

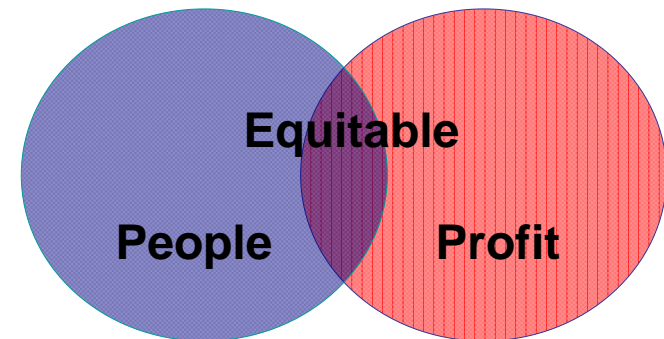
Collection System Sustainability

Surprising Results from a Carbon Footprint Analysis

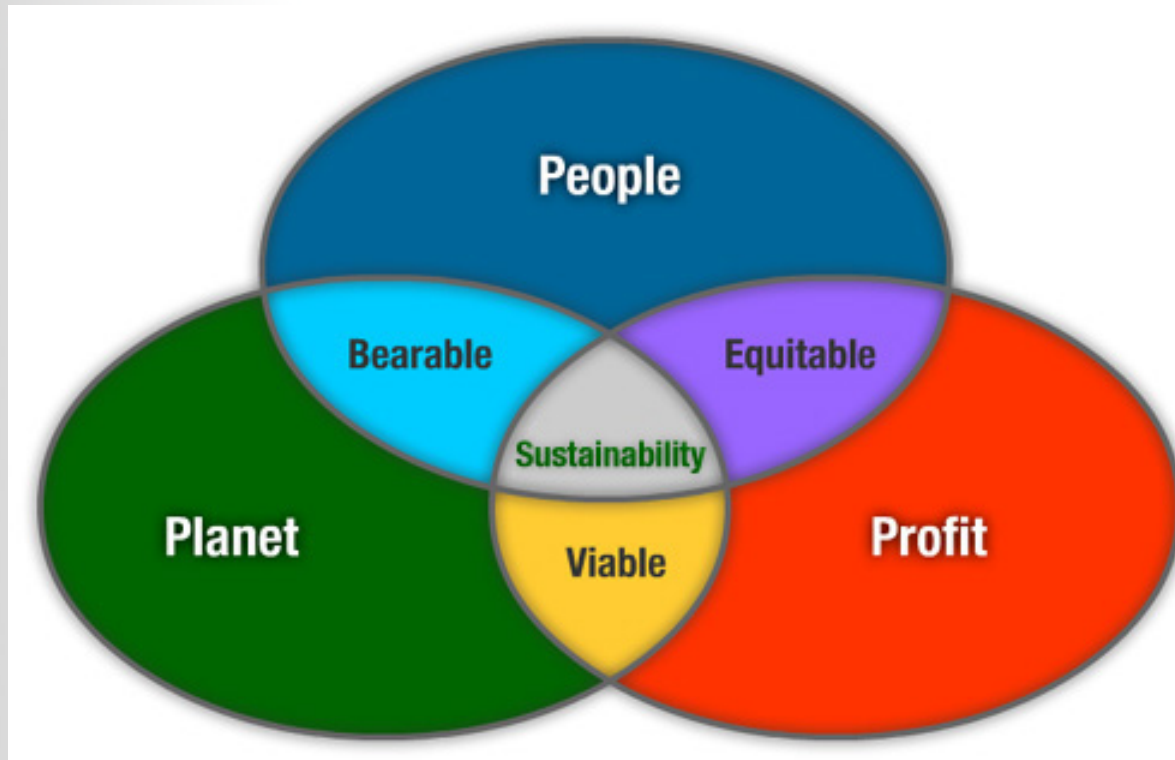


“BOTTOM LINE”

- Profit / Cost
 - Overall Project Cost
- People
 - Community Input
 - Public Opinion



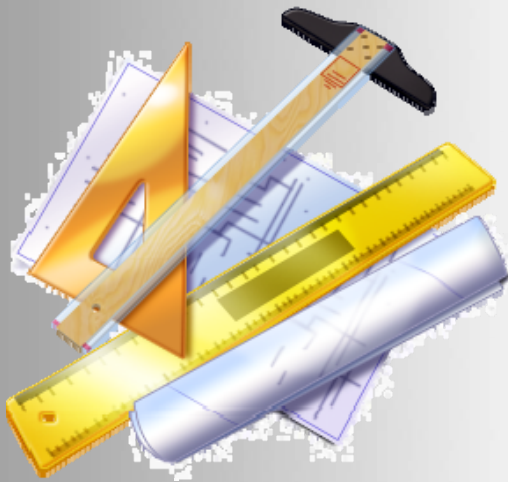
“TRIPLE BOTTOM LINE”



Sustainable Design

- What aspects of a project impact the planet/environment?
- All aspects need to be evaluated based on a equivalent value
- Quantifying Environmental Impact = Total Project Carbon Footprint





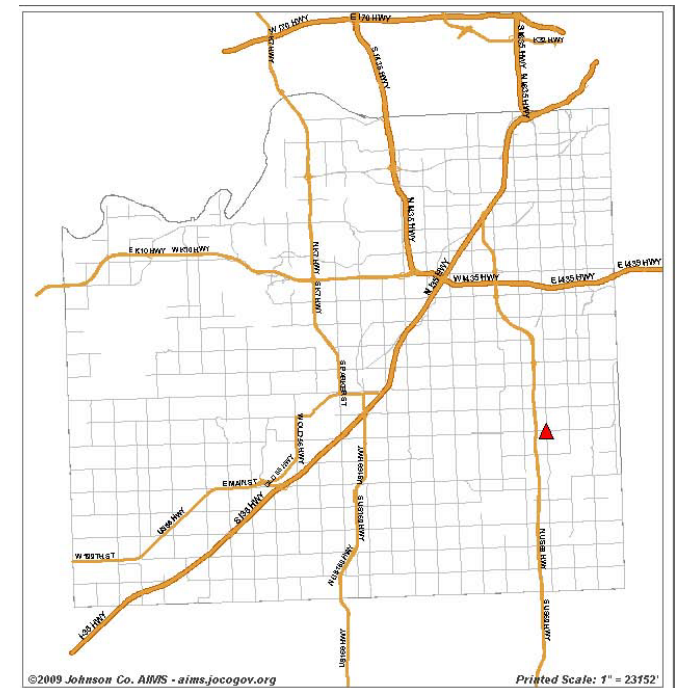
- Carbon dioxide equivalent (CO_{2e}) is a metric ton measurement
- Calculate the metric ton of CO_{2e} for various components of a project
 - construction methods
 - materials used
 - long term operation and maintenance



APPLYING “TRIPLE BOTTOM LINE”

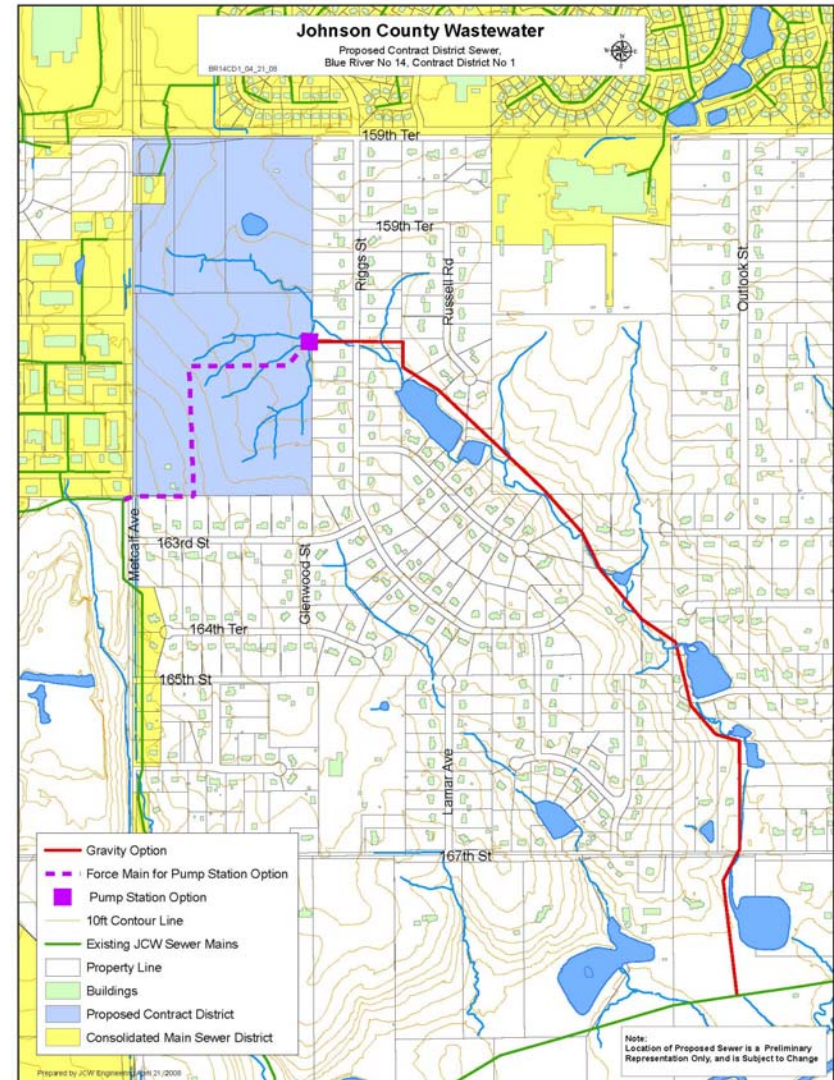
- A neighborhood in Johnson County presented two different project alternatives
- Alternatives Evaluation Includes
 - Capital Cost
 - Operation and Maintenance Cost
 - Total Carbon Footprint

- **Island in current served area**
- **Existing homes in natural drainage path**
- **Highly involved neighborhood association**
- **Original Master Plan**
 - Low density homes
 - Small area of commercial
 - Low Pressure Sewer/Gravity West
- **Current Master Plan**
 - High density and multistory residential
 - Large anchor retail commercial
 - Large strip mall commercial



GRAVITY VS. PUMP STATION

- Cost
(Construction/Operation)
 - Gravity \$2 million est.
 - Pump Station \$1.2 million est.
 - Est. 35 yr break even point w/operation and replacement
- Social Impact
- Environmental Impact
 - Carbon Footprint



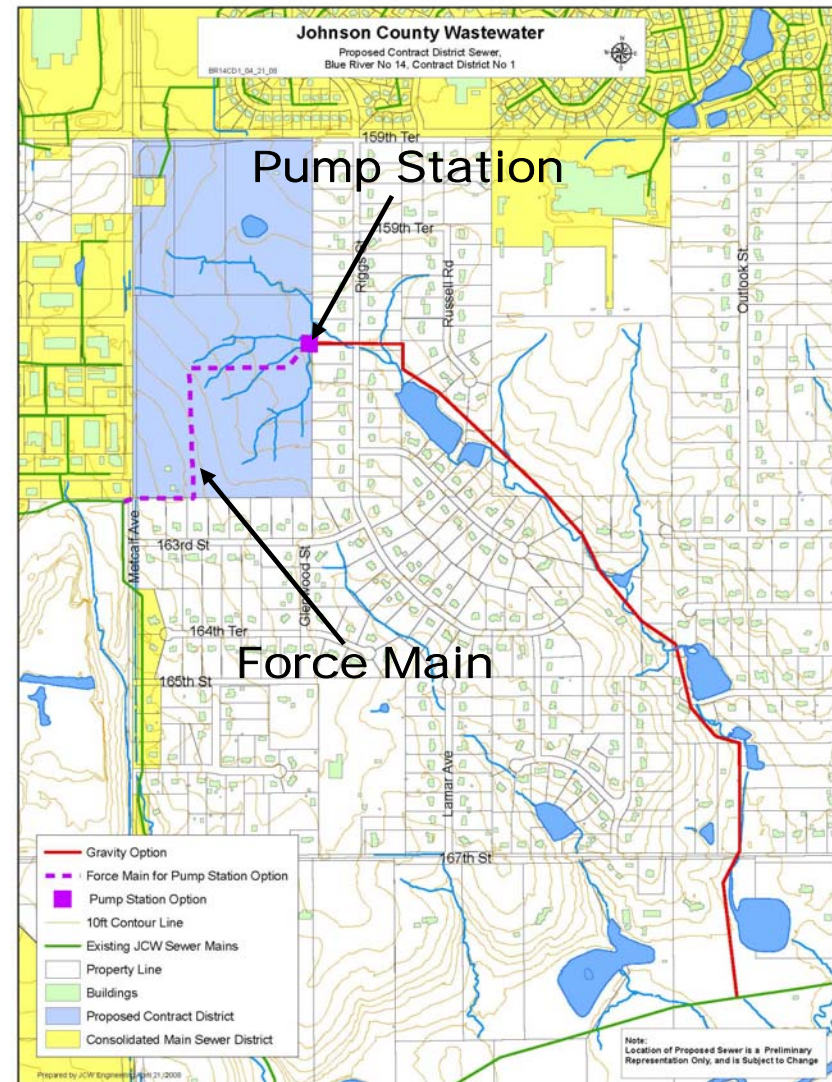
Gravity Main

- 6,700 feet total pipe length
- 18-inch and 15-inch SDR 35 PVC
- Depth of Excavation
- Construction and Installation Time



Force Main & Pump Station

- 2,100 feet
- 6-inch DIP
- Shallow Depth of excavation
- 2 or 3 300 gpm pumps
- 300 or 600 gpm firm capacity
- One generator to run 1 pump with adequate fuel for 24 hours



- Fuel Economy/Fuel Burned
- Embodied Energy – MJ/kg
- Emission Factor
 - Diesel fuel - kg CO_{2e}/MJ
 - Unleaded fuel - kg CO_{2e}/MJ
 - Kilowatts hour - kg CO_{2e}/kW-hr



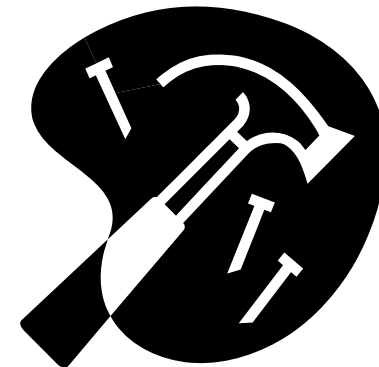
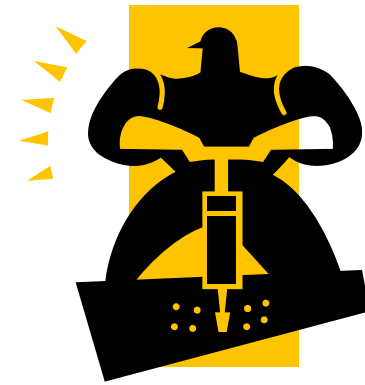
Activities Evaluated

- Surveying
- Storm Water Management
- Site Preparation
- **Trenching**
- Tie-in to existing main sewer
- Lift Station
- **Off-site hauling**
- Pipe laying and manhole construction
- Road Crossing – Jack and bore
- **Backfill placement and compaction**
- Site Restoration – seeding and mulching



Activities Evaluated

- Pumping (5-year ramp-up)
- Standby Generator Exercise
- Maintenance Crew (3 times per week)
- Haul Screenings (2 times per week)
- Tree Removal/Cutting

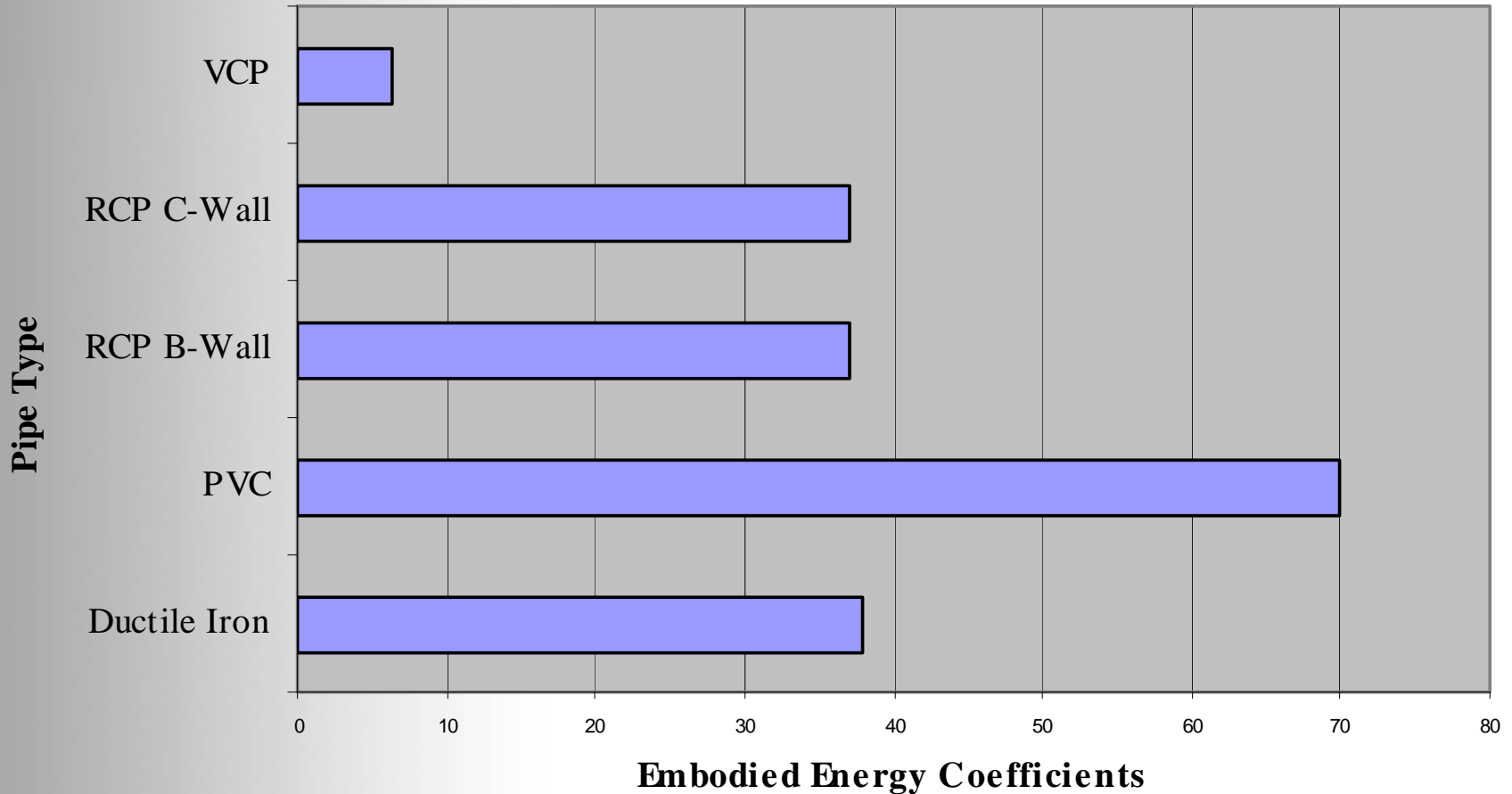


Materials Evaluated

- Stormwater BMP's
- **PVC SDR-35 pipe**
- **Ductile Iron Pipe**
- **Reinforced Concrete Pipe**
- **Pipe bedding**
- Manholes
- Pump and electrical
- Asphalt for street repair
- Steel casing for bore and jack



Pipe Material Embodied Energy Coefficients



PVC vs. DIP

Material	Shipped Length & Weight	Material Quantities	Total Length ft	Total Weight lb	Total Weight kg	Embodied Energy MJ/kg	Emission Factor kg CO _{2e} /MJ	Metric Tons CO _{2e}
18 inch SDR-35 PVC Pipe	22 feet 20.71 lb/ft	157 pieces	3454	71,532	32,515	70	0.17	387
15 inch SDR-35 PVC Pipe	22 feet 14.74 lb/ft	156 Pieces	3432	50,588	22,994	70	0.17	274
Gravity Main - SDR-35 PVC Subtotal								661
6 inch Ductile Iron Pipe	20 feet 16.75 lb/ft	107 Pieces	2140	35,845	16,293	38	0.17	105
Force Main - DIP Subtotal								105

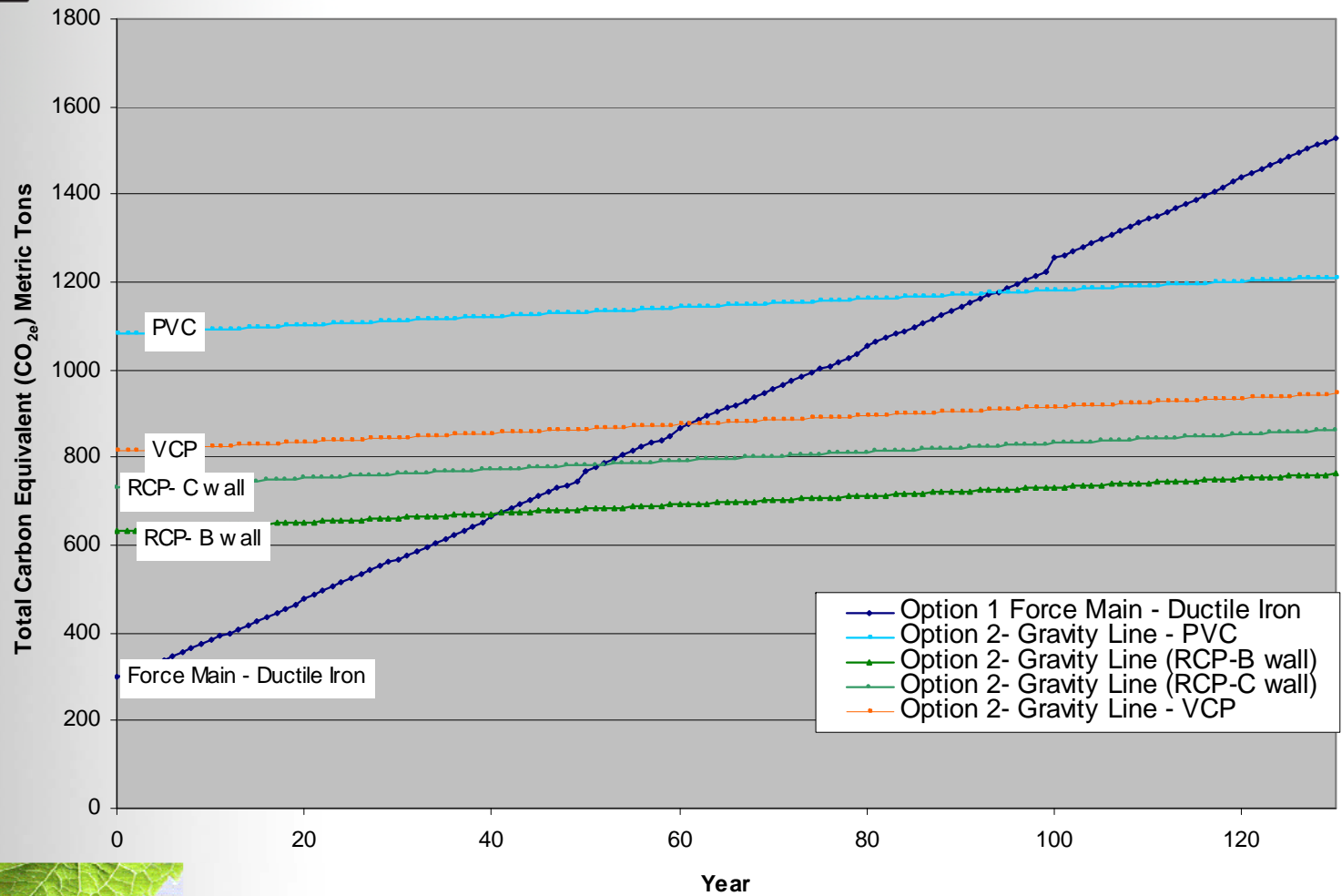


Carbon Footprint Comparison

Project Alternatives	Project Cost (\$)	Construction Carbon Footprint (Metric Tons CO₂)	O&M Carbon Footprint (Metric Tons CO₂ per year)
Gravity Sewer	2.0 million	1084	1.00
Force main & pump station	1.2 million	252	7.82



Carbon Footprint vs. Time

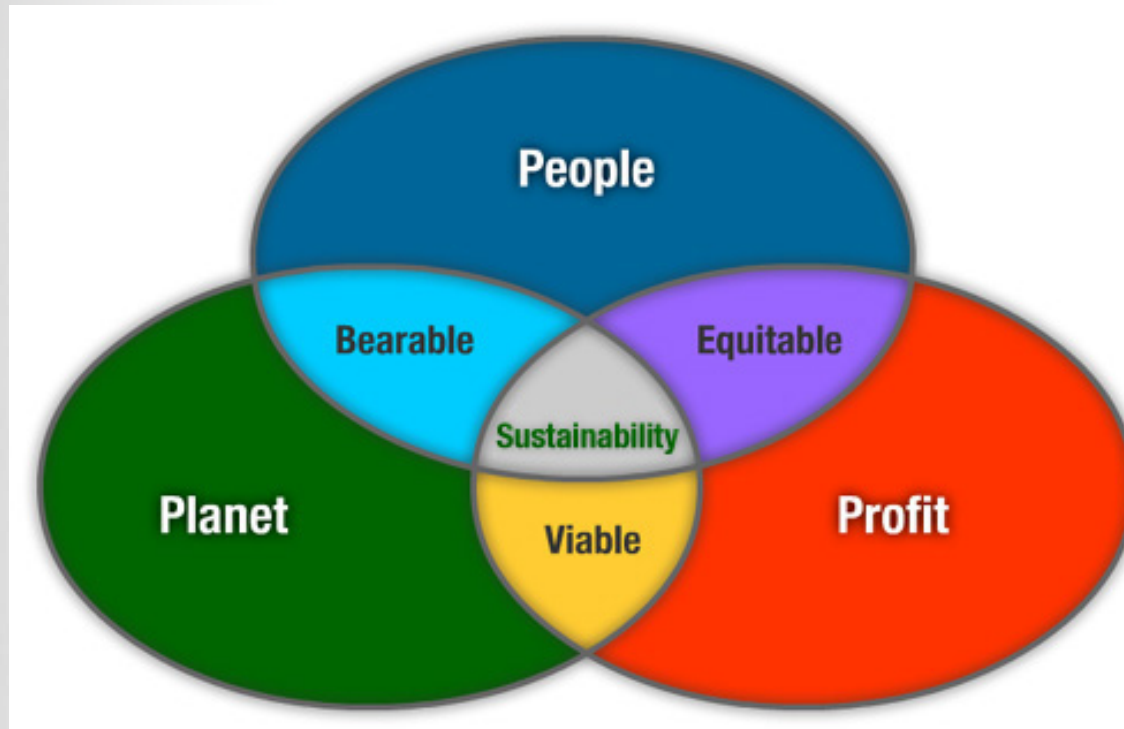


LESSONS LEARNED

- Pipe size – the bigger the pipe the larger carbon footprint
- Amount of material used – more materials, larger carbon footprint
- Mechanical equipment – replacement has a small effect on total carbon footprint
- Length of time – length of time for study period is important to determine cross over point
- Different sites – results will vary significantly



“Triple Bottom Line”





QUESTIONS?

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