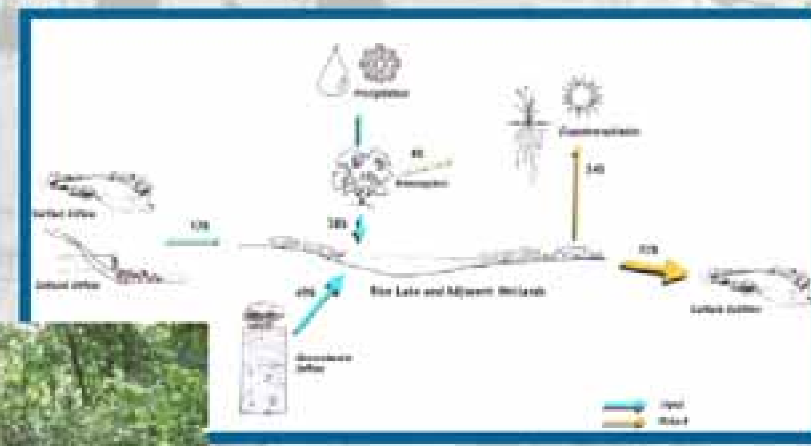
Rehabilitation/Engineer's Repair Report For Hardwood Creek (JD2)

SUMMARY DOCUMENT

Revised - November 17, 2003



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For Hardwood Creek (JD2)

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EOR EMMONS & OLIVIER RESOURCES

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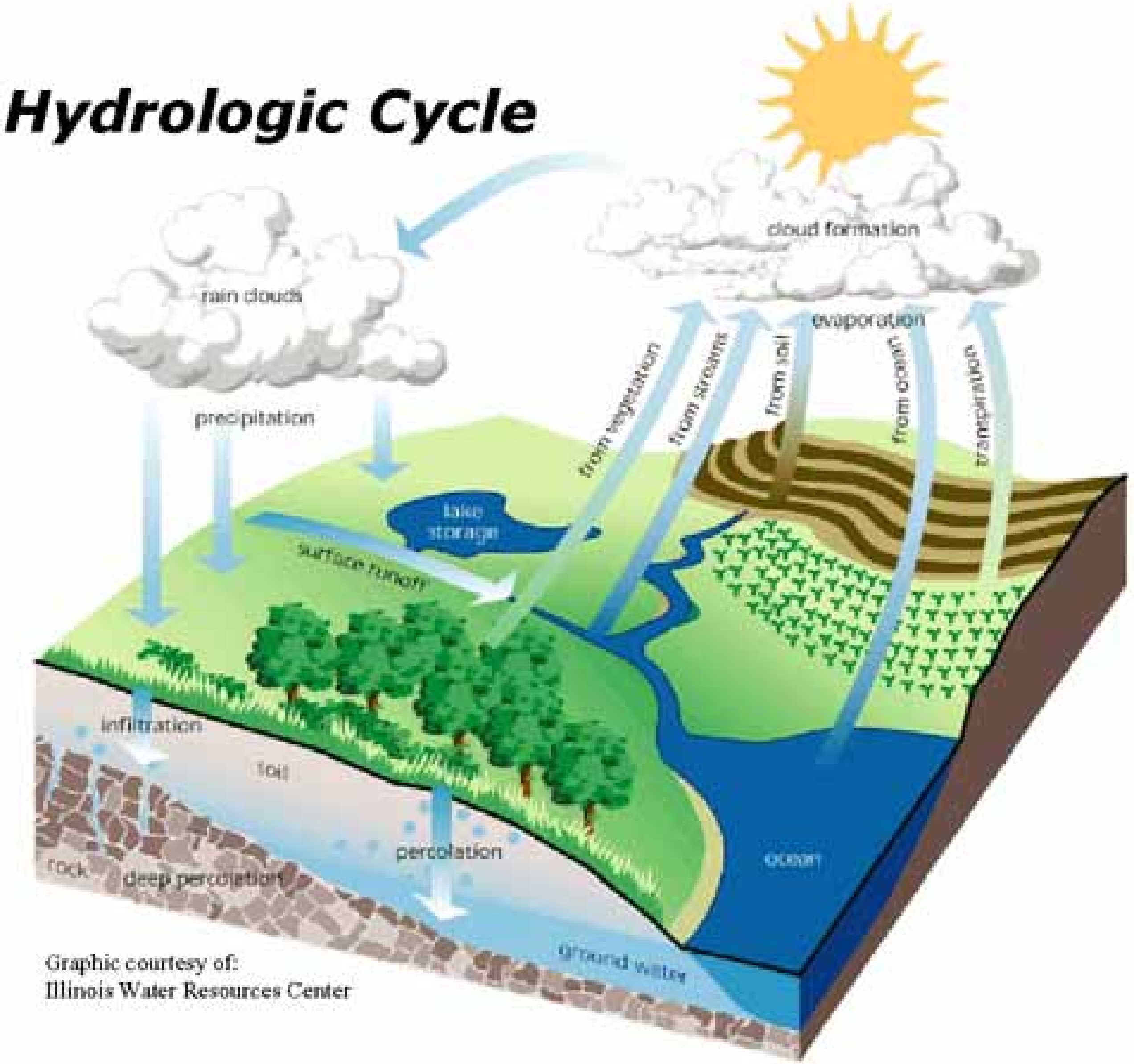
INTRODUCTION

This document is a summary of the technical document, "Rehabilitation/Engineer's Repair Report for Hardwood Creek/Washington County Judicial Ditch #2". The management and maintenance of Hardwood Creek and specifically Judicial Ditch #2 (HWC/JD2) has been a difficult issue that has challenged the Rice Creek Watershed District (RCWD) for many years. This document outlines the proposed design options to bring this complex problem to a balanced, successful resolution, that meets the needs of all parties involved.

A BALANCED APPROACH FOR HARDWOOD CREEK (JD2)

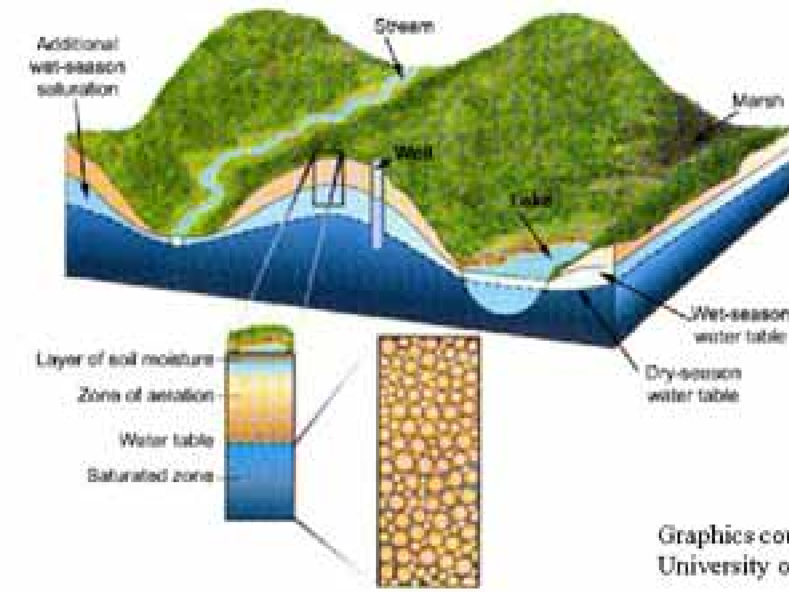
- Reduce Flooding
- Rehabilitate/Repair the HWC/JD2 Stream Corridor
- Restore Rice Lake
- Protect and Enhance Unique Natural Resource Features
- Improve Water Quality
- Create an Asset for the Local Community

Hydrologic Cycle



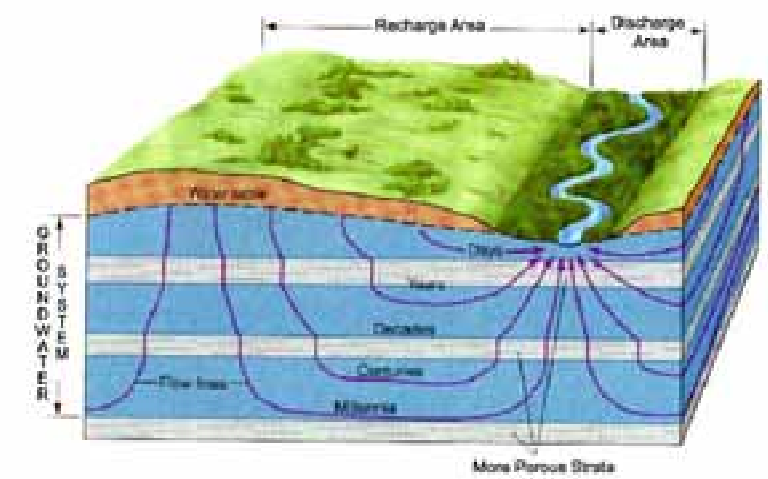
Graphic courtesy of:
Illinois Water Resources Center

Groundwater Flows



Graphics courtesy of:
University of Cincinnati

Period of Groundwater Flow



THE PATHWAYS OF WATER ON OUR LANDSCAPE

Water Sources & Flow Through the Landscape

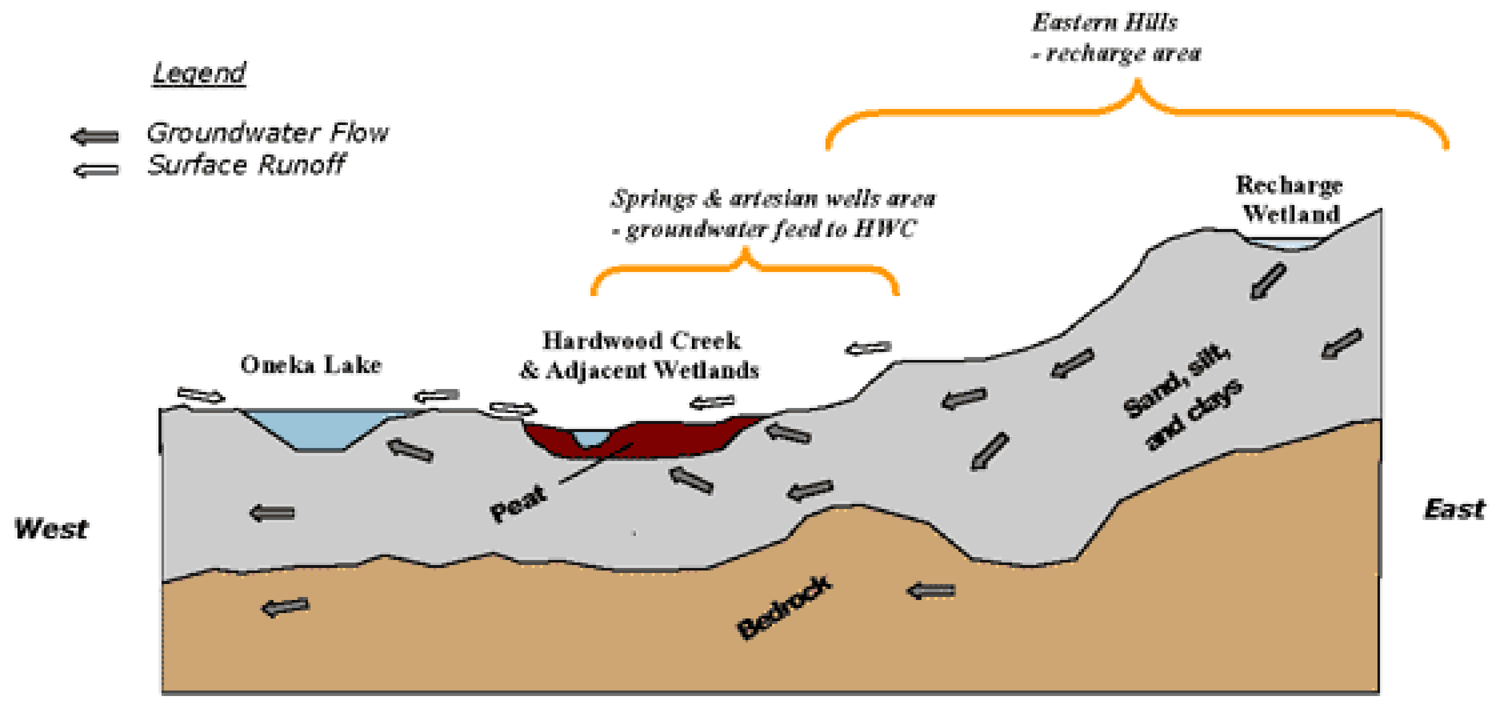
<u>Surface Water</u>

⇒ Large percentage soaks into the ground in the Hardwood Creek Watershed
⇒ Excess collects in low lying, wetland areas or runs off to creek

<u>Groundwater</u>

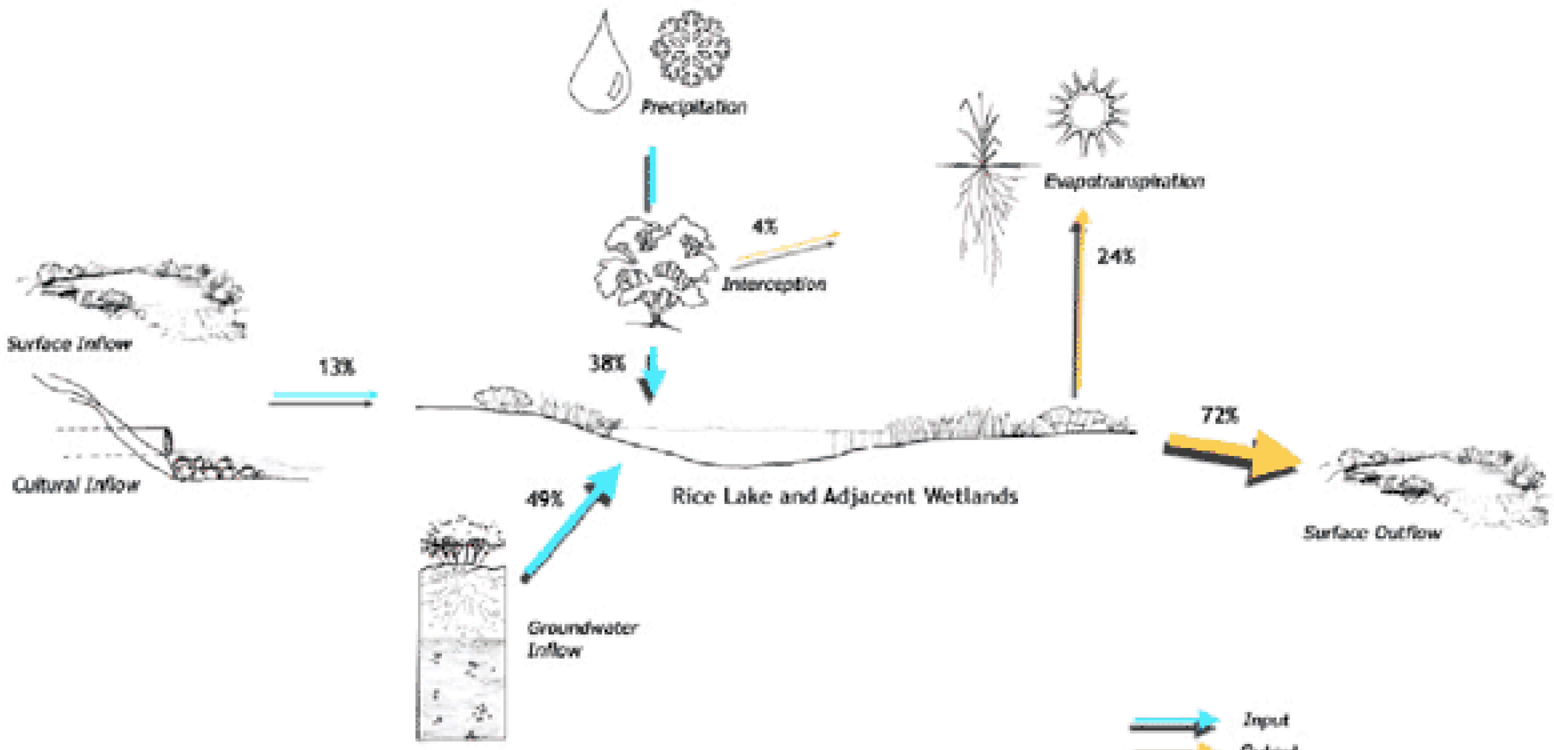
⇒ Begins as precipitation and surface water entering the ground through wetlands, lakes, streams and shallow depressions
⇒ Flows both laterally (shallow) and into deeper aquifers (recharge)
⇒ Emerges as baseflow, springs or "artesian" flow

Generalized Water Flow for Hardwood Creek Corridor



- Groundwater recharge is important to the natural systems of Hardwood creek
- HWC watershed soils allow high percentage of infiltration of rain water
- Water infiltrating near creek flows through peat directly to creek and surrounding wetlands
- Groundwater can move upward due to "artesian" pressure
- Constant baseflow and springs are signs of groundwater flowing
- Rare high quality natural communities are associated with springs and artesian conditions

WATER FLOW IN THE HARDWOOD CREEK CORRIDOR



Water Budget for Rice Lake

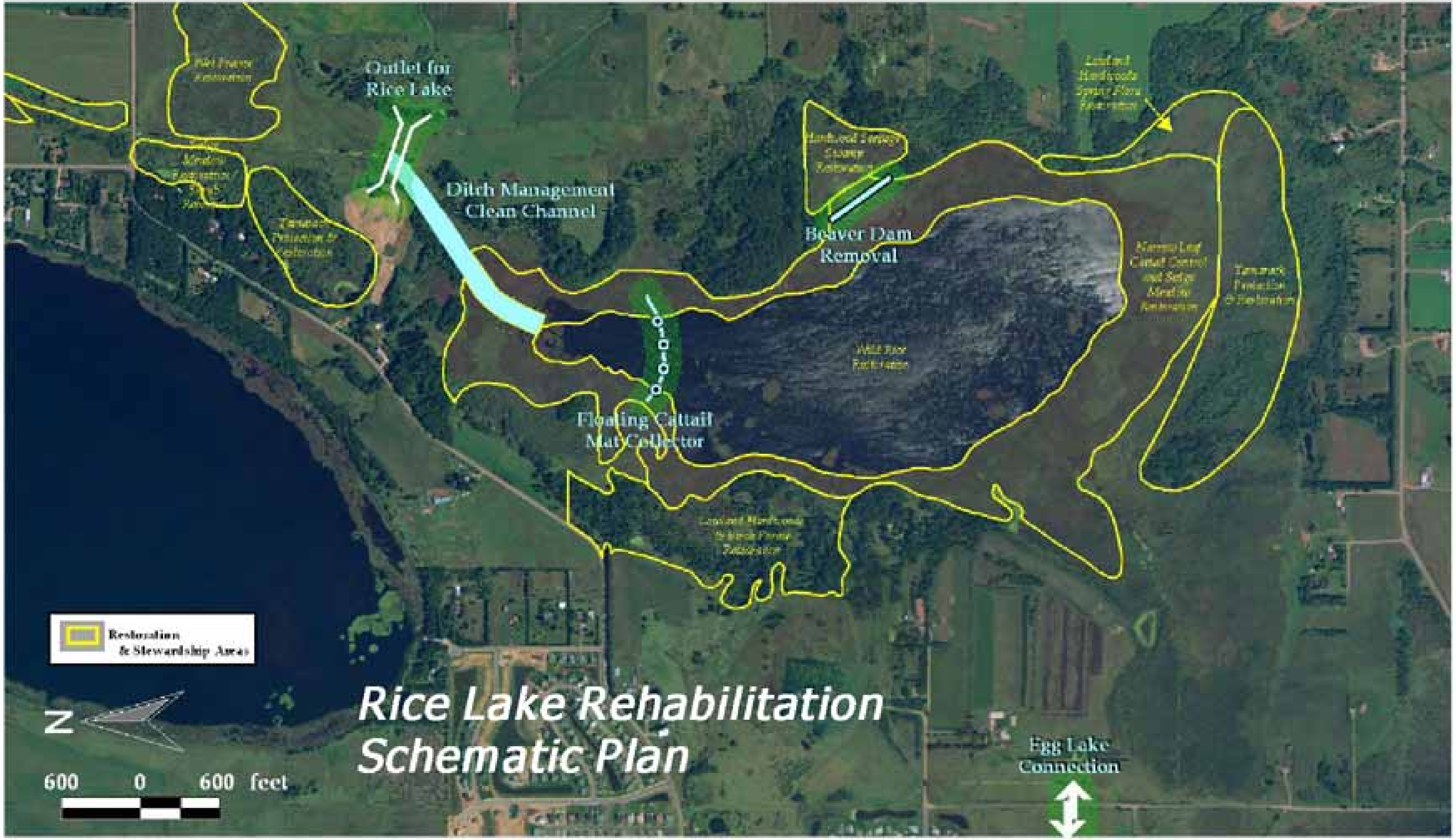
-Headwaters of Hardwood Creek

Input to Hardwood Creek Headwaters:

Groundwater (49%)
⇒ Flows to creek through glacial material and peat

Rainfall (38%)
⇒ Direct input to Rice Lake, wetlands and creek

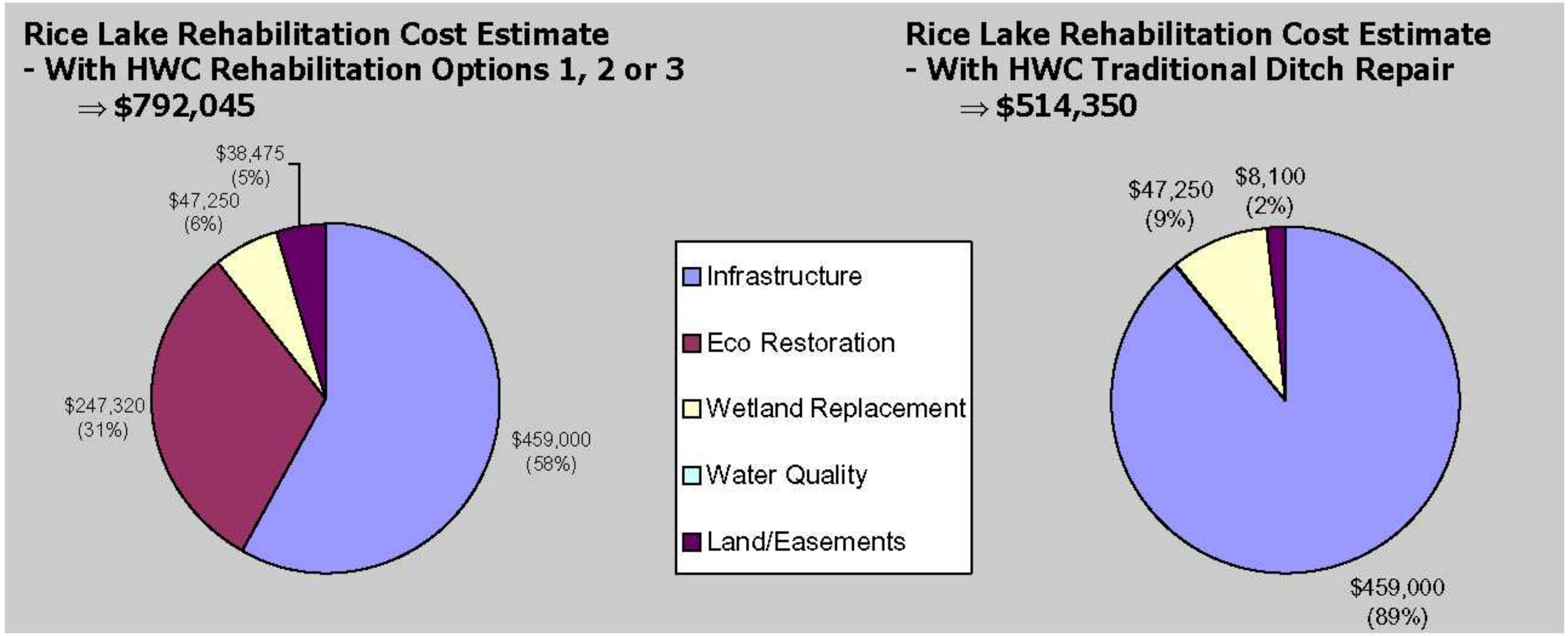
Surface Water (13%)
⇒ Flows to creek from runoff


Outlet for Rice Lake
Ditch Management - Clean Channel -
Beaver Dam Removal
Floating Cattail Mat Collector
Egg Lake Connection
Restoration & Stewardship Areas
N
600 0 600 feet
Rice Lake Rehabilitation Schematic Plan

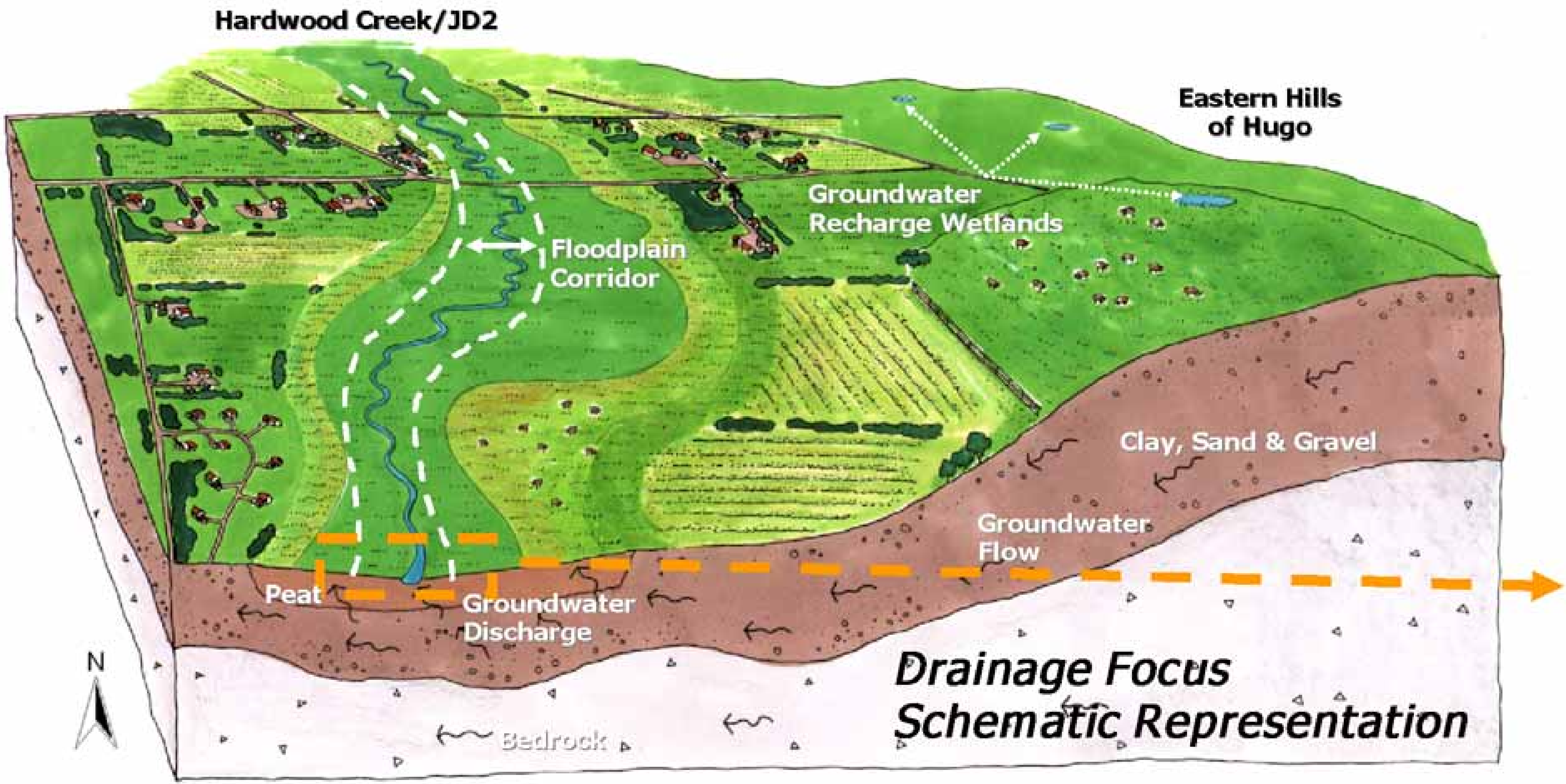
RICE LAKE REHABILITATION

Key Features

- Construct permanent outlet for lake
- Establish low flow outlet for lake at 919.9'
- Establish high flow outlet at 920.4'
- Outlet will be adjustable down to 919.2' for lake management/ restoration

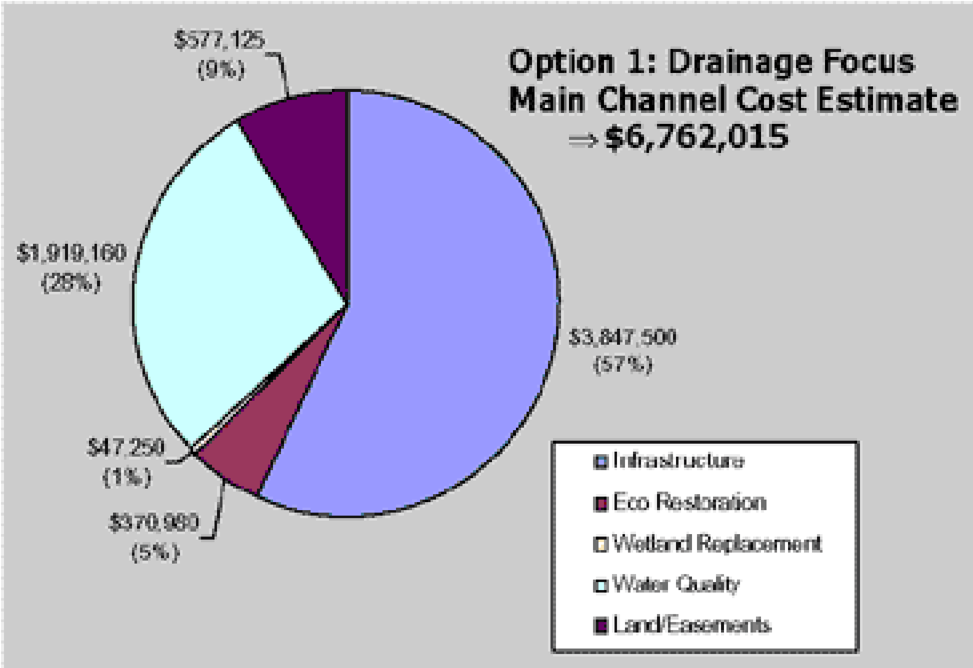


- Clean channel from lake to outlet location
- Remove beaver dams around lake as needed
- Restore wetland communities to pre-existing conditions
- Restore and reestablish wild rice
- Narrow leaf cattail management and control


Hardwood Creek/JD2
Eastern Hills of Hugo
Groundwater Recharge Wetlands
Floodplain Corridor
Clay, Sand & Gravel
Groundwater Flow
Peat
Groundwater Discharge
Bedrock
N
Drainage Focus
Schematic Representation

HARDWOOD CREEK

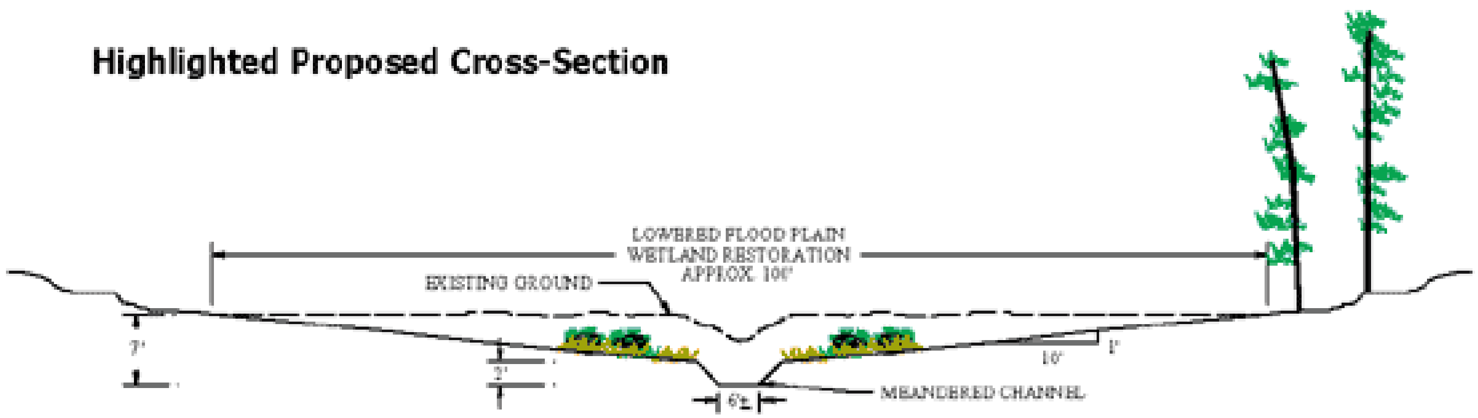
OPTION 1: DRAINAGE FOCUS

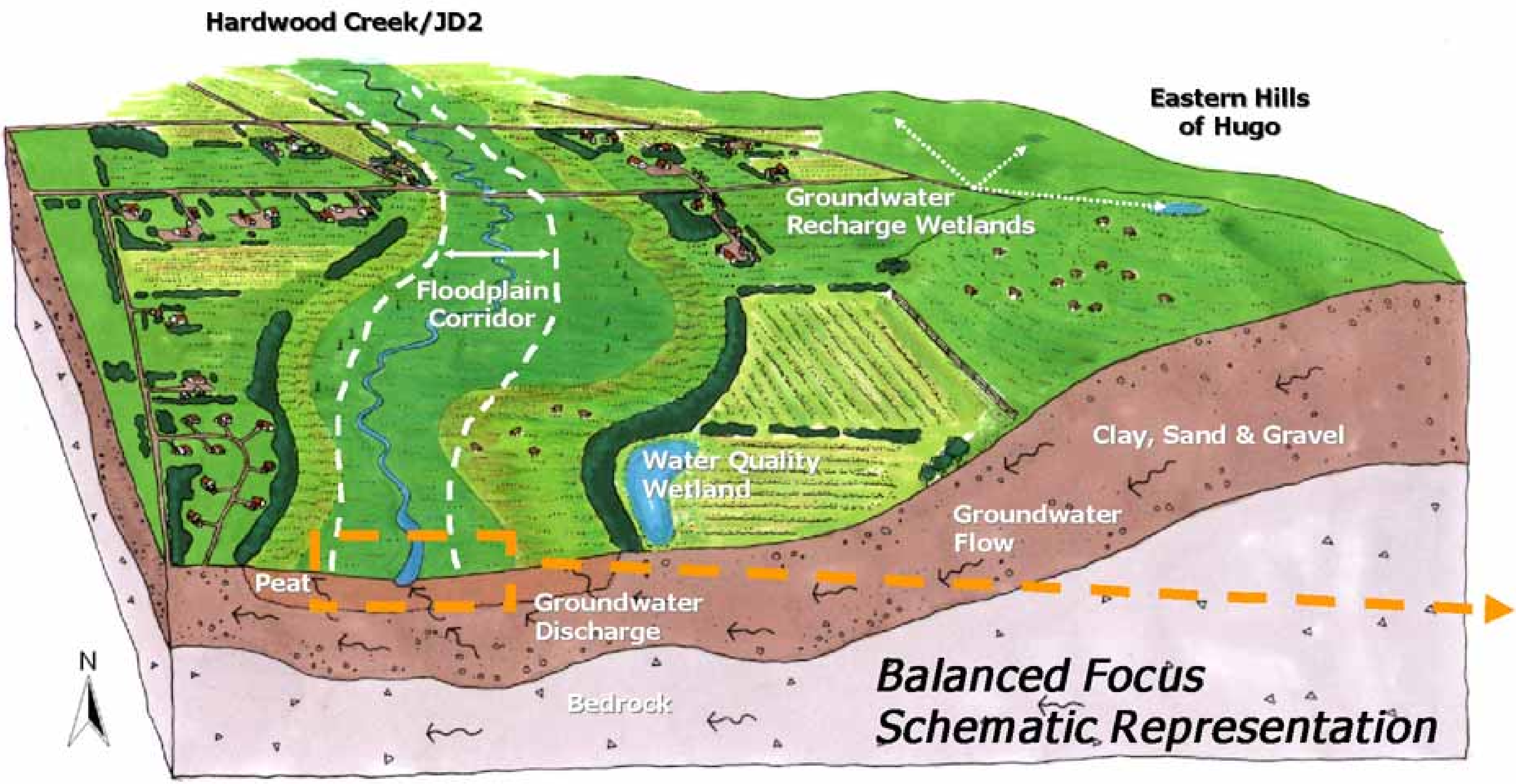


Key Features

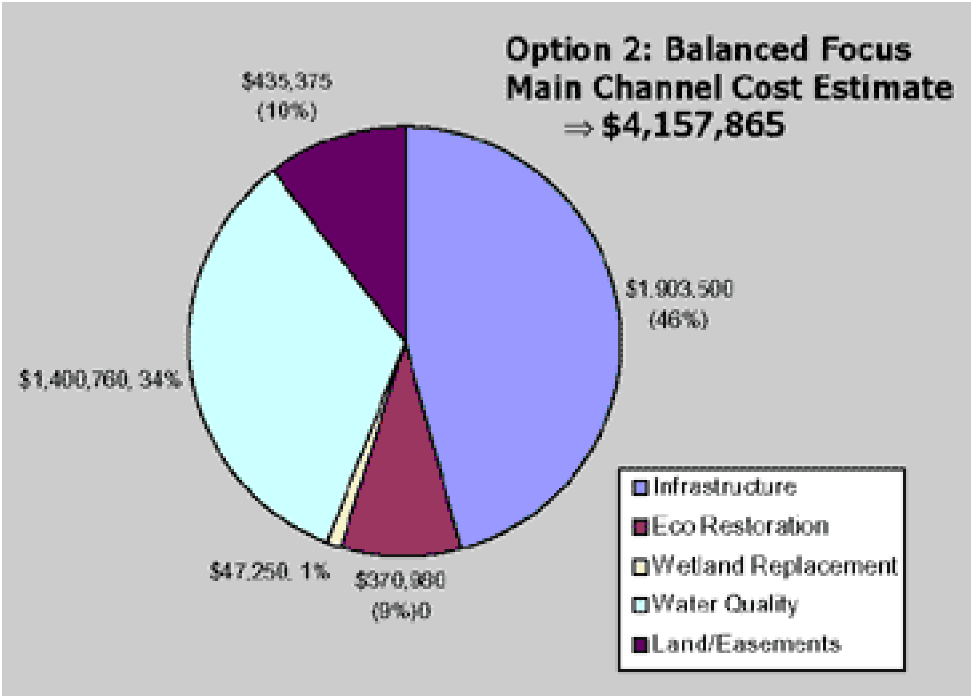
- Profile lowered to official profile
- New meandered channel constructed
- Channel widened to 100 feet
- Significant wetland impacts mitigated by wide meandering channel/wetland
- 100-yr and 2-yr floodplain improvements compared to full ditch repair
- Current wetland areas more available for periodic haying and pasture
- Grant money available for portion of project
- Moderate level of regulatory issues

Highlighted Proposed Cross-Section





Hardwood Creek/JD2
Eastern Hills of Hugo
Groundwater Recharge Wetlands
Floodplain Corridor
Clay, Sand & Gravel
Water Quality Wetland
Groundwater Flow
Peat
Groundwater Discharge
N
Bedrock
Balanced Focus Schematic Representation



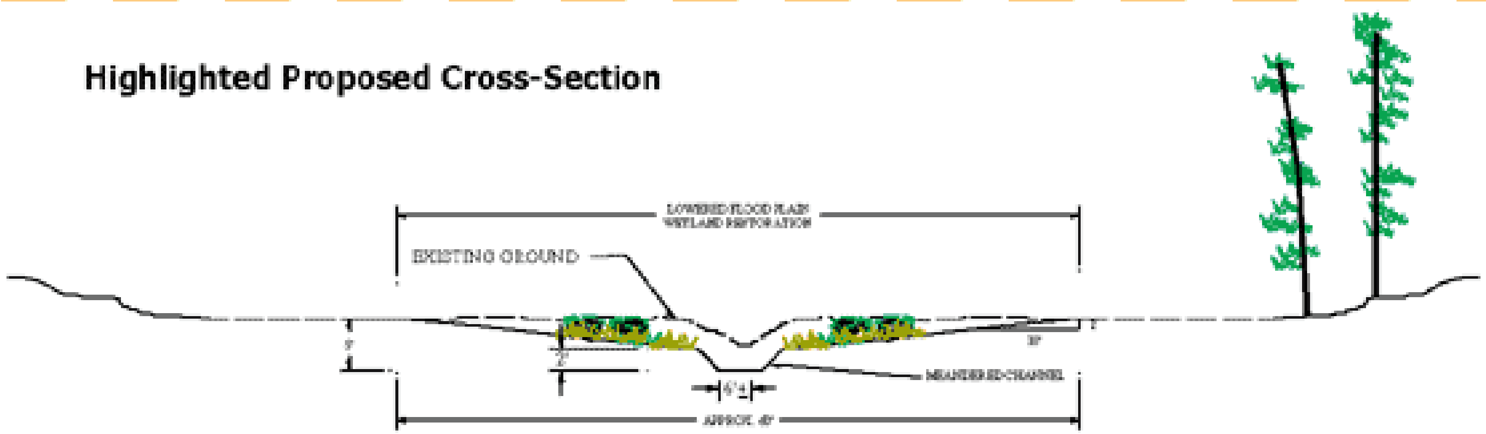
HARDWOOD CREEK

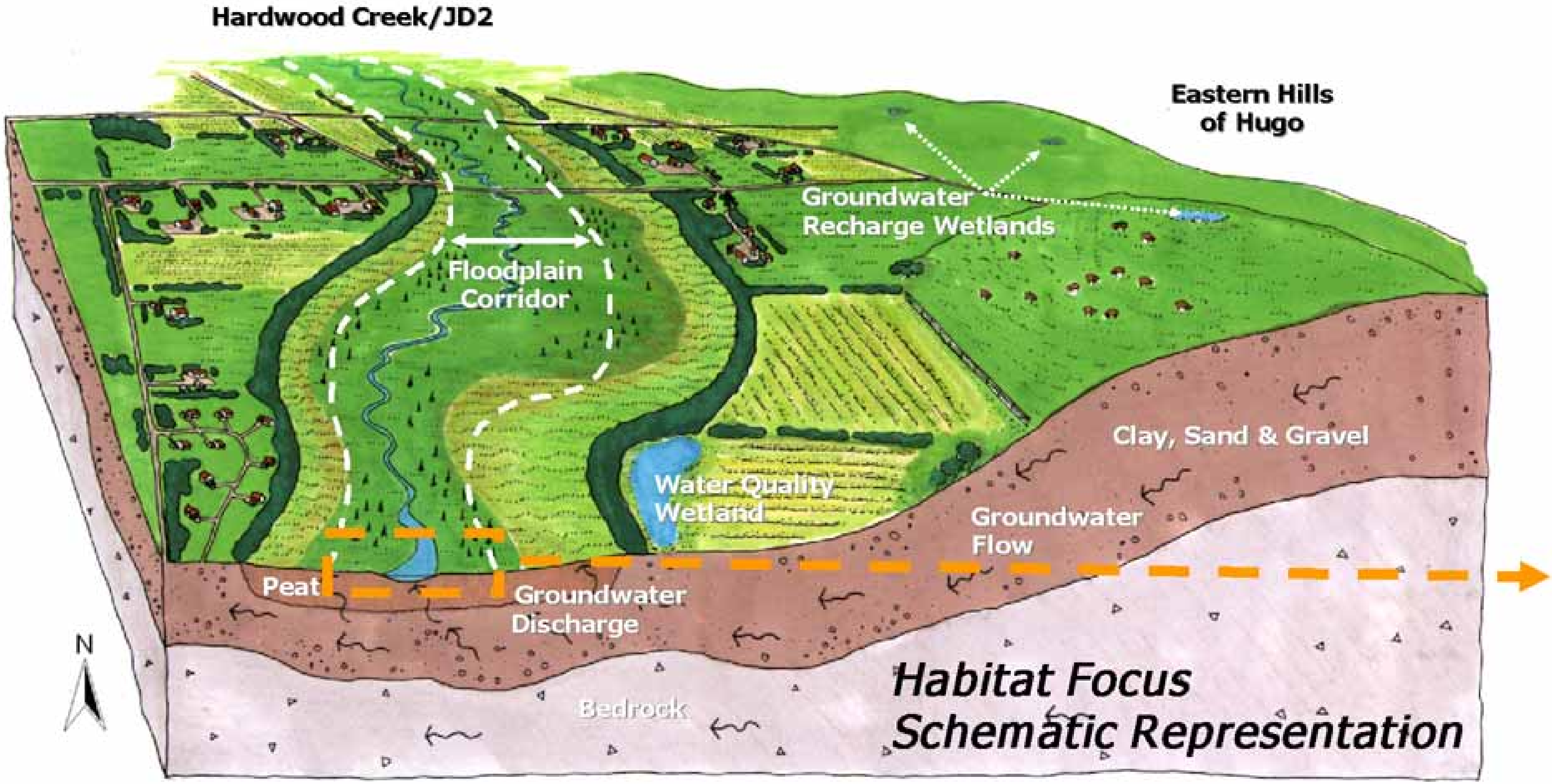
OPTION 2: BALANCED FOCUS

Key Features

- Profile lowered midway between existing and official
- New meandered channel constructed
- Channel widened to 60 feet
- Moderate wetland impacts mitigated by meandering channel/wetland
- 100-yr floodplain is lower than existing conditions and closely matches *Traditional Ditch* repair
- 2-yr floodplain is lower than existing conditions and slightly higher than *Traditional Ditch* repair
- Current wetland areas slightly more available for periodic haying and pasture
- Grant money available
- Minor level of regulatory issues

Highlighted Proposed Cross-Section

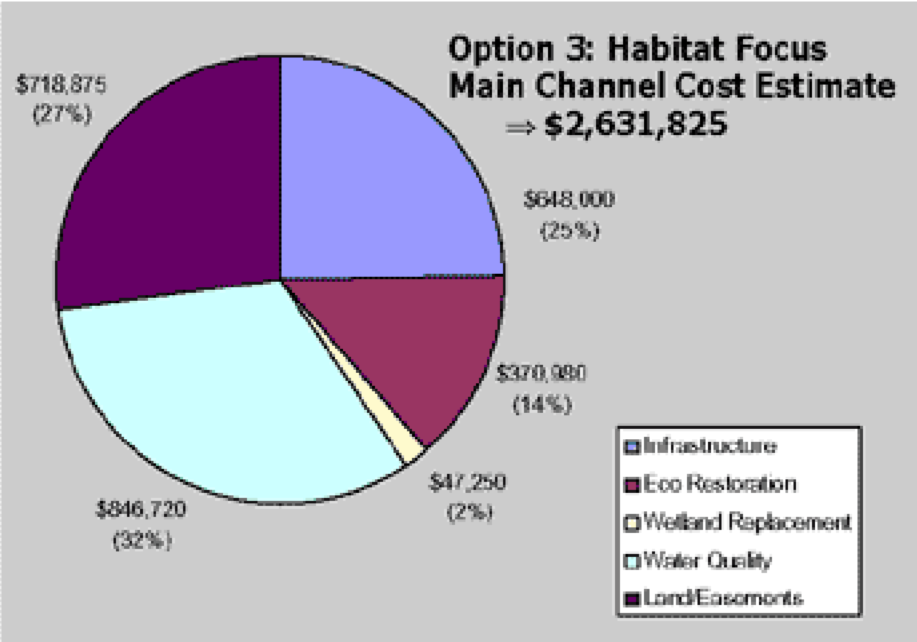




Hardwood Creek/JD2
Eastern Hills of Hugo
Groundwater Recharge Wetlands
Floodplain Corridor
Clay, Sand & Gravel
Water Quality Wetland
Groundwater Flow
Peat
Groundwater Discharge
N
Habitat Focus
Schematic Representation
Bedrock

HARDWOOD CREEK

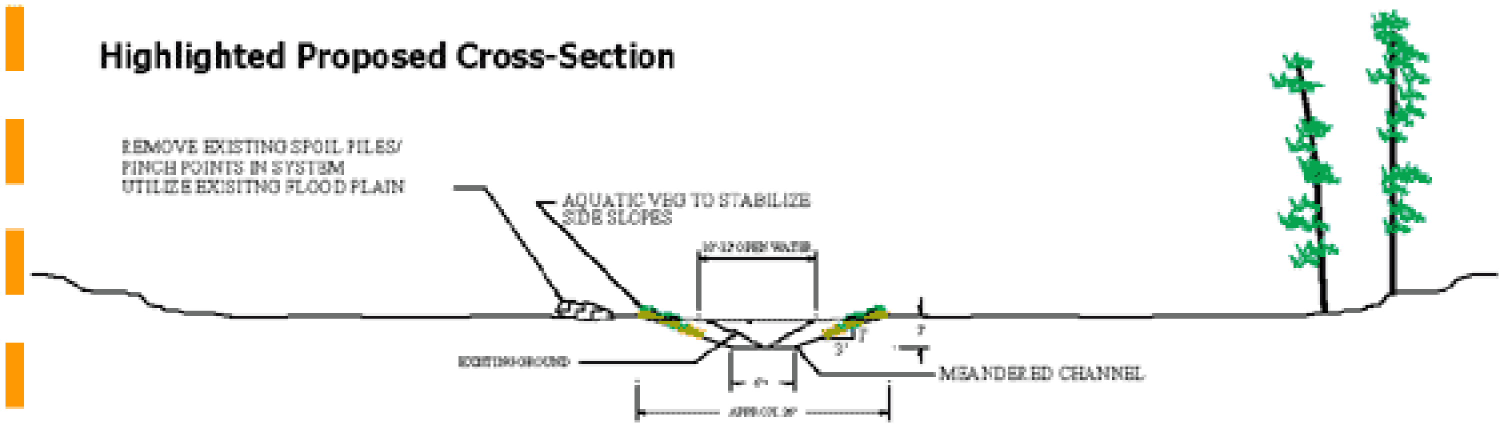
OPTION 3: HABITAT FOCUS

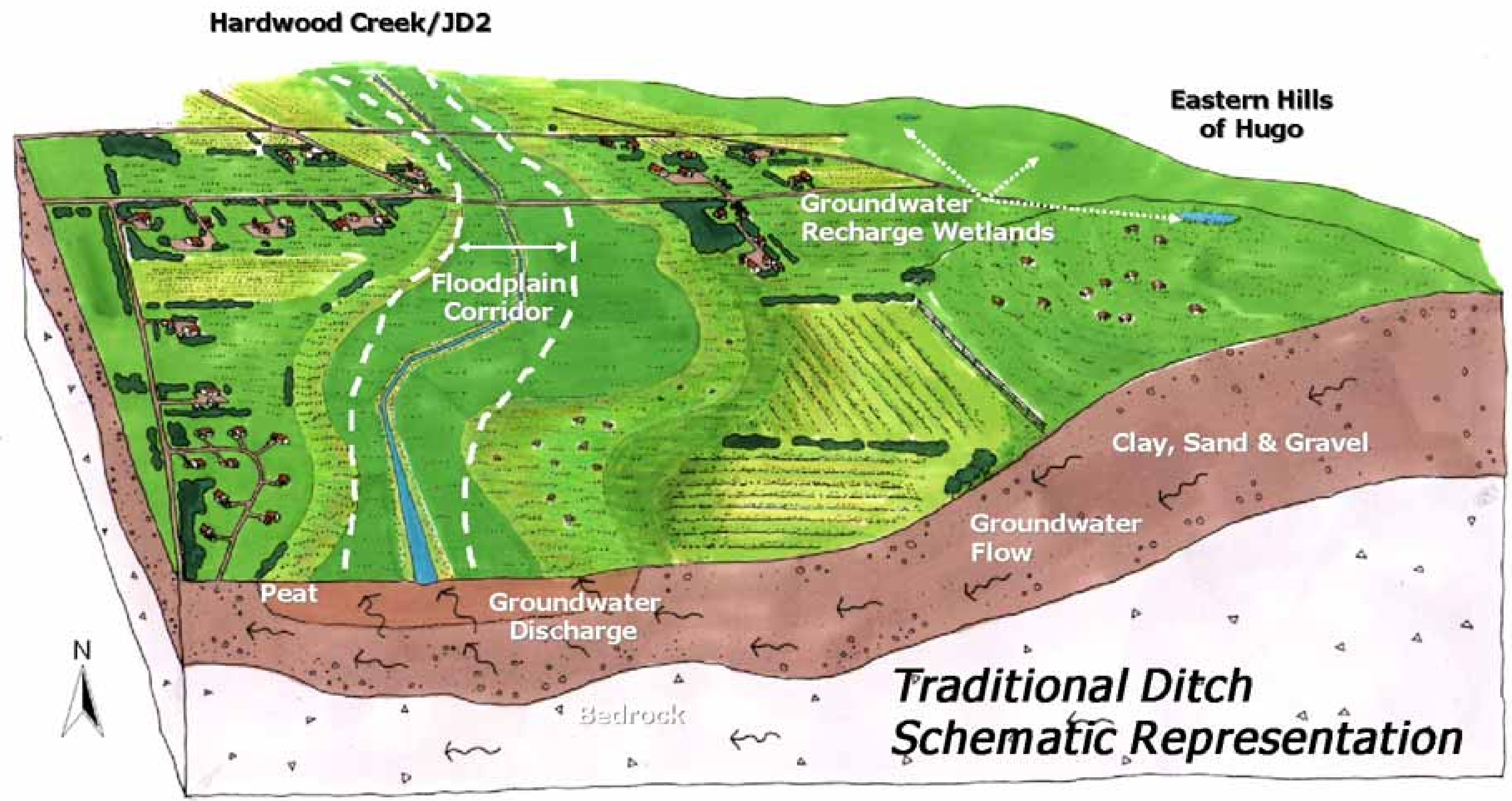


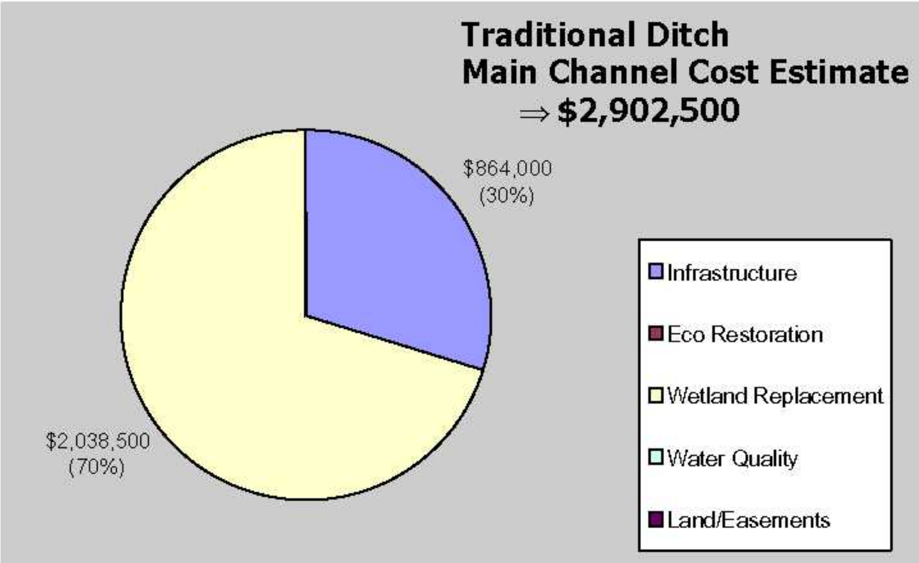
Key Features

- Profile slightly lower than existing conditions
- New meandered channel constructed
- Channel widened to an average of 25 feet
- Minimal wetland impacts mitigated by meandering channel
- 100-yr floodplain is slightly lower than existing conditions and higher than *Traditional Ditch* repair
- 2-yr floodplain is slightly lower than existing conditions higher than *Traditional Ditch* repair
- Current wetland areas marginally available for periodic haying and pasture
- Grant money available
- Minimal regulatory issues

Highlighted Proposed Cross-Section




Hardwood Creek/JD2
Eastern Hills
of Hugo
Groundwater
Recharge Wetlands
Floodplain
Corridor
Clay, Sand & Gravel
Groundwater
Flow
Peat
Groundwater
Discharge
N
Bedrock
Traditional Ditch
Schematic Representation



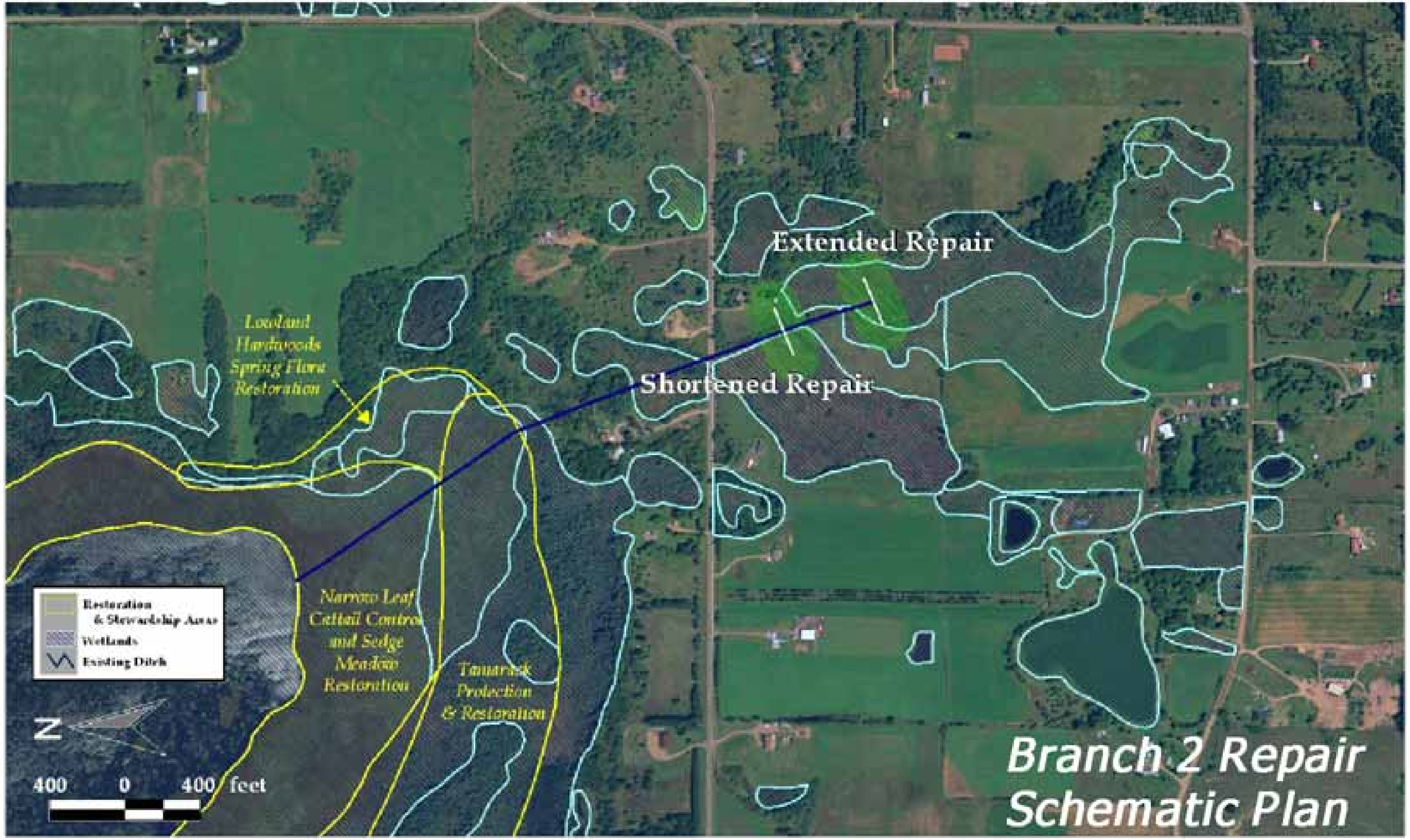
HARDWOOD CREEK
TRADITIONAL DITCH

Key Features

- Ditch lowered to official profile and built with original cross section
- Flood profile similar to that of Option 2: *Balanced Focus*
- Straight channel (no meander restoration)
- Significant wetland impacts
- 100-year and 2-year floodplains lower than existing conditions
- No grant available for project
- Higher associated maintenance cost

Additional Facts & Concerns

- High cost for limited benefits
- Traditional Ditch design does not fit with future stormwater conveyance needs
- While it may not be fully up-to-date with regard to environmental consideration, the Traditional Ditch approach has served agricultural landuses for nearly 100 years
- The hydraulic capacity of the Traditional Ditch is an important point of reference for newer design options, which address habitat concerns as well as providing drainage benefits



Extended Repair
Shortened Repair
Lowland Hardwoods Spring Flora Restoration
Narrow Leaf Cattail Control and Sedge Meadow Restoration
Tamarack Protection & Restoration
Restoration & Stewardship Areas
Wetlands
Existing Ditch
N
400 0 400 feet
Branch 2 Repair Schematic Plan

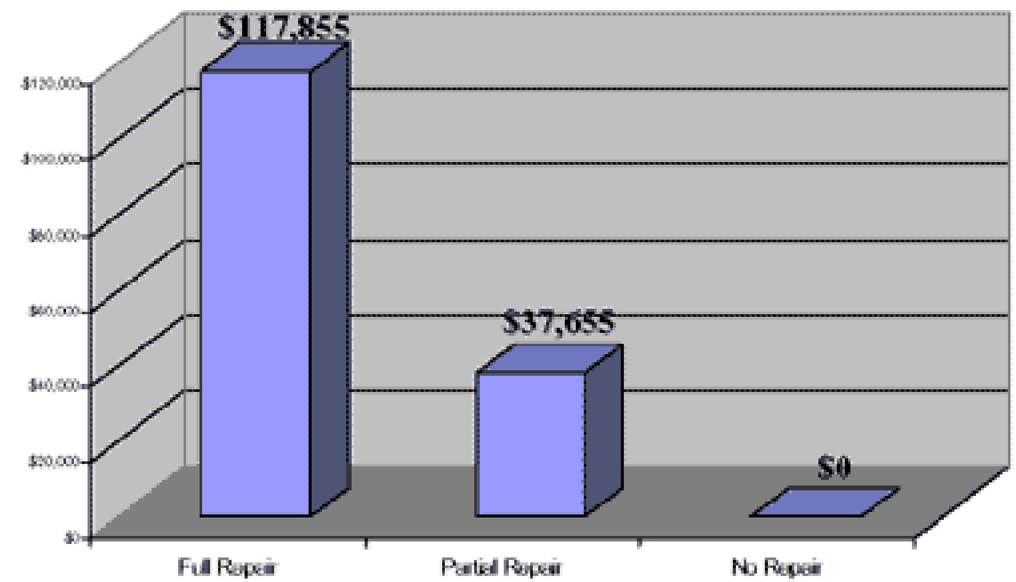
BRANCH 2 REPAIR

Key Features

Branch 2- Full Repair
- Profile lowered to official
- Existing channel cleaned and reconstructed to original geometry
- Channel alignment to follow original
- Significant wetland impacts
- 100-yr and 2-yr floodplain reductions from existing for entire system

Branch 2- Partial Repair
- Profile lowered to official for most of system
- Existing channel cleaned and reconstructed to original geometry for most of system
- Channel alignment to follow original
- Many wetland impacts avoided
- 100-yr and 2-yr floodplain reductions from existing for most of system

Branch 2- No Repair
- All wetland impacts avoided
- 100-yr and 2-yr floodplains unchanged from existing



Branch 2 Repair Cost Estimates

⇒ **Note: Costs do not include potential easement cost**

Cost Comparison Summary

Hardwood Creek Restoration Options	Main Channel Alteration	+	Rice Lake Rehabilitation	+ Branch 2 Repair Options		=	Initial Cost	+	Approximate Maintenance Cost	-	Approximate Grant Funds	=	Final Cost (includes 30 years of maintenance)
Option 1: Drainage Focus	$6,762,015	+	$792,045	+ *Full*	$117,855	=	**$7,671,915**	+	*30 years x* $20,000 *per year*	-	$1,000,000	=	**$7,271,915**
				+ *Partial*	$37,665	=	**$7,591,725**					=	**$7,191,725**
				+ *No Repair*	$0	=	**$7,554,060**					=	**$7,154,060**
Option 2: Balanced Focus	$4,157,865	+	$792,045	+ *Full*	$117,855	=	**$5,067,765**	+	*30 years x* $20,000 *per year*	-	$1,000,000	=	**$4,667,765**
				+ *Partial*	$37,665	=	**$4,987,575**					=	**$4,587,575**
				+ *No Repair*	$0	=	**$4,949,910**					=	**$4,549,910**
Option 3: Stream and Wetland Habitat Focus	$2,631,825	+	$792,045	+ *Full*	$117,855	=	**$3,541,725**	+	*30 years x* $20,000 *per year*	-	$1,000,000	=	**$3,141,725**
				+ *Partial*	$37,665	=	**$3,461,535**					=	**$3,061,535**
				+ *No Repair*	$0	=	**$3,423,870**					=	**$3,023,870**
Traditional Ditch	$2,902,500	+	$514,350	+ *Full*	$117,855	=	**$3,534,705**	+	*30 years x* $40,000 *per year*	-	$0	=	**$4,734,705**
				+ *Partial*	$37,665	=	**$3,454,515**					=	**$4,654,515**
				+ *No Repair*	$0	=	**$3,416,850**					=	**$4,616,850**

Glossary

Artesian - The condition under which groundwater flows to the earth's surface naturally

Evaporation - The process of water changing from a liquid into a vapor

Evapotranspiration - Comprises evaporation directly from soil and vegetation surfaces and transpiration through plant leaves

Groundwater Flow - Water which flows beneath the earth's surface that supplies underground aquifers, well, and springs

Infiltration - The process of water penetrating into the earth's surface

Percolation - The process of water trickling down through the earth's surface

Surface Water - Water which flow above the earth's surface that supplies surface water bodies, such as streams, wetlands rivers, lakes and oceans

Transpiration - The passage of water vapor from a living body (normally plant leaves) through a membrane or pores

Hardwood Creek

—2003

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