**DRAGONFLY FLATS AT FLY RANCH**

**Vision**

Imagine a community reflecting and illuminating Black Rock desert beauty, becoming part of the permanent, ever changing landscape. Days are inspired by constantly shifting light, colors and patterns. Genius of place inspires ethereal beauty and functional design to protect from the challenging environment. Emulating the unique Fly Geyser ecosystem, our solutions are powered by wind and sun, and manage precious rainwater. Dragonfly Flats offers comfort in a bio-inspired, resilient shelter as part of a vibrant ecologically restorative community.

Nature’s lessons and strategies provide much of the inspiration for Dragonfly Flats. Among the deepest patterns, the spiral is the geometric blueprint for LIFE- from our DNA, plant growth, the shape of a shell, to our galaxy. Recognizing the wisdom of this emergent pattern, we integrate the spiral across multiple scales to evoke a feeling of growth and transformation. The resilient form, modeled on the brilliance of the Desert land snail, efficiently encloses space using minimal materials, optimizes internal thermoregulation, and offers a beneficial wind profile. Black Rock Desert’s native Flame skimmer dragonfly inspired inclusion of efficient wind management and reflective iridescence to create practical beauty.

Embedding spiral growth patterns inspired by the Sunflower creates optimal organization and resource sharing. To organically create a balanced community, development and growth strategies are adopted to guide expansion.

Dragonfly Flats welcomes activities for daily interactive and community living. An environmental stewardship lifestyle includes landscape restoration, walking and bicycle riding. Dwellings are adaptable to various options, including homes, glamping, and eco-lodging for scientists, visionaries, artists and makers.

Pathways spiral toward the central Oasis where visitors and residents can engage in a variety of activities. Emulating the Date palm, the Oasis solar trees create energy for the community, harvest water, and provide shade and summer cooling. The multi-use Oasis will support communication hubs, collaborative workspace, a community herb garden and small kitchen, relaxation and recreation space, a small cafe, community resources, and creative space.

**Desert Dwelling**

Individual dwellings are designed to be efficient, comfortable, and attractive. Materials were selected for sustainability, low-maintenance, durability, recyclability, availability, and ease of construction. A Fibonacci spiral inscribed in a 6.4 meter(m) (21 foot) by 10.4 m (34 foot) rectangle encloses a 48 square meter (510 square foot) footprint that is 4.3 m (13 feet) high at the central spiral.

Modeled on the Venus flower basket, the multi-spiral latticed column efficiently increases structural strength and adds fluid beauty, while allowing daylight and ventilation through the core of the dwelling. Utilizing a cylindrical form with counter-spiraling elements, the column manages complex structural forces with grace. The column also accommodates plumbing, electrical and venting conduits.

Made with recycled aluminum, the column and floor framing optimize strength while reducing weight. Aluminum is corrosion resistant, low-maintenance, and long-lasting. The magnesium oxide board subfloor is impervious to water, fire, insects, mold and mildew while being environmentally friendly and non-toxic.

Functioning like tree roots, the foundation technology combines diamond and helical piers that are low-impact, strong and easy to install without heavy machinery or soil disturbance.

The building envelope is formed of composite modular panels providing exterior protected finish, insulation, and interior substrate. Panels are manufactured using recycled materials with an adaptive mold to reduce waste. They have a low carbon footprint and are non-toxic.

Simple furnishings are multi-purpose, comfortable and reconfigurable for maximum flexibility. Built-ins such as a Murphy bed, loft, and sleeping benches offer adaptability to accommodate up to 10 people.

Streamlined, efficient, small scale kitchen appliances similar to those in recreational vehicles are planned for the open kitchen area. Low-flow water fixtures and incinerating dry toilets reduce consumption while greywater is filtered for re-use in the landscape.

The eco-friendly Marmoleum flooring is a bio-based material, non-toxic, anti-microbial, durable and easy to maintain. The interiors incorporate environmentally friendly finishes.

**Integrated Systems and Technology**

The Dragonfly dwelling is its own unique ecosystem, collecting and processing water and gathering energy while optimizing local abundant resources of frequent wind, abundant sun, and periodic rain. Biomorphic in form and structure, the protective shape directs wind, and harvests water. Inspired by the genius of the Desert horned lizard, Desert land snail, and Window plant, we mimic effective water collection, thermoregulation, and diffused natural light for integrated passive and active solutions.

Strategic site planning and northeast building orientation leverage the northwest winds flowing over the reservoir collecting moisture and minimizes direct solar gain. Similar to the Desert land snail, the raised platform structure moderates the heat of the desert floor. Using the stack effect, cool night air is drawn in low and vented out high through the central column and panel ventilation strips to help cool the interior. The insulating panels buffer the living space from extreme diurnal temperatures.

Each dwelling seamlessly collects, conserves, and recycles water by harvesting rainwater from the exterior shell, channeling into a filtered gutter system, storing it underground in lightweight modular storage, and then returning it to a greywater system after use. Based on an average annual rainfall of 1000 mm, the dwelling can collect an estimated 49,000 liters per year to supply the 47,000 liters per year needed per occupant.

The Oasis solar trees also collect and store water and distribute it to individual dwellings as needed via an underground network inspired by Sagebrush roots.

Energy technology in the dwelling includes vertical wind turbines and a patented artificial wind machine that can run perpetually. Low-demand LED lights along with natural daylighting, and a smart electrical system reduce energy usage and balance supply and demand. The estimated energy usage for each dwelling is approximately 5400 kWh/year per person.

The dwelling vertical axis wind turbine produces about 1697 kWh/year and can be augmented by the seven Oasis solar tree wind turbines with an output of up to 49,700 kWh/year. The durable, high-output solar panels in the seven solar trees can also produce up to about 50,000 kWh/year in solar energy.

**Assembly**

Assembling a prototype dwelling is a key step in evaluating success in achieving the project goals of shelter, water, and energy.

The modular floor system comes to the site in a flat pack and can easily be assembled with hand tools. Once in place, the floor platform serves as a staging area for installing the prefabricated central column and composite wall panels. Our “Kit of Parts” system, where building components are pre-designed, pre-engineered, and prefabricated, for inclusion in a modular construction system requires minimal involvement of on-site construction trades. Modularity of the shelter design makes assembly and dis-assembly repeatable, allowing the creation of a multi-dwelling community with minimal disturbance.

The future central core Oasis solar trees are planned to be primarily constructed off-site and put in place with equipment. On site materials, including earth and stone, will be used to create the plaza and walkways.

The initial prototype dwelling rough cost is estimated to be $3700 per square meter ($350/sf), which approximates typical United States residential net-zero projects. This cost does not include fixtures, furniture, and equipment (energy and water systems, etc.). Further units can be constructed at a significantly lower cost as the adaptive mold will be reused.

Creating a prototype of the dwelling on site can begin after the architecture and engineering documents are finalized. During that time, we will collaborate with the Fly Ranch community and various suppliers and manufacturers to prepare for the build. Establishing collaborative relationships will be a priority throughout. The estimated time frame is flexible but could be accomplished within a few months.

We gained valuable insight and designed strategies to meet local operating conditions by studying the unique and delicate hydroecology of Fly Ranch and believe our project delivers an exciting gateway to the local ecology. Meeting Washoe County codes and building regulations for modular housing, this (48 m2) desert dwelling offers a scalable solution for thriving in the unpredictable Black Rock Desert. This proposal is located within the primary northern site to remain respectful of conservation boundaries. Organic shapes, patterns, and functional strategies derived from Nature’s genius are deeply embedded in one elegant solution. The design fosters environmental stewardship and aligns with ambitious goals that address climate change. Our environmental impact summary highlights our major sustainable design strategies

**ENVIRONMENTAL IMPACT SUMMARY**

**Location and Transportation**

* Environmentally friendly community encourages walking and biking
* Off-site vehicle parking

**Sustainable Sites**

* Site location preserves Fly Geyser and conservation boundaries
* Protects bird populations with visually obvious, vertical wind turbines
* Restores native habitat with native plants stimulates land vitality with reclaimed greywater
* Low-impact foundation system requires no excavation
* Eliminates large construction equipment to mitigate site disturbance
* Creates open space for visitors and community members

**Water Efficiency**

* Respects the native Northern Paiute culture by emphasizing the relationship between water and sustainability
* Rainwater harvested from the dwelling surface is channeled through a gutter system, and stored below ground in expandable modular storage units
* The rainwater is filtered and disinfected with UV before being pumped inside for use
* Employing waterless toilets and low flow faucets conserves precious water resources
* Utilization of waterless toilets prevents waste from entering the water table
* Greywater capture and filtration system re-uses water for landscaping restoration
* The Oasis solar trees capture and store a much larger volume of precipitation to share with the community as needed
* At a community scale shared water resources are collected and distributed in an underground network

**Energy and Atmosphere**

* With over 250 sunny days annually, regular winds that exceed 18 m/s this off-grid shelter is designed to integrate varied renewable energy sources and embrace net positive energy results
* Each dwelling leverages abundant wind energy with an exterior vertical axis wind turbine
* Inside is a self-contained, patented, and cutting-edge artificial wind machine that provides a continuous source of energy and works synchronistically with the wind turbine
* The renewable wind energy strategies reduce the overall carbon emissions footprint from fossil fuels
* A smart energy management system, efficient artificial lighting, and streamlined energy efficient appliances minimize energy demand and decrease overall footprint
* The Oasis structure comprised of 7 Solar trees are equipped with high output solar panels and larger vertical axis wind turbines

**Materials and Resources**

* The prefabricated composite envelope system requires no tooling, no manufactured waste, and offers maximum flexibility to address thermoregulation and enhanced comfort
* We selected durable, reusable, recyclable, non-toxic materials with a low CO2 footprint
* Fire resistant materials reduce the risk of the disastrous, lasting effects of fire on the ecosystem
* Our “Kit of Parts” lightweight components minimize fuel consumption during transportation
* Local, abundant earth and stone will be used to create the plaza and walkways

**Indoor Environmental Quality**

* We prioritized passive means of thermal comfort and ventilation
  + Well insulated envelope mitigates extreme diurnal and seasonal temperature shifts
  + Cool night air intake at entry tempers inside air temperature
  + As the indoor air rises, the heat is expelled through the open lattice column and ventilation panel strips
  + The iridescent surface treatment reflects UV radiation and limits solar heat gain
* The low emitting building materials and finishes contribute to good indoor air quality
* Daylighting offsets the need for electricity and offers sun-soaked beauty
* All interior lighting is efficient LED