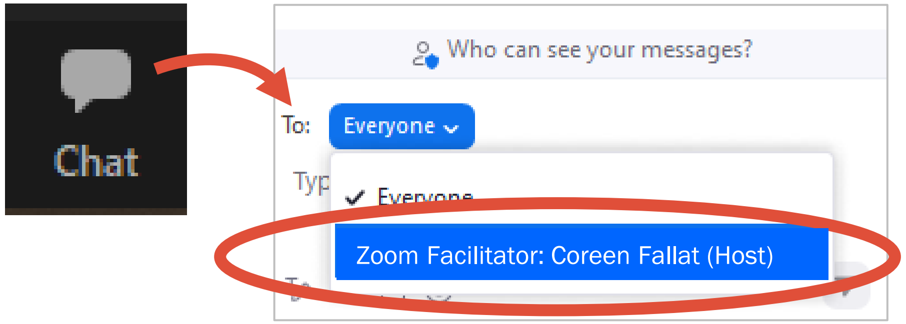
Back to Basics: Planning for Remediation and Continuing Obligations

DNR Remediation and Redevelopment Program

Meeting Logistics

Written Comments/Questions

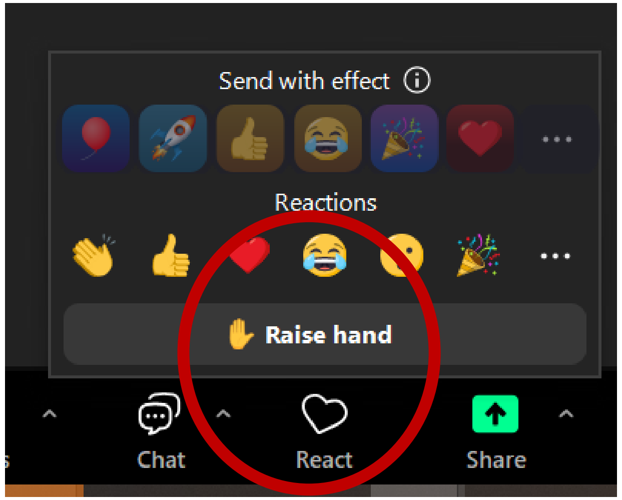
- Use chat and select Zoom facilitator in the “To” dropdown
- Remarks will be read out loud by facilitator



(direct message)

Verbal Comments/Questions

- In-Person: Raise hand and in-person moderator will help manage
- By Zoom: Select React to Raise hand to request a turn to talk (* 9 on phone)
- Please unmute when your name is called (*6 on phone)



Objectives

- Explain the importance of remedial action planning and design to achieve a successful project.
- Identify and evaluate the impact of continuing obligations when project planning.
- Compare different approaches to remedial action planning and design through real-world examples.
- Incorporate best practices and tips shared by the program into future projects.

NR 700 Process Overview

Jodie Thistle, PG

RR Program

WI Regulatory Framework

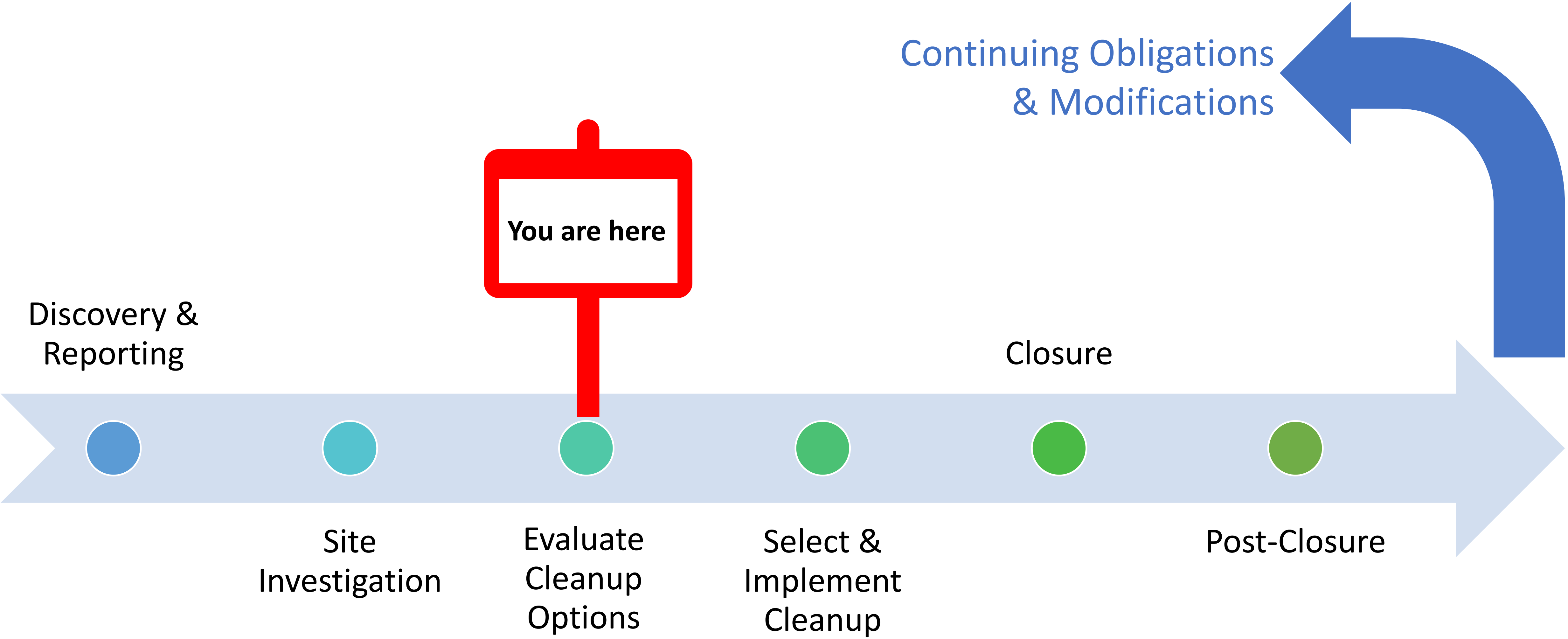
- Self-implementing, *responsible party* follows the steps
- Timelines
- DNR approvals
- Request technical review from DNR

Wisconsin Statutes
Chapter 292

Wisconsin Administrative Code
Chapters NR 700-799

WISCONSIN
DEPT. OF NATURAL RESOURCES

Wis. Admin. Code NR 700 - 799



Keep the End in Mind

What COs Can You Live With?

- No continuing obligations
- No or limited long-term costs
- Unrestricted use/reuse

- Continuing obligation (e.g., maintain a protective asphalt cap)
- Moderate long-term costs to maintain the protective cap
- Future construction may require DNR approval or soil management/ dewatering

- Several continuing obligations – for example:
  - Property use/occupancy is restricted
  - Mitigation system requires long-term maintenance and monitoring
  - Changes to property or structure layout require DNR approval
- Higher long-term costs to maintain or redevelop

Understanding Continuing Obligations & Selecting Remedial Actions

Tauren Beggs, DNR

NR 700 Submittal Requirements

Site
Investigation
Report
NR 716

Remedial
Actions Options
Report (RAOR)
NR 722

Remedial Action
Plan
NR 724

Documentation
NR 724.15

Monitoring
NR 724.17

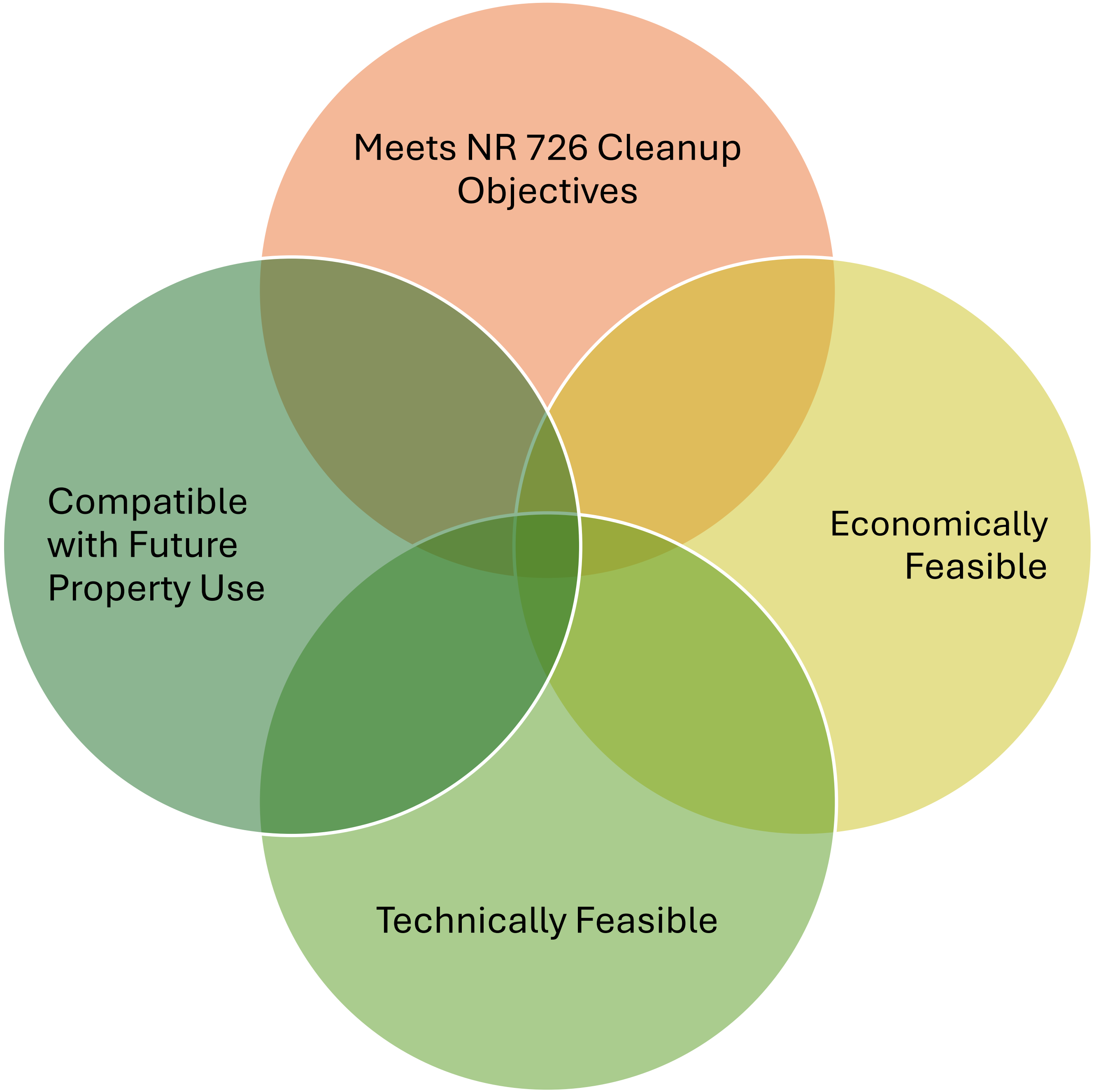
Remedial Actions Options Report (RAOR)

1. Identify likely cleanup actions
2. Evaluate options
3. Select one or more cleanup actions
4. Submit RAOR to DNR

NR 726 Cleanup Objectives

- ✓ Restore the environment to the extent *practicable*
- ✓ Reasonable period of time
- ✓ Minimize the harmful effects of the contamination to air, land or waters of the state
- ✓ Address exposure pathways
- ✓ Address the source of the contamination

Remedial Actions Options Report (RAOR)



Remedial Action Plan

- How will the remedy be implemented?
- Is DNR approval required?
- Is a plan to operate and maintain the remedy required?
- How will the remedy be documented?
- What continuing obligations are anticipated?
- Are other regulatory approvals or coordination needed?

Continuing obligations

Legal requirements that may be imposed on the property due to residual contamination from soil, groundwater or vapor and may include:

Engineering controls

- Caps to prevent direct contact or groundwater infiltration
- Vapor mitigation to prevent indoor air contamination

Property restrictions

- Land use
- Occupancy
- Building layout

Other future obligations

- Abandoning lost monitoring wells
- DNR approval for new well construction
- Wastewater permits for dewatering
- Managing contaminated soil

Consider What COs You Can Live With

- Annual inspection requirements
- Who will maintain the CO? Future cost to maintain the CO and who will pay
- How does the CO affect future property use, market value/salability?
- Is future redevelopment planned? Is the CO compatible?
- Will COs also be needed on neighboring properties?
- Who owns the property?

Balancing Remediation Approach And Long-Term Continuing Obligations

Harris Byers, Ph.D.

Stantec

Balancing Remediation Approach And Long-Term Continuing Obligations

OUTLINE

1. **ABCA / RAOR**
2. **Case Study**
3. **Questions**

Balancing Remediation Approach And Long-Term Continuing Obligations

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ABCA/RAOR

Analysis of Brownfield Cleanup Alternatives / Ch. NR722 Remedial Action Options Report

Systematic Approach to Evaluating **EFFECTIVE** Methods to Facilitate a Proposed Brownfield Cleanup/Reuse

1. Effectiveness (short term/long term)
2. Implementability
3. Restoration Timeframe
4. Economic Feasibility (COST)
5. Sustainability

ABCA/RAOR

Is Cost Just the Remedial Solution?

Encourage You to Discuss Longterm Costs With Clients During the ABCA/RAOE

ABCA/RAOR

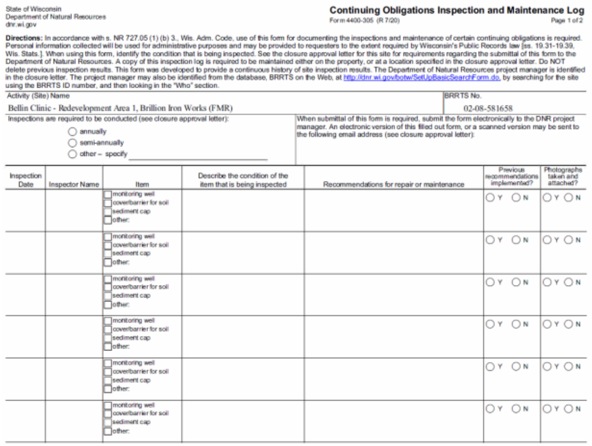
Onsite Cleanup
(Short-Term)

+

+

Stantec

Post-Development
(Long-Term)



State of Wisconsin
Department of Natural Resources
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Continuing Obligations Inspection and Maintenance Log
Form 4400-305 (R 7/20) Page 1 of 2

Directions: In accordance with s. NR 727.05 (1) (b) 3., Wis. Adm. Code, use of this form for documenting the inspections and maintenance of certain continuing obligations is required. Personal information collected will be used for administrative purposes and may be provided to requesters to the extent required by Wisconsin's Public Records law [ss. 19.31-19.39, Wis. Stats.]. When using this form, identify the condition that is being inspected. See the closure approval letter for this site for requirements regarding the submittal of this form to the Department of Natural Resources. A copy of this inspection log is required to be maintained either on the property, or at a location specified in the closure approval letter. Do NOT delete previous inspection results. This form was developed to provide a continuous history of site inspection results. The Department of Natural Resources project manager is identified in the closure letter. The project manager may also be identified from the database, BRRTS on the Web, at http://dnr.wi.gov/botw/SetUpBasicSearchForm.do, by searching for the site using the BRRTS ID number, and then looking in the "Who" section.

Activity (Site) Name: Bellin Clinic - Redevelopment Area 1, Brillion Iron Works (FMR)
BRRTS No.: 02-08-581658

Inspections are required to be conducted (see closure approval letter):
- annually
- semi-annually
- other – specify

When submittal of this form is required, submit the form electronically to the DNR project manager. An electronic version of this filled out form, or a scanned version may be sent to the following email address (see closure approval letter):

Inspection Date	Inspector Name	Item	Describe the condition of the item that is being inspected	Recommendations for repair or maintenance	Previous recommendations implemented?	Photographs taken and attached?
		monitoring well, cover/barrier for soil, sediment cap, other:			Y N	Y N
		monitoring well, cover/barrier for soil, sediment cap, other:			Y N	Y N
		monitoring well, cover/barrier for soil, sediment cap, other:			Y N	Y N
		monitoring well, cover/barrier for soil, sediment cap, other:			Y N	Y N
		monitoring well, cover/barrier for soil, sediment cap, other:			Y N	Y N
		monitoring well, cover/barrier for soil, sediment cap, other:			Y N	Y N

Balancing Remediation Approach And Long-Term Continuing Obligations

OUTLINE

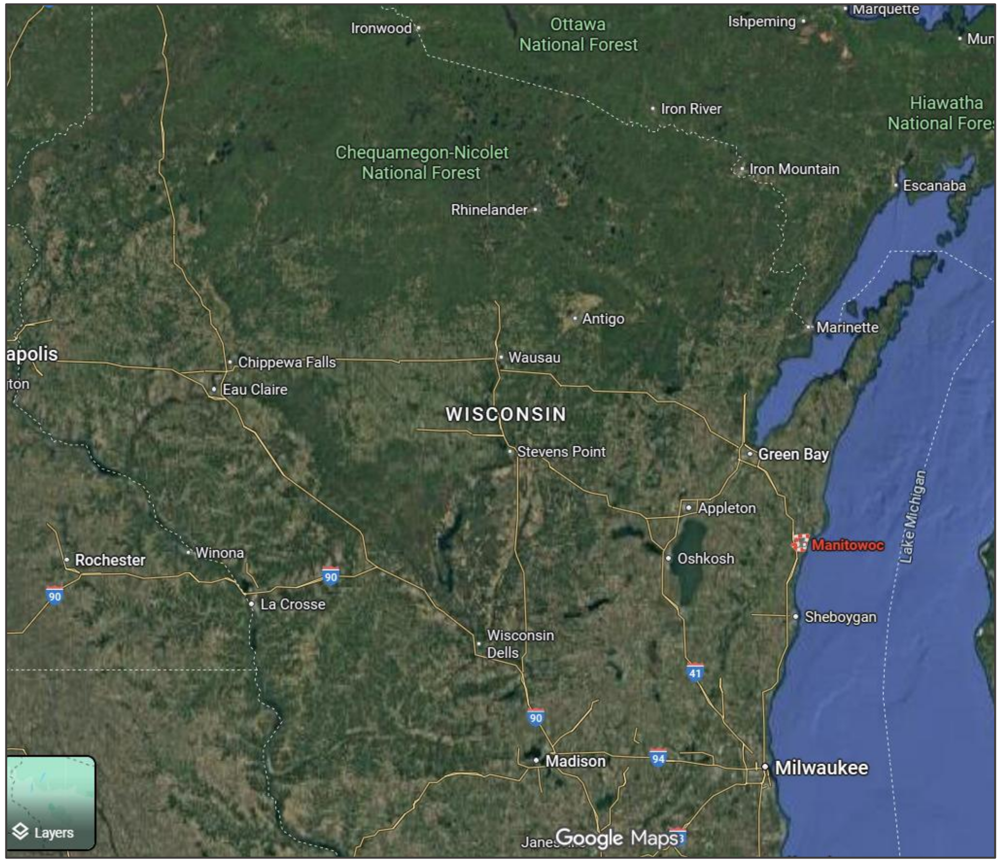
1. ABCA / RAOR
2. Case Study
3. Questions

Case Study

Property Location – Riverpoint District (Manitowoc, Wisconsin)

Major Waterways

City of Manitowoc

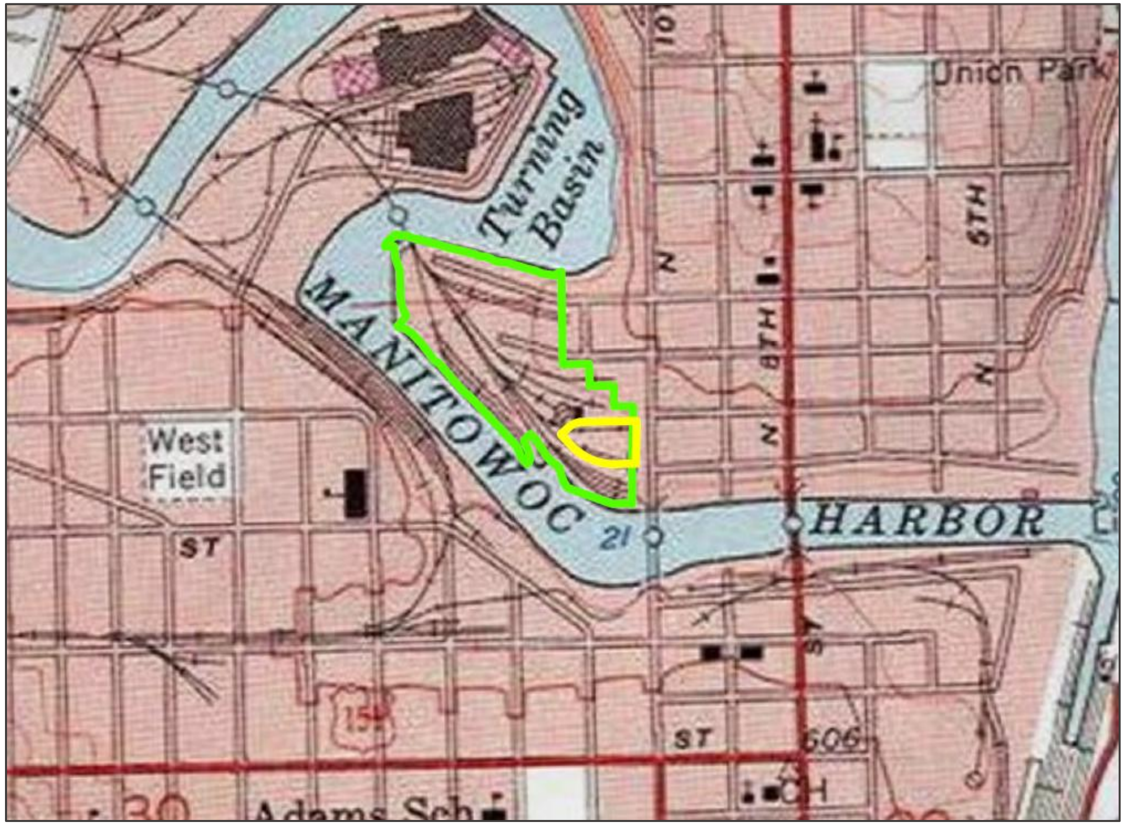


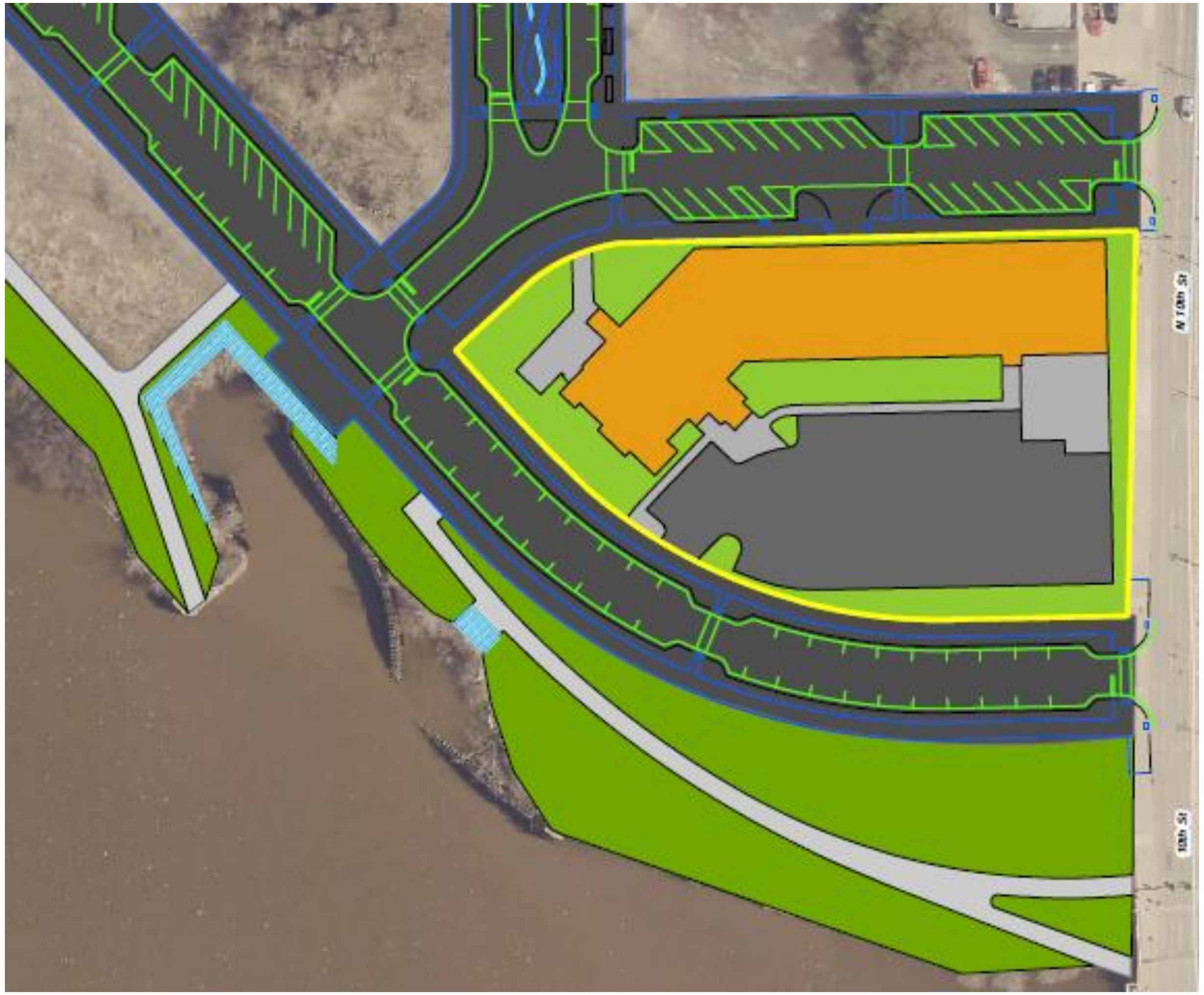
Case Study

Property Location – Riverpoint District (Manitowoc, Wisconsin)

Reuse Plan = 87-Unit Apt. Bldg.

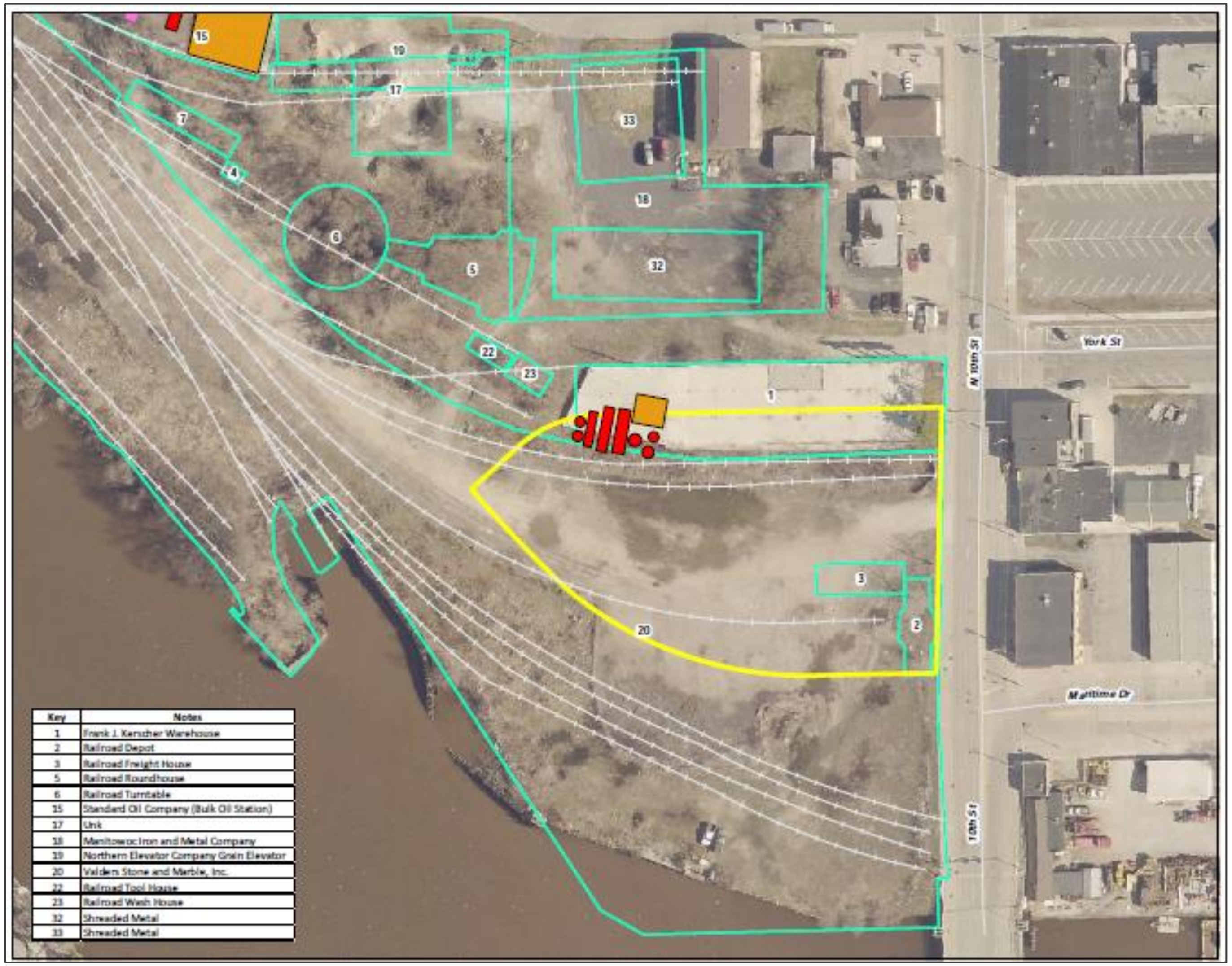
Property = 1.6 acres





Case Study

Site Challenges…….Prior Use (Shipbuilding; Railroad Depot; et al.)



Key	Notes
1	Frank J. Kerscher Warehouse
2	Railroad Depot
3	Railroad Freight House
5	Railroad Roundhouse
6	Railroad Turntable
15	Standard Oil Company (Bulk Oil Station)
17	Unk
18	Manitowoc Iron and Metal Company
19	Northern Elevator Company Grain Elevator
20	Valders Stone and Marble, Inc.
22	Railroad Tool House
23	Railroad Wash House
32	Shreaded Metal
33	Shreaded Metal

Legend

N

River North LLC Project Area

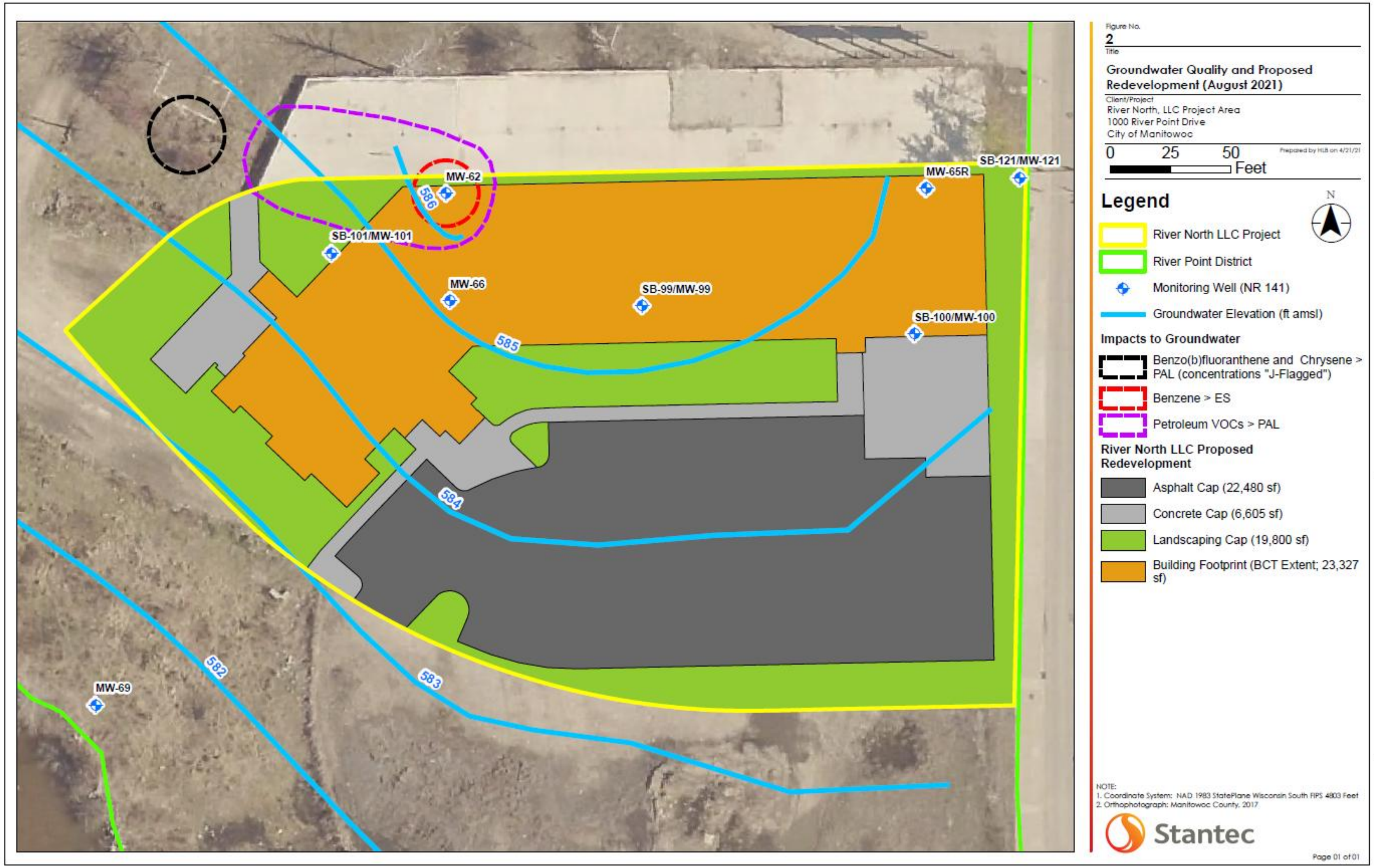
Prior Site Features (City Records)

- Oil House (2)
- Oil Tank (AST) (10)
- Pump House (1)
- Railroad Spurs
- Historic Site Features (see table for details)

Case Study

Site Challenges…….Subsurface Impacts (Historic Fill; Petroleum Impacts)

10,000 Yd³



Case Study

Site Challenges…….Is That It? (Shallow Groundwater; Vapor Risk)

GW = 587’
Slab = 586’

How to Install SSDS?

How Manage Pet. Impacted GW?

Case Study

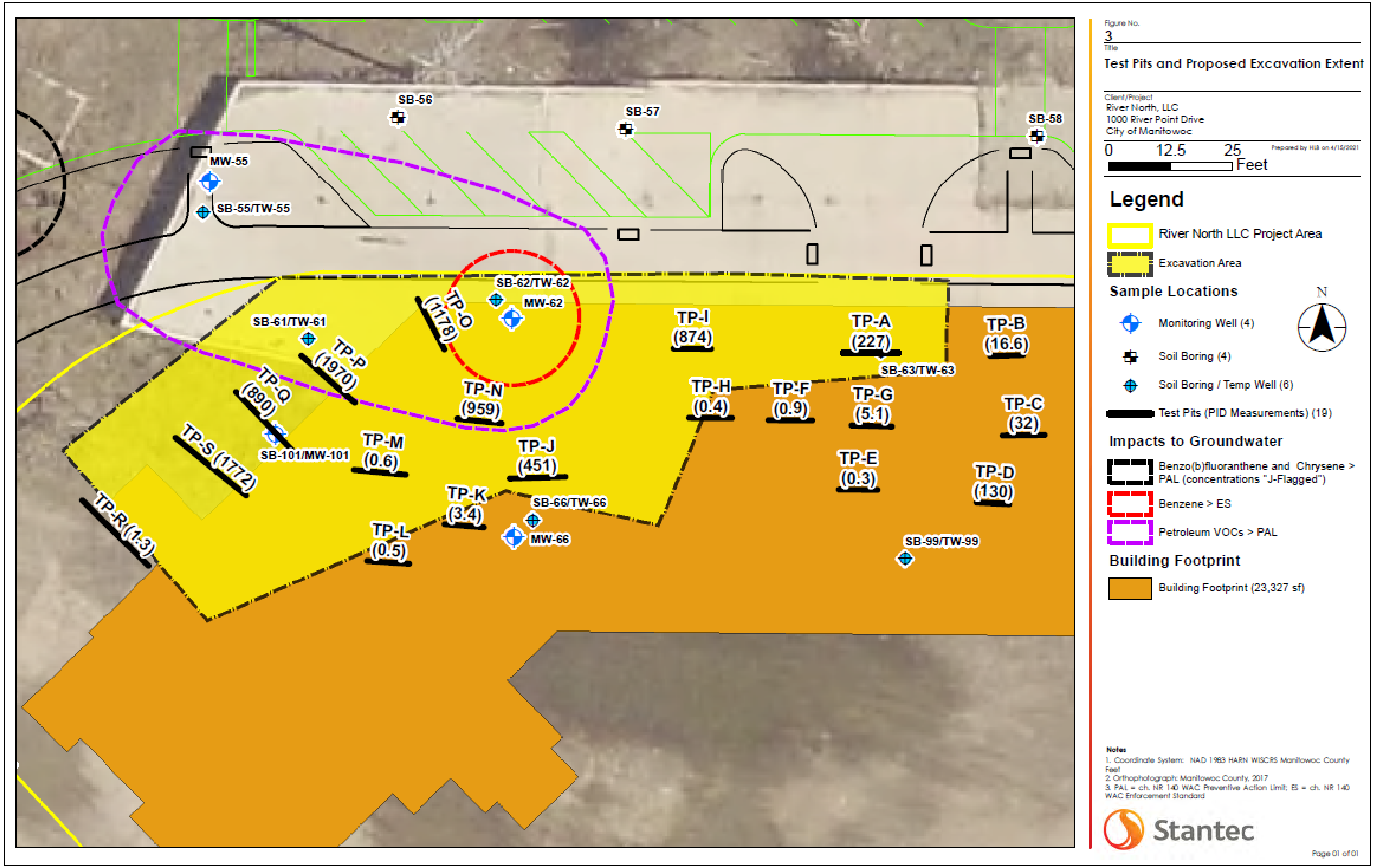
ABCA / RAOE

Remedial Options……

1. Natural Attenuation – Not Effective
2. Remediate All Impacts (Excavation) – Too Expensive (>$2MM)
3. Focused
    1. Excavation of Source Area (VOLUNTARY)
    2. Construct Engineered Barriers
    3. Continuing Obligation (Cap Maintenance; Groundwater)
    4. Passive SSDS (Also a Best Practice!!)

Excavation of Source Area

780 Tons of Soil



Case Study

Source Removal

Case Study

Construction of Passive Sub-Slab Venting System

Sub-Grade Pipes

Vapor Barrier

Concrete Slab

Case Study

Post-Construction Sub-Slab Vapor

Vapor Pins

Sampling

Case Study

Outcome = Healthy Housing With Reduced Continuing Obligations

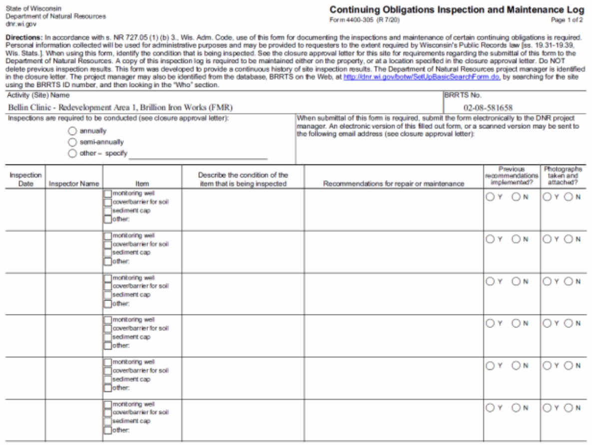
Onsite Cleanup
(Short-Term)

~$80,000

~$70,000

WISCONSIN ECONOMIC DEVELOPMENT

Post-Development
(Long-Term)



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Balancing Remediation Approach And Long-Term Continuing Obligations

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Elements of a Complex Site Remediation
WDNR Back to Basics

Leo Linnemanstons, PG
AECOM Senior Hydrogeologist

October 29, 2025

Overview

- Case Study of RAOR for Former Municipal Landfill
- Brief History of Landfill
- Review of the Site Conditions and Conceptual Site Model
- Development of the Remedial Alternative Options
- Remedial Design and Implementation

Site Chronology

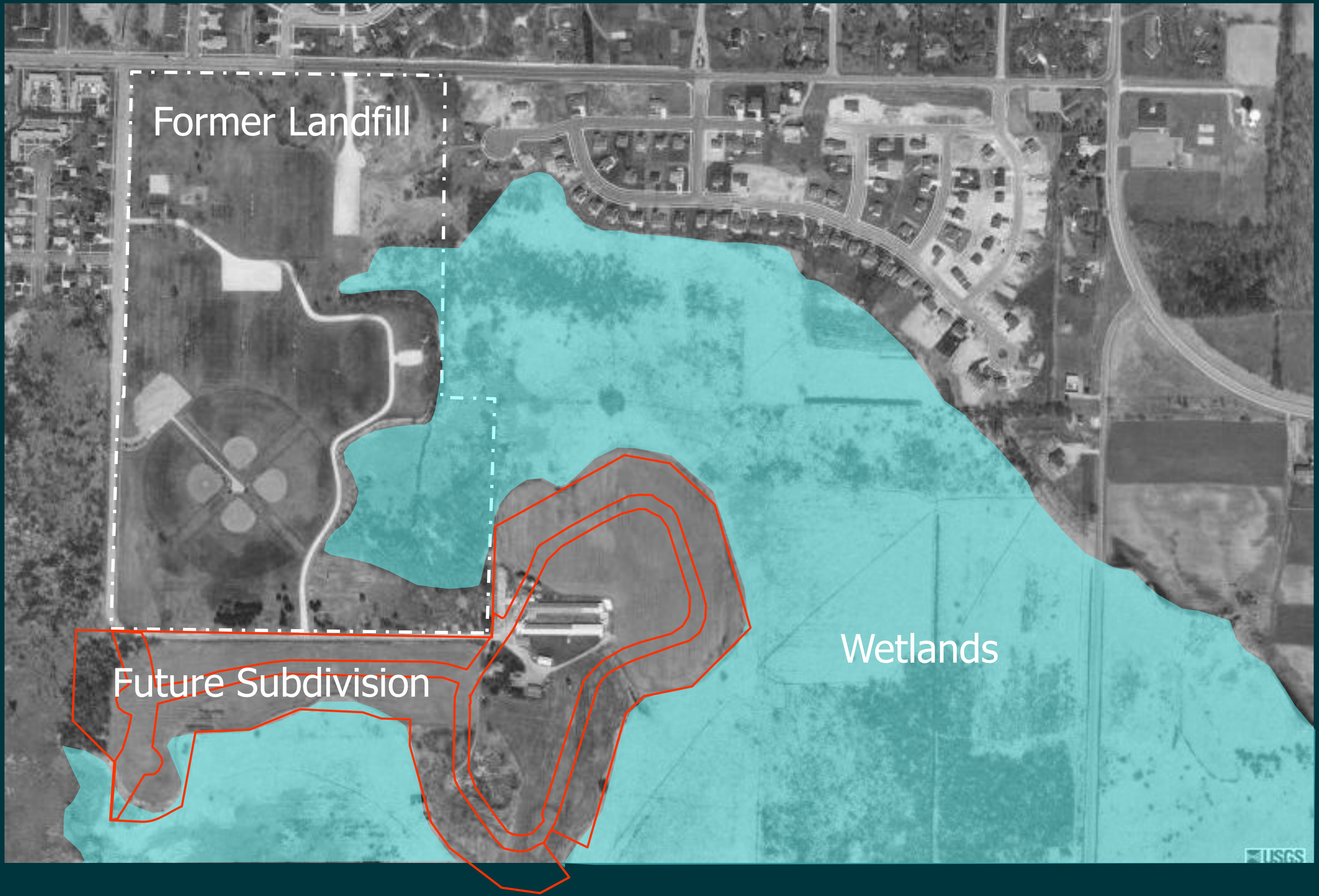
- 1951 – ’77 Municipal landfill operations.
- 1977 Landfill closure activities begin.
- 1987 Landfill officially abandoned.
- 1989 WDNR detects vinyl chloride and TCE in City Well
- 1993 WDNR issues Consent Order
- 1993 – ’97 Groundwater and methane investigations are conducted with WDNR input. (NR716 Site Investigations)
- 1998 Installed passive landfill gas migration trench along west side of site. (NR708 Interim Action)

Site Chronology

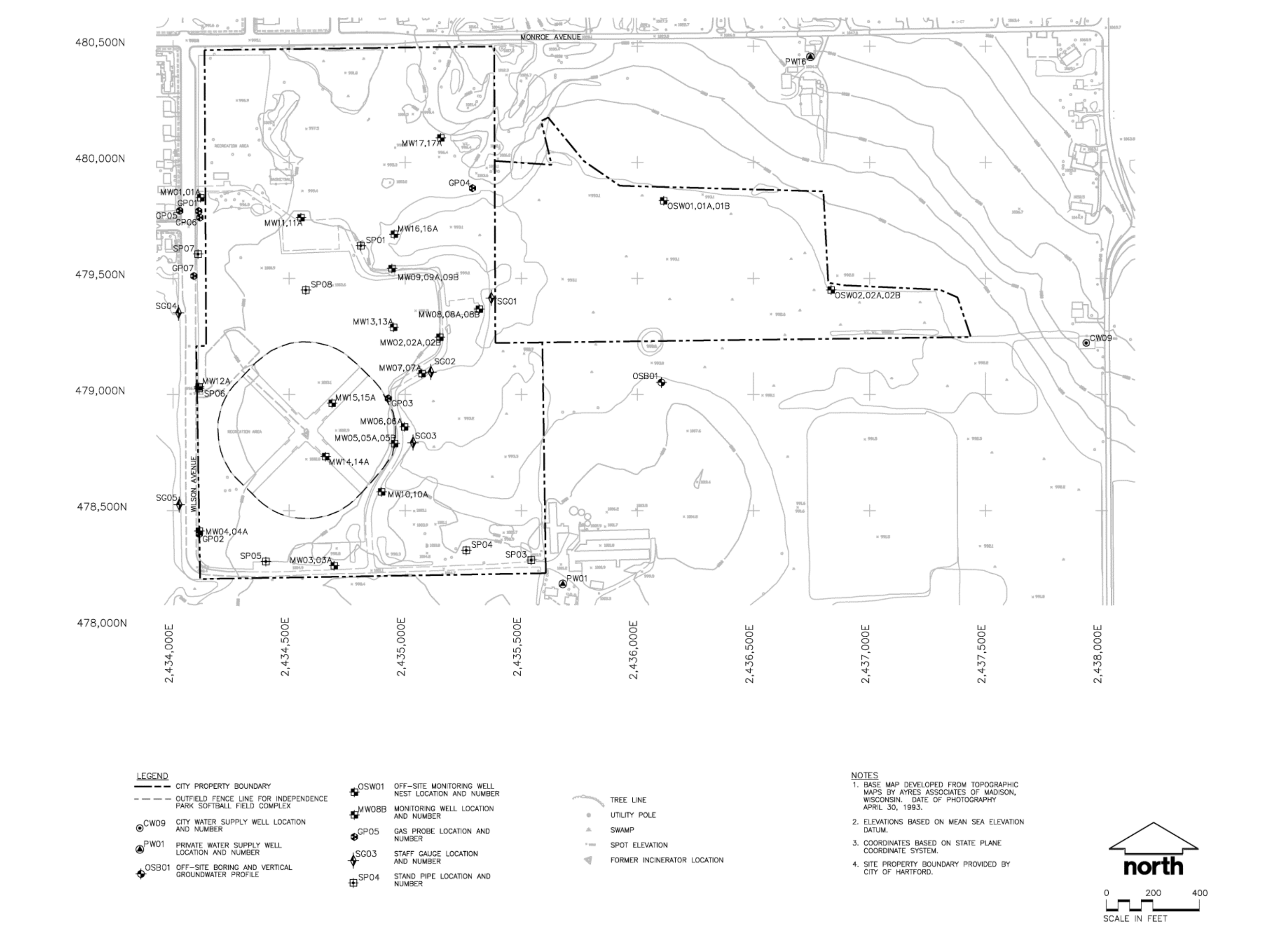
- 1999 – ’00 RAOR submitted and approved by WDNR. (NR722)
- 1999 – ’02 Conducted pilot and full-scale source area remedies. (NR724)
- 2001 – ’02 Source Treatment and Waste material excavation. (NR724)
- 2003 Installed passive landfill gas migration trench along southside of site. (NR724)
- 2008 Construction of Concession Stand and Restroom Building on landfill (WDNR approval). (NR718)
- 2019 – ’22 Vapor Intrusion Assessment and Investigation (NR716)
- 2002 – ’24 Annual Groundwater Monitoring.

Landfill Location and Vicinity Map

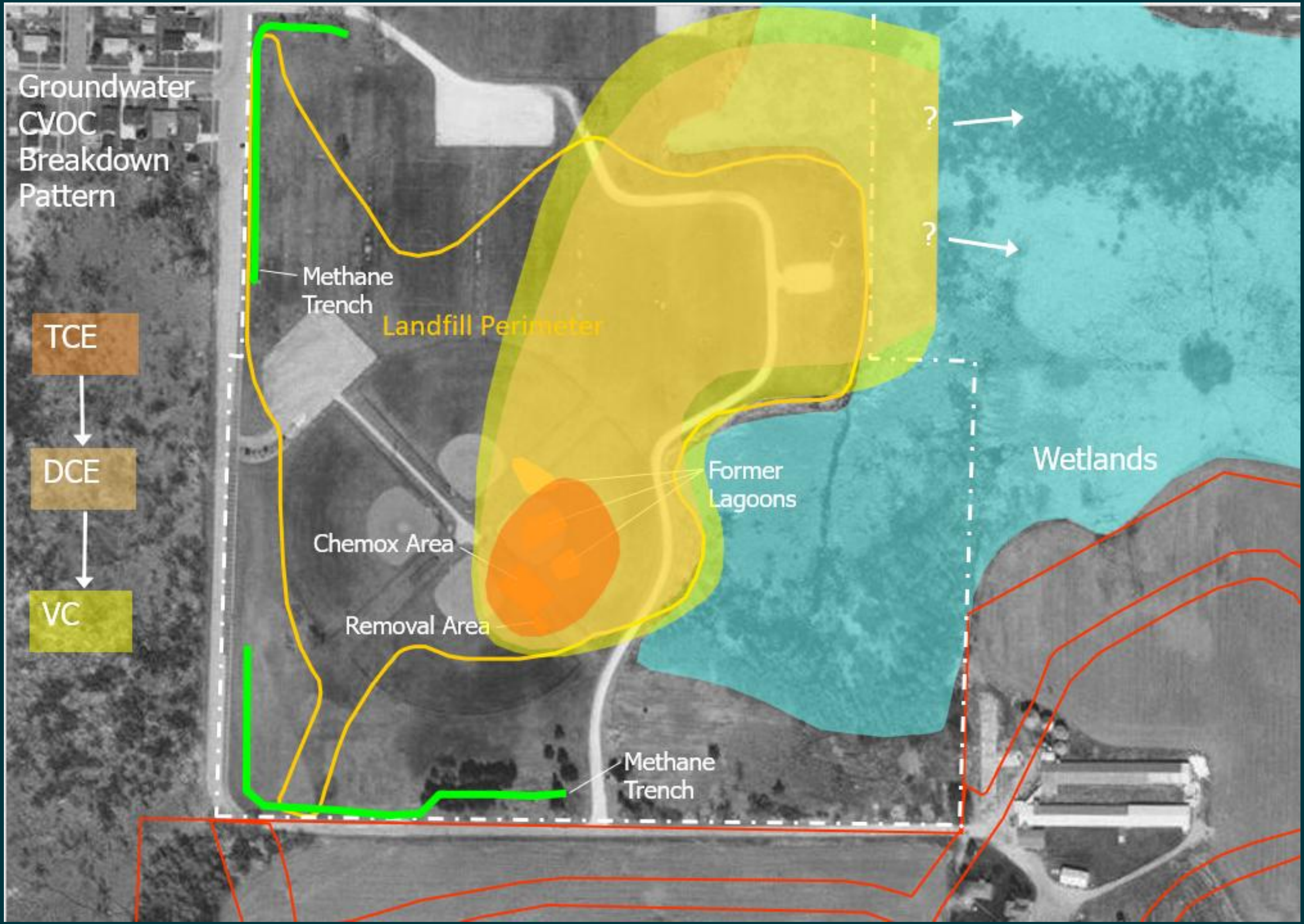
AECOM



Former Landfill Site Features Map



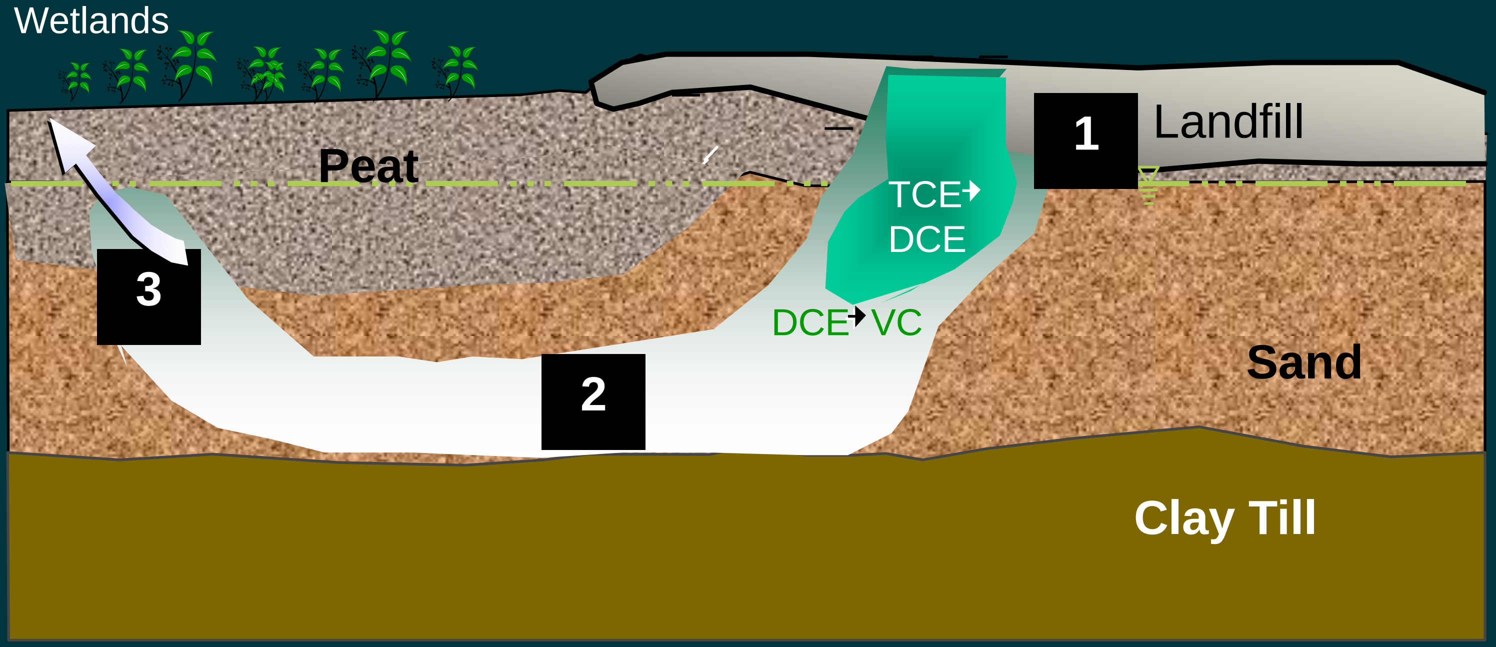
Former Landfill Site Conditions



Former Landfill Conceptual Site Model

AECOM

1	Degradation of Parent CVOCs to DCE and VC in and below anaerobic landfill
2	Limited degradation of VC in anaerobic subsurface
3	Probable discharge to wetlands. Lack of aerobic recharge maintains anaerobic conditions.



Remedial Action Objectives

1. Obtain final closure of the former landfill through a Chapter NR722, Wis. Adm. Code, source control action.
2. Minimize the affects of the remediation on the use of the park, preserving the investment in the park, and continuous use of the park.
3. Achieve Objective 1 and 2 in the most cost-effective manner.

Remedial Action Options Plan, August 1999

Range of Remedial Options Considered

PROCESS OPTIONS FOR EACH MEDIA	ALTERNATIVE 1	ALTERNATIVE 2	ALTERNATIVE 3	ALTERNATIVE 4	ALTERNATIVE 5	ALTERNATIVE 6	ALTERNATIVE 7
LANDFILL GAS	**LANDFILL GAS**						
Migration Control Trench	X	X	X	X	X	X	X
SOIL/WASTE	**SOIL/WASTE**						
No Action	X			X			X
Monitoring/Natural Attenuation							
Maintain Soil Layer Cover	X	X	X	X	X	X	X
Maintain Vegetation	X	X	X	X	X	X	X
Enhanced Biodegradation							
Soil Vapor Extraction					X		
Excavate and Dispose at Off-site Landfill		X	X			X	
GROUNDWATER	**GROUNDWATER**						
Monitoring	X	X	X	X	X	X	X
Monitoring/Natural Attenuation	X	X					
Slurry Wall							
Sheet Piles							
Extraction Wells and Treatment					X	X	
Enhanced Biodegradation			X	X			
Permeable Treatment Wall							X

Alternatives Evaluation

1. Landfill Gas
   - Investigation indicated some methane and little CVOCs
   - Permeable soil cap allowed venting of landfill gas
   - Potential migration pathway with frozen ground
   - Landfill gas collections systems are very disruptive to install and expensive to maintain
   - Passive perimeter collection system minimize disruption, addresses migration concern, minimal O&M
   - Potential added benefit of active LFG system is reduction of groundwater plume
   - LFG system may require air permit or have destruction requirements (supplemental fuel)

Alternatives Evaluation

2. Soil Source Area
   - Investigation identified source area underneath existing baseball fields (don’t want to destroy fields).
   - Conducted geophysics to determine if buried drums may be present (test pits conducted at anomaly locations).
   - Installation of impermeable cap (NR500) are very disruptive to install and expensive to construct.
   - Limited vadose zone and presence of saturated organic peat layer below buried landfill waste material.
   - Buried waste material was heterogeneous, and impractical to remove.

Alternatives Evaluation

3. Groundwater Plume
   - Investigation identified CVOC plume under park and migrating to wetland where groundwater discharged.
   - Strong anerobic conditions driving almost complete conversion of TCE to DCE to VC from source area to wetland.
   - Pump and treat may generate high volumes and degrade wetland by lowering water table and may cause land subsidence if peat layer compresses.
   - High capacity permit may be needed (Greater than 70 gpm system).

Alternatives Evaluation

3. Groundwater Plume
   - Treatment systems would require longterm O&M.
   - Air-stripping or carbon filtration are expensive.
   - Discharge either to POTW or through WPDES permit.
   - Permeable treatment wall (or funnel and gate) may not be constructable at identified plume depth (20 to 45 ft bgs).
   - Indefinite remediation time frame if source area could not be successfully reduced.
   - No public or private water supply receptors.

Economic Feasibility of Alternatives

AECOM

Alternative	ECONOMIC FEASIBILITY A. Capital costs			B. Annual O&M costs	Estimated Time to Closure (yrs)	C. Total present net worth			D. Potential future liability
	Expected	Minimum	Maximum			Expected	Minimum	Maximum	
Alternative 1 - Gas Migration Control Trench, No Action with Soil/Waste, and Groundwater Monitoring	$77,550	$77,550	$77,550	$45,860	20,10,30	$527,808	$385,275	$593,833	$1,000,000
Alternative 2 - Gas Migration Control Trench, Soil/Waste Excavation and Off-site Disposal, and Groundwater Monitoring	$767,745	$450,285	$1,085,205	$45,860	8,5,20	$1,075,470	$633,390	$1,535,463	$500,000
Alternative 3 - Gas Migration Control Trench, Soil/Waste Excavation and Off-site Disposal, and Groundwater Enhanced Biodegradation	$1,099,461	$782,001	$1,416,921	$80,780	6,5,20	$1,472,891	$1,104,531	$2,210,027	$250,000
Alternative 4 - Gas Migration Control Trench, No Action with Soil/Waste, and Groundwater Enhanced Biodegradation	$409,266	$409,266	$409,266	$80,780	15,10,30	$1,100,694	$951,308	$1,318,671	$750,000
Alternative 5 - Gas Migration Control Trench, Soil/Waste Vapor Extraction, and Source and Perimeter Groundwater Extraction and Treatment	$587,125	$587,125	$587,125	$93,640	6,5,20	$1,020,004	$961,001	$1,506,492	$250,000
Alternative 6 - Gas Migration Control Trench, Soil/Waste Excavation and Off-site Disposal, and Perimeter Groundwater Extraction and Treatment	$956,560	$639,100	$1,274,020	$92,140	6,5,20	1,382,505	1,006,987	2,178,660	$250,000
Alternative 7 - Gas Migration Control Trench, No Action with Soil/Waste, and Groundawter Permeable Treatment Wall	$1,192,919	$919,530	$1,595,639	$67,720	10,5,20	$1,647,327	$1,463,305	$2,286,244	$250,000

Evaluation of Ranges of Costs

- Capital Costs
- Annual O&M Costs
- Estimated Duration (Time to Closure)
- Total Net Present Worth
- Potential Future Liability

Detailed Analysis of Alternatives (NR 722 Criteria)

NR 722.07 Criteria for Evaluation of Alternative	Alternative 1 - Gas Migration Control Trench, No Action with Soil/Waste, and Groundwater Monitoring		Alternative 2 - Gas Migration Control Trench, Soil/Waste Excavation and Off-site Disposal, and Groundwater Monitoring		Alternative 3 - Gas Migration Control Trench, Soil/Waste Excavation and Off-site Disposal, and Groundwater Enhanced Biodegradation		Alternative 3A - Gas Migration Control Trench, Soil/Waste Vapor Extraction, and Groundwater Enhanced Biodegradation	
I. TECHNICAL FEASIBILITY	TECHNICAL FEASIBILITY							
A. Long Term Effectiveness	Description	Rating	Description	Rating	Description	Rating	Description	Rating
1. Degree the toxicity, mobility, and volume of contamination is expected to be reduced	No volume or mobility reduction except through natural attenuation, toxicity increases due to vinyl chloride.	1	Soil volume reduction, no groundwater reduction in mobility or volume, toxicity increases due to vinyl chloride.	3	Soil volume reduction, reduction in groundwater mobility, reduced volume and toxicity in groundwater.	9	Soil volume reduction, reduction in groundwater mobility, reduced volume and toxicity in groundwater.	7
2. Degree the remedial action option will protect public health, safety, welfare, and the environment	Protective of public health, safety, and welfare, existing contaminants may pose threat to the environment.	5	Protective of public health, safety, and welfare, existing contaminants may pose threat to the environment.	6	Protective of public health, safety, and welfare, system may reduce threat to the environment.	9	Protective of public health, safety, and welfare, system may reduce threat to the environment.	9
B. Short Term Effectiveness (Risk)	None.	9	Exposure risk during excavation to workers and public.	2	Exposure risk during excavation and system installation to workers and public.	1.5	Exposure risk during system installation to workers and public.	5
C. Implementability	IMPLEMENTABILITY							
1. Technical feasibility of construction and implementation	No construction required.	9	Minimal feasibility limitations.	7	Minimal feasibility limitations. Need to establish anaerobic and aerobic zones.	5	Minimal feasibility limitations. Need to establish anaerobic and aerobic zones.	6
2. Availability of materials, equipment, technologies, and services	Contractors and materials readily available.	9	Contractors and materials readily available.	8	Contractors, materials, and equipment readily available.	8	Contractors, materials, and equipment readily available.	8
3. Potential difficulties with construction or off-site disposal and treatment	None.	9	Limits of soil/waste not clearly defined and types of waste may cause off-site disposal difficulties.	5	Limits of soil/waste not clearly defined and types of waste may cause off-site disposal difficulties.	4	Minimal off-site disposal, relatively simple construction.	7
4. Difficulties with monitoring effectiveness	Minimal, but it is a complex site.	8	Minimal, but it is a complex site.	8	Minimal, but need to monitor the biodegradation.	6	Minimal, but need to monitor the biodegradation.	6
5. Administrative feasibility, including time needed to obtain licenses, permits or approvals	WDNR approval may be difficult and take a long time.	2	City approval for park construction, landfill disposal approvals, WDNR approval.	3	City approval for park construction, landfill disposal approvals, WDNR approval.	3	WDNR approval of enhanced biodegradation may be somewhat difficult.	7
6. Presence of any federal or state threatened endangered species	None identified within 1 mile of the site.	–	None identified within 1 mile of the site.	–	None identified within 1 mile of the site.	–	None identified within 1 mile of the site.	–
7. Technical feasibility of recycling, treatment, engineering controls, or disposal (O&M)	Simple long-term monitoring.	8	Simple long-term monitoring.	8	Monitoring and O&M of system is relatively straight forward.	6	Monitoring and O&M of system is relatively straight forward.	6
8. Technical feasibility of natural biodegradation	Natural attenuation is occurring and this alternative relies on it heavily.	4	Natural attenuation is occurring and this alternative relies on it heavily.	4	Natural attenuation is occurring and this alternative relies on it heavily.	7	Natural attenuation is occurring and this alternative relies on it heavily.	7
D. Restoration Time Frame	RESTORATION TIME FRAME							
1. Estimated time to closure (years)	20	1	8	6	6	7	6	7
2. Acceptability of time frame for restoration	Low probability due to proximity to sensitive receptors, toxicity of contamination, and minimal reduction of contaminant magnitude and mobility.	1	Moderate probability. Waste removal reduces contaminant magnitude, but does not greatly affect groundwater contaminant mobility & toxicity leaving contamination adjacent to sensitive receptors	4	High probability. Contaminant magnitude, toxicity, and mobility reduced. Possible off-site sensitive groundwater receptors addressed through groundwater control.	9	High probability. Contaminant magnitude, toxicity, and mobility reduced. Possible off-site sensitive groundwater receptors addressed through groundwater control.	9
Technical Feasibility Rating Subtotals		66		64		74.5		84
II. ECONOMIC FEASIBILITY								
A. Capital costs	$143,605		$822,745		$1,099,461		$556,886	
B. Annual O&M costs	$50,860		$50,860		$80,780		$86,140	
C. Total present net worth	$642,954	9	$1,164,021	5	$1,472,891	2	$955,094	7
D. Increased potential for future liability		1		2.5		8		7
Economic Feasibility Rating Subtotals		10		7.5		10		14
Total Rating		**76**		**71.5**		**84.5**		**98**

NR 722.07 Criteria for Evaluation of Alternative	Alternative 4 - Gas Migration Control Trench, No Action with Soil/Waste, and Groundwater Enhanced Biodegradation		Alternative 5 - Gas Migration Control Trench, Soil/Waste Vapor Extraction, and Source and Perimeter Groundwater Extraction and Treatment		Alternative 6 - Gas Migration Control Trench, Soil/Waste Excavation and Off-site Disposal, and Perimeter Groundwater Extraction and Treatment		Alternative 7 - Gas Migration Control Trench, No Action with Soil/Waste, and Groundwater Permeable Treatment Wall	
I. TECHNICAL FEASIBILITY	TECHNICAL FEASIBILITY							
A. Long Term Effectiveness	Description	Rating	Description	Rating	Description	Rating	Description	Rating
1. Degree the toxicity, mobility, and volume of contamination is expected to be reduced	No soil volume reduction, no reduction in groundwater mobility, reduced volume and toxicity in groundwater.	4	Soil volume reduction, reduction in groundwater mobility, reduced volume and toxicity in groundwater.	7	Soil volume reduction, reduction in groundwater mobility, reduced volume and toxicity in groundwater.	7	No soil volume reduction, control groundwater mobility, reduced volume and toxicity in groundwater.	8
2. Degree the remedial action option will protect public health, safety, welfare, and the environment	Protective of public health, safety, and welfare, system may reduce threat to the environment.	7	Protective of public health, safety, and welfare, system may reduce threat to the environment.	9	Protective of public health, safety, and welfare, system may reduce threat to the environment.	9	Protective of public health, safety, and welfare, system may reduce threat to the environment.	9
B. Short Term Effectiveness (Risk)	Exposure risk during excavation and system installation to workers and public.	7	Exposure risk during system installation to workers and public.	2	Exposure risk during excavation and system installation to workers and public.	1.5	Exposure risk during excavation and system installation to workers and public.	6
C. Implementability	IMPLEMENTABILITY							
1. Technical feasibility of construction and implementation	Minimal feasibility limitations. Need to establish anaerobic and aerobic zones.	5	Minimal feasibility limitations.	7	Minimal feasibility limitations.	7	Some physical constructions limitations.	5
2. Availability of materials, equipment, technologies, and services	Contractors, materials, and equipment readily available.	8	Contractors, materials, and equipment readily available.	8	Contractors, materials, and equipment readily available.	8	Contractors and materials readily available.	7
3. Potential difficulties with construction or off-site disposal and treatment	Minimal off-site disposal, relatively simple construction.	8	Minimal off-site disposal, relatively simple construction.	7	Limits of soil/waste not clearly defined and types of waste may cause off-site disposal difficulties.	4	Minimal off-site disposal, some construction difficulties with depths.	6
4. Difficulties with monitoring effectiveness	Minimal, but need to monitor the biodegradation.	6	Minimal, but need to show system effectiveness.	7	Minimal, but need to show system effectiveness.	7	Minimal, but need to show wall effectiveness.	7
5. Administrative feasibility, including time needed to obtain licenses, permits or approvals	WDNR approval of enhanced biodegradation may be somewhat difficult.	7	City approval for park construction, treatment permits, WPDES permit.	5	City approval for park construction, landfill disposal approvals, WPDES permit, WDNR approval.	2	DNR approval of an innovative technology	7
6. Presence of any federal or state threatened endangered species	None identified within 1 mile of the site.	–	None identified within 1 mile of the site.	–	None identified within 1 mile of the site.	–	None identified within 1 mile of the site.	–
7. Technical feasibility of recycling, treatment, engineering controls, or disposal (O&M)	Monitoring and O&M of system is relatively straight forward.	6	Monitoring and O&M of system is relatively straight forward, more equipment and components.	5	Monitoring and O&M of system is relatively straight forward, more equipment and components.	5	Monitoring of wall is relatively straight forward, O&M is more complex due to depth of wall.	6
8. Technical feasibility of natural biodegradation	Natural attenuation is occurring and this alternative relies on it heavily.	7	Natural attenuation is occurring and it enhances the effectiveness of this alternative.	6	Natural attenuation is occurring and it enhances the effectiveness of this alternative.	6	Natural attenuation is occurring and it enhances the effectiveness of this alternative.	6
D. Restoration Time Frame	RESTORATION TIME FRAME							
1. Estimated time to closure (years)	15	2.5	6	7	6	7	10	5
2. Acceptability of time frame for restoration	Moderate probability. Waste removal reduces contaminant magnitude, but does not greatly affect groundwater contaminant mobility & toxicity leaving contamination adjacent to sensitive receptors	5	High probability. Contaminant magnitude, toxicity, and mobility reduced. Possible off-site sensitive groundwater receptors addressed through groundwater control.	9	High probability. Contaminant magnitude, toxicity, and mobility reduced. Possible off-site sensitive groundwater receptors addressed through groundwater control.	9	High probability. Contaminant magnitude, toxicity, and mobility reduced. Possible off-site sensitive groundwater receptors addressed through groundwater control.	9
Technical Feasibility Rating Subtotals		72.5		79		72.5		81
II. ECONOMIC FEASIBILITY								
A. Capital costs	$409,266		$587,125		$956,560		$1,192,919	
B. Annual O&M costs	$80,780		$93,640		$92,140		$67,720	
C. Total present net worth	$1,100,694	5	$1,020,004	6	$1,382,505	3	$1,647,327	1
D. Increased potential for future liability		4		7		8		8
Economic Feasibility Rating Subtotals		9		13		11		9
Total Rating		**81.5**		**92**		**83.5**		**90**

Selected Remedial Alternative

The RAOR analyzed seven alternatives and presented the preferred remedy:

- Landfill Gas Migration Control (installed and maintained)
- Source Area Chemical Injection (performed with mixed results)
- Downgradient Enhanced Groundwater Biodegradation (subsequently replaced with long-term monitoring)

Landfill Gas Migration Control (installed and maintained)

- West Trench installed as Interim Action (1998)
- Southern Trench installed to complete remedy (2003)
  - Low maintenance passive venting
  - Installed with additional piping and valving to upgrade to active operation if required in the future.
  - Monitoring program began with monthly monitoring and has been reduced to quarterly.

Remedial Design and Implementation Documentation

Downgradient Enhanced Groundwater Biodegradation

(later replaced with longterm monitoring)

- Pilot test was performed for low-volume air sparging (AS) at downgradient end of the CVOC plume.
    - Results indicated that AS was a feasible technology, but its implementation would be disruptive. In addition, long term O&M would be necessary if the source could not be reduced.
- Pilot test was performed for soil vapor extraction (SVE) in source area
    - Results indicated that SVE would be difficult to implement in the buried waste material (preferential pathways disrupted the vacuum field, especially with limited vadose zone from which to extract vapors).

Remedial Design and Implementation Documentation

AECOM

Source Area Chemical Injection (performed with mixed results)

- Detailed soil probe investigation of proposed treatment area to define treatment area and chemical injection plan
- Pilot test was performed to confirm effectiveness of proposed chemical treatment (BiOx®)
- Three full-scale treatments applied in source area (2001-2002)
- Temporary VOC plume reduction, plume rebounded in 12 months (some mass reduction was achieved but did not significantly reduce the remediation time frame.
- Chemical Injection was designed based on groundwater concentrations, and underestimated contaminant mass contained in underlying peat.
- Chemical injection design did not account for preferentially treating residual BETX contamination (BETX was present in the source area, but not a constituent of concern in the chlorinated GW plume).

Long Term Monitoring over past 20 years

- The park has continued to be a high value asset for the community with high-use throughout the year.

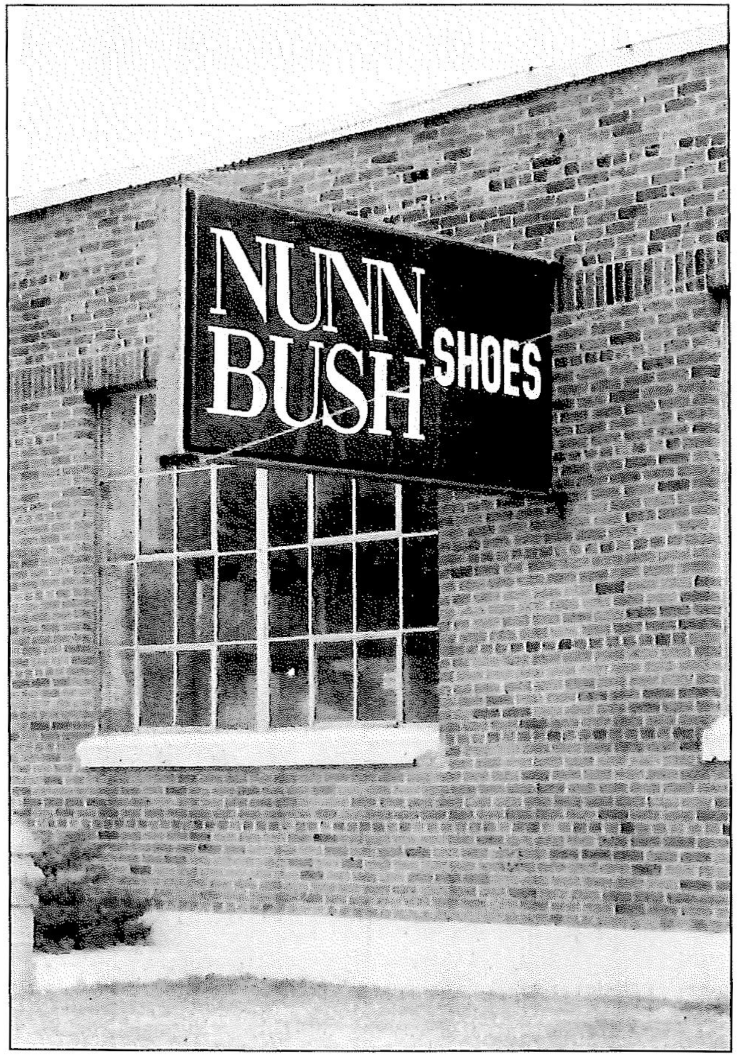
- Landfill gas monitoring at the perimeter gas probes and the passive trenches continues to indicate no landfill gas migration.

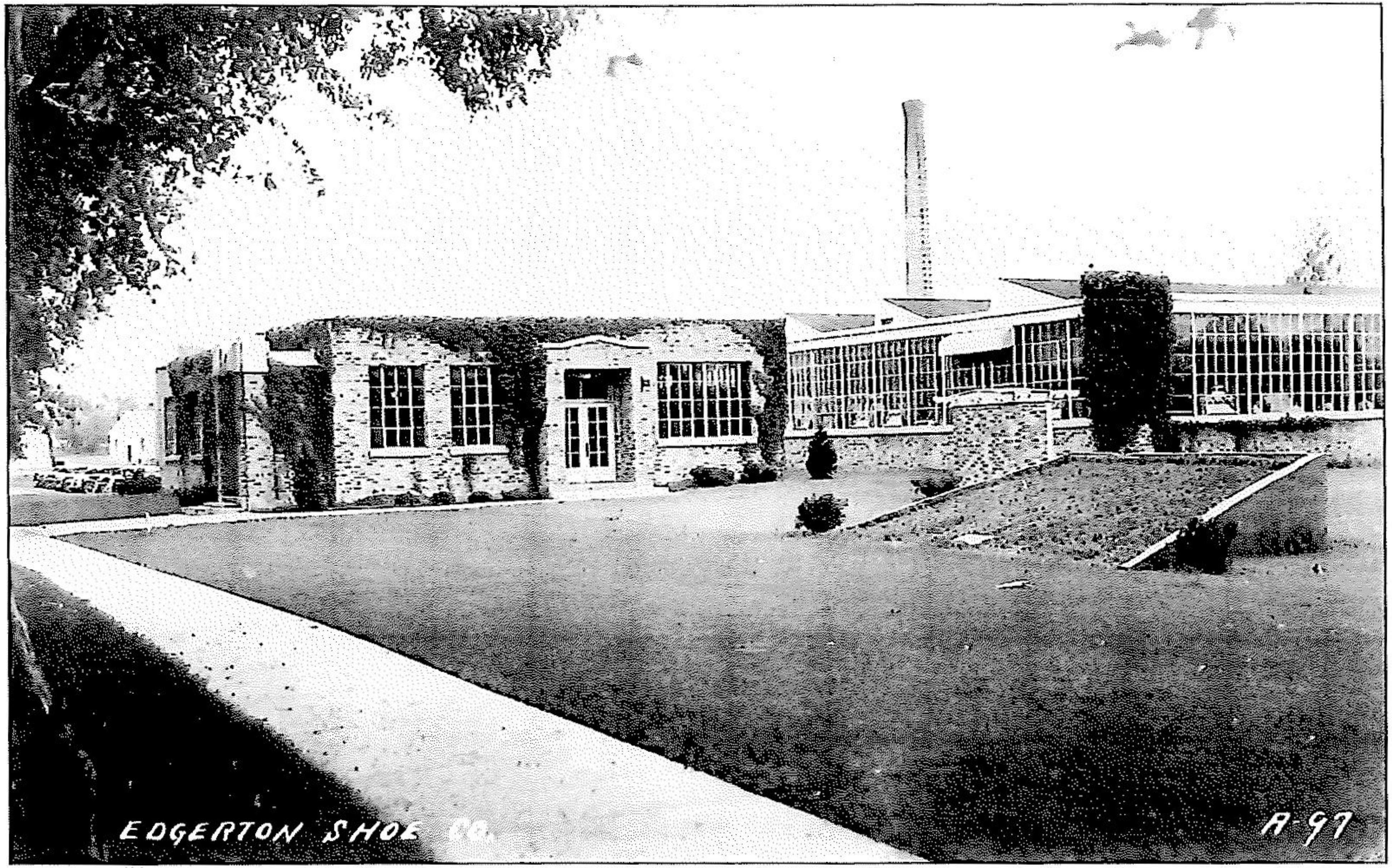
- Annual groundwater monitoring indicates that the groundwater plume remains stable with little change since source area chemical injections.

- Periodically alternatives are revisited to evaluate if the remediation time frame can be shortened.

Nunn Bush Shoe Factory Redevelopment

Ramona Flanigan, City of Edgerton

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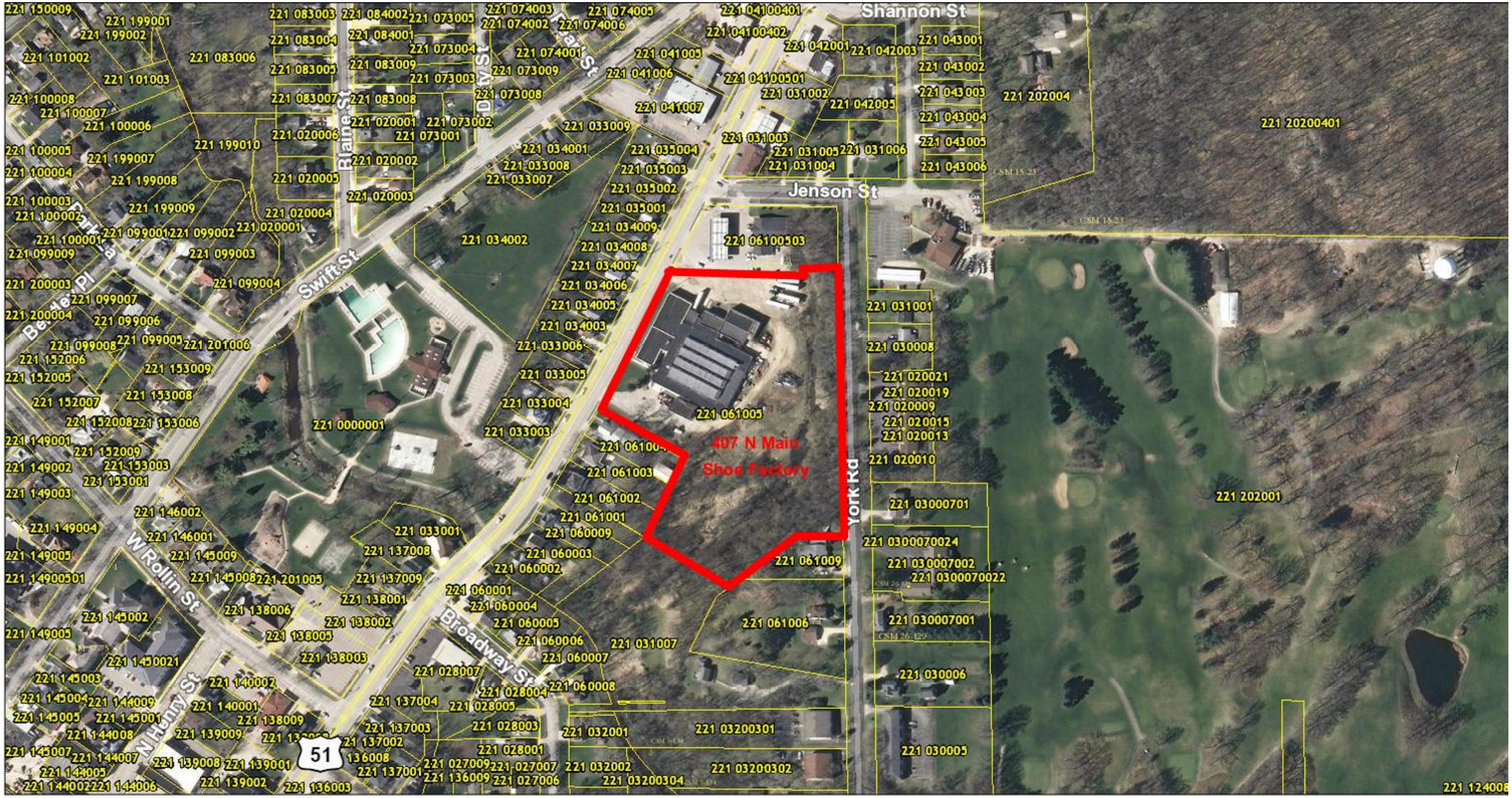


January 7, 2019

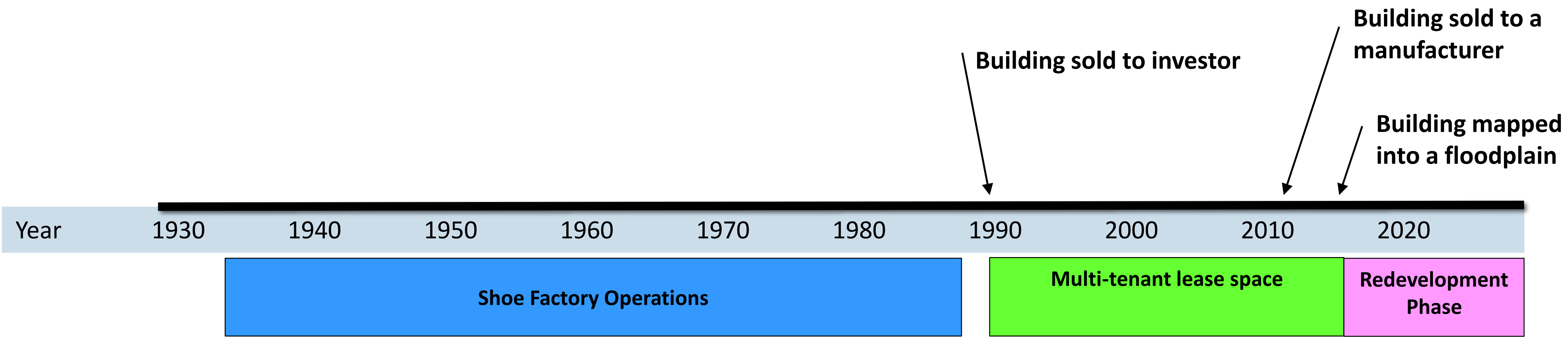
Parcels

1:2,606

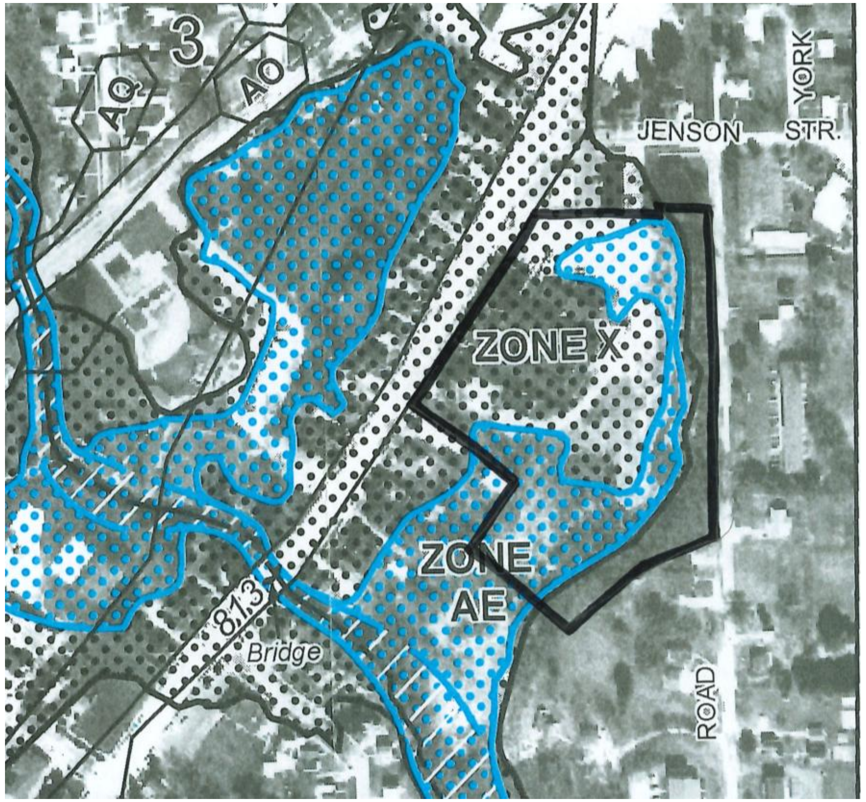
0 0.0325 0.065 0.13 mi

0 0.05 0.1 0.2 km

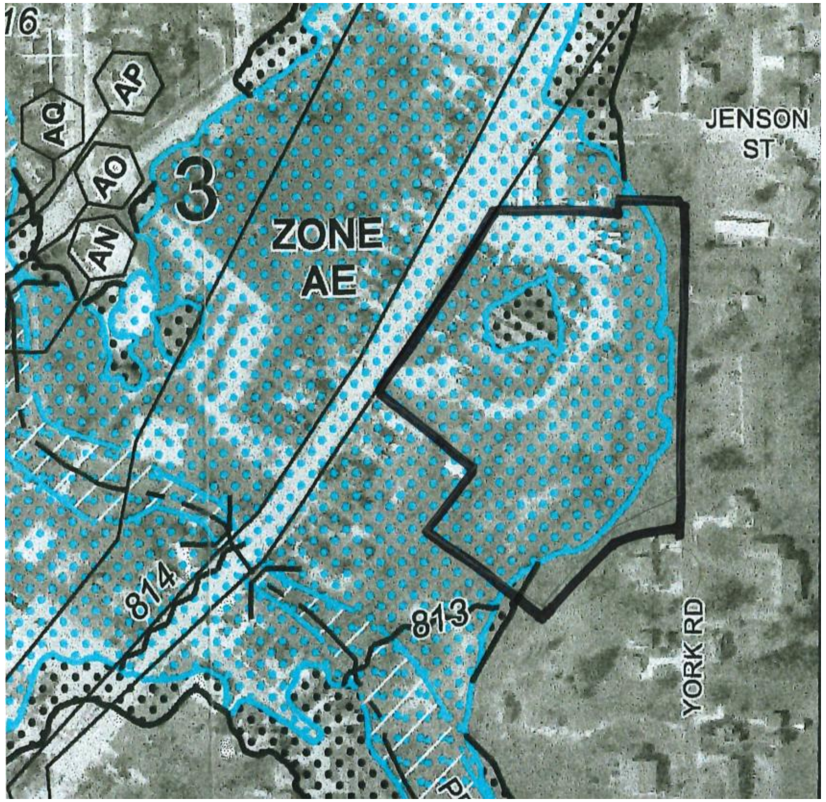
The Life of a Shoe Factory



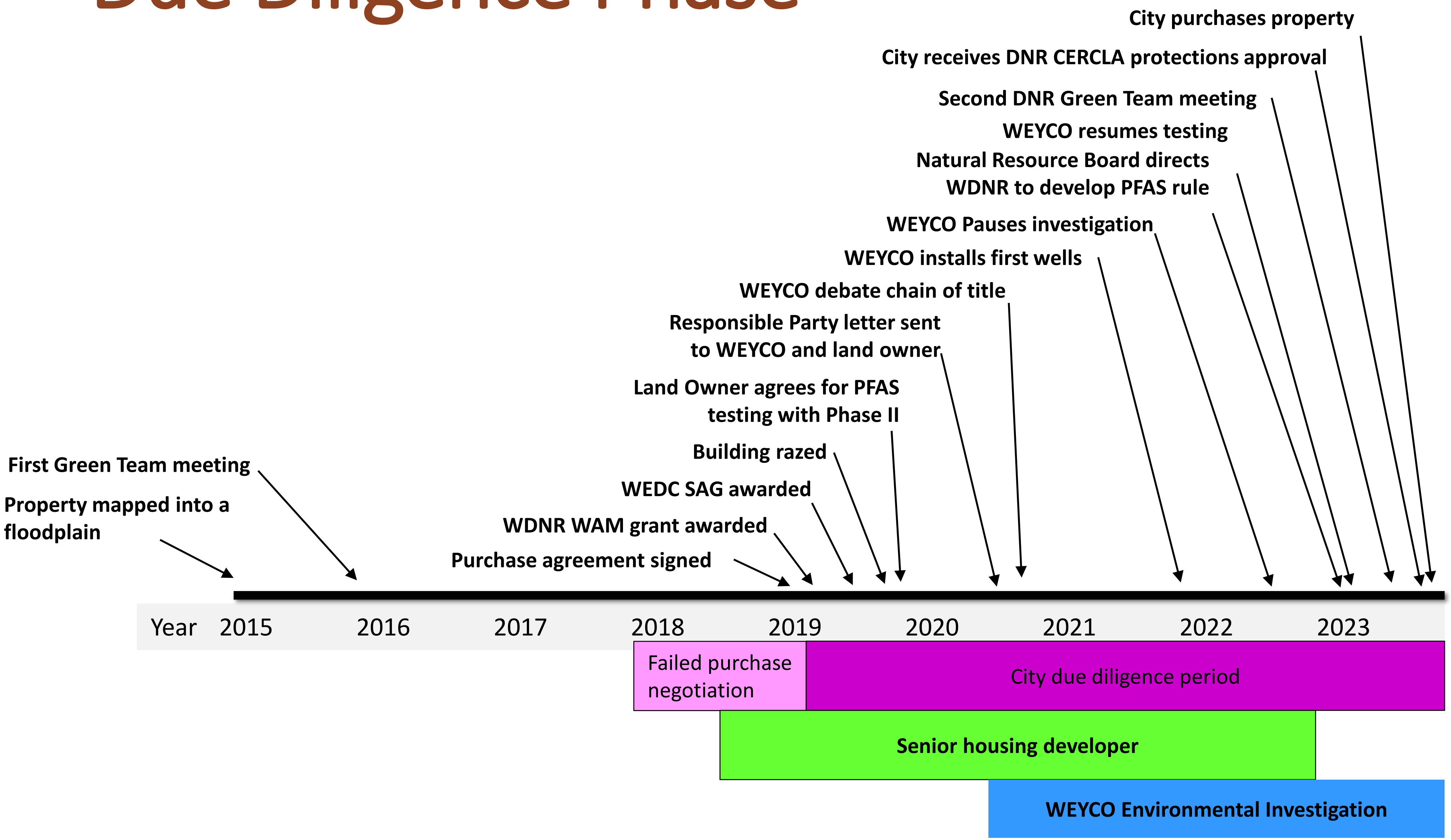
2008 Floodplain Map



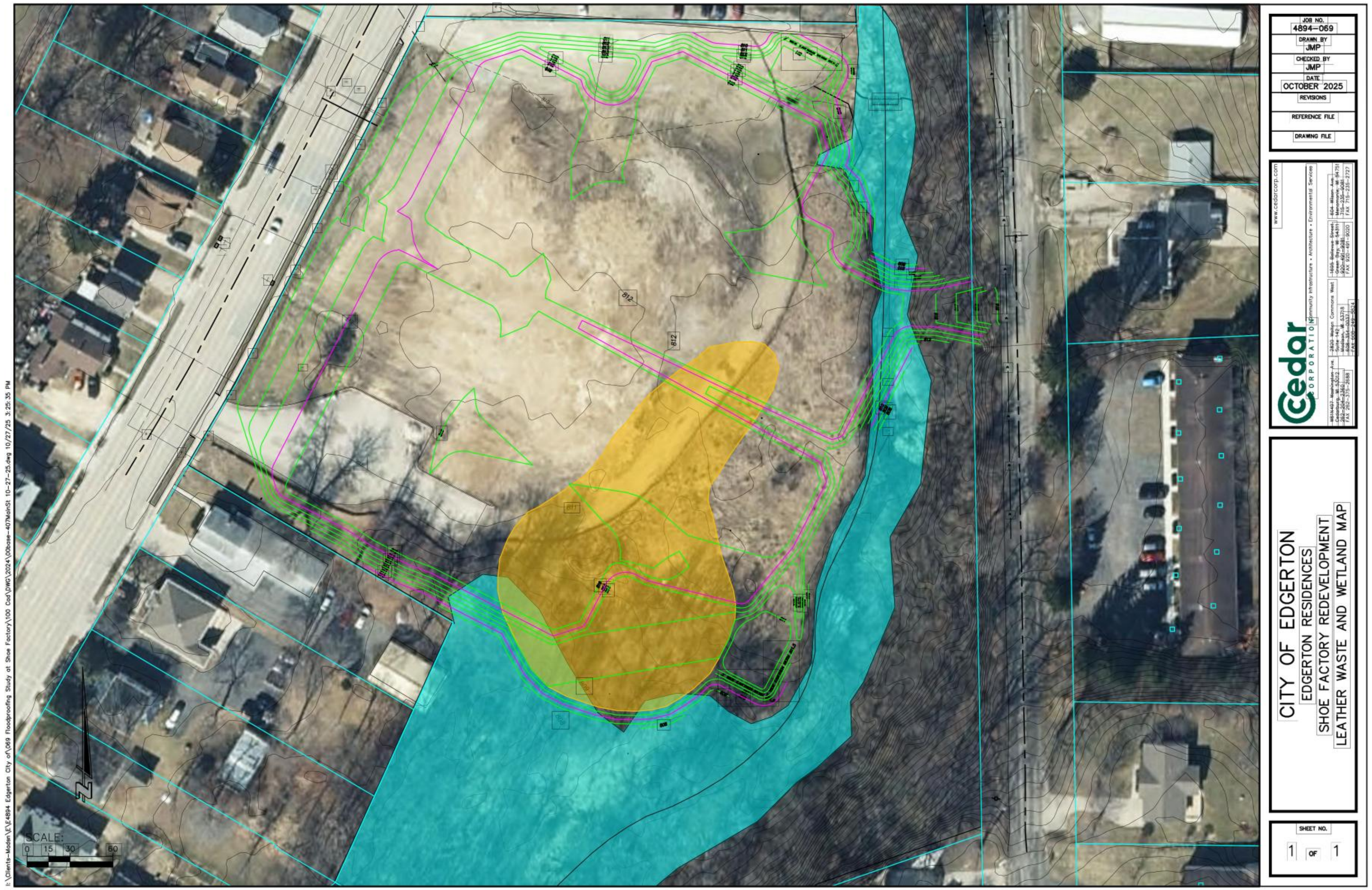
2015 Floodplain Map



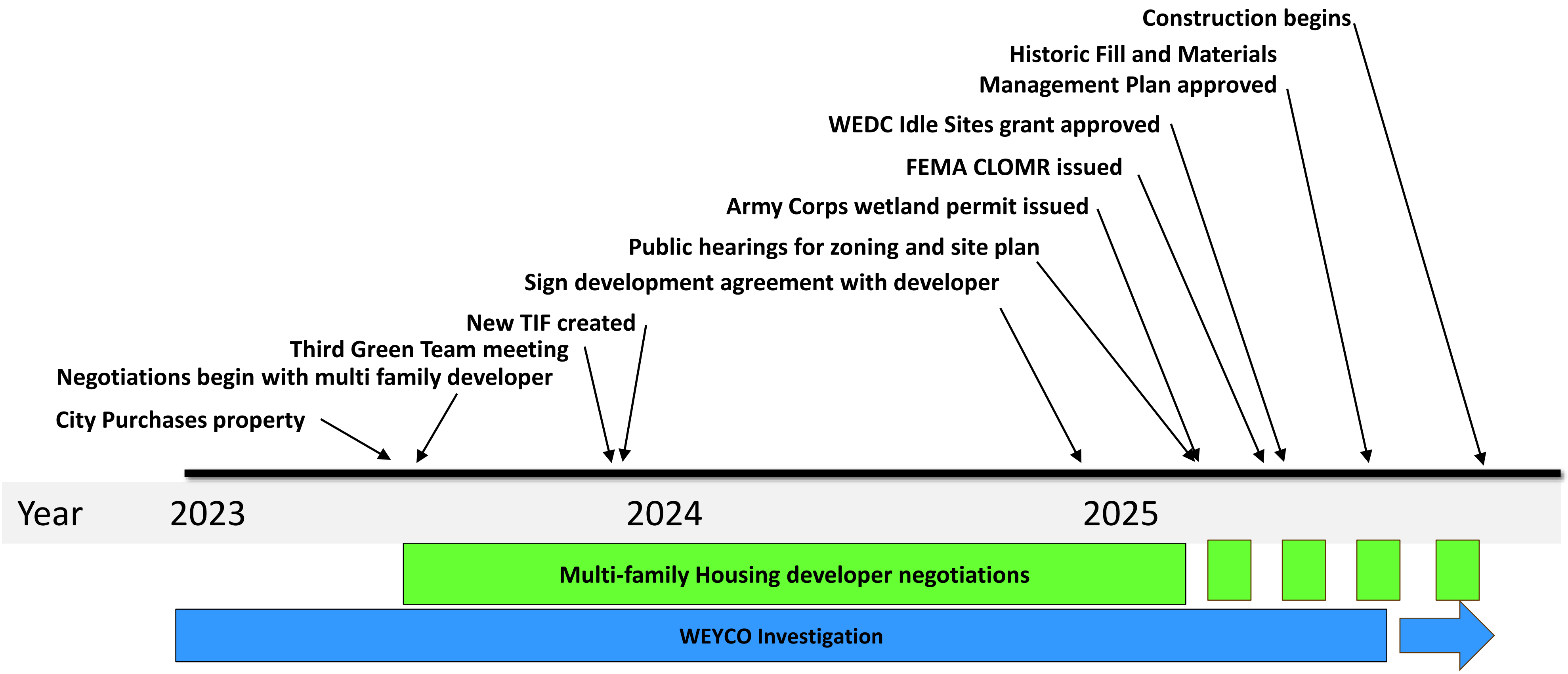
Due Diligence Phase



Wetland and Leather Scraps



Redevelopment Phase



Take Aways

- Seller
- Responsible party
- Good consultants
- Permitting agencies
- City Council and committees
- Economics
- TIF
- Willing Developer
- Grants
- Right place –right time
- Patience

Questions?

Case Study

Todd Schmidt and Sue McDade

Village of Waunakee

Tips, Tricks and Examples

Karen Campoli, DNR

Fee reviews & DNR Feedback

Recommend submittal of a review fee

- With SIWP, SIR and RAP to get feedback sooner in the SI process
- Can catch issues sooner - before reaching closure

Recommend submission of a RAOR

- Outline the decision for the chosen remedy, especially for complex sites
- Explain why certain options were or were not chosen (too expensive, ineffective, construction needs, etc.)

Reach out to DNR early

- Can help determine if site is ready for development

What is the Site's End Use?

Understand the end use of the site.

What COs will be applied at closure?

Residential building with parking lots?

Park/green space?

Imported soil to raise the grade/ capping?

On-site COs often mean more work in the future.

Think hard about the long-term costs associated with COs (NR 722.07(5)(b)).

Think About Vapor Early

- Assess early in the SI process to prepare for remediation (RR-800).
- Criteria for case closure at sites with vapor contamination available (NR 726.05(8)).
- Exceedance of a VRSL requires a remedial action to reduce the mass and concentration of volatile compounds to the extent practicable.
- Installation of VMS is not considered a remedial action.
- Think about off-site notifications. Talk to owners about COs before the 30-day notice letter and before submitting the closure packet.

Monitored Natural Attenuation (MNA) as a Remedy

Justify use with the collection and interpretation of MNA parameters

Consider collecting MNA parameters during the SI to establish pre-remedial conditions

Field Parameters:

Specific conductance
pH
temperature
oxidation reduction potential (ORP)
dissolved oxygen (DO)

Recommended parameters:

Nitrate, Manganese
Ferrous Iron
Sulfate

Moderated Panel Discussion

Derek Punches,

Godfrey & Kahn

Schedule: Back to Basics Sessions

Back to Basics Training: Planning for Remediation Oct 29, 2025

January 23, 2026

- **Applying for Closure and Maintaining Continuing Obligations**
- Madison, Milwaukee, TBD & virtual

April 21, 2026

- **Notifying Affected Parties and the Public**
- Locations TBD

Thank you!

https://forms.office.com/g/40ejbZuE2e

Back to Basics Training: Planning for Remediation Oct 29, 2025

CONNECT WITH US

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"WILD WISCONSIN: OFF THE RECORD"