North Carolina Surface Irrigation of Wastewater
Needs-To-Know

Chapter 1 – Wastewater Characteristics

1-1. Identify the sources of wastewater.

1-2. Describe the difference between domestic and industrial wastewater and list concerns with application of high strength industrial waste.

1-3. Define inorganic and organic as they relate to wastewater treatment.

1-4. Describe several important physical characteristics of wastewater and identify unusual conditions that could affect system operation.

1-5. Define total, suspended, and dissolved solids and explain their importance in wastewater treatment.

1-6. Define influent.

1-7. Define pathogen and explain its relevance with wastewater treatment.

1-8. Define effluent.

1-9. Identify what fecal coliform bacteria are and explain the role they play in wastewater treatment.

1-10. Define BOD (Biochemical Oxygen Demand) and explain the importance of BOD in wastewater treatment.

1-11. Define organic loading rate.

1-12. Define dissolved oxygen, describe its importance in wastewater treatment and describe methods for measuring it.

1-13. Describe the difference between aerobic and anaerobic wastewater treatment.

1-14. Define nutrients and how they affect the treatment of wastewater. Describe their role in the efficiency of wastewater treatment.

1-15. Define hydraulic loading rate.

1-16. Describe the effects of fats, oils and grease on wastewater treatment systems.

1-17. Define pH, alkalinity and acidity and explain how these factors affect the treatment of wastewater.

1-18. Define sodium adsorption ratio and explain its importance with land application of wastewater.

Chapter 2 – Pretreatment of Wastewater

Lagoons

2-1. List the four types of stabilization lagoons.

2-2. Explain the differences between, and describe the general operating parameters for the following:
- aerobic lagoons
- aerated lagoons
- anaerobic lagoons
- facultative lagoons

2-3. Explain the difference between a stabilization lagoon and a storage lagoon.

2-4. Define freeboard and explain the importance of maintaining adequate freeboard.

2-5. Define short-circuiting and explain why it is undesirable.

2-6. Define detention time and explain its importance in wastewater treatment.

2-7. List the advantages of multiple cell lagoons and describe the difference between lagoons operated in series and lagoons operated in parallel.

2-8. List the factors that influence lagoon performance and describe their importance.

2-9. Define photosynthesis and describe why is it important in stabilization lagoons.

2-10. Describe the daily fluctuation in dissolved oxygen in a normally functioning facultative lagoon.

2-11. List probable causes and corrective actions to be taken for each of the following:
- emergent and suspended aquatic vegetation
- erosion
- scum formation
- excessive algae
- solids accumulation
- odor production
- insufficient freeboard
- short-circuiting
- septicity

2-12. Describe the maintenance procedures for stabilization and storage lagoon dikes.

2-13. Describe the advantages of baffles/curtains in a lagoon system.

Tanks

2-14. Identify the components and functions of a septic tank.

2-15. List the factors that affect septic tank performance.

2-16. Explain the effect of hydraulic and organic overloading on septic tanks.

2-17. Define infiltration and exfiltration and explain why each is undesirable.

2-18. Describe the procedure for inspecting a septic tank for infiltration or exfiltration.

2-19. Describe the problems that can occur with septic tanks and the visible signs that can indicate these problems.

2-20. Describe why, when, and how solids should be removed from septic and dosing tanks.

2-21. Describe how scum depth is measured in a septic tank.

2-22. Describe how solids (septage) accumulation is measured in a septic tank.

2-23. Identify the agency that permits the removal of solids from septic and dosing tanks.

2-24. Identify the function of a dosing tank.

2-25. Describe the different types of dosing mechanisms and list the advantages and disadvantages of each.

2-26. Describe the types of establishments that require the use of grease traps or oil/water separators.

2-27. List the three forms of fats, oils, and greases.

2-28. Describe the components and the functions of a grease trap.

2-29. Describe, in general terms, the operation of grease traps associated with food service operations.

2-30. List the factors that affect grease trap performance.

2-31. Describe the importance of routine servicing of grease traps and identify who is authorized to dispose of grease from these units.

2-32. List the different types of oil/water separators associated with industrial operations and describe, in general terms, their operation.

Sand Filters

2-33. Describe the purpose of a sand filter.

2-34. Describe the basic design of sand filters.

2-35. List the different types of treatment processes that occur within sand filters.

2-36. Explain why intermittent dosing of sand filters is important.

2-37. List three types of sand filters.

2-38. Explain recirculation and how it affects filter treatment efficiencies.

2-39. List the variables that affect sand filter operation and performance.

2-40. Describe the relationship between pretreatment and sand filter performance.

2-41. Explain how media size, uniformity and depth affect treatment.

2-42. Explain the effects of high hydraulic and/or organic loads on sand filters.

2-43. Describe methods for distributing effluent over a sand filter and explain why even distribution is important.

2-44. Describe the routine maintenance procedures that are required for proper operation of a sand filter.

2-45. Explain why vegetation is undesirable in a filter and how to properly control it.

2-46. Describe the importance of controlling infiltration/inflow and how it affects sand filters.

Disinfection

2-47. Identify the purpose of wastewater effluent disinfection.

2-48. Explain the difference between disinfection and sterilization of wastewater.

2-49. List the three major types of disinfection.

2-50. List the advantages and disadvantages of chlorination.

2-51. Identify the types of chlorine commonly used to disinfect treated effluent.

2-52. Define chlorine dosage, chlorine demand and chlorine residual.

2-53. Identify the approved methods for determining chlorine residual.

2-54. List and briefly describe the factors that affect chlorination effectiveness.

2-55. Briefly describe the methods of chlorination.

2-56. Describe procedures for chlorine leak detection and the importance of fixing leaks immediately.

2-57. Explain why petroleum products and solid chlorine compounds should not be stored in the same area.

2-58. Briefly describe ultraviolet radiation as a method of disinfection.

2-59. List the advantages and disadvantages of ultraviolet radiation.

2-60. List the factors that affect the effectiveness of ultraviolet radiation as a method of disinfection.

2-61. Briefly describe ozonation as a method of disinfection.

2-62. List the advantages and disadvantages of ozonation.

Chapter 3 – The Natural Treatment System

Soils and Agronomy

3-1. Describe the components that make up soil.

3-2. Define soil profile.

3-3. Describe (in general terms) the following soil physical characteristics and explain the relationship of these factors to the operation of a surface irrigation system:
- soil texture
- soil structure
- organic matter content
- soil depth
- soil color
- soil drainage/wetness

3-4. Identify specific topography or landscape positions and describe how water movement is influenced by landscape position.

3-5. Define the term colloid and explain the importance of colloids in waste treatment.

3-6. Define the following terms:
- cations
- anions
- adsoprtion
- exchangeable cations

- soil solution
- cation exchange capacity

3-7. Explain the relationship between pH and cation exchange capacity.

3-8. Define the following soil moisture terms:
- saturation
- field capacity
- wilting point
- plant available water content
- infiltration
- permeability

3-9. List the three major ways soil can treat or renovate wastewater.

3-10. Name the various physical, chemical, and biological treatment processes that occur in soils.

3-11. Describe the fate of these waste constituents once they enter the soil/plant system:
- nitrogen
- phosphorus
- heavy metals
- pathogens
- persistent organic chemicals

3-12. List the functions that vegetation plays in surface irrigation systems.

3-13. Define macronutrient and micronutrient and list examples of each.

3-14. List three factors that influence nutrient availability and describe their importance.

3-15. As related to nutrient availability, define:
- sufficiency
- toxicity
- deficiency

3-16. Describe the five things that can happen to nutrients when applied to soils.

3-17. Describe the importance of a crop nutrient management plan for waste application sites.

3-18. List the four components of a nutrient management plan.

3-19. Define agronomic rate.

3-20. Define realistic yield expectation (R.Y.E.)

Groundwater and Hydrology

3-21. Define hydrologic cycle and describe (in general terms) its relationship to surface irrigation system operation and function.

3-22. Define evapotranspiration and describe its importance to surface irrigation system operation.

3-23. Define runoff and describe the impact it can have on surface waters.

3-24. Define eutrophication.

3-25. Define the following:
- saturated zone
- unsaturated zone
- water table
- groundwater

3-26. Explain the importance of depth to the water table at surface irrigation sites.

3-27. Explain the following concepts and their relationship to surface irrigation system function and operation:
- wastewater mounding
- lateral movement of groundwater and wastewater

Chapter 4 – Equipment

Pumps and Controls

4-1. Describe the purpose of a pump.

4-2. Define each of the following:
- suction head (lift)
- total dynamic head (TDH)
- friction head
- water horsepower
- discharge head
- brake horsepower
- total pump capacity
- motor horsepower

4-3. Explain how to calculate pump delivery rate.

4-4. Define dosing volume and describe how it is calculated.

4-5. Explain pump efficiency.

4-6. Describe a pump curve, where can it be obtained, and how can it be used.

4-7. Identify the problems which are associated with the condition that occurs when either the suction or discharge head exceeds the pump capacity.

4-8. Using diagrams, be able to identify the components of the following types of pumps. Describe applications for each type of pump and list the advantages and disadvantages of

using the pump in each application. Describe the hydraulic and solids handling capacity of each type of pump:

- centrifugal
- positive displacement, plunger type
- turbines
- positive displacement, diaphragm
- peristaltic pumps
- positive displacement, progressive cavity (screw-flow) type

4-9. Identify the importance of maintaining a water level equal to or above the top of a submersible pump.

4-10. Describe the effect of improper (too loose or too tight) pump packing on the operation and efficiency of a pump.

4-11. Describe the effect of improper lubrication on the operation and efficiency of pumps.

4-12. Identify which pumps must normally be primed in order to operate.

4-13. Identify situations that would cause a loss of prime and explain how to re-prime the pump.

4-14. Describe cavitation and how it affects a centrifugal pump.

4-15. Describe how a water hammer is created and how it affects pumps and piping.

4-16. Identify the proper location for and protection of electrical connections and controls.

4-17. Identify the purpose and function of simplex and multiplex controls.

4-18. Describe how each of the following pump controls work:

- bubble tubes
- float switches
- electrode switches
- pressure bulbs
- pump alternator
- irrigation controller

4-19. Explain the purpose of alternating the operation of two or more pumps.

4-20. Identify and describe the various types of water level alarms commonly used and explain how they work.

4-21. Identify the purpose and function of each the following control panel components:

- elapsed time meters
- run cycle timers
- relays
- telemetry
- alternators

- time delay relays
- microprocessors

4-22. Explain the importance of flow meters, pump run timers, and run counters and the requirements for their calibration.

4-23. Describe how to use pump control records to determine system performance.

Distribution Network and Devices

4-24. Define the following term and abbreviations as they relate to piping:
- I.D.
- O.D.
- I.P.S.
- P.I.P.
- Class
- S.D.R.

4-25. Explain how to interpret SDR values.

4-26. Identify the following common types of irrigation pipes, fittings, connections, and valves and state the application of each in a surface irrigation system:

- Pipe
  - cast iron
  - steel
  - cement asbestos
  - aluminum
  - DIP (ductal iron pipe)
  - PVC (Schedule 40 & 80)
- Fittings
  - elbow
  - tees
  - adapter
  - reducer
  - sleeve
  - wye
  - union
- Connections
  - flange
  - mechanical joint
  - bell and spigot
  - threaded
- Valves (Manual or Motor Activated)
  - gate

- plug
- butterfly
- check (ball and flapper)
- solenoid
- air relief valve
- pressure relief
- globe

4-27. Explain the difference between Schedule 40 and 80 PVC pipe.

4-28. Describe a typical pipe cleanout and explain how and why it would be used.

4-29. Describe the importance of anchoring pipes securely and how thrust blocking is used.

4-30. Explain how PVC cement works and where it should be used.

4-31. Identify the following common types of distribution devices:
- nozzle
- full circle
- gun
- micro spray heads
- rotary impact
- partial circle
- drip emitters

4-32. Describe the following types of irrigation systems, and list several advantages and disadvantages of each:
- stationary or solid set
- travelers
- center pivot and linear move

4-33. Explain the difference between a ring nozzle and taper bore nozzle on an irrigation gun.

4-34. Explain where all underground system components are located and the importance of maintaining plans or maps of these components.

4-35. Describe appropriate places for checking pressure heads in a surface irrigation system.

4-36. Identify the proper steps to take if you discover that the actual flow exceeds the system design flow.

Chapter 5 – Proper Waste Application

Irrigation Scheduling

5-1. Define irrigation scheduling.

5-2. List the three questions that must be answered before irrigating treated wastewater.

5-3. Explain the importance of soil moisture monitoring as it relates to operations at land-based waste treatment systems.

5-4. List three methods to estimate the amount of water present in the soil at the start of irrigation and describe each one in general terms.

5-5. Describe tensiometers and granular matrix sensors and discuss some advantages and disadvantages of each.

5-6. Explain why wastewater application must be adjusted seasonally.

5-7. List five factors that may influence the amount of wastewater that can be irrigated.

5-8. Describe how infiltration rate affects wastewater application.

5-9. Explain how to determine how much wastewater to irrigate.

5-10. Explain why the "permitted" application amount or rate is not feasible at all times.

5-11. Define discharge rate, precipitation rate, and application volume.

5-12. Explain why stationary sprinklers are designed to overlap.

5-13. Calculate the precipitation rate for a stationary sprinkler irrigation system.

5-14. Calculate the application volume for a stationary sprinkler irrigation system.

5-15. Determine the precipitation rate and effective coverage from manufacturer's literature for a traveling gun sprinkler.

5-16. Calculate the precipitation rate and application volume for a traveling gun sprinkler.

5-17. Calculate the required travel speed for a traveling gun sprinkler to apply the desired application volume.

5-18. Explain what effect changing nozzle diameter can have on discharge rate and wetted diameter.

5-19. Explain the effects of changing pressure on droplet size, drift, precipitation rate, and wetted sprinkler diameter.

5-20. Explain why sprinkler systems should be field calibrated.

5-21. Explain calibration procedures for stationary and traveling sprinklers.

Sampling

5-22. Describe how to determine permit sampling requirements and frequencies.

5-23. Describe how to take a soil sample and submit for analysis.

5-24. Describe, in general terms, the information available on a soil test report.

5-25. Describe the proper procedure for taking soil and plant tissue samples for analysis by an agronomy lab such as NCDA.

5-26. Describe the role of plant tissue analysis in managing and monitoring cover crops at a surface irrigation facility.

5-27. Describe how to take a waste sample from a lagoon and submit it for analysis.

5-28. Define the following terms:
- representative sample
- grab sample
- composite sample
- flow proportional composite
- timed composite
- split sample
- duplicate sample

5-29. Describe the need for proper sampling techniques and holding times.

5-30. Describe the importance of sampling groundwater at a surface irrigation site.

5-31. Describe how to minimize contamination risks while collecting groundwater samples.

Operations and Maintenance and Site Management

5-32. List several situations that might require an operator to vary the hydraulic loading rate.

5-33. Identify situations that may indicate that a system's malfunction is related to a "soil-related problem" rather than a mechanical one and describe management techniques that can be used to correct or minimize these problems.

5-34. Describe the relationship between hydraulic loadings and surface crusting, surface ponding and surface runoff.

5-35. Describe the importance of limiting traffic on spray fields.

5-36. List several soil characteristics that affect a soil’s ability to assimilate heavy metals.

5-37. Explain the relationship between soil pH and metal solubility in the soil.

5-38. Define the range of Sodium Adsoprtion Ratio's (SAR's) encountered in wastewater treatment and identify the SAR action level.

5-39. Explain why someone should call for technical assistance when the SAR level of the effluent is greater than 5.

5-40. Define Exchangeable Sodium Percentage (ESP) and describe the levels of ESP that should be of concern to a surface irrigation system operator.

5-41. Describe the importance of good cover crop management.

5-42. List the factors that should be considered when selecting crops for a surface irrigation system and describe why these factors are important.

5-43. Explain why perennial grass sods are effective in reducing erosion and nutrient losses.

5-44. Identify the proper time to irrigate or not to irrigate specific crops to optimize production and wastewater treatment efficiency.

5-45. Explain why harvesting the cover crop at a surface irrigation system is essential.

5-46. Explain why maintaining proper soil pH is critical to the management of a surface irrigation system.

5-47. Describe proper handling of pesticides at a surface irrigation site and the agency responsible for pesticide application.

5-48. Define Best Management Practice (BMP) and list BMP's commonly used at a surface irrigation site.

5-49. List the agencies or groups that can be contacted for technical assistance with crop and/or site management.

5-50. Describe how to recognize poor crop health.

5-51. List the steps that should be taken if a suitable vegetative cover is not present at a land application site.

5-52. Describe how soil test and plant tissue analysis information can be used in site management.

5-53. Explain why uniform distribution of effluent in fields is important.

5-54. Explain bleed-off within the system and describe the procedures for minimizing negative impacts.

5-55. Identify site conditions that indicate hydraulic overload and list possible actions to minimize hydraulic overload.

5-56. Explain how to determine leakage around piping and valves.

5-57. Identify evidence of damaged or improperly constructed appurtenances including groundwater monitoring wells.

5-58. Given precipitation and flow data from a system, determine what this information might imply about potential system problems (in/exfiltration).

5-59. Describe the need to periodically calibrate flow-measuring devices.

5-60. Explain where to find manufacturers literature on site-specific components and the need to perform service on these components.

5-61. Explain how to inspect and maintain the following:
- French drain or curtain drain
- Open drainage ditch and tiled ditches
- Terrace or other surface water diversions (e.g.. grass waterways)

5-62. List conditions under which an operator may need to look for expansion sites.

5-63. Explain the contents of the site operation and maintenance manual.

5-64. Identify the information that should be recorded in a daily site maintenance log book.

5-65. Describe an emergency action plan.

5-66. List the four basic steps that should be followed in the event of a chemical spill or a release of wastes at a surface irrigation facility.

5-67. Explain which agencies should be contacted in the event of a spill or release.

5-68. Describe the importance of controlling access to spray fields.

Chapter 6 – Math

Common Abbreviations

L	=	liter	PAN	=	plant available nitrogen
A	=	area (ft^2)	lbs	=	pounds
V	=	Volume (ft^3, gallons, etc)	conc	=	concentration
ft	=	feet	gal	=	gallons
ft^2	=	square feet	cm	=	centimeter
ft^3	=	cubic feet	mph	=	miles per hour
Q	=	quantity of flow (ft^3/sec, gpd)	MGD	=	million gallons per day

in	=	inches	m^3	=	cubic meters
gpm	=	gallons per minute	C	=	carbon
gpd	=	gallons per day	DO	=	dissolved oxygen
cfs	=	cubic feet per second	%	=	percent
ac	=	acre	=	=	equal to
ppm	=	parts per million	>	=	greater than
psi	=	pounds per square inch	<	=	less than
min	=	minute	≈	=	approximately
mL	=	milliliter	hrs	=	hours
mg/L	=	milligrams per liter			

Definitions

Area - the measurement of a surface in square units such as feet squared, yards squared, etc.

Circumference of a Circle - the length of the external boundary of a circle; for example, the rim of a basketball goal is 62".

Concentration (mg/L) - the amount of a substance in a given volume such, as 1 mg/L.

Diameter of a Circle - distance from one side of a circle to the other, such as a 3 inch inside diameter of a pipe.

Radius of a Circle - one half the diameter of a circle.

Flow Rate - the volume of a substance that would pass a point in a given amount of time, such as 2 gallons per minute flowing out of the end of a hose.

Field Flow Rate - total gpm for a field (unit area).

Friction - the energy lost by any system in motion due to the rubbing of molecules; for example, friction losses in a pipe.

Head - the distance that water under pressure would rise in a pipe if allowed to do so, such as two feet of head in the distribution lateral.

Hydraulic Soil Loading Rate - the number of inches of wastewater applied to an area of soil in a day, such as 0.5 in/day.

Hourly Loading Rate - the number of inches of wastewater applied to an area of soil in an hour, such as 0.2 in/hr.

Pi (π) - a known ratio that is constant in the geometry of circles ($\pi = 3.14$).

Pressure - the force applied to a unit area, such as the pressure in a water pipe.

Volume - the capacity of a container, such as a 1 gallon bucket.

Conversion Factors

1 acre (ac)	=	43,560 square feet (ft^2)
1 acre-inch (ac-in)	=	27,152 gallons per acre (gal/ac)
1 cubic foot (ft^3)	=	7.48 gallons
1 gallon of water	=	8.34 pounds of water
1 horsepower (hp)	=	0.746 kilowatts (kw)
1 milligram/Liter (mg/L)	=	0.226 pounds per acre-inch (lbs/ac-in)

Phosphorous (P) and Potassium Conversions (K)
(For Reference Only – Do Not Need to Memorize)

% P x 2.29 = % P_2O_5	% P_2O_5 x 0.44 = % P
% K x 1.2 = % K_2O	% K_2O x 0.83 = % K

Important Equations

6-1. Calculate the area of squares, rectangles and circles.

6-2. Calculate volume of tanks, cylinders, storage ponds, and lagoons.

6-3. Calculate the detention time of a structure given the volume and flow data.

6-4. Calculate pump delivery rate.

6-5. Convert concentration (mg/L) to pounds.

6-6. Calculate pounds of a substance given wastewater flow and concentration.

6-7. Calculate flow given velocity and area.

6-8. Calculate average flow rates.

6-9. Calculate the hydraulic loading rate given flow and area.

6-10. Calculate horsepower.

6-11. Calculate hydraulic soils loading rate given flow and area.

6-12. Calculate flow rate given hydraulic soils loading rate and area.

6-13. Calculate area given hydraulic soils loading rate and flow rate.

6-14. Calculate hourly hydraulic soils loading rate given flow and area.

6-15. Convert flow data (GPD) to application depth (acre-inches).

6-16. Calculate plant available nitrogen (PAN).

6-17. Calculate sodium adsorption ratio (SAR) from a wastewater analysis.

6-18. Calculate exchangeable sodium percentage (ESP) from a soil analysis.

6-19. Calculate the application rate (precipitation rate) for various types of wastewater application systems.

6-20. Determine time of system operation given application depth and application rate.

6-21. Calculate travel speed for traveling application equipment to meet a desired application rate.

Chapter 7 – Health and Safety

7-1. List the federal and state agencies that oversee worker safety in North Carolina.

7-2. Describe the health and safety responsibilities of the following:
- surface irrigation system owners
- site supervisors
- employees

7-3. List the components of a typical health and safety program.

7-4. Describe the information and training employers are required to provide regarding in-house chemicals.

7-5. Describe the types of personal protective equipment needed for working in and around surface irrigation facilities.

7-6. List the health and safety hazards associated with surface irrigation facilities.

7-7. List the health and safety measures that should be used to reduce health and safety hazards at surface irrigation facilities.

7-8. Explain when a process safety management and/or risk management program may be necessary.

7-9. Define the two types of confined spaces and describe the hazards associated with each.

7-10. Define "oxygen-deficient atmosphere" and describe the equipment required to enter such an atmosphere.

7-11. Describe "lockout/tagout" policies.

7-12. List the types of first aid training that are important for employees of a surface irrigation facility.

7-13. Describe the routine safety measures that should be followed when servicing surface irrigation equipment.

7-14. Explain the safety concerns of using traveling guns on sloping terrain.

7-15. Explain machine guarding.

7-16. Describe the safety procedures that should be followed when working around lagoons.

7-17. Describe the public health significance of vectors that may come into contact with wastewater.

7-18. Explain how to avoid contamination of ditches, waterways, and adjoining properties.

Chapter 8 – North Carolina Regulations

Permit Regulations and Requirements

8-1. Identify the regulations that govern the permitting of surface irrigation systems.

8-2. Identify the division of state government that is responsible for permitting surface irrigation systems.

8-3. Define non-discharge system.

8-4. Describe, in general, the application process for a new surface irrigation facility.

8-5. Describe the renewal requirements for a surface irrigation system permit.

8-6. Explain when a permit modification is required and give examples of changes that would require a modification.

8-7. Explain the requirement for an annual permit fee and describe the consequences for not paying it.

8-8. Describe the need to have a copy of the non-discharge permit and the importance of reading and understanding it.

8-9. Identify who is ultimately responsible for the violation of a permit condition.

8-10. Describe the minimum setback distances that must be maintained for surface irrigation systems.

8-11. List the operation and maintenance requirements contained in a typical spray (or drip) irrigation system permit.

8-12. Describe the importance of maintaining an inspection log.

8-13. Identify what state agency must be notified in the event of non-compliance with permit conditions and within what time period this notification must take place.

8-14. Describe situations or events that would require non-compliance notification.

8-15. List the types of monitoring that may be required in a surface irrigation system permit.

8-16. List the two types of activities that require monthly reporting.

8-17. Identify the form on which irrigation data must be reported, describe when the report is due, and list the information that must be reported on the form.

8-18. Identify the form on which wastewater or effluent monitoring data must be reported, describe when the report is due, and list the information that must be reported on the form.

8-19. Identify the state agency to which reports must be sent.

8-20. Describe the consequences for failing to comply with all monitoring and reporting requirements contained in a surface irrigation system permit.

8-21. Describe the possible consequences of not operating a surface irrigation system in accordance with its permit conditions.

Groundwater Regulations and Requirements

8-22. Identify the regulations that govern the maximum acceptable levels for parameters in groundwater.

8-23. Describe how to determine if a system's non-discharge permit requires monitoring wells and how to find out where they are located at the site.

8-24. Define compliance boundary and explain what actions are necessary if groundwater standards are exceeded at this boundary.

8-25. Define review boundary and explain what actions are necessary if groundwater standards are exceeded at this boundary.

8-26. Describe the proper exterior condition and labeling of a groundwater monitoring well.

8-27. Describe the importance of obtaining background or baseline groundwater samples prior to waste disposal activities.

8-28. Describe routine maintenance for groundwater monitoring wells.

8-29. Identify the report form that must be used to report groundwater monitoring data.

8-30. Describe how to complete a groundwater monitoring form.

8-31. Identify the state agency to which groundwater monitoring report forms must be sent.

Operator Regulations and Requirements

8-32. Identify the regulations that govern the actions of certified operators.

8-33. Identify the state agency that administers the operator certification program.

8-34. Identify the Commission that oversees the operator certification program.

8-35. Describe the responsibilities of the permittee with regards to designating an Operator in Responsible Charge (ORC) and Back-up Operator(s) in Responsible Charge (Back-up ORC).

8-36. Describe the basic requirements to obtain a surface irrigation system operator certificate.

8-37. List the responsibilities that all certified operators must fulfill to maintain their certification.

8-38. List the responsibilities of a certified operator that has been designated as the Operator in Responsible Charge for a surface irrigation system.

8-39. Describe the minimum visitation required from the ORC for a surface irrigation system.

8-40. Describe the difference between the ORC's responsibilities and the owner's responsibilities.

8-41. Describe the need to keep the permittee informed of any necessary repairs or maintenance.

8-42. Describe the responsibilities of a certified operator that has been designated as the Back-up ORC for a surface irrigation system.

8-43. Describe the circumstances under which a designated Back-up ORC may act as a surrogate for the ORC.

8-44. Define contract operations firm and describe their responsibilities.

8-45. Describe the types of disciplinary action the Certification Commission may take against a certified operator.

8-46. Describe the grounds for action by the Certification Commission against a certified operator.

8-47. Describe the terms for recertification following a disciplinary action by the Certification Commission.