

Sustainability Plans



SIGNATURE PAGE

Juva Life

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Sustainability Plan

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Preparation Date:

March 6, 2020

APPROVALS:

A handwritten signature in black ink that reads "Sylvia Fontes, CIH".



Sylvia Fontes, MS, CIH

March 6, 2020

A handwritten signature in black ink that appears to read "Cliff Nichols".

Cliff Nichols

March 6, 2020



2020 JUVA LIFE SUSTAINABILITY PLAN

Juva Life provides consistent, rigorously-tested Cannabis products and exceptional customer service through a honest, diverse, and expert staff. Juva Life is dedicated to providing a safe environment to both its staff and the community.

The responsibility of sustainability and environmental stewardship belongs to all users of a facility. A company will not only be judged on the quality of their goods and services, but also on their contributions to society and the care they show people and the environment (both inside and outside the organization). Competencies associated with environmental stewardship involve the need for managers to be able to plan, manage, and support Juve Life's commitment to protecting our resources and to oversee its commitment to sustainability of the built and natural environments. Juve Life will measure our performance success not only on the traditional bottom line, but also by maintaining harmony between society, the broader economy, and the built and natural environments. Sustainability efforts can have a large impact on our economic bottom line.

Project Sustainability

The literature suggests a large number of factors affect project sustainability. Factors that increase the likelihood of sustaining a project relate to:

- project design and implementation.
- the host organization.
- the broader community.

Recordkeeping

Additional steps may increase the likelihood of maintaining and meeting sustainability goals.

- Keep thorough and detailed records of sustainability and safety efforts.
- Good record keeping and reporting will allow Juve Life to quickly and efficiently showcase that we are in compliance with state regulations.

Records will promote quality assurance, may protect Juve Life in case of a legal investigation, and may protect public health in the event of a recall. Records will include:

- documenting each batch/lot of products sold.
- packaging and labeling procedures.
- copies of Juve Life's sanitation program.
- qualifications of the quality assurance person.

Worker Safety

Make worker safety a priority as safety training reduces healthcare costs while motivating employees to become more involved in projects such as a sustainability project.



Community Support

Ethnically and culturally diversified businesses gather more community support than less diverse businesses. Community support is integral to grassroot movements such as making a cannabis company sustainable. Environmentally sustainable projects are more likely to succeed with community backing when compared to projects without support (Bullard, 2015). The Mountain and Plains Education and Research Center anonymously surveyed cannabis workers across Colorado. A majority of industry employees are caucasian males below the age of 30 (Walters, 2017). Juva Life plans to hire local, diverse populations when recruiting for new hires. Consider creating a public forum to obtain community involved while simultaneously addressing any concerns or questions the public may have. Involving the community also completes the three goals of agricultural sustainability: providing environmental benefits, economic benefits, and social benefits.

Sustainability Matrix

The Matrix below identifies the sustainability initiatives and objectives that Juva Life projects need to target in order to build the potential for sustainability into our organization as a whole. Juva Life will seek to incorporate these sustainability objectives into our everyday operations and project plans during the development phase, and continue to address them during the implementation phase. Juva Life will set performance indicators to match with targets and measure them periodically with report cards. Juva Life will consult with utility companies and be sure we apply for rebates and incentives associated with our efforts.

The Matrix is a working document and will be used to track progress, and can continue to be developed as we identify new initiatives while working towards our sustainability goals. Studies have shown indoor air quality (IAQ) levels to be two to five times worse than outside air quality, and it has been estimated that up to 30% of buildings have IAQ problems. Therefore, IAQ issues may be added to our initiatives once our facility is complete and operations begin.

(Bullard, Robert. 2015. Environmental Justice in the United States. International Encyclopedia of the Social and Behavioral Sciences, Second Edition.)

(Walters, Kevin, Fisher, G., Tenney, L., & Kraiger, K. 2017. Work and Well-being in the Colorado Cannabis Industry. Mountain and Plains Education and Research Center.)

NOTE: All items indicated in 'bold. text throught the tables provided below are initiatives that will be implemented within the first year of operation.



WATER CONSERVATION

Sustainability Initiative:

Cannabis cultivation is a resource-intensive industry. Water and energy are the largest contributors to the industry's environmental footprint.

Juva Life's estimated water usage is provided below.

Activity	Usage	Details	Estimated water usage (gallons/day)
FogCO	1.8 gpm flow rate	12/day operation	1,296
Irrigation	0.5 gal/plant/day	6,776 sf flowering canopy 1452 sf vegetation canopy 2 plants/sf flower	4,840
Reverse Osmosis		Recovery rates 4 parts product / 1 part waste water (80% efficiency) 4,840 gals/0.8	6,050
Condensate Recovery pumps / recycle		3 Agams pumps x 8 gallons per hour x 12 hours/day 12 hours/day	(288) Recycled
Total Water Usage Per day			7,346
Notes:			

Reverse osmosis is a common water treatment method in the cannabis industry, but the treatment method produces a significant amount of waste water. Models vary in waste water production from a 1:1 ratio to a 1:3 ratio (one liter of usable water is produced for every three liters of waste water produced) (Anderson, 2018). We are using an reverse osmosis (RO) system by HydroLogic called Hyper Logic that operates up to 3:1 ratio, which is far superior to industry standards. Juve Life also has low volume drip irrigation with very little to no water run off that is controlled by our Anderson in-line filtration system. Water use will be tracked once a baseline has been established, a clear target reduction goal will then be defined, and steps to attain said goal will be document in this program.

Benefits:

Reusing water increases water quality. Other benefits include: increased diversion of water to sensitive ecosystems, decreased water scarcity, and decreased pollution.

(Anderson, Brittny. 2018. Sustainability at the forefront of Canadian Cannabis Policy and Regulation. Cannabis Legalization and Regulation Secretariat.)

(EPA. Water Reuse and Recycling: Community and Environmental Benefits. <https://www3.epa.gov/region9/water/recycling/> Site accessed on October 21, 2019)

(Silverberg, Carl. 2019. Environmental Sustainability in Cultivation: Part 1. Cannabusiness Sustainability)



Organizational Goals	Sustainability Objective	Sustainability Actions	Responsible Person	Targets	Current Status
Operate Efficiently	• Reduce water use • Conserve water • Re-use water	Suggestions: • Utilize automatic irrigation systems that waters crops according to growing medium moisture content. • Use low volume drip irrigation to reduce water run off. • Tensiometers may be used to monitor growing medium water tension and growing medium water condition (Anderson, 2018). • Water greenhouses in the mornings and evenings as cooler temperatures allow for slower evaporation rates. • Capture reverse osmosis waste for recycling. • Use efficient RO system. • Consider using additives such as Hydrogel products that assist in retaining moisture, reducing irrigation frequency. • Supplement water use with Grey Water – grey water is reuseable, nonpotable water from industrial, commercial, and residential sources. Grey water is typically used onsite for irrigation purposes (EPA, 2019). Other suggested initiatives: • Install waterless urinals • Install automatic flushers • Install low-flow fixtures and aerators		% decrease	% complete



EMISSIONS REDUCTIONS

Sustainability Initiative:

The carbon emissions created by cannabis cultivation may be offset by cannabis' ability to sequester carbon. The carbon sequestration potential of cannabis crops is on par with U.S. native trees and regenerating forests (Young, 2005). Cannabis potential is still below the potential of a managed plantation. However, greenhouse and outdoor cannabis operations require less energy when compared to indoor growing facilities (Young, 2005), making greenhouse/outdoor cannabis facilities the preferred, sustainable growers. Juve Life will utilize a blackout method within the greenhouse. Daylight will be used, as available to provide up to 12 hours of light to the plants. The blackout will be used to control to 12 hours. If 12 hours of daylight isn't available, lighting will be used as a supplement.

Composting reduces carbon dioxide, methane gas, and nitrous oxide emissions. Landfills are the largest producers of methane gas on Earth. Recycling, composting, and using materials efficiently will prevent the cannabis industry from adding to the landfill, thus reducing emissions.

Juva Life will not be performing carbon dioxide enrichment in the cultivation operations, reducing the amount of carbon dioxide typical of other cannabis operations. In addition, Juve Life will use a top-feed drip system for irrigation which minimizes water usage and therefore reduces runoff as well. This reduces the amount of runoff that needs to be collected and treated, further reducing energy usage. Lower water usage also reduces the energy needed to run the dehumidification process. Controlling humidity is essential to increase yield and reduce potential mold and other issues related with excess humidity.

Emissions will also be reduced via fleet management. The fleet greening plan includes the use of route management software (e.g. Onfleet, Samsara) which aids in planning route of travel and trips. This reduces unnecessary trips as many deliveries are included in one trip. It also, therefore, reduces the miles travelled. Drivers will be trained to drive the speed limit to provide for more efficient fuel usage. Drivers will turn off the engine when stopped for more than two minutes to further reduce fuel usage and subsequent emissions. Company vehicles will gradually be converted to hybrid vehicles, where possible.

Benefits:

Reducing emissions prevents waste from being added to the landfill, reduces costs to local governments to dispose of waste materials, improves air quality, increases energy efficiency, and improves the health of both employees and the public.

(Antos, Danielle. 2019. Sustainable Plastic Packaging Options for your Cannabis Products. CannabisIndustryJournal.com. Site accessed on October 21, 2019.)

(Young, Erin. 2005. Revival of Industrial Hemp: A systematic analysis of the current global industry to determine limitations and identify future potentials within the concept of sustainability. *Lund University*.)



Organizational Goals	Sustainability Objective	Sustainability Actions	Responsible Person	Targets	Current Status
Reduce Carbon Footprint	- Reduce carbon footprint - Reduce greenhouse gas emissions - Reduce air pollution	Suggestions: - Change manufacturing process – High density polyethylene (HDPE) bottles and closures may be produced from ethanol (sugarcane) rather than traditional fossil fuels (Antos, 2019). - Use pressure sensitive and shrink labels to eliminate the need for flame treatment – Flame treatments are traditionally used to make water-based adhesives, inks, and coatings bond with HDPE (Antos, 2019). Reduce waste by recycling and reusing products. Order supplies in bulk to reduce packaging. Purchase products made with post-consumer recycled content, wherever possible. Use cloud based solution to reduce internal need for printed paper. - Track Carbon Emissions – track electrical use to help gauge carbon output. - Reuse left over water from the infusion process. - Compost the “unusable” residual waste left behind during the reclaiming process. Utilize designated composting bins for: compostable paper, food scraps and non-cannabis plant debris. Utilize only compostable tableware. Educate staff to put this in designated compostable bin. Other suggested initiatives: Use teleconferences or Web Conferences rather than traveling to face-to-face meetings.		% decrease	% complete



		• Provide incentives to employees who use alternative transportation. • Use hybrid or alternative fuel fleet vehicles. • Create a carpool or Vanpool program. • Introduce flexible work practices to reduce peaks in energy usage. • Implement on-site amenities, such as dry cleaning or postal services to reduce travel.			
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RECYCLING

Sustainability Initiative:

Cannabis cultivators in the State of California are not required to render their waste unusable and unrecognizable (Cal Recycle, 2018). Cannabis waste is labeled as organic waste as long as it has not been combined with hazardous or toxic materials (Cal Recycle, 2018). Therefore, some cannabis waste may be reused.

There is potential to recycle packaging and manufacturing materials in the industry. Juva Life will require sustainable practices throughout the supply chain. Juva Life will work toward minimizing raw material use, purchase in bulk, and source locally, as able.

Benefits:

Reducing plastic use prevents plastic from entering the ocean, improving water quality. Reducing waste reduces carbon emissions, thereby, improving air quality.

(Antos, Danielle. 2019. Sustainable Plastic Packaging Options for your Cannabis Products. CannabisIndustryJournal.com. Site accessed on October 21, 2019.)

(Cal Recycle. 2018. Cannabis Waste. <https://www.calrecycle.ca.gov/swfacilities/compostables/cannabis> Site assessed on October 21, 2019.)



Organizational Goals	Sustainability Objective	Sustainability Actions	Responsible Person	Targets	Current Status
Allocate resources to maximize utilization	- Reduce plastic use - Reduce waste - Reuse	Suggestions: - Reduce product packaging size for products to reduce waste. - Use recycled polypropylene (PP) bottles (Antos, 2019). - Make packaging recyclable. - Use reuseable sieves during extraction or recycle disposable sieves. Recycle paper, plastic, glass, aluminum, rechargeable batteries; install signage. - Recycle boxes and other cardboard materials. - Recycle pallets, pallet wrap and all other wood debris. - Recycle toner and inkjet cartridges. - Properly dispose of all batteries that cannot be recycled. - Recycle green waste (i.e. Compost food and landscape waste). Recycle and reused products, to the extent feasible.		% decrease	% complete

ENERGY CONSERVATION & EFFICIENCY

Sustainability Initiative:

Energy demand is the largest contributor to the cannabis industry's environmental footprint. Lighting alone contributes to 80% of indoor cannabis total energy consumption (Sweet, 2016). Combining solar panels with LED lights will conserve the most energy for a sustainable future. In areas where renewable energy is not a viable option, LED lights with optimal light scheduling is necessary to achieve long-term sustainability.

One of the most challenging problems for commercial growers or plants is fungal disease. Fungal threats are ubiquitous and with the right environmental conditions a crop can be severely damaged or completely lost. When crop yield is compromised, economic inputs, including energy inputs, are in vain. The most energy intensive, and therefore, 'most polluting' crop or product is one that never makes it to the consumer market.

Securing yield is an energy saving practice in and of itself and controlling humidity secures yield. Humidity control in the Juva Life project is accomplished using a liquid desiccant technique developed in Israel for the greenhouse application. The Israeli inventor studied the greenhouse humidity problem and found the



mechanism that drives nighttime transpiration which is the source of high humidity at night. The environmental conditions that lead to fungal disease are present primarily during nighttime hours. The typical method of controlling humidity is to heat the greenhouse and purge the humidity with ventilation (exchange moist air for drier, outdoor air and heat it). This is a wasteful, escalating process since when the crop is heated, it transpires. Ventilation, or cooling, is used to remove this transpired humidity. Cooling must be offset by heating as heating creates transpiration. This is a continuous and escalating cycle that is disrupted with the Agam VLHC, which allows humidity to be absorbed by a hygroscopic, air filtering salt in a closed environment. By eliminating nighttime ventilation, or cooling, the cycle is disrupted leading to a large conservation of energy. The closed/dehumidified-by-absorption method reduces the required energy by more than 50%. Using the heat ventilation method leads to a heat loss rate of 8-10 W/m²C. The VLHC treated greenhouse requires 3-4 W/m²C.

If we consider all three zones of the greenhouse, or ~13,600 ft², in the Hayward, CA climate, the standard heat/purge method would require about 13,000 therms of heating per year. The VLHC equipped control requires about 5,100 therms of heating per year, or a ~8,000 therms annual savings. If we use values provided by the EPA, an avoidance of burning 8,000 therms saves about 43 metric tons of CO₂ emissions per year or the output of about six average homes using typical CO₂ generation rates for electricity production and the average home electricity consumption.

Juva Life plans to disperse supplemental lighting at the proposed rate of approximately half of a typical indoor grow, saving 277,521 KW hours. Sunlight will also be used in the green house, saving an estimated 774,450 KW hours. Thus, Juva Life's operations will save approximately 1, 051,972 KW hours. Details are provided below.

In Juva Life's greenhouse facilities, artificial lights will only be used to supplement energy from the sun rather than as a replacement. The greenhouse will use a blackout feature needed to control the amount of light the plants receive. Light fixtures will be dispersed at a rate of approximately half the rate of the typical indoor grow. Sunlight will be utilized as much as possible. Once 12 hours of light has reached the plants, the blackout system will be utilized to black out daylight. Artificial lighting will only be utilized when there is not 12 hours of daylight reaching the plants.

According to the National Conference of State Legislatures a typical 5000 square foot indoor cannabis cultivation facility uses 41,808 kilowatt-hours (kWh) of electricity per month or 100.34 kilowatt-hours per square foot per year. (Source: <https://www.ncsl.org/research/energy/electricity-use-in-marijuana-production.aspx>)

$$41,808 \text{ kWh per month} / 5000\text{sq.ft} = 100.34 \text{ kWh/sq.ft.}$$

Therefore, a typical indoor cultivation facility of Juva's size (13,250 sq.ft.) would use 1,329,494.40 kWh of electricity per year.

$$(13,250 \text{ sqft} \times 100.34 \text{ kWh/sq.ft}) \times 12 \text{ months} = 1,329,494.40 \text{ kWh/year}$$

To calculate the amount of kilowatt hours Juva will save by utilizing sunlight as the primary source we need to determine the ratio of energy savings. It is estimated that the San Francisco Bay Area gets 3,061.7 sunshine hours per year. Sunshine duration is a climatological indicator, measuring duration of sunshine in given period (usually, a day or a year) for a given location on Earth, typically expressed as an averaged value over several years. It is a general indicator of cloudiness of a location, and thus differs from insolation, which measures the total energy delivered by sunlight over a given period. (source: https://en.wikipedia.org/wiki/List_of_cities_by_sunshine_duration). The average sunshine duration per day is 8.388219 hours of sunshine per day.



$3,601.7 \text{ sunshine hours per year} / 365 \text{ days} = 8.388219 \text{ hours per day.}$

Juva's lighting controller will measure light levels and turn on and off supplemental lighting fixtures during the daylight cycle as needed. No supplemental lighting will be used during the night cycle. Therefore, Juva will save energy at a combined average rate of 0.5825152.

Flowering light cycle hours / avg. number of sunshine hours = rate of savings

$$12 / 8.388219178 = 0.699018265$$

Vegatative light cycle hours / avg. number of sunshine hours = rate of savings

$$18 / 8.388219178 = 0.466012177$$

Combined average rate of savings:

$$(0.699018265 \times 0.466012177) / 2 = 0.5825152.$$

Using the combined average rate of savings we can predict that Juva will save approximately 774,450.72 kWh per year.

Typical indoor yearly energy usage x Rate of Savings = Energy savings from natural light use

$$1,329,494.40 \text{ kWh/year} \times 0.5825152 = 774,450.72 \text{ kWh per year}$$

Juva will save additional electricity by dispersing lighting fixtures in the greenhouses at approximately half the rate of a typical indoor cultivation facility.

(Typical indoor yearly energy usage – Energy savings from natural light use) / 2 =

Energy savings from using fewer lighting fixtures

$$(1,329,494.40 - 774,450.72) / 2 = \text{additional } 277,521.84 \text{ kWh per year}$$

Therefore, Juva will save an estimated 1,051,972.56 kWh of electricity by utilizing their proposed greenhouse cultivation methods.

Energy savings from natural light use + Energy savings from using fewer lighting fixtures =

Total energy savings.

$$774,450.72 \text{ kWh per year} + 277,521.84 \text{ kWh per year} = 1,051,972.56 \text{ kWh per year}$$

Benefits:

Reducing energy use relieves pressure from the power grid without compromising the integrity of the product. It also reduces greenhouse gas emissions.

Utilizing the Agam VLHC method to control humidity, reduces energy usage and CO₂ emissions.

(Anderson, Brittny. 2018. Sustainability at the forefront of Canadian Cannabis Policy and Regulation. Cannabis Legalization and Regulation Secretariat.)

(Energy.gov. LED Lighting. Electricity and Fuel. Site accessed on October 21, 2019.)

(Quest. Energy Modeling. Energy Efficiency Modeling. <https://www.questrmg.com/energy-modeling/>. Site accessed on October 21, 2019.)



(Sweet, Sarah. 2016. The energy intensity of lighting used for the production of recreational cannabis in Washington State and implications for energy efficiency. Evergreen State College.)

(Walter, Jason. 2019. Making sustainability a California state of mind. Pacific Gas and Electric Company. <https://www.pge.com/en/mybusiness/save/smbblog/article/making-sustainability-a-california-state-of-mind.page>. Site accessed on October 22, 2019.)



Organizational Goals	Sustainability Objective	Sustainability Actions	Responsible Person	Targets	Current Status
Operate Efficiently	• Reduce energy use • Increase energy efficiency • Reduce CO₂ emissions	Suggestions: • Use Agam VLCH method for humidity control to reduce energy usage and CO₂ emissions. • Utilize interrupted grow light strategy. • Use LED lights – LED lights use 75% less energy and lasts 25 times longer than incandescent lighting (Energy.Gov, 2019). • Attach a quantum meter to the LED lights – LEDs only go on when the quantum meter drops below the minimum target. • Stagger light scheduling – Stagger lighting schedules to reduce peak demand (Brittney, 2018). • Properly sized, energy efficient heating and cooling system. • Utilize an energy recovery ventilation system - energy recovery ventilation systems condition incoming fresh air by using recycled waste energy from the exhaust air stream. The recovery ventilation system works with the HVAC system to both lower energy costs and to improve indoor environmental air quality (Walter, 2019). • Create an Energy Efficiency Model – Model predicts how much energy a building may use based on construction materials, the buildings mechanical systems, site-specific characteristics, occupancy, and local average climate conditions. The model will pinpoint areas of weakness and allow for corrections (Quest, 2019). Other suggested initiatives: • Use motion sensors, timers or other lighting controls. • Unplug chargers when not in use. • Use Energy Star equipment.		% decrease	% complete



		• Update insulation and/or windows. • Use programmable thermostats. • Tune up the HVAC and refrigeration yearly. • Set all computer monitors to turn off after 10 mins of inactivity.			
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RENEWABLE ENERGY

Sustainability Initiative:

Solar energy has the highest global potential to power the world. Juva Life will utilize greenhouses for growing our product. All greenhouses collect solar energy. Solar greenhouses are designed not only to collect solar energy during sunny days but also to store heat for use at night or during periods when it is cloudy.

Benefits:

Utilizing passive solar technologies will conserve water, improve air quality, and reduce green house gas (GHG) emissions.

(Kabira, Ehsanul, Kumarb, P., Kumarc, S., Adelodund, A., & Kim, K. 2018. Solar Energy: Potential and Future Prospects. Science Direct. 894-900.)

(Wiser, Ryan, Millstein, D., Mai, T., Macknick, J., Carpenter, A., Cohen, S., Cole, W., Frew, B., & Heath, G. 2016. The Environmental and Public Health Benefits of Achieving High Penetrations of Solar Energy in the United States. Lawrence Berkley National Renewable Energy Laboratory.)

Organizational Goals	Sustainability Objective	Sustainability Actions	Responsible Person	Targets	Current Status
Utilize Renewable Energy Sources	- Use less energy from traditional sources - Reduce carbon footprint	Suggestions: Create a passive solar design greenhouse – design the greenhouse for maximum solar efficiency, with the least amount of heat loss. - Research the Low Carbon Fuel Standard (LCFS) for credits.		% decrease	% complete



TOXIC MATERIALS/WASTE MANAGEMENT

Sustainability Initiative:

Minimizing waste and toxic materials is essential in promoting sustainability while still utilizing important chemical materials. Waste minimization refers to the use of source reduction and environmentally sound recycling methods to reduce toxic waste (EPA, 2016). Prevention is also a valuable tool in promoting sustainability.

Benefits:

Improving waste management and minimizing the use of toxic materials makes for a safer work place, improved indoor air quality, as well as a cleaner environment. In addition to preventing workplace injuries, spill and leakage prevention may help keep waterways clean and lower air pollution.

(EPA. 2016. Hazardous Waste Minimization. <https://archive.epa.gov/epawaste/hazard/wastemin/web/html/faqs.html> Site accessed on October 22, 2019.)



Organizational Goals	Sustainability Objective	Sustainability Actions	Responsible Person	Targets	Current Status
Reduce pollution and maintain safety	- Prevent toxic materials and chemical substances from becoming airborne, aerosolized, or made into dust. - Prevent toxic materials and chemical substances from running into sewers or waterways. - Recycle when applicable - Reduce toxic waste	Suggestions: Design and implement a comprehensive log of employee handling of chemicals. Keep commonly used personal protection equipment on hand – e.g, disposable booties, laboratory coats, appropriate NIOSH approved respirators (if needed), chemical-resistant splash goggles, chemical-resistant impervious gloves, beard nets, hair nets, and scrubs. Create a remote washing station or install a full shower. Keep sand, earth, or diatomaceous earth on hand in case of leaks/spills. Immediately inform authorities if a leak does occur. Keep drains covered in work areas to prevent toxic materials from going into waterways and sewers. Recycle waste packaging. Follow the EPA's waste minimization hierarchy: source reduction (waste prevention), recycling, energy recovery (converting waste into fuel), treatment, and disposal (EPA, 2016). Dispose of non-recyclable products via a licensed disposal contractor – WasteTracker. Use the Landfill/Incineration as a last resort.		% decrease	% complete