Advancing the Circular Economy
Lexicon of Concepts

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Air and Climate

Carbon Footprint whenever human activities involve the burning of fossil fuels, carbon dioxide is emitted. This waste will accumulate in the atmosphere, contributing to global climate change, unless it can be captured and stored by plants. The Carbon Footprint therefore measures the demand on biocapacity that results from burning fossil fuels in terms of the amount of forest area required to sequester these carbon dioxide emissions. It shows that the biosphere does not have sufficient capacity to sequester all the carbon we are currently emitting.

Carbon Intensity the amount of carbon by weight emitted per unit of energy consumed. A common measure of carbon intensity is weight of carbon per British thermal unit (Btu) of energy. When there is only one fossil fuel under consideration, the carbon intensity and the emissions coefficient are identical. When there are several fuels, carbon intensity is based on their combined emissions coefficients weighted by their energy consumption levels.

Criteria Pollutant a pollutant determined to be hazardous to human health and regulated under EPA's National Ambient Air Quality Standards. The Clean Air Act requires the U.S. Environmental Protection Agency to set National Ambient Air Quality Standards for six common air pollutants. These common air pollutants are found all over the country. They are particle matter, ground-level ozone, carbon monoxide, sulfur oxides, nitrogen oxides, and lead.

Downstream Emissions can be important to the manufacturer or the consumer, and may be scoped differently for each entity. For a manufacturer, downstream emissions are the individual or aggregate GHG emissions attributable to the distribution, use, and disposal of products. From the consumer's perspective, downstream emissions are emissions associated with disposal.

Greenhouse Gases water vapor, carbon dioxide, tropospheric ozone, nitrous oxide, methane, and chlorofluorocarbons (CFCs.)

Upstream Emissions can be important to the manufacturer or the consumer, and may be scoped differently for each entity. For a manufacturer, upstream emissions are the individual or aggregate GHG emissions attributable to the inputs and activities prior to manufacturing of products such as: material extraction, transportation of materials to manufacturing site, and other supply chain activities resulting in delivery of raw materials and supplies and energy/fuel/water to the manufacturing site. From the consumer's perspective, upstream emissions will include all of the above plus impacts of distribution to the point of purchase and to the product's site of use.

Circular Economy

Circular Economy is a generic term for an industrial economy that is, by design or intention, restorative and in which materials flows are of two types, biological nutrients, designed to reenter the biosphere safely, and technical nutrients, which are designed to circulate at high quality without entering the biosphere. In broader terms, the circular approach is a framework that takes insights from living systems. It considers that our systems should work like organisms, processing nutrients that can be fed back into the cycle – whether biological or technical - hence the closed loop or regenerative terms usually associated with it. General principles are:

- **Waste is food** biological and technical product components are designed by intention to be non-toxic, fitting within a materials cycle, designed for disassembly and re-purposing, and to be used again with minimal energy.
- **Diversity is strength** modularity, versatility, and adaptiveness should be prioritized in an uncertain and fast evolving world. Diverse systems are more resilient to external shocks than systems built simply for efficiency.
- **Energy must come from renewable sources** as in life, any system should ultimately aim to run on 'current sunshine' and generate energy through renewable sources.

Sustainable Return on Investment (SROI) is a methodology that identifies the initiatives that will best accomplish your project goals; optimize the total value of your project and position your project with the best possible business case for approval or funding. SROI determines the full value of a project by assigning monetary values to all of the costs and benefits—economic, social and environmental. These benefits are generally overlooked in a traditional economic assessment and therefore not revealed to stakeholders.

Triple Bottom Line expands the spectrum of values and criteria to account for organizational and societal success, beyond just focusing on financial outcomes, by integrating various measures of economic, environmental and social performance. The Triple Bottom Line is increasingly being recognized as a new framework for measuring business performance in the context of implementing sustainability initiatives. On a whole-economy scale, it can be seen as a way to internalize the true costs of depleting natural assets, and setting a course for accounting for and restoring public goods.

Clean Energy

Anaerobic Digestion a series of biological processes in which microorganisms break down biodegradable materials in the absence of oxygen.

Bioenergy consists of biomass-based transportation fuel or biomass-based commercial heat, industrial process heat or electrical power from cellulosic materials via gasification of other processes.

Biofuels fuels made from biomass resources or their processing and conversion derivatives, including ethanol, biodiesel, and methanol. Biomass means any organic matter that is available on a renewable or recurring basis including agricultural crops and trees, wood and wood wastes and residues, plants including aquatic, grasses, residues, fibers, and animal wastes, municipal wastes, and other waste materials.

Cogeneration also **c**alled Combined Heat and Power is production of electricity from steam, heat, or other forms of energy produced as a by-product of another process. Cogeneration raises the thermal efficiency of the power generating system by as much as 25-35%, significantly reducing power losses. Distribution losses represent steam heat lost in traps, valves, and steam pipes, and transmission losses in onsite fuel and electricity lines. In practice, these losses are very site-specific, and depend largely on plant size and configuration. Energy conversion losses occur in heat exchangers, preheat systems or other equipment where the transfer of energy from steam or other direct heat or cooling takes place, prior to delivery of energy to the process.

Combined Heat and Power also known as cogeneration is an efficient, clean, and reliable approach to generating power and thermal energy from a single fuel source. Since less fuel is burned to produce each unit of energy output, CHP reduces air pollution and greenhouse gas emissions. Typical CHP configurations include gas turbines or engines with heat recovery units or steam boilers with a steam turbine. CHP also has the potential to provide a range of benefits relative to grid resiliency, reduce power line losses and peak power demand management, and can help achieve Minnesota policy goals for energy efficiency, GHG reduction and renewable energy.

Distributed Generation generates electricity from many small, localized energy sources. Distributed generation reduces the amount of energy lost in transmitting electricity because the electricity is generated very near where it is used, perhaps even in the same building. This also reduces the size and number of power lines that must be constructed. Typical distributed power sources have low maintenance, low pollution and high efficiencies.

District Energy System a central energy conversion plant and transmission and distribution system that provides thermal energy to a group of buildings. Central energy systems that provide only electricity are not included. *District heat* is steam or hot water from an outside source used as an energy source in a building. The steam or hot water is produced in a central plant and piped into the building. The district heat may be purchased from a utility or provided by a physical plant in a separate building that is part of the same facility. *District chilled water* is chilled water from an outside source used as an energy source for cooling in a building. The water is chilled in a central plant and piped into the building.

Energy Efficiency means measures or programs, including energy conservation measures or programs, that target consumer behavior, equipment, processes, or devices designed to produce either an absolute decrease in consumption of electric energy or natural gas or a decrease in consumption of electric energy or natural gas on a per unit of production basis without a reduction in the quality or level of service provided to the energy consumer. (Mn HF 729 Article 12)

Energy Intensity a ratio of energy consumption to another metric, typically national gross domestic product in the case of a country's energy intensity. Sector-specific intensities may refer to energy consumption per household, per unit of commercial floor space, per dollar value industrial shipment, or another metric indicative of a sector. Improvements in energy intensity include energy efficiency and conservation as well as structural factors not related to technology or behavior.

Gasification a process that uses heat, pressure, and steam to convert hydrocarbons (e.g., biomass, coal or petroleum coke) directly into a gas composed primarily of carbon monoxide and hydrogen. A gasifier differs from a combustor in that the amount of air or oxygen available inside the gasifier is carefully controlled so that only a relatively small portion of the fuel burns completely. There are three primary products from gasification: hydrocarbon gases (also called syngas); hydrocarbon liquids (oils); and char (carbon black and ash).

Heat Pump (geothermal) a heat pump in which the refrigerant exchanges heat (in a heat exchanger) with a fluid circulating through an earth connection medium (ground or ground water). The fluid is contained in a variety of loop (pipe) configurations depending on the temperature of the ground and the ground area available. Loops may be installed horizontally or vertically in the ground or submersed in a body of water.

Micro-grid a local electric network with a collection of electric devices for local use and management, with a potential to increase reliability and efficiency.

Renewable Energy Sources the most common definition is that renewable energy is from an energy resource that is replaced by a natural process at a rate that is equal to or faster than the rate at which that resource is being consumed. RES capture their energy from existing flows of energy, from on-going natural processes, such as sunshine, wind, wave power, flowing water (hydropower), biological processes such as anaerobic digestion, and geothermal heat flow. Renewable energy sources may be used directly, or used to create other more convenient forms of energy. RES's are naturally replenished, but flow-limited. They are virtually inexhaustible in duration but limited in the amount of energy that is available per unit of time.

Thermal Storage the storage of heat or heat sinks (coldness) for later heating or cooling. Examples are the storage of solar energy for night heating; the storage of summer heat for winter use; the storage of winter ice for space cooling in the summer; and the storage of electrically-generated heat or coolness when electricity is less expensive, to be released in order to avoid using electricity when the rates are higher. There are four basic types of thermal storage systems: ice storage; water storage; storage in rock, soil or other types of solid thermal mass; and storage in other materials, such as glycol.

Waste Heat Recovery any conservation system whereby some space heating or water heating is done by actively capturing byproduct heat that would otherwise be ejected into the environment. In commercial buildings, sources of water heat recovery include refrigeration/air-conditioner compressors, manufacturing or other processes, data processing centers, lighting fixtures, ventilation exhaust air, and the occupants themselves. Not to be considered is the passive use of radiant heat from lighting, workers, motors, ovens, etc., when there are no special systems for collecting and redistributing heat.

Clean Production - Eco-Efficiency - Eco-Innovation

Clean Production applies ways to reduce and eliminate the reliance on toxic materials to make goods, to prevent air and water pollution, and to avoid wastes generation. This involves moving away from a cradle-to-grave linear industrial model, where raw materials are extracted and processed and the substances not directly useful to a factory become unwanted waste, to closed-loop systems in which the byproducts of one process become the feedstock of another. This requires progressively incorporating smaller and cleaner (in terms of emissions) material, water and energy flows. Renewable and non-toxic inputs become the primary substances in production, and product design minimizes product life-cycle impacts.

Clean Technology a term used to describe knowledge-based products or services that improve operational performance, productivity, or efficiency while reducing costs, inputs, energy consumption, waste, or pollution. Its origin is the increased consumer, regulatory and industry interest in clean forms of energy generation—specifically, perhaps, the rise in awareness of global warming and the impact on the natural environment from the burning of fossil fuels.

Eco-Efficiency applies a management strategy, linking financial and environmental performance to create more value with less ecological impact through:

- Optimized processes moving from costly end-of-pipe solutions to approaches that prevent pollution in the first place.
- Waste recycling using the by-products and wastes of one industry as raw materials and resources for another, thus creating zero waste.
- Eco-innovation: manufacturing “smarter” by using new knowledge to make old products more resource-efficient to produce and use.
- New services, such as leasing products rather than selling them, changing perceptions, and spurring a shift to product durability and recycling.
- Networks and virtual organizations: shared resources increase the effective use of physical assets.

Eco-Innovation the intent to achieve a higher level of ecological improvements – enhancing rather than depleting or degrading natural assets – through the commercial application of knowledge and associated cleaner technologies, in the production of goods and services. Eco-innovations can also occur in the infrastructure systems that support economies and natural resources use on which they depend.

Design Approaches for Superior Environmental Performance

Green and Sustainable Design Approach goes beyond traditional design – which meets regulatory standards, short-term economic goals, basic functional and aesthetic design goals – to pursue high-performing and ecologically neutral and socially responsible solutions. Green Design results in less resource intensity and significantly lower environmental impact than traditional design. Less detrimental outputs – such as greenhouse gas emissions and nonpoint source pollution – are released during construction, operations and life cycle. Human productivity conditions – such as healthy indoor air quality, comfort, and aesthetic amenities – are inherent in green design. Beyond the building's footprint, a green design maximizes the efficient interface with public infrastructure, historic and cultural preservation, and the building's reuse.

Integrated Design a collaborative method for designing buildings that emphasizes the development of a holistic design.

- The process requires extensive and multidisciplinary communication, between key stakeholders and design professionals, from conception to completion.
- Decision-making protocols and complementary design principles are established early in the process, along with project objectives that satisfy multi-stakeholder goals.
- Applies a whole building design approach that views a building's use and components – along with site, infrastructure, surrounding natural systems – functions as an interdependent system, rather than an accumulation of separate components.
- Often results in higher-performance at little or no additional cost.
- Sustainable site issues are addressed in the context of the overall project design.
- Often involves a synergy between different design elements and internal systems, and can result in tradeoffs between building envelope configurations, the sizing of internal mechanical and electrical systems, and building layout and orientation to maximize solar.
- Modest increases in productivity over the useful life of a building can more than pay back any initial capital cost premium for a high-performance design.
- Greater attention to detail and coordination during design phase may require higher design fees, which should be more than offset by operating savings.

Regenerative Design Approach looks to fully meet the aspirations of the project stakeholders *and* support the community; contributing to the local and regional ecology, it's socio-economic vitality and its fundamental and common pooled resource base. Regenerative Design is a process-oriented systems theory based approach to design. The term regenerative describes processes that restore, renew or revitalize their own sources of energy and materials, creating sustainable systems that integrate the needs of society with the integrity of nature. The basis is derived from systems ecology with a closed loop input-output model or a model in which the output is greater than or equal to the input with all outputs viable and all inputs accounted for. Ecosystems and regenerative design systems are holistic frameworks that seek to create systems that are waste free.

Restorative Design Approach places ecology at the forefront of design and applies an integrative and ecologically benign approach, to interface with living systems, in a way that minimizes environmentally destructive impacts from the built environment. This design approach, adopts cross-disciplinary methodologies, to connect fragmented disciplines, as a means to reverse environmentally destructive impacts, and achieve higher levels of natural systems restoration.

Smart Infrastructure consists of *natural* green infrastructure – forests, grasslands, wetlands, and surface waterways that provide ecological services resulting in cleaner water and air – and *engineered* green infrastructure – human-designed that protect, restore, and regenerate, to reduce impacts on ecological systems and function. It also includes more innovative approaches or techniques (advanced) not limited to traditional systems. Both forms of infrastructure can be complementary to achieve superior levels of energy and resource efficiency, preserve and enhance natural resources, and apply designs that soften the footprint of development and resource use.

Equity

Environmental Justice is fundamentally about rectifying environmental and associated health degradation imposed on communities of color, low income, national origin, and those without a voice in policy, decision-making, and development practices. The general principals of Environmental Justice are that no group of people should bear a disproportionate share of the negative environmental consequences resulting from industrial, governmental, and commercial operations or policies. It is also about preventing unfair treatment and future impositions that result in direct health and safety impacts from operations and policies, inequitable development patterns, and land-use practices.

Intergenerational Equity the legacy of how what we do in the present affects future generations. On many levels, current conditions are not sustainable and indicate future burdens will be immense. Consequences will further disproportionately affect populations without the means to make the rules, or that lack the economic and political power to change their conditions. This is contrary to the triad principles of sustainability that need to function in balance to construct a better future for many generations to come.

Social Equity is a broader issue going beyond environmental justice. It involves many facets including economic disparity, and in an environmental context, natural resource disparity and the negative downstream effects of pollution that often result in environmental injustice. Economic disparity varies between societies, historical periods, economic structures and systems, and disproportionate abilities to create wealth.

Industrial Ecology and Integrated Sustainable Systems

By-Product Synergy is the matching of undervalued waste or by-product streams from one facility with potential users at another facility to create new revenues or savings with potential social and environmental benefits. The process may involve the physical exchange of materials, energy, water and/or by-products and represents a crucial business opportunity to innovate across industrial processes and organizations by exercising best practices in waste reduction and environmental mitigation. By turning waste output from one company into a product stream for another company, not only are there reductions in waste, greenhouse gas emissions and the need for virgin-stream materials, there are also great opportunities for innovating new products and processes. The process brings clusters of facilities together to create closed-loop systems in which one facility's wastes become another's raw materials.

Closed-Loop Systems involve the evolution of industrial systems from linear, where resources are consumed and damaging wastes are dissipated into the environment to a more closed systems like that of ecological systems. In a linear process, materials and energy enter one part of the system and then leave either as products or by-products/wastes. Unless the supply of materials and energy is infinite and the carrying capacity of the natural systems can assimilate the wastes and emissions, this system is unsustainable. In most of our current industrial systems, some wastes are recycled or reused within the system while others leave it. In a more evolved and integrated industrial system, there is a dynamic equilibrium with ecological systems, where energy and wastes are constantly recycled and reused in closed loops by other processes within the system.

Eco-Industrial Park involves an industrial development that integrates infrastructure, facilities, and enterprises that result in synergies that enable tenant operations to align and interact in ways to achieve higher resource productivity than conventional industrial developments. Linkages between typically independent companies can involve, but are not limited to, sharing and exchanges of material and energy feedstock inputs and utilization of byproduct outputs. Other physical amenities that provide advantages to tenants, such as natural features to increase ecosystem services, multimodal transit options for workers, and intermodal transportation systems for raw materials and finished goods can be part of an EIP. The design, operations, and management of an EIP are strategically intended to reduce natural resource intensity, pollution, and waste disposal while increasing value-added activities and competitive advantages for participating enterprises and the surrounding community.

Industrial Ecology the science that examines the impact of industry and technology and associated changes in society and the economy on the biophysical environment. It examines local, regional and global uses and flows of materials and energy in products, processes, industrial sectors and economies and focuses on the potential role of industry in reducing environmental burdens throughout the product life cycle. Industrial Ecology in practice involves designing businesses and groups of businesses as if they were a series of interlocking ecosystems, interfacing benignly with the environment.

Applying industrial ecology requires that the industrial system be viewed not in isolation from surrounding ecological systems but in concert with them. As a result, a manufacturer throughout their supply chain will seek to optimize the total materials cycle from virgin material, to finished material, to component, to product, to waste product, and to ultimate disposal. Factors to be optimized include resources, energy, and capital.

Industrial Symbiosis is a way of achieving industrial ecology. Businesses coexist in a mutually beneficial relationship. Materials, energy, and water resource inputs are optimized, emissions and wastes minimized. Wastes that remain are recovered for use as feedstocks by other businesses within the system. Industrial symbiosis engages traditionally separate industries in a collective approach to competitive advantage involving physical exchange of materials, energy, water, and/or by products. The keys to industrial symbiosis are collaboration and the synergistic possibilities offered by geographic proximity.

Linear (Open) Versus Cyclical (Closed Loop) Systems applied industrial ecology involves the evolution of industrial systems from linear systems, where resources are consumed and damaging wastes are dissipated into the environment to a more closed systems like that of ecological systems. In a linear process, materials and energy enter one part of the system and then leave either as products or by-products/wastes.

Sustainability means ensuring that all future citizens have the opportunity to enjoy lives as rich and meaningful as our own, and in a natural environment that is at least as clean, intact, and healthy as that which we enjoy today. Activities that provide future generations with degraded natural resources, reduced economic opportunities or diminished social well-being are inherently less sustainable than policies and actions that maintain or improve these systems. (Source The Minnesota 2050 Project and the Minnesota Statewide Conservation and Preservation Plan 2008)

Sustainable Systems is a set of integrated industrial and ecological processes that equitably meets the biophysical needs of society while maintaining the integrity of life-supporting ecosystems over a long-term time horizon.

Systems Analysis is integral to industrial ecology, which requires a systems view of the relationship between human activities and environmental problems. Central to the systems approach is an inherent recognition of the interrelationships between industrial and natural systems. In an industrial production system, applying a systems view enables manufacturers to develop products in a sustainable fashion by understanding the life cycle impacts throughout each stage of production.

Progressive Food Production

Aquaponics is a food production system that combines conventional aquaculture, (raising aquatic animals such as snails, fish, crayfish or prawns in tanks), with hydroponics (cultivating plants in water) in a symbiotic environment. The goal of aquaponics is to be a more efficient and sustainable form of food production.

Urban Agriculture is an umbrella term encompassing a wide range of activities involving the raising, cultivation, processing, marketing, and distribution of food in urban areas.

- Home gardens are food-producing spaces on private, residential property that are used primarily by the property's residents or guests.
- Community gardens are smaller-scale urban agriculture sites (often serving a neighborhood) where individuals and families grow food primarily for personal consumption or donation.
- Urban farms are larger-scale, more intensive sites where food may be grown by an organization or private enterprise, and often include entrepreneurial opportunities like growing food for sale.

Urban and peri-urban agriculture (UPA) refers to the production, distribution and marketing of food and other products within the cores of metropolitan areas, and at their edges (including farms supplying urban farmers markets, community supported agriculture, and family farms located in metropolitan greenbelts). Looked at broadly, UPA is a complex activity, addressing issues central to community food security, neighborhood development, environmental sustainability, land use planning, agricultural and food systems, farmland preservation, and other concerns.

Vertical Farm(ing) is a closed growing system within a skyscraper greenhouse or on vertically stacked systems. It enables a farmer to achieve constant production of plants all year round without the influence of seasonal, regional or climatic influences. The modern idea of vertical farming uses techniques similar to glass houses, where natural sunlight can be augmented with artificial lighting and all environmental factors can be controlled by making use of CEA technology.

Resource Productivity

Biological Nutrient a material or chemical input, component, by product or other aspect of a sustainable product flowing through an industrial system and safely back to biological systems during product use or by mechanical or chemical separation at end of product use, in a manner beneficial to and protective of public health and environment and future generations.

Biomass organic waste, non-fossil material of biological origin that is a byproduct or a discarded product. Biomass waste includes municipal solid waste from biogenic sources, landfill gas, sludge waste, agricultural crop byproducts or livestock, straw, and other biomass solids, liquids, and gases; and lumber industry products, dead trees, foliage, etc., but excludes wood and wood-derived fuels (including black liquor), biofuels feedstock, biodiesel, and fuel ethanol. Biomass is considered a renewable energy source, and can be used as fuel and is most often burned to create steam that powers steam turbine generators. It is also used to make transportation fuels like ethanol and biodiesel, and chemicals like pyrolysis oil that can be burned like oil to produce energy.

Compost is the product resulting from the controlled decomposition of organic material that has been sanitized through the generation of heat and stabilized to the point that it is beneficial to plant growth. Compost bears little physical resemblance to the raw material from which it originated. Compost is organic matter resource that has the unique ability to improve the chemical, physical and biological characteristics of soils or growing media. It contains plant nutrients but is typically not characterized as fertilizer. Compost can be produced from many feedstocks. State and federal regulations exist to insure that only safe and environmentally beneficial compost can be marketed.

Recycling the process of collecting, sorting, cleansing, treating and reconstituting materials that would otherwise become waste, and returning them to the economic stream as raw materials for new, reused or reconstituted products.

Resource Flow Analysis a systematic methodology used for tracking the flow of materials through a country, region, city or organization. The outcomes of a resource flow analysis provide opportunity for a better understanding of how and where to manage material consumption and minimization.

Resource Intensity the efficiency of resource consumption as resource use per unit outcome, measured in resources (e.g. water, energy, materials) needed for the production, processing and disposal of a unit of good or service, or for the completion of a process or activity. Ways to express resource intensity include:

- Quantity of resource embodied in unit cost.
- On national level units of resource expended per unit of GDP
- Individually as a per-person unit of consumption.

High resource intensities indicate a high price or environmental cost of converting resource into Gross Domestic Product; low resource intensity indicates a lower price or environmental cost of converting resource into Gross Domestic Product.

Resource Productivity the efficiency of resource production as outcome per unit of resource use. Resource intensity and resource productivity both can be used as a metric for both economic and environmental cost. The sustainability objective is to maximize resource productivity while minimizing resource intensity.

Reuse the recovery or reapplication of a product for uses similar or identical to its original application, without manufacturing or preparation processes that significantly alter the original product.

Technical Nutrient a material or chemical input, component, by product or other aspect of a sustainable product flowing through and industrial system and safely back to an industrial system by mechanical or chemical separation at the end of product use, in a manner beneficial to and protective of public health and environment and future generations. A technical nutrient can be continually reused in a closed loop system in a manner beneficial to and protective of public health and environment.

Waste Prevention the design, manufacture, purchase or use of materials or products to reduce their amount or toxicity before they enter the municipal solid waste stream. Because it is intended to reduce pollution and conserve resources, waste prevention should not increase the net amount or toxicity of wastes generated throughout the life of a product.

Zero Waste is a philosophy and design principle to guide the redesign of a resource-intensive system, to achieve reduced materials consumption, minimize wastes, maximize recycling, and ensure products are recovered for productive use. The concept extends beyond recycling to form a circular system, where wastes are assimilated or reused, as in balanced natural systems. Practicing zero waste strategies involves taking a whole systems approach, optimizing material inputs, high efficiencies at the production level, and the comprehensive redesign of finished goods so that they are more cyclically recovered for productive use rather than disposed.

Water Optimization

Cascading occurs when a resource, such as water or energy, is used repeatedly in different applications. In successive uses, the resource is of lower quality, a lower level of refinement, and/or lower value. By definition, a cascade must include at least one use beyond the virgin use of the resource and is generally conceptualized as a downward step diagram. The cascade terminates when either a considerable amount of energy must be added to recover value from the resource or the resource is discarded. The environmental benefits of cascading are numerous, including the reduced use of virgin resources, the avoided impact of resource extraction, and the reduced deposition of waste into the environment.

Graywater is the untreated household wastewater that has not come into contact with toilet waste. Some state and local codes define gray water to also include wastewater from kitchen, showers, or bathtubs. *Blackwater is* wastewater from toilets and urinals. Some state and local codes define black water to also include wastewater from kitchen, showers, or bathtubs.

Integrated Water Resources Management (IWRM) is a process that promotes the coordinated development and management of water, land and related resources in order to maximize economic and social welfare in an equitable manner without compromising the sustainability of vital ecosystems. IWRM is a cross-sector policy approach, designed to replace the traditional, fragmented sector approach to water resources and management that has led to poor services and unsustainable resource use. IWRM is based on the understanding that water resources are an integral component of the ecosystem, a natural resource, and a social and economic good.

Reclaimed Water is wastewater that has been treated and purified for reuse. This can include: blackwater, graywater, stormwater, rainwater, and foundation water.

Wastewater is the used water from a home, community, farm, or industry that contains dissolved or suspended matter. Not fit for human consumption.

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