

THE NATIONAL RESOURCE

# The Resource Hiding in U.S. Wastewater

Municipal final effluent and direct industrial wastewater discharges in the United States contain enough nitrogen and phosphorus to theoretically support on the order of ten billion pounds of dry algal biomass per year.

Second Atmosphere is developing Aeroponic Algal Culture (AAC) to move part of that nutrient-driven growth into controlled infrastructure where algae can be measured, harvested, and potentially converted into useful biomass.

10.5  
BILLION LB/YEAR

Theoretical nutrient-supported dry algal biomass ceiling

5.26 million short tons | 28.8 million lb/day

THE COMPLETE NUTRIENT CYCLE

| 1 GROW FOOD                                                                      | 2 CONSUME                                                                              | 3 TREAT & DISCHARGE                                                                   | 4 RECOVER                                                                              |
|----------------------------------------------------------------------------------|----------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------|
| Nitrogen and phosphorus help produce crops, food, and other biological products. | People and animals retain part of those nutrients; the remainder enters waste streams. | Treatment protects public health, yet remaining nutrients can stay active downstream. | Controlled algal growth can capture nutrients in harvestable biomass before discharge. |

HOW THE REFERENCE CASE IS BUILT

| Wastewater stream           | Nitrogen       | Phosphorus     | Status / basis                                                    |
|-----------------------------|----------------|----------------|-------------------------------------------------------------------|
| Municipal final effluent    | 632M lb/year   | 83M lb/year    | Calculated from EPA flow and representative concentration proxies |
| Direct industrial discharge | 420M lb/year   | 153.5M lb/year | EPA reported and modeled likely nutrient discharges               |
| Combined reference case     | 1.052B lb/year | 236M lb/year   | Calculated; nitrogen is limiting under the reference composition  |

**Reference conversion:** 10% nitrogen and 1% phosphorus in dry algal biomass. Nitrogen supports 10.52B lb; phosphorus supports 23.64B lb. The lower result sets the nutrient-supported ceiling.

| REFERENCE CASE                                                                                                                                            | ADDITIONAL OPPORTUNITY                                                                                                                                                           |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <div><div>- Municipal final liquid effluent</div><div>- Direct industrial liquid discharges</div><div>- A clear national calculation boundary</div></div> | <div><div>- Agricultural and livestock nutrient streams</div><div>- Stormwater, runoff, and combined-sewer flows</div><div>- Selected sidestreams and process waters</div></div> |

**Definition:** 10.5 billion pounds is a calculated nutrient-supported theoretical dry-biomass ceiling. It describes the physical scale of the modeled resource rather than forecast production or revenue.

THE FULL OPPORTUNITY

# Environomic Value

Environomic value is Second Atmosphere's framework for the combined environmental and economic value created when nutrient pollution is prevented, existing communities and industries are protected, resources are recovered, and new infrastructure is built.

|                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                                                                                                                                                                            |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <div>01</div> <div>Value preserved</div> <div>Protect the economies and public systems already built around clean water.</div> <div><div>- Tourism, hospitality, beaches, boating, marinas, and waterfront business</div><div>- Commercial and recreational fisheries and charter businesses</div><div>- Drinking-water systems, municipal resources, property, and quality of life</div></div>        | <div>02</div> <div>Value recovered</div> <div>Turn a discharged liability into measured, harvestable resources.</div> <div><div>- Nitrogen and phosphorus incorporated into harvested biomass</div><div>- Potential organic carbon, energy, and industrial feedstocks</div><div>- Nutrient credits only where an approved program and measurement method exist</div></div>                 |
| <div>03</div> <div>Value created</div> <div>Build supply chains and skilled work around a new infrastructure category.</div> <div><div>- Concrete, structures, pumps, sensors, controls, and harvesting equipment</div><div>- Engineering, fabrication, construction, transport, processing, and laboratories</div><div>- Facility operations, skilled employment, and regional investment</div></div> | <div>04</div> <div>Value captured</div> <div>Create commercial pathways for Second Atmosphere and its partners.</div> <div><div>- Treatment contracts, facility development, equipment, and licensing</div><div>- Performance services, operations and maintenance, and technical support</div><div>- Biomass participation, suppliers, joint ventures, and facility ownership</div></div> |

PROTECT WATER-DEPENDENT ECONOMIES. RECOVER NUTRIENTS. BUILD PRODUCTIVE INFRASTRUCTURE.

HOW SECOND ATMOSPHERE PARTICIPATES

| 1 DEVELOP FACILITIES                                                                                         | 2 PROVIDE SYSTEMS                                                                                                   | 3 SCALE THE NETWORK                                                                                                    |
|--------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------|
| Treatment contracts and facility development align the platform with water-quality and infrastructure needs. | Equipment, controls, operations, maintenance, technical support, and performance services extend each installation. | Licensing, certified suppliers, joint ventures, biomass participation, and facility ownership can support replication. |

THE ENGINEERING PROGRAM

Second Atmosphere is integrating biofilm growth, nutrient removal, rigid surfaces, water delivery, harvesting, controls, operations, and economics into a repeatable facility platform.

| CALCULATED SCALE                                                                                                                                                                                                | CONDITIONAL VALUE                                                                                                                                                                                  |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| The national figure is a nutrient-supported theoretical ceiling. Practical production and project economics will be determined by operating data, site conditions, deployed capacity, and recovery performance. | Biomass pathways depend on source, composition, contaminants, processing, testing, regulation, and market acceptance. Credits apply only where approved measurement and regulatory programs exist. |