Marietta City Schools

2024-2025 District Unit Planner

Teacher(s)	IB ESS PLC	**Subject Group and Course**	Group 4 - ESS		
Course Part and Topic	Topic 4 Water and Aquatic Food Systems	**SL or HL / Year 1 or 2**	SL Year 2	**Time**	7 weeks
Unit Description and Texts		**DP Assessment(s) for Unit**			
• Oxford Textbook Topic 4 • Topic 4.1 Intro to Water Systems • Topic 4.2 Access to Freshwater • Topic 4.3 Aquatic Food Production Systems • Topic 4.4 Water Pollution Phenomenon: Water use has been growing at more than twice the rate of population increase in the last century, and although there is no global water scarcity as such, an increasing number of regions are chronically short of water.		• Formative/Summative assessment quizzes and activities/reports to check for understanding - Based in IB exam questions and format			

INQUIRY: establishing the purpose of the unit

Transfer Goals *List here one to three big, overarching, long-term goals for this unit. Transfer goals are the major goals that ask students to "transfer" or apply their knowledge, skills, and concepts at the end of the unit under new/different circumstances, and on their own without scaffolding from the teacher.*
Statement of Inquiry Most freshwater systems are naturally oligotrophic (nutrient poor). Significant ideas: The hydrological cycle is a system of water flows and storages that may be disrupted by human activity. The ocean circulatory system (ocean conveyor belt) influences the climate and global distribution of water (matter and energy).

The supplies of freshwater resources are inequitably available and unevenly distributed, which can lead to conflict and concerns over water security. Freshwater resources can be sustainably managed using a variety of different approaches. Aquatic systems provide a source of food production. Unsustainable use of aquatic ecosystems can lead to environmental degradation and collapse of wild fisheries. Aquaculture provides potential for increased food production. Water pollution, both to groundwater and surface water, is a major global problem, the effects of which influence human and other biological systems.

ACTION: teaching and learning through inquiry

Content / Skills / Concepts - Essential Understandings	**Learning Process** *Check the boxes for any pedagogical approaches used during the unit. Aim for a variety of approaches to help facilitate learning.*
<u>Students will know the following content:</u> • Solar radiation drives the hydrological cycle. • Freshwater makes up only a small fraction (approximately 2.6% by volume) of the Earth's water storages. • Storages in the hydrological cycle include organisms, soil and various water bodies, including oceans, groundwater (aquifers), lakes, rivers, atmosphere, glaciers and ice caps. • Flows in the hydrological cycle include evapotranspiration, sublimation, evaporation, condensation, advection (wind-blown movement), precipitation, melting, freezing, flooding, surface runoff, infiltration, percolation, and stream-flow or currents. • Human activities such as agriculture, deforestation and urbanization have a significant impact on surface runoff and infiltration. • Ocean circulation systems are driven by differences in temperature and salinity. The resulting difference in water density drives the ocean conveyor belt, which distributes heat around the world, and thus affects climate. •Access to an adequate freshwater supply varies widely. •Climate change may disrupt rainfall patterns and further affect this access. •As populations, irrigation and industrialization increase, the demand for fresh water increases.	Learning experiences and strategies/planning for self-supporting learning: ☒ Lecture □ Socratic seminar ☒ Small group/pair work ☒ PowerPoint lecture/notes ☒ Individual presentations ☒ Group presentations ☒ Student lecture/leading □Interdisciplinary learning Details:

• Freshwater supplies may become limited through contamination and unsustainable abstraction. • Water supplies can be enhanced through reservoirs, redistribution, desalination, artificial recharge of aquifers and rainwater harvesting schemes. Water conservation (including grey-water recycling) can help to reduce demand but often requires a change in attitude by the water consumers. •The scarcity of water resources can lead to conflict between human populations, particularly where sources are shared. •Demand for aquatic food resources continues to increase as the human population grows and diet changes. • Photosynthesis by phytoplankton supports a highly diverse range of food webs. •Aquatic (freshwater and marine) flora and fauna are harvested by humans. •The highest rates of productivity are found near coastlines or in shallow seas, where upwellings and nutrient enrichment of surface waters occurs. • Harvesting some species, such as seals and whales, can be controversial. Ethical issues arise over biorights, rights of indigenous cultures and international conservation legislation. •Developments in fishing equipment and changes to fishing methods have led to dwindling fish stocks and damage to habitats. •Unsustainable exploitation of aquatic systems can be mitigated at a variety of levels (international, national, local and individual) through policy, legislation and changes in consumer behaviour. •Aquaculture has grown to provide additional food resources and support economic development and is expected to continue to rise. • Issues around aquaculture include: loss of habitats, pollution (with feed, antifouling agents, antibiotics and other medicines added to fish pens), spread of diseases and escaped species (some involving genetically modified organisms). •There are a variety of freshwater and marine pollution sources. • Types of aquatic pollutants include floating debris, organic material, inorganic plant nutrients (nitrates and phosphates), toxic metals, synthetic compounds, suspended solids, hot water, oil, radioactive pollution, pathogens, light, noise and biological pollutants (invasive species). •A wide range of parameters can be used to directly test the quality of aquatic systems, including pH, temperature, suspended solids (turbidity), metals, nitrates and phosphates. •Biodegradation of organic material utilizes oxygen, which can lead to anoxic conditions and subsequent anaerobic decomposition, which in turn leads to formation of methane, hydrogen sulfide and ammonia (toxic gases). <u>Students will develop the following skills:</u>	*Students will learn through a combination of presentations, team/small group work, activities surrounding threats to and conservation of freshwater and aquatic food production systems* Other(s): Link and spiral other topics via projects **Formative assessment(s):** Quizzes In class activities Case studies Research assignments **Guidance:** ● **The effect of urbanization on water flows and potential of flash floods should be covered.** ● **Consider examples of unequal distribution and inequitable supply.** ● **Wild fisheries are also known as “capture fisheries”.** ● **Aquaculture is the farming of aquatic organisms in both coastal and inland areas that involves intervention in the rearing process to enhance production.** ● **Examine different points of view regarding harvesting of a controversial species; for example, the historical Inuit tradition of whaling versus modern international conventions.** ● **When looking at the increase in demand for food resources, consideration should be given to changes in attitude towards “health foods” and food fashions.** ● **Consider how two contrasting fisheries have been managed and relate to the concept of sustainability; for example, cod fisheries in Newfoundland and Iceland. Issues that should**

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- Discuss human impact on the hydrological cycle.
- Construct and analyze a hydrological cycle diagram.
- Evaluate the strategies that can be used to meet an increasing demand for
- fresh water.
- Discuss, with reference to a case study, how shared freshwater resources have
- given rise to international conflict.
- Discuss, with reference to a case study, the controversial harvesting of a
- named species.
- Evaluate strategies that can be used to avoid unsustainable fishing.
- Explain the potential value of aquaculture for providing food for
- future generations.
- Discuss a case study that demonstrates the impact of aquaculture.

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be covered include: improvements to boats, fishing gear (trawler bags), and detection of fisheries and boats via satellites. Management aspects should include: use of quotas, designation of marine protected areas (exclusion zones), and restriction on types and size of fishing gear (including mesh size of nets).

- **Students should understand maximum sustainable yield (MSY) as applied to fish stocks.**
- **Sources of freshwater pollution should include runoff, sewage, industrial discharge and solid domestic waste.**
- **Sources of marine pollution should include rivers, pipelines, atmosphere and activities at sea (operational and accidental discharges).**
- **The role of positive and negative feedback in the process of eutrophication should be covered. Coastal eutrophication can lead to red tide blooms.**
- **With respect to measuring aquatic pollution, polluted and unpolluted sites (for example, upstream and downstream of a point source) should be compared.**

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International Mindedness:

Many hydrological cycles are shared by various nations. This can lead to international disputes.

Unequal access to fresh water can cause conflict between countries that have an abundance of freshwater and those that do not.

Successful management of marine and some freshwater fisheries requires partnership between different nations.

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Summative assessments:
Group project
Summative assessment over each subtopic and over Topic 4 all

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Differentiation:

☒ Affirm identity - build self-esteem

☒ Value prior knowledge

☒ Scaffold learning

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Countries with limited access to clean water often have higher incidences of water-borne illnesses.	☒ Extend learning Details: ● *SWD/504 – Accommodations Provided* ● *ELL – Reading & Vocabulary Support* ● *Intervention Support* ● *Extensions – Enrichment Tasks and Project*

Approaches to Learning (ATL)

Check the boxes for any explicit approaches to learning connections made during the unit. For more information on ATL, please see the guide.

☒ Thinking

☒ Social

☒ Communication

☒Self-management

☒ Research

Details: This topic provides students with a vast amount of information that can be studied in many ways. The ATLs used for this subtopic will vary depending on the individual students and groups approach to showing their understanding of the material

Language and Learning	**TOK Connections**	**CAS Connections**
Check the boxes for any explicit language and learning connections made during the unit. For more information on the IB's approach to language and learning, please see the guide.	*Check the boxes for any explicit TOK connections made during the unit*	*Check the boxes for any explicit CAS connections. If you check any of the boxes, provide a brief note in the "details" section explaining how students engaged in CAS for this unit.*

☒ Activating background knowledge ☒ Scaffolding for new learning ☒ Acquisition of new learning through practice □ Demonstrating proficiency Details: *Students will acquire new vocabulary dealing with climate change and the impacts humans have on climate* *Connections:* *ESS: Climate change—causes and impacts (7.2); terrestrial food production systems and food choices (5.2); aquatic food production systems (4.3); resource use in society (8.2); sustainability (1.4)* *ESS: Climate change—causes and impacts (7.2); terrestrial food production systems and food choices (5.2) and aquatic food production systems (4.3); resource use in society (8.2) and sustainability (1.4).* *ESS: Biodiversity and conservation (topic 3); terrestrial food production systems and food choices (5.2); human population carrying capacity (8.4); resource use in society (8.2); sustainability (1.4)* *ESS: Terrestrial food production systems and food choices (5.2); climate change—causes and impacts (7.2); sustainability (1.4); resource use in society (8.2); biodiversity and conservation (topic 3); solid domestic waste (8.3)*	☒ Personal and shared knowledge ☒ Ways of knowing ☒ Areas of knowledge ☒ The knowledge framework Details: The hydrological cycle is represented as a systems model—to what extent can systems diagrams effectively model reality, given that they are only based on limited observable features? Aid agencies often use emotive advertisements around the water security issue—to what extent can emotion be used to manipulate knowledge and actions? The Inuit people have a historical tradition of whaling—to what extent does our culture determine or shape our ethical judgments? A wide range of parameters are used to test the quality of water and judgments are made about the causes and effects of water quality—how can we effectively identify cause–effect relationships, given that we can only ever observe correlation?	☒ Creativity ☒ Activity ☒ Service Details: *Students will discover ways to reduce water usage and prevent water pollution.* *Students will complete an activity looking at the effects of pollution on Midway Island by looking a bolluses that contain plastic and other pollution* *In combination with the National Wildlife Refuge System and The US Fish and Wildlife Service, these activities will be shared to promote awareness of the dangers of polluting our waterways.*

Resources

List and attach (if applicable) any resources used in this unit

- Oxford Environmental Systems and Societies ISBN 978-0-19-833256-5
- Biozone Environmental Science Student Workbook ISBN 978-1-927173-55-8
- Hodder Education Environmental Systems and Societies Study and Revision Guide ISBN 978-1-471-89973-7
- IB ESS Schoology Group

REFLECTION: considering the planning, process, and impact of the inquiry

What worked well	**What didn't work well**	**Notes / Changes / Suggestions**
List the portions of the unit (content, assessment, planning) that were successful	*List the portions of the unit (content, assessment, planning) that were not as successful as hoped*	*List any notes, suggestions, or considerations for the future teaching of this unit*
