Highland Park Golf Course Stream Restoration – Making a Resilient System

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Ivan Valentic, GPD

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Project Team

- Administration

Northeast Ohio Regional Sewer District

- Engineering and Construction

GPD GROUP®
Glaus, Pyle, Schomer, Burns & DeHaven, Inc.

RiverReach Construction

EnviroScience
Excellence In Any Environment

Sustainable Sports Solutions

- Partners

Mill Creek Watershed Partnership

WEST CREEK CONSERVANCY

Funding

$1.35 million
Ohio EPA - Water Resource Restoration Sponsor Program (WRRSP)

$257,000 NEORSD, Regional Stormwater Management Program

$92,400 USFS, GLRI grant for trees and shrubs

Ohio Environmental Protection Agency

USDA FOREST SERVICE DEPARTMENT OF AGRICULTURE

Great Lakes RESTORATION

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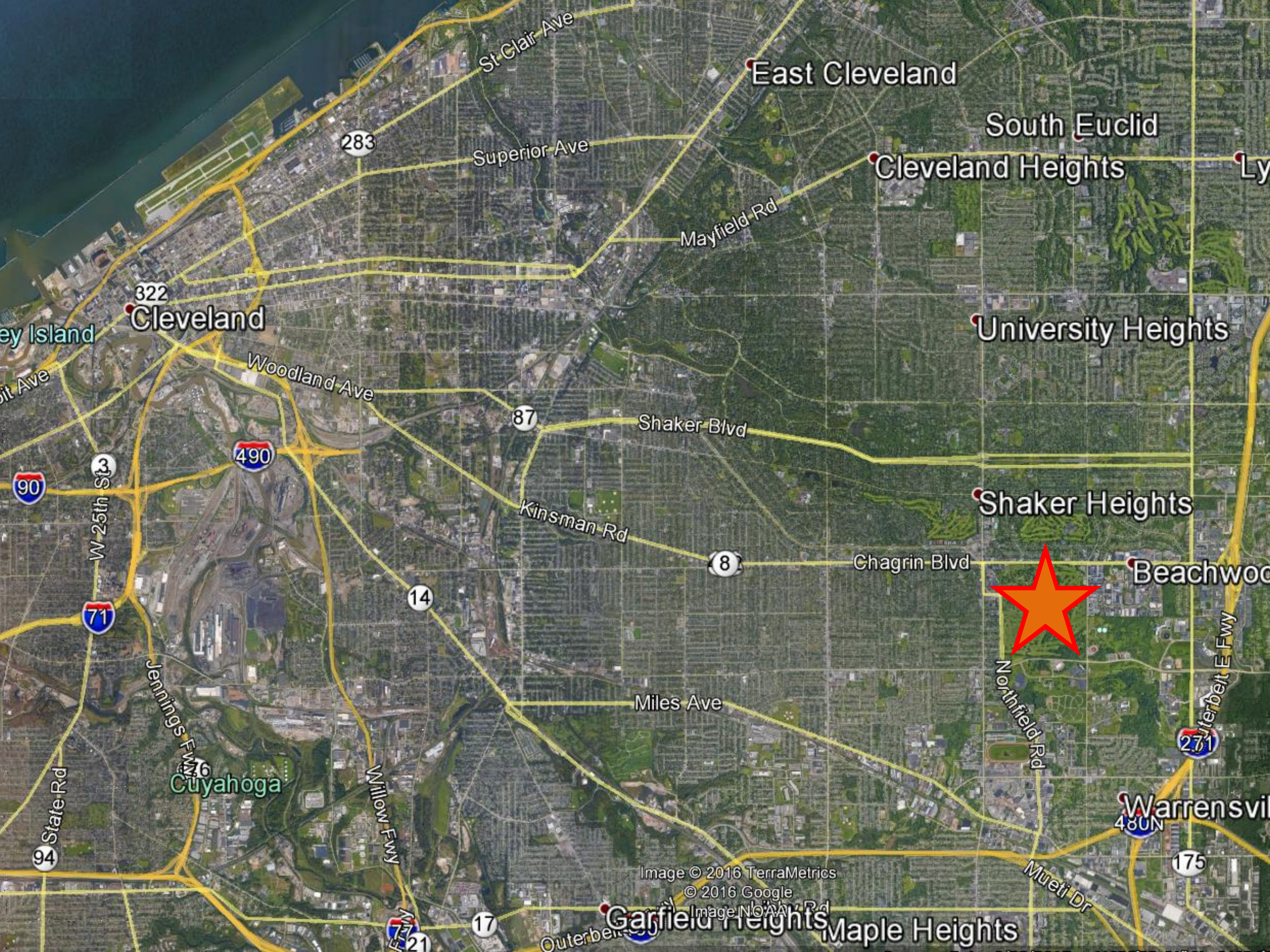

St Clair Ave
East Cleveland
283
Superior Ave
South Euclid
Cleveland Heights
Mayfield Rd
322
Cleveland
University Heights
Woodland Ave
87
Shaker Blvd
490
90
W 25th St
3
Shaker Heights
Kinsman Rd
8
Chagrin Blvd
Beachwood
14
71
Northfield Rd
Miles Ave
Jennings Fwy
Cuyahoga
Willow Fwy
State Rd
94
271
Warrensville
480N
175
Mueti Dr
Image © 2016 TerraMetrics
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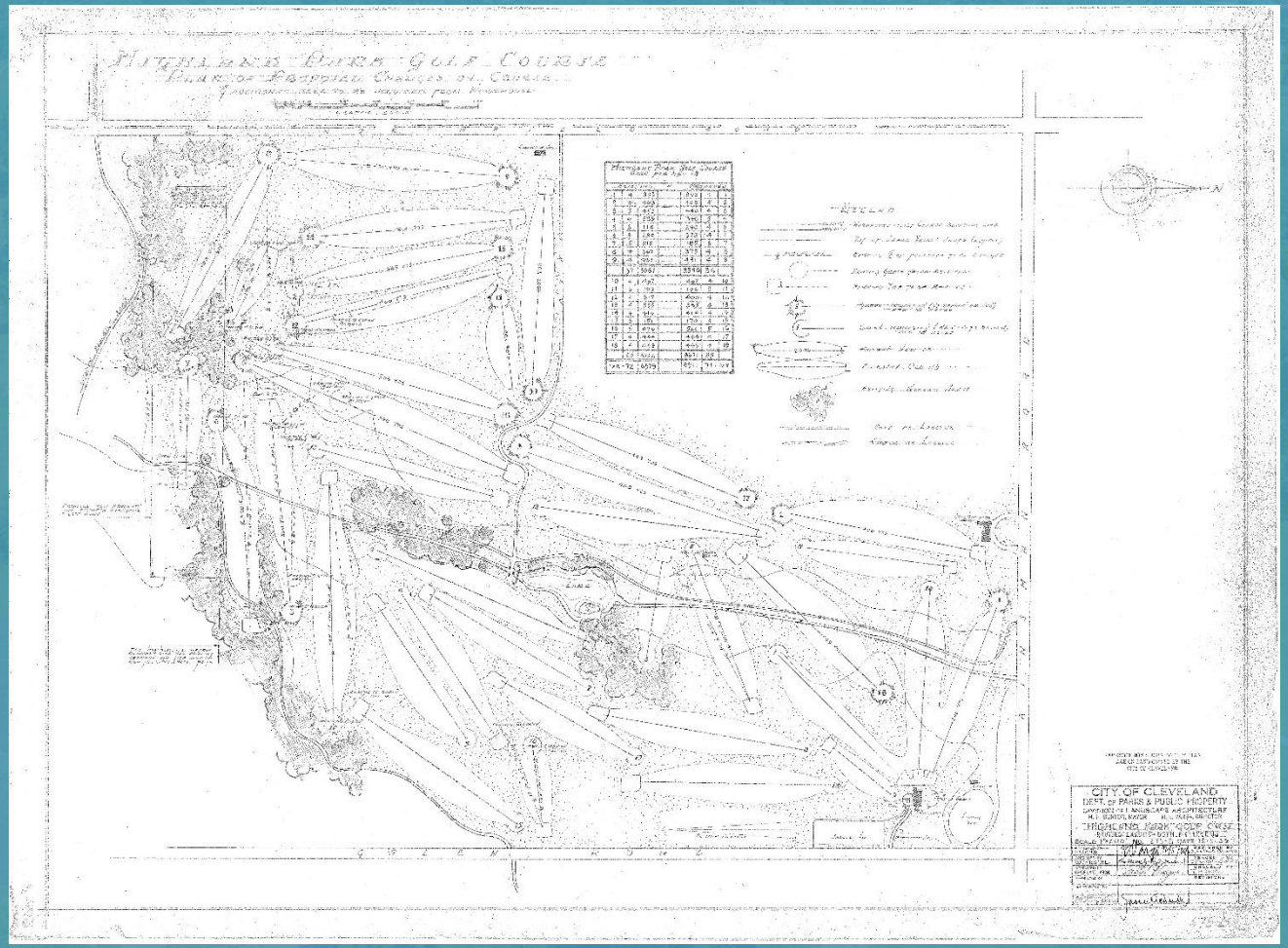
Image NOAA
17
Garfield Heights
Maple Heights

Project Area



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Project Area

- 1.7 square mile watershed
- 35% Impervious
- Two reaches
- Roughly 4,300 feet
- Two-acre in-line pond and dam

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Existing Conditions






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Existing Conditions

Existing Conditions

- Sinuosity = 1
- ER = 1.5
- BHR >2.0
- Rosgen B4c

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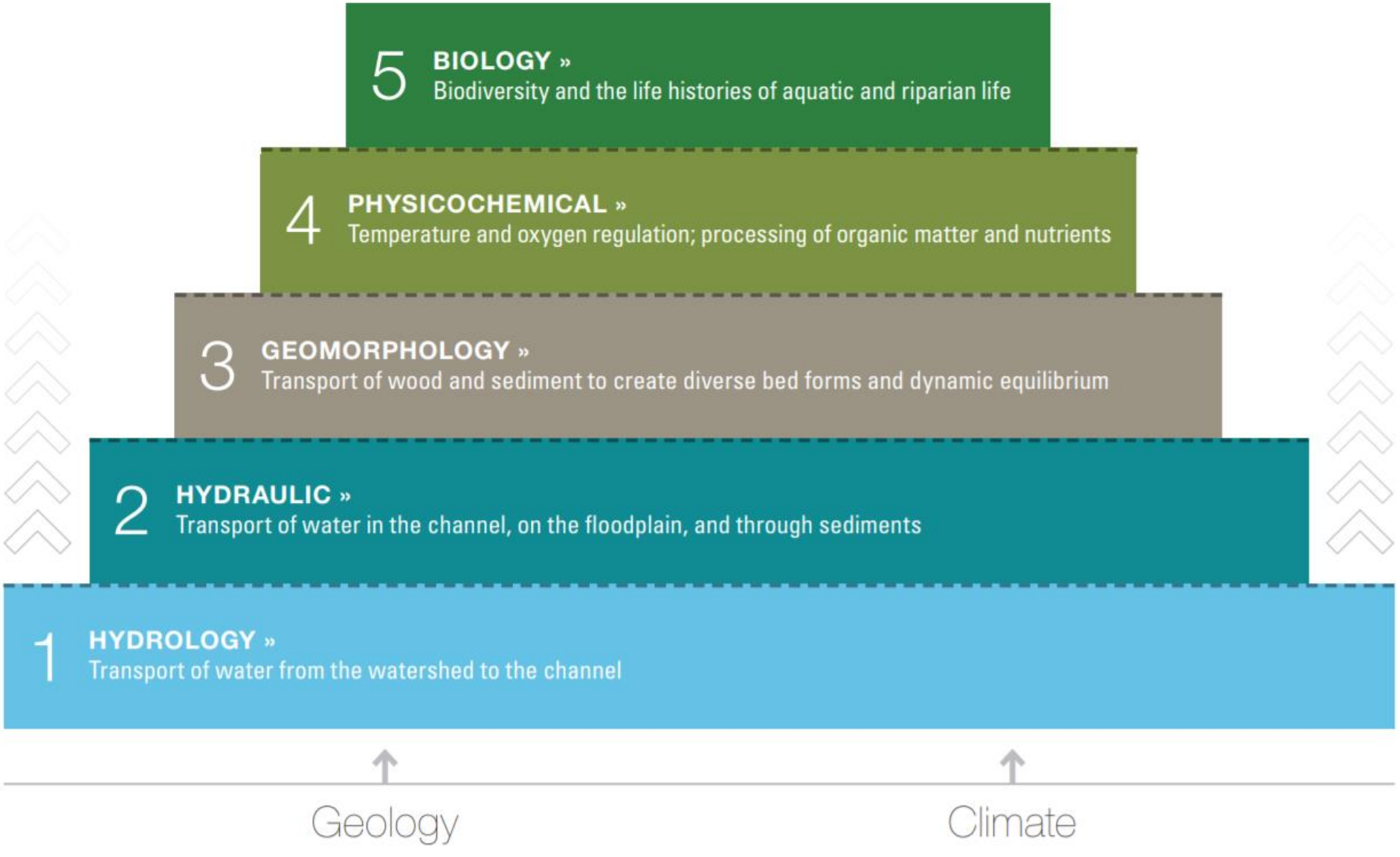
Project Development



FUNCTIONAL COMPONENT	EXISTING CONDITIONS	OPPORTUNITIES
Hydrology and Hydraulics	35% Impervious Surfaces Limited Floodplain Access Channelized system with high velocity and shear. Failing bridges and exposed water lines.	Improve floodplain connection. Improve floodplain connection and roughness to reduce stream energy.
Geomorphology (includes riparian vegetation)	Sinuosity = 1 Entrenchment ratio = 1.5 Bank height ratio = >2 Rosgen B4c Armored vertical banks and floodplain maintained as lawn. QHEI – 55.5	Improve sinuosity Increase the entrenchment ratio. Reduce the bank height ratio. Remove armoring and introduce natural stabilizing vegetation.
Chemical Water Quality (physiochemical)	35% Impervious surfaces One illicit discharge identified. Drain tiles outlet directly into the channel.	Remove the illicit discharge. Plant a dense floodplain buffer to filter GC runoff. Quality riffle habitat for oxygenation and nutrient reduction. Floodplain connectivity for pollutant/sediment processing.
Biological (stream and riparian)	IBI =20 (poor) – three fish species ICI = 24 (Fair)	Construct high quality, stable riffles for macroinvertebrates. Mill Creek Falls and other downstream obstructions limit the fish community.
Social	Active golf course. Failing bridges and exposed water lines. Fairways do not drain after floods.	Maintain or improve play of the course. Remove the failing bridges. Improve fairway drainage.

FUNCTIONAL COMPONENT	GOALS	OBJECTIVES
Hydrology and Hydraulics	Manage urban hydrology. Maintain velocities to allow passage of aquatic life. Improve course drainage after storms.	Maintain riffle velocities ≤3 feet/second. No drop features >0.3 feet at baseflow. **Maintain 10yr Q within the constructed floodplain.**
Geomorphology (includes bank vegetation)	Improve riparian habitat and riffle/pool development. Remove failing gabions and stone walls and prevent bed and bank erosion.	Expand riparian buffer to >10m where feasible. Significant amount of pool habitat >70cm. Bank height ratio ≤1.0 and floodplain width >2.0 times riffle width where feasible. Vertical and horizontal stability. **Improve stream pattern.**
Chemical Water Quality (physiochemical)	Support water quality.	Dense vegetation on the banks and floodplain. High quality riffle habitat. Improve floodplain connectivity **Partial dam removal.**
Biological (stream and riparian)	Create a connected, longitudinal stream and riparian corridor.	Construct high quality, stable riffles for macroinvertebrates. Increase the diversity of in-stream and riparian habitat.
Social	Stabilize and protect existing infrastructure. Maintain golf course play.	Protect or remove bridges and water lines. Improve public appreciation. Improve fairway drainage.

Design and Construction

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Design Approach

- Utilize the existing valley through a combination of a Raised Grade and Floodplain Creation approach
- Integrate stream patterns into golf course play, bridges, utilities and water lines
- Design intention was to contain the 10Yr storm within the created floodplain
- Modify the in-line pond with partial dam removal

Stream Pattern Pre and Post Construction

- Pattern influenced strongly by two factors
  - Bridges
  - Golf play
  - Consulted with golf course architect and local management staff

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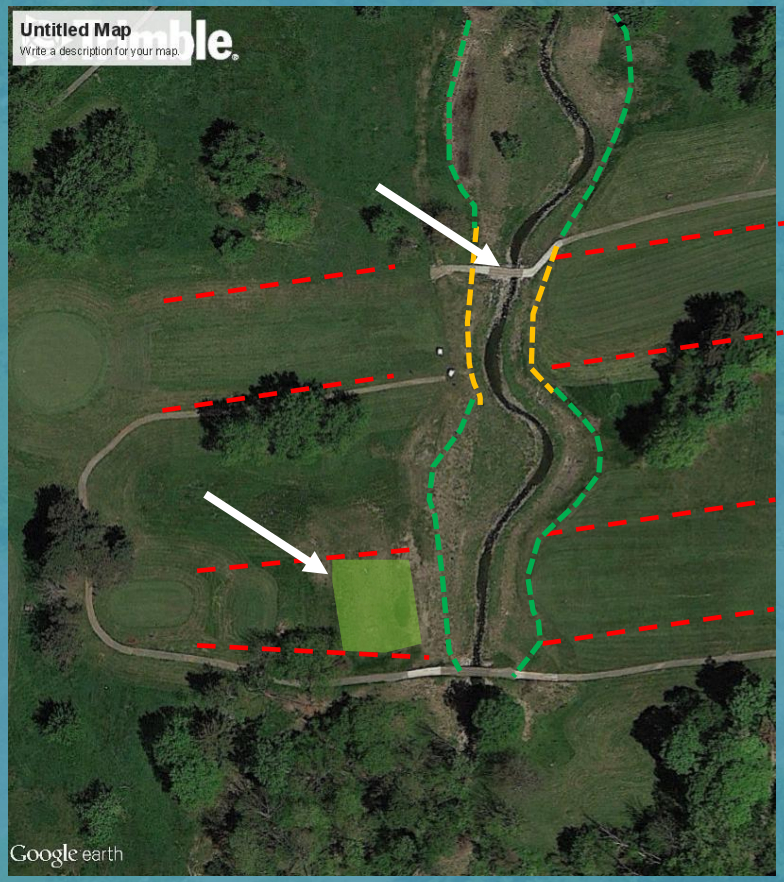
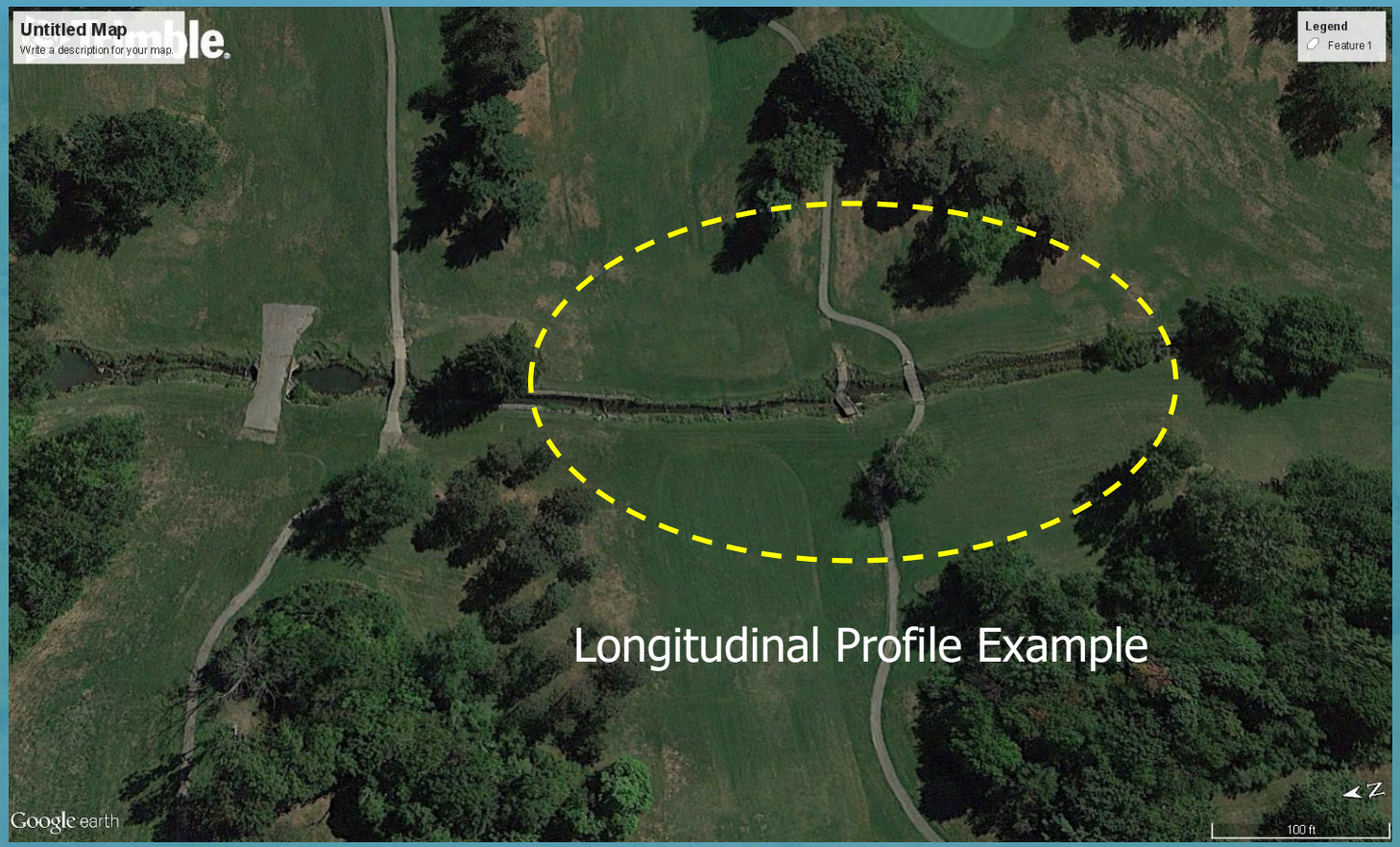
Golf Play and Bridges



- Shifted pattern to help golf play
- Added sinuosity between fairways
  - Expanded floodplain
  - Denser plantings
  - Wetland features
- Added tee boxes with spoil
- Moved one bridge due to shift in pattern and width of existing bridge



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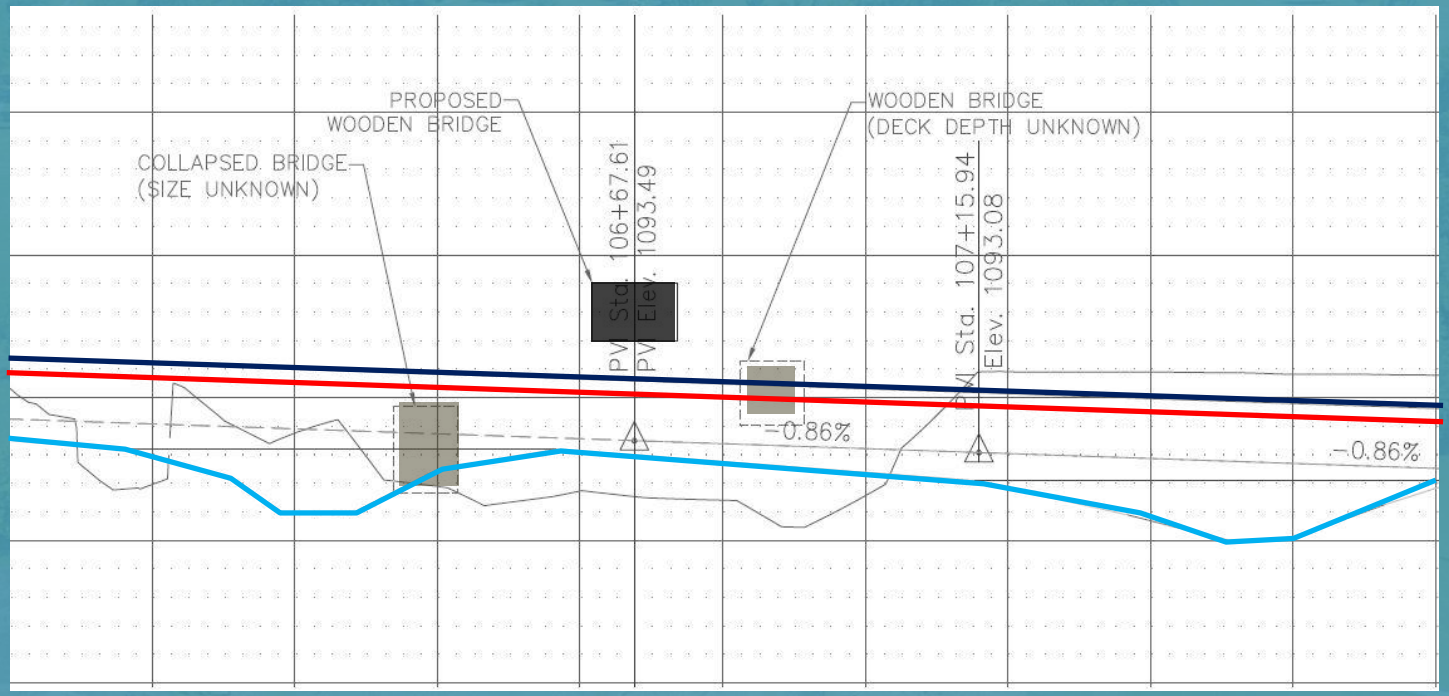
Longitudinal Profile



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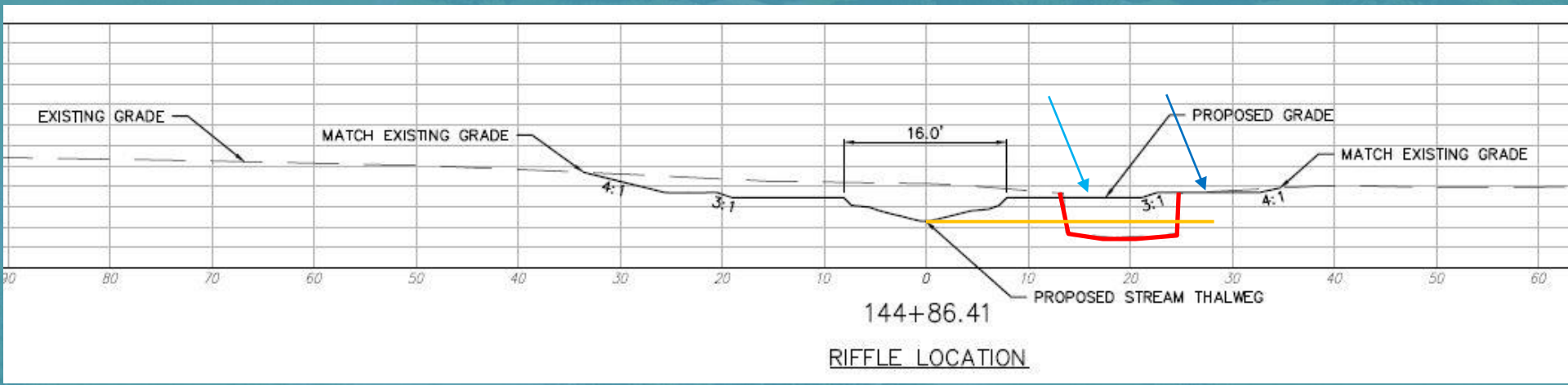
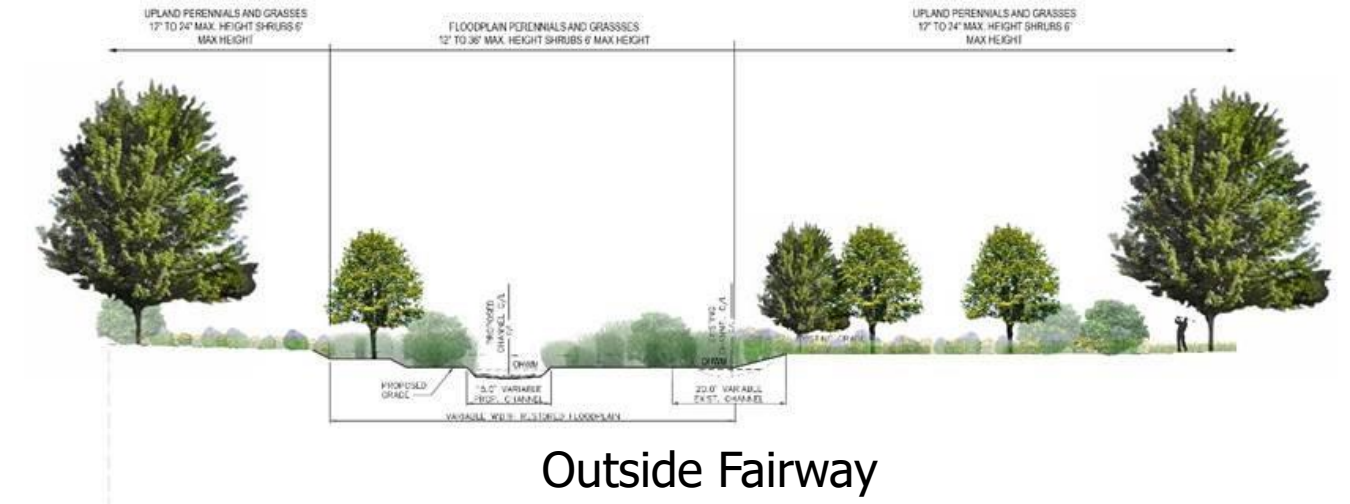
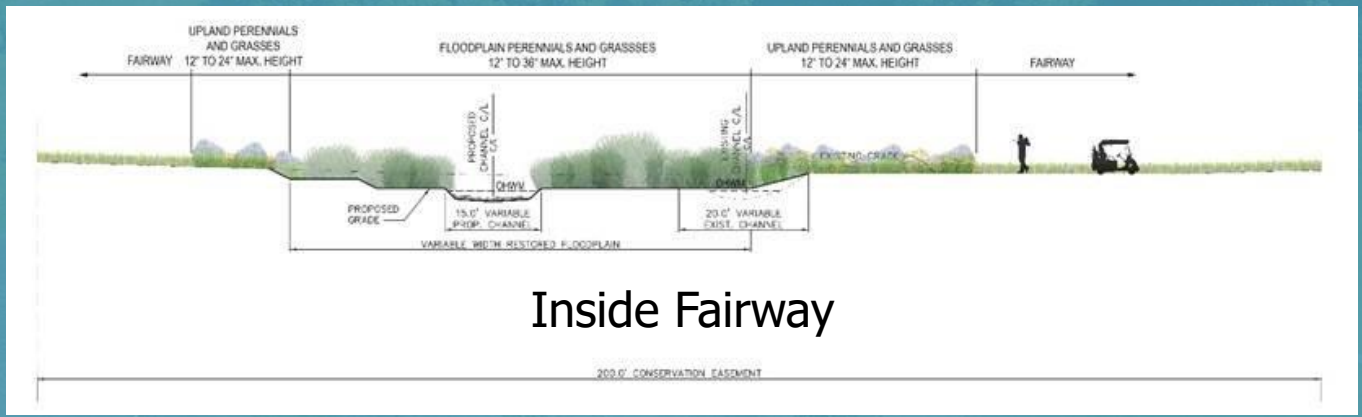
Dimension

- Based on three factors
  1. Existing morphologic indicators
  2. Regional characteristics
  3. Hydraulic modeling
- Floodplain limits and elevation influenced mostly by hydraulic modeling





Outside Fairway



Inside Fairway

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Existing In-Line Pond

- Shallow pond in-filled with sediment
- Poor functionality & water quality
- No use for golf course
- Thermal impact

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Restored In-Line Pond

- Stream restoration for continued sediment transport
- Functional floodplain
- Thermal impacts removed
- Storm water accessible to remnant pond area- converting to wetland.
- Dam partially removed but left as grade control

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Constructability

Advantages

- One owner
- Ample space for spoils
- Staging and access
- Opportunities for improvements

Challenges

- Safety
- Schedule
- Bridges
- Utilities/Irrigation
- Flashy Hydrology
- City Bridge
- Vegetation
- Communication
- Bedrock

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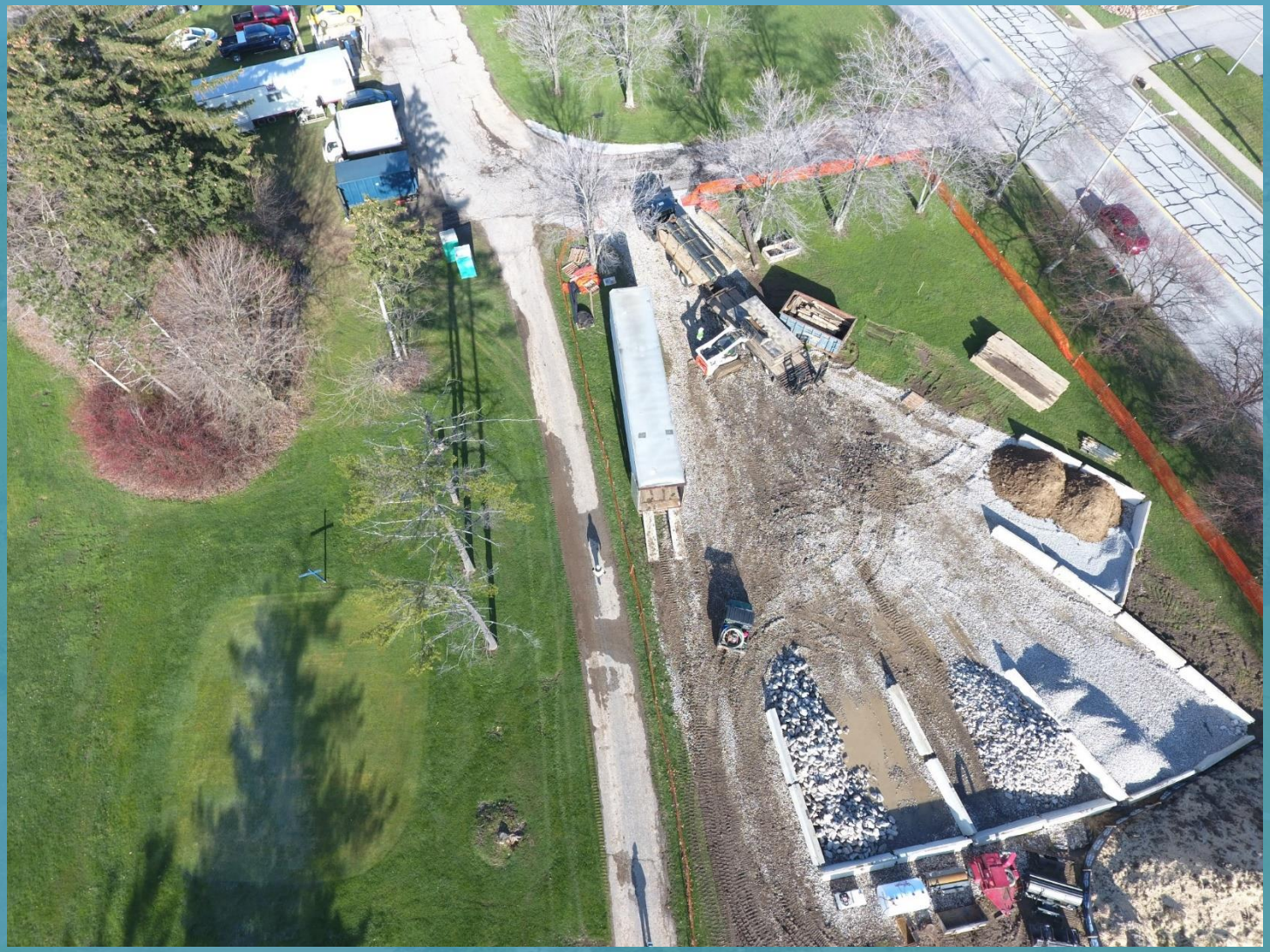

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Results

H&H Objectives

- Maintain riffle velocities ≤3 feet/second.
- No drop features >0.3 feet at baseflow.
- Maintain 10yr Q within the constructed floodplain.

H&H Objectives

H&H Objectives

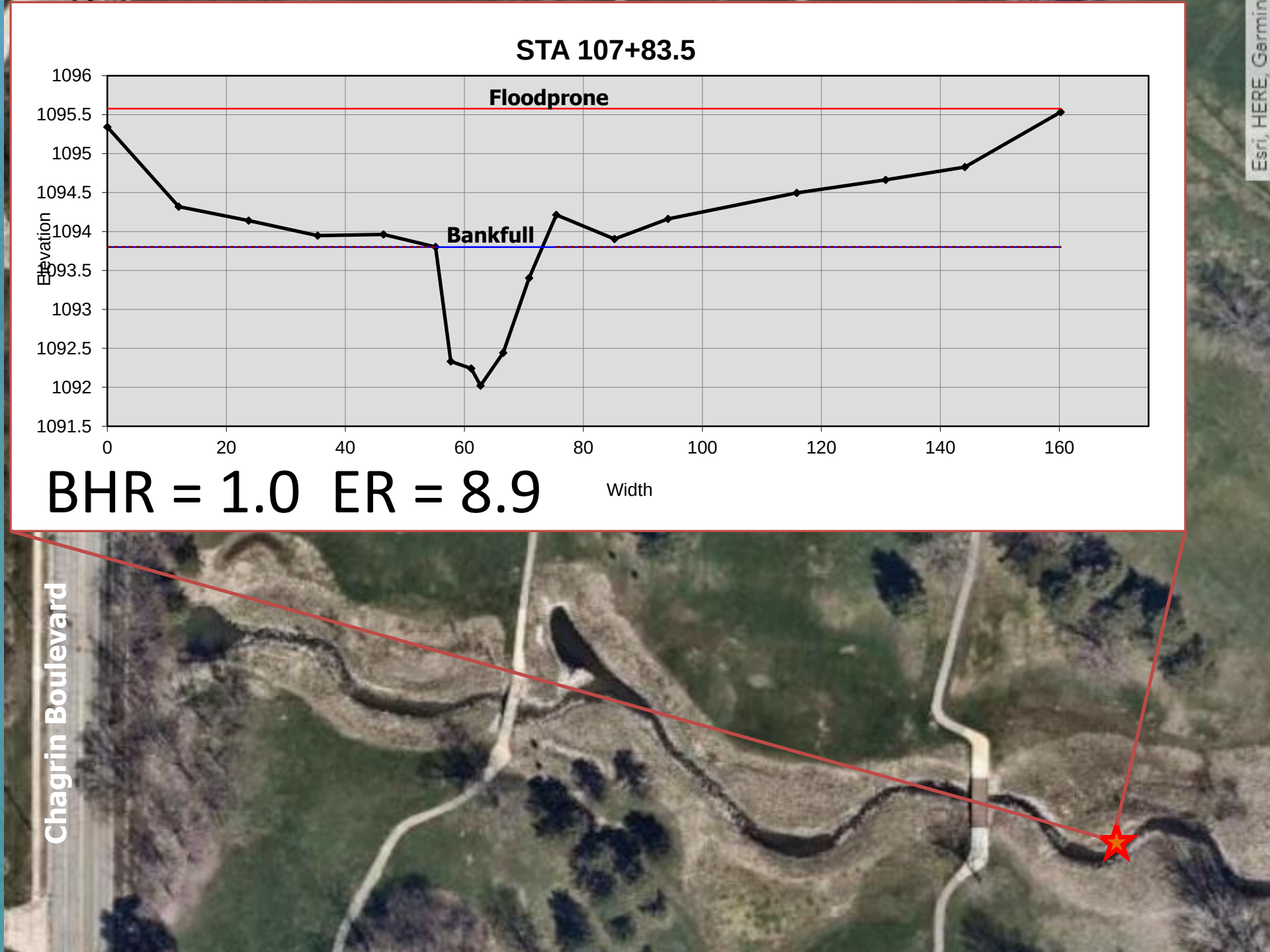
Geomorphology Objectives

- Riparian buffer >10m where feasible.
- Significant pool habitat >70cm.

QHEI Metric	RM 11.52 (2011/2017)	RM 10.70 (2011/2017)
Substrate	16.5/18	17/18
In-stream Cover	7/7	12/8
Channel Morphology	10/11	6/11
Bank Erosion/Riparian Zone	3/6	4/6
Pool/Glide and Riffle/Run		
- Pool Quality	10/8	5/8
-Riffle Quality	5/5	3/5
Gradient	4/4	4/4
Total	**55.5/59**	**51/60**

Geomorphology Objectives

- Target bank height ratio ≤1.0 and floodplain width >2.0 times riffle width where feasible.


STA 107+83.5
Floodprone
Bankfull
Elevation
Width
1096
1095.5
1095
1094.5
1094
1093.5
1093
1092.5
1092
1091.5
0
20
40
60
80
100
120
140
160
BHR = 1.0 ER = 8.9
Chagrin Boulevard
Esri, HERE, Garmin

Geomorphology Objectives

- No significant change in stream profile over time.

Geomorphology Objectives

STA 117+86.23	Elevation
Construction Drawing	1084.92
April 12, 2017	1084.91
March 23, 2018	1084.79
	-0.13

STA 124+92.64	Elevation
Construction Drawing	1079.22
April 12, 2017	1078.91
March 23, 2018	1079.02
	-0.20

STA 106+56.51	Elevation
Construction Drawing	1093.19
April 12, 2017	1092.71
March 23, 2018	1092.70
	-0.49

Water Quality Objective

- Support good water quality
  - Discharge tiles into the floodplain
  - Floodplain access for processing pollutants and sediment.
  - Plant a dense riparian buffer.
  - High quality riffle habitat.

Biological Objective

- Support biodiversity by providing high-quality in-stream and riparian habitat.
  - Stable riffles to support the macroinvertebrate community.
  - High quality fish community precluded by downstream barriers.

Social Objectives

- Protect or remove bridges and water lines.
- Improve fairway drainage.
- Improve public appreciation.

Social Objectives

Pre-construction

Post-construction

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Social Objectives

Pre-construction

Post-construction

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Social Objectives

Pre-construction

Post-construction

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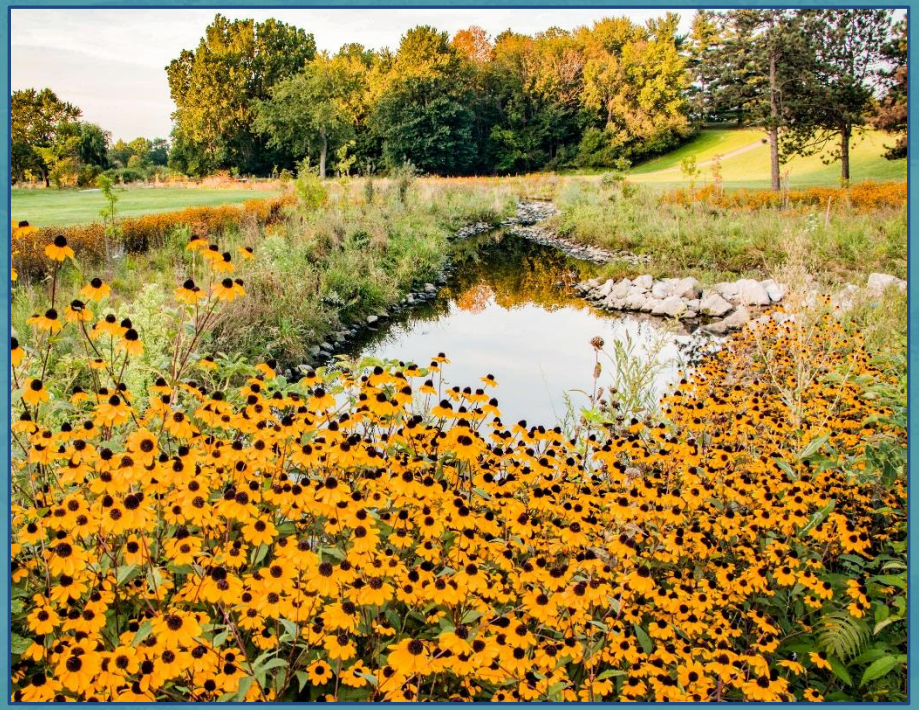
Social Objectives

Pre-construction

Post-construction



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What we might have done differently….

Design Phase

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VILLAGE OF HIGHLAND HILLS, OHIO

HIGHLAND PARK GOLF COURSE STREAM RESTORATION

BOARD OF TRUSTEES

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SHARON A. DUMAS	MEMBER
JULIUS CIACCIA	CHIEF EXECUTIVE OFFICER

PROJECT NO. 1311

VICINITY MAP
SCALE: NONE

INDEX OF DRAWINGS

60% DESIGN SUBMITTAL

ACCEPTED BY _____ DATE _____
JULIUS CIACCIA
CHIEF EXECUTIVE OFFICER
NORTHEAST OHIO REGIONAL SEWER DISTRICT

ACCEPTED BY _____ DATE _____
KELLIE C. ROTUNNO, P.E., BCEE
CHIEF OPERATING OFFICER
NORTHEAST OHIO REGIONAL SEWER DISTRICT

ACCEPTED BY _____ DATE _____
JAMES D. BUNSEY P.E.
DIRECTOR OF ENGINEERING AND CONSTRUCTION
NORTHEAST OHIO REGIONAL SEWER DISTRICT

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DESIGN-BUILD BY:

GPD GROUP
5995 TRANSPORTATION BLVD, SUITE 100
CLEVELAND, OHIO 44125
330-572-2100

ENVIROSCIENCE INC.
5070 STOW ROAD
STOW, OHIO 44224
330-688-0111

RIVERREACH CONSTRUCTION
92 31ST STREET NORTHWEST
BARBERTON, OHIO 44203
330-753-4722

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2 WORKING DAYS BEFORE YOU DIG
CALL TOLL FREE 800-362-2764
Call 800-925-0988 (Toll Free) Oil & Gas Producers Utility Protection Service

PROJECT NO: 1311
SHEET NO: SHEET 01/62
SHEET: G-001

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Construction Tolerances

Adaptive Management

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Stakeholders and Project Partners

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Two-year Plant Warranty

Irrigation Lines and Utilties

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Long-term O&M Plan


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CITY OF CLEVELAND OHIO

Highland Golf Course Stream Restoration
Operation & Maintenance Manual

Date: March 2017

Prepared By:

RiverReach Construction

EnviroScience
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Opportunity at the Pond

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Summary