

# TECHNICAL MEMORANDUM

**Date:** June 30, 2021  
**To:** Kimberly Swan, Clackamas River Water Providers  
**From:** Jennifer Schmidt, Herrera Environmental Consultants  
**Subject:** GIS Hazardous Materials Risk Analysis Results

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## INTRODUCTION

The Clackamas River is a source of drinking water for more than 300,000 people in Clackamas County and is an important resource for helping to meet future water demand in the region. The Clackamas River Water Providers (CRWP) represents five municipal surface water intakes on the Clackamas River: City of Estacada, Clackamas River Water, North Clackamas County Water Commission, South Fork Water Board, and City of Lake Oswego. Herrera Environmental Consultants (Herrera) was hired in 2011 to complete a series of geographic information system (GIS) analyses to help identify potential pathways for pollutant export to the Clackamas River from seven high-risk activity categories (Clackamas River Water Providers 2010):

- Septic Systems
- Agricultural Activities
- Forestry Activities
- Vulnerable Soils
- Urban Development
- Point-Source Pollutants
- Hazardous Materials

The goal of these GIS analyses was to map risk factors known to have a strong negative correlation with drinking water quality in the Clackamas River watershed. Mapped risk “hot spots” for each category provide a spatial context for both the geography and intensity of risk by activity that can be used by the CRWP to help prioritize mitigation efforts. In 2021, Herrera was hired to update these analyses to map changes that have may have occurred in the locations of risk “hot spots” in the watershed over the last decade based on new or updated GIS data. This memorandum focuses specifically on the results of the updated 2021 GIS Hazardous Materials Risk Analysis.



## POTENTIAL THREATS FROM HAZARDOUS MATERIALS SPILLS

The CRWP have identified potential spills involving the release of hazardous materials or petroleum products from commercial or industrial facilities with hazardous material storage tanks as being a significant source of risk to drinking water quality in the Clackamas River watershed. The commercial and industrial region at the bottom of the watershed, bounded by I-205 to the west, HWY 212/224 to the east, and north of the Clackamas River, is of particularly high concern. A recurring theme associated with major spills or release is confusion and uncertainty for first responders in the initial hours following an event. It is during these early hours however when the possibility to contain the spill still exists. Once a large spill enters a flowing body of water, it can quickly become out of control, impacting downstream critical resources such as drinking water intakes, endangered or threatened species habitat, spawning beds, nesting areas, hydroelectric facilities, wetlands, and well fields (Clackamas River Water Providers 2010).

## GIS HAZARDOUS MATERIALS SPILL RISK ANALYSIS

Herrera completed a series of GIS analyses to 1) map the locations and density of facilities storing or transporting large quantities of reportable hazardous substances in the Clackamas River watershed in four categories; and 2) identify potential pathways from facilities in the commercial and industrial focus area at the bottom of the watershed to the Clackamas River. The following sections provide more detailed information on these analyses, including analysis objectives, methods used to quantify risk, data sources used and limitations, and results.

### Analysis Objectives

The primary objectives of the GIS hazardous materials spill risk analyses were to:

1. Group facilities storing reportable quantities of hazardous substances from the HSIS database into 4 general categories based on chemical properties:
  - Oil (Petroleum or Vegetable)
  - Light or Medium Fractioned Petroleum
  - Solvents (Alcohols, Ketones, Chlorinated)
  - Acids and Bases
2. Analyze facility spill risk by category based on the total reported substance amount stored onsite, as well as the quantity being transported to and from the facility.

3. Identify potential spill pathways to the Clackamas River or its tributaries in the commercial and industrial focus area at the bottom of the watershed in the event of a hazardous substance release.

## Data Sources and Limitations

The primary GIS datasets required to assess the potential impact of a hazardous materials spill on source water quality in the Clackamas River are 1) facility locations from the Oregon State Fire Marshall (OSFM) Hazardous Substance Information System and 2) stormwater infrastructure (pipes, structures, and open channels). The following sections describe these datasets in more detail, including any major limitations that are important to keep in mind when interpreting the GIS hazardous materials spill risk analysis results.

### *Oregon OSFM Hazardous Substance Information System (HSIS) Database*

The Oregon Community Right to Know Unit (CR2K) collects, validates, and disseminates information on hazardous substances located throughout the state. This information is then made available to the public, emergency responders and planners, and local and state agencies via the Hazardous Substance Information System (HSIS) database so that informed decisions can be made on how to protect the environment and the public from hazardous material incidents (OSFM 2021). Facilities that use, store, manufacture, or dispose of reportable quantities of a hazardous substance are required to complete an HSIS form annually; detailed information on reporting requirements can be found in the HSIS Survey Instruction booklet ([http://www.oregon.gov/osp/SFM/docs/cr2k/cr2k\\_general/surveyinstrbook.pdf](http://www.oregon.gov/osp/SFM/docs/cr2k/cr2k_general/surveyinstrbook.pdf)).

Herrera obtained statewide hazardous substance facility locations extracted from the HSIS Public Version database that are current as of March 25, 2021. This database is identical to the Fire Version database made available to fire service personnel and other emergency responders, but all confidential and secured information (such as the specific onsite storage location at a facility) have been removed. The Public Version dataset contains detailed facility and hazardous substance information, including the facility name, type of business activity, number of employees, the substance type, quantity, physical state, and hazard class for each hazardous substance reported by the facility, whether the substance meets Environmental Protection Agency (EPA) Extremely Hazardous Substance (EHS) reporting levels, and the current hazard ranking used to determine the facility fee schedule. This data was used to group hazardous substances into categories and to identify facilities with high maximum reported storage or transport quantities. It was also used to identify the number of hazardous substances reported at each facility.

There are limitations to this data that are important to keep in mind when interpreting the analysis results. First, the quantity information provided in the database (average and maximum amounts stored onsite, and the average amount annually transported in and out of the facility) are provided as reportable ranges rather than exact values, and in some cases these ranges are

quite broad. Another important limitation is that this database only containing facilities with reportable quantities of hazardous substances; facilities storing hazardous substances in quantities below reportable quantities are not included in the analysis.

### ***Stormwater Utility Data***

The commercial and industrial area focus at the bottom of the watershed is within the Clackamas Water Environment Services (WES) service boundary and has extensive stormwater infrastructure that discharges to the Clackamas River at several outfalls. Clackamas WES provided Herrera with GIS stormwater infrastructure data, including the locations of stormwater pipes, structures, open channels, and detention ponds. This data was used in combination with topographic data to delineate areas draining to several major outfalls to the Clackamas River. Stormwater infrastructure data was not available for areas outside of the Clackamas WES service.

## **Methodology**

This section describes the GIS methods that Herrera used to assess the potential risk from hazardous material spills to the Clackamas River watershed from commercial and industrial facilities in the focus area at the bottom of the watershed. A brief discussion of the results of each analysis category is included in this section; discussion of overall results and relationships between analysis categories are included in the Results section.

### ***Hazardous Substance Storage Facilities***

Herrera extracted and mapped 512 facilities that use, store, manufacture, or dispose of reportable quantities of more than 3,500 hazardous substances in the Clackamas River watershed. Hazardous substances are stored as liquids, solids, and gases: 9% of the reported substances have a current hazard ranking of 1 (minimally hazard), 87% have a current hazard ranking of 2 (generally hazardous), less than 1% have a current hazard ranking of 3 (very hazardous), and 4% have a current hazard ranking of 4 (registered chemicals).

### ***Identifying Key Hazardous Substance Categories***

Herrera used a screening process with several steps to identify the most relevant facilities to target for spill response planning efforts. First, all reported hazardous substances identified as either gases or solids were removed from further analysis due to slower rates of dispersion and longer travel times to the Clackamas River. Although hazardous gas and solids could also pose a significant risk to source water quality under certain circumstances, liquid spills are much more common and have a broader travel radius, making them of particular concern to surface water quality.

As a next step, Herrera reviewed the list of storage container types in use by facilities and removed all hazardous substances being stored in underground storage tanks (USTs) from the

analysis. Spills from USTs certainly pose a serious environmental risk; however, these spills are more likely to result in groundwater and soil contamination rather than direct contamination to surface water. Oregon Department of Environmental Quality (DEQ) is responsible for maintaining permitting and clean-up programs for more than 5,000 operating permits in Oregon for large USTs (greater than 110 gallons for commercial or industrial facilities and greater than 1,100 gallons for residential or farm use); an analysis of UST permits in the Clackamas River watershed, as well as other permitted facilities, was completed as part of Point Source Pollution risk analysis completed by Herrera in 2021 and is available on the CRWP website.

After applying these filtering criteria, the HSIS database still contained records for nearly 200 unique chemical names stored at reportable quantities in the Clackamas River watershed. To help facilitate a more targeted analysis of risk in the lower watershed focus area, Herrera coordinated with CRWP and the Oregon Department of Ecology to group substances into 4 broad categories based on similar chemical properties, buoyancy in water, and potential response strategies that could be implemented if a spill were to occur. These categories, along with the numbers of facilities in the Clackamas River watershed, are shown in Table 1. The distribution of facilities by substance category is shown in Figure 1.

Table 1. Aggregation of Chemical Names in the Hazardous Substance Storage database.		
Category	Number of Unique Chemical Names	Number of Reporting Facilities
Light/Medium Fractioned Petroleum	41	65
Oil (Petroleum or Vegetable)	18	36
Solvents (Alcohols, Ketones, Chlorinated)	15	12
Acids and Bases	50	20

### *Analyzing Risk from HSIS Storage Facilities by Quantity*

Each facility that submits reportable quantities of hazardous substances to the HSIS database is required to provide the following information on quantities:

- **Average Amount:** This is the average amount of the chemical that the facility possessed during the previous 12 months, expressed as a range.
- **Maximum Amount:** This is the maximum amount of the chemical that the facility possessed during the previous 12 months, expressed as a range.
- **Amount In:** This is the amount of the substance transported to the facility during the previous 12 months, expressed as a range.

- **Amount Out:** This is the amount of the substance of the substance transported from the facility during the previous 12 months. This does not include 1) amounts transported from the facility due to accidental or intentional releases, 2) the fuel, gas, oil, etc. used in the facility vehicles, or 3) substances used up at the site.

To help facilitate further analysis, it was necessary to convert the reported amounts from gallon ranges to discrete numbers. Herrera used the top value in the reported range to assign a conservative discrete average, maximum, amount in, and amount out value to each facility by chemical category and then calculated the total amount of all hazardous substances stored onsite. The quantities used in this analysis are approximate and may in some cases be an overestimate. Figures 2 through 17 show the total amount for each type of reported quantity by substance category.

### *Potential Spill Pathways*

The final step in this analysis was to look at potential pathways from spills in the commercial and industrial focus area at the bottom of the watershed to the Clackamas River. Herrera used topographic data and Clackamas WES stormwater infrastructure data to delineate the contributing area draining to four outfalls discharging to the Clackamas River. These areas are shown in Figure 18. These boundaries are approximate and have not been field verified; however, they serve as a good starting point for identifying where a spill from a facility storing hazardous substances in the lower watershed could end up discharging to the Clackamas River. This information will allow the CRWP to plan spill response strategies that are able to potentially stop the spread of a hazardous substance before it is able to reach the Clackamas River.

## RESULTS AND RECOMMENDATIONS

The results of the 2021 hazards materials spill risk analyses for the Clackamas River watershed clearly that the commercial and industrial region, bounded by I-205 to the west, HWY 212/224 to the east, and north of the Clackamas River, should be a primary focus area for future emergency response planning efforts. The goal of this analysis was to help further focus what is at risk by analyzing the distribution and intensity of hazardous substances stored in the watershed in key chemical categories rather than by facility. This analysis helps to illuminate patterns in the data that can only be seen by analyzing the facilities by chemical categories rather than in aggregate.

As an example, the Oil (Petroleum/Vegetable) category contains the largest number of facilities, the largest number of gallons stored, and the densest concentration within the focus area at the bottom of the watershed; by comparison, there are only a handful of facilities in the Solvents categories, and although they are all located in the lower watershed, they are not intensely clustered. This implies that broad planning efforts are appropriate for spill response for facilities where oil is being stored, since these facilities are numerous and densely clustered, while

targeted facility-specific outreach might be more effective for the limited number of facilities storing solvents.

## REFERENCES

Clackamas River Water Providers. 2010. Drinking Water Protection Plan for the Clackamas River. September 2010. Obtained December 20, 2010, from agency website:

<http://www.clackamasproviders.org/contacts/7.html>.

DEQ. 2021. How to Report a Spill. April 6, 2021. Oregon Department of Environmental Quality.

<https://www.oregon.gov/deq/Hazards-and-Cleanup/env-cleanup/Pages/How-To-Report-A-Spill.aspx>

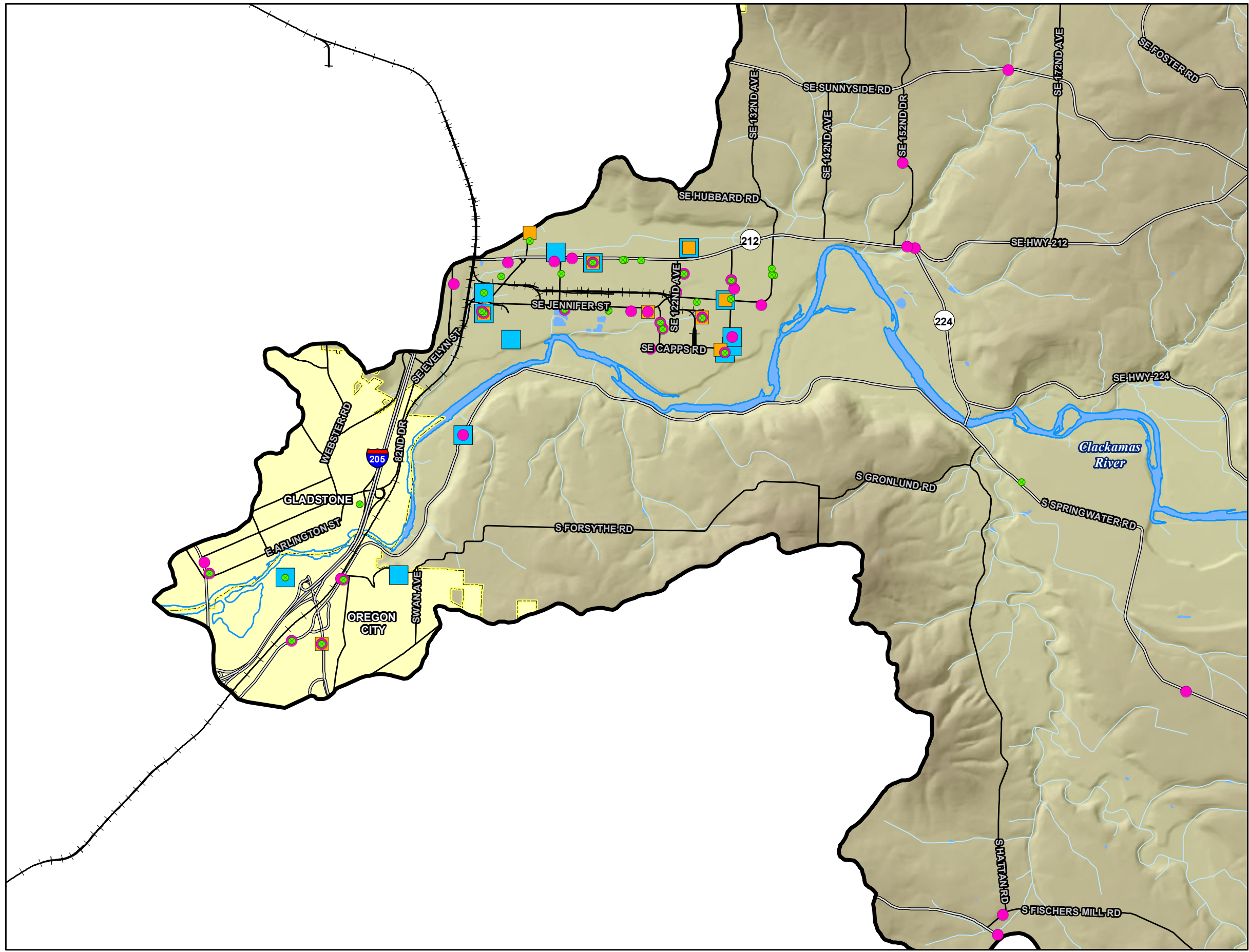
OSFM. 2021. Community Right to Know. December 6, 2013. Oregon State Police – Oregon Office of State Fire Marshal. [http://www.oregon.gov/OSP/SFM/Pages/CR2K\\_Home.aspx](http://www.oregon.gov/OSP/SFM/Pages/CR2K_Home.aspx)

Herrera. 2013. Hazardous Materials Risk Analysis Results. Herrera Environmental Consultants.

December 2013. [http://www.clackamasproviders.org/wp-content/uploads/2014/09/GIS\\_Hazardous\\_Materials\\_Risk\\_Analysis\\_Results\\_12102013-1.pdf](http://www.clackamasproviders.org/wp-content/uploads/2014/09/GIS_Hazardous_Materials_Risk_Analysis_Results_12102013-1.pdf).







**Figure 1.**  
**Hazardous Substance Storage**  
**Facilities in the Clackamas River**  
**Watershed.**

**Legend**

- Facilities storing oil (petroleum or vegetable)
- Facilities storing light or medium fractionated petroleum
- Facilities storing solvents
- Facilities storing acids and bases
- Railroad
- Highway or major arterial
- Arterial
- County boundary
- Clackamas River Watershed boundary
- City limits
- River
- Waterbody
- Stream
- National Forest boundary

N

0 1,750 3,500 7,000

Feet

Clackamas River Water Providers

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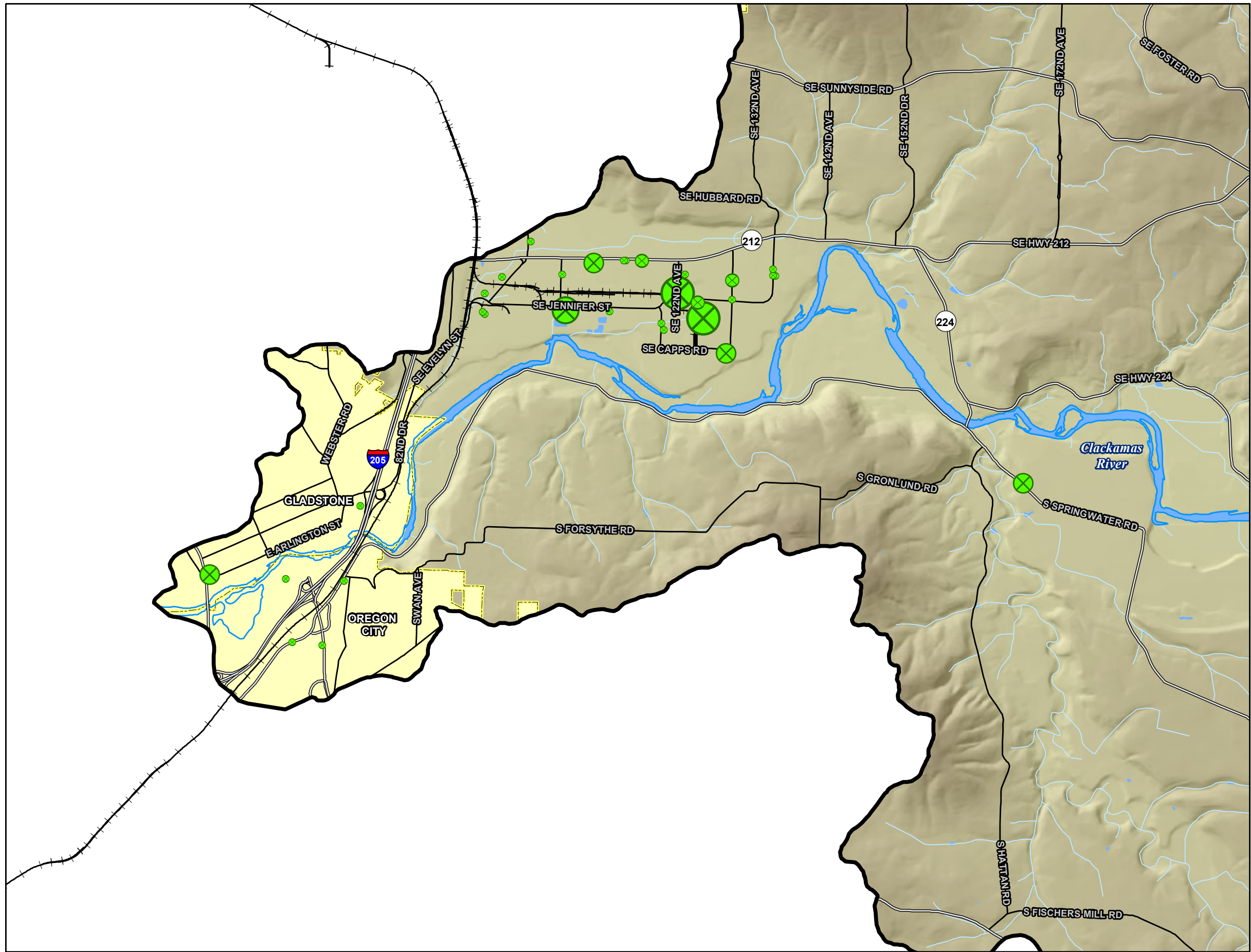
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HARN NAD83 (feet)

Produced By: GIS (JAS)  
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**Figure 3.**  
**Facilities Storing Reportable**  
**Quantities of Oil (Petroleum or**  
**Vegetable): Maximum Gallons**  
**Stored Onsite.**

**Legend**

Total maximum gallons stored onsite

- < 5,000 gallons
- 5,000 to 10,000 gallons
- 10,000 to 50,000 gallons
- 50,000 to 100,000 gallons
- > 100,000 gallons

Railroad

Highway or major arterial

County boundary

Clackamas River Watershed boundary

City limits

River

Waterbody

Stream

National Forest boundary

N

0 1,750 3,500 7,000

Feet

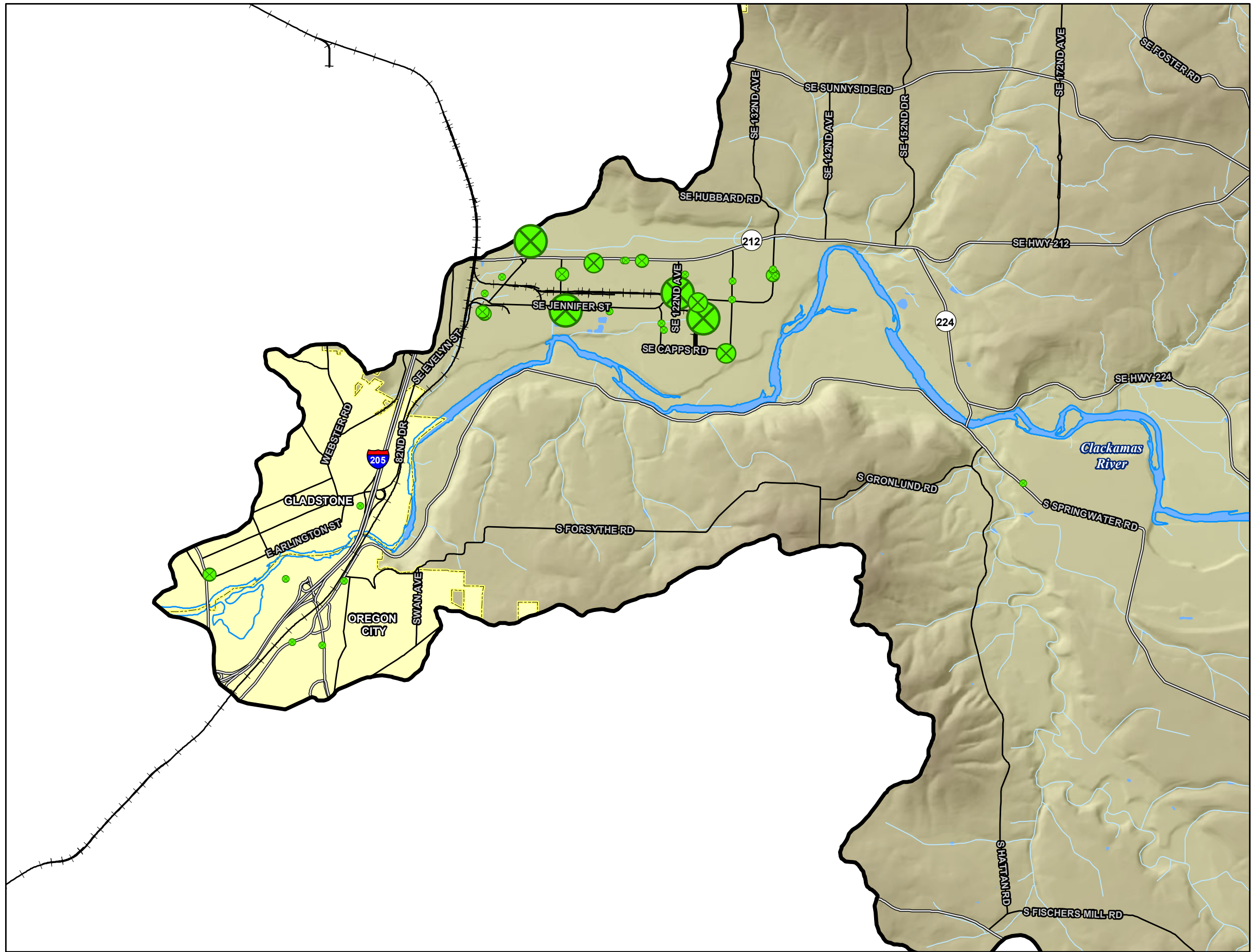
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Produced By: GIS (JAS)  
Project: K:\Projects\Y2010\10-04900-005\Project\Light\_Medium\_Fractioned\_Petroleum.mxd (6/16/2015)



**Figure 4.**  
**Facilities Storing Reportable**  
**Quantities of Oil (Petroleum or**  
**Vegetable): Total Gallons Transported**  
**to the Facility Annually**

**Legend**

Total maximum gallons transported in

- < 5,000 gallons
- 5,000 to 10,000 gallons
- 10,000 to 50,000 gallons
- 50,000 to 100,000 gallons
- > 100,000 gallons

Railroad

Highway or major arterial

County boundary

Clackamas River Watershed boundary

City limits

River

Waterbody

Stream

National Forest boundary

N

0 1,750 3,500 7,000

Feet

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Coordinates: Oregon State Plane North  
HARN NAD83 (feet)

Produced By: GIS (JAS)  
Project: K:\Projects\Y2010\10-04900-005\Project\Light\_Medium\_Fractioned\_Petroleum.mxd (6/16/2015)



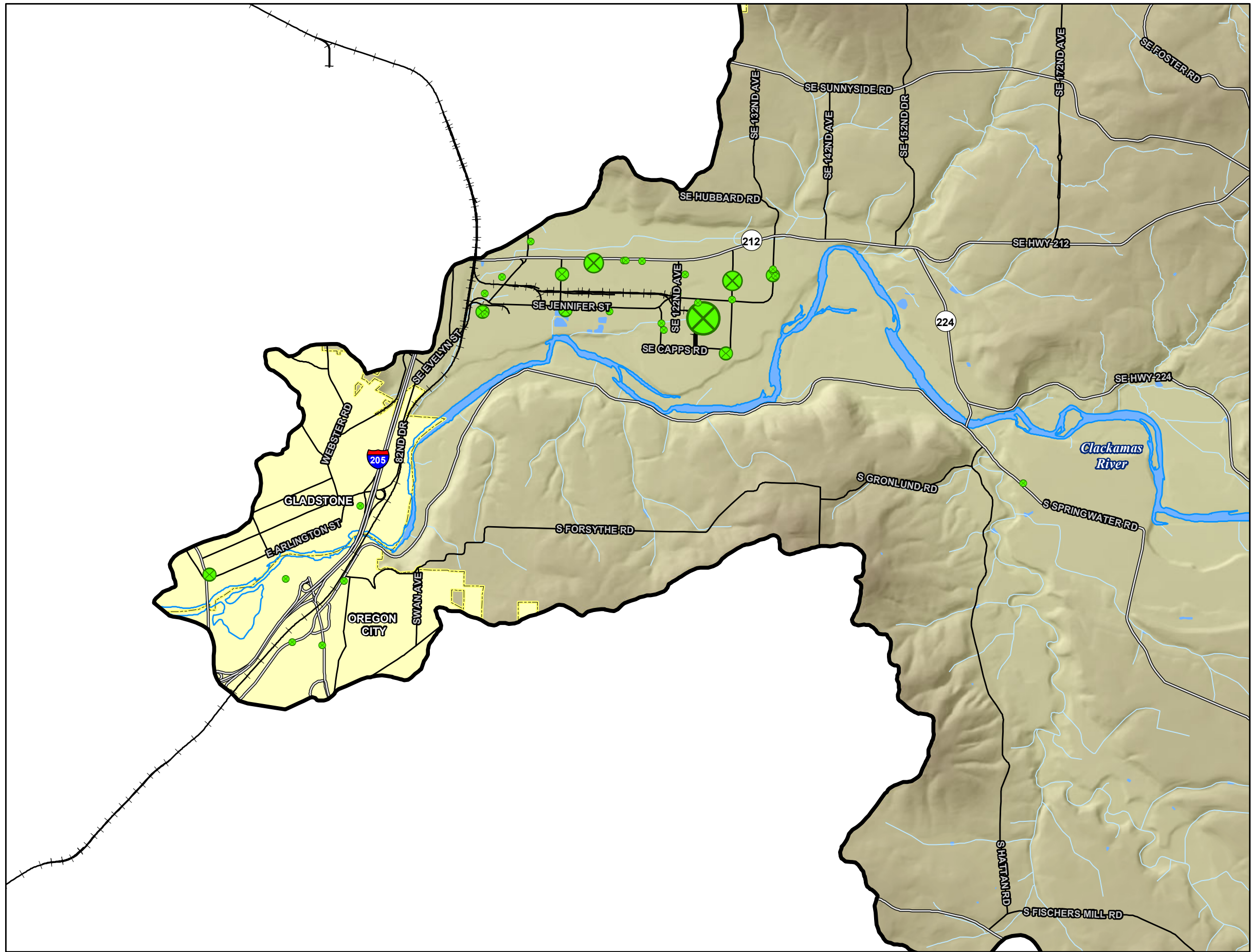


Figure 5.  
Facilities Storing Reportable  
Quantities of Oil (Petroleum or  
Vegetable): Total Gallons Transported  
from the Facility Annually

**Legend**

Total maximum gallons transported out

- < 5,000 gallons
- 5,000 to 10,000 gallons
- 10,000 to 50,000 gallons
- 50,000 to 100,000 gallons
- > 100,000 gallons

Railroad

Highway or major arterial

County boundary

Clackamas River Watershed boundary

City limits

River

Waterbody

Stream

National Forest boundary

N

0 1,750 3,500 7,000

Feet

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Coordinates: Oregon State Plane North  
HARN NAD83 (feet)

Produced By: GIS (JAS)  
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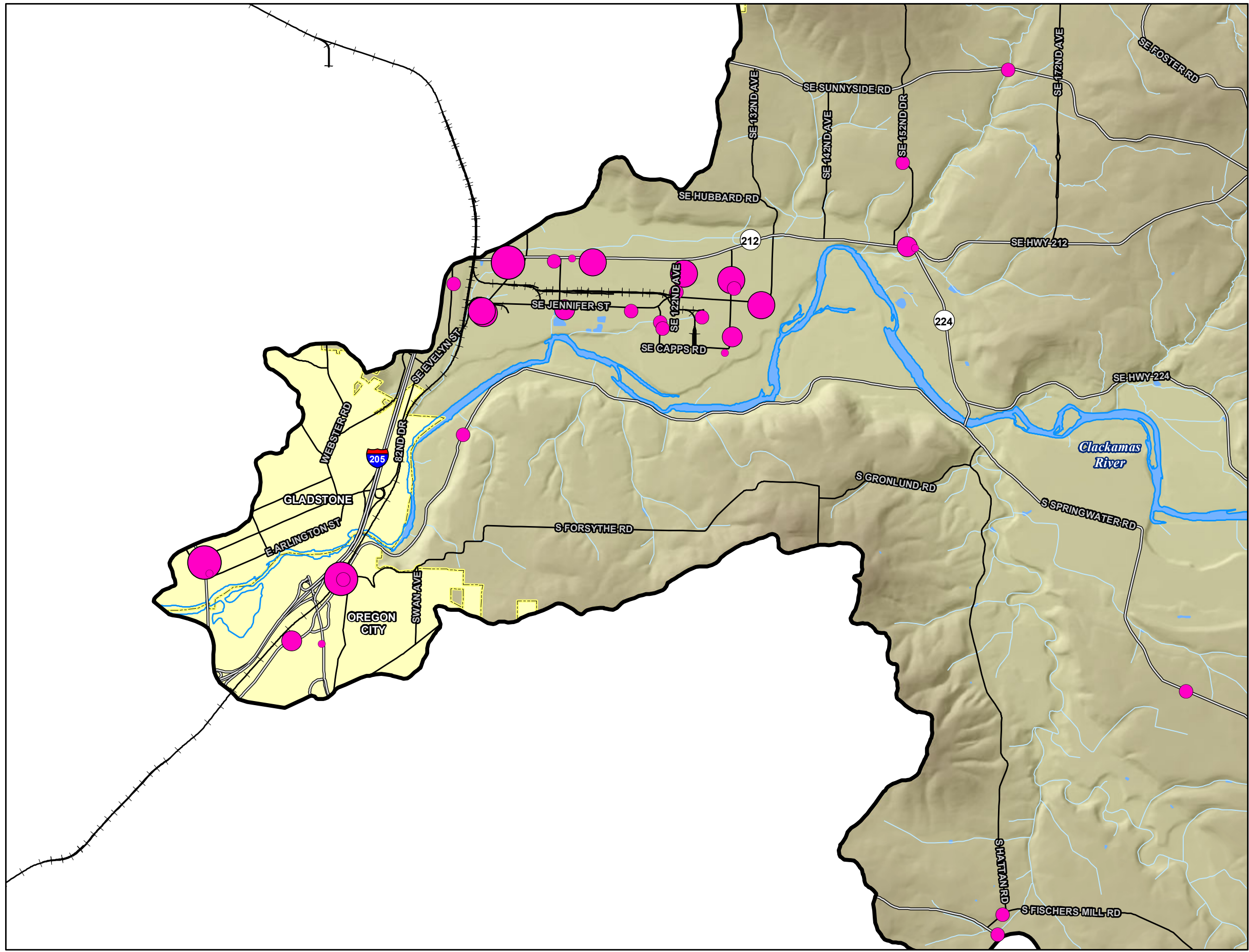


Figure 6.  
Facilities Storing Reportable  
Quantities of Light or Medium  
Fractionated Petroleum: Average  
Gallons Stored Onsite.

**Legend**

Light or medium fractionated petroleum

- < 500 gallons
- 500 to 5,000 gallons
- 5,000 to 10,000
- 10,000 to 50,000
- > 50,000

Highway or major arterial

Arterial

County boundary

Clackamas River Watershed boundary

City limits

River

Waterbody

Stream

National Forest boundary

N

0 1,750 3,500 7,000

Feet

Clackamas River Water Providers

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Coordinates: Oregon State Plane North  
HARN NAD83 (feet)

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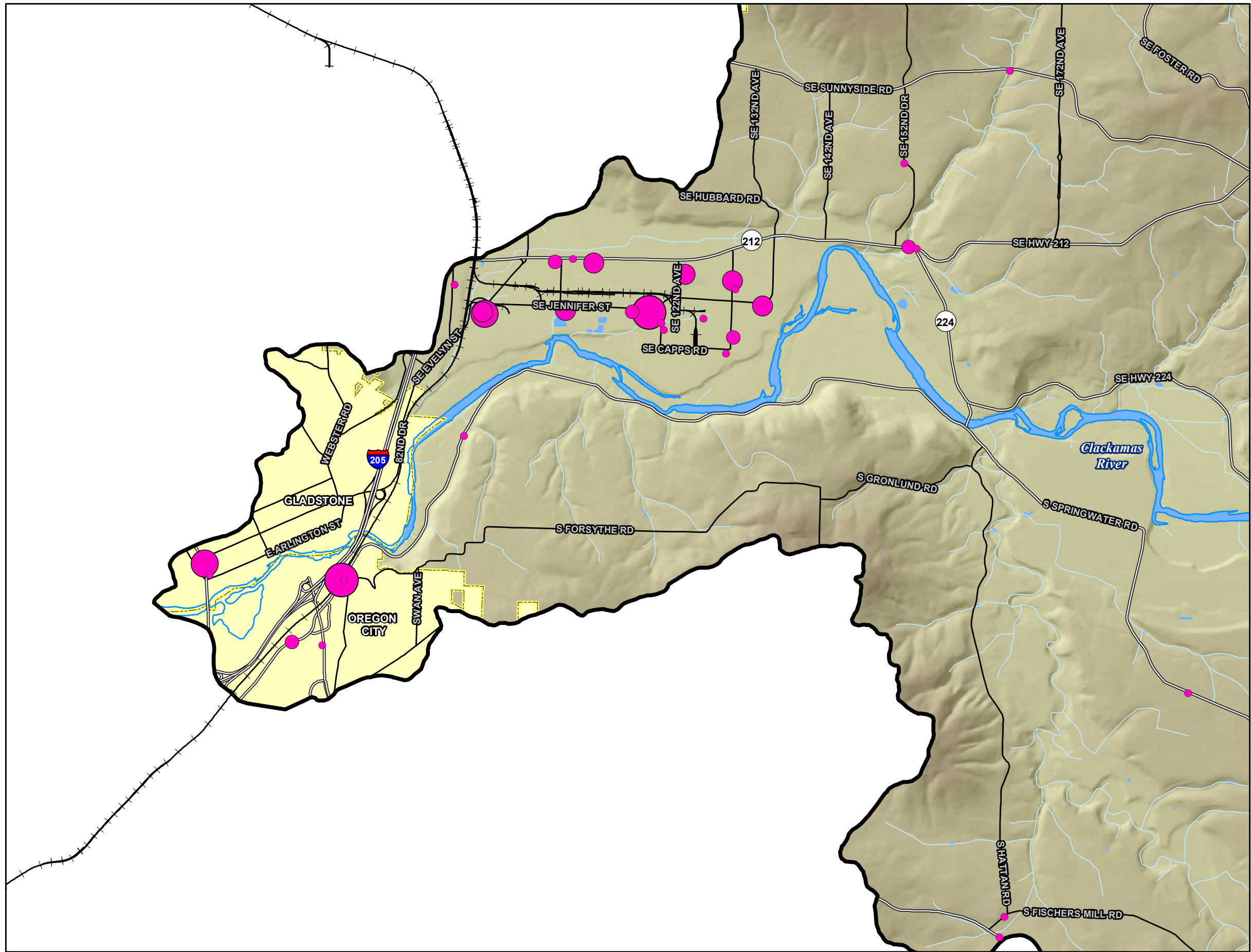


Figure 7.  
Facilities Storing Reportable  
Quantities of Light or Medium  
Fractionated Petroleum: Maximum  
Gallons Stored Onsite.

Legend

Light or medium fractionated petroleum

- < 5,000 gallons
- 5,000 to 10,000 gallons
- 10,000 to 50,000 gallons
- 50,000 to 100,000 gallons
- > 100,000 gallons

Highway or major arterial

Arterial

County boundary

Clackamas River Watershed boundary

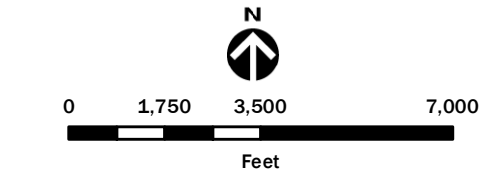
City limits

River

Waterbody

Stream

National Forest boundary



Coordinates: Oregon State Plane North  
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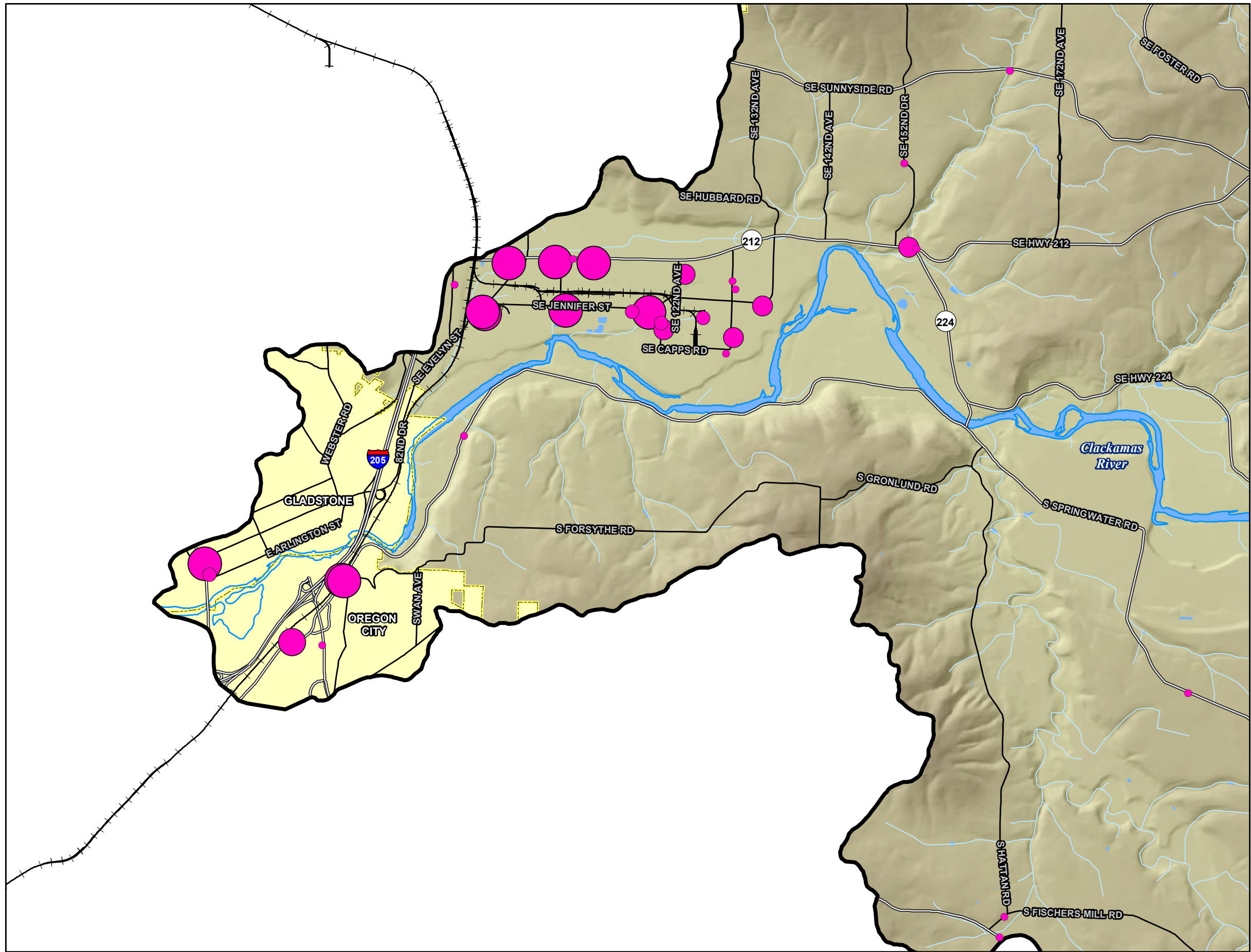


Figure 8.  
Facilities Storing Reportable  
Quantities of Light or Medium  
Fractionated Petroleum: Total Gallons  
Transported to the Facility  
Annually.

Legend

Light or medium fractionated petroleum

- < 5,000 gallons
- 5,000 to 10,000 gallons
- 10,000 to 50,000 gallons
- 50,000 to 100,000 gallons
- > 100,000 gallons

Highway or major arterial

Arterial

County boundary

Clackamas River Watershed boundary

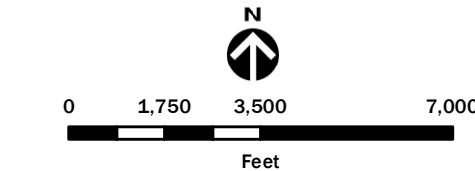
City limits

River

Waterbody

Stream

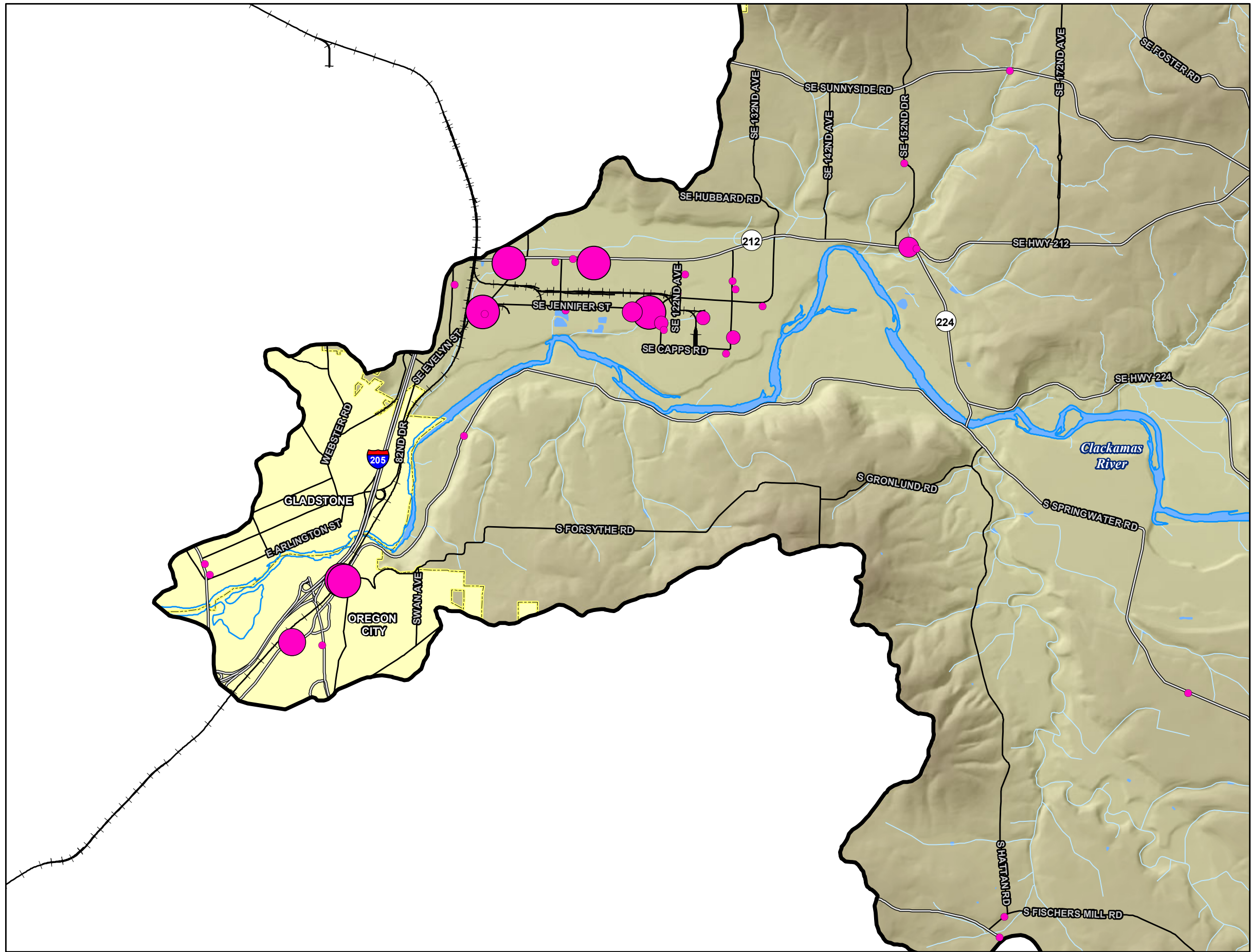
National Forest boundary



Coordinates: Oregon State Plane North  
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Produced By: GIS (JAS)  
Project: K:\Projects\Y2010\10-04900-005\Project\Light\_Medium\_Fractioned\_Petroleum.mxd (6/16/2015)





**Figure 9.**  
**Facilities Storing Reportable**  
**Quantities of Light or Medium**  
**Fractionated Petroleum: Total Gallons**  
**Transported from the Facility**  
**Annually.**

**Legend**

Light or medium fractionated petroleum

- < 5,000 gallons
- 5,000 to 10,000 gallons
- 10,000 to 50,000 gallons
- 50,000 to 100,000 gallons
- > 100,000 gallons

Highway or major arterial

Arterial

County boundary

Clackamas River Watershed boundary

City limits

River

Waterbody

Stream

National Forest boundary

N

0 1,750 3,500 7,000

Feet

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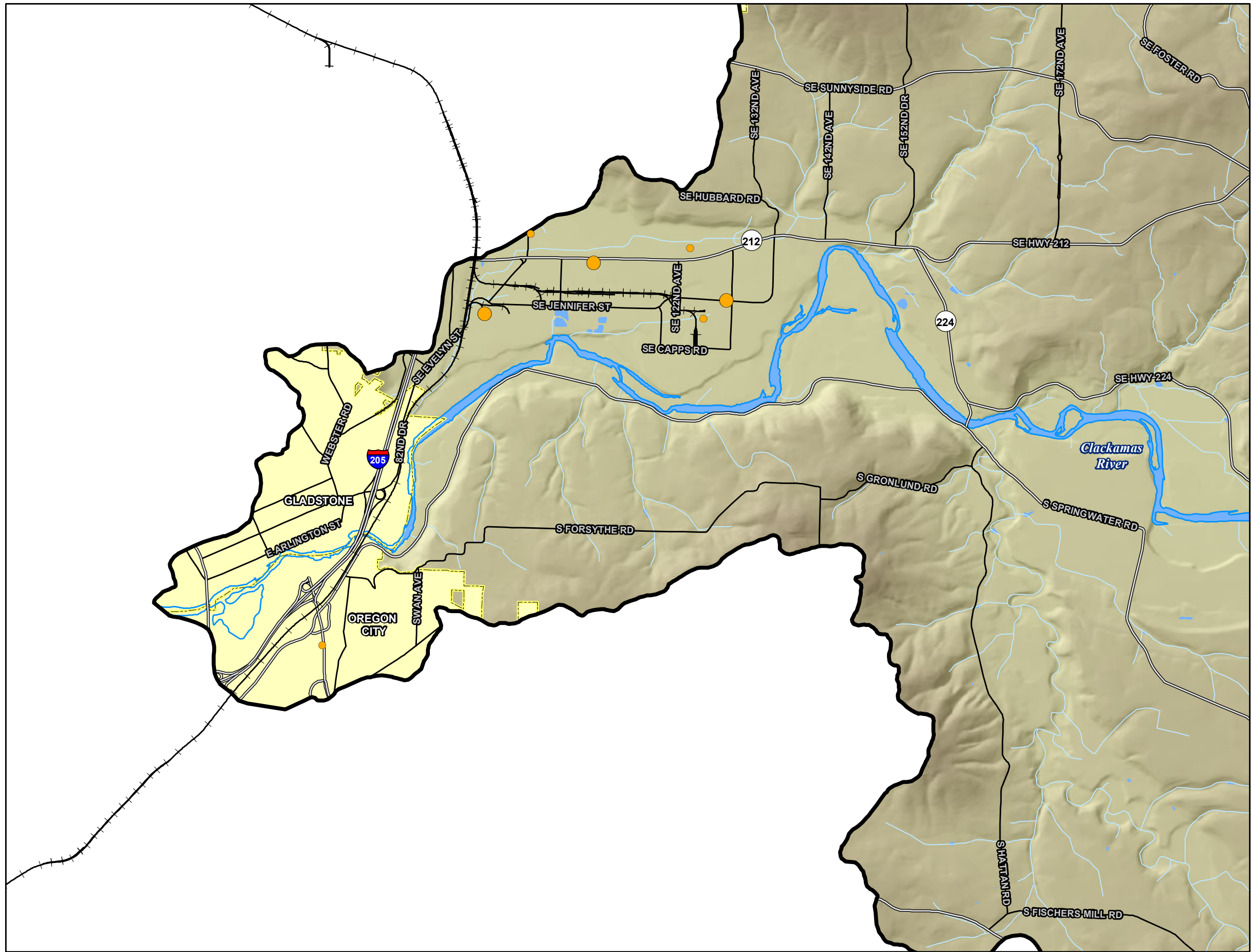


Figure 10.  
Facilities Storing Reportable  
Quantities of Solvents: Average  
Gallons Stored Onsite.

**Legend**

Facilities storing solvents

- < 500 gallons
- 500 to 5,000 gallons
- 5,000 to 10,000
- 10,000 to 50,000
- > 50,000

Highway or major arterial

Arterial

County boundary

Clackamas River Watershed boundary

City limits

River

Waterbody

Stream

National Forest boundary

N

0 1,750 3,500 7,000

Feet

Clackamas River Water Providers

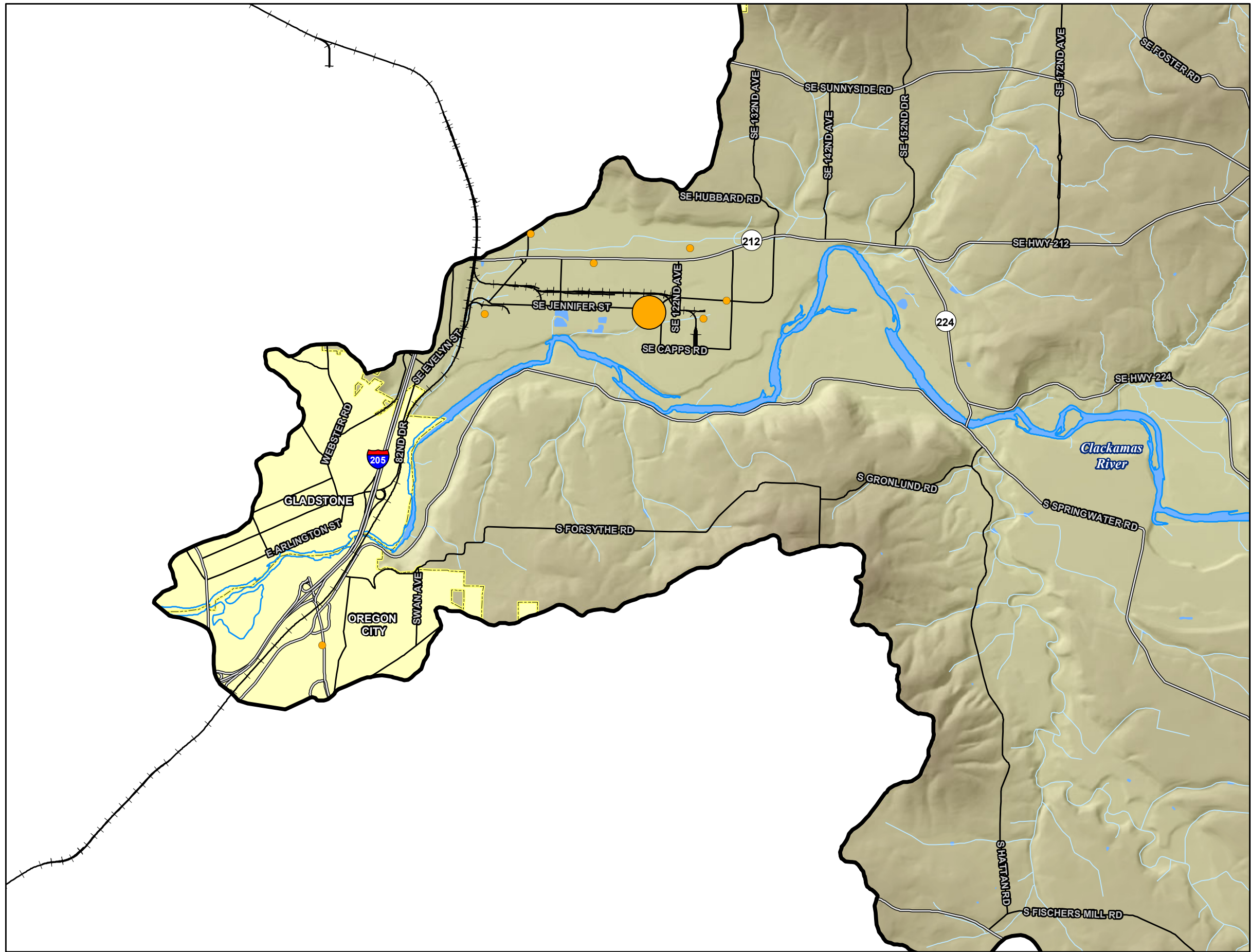
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Coordinates: Oregon State Plane North  
HARN NAD83 (feet)

Produced By: GIS (JAS)  
Project: K:\Projects\Y2010\10-04900-005\Project\Solvents.mxd (6/16/2015)





**Figure 11.**  
**Facilities Storing Reportable**  
**Quantities of Solvents: Maximum**  
**Gallons Stored Onsite.**

**Legend**

Facilities storing solvents

- < 5,000 gallons
- 5,000 to 10,000 gallons
- 10,000 to 50,000 gallons
- 50,000 to 100,000 gallons
- > 100,000 gallons

Highway or major arterial

Arterial

County boundary

Clackamas River Watershed boundary

City limits

River

Waterbody

Stream

National Forest boundary

N

0 1,750 3,500 7,000

Feet

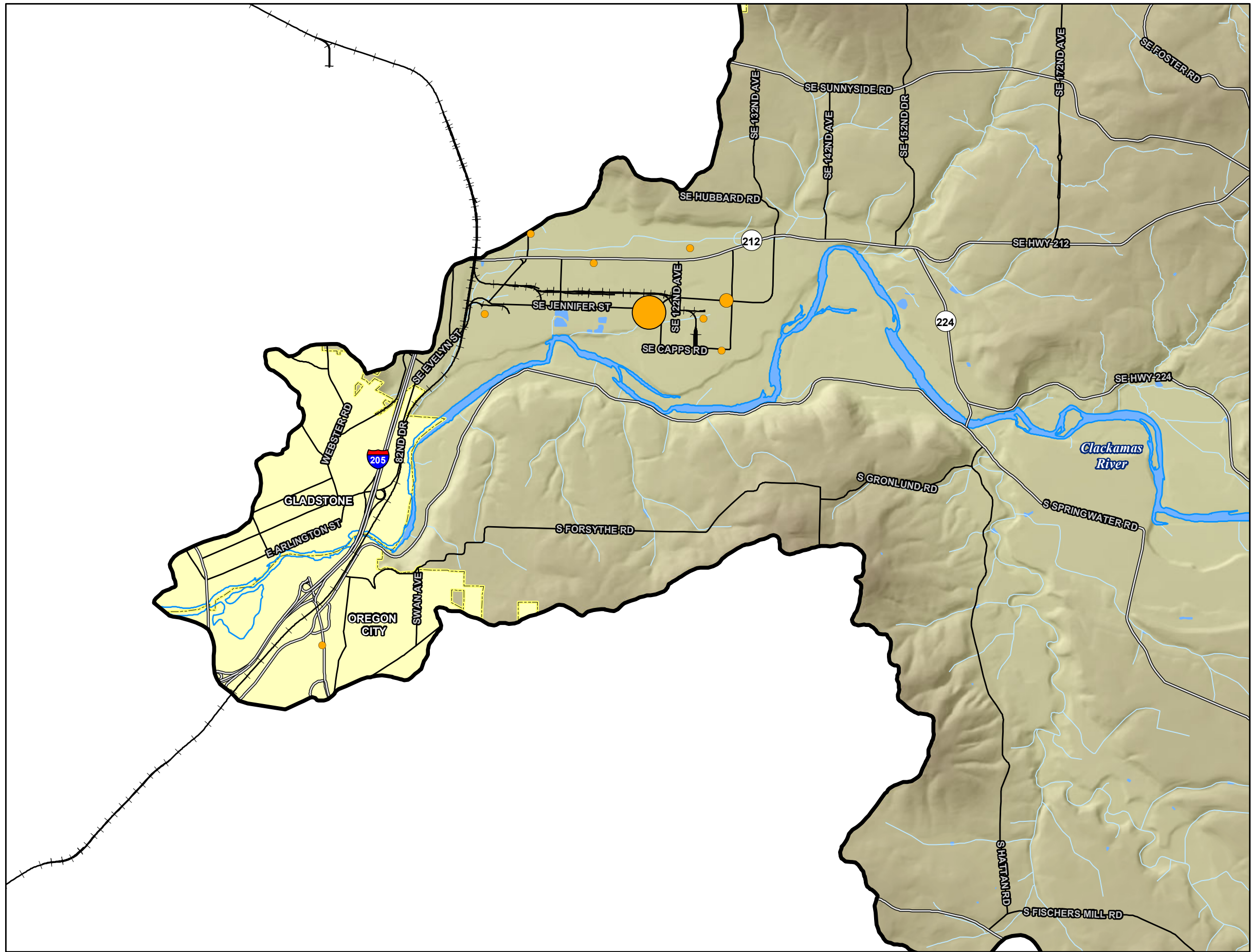
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Coordinates: Oregon State Plane North  
HARN NAD83 (feet)






Produced By: GIS (JAS)  
Project: K:\Projects\Y2010\10-04900-005\Project\Solvents.mxd (6/16/2015)




**Figure 12.**  
**Facilities Storing Reportable**  
**Quantities of Solvents: Total Gallons**  
**Transported to the Facility Annually.**


**Legend**


**Facilities storing solvents**


-  < 5,000 gallons
-  5,000 to 10,000 gallons
-  10,000 to 50,000 gallons
-  50,000 to 100,000 gallons
-  > 100,000 gallons

 Highway or major arterial

 Arterial

 County boundary


 Clackamas River Watershed boundary

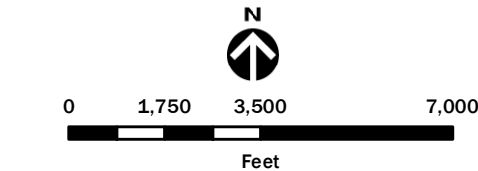
 City limits

 River

 Waterbody

 Stream

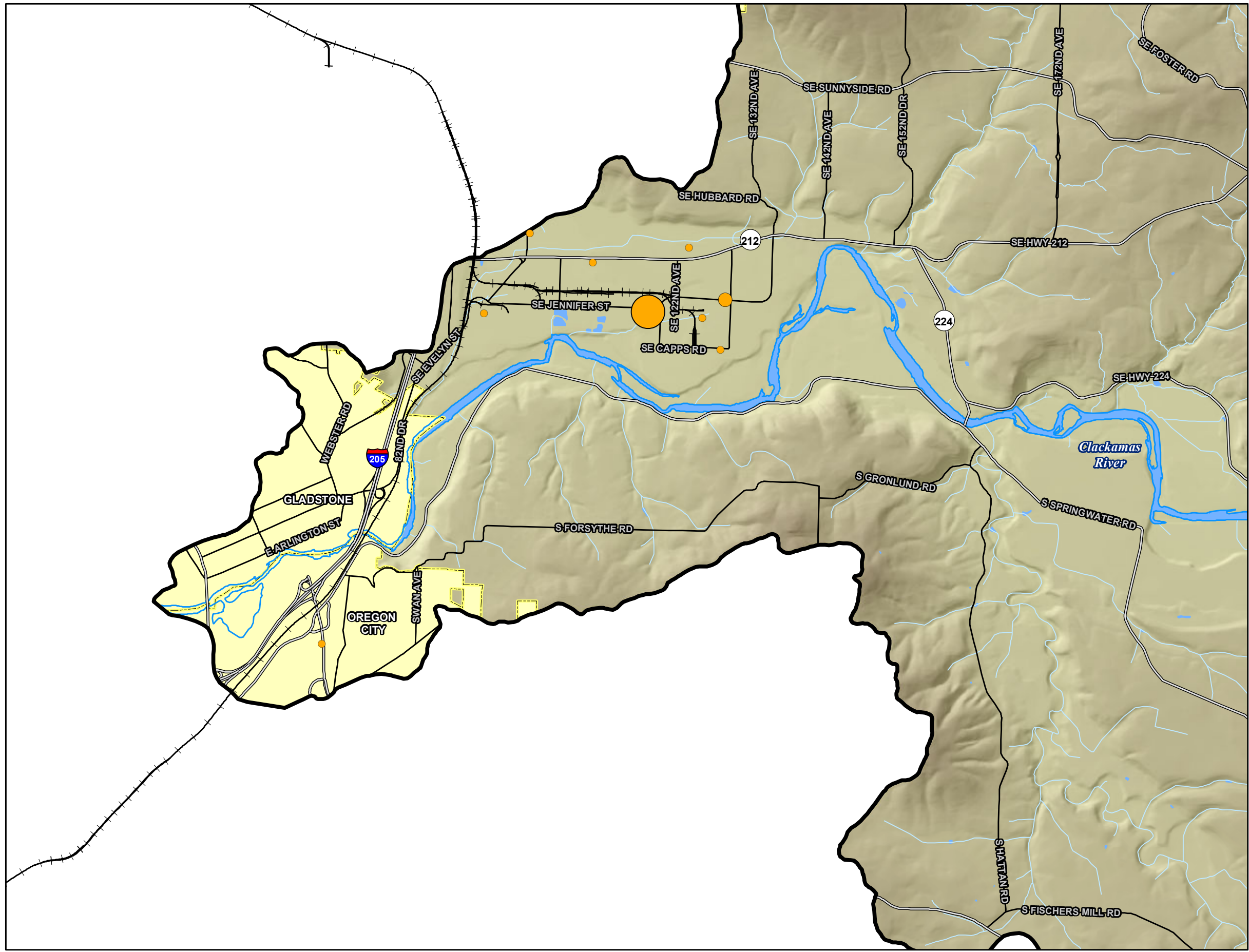
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Coordinates: Oregon State Plane North  
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**Figure 13.**  
**Facilities Storing Reportable**  
**Quantities of Solvents: Total Gallons**  
**Transported from the Facility**  
**Annually.**


**Legend**


**Facilities storing solvents**


-  < 5,000 gallons
-  5,000 to 10,000 gallons
-  10,000 to 50,000 gallons
-  50,000 to 100,000 gallons
-  > 100,000 gallons

 Highway or major arterial

 Arterial

 County boundary


 Clackamas River Watershed boundary

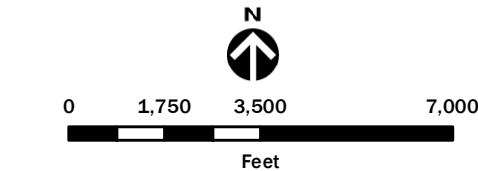
 City limits

 River

 Waterbody

 Stream

 National Forest boundary

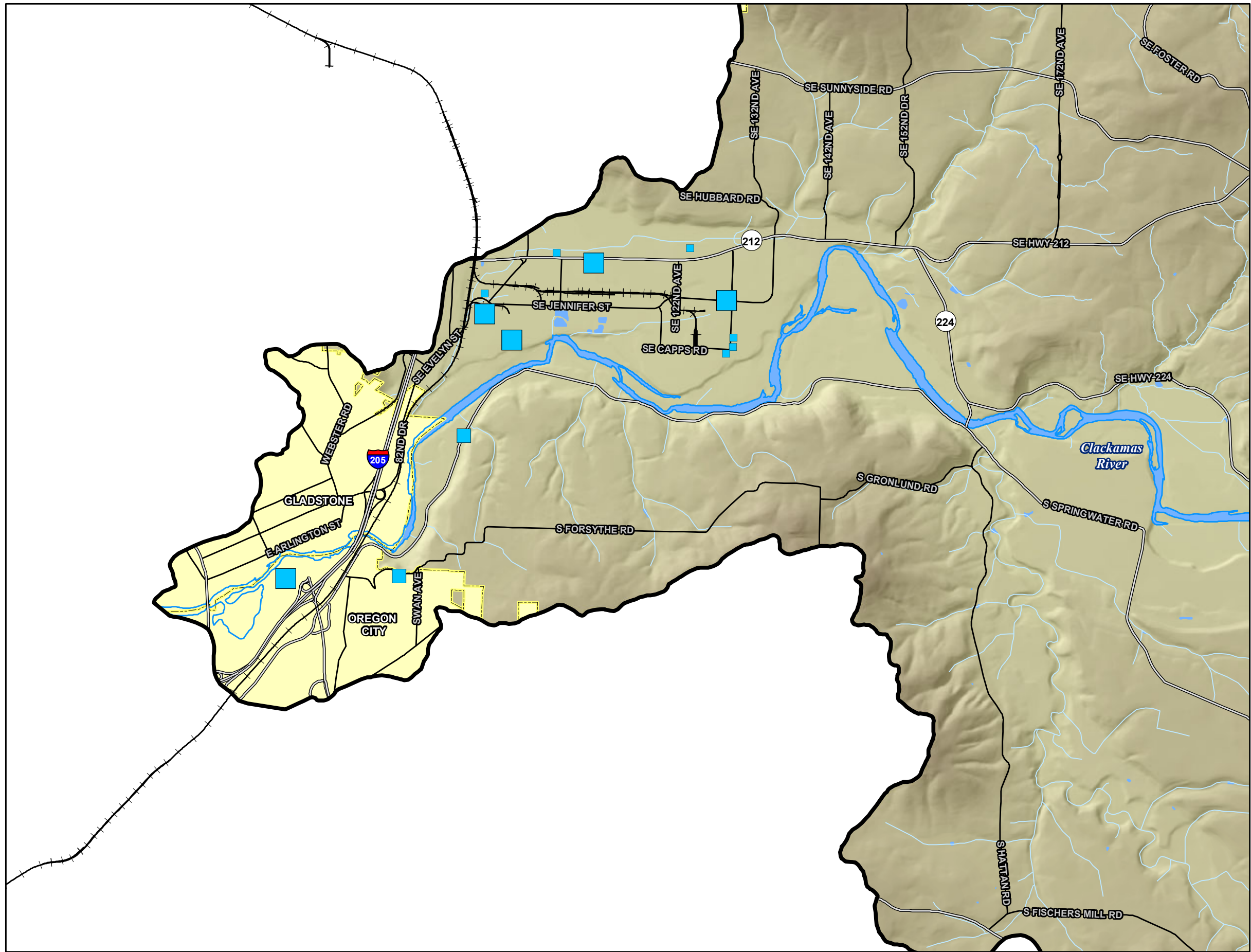


Coordinates: Oregon State Plane North  
HARN NAD83 (feet)

Produced By: GIS (JAS)  
Project: K:\Projects\Y2010\10-04900-005\Project\Solvents.mxd (6/16/2015)













**Figure 15.**  
**Facilities Storing Reportable**  
**Quantities of Acids or Bases:**  
**Maximum Gallons Stored Onsite.**

**Legend**


**Facilities storing acids and bases**

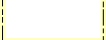
-  < 5,000 gallons
-  5,000 to 10,000 gallons
-  10,000 to 50,000 gallons
-  50,000 to 100,000 gallons
-  > 100,000 gallons

 Highway or major arterial

 Arterial

 County boundary


 Clackamas River Watershed boundary

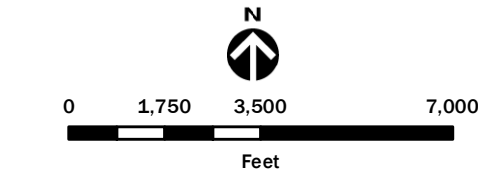
 City limits

 River

 Waterbody

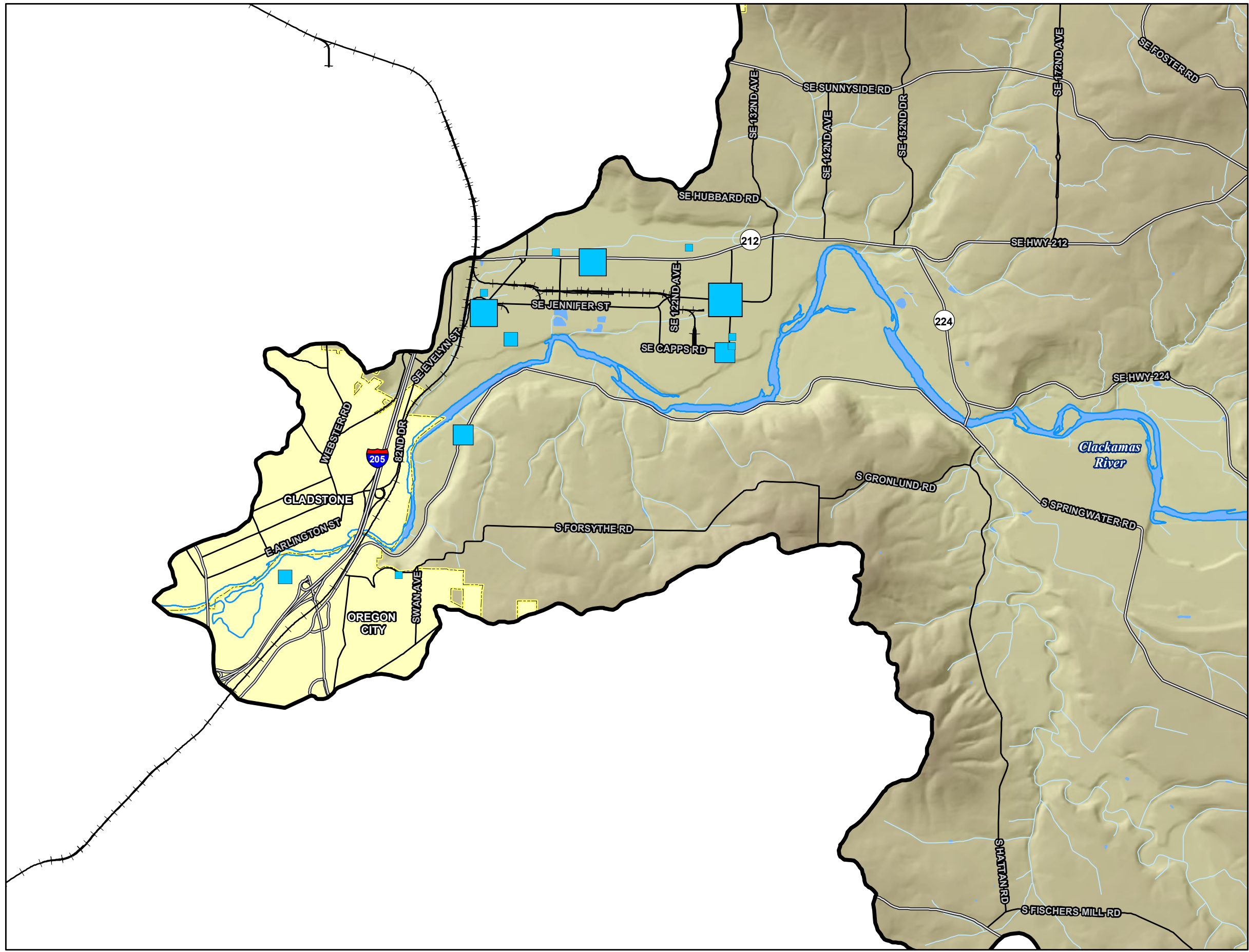
 Stream

 National Forest boundary



Coordinates: Oregon State Plane North  
HARN NAD83 (feet)

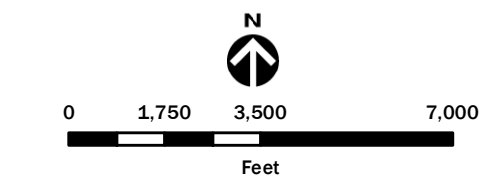
Produced By: GIS (JAS)  
Project: K:\Projects\Y2010\10-04900-005\Project\Acids\_and\_Bases.mxd (6/16/2015)



**Figure 16.**  
**Facilities Storing Reportable**  
**Quantities of Acids or Bases:**  
**Total Gallons Transported**  
**to the Facility Annually**

**Legend**

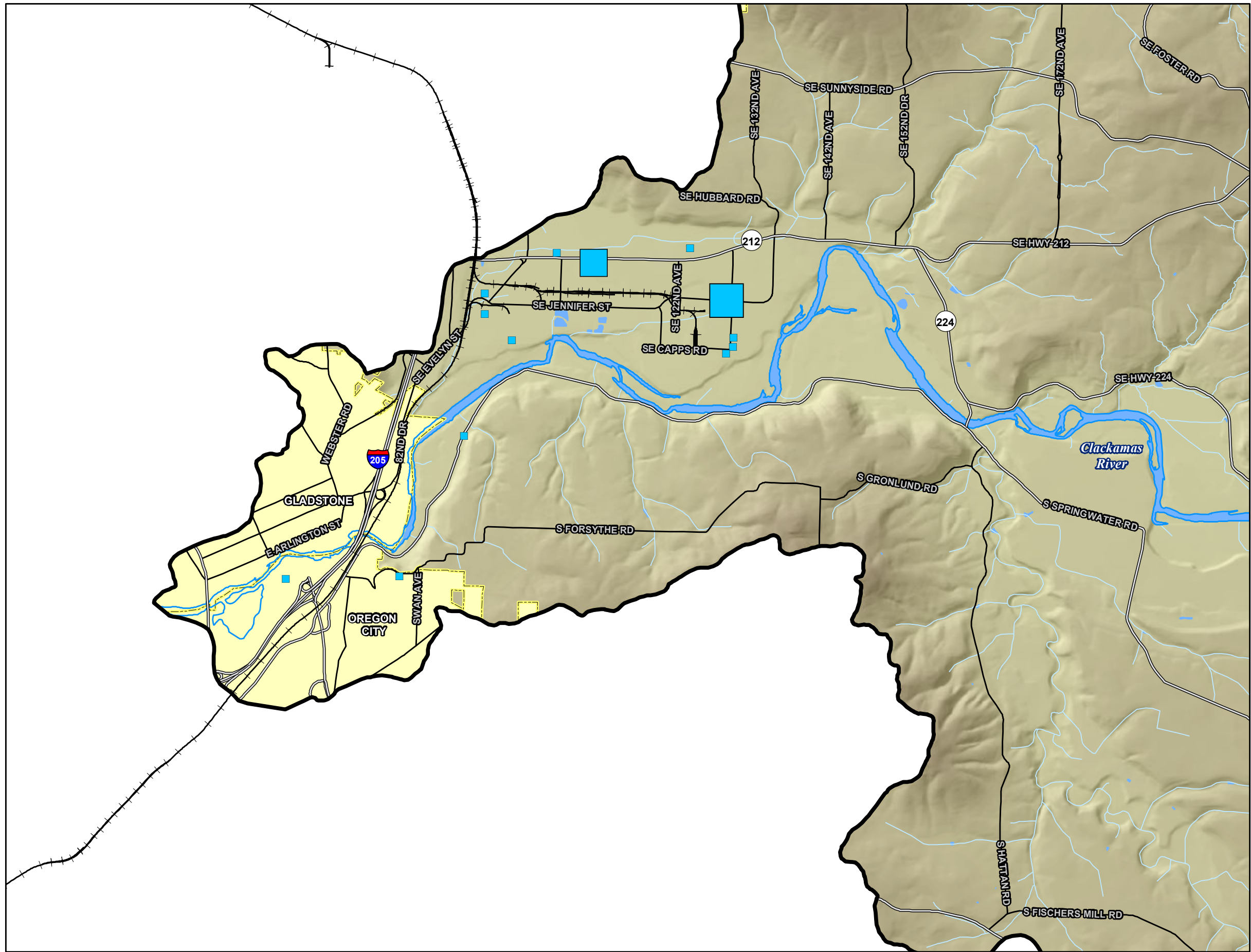
- Facilities storing acids and bases
- < 5,000 gallons
  - 5,000 to 10,000 gallons
  - 10,000 to 50,000 gallons
  - 50,000 to 100,000 gallons
  - > 100,000 gallons
- Highway or major arterial
- Arterial
- County boundary
- Clackamas River Watershed boundary
- City limits
- River
- Waterbody
- Stream
- National Forest boundary



Coordinates: Oregon State Plane North  
HARN NAD83 (feet)

Produced By: GIS (JAS)  
Project: K:\Projects\Y2010\10-04900-005\Project\Acids\_and\_Bases.mxd (6/16/2015)





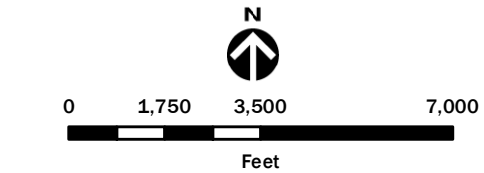
**Figure 17.**  
**Facilities Storing Reportable**  
**Quantities of Acids or Bases:**  
**Total Gallons Transported**  
**from the Facility Annually**

**Legend**

**Facilities storing acids and bases**

- < 5,000 gallons
- 5,000 to 10,000 gallons
- 10,000 to 50,000 gallons
- 50,000 to 100,000 gallons
- > 100,000 gallons

- Highway or major arterial
- Arterial
- County boundary
- Clackamas River Watershed boundary
- City limits
- River
- Waterbody
- Stream
- National Forest boundary



Coordinates: Oregon State Plane North  
HARN NAD83 (feet)

Produced By: GIS (JAS)  
Project: K:\Projects\Y2010\10-04900-005\Project\Acids\_and\_Bases.mxd (6/16/2015)

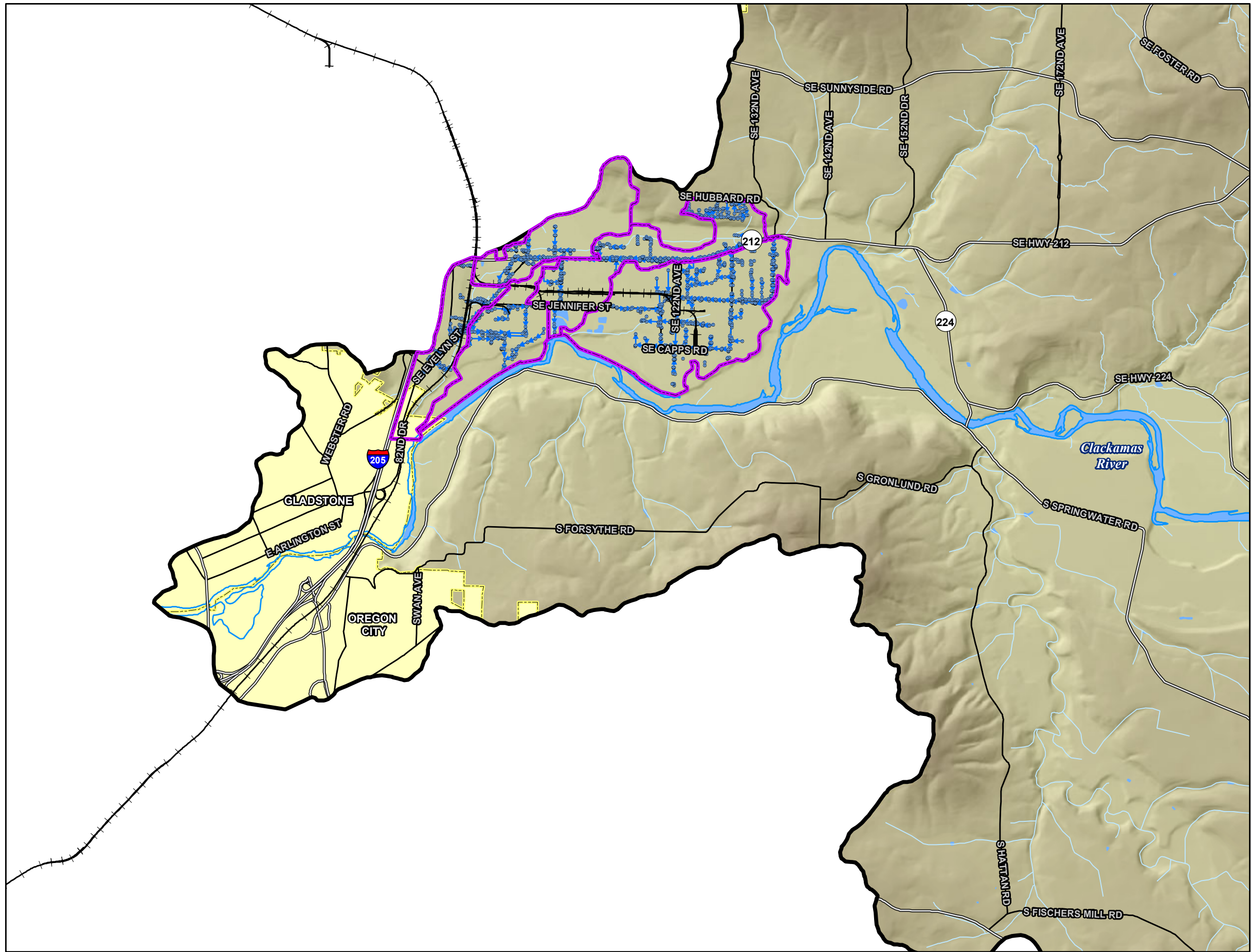
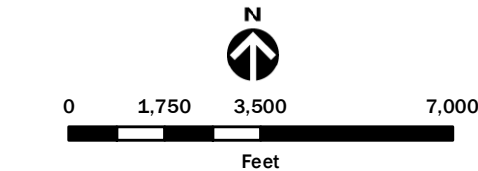


Figure 18.  
Drainage Areas and Stormwater  
Infrastructure.

Legend

- Approximate drainage area
- Stormwater structures
- Stormwater pipes
- Railroad
- Highway or major arterial
- County boundary
- Clackamas River Watershed boundary
- City limits
- River
- Waterbody
- Stream
- National Forest boundary



Coordinates: Oregon State Plane North  
HARN NAD83 (feet)

Produced By: GIS (JAS)  
Project: K:\Projects\Y2010\10-04900-005\Project\Drainage\_Infrastructure.mxd (6/16/2015)