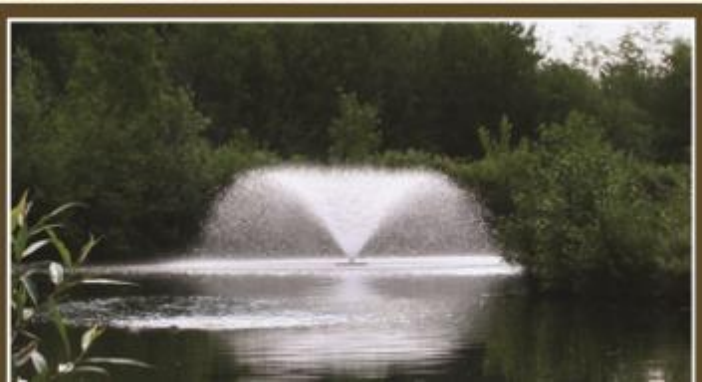
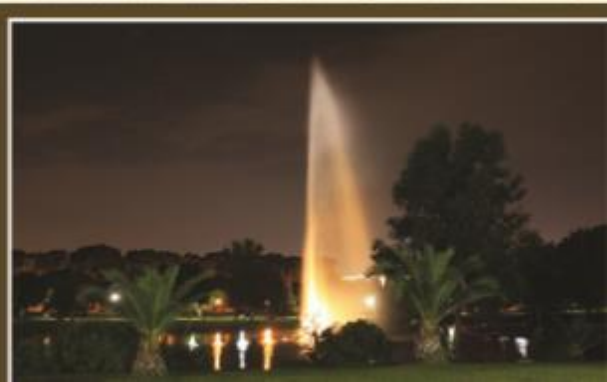
Sustainable Water Management

Cape Town- August 2019





WHAT WE WILL COVER

- Why People Buy Otterbine
- Lake Management & Water Chemistry
- Effects of Poor Water Quality
- Aeration
- Otterbine Products

FAMILY OWNED & OPERATED

- **Family Values:**
  The Barebo's have owned Otterbine more than 40 Years
- **Solvent:**
  Patient Capital
- **Dedication:**
  Dedicated To Our Customers, Distributors & Employees

We are here for the long term

Chuck & Terry Barebo

Chris Barebo, Charlie Barebo & Carla Barebo-Ott

THE FOLKS AT OTTERBINE

- Over 600 years of combined experience in the water quality business
- Average tenure is 16 years with the company

BRAND AWARENESS

- Started in 1954

  Otterbine is the oldest company currently in the turf and landscape water aeration market

- Market Leader

  Otterbine holds the innovator's share of the market

- Otterbine is a Generic Term for Aerator-Fountain

  As 'Kleenex' is to Tissue, 'Otterbine' is to Aerator-Fountains

- Customer Retention

  Tens of thousands of satisfied customers

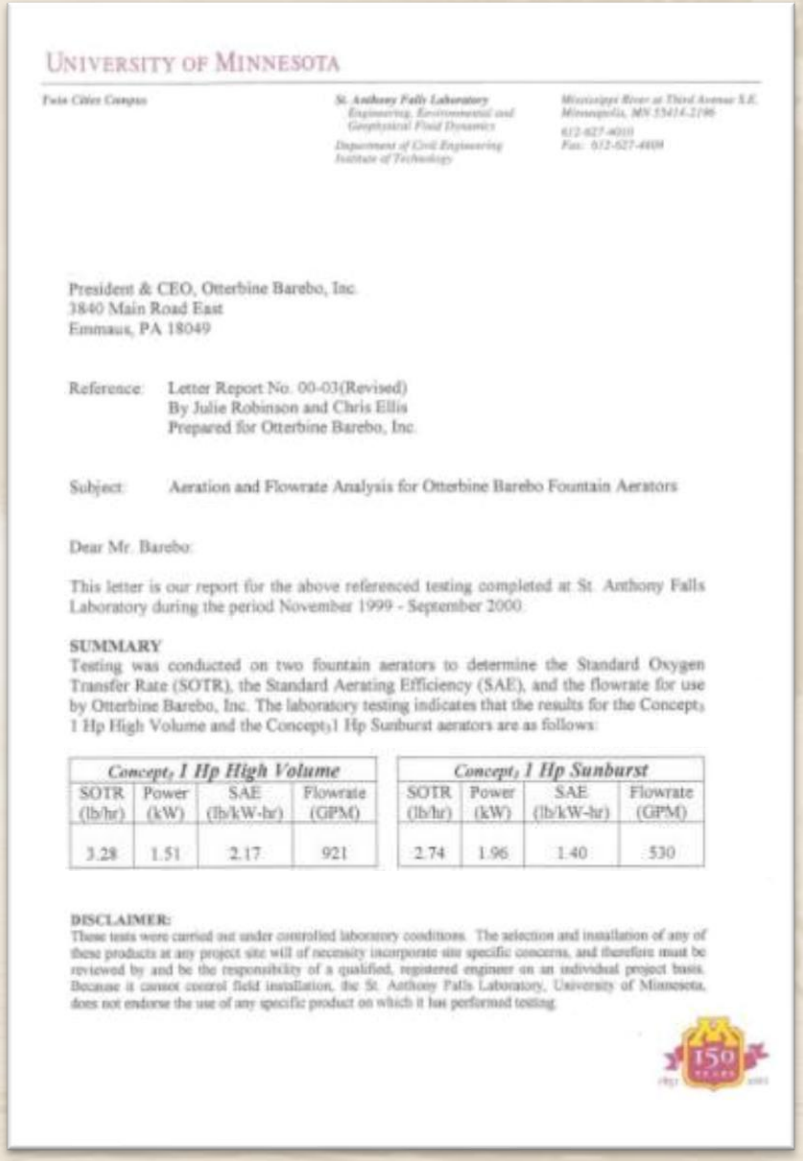
Original Otterbine
circa 1954

SCIENTIFIC EXPERIENCE

- Our experience in waste water treatment & aquaculture positions Otterbine as a s*cientific* rival to our fountain based competitors

PERFORMANCE

- Highest Oxygen Transfer Rates
  Otterbine units have the highest oxygen transfer and pumping rates in the industry
- Lowest Energy Costs
  Otterbine has on average the lowest energy costs in the industry



UNIVERSITY OF MINNESOTA

Twin Cities Campus

St. Anthony Falls Laboratory
Engineering, Environmental and Geophysical Fluid Dynamics
Department of Civil Engineering
Institute of Technology

Mississippi River at Third Avenue S.E.
Minneapolis, MN 55414-2196
612-627-4000
Fax: 612-627-4009

President & CEO, Otterbine Barebo, Inc.
3840 Main Road East
Emmaus, PA 18049

Reference: Letter Report No. 00-03(Revised)
By Julie Robinson and Chris Ellis
Prepared for Otterbine Barebo, Inc.

Subject: Aeration and Flowrate Analysis for Otterbine Barebo Fountain Aerators

Dear Mr. Barebo:

This letter is our report for the above referenced testing completed at St. Anthony Falls Laboratory during the period November 1999 - September 2000.

SUMMARY

Testing was conducted on two fountain aerators to determine the Standard Oxygen Transfer Rate (SOTR), the Standard Aerating Efficiency (SAE), and the flowrate for use by Otterbine Barebo, Inc. The laboratory testing indicates that the results for the Concept$_3$ 1 Hp High Volume and the Concept$_3$1 Hp Sunburst aerators are as follows:

Concept$_3$ 1 Hp High Volume			
SOTR (lb/hr)	Power (kW)	SAE (lb/kW-hr)	Flowrate (GPM)
3.28	1.51	2.17	921

Concept$_3$ 1 Hp Sunburst			
SOTR (lb/hr)	Power (kW)	SAE (lb/kW-hr)	Flowrate (GPM)
2.74	1.96	1.40	530

DISCLAIMER:

These tests were carried out under controlled laboratory conditions. The selection and installation of any of these products at any project site will of necessity incorporate site specific concerns, and therefore must be reviewed by and be the responsibility of a qualified, registered engineer on an individual project basis. Because it cannot control field installation, the St. Anthony Falls Laboratory, University of Minnesota, does not endorse the use of any specific product on which it has performed testing.

COMMITMENT TO (3RD PARTY) TESTING

- Safety Testing:
  All units are independently safety tested by ETL for all relevant US and EU standards. Otterbine is a UL approved panel builder conforming to UL standards
- Performance Testing:
  All units are independently tested by the University of Minnesota or GSEE for oxygen transfer and pumping rates

WARRANTY

- Strongest Industry Warranty:
  Otterbine features a 5-year ALL-INCLUSIVE warranty on aerating fountains
- Our ‘bumper to bumper’ warranty is stronger than that of any competitor

THANK YOU FOR CHOOSING OTTERBINE®

As stewards of the environment, Otterbine Barebo, Inc. strives to sustain our natural resources for future generations. As demand for water increases exponentially, it's more important than ever for us to be environmentally conscious and do what we can to aid in water conservation and the treatment of earth's most valuable asset, water.

For a complete list of our products, and how they benefit the environment, visit our website WWW.OTTERBINE.COM

WARRANTY REGISTRATION CARD

First Name: _____ Last Name: _____

Title: _____

Company: _____

Address: _____

City: _____ State: ____ Zip: _____ Country: _____

Email: _____ Phone: _____

I purchased my Otterbine from: _____

It was installed by: _____

Delivery date: ____ / ____ / ____ Installation date: ____ / ____ / ____

You can also register this unit and others online at www.otterbine.com/warranty

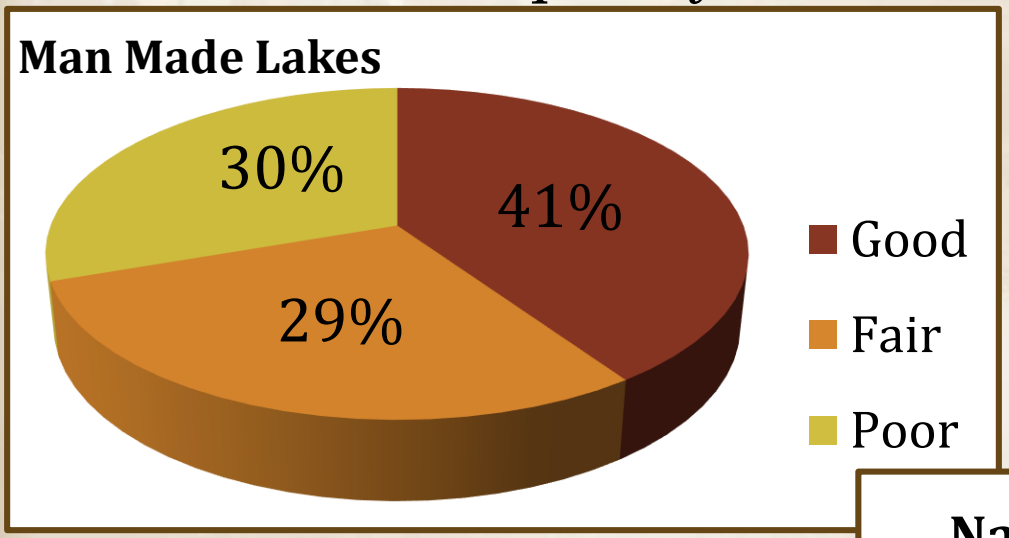
Serial numbers may be found on the opposite side of this card.

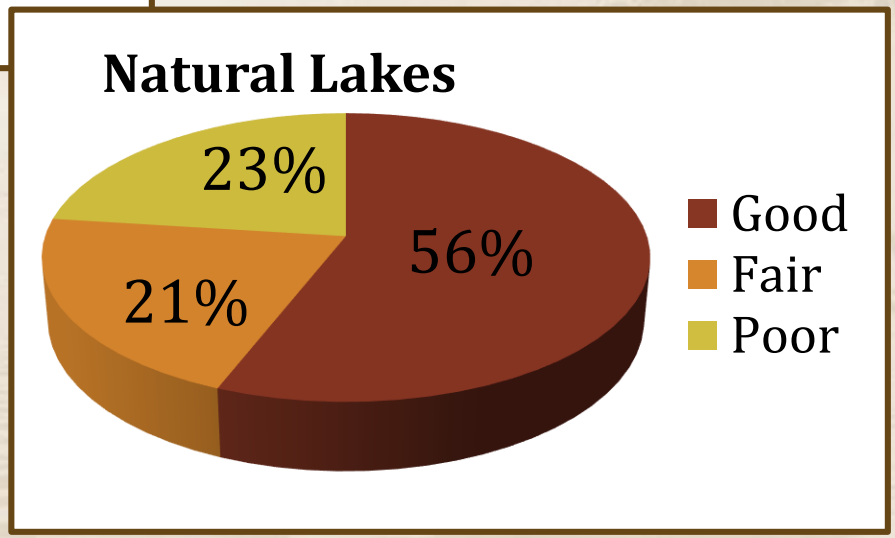
LOCAL SUPPORT

- Factory Trained Distributors the world over to support your customers
  - Design
  - Installation Support
  - Warranty and routine maintenance

WATER QUALITY VARIES

- EPA studies prove that man-made lakes have more water quality issues than natural lakes





CAUSES OF POOR WATER QUALITY

1. Sunlight, Temperature & Depth
2. Excessive Nutrients
3. Lack of Oxygen

LIGHT, TEMPERATURE, & DEPTH

>12ft/4m in depth for good water quality

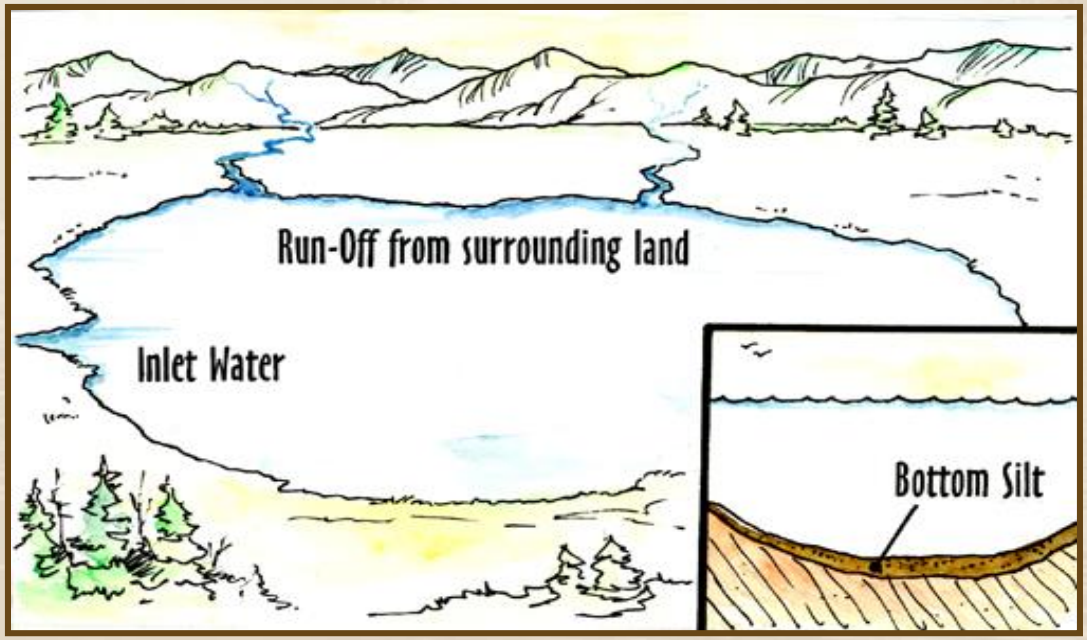
- Shallow lakes (less than 6 ft./ or 2m) receive UV light at the lake bottom
- The entire water column will be productive from a rooted weed and algae standpoint
- These lakes tend to be very warm
- This is a favorable condition for algae and aquatic weed growth

Shallow Lakes Are a Water Quality Management Challenge!

AQUATIC NUTRIENT SOURCES

Three most common sources are:

1. Sediment and Vegetation in the Lake
2. Run-off Water from Surrounding Turf Areas
3. Incoming Water



NUTRIENT CYCLING

- Simple algae reproduces as often as every 20 minutes and has a two week life cycle
- Dead algae sinks to the bottom of the lake adding to Biomass *(biological matter in the lake)*

Sediment can accumulate on the lake bottom at the rate of 1-5 in. or 2.5 - 12 cm Per Year!

RUN-OFF FROM SURROUNDING TURF AREAS

- USGA reports that studies by Dr. Beard estimate that up to 4% of fertilizers run-off or leach into lakes

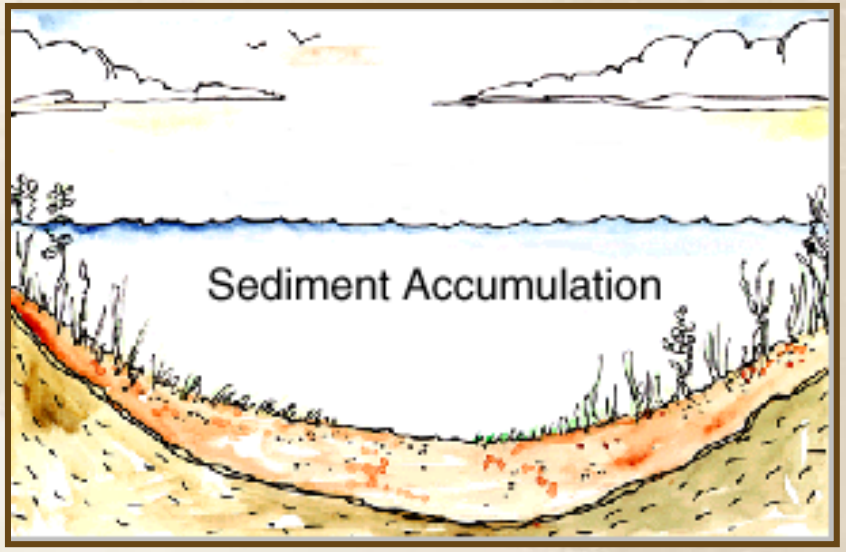
- If 16 metric tons are applied per season up to 1/2 ton or 500 kilograms of phosphorus can run-off into a lake.
  - One gram of phosphorus equals 100 grams of algae
- Leaves, grass clippings and other nutrients add to the problem.

NUTRIENT AND INLET WATERS

- Effluent from sewage, waste water treatment plants and leeching from septic systems
- Well water contains little or no Dissolved Oxygen
- Foaming is an indication of excess phosphorus

WATER STORAGE CAPACITY

- At a mid-range sediment accumulation rate of 3in or 8cm per year
  - A one surface acre or 4000 m^2 lake would lose 80,000 U.S. gallons or 300m^3 of capacity per year



OXYGEN'S ROLE IN POND/LAKE

Oxygen's Role in Pond:

- Support Animal & Plant Life
- Support Aerobic Digestion in the Consumption of Excess Nutrients

Healthy Ecosystem

- O_2 Producers Keep Pace with O_2 Consumers

  Natural Clean-Up Process Keeps Nutrients at Low Levels

Unbalanced Ecosystem

- Nutrients Outpace Digestion
- Oxygen Consumption Outpaces Supply

ORGANIC DIGESTION
Aerobic vs. Anaerobic Bacteria

AEROBIC (good)

- Requires Oxygen
- Fast
- Efficient
- Complete digestion
- Breaks down wastes into water, carbon dioxide and polysaccharides

ANAEROBIC (bad)

- Anoxic
- 5 to 6 times slower
- Inefficient
- Incomplete digestion
- Terrible odors
- Poisonous by-products
  - methane
  - hydrogen sulfide
  - ammonia

Bacteria's metabolic rate increases in warm temperature

WATER QUALITY TESTS
Appropriate US EPA Levels

Dissolved Oxygen	⇨	>4 mg\l Check before sunrise
BOD	⇨	<5 mg\l
pH	⇨	6 to 9 (7 - 8 are neutral)
Alkalinity	⇨	>50 mg\l is well buffered
Chlorophyll	⇨	<2 mg\l
Suspended Solids	⇨	<5 mg\l
Fecal Coliform	⇨	<200 colony forming units per 100ml *No human contact if >400
Total Nitrogen	⇨	<5 mg\l
Total Phosphorus	⇨	>.05 mg\l is considered high >.1 mg\l will experience algae blooms

POOR WATER QUALITY
Effects or Symptoms

- Algae
- Weeds
- Odors
- Fish Kills
- Insects
- Public Health

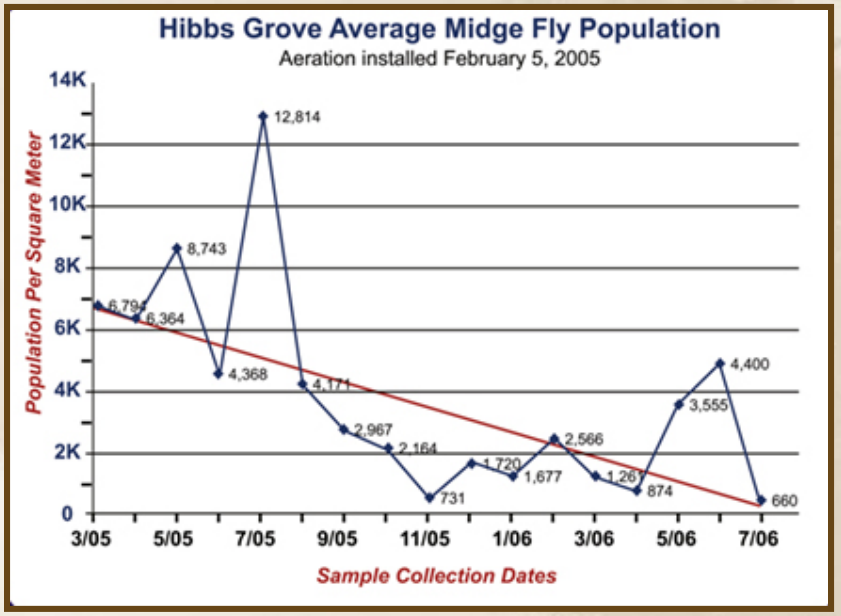
Once a lake has lost its ecological balance and goes into crisis, the costs of restoring the lake increases dramatically.

COST OF POOR WATER QUALITY

- Impact is on the property, both functionally and aesthetically
  - Clogged Irrigation System
    - Pumps, Valves, & Sprinklers
  - Sludge Build Up in the Lake
    - Loss of storage capacity
    - Black zone
  - Odors, Fish Kills, Insect Breeding
  - Loss of Aesthetic Appeal

INSECT CONTROL

- Insects breed in waters that are:
  - Rich in organics
  - Low in oxygen
  - Calm or still



- Recent case study
  - Insect larvae population at 6,794 per square meter (6X's the nuisance level)
  - Aeration system installed and run for 14+ months
  - Larvae population drops to 660 per square meter

SPECIFY BMP'S

- Swale to prevent run-off from entering lake
- Buffer plants on littoral shelf to absorb nutrients and slow erosion
- Aeration system to mix and promote digestion

AERATOR VS. FOUNTAIN

- Aerators move large volumes of water while adding dissolved oxygen
- Fountains use a nozzle under pressure to create a decorative spray pattern.

Aerator

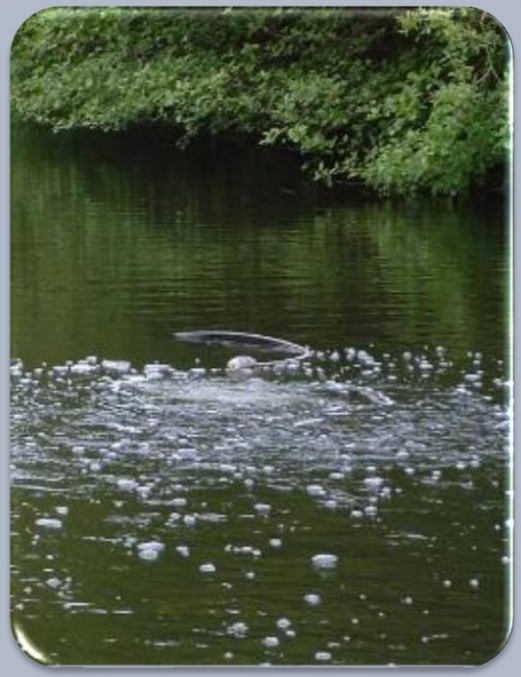
Fountain

WHAT DOES AERATION DO?

- Aeration improves water quality by impacting the 3 factors:
  1. **Oxygen:** Aeration encourages aerobic digestion of nutrients by adding oxygen
  2. **Nutrients:** These are kept in balance through digestion and oxidation
  3. **Temperature:** Mixing breaks down stratification adding O2 to lower levels

TYPES OF AERATION

Surface Aeration



Horizontal Mixers & Aspirators

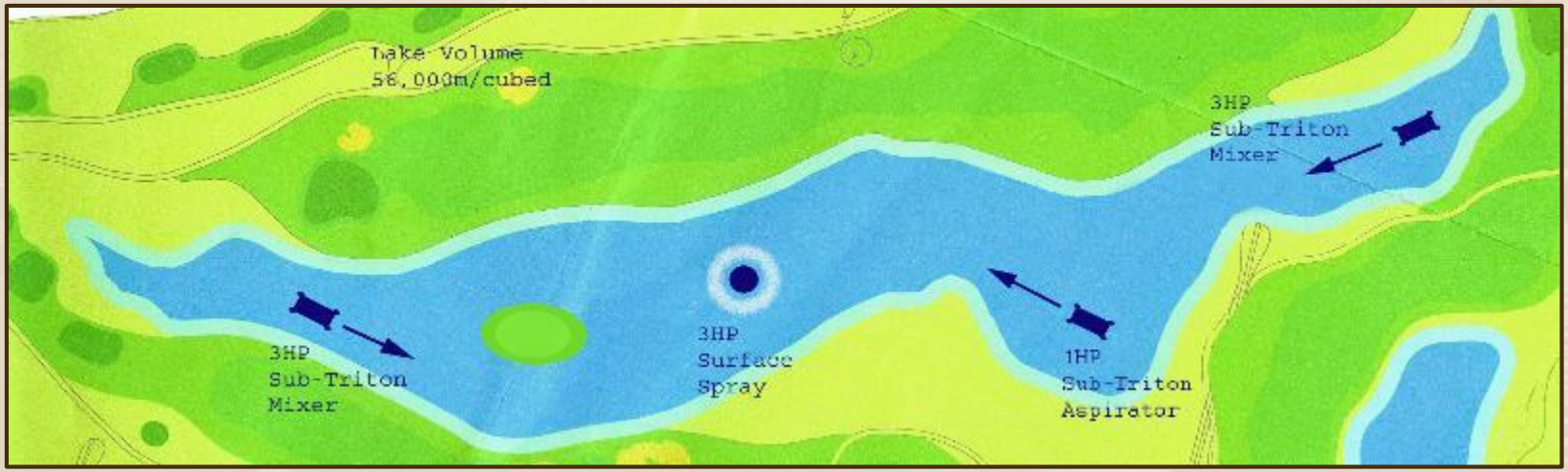
Air Diffusion

CRITERIA FOR AN AERATOR

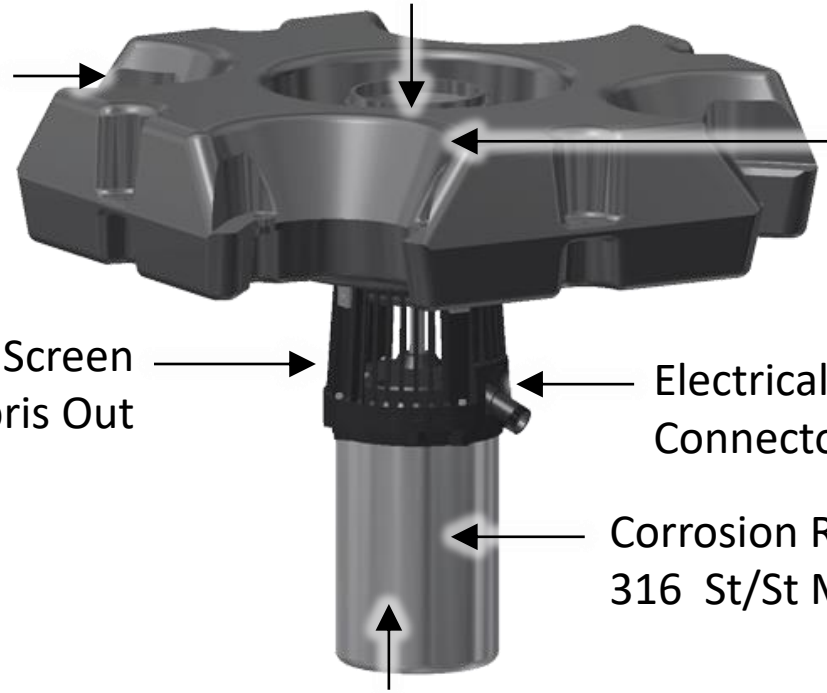
- **O^2 Transfer Rate:** True aerators are rated by their oxygen transfer rate.
  - Look for a system that has independent oxygen transfer testing to ASCE standards
  - Good Spray or Aspirating Aeration System will develop 2-3 lb. or 1-1.3 kilos of oxygen per hour.
- **High Pumping Rates:** Aerator must pump a minimum of 400GPM or 90m^3/hr
- **Safety Tested & Approved:** CE, CSA, ETL or UL.

AERATOR PLACEMENT

- Placement is dependent on size & shape
  - Place aerators or diffusers to insure maximum circulation
  - Use multiple units for best results
- Streams and canals are best suited for horizontal aspirating aeration systems



AERATING FOUNTAINS (CONCEPT 3: 1HP-5HP)



CONCEPT 3 PRODUCT ILLUSTRATION (AERATING FOUNTAINS)

Minimum Operating Depth = 30in (75cm)

Warranty = 5 years

CONCEPT 3 AERATION LINE

Sunburst

Gemini

Saturn

'Open Throat' Pumping Chambers with Stainless Steel Impeller

CONCEPT 3 DECORATIVE LINE

Phoenix

Tristar

Rocket

‘Decorative’ Pumping Chambers with Thermoplastic Impeller

CONCEPT 3 DECORATIVE LINE

Comet

Equinox

Genesis

Omega

CONCEPT 3 DECORATIVE LINE

Constellation

All C3 Products include:

- 5 Year Warranty
- Cable Quick Disconnect
- Fiberglass PCC with Surge Arrestor, GFCI, Timer and Disconnect
  (50Hz packages may vary)

Available Options:

- LED Lighting
- Wind Controls
- Custom Panels (PCCs)

AERATING FOUNTAIN LIGHTING OPTIONS

- LED Lighting (6.5W)
  Recommended Light Sets for 1HP-5H

Low Voltage LED Lights

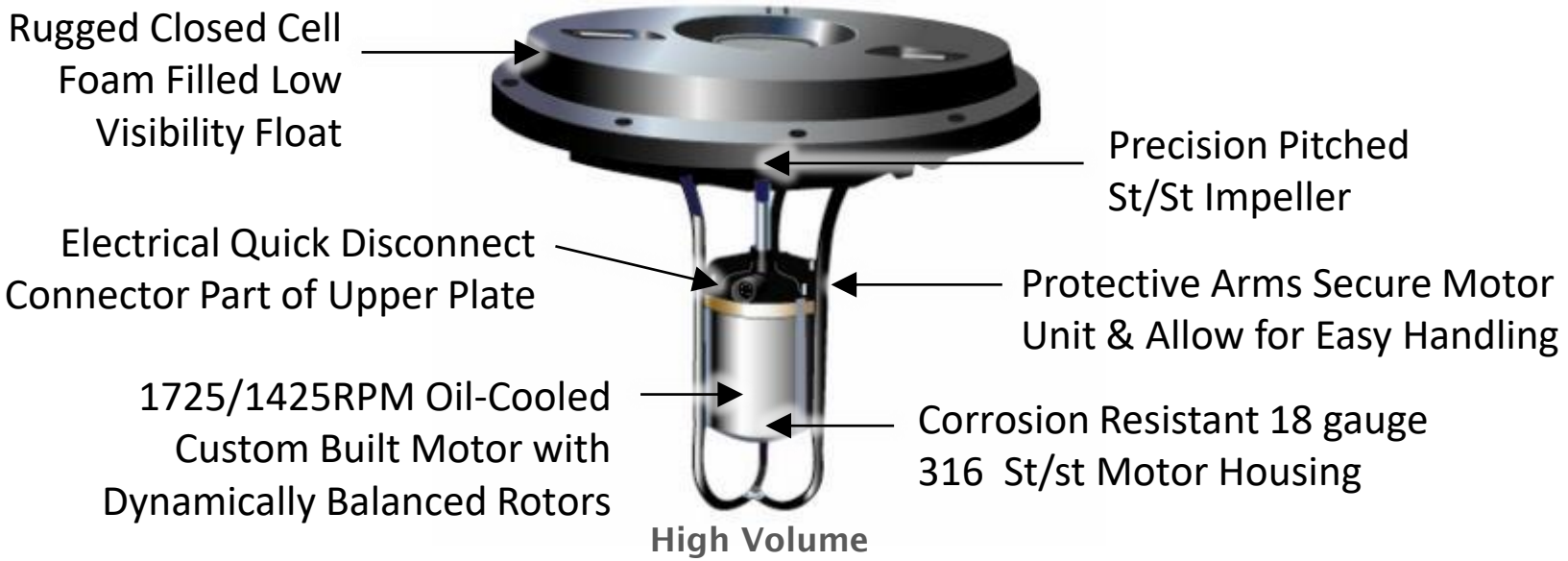
Low Voltage 4-Light Set

PERFORMANCE TESTING

Model	Flow Rate	OTR
1HP High Volume	**198.5m^3/hr**	**1.49kg/Hr**
1HP Sunburst	114.4m^3/hr	1.25kg/Hr
1HP Gemini	119.7m^3/hr	1.29kg/Hr
1HP Tristar	32.4.3m^3/hr	0.6kg/Hr
1HP Phoenix	32.4m^3/hr	0.6kg/Hr
1HP Rocket	23.7m^3/hr	0.55kg/Hr

3rd Party Testing completed by the University of Minnesota

INDUSTRIAL AERATORS (CONCEPT 2: 1HP-5HP)




Sub-Triton Aspirator


Triton Aspirator


Sub-Triton Mixer


Triton Mixer

CONCEPT 2 PRODUCT ILLUSTRATION (INDUSTRIAL AERATORS)

Minimum Operating Depth = 30–36 inches (75cm-1m) *varies by platform*

Warranty = 3+5 years

INDUSTRIAL AERATORS HIGH VOLUME

High Volume

Minimum Operating Depth = 40in

- Highest Independently Tested Flow Rate and OTR in the Industry
  - Flow Rate = 920GPM @ 1HP
  - Oxygen Transfer Rate = 3.28lbs/HP/Hr

INDUSTRIAL AERATORS MIXERS

Mixers
(Triton & Sub-Triton)

Minimum Operating Depth:
Triton = 3ft | Sub-Triton = 2.5ft

- Aim Unit to Provide Positive Flow
- 3HP Unit will Influence @ 575 Linear Feet

Triton Unit (floating): Ideal for water 10ft-15ft
Sub-Triton Unit (subsurface): Ideal for water 3ft-10ft

DIFFUSED AERATION

- Air Flo 3 Systems Include:
  - Compressor(s) with Valve Manifold in Cabinet Enclosure
  - Diffuser Manifold Assemblies/Pads
- Tubing Ordered Separately
  - Available in Weighted & Unweighted 100ft (30m) Lengths

The *NEW* Air Flo 3:
Compact, Versatile & Efficient with Quiet Operation

(Approximately 60ft from Cabinet Only Adds 3dB to Ambient Noise)

DIFFUSED AERATION AIR FLO 3

Air Flo 3

Diffused Air System

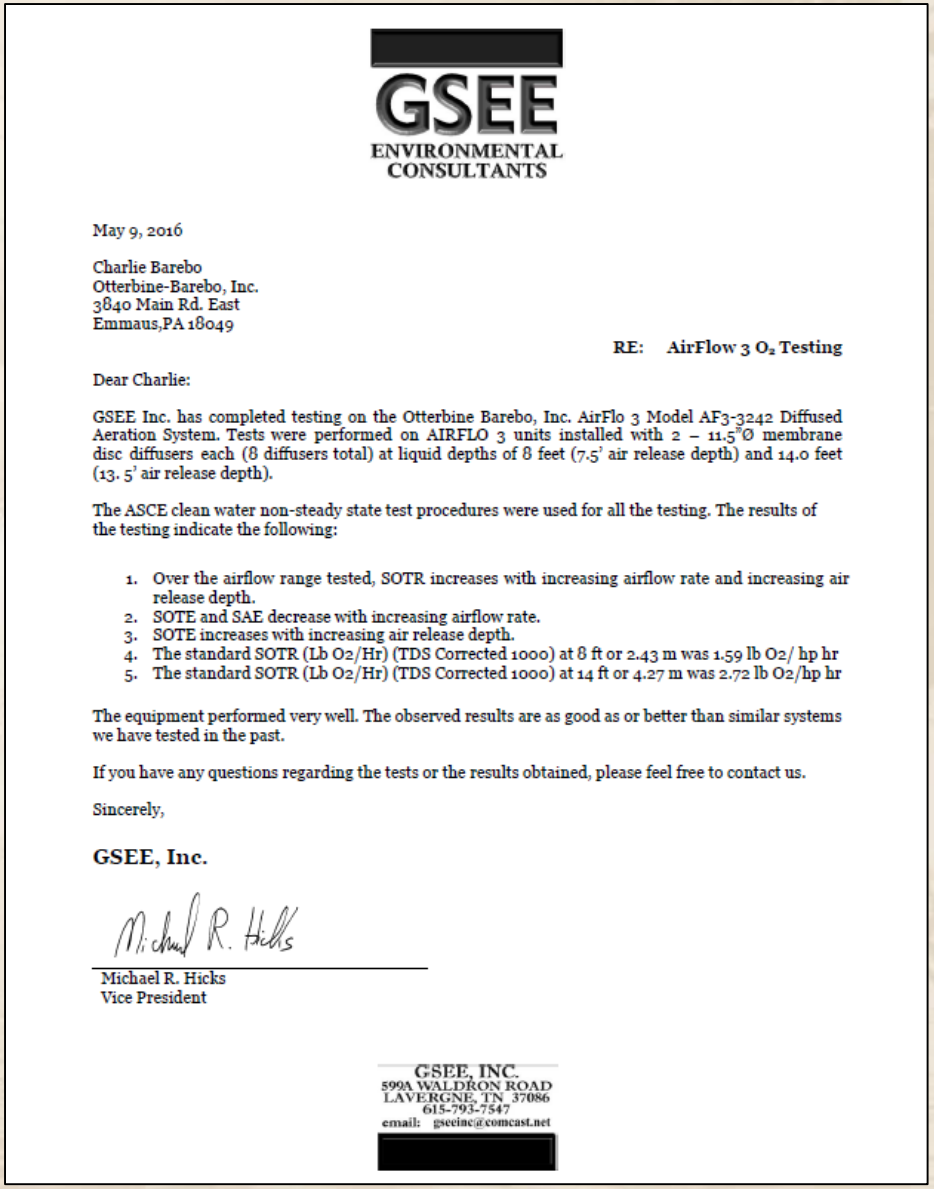
Operating Depth = 8ft to 40ft+
(2.4m to 12.2m)

- Energy Efficient, Quiet, Sub-Surface Option to Water Quality Management
- Natural Lake Appearance without the Disruption of Surface Sprays & Floats
- No Electricity in Water

AIR FLO 3 PERFORMANCE

Independent Testing by GSEE

- Standard SOTR at 8ft (2.4m) = **1.59lb** O_2/hp hr
- Standard SOTR at 14ft (4.3m) = **2.72lb** O_2/hp hr
- System loses 0.19 lbs or 9% oxygen transfer per 1ft (30 cm) decrease in depth



GSEE
ENVIRONMENTAL CONSULTANTS

May 9, 2016

Charlie Barebo
Otterbine-Barebo, Inc.
3840 Main Rd. East
Emmaus,PA 18049

RE: AirFlow 3 O_2 Testing

Dear Charlie:

GSEE Inc. has completed testing on the Otterbine Barebo, Inc. AirFlo 3 Model AF3-3242 Diffused Aeration System. Tests were performed on AIRFLO 3 units installed with 2 – 11.5"Ø membrane disc diffusers each (8 diffusers total) at liquid depths of 8 feet (7.5' air release depth) and 14.0 feet (13. 5' air release depth).

The ASCE clean water non-steady state test procedures were used for all the testing. The results of the testing indicate the following:

1. Over the airflow range tested, SOTR increases with increasing airflow rate and increasing air release depth.
2. SOTE and SAE decrease with increasing airflow rate.
3. SOTE increases with increasing air release depth.
4. The standard SOTR (Lb O2/Hr) (TDS Corrected 1000) at 8 ft or 2.43 m was 1.59 lb O2/ hp hr
5. The standard SOTR (Lb O2/Hr) (TDS Corrected 1000) at 14 ft or 4.27 m was 2.72 lb O2/hp hr

The equipment performed very well. The observed results are as good as or better than similar systems we have tested in the past.

If you have any questions regarding the tests or the results obtained, please feel free to contact us.

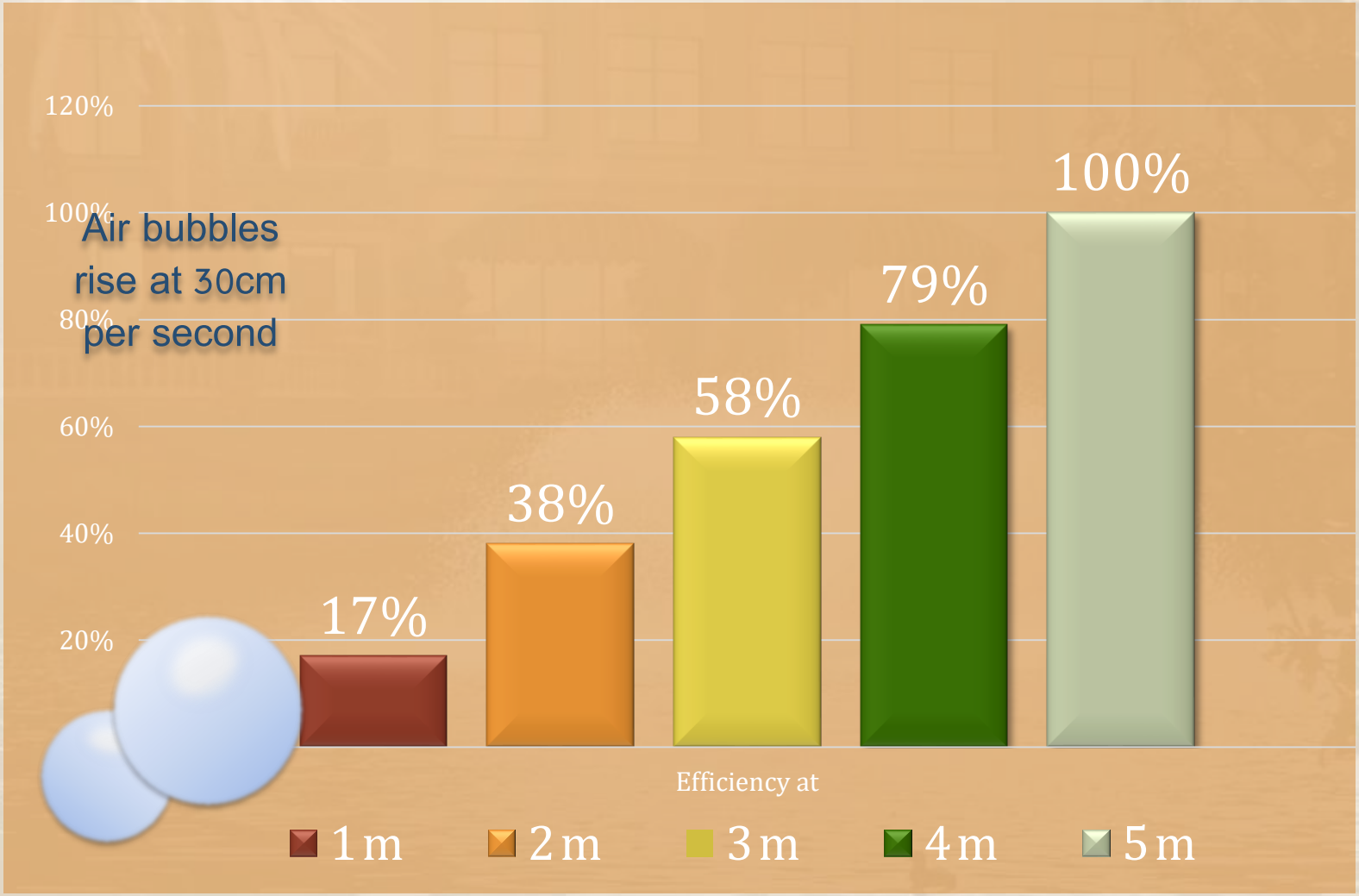
Sincerely,

GSEE, Inc.

Michael R. Hicks
Vice President

GSEE, INC.
599A WALDRON ROAD
LAVERGNE, TN 37086
615-793-7547
email: gseeinc@comcast.net

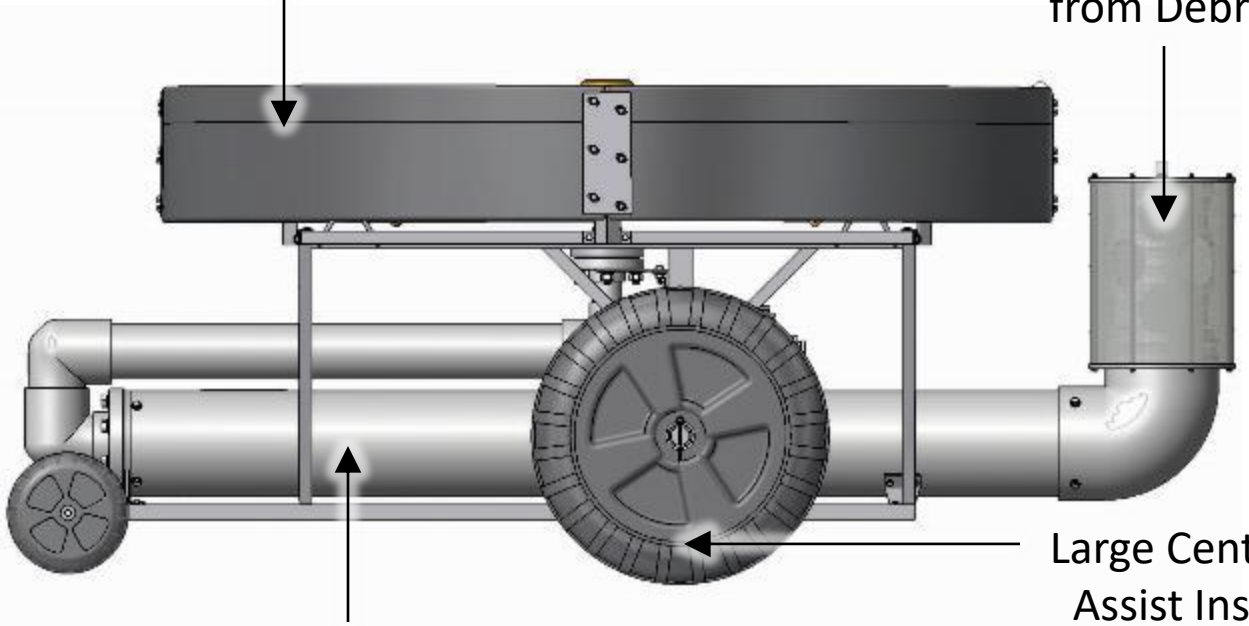
EFFICIENCIES AT DEPTH AIR FLO 3



GIANT FOUNTAIN (10HP, 15HP & 25HP)

Float Design Allows for Height Adjustments to Reduce Float Visibility

Removable St/st Intake Screen Protects Pump from Debris



Large Center Wheels Assist Installation & Removal

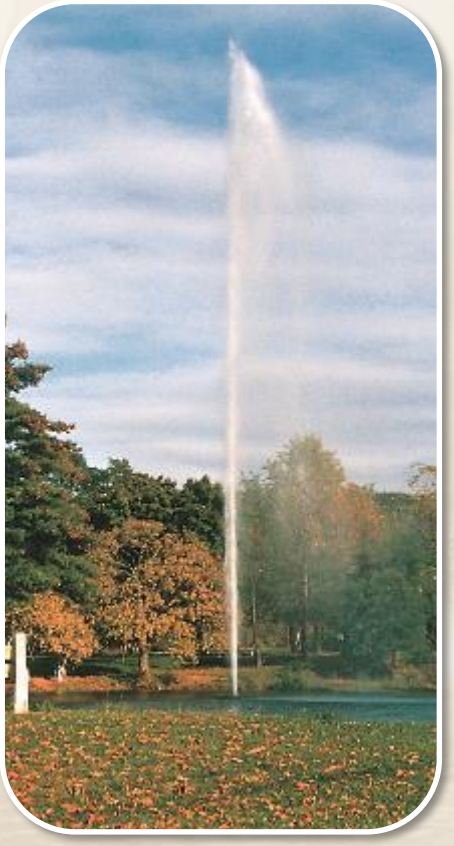
3450/2875RPM Grundfos Pump and Franklin Motor

GIANT FOUNTAIN PRODUCT ILLUSTRATION

Minimum Operating Depth = 40in (1m)

Warranty = 4 yrs (5 yrs with Sub-trol option)

GIANT FOUNTAIN (10HP, 15HP & 25HP)



Super Nova

Mystic

Polaris

GIANT FOUNTAIN (10HP, 15HP & 25HP)

Aqua Star

Triad

Giant Fountain Options:

- Electrical Quick Disconnect
- Sub-Monitor Controls *(3Ph only)*
  - Increases Warranty from 2yrs to 3yrs
- Fountain Glo Lighting
- Wind Controls
- Custom Panels (PCCs)

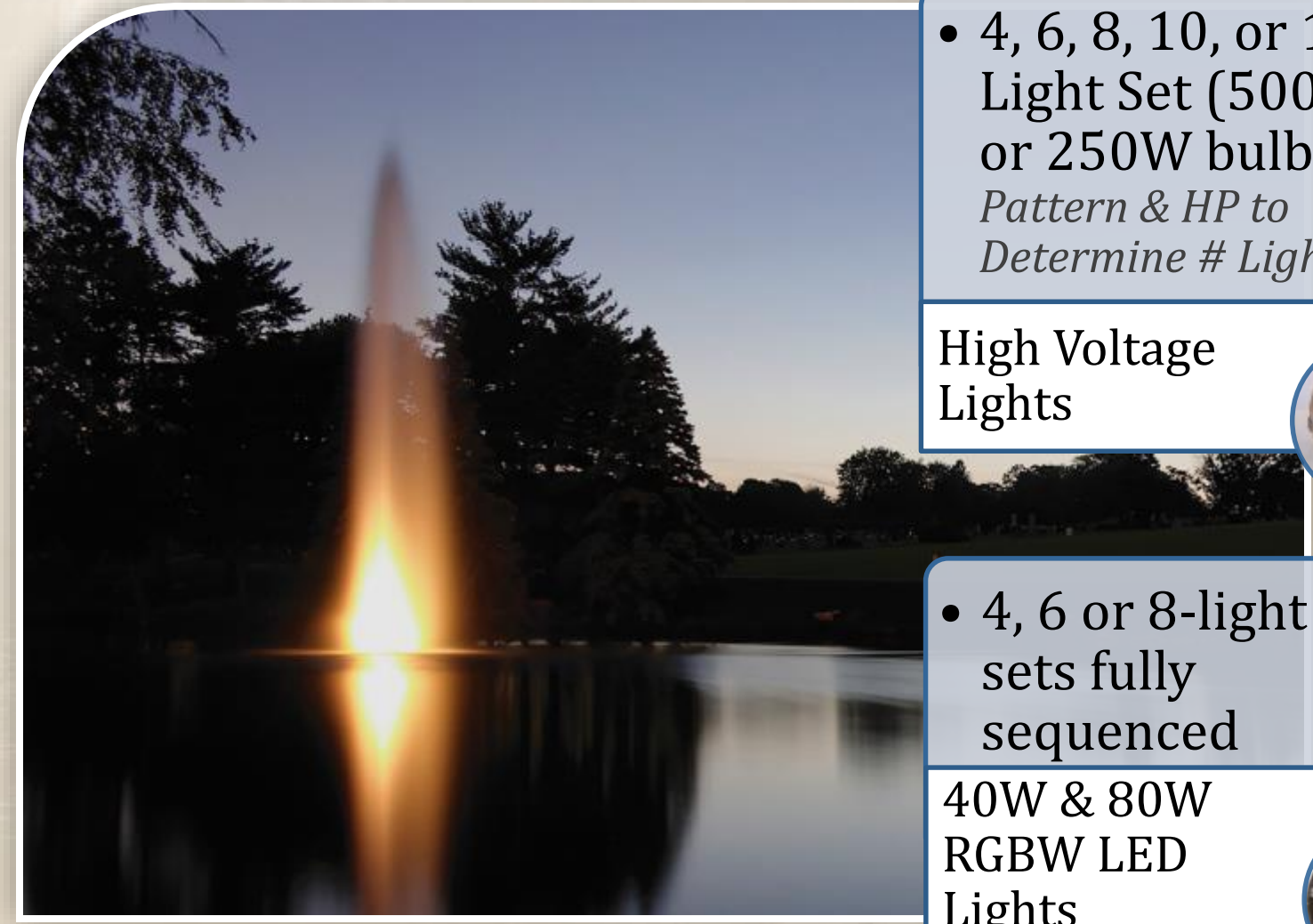
GIANT FOUNTAIN (10HP, 15HP & 25HP)

Aries

Equinox

New for 2019

GIANT FOUNTAIN LIGHTING



High Voltage 500W 4-Light Set

- 4, 6, 8, 10, or 12 Light Set (500W or 250W bulbs)
  Pattern & HP to Determine # Lights

High Voltage Lights

- 4, 6 or 8-light sets fully sequenced

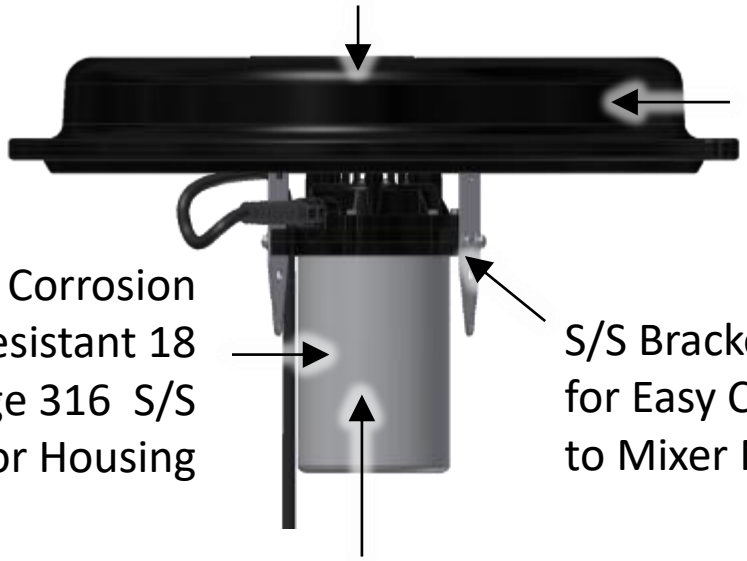
40W & 80W RGBW LED Lights

FRACTIONAL SERIES 1/2HP

4 AERATING PATTERNS +

Includes 4 Interchangeable Patterns with Corrosion Resistant Impellers

Rugged Low Visibility Foam Filled Polyethylene Float w/light Pockets

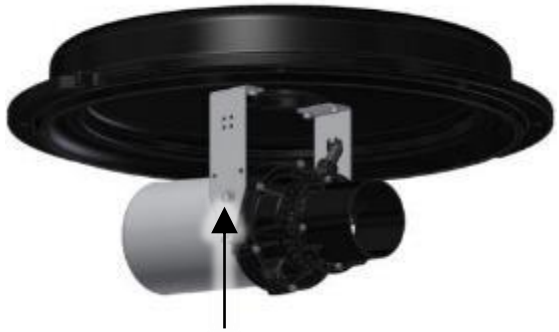


Corrosion Resistant 18 gauge 316 S/S Motor Housing

S/S Brackets Allow for Easy Conversion to Mixer Model

High Speed 1/2HP 1Ph 115V/230V 3250RPM Motor Incorporates a Silicon Carbide Rotary Seal

HORIZONTAL MIXER



S/S Brackets Allow Mixer to Adjust +/- 8 degrees

5 Systems in 1

4 Patterns & Horizontal Mixer

Comes Assembled as Gemini

FRACTIONAL SERIES PRODUCT ILLUSTRATION

Minimum Operating Depth = 16in (40cm)

Warranty = 2 years

FRACTIONAL SERIES 1/2HP PATTERNS

High Volume

Gemini

Phoenix

Rocket

FRACTIONAL SERIES 1/2HP MIXER

Mixer

Horizontal Mixer

- Aim to Provide Positive Flow
- Ideal for Canals, Inlets and Shorelines

NATURAL SOLUTIONS

OVERVIEW

- Why People Buy Otterbine
- Lake Management & Water Chemistry
- Effects of Poor Water Quality
- Aeration
- Otterbine Products

THANK YOU FOR YOUR TIME!

Please visit Otterbine at **www.otterbine.com**
or call 1-800-237-8837 (610-965-6018)