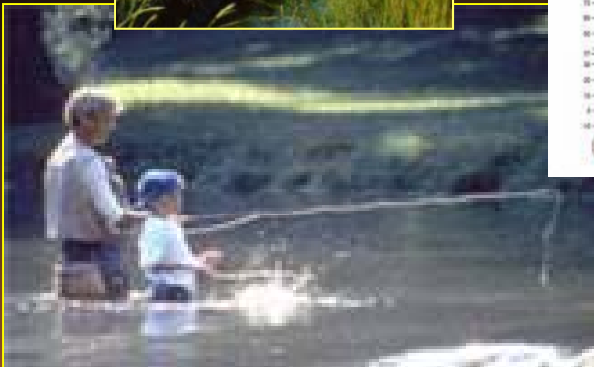
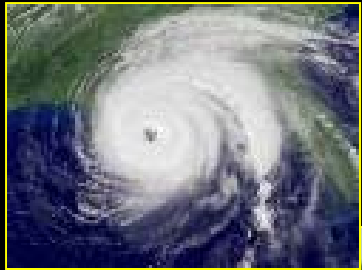


Regional Restoration in the Delaware Estuary Watershed



NRDA Workshop
December 9, 2010



To be discussed

The Delaware Estuary

brief orientation

Making our efforts count:

why can regional restoration help?

Regional Restoration Initiative

goals & approach

evolution

tools:

- *restoration matrices*
- *ecoservice framework*
- *project registry*

structure

case studies

NRDA

Regional Restoration Initiative

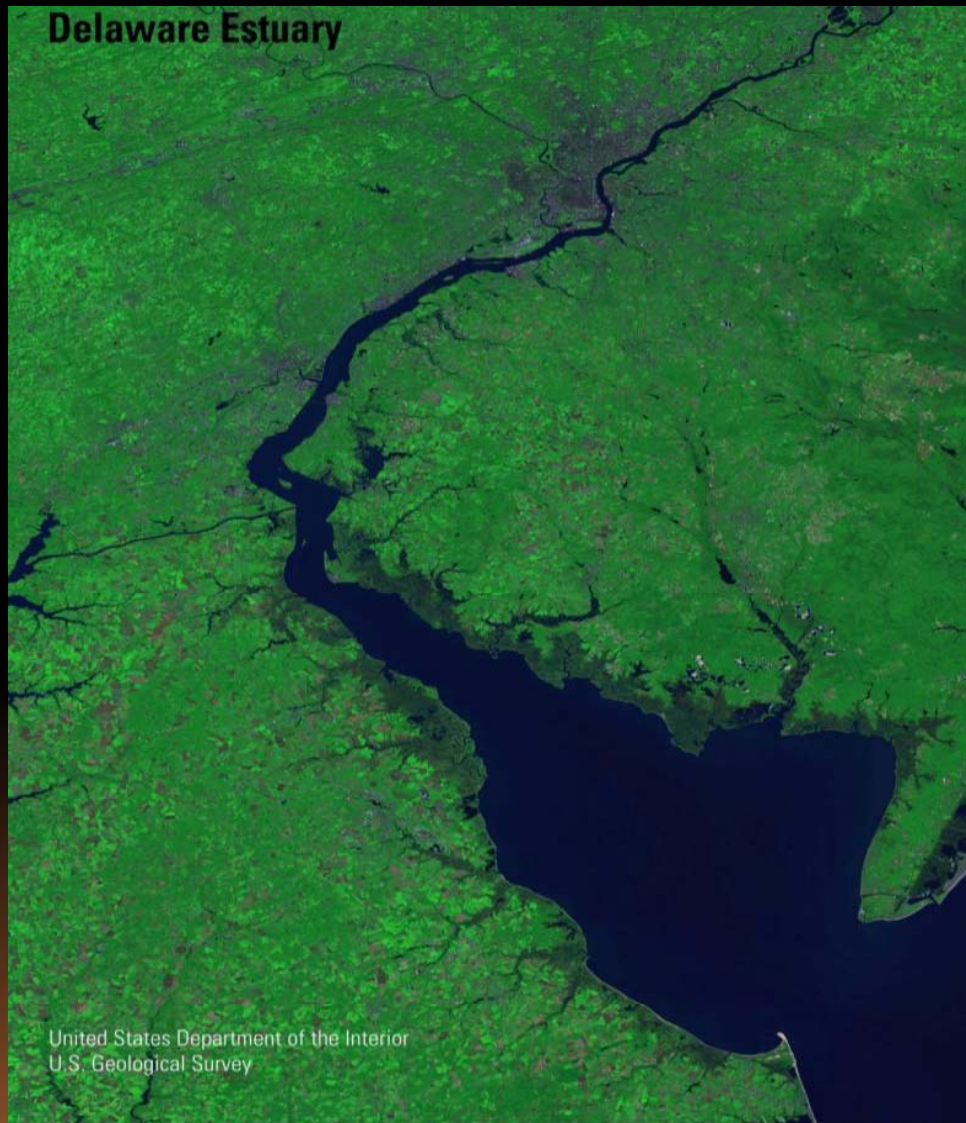
Blueprint for the Delaware Estuary



A Publication of the
Partnership for the Delaware Estuary
A National Estuary Program

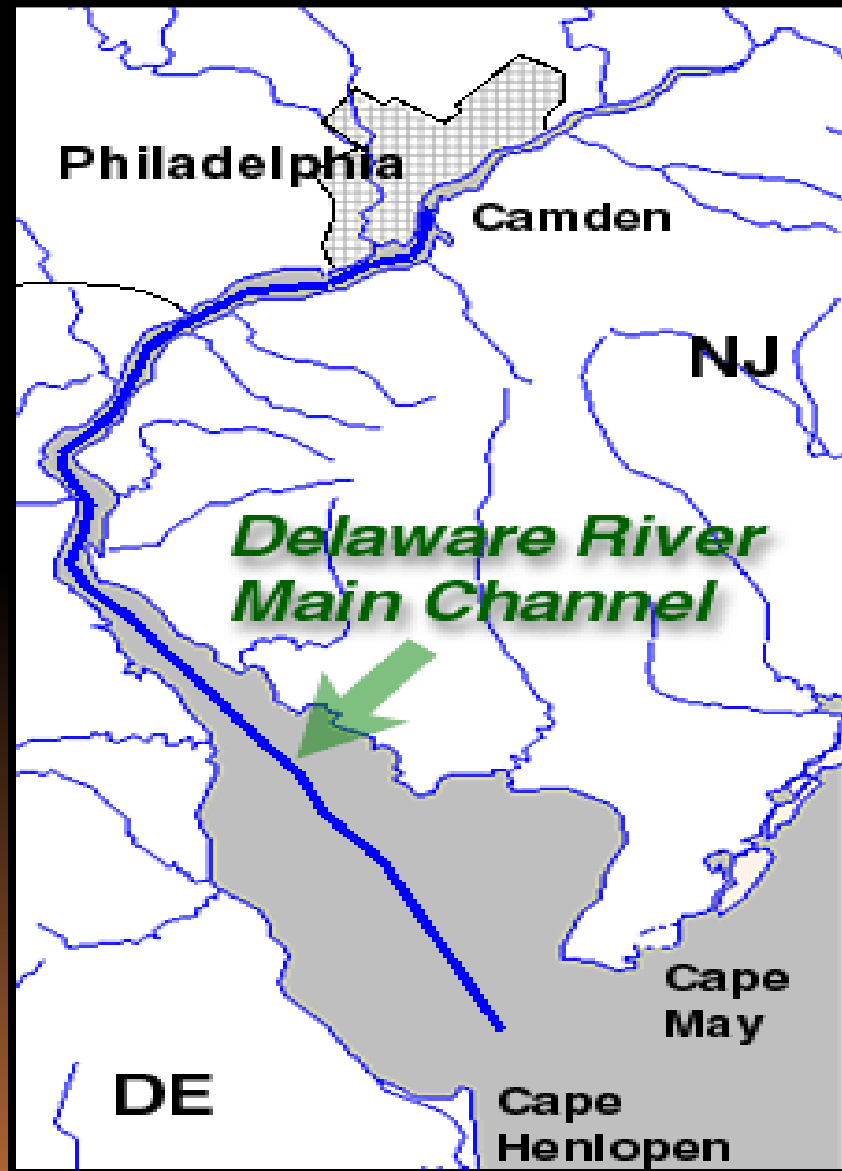
October 2009

Facts and Figures



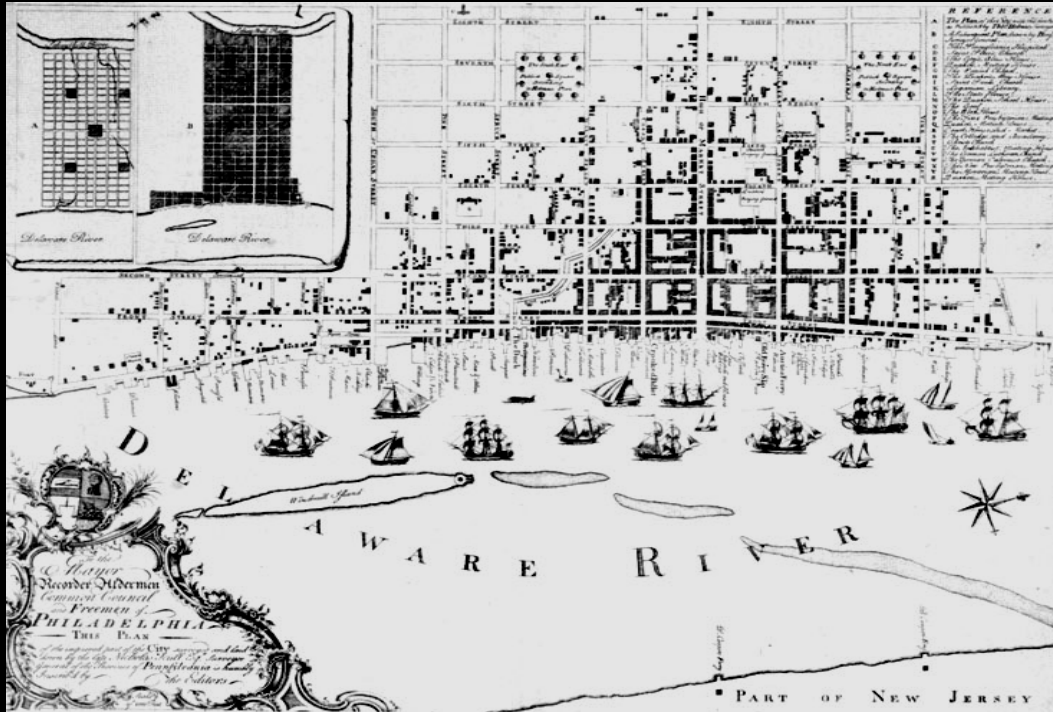
Facts and Figures

- Largest Freshwater Port in World
 - Approx 3,000 vessel arrivals/year
 - 3rd largest petro-chemical port in U.S.
-
- 75% of east coast oil
 - 1 million barrels of crude oil per day
 - Largest North American port for steel, paper, and meat imports
 - Port system generates \$19 billion in annual revenue
 - Home to 6 nuclear power plants

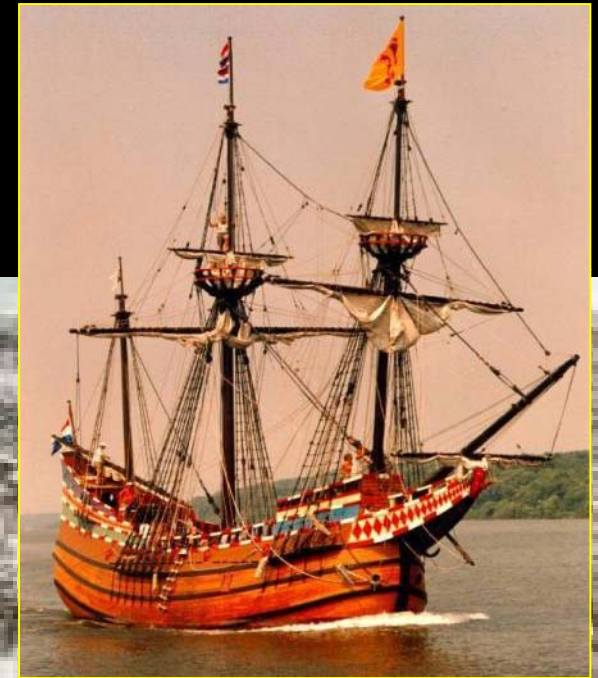


Slide adapted from USCG 2005

Seat of the Nation History as a “Working River”



**1762 map showing Philadelphia on
the Delaware River**



The Philadelphia Waterfront in the 1850's
Slide adapted from Jonathan Sharp, 2005

Also a “Living River”

Ecological Resources of the Delaware Estuary

- Largest breeding population of horseshoe crabs in the world
- One of the four most important shorebird migration sites in the world with the 2nd highest concentration of shorebirds in North America
- Habitat for protected endangered species populations of dwarf wedgemussels, short-nose sturgeon, bald eagles and bog turtles

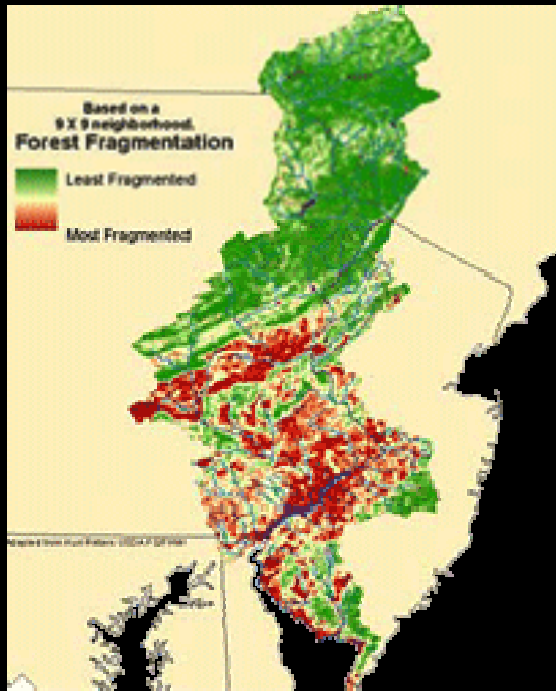


Delaware Estuary Resources Continued

- One of the largest freshwater tidal estuaries in the world, with rare freshwater tidal marshes and fauna
- 185 natural vegetation community types, 35 ecological systems
- More than 405,000 acres of wetlands that fringe the estuary, functioning as “kidneys for the system”, fish factories and providing flood protection



Complex Landscape



Upper Watershed:

“pristine” recreational area
water supply for NYC



Tidal River

4th largest US urban center
world’s largest freshwater
port

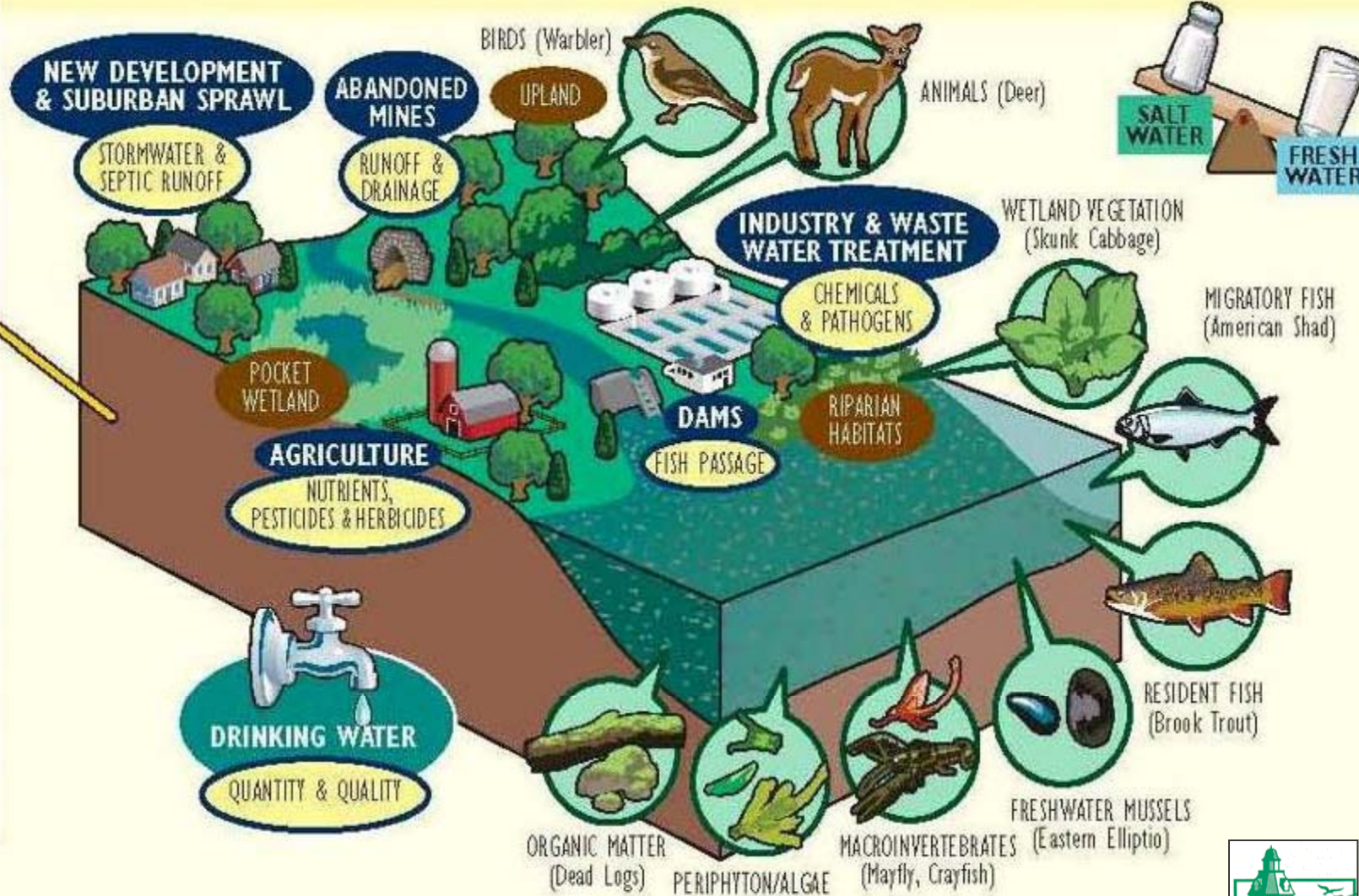


Lower Estuary:

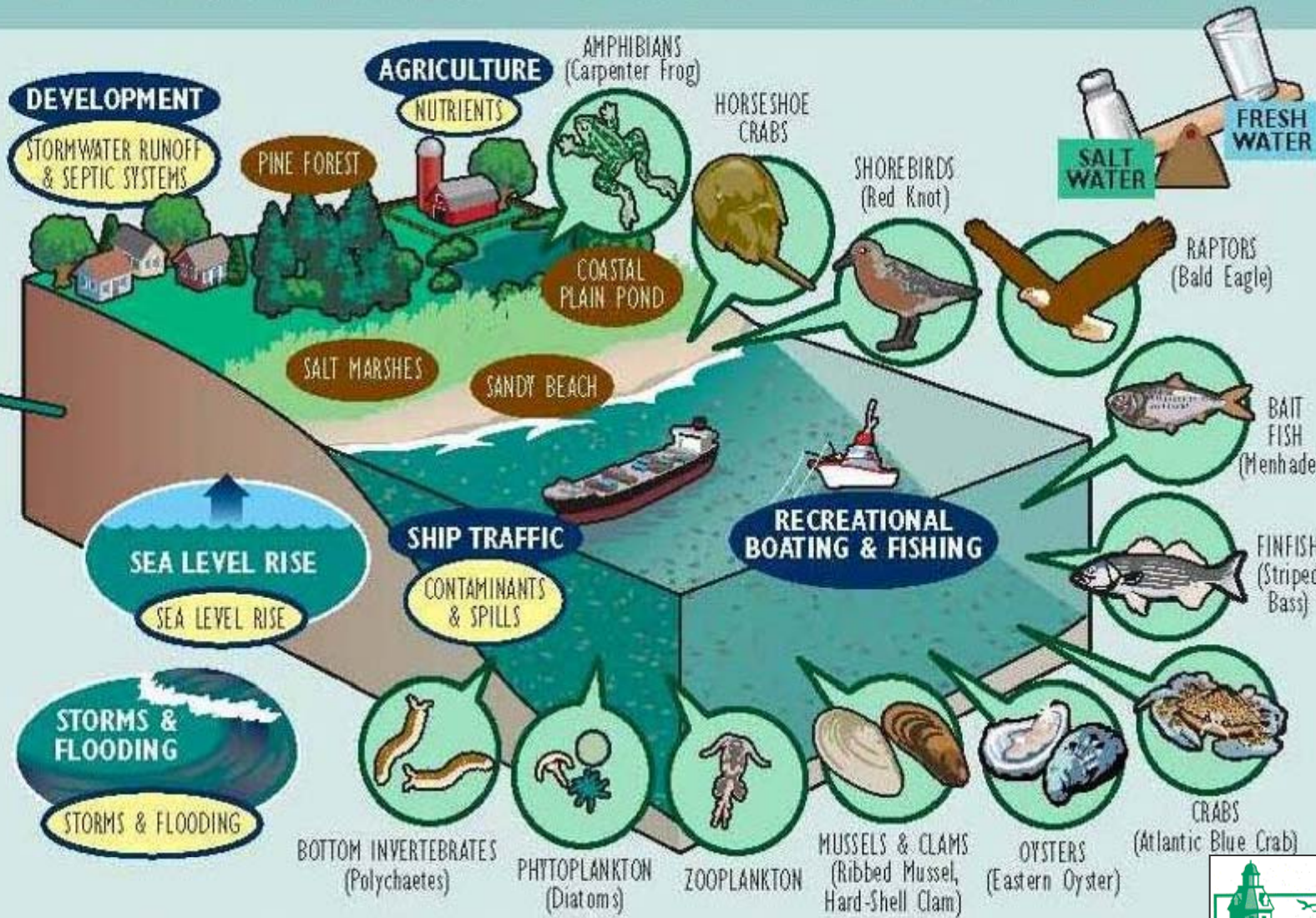
Water fowl, finfish, shellfish
Horseshoe crab population



SCHUYLKILL VALLEY REGION



DELAWARE BAY REGION



Evolving Complexity

DK 11

- Marcellus Shale
- Climate Change
- Withdrawals
- Wind Farms
- Land Use Change
- Development
- Emerging Pollutants
- Ecological Flows
- Spills, NRDA
- Dredging



11/27/2004

Regional Restoration – What is It?

**Geospatial
Overlay**

**Restoration
Needs**



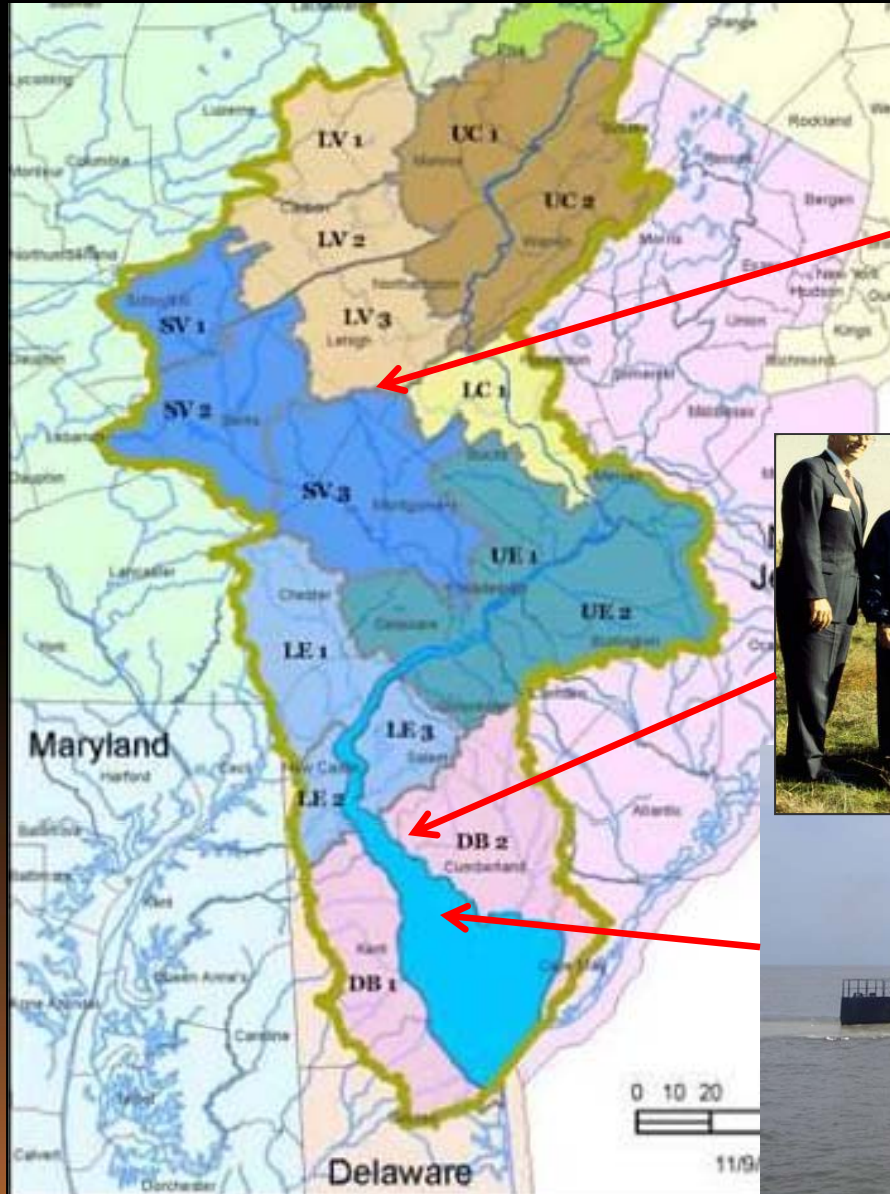
Regional Restoration?

Regional Restoration – What is It?

**Geospatial
Overlay**

**Restoration
Needs**

**Available
Projects**



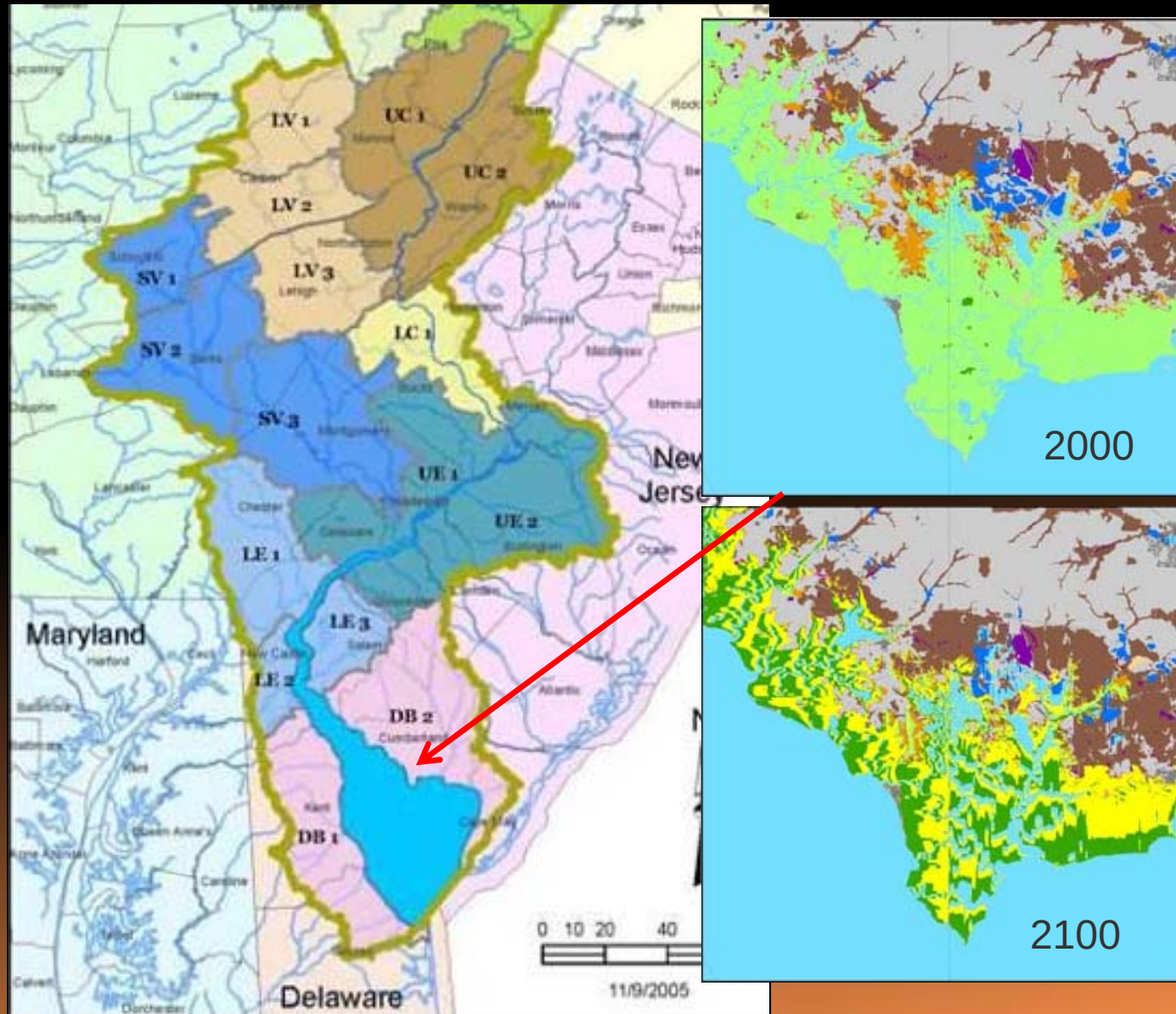
Regional Restoration?

Regional Restoration – What is It?

**Geospatial
Overlay**

Science

**Available
Projects**



Regional Restoration?

Regional Restoration – What is It?

**Geospatial
Overlay**

Science

**Project
R & D**



Regional Restoration?

Regional Restoration – What is It?

**Geospatial
Overlay**

**Project
R & D**



Regional Restoration?

Regional Restoration – What is It?

Coordination

State &
Regional
Agencies

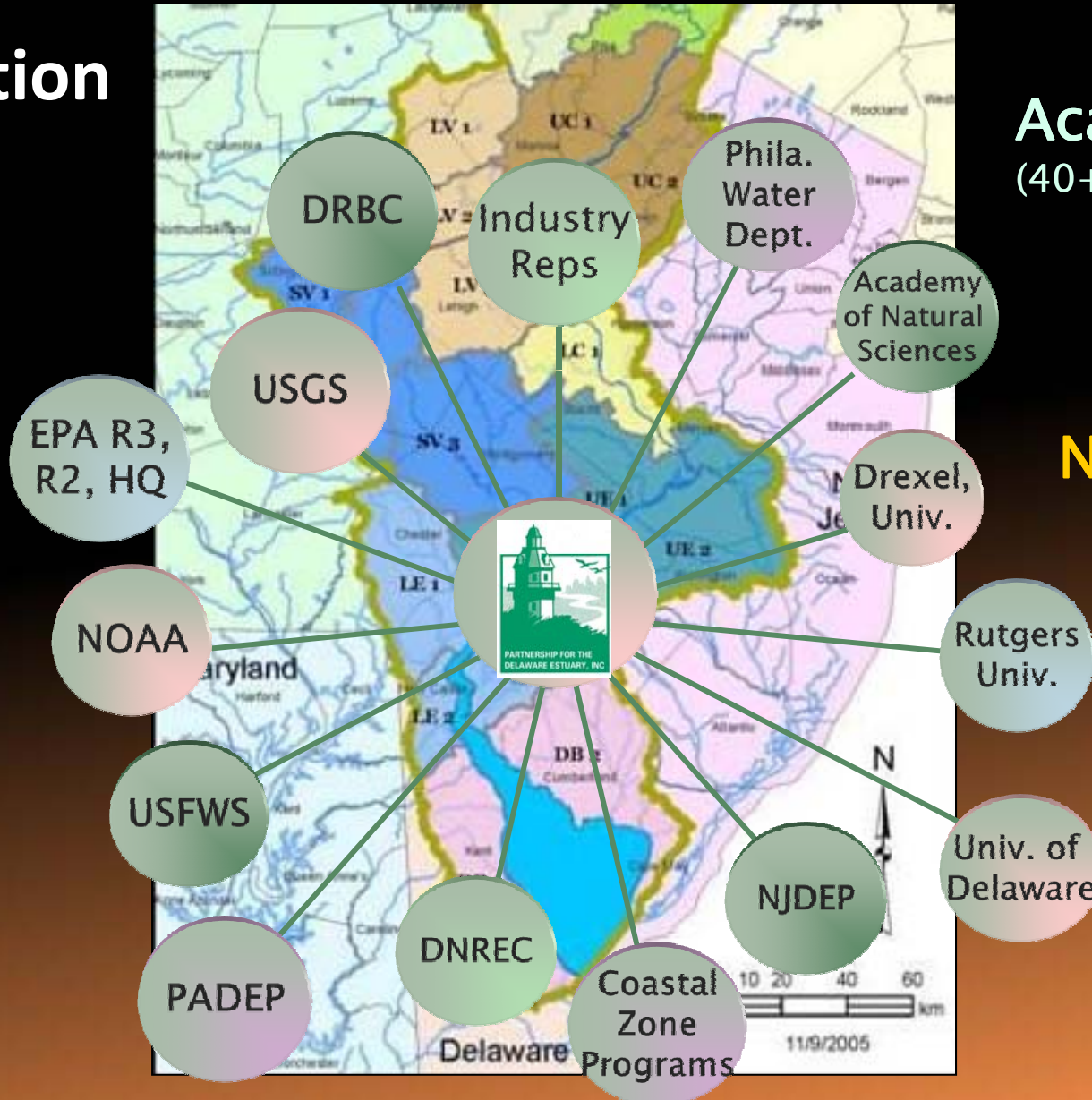
Federal
Agencies

Industry

Academia
(40+ universities)

NGO's

Cities



Regional Restoration?

Regional Restoration - Why?

- Proactive, not reactive
- Restoration from the system's perspective, includes gap analysis
- Science based – priorities yield maximum ecosystem benefits (uplift)
- Enhanced coordination
- Expedited identification of suitable projects
- Potential for restoration “up front” and larger projects
- Provides a one stop shop for projects

Goals & Approach

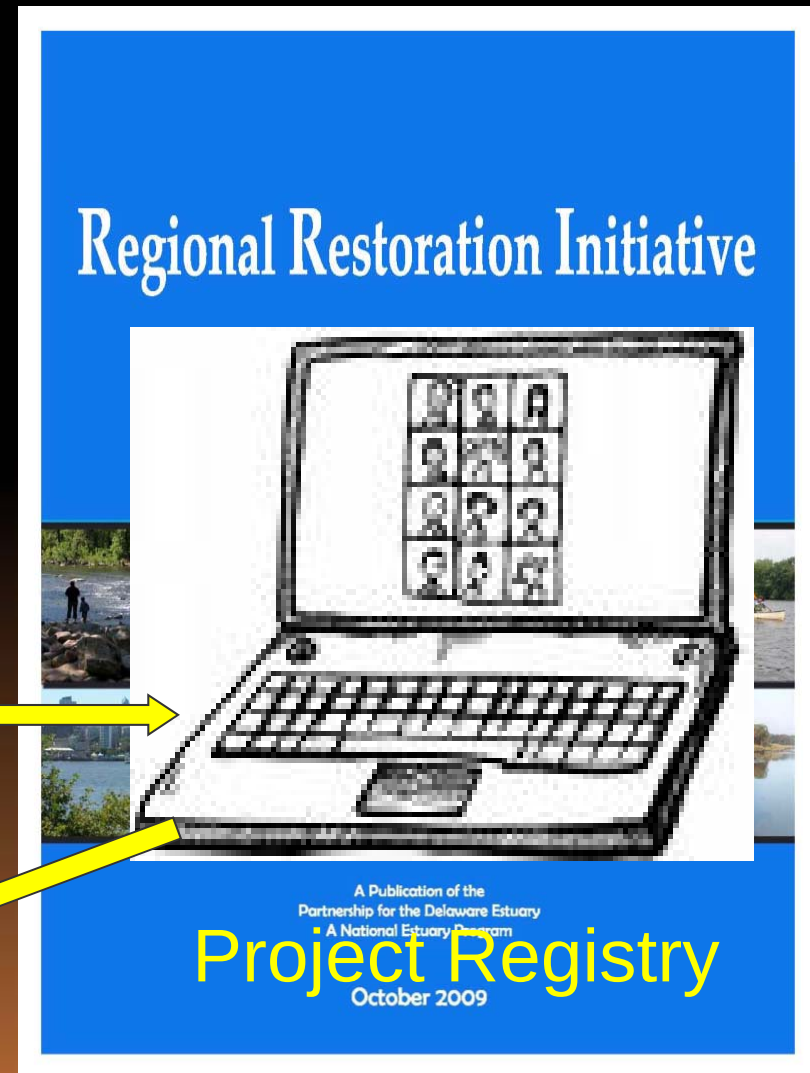
Inventory **ecologically significant resources** in different watershed regions

Assess **ecological goods and services** associated with them

Use a **natural capital valuation** approach to identify activities that maximize uplift in goods and services from them

Identify, inventory and rank specific **projects** that conserve, enhance or restore them

Identify high value activities for which we still need projects and work to fill these **project gaps**

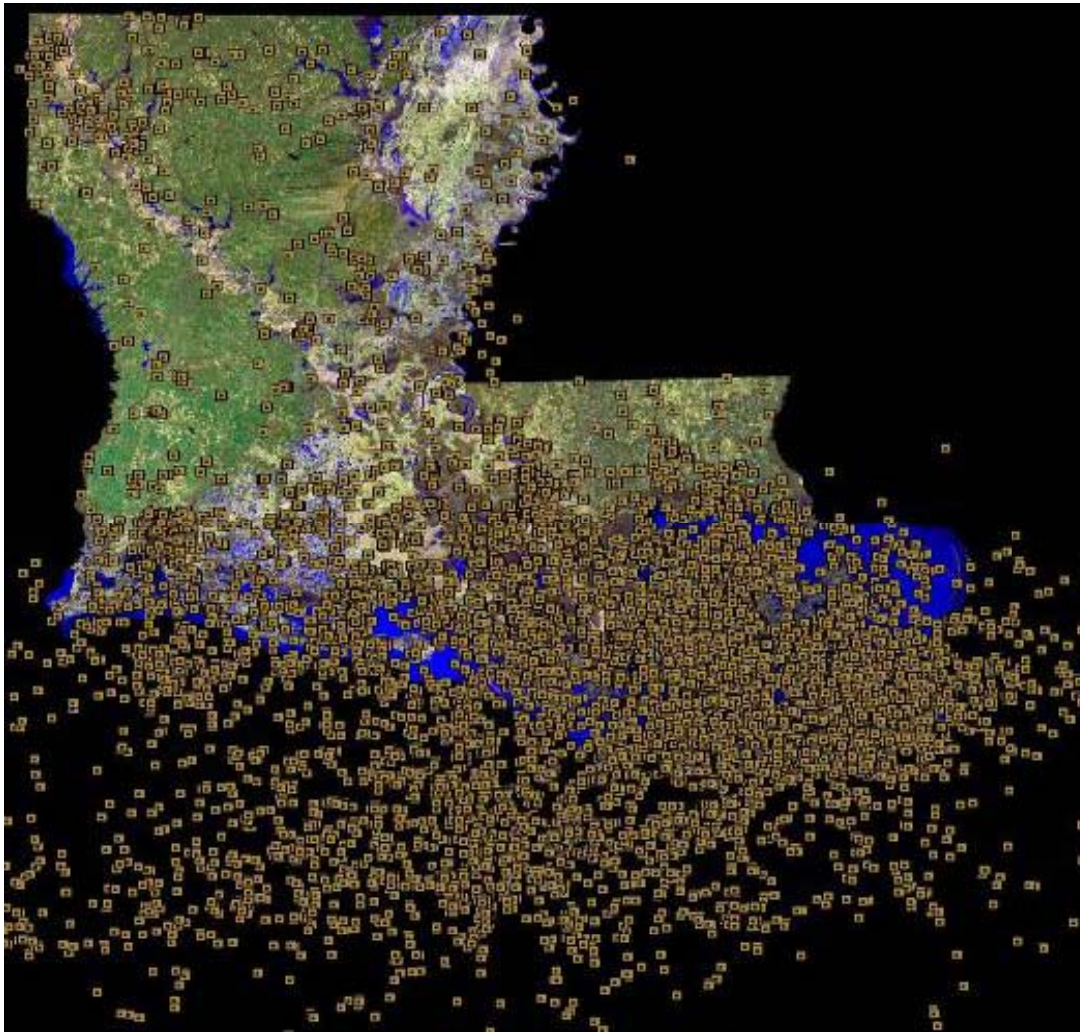


Evolution

Regional Restoration Initiative



LOUSIANA OIL SPILL STATISTICS



of Notifications/Year: 2000

% of U.S. Notifications: 20

% of U.S. Volume: 20

of NRDA cases ≈25

Slide from Karolien Debusschere, Office of the Governor

Restoration Opportunities



COASTAL		POTENTIALLY INJURED RESOURCES/SERVICES							
		Herbaceous Wetlands	Forested Wetlands	Beach/Shoreline/Streambed	Oyster Reefs (& other)	Water Column Org.	Birds	Wildlife	Cultural
C/E ⁽¹⁾	Coastal Herbaceous Wetlands	✓	✓		✓	✓	✓	✓	
	Coastal Forested Wetlands	✓	✓			✓	✓	✓	
	Coastal Beach/Shoreline/Streambed			✓		✓	✓	✓	
	Coastal Oyster Reefs (& other)				✓	✓	✓	✓	
	Coastal Artificial Reefs				✓	✓	✓	✓	
	Coastal SAV	✓			✓	✓	✓	✓	
PP ⁽²⁾	Coastal Herbaceous Wetlands	✓	✓		✓	✓	✓	✓	
	Coastal Forested Wetlands	✓	✓			✓	✓	✓	
	Coastal Beach/Shoreline/Streambed			✓		✓	✓	✓	
Ac/LP ⁽³⁾	Coastal Herbaceous Wetlands	✓	✓		✓	✓	✓	✓	
	Coastal Forested Wetlands	✓	✓			✓	✓	✓	
	Coastal Beach/Shoreline/Streambed			✓		✓	✓	✓	
	Coastal Oyster Reefs (& other)				✓	✓	✓	✓	
	Coastal SAV	✓				✓	✓	✓	
S ⁽⁴⁾	Coastal Water Column Org.					✓			✓
	Coastal Oyster Reefs (& other)				✓	✓			✓
	Birds						✓		✓
	Wildlife							✓	✓
PF ⁽⁵⁾	Birds						✓		✓
	Wildlife							✓	✓
	Recreation								✓
	Cultural								✓

- 1) Creation/Enhancement
 2) Physical Protection of Habitat
 3) Acquisition/Legal Protection
 4) Stocking of Fauna
 5) Physical Protection of Fauna

INLAND		POTENTIALLY INJURED RESOURCES/SERVICES							
		Herbaceous Wetlands	Forested Wetlands	Beach/Shoreline/Streambed	Upland Vegetation	Water Column Org.	Birds	Wildlife	Cultural
C/E ⁽¹⁾	Inland Herbaceous Wetlands	✓				✓	✓	✓	✓
	Inland Forested Wetlands		✓			✓	✓	✓	✓
	Inland Beach/Shoreline/Streambed			✓		✓	✓	✓	✓
	Inland Upland Vegetation				✓	✓	✓	✓	✓
PP ⁽²⁾	Inland Herbaceous Wetlands	✓				✓	✓	✓	✓
	Inland Forested Wetlands		✓			✓	✓	✓	✓
	Inland Beach/Shoreline/Streambed			✓		✓	✓	✓	✓
	Inland Upland Vegetation				✓	✓	✓	✓	✓
Ac/LP ⁽³⁾	Inland Herbaceous Wetlands	✓				✓	✓	✓	✓
	Inland Forested Wetlands		✓			✓	✓	✓	✓
	Inland Beach/Shoreline/Streambed			✓		✓	✓	✓	✓
	Inland Upland Vegetation				✓	✓	✓	✓	✓
S ⁽⁴⁾	Inland Water Column Org.					✓			✓
	Birds						✓		✓
	Wildlife							✓	✓
PF ⁽⁵⁾	Birds						✓		✓
	Wildlife							✓	✓
	Recreation								✓
	Cultural								✓

RESTORATION TYPES

Slide from Karolien Debusschere, Office of the Governor

Kreeger

Conceptual Matrix for the Delaware Estuary Ecosystem

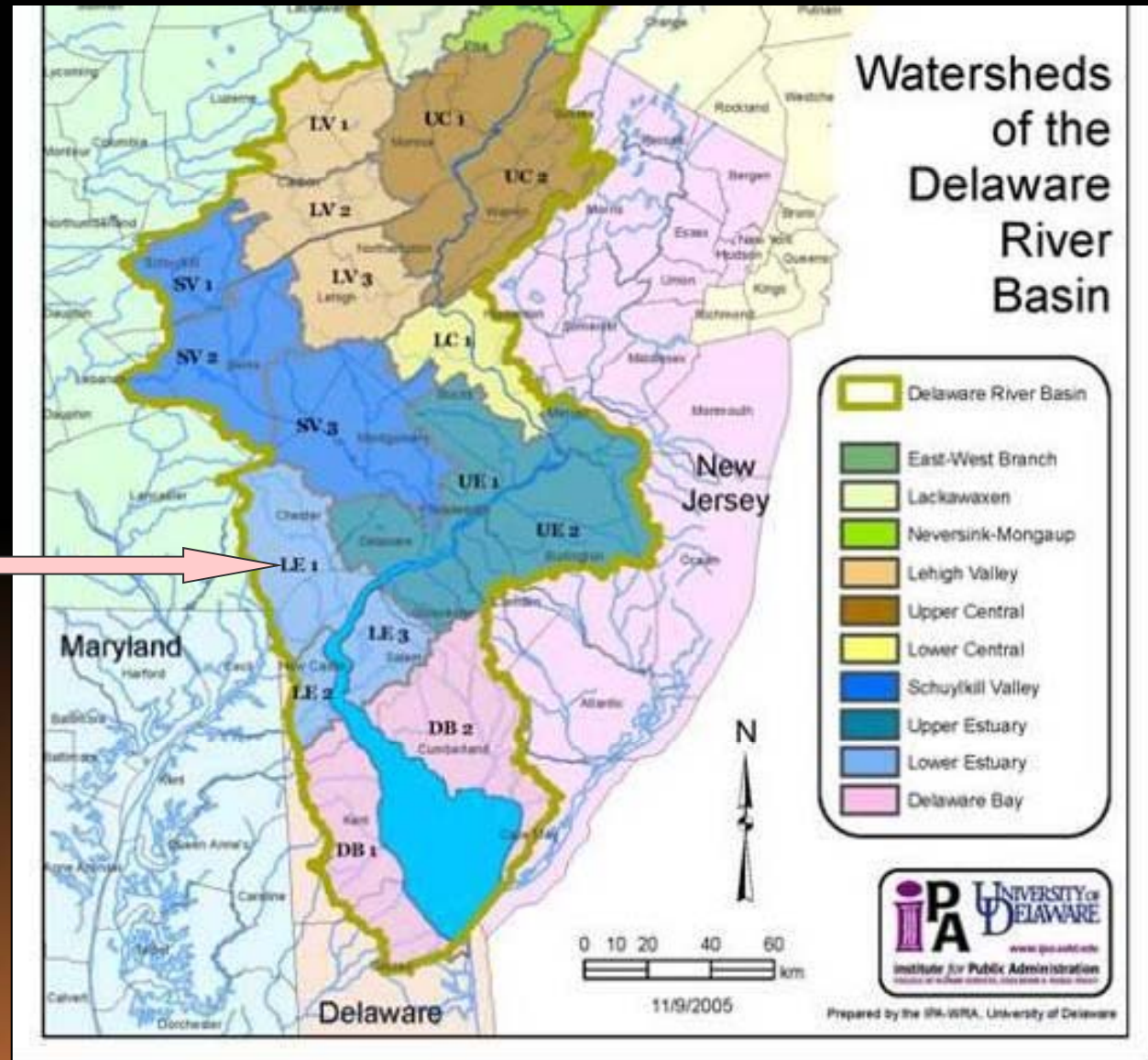
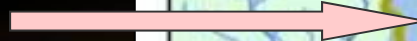
Number of Cells = 141			Nontidal Watershed					Tidal Estuary											
			Freshwater					Freshwater (<1 ppt)				Brackish (1-8 ppt)				Bay (>8 ppt)			
			Delaware River (above River Mile 133)		Other Rivers and Streams (below River Mile 133)			Approximately River Mile 82 to 133				Approximately River Mile 58 to 82				Approximately River Mile 0 to 58			
			Main Channel	Tributaries to Delaware River (e.g., Lehigh)	Schuylkill River & Its Tributaries	Christina River & Its Tributaries	Other Tributaries	Main Channel	Shallow Subtidal	Intertidal Edges, Shorelines	Wetlands	Main Channel	Shallow Subtidal	Intertidal Edges, Shorelines	Wetlands	Main Channel	Shallow Subtidal	Intertidal Edges, Shorelines	Wetlands
Aquatic	Pelagic	Physical	1a	2a	3a	4a	5a	6a	7a	8a	9a	10a	11a	12a	13a	14a	15a	16a	17a
		Chemical	1b	2b	3b	4b	5b	6b	7b	8b	9b	10b	11b	12b	13b	14b	15b	16b	17b
		Biological	1c	2c	3c	4c	5c	6c	7c	8c	9c	10c	11c	12c	13c	14c	15c	16c	17c
	Benthic	Physical	1d	2d	3d	4d	5d	6d	7d	8d	9d	10d	11d	12d	13d	14d	15d	16d	17d
		Chemical	1e	2e	3e	4e	5e	6e	7e	8e	9e	10e	11e	12e	13e	14e	15e	16e	17e
		Biological	1f	2f	3f	4f	5f	6f	7f	8f	9f	10f	11f	12f	13f	14f	15f	16f	17f
Terrestrial	Tidal Buffers*									8g	9g			12g	13g			16g	17g
	Riparian Buffers**		1h	2h	3h	4h	5h												
	Watershed Uplands**		1i	2i	3i	4i	5i			8i	9i			12i	13i			16i	17i
Socioeconomic			1j	2j	3j	4j	5j	6j	7j	8j	9j	10j	11j	12j	13j	14j	15j	16j	17j

Kreeger

23

Restoration Matrices

Sub-Watershed Scale
e.g., LE1



Basic Restoration Matrix

LE-1: Restoration Opportunities Layer

 No Opportunity  Project with Opportunity
 Opportunity but No Project

Natural Resources Restoration Opportunities		Habitats (examples)								Living Resources (examples only)													
		Terrestrial		Wetland			Aquatic			Birds		Fish		Shellfish		Other							
		Forest	Meadow	Riparian	Non-tidal Forested	Tidal / FW Marsh	Tidal Salt/Brackish Marsh	Streambed	Mud Flat	Hard Bottom	Open Water	Shorebirds	Songbirds	Raptors	Diadromous	Resident	Oysters	FW Mussels	HSC	Blue Crabs	Mammals	Herps	Macroinvt
Protection	Water Quality																						
	Water Quantity / Flow																						
	Land Acquisition Legal / ESA																						
Habitat Restoration & Enhancement	Habitat Creation																						
	Augmentation/ improvement/planning																						
	Function Enhanced																						
	Restored Hydrology																						
Fauna Enhancement	Fish Passage																						
	Stocking																						
	Mgt/ Quotas																						

Each circle will receive a unique cell code for use in the project directory & database²⁵
 The information shown contains examples only, to be refined in later stages of the RRI.

Project Registry

	Natural Resources		Terrestrial		Wetland		Aquatic		Birds		Fish		Shellfish
Enhancement Activity	Forest	Meadow	Riparian	Tidal Mt.	Mud Flat	Open Wr.	Rapports	Shore	Island	Resident	Oysters	Blue Crab	
Water Quality					Δ	Δ	Δ	Δ	Δ				
Habitat Creation					Δ	Δ	Δ	Δ	Δ				
Land Acquisition													
Restored Hydrology							Δ	Δ	Δ				
Fish Passage					Δ			Δ	Δ				

Basic Restoration Matrix (BRM)

Basic Project Info

Project Registry	Examples of Information in Project Registry
General Information	- Project Status - Implementation start date - Size of area directly manipulated - Size of area being monitored - CCMP Action
Contact Information	- Name, address - Agency/Organization/Project website - Confidentiality
Geographic Location	- State/County/City - HUC Code - Longitude/Latitude - USGS Topo Quad - Watershed subregion - GIS layer showing the restored area?
Habitat Types and Acreage Restored	- Wetland, Headwater, Urban Waterfront, etc. - Habitat Activity Type (Enhancement, Protection, Establishment, etc.) - Scale (acres, miles, linear feet, etc.) - Species Affected
Project Budget	- Original proposed project cost estimate - Total cost estimate for monitoring

Restoration Projects

Includes Uplift and Restoration Science/Outreach



Delaware Estuary Project Registry

Launched 12/1/2009

Currently contains >50 projects; e.g.,

- stream restoration
- wetlands enhancement and creation
- dam removal
- oyster revitalization



Goal: Inventory the full diversity of environmental improvement projects ; e.g.,

- “earth-moving” projects
- research/monitoring studies that support strategic restoration
- outreach projects that strengthen understanding about restoration

Utility:

- clearinghouse for potential funders
- tracking mechanism for restoration progress
- quantify and market the total restoration need within the Delaware Estuary River Basin

How to Submit Projects



[Home](#) | [Who We Are](#) | [Activities](#) | [Science & Research](#) | [News & Events](#) | [Learn](#) | [Lifestyle](#)

Delaware Estuary Project Registry



Register Projects by November 25th for PDE Alliance Consideration!

The PDE Project Registry, part of the overall Delaware Estuary Regional Restoration Initiative, identifies regional restoration needs and matches them with high impact projects and regional priorities. The Regional Restoration Project Registry will serve as a clearinghouse for restoration projects across the watershed.

Components of the RRI Project Registry:

**Get Started:
Register or Search for Projects**

**PDE Alliance
2010 Call for Projects**

**Learn more about:
Regional Restoration Initiative
and
Project Registry**

RRI Current Workshops and Events

The registry was launched on 12/1/2009 and currently contains more than 100 projects, including stream restoration,



WELCOME!



Project Registry Options

- [Register a New Project](#)
- [Update a Current Project](#)
- [Project Quick Search](#)
- [Keyword Search](#)
- [Advanced Search](#)

[About](#)
[Quick Search](#)
[Register a Project](#)
[Update a Project](#)
[Terms & Definitions](#)
[Keyword Search](#)
[Advanced Search](#)

Returning User Login

Email:
Password:

[click here to register](#)

Estuary News

To read past issues, [click here.](#)

Enter Your Email Address

Privacy by ☒ SafeSubscribeSM

[You Can Help the PDE](#)
[Make a Donation](#)

Quick Searches

The links below will run a Quick Search of all projects in the Project Registry for the following topic areas. To conduct a more refined search for a specific geographic area, use the [Advanced Search](#) feature. *Starred items are defined by clicking the link under Terms & Definitions.

Type of Activity/Project:

- [Restoration*](#)
- [Protection*](#)
- [Enhancement*](#)
- [Creation*](#)
- [Monitoring](#)
- [Research](#)
- [Education](#)
- [Climate Change](#)
- [Dam Removal](#)
- [Stormwater Management](#)

Habitat Type:

- [Upland/Forest](#)
- [Wetlands](#)
- [Riparian](#)
- [Aquatic/Marine](#)

Other

- [Projects created within past 30 days](#)
- [Projects updated within past 30 days](#)



Partnership for the Delaware Estuary

JOIN IN ITS REDISCOVERY

HOME | REGIONAL RESTORATION | **PROJECT REGISTRY** | REGISTER A PROJECT | ADVANCED SEARCH | TERMS & DEFINITIONS

About
Quick Search
Register a Project
Update a Project
Terms & Definitions
Keyword Search
Advanced Search

Log Out

Estuary News
To read past issues, click here.

Enter Your Email Address

SignUp

Privacy by ☒ SafeSubscribeSM



Partnership for the Delaware Estuary
One Riverwalk Plaza
110 South Poplar Street, Suite 202
Wilmington, DE 19801
800.445.4935 or 302.655.4990

Project Registry Submission Form

For all questions, choose only and all fields that apply. **Bolded fields** are required. *Starred items are defined by clicking the link under Terms & Definitions. For questions about the form, call (302) 655-4990 x107 or e-mail our restoration@delawareestuary.org

Contact Info

Please enter the name of your project and your contact information below to get started. You can opt to keep your entire project private or you can choose to just have certain answers kept confidential (i.e. withheld from public viewing) by checking the boxes to the right.

☐ I would like to keep the entire project private.

Private
Info

Name of Project:

Project Type:

- ☐ On-the-ground Restoration
- ☐ Education & Outreach (not associated with a restoration project)
- ☐ Research & Monitoring/Modeling (not monitoring associated with a restoration project)
- ☐ Other: (describe)

Contact Name:

☐

Instructions

- Fill in the form on the left with your project information.
- Determine if your entire project should be private or just certain information.
- Click the "Create Project" button to get started.
- Complete the remaining pages as instructed.
- Review your project and make changes as necessary.
- Print and submit your project.

Quick Searches

The links below will run a Quick Search of all projects in the Project Registry for the following topic areas. To conduct a more refined search for a specific geographic area, use the [Advanced Search](#) feature. *Starred items are defined by clicking the link under Terms & Definitions.

Type of Activity/Project:

- [Restoration*](#)
- [Protection*](#)
- [Enhancement*](#)
- [Creation*](#)
- [Monitoring](#)
- [Research](#)
- [Education](#)

Project Registry Submission Info

- Project Description
- Keywords
- Project Address
- Nearest City/Town
- Size of Project
- Type of Activity
- Total Estimated Project Cost
- Project Status
- Site ownership
- Project Duration
- Funding Secured?



How to Retrieve Projects



HOME | REGIONAL RESTORATION | PROJECT REGISTRY | REGISTER A PROJECT | ADVANCED SEARCH | TERMS & DEFINITIONS

WELCOME!



Project Registry Options

- [Register a New Project](#)
- [Update a Current Project](#)
- [Project Quick Search](#)
- [Keyword Search](#)
- [Advanced Search](#)

About

[Quick Search](#)
[Register a Project](#)
[Update a Project](#)
[Terms & Definitions](#)
[Keyword Search](#)
[Advanced Search](#)

Returning User Login

Email:
Password:

[click here to register](#)

Estuary News

To read past issues, [click here.](#)

Enter Your Email Address

Privacy by ☒ SafeSubscribeSM

You Can Help the PDE
[Make a Donation](#)

Quick Searches

The links below will run a Quick Search of all projects in the Project Registry for the following topic areas. To conduct a more refined search for a specific geographic area, use the [Advanced Search](#) feature. *Starred items are defined by clicking the link under Terms & Definitions.

Type of Activity/Project:

- [Restoration*](#)
- [Protection*](#)
- [Enhancement*](#)
- [Creation*](#)
- [Monitoring](#)
- [Research](#)
- [Education](#)
- [Climate Change](#)
- [Dam Removal](#)
- [Stormwater Management](#)

Habitat Type:

- [Upland/Forest](#)
- [Wetlands](#)
- [Riparian](#)
- [Aquatic/Marine](#)

Other

- [Projects created within past 30 days](#)
- [Projects updated within past 30 days](#)



Partnership for the Delaware Estuary

JOIN IN ITS REDISCOVERY

HOME | REGIONAL RESTORATION | PROJECT REGISTRY | REGISTER A PROJECT | ADVANCED SEARCH | TERMS & DEFINITIONS

About
Quick Search
Register a Project
Update a Project
Terms & Definitions
Keyword Search
Advanced Search

Returning User Login

Email:
Password:

Login

[click here to register](#)

Estuary News

To read past issues, [click here](#).

Enter Your Email Address

SignUp

Privacy by ☒ SafeSubscribeSM



Search Results

Aquatic/Marine Projects

2 Projects Found

Mill Creek (Bennett Property) Stream & Wetland Restoration

Registered | Updated: 10/21/2010 | 10/21/2010
Location: Hockessin, DE

Approximately 2,175 linear feet of Mill Creek will be restored using a variety of restoration techniques (e.g., rock toe and log toe protection, cross vanes, log vanes, root wads, riffle and pool sequences, and random bolder placement). This method of stream restoration measures the watershed inputs and valley type (e.g., size of drainage area, topographic relief, overland runoff).

Project Number: 10_0017

[view](#)

Upper Wissahickon Hydrologic Study

Registered | Updated: 10/29/2010 | 10/29/2010
Location: Ambler, PA

The upper Wissahickon Creek is presently under threat of being dewatered due to two new projects being proposed. The Wissahickon Valley

Quick Searches

The links below will run a Quick Search of all projects in the Project Registry for the following topic areas. To conduct a more refined search for a specific geographic area, use the [Advanced Search](#) feature. *Starred items are defined by clicking the link under Terms & Definitions.

Type of Activity/Project:

- [Restoration*](#)
- [Protection*](#)
- [Enhancement*](#)
- [Creation*](#)
- [Monitoring](#)
- [Research](#)
- [Education](#)
- [Climate Change](#)
- [Dam Removal](#)
- [Stormwater Management](#)

Habitat Type:

- [Upland/Forest](#)
- [Wetlands](#)
- [Riparian](#)
- [Aquatic/Marine](#)

Other

- [Projects created within past 30 days](#)
- [Projects updated within past 30 days](#)

[About](#)
[Quick Search](#)
[Register a Project](#)
[Update a Project](#)
[Terms & Definitions](#)
[Keyword Search](#)
[Advanced Search](#)

[Log Out](#)

[Estuary News](#)
To read past issues, click here.

Enter Your Email Address

Privacy by ☒ SafeSubscribeSM



Partnership for the Delaware Estuary
One Riverwalk Plaza
110 South Poplar Street, Suite 202
Wilmington, DE 19801
800.445.4935 or 302.655.4990
Info@DelawareEstuary.org

Project View

Project Number: 10_0017

Registered | Updated: 10/21/2010 | 10/21/2010

Contact Information

Name of Project:
Mill Creek (Bennett Property) Stream & Wetland
Restoration

Project Type:
On-the-ground Restoration

Contact Name:
Stephen Williams

Organization/Company:
DNREC- Division of Soil & Water Conservation

Contact Phone:
302-832-3100

Contact Email:
stephen.williams@state.de.us

Project Basics show/hide

Project Specifics show/hide

Outcomes & Implementations show/hide

Issues Addressed & Benefits Realized show/hide

Quick Searches

The links below will run a Quick Search of all projects in the Project Registry for the following topic areas. To conduct a more refined search for a specific geographic area, use the [Advanced Search](#) feature. *Starred items are defined by clicking the link under Terms & Definitions.

Type of Activity/Project:

- [Restoration*](#)
- [Protection*](#)
- [Enhancement*](#)
- [Creation*](#)
- [Monitoring](#)
- [Research](#)
- [Education](#)
- [Climate Change](#)
- [Dam Removal](#)
- [Stormwater Management](#)

Habitat Type:

- [Upland/Forest](#)
- [Wetlands](#)
- [Riparian](#)
- [Aquatic/Marine](#)

Other

- [Projects created within past 30 days](#)
- [Projects updated within past 30 days](#)

Note: Some projects in the registry are marked as private and will not be shown in the results.

Potential Users

Grant Agencies

ACES / Estuary Program

Mitigation / NRDA Trustees



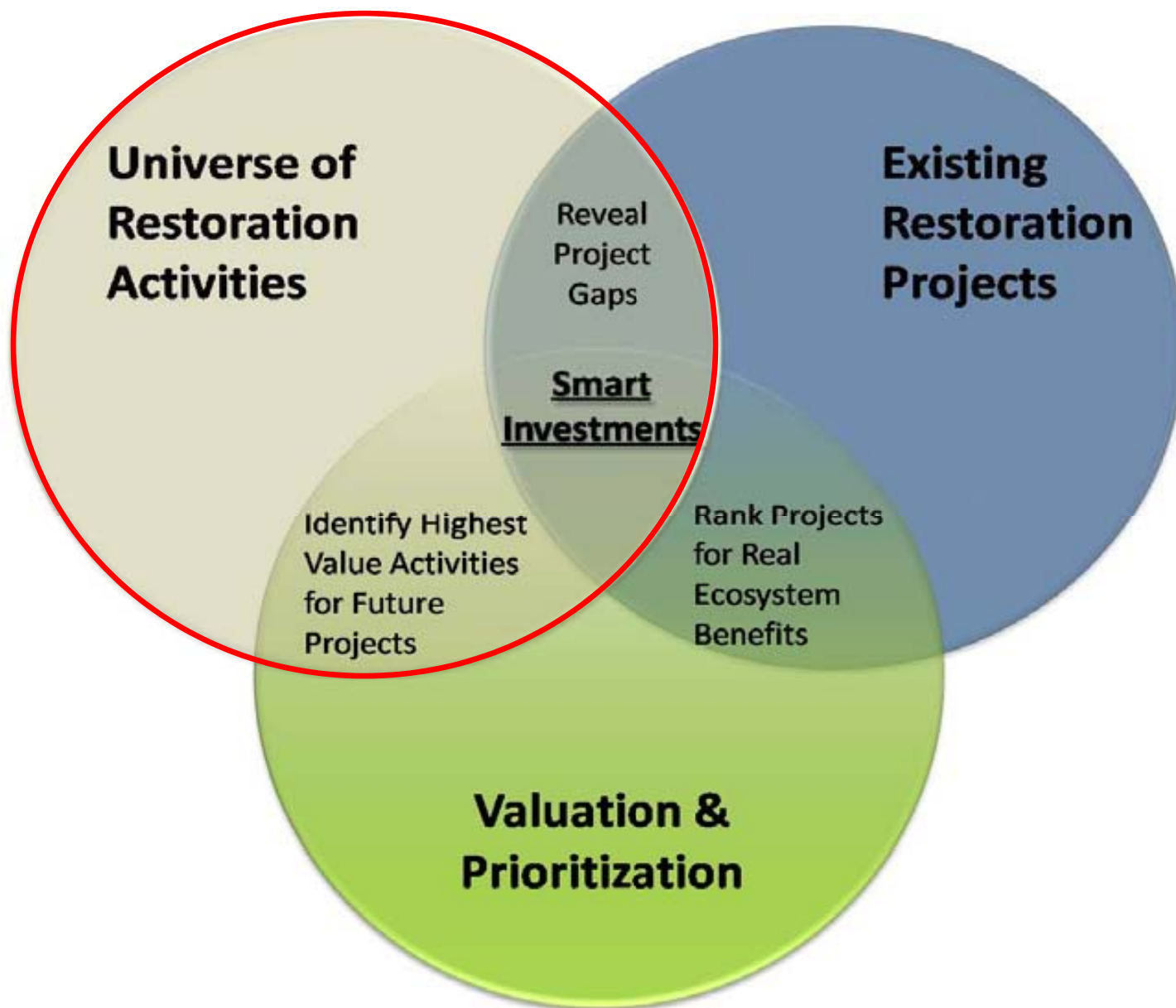
Other Applications

Tracking Progress on Restoration

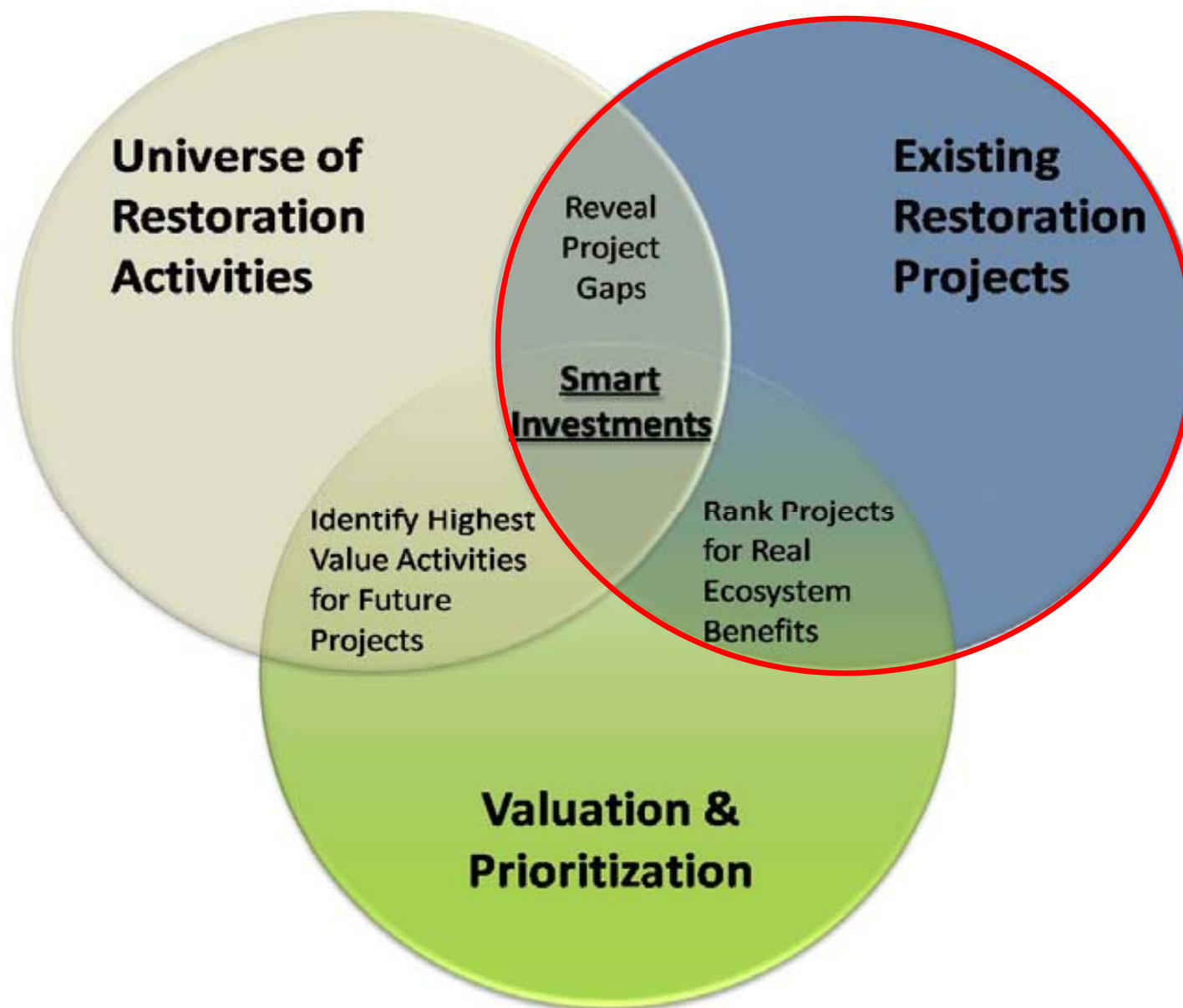
Marketing the Need to the Nation



RRI Science Track Goals



RRI Science Track Goals



Natural Capital Concepts

Millennium Ecosystem Assessment Values		<u>Supporting Value</u> • Value for ecological functioning (water quality improvement, habitat for fish and birds)
		<u>Provisioning Value</u> • Commercial value, extractable, food & fiber (fisheries, timber)
		<u>Regulating Value</u> • Shoreline Protection, Carbon Sequestration, TMDL mitigation
		<u>Cultural/Recreational/Historical</u> • Also Includes Spiritual, Aesthetic, Human Well-Being
Additional Values		<u>Functional Dominance</u> • Identifies species or habitats that are pivotal ecologically; i.e., their collapse would precipitate wider ecosystem collapse
		<u>Lack of Opportunity</u> • Challenges because of historically lost or minimal opportunity; limited window (e.g. urban waterfront restoration)
		<u>Critical Imperilment Value</u> • Species or habitat types that are in danger of being lost
		<u>Signature Type Value</u> • Hallmarks of the Delaware Estuary not found much elsewhere

Value-Added Decision Tools

> “Uplift”

Basic Restoration Matrix

LE-1: Restoration Opportunities Layer

 No Opportunity  Project with Opportunity
 Opportunity but No Project

Natural Resources Restoration Opportunities		Habitats (examples)								Living Resources (examples only)													
		Terrestrial		Wetland			Aquatic			Birds		Fish		Shellfish			Other						
		Forest	Meadow	Riparian	Non-tidal Forested	Tidal / FW Marsh	Tidal Salt/Brackish Marsh	Streambed	Mud Flat	Hard Bottom	Open Water	Shorebirds	Songbirds	Raptors	Diadromous	Resident	Oysters	FW Mussels	HSC	Blue Crabs	Mammals	Herps	Macroinvs
Protection	Water Quality																						
	Water Quantity / Flow																						
	Land Acquisition																						
	Legal / ESA																						
Habitat Restoration & Enhancement	Habitat Creation																						
	Augmentation/ improvement/planning																						
	Function Enhanced																						
	Restored Hydrology																						
Fauna Enhancement	Fish Passage																						
	Stocking																						
	Mgt/ Quotas																						

Each circle will receive a unique cell code for use in the project directory & database40
 The information shown contains examples only, to be refined in later stages of the RRI.



Value-Added Restoration Matrix

Restoration Activity					Terrestrial			Wetland	
					hab 1	hab 2	hab 3	hab 4	hab 5
			Scale	Key	Forest	Meadow	Other	Non-tidal Forested Wetland	Tidal Freshwater Wetland
Habitat Restoration		Cell Code	-	2a		2a	3a	4a	5a
		Projects Exist?					GAP		high need
	Natural Capital Values	Ecoservice Value	0-10	lo med hi			2	8	9
		Extractive Value (Trust)	0-10				2	4	1
		Functional Dominance	0-5	lo med hi			1	4	5
		Critical Imperiled	0-5	lo med hi			0	4	4
	Other Values	Signature Type	0-3	lo med hi			0	1	5
		Lack of Opportunity	0-3	lo med hi			1	0	0
		Other Considerations**	0-3	lo med hi			1	0	1
		Importance Score				na	7	21	25

Structure

Regional Restoration Initiative

Blueprint for the Delaware Estuary



Track 1

Regional Restoration
Workgroup (RRWG)

Track 2

PDE Alliance for
Comprehensive
Solutions (ACES)

Case Studies

ID Key
Resources

Ecological
Valuation

N.C. Outcomes
from Activities

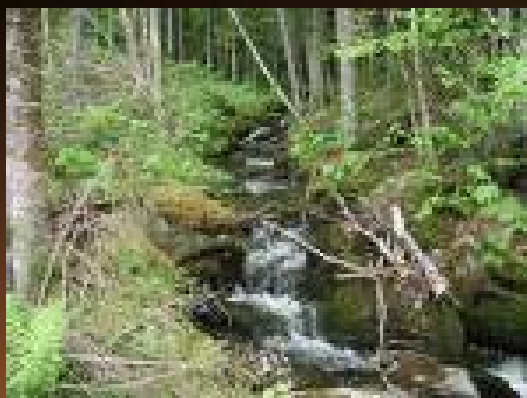
Project
Registry & Gaps



Tidal Marshes



Bivalve Shellfish



Headwater Streams



Urban Waterfront

Spills Happen

T/S ATHOS I



Thanksgiving, 2004



11/29/2004

Photo from USCG, 2005



11/29/2004

Photo from USCG, 2005

Most Oil Sunk



Photos from USCG, 2005

Deepwater Horizon

Can it happen here?

- Well Blow-Out

type of spill can't happen here

- 700x volume of *Athos I* spill

spill volume can't happen here

Lessons for the Delaware Estuary

- Prevention
- Response
- Recovery
- Mitigation

August 16 — August 29, 2010
Bloomberg Businessweek

**The Coast
Is Not Clear
Though the
BP oil spill's
impact is much
less severe than
feared, long-term
threats remain: wetlands
destruction, dead zones,
and climate change.
They make the
spill look almost
minor.**

By Peter Coy

STAC Brief

- Purpose: pose unaddressed science and management questions



Science and Technical Advisory Committee
Partnership for the Delaware Estuary:
A National Estuary Program
www.DelawareEstuary.org

Oil Spill Preparedness in the Delaware Estuary
Comments and Questions by the STAC

PREPARED BY:

Danielle A. Kreeger, Ph.D., Partnership for the Delaware Estuary
Desmond M. Kahn, Ph.D. Delaware Division of Fish and Wildlife
John Kraeuter, Ph.D., Rutgers University
Susan S. Kilham, Ph.D., Drexel University
David Velinsky, Ph.D., Academy of Natural Sciences of Philadelphia

DATE: July 27, 2010

The unprecedented environmental catastrophe underway in the Gulf due to the Deepwater Horizon oil spill provides a unique opportunity to re-examine the science and management of oil spill protection, response and mitigation in the Delaware Estuary.

Oil in the Delaware Estuary – STAC Questions

1. What is the combined volume, type and characteristics of oil entering the tidal portion of the Delaware Estuary each year?

- How has this changed over time?
- How do oil spills vary spatially and temporally?
- What are the typical types of oils spilled?
- How does recovery success vary with spill size or type?



Oil in the Delaware Estuary – STAC Questions

2. What is the cumulative environmental impact of various size spills?

- What type of baseline monitoring for oil compounds is needed for this assessment?

3. What is the relative impact of tidal oil spills versus other oil sources?

- Can oil fingerprinting and other methods be used to assess the relative amount of oils derived from different sources?

4. Are there new approaches to remediation that can be applied here, such as bioremediation ?



Oil in the Delaware Estuary – STAC Questions

5. Can a program be established to fund monitoring, assessment and mitigation of oil spill effects?

- Despite the size of the petrochemical industry and imported oil volumes, no baseline monitoring exists for oils and their effects

6. Can local researchers be engaged to help assess these unknowns?

- 40+ universities and diverse, relevant scientific expertise



Oil in the Delaware Estuary – STAC Questions

- 7. Can NRDA be strengthened, broadened or replicated to assess and repair injury to non-trust natural resources and ecosystem functions?**

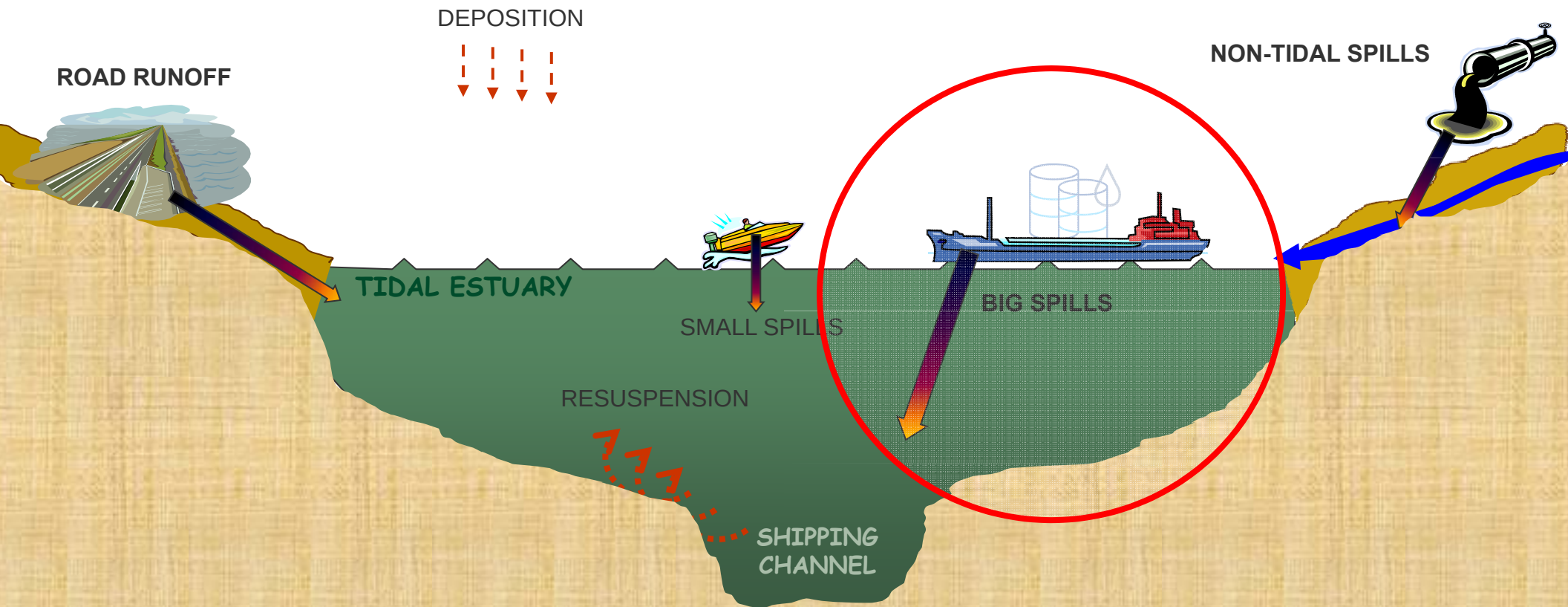
For a copy of the STAC Brief:

http://www.delawareestuary.org/science_stac_briefs.asp



Oil Sources in the Delaware Estuary

Observation: Oils, petrochemicals and hydrocarbons enter the environment through a variety of means and in many places



Additional Impacts

Standing Waves and Erosion



NRDA: a critical component of regional restoration

Efforts to build a Trust to go beyond NRDA have not progressed in the Delaware Estuary

Funding for the Gulf of Mexico restoration and the Chesapeake Executive Order – will that affect our efforts to grow the restoration pie here?

Can we do more with less?

INSIDE
Ask Dr. H.7
Monday's Child2
Comics10
Newsmakers2
Television8

Health & Science

MONDAY, JANUARY 10, 2005 B The Philadelphia Inquirer

A cooperative approach emphasizing restoration is how Athos I and other oil spills are handled today.

By Sandy Bauers and Tom Avril
INQUIRER STAFF WRITERS

Dressed in orange cold-weather survival suits, two researchers waded through ankle-deep muck onto the flats of Pea Patch Island, where oil swirled like chocolate syrup in shallow pools.

It was just weeks after the oil tanker Athos I spilled hundreds of thousands of gallons of crude oil into the Delaware River, and the two men were gathering samples to gauge the harm to the environment.

But though they worked together, they served different masters. David Beam works for the New Jersey Department of Environmental Protection, Andy Graham for a contractor hired by the tanker's owner.

If the spill had occurred 15 years ago, each side would have worked separately, gathering their own samples and sending them to different labs, and in all likelihood, fighting over the data for years in court.

The two researchers are part of a cooperative approach to restoring environments damaged by oil spills, the result of new legislation after the 1989 Exxon Valdez spill in Alaska.

The two sides agree ahead of time on what should be sampled
See **OIL SPILL** on D6

As Sunoco settles its 2000 spill at the Heinz refuge, new work may be done there. Page 6.

On Pea Patch Island: Researcher Andy Graham assessed oil-spill damage last month. Hired by the ship's owner, he's working with government scientists. At right, residue in the sand. At top, oily reeds.



Beyond mopping up

Inquirer photo by Michael...

Restoration for the Future



Kreeger

Summary

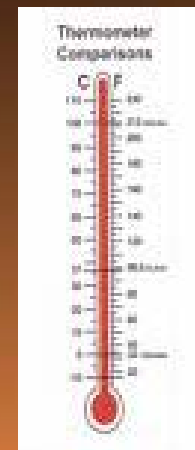
- Large and complex system
- Limited resources
- Broad CCMP
- Urgency



To have **Highest Impact**, must invest strategically in highest projects that yield maximum benefits to ecosystem goods and services

Regional restoration considers which activities are best across time and space at both the watershed and sub-watershed scale

The Project Registry and other RRI tools are available for potential use by trustees and others





– End –

