



Environment and
Climate Change Canada

Environnement et
Changement climatique Canada

Canada

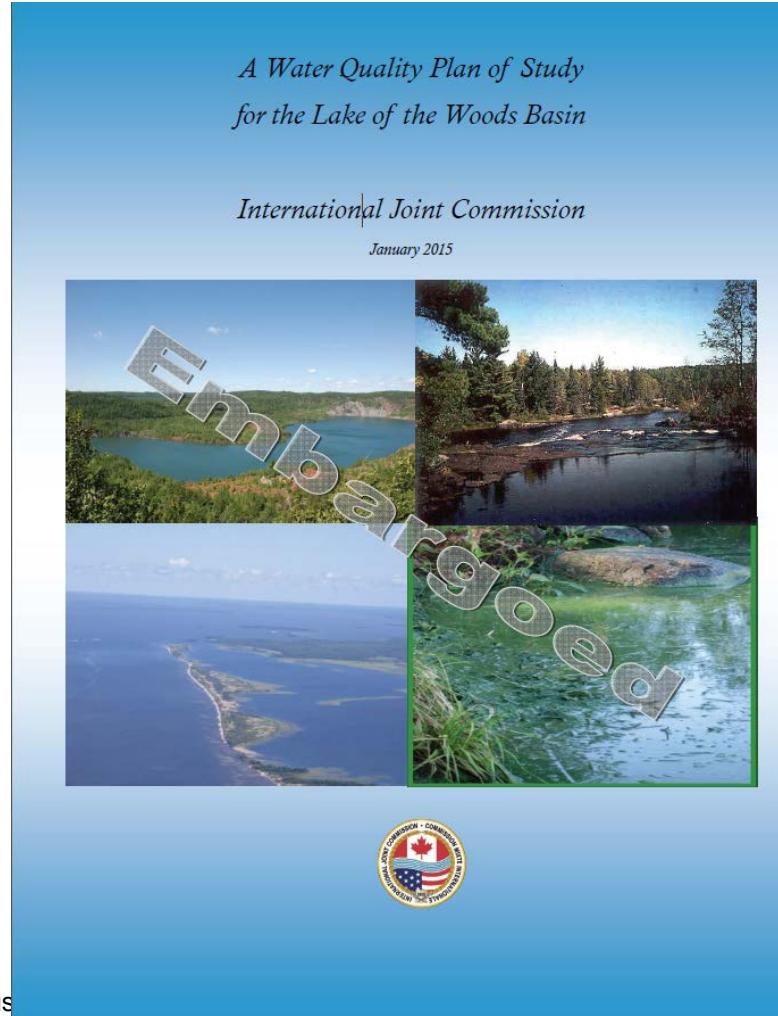


Draft ECCC Science Plan Rainy River and Lake of the Woods

Water Science and Technology

Context for the Draft Science Plan

- Focus on critical issue of algae
- Starting point
 - IJC PoS
 - Binational updates to the PoS
 - Build on existing knowledge and work
- Draft plan not ‘set in stone’—need and welcome input and feedback
- Goal is to produce the science that informs the best outcome possible for Lake of the Woods water quality
- Starting work on “no regrets” elements, the rest will come as we engage further



Environment
Canada

Environnement
Canada

Foundation for the draft Science Plan

Priority Theme	Plan of Study Projects and Activities	Priority Theme	Plan of Study Projects and Activities
Monitoring	1. International Monitoring Program for the Lake of the Woods Basin		16. Pilot Studies on Adaptive Control Measures for Hybrid Cattail and Rusty Crayfish in Infested Wild Rice Habitat
Nutrient Enrichment and Harmful Algal Blooms	2. Mass-Balance Models for Phosphorus and Nitrogen in the Lake of the Woods Basin 3. Internal Loads and Hypoxia in Lake of the Woods 4. Assessment of Iron Fluxes from Sediments on Cyanobacteria Bloom Formation in Lake of the Woods 5. Assessment of Nutrient Subsidies from Shorelines Due to Erosion from High Water Levels in Lakes and High Flows in Rivers 6. Application of Water Quality Models at Watershed and Basin-wide Scales to Apportion Nutrient Sources 7. Implementation of Nutrient Load-Reduction Strategies in Lake of the Woods Basin 8. Application of Satellite Imagery and Remote Sensing Tools to Map and Characterize Water Quality and Algal Blooms 9. Development of Predictive Models of Algal Blooms from Hydrological and Meteorological Processes 10. Influence of Altered Food-Web Structure on Production of Harmful Algal Blooms 11. Taxonomic Characterization of Algal Communities and Algal Toxins 12. Public Health and Animal Welfare Risks: State of Knowledge and the Need for Alerting Mechanisms		17. Comprehensive Assessment of Potential Invasion Risks to and within the Lake of the Woods Basin 18. Water Quality Risk Assessment for Zebra Mussels and Quagga Mussels 19. Climate Risk Assessment for Aquatic Invasive Species
Aquatic Invasive Species	13. Binational Aquatic Invasive Species Management Team and Prevention Strategy for the Lake of the Woods Basin 14. Evaluation and Implementation of Options to Manage Recent Zebra Mussel Infestation in Headwaters Areas in Minnesota 15. Ecological Impact of the Spiny Waterflea in Infested Boundary Lakes	Surface and Groundwater Contamination	20. Assessment of Binational Implementation of Water Quality Objectives for Sulfate, Copper, Nickel, and Mercury 21. Synthesis Report on Contaminants in Water, Aquatic Sediment, and Fish 22. Methylmercury Flux and Bioaccumulation in Large Border Lakes 23. Spatial Survey of Contaminants of Emerging Concern 24. Vulnerability Assessment of Border Waters to Contamination from Mining 25. Vulnerability Assessment of Border Waters to Contamination from Rail and Pipeline Transport of Petroleum and other Chemicals 26. Mining Effects Science Workshop
		Capacity Building	27. International Platform for Implementation 28. Review of Data Collection Programs and Monitoring in the Headwaters Regions of the Basin 29. Application of Regional Climate Models for the Basin and Improved Public Education and Engagement on the Issue of Climate Change 30. Development of the Lake of the Woods Basin Geospatial Mapping Framework and Public Communication Tool 31. Indigenous Perspectives on Ecosystem Health 32. Funding Program for Non-governmental Organizations to Promote Watershed Protection



Science Focus on nutrients and algae

Priority Theme	Plan of Study Projects and Activities	Priority Theme	Plan of Study Projects and Activities
Monitoring	1. International Monitoring Program for the Lake of the Woods Basin		16. Pilot Studies on Adaptive Control Measures for Hybrid Cattail and Rusty Crayfish in Infested Wild Rice Habitat
Nutrient Enrichment and Harmful Algal Blooms	2. Mass-Balance Models for Phosphorus and Nitrogen in the Lake of the Woods Basin 3. Internal Loads and Hypoxia in Lake of the Woods 4. Assessment of Iron Fluxes from Sediments on Cyanobacteria Bloom Formation in Lake of the Woods 5. Assessment of Nutrient Subsidies from Shorelines Due to Erosion from High Water Levels in Lakes and High Flows in Rivers 6. Application of Water Quality Models at Watershed and Basin-wide Scales to Apportion Nutrient Sources 7. Implementation of Nutrient Load-Reduction Strategies in Lake of the Woods Basin 8. Application of Satellite Imagery and Remote Sensing Tools to Map and Characterize Water Quality and Algal Blooms 9. Development of Predictive Models of Algal Blooms from Hydrological and Meteorological Processes 10. Influence of Altered Food-Web Structure on Production of Harmful Algal Blooms 11. Taxonomic Characterization of Algal Communities and Algal Toxins 12. Public Health and Animal Welfare Risks: State of Knowledge and the Need for Alerting Mechanisms		17. Comprehensive Assessment of Potential Invasion Risks to and within the Lake of the Woods Basin 18. Water Quality Risk Assessment for Zebra Mussels and Quagga Mussels 19. Climate Risk Assessment for Aquatic Invasive Species
		Surface and Groundwater Contamination	20. Assessment of Binational Implementation of Water Quality Objectives for Sulfate, Copper, Nickel, and Mercury 21. Synthesis Report on Contaminants in Water, Aquatic Sediment, and Fish 22. Methylmercury Flux and Bioaccumulation in Large Border Lakes 23. Spatial Survey of Contaminants of Emerging Concern 24. Vulnerability Assessment of Border Waters to Contamination from Mining 25. Vulnerability Assessment of Border Waters to Contamination from Rail and Pipeline Transport of Petroleum and other Chemicals 26. Mining Effects Science Workshop
Aquatic Invasive Species	13. Binational Aquatic Invasive Species Management Team and Prevention Strategy for the Lake of the Woods Basin 14. Evaluation and Implementation of Options to Manage Recent Zebra Mussel Infestation in Headwaters Areas in Minnesota 15. Ecological Impact of the Spiny Waterflea in Infested Boundary Lakes		27. International Platform for Implementation 28. Review of Data Collection Programs and Monitoring in the Headwaters Regions of the Basin 29. Application of Regional Climate Models for the Basin and Improved Public Education and Engagement on the Issue of Climate Change 30. Development of the Lake of the Woods Basin Geospatial Mapping Framework and Public Communication Tool 31. Indigenous Perspectives on Ecosystem Health 32. Funding Program for Non-governmental Organizations to Promote Watershed Protection



Direct links with draft science plan

Priority Theme	Plan of Study Projects and Activities	Priority Theme	Plan of Study Projects and Activities
Monitoring	1. International Monitoring Program for the Lake of the Woods Basin		16. Pilot Studies on Adaptive Control Measures for Hybrid Cattail and Rusty Crayfish in Infested Wild Rice Habitat
Nutrient Enrichment and Harmful Algal Blooms	2. Mass-Balance Models for Phosphorus and Nitrogen in the Lake of the Woods Basin 3. Internal Loads and Hypoxia in Lake of the Woods 4. Assessment of Iron Fluxes from Sediments on Cyanobacteria Bloom Formation in Lake of the Woods 5. Assessment of Nutrient Subsidies from Shorelines Due to Erosion from High Water Levels in Lakes and High Flows in Rivers 6. Application of Water Quality Models at Watershed and Basin-wide Scales to Apportion Nutrient Sources 7. Implementation of Nutrient Load-Reduction Strategies in Lake of the Woods Basin 8. Application of Satellite Imagery and Remote Sensing Tools to Map and Characterize Water Quality and Algal Blooms 9. Development of Predictive Models of Algal Blooms from Hydrological and Meteorological Processes 10. Influence of Altered Food-Web Structure on Production of Harmful Algal Blooms 11. Taxonomic Characterization of Algal Communities and Algal Toxins 12. Public Health and Animal Welfare Risks: State of Knowledge and the Need for Alerting Mechanisms		17. Comprehensive Assessment of Potential Invasion Risks to and within the Lake of the Woods Basin 18. Water Quality Risk Assessment for Zebra Mussels and Quagga Mussels 19. Climate Risk Assessment for Aquatic Invasive Species
Aquatic Invasive Species	13. Binational Aquatic Invasive Species Management Team and Prevention Strategy for the Lake of the Woods Basin 14. Evaluation and Implementation of Options to Manage Recent Zebra Mussel Infestation in Headwaters Areas in Minnesota 15. Ecological Impact of the Spiny Waterflea in Infested Boundary Lakes	Surface and Groundwater Contamination	20. Assessment of Binational Implementation of Water Quality Objectives for Sulfate, Copper, Nickel, and Mercury 21. Synthesis Report on Contaminants in Water, Aquatic Sediment, and Fish 22. Methylmercury Flux and Bioaccumulation in Large Border Lakes 23. Spatial Survey of Contaminants of Emerging Concern 24. Vulnerability Assessment of Border Waters to Contamination from Mining 25. Vulnerability Assessment of Border Waters to Contamination from Rail and Pipeline Transport of Petroleum and other Chemicals 26. Mining Effects Science Workshop
		Capacity Building	27. International Platform for Implementation 28. Review of Data Collection Programs and Monitoring in the Headwaters Regions of the Basin 29. Application of Regional Climate Models for the Basin and Improved Public Education and Engagement on the Issue of Climate Change 30. Development of the Lake of the Woods Basin Geospatial Mapping Framework and Public Communication Tool 31. Indigenous Perspectives on Ecosystem Health 32. Funding Program for Non-governmental Organizations to Promote Watershed Protection



Data to inform other projects

Priority Theme	Plan of Study Projects and Activities	Priority Theme	Plan of Study Projects and Activities
Monitoring	1. International Monitoring Program for the Lake of the Woods Basin		16. Pilot Studies on Adaptive Control Measures for Hybrid Cattail and Rusty Crayfish in Infested Wild Rice Habitat
Nutrient Enrichment and Harmful Algal Blooms	2. Mass-Balance Models for Phosphorus and Nitrogen in the Lake of the Woods Basin 3. Internal Loads and Hypoxia in Lake of the Woods 4. Assessment of Iron Fluxes from Sediments on Cyanobacteria Bloom Formation in Lake of the Woods 5. Assessment of Nutrient Subsidies from Shorelines Due to Erosion from High Water Levels in Lakes and High Flows in Rivers 6. Application of Water Quality Models at Watershed and Basin-wide Scales to Apportion Nutrient Sources 7. Implementation of Nutrient Load-Reduction Strategies in Lake of the Woods Basin 8. Application of Satellite Imagery and Remote Sensing Tools to Map and Characterize Water Quality and Algal Blooms 9. Development of Predictive Models of Algal Blooms from Hydrological and Meteorological Processes 10. Influence of Altered Food-Web Structure on Production of Harmful Algal Blooms 11. Taxonomic Characterization of Algal Communities and Algal Toxins 12. Public Health and Animal Welfare Risks: State of Knowledge and the Need for Alerting Mechanisms		17. Comprehensive Assessment of Potential Invasion Risks to and within the Lake of the Woods Basin 18. Water Quality Risk Assessment for Zebra Mussels and Quagga Mussels 19. Climate Risk Assessment for Aquatic Invasive Species
Aquatic Invasive Species	13. Binational Aquatic Invasive Species Management Team and Prevention Strategy for the Lake of the Woods Basin 14. Evaluation and Implementation of Options to Manage Recent Zebra Mussel Infestation in Headwaters Areas in Minnesota 15. Ecological Impact of the Spiny Waterflea in Infested Boundary Lakes	Surface and Groundwater Contamination	20. Assessment of Binational Implementation of Water Quality Objectives for Sulfate, Copper, Nickel, and Mercury 21. Synthesis Report on Contaminants in Water, Aquatic Sediment, and Fish 22. Methylmercury Flux and Bioaccumulation in Large Border Lakes 23. Spatial Survey of Contaminants of Emerging Concern 24. Vulnerability Assessment of Border Waters to Contamination from Mining 25. Vulnerability Assessment of Border Waters to Contamination from Rail and Pipeline Transport of Petroleum and other Chemicals 26. Mining Effects Science Workshop
		Capacity Building	27. International Platform for Implementation 28. Review of Data Collection Programs and Monitoring in the Headwaters Regions of the Basin 29. Application of Regional Climate Models for the Basin and Improved Public Education and Engagement on the Issue of Climate Change 30. Development of the Lake of the Woods Basin Geospatial Mapping Framework and Public Communication Tool 31. Indigenous Perspectives on Ecosystem Health 32. Funding Program for Non-governmental Organizations to Promote Watershed Protection



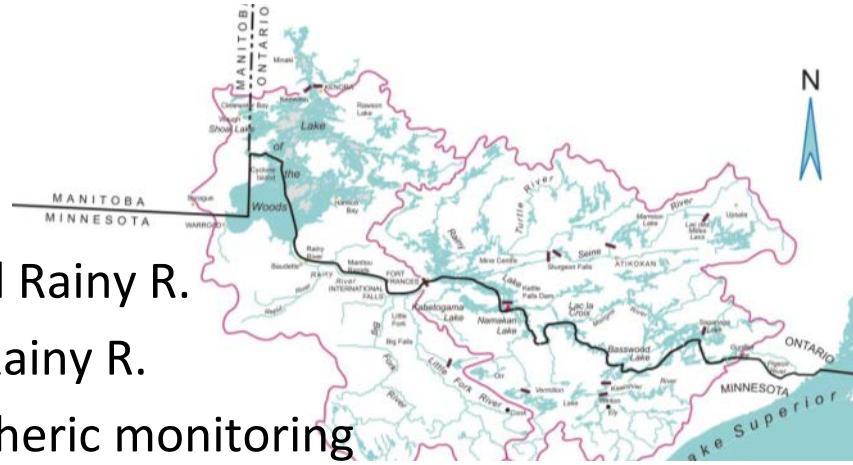
Component 1: Monitoring

- Water Quality Monitoring in the Lake of the Woods and the Rainy R. (based on POS#1)

- Baseline monitoring in LOW and Rainy R.
- Event based monitoring in the Rainy R.
- Enhanced tributary and atmospheric monitoring through partnership

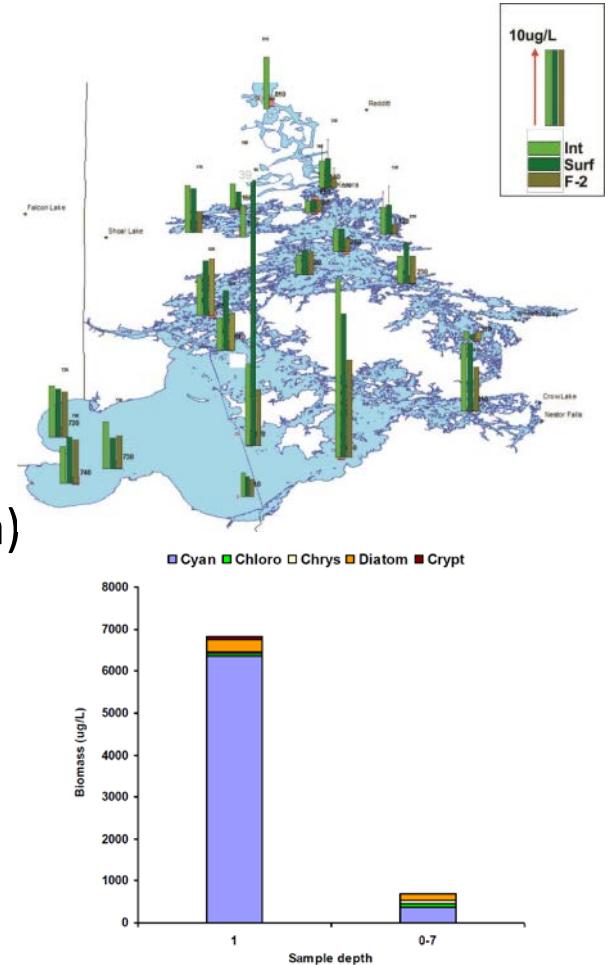
- Links to other POS projects

- POS#18
- POS#21
- POS#24
- POS#25
- POS#28



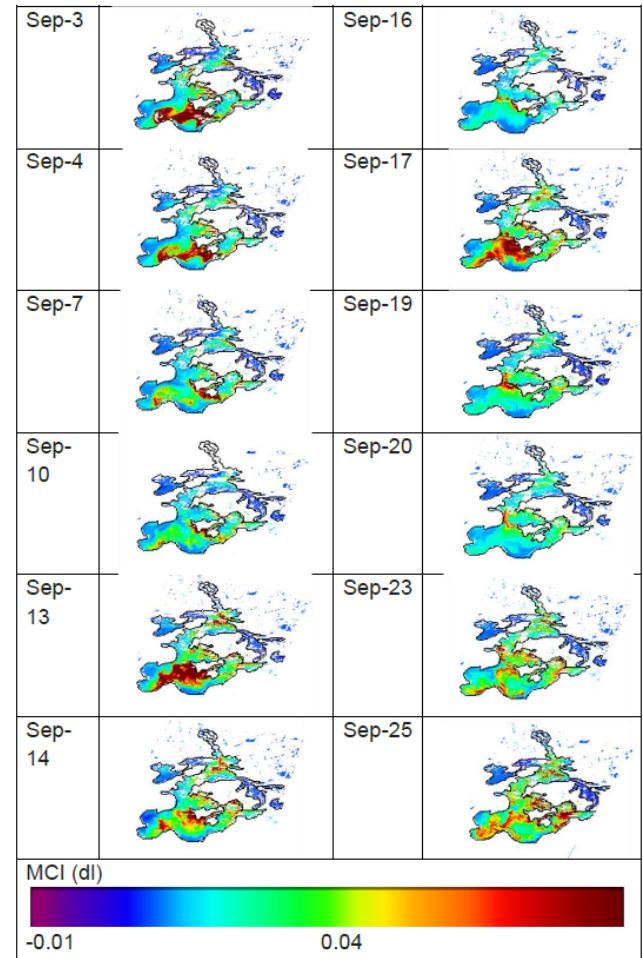
Component 2: Nutrient enrichment and algal blooms

- Address critical knowledge gaps in lake nutrient dynamics and algal blooms (based on POS#2,3,4,11)
 - Bloom species among LOW basins
 - Sources and types of toxins in LOW
 - Nearshore nutrient loading
 - Internal loading (resuspension and hypoxia)
- Links to other POS projects:
 - POS#8
 - POS#9
 - POS#10
 - POS#12



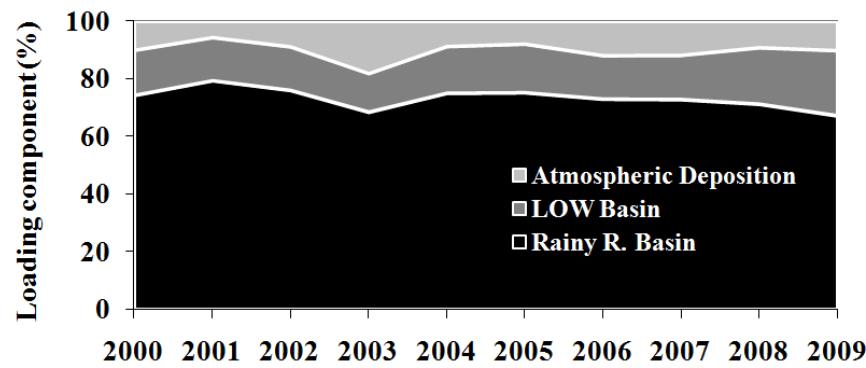
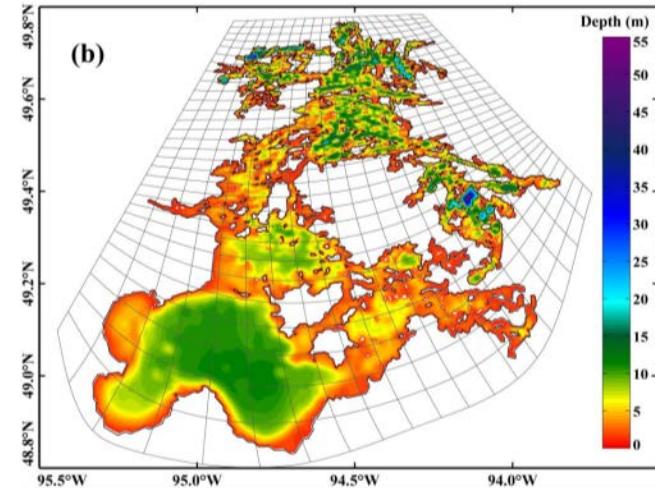
Component 3: Remote sensing

- Development of Remote sensing tools to identify and monitor algal blooms (based on POS#8)
 - Evolution of algal blooms
 - Near-real time monitoring of dynamic algal blooms
 - Methods for satellite detection of algal bloom composition
- Links to other POS projects:
 - POS#11
 - POS#30



Component 4: Modeling

- Develop integrated modeling framework for the watershed and the lake (based on POS#2,3,5,6,7,9,10)
 - Nutrient cycling and algal bloom triggers
 - Contribution to water quality objectives for LOW
 - Evaluation of BMPs and climate change impacts
- Links to other POS projects:
 - POS#18
 - POS#19
 - POS#28
 - POS#29



Component 5: Engagement and Partnerships

- Input and feedback on the Draft ECCC Science Plan welcome
- Committed to regular reporting on progress in science implementation and findings
- Committed to Open Data
- Partnerships are still needed to contribute to other projects by leveraging proposed activities
- Seeking partnerships to advance the *contaminant* and *capacity building* themes of the POS

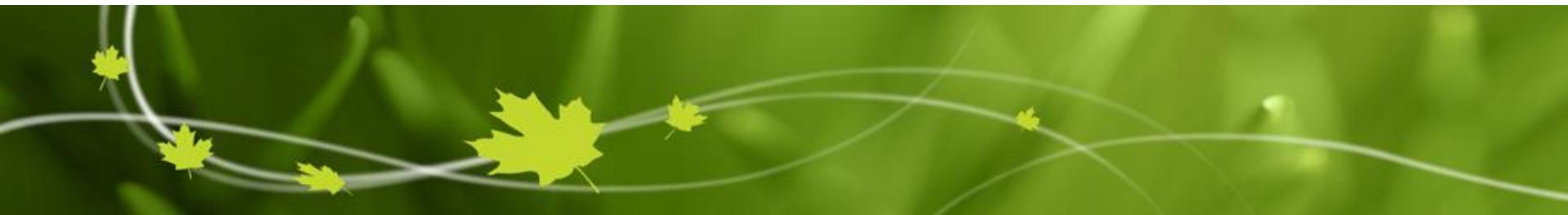
Surface and Groundwater Contamination	20. Assessment of Binational Implementation of Water Quality Objectives for Sulfate, Copper, Nickel, and Mercury 21. Synthesis Report on Contaminants in Water, Aquatic Sediment, and Fish 22. Methylmercury Flux and Bioaccumulation in Large Border Lakes 23. Spatial Survey of Contaminants of Emerging Concern 24. Vulnerability Assessment of Border Waters to Contamination from Mining 25. Vulnerability Assessment of Border Waters to Contamination from Rail and Pipeline Transport of Petroleum and other Chemicals 26. Mining Effects Science Workshop
Capacity Building	27. International Platform for Implementation 28. Review of Data Collection Programs and Monitoring in the Headwaters Regions of the Basin 29. Application of Regional Climate Models for the Basin and Improved Public Education and Engagement on the Issue of Climate Change 30. Development of the Lake of the Woods Basin Geospatial Mapping Framework and Public Communication Tool 31. Indigenous Perspectives on Ecosystem Health 32. Funding Program for Non-governmental Organizations to Promote Watershed Protection



Environment and
Climate Change Canada

Environnement et
Changement climatique Canada

Canada



Thank you!