APPENDIX C

Description of Flow Enhancement Technologies. In the petroleum industry, acidization is a treatment often used to increase reservoir permeability in carbonate rocks, and/or to remove near-wellbore drilling damage. An acidic fluid, typically a solution of hydrochloric acid, is pumped into an isolated portion of the wellbore to partially dissolve and open up new or existing fractures, or to enhance the near-wellbore permeability. The acidization work associated with the development of our EGS reservoir in carbonate rocks will be done by an experienced oilfield service company (Halliburton or equivalent) and should provide an initial indication of the potential for increasing the natural flow of this deeper geothermal zone. It will be carried out in our first (characterization) wellbore at depths between 1500-2100 ft, a region believed to consist of porous and fractured limestone mixed with other rock types. Prior to conducting the acidization work (and subsequent hydraulic fracturing), cores obtained from the continuously cored interval from 1500 to 2100 ft will be examined to provide assurance that the rocks within this target interval can be developed into a suitably productive reservoir using EGS techniques, and more specifically that the planned acidization treatment will be successful in enhancing the formation permeability.

Hydraulic stimulation (fracturing) will also be employed to improve the lateral permeability of the reservoir interval between 1500 to 2100 feet. The objective is to better connect the production well – through the interval of vuggy and fractured limestone -- to the natural system of near-vertical faults and fractures occurring in this region that provide the principal conduits for the upward flow of hot geofluid. Hydraulic fracturing has been employed to a limited extent in the conventional (i.e., hydrothermal) geothermal industry in the past, but concerns about impairing the productivity of the naturally fractured reservoirs by creating leakage paths or direct short circuit paths from injection to production wells have always dominated decisions regarding the extent to which this method of stimulation has been used.

Prior to commencing hydraulic fracturing operations, in order to preclude any degradation to the existing shallow geothermal system, we will carefully case and cement a string of surface casing through the current fractured rhyolite producing interval at about 300 feet, and extending beyond this interval to a final depth of 600 feet. We will then conduct hydraulic fracturing operations at pressures higher than those typical of commercial geothermal operations to date. Our team possesses considerable expertise in high-pressure hydraulic fracturing as a result of direct experience with hot dry rock (HDR) fracturing operations in the US and elsewhere.

Our overall plan is to develop a *vertical* EGS system with the cooled geofluid injected into a deeper region of competent limestone, capturing heat from the surrounding rock as it flows upward through the induced system of hydraulic fractures toward the principal reservoir interval between 1500 and 2100 feet, then mixing with the upwelling geofluid also flowing into this interval. This in not unlike the operation of the current HDR project at Soultz (the European Community HDR project at Soultz-sous-Forets in France), where the cooled geofluid is returned to the reservoir to mix with the naturally occurring hot fluids before production at the surface under the action of a submersible pump. (At Soultz, the injection rate is equal to the production rate, but tracer testing indicates that only a small portion of the reinjected fluid is returned to the surface at any one time.).

Experience in the US, Japan and Europe, where high-pressure hydraulic fracturing has been employed to enhance natural geofluid productivity in conjunction with numerous HDR [or more properly, hot wet rock (HWR) projects], indicates that the induced fracture systems almost always develop in near-vertical directions. For this reason, the relatively small horizontal separation between our two wellbores should not be a disadvantage, since a near-vertical system of open hydraulic fractures should adequately connect the deep injection well to the production well through the intervening vuggy limestone interval, with the injected fluid considerably augmented by the natural upward flow of hot geofluid in nearby natural faults and fractures. To gain the fullest possible understanding of our fracture-enhanced system, we will utilize microseismic monitoring to follow the course of our fracturing operations and employ tracer testing during the initial flow testing of our completed system.

Operation of the EGS System. During circulation, pressure will be maintained at levels high enough to inject all of the spent geofluid. To a degree, the required pressure will be dependent on the specific characteristics of the fracture system, but our experience indicates that it should be on the order of 1,000 psi or less for a system at this depth. Experience at HDR sites around the world further indicates that pressure-propped fracture systems are in a constant state of flux as circulation proceeds, with cooler pathways closing off and new pathways developing. We expect this to be the case for our system and will confirm that fact by periodic tracer testing. We thus anticipate that our system will be a true "heat mining" operation with our recirculated fluid drawing thermal energy from portions of the hot rock in the reservoir that would not be accessible to geothermal fluids under naturally existing pressure and flow conditions. We will further employ a downhole pump after the manner of the European HDR Project currently underway at Soultz in northeastern France to enhance our geofluid production rate to reach the required 950,000 pounds of fluid per hour (about 1900 gpm at ambient temperatures) for our power plant feed. Our water will be rejected from the plant at 200°F. About 10% of the produced geofluid will be lost to the atmosphere via the cooling towers of the power plant. The remaining 90% will be used for thermal applications in the AmeriCulture fish-rearing facility after being rejected from the power plant and prior to reinjection into the reservoir. Based on previous experience with this reservoir and recent flow testing described below, we anticipate the net water withdrawal of about 200 gpm will be well within the long-term sustainable limits of productivity for this reservoir.

The Power Plant. The geothermal resource that is presently available at the AmeriCulture site is 232°F, but the goal of our EGS project is to achieve temperatures of 300°F. In preparing this project plant, we have therefore looked at power plant performance over a resource temperature range of 230 to 300°F.