algaewheel®

Hybrid Attached Growth Technology

Algaewheel Technology

Sustainable Wastewater Treatment, Water Reuse and Resource Recovery

“Recovery and reuse” is preferable to “removal and disposal”

ONE∞water®
Treatment redefined

Executive Summary

Effective wastewater treatment protects the environment, human health and freshwater supplies. Further, it can provide a renewable freshwater supply and recover valuable natural resources

Wastewater Treatment and Reuse

- **Today, the goal of treatment systems is to process pollutants to a standard where they can be discharged safely into the environment**
- **Treatment in the future should be sustainable (low energy, low carbon) treating and recovering water suitable for reuse**
- **Further, treatment needs to be decentralised in order to;**
  - keep pipe networks viable (short and cost effect)
  - allow reuse water to be close to demand

Resource Recovery

- **Today, the valuable natural resources contained within wastewater are largely discharged (lost) causing harm to the environment**
- **Treatment in the future must include resource recovery**
- **Phycoremediation (cultivation and harvesting of algae to remove nutrients from wastewater) is the most efficient form of recovery**
- **The Algal biomass produced in this process is a high quality and renewable feedstock for many valuable by-products**

Executive Summary Cont.

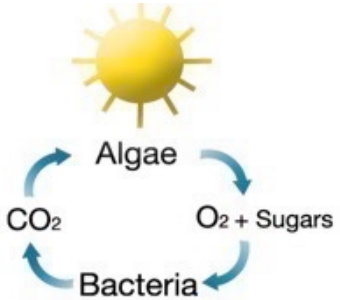
Algaewheel is a revolutionary technology that delivers a step change in sustainable decentralised wastewater treatment, water reuse and resource recovery for global markets

Wastewater Treatment and Reuse

- **Algaewheel's revolutionary hybrid fixed film technology combines the performance benefits of algal bio-films and MBBR's**
- **Algaewheel patented U.S. technology mimics nature by leveraging upon the symbiotic relationship between algae and bacteria**
  - algae use photosynthesis (daylight and carbon dioxide) to grow, giving off oxygen; reducing the need for costly aeration
- **Algaewheel is the only commercially proven algal treatment technology;**
  - consuming almost no energy, absorbs carbon in a largely autonomous, silent and odourless process
  - delivering high quality water suitable for reuse

Resource Recovery

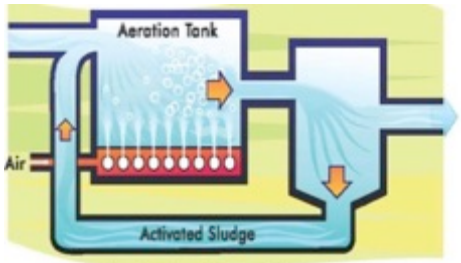
- **Current technologies have low cell productivity/m2 (high HRT) with large footprints and energy intensive (costly) algae harvesting**
- **Algaewheel produces >5x biomass than U.S. DOE current techno-economic baseline – based on High Rate Algal Pond (HRAP) productivity**
  - Potential to increase to >10x



Wastewater Treatment – Technology Challenges

>90% of all wastewater treated globally uses Activated sludge, a technology developed at the beginning of the last century

- **Activated sludge uses vast amounts of energy to dissolve oxygen into wastewater for bacterial uptake.**
- **Air only contains 20% oxygen, so the process highly inefficient and oxygen in water is usually less than 0.007%**
- **As a result, Activated Sludge plants are;**
  - very energy-intensive
  - complex and expensive to operate
  - struggle to sustainably meet water reuse treatment standards
  - generally large city-scale facilities to gain economies of scale
  - not suitable for the decentralised markets
- **Limited resource recovery**
  - majority of resources discharged to the environment or landfilled



Secondary Treatment Suspended Growth Process

Algaewheel Technology

Algaewheel® is an award winning technology that revolutionises the viability of sustainably expanding decentralised wastewater treatment, water reuse and resource recovery in a single fully integrated solution

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Treatment redefined

2015 Innovative Technology Award

Water Environment Federation
the water quality people™

601 Wythe Street, Alexandria, Virginia 22314-1994 | p 703.684.2400 | f 703.684.2492 | www.wef.org

July 20, 2015

Mr. Chris Limcaco
OneWater Inc.
201 N. Illinois Ave., Suite 1200
Indianapolis, IN 46204

Dear Mr. Limcaco:

It is my privilege and pleasure to notify you that OneWater Inc. and their technology, Algaewheel, has been selected by the WEF Board of Trustees as the 2015 recipient of the Innovative Technology Award!

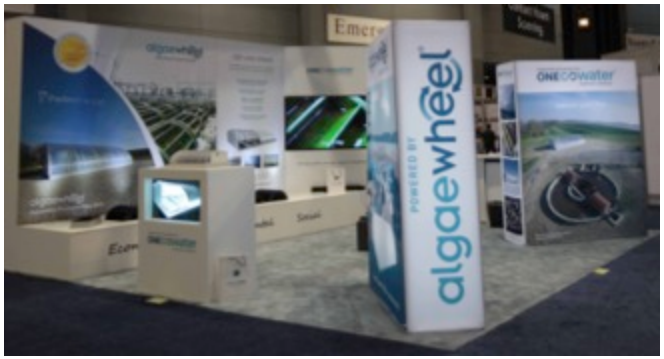
We hope you will join us at WEFTEC 2015 in Chicago, IL, to receive this award and be recognized among your colleagues. Throughout the conference week, OneWater Inc. and their technology, Algaewheel, will be recognized in the following ways:

- ***WEF Plaza Honors & Awards Display*** - A photograph will be featured in our **Honors & Awards Display**, prominently located in the Grand Concourse Lobby, McCormick Place.
- ***WEF Awards brochure*** - profiling all 2015 WEF Award recipients, the brochure will be placed in the hands of every WEFTEC attendee, and will be available at various locations throughout the Convention Center.
- ***WEF Awards and Presidential Reception and Ceremony*** – Tuesday, September 29, beginning at 4:30 p.m. at S100, South Building – Level 1, McCormick Place.

Congratulations on being selected for this significant honor!

Sincerely,

Eileen J. O'Neill
Executive Director
Water Environment Federation



Algaewheel – Track Record of High Performance

- **Proven, award winning U.S. patented technology**
- **Rapidly growing number of installations in U.S and international markets**
- **Approved by USEPA (since 2011)**
- **Meets stringent treatment standards;**
  - BOD <10 and TSS <10
  - NH3 <1
  - TN<10
- **Plant sizes from 10m3/day to 5,000m3/day**

ONEcowater® Treatment redefined

Decentralised Treatment for the 21st Century

Algaewheel – Powered By the Sun

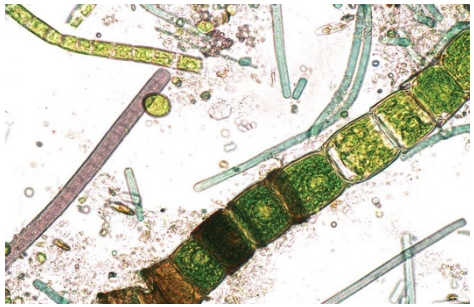
ONEcowater®
Treatment redefined

Rotating Algal Contactor (RAC) Technology

- Biological aeration
- Ultra low energy
- Stable, autonomous process
- Easy operations
- Low carbon process

Algaewheel's Disruptive Treatment Technology

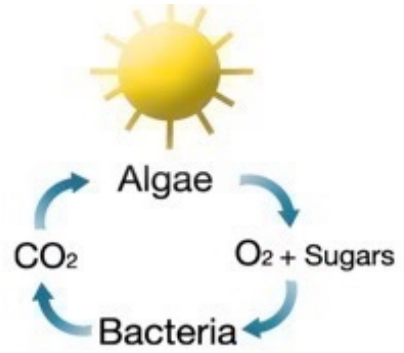
Algaewheel is a revolutionary Rotating Algal Contactor (RAC) utilizing a hybrid fixed film technology that combines the performance benefits of algal biofilms and MBBR.

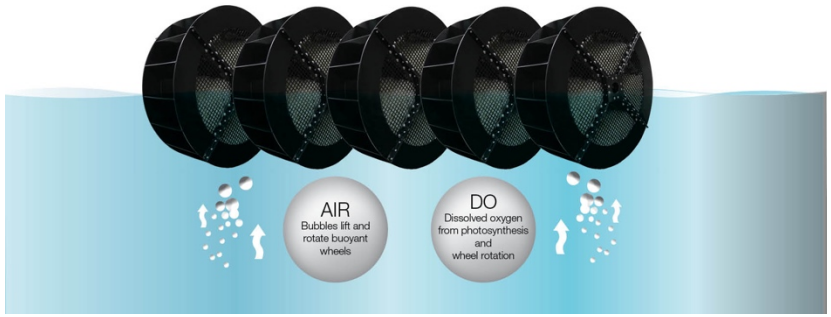


Biofilm containing algae and bacteria at 400x magnification

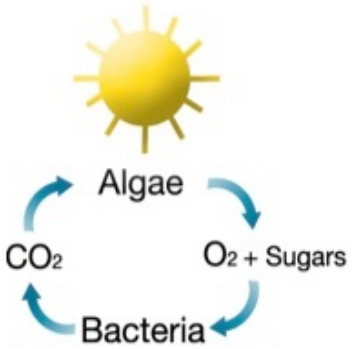
Algaewheel leverages the symbiotic relationship between algae and bacteria resulting in a step-change in sustainable treatment

- **Algal biofilm grows on wheel surface housing phototrophic organisms and bacteria**
  - photosynthesis delivers oxygen to bacteria and the water column
    - bacteria give off carbon dioxide that feed the algae
  - bacteria supplied with oxygen from algae versus large blowers in AS
  - MBBR media inside the Algaewheels delivering treatment 24/7
- **Simple, ultra-low energy air system rotates buoyant Algaewheels**
  - rising air bubbles collect in the fins, causing them to rotate
    - no other energy is required by the algaewheels to operate
- **The result, the most sustainable high performance treatment technology in the market today**





Biological Aeration



Mimicking Nature To Treat Wastewater

Photosynthesis produces 100% pure oxygen

Thick layer of biofilm on an Algaewheel

Thick layer of biofilm on a cobble from a river

Algaewheel delivers >300 times the treatment surface area than the footprint it occupies

Algaewheel: Power & Maintenance Cost Advantage

In many markets energy costs account for 50% or more of the total direct operating costs of a typical treatment plant

- **Algaewheel consumes >75% less power than Activated Sludge (AS) and MBBR process.**
- **Lower installed power will reduce maintenance costs**
- **Example for 1,000 M^3/d plant below.**

	HP	kW	Hours	kWh/d	**kWh/y**
Algaewheel	**6**	4	24	96	**35,040**
Activated sludge	25	18	24	432	**157,680**

AS aeration tank (oxidation ditch)

AS aeration tank pumps

Algaewheel pump skid

Modular Construction

Algaewheel Product Evolution 2019

algaewheel®

1200mm diameter

900mm diameter

420mm diameter

Algaewheel at Rest Stop, USA

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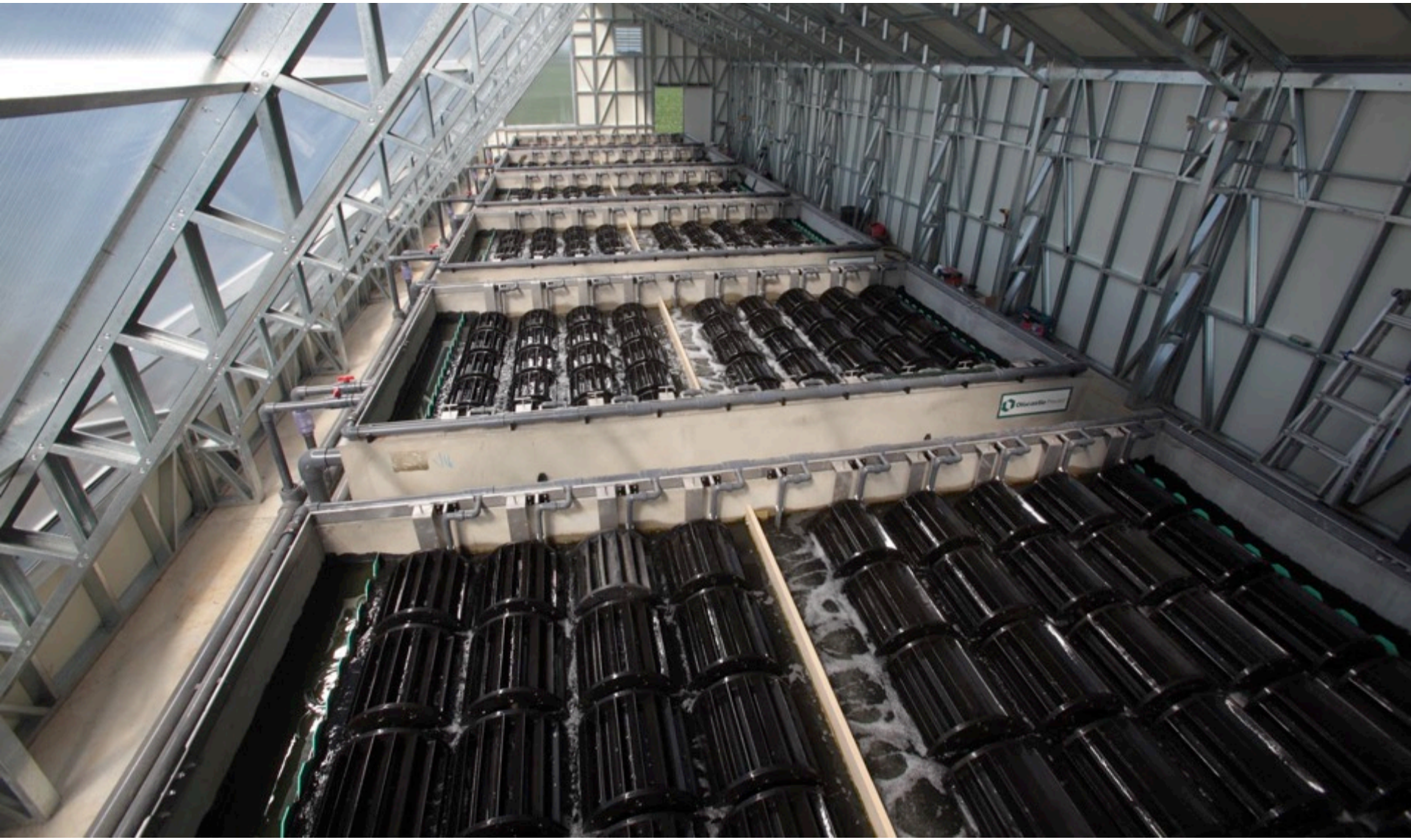
Algaewheel at Rest Stop, USA



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Algaewheel at School, USA

ONEwater®
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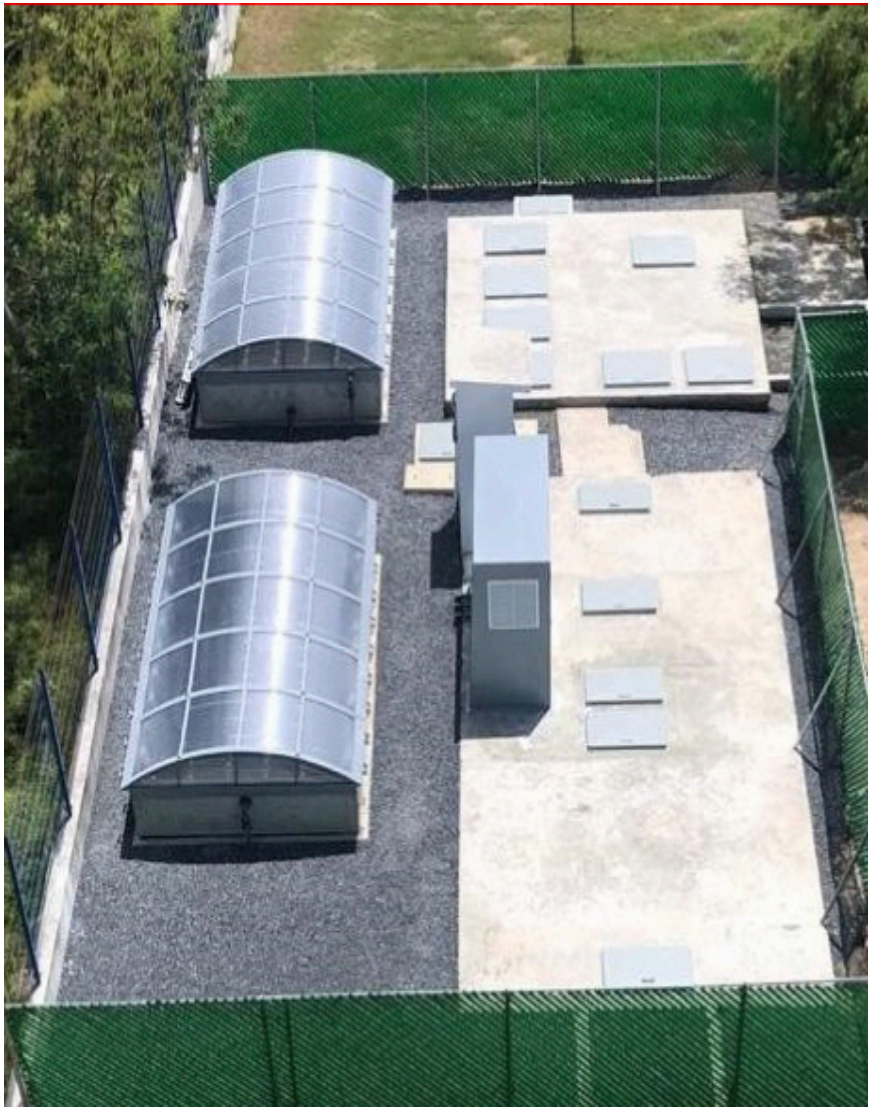
Algaewheel at a Municipality, USA

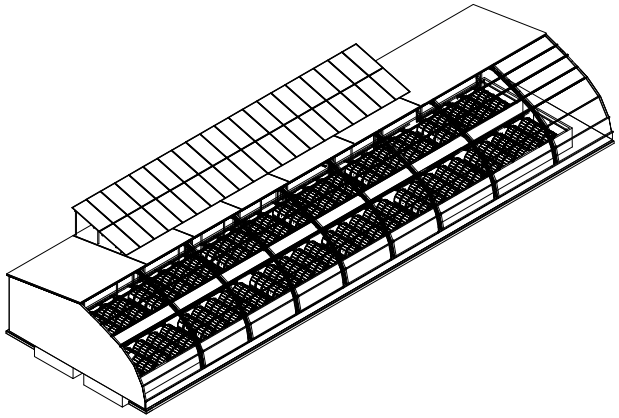
ONEwater® Treatment redefined

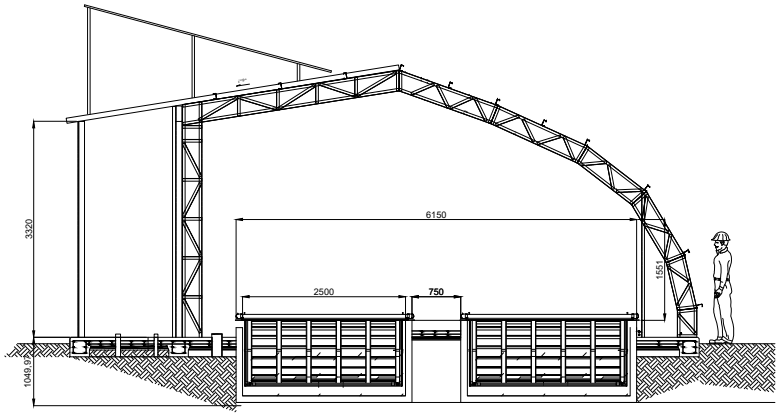
Algaewheel at a University, Mexico



ONEcowater® Treatment redefined

Example Plant Layout





SECCION "A-A"
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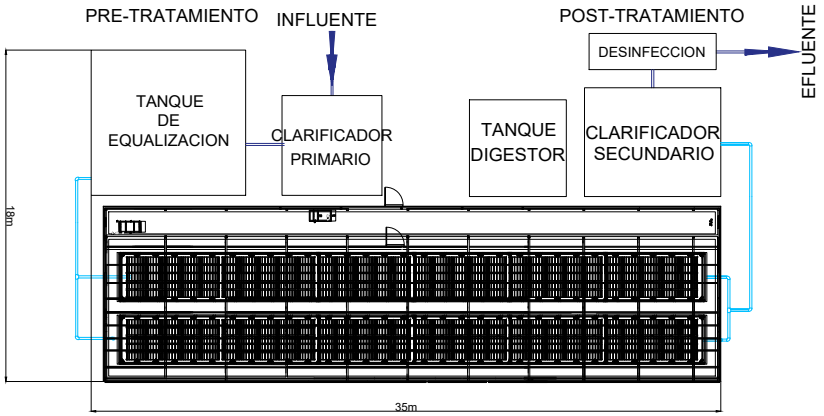


ESPECIFICACION DE TOLERANCIAS PARA CONSTRUCCION Y FABRICACION

TRABAJO DE PIEZAS MECANICAS	TRABAJO DE FABRICACION ESTRUCTURAL
TOLERANCIAS METRICAS	TOLERANCIAS METRICAS
100mm 0.15mm a 1000mm 0.4mm a 3000mm 0.8mm a 10000mm 1.6mm a	300mm 1mm a 1000mm 2mm a 10000mm 3mm a 20000mm 6mm a

NOTAS GENERALES

1. TRABAJESE ESTE PLANO EN CONJUNTO CON LOS PLANOS DE REFERENCIA, DE SER NECESARIO.
2. DIMENSIONES EN MILIMETROS A MENOS QUE SE INDIQUE LO CONTRARIO. LOS DIAMETROS SE PROPRCIONAN EN PULGADAS.
3. ELIMINAR FILOS Y REBABAS.

PLANOS DE REFERENCIA

REVISIONES

REV.	APROBO	FECHA

ONEWATER S. de R.L. de C.V.
Torre UMA, Piso 11,Ave. Manuel Gomez Morín, No. 2005
San Pedro Garza García, Nuevo León, C.P. 66297

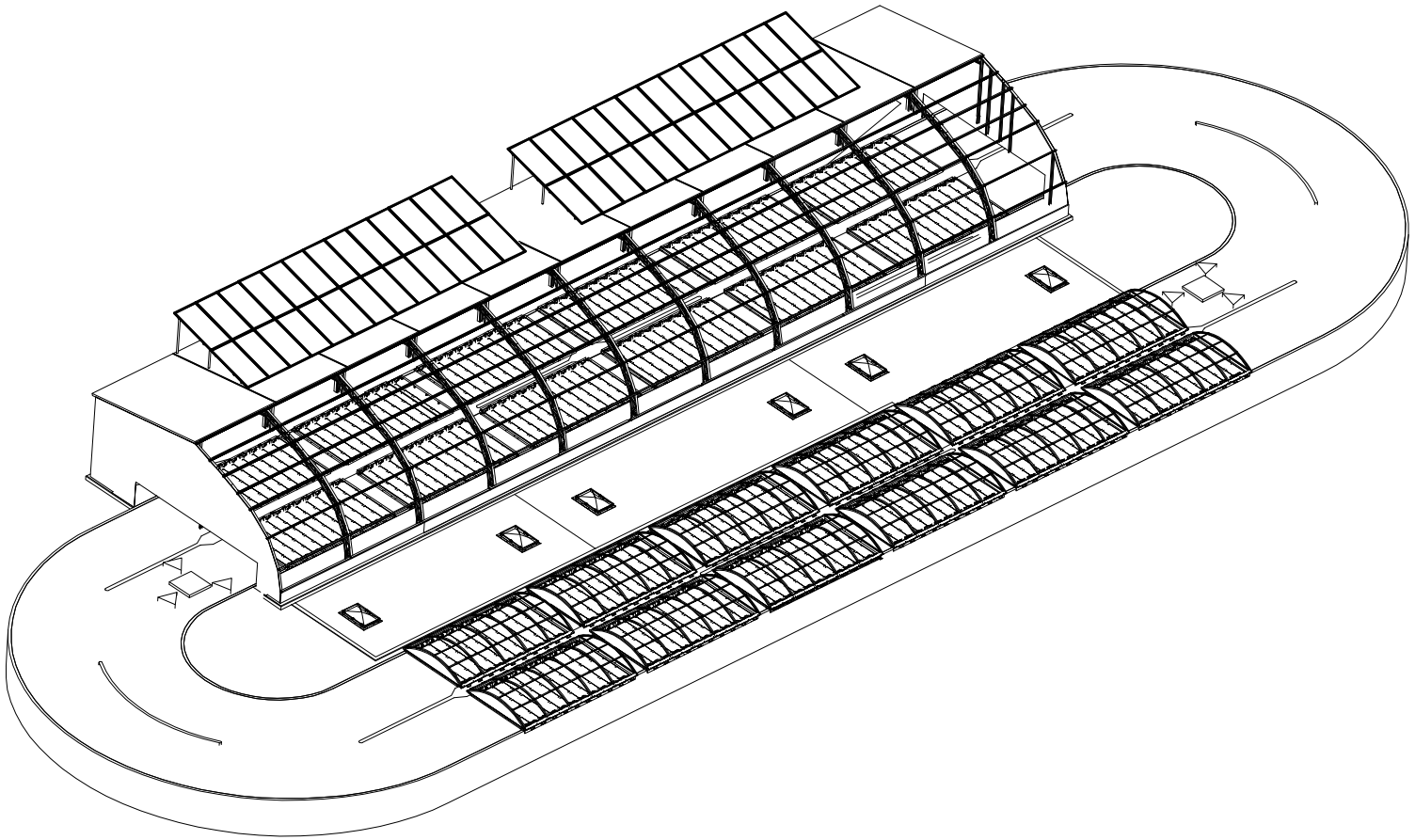
LOCALIZACION DE PROYECTO:	PROYECTO:
ONEWATER MEXICO	GENERAL

TITULO: ALGAEWHEEL HYBRID 15 LTS. 900mm WHEEL

DIBUJO:	J. DAVILA	PLANO:		REV.
APROBO:	S. ZUANIC		OWM-001-OXD-001-1	A
AUTORIZO:	A. COX	ESCALA: 1.100	FECHA: 20/08/2019	

ONEcowater® Treatment redefined

Algal Hybrid Plant – Raceway IFAS



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POWERED BY
algaewheel