WHITEPAPER

The Resilient Community

Storm & Flood-Safe High Efficiency, Integrated Municipal Wastewater Treatment Systems

A SYSTEMS APPROACH achieving FEMA 361, ICC-500 & NSSA Standards incorporating steel-reinforced concrete structures providing near absolute protection from EF-5 Tornado, Cat 5 Hurricane, Extreme Wind exceeding 250 MPH, Fires, Flood and Earthquakes.

A SYSTEMS APPROACH for achieving Efficient, Independent Control of Sludge Age, Surface Loading and Detention Time for Significantly Lower Construction, Labor, Maintenance and Electrical Power Costs.

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Order of Presentation

Foreword

Aging, vulnerable and obsolescent National infrastructure and developing Climate Departure are already reducing America's resiliency and economic wellbeing to a state of unquantifiable liabilities. As the effect of these conditions compound, they can form a Perfect Storm the results of which represent an existential threat to America's economy, national health and security and international relations.

Increasingly severe and more frequent flooding, tornado and hurricane "super storms", growing drought cycles and wildfires have stretched Federal, State and Local emergency resources to the limit across the country. Destruction of life, personal property, transportation, communication and public works infrastructure systems total billions of dollars annually. Losses to the Insurance Industry itself are in the billions of dollars.

In the "good old days" local revenue departments simply increased homeowners' tax bills to cover higher winter storm costs. After 40+ years of tax increases following upon tax increases, politicians have resorted to calling these taxes "service fees" due to citizen taxation fatigue and resentment. The 2008 mortgage and bankruptcy crisis has impacted the tax rolls and rendered many municipalities ratings to be downgraded with many large and small cities to face bankruptcy, themselves.

More Industries are relocating to "tax friendly" states from states that have been slower than others to develop more efficient stewardship of their public monies. However, costs of many government services are increasing dramatically due to the neglected condition and increasing obsolescence of public works systems and infrastructure. Studies indicate that the cost of rehabilitating America's neglected infrastructure systems is estimated at $1.6 trillion.

This document presents a resilient public works wastewater treatment plan, which is significantly more cost effective than traditional systems in terms of both construction costs and ongoing operations and maintenance costs. In addition to greater design and operational efficiencies, this system is flood, tornado, hurricane and fire-proof due to its storm-proof reinforced concrete "hardened" envelope which increases the building life cycle performance and protects the municipalities' investment.

Many community wastewater treatment plants are approaching their end of useful life and are hemorrhaging manpower, maintenance and utilities budget resources due to obsolescence, runaway maintenance costs and fines. The lifecycle savings achieved by the system discussed herein are significant vs traditional systems' and they are essentially impervious to extreme weather conditions, rising water levels, fire, flood and storm and the consequential recovery and repair costs.

The GPBG-CSE novel Patents-Pending Systems Approach achieves very high levels of facility safety, efficiency, economy and long-term cost control benefits for our systems' owners that are unavailable with any other system.

1.0 OVERVIEW - *Great Plains Biosciences Group, LLC*

1.1 Mission Statement

1.1.1 Great Plains Biosciences Group, LLC (GPBG) is a Clean Tech Project Development Company implementing high efficiency, environmentally responsible Best Practice Technologies. These are proven technologies, which support a disciplined systems-approach to mitigate impending global climate change, resources depletion and habitat loss crises.

1.1.2 Protection, conservation and management of regional air shed, topsoil, flora and fauna, mineral, fresh water and littoral marine resources quality are keys to sustainable economic and environmental viability.

1.1.3 Integrated resources management yielding improved environmental quality and infrastructure will support sustainable economic productivity and living standards.

1.2 Best Practice Practices and Technologies

1.2.1 GPBG's Best Practice Technologies become legacy Economic Development models achieving sustainable factors of production for the intergenerational, societal, and environmental benefit of the community and for the future of agriculture. These programs can allow ranchers and farmers to manage and resist predation by the competing interests for their land, resources, and products.

1.2.2 GPBG's Best Practice Technologies is a systems approach that provides for agribusiness sustainability and economic benefits by development of liquid transportation fuels, energy and chemicals production from biomass and coal while emphasizing elegant resource stewardship in process technologies. Sustainable production is a benchmark of our systems approach with resource conservation, environmental responsibility and efficiency as primary program goals.

1.3 GPBG Systems Approach

1.3.1 GPBG utilizes a disciplined Systems Approach, which ensures maximum efficiencies and minimum process and cyclic wastes. Future synergistic business models share resources and utilities for overall community vitality, prosperity, and wellbeing.

1.3.2 Virtually all of our Biofuels production byproducts and process wastewater can be consumed on site or recycled to achieve near-zero environmental discharges from the enterprises.

1.3.3 GPBG's Best Practice Technologies utilize solar, wind power and coal from enterprise sites; diversified animal production; animal processing/packing operations with process wastes utilization; cellulosic ethanol, methanol, and ammonia; and Fisher-Tropsch synthetic diesel and turbine fuels production; aquaponic fish production; and hydroponic vegetable and oil production.

1.4 Affordable, Sustainable Clean Energy and Water

GPBG's professionals can provide infrastructure projects achieving self-sufficient and sustainable electrical power, clean water and wastewater utilities for remote towns/villages.

GPBG can provide multi-fuel electrical power gensets capable of utilizing most conventional liquid fuels: unleaded gasoline, kerosene, diesel, biodiesel, and alcohol-fuel-blends. These gensets can use biofuels produced at the community level as well as systems powered by gasification of local biomass including animal manures and wastes.

Add to these benefits atmospheric carbon capture and other air quality management, biofuels development and disaster-response modular and transportable utility systems.

1.4.1 Water Resources Stewardship

i. Fresh water resources are critical to mankind's agricultural and industrial activities and our future generations' survival and wellbeing.

ii. The protection, conservation and stewardship of this critically important resource are **central elements** of every Great Plains Biosciences project.

iii. GPBG's Biofuels Programs **do not compete** with food resources or fragile fresh water systems.

2.0 ENVIRONMENTAL INDUSTRIAL PARK (EIP)

EIPs are collaborating business enterprises that utilize waste streams from one enterprise in an environmentally responsible manner in a cascade input to another enterprise, achieving high efficiencies, lower production costs and very low environmental effluent signatures.

BioFuel plants require continuous water, thermal and electrical power utilities. Dry mill grain BioEthanol plants yield Distillers Grains, a valuable and nutritional animal ration.

Co-production of plant and aquatic animals in controlled environments is very efficient and profitable:

2.1 **Hydroponics**: the process of growing plants in nutrient solutions with or without inert medium to provide mechanical support.

2.2 **Aquaculture:** the farming of aquatic organisms usually associated with water for trade, business or research (Plants & Animals).

Intensive concentration of plants and/or animals within very confined spaces require intensive environmental control of temperature, nutrients, heat, cooling, light, pH balance, and irrigation.

2.3 **Renewable fuels and "green power":** Bio refineries producing fuel alcohol, biodiesel and "green" power: wind, biomass, solar thermal, solar photovoltaic, geothermal, low-head and no-head hydro renewable power systems; chemicals, energy and fibers from oilseed and starch crops, lignocellulosic feedstocks and animal wastes; algae biofuel, animal feed & nutraceutical systems & photobioreactors.

i. GPBG's technology platforms include aquatic phytoremediation of problem/toxic process and metabolic wastewater; recovering and reutilization of the cleaned, safe water; and catalytic production of valuable biochemicals and biofuels from synthesis gas produced by gasification of the photosynthetic aquatic biomass.

ii. When integrated with animal CAFO operations or municipal wastewater treatment systems, wastewater treatment costs are greatly reduced and valuable added value products are created.

iii. For cattle feedlot, swine and dairy operations, problem odors are eliminated and problem effluent hormone and antibiotic components are extinguished.

2.3.1 For fuels production, dramatically less water is consumed and toxic atmospheric and wastewater effluents are eliminated.

3.0 PROFESSIONAL SERVICES [1.]

The firm's experience includes performing

i. Assessments, investigations, feasibility studies,

ii. Front-end Engineering Design (F.E.E.D.) and Detailed Engineering services,

iii. Project Development, and

iv. Construction oversight, commissioning, start-up and site operations.

3.1 GPBG is an interdisciplinary firm providing services in the following areas:

3.1.1 Energy and infrastructure: Industrial utilities plants efficiency and environmental optimization, water resources conservation, mining, industrial process and biological wastewater treatment/ reutilization, and performance contracting.

3.1.2 Distributed generation resources (DGR): Low emission, high efficiency distributed electrical power generation and cogeneration (CHP) systems; biomass thermal and electrical power plants; demand-side management; load management; peak shaving; emergency backup generation; power distribution systems upgrading/ hardening; power quality and reliability upgrading; uninterruptible power systems (UPS); energy storage.

3.1.3 Environmental: Remediation design and oversight, compliance auditing, permits preparation/submittal, property assessments, program writing, and training courses.

3.1.4 Ecological: Aquatic and terrestrial ecology, endangered species, wetlands, geology, NEPA studies, and water quality programs.

3.1.5 Planning: Resilience, sustainability, land use and feasibility studies, benefit/cost analysis, alternatives analysis, and NEPA studies.

3.1.6 Security services: Process and facility-critical thermal and electrical power systems, HVACR & IAQ systems upgrades; power quality, energy storage and UPS systems, microgrids, redundancy/hardening/reliability upgrades; security lighting including Highmast systems; passive surveillance (IR) systems; *etc*.

3.1.7 Emergency utilities modular systems for disaster response: GPBG can provide modular power systems, which produce emergency energy, water purification and ice production services, powered by conventional hydrocarbon fuels as well as bio-contaminated storm-damage biomass wreckage.

4.0 RESILIENT, SUSTAINABLE PUBLIC WORKS INFRASTRUTURE

Homeland Security's 2010 report ***Aging Infrastructure Issues,*** [2.] states that the dangers that America's crumbling transportation, utilities and public works infrastructure systems pose to our economic health are as great as those due to the current financial crisis.

4.1 The American Society of Civil Engineers (ASCE) indicated in a recent report that our infrastructure is failing and that it would take an estimated $1.6 trillion to upgrade the existing infrastructure.

4.1.1 Other government reports include similar findings and estimate upgrade needs at $225 billion for roads, $202 billion for wastewater treatment, $72 billion for waterways, $18 billion for airports, $11 billion for drinking water treatment, $10 billion for dams, and $127 billion for schools.

i. The U.S. Department of Transportation estimated in 2006 that freight bottlenecks and delayed deliveries due to congested highways and inefficient rail and deep-water transportation systems cost the United States $200 billion.

ii. "In the past two years (2008-2009), more than 67 dam incidents, including 29 dam failures, were reported to the National Performance of Dams program; more than 3,500 'unsafe' dams with conditions that could cause them to fail were reported." (J. Reese Meisinger)

4.2 Facilities are aging; their level of service, reliability, and performance are decreasing; and increasingly they are extended into natural environments and fragile ecosystems.

i. "In brief, America's infrastructure has been ignored for decades, is deteriorating, and is inadequate to support the population growth in the near future." (J. Reese Meisinger)

4.3 Insurance Industry Message - Prepare for Climate Change or Get Sued [3.]

4.3.1 Insurance companies have begun to file lawsuits against small towns and cities which haven't prepared for floods and storms that will cost the companies billions in payments.

4.3.2 In the first week of June 2014, Farmers Insurance Group insurance company backed away from a lawsuit against Chicago for failing to prepare for heavy rains and flooding it claimed were fueled by global warming, however the message is clear for governments: ***prepare now for climate change or pay the price.***

4.3.3 It was "the first loud shot in what I think will be a long-term set of litigation battles over failure to prepare for climate change," Michael Gerrard, who directs the Center for Climate Change Law at Columbia University in New York, told NBC News.

4.3.4 Farmers Insurance Group lawsuit argued that the cities have known that climate change had raised the frequency, duration, and intensity of regional rainfall since the 1970s and acknowledged vulnerabilities to increased flooding by adopting a Climate Action Plan in 2008.

4.3.5 "One could easily imagine architects and engineers being accused of professional malpractice for designing structures that don't withstand foreseeable climate-related events," he said.

4.3.6 Cities could become liable for negligence too if they, for example, decide to ignore new vulnerabilities exposed by a changing climate, according to Sean Hecht, a co-director of the Emmett Institute on Climate Change and the Environment at ULCA's Law School.

4.3.7 Lawsuits and the attention they received underscore "the power and influence that insurers have to truly change the calculus with which we all approach climate change."

4.4 Sea levels are rising at an accelerating rate, and the scientific community is confident that global warming is the most important cause. Higher sea levels translate to more and higher coastal floods.

4.4.1 Using local sea level projections based on global scenarios from the U.S. Army Corps of Engineers, and also used by the four-county Southeast Florida Regional Climate Change Compact, this analysis finds that floods rising 3 ft above the high tide line at Key West are near certain this century under any sea level rise scenario. **(4.)**

4.4.2 Six-foot floods range from very unlikely under slow rise, to 80% likely under fast rise.

4.4.3 Florida has 2,555 miles of road below 3 feet, 35 public schools, one power plant, and 966 EPA-listed sites such as hazardous waste dumps and sewage plants. At 6 feet, these numbers grow to more than 16,000 miles of road, 298 schools, 13 power plants, and 5,474 EPA-listed sites.

4.4.4 2120 square miles of land lie less than 3 feet above the high tide line in Florida. Some $156 billion in property value, and 300,000 homes, sit on that land. These figures jump to $580 billion and 1.4 million homes on 4660 square miles of land under 6 feet.

i. Every inch of sea level rise within these ranges will be more damaging than the previous inch.

ii. This escalating risk, considered together with recent acceleration in sea level rise and projections for that trend to continue, places Florida in double jeopardy.

iii. Damage from sea level rise and coastal flooding is likely to turn sharply upward during the course of this century.

4.4.5 $76 billion of Florida property sits on land less than two feet above the high tide line.

4.4.6 Within less than the term of a 30-year mortgage, sea level rise could cause floods this high to occur once every five years, or even every year, depending on location within the state.

4.4.7 Florida has 2,555 miles of road below 3 feet, 35 public schools, one power plant, and 966 EPA-listed sites such as hazardous waste dumps and sewage plants.

i. At 6 feet, these numbers grow to more than 16,000 miles of road, 298 schools, 13 power plants, and 5,474 EPA-listed sites.

4.5 Hurricane Superstorms **(5.)**

4.5.1 Hurricane Katrina was a massive Category 5 monster storm before it made landfall on August 29, 2005.

4.5.2 The Louisiana death toll was 1,836 people with damage estimates between $96 and $125 billion. Estimated insured losses were between $40 and $66 billion.

i. Katrina was ten times more destructive than the second most expensive hurricane, Andrew, which was also a Category 5 storm when it hit Florida in 1995.

4.5.3 An estimated 300,000 homes were destroyed or otherwise made uninhabitable in New Orleans, affecting about 75,000 people

4.5.4 More people were displaced (770,000) than during the Dust Bowl migration during the Great Depression.

4.5.5 At least 118 million cubic yards of storm debris and devastation resulted.

4.5.6 October 2012's Superstorm Sandy was the deadliest hurricane to hit the northeastern U.S. in 40 years and the second-costliest in the nation's history, according to the National Hurricane Center.

i. Sandy devastated the East Coast and created wind gusts as far west as Wisconsin and as far north as Canada and caused water levels to rise from Florida to Maine.

ii. More than 650,000 U.S. homes were damaged or destroyed by the storm, and more than 8 million customers lost power, according to the report.

iii. The highest storm surge measured by tide gauges in New Jersey was 8½ feet over normal levels and s more than 12½ feet at Kings Point on the western edge of Long Island Sound.

iv. The massive storm dropped 2-3 feet of snow in West Virginia.

4.5.7 The hurricane center attributed 72 U.S. direct deaths plus an additional 87 to Sandy, from Maryland to New Hampshire.

4.5.8 The deadliest hurricane in U.S. history hit Galveston, Texas, in 1900 and killed 8,000 to 12,000 people.

4.5.9 The report estimated damage caused by Sandy at $50 billion, greater than any U.S. hurricane except Katrina, which in 2005 caused $108 billion in damage, or $128 billion adjusted to 2012 dollars.

i. Hurricane Andrew in 1992 caused $26.5 billion in damage in Florida, or the equivalent of $44 billion today.

ii. In 2011, Hurricane Irene hit New York and New England, but had slowed down dramatically after reaching landfall, not resulting in nearly as much damage as was being anticipated.

4.6 Tornado Storm Threats [6.] [7.]

The United States has the most tornadoes of any country, averaging around 1,200 tornadoes per year causing thousands of injuries and deaths and damages in the billions of dollars.

4.6.1 A large portion of these tornadoes forms in an area of the central United States known as Tornado Alley; tornadoes also occur across northeastern Mexico.

4.6.2 This is primarily due to land forms extending from the tropics to the arctic and the absence of a major east-west mountain range to block air flow between these areas.

4.6.3 Tornadoes are most common in spring and least common in winter, but tornadoes can occur any time of year that favorable conditions occur.

4.6.4 Spring and fall experience peaks of activity, as those are the seasons when stronger winds, wind shear, and atmospheric instability are prevalent.

4.6.5 The effects of Climate Change trends are present. There is a correlation between increases in the sea surface temperature of the Gulf of Mexico and increases in atmospheric moisture content with tornado activity.

i. Increased moisture can fuel an increase in severe weather and tornado activity, particularly in cooler seasons.

4.6.6 More than half of the country's homes are located in counties at a high risk of hurricanes, tornados and earthquakes, according to a study by *RealtyTrac*. **(8.)**

i. 8 percent of homes are in "very high risk" areas;

ii. 47 percent are in "high risk" areas;

iii. 23 percent are in "medium risk" areas;

iv. 19 percent are in "low risk" areas, and

iv. 3 percent are in "very low risk" areas.

4.6.7 Climate Change is believed to be the cause of the increasing rates of sea level rise and the more frequent and more severe storms and droughts that are now evident in all regions of the county resulting in record property losses and human suffering.

i. Climate Departure—the year when temperatures at any specific spot on Earth will shift permanently a point outside their historic bounds.

4.7 <u>The 2014 Quadrennial Homeland Security Review</u>

4.7.1 Combating terrorism remains DHS's primary mission, but recent disasters have led DHS to adopt a risk-based approach to significant threats from both man-made and natural disasters which is identified in its 18 June 2014 second quadrennial report.

4.7.2 The 104-page report considers disastrous weather events a growing challenge, citing Hurricane Sandy, which killed at least 117 people and knocked out power to 8.5 million residents.

i. A changing climate will only increase the risk of more natural disasters, and such risk, combined with an aging infrastructure and population increases in vulnerable areas, sets the stage for a catastrophe.

4.7.3 DHS must improve technology transfer to ensure that new infrastructure is built to be more secure and resilient, and current infrastructure is well protected.

i. Preparedness and resilience initiatives are positive investments.

5.0 STORM and FLOOD-SAFE HIGH EFFICIENCY WWTP SYSTEMS [9.]

GPBG has developed a SYSTEMS APPROACH, which achieves compliance with FEMA 361, ICC-500 & NSSA Standards9

5.1 GPBG's Wastewater Treatment Plant (WWTP) design incorporating robust steel-reinforced concrete structures providing near absolute protection from EF-5 Tornado, Cat 5 Hurricane, rising water levels, Extreme Wind exceeding 250 MPH, Fires, Flood and Earthquakes.

5.2 GPBG's WWTP design utilizes insulated thin-shell reinforced concrete structures, which completely encloses the wastewater biological reaction elements and the mechanical and electrical components of the wastewater treatment facility.

5.3 Concrete thin-shells can be built economically for large free span structures.

- **i.** There are numerous advantages to this type of structure including strength, durability, energy efficiency, and relatively low cost.
- **ii.** These insulated thin-shell reinforced concrete structures incorporate free span concrete double curved roofs, which have numerous applications; the strength, durability, and energy efficiency of these structures are excellent.
- **iii.** These structures are constructed using inflated forms and local concrete and rebar as described in American Concrete Institute document, ACI 334.3R-05.
- **iv.** The inherent strength of concrete thin-shells allows these structures to be able to withstand exceptional loads caused by man-made and natural hazards.
- **v.** The natural shape of the structure provides redundancy through multiple load paths.
- **vi.** In the unlikely event that there would be a localized failure, the building envelope still maintains an adequate safety level.

5.4 GPBG's WWTP design achieves system protection from natural or man-made threats and operates without fugitive odors, noise, bird/animal nuisance or disease vectors; the insulated building maintains the optimum biological process temperature range.

5.5 GPBG's enclosed process basins and treatment works and on-site electrical power produced from WWTP biogas, solar and wind generators achieves energy self-sufficiency and the systems' capability to ride-through major storm events without contaminating the community from untreated sewage discharged from overtopped sewer plant tanks.

5.6 Years of droughts in the Western United States and Global fresh water shortages have made the re-use of wastewater an appropriate water resource; GPBG's enclosed systems support the development of wastewater reuse projects that are priced at nearly half of the cost to build, own and operate vs current state of the art systems.

5.7 GPBG's enclosed treatment process systems achieve reuse quality effluents utilizing efficient and cost effective technologies.

- **i.** US-EPA and Metcalf & Eddy's text guidelines for US domestic sewage guidelines provide for roughly 100 GPD/person. Influent strength BOD5 in the USA typically ranges from 200-250 mg/L. [11.]

ii. These systems can be engineered to meet all effluent discharge water quality requirements including aquifer recharge quality specification. (10.) (11.)(12.)

5.8 GPBG's integrated, hardened wastewater treatment system assures uninterrupted achievement of effluent discharge quality requirements.

6.0 ADVANCED WWTP JOINT VENTURE

GPBG established a Joint Venture with CREATIVE ENVIRONMENTAL SOLUTIONS, LLC (CES) to develop High Efficiency Integrated Modular Wastewater Treatment Systems.

6.1 High Efficiency Integrated Modular Wastewater Treatment Systems

CES is a Florida-based company with expertise in the design, construction, and operation of cost-effective State-of-the-Art water and wastewater treatment systems including the advanced activated sludge aeration and membrane filtration techniques.

CES's principals and senior managers have over 150 years engineering and management experience in all aspects of environmental management mechanisms with global man-power resources.

6.2 Wastewater Treatment Technologies and Services

The GPBG-CES wastewater team can provide Design Build (DB), Design Build Operate (DBO), and Design, Build, Operate, and Transfer (DBOT) services for applications ranging from advanced municipal wastewater and industrial wastewater treatment to wastewater reuse systems utilizing CCE's efficient and cost effective technologies.

6.3 The GPBG-CES Wastewater Treatment Plant (WWTP) Process

6.3.1 The GPBG-CES system is an optimized activated sludge process utilizing eductor aeration and elegant basin hydraulic dynamics to achieve very high oxygen transfer rates, which combined with membrane filtration, yields re-use quality effluent water.

i. This process represents a major breakthrough in the safe, reliable, and efficient management of municipal sewage and water re-use.

6.3.2 Raw Sewage, delivered through the municipal collection system, arrives at an influent manhole. The sewage then gravity flows into the mechanical bar screen structure. Here debris is trapped into the moving screen and deposited into the debris bin.

6.3.3 The sewage, clear of debris, flows into the plant's wet well (lift station). The wet well houses submersible pumps with lifting mechanism which move the influent sewage to the aeration basin. The pumps incorporate innovative aeration and hydraulic systems.

6.3.4 The aeration basin design avoids inefficient and costly surface aerators, or even more expensive fine bubble diffusers that require costly maintenance cycles to remain effective. Incorporating delivery of the aeration requirements concurrently with creating an engineered hydrodynamic circulation pattern that optimizes oxygen transfer efficiency, BOD5 consumption, nutrient removal and sludge thickening. The key process elements are achieved within a single activated sludge processing vessel.

6.3.5 Transfer of pumps, powering system aerators, re-circulate the aeration basin inventory and achieve the required aeration and hydraulic pattern. The mixed liquor from the aeration basin is gravity transferred to the membrane basin.

6.3.6 Hollow fiber membranes form the barrier for solid-liquid separation. The membranes are submerged in the mixed liquor and membrane pumps withdraw permeate from the mixed liquor through the hollow fiber membrane. The flow pattern through the membrane follows the outside-inside configuration and dead-end filtration mode.

6.3.7 The submerged membrane system supports operation of the aeration basin bioreactor at mixed liquor suspended solids concentrations in range of 8,000 - 10,000 mg/l and aeration basin loadings of 50 lbs BOD5/day-1000 ft^3 of inventory, at membrane 0.1 micron pore size and 15 L/m^2-hr flux.

6.3.8 Since, the submerged membrane operates in higher biomass content and dead-end filtration, the system is provided with an automatic membrane cleaning system. The cleaning is done by a combination of air scrubbing, backwashing and chemical cleaning.

i. A recirculation pumping system provides a continuous flow between the aeration basin and membrane basin.

6.3.9 Permeate from the membrane is dosed with chlorine from the gas chlorinator in the disinfection chamber. High quality effluent passes through a surge tank and then pumped to re-use applications.

6.3.10 The sludge accumulated at the center of the aeration basin is transferred to the sludge thickener. The thickened sludge is feed to a belt press for dewatering. Permeate from the belt press is recycled to the influent manhole; the dewatered sludge is collected.

i. The belt press is furnished with an odor and air toxics capture hood with the foul air being deodorized and sanitized by an in-duct UV-light based hydroxyl radical generator to safely dry scrub the air.

6.4 Significant Process Attributes

The process consists, minimally, of two tanks or basins; a single (one) tank aeration basin for activated sludge, driven hydraulically in series with a second single (one) tank that is a membrane basin whose effluent is finely filtered water and a separate mixed liquor recycle stream.

6.4.1 With the introduction of membrane filtration, the aeration basin operates at a significantly high-activated microbe concentration and ably supported by an eductor based oxygenation system.

6.4.2 There are no ancillary sub-systems and associated pumps, no clarifier required nor drive or traverse bridges. The site footprint is significantly smaller than a conventional plant with equivalent capacity through the elimination of un-necessary subsystems.

GPBG- CES WWTP - PROCESS FLOW DRAWING

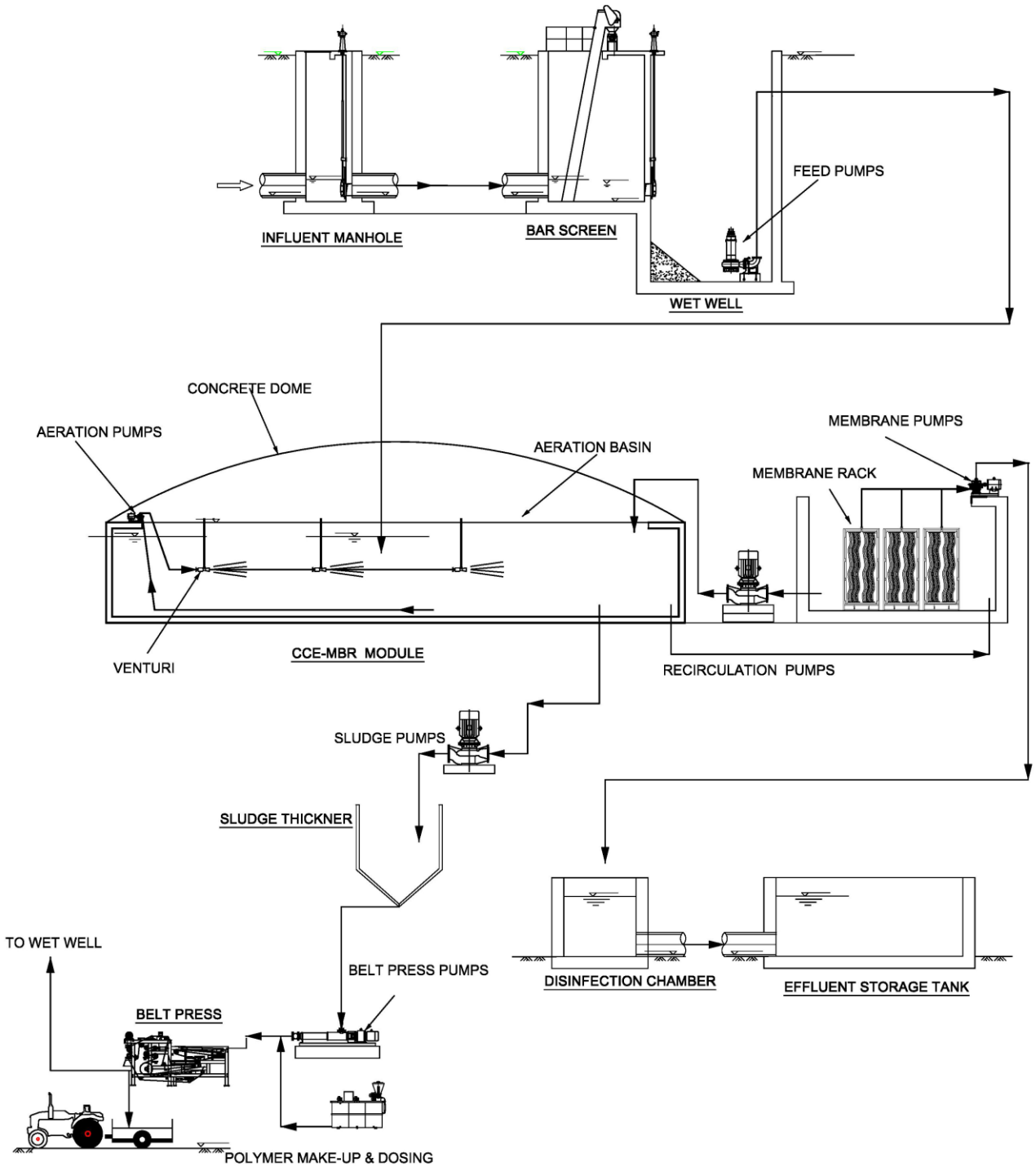
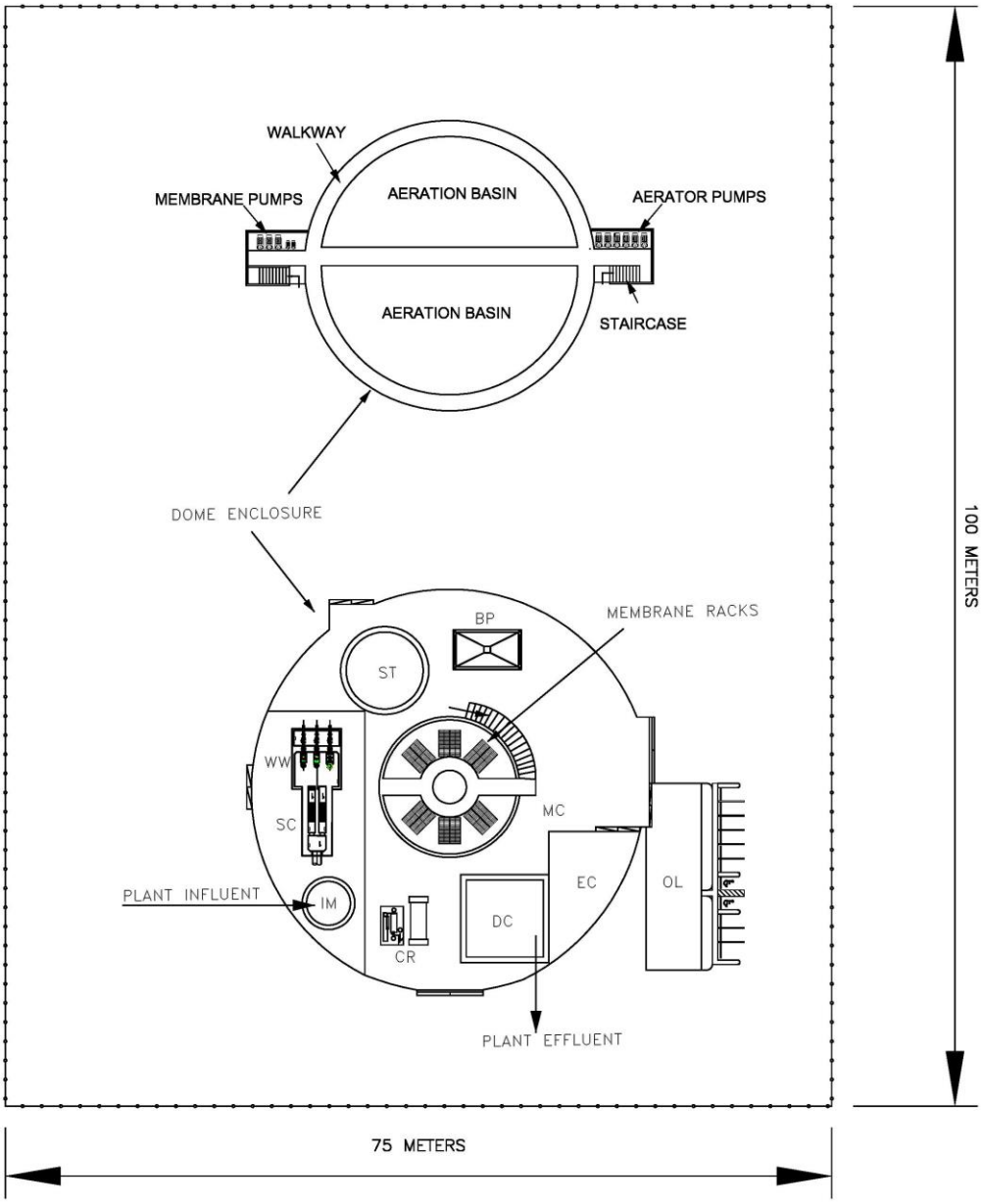


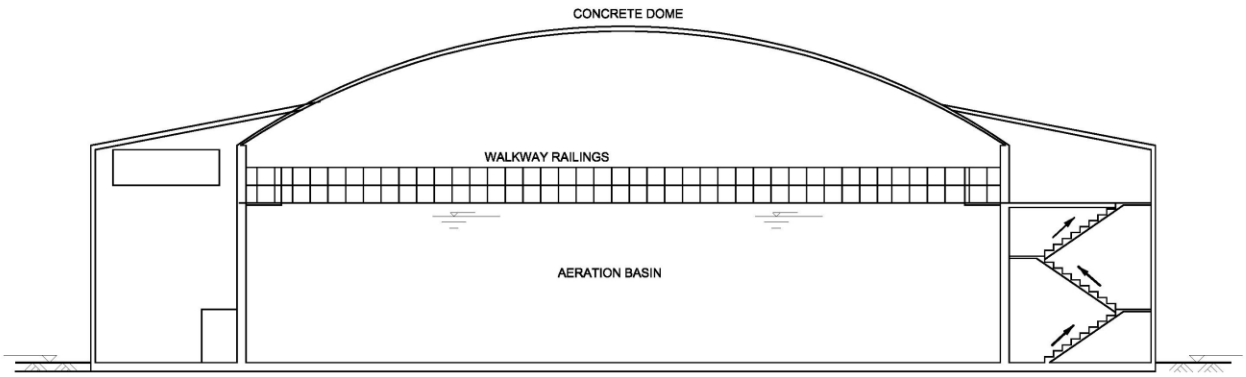
Figure 1.

GPBG - CES WWTP - GENERAL ARRANGEMENT LAYOUT

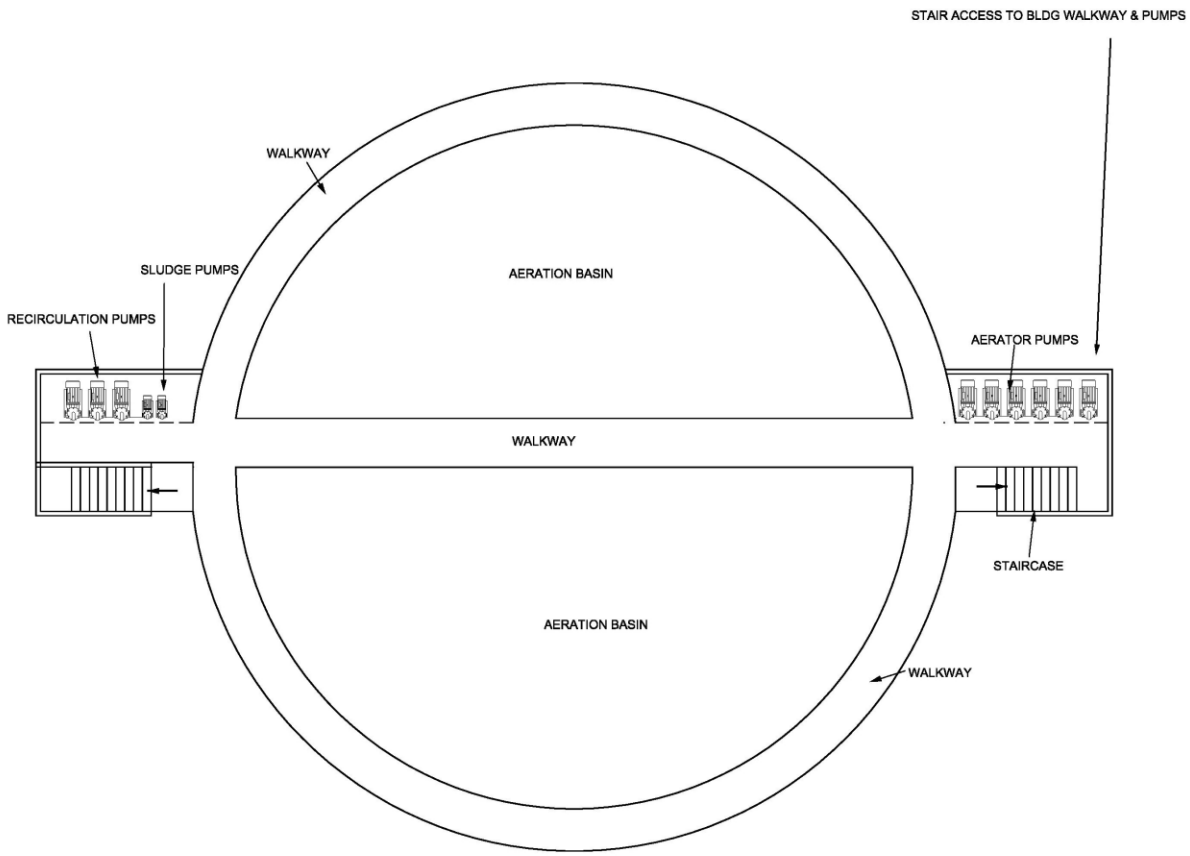


LEGEND
SC – Screen Chamber
WW – Wet Well
AB – Aeration Basin
BP – Belt Press
DC – Disinfection Chamber
ST – Sludge Thickener
IM – Influent Manhole
ST – Sludge Tank
CR – Chlorine Room
OL – Office & Lab
EC – Electric Switchgear
MC – Membrane Chamber

GPBG-CES WWTP - TYPICAL 1 MGD PLANT



SIDE ELEVATION



PLAN ELEVATION

6.5 **The GPBG-CES WWTP process achieves significant energy savings** (up to 50%) as the entire plant operates using two fluid pumps.

6.5.1 Atmospheric pressure air is aspirated into *very* fine bubbles in the recirculating activated sludge. The flow is in a torroidal pattern, down the aeration basin wall, across the bottom, up the center of the tank, then radially outward back to the walls.

6.5.2 A dual torroidal flow pattern is induced to create an upper and lower recirculation as *illustrated in Figure 4 "a"* with the external recirculation loop, that drives the internal pattern, *illustrated in Figure 4"b".* The upper zone is predominantly aerobic driving aerobic respiration cycles and the associated conversion of carbonaceous constituents from the influent wastewater as well as nitrification of the organic nitrogen and ammonia present. The lower zone is predominantly anoxic, driving de-nitrification reactions, thereby achieving nitrification and de-nitrification in a single vessel.

i. Surface aeration also occurs in conjunction with the aeration basin's flow pattern.

ii. The aeration basin's complete mix flow pattern precludes stagnant flow zones.

iii. Accurate control of Dissolved Oxygen is efficiently achieved in two ways;

a. Controlling variable-speed drive pumps by which increased air volumes are aspirated as the flow rate is increased, and

b. Modulating valves on the aeration basin transfer pumps.

iv. Oxygen Transfer Efficiency >28% is achieved through a synergy of the basin flow pattern and the mechanical dispersion of very fine air bubbles.

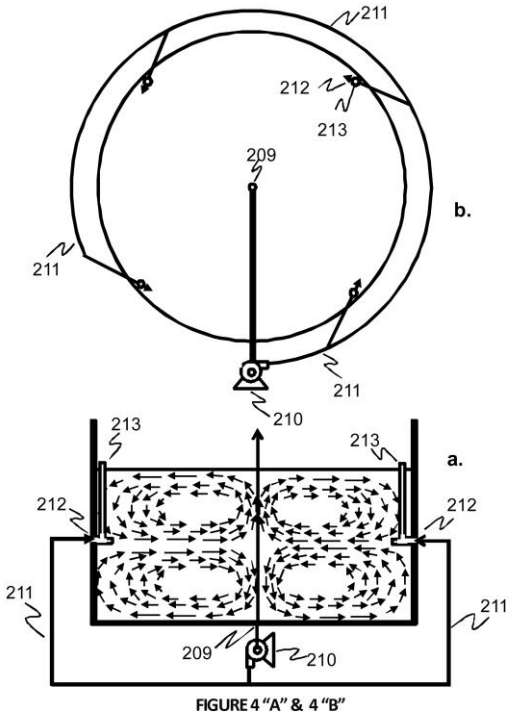


FIGURE 4 "A" & 4 "B"

6.6 Clarification is achieved by Membrane filtration of the effluent.

The use of the MBR provides three valuable functions:

6.6.1 A much higher mixed liquor concentration of activated sludge can be achieved which reduces the aeration basin volume requirements. Compared to the 15-30 lbs of BOD_5 consumed per day per 1,000 ft of aeration basin inventory performance for an extended aeration or other conventional activated sludge processes, the MBR can consume 50-100 lbs of BOD_5 per day per 1,000 ft of aeration basin inventory.

6.6.2 With conventional wastewater treatment, additional filtration is required to achieve reuse quality water; with our MBR technology, filtration post-treatment is not necessary as the membranes fine pores, ~0.1 micron, produce reuse grade permeate

6.6.3 The GPBG-CES integrated MBR technology achieves much longer average sludge "age" vs a conventional activated sludge process thereby eliminating the need for the additional equipment and costs conventionally required for sludge digestion.

6.7 THE GPBG-CES WWTP SYSTEM ADVANTAGES compared to the current standard for new small-scale wastewater plants include:

6.7.1 Reduced costs

i. Lower Capital Cost (as much as 40% lower),
ii. Lower Operation & Maintenance Costs (up to 50% less),
iii. Smaller foot print (typically 35% smaller) and
iv. Less time to construct and start-up (typically 35% less time)

Table 1. GPBG-CES WWTP Construction Economic Advantages

Operations & Maintenance	GPBG- CES Plant
Electrical Power	35% Less
Plant Labor	15% Less
Repair & Replacement Parts	50% Less
Total Savings	**35% Less**

Table 2. GPBG-CES WWTP Annualized Build, Operate & Own Savings

Annualized B.O.O. Costs	Total Savings
Amortized Installed Capital Costs	35% Less
Annual O & M Costs	35% Less
Annualized B.O.O. Costs	35% Less
Wastewater Cost	35% Less
Total Savings	**35% Less**

7.0 GPBG-CES WWT PROCESS FEATURES INCREASE EFFICIENCY

7.1 High Treatment Capacity

The GPBG-CES WWT process and plant design features enable operation at high specific bed loadings (50 to 100 lbs BOD5 converted per day per 1,000 ft^3 of bed inventory) which translate to lower aeration basin construction capital cost and flexible operations benefits.

7.2 No Conventional Clarification Required

The GPBG-CES WWT process and plant design features enable operation without the requirement for use of conventional clarifiers.

7.2.1 Primary clarifiers are un-necessary with just bar screening at the head works of the plant, and for larger plants, grit removal system is all that is required upstream of the membrane – bioreactor subsystems.

i. The 0.1 micron pores of the membrane used permits elimination of the need for secondary clarifiers to produce consistently high quality re-use water continuously even during diurnal peak flows.

7.3 Unique Hydraulics

Depending on effluent characteristics and flow rates, the GPBG-CES WWT system incorporates either cylindrical or conical primary aeration basin geometry, achieving a unique set of hydrodynamic flow patterns within the basin, both radially and vertically, in which several beneficial process conditions result, including the ability to:

7.3.1 Create separate aerobic and anoxic zones within a single vessel that permits conversion of the biological demand at high specific bed loadings (lbs BOD5 converted per day per 1,000 ft^3 of bed inventory).

7.3.2 Achieve biological nutrient removal of nitrogen and phosphorus by the creation of separate aerobic and anoxic zones within a single vessel ,

7.3.3 Achieve oxygen/aeration addition requirements by aspiration/eduction of ambient air into the externally re-circulated bed inventory and by surface entrainment vs use of more costly pressure blowers.

7.3.4 Achieve the maximum concentration of dissolved oxygen (DO) available to the concentrated bed inventory being re-circulated from the center bottom of the aeration basin which helps support successful operation at high bed loadings, which reduces aeration basin size, construction costs and aeration power consumption.

7.3.5 Achieve sludge thickening within the primary aeration basin by hydrodynamic concentration of bed solids inventory at the basin central bottom thereby reducing the amount of any sludge thickener required and potentially eliminating the need for thickeners entirely.

7.4 Membrane Filtration

An integrated membrane filtration system configured in a separate chamber from the primary aeration basin achieves numerous efficiency benefits, including:

7.4.1 Elimination of the conventional mechanical clarification basin and system, including all associated motors, gear boxes, skimmers, and excessive polymer flocculants. System construction, power, chemicals, operating and maintenance costs are reduced.

i. Higher quality effluent is achieved vs conventional clarifiers that require downstream filtration, thereby enabling smaller disinfection systems and less chemical usage which results in significantly reduced electrical power, chemicals, operating & maintenance costs .

ii. Higher mixed liquor concentrations of active microbiological species enables aeration basin operation at two-to-three times greater specific bed loadings vs conventional activated sludge aeration basins; this results in longer sludge "ages" and eliminates the need and cost for a separate sludge digestion tank.

7.5 Biological Nutrient Removal

This process and plant design feature of an aerobic zone superimposed over an anoxic zone achieves biological reduction of nitrogen and phosphorus by simultaneous nitrification and denitrification and biological cell mass growth processes respectively.

i. Recovery of Alkalinity & Filamentous Bacteria Control

a. In addition to denitrification reactions occurring in the anoxic zone, which supports nutrient removal and recovery of alkalinity lost during nitrification of the organic reduced nitrogen compounds and ammonia, stabilization of pH supports filamentous bacteria formation in ranges facilitating dewatering.

7.6 The System Approach for Modular and Flexible Design

The GPBG-CES WWT modular process and plant design benefits permits planners and facility owners to stage plant development and balance capital expenditures with greater financial flexibility.

7.6.1 As Distributed Generation has become the most appropriate platform for utility electrical power production and grid distribution due to higher efficiency, economic, reliability and environmental benefits, municipal sewage systems based on GPBG-CES WWTP systems are similarly appropriate.

7.6.2 Developing/refitting a community's sewage infrastructure systems from that of a single huge central treatment plant to one of several distributed, innocuous, totally enclosed and odor-free systems allows the community to manage its municipal wastewater liabilities at lower processing costs and also to reduce a potentially very significant construction and future annual maintenance costs of central plant-related sewage collection lines that would no longer be required.

7.6.3 The modular nature of the GPBG-CES WWT integrated system also ensures that the WWTP can be efficiently and rapidly expanded if/as community population increases.

i. One design strategy incorporates hexagonal shaped aeration basins which would facilitate an efficient future expansion by adding additional hexagonal basins in a hexagonal array layout.

a. This strategy achieves a construction cost advantage as the amount of material and direct labor would be reduced as the expanded facility's additional walls and structures would be reduced.

7.6.4 Lower Construction Costs, Long Term O & M Benefits

In addition to GPBG-CES WWTP's lower construction cost due to its compact design and minimum component count, modularity and minimum real estate site requirements. Long term savings accrue due to these systems' reduced moving parts, advanced SCADA automation, and ease of maintenance, which result in minimized electrical power consumption, and direct labor, supervision, operating and maintenance costs.

i. Minimum Site Requirements

a. The GPBG-CES WWT process and plant design has a significantly smaller site footprint required to achieve re-use quality discharge water compared to traditional WWTP's.

b. This is the result of eliminating conventional clarifiers and sludge digesters, utilizing reduced aeration and disinfection basin volumes and achieving lower sludge thickener requirements**.**

7.7 Effective Odor Management and Control

7.7.1 Aerobic conditions within the top section of the aeration bed and extended sludge age minimize the potential for odor production. GPBG-CCE WWT plants utilize a proprietary UV-light catalyzed hydroxyl radical-based air treatment system to destroy reduced sulfur compounds that may form during sludge dewatering.

7.7.2 These facilities can be appropriately located within communities to minimize collection pipin infrastructure as the facilities are very compact and odor problems are eliminated.

8.0 PATENTS PENDING PROVEN TECHNOLOGY

8.1 GPBG-CES WWT technology features are proven to consistently deliver high quality treated effluent in a variety of applications; hundreds of MBR process WWTPs producing re-use quality effluent water are currently in operation worldwide as well as are numerous WWTP's utilizing Venturi aerated, activated sludge basins in both designed facilities and retrofits.

8.2 GPBG-CES's novel Patents-Pending Systems Approach achieves very high levels of facility safety, efficiency, economy and long-term cost control benefits for our systems' owners that are unavailable with any other system.

9.0 KEY PERSONNEL

Resumes for CES key personnel are presented in Appendix B; WWTP Project Experience is summarized in Appendix C.

APPENDIX A

1. **<u>GPBG-CES' s team of professionals provides services in the areas of</u>**

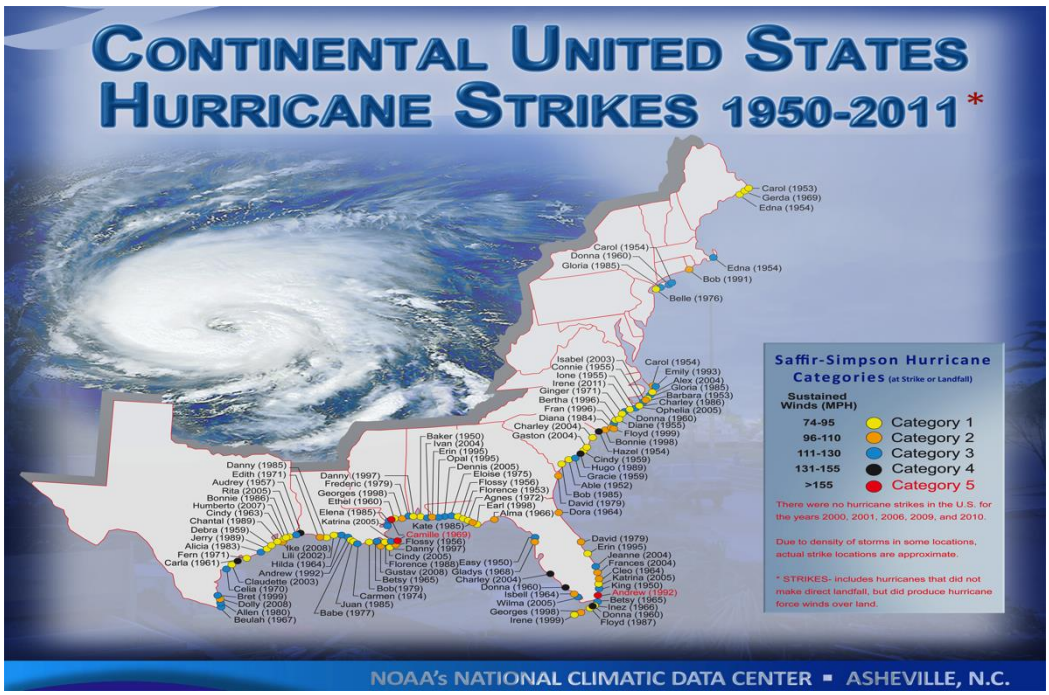
Master Planning	Special Utility District Entity
Project Development	State or Municipally Backed Bonds
Financial, Permitting and Legal issues	Private Industrial Development Bonds
Entity Corporate Structure issues	Public-Private venture-funding structures
Permitting and Legislative issues	Grain Origination Analysis
Front-end Engineering and Design (FEED)	Grain Supply Contracts
Detailed Design	Availability of energy contracts
Construction / Construction Management	Availability of project utilities
Operations and Maintenance	Program Management Support
State/regional grain production strategies	Product Off-take Agreements
Finance	Product Marketing

2. **http://www.dhs.gov/xlibrary/assets/st-aging-infrastructure-issues-research-technology.pdf**

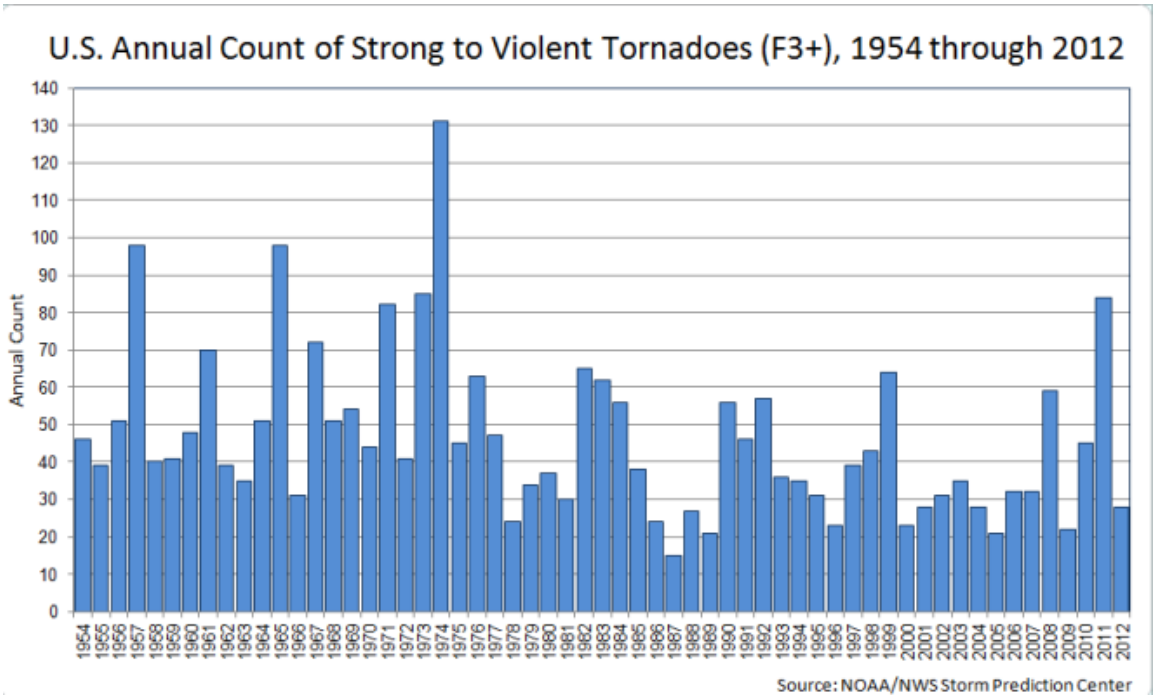
3. **http://www.nbcnews.com/science/environment/insurers-message-prepare-climate-change-or-get-sued-n122856**

4. **http://sealevel.climatecentral.org/uploads/ssrf/FL-Report.pdf**

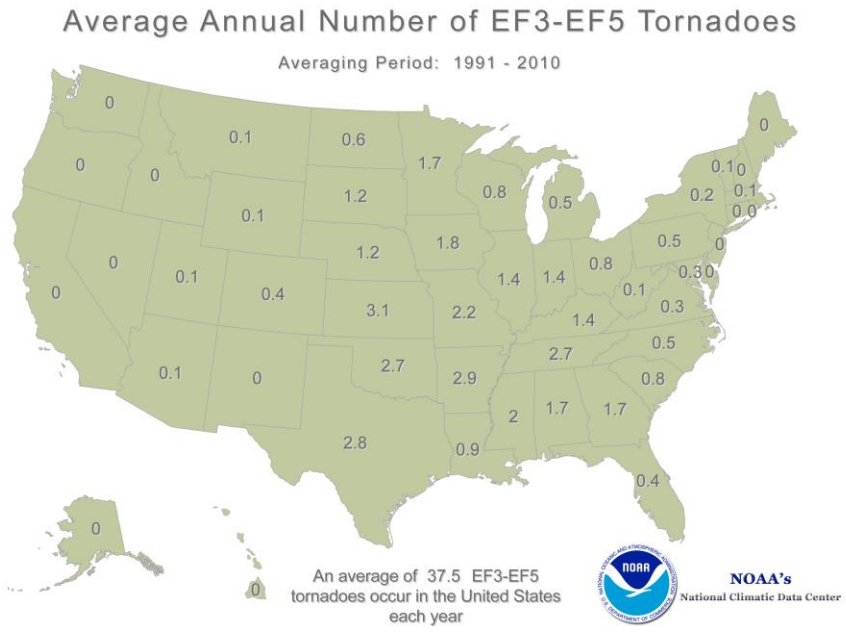
5. **NOAA – Severe Weather Conditions**



6. NOAA/NWS Storm Prediction Center

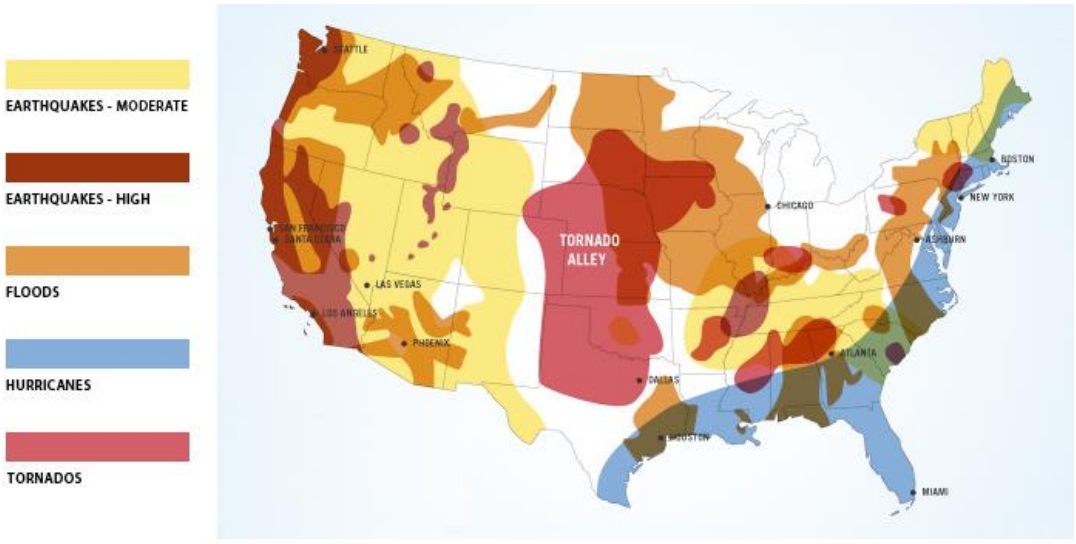


7. NOAA – An Average of 37.5 EF 3- EF5 tornados occur in the U.S. each year



8. http://www.realtytrac.com/content/foreclosure-market-report/realtytrac-2014-natural-disaster-housing-risk-report-8086

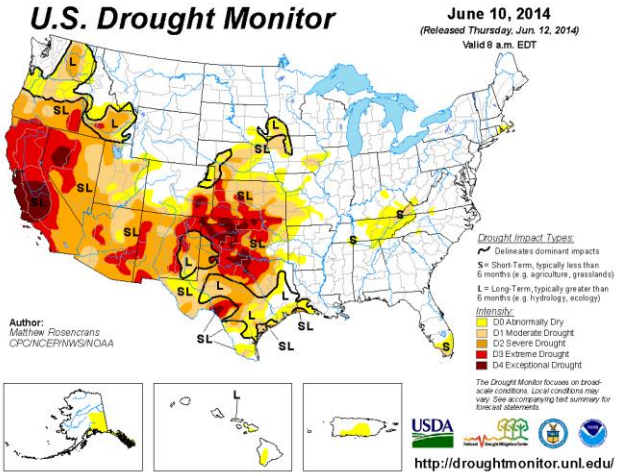
9. NOAA – Map of disaster areas



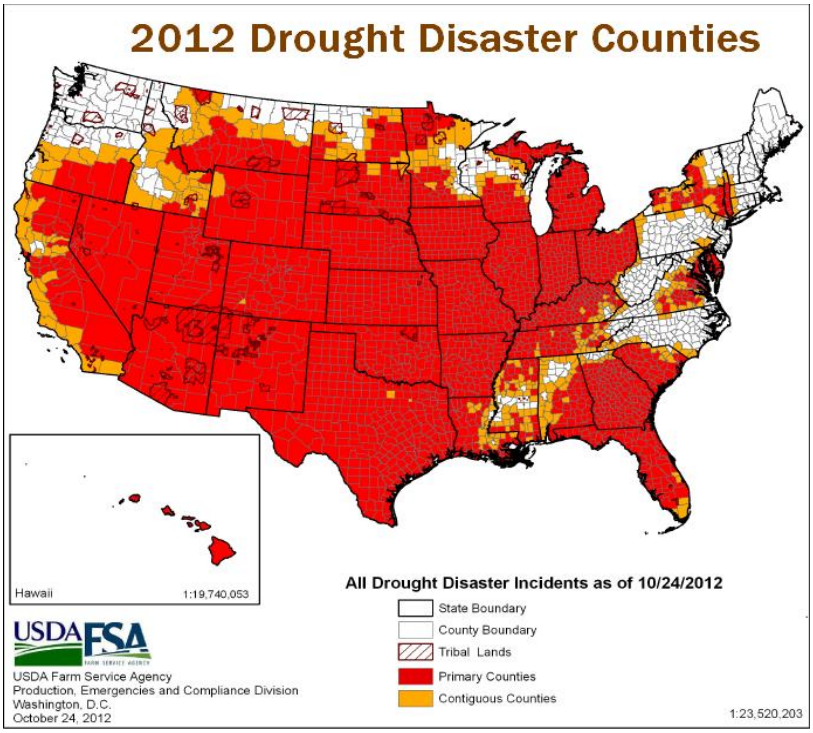
10. US EPA published guidelines provide that "*…as sources of water supplies have become limited, there has been greater use and acceptance of reclaimed wastewater effluents as an alternative source of water for a wide variety of applications, including:*

(a.) Landscape irrigation;
(b.) Agricultural irrigation;
(c.) Toilet and urinal flushing;
(d.) Industrial processing;
(e.) Power plant cooling;
(f.) Wetland habitat creation, restoration and maintenance; and
(g.) Ground-water recharge.

11. NOAA – US Drought Monitor



12. NOAA – US Drought Disaster Counties



APPENDIX B

RESUMES OF KEY PERSONNEL

Barry Liss, PhD, PE **Resume**

Company: Creative Environmental Systems, LLC

Position: Managing Member

Nationality: American

PhD ChE and a licensed Professional Engineer in Florida with over 38 years professional experience in the technical, financial and management aspects of energy and environmental engineering, including process engineering, regulatory compliance, marketing and technical support of air, water & wastewater, odor management, soil and ground water remediation, bio-mass & municipal waste to energy and hazardous waste processing systems; also synthetic fuel technology, coal conversion systems, fluidization engineering and fluid particle systems and alternative energy systems.

CAPABILITIES:

- Business Plan Preparation
- Coal Utilization
- Feasibility Studies, Alternative Designs & Reviews
- Field Testing & Demonstrations
- Fluidization Engineering & Fluid Particle Systems
- Food Waste, Yard Waste, MSW, & Bio-Solids Composting
- Groundwater & Soil Remediation
- New Source Prevention Standards (NSPS)
- New Source Reviews (NSR)
- Maximum Available Control Technologies (MACT)
- National Emissions Standards for Hazardous Air Pollutants (NESHAP)
- Odor Manageent Systems Design
- Odor Sampling, Testing & Characterization
- Permitting & Regulatory Compliance
- Pilot Testing & Scale-Up
- Prevention of Significant Deterioration (PSD) Studies
- Process Engineering
- Project Management
- Proposal & Other Technical Document Preparation
- Remedial Alternative Analyses & Action Implementation
- Site Assessments - Energy Audits
- Technical-Economic Evaluations Of Emerging Technologies
- Technical Marketing & Sales
- Title V - Clean Air Act Evaluations
- Waste-To-Energy Facility Design, Planning, Permitting
- Wastewater Reuse Standards & Systems Design
- Wastewater Treatment Systems Specification & Design

CURRENT WORK EXPERIENCE / SIGNIFICANT PROJECTS

2001-Current Innviron Corporation/EnviroPower Management, Inc. – Senior Process Engineering Consultant – Proposal and project management on solid waste management systems design, permitting and planning projects including waste-to-energy, composting, transfer stations, water treatment, wastewater treatment and air emissions control projects, including international tender response preparation. Overall process engineering integration for all CES waste to energy, water and wastewater treatment plant projects.

2005-Current Reardon Environmental, Inc. – Technical Marketing Consultant – Provides chemical engineering expertise to quantify reagent usages for company's ISCO based remediation projects. Also provides marketing netwroking and regulatory support functions.

2006-Current Classi Environmental, LLC – New Business Development Consultant – Marketing, proposal and project management responsibilities on all areas of energy and environmental engineering consulting including project planning, permitting and management for solid waste management, waste-to-energy, water treatment, wastewater treatment and air emissions control systems and services.

2011-Current Southern Waste Systems – Odor Management Consultant – Prepared permit application and modifications for SUN RECYCLING 12 - COLLEGE AVENUE MRF Odor Management Plan.

PRIOR EXPERIENCE / SIGNIFICANT PROJECTS

EMO Energy Solutions, LLC - Provided facility energy & water audits, modeling, energy efficiency retrofit specifications/designs, & energy awareness programs. Created a cost saving combined energy efficiency, effluent discharge and odor control improvement program for wastewater treatment plants.

Clean Air Systems, Inc. - Technical Director- Prepared Business Plan and provided technical support for development & marketing of company's air pollution control systems. Developed functional relationships with regulators and political leaders.

Noyes & Associates, Inc. Consulting on wastewater projects and marketing its patented water and wastewater treatment technologies. Also prepared business plan and supported capital funding efforts. Helped develop the program and team to enable small communities to take over water utilities from counties or other larger entities.

Terr-Aqua Enviro Systems, Inc. Consultant & Independent Representative – Consulting on air emissions projects and marketing its proprietary UV-Oxidation based air pollution control technology. Also prepared business plan and supported capital funding efforts for industrial air emissions and homeland security applications.

YURCO Hope Team Management Company, LLC – Executive Director - Organized team of over 30 companies, including a majority of the largest disaster recovery companies and prepared business plan to systematically assess, remediate and rebuild homes in the Hurricanes Katrina and Rita devasted areas.

ZYME-TECH, INC. - Invited to join in the formation of this new corporation, as Executive Vice President, which expanded the scope of Odor Control International, Inc. Successfully implemented the mal-odor abatement protocols in all of the waste management applications listed below. Corporate responsibility for all technical aspects of the company.

Odor Control International, Inc. - Developed formulations and application techniques for bioenzymatic treatment of mal-odors at landfills, waste water treatment plants, composting and other waste management facilities. Prepared business plan for company expansion.

NYSFC- Consultant for the Office of Energy-Related Inventions at the U. S. D.O.C.

DOE/METC-University of Massachusetts - Review of the thermodynamic, physical – chemical and detailed design issues for fluid bed coal gasifiers.

Systems, Science and Software - Prepared state of art survey on high temperature fluidization and ash agglomeration which resulted in the identification of a novel approach to the determination of incipient fluidization of sinterable solids. Assisted in population balance model preparation and data analysis related to coal gasifiers.

Hydrocarbon Research, Inc. - U. S. patent for HRI for novel multi-stage fluidized bed gasifier - heavy oil upgrading process.

Clean Fuels Institute/CUNY - Authored five (5) technical articles on coal conversion. Project manager for fast fluid bed gasifier pilot plant design and operation.

Union Carbide Corporation - Developed and demonstrated patented suCESssful techniques for injection of agglomerating coals into fluid bed hydrocarbonizer.

Chemical Construction Corporation - Performed engineering planning and analysis for Clean Boiler Fuel Demonstration Plant Program. Identified and planned commercial plant subsystem alternative/ feasibility studies. Developed reactor design manual.

EDUCATION:

B.Ch.E. The City College of New York.
M.Ch.E. The City College of New York.
Ph.D. The City University of New York
Thesis: Dynamic Behavior of Particulate Systems Involving Simultaneous Nucleation & Growth

TEACHING:

Process Instrumentation and Control Laboratory.
Non-Metallic Behavior Laboratory (polymer).
Metallic Behavior Laboratory (metallurgy).
Department of Chemical Engineering, The City College of New York.

AWARDS:

International Brotherhood of Teamsters Scholarship
Dr. J. J. Klein Fellowship
NASA Pre-Doctoral Traineeship

MEMBERSHIPS:

American Institute of Chemical Engineers.
American Chemical Society.
Water Environment Federation.

PATENTS/PRESENTATIONS/PUBLICATIONS –

- 3 Patents awarded and 3 patents pending
- Over 20 technical papers and conference presentations

Ganesh V. Kumar, PhD Resume

Company: Creative Environmental Systems, LLC, Singapore
Position: Chief Project Manager
Nationality: Singapore

Education:
Bachelor of Engineering: Bangalore University, 1988.
Master of Technology: Indian Institute of Technology, Bombay, 1990.
Ph. D: Indian Institute of Technology, Bombay, 1994.

Awards:
- Outstanding University Researcher, National University of Singapore
- Best Student Award, Undergraduate Studies

Books & Patents:
- Books Published – 1
- Patents Awarded – USA – 1, Singapore – 1, Singapore (Pending) - 1

Membership of Professional Bodies:
- The Institution of Engineers (India)
- Indian Society for Technical Education
- Quality Circle Forum of India
- Hyderabad Management Association

Key Assignments: Water & Waste Water Treatment, Waste Recovery

Technology Development
- Sludge less De-Coloration of Colored Waste Water. (Patent Pending)
- Raw Biogas Upgrading & Bottling
- Super Oxygenation of Drinking Water
- Micro-bubble Floatation System

Turnkey Projects Implementation
- Supervisory Project Manager for all CES-CES WTE WTP projects
- Designed, supplied and commissioned textile dyeing waste water treatment plant for textile effluent in Sihanouk Ville, Royal Crowntex Inc (RCI), Cambodia. **1Million Liters Per Day**
- Designed, implemented and commissioned bottled oxygenated water plant. This is the first such plant in Asia based on Asian technology. This plant has built in capability to produce alkaline water (negative ORP) and energy water as well, AENO Fresh, Johor Bahru, Malaysia. **10,000 Bottles/Day**
- Designed, supplied & commissioned bottled mineral water plant for Malee Mineral Water, Mersing, Malaysia. **125,000 Bottles/Day**
- Designed, supplied & commissioned integrated waste recovery plant including pollution control systems for 5E Resources, Pasir Gudang, Malaysia. **Overall 75,000 Liters/Day**
- Designed, supplied & commissioned lube oil moisture removal system for SPM Oil Recycling, Ipoh, Malaysia. **10,000 Liters/Day**
- Designed & commissioned biological waste water treatment system for MSM Food, Batu Pahat, Malaysia. **30,000 Liters/Day**
- Designed & commissioned biological waste water treatment system for Eng Hap Heng Manufacturing, Batu Pahat, Malaysia. **20,000 Liters/Day**

- Designed, supplied & commissioned used automotive lube oil re-refining system for Toan Thang Loi Company, HCM, Vietnam. **8,000 Liters/Day**
- Designed, supplied & commissioned super oxygenated bottled water plant for Good Health Oxygen, Johor Bahru, Malaysia. **200,000 Bottles/Day**
- Designed, implemented and commissioned bottled oxygenated water plant for VSRO Purified System. This plant has built in capability to produce Oxygenated Water & Alkaline water (negative ORP), Johor Bahru, Malaysia. **60,000 Bottles/Day**
- Designed & supplied MBR based containerized sewage treatment plant for Water Works Technology, Calgary, Canada. **5 Units of 20,000 Liters/Day.**

Design Services

- Design of Textile dyeing waste water treatment system for resuse. Tirupur, India**. 3 Systems, 10 Million Liters/Day, 5 Million Liters/Day & 4 Million Liters/Day**
- Design of 100MGD sewage treatment plant for Hyderabad city for Etimaad Engineering (Private) Limited, Lahore, Pakistan. **100 Million Gallons/Day**
- Design review of municipal sewage treatment plant in Yunan, China**. 5 Million Liters/Day**.
- Design review of commercial building sewage treatment system for Cam Tam Quality Management & Environmental Technology Ltd, HCM, Vietnam
- Design of Anaerobic Digestion (CMART) based treatment plant Palm Oil Mill Effluent for Ladang Rayat, Malaysia. **1.4 Million Liters per Day**

Consultant Services

- Consultant for US Filter to analyze the piping system in their ultra pure water plant at Chartered Semiconductor Manufacturing, Singapore.
- Consultant to Goodform GRP Pte. Ltd, Singapore for designing and installing the FRP piping from raw water intake to RO building for Hyflux Desalination Plant located at Tuas, Singapore.
- Conceptualized, formulated and implemented polymer nanofiber based molecular filter project for Defence Science Technology Authority, Singapore through National University of Singapore.

RESEARCH PUBLICATIONS

A. Papers in Refereed International Journals

1. Naik, N.K., R.Anbarasu and G.V.Kumar.1991. "Effect of Curing Stresses on the Behaviour of Fibre Reinforced Plastic Composites Under Biaxial Loading", *Journal of Materials Science*, 26:5753-5761.
2. Naik, N.K. and V.K. Ganesh. 1992. "Prediction of On-Axes Elastic Properties of Plain Weave Fabric Composites", *Composites Science and Technology*, 45:135-152.
3. Ganesh, V.K. and N.K.Naik. 1993. "Some Strength Studies on FRP Laminates*", Composite Structures*, 24:51-58.
4. Naik, N.K. and V.K.Ganesh.1993. "Optimum Design Studies on FRP beams with Holes", *Composite Structures*, 24:59-66.
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6. Ganesh, V.K.and N.K.Naik. 1994. "Thermal Expansion Coefficients of Plain Weave Fabric Laminates", *Composites Science and Technology*, 51:387-408.
7. Naik, N.K. and V.K.Ganesh.1994. "Failure Behavior of Plain Weave Fabric Laminates Under In-plane Shear Loading", *ASTM Journal of Composites Technology and Research*, 16:3-20.
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9. Naik, N.K. and Ganesh,V.K. 1995. "An Analytical Method for Plain Weave Fabric Composites", *Composites*, 26:281-289.
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12. Ganesh, V.K. and Naik, N.K. 1996."Failure Behavior of Plain Weave Fabric Laminates Under On-Axis Uniaxial Tensile Loading: III - Effect of Fabric Geometry", *Journal of Composite Materials*, 30:1823-1856.
13. Naik, N. K. and Ganesh, V. K. 1997. "Thermo-mechanical Behaviour of Plain Weave Fabric Composites: Experimental Investigations", *Journal of Materials Science*, 32:267-277.
14. Ganesh, V. K. and Naik, N. K. 1997. "(+45) Degree Off-Axis Tension Test for Shear Characterization of Plain Weave Fabric Composites", *ASTM Journal of Composites Technology & Research* ,19:77-85.
15. Ganesh, V.K., S. Ramakrishna, S.H. Teoh and N.K. Naik. 1997. "Microstructural Design of Textile Composites", *Journal of Materials and Design*, 18:175-181.
16. Ganesh V.K., S. Ramakrishna. 1998. "Prothesis: another concept", The European Periodical For Technical Textile Users : Protection, Sept-Nov. 1998: 56-60.
17. Ganesh V. K., S. Ramakrishna & HJ Leck. 1998. "Fiber Reinforced Composite Based Functionally Gradient Materials", *Advance Composites Letters*. 7:111-115.
18. Ganesh V.K., S. Ramakrishna, P.L. Loh, C.L. Chew and S.H. Teoh. 1998. "Functionally Graded Composites for Dental Applications", *Journal of Materials Science Research International.*
19. P. L. Loh, K. Ravi, V. K. Ganesh, S. Ramakrishna, and C. L. Chew. 2000. "Moisture Absorption of Carbon Fiber Reinforced Posts", *J. Dental Research*, **79**, 5 (2000) 1317.
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21. Aggarwal A., S. Ramakrishna & Ganesh V. K. 2002, " Predicting the Strenght of Diamond Braided Composites", *Journal of Composite Materials*, 36:625-643.
22. V. K. Ganesh and T.S. Choo, 2002, "Modulus Graded Composite Adherends for Single-Lap Bonded Joints", *Journal of Composite Materials*, 36:1757-1767.
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50. Kazutoshi Fujihara, V.K.Ganesh and S.Ramakrishna, "Dental and Orthopaedic Applications of Polymer Fibrous Composites", 8th Japan International SAMPE Symposium & Exhibition, November 18-21 2003, Tokyo Bigsight, Tokyo, Japan.
51. S.E. Sadique, S. Ramakrishna and V.K. Ganesh, Modeling the Biomechanics of the Craniofacial Structures Using Boundary Element Method – A New Approach. *4th International Conference on Biological Mechanisms of Tooth Movement and Craniofacial Adaptation,* Aug 18-21, 2003, USA.
52. S.E. Sadique, K. Fujihara, V.K. Ganesh, P.L. Loh, K.W.C. Foong, C.L. Chew and S. Ramakrishna, Z.M. Huang, R. Gopal, K. Fujihara and S. Ramakrishna, Development of a New Composite Orthodontic Archwire and Its Bridging Micromechanics Model Design. *14th International Conference on Composite Materials (ICCM-14)*, July 14-18 2003, San Diego, California, USA.

C. Books/Monographs, Chapters in Books

1) An Introduction to Biocomposites, Imperial College Press to be released this summer. Co-authored with Seeram Ramakrishna, Zheng-Ming Huang, Andrew Batchelor, Joerg Mayer.
2) Research work has appeared in the book titled "Woven Fabric Composites" (Technomic Publishers) authored by N. K. Naik (Doctoral Supervisor).
3) Research work has appeared as a chapter in the book edited by Prof. J. W. Bull (Blackie Academic & Professional). Authored by N. K. Naik (Doctoral Supervisor).
4) Research work has appeared as a chapter in the book titled "Composite Engineering Handbook" edited by Prof. P. K. Mallick, (Marcel Dekker, Inc., New York). Authored by N. K. Naik (Doctoral Supervisor).

D. Patents

1. Singapore Patent No. 79227, Granted: 27th Feb 2004: Fiber-Reinforced Composite Product with Graded Stiffness. Ramakrishna S, Ganesh VK, Teoh SH, Loh PL and Chew CL.
2. United States Patent No. 6,287,122 B1, Granted 11th Sept. 2001: Fiber-Reinforced Composite Product with Graded Stiffness. Ramakrishna S, Ganesh VK, Teoh SH, Loh PL and Chew CL.
3. Teo, K. Fujihara, P.L.Loh, K.W.C. Foong, V.K. Ganesh, S.Ramakrishna, C.L.Chew, "Fiber reinforced composite orthodontic brackets", Provisional US Patent Granted, June 2003.

E. Awards

1. Outstanding University Researcher Award: This is an annual award to recognize staff achievement and to stimulate quality research at the National University of Singapore. The award is made for quality research and not for quantity. Just one piece of excellent research work is sufficient for nomination.
2. Tan Kah Kee Young Inventors Merit Award (Singapore) for developmental work on Aesthetic Orthodontic Composite Archwires.
3. Best Student Award, M.E.I.Polyte

Daniel G. Noyes, BIE **Resume**

Company: **Classi Creative Environmental JV, LLC, USA**

Position: **Chief Process Manager**

Nationality: **American**

DAN G. NOYES, President, Noyes & Associates, Inc., Environmental Specialist

EDUCATION **Texas A&M University - Studies Industrial Engineering 1970-1974**

AREAS OF EXPERTISE

- Water Treatment,
- Wastewater Permits,
- Water Permits,
- Wastewater Treatment System Evaluation,
- Wastewater Operation, Sludge Processing,
- Water Operation,
- Pumping Systems,
- Disinfection Design,
- Project Management, Control Systems Design

PROFESSIONAL EXPERIENCE

1998 – Present: Downstream Environmental, L.L.C. – President, Founder. Specific application of the DMR BioReactor in the marketing of Non-Hazardous Wastewater Treatment, specifically concentrated grease trap waste. Projects include a successful 2-year pilot plant operation, which culminated in development of an urban friendly process with a 95% odor reduction and treatment efficiency in excess of 99.999%, allowing for direct discharge into public waterways.

1996 – 1997: Inc. - President, Founder. Developed e-Cell technology from lab unit to commercial scale systems. Created sales and marketing strategies and networks. Full size units used in Grumman Aerospace, Inc., Georgia-Pacific, Inc., the Abbeyville, La. Superfund site, and at the pilot plant system for the Grease Spot, L.L.C.

1989 - 1996: Noyes & Associates, Inc. - President, Founder. Designed, engineered, manufactured, and applied water and wastewater treatment and transfer technology. Developed bids and proposals. Invented new technology, most notable being the One Moving Part Plant, the Fluidized Bed BioReactor, The Kinetic Pump Having a Centerless Impeller, and High Efficiency Gas Entrainment Process. Developed markets in Mexico and across the United States. Recognized as the 25th fastest growing business in 1994; the 18th in 1995 by the Houston Chamber of Commerce.

1985 - 1989: Metro/Quip South, Inc. - President, Founder. Manufacturer's representative in the area of municipal wastewater equipment. Grew business from single man operation with 4 principals to a small company with 6 employees with 34 principals with an annual sales volume of $9 million per year.

1976 - 1985: George W. Noyes & Associates, Inc. - Salesman. Initially responsible for valve sales development in power generating boilers and petroleum heaters. Major accounts included ENTEC, Inc. and ARAMCO. Later sales efforts were broadened to include the wastewater treatment and transfer market. Major accounts were the City of Austin, City of Houston, City of Corpus Christi, and the Rio Grande Valley. Set sales records in the field of Wastewater pumping systems**. Water and wastewater systems sales, design and manufacturing were later incorporated.**

1975 - 1976: Cope-Vulcan, Division of White Consolidated Industries, Inc. Operated as a field technical engineer, supervising startup of boiler systems. Significant projects include the Bruce Mansfield Power Plant in Shippingsport, Pa., the Union Camp Paper mill in Savannah, Ga., and Salem Nuclear Power Plant in Salem NJ.

DANIEL G. NOYES CAREER HIGHLIGHTS

- Development of Process Technologies to Treat Hyper-Concentrated Organic Waste Streams (>100,000 mg/l BOD);
- Development of e-Cell technology,
- Development of Fluidized Bed BioReactor,
- Development of One Moving Part Treatment Plant,
- Development of the Kinetic Pump having a Centerless Impeller,
- Development of High Efficiency Process to Entrain Gas into Solution,
- Founded , Ecoloquip Inc.,
- First Small Clarifier Design to Utilize Maintenance Free Enclosed Gearbox,
- Development of Automatic Backwash Filter without Valves or Pumps,
- Assisted in Writing of Standards for the City of Austin Lift Station Design and Odor Control,
- Assisted in Writing Wastewater Treatment Plant Design Criteria for the Texas Natural Resource Conservation Commission ,
- Instructor at the Texas A&M Short School for Treatment Plant Operator Certification

Edward C. West, MSCE, MSBA, PE, Col. USACE, Ret.

Mr. West is a graduate of West Point and also holds a Masters in Civil Engineering from MIT as well as a Masters in Business Administration from George Washington University. During his military service, he also attended the Command and General Staff College, The Armed Forces Staff College, and the Industrial College of the Armed Forces.

From 1950 to 1972, he served as an officer in the United States Army, retiring in 1972 with the rank of Colonel. During his Army career, Mr. West supervised major design and construction work in the U.S. and overseas, commanded troop units in the U.S., Europe and the Far East, and served in the Office of the Chief of Research and Development and the Office of the Chief of Staff of the United States Army. He also commanded the Pittsburgh District of the U.S. Army Corps of Engineers.

After retirement from the Army, Mr. West joined Green Engineering Company in Sewickley, Pennsylvania as Executive Vice President. Subsequently he became Green's President and led the company through its transition from a family owned company to a company owned by its employees through an Employee Stock Ownership Trust, one of the first of its kind in the United States.
While with Green, Mr. West took personal on site charge of Green's responsibilities (engineering, construction, and procurement) for the Interama project, a joint venture of Green and the Finley Development Company. Interama was a major ($250,000,000) Inter-American trade, culture, educational, and entertainment center located in Dade County Florida.

Mr. West left the Green organization in 1976 to found his own suCESssful management consulting business. In 1978, through a consulting assignment he founded Agripost, Inc., a company engaged in economical, environmentally compatible solid waste disposal through a unique composting process which enabled the conversion of solid waste to fertilizer. He later became the President of Agripost and served in that capacity as the company was taken public, won its first contract, and built its first plant in Dade County Florida.

The plant was housed in a building occupying the space of seven football fields under roof, and processed 250,000 tons of municipal solid waste per year while producing 200,000 tons of fertilizer.

Mr. West resigned as Agripost's President in 1990. Since that time, he has been a consultant in real estate sales and development, solid waste disposal, prefabricated housing (Romania), innovative (large scale) odor control, and water purification.

Between 1992 and 1994, West served as second in command of a unique group formed at the request of the Governor of Florida and the Mayor of Homestead, FL to plan the rebuilding of the City after it was severely damaged by Hurricane Andrew. The plan was completed and approved in less than four months, and the group was further retained to oversee implementation of the plan.

At the present time, West is active in commercial and residential real estate sales, and as such has been consistently ranked in the top 5 % of real estate agents, nationwide. He is licensed in the State of Florida as a real estate broker, a real estate associate, and a mortgage broker. He has also served the community as president of Woodmont Country Club, Tamarac, FL., president of the Cloisters Subdivision of The Broken Sound Club, member of the Board of Governors of The Broken Sound Club, and active member of boards of various charitable organizations. West writes for local publications and is a regular public speaker.

Rodney (Rod) C. Kreie

Rodney (Rod) Kreie is the Chief Operating Member and co-founder of Great Plains Biosciences Group, LLC ("GPBG"), an early stage renewable energy development firm dedicated to the development of sustainable, biological-carbon cycle based fuel production and utilization technologies, and infrastructure systems.

At GPBG, Rod is responsible for daily operations and establishing strategies that will allow the company to develop, finance, and manage projects.

The GPBG strategy is to establish relationships with suitable partners that will provide high efficiency energy management/production with innovative technologies in unison with other compatible business enterprises.

Based on his extensive business and community services experience, Rod has an extensive network of professional associates whose expertise can provide the management and technical resources to support, enhance and optimize existing projects or support new projects development.

Certified Public Accountant – Rod is a CPA and practiced public accounting for almost 25 years. He has been a partner is several firms. Rod's last firm merged with CBIZ, a national accounting firm that is publically traded.

At the time of the merger his firm provided services to almost 1,400 clients in 37 states. While in public accounting, Rod participated in the startup of several new companies. His practice also included bank consulting, tax planning, financial planning, debt structuring, and business consulting.

Economic Development – Rod was chairman of Grant County Economic Development for over 20 years. His vision led to the current structure funded by the City and County. The entity operates independent of City and County government and has effectively recruited dairies, a fresh produce processor, a national retailer, a bio fuels plant, and many other business that have added to the local tax base. Through travel and solicitation of various industries, Rod has made many useful business contacts.

Project Management – Rod has been involved in the development of biofuels and other projects from the first planning stages through construction and plant commissioning and production start-up. This includes fund raising, project finance, technology selection, scheduling, contractor selection, feedstocks development and procurement, product marketing, byproducts value enhancement, operational efficiency optimization and operations management.

Banking – Rod has had involvement with banks as a shareholder, board member, bank president, and a consultant. Rod's bank experience ranges from bank startup and profitability enhancement through loan cleanup and bank sale.

Farming – Rod has been involved in a farming operation for many years. Alfalfa, corn, mile, soybeans, and barley were grown on almost 4,000 acres under sprinkler irrigation in southwest Kansas.

Benevolent Board Participation – Rod is currently on the Board of Trustees of Southwestern College, Winfield, KS and is Chairman of the Endowment Committee. Rod has also served on the United Methodist Health Ministry Fund and has been actively involved with their Investment Committee. He has also served on many other boards.

Other volunteer Participation – Rod has coached high-school girls fast pitch softball. He has also assisted with the girls high school golf team. He helped start the high school entrepreneurship class and later started another entrepreneurship club in the junior high. He has been a regular speaker in various high school classes. He has also been a presenter at various conferences and topics ranging from economic development to water projects.

Rod is also an avid Rotarian just completed serving a year as District Governor for the southern half of Kansas and the Oklahoma panhandle. In 2007 Rod spearheaded the relief effort in Greensburg, Kansas where Rotarians organized and supervised two graduation ceremonies, building 15 Habitat for Humanity houses, and many other volunteer services provided by Rotary Clubs throughout the United States. Many valuable relationships have been made with fellow Rotarians during training conferences; in 2008 Rod went to India for a month to work on clean water projects and to speak at Rotary Clubs throughout northeastern India.

He has also been involved in the Chamber of Commerce and served as president for a year. He was involved in the Kansas Society of CPA's on several committees. He has been the Master of Ceremonies for the Home Products Dinner where state and area politicians and a crowd of 2,000 attend. He has served as Chairman of Church council for the First United Methodist Church and also helped establish the Ulysses Teen Center out of a High School Entrepreneurship class project.

Education – Rod received his BS in Business Administration from Southwestern College in Winfield, Kansas in 1977. He has taken many courses since graduating emphasizing personal financial planning, tax planning, estate planning, business valuation, bank compliance, agri business, and other relevant courses.

Frank D. Parker, Jr.

Frank Parker enjoys a diverse management and technology career serving Industrial, Utility and Institutional clients and Government Agencies which include the Energy, Defense, Homeland Security and Justice Departments in various capacities as contractor, researcher and consultant. Frank currently serves as Chief Technology Officer as well as is Co-founder and Managing Board Member of several environmentally sustainable enterprises:

Great Plains Biosciences Group, LLC

Great Plains Biosciences Group is a sustainable agricultural and renewable energy technologies firm developing and consulting on biological-carbon cycle energy and fuels production, sustainable agricultural programs, public works, power and infrastructure systems.

The Global Center for Preparedness and Resilience

The Global Center for Preparedness and Resilience's provides preparedness and resilient consultancy, design and management solutions through technology, education, training, planning and certification for facilities, infrastructure, products, and projects.

These programs develop appropriate preparation measures for and responses to natural and man-made disasters to globally promote resilient infrastructure systems for the protection of physical assets and human life, and support sustainable economic growth for a resilient planet and biosphere, the life support system of our planet.

Primary emphasis of the Global Center currently include threats to the National Aviation Sector. The Aviation Sector of our National Transportation Infrastructure System is uniquely vulnerable to natural and manmade Aggressor Threat Risks due to highly concentrated physical plant features which include large volumes of highly flammable liquid fuels and dependence on operationally robust and critically precise utilities and digital systems.

It is self-evident that the US Aviation Transportation System is vulnerable to the evolving impact of Aggressor Drone-borne munition, EMP/IEMI and cybersecurity threats. The Global Center is focused on providing an ***Integrated Systems Approach*** to Aviation Infrastructure Risks Mitigation which can achieve significantly improved levels of protection for Civilian and DOD Aviation Operations.

The Global Center's program incorporates site surveys and sophisticated multi- Dimensional modeling to determine the candidate Airfield's Vulnerability/Risk profiles, the development of appropriate Risk Mitigation Strategies, and the Engineering Systems' Hardening and Management to support a resilient and safe national aviation logistical system.

Global Aquatic BioSystems, Inc.

Global Aquatic BioSystems, Inc. is a Public Benefit enterprise that has developed a successful, efficient and ecologically responsible alternative mosquito vector control program vs. dependence on employment of toxic chemical insecticides.

Our program assumes a new paradigm in long term mosquito control and abatement using safe, all-natural biological methods.

InfraGard

InfraGard is a partnership between the FBI and the private sector in which individuals representing businesses, academic institutions, state and local law enforcement agencies share information and intelligence to prevent hostile acts against the United States.

Frank is currently the Tampa Bay Area Florida's InfraGard Energy Sector Chief.

Integrated Systems Approach

Frank has developed a Systems Approach which synergistically achieves:

- national energy resources through flexfuel production facilities yielding cost-effective petroleum-replacement transportation motor fuels,
- GHG carbon dioxide (CO2) mitigation and improved air quality,
- beneficial utilization and extinguishment of problem biologically active agricultural and animal metabolic waste streams, including municipal/domestic wastewater effluents, and
- unemployment/underemployment problems through significant, sustainable employment.

This novel Systems Approach elegantly and efficiently solves these problems via an integrated system of optimized discrete process loops.

Wastes and byproducts of an upstream process become inputs to subsequent, downstream processes in a series of energy and materials cascades. These modular systems can be deployed to meet site feedstock resource base, infrastructure and logistics conditions, as needed. This strategy achieves sustainable ecologic systems, enterprise units and employment.

Background

Project Engineering - Frank has over thirty years product and project design, engineering and management experience in environmentally responsible, high efficiency, low emission engineered chemical process, cogeneration and utilities systems for a variety of manufacturing, hospital and other public organizations, government and military installation central power plant and "smart buildings" applications.

Greatly concerned with depletion and contamination of fresh water resources, and dedicated to its protection, conservation and reutilization, his work in constructed marshland and bioreactor systems, algae-based fuels and bioproducts date from the 1970s.

Power & Utilities - He has extensive industrial experience with Power and HVAC central plant boiler, chiller and compressed air systems upgrading, with Industrial and U.S. Military energy projects involving powerhouse utilities cost documentation, operator training and staffing optimization, improved facility operation and maintenance procedures, improved plant performance, energy efficiency and emissions control, reduction and management.

Research – Frank has worked with numerous Industrial, Institutional, State and Federal Agencies and private organizations including the Corps of Engineers, US Military Academy, West Point, USACE, USAF, NAVFAC, DOE, DOJ and InfraGard (FBI)

Projects focused on sustainable, environmentally responsible infrastructure, Public Works utilities production, optimization and hardening technologies and appropriate strategies. He has designed high efficiency, low emission, multi-fuel, futureproofed central utilities CHP systems producing electrical power, steam, chilled water, refrigeration and compressed air, water and wastewater utilities.

His programs incorporate process and domestic wastewater recycling/ reutilization systems to achieve the lowest sustainable long-term facility capital and operational Life-Cycle costs.

Management - His management experience includes ten years as President and CEO in specialty manufacturing, engineering, and operations consulting firm. Frank has a BA in Economics from Oglethorpe University (1969) with Physics and Chemical Engineering minors. He presently holds 2 U.S. Patents for energy and process control systems, with Patentable work ongoing in gasification, power and related environmental fields.

Utilities and Environmental Optimization Projects

Renewing Rural America - This program is an Economic Development engine incorporating the principals of Environmental Industrial Parks (EIPs) utilizing a systems-approach for achieving stable, robust economic viability in traditionally agricultural, rural communities. Renewing Rural America promotes efficiency and conservation; it produces clean energy, clean air, clean water and safe food programs.

This provides the structure for human and economic infrastructure development and the achievement of stable, high value direct and indirect employment in added-value agricultural enterprises.

This program demonstrates that a community can achieve improved economic viability by means of a strategy of environmental stewardship organized in an integrated, programmatic protocol of sustainable-versus-exploitive water and land use practices and added-value-versus-commodity business enterprises.

USMA – Implemented an Energy, Operations and Maintenance (O&M) Program which reduced USMA West Point's Central and Laundry Plants energy usage 29%; identified additional improvement opportunities in excess of 58%, then worth at least $ 5.47 Million/Yr. (1984 Dollars). USMA Contract DAAG60-84-C-0149.

USMC – Implemented an Energy, Operations and Maintenance (O&M) efficiency improvements achieved worth more than 25% at Marine Corps Base Quantico Va.'s Main Boiler Plant then worth more than $0.65 Million/Yr in direct fuel savings plus significant O&M savings (1984 Dollars). USMC Contract NOO123-84-0152/ZZ.

DoD - Utilities and O&M – Direct labor, energy and maintenance savings opportunities identified in the range of 25%-to-45% achievable across-the-board at US DoD shore facilities. In addition to improving Activity Readiness Standards of these facilities and moving significantly closer to compliance with Utilities Plant air & water emission/discharge environmental standards, these utilities optimization/ management programs represent direct energy reduction opportunities of more than $ 10 Billion/Yr (1985 USD) and $ 10-30 Billion/Yr (1985 USD) Maintenance, Repair & Replacement savings. DoD/Battelle-PNL Contract 064526-A-T1.

DoE - In collaboration with Dr. L. D. Clements, Frank co-designed and fabricated two spouted bed gasification reactors (synthesis gas producing) for the biomass gasification program pilot plant at the University of Nebraska at Lincoln's Biological Systems Engineering Department. He is active in the development of ultra-low emission/ultra-high efficiency Biorefinery applications for conversion of animal manures and other agricultural wastes and "industrial crops" to clean transportation fuels, energy, chemicals and synthetic fiber production.

International

World Bank - Frank led one-of-two US engineering teams (7 teams total) invited to respond to a World Bank RFP to retrofit Soviet-era coal plants in Poland; Frank's submittal won the Program Technical Review. Subsequent to World Bank Contract Award, Frank's Team returned the World Bank contract as Bank of Poland "fees" and contract terms were unacceptable.

Bahamas - Frank resolved the island's municipal and resort wastewater treatment plants problems on the Island of Nassau, The Bahamas, and prevented a cholera outbreak from progressing to epidemic levels for the Bahaman Ministry of Tourism.

Mexico - Working with the Ministry of Agriculture, State of Sonora, Mexico, he developed proposals for desalination of seawater for the agricultural water requirements of Sonora's Yaqui Valley agricultural region and for improved efficiency and reduced environmental discharges of CFE's electrical power generating station at Guaymas, Sonora.

Other - Frank has performed numerous energy efficiency survey projects which included: Tulane University, (New Orleans, LA); Shaw University, (Raleigh, NC); Meharry Medical College, (Nashville, TN); and numerous other Energy Efficiency Improvement/Performance Contracting Projects for schools, hospitals, resorts and hotels.

Frank performed state-of-the-art utilities optimization assessments and implementation projects for facilities including: Mead Johnson Nutritionals, (Evansville, IN); Clairol, (Stamford, CT); Bristol-Myers Squibb, (Wallingford, CT); Bristol-Myers Squibb, (Syracuse, NY); University of Evansville, (Evansville, IN); Evansville Brewing Company, (Evansville, IN); and University of Southern Indiana, (Evansville, IN); Frank designed and installed a 650 Ton Natural Gas engine-driven Trane/York Chiller refit-conversion for the Candler General Hospital, (Savannah GA), Rehabilitation, refit and upgrading of numerous Federal Department of Justice, SE Bureau of Prisons electrical power, HVAC and security systems under programmed and Emergency contracts.

CTO of team receiving 1ST algae biofuels R&D Grant issued by North Carolina (2008)

CTO & technologies team leader on collaboration for development of 3,100 Acre Florida Science & Renewable Energy Park incorporating fresh water conservation and reutilization, Solar, Wind and Waste-to-Energy (MWe) Best Practice, Biomass-to-Liquid fuels (BTL), Natural Gas-to Liquid fuels (GTL), Algae production for finfish & prawn, cold storage plant, greenhouse fruits & vegetables production, with distribution and logistics systems creating an AgraPlex integrated urban agriculture system yielding Clean Water, Clean Energy, Clean Air, Safe Food and Good Jobs. (Funding for project collapsed with the "Great Recession.")

CTO & technologies team leader on collaboration for development of a 2,400 acre

Bakersfield, Kern County, California Mixed Use Real Estate & Renewable Energy development incorporating a Catholic Children's' Hospital and K-12 schools, Public Safety and National Guard Centers supporting zero discharge public works utilities infrastructure featuring fresh water conservation and reutilization, Best Practice Solar, Wind and Waste-to-Energy (MWe), Biomass-to-Liquid fuels (BTL), Algae production for finfish & prawn, diary, winery, cold storage plant, greenhouse fruits & vegetables production, with distribution and logistics systems creating an AgraPlex integrated urban agriculture system yielding Clean Water, Clean Energy, Clean Air, Safe Food and Good Jobs. (Funding for project collapsed with the "Great Recession.")

CTO & technologies team leader on development of Tampa Florida's Science Museum's Renewable Energy and facility self-sufficiency exhibits incorporating fresh water conservation and reutilization, Solar, Wind and Waste-to-Energy (MWe), Algae production for finfish & prawn, greenhouse fruits & vegetables demonstration.

This program was selected over numerous other competing proposals. (Funding for project collapsed with the "Great Recession.")

CTO for team developing the "Monticello Village" concept - an "Age with Purpose" Platform and Program. The program incorporates a location based Community system of services deployed in a small village atmosphere that incorporates luxury cluster homes, single cottages and Village Apartment residences and for that extra support "all service" apartments units in the main Monticello building complex. The community boasts a comprehensive sustainable on site energy, water and food production plan.

CTO for team receiving National Science Foundation Phase 2 SBIR (extended for 3rd program year) for on-farm production of algae used for animal (currently poultry) feed supplement/ augmentation.

Currently developing small-scale modular biogas-to-D2 (diesel fuel - can be modified for aviation turbine fuel) utilizing stranded Municipal Wastewater Treatment Plant flare-gas biogas (CH4) for domestic municipality fleet fuel requirements. (Reference our RDIUP modular public works systems).

Special Environmental Projects

Frank collaborated with Dr. L.D. Clements, on the Design and Development of the Rapid Deployment Integrated Utilities Plant ("RDIUP") for USDoD and Refugee/ Humanitarian Agencies' Refugee Camps' potable water, solid wastes and wastewater field sanitation management and electrical power requirements; RDIUP is a modular 'Public Works System in a Box.' Frank's work has been recognized by a USAF-DoD 2004 Nunn-Perry Award and subsequently by the United States Air Force's nomination for a second Nunn-Perry Award in 2006.

Design of dry mill grain ethanol manufacturing plants, catalytic alcohol – methanol and ethanol production systems, BioFuel and BioPower MWe & MWt CHP Cogeneration systems, Process Wastewater recovery and reutilization, Hydroponics and Aquaculture systems, constructed marshland treatment systems incorporating Algae Biodiesel, 3rd Gen F-T & Fuel Alcohols Drop-in fuels production, and Coal Seam Methane/NatGas/Petroleum Product Water Desalination.

Example Papers and Presentations

Biomass Waste Utilization for Cogeneration, Dr. L.D. Clements, A.K. Janarthanan and F.D. Parker, resented at USDoE BIOENERGY '96, 15-20 September, 1996.

Strategies for the Economic and Environmental Management of Municipal Solid Waste, presented by F.D. Parker at Southface Energy Institute, USDoE, Sustainability Roundtable, 4 June, 1999.

Illinois Clean Coal Program {et al} - Environmental Industrial Park (EIP) Economic Development Programs and Power Point briefings, F.D. Parker and D.K. Roberts, various Energy and Environmental symposia, Nov. 2004.

The Rapid Deployment Integrated Utilities Plant (RDIUP System - Technology and Power Point briefings), Col. M. Morrow, USA Ret., F.D. Parker, and L.A. Zambrana, briefed by Col. M. Morrow, F.D. Parker and L.A. Zambrana at CE CERL/ERDC, Champlain, IL, AFCEE, Brooks AFB TX, AFCESA, Tyndall AFB FL, CENTOM, MacDill AFB FL, The Chief Engineer, ACE, the Pentagon, Washington DC, (Nov 2004).

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APPENDIX C

WASTEWATER TREATMENT EXPERIENCE

Appendix C provides summaries of many of the key projects in which CES and its strategically, ENVIROPOWER, and their personnel have played a significant role.

RIVERBEND PRAIRIE LEACHATE TREATMENT SYSTEM
Dalton, Illinois
Client: Land and Lakes Company

The project included the design of the gravity lines, fittings, manholes, and roadway restoration, preparing construction drawings and technical specifications, and obtaining the permits for construction. In addition, EnviroPower personnel were retained to evaluate the source of odors in the manholes, and to design an odor treatment system. EnviroPower personnel supervised construction of the project and provided QA/QC during construction.

KADUNA WASTEWATER TREATMENT FACILITY
Kaduna, Nigeria
Client: Municipality

EnviroPower personnel design a wastewater treatment plant for municipal and industrial wastewater for the Municipality of Kaduna. The facility included both primary and secondary treatment, with discharge to surface water. The facility was located in an industrial area and was specifically designed to handle dies and discharges from the garment industry in the area.

BERMAN ROAD LEACHATE TREATMENT FACILITY
Okachobee, Florida
Client: Waste Management Inc.

The project included the design and construction management of a wastewater treatment facility to treat landfill leachate. The design included a lined aeration ponds and secondary treatment using reverse osmosis. Treated water was discharged to surface water. EnviroPower personnel prepared the design, construction drawings, specifications, obtained the state and local permits, and evaluated the bid packages from the contractors. EnviroPower personnel also provided construction management for the facilities, and performed QA/QC during construction.

COUNTRYSIDE WASTEWATER TREATMENT FACILITY

Lake County, Illinois
Client: USA Waste

The project included the design of a wastewater treatment plant to treat leachate from an MSW Landfill. The facility included both primary and secondary treatment, and treated water was discharged to surface water. EnviroPower personnel prepared the design, construction drawings, specifications, obtained the state and local permits, and evaluated the bid packages from the contractors. EnviroPower personnel also provided construction management for the facilities, and performed QA/QC during construction.

KARACHI DHA 5.0 MGPD WWTP FACILITY

Karachi, Pakistan
Client: DHA

EnviroPower Personnel designed a 5.0 MGPD (19,000 m^3/day) wastewater treatment plant (WWTP) for Phase VIII of the Defense Housing Authority (DHA) in Karachi, Pakistan. The feasibility study for the project included the development of designs and detailed cost estimates for construction and operation of both a conventional activated sludge WWTP, and a modified plant using the One Moving Part (NOYES-OMP-PLANT) system developed by Noyes Associates (Noyes Technology). Based on the results of the feasibility study, it was determined that for the site conditions, the Noyes Technology, which is a modified Activated Sludge Treatment System, had a lower capital cost (30 percent lower) and operating cost (70 percent lower). The treatment facility consisted of a pump station, screens, aeration basin, clarifier, aerobic sludge digester, centrifuges to dewater the sludge, and a chlorination system to treat the effluent. The design requirements for the system specified a reduction in the BOD for the influent from over 400 mg/L, to less than 15 mg/L. The treated effluent was required to be of an aCESptable quality for use as irrigation water in parks and at the Golf Course.

KARACHI DHA 0.5 MGPD WWTP FACILITY

Karachi, Pakistan
Client: DHA

EnviroPower Personnel designed a 0.5 MGPD (2,000 m^3/day) wastewater treatment plant (WWTP) for the Defense Housing Authority (DHA) in Karachi, Pakistan. The feasibility study for the project included the development of designs and detailed cost estimates for construction and operation of both a conventional activated sludge WWTP, and a modified plant using the One Moving Part (NOYES-OMP-PLANT) system developed by Noyes Associates (Noyes Technology). Based on the results of the feasibility study, it was determined that for the site conditions, the Noyes Technology, which is a modified Activated Sludge Treatment System, had a lower capital cost (30 percent lower) and operating cost (70 percent lower). The treatment facility consisted of a pump station, screens, aeration basin, clarifier, aerobic sludge digester, centrifuges to dewater the sludge, and a chlorination system to treat the effluent. The design requirements for the system specified a reduction in the BOD for the influent from over 400 mg/L, to less than 15 mg/L. In addition, the treatment system was designed to accommodate a with range in initial flowrates, and high salt concentrations due to saline ground-water conditions in the area. The treated effluent was required to be of an aCESptable quality for use as irrigation water in parks and at the Golf Course.

BARKA 2,000 M^3/DAY WWTP FACILITY

Barka, Oman
Client: MRMEWR

EnviroPower personnel designed the 2,000 m^3/day wastewater treatment plant (WWTP) expansion for Barka Municipality and the Ministry of Regional Municipalities, Environment, and Water Resources (MRMEWR). The design included a reception tank, screens, concentric aeration basin and clarifier, centrifuges, and sludge drying beds. The design also included and option to modify the existing WWTP to be used as an aerobic sludge digester to replace the sludge drying beds. The system was designed for an average influent BOD of 400 mg/L, with an effluent BOD of 25 mg/L. The design included treatment of the effluent with chlorination so the effluent could be used for irrigation of agricultural areas and municipality parks and green areas. The system design was also modified to allow major fluctuations in the influent flowrates, resulting from delivery of the influent by tanker trucks. The system was also designed to provide treatment of leachate from an adjacent municipal solid waste (MSW) landfill.

MIRBAT 900 M³/DAY WWTP FACILITY

Mirbat, Oman

Client: Dhofar Municipality

Dhofar Municipalty requested that EnviroPower provide design and equipment supply for a 0.239 MGPD (900 m^3/day) wastewater treatment plant (WWTP) that would treat municipal sewage for the Municipality of Mirbat, Oman. EnviroPower formed a Joint Venture with Noyes Associates, the manufacturer of the wastewater treatment equipment, to design and provide the wastewater treatment equipment for the 0.239 MGPD (900 m^3/day) WWTP.

Based on the information provided by the Dhofar Municipality, an alternative design was developed using a modified type of activated sludge treatment system. The alternative design was based on a One Moving Part Plant (NOYES-OMP-PLANT) technology, with a concentric aeration basin and clarifier to minimize both the capital cost and operating cost of the plant, and sludge digester to reduce the quantity of sludge prior to disposal in the new MSW Landfill. The 0.239 MGPD (900 m^3/day) NOYES-OMP-PLANT WWTP design was selected as the recommended and specified conceptual plant design configuration because the proposed plant design:

- Could meet WWTP performance requirements within site area limitations,
- Could cost-effectively provide water at landscape reuse quality,
- Could be built faster than a conventional WWTP,
- Could provide sufficient flexibility for operation at the range of influent flowrates;
- Had fewer moving parts, which minimized maintenance costs and made the NOYES-OMP-PLANT WWTP easier to operate;
- The NOYES-OMP-PLANT WWTP was driven by one pump, which reduced the spare parts inventory, reduced the possibility of down time, and made the system much easier to operate and maintain; AND
- Minimized odors to the extent possible.

A preliminary engineering feasibility analysis resulted in the determination that overall site size and layout for the most reliable, easy to maintain, and most cost effective treatment plant process configuration to achieve the design requirements and specifications could easily fit on a plot of 840 m^2 (0.08 Hectares). The system design included an aerobic sludge digester to processs the sludge and covert the sludge to compost. This process minimized odors and converted the sludge into compost, which could be used for fertilizer. The system design could also be modified to use either sludge drying beds, or additional centrifuges instead of the aerobic sludge digester. This would reduce the overall cost of the system, but would increase the odors associated with the management and handling of the sludge.

TAQAH 600 M³/DAY WWTP FACILITY

Taqah, Oman
Client: Dhofar Municipality

Dhofar Municipalty requested that EnviroPower personnel provide the design and equipment supply for a 0.159 MGPD (600 m^3/day) wastewater treatment plant (WWTP) that would treat municipal sewage for the Municipality of Taqah, Oman. Globex formed a Joint Venture with Noyes Associates (Globex-Noyes JV), the manufacturer of the wastewater treatment equipment, to design and provide the wastewater treatment equipment for the 0.159 MGPD (600 m^3/day) WWTP. Based on the information provided by the Dhofar Municipality, EnviroPower personnel prepared an alternative design based on a One Moving Part Plant (NOYES-OMP-PLANT) technology, with a concentric aeration basin and clarifier to minimize both the capital cost and operating cost of the plant, and centrifuges and/or a sludge digester to reduce the quantity of sludge prior to disposal in the new MSW Landfill.

A preliminary engineering feasibility analysis resulted in the determination that overall site size and layout for the most reliable, easy to maintain, and most cost effective treatment plant process configuration to achieve the design requirements and specifications can easily fit on a plot of 560 m^2 (0.06 hectares). The system design included an aerobic sludge digester to process the sludge and covert the sludge to compost. This process minimized odors and converted the sludge into compost, which could be used for fertilizer. The system design could be modified to use either sludge drying beds, or additional centrifuges instead of the aerobic sludge digester. This reduced the overall cost of the system, but increased the odors associated with the management and handling of the sludge.

DHOFAR MINICIPALITY AEROBIC SLUDGE DIGESTER

Salalah, Oman
Client: Dhofar Municipality

The Dhofar Municipality requested the EnviroPower personnel to design, supply, and construct a 372 m^3/day Aerobic Sludge Digester at the existing Salalah WWTP, and a 15 tonne/day Compost Plant at the existing Salalah solid waste management facilities. Sludge waste from the primary and secondary settlement tanks was combined with a recycle stream of digested biosolids and was pumped into the Aerobic Sludge Digester through a fluid manifold pipe. Prior to re-entry to the Aerobic Sludge Digester, aeration was achieved by aspiration in the throat of a Venturi inserted in the pipe prior to the redistribution manifold. This configuration eliminated the need for conventional air diffusers or surface aerators, which were maintenance intensive and costly to operate due to high power input per ton of oxygen dissolved. The liquid pump was the only moving part of the system addition. The treated sludge from the Aerobic Sludge Digester was then sent to the existing dewatering belt press and dried to 30 percent by weight solids for transport to the proposed new 15 tonne/day Compost Plant. The supernatant from the Aerobic Sludge Digester was returned to the aeration basin of the existing plant.

The proposed design was selected because:

- Minimized odors to a much greater extent than the technologies recommended in the study by Parsons and ONEC;
- Could be built and operated at a low cost compared to conventional technologies;

- Could be built faster than an anaerobic sludge digester;
- Was more cost effective than thermal treatment systems;
- Provided a treated sludge suitable for composting;
- Minimized odors to the extent possible;
- Were the most reliable and easy to maintain of the viable alternatives; and
- Converted the sludge and green waste into a high quality compost that salable in Oman.

HERMEL WASTEWATER TREATMENT PROJECT

Hermel, Lebanon
Client: Municipality of Hermel, Cooperative Housing Foundation (CHF)

EnviroPower personnel performed a full detailed design of a hybrid system for treatment of solid waste and wastewater in the region of Hermel. The design included the segregation of the organic portion of solid waste by passing the mixed MSW through a sorting facility. The organic fraction was then grinded, mixed with treated wastewater, and added to the wastewater influent in a UASB (anaerobic) reactor. The mixture of wastewater and organics then passed through an extended aeration system in order to meet the effluent treatment requirements. The remaining solid waste was segregated, potentially recyclable materials were removed from the waste stream, and the rejects were transported to an MSW Landfill. The potentially recyclable materials were processed and sold into the local recycled materials markets.

The treatment processes were designed to eliminate contamination that is currently polluting the Assi River that flows into Syria. The Assi River is a major source of drinking water, and a main source of irrigation water on both the Lebanese and Syrian sides of the borders. The WWTP was design in a modular form, and took into consideration future growth of the area. The system was designed to accommodate the current population of 20,000 people, but was also designed to be incrementally expanded to accommodate up to 60,000 people. The WWTP included screens, inline solids grinders, anaerobic digesters, recovery of gas and production of electricity, and treatment of the effluent from the anaerobic digesters in a modified extended aeration system, including a concentric aeration basins and clarifiers, centrifuges, and sludge drying beds. An alternative design for the modified extended aeration treatment system was developed using the Noyes technology to minimize cost, reduce maintenance requirements, and improve operational performance.

CREATIVE ENVIRONMENTAL SYSTEMS, LLC (CES) - EPM WT & WWT PROJECTS

CES now serves as, and provides, the in-house water and wastewater expertise to EPM. Tabulated below are the CES-EPM water treatment (WT) & wastewater (WWT) projects at

- the numerous waste-to-energy (WTE) projects employing CES predecessor entity CLASSI CREATIVE ENVIRONMENTAL's WTE technology with Dr Barry Liss, PE serving as overall process engineering integrator,

- the projects Dr Ganesh V. Kumar (GVK) provided turnkey services, and
- the numerous projects Daniel G. Noyes managed as head of Noyes & Associates, Inc.

Tabulated below are DR. BARRY LISS, PE - ENVIROPOWER MANAGEMENT WASTE TO ENERGY POWER PLANT PROJECTS WATER & WASTEWATER TREATMENT SYSTEMS broken down by Global regions including:

- Asia,
- Africa and Europe,
- Middle East,
- Central & South America, and
- USA

DR. BARRY LISS, PE - ENVIROPOWER MANAGEMENT
WASTE TO ENERGY POWER PLANT PROJECTS
WATER & WASTEWATER TREATMENT SYSTEMS

Project List #	Power Plant Size	Location (City or Site or Region)	Country	WTP Capacity (m^3/hr)	WTP Installed CC ($US)	WWTP Capacity (m3/hr)	WWTP Installed CC ($US)	Project Type / Status
A-#		**ASIA**						
1	24	Mauritius (also 36MW)	Mauritius	87.48	$517,882	37.44	$422,061	Designed
2	24	Kabul	Afghanistan	87.48	$517,882	37.44	$422,061	PreProp.
3	72	Bali	Indonesia	262.44	$1,553,645	112.32	$1,266,183	Pending
4	72	Surabaya	Indonesia	262.44	$1,553,645	112.32	$1,266,183	Pending
5	480	Jakarta	Indonesia	1,749.60	$10,357,632	748.80	$8,441,222	Pending
6	36	Batam	Indonesia	131.22	$776,822	56.16	$633,092	Proposal
7	36	Sunter	Indonesia	131.22	$776,822	56.16	$633,092	Proposal
8	6.6	Trivandrum	India	79.99	$473,553	10.56	$232,637	Approved
9	24	Kochi	India	87.48	$517,882	37.44	$422,061	Designed
10	12	Calicut	India	94.20	$725,623	18.96	$315,684	Designed
11	6.6	Kannur	India	79.99	$473,553	10.56	$232,637	Designed
12	6.6	Thrissur	India	79.99	$473,553	10.56	$232,637	Designed
13	36	Bangalore	India	131.22	$776,822	56.16	$633,092	DesignOnly
14	72	Chennai (MV)	India	262.44	$1,553,645	112.32	$1,266,183	In Negoc.
15	96	Chennai (K)	India	349.92	$2,071,526	149.76	$1,688,244	Proposal
16	6.6	Srei Bagasse	India	79.99	$473,553	10.56	$232,637	Proposal
17	36	Himacha Pradesh	India	131.22	$776,822	56.16	$633,092	Proposal
18	12	Pondicherry	India	94.20	$725,623	18.96	$315,684	Proposal
19	6.6	Rice Husk	India	79.99	$473,553	10.56	$232,637	Pre=Prop.
20	36	Bhubaneswar	India	131.22	$776,822	56.16	$633,092	Designed
21	108	Karachi	Pakistan	393.66	$2,330,467	168.48	$1,899,275	Proposal
22	36	Lahore	Pakistan	131.22	$776,822	56.16	$633,092	Designed
23	120	Ho Chi Minh, City	Vietnam	437.40	$2,589,408	187.20	$2,110,306	PPA Pend.
24	36	Phenom Penh	Cambodia	131.22	$776,822	56.16	$633,092	Designed
25	36	Beijing	China	131.22	$776,822	56.16	$633,092	Proposal
26	120	Manilla	Philippines	437.40	$2,589,408	187.20	$2,110,306	Proposal;
27	144	Dhaka	Bangladesh	524.88	$3,107,290	224.64	$2,532,367	Proposal
	1701	**Asia Total**	w/Maurit. 24MW					

DR. BARRY LISS, PE - ENVIROPOWER MANAGEMENT
WASTE TO ENERGY POWER PLANT PROJECTS

WATER & WASTEWATER TREATMENT SYSTEMS

Project List #	Power Plant Size	Location (City or Site or Region)	Country	WTP Capacity (m^3/hr)	WTP Installed CC ($US)	WWTP Capacity (m3/hr)	WWTP Installed CC ($US)	Project Type / Status
E&A-#		**Europe & Africa**						
1	36	Coutonou	Benin	131.22	$776,822	56.16	$633,092	Designed
2	240	Addis Adaba	Ethiopia	874.80	$5,178,816	374.40	$4,220,611	Proposal
3	36	Ga. South	Ghana	131.22	$776,822	56.16	$633,092	Approved
4	36	Takoradi	Ghana	131.22	$776,822	56.16	$633,092	Proposal
5	6.6	Jeykjavic (also 2.2 ,4,4 ,8.8)	Iceland	79.99	$473,553	10.56	$232,637	PreProp.
6	36	Gortadroma	Ireland	131.22	$776,822	56.16	$633,092	ShortList
7	12	Pristina (6.6 too)	Kosovo	94.20	$725,623	18.96	$315,684	Designed
8	2 x 4.4		Ukraine	69.08	$550,050	13.90	$315,684	In Negoc.
9	6.6	Gabes	Tunisia	79.99	$473,553	10.56	$232,637	Designed
10	6.6	Djerba	Tunisia	79.99	$473,553	10.56	$232,637	Designed
	427.8	**Europe & Africa Total**	w/Jey.6.6, Pristina12 MW					
		-						
ME-#		**Middle East**						
1	72	Abu Dhabi	UAE	262.44	$1,553,645	112.32	$1,266,183	Designed
2	36	Amman	Jordan	131.22	$776,822	56.16	$633,092	Designed
3	336	Jeddah	Saudi Arabia	1,224.72	$7,250,342	524.16	$5,908,856	Designed
4	24	Trabrikab	Turkey	87.48	$517,882	37.44	$422,061	In Negoc.
5	12	Ordu	Turkey	94.20	$725,623	18.96	$315,684	PreProp.
6	12	Kus-Atak	Turkey	94.20	$725,623	18.96	$315,684	PreProp.
	492	**Middle East Total**						
		-						
		-						

Project List #	Power Plant Size	Location (City or Site or Region)	Country	WTP Capacity (m^3/hr)	WTP Installed CC ($US)	WWTP Capacity (m3/hr)	WWTP Installed CC ($US)	Project Type / Status
C/SA-#		**Central/South America**						
1	36	Villa Maria	Argentina	131.22	$776,822	56.16	$633,092	Designed
2	96	Cordoba	Argentina	349.92	$2,071,526	149.76	$1,688,244	Designed
3	36	Bower	Argentina	131.22	$776,822	56.16	$633,092	Designed
4	72	Quito	Equador	262.44	$1,553,645	112.32	$1,266,183	Proposal
5	120	Guayaquil	Equador	437.40	$2,589,408	187.20	$2,110,306	Proposal
6	24	Curacao	Curacao	87.48	$517,882	37.44	$422,061	Proposal
7	60	Panama City	Panama	218.70	$1,294,704	93.60	$1,055,153	Designed
8	12	David	Panama	94.20	$725,623	18.96	$315,684	Designed
9	12	Colon	Panama	94.20	$725,623	18.96	$315,684	Proposal
10	24	Pucallpa	Peru	87.48	$517,882	37.44	$422,061	Designed
11	36	Trujillo	Peru	131.22	$776,822	56.16	$633,092	Proposal
12	48	Chiclayo	Peru	174.96	$1,035,763	74.88	$844,122	Designed
13	60	Coho Norte	Peru (Lima)	218.70	$1,294,704	93.60	$1,055,153	Designed
14	12	Port Of Spain	Trinidad	94.20	$725,623	18.96	$315,684	Designed
15	36	Mexico City (also 12 & 24)	Mexico	131.22	$776,822	56.16	$633,092	Proposal
	684	**Cen./So. America Total**	w/Mex.36MW					
		-						
USA-#		**USA**						
1	48	Las Vegas	USA (NV)	7.00	$177,610			Permitting
2	36	Honolulu	USA	131.22	$776,822	56.16	$633,092	Proposal
3	36	Lafarge	Ohio	131.22	$776,822	56.16	$633,092	Designed
4	24	Ft. Campbell	USA (TN)	87.48	$517,882	37.44	$422,061	Pending
5	36	Ft. Knox	USA (KY)	131.22	$776,822	56.16	$633,092	Designed
6	0.1-2.2	Mobile	USArmy	NA	NA	NA	NA	In Review
	180	**USA Total**	wo/mobile					
	3484.8	**Company Total**						

COMPILATION OF GVK TURNKEY WATER AND WASTE WATER TREATMENT PROJECTS

Project	Location	Type	Capacity/Size
Royal Crowntex Inc (RCI)	Sihanouk Ville, Cambodia	Industrial WWTP	1 Million Liters/Day
AENO Fresh	Johor Bahru, Malaysia	Oxygenated Bottled Water	10,000 Bottles/Day
Malee Mineral Water	Mersing, Malaysia	Mineral Water Plant	125,000 Bottles/Day
5E Resources	Pasir Gudang, Malaysia	Industrial WWTP	75,000 Liters/Day
SPM Oil Recycling	Ipoh, Malaysia	Moisture Removal System	10,000 Liters/Day
MSM Food	Batu Pahat, Malaysia	Industrial WWTP	30,000 Liters/Day
Eng Hap Heng Manuf.	Batu Pahat, Malaysia	Industrial WWTP	20,000 Liters/Day
Toan Thang Loi Company	HCM, Vietnam	Lube Oil Re-Refining	8,000 Liters/Day
Good Health Oxygen	Johor Bahru, Malaysia	Oxygenated Bottled Water	200,000 Bottles/Day
VSRO Purified System	Johor Bahru, Malaysia.	Oxygenated & Alkaline Water	60,000 Bottles/Day
Water Works Technology	Calgary, Canada	Industrial WWTP	5 x 20,000 Liters/Day.
Tirupur #1	Tirupur, India	Industrial WWTP/Reuse	10 Million Liters/Day
Tirupur #2	Tirupur, India	Industrial WWTP/Reuse	5 Million Liters/Day
Tirupur #3	Tirupur, India	Industrial WWTP/Reuse	4 Million Liters/Day
Etimaad Engr. Pvt Ltd	Lahore, Pakistan	Municipal WWTP Design	100 Million GPD
Yunan WWTP	Yunan, China	Design Review	5 Million Liters/Day
Cam Tam	HCM, Vietnam	Design Review	
Palm Oil Mill	Ladang Rayat, Malaysia	(CMART) AD-WWT-WTE	1.4 Million Liters/Day

COMPILATION OF NOYES & ASSOCIATES WATER AND WASTE WATER TREATMENT PROJECTS

Project	Location	Type	Capacity/Size
Cypress Klein #1	Harris Co., TX	Municipal/Domestic WWTP	250,000 GPD
CNP #I	TX	Industrial WWTP	250,000 GPD
CNP #II	TX	Industrial WWTP	250,000 GPD
Southwest Chemical & Plastic	TX	Industrial WWTP	212,000 GPD
Harris Co. WC & ID #110	Harris Co., TX	Municipal/Domestic WWTP	250,000 GPD
Bammel U.D.	Harris Co., TX	Municipal/Domestic WWTP	267,000 GPD
City of Friendswood	Harris Co., TX	Municipal/Domestic WWTP	112,500 GPD
Cypress Klein #11	Harris Co., TX	Municipal/Domestic WWTP	250,000 GPD
April Sound	Montgomery Co., TX	Municipal/Domestic WWTP	235,000 GPD
Du Pont – Channelview	Channelview	Industrial WWTP	215,000 GPD
Addicks U.D. Rolling Green #1	Harris Co., TX	Municipal/Domestic WWTP	100,000 GPD
Woodlake #1	Woodlake	Municipal/Domestic WWTP	100,000 GPD
Nucor Steel #1	Leon Co., TX	Industrial WWTP	2-10,000 GPD
Lynes	Harris Co., TX	Industrial WWTP	2-15,000 GPD
Brushy Creek South	Travis Co., TX	Municipal/Domestic WWTP	100,000 GPD
Brushy Creek North	Travis Co., TX	Municipal/Domestic WWTP	100,000 GPD
Harris Co. M.U.D. #104	Harris County, TX	Municipal/Domestic WWTP	100,000 GPD
Texas Instruments	Harris Co., TX	Industrial WWTP	250,000 GPD
Diamond Shamrock	Deer Park, TX	Industrial WWTP	215,000 GPD
Shady Hollow	Travis Co., TX	Municipal/Domestic WWTP	2-100,000 GPD
Mariner	Harris Co., TX	Municipal/Domestic WWTP	2-5,000 GPD
Pyramid Derrick	Harris Co., TX	Industrial WWTP	30,000 GPD
Port Mansfield	Port Mansfield, TX	Municipal/Domestic WWTP	25,000 GPD
Aldine Forest	Harris Co., TX	Municipal/Domestic WWTP	225,000 GPD
Smith Industries	Columbus, TX	Industrial WWTP	50,000 GPD
Diversified Habitat	Matagorda Co., TX	Municipal/Domestic WWTP	215,000 GPD
University of Texas Lab	Smithville, TX	Municipal/Domestic WWTP	250,000 GPD
Lee Rowe	Harris Co., TX	Municipal/Domestic WWTP	212,000 GPD
Plains	Plains, TX	Municipal/Domestic WWTP	250,000 GPD
Velsicol Chemical	Harris Co., TX	Industrial WWTP	2-15,000 GPD
Bryan Power Plant	Brazos Co., TX	Industrial WWTP	2-10,000 GPD
Brazos Co. M.U.D. #1	Brazos Co., TX	Municipal/Domestic WWTP	150,000 GPD
Cypress Klein #111	Harris Co., TX	Municipal/Domestic WWTP	500,000 GPD
Harris Co. WC & ID #78	Harris County, TX	Municipal/Domestic WWTP	600,000 GPD
Rancy Country	Travis Co., TX	Municipal/Domestic WWTP	100,000 GPD
Highland Country Terrace	Harris Co., TX	Municipal/Domestic WWTP	250,000 GPD
Brazoria Co. M.U.D.	Brazoria Co., TX	Municipal/Domestic WWTP	150,000 GPD
Bechtel	Convent, Louisana	Industrial WWTP	2-12,000 GPD
Harris Co. M.U.D. #19	Harris County, TX	Municipal/Domestic WWTP	235,000 GPD
La Villa Water Plant	Hidalgo Co., TX	Municipal WTP	3,000,000 GPD

Gilbert Crest Utilities	**Harris Co., TX**	**Industrial WWTP**	**225,000 GPD**
Brazoria Co. Subdivision	**Brazoria Co., TX**	**Municipal/Domestic WWTP**	**100,000 GPD**
Buttercup Creek Austin	**Travis Co., TX**	**Municipal/Domestic WWTP**	**250,000 GPD**
Hermitage Oak Trailer Park	**Travis Co., TX**	**Municipal/Domestic WWTP**	**110,000 GPD**
Sommeral	**Burleson Co., TX**	**Municipal/Domestic WWTP**	**100,000 GPD**
Tool Water Plant	**Henderson Co., TX**	**Municipal WTP**	**2,000,000 GPD**
Transco	**Matagorda Co., TX**	**Municipal/Domestic WWTP**	**210,000 GPD**
Brushy Creek South	**Brushy Creek**	**Municipal/Domestic WWTP**	**530,000 GPD**
White Oak	**Harris Co., TX**	**Municipal/Domestic WWTP**	**250,000 GPD**
Richey Rd. M.U.D.	**Harris Co., TX**	**Municipal/Domestic WWTP**	**150,000 GPD**
Crossroads	**Travis Co., TX**	**Municipal/Domestic WWTP**	**90,000 GPD**
Bechtel Cities Services	**Travis Co., TX**	**Industrial WWTP**	**220,000 GPD**
Chasewood U.D.	**Harris Co., TX**	**Municipal/Domestic WWTP**	**150,000 GPD**
Woodlake #II	**Harris Co., TX**	**Municipal/Domestic WWTP**	**235,000 GPD**
Addicks U.D. Rolling Green #II	**Harris Co., TX**	**Municipal/Domestic WWTP**	**100,000 GPD**
Trigg Westland Oil	**Harris Co., TX**	**Industrial WWTP**	**235,000 GPD**
Southpoint	**Harris Co., TX**	**Municipal/Domestic WWTP**	**500,000 GPD**
Harris Co. M.U.D.#1	**Harris County, TX**	**Municipal/Domestic WWTP**	**250,000 GPD**
Highlands Country Terrace #1	**Harris Co., TX**	**Municipal/Domestic WWTP**	**230,000 GPD**
Woodlake	**Harris Co., TX**	**Municipal/Domestic WWTP**	**500,000 GPD**
Hiway Water	**La Grange**	**Municipal/Domestic WWTP**	**237,500 GPD**
Lakeside Airport	**Harris Co., TX**	**Municipal/Domestic WWTP**	**2-4,000 GPD**
Buttercup Creek	**Travis Co., TX**	**Municipal/Domestic WWTP**	**220,000 GPD**
Compaq	**Harris Co., TX**	**Industrial WWTP**	**100,000 GPD**
Mt. Belvieu	**Liberty Co., TX**	**Municipal/Domestic WWTP**	**90,000 GPD**
Brazoria Cty., Detention Ctr.	**Brazoria City**	**Municipal/Domestic WWTP**	**100,000 GPD**
Vidor I.S.D. & M.U.D.	**Vidor**	**Municipal/Domestic WWTP**	**225,000 GPD**
Hardin School	**Liberty Co., TX**	**Municipal/Domestic WWTP**	**100,000 GPD**
Spicewood Springs	**Travis Co., TX**	**Municipal/Domestic WWTP**	**500,000 GPD**
Fina Oil &Gas	**Harris Co., TX**	**Industrial WWTP**	**10,000 GPD**
NW Harris Co. M.U.D.#5	**Harris County, TX**	**Municipal/Domestic WWTP**	**500,000 GPD**
Quantum Chemical	**Harris Co., TX**	**Industrial WWTP**	**1,000 GPD**
Phillips 66	**Harris Co., TX**	**Industrial WWTP**	**2-1,000 GPD**
Chevron	**Harris Co., TX**	**Municipal/Domestic WWTP**	**1,500 GPD**
Morgans Point	**Morgans Point,TX**	**Municipal/Domestic WWTP**	**300,000 GPD**
Harris Co. M.U.D. #133	**Harris County, TX**	**Municipal/Domestic WWTP**	**3,000,000 MGD**
City of Santa Rosa	**Cameron Co., Texas**	**Clarifier**	**142 ft.**
District 99	**Harris Co., TX**	**Clarifier**	**140 ft.**
City of Elsa	**City of Elsa**	**Clarifier**	**103 ft.**
City of Corrigan	**Polk Co., TX**	**Clarifier**	**135 ft.**
Manning U.D.	**Manning U.D.**	**Sludge Concentrator**	
ARCO Bio-Plant	**Marion,** *TX*	**Flocculator**	**16 ft.**

Pine Ridge, South Dakota	**Pine Ridge, SD**	**Arc Bar Screen**	
Toluca, D.F. Mexico	**Toluca, Mexico**	**Municipal/Domestic WWTP**	**285,000 GPD**
Cuernavaca, Mexico	**Moreles, Mexico**	**Municipal/Domestic WWTP**	**3,000 GPD**
Paradise, D.F. Mexico	**Paradise, D.F. Mexico**	**Municipal/Domestic WWTP**	**78,000 GPD**
Cancun, Mexico	**Cancun, Mexico**	**Municipal/Domestic WWTP**	**110,000 GPD**
Acapulco, Gurrera, Mexico	**Acapulco, Mexico**	**Municipal/Domestic WWTP**	**1.95 MPD**
Campe Espejo, Argentina	**Argentina**	**Municipal/Domestic WWTP**	**12.0 MGD**
CEAS, D.F. Mexico	**Mexico**	**Municipal/Domestic WWTP**	**1.4 MGD**
N.W. Pine Mobil Park	**N.W. Pine**	**Municipal/Domestic WWTP**	**100,000 GPD**
Boulders Carefree, Arizona	**Arizona**	**Municipal/Domestic WWTP**	**90,000 GPD**
Nucor Steel	**Leon Co., TX**	**Industrial WWTP**	**210,000 GPD**

APPENDIX D

BIBLIOGRAPHY

Copies of the following articles referred to in Section 4, Page 9 :

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4. H. K. Trivedi. (2004) Flat-Plate Microfiltration Membrane Bioreactor Designed For Ultimate Nutrient Removal; pp 1-26, presented at WEFTEC 2004

5. E. Atasoy, S. Murat, A. Baban, M. Tiris, Membrane Bioreactor (MBR) Treatment of Segregated Household Wastewater for Reuse; Clean 2007, 35 (5), 465 – 472