



Consensus

Sustainable + Resilient Underwriting Standard

For Infrastructure

Unanimously Approved 09 Sept 2008. Unanimously Amended 01 Dec 2014.

Green + Resilient Infrastructure Underwriting Standard

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Sustainable + Resilient Infrastructure Standard

1. Sources / Referenced Standards

- *Building Resiliency Task Force Report to NYC Mayor & Speaker*© (Urban Green Building Council 2013)
- *Measuring Code Compliance Effectiveness for Fire-Related Portions of Codes Final Report*, National Fire Protection Association and Fire Protection Research Foundation (2008)
- *Eaton Outline of Safety Underwriting Attributes* (2012)
- *Envision Sustainable Infrastructure Rating System & Guidance Manual*, Institute for Sustainable Infrastructure (2014)
- *Fire Safe Adaptable Home* (NAHB)
- *Fortified*© Home & Business Stds. (IBHS 2007-12). “IBHS fortified structures cannot be designated in the following areas: low-lying barrier islands and coastal regions, close proximity to known seismic fault lines, close proximity to major levees, and steep slopes potentially subject to either erosion or wildfire.” Fortified requires adherence to its compliance process including renewal after a designated term limit expires. Fortified accumulated by State the areas of peril defined with mandatory, strongly recommended and higher achievement level recognition by design and structural performance metrics for:
 - o Hurricane prone regions
 - o Tornado & Hail Regions
 - o High wind regions with windspeed maps
 - o Earthquake regions
 - o Wildfire
 - o Flood zones
 - o Severe winter weather
- International Existing Building Code 2009 Edition
- *MTS ANSI 2.0 Integrative Process Standard for Sustainable Structures & Communities* (2012)
- *Natural Hazards, UnNatural Disasters: The Economics of Effective Prevention* © (World Bank & UN 2010)
- *NFPA 72 National Fire Alarm Code* 2007 Edition
- *NFPA 70 National Electrical Code* 2011 Edition
- *NYC Plan NYC & Post Sandy Building Code* (2013)
- *Perkins+Will Resiliency Framing Issues*© (2014)
- *Resilience Scoring Utility* 2011 Edition
- UN Sustainable Development Goals (SDGs), Key Summary Points - EGM on Science & SDGs (Mar. 21, 2013)
- *Wall Street Due Diligence*© Peer-reviewed & Released at NYSE on Sustainable Investment Business Case & Dangerous Climate Risk (2009 & 2013). *Dangerous* climate change is a word of art referenced in the Kyoto Protocol and defined by leading climate scientists including Jim Hanson formerly of NASA, as the state of climate change when the Earth’s atmospheric CO2 concentrations exceed 350 ppm. Levels as of October 14, 2014 are near 400 ppm and rapidly rising.
- *Weathering the Storm: Building Business Resilience to Climate Change*©, Center for Climate and Energy Solutions (2013)

2. Background / Perspective / Valuation Goals & Principles

Underwriting Defined: standards for raising capital for debt & equity including to issue bonds.

Resilient Defined:

1. Able to bounce back after change or adversity.
2. Capable of preparing for, responding to, and recovering from difficult conditions.

Syn.: TOUGH (New York City "Plan NYC" 2013)

The Australian mantra for adapting to climate change: Protect, Redesign, Rebuild, Elevate, Relocate and Retreat.

Resilient is also being defined as bouncing back from any extreme event which can include an internet crash, global epidemic, or climate change intensified events.

For Purposes of This Standard, Resilient Means both mitigation (carbon pollution reductions) addressing the need to prevent near term irreversible unmanageable dangerous climate change (climate bubble / crash), and adapting to the increasing intensified weather and climate events causing well-documented systemic damages to all economic sectors. This includes safety and acute and chronic events.

Wall St. Due Diligence Released at NYSE on Added Sustainable Investment Value Documents:

- High probability of imminent irreversible unmanageable dangerous climate change without 18 gigaton climate pollution reduction in next 10 years estimated to cost \$2 trillion. This is called Climate Bubble / Crash.
- JPMorgan publication states it is a high probability Black Swan event.
- Green building secondary financing market can provide the \$2 trillion because investors with over \$70 trillion in assets under management want to invest in green buildings / buy green building bonds. Green Bonds are vibrant \$20B+ market with all bonds quickly selling out.
- Secondary market is expected to create \$1 trillion private sector stimulus
- Leading investors, insurers and governments publicly document that ongoing systemic climate damages exists in all economic sectors caused by more intense and severe weather / climate events.
- Fluctuating Deaths, Rising Damages— 3.3 million deaths in the 40 years to 2010, Disasters can strike anywhere, & Damages are rising.

Peer-reviewed due diligence is comprised of over 30 reports, consensus standards, and investor surveys and was updated in 2013 by leading economists. The due diligence findings on added green property value including national statistically valid data were "baked into" the Underwriting Standards. For example, the due diligence showed that energy efficiency has substantially increased economic value by reducing operating costs. Accordingly, 40% of the Underwriting Green Value Score is energy efficiency.

Design, Construction & Valuation Principles & Goals:

- Even with the 18 gigaton climate pollution reduction in the next 10 years, severe weather / climate events will keep intensifying due to latent effect of climate pollution in the atmosphere and positive feedback loops / natural accelerators like: methane releases from decaying organic matter in unfrozen permafrost and ocean bottom methane hydrates, and cessation of ocean CO2 adsorption.
- The top priority is to prevent Irreversibility otherwise resiliency & safety are unmanageable.
- Resiliency design & construction is cost sensitive thus like rating systems, minimum prerequisites are required with recognition for superior performance above the minimum.
- Use of integrative process (IP) already incorporated into the Underwriting Standards substantially reduces construction costs and risk, thus the financial community encourages it to be a condition of financing. Higher achieving green + resilient design is only cost effective with IP.
- Address vulnerabilities to natural and manmade stressors in buildings, cities, communities, and design responses to them to help achieve stability + adaptability through the following goals:
 1. Provide Underwriting Achievement metrics reducing risk so insurers can write reasonably-priced risk-adjusted coverage again for climate change damages.
 2. Strengthen building, infrastructure, organization and community resistance to chronic stressors arising from a changing climate and resource drawdown
 3. Reduce physical risks posed by extreme weather events to building occupants, building systems, organizations, and communities
 4. Improve safety and stability during acute shocks from both manmade events and natural phenomena
 5. Maintain business, organizational and community continuity reducing interruptions including in the supply chain
 6. Reimagine & Rebuild the emotional, social, economic and physical systems to go beyond original conditions and standards to create stronger buildings, cities and communities.
- The built environment has a profound impact on safety, economy, health and productivity and is the largest industry.

3. Underwriting Standards Scoring Mechanics & Bond & Portfolio Certification

Based on the safety + resiliency features present at the asset / property or community level, these criteria are identified and summarized as to its value impact. Each safety + resiliency criteria identified has a description of underwriting / valuation impact.

Once these asset-specific features are identified and appropriate value is attributed through a numerical score on the Green Building Underwriting Standard, underwriters can use this information to appropriately assess an asset's risk profile and determine the CMP Green Score.

Once the Green + Resiliency Value Score is derived, it is intended to ride with the asset based on a vintage year. The Value Score is applicable to both internal decision making and external reporting to relevant parties including rating agencies, secondary market investors, corporate-level financial and environmental reporting, and other pertinent applications.

If the asset undergoes capital improvements at a future date, the Value Score should be recalculated, a new vintage year assigned, and then re-reported accordingly.

Certification to the Standard of bonds or portfolios should be conducted by professional assurance providers (CPA firms) engaging qualified environmental professionals.

INTEGRATIVE PROCESS + HOLISTIC PLANNING

4. Short-Term Hazard Preparedness + Mitigation - prerequisite

- Purpose: improve the safety of infrastructure users and property during periods of physical crisis. Increase resilience and long-term recovery prospects of the infrastructure from natural and man-made short-term hazards.

This includes assessing vulnerabilities on operations and facilities, managing risks and pursuing opportunities, setting priorities, and reassess and review recognizing that knowledge of extreme weather and climate evolves over time.

Provide backup fire safety communication.

- Underwriting Documentation:
 - For all projects, assess and plan for risk from Extreme Weather + Rain, Drought, Fire, Flooding, Hazardous Materials, Biohazards, Terrorism, Violent Conflict, Epidemics.
 - As appropriate based on location: regional, local, site + project specific issues including, but not limited to Wildfire, Seismic Events, Storm Surge, Earth Slide, Snow Slide, Volcanic Activity
 - Guidance – Fortified Standards

5. Integrative Process (IP) - prerequisite

Use of integrative process (IP) already incorporated into the Underwriting Standards, substantially reduces construction costs and risk, thus the financial community encourages it to be a condition of financing. In essence, IP includes all relevant design and construction professionals in workshops at the predesign and other key stages, to agree on the nature of property design and construction. Higher achieving green + resilient design is only cost effective with IP. LEED Homes and V4 provide credit for IP with the IP ANSI Standard as the reference standard; the Green Building & Homes Underwriting Standards do the same.

- Purpose: IP is well documented in reducing risk and construction costs
- Underwriting Documentation: ANSI IP 2.0 Standard required in owner's construction contract. At a minimum, energy, water, transportation and community must be explicitly covered in the construction contract.

6. Commissioning & Energy / Water Performance Disclosure - prerequisite

- Purpose: independent third party check ensuring the infrastructure was built & performs as designed
- Underwriting documentation:
 - Third party report verifying mechanical, electrical, plumbing, and renewable energy commissioning
 - Publicly disclosed bi-annually reported Energy and Water performance data.
- Reference Standards for buildings: LEED V4 Fundamental Commissioning description (LEED NC), LEED V4 Building Level Metering (LEED NC), LEED V4 Enhanced Commissioning, Path 2 (LEED NC). Infrastructure can use these commissioning standards.

7. Business Case Analysis, Post-Development Evaluation and Reporting - prerequisite

- Purpose: Provide Triple Bottom-line objective and transparent economic rationale for the project and support continuous improvement practices for project and future projects. Provide financial $ROI + \text{External Economics} + \text{Social and Environmental Costs and Benefits} \times \text{Adjusted for Uncertainty and Risk} = \text{Value for Money or Sustainable Impact Value}$. Calculated through internationally accepted multiple Beneficiary Cost Benefit and Risk Analysis Practices. Cost and benefits presented by category of beneficiary/stakeholder (owner, funder/financier, community, government, environment). Establish performance baselines and platform for measurement, monitoring and long term reporting. Factors considered include:
 - effects of the delivered works on local productivity, e.g., reduced congestion, lower operating costs, increased operating capacity, increased efficiency, and new operating alternatives.
 - evidence showing how the project will improve the overall business environment, e.g., increased productivity, improved access to facilities and infrastructure, increased alternative resources, facilities and infrastructure.
 - evidence of new employment opportunities that will be created and the skill base is expanded.
- Underwriting documentation: Written Business Case Analysis Report.
- References: Envision Business Case Evaluator or equivalent. Guide to Post-Occupancy Evaluation Slide Deck, University of Westminster, Guide to Post Occupancy Evaluation (HEFCE)

ACUTE / SHORT-TERM HAZARD PREPAREDNESS, MITIGATION + ADAPTION

8. Extreme Events: Emergency Planning – prerequisite

- Purpose: Knowing how to ensure utilities and fundamental services in case of extreme emergencies to prevent infrastructure interruption. This covers extreme winter weather, floods, tornados, wildfires, hurricanes, hazardous materials, terrorism, technological emergencies, and earthquakes. There is no insurance for climate-intensified events since carriers will not write new coverage due to extreme risk, and almost all existing insurance contracts have absolute

pollution exclusions; carbon pollution causing increased climate damages is a pollutant under the Clean Air Act.

- Underwriting documentation: statement of how to ensure continuation of utilities and fundamental services in case of emergency disrupting services for up to ten days.
- Guidance – Fortified for Extreme Winter Weather structures appurtenant to infrastructure. & Insurance Institute for Business and home safety online risk locator by zip code.
 - Fire. FEMA Guide 141, Emergency Management Guide for Business and Industry, October 1, 1993 | Pages 51 and 52 including Option 1 for evacuation. Options 2 through 5 regarding fire containment are optional. Note: A facility inspection by the Fire Department is not required.
 - Hazardous Materials Incidents. FEMA Guide 141, Emergency Management Guide for Business and Industry, October 1, 1993 | Pages 53 and 54. American Red Cross Fact Sheet on Shelter-in-Place
 - Technological Emergencies. FEMA Guide 141, Emergency Management Guide for Business and Industry, October 1, 1993 | Page 65
 - Identify Critical Business Systems. U.S. Small Business Administration / Prepare My Business.Org Checklist: Identify Critical Business Systems
 - Communications Plan. U.S. Small Business Administration / Prepare My Business.Org Checklist: Emergency Communications
 - Wildfires. U.S. Small Business Administration / Prepare My Business.Org Checklist: Wildfire Preparedness
 - Floods and Flash Floods
 - Floods: U.S. Small Business Administration / Prepare My Business.Org Checklist: Flood Preparedness
 - Flash Floods: Educate facility occupants about staying safe in a Flash Flood. Insurance Institute for Business & Home Safety Recommendations:
<https://www.disastersafety.org/flood/flood-preparedness-flash-flood-safety/>
 - Hurricanes. U.S. Small Business Administration / Prepare My Business.Org Checklist: Hurricane Preparedness
 - Tornadoes. U.S. Small Business Administration / Prepare My Business.Org Checklist: Tornado Preparedness
 - Severe Winter Storms. U.S. Small Business Administration / Prepare My Business.Org Checklist: Winter Weather Preparedness
 - Earthquakes . U.S. Small Business Administration / Prepare My Business.Org Checklist: Earthquake Preparedness

8. Back-up Power Above Flood Level – prerequisite

- Purpose: Even for infrastructure above the 500 year flood plain, intensified storms are causing periodic flooding and knocking out power since most power lines are above ground. The grid is increasingly failing due to storms, heatwaves, undercapacity, etc. causing loss of heating, cooling, refrigeration, electronic payment processing, wholesale & retail business operations. Design for:
 - Protection from outages from the grid including by floods, intense storms, heatwaves, undercapacity
 - Onsite Green-e Power not dependent on the grid

- Add Hookups for Temporary Generators & Boilers
- Have backup fuel supply with built in hand pumps
- Supply Drinking Water Without Power
- Ensure Toilets & Sinks Work Without Power
- Maintain Habitable Temperatures Without Power

Due to the longer duration of power outages for these extreme events, back-up power is needed for infrastructure to ensure operations since there is no insurance for climate induced interruptions which can hamper infrastructure operations.

- Underwriting documentation: description and verification of back-up power including test to insure it works. Locate back-up power, switching gear and / or power hook-ups and infrastructure and vital facility functions above the FEMA designated 500 year flood plain.
 - Exceed Fortified for Safer Business Standard Criteria 3.12: Back-up Electrical Power / Continuity of Business Operations. Reference: 2014 Fortified for Safer Business Standard, Volume 1
AND
 - Store on-site fuel and / or on-site /near-site renewable energy capacity for 10 days of continuous operation.
- Guidance – Fortified Standard for Flood Zones for structures appurtenant to infrastructure.

9. Access to First Aid, Communications, Food, Supplies + Potable Water – prerequisite

- Purpose: Intensified events created the need for round the clock back-up first aid, communications, food, supplies, and potable water and water reserves for a 10 day period. During these events 911 service is more frequently unavailable. There is no insurance for climate induced business interruptions including lack of potable water, first aid and communications.
- Underwriting documentation: Written evidence of backup first aid, food, supplies, communications and potable water. Infrastructure where there are people required to operate it including during emergencies, must meet these requirements.
 - Stock and Provide a First Aid Kit: Meet OSHA and ANSI NSI Z308.1-2003 Minimum Requirements for Workplace First Aid Kits including the Additional items listed in the ANSI standard + items that do not duplicate the ANSI standard as recommended by the Red Cross for first aid kits.
 - Page 2: OSHA Compliance for First Aid in the Workplace - About.com
 - Anatomy of a First Aid Kit - American Red Cross
 - Provide First Aid Training and CPR Training: Provide basic train classes for at least 10-15% of staff for First Aid and CPR.
 - First Aid, CRP and AED Certification - American Red Cross
 - Provide Emergency Preparedness Supplies: Provide 96 hours (4 days) of emergency supplies including water + food to accommodate all occupants as identified in the FEMA / Ready Business Emergency Supplies Checklist. Food can be compressed food bars.

- Provide portable emergency toilets. Pre-fabricated kits for 5 gal pails or similar are acceptable. Provide heavy duty plastic bags and ties for waste containment; sanitary wipes + sanitary gel for cleansing.
- FEMA / Ready Business Emergency Supplies Checklist
- Additional Guidance: Disaster Supply Kit - University of Missouri Extension
- Provide Fundamental Communication Capacity + Equipment: Provide at least one telephone land-line along with text messaging and an emergency alert radio as a minimum.
 - Maintain service for at least one conventional land-line telephone or provide one of the optional communication devices listed below, with the exception of Option 1.
 - Be prepared to Text via cell phone. Train at least 2 designated individuals or 10% of occupants on how to use the device(s), which ever is greater.
 - Provide and monitor a NOAA and Public Alert Certified Weather Radio with battery back-up. Train at least 2 designated individuals or 10% of occupants on how to use the device(s), which ever is greater.
 - Provide Family Radio Service (FRS) or General Mobile Radio Service (GMRS) or Walkie-Talkies for local use. Train at least 2 designated individuals or 10% of occupants on how to use the device(s), which ever is greater. Provide at least 2 devices; 3 for the first 200 occupants, 4 for the first 300 occupants or devices equal to 0.66% of occupants whichever is greater.
 - The following are options to a land-line telephone. There must be back-up power and / or back-up batteries provided for 3 days of services 24 / 7.
 - Option 1: Provide a Satellite Phone(s) + train at least 2 designated individuals or 2% of occupants up to 5 people or 0.66% of occupants whichever is greater on how to use the device(s). Test communications quarterly with at least (3) points of contact.
 - Option 2: Provide Citizen Band (CB) Radio(s) + train at least 2 designated individuals or 2% of occupants up to 5 people or 0.66% of occupants whichever is greater on how to use the device(s). Identify and semi-annually test communications with at least (3) points of contact at least 15 miles away that can provide emergency assistance.
 - Option 3: Provide an Amateur (HAM) Radio Unit(s) + license at least 2 designated individuals or 2% of occupants up to 5 people or 0.66% of occupants whichever is greater to use the device(s). Identify and semi-annually test communications with at least (3) points of contact that can provide emergency assistance.

10. Sites of Avoidance: Flood Plain, Storm Surge + Sea Rise – prerequisite

- Purpose: Selecting a location for infrastructure is an important part of the planning and design process. Understanding the importance of selecting the location and the impact to the design is an important first step in design. Where infrastructure is located impacts the safety and security of the community.

Uncontrolled water causes human and economic damage from floods and intense storms, and sea level rise and associated land subsidence. Property and infrastructure in coastal areas are increasing in risk from rising sea levels due to global warming / climate change. Avoiding the

construction of infrastructure in these areas substantially reduces risk to loss of life, property, (including water, wastewater removal & treatment, power, roads, transit, food supply / consumer access), health care delivery / access, solid waste, retail / consumer access, and business interruptions during extreme events.

As an important approach, communities protecting these areas are creating natural preserves which reduce the impact of loss due prohibition of permanent structures and infrastructure, but also the buffering and water adsorptive capacity. Parkland or golf course creation are secondary uses that reduce risk of loss.

Avoidance of karst or sandy topography in tidal areas is important due to the severe challenge of preventing sea water flooding from subterranean infiltration through the soil profile and porous bedrock, sewers, subsidence, and erosion.

Effect of Rising Seas & Resulting Subsidence: The 2014 US Climate Assessment Report, Chapter 2 at 45-46 documents that sea level has risen about 8 inches in the last 100 years, accelerating since the start of the industrial revolution, and factoring in dangerous climate change:

“semi-empirical” methods have been developed to project future rates of sea level rise based on a simple statistical relationship between past rates of globally averaged temperature change and sea level rise. These models suggest a range of additional sea level rise from about 2 feet to as much as 6 feet by 2100, depending on emissions scenario.”

“Nearly 5 million people in the U.S. live within 4 feet of the local high-tide level (also known as mean higher high water). In the next several decades, storm surges and high tides could combine with sea level rise and land subsidence to further increase flooding in many of these regions.”

Global carbon pollution is accelerating, rising by 2.3 percent in 2013 over 2012, with an estimated another 2.5% rise in 2014 to a level 65 percent above carbon pollution emissions in 1990 — the benchmark year established in the Kyoto Protocol (“Global Carbon Budget 2014,” Earth System Science Data Discussions, Sept. 21, 2014). Atmospheric CO2 concentrations are also rising exceeding 400 ppm in 2013, some 142% higher than pre-industrial concentrations in 1750 (World Meteorological Organization’s Annual Greenhouse Gas Bulletin, Sept. 9, 2014).

- **Requirement.** Avoid areas within 500 year flood plain or provide documentation of engineering solutions. Statistically, the 100 yr. floodplain has been determined to be underestimated especially when validated by extreme events and sea level rise. To ensure loss prevention and minimization, these additional risk factors must be taken into account through at a minimum a required additional margin of safety in delineating the 500 yr. floodplain. Even in areas with prolonged drought, storm events when they occur are more intense from dangerous climate change making the 500 yr. level appropriate for underwriting.

For non tidal areas, avoid the 500 yr. flood plain or provide an engineering solution. For tidal areas, avoid the areas inundated by 2’-6’ sea level rise, or provide an engineering solution as follows -

by 2015 for areas inundated by 2’ or less sea level rise
by 2016 for areas inundated by more than 2’ up to 3’ sea level rise
by 2018 for areas inundated by more than 3’ up to 4’ sea level rise
by 2020 for areas inundated by more than 4’ up to 5’ sea level rise

by 2022 for areas inundated by more than 5' up to 6' sea level rise

The above dates are identified recognizing the need for a risk based phased in approach, as well as a margin of safety given the additional adverse impacts of storm surges and accelerating rate of dangerous climate change.

- Underwriting Documentation: Recognized Map showing infrastructure location outside 500 year flood plain, or an engineering solution stamped and sealed by a licensed professional engineer taking into account expected increased flooding based on intensifying dangerous climate risk including rising seas, land subsidence, storm surges, intense rainfall and winter storm flooding. See Guidance below.
- Reference Standards: Fortified Standards for Flood Zones, Hurricane Prone Regions & High Winds for structures appurtenant to infrastructure
- Guidance: US Geological Survey digital mapping has a mean error of 7 meters (*Mapping Sea Level Rise*, CARA: <http://www.cara.psu.edu/about/mappingsealevelrise.asp>, thus more accurate tools are in use like Light Detection and Ranging (lidar) — a remote sensing method used to examine the surface of the Earth. Lidar needs correcting in marshy areas, thus use of Lidar and accurate mapping is covered at NOAA's Digital Coast website: <http://coast.noaa.gov/digitalcoast> & NOAA *Mapping Tool for Visualizing Sea Level Rise*: http://www.floods.org/Files/Conf2013_ppts/H8/H8_Carter.pdf

To determine the amount of sea level rise to date and current conditions in a given region, the best data are a combination of tide gauge data and data from Jason satellites. Both give direct measurements of sea level (communications with Willis, NASA JPL and Mitchem, USF College of Marine Science, Sept. 2014).

Tide gauge data are important for a historical perspective because many tide gauges around the US coast have been in continuous operation for 100 years or more. Sea level rise records from tide gauges are at the Permanent Service for Mean Sea Level (PSMSL, <http://www.psmsl.org>). For example, the record for Key West, FL is: <http://www.psmsl.org/data/obtaining/stations/188.php> shows sea level has gone up by about 200 mm there since 1913.

Tide gauges identify RELATIVE sea level rise, which is important for identifying the impacts of sea level rise. Relative sea level rise is the actual rise in water levels that is recorded locally, taking into account the effect of land subsidence as well.

To understand what is happening regionally as a supplement to tide gage data, sea level data from Jason satellites can be used (<http://www.aviso.oceanobs.com>) which show sea level change everywhere in the oceans over the past 20 years. However, Jason does NOT include the effects of local land motion, e.g., subsidence. And in some places like New Orleans, the effects of subsidence can be as large or larger than the effects of sea level rise.

The *Surging Seas* tool provides more data with coastal mapping of sea level rise scenarios and local characteristics covering 3000+ coastal communities: <http://sealevel.climatecentral.org>

- Relative Value: Value and associated positive expense impacts are defined by:
 - Decreased injury & loss of life
 - Decreased operating expenses including energy

- o Reduced maintenance costs
- o Reduced unexpected repairs, equipment downtime, business interruptions
- o Reduced capital outlays for repairs
- o Reduced insurance or reserve costs
- o Increased equipment life
- o Increased infrastructure life and value
- Expense Line Items Impacted
 - o Utilities – electricity, water, communications, infrastructure
 - o Repairs and Maintenance
 - o Insurance
 - o Replacement Reserves

11. Safe Design for Extreme Weather, Wildfire, Fire + Seismic Events – prerequisite

- Purpose: Design for extreme weather, wildfire and natural and manmade earthquakes. Earthquake risks are identifiable on seismic maps. Extreme weather encompasses more intense weather events particular to a location and its changing weather and climate. Wildfire risk is becoming greater especially in regions West of the Mississippi where drought is more frequent. Ensure general understanding of how and where internal and external fires usually occur and how they can be prevented, detected and mitigated from both manmade & natural causes, and address electrical surge damage & risk prevention & minimization. Design in underground tornado shelters to reduce deaths & injuries. Safeguard toxic materials stored in 500 year flood zones.
- Underwriting documentation: independent third party commissioning documents identifying construction designed to accommodate attributes in “Purpose” above and Fire Safety. Fortified Standards are applicable for structures appurtenant to infrastructure.
- Reference Standards: For structures appurtenant to infrastructure, Fortified Standards for Wildfires, Earthquake Regions, Tornado & Hail Regions, & High Wind Regions with windspeed maps

12. Adaptive Design for Flooding, Sea Rise, + Extreme Weather, Events + Hazards

- Purpose: Even though many regions are not at as high a risk as those covered in preceding prerequisites, all regions are experiencing more intense events making risk reduction adaptive design economically advantageous especially since there is no insurance for climate change damages. Adaptive design and proper maintenance reduces mold incidence, a substantial health and liability risk.
- Underwriting documentation: independent third party commissioning report documenting construction designing to Fortified Standards.
- Reference Standards: Fortified Standards for Wildfires, Earthquake Regions, Tornado & Hail Regions, & High Wind Regions with windspeed maps

13. Stormwater and Flood Management – Conventional & Natural Systems

- Purpose: In all regions, some more frequent than others, intensified events justify more rigorous stormwater and flood management systems to reduce risk especially since there is no insurance. Natural systems with resilient vegetation are preferable due to less capital cost and their reduction of pollution loads and flows and flood reduction due to natural retention and absorption of water. This includes reducing combined sewer overflows and sewer backups.
- Underwriting documentation: Documentation of effective onsite or adjacent stormwater and flood management.

14. Transit + Transportation Connectivity + Protection

- Purpose: During extreme events, access to protected transit and transportation facilitates critical networks including food supply and retail access, and normal operations and services.
- Underwriting Documentation: written description of nearby transit effectively protected from extreme events.

CHRONIC / LONG-TERM RESILIENCY + ADAPTATION

15. Improve Community Quality of Life – prerequisite

- Purpose: Infrastructure projects further the public interest and serve to improve the quality of life of communities they serve. All relevant community plans are reviewed and verified through stakeholder input. The project team achieved good project alignment with community plans. Potential negative impacts on nearby affected communities are reduced or eliminated.
- Underwriting documentation: Identify project's approved written statement on its improvements to the community's quality of life showing that it meets or exceeds important identified community needs including long terms requirements for sustainability.

16. Improved infrastructure access and walkability, reductions in commute times, traverse times to existing facilities and transportation. Improved user safety considering all modes, e.g., personal vehicle, commercial vehicle, transit and bike/pedestrian.

- Purpose: improve access for pedestrians, and vehicles to infrastructure especially during disasters.
- Underwriting description: documentation from commissioning report of accessibility during disasters by disaster type and how access is improved

17. Energy Efficiency, Atmosphere Protection + On-Site Renewable Energy - prerequisite

- Purpose: Energy efficiency and onsite renewable energy for operations greatly reduce expenses due to long term globally documented carbon energy price volatility in Wall St. Due Diligence, and also substantially reduce carbon pollution.

- Underwriting documentation: commissioning report documenting minimum 60% reduction in carbon energy use from an identical project using 100% carbon energy.

18. Ensuring Healthy, Non-Toxic Materials & Products: prerequisite

- Purpose: Infrastructure causes substantial human health and environmental hazards, and concomitant liability risks through direct daily human and environmental exposures to carcinogens, mutagens, teratogens and endocrine disruptors. Cities and manufacturers are responsible for these human health and environmental hazards and liability risks, and transfer the risks to investors when toxic infrastructure is financed by cities or others.

For example, on its website, EPA states that PVC drinking water piping leaches into raw and finished drinking water carried by the pipe, vinyl chloride, a known carcinogen.

In its “Toxin-Free Piping” Brochure, National Wildlife Federation (NWF) identifies this vinyl chloride risk and also that plastic piping leaches endocrine disruptors that are ingested by the public from raw and finished drinking water, and released into receiving waters by wastewater piping. NWF recommends specifying SMaRT sustainable/EPP certified products to avoid toxicity over the product’s life cycle. Industry estimates show that about 50% of US drinking water and wastewater piping is PVC and other plastic piping causing these unacceptable health, environmental, and liability risks.

Accordingly, about 150,000,000 people in the US are unknowingly subjected to daily ingestion of toxic carcinogens and endocrine disruptors from toxic infrastructure. This type of involuntary human health hazard and risk generates substantial public outrage and liability risk.

- Underwriting documentation: SMaRT Consensus Sustainable/EPP Certification Certificate or equivalent for all drinking water and wastewater piping. For all other infrastructure projects, 50% of products and materials used by weight are SMaRT or equivalent. SMaRT’s Cancer Policy requires elimination of toxic constituents presenting unacceptable public health and environmental risks, and SMaRT prohibits certification of products and materials containing over the life cycle, Stockholm and Rotterdam Treaties Toxic Chemicals. Further, SMaRT provides credit for up to 100% reduction of avoidance of 4,000 toxic chemicals undergoing global peer review and identified by EPA, UN Environmental Program, and Society for Toxicology & Chemistry, and also reduces carbon pollution over the life cycle.

Consensus standards reduce legal, technical, business, and political risk and uncertainty and thus are required for government and capital markets adoption. EPA’s Assistant Administrator for Water wrote supporting this type of market based approach to eliminate these hazards and risks (Dec. 19, 2013).

19. Funds & Resources are Committed for Long Term infrastructure Maintenance & Monitoring for Energy Efficiency & Renewable Energy

- Purpose: Commit funds and resources for long term O&M for 20 yrs. Minimum.
- Underwriting documentation: documentation of legally binding fund appropriation

20. Water Efficiency & Protection

- Purpose: Protect Fresh Water Availability, Reduce Potable Water Consumption
- Underwriting documentation: commissioning report showing measures protecting fresh water including runoff ponds, and use of water efficient fixtures providing 50% reduction in water flows.

21. Protect Wetlands + Avoid Steep Slopes and Adverse Geology

- Purpose: Wetlands are very high value resources with wetland mitigation credits selling for increasing higher levels. Wetlands also reduce flooding, storm surge and runoff pollution. Wetlands provide habitat for many needed species. Accordingly, wetlands are protected by the Clean Water Act with fines and liability.

Steep slopes and adverse geology present greater damages risks from intensified climate and weather events especially since there is no insurance coverage.

- Underwriting documentation: Identify nearby or adjacent wetlands, steep slopes and adverse geology on maps and legally binding protective measures taken like zoning and deed restrictions, or local government laws or policies.

22. Legally Logged Wood Certification

- Purpose: Use, possession, distribution or sale of wood illegally logged in the country of origin is a crime pursuant to the US Lacey Act. Legally logged forests provide many economic benefits including substantial reduction of climate risk. In addition to incarceration and liability risk, public knowledge of illegally logged wood possession destroys brand and reputation.
- Underwriting description & Reference Standard: For projects using wood, written certification of compliance to National Consensus Lacey Due Care Standard providing bona fide defenses to Lacey Act strict criminal liability, which also meets the requirements of similar illegal logging prohibition laws in Western Europe and Australia.

23. No Pesticide, Herbicide Use by Specifying Native Vegetative Landscaping

- Purpose: prevent use of toxic pesticides and herbicides that contaminate surface and groundwater and harm biota. Reduces risk of FIFRA liability for toxic pesticide use inconsistent with the label.
- Underwriting Documentation: Obtain commissioning report documenting use of native vegetative landscaping and operations manual provision prohibiting pesticide and fertilizer use.

24. Water Efficiency + Resilient Water and Landscapes: Building + Site

- Purpose: Native vegetation does not need watering thus saving utility bills and conserving water.
- Underwriting documentation: Obtain commissioning report documenting native vegetative landscape.

25. Reduced Site Environmental Impacts: Lighting, Heat-Island

- Purpose: Energy efficient lighting and reduced heat island effect reduces operating costs and carbon pollution.
- Underwriting documentation: Obtain commissioning report documenting minimum energy efficient lighting of at least 60% compared to conventional lighting and 50% heat island reduction from conventional design taking into account paved areas and roofs which can be minimized by native landscapes and green roofs.

26. Infrastructure Intangibles (For Information Only. Not Part of Sustainable + Resilient Value Score)

- Reduce project costs by reducing construction waste (comparable to existing underwriting standard attribute).
- Increased cash flow to manufacturers & retailers in Sustainable Manufacturing Underwriting Standard:
 - Reduce Net Embodied Energy using LCA covering all product stages
 - Sustainable Procurement Practices
 - Use Recycled Materials
 - Use Regional Materials
- Divert Waste from Landfills
- Reduce Excavated Materials Taken Off Site
- Provide for Deconstruction and Recycling
- Preserve prime farmland & greenfields
- Pesticides and Fertilizer Impacts
- Preserve Species Biodiversity
- Control Invasive Species
- Restore Disturbed Soils
- Maintain Wetland and Surface Water Functions
- Envision Sustainable Infrastructure Rating (achieves points for Underwriting Green + Resilient Value Score)
- Social resiliency by maintaining community social infrastructure, e.g., community meeting facilities, sidewalks promoting non-vehicle transportation, maintaining local retail, restaurants, day care, community organizations bringing people together like library groups improving local communication to reach out for help and assistance.
- Chronic long term food supply – Recognizing the interdependencies among food / water / energy / land / climate systems

- n. Upstream and downstream toxic impacts of products specified and potential toxic impacts during product's life in the home, building, and infrastructure (life cycle use phase)
- p. Maintaining economic diversity by supporting local economies

SUSTAINABLE + RESILIENT VALUE SCORE

SUSTAINABLE + RESILIENT VALUE SCORE FORMULA

For Sustainable+Resilient Infrastructure: 25-100 Score. Pass / Fail for Prerequisite / Credit Achievement

National Consensus *Green Property, Safety, Resiliency & Infrastructure Underwriting Standards*©

	Score	Value Ratio	Adjusted Score
Prerequisites		60%	30
Resiliency Score from Credits: 5 points per credit achieved		35%	65 possible
Envision Certification			
	YES	5%	5 possible
	NO	0%	
Sustainable+Resilient Value SCORE		100%	100 possible

Appendices

- 1. Perkins+Will Resiliency Checklist©**
- 2. Green Building Underwriting Standards' Revenues, Expenses & Intangibles**

COMMERCIAL

Revenues / Expense Reduction (some attributes are revenues, some expense reduction, some both but no double counting)

1. Energy Star / HERS Score / ASTM BEPA Standard result
2. Energy Star Certification
3. Climate Neutral Certified
4. Site Selection / Sustainable Sites: avoiding floodplains & wetlands
5. Development density / connectivity: redeveloped sites
6. Public transportation access
7. Water use reduction / Water efficiency / EPA Water Sense
8. Water efficient landscaping
9. Onsite Green-e Power
10. Outdoor air monitoring: ventilation system performance
11. Ventilation effectiveness: increasing outdoor air in the structure
12. IAQ Management Plan
13. Measurement & Verification: optimization of building energy / water over time
14. Adhesives & Sealants: reduced VOCs
15. Paints & Coatings: reduced VOCs
16. Composite Wood: no added formaldehyde
17. Chemical / Pollutant Control: improved indoor air quality
18. Daylight & Views
19. Green roof / heat island
20. Reducing Heat Island Effect
21. Stormwater management: reducing rate & quantity
22. Underfloor air: controllability of systems & thermal comfort
23. Integrative Process
24. Commissioning
25. Enhanced Commissioning
26. Recycling

Intangibles

1. LEED Rating
2. Mandatory Onsite Recycling (MR Prerequisite)
3. Building Reuse (MR 1)
4. Construction Waste Recycling (MR 2)
5. Resource Reuse (MR 3)
6. Local / Regional Materials (MR 5)
7. FSC Certified Wood (MR 7) (see Sustainable Manufacturing Underwriting Standard)
8. SMaRT Certified Sustainable Products (LEED Innovation Credit and Climate Neutral Credit) (see Sustainable Manufacturing Underwriting Standard)
9. Light Pollution Reduction (SS 8)

10. Open Space Restoration

HOMES

Revenues / Expense Reduction (some attributes are revenues, some expense reduction, some both)

1. Energy Efficiency Strategies Employed / HERS Score / Energy Star Certification
2. Energy Star Certification
3. Climate Neutral Certification
4. Energy Reduction: HVAC / Hot Water / Appliances
5. Home Orientation for Natural Solar Gain Efficiencies
6. Onsite Renewable Energy
7. Water Efficiency / Use Reduction
8. Non-Toxic Pest Control
9. Preferred Location and Infrastructure Stability
10. Community Resources and Public Transportation
11. Improved Durability
12. Integrative Process
13. Commissioning
14. Site Selection
15. Heat Island Reduction
16. Homeowner Education
17. LEED for Neighborhood Development Certification
18. Access to Open Space
19. LEED Low-VOC Materials
20. ENERGY STAR IAQ Verification
21. Indoor Environmental Quality / Ventilation / IAQ Effectiveness
22. Reduced Site Disturbance / Tree Protection

Intangibles

1. FSC Certified Wood (LEED-MR 7) (see Sustainable Manufacturing Underwriting Standard)
2. SMaRT Certified Sustainable/EPP Products (LEED Innovation and Climate Neutral) (see Sustainable Manufacturing Underwriting Standard)
3. Local / Regional Materials (LEED-MR 2)
4. Construction Waste (LEED-MR 3) (prerequisite: construction waste planning leads to reduced costs to builder, and to homeowner for construction costs if passed through)
5. Previously Developed (LEED-LL 3) (reduced costs to builder and to homeowner for construction costs if passed through)
6. Erosion control, minimized site disturbance, stormwater runoff (LEED-SS 1.1, SS 1.2, and SS 4)
7. Landscaping: no invasive species (LEED SS 2.1)
8. Ensure use of refrigerants that do not cause ozone layer depletion and climate change (LEED-EA 11)
9. Material Efficient Framing (LEED-MR 1) (framing order waste factor limit results in reduced costs to builder and to homeowner for construction costs if passed through)
10. LEED or GreenPoint Rating