



# Milwaukee Water Pollution Abatement Program (MWPAP) 1977-1995



# Place in CH2M HILL History



CHAPTER 4 - South Tahoe Public Utility Project

CHAPTER 10 - Upper Occoquan Sewerage Authority

**CHAPTER 13 - The Milwaukee Water  
Pollution Abatement Program**

CHAPTER 20 - Rocky Flats

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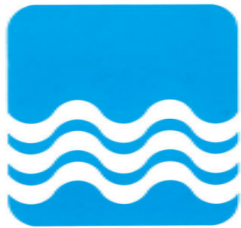
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# 1977



- Staff Size < 1,500 employees
- Annual Revenue ~ \$60 million
- No international network, No O&M Business Group
- In fact, no business groups (TBG / WBG / ESG)
- Corvallis OR – Company HQ
- Fred Merryfield passed away
- Ralph Peterson (future CEO) – PM for Wisconsin paper mills

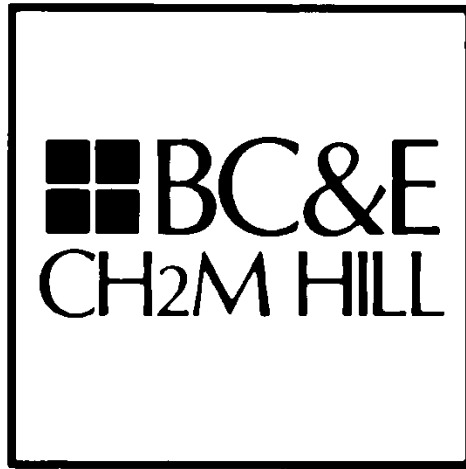


**Milwaukee Metropolitan  
Sewerage District**

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# CH2M HILL History - 1977



Black, Crow and  
Eidsness  
Gainesville, FL

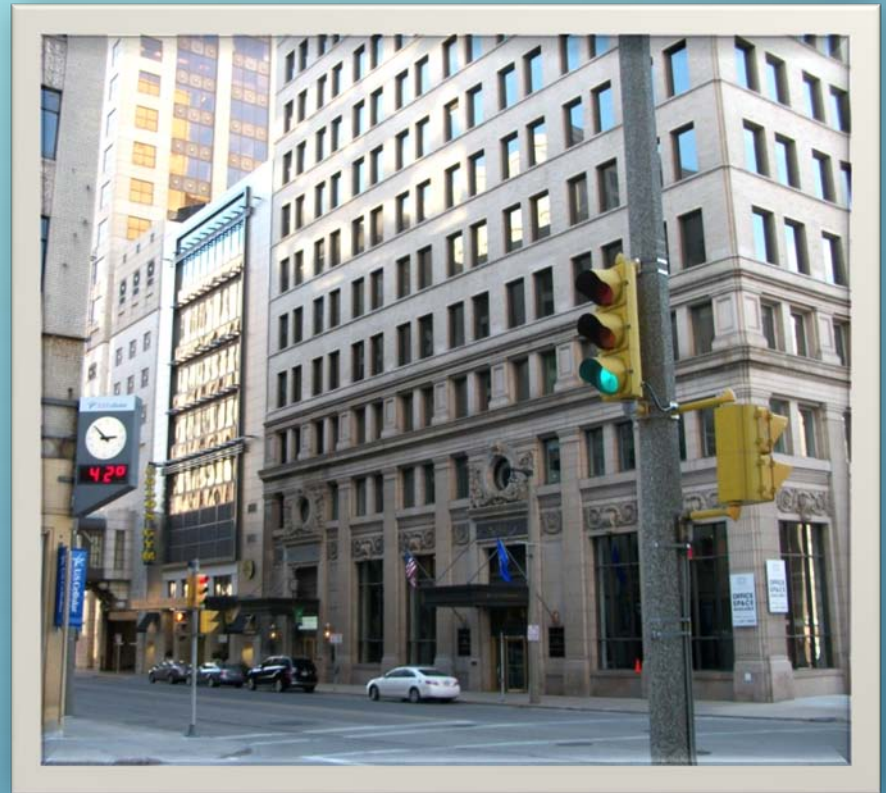
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# CH2M HILL (GLO / PMO) - 1977



**GLO – Mayfair Road**



**PMO – Water & Mason**

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# Prior to the Milwaukee Water Pollution Abatement Program (MWPAP)

- Community sewers
  - > 400 sanitary sewer overflow locations
  - ~ 120 combined sewer overflow locations
- MMSD interceptors
  - 20 +/- sanitary sewer overflow locations
- Treatment was provided at 2 MMSD plants and several community plants



# MWPAP Drivers

- Raw sewage overflows
- Wisconsin DNR law suit (Dane County)
  - Reduce overflows
  - Compliance schedule
- Illinois law suit (US District Court)
  - Eliminate overflows
  - Provide advanced treatment

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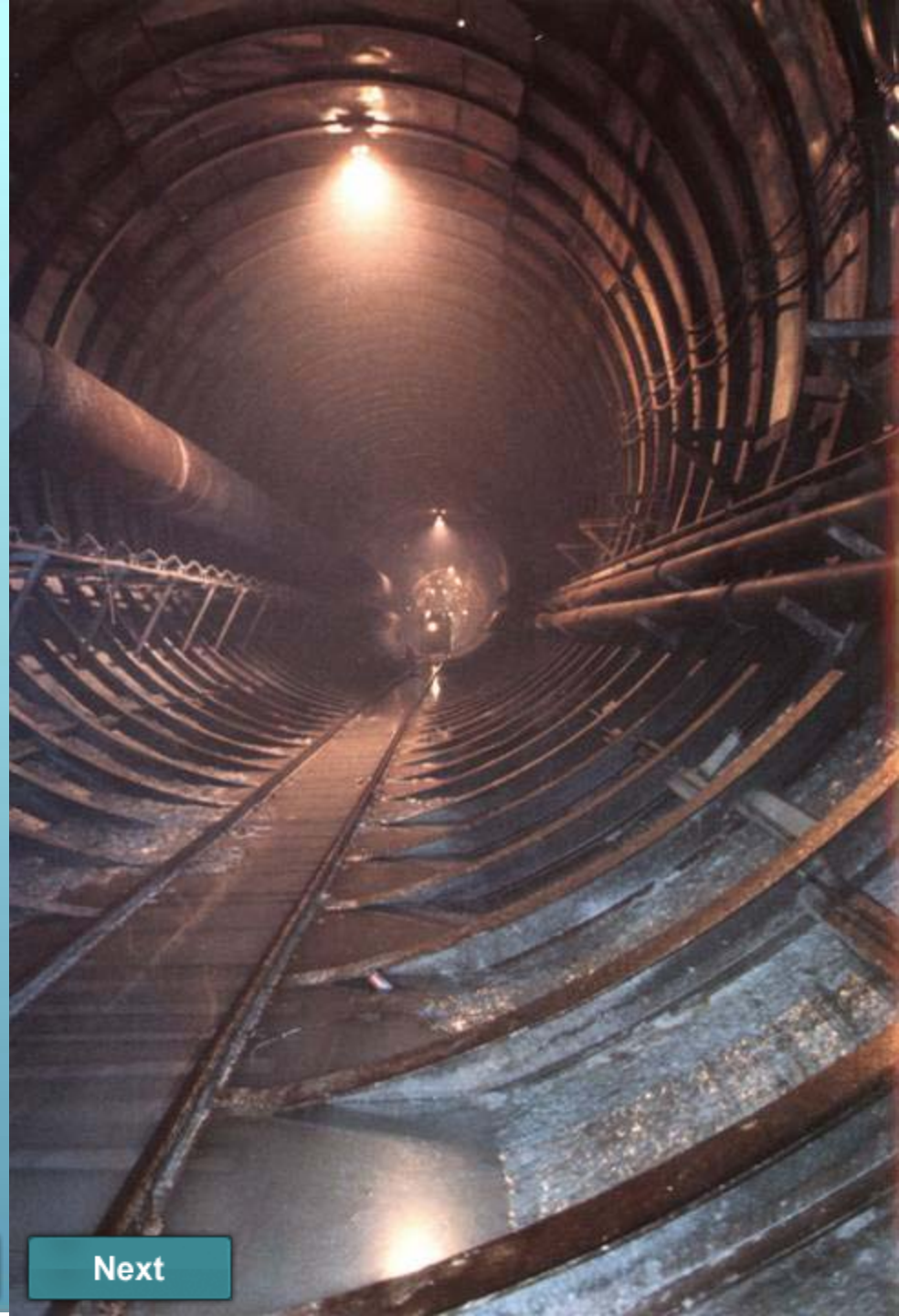


# Approach

- Program Management Office (master agreement)
- Master schedule 1977-1996
- Up to 600 engineers associated with up to 88 companies (MMSD & consultants)
- Over 300 construction contracts
- Worked closely with WDNR & EPA to maximize grant funding (~ 48%)

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# Main Program Elements

- CH2M HILL – Program Manager
- Tom Gibbs, Hank Padgham, Gary Beech, John Ramage

Element	Planning Lead	Design Lead
Wastewater System (interceptors / tunnels)	HNTB	HNTB
Jones Island WWTP	CH2M HILL	CH2M HILL
South Shore WWTP	Donohue (now AECOM+Donohue)	Donohue (AECOM+Donohue)
Solids Management	CDM (now CDM Smith)	(put into plant design)

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South Shore WWTP

Jones Island WWTP



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# Milwaukee Water Pollution Abatement Program



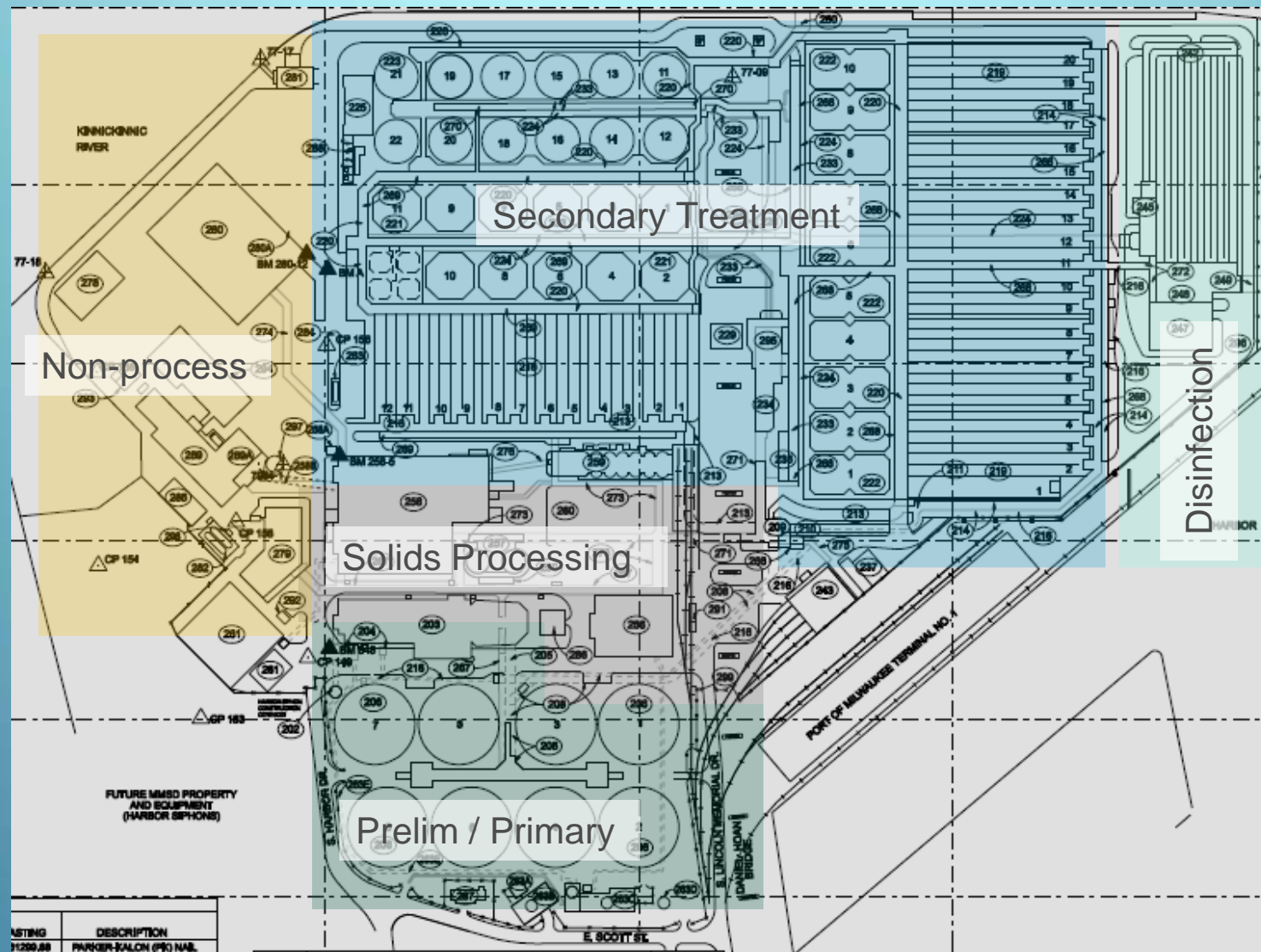
The Jones Island Wastewater Treatment Plant, listed on the National Register of Historic Landmarks, was one of the first plants to use the activated sludge process. Excess sludge is heat-dried and processed into Milorganite™, an organic fertilizer product sold and distributed around the world since 1923.

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# Jones Island – General Plan



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# Jones Island – Aeration Basin Diffusers



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# Jones Island Project History

- Planning / Pre-Design – 1978 thru 1981
- Design – 1981 thru 1993
- Construction – 1981 thru 1995
- Over 50 construction contracts
- Operations during construction critical
- No effluent permit violations

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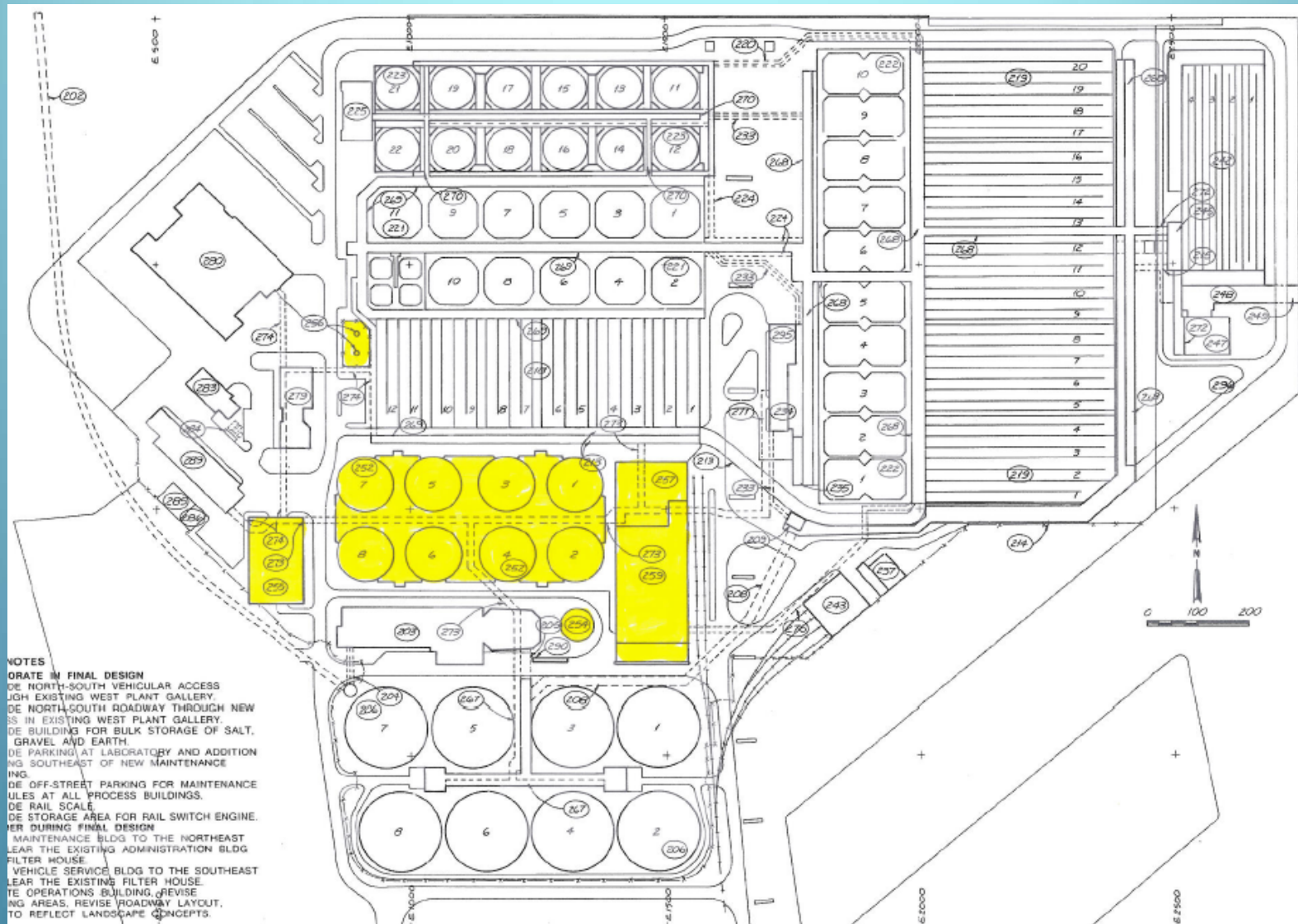
# **Jones Island – Planning and Design**

- Kim Erickson – Project Manager
- Key Concepts
  - Communication - No PCs, No e-mail
  - Design team located together
  - Corvallis core design team
  - Design contract lead engineers

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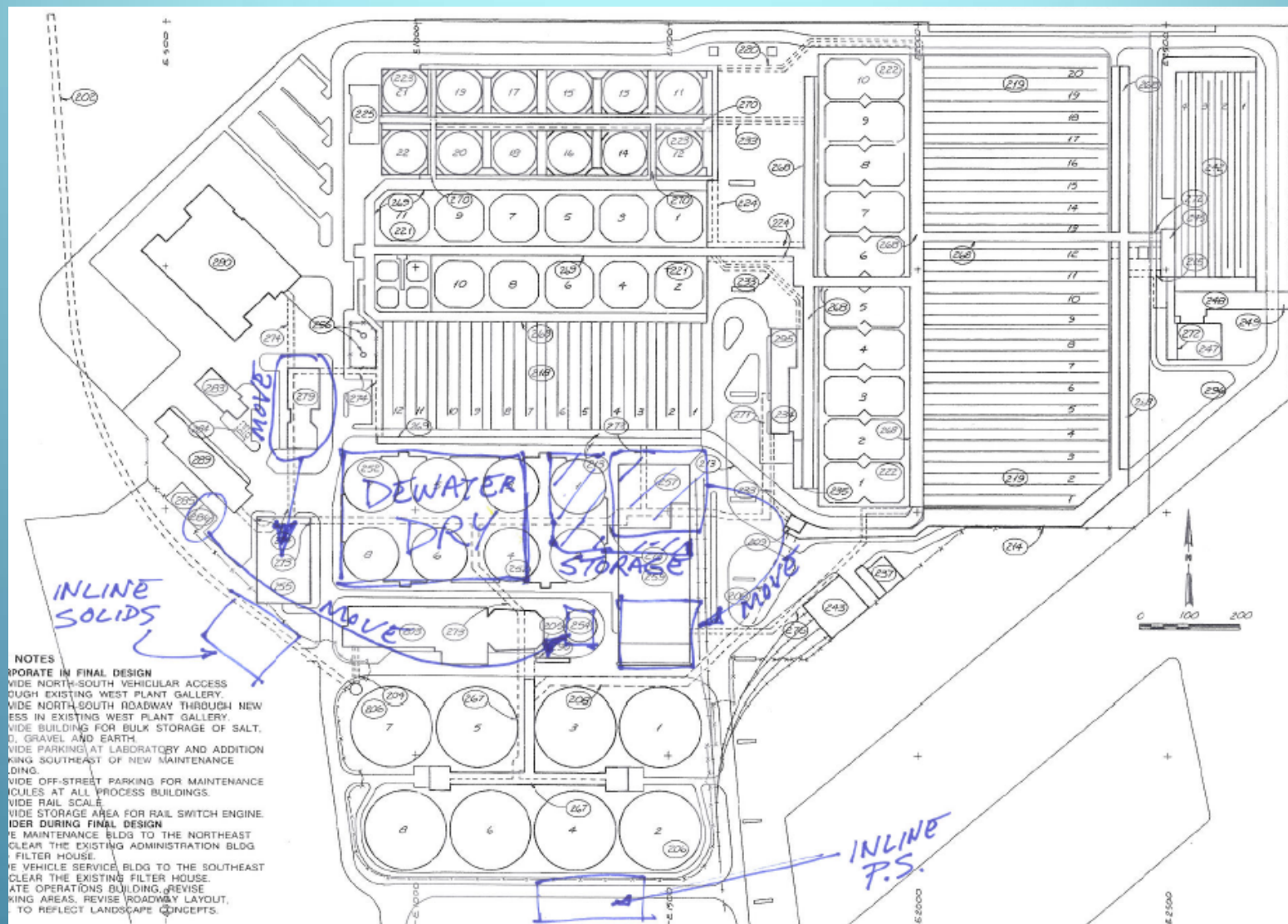
# Jones Island – 1981 Solids Plan



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# Jones Island – 1983 Project Plan

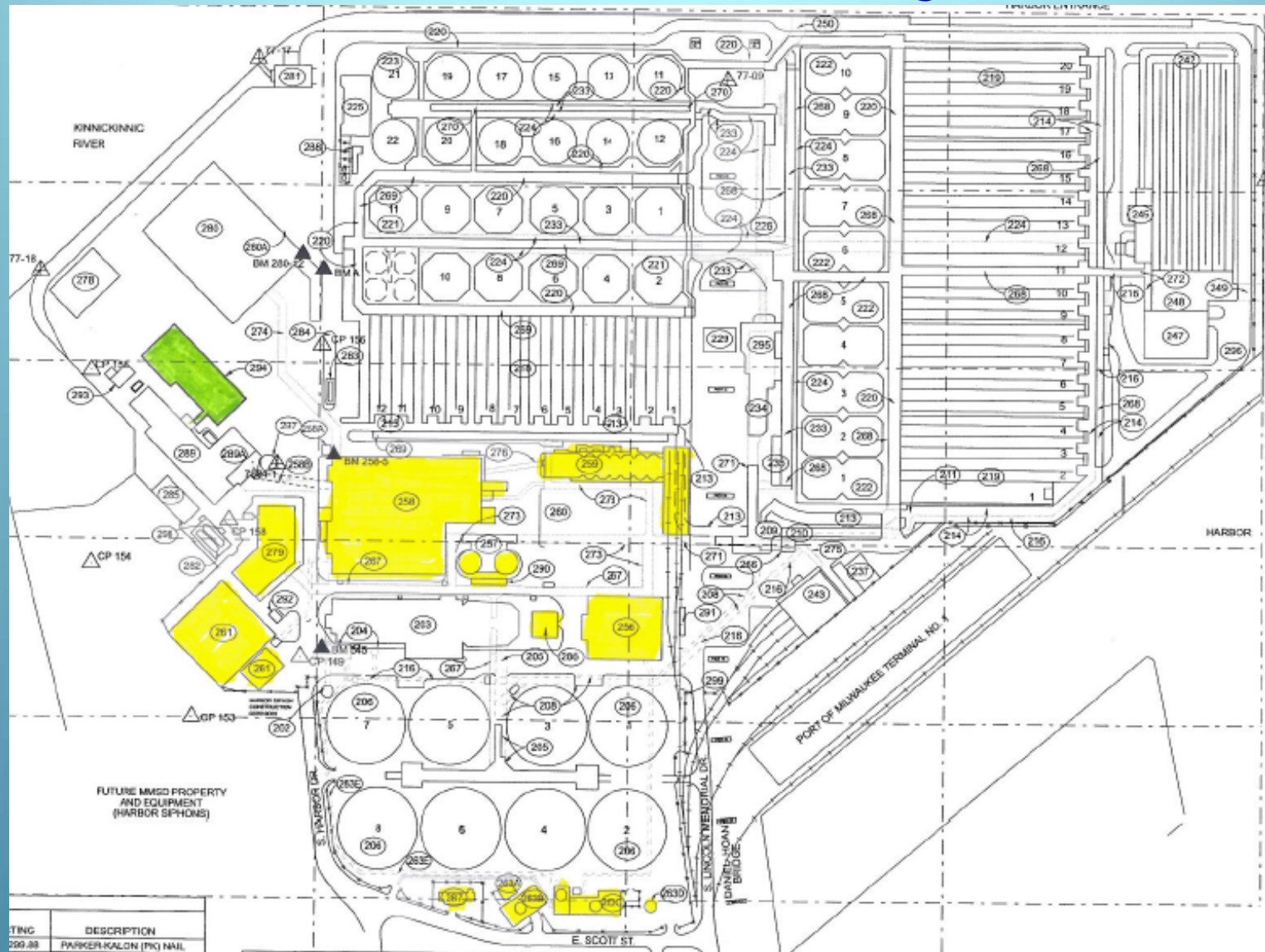


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# Jones Island – Final Project Plan

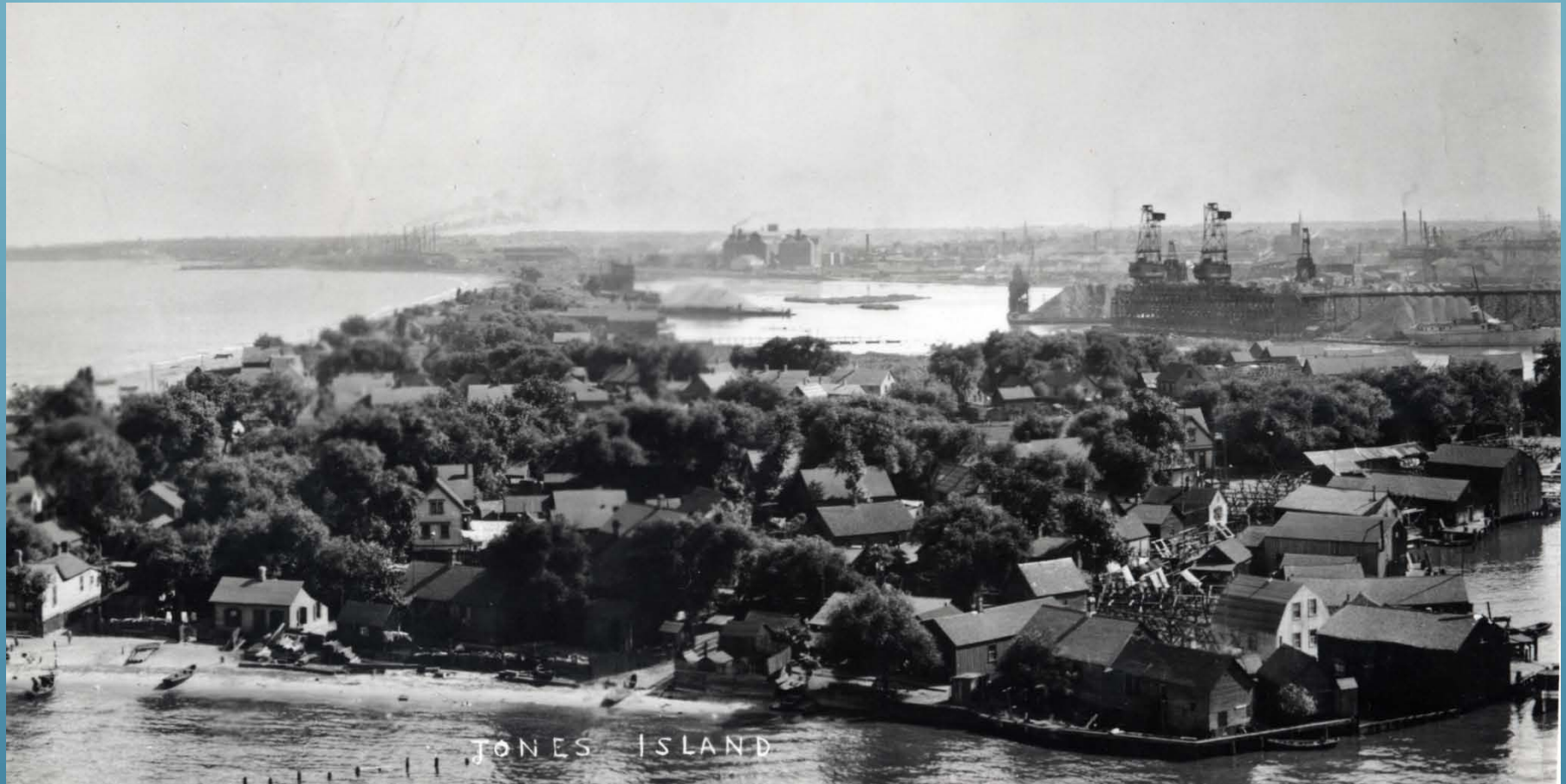


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# Jones Island – Kashube Fishing Village



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# Jones Island WWTP (WRF)



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# Jones Island Dewatering and Drying Facility



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# Jones Island Dewatering and Drying Facility

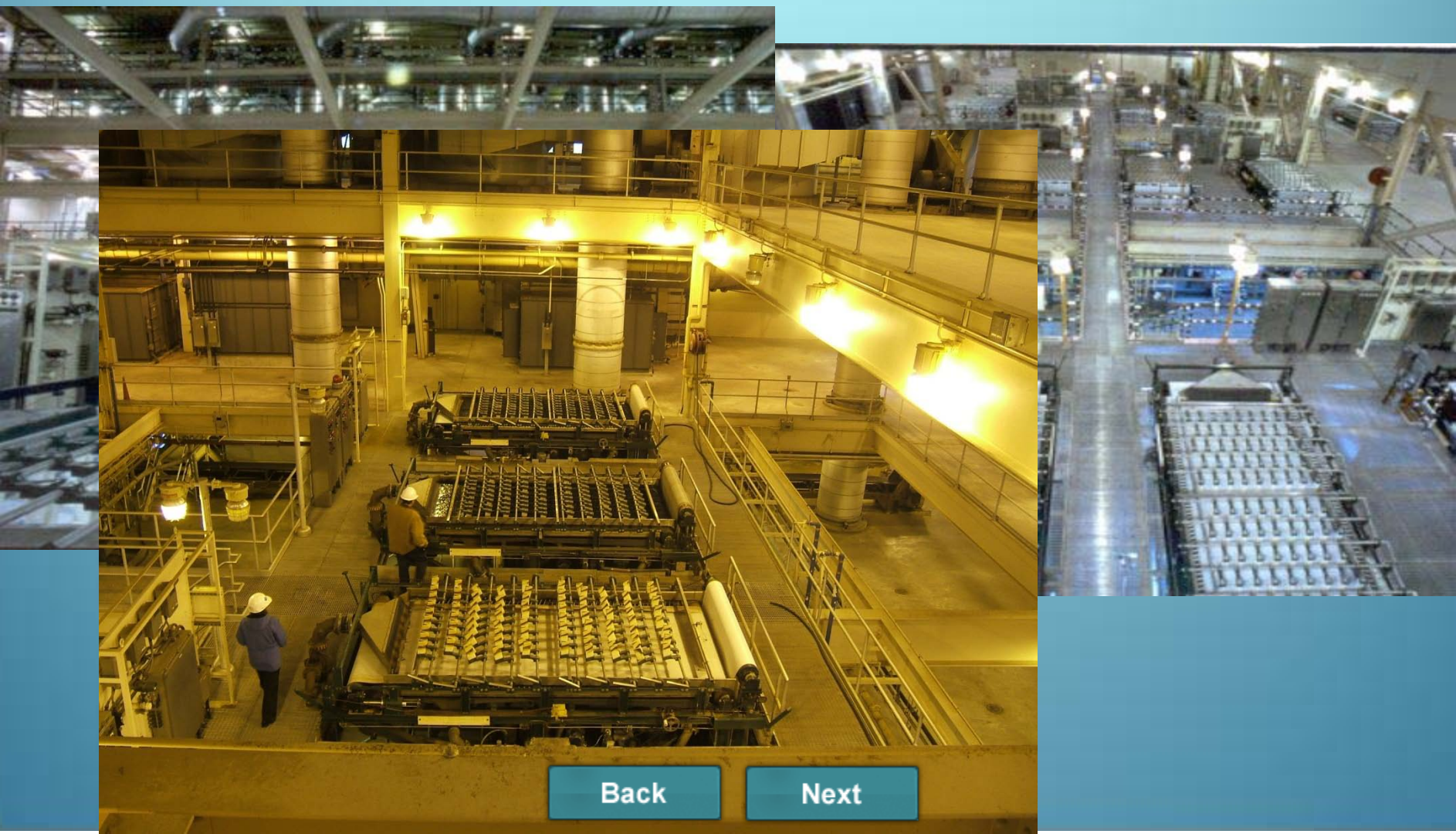


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# Jones Island Dewatering and Drying Facility



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# Jones Island – Dewatering and Drying Facility



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# Jones Island – D&D Factoids

- 1,575 drawings < 16 months
- 30,000+ cubic yards concrete
- 169,000 feet (32 miles) piling
- 1,300 miles wires
- 2+ miles sludge/product conveyors
- Milorganite samples

**CH<sup>2</sup>M HILL**

**(GLO)**



Engineers  
Planners  
Economists  
Scientists

Reuss Federal Plaza (1980s)

**(GLR / MKE)**



**CH<sup>2</sup>M HILL**

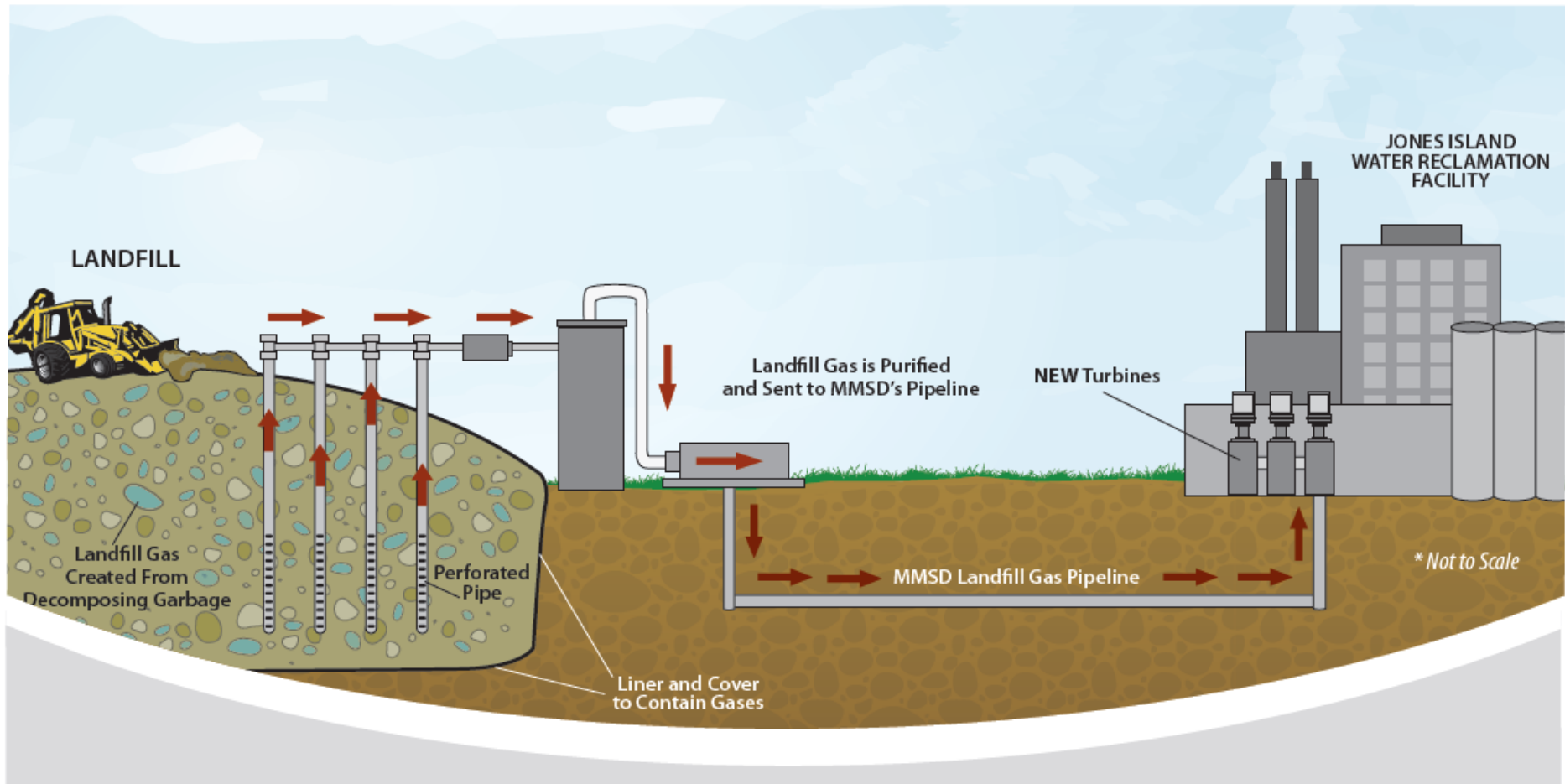
411 East Wisconsin (1990s)

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# Jones Island – 2012

## Landfill Gas to Energy

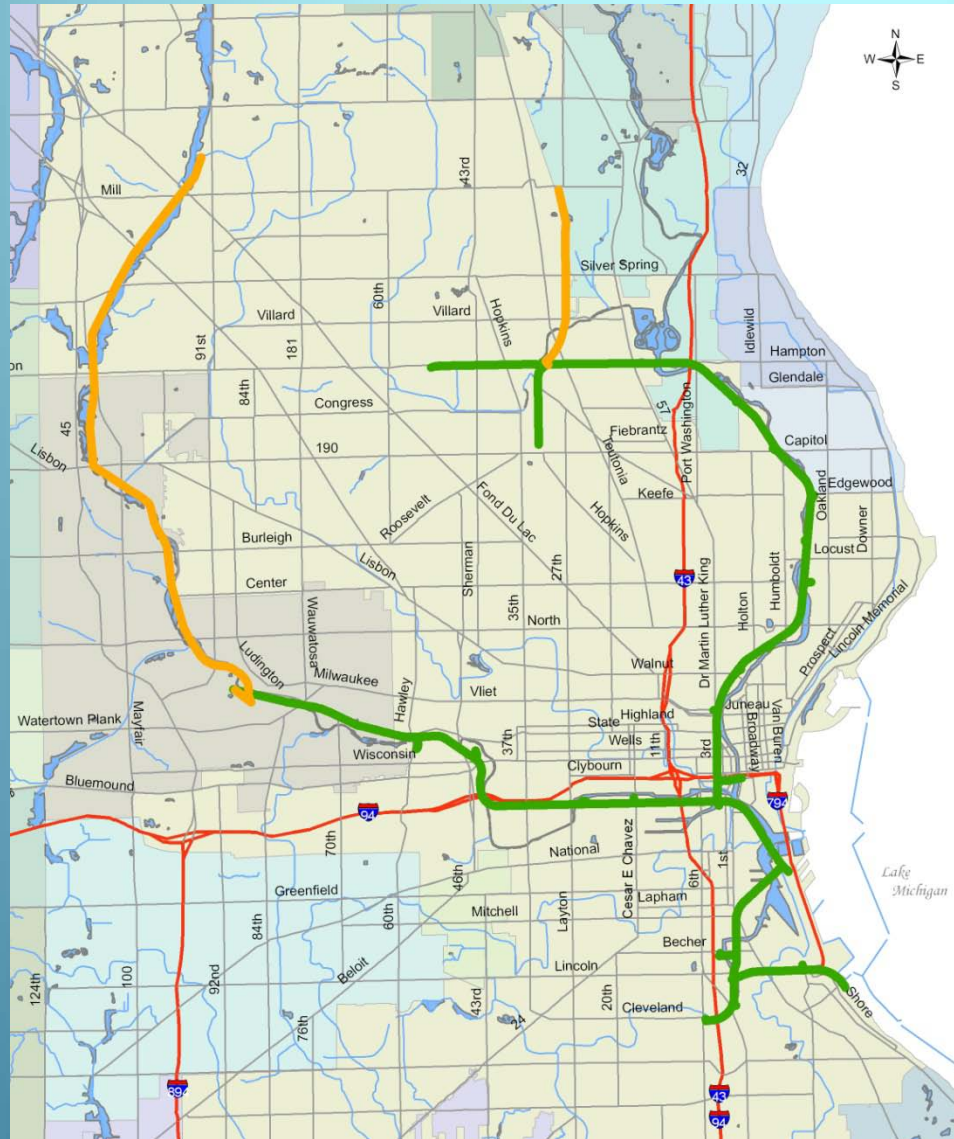


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Graphic: courtesy of MMSD





# Inline Storage System

Green is from  
MWPAP

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# Typical TBM (in shop)



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# TBM Cutterhead



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# TBM Launch Site



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# Typical Roof Support Rock Dowel System — possibly add straps/mesh



05.13.2009 08:15

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STA 251+35

“A Station that  
shall live in  
infamy.”

1<sup>st</sup> Problem!  
2500 GPM

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# Second Problem!

## Rock Dowels can't be installed



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# Combination: Rib and Boards Plus Water



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# Lesson Learned: Don't mine down hill



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# **A Tight, Wet 32'-4" Tunnel –**

**Not for the  
claustrophobic**

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# Connection bet. NS Ph 1 and Ph 2

## shortest , steepest waterslide in WI



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# Best use write-in-rain notebooks when underground



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**Just a peek!**



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**A bit wider, please.**



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# Breakthrough!



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# Inline Storage System at a Glance

- Collectors
- Shafts
- Tunnels
- Central Control System



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# Consolidated Shafts

- Intercepting structures capture overflows before spilling into the waterways
- Collector sewers consolidate overflows and route towards the tunnels
- 24 Dropshafts (IIHL Vortex Type-H)
  - reduced size of drop chamber by dissipating energy through wall friction
- 9 Maintenance Access shafts 15 - 27 feet in diameter

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# Tunnels

- 12 to 30 foot diameter
- ~ 20 miles long
- 300 feet below ground
- 400+ million gallons
- grouted rock surface
- 40% concrete lined
- 3 ~ 50 MGD dewatering pumps

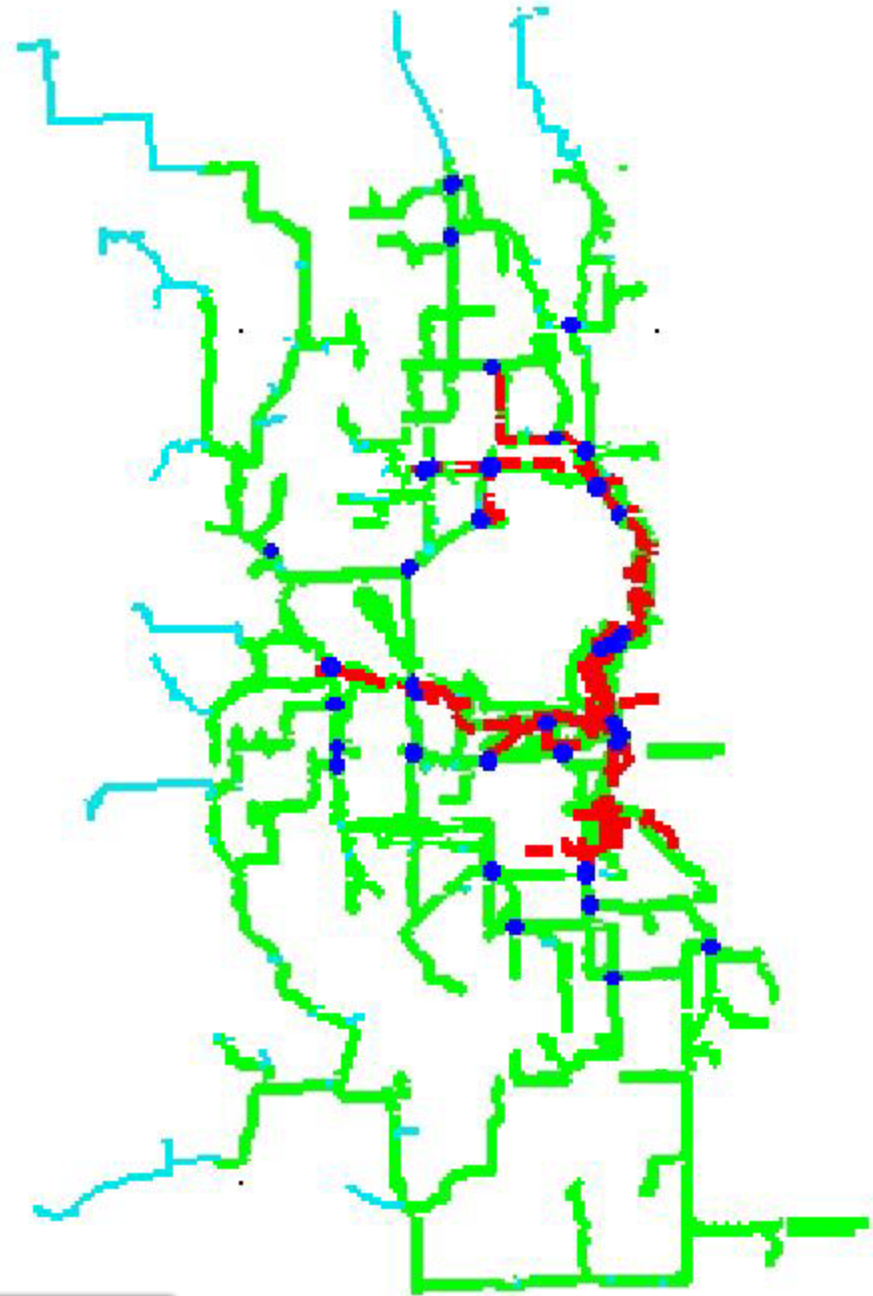


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# Real Time Controls

- 12 automated pump stations
- 38 automated diversions
- 176 passive diversions
- 250 level monitoring stations
- 103 RTUs
- Dedicated Telephone Lines
- Central control computer
- 17 weather stations

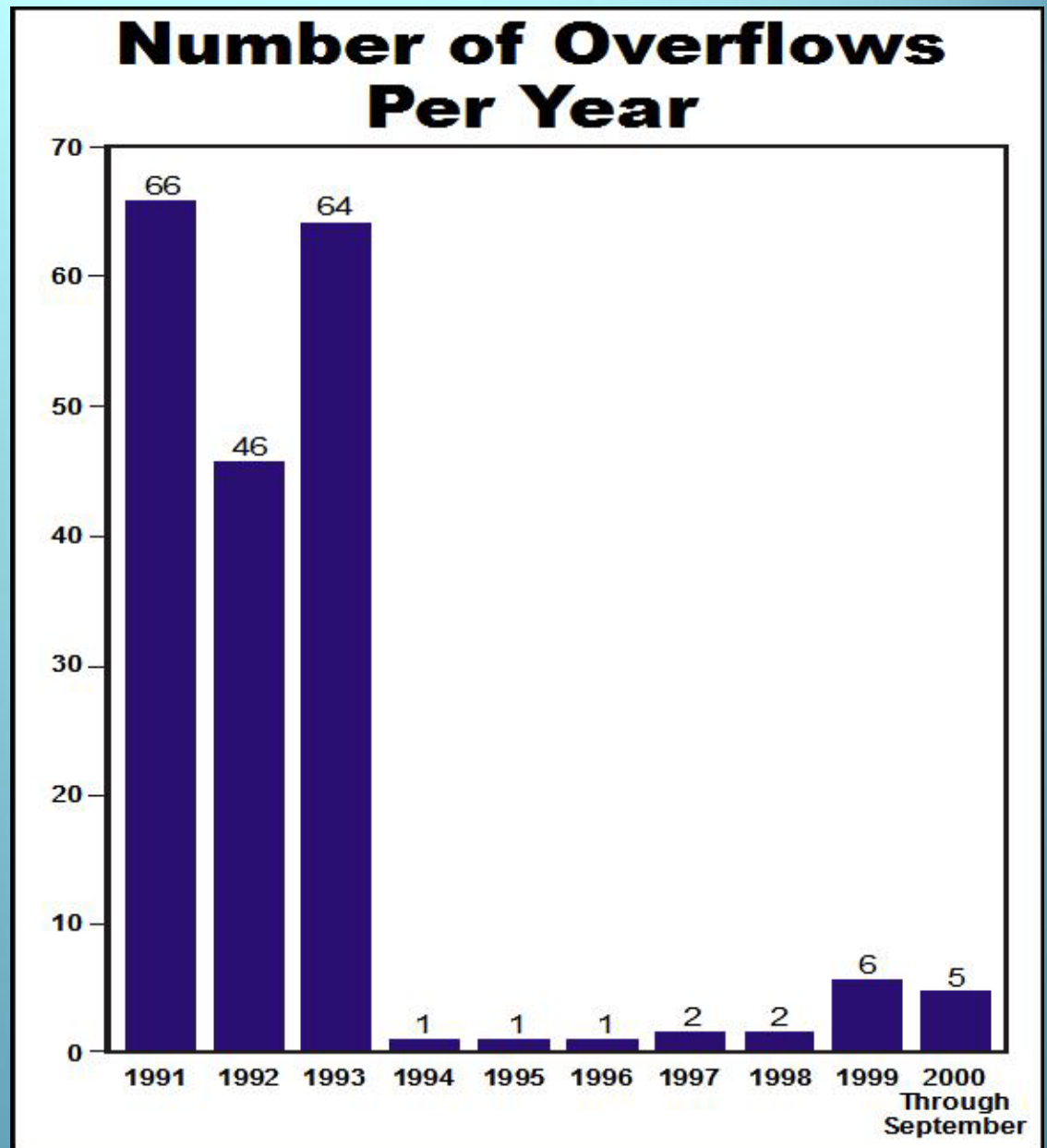


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# Number of CSO Overflows Pre (1991-1993) & Post (1994-2000) Deep Tunnel Operation

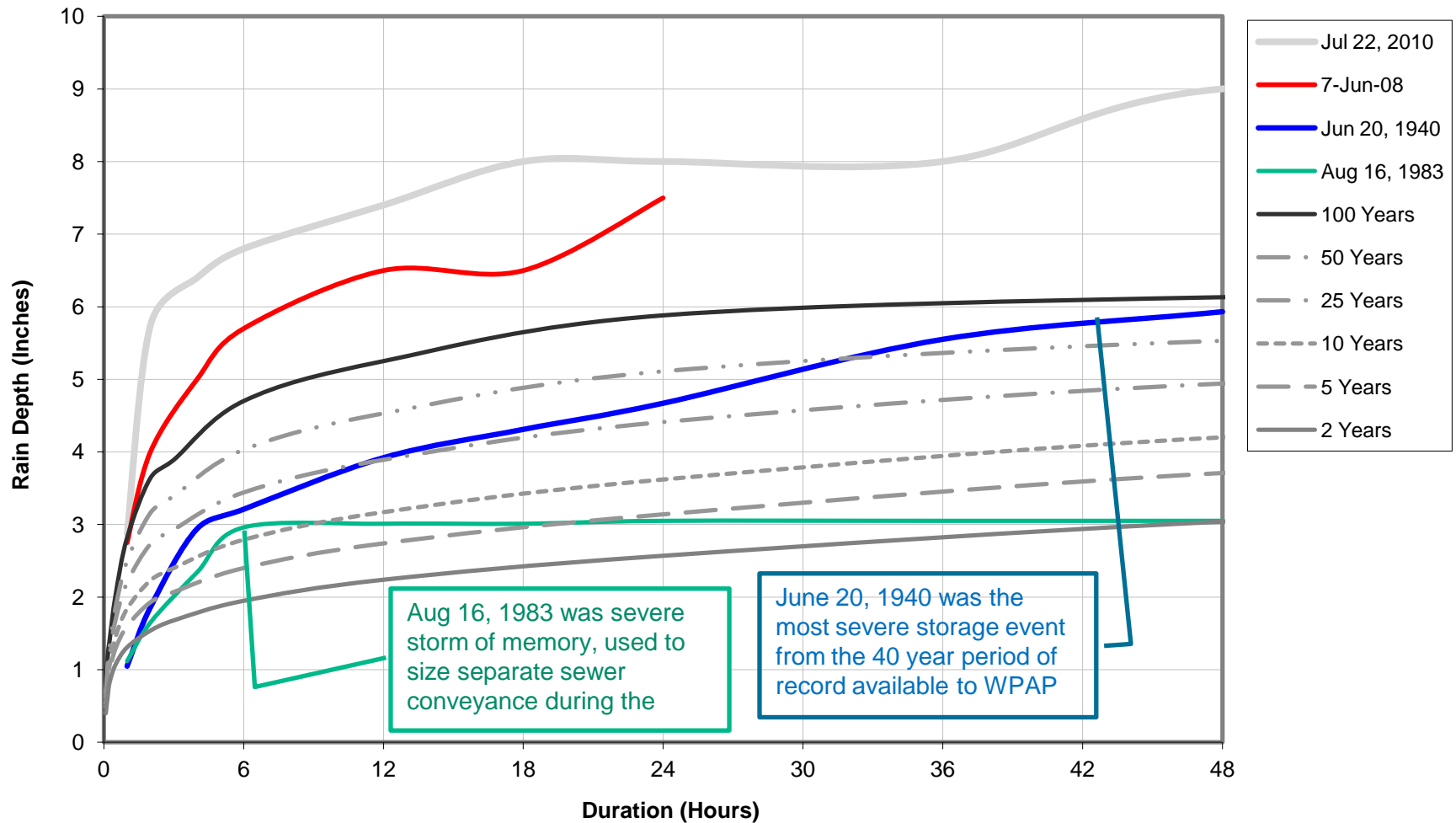


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**Depth Duration Frequency Curves**  
From SEWRPC Technical Report 40  
With Storm Data from Maximum Gage Reported to MMSD



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# MWPAP Summary

- Facility Plan w/Environmental Assessment ~ \$247M
- Jones Island Wastewater Treatment plant ~ \$678M
- South Shore Wastewater Treatment plant ~ \$203M
- Deep Tunnel ~ \$705M
- Combined Sewer Overflow/Connections to Deep Tunnel ~ \$338M
  
- Offsite Solids Management ~ \$52M
- MIS and Local Rehabilitation ~ \$32M
- Hydraulics and Control ~ \$30M

■ **Total Cost : \$2.3 billion**

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# MWPAP Breakdown of Costs

<u>Construction</u>	<u>(\$ Millions)</u>	<u>%</u>
Jones Island	534.7	23.2
South Shore	145.9	6.3
Offsite Solids	37.5	1.6
Interceptors & Relief Sewers	590.4	25.6
Combined Sewer Overflow	285.8	12.4
Sewer Rehabilitation	4.4	0.2
Hydraulics & Controls	20.1	0.9
<u>Non-Construction</u>		
Planning	78.3	3.4
Design	132.5	5.8
Program Management	143.1	6.2
Services During Construction	261.7	11.4
Land Acquisition	10.8	0.5
Payments to Municipalities	4.6	0.2
Other MMSD Costs	52.5	2.3

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# MWPAP Impact on Milwaukee Engineering

- EMCS
- Kapur and Associates
- TN and Associates
- Symbiont
- Donohue – *the current version*
- AES Engineering
- Superior Engineering



# MWPAP Impact on CH2M HILL

- Set the stage for major program work (Rocky Flats, Puerto Rico, London Olympics, etc)
- Set the stage for major tunnel work (Singapore, Thames River)
- Set the stage for core technologies (geotechnical, cost estimating, scheduling, permit and consent decree negotiation, real time controls, dropshaft hydraulics, utility management services)

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# MWPAP Impact on Water Quality



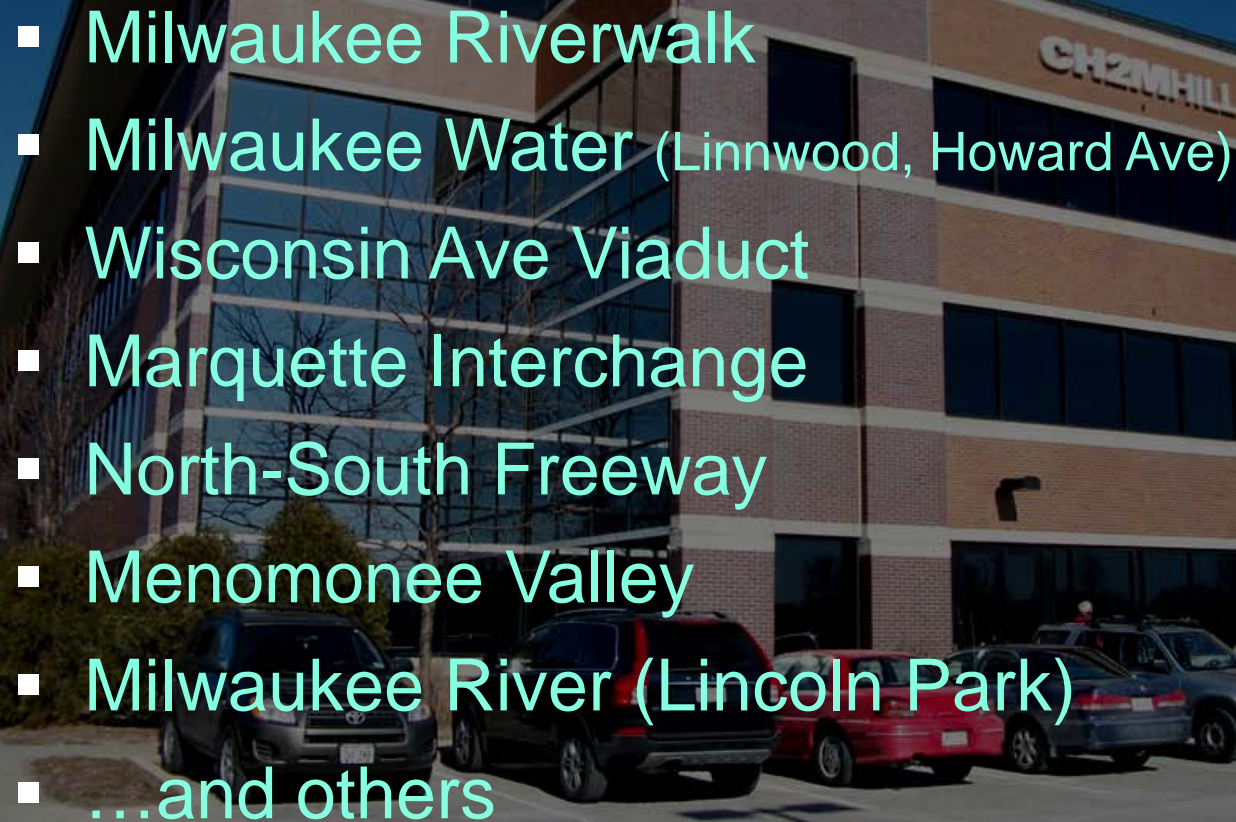
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# CH2M HILL Impact on Milwaukee

- 
- A photograph of a modern, multi-story office building with a brick and glass facade. The building has large windows reflecting the sky and surrounding environment. The name 'CH2MHILL' is visible on the upper right side of the building. In the foreground, there is a parking lot with several cars parked. The sky is clear and blue.
- Milwaukee Riverwalk
  - Milwaukee Water (Linnwood, Howard Ave)
  - Wisconsin Ave Viaduct
  - Marquette Interchange
  - North-South Freeway
  - Menomonee Valley
  - Milwaukee River (Lincoln Park)
  - ...and others

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# End of Presentation

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