

# **A Regulatory Guide to Geothermal Direct Use Development**

## **ARIZONA**

### **Introduction**

Geothermal resource temperatures range from low temperatures of 50 to 80 degrees F (10 to 27 °C), to temperatures exceeding 650 degrees F (343°C). Although power can be generated economically from resources as low as 218 degrees F (103° C), power generation projects typically favor resource temperatures above 300 degrees F (149° C). High temperature resources (>300 degrees F, 149°C) can also be used for direct-use applications. However, lower temperature resources (< 212° F, 100° C) are often better suited for these projects.

Low temperature, direct-use projects cover a variety of applications. Projects may include traditional space heating applications, as well as greenhouse heating, spas and swimming pools, aquaculture, crop drying, industrial processing and other activities requiring lower temperatures. Because these projects are primarily water use applications, they often fall under a different regulatory process than high temperature, power generation projects. Typically this process is shaped by water and wastewater laws and regulations, and administered by their respective state, and in some cases, federal water and wastewater resource agencies.

The intent of this document is to help guide developers of direct use geothermal projects through the regulatory process of drilling, using and disposing of low temperature geothermal fluids in Arizona. This guide will provide background on the state regulatory process and identify contact information necessary for completing the various applications and permits. This guide; however, cannot substitute for direct communication with the regulatory agencies. These agencies need to be contacted early in the process so that any regulatory hurdles are identified upfront and in time. Projects that are located on federal lands are regulated according to the national Geothermal Steam Act and related federal regulations.

### **Regulatory Process for Direct Use Applications**

A recent geothermal database for Arizona identifies 1,251 discrete thermal wells or springs in the state. The thermal fluids, however, are primarily put to traditional water resource uses; i.e., irrigation of field crops, municipal water supply and industrial uses, with little advantage taken of the heat carried by the waters. Geothermal exploration reports show Arizona has many areas with low-to-moderate-temperature fluids at depths sufficiently shallow to tap and use for energy. Areas of geothermal activity in Arizona are

mostly located in the basin and range areas in the southern part of the state, including the metropolitan Phoenix and Tucson areas.

The laws and statutes governing geothermal resources in the State of Arizona are contained in Arizona Revised Statutes, Title 27 Minerals, Gas and Oil, Chapter 4, Article 4 - Geothermal Resources ([ARS 27.651-677](#)). Administrative rules and regulations supporting ARS 27.651-677 can be found in Arizona Administrative Code [R12.7.101-199](#).

The State of Arizona defines “geothermal resources” as:

- (a) All products of geothermal processes embracing indigenous steam, hot water and hot brines;
- (b) Steam and other gases, hot water and hot brines resulting from water, other fluids or gas artificially introduced into geothermal formations;
- (c) Heat or other associated energy found in geothermal formations, including any artificial stimulation or introduction thereof; and,
- (d) Any mineral or minerals, exclusive of fossil fuels and helium gas, which may be present in solution or in association with geothermal steam, hot water or brines.

ARS 27.651-677 and the accompanying administrative code is primarily directed at high temperature geothermal resources for power production. Deep geothermal wells in search of steam or hot dry rock are permitted through the Oil and Gas Conservation Commission (OGCC). The OGCC generally does not permit relatively shallow water wells that produce warm or hot water for direct use purposes. Instead, low temperature geothermal wells, including but not limited to greenhouse heating, warm water aquaculture, space heating, irrigation swimming pools and spas, are regulated in accordance with the rules and statutes governing groundwater appropriation and well drilling regulations. As a result, a developer must acquire the resource by means of an application, permit and license procedure overseen by the appropriate resource agency. However, a developer should discuss a project involving reinjection of water from direct use geothermal water wells with the Arizona Geological Survey (AZGS). AZGS provides administrative support to OGCC and would know whether a project falls under OGCC regulatory authority.

The regulations governing low temperature, direct use geothermal projects differ from conventional water development projects in that direct use projects also need to dispose of the water once it has been used for its design application. Disposal is typically accomplished through direct injection of the geothermal water via an injection well, or through surface disposal.

The Arizona Department of Water Resources (DWR) and the Department of Environmental Quality (DEQ) are the lead agencies in charge of administering and enforcing the various rules and regulations governing water use and water quality in the State of Arizona. DWR is responsible for issuing water rights, well construction permits. The DEQ’s Water Quality Division is responsible for administering surface disposal of

wastewater, including geothermal fluids, while EPA Region 9 has regulatory authority over injection wells (in cooperation with the Oil and Gas Conservation Commission and DEQ). In addition to contacting state resource agencies, local and county agencies should be contacted early on in the development process to determine any local zoning issues and for construction permits.

The regulatory process for developing a low temperature, direct use geothermal project consists of the following steps:

- Gain access to lands either through lease or direct ownership.
- Contact local and/or county agencies to ensure compliance with local land use laws including building permits and zoning restrictions.
- Secure water right. **(DWR)**
- Obtain well construction permit/develop production well. **(DWR)**
- Determine fluid disposal plan and obtain permits for either underground injection or surface disposal. **(EPA, DEQ)**
- Contact Arizona Department of Agriculture if developing an aquaculture project. **(ADA)**

## **Water Rights**

### Background

The constitution and statutes of the State of Arizona guarantee the right to appropriate the public waters of the State of Arizona. However, groundwater appropriations in Arizona are administered separately from surface water appropriations and deviate somewhat from the traditional process of water rights permitting. Because of a declining supply of groundwater due to overdraft, the State of Arizona passed a Groundwater Management Code in 1980. The Code promotes water conservation and long-range planning and was designed to control over pumping of groundwater resources. In doing so, the Code established three levels of water management to deal with different groundwater conditions. These levels divide the state into resource areas with the lowest level of management applied to the state as a whole, and the highest level of management applied to Active Management Areas (AMAs) where groundwater overdraft is most severe.

The Arizona Department of Water Resources (ADWR) administers the rules and regulations governing groundwater withdrawals and use in the State of Arizona. The state statutes governing groundwater appropriations are codified in Arizona Revised Statutes Title 45, Chapter 2- Groundwater Code, which can be accessed by clicking [here](#). Arizona Administrative Code Title 12, Chapter 15- Department of Water Resources contains the administrative rules and regulations used to administer water resources in the state. AAC 12-15 can be accessed by clicking [here](#).

## Groundwater Permit Process

Obtaining the right to appropriate groundwater for a direct use geothermal project will depend on the location of the well and the amount of water pumped. The primary determinant in how the well is regulated is whether it is located in an Active Management Area (AMA). There are 5 AMAs in the state- Phoenix, Tucson, Pinal, Prescott and Santa Cruz. These areas are defined by groundwater basins and a project developer must contact ADWR to determine if a proposed well lies within an AMA.

Within an AMA, a person must have a groundwater right or permit to pump groundwater legally, unless the amount of water being withdrawn from the well is no greater than 35 gallons per minute. Wells of this size are typically designed for domestic purposes and are considered “exempt”. Exempt wells within an AMA are still required to register with the ADWR by submitting a Notice of Intention to Drill form (NOI). Non exempt well (wells exceeding 35 gpm) that are located outside of an AMA are also required to file a Notice of Intention to Drill form with ADWR, but do not need to secure a withdrawal permit. Non exempt wells that are located within an AMA need to obtain a withdrawal permit or Application for Drilling Permit. There are eight types of withdrawal permits covering various groundwater uses that are subject to different requirements. Most direct use geothermal wells should fall under the general industrial use permit.

## Notice of Intent to Drill

Exempt wells in AMAs, and any wells located outside of an AMA, must receive authority from ADWR prior to drilling by filing a Notice of Intent form (NOI). ADWR has developed a guide to well drilling in Arizona, which can be downloaded by clicking [here](#). The application procedure includes the following steps:

- Submit a NOI form to ADWR. There are different NOI forms depending on the application. Direct use geothermal projects would likely file Form 55-43B Notice of Intent to Drill and Abandon an Exploration/Specialty Well. The form can be downloaded by clicking [here](#). Information required on the form includes, name and address, location of the well, the proposed use, and well driller information including license/registration. The form takes about 2 weeks to process and requires a \$150 filing fee.
- Receive authorization to drill. Once the NOI form is complete and accurate, ADWR will provide the licensed well driller with a drilling card which authorizes drilling.
- Complete and file a well driller’s report. The well driller must complete a well driller’s report (provided by ADWR) including a well log. The report must be filed with ADWR within 30 days of equipping the well with a pump.
- File a Notice of Intention to Abandon a Well. The notice of abandonment must be filed with ADWR within 30 days of abandoning a well.

## Groundwater Appropriation in AMAs

Non-exempt wells located within an AMA must obtain a withdrawal permit from ADWR in accordance with ARS 41-1008 and 1079. There are eight types of withdrawal permits, each subject to different requirements. Most direct use geothermal projects would likely file a general industrial use permit. A copy of the form can be downloaded by clicking [here](#).

Before filing an application, ADWR encourages individuals to contact the Department and discuss the application process and review criteria. When filing the application, an applicant must provide a detailed description of all water uses and demands. An applicant must also complete a New Well Construction Supplement, DWR Form 55-90 and submit a detailed construction diagram verifying consistency with well construction and licensing rules as per AAC R12-15-801 et seq. All points of withdrawal must be measured and reported on an annual water withdrawal and use report. The application fee for the permit is \$150, and the permit fee is \$50, pursuant to ARS 45-113.

ADWR has up to 100 days to grant, extend or deny an application. In processing the application, ADWR will look for administrative completeness (is the form completed correctly with all necessary information) and substantively complete (are all state statutes and rules met). At the end of the substantive review (which can include a hearing), the Department will send the applicant a written notice either granting or denying the application. The permit application fee is \$150 and the permit fee is \$50. ADWR contacts are listed in Appendix A for each of the 5 Active Management Areas.

## Well Construction

The Arizona Department of Water Resources (ADWR) is the lead agency responsible for regulating all water wells, monitoring wells, geothermal wells, and injection wells. The state statutes governing well construction are presented in [ARS 45.591-605](#).

A developer interested in low temperature geothermal resources may want to review data from other wells in the area. ADWR maintains a database of information about existing wells including well size and depth, depth to water, water levels, flow rate, and construction. Click [here](#) for on-line access to this database. The Geo-Heat Center, located in Klamath Falls, Oregon also maintains an extensive database covering wells and springs greater than 50 °C (122 °F) for 16 western states. Information on the database can be found at <http://geoheat.oit.edu/databse.htm>.

## **Disposal of Geothermal Fluids**

The regulations governing the disposal of low temperature geothermal fluids will depend on the type of application. Non contact geothermal projects, where the geothermal fluids are kept in a closed system and do not come in contact with outside contaminants, should typically have an easier compliance path than projects where contact with potential contaminants is made. When contact is made and water quality is potentially degraded,

regulatory requirements may become more stringent to ensure that water quality is maintained.

There are basically three disposal options available to a developer of a direct use geothermal project: underground injection; disposal to surface waters; and/or, disposal to the ground or land application. In some cases, the regulatory agency(s) will specify the preferred disposal method. For example, in critical groundwater areas, reinjection may be required to ensure that the aquifer is maintained. However, in most cases, it will be up to the project developer to determine the preferred disposal method based on regulatory requirements and the cost of compliance.

### Underground Injection Control

The Underground Injection Control (UIC) Program was established in 1982 when Congress passed the Safe Drinking Water Act. This program regulates, to one degree or the other, every "injection" of "fluid" into the subsurface. An "injection" is the emplacement of "fluids" regardless of whether the injection requires the application of pressure or not, and a fluid is defined as any liquid, gas or semisolid which can be made to flow. The intent of the program is to preserve and protect underground water from becoming polluted.

From a resource perspective, the preferred method of disposing of geothermal fluids is to return them to the ground by way of injection wells. Injection wells are wells that are used as an entry point for some type of fluid (such as geothermal fluid), which is injected underground for temporary or permanent disposal or storage. The U.S. Environmental Protection Agency Region 9 has regulatory oversight of underground injection wells in the State of Arizona. However, EPA has to work cooperatively with the Arizona Department of Environmental Quality-Water Quality Program (ADEQ). ADEQ oversees groundwater resources in the state and administers an aquifer protection permit program. Project developers interested in reinjection of geothermal fluids will need to work with this program and may need to obtain an Aquifer Protection permit.

Project developers also need to coordinate with the Arizona Geological Survey (AGS) if considering reinjection. AGS provides staff support to the Oil and Gas Conservation Commission (OGCC). OGCC has overlapping state authority for certain types of injection wells. Touching base with AGS will help to clarify whether the OGCC's authority extends over a proposed injection well project.

The Underground Injection Control (UIC) Program, created under the authority of the Safe Drinking Water Act (SDWA), is a preventative program aimed at protecting existing and future underground sources of drinking water (USDWs). Shallow wells or disposal systems that direct fluids into the subsurface are known as Class V wells and can be authorized to inject by rule or permit. Class V wells that have the potential for ground water contamination or degradation are usually permitted. Low temperature, direct use injection wells fall under the definition of Class V wells. Those that do not have a potential to contribute to contamination or degradation of ground water are usually rule

authorized, once inventory information has been submitted according to the requirements of 40 CFR 144.26. Rule authorized means that a well meets the category definition and does not need to go through individual permitting. In addition to the inventory requirements, EPA may require the owner or operator of any well authorized by rule to submit additional information to determine if a well may be endangering a USDW.

The following information is needed to evaluate the impact a shallow injection well/disposal system will have on the local hydrogeologic system, potential for USDW contamination, and whether a permit for its operation should be required. An applicant should be prepared to submit this information to EPA Region 9 prior to constructing a well. Contacts are presented in Appendix x. In general, injection wells for direct use geothermal projects do not require a permit and are rule authorized as long as they are closed loops. Open loops system may require a permit depending on the operational parameters and exposure of the fluid to potential contaminants.

- Property owner and/or operator of facility, including address and phone number.
- Responsible party for the operation, maintenance, and closure of the injection system, including address and phone number.
- Name, address, phone number of contact at any State Agency associated with the project.
- Site map including extraction and injection well locations and pertinent hydrogeologic features.
- Description and operation of the injection well, including depth, construction information, injection rate and pressure.
- Description of well construction features ensuring that overlying aquifers will be isolated from injected and extracted geothermal brine.
- Analysis or description of the geothermal fluids being extracted/injected.
- Describe any impact to extracted water before re-injection.
- Review of current users of geothermal source and potential impacts on other vested water rights.

### Aquifer Protection Permit

A direct use geothermal project may be required to obtain an Aquifer Protection Permit (APP) if it discharges fluids to an aquifer, land surface or underground in such a manner that there is a reasonable probability that the pollutant will reach an aquifer. (A.R.S. §§ 49-241 through 49-252, and A.A.C. R18-9-101 through R18-9-403.) The Arizona Department of Environmental Quality (ADEQ) is the lead state agency administering the program and maintains a useful website explaining the program and the permitting process. The website can be accessed by clicking [here](#).

The APP program was designed to protect Arizona's groundwater. ADEQ encourages project developers to consult with them early on to determine whether an APP is required or if the project is exempt. Currently there is a list of 24 facility types that are exempt from the program, and a number of other project types that qualify for a general permit. At this point, direct use geothermal projects are not exempt, however, smaller, closed

loop projects may qualify under a general permit. To determine whether a project qualifies for an exemption or a general APP permit, an applicant should complete the form *Determination of Applicability*. The form can be downloaded by clicking [here](#) and requires a \$100 processing fee. The fee is non-refundable but can be applied against the cost of obtaining a general or individual APP if one is required.

If an individual or general permit is required, ADEQ encourages the applicant to complete a pre-application meeting to go over the APP permitting process. For individual permits, ADEQ has also prepared a support document entitled the [Individual Permit Guidance Document](#). This document explains how to complete an individual [application form](#). An initial fee of \$1000 is required for APP permitting. An additional fee of \$61/hr will be charged by ADEQ for permit processing and technical assistance. Once awarded, individual permits are typically good for the operational life of the project.

While there are numerous requirements necessary to obtaining an individual APP as specified in A.A.C. 18 A.A.C. 9, Article 2, the most critical are:

1. BADCT - The applicant must show that the best available demonstrated control technology will be used by the facility.
2. The applicant must show that aquifer water quality standards (AWQS) will not be violated in the aquifer at a point of compliance as a result of discharge from the facility. If water quality already exceeds standards at the time of permit issuance, the aquifer must not be further degraded.
3. Financial and technical capability.

General permits cover similar, or like projects, and do not require as an extensive application process as individual permits. There are currently 45 general permits ranging from permits requiring department notification, to permits authorized by simply meeting the criteria specified in rule. Most permit conditions are listed under 18 A.A.C. 9, Article 3.

There are 4 types of general permits. Type 1 requires no notification, however, best management practices must be followed to reduce or prevent pollution discharge. Type 1 general permit 1.05 allows for heat exchange system return water to be discharged if the flow is less than 1000 gpd. Type 2, Type 3 and Type 4 permits require a Notice of Intent and a supplemental Notice of Intent be submitted to ADEQ. Of the three permit types, a direct use geothermal project might qualify for a Type 3 General Permit. However, ADEQ will determine each project's permitting options, which may or may not include a general permit option. Type 3 general permit forms can be downloaded by clicking [here](#).

### Arizona Pollution Discharge Elimination System (AZPDES)

The Arizona Department of Environmental Quality-Water Permits Division (ADEQ) administers the Pollution Discharge Elimination System program for the State of Arizona. The goal of the AZPDES program is to control point source discharges of wastewater to ensure that the water quality of the receiving streams (including dry wash)

is protected. Levels of water quality that are required to maintain the various beneficial uses of the receiving streams are set forth in the Arizona Water Quality Act. The administrative rules for the AZPDES program are presented in Title 18, Chapter 9-Water Pollution Control, A901-C904, which can be viewed by clicking [here](#).

All point sources of wastewater discharge are required to obtain and comply with AZPDES permits. This includes any direct use geothermal project. The effluent limitations and other conditions contained in AZPDES permits are based upon preservation of the water quality standard. ADEQ maintains a website that provides AZPDES guidance and can be accessed by clicking [here](#).

A direct use geothermal project that discharges to surface waters will need to apply for an individual permit, as Arizona does not have a general permit developed for these types of projects as yet. For an individual permit, an applicant submits an application form and supporting documentation. The department reviews this information and develops facility specific conditions.

ADEQ has developed AZPDES forms for most application types. They are very similar to the federal forms that have been in place for the NPDES program and have the same names. Direct use geothermal projects will typically need to complete the *General Application* or Form 1, and either an *Initial Application for AZPDES Permits for Industrial and Commercial Operations that will discharge Non-domestic Wastewater* (Form 2D), or *Facilities That Do Not Discharge Process Wastewater* (Form 2E). ADEQ should be contacted early on to determine which form will be required. Agency contact information is provided in Appendix A.

The applicant must submit a complete application that includes the proper application forms and supporting documentation. Form 1 provides basic information such as nature of business, name, mailing address, location, existing permit numbers, etc. Form 2D or 2E provide more detailed information but typically do not require detailed engineering designs, but a narrative and drawing that describes the process flow and treatment train. A topographic map, latitude/longitude location of the discharge outfalls, and summary of the discharge data and analytical results are also required for the application. AZPDES forms can be downloaded by clicking [here](#).

For new sources, a project must apply 180 days before construction. It generally takes eight to 10 months to obtain an AZPDES permit. A project may not discharge until an AZPDES permit is issued for the discharge. In addition, no AZPDES permit can be issued that is inconsistent with a 208 water quality regional plan. To avoid an extended delay in processing the application, a project developer should contact their local planning office for more information on regional water quality plans. Currently, ADEQ does not charge any fees for application review or permitting.

For all AZPDES permits, ADEQ will develop discharge limits based on any applicable federal technological standards and applicable water quality standards. ADEQ must review any applicable technology based standard that applies to the facility operations.

EPA has developed technology based standards for a variety of industry types. These technology based standards specify the type of technology for treatment of the wastewater or a maximum concentration of pollutant in the wastewater or both. In addition, the department has developed water quality standards that apply to the receiving waters and depends on the designated uses of those waters.

In addition to an AZPDES permit, projects may also require an aquifer protection permit (APP), as well. The APP and AZPDES permit may have different monitoring requirements and different limits as the APP is focused on groundwater protection and AZPDES focuses on surface water.

### **Aquaculture**

The Arizona Department of Agriculture (ADA) regulates the operation of aquaculture facilities as per [Title 3, Chapter 2, Article 10](#) of the Arizona Administrative Code. Accordingly, all aquaculture facilities must obtain a license from ADA. On the license application form, the applicant must outline the facility operations including the facilities size, source and amount of water supply, disposal methods for tailing waters and solid wastes, and types of plants and animals grown or consumed at the facility. The annual license fee is \$100 per year, which expires December 31 of each year.

## Appendix A

### State Contact Information

#### Geothermal Regulations

Steve Rauzi  
Arizona Geological Survey  
416 W. Congress St, Suite 100  
Tucson, AZ 87501  
Phone: 520/770-3500  
Fax: 520/770-3505  
Email: [steve.rauzi@azgs.az.gov](mailto:steve.rauzi@azgs.az.gov)

#### Water Appropriations- Notice of Intention to Drill and Withdrawal Permits

Arizona Department of Water Resources  
500 North 3<sup>rd</sup> street  
Phoenix, AZ 85004-3903  
Phone: 602/417-2400  
<http://www.water.az.gov/adwr/>

Phoenix AMA  
Scott Miller  
500 North 3<sup>rd</sup> St  
Phoenix, AZ 85004-3903  
602/417-2465

Pinal AMA  
Cynthia Pogue  
1729 N. Trell Road, Suite 500  
Casa Grande, AZ 85222  
520/836-4857

Tucson AMA  
400 West Congress, Suite 518  
Tucson, AZ 85701-1374  
520/770-3800

Prescott AMA  
2200 East hillside Road  
Prescott, AZ 86301-4941  
928/778-7202

Santa Cruz AMA  
857 West Bell Road, Suite 3  
Nogales, AZ 85621-4545  
520/761-1814

### **Arizona Pollution Discharge Elimination System**

Surface Water Permits Unit  
1110 W. Washington St., Phoenix, AZ 85007)  
Phone: (602) 771-4665 or (602) 771-4633.  
E-mail: ([varga.chris@ev.state.az.us](mailto:varga.chris@ev.state.az.us))

### **Aquifer Protection Permit**

Industrial and Drywell Unit  
Kristie Kilgore, Supervisor  
Phone: (602) 771-4696 or, in-state (800) 234-5677  
E-mail: [kilgore.kristie@ev.state.az.us](mailto:kilgore.kristie@ev.state.az.us)

### **Underground Injection Control Wells**

U.S. EPA Region 9  
75 Hawthorne Street  
San Francisco, CA 94105  
Phone: (866)-EPA-WEST or, (415) 947-8000  
Website: <http://www.epa.gov/region09/water/index.html>

### **Aquaculture**

Arizona Department of Agriculture  
Division of Animal Services  
Helen Nasios  
Phone: 602/542-6309  
E-mail: <http://helen.nasios@agric.state.az.us>

## **Appendix B**

### **Geothermal References and Contacts**

#### **References**

Bloomquist, R.G., Black, G. L., Parker, D. S., Sifford, A., Simpson, S. J., Street, L.V., 1985, Evaluation and Ranking of Geothermal Resources for Electrical Generation or Electrical Offset in Idaho, Montana, Oregon and Washington: Bonneville Power Administration, US Department of Energy, pp. 1-504

Bloomquist, R. Gordon., Nimmons, John. T., Rafferty, Kevin, 1988, District Heating Development Guide, Legal, Institutional and Marketing Issues, Volume 1: for the Washington State Energy Office, funded by the US Department of Energy, pp. 1-268.

Bloomquist, R. Gordon, 1991, Geothermal, A Regulatory Guide to Leasing, Permitting, and Licensing in Idaho, Montana, Oregon and Washington: Bonneville Power Administration, 1-277.

Lund, John W., Lienau, Paul J., Lunis, Ben C., 1998, Geothermal Direct-Use Engineering and Design Guidebook: Geo-Heat Center Oregon Institute of Technology, sponsored by the US Department of Energy Idaho Operations Office, pp. 1-454.

Rafferty, Kevin, 2000, Geothermal Power Generation, A Primer on Low-Temperature, Small-Scale Applications: Oregon Institute of Technology, pp. 1-11.

Lund, John W., **date**, Pavement Snow Melting, Geo-Heat Center Oregon Institute of Technology, pp1-13.

Rafferty, Kevin, 2001, An Information Survival Kit for the Prospective Geothermal Heat Pump Owner: Geo-Heat Center, Oregon Institute of Technology, Grant No. DE-FG07-90ID 13040, pp. 1-23.

Rafferty, Kevin, 2001, Small Geothermal Systems: A Guide For The Do-It Yourselfer: Geo-Heat Center, Oregon Institute of Technology, Contract No. FG01-99-EE35098, pp. 1-30.

Lund, John W., **date**, Balneological Use of Thermal Waters: Geo-Heat Center, Oregon Institute of Technology, pp. 1-10.

Boyd, Tanya, Rafferty, Kevin, **date**, Aquaculture Information Package: Geo-Heat Center, Oregon Institute of Technology, Contract No. DE-FG07-90ID 13040, pp. 1-60.

Rafferty, Kevin, Boyd, Tonya, **date**, Geothermal Greenhouse Information Package: Geo-Heat Center, Oregon Institute of Technology, Contract No. DE-FG07-90ID 13040, pp.1-80.

## **Contacts**

Geo-Heat Center

Website: [www.oit.edu/-geoheat](http://www.oit.edu/-geoheat)

Geothermal Education Office

Website: [www.geothermal.marin.org](http://www.geothermal.marin.org)

Geothermal Resources Council

Website: [www.geothermal.org](http://www.geothermal.org)

Geothermal Heat Pump Consortium

Website: [www.geoexchange.org](http://www.geoexchange.org)

International Ground-Source Heat Pump Association

Website: [www.igshpa.okstate.edu](http://www.igshpa.okstate.edu)

U.S. Department of Energy

Website: [www.eren.doe.gov/geothermal](http://www.eren.doe.gov/geothermal)

Washington State University Energy Program

Website: <http://www.energy.wsu.edu/projects/renewables/geothermal.cfm>