GND:
POST-REFINERY FUTURES

05.18.2021

AGENDA

11:00 - 12:10 **PRESENTATION + Q&A**

12:10 - 12:20 **BREAK**

12:20 - 1:00 **DISCUSSION / WORKSHOP**

THIS IS OUR CITY

A BIG PIECE OF IT BLEW UP

By NBC10, accessible at https://www.nbcboston.com/news/national-international/massive-oil-refinery-leaks-toxic-chemical-philadelphia/2063470/

WHAT'S NEXT?

Credit: PHILLYMAG AP Photo/Matt Rourke

I HOPE IT'S BETTER THAN THIS

THEY DO TOO

Credit: Kimberly Paynter/WHYY

HOW CAN WE HELP?

OBJECTIVES

#1 ECONOMIC ENGINE

Cqd`sd `r l`mx `bbdrrhakd, khuhr

v`fd inar `r vd b`m.

#2 ENVIRONMENTAL JUSTICE

Accqdrr kdf`bx bnms`lhm`shnm, dmrtqd bkd`m `hq, oqnuhcd `bbd sn m`stqd

#3 POST-CARBON INDUSTRY

C`qanm-Mdtsq`k˝Omctrsqx + Rh

OUTCOMES

#1 LOCAL ACTION

#2 NATIONAL CASE STUDY

PROCESS

2019 2020 2021 2022 2023

COMMUNITY ORGANIZING

CBA NEGOTIATION

LINDY REPORT

ACCESS STUDY

PENN STUDIO

SUPERSTUDIO

LEGISLATION

INFRASTRUCTURE INVESTMENT

REDEVELOPMENT

+ OTHER ACTIONS

HOW CAN WE MAKE THE MOST OF THE SUPERSTUDIO?

1. **STAKE OUT A BOLD, PUBLIC VISION FOR THE REFINERY SITE**
2. **SUPPORT IT WITH RESEARCH**
3. **LINK IT TO NATIONAL TRENDS + POLICY**

MARCH APRIL MAY JUNE JULY AUGUST SEPTEMBER OCTOBER

RESEARCH

MIDREVIEW

DEVELOPMENT TYPOLOGY

LAF SUBMISSION

ALTERNATIVE SCENARIOS

POLICY PROPOSALS

LAF SUMMIT

RESEARCH: TOPIC AREAS

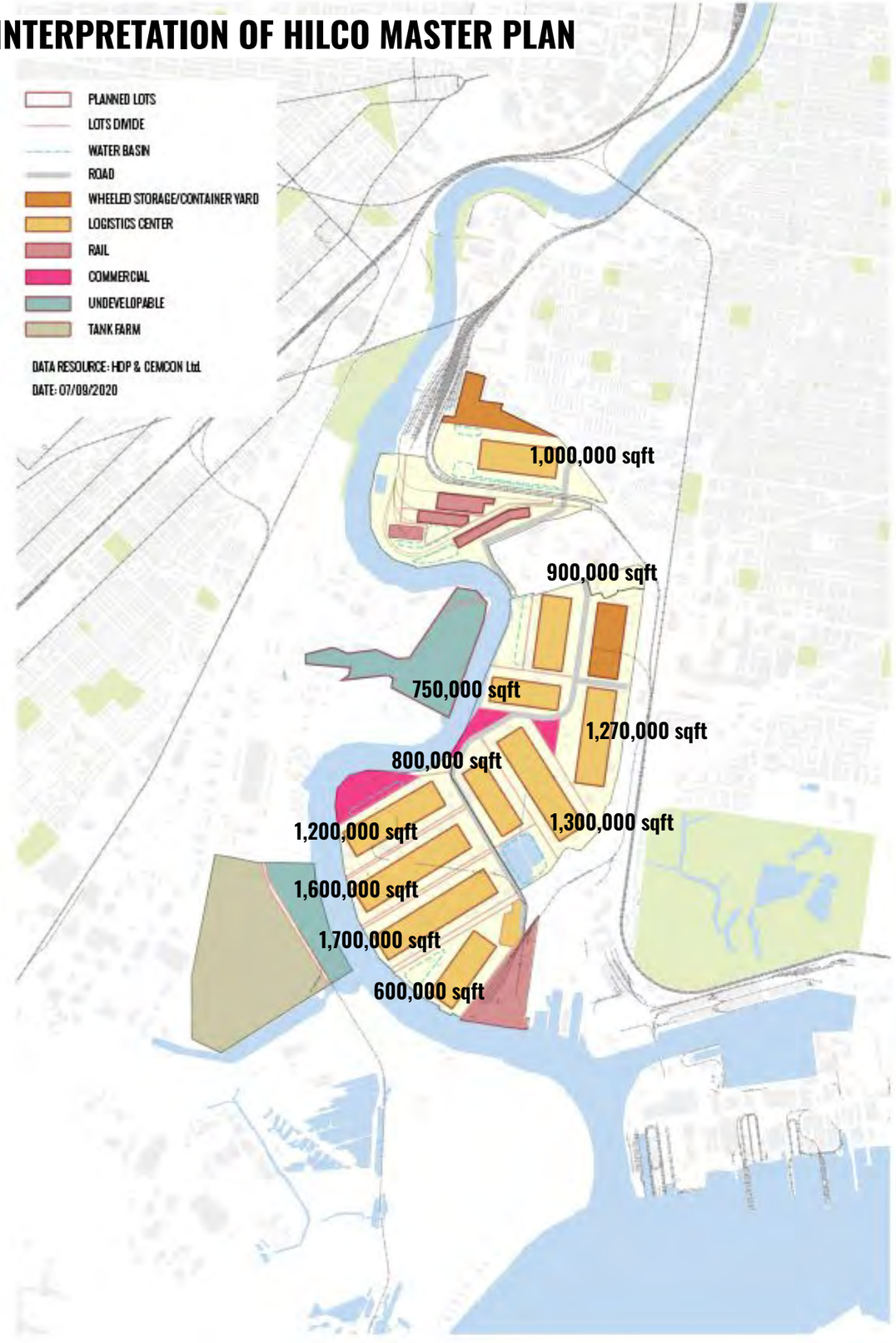
1. ECONOMIC DEVELOPMENT
2. AIR QUALITY
3. REMEDIATION
4. PARKS & ACCESS TO NATURE
5. MEMORY
6. NATIONAL REFINERY CONTEXT

ECONOMY


ABCO

Logistics is a viable use, but unlikely to fill up the site anytime soon

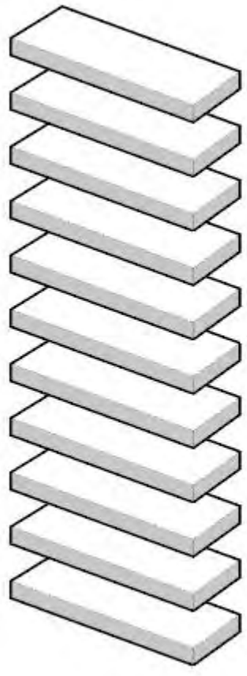
INTERPRETATION OF HILCO MASTER PLAN



PROPOSED

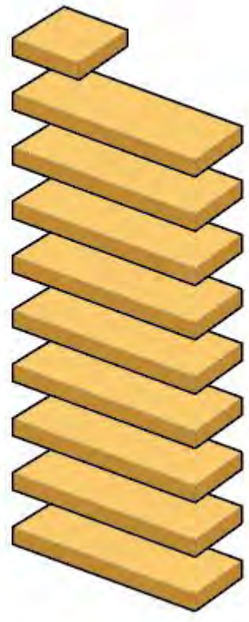
RECENT CONSTRUCTION

12 M sqft



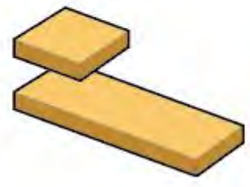
HILCO PLAN

9.4 M sqft

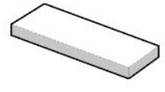


AMAZON
(IN PHILLY METRO AS OF SEPT, 2020)

1.3 M sqft

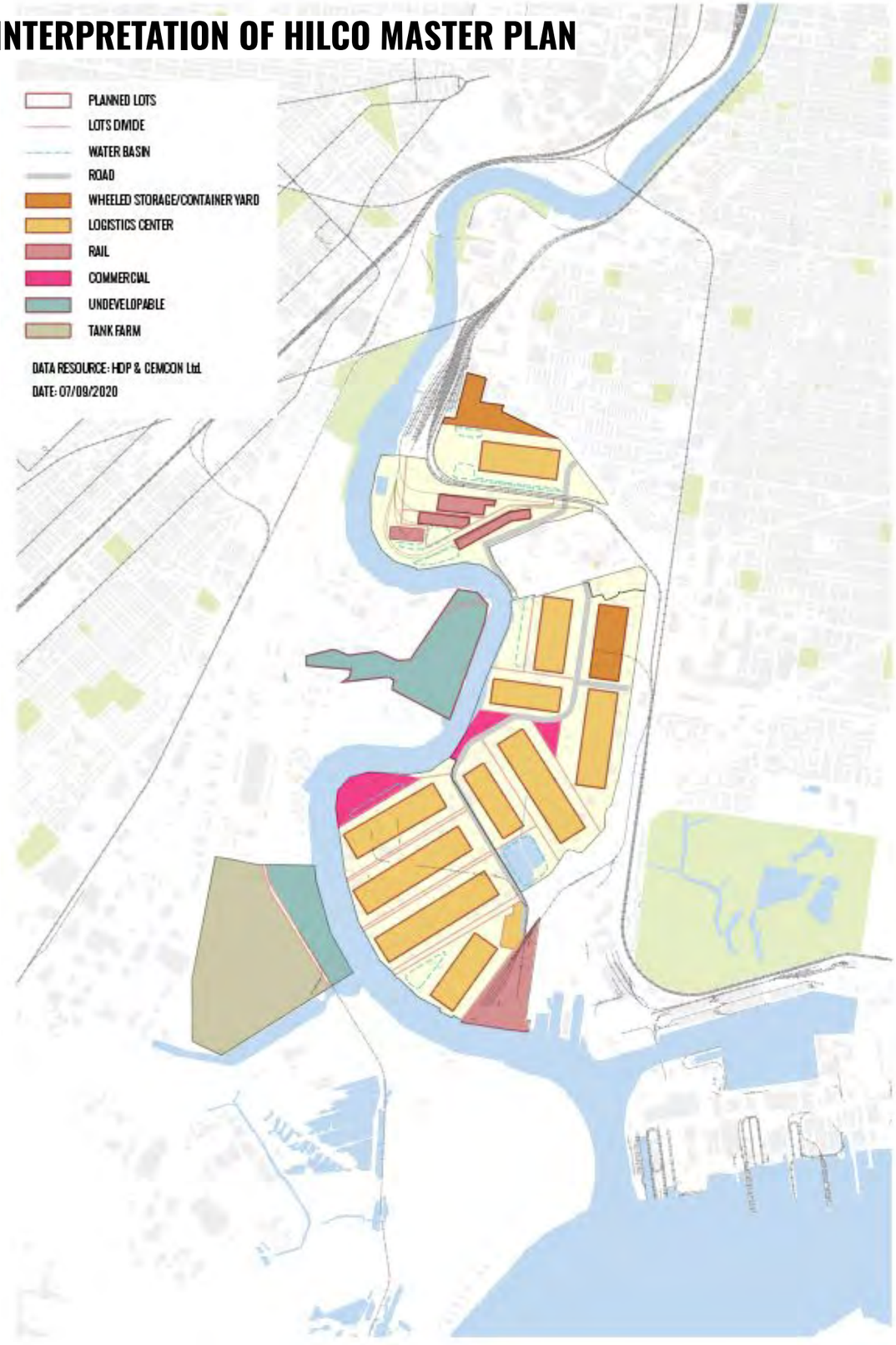


CITY OF PHILADELPHIA
(IN 2020)



= **1,000,000 sqft of warehouse space**

INTERPRETATION OF HILCO MASTER PLAN



HDP DEVELOPMENT TARGET

13-15 M sqft

- Warehouses
- E-Commerce
- Light Manufacturing
- Life Sciences
- Gas Stations
- Trucking Storage
- Retail & Restaurants

*DATA AND QUOTE COMES FROM HRP'S APRIL 14TH, 2021 PRESENTATION

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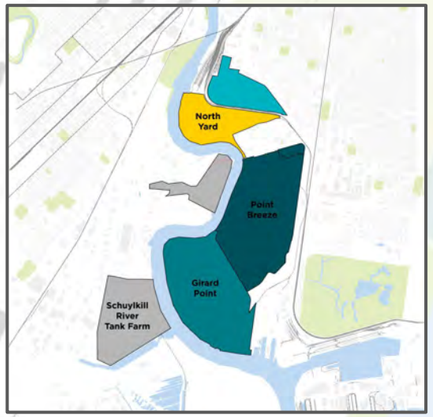
*DATA AND QUOTE COMES FROM HRP'S APRIL 14TH, 2021 PRESENTATION

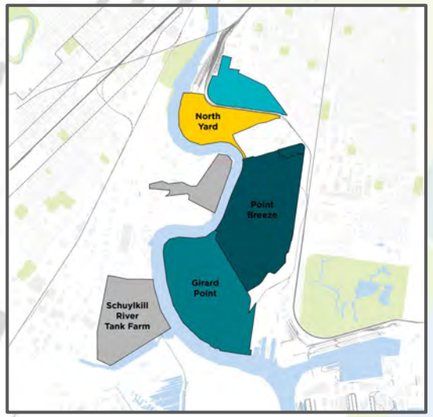
Life sciences is another big opportunity, but it's footprint may be even smaller


University City
Center City
The Navy Yard
Philadelphia International Airport



140 ACRES

PENNOVATION
8 ACRES



140 ACRES

WuXI AppTec, Inc
19 ACRES

To maximize the impact of life sciences, HIlco should consider the full life cycle of companies and products, from lab to manufacturing to distribution

FIG. 11: LIFE SCIENCES FIRM GROWTH STAGES

STARTUP
SHARED SPACE

Limited capital. Companies seek affordable space, often incubators, to maximize dollars for R&D.

Avisi
STRELLA BIOTECHNOLOGY
LONGEVITY BIOTECH
verix HEALTH
Zynerba
ScoutBio
context therapeutics
Linnaeus THERAPEUTICS
InnaMed
ALLEVI
GENOMIND
opertech bio

GRADUATE
2,000 - 15,000 SF

Series A funding. More space needed for pre-clinical research. Incubators tend to be too small or too expensive. Companies are sometimes too small for traditional commercial space. Affordability still critical to preserve funding for R&D.

Group K Diagnostics
Aro BIOTHERAPEUTICS
WindMIL THERAPEUTICS
SwanBio THERAPEUTICS
Chondrial Therapeutics, Inc.

MID-SIZE
15,000 - 50,000 SF

Series B funding for Phase I-III clinical trials. Space needs increase significantly, potentially including manufacturing.
Commercial space now viable.

CENTURY THERAPEUTICS
integral
PassageBio
INVISIBLE SENTINEL
Avid Radiopharmaceuticals
TMUNITY

MATURE
50,000 SF+ AND MANUFACTURING

Series C funding begins with commercialization & revenue. Increased SF for lab, office & potentially manufacturing. Eventually scaling/ expanding footprint, often into dedicated facilities or campuses.

Spark THERAPEUTICS
WuXi AppTec
Amicus Therapeutics
gsk
MERCK
Roche

Source: CBRE, PIDC, RESGroup, 2019

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Job access and equity are not givens: they require deliberate policy

LOGISTICS

- Higher wages than service industry, lower than refinery
- Higher job density than many types of manufacturing
- Working conditions problematic
- Automation is a long-term concern
- Need training and placement assistance to combat structural issues and achieve equity goals

LIFE SCIENCES

- Labs create jobs for PhDs
- Manufacturing more accessible, but requires specialized training
- Indirect jobs and business to business may be bigger opportunity
- Equity requires policy here too!

JOBS

PES 2018:

- 1,950 Direct Jobs

- 6,300 Indirect & Induced Full Time Jobs in Philadelphia

- $107,000 Average Salary

HRP PROJECTION:

CONSTRUCTION PHASE (13-15 YEARS):

- 9,580 Direct Jobs
- 3,750 Indirect & Induced Jobs

LONG TERM:

- 13,770 Direct Jobs
- 5,600 Indirect & Induced Jobs

*HRP'S APRIL 14TH, 2021 PRESENTATION

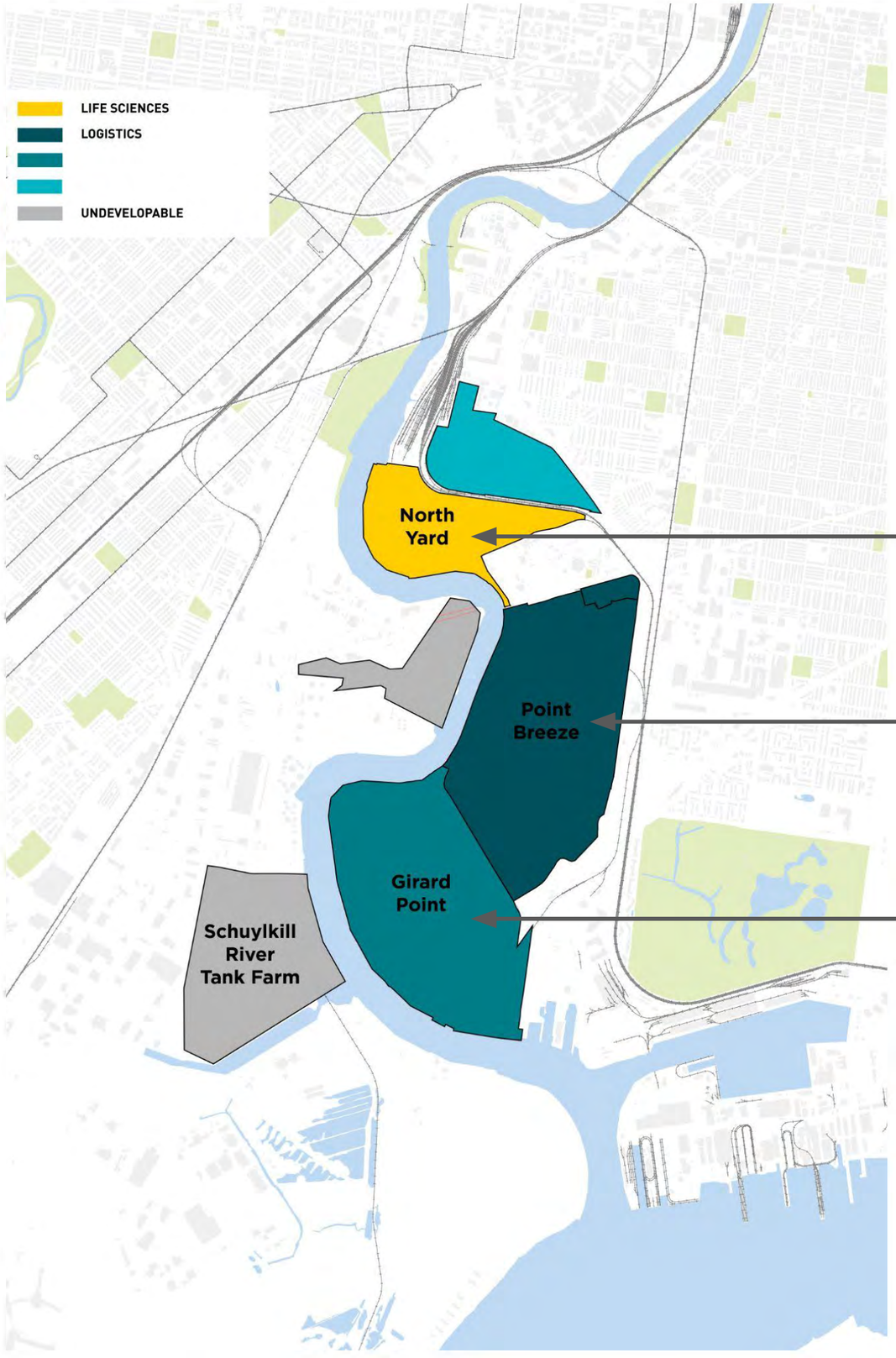
- $40,000 Average Warehouse Worker Salary
- $52,000 Average Truck Driver Salary
- $63,000 Average Freight Logistics Salary

*THE FUTURE OF WORK IN LOGISTICS, MIT, 2019

- $91,000 Staff Scientist Salary
- $68,000 Laboratory Manager Salary
- $55,000 Research Tecnician Salary

*THE FUTURE OF WORK IN LOGISTICS, MIT, 2019

Between market realities and remaining petroleum infrastructure, the fossil fuel legacy will be with us a while



- 2.2M square feet life sciences space assuming suburban format
- **minimum 3.5 years** at current construction and 100% capture rate
- **7 years** at 50% capture rate

- 10M square feet logistics
- **minimum 10 years** at current absorption and 100% capture rate
- **20 years** at 50% capture rate

Both logistics and life sciences companies may be leery of environmental hazards

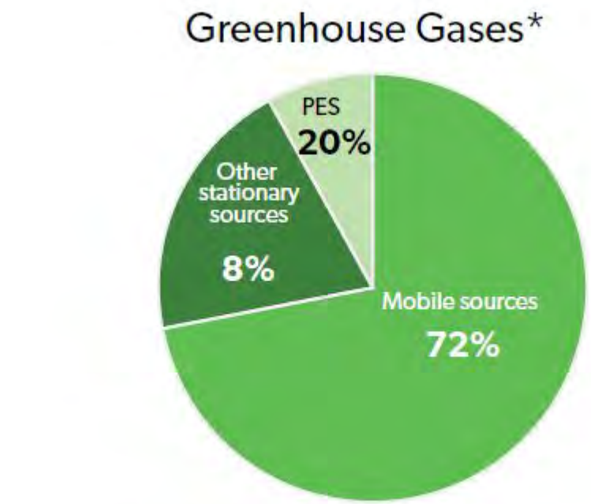
“Amazon is incredibly focused on environmental risk on any site. . .their criteria are very tough.” - Adam Gordon, Wildflower Ltd.

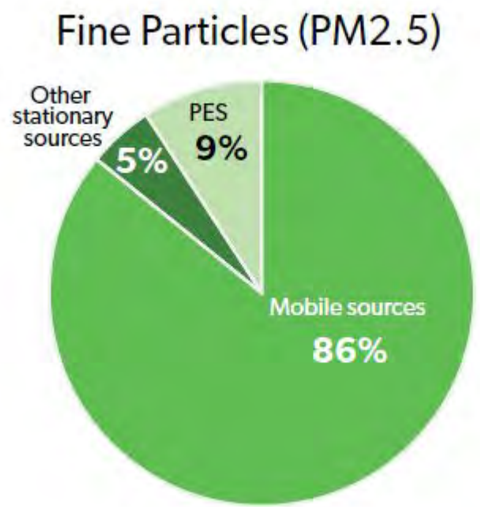
“Workers won’t want to be breathing legacy fumes because nobody is maintaining things” - Peter DeCarlo, Johns Hopkins University Environmental Health and Engineering

DISCUSSION

AIR QUALITY

The City underplayed the refinery's emissions

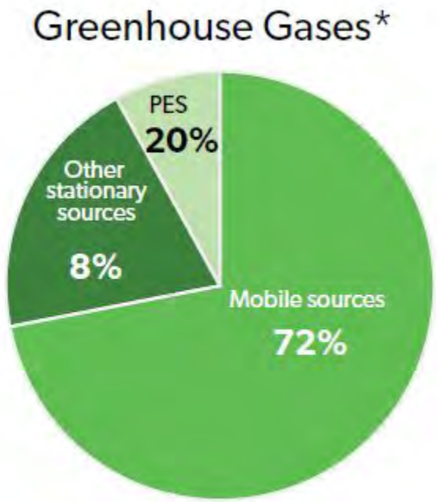




*Including carbon dioxide, methane, and nitrous oxide

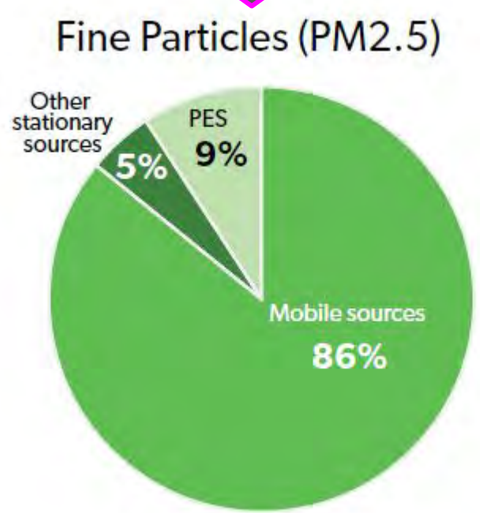
Sources: Abernathy and Thiel. “A Close Call and an Uncertain Future.”

Only counts direct refinery emissions, not product: +157,000 Tons CO2 / DAY, estimated social cost of $2.4B/year.



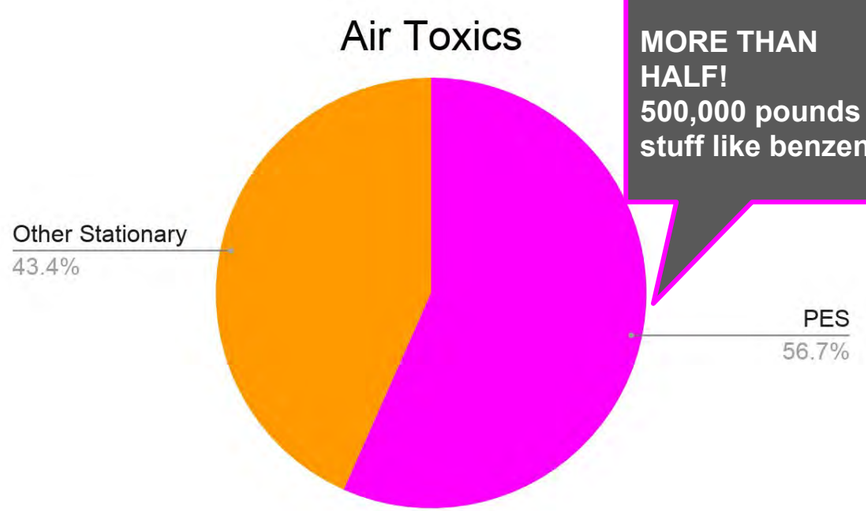
*Including carbon dioxide, methane, and nitrous oxide

Not just this. . . refinery violated its permit for 5 of the 6 criteria pollutants



The chart they conveniently forgot to draw.

MORE THAN HALF!
500,000 pounds of stuff like benzene



Plus when it blew up, that released a bunch of highly toxic hydroflouric acid, not counted here.

Sources: Abernathy and Thiel. “A Close Call and an Uncertain Future.” Interview: Peter diCarlo. April 26, 2021.

Air quality is everybody's problem

Worldwide , air pollution kills **7 million people** each year

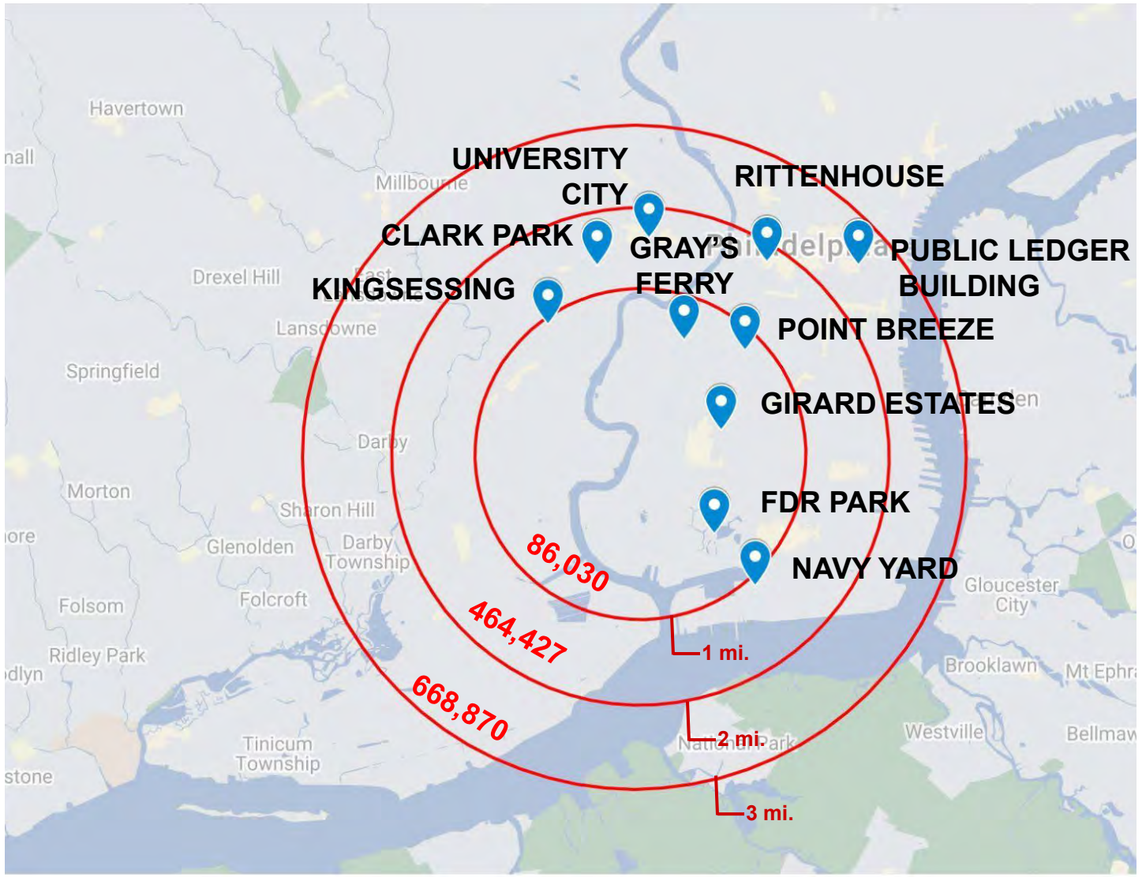
Philadelphia has the **highest cancer rate** of any large US city

Philadelphia has **higher rates of lung and kidney cancer** than the state average; both are linked ot particulates and benzene

Philadelphia has an **asthma hospitalization rate three times higher** than the state average

“I’ ve lived here all my life. I’ve buried so many people.”

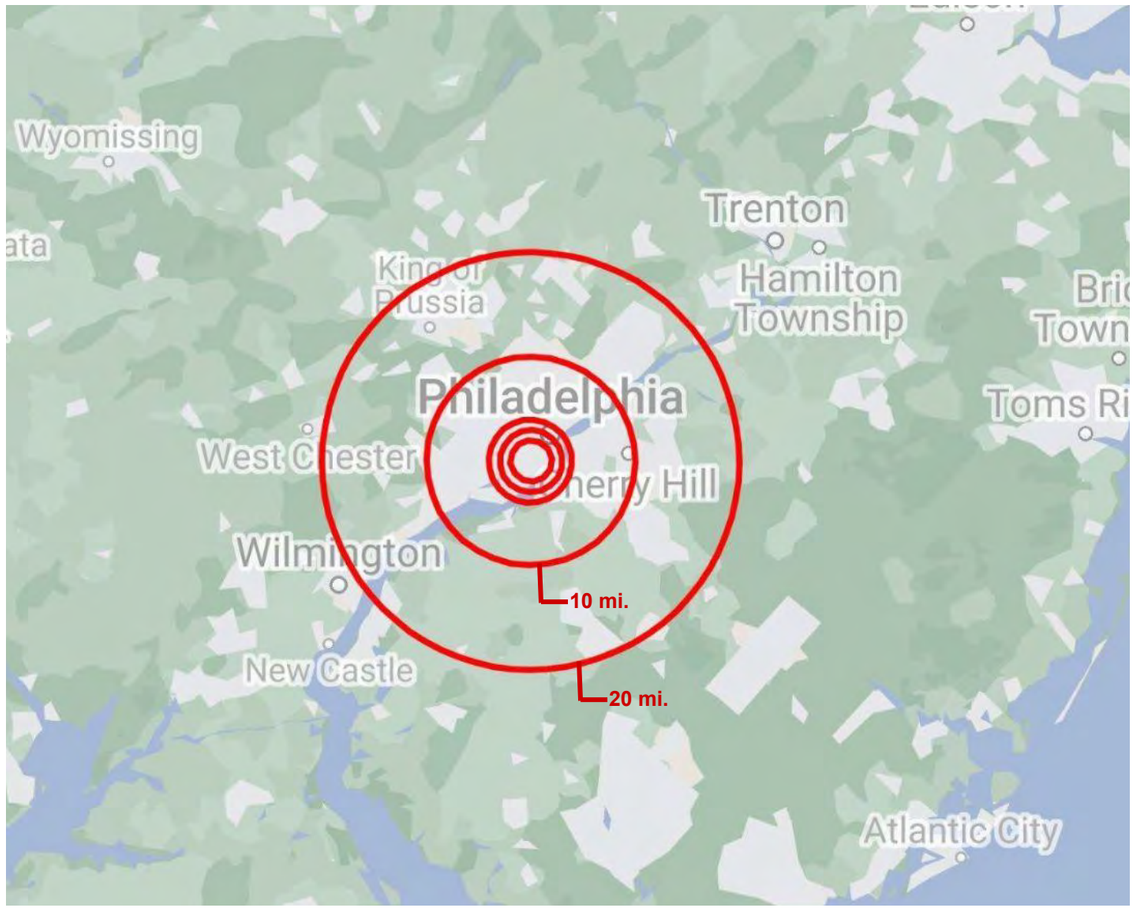
-Charles Reeves,
Tasker Morris Neighborhood Association



“When the wind blew right, you had elevated benzene in Rittenhouse Square.”

-Peter DeCarlo,

Johns Hopkins Department of Environmental Health and Engineering

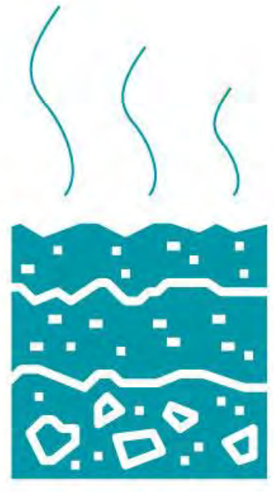


In a peer-reviewed study, living **within ten and twenty miles** of a Texas refinery was associated with a statistically significant **increase in risk of all cancer types**

-Williams et al. “Proximity to Oil Refineries and Risk of Cancer: A Population-Based Analysis. ***IMC˝O C`mbdq Rodbsq*** 2020 4(6).

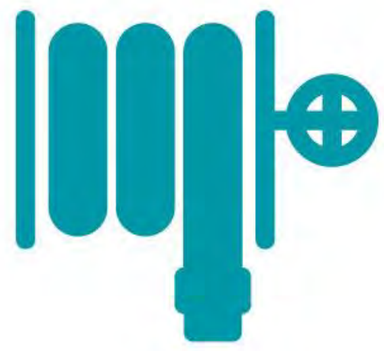
The refinery is still a hazard

“Shut downs of [refineries] have been associated with peaks in [benzene] exposure concentrations… effort should be placed on safe working methods pertaining to shutdowns.”

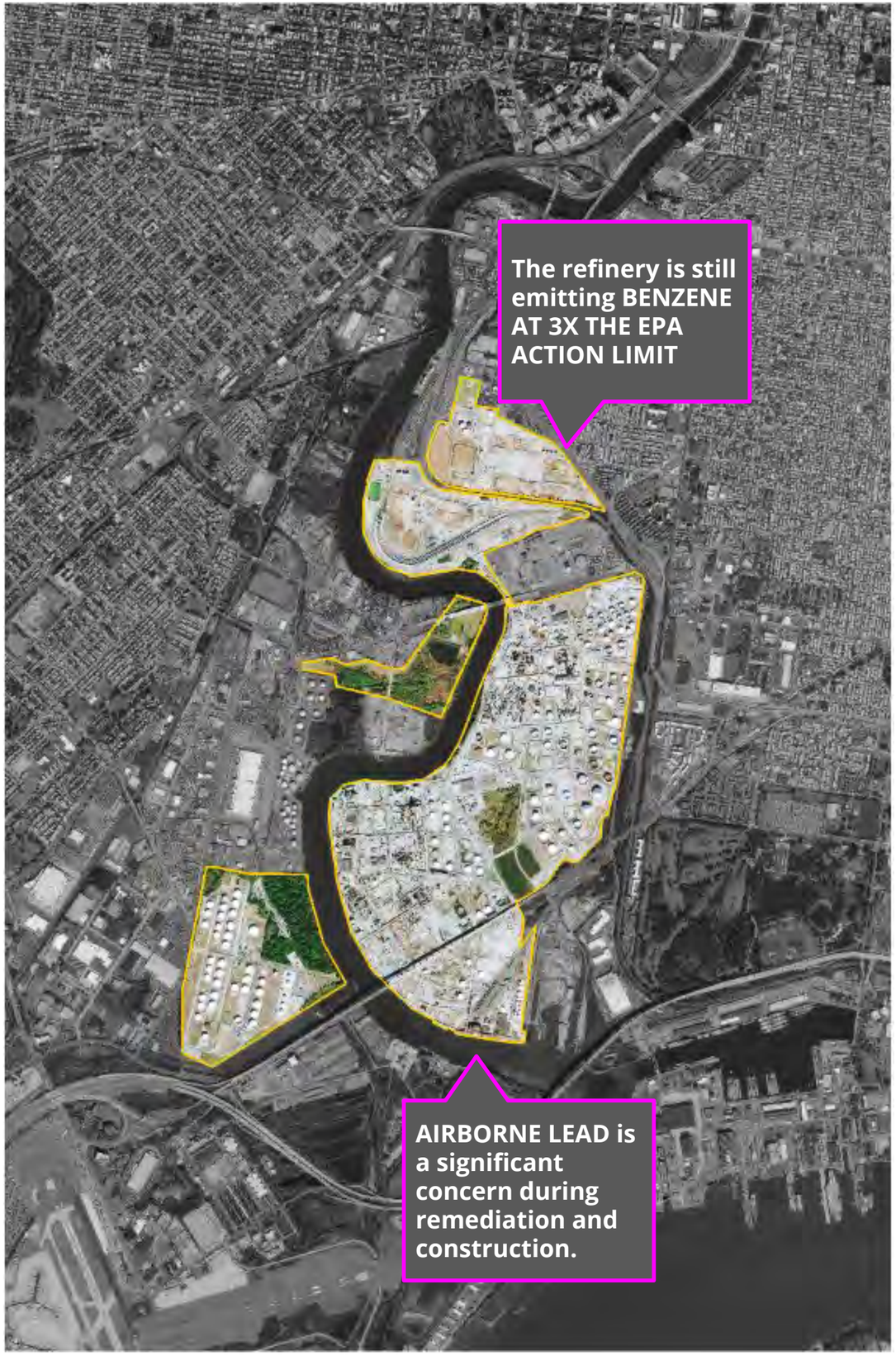


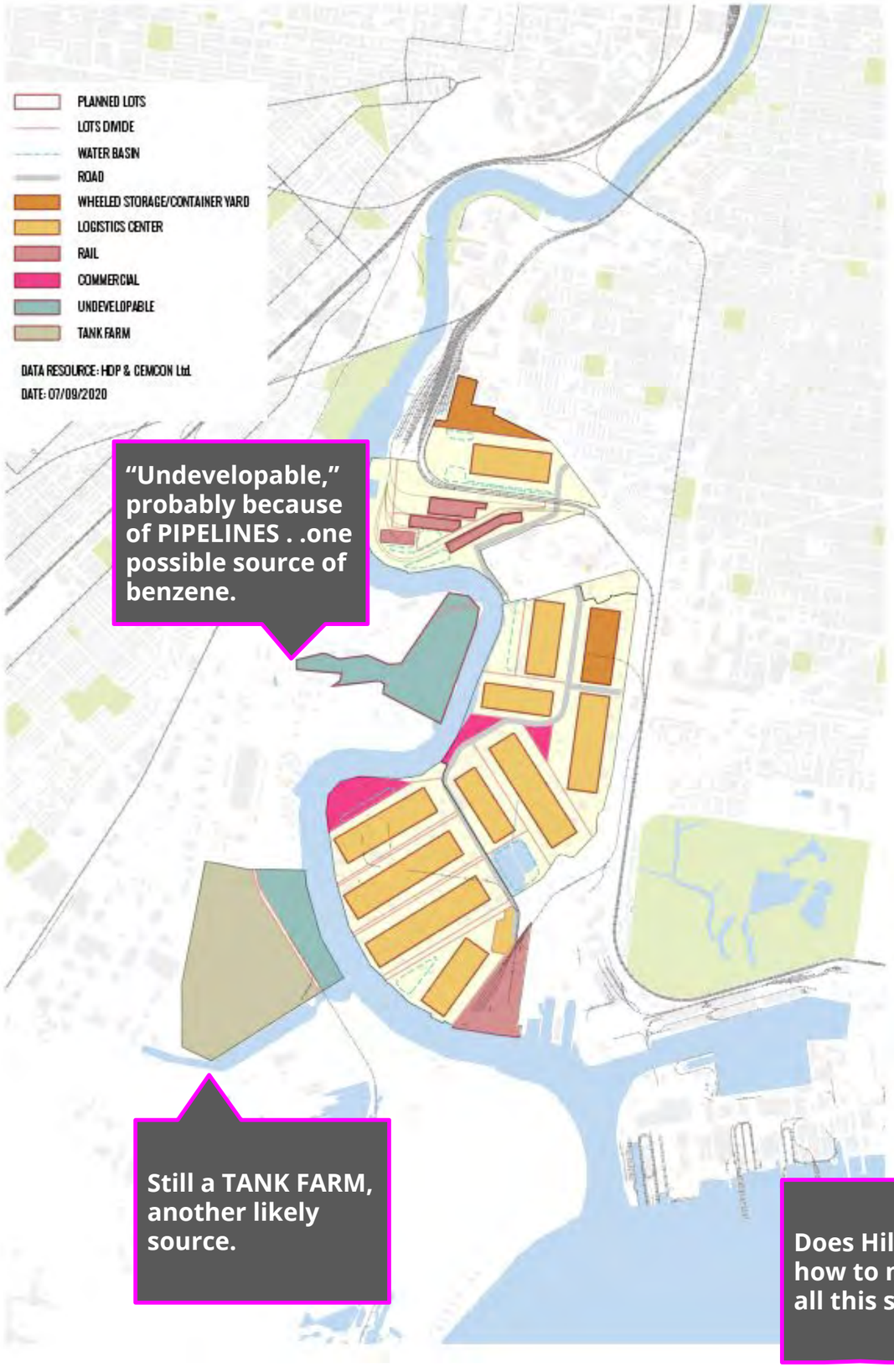
Continuing sources of Benzene emissions at the refinery site may include:

- Leaky tanks + storage containers
- Contaminated soil
- Hose and pipe connections



Tapani Tuomi, et al. “Managing Exposure to Benzene and Total Petroleum Hydrocarbons at Two Oil Refineries 1977–2014.” International Journal of Environmental Research and Public Health, vol. 15, no. 2, Jan. 2018, p. 197, doi:10.3390/ijerph15020197.


The refinery is still emitting BENZENE AT 3X THE EPA ACTION LIMIT
AIRBORNE LEAD is a significant concern during remediation and construction.


PLANNED LOTS
LOTS DIVIDE
WATER BASIN
ROAD
WHEELED STORAGE/CONTAINER YARD
LOGISTICS CENTER
RAIL
COMMERCIAL
UNDEVELOPABLE
TANK FARM
DATA RESOURCE: HDP & CEMCON Ltd.
DATE: 07/09/2020
"Undevelopable," probably because of PIPELINES . .one possible source of benzene.
Still a TANK FARM, another likely source.
Does Hilco know how to maintain all this stuff?

Logistics centers are bad for air quality too.

Pollution from trucking emits small toxic particles called “particulate matter” (PM) into the air.

These particles vary in size and toxicity and harm human health in different ways.

Particulate emissions from diesel vehicles and equipment contribute to health problems that include:

cardiovascular problems

cancer

asthma

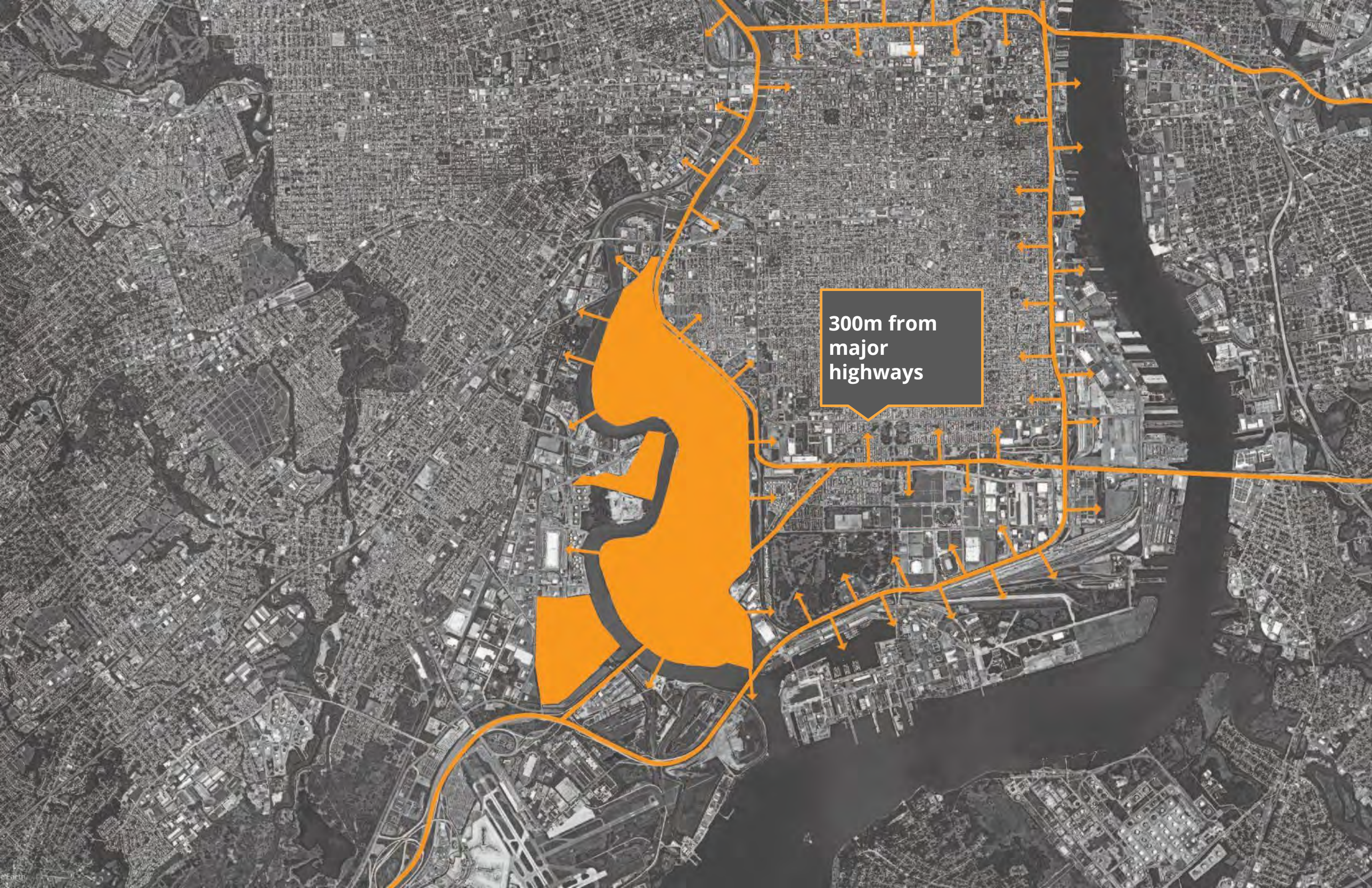
decreased lung function and capacity

reproductive health problems

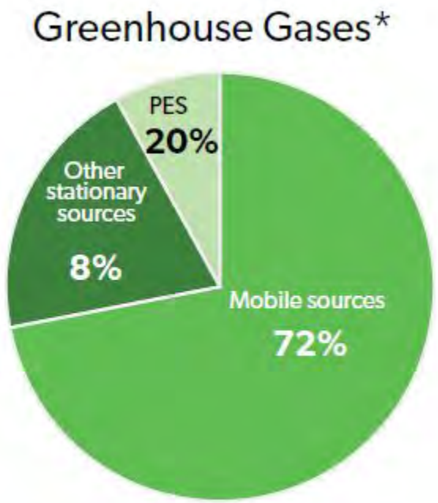
and premature death.

Storing Harm: The Health and Community of Goods Movement and Logistics. University of Southern California, Jan. 2012, https://envhealthcenters.usc.edu/wp-content/uploads/2016/11/Storing-Harm.pdf.


300m from refinery boundary

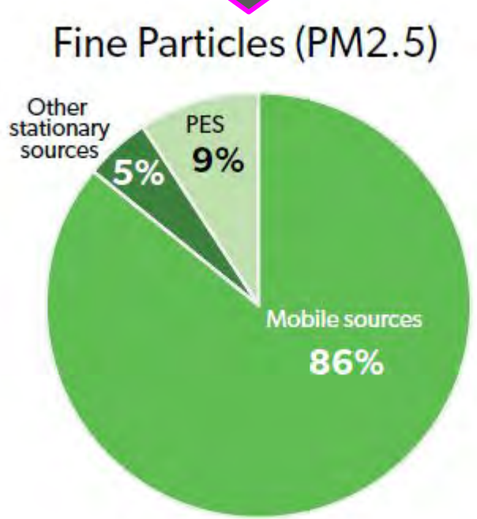

300m from major highways

A fifth of the way to carbon neutrality by 2050 (maybe)



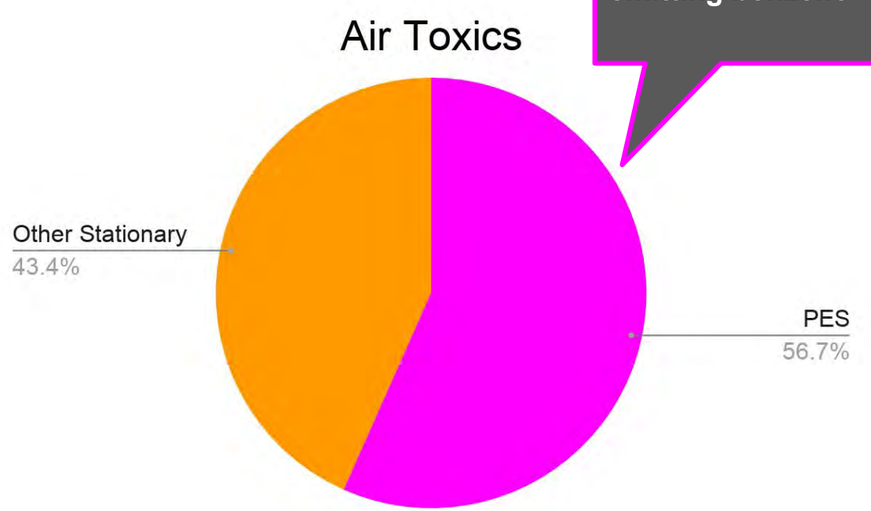
*Including carbon dioxide, methane, and nitrous oxide

Modest reductions in particulates. . .



Potentially offset by increases from trucking and congestion.

HUGE BENEFIT. . .but not if it keeps emitting benzene



Sources: Abernathy and Thiel. “A Close Call and an Uncertain Future.” Interview: Peter diCarlo. April 26, 2021.

Can we imagine a fully electrified site?

E-Commerce Mega-Warehouses, a Smog Source, Face New Pollution Rule

A plan aimed at the nation's largest cluster of warehouses is designed to spur electrification of pollution-spewing diesel trucks and could set a template for restrictions elsewhere.

DISCUSSION

REMEDIATION

1. State of the Site
2. Lead & Benzene
3. SLR & Flood
4. GND Remediation

REMEDIATION:

STATE OF THE SITE

CONTAMINANTS

Volatile Organic Compounds

- **Hard to Degrade**

- PAHs

EPA HIGH PRIORITY

1. Benzo(a)pyrene
2. Benzo(a)anthracene
3. Benzo(g,h,i)perylene
4. Benzo(b)fluoranthene
5. Dibenzo(a,h)anthracene
6. Chrysene
7. Napthalene

- **Easily Degradable**

- BTEXs

1. Benzene
2. 1,2,4-trimethyl benzene
3. Cumene/isopropyl benzene
4. Xylenes
5. Toluene

- MAH

6. Ethylbenzene

- MTBE

7. Methyl tert-butyl ether

- HVOC

8. PCE

- Organobromine

9. 1,2-dibromoethane

- LNAPL

10. Light Non-Aqueous Phase Liquid

Metals

- **Low Bioavailability**
  1. Lead (Pb)
  2. Chromium (Cr)
  3. Mercury (Hg)
- **Medium Bioavailability**
  1. Cobalt (Co)
  2. Manganese (Mn)
- **High Bioavailability**
  1. Arsenic (As)
  2. Nickle (Ni)
  3. Barium (Ba)
  4. Thallium (TI)

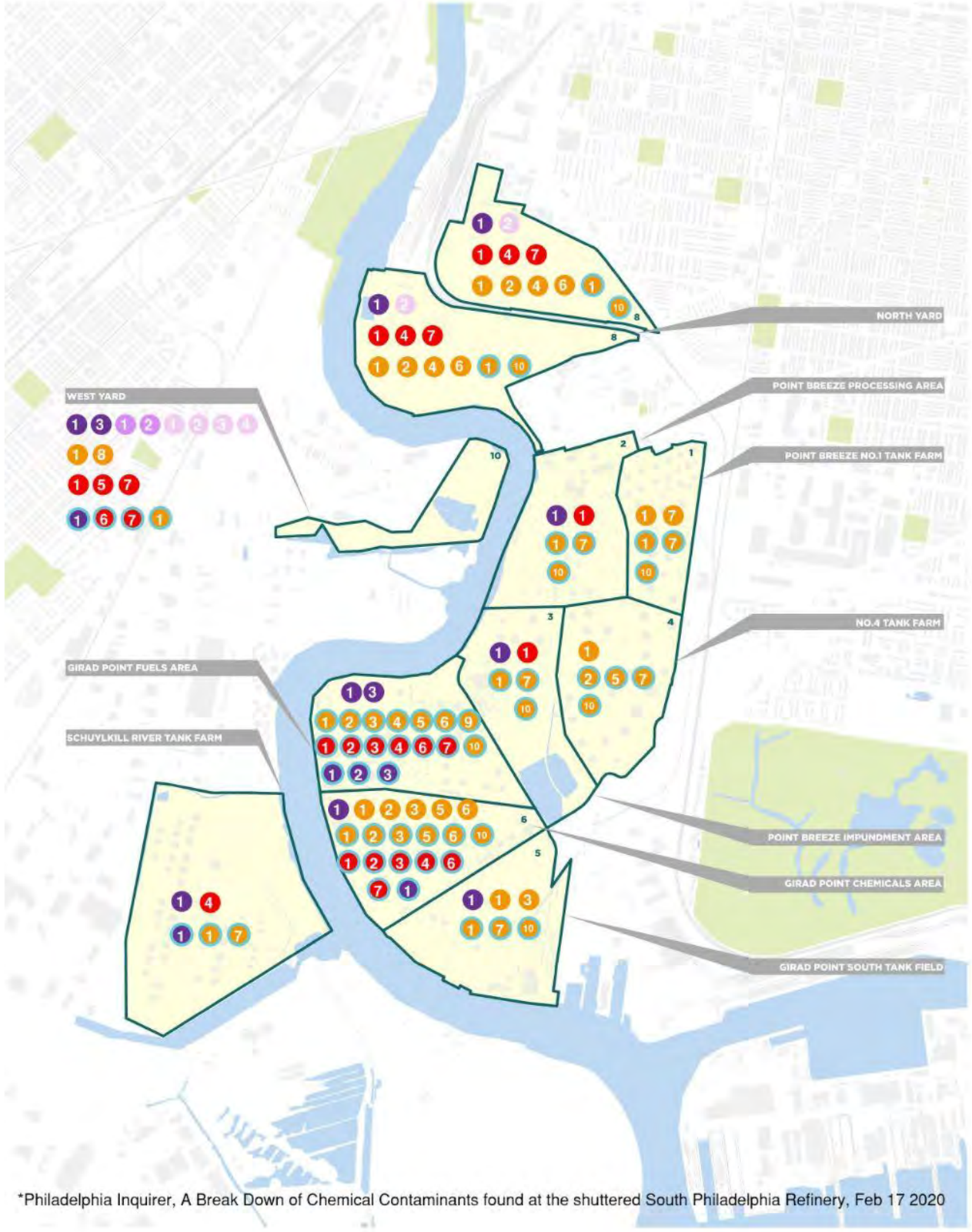
1 Contaminant in Soil

1 Contaminant in Groundwater

*Philadelphia Inquirer, A Break Down of Chemical Contaminants found at the shuttered South Philadelphia Refinery, Feb 17 2020

CONTAMINANTS

Soil & groundwater contamination found throughout the site

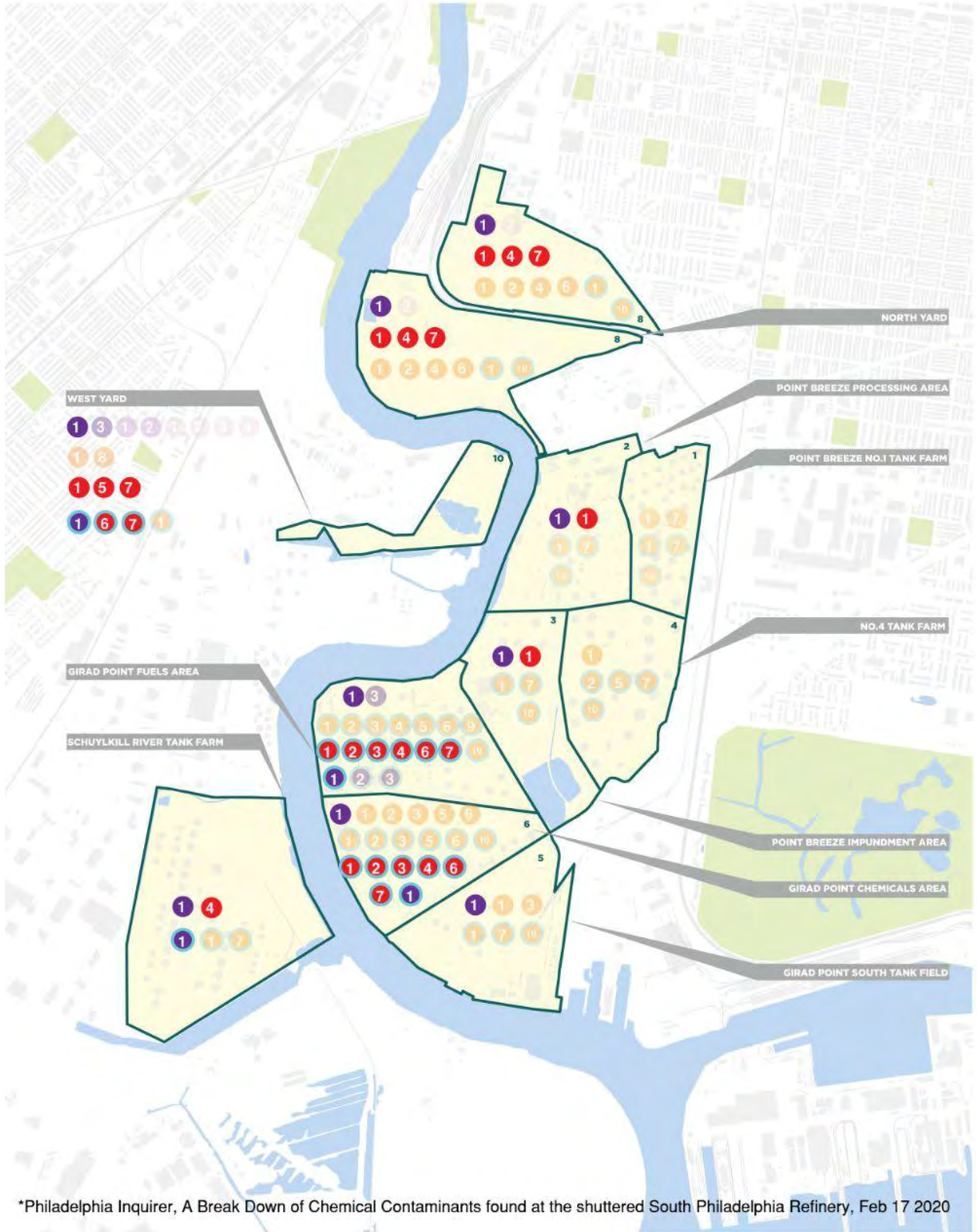


*Philadelphia Inquirer, A Break Down of Chemical Contaminants found at the shuttered South Philadelphia Refinery, Feb 17 2020

CONTAMINANTS

7 of **EPA's** 16 **High Priority Pollutants**

Lead Limit set to
2.5x Non-residential
&
5x Residential
Soil Standard



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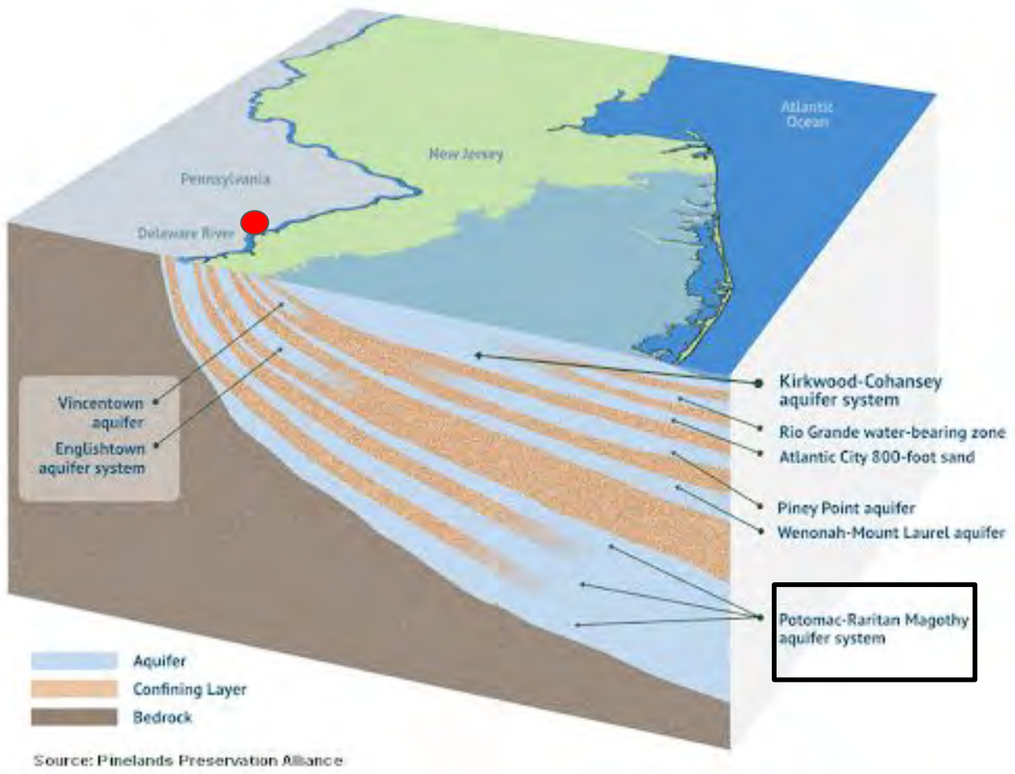
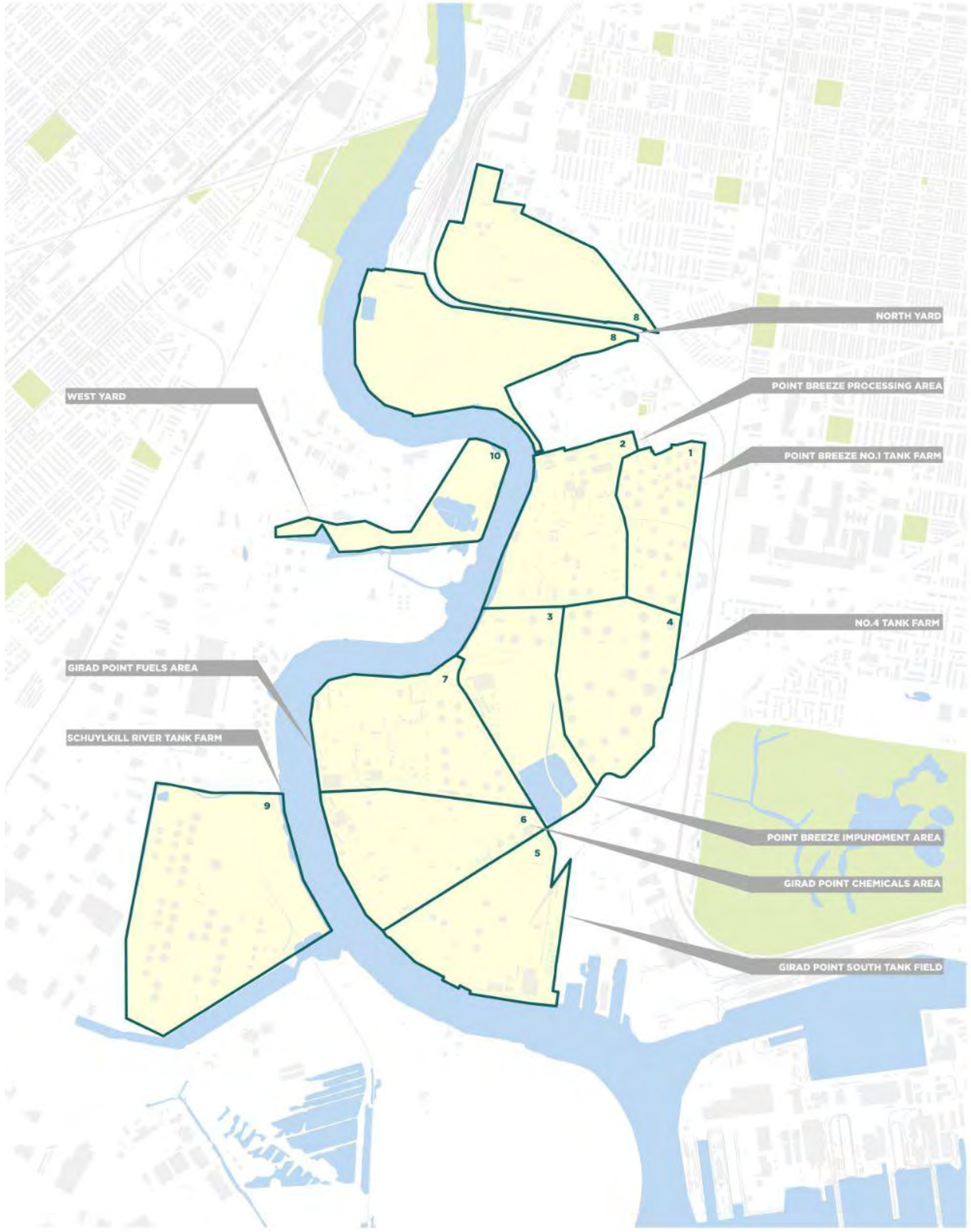
EVERGREEN AOIs

AOI 11

Potomac-Raritan Magothy Aquifer System



Source: Pinelands Preservation Alliance

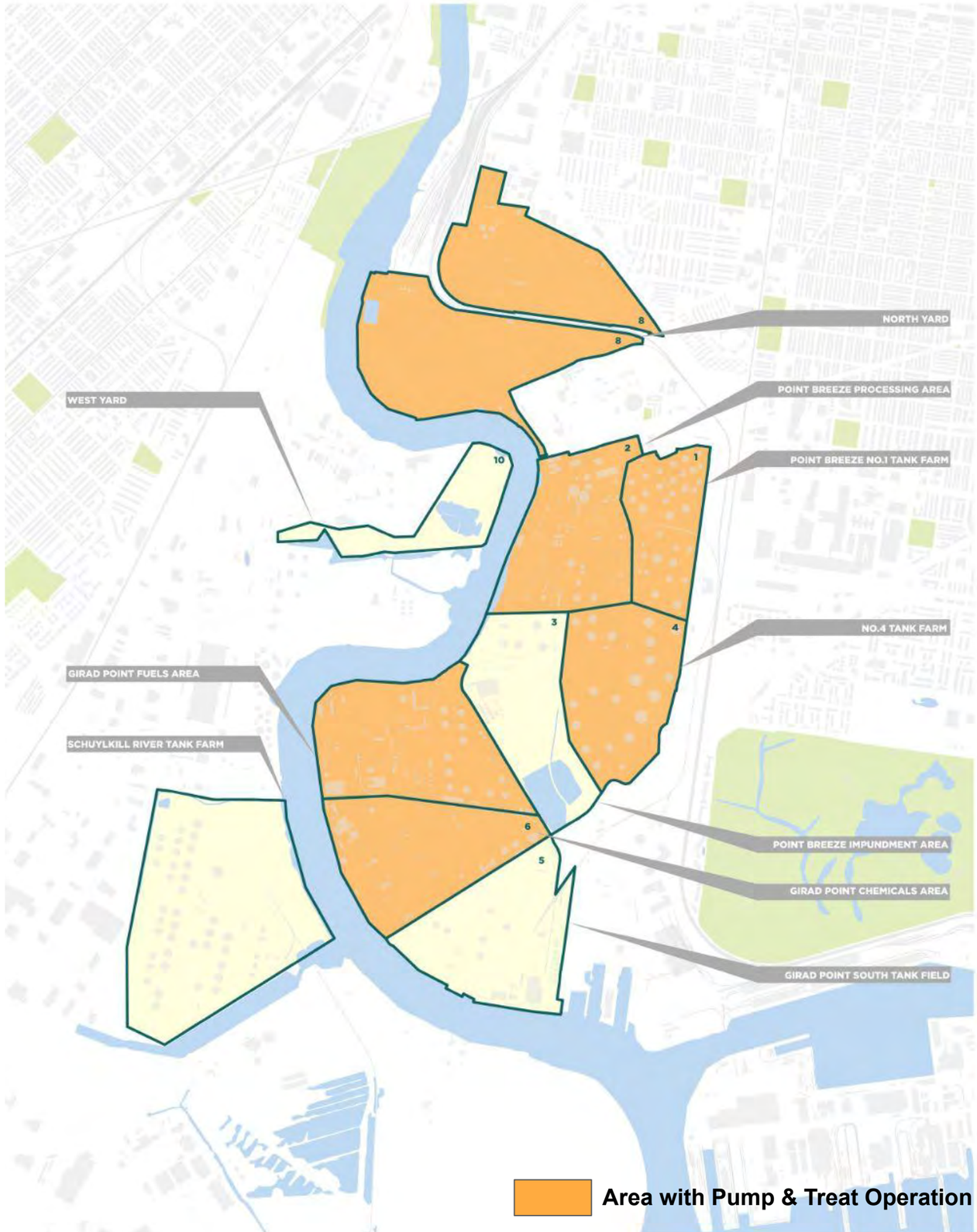


CURRENT CLEAN UP OPERATIONS

Groundwater treatment well underway

&

Soil remediation TBD



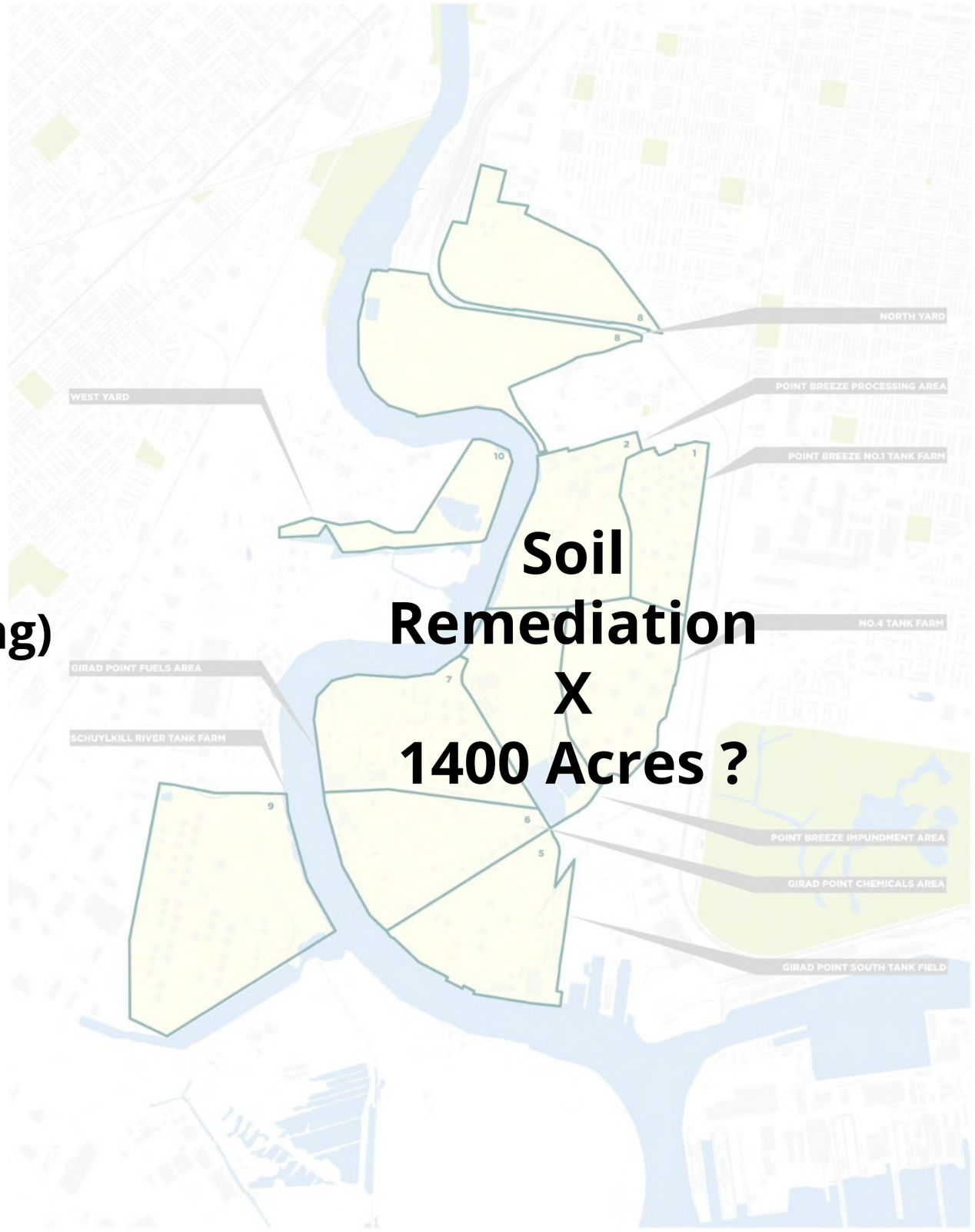
WHAT ABOUT CONTAMINATED SOIL?

MECHANICALLY-BASED METHODS

- **Remove and Replace Fill**
  Too expensive/infeasible
- **Cap and Cover (5ft Cover)**
  17M tons of fill
  1.2M truck loads
- **Air Treatments (SVE, Air Sparging)**
  Sub-grade Infrastructure Needed

BIO-BASED METHODS

- **Phytoremediation**
  Time; range
- **Bioremediation**
  Time; range
- **Soil Amendments**
  Time; range



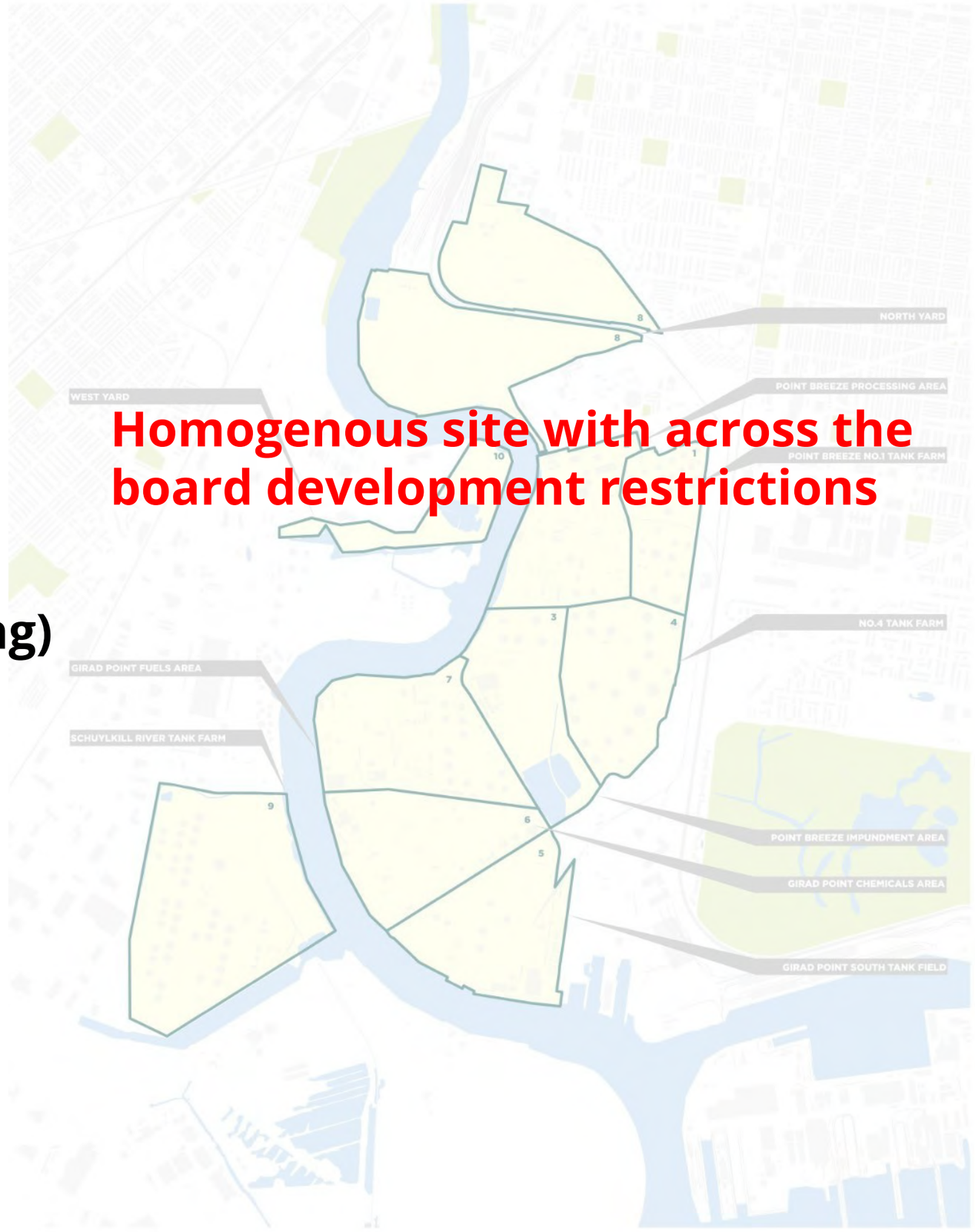
WHAT ABOUT CONTAMINATED SOIL?

MECHANICALLY-BASED METHODS

- **Remove and Replace Fill**
  Too expensive/infeasible
- **Cap and Cover (5ft Cover)**
  17M tons of fill
  1.2M truck loads
- **Air Treatments (SVE, Air Sparging)**
  Sub-grade Infrastructure Needed

BIO-BASED METHODS

- **Phytoremediation**
  Time; range
- **Bioremediation**
  Time; range
- **Soil Amendments**
  Time; range



Homogenous site with across the board development restrictions

REMEDIATION:

LEAD & BENZENE

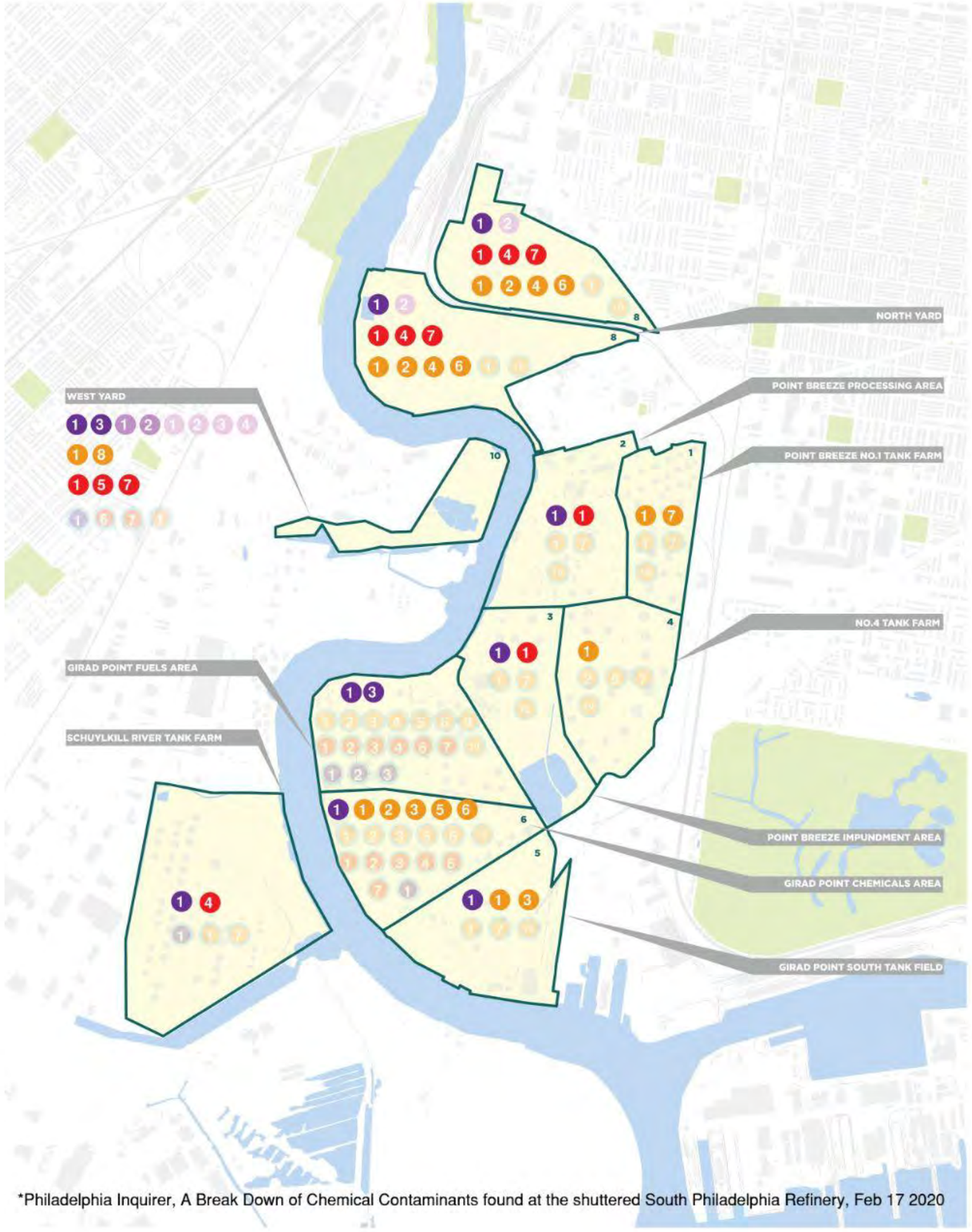
TWO MONSTERS IN SOILS

- **Low Bioavailability**
  1. Lead (Pb)
  2. Chromium (Cr)
  3. Mercury (Hg)
- **Medium Bioavailability**
  1. Cobalt (Co)
  2. Manganese (Mn)
- **High Bioavailability**
  1. Arsenic (As)
  2. Nickle (Ni)
  3. Barium (Ba)
  4. Thallium (Tl)

- **Hard to Degrade**
  - **PAHs**

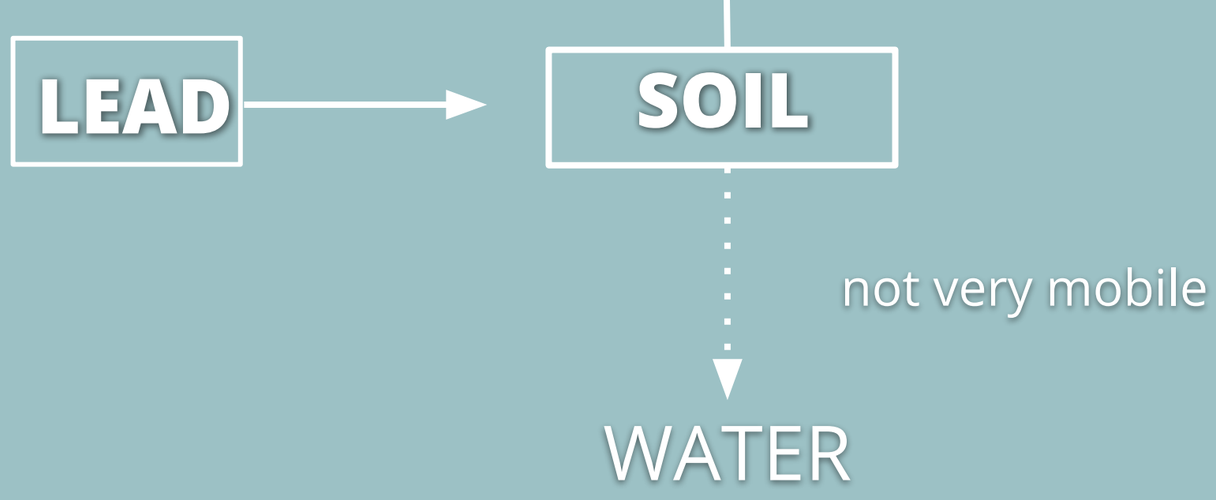
EPA HIGH PRIORITY
1. Benzo(a)pyrene
2. Benzo(a)anthracene
3. Benzo(g,h,i)perylene
4. Benzo(b)fluoranthene
5. Dibenzo(a,h)anthracene
6. Chrysene
7. Napthalene

- **Easily Degradable**
  - **BTEXs**
    1. Benzene
    2. 1,2,4-trimethyl benzene
    3. Cumene/isopropyl benzene
    4. Xylenes
    5. Toluene
  - **MAH**
    6. Ethylbenzene



*Philadelphia Inquirer, A Break Down of Chemical Contaminants found at the shuttered South Philadelphia Refinery, Feb 17 2020

“ Rather than total soil lead, bioavailability of soil lead is the important measure for protection of public health.”



BIND + COVER

-Phosphates
-pH adjustment
-Biochar

Lead binders are often good for plants (but plants are not good at absorbing lead)

BENZENE

AIR

SOIL

NAPL

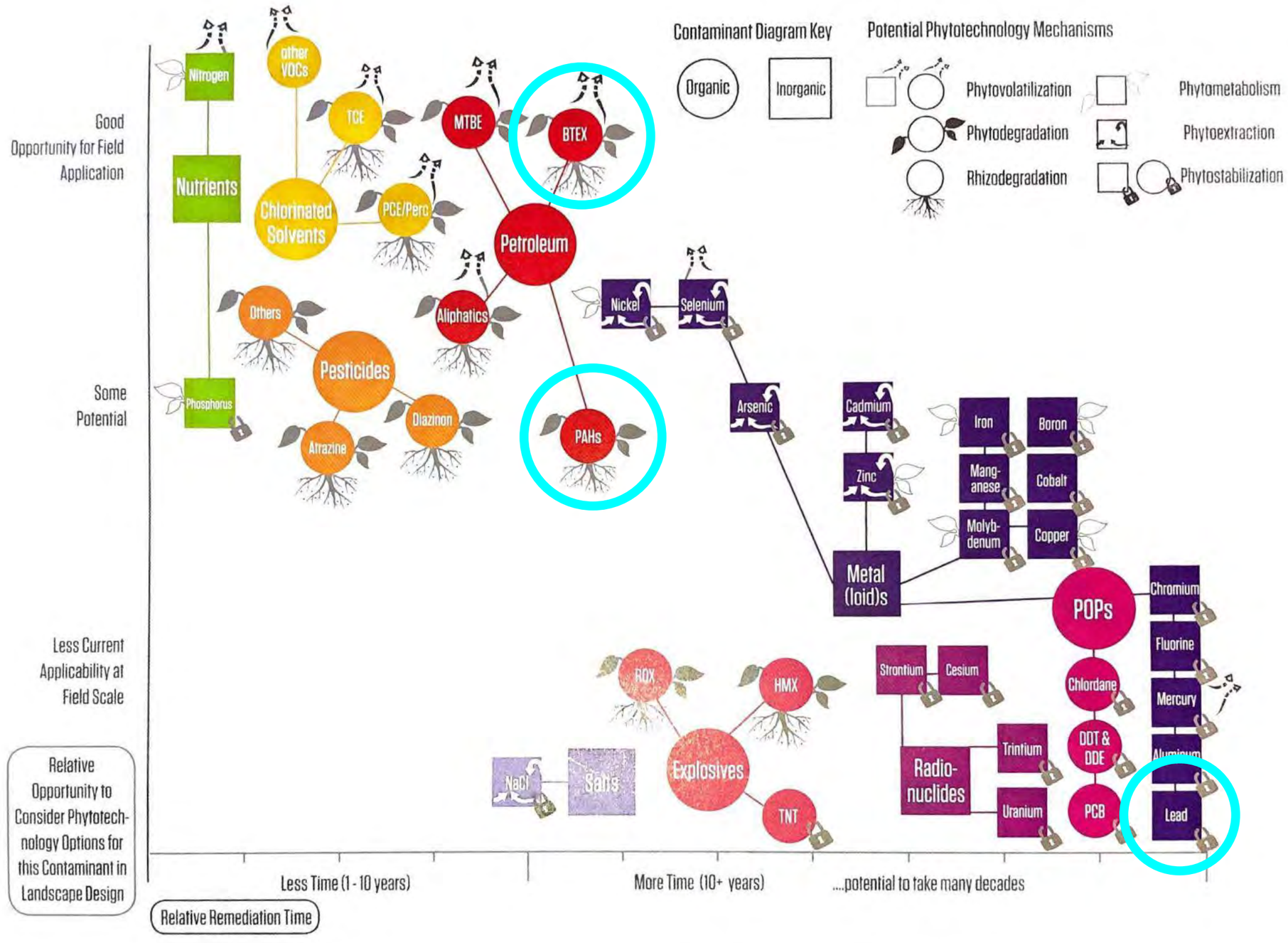
WATER

Phytoremediation
Bio-Degradation
Carbon Adsorption

Soil Vapor Extraction
Chemical Oxidation

Air Sparging

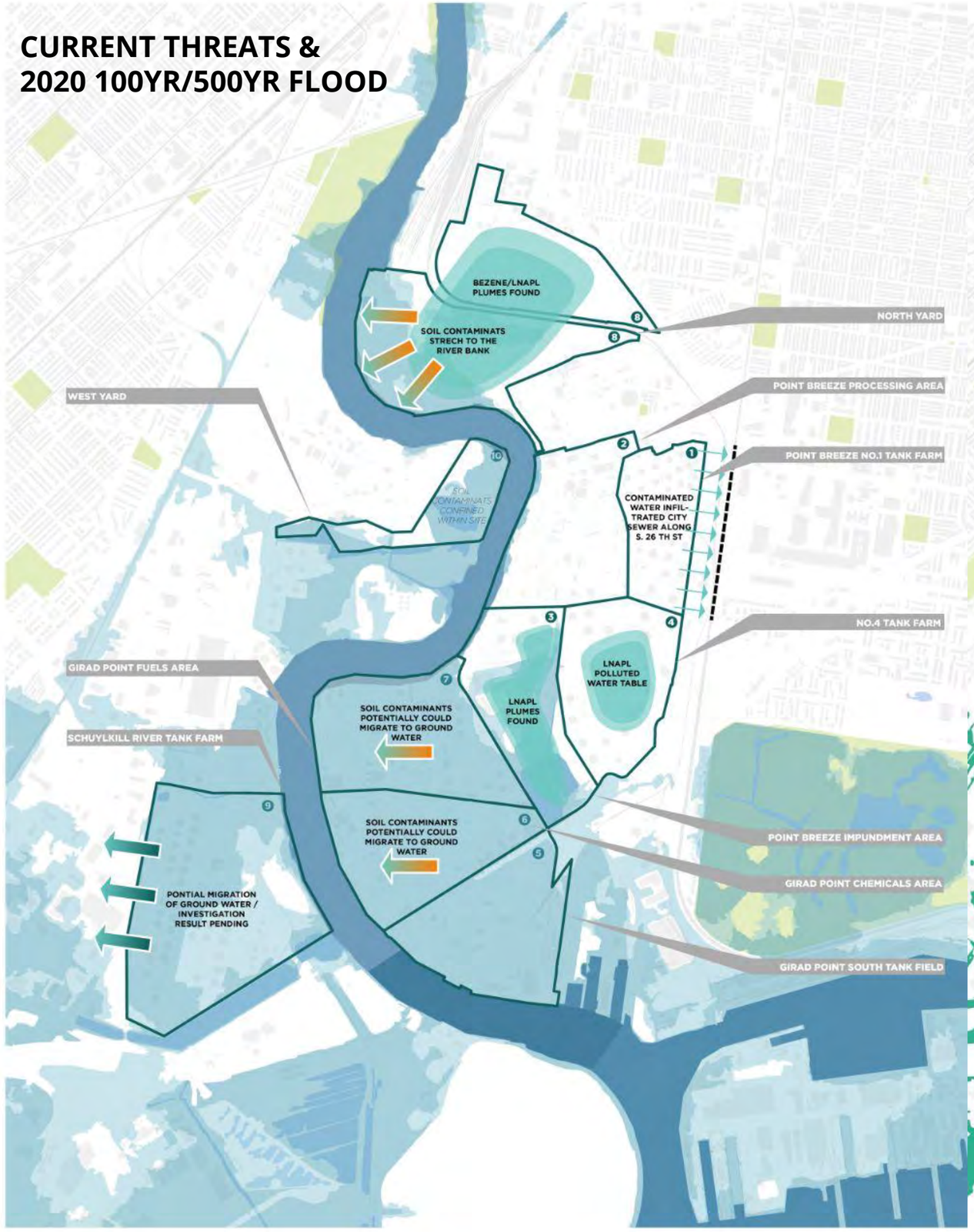
THE PHYTOREMEDIATION CHALLENGE



*from PHYTO: principles and rules for site remediation and landscape design P63

REMEDIATION:
SLR & FLOOD

CURRENT THREATS & 2020 100YR/500YR FLOOD

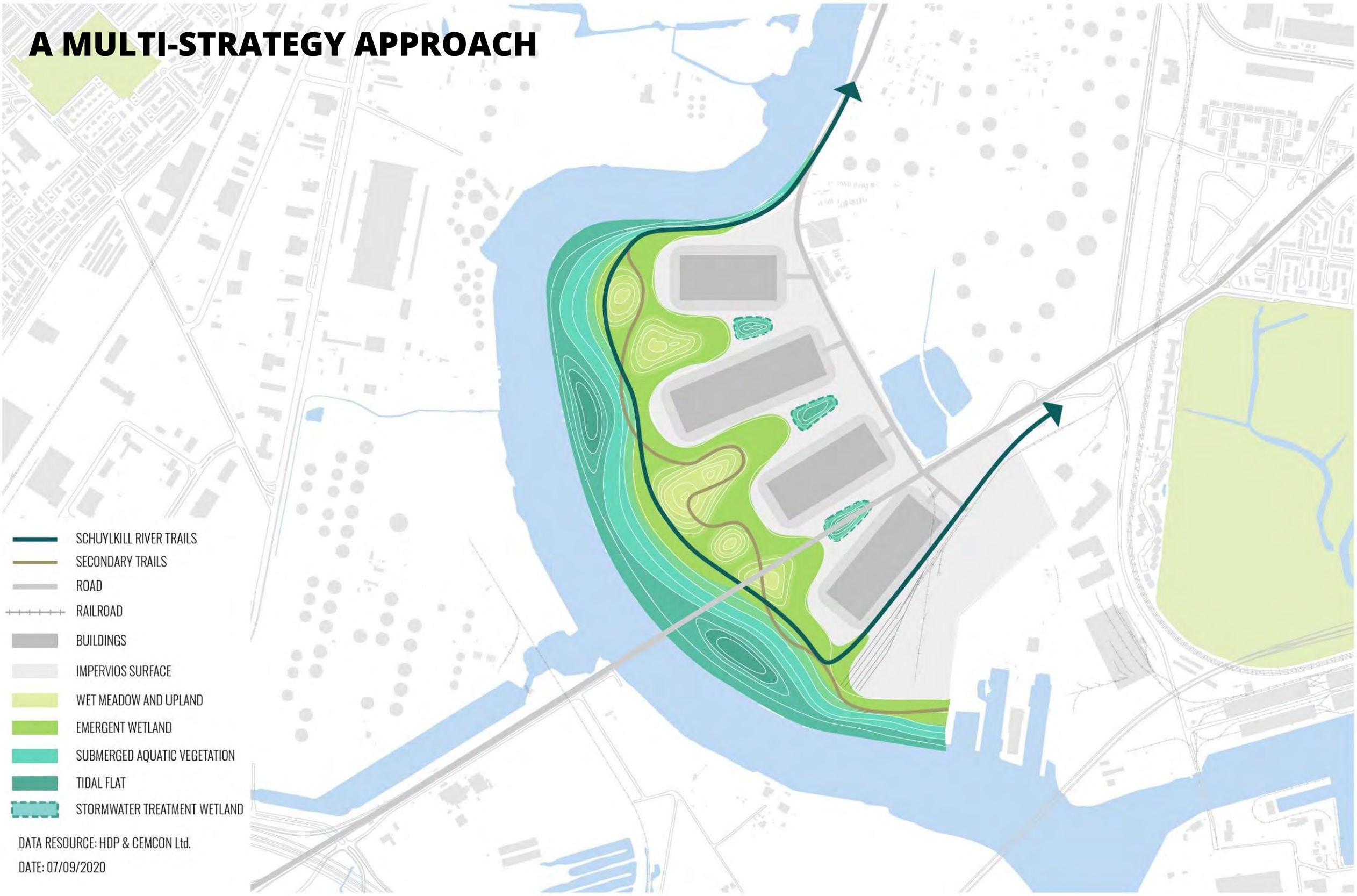


SEA LEVEL RISE PROJECTIONS

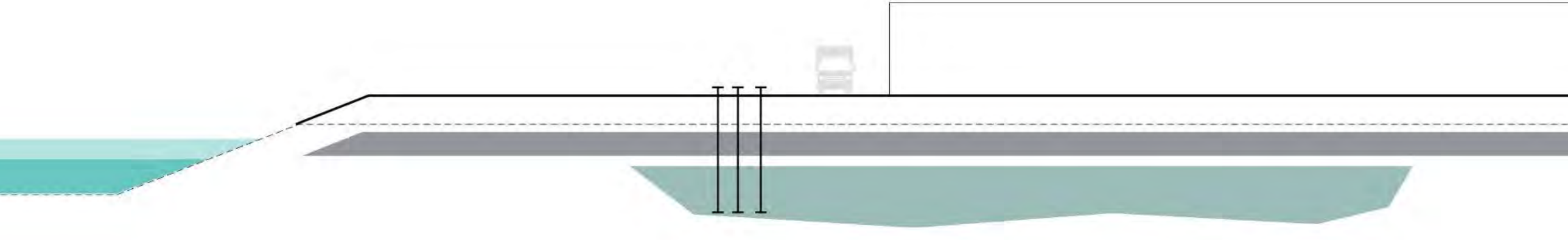
Assumption #1: Flooding contaminated soil/groundwater is bad.

Assumption #2: Protecting the entire site from flooding will flood others.

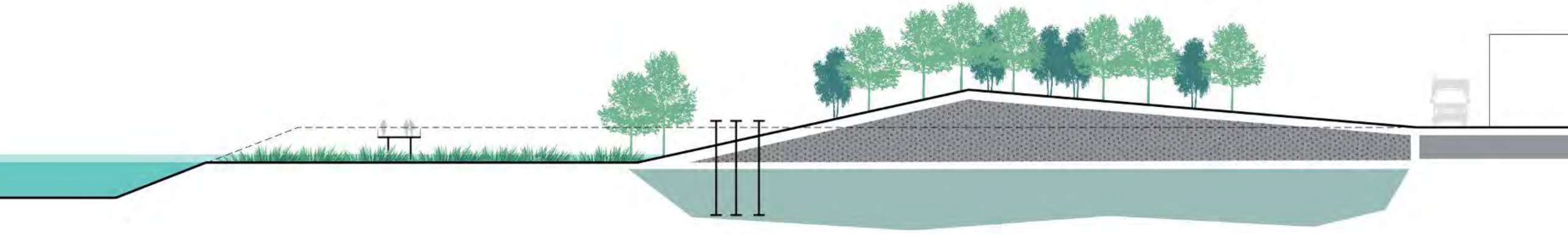
A MULTI-STRATEGY APPROACH



NOT THIS



MORE LIKE THIS



Room for the River
Room for People

GW
Ribbon

Mechanical GW
Treatment

Lead-lock Berm
+ Phyto Field

Cap + Cover
strategically

GND REMEDIATION

#1 REMEDIATION FIELD LAB

Site should be a field lab to test carbon sequestering remediation solutions that can be applied to other petroleum sites

#2 TRAINING GROUNDS

All remediation operations should be local training grounds for environmental tech and professional jobs

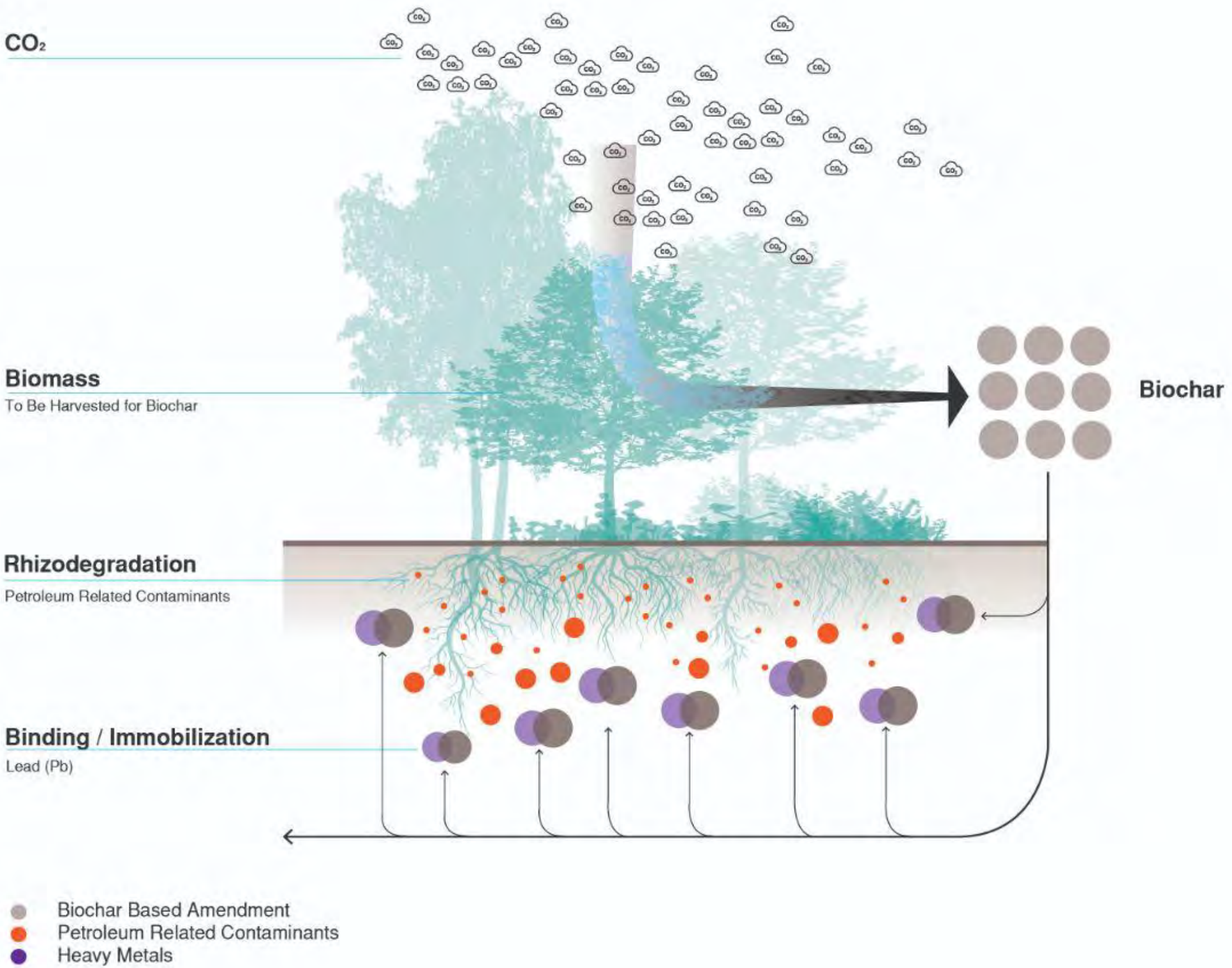
#3 JOBS

Local hiring and procurement requirements should be included for site remediation operations as site prep

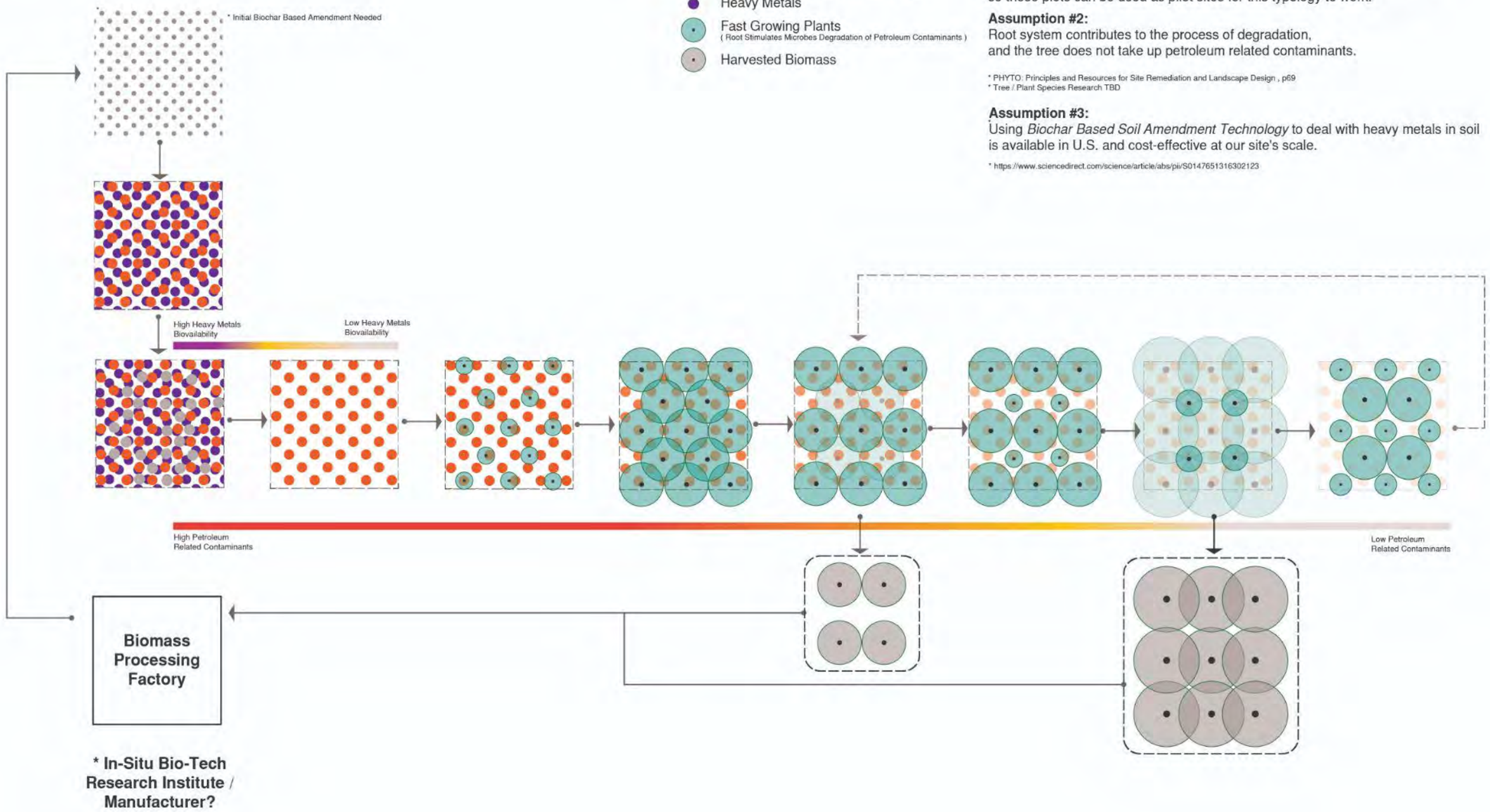
#4 PRODUCTIVE CYCLE

Remediation could be a model of an economically and environmentally productive cycle

A PRODUCTIVE REMEDIATION CYCLE



Biomass Farm Typology



Biochar Based Amendment
Petroleum Related Contaminants
Heavy Metals
Fast Growing Plants
(Root Stimulates Microbes Degradation of Petroleum Contaminants)
Harvested Biomass

Assumption #1:
There are areas with less heavy metals that can be carefully dealt with first, so these plots can be used as pilot sites for this typology to work.

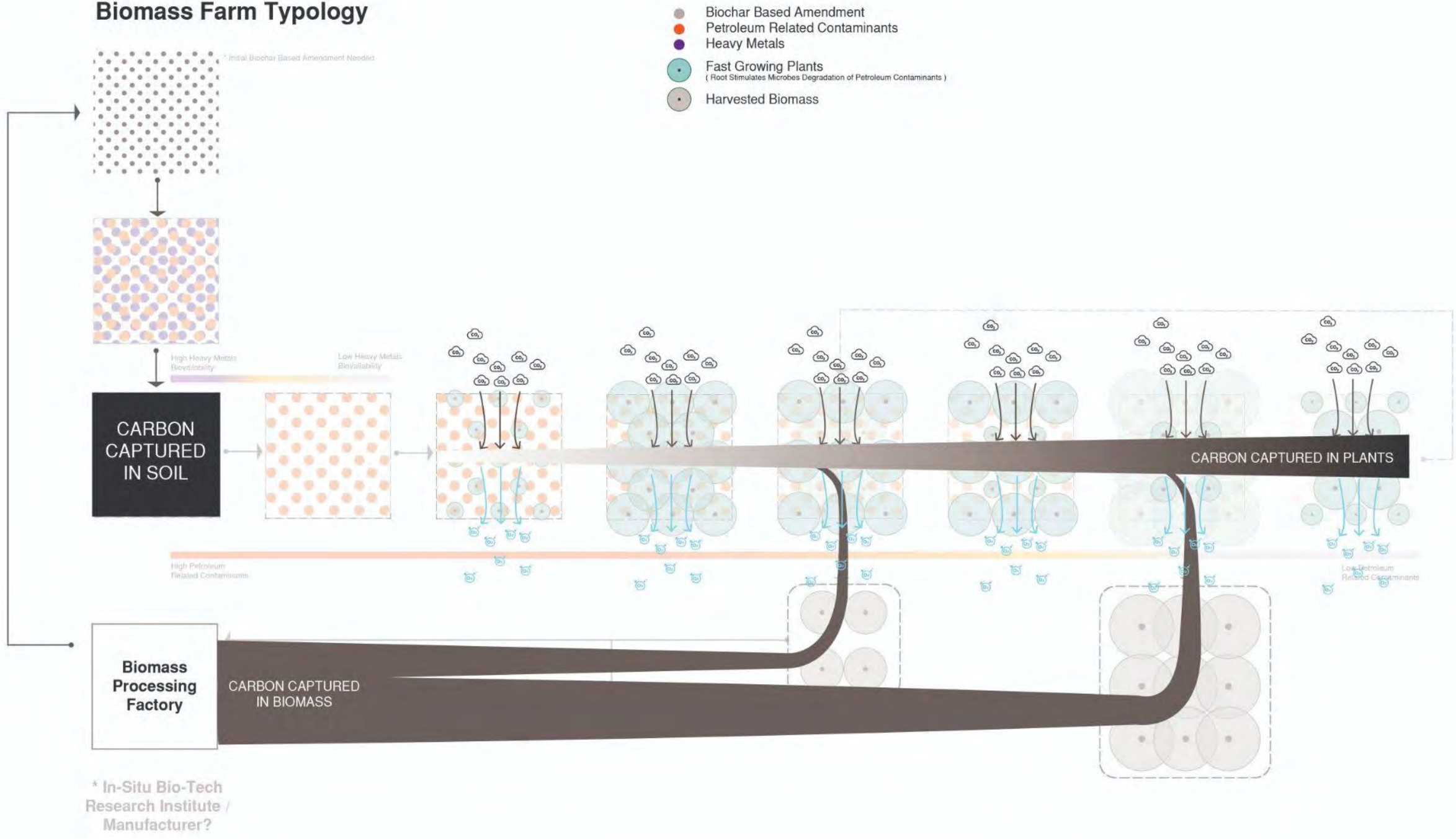
Assumption #2:
Root system contributes to the process of degradation, and the tree does not take up petroleum related contaminants.

* PHYTO: Principles and Resources for Site Remediation and Landscape Design , p69
* Tree / Plant Species Research TBD

Assumption #3:
Using *Biochar Based Soil Amendment Technology* to deal with heavy metals in soil is available in U.S. and cost-effective at our site's scale.

* https://www.sciencedirect.com/science/article/abs/pii/S0147651316302123

Biomass Farm Typology



Biomass Farm Typology

- Biochar Based Amendment
- Petroleum Related Contaminants
- Heavy Metals
- Fast Growing Plants
  (Root Stimulates Microbes Degradation of Petroleum Contaminants)
- Harvested Biomass

- Farm Jobs
- Bio-Tech Jobs
- Other Jobs
- Investment
- Profit Oppurtunities

Initial Biochar Based Amendment Needed

Farm Start Up
Purchase Contaminated Land / Biochar Based Amendment
Labor Employment

Remediated Land Redevelopment

Farm Maintenance
Purchase Plants / Fertilizers
Farm Equipments / Fuel / Battery
Labor Employment

High Heavy Metals Bioavailability

Low Heavy Metals Bioavailability

High Petroleum Related Contaminants

Low Petroleum Related Contaminants

Biomass Processing Factory

Bio-Tech Industry
Bio-Tech R&D Jobs
Bio-Tech Factory Workers
Supported Industry Jobs

Biomass Sale

Biomass Sale

Biochar Based Amendment Sale

Patent Authorization Fees

* In-Situ Bio-Tech Research Institute / Manufacturer?

CONTAMINANTS

Volatile Organic Compounds

- **Hard to Degrade**

- PAHs

EPA HIGH PRIORITY

1. Benzo(a)pyrene
2. Benzo(a)anthracene
3. Benzo(g,h,i)perylene
4. Benzo(b)fluoranthene
5. Dibenzo(a,h)anthracene
6. Chrysene
7. Napthalene

- **Easily Degradable**

- BTEXs

1. Benzene
2. 1,2,4-trimethyl benzene
3. Cumene/isopropyl benzene
4. Xylenes
5. Toluene

- MAH

6. Ethylbenzene

- MTBE

7. Methyl tert-butyl ether

- HVOC

8. PCE

- Organobromine

9. 1,2-dibromoethane

- LNAPL

10. Light Non-Aqueous Phase Liquid

Metals

- **Low Bioavailability**
  1. Lead (Pb)
  2. Chromium (Cr)
  3. Mercury (Hg)
- **Medium Bioavailability**
  1. Cobalt (Co)
  2. Manganese (Mn)
- **High Bioavailability**
  1. Arsenic (As)
  2. Nickle (Ni)
  3. Barium (Ba)
  4. Thallium (TI)

1 Contaminant in Soil

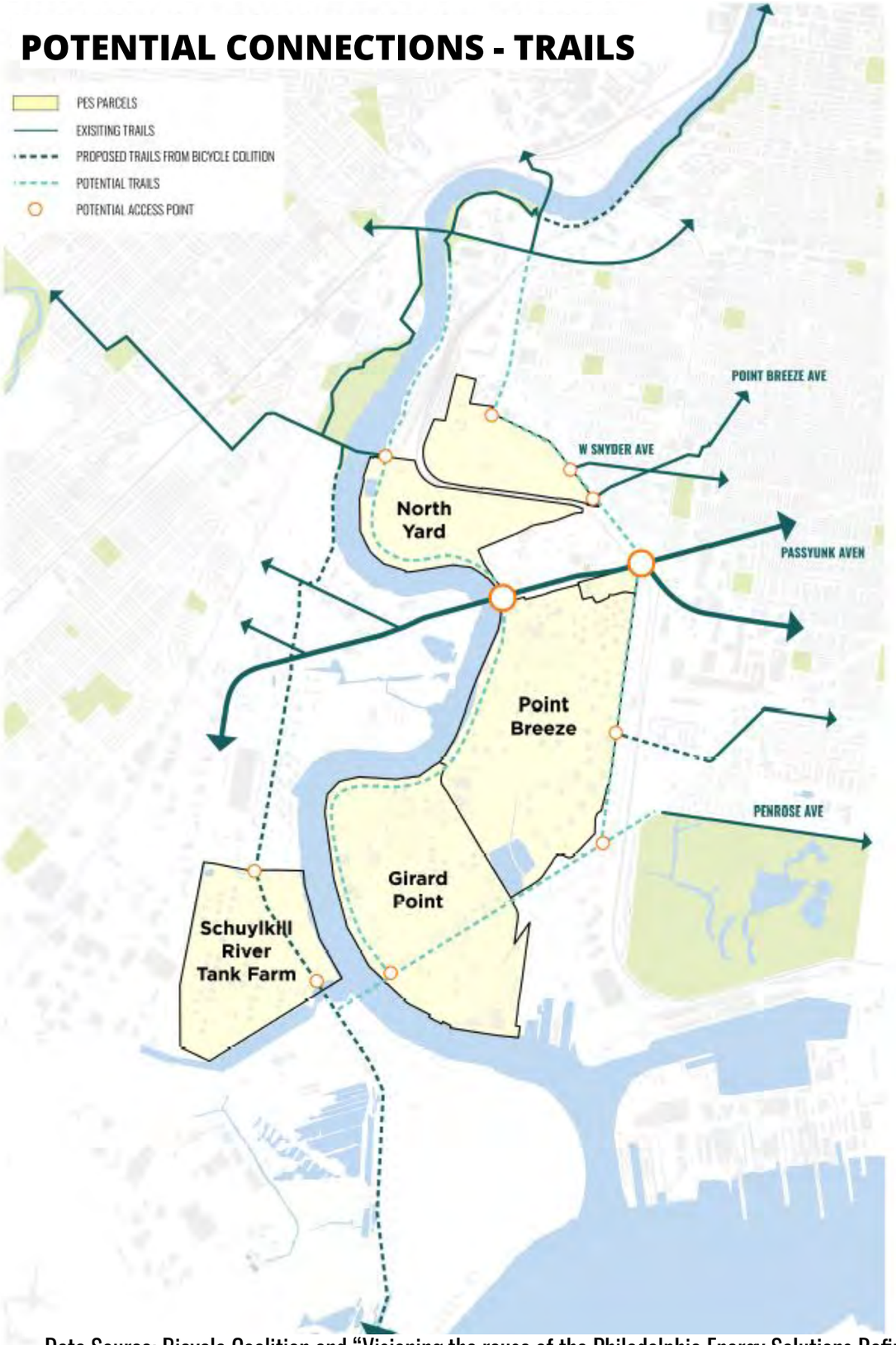
1 Contaminant in Groundwater

*Philadelphia Inquirer, A Break Down of Chemical Contaminants found at the shuttered South Philadelphia Refinery, Feb 17 2020

DISCUSSION


PARKS
+
ACCESS TO NATURE

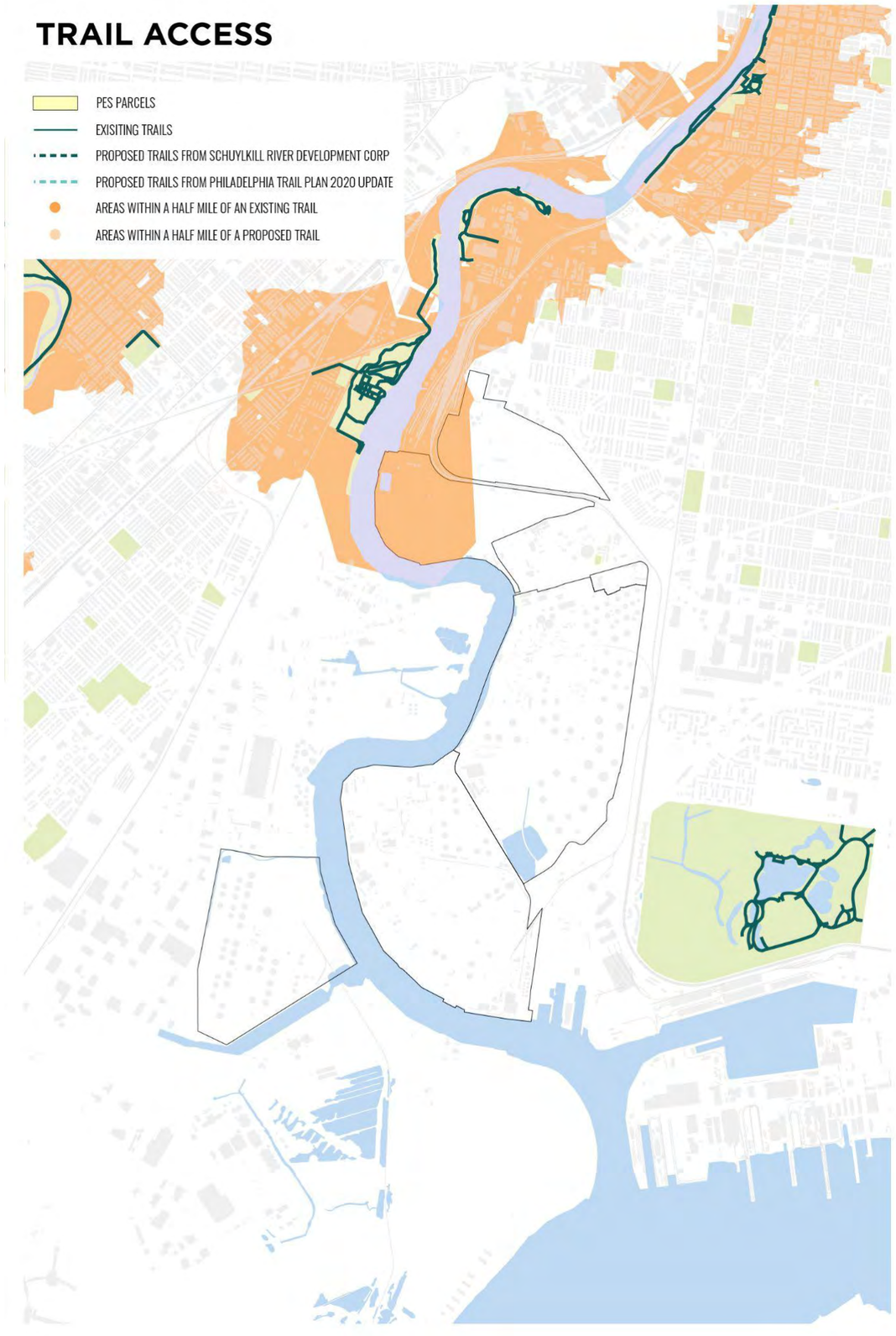
POTENTIAL CONNECTIONS - TRAILS



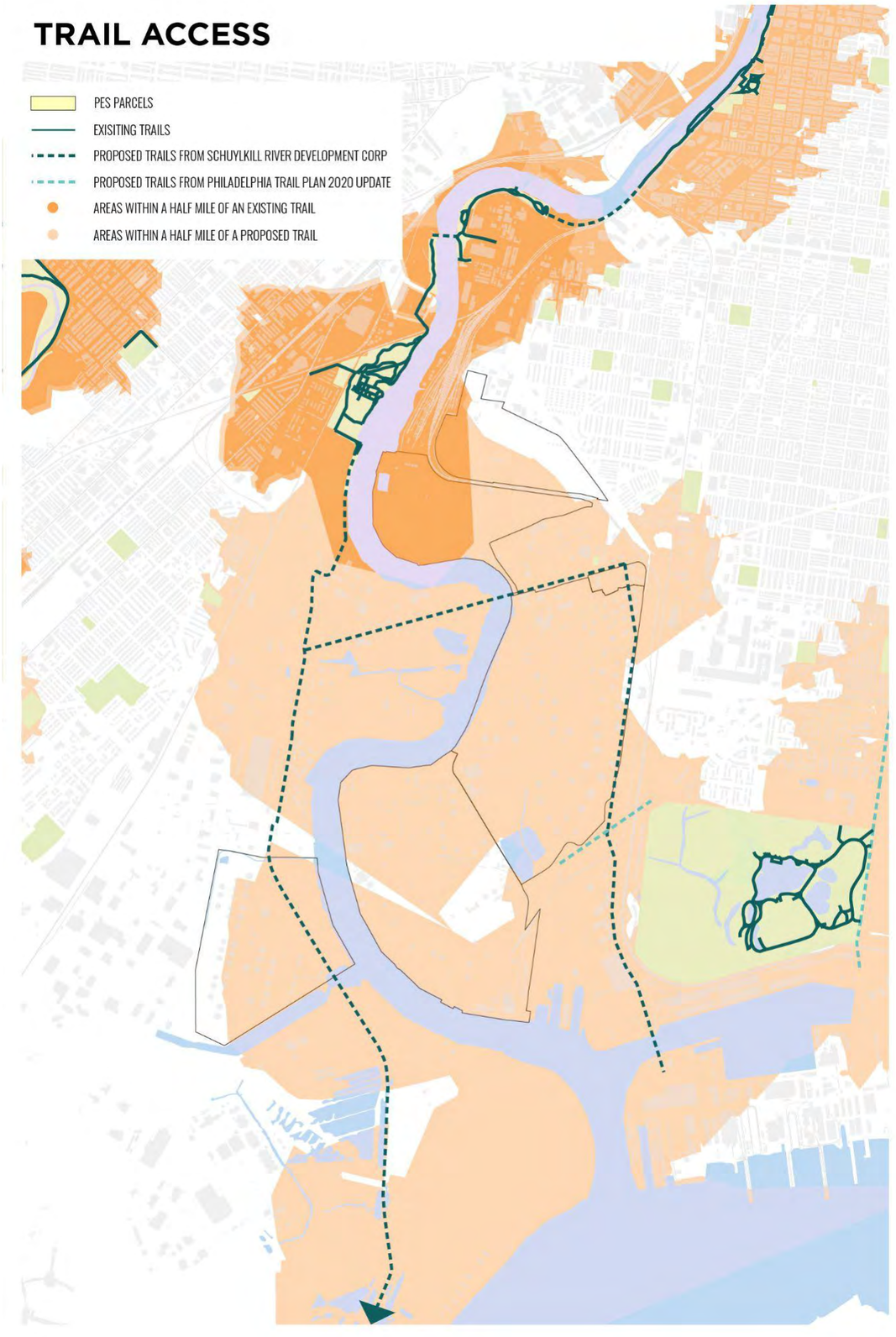
PUBLIC ACCESS FRAMEWORK

Data Source: Bicycle Coalition and “Visioning the reuse of the Philadelphia Energy Solutions Refinery Complex” from Clean Air Council & Lindy Institute for Urban Innovation

TRAIL ACCESS



TRAIL ACCESS



ACCESS TO TENNIS COURTS

ACCESS TO BASKETBALL COURTS

ACCESS TO ATHLETIC FIELDS

ACCESS TO PLAYGROUNDS

ACCESS TO DOG PARKS

ACCESS TO POOLS & SPRAYGROUNDS

ACCESS TO UNPROGRAMMED OPEN SPACE

DISCUSSION

MEMORY

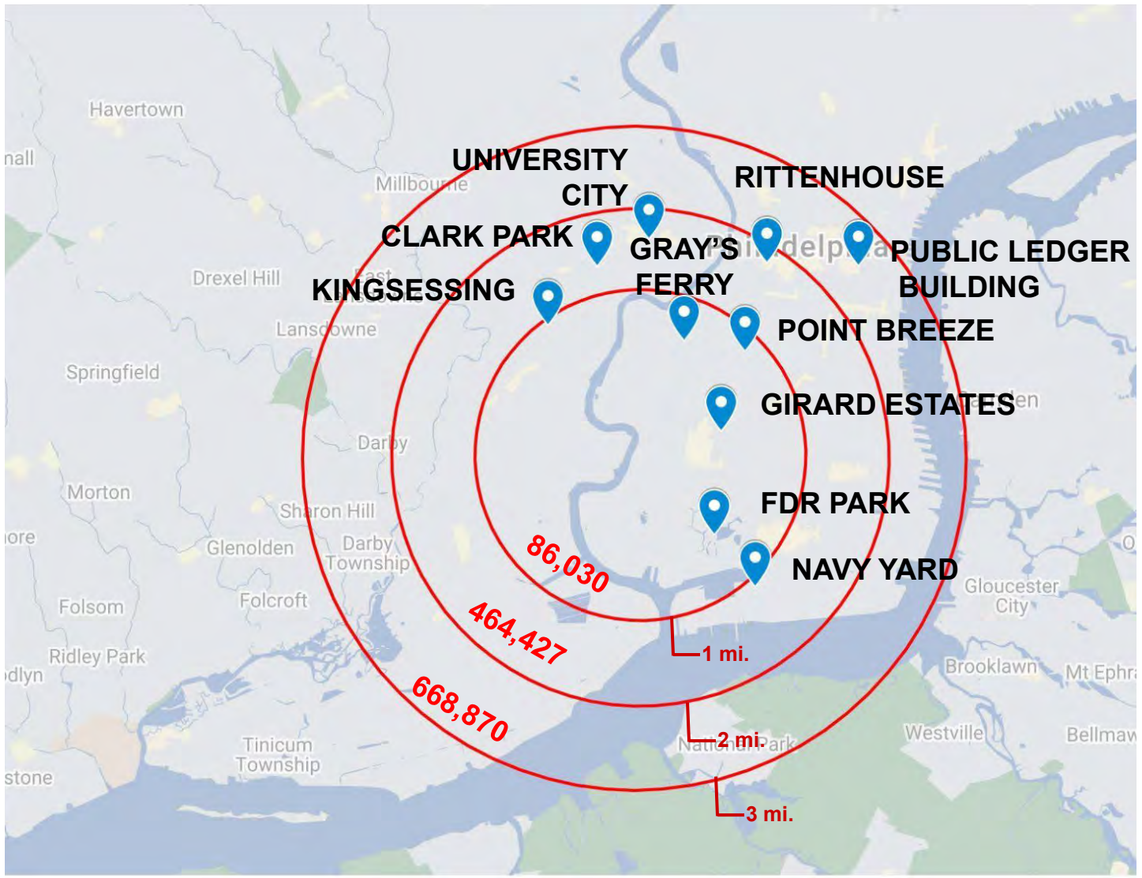
MEMORY: NARRATIVES

1. **Support a Community-Led Process**
2. **Make space for Justice and Recognition**
3. **Consider Physical presence within the city - industrial gateway, legacy, remediation**
4. **Acknowledgment of adjacent and regional health impacts**

COMMUNITY-LED PROCESS

"We ain't cutting no corners, we died, right? ... Make some space and put it on that land. We need for people to come and visit the refinery site, and find out how many people died there and find out what really happened with the air and the water, and it *got* to be on that site... to me it's a waste of time not to be there. I believe the community will back me, too...

We ain't fighting all these years for nothing, just for them to take their money and go away." - Charles Reeves, Tasker-Morris Neighborhood Assoc.



“I’ ve lived here all my life. I’ve buried so many people.”

-Charles Reeves,
Tasker Morris Neighborhood Association

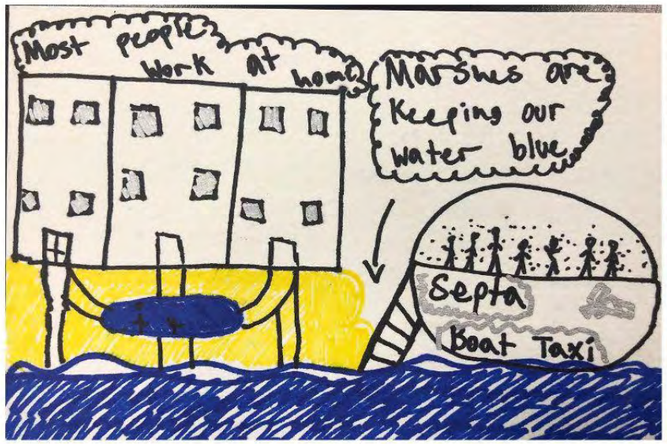
“Moving to an area with fresh air is a good way to reduce the possibility of death from exposure to benzene in the air..”

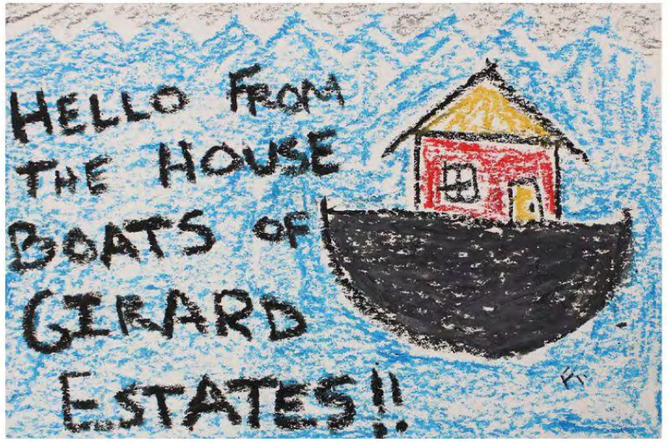
-CDC

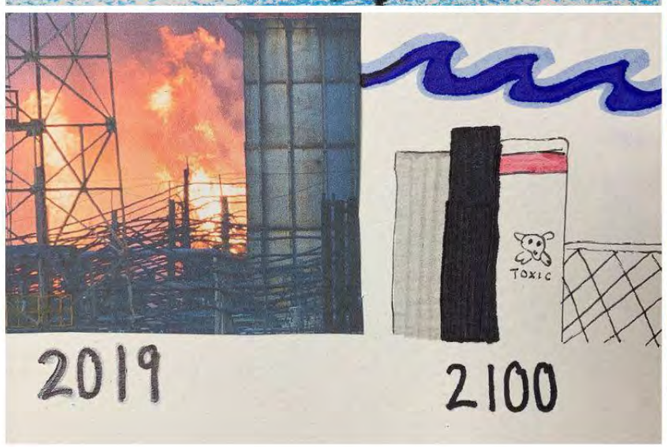
CURRENT COMMUNITY DOCUMENTATION

Several local initiatives have begun to collect and document community input about the refinery site, memory and imagined futures.

- Philly Thrive has organized protest events described as “impromptu memorials”
- The 2019 Peoplehood Parade in West Philly featured Philly Thrive and the right to clean air
- The Penn Program in Environmental Humanities has collected a postcard gallery from their campaign “Futures Beyond Refining” , and has collected interviews about the refinery from neighbors in Eastwick
- Interface Studio documented Eastwick’s Community Members’ goals in their planning report “Lower Eastwick Public Land Strategy”







JUSTICE + RECOGNITION

JUSTICE MEMORIAL - The Legacy Museum

The Legacy Musem - spearheaded by the Equal Justice Initiative - provides a national memorial that acknowledges the horrors of racial injustice, and recognizes victims of lynching on a national level.

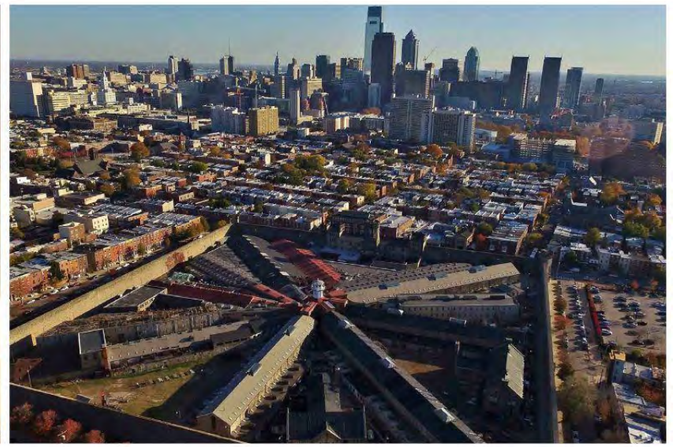
Through its Community Remembrance projects, counties can claim monuments displayed onsite, which list names of those lynched by county.

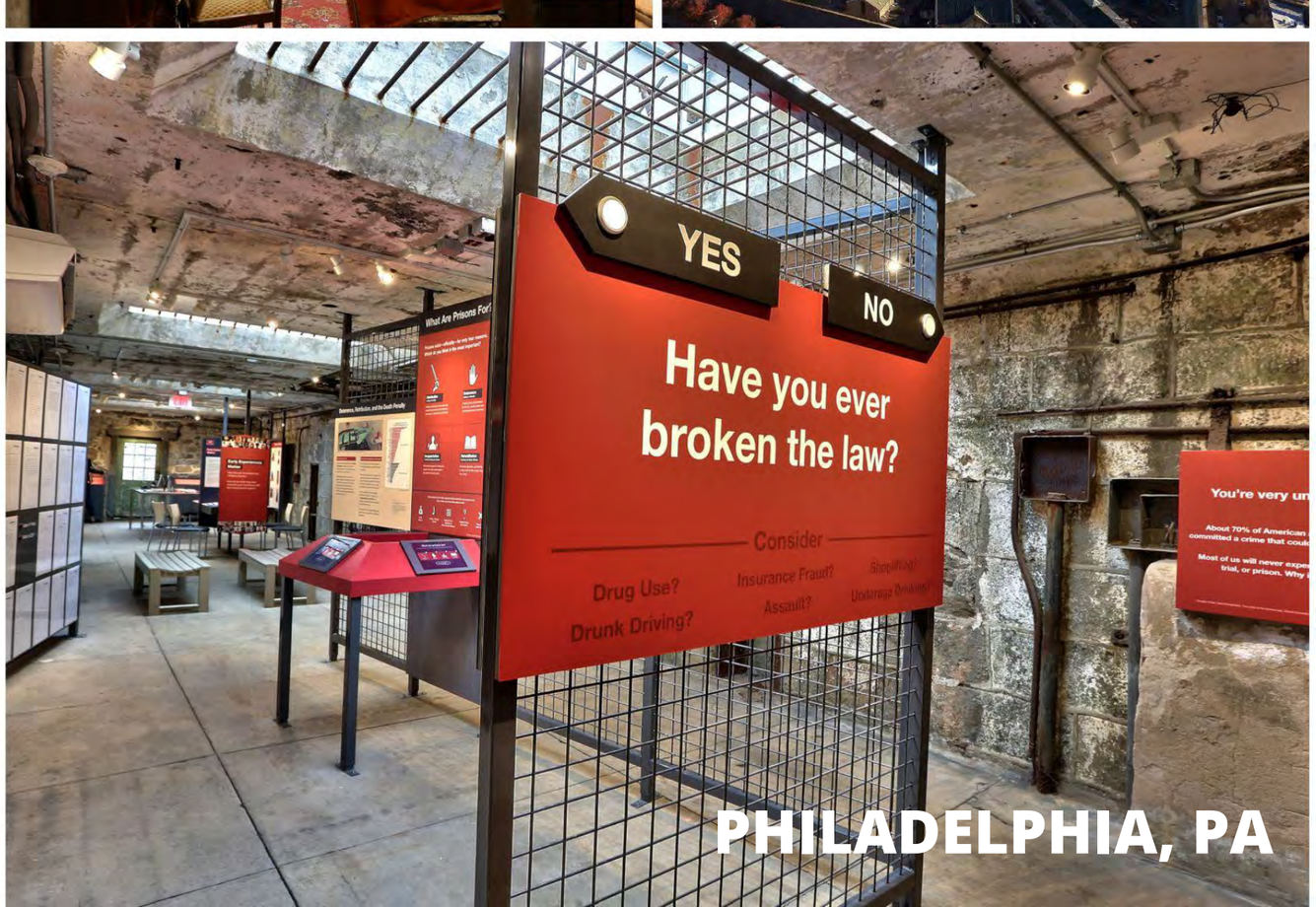
Also, communities throughout the nation can participate in soil collection ceremonies that accession soil from lynching sites to be included within The Legacy Musem's collection.

JUSTICE MEMORIAL - Eastern State Penitentiary

Eastern State Penitentiary was the world's first true "penitentiary," a prison designed to inspire penitence, and was the most expensive prison of its time.

Through experimental approaches to preservation, interpretation, and programing, EPS has updated its mission to focus on interpreting the legacy of American criminal justice reform.





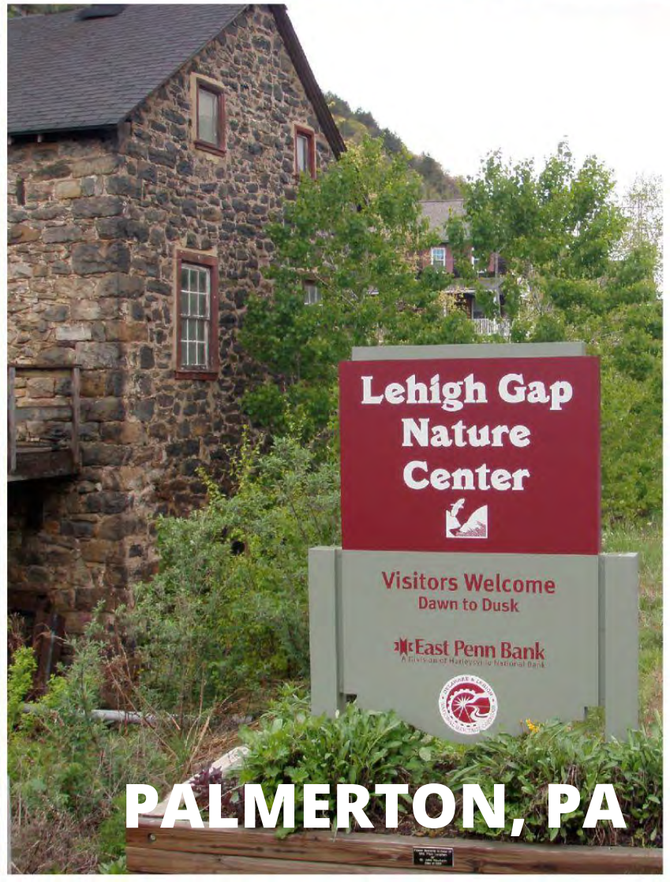
PHILADELPHIA, PA

INDUSTRIAL LEGACY

INDUSTRIAL LEGACY - Lehigh Gap in Palmerton, PA

The landscape of Lehigh Gap, surrounding Palmerton, PA, is designated a Superfund site. Zinc pollution from a smelting plant killed vegetative communities, creating compounding pollution issues and erosion.

Superfund financial resources support the Lehigh Gap Nature Center, and have funded research and deployment of a successional replanting program.



INDUSTRIAL LEGACY - Freshkills Park

Freshkills Park Plan and Freshkills Park Alliance envision a new park for New York City that is almost three times the size of Central Park.

Planned for development over the next 100 years, is caps Freshkills Landfill, which was the largest landfill in the world before closing in 2001.

Since then, the landscape has been engineered with layers of soil and infrastructure, and the area has become a place for wildlife, recreation, science, education, and art. The park interior is currently only accessible during special programs. Design by Field Operations.

REGIONAL HEALTH IMPACTS

REGIONAL HEALTH IMPACTS - Fukushima region

Fukushima memorial wind phone is a heavily-used monument that allows visitors to take time communing with the memory of a loved one.

The Fukushima Daiichi nuclear power plant is restricted, and a 40-year decommissioning process has begun.

Fukushima prefectural government has set a target of producing all of Fukushima's energy demands from renewable sources by 2040.

REGIONAL HEALTH IMPACTS - Chernobyl region

The Polesie State Radioecological Reserve and Chernobyl Exclusion Zone are regions monitored by Belarus and Poland, respectively.

In the Belarusian fallout area, the agency Bellesrad posts warning signs and gives safety recommendations.

Tours are led on both sides of the Pripyat river, and the scientific community marvels at the resurgence of wildlife communities.

Restricted areas of the Chernobyl region feature monuments to the meltdown tragedy, and many monuments have been erected around the world to honor the event.

DISCUSSION

NATIONAL CONTEXT

RESEARCH GOALS:

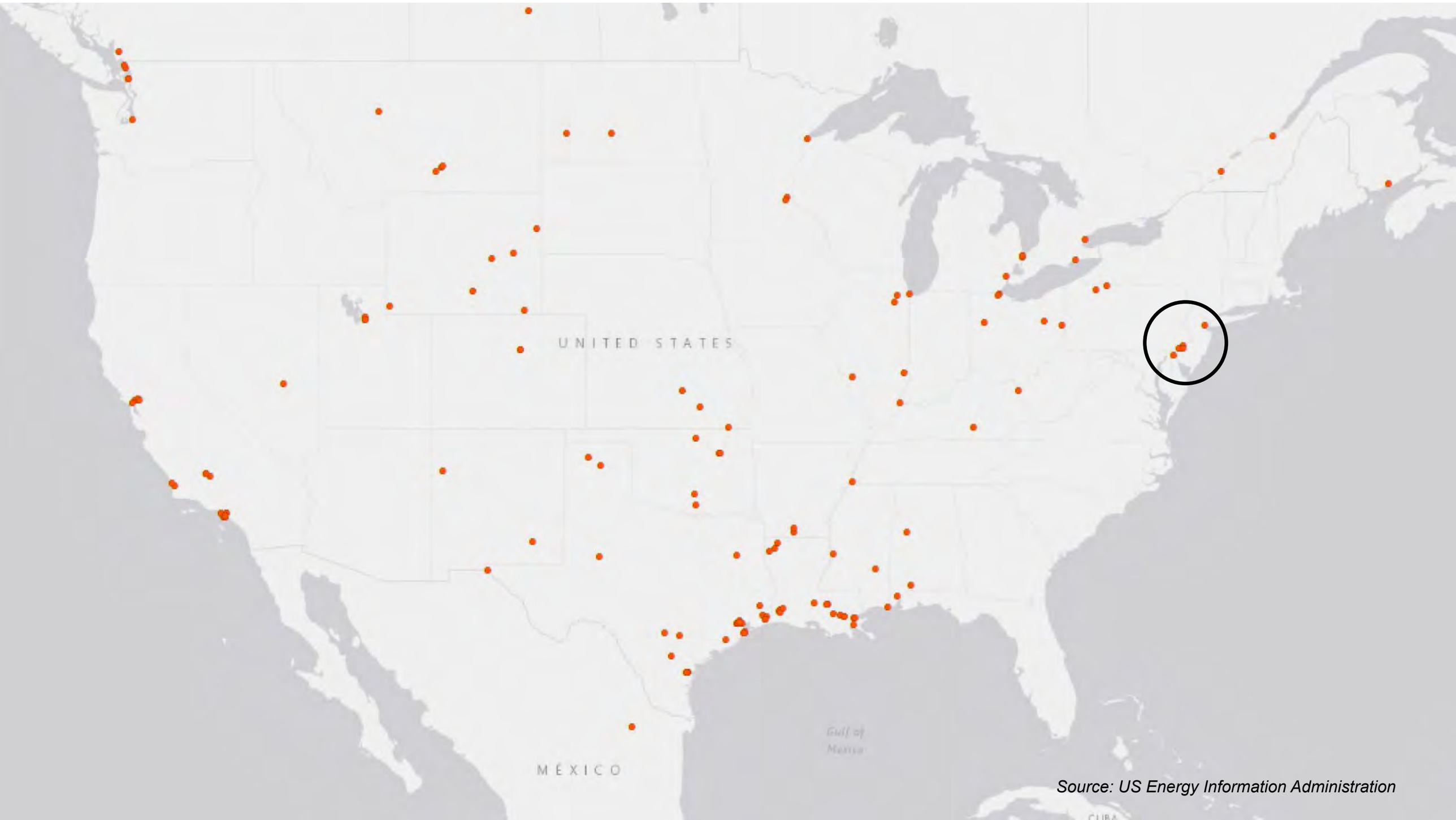
- **Understand the former PES Refinery site in the context of other operating and closed US Refineries.** How did its context and relationship to other refineries impact its closure and potential redevelopment.

- **Identify other operating and/or closed refineries with similar conditions to PES.** To what degree can the PES site may be a precedent for the anticipated closure of other urban US refineries?

- **Speculate on the impact of the closing of a refinery like PES on other petroleum assets and transportation infrastructure in the region.** Does the closing of PES bulster other assets or weaken them?

OIL REFINERIES

After PES closure, ~130 operating US refineries occupying approximately 108,000 acres (168 sq mi... Philly is 141 sq mi)
The US remains the largest refiner (increasing capacity), despite a 50% decline in the # of operating refineries since 1982.



Source: US Energy Information Administration

OIL FIELDS

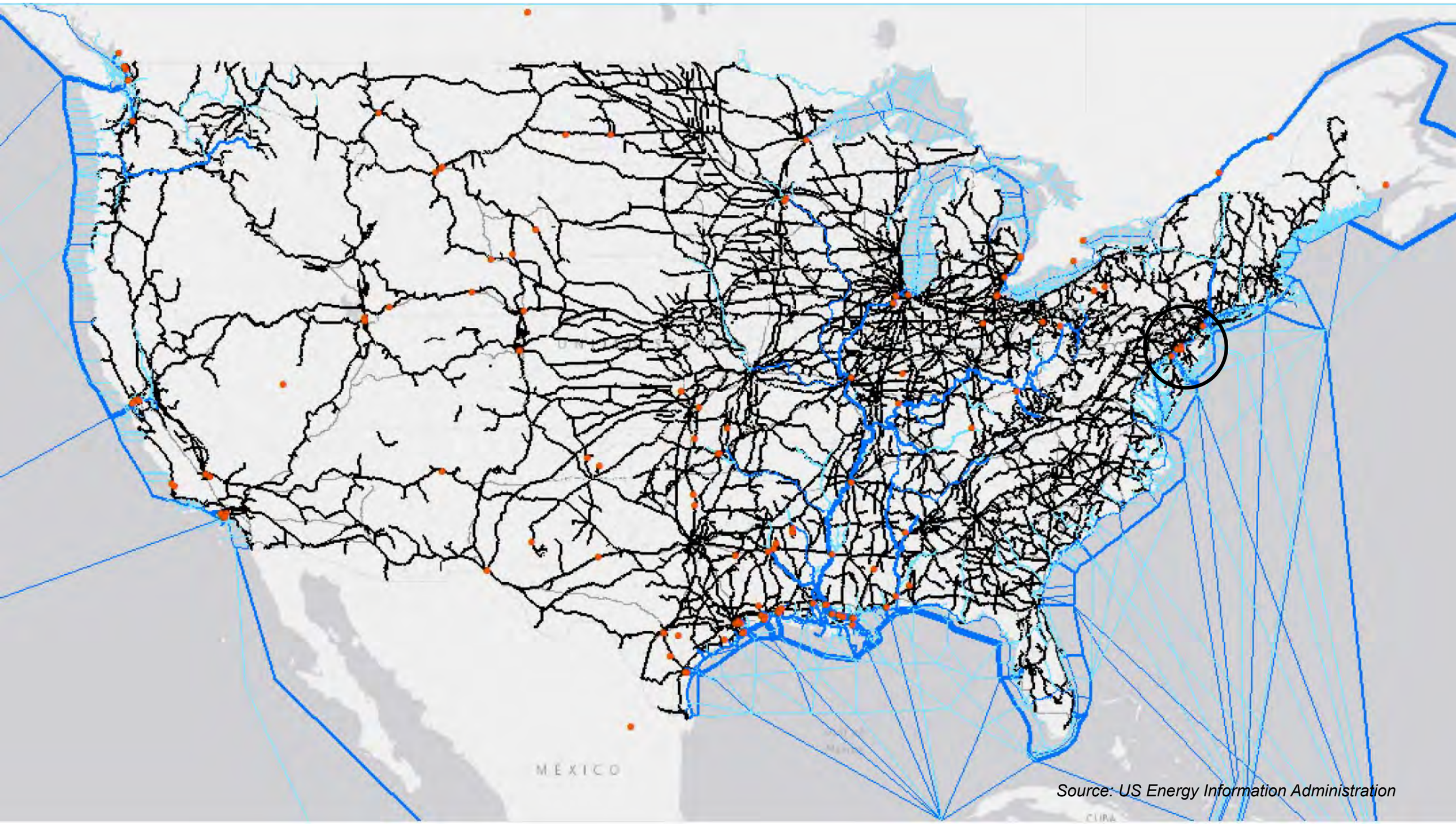
Some refineries are located at sources (oil fields/wells), others at markets (infrastructural and urban centers).

PES refinery began by processing crude from Western PA, but over time became reliant on transported fuels and foriegn imports.

Source: US Energy Information Administration

TRANSPORTATION INFRASTRUCTURE

Crude and petroleum products are moved using shared public infrastructure: rail (81%), highways (61%), and waterway (55%).

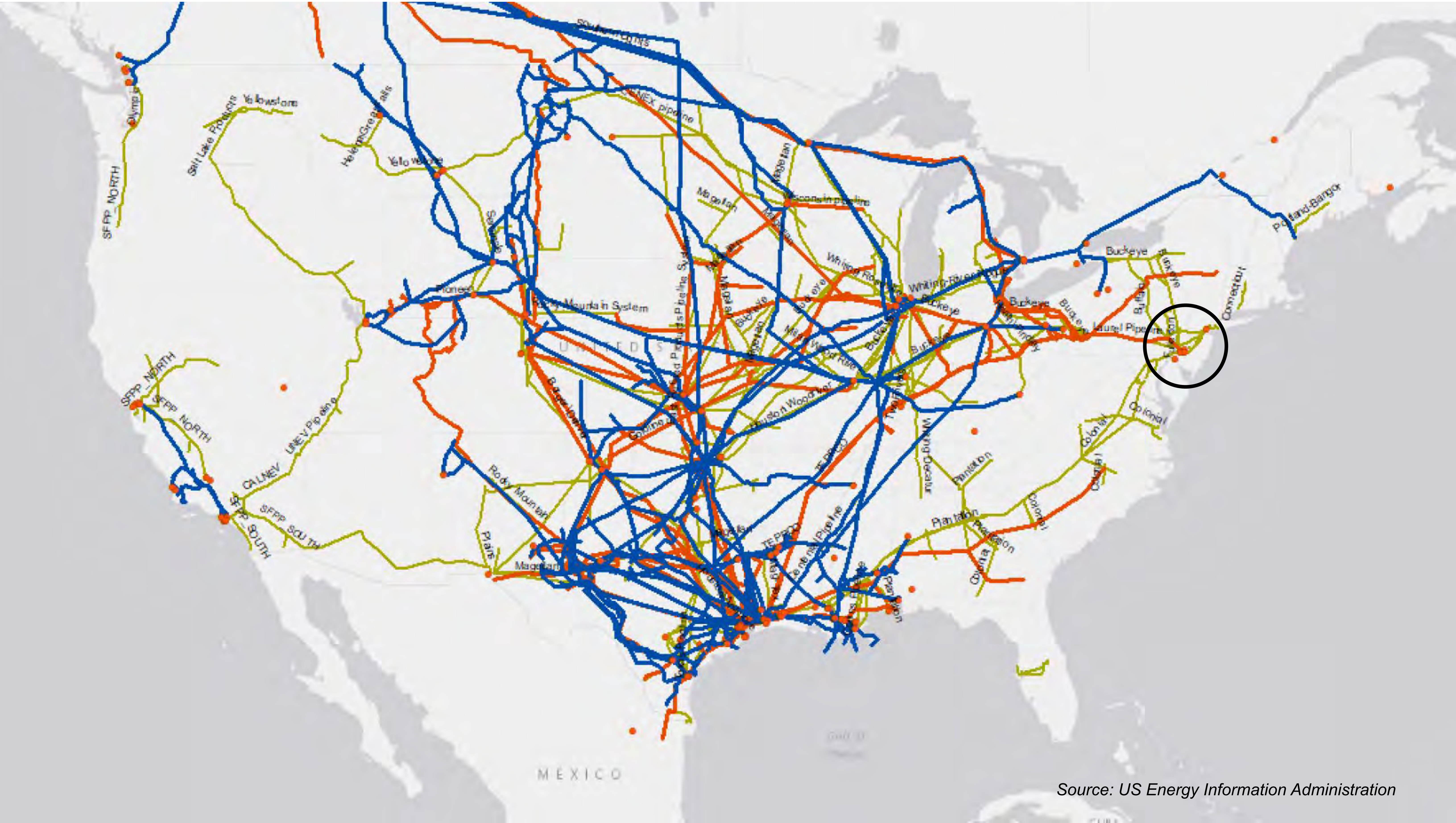


Source: US Energy Information Administration

PIPELINES

Over 1.63 million miles of pipelines connecting refineries to sources and markets.

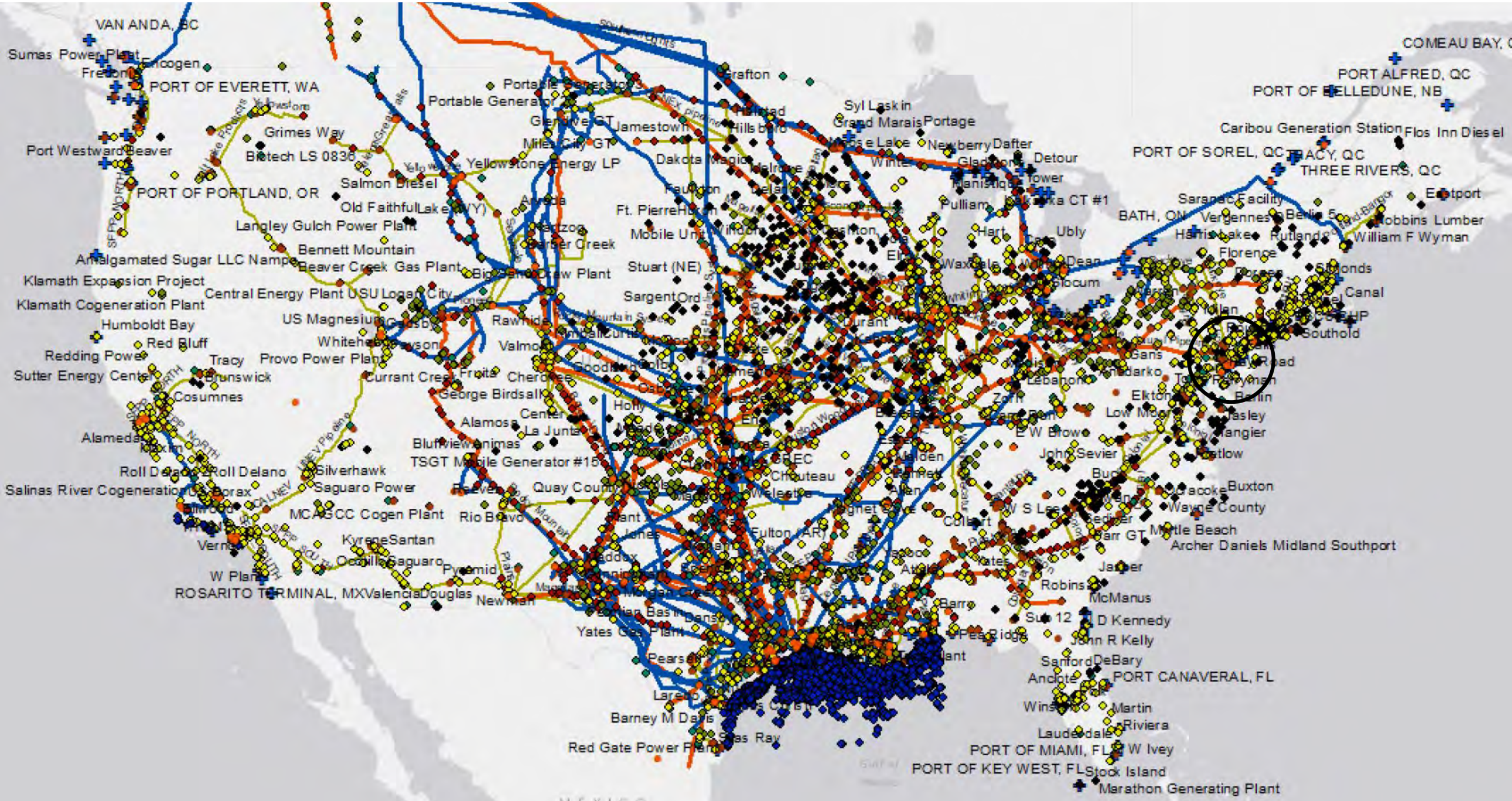
US Refineries: Hydrocarbon pipelines 34%, Petroleum pipelines 64%, Crude oil pipelines 61%



Source: US Energy Information Administration

OTHER FACILITIES

Pumping stations, storage facilities, power plants, and ports are interconnected locally and regionally with refineries.



Source: US Energy Information Administration

PES REGIONAL CONTEXT

EAST COAST

- **PES was the largest east coast refinery and the region's refineries are the only along the entire East Coast.**

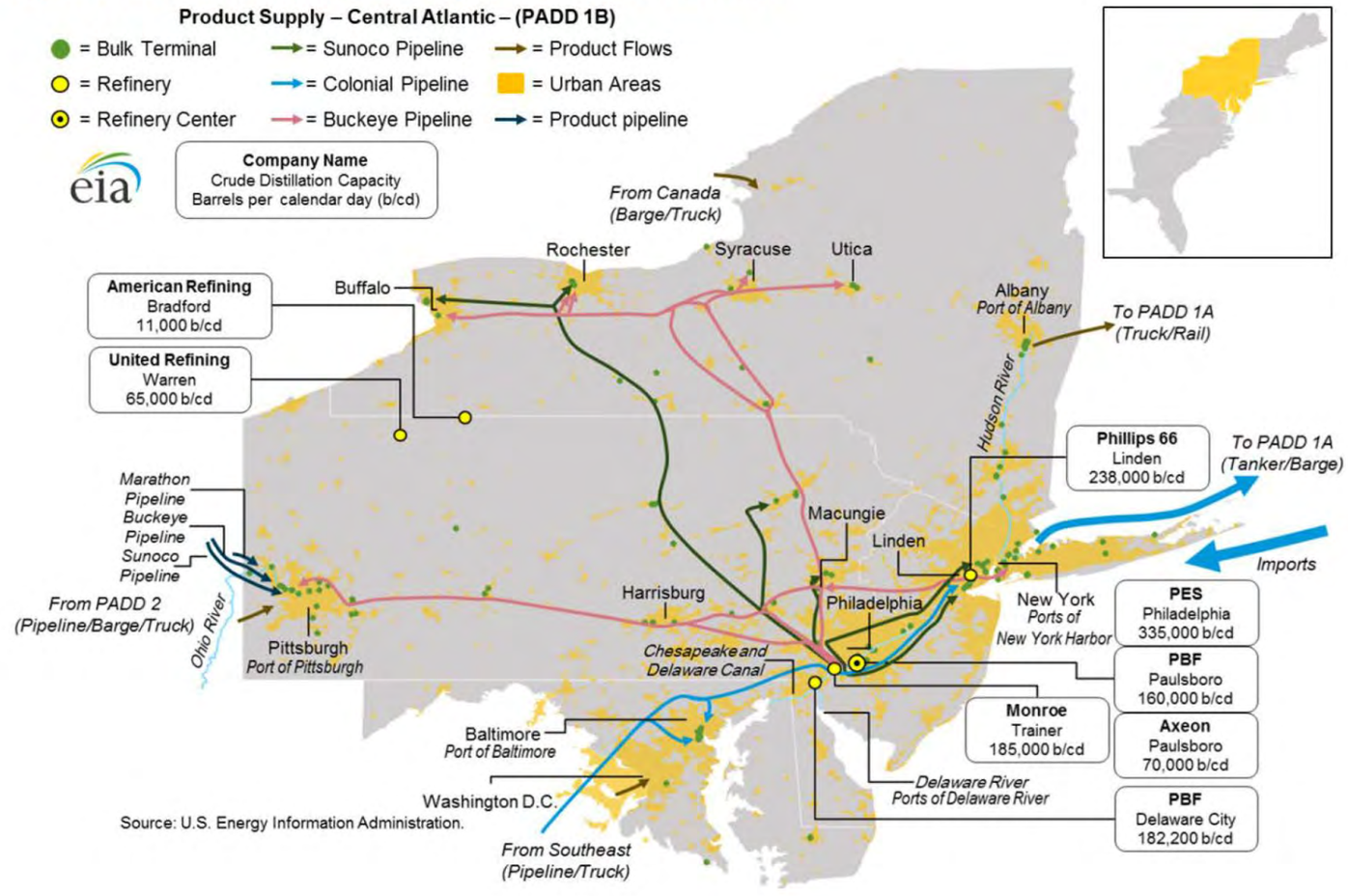
MID-ATLANTIC / NORTHEAST

- **The region is linked to western PA and upstate NY through petroleum product pipelines as well as the Midwest (Buckeye) and Gulf Coast (Colonial).**

PHILADELPHIA REGION

- **PES was 1 of 5 refineries in the region but was responsible for almost 50% the region's refining capacity.**

Figure 22. Central Atlantic refined petroleum infrastructure



Source: US Energy Information Administration,2012


LOCALLY
WHAT HAPPENS TO
THE INFRASTRUCTURE THAT
SUPPORTED A CLOSED REFINERY?
Grays Ferry Cogeneration
PORT OF PHILADELPHIA, PA
PHILADELPHIA (PES REFINING COMPLEX)
Eagle Point Power Generation
Uber Electric Power Plant
Edgystone Generating Station
PORT OF CHESTER, PA
Chester Operations
Chester Generating Station
TRAINER
Marcus Hook Refinery Cogen
Marcus Hook Energy LP
PORT OF PAULSBORO, NJ
PAULSBORO
PAULSBORO Paulsboro Refinery
Mickleton Station

NATIONAL CONTEXT DATA ANALYSIS:

- **Establish the appropriate spatial scales for analysis (1 mi, 10mi)**
- **Review demographic data: population, race, income (EPA EJ Datasets?)**
- **Identify contextual trends, typologies, and possible additional urban case studies anticipating the closure of other existing refineries.**
- **Digitize and spatialize refinery closure data for trends and case studies.**

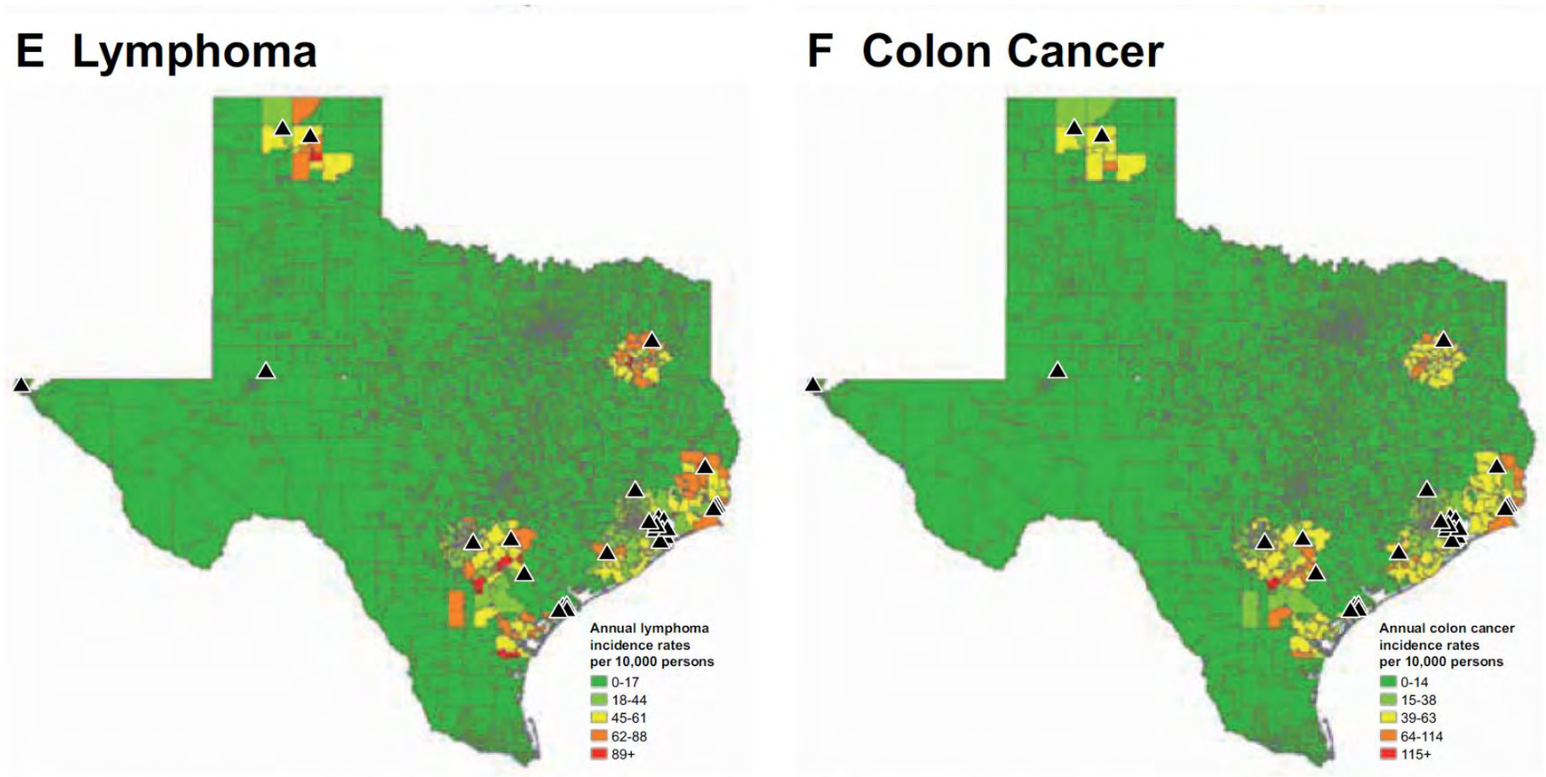
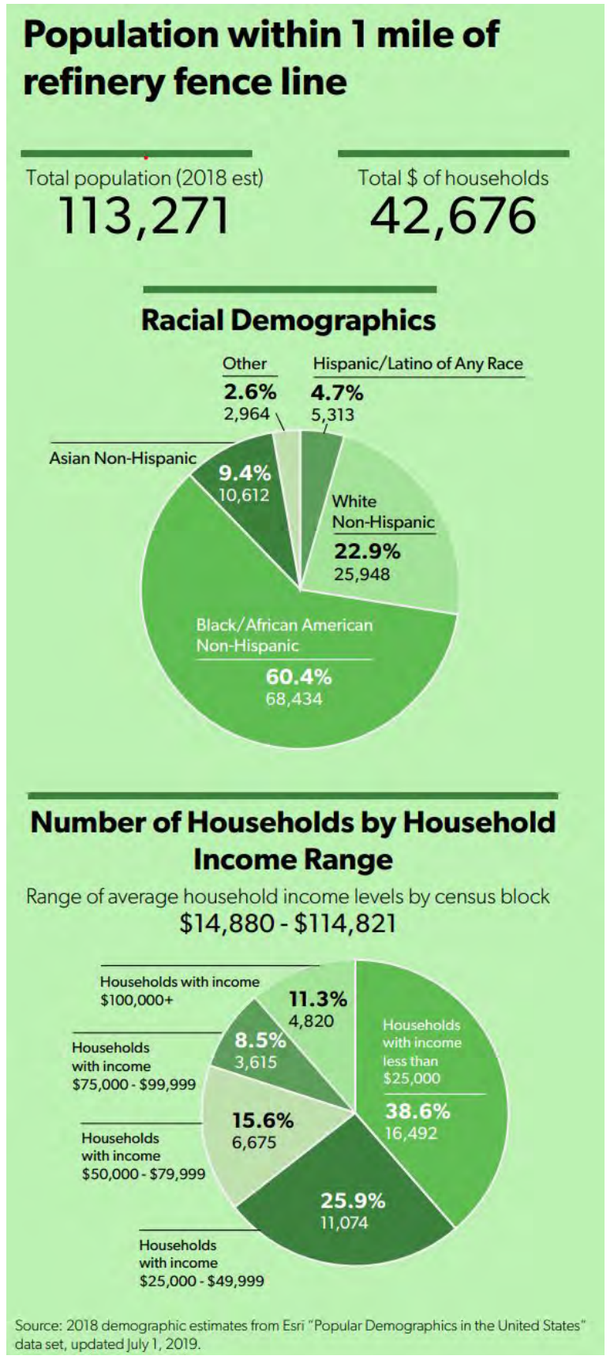


Figure 1. Heat map of cancer rate according to cancer type in Texas in relation to refinery location from 2001 to 2014.

Williams et al, Proximity to Oil Refineries and Risk of Cancer: A Population-Based Analysis, 2020, <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7691047/>



City of Philadelphia, "A Close Call and an Uncertain Future: An assessment of the past, present, and next steps for Philadelphia's largest refinery", 2019

31 US REFINERIES WITH MORE THAN 10,000 PEOPLE WITHIN 1 MI

REFINERY NAME	LOCATION		SIZE		TRANSPORTATION				PIPELINES			ADJACENT LAND CHARACTERISTICS			ADJACENT POPULATION	
Name	City	State	Capacity	Rank	Acres	Waterway	Rail	Highway	HydroPipe	PetroPipe	CrudePipe	Urban	Water	Mean Elevation	1mi_TotalPopulation	10mi_TotalPopulation
WILMINGTON	WILMINGTON	CA	139000	54	628	1	1	1	0	1	1	1	1	12	43620	1527362
PARAMOUNT	PARAMOUNT	CA	84500	77	56	0	1	1	0	1	0	1	0	23	40440	2055708
TORRANCE	TORRANCE	CA	150900	49	657	0	1	1	0	1	1	1	0	23	34044	1631152
EL PASO	EL PASO	TX	122000	57	561	0	1	1	0	1	0	1	0	1143	31332	512866
EL SEGUNDO	EL SEGUNDO	CA	269000	19	899	1	1	1	0	0	1	1	1	34	28598	1405004
BAYTOWN	BAYTOWN	TX	560500	2	4276	1	1	1	1	1	1	1	1	5	26926	681921
PHILADELPHIA (PES REFINING COMPLEX)	PHILADELPHIA	PA	310000	13	804	1	1	1	0	1	0	1	1	4	24560	1451921
LINDEN	LINDEN	NJ	241000	25	724	1	1	1	0	1	0	1	1	7	23723	1415615
LOS ANGELES (CARSON PLANT)	CARSON	CA	269200	18	563	1	1	1	0	1	1	1	0	8	23284	1704067
SOUTH GATE	SOUTH GATE	CA	8500	129	23	0	1	1	0	0	0	1	0	30	21846	2254755
HOUSTON	HOUSTON	TX	263776	20	679	1	1	1	1	1	1	1	1	7	20331	1101074
CHANNELVIEW	CHANNELVIEW	TX	0	141	3644	0	1	1	1	1	1	1	1	10	17898	364283
TOLEDO	OREGON	OH	160000	45	194	1	1	1	1	1	0	1	0	183	15885	298049
BATON ROUGE	BATON ROUGE	LA	502500	4	1923	1	1	1	0	1	1	1	1	16	15726	319936
DETROIT	DETROIT	MI	132000	55	174	1	1	1	1	1	0	1	1	179	15497	631763
CORPUS CHRISTI	CORPUS CHRISTI	TX	157500	46	885	1	1	1	1	1	1	1	1	8	15416	251667
CORPUS CHRISTI EAST AND WEST	CORPUS CHRISTI	TX	296470	14	1454	1	1	1	1	1	1	1	1	8	14872	271346
PORT ARTHUR	PORT ARTHUR	TX	603000	1	2979	1	1	1	1	1	1	1	1	1	14691	137876
CANTON	CANTON	OH	93000	69	196	0	1	1	1	0	1	1	0	334	13651	276370
SHREVEPORT	SHREVEPORT	LA	57000	95	205	0	1	1	1	1	1	1	0	71	13636	246813
WHITING	WHITING	IN	413500	7	1073	1	1	1	1	1	1	1	1	177	12951	557528
BEAUMONT	BEAUMONT	TX	362300	8	1194	1	1	1	1	1	1	1	1	6	12581	181650
DEER PARK	DEER PARK	TX	325700	12	1670	1	1	1	1	1	1	1	1	7	12474	602275
CHALMETTE	CHALMETTE	LA	190000	37	456	1	1	0	0	1	0	1	1	1	12391	460848
DELAWARE CITY	DELAWARE CITY	DE	182200	40	4575	1	1	0	0	0	0	1	1	10	12232	293716
LOS ANGELES (WILMINGTON PLANT)	WILMINGTON	CA	94900	67	294	1	1	1	0	1	1	1	0	1	11975	1353326
MARTINEZ	MARTINEZ	CA	156400	47	754	1	1	1	0	1	1	1	1	14	11888	373059
TULSA WEST	TULSA	OK	85000	75	849	1	1	1	0	1	1	1	1	198	10591	315714
RICHMOND	RICHMOND	CA	245271	24	1231	1	1	1	0	1	0	1	1	22	10104	447715

URBAN REFINERY EPICENTERS:

Los Angeles, CA

Houston, TX

Salt Lake City, UT

Corpus Christi, TX

OTHER MAJOR URBAN REFINERIES:

El Paso, TX

Linden, NJ

Toledo, OH

Baton Rouge, LA

Detroit, MI,

DISCUSSION