Metropolitan Water Reclamation District of Greater Chicago

WELCOME
TO THE MARCH EDITION
OF THE 2019
M&R SEMINAR SERIES

BEFORE WE BEGIN

- SAFETY PRECAUTIONS
  - PLEASE FOLLOW EXIT SIGNS IN CASE OF EMERGENCY EVACUATION
  - AUTOMATED EXTERNAL DEFIBRILLATOR (AED) LOCATED OUTSIDE
- PLEASE SILENCE CELL PHONES OR SMART PHONES
- QUESTION AND ANSWER SESSION WILL FOLLOW PRESENTATION
- PLEASE FILL EVALUATION FORM
- SEMINAR SLIDES WILL BE POSTED ON MWRD WEBSITE (www. MWRD.org: Home Page ⇒ Reports ⇒ M&R Data and Reports ⇒ M&R Seminar Series ⇒ 2019 Seminar Series)
- STREAM VIDEO WILL BE AVAILABLE ON MWRD WEBSITE (www.MWRD.org: Home Page ⇒ MWRDGC RSS Feeds)

James J. Yurik, Jr., P.E.
John Watson, P.E., C.F.M.

- **James Yurik** began his career at the MWRD in 1991, working in the Local Sewer Section of the Engineering Department as an Assistant Civil Engineer, where his main responsibility was administering the Infiltration and Inflow program. Since 2013, Jim has served the District as a Principal Civil Engineer in the Engineering Department, Stormwater Section. This position is in charge of the District's Green Infrastructure Program that promotes and implements green solutions to aid in flood prevention, and storm water reduction in collection systems.
  - **University of Illinois at Urbana-Champaign:** Bachelor of Science in Mechanical Engineering (BSME), Concentration in Pipe Flow and Thermodynamics, January 1986
  - **California State University,** Sacramento, CA**:** Completed Operation of Wastewater Treatment Plants Parts I, II and III
- **John Watson** is an associate civil engineer at the MWRD, where he manages green infrastructure stormwater projects and helped to develop their green infrastructure plan. Today, John is a Certified Floodplain Manager (**C.F.M**.) and a Professional Engineer. In his free time, John works on international development projects with Engineers Without Borders and with his church, with whom he has traveled to implement clean drinking water projects in Nigeria, Kenya, and Zambia, and Tanzania.
  - **University of Illinois at Urbana-Champaign:** Masters of Science in Civil Engineering - Environmental Hydrology & Hydraulic Engineering 2010
  - **Valparaiso University,** Valparaiso, IN**:** Bachelor of Science in Civil Engineering 2009

MWRD Green Infrastructure Program

Jim Yurik, PE and John Watson, PE
MWRD M&R Seminar Series 3/29/2019

Presentation Overview

- What is Green Infrastructure
- EPA Consent Decree
- Green Infrastructure Program Plan
- Projects
- Design Information
- Adaptive Management in GI
- National Green Infrastructure Certification Program
- Strengths, Limitations, and Trends in Green Infrastructure

Image: MWRD, JRW

What is Green Infrastructure?

Image: City of Chicago

Examples of GI

- Downspout Disconnection

Image: Storm Water Alliance for the Bay

- Rainwater Harvesting

Image: Aditya Rainwater Harvesters

- Rain Garden

Image: Washington State University Extension

Examples of GI

- Bioswales

Image: *Geosyntech ,Aaron Volkening*

- Permeable Pavements

Image: *MWRD, JRW*

- Green Roofs

Image: City of Chicago

Green Infrastructure Program Plan

- EPA Consent Decree from CSOs, entered Jan 6, 2014
- Requires TARP timeline & GI implementation
  - Rain Barrel Program
  - Land Use Policy
  - Community Assistance
  - Public Participation
  - Projects and Design Retention Capacity

EPA Consent Decree

- Distribute 10,000 rain barrels in the next three years, 15,000 rain barrels in the next five years---we distributed over 130,000.
- Obtain 2 million gallons of Design Retention Capacity (DRC) in the next five years, 5 million in the next ten years, 10 million in the next 15 years
- We were required to spend $325,000 in year 2014 for early GI program --- We spent over $600k.
- Law Department developed a Comprehensive Land Use Policy
- Stress community assistance and public participation and ensure uniform geographic coverage
- Emphasize Operations and Maintenance, IGAs now require M&O plans approved for all projects.

Exceeding Goals

- Consent Decree Requirements:
- Obtain 2 million gallons of DRC in the next five years, 5 million in the next ten years, 10 million in the next 15 years

- In the first five years, the District has already provided just under six million gallons of DRC, and anticipates at least two million more in 2019.

Green Infrastructure Projects at MWRD

Project	Approximate Cost to MWRD	Design Retention Capacity (MG)
Chicago Public Schools 2014-2018 (15 schools)	$4,300,000	2.78
Blue Island GI Project	$663,000	0.15
Wilmette Green Alleys	$130,000	0.07
Kenilworth Phase I	$1,200,000	1.32
Evanston Civic Center Parking Lot	$610,000	0.17
Northbrook: Wescott Park	$475,000	0.16

Green Infrastructure Projects at MWRD

Project	Approximate cost to MWRD	Design Retention Capacity (MG)
Niles – Oak Park GI	$169,000	0.05
Skokie Devonshire Park and Police Headquarters	$200,000	0.05
Berwyn Green Alleys	$666,700	0.62
Arlington Heights Police Station Parking Lot	$358,000	0.09
River Forest Gale Avenue Green Alley	$75,000	0.03
Wheeling Park District Chamber Park Parking Lot	$61,000	0.04

Intergovernmental Agreement (IGA)

1. An agreement between the District and the agency installing a GI project.
2. Ensures that the agency will follow through with construction of the project.
3. Ensures that the agency will meet diversity requirements if applicable
4. Ensures that the agency will operate and maintain the project after completion.
5. Ensures that the District will honor its financial commitment to the agency.

Rain Barrels

- The District's Rain Barrel Program utilized three distribution networks
  - Municipalities
  - non-government planning organizations and community groups
  - campus-type facilities
- Between 2014 and 2018, The District distributed 132,370 rain barrels.
- Assuming 55 gallons per barrel and 68 days of rain, the barrels keep almost ½ billion gallons of water out of the local sewer systems per year.

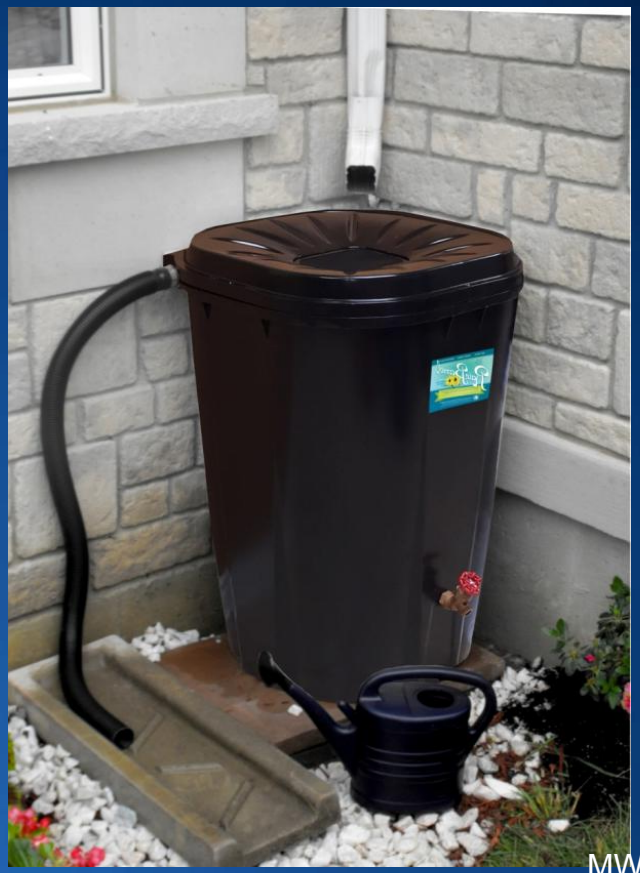


Image: MWRD PA

GI Community Assistance

- MWRD is committed to providing administrative and technical assistance to communities within its service area to facilitate the implementation of GI projects.
- MWRD worked with numerous stakeholders to share and gain knowledge on the:
  - Design
  - Installation
  - Maintenance of GI
- The District prioritizes GI projects that achieve MWRD's goals:
  - Reducing flooding
  - Reducing basement backups
  - Reducing CSO discharges

Partnerships

- City of Chicago:
  - Chicago Department of Water Management
  - Chicago Department of Transportation
  - Chicago Housing Authority
  - Chicago Public Schools
- Local Municipalities
- Partnering with others that have common goals in order to make our spending more effective.

Image: Data Conversion Laboratory

Public Participation

- The public's acceptance & appreciation of public GI projects is a first step to convincing the public of the need for GI improvements on private property
- The District will promote the use of GI through:
  - Watershed Planning Council meetings
  - Public workshops associated with projects
  - Publication of a webpage dedicated to GI
  - Development of stormwater master plans for Cook County

Pilsen / Blue Island Avenue Streetscape

Images: *MWRD, PA*

Pilsen / Blue Island Avenue Streetscape

Table 3: Changes in infiltration rate of permeable pavers at different locations of streetscape site (in mm/sec)

Date	Juarez Academy	Blue Island-North	Blue Island-South
October 2012	538.58	1077.17	1218.90
June 2013	255.12	255.12	510.24
June-End 2013	No Cleaning	Pavers Cleaned	Pavers Cleaned
August 2013	184.25	2692.91	10190.55
May 2014	141.73	1261.42	3784.25
July 2014		Pavers Cleaned	Pavers Cleaned
August 2014	141.73	2593.70	8418.90

Stickney Parking Lot Study

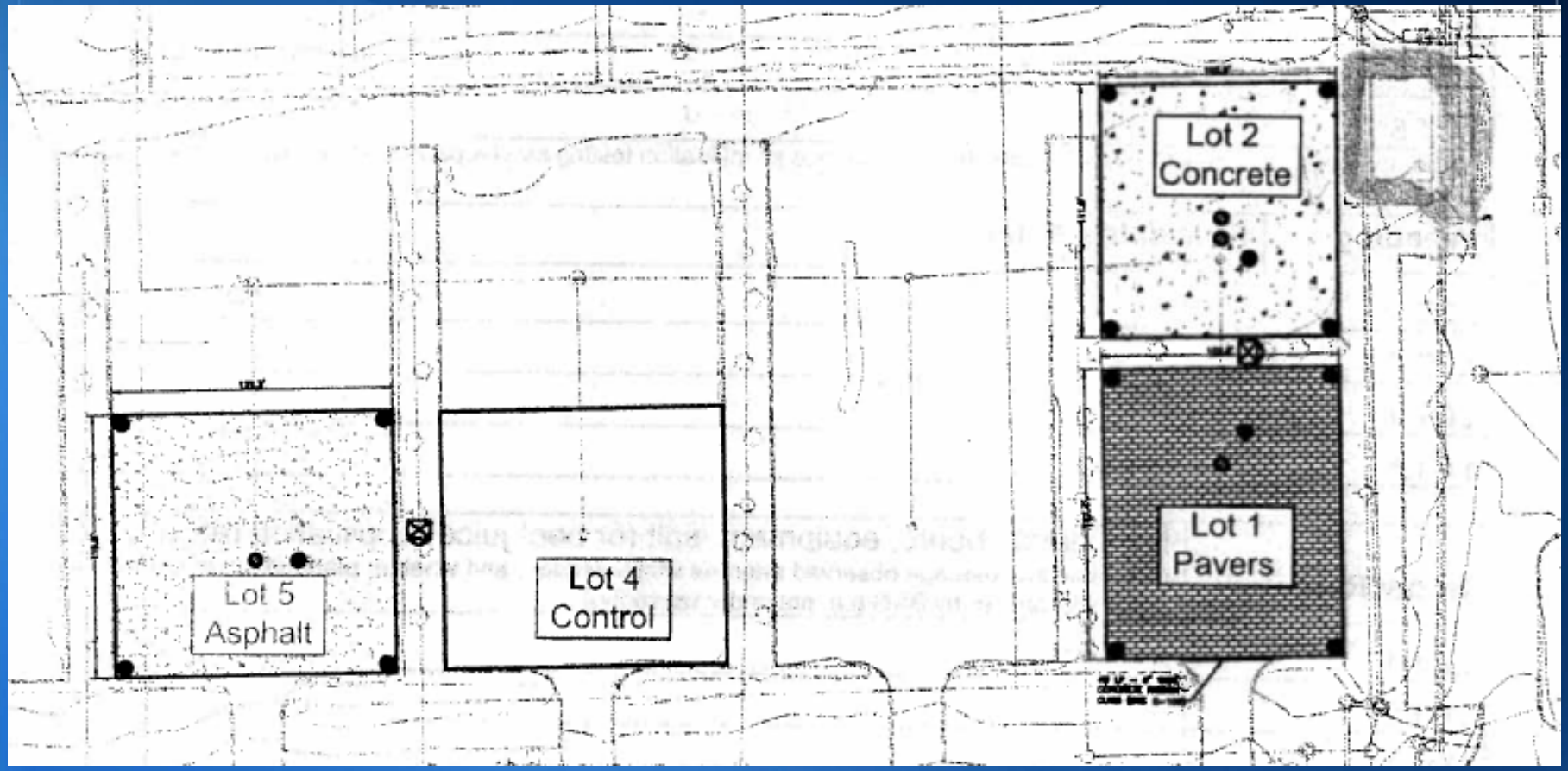


Image: *MWRD*

Stickney WRP Permeable Parking Lot

Stickney WRP Permeable Parking Lot

Mean Infiltration rate of permeable pavements during the five years of use at a car parking lot at the Stickney Water Reclamation Plant (in in/hr)

Year	Permeable Pavers	Permeable Concrete	Permeable Asphalt
2009	3600.00	5414.17	4407.87
2010	3415.75	4606.30	4337.01
2011	1006.30	3217.32	3458.27
2012	538.58	850.39	1289.76
2013	396.85	722.83	822.05
	Maintenance 10/9	Vacuum Street	Sweeper
2014	822.05	1020.47	1573.23

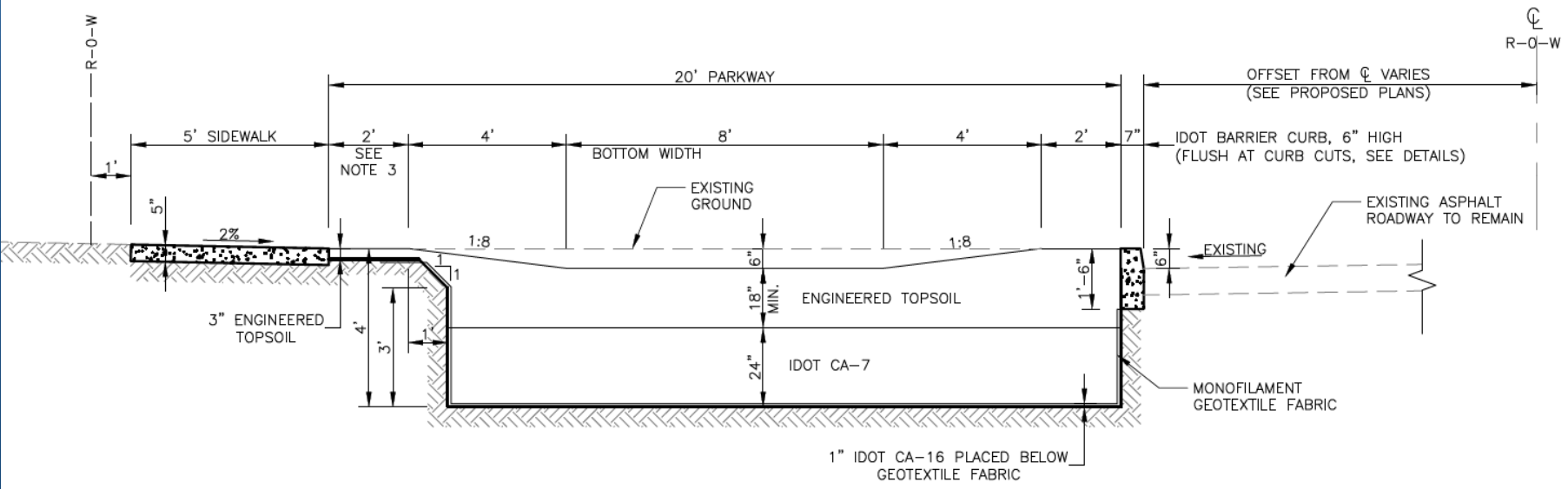
Mean of four measurements at random locations in each lot in 2009 and 2010. The 2011-2014 means are for and five measurements in drive areas and parking slots, respectively

Egan Water Reclamation Plant Permeable Parking Lot

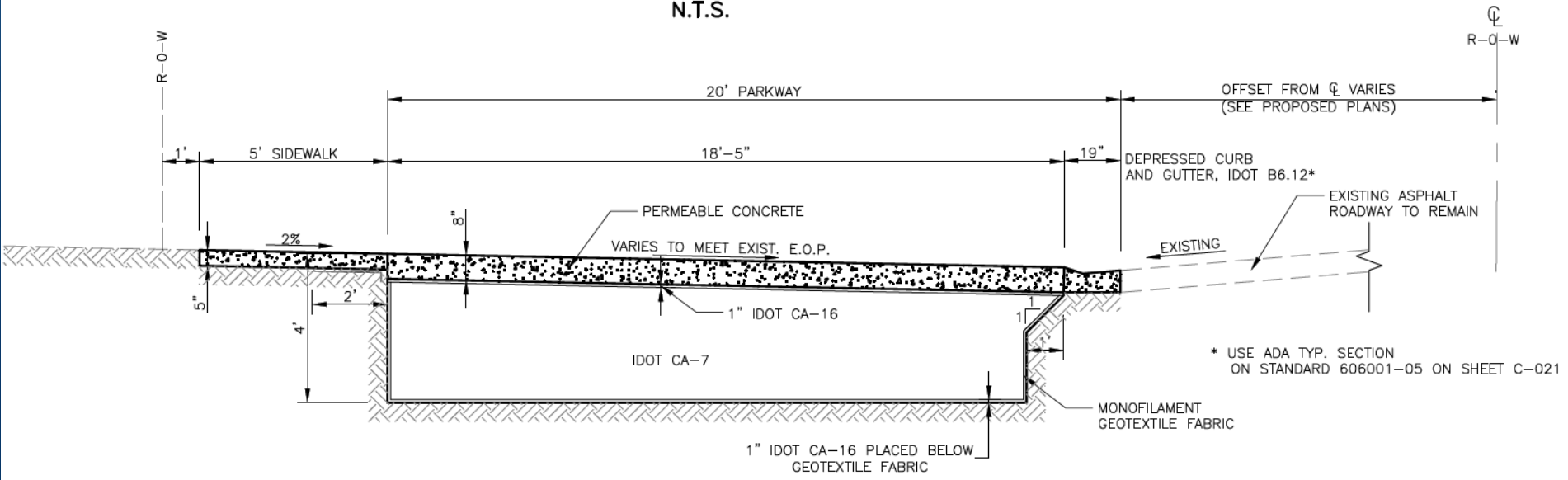
Egan Water Reclamation Plant Permeable Parking Lot

Egan Water Reclamation Plant Permeable Parking Lot

Blue Island Green Infrastructure Project
$663,000, 150,809 Gal DRC

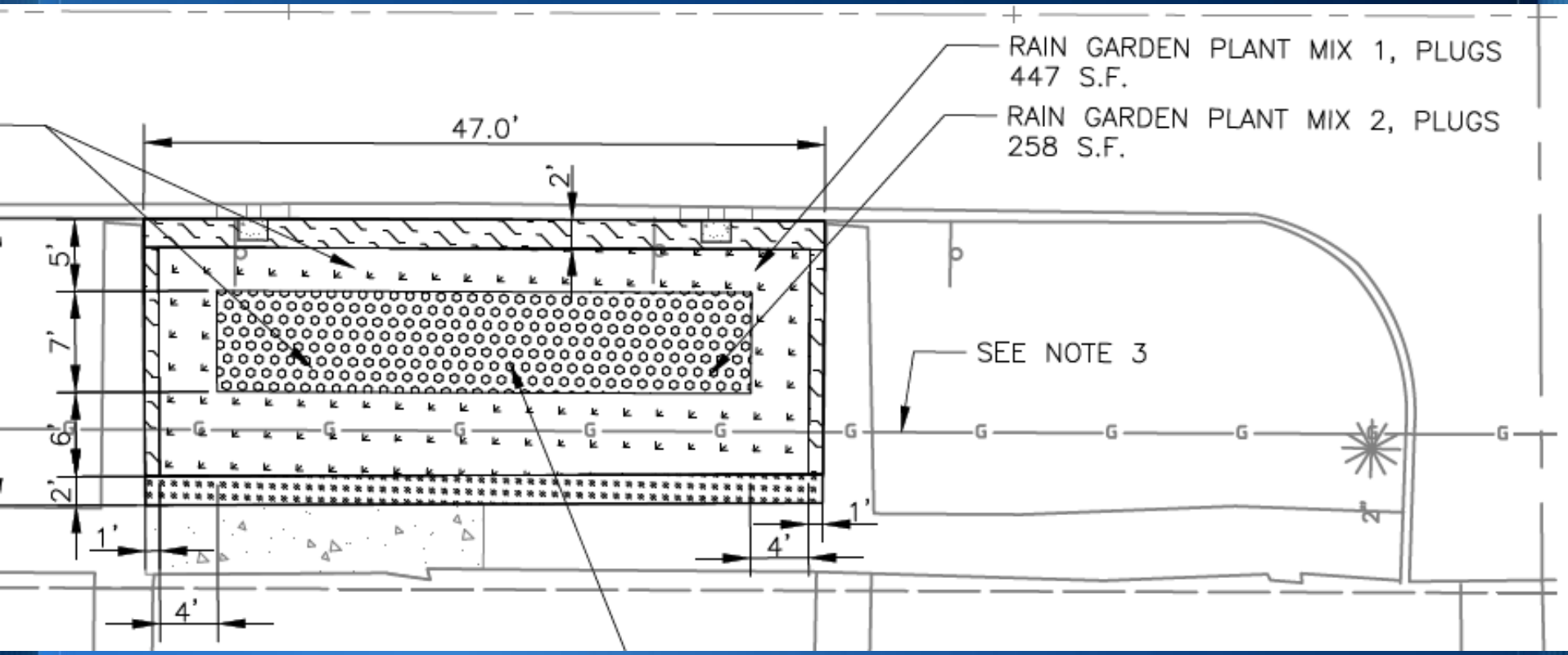


PROPOSED RAIN GARDEN TYPE A TYPICAL SECTION
N.T.S.

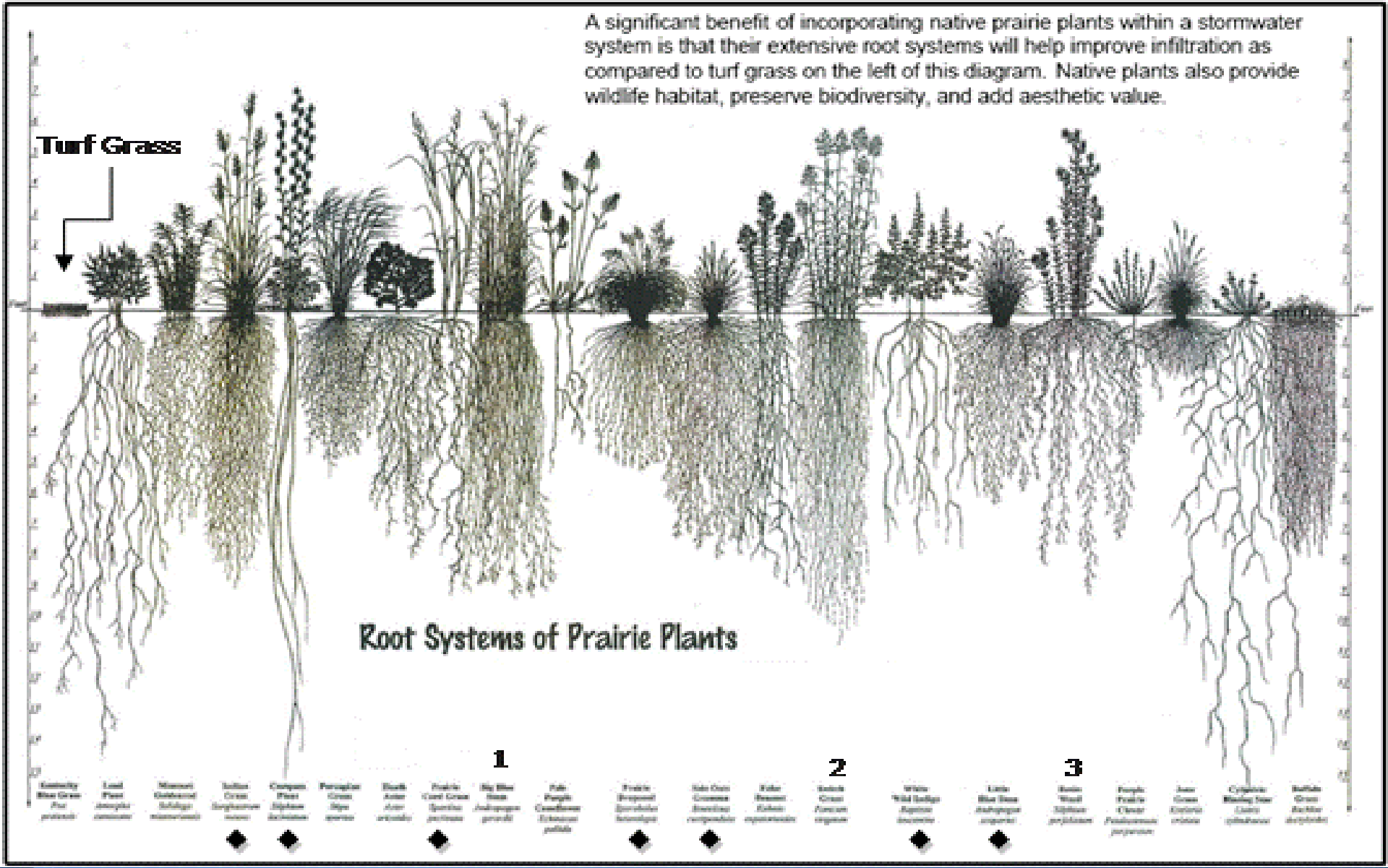


PROPOSED PERMEABLE PAVEMENT TYPICAL SECTION
N.T.S.

Typical Blue Island Landscaping Plan



- Different mix in bottom of rain garden of more inundation-tolerant plants
- Limit number of plant species to ease potential weeding issues



Root Systems: Turf Grass to Native Plants

Image: NRCS, City of Elgin


Image: MWRD, JRW

Image: *MWRD, JRW*

Finished Rain Garden and Permeable Parking Lot in Blue Island

8 locations in the same neighborhood

Images: *MWRD, JRW*

Chicago Public Schools, Space to Grow

- Rebuilding schoolyards in a sustainable way, including stormwater storage
- MWRD and DWM each dedicate up to $500,000 per school towards GI measures (basically splitting the projects in even thirds, overages to CPS)
- Elementary schools prioritized based on flood risk, site suitability, and socioeconomic factors
- The objective is to reduce local flooding and the amount of rainwater entering the local combined sewer system
- Already over 2.7 million gallons of stormwater retention
- MWRD committed an additional $1,000,000 for future design

Design Criteria for CPS Projects

- Maximize Stormwater Retention Volume
  - (minimum of 150,000 gallons per school).
- Stormwater elements to be visible for public education
- Exceed Chicago and MWRD Ordinance Requirements
  - City of Chicago Flow Vortex
  - Bulletin 70 Rainfall Data
- Any stormwater release to be of high water quality
- 15 schools constructed in 2014-18, 5 schools in 2019
- Projects have positively impacted thousands of local residents by providing:
  - A safe place for their children to play
  - Educating all to the benefits of GI
  - Providing much needed relief to localized flooding

Morrill School (Pre-Construction)

Image: *Google Maps*

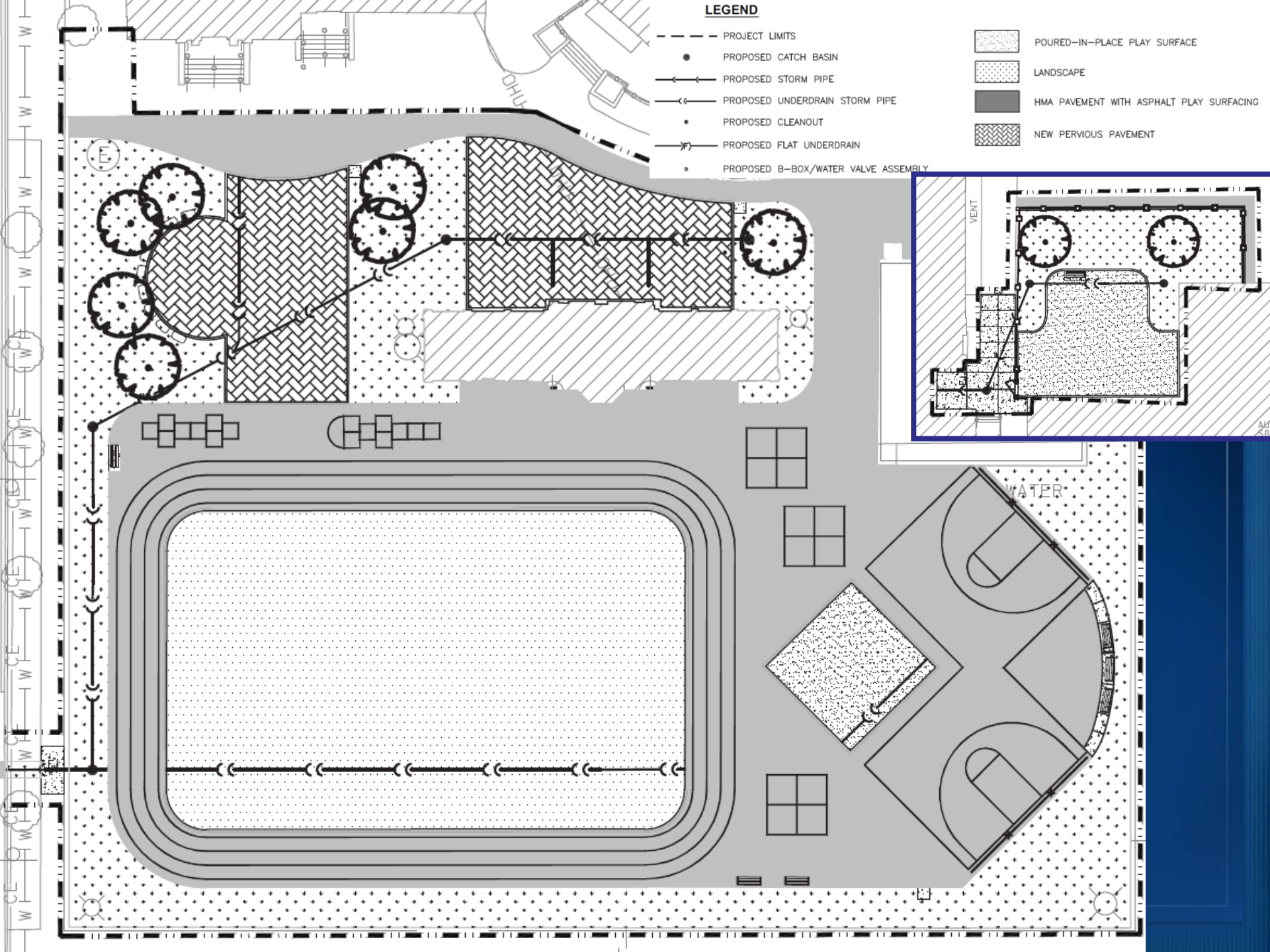

LEGEND
PROJECT LIMITS
PROPOSED CATCH BASIN
PROPOSED STORM PIPE
PROPOSED UNDERDRAIN STORM PIPE
PROPOSED CLEANOUT
PROPOSED FLAT UNDERDRAIN
PROPOSED B-BOX/WATER VALVE ASSEMBLY
POURED-IN-PLACE PLAY SURFACE
LANDSCAPE
HMA PAVEMENT WITH ASPHALT PLAY SURFACING
NEW PERVIOUS PAVEMENT
VENT
WATER

Image: *MWRD, Space to Grow Program*

Morrill Rendering – Fall 2014

Image: *MWRD, JRW*


Image: MWRD, JRW


Image: *MWRD, JRW*

Image: *MWRD, JRW*

Image: *MWRD, JRW*

Image: *MWRD, JRW*

Image: *MWRD, JRW*

Groundbreaking: July 11

Image: *MWRD, PA*

Community Planting / Ribbon Cutting Oct 7

Image: *MWRD, PA*

Image: *Google Maps*


Image: *Google Maps*

Image: *MWRD, JRW*

Evanston Phase II Project – Civic Center Parking Lot – Const. Spring 2014: $608,528 for 167,278 Gal DRC

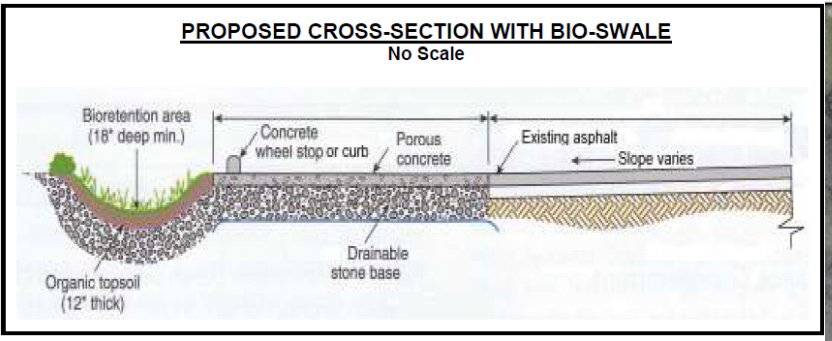
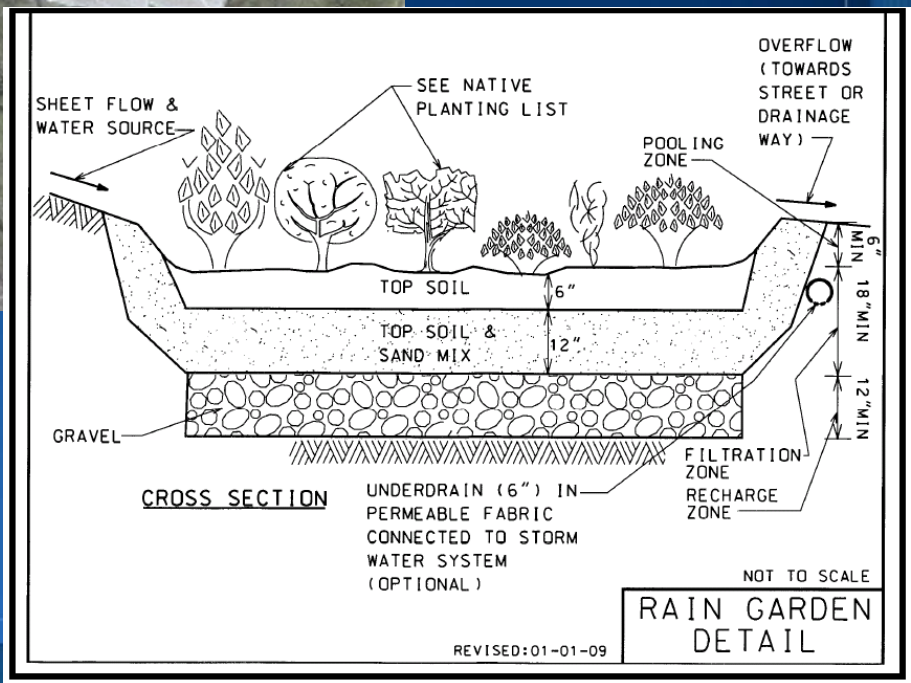


Image: *City of Evanston*

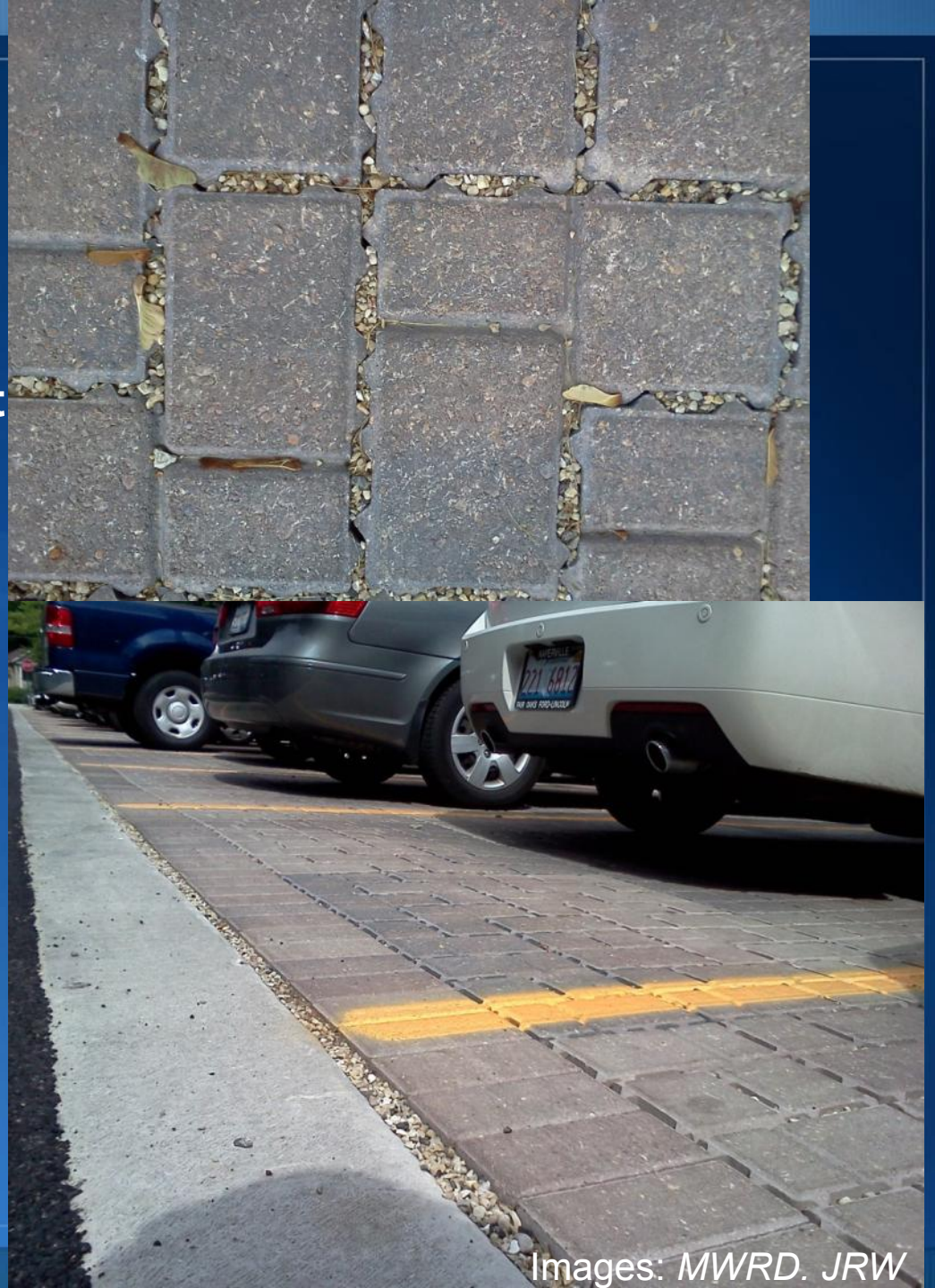
Evanston Civic Center



Images: *MWRD. JRW*

Evanston Pavement Type 1: Permeable Concrete

Evanston Pavement Type 1: Permeable Pavers (with Traditional Asphalt Driving Lane)



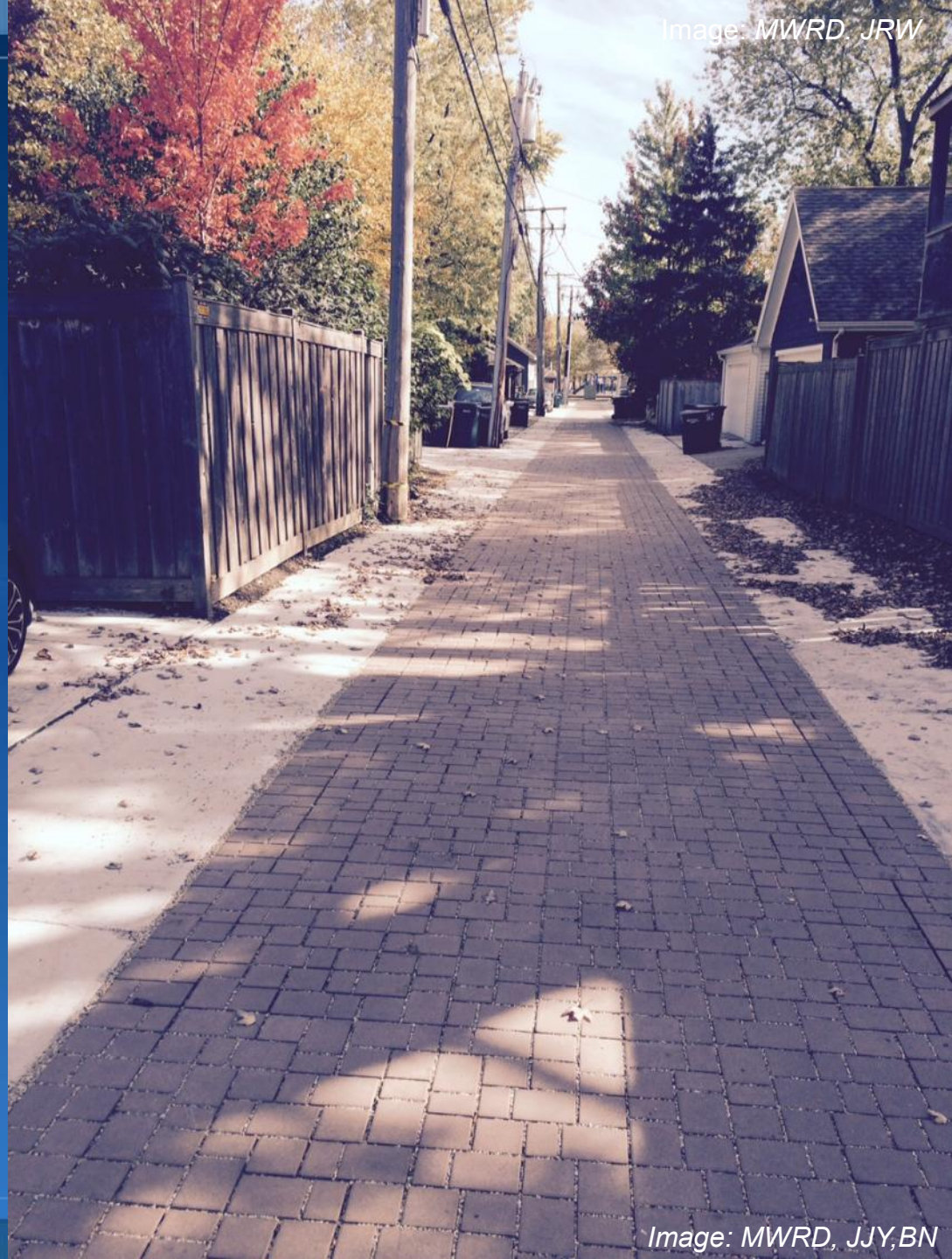
Images: *MWRD. JRW*

Evanston Pavement Type 2: Permeable Asphalt

Images: *MWRD. JRW*

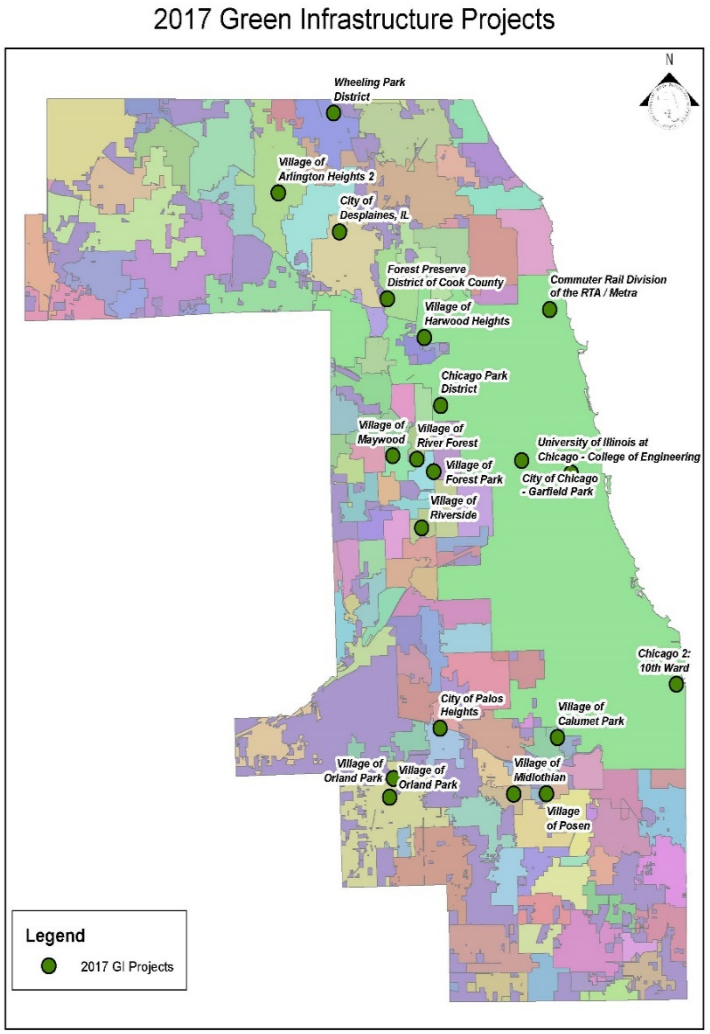
Wilmette Green Alleys

- Project Description:
  - Center section of alleys constructed with permeable pavers.
- Construction Cost:
  - $839,000 total
  - $130,000 MWRD Contribution
- Project Status:
  - Construction completed in 2016
- Design Retention Capacity:
  - 74,677 gallons



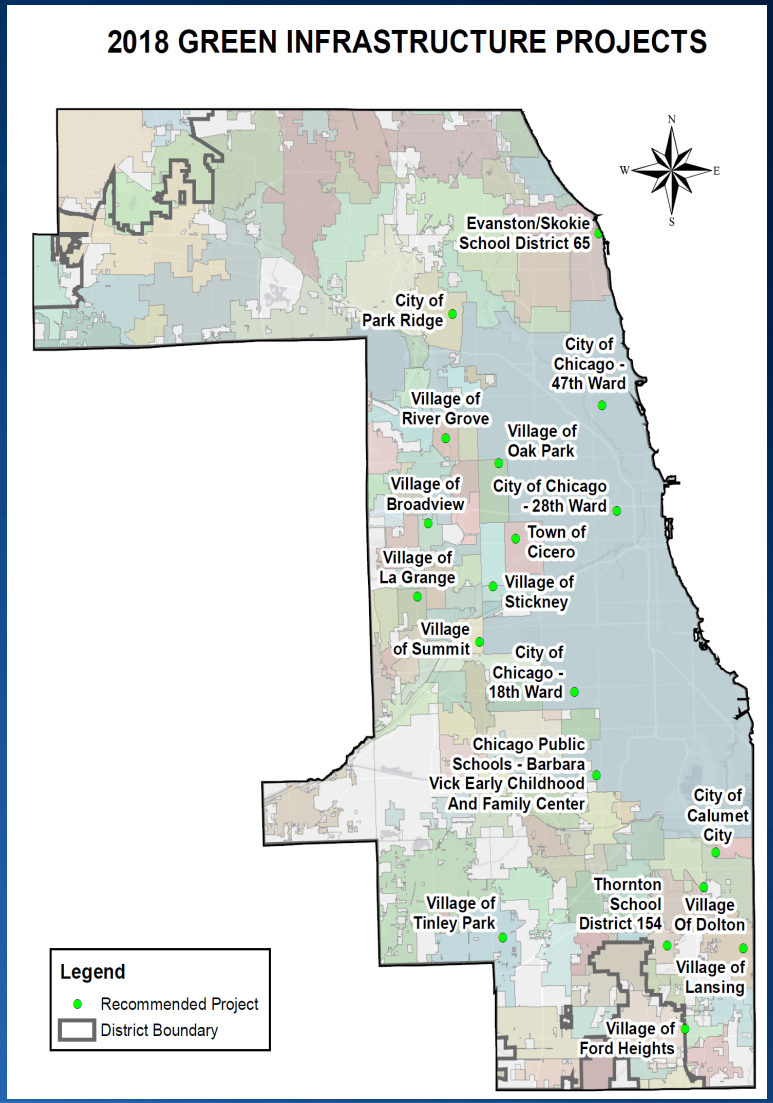
2017 Green Infrastructure Projects

- 2017 Call for Green Infrastructure Projects
- 20 Green Infrastructure Projects
- $11.7M estimated total Construction Costs
- 730 Structures Benefitted
- 3.6M gal Design Retention Capacity estimated
- 3 Projects already completed, most of the others to be done in 2019



2018 Green Infrastructure Projects

- 2018 Call for Green Infrastructure Projects
- 20 Green Infrastructure Projects were selected. Most projects will be started in 2019.
- $9.2M estimated total Construction Costs
- 708 Structures Benefitted
- 1.4M gal Design Retention Capacity (estimated)



18-IGA-01 Arlington Heights Police Station

- Project Description:
  - Construction of parking lot, permeable pavers, and a bio-infiltration basin.
- Construction Cost:
  - $1,515,000 total
  - $358,000 MWRD Contribution
- Project Status:
  - Construction completed in 2018
- Design Retention Capacity:
  - 90,807 gallons

Image: Arlington Hts.

Image: MWRD, JRW

18-IGA-16 Village of River Forest Green Infrastructure Project

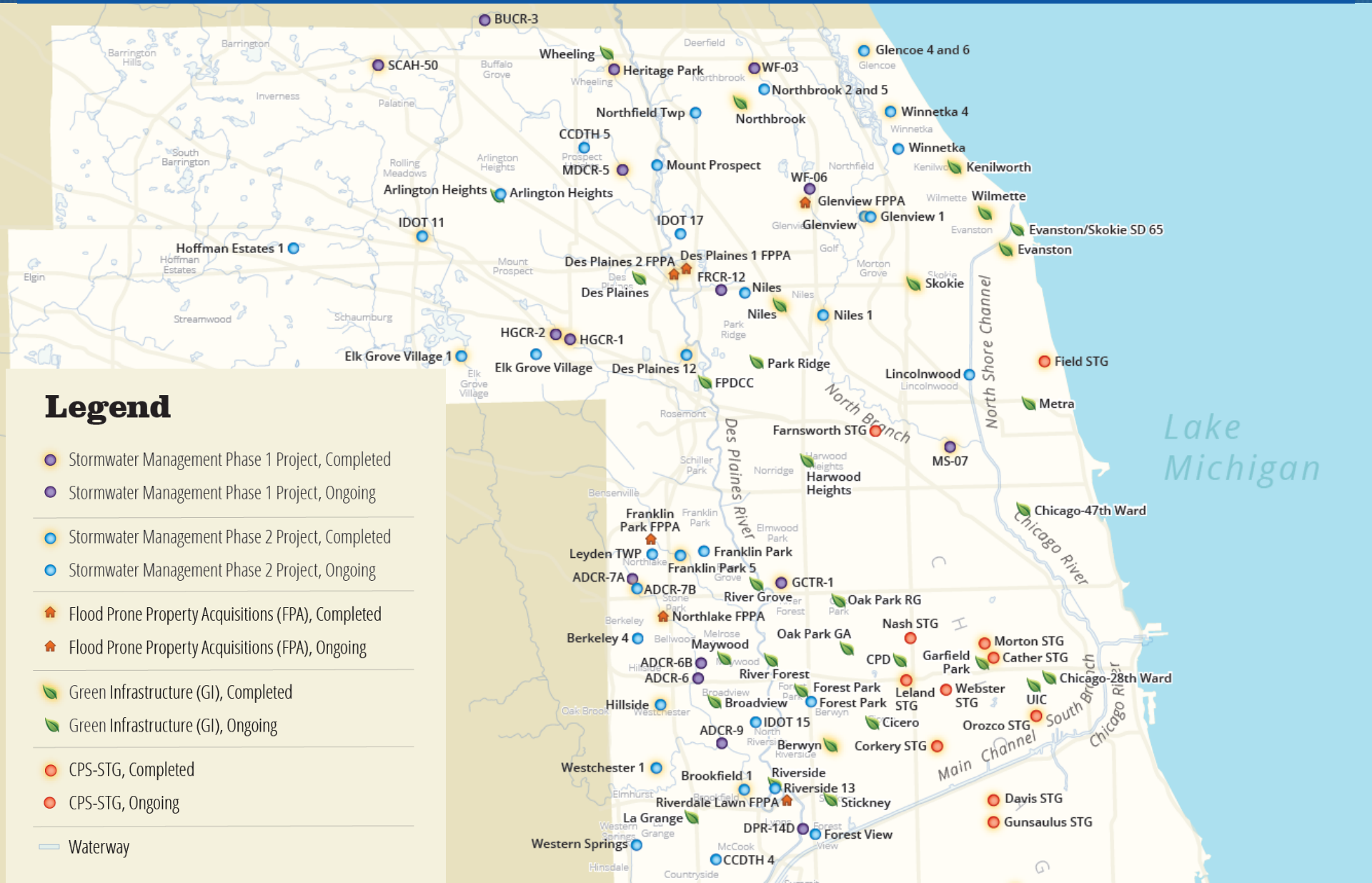
- Project Description:
  - Gale Avenue Green Alley Improvements which consisted of construction of a green alley located in the Village.
- Construction Cost:
  - $185,000 total
  - $75,000 MWRD Contribution
- Project Status:
  - Construction completed in 2018
- Design Retention Capacity:
  - 24,490 gallons

18-IGA-19 Wheeling Park District Green Infrastructure Project

- Project Description:
  - Chamber Parking Lot Reconstruction and
  - Construction of a bioretention basin located in the Village.
- Construction Cost:
  - $160,000 total
  - $61,000 MWRD Contribution
- Project Status:
  - Construction primarily completed in 2018 with some native plants to be installed in early 2019
- Design Retention Capacity:
  - 41,732 gallons

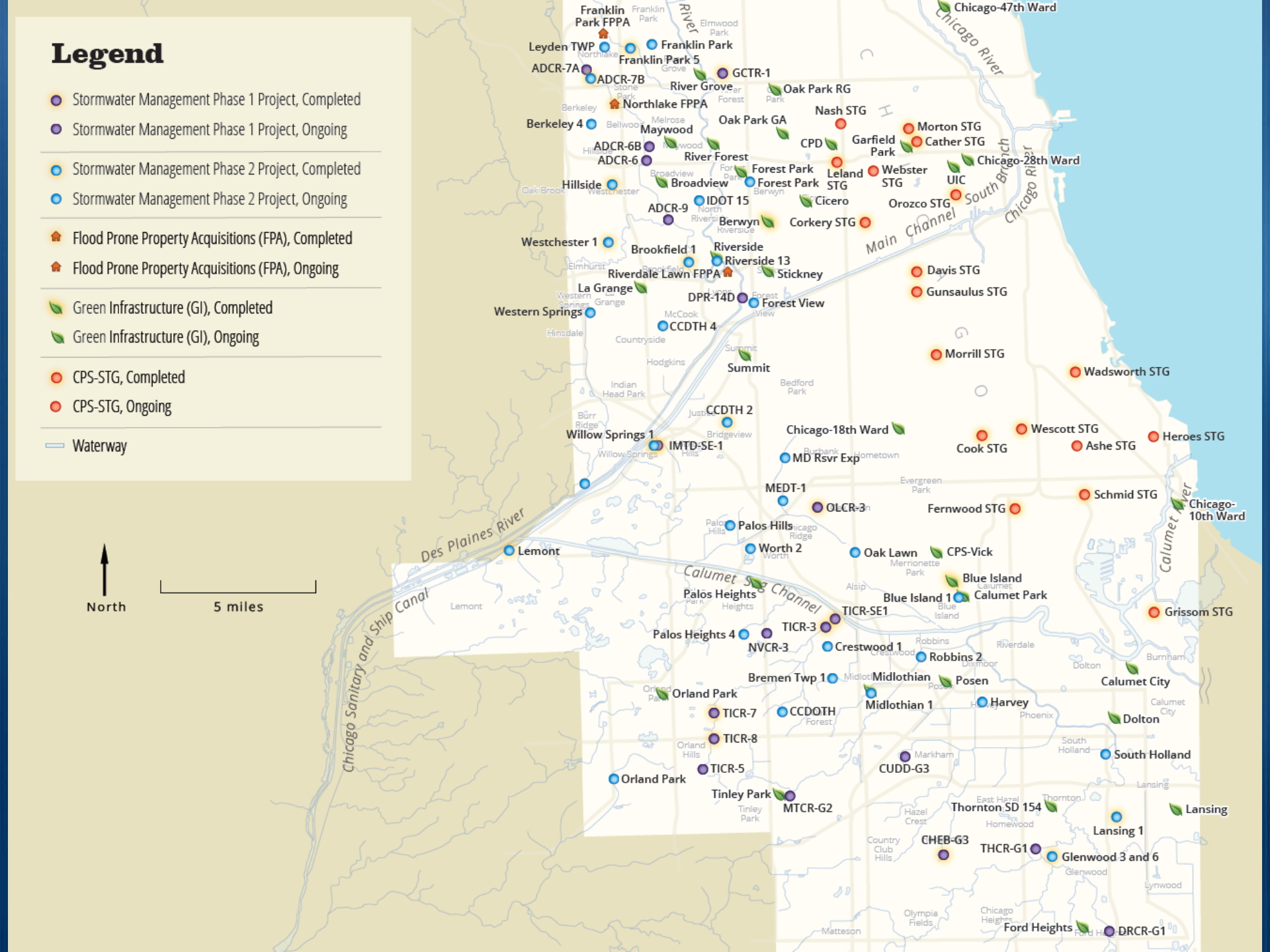
Image: MWRD, JJY

Stormwater Management Infrastructure Projects



Legend

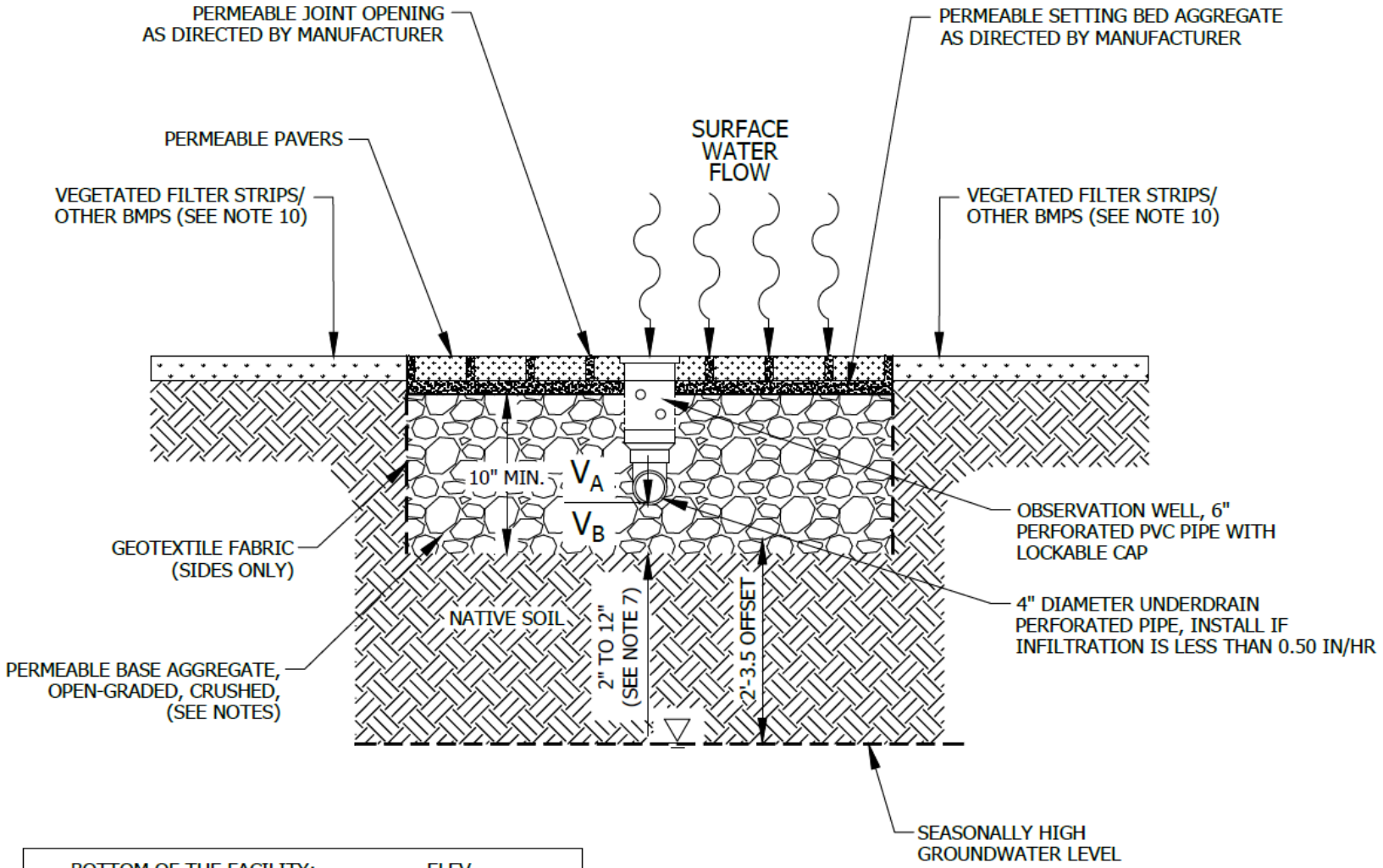
- Stormwater Management Phase 1 Project, Completed
- Stormwater Management Phase 1 Project, Ongoing
- Stormwater Management Phase 2 Project, Completed
- Stormwater Management Phase 2 Project, Ongoing
- Flood Prone Property Acquisitions (FPA), Completed
- Flood Prone Property Acquisitions (FPA), Ongoing
- Green Infrastructure (GI), Completed
- Green Infrastructure (GI), Ongoing
- CPS-STG, Completed
- CPS-STG, Ongoing
- Waterway


Legend
Stormwater Management Phase 1 Project, Completed
Stormwater Management Phase 1 Project, Ongoing
Stormwater Management Phase 2 Project, Completed
Stormwater Management Phase 2 Project, Ongoing
Flood Prone Property Acquisitions (FPA), Completed
Flood Prone Property Acquisitions (FPA), Ongoing
Green Infrastructure (GI), Completed
Green Infrastructure (GI), Ongoing
CPS-STG, Completed
CPS-STG, Ongoing
Waterway
North
5 miles
Franklin Park FPPA
Leyden TWP
Franklin Park
Franklin Park 5
ADCR-7A
ADCR-7B
GCTR-1
River Grove
Oak Park RG
Northlake FPPA
Berkeley 4
Maywood
Oak Park GA
Nash STG
Morton STG
Cather STG
CPD
Garfield Park
Chicago-28th Ward
ADCR-6B
ADCR-6
River Forest
Forest Park
Forest Park
Leland STG
Webster STG
UIC
Hillside
Broadview
IDOT 15
Cicero
Orozco STG
ADCR-9
Berwyn
Corkery STG
Westchester 1
Brookfield 1
Riverside
Riverside 13
Riverdale Lawn FPPA
Stickney
Davis STG
Gunsaulus STG
La Grange
DPR-14D
Forest View
Western Springs
CCDTH 4
Summit
Morrill STG
Wadsworth STG
CCDTH 2
Willow Springs 1
IMTD-SE-1
Chicago-18th Ward
Wescott STG
Cook STG
Ashe STG
Heroes STG
MD Rsvr Exp
MEDT-1
OLCR-3
Fernwood STG
Schmid STG
Chicago-10th Ward
Palos Hills
Lemont
Worth 2
Oak Lawn
CPS-Vick
Blue Island
Palos Heights
Blue Island 1
Calumet Park
TICR-SE1
Grissom STG
TICR-3
Palos Heights 4
NVCR-3
Crestwood 1
Robbins 2
Bremen Twp 1
Midlothian
Posen
Calumet City
Orland Park
Midlothian 1
Harvey
TICR-7
CCDOTH
Dolton
TICR-8
South Holland
TICR-5
CUDD-G3
Orland Park
Tinley Park
MTCR-G2
Thornton SD 154
Lansing
Lansing 1
CHEB-G3
THCR-G1
Glenwood 3 and 6
Ford Heights
DRCR-G1
Des Plaines River
Chicago Sanitary and Ship Canal
Calumet Sag Channel
Calumet River
Chicago River
Main Channel
South Branch
Chicago River

Green Infrastructure Technologies & Design Resources

- Standard Details and Notes (Appendix C of Watershed Management Ordinance)
- Technical Guidance Manual
- MWRD Green Book (in development)
- Freely available as CAD [DWG] and PDF format
  - *wmo.mwrd.org*

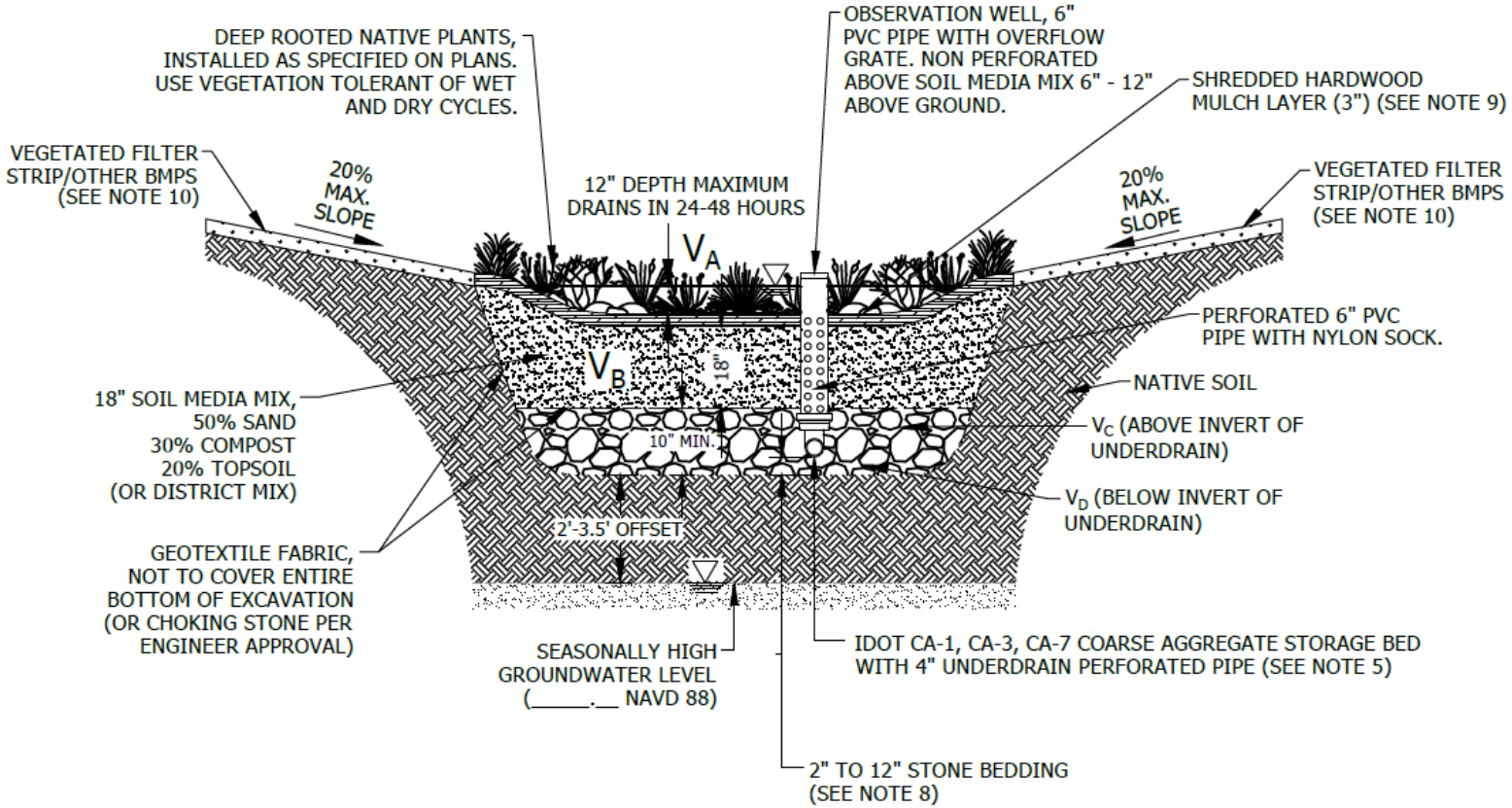
Permeable Paver Detail



BOTTOM OF THE FACILITY:	ELEV. _____
SEASONALLY HIGH GROUNDWATER:	ELEV. _____
SEPARATION:	FEET _____

VOLUME TYPE	SURFACE AREA	DEPTH	POROSITY	STORAGE VOLUME	VOLUME PROVIDED
V_A : COARSE AGGREGATE (ABOVE INVERT)			0.36	0.50 X 0.36 X V_A	
V_B : COARSE AGGREGATE (BELOW INVERT)			0.36	0.36 X V_B	

Bioretention Facility Detail

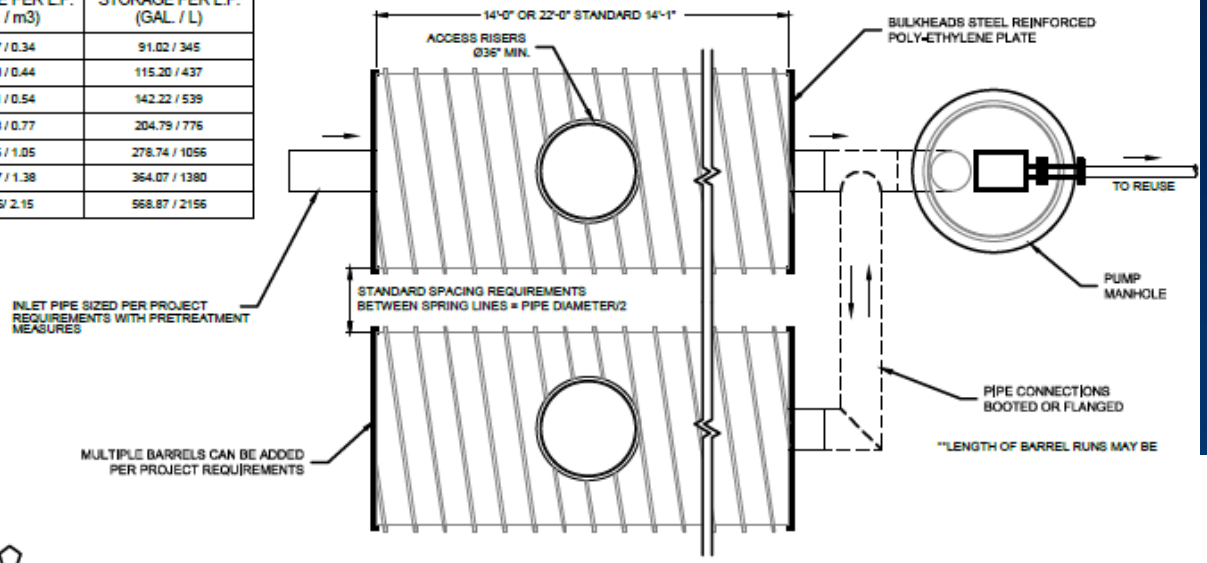


BOTTOM OF THE FACILITY:	ELEV. _____
SEASONALLY HIGH GROUNDWATER:	ELEV. _____
SEPARATION:	FEET _____

VOLUME TYPE	SURFACE AREA	DEPTH	POROSITY	STORAGE VOLUME	VOLUME PROVIDED
V_A : SURFACE STORAGE			1.00	1.00 X V_A	
V_B : SOIL MEDIA MIX			0.25	0.50 X 0.25 X V_B	
V_C : COARSE AGGREGATE (ABOVE INVERT)			0.36	0.50 X 0.36 X V_C	
V_D : COARSE AGGREGATE (BELOW INVERT)			0.36	0.36 X V_D	

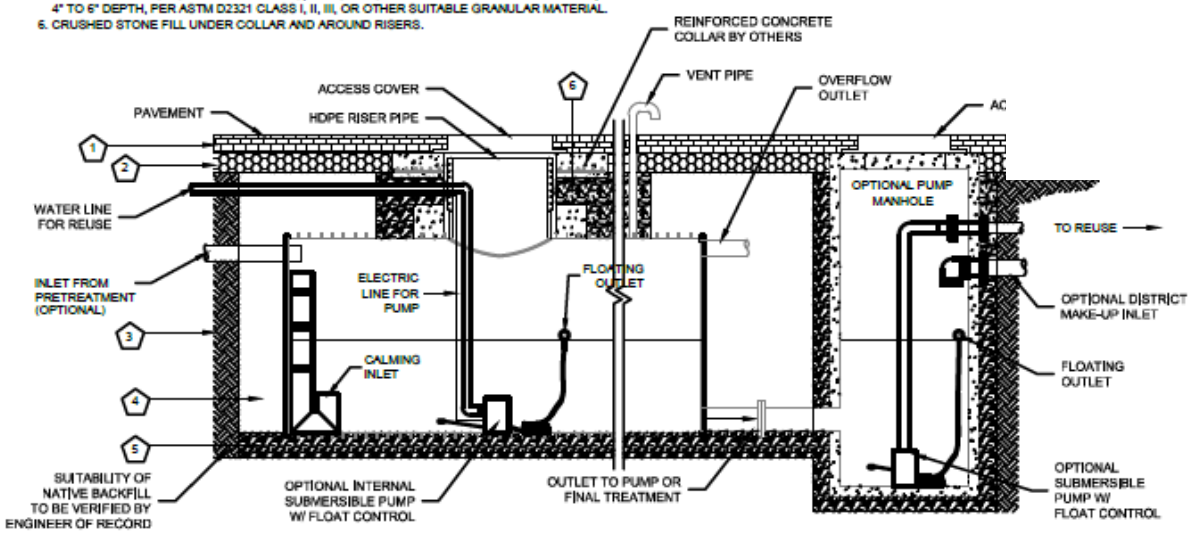
Stormwater Harvesting and Reuse System

STORAGE AVAILABILITY PER DIAMETER		
DIAMETER (IN / mm)	AVAILABLE STORAGE PER L.F. (C.F. / m3)	AVAILABLE STORAGE PER L.F. (GAL. / L)
48 / 1200	12.17 / 0.34	91.02 / 345
54 / 1350	15.40 / 0.44	115.20 / 437
60 / 1500	19.01 / 0.54	142.22 / 539
72 / 1800	27.38 / 0.77	204.79 / 776
84 / 2100	37.26 / 1.05	278.74 / 1056
96 / 2400	48.67 / 1.38	364.07 / 1380
120 / 3000	76.05/ 2.15	568.87 / 2156

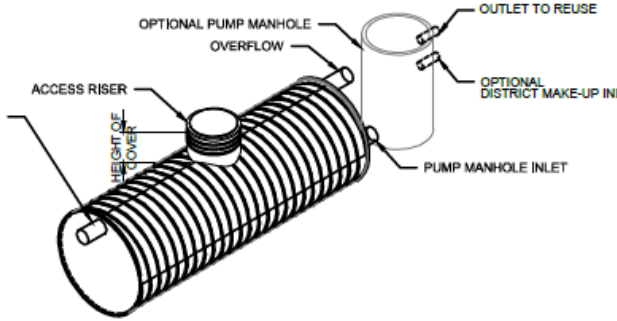


PLAN VIEW

KEY
1. RIGID OR FLEXIBLE PAVEMENT.
2. GRANULAR COMPACTED ROAD BASE.
3. ANY SUITABLE NATIVE OR GENERAL BACKFILL, SEE ENGINEER PLANS.
4. WELL GRADED GRANULAR FILL. ASTM D2321 CLASS I, II, III, OR EQUIVALENT. COMPACT TO MIN. 90% STANDARD DENSITY PER AASHTO T99. MAY INCLUDE ROAD BASE.
5. RELATIVELY LOOSE GRANULAR BEDDING, ROUGHLY SHAPED TO FIT BOTTOM OF BARREL, 4" TO 6" DEPTH, PER ASTM D2321 CLASS I, II, III, OR OTHER SUITABLE GRANULAR MATERIAL.
6. CRUSHED STONE FILL UNDER COLLAR AND AROUND RISERS.



ELEVATION VIEW



ISOMETRIC VIEW

A. IN
B. CO
C. CO
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OPER

1. PR
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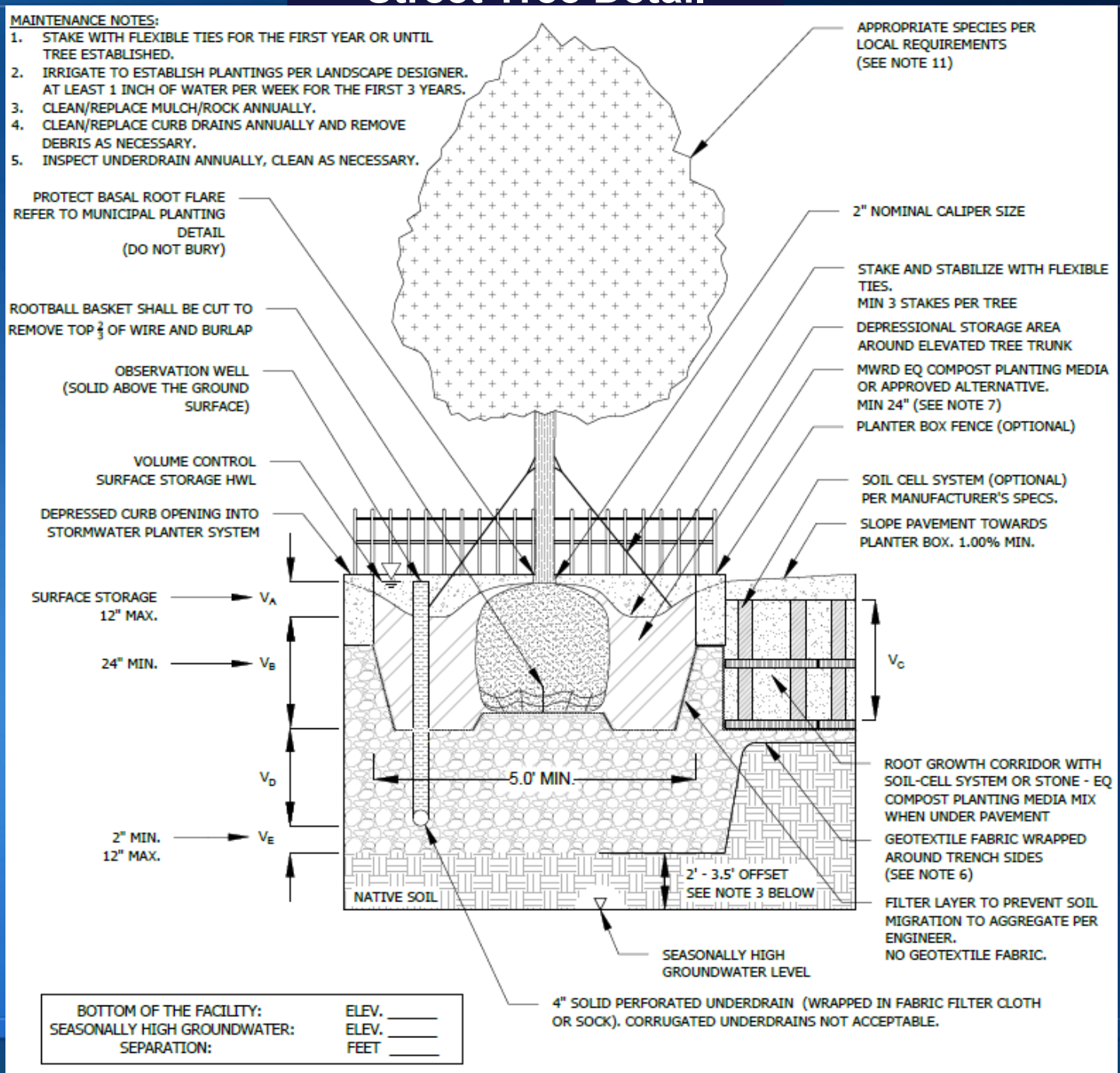
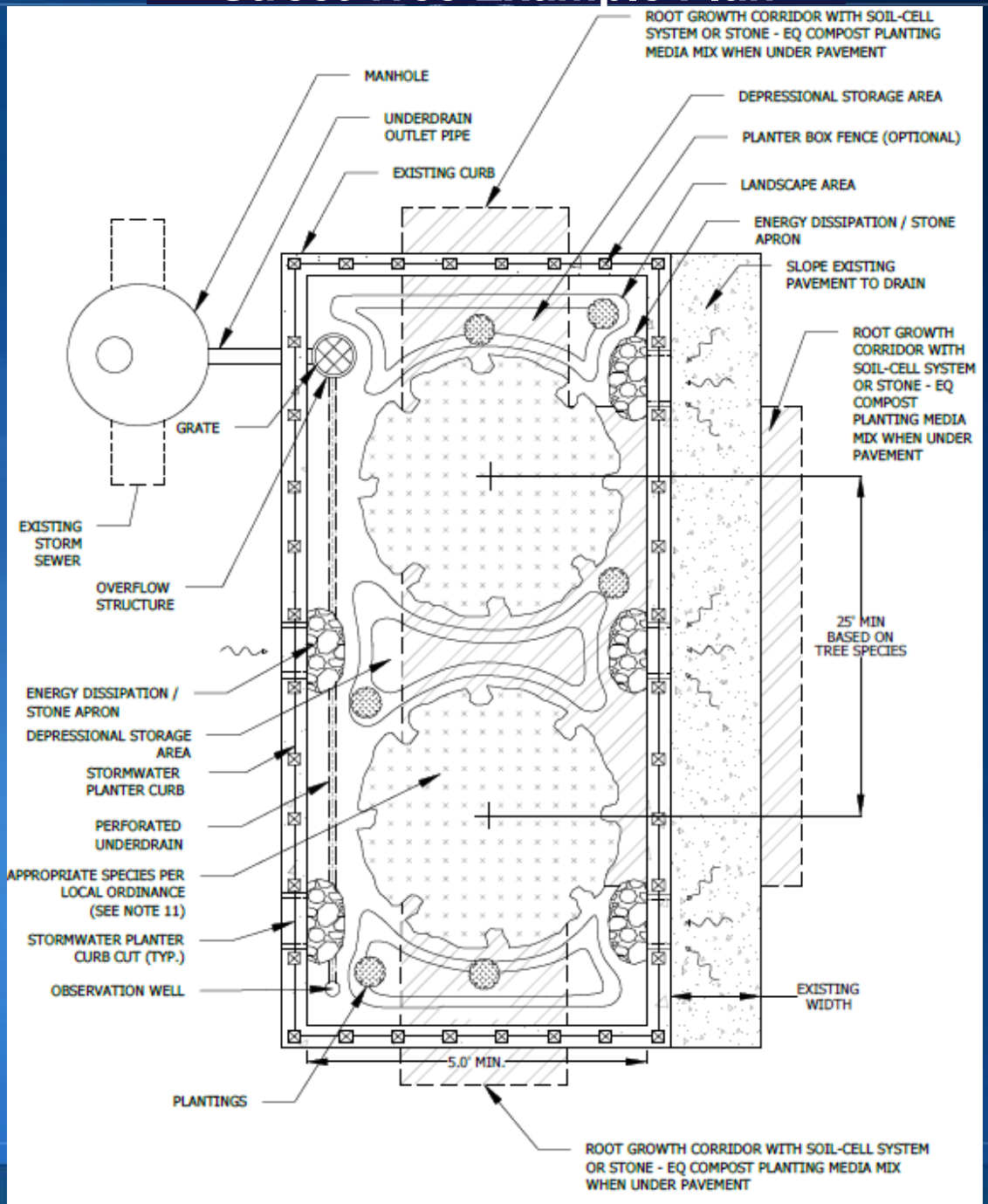
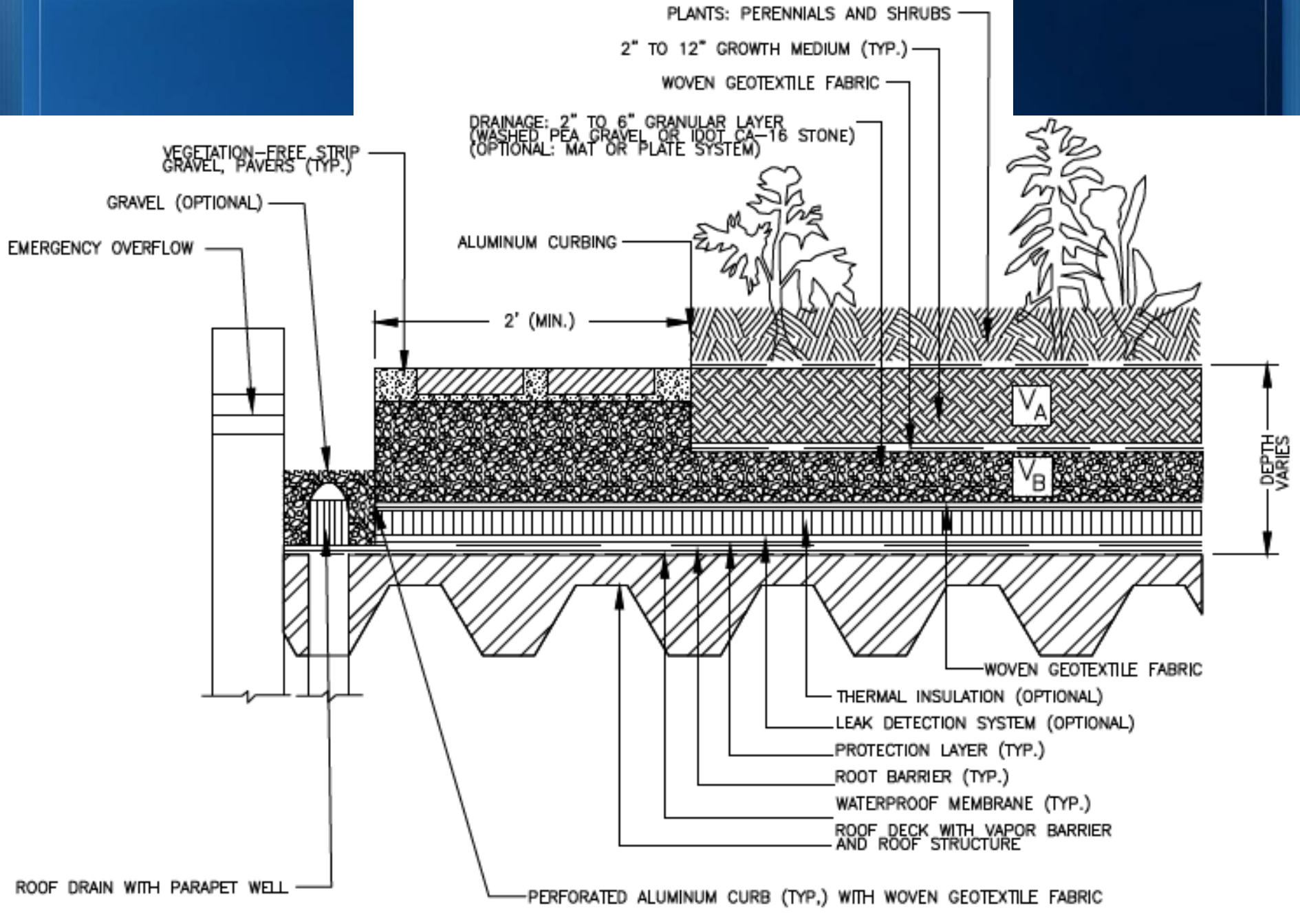
Street Tree Detail



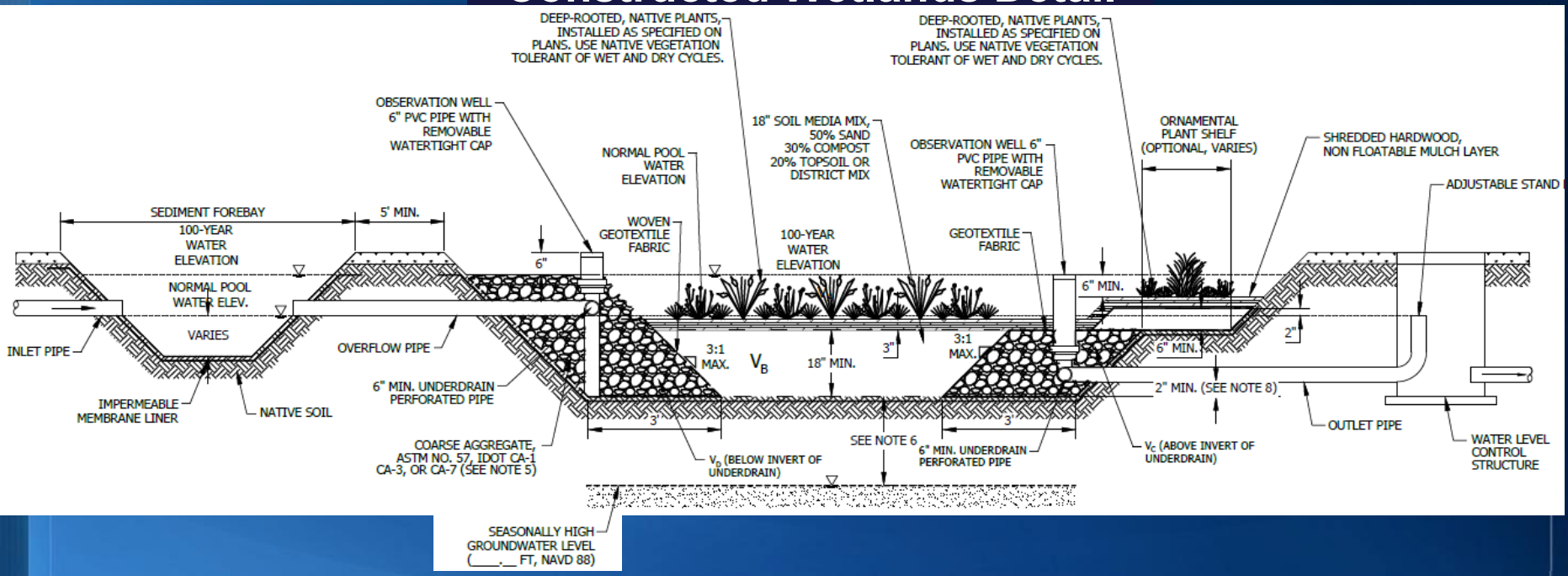
Street Tree Example Plan



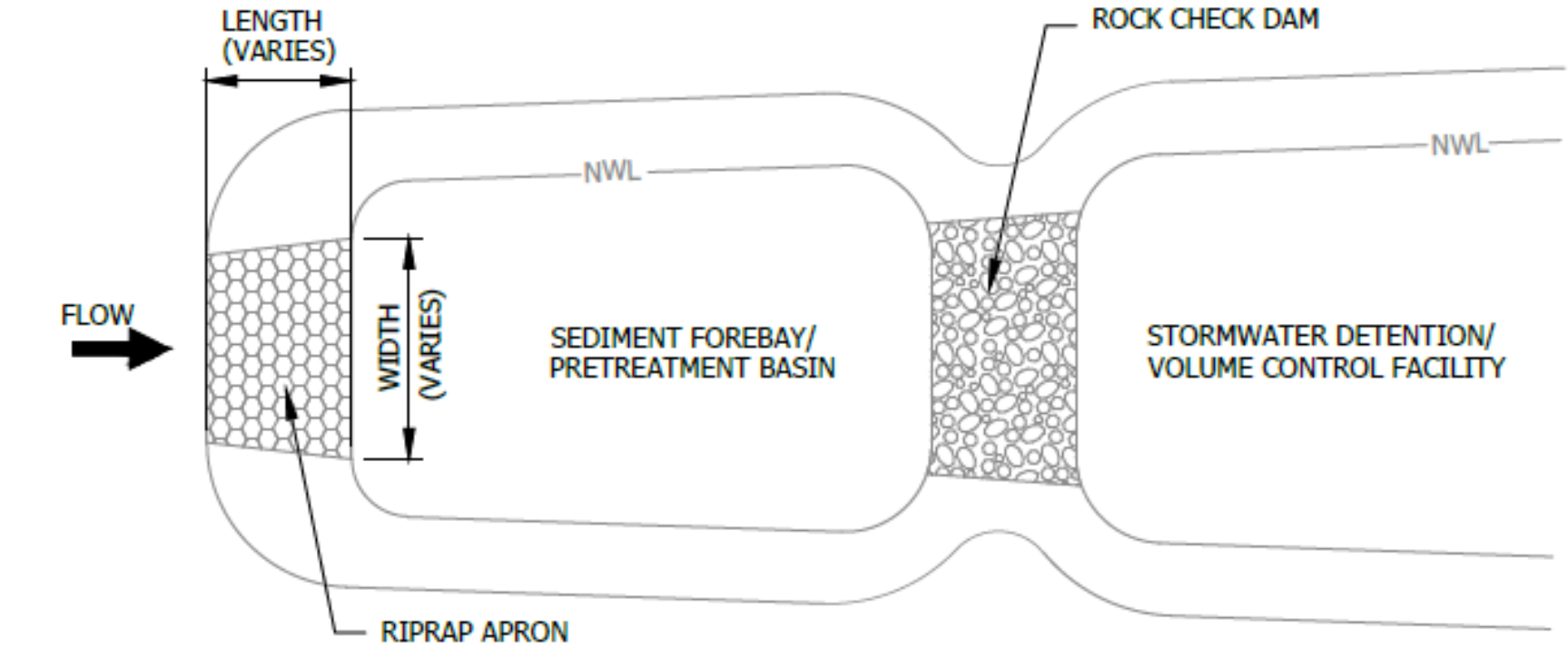
Green Roof Detail



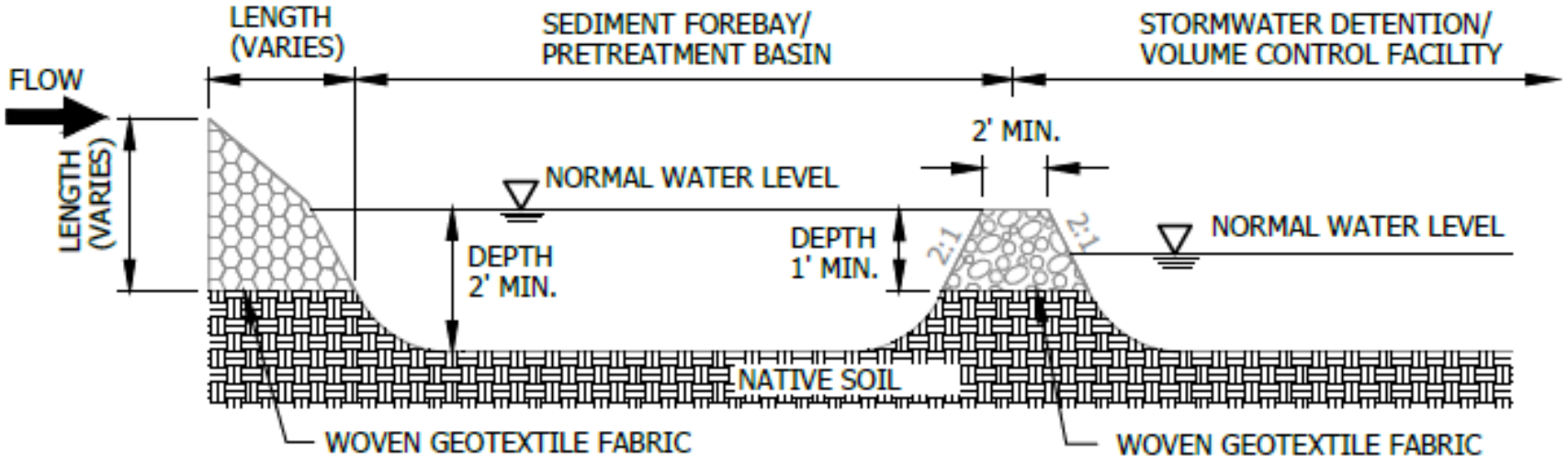
Constructed Wetlands Detail



Sediment Forebay Detail



PLAN VIEW

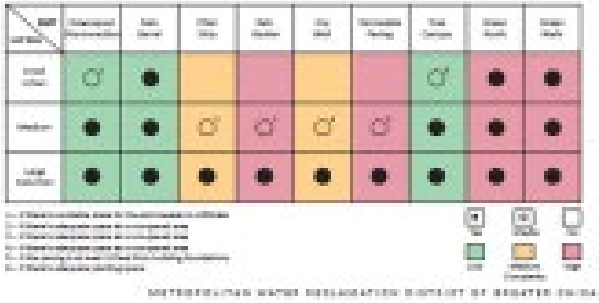


PROFILE VIEW

New GI Initiative - Green Book

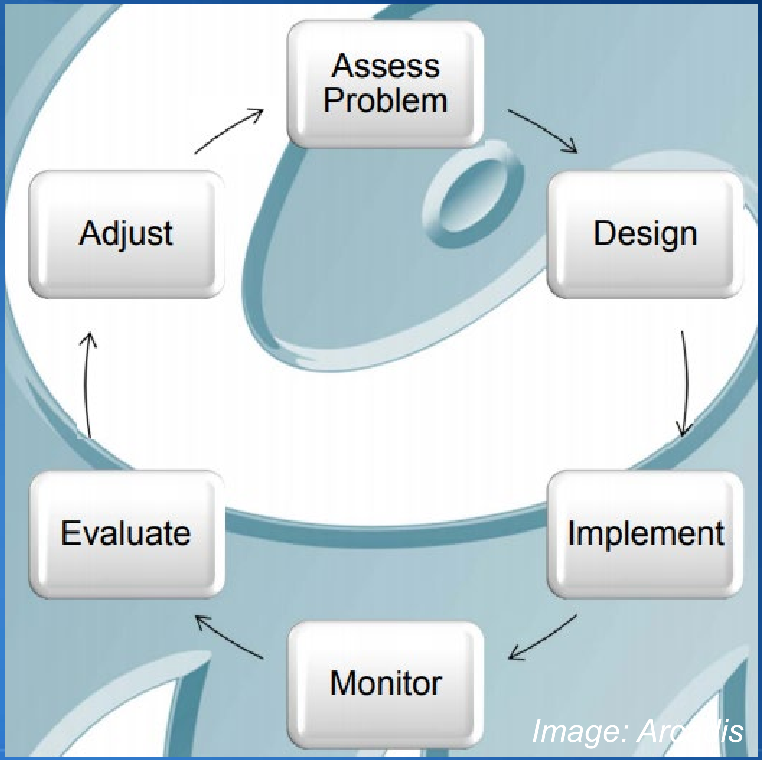
Develop Green Book targeting multiple audiences:

- Guide for residents to build rain gardens, etc.
- Enhanced green infrastructure details for developers
- Suite of GI/BMP details for use by municipal engineers



Adaptive Management in GI

- Improving designs and projects over time, based on:
  - Monitoring results
  - Stakeholder feedback: residents, maintainers, etc



Adaptive Management will naturally:

- Flex as uncertainty is further defined throughout time
- Is applied over longer time tables, allowing for continuous improvement
- Includes many phases, tasks, steps, projects and iterations (each better than the one before)
- Values participation of the stakeholder
- Uses monitoring, both quantitative and qualitative, as a basis for learning
- Produces a very efficient, effective result to attain the intended objective
- For more info, see “Green Infrastructure Implementation” book, (WEF, Arcadis et al 2014)

National Green Infrastructure Certification Program (NGICP)

- The MWRD is a charter member
- Sponsored by the Water Environmental Federation and DCWater
- Goal: Provide GI installation and maintenance training to contractors and other agencies
- Certify individuals that have successfully completed the training and passed a test.
- Pilot program in Chicago in April 2019.
- Register at ngicp.org

Image: WEF, ngicp

Strengths, Limitations, and Trends in GI

- Strengths
  - Catching the “first flush” to improve water quality
  - Creating green spaces, improving access to nature, providing some habitat
  - Helping to reduce local flooding for frequent storms
- Limitations
  - Can contribute, but cannot alone solve the large flooding events
    - *Unless combined with traditional stormwater infrastructure*
  - Typically higher maintenance requirements
  - Typically higher cost
- Trends
  - More green infrastructure
  - Mixes of green and grey on projects
  - Incorporation of GI into traditional projects (road replacements, streetscape, etc)

Questions?

Image: MWRD, JRW

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