

Subsurface Discharge of Treated Wastewater Effluent

Working Group

Final Report

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Table of Contents

EXECUTIVE SUMMARY2

BACKGROUND3

 GROUP CHARGE AND GOAL3

 PROCESS OF WORKING TOGETHER3

FOCUS ON ENVIRONMENTAL BENEFITS4

DESCRIPTION OF SYSTEMS4

REGULATORY FRAMEWORK5

 OREGON GROUNDWATER PERFORMANCE STANDARD5

Oregon Law5

Federal Regulations6

OREGON REGULATIONS6

 DEQ PERMITTING DECISION MAKING FOR SUBSURFACE DISCHARGE SYSTEMS6

 STATE GROUNDWATER PROTECTION REGULATIONS7

State Underground Injection Control (UIC) Regulations7

PILOT OR DEMONSTRATION PROJECT8

SUMMARY CHARTS8

 LEVEL OF INTEREST WITH OREGON MUNICIPALITIES8

REGULATORY OPTIONS9

AREAS OF REGULATORY FLEXIBILITY10

RECOMMENDATIONS11

POSSIBLE RULE REVISIONS11

APPENDIX A – WORKING GROUP MEMBERS13

APPENDIX B – DEQ CHART OF SUBSURFACE DISCHARGE PERMITTING REQUIREMENTS14

APPENDIX C – DEQ CHART OF GROUNDWATER PROTECTION REQUIREMENTS15

APPENDIX D – REGULATORY ISSUES SUMMARY CHART16

APPENDIX E – TECHNICAL ISSUES SUMMARY CHART17

Executive Summary

A group of selected Oregon Department of Environmental Quality (DEQ) Water Quality Managers and Oregon Association of Clean Water Agencies (ACWA) members met for 4 one-half day meetings to discuss the permitting issues associated with subsurface discharge of treated municipal effluent. The group detailed a number of different types of discharge systems that might be appropriate in Oregon, and provided details about permitting and technical issues associated with them.

It is the consensus of the group that subsurface discharge systems may be environmentally beneficial if installed correctly and in the right geographic and environmental conditions. The appropriate type of subsurface discharging system must be matched to the specific conditions of the site - - but in some locations, subsurface discharges that result in additional soil treatment and that improve the ecological water balance of the area by providing additional groundwater recharge may be environmentally preferred over conventional discharge solutions. Additional systems that use wetlands or bogs for treatment have the added benefit of providing improved habitat and ecological services for residents.

Background

Oregon municipalities are under pressure to meet increasingly difficult discharge limitations due to revisions in water quality standards, while pressure also mounts for retaining treated effluent in streams and rivers to augment flows, especially in summer low flow conditions.

Discharging treated effluent to the subsurface may be an environmentally sound practice that allows natural treatment and cooling of effluent, while retaining water in streams and recharging groundwater resources. Subsurface discharge is one component in identifying alternatives to direct surface discharge - - this is an important environmental tool for municipalities to meet current and pending environmental standards for temperature, nutrients, toxics, bacteria, the Endangered Species Act, increased stream flow in critical low-flow periods, to increase capacity for a growing communities, Total Daily Maximum Loads (TMDLs), and to provide infrastructure capacity at an affordable rate which is especially important for rural Oregon communities.

The ACWA/DEQ Subsurface Discharge Working Group was formed to review the status of subsurface discharge permitting options in Oregon, to outline environmental opportunities and concerns, and regulatory issues associated with subsurface discharge, and to reach consensus on the best path forward.

The facilitation and organization for the project was provided by ACWA.

Group Charge and Goal

Janet Gillaspie, Executive Director of ACWA, organized the group. She also staffed the working group and provided meeting facilitation.

Although initially organized to have 4 ACWA representatives and 4 DEQ representatives, shifts in DEQ staff resulted in a group of 7 total, with one DEQ seat empty.

The group included:

1. Bob Baumgartner, DEQ
2. Mark Cullington, DEQ
3. Mitch Wolgamott, DEQ
4. Anne MacDonald, URS
5. Darrell McLaughlin, City of Lebanon
6. Manny Molina, South Suburban Sanitary District
7. Sue Lawrence, City of Pendleton

The goal of the working group was to inventory possible subsurface discharge options for treated municipal wastewater effluent. For each of the discharge options, the state and applicable federal permitting pathway was identified and applicable environmental standards listed. The environmental opportunities and concerns were also listed. The types of information that should be included in a permit application were outlined. Environmental performance expectations likely included in a permit were identified. The other affected state and federal agencies were inventoried.

Process of working together

The group met in Portland for 4-hour meetings on

- January 29, 2004
- February 19, 2004
- February 25, 2004
- March 8, 2004.

The group worked on a consensus basis for developing its recommendations and report.

Focus on Environmental Benefits

There may be many environmental benefits of the subsurface discharge of treated effluent in the right geographical and environmental setting. The natural conditions of a specific site should be carefully evaluated when considering subsurface discharge options. Where site specific conditions warrant, subsurface discharge of treated effluent may provide a more cost effective means for municipalities to meet water quality standards that move beyond secondary treatment standards, while providing greater environmental benefit through natural treatment and cooling, increased stream flow, riparian and wildlife restoration, and groundwater recharge.

Using subsurface discharge options may provide a more comprehensive and sustainable concept for managing treated wastewater within the hydrologic cycle.

The group developed the following inventory of the potential benefits of using subsurface discharge of treated effluent. The benefits include:

- Allows water quality discharge standards for pollutants, such as temperature, to be met
- Uses water better for the environment and for the community by allowing treated effluent to recharge groundwater and receive additional treatment through the soil
- Views treated wastewater effluent as a resource and as an asset, not as a waste that must be disposed of as a liability
- Opportunities to incorporate benefits such as improved riparian and wildlife health, provide recreational opportunities, and increase stream flow into a single project, building more partnerships for projects that serve multiple purposes in a community, often building positive support for such projects with elected officials and community leaders
- Subsurface discharge options can be a more economical approach to meeting temperature standards; which is especially important in rural Oregon
- Maintains the hydrologic cycle, which in turn, may improve wildlife and riparian habitat
- Enhances other water quality ‘uses’ through good design
- Use the site conditions to find natural solutions, including subsurface discharge options
- Use of subsurface discharge options allowed by a well-developed state policy can help promote holistic thinking for managing water resources
- Improved quality of life – this option may improve the stewardship of environmental and community resources.

Description of systems

The group detailed these types of systems that may use subsurface discharge of treated effluent:

- Exfiltration Galleries
- Unlined Ponds or Lagoons
- Land Application over Agronomic Rates
- Hyporheic Injection (direct/indirect)
- Groundwater Recharge
- Rapid Infiltration
- Constructed Trenches
- Flood Channels
- Vertical Downflow (slow sand filter)
- Dry Wells
- Wetlands and Bogs
- Mounds

The systems can be sorted as below:

<i>Type of System</i>	<i>Hyporheic Zone discharge to Surface Water¹</i>	<i>Groundwater Recharge to aquifer</i>
Surface Discharge <i>Not likely regulated as an UIC²</i>		
Unlined ponds	✓	✓
Land application over agronomic rates	✓	
Rapid Infiltration	✓	✓
Constructed Trenches	✓	✓
Flood Channels	✓	
Irrigation Ditches	✓	✓
Wetlands	✓	
Subsurface Discharge <i>Likely regulated as an UIC</i>		
Exfiltration Galleries	✓	✓
Hyporheic Zone Discharge	✓	
Vertical Downflow	✓	✓
Drywells	✓	✓
Mounds	✓	✓
Aquifer Discharge <i>Likely regulated as an UIC</i>		
Groundwater Injection		✓

Regulatory Framework

All wastewater treatment systems operating in Oregon must have an environmental permit issued by DEQ. For facilities that do not discharge to surface “waters of the state”, a state Water Pollution Control Facilities (WPCF) permit is used. For facilities that discharge to surface water, DEQ issues a federal National Pollutant Discharge Elimination System (NPDES) permit.

Oregon Groundwater Performance Standard

Oregon law and Oregon regulations set the environmental performance standards for subsurface discharge systems.

Oregon Law

The controlling legislation is Oregon Revised Statutes (ORS) 468B.150 and 160. It requires that all groundwater be protected for both existing and future beneficial uses so that the state may continue to provide for whatever beneficial uses the natural water quality allows.

There is an antidegradation goal included in ORS 468B as the state directs groundwater resources be protected for beneficial uses - - including future beneficial uses. The law provides for standards, variances, and monitoring requirements for groundwater protection. All subsurface discharging systems considered in this report will be bound by this law - - ORS 468B - - and the performance standards it requires.

In Oregon, the Attorney General has ruled that all groundwater in the state is considered “waters of the state”; a public resource.

¹ Hyporheic zones are likely to impact surface water and would require a NPDES permit

² Not likely an UIC since the system is open to the air

Federal Regulations

Underground Injection Control devices (UICs) are permitted and regulated federally under the Safe Drinking Water Act. States are allowed to exceed federal regulations in designing their programs. The applicable federal regulations are included in 40 Code of Federal Regulations (CFR) 144, 145, and 146; these regulations have been incorporated into state regulation in Oregon Administrative Regulations (OAR) Chapter 340 Division 44.

One could argue that DEQ has identified all groundwater in Oregon as an Underground Source of Drinking Water (USDW) since the state has not been explicit about those groundwater resources that are protected for drinking water sources and those that are not. Flexibility exists within the federal system to determine what groundwater resources are or may be drinking water, and those that are not likely to be drinking water sources under 40 CFR 145 and 144.7.

The federal program also requires states to establish permit conditions applicable to all permits.

Oregon Regulations

The routine permitting regulations for DEQ are included in OAR Chapter 340, Division 45. These permitting requirements would apply to all subsurface discharging systems.

Depending on the configuration of the subsurface discharging system and the ever-evolving legal defining of “waters of the US”, subsurface discharging systems may be directly contributing to a surface stream such that DEQ would apply the surface water quality standards to the effluent. The Oregon Water Quality Standards are found in OAR Chapter 340, Division 41.

Systems discharging to the subsurface and impacting groundwater would need to meet the Oregon Groundwater Quality Regulations incorporated at OAR Chapter 340, Division 40. These regulations set background as the performance standard, and detail the ability to receive Concentration Limit Values up to the federal drinking water standard of Maximum Contaminant Level for groundwater constituents.

In addition, those subsurface discharging systems that inject wastewater below the ground through an UIC would be required to meet the Oregon UIC regulations incorporated in OAR Chapter 340, Division 44. This is the Oregon version of the federal Safe Drinking Water Act regulations pertaining to UICs. The UIC program is a federal program that is delegated to DEQ from EPA.

Subsurface discharging systems that rely on effluent reuse would be required to meet the standards of Oregon’s regulations for reclaimed water, included in OAR Chapter 340, Division 55. These regulations set performance standards and require a reclaimed water use plan be developed.

The chart below summarizes the decision-making process.

DEQ Permitting Decision Making for Subsurface Discharge Systems

The chart included as Appendix B summarizes DEQ’s permitting decision making for subsurface discharging systems (see OAR 340 Divisions 40, 41, and 44).

NPDES Permits Required for Subsurface Discharges

Legally defining what types of discharges are required to have a federal National Pollutant Discharge Elimination System (NPDES) permit under the Clean Water Act is unclear. EPA’s policy is that the following types of wastewater discharges are required to have NPDES permits:

- Discharges that make a direct connection to surface water;
- Discharges to a conveyance below the ordinary high-water mark;
- Discharges to any channel that carries flow even if not flowing when the discharge occurs;
- Discharges to constructed wetlands that then flow along the ground surface to a point of discharge to US waters.

Oregon DEQ and municipal system owners will want to think carefully about where NPDES permits offer greater legal protection and where state issued WPCF permits are most appropriate. If a subsurface discharge is designed to convey water to surface water it should be regulated under a NPDES permit.

Working through its rules, to permit a subsurface discharge of treated effluent, the permittee must demonstrate that it is providing protection for existing and future uses of groundwater; it must meet specific rule requirements and it must meet the UIC requirements in cases where the discharge mechanism is an UIC. Surface water discharges must meet water quality standards and any federal or state technology based standards.

State Groundwater Protection Regulations

The state rules outline a process for regulating discharges to groundwater or impacts on groundwater that are not UICs in OAR 340, Division 40. The chart included as Appendix B summarizes the requirements.

Under DEQ's Division 40, permits must be written to meet the concentration limits listed in the regulations or obtain a variance. The permit sets the applicable point of compliance. Only the Environmental Quality Commission (EQC) can allow a Concentration Limit Variance that exceeds the applicable drinking water standards. For new facilities, such as upgraded treatment plants that discharge to groundwater for the first time, the standard is background or the drinking water standards, whatever is lowest.

State Underground Injection Control (UIC) Regulations

The state operates the UIC program for the EPA as required by the Safe Drinking Water Act. The chart included as Appendix C summarizes the provisions of the Oregon UIC regulations; see OAR 340, Division 44.

Discharge prohibitions under Division 44 include:

- No direct discharge into groundwater if it may cause a violation
- Cesspools serving more than 20 people or new cesspools of any size
- Fluids from industrial or commercial processes that use hazardous substances or toxic materials including petroleum products.
- New sewage drain holes or sewage drill holes
- Fluids directly from floor pits or floor drains at industrial or commercial facilities.
- Motor vehicle waste from vehicle repair or maintenance activities.
- Industrial or municipal wastewater directly into an underground source of drinking water.
- Agricultural drainage.

In summary, in a NPDES or WPCF permit for a subsurface discharge of treated effluent, the permittee must demonstrate:

- Groundwater quality is protected for beneficial uses including drinking water use,
- There is no other reasonable alternative that would provide a greater protection to human health and the environment,
- Highest and best practical treatment is being used,
- Presence of any contaminants will not have potential to cause a violation of a primary drinking water standard,
- The project can meet background groundwater quality or established Concentration Limit Values,
- Adequate risk-based protection of future supplies – permits should demonstrate that no immediate risk or future risk to human health exists considering travel time, natural degradation; any plume of contamination could be contained or stopped, if necessary, prior to reaching a public water system well,
- Groundwater protection standards will be met at the appropriate point of compliance,
- Facility has adequate spill control procedures and capacity,

- Facility adequately controls toxics entering the wastewater system, and
- All applicable DEQ regulations have been followed.

Pilot or Demonstration Project

The group considered if it should recommend a pilot or demonstration project to showcase subsurface discharging systems. After discussion, the group concluded that a demonstration project would not provide a significant amount of additional statewide information to be worthwhile. The best subsurface discharge projects are very site specific due to geographic and environmental uniqueness. Specific projects and specific municipalities may decide to pursue limited pilot studies to gather adequate data for a specific project design.

Summary Charts

The group developed detailed charts summarizing the technical and regulatory issues for each type of subsurface discharge system.

The charts include descriptions of the systems, outlines of the regulatory framework, details of the environmental opportunities for each type of system, provides information on specific environmental concerns, and provides information on details that should be included in the permit application.

The charts were a brainstorming-type exercise by the working group participants. The lists are intended to be inclusive rather than exclusive and should be used for guidance.

The chart that describes the systems and provides the regulatory framework is included as Appendix B. The chart that details the environmental opportunities, preferred site conditions, permit application information, and other technical details is included as Appendix C.

Level of Interest with Oregon Municipalities

Many Oregon communities are thinking actively about subsurface discharge and reuse. At an ACWA workshop on temperature compliance options that included 95 municipalities, consultants, and DEQ staff, municipalities were asked to provide information about their level of interest in possible subsurface discharge options. Information about discharge options included:

<i>Location</i>	<i>WWTP Size</i>	<i>Considering</i>	<i>Actions to date...</i>
Eastern	5.5 MGD	Hyporheic injection	Hired consultant; completed demonstration test
Willamette Valley	35+ MGD	Wetlands; reuse	Hired consultant to complete some preliminary analysis; purchased property
Coastal	3.0 MGD	Wetlands	Started considering internally to City
Southern	1 MGD	Co-generation use of treated effluent for cooling water	Incorporated into facilities plan
Columbia River	12.5 MGD	Reuse	Hired consultant to consider reuse as part of wastewater master plan
Willamette Valley	3 MGD	Hyporheic injection/wetlands	Hired consultant; incorporated in facilities plan; completed preliminary studies
Willamette Valley	10 MGD	Reuse; hyporheic; land	Hired consultant and

		application; wetlands	incorporated into Facilities Plan; purchased property
Willamette Valley	2.5 MGD	Reuse; poplars; seasonal irrigation	Incorporated into facilities plan; incorporated into design; purchased property
Willamette Valley	6 MGD	Wetlands; reuse	Considering internally
Southern	20 MGD	Reuse	Hired consultant; incorporated into facilities plan; moving into design
Eastern	1.5 MGD	Flow augmentation	Incorporated in facilities plan
Central	7.5 MGD	Infiltration basins	Working with consultant
Southern	2.5 MGD	Reuse; unlined ponds; wetlands	Considering internally
Southern	4 MGD	Reuse; wetlands; land application	Hired consultant; purchased property
Willamette Valley	2.25 MGD	Hyporheic Injection	Considering internally
Central	5 MGD	Rapid infiltration; reuse	Incorporated into facilities plan; purchased property; moving into design

REGULATORY OPTIONS

The group discussed areas where DEQ's existing rules allow for flexibility in interpretation which in turn may allow additional use of subsurface discharge systems for treated effluent. The table below summarizes the discussion:

<i>Issue</i>	<i>Applicable Division of Oregon Rules</i>
Tie the point of compliance to the definition of underground source of drinking water in the federal definition	-40 -44
Concentration Limit Variance monitoring and determination - upfront level of effort for aquifers where the Department can conclude there is no adverse impact, such as a geothermal resource <ul style="list-style-type: none"> • If no adverse impact, no need for CLV • Abbreviated CLV process, if needed under rules 	-40
Limit Oregon definition of underground source of drinking water to the federal definition	-40 -44
Identify beneficial uses for ditches (different than for rivers) – may involve use of DEQ's alternative mixing zone rule	-41

Set as a reasonable assumption that some treatment will occur for underground sources of water used for drinking water	-40
Restrict future uses of underground sources of drinking water through easements or legal covenants such as deed restrictions	-40
State defines what the beneficial uses are of specific aquifers (joint DEQ and Health Services project)	-44
State defines “future use”	-40
State defines what an UIC is and how similar structures are not regulated as an UIC if they have above ground piping or soil on top of them	-40
Determine appropriate treatment for recharge (inventory Health Services)³	-55
Define beneficial uses of underground water as drinking water by defining point of compliance and assuming the underground water may receive disinfection prior to use as a drinking water	-40
Use a discharge to the Hyporheic zone as an allowed surface water discharging system and include as mixing zone	-40 -41
Expand definition of “man-made” lagoon or pond (point of compliance issues, wetlands/fish and wildlife issues)	-40 -41
Define a waste management area as a 3-dimensional area	-40
Approve “alternatives” on a system-by-system basis	-44
Define seasonal “perched” water as not an aquifer	-40 -44

Areas of Regulatory Flexibility

The group focused on ideas for incorporating regulatory flexibility into the existing regulations. Some ideas included:

- Clarifying the Point of Compliance; what is a reasonable boundary where the compliance with groundwater protection standards should be met
- Protection of aquifer water quality
- Primary drinking water standards be met
- Not allowing degradation/ getting treatment from soil /using mixing areas
- Extent of EPA oversight (USDW, policy, guidance)
- What is “direct connection” via connection for NPDES
- Highest and best treatment reasonable alternative, better protection
- To what level to protect drinking water – is it reasonable to assume there will be no treatment, or reasonable to assume some treatment as with surface water protection
- Aquatic life such as invertebrates in the hyporheic zone
- Risk to USDW (even if not a direct UIC into or above a USDW)

³ DEQ staff believes this may be better addressed through a rule change; is included on the DEQ rule making docket

- Do we need to define what aquifers are USDW by federal definition - this is different than current UIC regulations
- Designate and describe aquifers

Recommendations

The primary recommendation of the group is that these types of subsurface discharging systems be encouraged by DEQ as possible wastewater management tools for municipalities where they are environmentally beneficial. The necessary policy interpretations and clarifications to foster subsurface discharge opportunities where groundwater protection requirements can be met should be examined, and clear permitting guidance provided to DEQ permit writers. DEQ water quality management and staff should discuss and achieve clarity on the significance and process of permitting subsurface discharging options based on specific site conditions that can achieve environmental benefits through subsurface discharge options.

Secondary recommendations include:

- Work with EPA to receive additional clarification on UIC issues, including some rule interpretations
- Build an understanding of the broad environmental benefits and issues of subsurface discharges by informing and involving other natural resources agencies such as:
 - EPA
 - Oregon Department of Fish and Wildlife (ODFW)
 - Oregon Department of State Lands (DSL)
 - Oregon Department of Human Services (DHS)
 - Oregon Department of Agriculture
 - Oregon Water Resources Department (WRD)
 - Oregon Department of Land Conservation and Development (DLCD)
 - Other agencies identified in specific projects

In order to be effective, these meetings will need to be carefully organized around specific topics for each organization.

- Find and publicize applicable examples of environmentally – sound subsurface discharge projects from other areas.
- Institute a statewide subsurface discharge projects tracking system at DEQ.
- Both ACWA and DEQ should work collaboratively to provide technology transfer and other information sources on these topics to the consulting engineering community, other municipalities, special districts, counties, Oregon Association of Water Utilities, Pacific Northwest Clean Water Association, League of Oregon Cities, and other organizations.

Possible Rule Revisions

The group discussed if they wanted to recommend that specific DEQ rules be revised. In considering that, the group highlighted the difficulty in undertaking a rule revision and the length of time it takes to complete a rule revision. If rule revisions are going to be considered, the group recommended that the rule revisions be focused on the environmental benefits and overall environmental goals of the subsurface discharge of treated effluent. This could potentially be accomplished through DEQ's efforts to examine its wastewater reuse policies incorporated in Division 55.

The benefit of undertaking a rule revision is the increased assurance it provides to the regulated community.

If rule changes are warranted, some ideas that should be considered:

- CLV does not need to be set as background to meet state law direction,
- Revise the Oregon UIC rules to parallel the federal rules, or

- Add an overall watershed health goal that should be considered in addition to the specific groundwater regulations.

Outside of DEQ's jurisdiction, the group recommended that the Oregon plumbing code should be examined. Under the current interpretation of the plumbing code, all faucets within a structure must meet drinking water standard. This hampers some opportunities to use treated effluent for reuse, especially in industrial and manufacturing processes.

The DEQ mixing zone rule should be considered for hyporheic subsurface disposal.

Reuse Opportunities

An additional opportunity for municipalities is to find beneficial reuse opportunities for treated effluent. The group inventoried needed improvements to Oregon's reuse regulations to encourage the environmentally sound reuse of treated effluent. These suggested revisions include:

- Defining allowable advanced treatment systems for Level IV waters,
- Better defining allowable end uses to provide additional regulatory compliance assurance,
- Better matching required treatment levels to demonstrated and available treatment technologies, and
- Setting a specific treatment standard, that - - when met - - removes the treated water from further regulation, similar to the regulatory construct of biosolids when treated to Class A standards.

Appendix A – Working Group Members

Working Group Members:

Bob Baumgartner, Water Quality Policy and Standards Section Manager, Water Quality Division, Oregon DEQ, Portland

Mark Cullington, Land Application and Licensing Section Manager, Water Quality Division, Oregon DEQ, Portland

Mitch Wolgamott, Water Quality Manager, Eastern Region , Oregon DEQ, Pendleton

Anne MacDonald, Senior Project Manager, URS, Portland

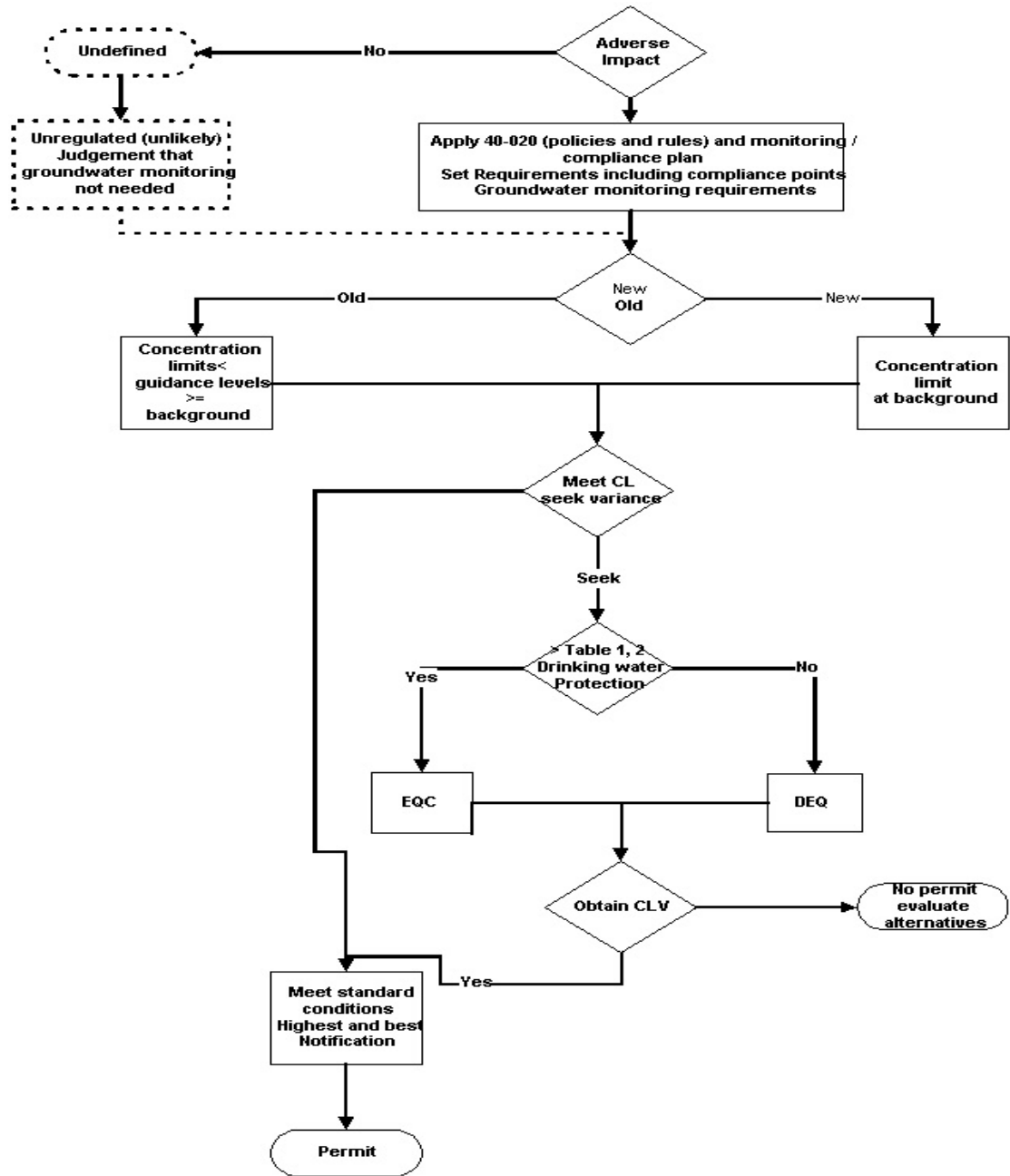
Darrell McLaughlin, Environmental Specialist, City of Lebanon, Lebanon

Manny Molina, General Manager, South Suburban Sanitary District, Klamath Falls

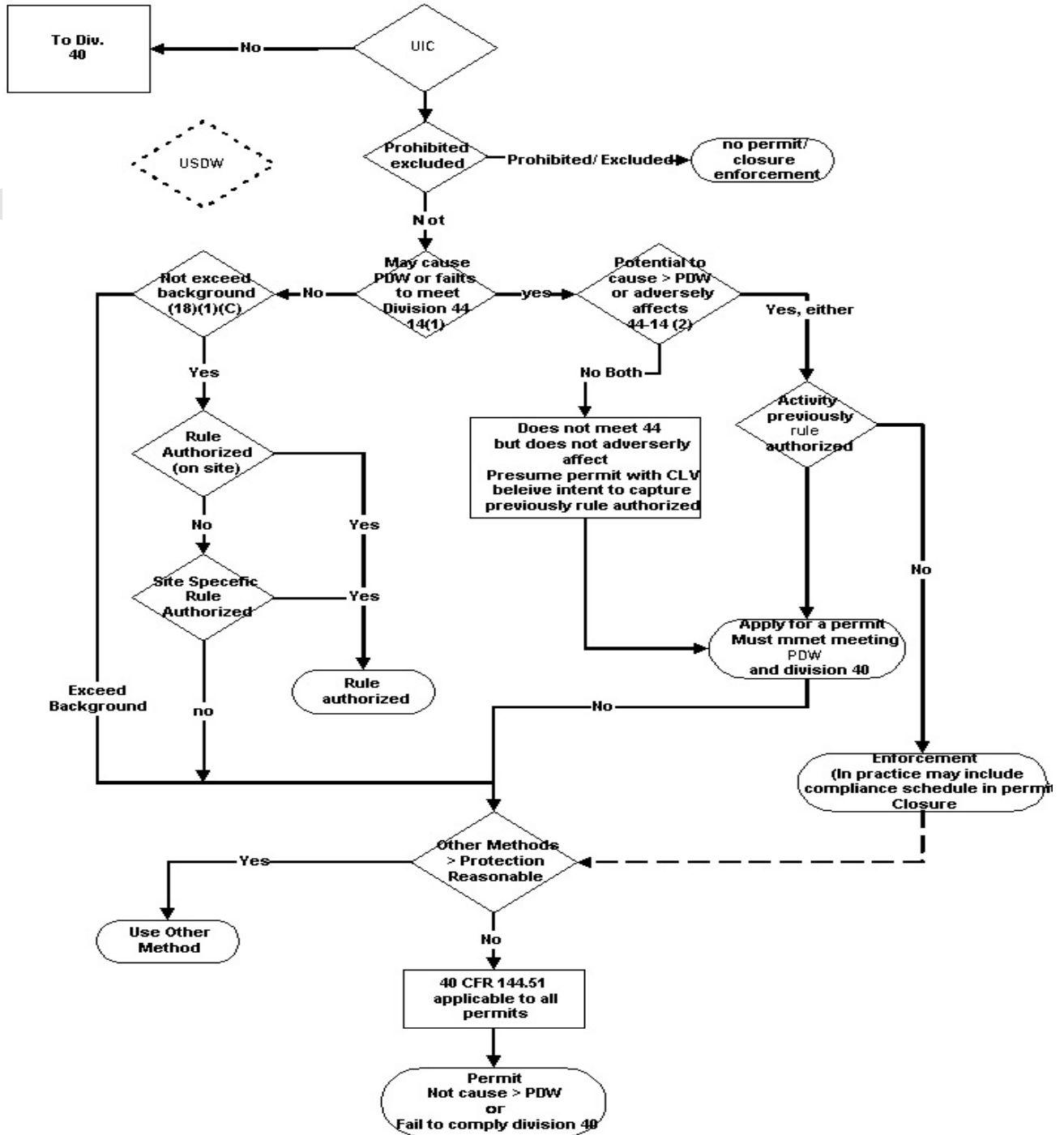
Sue Lawrence, Wastewater Superintendent, City of Pendleton, Pendleton

Janet Gillaspie, Executive Director, Oregon Association of Clean Water Agencies (ACWA), Portland

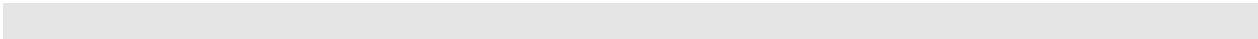
Appendix B – DEQ Chart of Subsurface Discharge Permitting Requirements



Appendix C – DEQ Chart of Groundwater Protection Requirements



Appendix D – Regulatory Issues Summary Chart



Appendix E – Technical Issues Summary Chart