



# River Model

## *Instructions for*

### **The Watershed Game - Rivers Model**

*A simulation exercise exploring land use choices to reduce sediment and other pollutants to meet water quality goals.*

#### **About this version of the Watershed Game - Rivers Model**

This version of the Watershed Game focuses on looking at a large river and the contributing watershed and adjacent land uses including large urban centers, residential areas, adjacent towns, industrial land areas, and park areas along a river.

#### **Objectives\***

Players will:

- Understand what a watershed is and recognize and encourage the need for watershed planning to solve larger water quality issues.
- Build their understanding about how land use and land management decisions affect water quality. Build knowledge about local development and municipal operations that affect water quality.
- Participants will be able to identify major sources of sediment or/and phosphorus.
- Increase their knowledge about stormwater and land use best management practices (BMPs) and how those practices are used to reach pollutant load reductions. Learn how their choices can prevent or reduce impacts.
- Understand that water bodies have limits - they can only take so much before water quality, habitat, and designated uses are degraded. Understand water quality impairments, regulations, impaired water designations, and how local land use & management has a key role to play in reaching goals towards clean water.
- Understand the need for individual and community level solutions for protecting water quality and habitat.
- *River Version specific objectives ....*
- 
- *And other local objectives as appropriate...*

#### **Goal of game**

Achieve a water quality and pollutant load standard (TMDL) for sediment by reducing sediment pollution from all land uses in the watershed through application of a variety of Best Management Practices or BMPs. Alternatively, a phosphorus standard may be substituted for sediment, depending on the needs of the audience.

#### **Materials**

- Game board
- BMPs for five land uses ( there are a total of 5 key rings)
- Watershed planning cards (on key ring)
- Chance cards
- 5 **Black** dry erase markers & wipe cloth
- Candy pieces to act as “money” (min. 35-40 pieces per game board)
- Large banquet style table (min of 6 feet)
- Weights or clamps to hold the game board on a table.

## **Background for Game Facilitators**

### **The Game Board - River Model**

- This is an example of a large river that flows through a community. It includes land use adjacent to the river but does not show the entire watershed.
- A watershed is....
- Sediment is a naturally occurring part of stream ecosystems, but like many things, when too much of it enters our waterways, it causes a number of problems for recreation and aquatic life in particular. Excessive sediment can clog fish's gills, smother spawning habitat, scour susceptible organisms from the stream bottom, and fill in habitat for stream "bugs" that provide food for fish. Erosion of stream banks from increased runoff can be a major source of sediment, and this erosion can also lead to loss of property and endangerment of infrastructure near waterways.
- Phosphorus is also naturally occurring, and a necessary element for stream ecosystems. When excessive phosphorus enters a stream, it can cause large growths of algae, reduced habitat for fish, and reduced oxygen levels as the algae dies and decomposes.
- Typical land-uses in a watershed include farmland, forests, residential areas, and cities (*explain what makes up each of these land uses categories.*)
- Typical impacts you could expect from these land-uses are:
  - Farmland – no buffer between cropping and the stream; wetlands drained for cropping; cows allowed uncontrolled access to the stream; and no conservation tilling.
  - Forests – Clear cutting; harvesting in or near sensitive storage areas; harvesting above highly eroding slopes; numerous stream crossings and extensive forest roads.
  - Residential – Vegetation along the waters edge removed; extensive removal of vegetation and soil grading on construction sites with no erosion control.
  - City – Wide streets; curb and gutter; removal of natural vegetation; loss of storage; and high percentage of impervious surface.
  - At any place along the stream in the watershed there can be pollution contributions from such things as eroding banks that can be a function of the natural landscape, but increasing the amount and speed of runoff can increase these contributions.
  - Even undeveloped land contributes a small amount of sediment & phosphorus to water bodies.

### **The Game Pieces – River Model**

A variety of BMPs can be used to prevent or mitigate pollution in the river and in the watershed. The ones represented in the game are not the only ones available, but represent a number of innovative and traditional stormwater management practices that have been used and shown to be effective in the appropriate situation. The costs represent a relative estimate of cost as compared to the other BMP's, but this will vary depending on circumstance and situation. Likewise, the effectiveness should be treated as relative, and depends on specific situations and appropriate implementation. In the

future, additional BMP game pieces may be developed and shared with game users. If you wish to add or modify an existing game piece, feel free, but please inform Northland NEMO, to ensure that your contribution can be shared with others.

## **Ready, Set, Play !**

### **I. Setting the Stage Before play begins.**

*\* Note: This section should take you no more than 5 minutes. Previous experiences and feedback from participants indicate that the game facilitators should talk less! Therefore, although the facilitator must address the following sections (Setting the Stage, Background, Rules, and Explanations), it is important to allow for participants to talk freely and discuss the BMPs and situations amongst themselves. Facilitators should promote inquiry based learning.*

*Facilitators should promote inquiry based learning.*

- Introductions of presenters
- Game is a fictional landscape.
- Intent is not to point fingers at any one land use as the main culprit of sediment or phosphorus and other pollutants, but recognize all land uses contribute, and point out what each land uses can do to limit sediment and phosphorus pollution in the watershed.
- Describe land uses & typical impacts expected from each one:
  - Parks & Open Space
  - Heavy Industrial
  - Residential
  - Downtown
  - Small City
- Describe game piece BMPs with description on back (hold on to all game pieces, candy, and markers until the game begins). Some BMPs cost more candy than others. Some are simple and easy, so they save you money. If you choose that BMP you get money from the bank. Each BMP has a label that describes what it does and how much it costs or saves.
- Describe **goal of game**, which is to reduce the sediment load in the river to a set limit (*see above. Currently set at a TMDL goal of 200 units or points*). *State the objectives from above in your own words*
- We have 3 years or rounds on which to meet this goal, in the case of the Game, implementing 1 BMP per year.
- Define key terms and their relevance: watershed, land use, sediment, Best Management Practice
- Describe yourself as the facilitator and another assistant as the banker. *Experience has found that having an assistant who serves as the banker to collect the money (chocolate and add the points up during the rounds affords the facilitator to focus on leading the game, discussions, and learning objectives.*

### **Background narrative- example of narrative**

Runoff from developed landscapes carries pollutants in it. One of the most widespread is sediment. Sediment clogs fish gills, smothers eggs and aquatic organisms, decreases light penetration, carries nutrients and toxic compounds, and isn't fun to swim in or

drink. High amounts of fast stormwater runoff cause erosion and carry sediment to the river. Another source of sediment in rivers comes from unstable, eroding river banks. A river can only take so much sediment before it starts to show poor water quality and habitat degradation.

This game uses a fictional landscape or a partial watershed to introduce players to sediment pollution and Best Management Practices (BMPs) designed to reduce sediment impact on the river. Five land uses are included on the game board (parks & open space, heavy industrial, residential, downtown, and a small city). The intent is not to focus on one land use as the main source of sediment pollution, but rather to point out what all land uses can do to limit sediment in the river.

*\* To date, this Rivers Version of the Watershed Game was designed to address sediment as an example of one of the pollutants local decision makers need to manage. However, other pollutants such as nutrients, chlorides, and toxic chemicals are discussed and can be further expanded on in future versions or instructions.*

### **Setup:**

- Divide players among land uses (\* at least two players per land use)
- Give each land use a budget of five candies
- Assign points 50 pollutant points for each land use and an upstream contribution of 100 points.
- 200 is the limit (for example our TMDL goal)

## **II. Play the Game !**

- Pass out the BMP cards to each group
- Pass out 5 candies to each group. This is “money” to buy BMPs
- Instruct each team to quickly review them, and lay them out in front of them. Allow the teams 2-4 minutes.
- **Rules: explain the rules**
  - Players can not swap BMPs between land use areas
  - Each team / player chooses one BMP per round
  - Pay banker/instructor for BMP selected
  - Each round, the BMP points are subtracted from the land use total

### **Pre-Round 1 - an opportunity to “buy” a watershed plan**

- Players have a chance to buy a watershed “plan” at start of the game for 1 candy. This is the only opportunity they have to do so.
  - *A plan may offer benefits in the future or it may be an expenditure of resources with little to no return. That is yet to be seen.*
  - *It may help guide their BMP selection the future,*
  - *it may cost a substantial investment of time and money,*
  - *it may lead to success.....*
  - *What we do know is that a Plan does not reduce their pollutant point total.*

- *Later, after round 1, those who purchased a “plan” may be rewarded by the instructor/banker giving them candies or money back. One candy returned per round has worked well.*

### Round 1

- Give teams/players 2-3 minutes to choose a BMP to implement.
  - Ask teams/players to discuss the BMPs they chose. Why? Cost or type? Have players explain what the BMP does.
  - Collect the money (candies) from the each team.
  - Have each team subtract the points from their land use point box.
  - Add up total sediment points remaining. Compare total sediment points remaining to goal and encourage group to meet goal
- \*\* Experience has found that having an assistant to the facilitator really helps. The assistant can collect money (chocolate and add up points and recalculate totals so the facilitator can concentrate on discussions, concepts, and learning objectives rather than spending valuable time on math.*

**Planning Pays Off (sometimes)** give candies to those who bought a “plan.”

### Round 2

- Give players 2-3 minutes to choose a second BMP to implement.
- Ask teams/players to discuss the BMPs they chose why? Cost or type? Have players explain what the BMP does.
- Collect the money (candies) from the each team.
- Have each team subtract the points from their land use point box.
- Add up total sediment points remaining. Compare total sediment points remaining to goal and encourage group to meet goal
- Discuss that even though we have implemented all these BMPs (two rounds worth now) we still have not reached our goal.

### Chance Cards - unforeseen circumstances and events.

Purpose: The injection of “chance cards” into the Watershed Game provides additional learning opportunities beyond BMPs. It also provides some dilemmas and unforeseen circumstances. Chance cards may either benefit or cost a land use team money (candy). (In the future, Chances may also add/subtract from point totals.) Chance cards were also developed to ensure that the simulation or learning experience does not end too quickly nor is it always so easy just to buy and implement BMPs to prevent or cleanup pollution. New this fall, is a trial to include all the Chance Cards together on the board and at the facilitator’s discretion, he/she may inform a particular land use team (or all of them) that they must randomly select a Chance Card. The Chance Cards are included at the end of this document and are draft and under development.

### Examples of a disasters

- barge spill in the river- costs to heavy industrial land use for clean up: take 1-2 candies

- 12 inch rainfall in 24 hrs blows out construction site erosion controls and plugs storm sewers which floods city & homes: take 1-2 candies

**Planning Pays Off #2 (sometimes)** give candies to those who bought a “plan.”

### Round 3

- Give players 2-3 minutes to choose a third BMP to implement. This round however, they should realize (or the facilitator should acknowledge) that they may not be able to use the BMPs they have left because they do not have enough money or candies. OR even if they do, they can start to see that they cannot reach the overall watershed goal.
- *Revisit the Game Rules.* Encourage players to work together to reach their sediment goal without actually saying “work together with other teams.”
  - *A suggested approach to this might be the following:* “We can see that we have implemented various BMPs, individual teams have reduced their contribution of sediment to the river, and overall, together we have got closer to our target reduction. However, we still have not met our goal. We also see that we all have various BMPs remaining in our toolbox, but perhaps not enough candy or funding to implement them. Does anyone have any suggestions for how we might get closer to our target reduction?”
  - Hopefully participants discover and offer the suggestion of partnering or collaborating with adjacent land uses. Sharing/borrowing/giving candy or funds to adjacent, cooperating partners. Combining money/candy to buy the most effective BMPs for the overall watershed.
- Ask teams/players to discuss the BMPs they chose why? Cost or type? Have players explain what the BMP does.
- Collect the money (candies) from the each team.
- Have each team subtract the points from their land use point box.
- Add up total sediment points remaining. Compare total sediment points remaining to goal and encourage group to meet goal
- Summarize the wide mix of BMPs used

### Wrap up

Obviously this isn’t a real-world situation. Different land-use contributes different pollutant loads and we don’t all have the same bank account. Also, although we initially asked you approach this as an individual land use unit, many of these problems can’t be solved alone. For instance, eroding bluffs aren’t always caused by one landowner and things upstream can impact things downstream. This is where working together at a community or watershed level will be especially important. Communication is critical. Support and encourage your local officials. Working together you can find the most efficient and effective ways to control pollutants going to your streams so we can preserve or restore what we value about them for ourselves and for future generations. (Could mention...you might hear this type of limit on a stream called a TMDL)

- Possible questions for discussion:
- What did you learn?
- What would you do differently if you played again?
- How does this game apply to work you are doing/would like to do?

- There are other impairments of the watershed that are also being addressed through watershed management, planning, and the implementation of BMPs.
  - *Impairments include bacteria, temperature, chlorides, mercury, PCBs and nutrients.*
  - *Different impairments call for difference BMPs although some BMPs may provide a response to several different impairments.*

**Storing the Game Board:** Make sure you erase the points and any writing on the Game Board as soon as play finishes! Otherwise the ink impregnates into the lamination and it won't come off.

Land Use	BMPs	Chance Cards
Urban Center	Install pervious pavement	Clean Water Grant
	Install green roofs	Flood
	Install stormwater treatment devices	Drought
	Capture and reuse stormwater runoff	EAB
	Sweep streets regularly	Toxic Spill
	Eliminate upstream pollution sources	
Small City	Implement Low Impact Development & redevelopment	Severe erosion or slump bank
	Control erosion at construction sites	Good Housekeeping Practices
	Train municipal staff	Coordination / Partnership
	Design/redesign streets to reduce runoff	Road salt/sand runoff pollution identified
	Sweep streets regularly	Upstream pollution load change
	Maintain stormwater ponds	New regulation imposed
Residential	Control erosion at construction sites	Clean Water Grant
	Design/redesign streets to reduce runoff	Flood
	Replace lawn with native plants	Drought
	Capture roof runoff	EAB
	Educate residents	Toxic Spill
		Severe erosion or slump bank
Parks & Open Space	Use integrated turf and landscape management	Good Housekeeping Practices
	Plant native trees and vegetation	Coordination / Partnership
	Revegetate shorelines	Road salt/sand runoff pollution identified
	Designate protected natural areas	Upstream pollution load change
	Design trails & public access to protect shorelines	New Regulation Imposed
	Capture and use stormwater runoff	Toxic Spill
Heavy Industrial	Install treatment train	Severe erosion or slump bank
	Implement operations and maintenance plans	
	Stabilize working access areas	
	Capture and filter stormwater	
	Create an emergency response plan	

### **Acknowledgement & Credits**

The game facilitator needs to verbally offer acknowledgment about the program, the development and origin of the Watershed Game tool.

#### ***Here is the acknowledgment text found on the River Version of the Game Board:***

The intent of the Watershed Game is to help individuals understand the connection and impact that land use decisions have on water and natural resources, to increase the knowledge of best management practices (BMPs), and to become more familiar with methods to achieve better water quality. The original River version of the Watershed Game was independently developed in 2007 by and through the creative efforts of the Mississippi Watershed Management Organization (MWMO) for its A View from the Big River: A Workshop about Land Use and Water Quality program. The MWMO's creative efforts were inspired by A View from the Lake program, developed by University of Minnesota Sea Grant, University of Minnesota Extension, the University of Wisconsin Extension and the Lake Superior Research Institute in 2006. When using this tool, acknowledgment must be given to MWMO and other organizations cited. Information regarding the MWMO may be found at [www.mwmo.org](http://www.mwmo.org).

Additional information regarding Northland NEMO Program, the Watershed Game, and other educational resources can be found at [www.northlandnemo.org](http://www.northlandnemo.org)

*Acknowledgement will also be in writing where suitable in the program materials.*

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*\* Some of these objectives were developed and respond specifically to the needs of the MWMO A View from the Big River Program (2007, 2008) and also from the RWMWD Connecting on the River NEMO Workshop (2008). Objectives may slightly change for other programs.*

**Illustrations of the Watershed Game - Rivers version**

Illustration of the Board Game Tool  
Actual size is approximately 2 1/2 x 6 feet.



Photograph of the Board Game Tool in use.



Photograph of Board Game Tool in use. Notice the game pieces.

Notice the water goal written with dry erase marker.