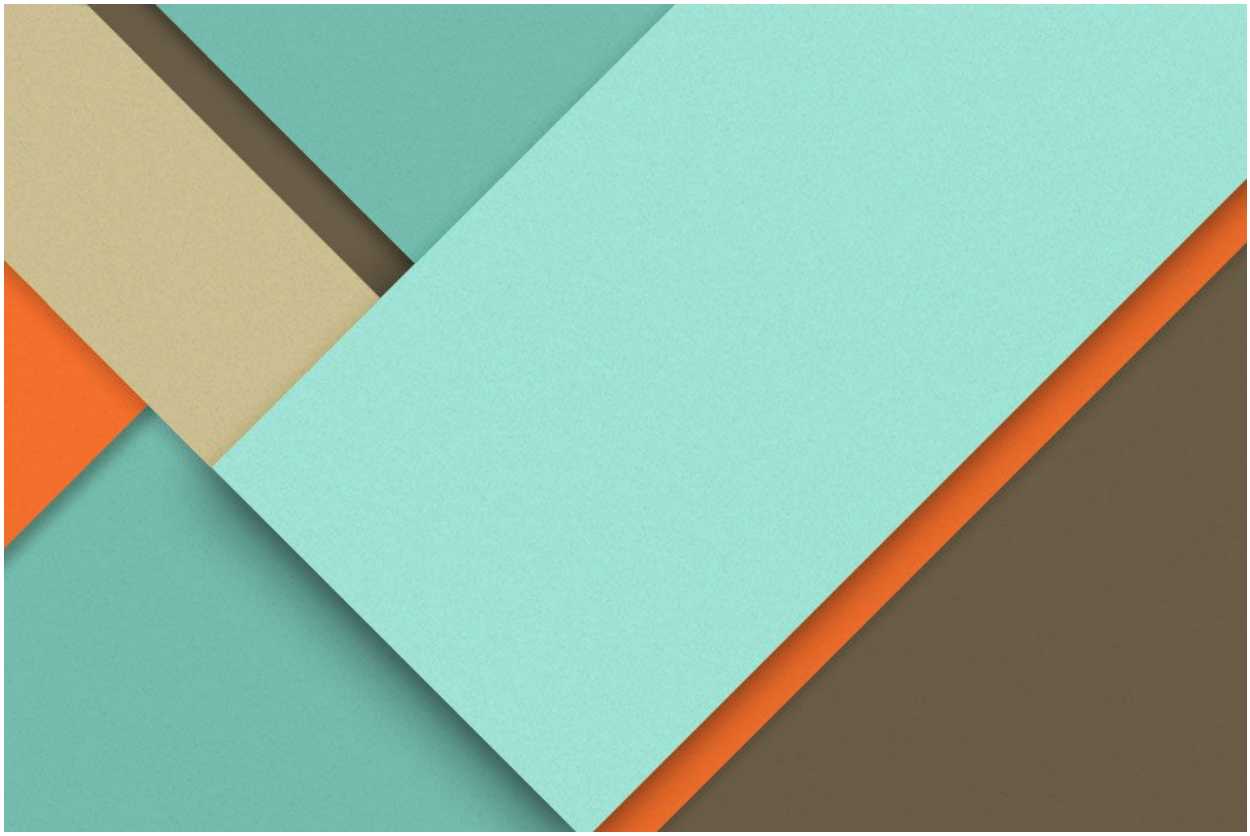

Fordhamopolis West:

The Integrated Ecological Smart City

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Submitted to: The Billionaire's Club

Samantha Cassidy
Elizabeth Davis
Olivia Greenspan
Bryan Kiel
Alyssa Melendez
Eavan Schmitt
Leigh Anne Statuto
Brian Tong

Executive Summary

Fluidity, efficiency, and respect are the three overarching concepts that shape the ideal city. Fluidity is seen in the curvaceous intersections that allow us to entangle ourselves with one another without bumping or shoving. Efficiency is seen in the timely and flawless functionality of infrastructure and organization. Respect is seen within the interactions between individuals, groups of people, and other lifeforms. It is a utopia of balance and equilibrium that enables every part to prosper and reach a state of completeness, or as the Romans would call “perfectio.”

Solar panels line the buildings, acting as both windows and iridescent veins pumping power into the hearts of each building. Levitating trains shoot across the horizons on bridges that hug the intersection between earth and sky, so that at dawn the sunlight reflects from the luminescent capsule, marking the axial line of the city. It shows that just as we are freed by motion, we are bound by motion. Transit lanes and sidewalk strips will not be slabs of man made rock, but rather porous acrylic glass elevated above grasses and mosses enabling both the prosperity of plant life and the flat surfaces craved by humans.

The buildings reach towards the sky, encapsulating crops and vegetation. Sculptures stand erect within public parks with the dual-purpose of water collection and aesthetic pleasure. Water is revered as the vital seed of life and energy that is captured in untraceable ways. There is a sense of egalitarianism that cultivates the air and creates the perfect environment for an individual’s stimulation and growth. The city is both the product and the muse of a society that cherishes the past and wades to the future, leaving not a single hazard to the ecological systems surrounding and encompassing it. This is the image of Fordhamopolis West, a proposed city that

will function according to the ecological principles from which our world prospers. The following sections titled, Water, Energy, Waste, Food, Transportation, and Social Benefits will unravel the planned execution of Fordhamopolis West, including the opportunities and obstacles that will be faced.

Water

Along with food, water is perhaps the first necessity for the existence and prosperity of human life. Many people across the world make the assumption that water is an infinitely renewable resource and therefore human populations may continue using it as though it will never run out. Even in locations like that of Fordhamopolis West, located in Western Washington State, this is simply not the case. By discarding water after it runs through our municipal plumbing systems, as the majority of United States cities do, we allow for a great deal of toxic agricultural and industrial runoff to occur during rainstorms. Furthermore, we not only release dead water back into the environment, creating huge swaths of aquatic environments in which nothing can live -- we also drive ourselves closer to a national water crisis, characteristically similar to that currently being faced by the state of California.[1]

An ecologically resilient system as proposed for Fordhamopolis West is imperative to rectifying this problem. It will ensure that each resident has not only enough water for the time being, but enough for the future. This will all be done without disturbing the surrounding environment. The ability to function without doing lasting harm to our surroundings is the primary goal of Fordhamopolis West as a whole. With regard to water specifically, the goals of

[1] "Drought in California Triggers Action Across the Golden State." Worldwatch Institute Europe. Accessed May 06, 2016. http://www.worldwatch-europe.org/node/322.

Fordhamopolis West are to minimize harm, reduce daily personal consumption (and therefore citywide demand), and achieve total reintegration and recycling.

Of course, ecological resilience is only one piece of the puzzle in a truly ideal city; the water infrastructure constructed in Fordhamopolis West will also have the benefit of improving its citizens' quality of life, both directly (through water quality and purity for everyday drinking and household use) and indirectly (through the irrigation and cultivation of the city's food supply, and the reserve of supplemental amounts of water for future use in times of need). In addition, the citizens will be spared the expense of a traditional municipal water system, which demands exorbitant amounts of money for maintenance and continuation of service.

Annual precipitation totals on the Olympic Peninsula can exceed two hundred inches per year in certain areas.[2] This being said, the collection of precipitation is both the easiest and the most important of the steps in the Fordhamopolis West water cycle. This collection will take several forms. First, all municipal buildings will be equipped with collection tanks on their rooftops that drain into basement reservoirs with sizes sufficient to store enough water to support that building for several weeks. These tanks may periodically be drained into the city's filtration system or used directly by building inhabitants in times of dire need. Collection containers connected to the municipal system will also be placed in public parks, designed attractively as water fixtures or sculptures. Additionally, the city's transportation pathways will become a part of the Fordhamopolis West water system. They will be coated with highly absorbent pavements like Tarmac's Topmix Permeable[3] that can drain away up to floodlike amounts of water in a

[2] United States Department of Agriculture Forest Service, "Olympic National Forest: Climate Information," accessed April 21, 2016. http://www.fs.usda.gov/detail/olympic/about-forest/?cid=fsbdev3_049559.
[3] Emily Matchar, "This Concrete Can Absorb a Flood," *Smithsonian Magazine*, October 5, 2015, accessed April 20, 2016, http://www.smithsonianmag.com/innovation/concrete-can-absorb-flood-180956830/?no-ist.

matter of minutes. They will also be placed over shallow reservoirs to drain into the filtration system described below.

As in New York City,[4] water collected in Fordhamopolis West will be funneled to a central location (or one of several central locations) and purified centrifugally, with particulate matter being literally spun out. The hard matter that collects on the walls of the centrifuges themselves will be incinerated, powdered and encapsulated to be used as fertilizer. The grey water that results from this process will then be piped to vertical farms located around the city for further bioremediation via "constructed wetlands"[5] that use the natural water uptake of plants to return the water to drinkable quality. The plants in these particular farms will not be intended for human consumption, but will function purely as filtration mechanisms and producers of oxygen; other farms at other locations in the city (described in the section titled "Food") will be used for food production. Through bioremediation of water in vertical farms, wastewater will actually be returned to drinking water quality, and the leftover sludge will be used as fertilizer after being treated. As described by Dr. Dickson Despommier:

> Sludge, derived from waste water treatment plants of many, but not all cities throughout the US, and treated with a patented process referred to as advanced alkaline stabilization with subsequent accelerated drying, is being turned into high grade topsoil and sold as such to the farming community at-large by N-Viro Corporation, Toledo, Ohio. The limiting factor in using municipal sludge for farming appears to be heavy metal contamination, mostly from copper, mercury, zinc, arsenic, and chromium. Vertical farms will be engineered to take in black or gray water, depending upon availability, and restore it to near drinking water quality using bioremediation.[6]

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[4] "New York City's Wastewater Treatment System," NYC Environmental Protection, accessed April 20, 2016, http://www.nyc.gov/html/dep/html/wastewater/wwsystem.shtml.

[5] Gregory Dicum, "The Dirty Water Underground," *New York Times*, May 31, 2007, accessed April 20, 2016, http://www.nytimes.com/2007/05/31/garden/31greywater.html?_r=0.

[6] "The Vertical Essay." Vertical Farm RSS. Accessed April 01, 2016. http://www.verticalfarm.com/?page_id=36.

The sludge derived from advanced alkaline stabilization with subsequent accelerated drying will be used for rooftop urban gardens. These green spaces will serve as social spaces and will return oxygen into the air, making the air in Fordhamopolis West the freshest in the world. Excess fertilizer may be packaged and sold at market value. The gray water which is returned to drinking water quality by the designated vertical farms will be distributed at a low cost in all arenas where potable water is necessary.

This system has the benefit of eliding many environmental and ethical concerns that most contemporary urban water systems must grapple with, especially in coastal areas: Fordhamopolis West will not need to interact with the oceanic ecosystems along the Pacific coastline at all, and will therefore not disturb or pollute those ecosystems, and the constant reuptake of recyclable water and relative lack of heavy electricity-based intervention means that the system will produce little to no runoff and minimal carbon emissions. Any water not captured that reenters the local water cycle will be remarkably pure in comparison to other urban environments. This will be the result of Fordhamopolis West not utilizing any harmful pesticides or emitting exhaust from transportation and will present a very low risk of harming the surrounding environment and the ecosystems that depend on the health of it.

Water will be distributed throughout Fordhamopolis West in the most efficient way possible. The aspects of water supply, wastewater, stormwater, and water quality will be considered in the design and management of the distribution systems. Fordhamopolis West aims to respect the natural drainage flows as much as possible by utilizing green infrastructure such as rain gardens to trap stormwater and sustain trees and plants. Streams and habitats will have been

naturally restored by reducing the groundwater flows into sewers, minimizing stormwater runoff into streams, and by reducing the overall demand for potable water.[7]

Community tailoring of infrastructure will be incorporated to restore and protect ecosystems, preserve community character and open space, improve quality of life, create jobs, and achieve other local benefits.[8] The source, use, treatment, and reintegration of water will all be kept at the local level. The equal distribution of water is extremely important within Fordhamopolis West. Public water lines will be extended to all homes. Water pipes will be separated based on their intended use and the level of treatment that will be needed for reintegration. Because we will be sourcing our water in many different ways, the city will utilize a decentralized wastewater treatment system. A decentralized wastewater treatment consists of a variety of approaches for collection, treatment, and dispersal and reuse of wastewater for individual dwellings, industrial or institutional facilities, clusters of homes or businesses, and entire communities. This type of system has many benefits including cost-effectiveness, sustainability, and safety in protecting the environment.[9] In addition to distribution, the reintegration of the water collected is key to the natural processes Fordhamopolis West is striving to mimic.

As the ultimate objective of Fordhamopolis West is total redundancy and sustainability, the reintegration of recycled and treated water will be the most integral step in the city's water system as a whole. Like most natural cycles, with the addition of this step, the Fordhamopolis

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[7] Nelson, Valerie I. "Sustainable Water Infrastructure." (n.d.): n. pag.*Sustainable Water Forum*. Coalition for Alternative Wastewater Treatment. Web. May 2016.
[8] Nelson, Valerie I. "Sustainable Water Infrastructure." (n.d.): n. pag.*Sustainable Water Forum*. Coalition for Alternative Wastewater Treatment. Web. May 2016.
[9] Linahan, David V. "Decentralized Wastewater Treatment: A Sensible Solution." *Clean Water Starts at Home: Decentralized Wastewater Program* (n.d.): n. pag. *EPA*. Environmental Protection Agency. Web. May 2016.

West water system will become a fully closed and self-sustaining feedback loop in which no water is wasted and no new water need be introduced save for the amount that comes into the city by natural, weather-based means and is collected for that purpose.

Once remediated by the constructed wetland system described above, the now fresh and drinkable water will be removed from the wetland (to be replaced with new grey water) and diverted back to residential, municipal and commercial buildings for regular use. This diversion will follow the directives for allocation described above, and will be achieved by channeling the remediated water back into the existing municipal water infrastructure with the aid of a series of diverter valves[10] that will direct the water to different destinations within the city at intervals. Following this stage, the consumption of the water will complete its reintegration, as it will have been purified by the constructed wetland enough that it will be essentially indistinguishable from fresh, "new" water. It should be noted that to maintain the purity of the filtered water, the materials used in Fordhamopolis West's municipal water infrastructure will not be any that would create a risk of toxicity or leaching in later years--i.e., no lead pipes or other fixtures containing heavy metals that could affect the health of the city's citizenry.

The city of New York uses nearly 1 billion gallons of water daily for various purposes. (See Figure 1-A.) This translates to mean that each of NYC's 8.5 million residents use nearly 120 gallons of water on a daily basis. At the same level of water consumption, Fordhamopolis West would require a daily supply of 12 million gallons of water, or 4.4 billion gallons of water each year.

[10] "Greywater System Examples," Greywater Action: For a Sustainable Water Culture, accessed May 04, 2016, http://greywateraction.org/greywater-system-examples/.

Though this sets a grave scene, water consumption in New York City has been steadily declining since the year 1988, and it has decreased by nearly 30% within the last 15 years[11]. With the introduction and incorporation of higher efficiency systems, the amount of water used within the city can continue to decrease. More specifically, showers account for nearly 17% of residential water usage (Figure 1-A). The standard shower head in the U.S. retains a 2.5 gallon per minute efficiency, which is also the maximum water flow permitted by the EPA since the introduction of the Clean Water Act in 1994[12]. Products that qualify for a "WaterSense" label under EPA standards are at least 20% more efficient than traditional products, but still maintain the same level of performance. If Fordhamopolis West required all households to install showerheads that had a 2.0 gal/min efficiency (or better), than Fordhamopolis West could save nearly 150 million gallons of water on an annual basis. Similarly, the city's water intake could be reduced by installing high efficiency toilets. Toilets, by far, are the leading source of indoor water consumption. Older toilets may use nearly 7 gallons of water per flush, which is a major source of wasted water[13]. Water saving toilets are 20-60% more efficient; today there are toilets on the market that use only 1.2 gallons per flush. Additionally, toilets that are WaterSense label certified, are extensively tested in order to meet proper performance and efficiency standards. By cutting back on water consumption, the city would not only save water, but energy and money as well.

In regards to the long-term, Fordhamopolis West will have a goal of reducing water consumption to 12% of the current model of consumption in New York City. Integration of

[11] "Water Consumption In The New York City | NYC Open Data." *NYC Open Data*. Web. May 2016.
[12] "Thanks to the EPA, Even If You Like Your Shower, You Can't Keep It." *CNS News*. 24 Mar. 2015. Web. May 2016.
[13] "Indoor Water Use in the United States." *US Indoor Water Use*. Web. May 2016.

composting toilets will begin in corporate buildings, continue into government owned buildings, and eventually enter the common household. As an example, Fordhamopolis West will look to the design of the Australian "Nature Loo." This model of toilet uses no water and has minimal electricity needs and is therefore an exemplar product to uphold the values of Fordhamopolis West.[14] Furthermore, shower designs will gradually go from regulating the shower heads to incorporating water recycling technology. We can look toward the Swedish "Shower of Tomorrow" that recycles 90% of the water and 80% of the electricity that goes into taking a hot water shower.[15]

The water collected and recycled in Fordhamopolis West will be used for both municipal purposes and private use by citizens. Our system will drastically reduce runoff, minimizing the risk of harm to the surrounding environment and the ecosystems within it. We will also prohibit discarding salvageable grey water, instead attempting to create a completely integrated, continuous potable water source for the city. This is no small feat, since this suggests supplying a population of 100,000 with as much as 12 million gallons of water daily (although the goal would be to consume less). It is important, however, to recall that the recycling and reintegration of water already in use will go very far with regard to meeting this demand. In addition, the remediation farms used for filtration will make this water not only usable, but potable and even desirable, without creating unnecessary waste products or creating a risk of pollution to the surrounding aquatic environment. Furthermore, Fordhamopolis West's water system will be integrated functionally as well as aesthetically, transcending the public conception of the drab

[14] "Questions about Composting Toilets," Ecoflo Wastewater Management, Accessed April 3, 2016, http://www.ecoflo.net.au/questions/compostingtoilets.aspx.
[15] "Explore Shower of the Future," Orbital Systems, Accessed April 3, 2016, https://orbital-systems.com/explore/.

municipal plumbing system in favor of inspired designs created with both form and function in mind.

Alternative Energy Sources

With a population of 100,000 in a 1 square mile area, the density of Fordhamopolis West is greater than any urban conglomeration in the United States.[16] This calls for radically-new thinking in terms of energy production. The end goal, then, is for Fordhamopolis West to be both a smaller consumer of energy through a number of mitigation programs related to lifestyle, industry, and transportation, and for the city to generate much of its energy within city limits, or connected to solely sustainable sources outside the city.

This ultimately means that city infrastructure, like roads and buildings, need to function as both users and producers of energy, and hopefully have a net-zero consumption need. The city also needs to take into account its location to determine how it can use the many forms of renewable energy that are used on a large scale today. Our geographic location may emphasize certain types of energy uses that may be best, and determine others are less useful. In the United States, energy consumption averages about 313 Million British thermal units--in New York City, however, this number is about half, at 121 MMBtu per person.[17]

The New York rate is a more reliable one to go on, since their energy consumption is smaller based on the density, and the density of Fordhamopolis West will be more similar to theirs. In fact, our density will be about 35% more than that of Manhattan, which is about 66,000

[16] "Watch 210 Years...in 2 Minutes", Eric Jaffe
http://www.citylab.com/housing/2015/06/watch-210-years-of-manhattan-densification-in-2-minutes/394736/
[17] "July 2013 Economic Snapshot", NYC Economic Development Corporation and "International Energy Statistics", US Energy Information Administration"

people per square mile.[18] Thus, our voracious energy needs will need to be about 70% ((do you mean 70x or 70% more?)) of Manhattan's, which is around 85 MMBtu per person, or 2550 kWh of electricity.

To put our energy needs in terms of kWh is helpful for a number of reasons. For one, it motivates our city planners and policy makers to think in terms of electricity. Moreover, nothing should produce Greenhouse Gas Emissions, including transportation or industry. All our processes, then, will work on electricity and not the fossil fuels that are prominent today. This also allows us to easily calculate what our needs would be. For instance, if 100,000 people need about 2550 kWh of energy per year, then we would need to produce about about 255,000,000 kWh a year, or 255,000 mWh. To figure out the actual capacity, we need to divide this number by the number of days in a year, and then hours. We are left with a need of 29 MW to power the needs of a very efficient, compact, and small city. Let's consider sources to get to our magic number: 29 MW.

Tidal

The first source of energy we will consider is new technology that has only small uses throughout the country. Tidal energy has been used since the second half of the 20th century, but never to a very large extent. One of the biggest examples in the world is the Sihwa Lake Tidal Power Station, which produces about 254 MW of energy per year.[19] The size of this power station is actually quite large. New York City, on the other hand, has a much smaller example of

[18] "Manhattan Borough Quick Facts", US Census Bureau.
[19] "Sihwa Lake Tidal Power Station," Wikipedia, accessed May 04, 2016, https://en.wikipedia.org/wiki/Sihwa_Lake_Tidal_Power_Station.

tidal power: The Roosevelt Island Tidal Energy (RITE) project, started by Verdant Energies, which uses about 30 turbines in the East River to generate 1050 KW of energy.

The technology of tidal power is actually relatively simple, although initial costs and installation are expensive. Tidal movements of water constantly spin turbines in the water, which generate energy that is collected in buoyant substations. This technology is especially advantageous because it is one of the more reliable sources of renewable energy; tidal patterns are predictable. Additionally, the substations can be connected to the grid easily, and tidal capture units can be submerged and thus hidden from view. Because of our location near the Strait of Juan de Fuca, the confluence between the Pacific Ocean and the Puget Sound, regular and substantial tides come through the area, which could make it an ideal spot for this type of energy system. We are presented with the possibility of using GE Oceade Tidal Turbines, which have shown to produce about 1.4 MW of energy each.[20] A few of these turbines could produce a substantial amount of our energy needs.

Tidal energy plants also have the potential to double as desalination plants. A company in Australia, Carnegie, has developed underwater buoys that generate electricity, a portion of which is used to power onshore desalination units. Onshore units utilize reverse osmosis methods to transform seawater into fresh, drinking water. Furthermore, Carnegie's desalination approach is efficient and emission free. Their system is superior to traditional desalination plants, which can contribute upwards of one million tons of carbon dioxide annually[21]. Similar tidal devices could be implemented on the coasts of Fordhamopolis West to provide the city with both power and quality drinking water.

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[20] "Oceade* Tidal Turbine Platform: Tapping the Potential in the Tides," GE Renewable Energy, accessed May 04, 2016, https://renewables.gepower.com/innovative-solutions/tidal-energy/oceade-tidal-turbine-platform.html.

[21] "Renewable Power from the Ocean's Waves." *Carnegie Wave Energy*. Web. May 2016.

Hydrogen Fuel Cells

A concept that has been tested quite heavily in recent years is the use of hydrogen fuel cells. The 2010 Vancouver Olympics made hydrogen fuel cells famous when buses used to transport fans and media alike were all powered by hydrogen. It's used as an energy source for public transportation vehicles and other smaller energy-hungry structures or processes can have very good impacts.

Hydrogen is the simplest element and the most plentiful element in the universe. Hydrogen has the ability to provide energy for an entire city. It is different from coal and gas, because it is not an energy source, it is an energy carrier. The way in which it works is through solar and wind power, fossil fuels, or nuclear energy that is used to split H2O into H2, hydrogen, and O2, oxygen in a process called electrolysis[22]. The oxygen and hydrogen are combined in a fuel cell to produce electricity, heat and water. Hydrogen fuel cells are virtually emission-free, other than the energy used to produce the actual fuel cell, and the only thing that is left behind is pure water. Essentially, hydrogen fuel cleans the air as it passes through. Similar to a battery, fuel cells convert the energy produced by a chemical reaction into electric power.

What makes them incredibly different is that as long as hydrogen is present within the fuel cell, it will never lose its charge. The extra hydrogen can be stored for later use when renewable energy sources are not available. Some of the benefits of hydrogen energy is its economic competitiveness, air quality and health improvements, and greenhouse gas reduction.[23]

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[22] "Hydrogen & Fuel Cells." *Renewable Energy World*. RenewableEnergyWorld.com, n.d. Web. Apr. 2016.

[23] "Hydrogen and Fuel Cells - Hydrogen Power." *Making Hydrogen Power, Hydrogen and Fuel Cells, Hydrogen Power*. N.p., n.d. Web. Apr. 2016.

One of the main downfalls of hydrogen fuel is the high-cost and energy needed to produce it. But, with increasing access to renewable resources, the cost would be more stable.

Nuclear energy has been a proven way to generate electricity throughout the world. France especially has been a leader in the industry. Along fault lines, there is a concern of earthquakes damaging the nuclear reactor's core. Columbia Nuclear, a plant located in Richland, Washington ranked number 39 on the list of earthquake prone nuclear reactors in the United States with the chances of an effectful earthquake being 1 in 47,619. This location is east of Fordhamopolis West and lies in the mid-hazard zone according to a US Geological Survey. Unfortunately, this survey thus indicates that Fordhamopolis West will be located in the high-risk zone with 64+ %g.[24]

Solar

Given the relative somberness of the weather in Washington State, Fordhamopolis West will receive very little sunlight compared to other locations on the West Coast, like Southern California. However, by optimizing what sunlight the city does get, it will be possible to access a valuable alternative power source. One intriguing example is the use of transparent solar panels, which can be used as window panes in any size of building. Some reports say they can generate up to 50 times the energy of traditional photovoltaics.[25] If used on all municipal buildings (and possibly subsidized for use by citizens) the energy could be transferred from the panels and

[24] Dedman, Bill. "What are the odds? US nuke plants ranked by quake risk," NBC News, Accessed April 16, 2016, http://www.nbcnews.com/id/42103936/#.VyovBPkrKCp

[25] Michigan State University, "Solar Energy that Doesn't Block the View," *MSU Today*, August 19, 2014, accessed April 20, 2016, http://msutoday.msu.edu/news/2014/solar-energy-that-doesnt-block-the-view/.

stored in a long-term large storage battery[26] for use in times of need. It is important to note, however, that because of the relative lack of sun exposure in Washington State, solar energy is more viable as a supplementary source of energy, perhaps to be used as a generator-like stopgap in the event of a natural catastrophe or weather emergency when the city's main power source would be unavailable.

Wind

Like with water, Fordhamopolis West would have an energy policy guided by redundancy and resiliency; the area would not experience a total outage should one of its multiple sources be rendered inoperable. One of its components would be a robust wind farm program in the vicinity of the Puget Sound and the Olympic Peninsula. While the State of Washington derives 6% of its electricity from wind power, none of it currently comes from this region, where wind farms are unprecedented; the closest existing cluster in the state is east of the Cascade Mountains. Fordhamopolis West would benefit from owning a wind farm situated along the Pacific Coast of the Olympic Peninsula owing to the high wind speeds in the area as depicted in Figure 2-A. Given that the farm would be located at least 10-20 miles offshore and have 50 m turbines, it would be able to capture wind power densities of 500-600 W/m^2, having "excellent" resource potential as determined by the US Department of Energy.

For comparison, the 125 square mile Maryland Wind Energy Area off the state's Atlantic Coast enjoys the same resource potential rating as Fordhamopolis West's potential wind farm;

[26] Chip Register, "The Battery Revolution: A Technology Disruption, Economics and Grid Level Application Discussion with Eos Energy Storage," *Forbes*, January 13, 2015, accessed April 20, 2016, http://www.forbes.com/sites/chipregister1/2015/01/13/the-battery-revolution-a-technology-disruption-economics-and-grid-level-application-discussion-with-eos-energy-storage/#7a071409248e.

observing that farm's characteristics aids in determining what could be expected from Fordhamopolis'. When fully built out, it would ultimately consist of 80-125 turbines and is projected to provide 500 MWh of energy, or 4,380 GWh annually, enough to provide for over 300,000 households[27](Figure 2-B). Since then, larger turbines have been developed; the Vestas V164-8MW has a nameplate output of 8 MW. The analysis in Figure 2-B shows a sample of the characteristics of the energy production and consumption of Fordhamopolis West compared to New York City, whose relatively low energy consumption Fordhamopolis West aims to emulate, and Baltimore, a city in close proximity to a wind farm soon to begin construction. Fordhamopolis West's policy of low energy usage would render the city consuming only about 30 MW per hour for residential purposes, which can be supplied with nine 8 MW turbines (taking into account a 45% efficiency factor). Assuming the same budget for construction costs as the Maryland wind farm, a similar farm could be established for Fordhamopolis West and have an immense energy surplus to sell to other customers outside of town. To connect Fordhamopolis West with this resource, the existing transmission line powering the northern peninsular cities would require a western extension. This existing infrastructure facilitates the sale of potential excess electricity generated to the rest of the state.

Finances

In Washington, electricity is sold for under 9 cents per kW/hr according to the National Renewable Energy Laboratory for the U.S. Department of Energy as released in 2016.[28] (See Figure 2-C.) Fordhamopolis West will retrieve 100% of its energy from renewable resources

[27] "Maryland Invites Applications for Offshore Wind Projects." *Offshore Wind*. Web. 22 Apr. 2016.
[28] "Electricity Price Maps," National Renewable Energy Laboratory, Accessed April 25, 2016,

including wind, solar, and tidal. Citizens of Fordhamopolis West will receive their electricity at a set base for free, with the option to upgrade. Electricity will therefore be considered a free product, with the only required price for consumers to pay being an annual fee to cover the maintenance and employment costs of operating the energy collection systems. There will be a long term goal of having an annual net gain of electricity. The amount of collected energy will exceed the amount consumed by the citizens of Fordhamopolis West, and will thus become a product to be sold to surrounding cities and those which are situated in locations with minimal access to renewable resources.

Energy Conclusion

In all, there prove to be a variety of ways that Fordhamopolis West can gain its energy needs without greenhouse gases, or reaching far beyond its borders for its energy resources. By reviewing our possibilities, including traditional alternatives and non-traditional, we come to find that 29 MW need is not a major challenge for 1 square mile on the Olympic Peninsula.

Solar energy seems to be a lack of concern. We think the best option would be to use transparent panels for municipal windows, ideally located within the city to get the best sun exposure. Even more important is to think about wind energy. Because of our close proximity to both a strait between two major bodies of water, as well as the Pacific Coast itself, the National Resources Energy Laboratory states that our location is excellent to outstanding in terms of wind productivity. Especially important would be off-shore wind farms that could transfer energy directly to our grid, and have the highest potential for energy generation.

Tidal energy seems to be the most intriguing of the non-traditional renewable sources. It's record as a proven energy-provider is quite varied: from massive projects in South Korea to small-scale projects in New York, tidal seems to be used for show-and-tell, as well as for legitimate purposes. I think because of our unique location, a combination of tidal and offshore wind can be a huge driver for energy production.

The benefits of having such a large budget means that initial costs of these energy sources will be covered by the grant we are applying for. The Lillgrund Wind Farm off the coast of Malmö, Sweden, has 48 Wind Turbines that continually produce energy when winds are blowing over 5 m/s, generating a total of 110 MW per year.[29] This project cost about 34 million Euros in 2016 dollars, just a small amount compared to our larger Fordhamopolis West project. While winds in the Øresund are much higher than in the Straits of San Juan de Fuca, off-shore wind still proves to be an efficient options in both energy production and in initial cost.

This specific case study goes to show that when reinvesting in a major city, we will have a few benefits of generating more energy-than-needed. One scenario would be that extra energy we generate would either be sold to neighboring cities through a series of energy-efficient power cables, as advocated for by the International Electrotechnical Commission (IEC).[30] Another benefit is the fact that our electrical needs would be padded by extra energy if some additional need were to go online. This could be the case for a weather disaster or improved technology that would need more energy. As transportation, lighting, food systems and other electricity-backed technologies come to Fordhamopolis, our ability to adapt will be bolstered by our overallowance for energy consumption, all from alternative, carbon-free methods.

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[29] http://www.power-technology.com/projects/100mwlillgrund/

[30] "Efficient Electrical Energy Transmission and Distribution, IEC" http://www.iec.ch/about/brochures/pdf/technology/transmission.pdf

Finally, it's important to address different energy solutions that may not be possible, or at the very least feasible, for our Fordhamopolis West location. Among these are both geothermal energy, and hydroelectric power. Geothermal certainly comes to mind when we think of all the geological activity on the West Coast, indeed within the Cascades in Washington. But our location is actually quite separated from these fault lines and the volcanic activity that results. There would be little geothermal activity where we are located, and the transport of this energy is much too expensive and unnecessary to justify it. Additionally, hydroelectric power is something well-used currently on the Olympic Peninsula (provide 2 examples). The problem with these plants is their short lifespan and ultimately negative consequences on the natural environment. Hydroelectric power changes the nature of lands, and because we have an expressed consent not to damage the habitats of wildlife or cut down old-growth forests, we believe that hydroelectric would be too expensive, too unsustainable, and too antithetical to justify.

Waste to Energy

In nature, there is no such thing as waste. Nutrients are reused and recycled throughout a complex ecosystem, where every organism has a specific function. A truly sustainable city would aspire to emulate nature's zero-waste policies. However, the conception of a waste-free city, even in the case of Fordhamopolis West, is an unrealistic goal. Acknowledging that there will be waste in Fordhamopolis West, the next most effective strategy involves emphasizing policies that promote the reduction of waste. In other words, Fordhamopolis West will strive to transform people's wasteful ideologies and shift societal behaviors to more sustainable ones.

Furthermore, Fordhamopolis West will pursue the most environmentally-friendly waste management approaches, such as incineration, composting, and plasma arc gasification. There will be no onsite landfills within Fordhamopolis West.

Additionally, the age old tale of the three r's--reduce, reuse, recycle--is still relevant and important. Take, for example, plastic bags: an item that defies all of these crucial practices. Plastic bags are still numerous even in a society that is well aware of their harmful impacts. First, the energy input of a plastic bag cannot be justified by its short product lifespan. Sometimes plastic bags are only used for several minutes before their disposal. Take, for instance, their short journeys from a grocery store to a home. Furthermore, in many regions, plastic bags are not eligible for recycling, so their ultimate destination is a landfill, or in the ocean among one trillion other plastic bags.[31] In addition to transforming societal values about waste, Fordhamopolis West will also strive to use and produce products that are eligible for recycling and have extended product lifespans.

According to the EPA, in 2013, Americans produced 4.40 pounds of waste per person per day. [32] Of this, 1.51 pounds was recycled and/or composted, meaning that the average American is still responsible for producing 2.89 pounds of inorganic, landfill-bound waste daily. In Fordhamopolis West, multiplying that 2.89 pounds by the population size (100,000 citizens) means that each day, 289,000 pounds of waste will be produced and will therefore need to be disposed of in a manner that is both palatable and livable for the population of the city and abides by the city's stated principal values of sustainability, redundancy and low environmental impact.

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[31] "Facts About the Plastic Bag PandemicShare."*Www.reuseit.com/*. Web. May 2016.
[32] "Advancing Sustainable Materials Management: Facts and Figures," EPA: The Environmental Protection Agency, accessed April 28, 2016, https://www.epa.gov/smm/advancing-sustainable-materials-management-facts-and-figures.

The conversion of this waste to usable energy would be highly advantageous to the city and would create another channel through which Fordhamopolis West could mimic and learn from nature. The most opportune ways to achieve this goal would be either incineration or plasma arc gasification, processes by which the waste is both disposed of via the introduction of heat and repurposed into energy. As described in detail below, incineration has been implemented to great effect in Sweden, allowing the country to reduce its overall landfill use to one percent;[33] plasma arc gasification is similar to incineration insofar as it uses extreme heat to generate energy, but has a far greater potential for sustainable generation. Either option would go a long way towards integrating even the city's waste products into the Fordhamopolis West circle of life and renewal.

Malmö, a city in Southern Sweden--across the Øresund from Copenhagen, Denmark--has led a revolution in waste-to-energy production. The city emphasizes the importance of recycling and maintains some of the top recycling numbers in the world, let alone Sweden. The Swedish Institute states that less than 1% of waste is sent to a landfill throughout the country, and that Sweden produces heat for more than 800,000 homes, and enough electricity to power 250,000 households through its 32 waste-to-energy plants[34]. Additionally, in Malmo, the public company, Sysav, leads waste collection efforts.[35] To get the results they have, they have heavily encouraged recycling in residential and public spaces; apartment blocks have a comprehensive recycling and waste management system where users separate organics, plastics, wood-based

[33] "The Swedish Recycling Revolution," Sweden: Sverige, accessed April 28, 2016, https://sweden.se/nature/the-swedish-recycling-revolution/.
[34] Ibid.
[35] "Sysav's Facilities," Sysav, accessed May 04, 2016, http://www.sysav.se/In-English1/Sysavs-facilities/.

material, paper, glass, and more, leaving very little for actual trash. The vast majority of the trash left is then incinerated in Sysav's waste-to-energy plant.

Malmo also has experimented with other initiatives, like food grinders in sinks that many US kitchens have but are quite rare to see in Europe, as well as a vacuum system in new apartments in Malmo's Western Harbour that suck small food scraps and other waste into a system to be collected outside.[36] Although experimental, these vacuum systems are actually quite intriguing since they eliminate the need for garbage pickup and removal.

In any society, one of the biggest challenges will always be waste management. For the city of Fordhamopolis West we wanted to challenge ourselves and push our limits a little farther by creating a zero-waste city, meaning that no waste will be sent to a landfill. Composting not only helps with waste management, but it will also supply soil for community gardens and other agricultural projects. In order to establish a zero-waste city, all products used in Fordhamopolis West must be biodegradable. This includes any beauty products, cleaning products, or recreational products. All packaging must be able to be composted as well, this means no plastic bags and no styrofoam. These restrictions are for all residential, industrial, and commercial buildings residing in Fordhamopolis West. Furthermore, rather than simply eliminating biodegradable products such as styrofoam, Fordhamopolis West will aim to replace those highly-desired products with environmentally friendly alternatives. For example, Ecovative is a company that has developed a sustainable styrofoam. Made out of mushrooms, it is a natural

[36] "How Malmo Leads the World on Waste Recycling," Allianz, Accessed May 04, 2016, https://www.allianz.com/en/about_us/open-knowledge/topics/environment/articles/091118-how-malmo-leads-the-world-on-waste-recycling.html/.

material that can be grown rather than manufactured. Further, it can be easily composted. Their high-performing styrofoam is also customizable and competitively priced.[37]

It is important that we have full participation from everyone within the city. To make things easier, we will install every home and business with a personal composting system. Whatever cannot be composted, will be recycled. We look to San Francisco for guidance in this endeavor to learn how composting can be done on a large-scale. The way that composting works, is that most of it is sent to a composting facility. This facility will be located within Fordhamopolis West. Much of the food waste and "brown matter," such as yard material, is processed at a compost facility, where they are grinded together to create a mixture that is ideal for microbial decomposition. The grinding system has controls that can regulate the temperature and oxygen levels to stimulate breakdown by beneficial organisms and kill potentially harmful microbes. It is feasted on by microbes, until they turn into rich compost, which acts as a natural fertilizer. Food scraps contain nutrients and carbon, which are essential resources for the environment and human health. Once everything is sufficiently broken down, finer material is screened out of the mix. It is then moved into outdoor piles called windrows, where it is "cured." The material is systematically wetted and turned to provide oxygen[38].

To provide an industrial system for this, Fordhamopolis West will use a process known as "Aerated Static Pile Composting." Because air movement is key for compost to break down as efficiently as possible, most systems mechanically sift the compost so air can get towards the middle of the pile. This process is labor-intensive as well as energy intensive. Aerated Static Pile Composting uses fans or other forms of air movers, placed at the bottom of the pile. The

[37] "Mushroom Packaging." *Ecovative Design*. Web. May 2016.
[38] Howard, Brian Clark. "How Cities Compost Mountains of Food Waste."*National Geographic*. National Geographic Society, 18 June 2013. Web. Apr. 2016.

pile does not have to be touched and breaks down very quickly. Large cities such as Edmonton, Alberta use this process, and has the same composting capacity as most other major cities. And because air can be generated on the electrical grid, the need for large machines and other carbon-necessary vehicles like backhoes and forklifts will not be needed.[39]

The process of composting is a natural process within nature. Composting is nature's way of recycling. Natural recycling occurs on a continuous basis in the natural environment. Organic matter is metabolized by microorganisms and consumed by invertebrates. The resulting nutrients are returned to the soil to support plant growth[40]. This continuous cycle of energy and nutrients is how we believe Fordhamopolis West will become truly sustainable

Another way that we can reintegrate our waste into the city is by turning it into energy using Plasma Arc Gasification. Plasma Arc Gasification is a process that successfully and efficiently transforms waste into energy (see Figure 3-A). It also has the ability to break down waste up to 1/300th of its original size.[41] Plasma is an ionized gas, which is a gas where electrons are flowing freely and giving positive or negative charges to atoms, thus making it a highly efficient conductor of electricity and generator of heat. Plasma is extremely common in the universe. Some of the many examples of plasma include lightning, St Elmo's fire nebula and the Sun. Man-made applications include plasma televisions and neon lights. Plasma gasification has four stages: feed handling, gasification, gas cooling, and syngas clean-up.[42]

[39] "3. Large-scale Composting." On-farm Composting Methods. Accessed May 06, 2016. http://www.fao.org/docrep/007/y5104e/y5104e07.htm.
[40] "Composting Process." *EcoChem: An Earth Friendly Company*. EcoChem, n.d. Web. Apr. 2016.
[41] "Plasma Gasification." *Phoenix Energy: Powering an Alternative Tomorrow*. Phoenix Energy, n.d. Web. May 2016.
[42] Ibid.

Plasma gasification is a multi-stage process which starts with feed inputs ranging from waste to coal to plant matter, and can include hazardous wastes.[43] The first step is to process the feedstock to make it uniform and dry, and have the valuable recyclables sorted out. The second step is gasification, where extreme heat from the plasma torches is applied inside a sealed, air-controlled reactor. During gasification, carbon-based materials break down into gases and the inorganic materials melt into liquid slag which is poured off and cooled. The heat causes hazards and poisons to be completely destroyed. The third stage is gas clean-up and heat recovery, where the gases are scrubbed of impurities to form clean fuel, and heat exchangers recycle the heat back into the system as steam. A turbine can be connected to the process to generate electricity, which can be used to not only power the plant, but provide an alternate clean source of renewable power to the community.[44]

The final stage is fuel production the output can range from electricity to a variety of fuels as well as chemicals, hydrogen and polymers.The Plasma Gasifier produces a gaseous product and an inert solid by-product; the individual amounts of which will depend on the type of waste being feed into the gasifier. Synthesis gas (syngas), the main output of the plasma gasifier, can be used as a fuel source in power plants, or treated further to generate hydrogen. It can also be used in the rural and industrial sector in the production of a wide range of polymers, chemicals, biofuels (including ethanol), fertilizers, pressure agents and more[45].

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[43] "Demonstration Plasma Gasification/vitrification System for Effective Hazardous Waste Treatment." Demonstration Plasma Gasification/vitrification System for Effective Hazardous Waste Treatment. Accessed May 06, 2016. http://www.sciencedirect.com/science/article/pii/S0304389405001585.

[44] Dodge, Ed. "Plasma Gasification: Clean Renewable Fuel through Vaporization of Waste." *Waste Management World*. INDUSTRIEMAGAZIN Verlag GmbH, 01 July 2009. Web. May 2016.

[45] "Plasma Gasification." *Phoenix Energy: Powering an Alternative Tomorrow*. Phoenix Energy, n.d. Web. May 2016.

The combination of city-wide social participation, and the utilization of sustainable waste treatment techniques, will allow Fordhamopolis West to manage both the production and management of its waste. Not only will Fordhamopolis West be void of the conventionally dormant and methane-ridden landfill, but its waste treatment facilities will be valuable and productive spaces. Composting, plasma arc gasification, and incineration will be key elements to the sustainable management of the cities waste. More importantly, however, will be the mutual understanding and collaborative efforts among citizens to prioritize the reduction and responsible management of their of waste.

Food

Historically, cities have imported most of their food in from their rural neighbors. The rise of industrialized transportation--namely, trucks--has allowed us only recently to enjoy the bounty of produce year-round, regardless of whether or not it is in-season or feasibly produced locally. While convenient, this system is not resilient. Intensive farming and water re-allocation due to drought are expediting the already rapid process of draining our Earth's natural resources. Further, the obesity epidemic prompts questions regarding the impact of urban food deserts on citizen health. For cities especially--despite living in neighborhoods that are dense, having excellent street connectivity, and being almost universally lined with sidewalks--obesity rates are higher than those in suburban areas.[46] It goes without saying that food production and management is of paramount importance in Fordhamopolis West.

[46] Lopez, Russell P., and H. Patricia Hynes. "Obesity, Physical Activity, and the Urban Environment: Public Health Research Needs." Environmental Health. Accessed May 04, 2016. http://www.ncbi.nlm.nih.gov/pmc/articles/PMC1586006/.

Vertical farms located within the city and responsibly allocated externally produced food will allow the citizens of Fordhamopolis West to eat a plant-based diet. We acknowledge that eating primary producers is the best way to take advantage of trophic levels, waste less energy, and live a healthy life (see Figure 4-A). Further, modern food scientists recommend a plant-based diet as the key to longevity as well as greater sustained energy levels on a day-to-day basis. Michael Pollan, American journalist and leading food writer, presents his motto to: "Eat food. Not too much. Mostly plants."[47] This will be integrated into the daily lives of the citizens of Fordhamopolis West.

If the field of nutrition is far too new to make any decisive claims about what people should be eating, and while we of course acknowledge that we cannot decide for an entire city of people what they will put on their plate for each meal, our plan incorporates a system by which the citizens of Fordhamopolis West will actively choose plant-based options. If a variety of locally produced produce is available in every building--unlike the modern urban food desert--citizens will undoubtedly reach for healthy options since the produce will be fresh and therefore supremely palatable. This section explores the sourcing and management of all of the food supplied to the citizens of Fordhamopolis West.

In order to account for the maximum eighty percent of daily calories that will not be supplied by crops grown within Fordhamopolis West itself, the city will require assistance from outside sources. While not contained within the limits of the city itself, these sources will be as consistent with the goals of Fordhamopolis West as possible. Specifically, this means that the sources will create minimal environmental impact. In order to remain consistent with

[47] Pollan, Michael. *Food Rules: An Eater's Manual*. New York: Penguin Books, 2009.

Fordhamopolis West, its outside food sources will be exceptionally local. Further, the providers from which we source will have standards for ethical and sustainable growing which align as those espoused by the farms within the city, described below. Contemporary models of agriculture--especially poultry production and cattle farming--will not be endorsed by Fordhamopolis West.

As such, we intend to source a large majority of calories from vertical farming companies based outside Fordhamopolis West. Aeroponic-based facilities, like Newark's Aerofarms[48] and aquaponic facilities like Chicago's The Plant[49], are ideal partners for Fordhamopolis West, as they align with our personal ecological goals. They do not place an undue burden on either their local ecosystems or those of Fordhamopolis West itself. In addition to their environmental benefits, such facilities would allow Fordhamopolis West and its partners to promote ethical consumption habits. C & S Hydro Huts, located in Otis Orchards, WA, would be one such ideal partner;[50] with their capacity of up to 7,000 plants and rapid turnover, they would be able to shoulder a considerable portion of the load feeding Fordhamopolis West requires. For a more extensive list, Washington State University has a "small farms finder" which offers an extensive list of farms located in or around Washington state and who generally abide by organic and sustainable practices.[51]

Further, our preference for a plant-based diet does not equate to a city of vegetarians. Rather, we plan on providing food such that meat will be considered as a supplement to a healthy

[48] "Our Technology," Aerofarms, accessed April 27, 2016, http://aerofarms.com/technology/.
[49] "What is 'The Plant?'," Plant Chicago, accessed April 28, 2016, http://plantchicago.org/2016/02/12/what-is-the-plant/.
[50] "About Us," C&S Hydro Huts, accessed May 2, 2016, http://cshydrohuts.com/about.php.
[51] "Small Farms Team." *Farm Finder: Harvest Schedule*. Web. 05 May 2016.

diet, rather than a centerpiece. Many of the farms on the small farm finder, such as "Abundantly Green" in Kitsap County, WA offers ethically produced, organic poultry.[52]

Self Production

Fordhamopolis West will use indoor and vertical farming technologies in order to augment the existing food production. At least twenty percent of the calories that the citizens of Fordhamopolis West will consume will be derived from in-city food production. A simple calculation (2000 * 100,000 * 365) demonstrates that there will need to be a minimum of 7.3 x 10^{10} calories provided to Fordhamopolis West each year. Twenty percent of that figure is 1.46 x 10^{10}. This is the amount of calories that will be produced within Fordhamopolis West each year.

Extremely-high rise buildings, similar to megatall skyscrapers, will provide the space necessary to accommodate this design. By producing twenty percent of the cities calories inside the city with a very small architectural footprint, Fordhamopolis West will act as a model of relieving farmland in order to allow it to return to its virgin state. By the time of Fordhamopolis West's construction, advanced hydroponic, aeroponic, and other related vertical farming technologies will likely have improved enough to allow for even more than one-fifth of the city's food to be sourced within its boundaries.

The full list of advantages of the vertical farm, as described by Despommier, include:

1. Year-round crop production
2. No weather-related crop failures
3. No agricultural runoff
4. Allowance for ecosystem restoration
5. No use of pesticides, herbicides, or fertilizers
6. Use of 70-96 percent less water
7. Greatly reduced food miles
8. More control of food safety and security
9. New employment opportunities

[52] Ibid.

10. Purification of grey water to drinking water
11. Animal feed from postharvest plant material[53]

The greatest challenge facing indoor farming currently is start-up and energy costs. The lighting required to grow to plants vertically is especially energy-intensive. But, as with all other technologies, the more people adopt the technology, the more prices drop.[54] This grant money will kickstart that process in Fordhamopolis West and, as a result, lower vertical farming costs for people all over the world.

It should be noted that these vertical farms will exist as part of each building in Fordhamopolis West. Vertical farms will not exist as their own entities but will rather be integrated into office, residential, and public buildings. Grocery stores will exist virtually alongside these farms; the farmers do not even have to go outside to deliver the food to the store. Rather, they'll simply have to transport it in an elevator. The nutritional content of the produce will be preserved and as a result will possess the ultimate nutritional value. This is described in greater detail in the distribution section.

Urban agriculture within Fordhamopolis West will provide a multitude of job opportunities for the population. Harvesting of the crops will be done by employed workers as well as interns and apprentices. Job opportunities will include maintenance and harvesting of the farms, management, and community outreach. As described by Dr. Dickson Despommier, vertical farming, "...will generate a new set of careers: managers, indoor controlled-agriculture specialists, waste-to-energy specialists, and farmworkers for the nursery, planting, monitoring,

[53] Despommier, Dickson D. *The Vertical Farm: Feeding the World in the 21st Century*. New York: Thomas Dunne Books/St. Martin's Press, 2010.
[54] Ibid.

harvesting, sorting, and selling."[55] Indeed, food production will be one of the largest commercial sectors and employers in Fordhamopolis West.

In our plan, we'd like harvesting of the produce to also be completed by community-based volunteers in order to diminish the gap between farmer and consumer. Interns and apprentices will also be hired; this hands-on experience with food production will encourage education about food sources while simultaneously working towards job preparation into the green job market. This will ensure a seamless transition from generation to generation of vertical farmer.

Distribution of food within Fordhamopolis West will be carried out in the most efficient way possible. Food that is produced within indoor vertical farms will be distributed to markets within the same buildings by means of specially designed elevators, that act as technologically advanced dumb-waiters. Food that is produced outside of Fordhamopolis West will be imported into the city via refrigerated and aerated maglev trains. The products will deposited at the East Central Station and then divided and distributed to grocery stores throughout the city. On average, food that is produced within Fordhamopolis West's vertical farms will be less expensive due to a non existence of distribution costs. This will eliminate the stigma of organic locally-grown food being of a higher price than mass-produced and manufactured edibles. All food will be available for purchase within office and higher education buildings.

While this model of food shopping is unconventional, we believe it will greatly improve the lives of the citizens of Fordhamopolis West since it saves time and energy. It will also help to improve the health of the citizens of Fordhamopolis West. Currently, many office buildings and

[55] Ibid.

schools have vending machines and in-building fast food operations. According to the National Center for Health Statistics at the Centers for Disease Control, convenience of fast food is one of the largest contributors to obesity. Their report on "Obesity and Socioeconomic Status in Adults" found that middle income people are the most overweight and eat fast food more regularly than anyone else. In contrast, 80 percent of those with low incomes cook at home at least five times a week.[56] Another study at the Department of Medicine, University of Minnesota Medical School corroborates these findings:

> These findings suggest public education regarding the unhealthfulness of fast food may not influence fast food consumption. Interventions targeting the issue of convenience and quick or efficient preparation of nutritious alternatives to fast food could be more promising.[57]

By eliminating the option to grab nutritionally deficient, highly processed fast food and replacing it with organic options (meaning both in type of food and the way in which it was grown), we create a system by which citizens do not have to struggle every day against the temptations of unhealthy food. In the words of Forrest Gump, "...and that's good. One less thing!"[58]

Food production within Fordhamopolis West for families will no doubt be led by vertical farms. Yet even with the existence of aeroponic and aquaponic facilities, the use of community farms that are based in soil will still be incorporated within the city for purposes of family food production and community engagement. We envision many of the rooftops in Fordhamopolis West to have gardens for residents and school groups to use. These gardens will be situated on

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[56] "Obesity and Socioeconomic Status in Adults: United States, 2005–2008." *Centers for Disease Control and Prevention*. Centers for Disease Control and Prevention, 14 Dec. 2010. Web. 05 May 2016.
[57] Forbes. Accessed May 05, 2016. http://www.forbes.com/sites/bethhoffman/2012/07/17/its-convenience-not-cost-that-makes-us-fat/#7c8c60f737be.
[58] "Quotes." IMDb. Accessed May 05, 2016. http://www.imdb.com/title/tt0109830.

raised beds, which will use soil-based gardening. We are implementing a system whereby we collect the food scraps from Fordhamopolis West to compost and use for soil. The California Recycle government website offers a variety of food scrap management case studies. Further, they point out the studies that proved most effective and function as models for other communities.[59]

The average raised bed, 12'x4'x1', will use approximately 1.8 cubic yards of soil.[60] This is sufficient for the growing of many garden-variety vegetables. There will be approximately 10 beds per roof, depending on the square footage of the rooftop. School groups, families, and other organizations will be free to use these beds for education, community involvement, and--of course--for growing produce. These green roofs will also improve the air quality of Fordhamopolis West astronomically.[61]

It is our hope that these food production and management initiatives will dramatically improve the quality of life of the citizens of Fordhamopolis West. We believe that the only thing that can truly go wrong in one's life is one's health. Food is a fundamental part of personal, public, and environmental health.

Further, we believe with this combination of interior and exterior sourcing, the citizens of Fordhamopolis West will have more than enough variety in their diets. Researchers at the Washington Center for Obesity Research have found that most Americans eat no more than 30 different foods routinely. Generally, they cycle through all of them in about four days.[62] We will

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[59] "Food Scraps Management Case Studies (Model Programs)." Food Scrap Case Studies: Food Scrap Management. Accessed May 06, 2016. http://www.calrecycle.ca.gov/organics/Food/CaseStudies/.
[60] "Aerated Static Pile Composting." Wikipedia. Accessed May 06, 2016. https://en.wikipedia.org/wiki/Aerated_static_pile_composting.
[61] "Benefits of Green Roofs." Benefits of Green Roofs. Accessed May 06, 2016. http://www.hrt.msu.edu/greenroof/benefits/index.html.
[62] "Gulp! The Quiz." Well. Accessed May 05, 2016. http://well.blogs.nytimes.com/2013/03/25/gulp-the-quiz/.

of course listen to and implement feedback from our citizenry to tailor to their individual tastes and needs. What we know for certain now is that these vertical farming technologies will provide a system by which almost any variety of real food can be produced, including two-legged animals.

As for the vertical farms intended for grey water remediation, they will be housed in separate buildings at the periphery of the city for sanitary purposes. Since the footprint of Fordhamopolis West is small, this water will still not need to be transported far. At the treatment center, blackwater first enter a centrifuge where the solid and liquid parts are separated and will be subsequently purified. This is described in greater detail in the waste management section.

Lastly, Fordhamopolis West will have a zero food waste policy. Food that is leftover in our office and school supermarkets will be donated to soup kitchens and homeless shelters. In a perfect world, homelessness will not exist. However, as of today, this is not the case. Not only does this donation have a social benefit, but the reduction of food waste will contribute to reducing greenhouse gas emissions. According to the Environmental protection agency, food waste is the second largest category of municipal solid waste (MSW) sent to landfills in the United States, accounting for approximately 18% of the waste stream.[63] This food is broken down by bacteria to produce methane, a potent greenhouse gas. Methane shown to have a warming potential of 21 times that of carbon dioxide.[64] By eliminating food waste through donation and composting, we also eliminate a large percentage of the noxious methane released into our atmosphere each day. Our composting initiatives are described in greater detail in the above Waste section.

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[63] "Turning Food Waste into Energy at the East Bay Municipal Utility District (EBMUD)." *Turning Food Waste into Energy (EBMUD)*. Web. 06 May 2016.
[64] Ibid.

Transportation

Fordhamopolis West will operate with a strict Zero-Emission transportation policy. Personal transit will be catered to an encouraged while mass-transit will also be available for use by commuters and travelers. As of 2016, transportation accounts for 21% Carbon Emissions in metropolitan New York City. This is a staggering percentage that will be non-existent in Fordhamopolis West. There will be no automobiles; diesel and gas vehicles will be banned within the perimeters of the city. Electric Vehicles and Hydrogen Fuel Cell Vehicles will be permitted within the city, but will mainly appear as a means of transportation into and out of the city. Many of the Personal Transit vehicles will be founded off of the ideas of Architecture Group Terraform ONE (Open Network Ecology). Specifically transportation planners will incorporate the concept of 'transology' when making decisions in regards to fleet purchases and traversing abilities. Terraform defines 'transology' as:

> 1 : a field of design concerned with the interrelationship of mobility and the environment.
>
> 2 : the totality or pattern of relations between vehicles and their fundamental settings.
>
> 3 : the art of transfer or conveyance from one place to another by taking into account the body and surroundings.[65]

The northern Olympic Peninsula has no existing rail infrastructure; grading new mainline rail trackage would run into problems of its own regarding curve radii, gradients, and the tunnels and viaducts that may be necessary to avoid the extremes of the two. Instead, Fordhamopolis

[65] "Mobility Projects," Terraform, Accessed May 6, 2016, http://www.terreform.org/projects_mobility.html.

West will use maglev technology to provide its citizens and the region with reliable, resilient, and rapid transit. Maglev trains traveling between Fordhamopolis West and other urban centers along the northern Olympic Peninsula will form the basis of short-range regional transit, while fuel cell-powered hydrofoil ferries would facilitate convenient car-free transport to points across the Puget Sound and Strait of Juan de Fuca. They will be powered by the renewable energy sources that power Fordhamopolis West, specifically tidal and wind power.

Currently, the Linimo in Japan's Chukyo region is the only existent maglev providing rapid transit-style service--that is, frequent stops within walking distance of everybody along the line. As such, it does not have a particular speed advantage over traditional rail rapid transit, but as a maglev it costs less to maintain than if the line were built as the former. Figure 33-A depicts local transit based in Fordhamopolis West. There will be two maglev routes: a 17-mile route between the ferry terminal and Port Angeles and a 7-mile route between the city's Mains Farm section and Sequim. Stations within the city will be spaced 0.3-0.4 miles apart to optimize coverage, leaving no acre no more than a 10-minute walk from a station.

Three of the maglev stations will also process freight. Two stations located on the city's borders, Southwest Gate and East Gate, will receive land cargo from land, while the city's ferry terminal along Dungeness Bay will receive water-based cargo. These stations will have their own unique freight functionalities in addition to being passenger stations. For example, East Gate Station will be the hub for food importation and dispatching to local distribution as deliveries can use "Sequim Boulevard" to access most of Fordhamopolis West without making many turns. On the other hand, Southwest Gate Station will be the hub for industrial imports and energy exports

due to the maglev's direct access west to Port Angeles, a town closer to Fordhamopolis West's wind and tidal farm operations.

The rugged terrain of the Olympic Peninsula surrounding Fordhamopolis West and the width of the waterways separating it from the next nearest urban centers presents unique challenges for transportation. While US 101 does provide a land route off to eastern points of egress from the peninsula, it is the *only* land route from this area, and would have inadequate capacity to support thousands more private automobiles, a possible reality if no attractive alternative is provided. However, Fordhamopolis West is located directly on the Strait of Juan de Fuca, opening up alternative methods to provide public transit on a regional level to connect Fordhamopolis West to rest of the Pacific Northwest.

Further developing the regional ferry system would make the best use of the natural geography of the Olympic Peninsula and keep capital costs and environmental impacts pertaining to new construction to a minimum. An attractive method of transportation other than the private automobile is imperative for connections to relatively nearby Seattle, the Pacific Northwest's largest metropolitan area. Given its size, proximity, and economic profile, it would be the single greatest source of potential tourism income for Fordhamopolis West. The most feasible terminal along the eastern coast of the Puget Sound for a route from Fordhamopolis West would be Edmonds, located halfway between Everett to the north and Seattle to the south, offering residents two-seat rides to either downtown via Sounder commuter rail. Along the same trackage is the Amtrak Cascades service offers longer range links to Vancouver, BC and Portland, OR. A case for optimizing interregional connectivity could be made for extending a branch of Link Light Rail from the Interstate 5 corridor (its current planned route) to Edmonds

Terminal. This would provide more coverage to areas of Seattle outside the immediate downtown area, 35-40 minutes away, and connect Fordhamopolis West with SeaTac International Airport, about 65-70 minutes away[66].

In order to naturally convince potential residents of public transit being a viable alternative to the private automobile if not the primary mode for intercity/regional travel, public transit modes must have a time advantage over driving. Driving from Fordhamopolis West to Downtown Seattle would be a 75-mile trip lasting two and a half to three hours, or even longer should one miss the ferry. Reducing this trip duration is possible with the utilization of hydrofoil passenger ferries, the fastest existing form of water-based transportation. Such services between Macau and Hong Kong cover distances of roughly 40 miles within an hour, including time spent launching and docking, on a frequent basis[67]. With about 50 miles between Fordhamopolis West and Edmonds Terminal, trip times of about 1:15 should be expected. A direct connection to Link Light Rail at Edmonds Terminal (via a branch from its currently-planned Interstate 5 corridor extension) yields a trip time to Downtown Seattle under 2 hours--faster than any possible trip by automobile from the northern coast of the Olympic Peninsula west of the Dungeness River, and without the need for parking at either end. While this trip duration still renders daily commuting unfeasible for most people, it increases travel possibilities, facilitating day tripping to and/or from Seattle without driving as a prerequisite.

For Victoria, BC however, being only 27 miles away puts it well within range of more frequent travel relative to Seattle--40 minutes away if assumed to have the same speed as the

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[66] "Lynnwood Link Extension." Sound Transit. March 04, 2015. Accessed May 06, 2016. http://www.soundtransit.org/Lynnwoodextension.

[67] "Kowloon (kln) Macau (mac)." TurboJET. Accessed May 06, 2016. http://www.turbojet.com.hk/en/routing-sailing-schedule/kowloon-macau/sailing-schedule-fares.aspx.

Hong Kong-Macau ferry. The "Cycling Capital of Canada"'s 10.6%[68] of commuters riding bicycles to work would be small compared to Fordhamopolis West's bicycle commuter share (as while Victoria is a relatively compact small city, this one will be even more so), but it would still be a draw for urban bicycle tourism, especially considering that Seattle would be a good deal further away. Frequent service would not be as necessary as it would be for the Edmonds route due to lower competition; the current service from Port Angeles has only two daily departures and the driving route would be unfeasibly circuitous.

Private transportation will inevitably remain the most suitable means of travel for some trips in Fordhamopolis West. Fixed route transit has its limitations, especially apparent when serving places without a. As a city of 100,000 residents living and working within one square mile, the city will be compact enough for citizens to complete daily tasks without having to move far; its municipal boundaries are within 15 minutes' walking distance from the shore (Figure T-33). The city's personal transit policy's main goal is to provide high quality pedestrian and non-motorized vehicle infrastructure.

Among other advantages over private automobiles, human-powered transport consumes no fuel sources and have greater spatial efficiency, as shown in Figure T-34. In a demonstration by the Australian Cycling Promotion Fund, accommodations for 69 people by bus, bicycles, and cars were shown next to each other, highlighting the significantly greater amount of space private automobiles use compared to other modes. Private automobile usage will not be promoted as a primary mode of transportation in Fordhamopolis West; automobiles powered by gas or diesel will be prohibited within city limits. The main presence of cars will be from

[68] "NHS Profile, Victoria, CY, British Columbia, 2011." Government of Canada, Statistics Canada. Accessed May 06, 2016.

outsiders commuting into the city, and even then only ZEVs (Zero Emission Vehicles) will be permitted to enter. As a city of no more than one square mile, driving one's own car would not be necessary for daily travel. To have provisions for even half of households to store their cars would require planning for parking garages and additional road space, reducing the spatial efficiency that the city aims to optimize. US 101, the only land route connecting the northern Olympic Peninsula to eastern destinations, is one lane wide in each direction east of Carlsborg; a new settlement the size of Fordhamopolis West would put undue strain on this highway if a significant number of cars is introduced onto it.

Since Fordhamopolis West will operate with a Zero Emission transportation policy, the bicycle fits in as a key player in the traffic scene. Similarly, Fordhamopolis West will encourage the use of longboards and scooters as modes of transportation. We can look to the concept of the Boosted Board as an additional mode of personal transit. This electric powered longboard is capable of speeds up to 22 miles per hour which presents a space-efficient form of transportation without having to sacrifice time-efficiency.[69] Terraform's concept of the 'Soft Car' will be further developed and incorporated into the transit grid as a lightweight and easily stored automobile.

The discussion of private transport cannot be considered complete without discussing the infrastructure on which it runs. The National Association of City Transportation Officials (NACTO) Urban Street Design Guide will be invaluable to designing the specifics of every inch of road space and sidewalk in Fordhamopolis West to encourage safe interactions between motorized and nonmotorized modes.

[69] "Boosted Boards," Boosted, Accessed May 5, 2016, http://shop.boostedboards.com/collections/boosted-boards.

Taking after the concept of "living streets", streets not designated as through routes (e.g. not having transit) will be designed for speed limits no greater than 20 mph through traffic calming techniques. The design of these local streets will reinforce the speed limit by aiding in ensuring that motorists exercise due care as they pass non-motorized road users like cyclists, skaters, and pedestrians when necessary. This can be done by designating most if not all local streets bidirectional and restricting their curb-to-curb width to a maximum of 30-36 feet (Figure T-38). Curb extensions at intersections into parking lanes decrease pedestrian crossing distances and improve the road user's field of vision at the intersection.

Arterials are wider roads on which the highest passenger and cargo volumes are expected, with speed limits at 25 mph. These will feature all modes--rail, automotive, and human-powered--and will thus be designed with a "complete streets" policy in mind[70]. Figure T-39 shows a sample cross-section of an arterial boulevard with light rail service in the median. Parking protected bike lanes, traffic islands, and intersection curb extensions are a few of many methods prescribed by NACTO to mitigate the risk of traffic crashes along a 160'-wide boulevard. As with local streets, arterial boulevards will have NACTO-guided intersection treatments to not only mitigate the risks that wide thoroughfares may bring, but also to create a sense of place along them. Trees will line much of the arterials' medians, reintroducing tree cover to an area that had largely lost it to agriculture. With Fordhamopolis West's omniscient urban agriculture program, it will be possible to retain both.

The city has been deliberately planned to be located away from US 101, the main thoroughfare of the northern Olympic Peninsula, to avoid the need to design the city's arterials

[70] Welle, Ben. *Cities Safer by Design: Guidance and Examples to Promote Traffic Safety through Urban and Street Design: Version 1.0*. Washington: World Resources Institute, 2015.

for through traffic consisting of large vehicles that would not make deliveries to it. The large blind spots of a semi-trailer truck leave their operators prone to injurious and often fatal misadventures when encountering tight street clearances at turns compounded with high pedestrian volumes and vehicles parked perilously close to intersections. A CityLab article from 2014 reported on a trend of decreasing size for delivery vehicles marketed for the United States, noting that "such a fleet shift could help city street designers implement...shorter crosswalks...more median islands…[curb extensions] that slow down the speed of traffic"[71]. With their shorter wheelbases, 23'-long cargo vans can make significantly sharper turns than semi-trailers can and with less blind spots to account for. With semi-trailers prohibited from Fordhamopolis West past designated transfer points at stations along its city limits, the city will be able to design most streets to accommodate cargo vans at the largest, enabling safer street designs in areas with high concentrations of vulnerable road users, like pedestrians and cyclists. This may increase the cost of some items due to the additional level of processing, but when weighed against the costs saved in improving public safety, it appears to be a more than favorable deal.

The citizens of Fordhamopolis West will possess full ownership of any of their own personal vehicles. This includes both motorized and nonmotorized methods of transit. As for mass transit, pricing will be based on a congestion fare system, similar to Uber's "Surge Pricing."[72] This means that travelers will pay a fare according to the time of day and the location of their destination. This will aid in alleviating congested traffic systems and allowing efficient a

[71] Jaffe, Eric. "How Super-Small, European-Style Delivery Vehicles Could Make U.S. Streets Safer." CityLab. Accessed May 06, 2016.
[72] "Uber Surge Pricing," Uber Estimate, Accessed May 01, 2016, http://uberestimator.com/uber-surge-pricing.

fluid travel time. For example, citizens will be encouraged to take different routes depending on the amount of traffic that is being monitored. In some situations, tolls and fares will be completely removed to incentivise citizens to move along different routes. With the success of this commuter programming, Fordhamopolis West will aim to have paid incentives for traveling certain routes at certain times.

Faced with a Zero Emission transportation policy, Fordhamopolis West is faced with the challenge of completely breaking away from orthodox transportation methods such as the diesel and gas powered engine. While this appears to be a daunting task, the transportation policy makers of Fordhamopolis West are both innovation and problem-solvers. They will make use of the porous absorbent paving as was described in the section titled 'Water.' They will work with those in charge of energy collection and distribution to determine the amount of power that will be allowed to be allocated to power electric modes of transit such as the Maglev trains.

Social Benefits and Citizen Wellness

Aside from the wellness benefits of clean water, healthy food, sanitary living conditions, and safe transportation, there are a variety of other wellness initiatives in Fordhamopolis West that we would like to discuss. Public schooling, free health care, and multiple job opportunities will allow this city to flourish. With an emphasis on health, no fast food chains will be permitted in the city; only wholesome food options will be available and will be equally accessible to all economic classes. Strategic city planning will allow for recreational parks to be within a ten minute walk from every residence. All sidewalks will be adorned with greenery and trees to encourage the local wildlife into the city realm and foster a connection to nature. The ultimate

goal of Fordhamopolis West is to be an urban environment that embraces natural components through symbiotic relationships and interconnected systems.

It should be restated that everything that a citizen of Fordhamopolis West could possibly need will be available inside the city. Following the insight of Jane Jacobs, all buildings would be mixed-use. In nature, life is not siloed into different sections; therefore, it does not make sense for buildings in Fordhamopolis West (or in any city, for that matter) to have simply one use. This will allow the energy of life to be integrated and to flow freely without disruption.

Fordhamopolis West need not be the first example of a city that designs in this fashion. Pasona O2 is a supreme example of integrating mixed-used buildings into the city landscape. Underground the Tokyo-based Japanese recruitment company, Pasona, exists 1000 square meters of underground farmland space in their Otemachi headquarters (Figure 6-A).[73] Here, urban farming is showcased to the public--underground an office building! As described by Kono Designs, the firm that designed the farm:

> During the 4 years of its operation, Pasona O2 promoted and educated its employees and wider public community to new underground farming technologies. Pasona O2 also provided seminars, lectures programs and relaxation space to bring urban dwellers an opportunity to appreciate rural natures and importance of farmland and agricultural industries. With both local and international media coverage, over 70,000 people visited O2, including prime minister of Japan at the time and other prominent public figures.[74]

What is particularly relevant in this section about Pasona O2 are the seminars, lectures, programs, and relaxation space that Pasona O2 provided for the public. This acknowledges an effort toward citizen wellness and will be replicated in Fordhamopolis West.

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[73] "KONO DESIGNS - Pasona-O2."*KONO DESIGNS - Pasona-O2*. Web. 01 Apr. 2016.
[74] "KONO DESIGNS - Pasona-O2."*KONO DESIGNS - Pasona-O2*. Web. 01 Apr. 2016.

Employment within Fordhamopolis West will consist of a variety of careers, most of which will take advantage of the innovative approaches to city living. In addition to the traditional careers that will be offered throughout the city, such as teaching positions, business sector jobs, and city governance, each of the previously mentioned sections will provide various job opportunities for those who reside in the city. These job opportunities will consist of harvesting, maintenance, and distribution within the urban farms in addition to overall educational outreach to the community regarding this method. Other careers will include operations management and maintenance within the departments working with waste management, transportation, electricity production, and water purification. Closely working with the major departments which make this city unique will allow residents of Fordhamopolis West to take an active part in its overall mission to become a city based on the principles of ecosystems.

Work hours within Fordhamopolis West will be restricted to one's place of work. Following the controversial bill which is in the process of being passed in France, those within this city will not be required to respond to emails, phone calls, or other means of communication from work once they have arrived at home. In an effort to maintain this balance between work and leisure, this "right to disconnect" will prevent people from feeling obligated to respond to work-related messages.[75]

Healthy and enjoyable atmospheres will be encouraged at work to foster increased productivity as well as overall happiness during the work day. As a work day progresses, the average amount of productivity among workers tends to decrease as oxygen levels within offices

[75] VIdon, Maya. "French Weigh 'right' to Disconnect from Work Emails at Home." USA Today. March 29, 2016. http://www.usatoday.com/story/news/world/2016/03/25/france-technology-time-off-work-emails/82070906.

plummet. In an effort to combat this trend, a variety of plants should be introduced into the workplace. Companies such as *Interior Plantscapes* work towards the beautification of offices with this intent in mind. In addition to increasing productivity, introducing plants into an office provide a happier workplace and creative tendencies for employees.[76] Office configurations and designs should all be based upon 300 sq ft. per person in a given area.

Education is integrated throughout Fordhamopolis West, but it will also include formal education centers. The education system will consist of two elementary schools, two middle schools, and one large high school which will cater to the entire city. These public schools will be diverse and scattered throughout the entire city so that there are no economic boundaries which arise from differing public school systems. Based upon a 25x25 foot classroom with 12 people, 100 sq ft. should be allotted to each student in a school.

Furthermore, the city will serve as an educational opportunity for the city's residents. The innovative methods used within the city for efficient water supply, electricity generation, waste management, transportation, and food production will be open to the public to increase knowledge regarding these topics. Not only will these practices be taught within the schools to educate youth about the importance of environmentally-friendly practices, but field trips to these offices and centers will also be required. City residents will have the opportunities to visit these areas as well in order to develop better understandings of how their city works. Education will not be something segmented off for the wealthy, nor will it end after high school or even higher education. The citizens of Fordhamopolis West, much like the citizens who visited Pasona O2,

[76] "Interior Plantscapes - Interior Plantscapes, Urban Plantscapes, Holiday Plants, Green Walls and Green Roofs, Corporate Gifts, Plant Leasing." Interior Plantscapes - Interior Plantscapes, Urban Plantscapes, Holiday Plants, Green Walls and Green Roofs, Corporate Gifts, Plant Leasing. 2015. Accessed April 02, 2016. http://www.interiorplantscapes.com/plants.html.

will be so intrigued by their community that educational programs will be commonplace and well-attended. As such, the citizens of Fordhamopolis West will not be removed from the inner workings of their city that many citizens of today's developed world take for granted; rather, they will be highly aware of where their food comes from, how their water is purified and distributed, and how their energy is generated and made available. The citizens of Fordhamopolis West will live with gratitude every day simply because they will be informed and aware citizens. Some of the children in Fordhamopolis West may even go on to "share the wealth" replicate the bounty of their city elsewhere in the world.

Based upon typical New York City apartments which are generally 900 sq ft. and shared by two people, 450-500 sq ft should be provided for housing complexes within Fordhamopolis West. Our calculations of 2,500 sq ft ground area per person and 150 sq ft per person in terms of buildings, provide us with the average height of buildings within the city to be 16.6 floors. While the overall height will vary based on the usage of building, we assume that many of the housing complexes will be of this stature.

Within Fordhamopolis West, all residential housing units will be integrated. That is to say no "low-income" housing units will exist separately. Rather, all housing will be integrated so as not to promote separation among socio-economic divides. "Luxury" housing will not exist in this city since all housing will fall under this category. Through this integration among housing, we hope to encourage diversity and relationships which can be cultivated through the sharing of residential space.

Fordhamopolis West will also include a variety of indoor and outdoor parks (including, but not limited to, the green roofs) that will be available for all to work, play, and relax in. The

plants in these parks will help to absorb extra water in the former Manila and will be the "lungs" of the city. Moreover, parks will be in a close proximity to every place of residence to ensure that all citizens have equal access to park amenities. We propose having parks located within a five to ten minute walk from every home. This enables all members of this city to actively engage in outdoor activities.

The parks within Fordhamopolis West will take on a variety of forms including traditional green spaces, areas of recreational sports, playgrounds, and gardens. Park designs will foster creative placemaking through the incorporation of cultural identities specific to a given neighborhood. "In creative placemaking, partners from public, private, non-profit, and community sectors strategically shape the physical and social character of a neighborhood, town, city, or region around arts and cultural activities. Creative placemaking animates public and private spaces, rejuvenates structures and streetscapes, improves local business viability and public safety, and brings diverse people together to celebrate, inspire, and be inspired."[77] This will serve as a model for the design of parks as well as for the entire design of the city.

Similar to New York City's various park activities throughout the summer months, these parks in Fordhamopolis West will also offer opportunities for activities which encourage learning, fitness, and community engagement. Following the idea that the city should be an educational wonderland, park activities will incorporate guided nature walks, urban agriculture classes, and other seasonal workshops. In the warmer months, free yoga, pilates, Zumba, and other fitness classes will also be provided. Through all of these activities and opportunities for learning and fitness, the Fordhamopolis West citizens will be able to come together to create

[77] Markusen, Ann, and Anne Gadwa. *Creative Placemaking*. Report. Washington DC: National Endowment for the Arts, 2010.

strong community ties regardless of age, socio-economic background, or race. These initiatives will level the playing field for citizens of every background to elevate Fordhamopolis West to an equal and high standard of living never before witnessed.

Fordhamopolis West will also boast an extensive variety of restaurants and nightlife. Restaurants will include cuisines from many different cultures showcasing the wide range of ethnicities present within the city. All restaurants will be required to source their food as locally as possible in order to maintain Fordhamopolis West's mission. Furthermore, there will be some local bars, theaters, and nightclubs for those interested in nightlife to responsibly enjoy.

In order to develop a comfortable environment for those in the city, we have developed the following square footage per person in each third place.

Gyms: 1 to 50 sq ft
Spas: 1 to 100 sq ft
Cafes: 1 per 100 sq ft
Bars: 10 sq ft
Night Clubs: 25 sq ft
Theaters: 10 sq ft x 2=20 sq ft

In total, 495 sq ft should be designated per person when constructing the third places within Fordhamopolis West.

Conclusion

Looking forward, Fordhamopolis West seeks to transcend its current status as a thought experiment and become a beautiful, enviable home for its 100,000 citizens. Following patterns originated by nature, the city will be able to thrive as part of the fabric of the surrounding

ecosystems that form the Olympic Peninsula. While this is certainly the most desirable outcome, it is also the most necessary, as recent climate events have made abundantly clear.

Human activity has produced an unprecedented level of change to the Earth's climate, which in turn has placed the resources that humans among all other life rely on for survival at risk. In the state of California and elsewhere, droughts and shortages of other necessary resources, coupled with the demand for said resources caused by industrial agriculture, are creating crises in which local ecosystems are disrupted beyond the point of restoration. This creates an atmosphere in which humans and nature are forced to compete. In addition, the exponential rate of growth experienced by the human population suggests that these circumstances are unlikely to change, and in fact will only become proportionally more dire. This seems to hold true unless certain entrenched human behaviors are changed drastically. Without at least cursory consideration for the damage done by industrial sprawl, this prosperity is not merely unsustainable, but doomed (an analogous scenario can be observed in Dr. Seuss's *The Lorax*).[78]

It is the goal of Fordhamopolis West to affect a drastic shift in contemporary and future understandings of how a city can and should function with regard to its citizens and its surrounding environment. While it remains on this page, however, this goal can only ever exist in the abstract. The responsibility to affect real change rests with all of the Earth's inhabitants, but especially those with the power to do so swiftly and effectively. This, after all, is the purpose of this very proposal: to lay out, in detail, a roadmap for those who can create change but are at a loss when considering where to start. Once started, hopefully, the quality of life enjoyed by the

[78] Dr. Seuss, *The Lorax* (New York: Random House, 1971).

inhabitants of Fordhamopolis West and the unscathed beauty of its surrounding environment will become a beacon for other cities and their planners, lighting the way to a new, sustainable future of living in harmony with nature rather than attempting to compete with or dominate it.

Appendix

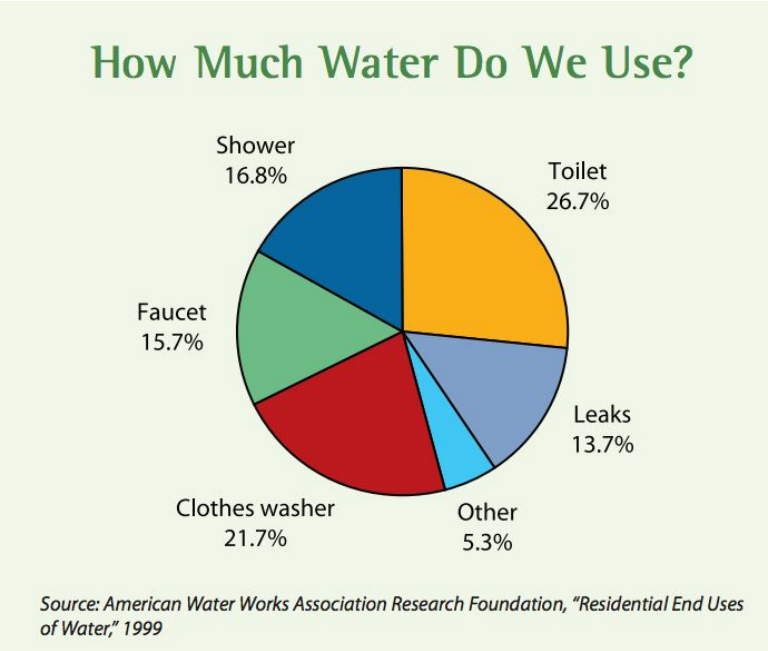


Figure 1-A: Dissection of Water Use by Residential Consumers

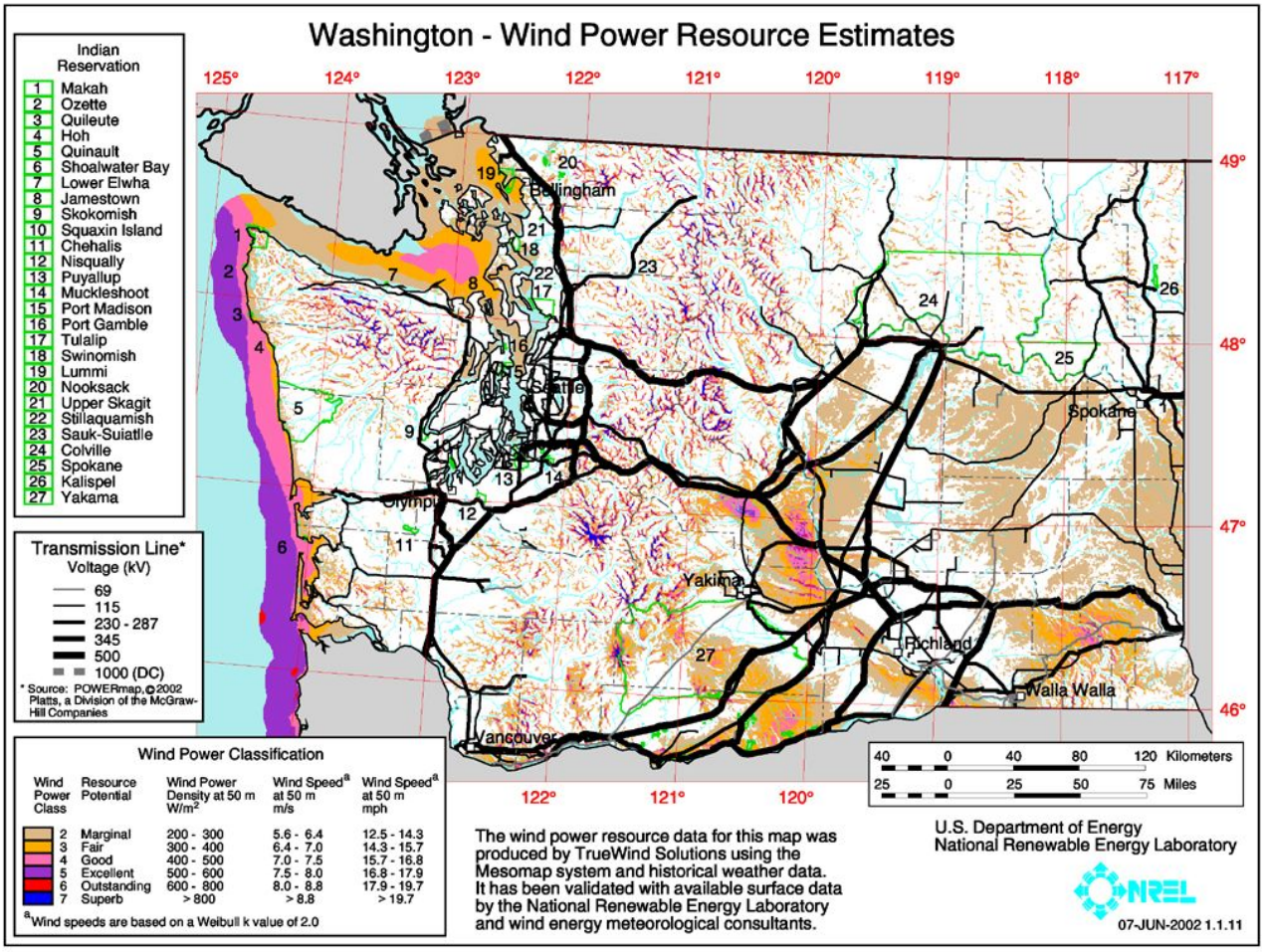


Figure 2-A: Wind speeds, wind power resource estimates, transmission lines, and Indian reservations within the State of Washington

Figure 2-B: Comparing energy consumption and production			
	New York, NY	**Baltimore, MD[79]**	**Fordhamopolis, WA**
Population (2014)	(2015) 8,491,079	(2014) 622,793	(projected) 100,000
Land area (sq mi)	304.8	80.9	1.00
Population density	27,858	7,698	100,000
Number of households (2010-2014)	3,095,931	242,212	[80]38,760
Mean household size	2.74	2.57	2.58
Mean annual electricity usage per capita (kWh)	2,627	5,074	2,627
Mean annual household electricity usage (kWh)	6,804	12534	6,778
Annual output for feasible reliance on wind (GWh)		3,036	263
Corresponding Primary Wind Farm	**n/a**	**MD Wind Energy Area**	**Fordhamopolis Wind Farm**
Number of turbines	-	80-125	50-78
Nameplate power rating (MW)	-	5	8
Projected capital cost of installation per turbine[81]	-	$9.700,000	$15,520,000
Projected total capital cost of installation ($ million)	-	$776-$1,212.5	$776-$1,212.5
Estimated total annual output (GWh)	-	1,577-2,464	1,577-2,464
% of city powered	-	52%-81%	600%-937-

[79] Only counting Baltimore households that would receive power from the Maryland Wind Energy Area if it were to solely power Baltimorean households.
[80] Derived from dividing projected population of 100,000 by mean household size of 2.58.
[81] $1,940/kWh. "The Cost of Wind Energy in the U.S." *The American Wind Energy Association.* Web. 22 Apr. 2016.

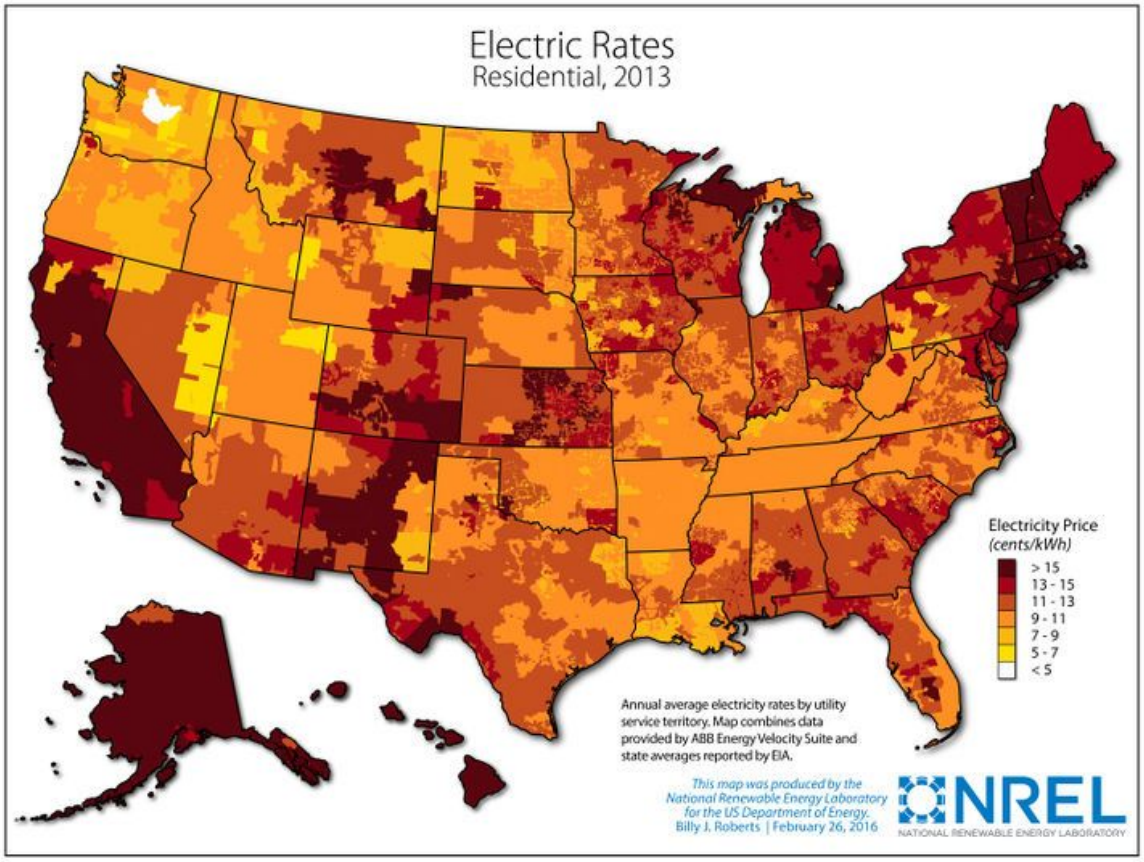


Figure 2-C: Electric Rates for Residential Consumers across the United States

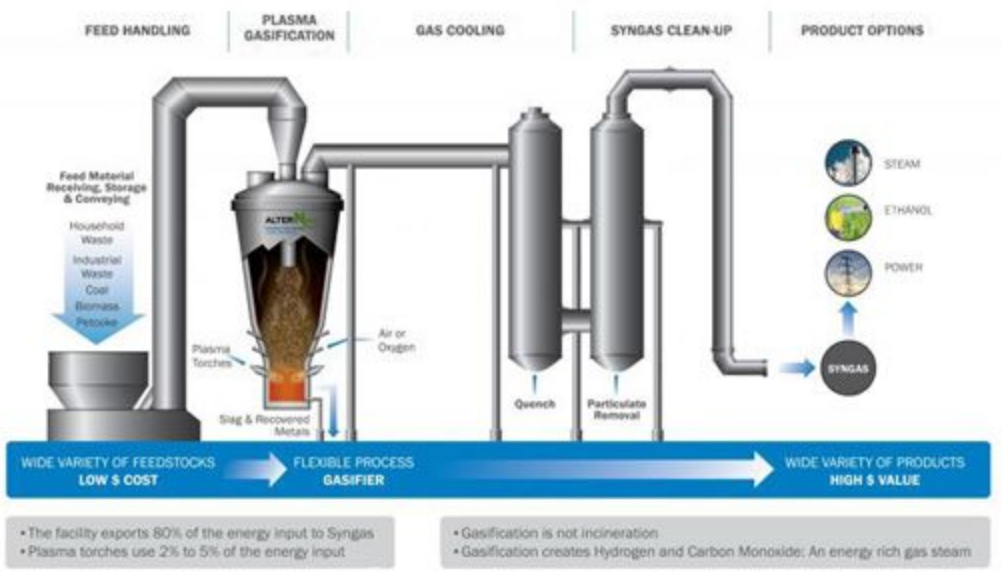
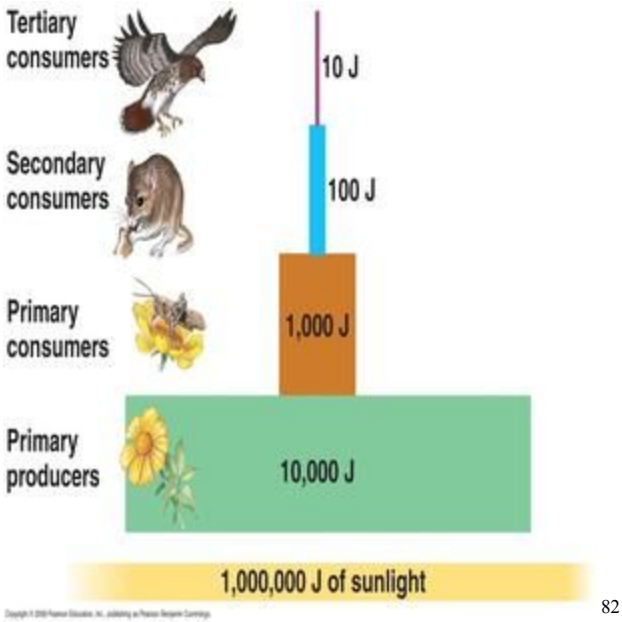


Figure 3-A: Plasma Arc Gasification



[82]

Figure 4-A: Trophic Levels

[82] "Home." *Chsibbio* -. Web. 06 May 2016.

Figure 6-A: Pasona O2

"KONO DESIGNS - Pasona-O2."*KONO DESIGNS - Pasona-O2*. Web. 01 Apr. 2016.

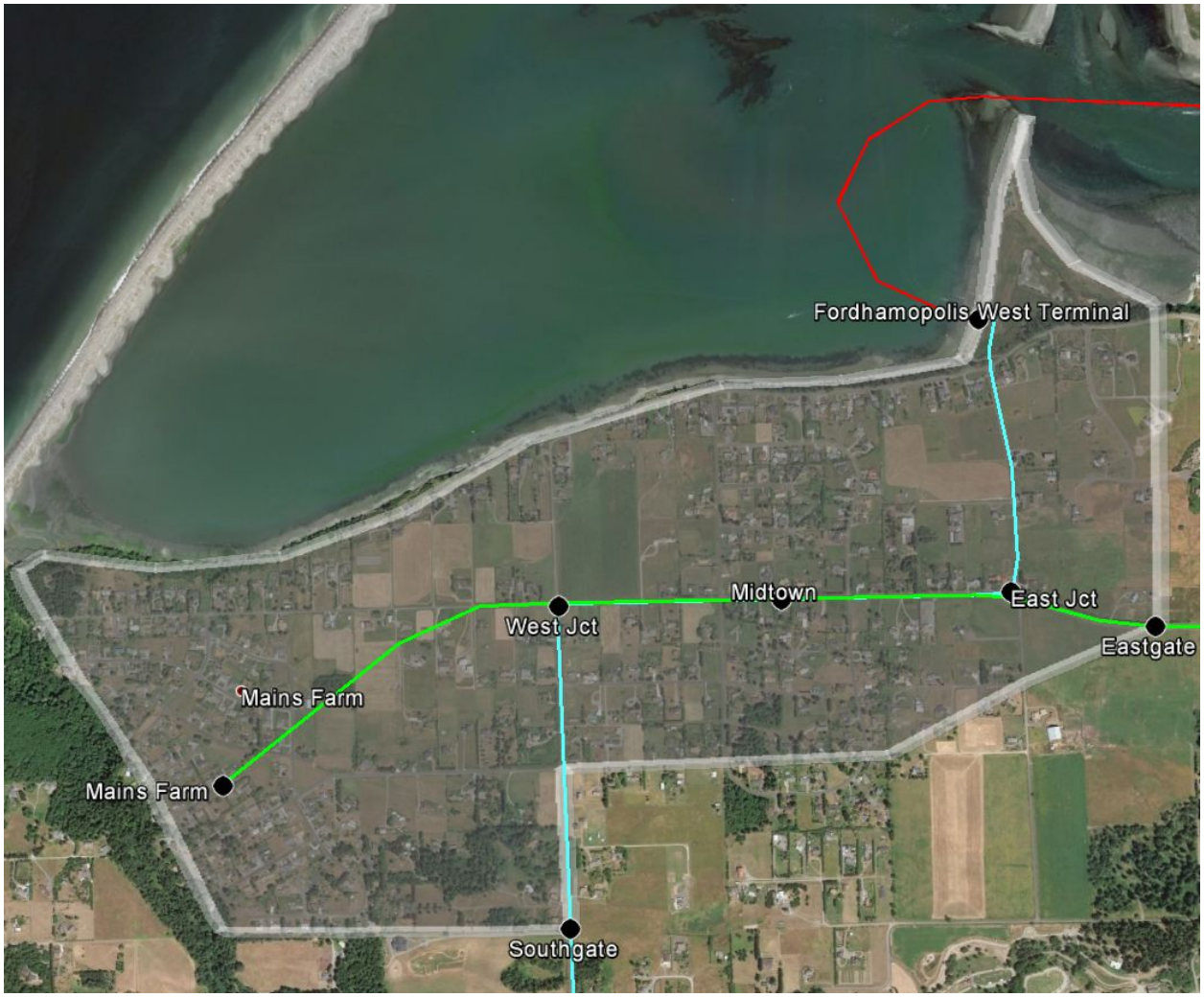


Figure T-33: A transit map for Fordhamopolis West. Ferries to Victoria and Edmonds in red. Maglev lines in blue and green. City land borders outlined in faded white.

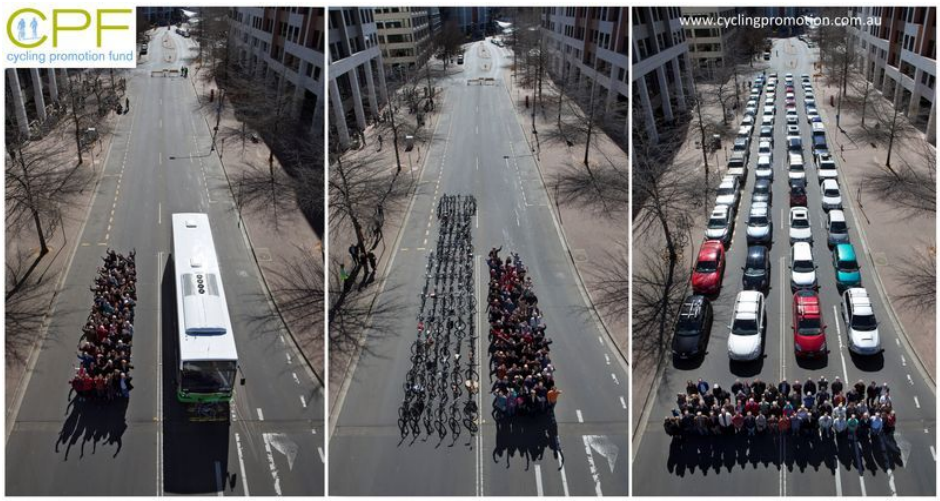


Figure T-34: A physical representation of 69 people fit onto different modes of transportation--bus, bicycles, and cars. Walker, Jarrett. "The Photo That Explains Almost Everything (updated!) — Human Transit." Human Transit. September 21, 2012. Accessed May 06, 2016.

Figure T-38: Sample cross-sections of Fordhamopolis West's local streets in midblock settings

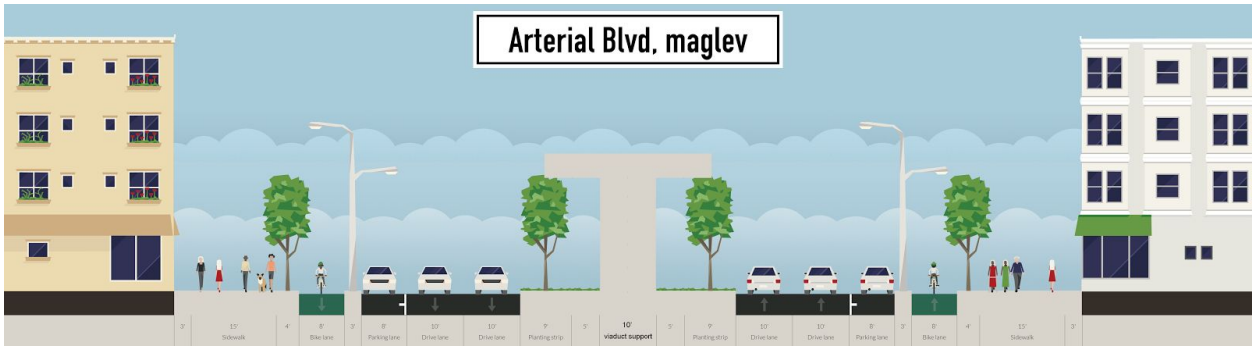
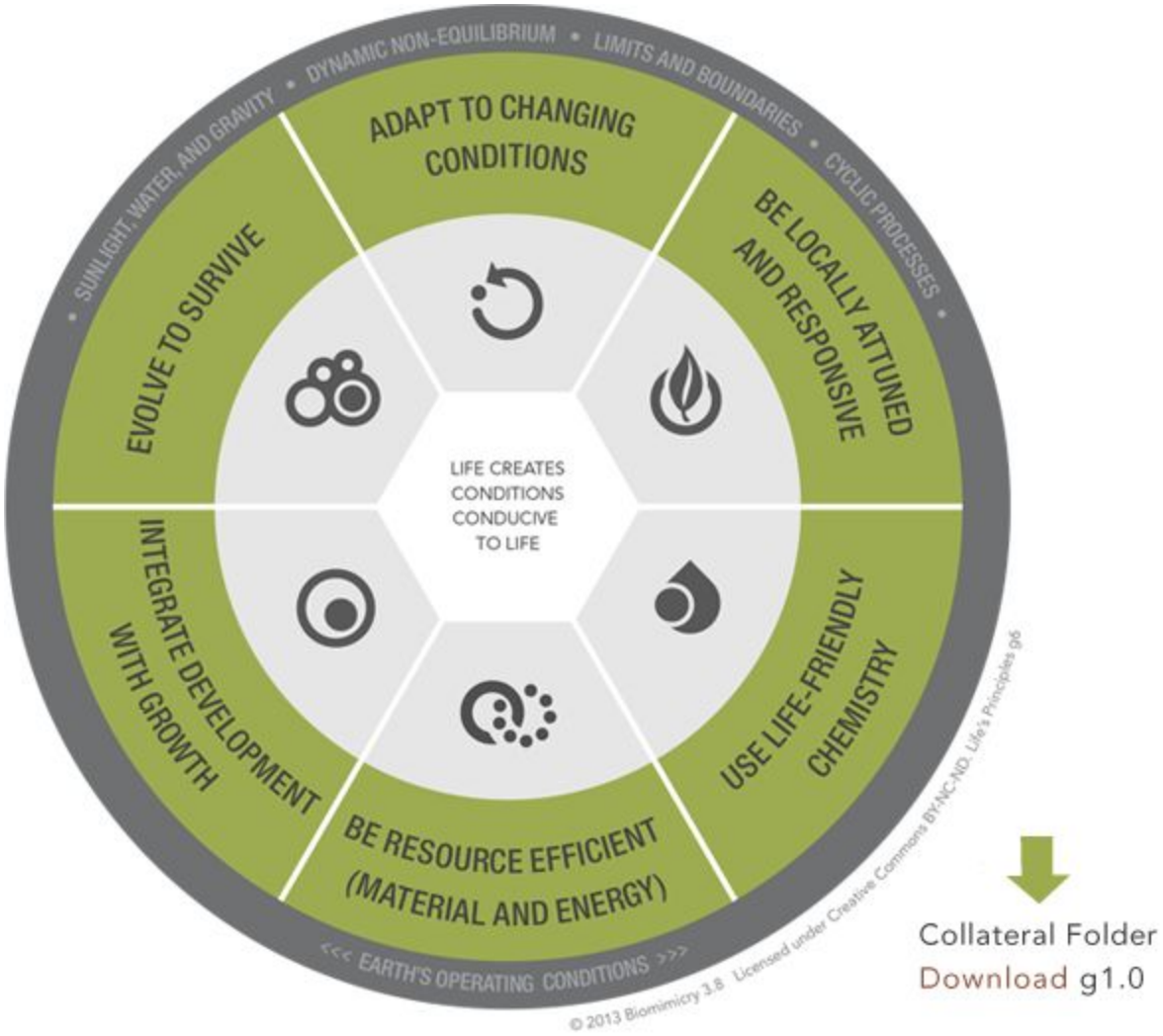


Figure T-39: Sample cross sections of an arterial with a maglev viaduct in the median.



- **Fordhamopolis West seeks to follow Life's Principles to create a sustainable, resilient, and redundant city.**