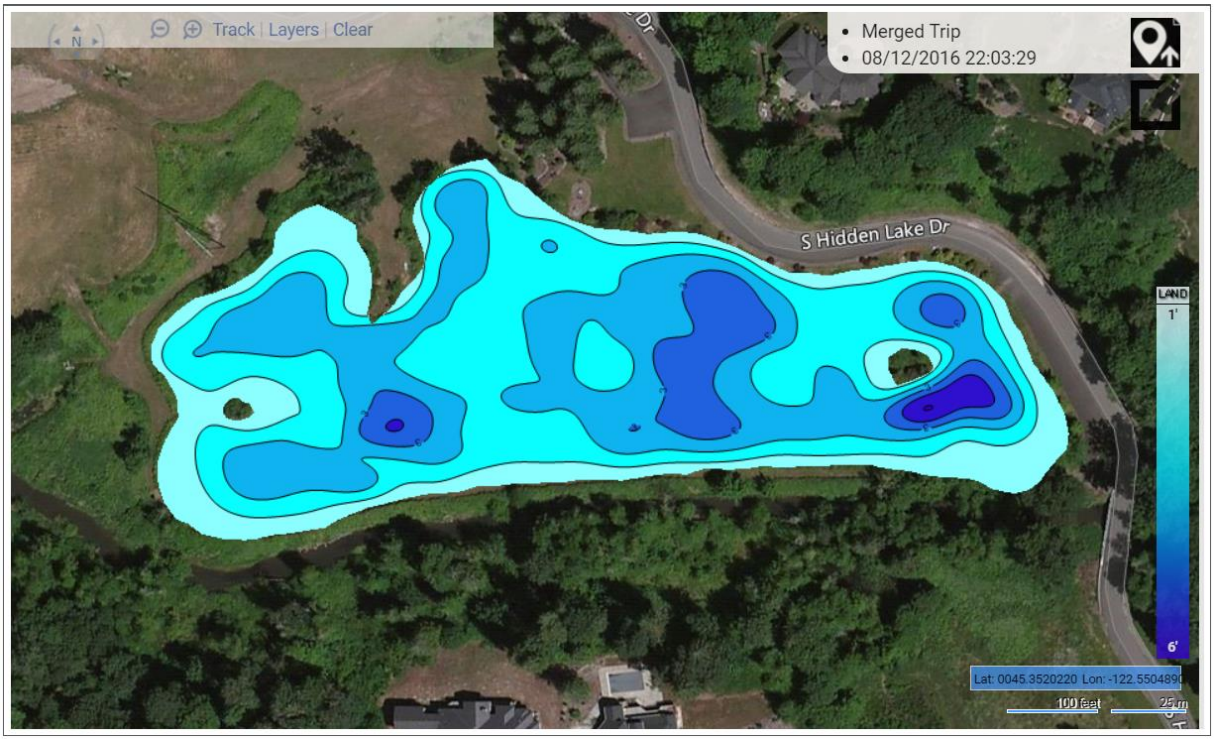
Hidden Lake Estates Aeration Plan 2019

Healthy ponds and lakes have the proper balance of oxygen and nutrients to sustain plants, fish and other living organisms. There are two sources for oxygen in the water; as a byproduct of photosynthesis, or from currents or wind pushing oxygen through the surface. Dissolved oxygen can be depleted because oxygen is being used even when it is not being replenished by natural current wind and mixing. An over abundance of plants and algae at the surface can cause oxygen depletion through thermal stratification and lead to fish kills when anoxic water is suddenly mixed throughout the water column during a wind event. Adding aeration is a permanent solution to increasing circulation of oxygenated water, it can help to balance water PH, interrupt nutrient cycling that drives algal blooms and decrease buildup of muck through aerobic decomposition. Aeration can also significantly decrease available habitat for water born flying insects like mosquitos and midge flies. Aeration is an important part of an effective management strategy for Hidden lake and I believe would be the single most effective step in terms of improving the overall water quality and aesthetics of the lake.



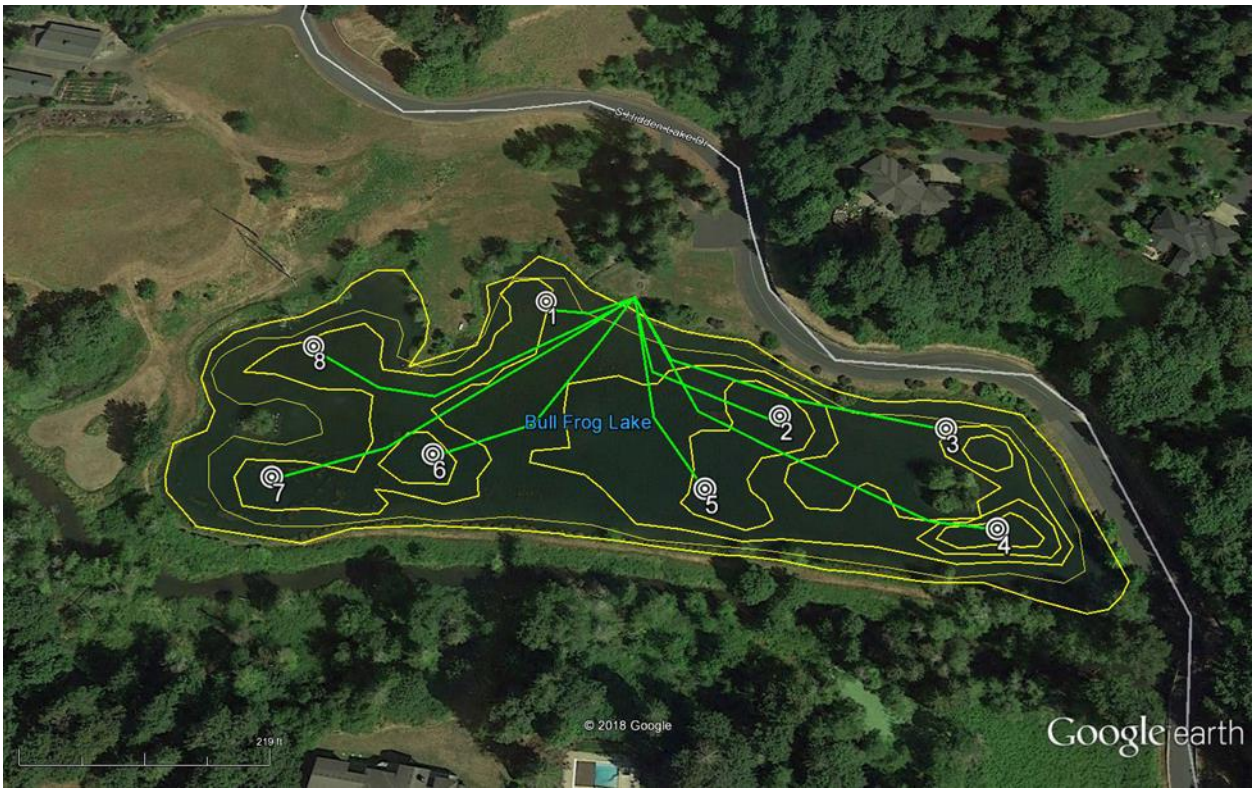
Lake dimensions:

Length Feet	Width Feet	Surface Area Acres	Average Depthe Feet	Maximum Depth Feet	Volume Acre Feet	Volume Gallons
950	250	5.49	3	6	16.47	5,366,765

Recommendations for aeration:

The proposed compressor location has been aggreed upon by the lake comittee at the north side of the lake. The compressor location and available power dictate the suitability of different types of compressors for this application. Other important factors in selecting a compressor include price, electrical costs of operation, maintenance costs, sound, difusser type, reliability and waranty . Choosing a multiple compressor system will provide additional reliability and a redundant air source. Due to the relatively large surface area to volume ratio of the water body as well as the large amount of biomass, I recommend dispersing the air with eight diffuser stations. I have recommended diffuser locations based on depth and proximity to one another.

Compressor locations and line lengths:



Diffuser	Line length Feet
Line 1	103
Line 2	247
Line 3	396
Line 4	500

Line 5	253
Line 6	305
Line 7	447
Line 8	408
Total	2659

Choosing a compressor system:

I recommend choosing a multiple compressor system. A multiple compressor system will reduce incremental cost of repairs or replacement of system components and create built in redundancy to ensure continuous operation. I have calculated system pressure based on air hose length and water depth. Below is a system pressure calculation based on the water depth and line length:

North side 1,2,3,8: 1154 feet of air tubing

Deepest aerator 6 feet Total system pressure (incl. friction loss): 4.59 PSI

South side 4,5,6,7: 1505 feet of air tubing

Deepest airator 6 feet Total system pressure (incl. friction loss): 4.77 PSI

Based on the system pressure there are two types of compressors that I would recommend, a rotary vane compressor or a rocking piston compressor. a rotary vane compressor spins carbon fins inside a housing, creating a large volume of air at a lower pressure they can be a good choice for aerating shallow waterbodies because of the relatively high volume of air for the motor size. Therefore, we could adequately aerate hidden lake using fewer compressors. The drawbacks of a rotary vane compressor are they require more maintenance, annual maintenance parts cost $200 per year to replace the carbon blades. Rotary vane compressors are less energy efficient and use about 40% more electricity compared to a rocking piston of the same horsepower. Noise is also an issue; rotary vain compressors are louder than rocking piston compressors. The compressors below are covered by a one year warranty.

GAST 1023 ROTARY VANE SEPTIC AIR PUMP

10.0 cfm Open Flow

10.0 psi Maximum Continuous Pressure

3/8'' Female Threaded Outlet

3/4 HP, 120/230VAC, 60 Hz, 9.6/4.8A

Comes Pre-Wired for 230VAC Operation –

Can Be Re-Wired for 115VAC in the Field

1 Phase, 1725 RPM

Dimensions: 16.20'' L x 6.50'' W x 8.88'' H

Includes All Filters and Mounting Feet

Replacement Parts Available

One Year Warranty

Rotary vane aeration system budget

Item	Quantity	Cost
Gast ¾ hp compressor	2	$1338.00
Self weighetd air line	3000 feet (10x300 foot rolls)	$3900.00
Hose fittings	50	$150.00
Hose clamps	50	$75.00
Dual head Difuser bases	8	$1112.00
Compressor manifold plumbing	2	$430.00
Compressor manifold mount	2	$250.00
Vented pump housing	2	$250.00
Pea gravel balest	8	$50.00
Materials sub total		$7555.00
Assembly Labor Estimate	10	$850.00
Instalation Labor Estimate	16	$1360.00
Total		$9765.00

Rocking piston compressors move a sealed piston back and forth to compress a lower volume of air at high pressure. The sealed piston requires less maintenance and shoud be rebuilt every three years with parts costing around $100. Rocking pistons are quieter and more energy efficient than rotary vane compressors. Due to these factors and the wide range of applications for these compressors, they have become industry standard for small lake aeration. The compressors below are covered by a one year waranty.

- Max. Flow: 5.4 scfm
- Max. Pressure: 30 psi
- Motor: 1/3 horsepower, PSC
- Voltage: 115 volt, 60 Hz, 1-phase
- Inlet / Discharge: 1/4” NPT
- Oil-less, non-lube piston and cylinder
- Long-life, high performance piston seal
- Head design allows easy piston seal replacement
- Twin fans provide cooling air through and around motor and cylinders
- Balanced for smooth, low vibration operation

Rocking piston system budget:

Item	Quantity	Cost
Thomas 2680 CE 50 1/3 hp piston compressor	4	$1916.00
Self weighetd air line	3000 feet (10x300 foot rolls)	$3900.00
Hose fittings	50	$150.00
Hose clamps	50	$75.00
Dual head Difuser bases	8	$1112.00
Compressor manifold plumbing	2	$430.00
Compressor manifold mount	2	$250.00
Vented pump housing	2	$250.00
Pea gravel balest	8	$50.00
Materials sub total		$8133.00
Assembly Labor Estimate	10	$850.00
Instalation Labor Estimate	16	$1360.00
Total		$10,343.00

The Vertex Air4-XL2 is a comparably sized retail aeration system from Vertex Water Features. The total cost reflects purchase of two units housed in aluminum enclosures. Aluminum enclosures also house air manifolds and include sound reducing sub assemblies. Each unit runs tandem rocking piston compressors. The compressor system comes preassembled and requires less assembly labor. This system employes two 9 inch rubber diffuser membranes on each stainless steel diffuser base. This system requires annual maintenance on the diffuser membranes. Each compressor is required to be rebuilt every three years. Rebuild kits cost $100. This product is covered by a 3 year waranty. Please see attached brocure for electrical requirements.

Vertex Air 4-XL2

Item	Quantity	Cost
Brookwood rocking piston compressor system 1/2hp	4	$9,951
Self weighetd air line	3000 feet (10x300 foot rolls)	$3900.00
Hose fittings	50	$150.00
Hose clamps	50	$75.00
Compressor manifold plumbing	2	Included
Dual 9” Rubber membrane Diffuser and SS base	16	Included
Powder coated aluminum enclosure sound antinuation sub assembly	2	included
Shipping		$350
Materials sub total		$14,426.00
Assembly Labor Estimate	5	$425.00
Instalation Labor Estimate	16	$1360.00
Total		$16,211.00

The Vertex Large Lake 33HE is similar to the air Air4-XL2 but is housed in one large cabinet and is only available in 230v. Please see attached brocure for electrical requirements.

Item	Quantity	Cost
Brookwood rocking piston compressor system 1/2hp	4	$9,694.00
Self weighetd air line	3000 feet (10x300 foot rolls)	$3900.00
Hose fittings	50	$150.00
Hose clamps	50	$75.00
Compressor manifold plumbing	2	Included
Dual 9” Rubber membrane Diffuser and SS base	16	Included
Powder coated aluminum enclosure sound antinuation sub assembly	2	included
Shipping		$325.00
Materials sub total		$14,144.00
Assembly Labor Estimate	5	$425.00
Instalation Labor Estimate	16	$1360.00
Total		$15,929.00

The Vertex High Flow 7 LX2 is a dual compressor system with larger horse power rocking piston pumps it would run each difusser at lower flow rates and is capable of supplying air to 7 defuser heads. It is covered by a three year waranty. Please see attached brocure for electrical requirements.

Item	Quantity	Cost
Brookwood rocking piston compressor system 3/4hp	2	$5,568.00
Self weighetd air line	3000 feet (10x300 foot rolls)	$3,900.00
Hose fittings	50	$150.00
Hose clamps	50	$75.00
Compressor manifold plumbing	1	Included
Dual 9” Rubber membrane Diffuser and SS base	14	Included
Powder coated aluminum enclosure sound antinuation sub assembly	1	included
Shipping		$332.00
Materials sub total		$10,025.00
Assembly Labor Estimate	5	$425.00
Instalation Labor Estimate	16	$1360.00
Total		$11,810.00

There are many options to consider in choosing the best system for hidden lake. I am able to demo different types of compressors on site in order to evaluate the need for sound antinuation.