

Minnesota State-Approved Technical Skill Assessments

7/1/2012

Pathway: Environmental Service Systems

Cluster: Agriculture, Food, and Natural Resources

CLUSTER/ PATHWAY/ PROGRAM	CERTIFICATION / ASSESSMENT TITLE	TYPE	ISSUING ORGANIZATION	WEBSITE Please report broken web links	ELIGIBILITY REQUIREMENTS / PREREQUISITES	ADMINISTRA- TION ELIGIBILITY (Written, Oral, Practical, etc.)	PASSING SCORE	COST	COMMENTS
<ul style="list-style-type: none"> For use at SECONDARY For use at SECONDARY For use at SECONDARY For use at SECONDARY 									
Natural Resources & Environmental Systems	NOCTI Natural Resources Pathway Assessment	Academic Assessment	NOCTI	Agriculture, Food & Natural Resources Assessments: http://www.nocti.org/BlueprintCategoryLinks.cfm?category=Agriculture, Food%26 Natural Resources		Online or written	National Norm	\$19 per post-test exam; \$31 for pre-test & post-test exam	Contact NOCTI directly to order assessments for your high school program; information is on their web site (http://www.nocti.org).
	NOCTI	NOCTI	TESTING AGREEMENT	Each institution/consortium should have a Testing Coordinator who contacts NOCTI to obtain assessment exams, proctoring information, data management needs, and other important functions. Click here for getting started: http://www.nocti.org/gettingstarted.cfm					

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Natural Resources & Environment- al Systems	Natural Resources: Environmental	Academic Assessment	CareerTech	http://www.okcareertech.org/educators/assessments-and-testing/testing/study-guides/study-guides-ok-works-2015-2016/EnvironmentalScienceNaturalResourcesS.G.pdf		Online	70%	\$12 per exam	\$12 for pretest and \$12 for posttest
	CareerTech Testing Information for Consortia Leaders and/or High School Testing Coordinators	CareerTech	TESTING AGREEMENT	Each institution/ consortium should have a Testing Coordinator who contacts CareerTech to obtain assessment exams, proctoring information, data management needs, and other important functions. Click here for the CareerTech Testing Agreement form: http://www.okcareertech.org/about/state-agency/divisions/testing					

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● For use at POSTSECONDARY

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Environment- al Service System	Class D Wastewater Operator Exam	Class D license	Minnesota Pollution Control Agency (MPCA)	Frequently Asked questions about Wastewater Operator Certification: http://www.pca.state.mn.us	1 year experience or 1 year college	Written	70%	\$100	
Environment- al Service System	Class D Water Operator Exam	Class D license	Minnesota Department of Health (MDH)	What a Class D Operator Needs To Know: http://www.health.state.mn.us/	1 year experience or 1 year college	Written	70%	\$60	

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PERFORMANCE INDICATOR	PERFORMANCE MEASURE	KEY: Y=Essential N=Not Essential O=Optional		COMMENTS
		COMMON CORE COMPETENCIES - Consensus among work group - Secondary	Postsecondary	
TOPIC 1: PERFORMANCE ELEMENT - Use analytical procedures to plan and evaluate environmental service systems.				
INDICATOR 01.01 Analyze and interpret samples.	MEASURE 01.01.01 Identify sample types and sampling techniques, explain the importance of unbiased sampling and collect samples.	Y	Y	Comments for Secondary: Studies in water and soil at secondary level at the awareness level.
	MEASURE 01.01.02 Determine the appropriate sampling techniques needed to generate statistical analysis data, and prepare valid chemical laboratory samples according to instructions.	N	Y	
	MEASURE 01.01.03 Analyze and interpret results of sample measurements.	N	Y	
	MEASURE 01.01.04 Identify basic laboratory equipment and environmental monitoring instruments and explain their uses.	Y	Y	
	MEASURE 01.01.05 Demonstrate the proper use and maintenance of basic laboratory equipment and environmental monitoring instruments (e.g., pH meter instrument).	Y	Y	
	MEASURE 01.01.06 Calibrate and use laboratory and field equipment and instruments according to standard operating procedures.	N	Y	

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		COMMON CORE COMPETENCIES - Consensus among work group -		
		Secondary	Postsecondary	
TOPIC 2: PERFORMANCE ELEMENT - Assess the impact of policies and regulations on environmental service systems.				
INDICATOR 02.01 Interpret laws affecting environmental service systems.	MEASURE 02.01.01 Identify laws associated with environmental service systems.	Y	Y	Comment from Secondary: Awareness at secondary level. Comment from Business/Industry: E.g., NPDES Permits, Safe Drinking Water Act.
	MEASURE 02.01.02 Identify the purposes of laws associated with environmental service systems.	N	Y	Comment from Business/Industry: Y-1: Understand the consequences.
	MEASURE 02.01.03 Abide by the specific laws pertaining to environmental service systems.	N	Y	

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		COMMON CORE COMPETENCIES - Consensus among work group -		
		Secondary	Postsecondary	
TOPIC 3: PERFORMANCE ELEMENT - Apply scientific principles to environmental service systems.				
INDICATOR 03.01 Apply meteorology principles to environmental service systems.	MEASURE 03.01.01 Monitor meteorological conditions and accurately record and document the data.	N	Y	
INDICATOR 03.02 Apply soil science principles to environmental service systems.	MEASURE 03.02.01 Explain the process of soil formation through weathering.	Y	N	
	MEASURE 03.02.02 Apply knowledge of soil orders to environmental service systems.	N	Y	Comment from Business/Industry: I.e., Land application of biosolids; waste water side. Comment from Secondary-Postsecondary: Source water characteristics.
	MEASURE 03.02.03 Describe the biodiversity found in soil and the contribution of biodiversity to the physical and chemical characteristics of soil.	Y	Y	Comment from Business/Industry: I.e., Land application of biosolids. Comment from Secondary-Postsecondary: Have to be considerate of small-size communities. Need to know how those soil systems treat water.
	MEASURE 03.02.04 Relate the activities of microorganisms in soil to environmental service systems.	Y	Y	Comment from Business/Industry: Doesn't look at septic systems/wetlands as a system. Comment from Secondary-Postsecondary: Consider impact of water and waste treatment in small communities/ ISTS (individual sewage treatment systems).
	MEASURE 03.02.05 Explain how the physical qualities of the soil influence the infiltration and percolation of water.	Y	Y	Comment from Business/Industry: Land application and biosolids.

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		COMMON CORE COMPETENCIES - Consensus among work group -		COMMENTS
		Secondary	Postsecondary	
	MEASURE 03.02.06 Identify the physical qualities of the soil that determine its use for environmental service systems.	Y	Y	Comment from Business/Industry: Land application and biosolids. Comment from Secondary-Postsecondary: Infiltration basins/waste water.
	MEASURE 03.02.07 Conduct tests of soil to determine its use for environmental service systems.	Y	Y	Comment from Business/Industry: Land application and biosolids.
	MEASURE 03.02.08 Identify land uses, capability factors and land capability classes.	Y	Y	Comment from Business/Industry: Land application and biosolids.
	MEASURE 03.02.09 Use a soil survey to determine the land capability classes for different parcels of land in an area.	Y	Y	Comment from Business/Industry: Land application and biosolids.
	MEASURE 03.02.10 Evaluate a master land-use management plan for a given area.	O	Y	Comment from Business/Industry: Water treatment side; water quality. Comment from Secondary-Postsecondary: Major project for students.
INDICATOR 03.03 Apply hydrology principles to environmental service systems.	MEASURE 03.03.01 Describe the world's water supplies and discuss the many uses of water.	N	Y	Comment from Business/Industry: Important to understand and be able to comprehend; how industry fits in the world.
	MEASURE 03.03.02 Research and debate/discuss one or more current environmental issues associated with the supplies of groundwater and surface water.	N	Y	Comment from Business/Industry: Important to know and understand; Research.
	MEASURE 03.03.03 Demonstrate knowledge of hydrogeology by differentiating between groundwater and surface water.	N	Y	

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		COMMON CORE COMPETENCIES - Consensus among work group -		COMMENTS
		Secondary	Postsecondary	
	MEASURE 03.03.04 Describe interactions between groundwater and surface water.	Y	Y	
	MEASURE 03.03.05 Use groundwater-flow equations and Darcy's Law to explain how geology and meteorology affect groundwater and groundwater flow.	N	O	Comments from Secondary-Postsecondary: Essential in water quality science.
	MEASURE 03.03.06 Define groundwater potential (sources/quantity).	Y	Y	Comment from Business/Industry: Potential is sources and quantities.
	MEASURE 03.03.07 Identify differences in groundwater potential.	Y	Y	
	MEASURE 03.03.08 Delineate groundwater potential zones.	Y	Y	
	MEASURE 03.03.09 Identify environmental hazards associated with groundwater supplies.	Y	Y	
	MEASURE 03.03.10 Describe precautions taken to prevent/reduce contamination of groundwater supplies.	Y	Y	
	MEASURE 03.03.11 Test and document the quality of groundwater supplies.	Y	Y	
	MEASURE 03.03.12 Determine and calculate the influence of the factors that influence the velocity of water through open and closed conduits.	Y	Y	

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		COMMON CORE COMPETENCIES - Consensus among work group -		COMMENTS
		Secondary	Postsecondary	
	MEASURE 03.03.13 Measure and document water flow through an open channel and interpret channel-flow analysis.	N	Y	
	MEASURE 03.03.14 Identify the operational components of a pumping or fluid movement system.	N	Y	Comment from Business/Industry: Basics and principles.
	MEASURE 03.03.15 Discuss design principles related to hydraulic systems and highflow technologies related to fluid movement.	N	Y	
	MEASURE 03.03.16 Install and maintain pumps and associated delivery systems.	N	Y	
INDICATOR 03.04 Apply best management techniques associated with the properties, classifications and functions of wetlands.	MEASURE 03.04.01 Describe the functions of wetlands and differentiate types of wetlands.	Y	Y	Comment from Business/Industry: Aquifer recharge areas water source protection; important to understand.
INDICATOR 03.05 Apply chemistry principles to environmental service systems.	MEASURE 03.05.01 Explain basic chemistry principles.	Y	Y	
	MEASURE 03.05.02 Distinguish the characteristics of inorganic and organic compounds as they relate to environmental service systems.	N	Y	Comment from Business/Industry: As related to the effects of chemical demand - example Cl ₂ .
	MEASURE 03.05.03 Apply standard operating procedures for use of chemicals in environmental service systems.	N	Y	

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		COMMON CORE COMPETENCIES - Consensus among work group -		COMMENTS
		Secondary	Postsecondary	
INDICATOR 03.06 Apply microbiology principles to environmental service systems [or processes - DJ].	MEASURE 03.06.01 Identify the basic structures of microorganisms and the major groups of microorganisms.	N	Y	
	MEASURE 03.06.02 Describe microbial growth in the environment [and process] and analyze the influence of environmental factors on microbial growth [as related to surface H ₂ O].	N	Y	Comment from Business/Industry: Important to surface water treatment.
	MEASURE 03.06.03 Collect, culture and examine microorganisms, following safety procedures.	N	Y	Comment from Business/Industry: As related to waste water biological processes; and important part of bacteria testing (water).
	MEASURE 03.06.04 Define the purposes of bioassay tests.	N	Y	Comment from Business/Industry: I.e., using Bac-T test as a example (as related to) waste water tests.
	MEASURE 03.06.05 Outline procedures for a bioassay test.	N	Y	Comment from Business/Industry: I.e., using Bac-T test as a example (as related to) waste water tests.
	MEASURE 03.06.06 Conduct bioassay tests related to environmental service systems and interpret results.	N	Y	Comment from Business/Industry: I.e., using Bac-T test as a example (as related to) waste water tests.

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		COMMON CORE COMPETENCIES - Consensus among work group -		
		Secondary	Postsecondary	
TOPIC 4: PERFORMANCE ELEMENT - Operate environmental service systems to manage a facility environment.				
INDICATOR 04.01 Use pollution control measures to maintain a safe facility environment.	MEASURE 04.01.01 Identify types of pollution and distinguish between point source and nonpoint source pollution.	Y	Y	
	MEASURE 04.01.02 Give examples of how industrial and nonindustrial pollution has damaged the environment.	Y	Y	Comment from Business/Industry: Important to understand.
	MEASURE 04.01.03 Survey the local area for evidence of industrial and nonindustrial pollution.	N	Y	
	MEASURE 04.01.04 Describe ways in which pollution can be managed and prevented.	Y	Y	
	MEASURE 04.01.05 Conduct tests to determine the presence and extent of pollution.	Y	Y	Comment from Secondary: Awareness at secondary level. Comment from Business/Industry: Wastewater discharge and source water protection.
INDICATOR 04.02 Manage safe disposal of all categories of solid in biosolids and waste (bi-products of wastewater treatment).	MEASURE 04.02.01 Describe different types of solid waste pertaining to treatment residuals.	N	Y	Comment from Postsecondary: Essential in the context of program. Comment from Business/Industry: As related to water and wastewater residuals and biosolids. Bi-products of water and waste water treatment process. Bi-products of water/waste water treatment.

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		COMMON CORE COMPETENCIES - Consensus among work group -		COMMENTS
		Secondary	Postsecondary	
	MEASURE 04.02.02 Evaluate environmental hazards created by different types of solid waste, solid waste accumulation and solid waste disposal as related to water and wastewater residuals and biosolids.	N	Y	Comment from Postsecondary: Essential in the context of program.
	MEASURE 04.02.03 Discuss practical management options for treating solid waste.	N	Y	Comment from Postsecondary: Essential in the context of waste water.
	MEASURE 04.02.04 Identify characteristics of solid waste treatment and recognize the byproducts of solid waste treatment.	N	Y	Comment from Postsecondary: Essential in the context of waste water.
	MEASURE 04.02.05 Collect and treat solid waste materials.	N	Y	Comment from Postsecondary: Essential in the context of waste water.
	MEASURE 04.02.06 Define sanitary landfill.	N	Y	Comment from Postsecondary: Essential in the context of waste water.
	MEASURE 04.02.07 Explain basic sanitary landfill operating procedures and design (biosolids and wastewater residuals).	N	Y	Comment from Postsecondary: Essential in the context of waste water.
	MEASURE 04.02.08 Evaluate sanitary landfill procedures.	N	O	Comment from Postsecondary: Essential in the context of waste water.
	MEASURE 04.02.09 Define compost and composting.	Y	Y	Comment from Postsecondary: Essential in the context of waste water. Comment from Business/Industry: Bi-solids management/treatment.
	MEASURE 04.02.10 Explain the basic concepts associated with solid waste incineration (biosolids).	N	Y	

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		COMMON CORE COMPETENCIES - Consensus among work group -		COMMENTS
		Secondary	Postsecondary	
	MEASURE 04.02.11 Describe the environmental impact of solid waste incineration (biosolids).	N	Y	
	MEASURE 04.02.12 Evaluate methods of incinerating solid waste, including those used in waste-to-energy plants (biosolids).	N	Y	
	MEASURE 04.02.13 Explain the importance of recycling.	Y	Y	Comment from Postsecondary: Essential in the context of program.
	MEASURE 04.02.14 Describe recycling methods and identify materials that can be recycled.	Y	Y	
	MEASURE 04.02.15 Survey and evaluate local recycling programs and procedures.	Y	N	
INDICATOR 04.03 Apply the principles of public drinking water treatment operations to ensure safe water at a facility.	MEASURE 04.03.01 Identify chemical and physical properties of drinking water.	N	Y	
	MEASURE 04.03.02 Illustrate the steps in the public drinking water treatment process.	N	Y	
	MEASURE 04.03.03 Demonstrate the use of water-testing instruments and water-treatment equipment for processing public drinking water.	N	Y	
	MEASURE 04.03.04 Define source water quality.	Y	Y	

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		COMMON CORE COMPETENCIES - Consensus among work group -		
		Secondary	Postsecondary	
	MEASURE 04.03.05 Define source water assessment steps.	N	Y	Comment from Business/Industry: Not entry level; N=Mostly engineering work; Y=Small town response; Consider for "size of city" person is employed in. Comment from Secondary-Postsecondary: Include small town assessments.
	MEASURE 04.03.06 Conduct and interpret source water assessments.	N	Y	
INDICATOR 04.04 Apply principles of wastewater treatment to manage wastewater disposal in keeping with rules and regulations.	MEASURE 04.04.01 Define wastewater.	Y	Y	
	MEASURE 04.04.02 Diagram the steps in wastewater treatment.	N	Y	
	MEASURE 04.04.03 Demonstrate the use of water-testing instruments and water-treatment equipment to treat wastewater.	N	Y	
INDICATOR 04.05 Manage hazardous materials to assure a safe facility and to comply with applicable regulations.	MEASURE 04.05.01 Identify types of hazardous materials.	Y	Y	
	MEASURE 04.05.02 Describe risks related to hazardous materials and describe health and safety practices to reduce risks from hazardous materials.	Y	Y	

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		COMMON CORE COMPETENCIES - Consensus among work group -		COMMENTS
		Secondary	Postsecondary	
TOPIC 5: PERFORMANCE ELEMENT - Examine the relationships between energy sources and environmental service systems.				
INDICATOR 05.01 Compare and contrast the impact of conventional and alternative energy sources on the environment.	MEASURE 05.01.01 Identify conventional energy sources and list conservation measures to reduce energy consumption.	N	O	
TOPIC 6: PERFORMANCE ELEMENT - Use tools, equipment, machinery and technology to accomplish tasks in environmental service systems.				
INDICATOR 06.01 Use technological and mathematical tools to map land, facilities and infrastructure.	MEASURE 06.01.01 Explain the importance of surveying and mapping for environmental service systems.	N	Y	Comment from Business/Industry: Utility mapping, GIS.
INDICATOR 06.02 Maintain tools, equipment and machinery in safe working order for tasks in environmental service systems.	MEASURE 06.02.01 Demonstrate proper use and maintenance of hand tools.	Y	Y	
	MEASURE 06.02.02 Operate equipment and machinery in accordance with manufacturers' instructions and OSHA standards, specifically addressing personal protective equipment and proper machine guarding.	Y	Y	
	MEASURE 06.02.03 Demonstrate proper preventive maintenance techniques and programs and how to set up a mock program preventive maintenance schedule.	Y	Y	Comment from Business/Industry: Important to understand such programs.

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An "assessment blueprint" is a document that indicates the knowledge and skills that will be covered in an assessment instrument and the percentage of the assessment that will be devoted to each area of knowledge and skills. The Minnesota assessment blueprints will be used to review the appropriateness of existing assessments by determining how closely those assessments match up to what the Foundation Knowledge & Skills teams have determined should be assessed. The assessment blueprints can also be used to guide the development of new assessments where suitable third-party assessments do not exist.

		SECONDARY	POST-SECONDARY	BUSINESS & INDUSTRY
		% of Assessment ↓	% of Assessment ↓	% of Assessment ↓
TOPIC 1	ACADEMIC FOUNDATIONS: Achieve additional academic knowledge and skills required to pursue the full range of career and education opportunities within a career cluster and/or career pathway.	13%	5%	5%
TOPIC 2	COMMUNICATIONS - Communicate clearly and effectively with reason including technical terminology and information.	12%	10%	11%
TOPIC 3	PROBLEM-SOLVING AND CRITICAL THINKING - Utilize critical thinking skills to make sense of problems and persevere in solving them. Employ valid, reliable research strategies. Demonstrate creativity and innovation.	12%	12%	11%
TOPIC 4	TECHNOLOGY APPLICATIONS - Use technology to enhance productivity.	10%	10%	8.5%
TOPIC 5	ORGANIZATIONAL AND GLOBAL SYSTEMS – Understand the environmental, social, and economic impacts of decisions within an organization. Understand global context of industries and careers.	4%	5%	12.5%
TOPIC 6	SAFETY, HEALTH, AND ENVIRONMENT – Understand the importance of safety, health, and environmental management systems and their importance to organizational performance and regulatory compliance.	4%	8%	8.5%
TOPIC 7	LEADERSHIP AND TEAMWORK - Use leadership in collaborating with others to accomplish productive organizational goals and objectives with an awareness of cultural/global competence.	12%	10%	8.5%
TOPIC 8	ETHICS AND LEGAL RESPONSIBILITIES – Know, understand, and model the importance of ethics, integrity, and legal responsibilities.	10%	15%	8.5%
TOPIC 9	CAREER DEVELOPMENT, EMPLOYABILITY, AND CITIZENSHIP –Attend to personal health and financial well-being. Know and understand the importance of employability skills. Plan education and career paths aligned to personal goals and employability goals. Act as a responsible and contributing citizen and employee.	10%	5%	5%
TOPIC 10	TECHNICAL LITERACY – Apply technical knowledge and skills required to pursue careers in a specific career cluster and/or career pathway.	13%	20%	21.5%
		100%	100%	100%

Agriculture, Food and Natural Resources: Environmental Service Systems

Career Pathway Plan of Study for ► Learners ► Parents ► Counselors ► Teachers/Faculty

*This Career Pathway Plan of Study (based on the Environmental Service Systems Pathway of the Agriculture, Food and Natural Resources Career Cluster) can serve as a guide, along with other career planning materials, as learners continue on a career path. Courses listed within this plan are only recommended coursework and should be individualized to meet each learner’s educational and career goals. *This Plan of Study, used for learners at an educational institution, should be customized with course titles and appropriate high school graduation requirements as well as college entrance*

EDUCATION LEVELS	GRADE	English/ Language Arts	Math	Science	Social Studies/ Sciences	Other Required Courses Other Electives Recommended Electives Learner Activities	*Career and Technical Courses and/or Degree Major Courses for Environmental Service Systems Pathway	SAMPLE Occupations Relating to This Pathway
<i>Interest Inventory Administered and Plan of Study Initiated for all Learners</i>								
SECONDARY	9	English/ Language Arts I	Algebra I or Geometry	Earth or Life or Physical Science	Government & Citizenship/ Geography	All plans of study should meet local and state high school graduation requirements and college entrance requirements. Supervised Agricultural Experience (SAE) and participation in appropriate FFA activities support and reinforce classroom and laboratory learning and should be a requirement for all	<ul style="list-style-type: none"> • Introduction to Agriculture, Food and Natural Resources • Introduction to Environmental Service Systems • Power Systems • Research in Natural Resources and Biotechnology • Internship in Environmental Service Systems 	Occupations Requiring Postsecondary Education <ul style="list-style-type: none"> ► Environmental Compliance Assurance Manager ► Environmental Sampling and Analysis Scientist/Technician ► Hazardous Materials Handler ► Hazardous Materials Technician ► Health and Safety Sanitarian ► Pollution Prevention and Control Technician ► Recycler ► Solid Waste Technician
	10	English/ Language Arts II	Geometry or Agl	Biology	U.S. History			
	11	English/ Language Arts III	Statistics & Probability	Chemistry or Physics	World History			
	<i>College Placement Assessments-Academic/Career Advisement Provided</i>							
	12	English/ Language Arts IV	Math Elective	Science Elective	Economics			
<i>Articulation/Dual Credit Transcribed-Postsecondary courses may be taken/moved to the secondary level for articulation/dual credit purposes.</i>								
POSTSECONDARY	Year 13	Required Transfer Curriculum Goals Determined by Local College Program in College Year 1 and Year 2 - Goal 1: Communication; Goal 2: Critical Thinking/Problem-Solving; Goal 3: Natural Science; Goal 4: Mathematical/Logical Reasoning; Goal 5: History and the Social and Behavior Sciences; Goal 6: The Humanities and the Arts; Goal 7: Human Diversity; Goal 8: Global Perspective; Goal 9: Ethical and Civic Responsibility; Goal 10: People and the Environment			All plans of study need to meet learners’ career goals with regard to required degrees, licenses, certifications or journey worker status. Certain local student organization activities may also be important to include.	<ul style="list-style-type: none"> • Environmental Systems • Soil and Water in the Environment • Environmental Service Systems Operations • Surveying and Mapping the Environment • Continue Courses in the Area of Specialization • Complete Environmental Service Systems Major (4-Year Program) 	Occupations Requiring Baccalaureate Degree <ul style="list-style-type: none"> ► Agricultural Educator ► Chemical Engineer ► Environmental Engineer ► Pollution Prevention and Control Manager ► Solid Waste Manager ► Toxicologist ► Water Environment Manager ► Water Quality Manager 	
	Year 14							
	Year 15	Continue courses in the area of specialization.						
	Year 16							