



# **Optimizing Industry Water Use (Phase II)**

**Great Lakes Protection Fund  
Project # 926.01**

***Applying Water Footprinting/Accounting Initiatives to Industrial  
Facilities in the Great Lakes Basin***

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November 2011

Project website: <http://cgli.org/waterfootprint/waterfootprint.html>

# Why This Project?

- Global concerns regarding water shortages and access to water
- International efforts to characterize water use practices and needs
- A number of water use accounting methodologies have been developed or are under development
- A critical need for industry to understand water use assessment and “footprinting” [water stewardship initiatives](#)
- There are several important questions regarding the initiative methodologies that need to be answered

# Global Water Initiatives

- Aquawareness
- **Alliance for Water Stewardship (EWP)**
- BIER Water Footprint Working Group
- **Carbon Disclosure Project -Water Disclosure**
- Corporate Water Gauge
- Federation House Commitment to Water Efficiency
- Global Environmental Management Initiative (GEMI)
- **Global Reporting Initiative**
- **Global Water Tool (WBCSD)**
- UNEP/SETAC Life Cycle Initiative
- Strategic Water Management Framework (Australia minerals)
- UN CEO Water Mandate
- Water Brief for Business
- **Water Footprint Network**
- Water Footprint Neutrality and Efficiency Project (UN)
- Water Neutral Offset Calculator
- WaterSense Certification Scheme
- Water Stewardship Initiative
- ISO Water Footprint Standard

Initiatives in bold text are those selected for more detailed analysis

# Study Design/Sponsors

- Great Lakes Industry study of nineteen water use accounting/water stewardship initiatives
  - Applying methodologies at high volume withdrawal/low consumptive use industries in water rich regions
  - Study uses a common metrics approach
  - Study sponsors: Council of Great Lakes Industries, Great Lakes Protection Fund, National Council for Air and Stream Improvement (NCASI), Electric Power Research Institute (EPRI)

# The Pilot Facility Approach

- Test use of water accounting initiatives at “real” facilities in the Great Lakes Basin
  - NewPage pulp/paper mill – Escanaba, MI
  - Consumers Energy coal fired electric utility – Grand Haven, MI
  - Shell petrochemicals refining plant – Sarnia, Ont.
  - Lafarge Portland cement plant – Bath, Ont.
- Utilize a “common metrics” approach to tease out responses expected to be generated by four to six of the more prevalent accounting initiatives
- Complete an interpretive analysis of study results relative to both Great Lakes water management needs and the evaluation of water use through these initiatives in general

# The Project Questions

(As revised November 2011)

1. *To what extent can or should the water accounting initiatives identified in this study be used to characterize/evaluate Great Lakes industrial uses and impacts?*
2. *Do these initiatives provide for recognition of water recycling or reuse practices commonly typical of industrial processes? How does this ability vary between sectors?*
3. *How do the initiatives relate to water conservation expectations within the industrial facility setting? Can water footprinting and other approaches be used by industrial water users to inform their water stewardship programs?*
4. *Can the initiatives be used to support sustainable economic development pursuits in the Great Lakes Basin? Are they equipped to properly characterize use of water in support of society's needs, services, and manufacture of products?*
5. *Can links be made between the tools and Great Lakes Compact/Agreement?*
6. *How do metrics compare to what companies are already reporting?*
7. *Are the initiatives applicable to a "water rich" region like the Great Lakes Basin?*

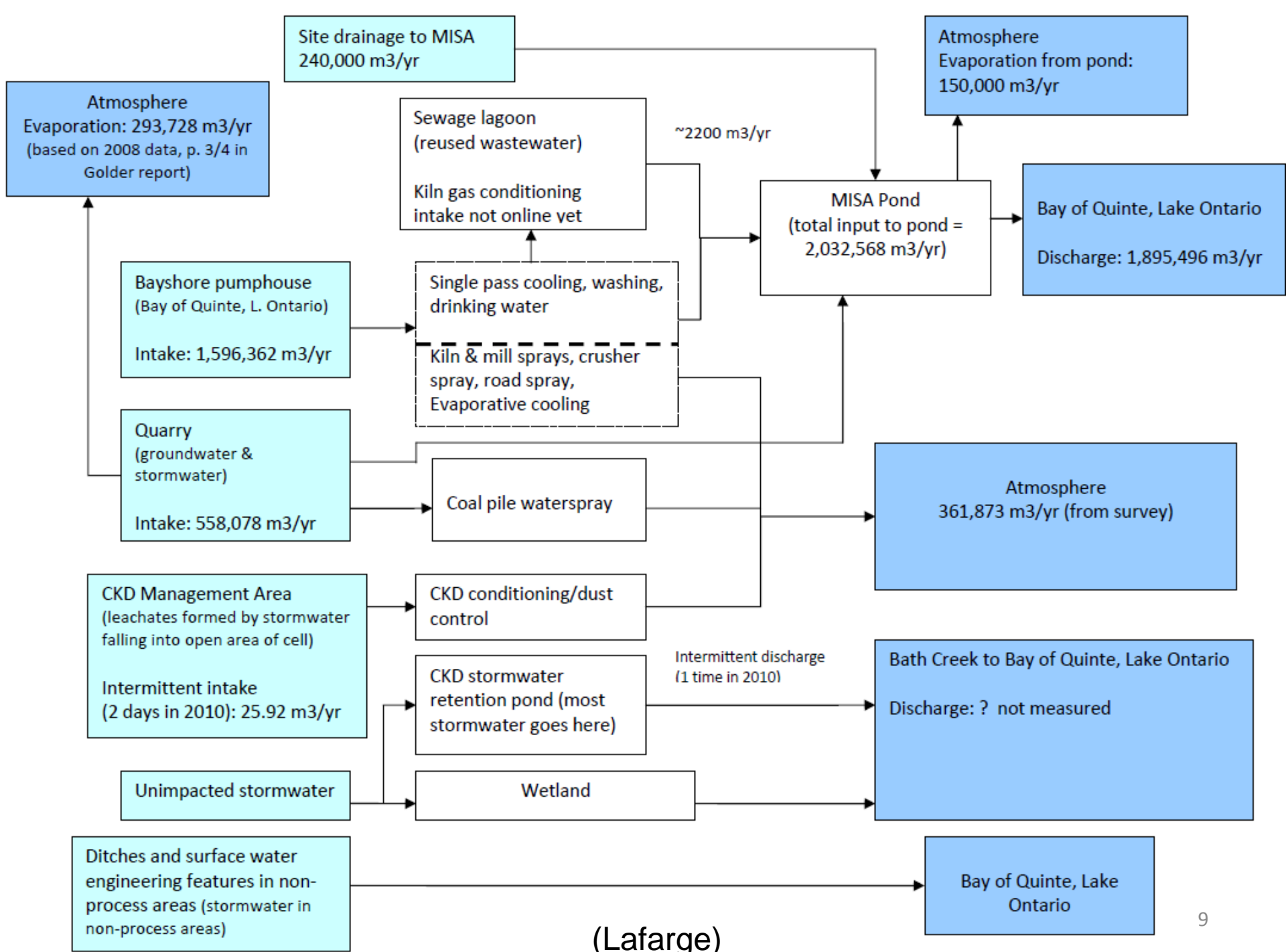
# Initial High Level Findings

- Water accounting systems resource intensive
- Each developed for a specific purpose
- While some common metrics employed, definitions vary
- Measurements and precision of measurements are issues
- May offer common language for reporting
- Can highlight information gaps and issues
- Can be used to demonstrate sustainable use
- The “numbers” only tell part of the story – impacts matter

(Lafarge)

# Understanding Water Flows is Complicated

- At first glance, it doesn't seem so complicated
  - Water is withdrawn from:
    - Bay of Quinte
    - a quarry
    - cement kiln dust (CKD) management area
  - Water is used at the site:
    - some water evaporates during use (e.g., kiln conditioning tower, dust control and coal pile waterspray)
  - Water is discharged to:
    - Bay of Quinte
    - Bath Creek

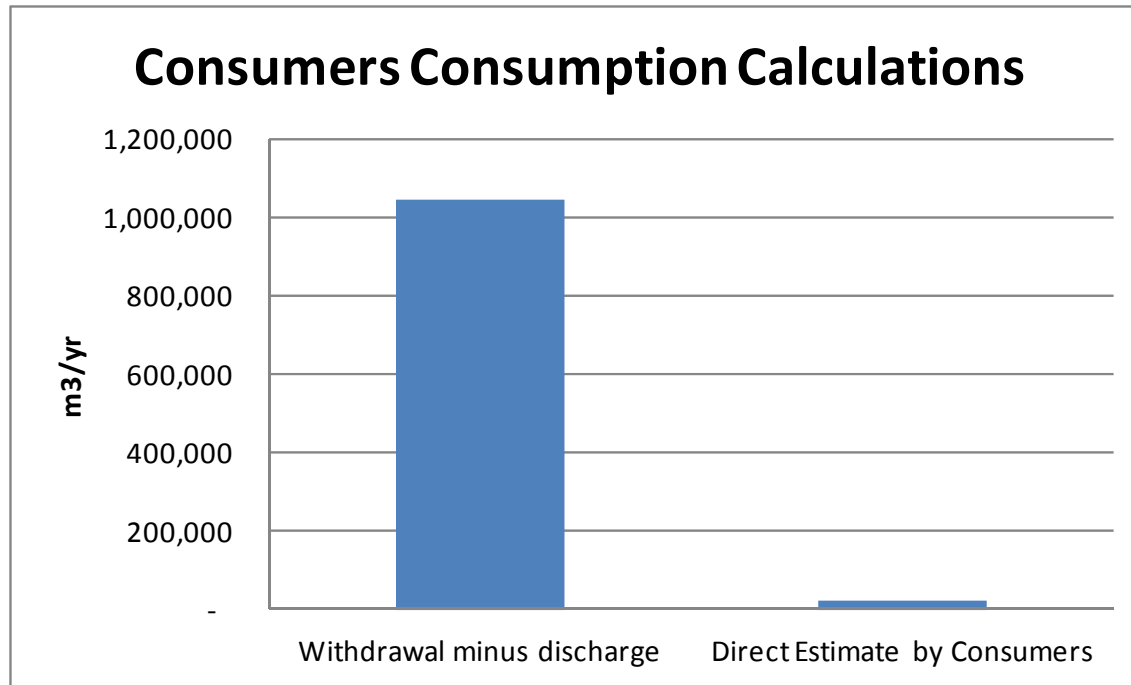


(Lafarge)

# Understanding Water Flows is Complicated

- Water is withdrawn from:
  - Bay of Quinte, quarry and CKD management area
  - BUT, quarry is fed by groundwater and stormwater runoff, AND, water is lost through evaporation from the quarry.
- Some of this water is used on the site:
  - Some water evaporates during use at the site (e.g. dust control and coal pile waterspray), the remainder of water withdrawn from the quarry and Bay of Quinte is discharged to a MISA Pond.
- Water is discharged to:
  - Bay of Quinte (MISA pond discharges here)
  - BUT MISA pond water balance needs to consider other inputs and losses
    - Inputs: water from quarry and Bay of Quinte PLUS stormwater runoff
    - Outputs: volume discharged to Bay of Quinte PLUS evaporation from MISA pond
  - Bath Creek (CKD management area stormwater discharges here)
- Furthermore, water isn't measured everywhere
  - No measurements of landfill leachate flow to groundwater
  - No measurements of CKD management area stormwater discharge to Bath Creek

# Available Data Suggest Withdrawal Minus Discharge $\neq$ Consumption



- GWT calculates consumption as withdrawal minus discharge (incomplete characterization)
- Consumers calculates consumption independently (fraction of groundwater is consumed)

(Consumers Energy)

# Hypothetical Conversion to Recirculating Cooling: Decreased Withdrawals, Increased Consumption

<b><i>Representative Literature Values for Fossil Fuel Plants (gal/MWh)</i></b>		
	<b>Withdrawal</b>	<b>Consumption</b>
<b>Once-through Cooling</b>	36,350	250
<b>Recirculating Cooling</b>	1005	687

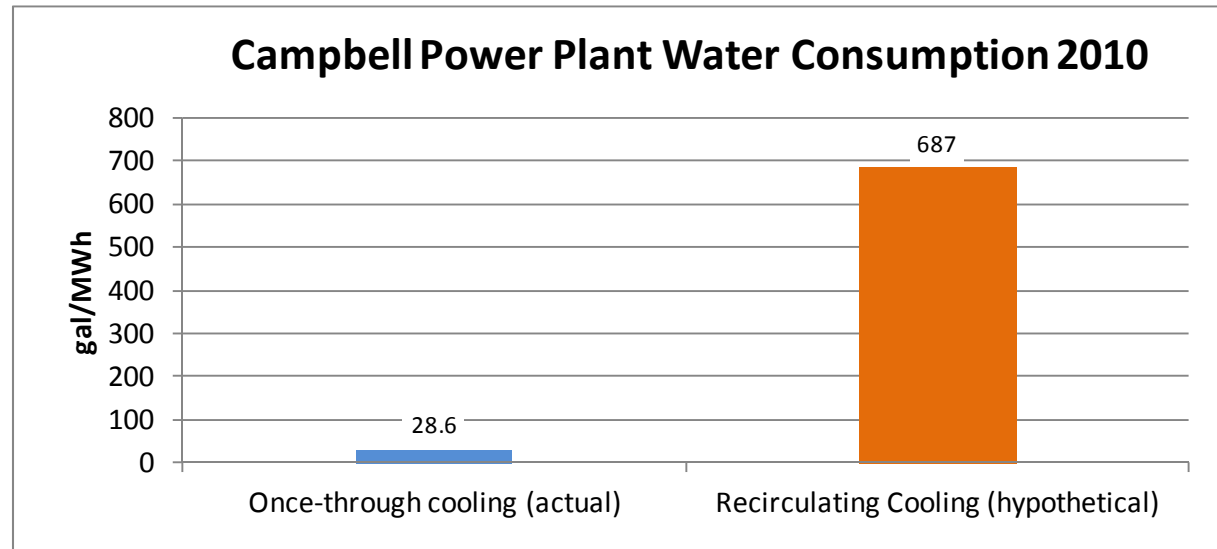
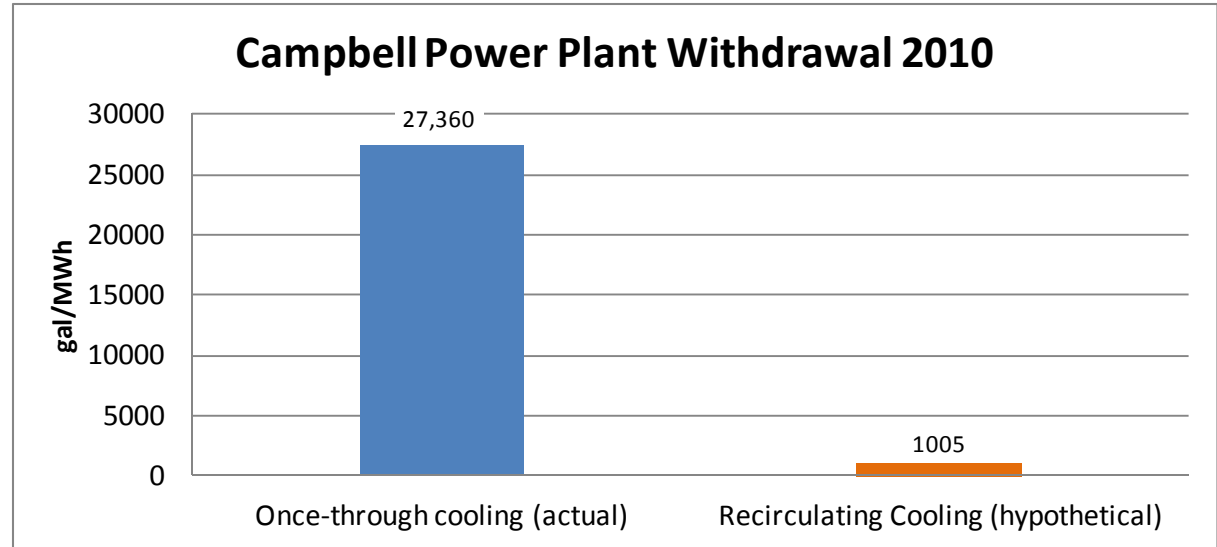
- Sources:
- EPRI, 2008. "Water Use for Electric Power Generation." Rep. No. 1014026, Electric Power Research Institute, Palo Alto, California.
  - USDOE, 2006. "Energy Demands on Water Resources: Report to Congress on the Interdependency of Energy and Water." U.S. Department of Energy.
  - NERL, 2011. "A Review of Operational Water Consumption and Withdrawal Factors for Electricity Generating Technologies". National Renewable Energy Laboratory, Technical report NREL/TP-6A20-50900, March 2011
  - Yang and Dziegielewski, 2007. "Water Use by Thermoelectric Power Plants in the United States". JAWRA

(Consumers Energy)

# Compare Withdrawal and Consumption with Estimations for Recirculating Cooling

Percent of Withdrawals Consumed:

- Actual = 0.1%
- Recirc. cooling = 68%



# Metric – Total Volume Consumed by Source

Initiative	Water consumption (million m <sup>3</sup> /year)
GWT	5.2
WFN	3.3
EWP	3.3

- GRI and CDP initiatives do not have water consumption metrics.
- Water consumption is not defined in the same way by the various initiatives.
- For NewPage, results vary by 60% depending upon the method of calculation and mode of data reconciliation.

# Metric – Withdrawal relative to total available supply

- The GRI, WFN, EWP, and CDP all treat water withdrawals relative to available supply in some fashion, indicating the metric's importance.
- The NewPage Escanaba withdrawal is 0.0006% of the Lake Michigan volume and 0.1% of the Lake Michigan net basin supply.
- The blue water scarcity,  $WS_{\text{blue}}$ , defined as the ratio of blue water footprint to blue water availability is 0.0001.

(NewPage)

# Metric – Internal Recycling and Reuse

- The GRI, GWT, EWP, and CDP have metrics for internal recycling and reuse indicating the metric's importance.
- Water recycling at NewPage Escanaba is estimated to be 620 million m<sup>3</sup>/year, or 1,200% of the annual water usage at the facility.
- Water recycling amount seems 'good' to us, but none of the initiatives provides guidance on interpreting the result.

# Suitability of Flow Measurements

- Volume withdrawn is less than volume discharged plus volume evaporated
  - Possibly due to condensate blowdown, rainfall influx into system, and possible discrepancies with inlet and outlet meters
- Measurement precision is suitable for current regulatory requirements and company uses

(Shell)

# Metrics Suited for Rivers

- Of 4 pilots, only facility located on a river
- Use of river flow rather than calculation of 'renewable supply' to lake simplifies impact analysis

# Grey WF has Limited Value

- Whole effluent testing of discharge streams is conducted monthly
- Discharge monitoring data demonstrate compliance with all regulations
- Grey WF method is pollutant specific
  - Less useful for assessing discharge quality than existing monitoring
  - Monitoring includes multiple constituents and is integrative

(NewPage)

# Metric – Economic and Social Benefits

- The NewPage Escanaba mill is the single largest employer in Delta County Michigan
- The mill employs approximately 1,100 people and generates 675 million dollars in revenue annually.
- Direct + indirect employment attributed to the NewPage Escanaba mill is estimated to be about 13% of the Delta Country population and nearly 26% of the Delta County labor force.

# Three Big Picture Findings

- 1. No one tool provides all the answers*
- 2. Devil can be in the details*
- 3. Context is key to value*

# No one tool provides all the answers

- Diverse set of tools are quite useful but have implicit boundaries
- Objectives for tools differ
- Risks in adapting tools for objectives not intended
- Other sustainability concerns are often missing
  - Ecological, social and economic
- No one tool addresses Great Lakes Compact issues

# Devil can be in the details:

## *Limitations and risks for misuse*

- Applying the various tools can provide useful insights, but...
  - Similar metrics but different definitions in different tools
  - Data inconsistencies with tool needs
  - Many metrics and tools under development and subject to refinement and changes

# Context is key to value

- Water use is not inherently bad
- Some frameworks put use in context
- Key is does use impact/limit other uses for environment or by humans
- Scale and scope matter
- Grey water footprint not useful in highly regulated contexts

# Project Personnel

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**Show me the Metrics!**

# Indicators and Metrics

- **Withdrawal Amounts**
  - **total volume abstracted by source**
  - **total volume consumed by source**
  - **water transfers (interbasin and ground/surface)**
  - **peak/average/seasonal use by source**
- **Withdrawal Source Characterization**
  - **sources under stress**
  - **sources affected by abstraction**
  - **amount of renewable water**
- **Withdrawal Permissions**
  - **permits and other consents**

# Indicators and Metrics

- Withdrawal Impact & Available Supply
  - relative to total available supply
  - upstream water use
  - effect on human services
  - effect on ecosystem services
- Discharge Amounts
  - total volume discharged to source
  - peak/average/seasonal discharge to each receiving water body
- Discharge Quality
  - conventional pollutant load (BOD/TSS)
  - other pollutant loads
  - non-regulated pollutant load

# Indicators and Metrics

- Discharge Permissions
  - permits and other consents
- Discharge Impact
  - eutrophication potential
  - effect on downstream human uses
  - effect on ecosystem (generally)
- Water quality/quantity benefit
  - effect on flow
  - effect on aquifer level
  - effect on water quality

# Indicators and Metrics

- Equitable and Transparent Governance
  - water recycling efficiency
  - water consumption per unit product
  - water resource management strategy (use and disclosure)
- Supply chain (NewPage only)
  - Supply chain water use/consumption related to wood supply

# Metrics provide good coverage of prominent initiatives

- European Water Partnership (regional AWS)
- Water Footprint Network
- Global Water Tool
- Global Reporting Initiative
- Carbon Disclosure Project (water disclosure)