Hydrologic Regime; Past and Present and Water Quality Implications

Waseca County Water Plan Meeting
Waseca County Courthouse Annex
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Topics

- Hydrologic Regimes, past and present
- Water Quantity Implications for Water Quality
- Floodplain Mapping and Management
Hydrologic Regimes

Def: Stream Flow Patterns of Base and Peak Flow Events

- **Timing** – Seasonal and diurnal patterns
- **Duration** – How long?
- **Magnitude** – How large is the flow in CFS or AFY?
- **Frequency** – Number of events in a given year?
- **Rate of Change** – How quickly did the water rise?
Hydrology of a System

Natural flow regimes are determined by the climate, runoff, catchment size and geomorphology without the impacts of dams, weirs, extraction and river management.

Activities or Developments which include or result in alteration to natural flow regimes of rivers and streams and their floodplains and wetlands include:

- Damming of rivers (including construction of weirs)
- Pumping
- Floodplain storage
- Change in drainage pattern
- Water extraction
- Construction of levee banks and other structures on the floodplain
- Extraction of gravel and alluvial sands and dredging
Indicators of Hydrologic Alteration - IHA

Know the limitations and constraints of available hydrology data!
- Availability of adequate data is a problem on small systems
- Past records do not reflect current conditions

Influenced by relationships to other stream health components:
- Water Quality; low flow = concentrated contaminants
- Connectivity; transfer of energy from channel to floodplain
- Geomorphology; influences they hydrologic regime
- Biology; influenced by flow variability
The following 3 slides show what is happening on the LeSueur River............
Precip trends – The precipitation is very variable. The green line indicated the average precip value, and with the exception of the 1990’s period, much of the precip stayed around the average value. We may be receiving higher intensity shorter duration events, which impact the flow in the river system.
Moving into the DMC, while precip is variable and near the average value, we are seeing more flow per inch of precip. Since the 1980s, more water is making it to the river than in the past. It takes less rain to increase the stage in the rivers than in the past. Whether it is a change in storage capacity, precip timing, or land is still being investigated/discussed.
3 – Monthly chart. Looking at the monthly average flow volume, the blue line represents before the 1980’s inflection point, and the red line is after that point. We are seeing an average increase in flow volume in every month since the 1980s time period.
The Entire Flow Regime - Full Range of Natural Variability ……

1.) Influences the kind and number of species
2.) Influences the size and shape of the stream channel
3.) Influences groundwater exchange
4.) Influences the frequency and Intensity of floods
Stream Flow = Master variable for stream ecosystems

Huge flows and low flows are necessary for a healthy system.

The Natural flow regime is important to aquatic species
- unnatural flows favor less sensitive species
- unnatural flows eliminate or move sensitive species
Other Issues related to Hydrologic Regimes

A. Connectivity

- How water bodies and waterways are linked to each other on the landscape

Connectivity is affected by structures placed within the water on the landscape. The following structures generally have a negative impact on Connectivity:

- Dams
- Roads, Bridges, Culverts and Crossings
- Levees and Ditches
- In Channel Weirs

What are the negative impacts?
- barriers for fish
- Altered aquatic community
- higher peak flows, increased erosion and sedimentation
B. Cumulative Effects

Drainage increases the total amount of channelized flow = increased connectivity, increased nutrient delivery and increased sedimentation

Acceleration of natural stream bank erosion processes resulting in stream instability, increased land loss and aquatic habitat loss

Redistribution of organic matter within the rivers and floodplains (on which invertebrates and vertebrates depend)
Topic #2 - Interaction between Water Quantity and Water Quality

High flows increase sediment loading rates to the system.
Increased flows are attributed to:
- changes in precipitation amounts
- changes in land use
- artificial drainage

Low flows increase pollutant concentrations.
Decreased flows are attributed to:
- extraction
- diversion
- artificial drainage
Negative Impacts of Altered Hydrology

Increased habitat for invasive species

Loss or disruption of ecological function

Riparian zone degradation through altered flow patterns

Increased flows causing more permanent flooding of some wetlands

Reduction of habitat due to change in area, frequency and duration of flooding of floodplains and terminal wetlands.
Solutions?

Apply conservation practices to the land
Adoption of conservation practices depends on:

- Landowner acceptance
- cost
- life span
- effectiveness
- Federal Farm Programs

Draft Cannon River Watershed WRAPS (wq-ws4-23a)

Cannon River Watershed: Summary of Developing Watershed Restoration and Protection Strategies

Le Sueur River Watershed WRAPS Report (wq-ws4-10a)

Summary, Le Sueur Watershed and Restoration and Protection Strategies (WRAPS) (wq-ws4-10b)
Topic #3 - Floodplain Mapping and Management

Floodplain maps are valuable tools for elected officials, land use managers and regulators.

- Developments can be directed when adjacent to the floodplain.
- Structures can be removed from the floodway.
- Landowners can receive accurate quotes for floodplain insurance.