• Evaluate the overall condition of Griswold Creek
• Determine stable channel dimensions & appropriate restoration techniques
• Starting point for future projects
• CRWP still available to provide site visits & recommendations & to help find grants
Chagrin River Watershed Partners, Inc.

- Non-profit organization formed in 1996 by watershed communities.
- Technical assistance to minimize flooding, erosion, and water quality issues.
- Biomonitoring specialists
- Joel Bingham
  - Manager Restoration Services
  - Designing and building streams since 2002
Stream Process
Fluvial Processes

Flow ↔ Sediment

- Interaction between flow and erodible sediments
- Sediment entrainment, transport and deposition

*Streams in equilibrium are said to maintain a balance between flow contribution and sediment transport and deposition

During the flood is when the power responsible for creating and maintaining the channel occurs

We evaluate habitat at base flow on a sunny day
Lane Model @ Equilibrium

Sediment Size
- Coarse
- Fine
- Flat
- Steep

Sediment Load

Stream Flow

EROSION
DEPOSITION
How do you study a river or stream?

Even though they are unique-

- Common features can classify and categorize streams for comparison

**Components of a Stream**
- Pattern
- Profile
- Dimension
Components of a Stream

Streambed Profile - Longitudinal profile

Dimension - Cross section

Bankfull - corresponds to flow stage just before entering the flood plain.*

Stream Pattern - Geometry

*Watershed flood plain.

Griswold Creek Watershed
Chagrin River Watershed
Channel Evolution

1. Vertical incision from floodplain
2. Widening – erosion of stream banks degradation
3. Deposition- aggradation
4. Creation of new channel at lower elevation
Channel Stability

- Extremely important to maintain both vertical elevation control
- Loss of access to floodplain initiates channel evolution process
- Caused by storm water, dredging, channelization, incision of a main stem river
Griswold Creek Assessment
Slope Variability = Power

Griswold Creek

Profile produced from Lidar topo elevation data
Impairments Summary

- Erosion
- Down-cutting
  - Headcut
- Sediment
  - Aggradation
  - Degradation
Erosion

- Natural and man-made causes
- Streams erode and deposit naturally
- Rate and magnitude of erosion
Headcut

- Is a limit of headward (moving upstream) erosion of the channel
- Areas of extreme power
- Niagara Falls is a head cut
Sediment Aggradation

- Sediment accumulates in overwide areas following erosion
- Sediment facilitates change
- Creates foundation for new floodplains
Degradation

- Erosion in high energy areas caused by stream adjustment
- Creates wider stream channels
Dams

• Create a barrier for wildlife
• Hinder movement of sediment downstream
• Create vertical stability
• Need maintenance
• High risk due to amount of elevation at one location
The Club at Hillbrook

Cross Section

Elevation

Longitudinal Profile

<table>
<thead>
<tr>
<th>bed</th>
<th>water srf</th>
<th>bankfull</th>
</tr>
</thead>
</table>

Griswold Creek Watershed
Chagrin River Watershed
The Club at Hillbrook

- Slope 1.1%
- Entrenched
- Degradational Phase - widening
- Active floodplain is 5ft down from original floodplain
- Commonly moves 6” diameter rocks
- Lacks useable floodplain
Geauga Park District’s Bessie Benner Metzenbaum Park

- Slope 0.8%
- Moderately entrenched
- Floodplains are more accessible
- Portions aggrading due to logjams
- Predominantly sand substrates – substrate easily transported by stream
- Large wetland surrounding
- Could be improved by making stream access floodplain more frequently - benefit downstream areas
Laurel School

- Moderately entrenched in lower reach
- Floodplains are more accessible
- Sediment transport functional = equilibrium
- Reach exhibits some stability
- Benefitted by reduction in gradient downstream of Fairmount Rd (Longitudinal profile)
Potential Causes & Conceptual Solutions

- Main stem Chagrin River incised- causing head cut erosion
- Increased storm water
- Channel incision – creating loss of floodplain access
- Dam failure

- Storm water control / detention
- Maintain or create vertical stability
- Create areas for floodplain
- Create areas for flood storage
Typical Condition 1 - Floodplain Expansion

Typical Condition 2 - Bank Stabilization
• Typical Raise-Grade

[Diagram showing restored channel dimensions, existing channel, earthen fill, and substrates.]
Concept Examples
Existing Condition
Bank Stabilization

Griswold Creek Watershed
Chagrin River Watershed
Existing Condition
Cross Sectional Area Curve

- Reference sites- Provide important information on stable, functional condition
- Blueprints for design and Construction

<table>
<thead>
<tr>
<th>Stream</th>
<th>Drainage Area (m²)</th>
<th>Cross Sectional Area (ft²)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Valley View</td>
<td>0.63</td>
<td>16.5</td>
</tr>
<tr>
<td>Wastewater</td>
<td>1.51</td>
<td>19</td>
</tr>
<tr>
<td>Treatment Plant</td>
<td>3.02</td>
<td>38.3</td>
</tr>
<tr>
<td>Metzenbaum Park</td>
<td>3.02</td>
<td>49.6</td>
</tr>
<tr>
<td>Laurel School #1</td>
<td>6.51</td>
<td>100.2</td>
</tr>
<tr>
<td>Laurel school #2</td>
<td>6.64</td>
<td>75.3</td>
</tr>
<tr>
<td>Hillbrook Club</td>
<td>6.51</td>
<td>100.2</td>
</tr>
<tr>
<td>Bowen Dam</td>
<td>6.64</td>
<td>75.3</td>
</tr>
</tbody>
</table>

Graph showing the relationship between drainage area and cross-sectional area with the equation:

\[ y = 21.97x^{0.6528} \]

\[ r^2 = 0.996 \]
Summary

What is happening?

- Griswold Creek is undergoing active channel adjustment
- Loss of floodplain access is overwhelming system with sediment
- Channels widening to make new floodplain
- Channel evolution process
Strategies

- Storm water storage and infiltration
- Decrease bank erosion
- Raise Grade to historic floodplain where feasible
- Vertical elevation control is important
- Need to prevent additional Channel evolution
- Headwater runoff storage Everyone in the watershed can do a part
- Cooperation and Collaboration to make things happen
Questions

- Joel Bingham, Restoration Manager

Chagrin River
Watershed Partners, Inc.

- Amy Brennan, Director
- Keely Davidson-Bennett, Program Associate
Extra
The Club at Hillbrook
Geauga Park District’s Bessie Benner Metzenbaum Park

- Re-attach floodplain
- Raise-grade
- Create floodplain and stormwater Storage
- Public Land
Tree Falls