Herrera Environmental Consultants, Inc.

Final Memorandum

To	Kimberly Swan, Clackamas River Water Providers
From	Jennifer Schmidt, Herrera Environmental Consultants
Date	May 31, 2012
Subject	GIS Point Source Pollutant Risk Analysis Results

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. In 2010, the CRWP developed a Drinking Water Protection Plan that outlined a series of strategies and programs to address potential threats to source water quality in the Clackamas River watershed. Herrera Environmental Consultants (Herrera) was hired to complete a series of geographic information system (GIS) analyses in order to help to identify potential pathways for pollutant export from the Clackamas River Watershed. The following major high-risk activity categories were identified in the Drinking Water Protection Plan (Clackamas River Water Providers 2010):

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

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 will provide a spatial context for both the geography and intensity of risk by activity that can be used by the CRWP help prioritize mitigation efforts. This memorandum focuses specifically on the methods and results of the GIS Point Source Pollutants Risk Assessment portion of the Drinking Water Protection Plan.

Potential Threats from Point Source Pollutants

The Clackamas River Water Providers (CRWP) has identified the need to implement a point source pollution subprogram to "inventory, track, evaluate, and monitor point sources (water quality and other permits) of potential pollution to understand these potential threats and work

with regulatory agencies, facilities, and permittees to reduce the potential threat to drinking water" in the Clackamas River watershed (Clackamas River Water Providers 2010). The U.S. Environmental Protection Agency (EPA) defines point source pollution as "any discernible, confined and discrete conveyance, including but not limited to any pipe, ditch, channel, tunnel, conduit, well, discrete fissure, container, rolling stock, concentrated animal feeding operation, or vessel or other floating craft, from which pollutants are or may be discharged" (EPA 2012).

Risks to source water quality from fixed point source pollution in the Clackamas River watershed include contaminant releases to groundwater and surface water, hazardous spills, and effluent discharges. Much of point source pollution in Oregon is regulated under the U.S. Clean Water Act through National Pollution Discharge Elimination System (NPDES) permits (Clackamas River Water Providers 2010); there are, however, several other types of permits and reporting procedure requirements for point source facilities in the Clackamas River watershed that may be useful for assessing the overall threat to source water quality in the Clackamas River watershed. These include hazardous waste generators; environmental cleanup site information (ECSI); underground storage tanks (UST); landfills and other solid waste generators; underground injection controls (UIC); and water pollution control facilities (WPCF).

GIS Point Source Pollutants Risk Analysis

Herrera performed a GIS analysis obtaining and mapping the locations of point source pollutant facilities in the Clackamas River watershed to help predict the overall potential risk to source water quality based on high density clustering of point source facilities. The primary objectives of this analysis were to:

1. Identify point source pollutant permitting and reporting requirements in Oregon.

2. Obtain the locations of point source facilities that have to comply with these requirements and map their distribution in the Clackamas River watershed.

3. Use the results of this analysis to identify and overlay areas in the watershed with the highest concentration of permitted point source facilities with surface water proximity to produce a map of cumulative predicted risk to source water quality from point source pollutants in the Clackamas River watershed.

The following sections provide more detailed information on this analysis, including data sources used and limitations, permit and regulatory program background information, requirements, and facility distribution in the watershed, and methodology for calculating cumulative point source pollutant risk.

Data Sources and Limitations

The primary data sources used to assess the risk of point source pollutants to source water quality in the Clackamas River watershed are the Oregon Department of Environmental Quality (DEQ) Facility Profiler and Underground Injection Control (UIC) databases. The following sections

describe these two databases in more detail, including any major limitations that are important to keep in mind when interpreting the GIS point source pollutant risk analysis results.

Oregon DEQ Facility Profiler Database

The Oregon DEQ Facility Profiler is a web-based database that contains information maintained by DEQ on regulated or permitted facilities and sites, including permitted air and water dischargers, hazardous and solid waste sites, cleanup sites, and leaking and underground storage tanks. Each regulated or permitted facility in the watershed contains a summary report with basic information about the facility as well as links to more specific information for each facility at the relevant DEQ or EPA program website. It is not uncommon for sites in the Facility Profiler database to belong to multiple programs. A list of these facilities with latitude and longitude information was extracted from the database and mapped in GIS by program.

It is important to keep in mind that site information in the Facility Profiler database is primarily summary in nature and does not include detailed site-specific information such as NPDES permitted discharge amounts. Without detailed facility-specific permit information, it is difficult to accurately compare the magnitude of risk between facilities; therefore the focus of this risk analysis was on identifying clustering of facilities rather than relative discharge rates. The amount of information available in the database varies significantly by program; full site-specific records can be obtained for an individual facility from DEQ on request.

Underground Injection Control (UIC) database

A summarized database of Underground Injection Control (UIC) sites is available online and is updated by DEQ on a weekly basis. One major limitation of the UIC database is that latitude and longitude information for a facility is not available without clicking on each individual record in the database. With approximately 200 UIC sites in Clackamas County, an individual review of each permit to obtain coordinate data for each site was not feasible. Instead, Herrera obtained a GIS shapefile of UIC sites that is current as of November 2009 from Oregon DEQ. If the results of this risk analysis indicate to the CRWP that UIC sites are of particular concern to source water quality in the Clackamas River watershed, Herrera recommends that a more in-depth analysis of the UIC database be completed to extract more current information on a site-by-site basis.

Methodology

This section describes the GIS methods used by Herrera to map regulated and permitted facilities in the Clackamas River watershed; and to assess the potential impact to source water quality from high-density clustering of all point sources in the watershed regardless of permit type or regulatory status.

Mapping National Pollutant Discharge Elimination System Permits

The Federal Water Pollution Control Act (Clean Water Act) and Oregon state law require any facility that discharges pollutants from a fixed point source location into wetlands, ponds, lakes, streams and rivers or to groundwater to obtain an NPDES permit. NPDES permits are categorized as either “individual” or “general”; individual permits are facility specific, while general permits cover a category of similar discharges rather than a specific site. Individual

permitted facilities require more frequent monitoring to assure that permit requirements are being met, and also have more stringent monitoring requirements for a greater variety of pollutants. According to the Oregon Department of Environmental Quality (DEQ), approximately 70% of individual NPDES permits are issued for the treatment and disposal of sewage (http://www.deq.state.or.us/wq/wqpermit/permitfaqs.htm).

General NPDES permits are issued by Oregon DEQ in more than 20 categories and regulate a wide range of discharges, including fish hatcheries, gravel mining, and petroleum hydrocarbon cleanups (http://www.deq.state.or.us/wq/wqpermit/indinfo.htm). Because these permits are regulated by a set of conditions for each category rather than by individual facility, they tend to require less oversight.

Herrera used information extracted from the Oregon DEQ Facility Profiler database to map 58 general and 8 individual active NPDES permits in 8 different categories in the Clackamas River watershed. Table 1 provides a summary of these permits by category; Figure 1 shows the distribution of permitted facilities in the watershed. Permitted Confined Animal Feed Operations (CAFOs) are addressed in the GIS Agricultural Activities Risk Analysis Results memorandaum.

Table 1. Number of active NPDES permits issued by permit type in the Clackamas River watershed.

NPDES Permit Category	Permit Type	Number of Active Permits
General	GEN01: Cooling water/heat pumps	1
	GEN02: Filter backwash	2
	GEN1200A Stormwater: Sand, gravel, and other non-metallic mining	2
	GEN1200C Stormwater: Construction activities – 1 acre or more	34
	GEN 1200Z: Industrial stormwater	19
Individual	Domestic wastewater treatment facility	5
	Industrial stormwater discharges	1
	Industrial wastewater discharges	2

Source: Oregon DEQ Facility Profiler database (May 2012)

As shown in Figure 1, the largest geographic concentration of facilities with active NPDES permits in the Clackamas River watershed is from the Highway 212/224 junction downstream to the mouth of the watershed in the City of Gladstone.

Mapping Water Pollution Control Facilities (WPCF) Permits

WPCF permits are required by Oregon DEQ for all facilities that discharge wastewater to the ground (http://www.deq.state.or.us/wq/wqpermit/permitfaqs.htm). The primary purpose of a WPCF permit is to protect groundwater from contamination and to prevent discharges to surface waters; no discharge to surface water is allowed under a WPCF permit. As with the NPDES program, WPCF permits are issued as either "individual" or "general"; they prevent groundwater

contamination from facilities like wastewater lagoons and onsite sewage disposal systems. General WPCF permits are issued in approximately a dozen categories.

Herrera used information extracted from the Oregon DEQ Facility Profiler database to map 7 general and 32 individual active WPCF permits in 6 different categories in the Clackamas River watershed. Table 2 provides a summary of these permits by category; Figure 1 shows the distribution of permitted facilities in the watershed

Table 2. Number of active WPCF permits issued by permit type in the Clackamas River watershed.

WPCF Permit Category	Permit Type	Number of Active Permits
General	GEN 1400A: Wineries, seasonal crop preparation, and fresh pack produce	2
	GEN 1400B: Canneries, food/animal processing, and extracts	1
	GEN1000: Gravel mining	4
Individual	Domestic on-site sewage system	29
	Domestic wastewater treatment facility	2
	Industrial wastewater discharges	1

Source: Oregon DEQ Facility Profiler database (May 2012)

As shown in Figure 1, the geographic distribution of active WPCF permits in the watershed is more dispersed than the NPDES permits are; this is likely due to the fact that the majority of the WPCF permits issued are for domestic on-site sewage systems in the portion of the watershed that is outside of treated sewer districts.

Mapping Environmental Contaminant Site Information (ECSI)

The Oregon DEQ ECSI database has been used by DEQ since 1989 to 1) track sites in Oregon with known or potential contamination from hazardous substances in groundwater, surface water, soil, or sediments; and 2) document sites where DEQ has determined that no further clean-up action is required ((http://www.deq.state.or.us/lq/ecsi/ecsi.htm). Sites contaminated or potentially contaminated with hazardous materials (solvents, metals, PCVs, petroleum hydrocarbons, etc.) that are added to the ECSI are reported to DEQ through a variety of sources, including investigative efforts; referral from other DEQ programs or agencies; reports of chemical spills; citizen complaints; and data submitted voluntarily by sites owners and operators. ECSI includes both potentially contaminated sites as well as sites known to be contaminated; therefore it is important to keep in mind that inclusion in the ECSI database does not necessarily confirm site contamination.

No regulatory significance is attached to the ECSI database itself; however, two subcategories of sites on the ECSI, the Confirmed Release List (CRL) and Inventory of Hazardous Substances (Inventory), do carry regulatory significance (http://www.deq.state.or.us/lq/ecsi/ecsifaq.htm#KindOfInfo). Sites are added to the CRL when a hazardous release has been confirmed, regardless of the quantity, potential impacts, or clean-up

actions taken; sites are added to the Inventory when removal or remedial action are needed to protect human health or the environment (http://www.deq.state.or.us/lq/ecsi/listing.htm). Sites can be removed from the CRL and Inventory following a formal delisting process, whereas sites are not removed from the ECSI database following remediation.

Herrera used information extracted from the Oregon DEQ Facility Profiler database to map 56 ECSI sites in the Clackamas River watershed; 10 of these sites are included on either the CRL or Inventory, and 17 sites require no further clean-up action. Figure 2 shows the distribution of these sites in the watershed. As shown in Figure 2, the largest geographic concentration of ECSI sites is from the Highway 212/224 junction downstream to the mouth of the watershed in the City of Gladstone, including 60% of sites listed on the CRL or Inventory. Potentially contaminated sites in the rest of the watershed tend to be concentrated primarily around highways and major arterials.

Mapping Hazardous Waste Generators

Hazardous waste generators in Oregon are regulated by U.S. EPA and Oregon DEQ and fit into the following three categories: 1) Conditionally Exempt Generators (CEG); 2) Small Quantity Generators (SQG); and 3) Large Quantity Generators (LQG). Table 3 provides a summary of the criteria used to determine what category a facility falls in. Under the federal Resource Conservation and Recovery Act (RCRA), all SQG and LQG facilities must notify DEQ of hazardous material activity and be assigned a DEQ/EPA identification number prior to treating, storing, disposing of, transporting, or offering for transportation any hazardous materials. CEG facilities are not required to notify DEQ, although many do "as an aid to record keeping and to obtain the identification number necessary to ship hazardous waste off-site for recycling or for permanent disposal" (DEQ 2007).

All SQG and LQF facilities are required to submit an annual report to DEQ by March 1st providing a summary of activities performed in the previous calendar year (http://www.deq.state.or.us/lq/hw/hwrptonlineforms.htm). These facilities are also required to comply with the Oregon Toxic Use and Hazardous Waste Reduction Act of 1989 (most recently revised in 2005) mandating pollution prevention planning. CEQ facilities may, but are not required, to join the Toxics Use and Hazardous Waste Reduction program (http://www.deq.state.or.us/lq/hw/tuhwr.htm).

Herrera used information extracted from the Oregon DEQ Facility Profiler database to map 57 hazardous waste generators in the Clackamas River watershed; 46 are CEQ facilities; 9 are SQG facilities; and 2 are LQG facilities. Figure 3 shows the distribution of these sites in the watershed. As shown in Figure 3, the largest geographic concentration of hazardous waste generators in the Clackamas River watershed are 1) in the area north of the Clackamas River near the junction of Highway 212/224 (including both LQG facilities); and 2) within the City of Sandy

Table 3. Criteria used for determine hazardous waste generator categories and associated regulatory requirements for facilities in the Clackamas River watershed.

Hazardous Waste Generator Category	Acute Hazardous Waste Generated	Hazardous Waste Generated	Spill Cleanup Containing Hazardous Waste Generated	Spill Cleanup Containing Acute Hazardous Waste Generated	Acute Hazardous Waste Onsite	Hazardous Material On-site
Conditionally Exempt Generator (CEG)	< 2.2 lbs[1]	< 220 lbs[1]	< 220 lbs[1]	---	---	< 2,200 lbs[2]
Small Quantity Generator (SQG)	---	220 to 2,200 lbs[1]	220 to 2,200 lbs[1]	---	---	> 2,200 lbs[2]
Large Quantity Generator (LQG)	> 2.2 lbs[1]	> 2,200 lbs[1]	> 2,200 lbs[1]	> 220 lbs[1]	2.2 lbs[2]	---

Source: DEQ (2007)

[1] Applies within any one calendar month.

[2] Applies at any time.

Mapping Solid Waste Disposal Sites and Landfill (SWIFT) Permits

Oregon DEQ requires the following types of facilities to apply for a Solid Waste Disposal Permit prior to starting operations (http://www.deq.state.or.us/lq/sw/permitswinstructions.htm):

- Municipal solid waste landfills;
- Industrial solid waste landfills, demolition landfills, wood waste landfills, and non-municipal land disposal sites;
- Energy recovery facilities and incinerators;
- Compositing facilities;
- Disposal site, land application disposal sites and land use for deposit, spreading, lagooning or disposal of sewage sludge, septage and other sludges;
- Transfer stations and material recovery facilities;
- Treatment facilities and petroleum contaminated soil remediation facilities

Herrera used information extracted from the Oregon DEQ Facility Profiler database to map 10 Solid Waste Disposal permits in the Clackamas River watershed, including 3 composting

facilities, 4 industrial facilities, and 3 municipal facilities. Figure 4 shows the distribution of these sites in the watershed. As shown in Figure, there is no significant clustering of facilities.

Mapping Underground Storage Tanks (UST) & Leaking Underground Storage Tanks (LUST)

The Federal Resource Conservation and Recovery Act (RCRA) and Oregon DEQ require an Underground Storage Tank (UST) General Permit Registration Certificate to Operate to be obtained for all commercial tanks storing gasoline, ethanol, diesel, and other listed substances with a capacity of more than 110 gallons or residential or farm use tanks with a capacity of more than 1,100 gallons. Only tanks with operating permit certificates are allowed receive fuel; tanks without operating permit certificates are not authorized to receive fuel and are considered out of service, including tanks with temporary closures (http://www.deq.state.or.us/pubs/permithandbook/ustpermits.htm).

The Oregon DEQ Leaking Underground Storage Tank (LUST) program handles issues related to the cleanup of soil and groundwater contamination from spills and releases from regulated USTs. If it is necessary to treat petroleum-contaminated soil from a LUST, the UST owner is required to obtain a Solid Waste Letter of Authorization (SWLA) permit from DEQ (http://www.deq.state.or.us/pubs/permithandbook/ustpcs.htm). Since Oregon began administering the federal LUST program in 1998, over 6,800 petroleum releases have been reported to DEQ. Approximately 5,400 of these sites have been cleaned up, leaving 1,400 active sites throughout the state. Oregon DEQ issues a "no further action" letter to a site when all regulatory cleanup requirements have been met (http://www.deq.state.or.us/lq/tanks/lust/costrecovery.htm).

Herrera used information extracted from the Oregon DEQ Facility Profiler database to map 65 active USTs with capacities ranging from 500 to more than 20,000 gallons. Many facilities have more than one active UST onsite. Herrera also mapped 487 active LUST sites; 44 of these have been reported to DEQ but have not had any cleanup, 52 are listed as having some cleanup started, and 391 are listed as having completed cleanup but have not been issued "no further action" letters. 76 of the LUST sites are regulated by DEQ, and 411 are non-regulated (i.e. heating oil tanks).

The distribution of UST and LUST sites are shown in Figure 5. As shown in Figure 5, the largest concentration of permitted USTs is a cluster of 26 tanks upstream of the surface water intakes near the junction of Highway 212/224 downstream to the mouth of the watershed in the City of Gladstone. The largest concentration of regulated LUSTs are 1) immediately north and northeast of the Clackamas River Water surface water intake; 2) on both sides of the Clackamas River near the Lake Oswego Municipal Water surface water intake; and 3) west of the intersection of SE 242nd Ave and Highway 212.

Underground Injection Controls (UIC)

Injection systems are any man-man design, structure, or activity which discharges below the ground or subsurface. Most UIC systems in Oregon are shallow and widely used to dispose of stormwater, including rainfall runoff and snowmelt and from properties, streets, and parking lots owned and operated by public or private entities. Business and industries may also use injection

systems to dispose of water that has come in contact with any raw material, product, by-product, or waste during manufacturing or processing (http://www.deq.state.or.us/wq/uic/uic.htm). Common UIC system designs include wells that are dry except when injecting fluids, trenches, perforated piping, sumps, drain fields, drill holes, and floor drains.

All UIC systems in Oregon must be registered with and approved by Oregon DEQ, either through issuance of an authorization by rule or a Water Pollution Control Facility (WPCF) permit. If an owner or operator cannot obtain DEQ approval, the system must be formally closed (http://www.deq.state.or.us/wq/uic/uic.htm). The following registration statuses may apply to UICs at various times during their operation:

- **Denied:** Failed to meet requirements and/or required data; non-compliant with state and/or federal rules;
- **Cleanup Site:** Listed on the state cleanup database as needing remediation; most are not registered and are non-compliant; no new UICs can be allowed and those existing must go through cleanup or be closed;
- **Incomplete or Information Request:** Failed to turn in required data; non-compliant.
- **Not Registered:** Site identified as having UICs as a result of site inspection, building permit application, complaints, or other means; non-compliant;
- **Registered and Rule Authorized:** Meets state and federal requirements; DEQ letter sent to owner and municipality;
- **Registered Only or Entered Old:** May predate existing rules and fails to meet all rule authorization requirements or partially completed registration with failure to submit all data; does not quality to operate; non-compliant with state/federal rules;
- **Permit:** Applied for a permit or is operating under a WPCF permit; compliant;
- **To clean up, ICP/VCP:** Site found during review to be contaminated; referred to cleanup and added to the cleanup database; must be remediated before existing or new UICs can be allowed or existing UICs must be closed;
- **Under Review:** Registration forms sent in and data entered; awaiting review;
- **Abandoned:** Cannot document that the UIC was closed following existing rules (state/federal) to protect groundwater; may be contaminated; liable for further fines, fees, cleanup, or enforcement;
- **Decommissioned or Closed:** DEQ received and approved closure to meet federal and state standards; compliant.

Herrera obtained and mapped a list of 198 UICs in the Clackamas County watershed from Oregon DEQ that is current as of November 2009. The number of UICs by registration status is provided in Table 4; the distribution of these features in the Clackamas River watershed is shown in Figure 6.

Table 4. Number of UICs by registration status in the Clackamas River watershed.

UIC Registration Status	Number of Underground Injection Controls (UICs)
Applied for Permit	95
Decommissioned or Closed	5
Denied	1
Incomplete or Information Request	2
Needs Permit	4
Not Registered	4
Registered and Rule Authorized	37
Registered Only	17
Registered with Permit	32
To ICP/VCP	1

Source: Oregon DEQ (2009)

As shown in Figure 6, the largest geographic concentration of UICs in the Clackamas River watershed are located 1) immediately north and northeast of the Clackamas River Water surface water intake; and 2) downstream of the City of Estacada. Oregon DEQ is currently developing templates for writing UIC WPCF municipal and industrial/commercial permits (Clackamas River Water Providers 2010); in the future, the DEQ UIC database will be cross-linked to the Oregon Facility Profiler database to identify sites with state permits or those needing cleanup.

Calculating Aggregate Point Source Pollution Risk

After Herrera identified permitting and regulatory requirements for point source facilities and obtained and mapped the locations of each category of facility in the Clackamas River watershed, the next step completed was to run a GIS analysis estimating the cumulative potential risk to source water quality from permitted or regulated point sources in the watershed. This was accomplished using the following methodology.

First, Herrera created a grid of 1-acre polygons covering the entire watershed and the number of mapped point source facilities within each polygon was calculated. Each polygon was assigned a ranking of 1 to 5 based on the density permits or registrations, with a value of 1 indicating a lower risk from point source pollution to source water quality and a value of 5 indicating a higher risk. Then the distance to the nearest tributary to the Clackamas River was calculated for each facility and a similar ranking score was applied based on relative proximity. Table 5 shows the detailed ranking scheme applied to these two datasets.

After a ranking scheme had been applied, the final step was to convert each dataset to a raster grid with 10-meter pixels and overlay the grids together to calculate a cumulative risk value for each pixel and map the data into low, moderate, and high risk categories. The results of this analysis showing cumulative risk from point source facilities on source water quality in the Clackamas River are shown in Figure 7.

Table 5. Ranking and ranking criteria applied to each GIS dataset to determine the risk from point source pollutants to source water quality in the Clackamas River watershed.

Dataset	Ranking Factor	Ranking Criteria
Number of Permits or Facility Registrations Per Acre	1	1
	2 to 5	2
	6 to 10	3
	11 to 15	4
	> 15	4
Proximity to Surface Water	0 to 150 feet	5
	150 to 300 feet	4
	300 to 500 feet	3
	500 to 1,000 feet	2
	> 1,000 feet	1

Results and Recommendations

Herrera mapped approximately 1,050 point source pollution permits or facility registrations in the Clackamas River watershed. Many facilities in the watershed have permits or registrations in more than one category that contribute to this overall total. As indicated in Figure 7 the regions with the highest risk from point source pollutants are located 1) near the City of Estacada and 2) near the mouth of the watershed. It is important to keep in mind that this risk analysis is not based on specific discharge data and represents density of facilities and their proximity to surface water only. Additional surface monitoring efforts should be considered for the high risk areas to evaluate water quality. Where impaired water quality is detected, this risk analysis can be used to support pollutant source tracking efforts.

Herrera recommends that the GIS datasets used in this analysis be updated every two to three years to make sure that the status of all facilities are current and that facilities that have been added or removed from the Facility Profiler and UIC databases are reflected. The results of the GIS maps and cumulative density analysis could be used to help identify specific high-risk regions to focus on or permit or registration categories to analyze, and detailed permits could then be obtained from DEQ for each facility. This would allow for the mapping of discharge rates and would provide for a better representation of risk from individual facilities to source water quality in the Clackamas River watershed. These more detailed data could also be used as potential input for future modeling efforts to quantify the overall risk of water quality

impairment from point sources relative to other pathways (e.g., septic systems, agricultural areas).

References

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Oregon Department of Environmental Quality (DEQ). 2007. *Small Quantity Generator Handbook.* February 2007. Obtained May 25, 2012 from agency website: http://www.deq.state.or.us/lq/pubs/docs/hw/SQGHandbook/SQGChap06.pdf

U.S. Environmental Protection Agency (EPA). 2012. *What is Nonpoint Source Pollution?* March 6, 2012. Obtained May 25, 2012 from agency website: http://water.epa.gov/polwaste/nps/whatis.cfm

FIGURES

Figure 1.
National Pollutant Discharge Elimination System (NPDES) and Water Pollution Control Facility (WPCF) permits issued in the Clackamas River watershed.

Legend

National Pollution Discharge Elimination System (NPDES) permit

- GEN 01: Cooling water/heat pumps
- GEN 02: Filter backwash
- GEN 10: Gravel mining
- GEN 1200A: Sand gravel and other non-metallic mining
- GEN 1200C: Construction activities (1 acre or more)
- GEN 1200Z: Industrial stormwater
- GEN14A : Wineries, seasonal crop preparation, fresh pack produce
- GEN14B: Canneries, food/animal processing, extracts
- Industrial wastewater discharges
- MS4 stormwater
- Domestic wastewater treatment facilities

Individual Water Pollution Control Facility (WPCF) permit

- Domestic on-site sewage system
- Domestic wastewater treatment facility
- Individual wastewater discharges

- National Forest boundary
- City limits
- Clackamas River Watershed boundary
- Surface water intake

N

0 8,000 16,000 32,000

feet

Clackamas River Water Providers — Working together to protect and conserve our drinking water.

HERRERA

Coordinates: Oregon State Plane North
HARN NAD83 (feet)

Produced By: GIS (JAS)
Project:
K:\Projects\10-04900-001\Project\Result_Maps\Point_Source_Pollutants_Results_Extent.mxd (6/9/2012)

INSET A

Aerial: USDA (2009)

Figure 2.
Environmental Cleanup Site Information (ECSI), Contaminant Release List (CRL), and Inventory sites in the Clackamas River watershed.

Legend

Environmental Cleanup Site Information (ECSI)

- Site listed on Contaminant Release List (CRL) or Inventory
- Contaminated site: Suspect site requiring further investigation
- Contaminated site - no further action required
- Surface water intake
- City limits
- Clackamas River Watershed boundary
- National Forest boundary

N

0 8,000 16,000 32,000

feet

Clackamas River Water Providers
Working together to protect and conserve our drinking water.

HERRERA

Coordinates: Oregon State Plane North
HARN NAD83 (feet)

Produced By: GIS (JAS)
Project:
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Figure 3.
Hazardouse waste generators in the Clackamas River watershed.

Legend

Hazardous waste generator

- Conditionally exempt generator (CEG)
- Small quantity generator (SQG)
- Large quantity generator (LQG)
- Surface water intake
- City limits
- Clackamas River Watershed boundary
- National Forest boundary

N

0 8,000 16,000 32,000

feet

Clackamas River Water Providers
Working together to protect and conserve our drinking water.

HERRERA

Coordinates: Oregon State Plane North
HARN NAD83 (feet)

Produced By: GIS (JAS)
Project:
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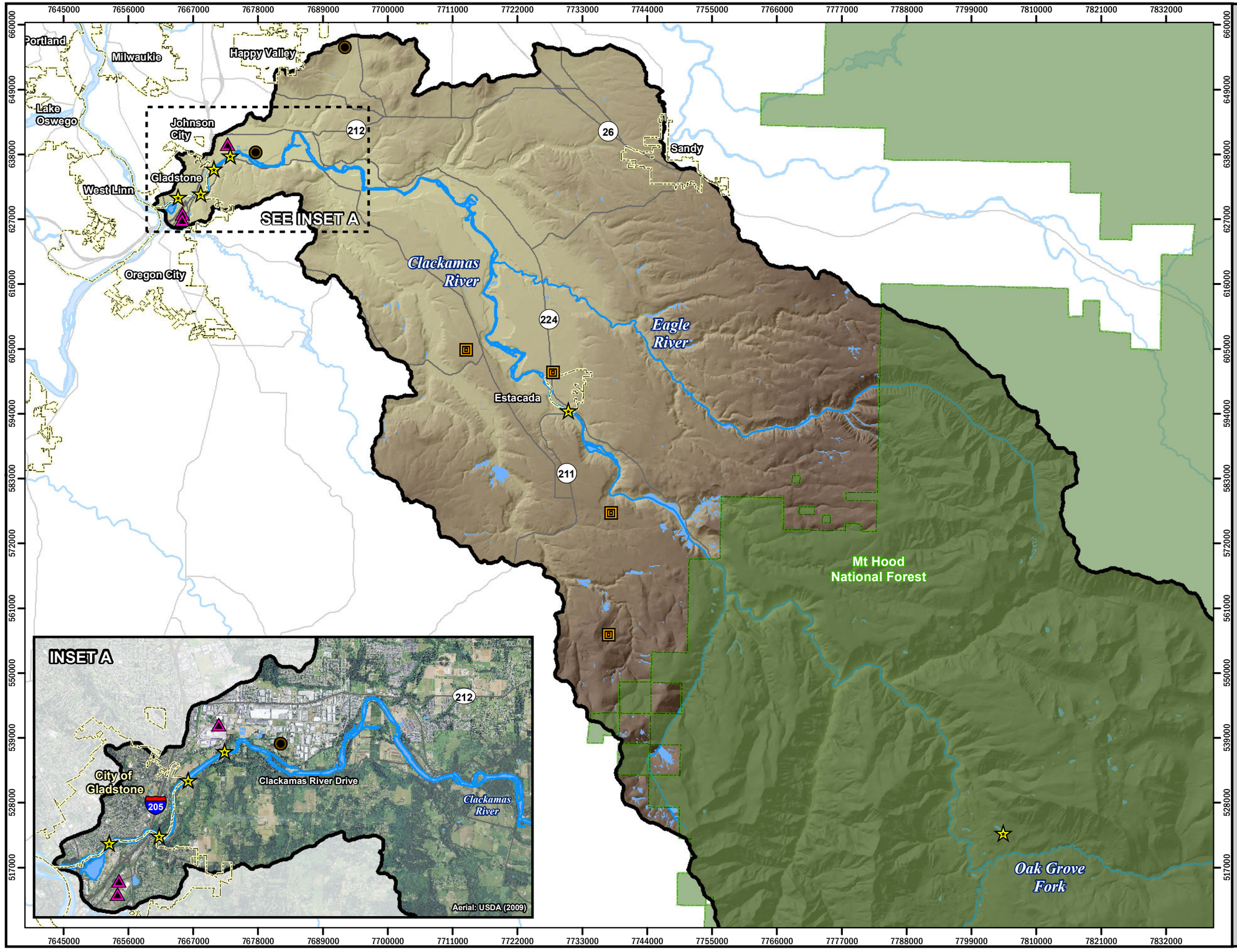
Figure 4.
Solid waste disposal site and landfill permits issued in the Clackamas River watesrhed.



Legend

Solid waste disposal site and landfill permits

- Compost
- Industrial
- Municipal
- Surface water intake
- City limits
- Clackamas River Watershed boundary
- National Forest boundary

N

0 8,000 16,000 32,000

feet

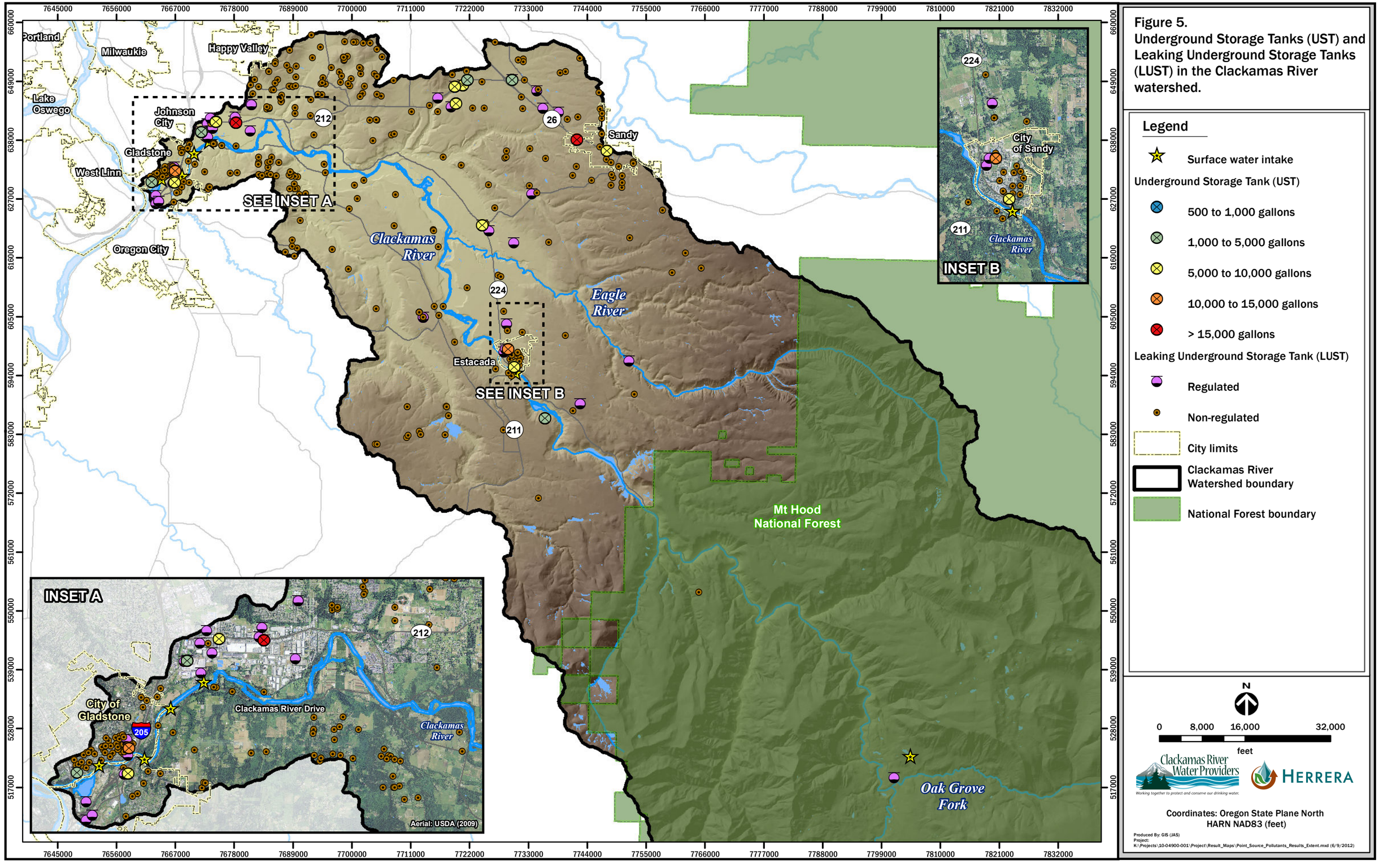
Clackamas River Water Providers
Working together to protect and conserve our drinking water.

HERRERA

Coordinates: Oregon State Plane North
HARN NAD83 (feet)

Produced By: GIS (JAS)
Project:
K:\Projects\10-04900-001\Project\Result_Maps\Point_Source_Pollutants_Results_Extent.mxd (6/9/2012)

Figure 5.
Underground Storage Tanks (UST) and Leaking Underground Storage Tanks (LUST) in the Clackamas River watershed.



Legend

- Surface water intake

Underground Storage Tank (UST)

- 500 to 1,000 gallons
- 1,000 to 5,000 gallons
- 5,000 to 10,000 gallons
- 10,000 to 15,000 gallons
- > 15,000 gallons

Leaking Underground Storage Tank (LUST)

- Regulated
- Non-regulated
- City limits
- Clackamas River Watershed boundary
- National Forest boundary

N

0 8,000 16,000 32,000

feet

Clackamas River Water Providers
Working together to protect and conserve our drinking water.

HERRERA

Coordinates: Oregon State Plane North
HARN NAD83 (feet)

Produced By: GIS (JAS)
Project:
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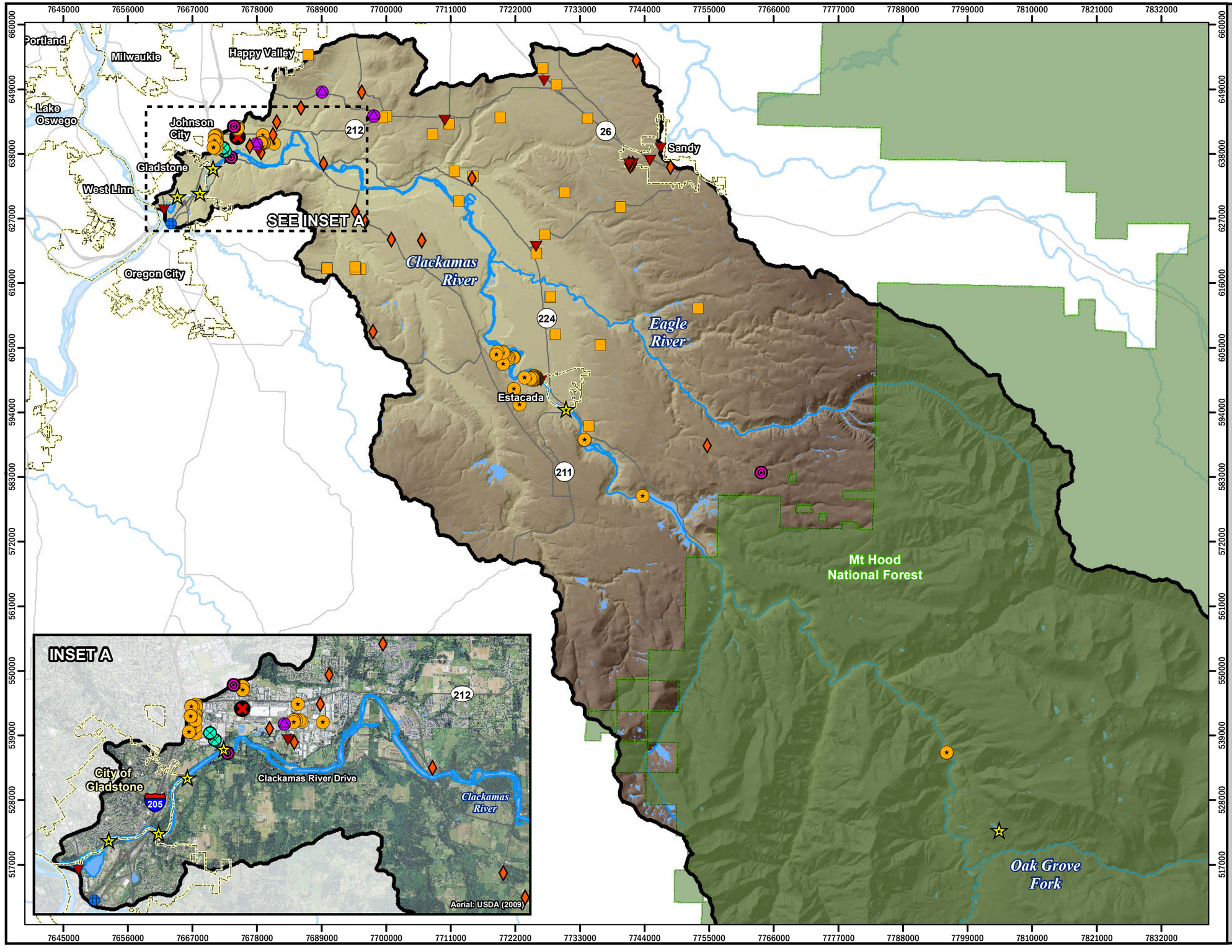

Figure 6.
Underground Injection Controls (UICs) registered with Oregon DEQ in the Clackamas River watershed.

Legend

Underground Injection Control (UIC) registration status

- Applied for permit
- Decommissioned or closed
- Denied
- Incomplete or information request
- Needs permit
- Not registered
- Registered and rule authorized
- Registered only
- Registered with permit
- ICP/VCP
- Surface water intake
- City limits
- Clackamas River Watershed boundary
- National Forest boundary

N

0 8,000 16,000 32,000

feet

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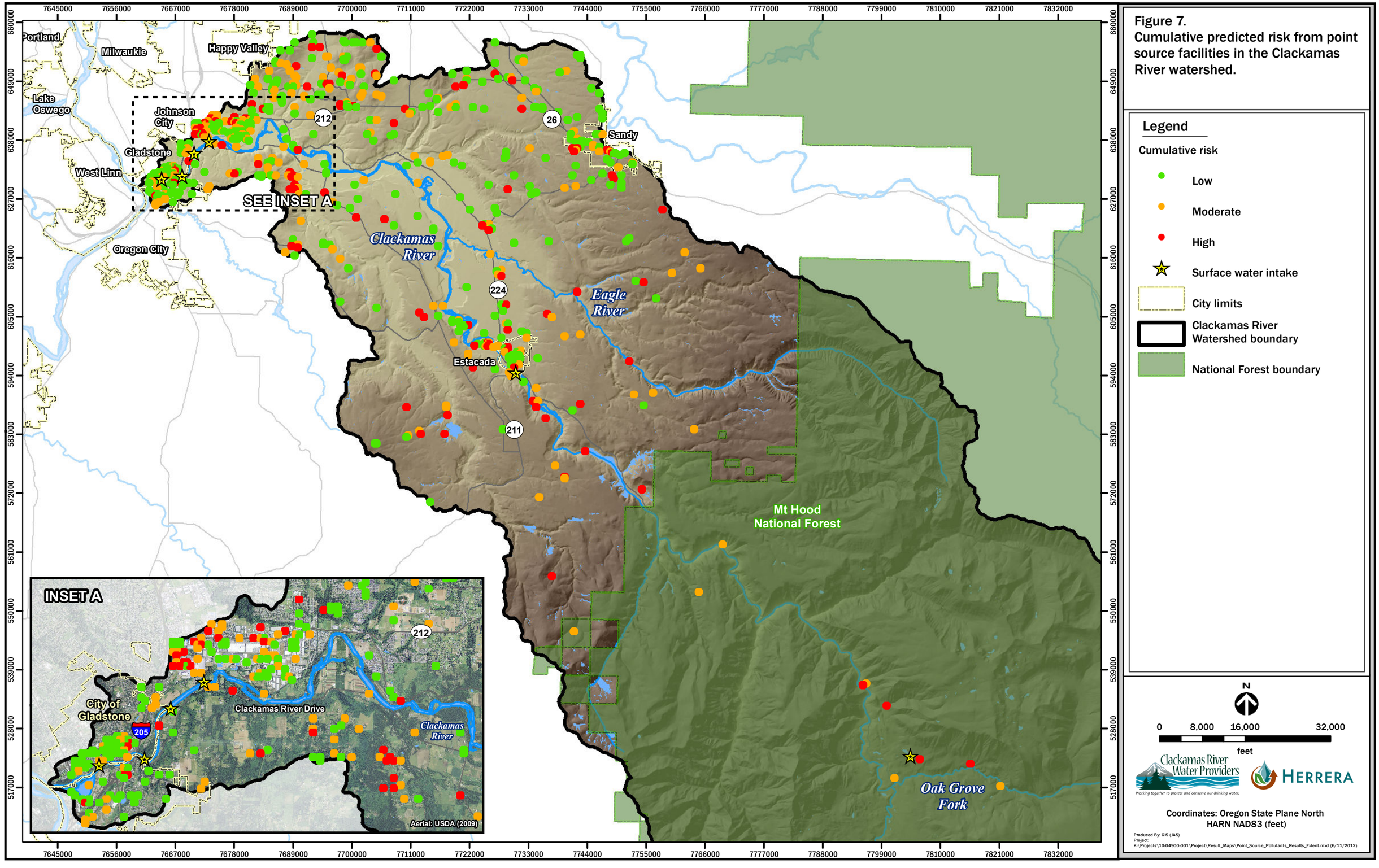

Figure 7.
Cumulative predicted risk from point source facilities in the Clackamas River watershed.

Legend

Cumulative risk

- Low
- Moderate
- High
- Surface water intake
- City limits
- Clackamas River Watershed boundary
- National Forest boundary

N

0 8,000 16,000 32,000

feet

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HERRERA

Coordinates: Oregon State Plane North
HARN NAD83 (feet)

Produced By: GIS (JAS)
Project:
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