

## MANITOBA ENVIROTHON WATER AND AQUATIC ECOSYSTEMS

Outcome Cluster	Code	Manitoba Envirothon Outcomes
Water and Aquatic Ecosystems as Resources	A1	Describe the ecological, economic and social benefits of aquatic ecosystems and riparian zones.
	A2	Describe the ecological functions of riparian zones.
	A3	Describe the different types of aquatic ecosystems.
	A4	Describe the different types of aquifers.
	A5	Describe historical trends in groundwater use, quantity and quality on the Canadian prairies.
	A6	Describe factors affecting water, and aquatic ecosystems, including biodiversity, non-native species, habitat reduction, pollution, climate change, and human activity.
Properties of Water, Water Bodies and Watersheds, and Aquatic Species Identification	A7	Describe the physical and chemical properties of water.
	A8	Describe the physical, chemical and biological properties of different types of aquatic ecosystems.
	A9	Explain how aquifer type relates to water quality and quantity.
	A10	Explain how physical and chemical properties of water affect aquatic ecosystems.
	A11	Describe the water cycle including the processes and phases of water involved.
	A12	Explain the relationship between climate and water.
	A13	Name the zones of a lake.
	A14	Describe the zones and structure of a lake.
	A15	Explain how a riparian zone affects the physical, chemical and biological properties of the adjacent water body.
	A16	Delineate the boundary of a watershed on a topographic map.
	A17	Describe features of healthy and unhealthy watersheds.

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	A18	List common solutes and particulates found in water bodies.
	A19	Describe how watershed geography and land use practices influence common solutes and particulates in surface and ground waters.
	A20	Explain how common solutes and particulates affect water quality and aquatic ecosystems.
	A21	Predict the general water quality of a specific body of water based on information about nearby sources of pollution.
	A22	Identify basic features of external and internal anatomy of fish.
	A23	Determine age and sex of a fish from features of its anatomy.
	A24	Name Manitoba's provincial fish.
	A25	Identify native and non-native aquatic species including plants, invertebrates and fish using a key.
	A26	Identify common aquatic invasive species present or anticipated in Manitoba.
Aquatic Ecology	A27	Describe the nitrogen cycle, phosphorus cycle, and carbon cycle in aquatic ecosystems.
	A28	Describe an aquatic food web, including interactions between organisms and energy flow in the web.
	A29	Give examples of aquatic organisms at different trophic levels.
	A30	Discuss the roles that groups of aquatic species play in the ecosystem.
	A31	Describe relationships of organisms within an aquatic ecosystem, including predation, competition and different types of symbiosis.
	A32	Explain why biodiversity is important in aquatic ecosystems.
	A33	Describe the preferred habitats of different types of aquatic species.
	A34	Explain the concept of carrying capacity within an aquatic ecosystem.
	A35	Name aquatic species and ecosystems that are at risk.

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	A36	List factors that contribute to the status of aquatic species and ecosystems at risk.
	A37	Give examples of invasive aquatic species present or anticipated in Manitoba.
	A38	Describe characteristics of invasive species that contribute to their success over native species.
Conservation and Management of Water and Aquatic Ecosystems	A39	Discuss the relationship between sustainable development and management of aquatic ecosystems.
	A40	Explain why management of water, fisheries and other aquatic resources is important in addressing issues such as conservation of biodiversity, non-native species habitat reduction, pollution, climate change and human activity.
	A41	Name government agencies responsible for overseeing water resources.
	A42	Describe laws and other methods used to protect water quality, aquatic ecosystems and fisheries from pollution, non-native species and other human impacts.
	A43	Discuss the interaction of competing uses of water, including industry, hydropower, irrigation, agriculture, transportation, navigation, recreation/sport, wildlife and fisheries.
	A44	Discuss the impact of competing water uses on the ability of an ecosystem to sustain wildlife, forestry, fisheries and other human needs.
	A45	Describe pressures on fish populations in Manitoba.
	A46	Describe different methods of conserving water.
	A47	Describe role of physical, chemical and biological tests in assessing and managing aquatic ecosystems.
	A48	Describe how to manage a riparian zone for ecosystem health.
	A49	Propose management decisions to address the conflicts between competing water uses.
	A50	Propose management decisions that would improve and protect water quality in the face of various environmental stresses.
	A51	Use results of physical, chemical and biological tests to assess water quality and make recommendations to improve aquatic ecosystem health.
	A52	Describe how to perform physical, chemical and biological water quality tests, including sampling techniques and equipment used.

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	A53	Calculate parameters related to flowing water, including velocity, volume and rate of flow.
	A54	Interpret results of physical, chemical and biological water quality tests.
	A55	Describe how Geographic Information Systems (GIS) are used in the management of water resources.