BONNEVILLE SEABASE
TOOELE COUNTY, UTAH

Jon Allred
Utah Energy Office
Salt Lake City, UT

Established in 1988, Bonneville SeaBase is a commercial SCUBA diving facility located at a collection of small ponds fed by the Grantsville Warm Springs (Figure 1). SeaBase bills itself as "Utah's inland sea for snorkelers and scuba divers." Business facilities include warm, freshwater showers, overnight outdoor camping, trailer rentals and retail sales of dive-related items. The facility welcomes individual clients for recreation and dive training and hosts school field trips, scout troop excursions and other group events. They average 200 visitors per month. Military surplus desalination equipment converts geothermal water for culinary use.

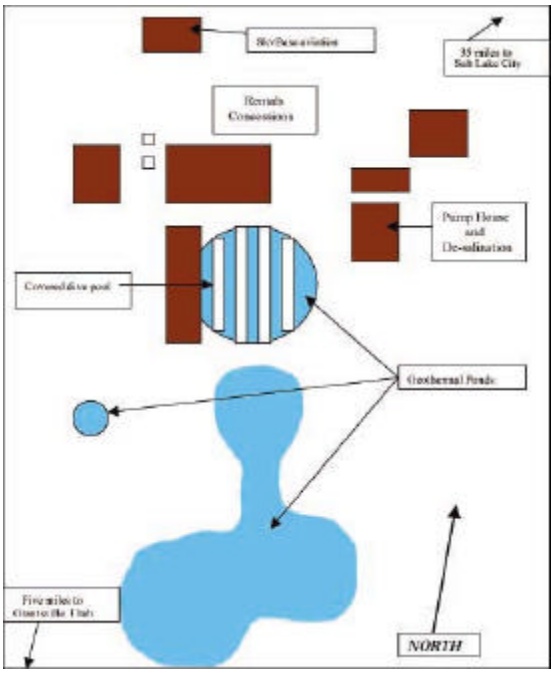

Figure 1. Map of Bonneville SeaBase.

The site is located five miles south of the Grantsville interchange at Interstate 80 and about the same distance north of the town of Grantsville, population 6,500. Located at the edge of Utah's west desert about 39 miles (63 km) west of Salt Lake City, Grantsville Warm Springs is a collection of about 20 naturally occurring geothermal springs that fill "hot pots" varying in depth from 15 to more than 60 ft (5 to 18 m). Deep pool temperatures reach 90ºF (32ºC); while, surface temperatures vary with the season, from a high of about 85ºF in summer to 61ºF (29 - 16ºC) in winter. A drilled well at the site provides additional geothermal flow that naturally overflows unless pumped into the ponds.

The springs are situated along the northeast flank of the Stansbury mountain range, part of the Middle Rocky Mountain physiographic province that is characterized by Basin and Range topography. The Stansbury range consists mainly of Paleozoic quartzite and carbonate rocks folded and thrusted along a generally north-south alignment. Rock units are fractured by tectonic activity and intruded by igneous masses, thereby creating permeable conduits for convective movement of hydrothermal fluid. Rising geothermal fluid mixes with shallow meteoric waters before reaching the surface.

Geothermal springs in this region tend to be rich in sodium chloride with total dissolved solids (TDS) ranging above 7,000 mg/L. Grantsville Warm Springs has a specific gravity of about 1.020 from a TDS concentration of about 26,500 mg/L, about equal to seawater. By contrast, TDS concentration in nearby Great Salt Lake water exceeds 100,000 mg/L. SeaBase reports that spring flow is declining, although some of the loss may be drought-related. Occasional events of heavy precipitation coincide with a temporary increase in geothermal flow. Of concern is the possibility that diminished flow at SeaBase is also due to irrigation well pumping by upstream landowners who are trying to "prove-up" water rights in anticipation of land development.

The opportunity to interact with true ocean creatures in a saline environment attracts diving clients and curious visitors from across the United States. SeaBase has participated in the transfer of marine animals to and from large aquariums and has cooperated in university study projects. The facility consists of four dive pools, some of which are covered by aluminum and plastic structures to help control water surface conditions. The surface area of pools totals about 30,000 sq ft (2,790 m^2) . Pool water is continuously freshened by mild artesian flow from underlying springs and is stocked with over 100 tropical marine animals, including angel, damsel, grouper, grunt, hog, puffer, nurse shark, jacks, mollies, tang, triggers and shrimp (Figure 2).

In addition to artesian flow, a drilled well and pump provide up to 200 gpm (13 L/s) of additional geothermal flow that is either fed into the water purification circuit or piped into some of the open pools to improve circulation. There is no overall automatic flow control and overflow from geothermal pools goes directly into an open ditch for soil percolation. There is no firm understanding of how this water cycle affects groundwater recharge.

Over the years, the pools have been excavated, contoured and interconnected to improve safety and provide greater interest and opportunity for both divers and marine animals. The deepest pool has been excavated to 62 ft (19 m) in order to accommodate more intensive SCUBA training (Figure 3). Outdoor camping and BBQ facilities are

available, and a powered parachute business located at an airstrip next door attracts clientele with interests compatible with SeaBase.

Figure 2. Tropical marine fish pool.

Figure 3. 62-ft (19-m) dive pool.

In spite of best efforts, pool water is always cloudy, with visibility ranging from 15 feet to as little as 4 ft (4.6 to 1.2 m). Marine life produces substantial waste, and divers inevitably kick-up large amounts of silt that can especially degrade conditions during periods of heavy use. At times, water visibility is only marginally suitable for marine animals and divers. Operators cite this situation as a limiting factor to the business development at SeaBase and a major demand on time and money in the search for solutions.

Efforts have been made to introduce marine creatures that help balance interactions between brine, plants and animals. SeaBase operators gather knowledge from a variety of sources and rely on practical experience through trial and error and careful observation. Meanwhile, operators are also occupied with business management tasks and key people frequently travel out-of-state and overseas as either tour guides or in pursuit of marine animals or other resources. Development of an effective biologic model of brine interactions with weather, aquatic habitat and diving activities at SeaBase could help resolve water clarity issues that affect marine health and diving enjoyment. This geothermal resource could also support commercial production of marine animals for both hobby and culinary use.

.