



The Basics of Lean and Clean

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Defining Lean

Lean is:

“A systematic approach to identifying and eliminating **waste (non-value added activities)** through continuous improvement by flowing the product at the pull of the customer in pursuit of perfection”

—The MEP Lean Network



What is Lean Manufacturing?

- A business model that emphasizes eliminating “waste” while delivering quality products at the least cost to the manufacturer and customers.
- Lean thinking focuses on three objectives:
 - Reduce production resource requirements by minimizing inventory, equipment, storage and production space, and materials;
 - Increase manufacturing velocity and flexibility; and
 - Improve quality and eliminate defects.



What is Lean Cont.

- Lean can provide an “entry point” for P2
- Lean methods create a *continual improvement-based*, waste elimination culture
- Lean tools can be used to address environmental concerns



The L&E Initiative

- OPEI coordinates a cross-office partnership including OPPT and OSWER.
- Work with P2 assistance providers, as well as, business assistance providers, with outreach activities.
- Work with specific companies, industrial sectors, Lean experts and EPA programs to:
 - Develop or adapt appropriate tools
 - Find applications for existing tools
 - Address regulatory barriers



Lean's Environmental "Blind Spots"

Lean's "Deadly Wastes"

1. Overproduction
2. Inventory
3. Transportation
4. Motion
5. Defects
6. Over Processing
7. Waiting



Where are environmental wastes?

- Excess materials use
- Pollution/emissions
- Scrap & non-product output
- Hazardous wastes



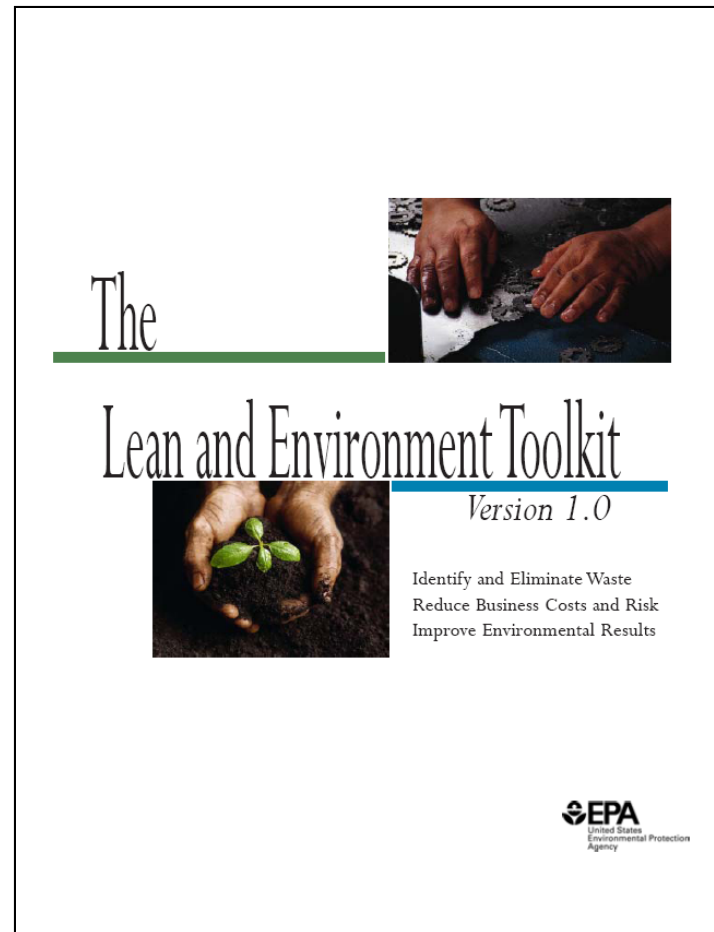
The P2 – Lean Connection

- Late 1990s: EPA, others began to see similarities between lean and P2
- Many lean efforts had environmental benefits:
 - Material savings
 - Less solid waste generated
 - Less energy use
- Developed The Lean Manufacturing and Environment report documenting these opportunities.



Making the Connection– The Lean and Environment Toolkit

- Identify and eliminate environmental waste
- Modified Value Stream Mapping
- Kaizen Events
- 6S= 5S plus Safety



The Toolkit and the Green Suppliers Network

- Green Suppliers Network is a direct application of the Toolkit
- Green Suppliers Network team helped in development
- Value Stream and Process Mapping sections are foundation of reviews
- Integral in collaborations with lean experts at Manufacturing Extension Partnership Centers





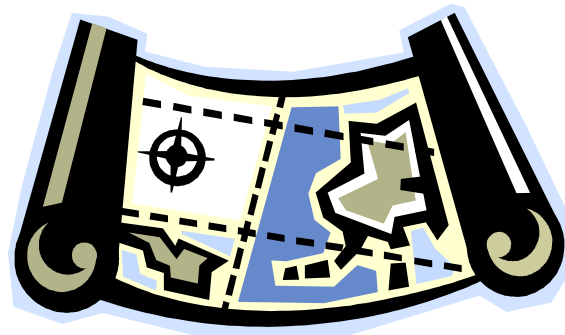
Value Stream Mapping

- **Value stream mapping** is a mapping method that enables an organization to “see” all the actions involved in producing a product or service
- **Current State Map**: Visual representation of existing operations (information and product flows)
 - Identify the largest sources of waste (non-value added activity) in the value stream
- **Future State Map**: Drawing of Lean flow (vision)
 - Develop implementation plan for Lean activities

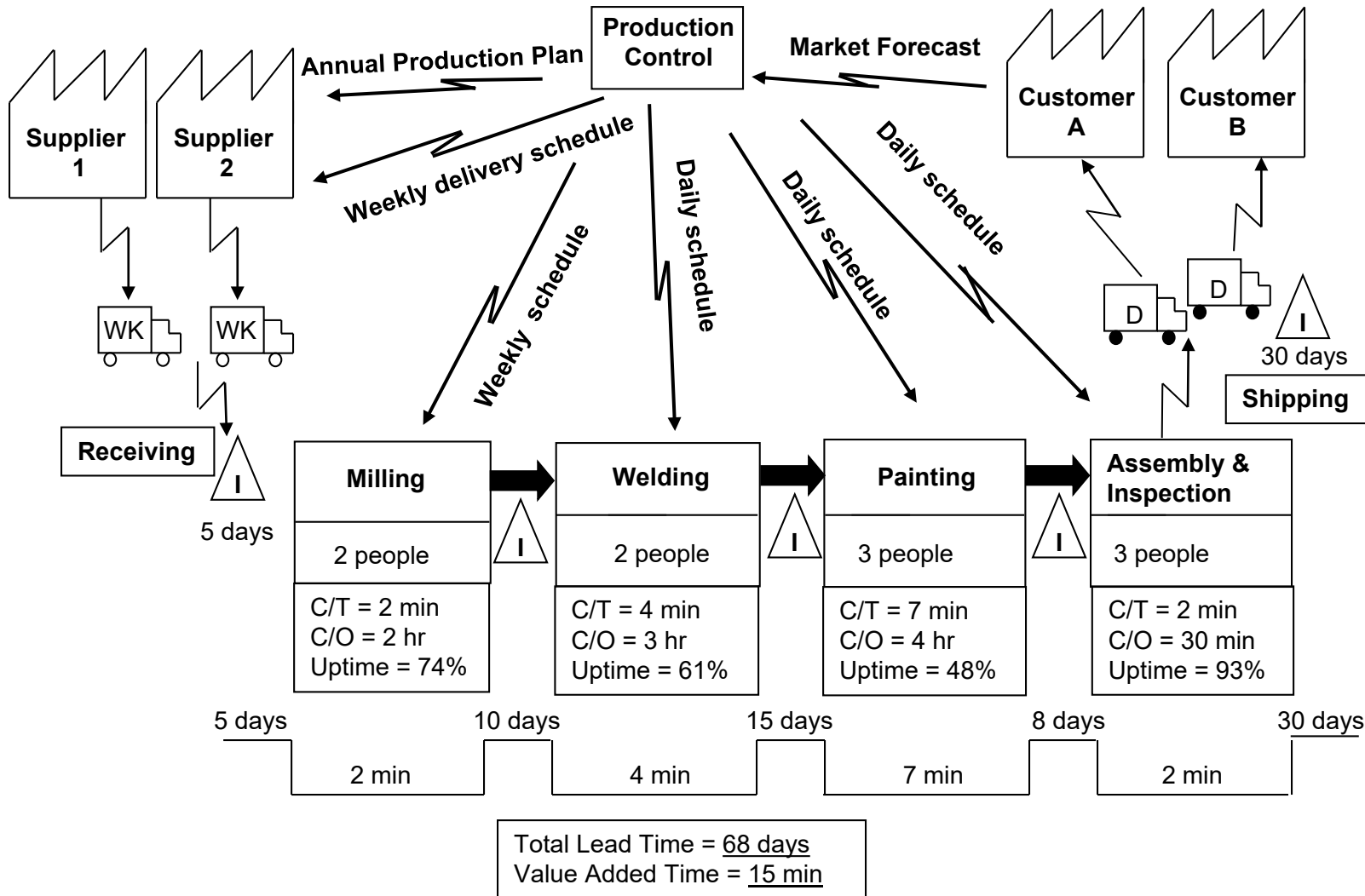


Map the Process

- Makes work visible
 - Visibility improves communication and understanding
- Identifies Improvement Opportunities
 - Eliminate the non-value added steps
 - Reduce wasted resources
- Diagnostics
 - Determine the cause of a problem or condition.
- Training and communication



Current State Value Stream Map





Enhanced Value Stream Mapping

- Use icons to identify processes with EHS opportunities
- Record environmental data for processes in VSMs
- Analyze materials use vs. need in a “materials line” for VSMs
- Expand the application of value stream mapping to natural resource flows
- Find Lean and Clean opportunities in future state VSMs



Types of Environmental Metrics

- Scrap/Non-Product Output
- Materials Use
- Hazardous Materials Use
- Energy Use
- Water Use
- Air Emissions
- Solid Waste
- Hazardous Waste
- Water Pollution/Wastewater

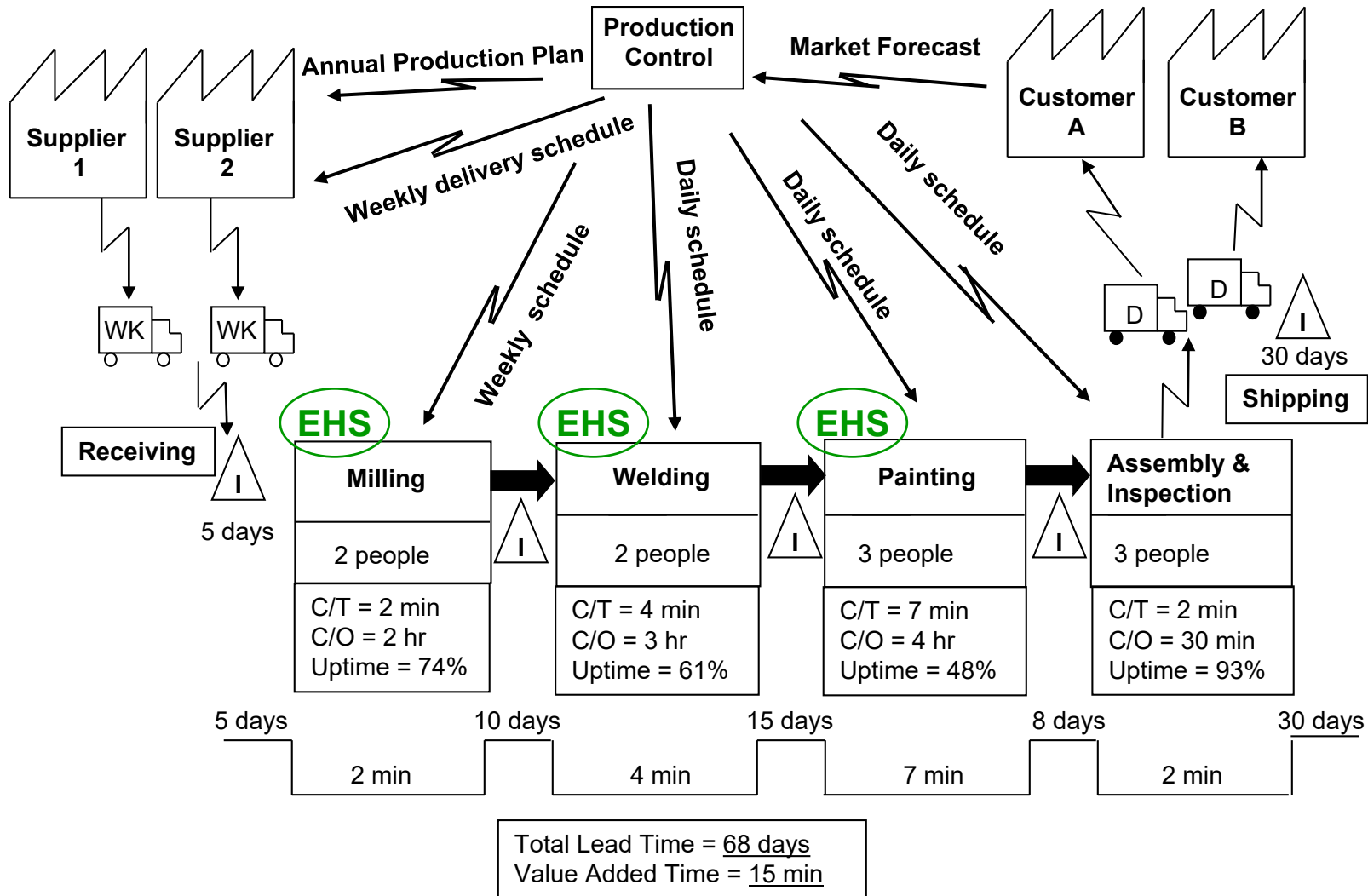




Common Processes with EHS Wastes and Opportunities

- Metal casting
- Chemical and heat treatment of materials
- Metal fabrication and machining
- Cleaning and surface preparation
- Bonding and sealing
- Welding
- Metal finishing and plating
- Painting and coating
- Waste management
- Chemical and hazardous materials management

Adding EHS Icons to Value Stream Maps



Record Environmental Data for Processes in VSMs

EHS

Milling

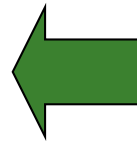
2 people

C/T = 2 min

C/O = 2 hr

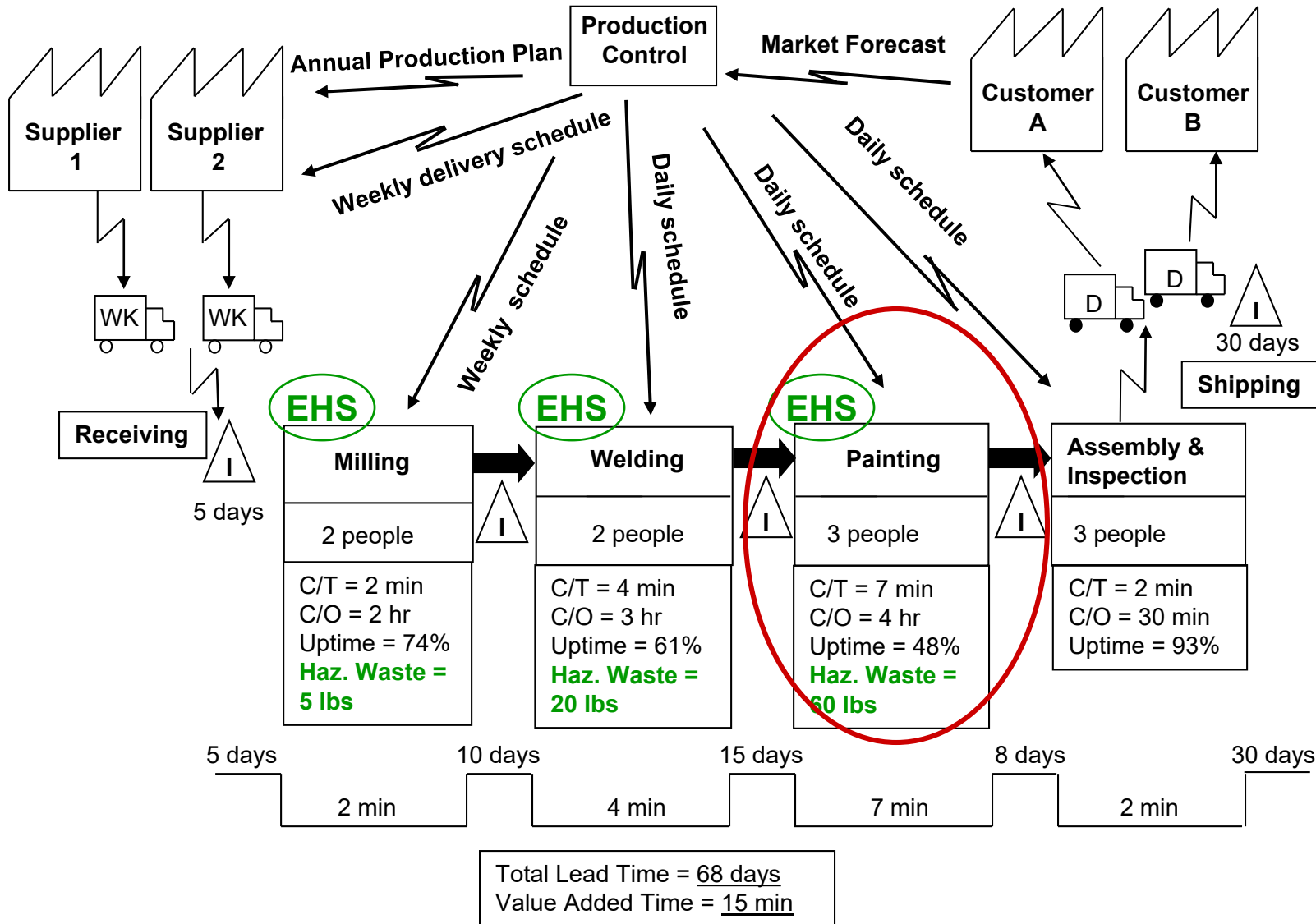
Uptime = 74%

**Haz. Waste =
5 lbs**



**Hazardous waste
generated per shift**

VSM with Environmental Metrics & EHS Icons



Analyze Materials Use Versus Need in a “Materials Line”

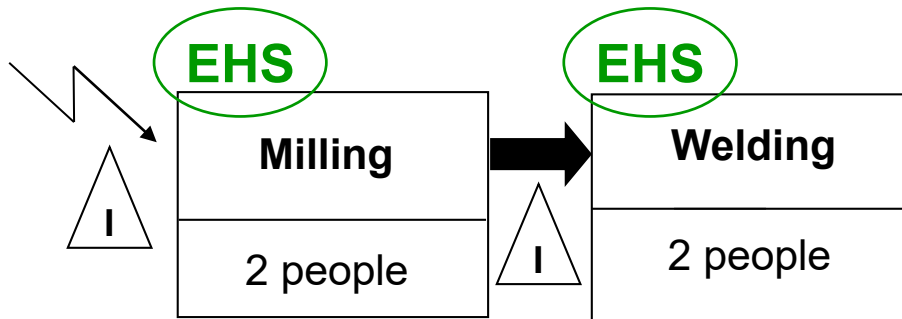
- The “**timeline**” on value stream maps looks at value-added and non-value-added time in the value stream




- Add a “**materials line**” to examine:
 - Amount of raw materials used by each process
 - Amount of materials that end up in the product and add value from the customer’s perspective



Example Materials Line



 **120 lbs**


15 lbs

80 lbs

5 lbs

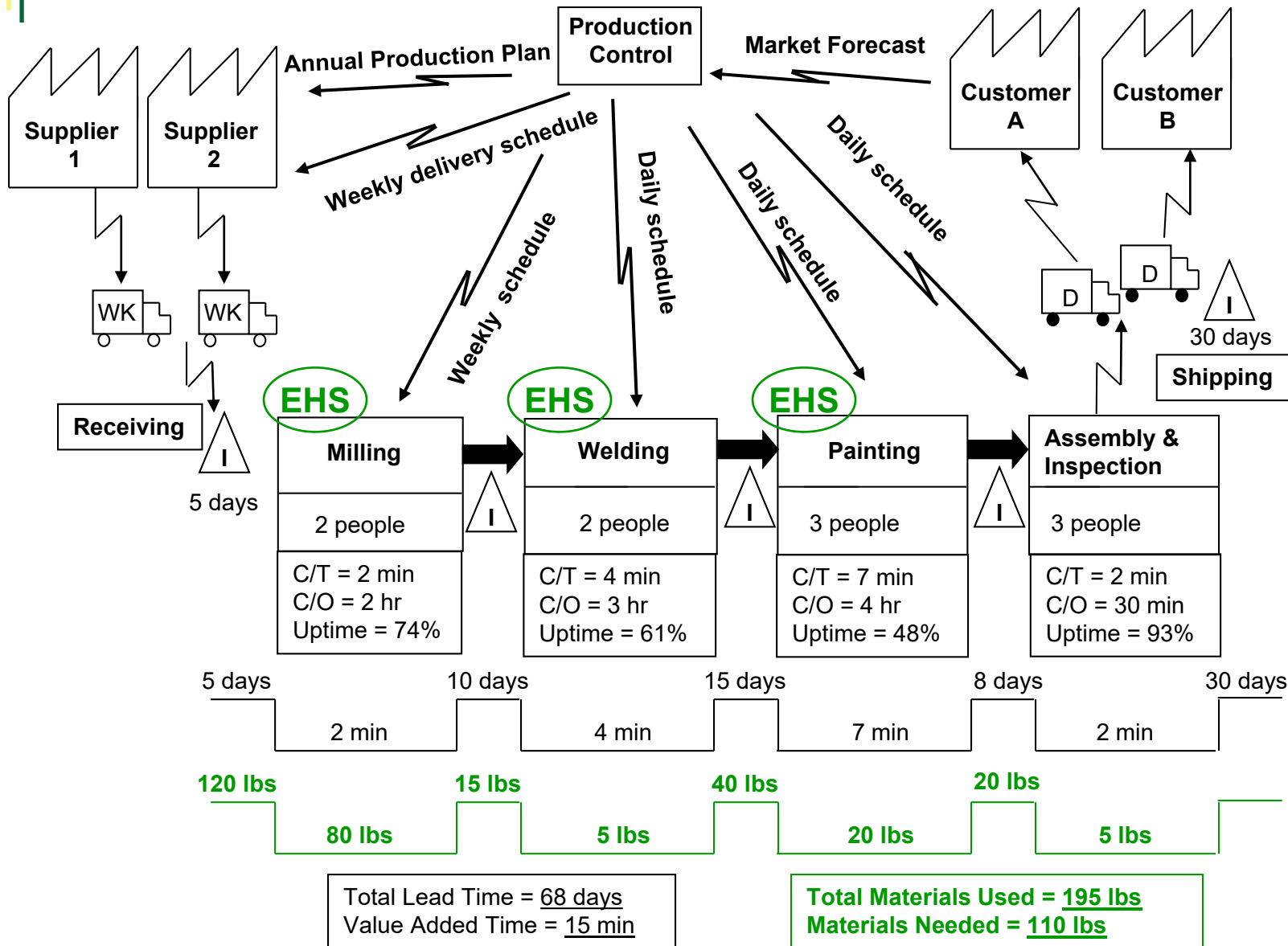
Materials Used = 135 lbs
Materials Needed = 85 lbs
Materials Wasted = 50 lbs

Top line:
Materials Used
by Process

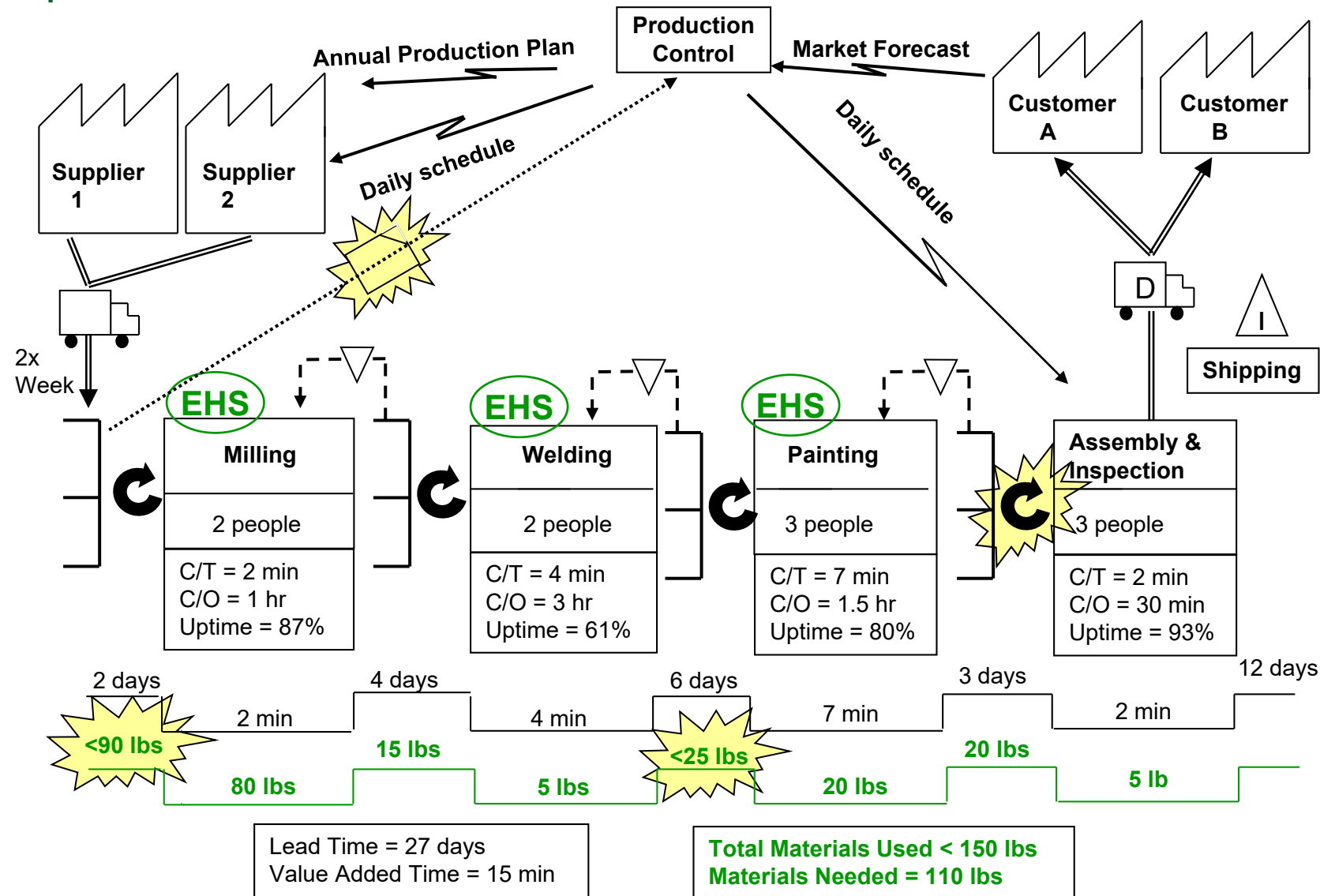
 Bottom line:
Materials Added to Product
During the Process

Materials lines can be developed for any major material source used in processes and products

VSM with Materials Line and EHS Icons



Example Future State VSM

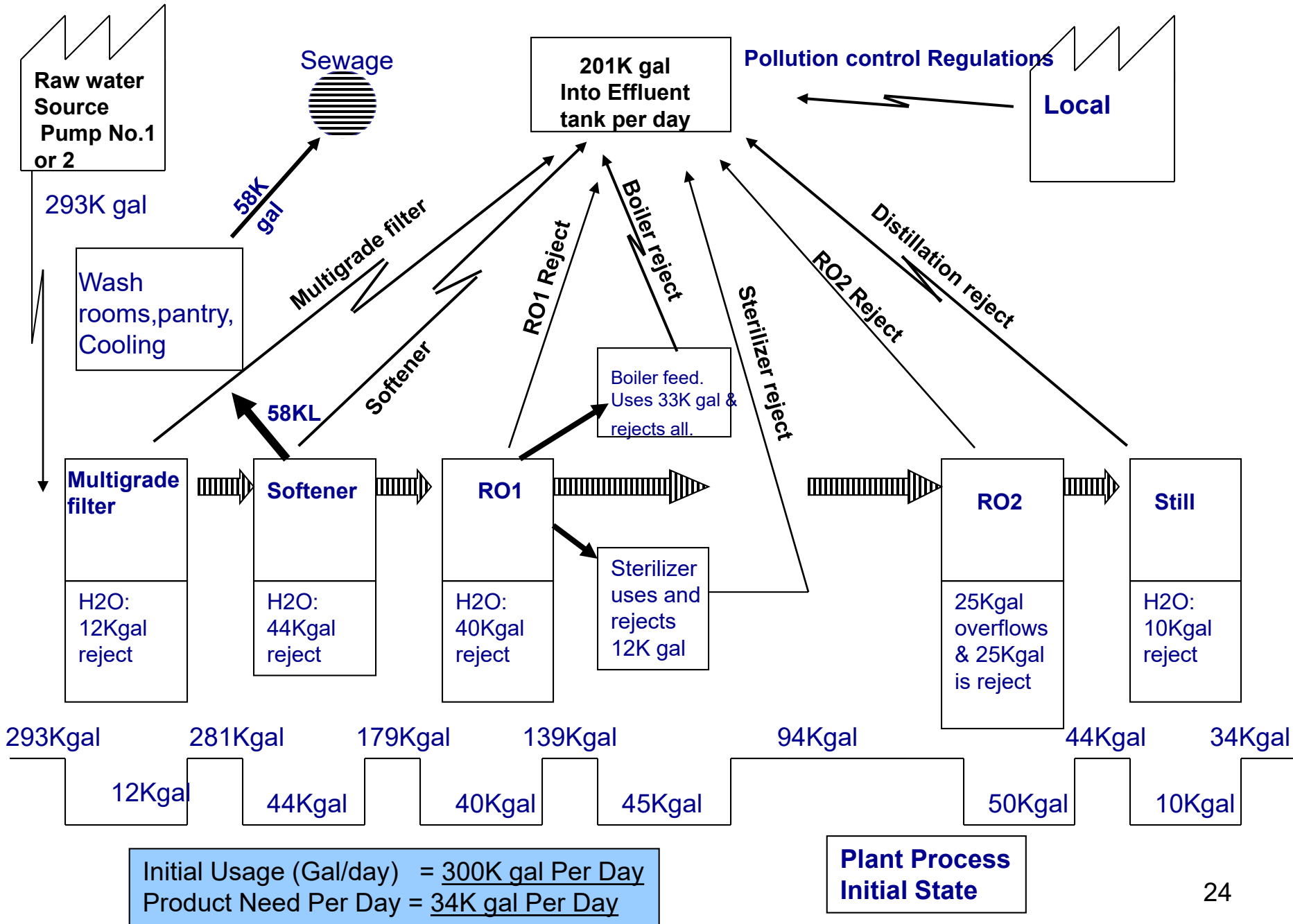


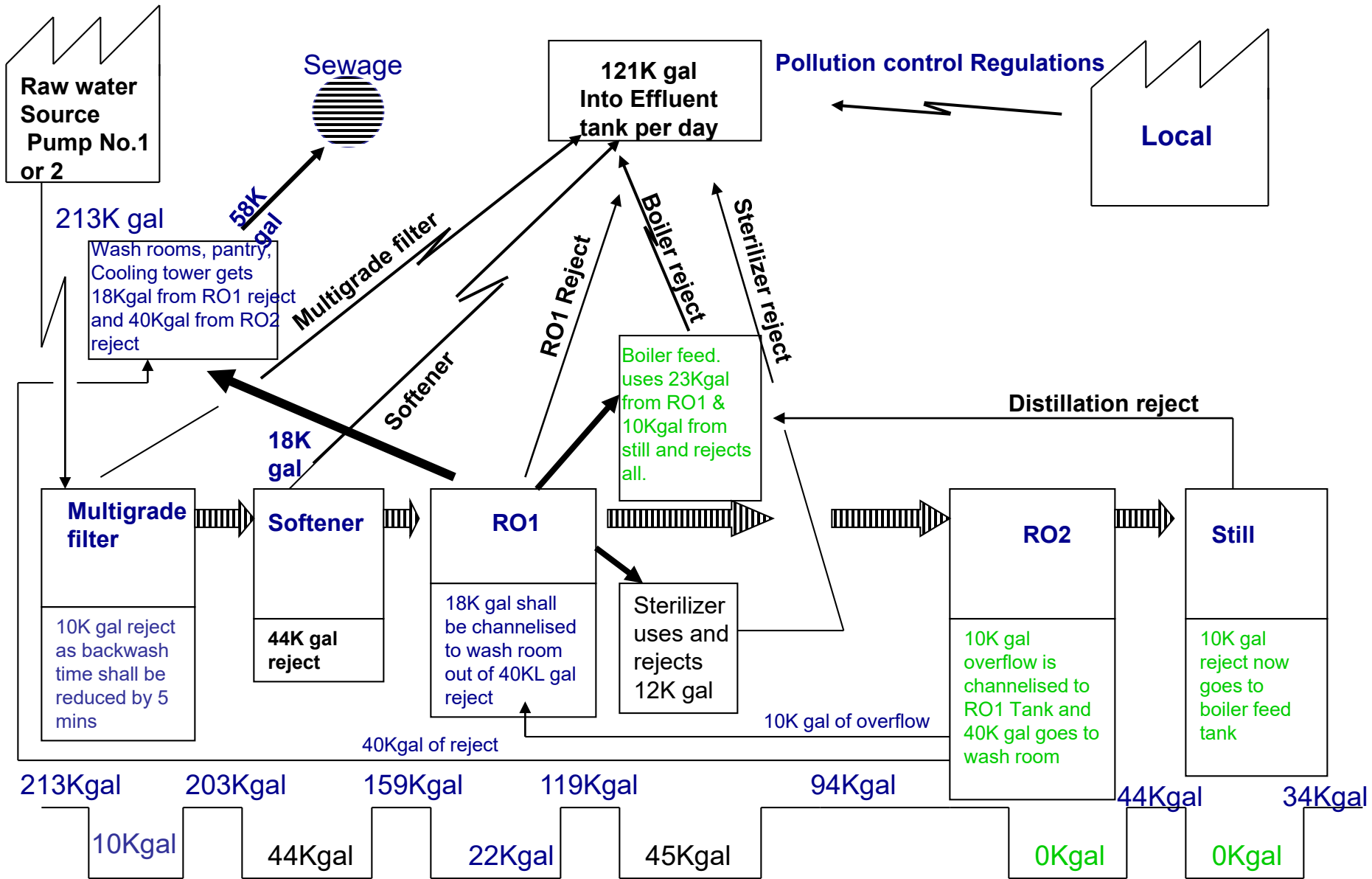


Expand the Application of Value Stream Mapping to Natural Resource Flows

- You can also use VSMS to look in more detail at the use of energy, water, and/or materials
 - Energy/water/materials used vs. needed
 - Environmental waste streams
 - Information flows to regulatory agencies







Usage goal (K gal)	= 213K gal / day
Achieved usage	= 233K gal / day
Product Need	= 34K gal/ day

Plant Process Goal and Achievement

- Achieved
- Ongoing
- Unchanged