Alberta Oil Sands Products Training

Maine Department of Environmental Protection and the United States Environmental Protection Agency

December 4 & 5, 2012

The Center for Spills in the Environment

University of New Hampshire

1.0 INTRODUCTION

High global oil prices and increasing demand in the United States and worldwide have made the development of significant petroleum resources in Alberta, Canada economically viable. The size of the oil sands resource in Alberta requires refinery capacity in addition to that available in the Midwest to bring the products petroleum to the market. The lack of pipeline capacity from Alberta makes the need for rail transportation even more important. Three existing rail lines could be used to transport the OSP to New Brunswick: 1) the Pan Am Railways tracks which come from New Hampshire through southern Maine and up the coast; 2) the Montreal, Maine and Atlantic Railway which goes through Jackman, Greenville and Brownville Junction, Maine; and 3) the Canadian National Railway tracks which stay north of Maine. (Figure 1) All rail lines are currently moving Bakken crude oil from North Dakota through Maine to the Irving refinery in New Brunswick.

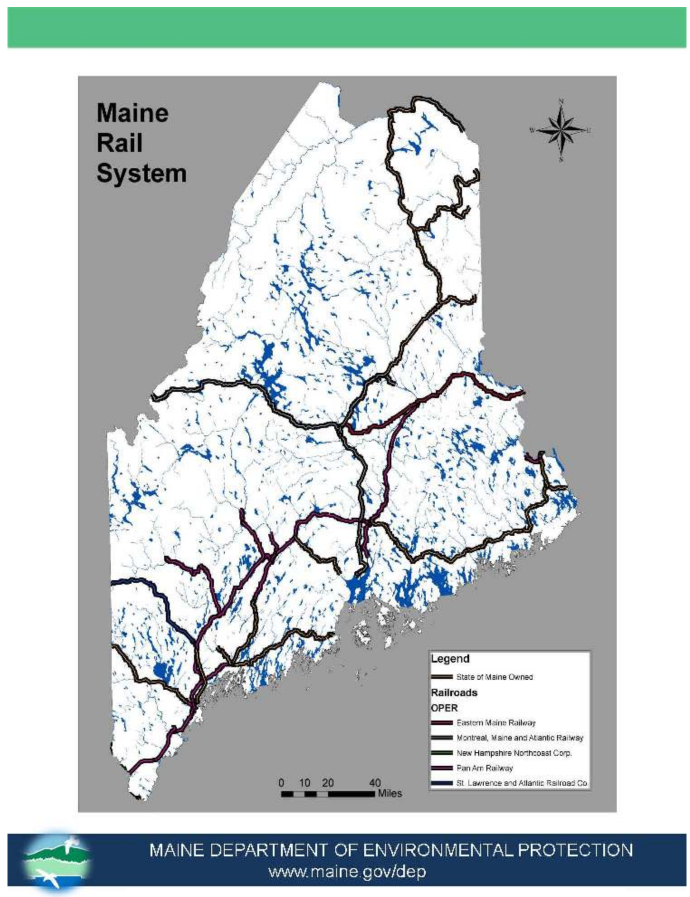


Figure 1: Maine Rail System

In order to prepare for the potential that OSP may be travelling through the area, the Maine Department of Environmental Protection (ME DEP) and the United States Environmental Protection Agency (USEPA) deemed it important to know more about the characteristics of this type of petroleum so they could better plan for potential incident responses if an accident occurred. The ME DEP and USEPA contacted the University of New Hampshire's Center for Spills in the Environment (CSE) to conduct a training for relevant State and Federal agencies on the important issues related to: OSP characteristics and transportation and response planning.

The CSE focuses on issues related to hydrocarbon spills. It is known nationally for its independence and technical excellence in the areas of environmental engineering, ocean engineering and marine science. CSE and its NOAA-funded sister center, the Coastal Response Research Center (CRRC), has conducted numerous workshops bringing together stakeholders from the spill response and restoration community. For this training, CSE assembled a group of technical experts that could provide the participants from ME DEP, USEPA, and other regional stakeholders with the knowledge required to better understand the unique characteristics of OSP and plan for the potential rail transportation of the product.

1.1 GOALS OF OSP TRAINING

The ME DEP and USEPA, working with CSE, developed several goals for the training:

- *Provide an overview of the OSP mining and refining process;*
- *Provide information on the chemical composition of OSP;*
- *Provide an overview of rail transportation of OSP;*
- *Provide information on the potential behavior and fate of OSP when spilled in marine or freshwater environments;*
- *Provide an overview of the OSP spill resulting from the failure of the Enbridge/Kalamazoo (MI) pipeline spill, to show potential response options, and;*
- *Evaluate resources at risk and response options for an OSP spill in Maine.*

1.2 OSP TRAINING ORGANIZATION AND STRUCTURE

The training was held at the University of Southern Maine Abromson Conference Center in Portland, Maine on December 4 and 5, 2012. Participation was by invitation only and included representatives from Maine and New Hampshire state agencies, Federal agencies, rail and pipeline companies, refinery companies, the Canadian government, and academia. (See appendix for list of participants.) Sixty participants attended technical and breakout sessions. On Day 1, experts briefed the participants on OSP characteristics and potential response strategies. On Day 2, participants discussed a series of questions aimed at assessing responses to OSP spills in freshwater, wetland, estuarine and marine environments:

- *What kind of OSP spills could occur from rail transportation?*
- *What response strategies would be employed for an OSP spill if it occurred today?*
- *What challenges would an OSP response face and how could this be improved in the future?*
- *What information or resource needs are required over time to improve OSP response?*
- *How does contingency planning need to change to prepare for OSP spills?*

Breakout groups on each environment had participants with diverse backgrounds. A group leader facilitated the discussion and a note taker recorded relevant information for presentation at a plenary session.

The body of this report provides a summary of the technical information presented in the training sessions. Section 10 summarizes the answers to the questions provided by the breakout groups. The appendices provide:

- the agenda for the training session;
- the attendance list;
- the technical presentations;
- summary notes from the plenary sessions;
- notes from the individual breakout sessions.

2.0 OVERVIEW OF OIL SANDS DEVELOPMENT IN ALBERTA

In order to provide a broad understanding of oil sands, Randy Mikula, Ph.D. (Kalium Research; Edmonton, Alberta) provided an overview of mining and the environmental issues related to the extraction and processing of the new material. The Canadian oil reserves in Cold Lake, Athabasca and Wabasca are estimated to be 170 billion bbl., In terms of overall petroleum reserves, Canada is third in the world. The United States is currently the largest importer of Canada's OSP.

Typically, OSP consists of 73% sand, 12% bitumen, 10% fines and 5% water. [N.B., This data and all of that presented below is contained in the presentations given at the training. See the appendix for these documents.] The large percentage of abrasive materials means that OSP requires significant processing near the mining sites to prepare it for transportation to refineries, either locally or at a distance. The mining operations are conducted in two ways: surface mining and *in situ* mining. Both processes use very large amounts of water. In surface mining, the OSP is removed by mining machines and moved to locations where it is crushed, and mixed with water to remove the bitumen. The resulting tailings are transported to large tailing ponds where consolidation occurs and fines are allowed to settle. Water usage is 2 to14bbl. per 1bbl. of bitumen recovered. From an environmental perspective, surface mining results in major disturbances to the landscape and the large tailing ponds. The current extent of disturbance is ~600km^2 with tailing containment about ~180km^2.

The dry stackable tailings process is increasing the reuse of water (up to 70%) and allowing the potential restoration of tailing ponds sites to boreal forests to occur more quickly. The addition of chemical additives to the consolidated tailing process has raised the issue of potential toxicity to surrounding water bodies. The process of spreading of thin layers tailings over large areas has shown promise to speed consolidation. New technology, using centrifuges, further reduces the volume of the tailing and increases water reuse to near 80%. These methods decrease tailing storage space requirements and speeds restoration potential.

The *in situ* process also requires extensive water use and is highly energy intensive. In the *in situ* process, steam made from saline groundwater is injected into deep oil sands deposits. Using steam assisted gravity drainage (SAGD) the bitumen's viscosity is reduced so that it can be pumped from the ground like conventional crude oil. The water is then separated from the extracted material and recycled.

There is a significant energy input associated with this extraction method. The standard extraction process requires huge amounts of natural gas. Currently, the oil sands industry uses about 4% of the Western Canada Sedimentary Basin natural gas production. By 2015, it is projected to increase by 2.5 times.

According to the National Energy Board of Canada, it requires about 1,200 cubic feet (34 m^3) of natural gas to produce one barrel of bitumen from *in situ* mining operations and about 700 cubic feet (20 m^3) for those where both gas and bitumen are extracted. Since a barrel of oil equivalent is about 6,000 cubic feet (170 m^3) of gas, this represents a large gain in energy. This being the case, Alberta regulators may choose to reduce exports of natural gas in order to provide fuel for the oil sands processing.

3.0 CHARACTERISTICS OF OIL SANDS PRODUCTS

An overview of the composition of OSP was presented by Heather Dettman, PhD of CanmetEnergy (Government of Canada). Bitumen is the extra heavy crude oil that remains in the geologic formation after *in situ* biodegradation processes occur. Approximately 50% of bitumen boils at temperatures below 524°C/975.2°F. Due to the biodegradation process, only the large organic acid molecules remain as part of the bitumen. These molecules have the high boiling points (>70wt% 524°C/975.2°F) and a low Total Acidic Number (TAN) of 3mgKOH/g material (3wt% in oil). This compares with vinegar which has 5% acetic acid and a TAN of 47KOH/g material.

In order to move bitumen efficiently through transmission pipelines, other petroleum products must be added to dilute it. These diluted bitumen products are called Oil Sands Products (OSP). Dilbit (diluted bitumen) is created by adding naphtha-based oils including natural gas condensate. While approximately 75wt% of the condensate has a low boiling point of 204.2°C/399.2°F, but the overall boiling point of the dilbit remains high at 524°C/975.2°F. This is important because it means a small fraction <20wt% will evaporate rapidly during a spill, but the remaining fraction will not. The slower evaporation of the remaining fraction reduces the potential air quality issues for responders and the public. Synbit is made by diluting bitumen by using synthetic crude oil from refineries. Like dilbit, the overall material maintains a high boiling point.

Dilbit and synbit transported through pipelines must meet certain specifications for viscosity, density and acidity. In order to meet these specifications, dilbit and synbit require diluent of lighter oils 30% and 50% by volume, respectively. Both have a TAN of ~1.9KOH/g material with less than 3.9wt% sulfur.

Internal corrosivity in pipelines can occur as result of water, sediments, organic acids or sulfur contained in the oils or OSP. Water becomes important if the sludge in which it is contacted settles, accumulates and increases at a given location. If water soluble organic acids are present, corrosivity is increased. OSP is generally low in water soluble organic acids due to the extensive washing that occurs during the sediment removal process instituted immediately after extraction. The washing not only reduces the organic acids, but also removes mud and sand that might normally be abrasive to the pipeline. Organic acids in OSP or other crudes can cause corrosion if they become concentrated; this can occur at high temperatures in the refinery process. In pipelines and rail cars these high temperatures, 280°C/392°F do not occur as the dilbit and synbit do not need to be heated to flow.

Sulfur is contained in most crudes, OSP and diluents. If released, the acidic sulfides may react with iron to form iron sulfides. In order for this to occur, sulfur in the OSP would need to be exposed to high temperatures, (350°C/662°F) along with high pressure catalysts that are part of the refinery process. These conditions do not usually occur in pipelines or rail cars.

In summary, research conducted as early as 1995 and more recently, on Alberta OSP have shown the material to be low in corrosivity.

4.0 RAIL TRANSPORTATION OF OIL SANDS PRODUCTS

Mr. William Fairfield of Canadian Pacific Railroad (CP) presented an overview of what crude oil or OSP rail cars would look like, the safety programs that are in place to avoid accidents and the response plans typically employed by major railroads. CP, although a major railroad carrier in

Canada, would not be transporting OSP through Maine. [N.B., The Montreal, Maine and Atlantic Railway would be the most likely carriers of OSP through Maine.]

The proposed OSP unit trains would contain 80 to 100 tank cars; each car has a 28,000 gallon capacity. They are constructed of 7/16 inch steel and have standard safety relief valves. New cars, which may be used starting in 2013, could carry up to 40,000 gal. Cars are typically owned, maintained and inspected by the transporter and expected to be a 40 year asset. The rail companies conduct additional inspections when the cars become part of a train. All cars are built to U.S. standards as specified in 49CFR174.

Railroads in the U.S and Canada are highly regulated and as such have specific standards for safe operations. Overall, in 2009, the incidence of accidents on Class I railroads was less than 3/million track miles. Railroad regulations are promulgated and monitored in both Canada and the U.S. as follows:

- Operating Rules for train crews;
- Locomotive Safety Rules;
- Freight Car Safety Rules;
- Train Brake Rules;
- Railway Track Safety Rules;
- Transportation of Regulated Products; and
- Safety Management System Regulations.

Each railroad company has its own internal policies, practices and procedures that ensure it meets or exceeds all of the standards prescribed by Federal regulations. As an example, CP's Safety and Regulatory Affairs and Environmental Services Departments are responsible for promoting employee, public and train accident prevention. In addition, they also coordinate with communities in accident prevention and emergency response preparedness in accordance with Federal, Provincial, State, and Municipal requirements.

Railroad companies have safety programs that include: track inspection and maintenance, rail car maintenance and train inspection. The track maintenance program includes: daily visual track and switch inspections and annual maintenance programs to renew track infrastructure materials (e.g., rails, ties and ballast). New technology has improved evaluations of problems in rail integrity, geometry and surface flaws.

Rail tank cars that move OSP are subject to 49CFR130-174. The CFR includes the construction specifications and prescribed safety systems. Placards on cars designate dangerous goods and identify products based on UN number as per North American Emergency Response Guide. Waybills prepared by the shipper show commodity, shipper and emergency contact information and are available to responders should an accident occur.

When a car is accepted by the railroad, it is inspected for its condition and the condition of its safety systems. Route track-side sensors are used to check for issues that might impact safety during transit (e.g., hot wheels, bearings).

Emergency response planning is conducted by each railroad carrier. It consists of developing a response plan for potential accidents, establishing a community outreach program to improve coordination and safety, and having a professional response network to address mishaps. The response plan outlines the chain of command, communication protocols and actions required as part of any incident. All plans are routinely tested and coordinated with local communities and their responders. To implement any plan the rail company has environmental professionals who are trained to address issues related to air and water quality and hazardous materials. These professionals are supported by contract emergency responders strategically located along the primary routes.

5.0 FATE AND BEHAVIOR OF SPILLED OIL SANDS PRODUCTS IN THE MARINE AND FRESHWATER ENVIRONMENTS

Dr. Bruce Hollebone, of Environment Canada made a presentation on the behavioral factors affecting OSP and the chemical changes which may occur when it is spilled in the environment. These changes, collectively referred to as weathering, are the physical, chemical and biological processes that affect the oil released into the environment. Weathering is one of the major drivers of oil behaviour (what it does in the environment?), fate (where it goes?), persistence (how long it lasts?) and effects (what it impacts?). The primary weathering processes are:

- Evaporation
- Photo-oxidation
- Water uptake and emulsification
- Particle interactions and sedimentation
- Dispersion
- Biodegradation

There are 12-13 types of OSP on the market and they differ slightly in how each reacts in the environment based on its specific properties. Evaporation is the best known weathering process. It is a physical process where molecules leave the liquid phase, but are not changed chemically. OSP will lose 10wt% (dilsynbit) to 20wt% (synbit) in a few hours, and a total of 15 and 24wt%, respectively over 10 days. By comparison, a light crude will lose ~25wt% in a few hours and ~35wt% by 10 days. The initial loss is due to evaporation and is important to understand for air quality and safety purposes.

Dissolution and solubility are minor factors (ppb to ppm levels) with respect to oil behavior, but they can impact biota and their habitats. The concentrations of the individual compounds in OSP that dissolve into water are a function of mixing energy, temperature and time.

Photo-oxidation of OSP increases the density of the remaining product and tends to increase the amount of water uptake and emulsion formation. The uptake of water during emulsification increases density and greatly increases viscosity. As a result, it changes the way OSP moves and how it sticks to other objects. Oil entrained in water may persist for a long time in the environment. Currently, models for photo-oxidation and emulsification are not well developed.

Particle interaction with OSP can occur in several ways and depends on the location or source of sediment. Suspended particles become adsorbed to oil and increase its density, often causing it to sink. In turbulent areas, such as surf zones or rivers with rapid currents, oil can be dispersed into small droplets where emulsification and sediment interactions occur simultaneously. These combined actions may result in tarball formation and sedimentation. Models for dispersion and sediment interaction are being developed.

Temperature affects many OSP properties (e.g., density and viscosity). Temperature also affects rates of weathering processes (e.g., evaporation and adsorption/sedimentation). Natural dispersion of OSP can occur if there is enough mixing energy in the water column to cause droplets to break away from the slick. Little is known about the mixing energies needed to disperse OSP, but it is less likely to occur once the lighter fractions such as the diluent have evaporated.

Biodegradation of the organic compounds of OSP will likely occur from weeks to months to years depending on conditions. Aerobic biodegradation is a much faster process than anaerobic biodegradation with nutrients and electron acceptors being the limiting factors. Microbes attack the smaller chain alkanes first followed by the unalkylated aromatics. Factors such as dispersal, burial by sediments, water quality and temperature all affect how rapidly and effectively biodegradation occurs.

There are many open questions that need to be answered in order to better predict or model how heavy oils or OSP react after a spill. The change in dilbit chemistry and behavior due to evaporation of the diluent still is not well known. The dispersion of OSP in water requires more knowledge of the droplet size, the rise time and the re-coalescence of the droplets. The interactions with sediments and the resuspension and remobilization potential are questions that need further study. Overall, little is also known of the impacts or long term persistence of OSP in the environment. More research also needs to evaluate the dissolution of OSP, so that bioavailability and toxicity can be established for biota present in the water column and the sediments.

6.0 EFFECTS OF OIL SANDS PRODUCTS ON BIOTA

A review of the effects of OSP on biota was presented by Dr. Peter Hodson of Queens University in Canada. Dr. Hodson has extensive experience studying the toxic effects of petroleum products on marine and aquatic biota. He noted that few studies have been done on the effects of OSP on biota and that much of the information is based on studies with compounds similar to those found in OSP.

The potential exposure and resulting impacts of OSP on biota will differ between marine and freshwater based on the behavior and fate of an OSP spill in the environments. Because the difference in density between OSP and freshwater is less than that between OSP and seawater there is a greater tendency for OSP to sink in freshwater. This means that in freshwater systems the impacts to species in the sediment tend to be a greater risk as the probability of sinking is higher. Conversely, in the marine environment, the floating OSP and greater depth to the bottom make water column biota more vulnerable. The amount of turbidity in the water also affects how the OSP behaves in the environment. In freshwater systems, there tends to higher amounts of turbidity due to the proximity of terrestrial runoff. In the marine environment there is generally less turbidity, although some estuarine systems fed by major river systems will have high turbidity. The suspended particles will tend to bind with the OSP and make it sink below the surface and possibly into the sediment. In flooding situations, as occurred in the Enbridge/ Kalamazoo River spill, terrestrial species in the floodplain were also exposed to OSP.

Other environmental characteristics such as wind and waves have a more significant impact on exposure of marine biota to OSP. These factors have a tendency to disperse the OSP and hence may broaden exposure to the biota. They also favor increased weathering, biodegradation and photolysis.

The effects OSP on biotic receptors is likely little different between marine and freshwater spills. Exposure however, is greater for freshwater biota because oil layers tend to be thicker, disperse more slowly (due to less turbulence) and population densities of fish and wildlife species are often higher. There is also the unique situation where terrestrial species which use freshwater (e.g., grizzlies and salmon) have greater chance for exposure than in the coastal ecosystem.

The impact of OSP on biological receptors is a function of the physical and chemical characteristics of the spill, the exposure, and the type of receptors present in the surrounding environment. The amount of exposure will be dependent on the distribution and concentration of the OSP and the extent of its accumulation in the biota. The biological receptors will be impacted by a spill based on their distribution, abundance and individual biological processes. For each spill, the unique combination of environmental and ecological characteristics will result in site specific biological responses.

The impacts of OSP on biota are related to the nature of its individual organic constituents. Compounds with low molecular weights tend to be more volatile, soluble and acutely toxic. Medium weight PAHs are more persistent and result in chronic toxicity. The heaviest weight hydrocarbons are the most persistent, the least toxic, but can cause smothering of benthic species. For OSP the volatile component is only 15%, which is usually lost in the first 24 hours. The remaining compounds are the more persistent, less toxic PAHs and higher molecular weight fractions. OSP has higher concentrations of alkyl PAH than lighter oils and are more likely to cause chronic impacts to embryos and early life stages of fish if the spawning areas are contaminated. Impacts to early life stages of fish and other organisms have an immediate and long term impact on the populations and ecosystem. Immediate mortality or chronic impacts to larvae may result in lower recruitment for populations. This lower recruitment has the potential longer-term impact of reduced recruitment over subsequent reproductive cycles.

The cleanup methods for OSP are often limited by access issues, high currents and the efficiency of the equipment. As demonstrated by the Enbridge/Kalamazoo spill, sinking OSP made locating and recovery the material very difficult. The destruction of habitat during recovery of sunken OSP can often be as devastating as the spill. The long term impacts of the spill, the potential habitat destruction during recovery, and the potential for effective ecosystem restoration all must be carefully evaluated as part of the OSP cleanup strategy.

There are many unknowns regarding the impacts of the OSP on biota. More research is needed on the toxicity of the different types of OSP on biota. The long term effects on reproduction success of populations are still unknown. The need for more baseline information for water bodies that might be potentially affected by spills is vital to effectively assessing long term impacts.

7.0 RESPONSE TECHNOLOGIES FOR OSP: ENBRIDGE OIL SPILL CASE STUDY FROM THE KALAMAZOO RIVER, MICHIGAN

The Enbridge/Kalamazoo OSP spill in July 2010 was a result of a ruptured pipeline. Although rail transportation of OSP is proposed for Maine, this case study is illustrative of the issues that could be encountered should a railroad accident occur adjacent to a river. Ms. Lori Muller a US EPA official involved with the incident presented an overview of the response for the estimated 843,000 to 1,000,000 gallon spill.

The impacted area is a 40 mile meandering river segment that during the time of the spill was at the 25 yr. flood stage, resulting in significant inundation to areas of the flood plain. The river also has numerous oxbows, islands and wetlands all which complicated the response effort. The Ceresco Dam is also on the affected segment. Initially, there was substantial confusion regarding the spill among Enbridge employees. Thus, substantial amounts of OSP were discharged adjacent to the river before the flow was stopped and the state and Federal agencies were notified. The initial notifications did not specify that the spilled oil was OSP. This also complicated the initial response.

During the first 40 days after the spill, there was an initial remedial operation plan that included responding to the potential public health hazard that might have been caused by the benzene diluent (30%) in the air. An extensive air monitoring program was conducted during the first 30 days to protect cleanup workers. Voluntary evacuations were undertaken for 60 residences in the immediate area. The USEPA also initiated a process to assess the amount and location of shoreline oiling, using a river adaptation of the NOAA Shoreline Cleanup Assessment Technique (SCAT). This provided a unified method for assessment and data collection that could be used for developing a cleanup strategy. The SCAT process also provided a systematic management process for the cleanup. Following the initial cleanup efforts, a SCAT reassessment of river segments was completed to determine if the areas were sufficiently clean.

After the initial cleanup and SCAT reassessment, the remediation strategy turned to the overbank areas in the floodplain. The remediation of these areas was driven by a new methodology: the Shoreline Overbank Assessment Technique (SORT). SORT used a USGS inundation model to provide the guidance for identifying and assessing the locations for remediation. The SORT method was initially used in 2011 and then as ReSORT in 2012 to revisit areas that needed further action. An overall outcome of this remedial process was development of a data management system that could be employed for future spill scenarios in freshwater systems.

Because the majority of the OSP spilled is dominated by heavy oil fractions, there was a significant effort in 2011 and 2012 to remediate the submerged oil in the river. The remediation team had a difficult time identifying the location of the submerged oil. The initial identification of submerged oil areas was done by coring and using long poles (poling) in 18 priority locations. Oil recovery was conducted in the spring and fall of 2011 to remediate these locations.

To improve the recovery of submerged oil, the team used a number of techniques with varying success. These included:

- Low pressure sediment flushing,
- Pressure with stingers,
- Dredging,
- Aeration, and
- Surface collectors, absorbent pads, pom-poms and sheen corralling.

In 2012, the remediation team conducted some additional scientific studies which have not been completed. These included:

- *Net Environmental Benefits Analysis (NEBA) Study*. This study weighs the risks of leaving oil in place compared to removal activities.
- *Submerged Oil Quantification Study*. This is a stratified random coring study, including all the geomorphic units in the river, to develop a valid estimate of the amount of oil present.
- *UV Epiflourescence Microscopy Study*. This study attempts to understand the structure of oil and mineral aggregates formed.

- *Biodegradation Study.* This study is focused on determining the effects of natural biodegradation on the OSP.

The results of these studies will contribute to the knowledge base for future river-based spills. The NEBA will provide a framework for evaluating the net benefits of future removal actions. The biodegradation study will provide significant knowledge regarding the potential value of biodegradation as part of an overall cleanup strategy for OSP spills.

8.0 ASSESSING NATURAL RESOURCE IMPACTS FROM THE ENBRIDGE PIPELINE SPILL ON THE KALAMAZOO RIVER

As part of the Enbridge/Kalamazoo cleanup, the resource trustees initiated a Natural Resource Damage Assessment (NRDA) to determine the value of the natural resources lost or damaged as a result of the OSP spill. Ms. Jessica Winter (NOAA), a member of the NRDA team, reported on the activity to date, including an overview of the NRDA process and the trustee's data collection.

The Oil Pollution Act of 1990 (OPA 90) and the subsequent regulations, established the requirement to assess the damages from oil spills and make the public whole for those injuries to natural resources and natural resource services. Damage assessment requires that the natural resource trustees are chosen from among the appropriate natural resource agencies in the area. The NRDA then proceeds through a stepwise process that includes:

- An initial resource assessment to determine whether injury to public trust resources has occurred. This work includes collecting time-sensitive data involving the substance released and its impact on trust resources to determine the extent and severity of injury.
- Trustees quantify injuries and loss of services and identify possible restoration projects using economic and scientific studies to compensate for the injuries and losses. In assessing the losses the trustees must evaluate the spatial extent of the injury, severity and duration.

- These impact assessment studies are used to develop a restoration plan and potential compensation for loss or impairment from the time of injury to recovery.
- The final step is to implement restoration and monitor its effectiveness, including adjustments, if required.

For the Enbridge/Kalamazoo spill, eight trustees, including two tribes, were designated to oversee the NRDA process. In discharging their responsibility, the trustees are conducting an assessment to determine what resources might have been impacted and identify the potential injuries. The trustees are coordinating with the response agencies to determine what information had been previously collected as part of the remediation process that might be useful in the NRDA process. Gaps were identified that would be needed to quantify the injury. It is important to understand baseline in order to establish damages and restore resource services. Data from the literature or studies from similar environments can provide insight into the river's baseline ecosystem.

The trustees initiated a number of studies to fill the data gaps necessary to determine the extent of injuries. These studies took into account: the nature of the oil spilled, the identified locations of oil damage, and impacts related to the remediation itself. The studies explored/included:

- The extent of oiling in the floodplain habitats;
- Vegetation surveys to determine the extent of oiling and potential invasive species expansion;
- Erosion issues related to the remediation;
- Fish kills and ongoing monitoring surveys for status and trends;
- Fish tissue surveys to assess potential exposure and sub-lethal health issues;
- Abundance and diversity of macroinvertebrates impacted by the sinking oil and cleanup process. (The cleanup process has the potential to impact habitat (e.g., sediment and vegetative cover));
- Mussels shell surveys to further assess the impacts of the spill and remediation on these populations;
- Chemistry studies of source OSP, water, sediment and biota;
- Wildlife recovery studies using animals treated at rehabilitation center and;

- Human use studies to determine the loss of the river for human recreation for two years.

Once these studies are complete and the impacts analyzed, the trustees will determine if any additional data gaps exist and then initiate the restoration and compensation phases of the NRDA. Reviewing the findings of these studies will be helpful to understanding response actions for any future OSP spills in Maine.

9.0 OSP TRANSPORTATIOM IN MAINE AND THE POTENTIAL RESOURCES AT RISK

The first day of the Maine training session provided an overview of the nature of OSP, the transportation issues associated with it, its potential impacts in the event of a spill, and information from case studies for strategies that might be employed to cleanup an OSP spill and conduct a NRDA. On the second day, Ms. Ginger McMullin of Maine DEP Response Services provided an overview of the status of current response strategies in the state, the potential rail corridors that might be used to transport OSP, and the potential resources that might be at risk.

The Maine DEP has developed 208 strategies in the State to respond to oil spills in sensitive areas of the coast. These strategies were developed in cooperation with Maine Inland Fish and Wildlife, Department of Marine Resources and Maine Geological Survey. These agencies help identify the habitats and resources at risk from marine oil spills. There are currently 98 Environment Vulnerability Index (EVI) maps for Maine's coastal area. These maps and the 25 underlying datasets are available in GIS. The ME DEP system has the ability to query various areas to determine potential resources at risk at the time of a spill. These resources include: major rivers and streams, lakes and ponds, water supplies, aquifers, threatened and endangered species, wildlife habitats, wetlands, fish runs, conservation lands and recreational sites.

The EVI's have only been developed for coastal areas. The potential rail transportation routes for OSP include the coastal route of Pan Am from the south but also the inland route of the Montreal, Maine and Atlantic Railway which goes through Jackman, Greenville and Brownville Junction, Maine. Thus, there are significant inland resources that have not yet been captured in the EVI Map system that may be important. As a result, response strategies have not been developed for spills that might occur along the inland rail corridors. In Maine along the rail corridors, as in the area of Michigan along the Enbridge pipeline, there are large areas where there is limited access for cleanup purposes. Many of these areas have significant stream, river, wetland, lake, and upland resources that might be impacted by a railroad spill of OSP.

10. BREAKOUT GROUP DISCUSSIONS OF OSP RESPONSE STRATEGIES

The training participants were distributed into one of five breakout groups based on their experience and expertise. Each breakout group had a group leader (facilitator) and a note taker. At the end of the breakout session, a volunteer from each group reported the findings to all the training participants. Two of the five groups were focused on potential issues resulting from spills in the marine environment and remaining three groups focused on the freshwater environment. [N.B., At this time, the only rail line identified as possibly OSP is inland. The marine discussions were held in the event that, though not anticipated now, future transport of heavy oils could occur in coastal regions.]   In all cases, the groups also addressed potential impacts in wetland habitats associated with the freshwater or marine environment.

Each of the groups was given five questions to direct their discussion:

1. For your environment, what kind of spill scenarios could occur?
2. For your scenarios, what would the response be now?
3. What issues/challenges would the response face (e.g. for the environmental unit, logistics, human dimension, health and safety) that are unique to these scenarios?
4. What information is needed and what questions should be answered to improve the response to these scenarios? Prioritize theses needs /answers (i.e. 12 months, 2-3 years, and 4+ years).
5. How does Contingency Planning need to change to accommodate an OSP spill?

By discussing and answering these questions, the groups were able to evaluate current readiness for an accident and also recommend and prioritize actions that should be taken to better prepare response agencies for future contingencies.

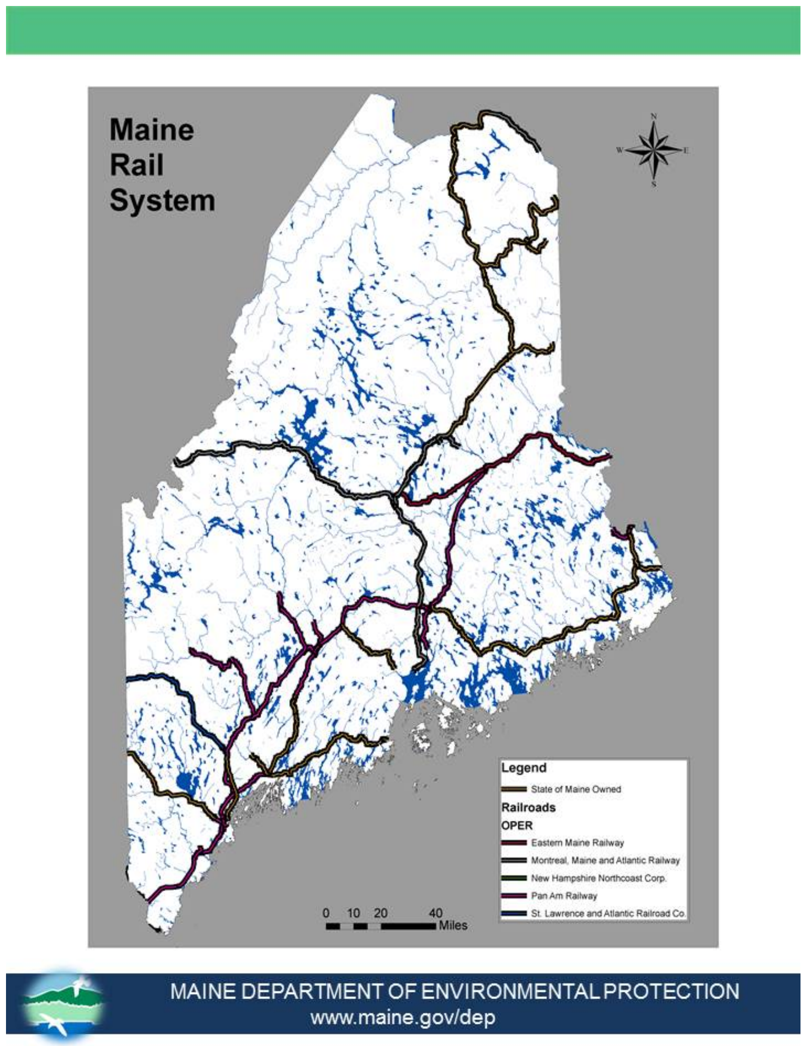


Figure 1: Maine Rail System

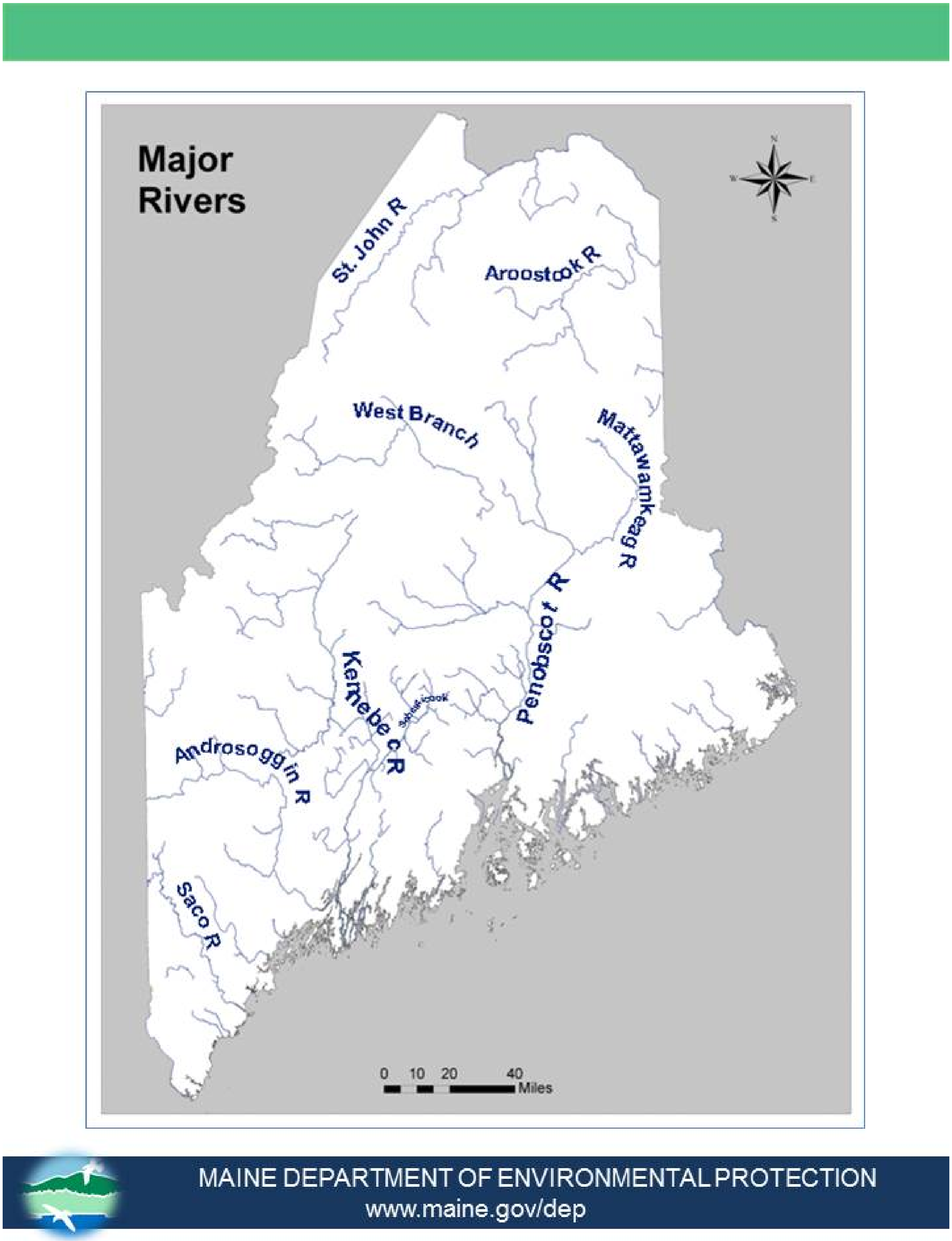


Figure 2: Maine Major Rivers

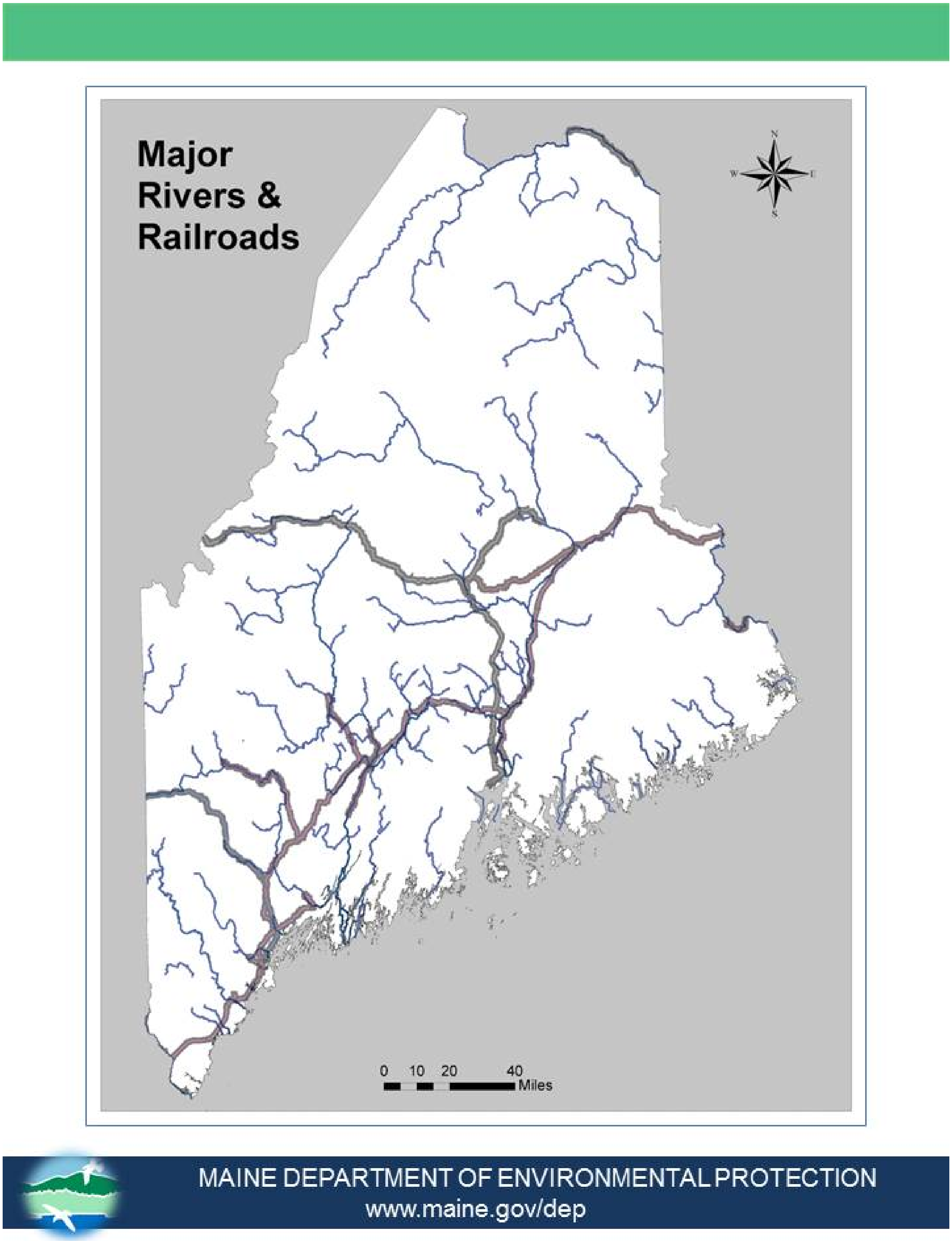


Figure 3: Maine Major Rivers & Railroads

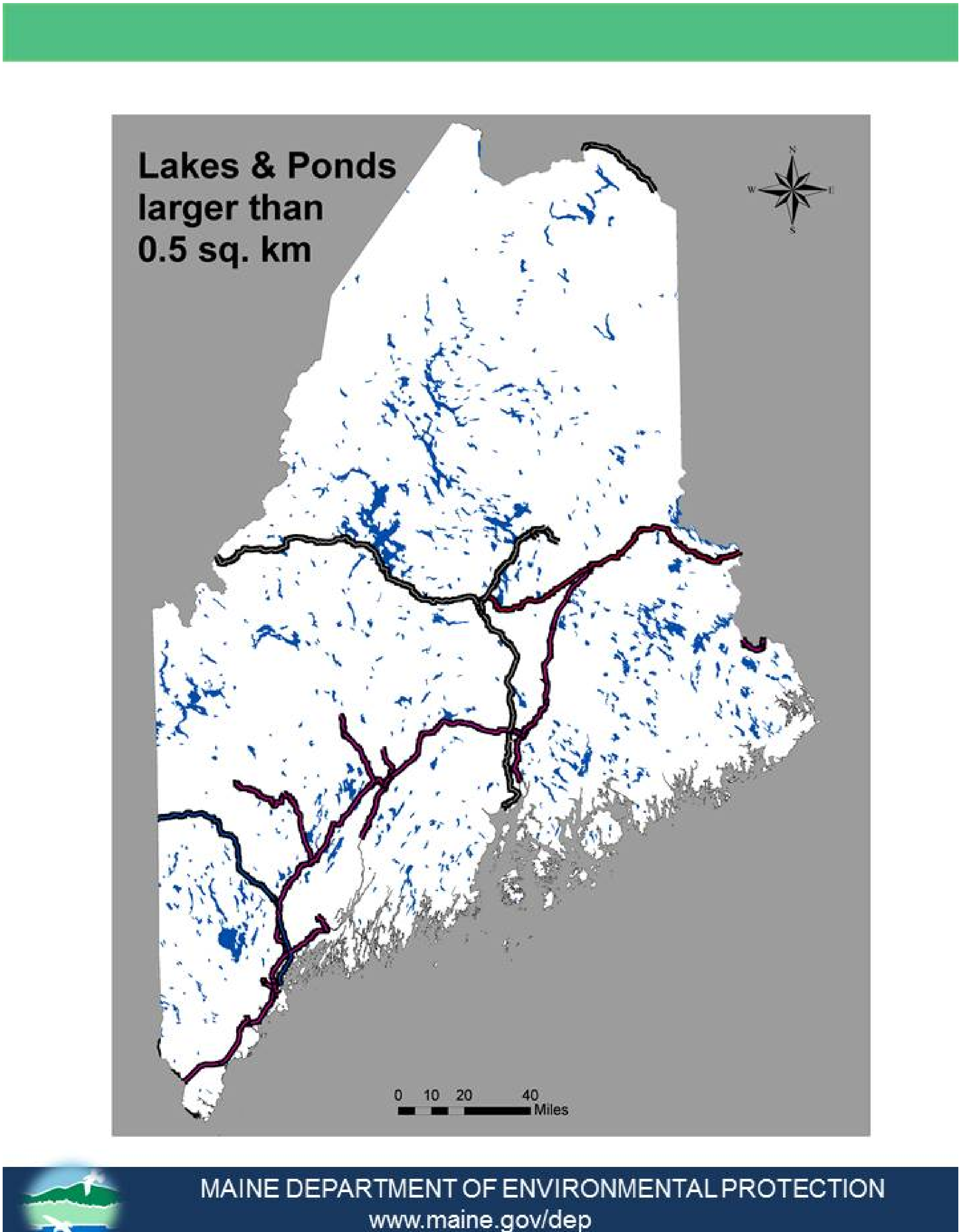


Figure 4: Maine’s Major Lakes & Ponds

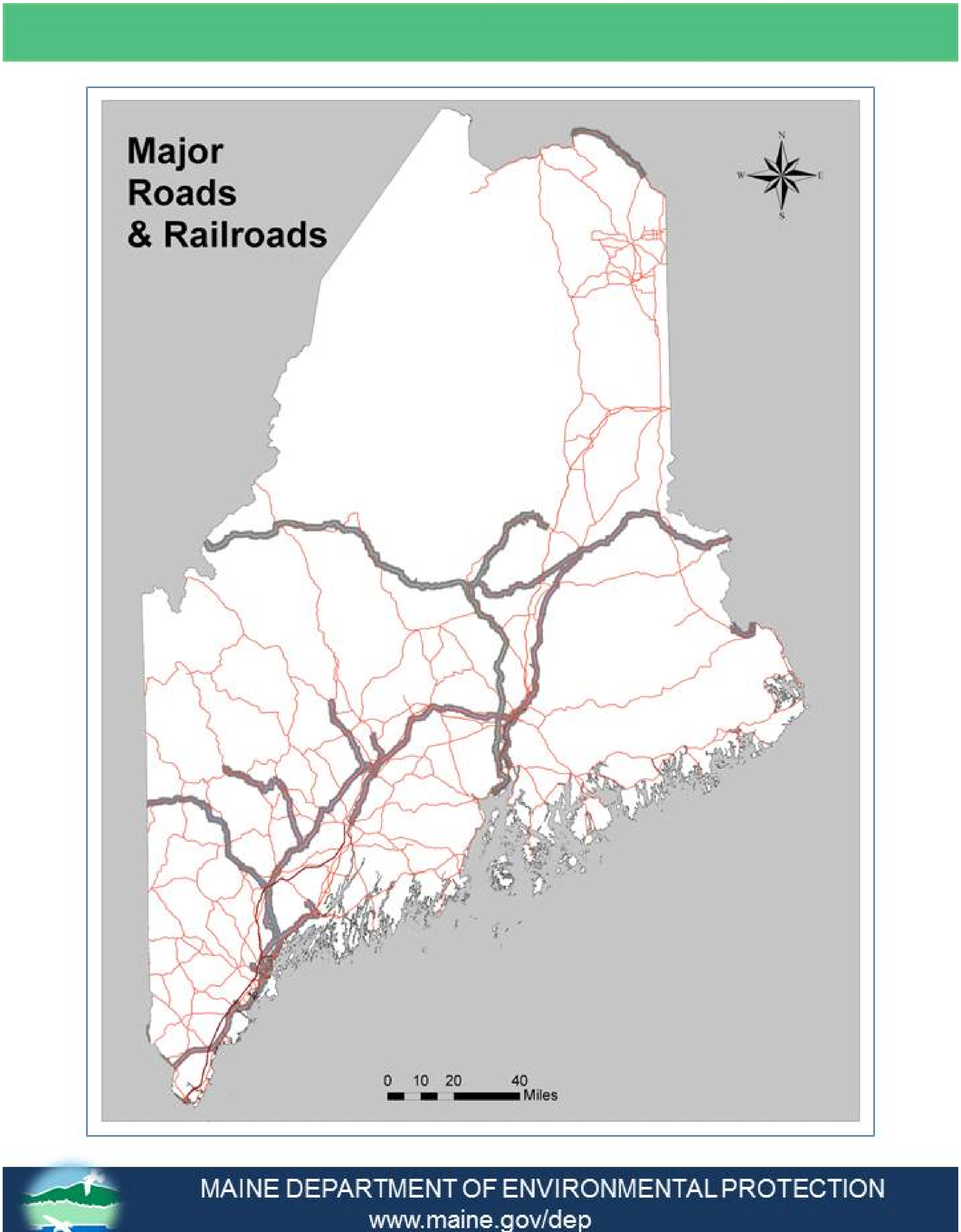


Figure 5: Maine's Major Roads & Railroads

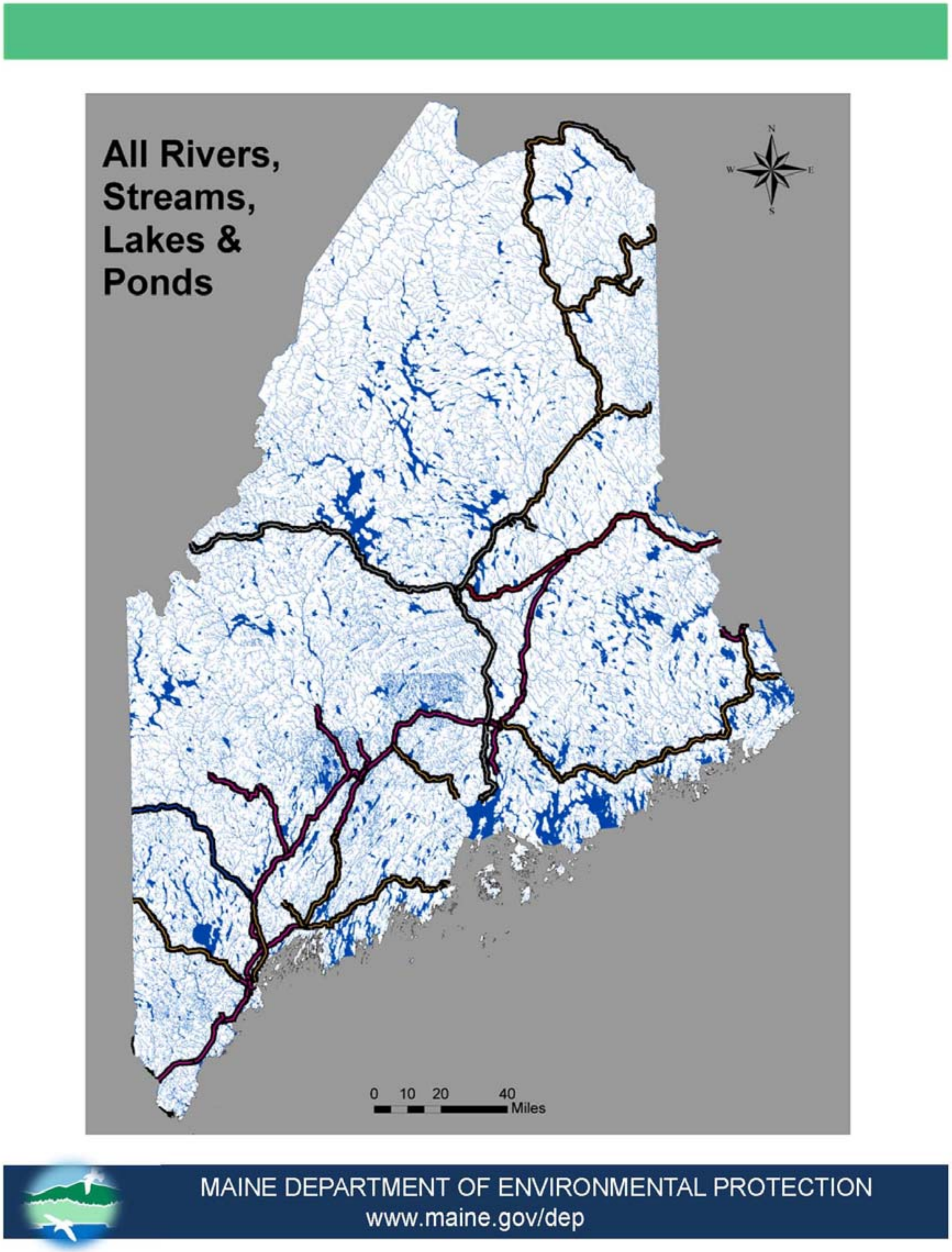


Figure 6: Maine’s Rivers, Streams, Lakes & Ponds

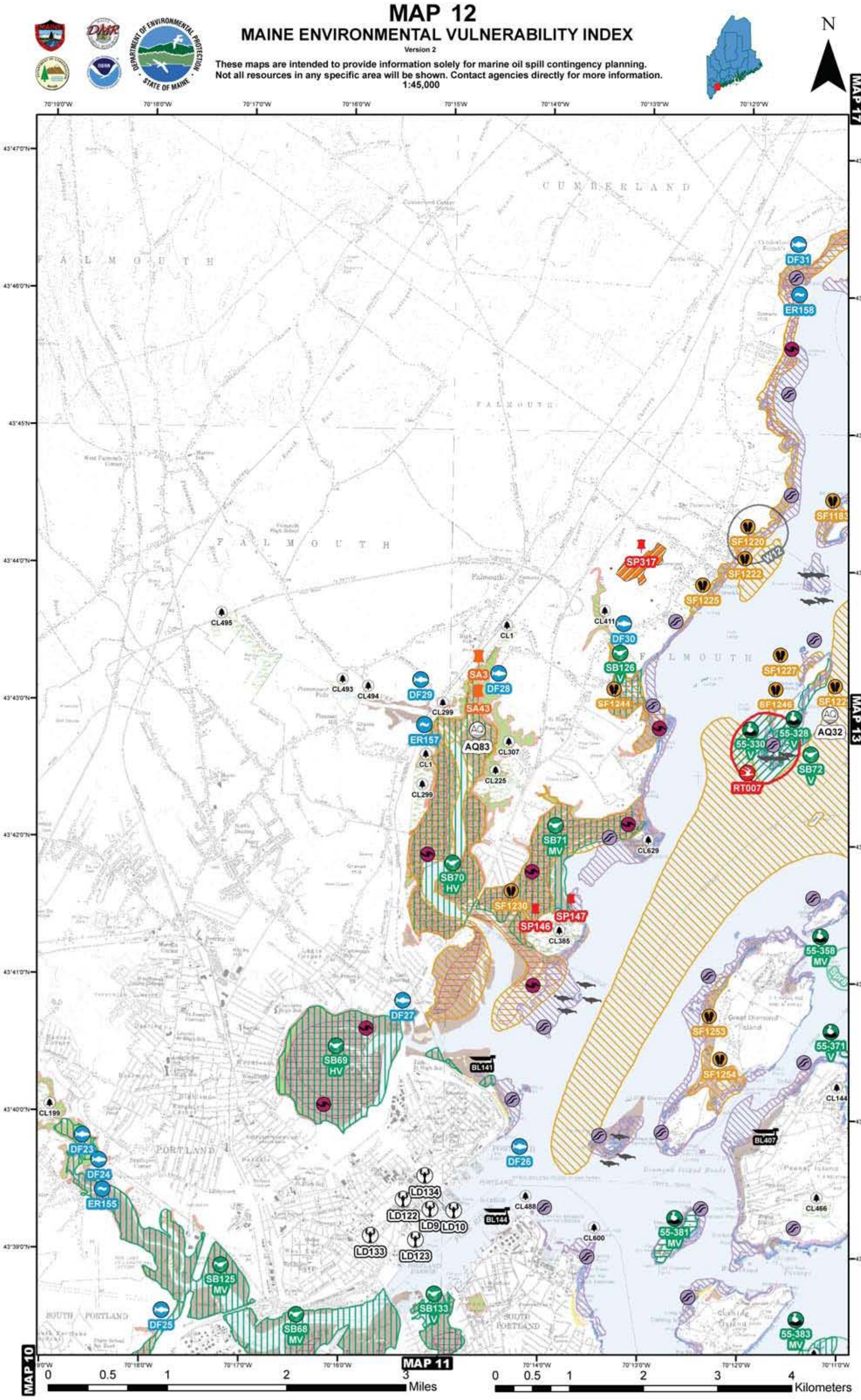

MAP 12
MAINE ENVIRONMENTAL VULNERABILITY INDEX
Version 2
These maps are intended to provide information solely for marine oil spill contingency planning.
Not all resources in any specific area will be shown. Contact agencies directly for more information.
1:45,000
N
MAP 17
MAP 13
MAP 10
MAP 11
CUMBERLAND
FALMOUTH
PORTLAND
SOUTH PORTLAND
DF31
ER158
SF1183
SF1220
W12
SF1222
SF1225
SP317
CL411
DF30
SB126 V
SF1244
SF1227
SF1246
55-330 V
55-328 V
AQ32
SB72 V
RT007
CL495
CL1
CL493
CL494
DF29
SA3
DF28
SA43
CL299
ER157
AQ83
CL307
CL225
SB71 MV
CL629
SB70 HV
SF1230
SP146
SP147
CL385
55-358 MV
DF27
SB69 HV
BL141
SF1253
SF1254
55-371 V
CL144
CL199
DF23
DF24
ER155
DF26
BL407
LD134
LD122
LD9
LD10
LD133
LD123
CL488
BL144
CL600
55-381 MV
CL466
SB125 MV
DF25
SB68 MV
SB133 LV
55-383 MV
0 0.5 1 2 3 Miles
0 0.5 1 2 3 4 Kilometers

Figure 7a

ENVIRONMENTAL SENSITIVITY MAP - 12

GEOGRAPHIC RESPONSE PLANS (BOOMING STRATEGIES) FOR THIS MAP AREA: B-05-1 B-06-1 B-07-1 B-08-1 B-08-2 B-09-1 B-09-2

THREATENED AND ENDANGERED SPECIES / SPECIES OF SPECIAL CONCERN

BALD EAGLE ESSENTIAL HABITAT (BE) | HARLEQUIN DUCK WINTERING HABITAT (HD) | PIPING PLOVER / LEAST TERN ESSENTIAL HABITAT (PPLT) | ROSEATE TERN ESSENTIAL HABITAT (RT)

Other T or E Species
SA: Sensitive Animal
SP: Sensitive Plant

Other SSC
SA = Sensitive Animal
SP = Sensitive Plant

BIRDS

EVI NO	COMMON NAME	SCIENTIFIC NAME	ST	FED	MONTHS PRESENT C= COMMON U=UNCOMMON J F M	A M J	J A S	O N D	SPRING MIGRATION	NESTING	FALL MIGRATION	WINTERING	MOLTING
RT007	Roseate Tern	*Sterna dougallii*	E	E		C C	C C		May	May Aug.			
SA3	Least Bittern	*Ixobrychus exilis*	SC			U U U	U U U	U	Apr. May	May Aug.	Aug. Oct.		

SENSITIVE PLANTS / RARE ANIMALS

EVI NO	COMMON NAME	SCIENTIFIC NAME	ST	FED
SA3	Least Bittern	*Ixobrychus exilis*	SC	
SA43	New England Cottontail	*Sylvilagus transitionalis*	SC	
SP146	Columbia Water meal	*Wolffia columbiana*	T	
SP147	Mountain Honeysuckle	*Lonicera dioica*	E	
SP317	Variable Sedge	*Carex polymorpha*	E	

SEABIRD NESTING ISLANDS (00-000)

EVI NO	COMMON NAME	SCIENTIFIC NAME	ST	FED	MONTHS PRESENT C= COMMON U=UNCOMMON J F M	A M J	J A S	O N D	SPRING MIGRATION	NESTING	FALL MIGRATION	WINTERING	MOLTING
55 328	Common Eider	*Somateria mollissima*			C C C	C C C	C C C	C C C	Mar. Apr.	Apr. Jul.	Sep. Oct.	Nov. Mar.	Jul. Sep.
	Common Tern	*Sterna hirundo*	SSC			C C	C C U		May	May Aug.	Aug. Sep.		
	Herring Gull	*Larus argentatus*			C C C	C C C	C C C	C C C		Apr. Aug.		Sep. Mar.	
55 330	Common Eider	*Somateria mollissima*			C C C	C C C	C C C	C C C	Mar. Apr.	Apr. Jul.	Sep. Oct.	Nov. Mar.	Jul. Sep.
	Common Tern	*Sterna hirundo*	SSC			C C	C C U		May	May Aug.	Aug. Sep.		
55 358	Common Eider	*Somateria mollissima*			C C C	C C C	C C C	C C C	Mar. Apr.	Apr. Jul.	Sep. Oct.	Nov. Mar.	Jul. Sep.
	Herring Gull	*Larus argentatus*			C C C	C C C	C C C	C C C		Apr. Aug.		Sep. Mar.	
55 371	Common Eider	*Somateria mollissima*			C C C	C C C	C C C	C C C	Mar. Apr.	Apr. Jul.	Sep. Oct.	Nov. Mar.	Jul. Sep.
55 381	Common Eider	*Somateria mollissima*			C C C	C C C	C C C	C C C	Mar. Apr.	Apr. Jul.	Sep. Oct.	Nov. Mar.	Jul. Sep.
	Double crested Cormorant	*Phalacrocorax auritus*			U	C C C	C C C	C U	Mar. Apr.	Apr. Aug.	Oct. Nov.		
	Herring Gull	*Larus argentatus*			C C C	C C C	C C C	C C C		Apr. Aug.		Sep. Mar.	
55 383	Black crowned Night Heron	*Nycticorax nycticorax*	SSC			U U C	C C U	U	Mar. Apr.	Apr. Aug.	Sep. Oct.		
	Common Eider	*Somateria mollissima*			C C C	C C C	C C C	C C C	Mar. Apr.	Apr. Jul.	Sep. Oct.	Nov. Mar.	Jul. Sep.
	Double crested Cormorant	*Phalacrocorax auritus*			U	C C C	C C C	C U	Mar. Apr.	Apr. Aug.	Oct. Nov.		
	Glossy Ibis	*Plegadis falcinellus*				U C C	C C C	U	Apr. May	May Aug.	Sep. Oct.		
	Herring Gull	*Larus argentatus*			C C C	C C C	C C C	C C C		Apr. Aug.		Sep. Mar.	

SHOREBIRDS (SB)

SHOREBIRD SITES ON THIS MAP INCLUDE ONE OR MORE OBSERVATIONS OF THE FOLLOWING SPECIES

COMMON NAME	SCIENTIFIC NAME	ST	FED	MONTHS PRESENT C= COMMON U=UNCOMMON J F M	A M J	J A S	O N D	SPRING MIGRATION	NESTING	FALL MIGRATION	WINTERING	MOLTING
Purple Sandpiper	*Calidris maritima*			C C C	C U		U C C	Apr. May		Oct. Nov.	Nov. Apr.	
Black bellied Plover	*Pluvialis squatarola*				C C	U C C	C U	May Jun.		Jul. Nov.		
Dunlin	*Calidris alpina*				U U	U C	C C	May Jun.		Aug. Nov.		
Greater Yellowlegs	*Tringa melanoleuca*				C C U	U C C	C U	Apr. Jun.		Jul. Nov.		
Hudsonian Godwit	*Limosa haemastica*					U U U	U			Jul. Oct.		
Killdeer	*Charadrius vociferus*			U	C C C	C C C	C U	Mar. Apr.	Apr. Aug.	Sep. Nov.		
Least Sandpiper	*Calidris minutilla*				C U	C C C	U	May Jun.		Jul. Oct.		
American Golden Plover	*Pluvialis dominica*					U U	U			Aug. Oct.		
Unidentified Sandpiper	*Calidris spp.*				U C C	C C C	U U	May Jun.		Jul. Oct.		
Unidentified Yellowlegs	*Tringa spp.*				C C U	U C C	C U	Apr. Jun.		Jul. Nov.		
Short billed Dowitcher	*Limnodromus griseus*				C U	C C C	U	May Jun.		Jul. Oct.		
Semipalmated Plover	*Charadrius semipalmatus*				C C	C C C	U	May Jun.		Jul. Oct.		
Semipalmated Sandpiper	*Calidris pusilla*				C C	C C C	U	May Jun.		Jul. Oct.		
Solitary Sandpiper	*Tringa solitaria*				C U	U C C	U	May Jun.		Jul. Oct.		
Spotted Sandpiper	*Actitis macularia*				U C C	C C C	U			Jul. Oct.		
Whimbrel	*Numenius phaeopus*	SSC				U U U				Jul. Sep.		
Lesser Yellowlegs	*Tringa flavipes*				U	C C C	U	May		Jul. Oct.		

RAFTING BIRDS

Winter (W) Spring (Spr) Summer (Su) Fall (F)

EVI NO	COMMON NAME	SCIENTIFIC NAME	ST	FED	MONTHS PRESENT C= COMMON U=UNCOMMON J F M	A M J	J A S	O N D	SPRING MIGRATION	NESTING	FALL MIGRATION	WINTERING	MOLTING
Spr5	Common Eider	*Somateria mollissima*			C C C	C C C	C C C	C C C	Mar. Apr.	Apr. Jul.	Sep. Oct.	Nov. Mar.	Jul. Sep.
Spr8	Common Eider	*Somateria mollissima*			C C C	C C C	C C C	C C C	Mar. Apr.	Apr. Jul.	Sep. Oct.	Nov. Mar.	Jul. Sep.
W12	Mallard	*Anas platyrhynchos*			U U C	C C C	C C C	C C C	Mar. Apr.	Apr. Jul.	Oct. Dec.	Sep. Mar.	Jun. Jul.
	Long tailed Duck	*Clangula hyemalis*			C C C	C U	U	C C C	Mar. Apr.		Sep. Dec.	Sep. Mar.	
	Canada Goose	*Branta canadensis*			U U C	C C C	C C C	C C U	Apr. May	Apr. Jun.	Oct. Nov.	Nov. Mar.	Jun. Jul
	American Black Duck	*Anas rubripes*			C C C	C C C	C C C	C C C	Feb. Apr.	Apr. Jul.	Oct. Dec.	Sep. Mar.	Jun. Jul.

FISH:

DIADROMOUS FISH (DF) ELVER RUNS (ER) HERRING SPAWNING AREAS (HS)

FW- FRESHWATER R- RARE

EVI NO	COMMON NAME	SCIENTIFIC NAME	ST	FED	MONTHS PRESENT J F M	A M J	J A S	O N D	SPAWNING	LARVAE	JUVENILE	ADULT
DF23	smelt rainbow	*Osmerus mordax*			x x x	x x x	x x x	x x x	Mar. Jun.	May Sept.	Jan Dec	Jan. Dec.
DF24	alewife	*Alosa pseudoharengus*			R R R	x x x	x x x	x R R	FW	FW	Jan Dec	Apr. Oct.
DF25	smelt rainbow	*Osmerus mordax*			x x x	x x x	x x x	x x x	Mar. Jun.	May Sept.	Jan Dec	Jan. Dec.
	eel american	*Anguilla rostrata*			x x x	x x x	x x x	x x x	N/A	Apr. Jun.	Jan Dec	Aug. Nov.
DF26	smelt rainbow	*Osmerus mordax*			x x x	x x x	x x x	x x x	Mar. Jun.	May Sept.	Jan Dec	Jan. Dec.
	eel american	*Anguilla rostrata*			x x x	x x x	x x x	x x x	N/A	Apr. Jun.	Jan Dec	Aug. Nov.
	alewife	*Alosa pseudoharengus*			R R R	x x x	x x x	x R R	FW	FW	Jan Dec	Apr. Oct.
DF27	smelt rainbow	*Osmerus mordax*			x x x	x x x	x x x	x x x	Mar. Jun.	May Sept.	Jan Dec	Jan. Dec.
DF28	smelt rainbow	*Osmerus mordax*			x x x	x x x	x x x	x x x	Mar. Jun.	May Sept.	Jan Dec	Jan. Dec.
DF29	salmon atlantic	*Salmo salar*				R x x	x x x	x R	FW	FW	Apr Jul	Apr. Oct.
	smelt rainbow	*Osmerus mordax*			x x x	x x x	x x x	x x x	Mar. Jun.	May Sept.	Jan Dec	Jan. Dec.
	eel american	*Anguilla rostrata*			x x x	x x x	x x x	x x x	N/A	Apr. Jun.	Jan Dec	Aug. Nov.
DF30	smelt rainbow	*Osmerus mordax*			x x x	x x x	x x x	x x x	Mar. Jun.	May Sept.	Jan Dec	Jan. Dec.
DF31	smelt rainbow	*Osmerus mordax*			x x x	x x x	x x x	x x x	Mar. Jun.	May Sept.	Jan Dec	Jan. Dec.
ER155	eel american	*Anguilla rostrata*			x x x	x x x	x x x	x x x	N/A	Apr. Jun.	Jan Dec	Aug. Nov.
ER157	eel american	*Anguilla rostrata*			x x x	x x x	x x x	x x x	N/A	Apr. Jun.	Jan Dec	Aug. Nov.
ER158	eel american	*Anguilla rostrata*			x x x	x x x	x x x	x x x	N/A	Apr. Jun.	Jan Dec	Aug. Nov.

SHELLFISH

SHELLFISH BEDS (SF) MUSSEL SEED CONSERVATION AREAS (MS)

FW- FRESHWATER R- RARE

EVI NO	COMMON NAME	SCIENTIFIC NAME	ST	FED	MONTHS PRESENT J F M	A M J	J A S	O N D	SPAWNING	LARVAE	JUVENILE	ADULT
SF1134	scallop sea	*Placopecten magellanicus*			x x x	x x x	x x x	x x x	Jul. Oct.	Jul. Nov.	Jan Dec	Jan. Dec.
SF1167	clam soft	*Mya arenaria*			x x x	x x x	x x x	x x x	May Sep.	May Oct.	Jan. Dec.	Jan. Dec.
SF1183	clam soft	*Mya arenaria*			x x x	x x x	x x x	x x x	May Sep.	May Oct.	Jan. Dec.	Jan. Dec.

Figure 7b

ENVIRONMENTAL SENSITIVITY MAP - 12

GEOGRAPHIC RESPONSE PLANS (BOOMING STRATEGIES) FOR THIS MAP AREA: B-05-1 B-06-1 B-07-1 B-08-1 B-08-2 B-09-1 B-09-2

SHELLFISH SHELLFISH BEDS (SF) MUSSEL SEED CONSERVATION AREAS (MS)

EVI NO	COMMON NAME	SCIENTIFIC NAME	ST	FED	MONTHS PRESENT J F M	A M J	J A S	O N D	SPAWNING	LARVAE	JUVENILE	ADULT
										FW- FRESHWATER R- RARE		
SF1220	clam soft	*Mya arenaria*			x x x	x x x	x x x	x x x	May Sep.	May Oct.	Jan. Dec.	Jan. Dec.
SF1222	blue mussel	*Mytilus edulis*			x x x	x x x	x x x	x x x	Jun. Sep.	Jun. Sep.	Jan Dec	Jan. Dec.
SF1225	clam soft	*Mya arenaria*			x x x	x x x	x x x	x x x	May Sep.	May Oct.	Jan. Dec.	Jan. Dec.
SF1227	clam soft	*Mya arenaria*			x x x	x x x	x x x	x x x	May Sep.	May Oct.	Jan. Dec.	Jan. Dec.
SF1229	clam soft	*Mya arenaria*			x x x	x x x	x x x	x x x	May Sep.	May Oct.	Jan. Dec.	Jan. Dec.
SF1230	clam soft	*Mya arenaria*			x x x	x x x	x x x	x x x	May Sep.	May Oct.	Jan. Dec.	Jan. Dec.
SF1244	clam soft	*Mya arenaria*			x x x	x x x	x x x	x x x	May Sep.	May Oct.	Jan. Dec.	Jan. Dec.
SF1246	clam soft	*Mya arenaria*			x x x	x x x	x x x	x x x	May Sep.	May Oct.	Jan. Dec.	Jan. Dec.
SF1253	clam soft	*Mya arenaria*			x x x	x x x	x x x	x x x	May Sep.	May Oct.	Jan. Dec.	Jan. Dec.
SF1254	clam soft	*Mya arenaria*			x x x	x x x	x x x	x x x	May Sep.	May Oct.	Jan. Dec.	Jan. Dec.

HABITATS: SEAL HAUL-OUTS COUNTS COMBINE HARBOR AND GRAY SEAL EELGRASS BEDS MARINE WORM HABITAT

COMMON NAME	SCIENTIFIC NAME	ST	FED	MONTHS PRESENT C= COMMON U=UNCOMMON J F M	A M J	J A S	O N D	MOLTING	PUPPING
Harbor Seal	*Phoca vitulina*			C C C	C C C	C C C	C C C	Aug.	Apr. Jun.
Gray Seal	*Halichoerus grypus*			C C C	C C C	C C C	C C C		Jan. Feb.

LOBSTER POUNDS (LP) **LOBSTER DEALERS (LD)** **HERRING WEIR SITES (HW)**

EVI NO	NAME	CONTACT / ADDRESS	PHONE	SIZE
LD10	New Meadows Lob. Co.	Mr. McAlency	775 1612	
LD122	C.B.S. Lobster		775 2917	
LD123	Nancy's Seafood		774 3411	
LD133	Portland Lobster Pound	Chris Norbet	699 2400	
LD134	Harbor Fish	Nick Alfiero	775 0251	
LD9	Custom House Seafood	Craig Johnson	773 2778	

AQUACULTURE SITES (AQ)

EVI NO	PRIMARY SPECIES	CONTACT / ADDRESS	PHONE	SIZE
AQ32	blue mussels	Tollef K. Olson	207 799 2022	1.65AC
AQ83	oysters	Eric Horne and Valy Steverlynck	207 865 9840	0.77AC

CONSERVATION LANDS (CL)

EVI NO	NAME
CL1	UNIDENTIFIED
CL144	DAVEIS SANCTUARY, PEAKS ISLAND
CL199	FORE RIVER SANCTUARY
CL225	GILSLAND FARM SANCTUARY
CL299	I 95 SCENIC AREA
CL307	ISLAND
CL385	MACKWORTH ISLAND
CL411	MILL CREEK PRESERVE
CL466	PEAKS ISLAND
CL488	PORTLAND BREAKWATER LIGHT
CL493	PRESUMPSCOT FALLS
CL494	PRESUMPSCOT RIVER BRIDGE
CL495	PRESUMPSCOT RIVER PRESERVE
CL514	RAM ISLAND
CL600	SPRING POINT LEDGE LIGHT
CL629	THE BROTHERS

BOAT LAUNCHES (BL) (state sponsored or assisted)

EVI NO	OWNER	TYPE	RIG PARKING	FLOATS	TIDE	TOILET
BL141	PORTLAND	TR		Y	PART	Y
BL144	SOUTH PORTLAND	TR	40	Y	ALL	Y
BL407	PORTLAND	TR		N	PART	

MARINE GEOLOGY LAYERS
Ranked most to least vulnerable

Marshes (1), Mud Flats, Sheltered (2), Coarse Flats & Bars, Exposed (3), Coarse Beaches & Riprap (4), Mixed & Low Energy Beaches (5), Sand Beaches (6), Rocky Shores (7), Sand Dunes (8), Coastal Barrier Resources System Area

Figure 7c

Figure 7(a,b,c): A sample of an Environmental Vulnerability Index (EVI) Map and information

10.1 Group A: OSP Spills in the Marine Environment

Group Members:
Wyman Briggs, U.S. Coast Guard, Northern New England (Group Lead)
Sara Booth, U.S. Coast Guard, MER
Joe Boudrow, U.S. Coast Guard, District 1
Rich D'Alessandro, Marine Spill Corporation
Dan Davis, Maine DEP Response Division
Stephen Flannery, Maine DEP Response Division
Patrick McNeilly, U.S. Coast Guard, District 1
Nick Payeur, Portland Pipeline Company
Joe Payne, Friends of Casco Bay
Robert Starkes, ECRC-SIMEC
Heather Ballestero, University of NH Center for Spills in the Environment (Recorder)

Group A identified the many significant environments that could be impacted along the coast by a spill from the railroad, primarily Pan Am.

The group identified three spill types that ranged from worst-case to small spill to discuss spill scenarios, response strategies and challenges. The scenarios were: Scarborough Marsh, worst case spill; Kennebec River, medium spill; Fore River to Casco Bay, small spill.

The Scarborough Marsh/worst case spill was characterized as a 40+ car train carrying OSP colliding with a passenger train. Derailment occurred over Scarborough Marsh during the late fall with threat of foul weather and submerged OSP. There is a recent response plan that has been updated for this region. However, the plan is designed to address oil coming into the marsh from the harbor and the bay not from upland. Access to the marsh would be difficult. This marsh ecosystem, like many others on the coast, is part of an important flyway in the spring and fall and a nesting area for birds and nursery area for invertebrates and fish in the spring and summer. Protection of these resources from oiling and remedial impacts would be important. Any remedial activity would also need to consider the health and safety of the responders and public in the surrounding area from air impacts. The Enbridge/Kalamazoo spill showed that a spill of OSP would have short term air impacts, from hours to days.

The group characterized a moderate spill as one at a bridge crossing the Kennebec near Augusta, Maine. The spill, of one leaking car of 28,000 gal., would potentially impact the estuarine river environment south of Augusta in the Kennebec and Sasanoa Rivers. Such an estuarine spill is outside the marine response zone, so little planning has been done.

The light fractions could be contained by booms and skimmers. The heavy sediment load in high runoff periods would probably contribute to making the OSP sink. Currently, there is no knowledge as to where that oil might collect downstream. The Kennebec River has a significant population of short-nose sturgeon, an endangered species. It is also home to significant bald eagle populations and is under study by the National Marine Fisheries Service (NMFS) for an Atlantic salmon habitat conservation plan.

The smallest spill scenario identified was an embayment of Casco Bay near the Fore River going into Portland Harbor. A spill in this area would be closest to the Portland Harbor response equipment and access via vessel would be easier than for the other spills. In this coastal area, the Maine DEP has developed effective response strategies. As with the other spills, the sinking oil would represent a significant problem and strong tidal influences might make locating it difficult. From the human perspective, this spill would be in one of the more densely populated parts of the state, so that health and safety concerns would be important. Media coverage for any spill in the Portland area would be intense, thus the need to have effective communications with the public.

Group A viewed health and safety issues as one of the greatest challenges to any response. Potentially, high benzene levels associated with dilbit may require responders to wear respirators for up to 9 days (as done in the Kalamazoo spill). Odor and unknown toxicity from the dilbit make spills in populated areas a concern. Maine responders are familiar with heavy bunker oil, as well as light fractions, and have developed response plans to remediate those spills. What is unknown are the long term effects of OSP in Maine's environment (e.g., chronic toxicity, habitat impacts). This lack of knowledge affects decisions such as whether to cleanup a spill to baseline or to allow natural attenuation to be part of the cleanup strategy.

Currently, there is not a capacity to handle and rehabilitate wildlife. Any OSP spill that involves wetlands and coastal waters will potentially result in impacts to birds. Coastal marshes are key breeding and flyway habitat for waterfowl and wading birds.

Group A indicated that the behavior of OSP in Maine coastal waters is not well understood. Important questions which need to be addressed include:

- How persistent is the OSP when it reaches saline water and how will it behave?
- What is the probability of OSP sinking, and to what depths?
- If OSP does sink, what equipment is currently available to capture and remove it?
- In the next 1-4 years, what kind of equipment must be developed to cleanup submerged oil and will Maine responders have access to that equipment?

Group A indicated that contingency planning would need to change to address the potential sinking issues that occur with OSP and other heavy oils. The sinking oil manual of ECRC and continuing research by the U.S. Coast Guard should be incorporated into all future contingency plan documents. Response strategies for marshes and wetlands need to be developed to include decision matrices to evaluate the potential impacts of cleanups in these habitats. Other cleanup strategies (e.g., *in situ* burning and dispersant use) also need to be evaluated and protocols established for their use, if they are adopted.

10.2 Group B: OSP Spills in the Marine Environment

Group Members:
Gary Shigenaka, NOAA Office of Response and Restoration (Group Lead)
Dave Byers, Washington State Dept. of Ecology
Elise DeCola, Nuka Research
Lauren Fullam, U.S. Coast Guard District 1
Robert Gardner, Maine Emergency Management

Rhianna Macon, U.S Coast Guard MER
Thomas Smith, Maine DEP Response Division
Erin Summers, Maine Dept. Marine Resources
Katie Brouse, University of NH Center for Spills in the Environment (Recorder)

The group identified a number of significant coastal rivers that are crossed by the railroad that could be impacted by an OSP spill. These include: the Piscataqua, Saco, Androscoggin, Kennebec, and Penobscot. All are significant rivers with fish runs. They also identified two important salt marshes, Wells (Rachel Carson) and Scarborough, which are significant environmental resources. There are a number of bays which might also be impacted by a railroad spill including Saco Bay, Casco Bay and Penobscot Bay.

Spill scenarios were classified by Group B as: major leak, minor leak and no leak. A major leak in Scarborough Marsh (one of the State's most important) would require the mobilization of both state, private sector, and Coast Guard equipment and personnel. Containment would be the first order of response using skimmers, power packs and vacuum equipment. Pompoms and sorbent line can also work well for heavy oil. Access would be good by boat from Portland, but the upper marsh areas would be more difficult. Decisions would need to be made about leaving oil in place and allowing natural attenuation to occur. Species of particular concern would be ducks and loons in winter and the endangered piping plover during their nesting season (March 15 - August 31) (www.fws.gov/mainefieldoffice/Piping_plover.html).

Spills in major rivers like the Kennebec and Penobscot would probably be in the freshwater above the salinity front. Heavy sediment loads in these rivers would influence the behavior of the OSP by increasing the amount of sinking. The sinking oil would cause a major problem in terms of locating and remediating it effectively. Nets and floating silt fences might be employed to help with this cleanup.

There is a potential for waterfowl and anadramous fish being impacted in these major rivers. Several of the rivers have been designated as essential habitat for Atlantic salmon. Intakes for industry and lobster ponds might also be impacted by any OSP spill. Downstream shellfish and worm beds could suffer impacts if the oil is not captured.

The group identified numerous challenges that would be faced by personnel responding to an OSP railroad incident. Chief among these challenges is effective communications with the public and other stakeholders. Being able to communicate the health and environmental issues related to a bitumen/dilbit release is very important. One effective way identified is to start an education program for the public at the community and NGO level when it is known that OSP will be coming through the state by rail. Providing accurate information about risks and response strategies will help with public perception should an incident happen.

Communicating with the fishing industry, which has a stake in any oil spill incident, is a key issue. The seafood industry and the tourist industry are economic drivers in Maine and protection of those industries is important in terms of response. Issues surrounding natural attenuation versus full cleanup are complex. The public needs to be educated about this decision process, if natural attenuation becomes part of an OSP cleanup strategy.

Group B identified several information gaps that need to be filled in the coming years, although these needs were not prioritized. They included:

- Diluents expected;
- Dilbit/bitumen behavior in seawater at a range of salinities;
- Toxicity testing for coastal species present in Maine;
- Effectiveness of depuration of coastal species present in the northeast waters.

Finally, Group B identified several ways that contingency planning should change to accommodate for an OSP spill. Currently, the planning is based on spills occurring offshore, or harbors and moving upstream. In the case of the potential OSP scenarios, the spill will more likely occur upstream so response scenarios need to reflect that change. Contingency planning also needs to be updated to include communication protocols for the public and other stakeholders (e.g., tourist and seafood industries).

The state is already participating in a “mussel watch” program. This background information could be useful if a spill occurs. Any contingency plans should also be evaluated and adjusted to address changes in behavior that might occur from OSP or any heavy oil as it moves downstream from fresh to marine environments. Baseline data are critical for establishing cleanup standards and for NRDA. So collecting as much information or identifying existing data on key habitats and species where spills might occur is very important.

10.3 Group C: OSP Spills in the Freshwater Environment

Group Members:
Brue Hollebone, Environment Canada (Group Lead)
Mike Barry, U.S. EPA
Sheryl Bernard, Maine DEP Response Division
Ken Brown, Portland Pipeline Corp.
Mark Hyland, Maine Emergency Management
Donald Katnik, Maine Inland Fisheries and Wildlife
Dave McIntyre, US EPA
Bart Newhouse, Maine DEP Response Division
Ken Stout, Montreal Maine and Atlantic Railway
Scott Whittier, Maine DEP Response Division
Jessica Winter, NOAA Office of Response and Restoration
Charlie Watkins, University of NH (Recorder)

It was envisioned that a spill scenario in the freshwater habitats of the state traversed by railroads would be a derailment of 1-14 train cars (28,000 gallons OSP/car). The speed of the train would be a major factor in the amount of OSP spilled. Notification regarding the spill would be quick (within 30 minutes). Spills in this environment would be directly into water bodies (rivers, lakes or streams) or on land where it might in turn flow directly into wetlands or water bodies. Spills during winter would be very difficult to cleanup; however, at that time OSP would be more viscous and resistant to spreading. Spring would be the worst time for a spill in this environment due to higher water flow, bad roads and the nesting season for wildlife. Spills into lakes would tend to move slower than in rivers and streams making containment and cleanup easier. Bogs and wetlands provide a much different challenge to cleanup because of access and equipment effectiveness. For inland spills, it is likely that multiple environments would be impacted.

The response to this type of spill would come initially from the railroad and their contractors. Maine DEP would have an incident commander on site and, in most cases, USEPA would defer to the state's incident commander. In cases of larger spills, USEPA would provide greater support (≥100,000 gal.). Response equipment is readily available from Maine DEP and their contractors. Heavy oil may require special skimmers which are available from contractors in the region. Submerged oil is difficult to locate and cleanup. Using divers to locate and remove oil might be effective. Dredging and burning are techniques that have been used previously. Restoration may require capping with sand and then using native material to create new habitat. Wetland restoration may also employ natural attenuation and passive restoration.

This group identified several issues/challenges to any response in the freshwater environment including:

- Access to remote areas;
- Lack of organized response in unorganized townships;
- Limited tracking ability for submerged oil;
- Lack of product information; and
- Health and safety for the responders and local residents.

Much of the rail corridor in northern Maine is in remote locations. Access is limited and the logistics of mounting a response effort are difficult. In some cases, access to rail corridors may be better from Canada. Communication is also difficult as there is limited cell phone service in those areas. In the unorganized towns, there is no governmental or other support structure that would make communication and cleanup easier.

Currently, there has been limited planning for inland spills. Coastal response personnel have limited experience with remote inland incident response. Some international exercises have been conducted which indicated that some issues may need to be resolved when addressing rivers or wetlands that cross borders. Response times will probably be slow in the remote areas as equipment and personnel are stockpiled closer to the coast.

Information on the nature of the spilled substances in terms of Materials Safety Data Sheets (MSDS) will be available rapidly. However, the MSDS is often general and the ability to obtain accurate information quickly on the nature of the constituents in the OSP from the shippers will be critical to providing responders with the proper information. Delays in obtaining this information will also hamper: (1) communication with the public, and (2) determination of the need for evacuations. Misinformation is often an issue in establishing credibility with local citizens.

This group prioritized the information needed into immediate and mid/long term time frames. Some immediate actions that should occur include obtaining better information about the chemical composition of any dilbit/synbit that might be transported through Maine. In addition, any lessons learned from previous spills like the Enbridge/Kalamazoo would be helpful in preparing for incidents.

For mid/long term preparation, the State should consider staging equipment and constructing facilities inland more central to potential rail accidents. There is a need for more baseline environmental information including drainage patterns, river flow information and locations where sinking oil might accumulate. Biological baselines do not exist for many of the water bodies which are critical for protecting valuable resources and establishing restoration standards.

In order to improve response in remote areas, there is a need to train local responders (e.g., fire departments and town officials) in the methods required for OSP remediation. Joint contingency planning with Canada would enhance response capabilities in border locations. State responders need additional training to improve capability to handle remote inland spills with limited access.

Contingency Planning needs to be expanded to account for potential inland spills. Inland EVI maps need to be developed to identify important resources. Modifications of the SCAT technique need to be developed and implemented for inland rivers and streams. The techniques need to be expanded to address overbanks, river and streambeds and lake bottoms. Lessons learned from the Enbridge/Kalamazoo spill may help with implementation of these assessment methods. Submerged oil modeling for heavy oil also needs to be developed for use in the inland environments and incorporated into response strategies.

10.4 Group D: OSP Spills in the Freshwater Environment

Group Members:
Peter Kinner, University of NH Center for Spills in the Environment (Group Lead)
Debra Wick, National Response Corp.
Heather Dettman, CanmetEnergy (via WebEx)
Dwight Doughty Maine DOT Environmental Office
Ginger McMullin, Maine DEP Response Division
Dave Nagy, Pan Am Railways
Kara Walker, Maine DEP Response Division
Karen Way, US EPA
Mindy Bubier, University of New Hampshire (Recorder)

Group C focused on derailments as the type of incident that would result in an OSP spill in freshwater bodies or wetland areas. With double couplers now connecting cars, the potential for more than one rail car derailing versus just one is significantly greater. Freshwater spills in Maine can be classified into those that occur in remote areas of the State (areas in the northern counties) and those in more populated areas. The receiving waters could be streams, ponds, lakes, or freshwater wetlands or a combination of these habitats.

The response to any of these types of OSP spills would be the same as currently employed by Maine DEP for heavy oils. The first response would come from local responders (e.g., fire departments). The emergency responders will conduct an initial safety assessment including air monitoring. The initial actions would be to assess the spill, stop the leak, control spread of material, and use local knowledge of the area to protect resources. Responders use this local knowledge to prioritize their actions. This process would be the same in all locations in accordance with current protocols. The difficulty with many freshwater spills in remote areas is obtaining access to the site and getting personnel and equipment to it efficiently and quickly.

The group identified several issues and challenges to any response. These included:

- Seasonality;
- Communications;
- Jurisdiction for funding;
- Accessibility;
- Flooding; and
- Human dimensions.

The seasonal changes in weather can make response challenging. Winter restricts travel, hampers working conditions and introduces ice to the cleanup process. Flooding in streams and rivers is normally a spring issue. This occurred in the Enbridge/Kalamazoo spill where river flooding spread OSP into floodplains and further downstream. Flooding also tends to introduce more sediment into the water bodies which can enhance sinking of OSP. Seasonality also has a bearing on the human population that might be impacted. Summer increases the number of vacationers that visit even the more remote areas of the state. These higher numbers might increase issues related to communication and potential evacuations in the case of large spills or potential air quality issues.

The group identified a number of areas where information and actions are required in the next few years if OSP or even heavy oils are transported through inland areas of the state. Immediate activities should include developing simple fact sheets that can be distributed to responders and town officials where trains will be carrying OSP. These sheets would provide information such as:

- How to identify OSP and its important properties as identified on the MSDS;
- Who should be notified;
- What type of monitoring is required; and
- What type of training is available for responders?

In order for Maine DEP to respond effectively to these spills there needs to be sufficient funding and staff to cover the state's response responsibilities. As part of that funding, the DEP needs to continue to build the database of resources at risk (EVI maps) to include the vast inland areas of the state. This requires locating existing environmental data resources and identifying significant data gaps. By identifying sensitive resources, the DEP can better develop Geographic Response Strategies (GSR) that can be applied along transportation corridors. The GSRs should be field tested and, ideally, test deployments to critical areas should be performed. Based on those exercises, the most effective GSRs can be prioritized.

There is a significant need to improve communications between the rail operators and the regulatory agencies. By meeting face to face, two to three times per year, there would an opportunity to: improve communication during spills, upgrade contingency plans, and eliminate common problems (e.g., local area place names vs. map names).

Future contingency planning should use and improve upon work that has been done for crude oil spills. Then by applying knowledge of how OSP might differ from crude oil, the plans can be updated and improved to address OSP responses. For the most part, the work regarding heavy oils has been done for marine and coastal areas. The planning for inland areas now needs to be completed. New Brunswick and Quebec may be in the process of doing a similar planning process, so working cooperatively to share information and ideas may improve the planning process.

10.5 Group E: OSP Spills in the Freshwater Environment

Group Members:
Kurt Hansen, U.S. Coast Guard (Group Lead)
Cosmo Caterino, US EPA
Peter Hodson, Queens University (Canada)
Brian House, Moran Environmental Recovery
Steve Lehmann, NOAA Office of Emergency Response and Restoration
Lori Muller, US EPA
Robert Shannon, Maine DEP Response Division
Tom Tardif, Montreal, Maine and Atlantic Railway
Sandy Amborn, University of New Hampshire (Recorder)

Group E identified the most likely spill scenario to be a derailment or a valve failure on a tank car. In either of these situations, the spill would flow to water bodies, following the land contours or enter the water directly. The receiving waters would be streams or rivers, ponds or lakes, and/or freshwater wetlands. Seasonal floods (spring) or heavy rains would increase the spreading of the OSP. Winter ice and snow may slow the movement of OSP by increasing its viscosity and trapping the oil in the ice.

The current response to a heavy oil spill and, consequently the response to a potential OSP spill, will be the same. First responders will arrive on the scene to assess the situation and coordinate with the railroad to stop the leak. Agencies with local knowledge of significant environmental resources (e.g., Maine Inland Fisheries and Wildlife) are important in helping to identify habitats that deserve special protection. Standard approaches exist that could be applied to an OSP rail spill. These identify the communication protocols and standard actions to use. Going forward these protocols will need to be adjusted to address any differences in approach required for OSP. Inland spills along the rail routes, particularly in northern Maine, will be logistically difficult because of access problems and the lack of resources and equipment available in that part of the state. With OSP, there will be a need for air monitoring, particularly in the early days of any spill. The monitoring will be needed to address equipment needs for first responders and to determine what if any evacuations should occur.

Group E identified several challenges related to response actions for an OSP spill. These included:

- Establishing air monitoring;
- Understanding the product specifications of the OSP spilled; and
- Determining whether the product is floating or sinking.

Understanding the constituents of an OSP is important so that potential air issues can be addressed and monitored properly. MSDSs are generic and lack the specifics on the amount of volatiles and PAHs that might be introduced into the environment. Knowledge that the product is OSP will avoid the miscommunication issues experienced during the Enbridge/Kalamazoo spill.

Each of the potential receiving water bodies represents different challenges to responders. Rivers and streams have different reaches, rapids, pools, impoundments, and floodplains, all of which require different strategies for containment. Rapids and waterfalls may emulsify oil and increase density or create mats. Submerged oil could concentrate where dams or natural depositional areas exist (e.g., in oxbows or around wetlands). If rivers or streams are used as water sources, an OSP spill could result in issues with wells or intakes. .

Ponds and lakes present other cleanup problems. Lakes and ponds are often more developed with vacation residences. Thus, the issues related to protection of the population become more significant. Lakes and ponds are routinely used as water sources for communities and also individual residences. Unlike rivers and streams, the bathymetry of lakes is important to cleaning up of any sinking OSP. For many lakes and ponds in remote areas, bathymetric information knowledge is limited. Wildlife and fishery resources are also potentially at risk and as a result may impact the human population's recreational opportunities. Wetlands, because of nature of the vegetated habitat, are very sensitive to cleanup methods. Evaluation of any cleanup method must consider the value of cleanup vis-à-vis natural attenuation. Cleanup methods may be limited to above ground cleanup to avoid additional damage due to more invasive methods.

Group E identified a number of high (H), and some low (L) priority needs to improve the response to OSP spills in the future. The high (H) and medium (M) priorities for information include:

- Identify who controls water levels/dam operations (H);
- Verify oil recovery assets (H);
- Develop information on the diluents expected in the OSP shipped through the state (H);
- Collect information about the toxicity, fate and transport of OSP that will move through the state (H);
- Conduct more research on qualitative assessment techniques (M);
- Update lessons learned from similar spills (H);
- Identify appropriate new recovery equipment and techniques (M);
- Collect and synthesize baseline and existing data for resources along rail corridors that can be used for NRDA assessments or determining restoration goals (L).

Future Contingency Planning needs to design response strategies for inland areas based on location and habitat type. The plans also need to address OSP responses actions. Contingency Plans should include training for responders at the state and local levels to introduce them to OSP, its properties, and how responses may differ or be the same as for other heavy oil spills. Contingency planning should establish communication protocols to increase the dissemination of new information on OSP to state and local planning organizations as it becomes available.

10.6 Summary of the Breakout Group Discussions

There were several consistent recommendations made by the breakout groups. They included actions that should be taken in preparation of OSP transiting the State by rail, as well as longer term activities that could improve response activities. These recommendations include:

- Improve communication between agencies, the private sector, the OSP industry and communities to improve response times and make important information more readily available;
- Provide training related to OSP to first responders and community planning personnel along train routes;
- Obtain and disseminate information about OSP characteristics (i.e., toxicity, behavior, components as they become available);
- Collect available baseline data for areas adjacent to all rail corridors;
- Develop EVI maps for inland areas to identify priority resources;
- Develop response strategies to address accidents related to OSP rail shipments.

Appendices

I. Agenda
II. Presentations
III. Breakout Group Questions
IV. Breakout Groups
V. Participant list
VI. Notes taken during Plenary Sessions
VII. Notes taken for each Breakout Session

Appendix I

Agenda

Center for Spills in the Environment
Oil Sands Products Training

University of Southern Maine - Abromson Conference Center
December 4 & 5, 2012

AGENDA—TUESDAY, DECEMBER 4

8:30 AM Registration

9:00 AM Welcome & Introductions
Nancy Kinner, *Center for Spills in the Environment (CSE)*
Ginger McMullin, *Maine Dept. of Environmental Protection, Response Services*
Cosmo Caterino, *United States Environmental Protection Agency*

9:15 AM Background and Goals
Nancy Kinner, *CSE*

9:30 AM Oil Sands Overview and Natural Resource Development
Randy Mikula, *Kalium Research*

Group Discussion

10:30 AM Break

10:45 AM Characteristics of Oil Sands Products
Heather Dettman, *Natural Resources Canada*

Group Discussion

11:30 AM Lunch

12:30 PM Transportation of Oil Sands Products
William Fairfield, *Canadian Pacific*

Group Discussion

1:15 PM Fate, Behavior & Modeling of Spilled Oil Sands Products (Freshwater & Marine Environments)
Bruce Hollebone, *Environment Canada*

Group Discussion

2:00 PM Effects of Oil Sands Products on Biota
Peter Hodson, *Queen's University*

Group Discussion

2:45 PM Break

3:00 PM Enbridge/Kalamazoo Case Study including Response Technologies for Oil Sands Products
Lori Muller, *U.S. Environmental Protection Agency, Region 5*

Group Discussion

3:45 PM **Assessing Natural Resource Impacts from the Enbridge Pipeline Spill into the Kalamazoo River**
Jessica Winter, *NOAA ORR, Assessment & Restoration Division*

Group Discussion

4:30 PM **Wrap Up & Adjourn**

6:00 PM Dinner at *Pete and Larry's Restaurant & Lounge*, Clarion Hotel

AGENDA—WEDNESDAY, DECEMBER 5

9:00 AM **Goals and Format Day II (Breakout Groups by Spill Environment—Freshwater River, Pond/Lake, Wetlands, Estuary, Salt Marsh)**

9:15 AM **Transportation of Oil by Rail in Maine & Resources at Risk**
Ginger McMullin, *Maine DEP*

10:00 AM **Break**

10:15 AM **Breakout Groups: Session 1**

Breakout Questions:

- For each environment, what kinds of spill scenarios could occur?
- For these scenarios, what would the response be now?
- What issues/challenges would the response face (e.g., for the environmental unit, logistics, human dimensions, health & safety) that are unique to these oil sands spill scenarios?
- What information is needed and what questions should be answered to improve the response to these scenarios? Prioritize these needs/answers (i.e., which address in 12 months, 2-3 years, 4+ years).
- How does Contingency Planning need to change to accommodate an oil sands spill?

12:00 PM **Lunch**

1:00 PM **Breakout Group Session II**

2:30 PM **Breakout Group Reports**

3:30 PM **Conclusions and Next Steps**

4:00 PM **Closing Remarks (ME DEP, EPA, USCG)**

Appendix II

Presentations

Center for Spills in the Environment

WELCOME

OILS SANDS PRODUCTS TRAINING

December 4 – 5, 2012

Oil Sands Products Training

December 4 – 5, 2012

Nancy E. Kinner
Center for Spills in the Environment
University of New Hampshire

Logistics

- Fire Exits
- Restrooms
- Dining: breakfast, lunches and snacks
  - Please pay Kathy Mandsager $28 to cover food
- This evening:
  - Optional dinner (head count needed)
  - Dutch treat
  - Clarion Hotel – Pete and Larry's Restaurant
    - 6:15 PM
  - Logistical questions: see Kathy or me

Thank You

- Maine Department of Environmental Services
  - Ginger McMullin
  - Barbara Parker – until October 2012
- USEPA Region I
  - Cosmo Caterino

THANK YOU PARTICIPANTS!!

Center for Spills in the Environment (CSE)

- Housed at University of New Hampshire
- Focus on hydrocarbon-based spills
- Center funded by variety of sources to facilitate workshops and conduct training

Why UNH?

- Excellence in marine science and environmental engineering
- No oil production or refining
- Reputation as independent, honest broker

Why CSE?

- NOAA partnership with UNH on Coastal Response Research Center (CRRC)
  - Exclusively NOAA concerns
  - NOAA funding cutbacks
- Need for center to address Non-NOAA spill-related issues
  - CSE is that center

Oil Sands Products Training

- Lots of confusion about names:
  - Dilbit, tar sands oil sands
  - What is it? What's the difference?
- We are talking about Oil Sands Products (OSP)!!!
  - Don't know what that is????
  - Stay tuned

Background to OSP Training

- Oil sands development in middle of North America
  - Alberta, Canada
- Demand for energy at coasts is great
- Movement of OSP to coasts
  - Pipelines
  - Railways

Center for Spills in the Environment CSE

Maine Involvement

- Possible OSP refining at Irving Oil refinery in St. John, New Brunswick
- Shipment of OSP from Canada via rail across Maine
- MEDEP and USEPA Reg I <u>proactive</u> on response training

Center for Spills in the Environment CSE

Goals of OSP Training

1. Basic education about OSP
   - What is it?
   - Where does it come from?
   - What are its characteristics?
   - How is it transported by rail?

Center for Spills in the Environment CSE

Goals of OSP Training

2. OSP Spill Response
   - Fate, behavior, modeling of spilled OSP
   - Effects of OSP on biota
3. Case Studies
   - Enbridge/Kalamazoo
     - Response
     - Impact assessment

Goals of OSP Training

4. Applying We Learn to Maine
   - Freshwater
   - Marine
   - Rail Routes
   - Response planning
   - Resources at Risk

Today's Speakers

- MEDEP and USEPA Reg I charge to CSE
  - Get best experts to talk to us
  - Encourage participants to listen, learn and ask questions

Agenda

Breakout Group Questions

- For each environment, what kinds of spills scenarios could occur?
- For these scenarios, what would the response be now?
- What issues/challenges would the response face that are unique to these OSP scenarios?
- What information is needed and what questions should be answered to improve response?
- How does contingency planning need to change to accommodate an OSP spill?

Training Outcomes

- We are all more educated about OSP
- Videotape today's talks
  - Available at CSE website
    - Not discussion
- Training report available on CSE website

Facilitation Pledge

- I will recognize and encourage everyone to speak
- I will discourage side conversations
- I commit to:
  - Being engaged in meeting
  - Keeping us on task and time
  - Being neutral, fair, kind, and faithful to the process
- Stop me if I am not doing this!

Oil Sands/Tar Sands Overview: Resource Development

Randy Mikula

oilsands@shaw.ca

KALIUM Research

Introduction :

- The oil sands geology
- The resource and reserve: Surface mining and in-situ
- Environmental Issues associated with oil sands development
- Oil sands impact on the Canadian economy/products and markets

oilsands@shaw.ca


Alberta
Athabasca
Peace River
Fort
McMurray
Peace River
Cold
Lake
Edmonton
Calgary


Athabasca
Peace River
Wabasca
Cold Lake
Edmonton
Light
Oil
Heavy
Oil

Natural Outcrops along the Athabasca River just North of Fort McMurray

oilsands@shaw.ca

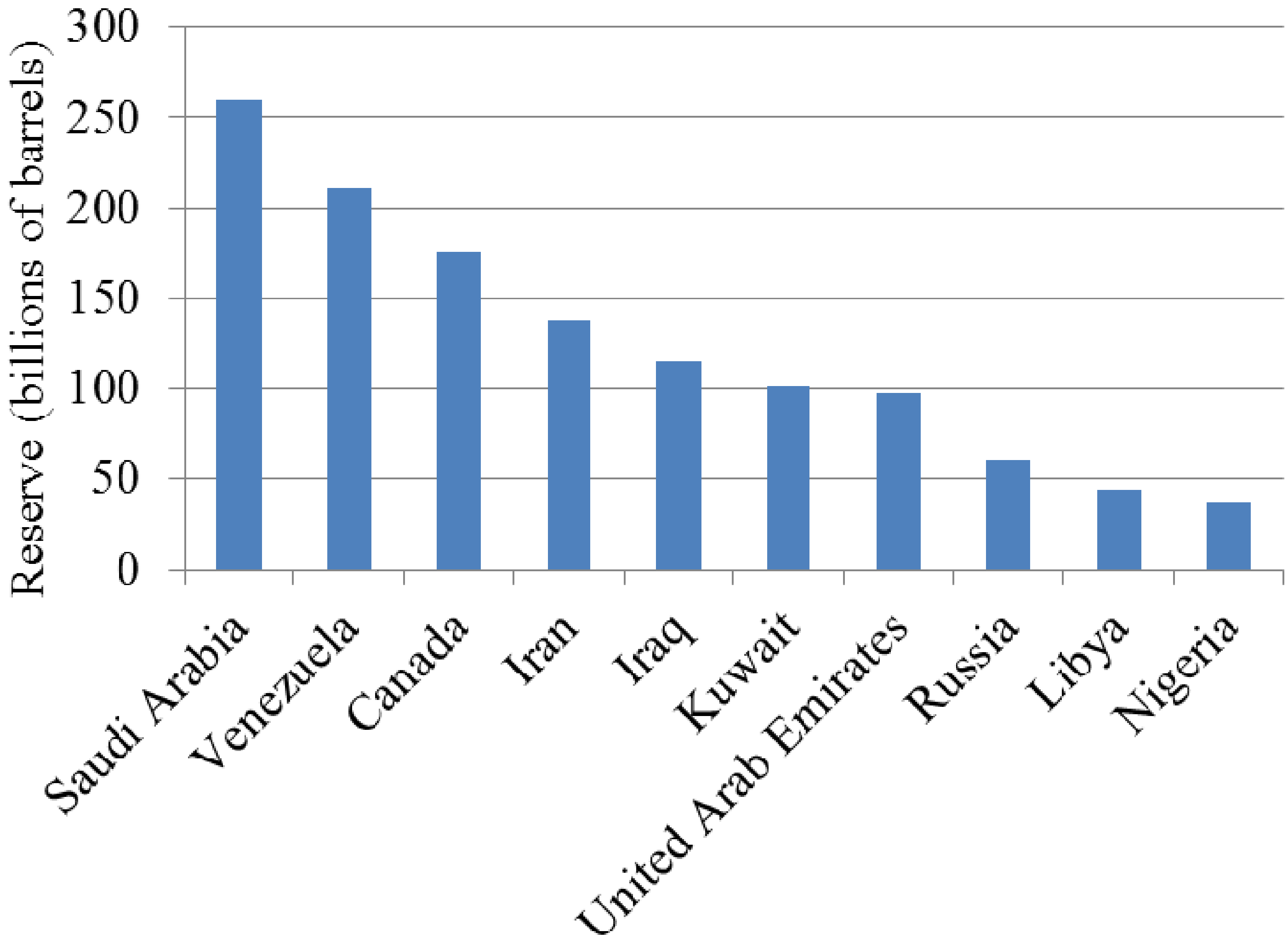
KALIUM Research


Glacial
Till
Oil Sands

Natural Outcrop along the Athabasca River, Tar Island, Just Upstream of the Suncor Mine

oilsands@shaw.ca

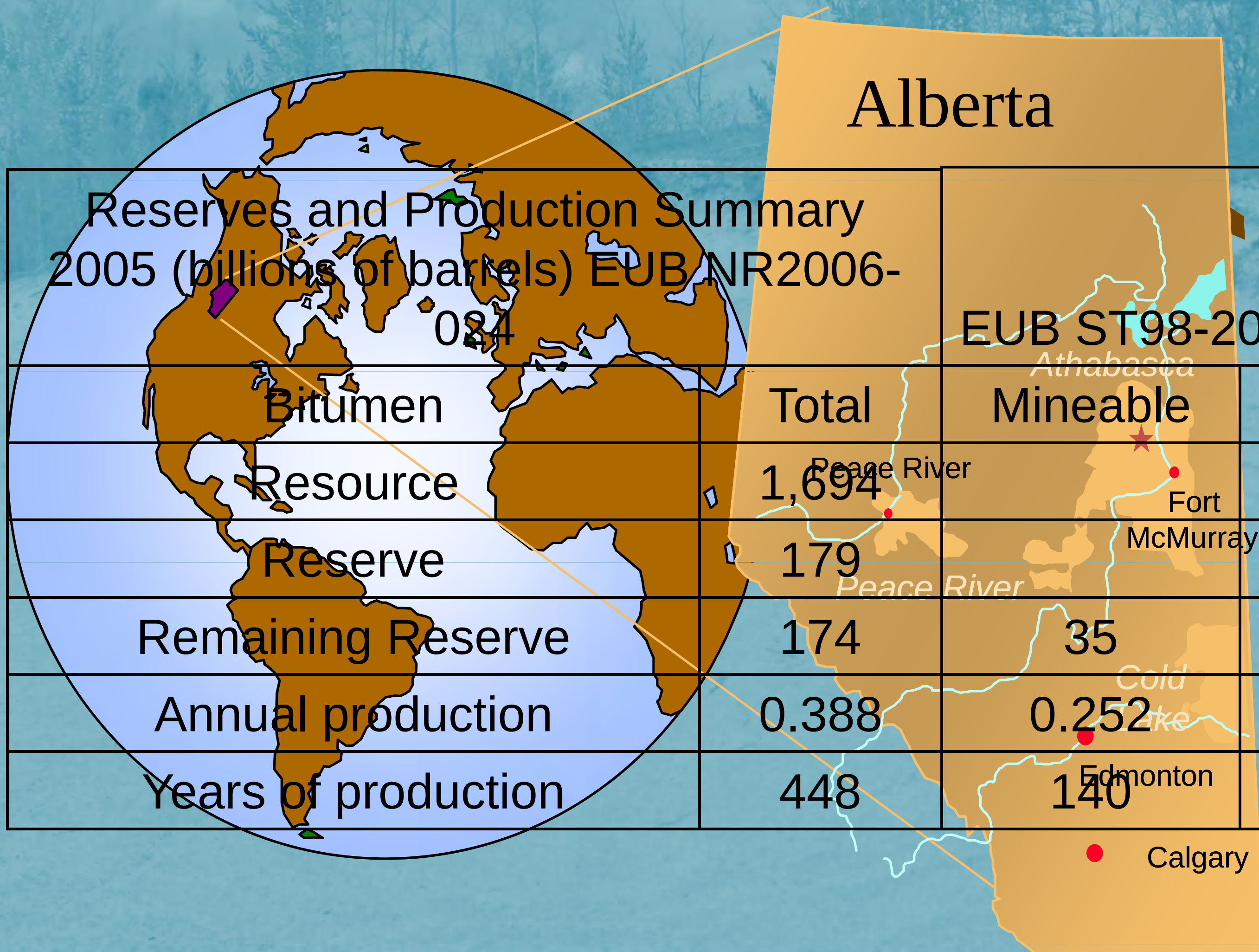
KALIUM Research



Canadian Reserves on the world stage: since 2002 Canada has been the biggest exporter of oil to the United States

oilsands@shaw.ca

KALIUM Research



Reserves and Production Summary 2005 (billions of barrels) EUB NR2006-024		EUB ST98-2007	
Bitumen	Total	Mineable	in situ
Resource	1,694		
Reserve	179		
Remaining Reserve	174	35	144
Annual production	0.388	0.252	0.189
Years of production	448	140	760

Reserves and Production Summary 2009 (ERCB ST98-2010) in billions of barrels			
Bitumen	Total	Mineable	in situ
Resource	1,805	131	1,674
Reserve	176	38	138
Remaining Reserve	170	34	135
Annual Production	.544	.302	.246
Years of Production	312	113	553

Approximately a 20% production increase in 2 years; 27 fewer years to reclaim

oilsands@shaw.ca

KALIUM Research

•First Nations people used bitumen to treat their canoes;

•18th century: oil sands first seen by European explorers;

•1906 to 1917: tried to drill for oil;

•1913 Sidney Ells (from our original department) conducted first work on extracting using hot water; continued in 20's by Karl Clark who develops the Clark Hot Water Process;

•1920's to 1948 hot water extraction used to produce bitumen for roofing and roads (Fitzsimmons: Bitumount);

•1936 to '40's Abasands (Max Ball) plant produces diesel from oil sands but plant burned and interest lost after end of 2nd world war;

•1967 GCOS starts operations (now Suncor): world's first oil sand's operation;

•1978 Syncrude starts production.

•1974 AOSTRA underground test facility built for in situ production testing; Cold Lake in situ starts up in 1985.

Oil Sand Composition

•Oil sand consists of sand, fines (clays), bitumen, and water (with soluble salts). Composition ranges from (wt%):

Sand 55 – 80 %

Fines 5 – 34%

Bitumen 4 – 18%

Water 2 – 15%

•There are 3 main classes of ore based on bitumen content:

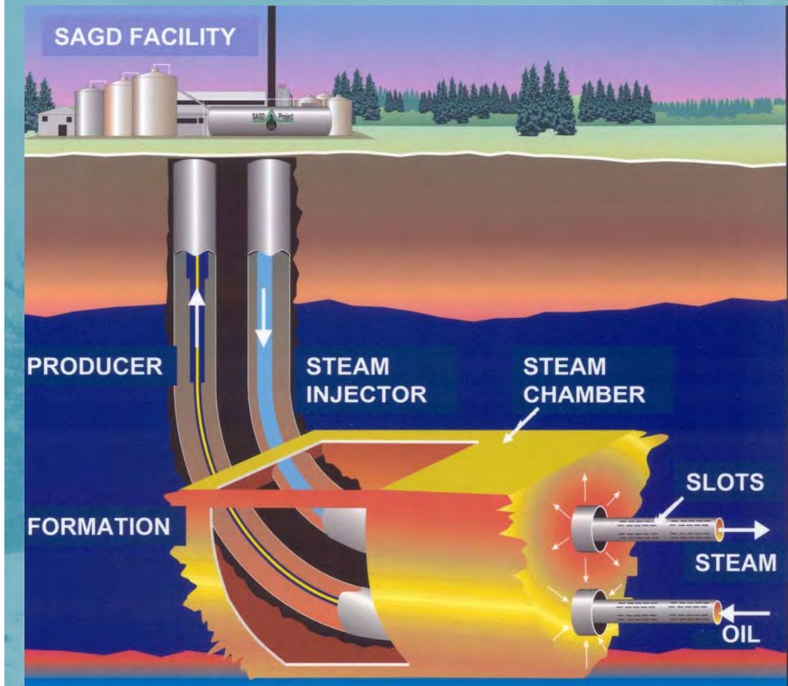
High Grade: > 12% bitumen

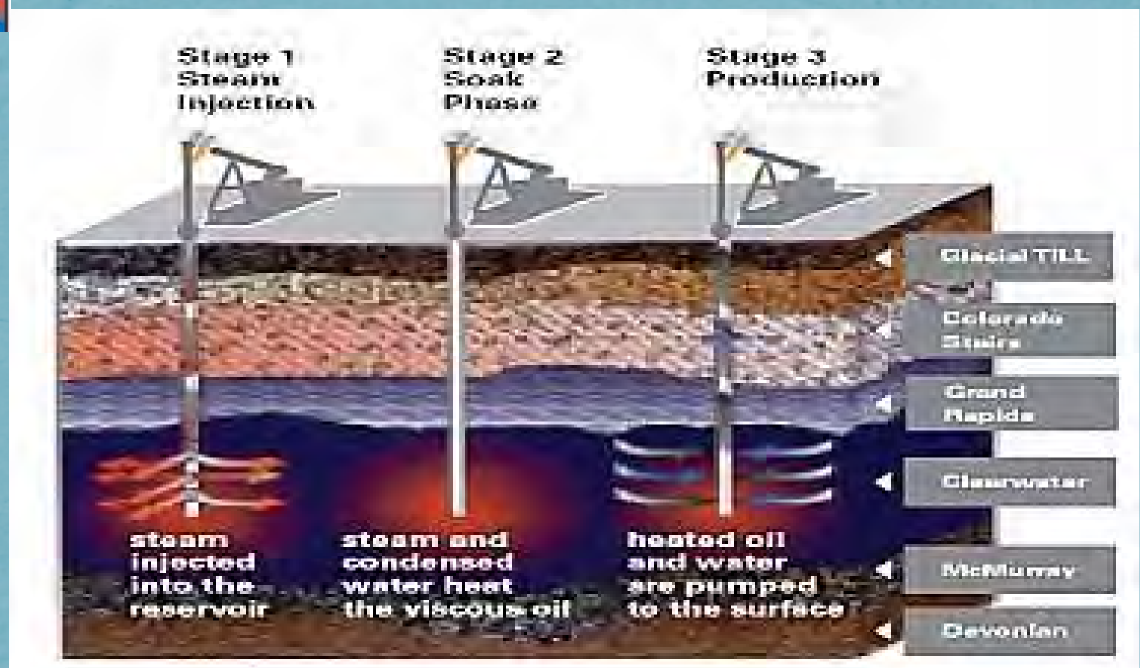
Average Grade: 9 – 12 % bitumen

Low Grade: < 9 % bitumen

•A typical ore = 73% sand, 12% bitumen, 10% fines, 5% water

A lot of water is required to produce a barrel of bitumen!





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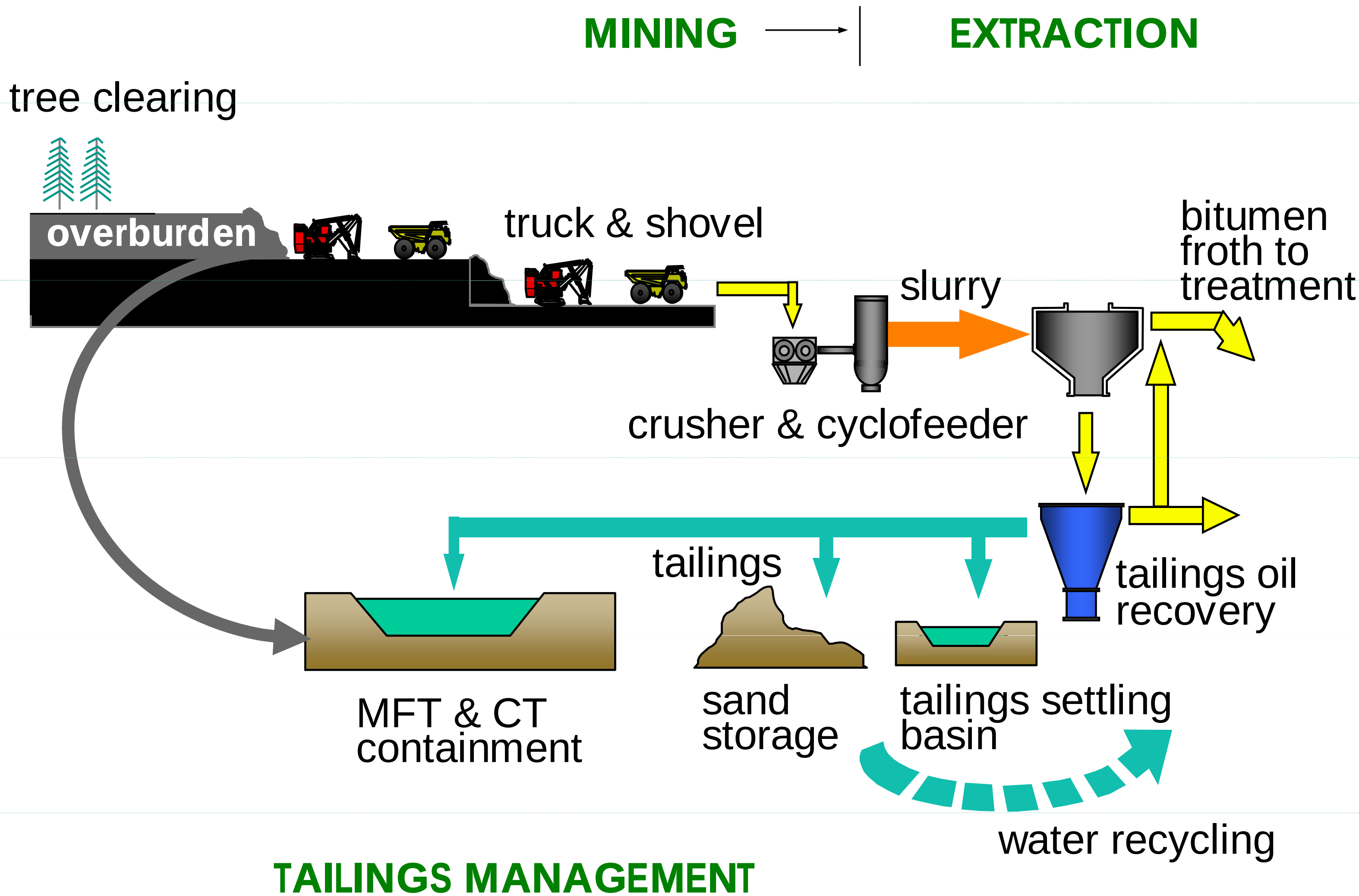
KALIUM Research



Courtesy Syncrude

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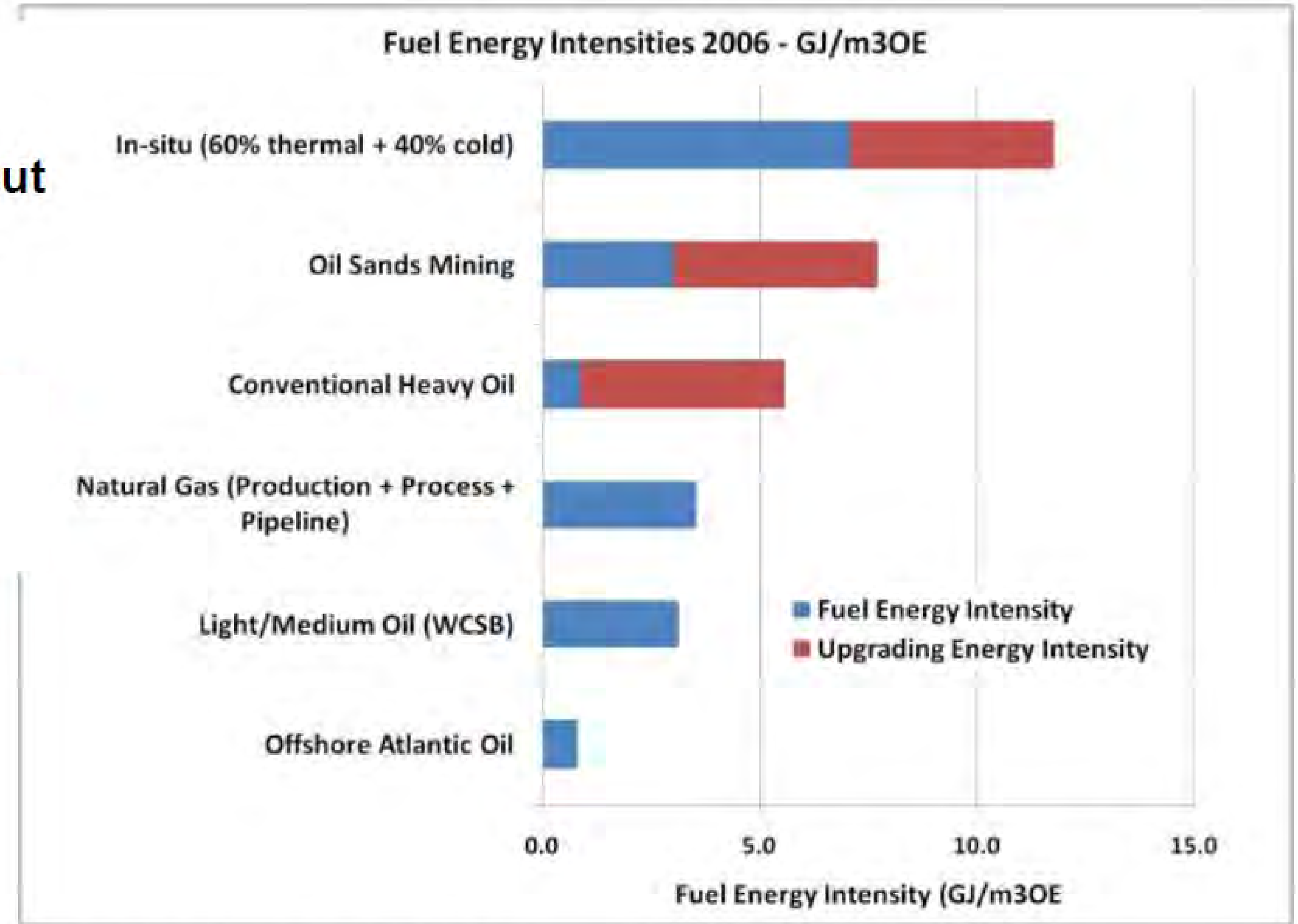
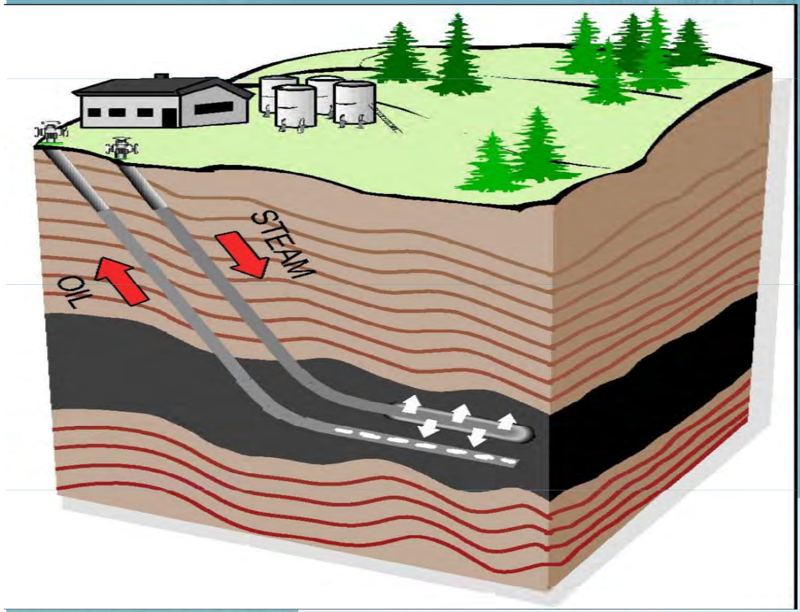
1 m^{3}OE ~ 40 GJ
So 10 GJ/m^{3}OE ~
Is about 25% of the input energy in the product
1 GJ/m3OE ~ 2.5%



Source: Clearstone et al - An Air Quality Impact Study of Canada's Oil and Natural Gas Industry – October, 2008

Surface mining vs. in situ production



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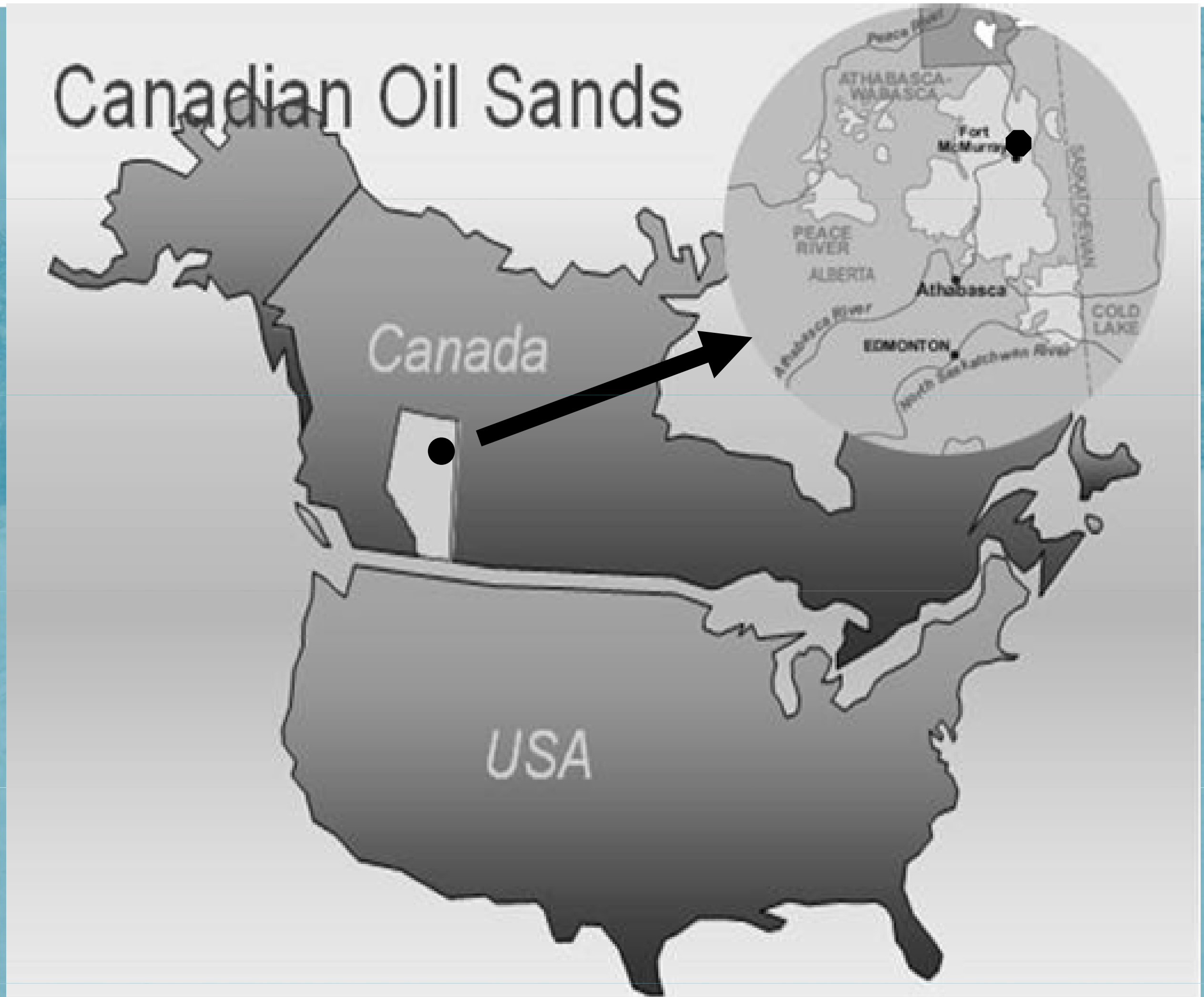
MARION
DRESSER
39G
16


784



The area occupied by the circle is approximately 400,000km^2, and the area of the oil sands resource (in white) is approximately 141,000km^2. Currently land disturbance due to oil sands development is about 600km^2, with tailings containment about 180km^2.

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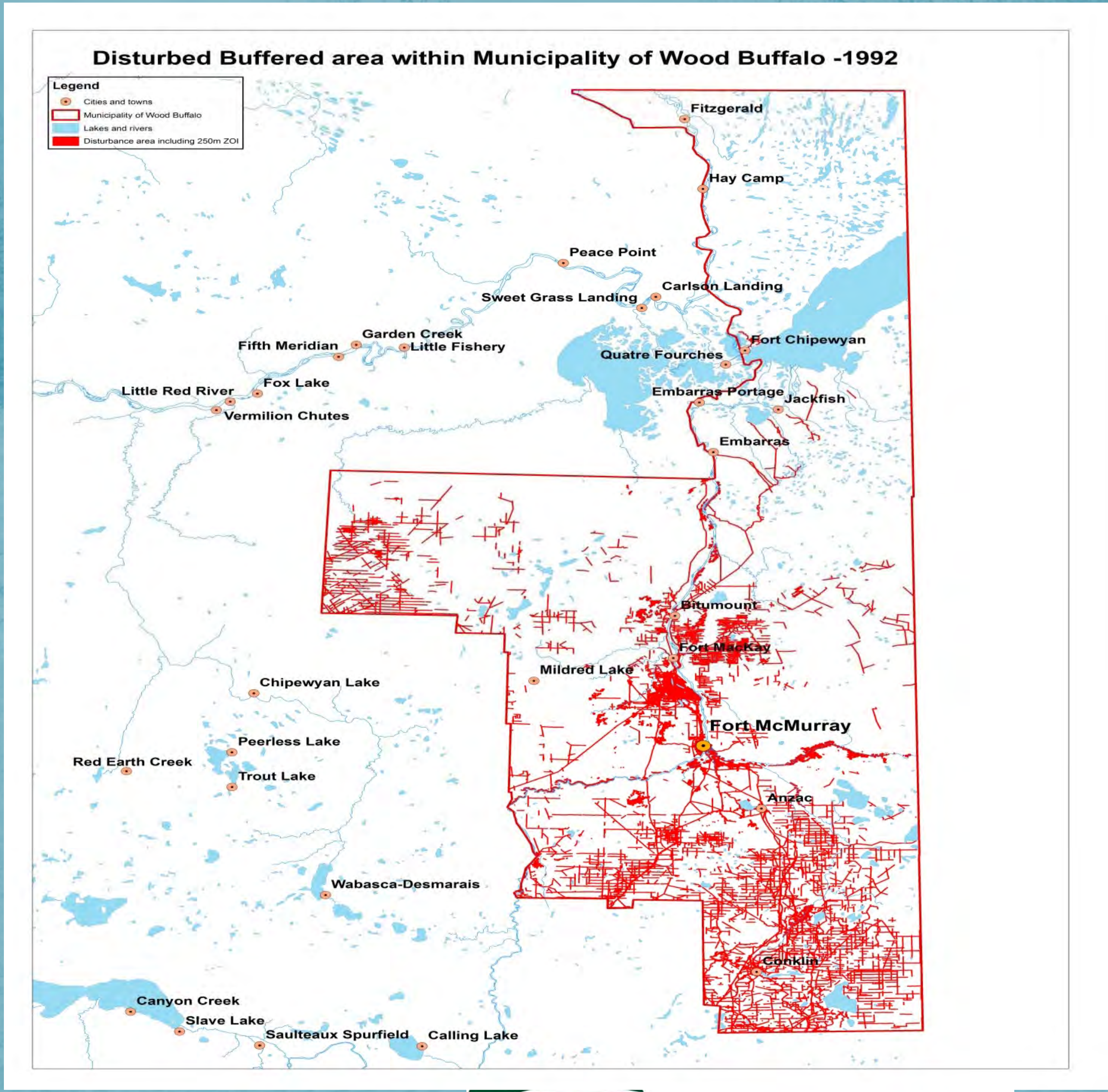

MSES
Management and Solutions in Environmental Science

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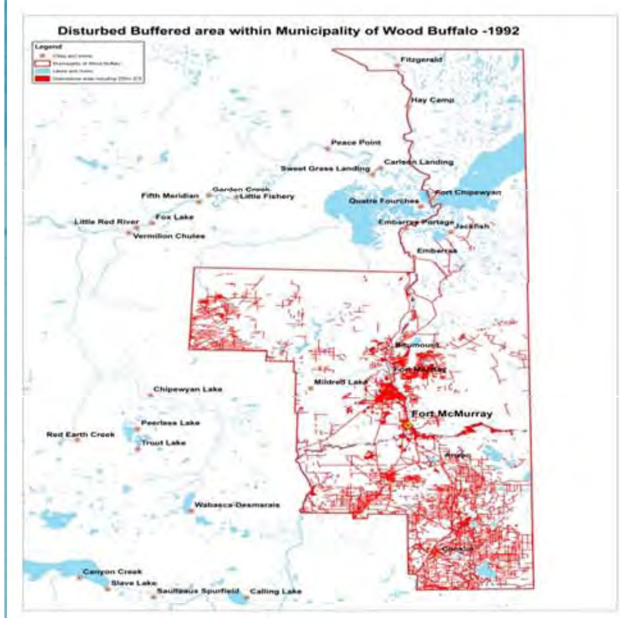

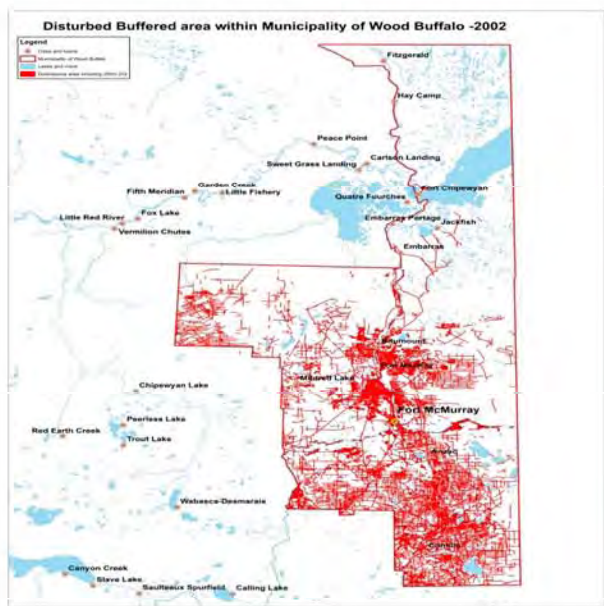

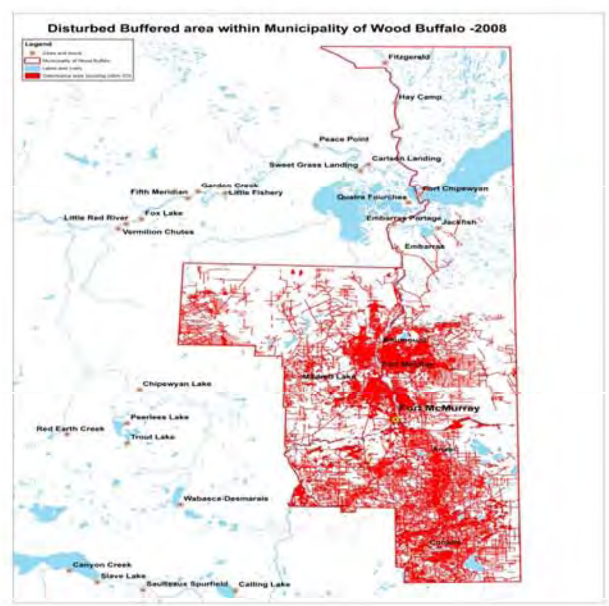

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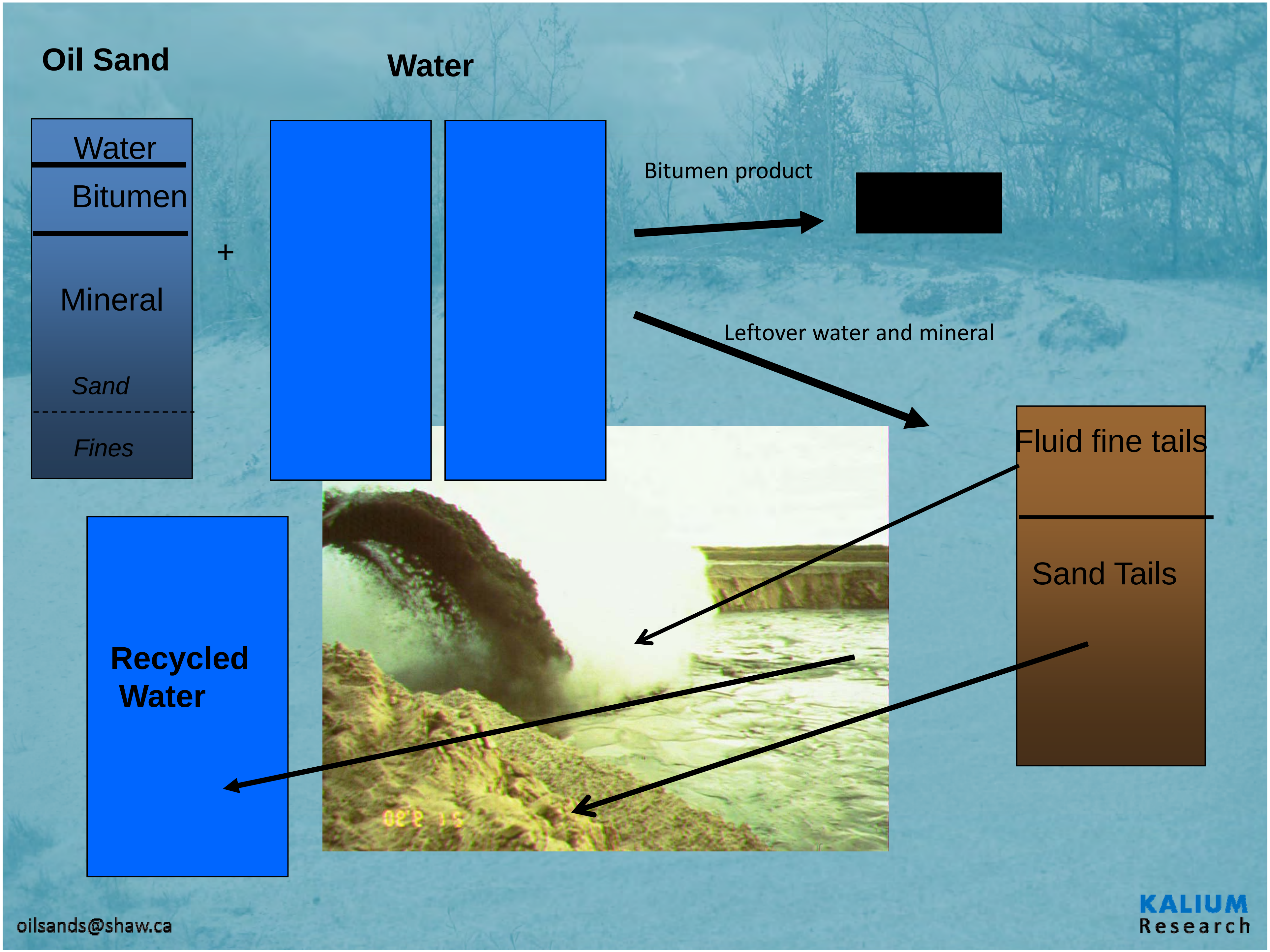
No nation can long be secure in this atomic age unless it be amply supplied with petroleum . . . It is the considered opinion of our group that if the North American continent is to produce the oil to meet its requirements in the years ahead, oil from the Athabasca area must of necessity play an important role.

J. Howard Pew (GCOS 1960’s)



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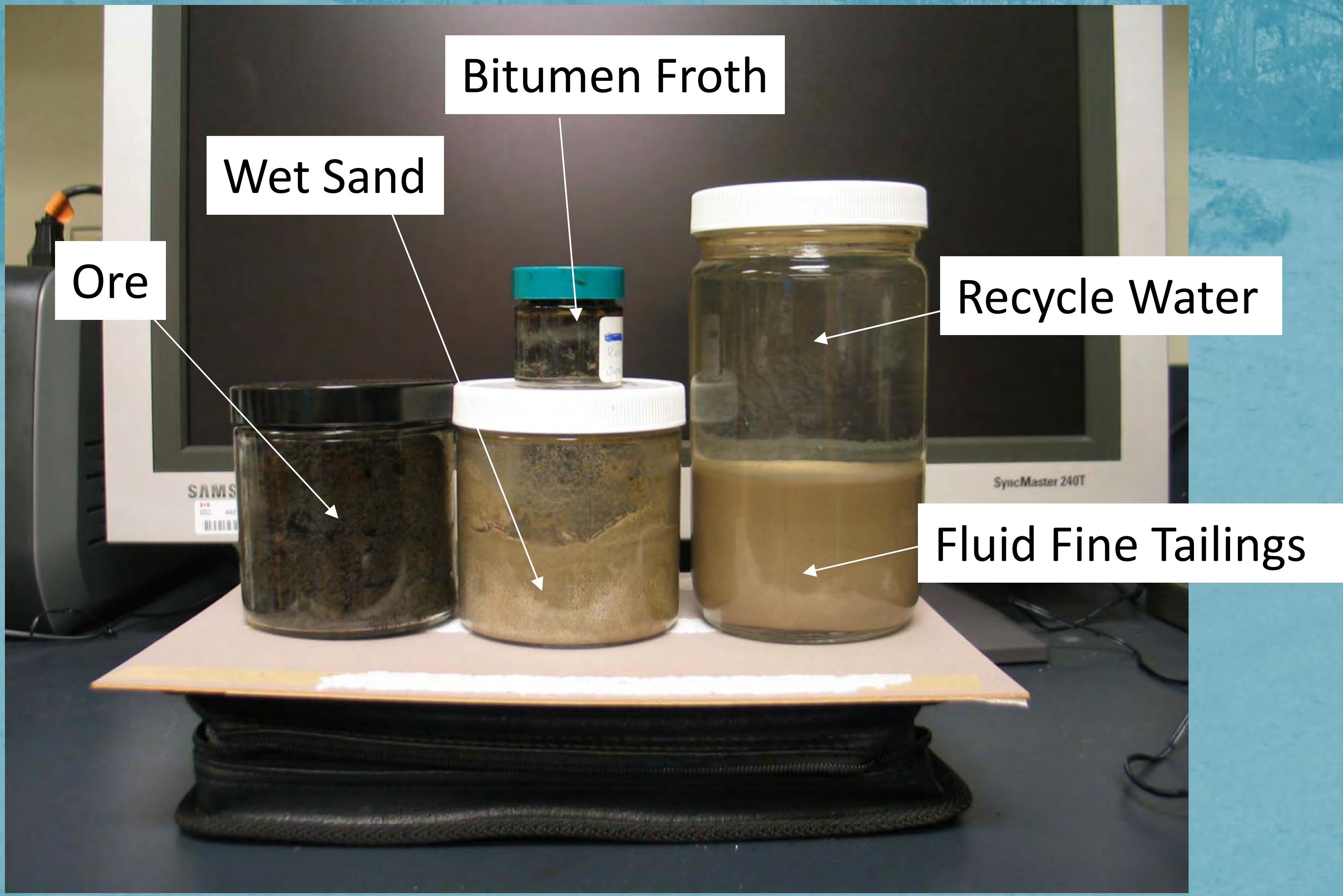

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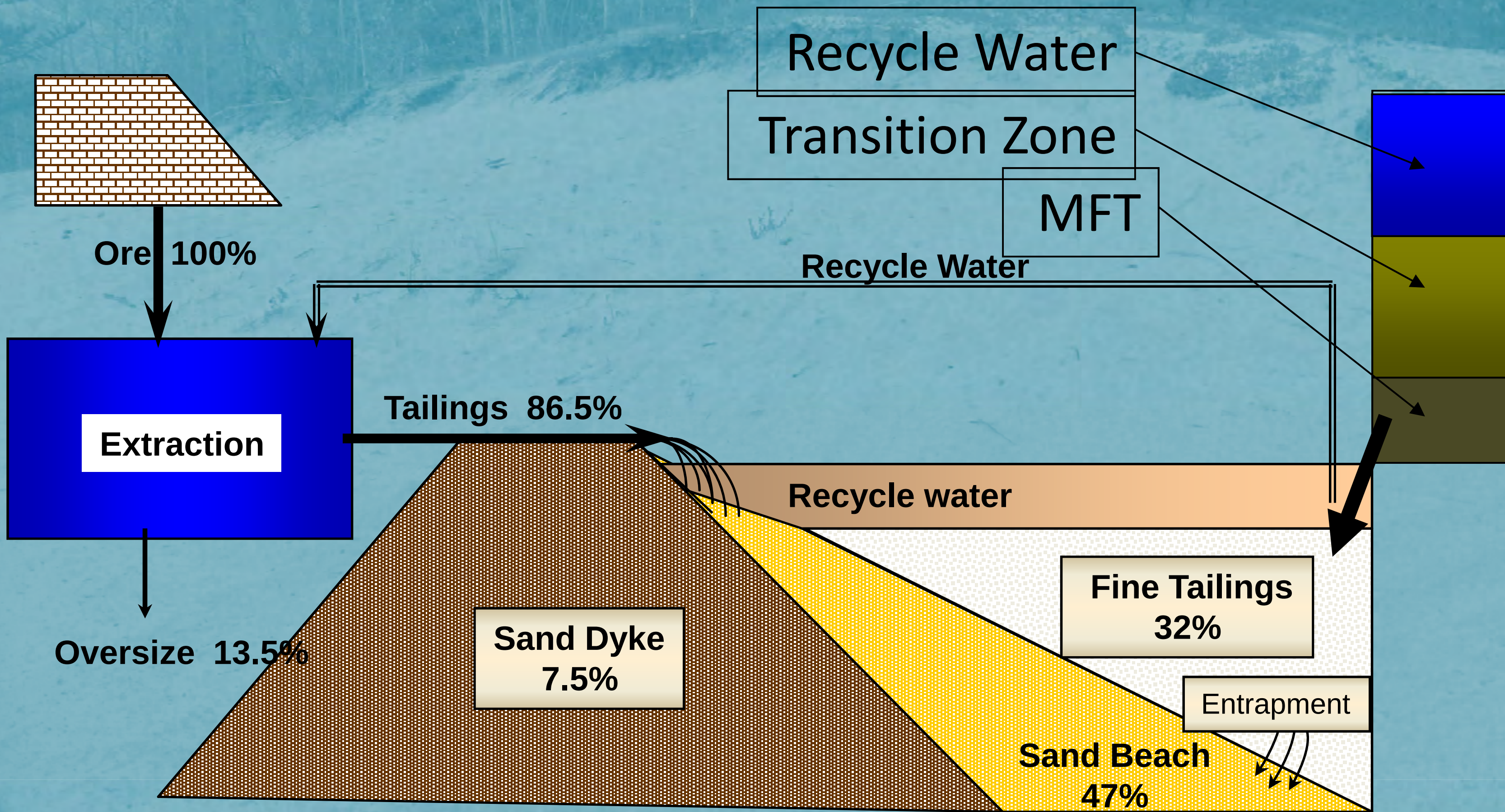
The sand tailings are used to build the containment for the fine tailings



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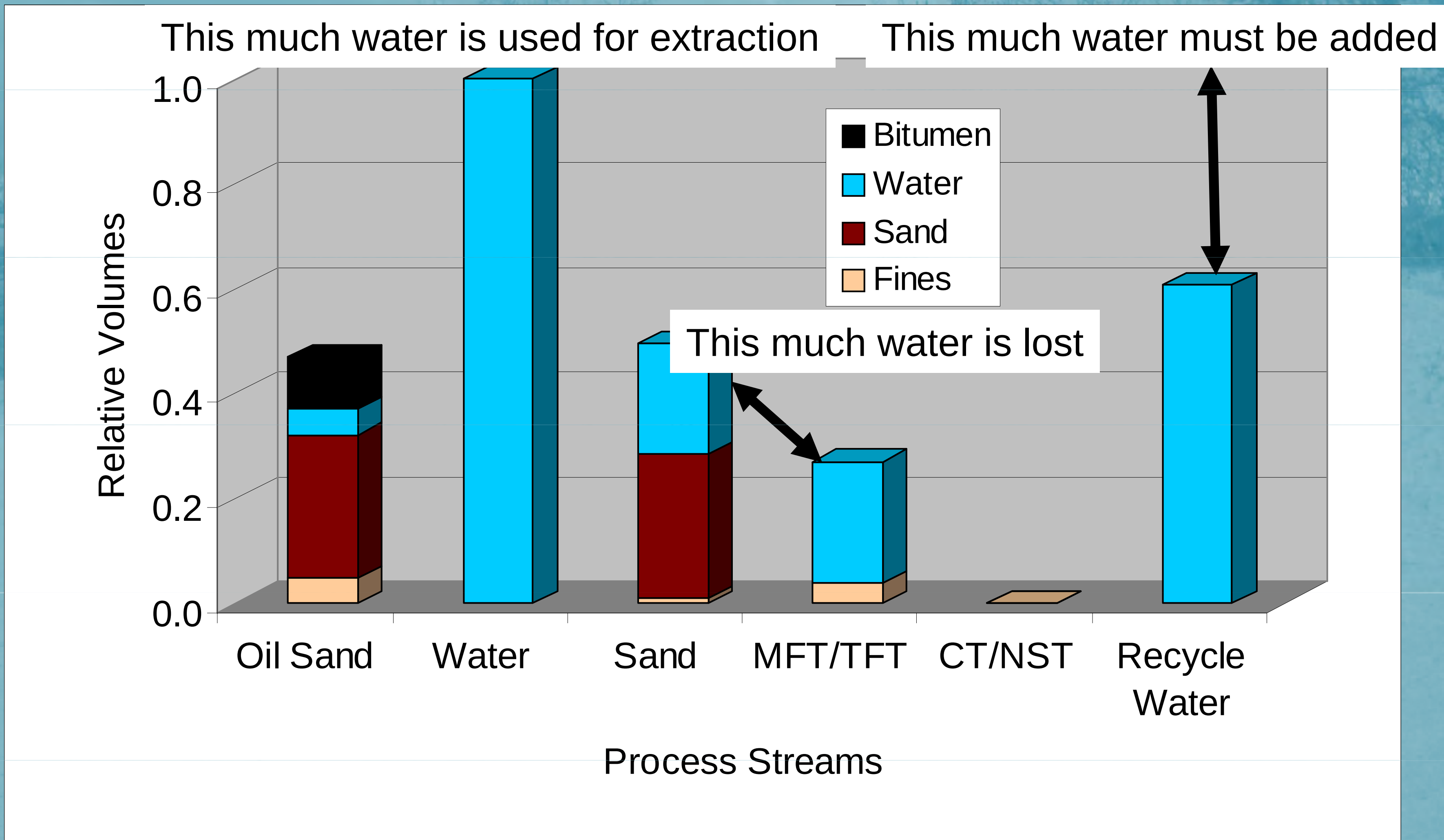

Water used for extraction: Approximately 12 barrels per barrel of bitumen
Water Recycled: Approximately 70%
Water lost to tailings: Approximately 4 barrels per barrel of bitumen

(this is for a typical ore)

The tailings containment structures are some of the largest man made features on the planet.

Dry stackable tailings technology is one way to reduce the volume of the accumulated fluid fine tailings. Dry stackable tailings implementation will allow for reclamation of the boreal forest, and reduce the water requirement from the Athabasca river.

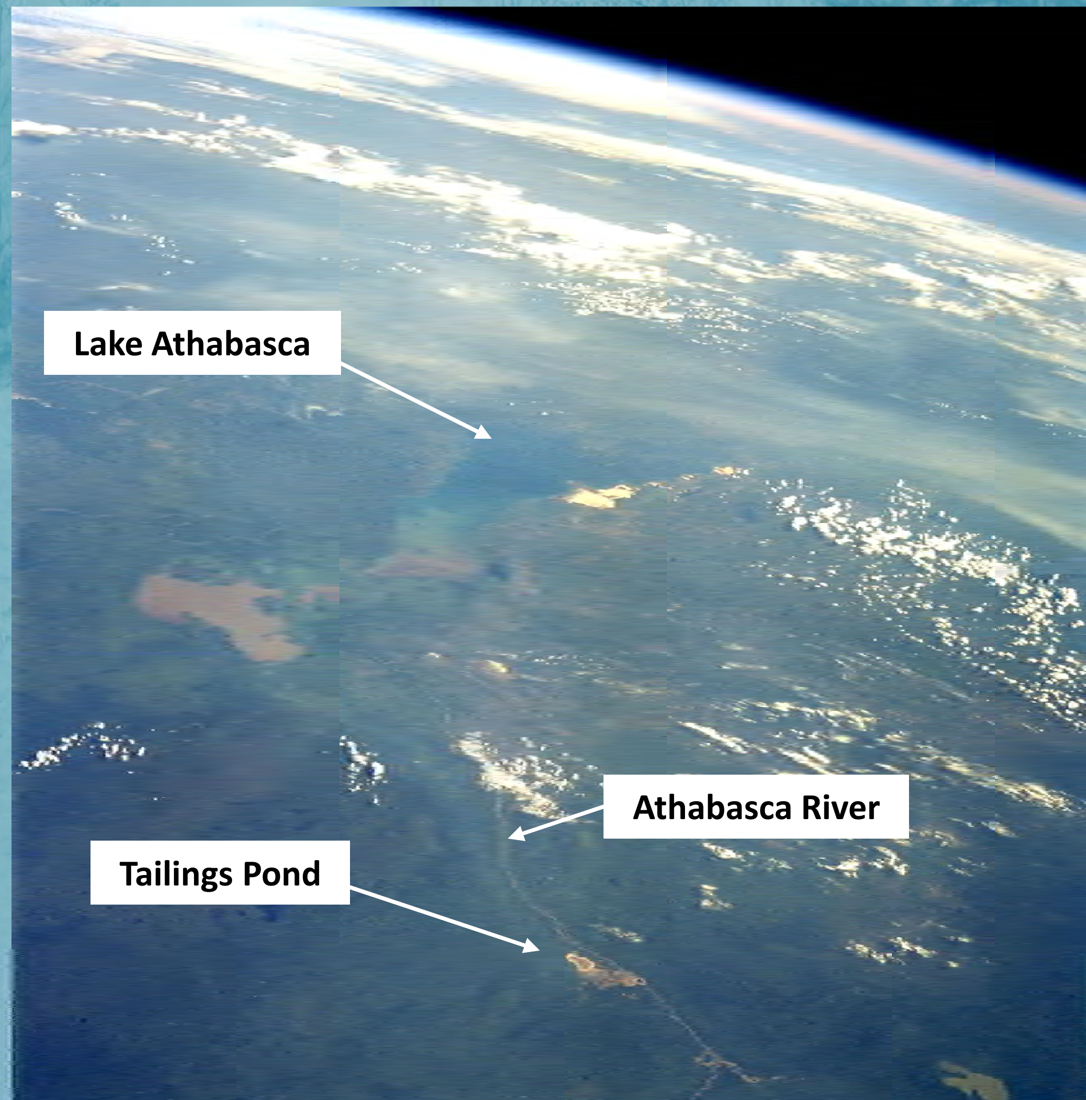

Photo courtesy of NASA, space shuttle program

Aerial photo from approximately 1987 when the “best available technology” was water capping of the accumulated fluid fine tailings or sludge.

CT/NST technology promised to increase water re-use from 75% to over 80%, but now even this improvement on the “best available technology” proposes to have an end pit lake containing leftover fluid fine tailings or MFT.

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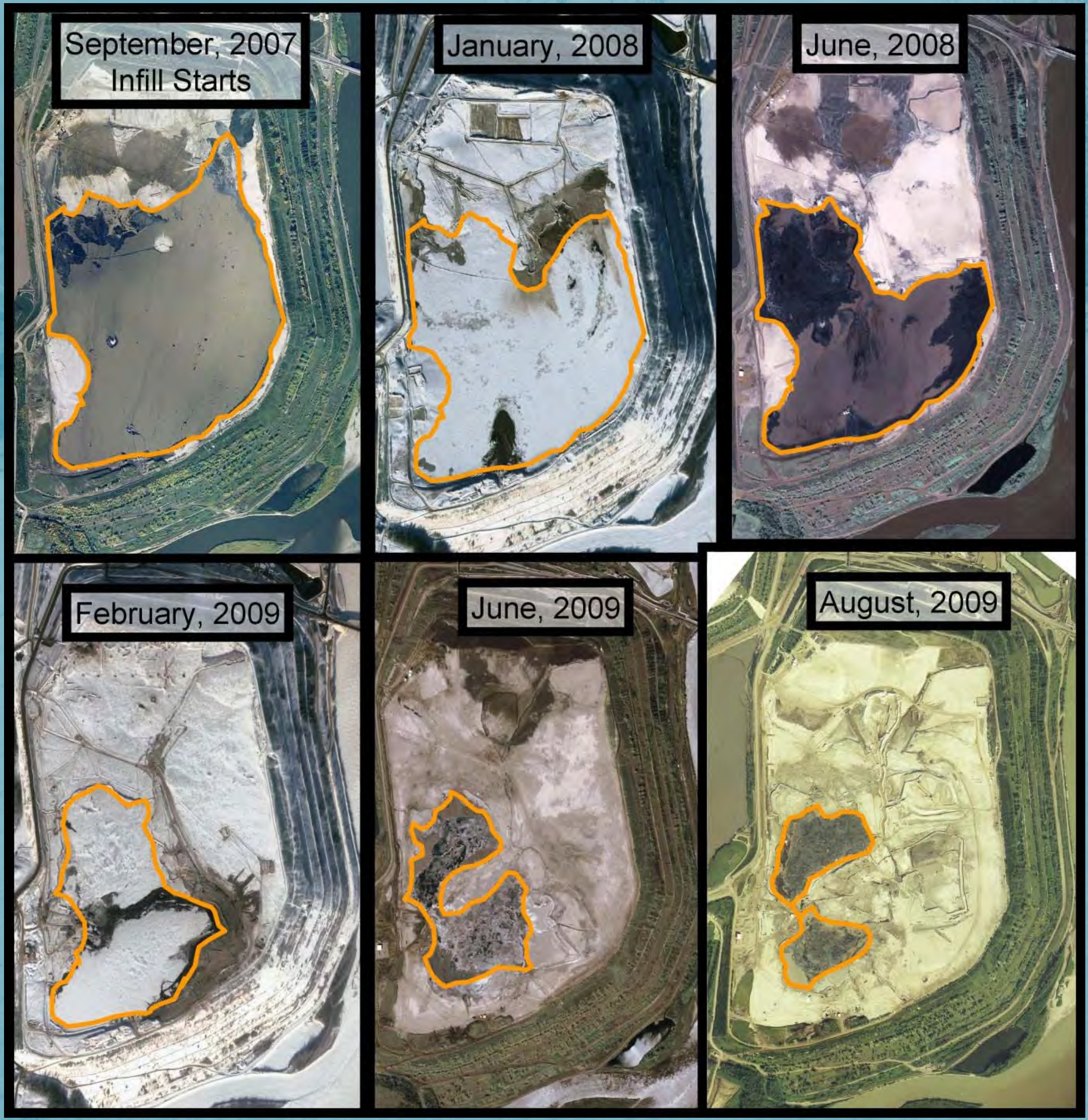

Suncor Pond 1
Reclamation

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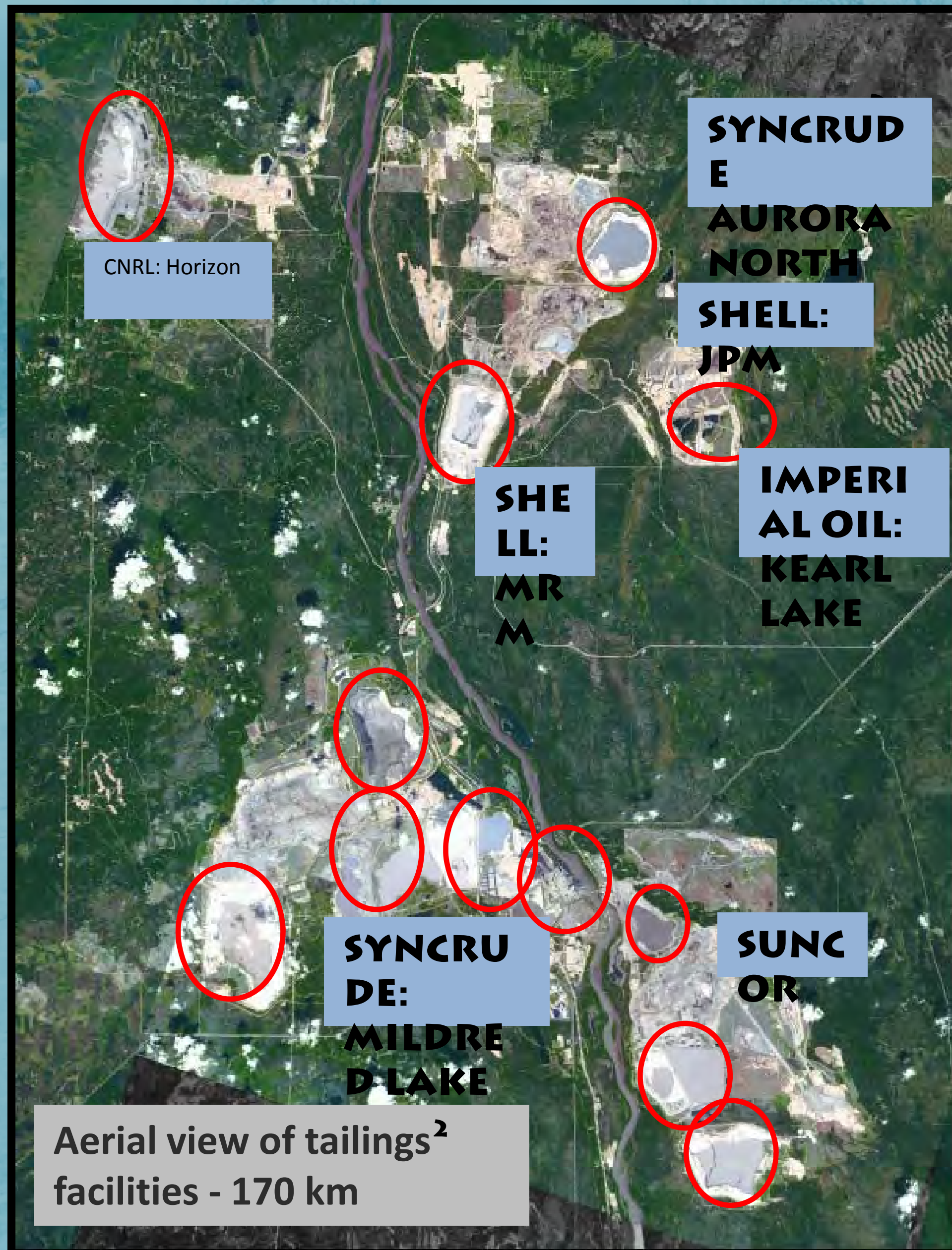
Suncor Pond 1 September 2010 (Wapisiw Lookout)



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Slide courtesy Alan Fair IOSTC 2012, Edmonton

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Tailings research at CETC-Devon: Minimizing the Environmental Impact of Oil Sands Development

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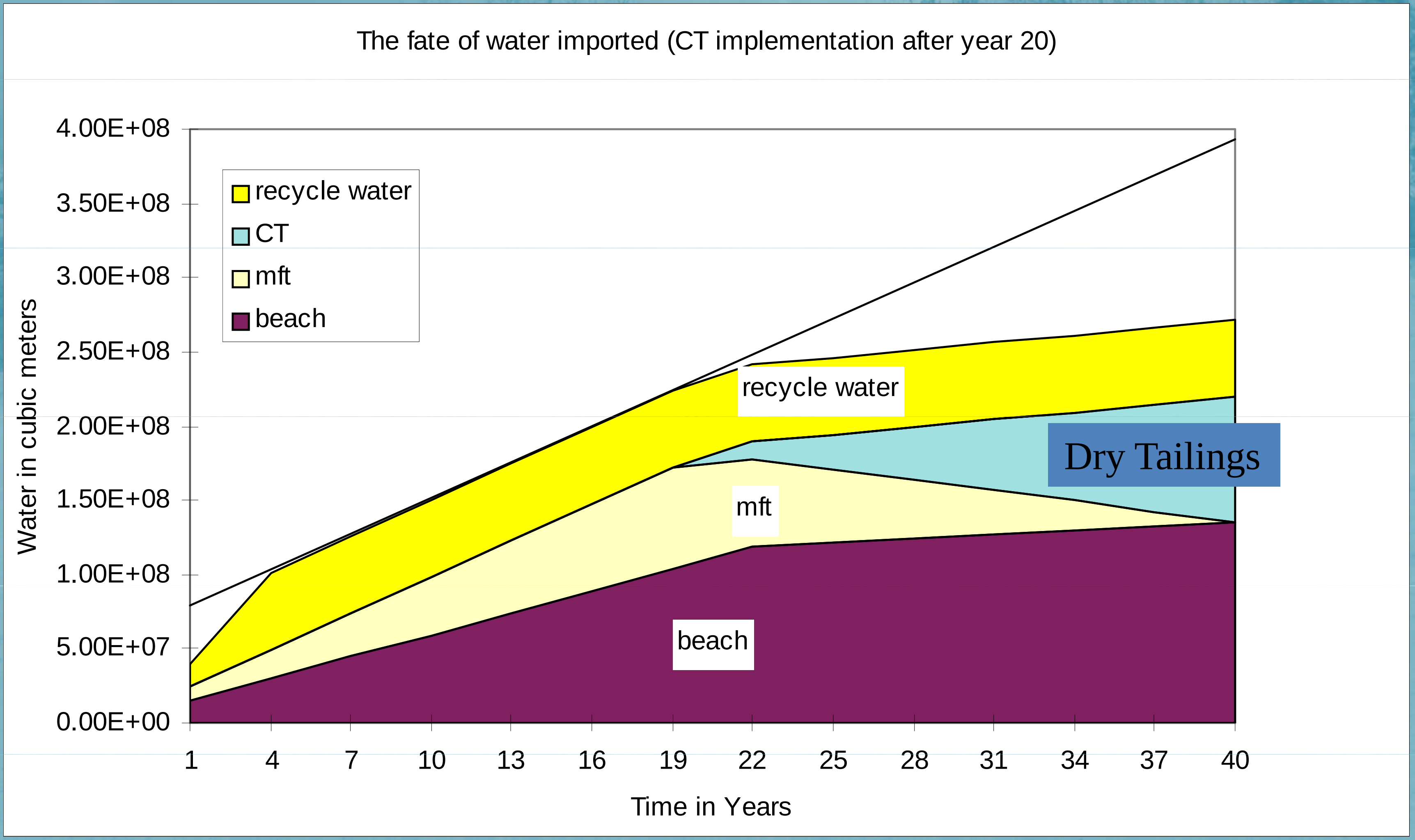

Storage volume limitations will drive new tailings technologies as much as water availability. Without the implementation of some other dry stackable tailings technology, long term storage volumes could become unsustainable.

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THE CT PROCESS
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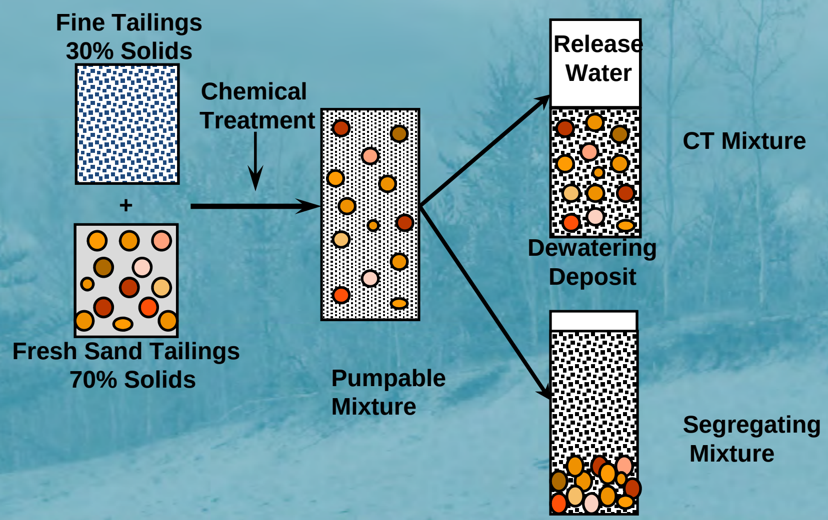
Research



With the correct recipe, CT or NST is pumpable, but rapidly releases recycle water, leaving a trafficable surface for reclamation of the boreal forest. Without the correct recipe, the mixture will segregate, leaving a fluid material unsuitable for reclamation.

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Commercial Scale CT at Suncor

2006

The circled area represents the commercial version of the swimming pool experiment in the previous slide, and the photographs show the trafficable surface created. Water released from this pond was returned to the extraction process, reducing storage volumes and reducing withdrawal from the Athabasca river.

MFT DEWATERING

aka Thin Lift

aka TRO

aka AFD

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Thin lift dewatering

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Centrifuged fluid fine tailings

Increased water recycle
Reduced volume
No fluid storage requirement
Reclamation behind the mining operation

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Centrifuge 2010

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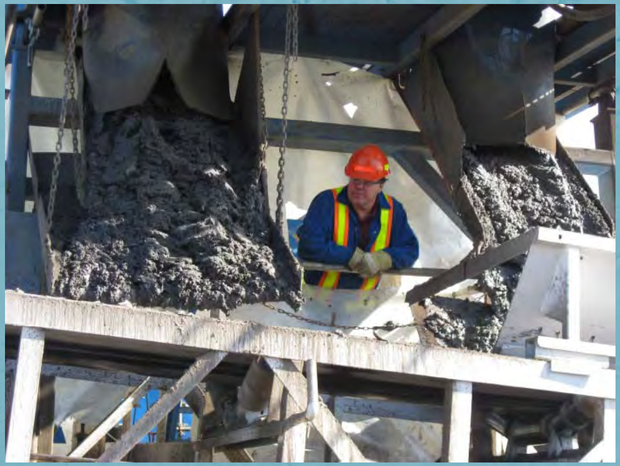

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October issue of Alberta Oil Magazine

A new standard in fluid fine tailings dewatering:
Syncrude Centrifuge Pilot cell #3

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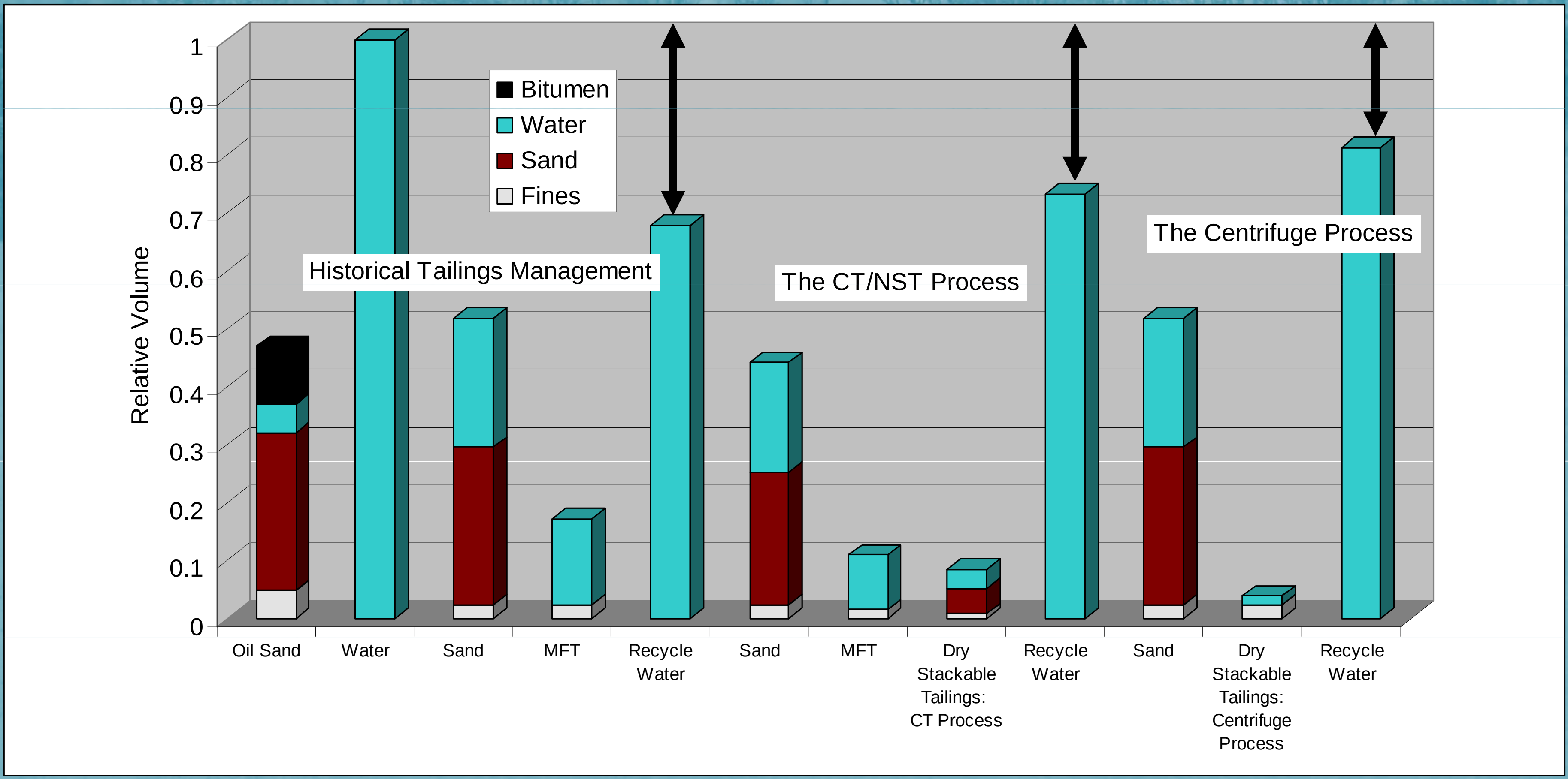

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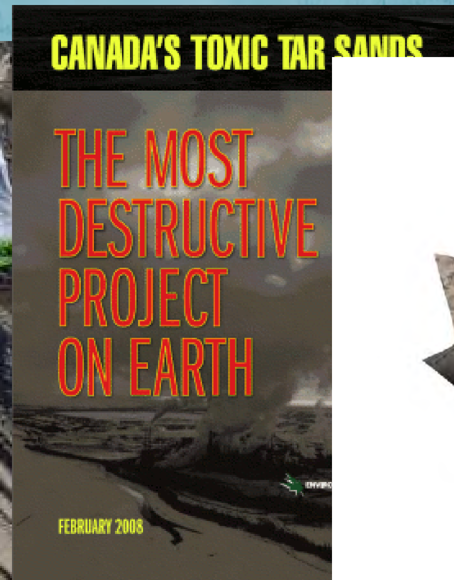

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Pond Construction: MORDOR?

Seepage and runoff collection

KALIUM Research

The arrow marks Mildred Lake, adjacent to Syncrude’s tailings pond; the Mildred Lake Settling Basin.

The Department of Fisheries and Oceans routinely harvests game fish from this lake to restock a sport fishing lake south of Fort McMurray (Lac La Biche)

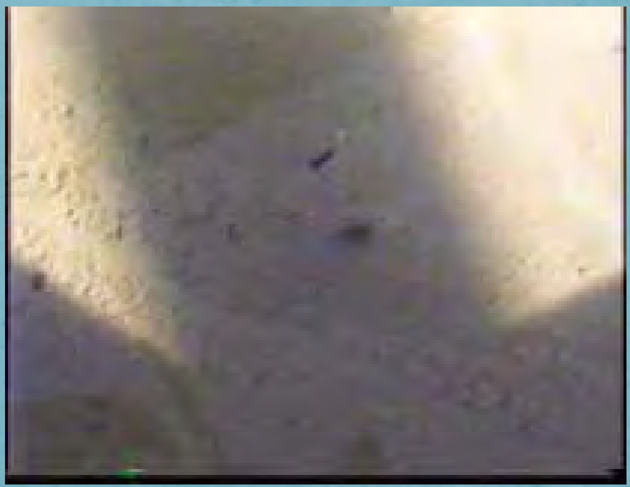
Progress is slow but measurable

BEFORE: The Syncrude Base mine

SUMMARY

Several tailings management options are commercialized or have been demonstrated at close to commercial scale. Although progress has been slower than anyone would like, mined out areas are becoming available and are being utilized to implement a variety of stackable tailings technologies.

Water conservation by the use of "dry stackable tailings" management options will have significant implications for the recycle water chemistry, possibly offering the opportunity to improve water quality from an environmental perspective.



Water bugs and goldfish in composite tailings release water

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Any Questions?

CHARACTERISTICS OF OIL SANDS PRODUCTS

Heather D. Dettman

Center for Spills in the Environment
Oil Sands Products Training
Portland, Maine
December 4 & 5, 2012

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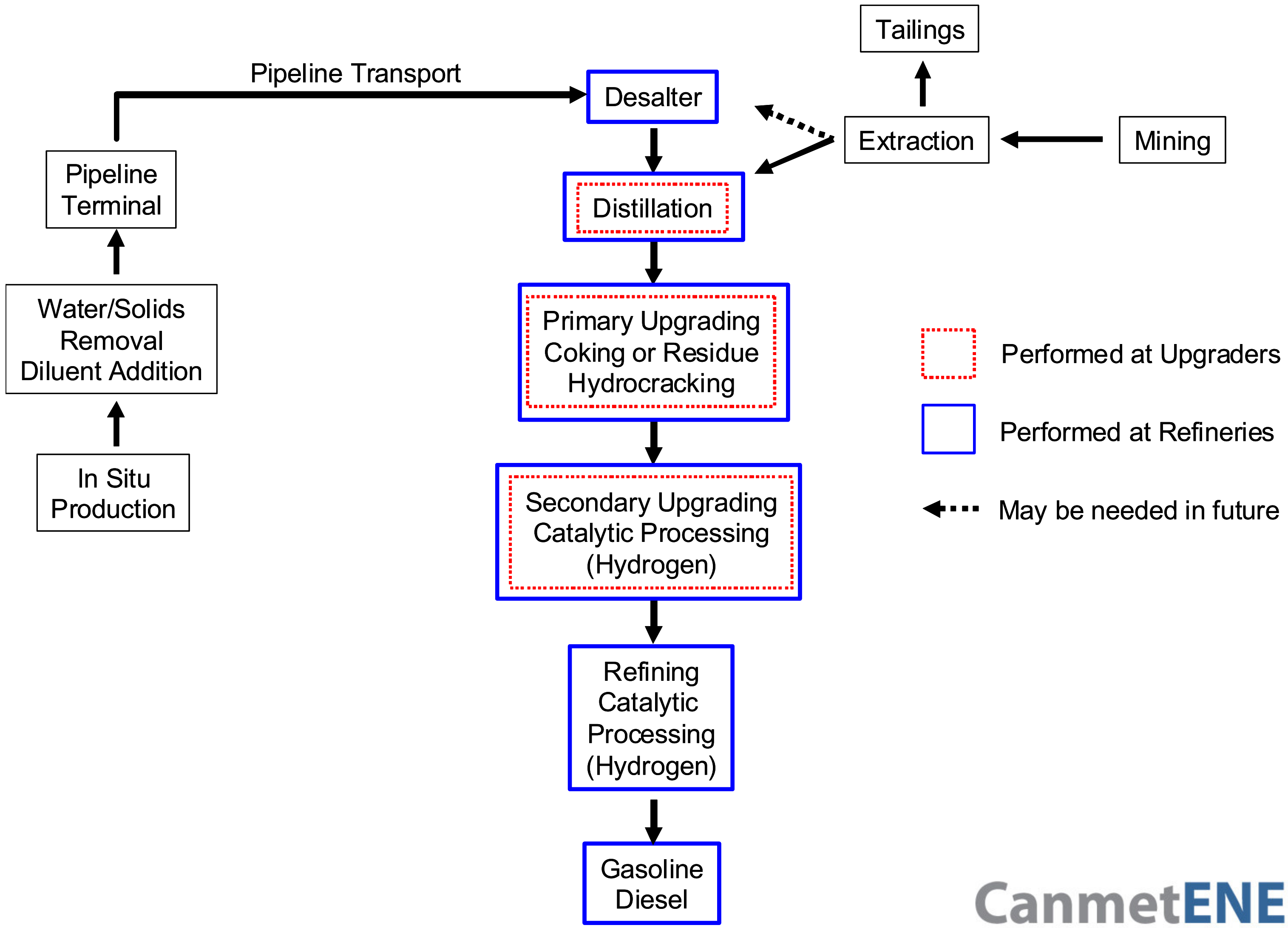
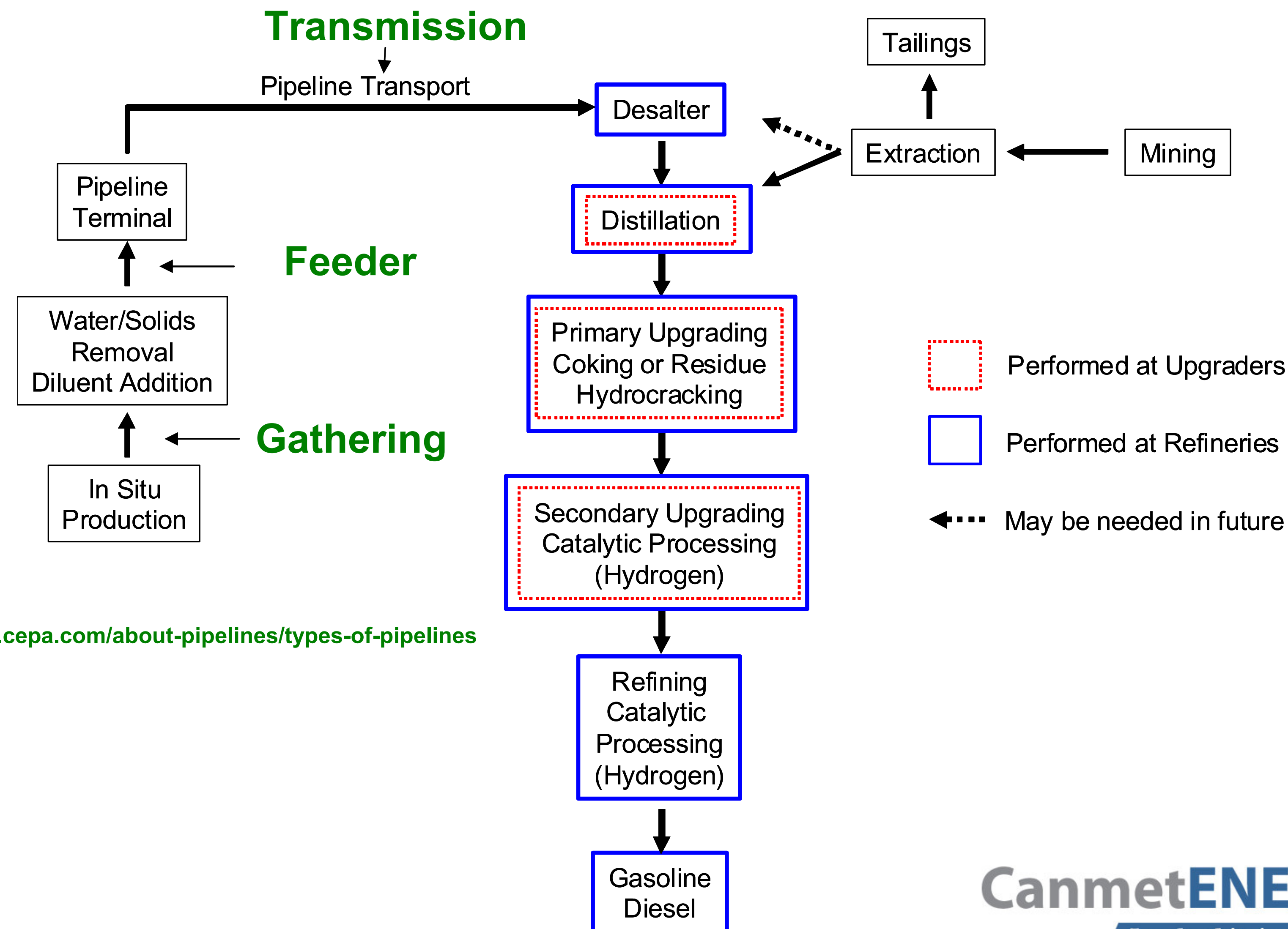
Canada

Simplified "Oil Sands to Motor" Value Chain



Pipeline Definitions



http://www.cepa.com/about-pipelines/types-of-pipelines

What Is Bitumen?

- Bitumen is the "extra heavy" crude oil that remains after the biodegradation of oil in Northern Alberta
  - Initial boiling point is 204°C/399.2°F
  - Approximately 50wt% of the oil boils at temperatures below 524°C/975.2°F
  - Biodegradation has resulted in organic acids being left behind in the oil
    - Total acid number (TAN) is 3mg KOH/g which corresponds to an organic acid content of 3wt% in the oil
      - Organic acid species in bitumen are relatively large molecules with 70wt% boiling above 524°C/975.2°F
      - [By comparison, vinegar for our salads is 5wt% acetic acid which corresponds to a TAN of 47mg KOH/g (by calculation)]

What Is Used to Dilute the Bitumen?

- Diluent such as CRW condensate to make "dilbit"
  - "Naphtha"-based oil which can include natural gas condensate
    - Natural gas condensate is the "liquid" that is produced with natural gas where the lowest boiling component is butane which boils at -0.5°C/31.9°F
  - Approximately 75wt% of the condensate boils at temperatures less than 204°C/399.2°F
  - Final boiling point is approximately 524°C/975.2°F
- Synthetic crude oil, an upgraded product from an upgrader/refinery, can also be used to make "synbit"
  - Less than 50wt% of the synthetic crude oil boils at temperatures less than 204°C/399.2°F
  - Final boiling point is approximately 524°C/975.2°F

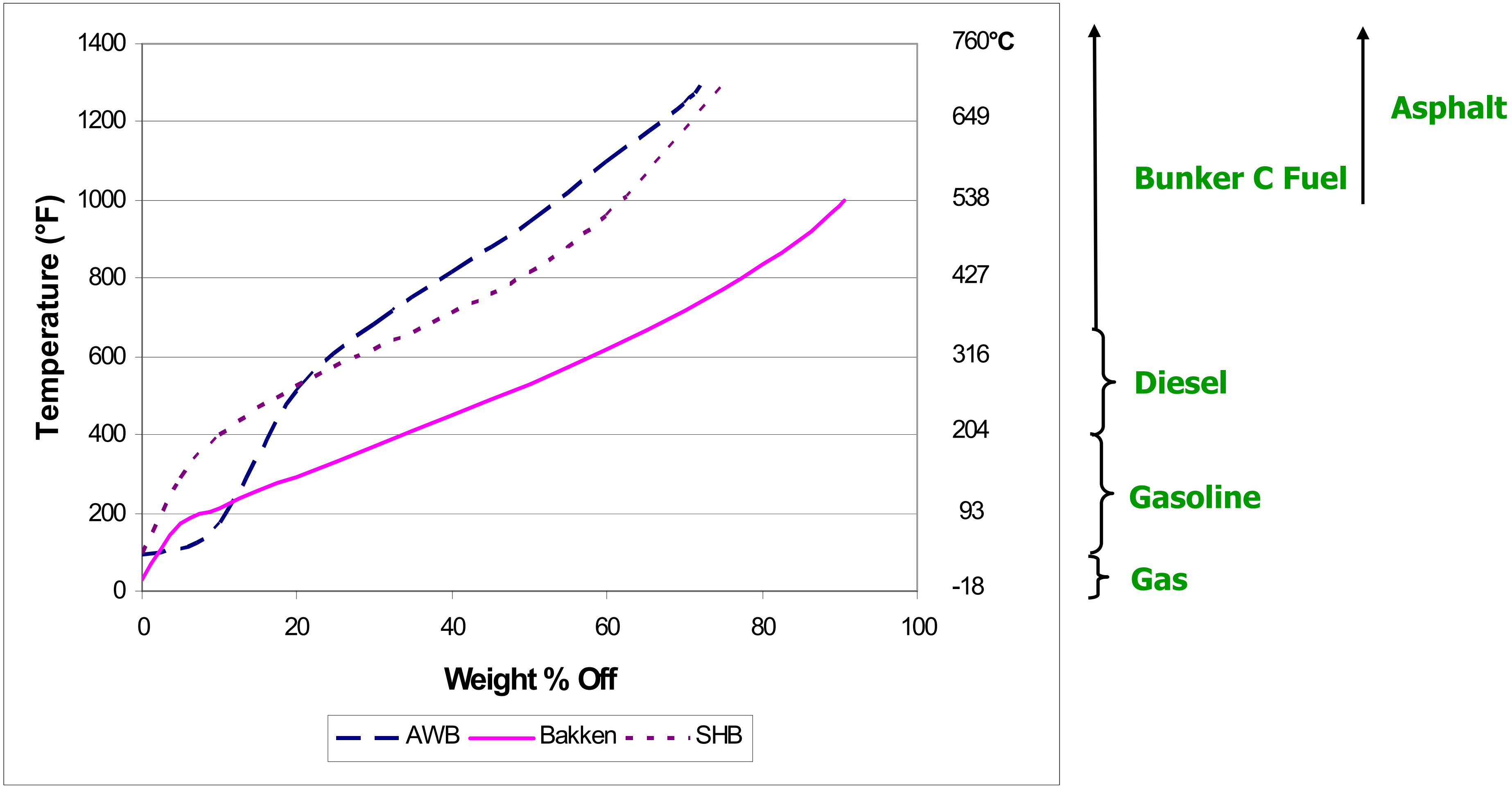
Dilbit and Synbit Specifications

- Bitumen is diluted with light oil to meet transmission pipeline specifications for density and viscosity
  - Needs 30% by volume of diluent for dilbit
  - Needs 50% by volume of synthetic crude oil for synbit

- Characteristics of dilbit/synbit are in the range of
  - TAN value of 1.6mg KOH/g
  - Sulfur content of 3.9wt%

For composition information for Alberta transmission pipeline commodities, see http://www.crudemonitor.ca/

Boiling Ranges of Petroleum Products



Access Western Blend Dilbit (AWB)
Surmont Heavy Blend Synbit (SHB)

Bakken is included for comparison

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Are Oil Sands Products More Corrosive Than Other Crudes?

- Due diligence work performed in 1995 indicated that all oil commodities being transported in Alberta transmission pipelines had low corrosivity under pipeline conditions
- Current understanding of possible contributions of organic acid, sulfur, and sediment contents to oil corrosivity under pipeline conditions support the earlier results; new measurements show that oils sands products have similar results to other crudes
- Industry experience has been consistent with these results

(J. Been and J. Zhou, "Corrosivity of Dilbit and Conventional Crude Oil in Transmission Pipelines", NACE Northern Area Eastern Conference, Paper Number 2, Toronto, Canada, Oct. 28-31, 2012 (Based on the report at http://www.ai-ees.ca/media/6860/1919_corrosivity_of_dilbit_vs_conventional_crude-nov28-11_rev1.pdf)

What Can Cause Internal Transmission Pipeline Corrosion

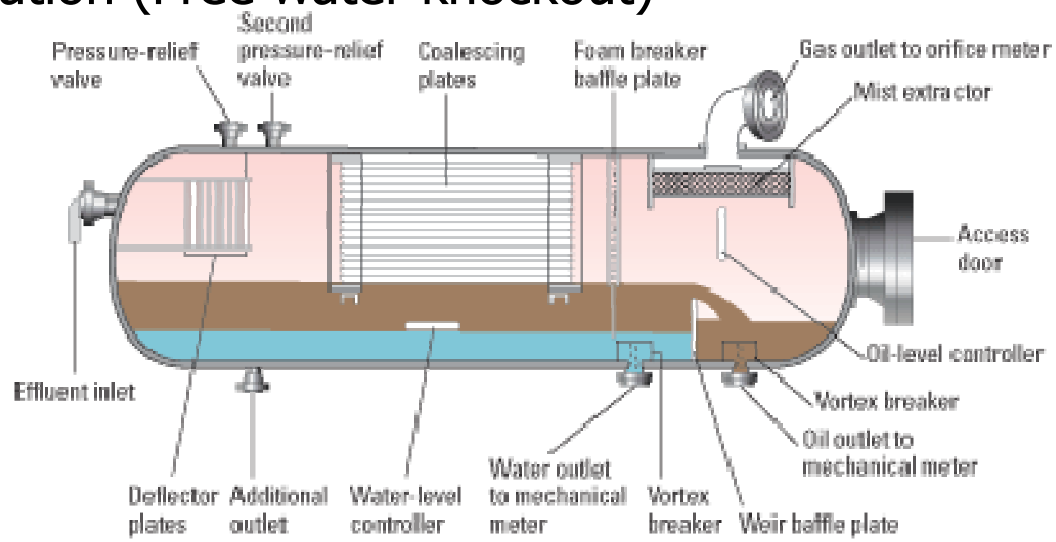
- Water is a key component that can cause corrosion in all types of pipelines for all types of commodities (i.e. light, heavy, or oil sands products)
  - Oil-wet pipelines have negligible corrosion rates
  - If sludge starts to settle out, then water contents can increase at that location and the pipe can become water-wet
  - Water corrosivity can be increased if water-soluble organic acids are present
    - For oil sands products, the content of water-soluble organic acids in the oil is very low due to extensive washing with hot water during production, and the use of floatation during the dewatering process

Transport of In Situ Production

- For example, steam-assisted gravity drainage (SAGD) produces an oil-water mixture that comes out of the ground at approximately 230°C (446°F)
- For transportation by transmission pipeline:
  - Water and solids have to be removed
  - Final transmission pipeline specifications for dilbit/synbit require:
    - Density @ 15°C/59°F ≤ 940 kg/m^3
    - Viscosity @ pipeline temperature ≤ 350cSt
    - Basic sediment & water content (BS&W) ≤ 0.5% by volume
- For transportation by train, oil sands products should have similar quality characteristics....

Sediment and Water Removal

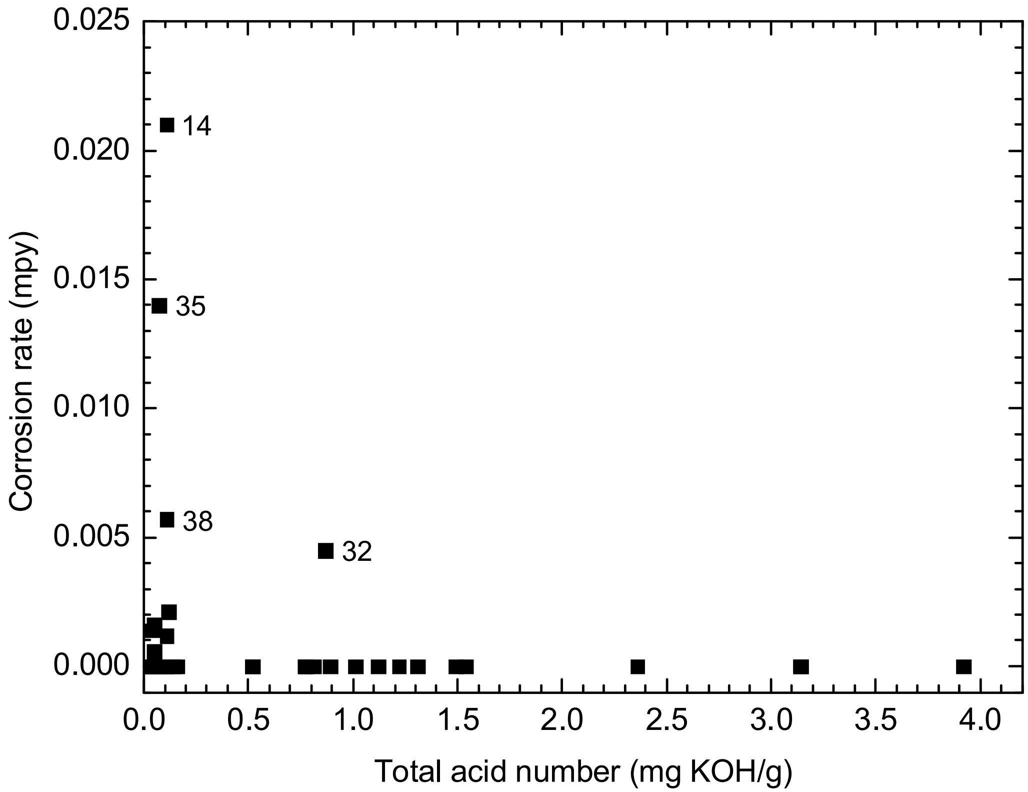
- Sediment (mud and sand) and water are removed in two steps:
  - Floatation (Free water knockout)



Schlumberger website - http://www.glossary.oilfield.slb.com/DisplayImage.cfm?ID=630

  - Dehydration/gravity separation/emulsion breaker (Heater treater)

Corrosivity Test Work, in 1995 and now



Courtesy of W. Friesen, CanmetENERGY

Due diligence study was performed on commodities being transported by pipeline in 1995 by CanmetENERGY

Corrosion rates were very low, less than 0.022mpy, and did not correlate with total acid number (TAN) for values up to 3.9mg KOH/g

New test method, ASTM G205-10: Standard Guide for Determining Corrosivity of Crude Oils, ASTM International (www.astm.org) found that oil sands products have the same results as other crudes

S. Papavinasam, NACE Northern Area Eastern Conference, Paper Number 10, Toronto, Canada, Oct. 28-31, 2012

When Can Organic Acids in Crudes Cause Corrosion?

- Organic acids (also called “naphthenic acids”) in crude oils can cause corrosion if they get concentrated
  - This can occur in a refinery during distillation at temperatures above their boiling points which are generally temperatures greater than 200°C/392°F
    - For bitumen, initial boiling point of its organic acids is 280°C/536°F
- Global crude corrosivity in refineries also depends upon organic acid size and structure
  - Bitumen has been found to have relatively low corrosivity under refinery conditions despite its high TAN value [Dettman *et.al.* CORROSION/2012, paper no. 01326 (Houston, TX:NACE 2012, pp.1-15]

What about Sulfur?

- Acidic sulfides like hydrogen sulfide (H_2S) and mercaptans can interact with iron to form iron sulfides
- Similar to most crudes, diluent and thermally-treated bitumen (i.e. SAGD production) can contain H_2S
- Most of the sulfur in oil sands products is bound in hydrocarbon structures that require refinery processes including heat (i.e. 350°C/662°F), high pressure hydrogen, and catalysts to remove it

What about Sand?

- All crude oils come out of the ground so can contain sediment (mud, sand, salts)
  - Sediment carried by the oil-water mixture is separated from the oil by the floatation of the oil from the water, and gravity separation of solids
  - Once the oil sands product meets pipeline specification for BS&W, the remaining sediment in the oil is in the size range of silt (mud) to very fine sand

    [http://en.wikipedia.org/wiki/Particle_size_(grain_size)]
  - As sand particles are very small and are low in concentration, erosion is not a concern in transmission pipelines

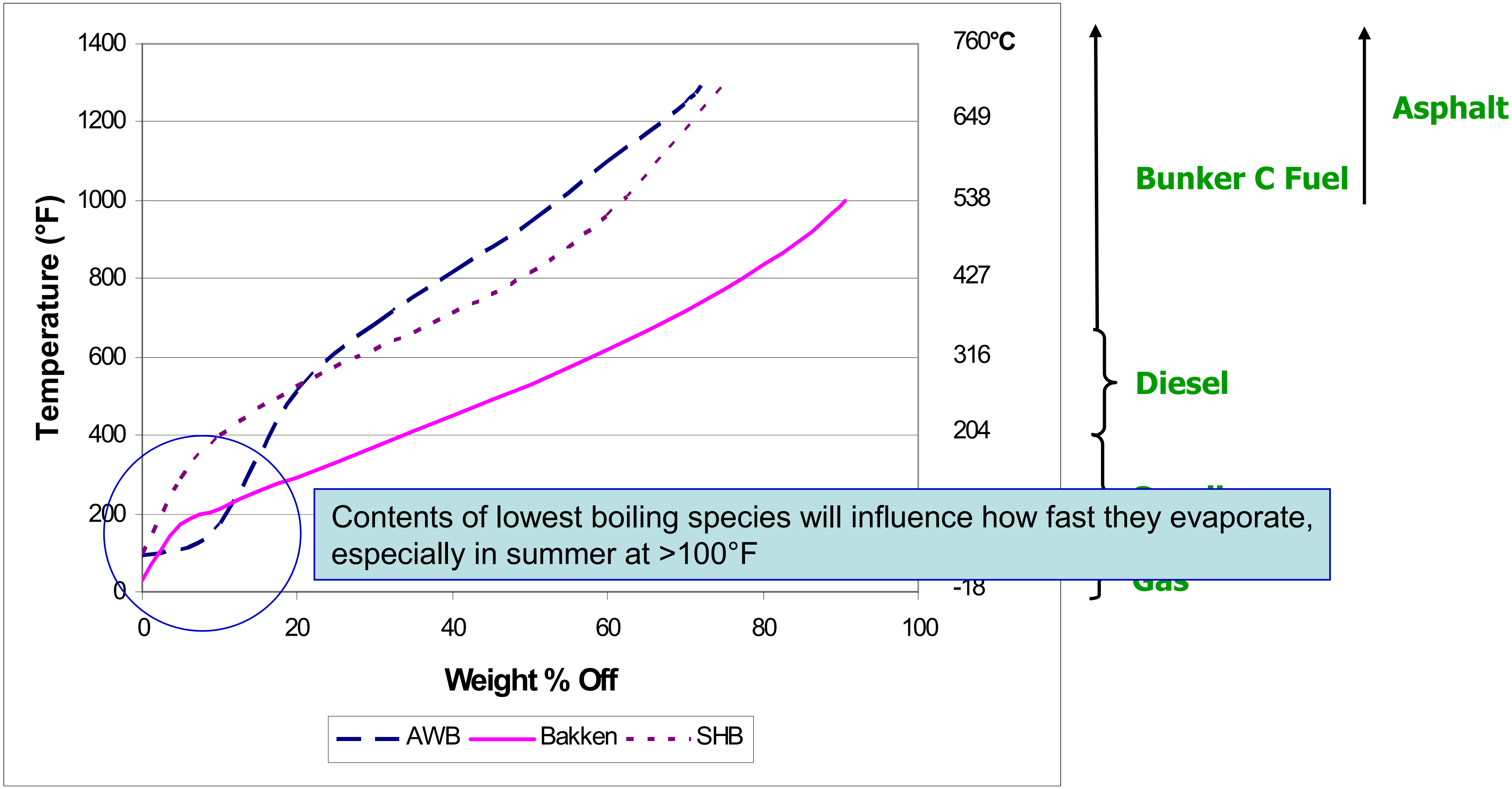
Conclusions

- Oil sands products being transported out of Alberta by transmission pipelines
  - Consist of blends of bitumen and light oil (diluent or synthetic crude oil) to make dilbit or synbit, respectively
  - Meet quality specifications for density, viscosity, and basic sediment and water (BS&W) content
  - Are not more corrosive than other crudes

Discussion Points with Regards to Spill Clean-up

- Characteristics to consider
  - Content of lowest boiling components that boil below 200°F
    - Air quality immediately after the spill
    - Rate of loss
  - Content of highest boiling components

Discussion Points for Spill Clean-Up (cont'd)



Contents of lowest boiling species will influence how fast they evaporate, especially in summer at >100°F

Access Western Blend Dilbit (AWB)
Surmont Heavy Blend Synbit (SHB)

Bakken is included for comparison

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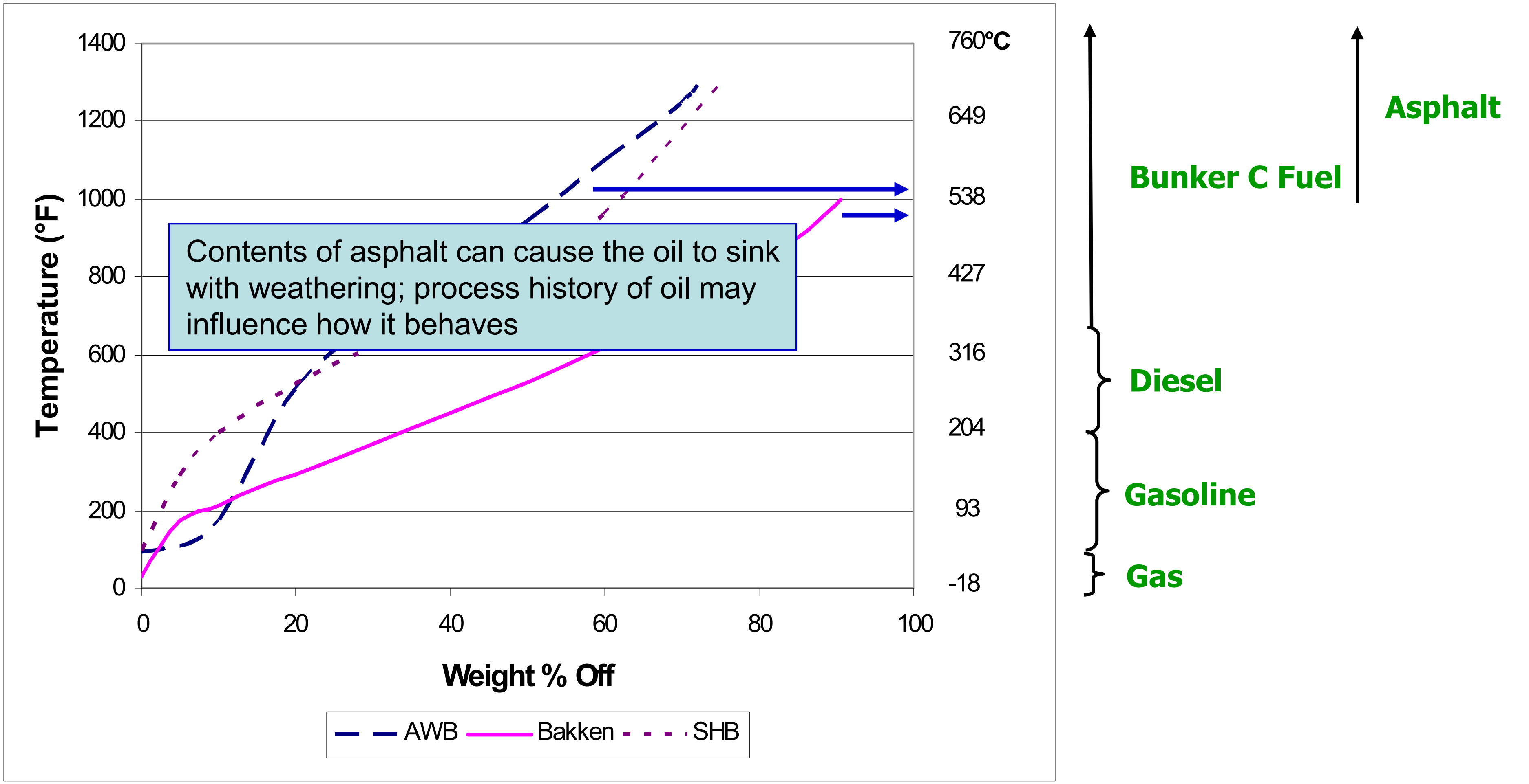
Discussion Points for Spill Clean-Up (cont'd)



Access Western Blend Dilbit (AWB)
Surmont Heavy Blend Synbit (SHB)

Bakken is included for comparison

Canadian Pacific Railway
Operating in Your Community

Railway Movement of Oil Sands Products

December 4, 2012

Who is Canadian Pacific?

CANADIAN PACIFIC

Canadian Pacific (CP) is a privately owned and operated railway transportation company, which is federally regulated in all aspects of railway operations. CP operates over 15,800 miles of tracks and employs approximately 15,000 people throughout Canada and the United States.

CP is committed to being the safest, most fluid railway in North America. We believe our success depends on more than our ability to understand our business and customers – we must also appreciate the issues that matter to the communities in which we live and do business – safety, quality of life and the environment.

The Car

The General Service Tank Car

- 28,000 gallon car7/16” thick carbon steel
- Non-jacketed
- No Head Protection
- Standard Valve arrangement One or Two Pressure Relief Devices (outside top operated platform)
- Bottom Outlet
- Vapor & Liquid valves
- Vacuum Relief Valve
- Bolted and Hinged Manway

Upcoming Demands

- Increased Demand for Transportation
- •Increased New Car Build/Lease Demand Unit train compatible
- Built-in safety
- True 40-year assets
- Shared safety costs

Content

- About Canadian Pacific
- Railways from Canada
- CP Safety Performance and Framework
- Emergency Planning & Response Process
- Emergency Response Pre/Post Incident
- If an Incident Occurs

Summary

CP is:

- Important to provincial and national economies
- Among the safest railways in North America
- Highly regulated
- Well prepared for any form of emergency
- Proactively works with communities
- Investigates any/all incidents for learning’s

Today, the Canadian rail industry:

- Employs more than 34,500 people full time
- Pays more than $1.1 billion in taxes to Canadian governments
- Transports more than the equivalent of 11 million truckloads of resource products, consumer, and manufactured goods

•American Association of railways, 2006, 2007

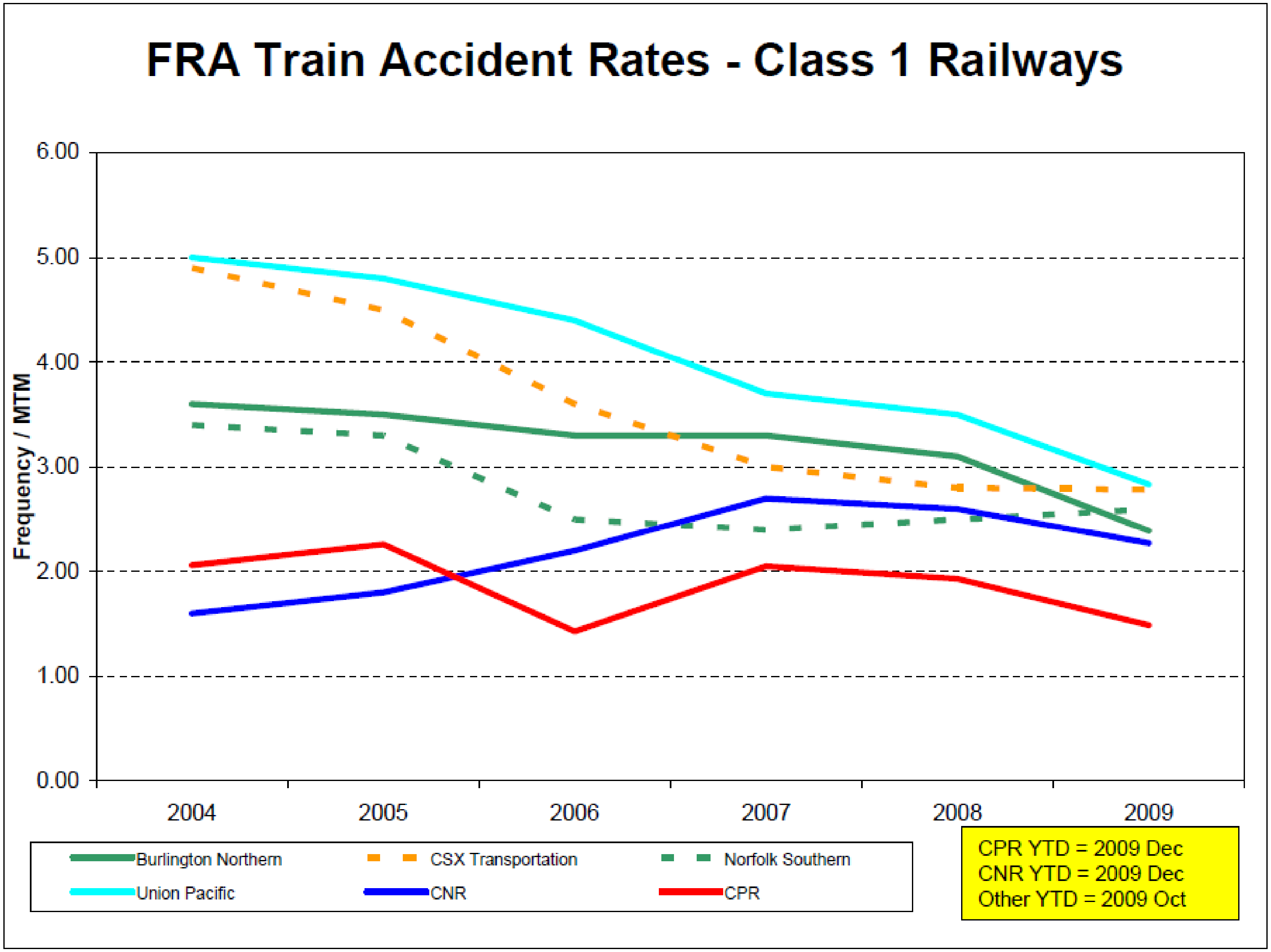
CP Safety Framework

CANADIAN PACIFIC

- Safety Performance
- Railway Industry regulations
- Internal Safety Policies
- Safety and Technology:
  - Track Maintenance
  - Rail Car Specification & Inspections
  - Customer Responsibilities
  - Train Inspections – Departure/Enroute

Safety Framework - Best in Class Performance

Canadian Pacific



Regulations

- Railway industry is heavily regulated on virtually all aspects of operations and safety
- CP is federally regulated and is monitored by Transport Canada (TC) and the FRA:
  - Railway Operating Rules for train crews
  - Locomotive Safety Rules
  - Freight Car Safety Rules
  - Train Brake Rules
  - Railway Track Safety Rules
  - Transportation of Regulated Products
  - Safety Management System Regulations

Internal Policies

- Internal CP policies, practices and procedures ensure that we meet or exceed all of the standards prescribed by federal regulations
- CP's Safety and Regulatory Affairs and Environmental Services departments are dedicated to and responsible for promoting employee, public and train accident prevention. In addition they:
  - monitor safety and accident trends
  - ensure appropriate corrective actions are implemented
  - provide world-class expertise in formal accident investigations
- CP coordinates with communities in prevention and Emergency Response preparedness in accordance with Federal, Provincial ,State,and Municipal requirements

Track Maintenance

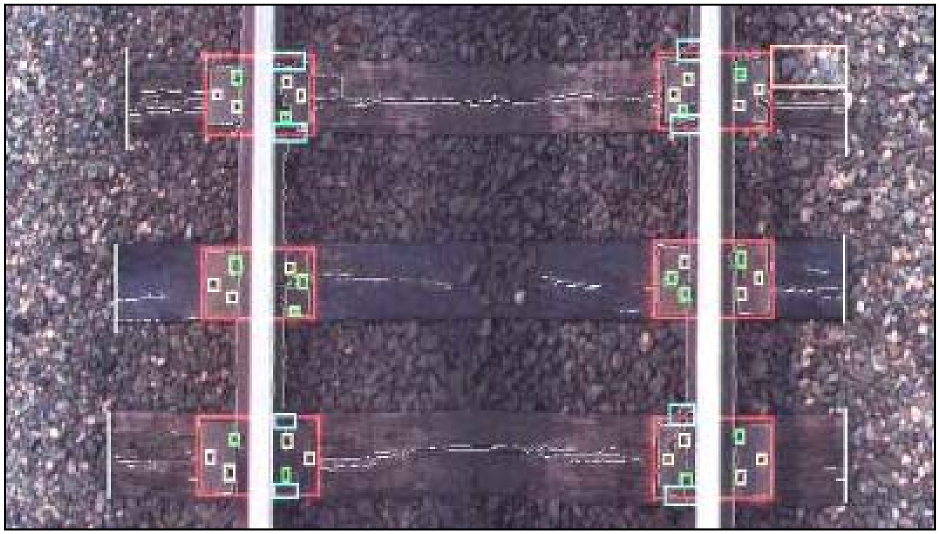
- CP is regulated by the TC/FRA and has a set of "Standard Practice Circulars" for all elements of track construction and maintenance
  - Visual track inspections, with supplemental track patrols for temperature extremes, high water or other emergent conditions
  - Walking inspections at all switches. All track joint bars undergo close visual inspection every spring and fall
  - Daily routine maintenance by two and four-person crews, with specially designed track maintenance vehicles
  - Annual maintenance programs to renew track infrastructure materials, such as rails, ties and ballast

Track Maintenance

- Checking track structure and geometry up to four times per year using automated track evaluation car, which measures:
  - Track gauge
  - Cross-level
  - Alignment
  - Curve elevation and design
  - Rail wear
  - Lateral crosstie resistance under load
- Induction/ultrasonic rail testing conducted up to four times per year. Portions of rail with internal rail flaws are removed immediately, or protective measures are put in place
- Grinding rail up to twice a year to correct surface cracks and rail shape irregularities

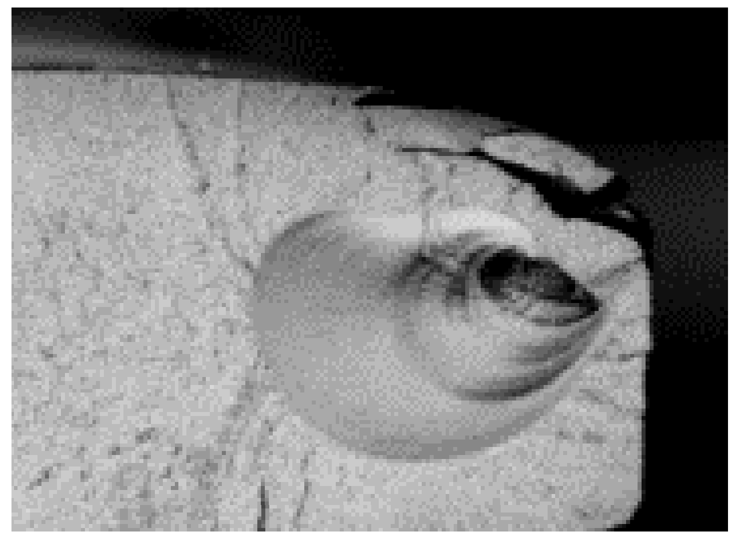
Track Evaluation Car (TEC)

- High-tech mobile scanning laboratory electronically checks the condition of the track
- GPS technology used to pinpoint exact repair locations for track maintenance personnel
- Restorative measures known as surfacing ensures the track surface, alignment and gauge are all maintained within prescribed standards
- Joint bar inspection (vision technology) added in 2006



Rail Flaw Detector Cars

- Inspects main track at regular intervals
- Uses ultrasonic and induction system to detect internal flaws in rail.
- Rail flaws are removed immediately, or protective measures are put in place
- Technology upgraded in 2005 to detect smaller cracks (B-Scan)



Rail Grinding

- Rail grinding to control surface cracks before they grow in an effort to prevent internal defects and other rail irregularities
- 11,700 miles ground annually
- Rails are reshaped from 1 to 4 times per year
- Removal of surface cracks also improves ultrasonic inspection
- Turnouts and road crossings

Award-Winning Grade Crossing Sightline Improvement Program

- Improves safety, lowers costs and is environmentally sustainable
- 1165 public crossings treated in 2006 with innovative techniques which minimize herbicide use and encourage establishment of low growing plant species resulting in improved sightlines, increased safety and lower long-term maintenance costs

Rail Car Specifications & Inspections

- CP moves product for various chemical and petroleum-based customers. Products are subject to regulations requiring:
  - Adherence to 49 Code of Federal Regulations (49CFR) for transportation of hazardous material for Air/Rail/Highway/Water:
    - construction to U.S. Dept. of Transportation (DOT) specs
    - normalized steel construction
    - protective head shields
    - AAR and ASTM steel and weld testing
    - double shelf couplers
    - special pressure and thermal control valves, and more
  - Placards on cars that designate Dangerous Goods ID products based on UN number as per North American Emergency Response Guide) NAERG
  - Waybills showing commodity, shipper and emergency contact information, UN ID number and Hazard Class
  - In-train placement restrictions
  - Special yard handling and restricted switching speed

Customer

- Offers shipment “Bill of Lading” to CP Transportation Service Representative (TSR) via fax/e-mail
  - Triggers release of rail car to railway
  - Information must pass through rigorous edits
  - Information entered into system
  - Systematic checks on variable information (Technical Name, Packing Group, etc.)
  - System prompts visual verification of key ER data (Emergency Response Assistance Plan and 24 HR numbers)
  - TSR generates work order for crews to lift from Customer facility which includes dangerous goods waybill information

Customer Facilities

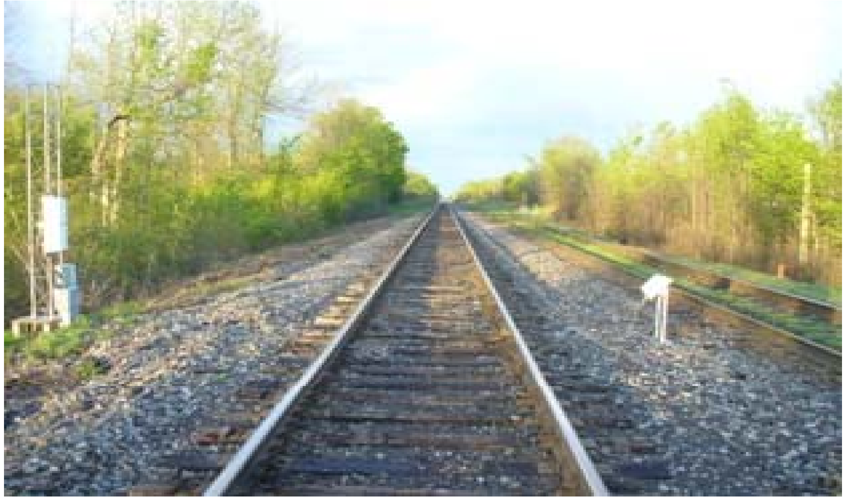
- Railway crew removes car from shipper facility with shipper supplied product documentation (work order)
  - Crew inspects each car prior to lifting and tests the brakes
  - Defective cars or non-listed cars are rejected at the shipper's facility
- Railcar is placed on a train and the manifest list is generated creating movement documents for train crew
  - Out-bound consist list (train wheel report/manifest list) - displays all cars in train and flags Hazmat cars
  - Compressed Waybills (Hazmat Shipping Documents are created and validated - - 4 progressive and linked steps - - for each regulated car)
- Train is inspected and brake tested by crews or other qualified employees
- Inspection results are provided to train crew and recorded on a form that stays with train to destination

Train Inspection Process

- Prior to departure, all trains are inspected:
  - Proper air brake pressure & brake application
  - Condition of wheels and bearings
  - Safe working condition of all rail car components
  - Loose, dragging or misaligned equipment
  - Secure lading on open freight cars
  - Safe locomotive operating characteristics
- Train receives numerous inspections while en-route by:
  - Track side detectors and other technologies
  - Track maintenance and Signals & Communications employees
  - Train crews during train meets or passing by other trains
- All trains transporting regulated goods receive a pull-by inspection at each location where train crews are changed
- All trains carry consist and product info on-board, allowing First Responders to refer to, and copy, documents

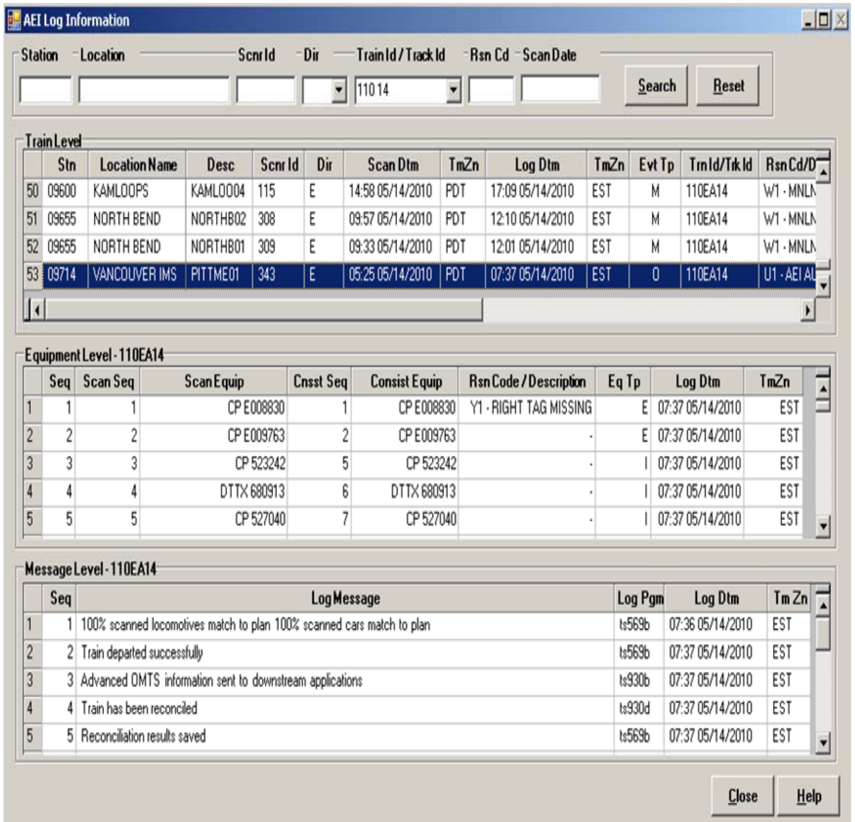
Train Consist – Rail Car Position

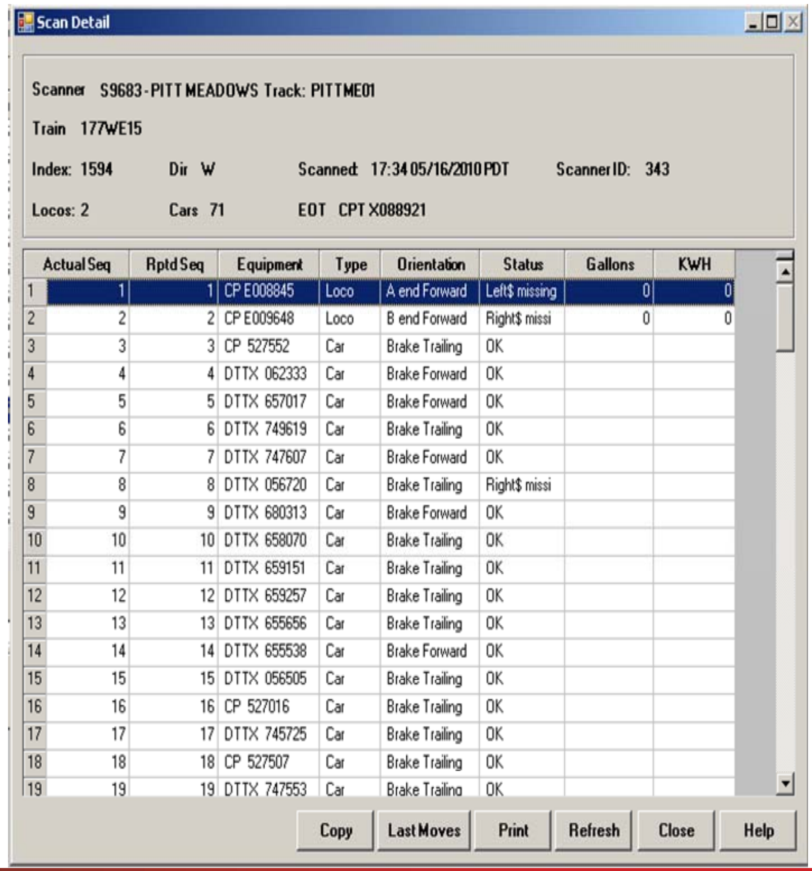
- Each rail car is equipped with Automatic Equipment Identifier (AEI) card.
- Card is a simple circuit board that contains basic information about the rail car
- Track side AEI readers access information from the card and produces an electronic list of all the cars
- Train departs yard and first AEI reader compares rail car position information to an electronic train consist



Train Consist - Departures

- Discrepancies are investigated and corrective action taken:
  - Train crew notified and consist is manually updated each time a car is added or removed from the train for any reason
  - Radio waybill is processed for loaded rail cars





- ***CP uses new, evolving technology designed to inspect trains for safe railway operations. Examples include*:**
  - Acoustic bearing detectors give advance warning of wheel bearings in distress by analyzing the noise emanating from the bearing. First such detector to be used in Canada was installed in 2004 just outside Vancouver, BC
  - Hot bearing and hot wheel detectors tell crews (mechanical voice) when their train is “running a temperature” and needs to be inspected
  - Wheel impact load detectors (WILD), which diagnose wheel and other equipment problems that may be exerting unusual stress on rails
  - Locomotive event recorders (black boxes) record all control inputs used to monitor proper train handling performance and disclose crucial data in the event of an accident investigation
  - Loco cams are cab-mounted, forward-facing digital camcorders to capture accidents and near miss violations at grade crossings. Installed in all new locomotives since November 2005

How We Prepare

- Emergency Response Plan
- Community Relationships
- Environmental Protection

Emergency Response Plan

- *“CP believes that it is the collective responsibility of its 15,000+ employees to ensure the safety and security of the communities in which it operates, the environment, and their fellow employees” **
- CP has an extensive Emergency Response Plan - applies to all employees from front-line to executive level
- Plan is regularly updated and tested internally
- Recognizes that all incidents are of concern to communities, and our actions are an indication of commitment to community safety

• CP Emergency Response Plan

Emergency Response Plan

- The plan is routinely compared to, and tested in conjunction with, local community (fire, police, communications) Emergency Response Plans
- In an average year, in communities throughout the system, CP:
  - Participates in 20 emergency planning integration meetings / training sessions
  - Conducts 10 “table-top” disaster exercises
  - Coordinates 4 TRANSCAER Fairs / ER workshops
  - Participates in 5 full-scale mock disasters

Mock Disaster, Shoreview 2004

Community Relationships

- Three pillars of CP's community relationships:
  - Develop key relationships BEFORE an incident
  - Coordinate stakeholder needs during an incident
  - Provide meaningful follow-up post-incident

- Programs include:
  - 1-800 Community Connect (inquiry) line
  - Community Advisory Panels (issues resolution or development planning)
  - Coordination with other departments: safety enforcement and environmental remediation
  - Holiday Train, CP Empress Steam Train
  - Community Investment (community, safety, environment)
  - Operation Lifesaver

Environmental Protection

- CP's Environmental Services (ES) has industry-leading experts in the areas of hazardous materials containment, environmental remediation and air and water migration prediction
- As a significant component of Emergency Response Plan coordination, this group prepares for the worst-case scenario through extensive planning, training, and testing
- ES has established a network of resources in an effort to **reduce** response time, potential impact to Community and the Environment
  - 24-7 on-call response system
  - Network of qualified contract experts and equipment are strategically identified for immediate response
  - Response is less than 4 - 6 hours depending on location

Environmental Protection

Primary Emergency Response Contractors

British Columbia
Quantum Murray – Kamloops, BC
Alberta
Quantum Murray – Calgary, AB
Saskatchewan
Envirotec – Saskatoon, SK
Manitoba
Euroway – Winnipeg, MB
Ontario
PSC – Hamilton, ON
Quebec
Onyx – Montreal, QC

St Paul & Chicago Service Area
Wevele – Minneapolis, MN
Earth Movers - Minot, MD
Onix – Chicago, IL

North East US
Op-Tech – Syracuse NY

A textbook example of emergency management

"After attending well over two hundred accidents over the years, all I can say is that the performance of the (CP) team you assembled in Red Deer was rather impressive. Furthermore, the way by which your company coordinated its efforts with numerous local responders and with the shipper representatives could be used, in my opinion, as a book example for emergency handling."

Special Investigator - Dangerous Goods
Transportation Safety Board of Canada

If an Incident Occurs

- Incident Priorities
- Call-Out Process
- Community Safety & Communication
- Environmental Considerations

Post Incident Process

- Investigation
- Investigation of Safety – Related Occurrences Protocol (ISROP)
- Debriefing & Follow-up Communication

Incident Priorities

- CP's response team focuses on four priorities:

  1. Community and employee safety
     - Assess ongoing risk to local residents and take appropriate action
     - Public communication re: risk, claims
  2. Environmental mitigation and remediation
  3. Investigation
     - Identification and preservation of evidence
     - Analysis and application for future prevention
  4. Restoration of the railway

The Call-out Process

- When a train incident is confirmed by the train crew, CP's Network Management Centre (NMC) initiates a thorough call-out process:
  - First Responders – police, fire, ambulance are notified immediately
  - Product identification and emergency handling information is secured from the train crew, CP Customer Service and the shipper. This information is transmitted to on-scene responders
  - Staff, specialists, and executive – Operations, Engineering, Mechanical, Environmental Services, Safety & Regulatory Affairs, Claims and Community Relations are mobilized to the site, as required
  - Regulatory agencies, including Transport Canada, Transportation Safety Board,FRA,State, and Provincial authorities are provided with preliminary details to guide their mobilization decisions

The Call-out Process

- Shipper is notified. If commodity is Regulated Goods, the shipper or contractor will mobilize to site
- Depending on incident severity and type, CP's extensive network of pre-qualified and specialized contracted services are notified and mobilized to the site. Expertise includes:
  - Environmental containment and remediation (network-wide framework of responders)
  - Dangerous Goods Material containment
  - Air/water migration (plume prediction)

Community Safety & Communication

- CP Community Relations staff coordinate the flow of information between:

Internal Departments	Community Stakeholders
Environmental Affairs Claims CP Police Service Operations Train crew, mechanical, and engineering staff	Elected officials (Mayor) Municipal managers Emergency Response officials (communications & site control) Customer liaison Regulatory contact –TC, TSB, Federal, Provincial Authorities and elected officials representing local constituents

- In the event of an evacuation, Community Relations will support the coordination of residential/community needs with public information, housing, social and food services agencies

Environmental Considerations

- Assesses situations from early observations and manifest information
- Meet with internal & external responders and regulators & establish incident control processes
- Establish initial mitigation plan in consultation with regulators
- Once situation under control, develop long-term remediation plan in consultation with regulators

Investigation

- With any mode of transportation, accidents do happen, however:
  - CP does its best to build multiple barriers into its operations to reduce both severity and frequency of accidents.
  - CP has a comprehensive Train Accident Cause-Finding Program.
    - All front line managers are trained in this program to ensure ALL relevant evidence is gathered and analyzed to identify root causes.
    - CP also provides this training to Transport Canada, Transportation Safety Board,State, and Provincial regulators.

Investigation

- In the past two years, as a supplement to our cause-finding program, CP has implemented the Investigation of Safety-Related Occurrences Protocol (ISROP)
- The results of every investigation, along with identified corrective actions are logged into a database to identify trends or systemic issues and to track corrective actions
- Corrective action plans are implemented to prevent recurrence

Benefits of using ISROP:

- Assist investigators in preparing for an investigation
- Standardize investigative procedures
- Improve the quality and type of data collected
- Improve analysis of the data
- Improve understanding of contributing factors
- Develop and implement more effective corrective actions to create a safer workplace

ISROP is used when there are:

- Any fatalities of, or serious injuries to, members of the community or employees
- Significant damage to company and/or private property
- Serious damage to the environment

Debriefing & Follow Up Communication

- All incidents are "debriefed" among CP personnel and regulators
- If serious incidents occur with impact to the community, CP participates in debriefings with community representatives, local leaders and first responders
- Debriefing involves communication of evidence found (to date), analysis conducted re: response processes and lessons applied to ongoing operations

Conclusion

CP is:

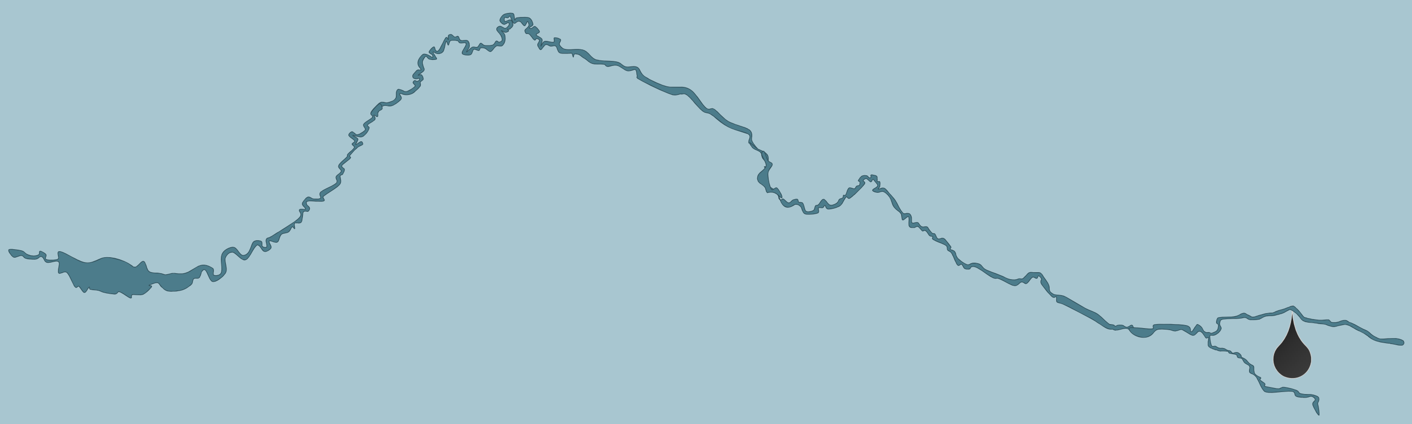
- Important to local and national economies
- Among the safest railways in North America
- Highly regulated
- Well prepared for any form of emergency
- Dedicated to working proactively with communities
- Committed to investigating all incidents to enhance preventive approach

RESPONSE TECHNOLOGIES FOR OIL SANDS PRODUCTS

ENBRIDGE OIL SPILL CASE STUDY

KALAMAZOO RIVER, MICHIGAN

December 4, 2012

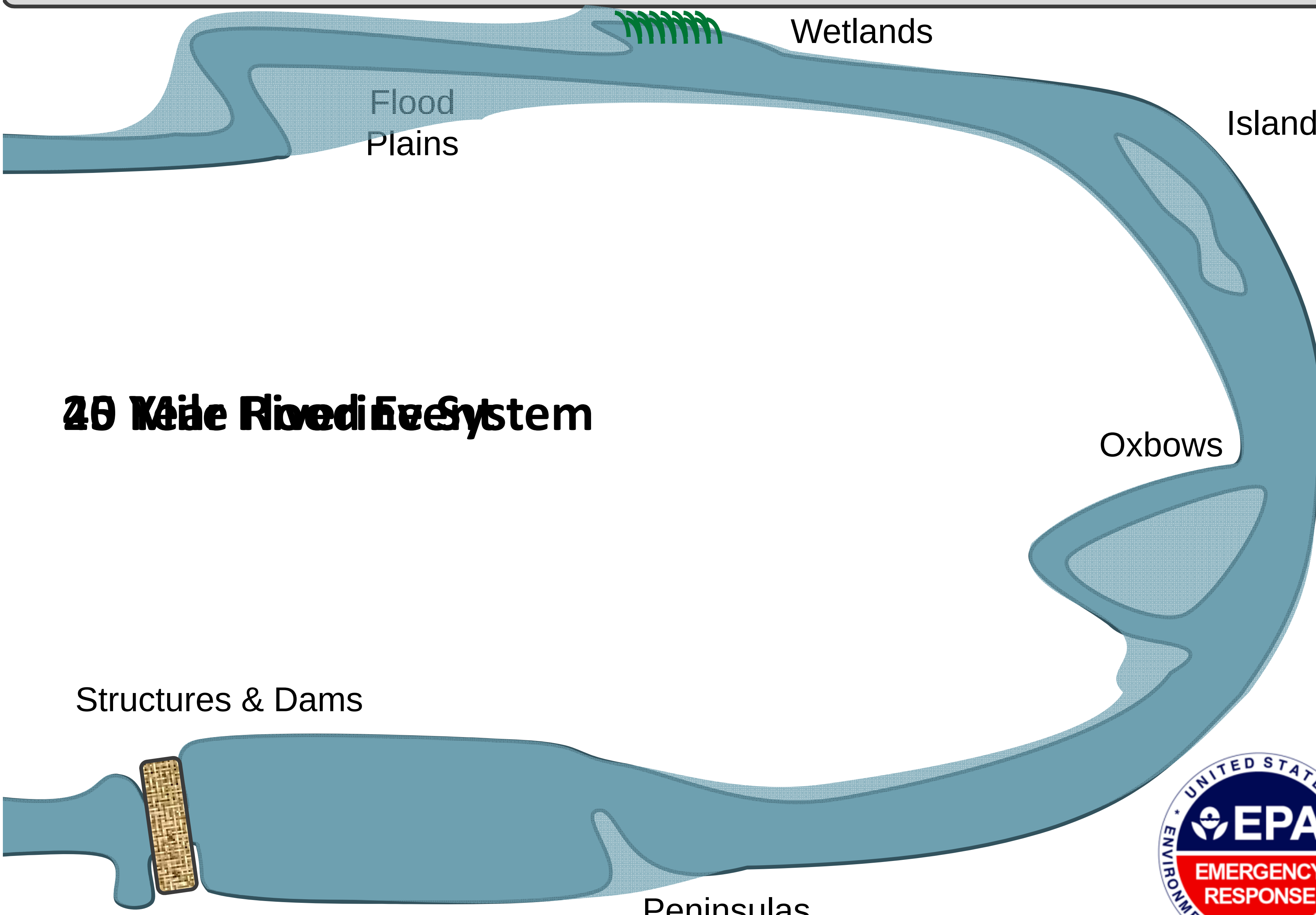


What Happened?

Day 1: July 26, 2010

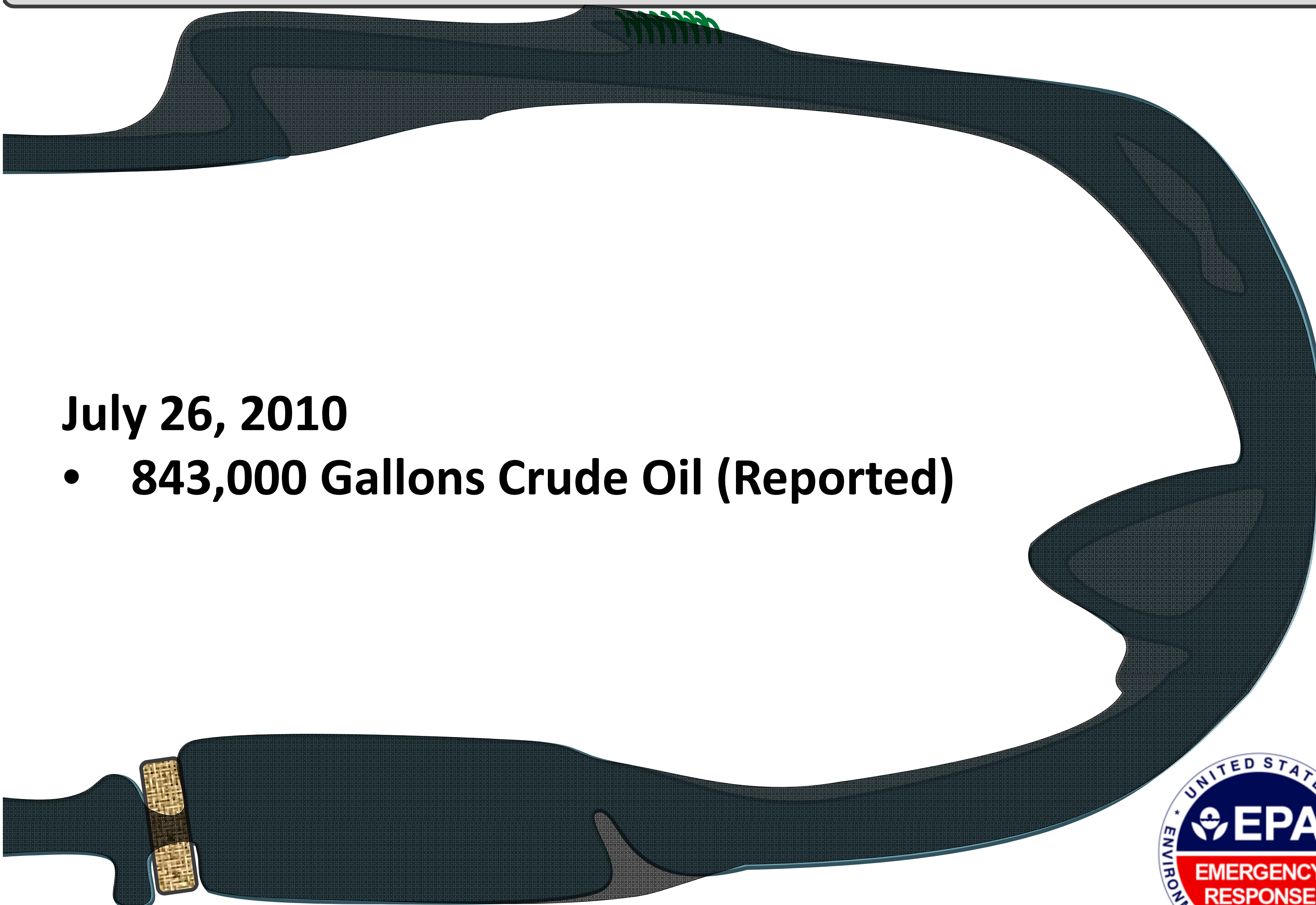
Oil Spill Conceptual Model

River Characteristics



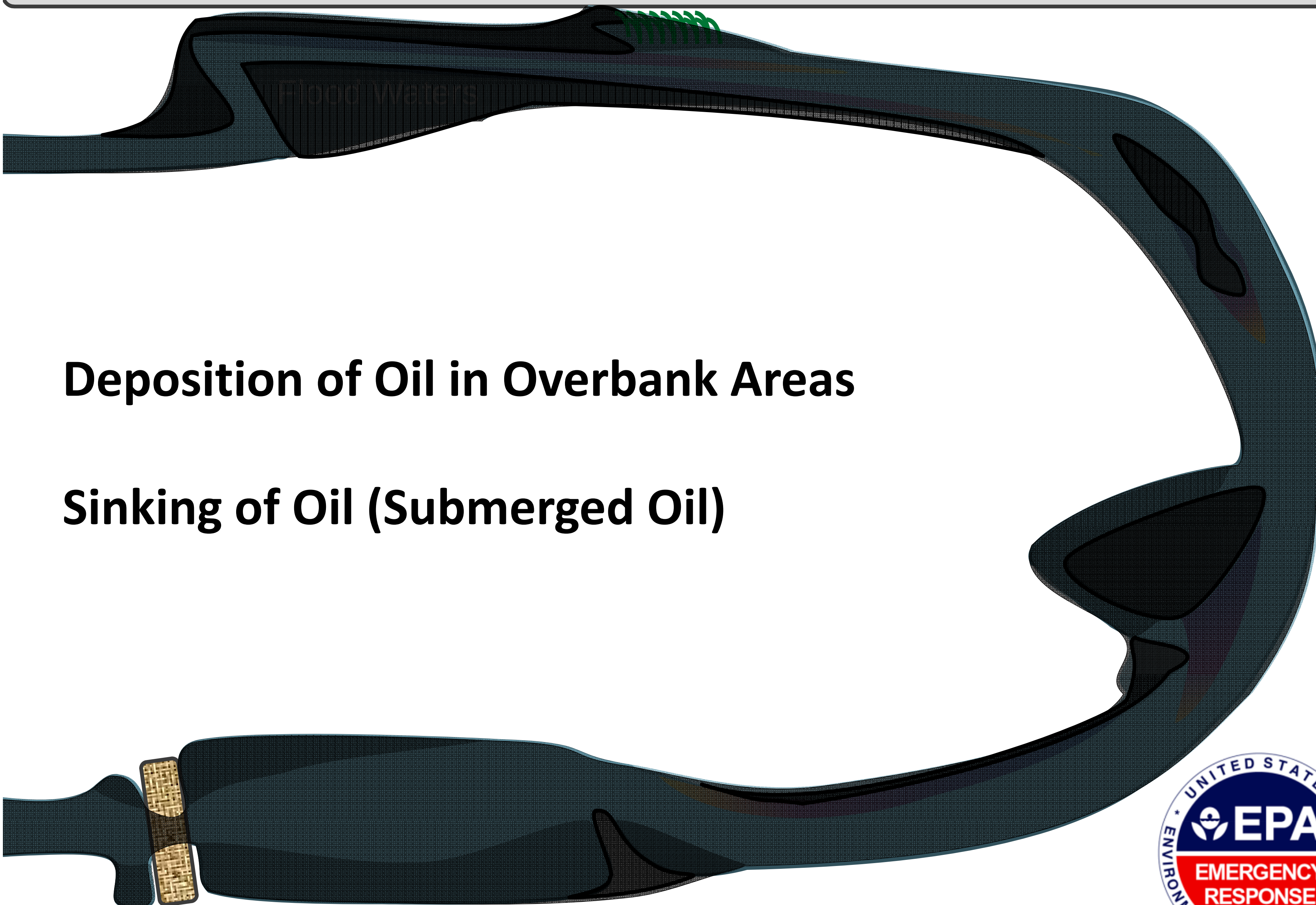
EMERGENCY RESPONSE

Oil Spill Conceptual Model Initial Release



July 26, 2010

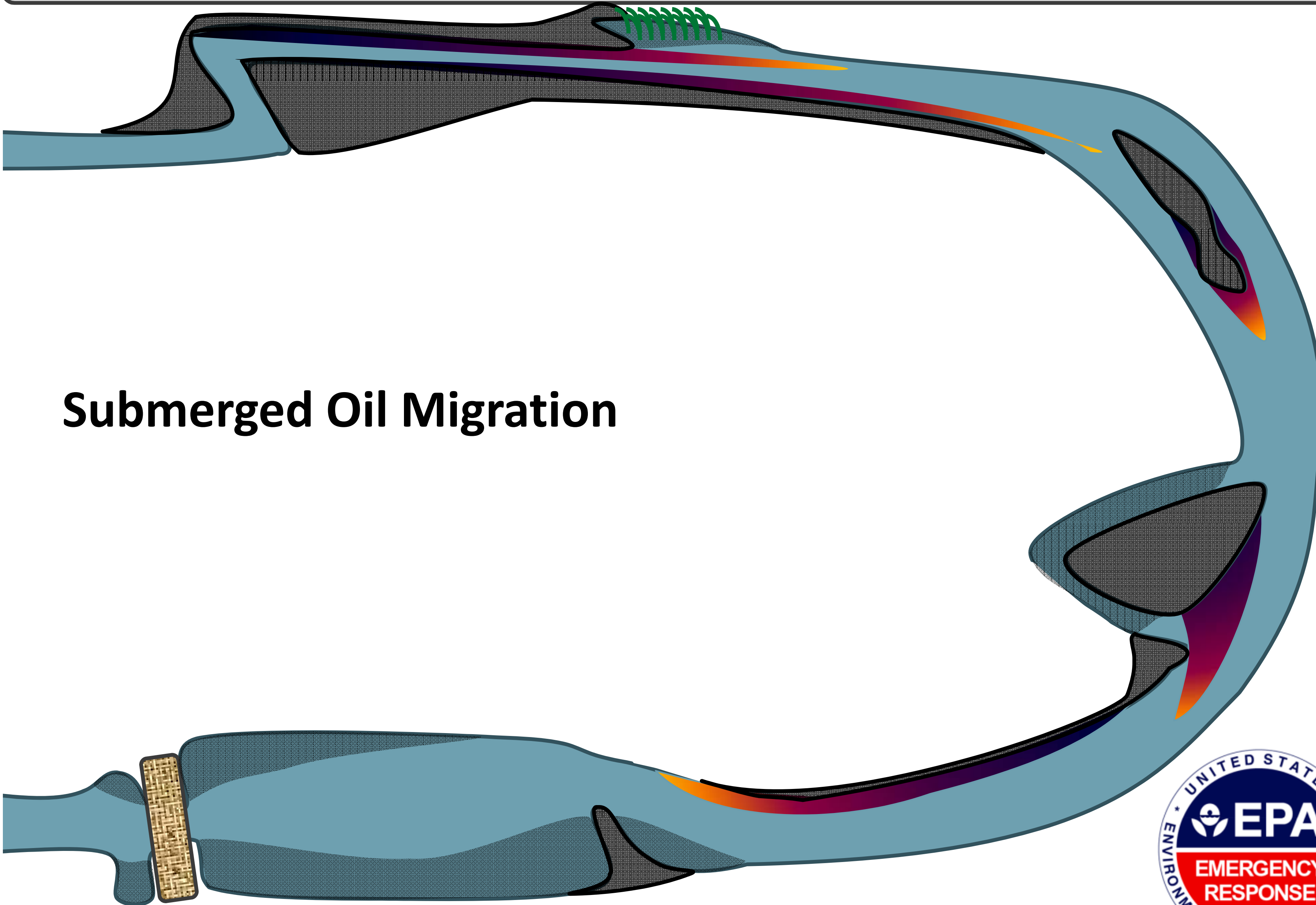
- **843,000 Gallons Crude Oil (Reported)**



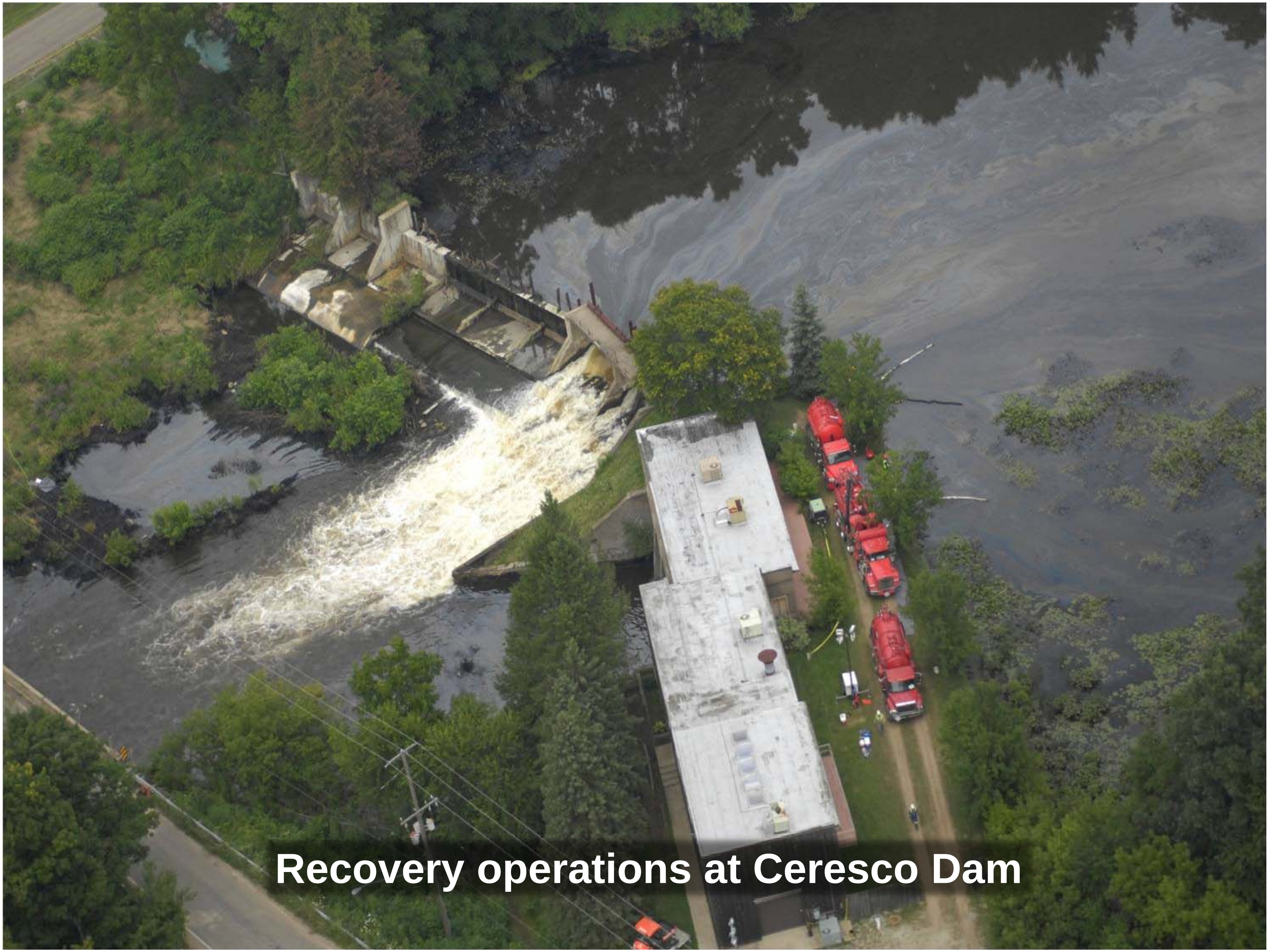
Deposition of Oil in Overbank Areas

Sinking of Oil (Submerged Oil)

Oil Spill Conceptual Model Submerged Oil Migration



Submerged Oil Migration



Recovery operations at Ceresco Dam

AIR MONITORING AND SAMPLING

Public Health: Benzene

- Enbridge Line 6B Oil – Tar Sands Crude with Diluent additive
- Diluent containing benzene @ 30% additive to Line 6B Crude Oil
- Public Health concern for residents and workers during first 30 days
- Thousands of air monitoring readings collected
- Hundreds of air samples collected
- Voluntary evacuation at 60 residences

AIR MONITORING AND SAMPLING

Public Health: Benzene

- Air monitoring conducted using:
  - MultiRAEs
  - Benzene UltraRAEs
  - AreaRAEs
  - Draeger tubes
  - HAPSites

- Air Sampling conducted using:
  - Summa Canisters
  - Tedlar Bags – Mobile Lab

- Evacuation and Re-entry Decision Trees Established

- Benzene – main public health driver

- Evacuation Action Level – 200 ppbv benzene when monitoring
  60 ppbv benzene when sampling

- Reoccupation Action Level – 6 ppbv benzene – sampling

60 ppb is based on a 10-fold adjustment of the ATSDR intermediate MRL (6 ppb).

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
EPA
EMERGENCY RESPONSE

Overbank Assessment

Evolution: SCAT

2010 **2011** **2012**

SPILL → **SCAT**

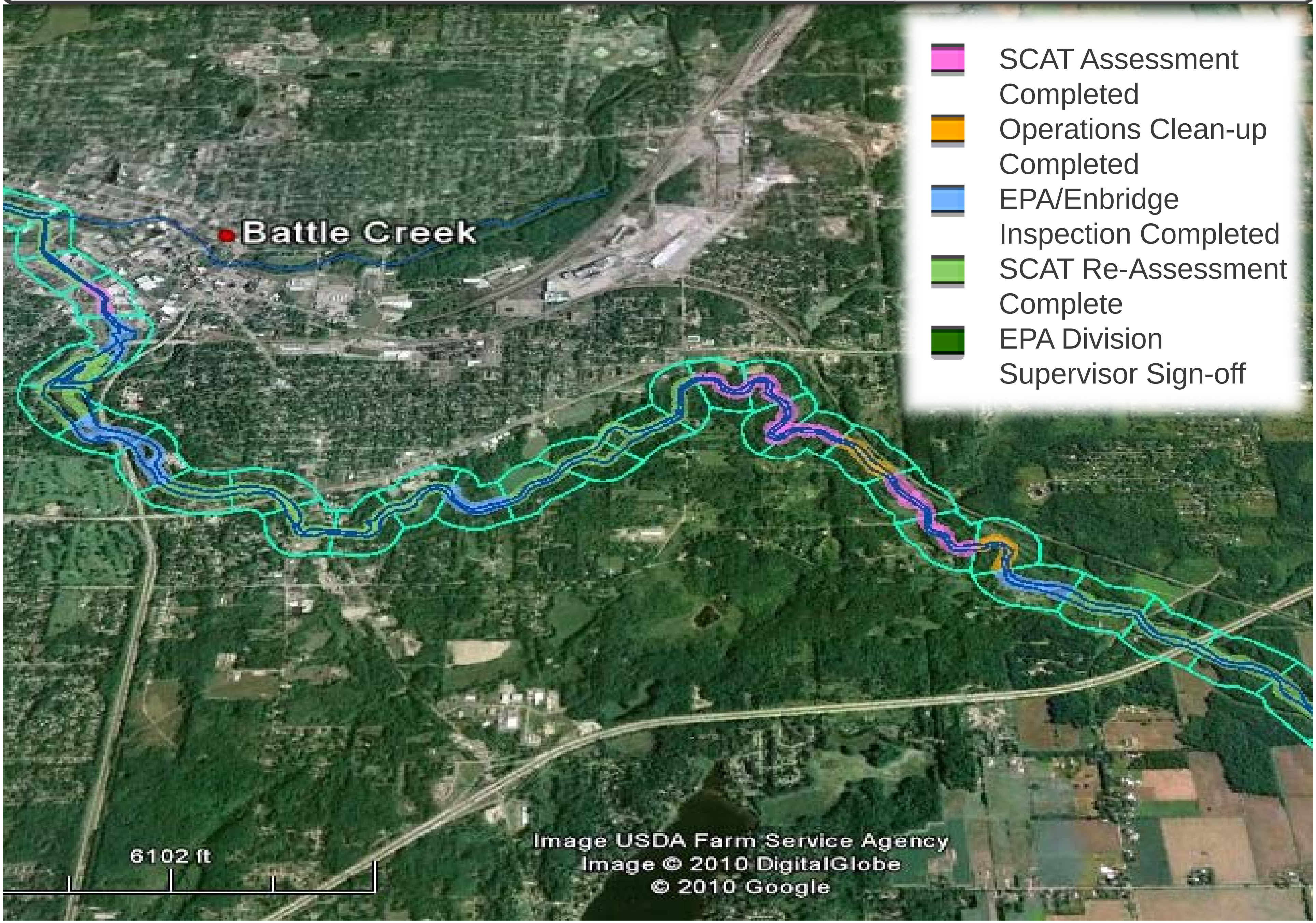
Shoreline
Cleanup
Assessment
Technique

A systematic approach that uses standard terminology to collect data on shoreline oiling conditions and supports decision-making for shoreline cleanup

- NOAA/USCG assessment technique adapted for a riverine system
- 5 Phases
  1. SCAT Assessment
  2. Operations Clean-up
  3. EPA/Enbridge Inspection
  4. SCAT Re-Assessment
  5. EPA Division Supervision Sign-off

Rapid Assessment of **Entire Valley**, with Specific Emergency Cleanup Recommendations

SCAT Progress Tracking



SCAT Progress Tracking

Division C

Group	MP	Shoreline Clean-Up Completed	Overbank Areas Clean-Up Completed	Comments / Forecast Dates
Group 1 (4.00 mi)	2.25			
	2.50			
	2.75			
	3.00			
	3.25			Alpha Island SOTF
	3.50			
	3.75			
	4.00			
	4.25			SOTF, Echo Island Safety Restricted
	4.50			
	4.75			
	5.00			
	5.25			
	5.50			
	5.75			
	6.00			
Group 2 (3.75 mi)	6.25			
	6.50			
	6.75			
	7.00			
	7.25			
	7.50			
	7.75			
	8.00			
	8.25	90%		Island Safety Restricted
	8.50			
	8.75			
	9.00			
	9.25			
	9.50			
	9.75			
Group 3 (2.25 mi)	10.00			
	10.25			
	10.50	100%		SCAT Pt. EPS038 remains
	10.75	100%		OB not complete
	11.00			
	11.25	100%		SCAT Pt. EPA053 remains, OB not complete
	11.50	100%		
	11.75	100%		OB not complete
	12.00	100%		OB not complete
Group 4 (5.25 mi)	12.25			
	12.50			
	12.75			
	13.00			
	13.25			
	13.50			
	13.75			
	14.00			
	14.25			
	14.50			
	14.75			
	15.00			
	15.25			
	15.50			
	15.75			
	16.00	100%		
	16.25			
	16.50			
	16.75			
	17.00			
	17.25			

Submitted for EPA Division Supervisor Sign-off

SCAT Process	Percent Complete	9/17	9/16	9/15	9/14	9/13	9/12	9/11	9/10	9/9	9/8	9/7	9/6	9/5	9/4	9/3	9/2	9/1	8/31	8/30	Total at Completion
		Cumulative Sections Completed																			
SCAT Assessment Completed (Step 1)	100%	61	61	61	61	61	61	61	61	61	61	61	61	61	61	60	47	47	39	31	61
Operations Clean-Up Completed (Step 2)	87%	53	53	52	41	35	33	23	20	19	19	16	11	24	21	22	20	20	19	19	61
Enbridge/EPA Inspection Completed (Step 3)	84%	51	46	41	32	24	22	21	19	16	11	11	11	8	8	9	6	6	6	6	61
SCAT Re-Assessment Completed (Step 4)	72%	44	34	31	24	20	17	17	13	11	11	10	6	4	4	3	2	2	2	2	61
EPA Division Supervisor Sign-Off (Step 5)	2%	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	61

***SCAT Initial Assessment**

- * 0 - 1/4 sections remaining

*** Operations Clean-up**

- * 8 - 1/4 sections remaining

***Enbridge/EPA Inspection**

- * 10 - 1/4 sections remaining

***SCAT Re-assessment**

- * Deadline - September 22
- * 17 - 1/4 sections remaining
- * 4 Must complete daily

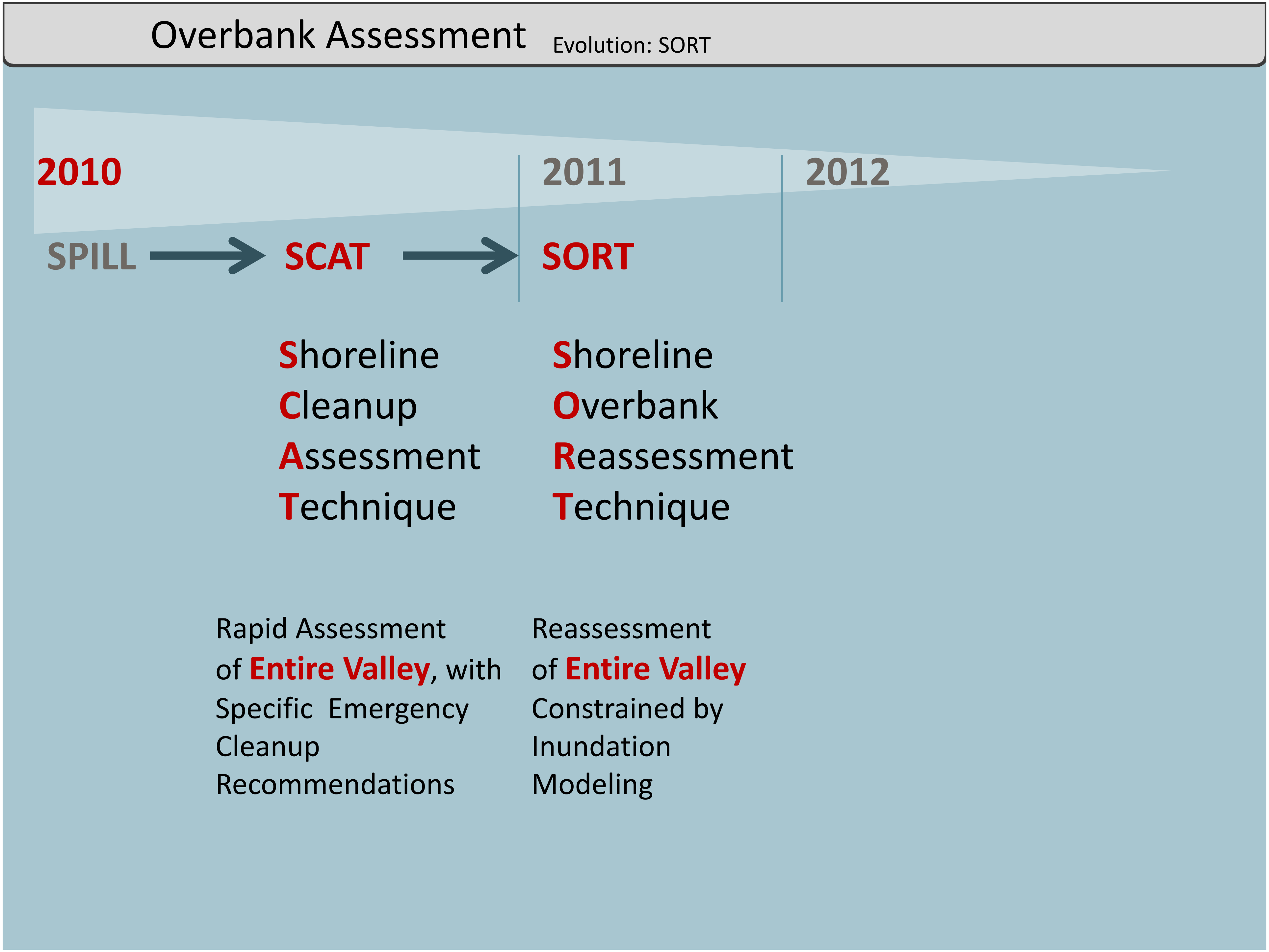
Then What?
Day 40 through Day 607

Overbank Work

Submerged Oil Work

Removal and disposal of 186,000 yd^3 of impacted soil and debris

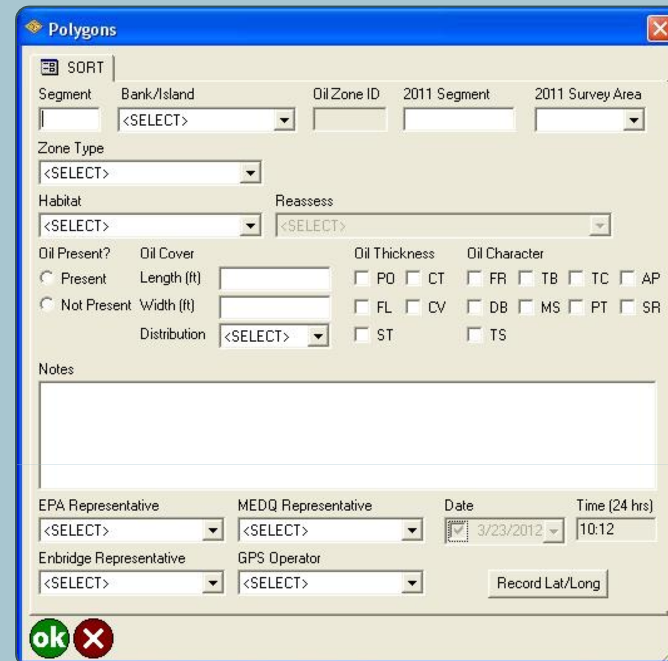

Talmadge Creek



Overbank Assessment
Evolution: SORT
2010
2011
2012
SPILL
SCAT
SORT
Shoreline
Cleanup
Assessment
Technique
Shoreline
Overbank
Reassessment
Technique
Rapid Assessment of Entire Valley, with Specific Emergency Cleanup Recommendations
Reassessment of Entire Valley Constrained by Inundation Modeling

SORT Basic Information Captured By SORT

1. In what habitat does the oil reside?
2. How much oil is there?
   - Thickness and %Cover
3. What is the condition of the oil?



SORT Classification Field Guide

Shoreline/Overbank

Emergent Herbaceous

Scrub-Shrub

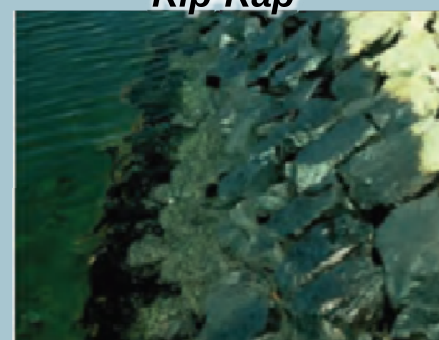
Swamp

Lawn/Maintained Land

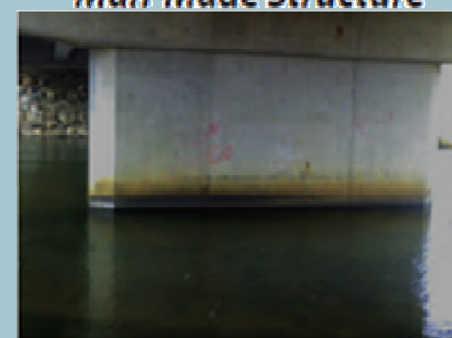
Low Vegetated Bank

Sand and Gravel Banks

Rip-Rap



Man-Made Structure

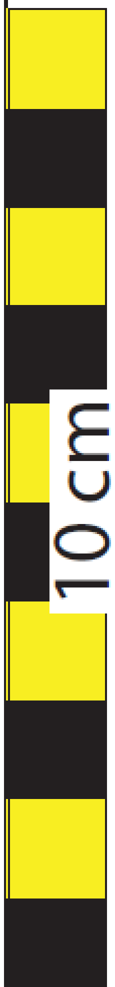


Habitats:

1. Emergent Herbaceous Wetland
2. Scrub Shrub (woody veg<20’ tall)
3. Swamp (woody veg > 20’ tall)
4. Lawn/Maintained Land (parks, residential lawns, pastures, ect.)
5. Low Vegetated Bank (dipping or flat river banks with roots, grasses, ect.)
6. Sand and Gravel Banks
7. Rip-Rap
8. Man-Made Structures (bridges, dams, ect)

SORT Classification Field Guide

Shoreline/Overbank — Emergent Herbaceous — Scrub-Shrub — Swamp — Lawn/Maintained Land



Oil Distribution

C	Continuous	91 - 100%
B	Broken	51 - 90%
P	Patchy	11 - 50%
S	Sporadic	1 - 10%
T	Trace	<1%

Extra Guidelines:

When mapping oil coats and covers on rooted vegetation (Stems, Tree Trunks in Emergent Herbaceous, Scrub-Shrub, Swamp) use "TAR" for oil type. An additional descriptor, TS-trunks and stems, should be checked as well.

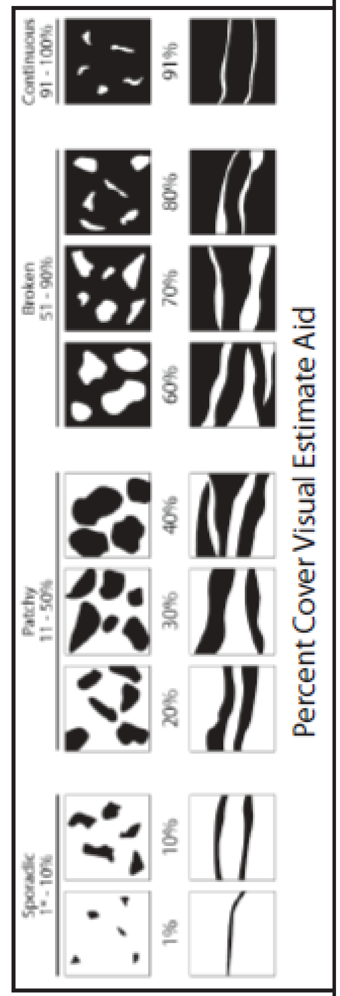
Tar balls and Patties must have a thickness of "CV-Cover" recorded

Surface Oiling Descriptors - Thickness

PO	Pooled Oil (fresh oil or mousse > 1 cm thick)
CV	Cover (oil or mousse from >0.1 cm to <1 cm on any surface)
CT	Coat (visible oil <0.1 cm, which can be scraped off with fingernail)
ST	Stain (visible oil, which cannot be scraped off with fingernail)
FL	Film (transparent or iridescent sheen, or oily film)

Surface Oiling Descriptors - Type

FR	Fresh Oil (unweathered, liquid oil)
MS	Mousse (emulsified oil occurring over broad areas)
TB	Tarballs (discrete accumulations of oil <10 cm in diameter)
PT	Patties (discrete accumulations of oil >10 cm in diameter)
TC	Tar (highly weathered oil, of tarry, nearly solid consistency)
SR	Surface Oil Residue (non-cohesive, heavily oiled surface sediments, characterized as soft, incipient asphalt pavements)
AP	Asphalt Pavement (cohesive, heavily oiled surface sediments)
NO	No Oil
DB	Debris: logs, vegetation, rubbish, garbage, and response items such as booms
TS	Trunks and Stems



6. Sand and Gravel Banks
7. Rip-Rap
8. Man-Made Structures (bridges, dams, ect)

MP 5.92 Excavation

Overbank Assessment

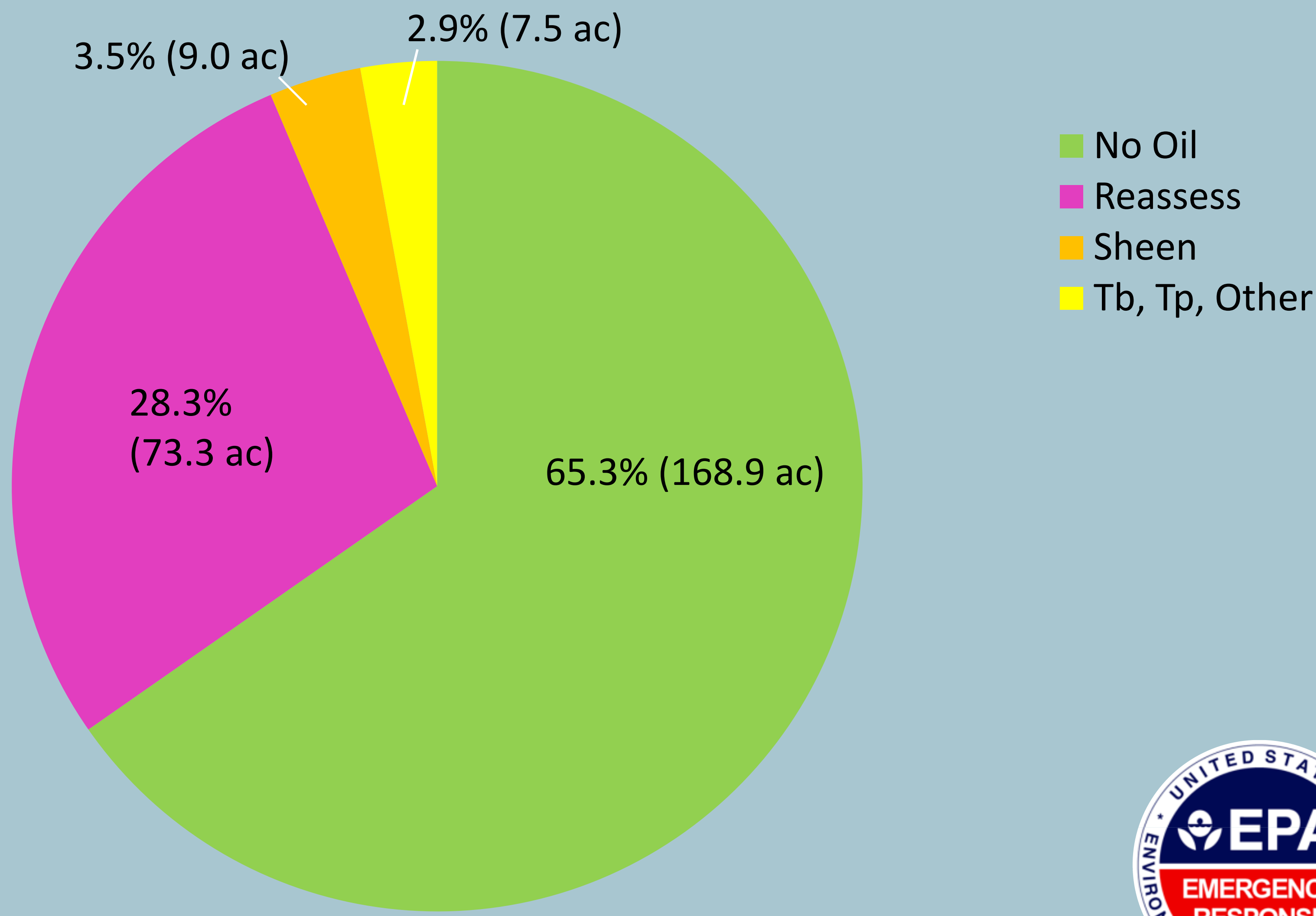
Evolution: ReSORT

2010		2011	2012
SPILL →	SCAT →	SORT →	ReSORT (SORT2012)
	Shoreline Cleanup Assessment Technique	Shoreline Overbank Reassessment Technique	Revisiting SORT
	Rapid Assessment of **Entire Valley**, with Specific Emergency Cleanup Recommendations	Reassessment of **Entire Valley** Constrained by Inundation Modeling	Revisiting **Specific Areas** based on Previous Two efforts

ReSORT

- Target Based Approach (426 target areas)
  - Areas of excavation
  - Areas that were covered with water during SORT
  - Areas where Film, or Sheen were noted in SORT
- Consensus in the Field:
  - No more “When In Doubt Map it out”
- Established Sheen Testing Protocol
- Goal: Two Intense Weeks

ReSORT Results and Observations



EPA EMERGENCY RESPONSE
UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

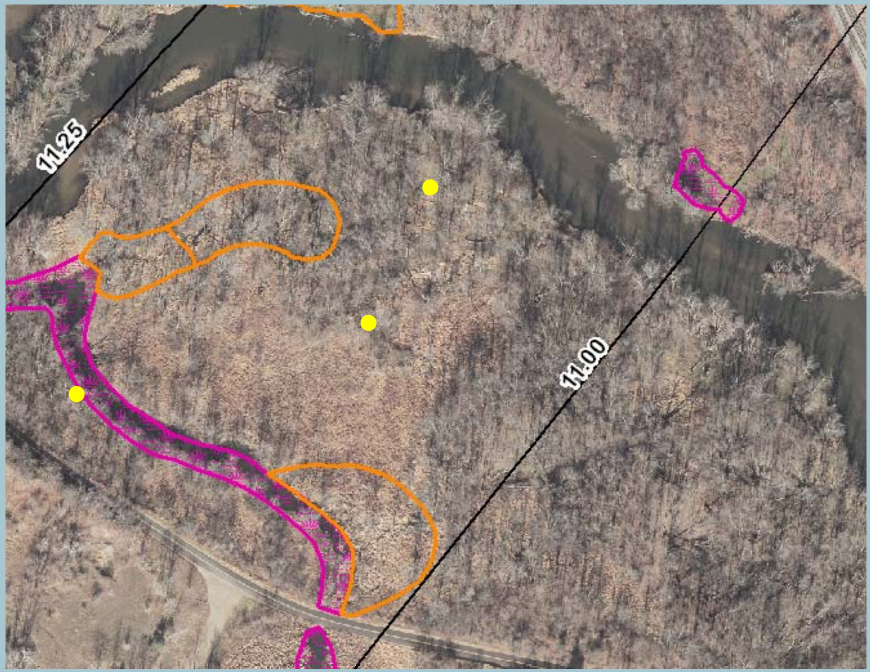
ReSORT Target Areas

426 target sites: 258.78 acres to be surveyed

ReSORT Results and Observations

2011 SORT

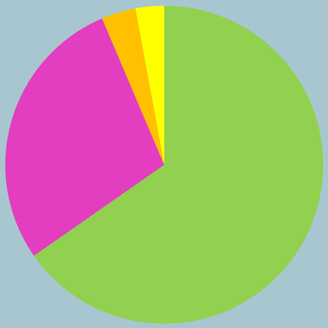
2012 ReSORT



Sheen Observed

Tb, Tp, Other Observed

Reassess

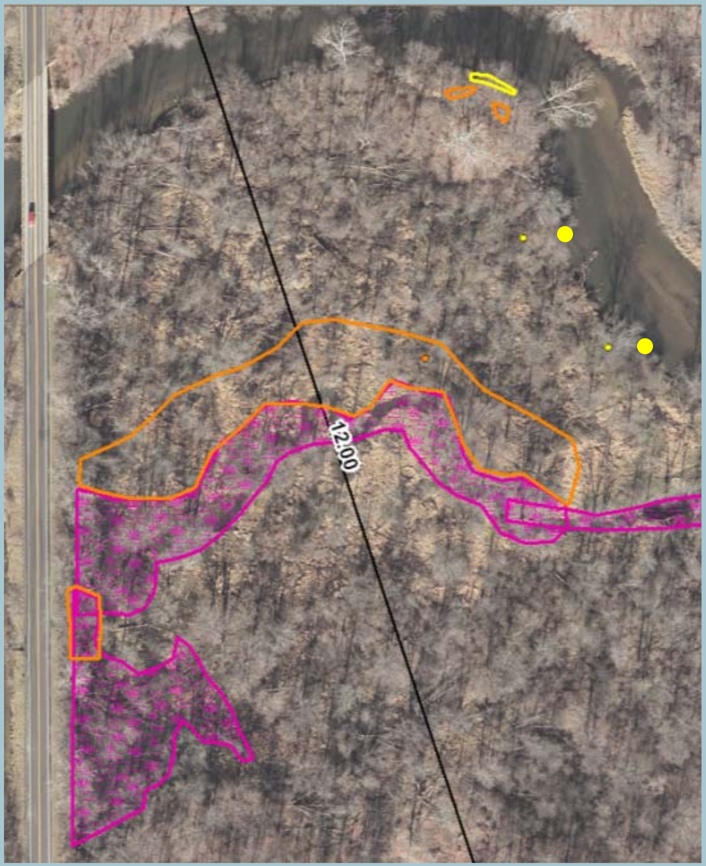


EMERGENCY RESPONSE

ReSORT Results and Observations

2011 SORT

2012 ReSORT



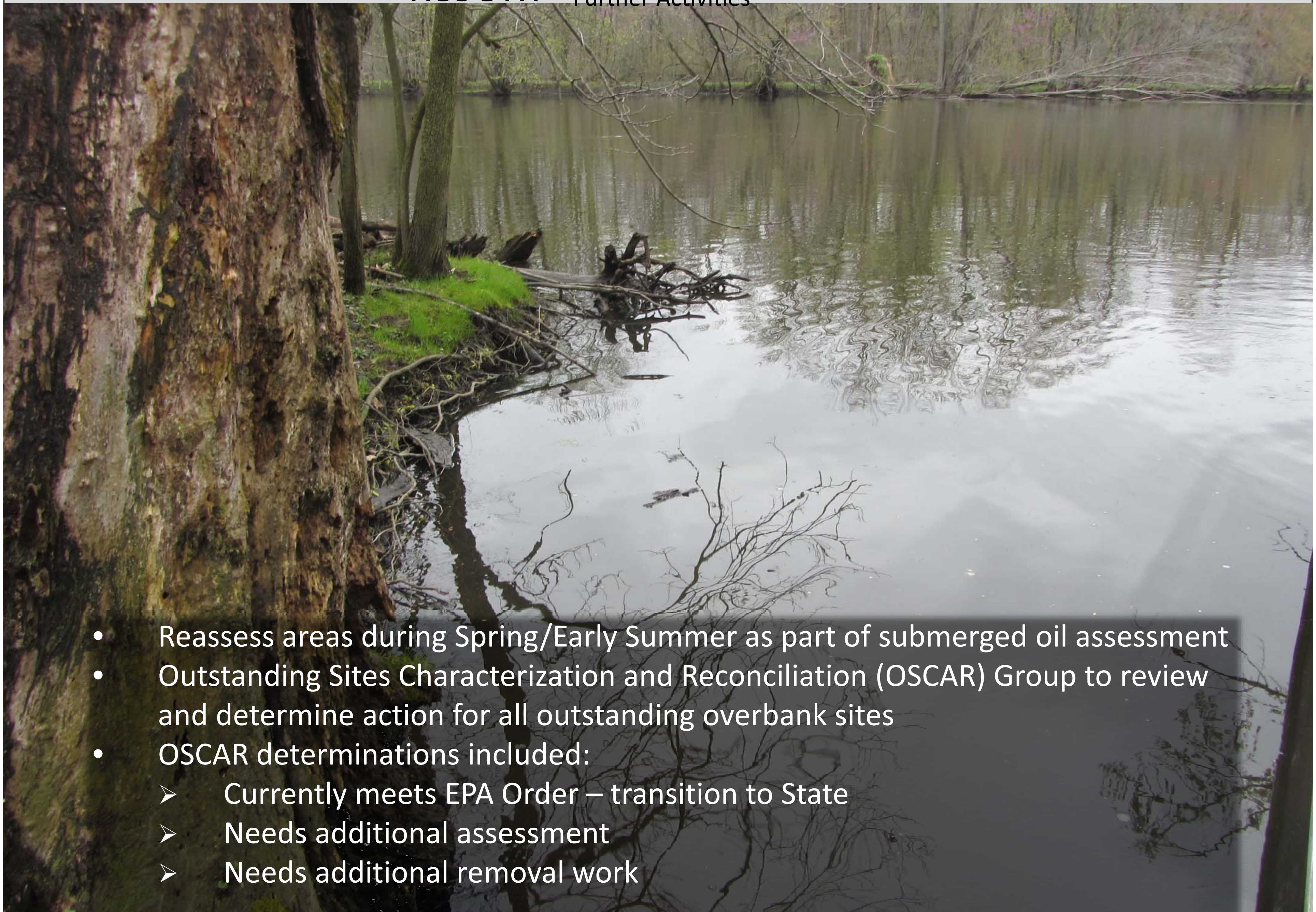
Sheen Observed

Tb, Tp, Other Observed

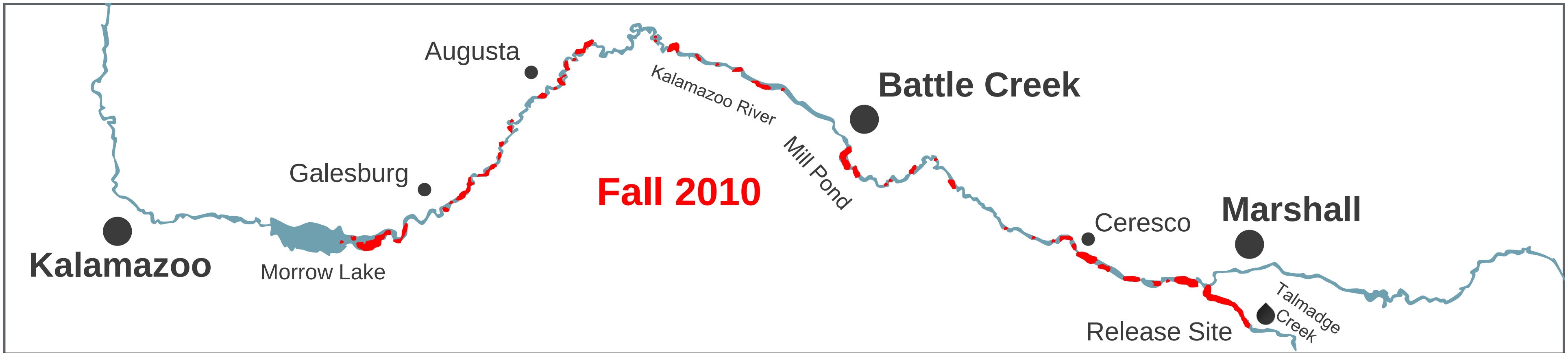
Reassess

ReSORT Results and Observations

ReSORT Further Activities



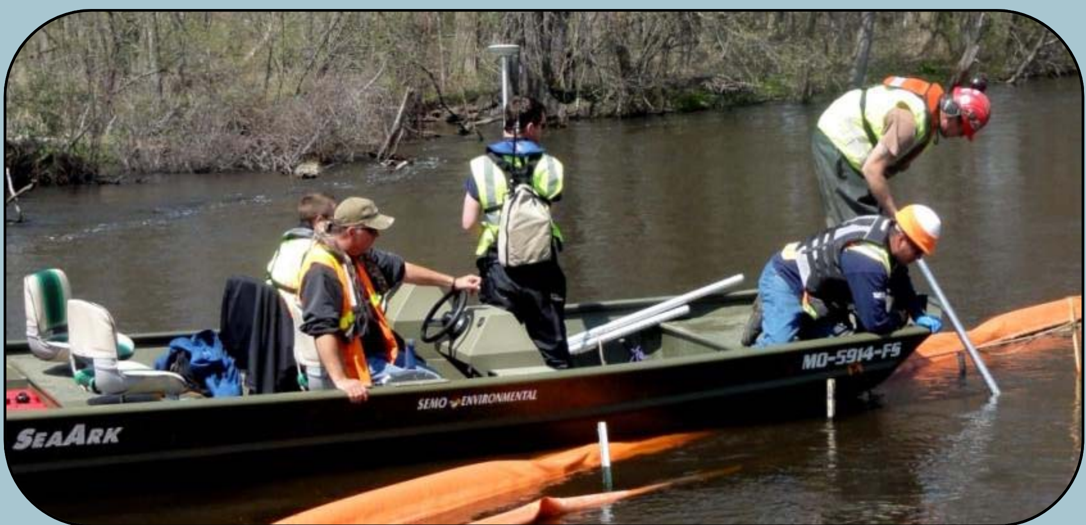
- Reassess areas during Spring/Early Summer as part of submerged oil assessment
- Outstanding Sites Characterization and Reconciliation (OSCAR) Group to review and determine action for all outstanding overbank sites
- OSCAR determinations included:
  - Currently meets EPA Order – transition to State
  - Needs additional assessment
  - Needs additional removal work

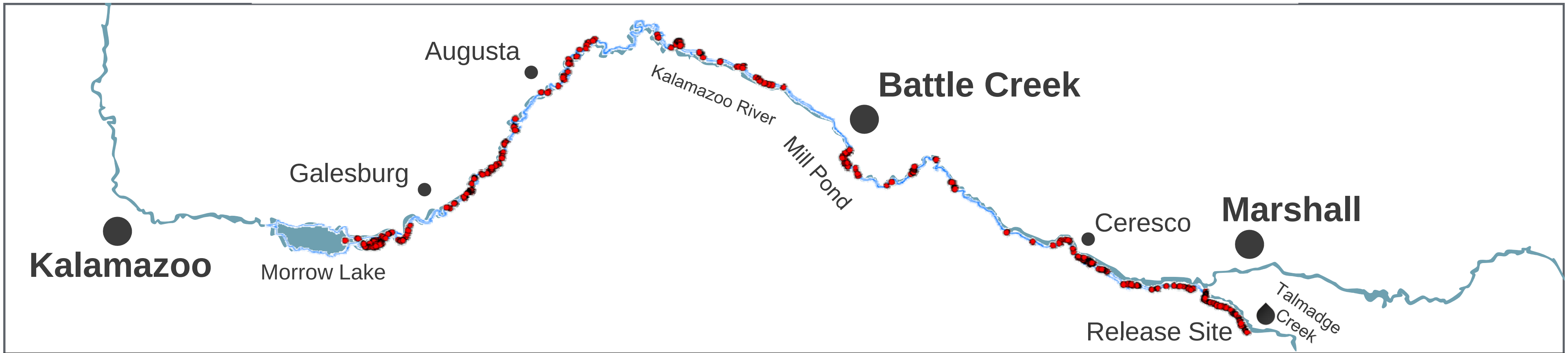


Submerged Oil Assessment

Identification of Oil

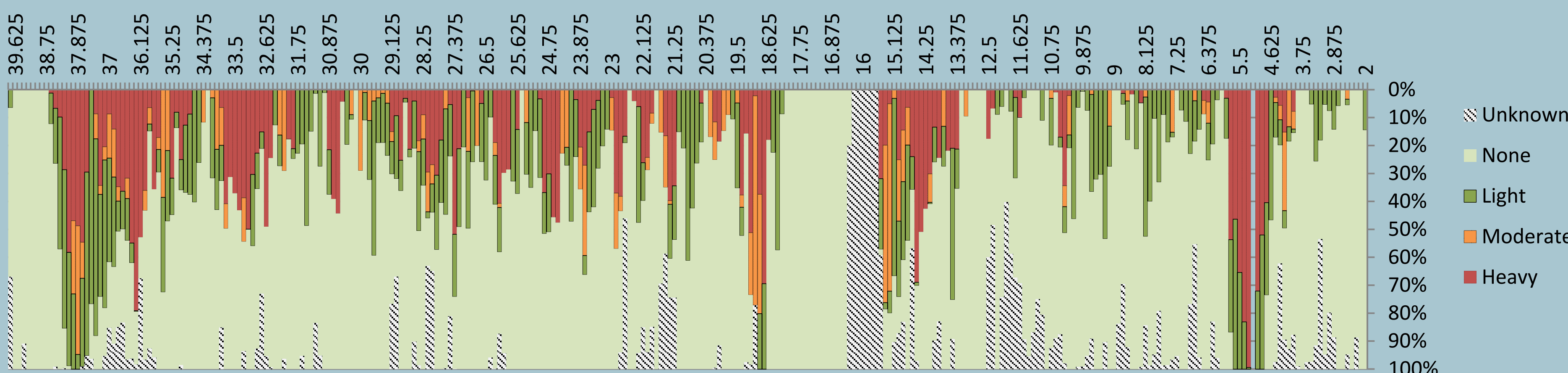
- Poling (3,500+ points)
- Coring (500+ cores)
- 18 priority areas identified



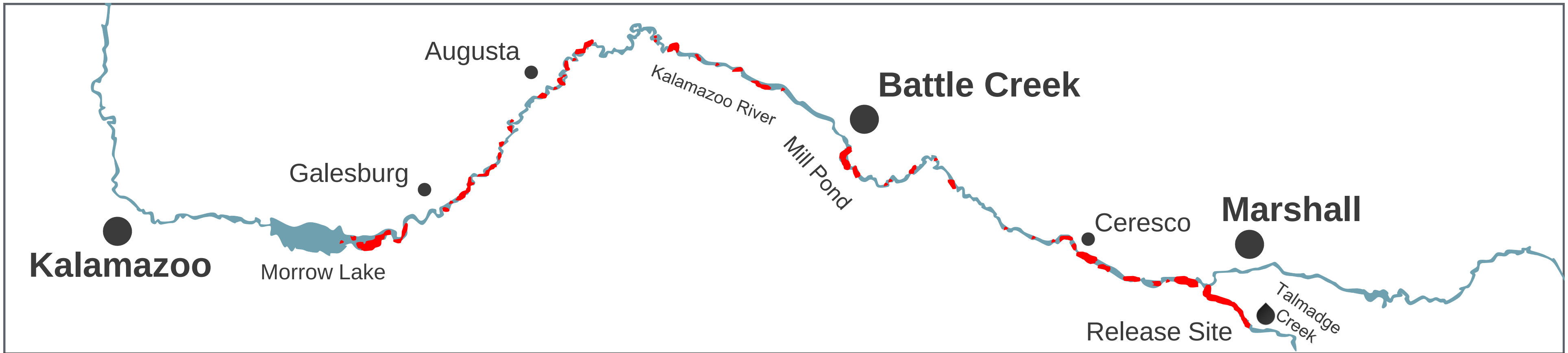


Summary of Work 2011

Submerged Oil – Distribution by Area

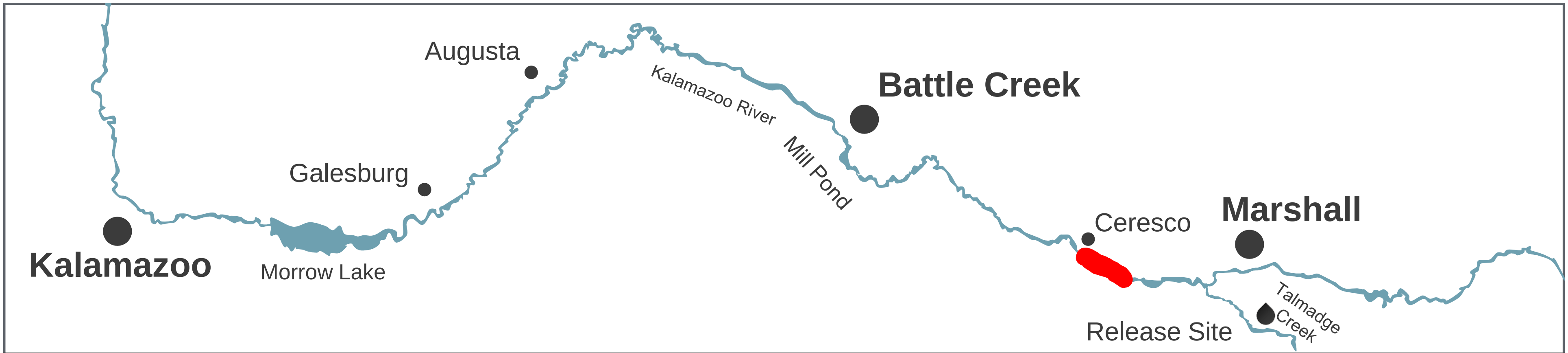


Spring 2011



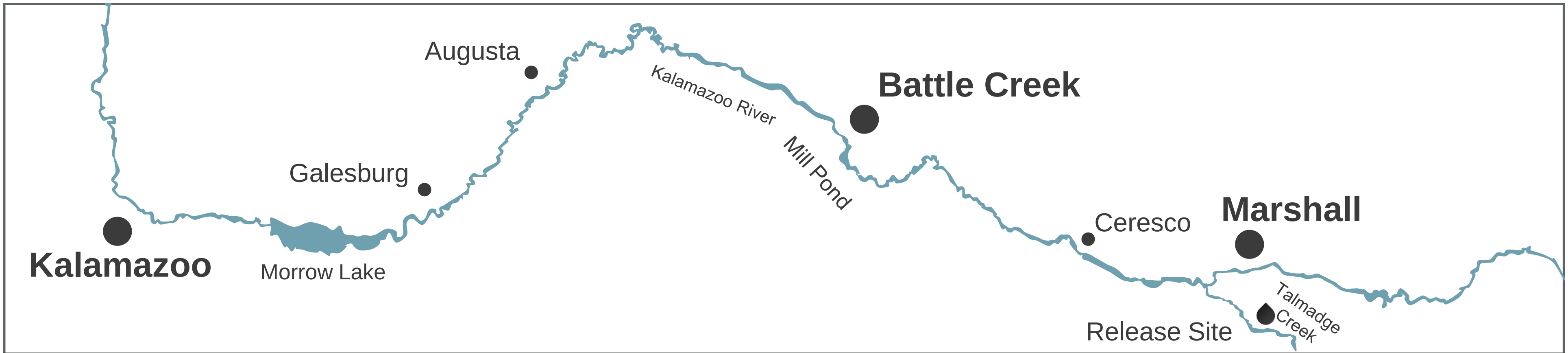
Submerged Oil

2011 Recovery Techniques



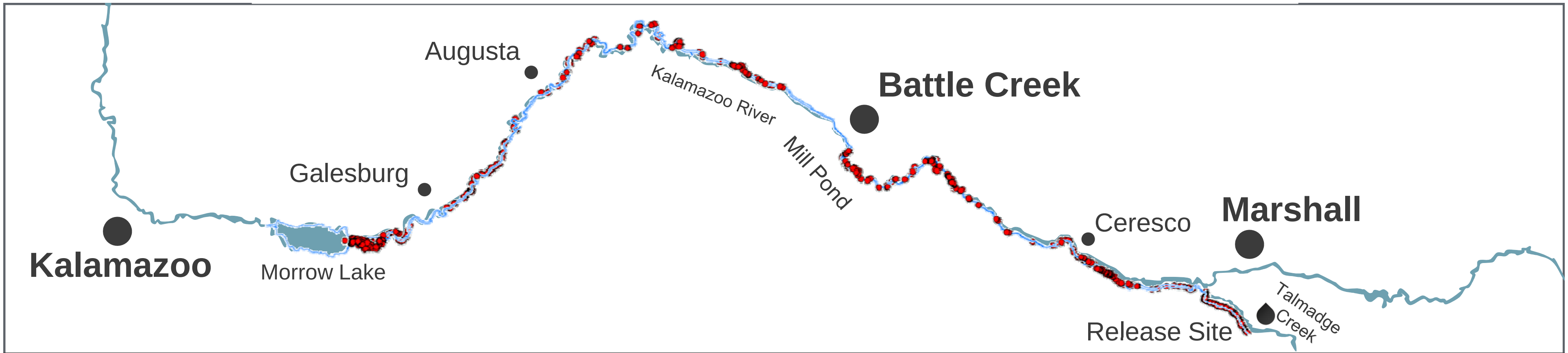
Submerged Oil

Ceresco Recovery



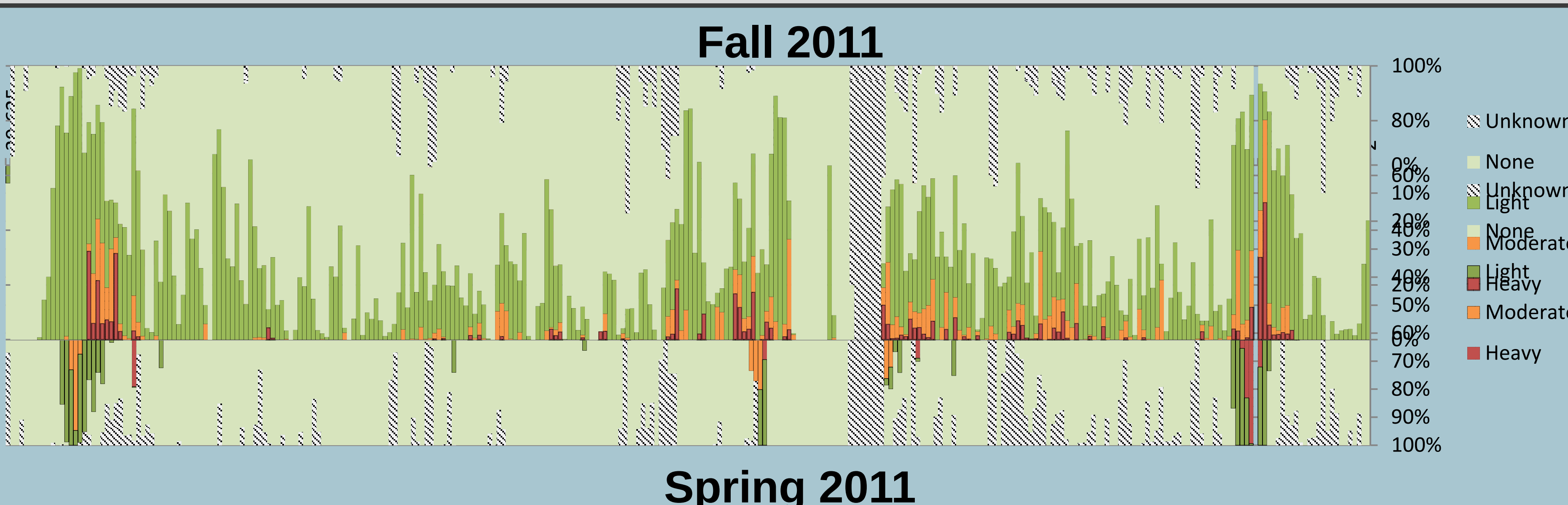
Submerged Oil

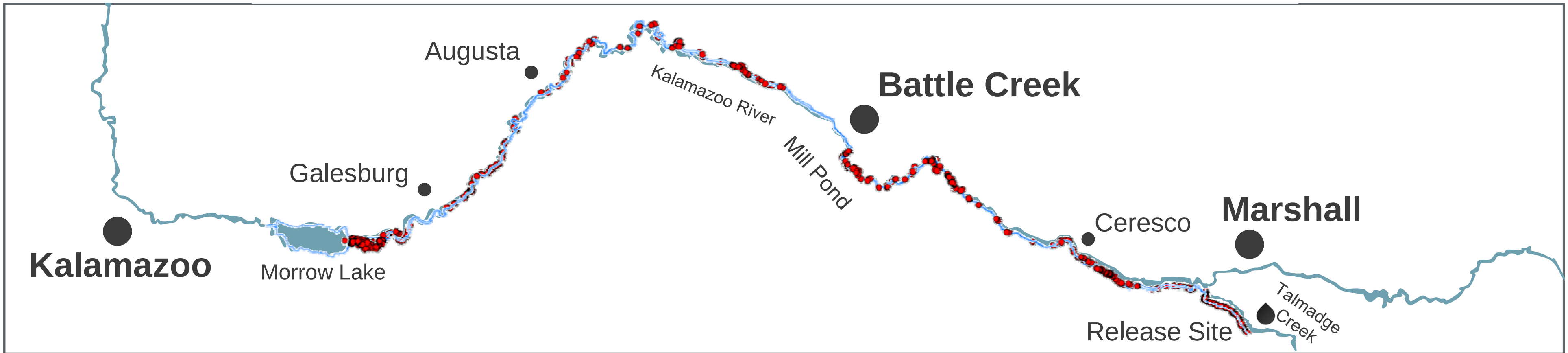
Morrow Lake Recovery



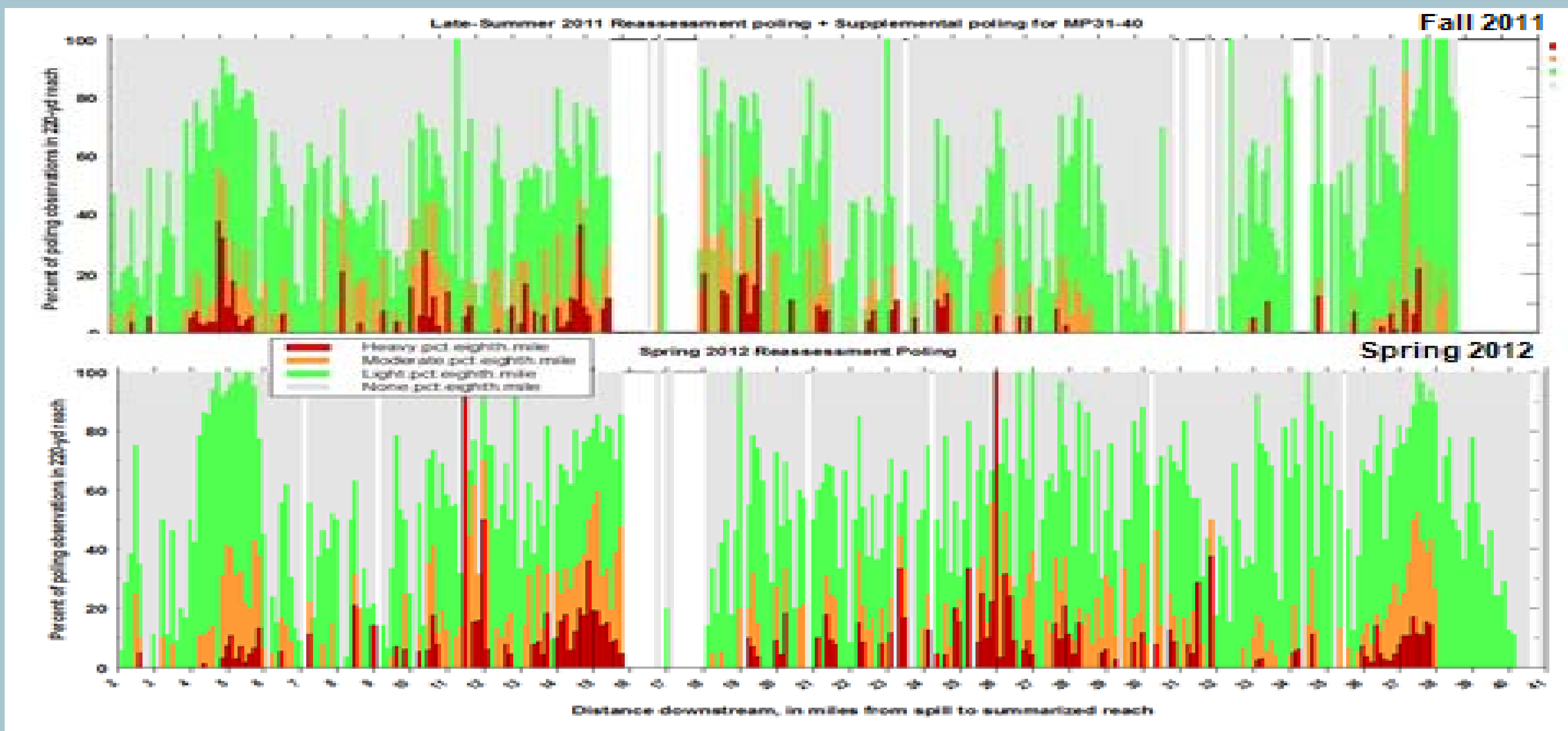
Summary of Work 2011

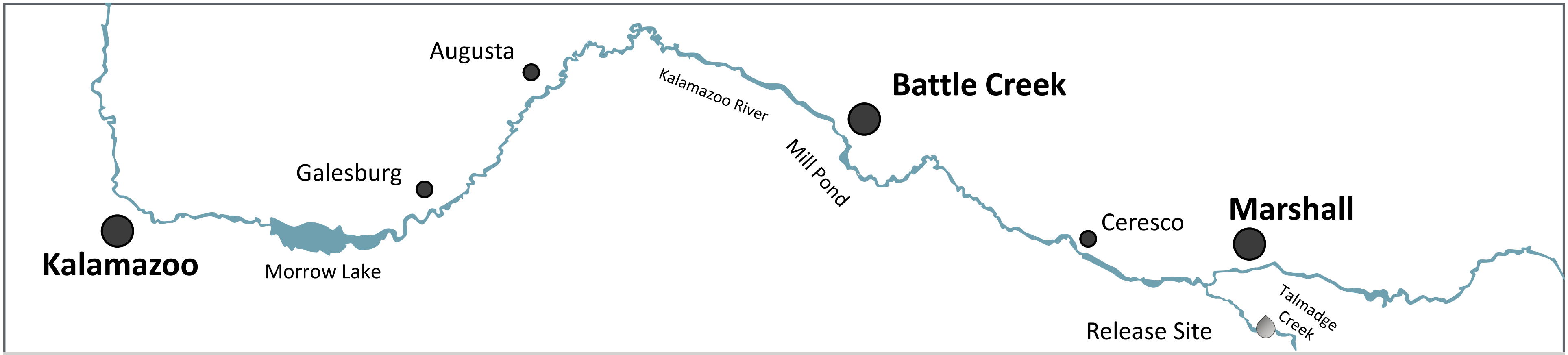
Submerged Oil – Distribution by Area





Summary of Work 2011 Submerged Oil – Distribution by Area

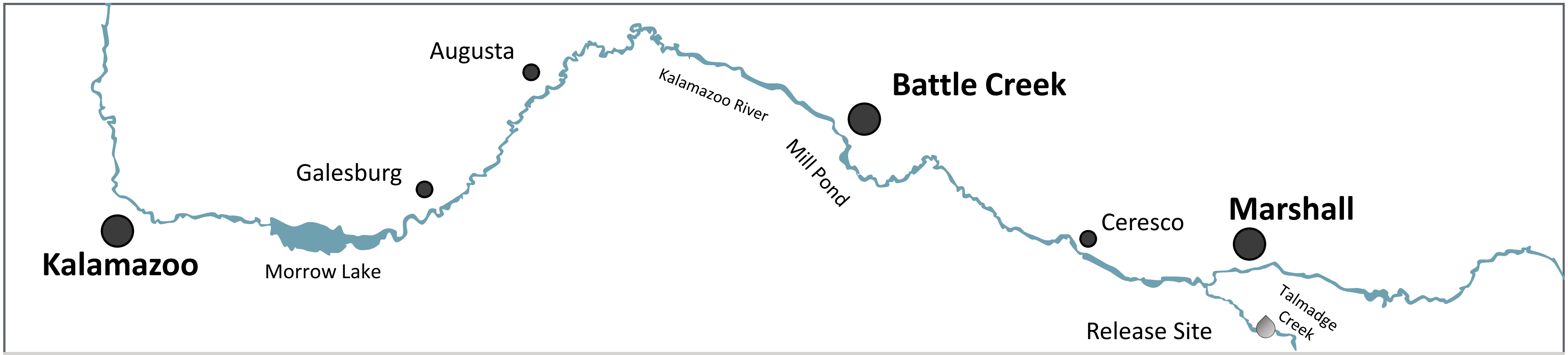




Conducted Scientific Studies during 2012

- Net Environmental Benefit Analysis (NEBA)
- Submerged Oil Quantification Study
- UV-Epifluorescence Microscopy Study
- Biodegradation Study
  - This study was commissioned by the FOSC through the U.S. EPA Environmental Response Team (ERT) and led by Mark Sprenger

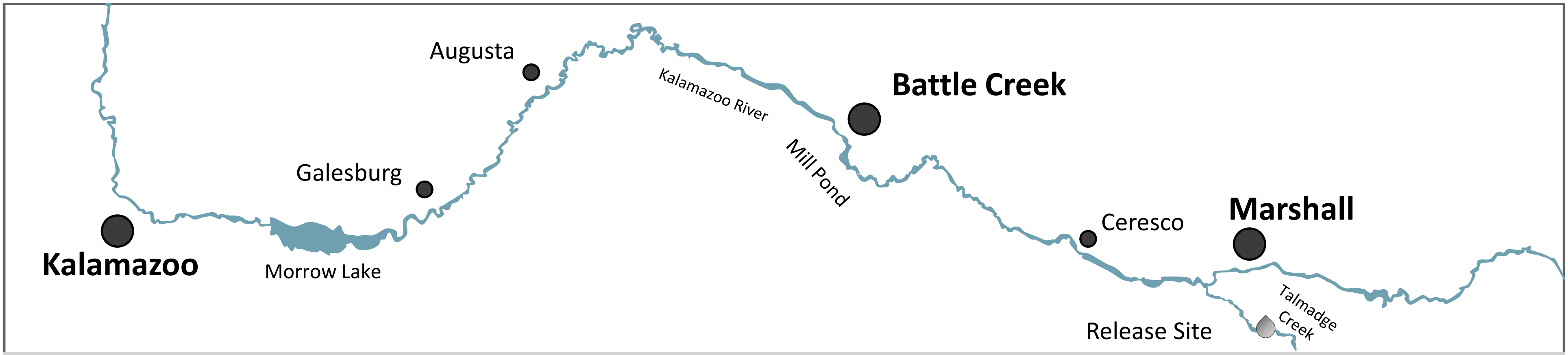
Note, the above studies have not been finalized and are not yet available for public release



Net Environmental Benefit Analysis

NEBA

- Weighs the environmental risks associated with leaving residual submerged oil in place as compared to ecological impacts resulting from additional oil recovery actions.
- Addresses only potential ecological effects. Does not address human health impacts or other designated uses of a water body.
- Addresses habitats and considers resource impact on most sensitive species affected by oil and;
- Evaluates potential impacts from specific submerged oil recovery actions.
- Process led by Faith Fitzpatrick (USGS) as one of three site Science Coordinators. Documents were prepared by members of the Scientific Support Coordination Group (SSCG) including MDEQ, USGS, EPA, USFWS and the Kalamazoo River Watershed Council



Submerged Oil Quantification

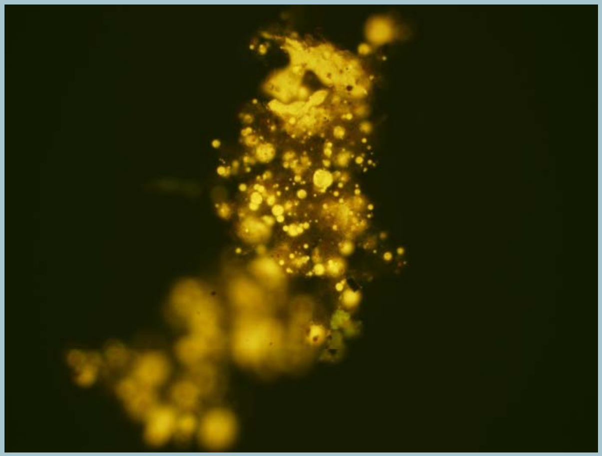
Stratified Sediment Sampling

<u>Generalized Random Tessellation Survey (GRTS)</u>

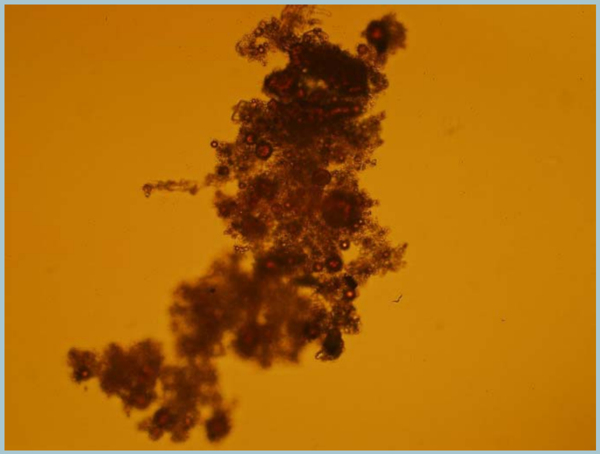
Coring locations were selected using a GRTS model.

- The coring locations were randomly selected from heavy/moderate and light/none polygons within the 10 different stratified geomorphic units (i.e. Impounded waters, depositional backwaters, oxbows, etc.)
- Stratified – likely to reduce variance of the oil estimate.
- Spatially balanced – across the entire site.
- Study led by U.S. EPA and Enbridge with support from oil spill forensic chemistry experts supporting EPA (Greg Douglas from Newfields) and Enbridge (Ann Arbor Technical Services)

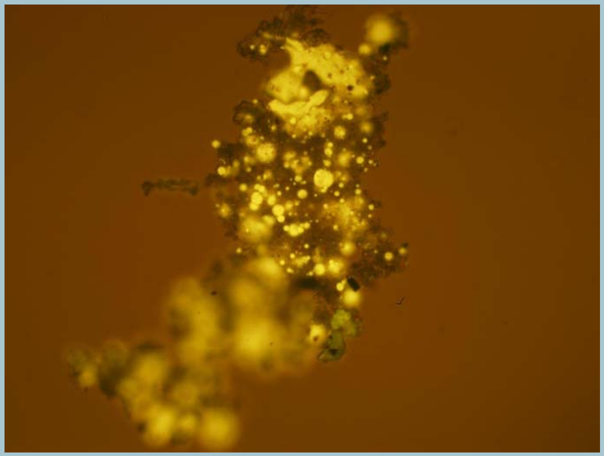
Photomicrographs of Line 6B Oil-Mineral Aggregates (OMA)



UV epifluorescence



Bright field transmitted light



Combined illumination

Oil-mineral aggregates are oil droplets stabilized by fine mineral particles.

Dr. Ken Lee (Fisheries and Oceans Canada) prepared this OMA in his laboratory using Line 6B oil and Kalamazoo River sediments.

Study commissioned by the FOSC through the Scientific Support Coordination Group (SSCG) – Dr. Ken Lee is a member of the SSCG

2012 Sheen Management at Ceresco Dam Impoundment

Assessing Natural Resource Impacts from the Enbridge Pipeline Spill into the Kalamazoo River

Stephanie Millsap, Lisa Williams, and Joseph Haas - *U.S. Fish & Wildlife Service*

Sharon Hanshue and Jay Wesley - *Michigan Department of Natural Resources*

William Taft and Michael Walterhouse - *Michigan Department of Environmental Quality*

Jessica Winter - *National Oceanic and Atmospheric Administration*

R Todd Williamson - *Match-E-Be-Nash-She-Wish Tribe of Pottawatomi*

Douglas Beltman, Allison Ebbets, and Kaylene Ritter - *Stratus Consulting*

Donald E. Tillitt, Diana Papoulias, and Diane Nicks - *U.S. Geological Survey*

Peter Badra - *Michigan State University*

Presentation Outline

- Natural Resource Damage Assessment overview
- Enbridge oil spill incident description
- Trustees' data collection efforts

Oil Pollution Act Authorizes Natural Resource Damage Assessment

OPA (33 U.S.C. §§ 2701, *et seq.*) and NRD Regulations: 15 C.F.R. Part 990

"The goal of OPA is to make the environment and the public whole for injuries to natural resources and services resulting from an oil spill into navigable waters and adjoining shorelines."

-15 C.F.R. 990.10

Trustees assess natural resource injuries on behalf of the public

There are eight trustees for the Kalamazoo River Oil Spill

How NRDA Restores and Protects Trust Resources

Trustees work with Response Agencies and Responsible Parties to:

- Ensure protection of trust resources during response;
- Identify and quantify lost resources/services;
- Implement projects to restore injured resources and their associated services to their baseline condition (primary restoration); and
- Implement additional projects to compensate the public for interim losses (compensatory restoration).

NRDA seeks to determine:

- What natural resources are/have been injured?
- What was the extent of the injury?
  - Spatial extent
  - Duration
  - Severity
- How long will the injury take to recover?
- What types of restoration projects can address the injuries?
- How much restoration is needed to compensate for the injuries over time?

The Incident

- 30" underground pipeline ruptured on July 25, 2010
- Approximately 1 million gallons of tar sands crude oil released
- Oil seeped through wetland soils into a creek tributary to the Kalamazoo River

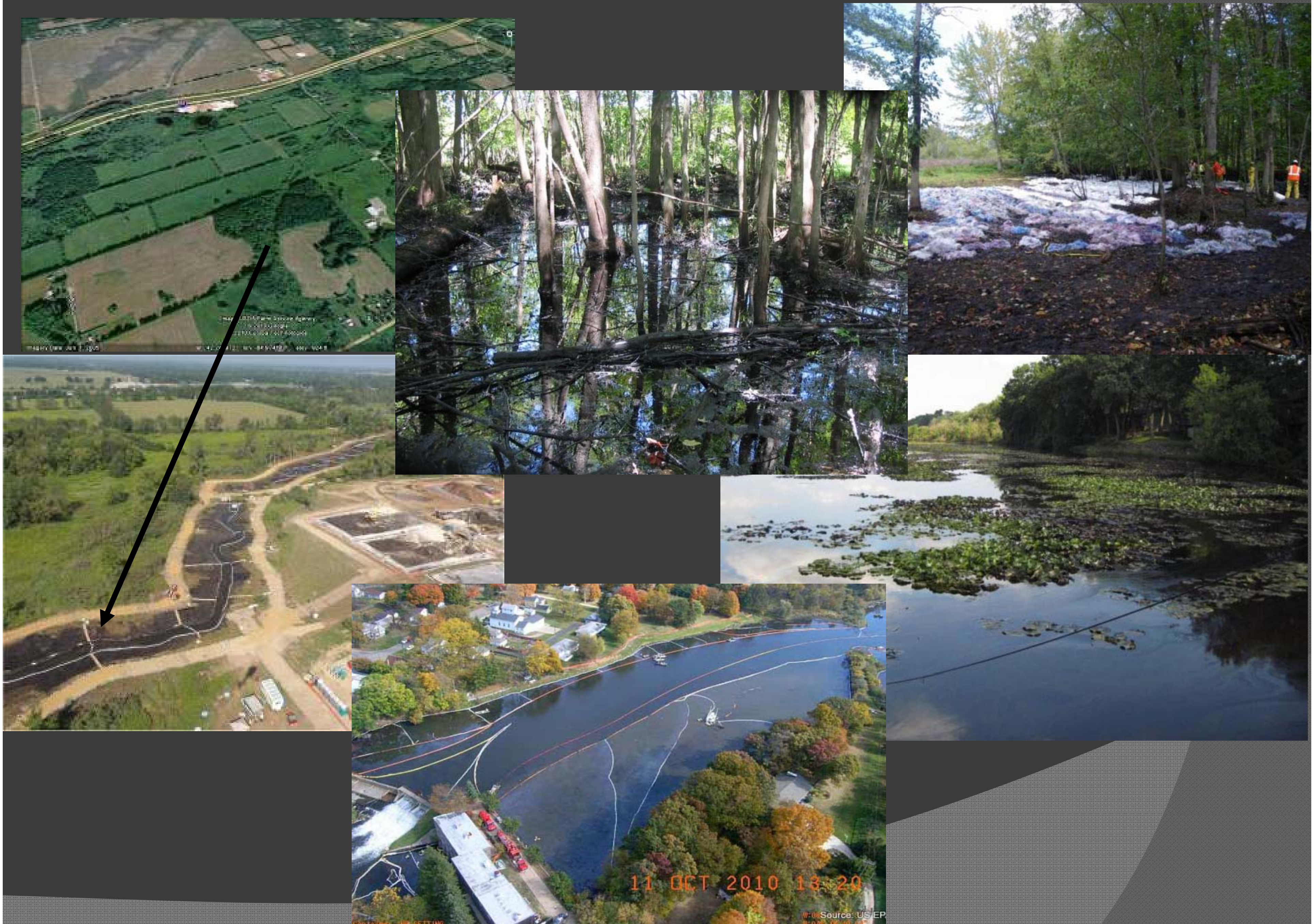
The Material

- 2 products in pipeline at the time of the rupture:
    - Starting a batch of Cold Lake Blend (77%)
        - 70% bitumen
        - 30% diluent (natural gas condensate)
    - End of a batch of Western Canadian Select (23%)

The Setting

Ceresco Dam

Morrow Dam


11 OCT 2010 13:20
Source: US EP

Assessment Tasks

- Identify probable injuries
- What data are response agencies collecting that can be used for injury characterization?
  - Coordinate with response agencies to share the data
  - Identify data gaps, develop sampling plans
- What baseline data are available and how informative are they?
  - Is it possible to conduct similar surveys post-spill?

Overview of NRDA Data Collected

- Extent of oiling in floodplain habitats
- Vegetation
- Erosion
- Fish
- Aquatic macroinvertebrates
- Mussels
- Chemistry (source oil, water, sediment, and biota)
- Wildlife
- Impacts to human uses

Floodplain Oiling Survey

- Objectives
  - Identify and characterize extent and degree of oiling in the floodplains
  - Characterize the general floodplain habitat types in the areas of the spilled oil
- Methods and Results
  - Transects at 50m intervals
  - 744 transects surveyed representing 23 river miles and associated floodplains
  - 66% of transects were oiled to some extent
  - Field observations provided to Response and data later used by Response

Rapid Vegetation Survey

- Identify types of vegetation present
- Identify rates of invasive plant species in order to compare over time

Erosion

- Proactively raised concerns to Response Agencies based on field observations.
- Reviewing erosion control plans and evaluating monitoring results.

Fish Kill Surveys

- Conducted by state fishery biologists
- Followed previously published standard protocols
- No fish kills observed in spill area

Fish Status And Trends

- Conducted by state fishery biologists
- Followed standard protocols
  - 6 locations (2 upstream reference sites)
  - Baseline data at two sites - including a long-term monitoring site

Fish Status and Trends

- Fish data included:
  - Catch per effort and length
  - Species identification
- Habitat data included:
  - Conductivity, temperature, substrate, channel width and depth, velocity, bank and riparian condition, and large woody debris density
- Results
  - Talmadge Creek fish community was reduced and habitat greatly diminished in 2010. Some recovery in 2011.
  - Kalamazoo River: Some declines in fish community diversity and abundance at some sites.
  - Ongoing cleanup activities require continued monitoring.

Fish Exposure and Health

- Data collected in cooperation with USGS
  - 110 fish from 4 sampling locations
    (includes 1 upstream reference)

- Analyses include:
  - Health assessment index
  - Histopathology of gill, spleen, head kidney tissues
  - Collected and archived bile samples for possible future analysis
  - Differential analysis of blood smears (potential)

Aquatic Macroinvertebrate Survey

- State biologists followed pre-existing protocols to assess abundance and diversity
  - 7 locations on Kalamazoo River and Talmadge Creek
  - Included locations with past data
- Results
  - In 2010, reduced diversity and abundance.
  - In 2011, scores improved, but abundance was still impacted.
  - Decreased vegetative cover exposed more of the stream channel to sunlight, altering community composition
  - Ongoing cleanup work requires further monitoring.

Mussel Shell Survey

- Assessed physical condition of post-mortem mussel shells:
  - Broken vs. crushed
  - Degree of weathering, ranging from “fresh dead” to “heavily worn”
- 18 species documented
- Crushed and freshly dead shells found within spill area but not in reference area

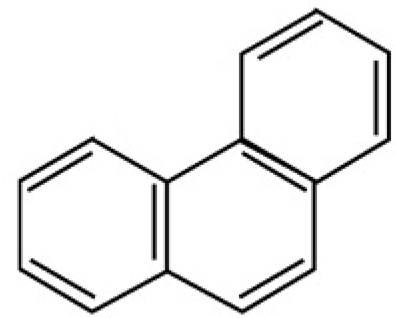
Chemistry Analysis

- Water Column
  - 90 samples at 8 locations
- Mussel tissue
  - 12 composite samples at 4 locations
- Sediment
  - 12 composite samples at 4 locations
    - Co-located with mussel tissue samples

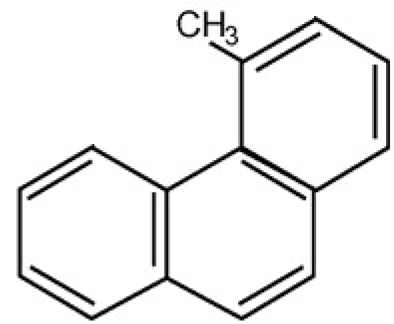
PAH Analytes

- Response generally analyzed for 16 priority PAHs
- Alkylated PAHs are more abundant, persist for a longer time, and are sometimes more toxic than the parent PAHs
- NRDA PAH analyses included alkyl homologues
- Some analyses also included heavy metals that are known to be elevated in the source oil (e.g. vanadium)

A. Phenanthrene



C. 1-Methylphenanthrene



Wildlife Recovery

- Wildlife recovery and rehabilitation center recorded
  - level of effort and geographic coverage of wildlife operations
  - capture, treatment, and release of oiled animals
- Over 3,000 turtles, 170 birds, and 38 mammals were brought to the rehabilitation center, with survival rates to release of 97%, 84%, and 68%, respectively

Human Uses

- River closed to public access for nearly 2 years.

- Trustees are evaluating recreational use of the river to determine when it recovers to baseline conditions and estimate damages.

Key Features of Oil Sands Pipeline Spill for NRDA

- Heavy oil fate and transport
- New cleanup techniques
- Diluted bitumen toxicity

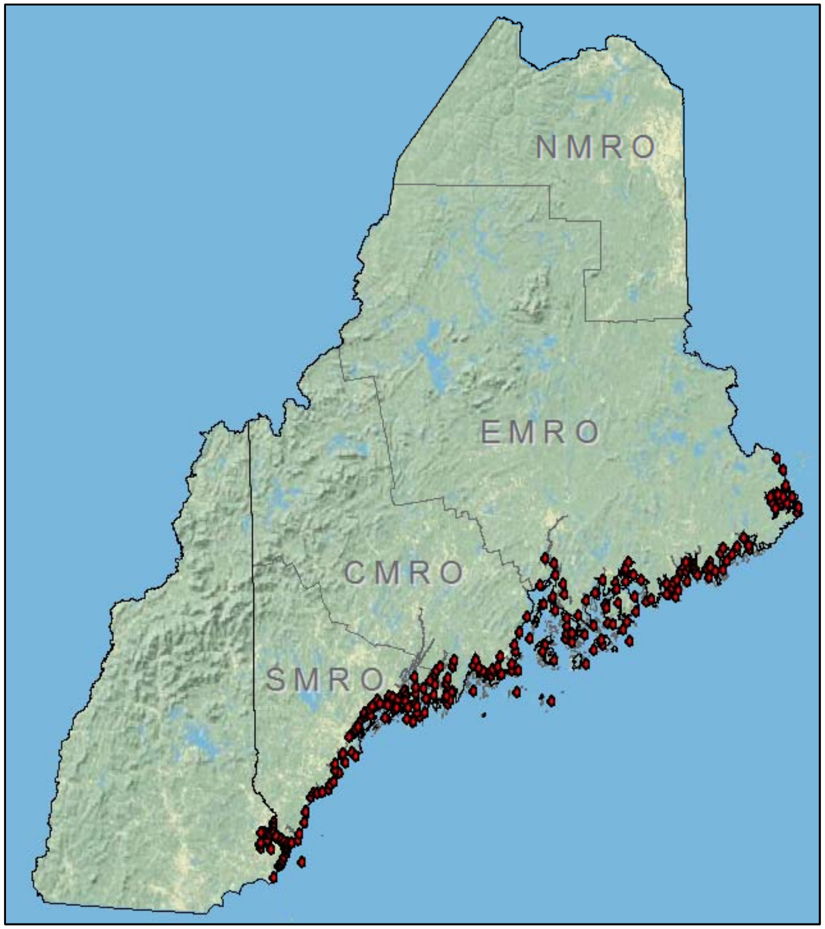
Contact Information

Jessica Winter
NOAA Office of Response and Restoration
7600 Sand Point Way, Seattle, WA 98115
(206) 526-4540
jessica.winter@noaa.gov

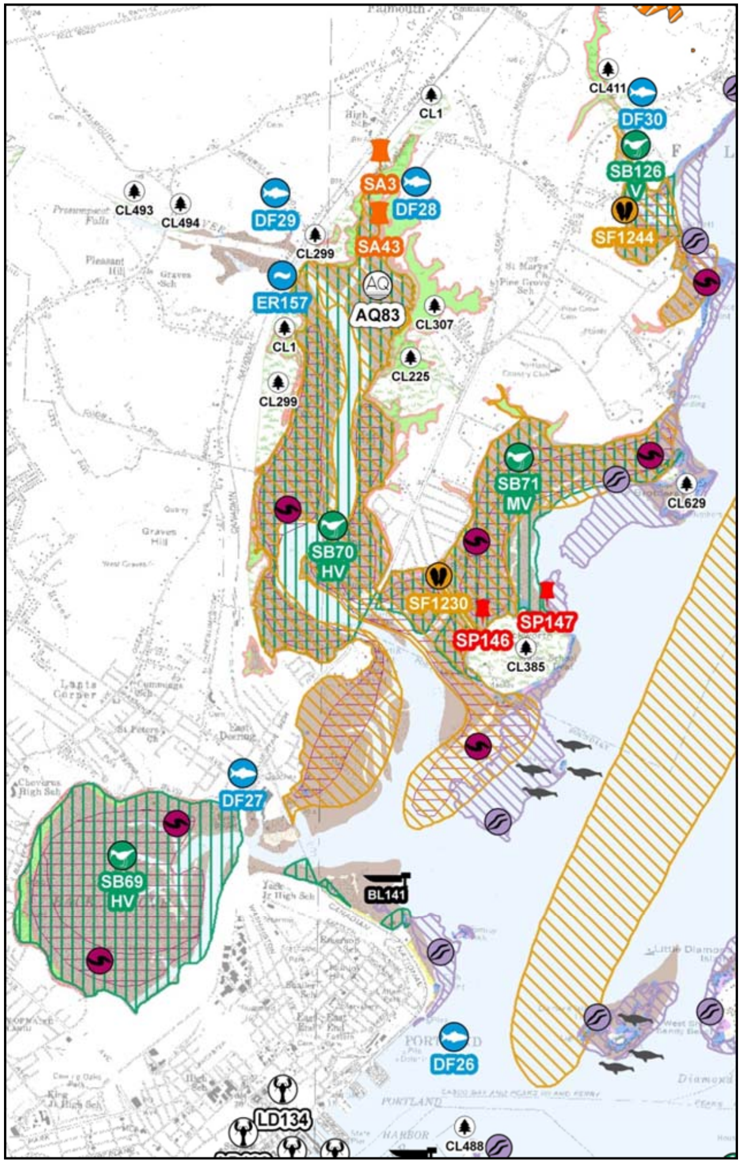
Transportation Routes & Resources at Risk

Ginger McMullin
Response Planning Coordinator
Division of Response Services

GEOGRAPHIC RESPONSE STRATEGIES



- Specific strategies for sensitive areas
- 208 in Maine
- Active testing and review program



ENVIRONMENTAL VULNERABILITY INDEX MAPS

- Identify resources and habitats at risk from marine oil spills
- Atlas of 98 maps coastwide
- Strong partnership with IF&W, DMR and MGS

25 Data Sets

Threatened & Endangered Species

- Piping Plover / Least Tern Essential Habitat
- Roseate Tern Essential Habitat
- Bald Eagle Essential Habitat
- Harlequin Duck Wintering Habitat
- Atlantic Salmon Habitat (where endangered)
- Other Coastal Threatened or Endangered Species
- Species of Special Concern

SA = Sensitive Animal **SP = Sensitive Plant**

Birds

- Shorebird Areas
- Seabird Nesting Islands
  Red outline if threatened or endangered species present on island

EVI ID#
RANKING

Rankings: C=Critical HV=Highly Vulnerable MV= Moderately Vulnerable V=Vulnerable

Rafting Birds Areas with counts greater than 200 individuals 2000 - 2004 Aerial Survey Data

- Fall Rafting Bird Observations
- Summer Rafting Bird Observations
- Winter Rafting Bird Observations
- Spring Rafting Bird Observations

Fish

- Diadromous Fish Runs
- Elver Runs
- Herring Spawning Areas

Shellfish

- Lobster Pounds
- Shellfish Beds
- Mussel Seed Conservation Areas

Habitats

- Marine Worm Areas
- Eelgrass Beds
- Seal Haul-Outs

Human Resources

- AQ Aquaculture Lease Sites
- Herring Weir Sites
- Lobster Dealers
- Conservation Lands
- Boat Launch State Sponsored or Assisted, Trailerable

Coastal Marine Geologic Environments

Ranked from most to least vulnerable

- Marshes (1)
- Mud Flats, Sheltered (2)
- Coarse Flats & Bars, Exposed (3)
- Coarse Beaches & Riprap (4)
- Mixed & Low Energy Beaches (5)
- Sand Beaches (6)
- Rocky Shores (7)
- Sand Dunes (8)

Coastal Barrier Resources System Area

ENVIRONMENTAL SENSITIVITY MAP - 17

GEOGRAPHIC RESPONSE PLANS (BOOMING STRATEGIES) FOR THIS MAP AREA: B-11-1 B-12-1 B-12-2 B-12-3 B-13-1

THREATENED AND ENDANGERED SPECIES / SPECIES OF SPECIAL CONCERN

BALD EAGLE ESSENTIAL HABITAT (BE) · HARLEQUIN DUCK WINTERING HABITAT (HD) · PIPING PLOVER / LEAST TERN ESSENTIAL HABITAT (PPLT) · ROSEATE TERN ESSENTIAL HABITAT (RT)

Other T or E Species
SA: Sensitive Animal
SP: Sensitive Plant

Other SSC
SA = Sensitive Animal
SP = Sensitive Plant

BIRDS

EVI NO	COMMON NAME	SCIENTIFIC NAME	ST	FED	J	F	M	A	M	J	J	A	S	O	N	D	SPRING MIGRATION	NESTING	FALL MIGRATION	WINTERING	MOLTING
BE202A	Bald Eagle	*Haliaeetus leucocephalus*	T	T	C	C	C	C	C	C	C	C	C	C	C	C		Feb.- Sep.		Oct.- Jan.	
BE202D	Bald Eagle	*Haliaeetus leucocephalus*	T	T	C	C	C	C	C	C	C	C	C	C	C	C		Feb.- Sep.		Oct.- Jan.	
BE268A	Bald Eagle	*Haliaeetus leucocephalus*	T	T	C	C	C	C	C	C	C	C	C	C	C	C		Feb.- Sep.		Oct.- Jan.	
BE268B	Bald Eagle	*Haliaeetus leucocephalus*	T	T	C	C	C	C	C	C	C	C	C	C	C	C		Feb.- Sep.		Oct.- Jan.	
SA13	Salt Marsh Sharp Tailed Sparrow	*Ammodramus caudacutus*	SC						U	C	C	C	C	U			Apr.- May	May - Aug.	Jul.- Oct.		

(MONTHS PRESENT: C= COMMON U=UNCOMMON)

SENSITIVE PLANTS / RARE ANIMALS

EVI NO	COMMON NAME	SCIENTIFIC NAME	ST	FED
SA13	Salt Marsh Sharp Tailed Sparrow	*Ammodramus caudacutus*	SC	

SHOREBIRDS (SB) SHOREBIRD SITES ON THIS MAP INCLUDE ONE OR MORE OBSERVATIONS OF THE FOLLOWING SPECIES

COMMON NAME	SCIENTIFIC NAME	ST	FED	J	F	M	A	M	J	J	A	S	O	N	D	SPRING MIGRATION	NESTING	FALL MIGRATION	WINTERING	MOLTING
Unidentified Yellowlegs	*Tringa spp.*						C	C	U	U	C	C	C	U		Apr.- Jun.		Jul.- Nov.		
Spotted Sandpiper	*Actitis macularia*						U	C	C	C	C	C	U					Jul.- Oct.		
Solitary Sandpiper	*Tringa solitaria*							C	U	U	C	C	U			May - Jun.		Jul.- Oct.		
Semipalmated Sandpiper	*Calidris pusilla*							C	C	C	C	C	U			May - Jun.		Jul.- Oct.		
Semipalmated Plover	*Charadrius semipalmatus*							C	C	C	C	C	U			May - Jun.		Jul.- Oct.		
Short-billed Dowitcher	*Limnodromus griseus*							C	U	C	C	C	U			May - Jun.		Jul.- Oct.		
Pectoral Sandpiper	*Calidris melanotos*						U	U		U	C	C	U	U		Apr.- May		Jul.- Nov.		
Unidentified Sandpiper	*Calidris spp.*						U	C	C	C	C	C	U	U		May - Jun.		Jul.- Oct.		
Lesser Yellowlegs	*Tringa flavipes*							U		C	C	C	U			May		Jul.- Oct.		
Least Sandpiper	*Calidris minutilla*							C	U	C	C	C	U			May - Jun.		Jul.- Oct.		
Killdeer	*Charadrius vociferus*					U	C	C	C	C	C	C	C	U		Mar.- Apr.	Apr.- Aug.	Sep.- Nov.		
Greater Yellowlegs	*Tringa melanoleuca*						C	C	U	U	C	C	C	U		Apr.- Jun.		Jul.- Nov.		
Black-bellied Plover	*Pluvialis squatarola*							C	C	U	C	C	C	U		May - Jun.		Jul.- Nov.		

RAFTING BIRDS Winter (W) Spring (Spr) Summer (Su) Fall (F)

EVI NO	COMMON NAME	SCIENTIFIC NAME	ST	FED	J	F	M	A	M	J	J	A	S	O	N	D	SPRING MIGRATION	NESTING	FALL MIGRATION	WINTERING	MOLTING
W16	Unidentified Goldeneye	*Bucephala spp.*			C	C	C	C	C	U	U	U	C	C	C	C	Mar.- Apr.	Apr.- Jul.	Oct.- Dec.	Oct.- Mar.	Jul.- Aug.
	Common Eider	*Somateria mollissima*			C	C	C	C	C	C	C	C	C	C	C	C	Mar.- Apr.	Apr.- Jul.	Sep.- Oct.	Nov.- Mar.	Jul.- Sep.
	Bufflehead	*Bucephala albeola*			C	C	C	C	U				U	C	C	C	Apr.- May		Sep.- Dec.	Nov.- Mar.	

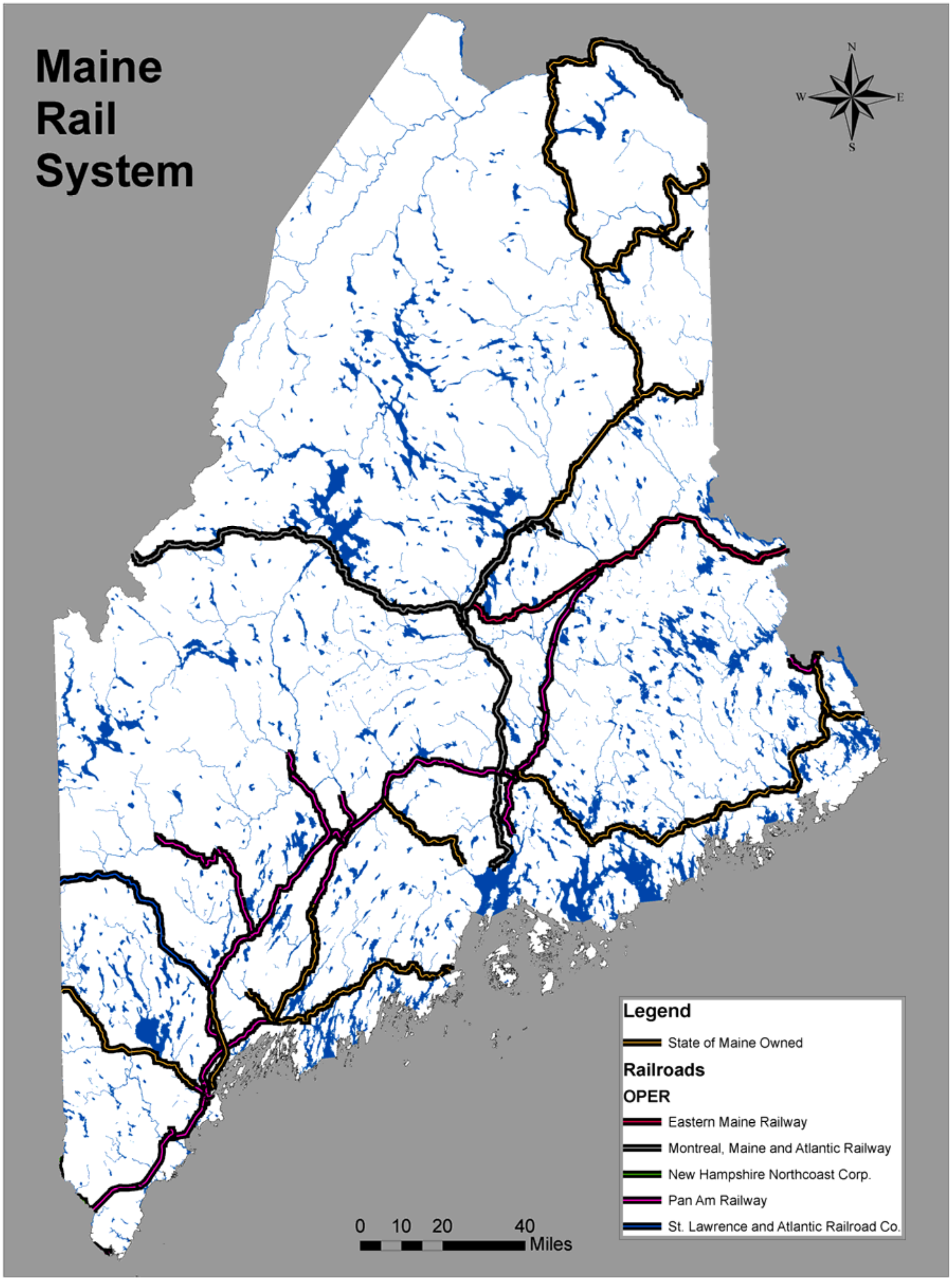
FISH: DIADROMOUS FISH (DF) · ELVER RUNS (ER) · HERRING SPAWNING AREAS (HS)

EVI NO	COMMON NAME	SCIENTIFIC NAME	ST	FED	J	F	M	A	M	J	J	A	S	O	N	D	SPAWNING	LARVAE	JUVENILE	ADULT
DF33	smelt rainbow	*Osmerus mordax*			x	x	x	x	x	x	x	x	x	x	x	x	Mar.-Jun.	May-Sept.	Jan-Dec	Jan.-Dec.
	eel american	*Anguilla rostrata*			x	x	x	x	x	x	x	x	x	x	x	x	N/A	Apr.-Jun.	Jan-Dec	Aug.-Nov.
	alewife	*Alosa pseudoharengus*			R	R	R	x	x	x	x	x	x	x	R	R	FW	FW	Jan-Dec	Apr.-Oct.
	trout brook	*Salvelinus fontinalis*			x	x	x	x							x	x	FW	FW	FW	May-Sep.
	trout brown	*Salmo trutta*												x	x	x	FW	FW	FW	Oct.-Feb.
	shad american	*Alosa sapidissima*					R	R	x	x	x	x	x	x	R	x	FW	FW	May-Oct	May-Sep.
DF34	smelt rainbow	*Osmerus mordax*			x	x	x	x	x	x	x	x	x	x	x	x	Mar.-Jun.	May-Sept.	Jan-Dec	Jan.-Dec.
	trout brook	*Salvelinus fontinalis*			x	x	x	x							x	x	FW	FW	FW	May-Sep.
	eel american	*Anguilla rostrata*			x	x	x	x	x	x	x	x	x	x	x	x	N/A	Apr.-Jun.	Jan-Dec	Aug.-Nov.
DF35	smelt rainbow	*Osmerus mordax*			x	x	x	x	x	x	x	x	x	x	x	x	Mar.-Jun.	May-Sept.	Jan-Dec	Jan.-Dec.
DF36	smelt rainbow	*Osmerus mordax*			x	x	x	x	x	x	x	x	x	x	x	x	Mar.-Jun.	May-Sept.	Jan-Dec	Jan.-Dec.
DF37	smelt rainbow	*Osmerus mordax*			x	x	x	x	x	x	x	x	x	x	x	x	Mar.-Jun.	May-Sept.	Jan-Dec	Jan.-Dec.
DF38	smelt rainbow	*Osmerus mordax*			x	x	x	x	x	x	x	x	x	x	x	x	Mar.-Jun.	May-Sept.	Jan-Dec	Jan.-Dec.
DF39	smelt rainbow	*Osmerus mordax*			x	x	x	x	x	x	x	x	x	x	x	x	Mar.-Jun.	May-Sept.	Jan-Dec	Jan.-Dec.
DF40	smelt rainbow	*Osmerus mordax*			x	x	x	x	x	x	x	x	x	x	x	x	Mar.-Jun.	May-Sept.	Jan-Dec	Jan.-Dec.
ER159	eel american	*Anguilla rostrata*			x	x	x	x	x	x	x	x	x	x	x	x	N/A	Apr.-Jun.	Jan-Dec	Aug.-Nov.
ER160	eel american	*Anguilla rostrata*			x	x	x	x	x	x	x	x	x	x	x	x	N/A	Apr.-Jun.	Jan-Dec	Aug.-Nov.

(MONTHS PRESENT; FW=FRESHWATER R=RARE)

- Access database with agency supplied data
- Custom GIS script tool selects all “EVI numbers” on screen
- Populates table linked to Access report
- Very fast reports “on the fly” of resources in the immediate area

LINK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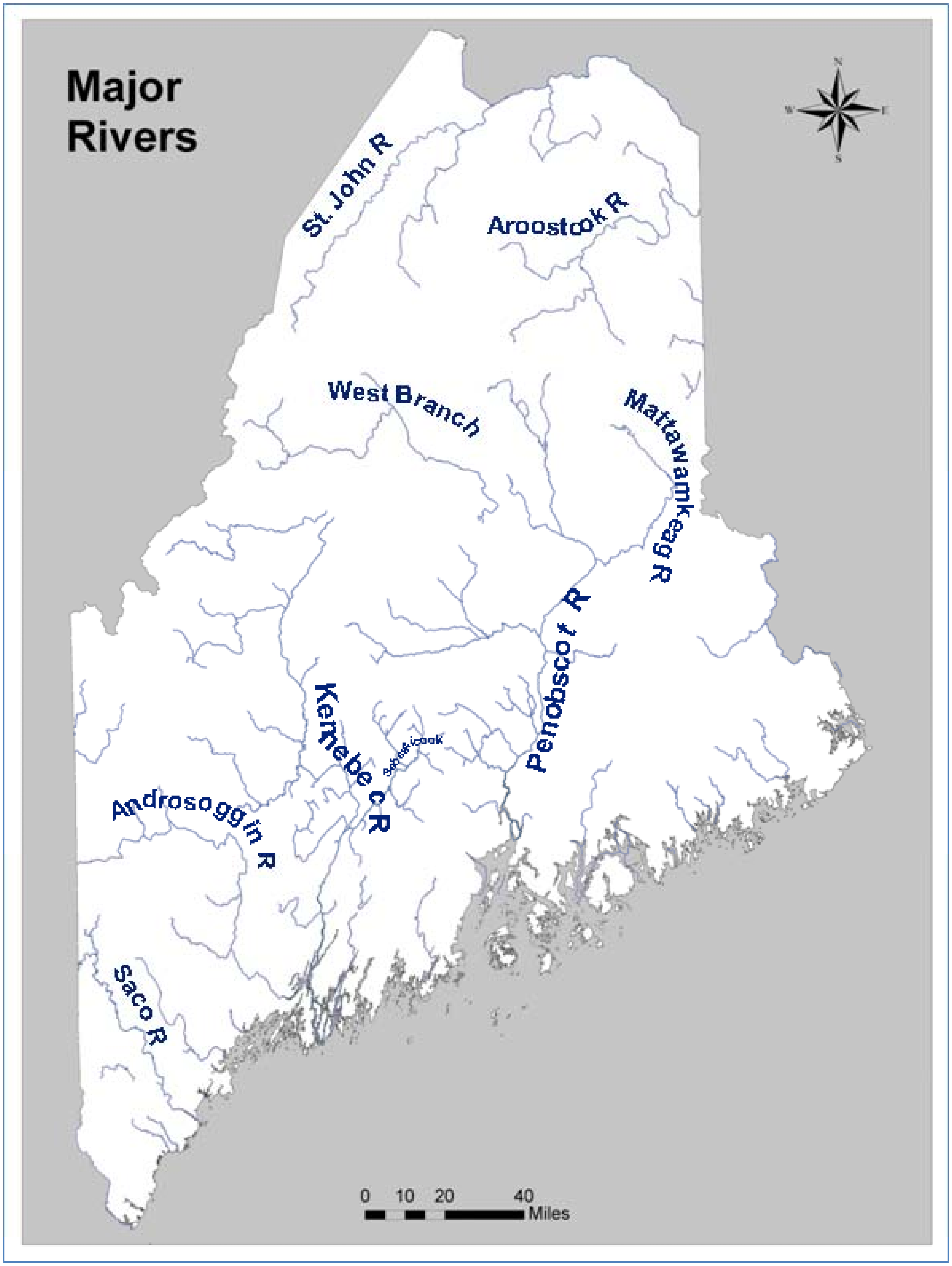
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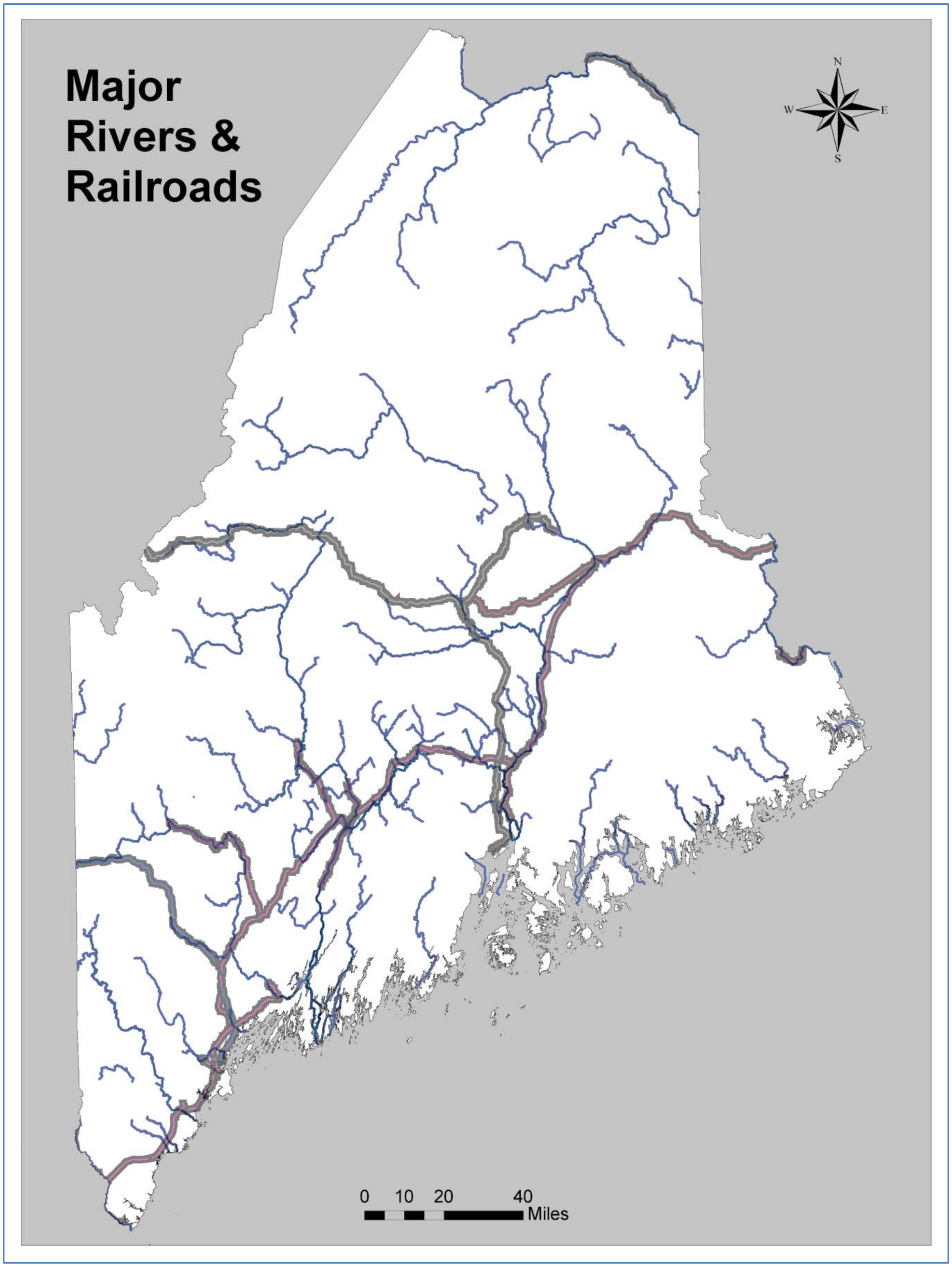
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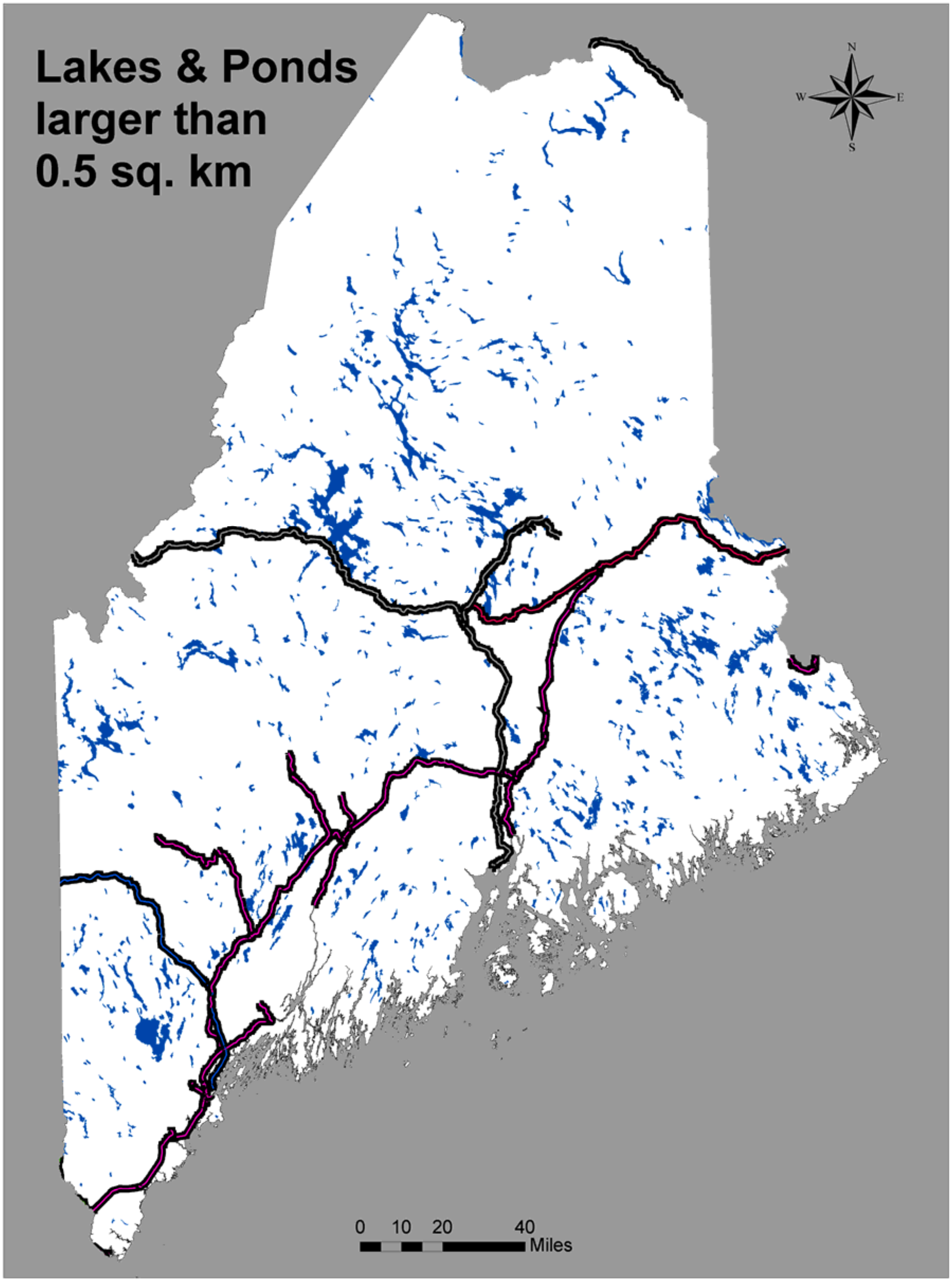
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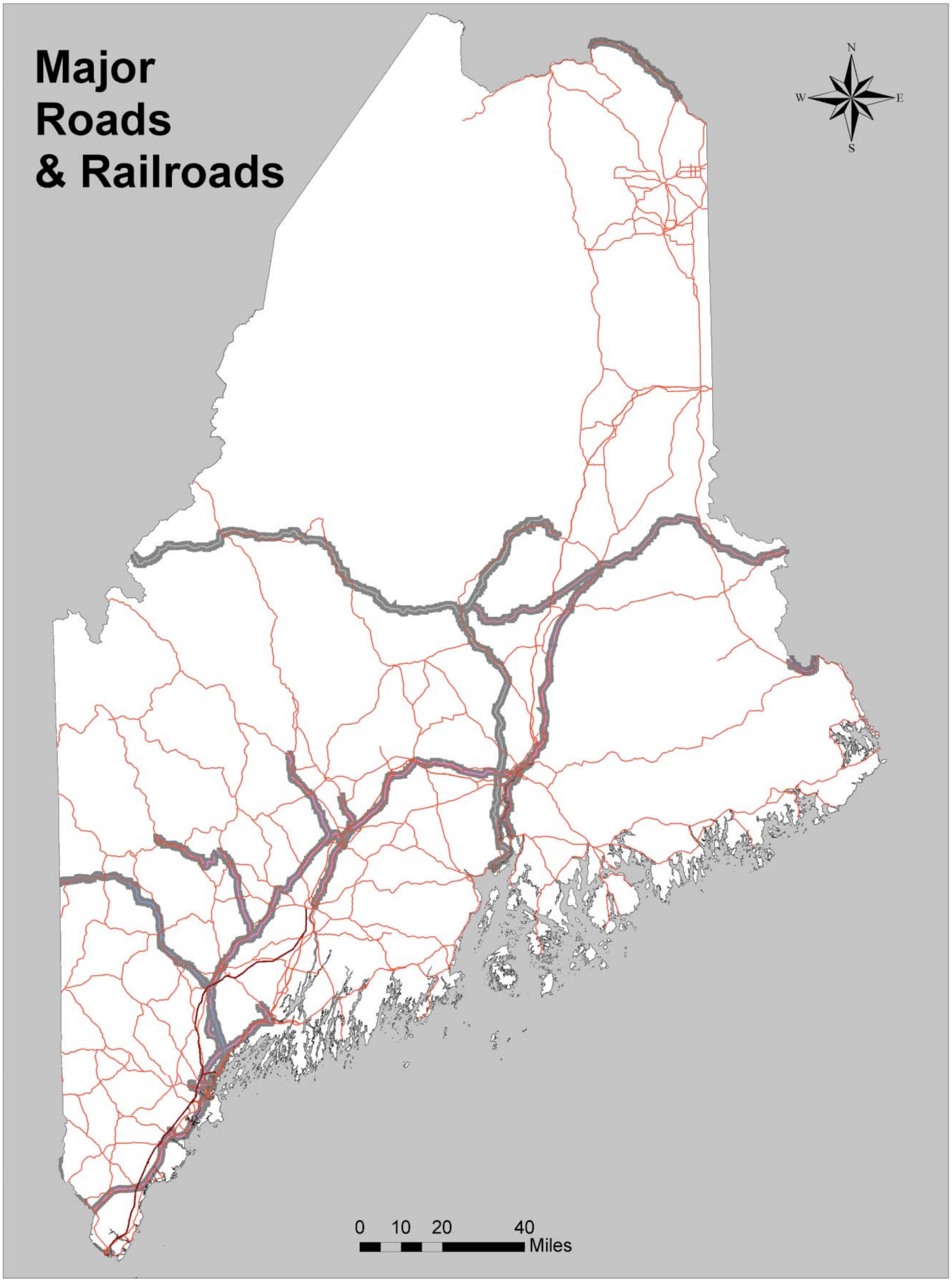
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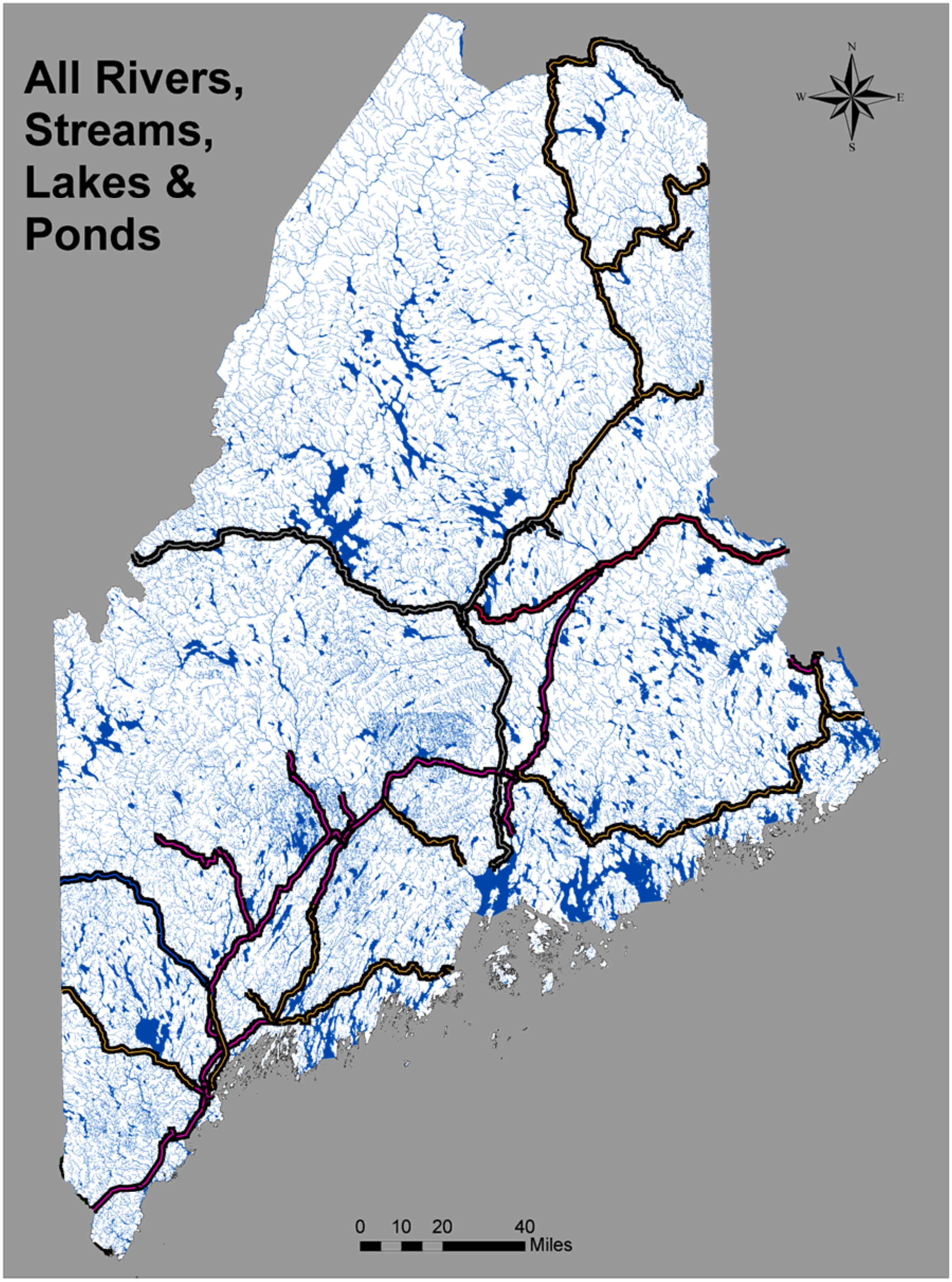

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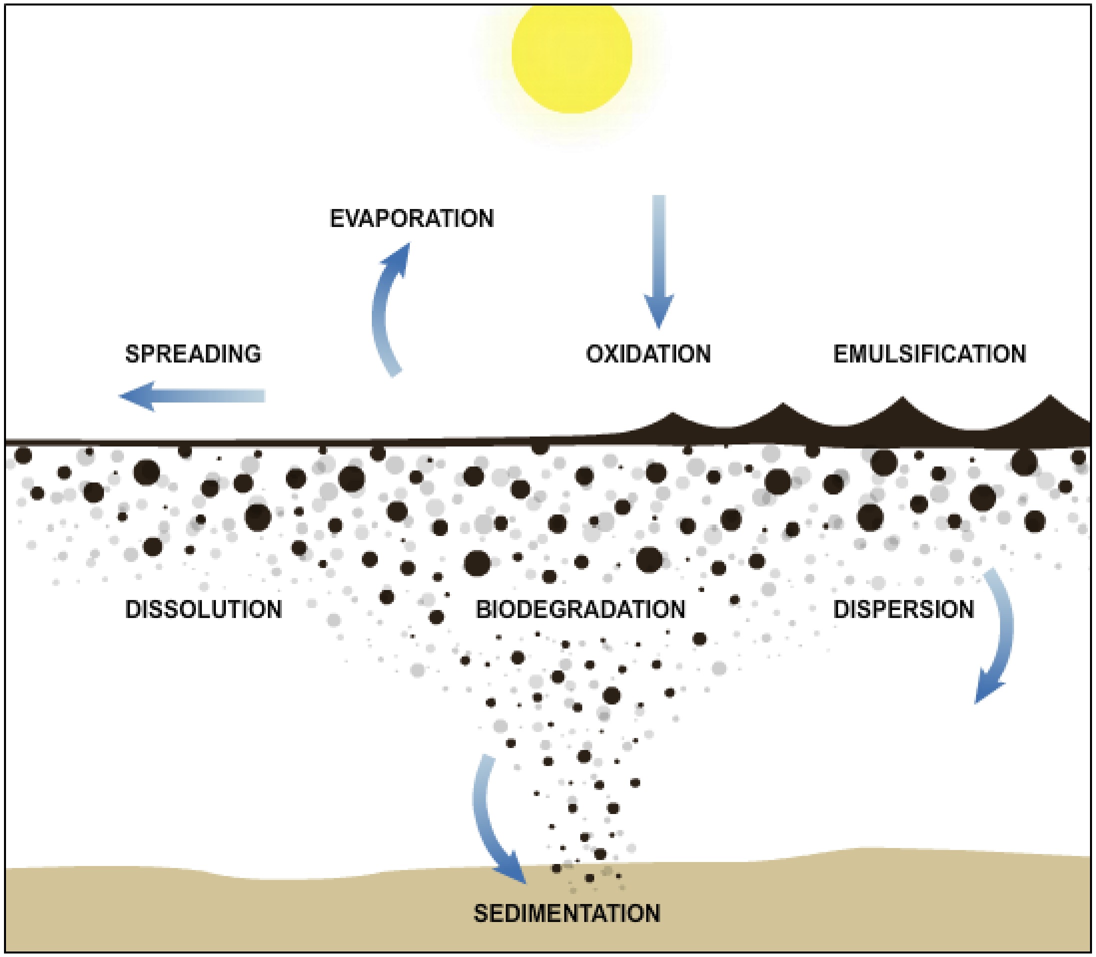
Resources at Risk



Resources at Risk

Public Drinking Water Supplies

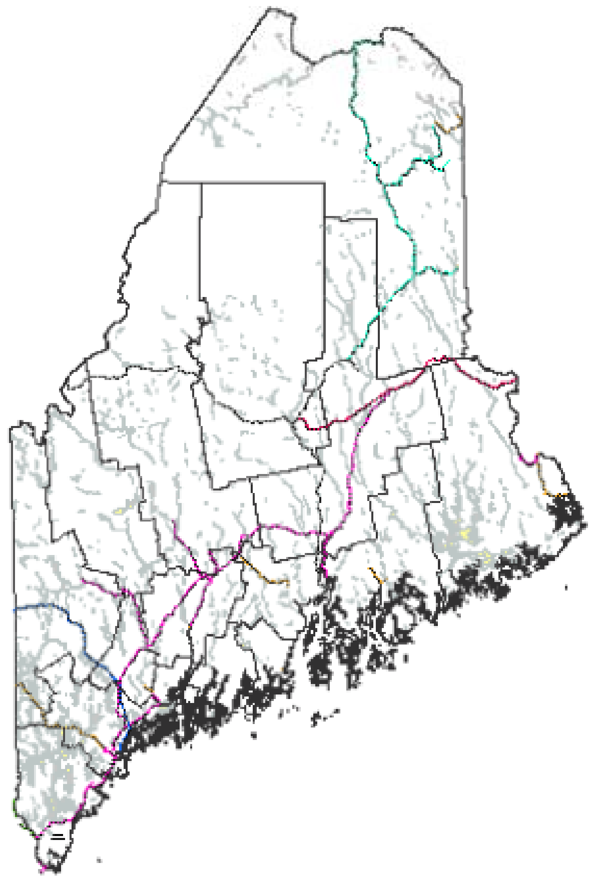
- Community PWS
- Surface Water Intake PWS
- Transient PWS
- Non-transient, non-community PWS
- Non-public
- No details

Resources at Risk

Sand and Gravel Aquifers

10-50 gallons/min.

> 50 gallons/min.



Resources at Risk

Endangered, Threatened

Golden Eagle, Least Bittern, Northern Black Racer (E)

Upland Sandpiper, Blanding's Turtle, Northern Bog Lemming (T)

Species of Special Concern

Bald Eagle, Ribbon Snake, Spring Salamander

Atlantic Salmon Habitat

Resources at Risk

Resources at Risk

- Diadromous Fish Runs
- National Wetlands Inventory
- Conservation Lands
- Boat Launches

www.maine.gov/dep

Appendix III

Breakout Group
Discussion Questions

Center for Spills in the Environment
Oil Sands Products Training

University of Southern Maine - Abromson Conference Center
December 4 & 5, 2012

For each environment, what kinds of spill scenarios could occur?

For these scenarios, what would the response be now?

What issues/challenges would the response face (e.g., for the environmental unit, logistics, human dimensions, health & safety) that are unique to these oil sands spill scenarios?

What information is needed and what questions should be answered to improve the response to these scenarios? Prioritize these needs/answers (i.e., which address in 12 months, 2-3 years, 4+ years).

How does Contingency Planning need to change to accommodate an oil sands spill?

Appendix IV

Breakout Groups

Center for Spills in the Environment

Oil Sands Products Training

University of Southern Maine—Abromson Conference Center

December 4 & 5, 2012

Breakout Groups

Group A (Marine Environment)	Group B (Marine Environment)	Group C (Freshwater Environment)
Group Lead: Wyman Briggs	Group Lead: Gary Shigenaka	Group Lead: Bruce Hollebone
Recorder: Heather Ballestero	*Recorder: Katie Brouse*	*Recorder: Charlie Watkins*
Sara Booth Joe Boudrow Rich D'Alessandro Dan Davis Stephen Flannery Patrick McNeilly Nick Payeur Joe Payne Robert Starkes	David Byers Elise DeCola Lauren Fullam Tom Gallant Robert Gardner Rhianna Macon Thomas Smith Erin Summers	Mike Barry Sheryl Bernard Ken Brown Mark Hyland Donald Katnik Dave McIntyre Bart Newhouse Ken Strout Scott Whittier Jessica Winter

Group D (Freshwater Environment)	Group E (Freshwater Environment)
Group Lead: Peter Kinner	Group Lead: Kurt Hansen
Recorder: Mindy Bubier	*Recorder: Sandy Amborn*
Heather Dettman Dwight Doughty Ginger McMullin Dave Nagy Kara Walker Karen Way Deborah Wick	Peter Blanchard Cosmo Caterino Peter Hodson Steve Lehmann Lori Muller Robert Shannon Tom Tardif Jon Woodard

Appendix V

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Center for Spills in the Environment

Oil Sands Products Training

University of Southern Maine—Abromson Conference Center

December 4 & 5, 2012

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Appendix VI

Plenary Session Notes

Notes from the Oil Sands Products Training

Center for Spills in the Environment

December 4, 2012

Portland, ME

Introduction to the Training- Nancy Kinner

-Goals of the Training are to provide:

- Basic education on OSP
    - What is it
    - Where from
    - Characteristics
    - How transport by rail
- What is the Oil spill response for OSP
    - Type of response
    - Biological cleanup

-What are the potential impacts of spills of OSP?

-Day 2 Applying what we learned

- Environments that might be impacted
- Rail routes
- Planning
- Resources at risk

Presentation 1   Background: Overview and Development- Randy Mikula

Resource

-Canada exports lots of light oil (from the East in Alberta: Edmonton) and heavy oil (from the West) to US, major source of Canadian income.

-North/central, heavy bitumen product.

-Canada is #3 worldwide for oil reserves behind Saudi Arabia and Venezuela. Much of Canada's reserve is heavy oil. Potential resource is170 billion bbl.
-Although production long-term is possible, the environmental impacts are still not completely known.
-Oil sand composition: sand, fines (clay or silt), water, bitumen; only 12% is bitumen with most (~73%) sand. Bitumen is rated in 3 classes .12% High, 9-12% Ave. ,9% Low.
Mining
Insitu
- Injects steam into the ground heat product and remove from the ground with water. The process uses a 3well system mostly with new 1 well systems being introduced. Ground water or saline water is used to make steam.
-60% thermal and 40% coal used to take oil out of the ground (have to heat to get oil out of the ground)
-Lots of energy to make bitumen like sweet crude. Thirty percent of the energy from bitumen is required for insitu removal
-Energy intensive process.
Surface mining
-Uses large machines and requires significant remediation after mining the area. Currently 141000km3 large land disturbance.
Processing
- Utilizes large amounts of water. Overall two volumes of water for one volume of oil made. The process takes 2-14 barrels of water to 1 barrel of bitumen, but water can be recycled in tailing ponds.
-Fluid fine tails take a very long time to settle out (32%of the tailing) Over timecan change it from a fluid to more of a solid (dry stackable tailings). Currently working to reduce settlement time.
-Consolidated Tailings (CT) process: tailings with chemical treatment to reduce time alum and other low toxic substances.
-Tailing Reduction Operation (TRO) process: spread out tailings, it dries naturally, however it takes lots of land. Also trying centrifuge process to speed up settlement
-Toxicity issues exist with tailings water so it requires processing.

Questions:
-What are the chemicals used to solidify the tailings?
    -Gypsum or alum
    -acrylamide (used in water treatment already)

-toxicity of treatment tailings, there are better components, but they are more toxic, thus not used.

-Water used for in-situ, is it treated/any chemicals?

-Need high quality water for steam, usually use saline water. Could potentially be using a high quality ground water.

-Water quantity is not well mapped out in northern Canada (saline and fresh). Water treatment chemicals for this are similar to those in common water treatment.

-What environmental impact are Canadians willing to accept to get the oil?

-Oil sands vs. tar sands? -tar sands possibly have negative connotations currently. Tar sands originally because of the feat it took to transform it into usable oil. Currently oil sand is more common due to the controversy, with tar sands used occasionally. It can be interchangeable.

-Synthetic Crude (SynCrude) - Industry decided it had a negative connotation

-To go through a pipeline it has to be fluid enough to pump, has regulations on it.

-Bitumen may be diluted with a solvent or gas condensate.

Presentation 2 Characteristics of Oil Sands Products-Heather Dettman

-Three types of pipelines come from the fields (first comes out with sand and water goes through gathering pipeline) goes to transmission pipeline, water and sand is removed, then is fed through another pipeline to a transportation terminal (pipeline terminal).

-Initial gathering pipeline receives a lot of wear and tear, not the final product where sands are removed.

- There is Media confusion with gathering pipelines and transmission pipelines.

-Bitumen is the extra heavy crude oil that remains after biodegradation [and physical weathering] of oil in Northern Alberta. Organic acid species are large molecules, but not corrosive compared to vinegar 3mgKOH/gm.—3wt%.

-Dilute Bitumen with condensate Redwater Alberta (CRW; yet not actually from there anymore) makes “dilbit”

- Naphtha- based oil which uses liquid natural gas condensate
- synthetic crude oil, upgraded product from an upgrader/refinery, also used to made “synbit”

-Both Dilbit and Synbit has to meet transmission pipeline specifications

- Review www.crudemonitor.ca/ to find info about transportation of oil in pipelines and specifications.

-Low corrosiveness of product with ex-situ studies and confirmed with data from industry operations.

-Water can be corrosive, regardless of oil type. If there is sludge settling out in pipelines then water can accumulate there and the water may corrode a pipeline.

-Organic acids matter more during refining (naphthenic acids). During distillation, acids can reach boiling point and potentially be corrosive, however, bitumen has been found to have low corosivity during refining.

- This is due to the size and structure of the molecules- the larger molecules in bitumen make for less corrosion (compared to smaller structured molecules).
- The washing of the oil sands to remove sand further reduces acid content.

Questions:

-Any there any connection between Dilbit and Synbit or any connection between extraction?

-There are no connections, it depends on availability of diluent (it's cheaper as compared to synthetic).

-What is the process for separating oil from water using oil floatation, since the density of bitumen is almost identical to water?

-They add some diluent prior to separation.

-How does this bitumen vary from bitumen from Venezuela?

-Venezuela does the coking process (use shorter pipeline) and thermal process then they send it to ships for transport. The thermal process alters asphalts and polar compounds (destroying them). This could affect emulsification tendencies. More polar compounds=more emulsions.

-The base oil is the same (very similar).

- In Venezuela crack I,) then send it.

-Do pipeline coverings disassociate from the pipeline may separate due to temperature differences, causing water intrusion?

-Pipelines are designed to operate at certain temperatures, there is no heating of transmission pipelines.

-Thermal pipeline in occur in Alberta, but not outside

- Diluent is added to maintain conditions within boundaries of pipeline.

-Do Synbit and Dilbit have higher propensity to sink upon weathering relative to unblended crude oil (e.g., natural crudes, Alaska North Slope, lighter crudes)?

-Synbit may be better behaved than dilbit.

-Blended products will not perform the same as lighter oils (obviously depending on spill conditions; weather, temp, wind, waves, response time).

-Do Volatiles in bitumen pose to responders? What is their residence time?

-Pentane is relatively high in dilbit, lower boiling point (~97 F) so at higher temperatures it may be a concern. As pentane volatilizes, other lighter fractions are released.

-What type of aromatics are of concern (e.g., BTEX) to responders during warm weather response?

-Crude monitor website has numbers.

<u>Presentation 3 Transportation of Oil Sands Products- William Fairfield</u>

-Train tank car carries 28,000 gallons, single walled 7/16" steel. New cars may carry 40,000 gallons.

-High regulations on train cars, railroad tracks.

-Unit trains normally have 80 cars for oil with 2 engines

Tank cars all privately owned and constructed to 49CFR USDOT specs. and have pressure and thermal control valves.

Planning

For incidents the process includes:

- First responders
- Product ID occurs
- Environmental specialists
- Shipper notification of the incident
- Contractor call out –cleanup
- Community relations for flow of info and support for community
- Assess situation for the dilbit spill
- Meet with onsite responders
- Determine mitigation
- Investigate accident using standardized procedures
- Debrief on incident within 2 weeks

Questions:

-Do shipping documents differentiation between dilbit, light crudes, etc?

-the railroad expects shipper to properly classify what they have with proper documentation

-Is it classified as crude oil or differentiated?

-It depends on flashpoint of product, oil sands product would not be listed in the regulations, The product has to be fully tested then classified before inclusion in the regulations.

-Where does Canadian Pacific transporting oil sands to?

-Canadian Pacific carries very little by rail; it is mostly the other railways. If they did, it would go through Southern Alberta to Chicago then on from there.

-Do you offer any rail lines to ME at this time?

-No

-From a response perspective, would you respond to an oil sands spill differently than a crude oil or other oil spill on rail?

-No, they do carry a lot of light sweet crude and are ramping up for response to a spill with that product.

-The two railroads in Maine are bringing oil in, but no bitumen at this point.

-What is the most likely scenario that would result in a spill?

-a main line derailment (faster speed), whether bearing/wheel burn off, (if hot box doesn't detect it, the axel can break off)

-In the train derailment in New Jersey near Philly it was an issue that they didn't have a crane in the area and had to leave a rail car there. What type of response tools do you have available in Maine?

-We have a hook on a crane, with capability for smaller things but can pivot a car off otherwise a larger something needs to be brought in.

-Will there be a difference in product loaded into tank cars than that loaded into pipelines? Raw bitumen can't go into pipelines without diluent.

- Railcars will probably be the same, it may need to be heated going in and going out seeing how pipelines keep heat to keep it moving.

Presentation 4   Fate, Behavior and Modeling-Bruce Hollebone (slides not posted, presentation not filmed)

(Presentation can't be publically shared due to current litigation.)

-Models are a tool to predict what oil will do in the environment –predict oil movement in environment (trajectory), and transformation by environmental factors (weathering).

-Behavior is physical/chemical transformation, weathering.

-Fate is the eventual end-point state of oil

-The primary processes affecting OSP are evaporation, emulsion, dissolution, photochemical and biological oxidation.

- Properties change in the environment changes oil behavior, what it does where it goes (fate)

-Oil sands products occur in 12 or 13 different types that are on the market, they are different blends, and the different composition changes how they'll act in the environment

- Fresh and light oils move with 3-4% of wind speed, while the more weathered and heavier oils move 2-3; 1-2; 0.5-1 (tar balls)

-Evaporation is a physical process/ thermodynamic process; molecules are removed but not chemically altered.

-Dilbit evaporates about 15% rapidly within an hour (probably the diluent). This is compared to crude oil which evaporates quickly, but has a more curved slow release of different compounds (15 C)

-Photo-oxidation causes density and chemical changes in oil. Increases in density, makes oil more acidic, and can make oil take up more water.

-Oil exposed to sun, forms a "skin".

-Water uptake forms emulsions, increasing oil density.

-Water incorporation in either emulsion or entrained water can change what type of response measure you use.

-Dilbit is fairly fluid; emulsions with dilbit turns to something like sticky peanut butter.

-Evaporation with more photo-oxidation and there are more water incorporation.

-The interaction with suspended particles: oil separated and driven down into water, interacts with particles in the water and attaches to them. It doesn't return to slick, it hovers where it is.

-OMA- oil mineral aggregate

-OSA- oil sediment aggregate

-Dispersion and sediment interaction enhanced by wave action, storms

-Temperature-- density increases with decreasing temperature

-Daily and seasonal variations in temperature are factors.

-Temperature affects many oil properties (viscosity, interfacial tension).

-Chemical weathering-largest changes occur rapidly; slow degradation later with light ends evaporating sooner (<25).

-In biodegradation: straight chain alkanes eaten first, then unalkylated aromatics. Biodegradation can take months to years; aerobic is faster than anaerobic; biodegradation is limited by nutrients and electron acceptors.

-Open questions:

-Not known how fast the various components evaporate (impacts how long should responders wear respirators).

-Dispersion in water is related to droplet size, rise time, coalescence.

-Not sure of timing of resuspension and remobilization.

-Not sure of dissolution in water and bioavailability.

- Toxicity, can be inferred, but has not been tested yet.

-How much will persist, how much will biodegrade

- The interactions of all factors affect behavior.

Questions:

-Has there been dispersant testing on dilbit?

-They have done swirling flask test, but not evaporation tests: in the preliminary tests, doesn't work well.

-Has anyone at NOAA been doing test with low specific gravity, eg., polypropylene.

-People have talked about adding particulates to help disperse (e.g., chalk, dolomite).

-Possibly can use gelling agents for small spills.

-Techniques, successful, that have been applied in the field.

-In two dilbit spills, it spilled and stayed. It was an Issue removing it from riprap. They followed protocol from limiting contact with water.

-Quick response is key to clean up of these materials.

-What is the probability of oil sands sinking in cold water?

-We cannot answer at this time, one of the open questions for the research

-Cleanup teams can use air bubbles to float oil up and collect it.

Presentation 5   Effects of oil sands Products on biota-Peter Hodson

-Differences between freshwater spill vs. marine spill include

- -Scale of spills
- -Ecosystem characteristics of receiving waters
- -Oil behavior and fate
- -Receptors, their biology and ecology
- -Type of clean-up methods

-An OSP spill in the Kalamazoo River, July 26, 2010 was an estimated 20,082 bbls of crude

-For comparison DWH was 4.9 million bbls

-Freshwater spills generally have lower volume, low dilution capacity and limited area to spread and disperse.

-Ocean spill encounter higher wind and wave energy.

-Oil will more likely sink in freshwater due to usually running off land and greater suspended sediment.

-Chemistry of oil includes SARA: Saturates Aromatics Resins Asphltenes

- -Saturates are branched aliphatics
- -Aromatics have ring structure

-Increasing molecular weight oils have decreased volatility, water solubility, uptake by biota and acute toxicity. High concentrations of these smaller compounds (e.g., aromatics, saturates) have acute issues while aromatics and asphaltenes stay around for a longer time and pose more chronic effects. HMW compounds hang out and are considered carrier compounds; more involved with burial and not toxicity.

-Dilbit has a less of a chance of causing fish kills as it as higher molecular weight fractions than light oils.

-There is a greater chance that lighter oils will impact spawning via chronic toxicity.

Questions:

-How do you evaluate the impacts of leaving oil in place or having the cleanup impacts?

- -If the oil had been left (Pine River) clinging to the logs, there could have been more impacts from the PAHs, also public impression of leaving oil in the ecosystems: damned if you do, damned if you don't.

-How successful do you think you would be arguing that leaving the logs would do less damage?

-Response time is critical, if you can avoid the damage, that is the best option. Otherwise, cat is out of the bag, damage on damage.

-Discussion on Endpoint: what is an acceptable state to leave the river in?

- Where do you want to end up when you can't get back to the baseline: how clean is clean? It is possible to go too far.

-Compare Alberta sands to light crude: do we know are there oil sands that contain higher components of these aromatics?

-Oil sands do contain more aromatics than some crudes. 2-3 of about 12 oil sands have higher aromatics than other crudes, however, those are single samples; no comprehensive analysis has yet been conducted.

<u>Presentation 6 Enbridge/Kalamazoo Case Study-Lori Muller</u>

-Kalamazoo is a 40 mile meandering river

-The amount of spill reported was 843,000 gal; the volume of 1,000,000 gal was collected.

-During the spill the River was at a 25yr. flood state. This resulted in oil being spread into the flood plain.

The Remediation was divided into 2 Phases : days 1-40 and days 40 to 607.

-Day1-40 was initial remedial ops.

-Air monitoring and sampling

- 30%dilutant additive
- Public hazard first 30 days

Explosive hazard at site

- Volunteer evacuations at 60 residences.
- Decision trees developed for evacuation and reentry.
- Spill overbank as far away as two miles. Needed to cut access to get there this resulted in more terrestrial impacts.
- The Team utilized SCAT for rapid assessment of valley with cleanup areas
  - Ops cleanup reassess
  - Identified key locations where oiled areas were

Day 40-607

-SCAT became SORT, an overbank technique for overbank work.

-USGS designed inundation model of where to look for oil in riparian zones 2011-2012

-RESORT was a relook at 426 areas previously addressed in assessment 2012

-Fall 2010-2012 submerged was assessed and removed. Methods tried included;

- Oil low pressure sediment flushing
- Pressure with stingers
- Dredging
- Using aerator
- Surface collectors absorbent pads and pom-poms and sheen corralling.

Questions:

-What endangered species involved with submerged oil?

-Jessica Winter will address in next session.

-There were areas noted by the trustees where they would characterize sediment, species, and response strategies. Nesting bats- response couldn't go there because the bats.

-What health and safety levels were utilized?

-Full face respirators were used in the area closest to the spill; responders could stop wearing them after 9th day, but were still taking readings.

-1.1 mil gallons recovered- close to 1mil in first year and more slowly since then.

-Have factors leading to the submergence of oil become clear?

-Possibly due to warm weather.

- Haven't had to deal with OSP before. Not sure of dilbit characterisitcs contribution.

-Why did it sink?

-Still some studies going on.

- High flood condition in very turbid water. Formed mineral – oil aggregates. High turbidity caused little droplets of oil that sank. Submerged oil is usually small droplets that sank not a giant mat that sank.

-what will be available to people in the future

-focus on this type of oil, distribute knowledge of oil

-response techniques distributed, can it be distributed yet?

-talmange (sp) creek, is there a requirement ot monitor what happens to the creek?

-creek on privately owned land; ordered to monitor for a sheen.

-why was the spill as large as it was?

-Coincidence that it occurred <1mi away from pumping station.

-It started to smell. Regular shut down at Enbridge. There was a shutdown, and kept resetting the alarm, thinking that nothing was wrong. Miscommunication of the operators.

-Was there a good baseline for knowing how clean was clean in this spill?

- Some data from previous State collections.

Presentation 7 Assessing Natural Resource Impacts from Enbridge Pipeline Spill- Jessica Winter

-NRDA comes from OPA (1990)

-Eight Trustees including 2 native tribes were selected.

-Base line definition: is the condition of the river if spill had not happened. Critical to establishing impacts, damages and restoration.

-Oil was Cold Lake blend 70% of bitumen and 30% condensate

-Initial data collected for the baseline:

- Rapid veg survey
- Erosion control monitoring &mitigation planning
- Fish kill survey Michigan protocols
- Michigan status and trends –sites on Tallmadge creek and Kalamazoo river

-Some recovery observed in 2011. Continuing to monitor:

- Tissue analysis
- Benthic survey ongoing
- Mussels damaged by boats. Conducted mussel shell surveys
- Chemistry, water , mussel tissue-- focused on alkylated PAH oils and vanadium
- Monitor rehab recovery from wildlife
- Human use study on lost uses- recreation

Questions:

-Some of the oil got 2 miles away, what were you looking for?

-Floodplain assessment: forest, backyard, wetlands, characterization of habitat.

-Coal tar in river cleanup in Maine choice- leave in situ and cap it

-not considered, were looking at natural attenuation

-No document for fish kill NRDA process?

-Look at fish habitat as indicator of fish population how well it would have been doing. Don't have to actually count, can use habitat. Trustees will make an NRDA claim for fish.

-High river level, so DO didn't get too low.

-Expect fish kill from volatiles

-Were odors experienced anywhere else?

-We could smell it a few miles down river. There were many odor issues which did impact businesses in the area.

Day 2 Wed, Dec 5, 2012

This was a special session to address questions from the participants as a result of the first day.

Introductory questions:

-When dilbit is shipped by pipeline is temp different than other fluids:

-Pipelines are designed for max pressure. If dilbit is more viscous than normal fluids, the temp doesn't matter, but the throughput will be lower.

-Is heat a problem in pipeline delamination?

-Never heard of it applied to the inside, but not sure.

-Pipeline transmission of oil sands bitumen, specifications of pipelines?

- Specifics of a pipeline-depends on pipeline. Pressure for a pipeline is fixed, it depends on steel. Viscosity, depends on oil grade, pipelines can only deal with a certain range of viscosity; it depends on pipeline, there is an upper limit. Acidity is more of a refinery issue and not a pipeline issue, but fluids are screened. Sand in pipelines also has an limit for what will be accepted-

-Pipelines and water; there is usually more water than sediment in bitumen.

-Have any pipeline spills been caused by internal corrosion?

-Referencing oil sands, there have been some caused by internal corrosion, but there is a difference between transmission and gathering lines. The transmission lines are more abused. There are no known internal corrosion from oil sands products. The transmission and gathering lines are cleaned on occasion.

-Do rail cars need to be jacketed?

-All are non- jacketed cars.

-Is there a placard needed on the car when shipping oil sands products?

-Not sure what placard will be used at present, possibly 1267. Placards required on both ends of the cars, it is considered a hazmat in Canada (less restrictive than US). US will definitely need placards. ID placards 1267 is assigned to most crude oil trains coming from Canada.

-Due to dangers of dilbit/synbit, will we ever be able to model effects?

-Given roughly a dozen dilbit/synbit, how far are we away from modeling the fate and behavior?

-How do we deal with uncertainty? Models need numbers to give outputs. From oil monitor website, we can get approximate properties, but there have to be lab tests for actual values before the modeling can reduce the high uncertainties.

-Should responders expect dilbit to respond like submerged oil?

-In previous spills in freshwater where it sunk, and others where it hasn't sunk. Each spill is different and it depends.

- Open questions:

-Given the evaporation of the light ends, how to we model the fate of the light ends?

-test and simulate behavior in the lab, look at lab results and look at what has actually happened in the field and extrapolate from that.

-Does dilbit stratify overtime?

-We have stored for years and get some stratification after long time. There is a diversity of densities in dilbit, but after months, it has shown little stratification

-Are there difference between responding to dilbit and conventional oil

-Similar to responding to heavy marine fuels with certain skimmers, looking for sunken behavior.

-Product picks up water and incorporates water as it sits on water, but there are not great models for that at this time.

-Have there been any synbit spills, if so what was the behavior learning for sinking behavior?

-Not any to anyone's knowledge: there has been a dilbit/synbit blend spill, it behaved very similar to heavy crude oil, it remained on the water only quickly and was removed quickly. Could use spill treating agent Corexit 980 to get off rocky shorelines, also heavy oil skimmers

-How do you get sediment out of OSP? Also unclear about how air clean up worked?

-During response no sediment removal occurred from recovered oil. Use air as an air boom, hasn't been very successful in Kalamazoo to refloat oil, hard to move an air bubble, the water jets were more effective.

-What characteristics of oil sands will we want to know from manufacturer/shipper to be able to respond to a spill

-BTEX gives part of the story

-Would regulations need to be altered for waterfront facilities storing dilbit?

-USCG also has regulation, but no, spill response regs. They should have addressed group 6 oils (heavier than water oils) and are incorporated into regs. Even with the diluent, they are still covered under regs.

-No oil sands products shipped to Maine now.

<u>Presentation 8   Transportation of Oil by Rail in Maine and Resources as Risk-Ginger McMullin</u>

-There 25 data sets with sensitive species in GIS.

-Pan Am

-Railroad is carrying Bakken crude currently

- NPMS https://www.npms.phmsa.dot.gov/

Questions:

- Agriculture is looked at as well, not just natural resources (e.g., soil health years later from a human dimensions, socioeconomic issue).

-Locate those areas susceptible

-Federal gov't looks at pipelines, they have already done a lot of resource mapping, has done it on a level different than Maine DEP. Can be found on NPMS website (above)

Appendix VII

Breakout Group Notes

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Breakout Group A

SCENARIO 1: Scarborough Marsh
40+ car OSP Train collision with a passenger train, derailment over Scarborough Marsh during Late Fall with threat of foul weather and submerged OSP

For each environment, what kinds of spill scenarios could occur?
(Considerations: scale and type of environment)
80 car max on a train (28,000 gallons/car); 35 cars would most likely be worst-case

- Estuarine Rivers

-Penobscot River and islands

- Embayments

- Salt Marshes

-**Scarborough Marsh** (3-4 mi south of Portland)
-Train derailment (large scale> 40 train cars)
 -nor'easter or other storm event that would compromise tracks
-Single track, Downeaster train collision (rescue situation)
-Black point road, vehicle traffic
 -vehicle accident
-Most of track is inaccessible by road (>1mi from road), also across marsh, can't drive over marsh or possibly have to cross water body (ice in winter)
-Worst-case season: Late Fall (migratory birds)
 -Winter (oil collection would be easier)
 -Late spring for environmental issues: not environmental issues
-Marsh is very protected, responders can't move freely in affected area.
-Many limitations to response (e.g., treading oil into sediment)
-Public sentiment around marsh, important to public (human dimensions issues)
-Nursery ground for fish species (e.g., striped bass)
-Recreational facilities.
-Early Fall could pose another storm event that could stimulate the oil to sink (e.g., sediment and mixing energy)
-10ft tidal range with rapid tidal current; difficult area to groom (chance of recurrence of oil)
-Scarborough is a large residential town (burning options limited)

For these scenarios, what would the response be now?
Scarborough Marsh worst-case scenario:
-Geographic response strategy for this region, recently updated (N.B., strategy designed for preventing oil coming into marsh from offshore, not coming into it, also some attention on oil flowing in and out).
-What plan the railroad has for this specified region (generic response plans from railways)
- (1) Safety first (e.g., respirators, limits workers to trained professionals with appropriate equipment, level B PPE, 40 hr trained workers)
  -Large resource of trained individuals in northeast
  -Does railroad have equipment/people qualified, capable to deal with this - most likely?

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Call local OSROs
-Difficulty evacuating passengers
- (2) Secure source, remove cars that are not damaged
-How far away is the railway agency and location of equipment to lift the cars
-location of vacuum truck and accessibility (vacuum trucks, larger response vehicles will have to be rail mounted)
-Pumpable products in OSP (not part of MSRC [or other response agencies] don't have contract with railroads or legally approved products-legal staff would have to get involved)
-Staffing availabilities on railroad agencies.
- Spill response is usually contracted out, in house resources for railroads to respond to spills
-Difficulty getting to derailed train cars and moving them, potential continual spillage and spilled OSP moving around with tides.
-Repercussions, socioeconomic
-Amtrak, would be shut down
-other products travelling by train (e.g., chemicals, fuel, heating oil)
-other industries may have to be shut down temporarily
-Who is responsible party (shipper, railroad)? Railroad is ultimately responsible for safe transport of whatever material.
-RP is a local railroad: expensive
-limits of liability, different than ship and road; railroads would potentially reach liability limit quickly (federalizing response-oil spill trust fund)
-CERCLA, depending on what is mixed in as diluents, what would be applied; CERCLA, Trust fund
-Potential of OSP to sink (above: storm event after spill)

What issues/challenges would the response face (e.g., for the environmental unit, logistics, human dimensions, health & safety) that are unique to these oil sands spill scenarios?

-MSDS some give OSP "basic oil" but wearing respirators for 9 days would be a different beast (one example)
-Potential high benzene level, worker safety and evacuations
-Odor issues that have a vast potentially affected region
-Unknown toxicity
-Bunker fuel, condensate, gasoline, diesel; OSP is nothing unusual, response to all of those are similar
-OSP could potentially stay around after initial lighter compounds volatilize; heavy compounds remain, what would clean-up options be?
-PAH components are unknown in OSP, toxicity issues in environment still unknown
-<u>Toxicity unknown</u> in this environment: leaves a difficult decision to leave it in marsh vs. clean it up.
-Long term fate and effects of OSP (e.g., decision making leave vs. stay)
-Lot's of pressure on both ends leave it, remove it; <u>how clean is clean</u>?

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-Possibly more like a ground spill than a marine spill, in a ground spill, clean up bulk then let edges naturally attenuate
-possible pre designation for where areas would be cleaned or where OSP would stay.
-<u>Won't have natural dispersion</u> (not a high mixing energy environment)
    -No action choice: OSP may persist for a long time due to the low mixing energy
-<u>Wildlife issues</u>
    -capacity for bird capture, rehabilitation; not just local population, migratory birds, national and international birds.
    -waterfowl, owls, wading birds

What information is needed and what questions should be answered to improve the response to these scenarios? Prioritize these needs/answers (i.e., which address in 12 months, 2-3 years, 4+ years).

-Persistence of compounds?
-Submerged oil, possibility of it sinking?
-Removal of submerged oil if it sinks, do we have specialized equipment to remove that spilled oil?
    -Submerged oil equipment is under development
    -uniqueness of each spill

How does Contingency Planning need to change to accommodate an oil sands spill?
-What type of equipment would be used for response (submerged oil)? Where would it be from, because there isn't any in the area currently?
-Sinking oil manual ECRC- source of information (sediments, refloating technology) [public access?]
-USCG continual research and development (report date?)
    -NEPA, EIS analysis preexisting for implementation of new technology
-Response impacts on marsh
-Net Environmental Benefit Analysis, overall positive effect
-Train derailment at high tide, there will be vast coverage of the marsh
-Look into possibility of burning
-"friendly" dispersant considerations
-Prevention measures
    -Speed limit for trains with restrictions in specific areas (e.g., marsh) for trains carrying hazmat
-Developing strategies for limiting the migration of submerged oil (e.g., fencing)
    -Don't have the equipment or have no procedure for applying it
    -ECRC for case example (train derailment with Bunker C over Wabamun Lake, Alberta): for sinking oil
    -Maine DEP case studies:

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- Sanborn Pond, Brooks, ME six oil (sinking oil)
  - -still seeing oil
  - -inversion with different densities in water temperatures
- -Mill in Winthrop, six oil

-Ongoing response that doesn't need respirators (upstream and downstream boom deployment; sensitive area deployment).
-Rail looked at during heavy event: prevention- analyze how vulnerable the area is
-Discuss with railroads what they currently have in place for response plans and capabilities and heavy lifting capabilities

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SCENARIO 2: Railroad bridge crossing (or near river) Near Augusta. Spill in estuarine river environment, South of Augusta in Kennebec and Sassinoa Rivers. Compromised track (possible spring). One leaking Car in Kennebec river (<28,000 gallons)

For each environment, what kinds of spill scenarios could occur?
(Considerations: scale and type of environment)

- - Estuarine Rivers

-Penobscot River and islands, Kennebec, Sacco rivers, Bangor,
-Around Brunswick, along Kennebec river

- Embayments

-

- Salt Marshes

For these scenarios, what would the response be now?
-Most Equipment from Portland
-Booming strategies, preventative
-air monitoring
-considering evacuation (residential and business)
-EVI data
    -Identify sensitive areas and prevention strategies
-DEP has contracts with …
-OSP product

What issues/challenges would the response face (e.g., for the environmental unit, logistics, human dimensions, health & safety) that are unique to these oil sands spill scenarios?
-Historical areas
-National security issues with ports
-Bath Iron employer (socioeconomic issues)
-Bath-large municipality
-Residential issues (human health and safety, evacuations)
-Easily accessibly
-Significant tidal current
-Fish and wildlife
    -Migratory fish (chad, Atlantic salmon, striped bass, sturgeon, lobster)
    -Merrymeeting Bay, large estuary upstream
    -7 tributaries to Merrymeeting bay
    -Shellfish
-Recreation
-Traffic Issues
-Waterfront restaurants
-Worms (mudflats)
-May freeze in winter
-Challenges to boom with strong currents
-Ice conditions, ice chunks floating up and down

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-Flooding
-Snags and old structures in River (navigation hazards)
-Narrow river
-Shallow water
-Boat ramps (accessibility)
-More attention from media and state government
-Water intake points (industry, cooling)?
-Flooding issues (akin to Kalamazoo) especially in spring
-OSP sinking, more turbidity in cold spring (water higher density)
-Logs and branches with spring flooding
-

What information is needed and what questions should be answered to improve the response to these scenarios? Prioritize these needs/answers (i.e., which address in 12 months, 2-3 years, 4+ years).
-Not sure whether it would sink or not
-Fast water response
-Sinking oil impaction from fast water
-Fish exposure in moving water
-anadromous species
-sturgeon migration
-toxicity issues (e.g., benzene)
-cold weather influences on OSP in fresh water
-Depth and response options
-water speed and influences on submerged OSP
-Identify natural collection points? That far up river is not included in response plans, needs to be mapped out for collection points.
-Can't boom in fast water, possible diversion techniques; look at Pen…River. As case study. Used lobster traps with pom-poms for sunken oil (recovery options)
-Bottom substrate (holowell) bedrock bottom, may be more migration, less submerged
-identify deposition areas for submerged oil (look for drift wood, etc).
-Slower moving areas
-Most seasons there is a strong salt wedge; this may influence sunken oil, causing it to rise.

How does Contingency Planning need to change to accommodate an oil sands spill?
-Pre-identify sensitive areas and areas of deposition where sunken oil may pool
-EVI's need to be updated for area
-GRS updated for region
-Pre-identify water body crossings for railroads, especially large rivers; do rails have response plans for that water body.
-Plans for disposal of debris
-Contingency plan has to identify availability of specialized equipment for potential sunken oil
    -identify strategy
    -How to source that strategy (equipment)

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-Will the OSP sink?
-shut down railroad (that line)
Small railroads exempt back in the day
-is there a requirement from FRA?
-type of contingency plan for water bodies and specific water bodies
-local and regional
-Bunker C is moved around a lot, going to mills, south of Augusta

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SCENARIO 3: Embayment Casco Bay near Fore River going into Portland Harbor, (Medium Spill: 6 railcars). Railway bridge (next to Sprague facility) about 0.5 miles to Casco Bay from there.

For each environment, what kinds of spill scenarios could occur?
(Considerations: scale and type of environment)

- - Estuarine Rivers

Embayments
-

- Salt Marshes

For these scenarios, what would the response be now?
-Geographic Response Strategy that has been tested in Fore River
-1knot river flow, fairly easy to boom
-Flow has influence of 10ft tidal range
-upstream is estuary
-(previous spill Julian Spill)
-MSRC has large store of equipment, NRC, clean harbors, boom tech,
-lots of boom already in water
-Hour north of Portsmouth, available equipment there and also 2 hour south in Boston
-Extra media coverage
-Population density
-Industry in area (Sprague)
-Gets into larger embayment, Casco Bay islands, ferries, commuters, fishing industry, tourism, commercial activities, waterfront restaurants
-Under dock treatment in urban areas (pile cleaning)
-Water intake issues (specifically with sinking oils)
-Upstream marsh environment

What issues/challenges would the response face (e.g., for the environmental unit, logistics, human dimensions, health & safety) that are unique to these oil sands spill scenarios?
-Saltwater, there is less chance of OSP sinking
-High media coverage, risk communication needs
-Dense population
-Negative view of tar sands, involving concerned citizens
-A product that isn't benefitting Maine (aside from through tax), however the product is going through, but not used for Maine.
-Costs per day for response
-Power plant there, not critical, but important if there is an intake
-mandatory or voluntary evacuation (pre-education of OSP)
-sunken oil response, what other pollutants will be stirred up (Dredging spoils, mercury, PCBs)
    -grey literature has some background studies on this
-Lack of experience and equipment to respond to sunken oil
-mudflats and channels (different water depths along channel)

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-Habitat: eel grass
    -clam beds, lobster beds, aquaculture
-Can't migrate into more freshwater habitats
-difference from river environment: shoreline is good for boom, short travel distance before it hits an object (docks, coastlines) possibility of less submerged oil because of the high surface area of things to stick to (rip rap, docks)
-Public outrage, recreational vessels
    -public sentiment after spill 14 years ago "here we go again"
-Chanel depth
    -Kalamazoo example was shallow water, no example of response for submerged oil in multiple habitats (sandy, rocky) at depths (>4 ft; up to 35 ft depth in channel)

What information is needed and what questions should be answered to improve the response to these scenarios? Prioritize these needs/answers (i.e., which address in 12 months, 2-3 years, 4+ years).
-Toxicity
-sink or not, and how long
-vapor hazards
-response considerations
-railroads and response capabilities they have
-contracting agencies (e.g., MSRC)
-Got a plan in place
-Haven't practiced grey responsible party
-FOSC can federalize a spill in a moment
-OSC would assume responsibility, start hiring contractors immediately
-investigate what railroads have and what they do not
    -clear expectations

How does Contingency Planning need to change to accommodate an oil sands spill?
-Is there a contingency plan for the railroad?
-Who are prime contractors?
-MSRC would be activated by Coast Guard (railroad is not their customer)-could be a task order under coast guard
-Have to be members with MSRC to be involved.
-Not on list of MSRC product, the OSP would have to be on the list
-OPA doesn't include OSP, must be included
-Area that already has contingency plans
-GRS in place
-Contingency plans may need altercations for components of this product
-Six oil and gasolines
-No strong response for sinking oil, won't sink as readily in saltwater
-if it sinks, very little knowledge and little equipment and experience.
    -nasty, sticky spill. Sunken oil is an unknown (but it is with any spill; every spill is

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unique)
-Most products fate and behavior are known in a range of environments; however, OSP has more unknowns
-Maine is not equipped to deal with sunken oil
-Most oil is a mix of many compounds
    - OSP is two different components (diluents and bitumen)
-How to contain migration of sunken oil
-if grass or something gets incorporated with oil it may help keep oil afloat.
    -first response options; yet additions to spilled product is controversial (difficult to approve)

Scenario 1: Scarborough Marsh
2. no specialized equipment for sunken OSP
-Not effective strategy
-difficult to access
-Highly vulnerable environment
-Response tradeoffs: sensitivity of marsh vs. removal: how clean is clean
-Safety and health of humans
4.Vapor hazard
Whether or not it will sink
Best technology for responding to sunken oil
Tradeoffs: aggressive removal versus natural attenuation: How clean is clean
Number of stakeholders for marsh (e.g., Audubon, friends of Scarborough marsh)
Natural flyway for waterfowl (international migratory birds)

Scenario 2: Kennebec
2.challenging response
-Cold weather, ice, river currents
Outside of marine response zone- inland of marine response zone
-little contingency planning except for what railroads may have
4. Where sunken oil would collect
-what's at risk (no EVI, no GRS)
-Do have protected and endangered species (e.g., eagles, sturgeon)
-That far up river, not covered in contingency plan

Scenario 3: Fore River into Casco Bay
2.-Effective strategy
-Closest to response equipment
-Challenges of being close to large population
-high media coverage
4.Sunken oil and how to deal with it, especially

All: sunken oil not covered in contingency plan
Need to know under what conditions do OSP oils sink (e.g., temperature, salinity, turbidity)

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Baseline data for affected areas, clean-up standards.

Group A:
Question 1

- Worst-case: Scarborough Marsh
- Medium spill: Kennebec
- Small spill: Fore River into Casco Bay

Scenario 1: Scarborough

- 40+ car OSP Train collision with a passenger train, derailment over Scarborough Marsh during Late Fall with threat of foul weather and submerged OSP
-

Scenario 2

- **Railroad bridge crossing (or near river) Near Agusta. Spill in estuarine river environment, South of Agusta in Kennebek and Sassinoa Rivers. Compromised track (possible spring). One leaking Car in Kennebek river (<28,000 gallons)**

Scenario 3

- **Embayment Casco bay near Fore River going into Portland Harbor, (Medium Spill: 6 railcars). Railway bridge (next to Sprague facility) about 0.5 miles to Casco Bay from there.**

Issues and information needs Scenario 1

- no specialized equipment for sunken OSP
- Not effective strategy
- difficult to access
- -Highly vulnerable environment
- -Response tradeoffs: sensitivity of marsh vs removal: how clean is clean
- -Safety and health of humans
- Vapor hazard
- Whether or not it will sink
- Best technology for responding to sunken oil
- Tradeoffs: aggressive removal versus natural attenuation: How clean is clean
- Number of stakeholders for marsh (e.g., Audubon, friends of Scarborough marsh)
- Natural flyway for waterfowl (international migratory birds)

Issues and information needs Scenario 2

- challenging response
- -Cold weather, ice, river currents
- Outside of marine response zone- inland of marine response zone
- -little contingency planning except for what railroads may have
- Where sunken oil would collect
- -what's at risk (no EVI, no GRS)
- -Do have protected and endangered species (e.g., eagles, sturgeon)
- -That far up river, not covered in contingency plan

Issues and information needs
Scenario 3

- .-Effective strategy
- -Closest to response equipment
- -Challenges of being close to large population
- -high media coverage
- Sunken oil and how to deal with it

Contingency Planning Changes

- sunken oil not covered in contingency plan
- Need to know under what conditions do OSP oils sink (e.g., temperature, salinity, turbidity)
- Baseline data for affected areas, clean-up standards.

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Introductions
Salt water influence into the freshwater rivers
Consider potential marine incidents

Overview

- Coastal impacts – PanAm line comes across from NH – spills go really fast & meet out in the bay
- Goes through mid-section of Scarborough Marsh – largest one in the state
- Saco – runs along Saco River
- Portland – big rail yard has various drainages known & unknown into the harbor
- Androscoggin River
- Going off to Bath/Brunswick – owned & operated by the state
- Through Augusta
- Kennebec River – flows rapidly, tide runs 8-12? Feet
- Androscoggin River drains down through Brunswick
- Bangor area runs across & up Penobscot River – tidal up to Bangor – in Bangor mostly freshwater, as you move down it becomes mixed & then saltwater
- Secondary concern amongst several of those rivers – fair amount of spring flooding; every several years it will be very significant
- It will flood the tracks in Bangor
- Are we going to focus just on rail or also on vessels?
    - Charge is primarily rail – not pipelines, not vessels
- Marine spill planners are almost always focused on offshore risks; now we're shifting focus to spill that would come from land into a marine environment; now marshes & estuaries are entry point into marine environment; ebb tide is friend
- Geographic plans are designed to take into account offshore environment
- In the state of WA do the response plans consider rail spills?
    - Very few of them consider rail
    - May have rail into one of the rivers; river receptors into pipeline spills
- Are there applicable GRPs in ME that consider rail spills?
    - Addressing how to deal with oil in both tides, but most of the assumptions are that it's an offshore source
    - All the GRPs were created by stakeholders
    - What we're doing now is evaluating/testing strategies; it's time consuming; addressing more of the land-based spill coming into marine environment

For each environment, what kinds of spill scenarios could occur?

- Estuarine Rivers – could be impacted by a rail incident and are in marine environment
    - Piscataqua
    - Saco – SF (Spring Floods)
    - Androscoggin - SF
    - Kennebec - SF

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- Penobscot – SF
- Presumpscot – small river but it would drain into Casco Bay

- Embayments
  - Casco Bay
  - Saco Bay
  - Penobscot Bay
- Salt Marshes
  - Wells (Rachel Carson Preserve)
    - Less direct
  - Marsh Stream
    - Would be as a result of a spill to the Penobscot
  - Scarborough
    - Potential direct release into the marsh – rail already goes through there
    - Is there any sort of response plan in place?
      - There's a GRS that we modified; it's probably to boom stuff out; the most important thing we learned is that the current regime is extremely interdependent/dynamic – tides, sand bars, currents, etc.
      - Marsh, in terms of depth – not exceptionally deep – but railroad is right through the middle of it
      - To bring equipment in would be difficult; have to crane everything in; there's a boat launch
      - Summer vs. Winter – winter would be a very challenging response
      - Is there any variation during the year for transportation volume?
        - No
      - Does the substrate freeze up?
        - It still moves though
      - Various manmade gulleys cut through from historic hay harvest – spills would move through there
      - Trying to understand what the salinity is going to be like – does it always depend?
        - It's pretty salty
        - It's all tidally influenced, except during spring floods when you'll get runoff
      - If you've got a light condensate with the dilbit, & you get in there quickly, would it burn well?
      - Jet fuel at old Brunswick naval station – does the rail run close to there?
        - No
      - Rail vs. pipeline spill – 20,000 plus or minus in rail car – scope would be much more limited & event shorter
      - Is there instantaneous release?
        - No
        - Bunker C – if it's any type of release it would be small
        - Where would it fall of the track? Hard rocky environment train goes a little bit faster.
    - Example from Canada – wasn't dilbit but a heavy bunker oil – big

mess, major cleanup challenge

For these scenarios, what would the response be now?

Scarborough Marsh:

- Train derailment with major release – what would general response be?
  - Mobilize containment equipment
  - CG could get MSRC involved through USCG/MSRC contract only if CG federalizes the response
  - Non-member service agreement?
  - What are requirements for contractors to have marine response?
    - They don't have one
  - Send personnel & our equipment down – clean harbors & people like that to recover what's recoverable in immediate area; be in touch w/railroad; plan based on tide, air monitoring, etc.
  - This marsh would be in CG jurisdiction? Yes. Have the sectors thought through rail type of incident? They have – Sector Northern New England
  - Does the area plan have rail scenario?
    - No but gets talked about periodically
- What would MSRC do for spill in Scar. marsh?
  - Talk w/state
  - Containment
  - Marco skimmers, power packs, vacuum trucks
  - Access could be the problem
  - Trooping around in marsh or would it self-attenuate?
  - Passive recovery
    - Pompoms works well for heavy oil
    - Sorbent line
- Oyster population – there is a program in place for seafood safety in event of spill
- Does MSRC have capability of directly addressing recovery – heavy group 5 oil
  - Yes, heavy skimmers
  - But heavy equipment – excavating equipment – orders from NOAA?
  - Let oil run down boom into skimmer on ebb tide
  - Marco skimmers, jbf, drums
  - Deployable recovery containment vessels
  - Good boat ramp
  - Skimmers in Portland
- If oil adheres to the bottom?
  - Smear & resmear

    - Historically left it alone
    - Pick up floating oil – use pompoms & smears – left weeds alone – depends on the situation what you're going to do
- Species of particular concern?
    - Nesting birds – piper plover
    - Wintertime – goldeneye ducks, loons
- EVI would reflect the species of concern

Estuarine Rivers

Salinity –

- On Penobscot. & Kennebec. Rivers, don't have to go very far up the river before there's a change in salinity
- Spill locations would be much more freshwater until they got flushed down toward the sea
- Depending on time of year there could be more silt which would make it more likely to sink
- Particularly when talking about flood stages – heavy sediment – would tend to make oil sink, but in freshwater, oil would tend to float – almost guessing game to figure out how it would behave
- Would water quality affect behavior of the oil in industrial areas?
    - All of the mills are served by rail – derailment/discharge is possible
    - Baseline for cleanup?
        - One thing that has been used in past is mussel watch data because bivalves take up contaminants
- Does ME DEP have an equivalent to a mussel watch type of program?
    - We have public health division that does shellfish, red tide, etc. – but it's more for shutting down fishing & certain flats and that kind of thing.
- Freshwater – likely to be denser; saltwater – likely to be less dense
- For MSRC – Have you thought through spill scenarios like this, for an oil that is not necessarily contiguous?
    - In the past, we dragged w/pompoms; sent divers down to check for water clarity – Athos I spill response strategies for submerged oil
    - Kalamazoo – they had PVC pipe with holes (aerating system); weed wacker
- What would you do if you had a lot of oil neutrally buoyant?
    - Can't track it electronically
    - Selendang Ayu - Actively went out with nets & trolled for it
    - Floating silt fence type boom w/polypro skirt – would at least give indicator if the stuff is there
- Water intakes for small scale lobster holding facilities/lobster pounds – potentially impacted resources
    - Are the pounds open to the water? Yes. If you have a co-op or dealer that has a holding facility it would be an intake pipe
- Seabrook has seawater intake (reference Athos I)
    - Volume of oil would be insufficient from a rail incident to impact but from a marine perspective, that's a major issue
    - They don't close their intakes – you would have to power the plant down;

they'll be able to restrict the flow & operate for a number of hours

- Could go into combined sewer and end up going into sewer treatment facilities
    - In high flood situations, treatment plants could be bypassed & oil run directly into water bodies – CSO potential source into bodies of water where you wouldn't otherwise expect oil input
    - Economic loss
    - Political? – closing flats – but flats are opened & closed all the time
        - Dilbit would sink
        - WA state – oil on tidal flat – state would ask for recovery
        - ME – get a lot of tidal flushing

Embayments

3. What issues/challenges would the response face (e.g., for the environmental unit, logistics, human dimensions, health & safety) that are unique to these oil sands spill scenarios?

- Passive recovery tends to be politically contentious
- Communication to the public is very important
    - Bitumen – higher pH levels, toxicity
- Health – (perception of) chronic health issues, esp. in seafood
    - Even things that happen hundreds of miles away have a big impact on public perception; e.g., when towers were taken down in 2001, ME governor was getting calls that people thought their health was being affected from the dust
- Is there a way to do something in advance of an incident?
    - Area committees, LEPCs can do active outreach & engagement along w/industry & all the stakeholders – but it's time consuming
    - Nuclear industry has done a very good job over the years, because of the perception – making info available on reliable websites, info is in the hands of people who are trusted – info available so people can see it ahead of time; communicate that we know there are risks & this is how we are managing the risks
        - Follow-up – so who does that?
            - Area committees
            - Responsible party (but resp. party won't be trusted)
            - RRT can play a role in that as well

When?

A good time to do it is once the product (dilbit & synbit start coming into the state) – that's a good time to start educating people, or even before that – once you have confirmation that it's going to come into the state (example: natural gas/info to first responders & public ahead of time)

Is that something that will happen naturally/easily?

It wouldn't be organic. (ME)

Even thought state tries to get ahead, public perception

Specific issues related to this particular product?

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Economic impact – grew up in a town that relied on fishing industry
Fishing community & fisheries market perceptions will be an issue for communities that depend on commercial fishing
Is that unique to this product? With regard to water column
Would want to see more testing/research on how it would behave in water environment
What conditions do you need to make it sink?
With respect to seafood – how chronic is it?
We don't have enough information on how it's going to behave in seawater. Air monitoring, collection strategy will be the same, but what will happen to it in seawater? In most cases, seawater is a more dynamic environment.
Comparing to Kalamazoo – a lot harder to find in deepwater.
Some of the estuaries – either bedrock bottom or mud bottom depending on where – changes flow rate.
WA state – currently getting it by barge from Vancouver – wasn't reported until an inquiry was made
Knowing if you're dealing w/synbit vs. dilbit; if you have dilbit what are percentage diluent components; synbit has the same characteristics as a crude, but dilbit does not
It seems like you need to know what the stuff is, but it seems like there are no regulatory mechanisms
Additives aren't being taken into consideration – it's being treated like a crude oil – for response purposes; we need a way to get the information
Would dilbit vs. synbit really impact response at the beginning?
If it were a vessel & offshore & people wanted to use dispersants, I don't know if that would be the best.
Has that dispersant be demonstrated as effective against that crude?
Could use dispersants within 3 nautical mi. in WA because there is deepwater close to shore.
What do you need to know & why?
Is it dilbit or synbit?
What's the diluent?
Within CRW there seems to be variation – is it heavy benzene or lighter benzene; what are the other materials in there? That will impact what we monitor – driver is health & safety.
There seems to be no regulatory req. to call oil sands anything more than crude oil on the other side of the country; we need to know if it's an oil sands product that's been cut with a diluent
Need to know from an environmental perspective as well (in addition to health & safety) – helpful to have any indication as to behavior after initial release
Regulatory change? Would need to include DOT/PHMSA, EPA & USCG. How would we pursue new placarding & notification? (NRC? Chemtrec?) Are railroads regulated like vessels, as far as knowing what they're carrying?
WA has been trying to get at some of this. Asking shippers to provide more information about the nature of the product that is being shipped. Pushback – some of the information is considered proprietary.
Enbridge Kalamazoo spill..for a long time Enbridge said it was crude oil.
Irving says ME can call Irving & get the assay
In WA – all bulk oil transfers over water are documented
DOT would definitely have to be involved

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Does your link to industry give you an in, in a way that public agency isn't able to?
First we need to know what it is. How do you find out? Hoops – a lot of steps.
Look at the train list, find out the point of origin & call the point of origin. Some railroads are easier to deal with than others.
Knowing what is in it is important – in WA had a biodiesel spill & it ate the skimmers – probably combination of methanol & sodium hydroxide.

4. What information is needed and what questions should be answered to improve the response to these scenarios? Prioritize these needs/answers (i.e., which address in 12 months, 2-3 years, 4+ years).

Sources of information?

What is the diluent?
How does it behave in saltwater? How does it behave in a range of salinities?
Need to know beforehand whether it is dilbit vs. synbit
Ohmsett testing (bring this up to ICCOPR)
Chronic toxicity testing/information – esp. if it's sinking into the sediment
Seafood safety (e.g., Can we take the shellfish/clams & clean them?)

5. How does Contingency Planning need to change to accommodate an oil sands spill?

- Would add to contingency plan a mussel watch program or something similar – any of ME's public health sampling programs
    - Could ask them to add data such as PAH's
- Talk more about scenario when oil is starting out in one type of behavior/environment, and then as it moves down & environment changes, behavior changes
- Potential fisheries interactions with mid-water or submerged oil
- Communication to the public regarding the product & its risks – being able to provide info to public but also to first responders during the first 2 or 3 hours – pre-event information even if it's canned material
    - Example – rail car rollover – trade name is latex – turns out there were 4 under the name of latex
- Review contingency plan to note differences from offshore spills coming onto land vs. land-based spill going offshore

Group B Plenary Session – Marine Environment

Salt Marshes, Embayments, Estuarine Rivers

I. What types of spill scenarios could occur?
   a. Minor leak
   b. Major leak
   c. No leak

II. Seabrook has seawater intake (reference Athos I)

III. WA state – currently getting it by barge from Vancouver – wasn't reported until an inquiry was made

IV. Additives aren't being taken into consideration – it's being treated like a crude oil – for response purposes, we need a way to get the information

V. Saltwater, freshwater & interface between the two – dilbit & synbit; differences in diluents
   a. Floater
   b. Sinker
   c. Mid-water neutrally buoyant

VI. Natural resources
   a. timing of action
   b. When to shut down intakes
   c. Seals

VII. Vapors at the surface could be elevated

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For each environment, what kinds of spill scenarios could occur?

Combined environments:

1-14 train cars (20-40 mph, 26,000 gallons oil/car) is likely derailment
Speed major factor in amount spilled

Unit train sizes:

80-100 cars max

Causes of derailment:

Wheel damage/Broken rail: 4-5 cars (100,000 gallons)
Crossings:

Time of notification in train wreck would be quick

Standard protocol: communication every 30 min (worst case), 5 mile notification

Rail accidents are instantaneous releases vs. pipelines which can be continuous

Additional hazard materials may be released from other cars and complicate response.

Unit trains are preferred over mixed cargo. (applied in MMA) Panam is running mixed trains.

Different accidents in different environments?

Over land flow and/or directly into water. Concerned with sediment interaction and immediately sinking.

Seasons: winter harsh conditions but osp more viscous (less movement)
Captured under ice, roads more compact but may not be plowed
Spring is worst time for spill: more water flow, roads bad, nesting seasons.

Mobility of oil spilled for the various environments:

Lakes: oil moves slower
Rivers/Streams: oil may spread faster
Bogs may offer a different scenario than the 3 listed.

Spills will likely affect combined environments

- Streams/Rivers
  - Drop-offs
  - Washouts (storms)

    - Possible inspection
- Ponds/Lakes
    - drop-offs
    - public water supply
- Wetlands

For these scenarios, what would the response be now?

Pace of response, equipment resources, responders

*Railroad/shipper is initial responder for cleanup, with OSRO.
*ME DEP owns lots of equipment and has been used successfully before.
*EPA will have federal authority.
*Turnaround time on Spill modeling, NOAA?
*Need for air monitoring

Derailment (4-5 cars)

Railroad make notifications: size of spill, local responders and DEP come in and most senior person is incident commander, unified command established. EPA will defer to ME DEP but will help as needed (large spills 100,000 gal +). Railroad/shipper is initial responder for cleanup although EPA person is likely to be sent to train incident. OSRO likely hired by responder. Emergency response plan, established contractors, contacts, OSRO is Clean Harbors. Responders make initial communication, access routes.

- Streams/Rivers
  Restoration
    Level of toxicity

- Ponds/Lakes
  Tools/equipment:
    Response equipment readily available: Skimmers, booms, sorbents, pumps are in place owned by DEP or ME contractors. Need more materials (sand bags, PVC bags) for dams. Heavy oil spills require special skimmers. Clean Harbors experienced with heavy oil spills.
  Assessment/Monitoring
    Floating spills are simpler to monitor: skat teams, over flights, Alaskan Clean Seas using infrared for oil under ice

Submerged oil: much more difficult to get at, burning is possible response technique. Finding and getting at submerged oil is the big issue. Divers with pumps/vacuums to remove oil on bottom.
Dredging? (not in protected wetlands)

Divers surveys/maps, sampling (lobster traps), polling, drilled through ice

Sample for benzene, PPB PID Ultra RAE. EPA mobilize contractors to aid in monitoring and has equipment/monitoring capabilities. ERT team in NJ, mobile lab to run air samples. Closest EPA office in Boston with 6 hr response time. Aircraft to aid in spill (1 day response time). Canadian services may be activated for info and monitoring.

Restoration
Level of toxicity?
Capping: sand for filtration layer and stone

- Wetlands
  - Restoration
    - Natural attenuation

What issues/challenges would the response face (e.g., for the environmental unit, logistics, human dimensions, health & safety) that are unique to these oil sands spill scenarios?

*Remoteness of response
*Lack of local response in unorganized townships
*Limited tracking/response for submerged oil
*Product information
*Health and Safety monitoring (air)

Logistics

Equipment readily available for sunken oil is limited. Only thought about coastal environments and have not much experience being in back woods. FEMA must set up a camp-no hotels (need to house 100+ people). Long distance commutes (to site and back), set up camp, life support systems. Access point to railroads may be better from Canadian side, easier to bring equipment from Canada. Quebec and New Brunswick. Cellphone service may be issue, radios. Logging companies would be cooperative.

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Response

Access to chemical data and MSDS sheets. No internet access in woods. Shipping papers, basic emergency response guide book are readily available. If it was an unusual train it would be documented and known ahead of time. Inland spill planning is limited in current Contingency planning. OSP scenarios will have long response time (24 hrs) depending on location and time of year. Waste management must be properly handled. Coastal response people do not have inland training. Have conducted some international exercises have been conducted and rivers/slopes go across boarder which may pose issues. Majority of streams in our case go east and not into Canada.

EPA timelines for response would be 6-8hrs (limited responders/equipment) and additional help would take longer. Monitoring equipment would be implemented in a day. Environmental Response contractor, OSRO. Fire departments. Irvin Oil good source of response equipment

Health and Safety

MSDS sheets not usually on train but can be made available. Emergency response information is available (guide book) ERG. Crude oil has many components. Dilbit. Respirator equipment, need to know what safety equipment is necessary. Allowable concentrations vary for VOCs. BTEX in dilbits are a concern. Assume worst case scenario for safety. Hexanes. MSDS does not show % of constituents or shows too broad of a range. ASSAY. Need to be aware of all available forms of information for contaminants during spill. Flammability, temperature, pressure. Remote location and medical treatment is far away. Winter can be harsh and road access is very difficult. Medical services on hand or nearby dedicated to responders.

Special concerns in talking to local residents regarding local spill

Misinformation is an issue, public wants the truth. Residents may get scared. Partner with local health department in case of spill.

Evacuations

Short term evacuation. More people may be affect in short term for this type of spill vs. an oil tanker. Remote areas therefore may not be any local establishments. Local people on response team would provide necessary information. Evaacuation during a derailment may be difficult.

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What information is needed and what questions should be answered to improve the response to these scenarios? Prioritize these needs/answers (i.e., which address in 12 months, 2-3 years, 4+ years). Capabilities?

Immediate: Chemical info, suken oil response capabilities. Lessons learned from previous spills.

Mid/long term: Baseline data, outreach to local officials (fire department, education). Staging equipment inland. Interstate route response planning, RRT. International, (Canada). JCP (Joint contingency planning). who would write the new contingency plan? Is a separate committee needed and bringing in new stakeholders.

EPA best management practices, lesson learned from Kalamazoo may not be available quickly. Experience with HFO will help. Flow patterns for boom locations needed. Possible restaging of equipment, construct new facilities, new partnerships (logging companies, paper mills). Weather stations, flow gauges (available for major waters).

Wildlife responders may face challenges with different types of animals. Concerns with catching bear, muskcrat, frogs, Great blue heering. Species may lay eggs in sediment. River otters are more difficult to clean than turtles. Larger animals may be driven away due to commotion of response. Many water sources available if one is taken away.

Baseline environmental data for inland/river systems needed. Limited water quality testing in waters. *Not much information on bottom types for lakes/streams

Info of Constituents/chemistry of oil is needed.

Suken oil response: methods to contain before gets into water. River boom is necessary and surface to bottom skirts. Jelling agents (application issue)

Immediate: Chemical info, suken oil response capabilities,

Mid/long term: Baseline data, outreach to local officials (fire department, education). Staging equipment inland. Interstate route response plannig, RRT. International, (Canada). JCP, Joint contingency planning.

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How does Contingency Planning need to change to accommodate an oil sands spill?

*retrofitted for inland response! Inland EVI (environmental vulnerability index)
*Submerged oil response and modeling of heavy oil
*Scat modification and assessment techniques for inland, overbanks, riverbeds, lake bottoms.

*contacts for inland spill will be different than coastal zone spills
*more robust air monitoring for health and safety
*Cameras on trains can provide videoography of train rail/surroundings (what receiving environment looked like pre and post spill)
*Must identity who has the information that you are looking for…contacts
*Google earth like images on train tracks
*Separate committee for local emergency response, who would write the new contingency plan?

*Pre established areas for medical pick up

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Group D –Freshwater Environment
Group Lead: Peter Kinner
Recorder: Mindy Bubier
Participants
Heather Dettman (Virtual)
Dwight MEDOT Mgr Groundwater Haz Waste Divisions
Karen EPA Region 1 On Scene Coordinator –Boston Office
Kara Walker -MEDEP Office of Response
Deborah Wick National Response Corporation
Dave Nagy PanAm Railways –Safety and Security
Ginger Response Planning Coordinator

1. For each environment, what kinds of spill scenarios could occur?

- Streams/Rivers
- Ponds/Lakes
- Wetlands

Train Derailments
Concern regarding "double couplers." With this device it requires a greater weight to break the coupler, which would lead to more than one tanker derailing versus just one.
Spill in a remote area
Spill in populated area
Old Orchard Beach Salt March

Spill in a pond vs. a spill in a River

Factors	Streams/Rivers	Ponds/Lakes	Wetlands
Habitat			
Access			
Seasonality			
Population Density			
Volume of Spill			
Product Type			
Toxicity			
Floating			
Sinking			
Available Resources			
Fate	Will end up in Pond or Lake	Somewhat Contained	Somewhat Contained
Receptors			
Cultural Resources (i.e. dams)			

Drinking water supplies			

2. For these scenarios, what would the response be now?

Notification

First response is 911 and fire department will respond. Conductor and engineer will make the call 911, DEP, shipper and receiver.

NRC will notify DEP and EPA. EPA will call State first to make sure they have received notification. EPA will respond b/c it is a train or greater than 1,000 gallons.

Emergency responders will respond and conduct initial safety and assessment (i.e. air monitoring). Shipper and receiver will provide information (MSDS) on product for emergency responder. On scene commander will take control.

Initial Response

Assessment
Stop the spill
Proactive Measures to stop spreading –booming etc.
May rely on local knowledge of geography etc. during initial response.

Trains do not have their own resources at facility, but would have an emergency response plan which list local Emergency response or contract such as ENPRO.

Responsibility falls onto owner and operator. Direct responsibility is where oil is coming from. If a rail, it would be the owner of the rail

Initial culpability responsibility “Open 90” Rail transporter

Prioritization of spill response:
What should be targeted first?
Where is it going to go? -Look at watershed.

3. What issues/challenges would the response face (e.g., for the environmental unit, logistics, human dimensions, health & safety) that are unique to these oil sands spill scenarios?

Size, seasonal
Communication
Whose jurisdiction, EPA vs. Coast Guard. Who has to open the fund to get money to clean-up?
Inland Accessibility
Cold weather –product under the ice
Flooding

Human resources, Maine has a seasonal population. How quick does the response need to be (i.e. evacuation) during times of high population.
Remote versus populated areas.

4. What information is needed and what questions should be answered to improve the response to these scenarios? Prioritize these needs/answers (i.e., which address in 12 months, 2-3 years, 4+ years).

Simple Factsheet with what we know. So when the time comes that it is shipped through the State Fact Sheet can be distributed.

- How do you identify that you have and OSP. What will I see on a MSDS Who should I contact?
- What do I do?
- What type of monitoring might be necessary?
- What training is available?

Additional Staffing and Funding for DEP.
Identify what it is we want to protect and where it is.
Need biologist input to identify resources at risk due to potential water column impacts?
Build geographic response plans (GRP) for rail line.
Field verify information in plans
Test response plans

FRA Program that creates a database which identifies "what goes through my town". Counties could put in a transponder which registers car.
SARA Tier II reporting requires this information already, but only on an annual reporting basis.
Notification process would help both regulators and railway.

Information on weigh bills that identifies type of product i.e. OSP

More funding to upgrade and update Maine Oil Spill Information System (MOSIS)

A lot more information on access to potential spill areas
Rail company has information on this for maintenance purposes. PanAm has about 100 miles, MMA probably does too.

Increased communication
There are three rail operators and regulatory agency. They could meet regularly (one – two times per year.)
There are various groups in each state –who is talking to one another. It seems like many people are asking the same questions, but not all in the same time or place.
Whose rail line is it and who should be contacted?
What about interchange?
What could be common miscommunications –local area names versus mapped names.

Training for local communities

CRX, Dupont and Transcaer-“Train” that is used for training. Would be good for PanAm to have their own equipment for this training. Create OSP specific training. A “table top” training may be adequate. Region teams should be sent to specific training.
Funding for training for OSR is lacking, lots of turn-over at smaller fire departments etc. increases cost of training.
Rail company can help with training by bringing equipment on a side rail.
How many people to train and who?
Larger communities are often well represented, but what about small towns
Mutual response may cover this. If neighboring communities are trained, they are going to respond.
Rail safety training video is available.
DVD will be available in early 2013
Get in touch with PanAm Railways -Dave Nagy.

Equipment
Helicopters, boats
PanAm would have equipment to help.
Potential for heavy equipment returning from IRAQ that can be obtained by police departments and fire departments.
Spill response equipment
Technology for field
Phones.
Creating database of equipment available from State agencies

5. How does Contingency Planning need to change to accommodate an oil sands spill?

Start the same way for a crude oil spill –geographic response plan for inland spills and then understand how ORP is different.

Start Contingency plan for inland.
Marine is handled
New Brunswick and Quebec are likely facing same scenario could cooperate with them.
Update Area Contingency plans beyond Marine environment.

Can evaluate rail speed mapping to identify potential risk areas.

Group D Scenario

- Focused on derailments
- Initial response would be similar to any crude/heavy oil
- We’ve done this before
- But with how can we do it better?

Our wish list for moving forward…

- Communications between groups need to be enhanced
  - Local Responders, Railways, and Interagency
- Inland sensitive areas need to be pre-identified; including identifying more of them (natural resource and economic partners)

Our wish list for moving forward…

- Use sensitive area mapping to develop paper Geographic Response Strategies along vulnerable transportation corridors
- Field check strategies and eventually perform test deployments
- Prioritize those strategies

Our wish list for moving forward…

- Development of fact sheets
  - For the public
  - For first responders
- Develop relationships to provide training
- Helicopters

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For each environment, what kinds of spill scenarios could occur?

Rail car derailment or accident, valve failure, washed out rail line in remote areas (e.g. rain storms and seasonal influences). Bridge failure over rivers
Spills on land near storm drains or other avenue to aquatic system

- Streams/Rivers
  lands on land and goes to water or directly to receptor
  flood or no flood
  season?
  frozen ice or no ice
  spawning of salmon-timing- may influence tactics

- Ponds/Lakes
  lands on land and goes to water or directly to receptor

- Wetlands
  lands on land and goes to water or directly to receptor

For these scenarios, what would the response be now?

Sources of information for each environment- are they the same or are they different
Look at local knowledge-contact local agencies like inland fisheries and wildlife
Coordinate with local resources- railway, fire department
How get information about the product- hazards
Is fire and issue with a spill? Not out of the questions especially with mixed cargo and risks of electrical system and diesel engine of the rail engine.
Start with what is commensurate to what the spill is-
One car vs. whole train?
Questions by rail owner:
Is there anything leaking?
On water/near water?
Who to call next?
What the resources are at risk

Standard protocol? Can we consider this material to be similar to other materials that we are used to working with? Respond similarly to other like materials. Still complex material-heavy oil.
Needed more air monitoring equipment in Enbridge spill. Wrong MSDS given.
24 hrs to get sample and run chemical analysis on- normally done due to legal matters
Standard practice to notify supplier about spill, so could get specific chemical information.
Responded with existing capabilities and expertise during Enbridge spill. Local authorities expect clean-up to happen in the spill locality-not letting it move.

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Need to know the shape of water body and have properly trained clean-up personal to reduce mobility. Consider prevailing winds.

Town of Jackman has air monitoring equipment, volunteers, but not ppb capabilities.

Have to work to get the rail line operating again to improve clean-up efforts. Clean-up may take priority or this could be a challenge to clean-up operations. PR issue too- who gets priority? Not necessarily product driven.

As long as floating can respond normally. Sinking becomes problematic. Deposition areas also entrain sand and debris.

Frozen conditions on lakes-consider
Speed of rail cars can influence severity

What issues/challenges would the response face (e.g., for the environmental unit, logistics, human dimensions, health & safety) that are unique to these oil sands spill scenarios?

General
Air monitoring may be the major challenge-noxious- potential for high benzene levels
Materials are proprietary and MSDS are generic
Location:
Far away/remote areas-logistical problems
Proximity to humans- air contamination
Weather conditions-temperature, pressure,
Water and flood levels
Product may be neutrally buoyant, but picks up debris and can submerge
White pom-poms in series to monitor where the oil is in the water column- used in Enbridge spill- labor intensive-not a great recovery method
Underwater cameras could be employed, but may not be able to tell
Make sure recovery equipment is the appropriate for viscous oil, appropriate pumps (maybe worse in rivers)

Streams and Rivers
Lateral transport in rivers, mixing, becoming more volatile in high energy areas-may reduce air quality issues earlier on
Nature of the turbidity matters. Silt may not cause oil to sink. Sand may cause oil to sink.
Waterfalls may emulsify oil and increase density-causes to sink. Can cause oil to disperse.
Is there anything unique about the shoreline in Maine vs. Kalamazoo? Any receding rivers could become an issue for contamination in drinking wells. Maybe the case in the Androscoggin River.
Flow variability and interaction with groundwater need to be considered
Where are areas of deposition- outer bends of rivers and man-made structures, delta areas,

oxbows?
Army corps may have capacity to hold water back in dams/spill ways. Can control the flows in most major rivers in Maine
Different flow regimes in different reaches and habitats
Increased debris
More flow possibly on bottom or river in Enbridge- dam with silt nets/screening
Dams are access areas for personnel
Drags and drops to grab oil from the bottom – sediments separate out when bring to top
Once oil sinks- how do quantify how much is there? (Not a static environment), but from rail car easier to quantify.
Does the dispersed oil re-coalesce when came back to surface? Saw evidence of this in Enbridge.
Removal of debris can alter habitat (e.g. fish spawning beds)

Ponds and Lakes
Depth
Potential increase of human population-more development
Drinking water
Understanding bathymetry is critical-not a lot of data
Wave action
Interactions with wildlife
Beaver dams

Wetlands/floodplains
Interactions with wildlife
Hydric soils in drier months
Beaver dams
Habitat sensitivity-natural attenuation? Take only what is above-not roots-more passive clean-up
Vernal pools
Access issues
Damaging habitat just by accessing – balancing access with habitat integrity
Different fate of product in this environment-increase availability to organisms?

What information and capabilities are needed and what questions should be answered to improve the response to these scenarios? Prioritize these needs/answers (i.e., which address in 12 months, 2-3 years, 4+ years).

A large area spill would stress regional and the state's capacity to do adequate air monitoring. (M)

Need to know who has control of water levels/dams in rivers (H)
Verify group 5 oil recovery assets and assessment (H)

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How much of the hydrocarbon diluent is benzene? Shipping information may contain chemical composition better than MSDS. Need a fast approach to get accurate information about the product and where to get that information (H)
More research on properties, fate and transport, toxicity of product-include tanks tests on OSP-Bedford Institute? CRREL? UNH flume (H)
Qualitative assessment techniques-more research on (H)
Lessons-learned from similar spills and document research needs on a continuous basis (H)
Risk-based analysis/management-DEP could have a framework for this and identify high consequence areas (L)
NRDA- synthesize existing data of all the resources along rail corridor-determine where base-line is (L)
Identify appropriate and new recovery equipment and techniques needs for group 5 oil (M)
Continue to support innovation of recovery technology (L)
Have more information to develop a timeline of if and when this product is coming to the area (H)

How does Contingency Planning need to change to accommodate an oil sands spill?
Design a response strategy based on different areas/habitats?
Develop outreach products
Update plans
Do we need to develop plans that are specific to the product?
Better plans to address river habitats
Include specific response plans for different products in training
Develop contingency plans for local responders-e.g. state fire academies, emergency responders
Revitalize inland area response plans
Mutual aid agreements
Have a forum to disseminate information on response to LEPC (Local Emergency Planning Committees) - lead by state agencies?
Regional response (RRT) – include in upcoming agenda and overall plan (RCP)

Group E plenary report out
Question 1

- Size doesn't matter
- Most likely scenario: a derailment or valve failure
  - Product could go directly to water
  - Product could flow over soil to water or marsh

Question 2

- Standard approach to oil release emergency (size, product and location)
- Likely difficult logistics (very urban or very rural)
- Need for air-monitoring
- Mostly similar to a heavy oil release

Question 3

- General
  - Air monitoring
  - Product specifics
  - Floating vs. submerged
- Rivers & Streams
  - Different reaches (quiet vs. rapids)
  - Dynamic (flow, dams, waterfowl)
  - Potential impacts – groundwater
  - Depositional areas & Debris (log jams)

Question 3 (cont'd)

- Ponds & Lakes
  - Drinking water sources
  - Bathymetry
  - Interactions with beaver dams
  - Surface forcings (wind & waves)
- Wetlands/Floodplains
  - Different methods (alternatives?
  - Habitat sensitivity

Question 4

- A large area spill would stress regional and the state's capacity to do adequate air monitoring. (M)
- Need to know who has control of water levels/dams in rivers (H)
- Verify group 5 oil recovery assets and assessment (H)
- How much of the hydrocarbon diluent is benzene? Shipping information may contain chemical composition better than MSDS. Need a fast approach to get accurate information about the product and where to get that information (H)
- More research on properties, fate and transport, toxicity of product-include tanks tests on OSP-Bedford Institute? CRRL? UNH flume (H)
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- Have more information to develop a timeline of if and when this product is coming to the area (H)

Question 5

- Outreach products for Public, LEPCs, FDs, Responders
- Review existing inland plans