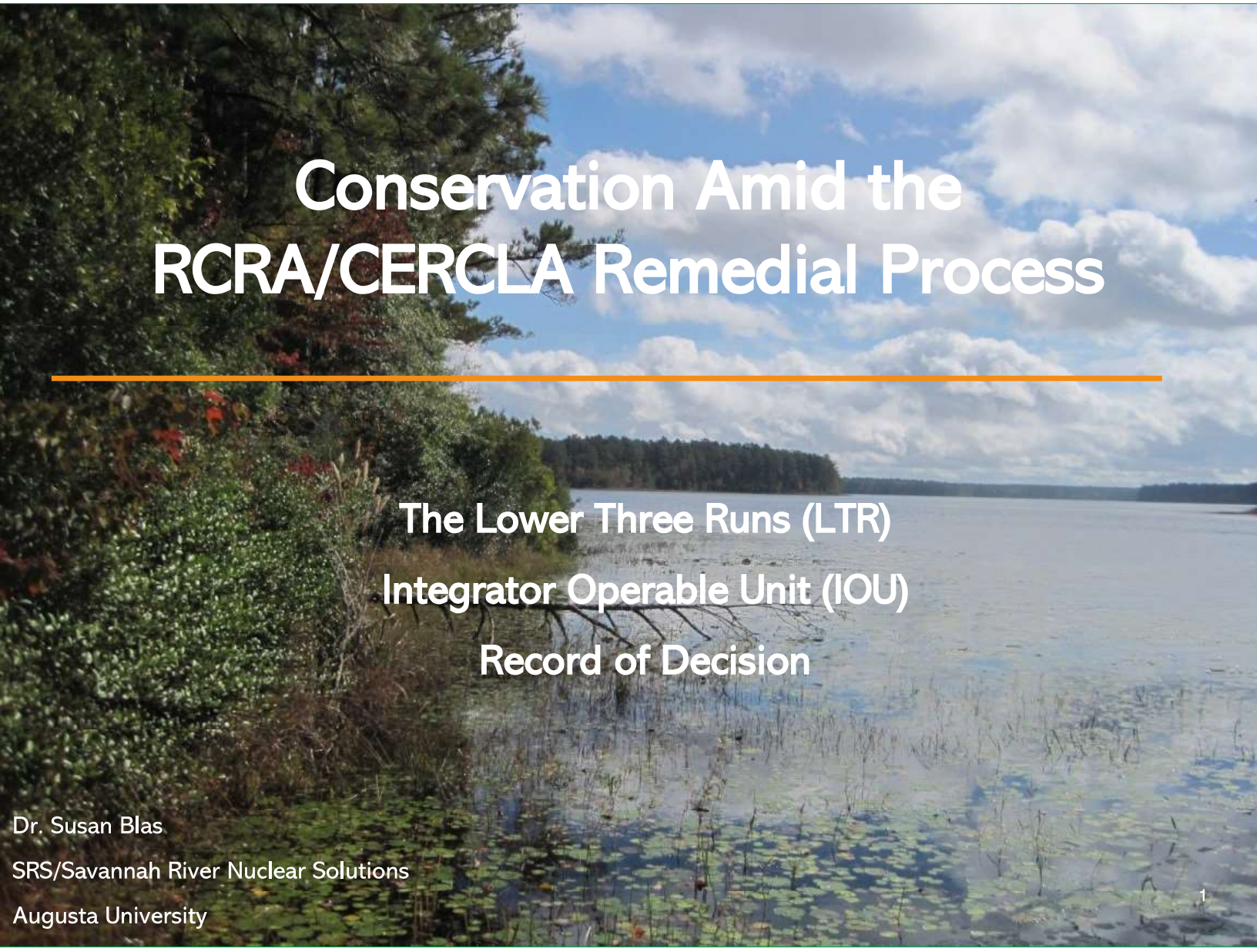
Contract No:

This document was prepared in conjunction with work accomplished under Contract No. DE-AC09-08SR22470 with the U.S. Department of Energy (DOE) Office of Environmental Management (EM).

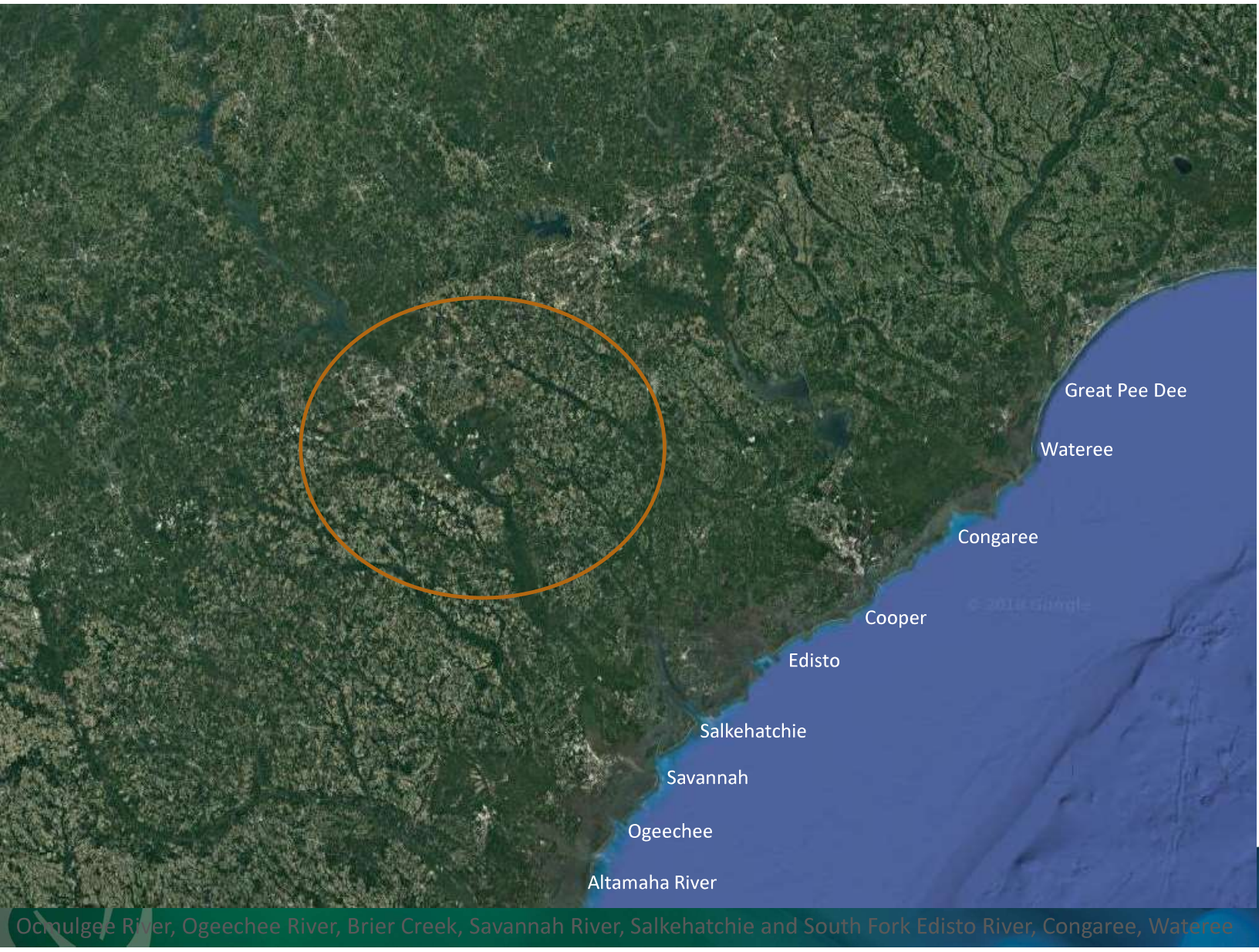
Disclaimer:

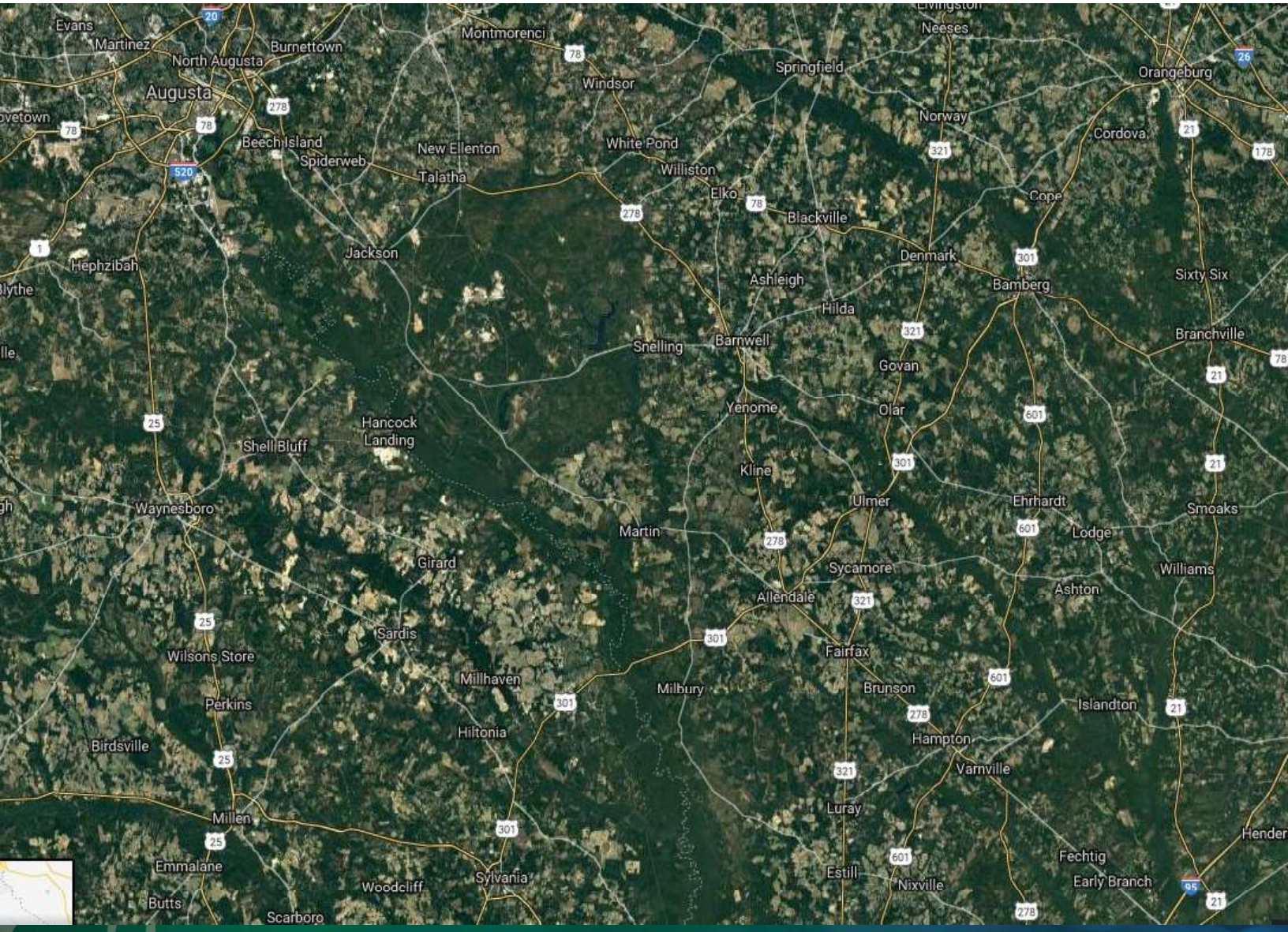


Conservation Amid the RCRA/CERCLA Remedial Process

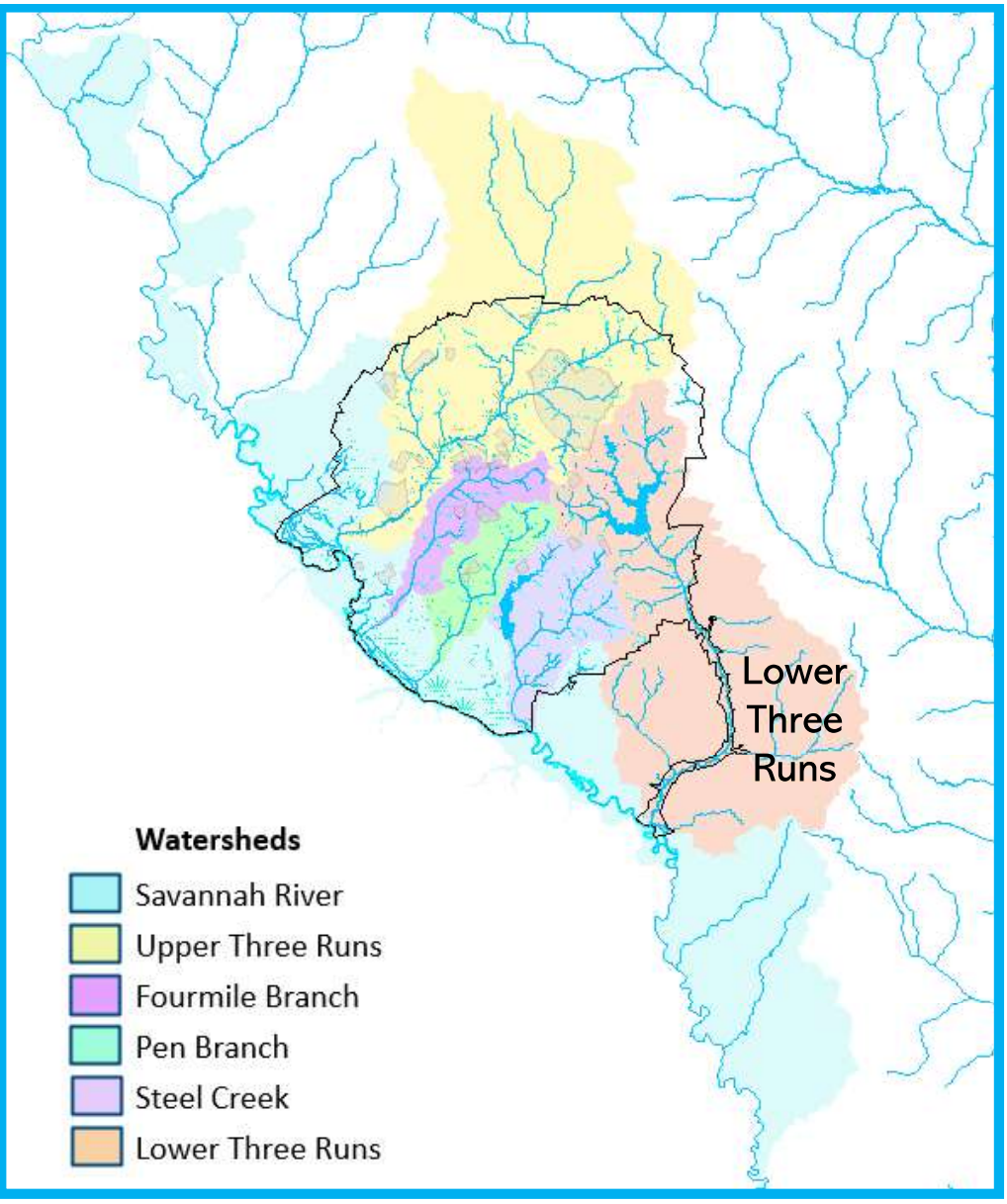
The Lower Three Runs (LTR) Integrator Operable Unit (IOU) Record of Decision

Dr. Susan Blas
SRS/Savannah River Nuclear Solutions
Augusta University


Great Pee Dee
Wateree
Congaree
Cooper
Edisto
Salkehatchie
Savannah
Ogeechee
Altamaha River
Ocmulgee River, Ogeechee River, Brier Creek, Savannah River, Salkehatchie and South Fork Edisto River, Congaree, Wateree



Brier Creek, Savannah River, Salkehatchie and South Fork Edisto River



SRS Watersheds and Stream Systems

SRS is a National Priorities List (NPL) Site (CERCLA)

Streams systems were added to the SRS Federal Facility Agreement (FFA) in1997

Integrator Operable Unit (IOU)

- Surface water,
- Sediment/floodplain soils
- Biota

LTR Canal/Pond System – Birds' Eye View

Purpose of the IOU Program

- Evaluate contaminants in SRS stream systems
  - Assess **human health risk**
  - Assess the **ecological health** of the stream system
  - Determine if **remedial actions** are needed to protect human health or the environment

- Final IOU remedial decisions are made when all cleanup actions within the watershed are complete (i.e., **no sources** of contamination)
- LTR is the first IOU to reach **final decision** phase

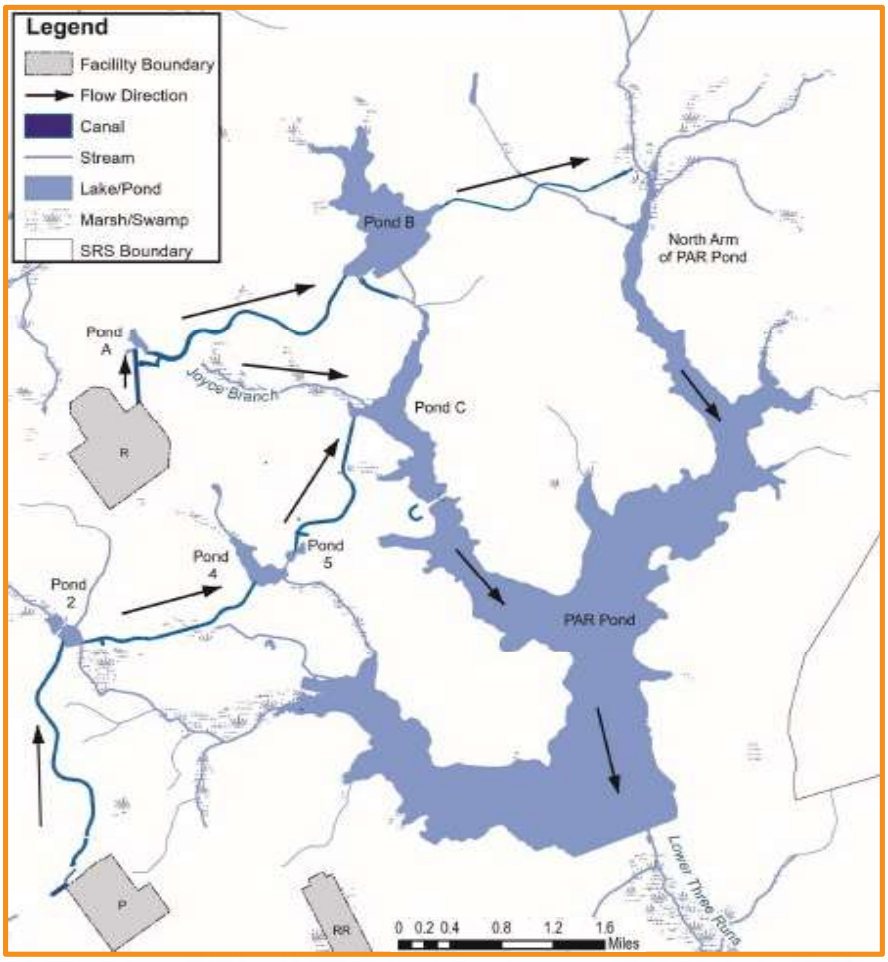
Canal Outlet Structure to Joyce Branch (Old Discharge Canal)

History of R- and P-Reactor Operations

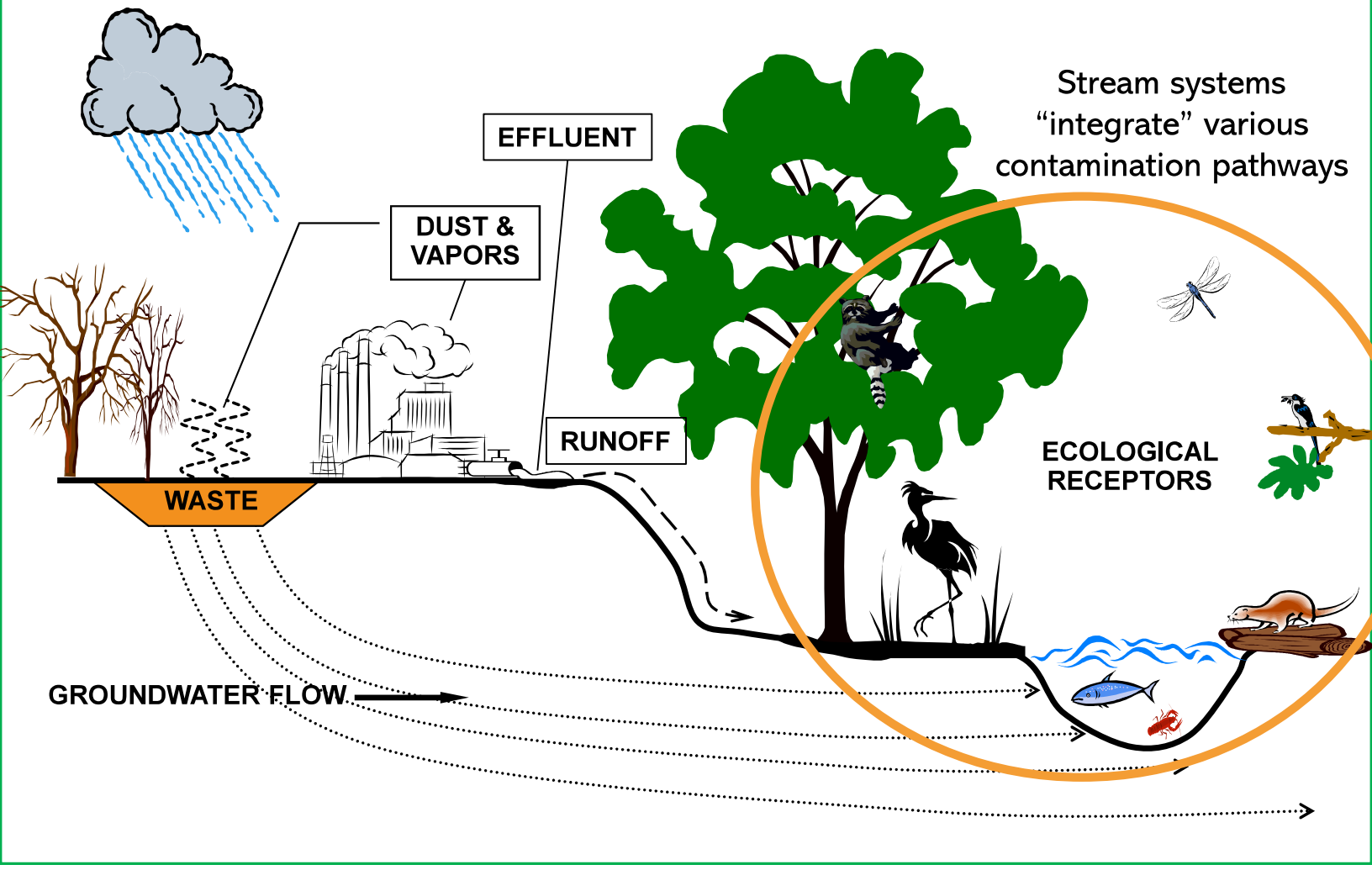
- R-Reactor began operations in 1953; P-Reactor in 1954
  - Prior to creation of PAR Pond, R-Reactor discharged heated water directly into Joyce Branch (the "Old Discharge Canal")
  - In 1958, PAR Pond was created by constructing an earthen dam across the LTR creek, and the pre-cooler ponds and canal system were constructed
  - Effluent discharges from R-Reactor ceased in 1964
- PAR Pond also served as a cooling reservoir for P-Reactor until 1988
  - Heated water was released through a second series of canals and smaller pre-cooler impoundments into Pond C and then released into the "hot arm" (middle arm) of PAR Pond.
  - Prior to creation of PAR Pond, P-Reactor discharges were sent to Steel Creek

Reactor Flow Direction for Canal/PAR Pond System

- Effluent from R-Reactor was routed through R Discharge Canal to PAR Pond
- Effluent from P-Reactor was routed to Pond C and released into the middle arm of PAR Pond



Conceptual Exposure Model



Human Health

- **IOU Receptors**
  - **Human Health**
    - ***On-site Worker***
    - ***Adolescent Trespasser***
    - ***Potential Resident***
    - ***Fisherman (subsistence level)***
    - ***Recreational Hunter***

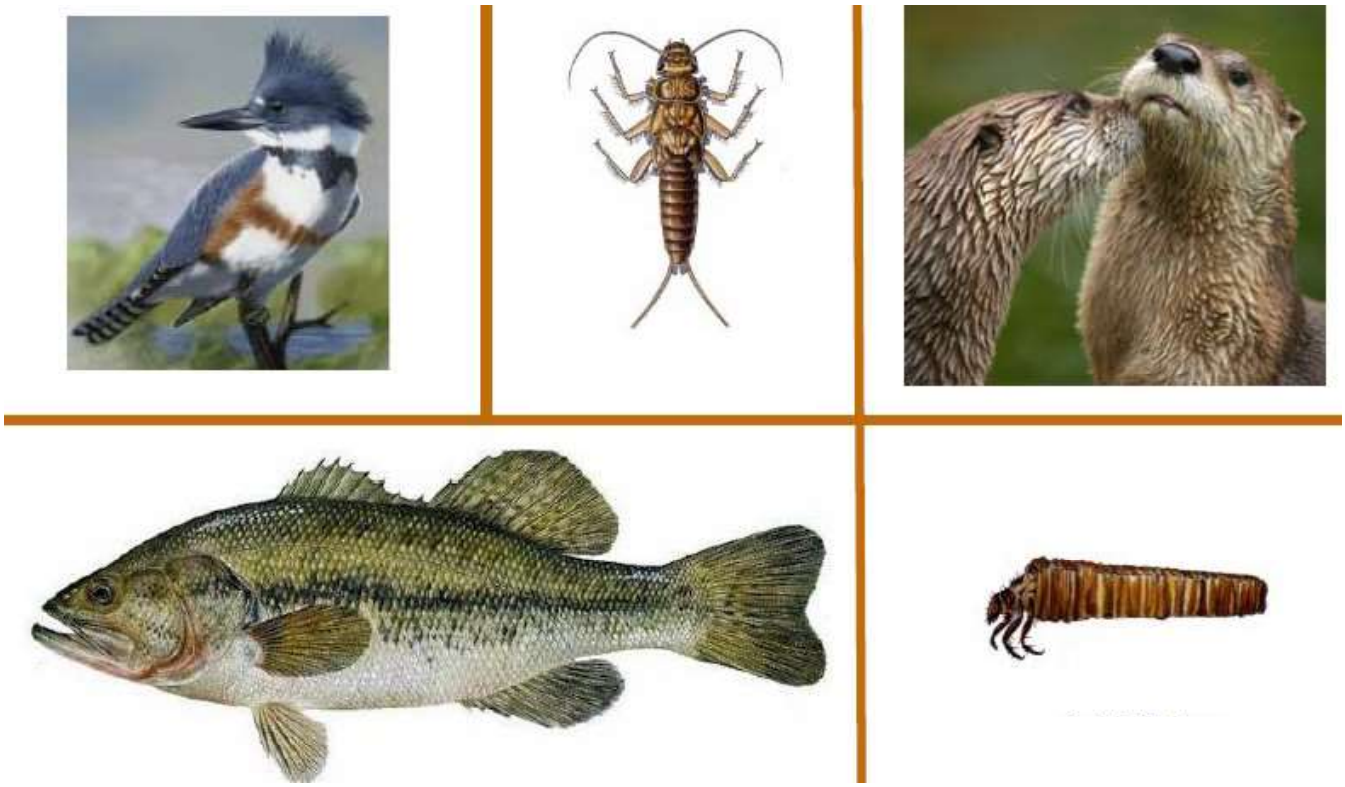
USEPA **soil** Regional Screening Levels (RSLs) (non-radionuclides) and Preliminary Remediation Goals (PRGs) (radionuclides) are used to calculate risk.

Surface water results compared to Maximum Contaminant Level (MCL) (or RSL/PRG in absence of MCL). MCLs are legally enforceable primary standards

Fish ingestion RSLs/PRGs were used as thresholds for recreational fisherman scenario. Results of fish tissue analysis compared to RSLs/PRGs.

Ecological Screening

Ecological screening thresholds, trophic modeling, and biological data



2009-2010 Characterization

Media	Data Records (# Samples/Analyses)
Sediment	424 / 6274
Sediment / Soil LaBr	517 / 33,587 343 / 343
Surface Water	129 / 16,666
Fish	24 / 1000
Total Samples / Analyses	1437 / 57,870

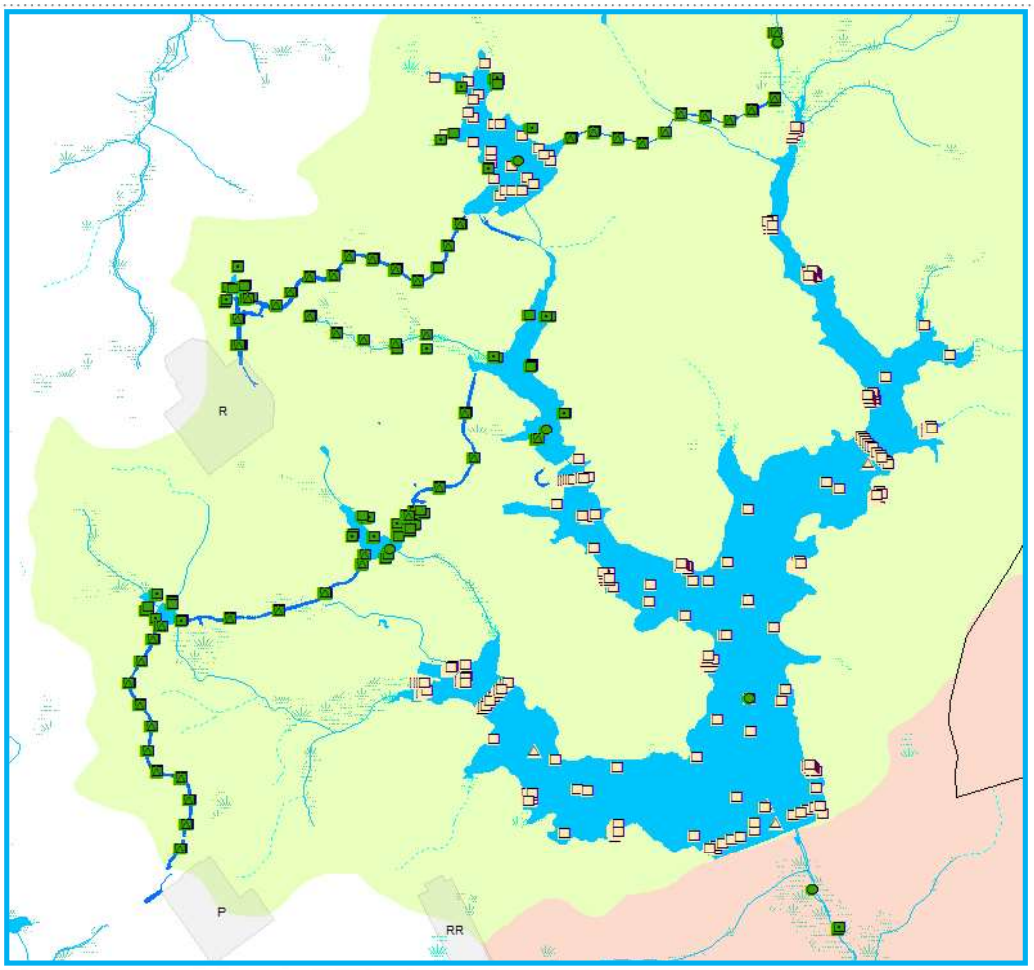
Does not include PAR Pond data: Under a NEPA (Interim Action) ROD Jan. 1995 to maintain water levels (limits exposure to sediments).

LaBr = Lanthium Bromide field detector

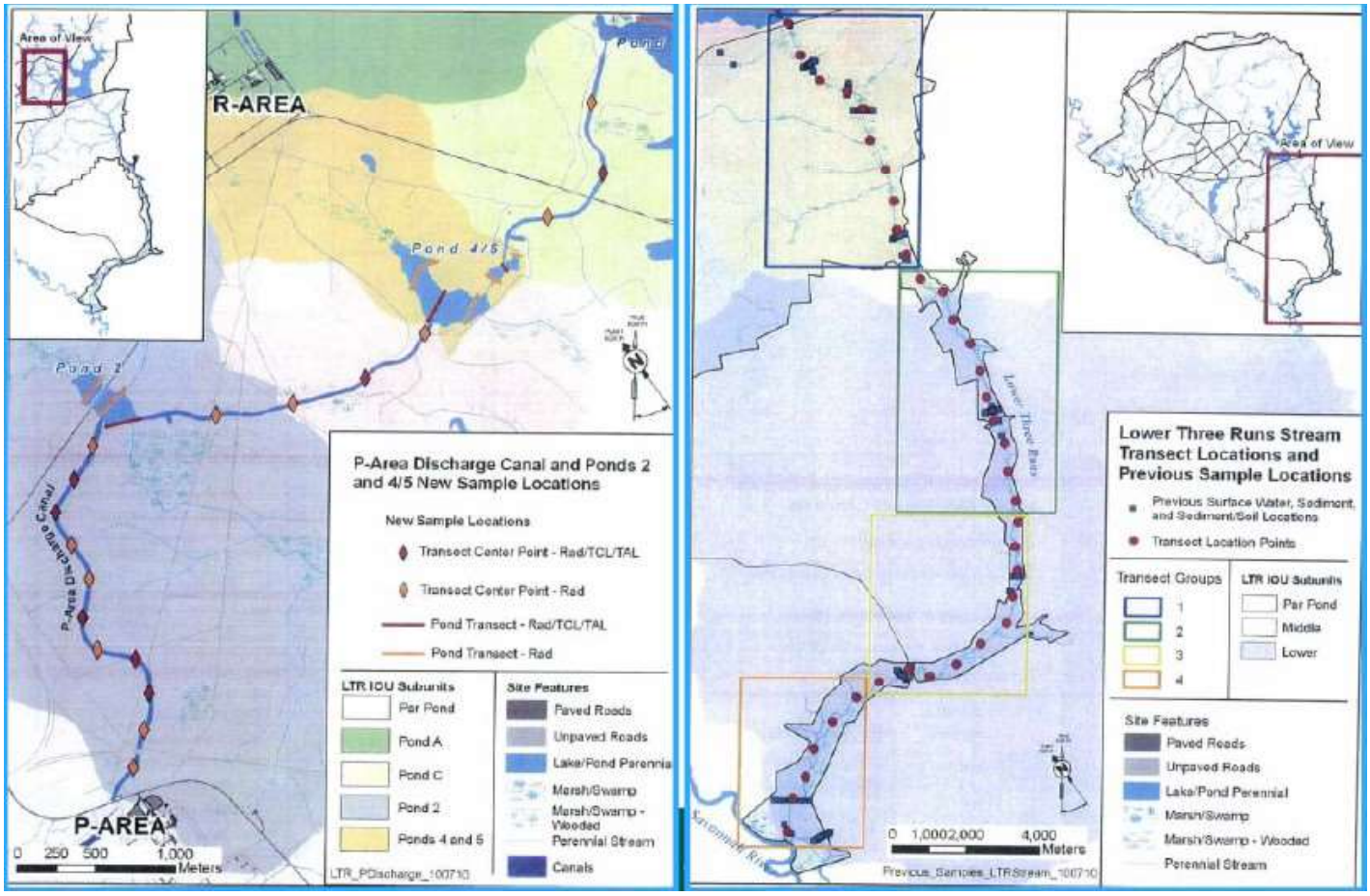
LTR IOU –Assessment

Data Coverage

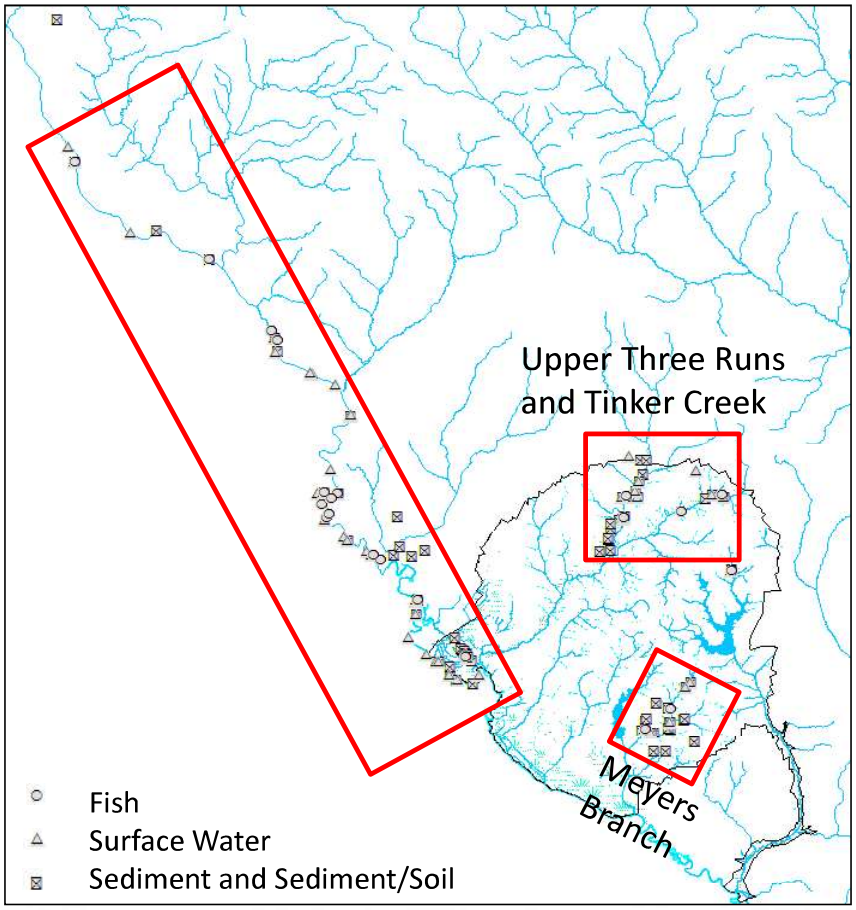
Ensuring adequate data exist to support remedial decision making.



LTR IOU – Assessment Canals/Stream



Background Data



- A wealth of background data are available
- Data pedigree is a consideration
- Regulatory approval was needed for approval of the definitive dataset

Risk Assessment Results

On the backdrop of historic reactor operations…

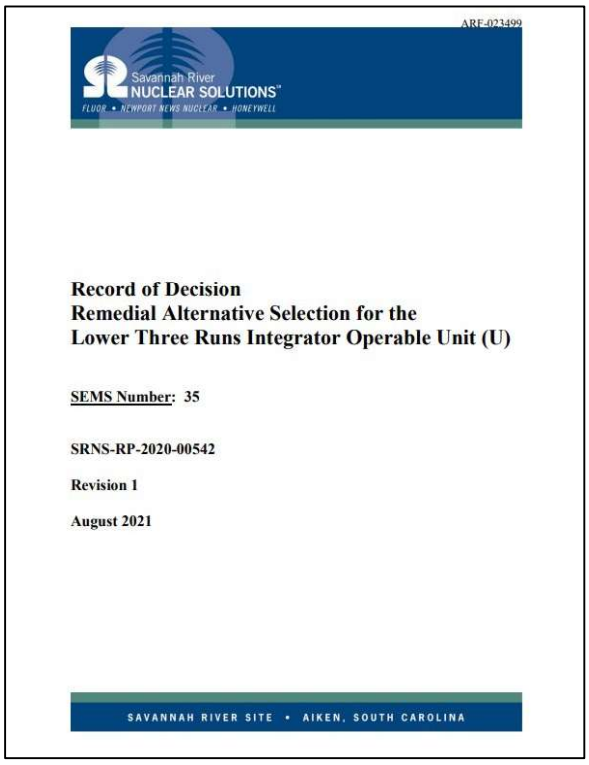
- Unacceptable risk to human health (on-site worker, hypothetical subsistence fisherman)
- Cesium-137 (sediment/fish) and mercury (fish) are the primary risk drivers
- Land Use Controls are needed (to limit exposure)

Record of Decision

The ROD specifies what protective and cleanup actions are required, along with assurances of long-term monitoring.

The ROD acknowledges the successful completion of decommissioning and closure of both P and R Areas.

P and R Reactor facility operations contributed to the LTR stream corridor contamination.


ARF-023499

Savannah River NUCLEAR SOLUTIONS

FLUOR • NEWPORT NEWS NUCLEAR • HONEYWELL

Record of Decision
Remedial Alternative Selection for the
Lower Three Runs Integrator Operable Unit (U)

SEMS Number: 35

SRNS-RP-2020-00542

Revision 1

August 2021

SAVANNAH RIVER SITE • AIKEN, SOUTH CAROLINA

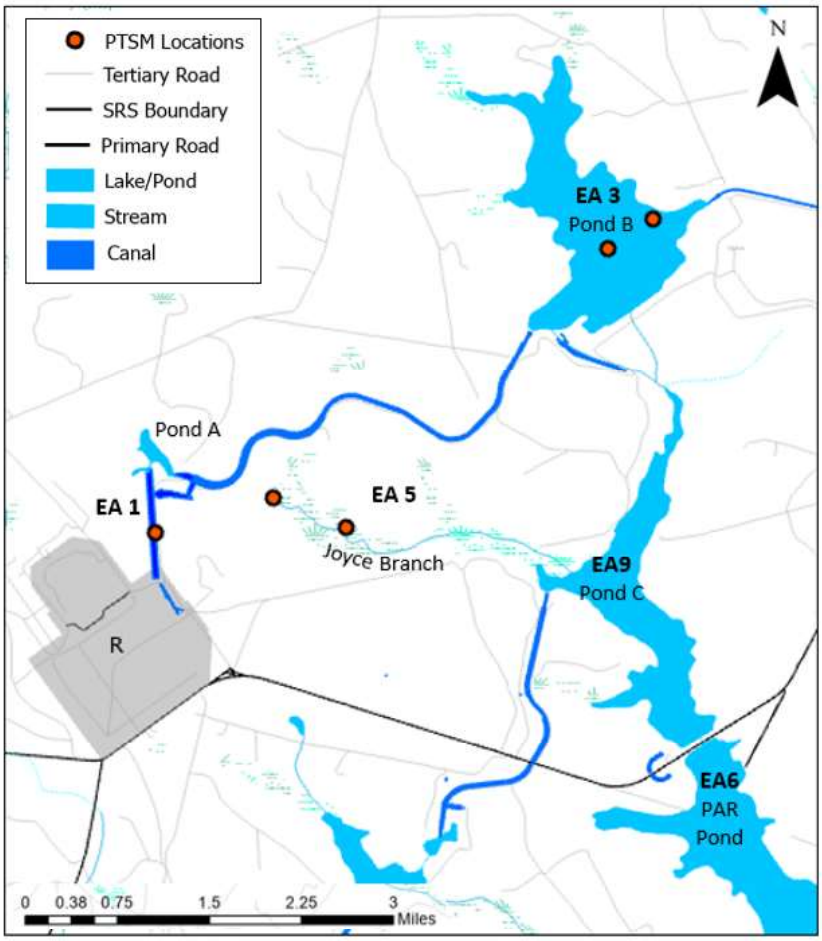
The first SRS ROD to outline the final closure for a large stream system.

ROD - Selected Remedy

- The ROD (2021) identified the selected remedies for the LTR IOU Upper subunit as:
  - *Land Use Controls (LUCs) with Monitored Natural Recovery (MNR)*
  - *Excavation, Treatment and Disposal of Principal Threat Source Material (PTSM) Sediment/Soil* at one location (R-Area Discharge Canal)
  - *Maintain Water in Ponds* for EA3 (Pond B) and EA6 (PAR Pond).
- The future land use will be non-residential and primarily used for environmental/ecological research with USDOE maintaining control of the land.
- Five-year remedy reviews will be conducted (waste left in place).

Cs-137, Mercury, and Principal Threat Source Material (PTSM)

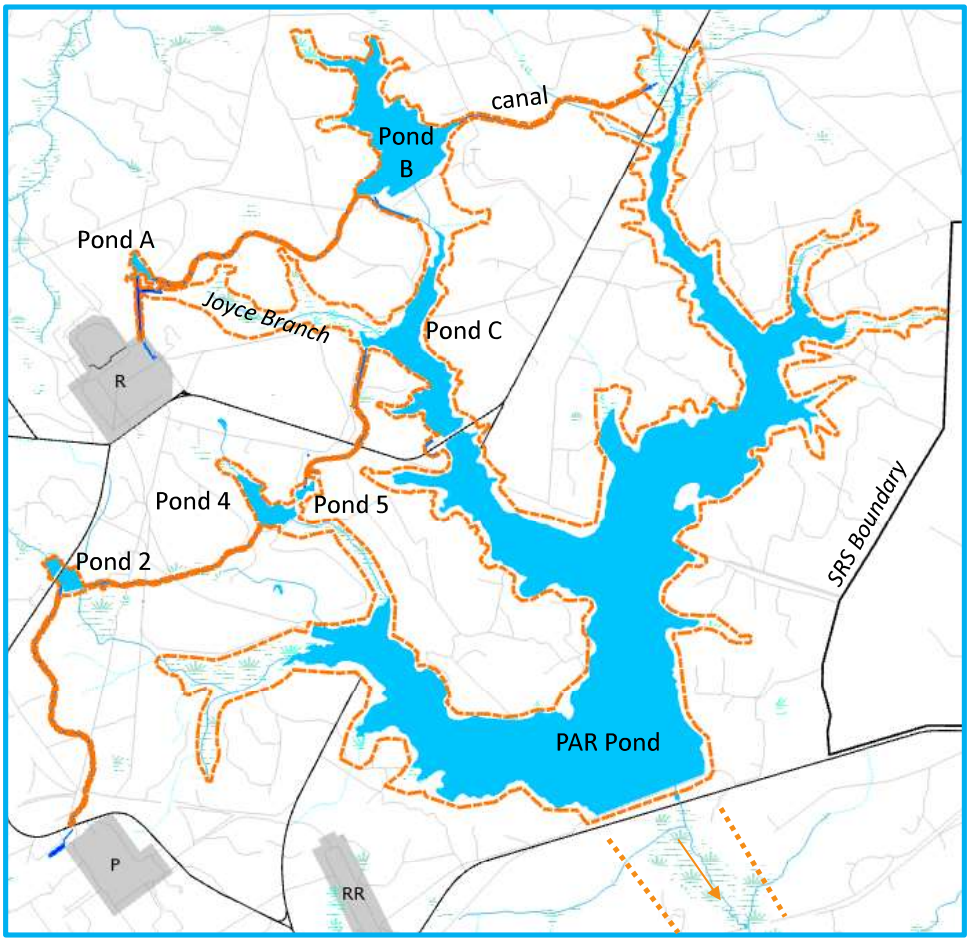
- Contamination from reactor discharges resulted in **Cs-137** in sediment/soil
- **Mercury** was also introduced in surface water due to pumping river water from the Savannah River
  - **Fish** contain levels of **Cs-137** and **mercury** that pose a potential threat to the recreational fishermen
  - Fishing is prohibited on SRS except for monitoring/research purposes
- Sample locations with sediment/soil levels above **PTSM** for **Cs-137** were identified



Land Use Controls (LUCs)

LUCs include:

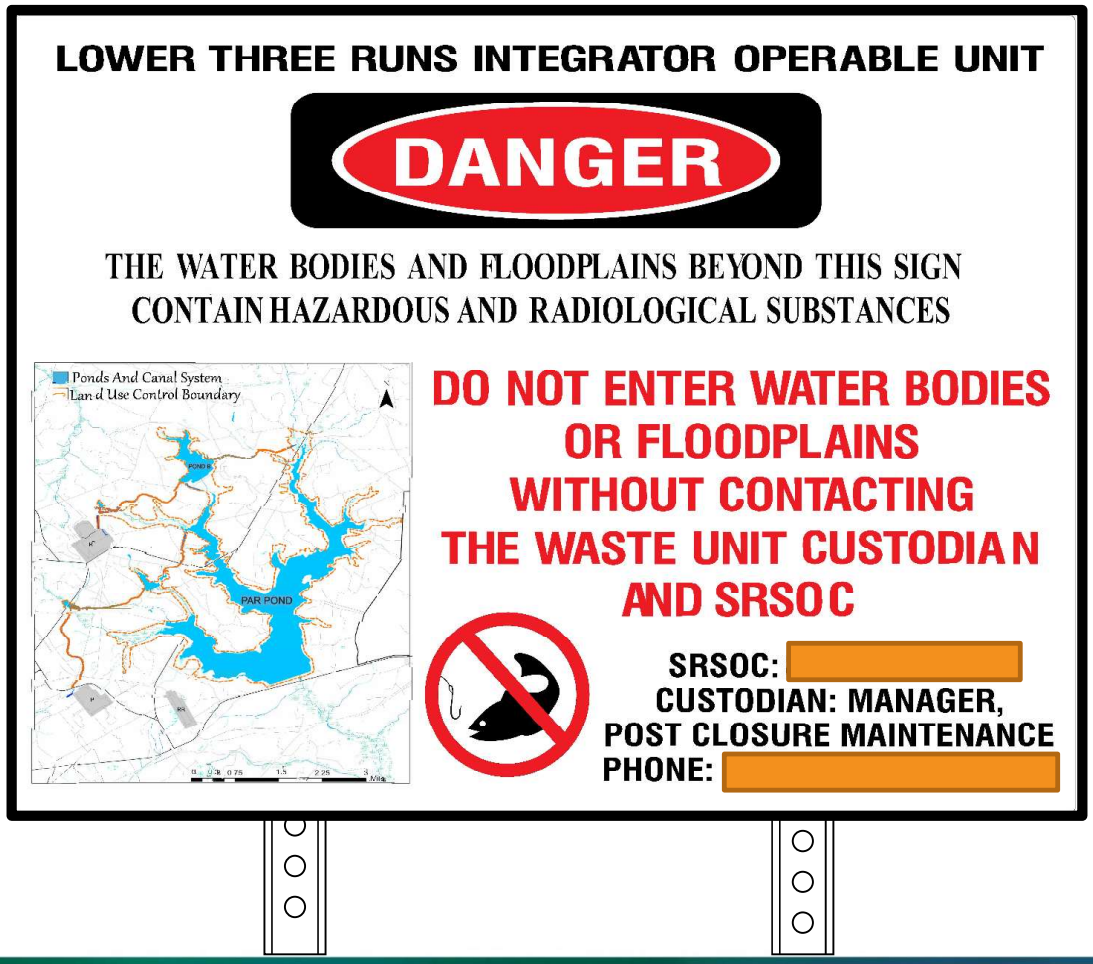
- Worker notification
- Site Use permit for intrusive sampling
- Institutional controls
- Deed restrictions



Legend

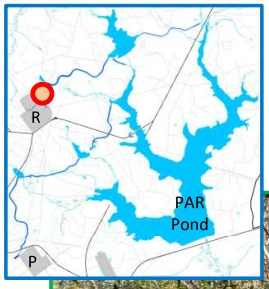
- = *LUC Boundary*
- = *Stream/Pond*
- = *SRS Boundary*
- = *Road*
- = *Facility Boundary*

Land Use Controls (LUCs) - Signage

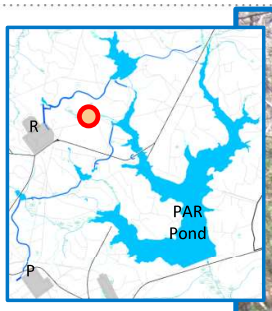


Signs and Fencing

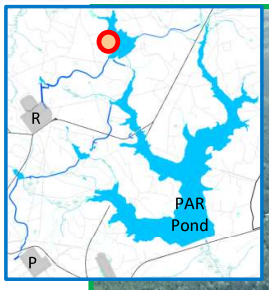
R-Area Discharge Canal – PTSM Location SEDIMENT REMOVAL



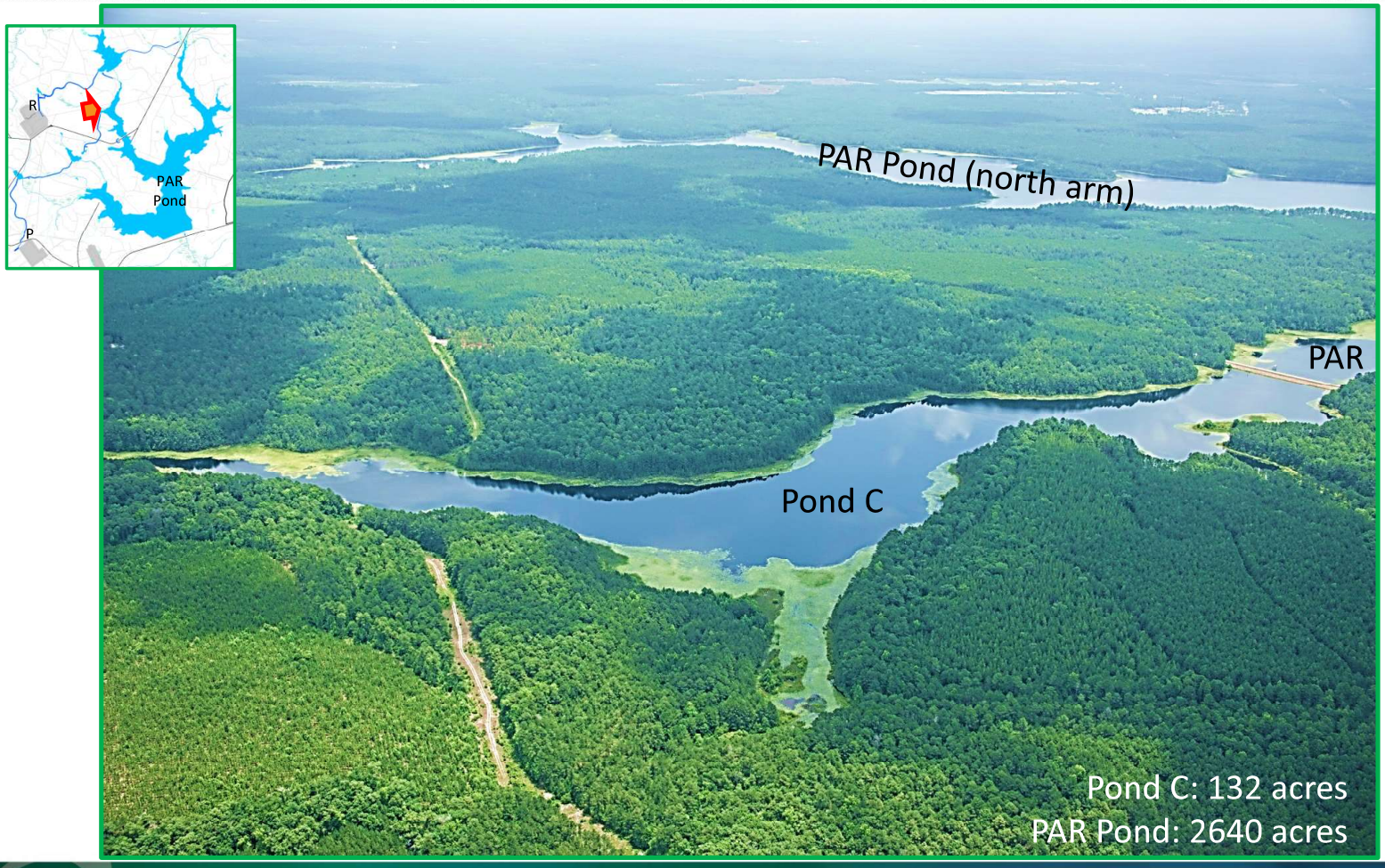
Joyce Branch (Old R-Area Discharge Canal) - SIGNAGE/GATES



Pond B – PTSM Locations – MAINTAIN WATER



Pond C and PAR Pond (North Arm) Connected via Reverse Riser



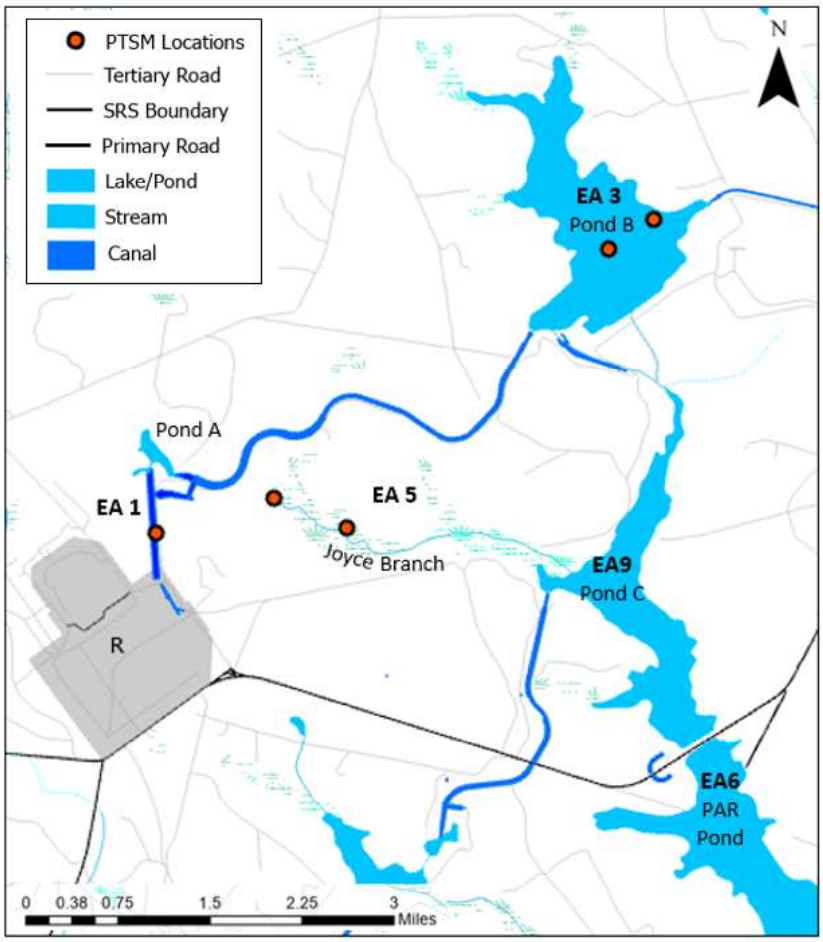
Monitored Natural Recovery (MNR)

- Monitored Natural Recovery (MNR) uses ongoing, naturally occurring processes that reduce the bioavailability or toxicity of contaminants in sediment (e.g., radiological decay and deposition).
  - Physical half-life for Cs-137 is 30.2 years. Effective (biological) half-life can be much shorter
  - Cs-137 strongly binds with clay soil minerals (e.g., kaolinite, illite minerals)
- The land use for the LTR IOU is compatible with natural recovery: non-residential, non-industrial, primarily used for environmental/ecological research with USDOE maintaining control of the land.

MNR Monitoring

- Monitoring consists of:
  - Aerial gamma survey for Cs-137
  - Fish collections for Cs-137 and mercury
    - *Pond B*
    - *PAR Pond*
    - *Pond C*

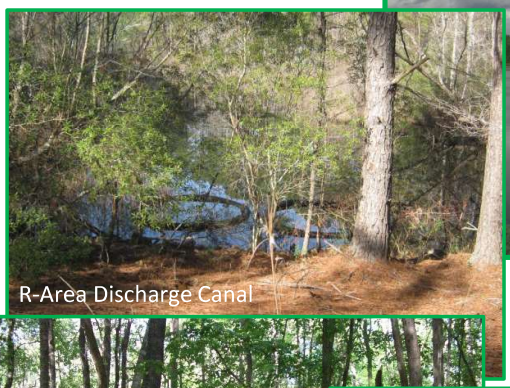
  - Sediment sampling (based on aerial surveys) for Cs-137
- Monitoring will support five-year remedy reviews
- The monitoring plan will be re-evaluated after Cs-137 activities decay below PTSM levels.



Background

- The SRS was designated as a National Environmental Research Park (NERP) in 1972.
  - DOE maintains a network of research reserves (Set-Asides)
- The LTR system is used for ecological research and has been studied since the pond/canal system was created.
  - SREL, USFS-SR, and SRNL are the primary entities
- The LTR IOU system will still be educating and training our future radio-ecologists / scientists *(photo of SREL graduate student)*


Pond B

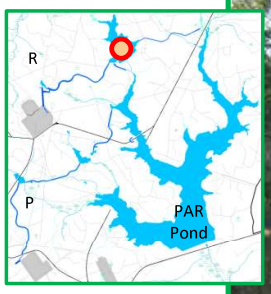

R-Area Discharge Canal


Lower LTR


PAR Pond

SREL = Savannah River Ecology Laboratory-UGA
USFS-SR = United States Forest Service – Savannah River
SRNL = Savannah River National Laboratory

Pond B



Boat dock and floating sampling enclosures for tadpoles/fish to assess bio-uptake

Final Outcome

- The remedial decision for LTR was a positive step in environmental stewardship
  - protecting research opportunities,
  - waterfowl flyways,
  - ecological habitats and wildlife
- The selected remedy was a collaboration with state and federal regulators/stakeholders
  - culminated in substantial cost savings
  - protection of ~30 miles of canals/stream system
  - protection of over 3,000 acres of aquatic habitat
  - establishes long-term protection and monitoring


Black Bear
American Alligator
Bobcat
Belted Kingfisher
Tiger Swallowtail
Beaver
Marbled Salamander
Southern Toad
Brown Water Snake
Red Cockaded Woodpecker
Cotton Mouse
Red Salamander
Eastern Mosquito Fish
Shortnose Sturgeon
Gray Fox
Yellow-bellied Slider
Stonefly
Dragonfly
Yellowfin Shiner
Cotton Rat
Southern Leopard Frog
Barking Tree Frog
Bald Eagle
Live Oak
Cherokee Rose
Raccoon
Wood Stork
Mushroom
Lesser Siren

Savannah River Site and the Lower Three Runs Watershed