

From Disaster to Recovery: Smart Tools for Disaster Debris

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TOOLBOX



PLANNING



DEBRIS ESTIMATION



STAGING



LOGISTICS



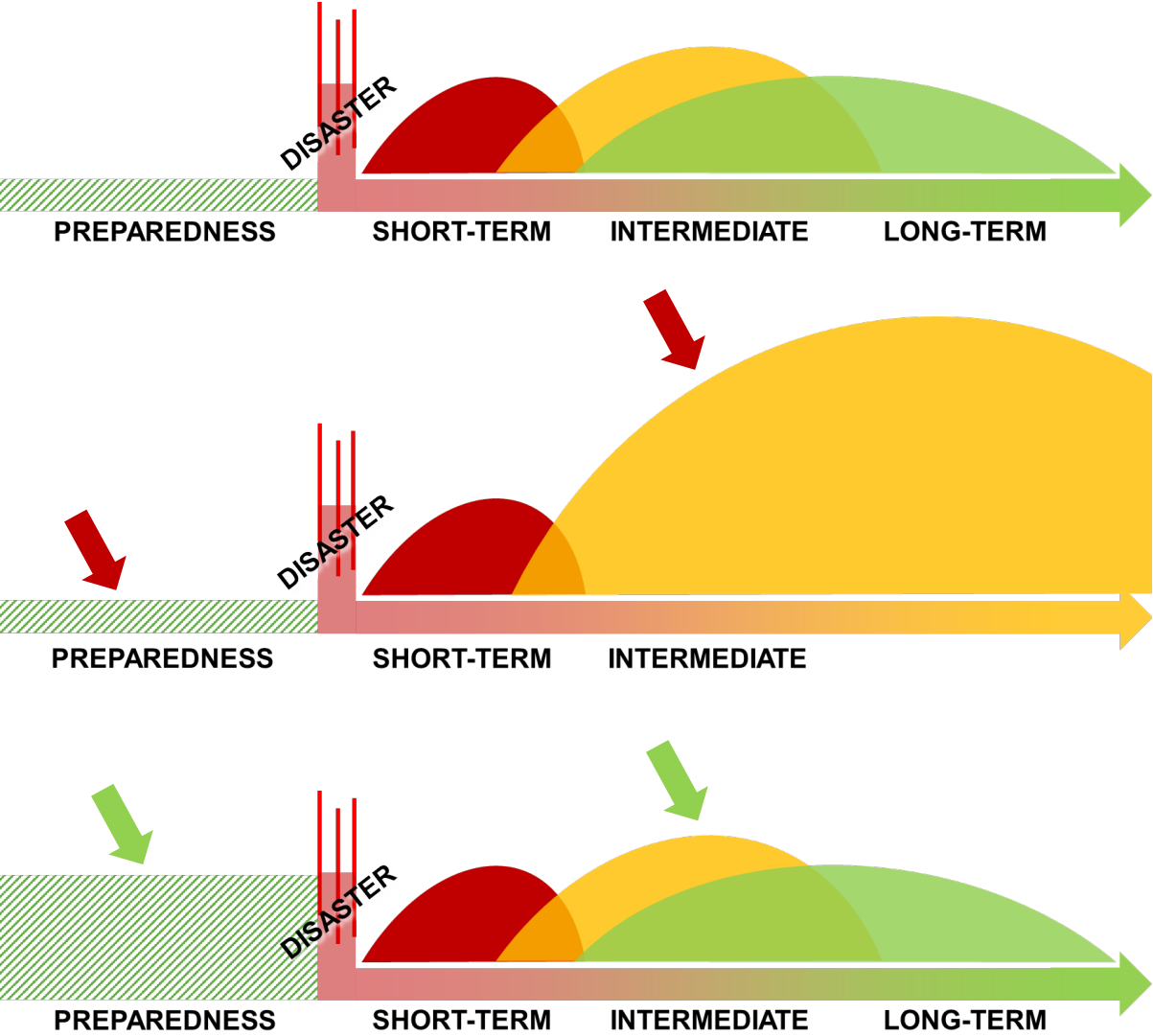
Impacts of Debris on Communities



- Debris removal is third largest cost across FEMA's emergency response work (Cat. A)
- Debris and removal activities slow down response and recovery:
 - Large quantities of debris can make recovery efforts difficult by, for example, hindering emergency personnel, damaging or blocking access to critical infrastructure, and posing threats to human health and the environment
- Debris creates adverse social, economic, and environmental effects such as:
 - Soil, water, and air pollution
 - Spread of diseases
 - Promotes illegal dumping and burning
 - Detracts future investments in the community
- Communities view debris as a stressful, visual reminder of disaster's devastation



Procrastiplanning



WHAT WE THINK IS HAPPENING

Planning and preparedness focuses on immediate response efforts. Plans are drawn up and resources are acquired and staged.

WHAT REALLY HAPPENS

Immediately following a disaster, lifesaving efforts take place and cleanup begins. The question is **then** asked, what do we do with the waste?

WHAT SHOULD HAPPEN

Planning and preparedness includes recovery and addresses waste management issues before an incident takes place. Waste management plans are routinely update/exercised.

Resilient Communities

Communities can prevent or reduce possible hazards created by disasters by having resilient infrastructure and sustainable materials management strategies and policies

Recover faster, encouraging residents and businesses to stay in the area and helping a faster re-establishment of community lifelines

Contain less harmful materials that can be released, minimizing hazardous debris and possible contamination

Generate less debris, spending less money on cleanup and debris management

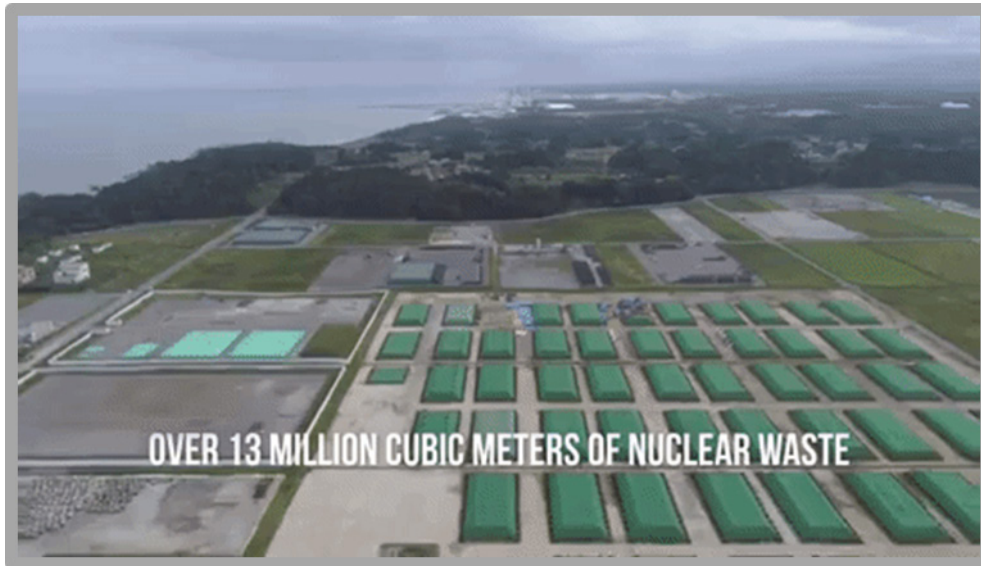
Use fewer resources to rebuild, resulting in fewer emergency response and reduced disaster recovery costs



Logistics & Staging



Why is this important?



Case Study: 2011 Joplin Tornado



- Joplin, Missouri was struck by tornado on May 22, 2011 that was rated as EF-5 on Enhanced Fujita Scale with maximum winds of 200 mph
- Path of entire tornado was 22.1 miles long and up to 1 mile in width
- Tornado displaced 14,000 people, injured thousands of residents, and caused 162 deaths
- Tornado heavily damaged 8,000 structures, including community's hospital, junior college, and eight local schools

Visualizing 3,000,000 yd³: Familiar Comparisons

- Olympic-sized swimming pool: 918 pools
- Standard bathtubs: 12,000,000 standard bathtubs
- Basketball court: 1,723 courts (with a 10-foot height)
- 55-gallon drums: 11,111,111 drums
- School buses: 40,541 buses



Decision Support Tools for Incident Response “Toolbox”



Decision Support Tools for Incident Response

“Toolbox” Description



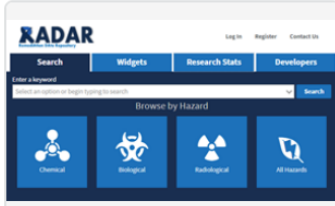
- Website for disaster response software tools and resources
- Focus on debris management during emergencies
- Supports large-scale incidents like nuclear accidents and hurricanes
- Assists federal, state, local, tribal, and territorial governments
- Covers pre-planning, mitigation, response, and recovery phases
- Wide range of response-related tools available
- Easy-to-use filters for hazard-specific and activity/phase-specific tools

Find waste management tools to support response-related decisions

Managing waste resulting from disasters can be a complicated and resource intensive process, especially during large-scale incidents such as the Fukushima Daichi Nuclear Power Plant accident or severe hurricanes. For these large-scale incidents, federal, state, local, tribal, and territorial governments need tools to assist them with waste management decisions in the pre-planning, mitigation, response, and recovery phase of an incident. Below you will find tools that are available to support many response-related tasks. Use the filters to quickly find tools that are specific to hazards and/or response activities/phases.


Hazard

Response Activities/Phases




Explore Research Data

Explore emergency response research data housed in EPA's Remediation Data Repository (RADAR).



Design a Sampling Plan

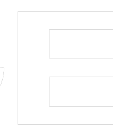
Conduct a tradeoff analysis to assess and compare differences in resource demands among different sampling strategies.



Analyze Chemical and Biological Decontamination Strategy Tradeoffs

Analyze the tradeoffs in building

Decision Support Tools for Incident Response “Toolbox” Overview



Hazard

All Hazards

- All Hazards
- Biological
- Chemical
- Foreign Animal Disease
- Natural Disaster

Response Activities/Phases

Waste Management

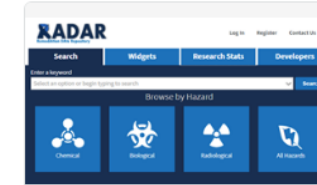
- Monitoring
- Recovery
- Sampling Characterization
- Transportation
- Waste Management

Hazard

All Hazards

Response Activities/Phases

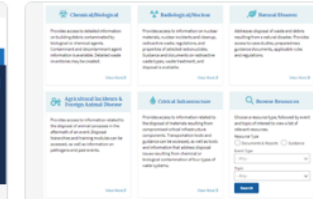
Waste Management



Explore Research Data

Explore emergency response research data housed in EPA's Remediation Data Repository (RADAR).

[Search for Research Data](#)



Review Waste Management and Disposal Guidance

Explore a collection of waste management and disposal guidance available for chemical, biological, radiological and natural disaster responses.

[Explore Waste Management Guidance](#)



Estimate Waste Stream Quantities

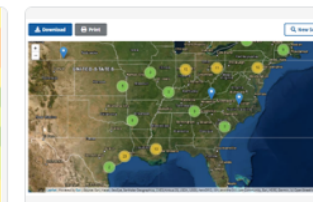
Calculate an estimate for the weight and volume of materials that may require disposal.

[Generate Waste Estimates](#)



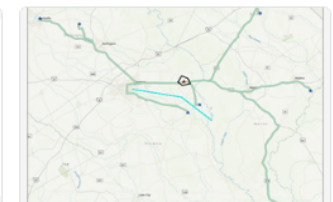
Site a Location to Stage/Store Waste & Debris

Conduct a suitability analysis to identify potential locations for staging and storing waste and debris.



Locate Treatment and Disposal Facilities to Manage Waste

Identify and map potential landfill, combustion, and other treatment and disposal facilities (e.g., rendering plants, wastewater treatment plants, autoclaves) to manage and dispose of waste.



Estimate Resources to Route Waste & Debris

Estimate resource demands (cost and time) associated with transporting large volumes of waste.



All Hazards Waste Management Planning Tool



All Hazards Waste Management Planning Tool

(<https://wasteplan.epa.gov>)



- Purpose: Assist users in generating pre-incident waste management plan
- Audience: Tribal, state, and local planners
- Features:
 - Walks user through various issues which should ideally be addressed in pre-incident waste management plan. Provides sample language to assist user
 - Prompts user to enter data on various aspects of anticipated event
 - Provides user with information on potential waste streams, estimated waste volumes, and potential facility types (e.g., incinerators, landfills), based on information entered by user and data from I-WASTE/DDRT
 - Stores all information in tool, allowing for updating as new data ~~is~~ **are**-obtained
 - Allows user to download MS Word version of their plan, which then can be further edited



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All Hazards Waste Management Planning Tool (AHWMPT)

Welcome to the AHWMPT! This tool assists emergency managers and planners in the public and private sectors in creating or updating a comprehensive plan for managing materials and wastes generated from manmade and natural disasters. The tool walks the user through the process of developing and implementing a plan. The tool also contains many resources that can be used as aids to various aspects of the planning process.



Start a Plan

Start creating a waste management plan

[Start](#)



My Plans

View your existing plans and plans shared with you

[Manage](#)



Resources

Learn about additional waste management planning resources

[Go](#)



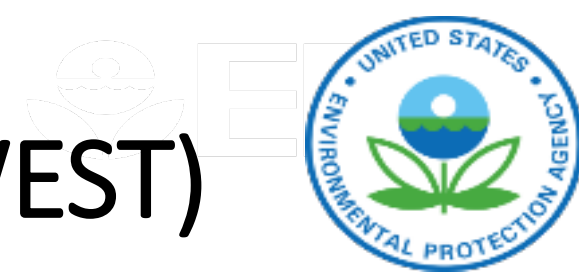
Tool “Contents”

- Plan Overview
- Material & Waste Streams
- Waste Characteristics, Sampling and Analysis
- Waste Management Strategies and Sites
- Waste Management Facilities
- Transportation
- Tracking and Reporting
- Community Outreach
- Resource Summary

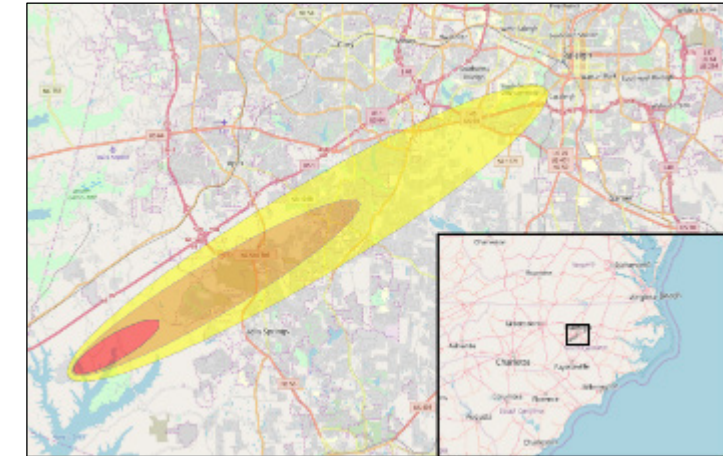
Waste Estimation Support Tool



Waste Estimation Support Tool (WEST)



- Need: Management of waste from chemical, biological, and radiological incidents is complicated by fact that decontamination decisions have profound impact on characteristics of resulting waste streams
- Scientific Approach: GIS-based tool that can assist in planning/preparedness activities at all levels of government– capable of estimating waste amounts, characteristics, contamination levels for radiological and biological incidents
- Impacts: Generate first-order estimate of waste quantity and activity, identify potential triage/staging/storage/disposal options, assess impact of decontamination strategies on waste generation, and identify starting points for policy discussions



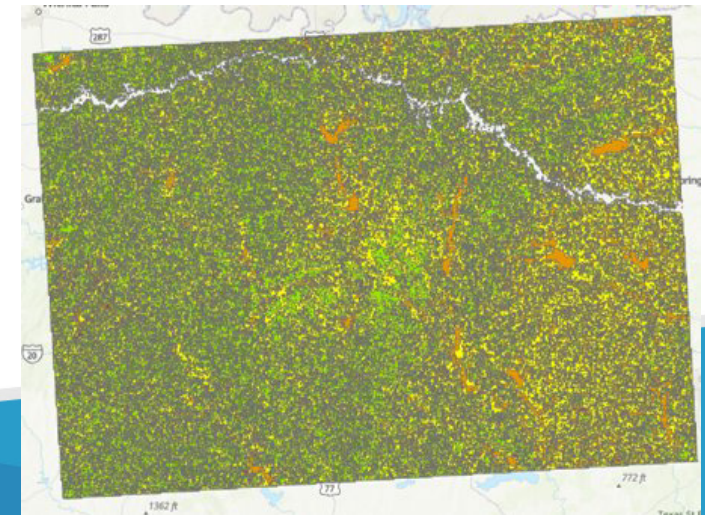
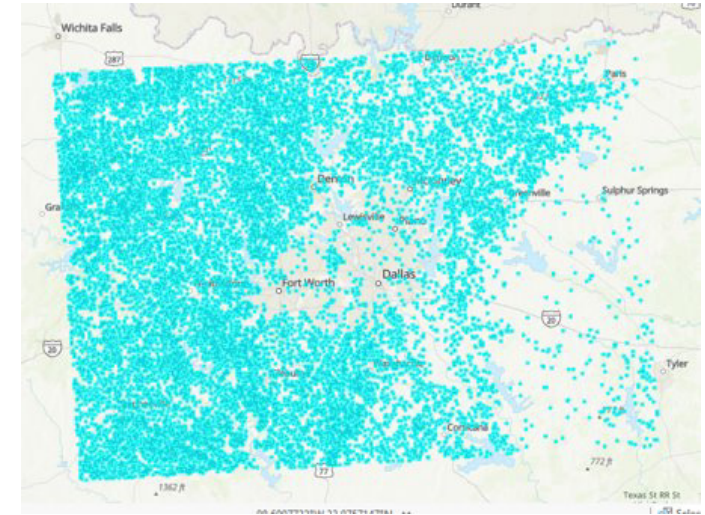
Grand Totals		Building Decon	Building Demo	Ground Surfaces
Zone Number (0)	Census Tract (0)			
1	42101000100			
2	42101014200			
3	42101014300			
	42101014400			
<input type="button" value="Select All"/>	<input type="button" value="Select All"/>	<input type="button" value="Apply Filter"/>	<input type="button" value="Clear Filter"/>	<input type="button" value="Export Data To Excel"/>
	Total Biomass (kg)	Total Biomass (m3)	Trunk Mass (kg)	
Totals	5.95E+09	6.63E+06	1.92E+09	
	5.95E+09	6.63E+06	1.92E+09	

Waste Storage and Staging Site Selection Tool



Waste Storage & Staging Tool: Description

- Needs: Identify candidate sites and their total available land surface areas using environmental criteria for staging waste
- Scientific Approach: Develop GIS-based model that uses spatial information and analysis techniques to support suitability analysis to identify candidate staging areas for consideration
- Impacts: Tool provides decision makers better understanding and potential options for managing waste and to illuminate potential capacity constraints to inform increased preparedness

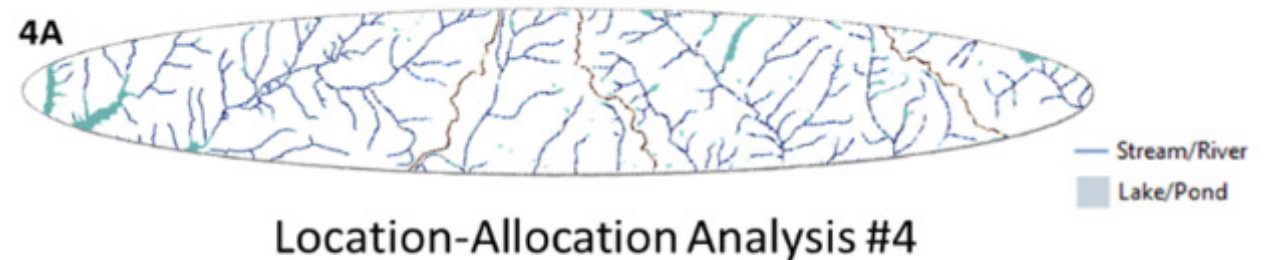
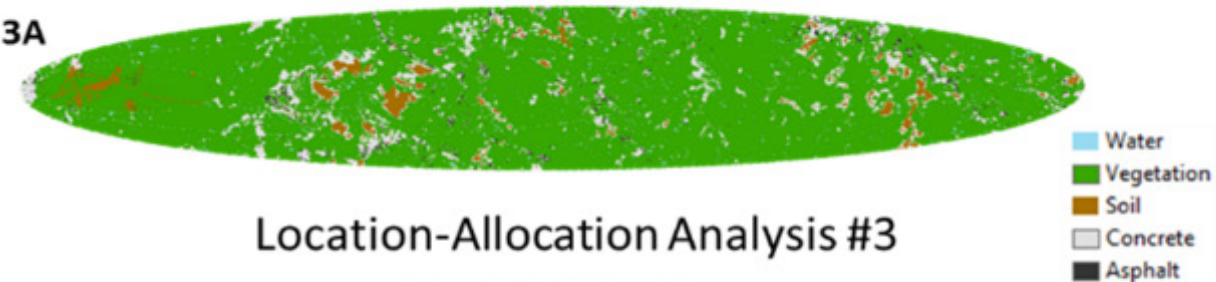
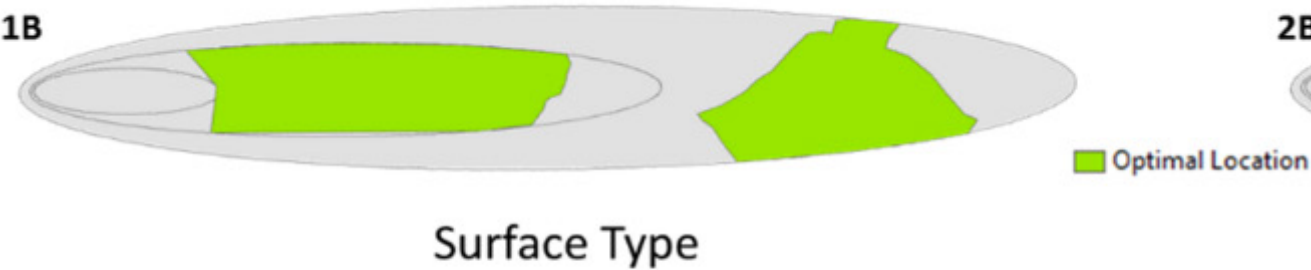


Waste Storage & Staging Tool: Results

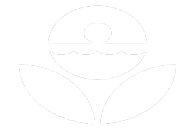
Waste Volume by Census Tract (yd³)



Digital Elevation Model (m)



Suitability Options



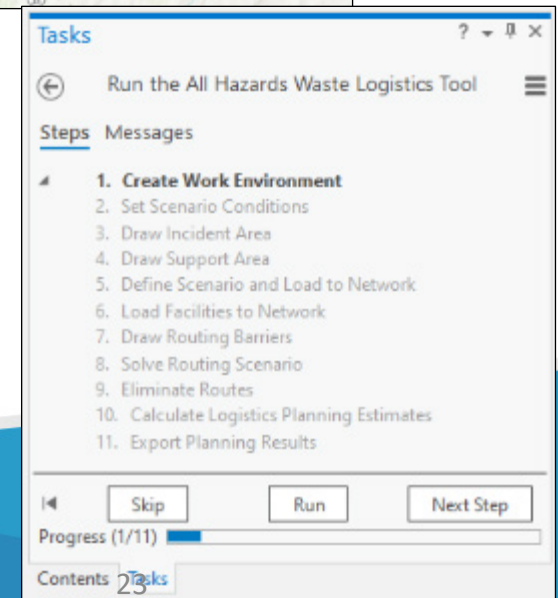
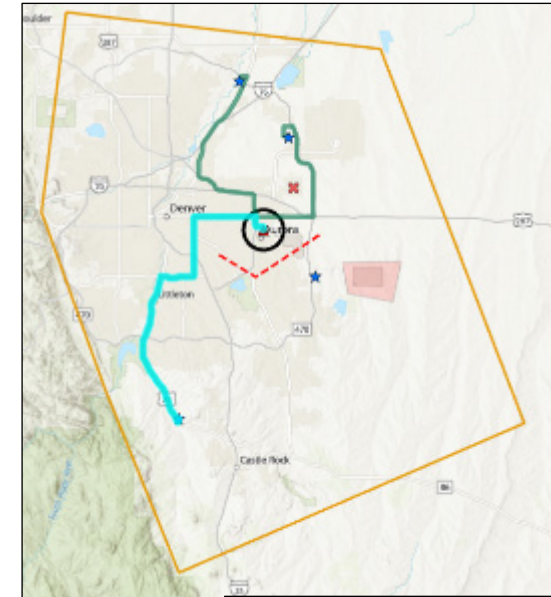
Essential Layer	Suitable (1)	Not Suitable (0)
Land Use/Land Cover*	<ul style="list-style-type: none"> • Developed, Open Space (21) • Developed, Low Intensity (22) • Barren Land (Rock/Sand/Clay) (31) • Dwarf Scrub* (51) • Shrub/Scrub (52) • Grassland/Herbaceous (71) • Sedge/Herbaceous* (72) <p>*Alaska only</p>	<ul style="list-style-type: none"> • Open Water (11) • Perennial Ice/Snow (12) • Developed, Medium Intensity (23) • Developed, High Intensity (24) • Deciduous Forest (41) • Evergreen Forest (42) • Mixed Forest (43) • Lichens* (73) • Moss* (74) • Pasture/Hay (81) • Cultivated Crops (82) • Woody Wetlands (90) • Emergent Herbaceous Wetlands (95)
Slope	< 10% change in elevation	> 10% change in elevation
Surface Water (Distance from Water)	> 500 m	< 500 m
Road (Distance from Road)	200 m – 500 m	< 200 m and > 500 m
Soil Infiltration¹²	Hydrologic soil groups C, D, or C/D	Hydrologic soil groups A, B, A/D, or B/D

All-Hazards Waste Logistics Tool

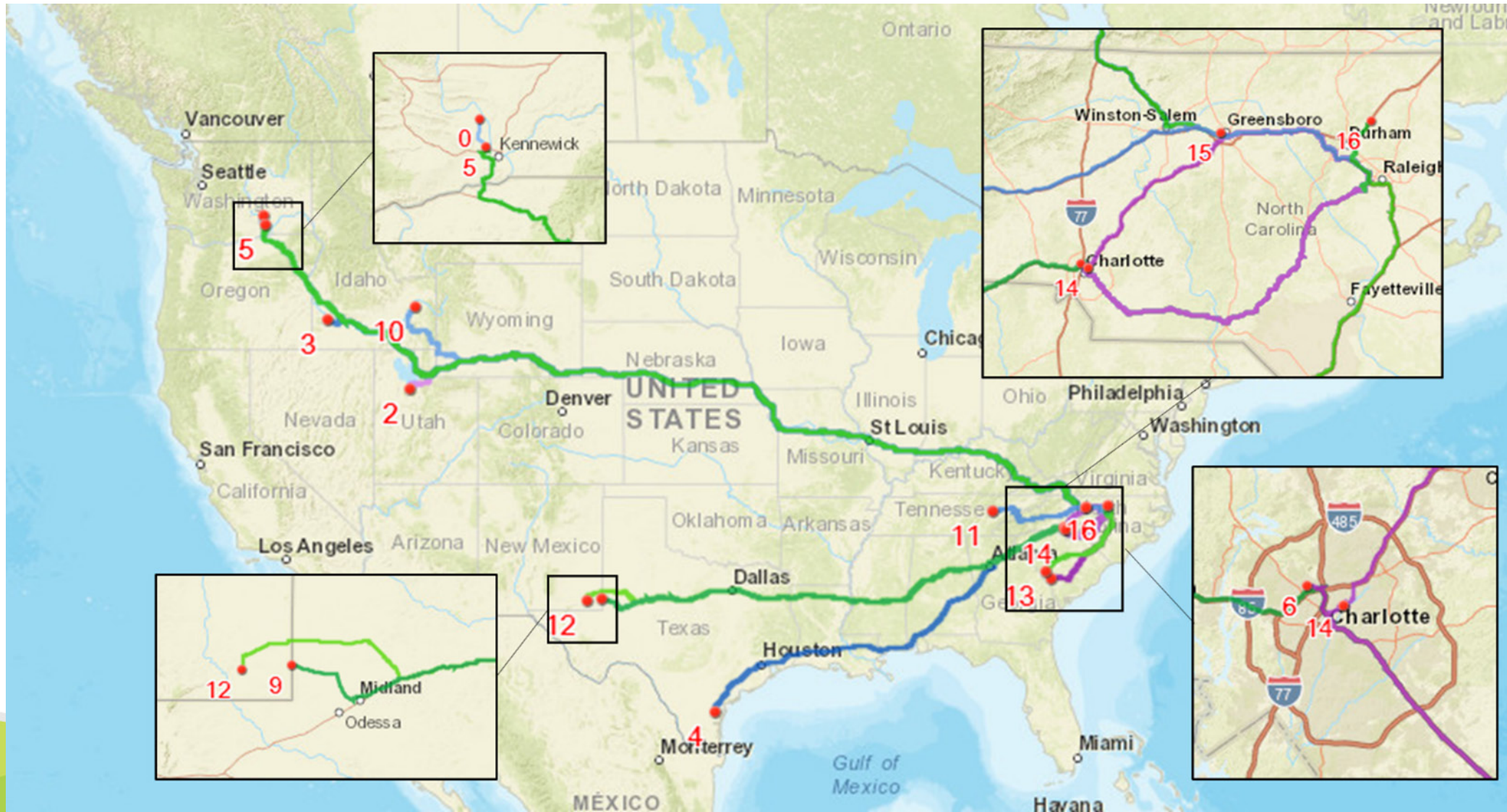


All-Hazards Waste Logistics Tool

- Needs: Evaluate considerations related to the resource demands associated with transporting and disposing of large volumes of waste
- Scientific Approach: develop spatial model and analysis techniques to support evaluating resource demands associated with transporting waste
- Impacts: calculates the cost and time to manage a user-specified quantify of waste and allows users to run routing scenarios with user-defined destinations. Factors specific to waste type, hauling rates, and acceptance rates allow users to explore options and evaluate constraints to improve preparedness for managing large volumes of waste



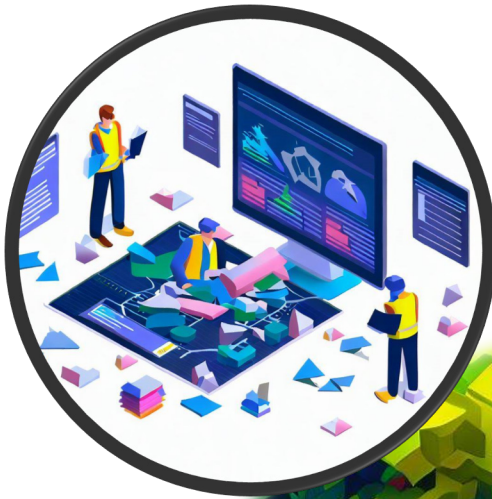
Waste Logistics Tool: Example



TOOLBOX



PLANNING



DEBRIS ESTIMATION



STAGING



LOGISTICS



Thank You!



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All-Hazards Waste Logistics Tool,

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