engineering and Administration | \$ 566,188          |
|   |                 |                   | Total Estimated Project Cost              | <u>\$ 2,830,938</u> |

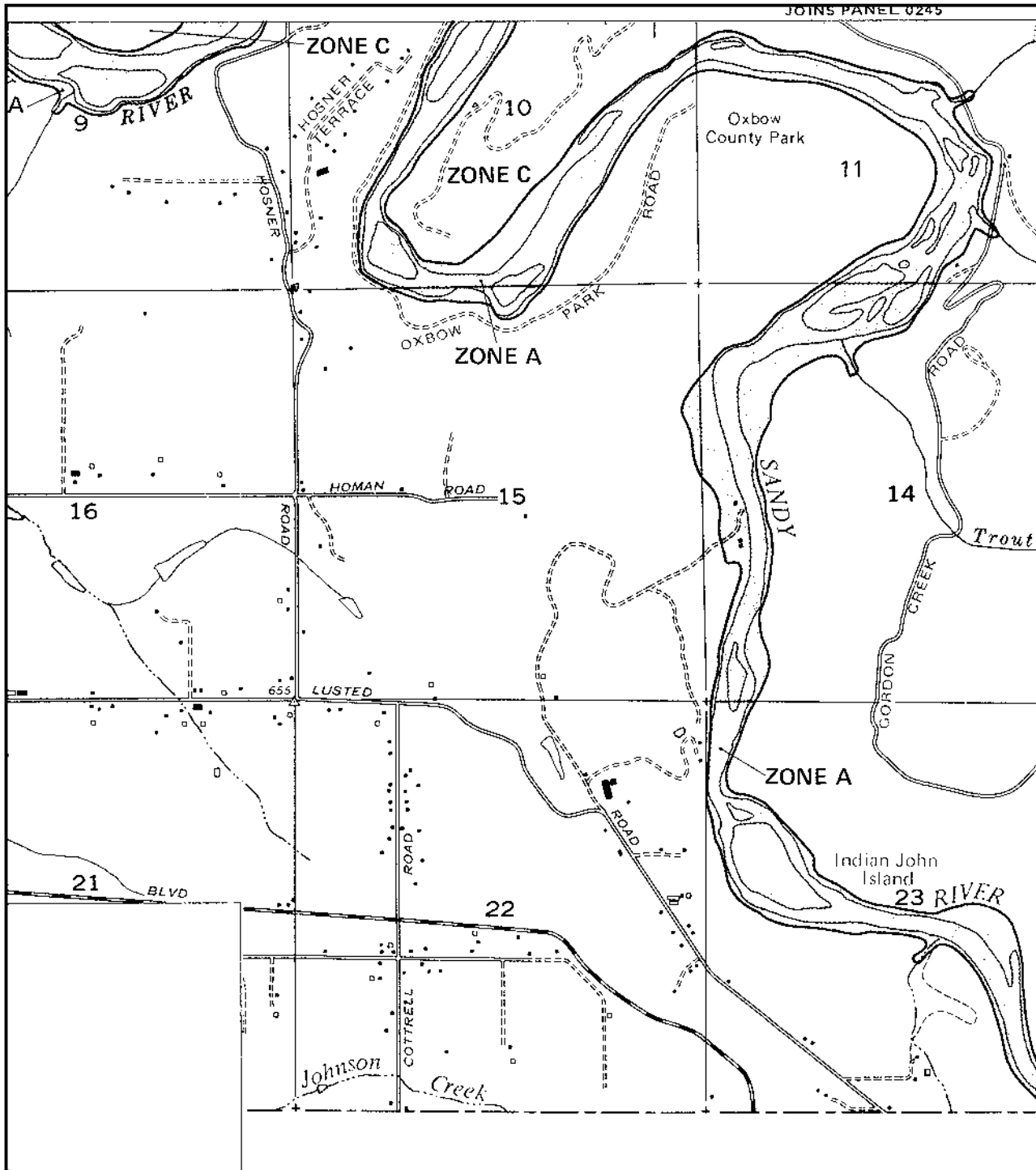




Engineer's Opinion of Probable Construction Cost - Preliminary Design Level (+30%, -20%)

Site: Diacks Pond  
 Alternative: DP-5

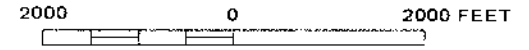
| Item  | Unit of Measure | Quantity Required | Unit Cost     | Total Cost          |
|---|-----------------|-------------------|---------------|---------------------|
| <b>CONSTRUCTION</b>                                   |                 |                   |               |                     |
| <b>MOBILIZATION/DEMOb (10% of Const. Cost)</b>        | Lump Sum        | 1                 | NA            | \$ 87,130           |
| <b>STEEL PIPE AND INSTALLATION</b>                    |                 |                   |               |                     |
| <b>PIPE FITTINGS, CONNECTIONS AND APPURTENANCES</b>   |                 |                   |               |                     |
| Standard Connection                                   | EA              | 2                 | \$ 6,750.00   | \$ 13,500           |
| Lockbar Connection                                    | EA              | 4                 | \$ 16,250.00  | \$ 65,000           |
| Manway Access   | EA              | 3                 | \$ 48,906.25  | \$ 146,720          |
| New Flow Meter Vault                                  | EA              | 1                 | \$ 125,000.00 | \$ 125,000          |
| <b>SITE WORK</b>                                      |                 |                   |               |                     |
| Geogrid Retaining Wall                                | LF              | 150               | \$ 427.89     | \$ 64,190           |
| Culverts with Fill                                    | LS              | 1                 | \$ 265,428.75 | \$ 265,430          |
| Breach Dam  | LS              | 1                 | \$ 37,500.00  | \$ 37,500           |
| Access Improvements                                   | LS              | 1                 | \$ 10,625.00  | \$ 10,630           |
| Gravel Roadway and Staging Areas                      | YD <sup>2</sup> | 740               | \$ 10.98      | \$ 8,130            |
| Construction Entrance                                 | EA              | 2                 | \$ 1,756.89   | \$ 3,520            |
| Erosion Control                                       | LF              | 330               | \$ 4.69       | \$ 1,550            |
| Clearing and Grubbing                                 | ACRE            | 0.326             | \$ 5,593.75   | \$ 1,830            |
| Tree Removal  | EA              | 1                 | \$ 762.50     | \$ 770              |
| Tree Replacement                                      | EA              | 3                 | \$ 450.00     | \$ 1,350            |
| Site Restoration and Wetland Mitigation               | LS              | 1                 | \$ 118,750.00 | \$ 118,750          |
| Protect Existing 16" Water Line in Place              | LS              | 1                 | \$ 7,425.00   | \$ 7,430            |
| Subtotal - Construction                               |                 |                   |               | \$ 958,430          |
| <b>EASEMENTS</b>                                      |                 |                   |               |                     |
| Permanent Easement                                    | ACRE            | 0.5               | \$ 4,000      | \$ 2,000            |
| Construction Easement                                 | ACRE            | 1                 | \$ 1,000      | \$ 1,000            |
| Subtotal - Easement                                   |                 |                   |               | \$ 3,000            |
| <b>ENGINEERING AND ADMINISTRATION</b>                 |                 |                   |               |                     |
| Design/Permitting - Consultant (10%)                  |                 |                   |               | \$ 96,143           |
| Inspection/Construction Management - Consultant (10%) |                 |                   |               | \$ 96,143           |
| Administration/Management - City (5%)                 |                 |                   |               | \$ 48,072           |
| Subtotal - Engineering and Administration             |                 |                   |               | \$ 240,358          |
| Total Estimated Project Cost                          |                 |                   |               | <u>\$ 1,201,788</u> |



JOINS PANEL 0245



APPROXIMATE SCALE



NATIONAL FLOOD INSURANCE PROGRAM

**FIRM**  
FLOOD INSURANCE RATE MAP

MULTNOMAH COUNTY,  
OREGON  
(UNINCORPORATED AREAS)

PANEL 450 OF 550  
(SEE MAP INDEX FOR PANELS NOT PRINTED)

COMMUNITY-PANEL NUMBER  
410179 0450 A

EFFECTIVE DATE:  
JUNE 15, 1982



Federal Emergency Management Agency

This is an official copy of a portion of the above referenced flood map. It was extracted using F-MIT On-Line. This map does not reflect changes or amendments which may have been made subsequent to the date on the title block. For the latest product information about National Flood Insurance Program flood maps check the FEMA Flood Map Store at [www.msc.fema.gov](http://www.msc.fema.gov)



# Portland Water Bureau Bull Run Conduits

*by:*

*G&E Engineering Systems Inc.*

*6315 Swainland Road  
Oakland, CA 94611  
(510) 595-9453 (510) 595-9454 (fax)  
eidinger@earthlink.net*

*Principal Investigators: John Eiding, P.E., S.E.  
Donald Duggan, P.E.*

*Prepared for:*

*Goettel & Associates Inc.*

*G&E Report 32.29.02, Revision 0  
February 25, 2005*

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**Detailed report redacted  
for security reasons.**



City of Portland  
Bureau of Water Works  
Conduit Trestle System Vulnerability Reduction Project  
February 22, 2005

Requested Information for FEMA Pre-Disaster Mitigation Grant Application

### **Diack's Pond**

\* A description of the ground disturbance with dimensions (area, volume, depth, etc.) and location.

Vulnerability mitigation at this site includes installing new culverts under the existing roadway and conduits.

During construction an area approximately 400 ft. x 250 ft. at the location of the trestles will potentially be disturbed at this site. An additional triangular area approximately 120 ft. x 340 ft. will potentially be used for construction staging. The total area disturbed during construction will be a maximum of approximately 2.76 acres.

The estimated volume of excavation required to construct the new culverts under the existing roadway and conduits is based on an average depth of excavation of 7 ft. over the area of the culverts to be installed under the roadway (approximately 50 ft. long x 20 ft. wide) and an average depth of excavation of 2 ft. over the area of the culverts to be installed under the conduits (approximately 65 ft. long x 20 ft. wide) for a total of approximately 355 cubic yards of excavation. Backfill around the new conduits and headwalls (approximately 115 ft. long x 25 ft. wide x 5 ft. deep), and fill to encapsulate the conduits (approximately 115 ft. long x 50 ft. wide x 5 ft. deep) will result in fill of approximately 1,600 cubic yards. The net result will be a fill of approximately 1,245 cubic yards.

The location of the ground disturbance will be confined within the limits of the temporary and permanent easements shown on the attached figure.

\* The past use of the area to be disturbed, noting the extent of previously disturbed ground.

The area to be disturbed is and has been occupied by the conduits. The extent of previous disturbance in this area during the original construction of the conduits most likely included an open-cut trench and a lay-down area for the pipe which was most likely along the existing roadway that runs parallel to the conduits. The project area is designated Commercial Forest Use (CFU).

\* A USGS 1:24,000 scale or other site map showing location and extent of ground disturbance.

See attached map showing site.

## **Sester's Pond**

- \* A description of the ground disturbance with dimensions (area, volume, depth, etc.) and location.

Vulnerability mitigation at this site includes installation of approximately 585 feet of new steel pipe to reroute Conduit #2 away from the dam and approximately 610 feet of new steel pipe to reroute Conduit #4 away from the dam. The new conduits will cross the channel over 200 feet downstream of the dam. The conduits will be installed below the probable depth of scour and encased in concrete where they cross the channel.

During construction an area approximately 700 ft. x 400 ft. at the location of the trestles will potentially be disturbed at this site. The total area disturbed during construction will be a maximum of approximately 6.4 acres.

Bedding and fill will replace excavated material so there will be essentially no net fill at this location.

The location of the ground disturbance will be confined within the limits of the temporary and permanent easements shown on the attached figure.

- \* The past use of the area to be disturbed, noting the extent of previously disturbed ground.

The area to be disturbed is and has been occupied by the conduits and a wetland. The extent of previous disturbance in this area during the original construction of the conduits most likely included an open-cut trench and a lay-down area for the pipe. The project area is zoned Exclusive Farm Use (EFU).

- \* A USGS 1:24,000 scale or other site map (electronic?) showing location and extent of ground disturbance.

See attached map showing site.



**HISTORICAL DAMAGES: INFLATION CALCULATOR**

Analyst: **K.A. Goettel**  
 Date: **1/16/2005**

This damage inflation calculator will calculate the value in current dollars of damages estimates for past disaster events.

Enter Current Year: **2005** Project: **update economic impact: water and wastewater**

**CONVERT OLD DAMAGE ESTIMATE TO CURRENT DOLLARS**

| Old Damage Estimate (dollars) | Disaster Year (4 digit year) | Damage Estimate (Current Dollars) |
|-------------------------------|------------------------------|-----------------------------------|
| \$103                         | 2001                         | \$113.46                          |
| \$33.50                       | 2001                         | \$36.90                           |
| \$35.00                       | 2001                         | \$38.56                           |
| \$17.50                       | 2001                         | \$19.28                           |
| \$8.75                        | 2001                         | \$9.64                            |

NOTE: For this adjustment to be meaningful, the inventory of damaged property must be similar today as it was when the old damage estimate was made

**DATA SOURCES AND DOCUMENTATION**

2001 values are from What is a Benefit? page 4-12  
 1999 to 2004 CPI data from Federal Reserve Bank of Minneapolis (1-16-05):  
<http://minneapolisfed.org/research/data/us/calc/hist1913.cfm>

**UPDATE FOR YEARS AFTER 1999**

| Year | CPI Change (percent increase) |
|------|-------------------------------|
| 1999 | 2.20%                         |
| 2000 | 3.40%                         |
| 2001 | 2.80%                         |
| 2002 | 1.60%                         |
| 2003 | 2.20%                         |
| 2004 | 3.00%                         |
| 2005 | 3.00%                         |
| 2006 | 3.00%                         |
| 2007 | 3.00%                         |
| 2008 | 3.00%                         |
| 2009 | 3.00%                         |
| 2010 | 3.00%                         |
| 2011 | 3.00%                         |
| 2012 | 3.00%                         |
| 2013 | 3.00%                         |
| 2014 | 3.00%                         |
| 2015 | 3.00%                         |
| 2016 | 3.00%                         |
| 2017 | 3.00%                         |
| 2018 | 3.00%                         |
| 2019 | 3.00%                         |
| 2020 | 3.00%                         |

IMPORTANT NOTE: If current year is >1999, then you MUST enter annual CPI data in green cells at left for each year up to last year.

Damage Inflation Calculator: Version 1.1, August 19, 1999

PRINT BLOCK BELOW:

**HISTORICAL DAMAGES: INFLATION CALCULATOR**

Analyst: **K.A. Goettel**  
 Date: **1/16/2005**

This damage inflation calculator will calculate the value in current dollars of damages estimates for past disaster events.

Enter Current Year: **2005** Project: **0 update economic impact: water and wastewater**

**CONVERT OLD DAMAGE ESTIMATE TO CURRENT DOLLARS**

| Old Damage Estimate (dollars) | Disaster Year (4 digit year) | Damage Estimate (Current Dollars) |
|-------------------------------|------------------------------|-----------------------------------|
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| \$33.50                       | 2001                         | \$36.90                           |
| \$35.00                       | 2001                         | \$38.56                           |
| \$17.50                       | 2001                         | \$19.28                           |
| \$8.75                        | 2001                         | \$9.64                            |

For this adjustment to be meaningful, the inventory of damaged property must be similar today as it was when the old damage estimate was made.

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| 2007 | 3.00%                         |
| 2008 | 3.00%                         |
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| 2014 | 3.00%                         |
| 2015 | 3.00%                         |
| 2016 | 3.00%                         |
| 2017 | 3.00%                         |
| 2018 | 3.00%                         |
| 2019 | 3.00%                         |
| 2020 | 3.00%                         |

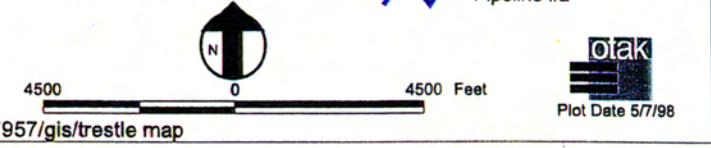
IMPORTANT NOTE: If current year is >1999, then you MUST enter annual CPI data in green cells at left for each year up to last year.

Damage Inflation Calculator: Version 1.1, August 19, 1999

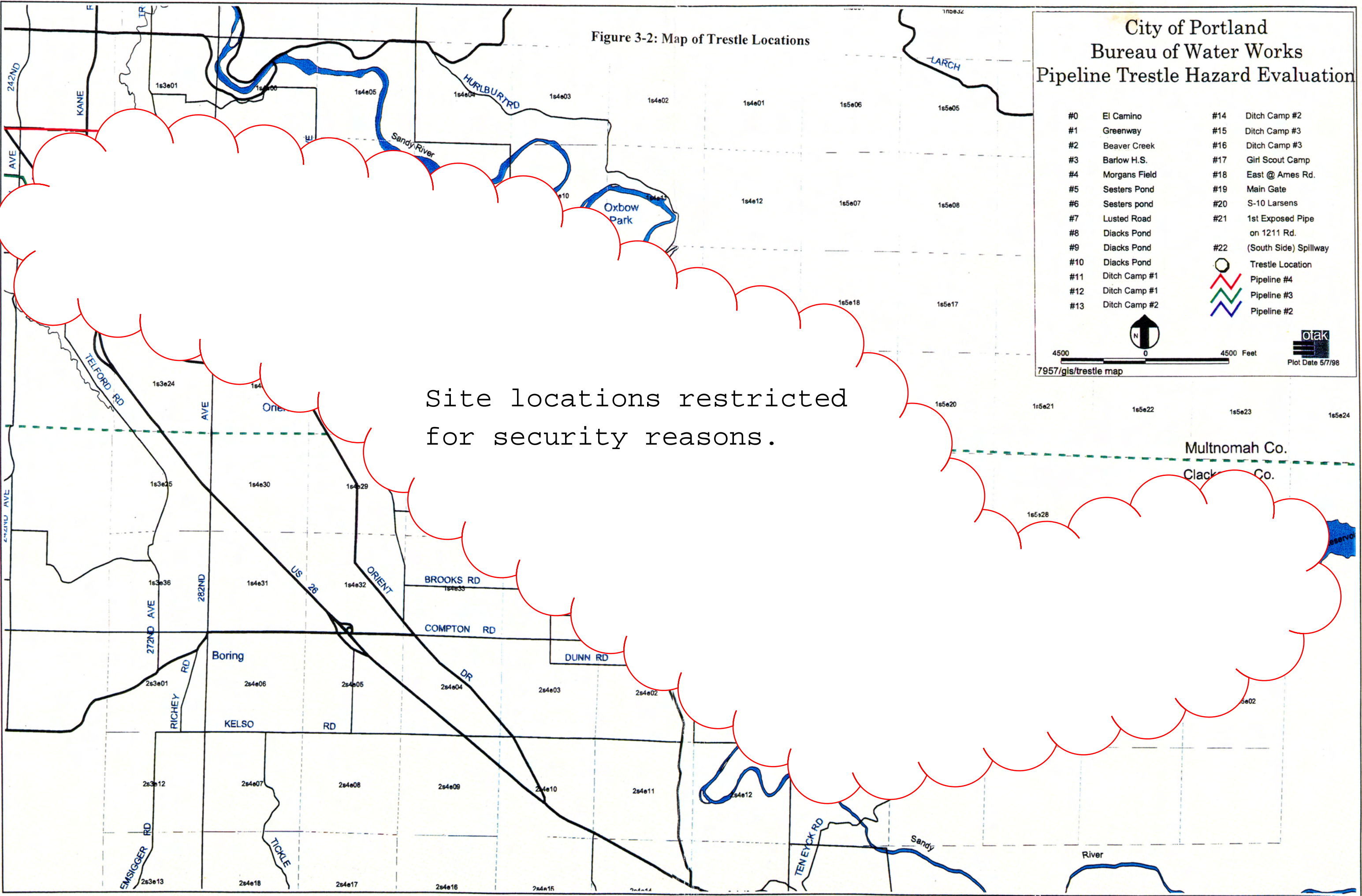
Figure 3-2: Map of Trestle Locations

City of Portland  
Bureau of Water Works  
Pipeline Trestle Hazard Evaluation

- |     |               |     |                              |
|-----|---------------|-----|------------------------------|
| #0  | El Camino     | #14 | Ditch Camp #2                |
| #1  | Greenway      | #15 | Ditch Camp #3                |
| #2  | Beaver Creek  | #16 | Ditch Camp #3                |
| #3  | Barlow H.S.   | #17 | Girl Scout Camp              |
| #4  | Morgans Field | #18 | East @ Ames Rd.              |
| #5  | Sesters Pond  | #19 | Main Gate                    |
| #6  | Sesters pond  | #20 | S-10 Larsens                 |
| #7  | Lusted Road   | #21 | 1st Exposed Pipe on 1211 Rd. |
| #8  | Diacks Pond   | #22 | (South Side) Spillway        |
| #9  | Diacks Pond   |     |                              |
| #10 | Diacks Pond   |     |                              |
| #11 | Ditch Camp #1 |     |                              |
| #12 | Ditch Camp #1 |     |                              |
| #13 | Ditch Camp #2 |     |                              |



Site locations restricted for security reasons.





-----  
Forwarded Message:

Subj: **RE: PDM Policy Question**  
Date: 2/9/2005 12:37:51 PM Pacific Standard Time  
From: [Matthew.Smith@dhs.gov](mailto:Matthew.Smith@dhs.gov)  
To: [KenGoettel@aol.com](mailto:KenGoettel@aol.com)  
CC: [Jonathan.Smith1@dhs.gov](mailto:Jonathan.Smith1@dhs.gov)  
*Sent from the Internet ([Details](#))*

Good afternoon, Dr. Goettel,

Yes, sub-applicants using the FEMA default assumptions built into the BCA Earthquake Full Data module Version 6.0.0 would have a credible analysis, as long as they do not manipulate the module or the standard values.

Concerning the Continuity Premium, the problem is a training issue. You are correct that the new module does not work like the previous Seismic Full Data modules. If no Continuity Premium applies for the project, the user leaves that field blank. The module does not double count benefits if that field is left blank; instead, it counts only the original value entered by the user. The sub-applicant does not need to alter their values at all to have a competitive and realistic BCA.

Please let me know if you have any further questions. I will respond to your previous e-mail in a few minutes. Take care.

Thanks,  
Matt

-----Original Message-----

**From:** KenGoettel@aol.com [mailto:KenGoettel@aol.com]  
**Sent:** Wednesday, February 09, 2005 10:21  
**To:** Smith, Matthew  
**Subject:** PDM Policy Question

Matthew,

On behalf of several sub-applicants I have a FEMA PDM Policy question.

If a sub-applicant's BCA uses the "standard" FEMA data/assumptions built into the BCA Earthquake Full Data Module Version 6.0.0 exactly, will the result be deemed "credible" in the review process?

Here is the conundrum: Using the Version 6.0.0 "standard" data exactly results in a double counting of the continuity premium and has inflated seismic hazard numbers, which in turn inflate the BCR, as per my earlier e-mail.

On the other hand, if a sub-applicant uses more realistic seismic hazard numbers then the application will be much less competitive (lower BCR) than those applications using the FEMA "standard" data. Thus, a more "honest" BCR penalizes the sub-applicant because the reviewers cannot raise an incorrect BCR but rather only lower the value from the sub-applicant's submitted value.

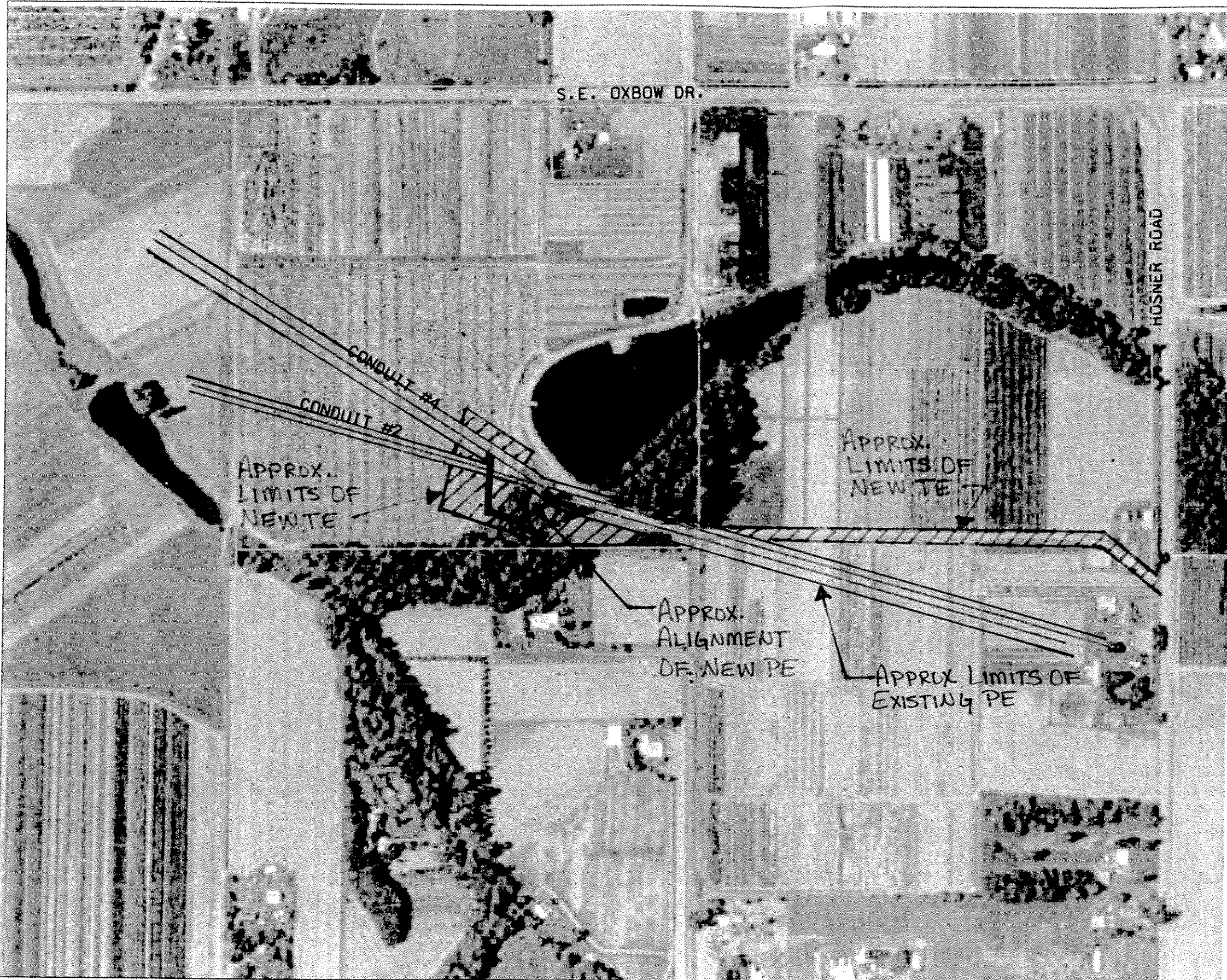
My suggestion is to

- a) use the FEMA "standard" seismic hazard data for the submitted BCR, and
- b) show, for reference, the BCR with more realistic seismic hazard data.

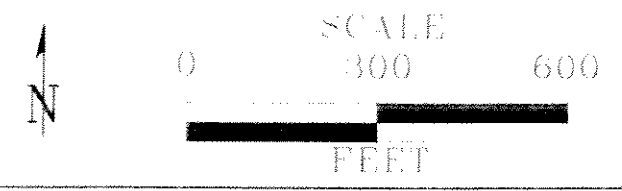
Please advise ASAP. This question is critically important to how many sub-applicants prepare their 2005 PDM applications and the state deadlines are imminent.

Best regards,

Ken Goettel

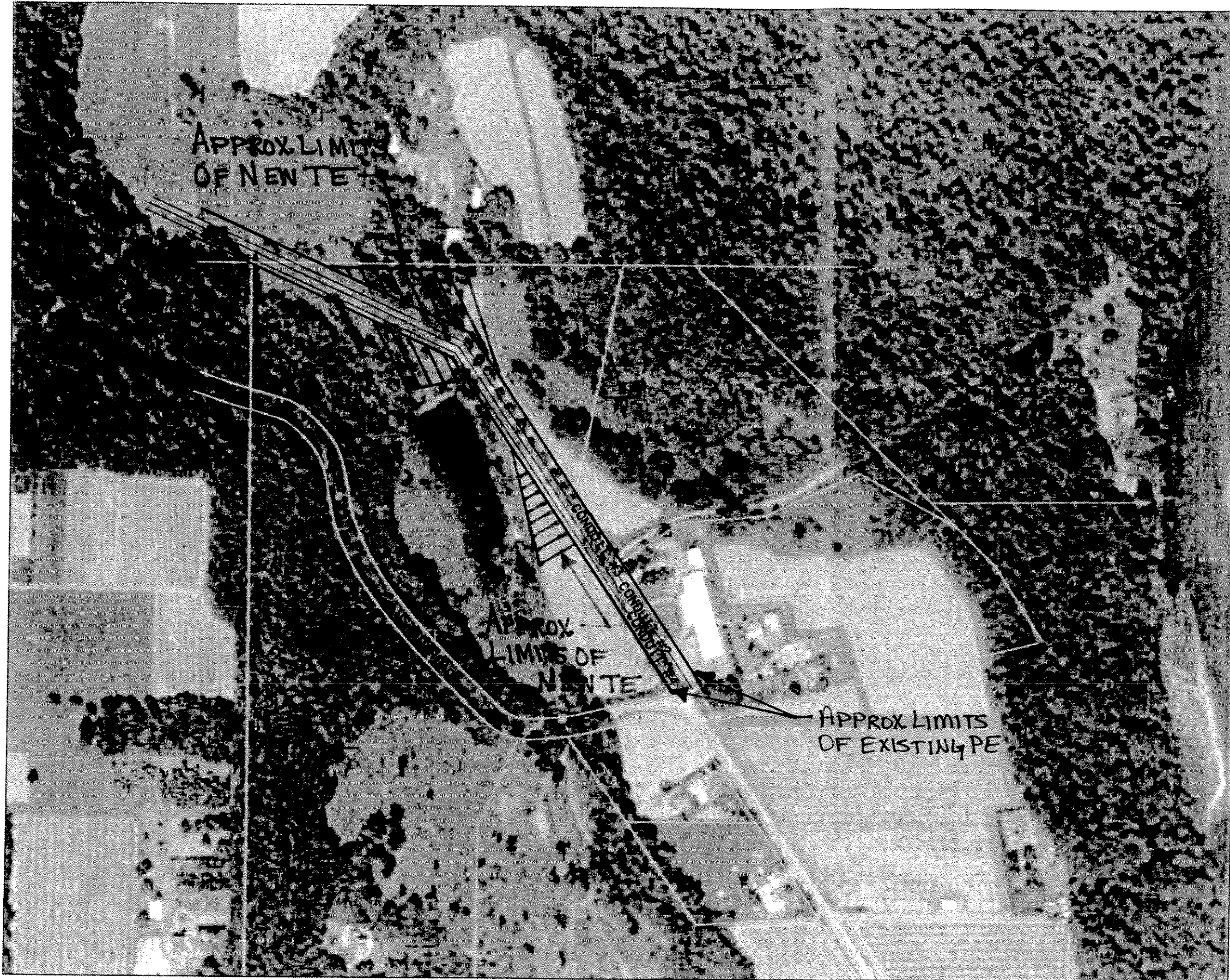


- TE - TEMPORARY CONSTRUCTION EASEMENT
- PE - EXISTING PERMANENT EASEMENT
- PE - NEW PERMANENT EASEMENT ALIGNMENT

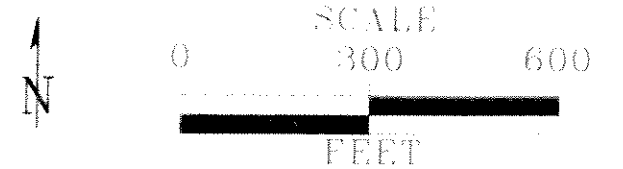


TRESTLES #5 & #6  
SESTOR'S POND





TE - TEMPORARY CONSTRUCTION  
EASEMENT  
PE - EXISTING PERMANENT  
EASEMENT



TRESTLE #8 & #9 & #10  
DIACKS POND

**City of Portland, Oregon**

**Seismic Retrofit Project:**

**Bull Run Conduits (Water Transmission  
Pipes) at Vulnerable Crossings**

**BENEFIT-COST ANALYSIS REPORT**

**Prepared by:**

**Kenneth A. Goettel  
Goettel & Associates Inc.  
1732 Arena Drive  
Davis, CA 95616**

**With Engineering Vulnerability Evaluations by:**

**John Eiding, PE, SE  
G&E Engineering Systems Inc.  
6315 Swainland Road  
Oakland, CA 94611**

**February 16, 2005**



## Executive Summary

This mitigation project is a seismic upgrade for Bull Run conduits (water transmission pipes) at two locations identified as the most vulnerable crossings with the greatest potential for loss of water service: 1) Diack's Pond, the only location where all three conduits are co-located, and 2) Sestor's Pond, where two conduits are collocated.

Benefit-cost analysis for the seismic upgrade was completed using the FEMA **BCA Earthquake Full Data Software** (Version 6.0.0, November 22, 2004).

Every data input into this benefit-cost analysis was done in compliance with FEMA Guidance, including **What is a Benefit?** and the **Structural Earthquake Data Template** (12/16/2004) from the Mitigation BCA Toolkit CD. Data documentation for each data entry into the benefit-cost analysis is included in an annotated version of the Data Template:

**PWB Bull Run BCA Data Documentation.doc** which is attached to the E-Grants application as supporting documentation.

This benefit-cost analysis is based on the comprehensive seismic vulnerability evaluations of this the entire Portland water supply system (Bull Run conduits and the ground water system) by Dames & Moore (1996), EQE (1999) and Mohammadi (2000). In addition, these specific pipeline upgrades were further evaluated by G&E Engineering (2005) who did a probabilistic evaluation of the entire conduit and ground water system's expected performance in future earthquakes.

This seismic retrofit will reduce damages in future earthquakes; however, the primary objective is to minimize the economic impacts of loss of water service to the people served by Portland Water.

A representative latitude/longitude, midway between the Diack's Pond and Sestor's Pond project locations, was used for seismic hazard calculations using the seismic hazard data built into the **BCA Earthquake Full Data Software**: latitude: 45.4776°, longitude 122.3085°.

Benefit-cost results are:

|                            |                     |
|----------------------------|---------------------|
| <b>Total Benefits:</b>     | <b>\$36,921,546</b> |
| <b>Total Project Cost:</b> | <b>\$4,053,724</b>  |
| <b>BCR:</b>                | <b>9.11</b>         |

This benefit cost ratio is high because pipe failures in earthquakes would result in extended loss of water service and very large economic impacts (as per FEMA What is a Benefit?) to the over 800,000 people served by Portland Water.

## Suggested Text for Technical Portions of E-Grants Application

Numbered items below correspond to numbered sections and subsections in E-Grants.

**PORTLAND WATER may add additional narratives from above introduction or PORTLAND WATER narratives as desired.**

### 6. Mitigation Activity Information

*What type of activity are you proposing?*

PDM Competitive Project Activity

205.6 Structural Retrofitting/Rehabilitating Public Structures – Seismic

401.1 Water and Sanitary Sewer System Protective Measures

### 7. Hazard Information (Part 1 of 3)

*Describe the problem to be mitigated. Include the geographic area in your description.*

The Portland Water system is located in a high seismic hazard area. Seismic vulnerability studies, Dames & Moore (1996), EQE (1999) and Mohammadi (2000), G&E Engineering (2005), have identified major seismic vulnerabilities. Loss of water service to the more than 800,000 people served would result in enormous economic impacts (as per FEMA What is a Benefit?).

This mitigation project is a seismic upgrade for two locations where conduits cross stream channels on trestles: Diack's Pond and Sestor's Pond locations.

A representative latitude/longitude, midway between the Diack's Pond and Sestor's Pond project locations, was used for seismic hazard calculations using the seismic hazard data built into the **BCA Earthquake Full Data Software**: latitude: 45.4776°, longitude 122.3085°.



## 7. Hazard Information (Part 2 of 3)

*Select hazards to be mitigated.*

Seismic. Seismic hazards include ground shaking for both project sites as well as the potential for dam failures, erosion/scour of trestles, and landslide failures. The probabilistic risk evaluation for the entire Portland water supply system (Bull Run Conduits and grown water system) included quantitative vulnerability evaluations of potential failure modes for key elements of both water supply systems.

See G&E Engineering Report (2005) Section 2, Geologic Hazards for discussion of seismic sources and seismic hazards for these locations.

## 7. Hazard Information (Part 3 of 3)

*FIRM Information. Is the project located within a hazard area?*

The project sites are not within FEMA-mapped floodplains.

**Portland to verify and correct if necessary.**

## 8. Scope of Work (Part 1 of 3)

*Describe the need for this activity, the problems it will address, the goals and objectives and the methodology for implementing this activity.*

*Need for this Activity*

The Portland Water system is located in a high seismic hazard area. Seismic vulnerability studies, Dames & Moore (1996), EQE (1999) and Mohammadi (2000), G&E Engineering (2005), have identified major seismic vulnerabilities.

Loss of water service to the more than 800,000 people served would result in enormous economic impacts (as per FEMA What is a Benefit?): \$106,192,000 per system day of lost water service.

*Problems it will address*

This mitigation project is a seismic upgrade for Bull Run conduits (water transmission pipes) at two locations identified as the most vulnerable crossings with the greatest potential for loss of water service: 1) Diack's Pond, the only location where all three conduits

are co-located, and 2) Sestor's Pond, where two conduits are collocated.

### *Goals and Objectives*

The primary goal is to minimize service outages and shorten restoration times for water service in future earthquakes.

### *Methodology for implementing this activity*

At Diack's Pond, the existing non-engineered dam will be breached (drained) to obviate the potential for dam failure washing out the conduits. The existing stream channel will be channeled into a concrete box culvert under the pipes and pipes hardened against scour by concrete encasement, along with additional structural improvements.

At Sestor's Pond, the conduits will be relocated downstream of the dam, relocated under the stream (below scour depth) and encased to further harden them.

## **8. Scope of Work (2 of 2)**

*The details of the schedule are provided below.*

**PORTLAND WATER insert schedule details here.**

## **10. Decision Making Process**

*Describe the process you used to decide that this project is the best solution to the problem.*

The seismic vulnerability of the entire Portland water system has been evaluated by a several seismic vulnerability engineering studies: Dames & Moore (1996), EQE (1999) and Mohammadi (2000), G&E Engineering (2005), have all identified major seismic vulnerabilities.

This specific mitigation project was selected because the Diack's Pond and Sestor's Pond crossings are specifically identified as having both a high vulnerability and a high potential to extend the durations of loss of water service if they fail in future earthquakes.



*Explain why this project is the best alternative*

Other stream crossings also have vulnerabilities, but to a lower extent than the crossings at Diack's Pond and Sestor's Pond and/or a significantly smaller impact of loss of water service because of the redundancy in the existing conduit system (3 conduits, with two interties between conduits). Thus, retrofit of other crossings, which is desirable and does further reduce likely future outages, would have much smaller positive impacts on restoring water service after a major earthquake than do the proposed projects at Diacks' Pond and Sestor's Pond.

Thus, the proposed projects at Diack's Pond and Sestor's Pond are more cost-effective with higher BCRs than alternative trestle mitigation projects.

## **11. Cost Estimate**

*Total project cost estimate:*

\$4,053,724

NOTE: this E-Grants section has no space for any commentary. See also project cost section under "Cost Effectiveness"

## **13. Cost Effectiveness Information**

*Attach the BCA if completed for this project.*

Benefit-cost analysis for the seismic retrofit was completed using the FEMA **BCA Earthquake Full Data Software** (Version 6.0.0, November 22, 2004) from the Mitigation BCA Toolkit CD (Version 2.0, January 2005).

Every data input into this benefit-cost analysis was done in compliance with FEMA Guidance, including **What is a Benefit?** and the **Structural Earthquake Data Template** (12/16/2004) from the Mitigation BCA Toolkit CD.

Data documentation for each data entry into the benefit-cost analysis is included in an annotated version of the Data Template: **PWB Bull Run BCA Data Documetation.doc** which is attached to the E-Grants application as supporting documentation.

Submitted BCA: **PWB Bull Run BCA 01.xls**

*What is the source and type of the problem?*

The Portland Water system is located in a high seismic hazard area. Seismic vulnerability studies, Dames & Moore (1996), EQE (1999) and Mohammadi (2000), G&E Engineering (2005), have identified major seismic vulnerabilities in the water supply systems.

Loss of water service to the more than 800,000 people served would result in enormous economic impacts (as per FEMA What is a Benefit?): \$106,192,000 per system day of lost water service.

This specific mitigation project was selected because the Diack's Pond and Sestor's Pond crossings are specifically identified as having both a high vulnerability and a high potential to extend the durations of loss of water service if they fail in future earthquakes.

Failure of these pipelines would result in extended durations of loss of water service for many customers.

*How frequent is the event?*

This project locations have a high level of seismic hazard, including not only ground motions but potential failures from failure of non-engineered dams that are immediately upstream of the Diack's Pond and Sestor's Pond crossings.

For reference, here are the ground motions for three return periods as calculated by the FEMA Earthquake Full Data Software Version 6.0 for this latitude/longitude for Type D, Firm Soil.

**Selected Earthquake Frequency Data  
From FEMA/USGS Seismic Hazard Data  
in BCA Earthquake Full Data Software  
for this latitude/longitude**

|                    |                 |                |                |
|--------------------|-----------------|----------------|----------------|
| <b>Probability</b> | 10% in 50 years | 5% in 50 years | 2% in 50 years |
| <b>PGA (% g)</b>   | 24.0712         | 31.19          | 40.5419        |

*How severe is the damage?*

Seismic vulnerability analyses of the whole Portland water supply system (G&E Engineering) has the following results for a PGA of 24% g (the midpoint of the 16% to 32% PGA bin in the FEMA BCA Earthquake Software:



### System Days Lost at 24% g Shaking

| System State                | System Days Lost Without Ground Water System | System Days Lost With Ground Water System |
|-----------------------------|--|---|
| <b>As-Is Condition</b>      | 45.47  | 10.31                                     |
| <b>After Mitigation</b>     | 29.90  | 7.14                                      |
| <b>Reduction (benefits)</b> | 15.57  | 3.18                                      |

Note: 3.18 days is correct value, rounded to nearest 0.01 day.

The above results show that system days of water outages are greatly reduced by the partial availability of the ground water system. That is, absent the ground water system, system days of outages from conduit failures would be much larger and the benefits of the proposed mitigation project would be much higher.

However, even considering the ground water system there is still a substantial seismic vulnerability due to expected failures of key components of the ground water system (see G&E Engineering Report). Thus, there are very substantial benefits from the proposed project – a reduction in more than 3 system days of loss of water service, with a calculated benefit of avoiding about \$106,000,000 per day in economic impacts of loss of water service (as per FEMA What is a Benefit?).

*What kinds of property are at risk?*

The primary impact of damage to these pipelines are the major economic impacts from extended loss of water service to the more than 800,000 people served by Portland Water and the increased risk of fire following earthquake from loss of water service for fire flows.

*Are there better alternative ways to solve this problem?*

No. Without the proposed mitigation actions at these eight highest hazard locations, failure of the transmission pipes will inevitably result in extended durations of loss of wafer service to a large number of people, with correspondingly enormous economic impacts.

The proposed seismic retrofit targets the large diameter conduits ad the two locations with a combination of both the highest vulnerability and the largest impact on duration of loss of water service if they fail in future earthquakes: Diack’s Pond and Sestor’s pond.

More expensive seismic retrofits targeting additional water system components were evaluated and rejected as not being as cost-effective as this project.

*Are the mitigation project costs well documented and reasonable?*

Yes.

Black & Veatch as completed preliminary design work for these crossing upgrades (INSERT: reference to B&V report), along with engineering cost estimates (attached).

*Attachments*

**INSERT complete list of all attachments, with exact final file names here as numbered list.**

- 1.
- 2.
- 3.
4. etc.

### **13. Cost Effectiveness (Part 2 of 2).**

*History of past damages*

Recent earthquakes in the Pacific Northwest, such as the 1993 Scotts Mills earthquake and the 2002 Nisqually earthquake were too far from Portland to have caused significant damage to the Portland water system. However, the review of seismic hazards by G&E Engineering (2005, see Section 2: Geologic Hazards) and the FEMA/USGS seismic hazard data in the BCA Earthquake Full Data Software unequivocally document the high level of seismic hazard.

Several quantitative seismic vulnerability studies, by nationally-respected firms (IDames & Moore (1996), EQE (1999) Mohammadi (2000), G&E Engineering (2005)), have all identified major seismic vulnerabilities in the water supply systems. Thus the very high potential for damages and very large economic impacts from prolonged loss of water service in future earthquakes is thoroughly documented.

## 15. Maintenance Schedule and Costs

This proposed structural seismic retrofit is a permanent solution to the seismic vulnerability by upgrading these pipelines at the identified crossings at Diack's Pond and Sestor's Pond. No additional maintenance is required to maintain the effectiveness of these structural upgrades.

## 16. Evaluation Information (1 of 4)

**PORTLAND WATER INSERT ANSWERS**

## 16. Evaluation Information (2 of 4)

*Describe the desired outcome and methodology in terms of the mitigation objectives to be achieved.*

This project will fully meet the primary goal to reduce restoration times for water service in future earthquakes.

**PORTLAND WATER INSERT ANSWERS to other questions**

## 16. Evaluation Information (3 of 4)

**PORTLAND WATER INSERT ANSWERS**

## 16. Evaluation Information (4 of 4)

*Please provide the percent of the population benefiting from this mitigation activity.*

**100% of the more than 800,000 people served by the PORTLAND WATER.**

*Net present value of benefits:* **\$36,921,546**

*Total Project Cost Estimate:* **\$4,053,724**

*What is the BCR?* **9.11**

This benefit cost ratio is unusually high because of the very large economic impact of extended durations of loss of water service to the more than 800,000



people served by Portland Water, calculated as per FEMA Guidance in What is a Benefit?

*Analysis type.*

**FEMA Earthquake Full Data Software  
Version 6.0.0,**

*What is the primary hazard?*

**Earthquake**

*What secondary hazards were considered?*

**Fire following earthquake, which is included in the What is a Benefit? method for evaluating the economic impacts of loss of water service.**

**Additional potential for pipe failures from dam failures, flooding and landslides was also included in the probabilistic risk analyses for both the Bull Run conduit system and the ground water supply system.**

*Does this mitigation activity protect a critical facility?*

*If yes, select the type of critical facility to be protected.*

**YES. Potable water facilities are explicitly included in FEMA's defined list of critical facilities as per Section 4.1 in the FEMA 2005 PDM Guidance.**

*Comments.*

## BENEFIT-COST RESULTS

|  |   |
|--|---|
| Building Name:                                 | Bull Run Water Conduits, Portland Water Bureau  |
| Building Type:                                 |   |
| Building SDF Before-Mitigation \ User Entered: | User Model No   |
| Building SDF After-Mitigation \ User Entered:  | User Model Yes  |
| Project Description:                           | Seismic retrofits for two crossings for conduits. See G&E Engineering Report (2005) and earlier engineering studies referenced therein for detailed analysis and project details. |

### REFERENCE INFORMATION FROM LEVEL ONE DATA

|                             |      |
|-----------------------------|------|
| Discount Rate (%)           | 7.00 |
| Project Useful Life (years) | 50   |

### SUMMARY OF EXPECTED ANNUAL DAMAGES AND BENEFITS WITHOUT CASUALTIES AVOIDED

|                                    | Expected Annual Damages Before-Mitigation | Expected Annual Damages After-Mitigation | Expected Annual Benefits | Present Value of Annual Benefits |
|------------------------------------|---|--|--------------------------|----------------------------------|
| Building Damages                   | \$0                                       | \$0                                      | \$0                      | \$0                              |
| Contents Damages                   | \$0                                       | \$0                                      | \$0                      | \$0                              |
| Displacement Costs                 | \$0                                       | \$0                                      | \$0                      | \$0                              |
| Business Income Lost               | \$0                                       | \$0                                      | \$0                      | \$0                              |
| Rental Income Lost                 | \$0                                       | \$0                                      | \$0                      | \$0                              |
| Services Lost                      | \$8,917,766                               | \$6,242,436                              | \$2,675,330              | \$36,921,546                     |
| <b>Total Losses &amp; Benefits</b> | <b>\$8,917,766</b>                        | <b>\$6,242,436</b>                       | <b>\$2,675,330</b>       | <b>\$36,921,546</b>              |

### SUMMARY OF BENEFITS AND COSTS WITHOUT CASUALTIES AVOIDED

|   |              |
|---|--------------|
| PROJECT BENEFITS                              | \$36,921,546 |
| PROJECT COSTS                                 | \$4,053,724  |
| BENEFITS MINUS COSTS                          | \$32,867,822 |
| BENEFIT-COST RATIO WITHOUT CASUALTIES AVOIDED | 9.11         |

### SUMMARY OF BENEFITS AND COSTS WITH CASUALTIES AVOIDED

|   | Expected Annual Casualties Before Mitigation | Expected Annual Casualties After Mitigation | Value of Expected Annual Avoided Casualties | Present Value of Annual Avoided Casualties |
|---|--|---|---|--|
| Minor Injuries                              | 0.00E+00                                     | 0.00E+00                                    | \$0   | \$0  |
| Major Injuries                              | 0.00E+00                                     | 0.00E+00                                    | \$0   | \$0  |
| Deaths                                      | 0.00E+00                                     | 0.00E+00                                    | \$0   | \$0  |
| <b>Total Casualties Avoided</b>             |  |   | <b>\$0</b>                                  | <b>\$0</b>                                 |
| PROJECT BENEFITS WITHOUT CASUALTIES AVOIDED |  |   |   | \$36,921,546                               |
| PROJECT BENEFITS WITH CASUALTIES AVOIDED    |  |   |   | \$36,921,546                               |
| PROJECT COSTS                               |  |   |   | \$4,053,724                                |
| BENEFITS MINUS COSTS                        |  |   |   | \$32,867,822                               |
| BENEFIT-COST RATIO WITH CASUALTIES AVOIDED  |  |   |   | 9.11                                       |

<< Back

**FEMA Disclaimer: The results produced by this analysis are neither conclusive evidence that the proposed project is cost-effective, nor a guarantee that a project is eligible for any government grant for whatever purpose.**

#### FEMA DISCLAIMER

The results produced by use of the Benefit-Cost Analysis Program are neither conclusive evidence that a proposed project is cost-effective, nor a guarantee that a project is eligible for any government grant for whatever purpose.

## Data Documentation Template

### Earthquake Data Analysis Methodology: Structural Retrofits of Buildings

#### PROJECT: SEISMIC RETROFIT of WATER CONDUITS (TRANSMISSION PIPES) AT DIACK'S POND and SESTOR'S POND, PORTLAND WATER BUREAU, CITY OF PORTLAND, OREGON

This data documentation template is designed to assist Benefit-Cost (BC) analysts in recording the data and methodologies utilized in their Benefit-Cost Analysis (BCA). BC analysts should keep in mind that a well-documented BCA means that a knowledgeable BC analyst should be able to re-create the BCA from the supporting documentation provided (with a Mitigation application submitted for funding) without any additional explanation. BC analysts should provide an electronic or paper copy of the full BCA to compliment any template or summary submitted to FEMA for review.

This data documentation guidance and the Earthquake Full Data Module are intended for BCA of structural seismic mitigation projects for buildings. For non-structural seismic mitigation projects do not use the Full Data Module. Rather, use the Non-Structural Module and see the non-structural data documentation template.

| Data Type  | Value  | Description   | Documentation  | Source   |
|--|--|---|--|--|
| <b>Discount Rate</b>   | <b>The OMB-mandated discount rate of 7% must be used for all BCAs.</b> | <ul style="list-style-type: none"> <li>The discount rate determines the time-value of money</li> <li>In a FEMA benefit-cost analysis, a discount rate is used to calculate a value today (the Net Present Value) of future benefits so that they can be compared to the costs of a mitigation project.</li> </ul> | <ul style="list-style-type: none"> <li>Electronic or paper copy of the BCA.</li> <li><b>The OMB-mandated discount rate of 7% must be used for all BCAs.</b></li> </ul> | <ul style="list-style-type: none"> <li><b>The OMB-mandated discount rate of 7% must be used for all BCAs.</b></li> </ul> |
| <p><b>This Mitigation Project:</b></p> <p><b>Discount rate = 7.00% as per FEMA/OMB guidance.</b></p> |  |   |  |  |



| <b>Data Type</b>                                       | <b>Value</b>  | <b>Description</b>  | <b>Documentation</b>  | <b>Source</b>  |
|--|---|---|---|--|
| <b>Building Type</b>                                   | Selection of one of the building construction types within the module | <ul style="list-style-type: none"> <li>• Building structural type and number of stories above grade.</li> <li>• Major determinant of anticipated earthquake damage.</li> </ul>  | <ul style="list-style-type: none"> <li>• Reference source utilized to determine classification of building type (Ex. engineer, building official).</li> </ul>   | <ul style="list-style-type: none"> <li>• Engineer or local building official or other person knowledgeable about structural building types</li> <li>• See definitions of building types in Earthquake Technical Manual Chapter 6</li> </ul>                        |
| <b>Building Floor Area</b>                             | Expressed in square feet  | <ul style="list-style-type: none"> <li>• The total heated, enclosed area in the building. Used in conjunction with replacement value to determine potential damages in various wind events.</li> </ul>                                | <ul style="list-style-type: none"> <li>• Various forms are acceptable, including tax records, signed appraisals, surveys, and estimates from photographs.</li> <li>• Reference or provide a copy of source utilized.</li> </ul>       | <ul style="list-style-type: none"> <li>• Local tax office or appraiser's office, surveyor, title and documents with building footprint.</li> <li>• Homeowner estimates or measured drawings accompanied by photographs.</li> </ul>                                 |
| <b>Building Replacement Value (BRV)</b>                | Expressed as dollars per square foot                                  | <ul style="list-style-type: none"> <li>• The cost for labor and materials to build a similar building at the same location.</li> <li>• A key determinant of the amount of damage.</li> </ul>  | <ul style="list-style-type: none"> <li>• Letter from local building department or residential builder.</li> <li>• Or, photocopied pages from standard residential cost reference manual for the specific type of building.</li> </ul> | <ul style="list-style-type: none"> <li>• Local building department, builder, contractor, or architect.</li> <li>• Standard references such as Marshall &amp; Swift Residential Cost Handbook, and Means Square Foot Cost Guide.</li> </ul>                         |
| <b>Building Damage that would Result in Demolition</b> | Percentage of building replacement value                              | <ul style="list-style-type: none"> <li>• FEMA standard value is 50%.</li> <li>• Low cost or poorly maintained buildings may have lower thresholds; buildings of historical or other importance may have higher thresholds.</li> </ul> | <ul style="list-style-type: none"> <li>• No documentation required if standard value used.</li> <li>• Provide documentation and the basis of the estimate for values other than 50%.</li> </ul>                                       | <ul style="list-style-type: none"> <li>• Values other than 50% should include consultation with real estate appraiser, economist, local building inspector, contractor, builder or construction company, architect or building engineer, planners, etc.</li> </ul> |
| <b>This Mitigation Project:</b>                        |   |   |   |  |
| <b>NONE. No building involved in this project</b>      |   |   |   |  |

| Data Type             | Value                | Description  | Documentation  | Source   |
|-----------------------|----------------------|--|--|--|
| <b>Contents Value</b> | Expressed as dollars | <ul style="list-style-type: none"> <li>• The cost to replace the contents of a building.</li> <li>• Contents damage includes items like furniture, office equipment, personal belongings, and non-permanent room dividers.</li> <li>• Contents do not include items that are permanent parts of the building such as electrical and plumbing systems.</li> <li>• FEMA standard for residential buildings is 30% of the replacement value of the building.</li> </ul> | <ul style="list-style-type: none"> <li>• 30% value for residential buildings: no documentation required.</li> <li>• For other values for residential buildings and for non-residential buildings, provide detailed descriptions of contents, value and the means by which value was assessed.</li> </ul> | <ul style="list-style-type: none"> <li>• No source required if a residential building and FEMA standard is used.</li> <li>• Otherwise, review insurance records, signed appraisals, purchase receipts, estimates based on current market prices for similar contents.</li> </ul> |

**This Mitigation Project:**  
**NONE. No contents considered in this analysis.**

| Data Type                 | Value   | Description  | Documentation  | Source   |
|---------------------------|---|--|--|--|
| <b>Displacement Costs</b> | Expressed as dollars per square foot per month, and one time and monthly costs. | <ul style="list-style-type: none"> <li>The costs borne by occupants during the time when a building is damaged and they are unable to occupy it.</li> <li>Costs may include rent for alternative living spaces, rent for storage space, additional commuting time, additional day care, unpaid time off work, rental trucks, etc.</li> <li>All these may be estimated when supported by credible documentation and sources.</li> </ul> | <ul style="list-style-type: none"> <li>Alternative living space documented by copies of rental costs from realtors, leasing agents or newspapers, among others.</li> <li>Rental for storage spaces may be supported by copies of advertising, records of contacts with rental companies.</li> <li>Extra commuting costs and day care may be estimated as long as the estimation methodology is explained.</li> </ul> | <ul style="list-style-type: none"> <li>Photocopies of ads for rental spaces in the community, records of phone contacts with rental agencies, receipts from similar rentals.</li> <li>For residential properties, typical displacement costs are \$0.50 to \$1.00 per square foot per month. Typical other monthly costs and one-time costs are \$500 each.</li> <li>Use standard figures where possible [i.e. 34.5 cents per mile for additional commute].</li> </ul> |

**This Mitigation Project:**

**NONE. No displacement costs or displacement time considered in this analysis.**

| Data Type        | Value               | Description  | Documentation  | Source  |
|------------------|---------------------|--|--|---|
| <b>Occupancy</b> | Number of occupants | <ul style="list-style-type: none"> <li>Average (not peak) occupancy on 24/7/365 basis</li> </ul> | <ul style="list-style-type: none"> <li>Provide description of estimates methodology utilized (to establish number of employees and visitors at different times of days and days of week).</li> </ul> | <ul style="list-style-type: none"> <li>Building owner or manager</li> </ul> |

**This Mitigation Project:**

**NONE. Occupancy and life safety benefits not considered in this analysis.**



| Data Type   | Value  | Description   | Documentation   | Source  |
|---|--|---|---|---|
| <b>Dollar Value for Minor/Major Injuries</b>  | Dollars (present year value per person)<br><br>Major injury = \$17,047<br><br>Minor injury = \$1,705 | <ul style="list-style-type: none"> <li>• Average of the estimated values for the treatment of major and minor injuries per person.</li> </ul> | <ul style="list-style-type: none"> <li>• If typical values in FEMA software are used then provide print out of software.</li> <li>• If user-determined values are used provide full documentation of reasons for differences from FEMA typical values.</li> </ul> | <ul style="list-style-type: none"> <li>• FEMA “What is a Benefit” guidance</li> </ul> |
| <b>Dollar Value of a Casualty</b>   | Dollars (present year value per person)<br><br>Casualty = \$2,961,300                                | <ul style="list-style-type: none"> <li>• Estimated value of the loss of one person.</li> </ul>  | <ul style="list-style-type: none"> <li>• If typical values in FEMA software are used then provide print out of software.</li> <li>• If user-determined values are used provide full documentation of reasons for differences from FEMA typical values.</li> </ul> | <ul style="list-style-type: none"> <li>• FEMA “What is a Benefit” guidance</li> </ul> |
| <p><b>This Mitigation Project:</b></p> <p><b>Current FEMA values given above, but not applicable to this BCA.</b></p> <p><b>Minor injury: \$1,705</b></p> <p><b>Major injury: \$17,047</b></p> <p><b>Death: \$2,961,300</b></p> |  |   |   |   |

| Data Type                       | Value                                   | Description  | Documentation   | Source  |
|---------------------------------|---|--|---|---|
| <b>Value of Loss of Service</b> | Dollar value of loss of public services | <ul style="list-style-type: none"> <li>For public services, daily value of service is estimated by the daily cost of providing service.</li> </ul> | <ul style="list-style-type: none"> <li>Provide copy or reference the annual operating budget for public facility.</li> <li>For critical facilities, see What is a Benefit? Guidance.</li> </ul> | <ul style="list-style-type: none"> <li>Agency providing service (annual operating budget for public facility).</li> </ul> |

**This Mitigation Project:**

**The economic impact of loss of water service (per capita per day) given in FEMA’s What is a Benefit? is \$103 (2001). This value is updated to 2005 using the FEMA Inflation Calculator to \$113.46.**

**The What is a Benefit? value for fire losses (for loss of water service) for a moderate climate zone (applicable to Portland which has a generally dry summer) is \$17.50. This value is updated to 2005 using the FEMA Inflation Calculator to \$19.28. See attached file FEMA Inflation Calculator 2005 Water.xls for documentation of these calculations, per FEMA guidance.**

**The combined economic impact (loss of water service, fire) is thus the sum of the above: \$132.74**

**The population served by the Portland Water Bureau is more than 800,000. This population combined with the daily economic impact per capita yields a daily value of \$106,192,000 for the economic impact of complete loss of water service. See: BCA Supporting Calcs.xls for computational details. Here, complete loss of water service (one system day of no service) could be one day with no customers with water, or 10 days with 10% of the customers with now water etc., as per What is a Benefit? FEMA guidance. In the FEMA BDC Earthquake Full Data Software, the value of service is entered as a proxy “annual value of service” of \$38,760,080,000, which when divided by 365 yields the correct calculated daily value of water service of \$106,192, 000.**

**See PWB Bull Run BCA Supporting Calcs.xls for computational details.**

| Data Type                 | Value                                   | Description   | Documentation  | Source  |
|---------------------------|---|---|--|---|
| <b>Continuity Premium</b> | Multiplier on ordinary value of service | <ul style="list-style-type: none"> <li>Applies only to services critical to immediate disaster response and recovery (police, fire, and emergency responders).</li> </ul> | <ul style="list-style-type: none"> <li>No documentation required if FEMA standard values are used.</li> <li>Exception to standard values requires detailed explanation of source used and method applied.</li> </ul> | <ul style="list-style-type: none"> <li>See “What is a Benefit?” guidance for standard values.</li> <li>Developing non-standard values may involve working with organization or agency providing service.</li> </ul> |

**This Mitigation Project:**

**NONE for this BCA. Economic impacts of loss of water service calculated as described above under Value of Loss of Service.**

| Data Type                      | Value                           | Description   | Documentation  | Source   |
|--------------------------------|---------------------------------|---|--|--|
| <b>Loss of Business Income</b> | Net (not gross) business income | <ul style="list-style-type: none"> <li>For commercial facilities, loss of net business income is the measure of loss of function when damage results in closure of the facility.</li> </ul> | <ul style="list-style-type: none"> <li>No documentation required if FEMA standard values are used.</li> <li>If estimated, include a description of how derived.</li> </ul> | <ul style="list-style-type: none"> <li>The FEMA HAZUS earthquake loss estimation software has typical values for many classes of business that are applicable to all hazards.</li> </ul> |

**This Mitigation Project:**

**NONE**



| Data Type   | Value | Description   | Documentation  | Source   |
|---|-------|---|--|--|
| <b>Mitigation Project Useful Lifetime</b>   | Years | <ul style="list-style-type: none"> <li>• Estimated amount of time that mitigation action will be effective.</li> <li>• Includes any maintenance activities that will be done to prolong effectiveness.</li> </ul> | <ul style="list-style-type: none"> <li>• Reference FEMA standard value if utilized.</li> <li>• If FEMA standard value is not utilized then include a justification of the value entered.</li> <li>• May also attach a letter, e-mail, etc. from credible agency documenting this estimate (if resource other than FEMA standard value).</li> </ul> | <ul style="list-style-type: none"> <li>• FEMA guidance.</li> <li>• Government representative or private professional with expertise relevant to the proposed project.</li> </ul> |
| <p><b>This Mitigation Project:</b></p> <p><b>50 years: as per FEMA guidance for public infrastructure..</b><br/> <b>FEMA YELLOW BOOK on BCA Toolkit CD, Table 24 on page A-5 in Appendix A.</b></p> |       |   |  |  |

| <b>Data Type</b>   | <b>Value</b>       | <b>Description</b>  | <b>Documentation</b>  | <b>Source</b>  |
|--|--------------------|---|---|--|
| <b>Mitigation Project Cost (includes data inputs for net mitigation project cost and additional annual maintenance cost (\$/yr) for a project)</b> | Total dollar value | <ul style="list-style-type: none"> <li>Estimated total cost of the proposed mitigation action <b>(not just the Federal share)</b> and any maintenance activities that will be done to prolong effectiveness.</li> </ul> | <ul style="list-style-type: none"> <li>Narrative summary in the BCA module should state that this value comes from a potential or submitted project application.</li> <li>Applicant should provide a detailed cost breakdown, rather than a lump sum value, from an engineering cost estimate.</li> <li>Must document source and reasoning in estimate of maintenance activity cost.</li> </ul> | <ul style="list-style-type: none"> <li>Should support the value submitted with the project application.</li> <li>Government representative or private professional with expertise relevant to the proposed project.</li> <li>For maintenance values, consult Government representative or private professional with expertise relevant to the proposed project.</li> </ul> |

**This Mitigation Project:**

**Diack's Pond site            \$1,201,786**  
**Sestor's Pond site         \$2,830,938**  
**Subtotal project cost:    \$4,032,724**  
**Pre-Award Costs            \$21,000 (seismic vulnerability evaluation and benefit-cost analysis)**  
**TOTAL PROJECT COST \$4,053,724**

See attached engineering cost estimates from Black & Veatch (Feb. 9, 2005) for line item engineering cost estimates.

Annual maintenance costs are nil for the seismic retrofit, which are permanent structural upgrades.

There are no relocation costs for this project.

| Data Type  | Value   | Description  | Documentation  | Source  |
|--|---|--|--|---|
| <b>Seismic Hazard Data</b>   | Seismic Hazard Calculator (patch) which uses 3-points (10% , 5%, and 2% PE in 50-years) | <ul style="list-style-type: none"> <li>Measures of the probability and severity of earthquakes at the site.</li> </ul> | <ul style="list-style-type: none"> <li>Provide a copy or reference source utilized.</li> </ul> | <ul style="list-style-type: none"> <li>USGS Website <a href="http://eqhazmaps.usgs.gov/">http://eqhazmaps.usgs.gov/</a>, seismic hazard reports, State reports, Contractor reports, etc.</li> <li><b>These values need to be adjusted depending on the site soil type.</b></li> </ul> |
| <p><b>This Mitigation Project:</b></p> <p><b>For this BCA the standard FEMA seismic hazard data in the BCA Earthquake Full Data Software Version 6.0.0 from the BCA Toolkit CD Version 2.0 (January 2005) were used for this analysis, for Firm Soil Type D.</b></p> |   |  |  |   |



| Data Type                                    | Value   | Description  | Documentation  | Source  |
|--|---|--|--|---|
| <b>Soil Type</b>                             | Soil classification used in building codes, and important factor in seismic hazard level at project site. | <ul style="list-style-type: none"> <li>There are two common classification systems, S0, S1, S2, S3 and S4 in the old Uniform Building Code and a newer system with A, B, C, D, E F for soils varying from rock to very soft soils, used in the International Building Code.</li> </ul> | <ul style="list-style-type: none"> <li>Provide copies or reference source soil type map utilized (local engineering studies, county or state).</li> </ul>  | <ul style="list-style-type: none"> <li>Geotechnical engineers, State geological surveys.</li> </ul>   |
| <b>Expected Annual Number of Earthquakes</b> | Frequency   | <ul style="list-style-type: none"> <li>Annual probabilities of various levels of ground shaking, expressed in PGA (Peak Ground Acceleration, relative to “g” the acceleration of gravity)</li> </ul>   | <ul style="list-style-type: none"> <li>If Full Data calculated values are utilized then verify their applicability.</li> <li>Provide a detailed description of how user-determined values were developed. Reference the instructions in the Earthquake Data Derivation Chapter to for guidance.</li> </ul> | <ul style="list-style-type: none"> <li>Earthquake Data Derivation Chapter in the Mitigation BCA Toolkit CD.</li> <li>Use software modules for Seismic Hazard Calculations</li> <li>Follow calculation procedures in Earthquake Data Derivation Chapter</li> <li><b>These values need to be adjusted depending on the site soil type.</b></li> </ul> |

**This Mitigation Project:**

**For this BCA, the standard FEMA seismic hazard data in the BCA Earthquake Full Data Software Version 6.0.0 from the BCA Toolkit CD Version 2.0 (January 2005) were used for this analysis.**

**No additional adjustments were made for soil/rock type and no adjustments were made to the expected annual number of earthquakes calculated by the FEMA software.**

| Data Type                               | Value  | Description  | Documentation  | Source  |
|---|--|--|--|---|
| <b>Building Seismic Damage Function</b> | Percent damage of building replacement value for each level of ground shaking. | <ul style="list-style-type: none"> <li>Estimate of building damages for each level of ground motion</li> <li>Use software modules for Seismic Hazard Calculations</li> <li>Follow calculation procedures in Earthquake Data Derivation Chapter Estimate</li> </ul> | <ul style="list-style-type: none"> <li>Use Fragility Curve Calculator software to generate seismic damage functions</li> <li>For structural retrofit of bridges or utility systems, damage functions must be generated by structural engineer</li> </ul> | <ul style="list-style-type: none"> <li>Earthquake Data Derivation Chapter in the Mitigation BCA Toolkit CD.</li> <li>Use Fragility Curve Calculator for seismic damage function estimates</li> <li>Follow calculation procedures in Earthquake Data Derivation Chapter</li> <li>Or use building (facility) specific seismic damage function generated by a structural engineer</li> </ul> |

**This Mitigation Project:**

**NONE applicable to this project which does not involve any buildings.**

| Data Type                              | Value   | Description  | Documentation   | Source  |
|--|---|--|---|---|
| <b>Content Seismic Damage Function</b> | Percent damage of building content value for each level of ground motion. | <ul style="list-style-type: none"> <li>Estimate of building content damages for each level of ground motion</li> <li>Use software modules for Seismic Hazard Calculations</li> <li>Follow calculation procedures in Earthquake Data Derivation Chapter Estimate</li> </ul> | <ul style="list-style-type: none"> <li>No documentation required if FEMA standard values are used for residential and other ordinary buildings use typical values.</li> </ul> | <ul style="list-style-type: none"> <li>Earthquake Data Derivation Chapter in the Mitigation BCA Toolkit CD.</li> <li>Follow calculation procedures in Earthquake Data Derivation Chapter</li> </ul> |

**This Mitigation Project:**

**None for this project, which does not involve any contents.**

| Data Type   | Value  | Description  | Documentation  | Source  |
|---|--|--|--|---|
| <b>Displacement Time</b>  | Days, increases with wind damage (building percent damage) | <ul style="list-style-type: none"> <li>The time period for which occupants are expected to be displaced to temporary quarters due to wind damage.</li> </ul> | <ul style="list-style-type: none"> <li>No documentation required if FEMA standard values are used for residential and other ordinary buildings use typical values.</li> <li>Provide data derivation method for techniques used.</li> </ul> | <ul style="list-style-type: none"> <li>See “What is a Benefit” guidance for residential and critical facilities.</li> </ul> |
| <p><b>This Mitigation Project:</b></p> <p><b>No displacement costs or times considered in this BCA.</b></p> |  |  |  |   |



| <b>Data Type</b>           | <b>Value</b>   | <b>Description</b>  | <b>Documentation</b>   | <b>Source</b>  |
|----------------------------|--|---|--|--|
| <b>Functional Downtime</b> | Days, increases with wind damage (building percent damage) | <ul style="list-style-type: none"> <li>The time period for which public or commercial services are lost from a building.</li> </ul> | <ul style="list-style-type: none"> <li>For ordinary buildings, typical values in FEMA software.</li> <li>For critical buildings, use “What is a Benefit?” guidance.</li> </ul> | <ul style="list-style-type: none"> <li>No local source required if FEMA typical values are used.</li> <li>Developing non-standard values may involve working with organization or agency providing service.</li> </ul> |

**This Mitigation Project:**

**For functional downtimes, much shorter values (resulting in lower benefits) were calculated rather than using the FEMA default values, which do not apply to this situation. The functional downtime is expressed as system days of loss of water service. See G&E Engineering Report (2005) for computational details.**

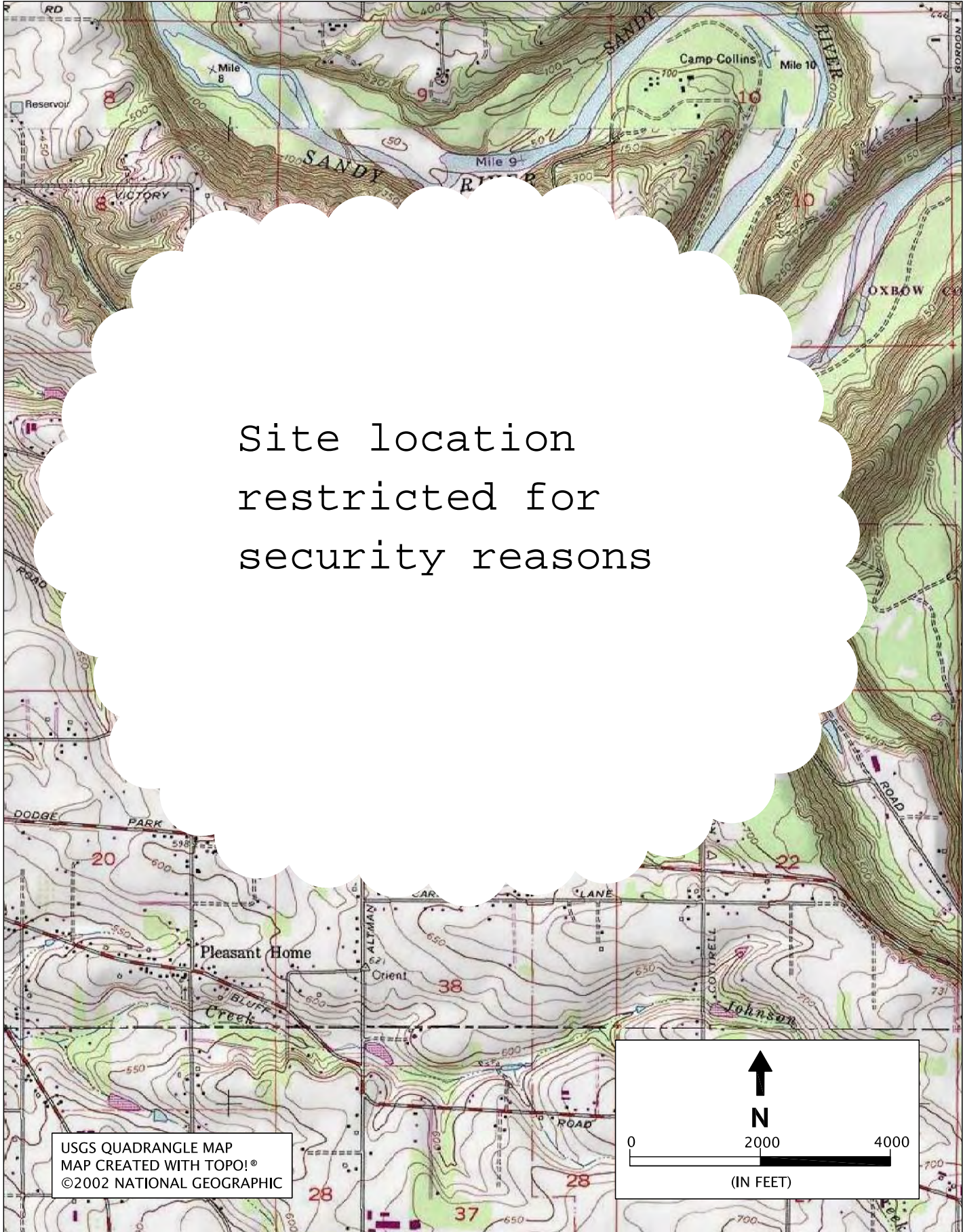
**Downtime is considered ONLY for the 16% to 32% PGA bin the FEMA BCA Software. At lower levels of ground shaking the combination of the conduit system and the ground water system can supply adequate water.**

**At higher levels of ground shaking, which have a low probability for this location, failure of the Sandy River Bridge crossings are likely. In this case, whether or not conduits are upgraded has little impact on restoration of water service because the estimated repair times for the bridge crossings are much longer than for conduit repairs and no water can be conveyed without repairing the bridge crossings.**

**The “zero” values for downtime in higher PGA bins does not mean that there will be no loss of water service, but rather than there is no change in loss of water service before and after this mitigation project and thus no benefits are attributable to this mitigation project for these levels of ground shaking.**

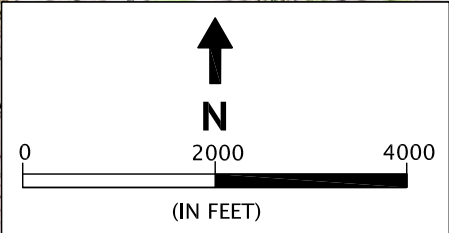
**These downtime estimates are derived from very quantitative modeling of the seismic performance of the entire Portland water supply system (Bull Run and ground water system): Dames & Moore (1996), EQE (1999) and Mohammadi (2000) with additional probabilistic calculations drawing heavily on the previous engineering studies as documented in the G&E Engineering Report (2005).**

| Data Type   | Value   | Description   | Documentation   | Source   |
|---|---|---|---|--|
| <b>Casualty Rate</b>  | Death Rate per 1,000 occupants and Major/Minor Injury Rate per 1,000 occupants for each level of ground motion. | <ul style="list-style-type: none"> <li>Estimated number of deaths, and major/minor injuries per seismic event.</li> </ul> | <ul style="list-style-type: none"> <li>If typical values in FEMA software are used then provide print out of software.</li> <li>If user-determined values are used provide full documentation of reasons for differences from FEMA typical values.</li> </ul> | <ul style="list-style-type: none"> <li>The casualty results depend strongly on the entered occupancy of the building, which should be obtained from the building owner or manager.</li> <li>No local source required if FEMA typical values are used.</li> </ul> |
| <p><b>This Mitigation Project:</b></p> <p><b>NONE. Casualties not considered in this BCA.</b></p> |   |   |   |  |



Site location  
restricted for  
security reasons

USGS QUADRANGLE MAP  
MAP CREATED WITH TOPO!<sup>®</sup>  
©2002 NATIONAL GEOGRAPHIC



Jan 04, 2005 - 13:17:04 DWG Name: BlackVeaCo-1-01-03 VM FIGURE SP-1.dwg Updated By: cmp

**GEODESIGN** INC  
1201 SE Tech Center Drive - Suite 160  
Vancouver, WA 98683  
Off 360.693.8416 Fax 360.693.8426

BLACKVEACO-1-01-03

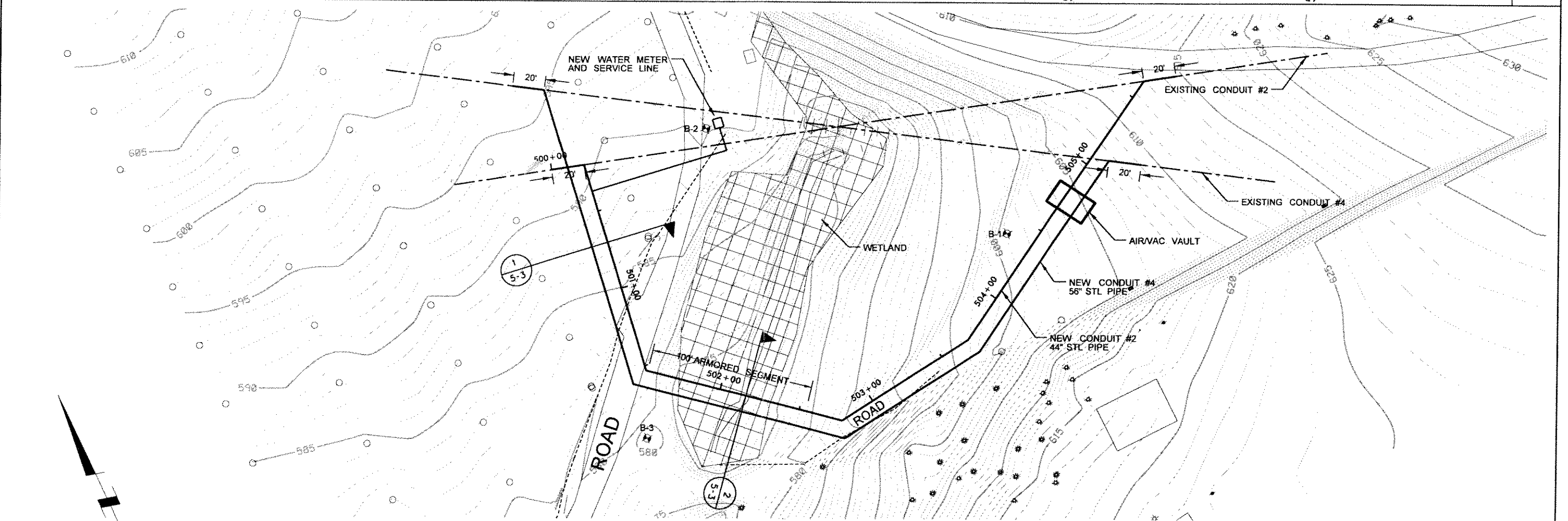
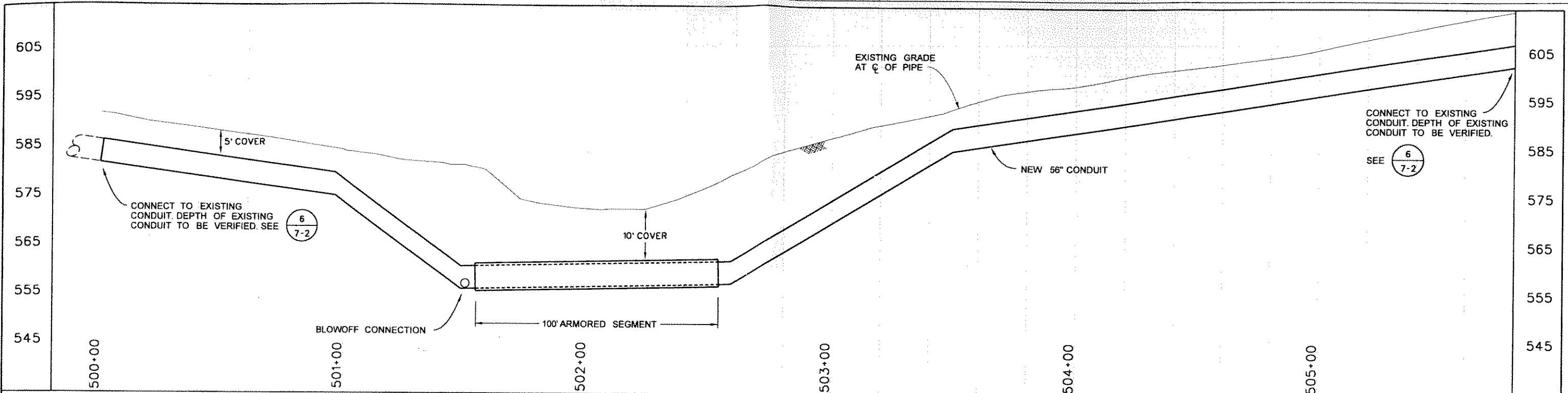
DECEMBER 2004

VICINITY MAP

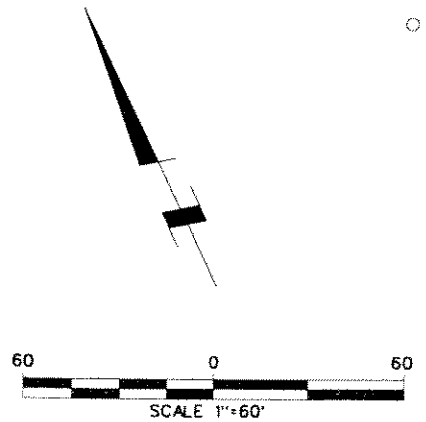
BULL RUN CONDUIT TRESTLES (SESTER'S POND)  
MULTNOMAH COUNTY, OR

FIGURE SP-1





SDATES \$TIMES \$FILES 01-17-2005



|   |           |      |      |
|---|-----------|------|------|
| <p><b>WARNING</b></p> <p>IF THIS BAR DOES NOT MEASURE 1" THEN THE DRAWING IS NOT TO SCALE</p> | REVISIONS | BY   | DATE |
|   |           |      |      |
|   |           |      |      |
|   |           |      |      |
|   | SURVEY    |      |      |
|   | BOOK      | PAGE |      |



CITY OF PORTLAND  
BUREAU OF WATER WORKS

SUBMITTED \_\_\_\_\_ DATE \_\_\_\_\_

\_\_\_\_\_ DATE \_\_\_\_\_

**TRESTLE #5 & #6**  
**SESTERS POND**  
SP-2  
OPEN CUT

PLAN AND PROFILE SHEET

|                                |           |
|--------------------------------|-----------|
| DATE                           | PROJ NO   |
|                                | 1/4 SEC   |
| SCALE V 1" = 20'<br>H 1" = 60' | FILE NAME |
| DESIGN                         | DRAWN BY  |
| CAD CK                         | SURVEYED  |
|                                | SHEET     |
|                                | 5-1 OF -  |