

# BUILDING A WORLD OF DIFFERENCE

## “ENVISION”ING THE LCA OF A WASTEWATER TREATMENT PLANT

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# AGENDA

## Three-Act Play

Act One- Intro to ENVISION

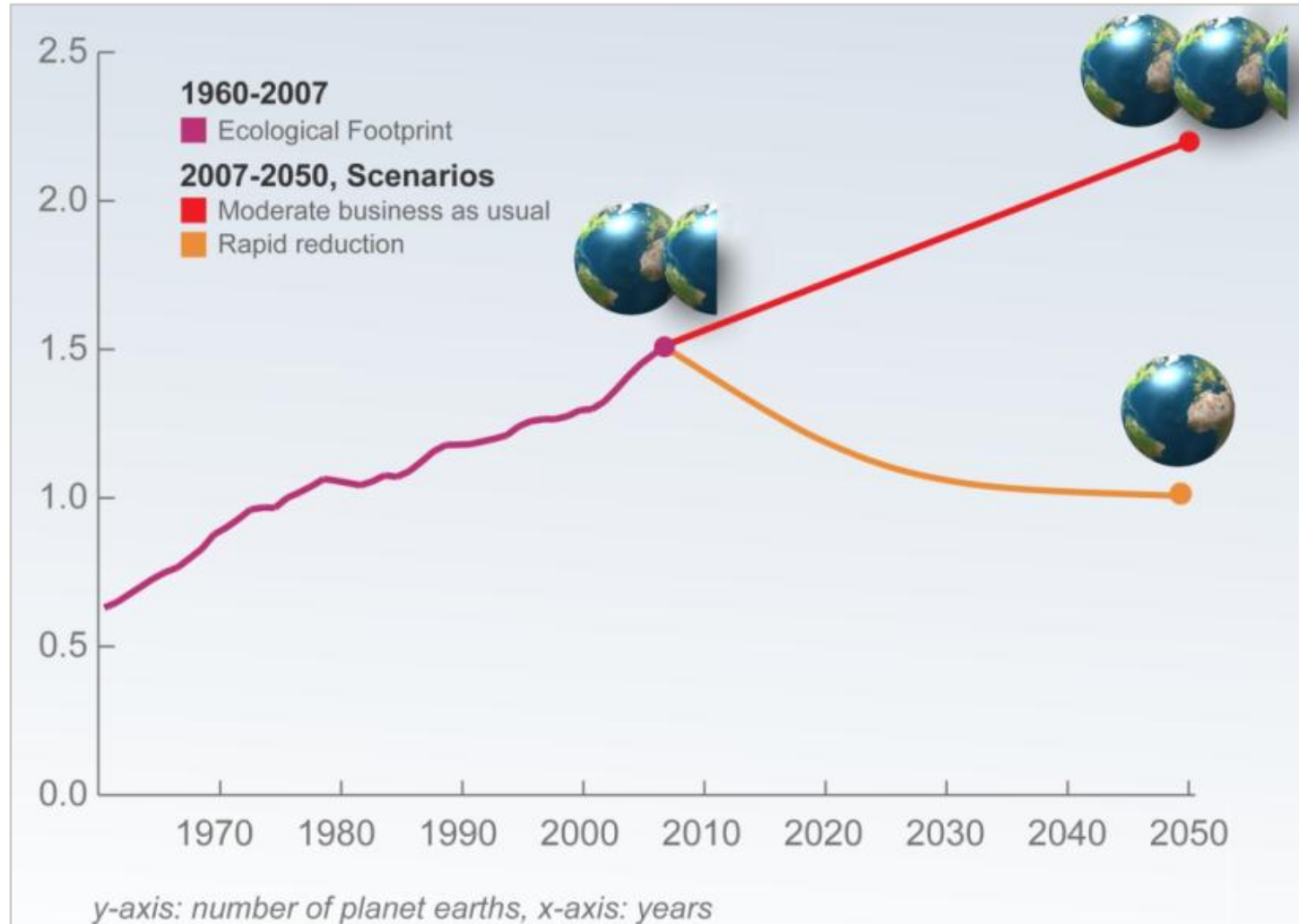
Act Two- Intro to LCA

Act Three- Harmony between the tools



Act-One Follows...

# RESOURCE DEPLETION



# AMERICA'S CHANGING INFRASTRUCTURE



# REPORT CARD FOR AMERICA'S INFRASTRUCTURE

- 15 Categories rated
- Overall grade: D
- \$2.2 Trillion
- Ranked 23<sup>rd</sup> Worldwide



Infrastructure needs improvements in categories

# INTRODUCTION TO ENVISION

- **The Need for Envision**
- **What is Envision?**
  - The Process
  - The Credit List
- **Envision in the Marketplace**
  - Example Water Projects
  - Black & Veatch Position

## THE ENVISION™ RATING SYSTEM



Jointly Developed

The Institute for Sustainable Infrastructure is a not-for-profit education and research organization founded by the American Public Works Association, the American Council of Engineering Companies and the American Society of Civil Engineers.

### Envision is Backed by Major National Member Organizations



# ENVISION™ IS UNIQUELY QUALIFIED TO ADDRESS AMERICA'S INFRASTRUCTURE

- Envision™ applies to all civil infrastructure
- Addresses design, planning, construction and maintenance
- Applicable at any point in an infrastructure project's life cycle
- Speaks to the triple bottom line: social, economic and environmental goals
- Designed to keep pace with a changing concept of sustainability



# 60 CREDITS IN 5 CATEGORIES



**QUALITY  
OF LIFE**

**Purpose, Community, Wellbeing**



**LEADERSHIP**

**Collaboration, Management, Planning**



**RESOURCE  
ALLOCATION**

**Materials, Energy, Water**



**NATURAL  
WORLD**

**Siting, Land & Water, Biodiversity**



**CLIMATE  
AND RISK**

**Emission, Resilience**

# WHAT TYPES OF INFRASTRUCTURE WILL ENVISION™ RATE?



## ENERGY

Geothermal  
Hydroelectric  
Nuclear  
Coal  
Natural Gas  
Oil/Refinery  
Wind  
Solar  
Biomass



## WATER

Potable water distribution  
Capture/Storage  
Water Reuse  
Storm Water Management  
Flood Control



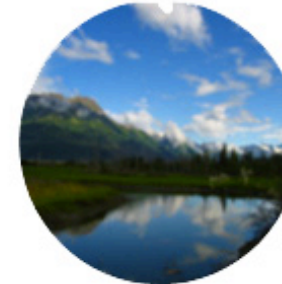
## WASTE

Solid waste  
Recycling  
Hazardous Waste  
Collection & Transfer



## TRANSPORT

Airports  
Roads  
Highways  
Bikes  
Pedestrians  
Railways  
Public Transit  
Ports  
Waterways



## LANDSCAPE

Public Realm  
Parks  
Ecosystem Services



## INFORMATION

Telecommunications  
Internet  
Phones  
Satellites  
Data Centers  
Sensors

**Comprehensive system that covers most aspects of infrastructure**



# ENVISION™ CREDIT LIST



## CREDIT LIST



### 1 PURPOSE

- QL1.1 Improve Community Quality of Life
- QL1.2 Stimulate Sustainable Growth & Development
- QL1.3 Develop Local Skills & Capabilities

### 2 WELLBEING

- QL2.1 Enhance Public Health & Safety
- QL2.2 Minimize Noise and Vibration
- QL2.3 Minimize Light Pollution
- QL2.4 Improve Community Mobility & Access
- QL2.5 Encourage Alternative Modes of Transportation
- QL2.6 Improve Accessibility, Safety, & Wayfinding

### 3 COMMUNITY

- QL3.1 Preserve Historic & Cultural Resources
- QL3.2 Preserve Views & Local Character
- QL3.3 Enhance Public Space
  
- QL0.0 Innovate or Exceed Credit Requirements



### 1 COLLABORATION

- LD1.1 Provide Effective Leadership & Commitment
- LD1.2 Establish A Sustainability Management System
- LD1.3 Foster Collaboration & Teamwork
- LD1.4 Provide for Stakeholder Involvement

### 2 MANAGEMENT

- LD2.1 Pursue By-Product Synergy Opportunities
- LD2.2 Improve Infrastructure Integration

### 3 PLANNING

- LD3.1 Plan For Long-Term Monitoring & Maintenance
- LD3.2 Address Conflicting Regulations & Policies
- LD3.3 Extend Useful Life
  
- LD0.0 Innovate or Exceed Credit Requirements



### 1 MATERIALS

- RA1.1 Reduce Net Embodied Energy
- RA1.2 Support Sustainable Procurement Practices
- RA1.3 Use Recycled Materials
- RA1.4 Use Regional Materials
- RA1.5 Divert Waste From Landfills
- RA1.6 Reduce Excavated Materials Taken Off Site
- RA1.7 Provide For Deconstruction & Recycling

### 2 ENERGY

- RA2.1 Reduce Energy Consumption
- RA2.2 Use Renewable Energy
- RA2.3 Commission & Monitor Energy Systems

### 3 WATER

- RA3.1 Protect Fresh Water Availability
- RA3.2 Reduce Potable Water Consumption
- RA3.3 Monitor Water Systems
  
- RA0.0 Innovate or Exceed Credit Requirements



### 1 SITING

- NW1.1 Preserve Prime Habitat
- NW1.2 Protect Wetlands & Surface Water
- NW1.3 Preserve Prime Farmland
- NW1.4 Avoid Adverse Geology
- NW1.5 Preserve Floodplain Functions
- NW1.6 Avoid Unsuitable Development on Steep Slopes
- NW1.7 Preserve Greenfields

### 2 LAND+WATER

- NW2.1 Manage Stormwater
- NW2.2 Reduce Pesticide & Fertilizer Impacts
- NW2.3 Prevent Surface & Groundwater Contamination

### 3 BIODIVERSITY

- NW3.1 Preserve Species Biodiversity
- NW3.2 Control Invasive Species
- NW3.3 Restore Disturbed Soils
- NW3.4 Maintain Wetland & Surface Water Functions
  
- NW0.0 Innovate or Exceed Credit Requirements



### 1 EMISSIONS

- CR1.1 Reduce Greenhouse Gas Emissions
- CR1.2 Reduce Air Pollutant Emissions

### 2 RESILIENCE

- CR2.1 Assess Climate Threat
- CR2.2 Avoid Traps & Vulnerabilities
- CR2.3 Prepare For Long-Term Adaptability
- CR2.4 Prepare For Short-Term Hazards
- CR2.5 Manage Heat Island Effects
  
- CR0.0 Innovate or Exceed Credit Requirements



# INSIDE EACH CREDIT

## LEVELS OF ACHIEVEMENT

IMPROVED	ENHANCED	SUPERIOR	CONSERVING	RESTORATIVE
<p><b>(1) No adverse effects.</b> Project team works with the community, property owner and required regulatory and resource agencies to identify public space resources and develop possible solutions. Feasibility analysis done for incorporating preservation, enhancement, or the creation of new spaces into the project. Project is designed such that it results in no long-term adverse effects and may include mitigation. Project may result in minor temporary impacts. (A, B)</p>	<p><b>(3) No Impact to resources.</b> Project team works with the community, property owner and required regulatory and resource agencies to develop avoidance solutions. Focus is on no impact to resource. The project has no significant permanent impact to the resource. Temporary impacts are minimized. Consideration given to the creation of new public space. (A, B)</p>	<p><b>(6) Improvement and enhancement.</b> Project team identifies and implements meaningful enhancement or the creation of new public space. The project team works with stakeholders</p>	<p><b>(11) Overall net benefit.</b> Examples include creating new space or facilities; addition of recreational facilities to an existing resource and/or significantly improving access</p>	<p><b>(13) Substantial restoration.</b> Restoration of existing plazas,</p>

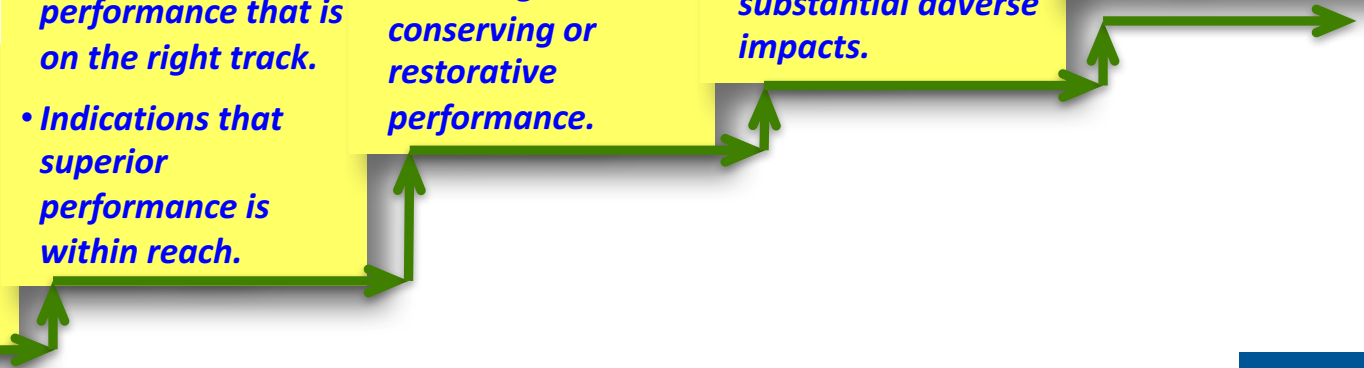
- Performance that is above conventional.
- Slightly exceeds regulatory requirements.

- Sustainable performance that is on the right track.
- Indications that superior performance is within reach.

- Sustainable performance that is noteworthy but not conserving.
- Point scores are designed to provide incentives for achieving conserving or restorative performance.

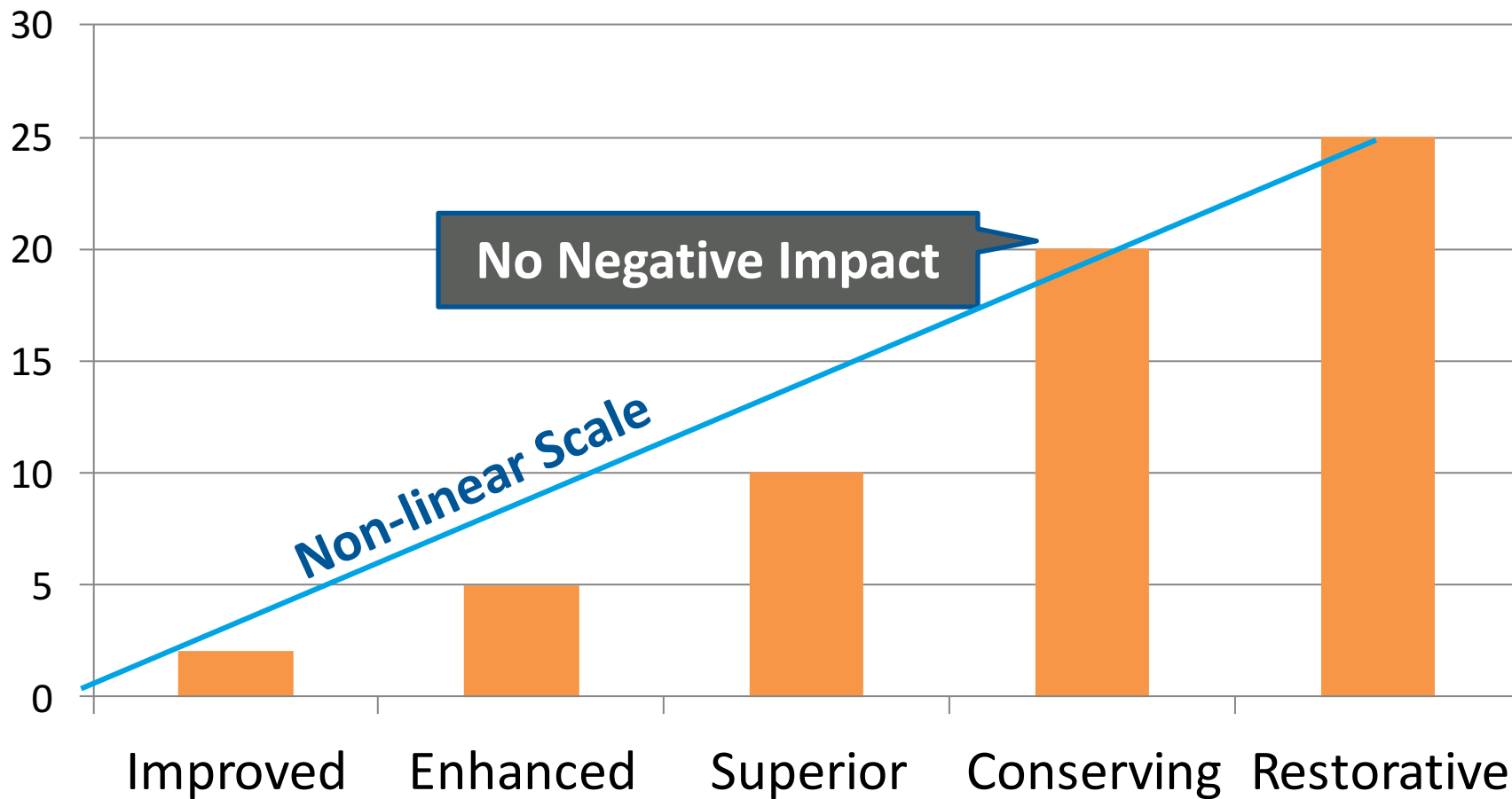
- Performance that has achieved essentially zero negative impact.
- Beneficial in the sense that conventional projects have substantial adverse impacts.

- Performance that restores natural or social systems.
- Such performance receives the highest award possible, and is celebrated as such.
- Not applicable to all objectives.



# LEVELS OF ACHIEVEMENT

## QL1.1 IMPROVE COMMUNITY QUALITY OF LIFE



# AWARD LEVELS

Recognition Level	Minimum Applicable Points	Minimum in Each Category
Bronze	20%	No minimum category percentage required
Silver	30%	
Gold	40%	
Platinum	50%	



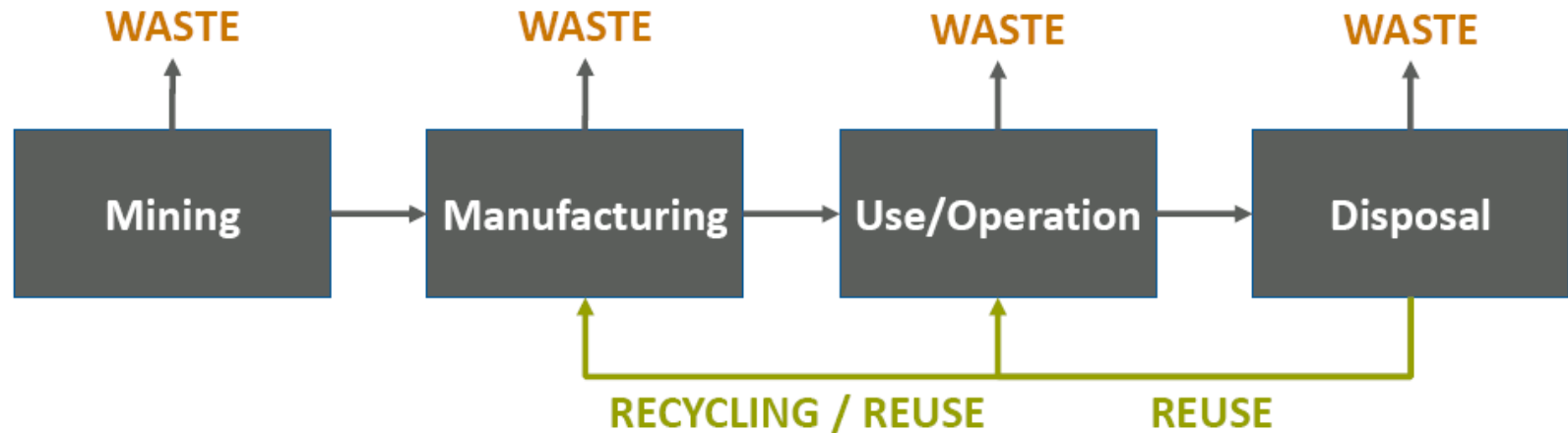
It is impossible to score 100% points

# ACT TWO

# LIFE CYCLE ANALYSIS



# LIFE CYCLE ASSESSMENT PRINCIPLE



- Track Mass Flows using a Broad “Holistic” Approach
- Track Energy Use and Tie this to Materials (e.g. Fossil Fuels)
- Assess *Potential* Impact of Constituent Mass Loads and Energy Under Different Categories

**LCA is an ultimate mass balance**



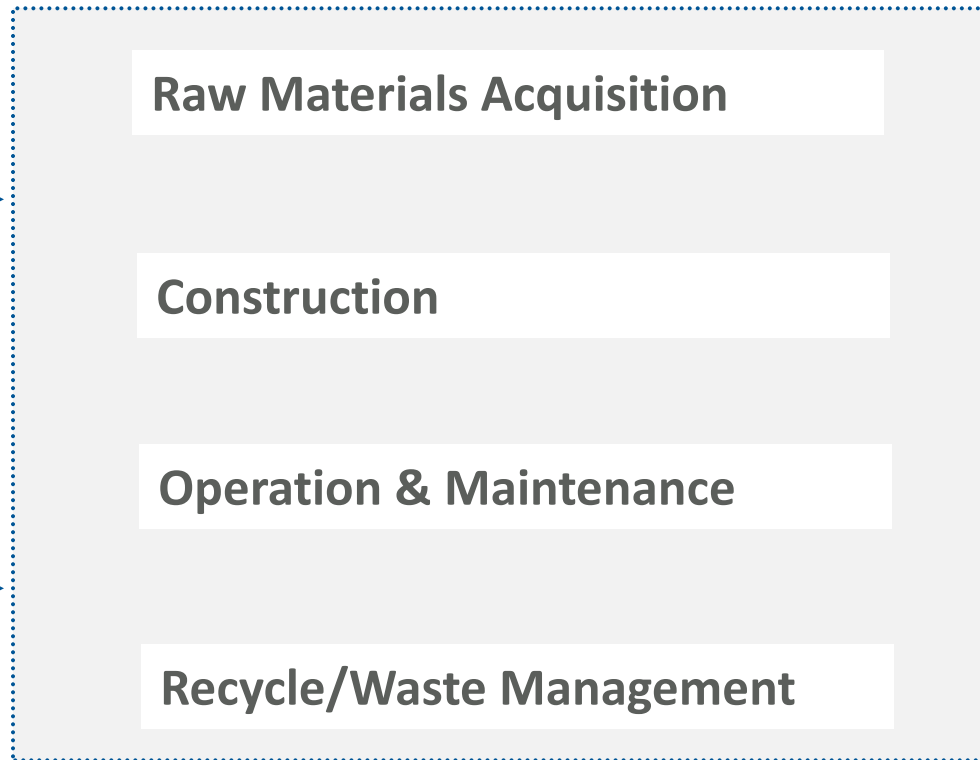
# LCA: INPUTS AND OUTPUTS

## INPUTS

Raw  
Materials



Energy



*System Boundary*

## OUTPUTS

Air  
Emissions



Solid wastes



Co-products



# LCA SOFTWARE

- SimaPro
  - <http://www.pre.nl/content/simapro-lca-software>
- GaBi
  - <http://www.gabi-software.com/>
- TEAM
  - [https://www.ecobilan.com/uk\\_team.php](https://www.ecobilan.com/uk_team.php)
- OpenLCA
  - <http://www.openlca.org/>

## Multiple

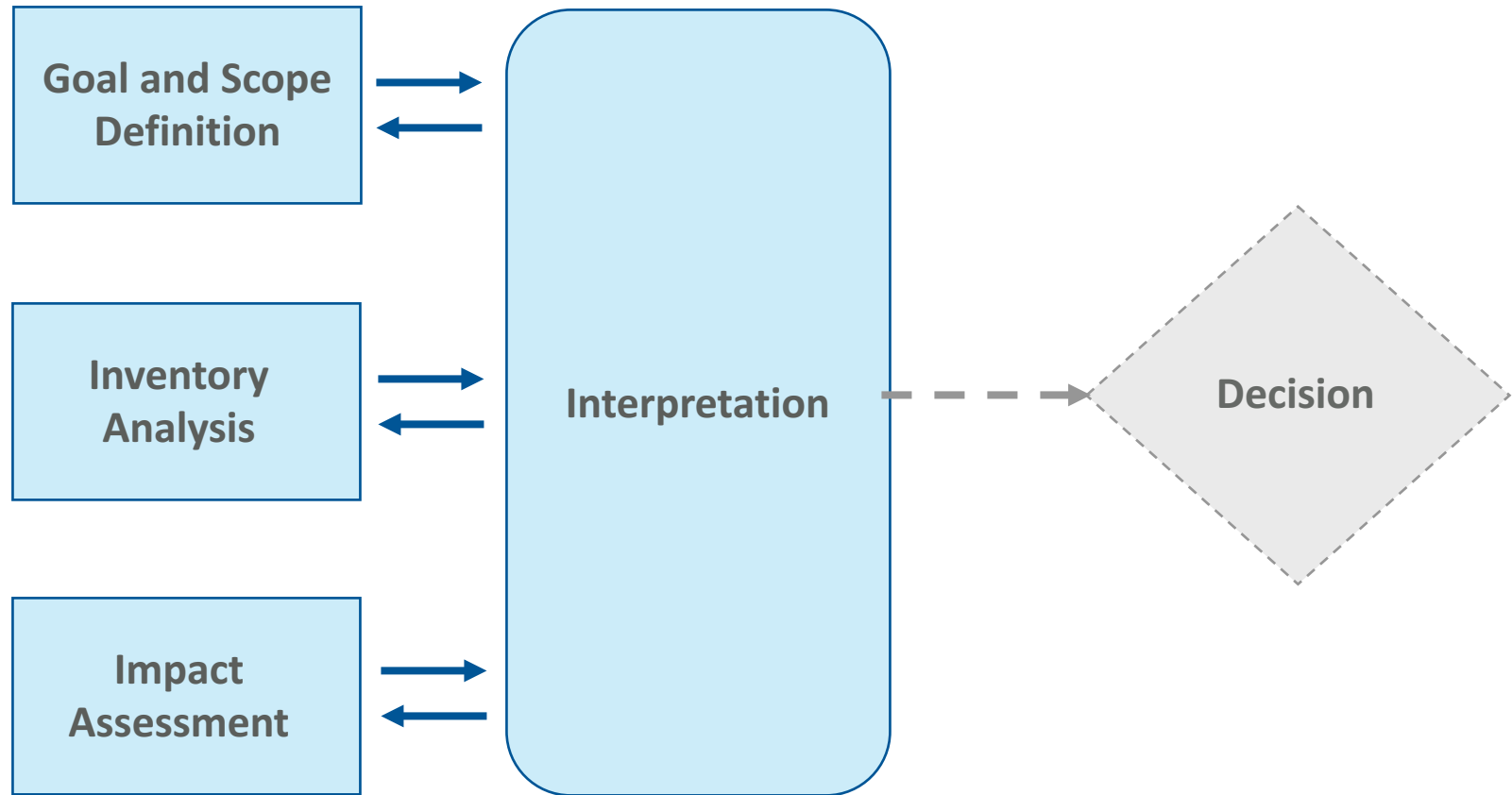
### Databases:

ecoinvent v.2, US LCI, ELCD, US Input Output, EU and Danish Input Output, Dutch Input Output, LCA Food, Industry data v.2.

## Multiple Assessment Methods:

ReCiPe, Eco-indicator 99, USEtox, IPCC 2007, EPD, Impact 2002+, CML-IA, Traci 2, BEES, Ecological Footprint, EDIP 2003, Ecological scarcity 2006, EPS 2000, Greenhouse Gas Protocol and others.

# LCA FRAMEWORK- ISO 14000 SERIES



Which Impacts are Most Relevant to Water/Wastewater Treatment Design?

# IMPACT CATEGORIES FOR WATER/WASTEWATER

## IMPACT CATEGORIES

Life Cycle Impact

- Global Warming Potential
- Eutrophication Potential-Nitrogen Load
- Eutrophication Potential-Phosphorus Load
- Terrestrial Acidification Potential
- Human Toxicity (Carcinogens and Non Carcinogens)
- Terrestrial Eco-Toxicity
- Photochemical Oxidation Potential
- Aquatic Eco-Toxicity
- Fossil Energy Depletion
- Ozone Layer Depletion
- Water Use
- Water Consumption

*Based on Impact 2002+ & Review of 20 Papers*



# ACT THREE

# LCA WITH ENVISION™



# LCA USE IN ENVISION



## Resource Allocation

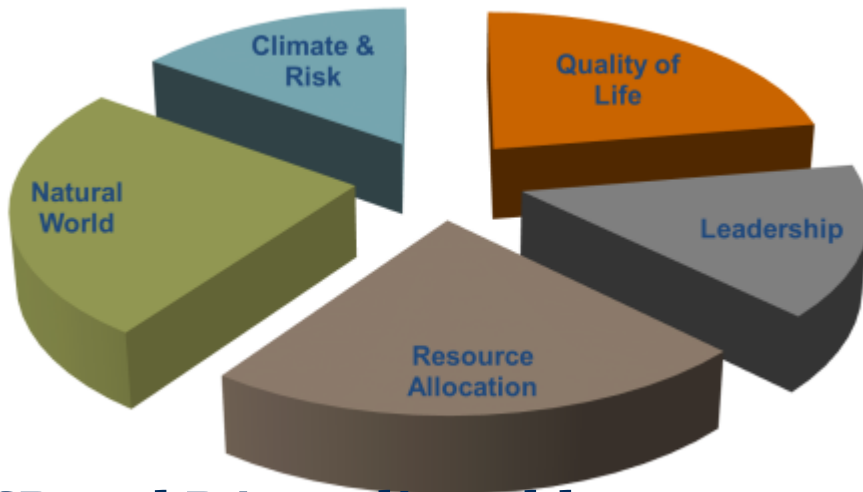
- Non-renewable energy use
- Water footprint



## Climate & Risk

- Pollution control
- Carbon footprint

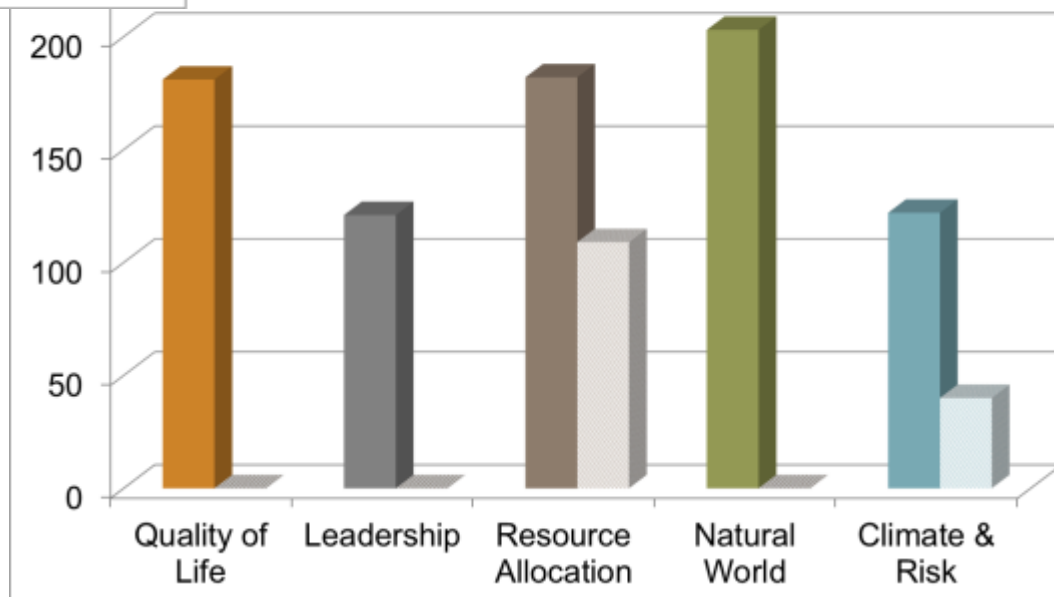
# CREDITS FOR LCA IN ENVISION



**CR and RA credits add up to 35% to total ENVISION™**

**LCA credits for CR and RA add up to 20% to total**

■ Total Envision Credits ■ Total LCA Credits



**Project can win Bronze Award**

# FEE SCHEDULE\*

- Registration Fee: \$1,000
- Verification Fee

Project Size (\$)	Non-Member Price	ISI Member Price
Up to 2M	\$3000	\$2400
2-5M	\$8500	\$7000
5-25M	\$17,000	\$14,000
25-100M	\$25,000	\$21,000
100-250M	\$33,000	\$28,000
Over 250M	\$5000 per 100M above base price of \$20,000	

\* Verified January 2017

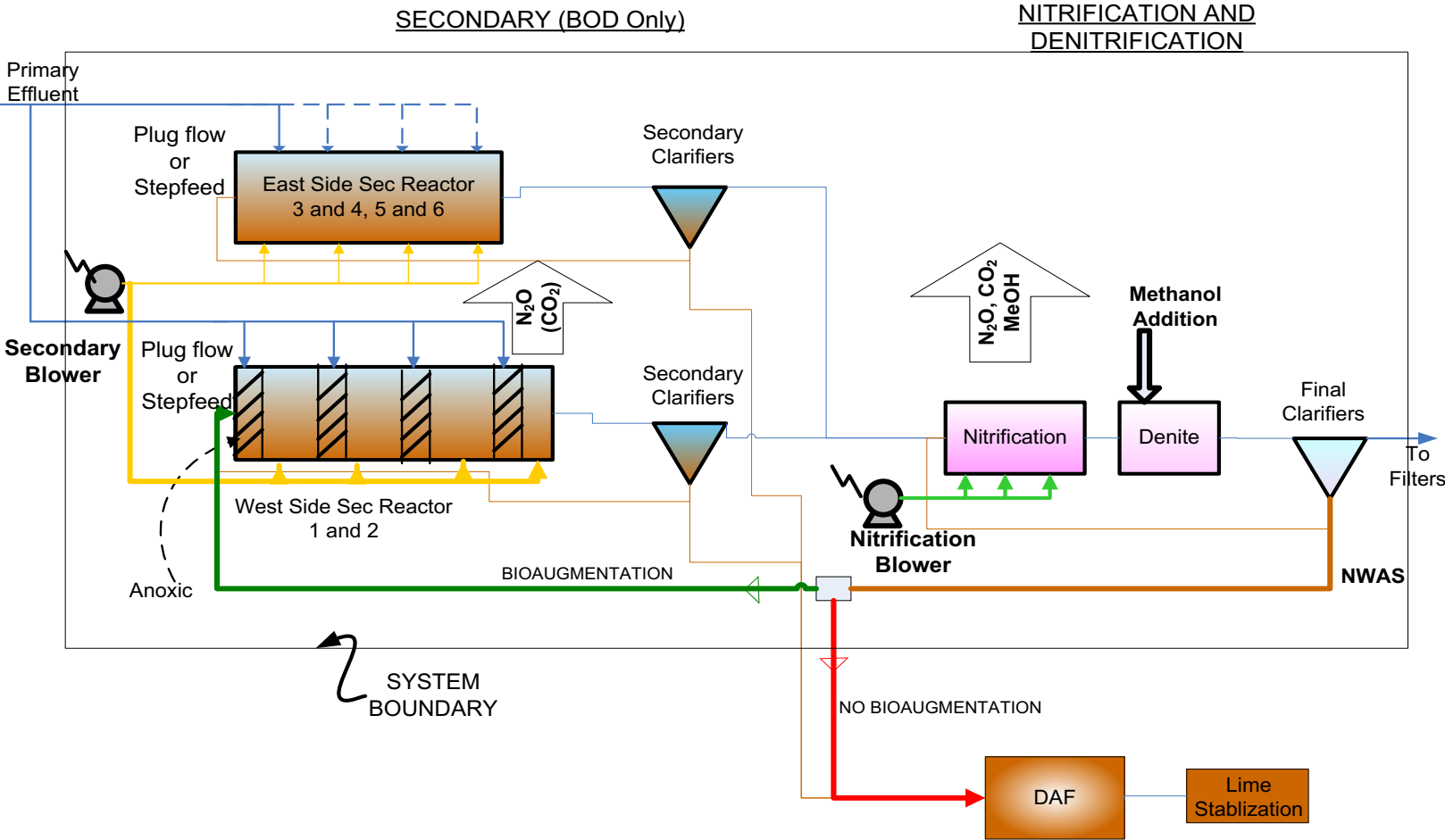


# CASE STUDY

# BLUE PLAIN AWTF



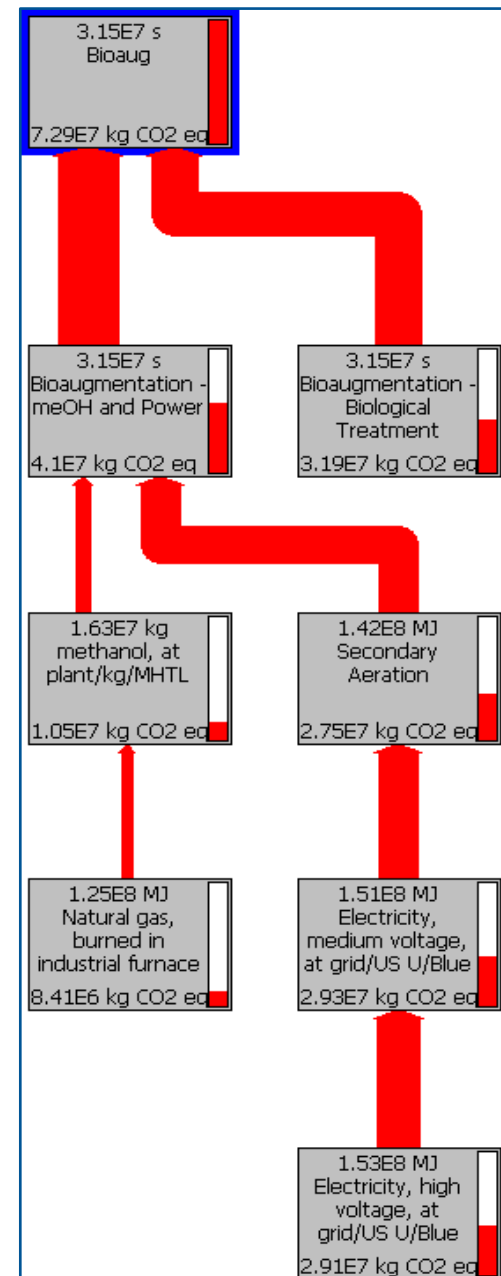
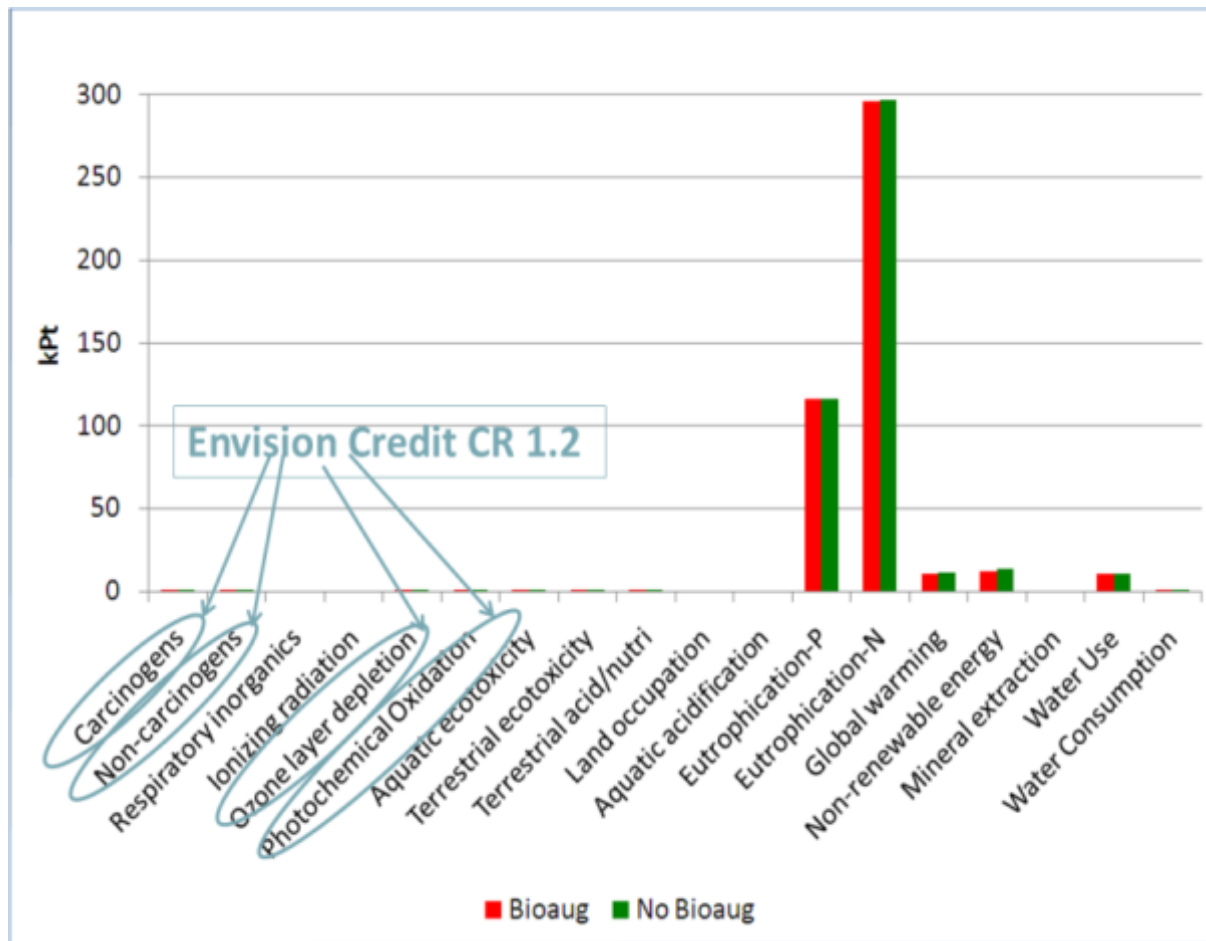
# PROPOSED ALTERNATIVES FOR BLUE PLAINS WWTP

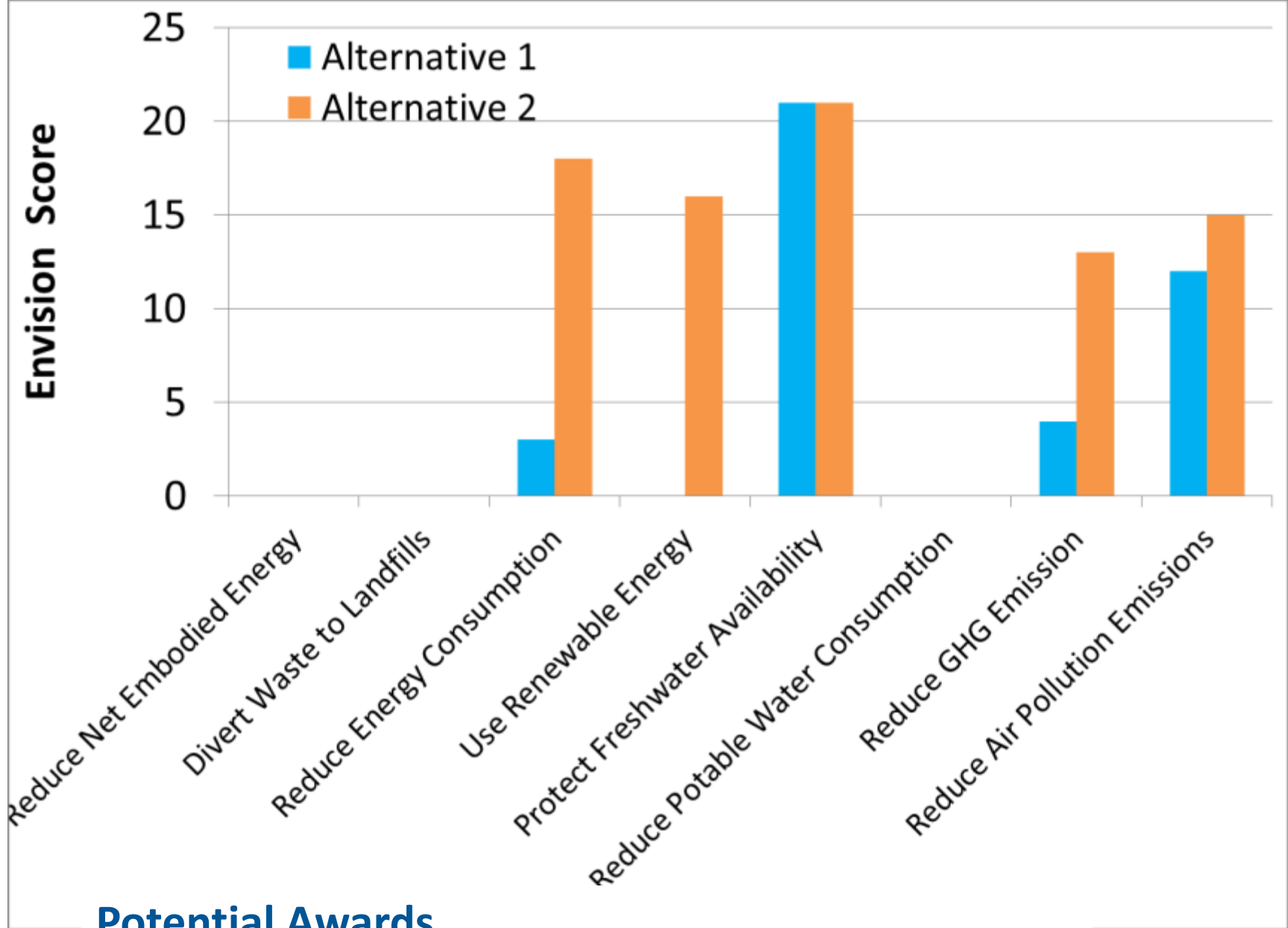


# ALTERNATIVES ANALYZED

- Alternative 1-
  - Bioaugmentation
  - Nitrified WAS recycled to the aeration basins
- Alternative 2-
  - Hypothetical condition
  - Biogas produced at the plant used to all the facility lighting
  - Biogenic methanol addition for denitrification

# LCA OUTPUTS





### Potential Awards

Alt 1 Score=  $40/149 = 0.27$  → Bronze

Alt 2 Score=  $83 /149 = 0.56$  → Platinum



# COMMITMENT TO ENVISION

- **B&V** Charter Member in 2013 (cost \$70k), committed to 100+ Employees Trained as ENV SP (currently stalled at 76 employees)
- RFPs Containing Envision Requirements Starting to Appear (KC MO, NYCDEP, Houston, LA County, Alliant Energy, others?)
- 2 B&V Wins using Envision
  - Pinellas County, FL (incumbent unable to do Envision)
  - OK Creek In-Line Storage & Gate Structure, KC MO (demonstrated potential points)
- Sponsored Training in Phoenix & St Louis
- Andrew Shaw on the Envision Review Board (ERB)

Building a **world** of difference.®

**Together**



**BLACK & VEATCH**

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